1965 OLDSMOBILE

CHASSIS SERVICE MANUAL

NO. 1

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FOREWORD

This Manual provides information on chassis service procedures, adjustments and specifications for 1965 Oldsmobiles. An understanding of the material contained herein and in monthly issues of the Oldsmobile Service Guild and Dealer Technical Information Bulletins, issued when necessary, will assist service personnel in properly maintaining the quality to which Oldsmobile cars are built.

A separate Manual, the 1965 Oldsmobile Body Service Manual, contains body service information on all series and models used in 1965.

PRICE: THREE DOLLARS

SERVICE DEPARTMENT

OLDSMOBILE DIVISION

GENERAL MOTORS CORPORATION

LANSING, MICHIGAN

Sept., 1964, Oldsmobile Div.,
General Motors Corp., Lansing Mich.

Litho in U.S.A.
GMP—B 6075

GENERAL INFORMATION

CONTENTS OF SECTION 1

1965 MODEL IDENTIFICATION

A five digit number, called the car series and body style designation number, identifies any car as to series and style. Reading from left to right, the digits represent the following:

The first digit indicates the General Motors Division.

The second and third digits are Fisher Body Shell Designation. The third digit also is used to designate the V-6 or V-8 engine (odd numbers indicate V-6 and even, V-8 engine).

The fourth and fifth digits are body style designation.

EXAMPLE: 3 3 3 2 7

- 2 7 — Club Coupe
- 3 3 — Standard F-85 Series V-6
- 3 — GM Division (Oldsmobile)

BODY AND STYLE NUMBERS

The body and style numbers are stamped on a plate and is mounted on the left upper cowl. (Fig. 1-1)

Information on this plate shows:

1. Style Number
2. Body Number

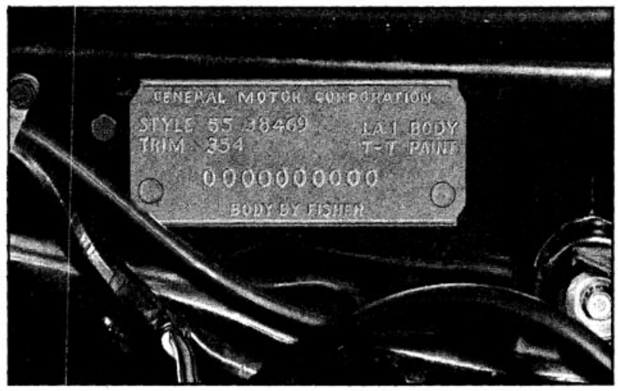


Fig. 1-1 Body and Style Number Plate Location

3. Trim Number
4. Paint Number (Color Specification)
5. Accessories

All Fisher Body numbers are prefixed by a letter or letters indicating the plant at which the body was assembled.

F-85 bodies are coded as follows:

LA - Lansing	BF - Fremont
BA - Baltimore	KC - Kansas City

All 88 and 98 series are coded as follows:

LA - Lansing	BL - Linden
BA - Doraville	BC - South Gate
BK - Kansas City	BT - Arlington

All 98 series will be assembled at Lansing.

NOTE: When writing service orders, preparing AFAs, or correspondence, it is very important that all letters and numbers be included for correct body identification.

1965 MODEL DESIGNATION

Series	Body Description or Name	Chassis Designation	Body Code	Sales and Scheduling Code
33300 Standard F-85 V-6 Engine	Club Coupe	33327	27	3327
	Station Wagon - Two Seat	33335	35	3335
	Four Door Sedan	33369	69	3369
33400 Standard F-85 V-8 Engine	Club Coupe	33427	27	3427
	Station Wagon - Two Seat	33435	35	3435
	Station Wagon - Two Seat Extended	33455	55	3455
	Station Wagon - Three Seat Extended	33465	65	3465
	Four Door Sedan	33469	69	3469
33500 Deluxe F-85 V-6 Engine	Sports Coupe	33527	27	3527
	Station Wagon - Two Seat	33535	35	3535
	Four Door Sedan	33569	69	3569
33600 Deluxe F-85 V-8 Engine	Station Wagon - Two Seat	33635	35	3635
	Four Door Sedan	33669	69	3669
33800 Cutlass F-85 V-8 Engine	Coupe	33827	27	3827
	Hardtop Coupe	33837	37	3837
	Convertible	33867	67	3867
	Custom Station Wagon - 2 Seat Ext.	33855	55	3855
	Custom Station Wagon - 3 Seat Ext.	33865	65	3865
35200 Jetstar 88	Holiday Coupe	35237	37	5237
	Holiday Sedan	35239	39	5239
	Convertible	35267	67	5267
	Celebrity Sedan	35269	69	5269
35400 Jetstar I	Hardtop Coupe	35457	57	5457
35600 Dynamic 88	Holiday Coupe	35637	37	5637
	Holiday Sedan	35639	39	5639
	Convertible	35667	67	5667
	Celebrity Sedan	35669	69	5669
35800 Delta 88	Holiday Coupe	35837	37	5837
	Holiday Sedan	35839	39	5839
	Celebrity Sedan	35869	69	5869
36600 Starfire	Hardtop Coupe	36657	57	6657
	Convertible	36667	67	6667
38400 Ninety-Eight	Holiday Sports Coupe	38437	37	8437
	Holiday Sports Sedan	38439	39	8439
	Convertible	38467	67	8467
	Town Sedan	38469	69	8469
38600 Ninety-Eight	Luxury Sedan	38669	69	8669

Model identification in the following sections will use the Sales and Scheduling Code.

VEHICLE IDENTIFICATION NUMBER PLATE

The 1965 vehicle identification number plate is located on the left front door pillar as illustrated in Fig. 1-2.

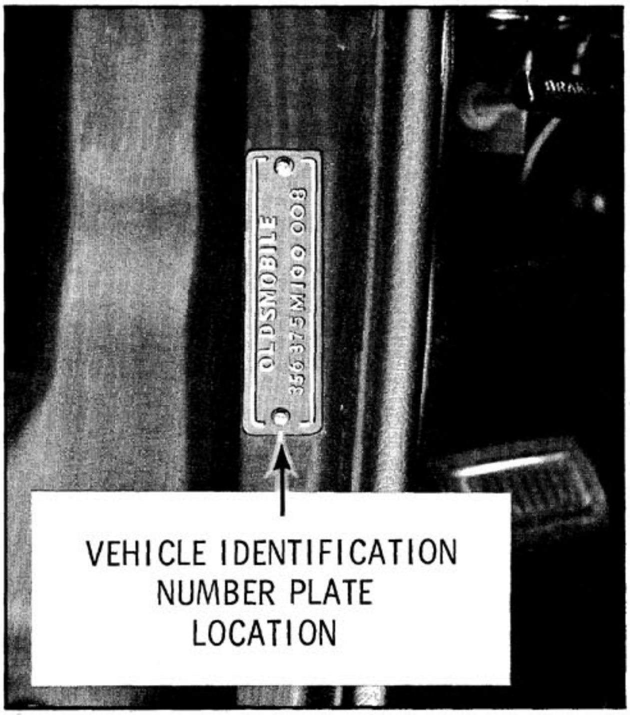


Fig. 1-2 Vehicle Identification Number Plate Location

The vehicle identification number starts with 100001 at each plant and will be in sequential order regardless of series prefix. Each unit number is prefixed by a letter and six numbers which have designations as shown in Fig. 1-3.

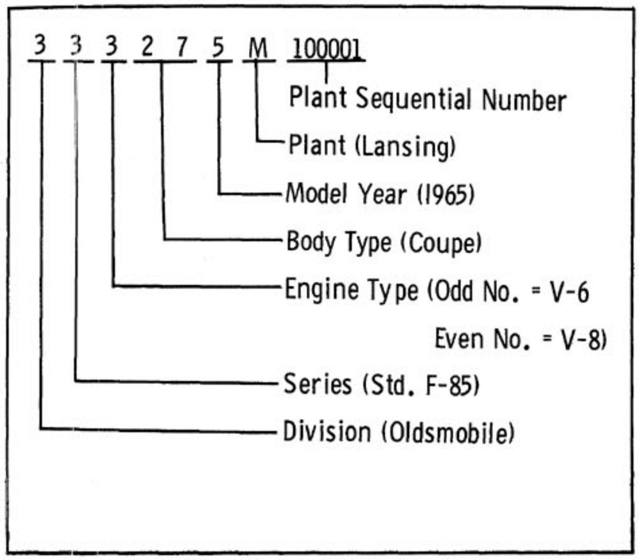


Fig. 1-3 Vehicle Identification Plate Data

STARTING VEHICLE IDENTIFICATION NUMBERS

(Example Numbers)

F-85s				
Series	Plant Letter "M" Units Built At Lansing, Mich.	Plant Letter "B" Units Built At Baltimore, Md.	Plant Letter "Z" Units Built At Fremont, Calif.	Plant Letter "K" Units Built At Kansas City, Mo.
33300 Std. V-6	333275M100001	333275B100001	333275Z100001	333275K100001
33400 Std. V-8	334275M100002	334275B100002	334275Z100002	334275K100002
33500 Deluxe V-6	335275M100003	335275B100003	335275Z100003	335275K100003
33600 Deluxe V-8	336355M100004	336355B100004	336355Z100004	336355K100004
33800 Cutlass V-8	338675M100005	338675B100005	338675Z100005	338675K100005

STARTING VEHICLE IDENTIFICATION NUMBERS (Cont'd.)

Jetstar 88 Through Ninety-Eight Series						
Series	Plant Letter "M" Units Built At Lansing, Mich.	Plant Letter "R" Units Built At Arlington, Texas	Plant Letter "D" Units Built At Atlanta, Ga.	Plant Letter "X" Units Built At Kansas City, Kansas	Plant Letter "E" Units Built At Linden, N.J.	Plant Letter "C" Units Built At South Gate, California
35200 Jetstar 88	352375M100006	352375R100006	352375D100006	352375X100006	352375E100006	352375C100006
35400 Jetstar I	354575M100007	354575R100007	354575D100007	354575X100007	354575E100007	354575C100007
35600 Dynamic 88	356375M100008	356375R100008	356375D100008	356375X100008	356375E100008	356375C100008
35800 Delta 88	358375M100009	358375R100009	358375D100009	358375X100009	358375E100009	358375C100009
36600 Starfire	366575M100010	366575R100010	366575D100010	366575X100010	366575E100010	366575C100010
38400 Ninety-Eight	384375M100011			BUILT ONLY IN LANSING PLANT.		
38600 Ninety-Eight Luxury	386695M100012					

ENGINE UNIT NUMBER

(For Manufacturing and Service Use)

The V-6 engine has a date code stamped on the right cylinder block deck face. (Fig. 1-4) The date code consists of two letters and three numbers. The first letter indicates the model year ("L" for 1965). The second letter shows engine

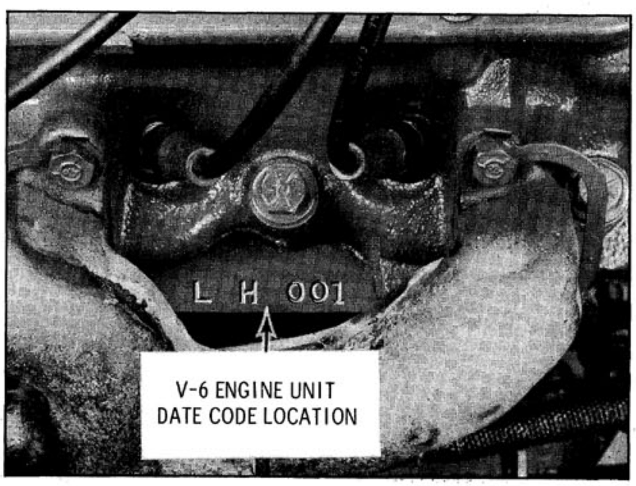


Fig. 1-4 V-6 Engine Unit Number Location

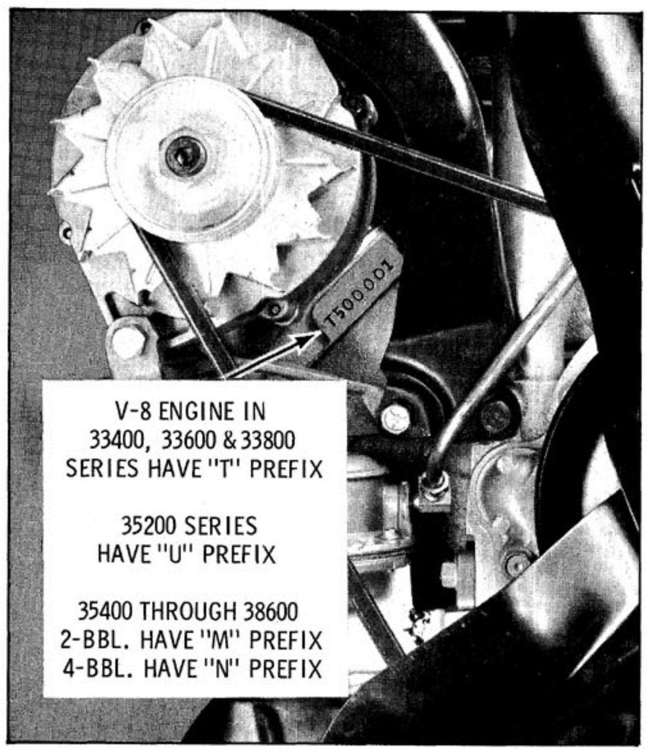


Fig. 1-5 V-8 Engine Unit Number Location

ENGINE IDENTIFICATION CHART

Series	Engine Unit Number: Prefix Code Letter	Starting Unit Number	Suffix Code Letter	Engine Color	Carb. Type	Head Gasket Thickness	Comp. Ratio
33300 & 33500 (F-85 V-6)	LH	001	-	Blue	1 bbl.	.020"	9.0 :1
33300 & 33500 (F-85 V-6 Export Low Comp.)	LJ	001	-	Blue	1 bbl.	.020"	7.6 :1
33400, 33600 & 33800 (F-85 V-8)	T	500001	-	Gold	2 bbl.	.025"	9.0 :1
33400, 33600 & 33800 (F-85 V-8 Export Low Comp.)	T	500002	E	Gold	2 bbl.	.025"	8.3 :1
33827, 33837, 33867 & L-74 & L-76 Optional	T	500003	G	Gold	4 bbl.	.025"	10.25:1
All F-85 Series With Low Comp. Export Option	T	500004	H	Gold	4 bbl.	.025"	8.3 :1
35200 (Jetstar 88 Std. V-8) (High Comp.)	U	500001	-	Gold	2 bbl.	.025"	10.25:1
35200 (Jetstar 88 Low Comp. V-8) (Export Option)	U	500002	E	Gold	2 bbl.	.025"	8.3 :1
35200 (Jetstar 88 Std. V-8) (High Comp. L-74 or L-76 Option)	U	500003	G	Gold	4 bbl.	.025"	10.25:1
35200 (Jetstar 88 Low Comp. V-8) (Export Low Comp. Option)	U	500004	H	Gold	4 bbl.	.025"	8.3 :1
35200 (Jetstar 88 Low Comp. Domestic) (L-65)	U	500005	L	Gold	2 bbl.	.025"	9.0 :1
35600 & 35800 (Std. Comp.) Dynamic 88 & Delta 88	M	001001	-	Red	2 bbl.	.025"	10.25:1
35600 & 35800 (Export Low Comp.)	M	001002	E	Red	2 bbl.	.025"	8.3 :1
35600 & 35800 Domestic Low Comp. Option (L-65)	M	001003	L	Red	2 bbl.	.025"	9.0 :1
35400, 36600, 38400, 38600 & L-74 Option Std. Comp.	N	001004	-	Red	4 bbl.	.025"	10.25:1
Export Low Compression	N	001006	E	Red	4 bbl.	.025"	8.3 :1
35400, 36600 & L-75 & L-77 Option	N	001005	S	Red	4 bbl.	.025"	10.5 :1

usage ("H" for standard compression and "J" for export low compression) and the three numbers identify when the units were built or when an engineering change was made.

V-8 engines have the engine unit number stamped on a machined pad at the front of the right cylinder head. (Fig. 1-5)

V-8 engines used in F-85 Series (33400, 33600 and 33800) have a "T" prefix and the starting unit number is 500001.

Engines in the Jetstar 88 Series (35200) have a "U" prefix and also have a starting number of 500001.

Engines used in all other series (35400 through 38600) have an "M" prefix for 2-bbl. and "N" prefix for 4-bbl. carburetor equipped engines with a starting unit number of 001001.

For engine usage, refer to Engine Identification Chart.

TRANSMISSION SERIAL NUMBER

SYNCHROMESH TRANSMISSION:

No serial number is used on synchromesh transmission.

A date code number stamped on the case indicates the date the unit was built.

JETAWAY TRANSMISSION:

On F-85s (33300 through 33800) and Jetstar 88 (35200) series, the transmission MODEL and CODE NUMBERS are stamped on the servo cover located at the right hand side of the transmission case. (Fig. 1-6)

NOTE: A limited number of 1965 Jetaway transmissions will have a green metal plate attached to the right hand side of the transmission case showing Model and Code Numbers.

Model Letters will indicate transmission usage.

Code Numbers consist of two digits for model year, two letters for transmission model number and three digits to indicate the day the unit was built.

EXAMPLE: 6 5 LJ 0 0 1

- 0 0 1 — First day of production
- LJ — Model LJ (V-6 Usage)
- 6 5 — 1965 Model Year

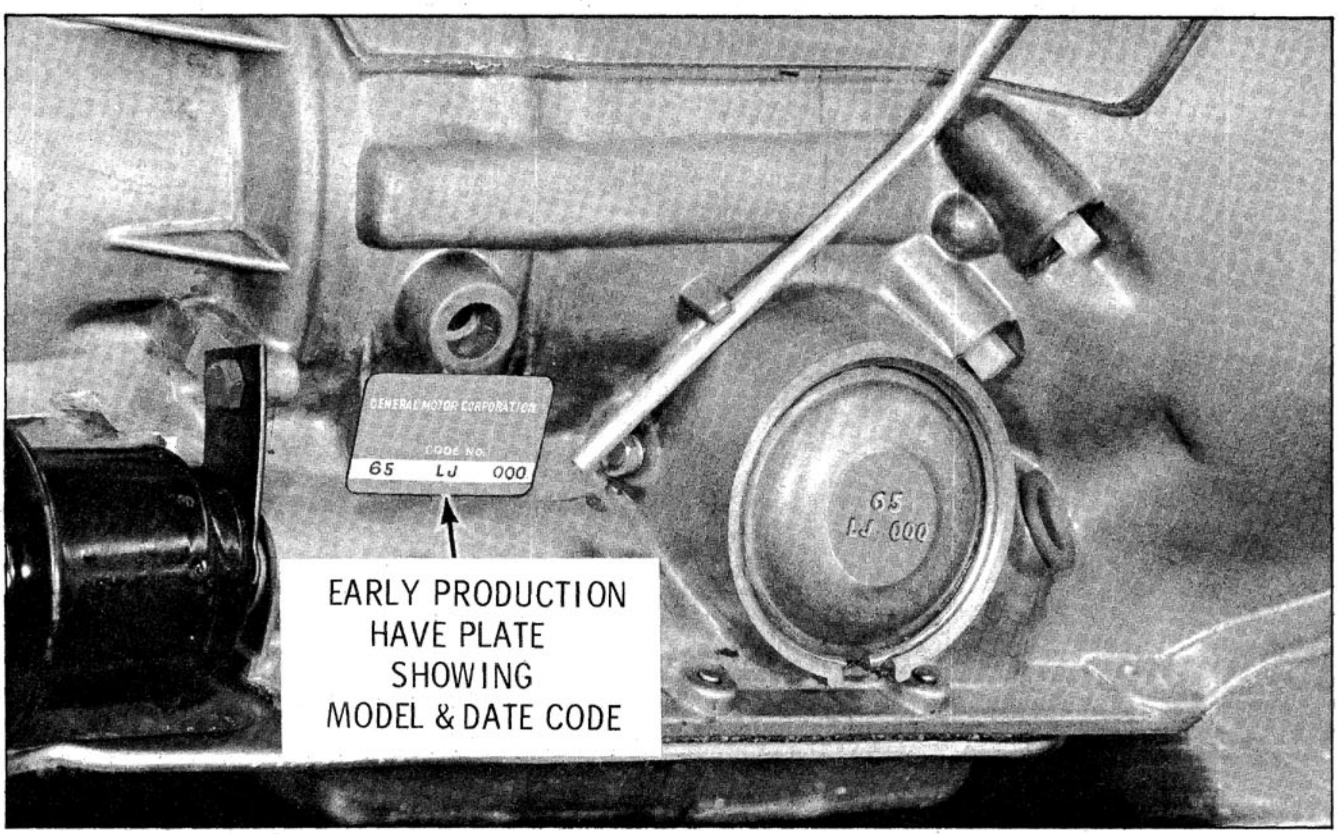


Fig. 1-6 Jetaway Model and Date Code Location

Transmission model letters with engine or series usage are shown below:

MODEL LETTERS	SERIES OR ENGINE USAGE
LJ . .	V-6 in 33300 and 33500 Series
MJ . .	V-8 L.C. in 33400 and 33600 Series Plus 33800 S/W
MK . .	V-8 H.C. Std. in 33800 Series Plus F-85 With L-74 OPTION
MT . .	V-8 L.C. and H.C. 35200 Series
MU . .	V-8 H.C. with L-74 and L-76 OPTION in 35200 Series

TURBO HYDRA-MATIC TRANSMISSION

On 35400 through 38600 series, the Turbo Hydra-Matic serial number is stamped on a plate located on the right side of the case. (Fig. 1-7)

Four different Turbo Hydra-Matic transmission assemblies are used and the starting serial numbers with each engine usage are shown below.

STARTING SERIAL NO.	USAGE
65-0A-1001 . . .	2 Bbl. High Compression
65-0B-1001 . . .	4 Bbl. High Compression (Including Starfire)
65-0C-1001 . . .	2 Bbl. Low Compression
65-0E-1001 . . .	2 Bbl. & 4 Bbl. for Heavy Duty

DIFFERENTIAL RATIOS

The standard and Anti-Spin differential ratio code letters (1/4" high) are stamped on the right rear inboard side of the axle housing tube. (Fig. 1-8)

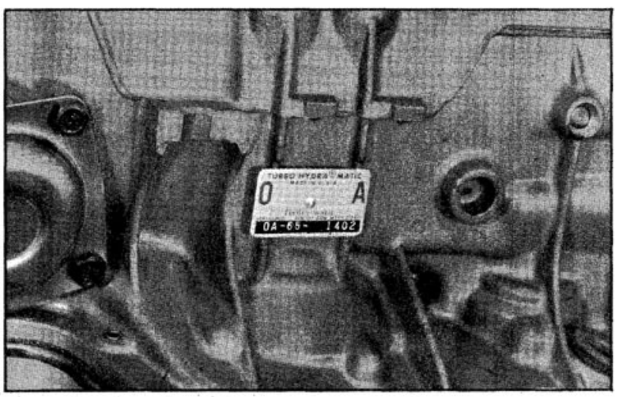


Fig. 1-7 Turbo Hydra-Matic Serial Number Plate Location

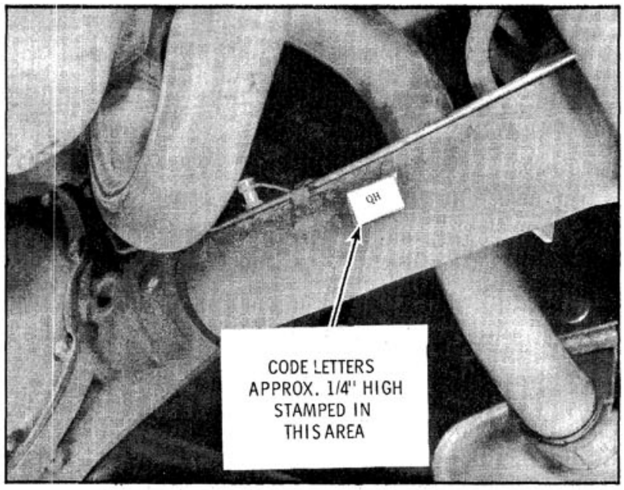


Fig. 1-8 Differential Ratio Code Location

Letters, for both standard and Anti-Spin differentials, indicating corresponding ratio for each series are shown in the following table:

F-85 SERIES
ALL MODELS EXCEPT EXTENDED STATION WAGONS

Ratio	Code Standard Differential	Letters Anti-Spin Differential
39:14 (2.78)	SA	SB
40:13 (3.08)	SC	SD
42:13 (3.23)	SE	SF
39:11 (3.55)	SI	SJ
Extended Station Wagons		
37:12 (3.08)	SM	SN
42:13 (3.23)	SO	SP
39:11 (3.55)	SU	SY
Jetstar 88 Series (5200)		
40:13 (3.08)	RC	RD
42:13 (3.23)	RE	RF
39:11 (3.55)	RG	RH

Jetstar I Through Starfire Series (5400, 5600, 5800, 6600)		
41:15 (2.73)	QA	QB
41:14 (2.93)	QC	QD
40:13 (3.08)	QE	QF
42:13 (3.23)	QG	QH
41:12 (3.42)	QI	QJ

NINETY-EIGHT SERIES (8400 and 8600)		
41:15 (2.73)	QK	QL
40:13 (3.08)	QM	QN
42:13 (3.23)	QO	QP
41:12 (3.42)	QQ	QR

TIRE INFORMATION

RECOMMENDED COLD TIRE INFLATION PRESSURES

When the car is driven a few miles, tires warm up causing pressure increase. If tire pressures are checked when the tires are warm, they should be five pounds over the pressures shown in the chart below.

Overinflation at light loads is not recommended due to adverse effect on car ride.

MAXIMUM VEHICLE LOADING AND TIRE SELECTION

Manufacturer's original equipment 4-ply rating tires are designed and thoroughly tested to meet all normal requirements of your vehicle and are adequate for intermittent full load service with inflation pressures recommended.

Eight-ply rating tires are capable of greater load capacity at higher inflation pressures. Their use is particularly applicable on Station Wagons. These tires are a recommended heavy-duty service option for continuous full load service. Oversize tires give some increase in load capacity and are available on most models.

TIRE PRESSURES

		Average Owner Up to 5-Passenger Load		Continuous Service With Over 5-Passenger Load	
	Tire Ply Rating	(Normal Inflation) Front	Rear	(Maximum Inflation) Front	Rear
All Models except Station Wagons	4	24	24	24*	30
	8	24	24	24*	40
Station Wagons	4	24	28	24*	30
	8	24	28	24*	40

*Front tire loads do not increase appreciably with passenger or cargo loading; therefore, the above is recommended for best steering characteristics.

LOAD CAPACITIES

All Models except Station Wagons	- 1100 lbs. Total	3 Passengers Front Seat 3 Passengers Rear Seat 200 lbs. Luggage
Station Wagons - 2 Seat	- 1200 lbs. Total	3 Passengers Front Seat 3 Passengers Rear Seat 300 lbs. Luggage
Station Wagons - 3 Seat	- 1200 lbs. Total	3 Passengers Front Seat 3 Passengers Second Seat 2 Passengers Third Seat or 300 lbs.

When towing trailers, the allowable passenger and cargo load must be reduced by an amount equivalent to the trailer tongue load.

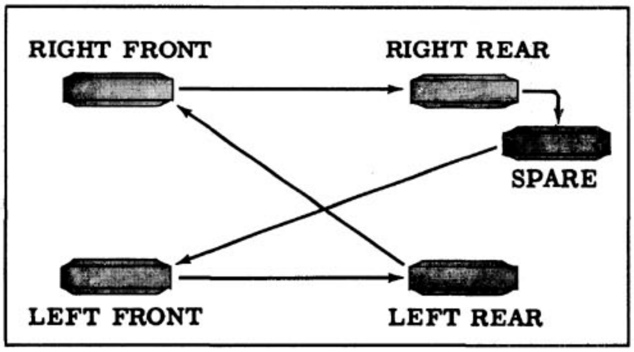


Fig. 1-9 Tire Rotation Chart

TIRE ROTATION

Rotate all five tires every 6,000 miles in accordance with Fig. 1-9.

STARTING CAR WITH BATTERY FAILURE

JETAWAY AND TURBO HYDRA-MATIC EQUIPPED

For safety reasons, the Jetaway and Turbo Hydra-Matic transmissions are designed so that in the event of battery failure, the engine cannot be started by pushing the car. To start the car when the battery has failed, use an auxiliary battery with jumper cables.

NOTE: Be sure to observe correct polarity when connecting the auxiliary battery to prevent possible damage to the diodes in the Delcotron generator charging unit.

SYNCHROMESH TRANSMISSION EQUIPPED

To start the engine by pushing the car, move the gearshift lever to high gear, depress the clutch pedal, and turn on ignition switch. When the vehicle reaches a speed of 10 MPH, release the clutch pedal slowly.

TOWING PRECAUTIONS

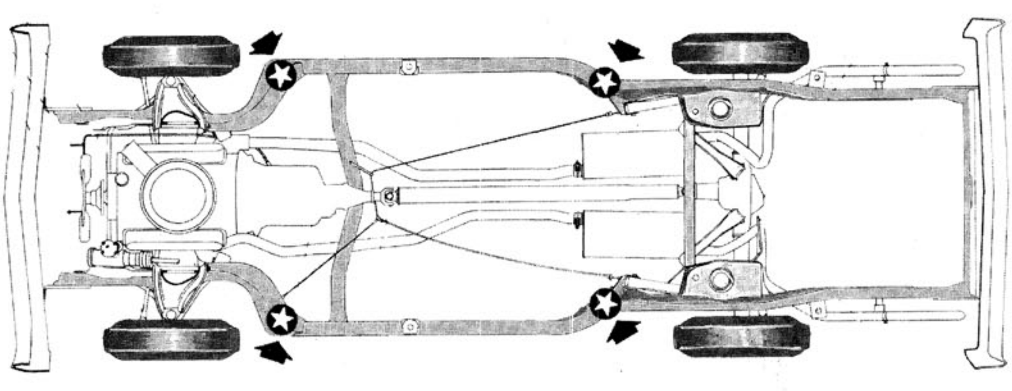
Except when the transmission, propeller shaft or rear axle has become damaged or when the transmission is low on fluid, the car may be towed with the selector lever in the "N" (Neutral) position at speeds up to 45 MPH, for distances up to 50 miles. For higher speeds, longer distances, or if the transmission has become damaged or has lost fluid, it is recommended that the car be towed with the rear wheels off the ground or the propeller shaft disconnected at the differential and secured to the frame or exhaust pipe. If the car is towed with the rear wheels off the ground, the steering wheel should be centered and lashed to the window division channel or held in centered position with a steering clamp. The car should not be lifted more than six inches off the ground or towed at speeds above 45 MPH. When towing with the wheels off the ground, it is recommended that a 4" x 4" timber be located beneath the lower edges of the bumper to prevent lift chains damaging the lower panel.

HOISTING THE CAR

When supporting car on a floor jack or floor stand, the car should be supported at the suspension points only. Under no condition should the car be supported at the extreme ends of frame or on the frame side rail.

When using a frame contact type lift, position the contact pads to lift the frame rails at points shown in Fig. 1-10.

The car should not be lifted at the front or rear bumper with anything other than the bumper jack provided with the car.



LIFT POINTS

Fig. 1-10 Lift Points

GENERAL SPECIFICATIONS

Series	F-85 Series 3300-3400-3500-3600 & 3800 Standard Station Wagon	Vista-Cruiser	All Others	Jetstar 88 (5200)	Jetstar I Thru Starfire Models (5400-5600, 5800 & 6600)	98 (8400 and 8600)
Wheel Base	115"	120"	115"	123"	123"	126"
Tread Width						
Front	58"	58"	58"	62.5"	62.2".	62.5"
Rear	58"	58"	58"	63"	63"	63"
Overall Length	202.7"	207.7"	204.4"	216.9"	216.9"	222.9"
Overall Width	74.4"	74.4"	73.8"	80"	80"	80"
Overall Height	55.4"	58.3"	54.5"	55.5"	55.5"	55.8"
Engine Displacement (Cu. In.)	V-6 225 V-8 330	V-8 330	V-6 225 V-8 330	V-8 330	V-8 425	V-8 425
Taxable Horsepower	V-6 33.7 V-8 49.6	V-8 49.6	V-6 33.7 V-8 49.6	V-8 49.6	V-8 57.8	V-8 57.8

1965 PAINT SERVICE NUMBERS

EXTERIOR COLORS

Comb. Code	Color Name	DuPont Stock No.	R. M. Stock No.
A	Ebony Black	88	A- 946
B	Nocturne Mist	4622-L	A-1709
C	Provincial White	4024-L	A-1199
D	Lucerne Mist	4630-L	A-1720
E	Royal Mist	4631-L	A-1721
H	Laurel Mist	4633-L	A-1716
J	Forest Mist	4634-L	A-1717
K	Ocean Mist	4628-L	A-1718
L	Turquoise Mist	4629-L	A-1719
N	Burgundy Mist	4624-LH	A-1711M
R	Target Red	4625-LH	A-1712M
T	Mohave Mist	4627-L	A-1714
V	Almond Beige	4401-L	A-1530
W	Sterling Mist	4623-L	A-1710
Y	Saffron Yellow	4620-L	A-1715

INTERIOR COLORS

Gloss		
Black	88	A-946
Parchment	9000-L	62T82
Medium Blue	4630-L	65V22
Midnight Blue	4631-L	65B26
Medium Green	4633-L	65V32
Midnight Green	4634-L	65V33
Medium Turquoise	4628-L	65B31
Medium Red	4625-LM	65B52R
Medium Fawn	9171-L	65B84
Medium Slate	4623-L	65B14
Dark Slate	9175-L	65V12
Dark Turquoise	9176-L	65B32
Dark Fawn	9177-L	65B80
Dark Red	9181-LH	65B56R
Red	9183-LH	65B53R
Flat		
Black	4428-L	A-946
Midnight Blue	9192-L	65B28
Midnight Green	9193-L	65B35
Dark Slate	9196-L	65B17
Dark Turquoise	9197-L	65B36
Dark Fawn	9198-L	65B87
Dark Red	9201-LH	65B55M

CAPACITIES

Item	F-85 Series V-6 (3300 & 3500)	F-85 Series V-8 (3400, 3600 & 3800)	Jetstar (5200)	All Others (5400 Thru 8600)
Cooling System*				
With Air Conditioning	11.2 Qts.	19.3 Qts.	17.0 Qts.	18.0 Qts.
Without Air Conditioning	10.7 Qts.	16.9 Qts.	16.5 Qts.	17.5 Qts.
Engine Crankcase	4 Qts.	4 Qts.	4 Qts.	4 Qts.
With Filter Change	5 Qts.	5 Qts.	5 Qts.	5 Qts.
Synchromesh Transmission				
3-Speed	2 Pts.	2 Pts.	2 Pts.	3 Pts.
4-Speed	2-1/4 Pts.	2-1/4 Pts.	2-1/4 Pts.	2-1/4 Pts.
Jetaway and Turbo Hydra-Matic Transmission				
Oil Pan Removed	3 Qts.	3 Qts.	3 Qts.	4 Qts.
Complete Overhaul	9 Qts.	9 Qts.	9 Qts.	9 Qts.
Power Steering				
Complete System	1-3/4 Qts.	1-3/4 Qts.	1-3/4 Qts.	1-3/4 Qts.
Pump Only	1 Qt.	1 Qt.	1 Qt.	1 Qt.
Differential	3 Pts.	3 Pts.	3 Pts.	4-3/4 Pts.
Gasoline Tank	20 Gal.	20 Gal.	25 Gal.	25 Gal.

*Without Heater - Subtract .7 Qt. on F-85s (V-6 and V-8)
Subtract 1 Qt. on all other Series

PERIODIC MAINTENANCE

ENGINE CRANKCASE OIL

It is recommended that an oil which, according to the label on the can, is (1) ''intended for service MS'' and (2) ''Passes car makers' tests'' or ''Meets General Motors Standard GM-4745M''.

The proper oil viscosity to use depends on the prevailing atmospheric temperature. The following chart will serve as a guide in selecting the proper oil viscosity.

Lowest Anticipated Temperatures	SAE Viscosity Number
Above +32°F.	20W, 10W-30
32°F to 0°F.	10W, 10W-30*
Below 0°F.	5W, 5W-20*
*5W-30 oil may be used at temperatures below freezing.	

OIL FILTER

The full flow oil filter filters 100% of the oil delivered by the pump. For this reason, the interval or change is very important. The oil filter should be changed every 6 months or 6,000 miles, whichever occurs first. Operating conditions may require more frequent replacement.

Replace oil filter as follows:

A. Loosen filter with wrench, then remove and discard filter.

B. Clean out filter body casting.

C. With new seal seated on face of new filter, install filter and tighten to 17 ft. lbs.

D. Add oil, start engine and check for leaks.

CRANKCASE BREATHER (OR POSITIVE CRANKCASE VENTILATION FILTER)

All Engines:

At every oil change, more often under dusty conditions, remove cap, wash in kerosene and re-oil with SAE 10W-30 oil.

POSITIVE CRANKCASE VENTILATION VALVE

All Engines:

At every 12,000 miles (or at the oil change period nearest to this interval), wash positive crankcase ventilation valve in kerosene and blow out hoses.

DISTRIBUTOR

The breaker cam should be lubricated with a thin film of Ball Bearing Lubricant every 12,000 miles or whenever the contact assembly is replaced. No other lubrication is required.

RECOMMENDED OIL CHANGE INTERVAL

Engine oil changes should be made at 60 day intervals, but never to exceed 6,000 miles. Use oil which, according to label on can, is intended for service "MS".

NOTE: When changing the oil during the fall and winter seasons, consider the lowest anticipated temperature for the next 60 days. If the temperature is expected to be occasionally below 0°F., 5W-20 oil is recommended. In areas where the temperature will be consistently 0°F. or below, 5W is recommended.

SAE 5W oil is not recommended for sustained high speed driving when the temperature is above 60°F.

SAE 30 oil may be used when the prevailing daylight temperature is above 90°F.

Certain driving conditions, such as dust storms and frequent driving on dusty roads, necessitate more frequent oil changes.

If higher detergency is required to reduce varnish and sludge formation, a thoroughly tested and approved concentrate - "High Detergency Concentrate" - is available.

The use of "break-in" oil, "tune-up" compounds, "friction reducing" compounds, etc. in Oldsmobile engines is specifically NOT recommended.

When changing oil, drain the crankcase after the engine has reached normal operating temperature to insure complete removal of the oil. Oil pan drain plug torque is 40 ft. lbs.

CRANKCASE CAPACITY

Oil change only, 4 qts.

Oil and filter change, 5 qts.

OIL LEVEL

The engine oil dip stick, located on the left side of the engine, is marked "Full", "Add 1", and "Add 2". The oil level should be maintained in the safety margin, neither going above the "Full" line nor under the "Add 2" line. The oil level should be checked at every refueling and oil added to maintain the proper level. (Fig. 2-1)

AIR CLEANER

NON-DISPOSABLE TYPE (V-6 ENGINES)

At every 12 month period or 12,000 miles, more often under dusty conditions, remove filter element, wash in kerosene, dip in SAE 10W-30 oil and squeeze to remove excess oil.

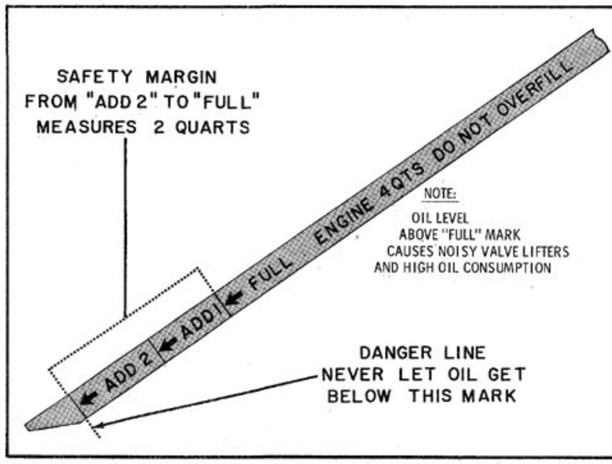


Fig. 2-1 Engine Oil Dip Stick

DISPOSABLE ELEMENT TYPE (V-8 ENGINES)

This air cleaner incorporates a disposable air filter element. Soft plastic flanges are used as self-contained gaskets which seal the air cleaner body and cover. Therefore, all air must pass through the filter element.

The air filter element should be replaced every 18,000 miles under normal driving conditions, and more frequently under dusty driving conditions. Do not attempt to service the element.

The filter element should be replaced as follows:

A. Remove air cleaner assembly to prevent dirt from falling into carburetor.

B. Remove filter element from air cleaner.

C. Clean dust and dirt from metal surfaces of air cleaner body and install new filter element.

D. Install air cleaner assembly on carburetor.

JETAWAY AND TURBO HYDRA-MATIC TRANSMISSIONS

AUTOMATIC TRANSMISSION FLUID

Use only General Motors Automatic Transmission Fluid (Hydra-Matic Fluid) or fluids with the following identification on the container: Brand name, including the words "Fluid Type A" plus the mark AQ-ATF-Number and Letter A embossed on the top of the can as follows: "AQ-ATF-Number A".

CHECKING AUTOMATIC TRANSMISSION FLUID LEVEL—(Fig. 2-2)

Fluid level should be checked at the oil filler

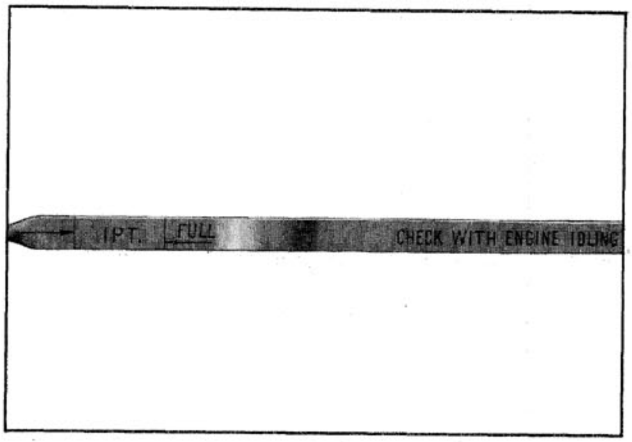


Fig. 2-2 Jetaway and Turbo Hydra-matic Dip Stick

tube, located at the rear of the right exhaust manifold, at each engine oil change interval. Check must be made with the engine idling and the selector lever in the "Park" position. Fluid level must be maintained at the "Full" mark (transmission warm).

CAUTION: Do not fill above "Full" mark as this will cause foaming and will result in improper operation.

DRAIN INTERVAL

Change fluid and filter at two years or 24,000 miles. Under more severe service, change fluid and filter at 12,000 mile intervals.

DRAINING JETAWAY AND TURBO HYDRA-MATIC TRANSMISSIONS

JETAWAY (3300 THROUGH 5200 SERIES)

A. Remove oil pan and permit fluid to drain.

B. Clean oil pan. Install new gasket and reassemble to transmission.

C. Add three quarts of fluid.

D. With the selector lever in "Park" position and the car on a level surface, start engine. With engine running, add fluid to bring level to "Full" mark on dip stick.

NOTE: Approximately three quarts of fluid are required to fill the Jetaway transmission when the fluid is drained by removing the pan. Nine quarts are required after an overhaul.

TURBO HYDRA-MATIC (5400 THROUGH 8600 SERIES)

A. Remove oil pan and permit fluid to drain.

B. Clean oil pan. Install new gasket and reassemble to transmission.

C. Add four quarts of fluid.

D. With the selector lever in "Park" position and the car on a level surface, start engine. With engine running, add fluid to bring level to "Full" mark on dip stick.

NOTE: Approximately four quarts of fluid are required to fill the Turbo Hydra-Matic transmission when the fluid is drained by removing the pan. Nine quarts are required after an overhaul.

SYNCHROMESH TRANSMISSION

Periodic or seasonal changes of lubricant is not recommended.

The lubricant level should be checked at each engine oil change interval. Maintain lubricant level with SAE 80, where available or SAE 90 Multi-Purpose gear lubricant meeting requirements of MIL-L-2105B.

CAUTION: Always clean dirt or foreign material from around plug before removing.

CAPACITIES OF TRANSMISSIONS ARE AS FOLLOWS:

3300 through 5200 Series:
3-Speed . . . . 2 pts.
4-Speed . . . . 2-1/4 pts.

5400 through 6600 Series:
3-Speed . . . . 3 pts.
4-Speed . . . . 2-1/4 pts.

POWER STEERING GEAR AND PUMP

Check lubricant level in pump reservoir at each engine oil change interval. Maintain lubricant level with GM Power Steering Fluid, Part No. 1050017. If this lubricant is not available, use Automatic Transmission Fluid Type A "AQ-ATF . . . A".

Power steering gear lubrication is accomplished by the oil supplied to the gear from the pump.

CAPACITIES OF THE POWER STEERING UNITS ARE:

COMPLETE SYSTEM

All Series . . . . 1-3/4 qts.

PUMP ASSEMBLY

All Series . . . . 1 qt.

MANUAL STEERING GEAR

Check lubricant level every 36,000 miles. When necessary, add Water Resistant EP Chassis Grease (Multi-Purpose Chassis Lubricant) to level of filler hole.

DIFFERENTIAL

Check lubricant level at each engine oil change period.

CONVENTIONAL DIFFERENTIAL:

Maintain lubricant level with SAE 90 Multi-Purpose Gear Lubricant, meeting requirements MIL-L-2105B or Part No. 1050081.

ANTI-SPIN DIFFERENTIAL:

Maintain lubricant level with Part No. 1050081.

IMPORTANT: Use of other than the above mentioned type of lubricant in the Anti-Spin differential may cause chatter. If the wrong type of lubricant is used in the Anti-Spin, it will require draining the differential and installing the recommended lubricant (Part No. 1050081). It may be necessary to drive Anti-Spin equipped cars for distances of 50 miles or more to allow the new lubricant to work through the units before the chatter will disappear.

CAUTION: Always clean dirt or foreign material from around plug opening before removing filler plug.

CAPACITY OF THE DIFFERENTIAL IS:

3300 through 5200 Series . . . . 3 pts.
5400 through 8600 Series . . . . 4-3/4 pts.

FRONT SUSPENSION AND STEERING LINKAGE

STEERING LINKAGE—ALL MODELS:

Every six months or 12,000 miles, whichever occurs first, lubricate the steering linkage with a multi-purpose chassis lubricant.

BALL JOINTS—3300 THROUGH 3800 SERIES:

Every six months or 12,000 miles, whichever occurs first, lubricate with multi-purpose chassis lubricant.

BALL JOINTS—5200 THROUGH 8600 SERIES:

Initial or first lubrication interval at 36,000 miles (no time limit). Thereafter, every six months or 12,000 miles, whichever occurs first, with a multi-purpose chassis lubricant.

LOCATION OF LUBRICATION POINTS ARE LISTED BELOW

	SERIES	
	3300 through 3800	5200 through 8600
Lower Control Arm Ball Joints	2	2
Upper Control Arm Ball Joints	2	2
Tie-Rod Ends	2	2
Relay Rod	2	2
Idler Arm		2
Pitman Arm		1

NOTE: On 5200 Series through 8600 Series, the plugs in the ball joints have to be removed and lubrication fittings installed prior to lubrication of joints.

THROTTLE, TRANSMISSION, CLUTCH AND PARKING BRAKE LINKAGE

At each engine oil change interval, all friction and bearing surfaces in the linkage for the throttle, transmission, clutch and parking brake should be lubricated with SAE 10W-30 oil. Ball and socket in the throttle linkage should be lubricated with special lubricant, Part No. 1050169, only, whenever they are disassembled.

SERVICE BRAKES

The fluid level in the master cylinder located at the left rear side of the engine compartment should be checked at each engine oil change interval. If necessary to add fluid, use GM Brake Fluid Supreme No. 11. On all standard and power brakes, the fluid level must be maintained at 1/4" below the top of the reservoir.

CAUTION: Extreme care must be exercised to prevent entry of dirt into the master cylinder.

NOTE: Brake linings should be periodically inspected for wear. The frequency of this inspection depends upon driving conditions such as traffic or terrain, and also the driving techniques of individual owners.

BATTERY

Check battery liquid level at each engine oil change interval or once a month or more often, when refueling in hot weather. Level should reach the bottom of the split ring in the vent well.

CAUTION: DO NOT OVERFILL.

Clean top of battery and terminals every 12,000 miles and check tightness of battery hold-down bolt. To properly clean battery:

A. Make sure vent plugs are closed tight.

B. Remove battery cables from battery.

C. Clean battery with a diluted ammonia or soda solution. When the solution stops foaming, rinse with clear water.

D. Clean battery cable clamps with diluted ammonia or soda and rinse with clear water. Apply a thin coating of petrolatum to terminals and clamps, after installing clamps.

COOLING SYSTEM

F-85 SERIES—The coolant should be kept at 3/4" below top of filler neck seat with engine cold.

ALL OTHER SERIES—Keep coolant level to "Fill-Cold" mark on radiator.

ALL SERIES:

The coolant system should be periodically inspected for leaks and where found, corrected.

The cooling system is designed for use of a highly inhibited "year around" Ethylene-Glycol solution both summer and winter.

Every two years, the system should be completely drained. When refilling, use Oldsmobile "year around" Ethylene-Glycol, Part No. 389200 or equivalent Ethylene Glycol coolant labeled as meeting specification GM1899-M.

NOTE: Alcohol base coolants are not recommended at any time.

For desired degree of protection, the following chart may be used as a guide.

COOLANT PROTECTION CHART

Series			Quarts of Ethylene-Glycol Year-Around Coolant Part No. 389200 or Equivalent							
			5	6	7	8	9	10	11	12
3300 & 3500 (V-6 Engine)	Temperature Protection Point	Without Air Conditioning	-25°F	-50°F						
		With Air Conditioning	-21°F	-43°F						
3400, 3600 & 3800 (V-8 Engine)	Temperature Protection Point	Without Air Conditioning				-25°F	-40°F	-58°F		
		With Air Conditioning					-25°F	-37°F	-54°F	
5200 (V-8 Engine)	Temperature Protection Point	Without Air Conditioning				-31°F	-48°F			
		With Air Conditioning				-27°F	-42°F			
5400 Through 8600 (V-8 Engine)	Temperature Protection Point	Without Air Conditioning				-24°F	-38°F	-55°F		
		With Air Conditioning				-21°F	-34°F	-49°F		

SPEEDOMETER CABLE

The cable should be lubricated every 24,000 miles. Apply a coating of speedometer cable grease to the lower two-thirds of the cable only. This will properly lubricate the upper one-third of the casing, giving an even coating of lubricant the full length of the flexible cable, without danger of excess grease working up into the speedometer head.

NOTE: Care must be exercised to prevent entrance of dirt into the speedometer casing.

BODY LUBRICATION POINTS

(Check and Lubricate as Required)

HOOD LATCH:

Lubricate the latch pilot bolts and latch locking plate with a thin film of No. 630 AAW Lubriplate. Use a light oil for pivot points.

HOOD HINGES:

(AT EVERY ENGINE OIL CHANGE)

SAE 10W-30 oil should be used to lubricate the hood hinges, care being taken not to allow the oil to drop on fenders or other exposed painted surfaces.

GAS TANK FILLER DOOR HINGE:

Apply a few drops of SAE 10W-30 oil to friction points of door hinge. Work door several times and wipe off excess lubricant.

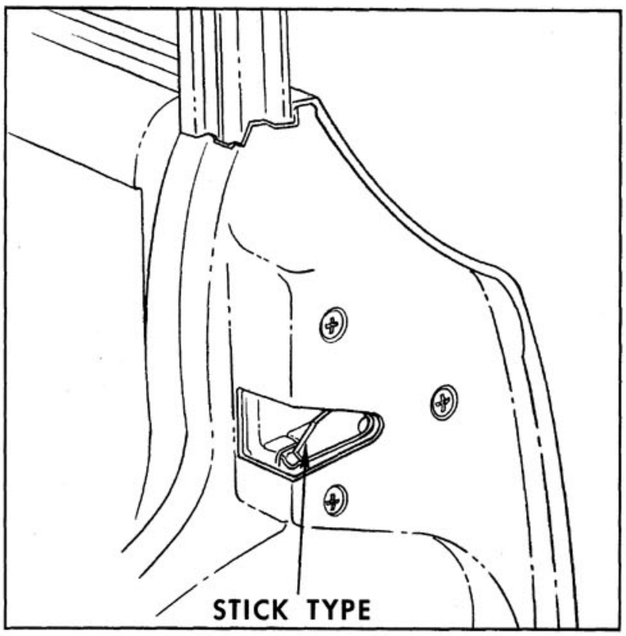


Fig. 2-3 Door Lock Fork Bolt Lubrication

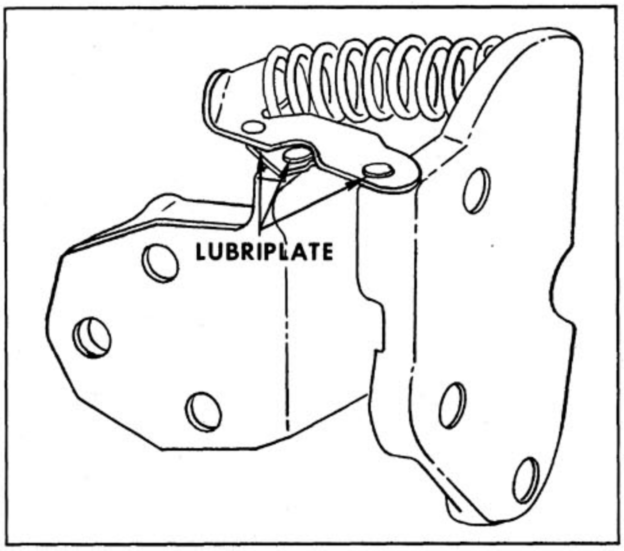


Fig. 2-4 Door Hinge and Hold Open Assembly

WINDSHIELD WIPER TRANSMISSION BEARING:

Lubricate windshield wiper transmission bearing with 10W-30 oil every 24,000 miles.

DOOR LOCK FORK BOLT

Wipe off dirt and apply a thin coat of stick-type lubricant to top surface of lock bolt striker teeth indicated in Fig. 2-3. After lubrication, close door several times and remove excess lubricant along the side edge of teeth.

DOOR HINGE AND HOLD OPEN ASSEMBLY

Wipe off dirt and apply a light coat of Lubriplate 630 AAW or its equivalent at points indicated in Fig. 2-4. The hinge pins should be lubricated with SAE 10W-30 oil.

DOOR JAMB SWITCH

Apply a thin coat of No. 630 AAW Lubriplate or equivalent to end surface of switch plunger.

REAR COMPARTMENT LID AND TAILGATE LOCKS

On rear compartment lid locks, apply a thin film of Lubriplate 630 AAW or its equivalent. (Fig. 2-5)

On tailgate locks, apply a thin film of Lubriplate 630 AAW or its equivalent to the bolt at the striker contact areas.

TAILGATE LOCK STRIKER

Apply a thin coat of stick-type lubricant to

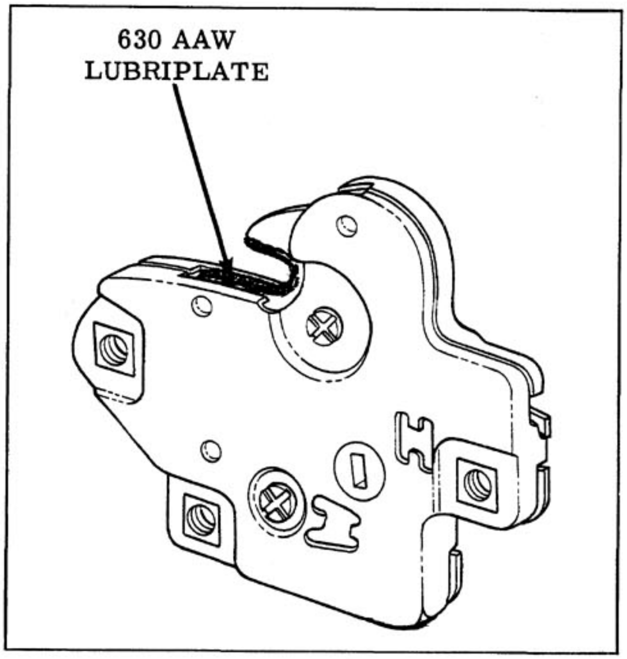


Fig. 2-5 Rear Compartment Lid and Tailgate Lock Bolt

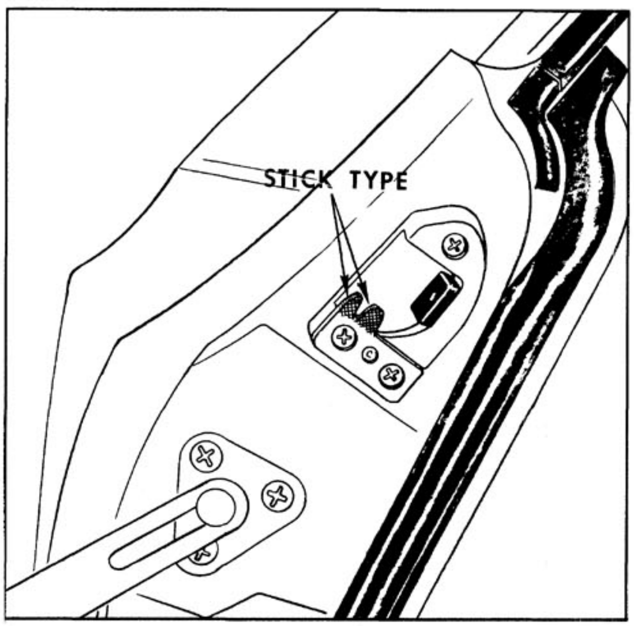


Fig. 2-6 Tailgate Lock Striker

surface of lock bolt striker teeth. (Fig. 2-6) After lubrication, close door several times and remove excess lubricant.

TAILGATE HINGES

The hinges should be lubricated lightly at all pivot points with SAE 10W-30. (Fig. 2-7)

REAR COMPARTMENT AND TAILGATE LOCK CYLINDERS

A small quantity of lock lubricant occasionally

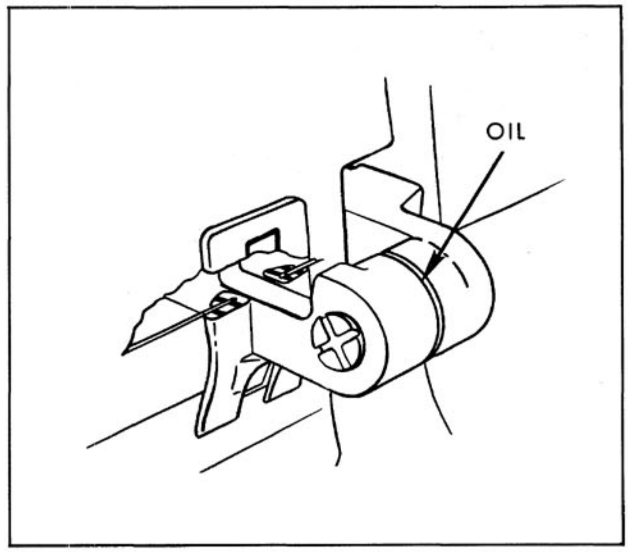


Fig. 2-7 Tailgate Hinge

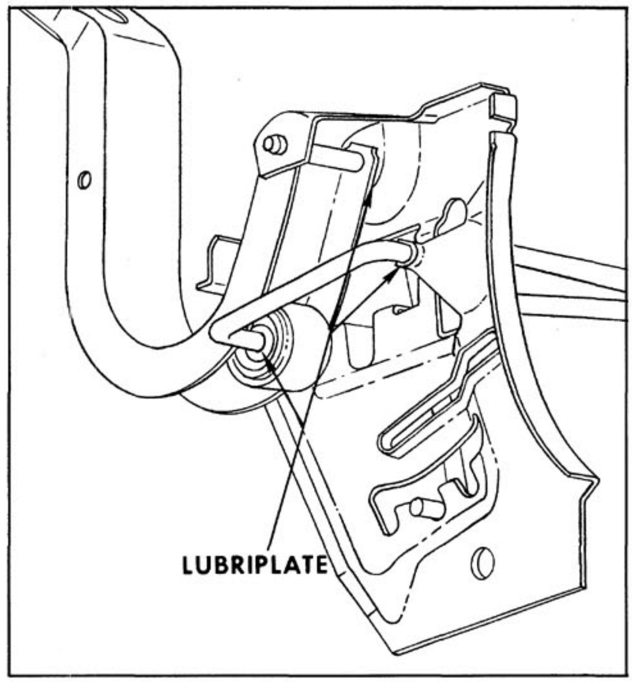


Fig. 2-8 Rear Compartment Lid Hinge

applied to the lock cylinders will prevent sticking.

REAR COMPARTMENT LID HINGES AND TORQUE RODS

Apply Lubriplate 630 AAW or equivalent to hinges and torque rods at friction points. (Fig. 2-8)

FRONT SEAT ADJUSTER MECHANISM

Manual Seat

A thin film of Lubriplate 630 AAW or its equivalent should be applied to the seat tracks as needed.

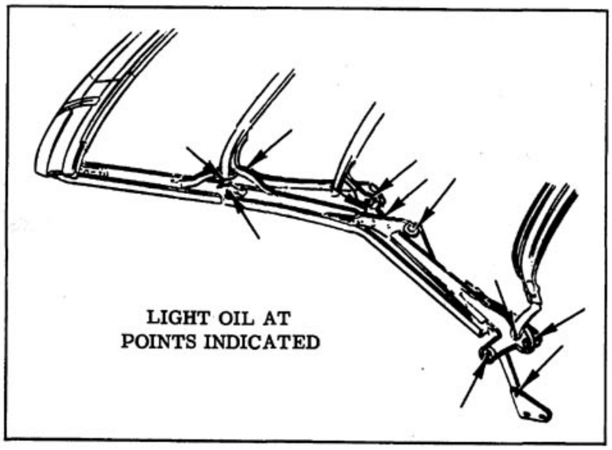


Fig. 2-9 Folding Top Linkage

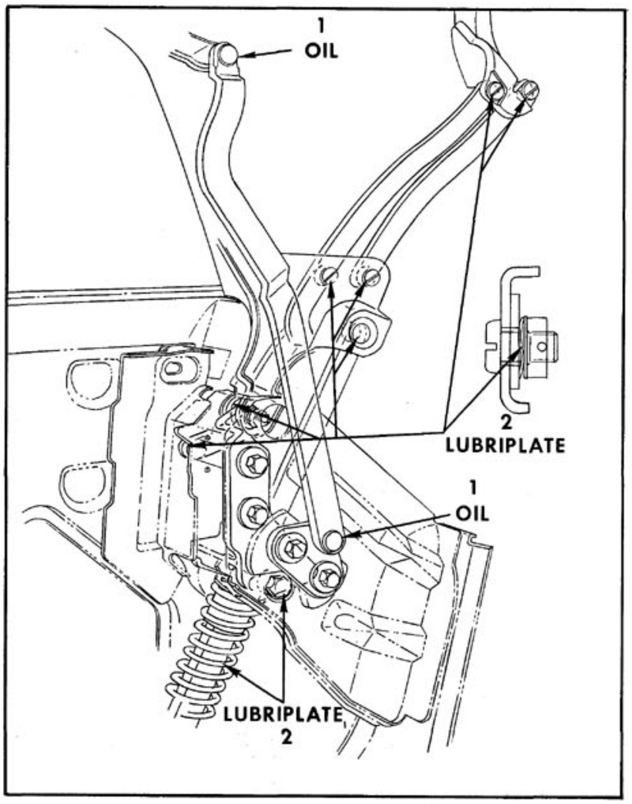


Fig. 2-10 Folding Top Linkage

2, 4 and 6-Way Electric Seats

Thoroughly wipe off old lubricant to clean jack screw. Apply a thin film of Lubriplate 630 AAW or its equivalent to jack screw and seat tracks, being careful not to soil seat trim. Operate the seat adjuster to limit of all positions. Apply a small amount of oil to linkage. Wipe off excess lubricant.

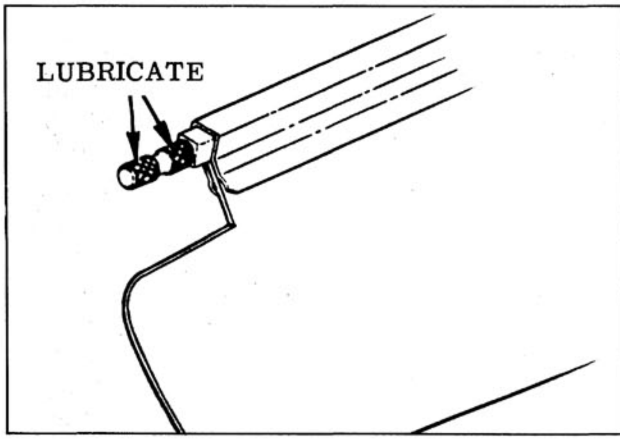


Fig. 2-11 Sunshade Rod

FOLDING SEAT LINKAGE AND LOCK

Apply a sparing amount of dripless oil to all frictional points, work folding seat as required and wipe off excess lubricant.

FOLDING TOP LINKAGE (CONVERTIBLE)

Apply a sparing amount of light oil to bearing points indicated in Figs. 2-9 and 2-10. Wipe off excess lubricant to prevent soiling trim.

FOLDING TOP LIFT CYLINDER PISTON RODS

With folding top in raised position, wipe exposed portion of each top lift cylinder piston rod with a cloth dampened with brake fluid to remove any oxidation or accumulated grime. With another clean cloth, apply a light film of brake fluid to the piston rod to act as a lubricant.

NOTE: Use caution so that brake fluid does not come in contact with any painted or trimmed parts of the body.

SUNSHADE ROD

Remove sunshade from support and apply a thin film of stick-type lubricant to end of sunshade rod. (Fig. 2-11)

INSTRUMENT PANEL COMPARTMENT DOOR HINGE

Wipe off dirt and apply a sparing amount of dripless oil to hinge frictional points. Operate door several times and wipe off excess lubricant.

OLDSMOBILE GUARDIAN MAINTENANCE SCHEDULE

MAINTENANCE SERVICE	MONTHS	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48
	MILEAGE (In Thousands)			6			12			18			24			30			36			42			48
Change Engine Oil		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
*Clean Oil Inlet Breather Cap		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Check All Fluid Levels		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Lubricate Linkage (Transmission, Throttle and Parking Brake)		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
*Replace Oil Filter				X			X			X			X			X			X			X			X
Inspect Ball Joint and Tie-Rod End Seals For Damage (Exc. F-85)				X			X			X			X			X			X			X			X
Lubricate and Check Steering Linkage For Lash and Wear				X			X			X			X			X			X			X			X
Lubricate and Check Ball Joints For Wear (F-85 Only)				X			X			X			X			X			X			X			X
Rotate Tires				X			X			X			X			X			X			X			X
*Clean and Oil Standard Air Cleaner (V-6 Only)							X						X						X						X
Clean and Gap Spark Plugs, Adjust Distributor Points & Set Timing							X						X						X						X
Adjust Carburetor idle Speed and Mixture							X						X						X						X
Inspect Cooling System & Add Coolant If Necessary (Change Coolant Every 24 Months)							X						X						X						X
Clean Battery Cable & Terminals							X						X						X						X
Clean P.C.V. Check Valve, Hoses and Filter							X						X						X						X
*Change Heavy Duty Air Cleaner Element (Except V-6)										X									X						
Adjust Transmission Band (Jetaway Only)													X												X
Change Automatic Transmission Fluid and Filter													X												X
Lubricate and Check Ball Joints (Except F-85)																			X			X			X
Repack Front Wheel Bearings		WHEN BRAKE MAINTENANCE REQUIRES REMOVAL OF FRONT DRUMS																							
Service Air Conditioning		AS REQUIRED—SEE SECTION 14																							

*May require more frequent service under dusty operating conditions.

NOTE: Low or average mileage drivers (less than 6,000 miles in a 60-day period) should use each two-month maintenance interval.
High mileage drivers (6,000 miles or more in 60 days) should use mileage intervals only.

ENGINE

(ALL SERIES)

CONTENTS OF SECTION 3

V-6 ENGINE
33 AND 35 SERIES

V-8 ENGINE
ALL EXCEPT 33 AND 35 SERIES

V-6 ENGINE

DESCRIPTION (Fig. 3-1)

A V-6 engine of 225 cubic inches displacement is standard equipment on 33 and 35 series cars.

The same basic engine is used for both Synchromesh and automatic transmissions. Both engines have a bore of 3.750 inches and a stroke of 3.400 inches. Synchromesh transmission engines are equipped with a cast iron flywheel and flywheel housing, while automatic transmission engines are equipped with a stamped steel flywheel which is bolted to the transmission. All V-6 engines have 9.0:1 compression ratio pistons.

ENGINE CONSTRUCTION

Cylinder Crankcase

The V-6 cylinder crankcase is cast iron. It has two banks of cylinders which form a 90° angle. The crankcase section extends below the centerline of the crankshaft to form a continuous flat surface with the rear bearing cap and timing chain cover, permitting installation of the oil pan with a one-piece gasket.

The left bank of cylinders (as viewed from the driver's seat) is set forward of the right bank so connecting rods of opposite pairs of pistons and rods may be connected to the same crankpin.

The cylinders in the left bank are numbered (from front to rear) 1-3-5. Cylinders in the right bank are numbered (from front to rear) 2-4-6.

Crankshaft and Bearings

The crankshaft is supported in the crankcase by steel-backed full precision bearings, all having the same nominal diameter. Except for the thrust bearing, all bearings are identical. The thrust bearing takes end thrust and has flanges for that purpose. Number 2 bearing is the thrust bearing.

Connecting Rods and Pistons

The lower end of each rod is fitted with a steel-backed full precision-type bearing. The piston pin is a press fit into the upper end. The outer ends of the piston pin are a slide fit in the piston.

Two compression rings and one oil control ring are located above the piston pin. The cast iron compression rings in the two upper grooves of the piston have a groove or bevel cut around the inner edge on one side.

Cylinder Heads

Cylinder heads are cast iron with valve stem guides cast in place. Right and left cylinder heads are identical and interchangeable. Although, in service, it is good practice to install the cylinder heads on the side from which they were removed.

Camshaft and Valve Mechanism (Figs. 3-2 & 3-3)

The camshaft is located above the crankshaft between the two banks of cylinders, where it is supported in five steel backed babbit bearings. It is driven at 1/2 crankshaft speed by sprockets and a single outside guide type chain.

The V-6 engine is equipped with timing chain dampers as shown in Fig. 3-2.

Hydraulic valve lifters and one piece push rods are used to operate overhead rocker arms and valves of both banks of cylinders from a single camshaft. This system requires no lash adjustment at time of assembly or in service. Construction and operation of hydraulic valve lifters are described later.

The rocker arms for each bank of cylinders are mounted on a tubular steel shaft supported on the cylinder head by die cast brackets.

The rocker arms are die cast aluminum with inserts at the push rod socket and the valve stem contact face. The rocker arms are offset slightly to accommodate the different planes of movement of the valves and the push rods. (Fig. 3-4)

Hydraulic Valve Lifters

In addition to its normal function of a cam follower, each hydraulic valve lifter also serves as an automatic adjuster which maintains zero lash in the valve operating linkage under all operating conditions.

As shown in Fig. 3-5, all parts of a hydraulic lifter are housed in the body, which is the cam follower. The body and the plunger are ground to very close limits, then a plunger is selectively fitted to each body to assure free movement with very little clearance. The push rod seat is free to move with the plunger in the body.

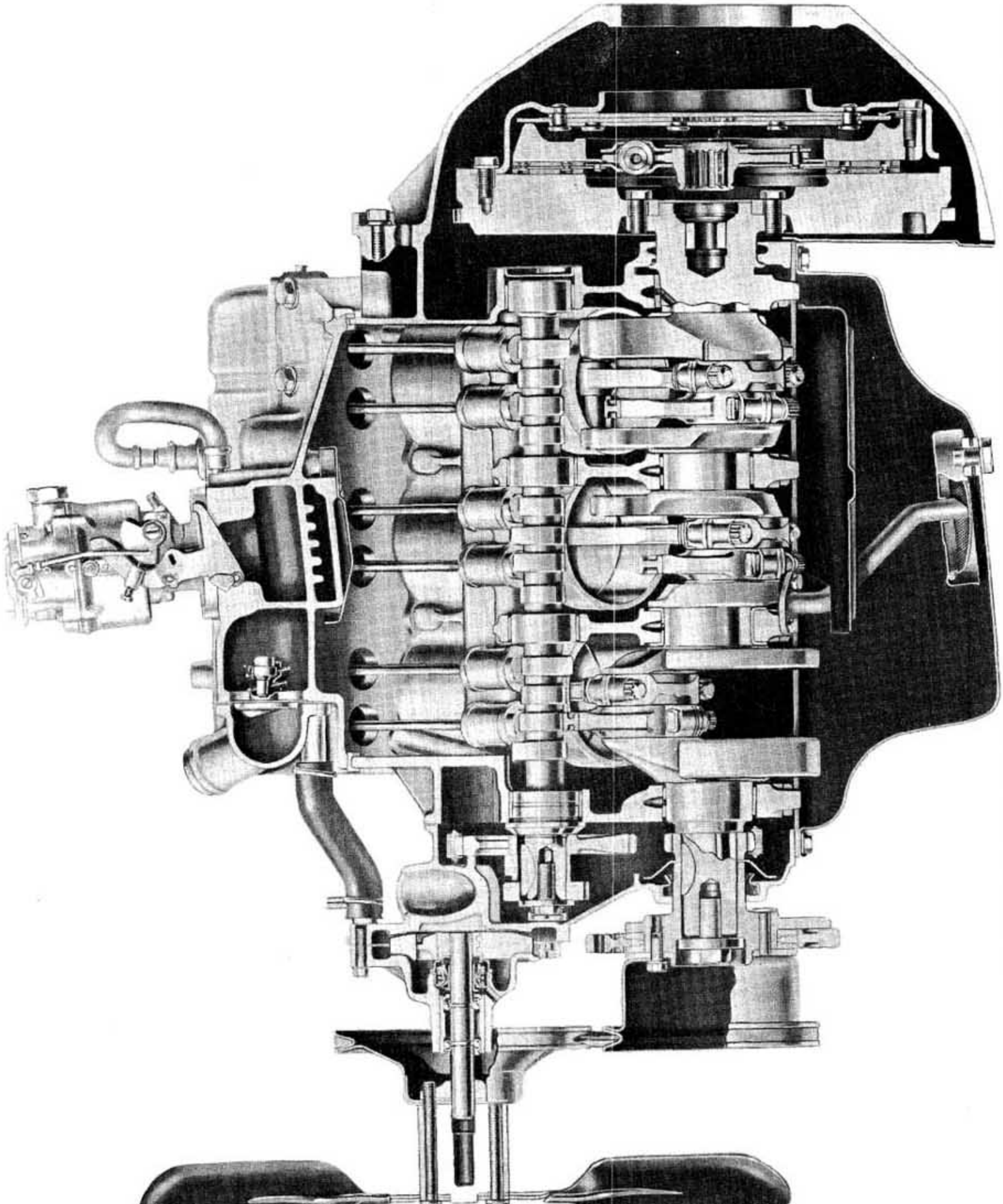


Fig. 3-1 Engine Side Sectional View

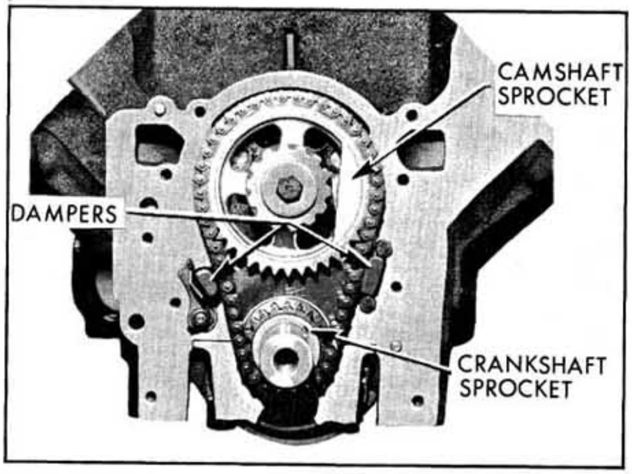


Fig. 3-2 Timing Chain and Sprockets

The plunger and seat are pressed toward the upper end of the lifter body by a coil spring which also holds a check ball retainer against the lower end of the plunger. When lifter is out of engine, a spring wire retainer holds all parts in the body. The ball retainer holds a spring loaded check ball in position over the lower end of a feed hole in the plunger. (Fig. 3-5)

When the valve lifter is installed in the engine, the push rod holds the seat and plunger downward and clear of the plunger retainer at all times. The plunger spring then presses the lifter body down against the camshaft and presses the plunger and seat up against the push rod with an eight

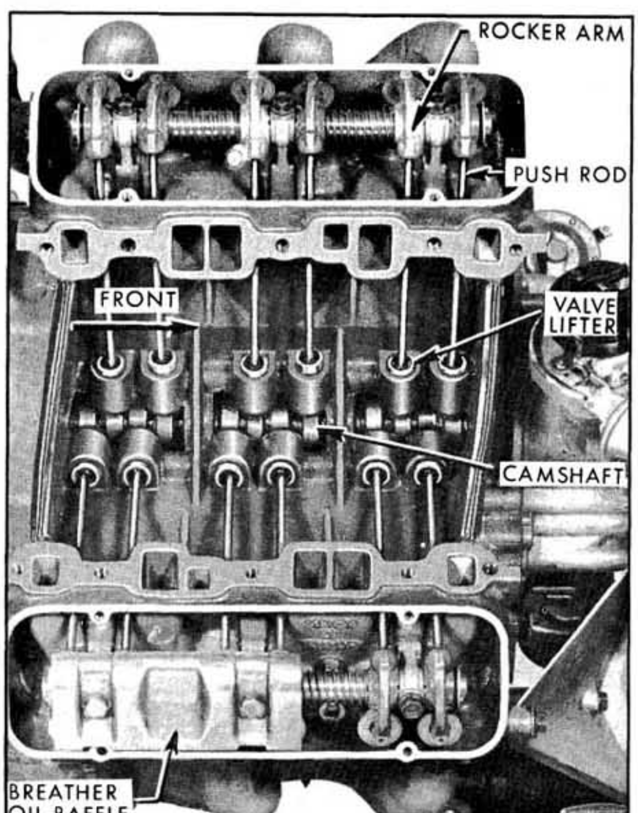


Fig. 3-3 Valve Mechanism

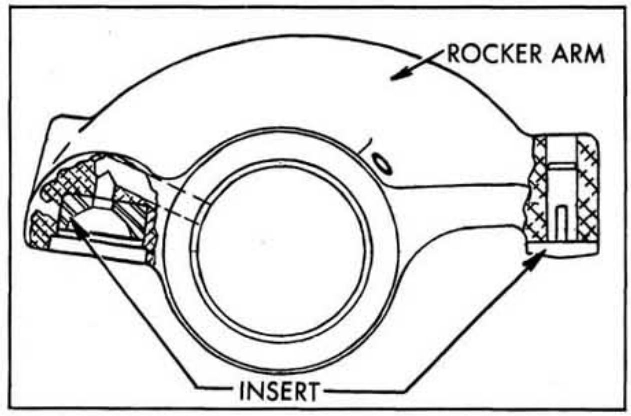


Fig. 3-4 Valve Rocker Arm

pound load, this is enough to take up all lash clearances between parts in the valve linkage without affecting positive seating of the valve.

Oil is fed to all lifters through galleys in the crankcase. Oil enters each lifter through grooves and oil holes in the lifter body and plunger, flows down into the chamber below the plunger through the feed hole and around the check ball. The first few cycles of operation after the engine is started forces out all air and completely fills the plunger and lower chamber of each lifter with oil.

At the start of a cycle of valve operation, the lifter body rests on the camshaft base circle.

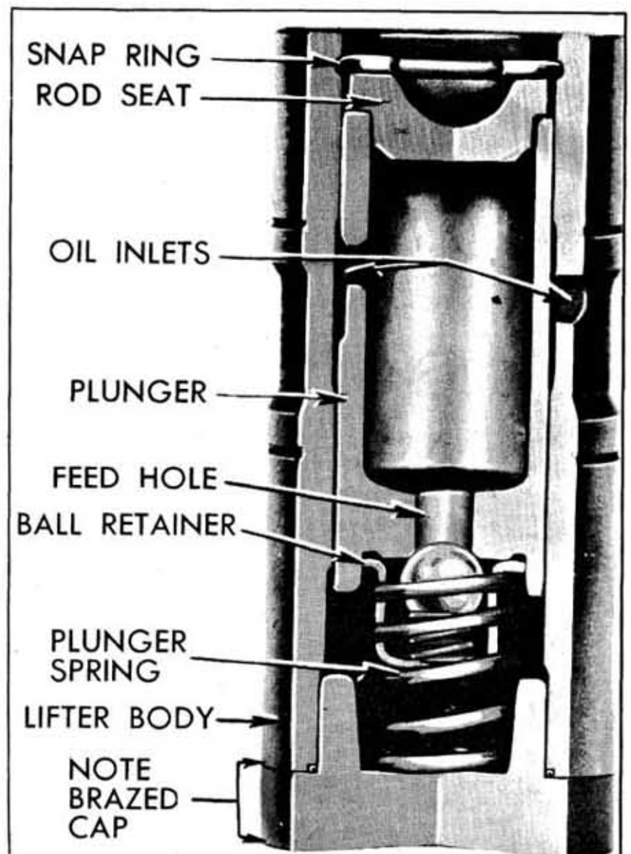


Fig. 3-5 Hydraulic Valve Lifter Sectional View

The plunger spring holds all lash clearances out of the valve linkage.

As the rotating camshaft starts raising the valve lifter body, the check ball spring and oil in the lower chamber, firmly seat the check ball against the plunger to prevent appreciable loss of oil from the lower chamber. The lifting force against the body is then transmitted through the entrapped oil to the check ball and plunger so that the plunger and push rod seat move upward with the body to operate the linkage which opens the engine valve.

As the camshaft rotates further to close the engine valve, the valve spring forces the linkage and lifter to follow the cam down. When the engine valve seats, the linkage parts and lifter plunger stop but the plunger spring forces the body to follow the cam downward .002" to .003" until it again rests on the camshaft base circle. Oil pressure against the check ball from the lower chamber ceases when the plunger stops and allows passage of oil past the check ball into the lower chamber to replace the slight amount of oil lost by "leak-down".

During the valve opening and closing operation a very slight amount of oil escapes through the clearance between plunger and body and returns to the crankcase. This slight loss of oil (called "leak-down") is beneficial in providing a gradual change of oil in the lifter, since fresh oil enters the lower chamber when pressure is relieved on the check ball at the end of each cycle of operation.

When engine temperature increases and the valve linkage parts expand, the plunger must move to a slightly lower position in the lifter body to assure full closing of the engine valve. When engine temperature decreases and the linkage parts contract, the plunger must move to a slightly higher position in body to prevent lash clearances in the valve linkage. In either case, the capacity of the lower chamber changes and the volume of oil present is automatically controlled by passage of oil through the plunger feed hole.

ENGINE LUBRICATION SYSTEM

The engine lubrication system is the force feed type in which oil is supplied under pressure to the crankshaft, connecting rods, camshaft bearings and valve lifters. Oil is supplied under controlled volume to the rocker arm bearings and push rods. All other moving parts are lubricated by gravity flow or splash.

Oil Supply

The supply of oil is carried in the oil pan which is filled through a filler opening in the left valve cover. The filler opening is covered by a combination filter and ventilating cap which contains a metal gauze to exclude dust. An oil dip stick on the left side of the crankcase is provided to check oil level.

Oil Pump

The oil pump is located in the timing chain cover where it is connected by a drilled passage in the cylinder crankcase to an oil screen housing and pipe assembly. The screen is submerged in the oil supply and has ample area for all operating conditions. If the screen should become clogged for any reason, oil may be drawn into the system over the top edge of the screen which is held clear of the sheet metal screen housing.

Oil is drawn into the pump through the screen and pipe assembly and a drilled passage in the crankcase which connects to drilled passages in the timing chain cover. All oil is discharged from the pump to the oil pump cover assembly. The cover assembly consists of an oil pressure relief valve, an oil filter by-pass valve and a nipple for installation of an oil filter. The spring loaded oil pressure relief valve limits the oil pressure to a maximum of 33 pounds per square inch. The oil filter by-pass valve opens when the filter has become clogged to the extent that 4-1/2 to 5 pounds pressure difference exists between the filter inlet and exhaust to by-pass the oil filter and channel unfiltered oil directly to the main oil galleys of the engine.

Oil Filter

A full flow oil filter is externally mounted to the oil filter cover nipple on the right side of the engine just below the Delcotron. Normally, all engine oil passes through the filter element, however, if the element becomes restricted, a spring loaded bypass valve opens as mentioned previously.

Main Oil Galleys

The main oil galleys run the full length of the crankcase and cut into the valve lifter guide holes to supply oil at full pressure to the lifters. Connecting passages drilled in the crankcase permit delivery of oil at full pressure to all crankshaft and camshaft bearings.

Crankshaft, Connecting Rods and Pistons

Holes drilled in the crankshaft carry oil from the crankshaft bearings to the connecting rod bearings. Pistons and cylinder walls are lubricated by oil forced through a small notch in the bearing parting surface on the connecting rod, which registers with the hole in the crankpin once in every revolution. Piston pins are lubricated by splash.

Timing Chain and Sprockets

Drilled holes in the camshaft connect the front camshaft bearing journal to the keyslot in the front of the camshaft. Oil flows from the journal into the keyslot over the woodruff key in the space between the key and the camshaft sprocket and fuel pump eccentric.

The forward end of the fuel pump eccentric incorporates a relief which allows the oil to escape between the fuel pump eccentric and the camshaft distributor gear. The oil stream strikes the distributor shaft gear once each camshaft revolution and provides ample lubrication of the timing chain and sprockets by splash.

Rocker Arms, Valves, and Push Rods

The rocker arms and valves on each cylinder head are supplied with oil from the oil galleys through holes drilled in the front of the cylinder block and cylinder head. The hole drilled in the cylinder head ends beneath the front rocker arm shaft bracket. A notch cast in the base of the rocker arm shaft bracket allows the oil to flow up inside the bracket in the space between the bracket and bolt to the hollow rocker arm shaft which is plugged at both ends. Each rocker arm receives oil through a hole in the under side of the shaft. Grooves in the rocker arm provide lubrication of the bearing surface. Oil is metered to the push rod seat and valve stem through holes drilled in the rocker arm. Excess oil drains off and returns to the oil pan through passages in the cylinder head and block.

ENGINE COOLING SYSTEM

The engine cooling system is the pressure type with thermostatic control of coolant circulation.

The cooling system is sealed by a pressure type radiator filler cap which causes the system to operate at higher than atmospheric pressure. The higher pressure raises the boiling point of the coolant and increases the cooling efficiency of the radiator. The 15 pound pressure cap used raises the coolant boiling point approximately 46°.

The pressure type radiator filler cap contains a blow off or pressure valve and a vacuum or atmospheric valve. The pressure valve is held against its seat by a spring of predetermined strength which protects the radiator by relieving the pressure if the pressure should exceed that for which the radiator is designed.

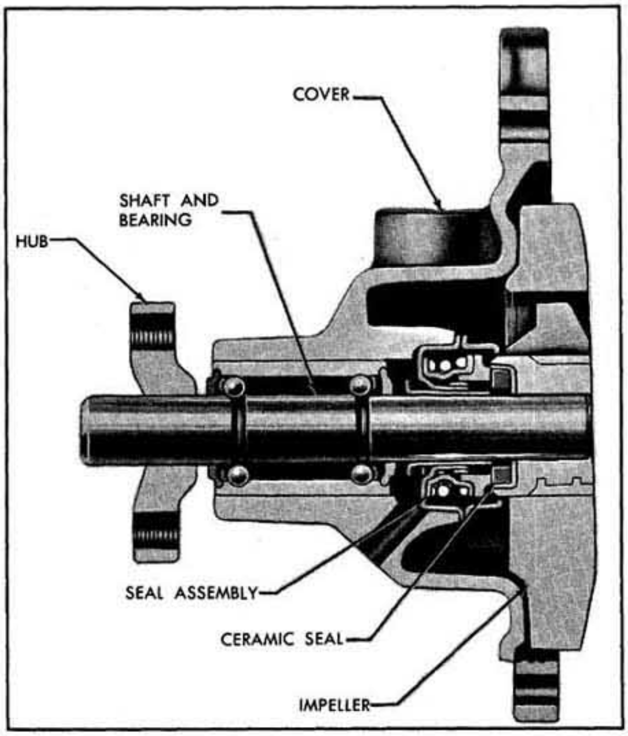


Fig. 3-6 Water Pump Cover

The vacuum valve is held against its seat by a light spring which permits opening of the valve to relieve vacuum created when the system cools off.

The coolant is circulated by a centrifugal pump mounted on the front cover which forms the outlet side of the pump. The engine fan and pulley(s) are bolted to the pump shaft hub at its forward end. Thus both the fan and pump are belt driven by a crankshaft pulley bolted to the harmonic balancer. The pump shaft and bearing assembly is pressed in the aluminum water pump cover. The bearings are permanently lubricated during manufacture and sealed to prevent loss of lubricant and entry of dirt. The pump is sealed against coolant leakage by a packless non-adjustable seal assembly mounted on the pump cover in position to bear against the impeller hub. The inlet pipe cast in the pump cover feeds into the passage formed by the cover and the front face of the impeller, which is mounted on the bearing shaft with the vanes facing rearward. Coolant flows through the inlet passage to the low pressure area at the center where it then flows rearward through three openings in the impeller. Vanes on the rotating impeller cause the coolant to flow radially outward through two discharge passages cast in the timing chain cover. These passages deliver an equal quantity of coolant to each cylinder bank water jacket. (See Figs. 3-6 and 3-7.

The coolant then flows rearward through the water jacket which surrounds each cylinder barrel and extends below the lower limit of piston ring travel. After flowing the full length of the cylinder

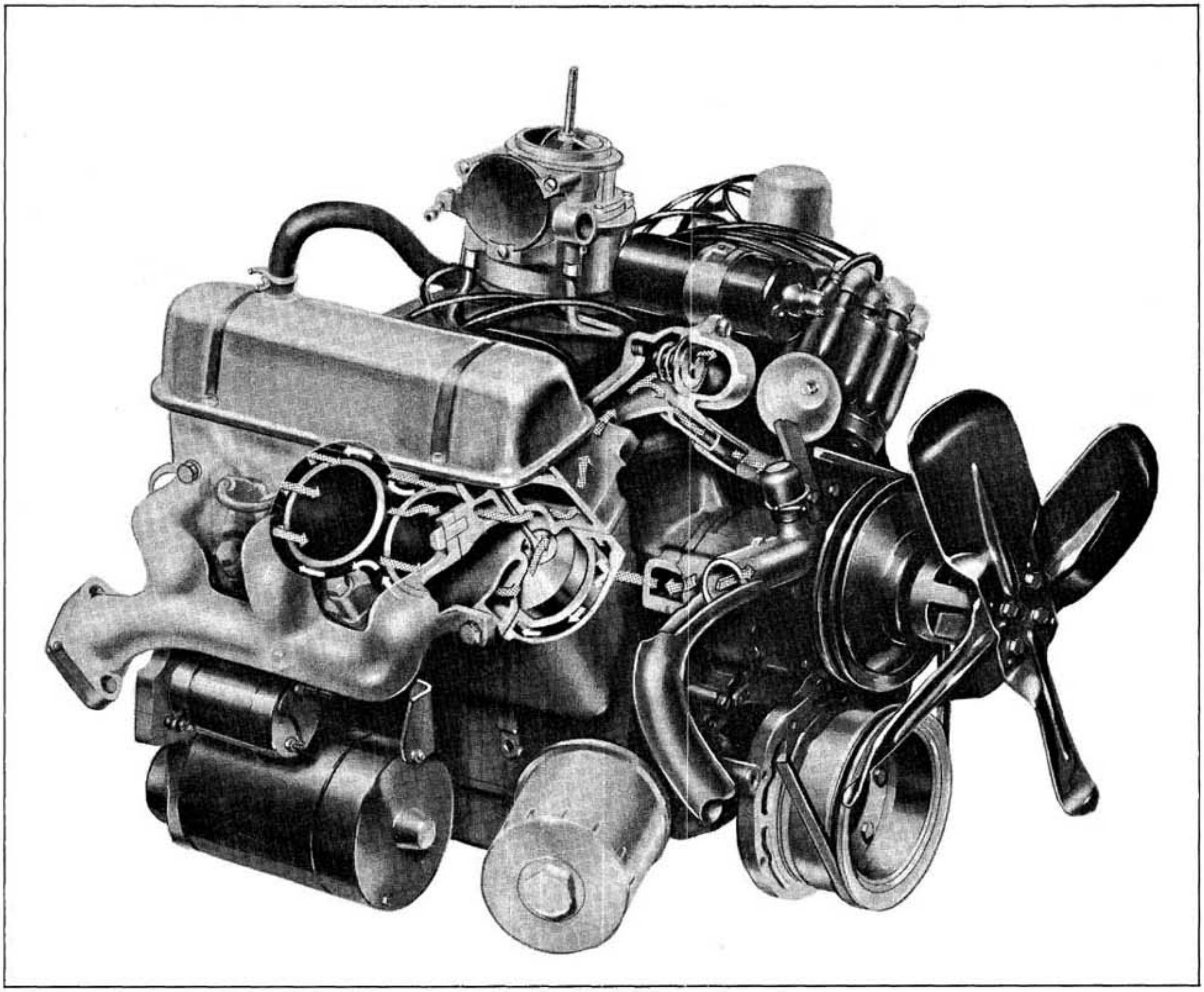


Fig. 3-7 Engine Coolant Flow

banks, the coolant flows up through openings to the rear of the cylinder bank into the cylinder heads. The coolant flows forward in the cylinder heads to cool the combustion chamber areas. At the forward end of the cylinder heads the coolant flows into the intake manifold.

Next, the coolant flows into the intake manifold water passage from the forward port of the cylinder heads to the thermostat housing and thermostat by-pass. A nipple in the mainfold allows connection of the heater hose. See Fig. 3-7.

A pellet type thermostat housed in the forward (outlet) end of the intake mainfold controls the circulation of water through the engine radiator. During cold engine operation when the thermostat is closed, a thermostat by-pass, open at all times, allows recirculation of coolant through the engine to provide rapid warm-up. When the thermostat opens, (177° - 182°F) coolant is directed to the upper tank of the radiator, through the radiator core and lower tank to the water pump inlet where the cycle is repeated.

Excessive Oil Consumption

If an engine is reported to be using an excessive amount of oil, a thorough inspection should be made for external leaks and the conditions of operation should be carefully considered before assuming that the engine is using too much oil as a result of an internal condition.

Place clean paper on the floor under engine and run the engine at medium speed until the oil is thoroughly warmed up, then stop the engine and check for oil leaks and dripping on the paper. Inspect both sides, front and rear ends of engine for wet spots. Pay particular attention to rocker arm cover, timing chain cover, and lower crankcase gaskets. All external leaks should be corrected and the results noted before attempting any internal correction.

The conditions of operation have an important bearing on oil consumption. The following points should be checked:

1. Improper reading of oil gauge rod. An erroneous reading will be obtained if car is not level, gauge rod is not pushed down against stop, or insufficient drain-back time (1 minute) is not allowed after stopping engine. An oversupply of oil may have been added if gauge rod markings were not understood. The space between the "FULL" and "ADD" marks represent 1 quart.

2. Oil too light. The use of oil of lower viscosity than specified for prevailing temperatures will contribute to excessive oil consumption.

3. Continuous high speed driving. In any automobile engine, increased oil consumption per mile may be expected at speeds above 60 MPH.

4. High speed driving following slow speed town driving. When a car is used principally for slow speed town driving under conditions where considerable crankcase dilution occurs, a rapid lowering of oil level may occur when the car is driven for some distance at high speed. This is because the dilution from town driving is removed by the heat of the high speed driving. This condition is normal and should not be mistaken for excessive consumption.

5. Valve Guides worn. Excessive clearance between the valve stem and valve guide can result in high oil consumption.

6. Piston rings not worn in. A new engine, or an engine in which new rings have been installed, will require sufficient running time to wear in the rings against the cylinder walls. During the wear-in period a higher than average oil consumption rate is to be expected, and no attempt should be made to improve oil economy by replacing rings before the engine has been in service for at least 5000 miles.

EXCESSIVE VALVE NOISE

Checking Noise Level of Valve Mechanism

The noise level of the valve mechanism cannot be properly judged where the engine is below operating temperature when the hood is raised or when the valve rocker arm covers are removed.

Before attempting to judge valve noise level, the engine must be thoroughly warmed up (at least 20 minutes of operation at 1200 to 1500 RPM) to stabilize oil and coolant temperatures and bring all engine parts to a normal state of expansion. When the engine is warmed up, listen for engine noise while sitting in the drivers' seat with the hood closed. Run the engine at idle and at various higher speeds. It is advisable to observe the noise level in several engines that have been properly broken in, in order to develop good judgment for checking the noise level in any given engine.

Cause of Noise In Valve Mechanism

If the preceding check indicates the valve mechanism is abnormally noisy, remove the rocker arm covers so that the various conditions that cause noise may be checked. A piece of heater hose of convenient length may be used to pick out the particular valves or valve linkages that are causing abnormal noise. With the engine running at a speed where the noise is pronounced, hold one end of hose to an ear and hold other end about 1/2" from point of contact between rocker arm and valve stem. Mark or record the noisy valves for investigation of following causes.

1. Excessive Oil In Crankcase. Crankcase oil level high enough to allow the crankshaft to churn the oil will cause air bubbles in the lubricating system. Air bubbles entering the hydraulic lifters will cause erratic operation resulting in excessive lash in the valve linkage. Locate and correct cause of high oil level, then run engine long enough to expel air from system.

2. Sticking, Warped or Eccentric Valves, Worn Guides. Sticking valves will cause irregular engine operation or missing on a low speed pull and will usually cause intermittent noise.

   Pour penetrating oil over the valve spring cap and allow it to drain down the valve stem. Apply pressure to the one side of the valve spring and then the other, and then rotate the valve spring about 1/2 turn. If these operations affect the valve noise, it may be assumed that valves should be reconditioned.

3. Worn or scored parts in the valve train. Inspect rocker arms, push rod ends for scoring. Check push-rods for bends, valve lifters and camshaft surfaces for scoring. Replace faulty parts.

4. Valves and seats cut down excessively. Noisy and improper valve action will result if a valve and its seat have been refinished enough to raise the end of the valve stem approximately .050" above normal position. In this case it will be necessary to grind off the end of the valve stem or replace parts. The normal height of the valve stem above the

valve spring seat is 1.825".

5. Faulty Hydraulic Valve Lifters. If the preceding suggestions do not reveal the cause of noisy valve action, check operation of valve lifters.

Checking Hydraulic Valve Lifters

When checking hydraulic valve lifters, remember that grit, sludge, varnish or other foreign matter will seriously affect operation of these lifters. If any foreign substance is found in the lifters or engine where it may be circulated by the lubrication system, a thorough cleaning job must be done to avoid a repetition of lifter trouble.

To help prevent lifter trouble, the engine oil and oil filter must be changed as recommended.

When the car is delivered, faulty valve lifter operation usually appears under one of the following conditions:

1. Rapping noise only when engine is started. When engine is stopped, any lifter on a camshaft lobe is under pressure of the valve spring; therefore, leak down or escape of oil from the lower chamber can occur. When the engine is started a few seconds may be required to fill the lifter, particularly in cold weather. If noise occurs only occasionally, it may be considered normal requiring no correction. If noise occurs daily, however, check for (a) oil too heavy for prevailing temperatures (b) excessive varnish in lifter.

2. Intermittent Rapping Noise. An intermittent rapping noise that appears and disappears every few seconds indicates leakage at check ball seat due to foreign particles, varnish, or defective surface of check ball or seat. Recondition, clean, and/or replace lifters as necessary.

3. Noise on idle and low speed. If one or more valve lifters are noisy on idle and up to approximately 25 mph but quiet at higher speeds, it indicates excessive leakdown rate or faulty check ball seat on plunger. With engine idling, lifters with excessive leak-down rate may be spotted by pressing down on each rocker arm above the push-rod with equal pressure. Clean or replace noisy lifters.

4. Generally noisy at all speeds. Check for high oil level in crankcase. With engine idling, strike each rocker arm above push rod several sharp blows with a mallet; if noise disappears, it indicates that foreign material was keeping check ball from seating. Stop engine and place lifters on camshaft base circle. If there is lash clearance in any valve linkage, it indicates a stuck lifter plunger, worn lifter body lower end, or worn camshaft lobe.

5. Loud noise at normal operating temperature only. If a lifter develops a loud noise when engine is at normal operating temperature, but is quiet when engine is below normal temperature, it indicates an excessively fast leak-down rate or scored lifter plunger. Clean or replace lifter.

ENGINE VIBRATION OR NOISE

If unusual vibration or noise develops in the car, test first to determine whether the condition originates in the engine or in other operating units. Time will often be saved by checking the recent history of the car to determine whether the vibration became noticeable gradually or followed an accident or installation of repair parts.

Vibration or noise is usually more pronounced at a certain car speed. If the engine is run at the equivalent speed with car standing and transmission in neutral, the condition will still exist if the engine or clutch is at fault. If the trouble does not exist with engine running and car standing still, the engine is not at fault.

Engine Tune-Up

An engine which is not properly tuned will run rough and vibrate, particularly at idling and low speeds. A thorough engine tune-up operation is the proper correction.

Fan, Delcotron Belt(s) or Water Pump

Bent fan blades will cause vibration and noise. Remove fan belt and run engine. If vibration or noise is eliminated or reduced it indicates that the condition is caused by the fan, Delcotron, belt, or possibly the water pump. Check water pump for rough or noisy bearings and replace parts as necessary.

Inspect fan belt, all pulleys, balancer, fan blades and Delcotron for undercoating or other material that would cause an unbalanced condition.

Check fan blades for excessive runout and correct if necessary. Check all pulleys for abnormal runout or wobble and replace if necessary. Reinstall fan belt and adjust to proper tension.

With engine running, place one hand on Delcotron and slowly open throttle from idle to approximately 60 MPH. If Delcotron vibrates to create a noise in the car, it will vibrate enough to be felt by the hand. As the engine is slowly speeded up the Delcotron may be felt to go into periods of vibration at different engine speeds. Noise caused by the Delcotron should occur at the same time that Delcotron vibration occurs.

Repair or replace a noisy Delcotron.

Engine Mountings

Vibration may be caused by loose, broken, or deteriorated engine mountings. Tighten loose mountings or replace faulty mountings.

Crankshaft Balancer

Loose or broken rivets in the crankshaft balancer may cause vibration in the engine. If the balancer is damaged in such a manner that the parts cannot function freely, extreme roughness will result which may eventually break the crankshaft. A balancer which shows evidence of damage or which is suspected of being inoperative should be replaced and the result noted, since it is not possible to test the balancer any other way.

Unbalanced Connecting Rods or Pistons

Vibration will result if connecting rods or pistons are installed which are not of equal weight with all other rods or pistons in engine. If new parts have recently been installed, these should be checked to determine whether they are standard parts or if they have been altered in weight by filing, machining or other repairs.

Unbalanced Clutch Assembly or Flywheel

Engine roughness may be caused by an unbalanced combination of clutch, flywheel and crankshaft even though these units are balanced individually during manufacture. Unbalance may occur if clutch or flywheel is removed without marking to allow reinstallation in original position.

Unbalanced Flywheel or Converter Pump

Vibration existing with Jetaway transmission may be due to unbalanced flywheel or converter pump.

COOLING SYSTEM TROUBLE DIAGNOSIS

Excessive Water Loss

If the radiator is filled too full when cold, expansion when hot will overfill the radiator and coolant will be lost through the overflow pipe. Adding unnecessary water will weaken the anti-freeze solution and raise the temperature at which freezing may occur.

The use of alcohol anti-freeze with a high temperature radiator thermostat will cause boiling and loss of coolant through the overflow pipe.

If the cooling system requires frequent addition of water in order to maintain the proper level in the radiator, check all units and connections in the cooling system for evidence of leakage. Inspection should be made with cooling system cold. Small leaks which may show dampness or dripping can easily escape detection when the engine is hot, due to the rapid evaporation of coolant. Tell-tale stains of grayish white or rusty color, or dye stains from anti-freeze, at joints in cooling system are almost always sure signs of small leaks even though there appears to be no dampness.

Air or gas entrained in the cooling system may raise the level in radiator and cause loss of coolant through the overflow pipe. Air may be drawn into the cooling system through leakage at the water pump seal. Gas may be forced into the cooling system through leakage at the cylinder head gasket even though the leakage is not sufficient to allow water to enter the combustion chamber. The following quick check for air leaks on suction side of pump or gas leakage from engine may be made with a piece of rubber tubing and a glass bottle containing water.

1. With cooling system cold, add water to bring coolant to proper level.
2. Block open the radiator cap pressure valve, or use a plain cap, and be sure radiator cap is on tight. Attach a suitable length of rubber hose to overflow pipe.
3. Run engine in neutral at a safe high speed until the engine reaches a constant operating temperature.
4. Without changing engine speed, put the free end of rubber hose into a bottle of water, avoiding kinks or low bends that might block the flow of air.
5. Watch for air bubbles in water bottle. A continuous flow of bubbles indicates that air is being sucked into the cooling system, or exhaust gas is leaking into the cooling system past the cylinder head gasket.

Overheating of Cooling System

It must be remembered that the Oldsmobile pressure system operates at higher temperatures than systems operating at atmospheric pressure. Depending on the pressure in cooling system, the temperature of water or permanent type anti-freeze will go considerably above 212°F without danger of boiling.

In cases of actual overheating the following conditions should be checked:

1. Excessive water loss.
2. Slipping or broken fan belt.
3. Radiator thermostat stuck, radiator air passages clogged, restriction in radiator core, hoses, or water jacket passages.
4. Improper ignition timing.
5. Shortage of engine oil or improper lubrication due to internal conditions.
6. Dragging brakes.

CYLINDER HEAD AND VALVE SERVICE

Cylinder Head Removal

1. Drain radiator and cylinder block. Disconnect battery cable.
2. Remove air cleaner assembly. Disconnect all pipes and hoses from carburetor. Remove coil. Disconnect water temperature indicator wire from switch.
3. Disconnect accelerator linkage. Disconnect throttle return spring. Disconnect positive crankcase ventilator hose.
4. Slide front thermostat bypass hose clamp back on hose. Disconnect bypass hose at timing chain cover to allow coolant to drain from manifold. Disconnect upper radiator hose at outlet.
5. Disconnect heater hose at intake manifold.
6. Remove bolts attaching intake manifold to cylinder heads.
7. Remove intake manifold and carburetor as an assembly. Remove intake manifold gasket and seals.
8. Pull spark plug wire retainers from brackets on rocker arm cover. Disconnect spark plug wires at plugs and swing wires and retainer out of the way.
9. Remove screws attaching rocker arm cover to cylinder head. On right side remove positive crankcase ventilator valve. Remove rocker arm cover and gasket. Remove rocker arm shaft bracket to cylinder head attaching bolts. Remove rocker arm and shaft assembly. Oil baffle is mounted under rear bolts on right rocker arm and shaft assembly.
10. Remove push-rods.

    NOTE: If lifters are to be serviced, remove them. Otherwise protect the lifters and camshaft from the entrance of dirt by covering the area with clean cloths.

11. Remove Delcotron mounting bracket and brace attaching bolts. Position Delcotron out of the way.
12. Remove power steering pump rear bracket to cylinder head attaching bolts.
13. If equipped with Jetaway transmission, remove filler tube support to exhaust manifold bolt.
14. Remove exhaust manifold to exhaust pipe bolts.
15. Remove cylinder head bolts.
16. Remove cylinder head with exhaust manifold attached.
17. If work is to be done on head, remove exhaust manifold on bench.

Reconditioning Valves and Guides

1. Place cylinder head on clean smooth surface.
2. Using suitable spring compressor, compress valve spring and remove cap retainers. Release tool and remove spring and cap.
3. Remove valves. Valves should be set aside so they may be re-installed in original location.
4. Remove carbon from combustion chamber of heads, using care to avoid scratching the head or the valve seats.
5. Clean carbon and gum deposits from valve guide bores.
6. Clean valves. Inspect valve faces and seats for pits, burned spots or other evidence of poor seating.
7. Grind or replace valves as necessary. If a valve head must be ground to a knife edge to obtain a true face, the valve should be replaced; as a sharp edge will run too hot. 45° is the correct angle for valve faces.
8. Valve stem guides are non-replaceable, due to being cast in place. If a valve stem has excessive clearance in its guide, the guide must be reamed .003" oversize, using Reamer

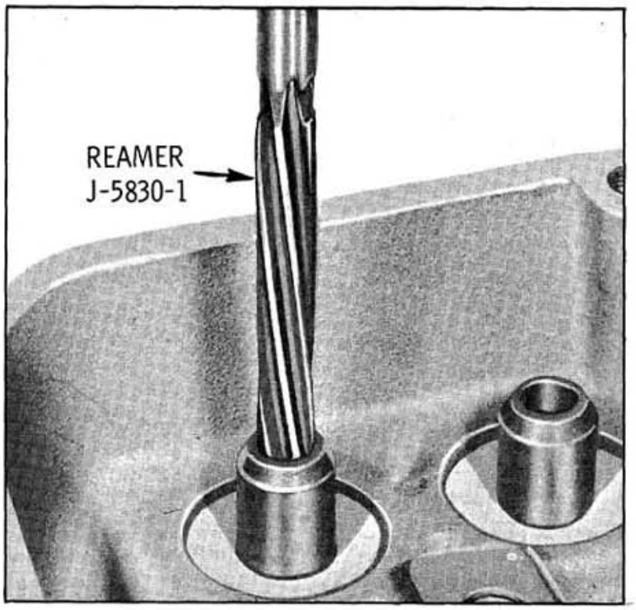


Fig. 3-8 Reaming Valve Guide

J-5830-1. (Fig. 3-8) Oversize valves (.003") are available.

9. True up valve seats to 45°. Cutting a valve seat results in lowering the valve spring pressure and increases the width of the seat. The nominal width of the valve seat is 1/16". If a valve seat is over 5/64" wide after truing up it should be narrowed to specified width by the use of 20° and 70° stones.

Improper hydraulic valve lifter operation may result if valve and seat are refinished to the extent that the valve stem is raised more than .050" above normal height. In this case it will be necessary to replace parts.

The normal height of the valve stem above the valve spring seat surface of the head is 1.825".

10. Lightly lap the valves into seats with fine grinding compound. The refacing and reseating operations should leave the refinished surfaces smooth and true so that a minimum of lapping is required. Excessive lapping will groove the valve face preventing a good seat when hot.

11. Test valves for concentricity with seats and for tight seating. The usual test is to coat the valve face lightly with Prussian blue and turn the valve against seat. If the valve seat is concentric with the valve guide a mark will be made all around the seat, while if the seat is not concentric with the guide, a mark will be made on only one side of the seat. Next, coat the valve seat lightly with Prussian blue. Rotate the valve against the seat to determine if the valve face is concentric with the valve stem, and if the valve is seating all the way around. Both of these tests are necessary to prove that a proper seat is being obtained.

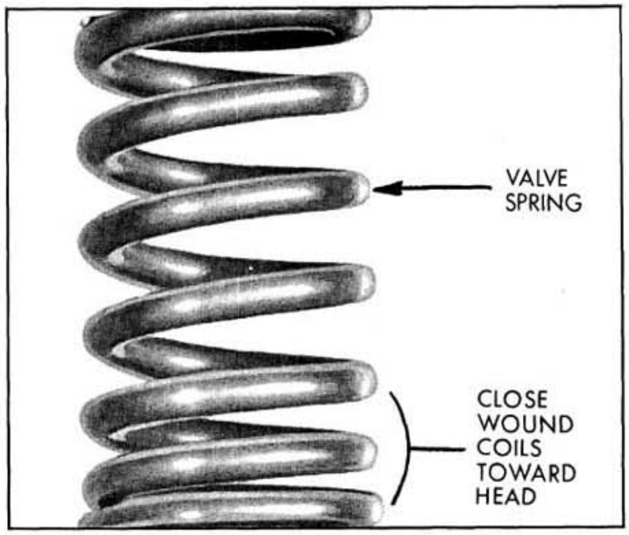


Fig. 3-9 Valve Spring

12. Lube stems and tips with engine oil and reinstall valves, valve springs, caps and cap retainers, using same equipment used for removal. Install valve spring with closely wound coils toward the cylinder head. (Fig. 3-9)

Replacement of Rocker Arms

1. Remove rocker arm and shaft assembly.

2. Remove cotter pin, plain washer and spring washer from each end of the rocker arm shaft.

3. Remove bracket bolts. Slide rocker arms and brackets off shaft.

4. Clean and inspect all parts, taking particular care to clean out all oil holes. Replace parts that are excessively worn.

5. Assemble springs, rocker arms and brackets on shaft. Take care that the assembly for the right side has the notch in the shaft forward and the left side has the notch to the rear.

6. Install spring washer, flat washer and cotter pin on each end of shaft in order named.

7. Install bolts with plain washers through the brackets and shaft so the notch in the right assembly is up and to the front and the notch in the left assembly is up and to the rear.

Installation of Cylinder Head

1. Wipe off engine block gasket surface and be certain no foreign material has fallen in the cylinder bores, bolt holes, or in the valve lifter area. It is good practice to clean out bolt holes with air.

2. Install new head gasket on cylinder block. Dowels in the block will hold the gasket in position. Always handle gaskets carefully to avoid kinking or damage to the surface treatment of the gasket. Do not use any type of sealing material on head gaskets. The gaskets are coated with a special lacquer to provide a good seal, once the parts have warmed up.

3. Assemble exhaust manifold to cylinder head. Torque bolts to 15 ft. lbs.

   NOTE: Jetaway transmission filler tube bracket fastens to rear bolt, right side.

4. Clean gasket surface of cylinder head and carefully set in place on the engine block dowel pins.

5. Clean and coat the head bolts with sealer. Install bolts as shown in Fig. 3-10.

6. Tighten the head bolts a little at a time about three times around in the sequence shown in Fig. 3-11, then torque the bolts in the same sequence to 70 ft. lbs.

Use an accurate torque wrench when installing head bolts and do not overtighten. Uneven tightening of the cylinder head bolts can distort the cylinder bores, causing compression loss and excessive oil consumption.

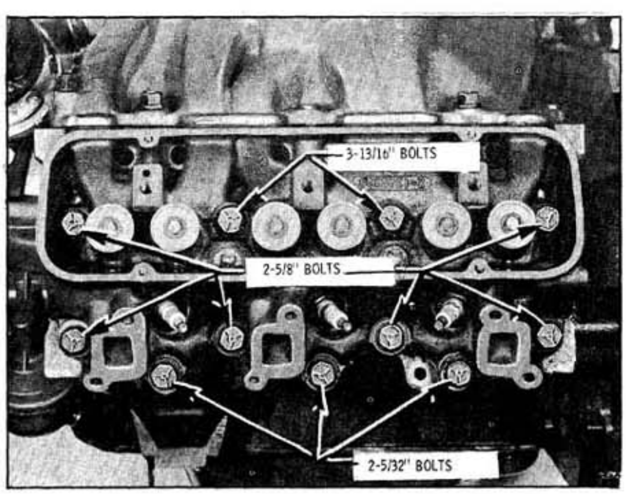


Fig. 3-10 Cylinder Head Bolt Installation

Installation of Rocker Arm and Shaft Assemblies

1. Install push-rods through cylinder head openings so rods are correctly positioned on lifter plungers.

2. Clean bases of rocker arm shaft brackets and bracket bosses on cylinder head.

3. Check notch on one end of rocker arm shaft. Be sure it is positioned correctly.

4. Tilt the rocker arms toward the push rods and locate the top of each push rod in its rocker arm seat.

5. Draw down the rocker arm and shaft assembly by tightening the bracket bolts a little at a time. Use a reliable torque wrench to torque the bracket bolts to 35 ft. lbs. Do not overtighten.

6. Install rocker arm cover and gasket. On right side connect positive crankcase ventilation.

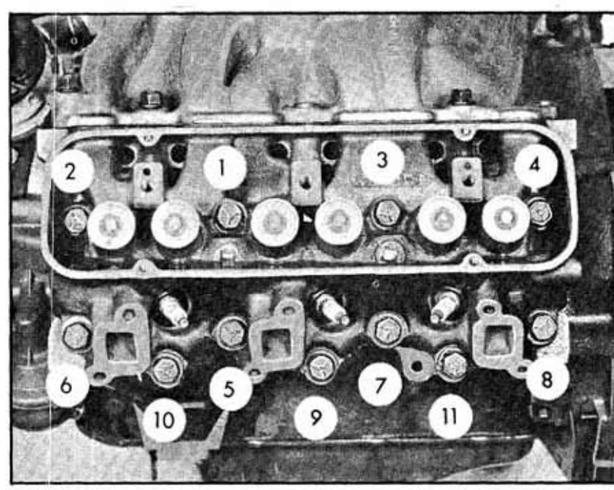


Fig. 3-11 Cylinder Head Bolt Tightening Sequence

7. Connect spark plug wires and set retainers in position on brackets.

VALVE SPRING REMOVAL AND INSTALLATION—HEAD INSTALLED

1. Remove valve cover and rocker arm assembly.

2. Install Tool BT-72-1-B into spark plug hole and use air to hold valves against their seat.

3. Using Tool BT-6413 compress valve spring as shown in Fig. 3-12 and remove valve cap retainers, valve cap and valve spring.

4. To install - reverse removal procedure.

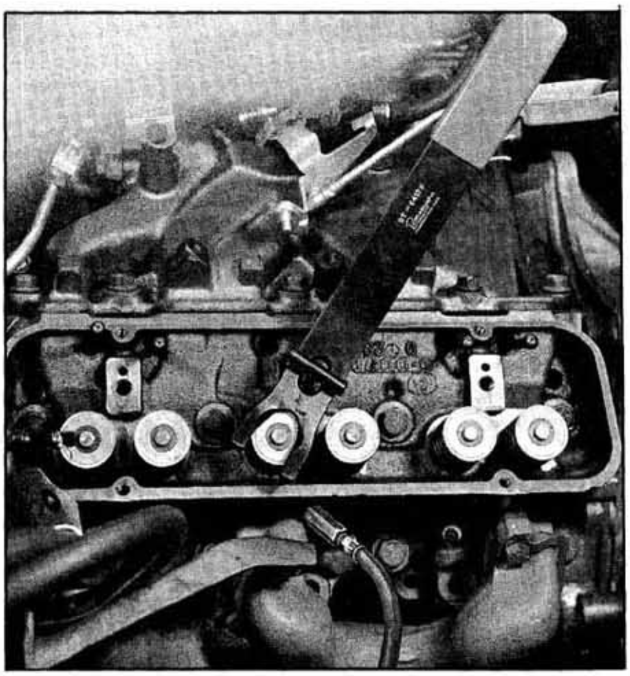


Fig. 3-12 Valve Spring Removal

Installation of Intake Manifold

1. Place new rubber manifold seal in position at front and rear rails of cylinder block. Be sure pointed ends of seal fit snugly against block and head. (Fig. 3-13)

2. Set intake manifold in place carefully and start two guide bolts on each side.

3. Lift the manifold slightly and slip the gaskets into position as shown in Fig. 3-14. Take care to see that the gasket is installed with the three intake manifold ports aligned with the head and manifold. The gasket should be installed as shown in Fig. 3-14 on the left side and reversed for right side installation.

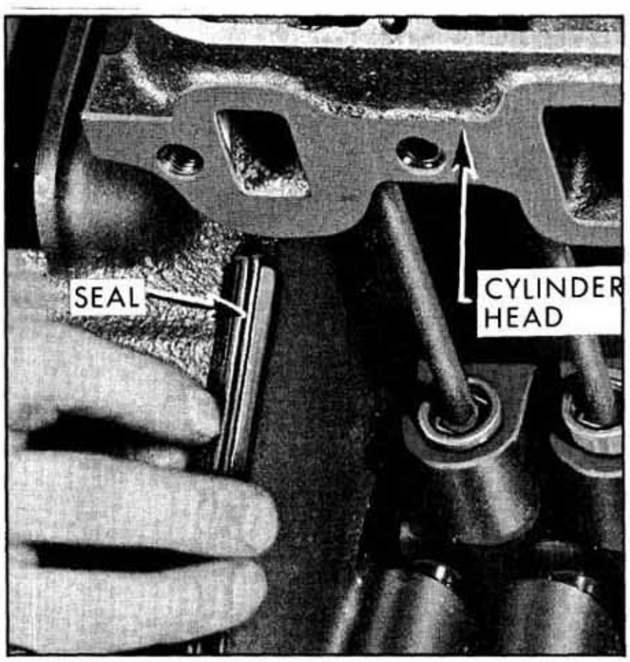


Fig. 3-13 Intake Manifold Seals

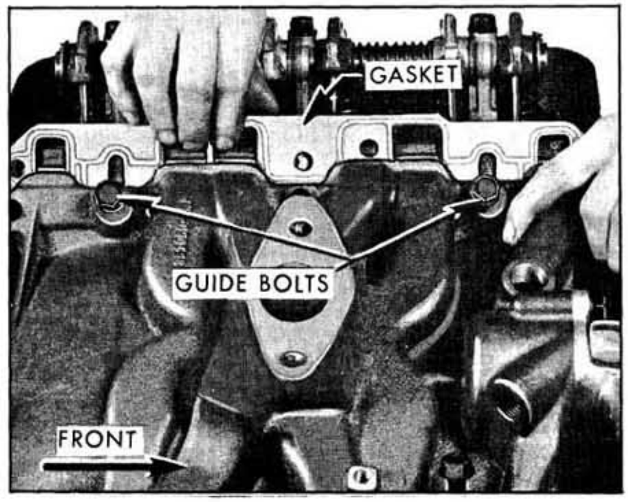


Fig. 3-14 Intake Manifold Gasket

4. Install manifold attaching bolt in open bolt hole as shown in Fig. 3-15. Open bolt hole is held to close tolerances and the bolt in this location serves to locate the manifold fore-and-aft.

5. Install remaining manifold to cylinder head bolts. Longer bolts at forward location. Torque bolts alternately and evenly to 35 ft. lbs.

HYDRAULIC VALVE LIFTER SERVICE

Removal of Valve Lifters

1. Clean dirt from cylinder heads and adjacent parts to avoid getting dirt into engine. It is extremely important to avoid getting dirt into the valve lifters.

2. Remove Intake Manifold.

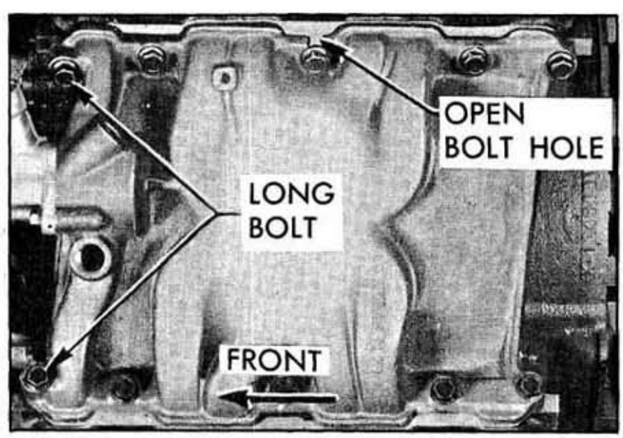


Fig. 3-15 Intake Manifold Installation

3. Remove Rocker Arm Covers and Rocker Arm and Shaft Assemblies.

4. Remove push-rods and remove valve lifters that require service. Place lifters in a wooden block having numbered holes or use other suitable means of identifying them according to original position in the engine.

5. If less than a complete set of lifters is being removed, immediately disassemble one or two for presence of dirt or varnish. If lifters contain dirt or varnish, it is advisable to remove all lifters for cleaning and inspection. Otherwise, it will be satisfactory to service only those lifters that are not operating properly.

6. Examine the cam contact surface at lower end of lifter body. If this surface is excessively worn, galled, or otherwise damaged, discard the lifter assembly. In this case also examine the mating camshaft lobe for excessive wear or damage.

Disassembly and Cleaning of Lifters

1. Disassemble each valve lifter by using a push-rod to hold down the push-rod seat while removing the plunger retainer from the lifter body. Remove push-rod seat and plunger from lifter body.

   NOTE: If a plunger sticks in lifter body place lifter in large end of Plunger Remover BT-6416, with plunger inward. While holding lifter with thumb, rap the open end of remover against a block of wood with just enough force to jar the plunger from body.

2. Drain oil out of body into waste can and remove the ball retainer, ball, ball spring, and plunger spring. A strainer placed over waste can will prevent dropping these parts into can.

3. Wash parts in a suitable cleaning solution and air dry.

Inspection of Hydraulic Lifter Parts

1. Lifter Body. Inspect inner and outer surfaces of body for blow holes and scoring. Replace lifter assembly if body is roughly scored or grooved, or has a blow hole extending through the wall in position to permit oil leakage from lower chamber. The prominent wear pattern just above lower end of body should not be considered a defect unless it is definitely grooved or scored; it is caused by side thrust of cam against body while the lifter is moving vertically in its guide.

   Inspect the cam contact surface on lower end of lifter body. Replace the lifter assembly if this surface is excessively worn, galled, or otherwise damaged. A lifter body that has been rotating will have a round wear pattern and a non-rotating lifter body will have a square wear pattern with a very slight depression near the center.

   Either condition is normal and such bodies may be continued in use if the surface is free of defects.

2. Lifter Plunger. Using a magnifying glass, inspect the check ball seat for defects. Inspect outer surface of plunger for scratches or scores. Small score marks with a rough, satiny finish will cause the plunger to seize when hot but operate normally when cool. Defects in check ball seat or scores or scratches on outer surface of plunger which may be felt with a fingernail are causes for replacing the lifter assembly. This rule does not apply to the slight edge which may sometimes be present where the lower end of plunger extends below the ground inner surface of the body. This edge is not detrimental unless it is sharp or burred.

   A blackened appearance is not a defective condition. Sometimes the discoloration serves to highlight slight grinder chatter marks and give the outer surface of plunger a ridged or fluted appearance. This condition will not cause improper operation, therefore it may be disregarded.

3. Push Rod and Seat. Replace the push rod seat if the area where the push rod contacts is rough or otherwise damaged. Replace any push rod having a rough or damaged ball end.

4. Check Ball. Using a magnifying glass, carefully examine the check ball for nicks, imbedded material or other defects which would prevent proper seating. Such defects would indicate the cause of intermittently noisy lifter

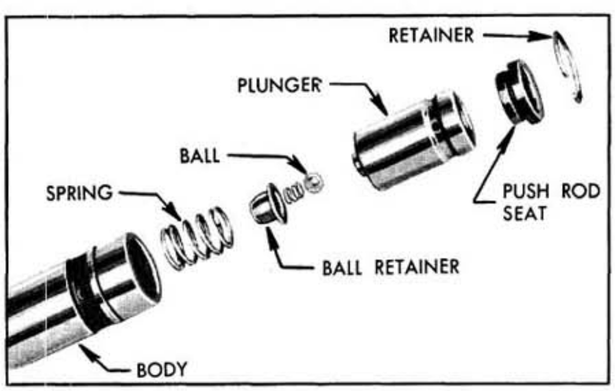


Fig. 3-16 Hydraulic Valve Lifter Parts

operation. Even though no defects are found it is always advisable to discard the old ball and use a new one when reassembling the lifter.

5. Check ball spring. Examine check ball spring for wear or damage. Replace any spring that is distorted or shows evidence of wear.

6. Ball Retainer. Replace a retainer which is cracked or which has a heavily pounded area between the two holes. A small bright spot where the ball contacts the retainer is the normal condition.

7. Plunger Spring. Replace the plunger spring only if it is distorted or damaged. Exhaustive tests have shown that plunger springs seldom break down in service.

Assembly and Valve Lifter Leak-Down Test (Fig. 3-16)

IMPORTANT: Lifters must be assembled while submerged in Hydraulic Lifter Test Fluid BT-59 and leak-down tested before placing into service.

1. Install Adapter 105-2 in reservoir of Tester BT-60, then fill reservoir with Hydraulic Lifter Test Fluid BT-59, 1/2" below top of reservoir.

2. Assemble ball check and retainer into plunger. Make sure retainer flange is pressed tight against bottom of recess in plunger.

3. Install plunger spring over ball check retainer.

4. Hold plunger with spring up and insert into lifter body. Hold plunger vertical to prevent cocking spring.

5. Place assembly into the tester cup then position push rod seat onto plunger.

6. Position the 1/4" steel test ball on the push rod seat. Lower tester ram until it contacts the steel ball.

7. Allow ram to move downward by its own weight until air bubbles disappear.

8. Raise ram, then allow to lower as in Step 7.

   Repeat this procedure several times or until all air is expelled from lifter.

   CAUTION: Do not attempt to expel air from lifter by pumping on ram.

9. After all air is expelled, allow ram to bleed down lifter until retaining groove is exposed.

10. Install retaining ring.

11. Adjust ram screw so that it contacts the steel ball in the push rod seat when the pointer is at the start line.

12. Raise arm, then start test by resting ram on steel ball. Rotate reservoir one revolution every 2 seconds and time the indicator from the start to the stop line. (Fig. 3-17) Allowable tolerance for leak-down rate is 12 to 60 seconds.

13. If leak-down tolerance is within specifications, the lifter can be placed in service without removing test fluid.

Installation of Valve Lifters

Make certain that valve lifter guide holes and adjacent area of cylinder block are clean, then liberally lubricate the camshaft and lifter bores with engine oil and install valve lifters. Each lifter must slide freely in its guide hole.

Complete the installation of all parts by reversing the procedure for removal.

TIMING CHAIN, COVER AND CAMSHAFT SERVICE

Timing Chain Cover Removal

1. Drain radiator and block.

2. Disconnect upper radiator hose and heater return hose at water pump, disconnect lower radiator hose. Remove attaching bolts and brackets and remove radiator core.

3. Remove fan, fan pulleys and belt(s).

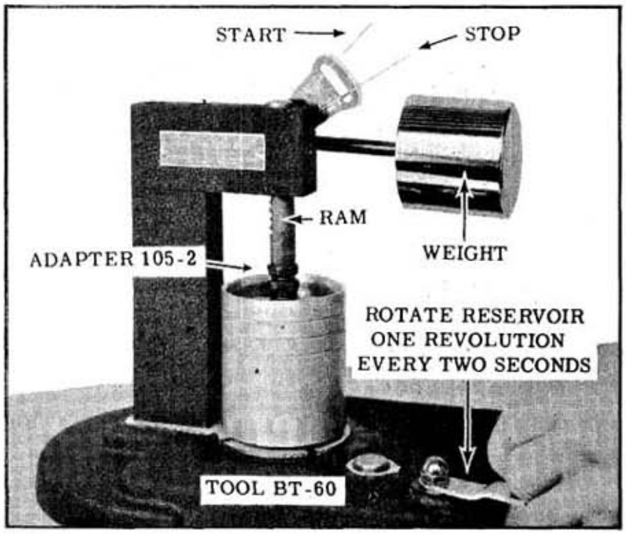


Fig. 3-17 Valve Lifter Bleed Down Test

4. Remove crankshaft pulley and pulley reinforcement.
5. Remove harmonic balancer to crankshaft bolt and washer. Remove harmonic balancer. It may be necessary to tap the balancer with a plastic mallet to start it off the crankshaft.
6. If car is equipped with power steering, remove steering pump bracket bolts attached to timing chain cover and loosen or remove other bolts to allow the brackets and pump to be moved out of the way.
7. Disconnect fuel lines and remove fuel pump.
8. Remove Delcotron and brackets.
9. Remove distributor cap and pull spark plug wire retainers off brackets on rocker arm cover. Swing distributor cap, with wires attached, out of the way. Disconnect distributor primary lead.
10. Remove distributor. If timing chain and sprockets are not going to be disturbed, note position of distributor rotor for reinstallation in same position.
11. Loosen and slide front clamp on thermostat bypass hose rearward.
12. Remove bolts attaching timing chain cover to cylinder block. Remove two oil pan to timing chain cover bolts. Remove timing chain cover assembly and gasket. Thoroughly clean the cover, taking care to avoid damage to the gasket surfaces.

Crankshaft Oil Seal Replacement

1. Remove front cover.
2. Lay front cover flat on bench.
3. Remove seal retainer with drift. (Fig. 3-18)

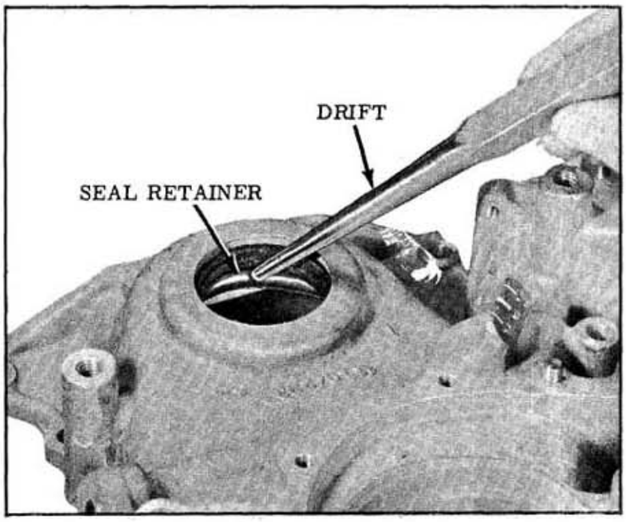


Fig. 3-18 Removing Front Oil Seal

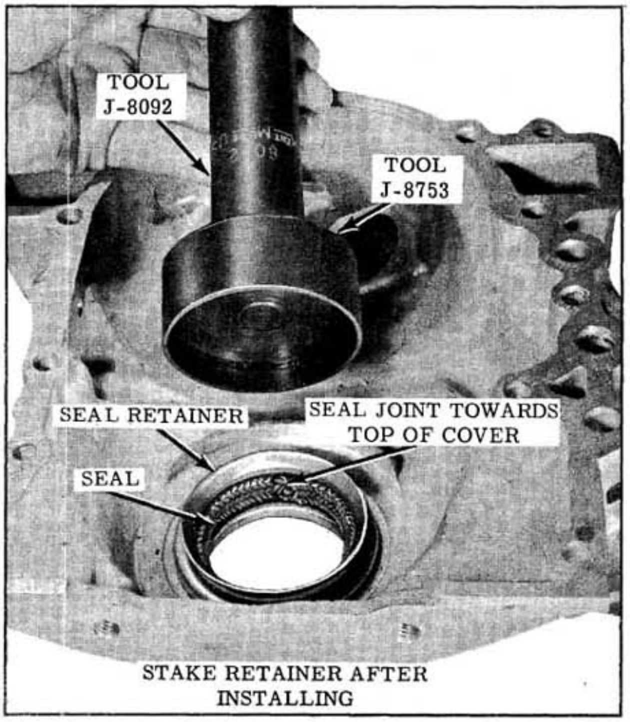


Fig. 3-19 Installing Front Seal

4. Assemble seal in retainer.
5. Support front cover on block of wood. Apply 1050026 sealer to outside of seal retainer.
6. Place seal and retainer in cover with seal joint towards top of cover, and install with Tool J-8753 until seated. Stake retainer securely. (Fig. 3-19)
7. Place Tool J-8753-2 in seal and push tool a little at a time from both sides of the seal until tool goes through seal. (Fig. 3-20)

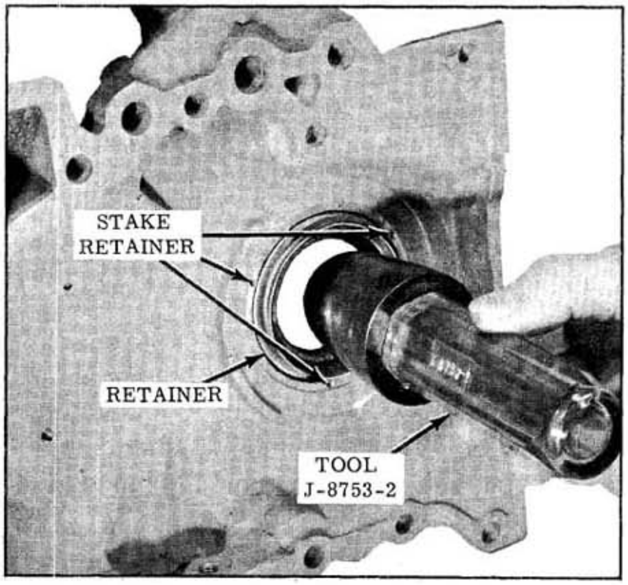


Fig. 3-20 Sizing Front Oil Seal

Timing Chain Cover Replacement

Reinstall timing chain cover by reversing removal procedure, paying particular attention to the following points.

1. Remove oil pump cover and pack the space around the oil pump gears completely full of petroleum jelly. There must be no air space left inside the pump. Reinstall cover using new gasket. This step is very important as the oil pump may "lose its prime" whenever the pump, pump cover or timing chain cover is disturbed. If the pump is not packed, it may not begin to pump oil as soon as the engine is started.

2. The gasket surface of the block and timing chain cover must be smooth and clean. Use a new gasket and be certain it is positioned correctly.

3. Position timing chain cover against block and be certain dowel pins engage dowel pin holes before starting bolts.

4. Lube the bolt threads before installation.

   NOTE: If the car is equipped with power steering the front steering pump bracket should be installed at this time.

5. Lube the OD of the harmonic balancer before installation to prevent damage to the seal during installation and when the engine is first started.

Timing Chain and Sprocket Removal

1. With timing chain cover removed, temporarily install harmonic balancer bolt and washer in end of crankshaft. Turn crankshaft so sprockets are positioned as shown in Fig. 3-21. Doing so will make it easier to reinstall parts. Remove harmonic balancer bolt and washer using a sharp rap on the wrench handle to start the bolt out without changing position of sprockets.

   NOTE: It is not necessary to remove timing chain dampers unless they are worn or damaged and require replacement.

2. Remove front crankshaft oil slinger.

3. Remove bolt and special washer retaining camshaft distributor drive gear and fuel pump eccentric to camshaft forward end. Slide gear and eccentric off camshaft.

4. Use two large screwdrivers to alternately pry the camshaft sprocket then the crankshaft sprocket forward, until the camshaft sprocket is free, then remove the camshaft sprocket and chain and finish working crankshaft sprocket off crankshaft.

5. Thoroughly clean the timing chain, sprockets, distributor drive gear, fuel pump eccentric and crankshaft oil slinger.

Timing Chain and Sprocket Installation

1. Turn crankshaft so number one piston is at top dead center.

2. Turn camshaft so with sprocket temporarily installed, timing mark is straight down. See Fig. 3-21. Remove sprocket.

3. Assemble timing chain on sprockets and slide the sprocket and chain assembly on the shafts with the timing marks in their closest together position and in line with the sprocket hubs. (Fig. 3-21)

   NOTE: It will be necessary to hold spring loaded timing chain damper out of the way while sliding chain and sprockets into position.

4. Assemble slinger on crankshaft with ID against sprocket. (Concave side toward front of engine.)

5. Slide fuel pump eccentric on camshaft and key with oil groove forward. See Fig. 3-22.

6. Install distributor drive gear. See Fig. 3-22.

7. Install drive gear and eccentric bolt and retaining washer. Torque to 45 ft. lbs.

8. Reinstall timing chain cover.

Camshaft Replacement

1. Remove rocker arm and shaft assemblies, push rods and valve lifters.

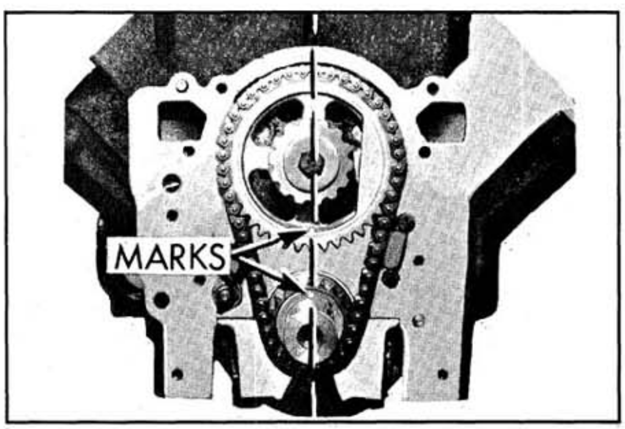


Fig. 3-21 Timing Chain and Sprockets

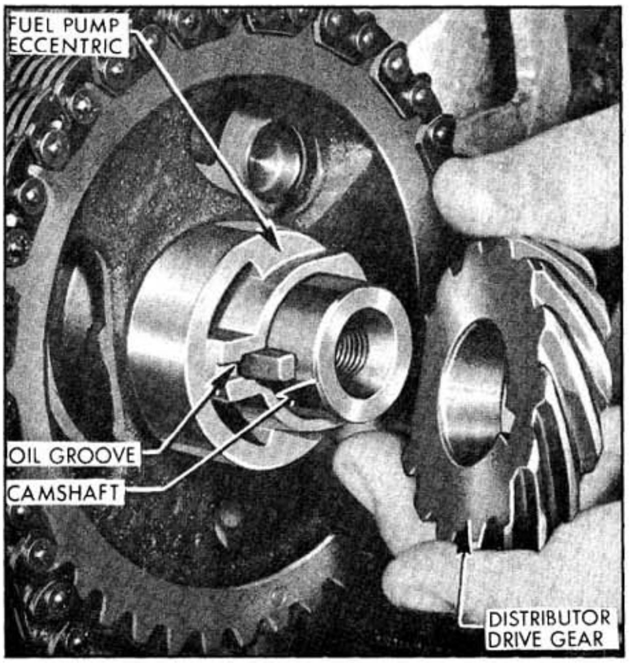


Fig. 3-22 Fuel Pump Eccentric

2. Remove timing chain cover, timing chain and sprocket.

3. Slide camshaft forward out of bearing bores carefully to avoid marring the bearing surfaces.

4. Replace camshaft by reversing removal procedure, taking particular care to avoid damage to the camshaft bearings.

Camshaft Bearings

The steel-backed babbit-lined camshaft bearings are pressed into the crankcase. Going from front to rear, each bearing is bored .030" smaller than the preceding bearing, and each camshaft journal is correspondingly reduced in diameter.

Slightly scored camshaft bearings will be satisfactory if the surfaces of camshaft journals are polished and bearings are cleaned up to remove burrs, and the fit of the shaft in bearings is free and within the clearance limits of .0015" to .004".

REMOVAL AND INSPECTION OF OIL PAN, OIL PUMP PIPE AND SCREEN ASSEMBLY

1. Raise car and support on stands.

2. Drain oil.

3. Remove lower flywheel housing bolts. Remove housing.

4. Remove oil pan bolts and lower oil pan enough to remove oil pump pipe and screen to cylinder block bolts. (Fig. 3-22A)

   NOTE: On Synchromesh it will be necessary to raise engine.

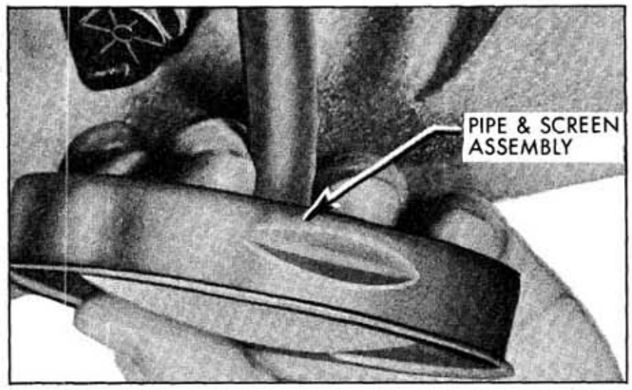


Fig. 3-22A Oil Pump Pipe and Screen Assembly

5. Rotate crankshaft to provide maximum clearance at forward end of oil pan. Move front of pan to the right and lower pan.

6. Clean oil pan. Pry screen out of housing and examine for evidence of clogging due to deposit of sludge or other foreign material.

7. Clean the screen and housing thoroughly in solvent and blow dry with air stream.

8. Snap screen into housing.

Install by reversing removal procedure, paying particular attention to the following points.

1. Make sure oil pump pipe flange gasket surface of block is smooth and free of dirt.

2. Use a new gasket and tighten bolts to 15 ft. lbs. torque.

3. Tighten pan bolts evenly. Do not over tighten.

OIL PUMP SERVICE

Removal of Oil Pump Cover and Gears

1. Remove oil filter.

2. Remove screws attaching oil pump cover assembly to timing chain cover. Remove cover assembly and slide out oil pump gears.

Inspection

1. Wash off gears and inspect for wear, scoring, etc. Replace any unsatisfactory gears.

2. Remove the oil pressure relief valve cap, spring and valve. (Fig. 3-23). Oil filter bypass valve and spring are staked in place and should not be removed.

3. Wash the parts thoroughly and inspect the relief valve for wear or scoring. Check the relief valve spring to see that it is not worn on its side or collapsed. Replace any relief

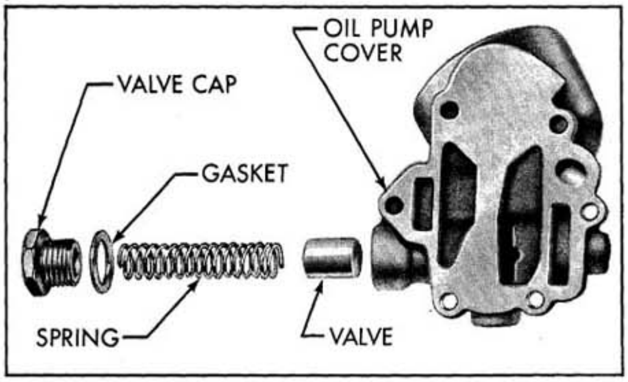


Fig. 3-23 Oil Pump Cover

valve spring that is questionable. Thoroughly clean the screen staked in the cover.

4. Check the relief valve in its bore in the cover. The valve should have no more clearance than an easy slip fit. If any perceptible side shake can be felt, the valve and/or the cover should be replaced.

5. Check filter bypass valve for cracks, nicks, or warping. The valve should be flat and free of nicks or scratches.

Assembly and Installation

1. Lubricate and install pressure relief valve and spring in bore of oil pump cover. (Fig. 3-23) Install cap and gasket. Torque cap to 35 ft. lbs. with a reliable torque wrench. Do not overtighten.

   NOTE: PRESSURE RELIEF VALVE CAP HAS NO HOLE TAPPED FOR INSTALLATION OF OIL PRESSURE SWITCH.

2. Install oil pump gears and shaft in oil pump body section of timing chain cover to check gear end clearance.

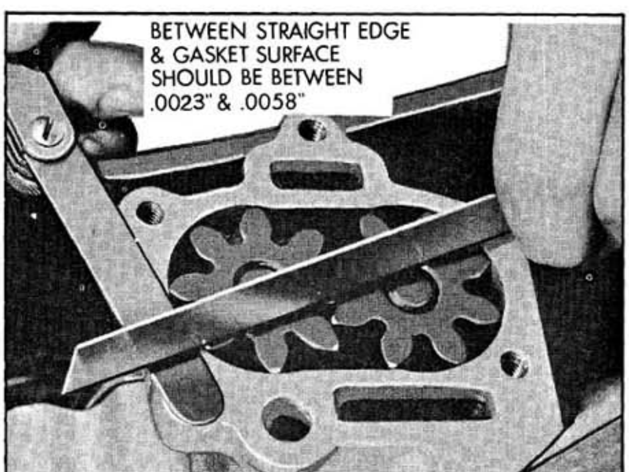


Fig. 3-24 Checking End Clearance

3. Place a straight edge over the gears and measure the clearance between the straight edge and the gasket surface. Clearance should be between .0023" and .0058". If clearance is less than .0023" check timing chain cover gear pocket for evidence of wear. (Fig. 3-24)

4. If gear end clearance is satisfactory, remove gears and pack gear pocket full of petroleum jelly. Do not use chassis lube.

5. Reinstall gears so petroleum jelly is forced into every cavity of the gear pocket and between the teeth of the gears. Place new gasket in position. (Fig. 3-25)

   NOTE: THIS STEP IS VERY IMPORTANT. UNLESS THE PUMP IS PACKED WITH PETROLEUM JELLY, IT MAY NOT PRIME ITSELF WHEN THE ENGINE IS STARTED.

6. Install cover assembly screws. Tighten alternately and evenly. The torque specification is 12 ft. lbs.

7. Install filter on nipple.

REPLACEMENT OF CONNECTING ROD BEARINGS

A connecting rod bearing consists of two halves or shells which are alike and interchangeable in rod and cap. When the shells are placed in rod and cap the ends extend slightly beyond the parting

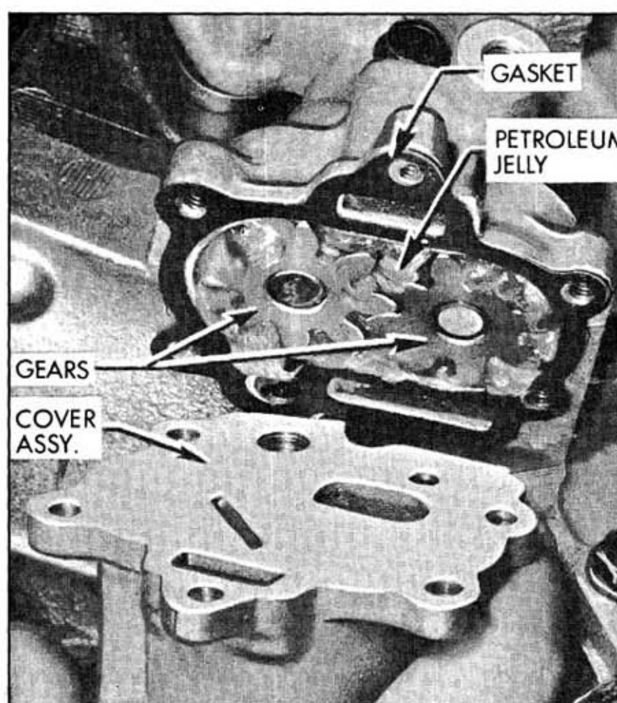


Fig. 3-25 Packing Oil Pump

surfaces so that when rod bolts are tightened the shells will be clamped tightly in place to insure positive seating and to prevent turning. The ends of shells must never be filed flush with parting surface of rod or cap.

If a connecting rod bearing becomes noisy or is worn so that clearance on crankpin is excessive, a new bearing of proper size must be selected and installed since no provision is made for adjustment.

Inspection of Connecting Rod Bearings and Crankpin Journals

After removal of oil pan, disconnect two connecting rods at a time from crankshaft and inspect the bearings and crankpin journals. While turning crankshaft it is necessary to temporarily reconnect the rods to crankshaft to avoid possibility of damaging the journals through contact with loose rods.

If connecting rod bearings are chipped or scored they should be replaced. If bearings are in good physical condition check for proper clearance on crankpin as described below.

If crankpin journals are scored or ridged the crankshaft must be replaced, to insure satisfactory life of connecting rod bearings. Slight roughness may be polished out with fine grit polishing cloth thoroughly wetted with engine oil. Burrs may be honed off with a fine oil stone.

Use an outside micrometer to check crankpins for out-of-round. If crankpins are more than .0015" out-of-round, satisfactory life of new bearings cannot be expected.

Checking Clearance and Selecting Replacement Bearings

Service bearings are furnished in standard size and several undersizes.

The clearance of connecting rod (and crankshaft) bearings may be checked by use of Plastigage.

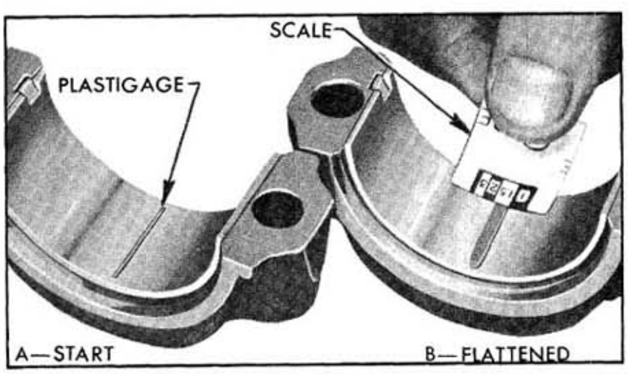


Fig. 3-26 Checking Bearing Clearance

1. Remove connecting rod cap with bearing shell. Wipe oil from bearing and crankpin journal.

2. Place a piece of Plastigage lengthwise along the bottom center of the lower bearing shell (Fig. 3-26, View A), then install cap with shell and tighten bolt nuts to 35 ft. lbs. torque.

   NOTE: The rib on edge of cap and the conical boss on web of rod must be toward rear of engine on all rods in left bank and toward front of engine in right bank.

3. DO NOT TURN CRANKSHAFT with Plastigage in bearing.

4. Remove bearing cap with bearing shell, the flattened Plastigage will be found adhering to either the bearing shell or the crankpin. Do not remove it.

5. Using the scale printed on the Plastigage envelope, measure the flattened Plastigage at its widest point. The number within the graduation which most closely corresponds to the width of Plastigage indicates the bearing clearance in thousandths of an inch. See Fig. 3-26, View B.

6. The desired clearance with a new bearing is .0002" to .0023". If bearing has been in service it is advisable to install a new bearing if the clearance exceeds .003"; however, if bearing is in good condition and is not being checked because of bearing noise, it is not necessary to replace the bearing.

7. If a new bearing is being selected, try a standard size, then each undersize bearing in turn until one is found that is within the specified limits when checked for clearance with Plastigage.

   NOTE: Each undersize bearing shell has a number stamped on outer surface on or near the tang to indicate amount of undersize.

8. After the proper size bearing has been selected, clean off the Plastigage, oil the bearing thoroughly, reinstall cap with bearing shell and tighten bolt nuts to 35 ft. lbs. torque.

9. With selected bearing installed and bolts tightened, it should be possible to move connecting rod freely back and forth on crankpin as allowed by end clearance. If rod cannot be moved, either the bearing is too much undersize or a misaligned rod is indicated.

REPLACEMENT OF CRANKSHAFT BEARINGS

A crankshaft bearing consists of two halves or shells which are not alike and not interchangeable in cap and crankcase. The upper (crankcase) half of the bearing is grooved to supply oil to the connecting rod bearings while the lower (bearing cap) half of the shell is not grooved. The two bearing halves must not be interchanged. All crankshaft bearings except the thrust bearing are identical. The thrust bearing is longer and flanged to take end thrust. When the shells are placed in crankcase and bearing cap, the ends extend slightly beyond the parting surfaces so that when cap bolts are tightened the shells will be clamped tightly in place to insure positive seating and to prevent turning. The ends of shells must never be filed flush with parting surface of crankcase or bearing cap.

If the thrust bearing shell is disturbed or replaced it is necessary to line up the thrust surfaces of the bearing shell before the cap bolts are tightened. To do this, move the crankshaft fore and aft the limit of its travel several times with the bearing cap bolts finger tight.

Crankshaft bearings are the precision type which do not require reaming to size or other fitting. Shims are not provided for adjustment since worn bearings are readily replaced with new bearings of proper size. Bearings for service replacement are furnished in standard size and undersizes. Under no circumstances should crankshaft bearing caps be filed to adjust for wear in old bearings.

Inspection of Crankshaft Bearings and Crankshaft

After removal of oil pan, oil pump pipe and screen, perform the following removal, inspection and installation operations on each crankshaft bearing in turn so that the crankshaft will be well supported by the other bearings.

NOTE: If crankshaft has been removed to check straightness the following procedure is suggested.

Rest crankshaft on "veeblocks" at number one and number five main bearing journals. Check indicator runout at No. 2, 3 and 4 main bearing journals. Total indicator readings at each journal should not exceed .003".

While checking runout at each journal note relation of "high" spot (or maximum eccentricity) on each journal to the others. "High" spot on all journals should come at the same angular location. If "high" spots do not come at nearly the same angular location, crankshaft has a "crook" or "dogleg" in it and is unsatisfactory for service.

1. Since any service conditions which affects the crankshaft bearings may also affect the connecting rod bearings, it is advisable to inspect connecting rod bearings first. If crankpins are worn to the extent that crankshaft should be replaced, replacement of crankshaft bearings only will not be satisfactory.
2. Remove one bearing cap, then clean and inspect lower bearing shell and the crankshaft journal. If journal surface is scored or ridged, the crankshaft must be replaced to insure satisfactory operation with new bearings. Slight roughness may be polished out with fine grit polishing cloth thoroughly wetted with engine oil, and burrs may be honed off with a fine stone.
3. If condition of lower bearing shell and crankshaft journal is satisfactory, check the bearing clearance with Plastigage as described for connecting rod bearings.
4. When checking a crankshaft bearing with Plastigage, turn crankshaft so that oil hole is up to avoid dripping of oil on Plastigage. Place paper shims in lower halves of adjacent bearings and tighten cap bolts to take the weight of crankshaft off the lower shell of bearing being checked.
5. If bearing clearance exceeds .003", it is advisable to install a new bearing; however, if bearing is in good condition and is not being checked because of bearing noise, it is not necessary to replace the bearing.

Selection and Installation of a New Crankshaft Bearing

1. Loosen all crankshaft bearing cap bolts 1/2 turn, and remove cap of bearing to be replaced.
2. Remove upper bearing shell.
3. The crankshaft journal cannot be measured with an outside micrometer when shaft is in place; however, when upper bearing shell is removed the journal may be checked for out-of-round by using a special crankshaft caliper and inside micrometer. The caliper should not be applied to journal in line with oil hole.

   If crankshaft journal is more than .0015" out-of-round, the crankshaft should be replaced since the full mileage cannot be expected from bearings used with an excessively out-of-round crankshaft.

4. Before installation of bearing shells make sure that crankshaft journal and the bearing seats in crankcase and cap are thoroughly cleaned.
5. Coat inside surface of upper bearing shell

with engine oil and place shell against crankshaft journal so that tang on shell will engage notch in crankcase when shell is rotated into place.

IMPORTANT: Upper bearing shells have an oil groove in their center, while lower shells are plain. They must not be interchanged.

6. Rotate bearing shell into place.

7. Place lower bearing shell in bearing cap, then check clearance with Plastigage as previously described.

8. The desired clearance with a new bearing is .0005" to .0025". If this clearance cannot be obtained with a standard size bearing, insert an undersize bearing and check again with Plastigage.

   NOTE: Each undersize shell has a number stamped on outer surface on or near the tang to indicate amount of undersize.

9. When the proper size bearing has been selected, clean out all Plastigage, oil the lower shell and reinstall bearing cap. Clean the bolt holes and lube bolts, then torque cap bolts to 70 ft. lbs. The crankshaft should turn freely at flywheel rim; however, a very slight drag is permissible if an undersize bearing is used.

10. If the thrust bearing shell is disturbed or replaced it is necessary to line up the thrust surfaces of the bearing shell before the cap bolts are tightened. To do this, move the crankshaft fore and aft the limit of its travel several times with the thrust bearing cap bolts finger tight.

11. After bearing is installed and tested, loosen all bearing cap bolts 1/2 turn and continue with other bearings. When bearings have been installed and tested, tighten all bearing cap bolts to specification.

Installation of Rear Bearing Oil Seals

Braided fabric seals are pressed into grooves formed in crankcase and rear bearing cap to rear of the oil collecting groove, to seal against leakage of oil around the crankshaft.

Neoprene composition seals are placed in grooves in the sides of bearing cap to seal against leakage in the joints between cap and crankcase. The neoprene composition swells in the presence of oil and heat. The seals are undersize when newly installed and may even leak for a short time until the seals have had time to swell and seal the opening.

The braided fabric seal can be installed in crankcase only when crankshaft is removed; however, the seal can be replaced in cap whenever cap is removed. Remove old seal and place new seal in groove with both ends projecting above parting surface of cap. Force seal into groove, using Tool J-8753-1, until seal projects above the groove not more than 1/16". Cut ends off flush with surface of cap, using sharp knife or razor blade. Lube the seal with heavy engine oil just before installation.

CAUTION: The engine must be operated at slow speed when first started after new braided seal is installed.

The neoprene composition seals are slightly longer than the grooves in the bearing cap. The seals must not be cut to length. Just before installation of bearing cap in crankcase, lightly lubricate the seals and install in bearing cap with upper end protruding approximately 1/16".

After cap is installed, force seals up into the cap with a blunt instrument to be sure of a seal at the upper parting line between the cap and case.

REPLACEMENT OF PISTONS, RINGS, AND CONNECTING RODS

Removal and Disassembly of Piston and Rod Assemblies

1. Remove cylinder heads.

2. Examine the cylinder bores above the ring travel. If bores are worn so a shoulder or ridge exists at this point, remove the ridges with a ridge reamer to avoid damaging rings or cracking ring lands in pistons during removal.

3. Use a silver pencil or quick drying paint to mark the cylinder number on all pistons, connecting rods and caps. Starting at the front end of the crankcase, the cylinders in the right bank are numbered 2-4-6 and in the left bank, are numbered 1-3-5.

4. Remove cap and bearing shell from number one connecting rod. Install connecting rod bolt guide hose on the bolts to hold the upper half of the bearing shell in place.

   NOTE: Use a short piece of hose slipped over connecting rod bolt as a guide.

5. Push the piston and rod assembly up out of the cylinder. Then remove guides and reinstall cap and bearing shell on rod.

6. Remove other rod and piston assemblies in same manner.

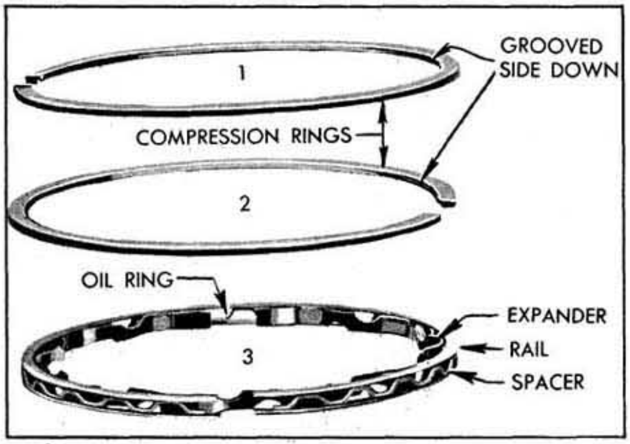


Fig. 3-27 Piston Rings

7. Remove compression rings with expander and remove oil ring by removing the two rails and spacer-expander which are separate pieces in each piston third groove. (Fig. 3-27)

8. To remove piston pin - set up Tool BT-6408 and Adapter BT-6408-5 as shown in Figs. 3-86 and 3-87.

INSPECTION OF CYLINDER BORES

Inspect cylinder walls for scoring, roughness or ridges which indicate excessive wear. Check cylinder bores for taper and out-of-round with an accurate cylinder gauge at top, middle and bottom of bore, both parallel and at right angles to the centerline of the engine.

A cylinder bore which is tapered .005" or more or is out-of-round .003" or more, is unacceptable.

Inspection of Pistons, Rings and Pins

Clean carbon from piston surfaces and under side of piston heads. Clean carbon from ring grooves with suitable tool and remove any gum or varnish from piston skirts with suitable solvent.

Carefully examine pistons for rough or scored bearing surfaces, cracks in skirt or head, cracked or broken ring lands, chipping or uneven wear which would cause rings to seat improperly or have excessive clearance in ring grooves. Damaged or faulty pistons should be replaced.

The pistons are cam ground, which means that the diameter at a right angle to the piston pin is greater than the diameter parallel to the piston pin. When a piston is checked for size, it must be measured with micrometers applied to the skirt at points 90° to the piston pin. (Fig. 3-28) The piston should be measured (for fitting purposes) 1/4" below the bottom of the oil ring groove.

Inspect bearing surfaces of piston pins and check for wear by measuring worn and unworn surfaces with micrometers. Rough or worn pins should be replaced. Test fit of piston pins in piston bosses. Occasionally pins will be found tight due to gum or varnish deposits. This may be corrected by removing the deposit with a suitable solvent. If piston bosses are worn out-of-round or oversize, the piston and pin assembly must be replaced. Oversize pins are not practical due to the pin being a press fit in the connecting rod. Piston pins must fit the piston with an easy finger push at 70°F.

Examine all piston rings for scores, chips or cracks. Check compression rings for tension by comparing with new rings. Check gap of compression rings by placing rings in bore at bottom of ring travel. Measure gap with feeler gauge. Gap should be between .010" and .020". If gaps are excessive (over .020") it indicates the rings have worn considerably and should be replaced.

Pistons

Standard size service pistons are high limit or maximum diameter; therefore, they can usually be used with a slight amount of honing to correct slight scoring or excessive clearances in engines having relatively low mileage. Service pistons are also furnished in .010" oversize. All service pistons are diamond bored and selectively fitted with piston pins; pistons are not furnished without pins.

Honing Cylinders

To hone cylinders, use clean sharp stones of proper grade for the amount of metal to be removed, in accordance with instructions of the hone manufacturer. Dull or dirty stones cut unevenly and generate excessive heat. When using coarse or medium grade stones use care to leave sufficient metal so that all stone marks may be removed with the fine stones used for finishing to provide proper clearance.

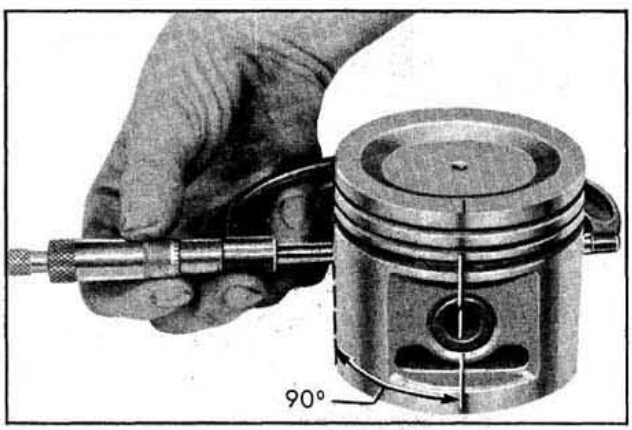


Fig. 3-28 Measuring Piston

When finish honing, pass the hone through the entire length of cylinder at the rate of approximately 60 cycles per minute. This should produce the desired 45° cross hatch pattern on cylinder walls which will insure maximum ring life and minimum oil consumption.

It is of the greatest importance that refinished cylinder bores are trued up to have not over .0005" out-of round or taper. Each bore must be final honed to remove all stone or cutter marks and provide a smooth surface. During final honing, each piston must be fitted individually to the bore in which it will be installed and should be marked to insure correct installation.

After final honing and before the piston is checked for fit, each cylinder bore must be thoroughly washed to remove all traces of abrasive and then dried thoroughly. The dry bore should then be brushed clean with a power-driven fiber brush. If all traces of abrasive are not removed, rapid wear of new pistons and rings will result. A satisfactory method of fitting pistons is as follows:

1. Place a strip of .0015" feeler gauge against the upper side of the bore, at 90° to the normal piston pin location. Attach scale J-5515 to feeler gauge. (Fig. 3-29)
2. Insert piston with pin and rings removed, into bore with head downward.
3. While holding the piston in the center of its normal travel, slowly pull the scale in a straight line and note the reading on the scale. the reading should be between 3 to 8 pounds while pulling the feeler gauge out of the bore.

Each piston should be fitted to its individual cylinder and marked for that cylinder.

NOTE: Both block and piston must be at very nearly the same temperature when measurements are made or errors due to expansion will occur. A difference of 10°F. between parts is sufficient to produce a variation of .0005".

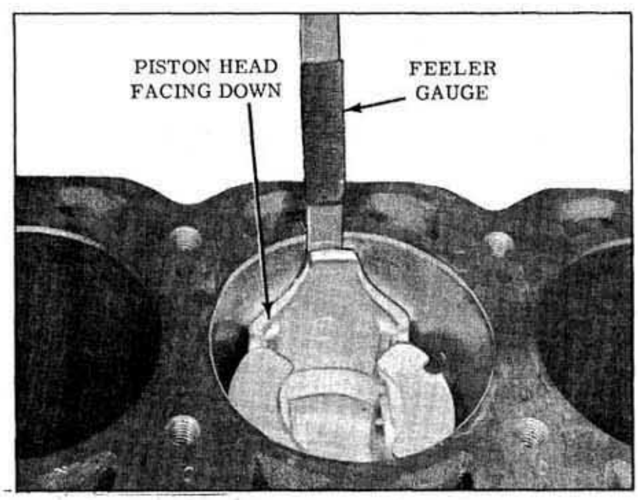


Fig. 3-29 Checking Piston Clearance

Fitting New Piston Rings

When new piston rings are installed the glazed cylinder walls should be slightly dulled, but without increasing the bore diameter, by means of the finest grade of stones in a cylinder hone. New piston rings must be checked for clearance in piston grooves and for gap in cylinder bores; however, the flexible oil rings are not checked for gap. The cylinder bores and piston grooves must be clean, dry and free of carbon and burrs.

With rings installed, check clearance in grooves by inserting feeler gauges between each ring and its lower land because any wear that occurs forms a step at inner portion of the lower land. If the piston grooves have worn to the extent that relatively high steps exist on the lower lands, the piston should be replaced because the steps will interfere with the operation of new rings and the ring clearance will be excessive.

When fitting new rings to new pistons, the side clearance of the compression rings should be .003" to .005" and side clearance of the oil ring should be .0035" to .0095".

To check the end gap of compression rings, place the ring in the cylinder in which it will be used, square it in the bore using the upper end of a piston, then measure the gap with feeler gauges. Piston rings should not have less than .010" gap when placed in cylinder bores. If gap is less than .010", file the ends of rings carefully with a smooth file to obtain proper gap.

ASSEMBLY AND INSTALLATION OF PISTON AND CONNECTING ROD ASSEMBLIES

1. To assemble piston and pin to connecting rod, set up Tool BT-6408 and Adapter BT-6408-4 as shown in Figs. 3-88 and 3-89.
2. If the piston and rod assembly is to be installed in the left bank, the assembly must be made as shown in Fig. 3-30.
3. If the piston and rod is to be installed in the right bank, the assembly must be made as shown in Fig. 3-31.
4. Assemble piston and rod on spring-loaded guide pin.
5. Lubricate piston pin to avoid damage when pressing through the connecting rod.

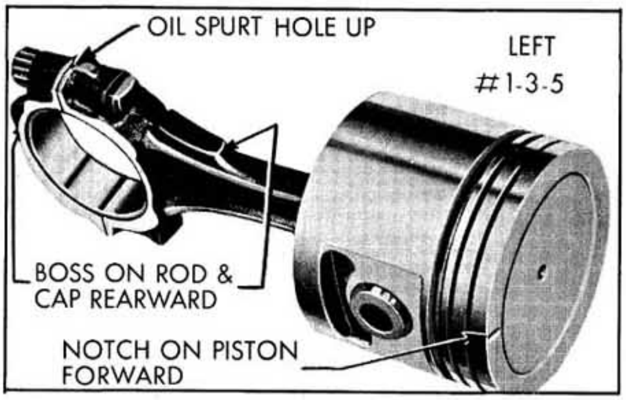


Fig. 3-30 Left Bank Piston and Rod Assembly

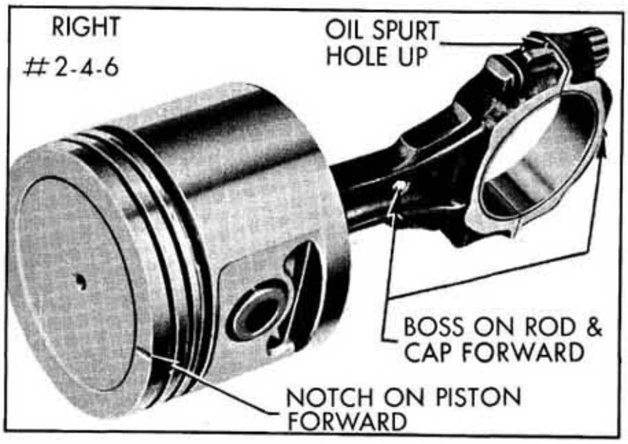


Fig. 3-31 Right Bank Piston and Rod Assembly

6. Install drive pin in upper end of piston pin. Press on drive pin until piston pin bottoms.

7. Remove piston and rod assembly from press. Rotate piston on pin to be sure pin was not damaged during the pressing operation.

8. Install piston rings as shown in Fig. 3-32. Position expander ends over piston pin. Install oil ring rail spacer, and oil ring rails. Position gaps in rails up on same side of piston as oil spit-hole in connecting rod. Install compression rings in upper two grooves. If a single chrome plated compression ring is used, the chrome ring must be installed in the top groove.

9. Install compression rings in top and center groove. See Fig. 3-32.

NOTE: All compression rings are marked with a dimple, a letter "T", a letter "O" or word "TOP" to identify the side of the ring which must be assembled toward the top of the piston. If a single chrome plated compression ring is used, the chrome ring must be installed in the top groove.

10. Make sure cylinder bores, pistons, connecting rod bearings and crankshaft journals are absolutely clean, then coat all bearing surfaces with engine oil.

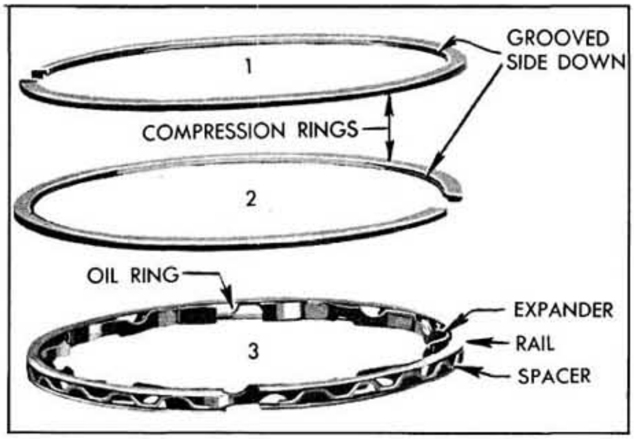


Fig. 3-32 Piston Rings

11. Before installation of a piston and rod assembly in its bore, position the crankpin straight down.

12. Remove connecting rod cap and, with bearing upper shell seated in rod, install connecting rod guides. These guides hold the upper bearing shell in place and prevent damage to the crankpin during installation of the connecting rod and piston assembly.

13. Make sure the gap in the oil ring rails is up, toward center of engine and the gaps of the compression rings are not in line with each other or the oil ring rails. Be certain the ends of the oil ring spacer-expander are butted together, not lapped over.

14. Lubricate the piston and rings and install in bore by compressing the rings either with a "wrap around" compressor or a split ring type such as shown in Fig. 3-33.

15. Select new connecting rod bearing, if necessary. Otherwise, install cap with bearing lower shell on rod and tighten bolt nuts to 35 ft. lbs. torque.

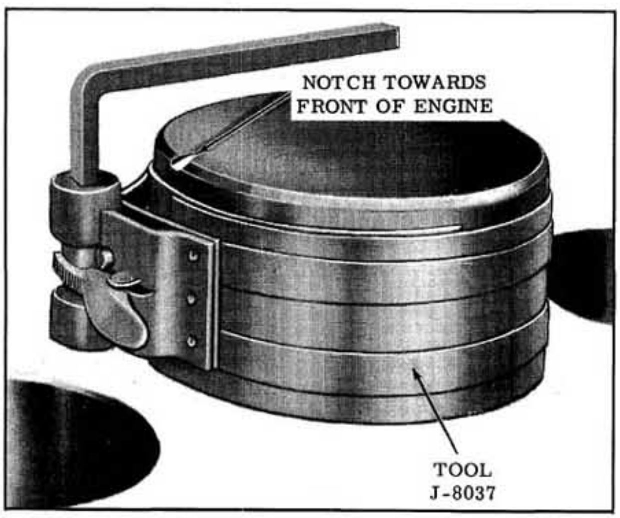


Fig. 3-33 Piston Ring Compressor

16. Install all other piston and rod assemblies in same manner. When piston and rod assemblies are properly installed, the oil spit holes in the connecting rods will be up, toward the camshaft, the rib on the edge of the rod cap will be on the same side as the conical boss on the connecting rod web and these marks, (rib and boss) will be toward the other connecting rod on the same crankpin. (Figs. 3-30 and 3-31)

17. Check end clearance between connecting rods on each crankpin using feeler gauges. Clearance should be between .005" and .012".

18. Install cylinder heads. Install oil screen and oil pan.

    IMPORTANT: After installation of new pistons and rings, care should be used in starting the engine and running it for the first hour. Avoid high speeds until the parts have had a reasonable amount of break in to avoid scuffing.

ENGINE MOUNTING REPLACEMENT

Removal of Front Mounts

1. Raise car and provide frame support at front of car.

2. Install engine support bar Tool BT-6424 and Adapter 6424-2.

3. Remove mount to engine block bolts. Raise engine slightly and remove mount to mount bracket bolt and nut. Remove mount.

Installation of Front Mount

1. Install mount to engine block bolts and torque to 55 ft. lbs.

2. Lower engine so mounts rest on brackets in normal manner. Install mount to bracket bolt and torque to 60 ft. lbs.

3. Remove engine support bar and lower car.

Removal of Rear (Transmission) Mount

To remove mount, remove attaching bolts, raise transmission and remove mount.

FLYWHEEL REPLACEMENT

1. Remove transmission.

2. Remove six bolts attaching flywheel to crankshaft flange.

3. Inspect flywheel. If cracked at flywheel bolt holes, replace flywheel.

4. Inspect crankshaft and flywheel to be installed for burrs. Remove any burrs with a mill file.

5. Install flywheel. Bolt holes are unevenly spaced so all flywheel bolts may be installed with flywheel in only one position. Install bolts and torque evenly to 60 ft. lbs.

6. Mount dial indicator to engine block and check flywheel run-out at three flywheel attaching bosses. Run-out should not exceed .015".

   NOTE: The crankshaft end play must be held in one direction during this check.

7. If run-out exceeds .015", attempt to correct by tapping high side with mallet. If this does not correct, remove flywheel and check for burrs between flywheel and crankshaft mounting flange.

COOLING SYSTEM (Figs. 3-34 and 3-35)

COOLING SYSTEM SERVICES

Refer to Periodic Maintenance Lubrication, Section 2.

FAN BELT ADJUSTMENT OR REPLACEMENT

A tight fan belt will cause rapid wear of the Delcotron and water pump bearings. A loose belt will slip and wear excessively and cause noise, engine overheating and unsteady Delcotron output. A fan belt, which is cracked, frayed or worn so that it bottoms in the pulleys, should be replaced.

The fan belt may be replaced by loosening the the Delcotron brace at both ends, slightly loosening the Delcotron mounting bolts and moving Delcotron inward to provide maximum slack in the belt.

All belts are adjusted using Tool BT-33-70-M.

WATER PUMP (Fig. 3-34)

The water pump is serviced only as an assembly.

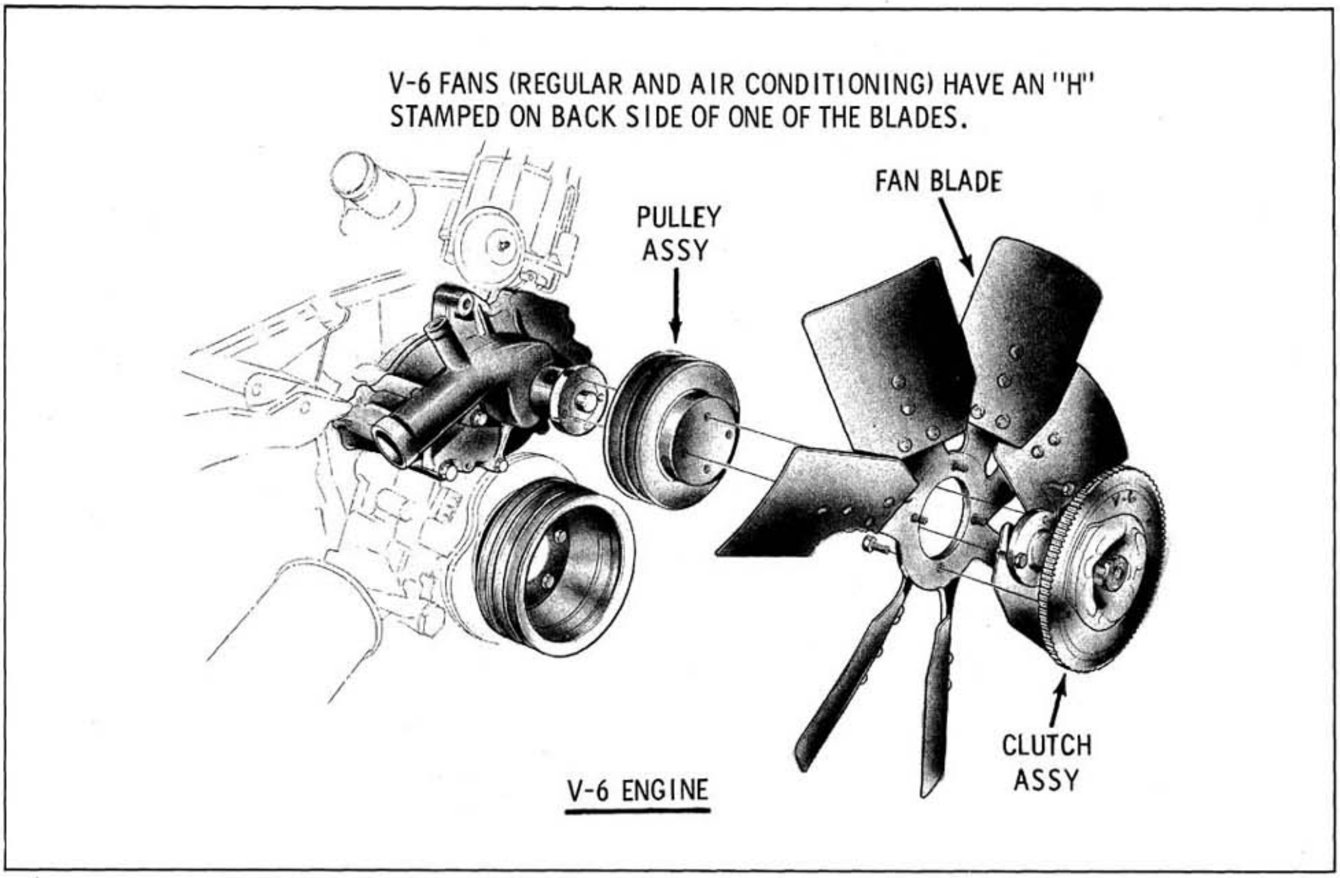


Fig. 3-34 Fan and Pulley

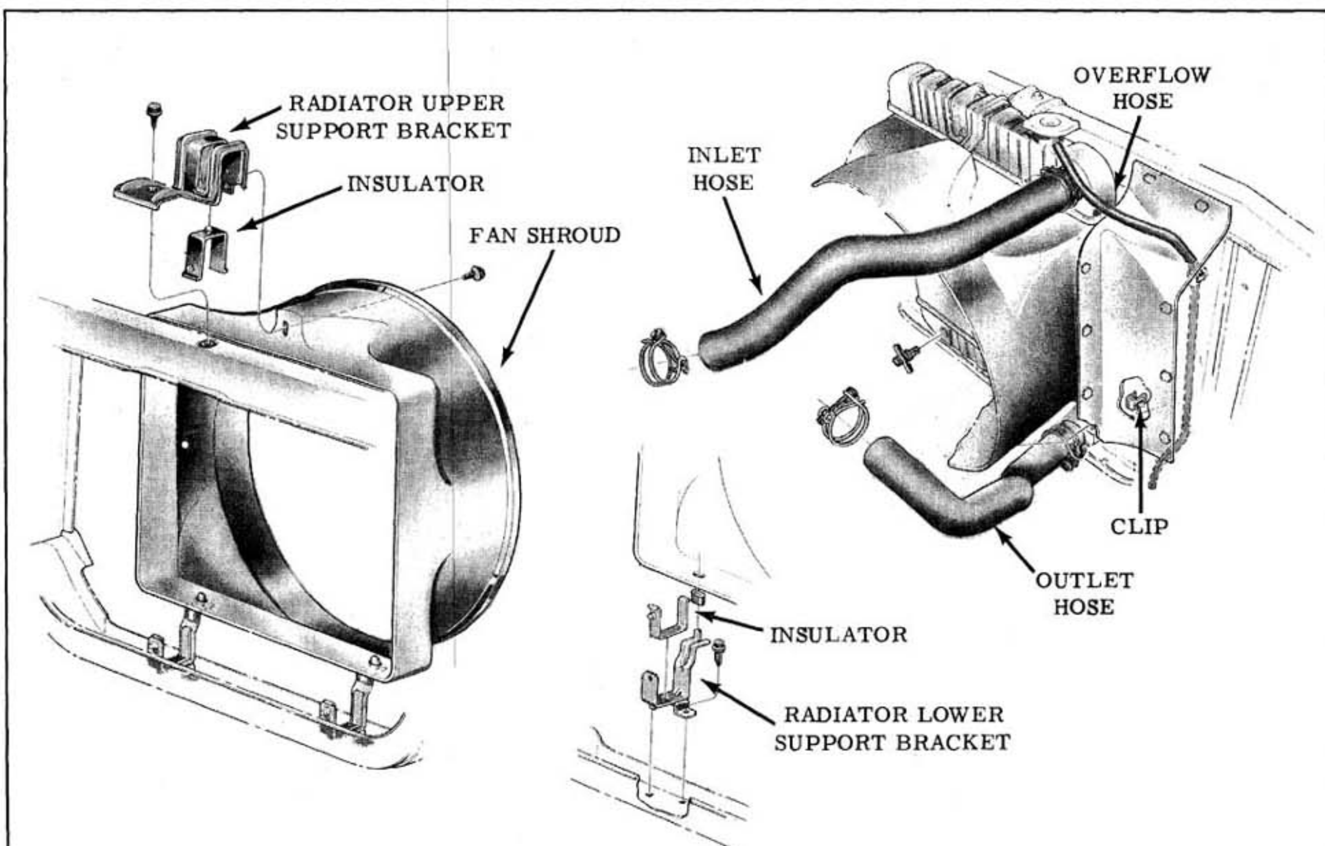


Fig. 3-35 Radiator

Removal

1. Drain cooling system being sure to drain into a clean container, if anti-freeze solution is to be saved.

2. Loosen belt or belts, then remove fan blade, and pulley or pulleys from hub on water pump shaft. Remove belt or belts.

3. Disconnect hose from water pump inlet and heater hose from nipple. Remove bolts, then remove pump assembly and gasket from timing chain cover.

4. Check pump shaft bearings for end play or roughness in operation. If bearings are not in serviceable condition, the assembly must be replaced.

Installation

1. Make sure the gasket surfaces on pump and timing chain covers are clean. Install pump assembly with new gasket. Bolts with lockwashers must be tightened uniformly.

2. Connect radiator hose to pump inlet and heater hose to nipple, then fill cooling system and check for leaks at pump and hose joints.

3. Install fan pulley or pulleys and fan blade, tighten attaching bolts securely. Install belt or belts and adjust for proper tension.

FAN CLUTCH

A torque limited thermostatically controlled fan assembly is used on all air-conditioned cars. Through pulley ratio changes, the fan rotates faster than a conventional fan at low engine speeds. This improves low-speed cooling at idle.

The fan clutch engages when the radiator discharge air reaches 160° - 170°F. Engagement of the clutch allows the fan to rotate up to a maximum of 1750 to 1950 rpm. When the radiator discharge air drops to 135°F. or below, the clutch disengages, which allows the fan to run a maximum of approximately 1500 rpm.

The thermostatically controlled fan clutch is serviced only as an assembly.

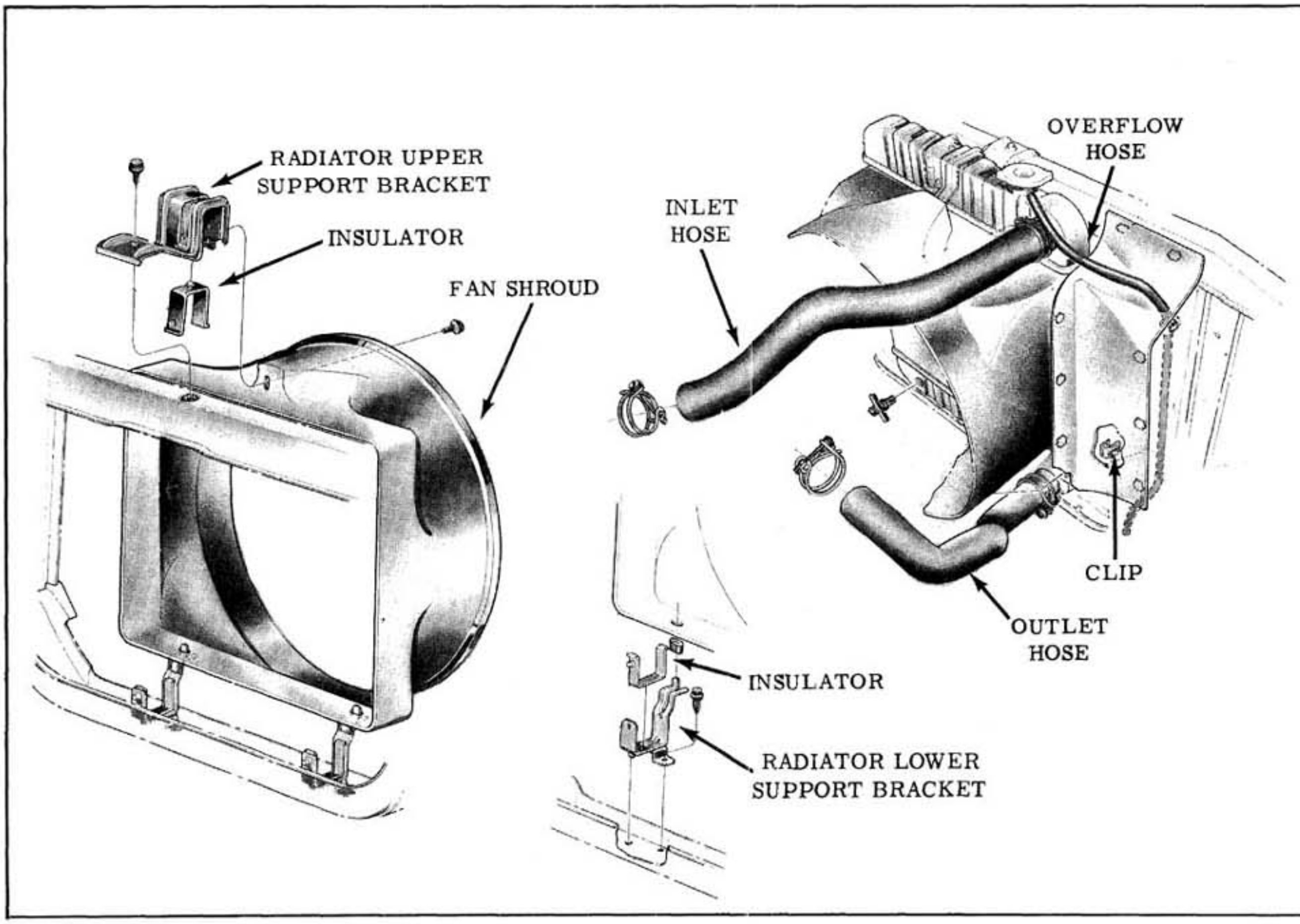


Fig. 3-36 V-6 Fuel System (All Except Air Conditioning)

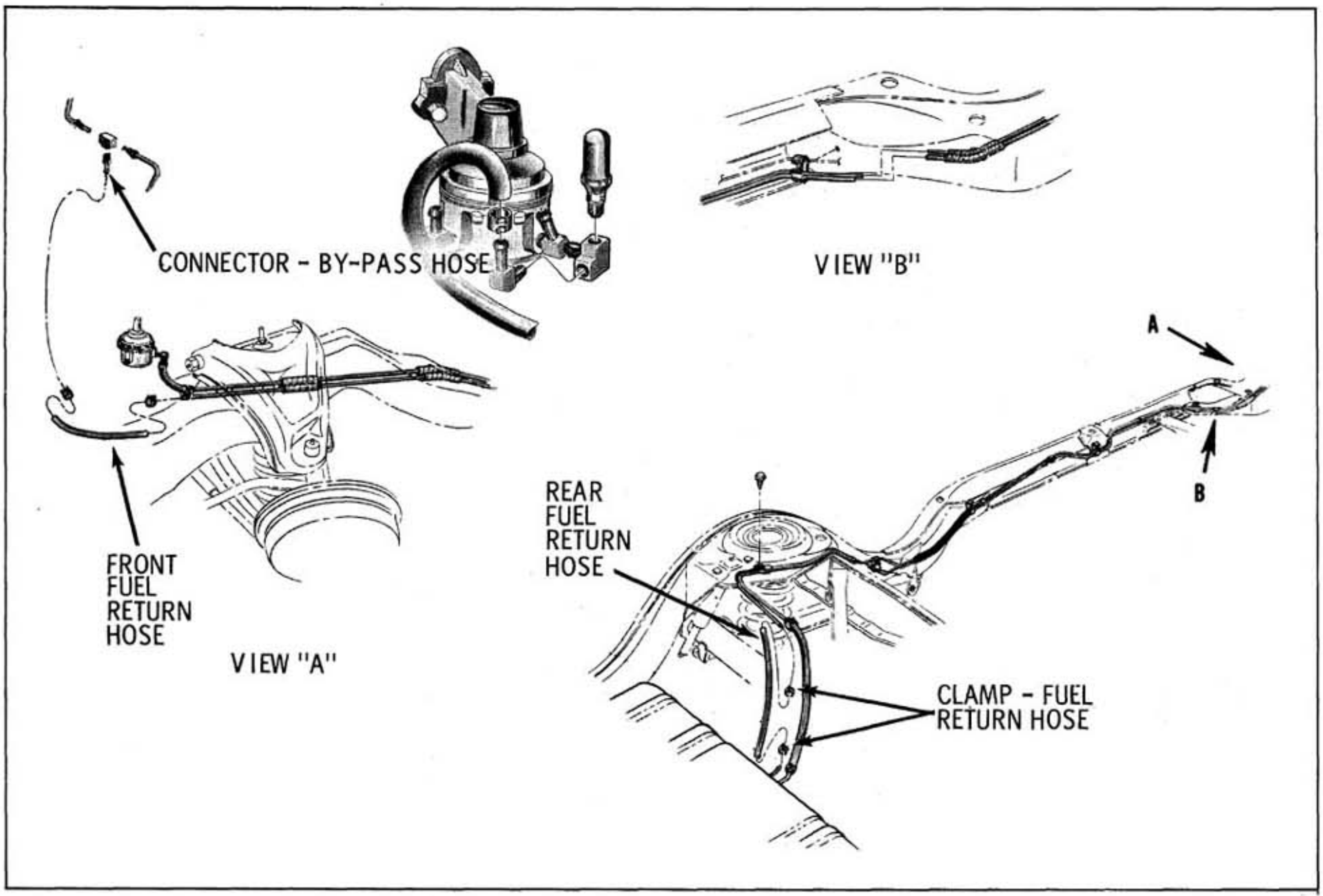


Fig. 3-37 V-6 Fuel System (Air Conditioning Equipped)

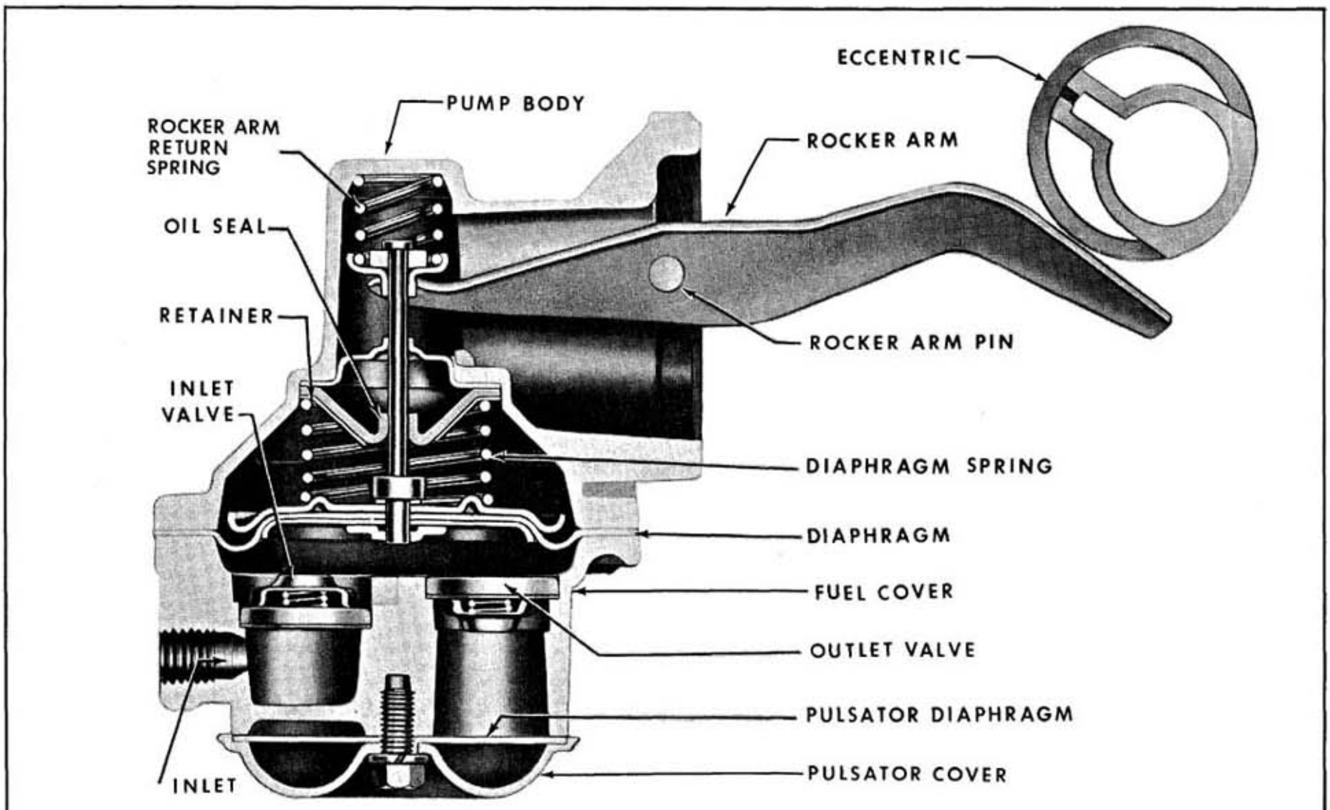


Fig. 3-38 Fuel Pump (Cross Sectional View)

FUEL AND EXHAUST SYSTEM

FUEL SYSTEM

Refer to Figs. 3-36 and 3-37.

FUEL PUMP (Fig. 3-38)

GENERAL DESCRIPTION

The fuel pump on all models with or without heater or air conditioning, is a single action pump.

OPERATION

The fuel pump draws gasoline from the tank and supplies it to the carburetor in sufficient quantity to meet engine requirements at any speed or load.

The fuel pump rocker arm is held in constant engagement with the eccentric on the camshaft by the rocker arm spring. As the outer end of the rocker arm moves up, the fuel link pulls the fuel diaphragm down. The enlargement of the fuel chamber draws fuel from the tank through the inlet valve and into the fuel chamber.

The pump delivers fuel to the carburetor only when the pressure in the outlet line is less than the pressure maintained by the diaphragm spring. When the carburetor float needle valve opens, the spring expands and moves the diaphragm up to force fuel past the outlet valve to carburetor. When the carburetor float needle valve closes (on cars without a fuel return line), the pump builds up pressure in the fuel chamber until the diaphragm spring is again compressed. The diaphragm then remains stationary until more fuel is required by the carburetor.

A pulsator is used to insure a solid charge of fuel to the carburetor.

FUEL PUMP INSPECTION AND TEST (ON CAR)

Before testing the fuel pump for volume flow, a new fuel filter should be installed.

As filtered foreign material builds up within the filter, fuel flow restriction increases, resulting in a decrease of volume flow at the filter outlet. When the restriction becomes excessively high, volume flow to the carburetor can drop below engine requirements although the fuel pump is still capable of meeting volume specifications.

1. Be sure there is gasoline in the tank.

2. Check for loose line connections. A leak at the pressure side of the system (line from pump to carburetor) will be indicated by dripping fuel. A leak in the suction side of the system (line from gas tank to pump) will not be apparent except in its effect of reducing volume of fuel on the pressure side of the system. Tighten loose line connections. Tighten fuel pump diaphragm flange screws.

3. Look for bends or kinks in lines which will reduce fuel flow.

4. Test fuel flow as follows:

   a. Disconnect fuel line at the carburetor.

   b. Ground primary terminal of distributor with jumper lead so that engine can be cranked without firing.

   c. Place suitable container at end of fuel line and crank engine a few revolutions.

      NOTE: If little or no gasoline flows from open end of line, then the fuel line or tank filter is clogged or the pump is inoperative. Before removing pump, disconnect fuel lines at fuel pump and at gas tank and blow through them with an air hose to make sure they are clear. Reconnect fuel lines to pump and gas tank, then re-test fuel flow while cranking engine.

5. Even if fuel flows in good volume from line at carburetor, it is advisable to make certain that pump is operating within limits.

   a. Attach a low reading pressure gauge to upper end of pump to carburetor line.

   b. Run engine at approximately 1000 rpm (using gasoline in carburetor bowl) and note reading on pressure gauge.

   c. If pump is operating properly, the pressure will be 5 to 6 pounds and will remain constant. If pressure is too low or too high or varies materially at different speeds,

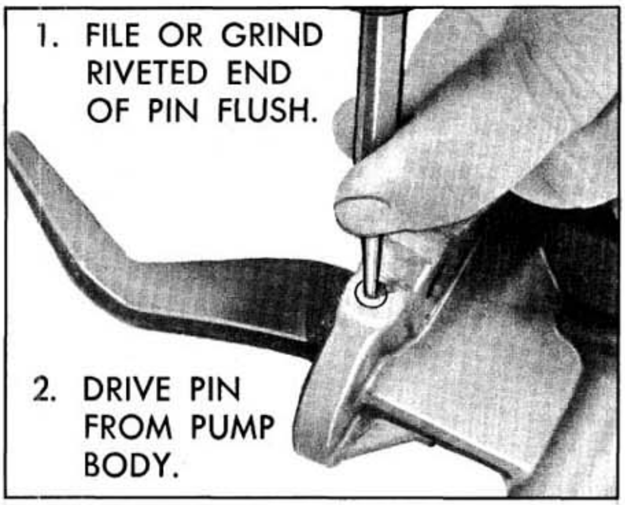


Fig. 3-39 Removing Rocker Arm Pin

the pump should be removed for repair or replacement.

DISASSEMBLY

1. Clamp pump carefully in vise by one ear of mounting flange Clear dirt from outside of pump.
2. Refer to Fig. 3-39.
3. Remove pulsator diaphragm cover attaching bolt and remove diaphragm cover and diaphragm.
4. Remove fuel cover attaching screws and remove cover.
5. Remove pull rod and diaphragm assembly and rocker arm return spring. (Fig. 3-40)
6. To remove valves, remove burrs produced by staking and pry inlet valve assembly from fuel cover and push outlet valve assembly through cover from pulsator side of cover.

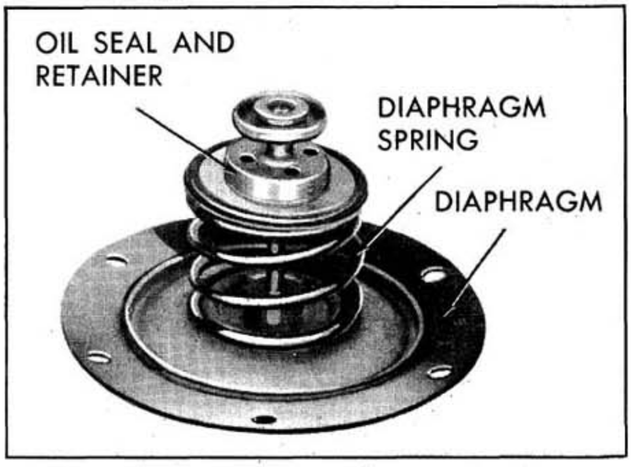


Fig. 3-40 Diaphragm Assembly

Cleaning and Inspection

1. Clean and rinse all metal parts in solvent. Blow out all passages with air hose.
2. Inspect pump body and cover for cracks,

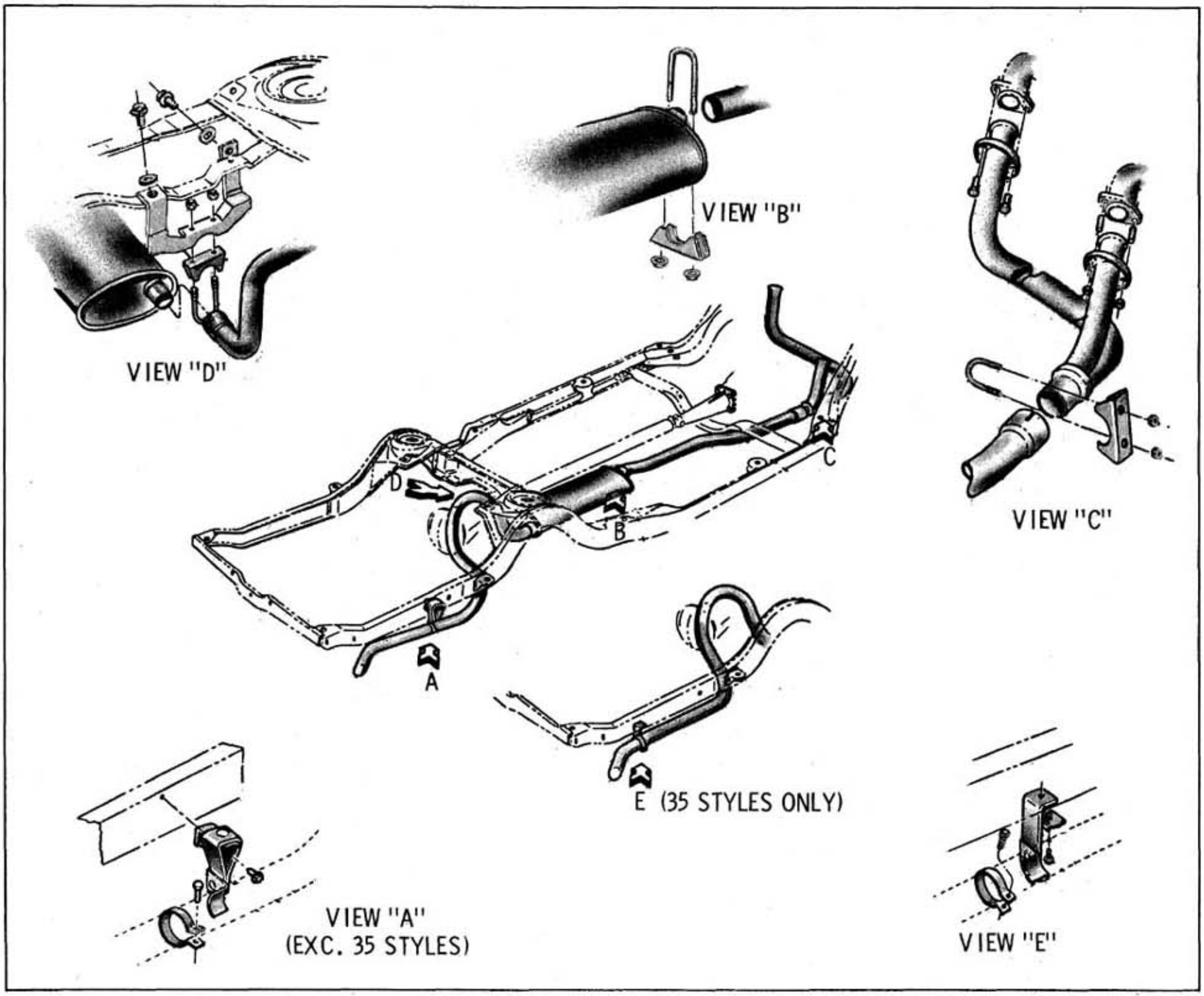


Fig. 3-41 Exhaust System

breakage and distorted flanges. Examine all screw holes for stripped or crossed threads. Replacement of pump assembly is advisable, if either condition is encountered.

Assembly

1. Place valve gaskets in recesses provided in fuel cover Place valve assemblies on top of gaskets. Inlet valve must have spring cage facing out of cover and the outlet valve must have the spring cage facing into cover. Stake valves in place.
2. Install rocker arm return spring in pump body. Be sure rocker arm return spring is properly seated to pull rod and diaphragm assembly.
3. Position fuel cover, aligning outlet opening with ear of mounting flange. Install attaching screws and tighten evenly and securely.
4. Install new pulsator diaphragm, position diaphragm cover and install attaching bolt.
5. Position rocker arm in pump body and connect to pull rod.
6. Install rocker arm pin through pump body and rocker arm.

ENGINE TIGHTENING SPECIFICATIONS

Use a reliable torque wrench to tighten the parts listed to prevent straining or distorting the parts or possibly damaging the threads. It is important that the torque specifications be strictly observed. Over tightening to any extent may damage threads, thus preventing proper torque from being attained, requiring replacement or repair of the damaged part.

Cylinder head attaching bolts must be dipped in a non-hardening lubricant and sealer that prevents seizure of head bolts in the cylinder block due to coolant seepage.

TORQUE SPECIFICATIONS

Part	Application	Thread	Torque Ft. Lbs.
Plug	Spark	14mm	35
Plug	Crankcase drain	1/2 -20	35
Bolt	Water pump and timing chain cover to block	5/16-18	25
Bolt	Water pump cover to timing chain cover	1/4 -20	9
Bolt	Water outlet to intake manifold	5/16-18	25
Bolt	Intake manifold gasket clamp to block	5/16-18	15
Bolt	Intake manifold to cylinder head	3/8 -16	35
Bolt	Exhaust manifold to cylinder head	3/8 -16	35
Bolt	Carburetor to intake manifold	5/16-18	15
Bolt	Fuel pump to timing chain cover	5/16-18	25
Bolt	Camshaft Sprocket to camshaft	7/16-20	45
Bolt	Rocker arm shaft bracket to cylinder head	3/8 -16	35
Screw	Rocker arm cover to cylinder head	1/4 -20	5
Bolt	Cranking motor to cylinder block	3/8 -16	35
Bolt	Distributor clamp to timing chain cover	3/8 -16	17
Bolt	Crankshaft bearing cap to crankcase	1/2 -13	70
Plug	Cylinder block water drain	1/4 -18	20
Bolt	Cylinder head to block	7/16-14	70
Bolt	Upper flywheel housing to cylinder block	3/18-16	40
Bolt	Lower flywheel housing to block and upper flywheel housing	5/16-18	12
Bolt	Flywheel to crankshaft	7/16-20	60
Bolt	Harmonic balancer to crankshaft	5/8 -18	160
Nut	Connecting rod bolt	11/32-24	35
Bolt	Oil pan to block	5/16-18	15
Bolt	Oil screen housing pipe and flange assembly to block	1/4 -20	9
Bolt	Timing chain cover to block	5/16-18	25
Cap	Oil pressure relief valve		35
Screw	Oil pump cover assembly to timing chain cover	1/4 -20	12
Switch	Oil pressure		10
Bolt	Fan and pulley to water pump hub	5/16-24	25
Bolt	Pulley and reinforcement to harmonic balancer	5/16-18	25
Bolt	Engine mount to cylinder block	7/16-14	55
Bolt	Engine mount to frame bracket	7/16-20	65

GENERAL SPECIFICATIONS

Item	225 Cubic Inch V-6 Engine
Type - No. of cylinders	90° V-6
Valve arrangement	In Head
Bore and stroke	3.750" x 3.400"
Piston displacement	225 cubic inches
Cylinder Numbers Front to Rear	
Right Bank	2-4-6
Left Bank	1-3-5
Firing Order	1-6-5-4-3-2
Cylinder Block Material	Cast Iron
Cylinder Liners	None
Crankshaft Bearings Number and Type	4 replaceable liners
Material	Durex 100A
Bearing Which Takes End Thrust	No. 2
Connecting Rod Bearings - Type	Replaceable Liner
Material	Durex 100A
Piston Material and Surface Treatment	Aluminum Alloy
Piston Pin Offset	.040"
Compression Rings Material and Surface Treatment	
#1	Iron - Chrome Plated
#2	Lubrited
Oil Ring - Type	Dual Steel Rail With Spacer
Oil Ring Expander	Steel Hump Type
Location of all Piston Rings	Above Piston Pin
Camshaft Type and Material	Cast Alloy Iron
Camshaft Drive	Chain
Number and Type of Camshaft Bearings	4 Steel Backed Babbit
Valve Lifter Type	Hydraulic
Valve Spring Type	Single Helical
Oiling System Type	Forced Feed
Oil Supplied to Bearing Surfaces	
Crankshaft, Camshaft and Connecting Rods	Full Pressure
Pistons, Pins	Splash
Cylinder Walls	Splash and Nozzle
Valve Lifters	Full Pressure
Rocker Arms	Low Pressure
Normal Oil Pressure	33# at 2400 RPM
Oil Reservoir Capacity - Quarts	4 (5 with Dry Filter)
Cooling System Type	Pressure (15# Radiator Cap)
Water Temperature Control	180° Thermostat
Cooling System Capacity (Quarts)	
Less Heater	11.5
With Heater	13
Fan Diameter, Number of Blades	
Regular	17-1/8" - 4 (Shrouded)
With Air Conditioning	17" - 7 (Shrouded)
Fan Drive	
Regular	Water Pump Shaft
With Air Conditioning	Torque and Temperature Sensitive Clutch

ENGINE DIMENSIONS, FITS AND ADJUSTMENTS.

NOTE: These dimensions and limits for fit of parts apply to new parts only.

Item	225 Cubic Inch V-6
Crankshaft journal diameter	2.500"
Crankshaft journal to-bearing clearance	.0005" - .0021"
Crankshaft end play at thrust bearing	.004" - .008"
Crankshaft bearing effective length	
#1	.864"
#2	1.057"
#3	.864"
#4	.864"
Crankpin journal diameter	1.9995" - 2.0005"
Crankpin journal to bearing clearance	.002"
Connecting rod end play on crankpin	.005" - .012" (Total both rods)
Connecting rod bearing length	.820"
Piston clearance in bore	.0002" - .0023"
Piston pin diameter	.9394" - .9397"
Piston pin length	2.960"
Piston pin fit at 70° F in piston	Easy Finger Push
Piston pin fit in connecting rod	.0007" - .0015" Press
Piston ring side clearance in groove	
Compression ring	.003" - .005"
Oil ring	.0035" - .0095"
Piston ring gap, compression ring in bore	.010" - .020"
Oil ring in bore	.015" - .035"
Camshaft bearing journal diameter	
#1	1.755" - 1.756"
#2	1.725" - 1.726"
#3	1.695" - 1.696"
#4	1.665" - 1.666"
Camshaft journal clearance in bearings	.0005" - .0035"
Valve lifter diameter	.8422" - .8427"
Valve lifter clearance in block	.0005" - .003"
Valve lifter leakdown rate, in test fixture	12 to 60 sec.
Rocker arm ratio	1.6 to 1
Rocker shaft O.D.	.8093" - .8098"
Rocker arm clearance on shaft	.0017" - .0032"
Valve head diameter inlet	1.625"
Valve head diameter exhaust	1.3750"
Valve seat angle inlet and exhaust	45°
Valve stem diameter inlet	.3412" top .3407" bottom
Valve stem diameter exhaust	.3407" top .3402" bottom
Valve stem clearance in guide	
Inlet	top .001" - .003" bottom .0015" - .0035"
Exhaust	top .0015" - .0035" bottom .002" - .004"
Valve Spring	
Valve closed pounds @ length	64 @ 1.640"
Valve open pounds @ length	168 @ 1.260"

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V-8 ENGINE

DESCRIPTION

The same basic 330 cubic inch V-8 engine is used in all 34, 36, 38 and 52 series. The 425 cubic inch V-8 engine which is used in 54 through 86 series is similar in design to the 330 cubic inch V-8 engine. Because of the similarity between the two engines, the service procedures, unless otherwise specified, will be combined.

The left bank of cylinders (as viewed from the driver's seat) are numbered (from front to rear) 1-3-5-7. Cylinders in the right bank are numbered (from front to rear) 2-4-6-8. (Fig. 3-50)

Periodic maintenance for the engines is covered in Section 2 of this manual. The specifications for each engine is listed at the back of this section.

The illustrations used throughout this section are typical of both engines unless otherwise indicated.

ENGINE ASSEMBLY

Removal

1. Drain radiator.
2. Remove hood, marking hinge for reassembly.
3. Disconnect battery.
4. Disconnect radiator hoses, heater hoses, vacuum hoses, power steering pump hoses (as necessary), starter cable at junction block, engine to body ground strap, fuel hose from fuel line, wiring and accelerator linkage.
5. Remove fan blade and fan pulley, coil and upper radiator support.

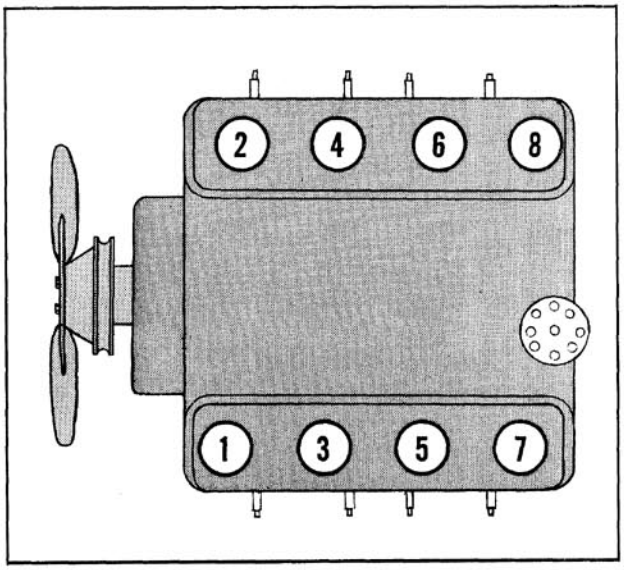

Fig. 3-50 Cylinder Numbers

6. Raise car.
7. Disconnect exhaust pipes at manifold.
8. Remove torque converter cover and install Converter Holding Tool J-21654.
9. Remove engine mount through bolts and support engine using Tool BT-6424.
10. Lift engine and secure transmission chain support to frame.
11. Remove three bolts, converter to flywheel.
12. Remove six bolts, transmission to engine.
13. Lower car.
14. Secure lift chain to engine, disconnect Tool BT-6424 and remove engine. NOTE: Be careful of vacuum modulator line.

Installation

1. Fasten chain to engine.
2. Locate engine dowels into transmission and position through bolts into mounts and tighten.
3. Replace six bolts, transmission to engine.
4. Replace three bolts, converter to flywheel.
5. Remove Converter Holding Tool J-21654 and replace torque converter cover.
6. Remove transmission support chain.
7. Connect exhaust pipes to manifold.
8. Lower car and remove lift chain.
9. Reconnect radiator hoses, heater hoses, vacuum hoses, power steering pump hoses (as necessary), starter cable at junction block, engine to body ground strap, fuel hose to fuel line, wiring and accelerator linkage.
10. Replace fan pulley, fan blade, upper radiator support and coil.
11. Install and align hood.
12. Fill radiator.
13. Connect battery.

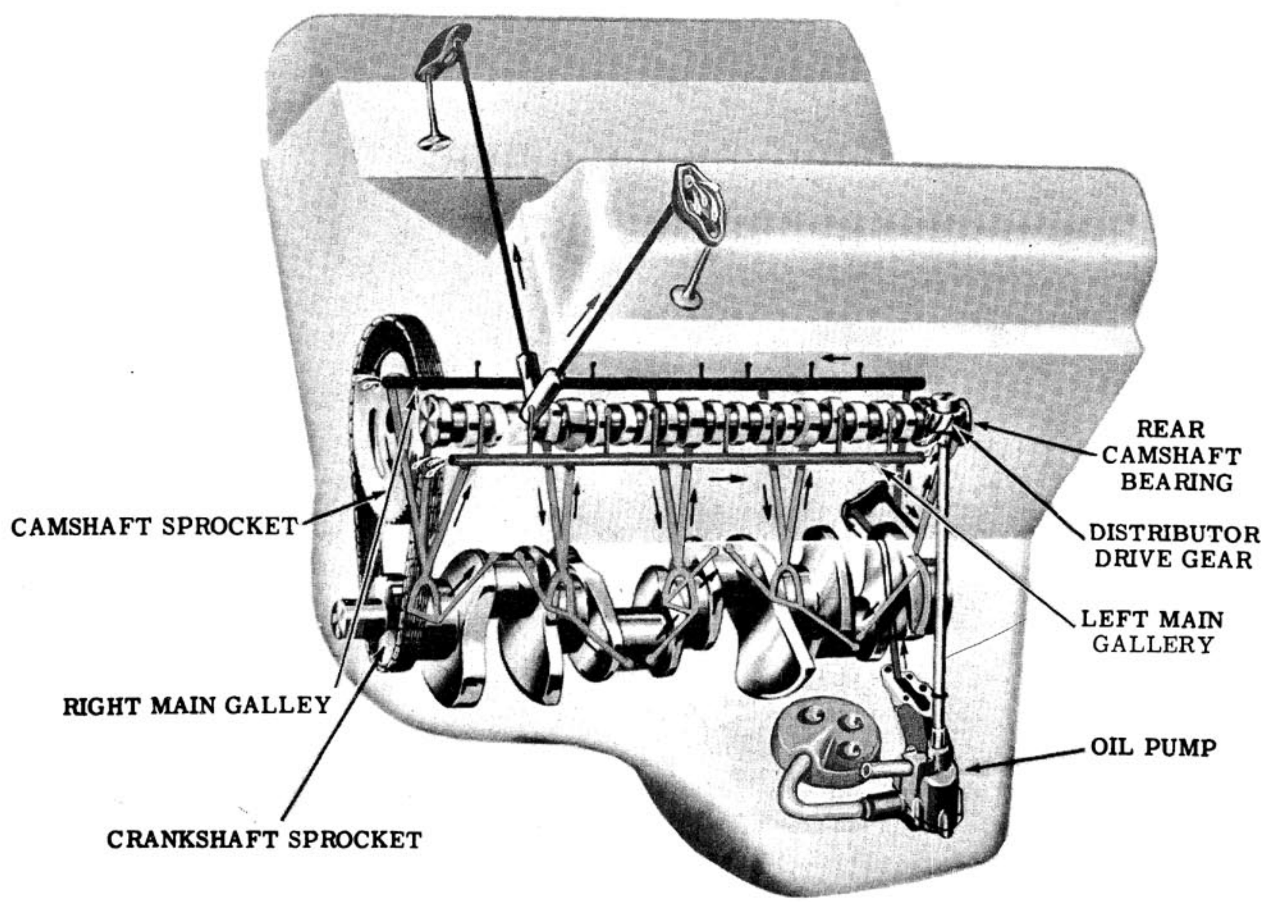

Fig. 3-51 Engine Oil Flow

INTAKE MANIFOLD

Removal

1. Remove air cleaner assembly.

2. Drain radiator, then disconnect upper radiator hose and thermostat bypass hose from water outlet. Also, disconnect heater hose at rear of manifold, if car is so equipped.

3. Disconnect throttle linkage.

4. Remove fuel and vacuum lines from carburetor.

5. Remove coil mounting bolt. Wires may be left connected to coil if desired.

6. Disconnect and/or remove generator, power steering pump and air conditioning compressor brackets as necessary.

7. Disconnect temperature gauge wire.

8. Remove intake manifold bolts; then remove manifold with carburetor attached.

   NOTE: It will be necessary to remove the distributor on 425 cubic inch engines to provide removal clearance.

9. Clean machined surfaces of cylinder head and intake manifold with a putty knife. Use extreme care not to gouge or scratch machined surface.

Installation

1. Coat both sides of gasket sealing surface that seal the intake manifold to the head with 1050026 Sealer and position intake manifold gasket.

2. Install end seals, being sure that ends are positioned under cylinder heads as shown in Fig. 3-52.

   NOTE: The 425 cubic inch engine uses a one-piece intake manifold gasket as shown. The 330 cubic inch engine uses two gaskets.

3. Position intake manifold on engine and connect thermostat bypass hose hose to water pump.

4. Install intake manifold bolts. Torque alternately to 35 ft. lbs. (Fig. 3-53) Position coil

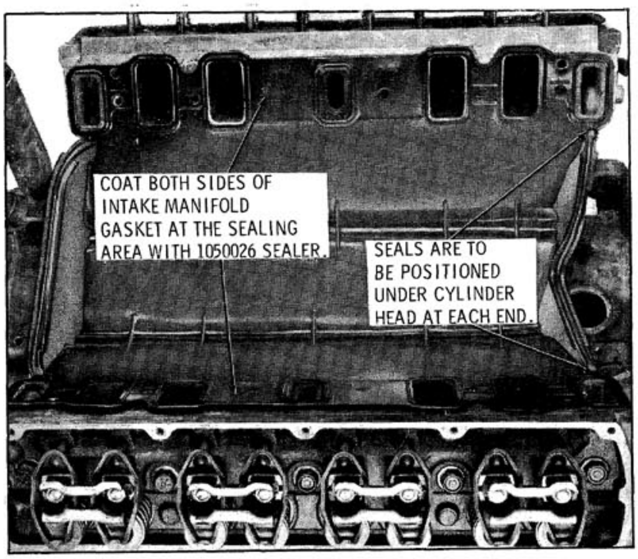

Fig. 3-52 Intake Manifold

and install mounting bolt.

5. Connect temperature gauge wire.
6. Install fuel and vacuum lines.
7. Connect upper radiator hose, spark plug wires, heater hose, throttle linkage and install air cleaner assembly.
8. Fill cooling system.

NOTE: Refer to Section 2, PERIODIC MAINTENANCE, for cooling system recommendations.

Choke Heat Stove

Figure 3-54 shows an exploded view of the choke heat stove.

EXHAUST MANIFOLD

Removal

1. Remove the crossover pipe (disconnect exhaust pipe if equipped with dual exhaust).
2. For the right manifold, disconnect the exhaust pipe.
3. Straighten lock tabs and remove the manifold to head attaching bolts, washers and locks and remove the manifold.
4. Clean manifold and cylinder head machined surfaces with a putty knife. Use care not to gouge or scratch machined surfaces.

Installation

1. Install manifold to head bolts and torque to 25 ft. lbs.

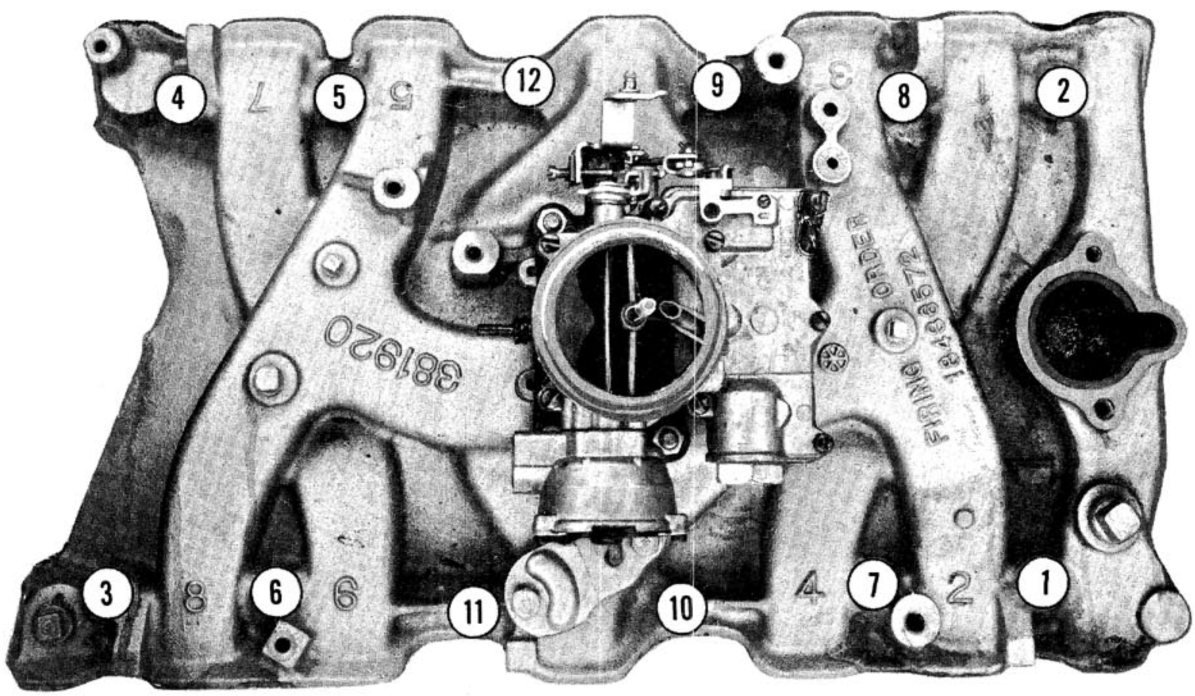

Fig. 3-53 Intake Manifold Torque Sequence

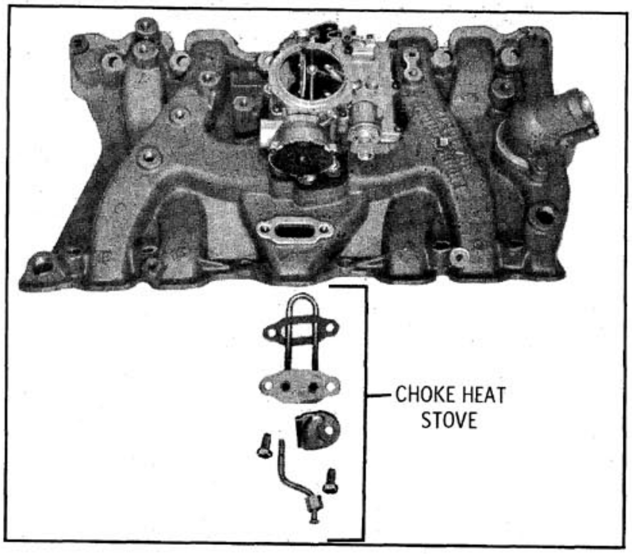

Fig. 3-54 Intake Manifold Choke Heat Stove

2. Bend bolt locks to retain bolts.

3. Reconnect disconnected parts.

VALVE COVER

Removal

1. Disconnect positive crankcase ventilation from right valve cover.

2. Disconnect spark plug wires and move away from valve cover.

3. Remove valve cover to cylinder head attaching screws. Remove accessory mounting brackets as necessary and remove valve cover.

Installation

Reverse removal procedure. Torque valve cover attaching screw to 7 ft. lbs. For mounting brackets, torque attaching bolts as follows:

5/16" thread	25 ft. lbs.
3/8 " thread	35 ft. lbs.
7/16" thread	50 ft. lbs.

ROCKER ARM ASSEMBLIES Fig. 3-55

Removal

1. Remove valve cover.

2. Hold the stud to prevent it from turning and remove rocker arm stud nuts, washer, lock plates, pivots and rocker arms. (Fig. 3-55A)

NOTE: Remove each set (one set per cylinder) as a unit.

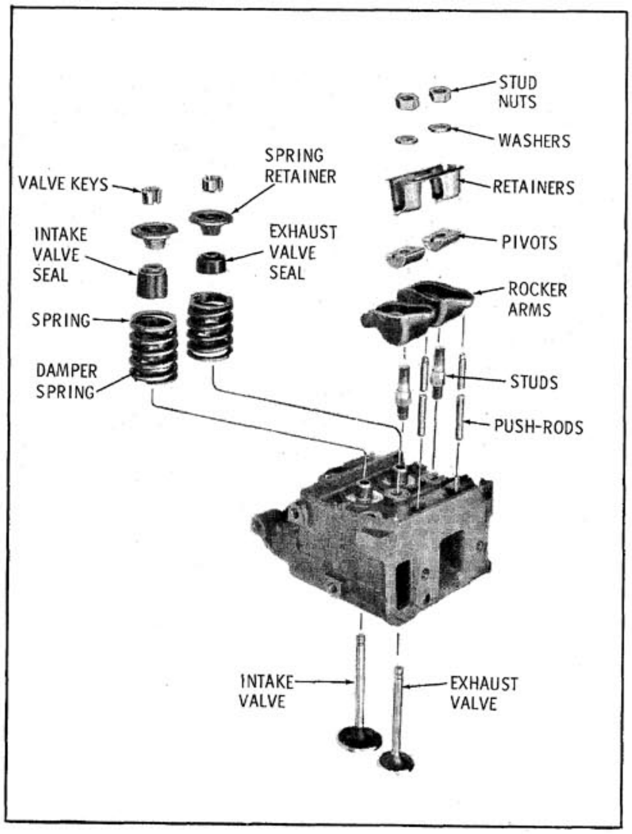

Fig. 3-55 Cylinder Head - Exploded View

Installation

1. Torque studs to 35 ft. lbs.

2. Position a set of rocker arms (for one cylinder) on the proper studs.

3. Install the pivots and lock plates, being sure the tangs on the lock plates seat properly in the pivots. Coat wear points with 1050169 Lubricant.

4. Install the hardened flat washers and nuts. Torque nuts to 25 ft. lbs.

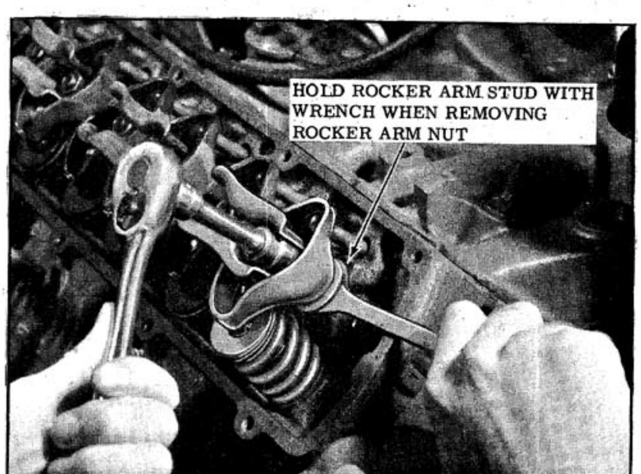

Fig. 3-55A Removing Rocker Arm

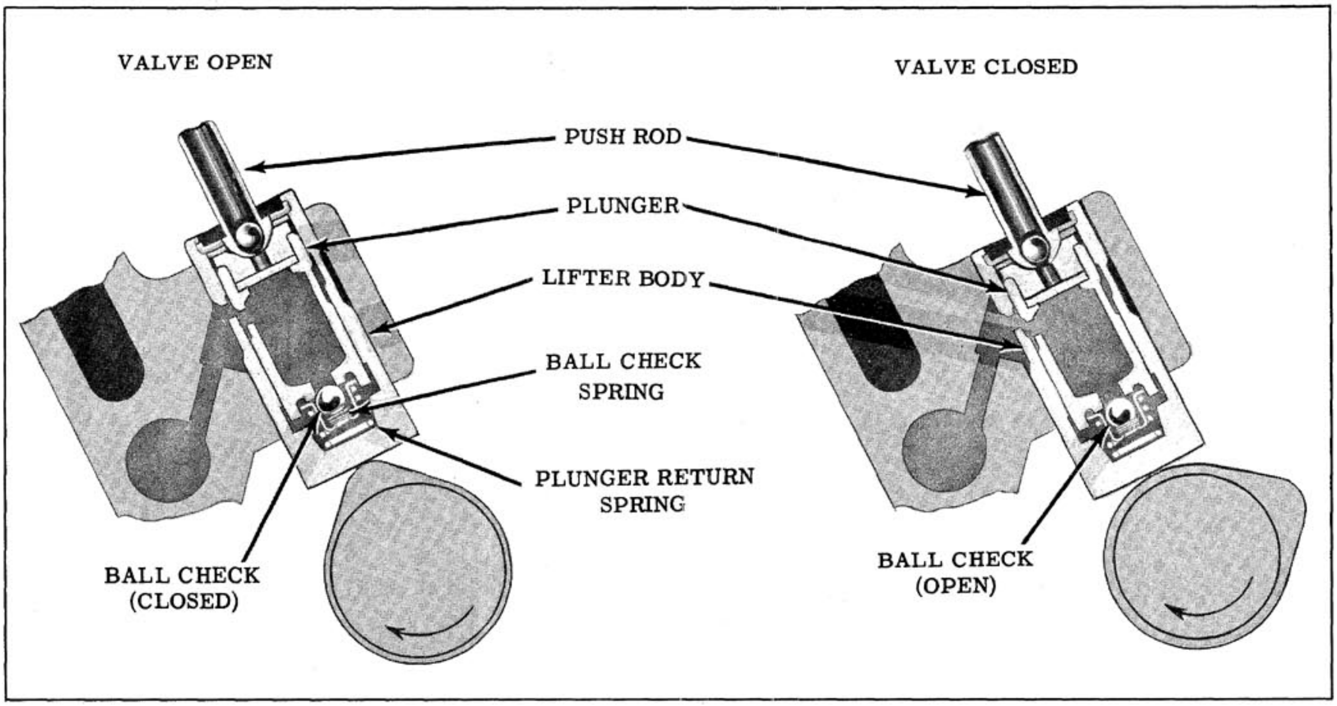

Fig. 3-56B Valve Lifter Operation

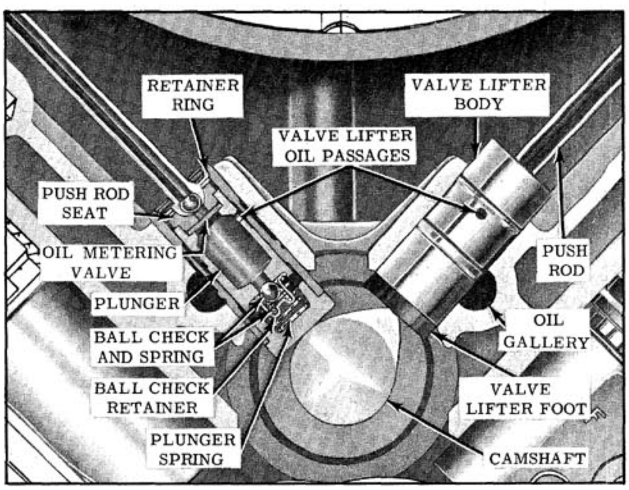

Fig. 3-56A Valve Lifter Operation

NOTE: Both lifters should be in closed valve position when installing nuts.

CAUTION: Never exceed specified torque on nuts. Check to be sure clearance exists between push-rod and push-rod hole (in cylinder head). If no clearance exists, the lock plate must be replaced.

VALVE LIFTERS

Operation

Oil is supplied to the lifter through a hole in the side of the lifter body which indexes with a groove and hole in the lifter plunger. Oil is then metered past the oil control valve in the lifter, through the push-rods to the rocker arms. (Fig. 3-56)

When the lifter begins to ride up the cam lobe, the ball check is held against its seat in the plunger by the ball check spring which traps the oil in the base of the lifter body below the plunger. The plunger and lifter body then raise as a unit, pushing up the push-rod to open the valve. The force of the valve spring which is exerted on the plunger through the rocker arm and push-rod causes a slight amount of leakage between the plunger and lifter body. This "leak-down" allows a slow escape of trapped oil in the base of the lifter body. As the lifter rides down the other side of the cam lobe and reaches the base circle or "valve closed" position, the plunger spring quickly moves the plunger back (up) to its original position. This movement causes the ball check to open against the ball spring, and oil from within the plunger is drawn into the base of the lifter. This restores the lifter to zero lash.

Removal

IMPORTANT: Valve lifters and push-rods should be kept in order so they can be reinstalled in their original position in the cylinder block.

1. Remove intake manifold and gasket.

2. Remove valve covers, rocker arm assemblies and push-rods.

3. On varnished lifters, apply carburetor cleaning solution to lifter body. Allow five minutes for solution to remove varnish.

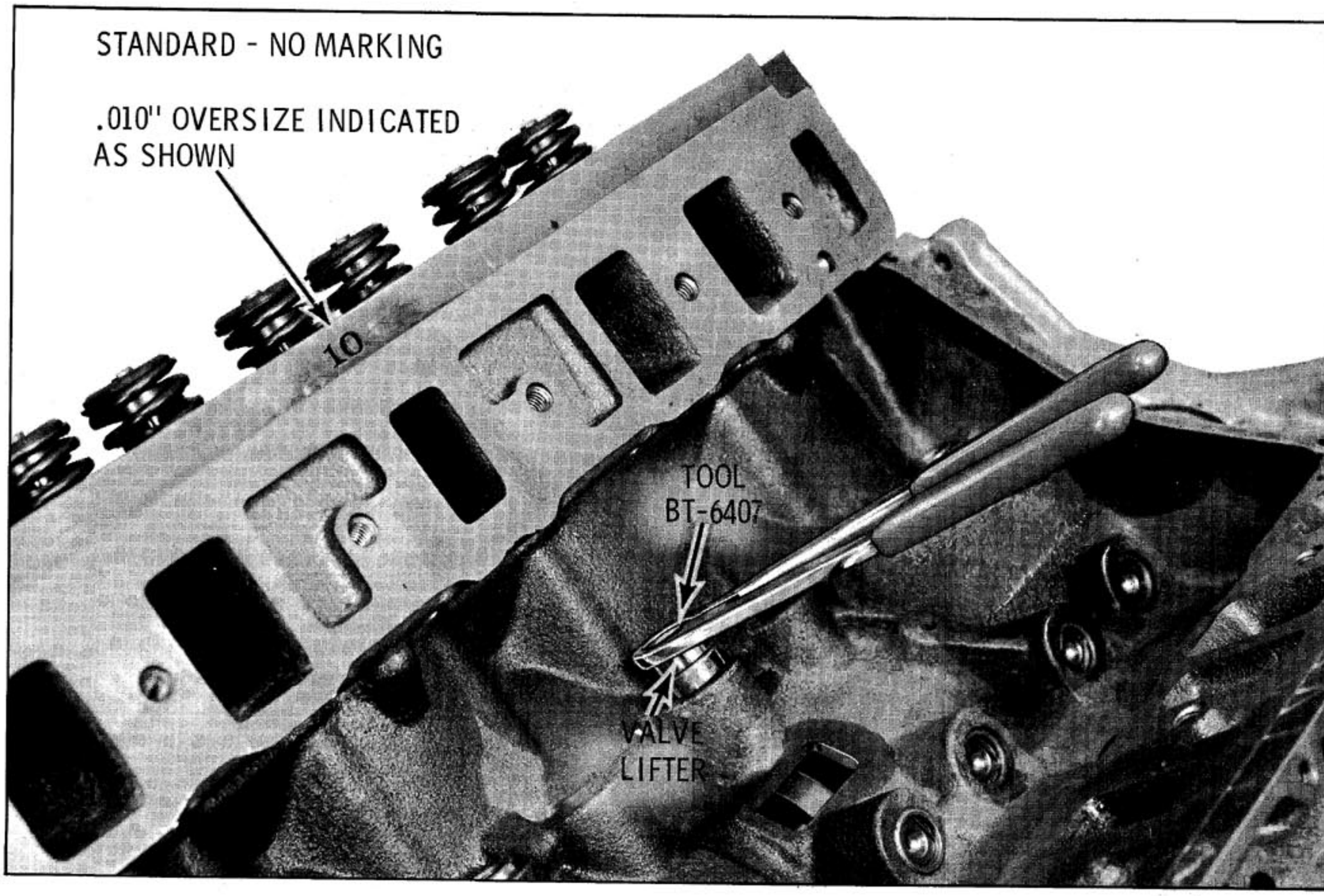

Fig. 3-57 Removing Valve Lifter

4. Remove lifters. Use of Tool BT-6407 will aid in removal of varnished lifters. (Fig. 3-57)

Disassembly

1. Remove retainer spring with Tool BT-31 or small screwdriver.

2. Remove push-rod seat and oil control valve.

3. Remove plunger and plunger spring. If plunger is stuck tight, allow lifter to soak in carburetor cleaning solvent for approximately five minutes, then remove.

   NOTE: Available Tool BT-6438 can be used to remove plunger.

   CAUTION: Carburetor cleaning solvent should be used in a well ventilated room. Avoid contact with skin and prolonged breathing of fumes.

4. Remove ball check retainer from plunger, then remove ball and spring.

Cleaning and Inspection

After lifters are disassembled, all parts should be cleaned in clean solvent. A small particle of foreign material under the ball check valve will cause malfunctioning of the lifter. Close inspection should be made for nicks, burrs, or scoring of parts. If either the body or plunger is defective, replace with a new lifter assembly.

IMPORTANT: Do not condemn valve lifters that have a slight gap or show evidence of leakage where the lifter foot is welded to the lifter body, unless the leak-down rate is not within specifications. (See VALVE LIFTER LEAK-DOWN)

NOTE: Whenever lifters are removed, check

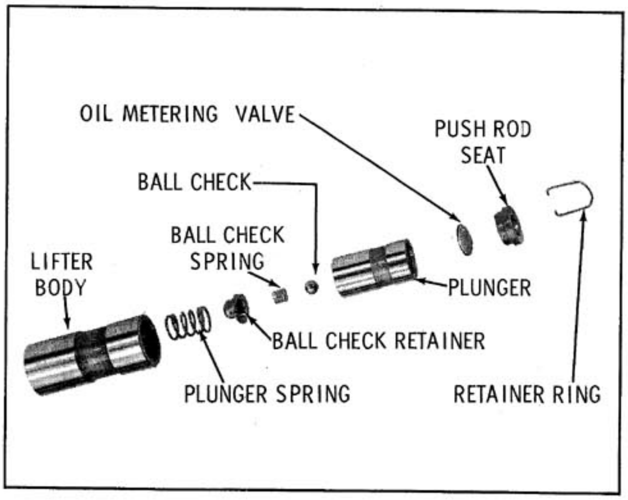

Fig. 3-58 Valve Lifter - Exploded View

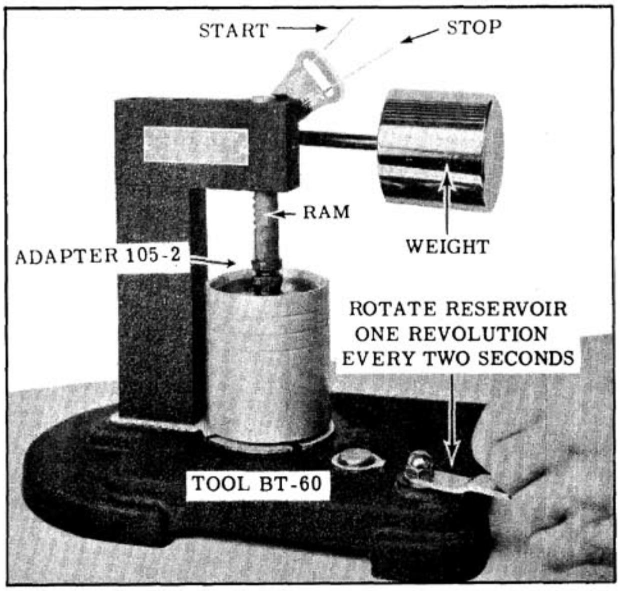

Fig. 3-59 Valve Lifter Bleed Down Test

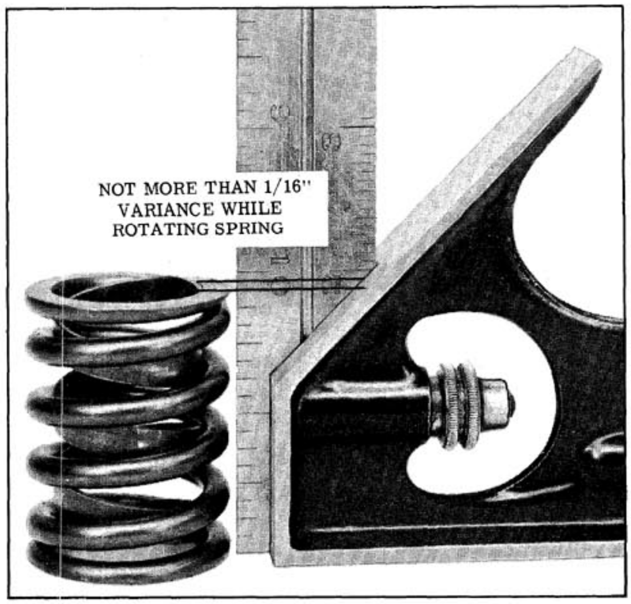

Fig. 3-60 Valve Spring Checking

the lifter foot for abnormal wear as follows:

1. Place a straight edge across the lifter foot.

   NOTE: Lifter foot must be clean and dry.

2. While holding the lifter at eye level, check for light between the straight edge and lifter foot.

3. If light indicates a flat or concave surface of the lifter foot, the lifter should be replaced and the camshaft inspected for wear. Wear at the CENTER of the cam base circle is NORMAL. The camshaft should be replaced ONLY when wear is present across FULL WIDTH of cam base circle.

Assembly and Valve Lifter Leak-Down Test

IMPORTANT: Lifters must be assembled while submerged in Hydraulic Lifter Test Fluid BT-59 and leak-down tested before placing into service.

1. Install Adapter 105-2 in reservoir of Tester BT-60, then fill reservoir with Hydraulic Lifter Test Fluid BT-59, 1/2" below top of reservoir.

2. Assemble ball check and retainer into plunger. (Fig. 3-58) Make sure retainer flange is pressed tight against bottom of recess in plunger.

3. Install plunger spring over ball check retainer.

4. Hold plunger with spring up and insert into lifter body. Hold plunger vertically to prevent cocking spring.

5. Place assembly into the tester cup, then position oil control valve and push-rod seat onto plunger.

6. Position the 1/4" steel ball on the push-rod seat. Lower tester ram until it contacts the steel ball.

7. Allow ram to move downward by its own weight until air bubbles disappear.

8. Raise ram, then allow to lower as in Step 7. Repeat this procedure several times or until all air is expelled from lifter.

   CAUTION: Do not attempt to expell air from lifter by pumping on ram.

9. After all air is expelled, allow ram to bleed down lifter until retaining groove is exposed.

10. Install retaining ring.

11. Adjust ram screw so that it contacts the steel ball in the push-rod seat when the pointer is at the start line.

12. Raise arm, then start test by resting ram on steel ball. Rotate reservoir one revolution every two seconds and time the indicator from the start to the stop line. (Fig. 3-59) Allowable leak-down rate is 6 seconds minimum for used lefters, and 9 to 60 seconds for new lifters.

13. If leak-down tolerance is within specifications, the lifter can be placed in service without removing test fluid.

Valve Lifter Diagnosis

1. Momentarily Noisy When Car is Started:

This condition is normal. Oil drains from the lifters which are holding the valves open when the engine is not running. It will take a few seconds for the lifter to fill after the engine is started.

2. Intermittently Noisy on Idle Only, Disappearing When Engine Speed is increased:

   Intermittent clicking may be an indication of a flat or pitted ball, or it may be caused by dirt.

   Correction: Clean the lifter and inspect. If ball is defective, replace lifter.

3. Noisy At Slow Idle or With Hot Oil, Quiet With Cold Oil or As Engine Speed is increased:

   Insert a .015" feeler gauge between the rocker arm and valve stem. If noise momentarily disappears and then re-appears after a few seconds with the feeler still inserted, it is an indication that the lifter leak-down rate is too fast.

   Correction: The lifter must be replaced.

4. Noisy at High Car Speeds and Quiet at Low Speeds.

   a. High oil level - Oil level above the "Full" mark allows crankshaft counter-weights to churn the oil into foam. When foam is pumped into the lifters, they will become noisy since a solid column of oil is required for proper operation.

   Correction: Drain oil until proper level is obtained. See PERIODIC MAINTENANCE Section.

   b. Low oil level - Oil level below the "Add 2" mark allows the pump to pump air at high speeds which results in noisy lifters.

   Correction: Fill until proper oil level is obtained. See PERIODIC MAINTENANCE Section

5. Noisy at Idle Becoming Louder as Engine Speed is increased to 1500 rpm.

   a. This noise is not connected with lifter malfunction. It becomes most noticeable in the car at 10-15 mph "L" range, or 30-35 mph "D" range, and is best described as a hashy sound. At slow idle, it may be entirely gone or appear as a light ticking noise in one or more valves. It is caused by one or more of the following:

      (1) Badly worn or scuffed valve tip and rocker arm pad.

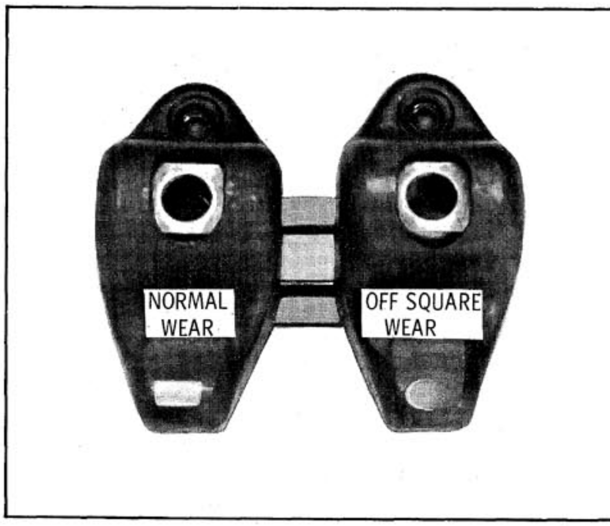

Fig. 3-61 Rocker Arm Wear

      (2) Excessive valve stem to guide clearance.

      (3) Excessive valve seat runout.

      (4) Off square valve spring.

      (5) Off square rocker arm pad.

      (6) Excessive valve face runout.

      (7) Valve spring damper clicking on retainer.

      (8) Distorted lock plate.

      (9) Two barrel engine push-rod in a four barrel engine.

Diagnosis

Remove valve covers and while listening with a stethoscope, locate noisy valves by increasing engine speed slightly above idle, about 1500 rpm. With gloved hand, push sideways on valve spring. Noise will change, either becoming louder or disappearing completely. Some noise will be present in all valve locations. It is necessary to determine which are actually responsible for the noise.

Correction:

a. Occasionally this noise can be eliminated by rotating the valve spring and valve. Crank engine until noisy valve is off its seat. Rotate spring. This will also rotate valve. Repeat until valve becomes quiet. If correction is obtained, check for an off square valve spring. If spring is off square more than 1/16" in free position, replace spring. (Fig. 3-60)

b. Observe rocker arm pad for excessive wear or excessive off square. Replace as required. (Fig. 3-61)

c. If correction is not obtained, check for excessive valve stem to guide clearance. If necessary, correct as required.

6. Valves Noisy Regardless of Engine Speed.

This condition can be caused by foreign particles or excessive valve lash.

Correction:

a. With transmission in NEUTRAL and parking brake on, run the engine at a high speed.

If this method does not quiet the lifter, strike the rocker arm above the push-rod with a mallet while the engine is idling. This method of correction has proven successful for dislodging a foreign particle which is preventing the ball from seating properly.

b. Check for valve lash by turning engine so the piston in that cylinder is on top dead center of firing stroke. If valve lash is present, the push-rod can be freely moved up and down a certain amount with rocker arm held against valve.

Valve lash indicates one of the following:

(1) Worn push-rod.

(2) Worn rocker arm.

(3) Lifter plunger stuck in down position due to dirt or varnish.

(4) Defective lifter.

Checking of the above four items:

Remove the rocker arm assemblies then proceed as follows:

1. Observe upper end of push-rod. Excessive wear of the spherical surface indicates one of the following conditions.

   a. Improper hardness of the push-rod ball. The push-rod and rocker arm must be replaced.

   b. Improper lubrication to the push-rod. The push-rod and rocker arm must be replaced. The oiling system to the push-rod should be checked.

2. If push-rod appears in good condition and has been properly lubricated, replace rocker arm and recheck valve lash.

3. If valve lash exists and push-rod and rocker arm are okay, trouble is in the lifter. Lifter should be replaced.

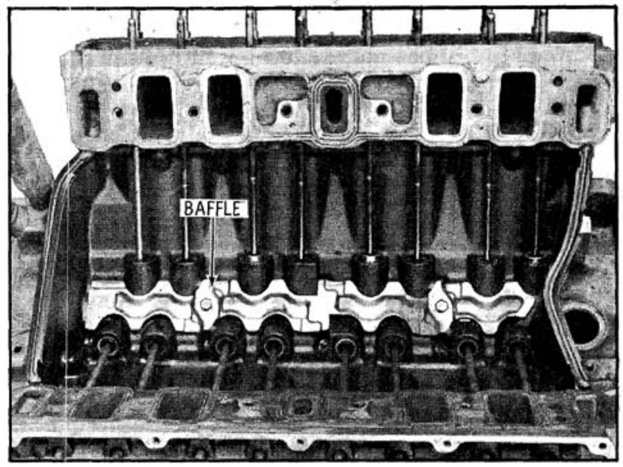

Fig. 3-62 Baffle Installation

Installation

1. Install lifters and push-rods into original position in cylinder block.

   NOTE: Four barrel 330 cubic inch engine push-rods are .027" longer than two barrel 330 cubic inch engine push-rods and are identified by a blue band at each end.

2. Install baffle (if removed) in 425 cubic inch engine as shown in Fig. 3-62. Install manifold gaskets and manifold.

3. Position rocker arms, pivots, lock plates, washers and nuts on cylinder head as shown in Fig. 3-63.

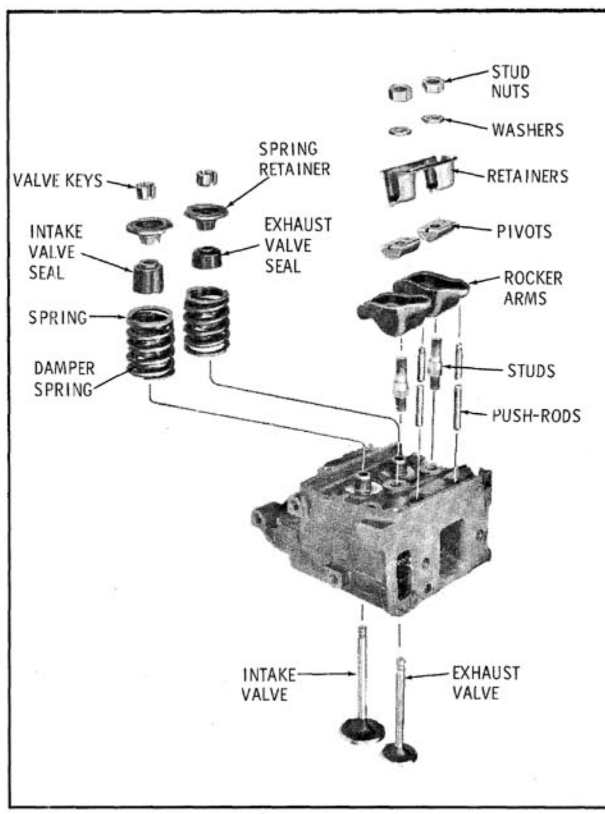

Fig. 3-63 Cylinder Head - Exploded View

4. Install intake manifold and valve cover, connect spark plug wires and install air cleaner.

CYLINDER HEAD AND GASKET

Removal

1. Drain radiator and cylinder block.
2. Remove intake manifold.
3. Disconnect exhaust crossover pipe for left side and/or crossover pipe and exhaust pipe for right side.
4. Remove valve cover.

   NOTE: Loosen or remove any accessory brackets which interfere.
5. Remove ground strap from right cylinder head.
6. Remove cylinder head bolts and remove cylinder head with exhaust manifold and rocker arms attached.

   CAUTION: DO NOT BEND OIL DIP STICK TUBE WHEN REMOVING OR INSTALLING LEFT CYLINDER HEAD.

Installation

Head gasket should be coated on both sides with Part No. 1050026 Sealer or equivalent before installation.

Clean and lubricate cylinder head bolts with engine oil. Torque head bolts to 80 ft. lbs. (Fig. 3-64) and torque exhaust manifold to head bolts to 25 ft. lbs.

VALVES AND SPRINGS (HEAD REMOVED)

NOTE: Valves used on 54 and 66 Series are .030" longer than other V-8 valves and are identified by a groove. (Fig. 3-64A)

Removal

1. Remove spark plugs and exhaust manifold.
2. Remove valve keys by compressing valve spring with a tool such as J-7541 or OTC-CF-11.
3. Remove valve spring retainers and springs. (Fig. 3-63)
4. Remove oil deflectors from valve stems.
5. Remove valves. Keep valves separated so they can be installed in their original locations. (Fig. 3-65)

Installation

1. Install valves in their respective guides.
2. Install new oil deflectors over valve stem. Position deflectors down as far as possible on valve stem. The deflectors will correctly position themselves when the engine is started.
3. Position valve springs over valve stems.
4. Install valve spring retainers then compress springs with a tool such as J-7541 or OTC-CF-11 and install valve stem keys.
5. Check valve springs and keys to be sure they are properly seated.
6. Install exhaust manifold. Torque bolts and nuts to 25 ft. lbs.

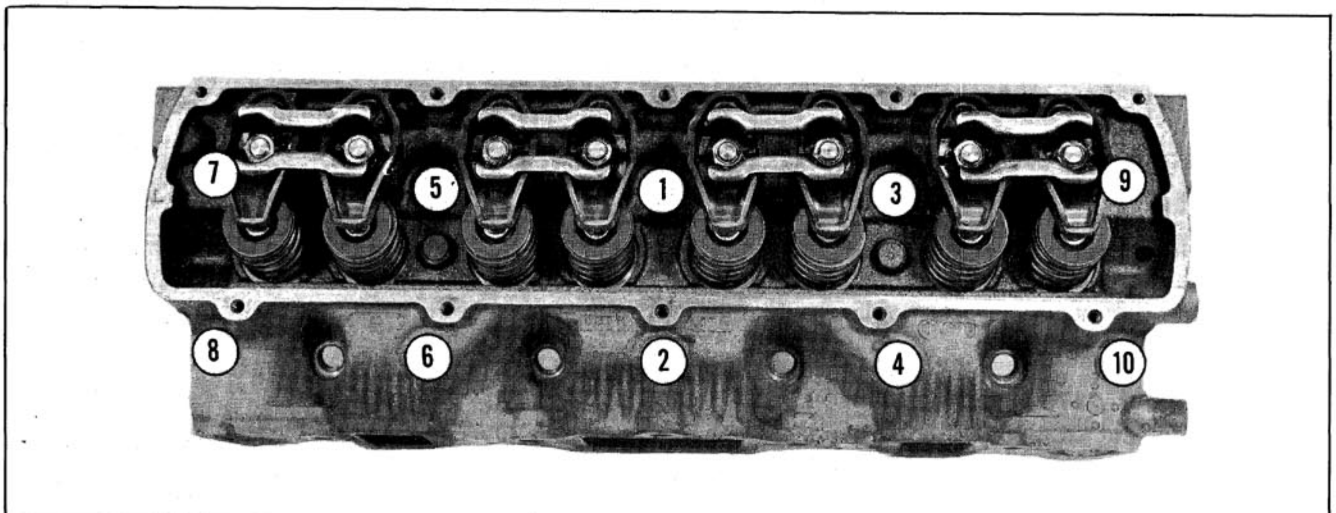

Fig. 3-64 Cylinder Head Torque Sequence

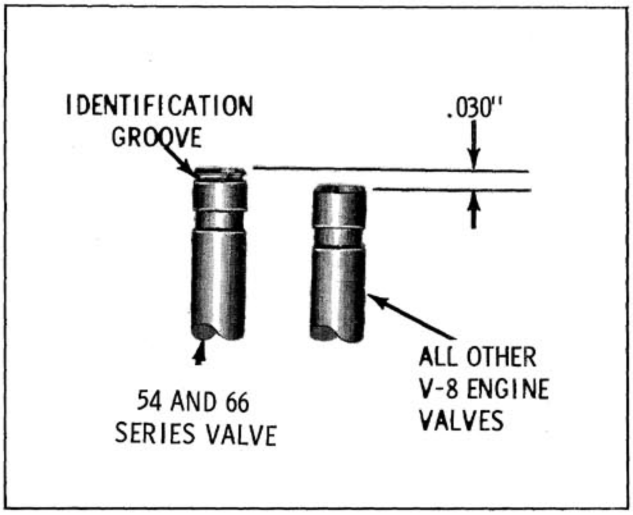

Fig. 3-64A Valve Identification

7. Set spark plug gap (.030"). Lubricate plug threads with one drop of SAE 10W30 oil and re-install plugs. Torque to 35 ft. lbs.

Reconditioning Valves

When reconditioning valves and valve seats, clean carbon from cylinder heads and valves using extreme care not to gouge or scratch machined surfaces. A soft wire brush is suitable for the purpose. Whenever valves are replaced or new valves installed, the valve seats must be reconditioned. If valve guide bores are worn excessively, they can be reamed oversize. This will require replacement of the valves. The guide bores should be reamed before grinding the valve seats. Valve clearance in guide bore should be .001" to .003".

Measuring Valve Stem Height

Whenever a new valve is installed, or after grinding valves, it will be necessary to measure valve stem height as follows:

Install Gauge BT-6428 as shown in Fig. 3-66.

There should be at least .035" clearance (on all

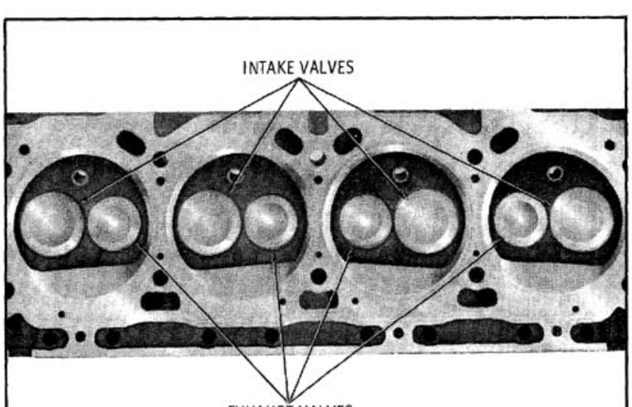

Fig. 3-65 Valve Location

Fig. 3-66 Measuring Valve Stem Height

except 54 and 66 Series, which should have a clearance of at least .005") between gauge surface and end of valve stem. (Valve stem can be gauged with or without the valve spring retainer on the valve.) If clearance is less than specifications, remove valve and grind tip of valve stems as required on a valve refacing machine using the "Vee" block attachment to insure a smooth 90° end. Also be certain to break sharp edge on ground valve tip. Observe an original valve to determine chamfer.

After all valve keys have been installed on valves, tap each valve stem end with a hammer to seat valve retainers and keys. Using Gauge BT-6428 as shown in Fig. 3-66 and Fig. 3-67, re-gauge all valves between valve stem and gauge and valve retainer and gauge. If any valve stem end is less than .030" above retainer, the valve is too short and a new valve must be installed.

EXAMPLE:

Valve Retainer to Gauge Clearance	.060"
Minus Valve Stem to Gauge Clearance	.035"
	.025"

This is less than .030" and a new valve should be installed.

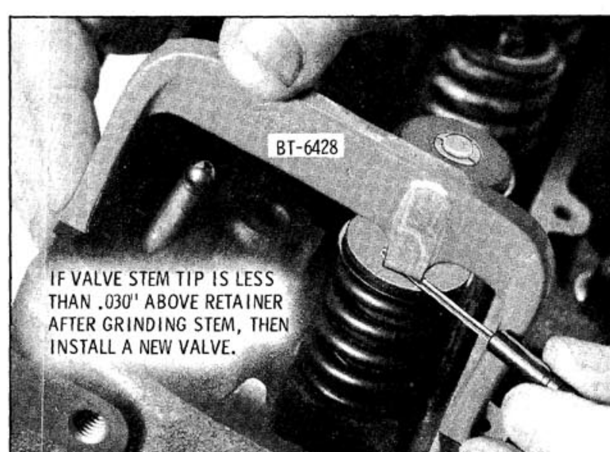

Fig. 3-67 Measuring Valve Retainer Height

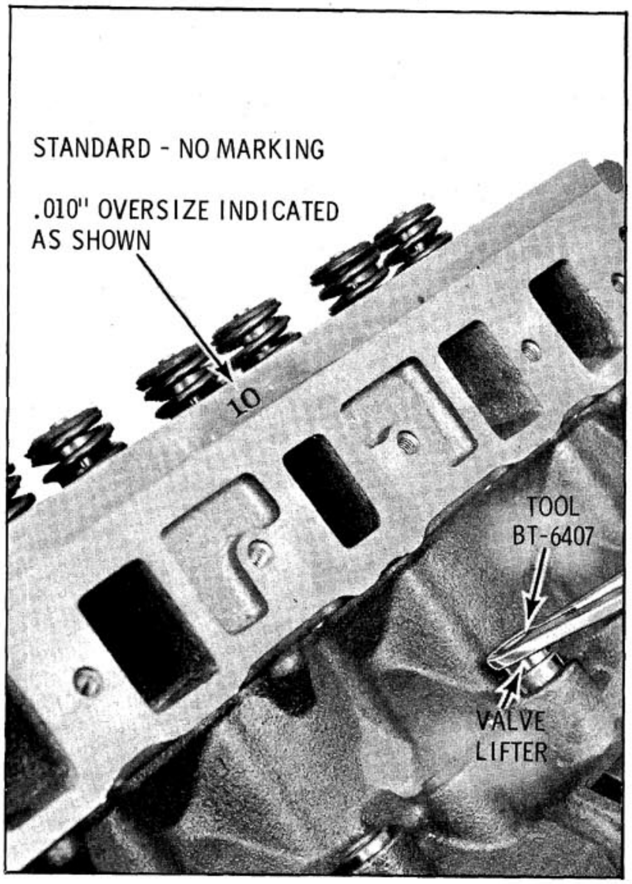

Fig. 3-68 Valve Guide Bore Marking

VALVE GUIDE BORES

As previously stated, if the valve guide bores are worn excessively, they can be reamed oversize. The following reamers are available:

BT-6414-1 .003" Oversize Valve Guide Reamer

BT-6414-4 .005" Oversize Valve Guide Reamer

BT-6414-3 .013" Oversize Valve Guide Reamer

If a standard valve guide bore is being reamed, use the .003" or .005" oversize reamer. For the .010" oversize valve guide bore, use the .013" oversize reamer. If too large a reamer is used and the spiraling is removed, it is possible that the valve will not receive the proper lubrication.

Occasionally a valve guide bore will be oversize as manufactured. These are marked on the inboard side of the cylinder heads on the machined surface just above the intake manifold surface, Fig. 3-68. These markings are visible without removing any parts other than the air cleaner assembly. Before removing the cylinder heads to perform service to either the valves or valve guide bores, the cylinder heads should be inspected to determine if these markings are present. If no markings are present, the guide

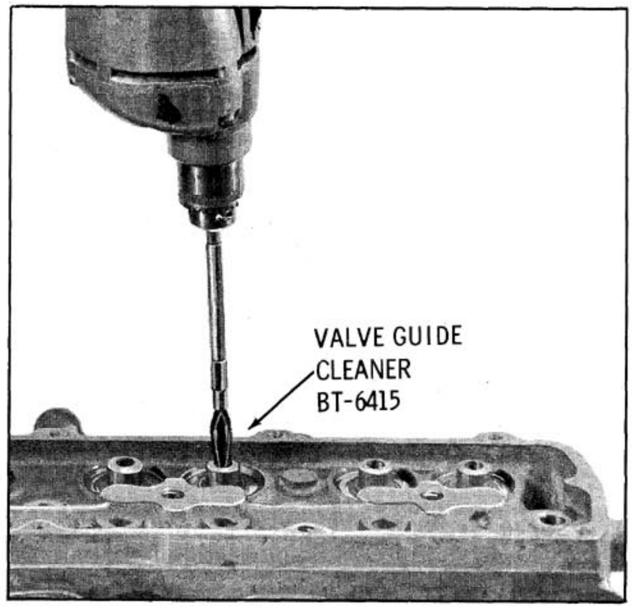

Fig. 3-69 Cleaning Valve Guide Bores

bores are standard. If oversize markings are present, any valve replacement will require an oversize valve. Service valves are available in five different stem diameters: Standard, .003" oversize, .005" oversize, .010" oversize, and .013" oversize.

REAMING PROCEDURE

Before attempting to ream the valve guide bores they should be cleaned using Tool BT-6415 as shown in Fig. 3-69.

This procedure to ream valve guide bores using Tool BT-6414 is shown in Fig. 3-70. Use care to hold reamer straight in valve guide bore.

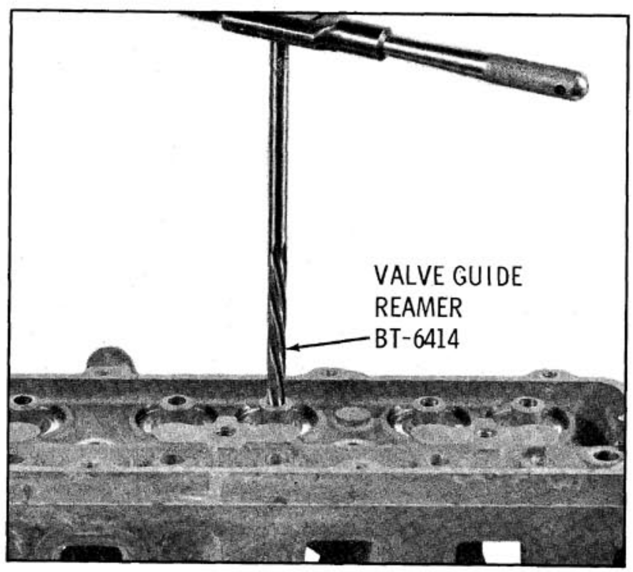

Fig. 3-70 Reaming Valve Guide Bore

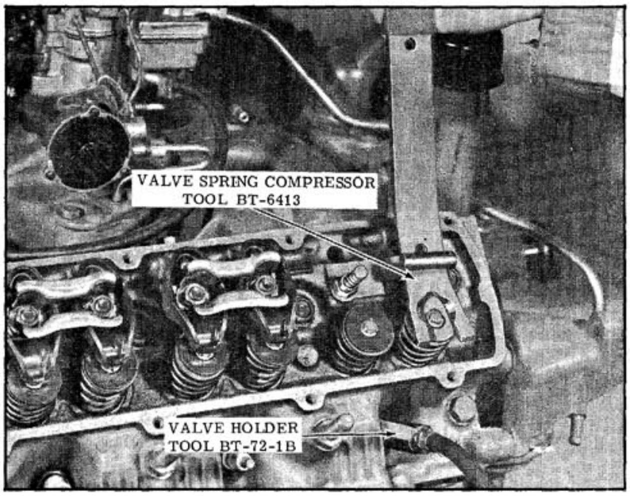

Fig. 3-71 Removing Valve Spring

REPLACING VALVE SPRING (HEAD ON ENGINE)

To replace a worn or broken valve spring without removing the cylinder head proceed as follows:

Removal

1. Remove rocker arm assemblies.
2. Remove spark plug and install Tool BT-72-1-B into spark plug hole and attach to an air hose to hold the valve against its seat.
3. Install Tool BT-6413, (Fig. 3-71) compress the valve spring until valve keys are accessible, then remove keys, spring retainer cups, and springs.

   NOTE: If valve spring does not compress, tap Tool with a hammer to break bind at retainer and keys.

Installation

1. Install valve spring and spring retainer. Using Tool BT-6413 compress the valve spring until the valve keys can be installed.
2. Install spark plugs. Torque 35 ft. lbs.
3. Install rocker arm assemblies.

OIL PAN

Removal

1. Remove the dip stick.
2. Hoist the car and drain oil.

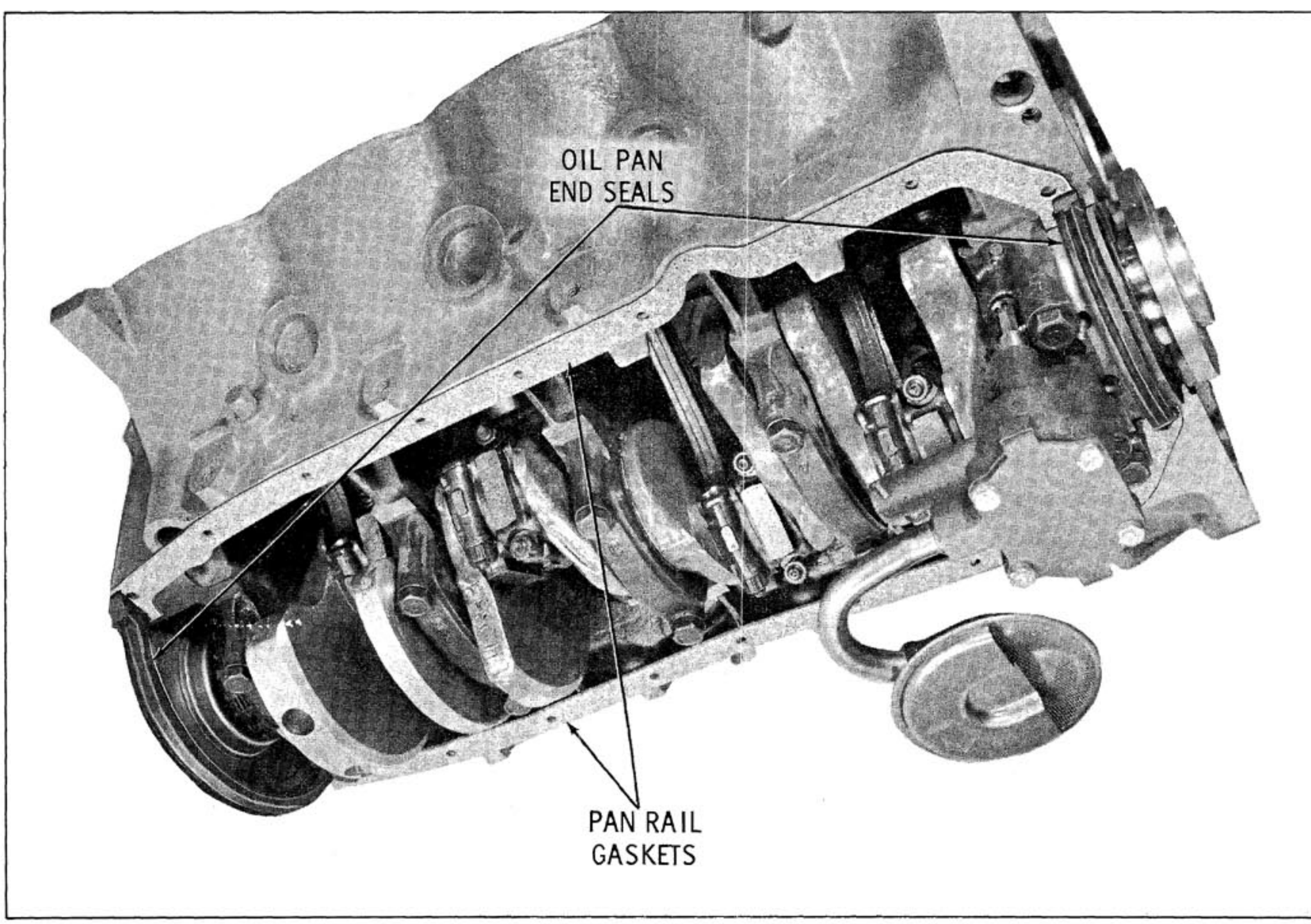

Fig. 3-72 Oil Pan Installation

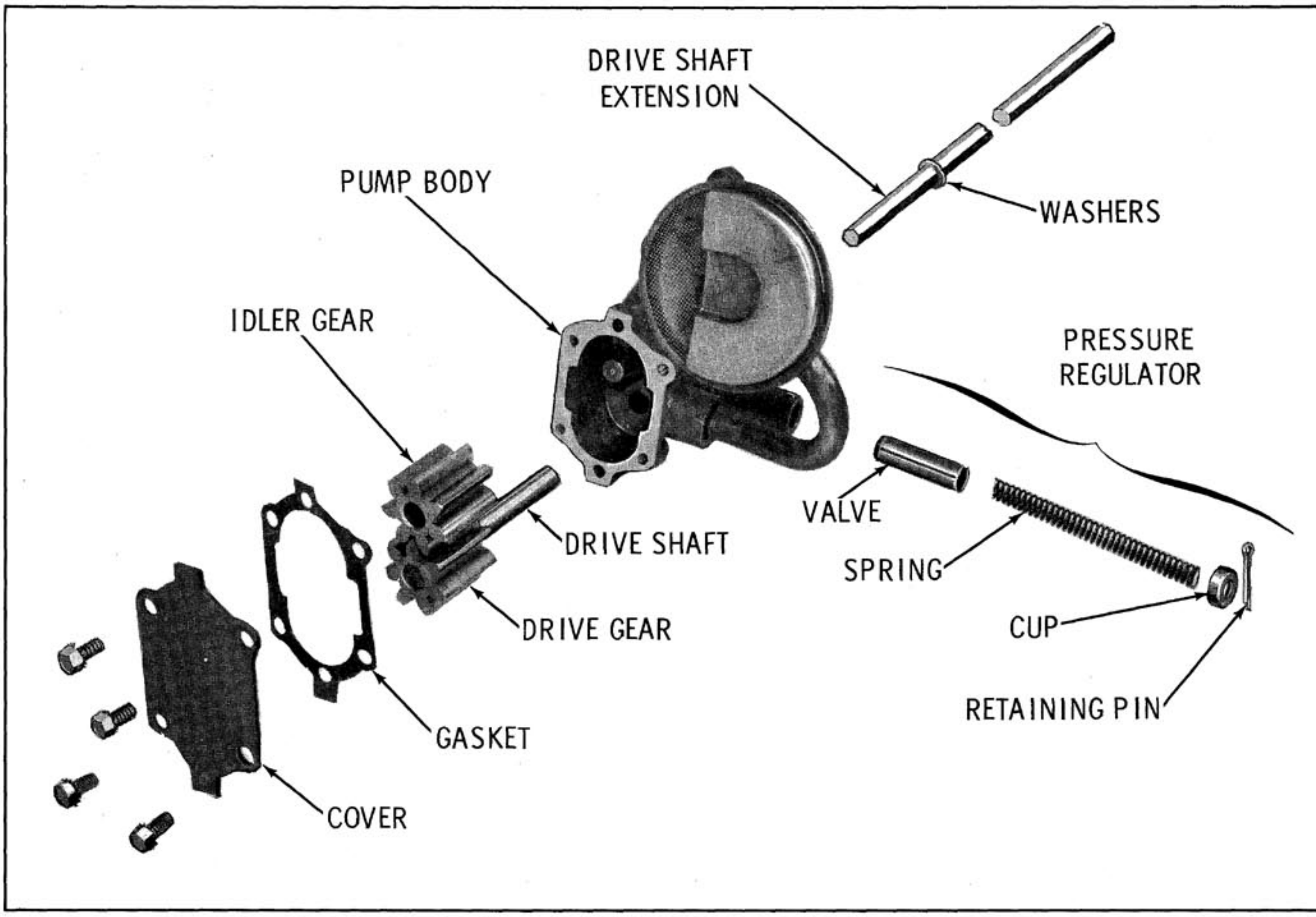

Fig. 3-73 Oil Pump - Exploded View

3. a. (34, 36, and 38 Series) Disconnect exhaust pipe from right exhaust manifold.

   b. (52 through 86 Series) Lower relay rod by disconnecting idler arm or pitman arm.

4. Disconnect engine mounts and jack front of engine up as far as possible using engine Support Tool BT-6501 as shown in Fig. 3-111.

   CAUTION: Be sure distributor does not contact cowl and fan blades do not contact fan ring. Position No. 1 crankshaft throw up.

5. Remove crossover pipe and starter.

6. Remove oil pan attaching bolts and remove oil pan.

Installation

1. Install rear pan seal (rubber).

2. Apply 1050026 Sealer to both sides of pan gaskets (cork) and install on block.

3. Install front seal (rubber).

4. Wipe lube (Part No. 1050169) on seal area and install pan. Torque 5/16" bolts to 15 ft. lbs. and 1/4" bolts to 10 ft. lbs. Fill crankcase as explained in the PERIODIC MAINTENANCE Section.

OIL PUMP

Removal

1. Remove oil pan. (Refer to OIL PAN - Removal)

2. Remove the oil pump to rear main bearing cap attaching screws, then remove pump and drive shaft extension.

Disassembly (Fig. 3-73)

1. Remove the oil pump drive shaft extension.

   NOTE: Do not attempt to remove the washers from the drive shaft extension. The drive shaft extension and washers must be serviced as an assembly. (Fig. 3-74)

2. Remove the cotter pin, cup, spring and the pressure regulator valve.

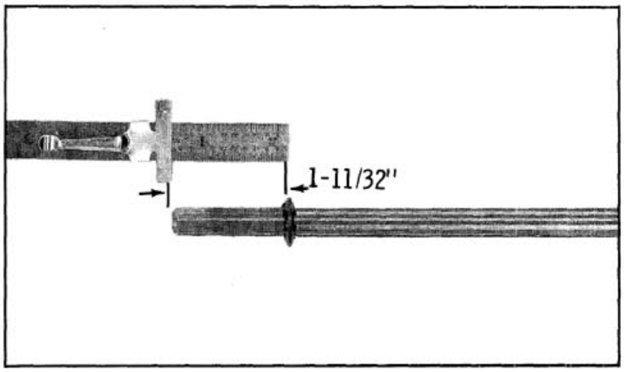

Fig. 3-74 Oil Pump Drive Shaft Extension

CAUTION: Position thumb over pressure regulator bore before removing cotter pin as the spring is under tension.

3. Remove the oil pump cover attaching screws and remove the oil pump cover and gasket.

4. Remove the drive gear and idler gear from the pump body.

Inspection

Check the gears for scoring or other damage. If they are damaged, new gears should be installed. During assembly the gear end clearance should be gauged. Proper end clearance is .0025" - .0065". Also check the pressure regulator valve, valve spring and bore for damage. Proper valve to bore clearance is .0025" - .0050".

Assembly

1. Install the drive gear into the pump with the hex ID of the drive shaft toward the oil pump mounting pad, then install the idler gear.

2. Position a new gasket on the pump body and install the oil pump cover. Tighten the cover screws to 8 ft. lbs.

3. Position the pressure regulator valve into the pump cover, closed end first, then install the spring cup and retaining pin.

IMPORTANT: When assembling the drive shaft extension to the drive shaft, the END OF THE EXTENSION NEAREST THE WASHERS MUST BE INSERTED INTO THE DRIVE SHAFT.

Installation

1. Insert the drive shaft extension through the opening in the main bearing cap and block until the shaft mates into the distributor drive gear.

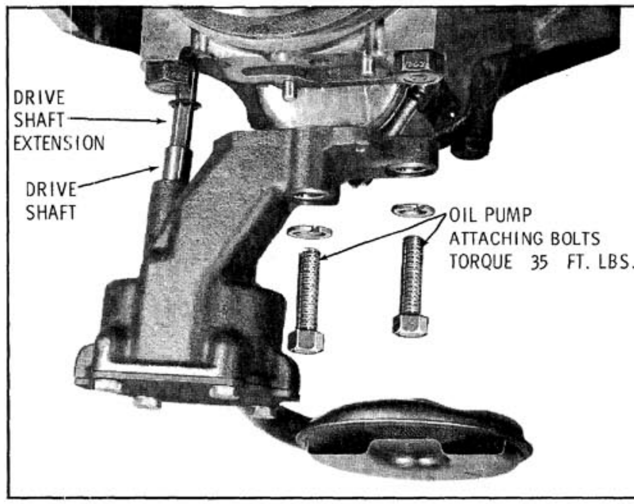

Fig. 3-75 Oil Pump Installation

2. Position pump onto the rear main bearing cap and install attaching bolts. Torque bolts to 35 ft. lbs. (Fig. 3-75)

3. Install the oil pan. Refer to OIL PAN - Installation.

CONNECTING ROD AND PISTON ASSEMBLY

Removal

1. Remove intake manifold, head or heads.

2. Remove oil pan.

3. Remove oil pump assembly.

IMPORTANT: Stamp cylinder number on the machined surfaces of the bolt bosses of the connecting rod and cap for identification when reinstalling. If the pistons are to be removed from the connecting rod, mark cylinder number on piston with a silver pencil or quick drying paint. The right bank is numbered 2-4-6-8, left bank 1-3-5-7.

Examine the cylinder bore above ring travel. If ridge exists, remove ridge with ridge reamer before attempting to remove the piston and rod assembly.

4. Remove rod bearing cap and bearing.

5. Install guide hose over threads of rod bolts. This is to prevent damage to bearing journal and rod bolt threads. (Fig. 3-76)

6. Remove rod and piston assembly through the top of the cylinder bore.

7. Remove other rod and piston assemblies in the same manner.

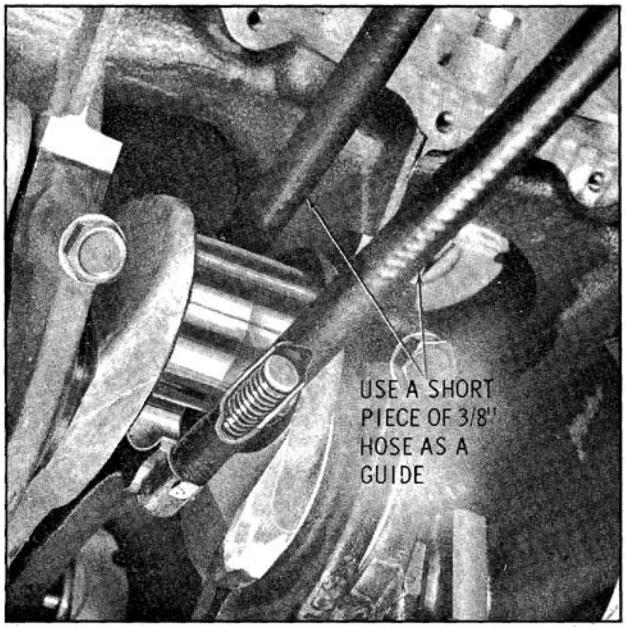

Fig. 3-76 Connecting Rod Bolt Guides

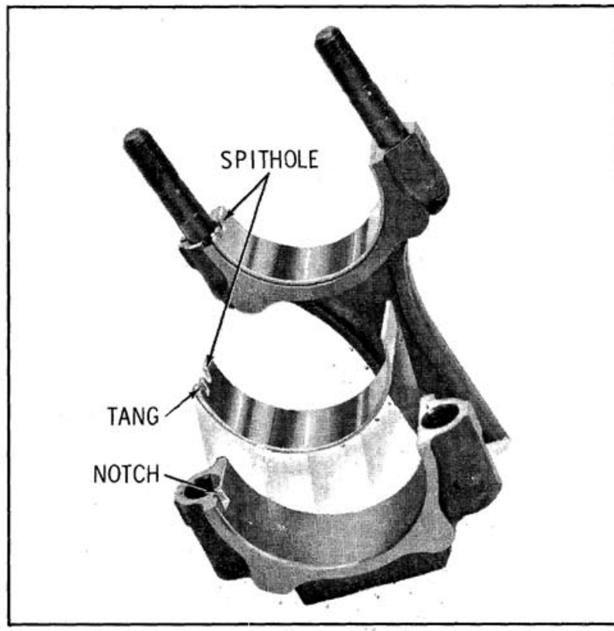

Fig. 3-77 Bearing Tang and Notch

ROD BEARINGS

The connecting rod bearings are assembled with a slight projection above the rod and cap faces to insure a positive contact. Adjustment for wear is compensated by replacing the bearing.

Connecting rod bearings can be replaced without removing the rod and piston assembly from the engine.

1. Remove oil pan.

   NOTE: It may be necessary to remove oil pump to provide access to rear connecting rod bearings.

2. With connecting rod journal at the bottom, stamp cylinder number on machined surfaces of connecting rod and cap for identification when reinstalling, then remove caps.

3. Inspect journals for roughness and wear. Slight roughness may be removed with a fine grit polishing cloth saturated with engine oil. Burrs may be removed with a fine oil stone. If the journals are scored or ridged, the crankshaft must be replaced.

4. The connecting rod journals can be checked for out-of-round with the use of a micrometer. Maximum out-of-round must not exceed .0015".

   NOTE: Refer to ENGINE SPECIFICATIONS Chart at the back of this section.

If plastigauge is to be used:

5. Clean oil from journal bearing cap, connecting rod, and outer and inner surface of bearing inserts. Position insert so that tang is properly aligned with notch in rod and cap. (Fig. 3-77)

6. Place a piece of plastigauge in the center of lower bearing shell.

7. Reinstall bearing cap and torque to 42 ft. lbs.

8. Remove bearing cap and determine bearing clearances by comparing the width of the flattened plastigauge at its widest point with the graduation on the plastigauge container. The number within the graduation on the envelope indicates the clearance in thousandths of an inch. (Fig. 3-78) If this clearance is greater than .0035", replace the bearing and recheck clearance with plastigauge.

   NOTE: Lubricate bearing with SAE 10W30 oil before installation. Repeat Steps 2 through 7 on remaining connecting rod bearings. All rods must be connected to their journals when rotating the crankshaft to prevent engine damage.

9. Measure the rod side clearance as shown in Fig. 3-79.

ROD ASSEMBLY

If a rod is twisted or bent, a new rod must be installed. NO ATTEMPT SHOULD BE MADE TO STRAIGHTEN CONNECTING RODS.

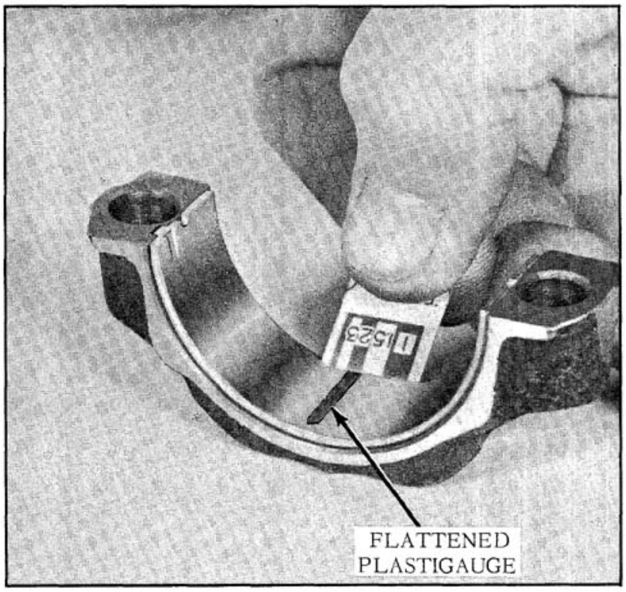

Fig. 3-78 Checking Oil Clearance

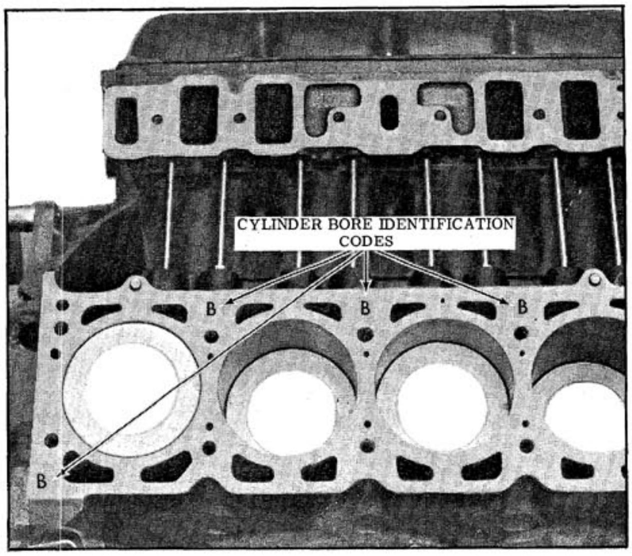

Fig. 3-79A Cylinder Bore Marking

PISTON

MEASURING PISTON

NOTE: Refer to ENGINE SPECIFICATIONS Chart at the back of this section.

When replacing pistons, the original cylinder size is stamped with a code letter on the block near each cylinder on the cylinder head surface. (Fig. 3-79A)

When measuring piston for size or taper, measurement must be made on skirt 90° from piston pin hole (with the piston pin removed).

When measuring taper, the largest reading must be at the bottom of the skirt. Allowable taper is .000" to .001".

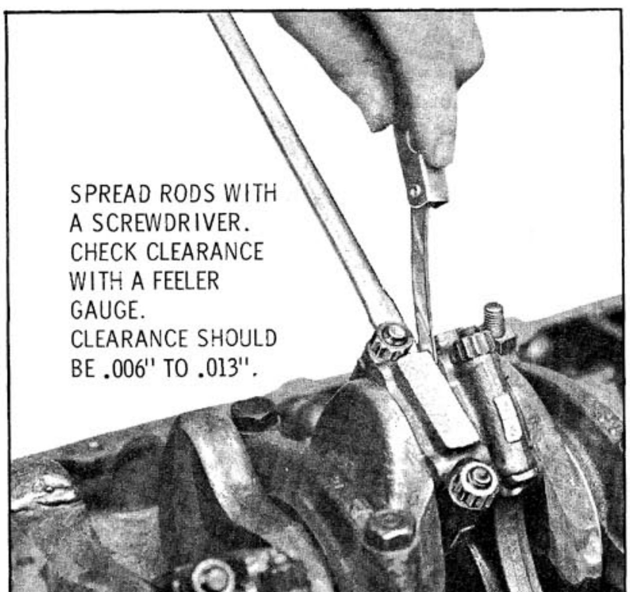

Fig. 3-79 Connecting Rod Side Clearance

NOTE: On some cars, oversize pistons may be found. These pistons will be either .005" or .010" oversize.

NOTE: The piston and cylinder bore must be free of oil and at the same temperature.

1. Place a strip of .0015" feeler gauge against the upper side of the bore, at 90° to the normal piston pin location. Attach Scale J-5515 to feeler gauge. (Fig. 3-80)

2. Insert piston with pin and rings removed, into bore with head downward.

3. While holding the piston in the center of its normal travel, slowly pull the scale in a straight line and note the reading on the scale. The reading should be between 3 to 12 pounds while pulling the feeler gauge out of the bore.

Each piston should be fitted to its individual cylinder and marked for that cylinder.

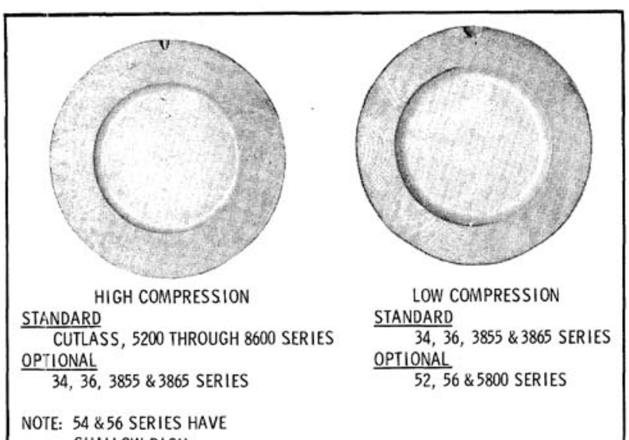

Fig. 3-80 Piston Identification

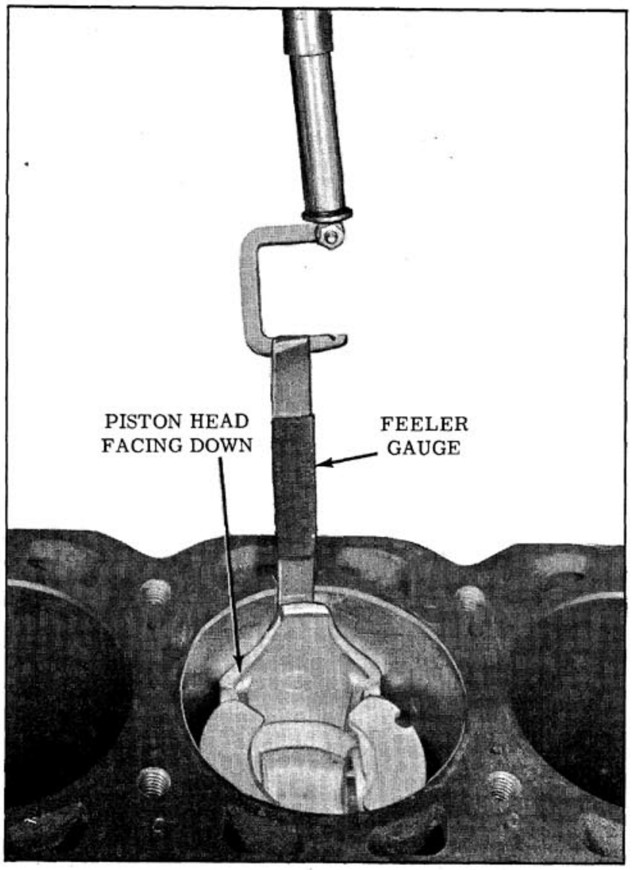

Fig. 3-81 Checking Piston Clearance

CHECKING CYLINDER BORE

NOTE: Refer to ENGINE SPECIFICATIONS Chart at the back of this section.

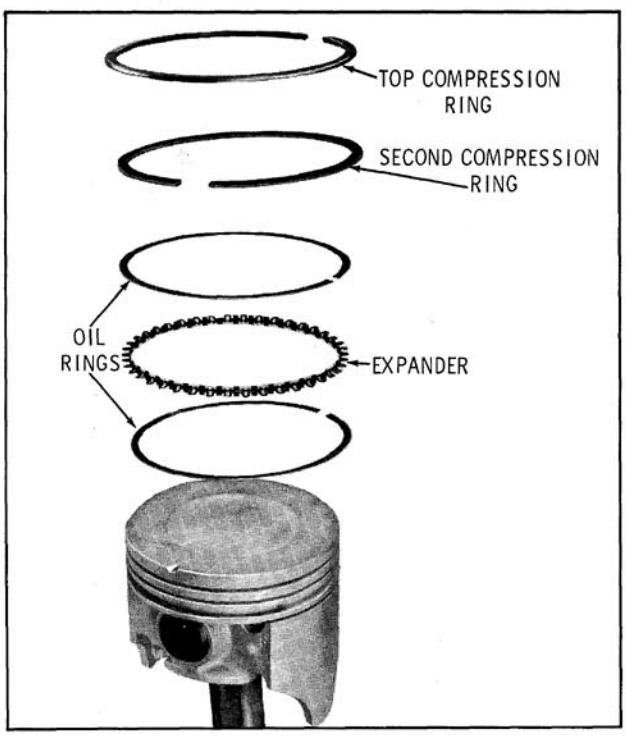

Fig. 3-82 Piston Rings

Cylinder bore size can be measured with inside micrometers or a cylinder gauge. Maximum allowable taper of the cylinder bore is .010". The most wear will occur at the top of the ring travel.

Reconditioned cylinder bores should be held to not more than .001" out-of-round and .001" taper.

It is important that reconditioned cylinder bores be thoroughly washed with a soap and water solution to remove all traces of abrasive material to eliminate premature wear.

CLEANING PISTON

Clean the pistons by scraping carbon off the top of the piston. Deposits in the ring grooves should be removed with a suitable ring groove cleaning tool. It is important that the ring grooves be completely free of deposits.

RINGS
(Fig. 3-82)

The pistons have three rings (two compression rings and one oil ring). The oil rings consist of two rails and an expander.

Ring Tolerances

When installing new rings, ring gap and side clearance should be checked as follows:

Piston Ring and Rail Gap

Each ring and rail gap must be measured with

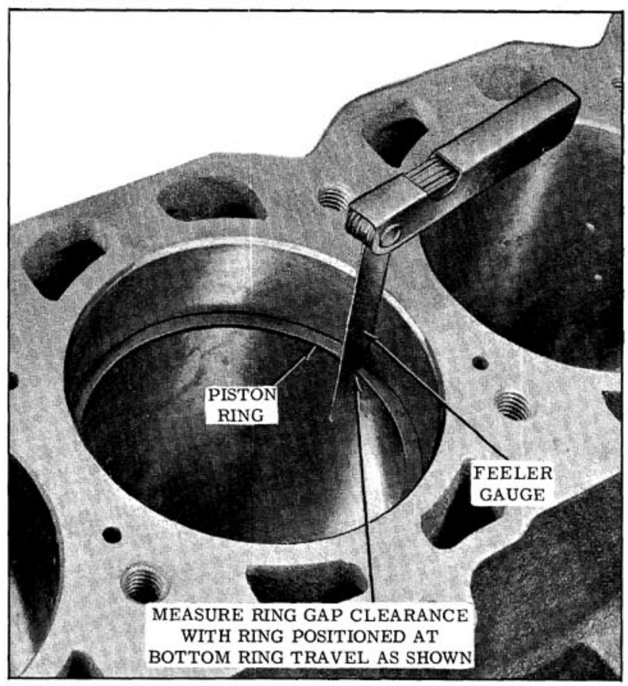

Fig. 3-83 Measuring Piston Ring Gap

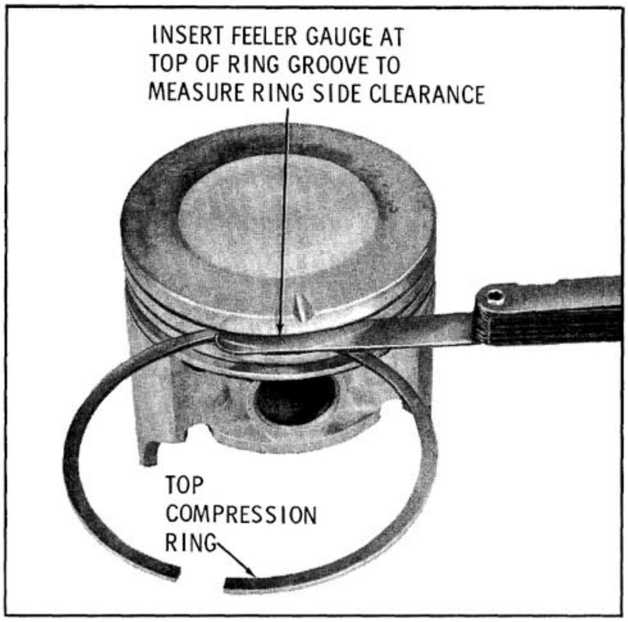

Fig. 3-84 Piston Ring Side Clearance

the ring or rail positioned squarely and at the bottom of the ring-travel area of the bore. (Fig. 3-83)

If the gap measurement is less than .010" to .020" for compression rings and .015" to .055" for oil rings, minimum, file the ends of rings and rails until the minimum gap is obtained. Ends of rings and rails must be filed square. Break sharp corners after filing.

Side Clearance

Each ring must be checked for side clearance (see chart) in its respective piston groove by inserting a feeler gauge between the ring and its upper land. (Fig. 3-84) The piston grooves must be cleaned before checking ring for side clearance.

NOTE: To check oil ring side clearance, the oil rings must be installed on the piston.

ALLOWABLE SIDE CLEARANCE

Oil Rings	.0001" to .0051"
Compression Ring	.0018" to .0038"

Ring Installation (Fig. 3-82)

IMPORTANT: For service ring specifications and detailed installation instructions, refer to the instructions furnished with the parts package.

ROD AND PISTON ASSEMBLY

Installation

1. Install connecting rod bolt guide hose over rod bolt threads. (Fig. 3-76)

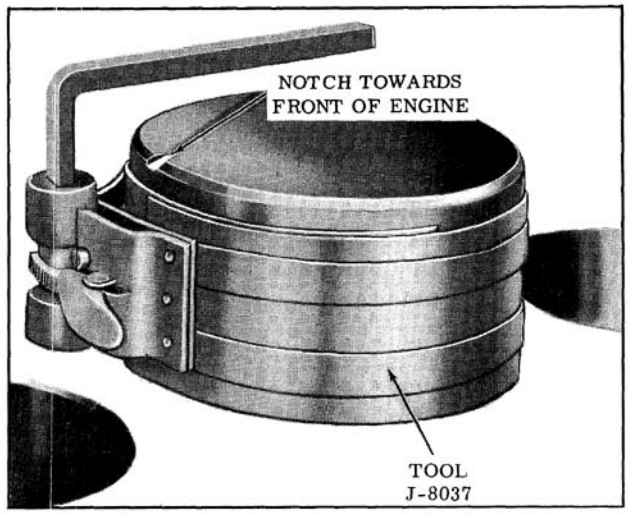

Fig. 3-85 Piston Ring Compressor

2. Apply SAE 10W30 oil to rings and piston, then install piston ring compressing tool on piston. (Fig. 3-85)

3. Install assembly in its respective cylinder bore so notch cast in top of piston is towards the front of engine.

4. Lubricate the crankshaft journal with SAE 10W30 oil and install connecting rod bearing and cap, with bearing index tang in rod and cap on same side.

   NOTE: When more than one rod and piston assembly is being installed, the connecting rod cap attaching nuts should only be tightened enough to keep each rod in position until all have been installed. This will facilitate installation of remaining piston assemblies.

   The clearance between the adjacent rods, when checked with a feeler gauge on each crankpin, should be from .002" to .011". (Fig. 3-79)

5. Torque rod bolt nuts to 42 ft. lbs.

PISTON PINS

The correct piston pin fit in the piston is .0003" to .0005" loose. If the pin to piston clearance is to the high limit (.0005"), the pin can be inserted in the piston with very little hand pressure, and will fall through the piston by its own weight. If the clearance is .0003", the pin will not fall through. It is important that the piston pin hole be clean and free of oil when checking pin fit. The pin is a press fit in the connecting rod.

Whenever the replacement of a piston pin is necessary, use the following procedure.

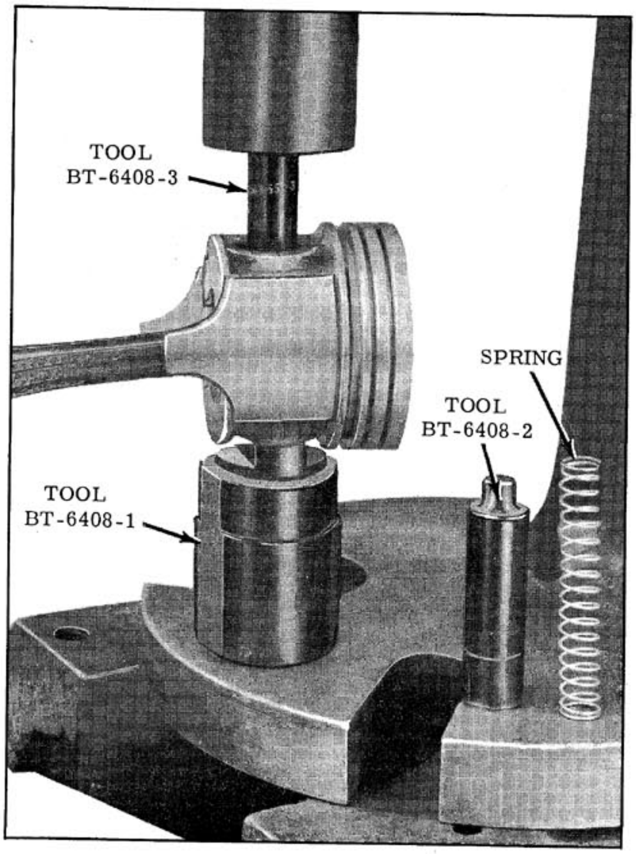

Fig. 3-86 Removing Piston Pin

Removal

1. Place piston on piston pin remover Tool BT-6408-1, with the letter "F" on piston facing up.

2. Place Remover Tool BT-6408-3 in piston pin as shown in Fig. 3-86, and press pin out.

Installation

1. Place spring, Tool BT-6408-5, and guide stop Tool BT-6408-2 in main body Tool BT-6408-1. (Fig. 3-87)

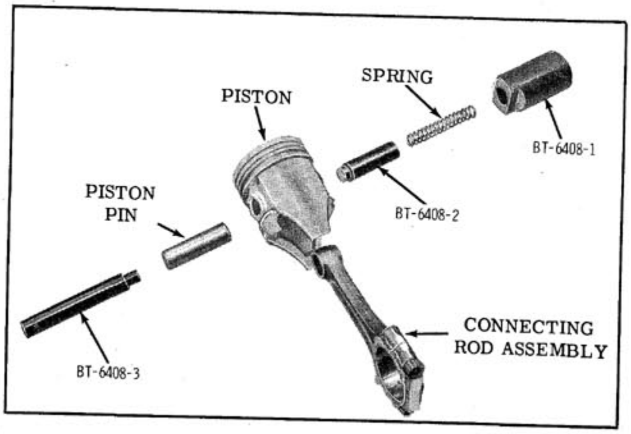

Fig. 3-87 Tool BT-6408

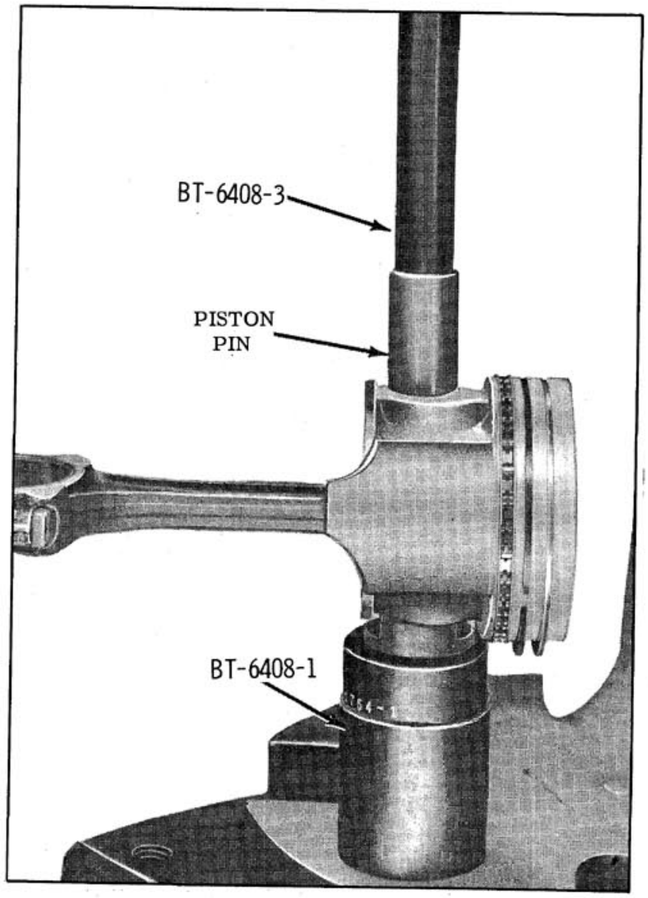

Fig. 3-88 Installing Piston Pin

2. Place piston on Tool BT-6408-1 with letter "F" facing up. Refer to Fig. 3-89 for correct rod and piston assembly.

3. Coat piston pin with SAE 10W30 oil. Place pin in piston as shown in Fig. 3-88. Press in piston pin with Tool BT-6408-3 until it makes contact with guide stop Tool BT-6408-2 in main body Tool BT-6408-1. This will automatically center the pin in the piston. Pin to connecting rod fit is .0008" to .0016" tight.

CRANKSHAFT PULLEY

Removal

1. Remove belt(s). Remove fan.

2. Hoist car.

3. Remove four pulley bolts and pulley.

Installation

1. Install pulley, and four bolts. Torque to 20 ft. lbs.

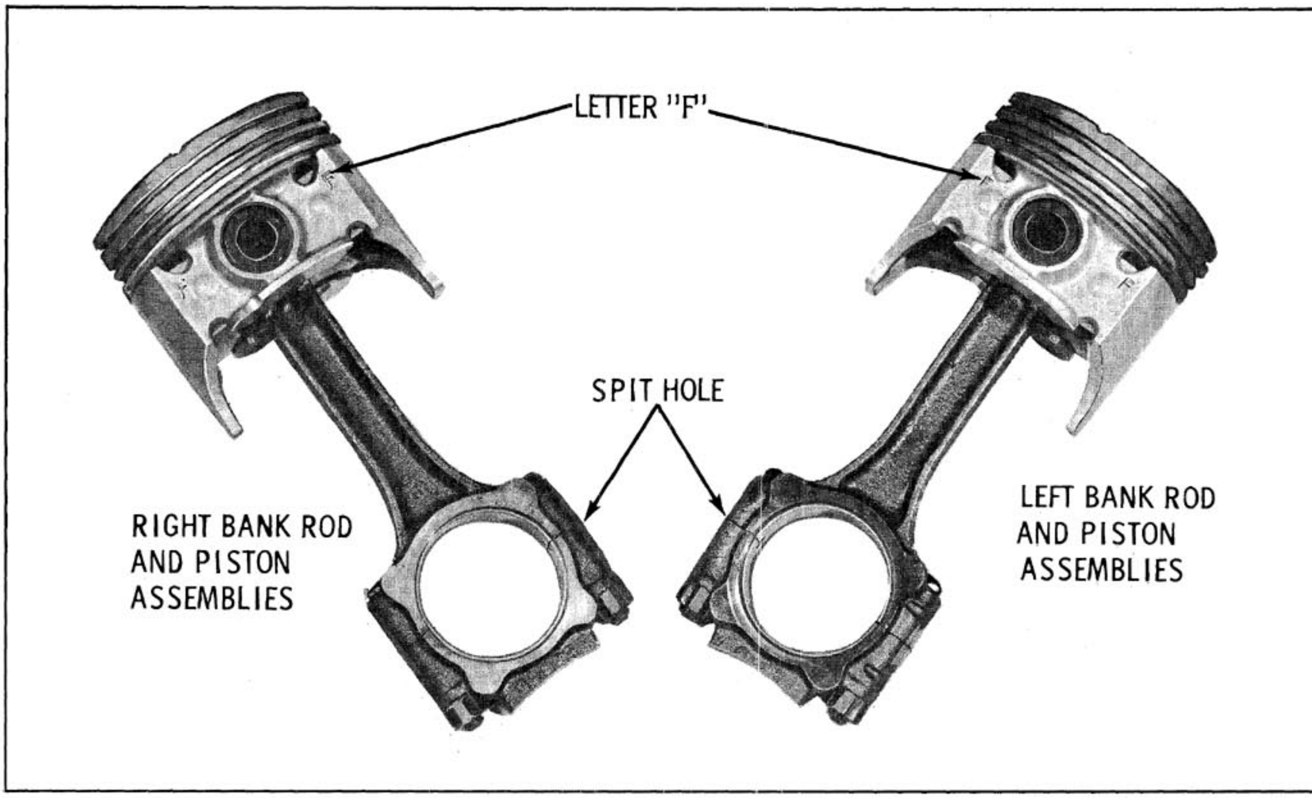

Fig. 3-89 Piston and Connecting Rod Assembly

2. Install fan pulley and fan.

3. Install belt(s). Adjust belts using Tool BT-33-70M.

CRANKSHAFT PULLEY HUB

NOTE: A harmonic balancer is used in place of the pulley hub on all except two barrel low compression 330 cubic inch engines.

Removal

1. Remove belts. Remove fan, fan pulley, and crankshaft pulley.

2. Remove crankshaft pulley hub bolt and washer.

3. Remove pulley hub.

Installation

1. Apply 1050026 Sealer to inside diameter of pulley hub and to crankshaft key to prevent possible oil leakage. Coat outside area of crankshaft pulley hub which enters seal with Special Seal Lubricant, Part No. 1050169.

2. Install pulley hub on crankshaft.

3. Install pulley hub washer and bolt. Torque 50 ft. lbs.

4. Install belt(s). Use Tool BT-33-70M and adjust.

FRONT COVER

Removal

1. Drain cooling system.

2. Disconnect heater hose, bypass hose, and both radiator hoses.

3. Remove all belts, fan and fan pulley, crankshaft pulley, and pulley hub.

4. Remove oil pan.

5. Remove cover to block attaching bolts and remove cover, timing pointer and water pump assembly. (Fig. 3-90)

Installation

1. Install new cover gasket. Apply 1050026 to gasket around water holes and place on block.

2. Install front cover, timing pointer and water pump assembly.

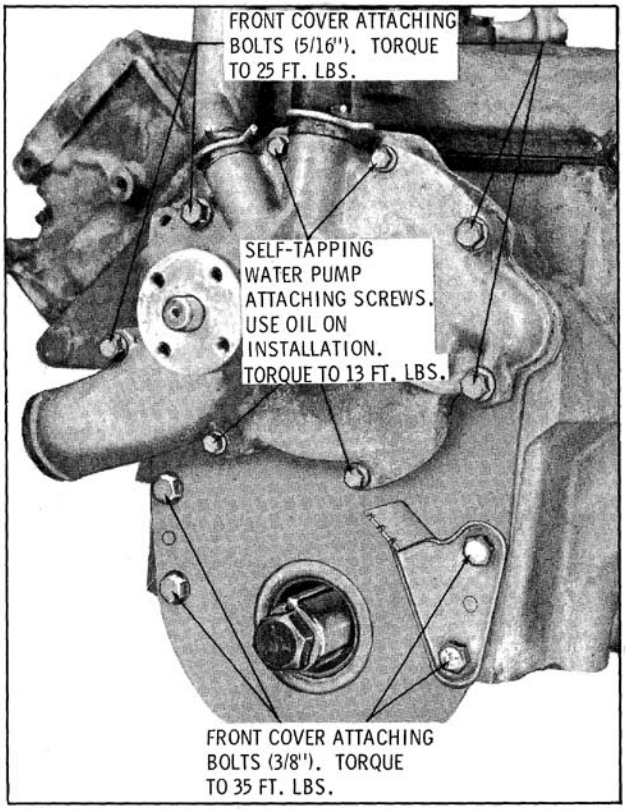

Fig. 3-90 Engine Front Cover Bolts

3. Apply SAE 10W30 oil to bolts (threads and heads) and install. Torque bolts evenly as indicated.

4. Apply lubricant 1050169 on pulley hub seal surface.

5. Install pulley hub and pulley hub bolt. Torque 50 ft. lbs.

6. Connect heater hose, bypass hose and radiator hoses.

7. Install crankshaft pulley and four attaching bolts. Torque to 20 ft. lbs.

8. Install fan pulley, fan and four attaching bolts. Torque bolts to 20 ft. lbs.

9. Install belts and adjust using Tool BT-33-70M.

10. Install oil pan.

11. Fill radiator and crankcase.

OIL SEAL

Removal (Front Cover Installed)

1. Remove the belts.

2. Remove the crankshaft pulley and pulley hub.

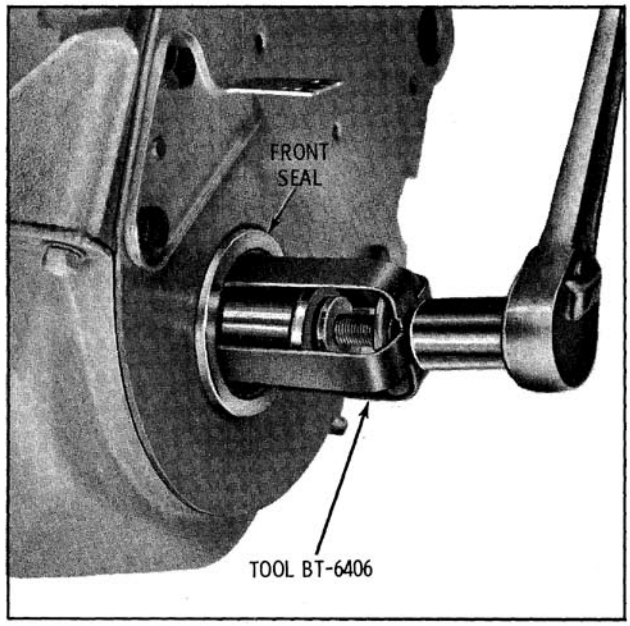

Fig. 3-91 Front Oil Seal Removal

3. Using Tool BT-6406, remove oil seal as shown in Fig. 3-91.

Installation

1. Apply 1050026 Sealer to outside diameter of seal.

2. Using Tool BT-6405, install oil seal as shown in Fig. 3-92.

3. Install the pulley hub and crankshaft pulley.

4. Install and adjust belts.

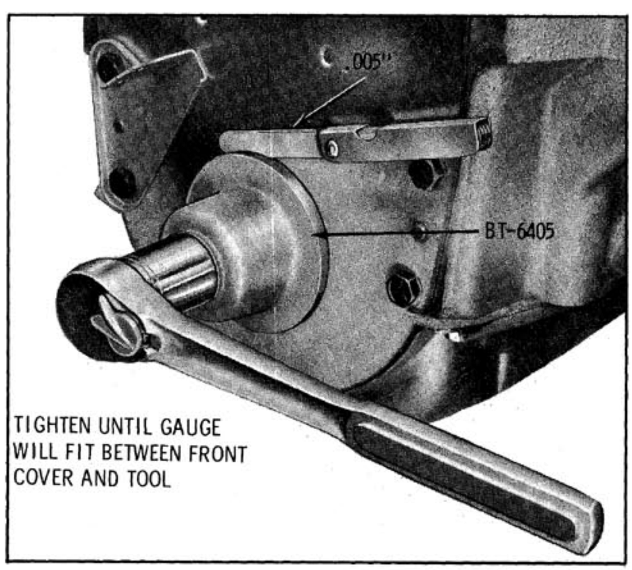

Fig. 3-92 Front Oil Seal Installation

TIMING CHAIN AND GEARS (With Front Cover Removed)

Removal

1. Remove fuel pump eccentric.
2. Remove oil slinger, crankshaft gear, chain, and cam gear.

Installation

1. Install camshaft gear, crankshaft gear, and timing chain together, and align timing marks. (Fig. 3-93)
2. Install fuel pump eccentric with flat side rearward. (Fig. 3-94)
3. Install oil slinger. (Fig. 3-94)

CAMSHAFT (Fig. 3-94-A)

Removal

1. Remove radiator, air conditioning condenser and front end sheet metal as necessary.
2. Remove fuel pump.
3. Remove front cover.
4. Remove oil slinger, timing chain and gears.

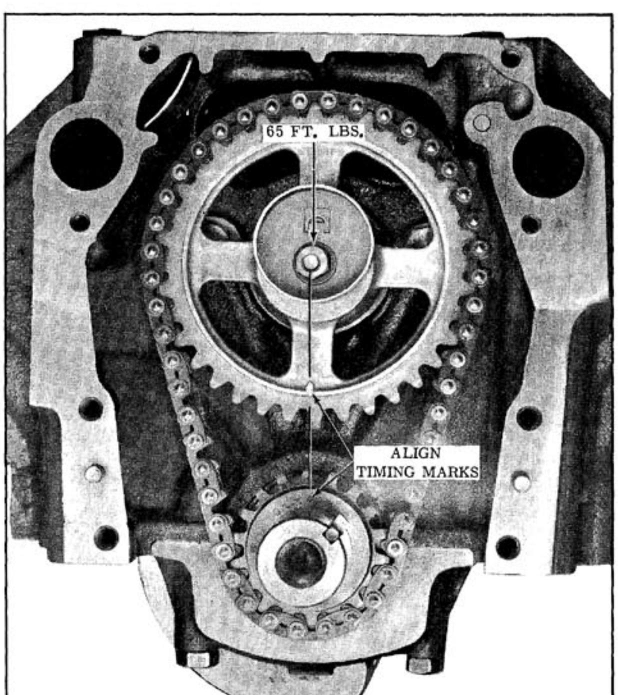

Fig. 3-93 Timing Gear Position

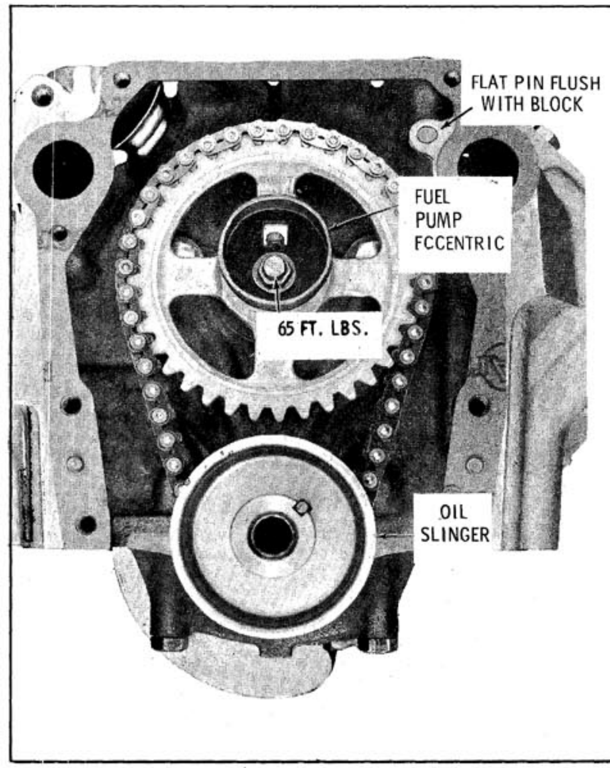

Fig. 3-94 Fuel Pump Eccentric

5. Remove distributor.
6. Remove intake manifold.
7. Remove rocker arm assemblies, push-rods and valve lifters.
8. Remove camshaft by carefully sliding it out the front of the engine.

Installation

NOTE: To insure proper camshaft installation and to provide initial lubrication, it is extremely important that whenever a camshaft is installed it must first be coated liberally with GM Concentrate, Part No. 582099.

1. Install camshaft CAREFULLY.
2. Install valve lifters, push-rods, and rocker arm assemblies and valve covers.
3. Install intake manifold.
4. Install timing chain and gears, oil slinger and front cover.
5. Install fuel pump.
6. Install radiator, air conditioning condenser and front end sheet metal as necessary.
7. Install distributor. Refer to ELECTRICAL Section.

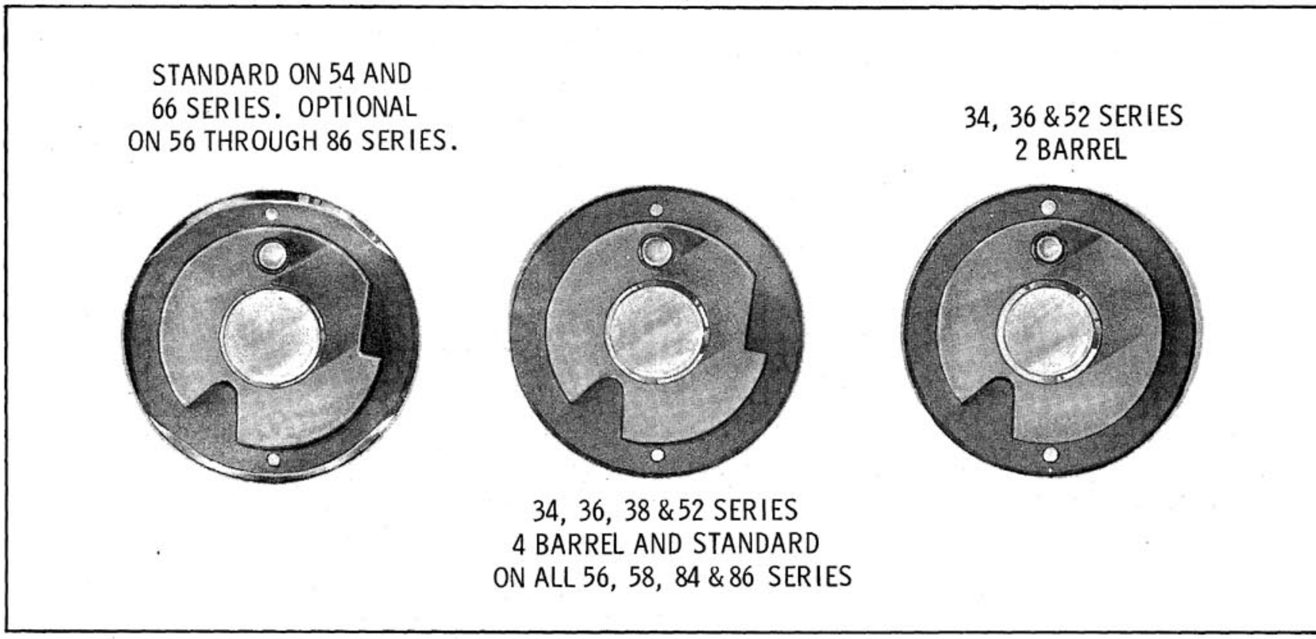

Fig. 3-94A Camshaft Identification

CAMSHAFT BEARINGS

The camshaft bearings must be replaced in complete sets. All bearings must be removed before any can be installed. Number 1 bearing must be removed first, then number 2, then 3, 4 and 5. When installing the bearings, number 5 must be installed first, then number 4, 3, 2 and 1.

Included with the available tools is Camshaft Bearing Remover and Installer Set BT-6409 shown in Fig. 3-112.

This set can be used to remove cam bearings with the engine either in or out of the car. To replace bearings with engine in car, proceed as follows:

Removal

(Camshaft Removed)

1. Install #1 Cam Bearing Remover and Installer BT-6409-1 on Handle J-8092 (existing tool) and drive out front cam bearing.

2. Place Pilot BT-6409-6 on Driver BT-6409-7 and install #2 Cam Bearing Tool BT-6409-2 on driver and drive out #2 bearing.

3. Remove #3 and #4 bearings in the same manner, using BT-6409-3 and BT-6409-4 removers.

   NOTE: Each cam bearing is a different diameter and the correct sequence must be used both for removal and installation.

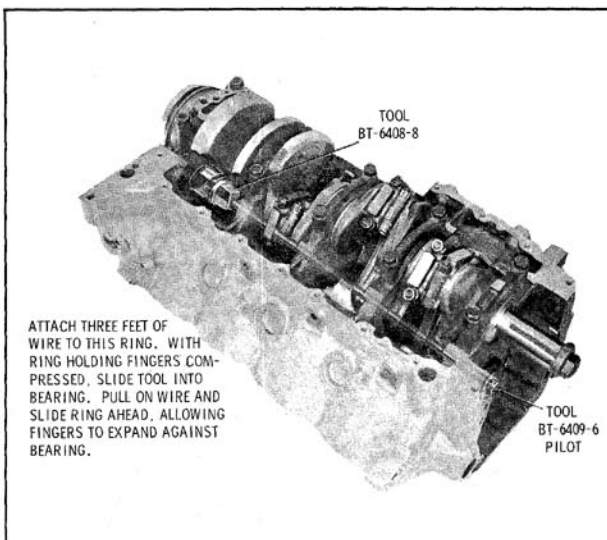

Fig. 3-95 Removing Rear Cam Bearing

4. To remove #5 bearing with engine in chassis, use puller BT-6409-8 as shown in Fig. 3-95.

Installation

NOTE: To aid in aligning bearings with oil passages, place each bearing in the front bore with tapered edge toward block and align the oil hole in the bearing with the center of the oil slot in the bore. Mark top of bearing. When installing the bearings the mark will act as a guide.

1. Place new #5 bearing on BT-6409-5 and drive bearing in until the last white line on the

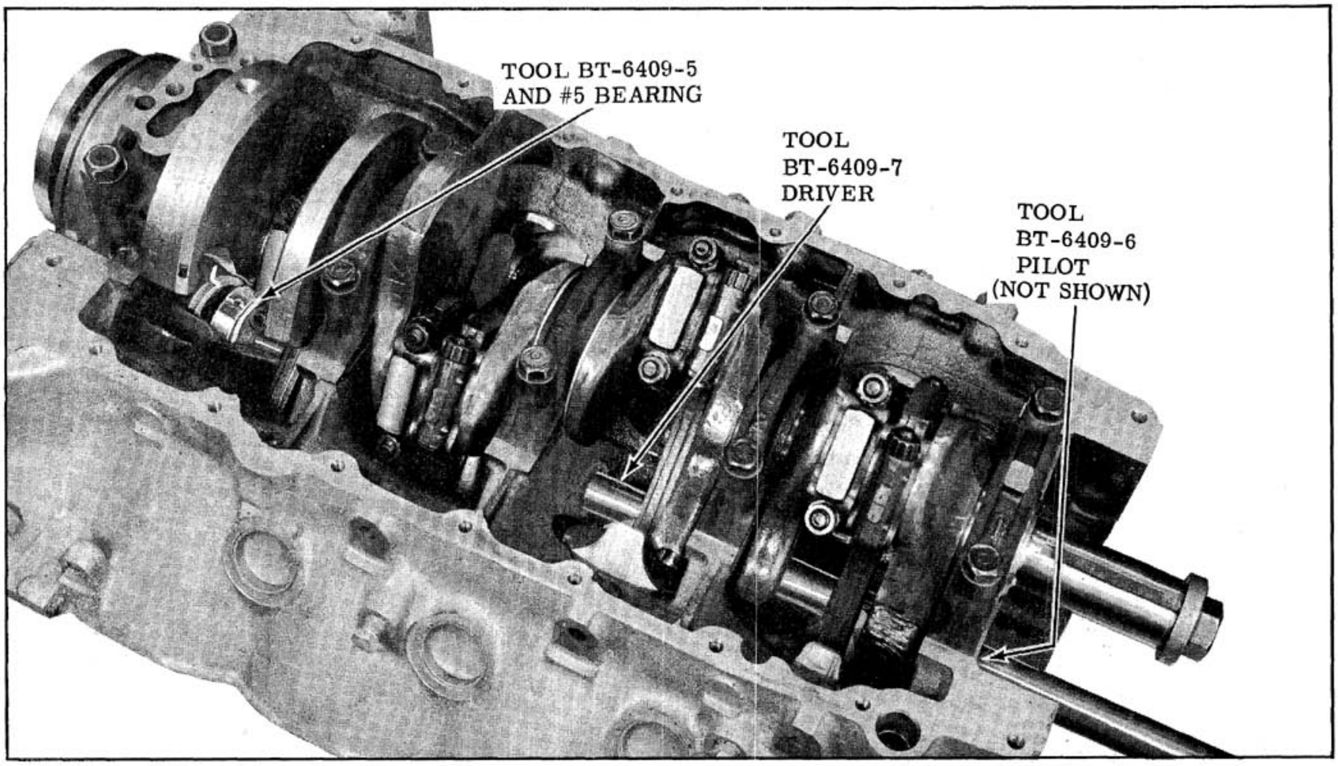

Fig. 3-96 Installing Rear Cam Bearing

driver is flush with the front face of the pilot. (Fig. 3-96)

2. Use BT-6409-9 to check oil hole opening as shown in Fig. 3-97.

3. Remove BT-6409-5 Installer and install BT-6409-4. Place #4 bearing on installer and drive in until second to last white line on driver is flush with pilot.

4. Follow the same procedure to install #3 and #2.

5. Install Tool BT-6409-1 on Handle J-8092 and place #1 bearing on installer. Drive bearing in until white line on Installer BT-6409-1 is flush with front face of block. (Fig. 3-98)

6. Use BT-6409-9 to check all oil hole openings. Wire must enter hole or the bearing will not receive sufficient lubrication. (Fig. 3-97).

7. Reinstall previously removed parts.

Camshaft and Oil Gallery Plugs (Fig. 3-99)

The left hand rear oil galley plug is not shown. It is a threaded plug in the end of the left galley just forward of the distributor. A small hole is provided in the plug for distributor lubrication. The cup plug shown provides access to the threaded plug.

The front oil galley plugs (not shown) are threaded. Each have a small hole which provides lubrication for the timing chain and gears.

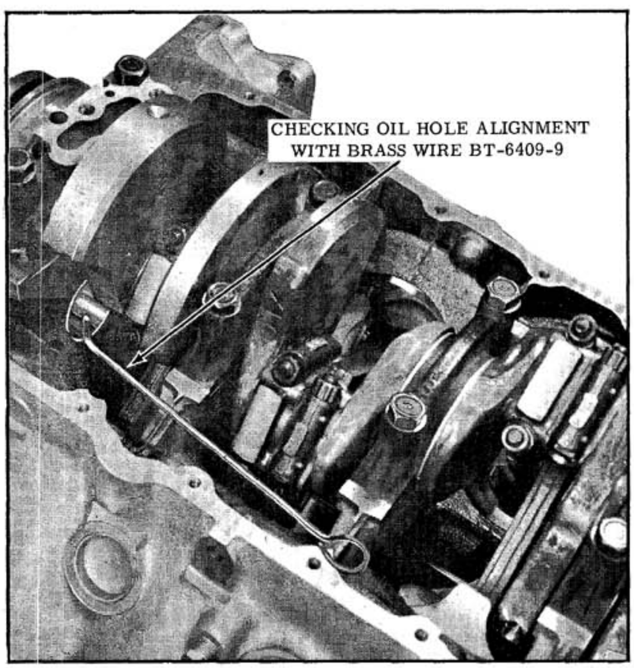

Fig. 3-97 Checking No. 5 Oil Hole

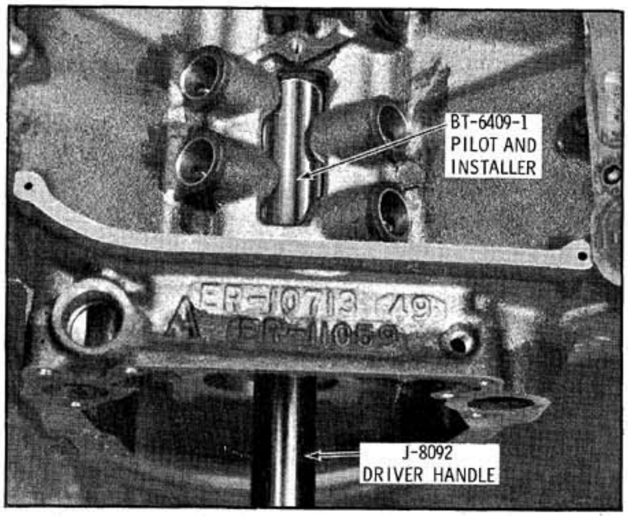

Fig. 3-98 Installing No. 1 Cam Bearing

CRANKSHAFT

Removal

It is recommended that the crankshaft be replaced with the engine out of the chassis. In order to remove the crankshaft, the oil pan, front cover, connecting rods, transmission and flywheel must be removed from the engine.

Installation

1. Position upper half of main bearings in block and lubricate with SAE 10W30 oil.

2. Install a new rear main bearing seal. (Fig. 3-100 for 330 cubic inch engine or Fig. 3-101 for 425 cubic inch engine)

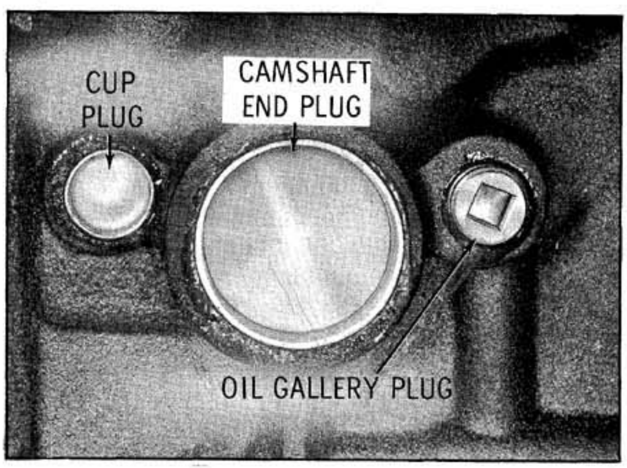

Fig. 3-99 Camshaft and Oil Gallery Plugs

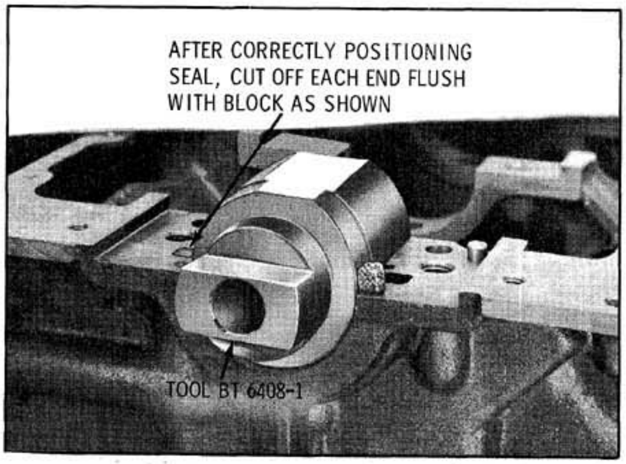

Fig. 3-100 Installing Rear Main Oil Seal - Upper Half 330 Cubic Inch

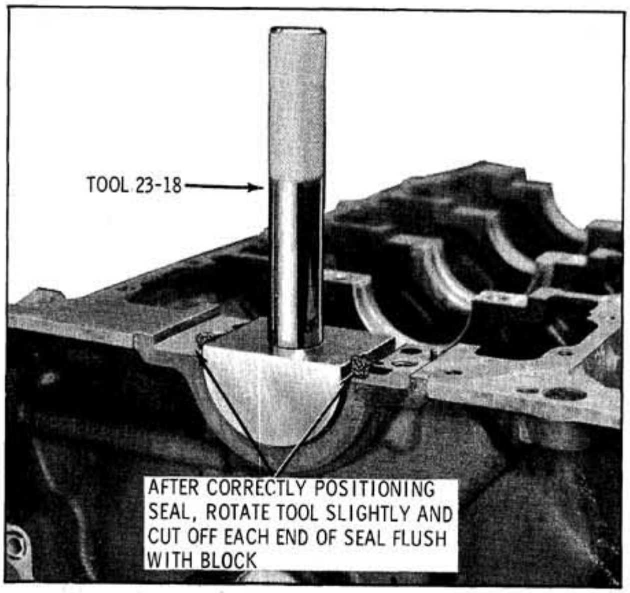

Fig. 3-101 Installing Rear Main Oil Seal - Uppe. Half 425 Cubic Inch

3. After oil passages in crankshaft have been checked for being open and shaft is clean, place shaft in block. Lubricate thrust flanges of the center bearing with 1050169 Lubricant. Install caps with lower half of bearing lubricated with SAE 10W30 oil. Lubricate cap bolts with Part No. 1050125 and install, but do not tighten.

4. With a block of wood (Fig. 3-102) bump shaft in each direction to align thrust flanges of center main bearing.

5. Torque numbers 1, 2, 3 and 4 main bearing cap bolts to 80 ft. lbs. and number 5 bolt to 120 ft. lbs.

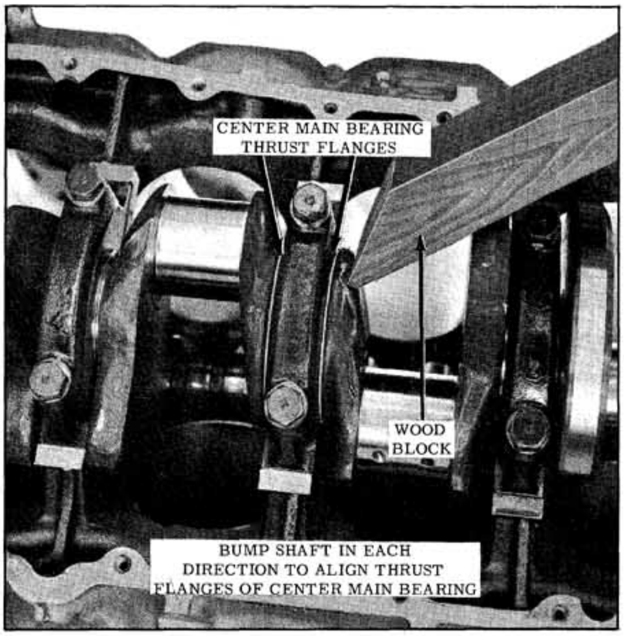

Fig. 3-102 Aligning Center Main Bearing Flanges

6. Reassemble engine and install in chassis.

MAIN BEARINGS

Main bearing clearance must not exceed .0035" on all bearings. The .0035" clearance is permissible only if the engine is disassembled for other than a bearing noise condition. If bearings are noisy or if a visual inspection indicates defective bearings, new bearings must be installed within the specifications outlined under MAIN BEARINGS - REPLACE.

Bearings which fall within the .0035" specification should not be rejected if the bearings show a normal wear pattern or slight radial grooves, unless it has been established to be defective.

Checking Bearing Clearances

1. Remove bearing cap and wipe oil from crankshaft journal and outer and inner surfaces of bearing shell.

2. Place a piece of plastigauge in the center of bearing.

3. Use a floor jack or other means to hold crankshaft against upper bearing shell. This is necessary to obtain accurate clearance readings when using plastigauge.

4. Reinstall bearing cap and bearing. Place Part No. 1050125 Lubricant on cap bolts and install. Torque to 80 ft. lbs. and No. 5 bolt to 120 ft. lbs.

5. Remove bearing cap and determine bearing clearance by comparing the width of the flattened plastigauge at its widest point with graduation on the plastigauge container. The number within the graduation on the envelope indicates the clearance in thousandths of an inch. (Fig. 3-78) If this clearance is greater than .0035", REPLACE BOTH BEARING SHELLS AS A SET. Recheck clearance after replacing shells. (Refer to MAIN BEARINGS - REPLACE)

   NOTE: Main bearing end thrust clearance should be .004" to .008" as checked with a dial indicator.

Main Bearings—Replace

Main bearing clearances not within specifications (.0005" to .0021") must be corrected by the use of selective upper and lower shells. UNDER NO CIRCUMSTANCES should the use of shims behind the shells, to compensate for wear, be attempted.

IMPORTANT: The upper and lower shells must be installed in pairs. Sizes of the bearings are located on the tang.

To install main bearing shells, proceed as follows:

1. Remove bearing cap and remove lower shell.

2. Insert a flattened cotter pin or roll out pin in the oil passage hole in the crankshaft, then rotate the crankshaft in the direction opposite to cranking rotation. The pin will contact the upper shell and roll it out.

3. The main bearing journals should be checked for roughness and wear. Slight roughness may be removed with a fine grit polishing cloth saturated with SAE 10W30 oil. Burrs may be removed with a fine oil stone. If the journals are scored or ridged, the crankshaft must be replaced.

   NOTE: The journals can be measured for out-of-round with the crankshaft installed by using a crankshaft caliper and inside micrometer or a main bearing micrometer. The upper bearing shell must be removed when measuring the crankshaft journals. Maximum out-of-round of the crankshaft journals must not exceed .0015".

4. Clean crankshaft journals and bearing caps thoroughly before installing new main bearings.

5. Apply Special Lubricant (Part No. 1050169)

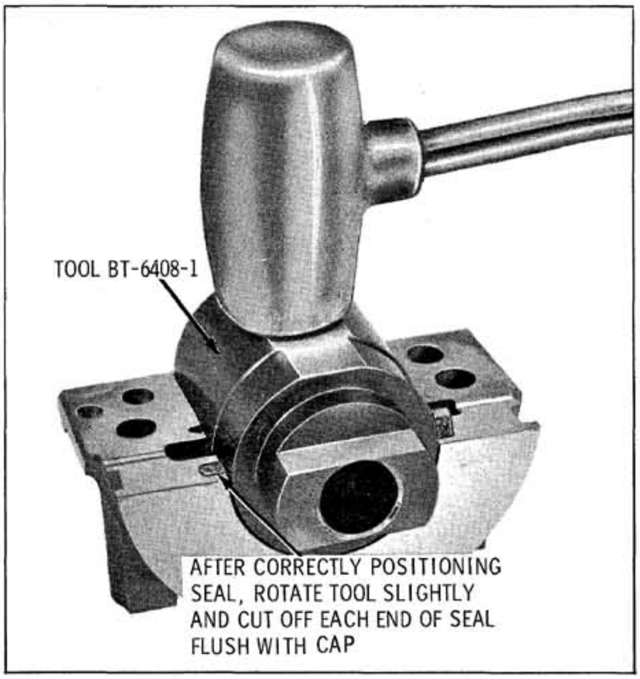

Fig. 3-103 Installing Rear Main Oil Seal Lower Half - 330 Cubic Inch

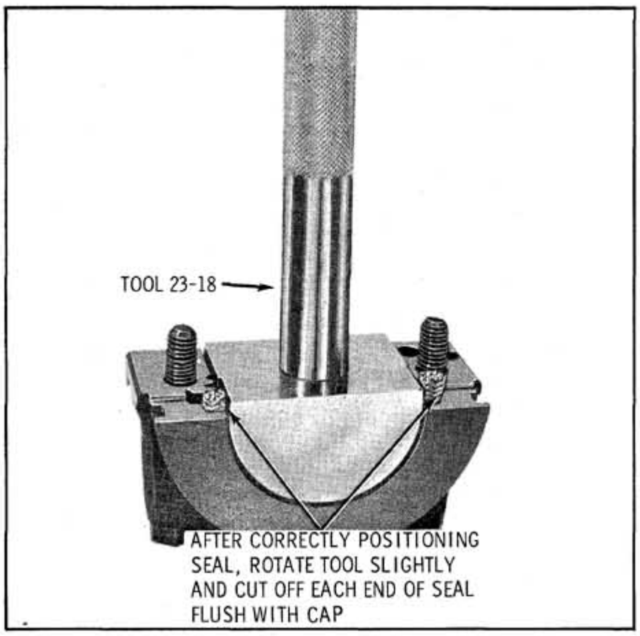

Fig. 3-104 Installing Rear Main Oil Seal Lower Half - 425 Cubic Inch

to the thrust flanges of bearing shells on No. 3 bearing.

6. Place new upper shell on crankshaft journal with locating tang in correct position and rotate shaft to turn it into place using cotter pin or roll out pin as during removal.

7. Place new bearing shell in bearing cap.

8. No. 5 bearing - install new asbestos oil seal in the rear main bearing cap. (REAR MAIN BEARING OIL SEAL) (Fig. 3-103 for 330 cubic inch engine or Fig. 3-104 for 425 cubic inch engine)

9. Install bearing caps, lubricate bolt threads with Part No. 1050125 Lubricant and install. Torque numbers 1, 2, 3 and 4 to 80 ft. lbs. and number 5 to 120 ft. lbs.

REAR MAIN BEARING UPPER OIL SEAL

Repair

Tools have been released to provide a means of correcting engine rear main bearing upper seal leaks without the necessity of removing the crankshaft. The procedure for seal leak correction is listed below.

1. Drain oil and remove oil pan and rear main bearing cap.

2. Insert Packing Tool BT-6433 or BT-6434 against one end of seal in cylinder block and drive the old seal gently into the groove until it is packed tight. This varies from 1/4" to 3/4" depending on the amount of pack required. (Fig. 3-106)

3. Repeat this on the other end of the seal in the cylinder block.

4. Measure the amount the seal was driven up on one side; add 1/16", then cut this length from the old seal removed from the main bearing cap with a single edge razor blade. Measure the amount the seal was driven up on other side. Add 1/16" and cut another length from old seal. Use main bearing cap as a holding fixture when cutting seal as shown in Fig. 3-107.

5. Place a drop of 1050026 Sealer on each end of seal.

6. Work these two pieces of seal into the cylinder block (one piece on each side) with two small screwdrivers. Using Packing Tool, pack these short pieces up into the block. Use Seal Trimming Tool BT-6436 to trim seal flush with block as shown in Fig. 3-108.

   NOTE: Place a piece of shim stock between seal and crankshaft to protect bearing surface before trimming.

7. Form a new rope seal in the rear main bearing cap as outlined for the affected engine.

8. Assemble the cap to the block and torque to specifications.

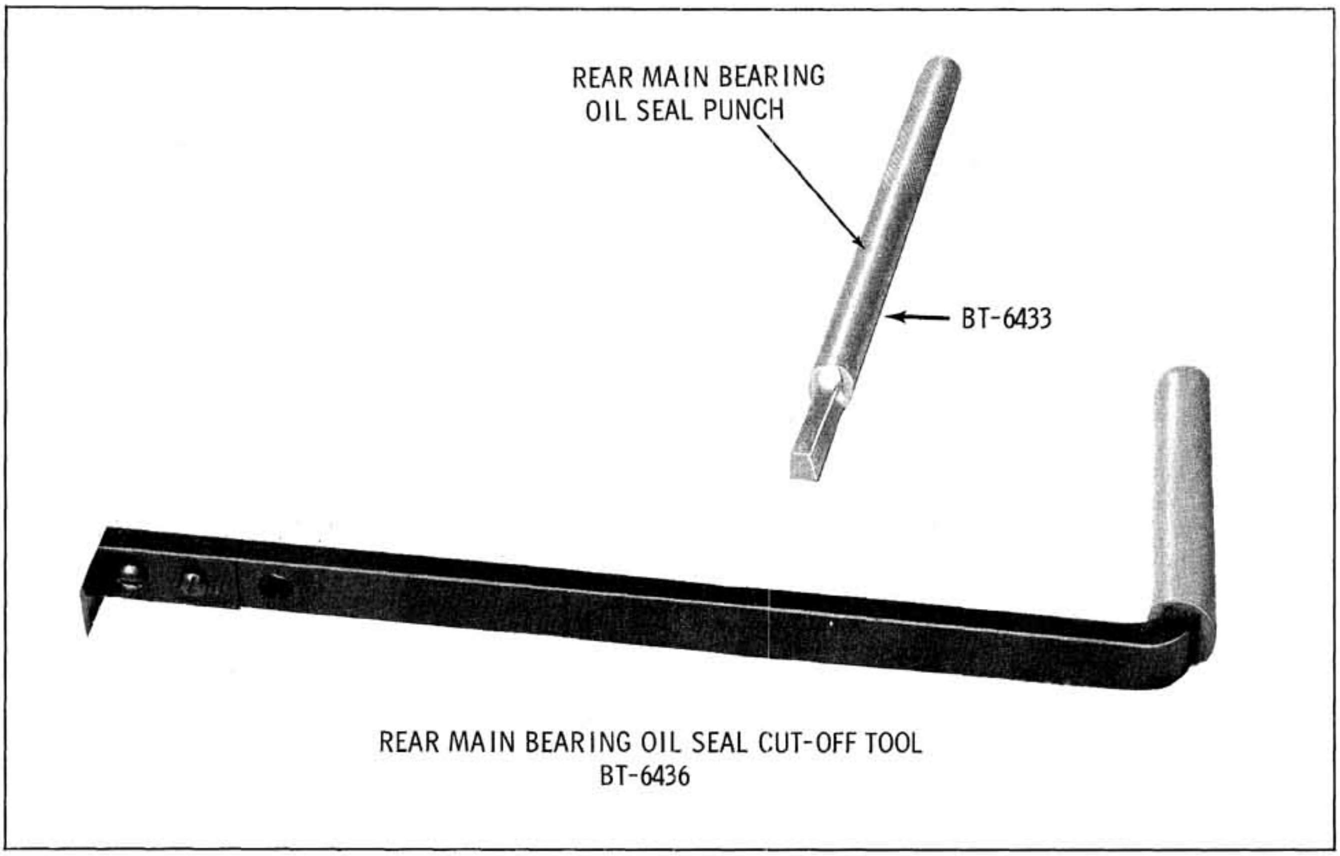

Fig. 3-105 Rear Main Seal Repair Tools

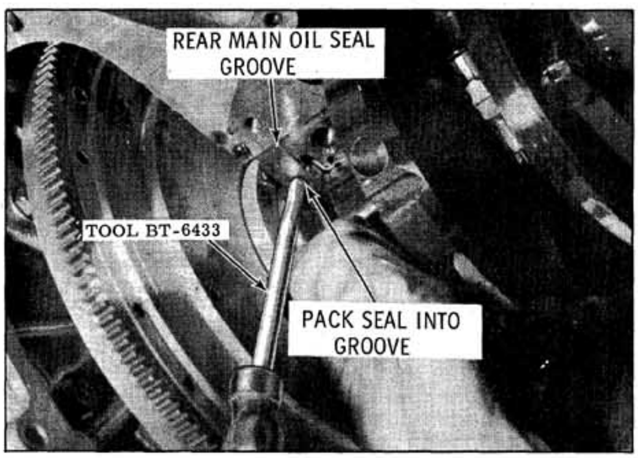

Fig. 3-106 Packing Old Seal

REAR MAIN OIL SEALS

Removal

1. Remove oil pan.
2. Remove the rear main bearing cap.
3. Remove rear main bearing insert and old seals.
4. Clean bearing cap and seal grooves and inspect for cracks.

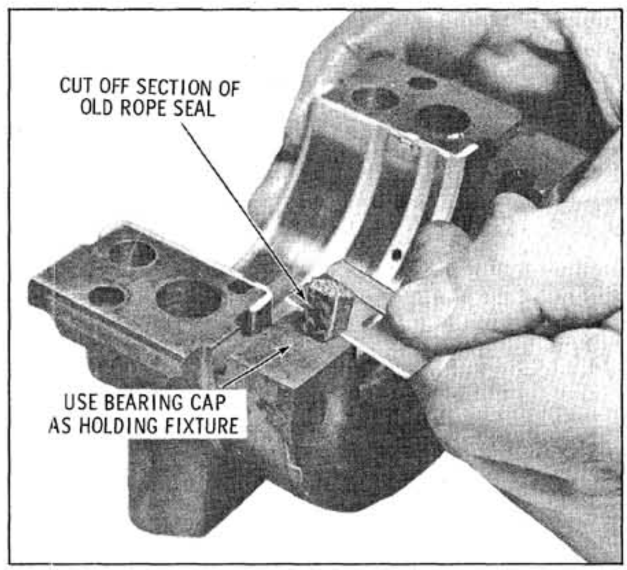

Fig. 3-107 Cutting off Lower Seal Ends

Installation

1. Install seal into bearing cap, packing by hand.
2. Using seal installer, hammer seal into groove. (Fig. 3-103 for 330 cubic inch engine or Fig. 3-104 for 425 cubic inch engine)

NOTE: To check if seal is fully seated in the bearing cap, slide the tool away from

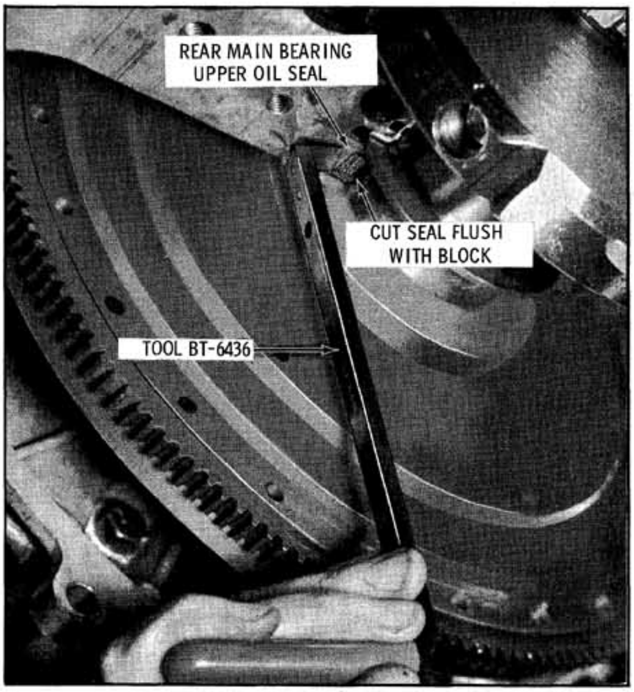

Fig. 3-108 Cutting Off Upper Seal Ends

seal. With tool fully seated in the bearing cap, slide tool against the seal. If undercut area of tool slides over the seal, the seal is fully seated. If tool butts against the seal, the seal must be driven further into the seal groove. Rotate tool before cutting off excess seal packing.

3. With tool slightly rotated, cut seal flush with mating surface. With screwdriver, pack seal end fibers towards center, away from edges. Rotate seal installer when cutting seal to avoid damage to tool.

4. Clean bearing insert and install in bearing cap.

5. Clean crankshaft bearing journal and seal contact.

6. Install bearing caps, lubricate bolt threads with Part No. 1050125 Lubricant and install. Torque numbers 1, 2, 3 and 4 to 80 ft. lbs. and number 5 to 120 ft. lbs.

7. Install pan with new gaskets. (Fig. 3-72)

8. Install lower flywheel cover.

PILOT BEARING (SYNCHROMESH)

On Synchromesh equipped cars a pilot bearing is located in a bore in the rear end of the crankshaft.

When removing the pilot bearing, remove with Pilot Bearing Puller J-1448-1. (Fig. 3-109). All

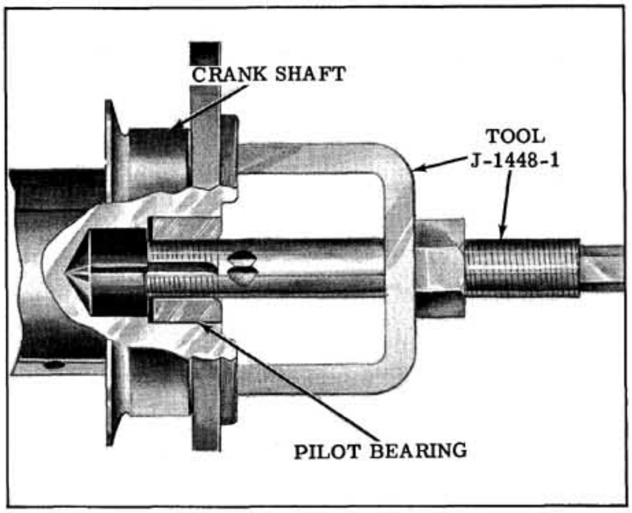

Fig. 3-109 Removing Pilot Bearing

old lubricant in the reservoir behind the bearing should be removed.

Install the new bearing using Tool J-4530-1, (Fig. 3-110). Add 1/4 ounce (level tablespoonful) of front wheel bearing grease to the reservoir.

FLYWHEEL

One bolt hole in the flywheel is offset and it will attach to the crankshaft in only one position.

Flywheel Ring Gear

The flywheel ring gear may be replaced if damaged. Drill two 3/16" holes in the gear, and then split with a sharp chisel.

Heat the new gear with a torch and place in position on the flywheel. As the gear cools, it will become tight on the flywheel.

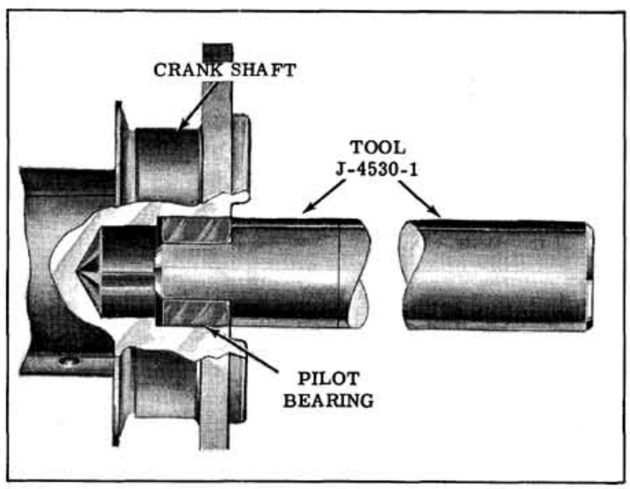

Fig. 3-110 Installing Pilot Bearing

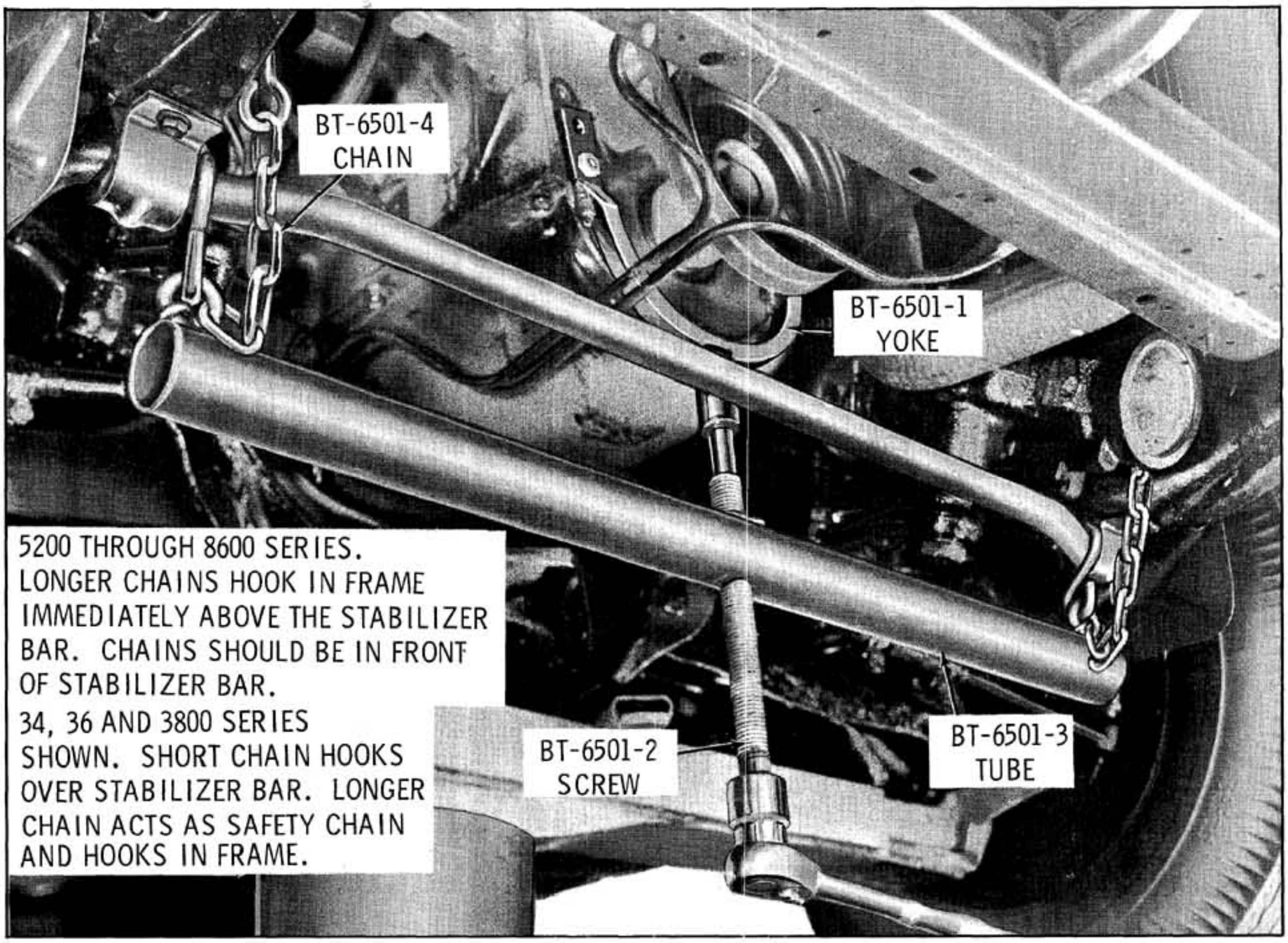

Fig. 3-111 Engine Support Tool BT-6501

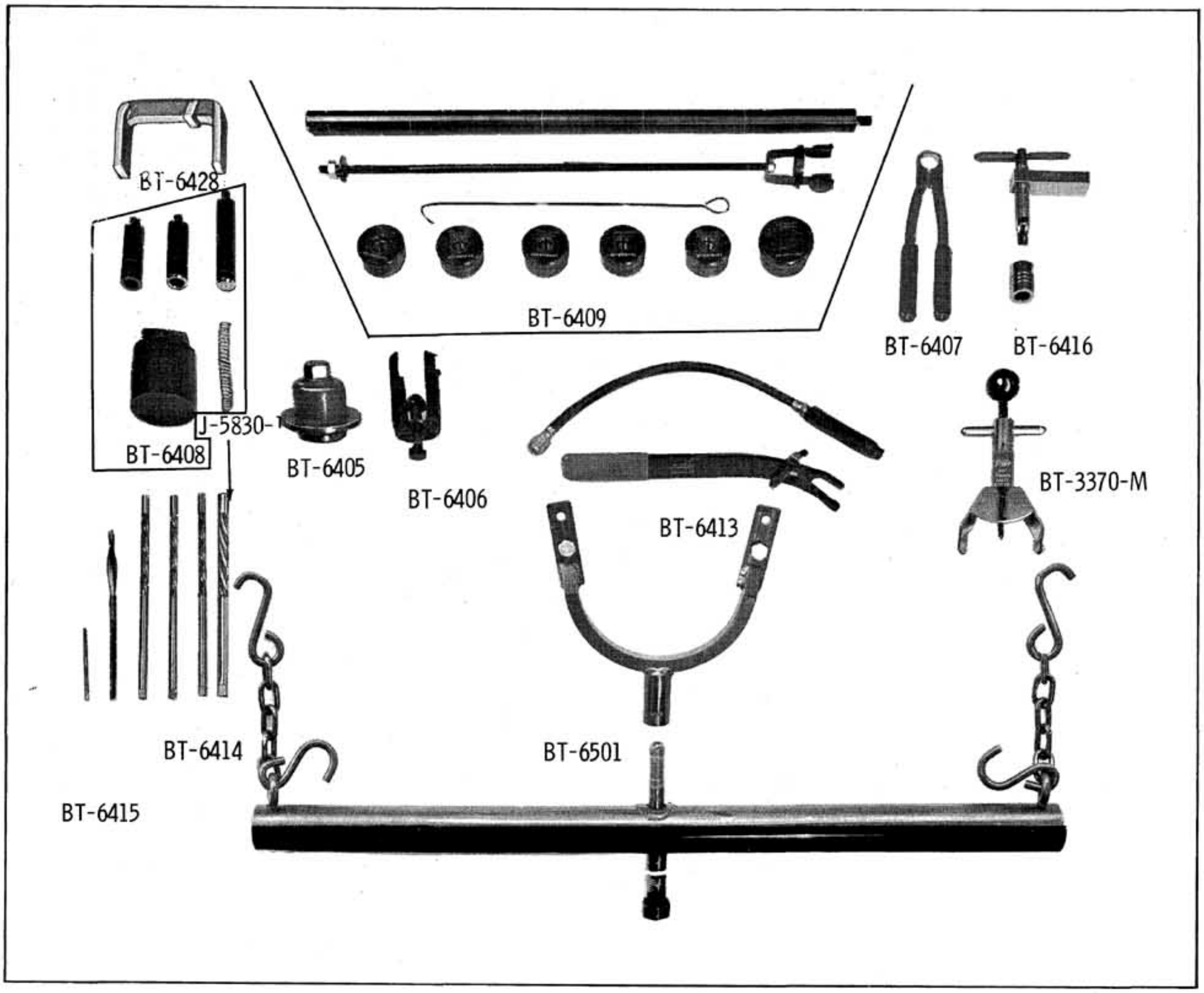

Fig. 3-112 Tools

BT-33-70M	Belt Gauge Narrow Legs for New Engine Application
BT-6405	Front Cover Crankshaft Seal Installer
BT-6406	Front Cover Crankshaft Seal Remover
BT-6408	Combination Piston Pin Remover and Installer and Rear Main Bearing Seal Installer
BT-6409	Cam Bearing Remover and Installer Set. Used Without R&R Engine or Transmission
BT-6413	Valve Spring Compressor V-6 and V-8 (On Car)
BT-6414-1	.003" Oversize Valve Guide Reamer
BT-6414-4	.005" Oversize Valve Guide Reamer
BT-6414-3	.013" Oversize Valve Guide Reamer
BT-6415	Valve Guide Cleaner
BT-6438	Valve Lifter Plunger Puller
BT-6419	Exhaust Manifold Heat Riser Bushing Remover and Installer
BT-6501	Engine Support Bar
BT-6428	V-8 Valve Gauging Tool

COOLING, FUEL, AND EXHAUST SYSTEM

COOLING SYSTEM

MAINTENANCE RECOMMENDATIONS

Refer to Section 2, PERIODIC MAINTENANCE.

DESCRIPTION

The engine cooling system is of the pressure type employing a 15 lb. pressure radiator cap. The water pump is a centrifugal type, and circulation is controlled by a thermostat located under the water outlet in the intake manifold. Full length water jackets allow the engine coolant to completely surround all cylinders.

On 33 through 38 series, a downflow type radiator is used. On 52 through 86 series, a crossflow type radiator is used. The operation of both systems is the same except for flow of water through the radiators.

OPERATION

The water pump discharges coolant through the front engine cover into both banks of the block. The coolant then flows through the full length water jackets in the block, up into the two cylinder heads, through the heads and then flows from the front of each cylinder head through the intake manifold water passage to the water outlet and finally to the radiator.

When the thermostat is closed, all the coolant flows through the bypass to the inlet side of the water pump and back to the engine block.

The 15 pound pressure radiator cap raises the boiling point of the coolant to approximately 258°F with a -20° solution of permanent anti-freeze.

CAUTION: When removing the radiator cap, turn the cap counterclockwise to the point where pressure is released. After all the pressure has been released, the cap can then be SAFELY removed.

DRAIN AND REFILL

Before draining the cooling system, inspect the system and perform any necessary service to insure that it is clean, does not leak, and is in proper working order.

1. Completely drain the system by opening drain valves at the radiator lower tank and removing plugs on each side of the engine block.

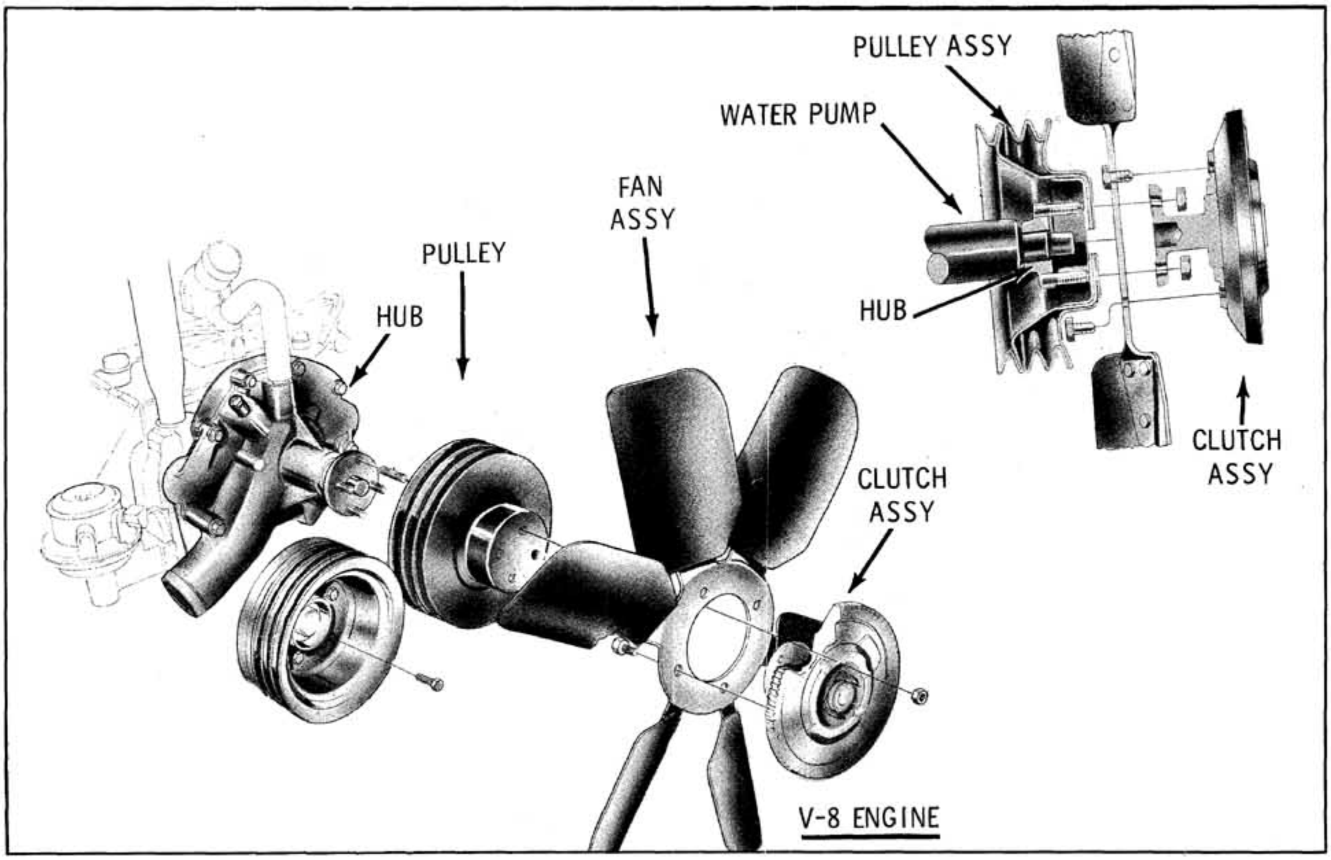

Fig. 3-120 Fan and Pulley

NOTE: If coolant drains out dirty, or if deposits are seen in the radiator, the cooling system should be flushed.

2. Refill cooling system with recommended coolant. (Refer to PERIODIC MAINTENANCE, Section 2 for recommended coolant if new coolant is used.)

FAN (Fig. 3-120)

The fan blades and pulley can be removed without disturbing the water pump or radiator. On air conditioned equipped cars it will be necessary to detach fan ring and slide it back over the fan.

NOTE: If belt tension on pulley is not released, the fan can be removed without disturbing the pulley by removing four attaching bolts. When the first two bolts are removed, replace with aligning studs. The tension of the belt will keep the pulley in position.

PULLEY (Fig. 3-120)

Removal

1. Loosen Delcotron and link adjusting bolt and remove belts from pulley.

NOTE: If equipped with air conditioning, detach fan ring and slide back over fan.

2. If equipped with power steering, remove power steering pump belt.

3. a. All except air conditioned cars - remove fan and pulley to water pump attaching bolts.

   b. Air conditioned equipped cars - remove fan clutch to water pump attaching nuts.

4. Remove fan pulley.

Installation

1. Reverse removal procedure.

2. Install belt(s) on pulley and adjust to proper tension using Tool BT-33-70-M.

RADIATOR

Fig. 3-121 34, 36 & 38 Series
Fig. 3-122 34, 36 & 38 Series with Air Conditioning
Fig. 3-124 52 through 86 Series

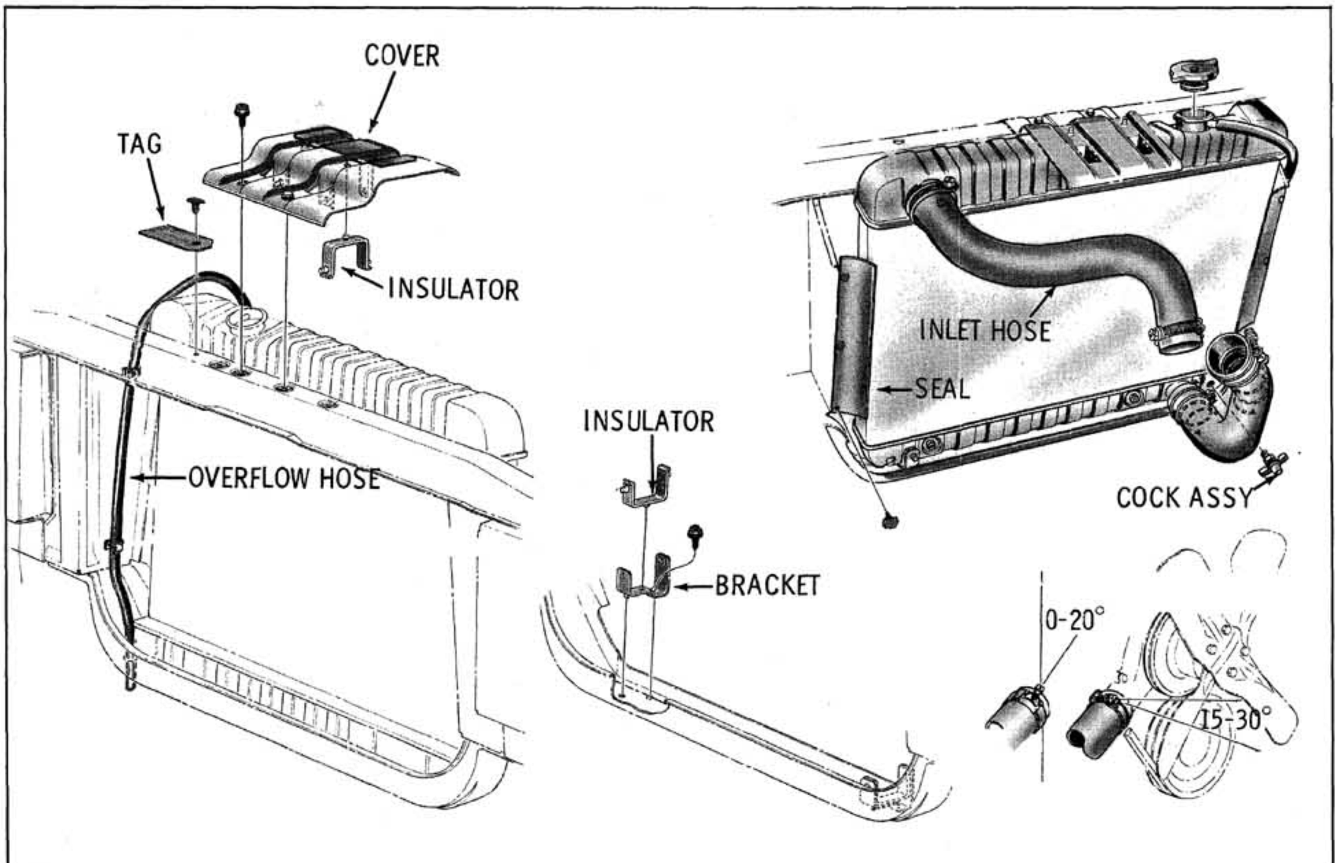

Fig. 3-121 Radiator 34-36 and 38 Series

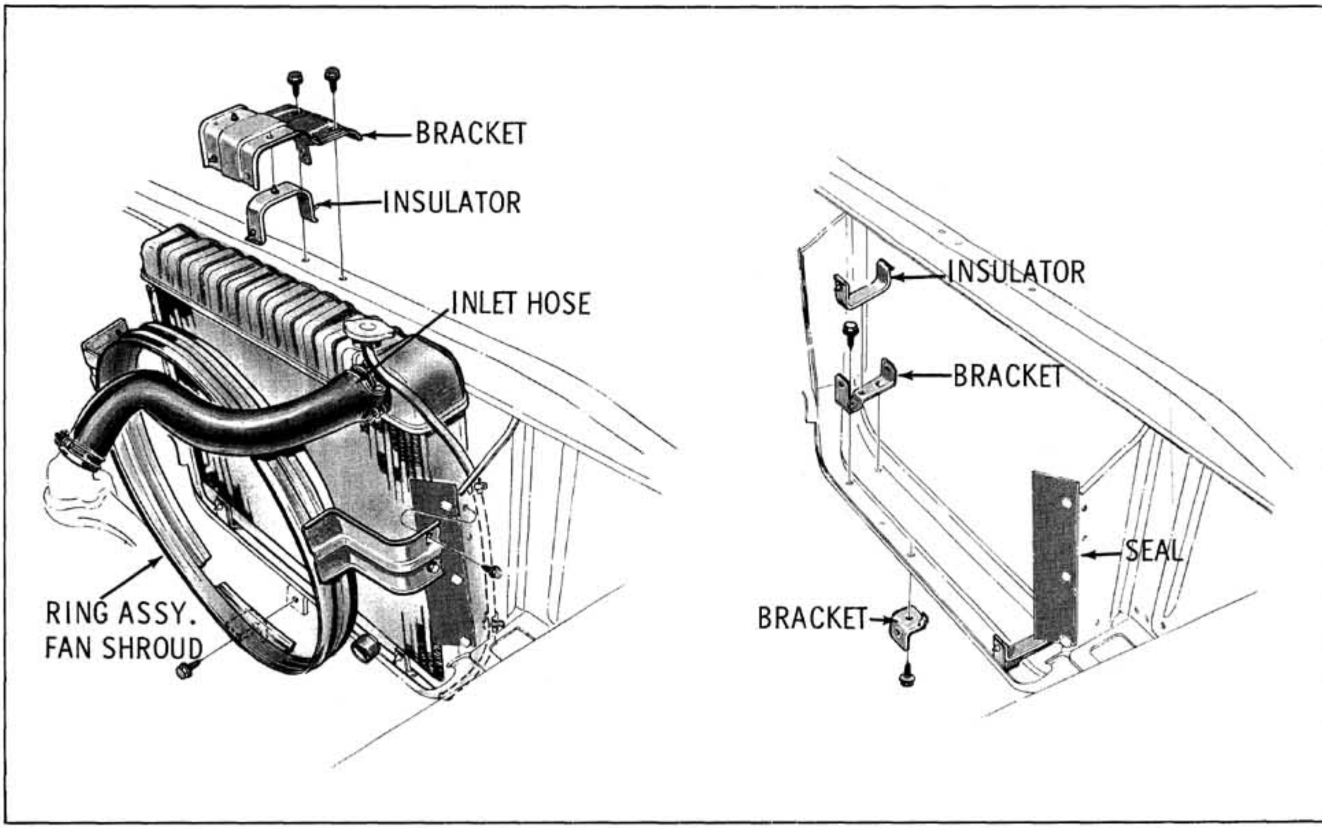

Fig. 3-122 Radiator - 34-36 and 38 Series with Air Conditioning

Removal

1. Drain cooling system.

2. Remove upper radiator bracket.

   NOTE: On air conditioned equipped cars, detach the fan ring and slide back over fan.

3. Remove upper and lower radiator hose and overflow hose.

4. If car is equipped with an automatic transmission, disconnect and cap cooler lines.

5. Lift radiator upward to disengage from lower supports and remove from car.

Installation

1. Reverse removal procedure.

2. Fill radiator, using existing coolant or new coolant, as recommended in PERIODIC MAINTENANCE, Section 2.

WATER PUMP

Removal

1. Drain cooling system.

2. Disconnect heater and bypass hose and lower radiator hose from pump.

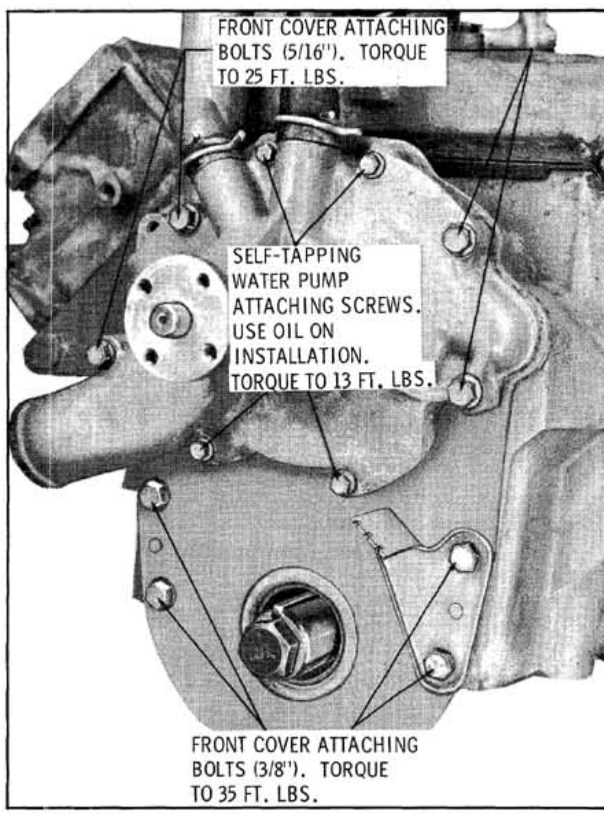

Fig. 3-123 Engine Front Cover Bolts

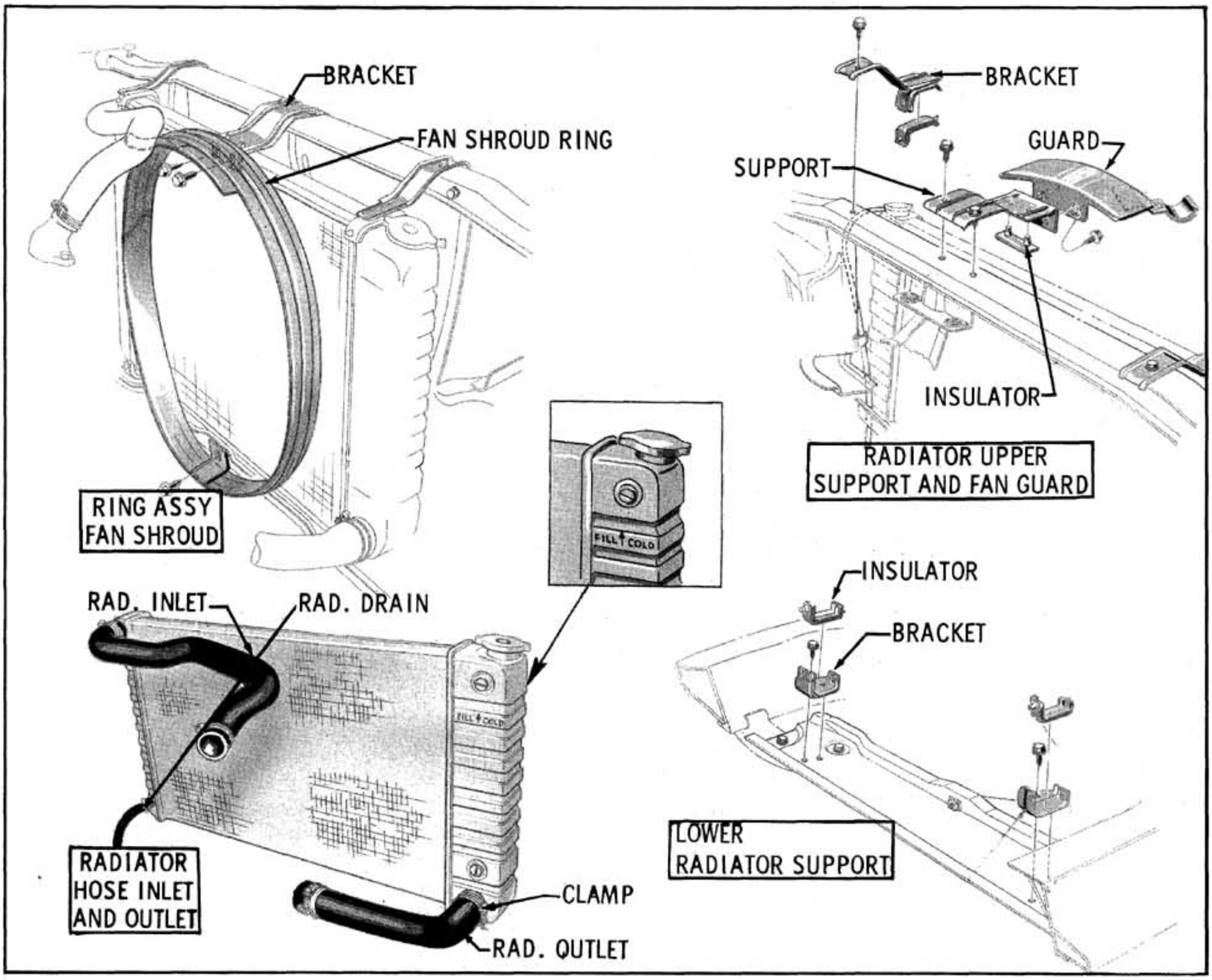

Fig. 3-124 Radiator - 52 through 86 Series

3. Loosen pulley belts and remove fan and pulley. On air conditioned equipped cars, remove the clutch and fan assembly and pulley.

4. Remove water pump to front cover attaching bolts. (Fig. 3-123)

Installation

1. Apply a thin coat of 1050026 Sealer to the pump housing to retain the gasket, then position the gasket on the housing.

2. Install the pump assembly in the front cover. Torque self-tapping bolts to 13 ft. lbs. and 5/16" bolts to 25 ft. lbs. Use oil on the self-tapping bolts.

3. Install pulley and fan. Torque fan to pump bolts to 20 ft. lbs. On air conditioned equipped cars install pulley and fan and clutch assembly. Torque nuts to 20 ft. lbs.

4. Install pulley belt(s) and adjust belt tension using Tool BT-33-70-M.

5. Refill cooling system. If new coolant is used, see Section 2, PERIODIC MAINTENANCE for recommended coolant.

FUEL SYSTEM (Figs. 3-126 through 3-130)

DESCRIPTION

All 33 through 38 series fuel tanks have a capacity of 20 gallons. All 52 through 86 series tanks have a capacity of 25 gallons. The filler cap is located behind the license plate on all models except station wagons. On station wagons, the filler cap is located in the left quarter panel. Venting is provided by a hose and pipe on all models except station wagons. On station wagons, the venting is through a hose to the top of the filler neck. Station wagon caps are vented.

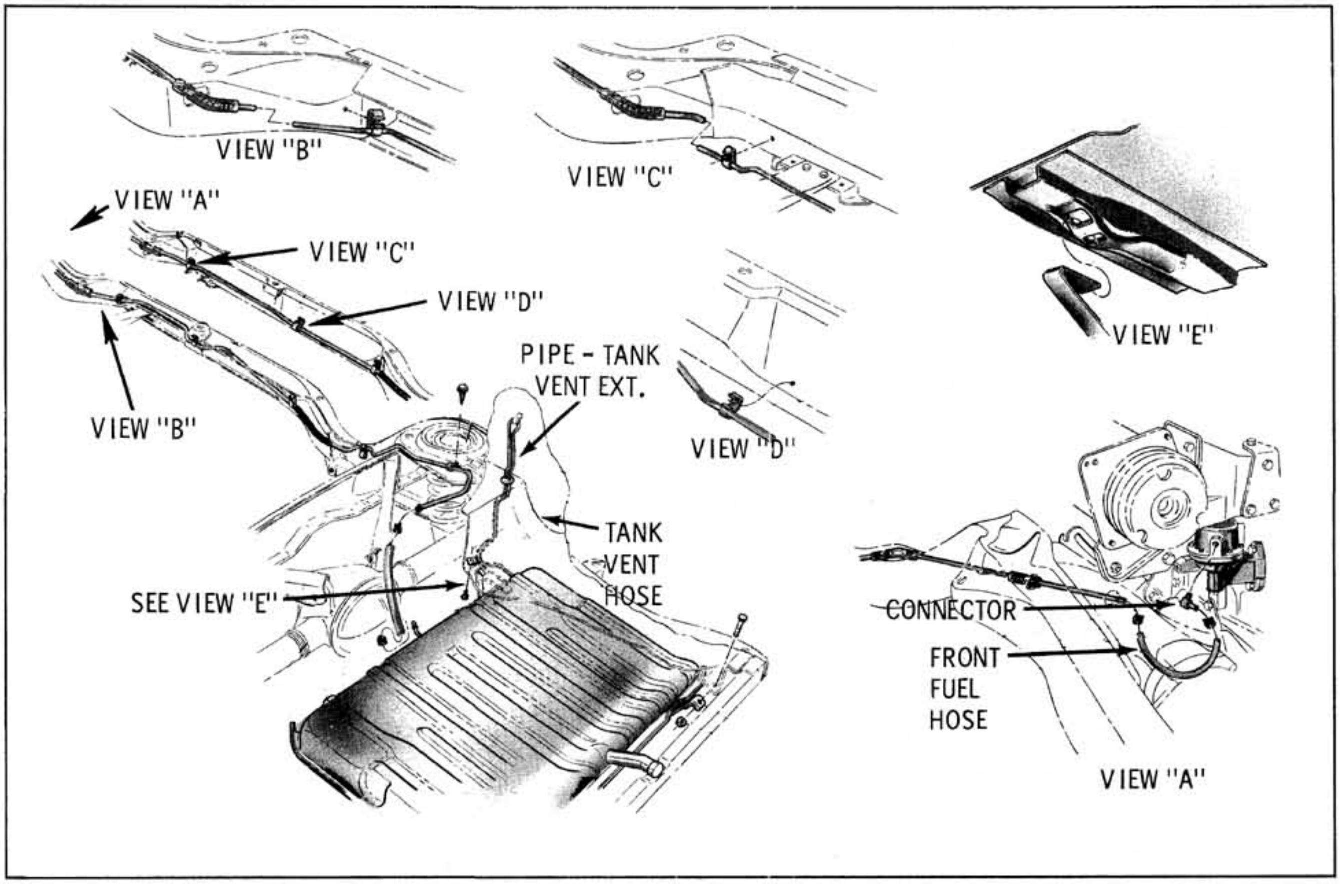

Fig. 3-126 V-8 Fuel Line Routing (34-36 and 38 Series)

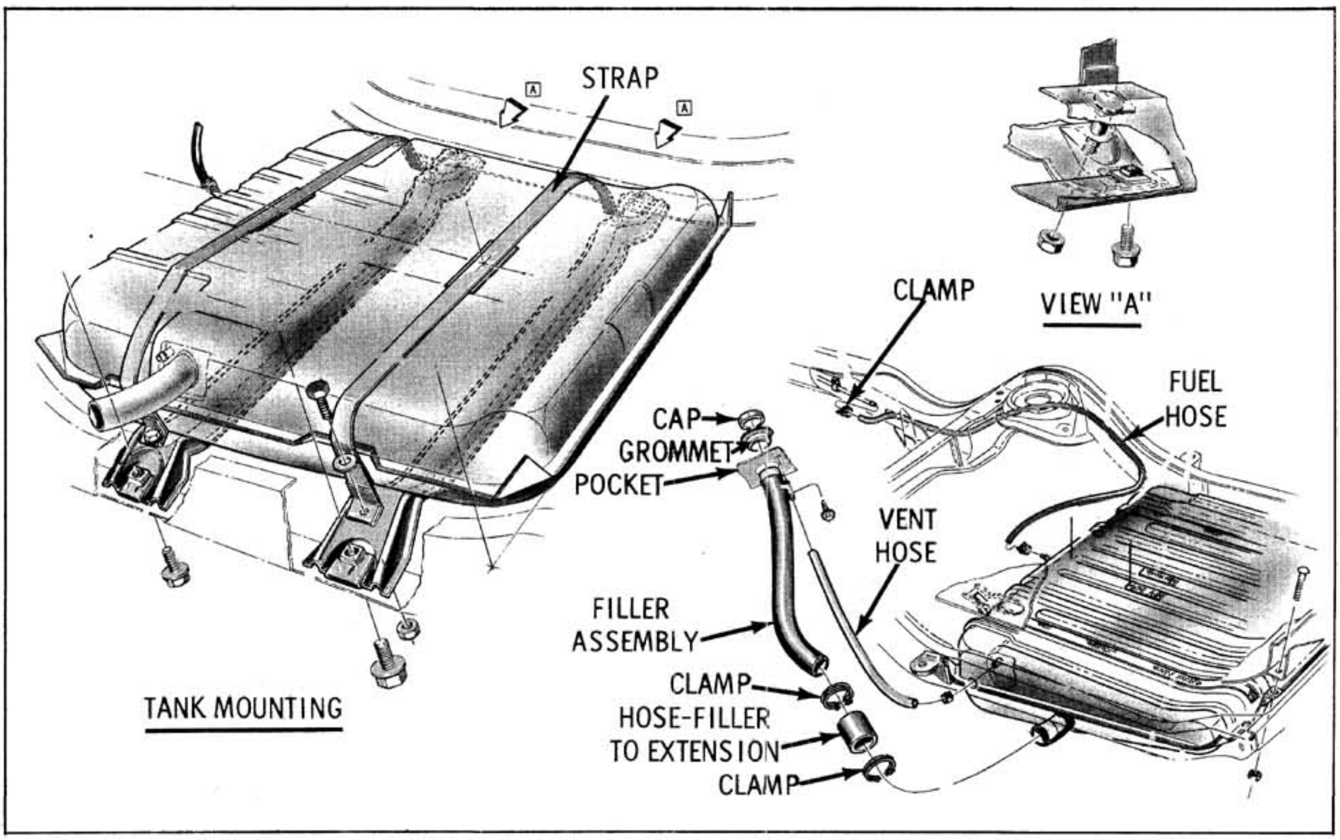

Fig. 3-127 Fuel System - Station Wagon

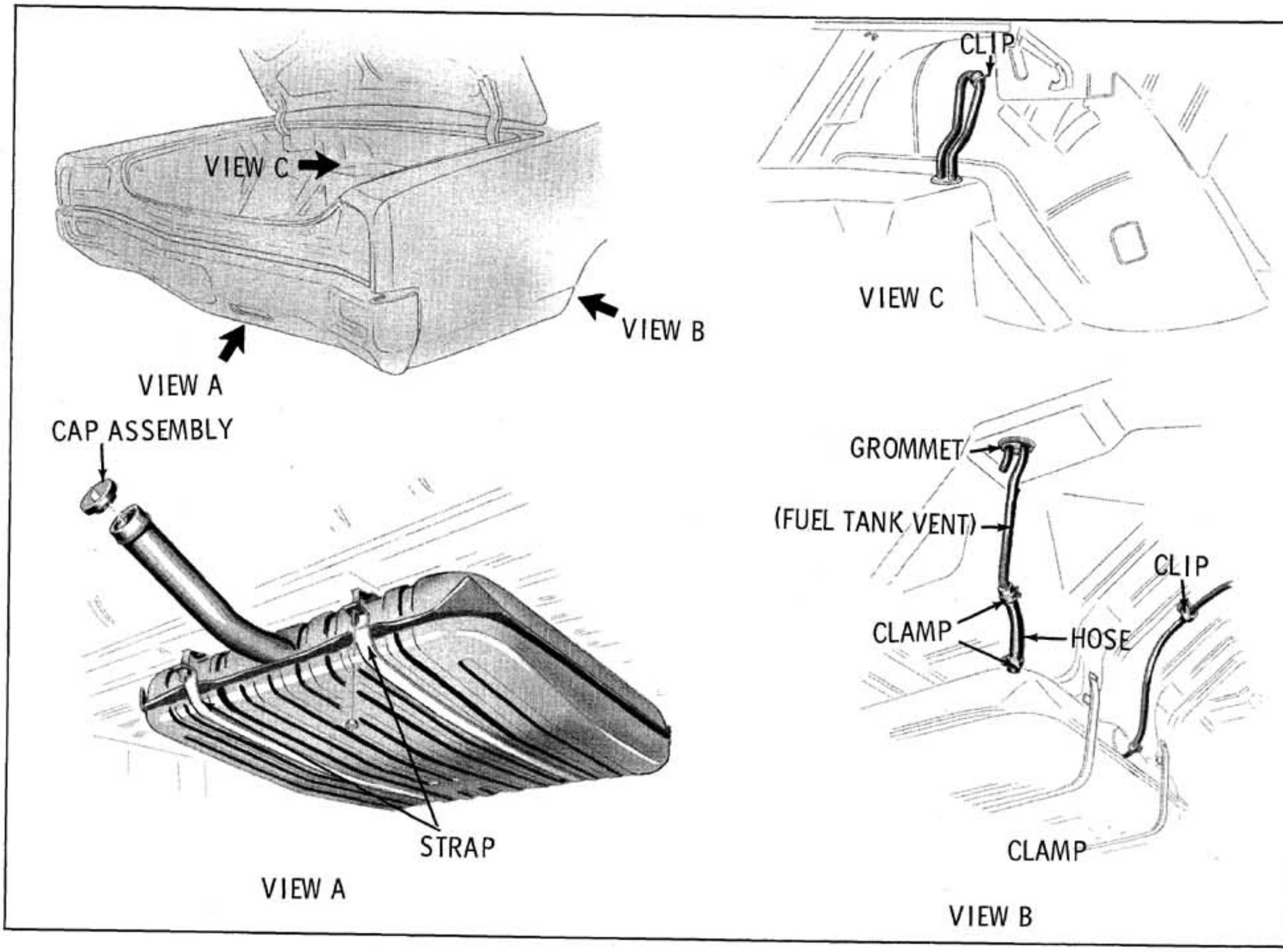

Fig. 3-128 Fuel System - 52 through 86 Series

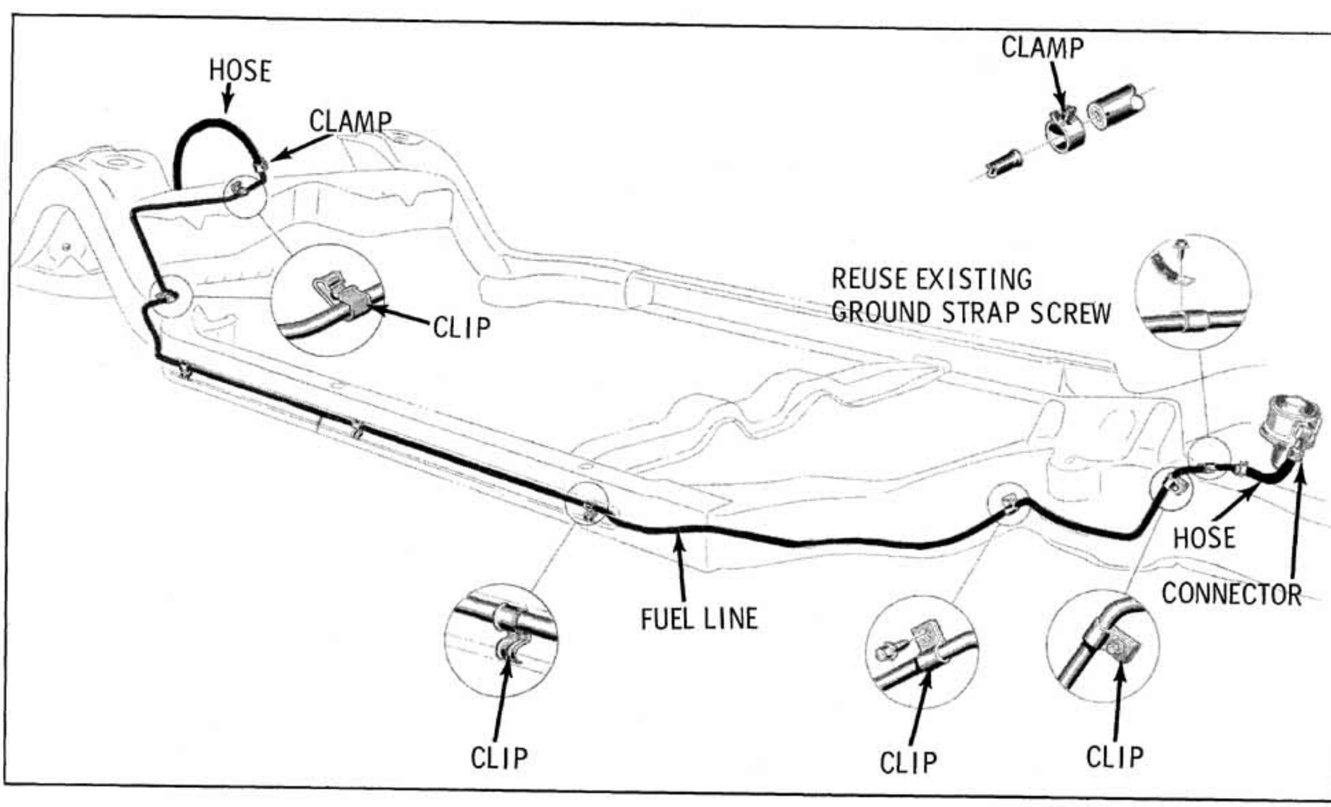

Fig. 3-129 Fuel System - 52 through 86 Series

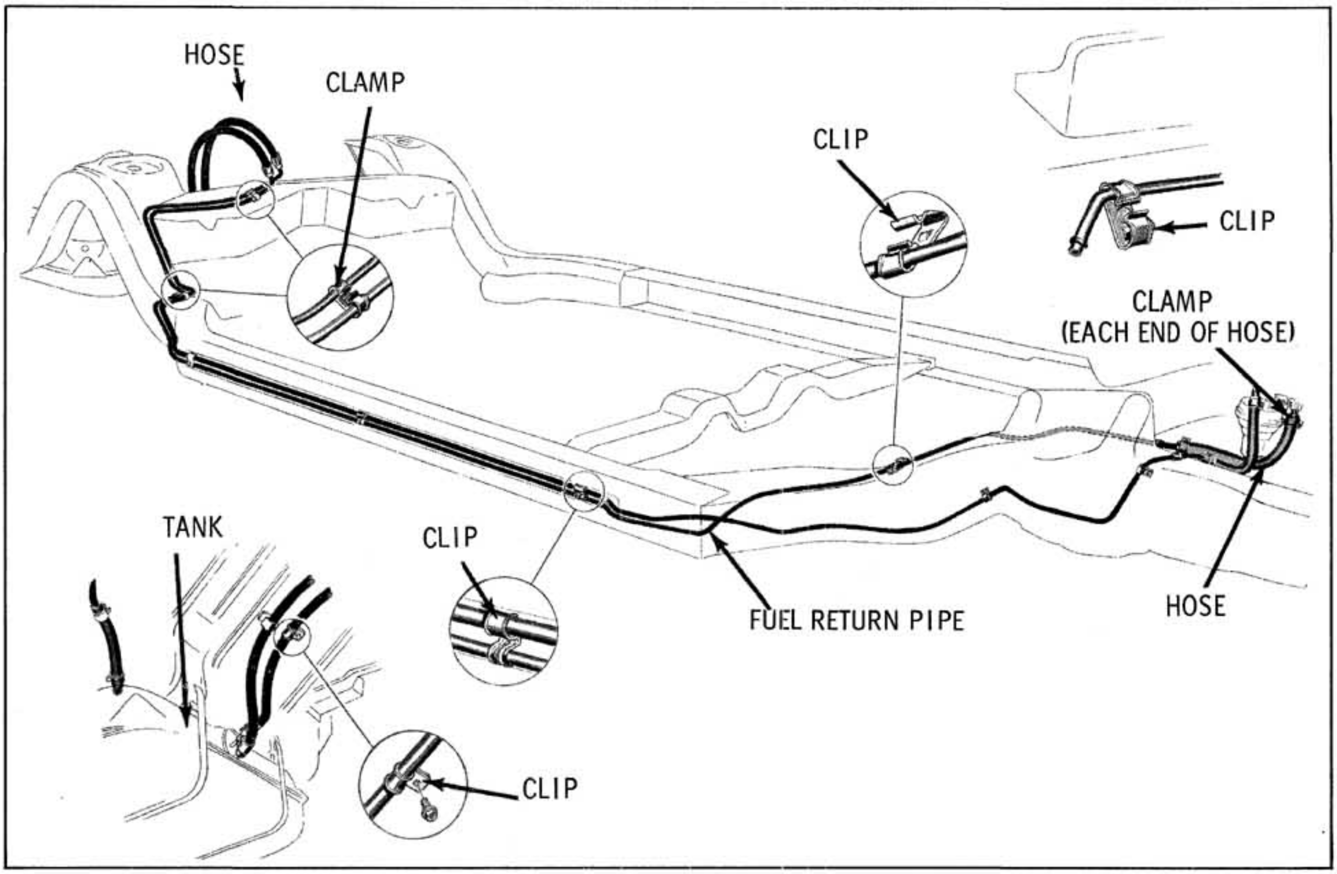

Fig. 3-130 V-8 Fuel Return - 52 through 86 Series with Air Conditioning

The tank gauge unit has a Saran fuel filter, on the end of the suction pipe which prevents entry of dirt or water into the fuel lines. The filter is a push fit on the end of the pipe and should be pressed on so that the pipe bottoms on the shoulder inside the filter.

CAUTION: If a car is to be stored for any appreciable length of time, the gasoline should be drained from the complete fuel system - including carburetor, fuel pump, all fuel lines, and fuel tank, in order to prevent gum formations and resultant improper engine performance.

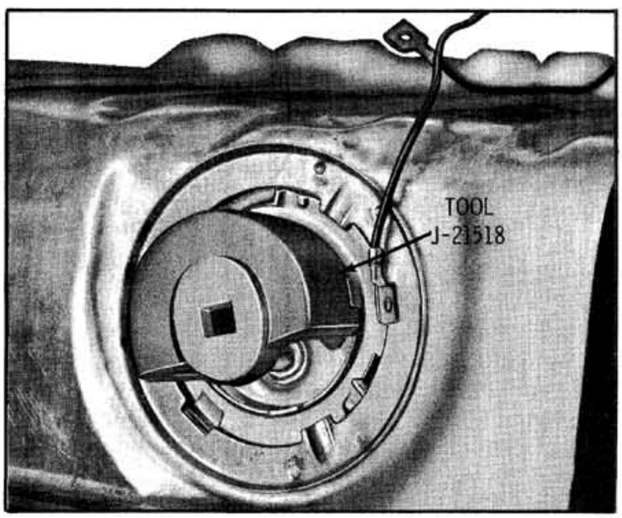

Fig. 3-131 Removing Fuel Gauge

FUEL GAUGE TANK UNIT

Removal

1. Disconnect gauge wire at connector.
2. Remove fuel gauge retainer using Tool J-21518. (Fig. 3-131)
3. Remove fuel gauge.

Installation

1. Position fuel gauge in tank as shown in Fig. 3-132.
2. Install gauge retainer using Tool J-21518.
3. Connect fuel gauge wire.

FUEL TANK

Draining Fuel Tank

1. Insert a length of hose into the gas tank, pipe nipple end first, until weighted end of hose rests on bottom of tank.

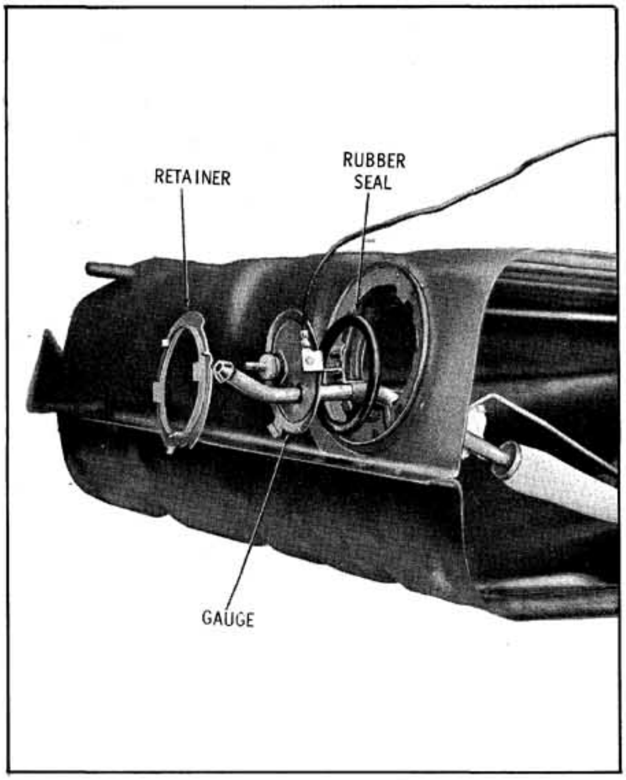

Fig. 3-132 Installing Fuel Gauge

2. Cut a small slit in hose near the outer end and insert chuck of air hose into hose slit; a short blast of air will cause the gas to flow.

NOTE: The tank can be drained rapidly by raising the front of car several feet off the floor when performing the above operation.

Removal (All except station wagons)

1. Drain tank.
2. Disconnect gas hose from fuel line.
3. Disconnect the gauge wire at connector in rear compartment; then feed wire through floor. Remove the two tank straps and lower tank.

Installation (All except station wagons)

1. Position tank gauge wire to the rear of tank.
2. Install tank and position the two tank straps and tighten bolts.
3. Feed gas gauge wire through floor and connect at the connector in the rear compartment.
4. Connect gas hoses at tank.
5. Fill tank.

FUEL TANK—Removal and Installation—Station Wagons

The fuel tank on station wagons is attached as shown in Fig. 3-127.

FUEL AND FUEL RETURN LINE REPAIR PROCEDURE

1. Cut out damaged portion of fuel line.
2. Cut a piece of hose 4" longer than portion of line removed.
3. Slide clamps onto pipe and push hose 2" onto each portion of fuel pipe.
4. Clamp hose to pipe on each side of repair.

FUEL PUMP

The fuel pump on all models, with or without heater or air conditioning, is a single action pump.

The fuel pump rocker arm is held in constant engagement with the eccentric on the camshaft by the rocker arm spring. As the end of the rocker arm which is in contact with the eccentric moves upward, the fuel link pulls the fuel diaphragm downward. The action of the diaphragm enlarges the fuel chamber drawing fuel from the tank through the inlet valve and into the fuel chamber. (Fig. 3-133)

The pump delivers fuel to the carburetor only when the pressure in the outlet line is less than the pressure maintained by the diaphragm spring. Therefore, when the carburetor float needle valve opens, the spring will expand to move the diaphragm upward to force fuel past the outlet valve to the carburetor. When the carburetor float needle valve closes, the pump builds up pressure in the fuel chamber until the diaphragm spring is again compressed. The diaphragm will then remain stationary until more fuel is required by the carburetor.

INSPECTION AND TEST (ON CAR)

1. Be sure there is gasoline in the tank.
2. Check for loose line connections. A leak at the pressure side of the system (line from pump to carburetor) will be indicated by dripping fuel. A leak in the suction side of the system (line from gas tank to pump) will not be apparent except in its effect of reducing volume of fuel on the pressure side of the system. Tighten fuel pump diaphragm flange screws.

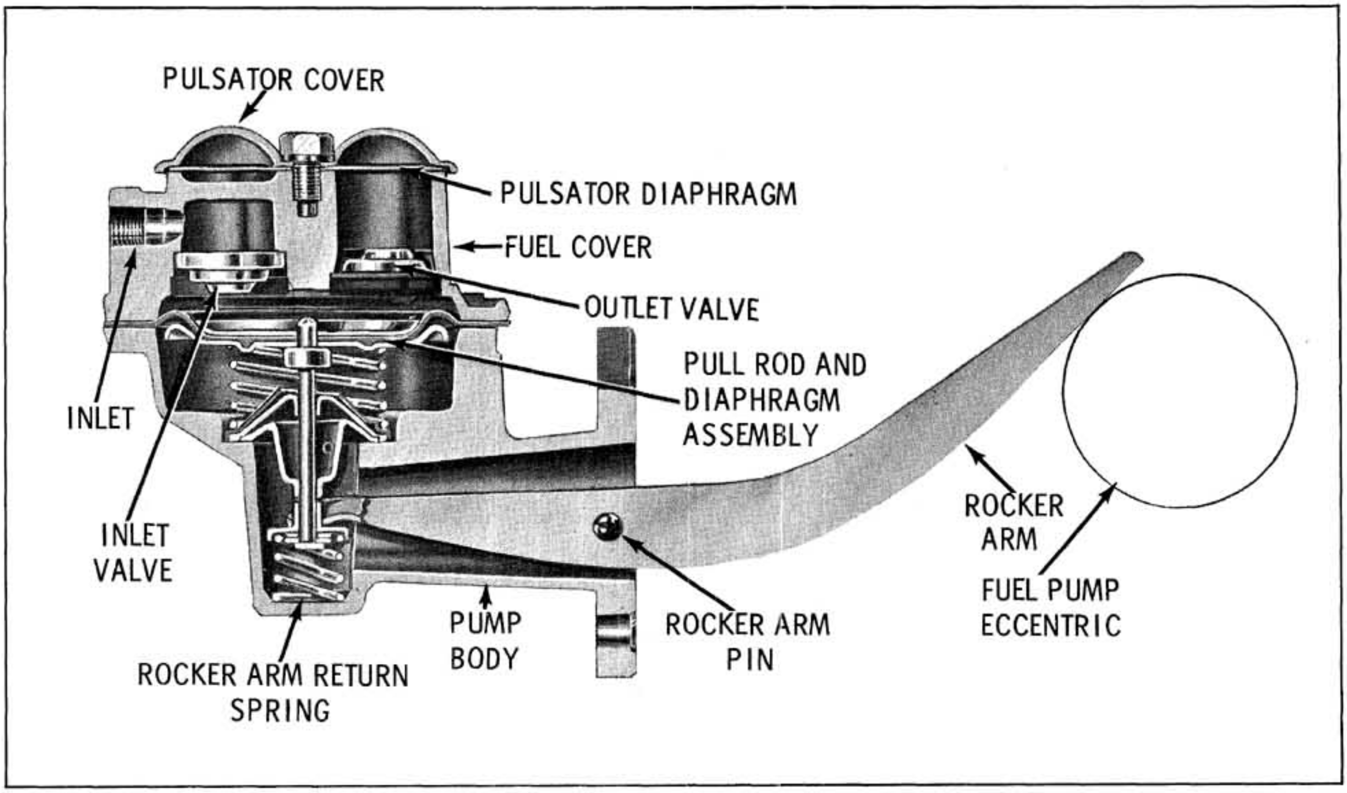

Fig. 3-133 Fuel Pump Assembly

3. Look for bends or kinks in lines which will reduce flow.

4. Test fuel flow as follows:

   a. Ground primary terminal of distributor with jumper lead so that engine can be cranked without firing.

   b. Disconnect fuel line at the carburetor.

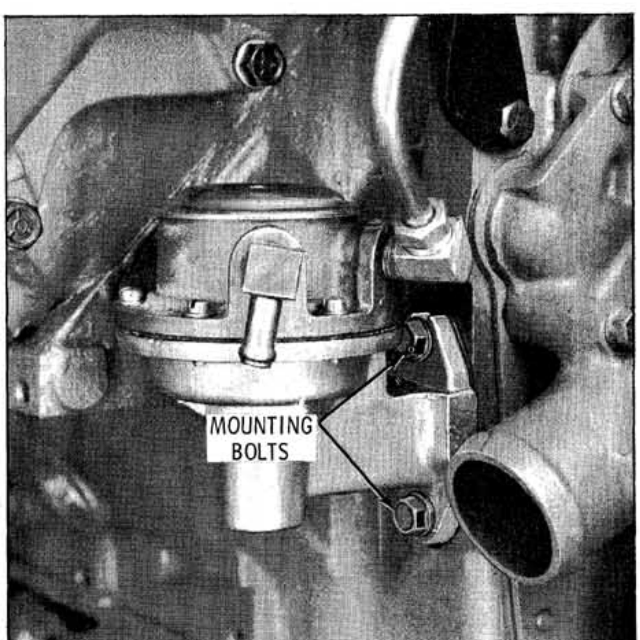

Fig. 3-134 Fuel Pump Mounting

   c. Place suitable container at end of fuel line and crank engine a few revolutions.

   NOTE: If little or no gasoline flows from open end of line, then the fuel line is restricted, gas tank filter restricted or the pump is inoperative. Before removing pump, disconnect fuel lines at fuel pump and at gas tank and blow through them with an air hose to make sure they are clear. Reconnect fuel lines to pump and gas tank.

5. Even if fuel flows in good volume from line at carburetor, it is advisable to make certain that pump is operating within limits.

   a. Disconnect fuel line at carburetor and attach a low reading pressure gauge.

   b. Run engine at approximately 1000 rpm (using gasoline in carburetor bowl) and note reading on pressure gauge.

   c. If pump is operating properly, the pressure will be 7 to 8-1/2 psi constant. If pressure is too low or too high or varies materially at different speeds, the pump should be removed for repair or replacement.

Removal and Installation

1. Disconnect fuel lines at fuel pump.

2. Remove fuel pump to engine block mounting

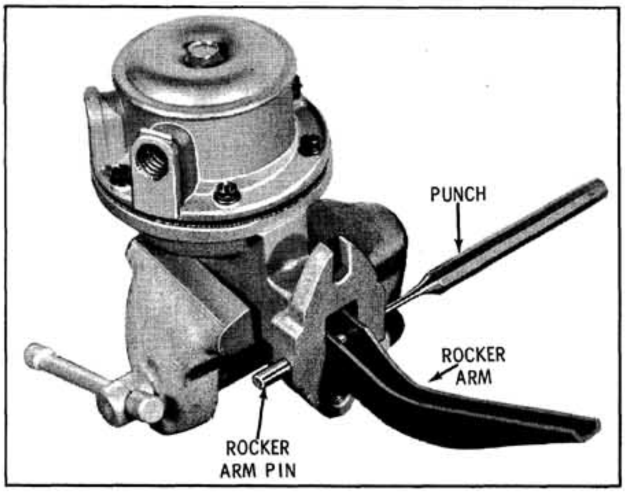

Fig. 3-135 Removing Rocker Arm Pin

bolts, and then remove fuel pump. (Fig. 3-134)

Disassembly

1. Clamp the pump carefully in vise.

2. Using a 3/16" drill, drill through the aluminum plugs at each end of the rocker arm pin.

   NOTE: These plugs are approximately 1/4" long.

3. Drive out the rocker arm pin using a small punch, then remove the arm. (Fig. 3-135)

   CAUTION: Use care not to damage the pump body when removing the pin.

4. Remove the pulsator diaphragm cover attaching bolt then remove the diaphragm cover and diaphragm.

5. Remove the six fuel cover attaching screws, then remove the cover.

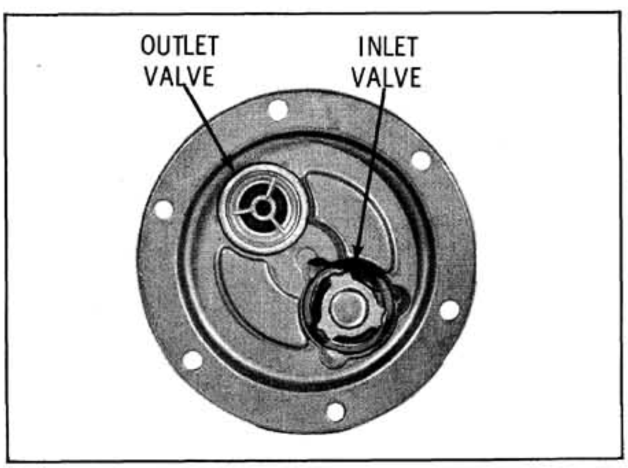

Fig. 3-136 Fuel Valves

6. Remove the pull rod and diaphragm assembly, and rocker arm return spring.

7. To remove the valves, remove the burrs produced from staking then:

   a. Pry the inlet valve assembly from the fuel cover.

   b. Push the outlet valve assembly through the cover from the pulsator side of the cover.

Cleaning and Inspection

1. Clean and rinse all metal parts in solvent. Blow out all passages with compressed air.

2. Inspect the pump body and cover for cracks, breakage, and distorted flanges. Examine all screw holes for stripped or crossed threads. Replace the pump assembly if damage to the body is encountered.

Assembly

1. Place the valve gaskets in the fuel cover recesses provided in the fuel cover.

   a. Place the inlet valve on top of the gasket with the spring cage facing out of the cover as shown in Fig. 3-136.

   b. Place the outlet valve on top of the gasket with the spring cage facing into the cover. (Fig. 3-136)

   c. Stake the valves in place.

2. Install the rocker arm spring in the pump body making sure that the spring is properly seated in the pull rod end of the diaphragm assembly. (Fig. 3-137)

3. Position the fuel cover, aligning the attaching

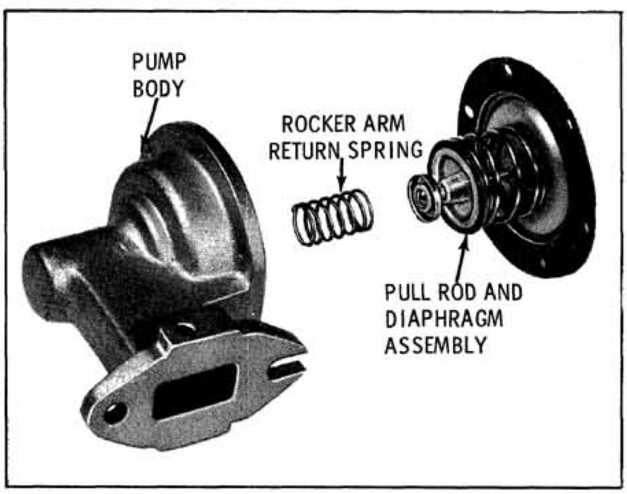

Fig. 3-137 Fuel Pump - Exploded View

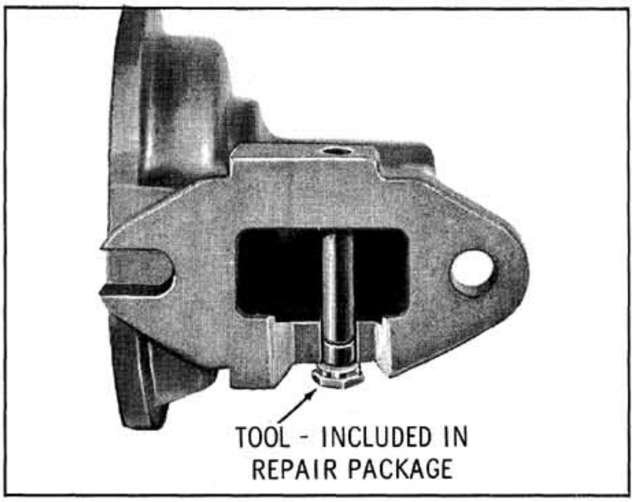

Fig. 3-138 Centering Rocker Arm Pin

screw between the inlet and outlet openings, with the front of the engine when in the as-installed position.

4. Install a new pulsator diaphragm on the fuel cover, then position the cover and secure with the attaching bolt.

5. Position the rocker arm in the pump body with the forked end of the rod on the rocker arm return spring retainer portion of the pull rod assembly. Make sure that the rocker arm return spring is properly seated in the spring retainer of the pull rod end of the diaphragm assembly. (Fig. 3-133)

6. Install the rocker arm pin through the pump body and the rocker arm, with the chamfered end first. Use the centering tool furnished in the kit to insure the correct positioning of the pin, thus making sure that it is centered in the pump body. (Fig. 3-138)

7. Place one aluminum plug on each side of the rocker arm pin.

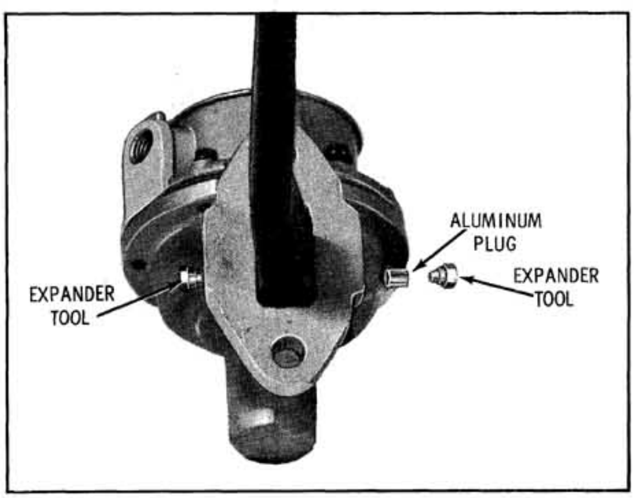

Fig. 3-139 Installing Rocker Arm Pin

8. Position an expander tool, furnished in the kit, against each aluminum plug. (Fig. 3-139)

   a. Push the point of the expander tool into the aluminum plug far enough by hand to make a centering dimple. This will give the correct relationship between the expander tool and the plug.

   b. Place the pump in a vise with the expander tools against the jaws.

   c. Close the vise jaws until the expander tools just shoulder against the pump body. This properly expands the aluminum plugs in the pump body.

   NOTE: Care must be exercised to prevent breaking the pump body with the vise.

9. Remove the pump from the vise, then remove the expander tools.

EXHAUST SYSTEM (Figs. 3-140 through 3-150)

EXHAUST MANIFOLD HEAT VALVE

The exhaust manifold heat valve, located in the left manifold, is the integral type, but can be replaced with the following procedure:

1. Remove the manifold from the engine.

2. Cut the shaft on each side of the valve welds with a hacksaw or cutting torch.

3. Remove the valve and the weight end of the shaft from the manifold. The shaft end and plug can be removed by using a punch from the weight side.

4. Remove the bushings with BT-6419, Bushing Remover and Installer.

5. Clean the bushing bore of the manifold.

6. Lubricate the OD of the bushings, with the largest taper inboard, press the new ceramic lined steel bushings into the manifold with BT-6419, Bushing Remover and Installer, as shown in Fig. 3-140. Two bushings are used on the weight end.

7. Install the plug in the counterbore of the manifold opposite the weight end, then stake in place.

8. Slide a new valve into the manifold.

9. Insert a new shaft into the manifold, through the valve and bushings. Install the spring on the shaft and position on the weight and shaft

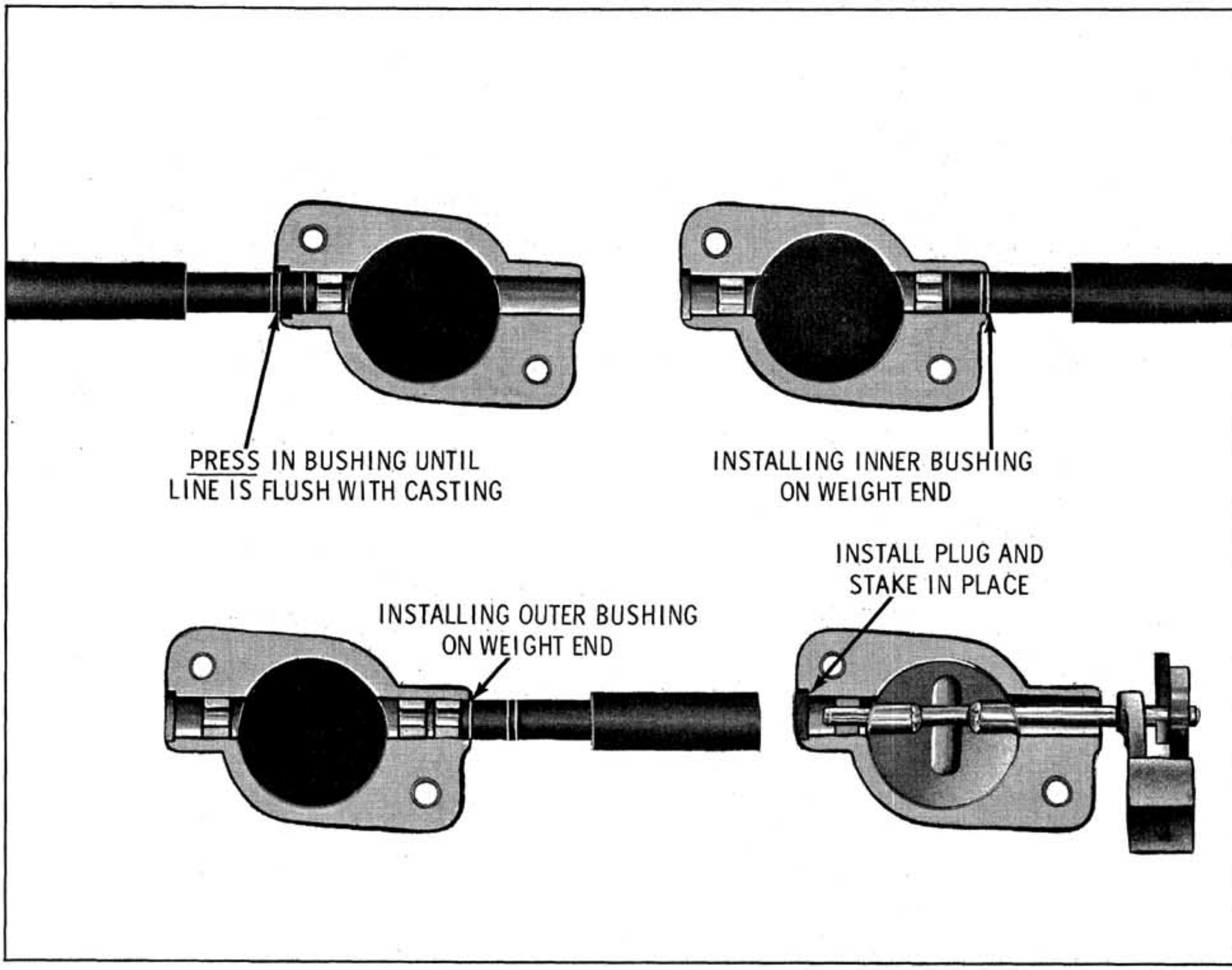

Fig. 3-140 Exhaust Manifold Heat Valve Replacement

in the closed position with 1/8" clearance between the weight and the manifold.

10. Position a new valve with the long portion of the valve closer to the manifold outlet than on the short side of the valve.

11. With stainless steel welding rod, electric arc weld the valve to the shaft.

NOTE: The valve should be welded in the same places as the original valve.

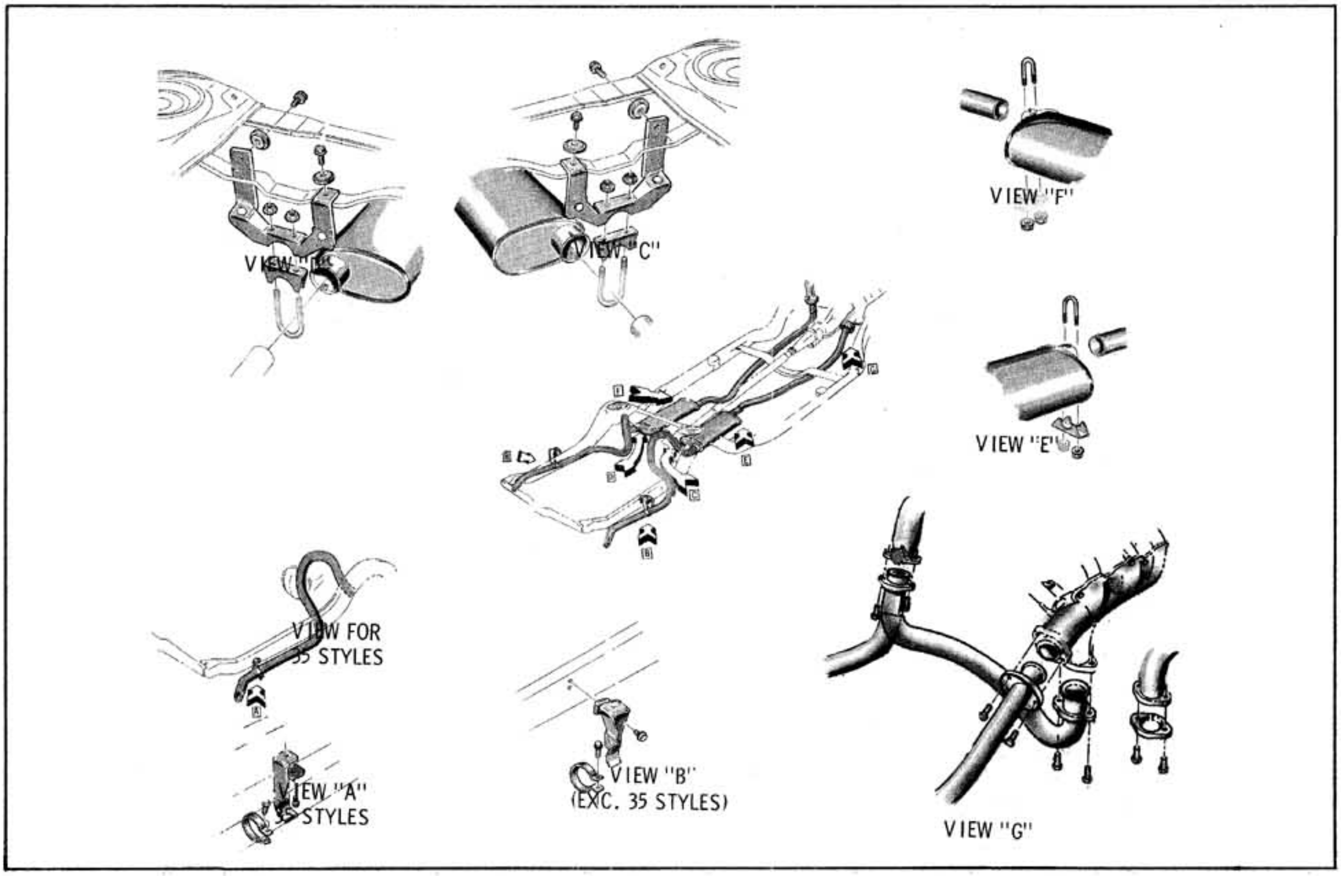

Fig. 3-141 34-36 and 38 Series Dual Exhaust

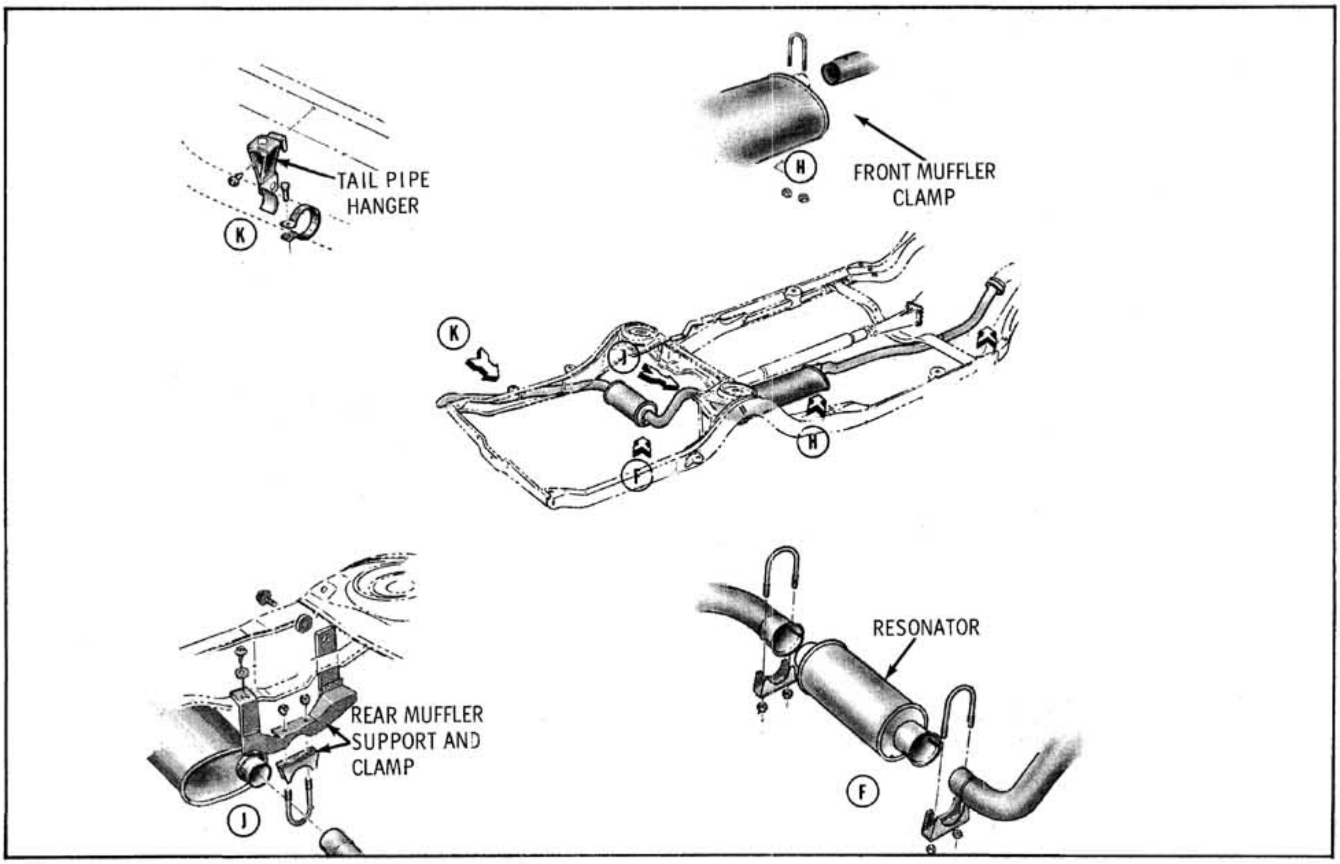

Fig. 3-142 34-36 and 38 Series Single Exhaust

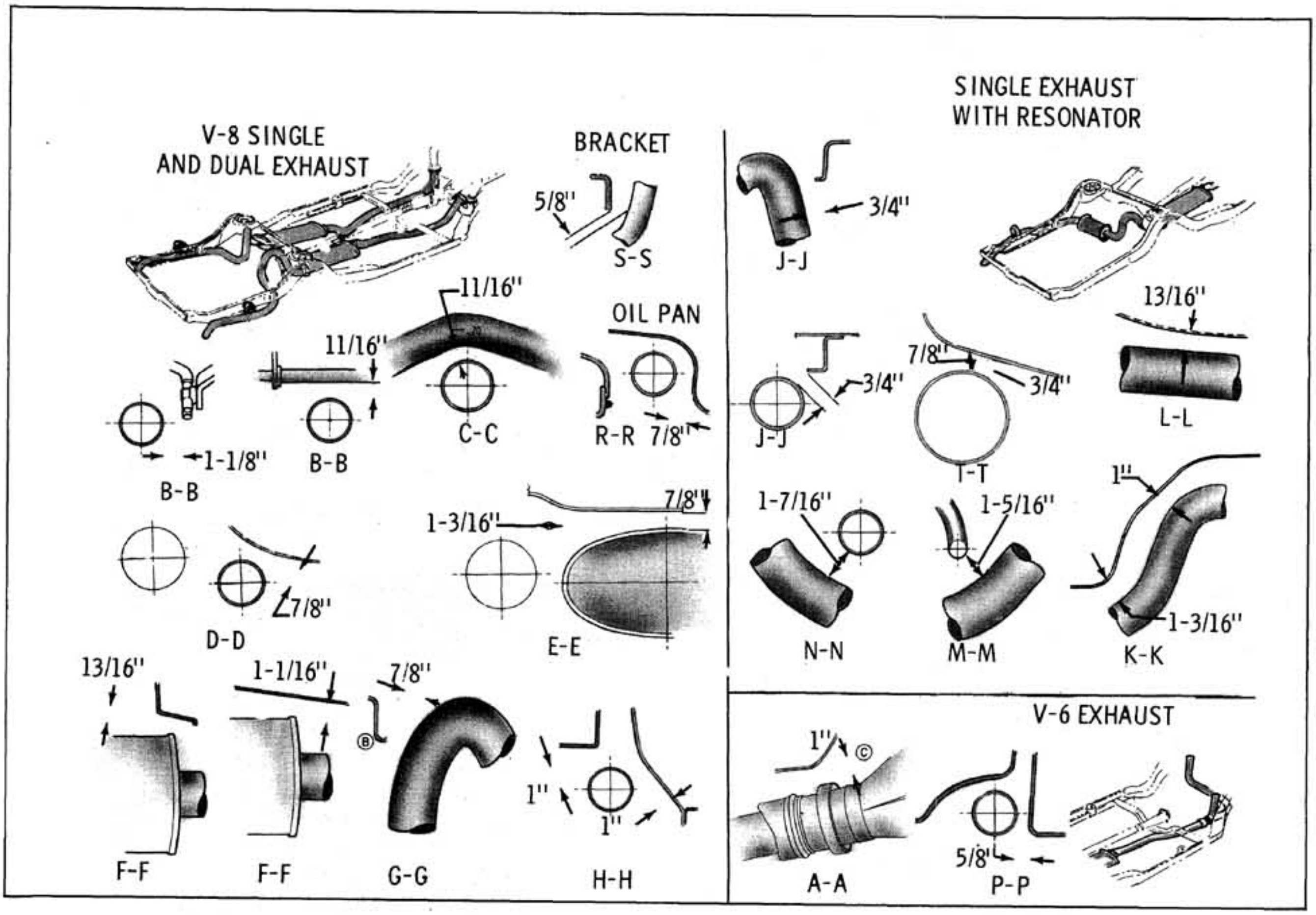

Fig. 3-143 34-36 and 38 Series Exhaust Clearance

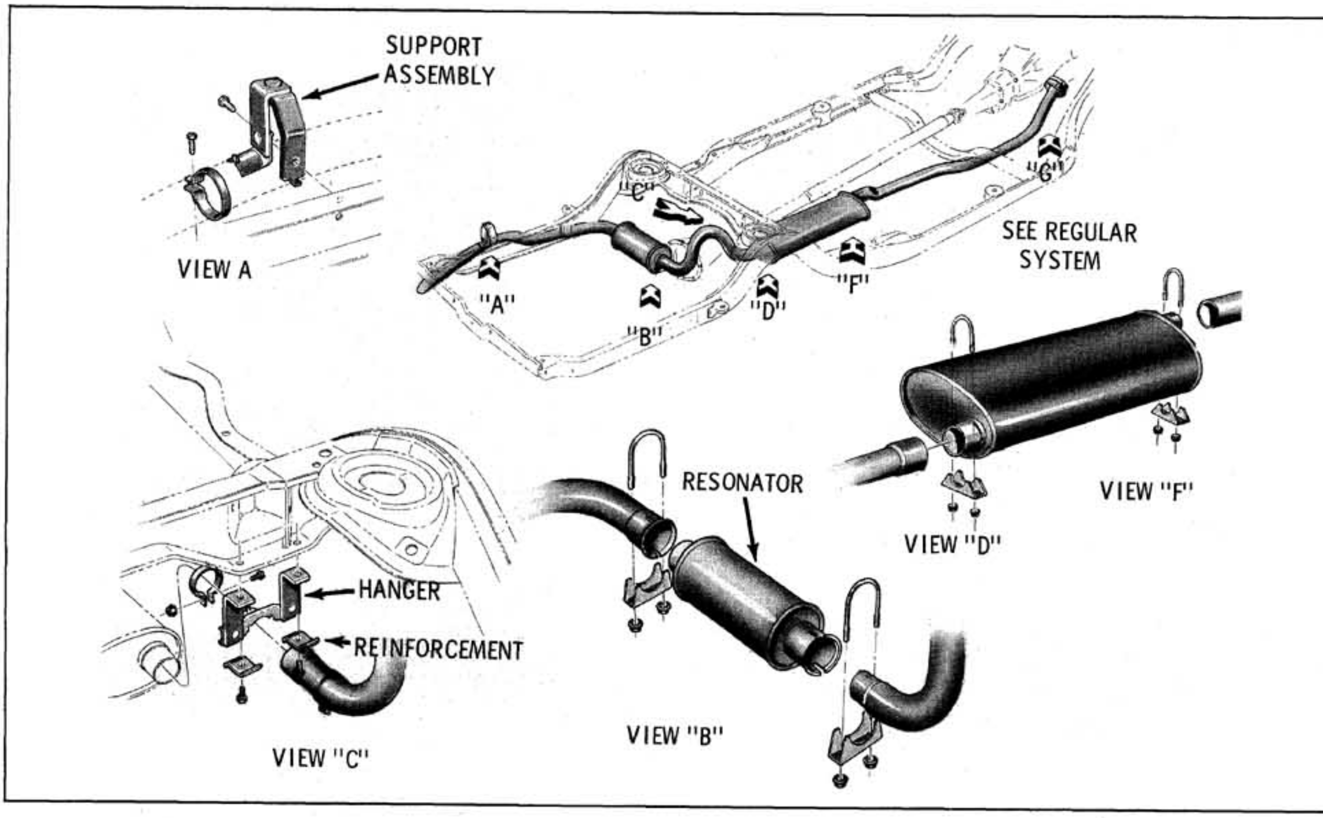

Fig. 3-144 55 and 65 Styles Exhaust

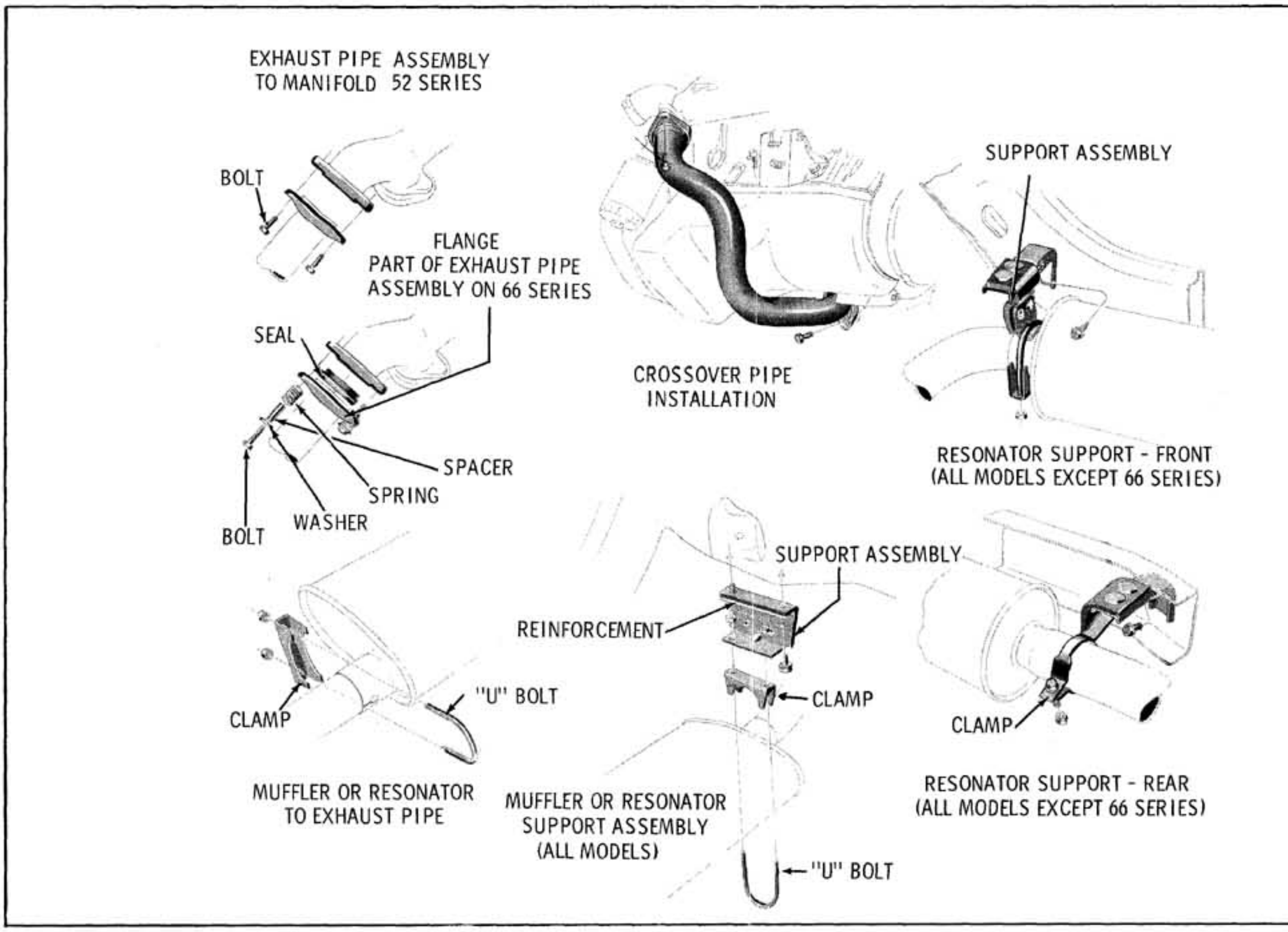

Fig. 3-145 52 through 86 Series Exhaust

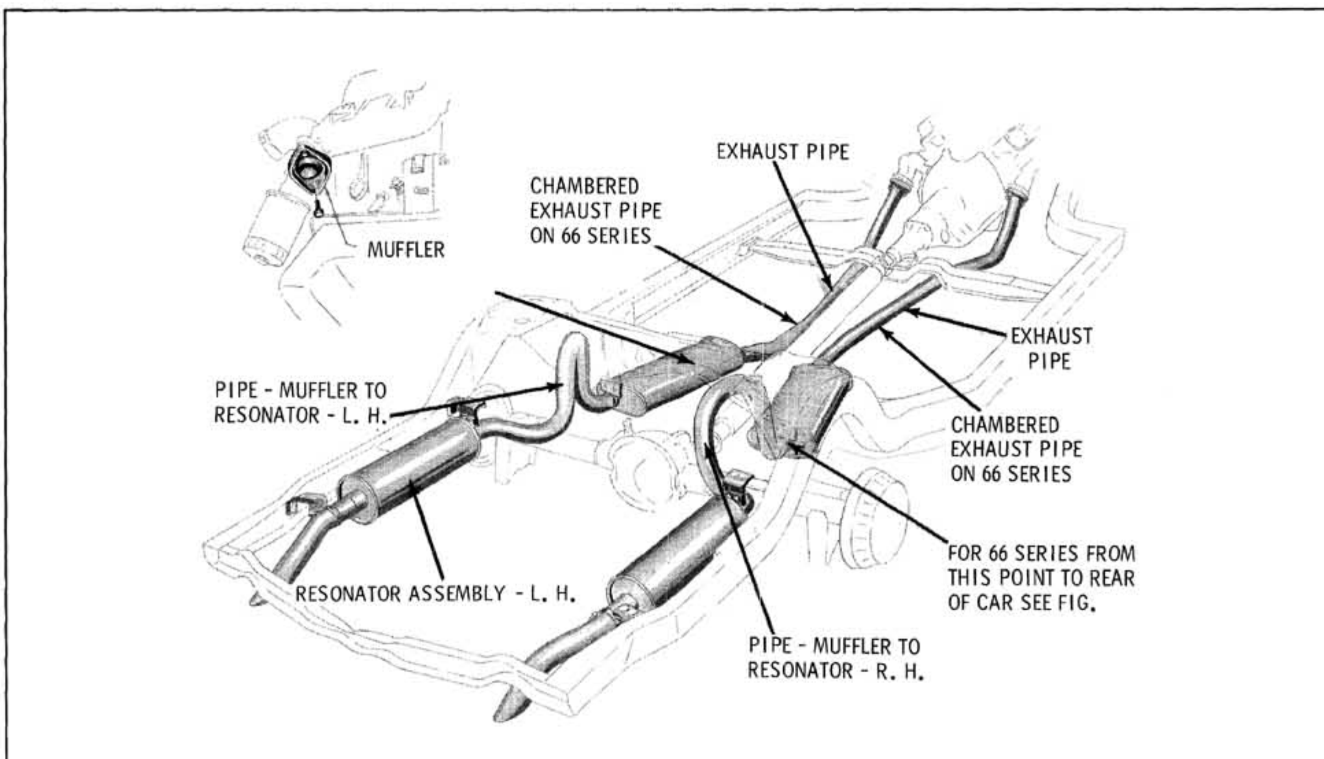

Fig. 3-146 52 through 86 Series Exhaust

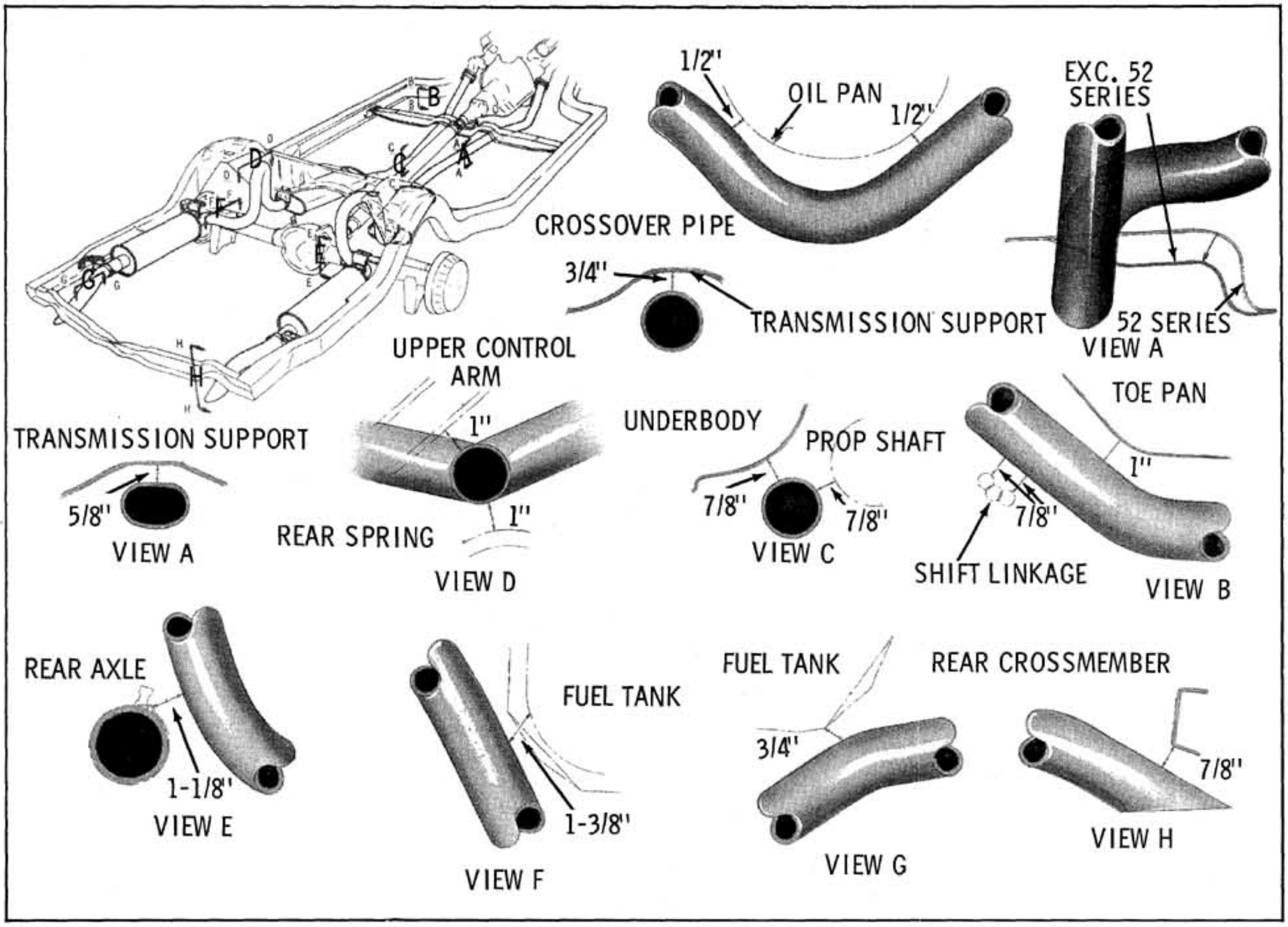

Fig. 3-147 62 through 86 Series Exhaust

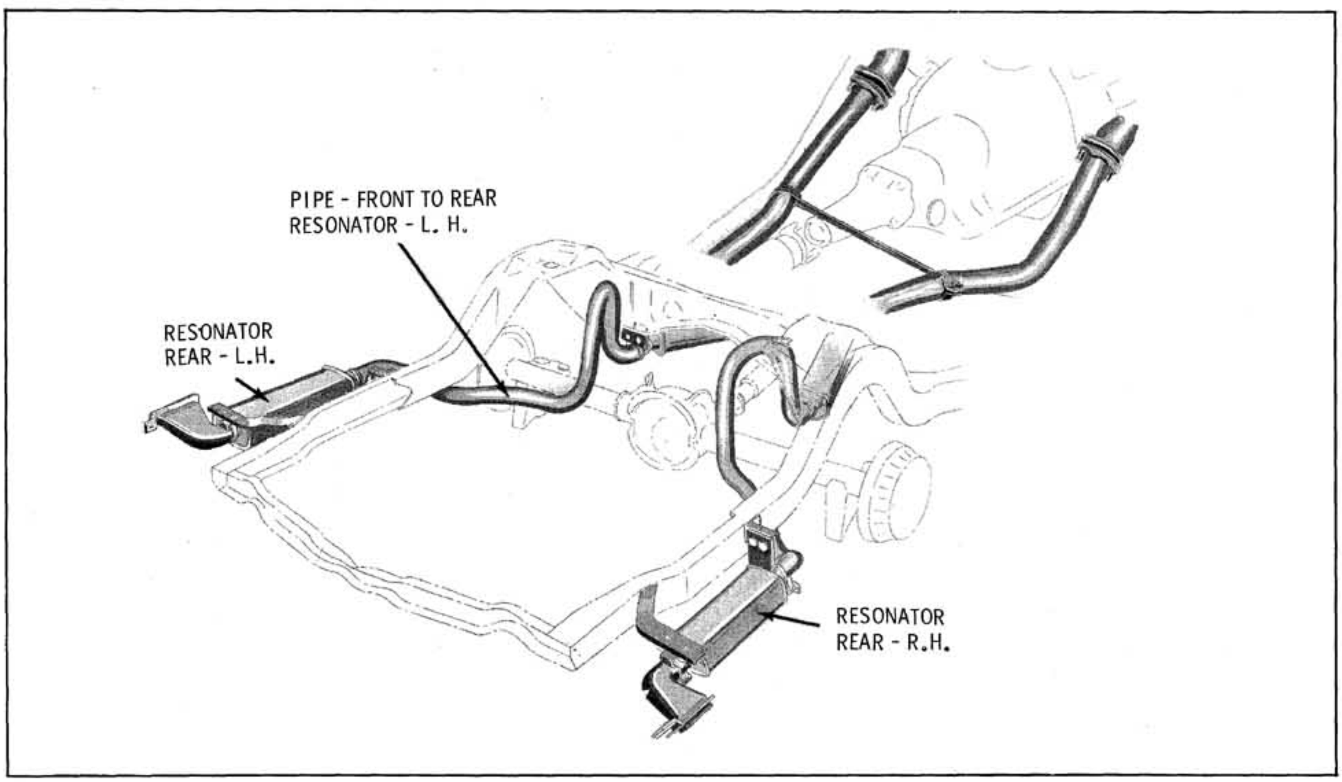

Fig. 3-148 66 Series Exhaust

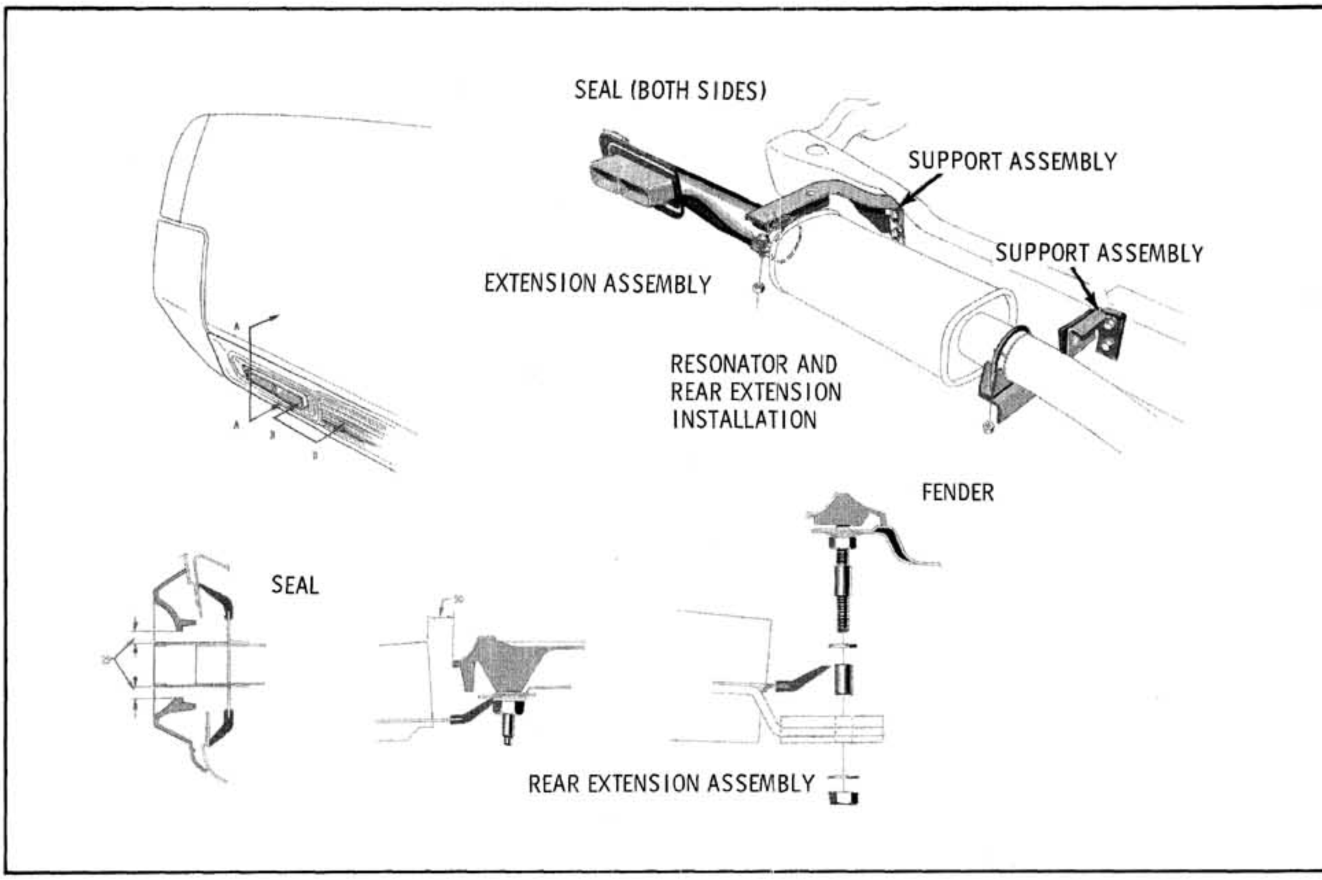

Fig. 3-149 66 Series Exhaust

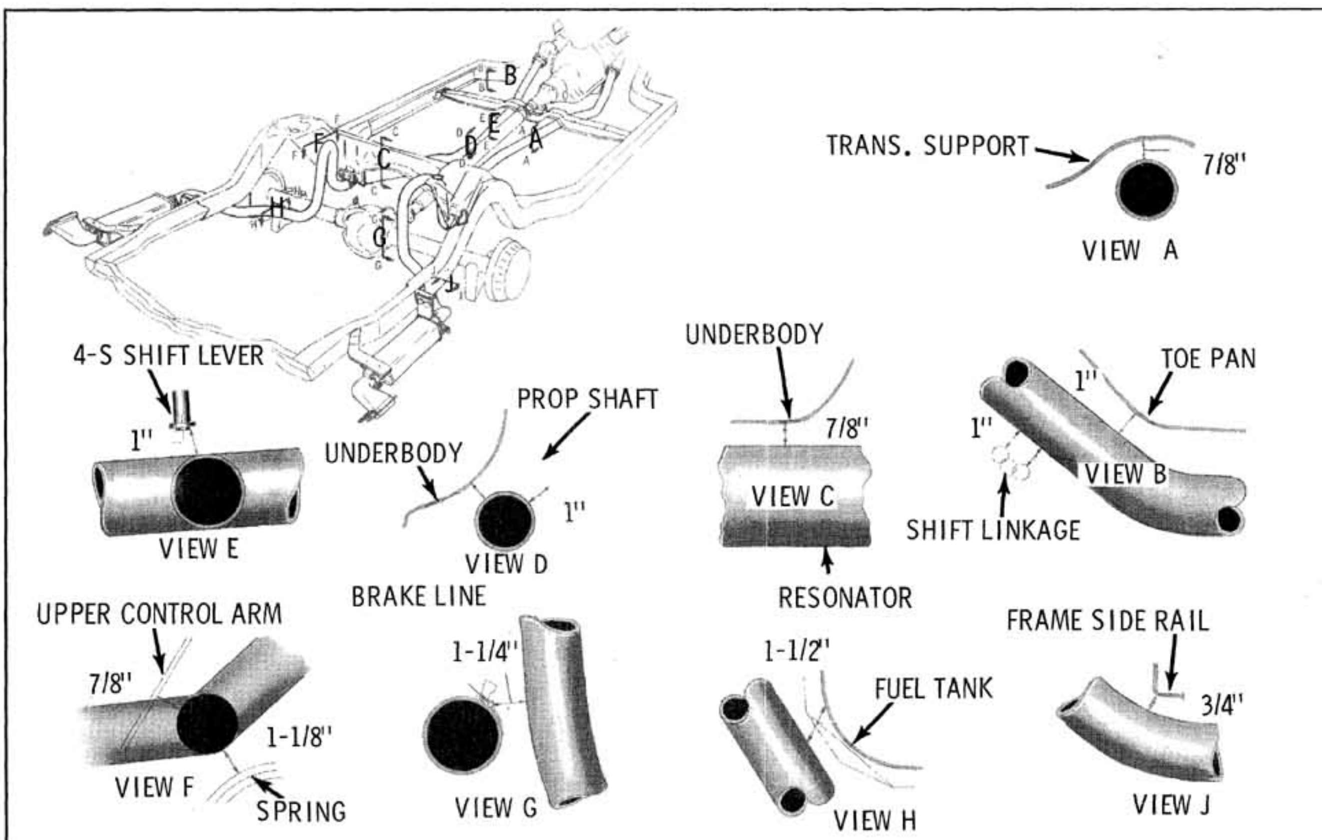

Fig. 3-150 66 Series Exhaust

ENGINE MOUNTS

FRONT

Removal

1. Support engine with Tool BT-6501. (Fig. 3-151)
2. Remove mount to support bolt, and engine to mount bolts.

Installation

To install new mount, install bolts loosely then torque mount to engine bolts to 45 ft. lbs., then mount to support bolt to 60 ft. lbs.

REAR (TRANSMISSION MOUNT)

Removal

The rear mount is commonly referred to as the rear transmission mount or the rear engine mount.

It can be removed by:

1. Removing mount to support bar bolts.
2. Removing mount to transmission rear bearing retainer bolts.
3. Raise rear of transmission slightly and remove mount.

When installing, torque all bolts to 45 ft. lbs.

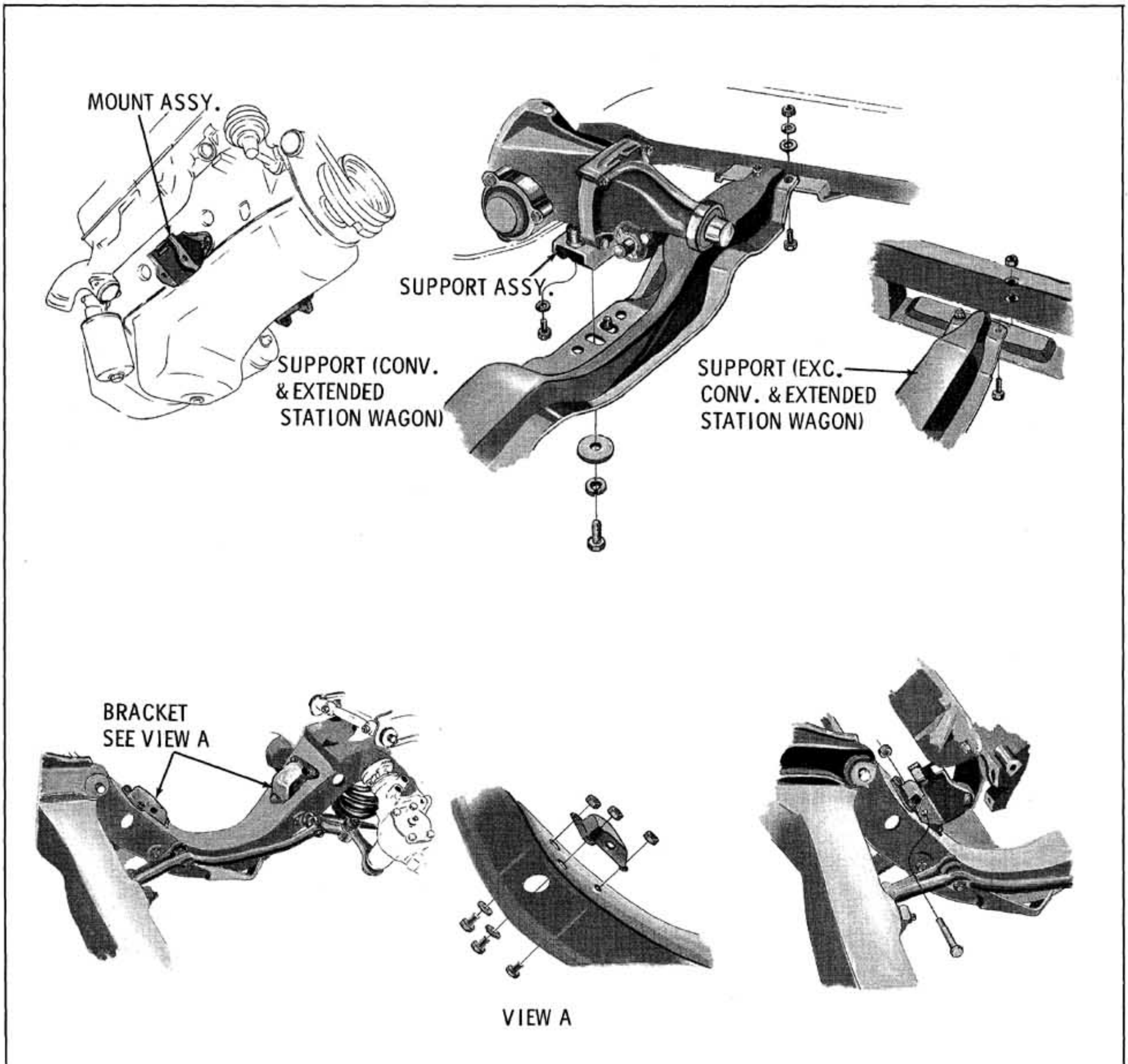

Fig. 3-151 Engine Mounts (33 through 38 Series)

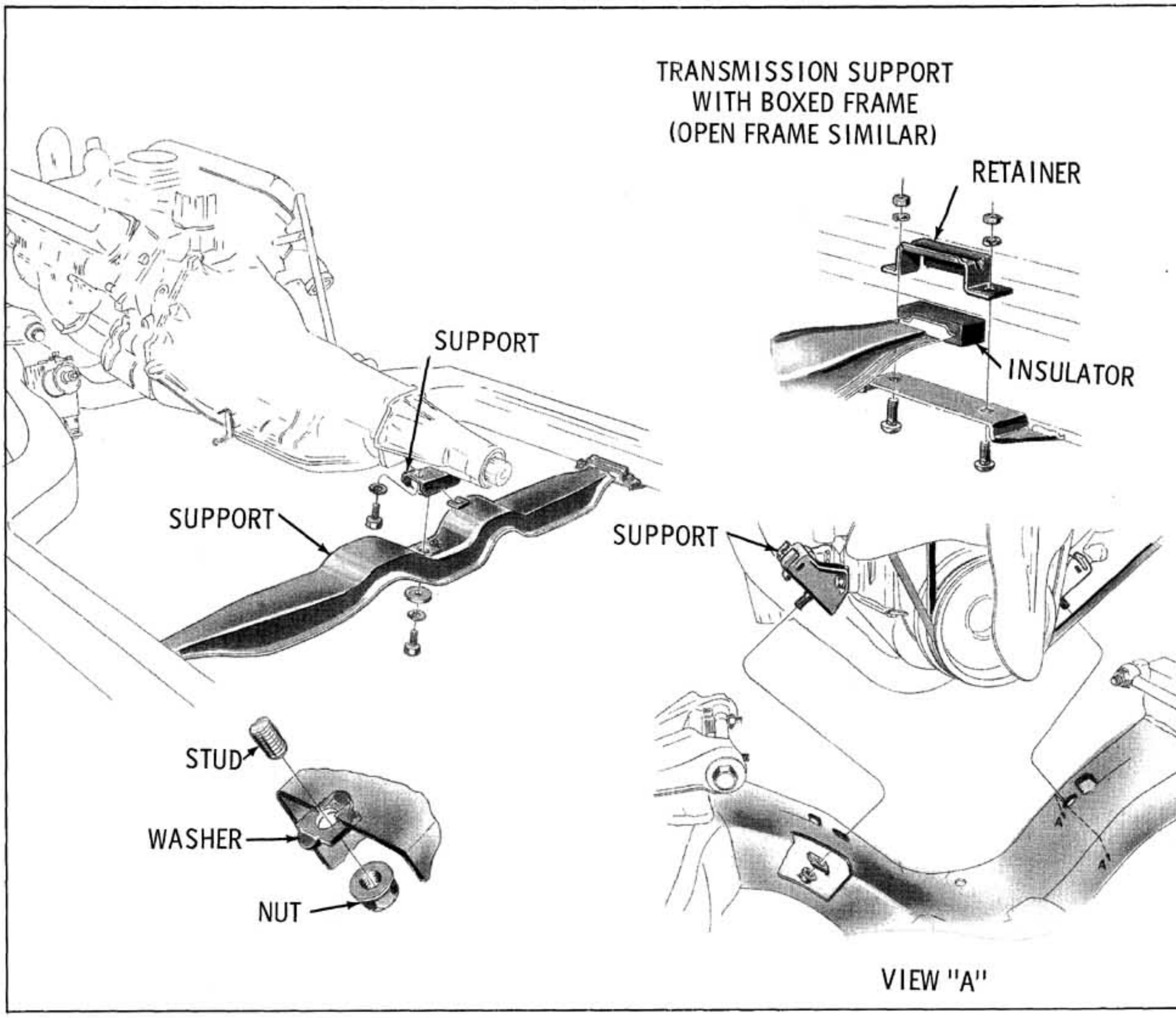

Fig. 3-152 Engine Mounts (52 through 86 Series)

330 CUBIC INCH ENGINE SPECIFICATIONS

CYLINDER BLOCK	
Engine Type	90° V-Type
No. of Cylinders	8
Bore and Stroke (all)	3.9385" x 3.3850"
Piston Displacement (all)	330 Cu. In.
Compression Ratio	2 Bbl. 9.0:1, 4 Bbl. 10.25:1
Firing Order	1-8-4-3-6-5-7-2
Main Bearing Bore (I.D.)	2.687"-2.688"
CRANKSHAFT	
Diameter-Main Bearing Journal (all)	2.4995"-2.4985"
Width-Main Bearing Journal (with fillets)	
No. 1	1.185"
No. 2 & 4	1.156"-1.166"
No. 3	1.199"-1.201"
No. 5	1.872"
Diameter-Connecting Rod Bearing Journal	2.1248"-2.12388"
Width-Connecting Rod Bearing (with fillets)	1.877"-1.880"
Length-Overall Crankshaft	26.470"
Diameter - Oil Holes in Crankshaft	.201"-.209"
Clearance - Crankshaft End Thrust	.004"-.008"
MAIN BEARINGS	
Oil Clearance-Crankshaft Vertical (all)	.0015"-.0031"
Width-Bearing Shell	
No. 1, 2, and 4	.970"-.980"
No. 3	1.193"-1.195"
No. 5	1.624"
CONNECTING RODS	
Length-Center to Center	5.998"-6.002"
Diameter-Connecting Rod Bore	2.2495"-2.2500"
Diameter-Pin Bore	.9791"-.9795"
Bearing Clearance - Crankshaft (vertical)	.0015"-.0030"
Side Clearance - Crankshaft End	.002"-.013"
PISTON	
Diameter Nominal Outside	3.9375"
Length Overall	3.620"
Top of Piston Pin to Center	1.615"
Clearance at Thrust Surface (selective)	.00075"-.00125"
Weight Less Pin & Rings (all)	20.670 oz.
Skirt Taper	.0000"-.0010" Larger at Bottom
Ring Width (2 compression)	.0803"
(1 oil)	.1886"
PISTON PINS	
Diameter	.9807"-.9803"
Length Overall	3.116"-3.136"
Pin to Piston Clearance	.0003"-.0005" Loose
Pin to Rod Clearance	.0008"-.0016" Tight
PISTON RINGS	
No. of Compression Rings (per piston)	2
Width of Compression Rings (top & bottom)	.0780"-.0775"
Gap Clearance Compression Rings	.010"-.020"
Clearance in Groove Compression Rings - Upper	.0018"-.0033"
Lower	.0018"-.0038"
No. of Oil Rings (per piston)	1
Gap Clearance, Oil Ring	.015"-.055"
Clearance in Groove - Oil Ring	.0001"-.0051"

330 CUBIC INCH ENGINE SPECIFICATIONS (Cont'd.)

CAMSHAFT	
Bearing Journal Diameters	
No. 1	2.0373"-2.0365"
No. 2	2.0173"-2.0165"
No. 3	1.9973"-1.9965"
No. 4	1.9773"-1.9765"
No. 5	1.9573"-1.9565"
Width (including chamfers)	
No. 1	.810"
No. 2, 3, and 4	.768"
No. 5	.775"
Journal Clearance in Bearing (all)	.0012"-.0050"
End Thrust	.011"-.077"
VALVE - INTAKE	
Diameter - Head	1.886"-1.870"
Diameter - Stem	.3425"-.3432"
Angle - Valve Seat	45°
Width - Valve Seat	.037"-.075"
Overall Length (all)	4.740"
Clearance in Guide	.0010"-.0027"
Lash	Hydraulic
VALVE - EXHAUST	
Diameter - Head	1.567"-1.557"
Diameter - Stem	.3420"-.3427"
Angle - Valve Seat	45°
Width - Valve Seat	.037"-.075"
Overall Length (all)	4.728"
Clearance in Guide	.0015"-.0032"
Lash	Hydraulic
VALVE GUIDES	
Inside Diameter (intake & exhaust)	.3442"-.3452"
VALVE SPRINGS	
Length	1.96"
Diameter - Wire	.192"
Inside Diameter	1.065"-1.041"
Load @ 1.670"	76-84 Lbs.
Load @ 1.270"	180-194 Lbs.
VALVE LIFTERS	
Diameter - Body	.8422"-.8427"
Length - Overall	2.000"
Clearance in Boss (selective)	.0005"-.0020"
CAMSHAFT SPROCKET	
Width of Sprocket	.410"-.400"
Pitch	.500"
No. of Teeth	36
Overall Width of Gear	.471"-.461"
CRANKSHAFT SPROCKET	
Width of Sprocket	.410"-.400"
Overall Width of Gear	1.00"-.993"
Pitch	.500"
No. of Teeth	18
TIMING CHAIN	
Width	.740"-.750"
No. of Links	48
Pitch	.500"

425 CUBIC INCH ENGINE SPECIFICATIONS

CYLINDER BLOCK	
Engine Type	90° V-Type
No. of Cylinders	8
Bore and Stroke (all)	4.126" x 3.975"
Piston Displacement (all)	425 Cu. In.
Compression Ratio	2 Bbl. 9.0:1, 4 Bbl., 66 Series 10.5:1
Firing Order	1-8-4-3-6-5-7-2
Main Bearing Bore (I.D.)	3.188"-3.189"
CRANKSHAFT	
Diameter-Main Bearing Journal (all)	3.0003"-2.9993"
Width-Main Bearing Journal (with fillets)	
No. 1	1.185"
No. 2 & 4	1.156"-1.166"
No. 3	1.199"-1.201"
No. 5	1.872"
Diameter-Connecting Rod Bearing Journal	2.5003"-2.4988"
Width-Connecting Rod Bearing (with fillets)	1.877"-1.880"
Length-Overall Crankshaft	26.470"
Diameter - Oil Holes in Crankshaft	.201"-.209"
Clearance - Crankshaft End Thrust	.004"-.008"
MAIN BEARINGS	
Oil Clearance-Crankshaft Vertical 1, 2, 3 & 4	.0015"-.0031"
5	.0020"-.0034"
Width-Bearing Shell	
No. 1, 2, and 4	.970"-.980"
No. 3	1.193"-1.195"
No. 5	1.624"
CONNECTING RODS	
Length-Center to Center	6.996"-7.000"
Diameter-Connecting Rod Bore	2.6243"-2.6250"
Diameter-Pin Bore	.9791"-.9795"
Bearing Clearance - Crankshaft (vertical)	.0008"-.0018"
Side Clearance - Crankshaft End	.002"-.013"
PISTON	
Diameter Nominal Outside	4.125"
Length Overall	3.620"
Top of Piston Pin to Center	1.615"
Clearance at Thrust Surface (selective)	.00075"-.00125"
Weight Less Pin & Rings (all)	23.460 Oz.
Skirt Taper	.0000"-.0010" Larger at Bottom
Ring Width (2 compression)	.0803"
(1 oil)	.1886"
PISTON PINS	
Diameter	.9803"-.9807"
Length Overall	3.116"-3.136"
Pin to Piston Clearance	.0003"-.0005" Loose
Pin to Rod Clearance	.0008"-.0016" Tight
PISTON RINGS	
No. of Compression Rings (per piston)	2
Width of Compression Rings (top & bottom)	.0780"-.0775"
Gap Clearance Compression Rings	.013"-.023"
Clearance in Groove Compression Rings - Upper	.0018"-.0033"
Lower	.0018"-.0038"
No. of Oil Rings (per piston)	1
Gap Clearance, Oil Ring	.015"-.055"
Clearance in Groove - Oil Ring	.0021"-.0081"

425 CUBIC INCH
ENGINE SPECIFICATIONS (Cont'd.)

CAMSHAFT	
Bearing Journal Diameters	
No. 1	2.0373"-2.0365"
No. 2	2.1073"-2.0165"
No. 3	1.9973"-1.9965"
No. 4	1.9773"-1.9765"
No. 5	1.9573"-1.9565"
Width (including chamfers)	
No. 1	.810"
No. 2, 3, and 4	.768"
No. 5	.775"
Journal Clearance in Bearing (all)	.0012"-.0050"
End Thrust	.011"-.077"
VALVE - INTAKE	
Diameter - Head	2.000"-1.990"
Diameter - Stem	.3425"-.3432"
Angle - Valve Seat	45°
Width - Valve Seat	.037"-.075"
Overall Length Starfire	4.677"
Clearance in Guide	4.707"
Lash	Hydraulic
VALVE - EXHAUST	
Diameter - Head	1.629"-1.619"
Diameter - Stem	.3420"-.3427"
Angle - Valve Seat	45°
Width - Valve Seat	.037"-.075"
Overall Length Starfire	4.665"
Clearance in Guide	4.695"
Lash	Hydraulic
VALVE GUIDES	
Inside Diameter (intake & exhaust)	.3442"-.3452"
VALVE SPRINGS	
Length	1.96"
Diameter - Wire	.192"
Inside Diameter	1.065"-1.041"
Load @ 1.670"	76-84 Lbs.
Load @ 1.270"	180-194 Lbs.
VALVE LIFTERS	
Diameter - Body	.8422"-.8427"
Length - Overall	2.000"
Clearance in Boss (selective)	.0005"-.0020"
CAMSHAFT SPROCKET	
Width of Sprocket	.529"-.521"
Pitch	.500"
No. of Teeth	36
Overall Width of Gear Hub	.471"-.461"
CRANKSHAFT SPROCKET	
Width of Sprocket	.530"-.520"
Overall Width of Gear	1.001"-.993"
Pitch	.500"
No. of Teeth	18
TIMING CHAIN	
Width	.875"-Morse, .844"-Linkbelt
No. of Links	48
Pitch	.500"

ENGINE SPECIFICATIONS (ALL V-8 ENGINES)

FLYWHEEL	
No. of Teeth on Starter Gear	166
No. of Teeth on Starter Pinion	9
LUBRICATION SYSTEM	
Crankcase Capacity Drain and Refill	4 Qts.
Drain & Refill with Filter Change	5 Qts.
Oil Pump	
Clearance Pressure Relief Valve in Bore	.0025"-.0050"
End Clearance - Gear	.0025"-.0065"

SPECIFICATIONS

COOLING SYSTEM	
CAPACITY	
34-36 and 38 Series	
without A/C	16.9 Qts.
with A/C	19.3 Qts.
52 Series	
without A/C	16.5 Qts.
with A/C	17.0 Qts.
54 through 86 Series	
without A/C	17.5 Qts.
with A/C	18.0 Qts.
Pressure Cap	
With or Without Air Conditioning	15 Lbs.
Thermostat	180°
FUEL PUMP	
Pressure	7 to 8-1/2 Lbs.

TORQUE SPECIFICATIONS

NOTE: Specified torque is for installation of parts only. Checking of torque during inspection may be 15% below that specified.

Application	Ft. Lbs.
FUEL PUMP	
Fuel Pump to Block Bolt and Nut	25
Fuel Pump Eccentric to Camshaft	65
EXHAUST SYSTEM	15-20

TORQUE SPECIFICATIONS (Cont'd.)

Application	Ft. Lbs.
ENGINE	
Crankshaft Bearing Cap Bolts (Nos. 1, 2, 3 & 4)	80
Crankshaft Bearing Cap (No. 5)	120
Cylinder Head to Block	80
Connecting Rod Nuts	42
Oil Pump to Bearing Cap Bolts	35
Oil Pump Cover to Pump Bolts	8
Rocker Arm Studs to Head	35
Rocker Arm Nuts to Studs	25
Valve Cover Bolts	7
Oil Pan Bolts 5/16"	15
Oil Pan Bolts 1/4"	8
Oil Pan Drain Plug	50
Crankshaft Balancer or Hub to Crankshaft Bolt	50
Oil Filter Element to Base	20
Oil Filter Assembly to Cylinder Block Bolts	35
Front Cover to Cylinder Block Bolts 3/8"	35
Front Cover to Cylinder Block Bolts 5/16"	25
Fan Driven Pulley to Hub Bolts	20
Fan Driving Pulley to Hub or Balancer Bolts	20
Water Pump to Front Cover Bolts	13
Water Outlet to Manifold Bolts	20
Intake Manifold to Cylinder Head Bolts	35
Intake Manifold Baffle to Cylinder Block Bolts	8
Exhaust Manifold to Cylinder Head Bolts	25
Carburetor to Intake Manifold Bolts	15
Tube and Plate to Intake Manifold Bolts	15
Air Cleaner to Carburetor Stud	5
Motor Mount to Cylinder Block Bolts	50
Starter to Cylinder Block Bolts	35
Starter Brace to Cylinder Block Bolt	25
Starter Brace to Starter Bolt	15
Distributor Clamp to Cylinder Block Bolt	14
Spark Plugs	35
Coil to Intake Manifold Bolt	15

For Torque Requirements on Generator, Power Steering and Compressor Mounting Brackets, Refer to Table Below:

Bolt Size	Torque
5/16"	25
3/8"	35
7/16"	50

CARBURETION

(ALL SERIES)

CONTENTS OF SECTION

SPECIFICATIONS

The specifications for all carburetors are found at the end of this section. For step-by-step disassembly and assembly procedure, refer to the appropriate sub-section (Model BC, 2GC, 4GC).

MODEL BC
33 & 35 Series

MODEL 2GC
34-36-38-52-56-58 SERIES

Refer to Page 4-11

MODEL 4GC
34-36-38-52-54-56-58-66-84-86 SERIES

Refer to Page 4-17

SPECIFICATIONS

MODEL BC CARBURETOR

THEORY OF OPERATION

The Rochester Model BC carburetor is a single, downdraft, automatic choke model, used on the V-6 engine, for both Jetaway transmission and synchromesh application.

GENERAL DESCRIPTION (Fig. 4-1)

The Model BC carburetor incorporates the six systems of carburetion: Float, Idle, Main Metering, Power, Pump and Choke.

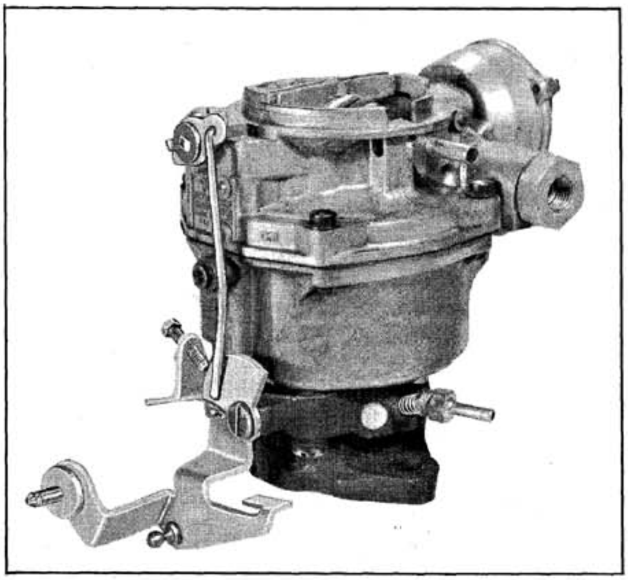

Fig. 4-1 Carburetor Assembly

FLOAT SYSTEM (Fig. 4-2)

The Model BC carburetor employs the conventional needle and seat to control fuel level in the float bowl. With the concentric float bowl design, dual floats are used to maintain a constant fuel level at all times. The float bowl is designed so that the fuel is centrally located around the main well.

As shown, components of the float system are the inlet fitting and gasket, fuel filter and gasket, pressure relief spring, needle valve and seat and the float. It should be noted that the fuel filter at the fuel line connection, behind the fuel inlet nut, is spring loaded. This provides a pressure relief feature so that in the event the filter should plug, the restriction would cause fuel pump pressure to overcome the spring and allow fuel to bypass the filter.

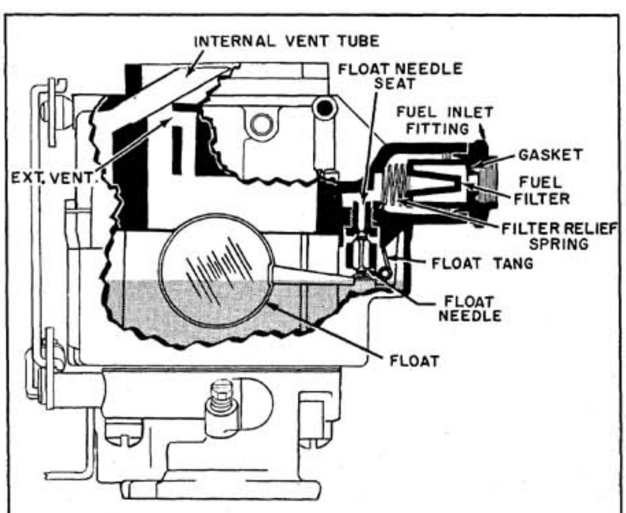

Fig. 4-2 Float System

When the float bowl fuel level is low, the float drops downward and allows the needle to come off its seat. This allows fuel to flow into the float bowl from the engine fuel pump supply. The fuel intake continues until the fuel level reaches the correct height set by the float level adjustment.

The float drop tang at the rear of the float hanger prevents the float needle from dropping out of the seat during disassembly and assembly operations.

Three air vents are used for transmitting air pressure to the fuel in the float bowl. Two external vents, located in the air horn just beneath the air cleaner, supply atmospheric pressure to the fuel in the float bowl and are used to remove fuel vapors which might disrupt engine operation during prolonged, hot engine idling.

An internal vent tube, located inside the air horn bore, extends upward from the float bowl to the base of the air cleaner to provide a balance between external and internal air pressures acting upon the fuel in the float bowl.

IDLE SYSTEM (Fig. 4-3)

At idle speeds, the throttle valve is nearly closed so there is not enough air flow through the venturi to lift fuel from the float bowl. Therefore, to supply enough fuel for idle and off idle requirements, a separate system is used called the idle system. To make fuel flow, manifold vacuum is applied directly to the fuel in the bowl from the idle needle hole and off idle port as the throttle valve is gradually opened. The idle system consists of the idle pickup tube, idle tube, idle passages, idle air bleeds, idle mixture adjustment needle, idle discharge holes, and an idle speed adjustment screw.

Atmospheric pressure acting on the fuel in the float bowl, forces fuel through the main metering jet into the main well. The fuel then travels through an anti-bubble screen located inside the

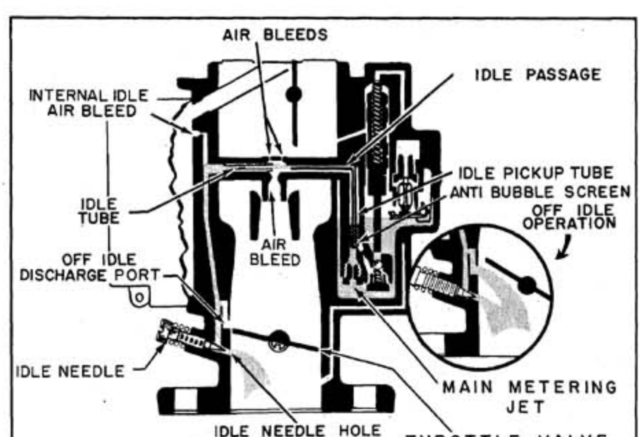

Fig. 4-3 Idle System

main well to break up any vapor bubbles which might form during hot engine idle. The fuel then travels up through the idle pickup tube and through the crossbar channel in the air horn. Air is then bled into the idle fuel at the center of the crossbar through the two top bleeds and nozzle hole. The air-fuel mixture then is picked up by the horizontal idle tube in the crossbar and metered through a calibrated restriction, then passes on into the vertical down channel where it is further bled with air by an internal idle air bleed in the vertical channel in the top of the float chamber. The fuel then travels downward, past the off idle discharge port where more air is picked up to mix with the fuel mixture and it then passes out the idle needle port below the throttle valve. Here the fuel mixture mixes with air coming past the slightly open throttle valves and passes on into the engine as a combustible idle mixture.

Except for the idle mixture adjustment needle, the idle system is specifically calibrated for low engine speeds.

Off-Idle Operation (See inset of Fig. 4-3)

As the throttle valve is opened slightly and engine speed increases, extra fuel is needed to combine with the additional air going by the throttle valve. This fuel is supplied by the off-idle discharge port.

The idle air bleed passage in the top of the float chamber serves a second purpose. When the engine is first stopped, the fuel in the carburetor is heated by warm air rising from the engine and tends to form vapor in the idle system. A bleed to the float chamber permits the idle system to vent, thereby, preventing hard, hot starting due to vapor build-up in the idle system.

Further opening of the throttle valve causes increased air flow through the carburetor bore which causes fuel delivery from the main nozzle. It should be remembered, however, that idle port discharge does not cease at this transfer point, but rather diminishes as main nozzle discharge increases. Thus, the two systems interact and produce a smooth air-fuel flow at all engine speeds.

MAIN METERING SYSTEM (Fig. 4-4)

Once air flow is sufficient to create enough pressure differential in the small venturi for fuel flow to start from the main nozzle, the transfer point has been reached and the carburetor starts metering from the main metering system.

Since the low pressure point is now in the small venturi area, fuel will be forced from the fuel bowl through the main metering system into the venturi.

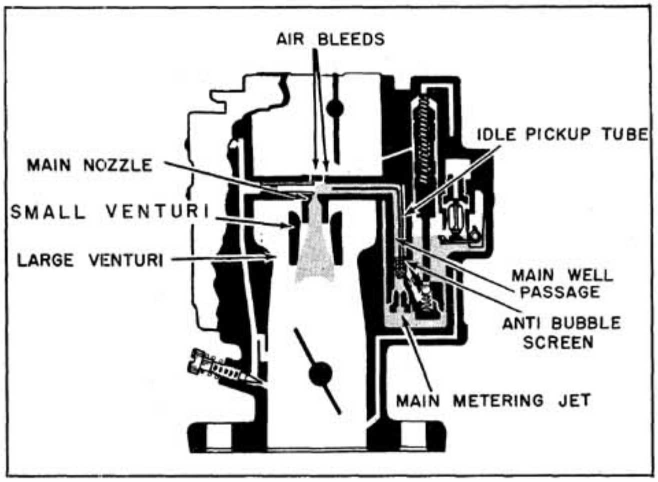

Fig. 4-4 Main Metering System

The calibration of the main metering jet and air bleeds in the crossbar maintain economical air-fuel ratios throughout the main metering or cruising range. Therefore, no adjustments are necessary in the main metering system.

POWER SYSTEM (Fig. 4-5)

A vacuum operated power system is used in the carburetor to provide additional fuel for sustained high speed operation or increased road load power. A direct manifold vacuum passage within the carburetor to the engine intake manifold connects to the power piston. Under heavy engine load, the manifold vacuum drops, thereby, decreasing the vacuum pull on the power piston and the piston is forced downward by a spring above the power piston. The power piston spring is specifically calibrated to force the power piston downward at a given manifold vacuum.

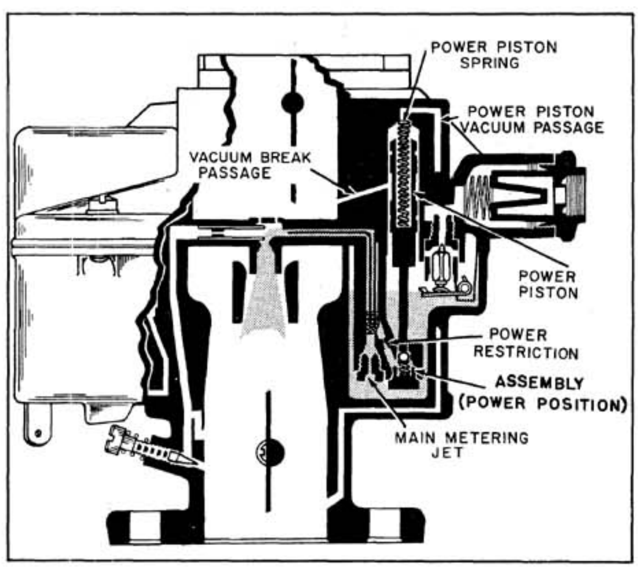

Fig. 4-5 Power System

The downward motion of the power piston unseats the spring loaded ball in the power valve assembly. Fuel passes around the ball in the base of the main well support. The calibrated power restriction meters the fuel prior to joining the fuel from the main metering jet. There is no adjustment required for the power system.

The vacuum break passage which is drilled from the bore of the air horn to the power piston chamber serves to relieve any vacuum build-up around the piston diameter. This vacuum, if unrelieved, will draw fuel vapors from the float bowl past the piston and down the vacuum passage into the manifold, resulting in an overly rich mixture.

PUMP SYSTEM (Fig. 4-6)

Extra fuel for smooth, quick acceleration is supplied by a double spring pump plunger. Rapid opening of the throttle valve, as in the case where accelerating from low speed, causes an immediate increase in air velocity in the carburetor venturi and bore area. Since fuel is heavier than air, it requires a short period of time to "catch up" with the air flow. To avoid a leanness during this momentary lag, the accelerator pump furnishes a quantity of liquid fuel sprayed into the air stream to mix with the incoming air and maintain the proper air-fuel mixture.

The pump is attached by linkage to the throttle lever. When the throttle valve is closed, the pump plunger moves upward in its cylinder allowing fuel to flow from the float bowl through a slot in the side of the pump well, into the pump well, through the vapor check ball passage, bypassing the plunger head, and on into the bottom of the pump well. The pump discharge ball is seated at this time to prevent fuel and air from draining into the pump well from the pump discharge passage.

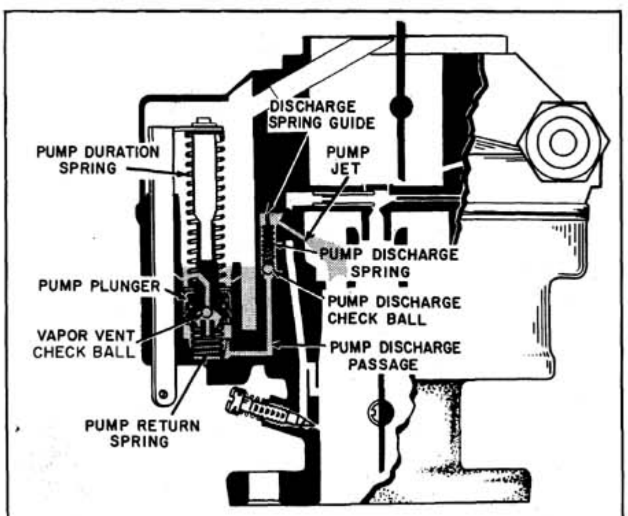

Fig. 4-6 Pump System

When the pump plunger is moved downward for acceleration, the force of the stroke seats the vapor check ball in the pump plunger head to prevent fuel flow back into the float bowl. Downward motion of the pump plunger forces fuel up through the discharge passage and lifts the pump discharge check ball from its seat and then passes on through the pump jets into the venturi area where it strikes the side of the small venturi atomizing the fuel with the air and is delivered to the engine.

The check ball, inside the pump plunger head, provides relief for any vapors which might form in the pump well during "hot idle" or "hot soak". The check ball is designed so that it can move up and down in its passage. Normally, the ball is down or unseated by gravity and fuel vapors forming in the bottom of the pump well are automatically vented into the float bowl area and, consequently, out the air horn vent.

CHOKE SYSTEM (Fig. 4-7)

The purpose of the choke system is to provide a richer mixture for cold engine starting and operation. Mixture enrichment is necessary because fuel vapor has a tendency to condense on cold engine parts, such as the inside area of the intake manifold and cylinder head, thereby, decreasing the amount of combustible mixture available in the engine cylinder.

The choke system includes a thermostatic coil, choke housing, choke piston, choke valve, fast idle cam and linkage. It is controlled by a combination of manifold vacuum, air velocity against the offset choke valve, and tension of the thermostatic coil.

When the engine is cold, tension of the thermostatic coil holds the choke valve closed. Starting the engine causes air velocity to strike the offset

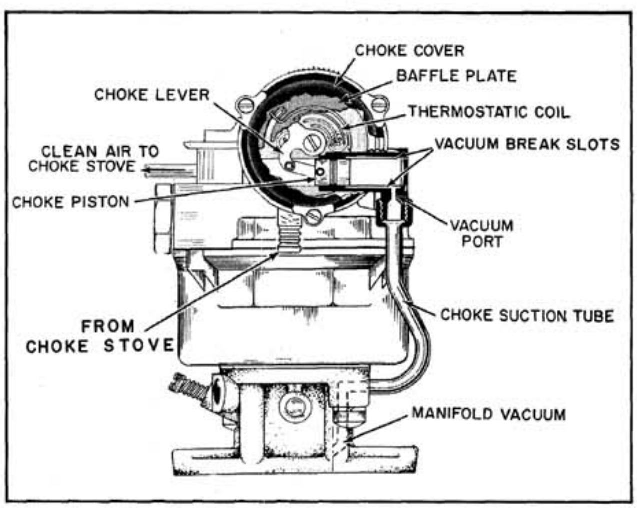

Fig. 4-7 Choke System

choke valve which tends to open it along with the action of intake manifold vacuum connected by a passage directly to the choke piston bore. After a slight opening of the choke valve, the tension of the thermostatic coil balances the force of air on the valve and the pull of vacuum at the choke piston.

As the engine warms up, the manifold vacuum which exists in the choke housing pulls hot air from the choke stove through an air passage in the side of the choke housing to heat the thermostatic coil.

A baffle plate inside the choke housing, next to the thermostatic coil, serves to distribute heat from its entry point at the side of the coil evenly throughout the choke housing, to prevent hot spots which would cause uneven opening of the choke valve. The thermostatic coil relaxes gradually until the choke valve is fully opened.

As the engine is accelerated during warm-up, the corresponding drop in manifold vacuum on the choke piston and reduced air flow against the offset choke valve, allows the thermostatic coil to momentarily close the choke, providing a richer mixture.

During warm-up it is necessary to provide a faster idle to prevent engine stalling. This is accomplished by a fast idle cam which is connected by a link to the upper choke lever on the choke shaft. The idle screw on the throttle lever contacts graduated steps on the fast idle cam to provide a faster idle than normal, to prevent engine stalling during the warm-up period. When the engine is fully warm and the choke valve is wide open, the fast idle cam rotates so the idle screw rests on the low step on the fast idle cam where normal curb idle is obtained.

If the engine becomes flooded during the starting period, the choke valve can be partially opened manually to allow increased air flow to the carburetor. This is accomplished by depressing the accelerator pedal to the floor. The unloader projection on the throttle lever contacts the edge of the fast idle cam and, in turn, partially opens the choke valve.

DISASSEMBLY, CLEANING AND INSPECTION OF MODEL BC CARBURETOR

DISASSEMBLY OF CHOKE

1. Loosen 1/2" fitting on choke suction tube and push fitting and gasket seal downward on the tube. Visibly check location of scribe mark on choke cover in relation to index point on choke housing.

2. Remove three choke cover attaching screws and retainers, remove choke cover, cover gasket, and thermostatic coil assembly from carburetor.

3. Remove baffle plate inside choke housing.

4. Remove choke piston and lever assembly from inside choke housing by removing lever attaching screw from center of choke shaft. (Fig. 4-9)

5. The choke piston may be removed from the choke piston lever by shaking out the choke piston pin.

6. Remove two choke housing attaching screws inside choke housing, then remove choke housing from air horn. (Fig. 4-9)

7. Remove fast idle cam attaching screw. Then the fast idle cam and choke rod can be removed from upper choke lever by carefully rotating assembly upward and sliding end of rod out of upper choke lever. The choke rod can now be removed from the fast idle cam

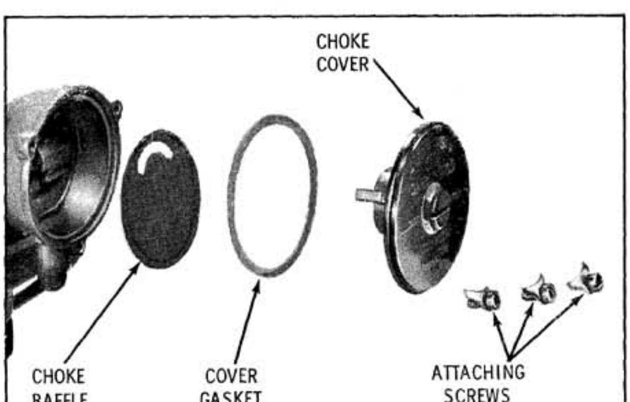

Fig. 4-8 Choke Baffle and Cover

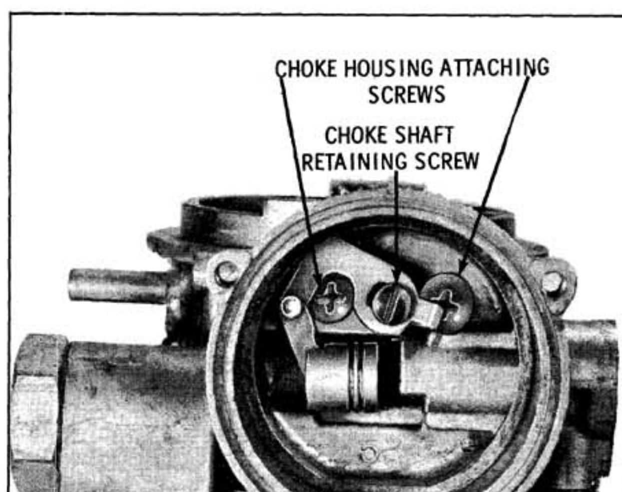

Fig. 4-9 Choke Housing Attachment

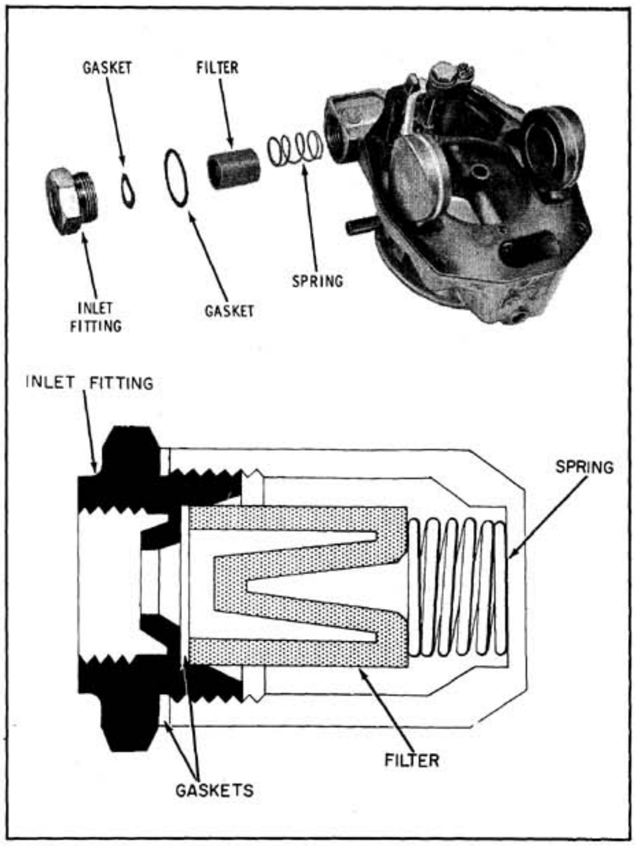

Fig. 4-10 Fuel Inlet Filter

by rotating cam over the end of the choke rod.

8. To remove choke valve, remove stake on the end of choke valve screws. Remove the two

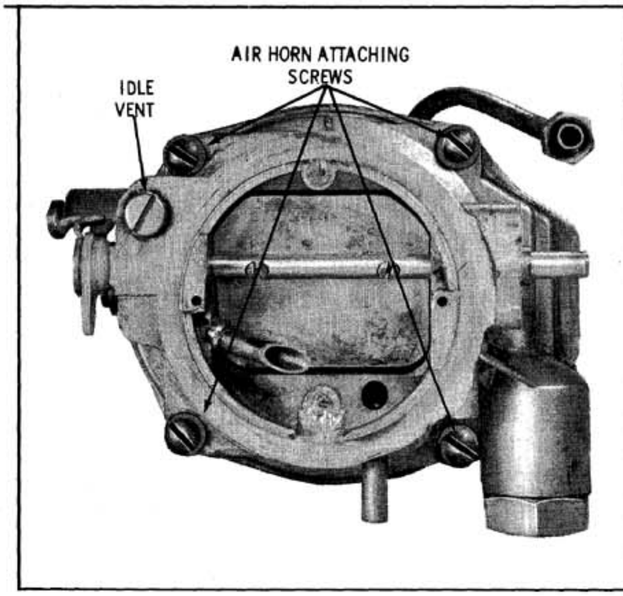

Fig. 4-11 Air Horn Attachment

choke valve attaching screws from the choke shaft and pull upward on choke valve to remove from shaft. Choke shaft and lever assembly can now be removed from air horn. Note position of choke trip lever in relation to upper choke lever tang for ease in reassembly.

AIR HORN DISASSEMBLY

1. Remove fuel filter inlet nut and gasket. Then remove filter, filter spring and gasket be-

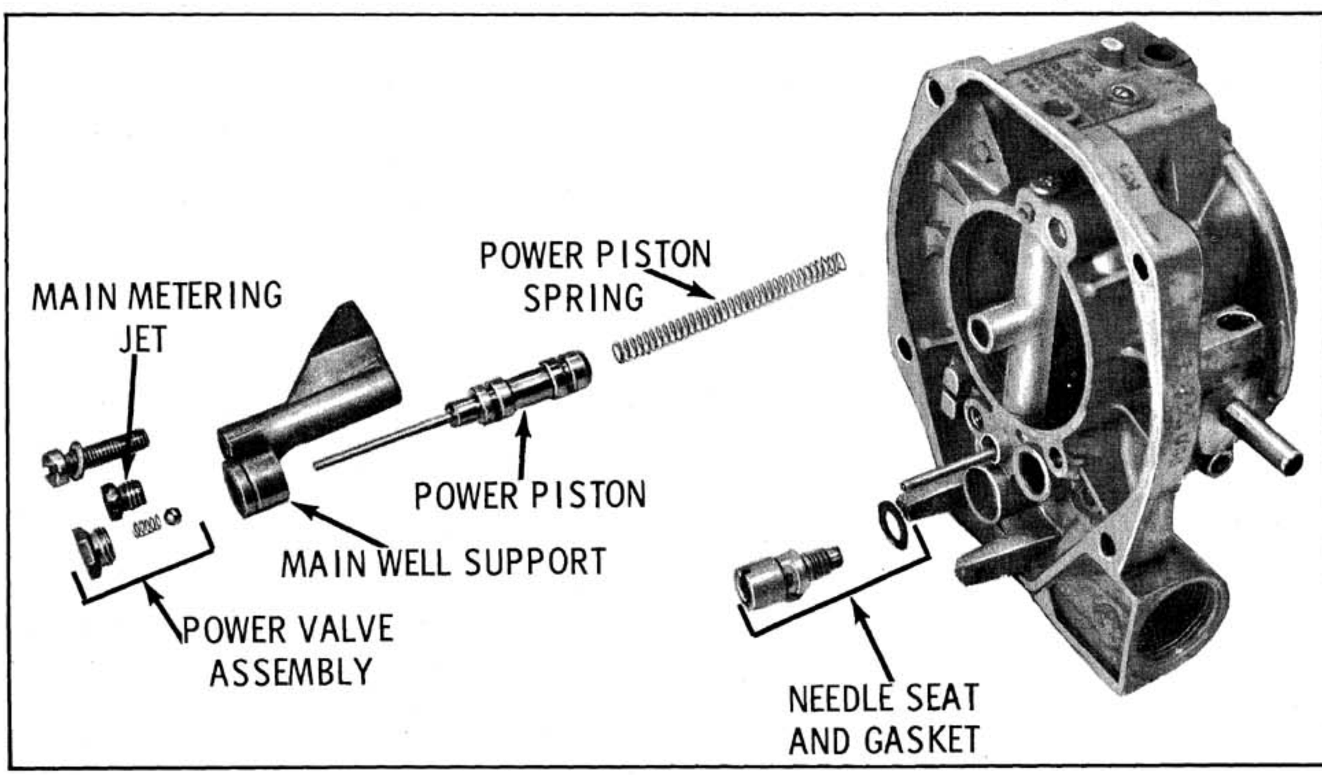

Fig. 4-12 Air Horn

tween filter element and back side of inlet nut. (Fig. 4-10)

NOTE: Large open end of filter element always faces the fuel inlet nut. (Fig. 4-10)

2. Remove four air horn attaching screws. Lift air horn straight up from bowl so as not to damage float. Place air horn, float side up, on a flat surface. (Fig. 4-11)

3. Remove float hinge pin and lift float assembly from air horn. Float needle may now be removed.

4. Remove float needle seat and gasket.

5. Remove main metering jet from bottom of main well support. (Fig. 4-12)

6. Remove hex head power valve check ball retainer from bottom of support, then remove power valve spring and ball. (Fig. 4-12)

7. Remove screw at base of main well support, then remove the main well support from air horn. (Fig. 4-12)

NOTE: Screen in the main well is not removable. If necessary to replace the screen, it will be necessary to replace the main well support.

8. Remove power piston and power piston spring from air horn.

NOTE: Do not remove idle pickup tube from air horn as it is pressed in place.

9. Remove air horn gasket.

FLOAT BOWL DISASSEMBLY (Fig. 4-13)

1. Remove small "O" ring seal around power piston vacuum tube on top of inner bowl parting surface.

2. Using a pair of long nose pliers, remove pump discharge guide. Pump discharge spring and ball may now be removed by inverting bowl and shaking into palm of hand.

3. Remove two hairpin clips from pump link and then remove pump link from throttle lever and pump plunger rod.

4. Remove the pump plunger from the float bowl by pulling straight upward.

5. Remove pump return spring from bottom of pump well.

NOTE: Do not remove choke suction tube from throttle body.

6. Place carburetor bowl with suction tube projected over edge of flat surface and remove two throttle body attaching screws. Throttle body and gasket may now be removed.

THROTTLE BODY DISASSEMBLY (Fig. 4-14)

1. Remove idle mixture adjusting needle and spring.

2. Remove idle stop screw from throttle lever if necessary to replace.

NOTE: Due to close tolerance fit of the throttle valve in the bore of the throttle body, do not remove the throttle valve or shaft from the throttle body.

CLEANING AND INSPECTION

The carburetor should not be cleaned in any solution other than a cold immersion type cleaner.

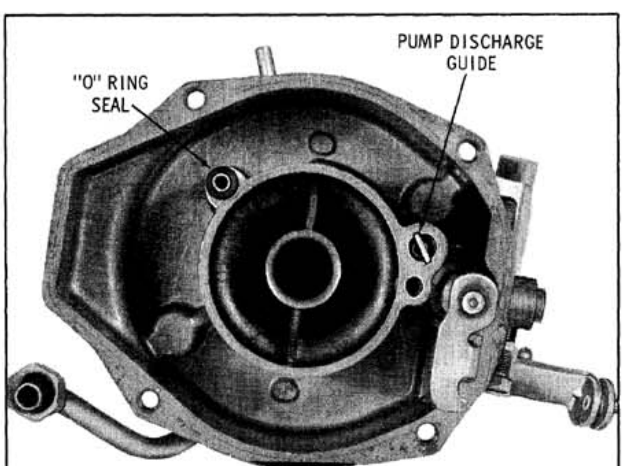

Fig. 4-13 Float Bowl Disassembly

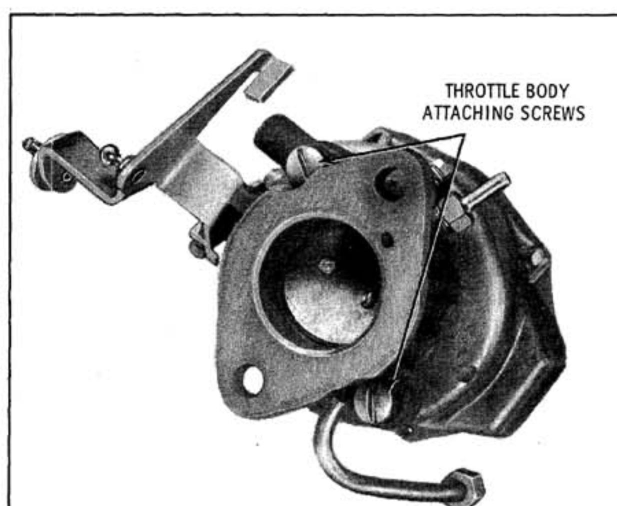

Fig. 4-14 Throttle Body

1. Thoroughly clean carburetor castings and metal parts in carburetor solvent.

   CAUTION: The pump plunger, gaskets and any fiber or rubber parts should not be immersed in the carburetor cleaner. Clean the pump assembly in clean gasoline only.

2. Clean and dry all passages in castings with compressed air. Do not pass drills or wires through jets or passages, as this may score the passage and upset metering.

3. Clean filter and screen of dirt or lint. If filter is plugged or screen is distorted or plugged, they should be replaced.

ASSEMBLY

THROTTLE BODY ASSEMBLY (Fig. 4-14)

1. Install idle stop screw in throttle lever, if removed.

2. Screw idle mixture adjusting needle and spring into throttle body until it is finger tight. Back needle out 1-1/2 turns as a temporary idle mixture adjustment.

3. Using a new gasket, attach throttle body to bowl using two screws and lockwashers. Tighten screws evenly and securely.

FLOAT BOWL ASSEMBLY (Fig. 4-15)

1. Install 3/16" steel ball into pump discharge cavity. Carefully insert pump discharge spring and guide on top of ball. Tap the discharge guide lightly to seat flush with the float bowl casting.

   NOTE: The pump discharge guide is installed correctly when it is at right angles with the pump discharge jet.

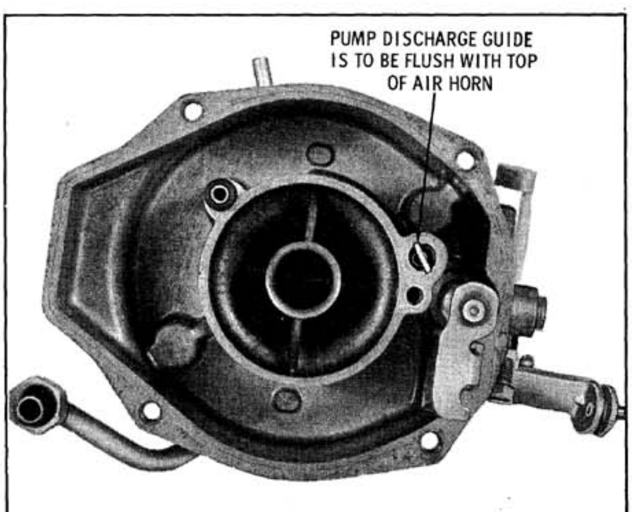

Fig. 4-15 Float Bowl Assembly

2. Place pump return spring in pump well and bottom spring in well by forcing downward with index finger.

3. Install pump plunger assembly in bowl, making sure not to curl cup during installation.

4. Install small "O" ring seal around power piston vacuum tube on top of inner bowl parting surface.

5. Attach pump link to pump plunger rod and throttle lever using two hairpin clips.

   NOTE: Bend in pump link will face away from throttle shaft when installed correctly.

AIR HORN ASSEMBLY (Fig. 4-16)

1. Install float needle seat and gasket.

2. Place new air horn gasket on top of air horn. Check to be sure that all air horn and gasket holes are in line.

3. Install power piston spring and power piston in vacuum cavity.

   NOTE: Piston should ride free in cavity.

4. Install power valve ball (small steel ball), power valve spring, and retainer in main well support.

5. Attach main well support to air horn assembly and tighten attaching screw securely. Tighten power valve retainer.

   NOTE: Check for free motion of power piston.

6. Install main metering jet in main well support.

7. Place float needle in float needle seat.

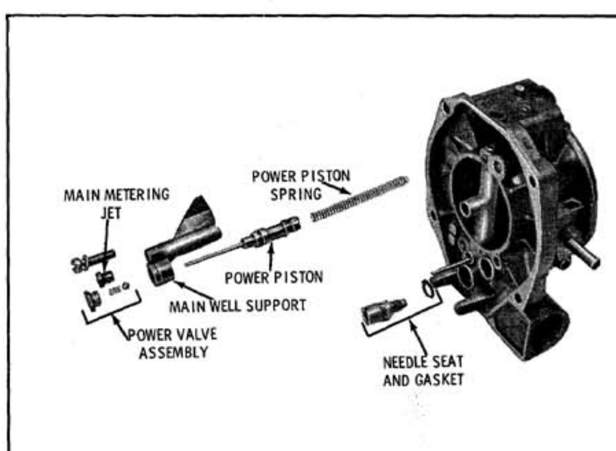

Fig. 4-16 Air Horn

8. Place float carefully in position with drop tang pointing downward towards air horn and install float hinge pin.

FLOAT LEVEL ADJUSTMENT (Fig. 4-101)

FLOAT DROP ADJUSTMENT (Fig. 4-101)

9. Install air horn to bowl assembly being careful to lower the air horn straight down so that the floats will not be bent during installation.

10. Install four air horn to float bowl attaching screws and tighten evenly and securely.

11. Install filter gasket inside fuel inlet nut, filter relief spring, and filter element, retaining in place with the fuel inlet nut and gasket.

CHOKE ASSEMBLY

1. Install hex choke suction tube fitting and new packing over choke suction tube before assembling choke housing to the air horn. Install choke housing to air horn. Tighten screws evenly and securely.

2. Tighten choke housing suction tube fitting sufficiently to prevent loss of vacuum.

3. Install upper choke lever on choke shaft so that the tang points toward the air horn casting.

4. Assemble choke shaft into air horn from the throttle lever side. Tang on the trip lever should be above the tang on the upper choke lever.

5. Install choke valve into the slot in the choke shaft. RP trade mark should face upward. Install two choke valve attaching screws.

6. To insure proper end clearance between the choke trip lever and choke rod lever, move the choke shaft horizontally to obtain .020" clearance between the two levers. Then tighten the two choke valve attaching screws securely and stake in place.

7. Assemble choke piston to the choke piston lever using small piston pin. Install choke piston and lever assembly into choke housing by placing choke piston into the choke piston bore.

8. Align flats on the choke shaft with the flats in the choke piston lever. Install attaching screw into the end of the choke shaft and tighten securely to retain choke piston lever to the choke shaft. Make sure choke piston lever is seated on the flats of the choke shaft.

9. Install baffle plate into the choke housing. Place new choke cover gasket onto the thermostatic coil and cover assembly and then install the thermostatic coil to the choke housing.

10. Rotate the thermostatic cover and coil assembly clockwise until the tang on the thermostatic coil picks up the tang on the choke piston lever and begins to close the choke valve. Keep rotating in a clockwise direction until the index mark on the choke cover is in the proper position, as specified, with the center mark on the choke housing. See Fig. 4-101.

11. Install three retainers and attaching screws to the choke cover and housing. Tighten securely. Recheck to see that the adjustment previously made was not moved.

12. Install the choke rod to the fast idle cam as shown, then carefully insert the upper end of the choke rod into the upper choke lever. The bend in rod must face towards the idle mixture adjusting needle.

13. Attach the fast idle cam to the throttle body assembly with the fast idle cam screw and tighten securely. The steps on the fast idle cam should face towards the idle speed screw.

CHOKE ROD ADJUSTMENT (Fig. 4-101)

UNLOADER ADJUSTMENT (Fig. 4-101)

14. If the choke suction tube and seal assembly in the throttle body requires replacement, proceed as follows. This operation must be performed after the carburetor is completely assembled.

    a. Loosen throttle body to bowl attaching screws.

    b. Place the flared end of the choke suction tube with the seal, into throttle body. Using Tool BT-45, tap lightly to hold seal into the throttle body. Rotate tube while tapping seal so that it is started uniformly and evenly into the throttle body assembly.

    c. Install hex fitting and new packing under upper end of tube and fasten the tube to the choke housing by turning hex nut finger tight.

    d. Using Tool BT-45 and hammer, spread the seal into throttle body securely.

    e. Completely loosen hex nut and check that tube is tight in throttle body (will not turn).

    f. Tighten throttle body to bowl attaching screws evenly and securely, then tighten hex nut to choke housing securely.

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MODEL 2GC CARBURETOR

THEORY OF OPERATION

There are six basic systems used in the Model 2GC; float, idle, part throttle, power, pump and choke.

FLOAT SYSTEM (Fig. 4-21)

The 2GC carburetor employs a single float. As fuel is consumed, the float drops and opens the needle seat. Fuel then enters the float bowl, raises the float and closes the needle seat, maintaining correct fuel level in the float bowl under all operating conditions.

IDLE SYSTEM (Fig. 4-22)

The idle system supplies the fuel required for normal curb idle, off idle and low speed operation.

To minimize fuel vapor formation in the carburetor bowl, an external vent opens when the throttle valves are in the idle position.

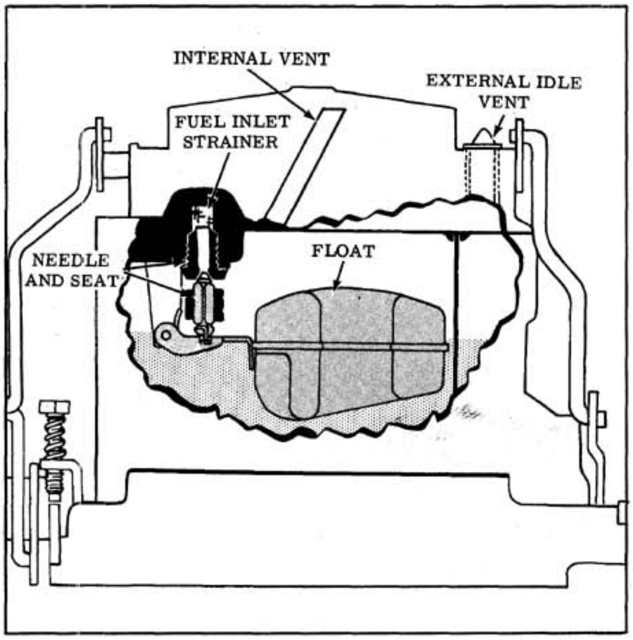


Fig. 4-21 Float System

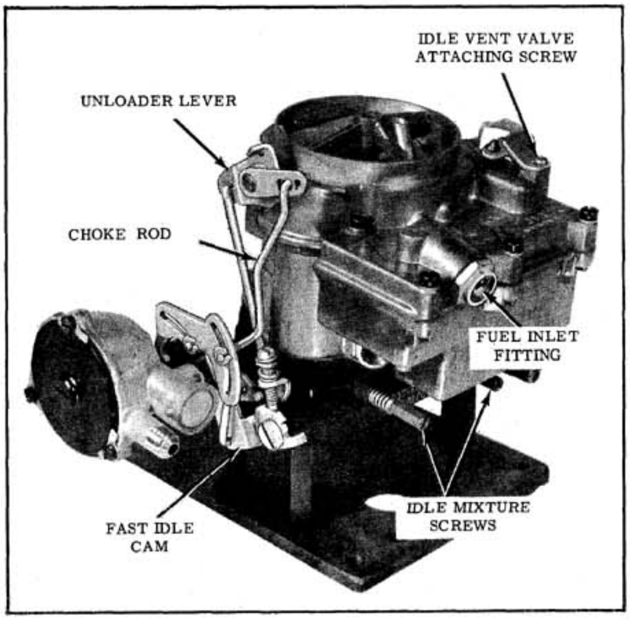


Fig. 4-20 Carburetor Assembly

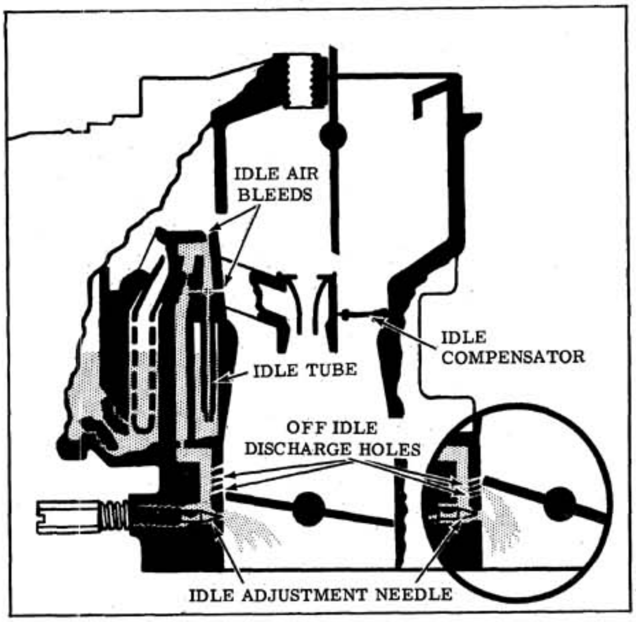


Fig. 4-22 Idle System

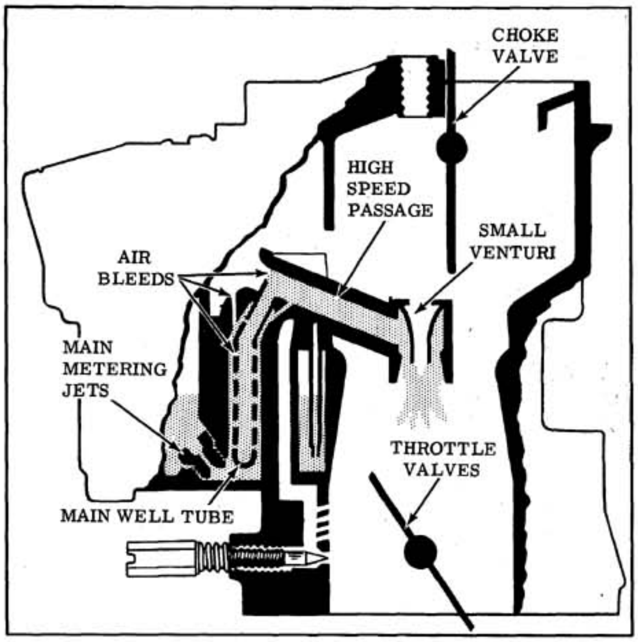


Fig. 4-23 Part Throttle System

Cars equipped with factory installed A/C are equipped with an idle compensator to prevent stalling under prolonged "hot idle" conditions. When underhood temperatures rise, a bi-metal strip lifts the valve off its seat allowing additional air to enter below the throttle valves, offsetting the enrichening effects of the higher temperatures.

PART THROTTLE (Fig. 4-23)

As the throttle valves open, the speed of air entering the carburetor bore increases and raises the vacuum in the small venturi area. Fuel is then drawn from the float bowl into the main well, where air bleeds are provided, and into the venturi.

POWER SYSTEM (Fig. 4-24)

When more power is needed or high speed driving is maintained, a vacuum operated power piston and power valve provide additional fuel.

When manifold vacuum drops below approximately 9" hg. the power piston spring forces the piston down to unseat the spring loaded power valve, permitting additional fuel to flow through the main well tubes.

PUMP SYSTEM (Fig. 4-25)

The accelerator pump provides the fuel necessary for smooth operation during acceleration by forcing additional fuel into the air stream.

CHOKE SYSTEM (Fig. 4-26)

The choke system is designed to work independently of the fast idle which provides a relatively short choking period with adequate fast idle for a cold engine. A thermostatic coil closes the choke valve for cold operation and gradually releases the choke during the warm-up period. To maintain a more exacting air-fuel ratio during warm-up, the force of the thermostatic coil is opposed by air velocity against the offset choke valve and a vacuum piston and link assembly. To prevent a closed choke condition with a wide open throttle, a tang on the unloader lever contacts the choke lever and holds the choke valve partially open to prevent a loading condition. This also provides an unloader to open the choke valve when starting a flooded engine.

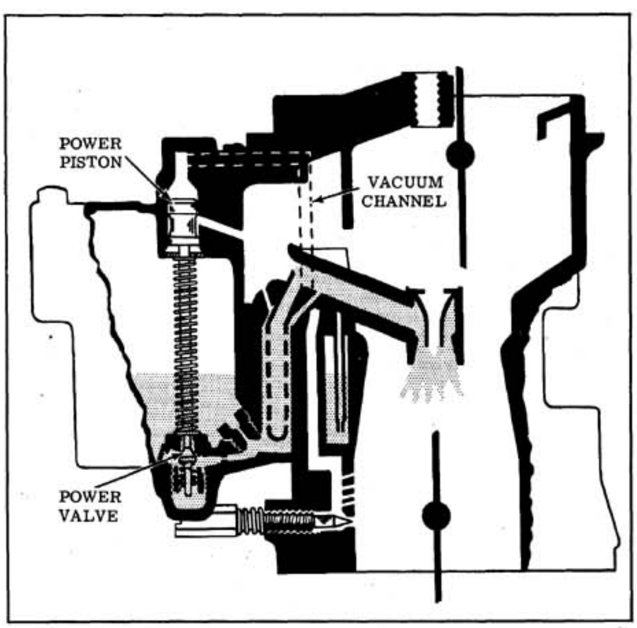


Fig. 4-24 Power System

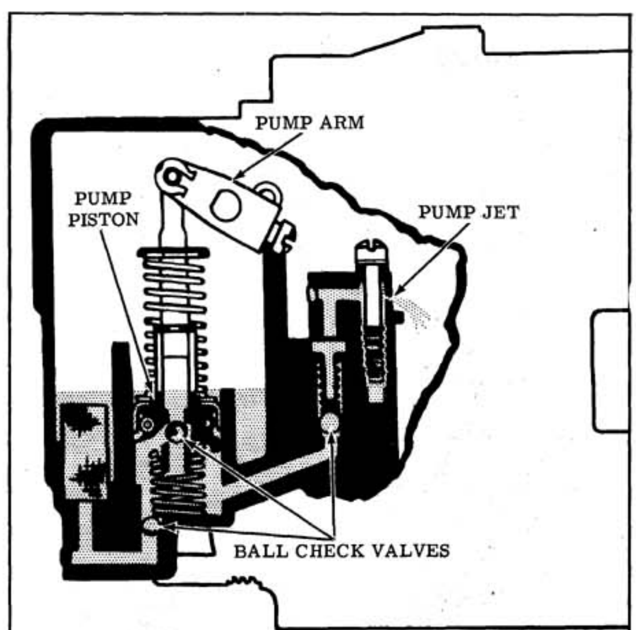


Fig. 4-25 Pump System

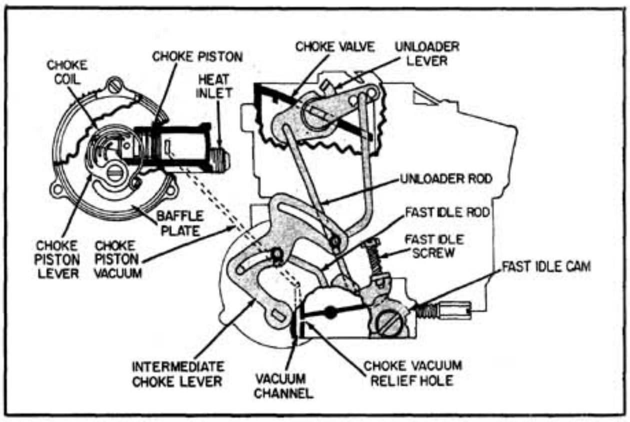


Fig. 4-26 Choke System

CARBURETOR ASSEMBLY

REMOVE AND INSTALL

1. Remove air cleaner.
2. Disconnect linkage.
3. Disconnect fuel line from carburetor.
4. Disconnect choke pipe.
5. Disconnect vacuum lines.
6. Remove throttle body to intake manifold nuts or bolts.
7. Remove carburetor.

To install, reverse removal procedure and make adjustments outlined under ADJUSTMENTS (ON THE CAR).

Torque carburetor to intake manifold nuts or bolts to 14 ft. lbs.

CARBURETOR DISASSEMBLY

AIR HORN

1. Mount carburetor on Holding Fixture BT-30-14 or J-5923-B. (Fig. 4-27)
2. Remove fuel inlet fitting and gasket, then remove the filter.
3. Remove the idle vent valve retaining screw, shield and vent.
4. Remove retainer clip from the intermediate choke rod and unloader rod and remove the intermediate choke and unloader rods.
5. Remove retainer spring clip from the upper end of the pump rod at the pump lever and disconnect the upper end of the pump rod.
6. Remove the eight air horn attaching screws, then lift the air horn straight up to remove.

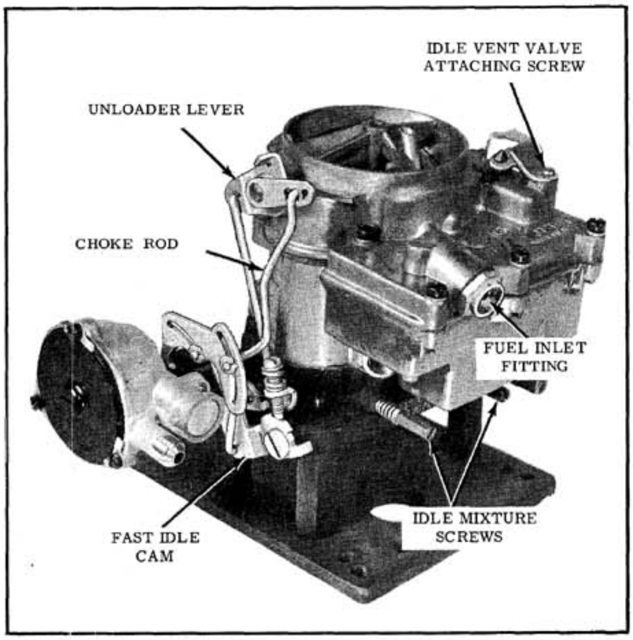


Fig. 4-27 2GC Carburetor

7. Invert the air horn and place on a flat surface; then remove the float hinge pin, float and needle assembly. (Fig. 4-28)
8. Remove the float needle and seat and gasket using Tool BT-52.
9. Remove the power piston by depressing piston stem and allowing it to snap free.
10. Remove the retainer from the pump plunger shaft and remove pump plunger.
11. If the pump lever and shaft or inner arm is to be replaced, loosen the set screw on the inner arm.
12. Remove the air horn gasket.

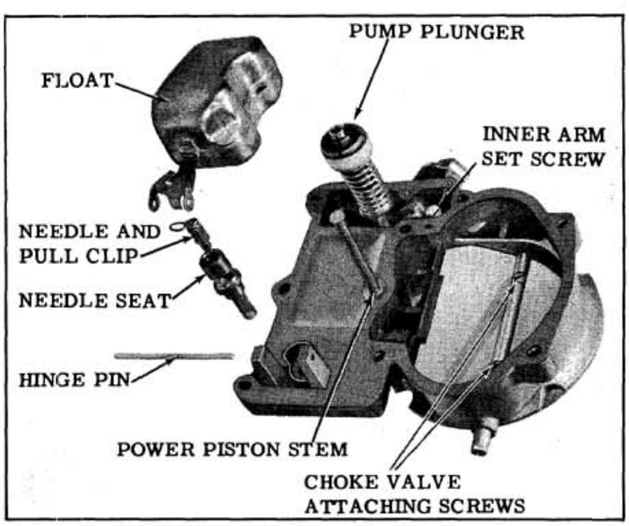


Fig. 4-28 Air Horn

13. If the choke valve or shaft is to be replaced, remove the two choke valve attaching screws; then remove the choke valve, choke valve shaft and unloader from the air horn.

FLOAT BOWL (Fig. 4-29)

1. Remove baffle, pump inlet filter screen and pump plunger return spring; then remove aluminum ball check from bottom of pump well.

2. Remove main metering jets and power valve.

3. If equipped with an idle compensator (factory installed air conditioned cars only) remove attaching screws and remove idle compensator and gasket.

4. Remove venturi cluster attaching screws and remove cluster and gasket.

   NOTE: The cluster center screw is larger and has a gasket since it is located in the pump discharge passage.

5. Using a pair of needle-nosed pliers, remove the pump discharge spring guide, then remove the spring and steel ball. (Fig. 4-30)

6. Invert float bowl and remove the three throttle body attaching screws, then remove the throttle body and gasket.

THROTTLE BODY AND CHOKE LINKAGE (Fig. 4-31)

1. Remove the fast idle cam attaching screw.

2. Remove the three choke cover attaching screws and retainers, then remove the cover and gasket.

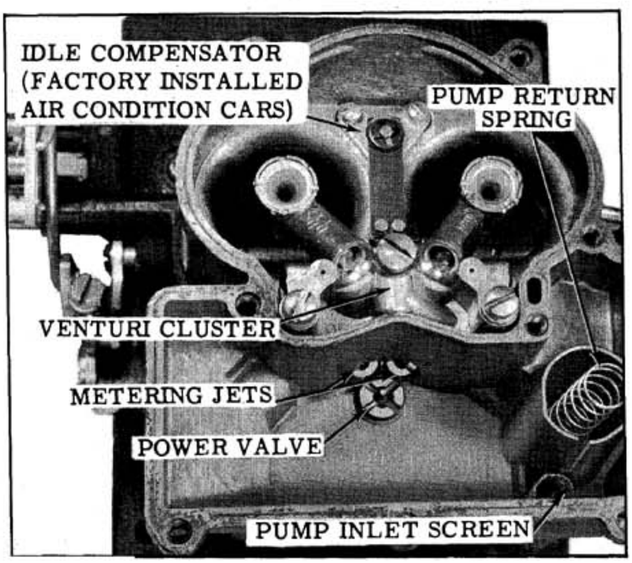


Fig. 4-29 Float Bowl Assembly

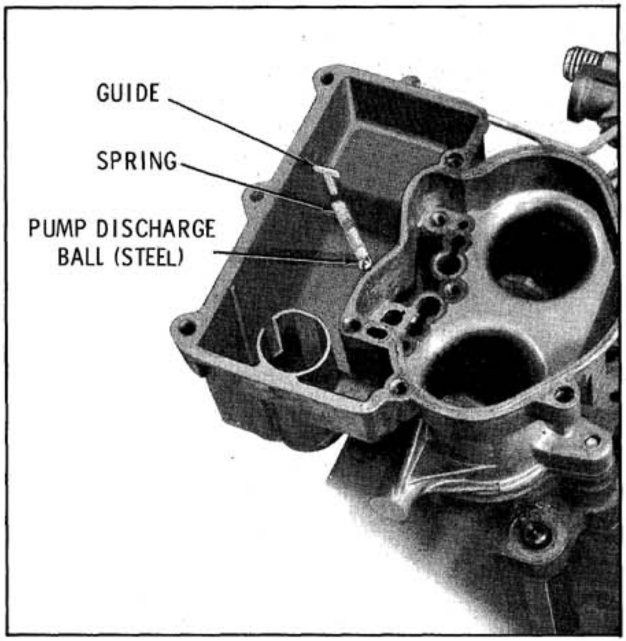


Fig. 4-30 Pump Discharge Guide

3. Remove baffle plate from choke housing.

4. Remove the choke piston attaching screw, then remove piston link and lever assembly. The piston can be removed from the link by removing the piston pin.

5. Remove the two choke housing attaching screws, then remove the choke housing with linkage.

6. Remove the choke housing gasket, then remove the choke lever and shaft with linkage from the choke housing.

7. The idle mixture needle screws may be removed for cleaning or replacement.

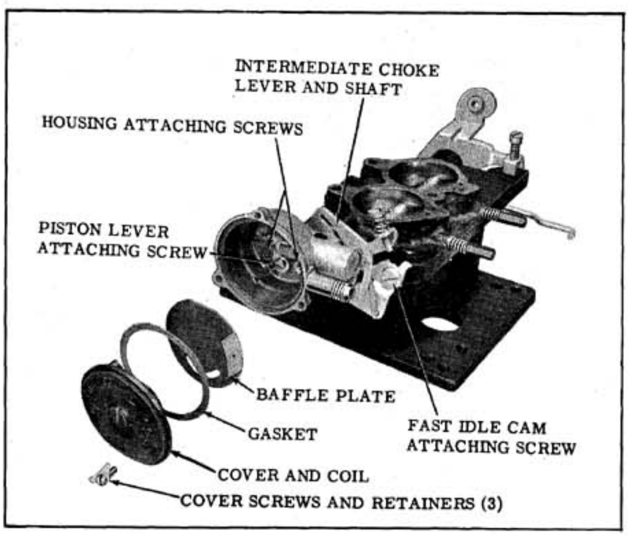


Fig. 4-31 Throttle Body and Choke

NOTE: No attempt should be made to remove the throttle valves or shaft as it may be impossible to reassemble the throttle valve correctly in relation to the idle discharge orifices.

CLEANING OF PARTS

The carburetor should not be cleaned in any solution other than a cold immersion type cleaner.

1. Thoroughly clean carburetor castings and metal parts in carburetor solvent.

   CAUTION: The choke coil, housing and pump plunger should not be immersed in solvent. Clean pump in clean gasoline only.

2. Clean and dry all passages in casting with compressed air. Do not pass drills through jets or passages.
3. Clean filter of dirt or lint. If filter is plugged, it should be replaced.

INSPECTION OF PARTS

1. Check float for dents or excessive wear at hinge pin holes.
2. Shake float to check for leaks.
3. Examine float needle and seat. If grooved, replace with a new matched float needle, seat and gasket assembly.
4. Inspect the idle mixture adjusting needles for burrs or ridges. Replace if necessary.
5. Inspect the upper and lower surfaces of the float bowl to see that the small sealing beads are not damaged. Damaged beading may result in air or fuel leaks at that point.
6. Inspect holes in pump rocker arm, fast idle cam and throttle shaft lever. If holes are worn excessively or out-of-round to the extent of improper operation of the carburetor, the worn parts should be replaced.
7. Inspect the steps on the fast idle cam for excessive wear. If worn, replace cam to assure proper engine operation during the warm-up and choking periods.
8. Inspect the pump plunger for cracks or creases. If damaged, replace the pump plunger as an assembly.
9. Inspect the throttle body to make sure idle passages and vacuum channels are open.

CARBURETOR ASSEMBLY

THROTTLE BODY (Fig. 4-31)

1. If removed, install the slow idle speed screw.
2. If removed, install the fast idle lever on the end of the throttle shaft with attaching screw. Install the fast idle speed screw and spring in the lever.
3. If removed, install the idle mixture needles and springs in the throttle body. Tighten finger tight, then back out 1-1/2 turns as a preliminary idle adjustment.
4. Install the intermediate choke lever and shaft, with linkage attached, in the choke housing. The lever should extend upward between the attaching screw bosses.
5. Install the choke housing gasket, then position the choke housing on the throttle body and install the two attaching screws.
6. If removed, install the choke piston on the link so that the piston hole is facing outward.
7. Install the choke piston lever and link assembly in the choke housing, then install the attaching screw.
8. Position the fast idle cam on the throttle body and install attaching screw.
9. Place a new gasket on the bottom of the float bowl with holes aligned, then position the throttle body on the gasket and install the three attaching screws. Tighten screws evenly and securely.

FLOAT BOWL

1. Install the pump discharge (steel) ball, spring and guide in the passage in the venturi cluster mounting surface. (Fig. 4-30)
2. Install the venturi cluster, gasket, and attaching screws. Screw with gasket must be inserted in center hole.
3. If equipped with idle compensator, install compensator and gasket between the two large venturi, using two self-tapping screws. Do not overtighten.
4. Install the main metering jets and power valve.
5. Install the pump inlet (aluminum) ball and the pump return spring in the pump well. Install the pump inlet screen and the baffle in the float bowl.

AIR HORN

1. If removed, install choke unloader lever on choke shaft. Tang on unloader lever faces outward. Install the choke shaft in air horn by inserting it from the choke side, then install choke valve in the choke shaft with the letters RP facing upward.

    a. Install the choke valve screws. Center the choke valve before tightening choke valve screws. .020" clearance should be maintained between choke unloader lever and the air horn casting. Tighten choke valve screws and stake lightly in place.

2. If removed, position the pump inner lever in the air horn, install the pump lever and shaft and tighten retaining screw.

    NOTE: Lubricate shaft with light grease.

3. Install the pump plunger shaft in the pump lever so that the end is pointing inward, then install the retainer.

4. Position the float needle seat gasket and small filter screen on the seat. Install seat in air horn with BT-52.

5. Install the power piston and lightly stake the casting. Make sure piston travels freely.

6. Install the air horn gasket, float and needle assembly and float hinge pin.

FLOAT LEVEL ADJUSTMENT (Fig. 4-102)

Make sure the float is properly aligned on the air horn. If it is necessary to bend the float arm for alignment purposes, recheck the float level setting.

FLOAT DROP ADJUSTMENT (Fig. 4-102)

If necessary to adjust, bend the float tang which contacts the needle seat. Bend the tang toward the seat to decrease the float drop and away from the seat to increase the drop.

COMPLETION OF CARBURETOR ASSEMBLY (Fig. 4-32)

1. Install the air horn on the float bowl while guiding accelerator pump in place. Install and tighten the eight air horn screws evenly and securely.

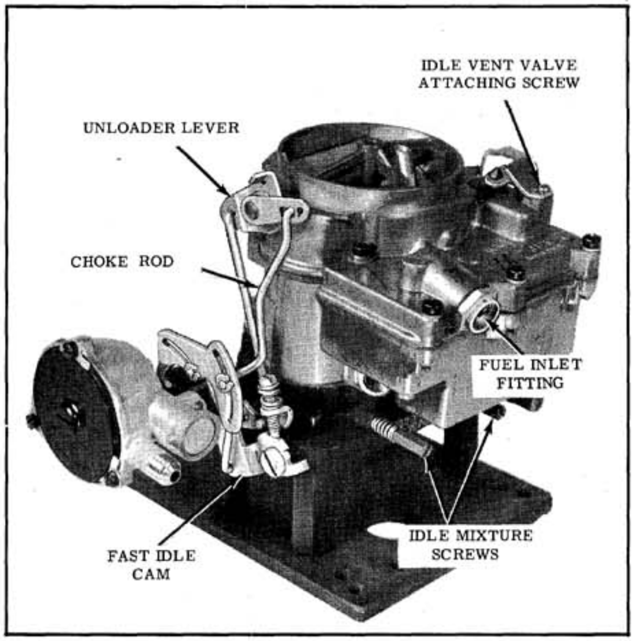


Fig. 4-32 Carburetor Assembly

2. Position the upper end of the pump rod on the pump lever and retain with spring clip.

3. Position idle vent valve and shield on air horn and retain with attaching screw.

4. Install the fuel inlet filter screen with the closed end inward, then install the inlet fitting and gasket.

5. Install choke unloader rod into unloader lever (end of rod facing inward). Then connect lower end of rod to fast idle lever, retaining with clip.

6. Install intermediate choke rod into upper choke lever (end of rod facing inward). Then connect lower end of rod to intermediate lever retaining with horseshoe clip.

7. Make adjustment as outlined in Figs. 4-102 and 4-105.

MODEL 4GC CARBURETOR

THEORY OF OPERATION

FLOAT SYSTEM (Fig. 4-40)

The Model 4GC carburetor uses two sets of twin floats to maintain correct fuel level in both primary and secondary sides of the float bowl under all conditions of operation.

Fuel enters the carburetor through the inlet fitting on the primary side of the air horn. It first passes through a sintered bronze fuel filter located just behind the fuel inlet nut. It should be noted that the fuel filter is spring-loaded. This provides a pressure relief feature so that in the event the filter should plug, the restriction will cause fuel pump pressure to overcome the spring and allow fuel to bypass the filter. After the fuel passes through the inlet filter, it goes to the primary needle seat, and to the secondary needle seat through a channel, across the top of the air horn. As the fuel level on the primary side of the carburetor drops, the twin floats drop, moving the float needle off its seat.

The primary and secondary float assemblies on 34, 36, 38 and 52 series (Fig. 4-40A) are new in that the pontoons are made of a closed cell plastic compound. The new material has less weight and is consequently more buoyant than the conventional brass pontoon and are, therefore, smaller. The smaller pontoons allow a greater fuel reserve in the float bowl. The floats are spring-loaded by a torsion spring located on the hinge pin between the float hanger posts. The purpose of the torsion spring is to supply additional pressure on the float arm to assist the float in closing the float needle valve.

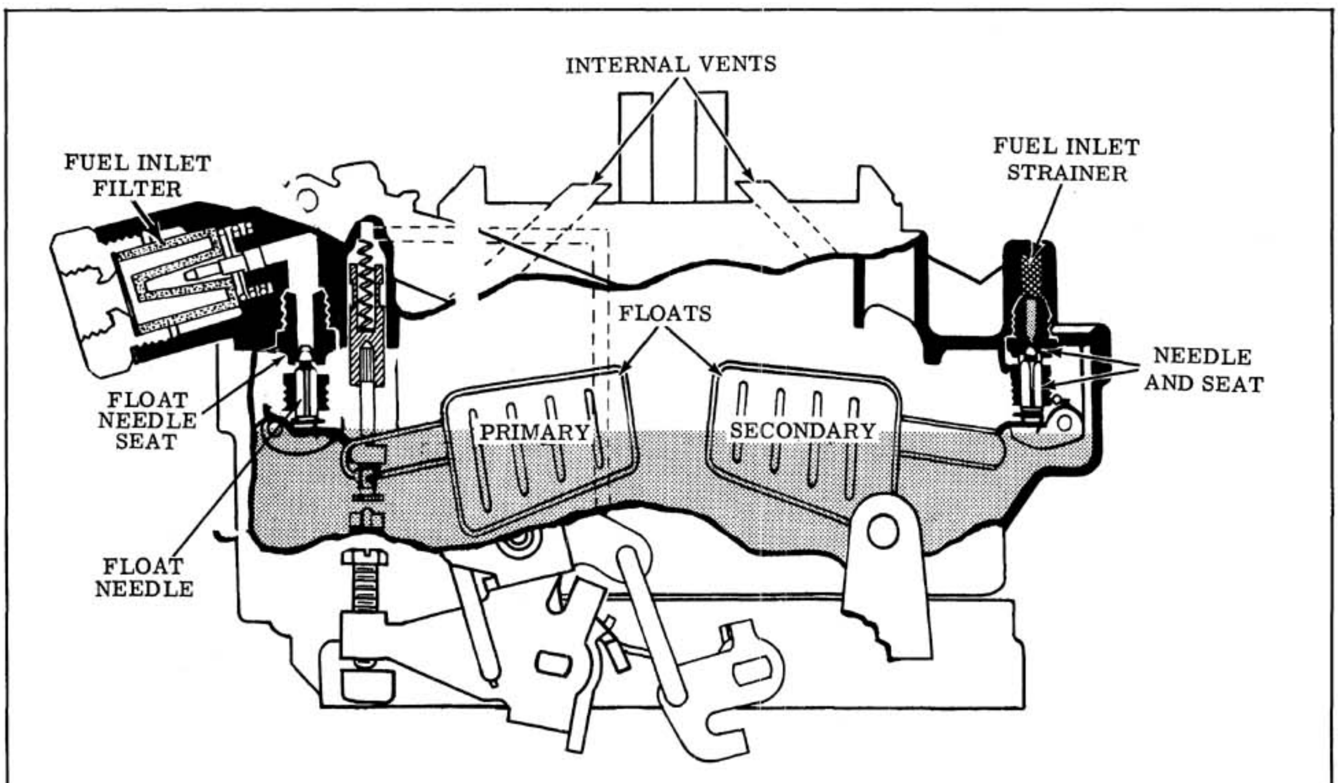


Fig. 4-40 Float System (54 through 86 Series)

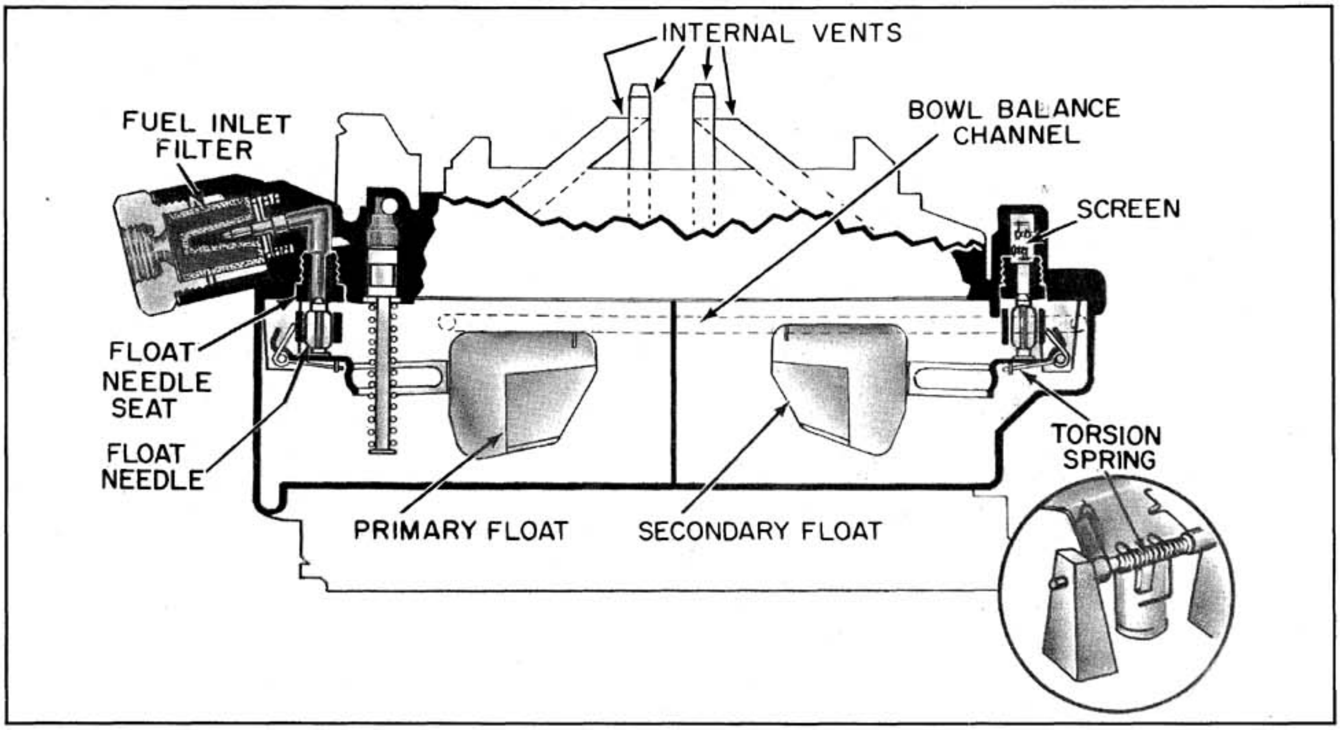


Fig. 4-40A Float System (34-36-38 and 52 Series)

IDLE SYSTEM (Fig. 4-41)

An adjustable idle system in the primary side and a fixed idle system in the secondary side of the carburetor supplies the fuel required for normal curb idle, off-idle and low speed range.

In the primary bores, the quantity of air-fuel mixture supplied for curb idle is controlled by the idle mixture needles which may be adjusted to provide smooth idle operation. In the secondary bores, the quantity of idle air-fuel mixture is controlled by the fixed size of the discharge holes located in the rear of the secondary throttle bores. The secondary fixed idle mixture supplements the primary adjustable idle mixture to provide a stable air-fuel mixture for the engine cylinders.

Operation of the primary and secondary idle system is similar. The idle fuel is drawn from the float bowl through the main metering jets into the main well, passing through the calibrated idle tube restriction and idle tubes. Air joins this fuel at the calibrated air bleed. The air-fuel mixture then passes through a calibrated restriction. More air is added at the second idle air bleeds and pāsses down through the lower idle air bleeds and idle discharge holes. The resultant mixture is then discharged into the throttle bore from the idle needle holes.

As the throttle valves are opened from the curb idle position, air entering the idle discharge holes gradually diminishes. When these holes become exposed to manifold vacuum, they then become fuel discharge holes to meet the increased demand of the engine.

Further opening of the throttle valves increases the air velocity through the carburetor sufficiently to cause the air to strike the end of the extended lower idle air bleed, creating a lower pressure within the bleed tube. As a result, fuel begins to discharge from this bleed tube and continues to do so throughout the part throttle and wide open throttle ranges, supplementing the nozzle delivery.

To adjust the idle mixture, a tapered needle is used to vary the opening of the discharge hole. When the needle is turned in, the area is decreased and the idle mixture becomes leaner.

In order to minimize difficulty in hot weather starting or rough idling due to fuel vapor formation in the carburetor bowl, the external vent opens when the throttle valves are in the idle position. It consists of an actuating tang which

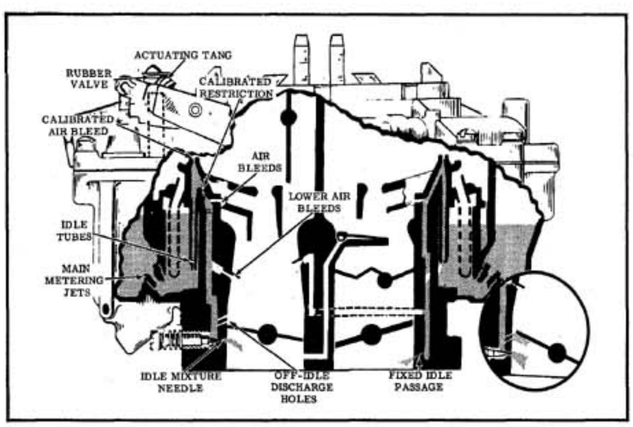


Fig. 4-41 Idle System

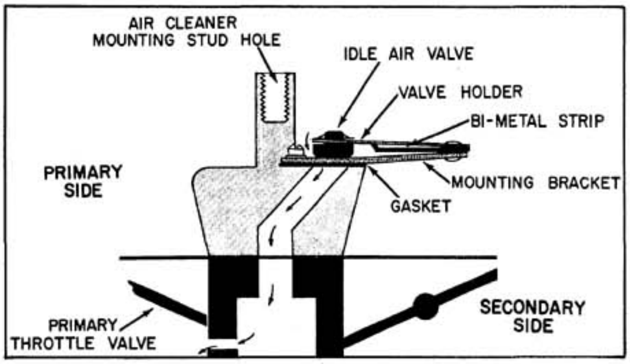


Fig. 4-42 Idle Compensator

operates a rubber valve mounted over the vent hole.

When the throttle valves are closed, the actuating tang contacts the spring arm and holds the vent valve open. This permits vapors from the fuel bowl to be vented to the outside. As the throttle valves are opened, the spring closes the vent valve returning the carburetor to an internal balance.

All carburetors on air conditioning equipped cars incorporate an idle compensator to prevent stalling under prolonged "hot idle" conditions. (Fig. 4-42)

When underhood temperatures rise to a predetermined value, the bi-metal strip lifts the valve off its seat. This allows additional idle air to enter below the throttle valves, offsetting the enrichening effects of the high engine temperatures. When underhood temperatures are lowered, the valve closes and the idle operation returns to normal.

PART THROTTLE SYSTEM (Fig. 4-43)

As the throttle valves are opened to a greater degree and more air is drawn through the carburetor, it is necessary to provide means, other

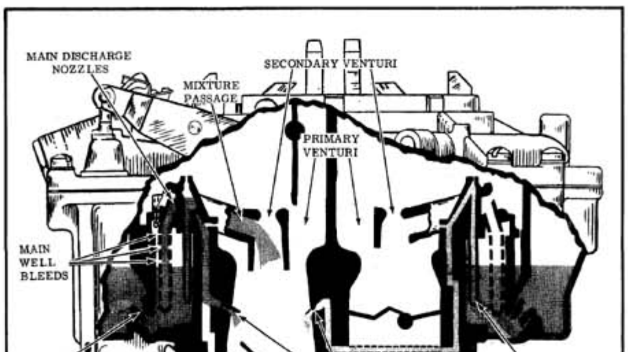


Fig. 4-43 Part Throttle System

than the idle system, for supplying additional fuel to meet the engine requirements. The primary side of the carburetor meets the increased demand for fuel in the following manner.

At a point of sufficient throttle opening, manifold vacuum, multiplied several times in the primary and secondary venturi, is transmitted to the tip of the main well tubes or main discharge nozzles. This vacuum draws fuel from the float bowl through the calibrated main metering jets and into the main well tubes. After passing through the main well tubes, air joins the mixture at the main well bleeds. The mixture then passes from the tip of the nozzle through the mixture passage, to the secondary venturi, and into the intake manifold.

As the throttle opening is progressively increased and more fuel is drawn through the main well tubes, the fuel level in the main well drops. The calibrated holes in the main well tubes are proportionately exposed to the air in the upper well area. When this occurs, they become air bleeds mixing progressively more air with the fuel passing through the main well tubes. Although the nozzle suction is increased by increasing the throttle opening, the fuel mixture to the engine remains constant throughout the part throttle range.

As throttle opening increases, the lower idle air bleeds become part throttle feed nozzles in the main bore below the primary venturi. Discharge nozzles are located in the venturi wall on the primary side and are fed by the idle tubes on the secondary cluster. These nozzles provide an additional source of fuel to maintain a constant mixture ratio at wide primary throttle openings. The tubes act as nozzles and supplement the fuel discharge of the main system to fill the gap between late part throttle and pre-power system operation. Fuel is discharged from these nozzles at throttle openings which correspond to a steady speed of approximately 70 to 90 mph. No fuel is discharged until the primary throttles are opened sufficiently to allow air flow to create a low pressure area at the tube. Fuel then flows throughout the remainder of the part and wide-open throttle range. The secondary throttle valves of the carburetor do not open until the primary linkage engages the secondary throttle shaft. They then open fully during the final few degrees of primary throttle travel. The secondary side, therefore, supplies fuel through a portion of the part throttle range and through the power range.

POWER SYSTEM (Fig. 4-44)

To achieve the proper mixtures required when more power is desirable or sustained high speed driving is to be maintained, the carburetor employs the use of a vacuum-operated power piston in the air horn and a power valve in the float bowl.

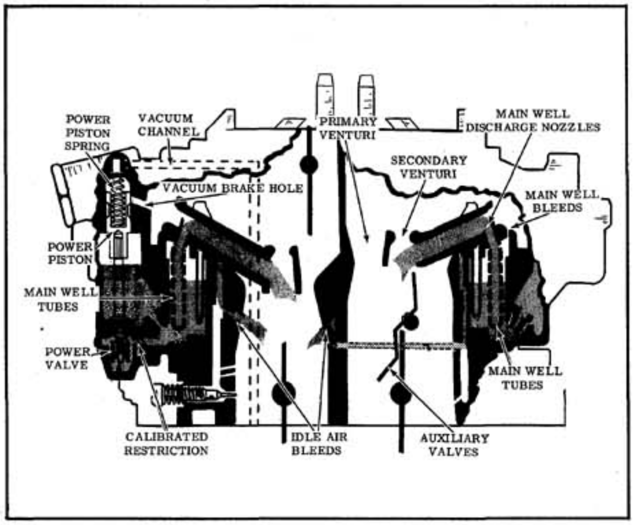


Fig. 4-44 Power System

The power system is located on the primary side of the carburetor. The power piston vacuum channel is exposed to manifold vacuum beneath the throttle valves. The vacuum in this channel varies directly with manifold vacuum. In the idling and part throttle ranges, the manifold vacuum is normally quite high. This vacuum is sufficient to hold the power piston in its extreme up position. However, as the throttle valves are progressively opened, the vacuum drops.

When the vacuum drops below approximately 9" hg., the calibrated spring beneath the power piston forces the piston down. This situation occurs at very high driving speeds or on rapid accelerations. When the piston drops, it unseats the spring-loaded power valve. This permits additional fuel to flow from the float bowl through the calibrated power restriction, and into the main wells. The additional fuel supplements fuel already flowing through the main metering system, making the mixture being delivered to the manifold considerably richer than normal part throttle mixtures.

It will be noted that the power piston cavity in the carburetor air horn is connected to the main air flow passage by a vacuum break hole. This hole prevents the vacuum, acting on the piston, from also acting on the top of the fuel in the float bowl. Any leakage of air past the upper grooves of the piston will be compensated for by this vacuum break hole and will not affect carburetor calibration.

It is also in this range that the secondary side of the carburetor provides additional air and fuel to the engine for increased power. For high speed operation, beyond the part throttle range, the throttle linkage engages the secondary throttle valves and opens them completely in the remaining few degrees of primary throttle travel. Manifold vacuum acting on the secondary side of the carburetor is multiplied at the primary and secondary venturi, drawing fuel from the float bowl through the calibrated main metering jets into the main wells. This fuel then passes through the main well tubes and is bled in a manner similar to that described previously in the operation of the primary main well air bleeds.

This mixture is bled further at the main well bleeds and is then drawn to the tips of the main well tubes. It then passes through the mixture passage to the secondary venturi and is discharged into the intake manifold.

The lower idle air bleeds also supply fuel throughout the power range in a manner similar to that described under the part throttle system operation.

The auxiliary valves provide a means for controlling secondary bore opening according to air velocity at wide-open throttle. High velocity allows good metering and also holds the valves open, so that the secondary metering system can supply the correct air-fuel mixture.

Low air velocity, in turn, reduces metering efficiency. When this condition occurs, the spring tension overcomes the air velocity and closes the valves. Air which was going through four bores, now passes through only two; the velocity is twice as high and good metering control is extended over a wider range of low speed and wide-open throttle operation.

PUMP SYSTEM (Fig. 4-45)

When the throttle is opened rapidly, the air flow and manifold vacuum change almost instantaneously, while the heavier fuel tends to lag behind, causing a momentary leanness. The accelerator pump provides the fuel necessary for smooth operation during rapid acceleration.

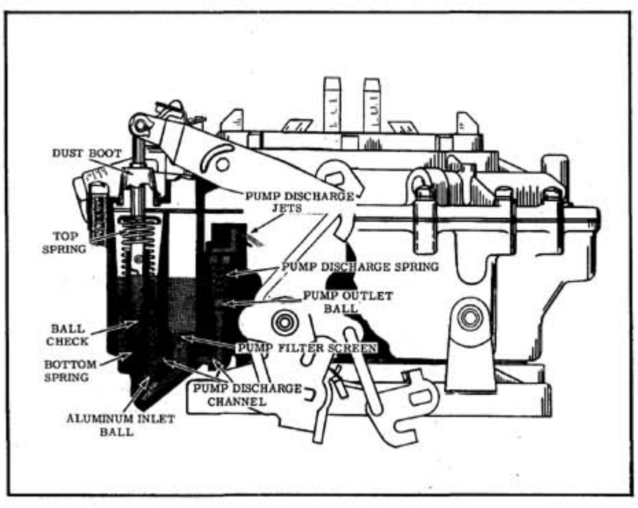


Fig. 4-45 Pump System

A double spring pump plunger is used on the carburetor. The rates of compression of the top spring and the bottom spring are calibrated to insure a smooth sustained charge of fuel for acceleration. On the pump intake, or upstroke of the plunger, fuel from the float bowl passes through the pump filter screen, unseating the aluminum inlet ball, and filling the pump well. The accelerator pump is connected through the pump shaft and lever assembly and pump rod to the throttle lever.

Upon acceleration or downstroke of the pump plunger, the force of fuel in the pump well seats the inlet ball. The fuel is then forced through the discharge channel, unseating the pump outlet ball, and then discharges through the pump jets into the air stream. At the end of the discharge, the outlet ball is returned to its seat by the spring, which prevents air being drawn back into the fuel channel during the intake stroke.

The pump plunger head is vented to minimize the effect of fuel percolation in the pump well. This is accomplished by the design of a ball check and seat in the plunger head. Any build-up of fuel vapors in the pump well will rise, bypass the ball and vent into the float bowl. This insures a solid charge of fuel beneath the plunger head for rapid acceleration.

The carburetor also makes use of a pump plunger shaft dust boot, which serves the dual purpose of preventing dirt and foreign material from entering the fuel bowl through the shaft opening on the top of the air horn, and also provides the proper seal necessary to maintain internal balance.

CHOKE SYSTEM (Fig. 4-46)

The choke system provides the engine with extra fuel during cold engine starting to maintain the correct air-fuel mixture ratios in the cylinders for combustion.

The thermostatic coil closes the choke valve when the engine is cold. To maintain the correct air-fuel ratio during warm-up, the choke piston under manifold vacuum opposes the choke coil and opens the choke valve.

As the engine begins to warm up, the thermostatic coil gradually relaxes its tension through the application of manifold heat. Air velocity against the offset choke valve and continued vacuum pull on the choke piston opens the choke valve until it is completely open, at which point the engine will be at operating temperature and choking is no longer needed.

CARBURETOR ASSEMBLY

Removal and Installation

1. Remove air cleaner assembly.

2. Disconnect linkage.

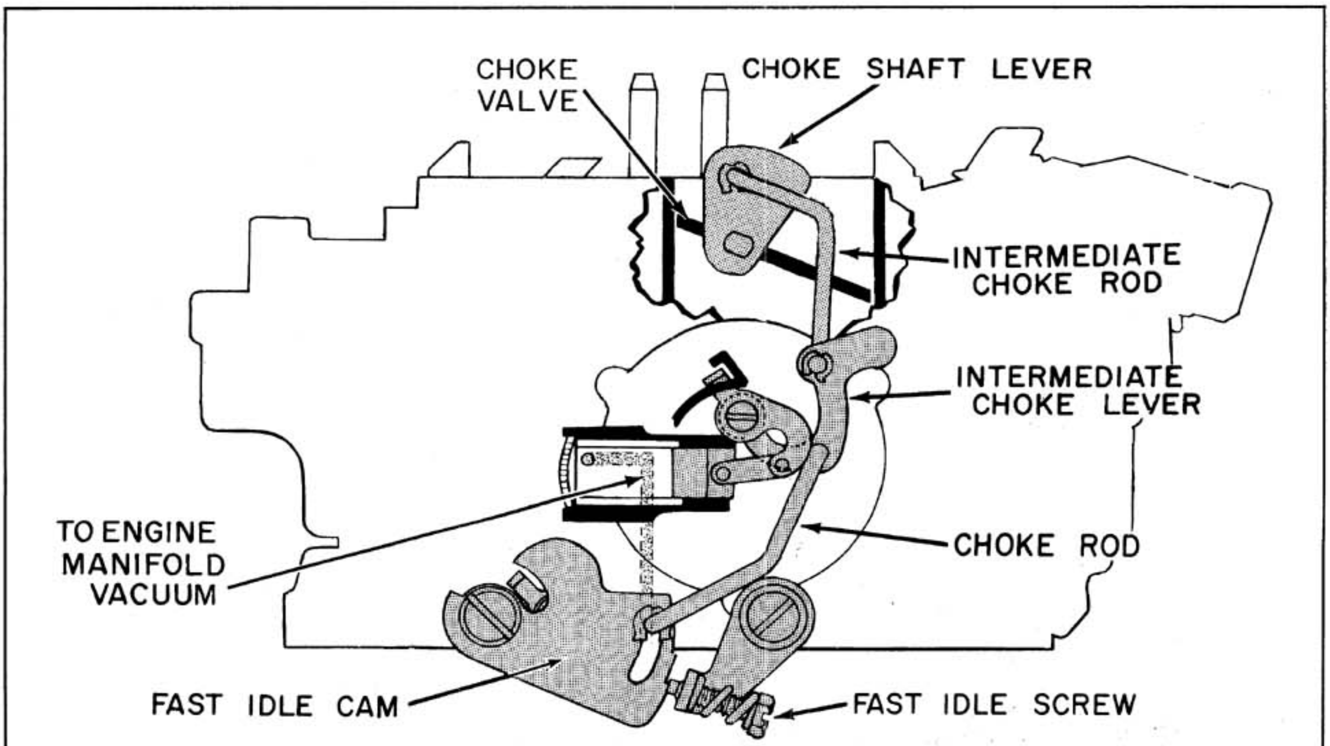


Fig. 4-46 Choke System

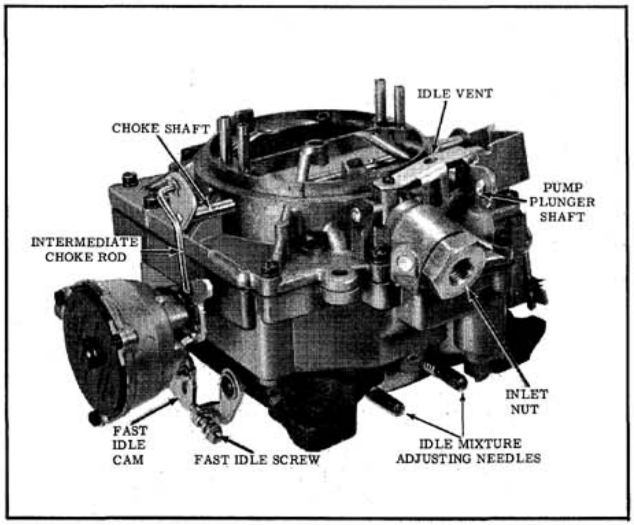


Fig. 4-47 4GC Carburetor Assembly

3. Disconnect choke tube.

4. Disconnect fuel and vacuum lines.

5. Remove four throttle body-to-intake manifold bolts and remove carburetor.

To install, reverse removal procedure and make adjustments outlined under ADJUSTMENTS (ON CAR). Torque carburetor to intake manifold bolts 14 to 17 ft. lbs.

DISASSEMBLY

Disassembly of Air Horn (Fig. 4-48)

1. Mount the carburetor on Holding Fixture J-5923-B or 30-14.

2. Remove the fuel inlet nut and gasket, then remove the filter, and gasket between filter element and back side of inlet nut. (Fig. 4-49)

3. Remove idle vent valve screw, shield and valve.

4. Remove the retainer from the upper end of the pump rod and disengage rod.

5. Remove the retainer from pump plunger shaft and remove the pump plunger and pump rod from carburetor.

6. Remove the retainer from the intermediate choke rod and unhook rod from choke lever.

7. If the choke shaft is to be removed:

   a. Remove the small screw holding the choke unloader lever to the choke shaft, then remove the lever.

   b. Remove the two small brass choke valve retaining screws and discard. Remove the choke valve and the choke shaft.

8. Remove the 13 air horn attaching screws, (one screw is recessed in the top of the air horn).

9. Carefully lift the air horn until the float assemblies are clear of the carburetor body.

   CAUTION: The air horn gasket must be removed with the air horn or the primary float assembly will be damaged.

10. Remove the hinge pin (torsion spring on 34, 36, 38 and 52 Series) from the primary float assembly, and remove the float and needle. (Fig. 4-48) Do not remove the float balance spring unless it is distorted and needs replacement.

11. Remove the primary float needle seat and gasket, using Tool BT-52.

    NOTE: The float needle and seat are matched and must be installed as an assembly.

12. Remove the hinge pin, (torsion spring, 34, 36, 38 and 52 Series), float assembly, needle seat gasket and filter screen from the secondary side of the air horn. Do not remove the float balance spring unless it is distorted and needs replacement.

13. Remove the air horn gasket.

14. Remove the power piston assembly by depressing the stem and allowing it to snap back into position.

15. Remove the pump plunger assembly by removing the retainer and sliding the shaft through the seal. Remove the seal from the top side of the air horn casting.

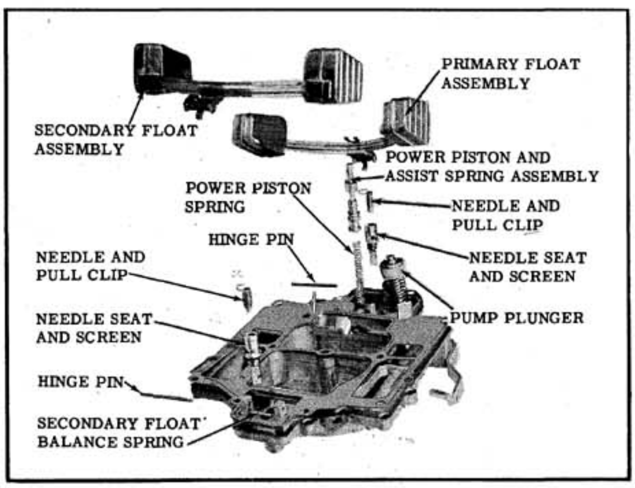


Fig. 4-48 Air Horn Assembly

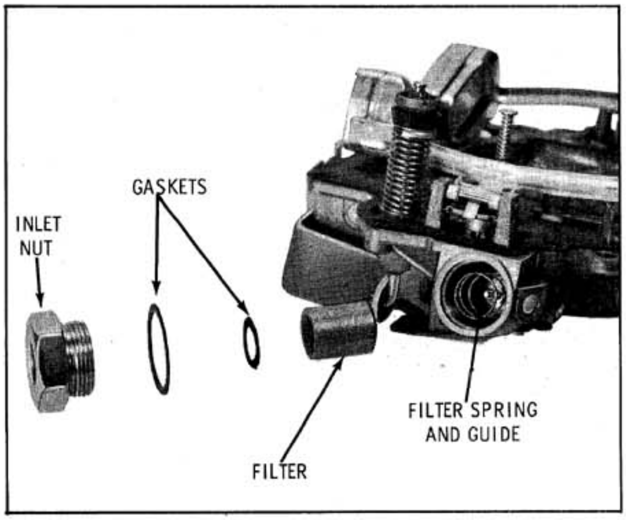


Fig. 4-49 Fuel Inlet Filter

Disassembly of Float Bowl

1. Remove the fast idle cam attaching screw. (Fig. 4-47)
2. Remove the three choke cover attaching screws and retainers, then remove the choke cover, gasket and baffle from the choke housing. (Fig. 4-50)
3. Remove the piston lever attaching screw and remove piston and lever.
4. Remove the two choke housing attaching screws, then remove the choke housing and linkage from the carburetor body.
5. Remove the intermediate choke lever and shaft with linkage from the choke housing, then remove choke housing gasket.
6. Remove the throttle dashpot by removing the attaching screw.

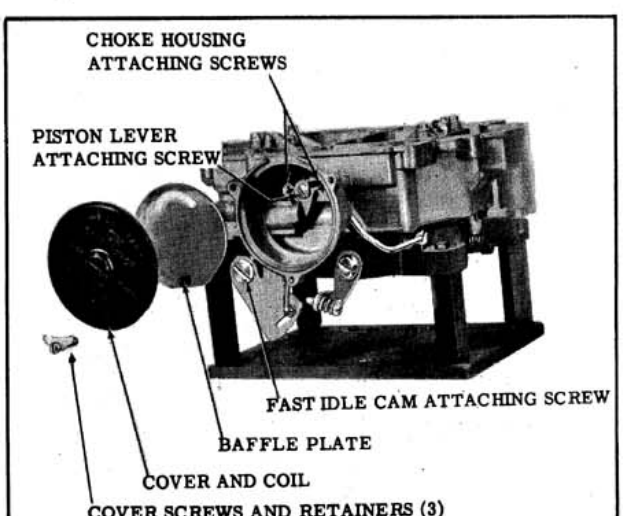


Fig. 4-50 Choke Assembly and Fast Idle Cam

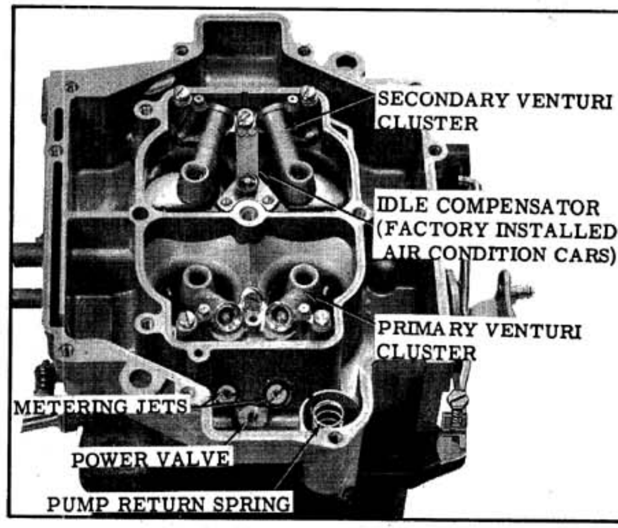


Fig. 4-51 Float Bowl Assembly

7. Remove the three attaching screws and lock-washers from the venturi cluster on the primary side, then remove the cluster and gasket. (Fig. 4-51)
8. Remove the three attaching screws and lock-washers from the venturi cluster on the secondary side, then remove the cluster and gasket.
9. Remove the idle compensator attaching screws, then remove the idle compensator and gasket.
10. Remove both metering jets from the primary (pump) side of the carburetor body.
11. Remove the power valve and gasket.
12. Remove both metering jets from the second-ary side of the carburetor. Keep them in a separate group.
13. Remove the pump return spring from the pump well, then invert the carburetor body to remove the aluminum pump inlet ball from the well.
14. Remove the small T-shaped pump discharge spring guide with needle-nose pliers, then remove the small spring and steel ball. (Fig. 4-52)
15. If it is necessary to clean or replace the small screen next to the pump plunger bore, remove the retainer ring and screen.
16. Invert the carburetor body and remove the four throttle body attaching screws. Remove the throttle body and gasket. (Fig. 4-53)
17. Remove the secondary auxiliary throttle valve assembly from the carburetor body.

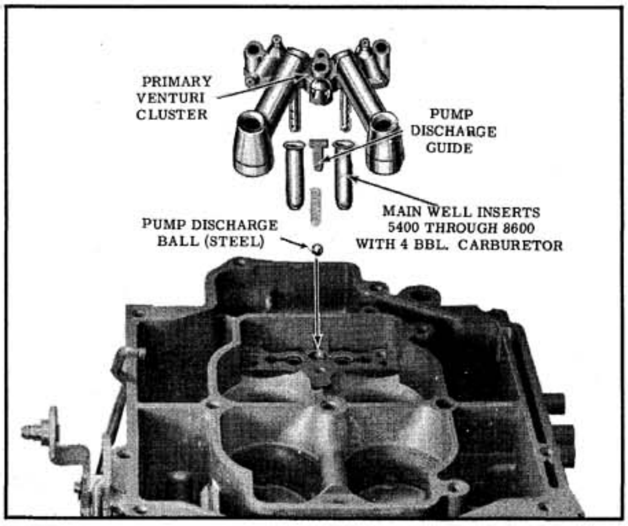


Fig. 4-52 Pump Discharge and Cluster

Disassembly of the Throttle Body

NOTE: No attempt should be made to remove the throttle valve or shaft from the throttle body as it may be impossible to reassemble the throttle valves correctly in relation to the vacuum advance and idle discharge orifices.

The idle mixture needle screws may be removed for cleaning or replacement. Also the slow and fast idle speed screws can be removed if necessary.

CLEANING OF PARTS

The carburetor should not be cleaned in any solution other than a cold immersion type cleaner.

1. Thoroughly clean carburetor castings and metal parts in carburetor cleaning solvent.

   CAUTION: The choke coil, housing and pump plunger should not be immersed in solvent. Clean pump in clean gasoline only.

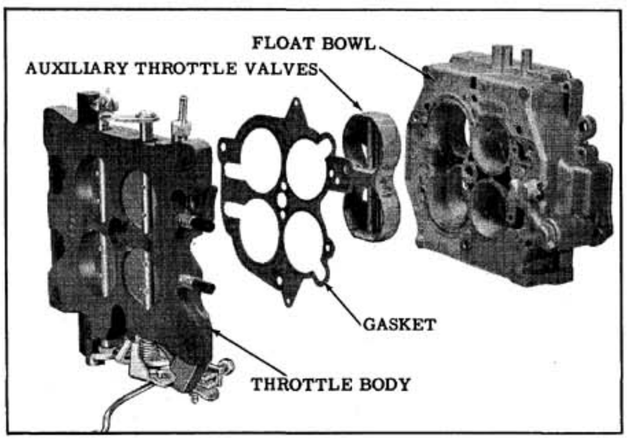


Fig. 4-53 Auxiliary Throttle Valve

2. Blow all passages in casting dry with compressed air. DO NOT PASS DRILLS THROUGH JETS OR PASSAGES.

3. Clean filter screens of dirt or lint. If the filter screens are distorted or plugged, they should be replaced.

INSPECTION OF PARTS

1. Check brass floats for dents or excessive wear at hinge pin holes.

2. Shake brass floats to check for leaks.

3. Examine float needle and seat. If grooved, replace with a factory matched float needle, seat and gasket assembly.

4. Inspect the idle mixture adjusting needles for burrs or ridges. Replace if necessary.

5. Inspect the upper and lower surfaces of the carburetor body to see that the small sealing beads are not damaged. Damaged beading may result in air or fuel leaks at that point.

6. Inspect holes in pump rocker arm, fast idle cam and throttle shaft lever. If holes are worn excessively or out-of-round to the extent of improper operation of the carburetor, worn parts should be replaced.

7. Inspect the steps on the fast idle cam for excessive wear. If excessive wear is noted, cam should be replaced to assure proper engine operation during the warm-up and choking periods.

8. Inspect the pump plunger cups for cracks or creases. If the pump plunger cups are damaged, replace the pump plunger as a complete assembly.

9. Inspect the throttle body assembly. Make sure the idle passages and vacuum channels are clean.

10. Inspect filter and screens. If screens or filter are distorted or plugged, they should be replaced.

As mentioned during the disassembly of the carburetor, there is a very close tolerance fit of the throttle valves in the throttle body. Also the idle discharge orifices are drilled in relation to a properly fitting valve. Therefore, if the throttle valves, levers or shafts are worn excessively or damaged, a complete throttle body assembly is required.

ASSEMBLY

Throttle Body

1. Install the idle mixture needles and springs finger tight. Back out the needles 1-1/2 turns as a preliminary idle adjustment.

2. If removed, install the slow and fast idle screws in the throttle levers.

Float Bowl

1. With the float bowl in the inverted position, install the auxiliary throttle valve assembly so that the calibrated spring operating pin is down. (Fig. 4-53)

2. Position the throttle body gasket on the float bowl so that all holes are properly aligned.

3. Place the throttle body on the float bowl and install the four attaching screws. Tighten the center screw to 10 ft. lbs. and the outer screws to 4 ft. lbs.

4. Place the float bowl upright on the holding stand.

5. Install the pump outlet steel ball, spring and T-shaped guide in the center hole of primary venturi cluster mounting surface in float bowl. (Fig. 4-54)

6. Install the power valve and gasket, and the two primary main metering jets. (Fig. 4-55)

   NOTE: The metering jets have a number stamped on the slotted end. The two jets with the lower number are the primary metering jets.

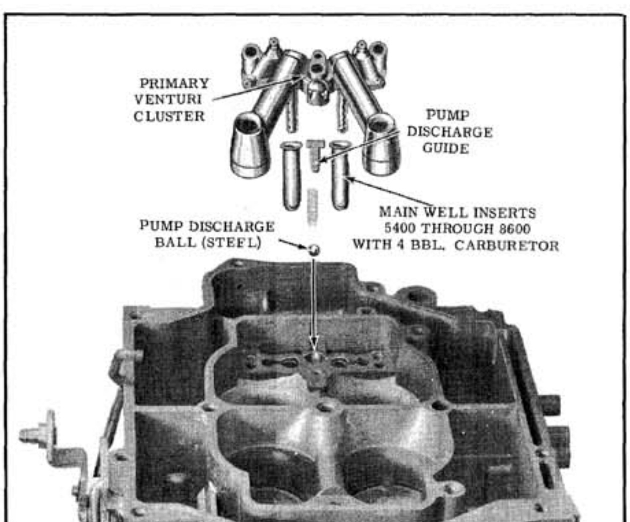


Fig. 4-54 Pump Discharge and Cluster

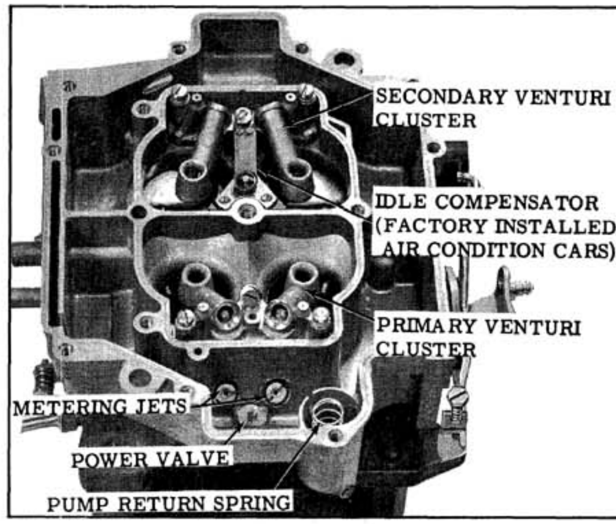


Fig. 4-55 Float Bowl Assembly

7. Install the two secondary main metering jets.

8. Install compensator and gasket and retain with two screws. Make sure the compensator is seated firmly in the passage and tighten screws securely.

9. Install the secondary venturi cluster and gasket and retain with three attaching screws and washers.

   NOTE: The secondary cluster does not have pump discharge nozzles.

10. Install primary venturi cluster and gasket and retain with three attaching screws and lockwashers.

11. Install the pump inlet aluminum ball and the pump return spring in the pump plunger well. Be sure the spring is seated over the ball.

12. Install the pump inlet screen and retainer if removed.

13. Install the choke housing gasket, intermediate choke lever and shaft with linkage in the choke housing. (Fig. 4-56)

14. Install the choke housing on the float bowl and retain with two attaching screws. Be sure the intermediate choke shaft lever is extending downward between the two attaching screw bosses.

15. Install the choke lever, link and piston assembly and attach lever to the intermediate choke shaft.

    NOTE: The choke piston pin hole in the piston should be pointing inward.

16. Install fast idle cam with attaching screw.

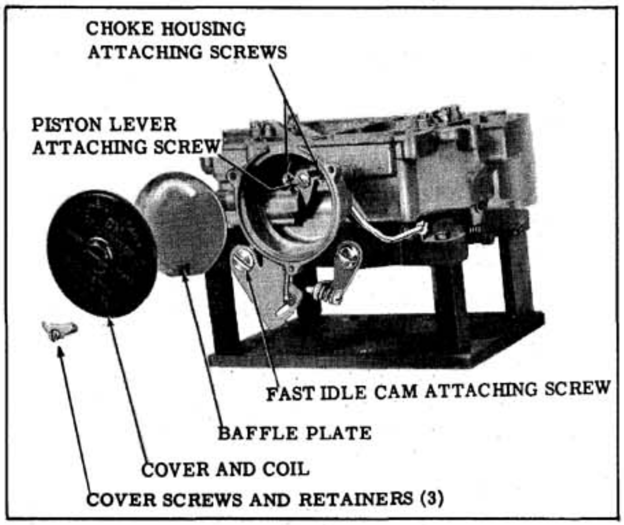


Fig. 4-56 Choke Assembly and Fast Idle Cam

Assembly of the Air Horn (Fig. 4-57)

1. Install the power piston in the bore and stake the casting very lightly to hold the piston in place.

2. Install the pump plunger rubber seal in the air horn by inserting the small end through from the bottom. The lips of the seal must be seated on both sides of the cover.

3. Insert the pump plunger shaft through the rubber seal.

4. Position the gasket on the air horn.

5. Install both float needle seats and gaskets, with filter screen on secondary side only using Tool BT-52.

6. Position secondary float assembly on air horn, (position torsion spring, 34, 36, 38 & 52 Series), and install hinge pin. (Fig. 4-40)

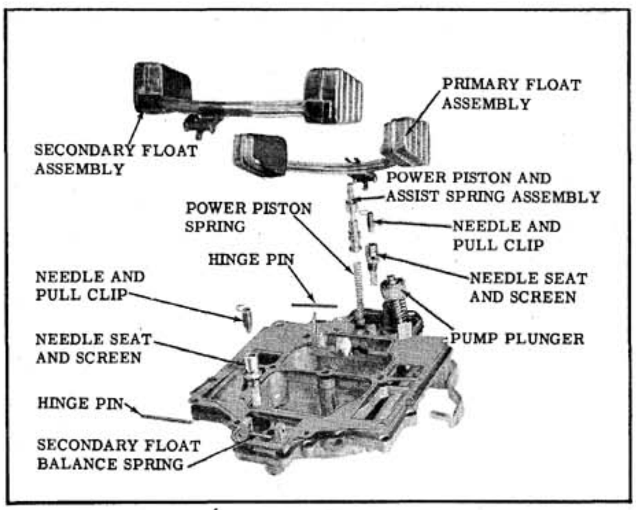


Fig. 4-57 Air Horn Assembly

7. Install primary float assembly. Make sure tang on rear of the float arms is over the balance spring.

8. Make float adjustments.

FLOAT ADJUSTMENTS (Fig. 4-103)

When checking the primary float level, be sure that the float arms do not rest on the baffles. A minimum of .030" must be maintained between the float arms and the baffles. If the minimum clearance does not exist after the float adjustments are made, it will be necessary to file the float arms.

NOTE: Do not file the baffles. The floats must be positioned so that they do not contact the side of the carburetor body.

The 54 through 86 Series 4GC carburetor has a vacuum assist spring.

COMPLETION OF CARBURETOR ASSEMBLY

1. Carefully guide the air horn assembly on the carburetor body so that the pump plunger, power valve stem, and floats will not be damaged.

2. Align the holes in the air horn, gasket, and body and just start the 13 air horn attaching screws.

3. Tighten evenly and securely the inner attaching screws (including the screw through the inner wall), then tighten the remaining outside attaching screws in the same manner.

4. If choke shaft was removed, install the choke shaft in the air horn by inserting it in the hole from the same side as the choke.

   a. Slide the choke valve through the shaft so that the letters "RP" on the valve are facing up when the valve is closed.

   b. Install two new small choke valve to shaft attaching screws. Close the choke valve to align choke in air horn, then tighten screws.

5. Install the rubber idle vent valve and shield on top of the air horn. Make sure valve seats properly on air horn.

6. Insert upper end of the pump rod through the outer hole in the pump lever by lifting up on the lever, then install the retainer. Insert pump plunger shaft in pump lever and install retainer.

7. Install the fuel inlet filter, the gasket between inlet nut and the filter, the inlet nut gasket and the inlet nut.

8. Install the choke unloader lever on the choke shaft.

9. Install the intermediate choke rod into the choke lever.

10. Install dashpot assembly.

ADJUSTMENTS (ON OR OFF THE CAR) Refer to Fig. 4-103 for the following adjustments

Intermediate Choke Rod and Choke Coil Adjustment

The choke vacuum piston must be properly positioned with respect to the vacuum slots in the choke housing bore to provide proper choke pull-off action.

Fast Idle Cam Rod Adjustment

In addition to the intermediate choke rod and choke coil adjustment, it is necessary to adjust the fast idle cam rod to the cam. This insures proper positioning of the fast idle cam when the choke coil is in operation.

Secondary Throttle Lockout Adjustment

The secondary throttle lockout prevents opening of the secondary throttle valves until the engine has reached normal operating temperature. Insufficient clearance at the lock point will allow the fast idle cam to strike the tang and prevent the choke from closing.

Secondary Throttle Contour Clearance Adjustment

The secondary throttle contour clearance adjustment, which is performed after the lockout adjustment, actually times the unlocking of the secondary throttle valve in relation to engine temperature.

Pump Rod Adjustment

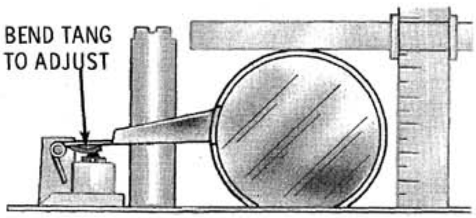
While holding the throttle valves closed, idle speed screw backed out, measure the distance from the top of the air horn casting to the bottom edge of the pump plunger shaft.

Unloader Adjustment

If the engine "loads up" or becomes flooded when cold starting, it is necessary to mechanically open the choke valve a small amount to admit more air and facilitate starting. This is accomplished when the tang on the pump lever contacts a tang on the choke shaft at wide-open throttle.

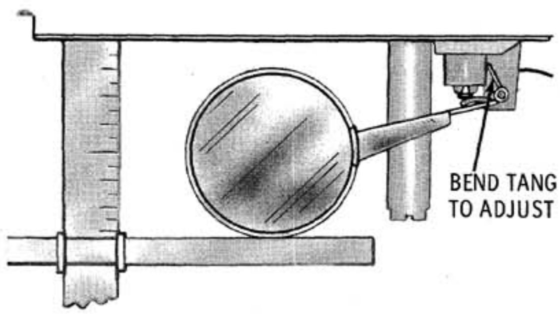
IMPORTANT: If the unloader adjustment was made off the car, it will be necessary to recheck the adjustment with the accelerator pedal completely depressed after the carburetor is installed. If the unloader adjustment appears to be incorrect, the throttle linkage adjustment should be checked to insure complete opening of the throttle valves.

SERIES AND TRANSMISSION	FLOAT LEVEL	FLOAT DROP	CHOKE ROD	UNLOADER	CHOKE SETTING
33 & 35 SYNCHROMESH	1-9/32"	1-3/4"	.075"	.300"	Index
33 & 35 JETAWAY	1-9/32"	1-3/4"	.075"	.300"	Index



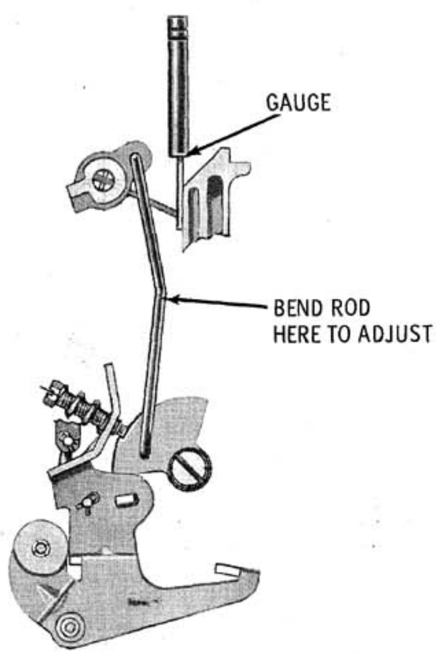
FLOAT LEVEL ADJUSTMENT

Measure from air horn gasket
to the bottom of each float.



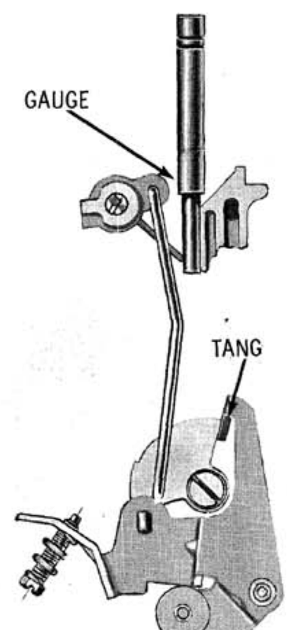
FLOAT DROP ADJUSTMENT

Float hanging free, measure
from gasket to bottom of float.



CHOKE ROD ADJUSTMENT

With idle screw resting against
shoulder of highest step, bend
choke rod to obtain correct
specification between lower
edge of choke valve and dividing
wall of air horn.

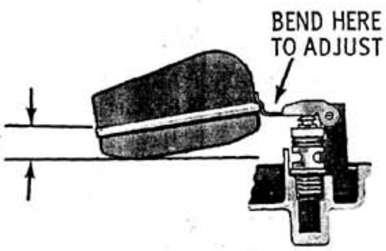


UNLOADER ADJUSTMENT

Bend tang as necessary to allow
insertion of specified gauge between
edge of choke valve and dividing
wall of air horn.

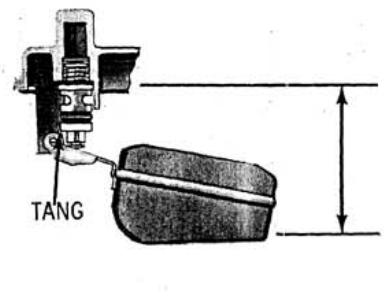
Fig. 4-101 BC Carburetor Adjustments

SERIES	FLOAT LEVEL	FLOAT DROP	PUMP ROD	CHOKE ROD	UNLDR ADJMT	INTER CHOKE ROD*		CHOKE SETTING
34 & 36 SERIES	3/4"	1-7/8"	1-1/16"	.150"	.160"	Flush		Index
52 SERIES	19/32"	1-7/8"	1-1/16"	.150"	.160"	Flush		Index
* 56 & 58 SERIES EXC. A/C	3/4"	1-7/8"	1-1/16"	.150"	.160"	1/32"		Index * SMT. 1 N. L.
56 & 58 SERIES WITH A/C	19/32"	1-7/8"	1-1/16"	.150"	.160"	1/32"		Index



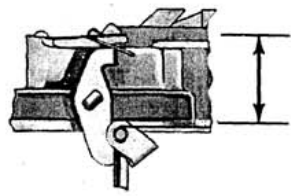
FLOAT LEVEL ADJUSTMENT

Measure from gasket to sharp edge of seam.



FLOAT DROP ADJUSTMENT

Bend float tang to obtain correct dimension from gasket to bottom of float.

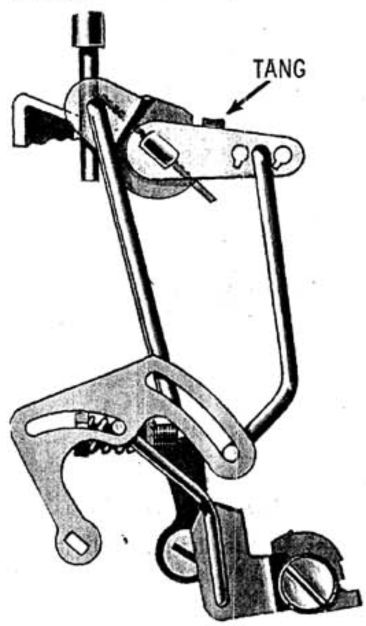


PUMP ROD

Completely close throttle valves. Bend pump rod to obtain correct specification. Measure from air cleaner mounting flange to top of pump rod.

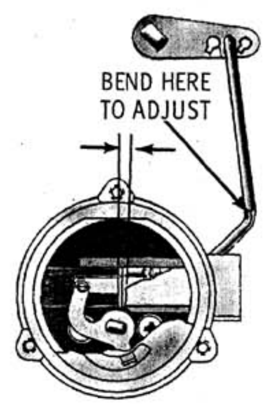
CHOKE ROD ADJUSTMENT
56 AND 58 SERIES

Fast idle cam screw just contacting second step of cam against shoulder as shown. Bend choke rod to obtain proper clearance between choke valve and air horn.



UNLOADER ADJUSTMENT

Throttle valves wide open position. Bend tang on dechoke lever to obtain specified dimension.

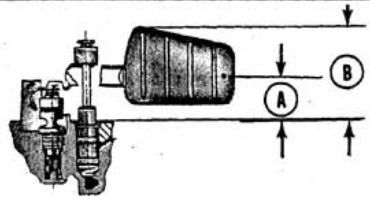


INTERMEDIATE CHOKE ROD ADJUSTMENT

Hold linkage up. Bend rod to properly position piston in bore.

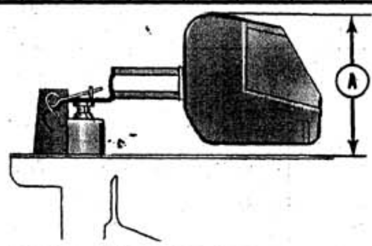
Fig. 4-102 2GC Carburetor Adjustments

ENGINE	FLOAT LEVEL				FLOAT DROP												CHOKE SETTING
	PRI		SEC														
	A	B	A	B	PRI	SEC	C	D	E	F	G	H	I				
330 CU. IN.	* 1-15"/32		* 1-15"/32		1-1/4"	1-1/4"	Flush	.050"	.120"	1.00"	.015"	.015"	.030"				Index
425 CU. IN. EXC. A/C	3/4"	1-15"/32	3/8"	1-3/8"	1-3"/32	1-1/8"	Flush	.050"	.120"	1.00"	.015"	.015"	.030"				Index
425 CU. IN. WITH A/C	11/16"	1-7"/16	3/8"	1-3/8"	1-1"/16	1-3"/16	Flush	.050"	.120"	1.00"	.015"	.015"	.030"				Index
* 52 Series with A/C-dimension "A" should be 1-7/16"																	

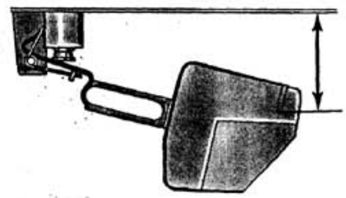


FLOAT LEVEL ADJUSTMENT
54 through 86 Series

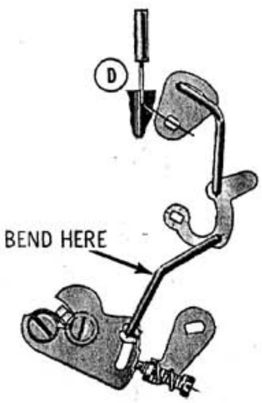
Gasket in place



FLOAT LEVEL ADJUSTMENT
34, 36, 38 & 52 Series
Gasket in place

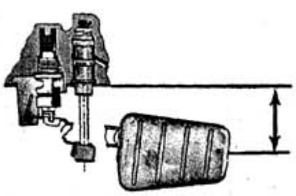


FLOAT DROP ADJUSTMENT
34, 36, 38 & 52 Series



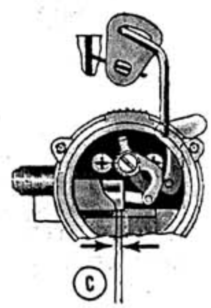
FAST IDLE CAM ROD ADJUSTMENT

Screw should just contact shoulder next to highest step of fast idle cam. Hold intermediate choke rod and fast idle cam rod up and check clearance between top edge of choke valve and dividing wall of air horn.



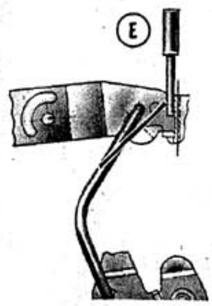
FLOAT DROP ADJUSTMENT
54 through 86 Series

Bounce floats lightly



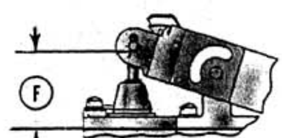
INTERMEDIATE CHOKF ROD ADJUSTMENT

Raise intermediate choke lever to its full up position.



UNLOADER ADJUSTMENT

Accelerator pedal completely depressed. Bend tang on pump lever to adjust.



PUMP ROD ADJUSTMENT

With carburetor in closed bore position, bend pump rod to obtain specified dimension.

SECONDARY ACTUATING LEVER ADJUSTMENT

Throttle valves fully closed. Remove slack from linkage and bend actuating tang to obtain specified clearance.

SECONDARY THROTTLE LOCKOUT ADJUSTMENT

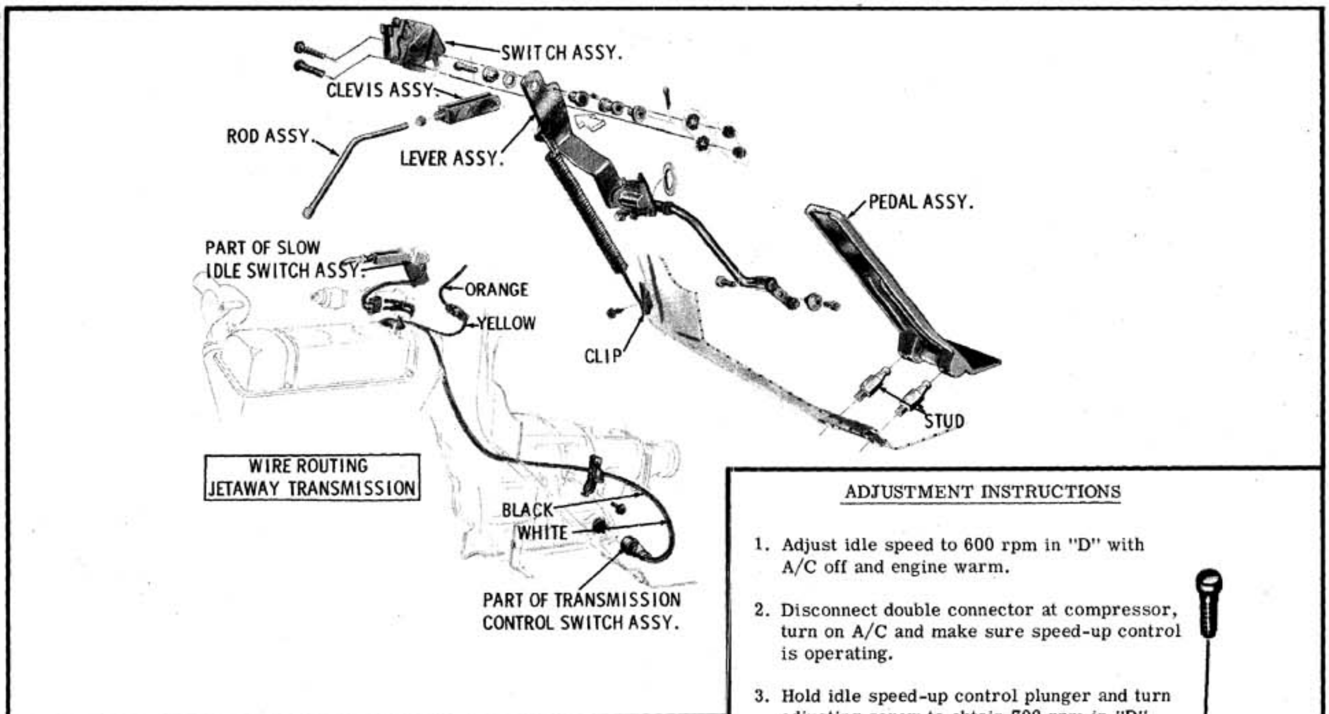
Bend tang as necessary to obtain specified clearance between tang and top edge of slot in fast idle cam.

SECONDARY THROTTLE CONTOUR CLEARANCE ADJUSTMENT

Bend tang as necessary to obtain specified clearance between tang and fast idle cam.

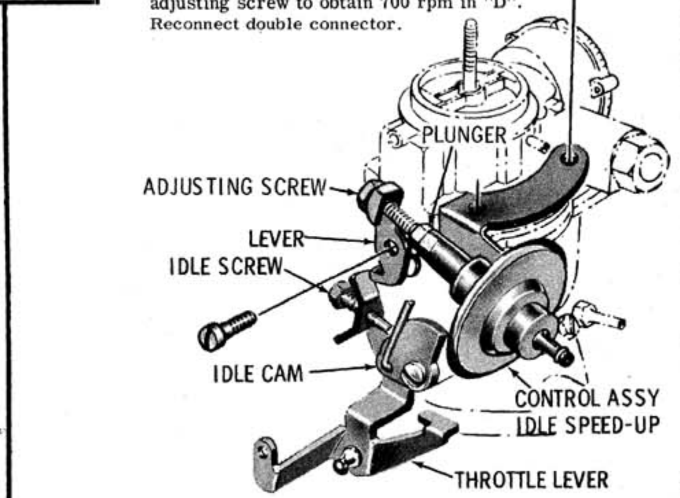
Fig. 4-103 4GC Carburetor Adjustments

ON CAR ADJUSTMENTS V-6



ADJUSTMENT INSTRUCTIONS

1. Adjust idle speed to 600 rpm in "D" with A/C off and engine warm.
2. Disconnect double connector at compressor, turn on A/C and make sure speed-up control is operating.
3. Hold idle speed-up control plunger and turn adjusting screw to obtain 700 rpm in "D". Reconnect double connector.



A. Idle Switch Adjustment - J. T. Cars Only
   1. Carburetor in closed throttle position and switch attaching screws loose.
   2. Move switch toward front of car until switch stop screw bottoms against plastic case of switch.

      NOTE: Do not adjust stop screw.

B. Transmission Control Switch Adjustment - J. T. Cars Only
   1. Carburetor in wide-open throttle position and switch plunger pushed in until it bottoms out.
   2. Adjust link until it will just slip over carburetor lever pin, then screw link into plunger 1-1/2 turns, tighten locknut and connect linkage.

C. Slow Idle Adjustment
   1. Engine warm, carburetor in slow idle position and idle switch properly adjusted.
   2. Adjust the slow idle screw to obtain 600 rpm with synchromesh in neutral and Jetaway in "D". If equipped with air conditioning, refer to adjacent illustration.

D. Accelerator Linkage Adjustment
   1. Slow idle properly adjusted and carburetor in slow idle position.
   2. Adjust swivel on carburetor rod to give 4-1/4" from centerline of swivel to top of well in dash.

E. Dashpot Adjustment - J. T. Cars Only
   1. Slow idle properly adjusted and carburetor in slow idle position.
   2. Engine off, dashpot plunger fully compressed, adjust dashpot plunger to obtain .060" clearance between dashpot plunger and throttle lever.

Fig. 4-104 On-the-Car Adjustments (V-6 Engines)

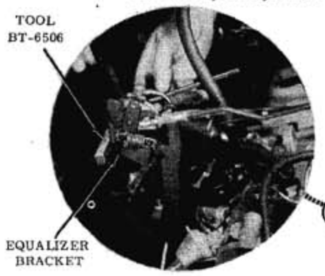
ON CAR ADJUSTMENTS V-8

1. EQUALIZER ROD ADJUSTMENT 52 - 86 SERIES

CONDITION - Carburetor rod disconnected

ADJUSTMENT - Adjust equalizer rod to obtain 1/2" clearance between equalizer bracket and dash.

NOTE - Second type linkage has a one-piece equalizer rod and does not require adjustment.

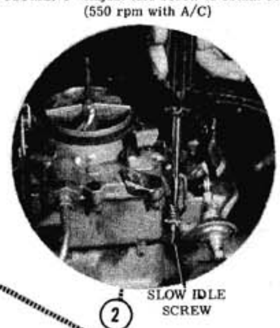


2. SLOW IDLE ADJUSTMENT

CONDITIONS - Parking brake applied, engine running and warm, carburetor in slow idle position, transmission in "DRIVE", A/C "OFF".

NOTE - Transmission stator must be in the high angle position (test lamp on)

ADJUSTMENT - Adjust idle screw to obtain 500 rpm (550 rpm with A/C)

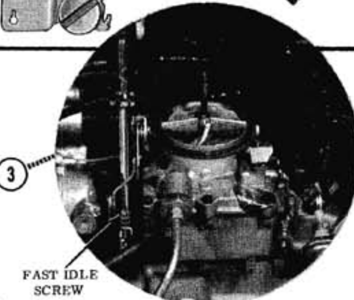


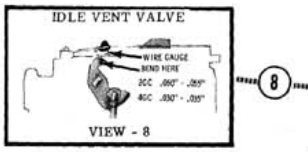
3. FAST IDLE ADJUSTMENT

CONDITIONS - Engine warm, transmission in "NEUTRAL", fast idle screw on low step of fast idle cam and against shoulder of next step.

ADJUSTMENT - Adjust fast idle screw to obtain 900 rpm with 2-barrel carburetor and 1100 rpm with 4-barrel carburetor.

NOTE - This is a new specification for 4-barrel carburetors.

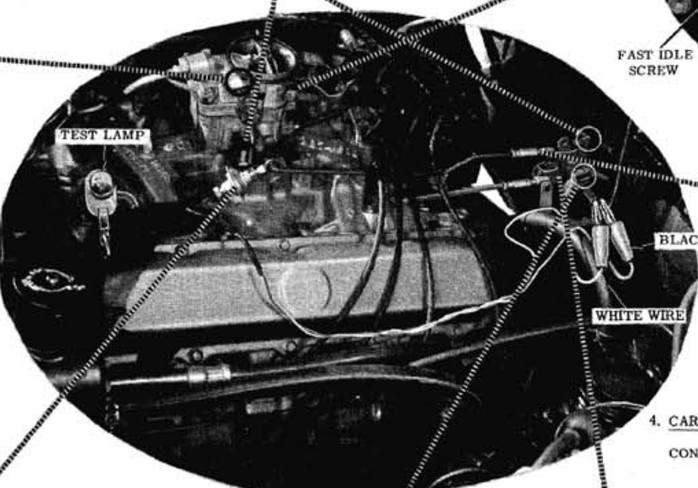


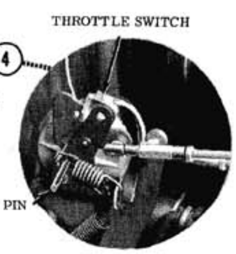


8. IDLE VENT ADJUSTMENT

CONDITIONS - Slow idle properly set, carburetor in slow idle position, engine off.

ADJUSTMENT - Adjust idle vent as shown in View 8. Gauge at largest opening between rubber seal and vent hole.

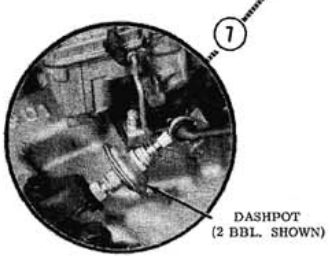




4. CARBURETOR ROD ADJUSTMENT

CONDITIONS - Slow idle properly adjusted and carburetor in slow idle position, engine off.

ADJUSTMENT - Adjust carburetor rod so that a 1/4" diameter pin can be freely inserted through hole in throttle switch lever and switch boss. (Test lamp on)



7. DASHPOT ADJUSTMENT 2GC CARBURETOR

CONDITIONS - Carburetor in correct SLOW idle position, engine off, dashpot fully compressed.

ADJUSTMENT - Adjust dashpot to obtain .060" clearance with throttle lever and tighten locknut.

ALTERNATE METHOD 2GC CARBURETOR

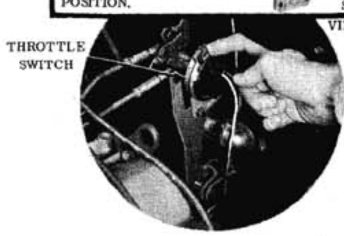
CONDITIONS - Fast idle set correctly, fast idle screw on highest step of Fast Idle Cam, engine off.

ADJUSTMENT - Adjust dashpot until plunger just contacts throttle lever, then extend dashpot two full turns and tighten locknut.

DASHPOT ADJUSTMENT 4GC

CONDITIONS - Fast idle set correctly, fast idle screw on highest step of Fast Idle Cam, engine off.

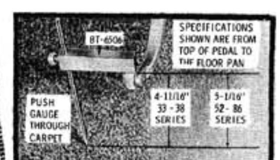
ADJUSTMENT - Adjust dashpot until plunger just contacts throttle lever, then tighten locknut.

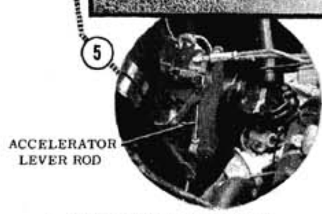


6. THROTTLE SWITCH ADJUSTMENT

CONDITIONS - Slow idle, carburetor and accelerator rod properly adjusted, engine off.

ADJUSTMENT - Adjust switch as shown in View 6, then depress accelerator pedal through detent and release.





5. PEDAL HEIGHT ADJUSTMENT

CONDITIONS - Slow idle and carburetor rod properly adjusted and carburetor at slow idle, engine off.

ADJUSTMENT - Adjust accelerator lever rod to obtain pedal height dimension shown.

Fig. 4-105 On-the-Car Adjustments (V-8 Engines)

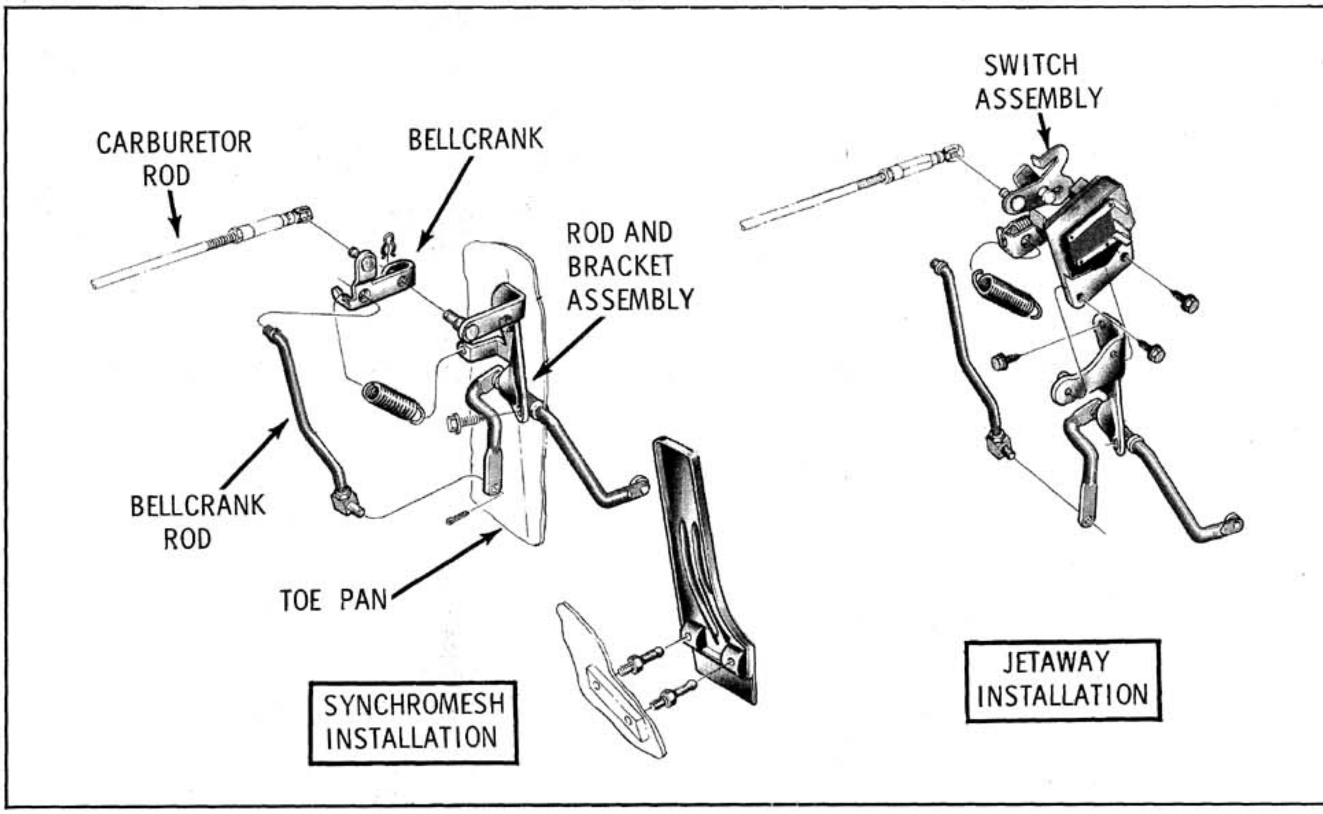


Fig. 4-106 34-36-38 and 52 Series Throttle Linkage

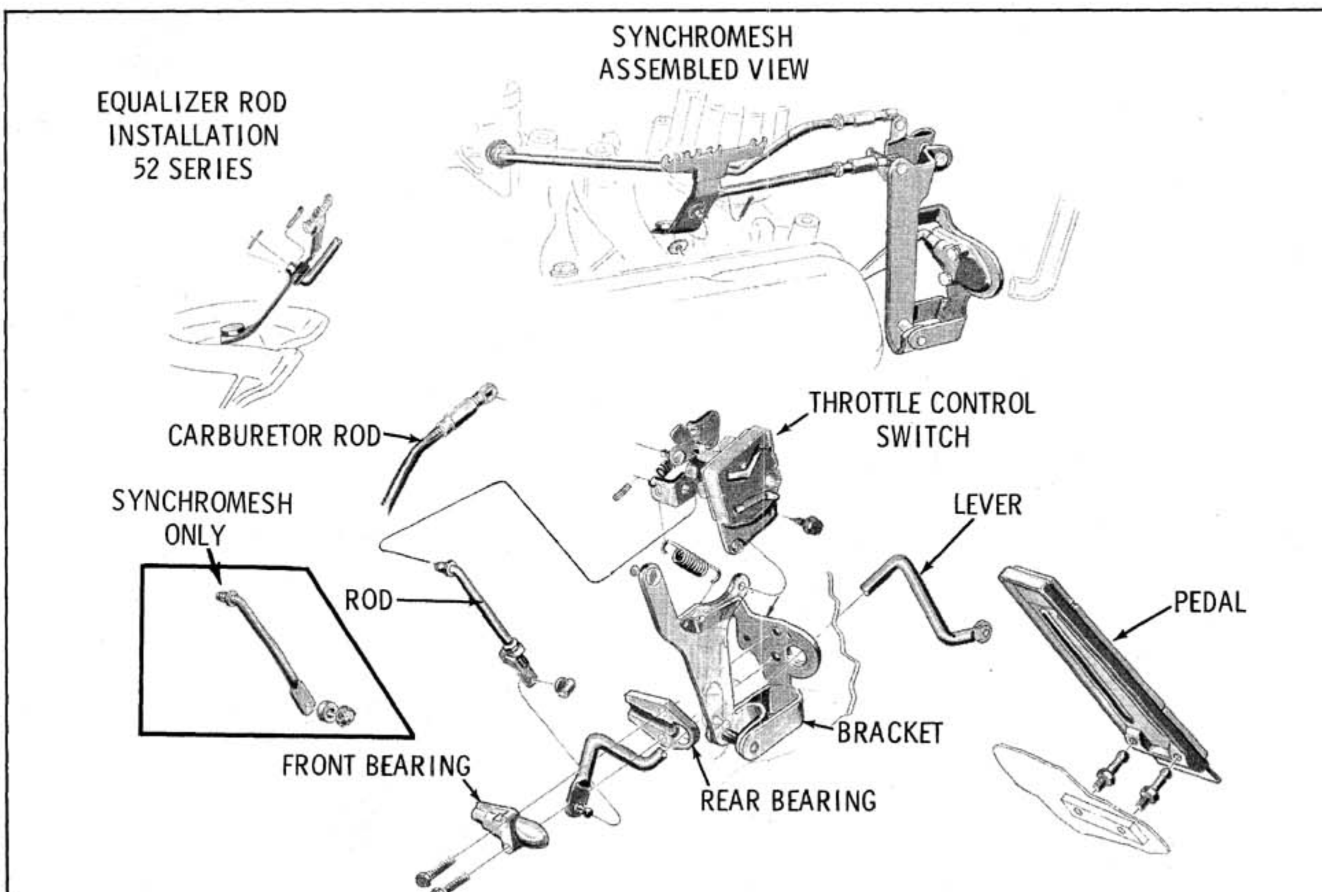
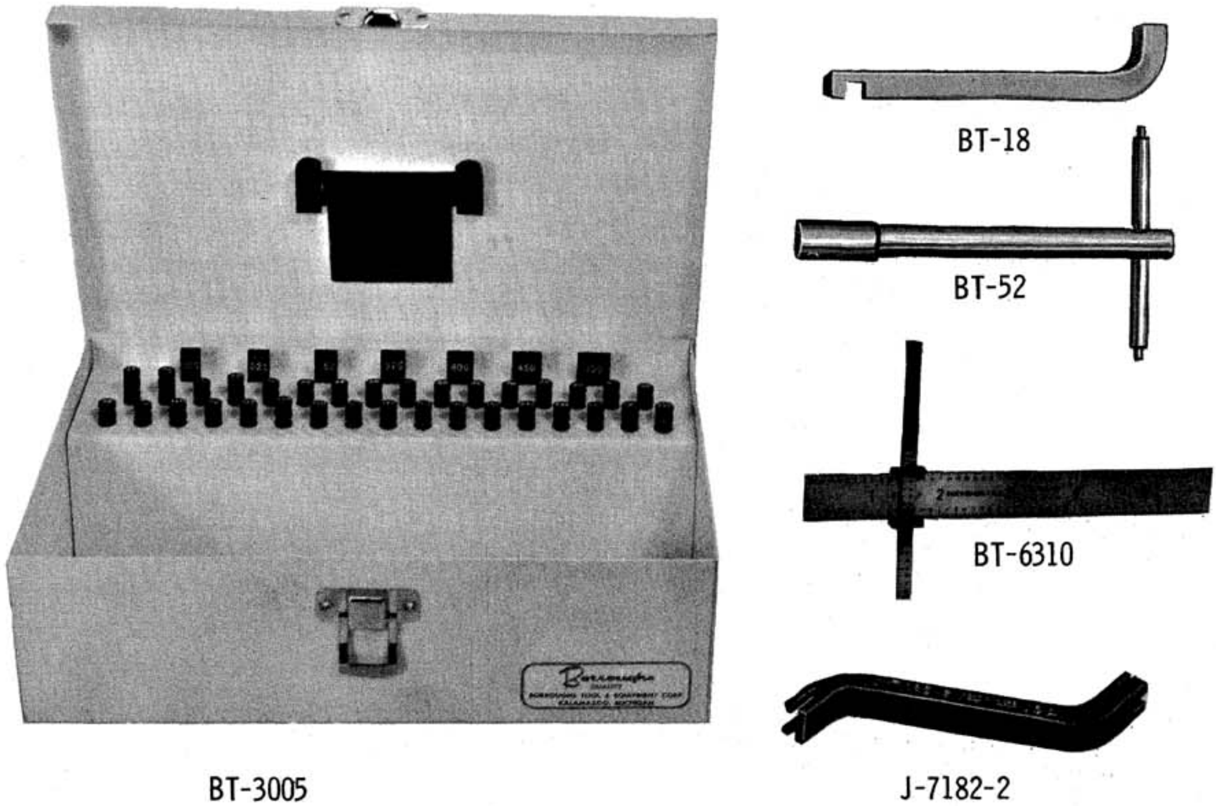


Fig. 4-107 54 through 86 Series Throttle Linkage



BT-18	BENDING TOOL - PUMP ROD
BT-52	FLOAT NEEDLE SEAT REMOVER
BT-3005	UNIVERSAL CARBURETOR ADJUSTING KIT
BT-6310	CARBURETOR FLOAT GAUGE
J-7182-2	BENDING TOOL - FLOAT AND VACUUM ASSIST TANG 4GC

Fig. 4-108 Tools

ENGINE TUNE-UP

(ALL SERIES)

CONTENTS OF SECTION 5

ENGINE TUNE-UP

To maintain the most satisfactory engine performance, it is recommended that the following items be performed every 12,000 miles: Service the spark plugs and ignition points, check the timing, idle mixture, slow and fast idle speed.

Refer to Sections 1 and 2 (General Information and Periodic Maintenance) for additional information.

SPARK PLUGS

1. Remove foreign material from around the spark plug holes and remove the spark plugs.

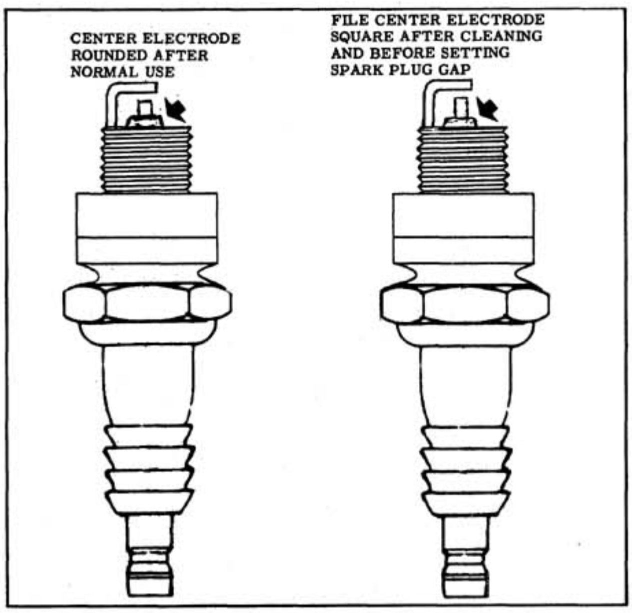


Fig. 5-1 Filing Center Electrode

2. Clean exterior of plugs and inspect for cracked insulators or excessively burned electrodes.

3. Clean all serviceable plugs with an abrasive type cleaner. File center electrode flat. (Fig. 5-1) Do not file center electrode on new plugs.

4. Adjust spark plug gap to .030" using a round feeler gauge.

5. Install plugs using new gaskets and torque 35 ft. lbs.

DISTRIBUTOR CONTACT POINTS

1. Inspect points, check for excessive burning or pitting. Replace if necessary.

2. Remove scale from points with a fine cut contact point file. Do not attempt to remove all roughness.

3. Apply a film of cam and ball bearing lubricant or equivalent to the breaker cam.

DWELL ANGLE

1. Calibrate dwell meter to set line and connect one lead of dwell meter to the primary distributor lead terminal (negative (-) terminal of coil) and the other lead to ground.

2. With engine running at idle speed, insert Dwell Adjusting Tool J-6296 or BT-1501 through distributor window into the head of the adjusting screw. (Fig. 5-2) Adjust dwell angle to 30°.

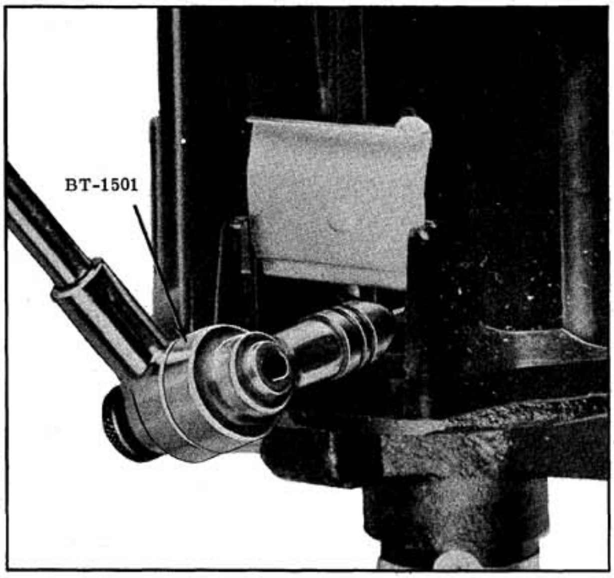


Fig. 5-2 Adjusting Dwell Angle

IGNITION TIMING

The ignition timing marks are located on the engine front cover. A saw slot on the balancer indicates engine top dead center. (Fig. 5-3)

To adjust ignition timing, proceed as follows:

1. Disconnect distributor vacuum line at carburetor and cover fitting with tape.

2. Adjust engine speed to 850 rpm. (550 rpm on V-6).

3. With the use of a timing light set timing according to chart. To adjust the ignition timing loosen the distributor clamp bolt and rotate the distributor.

   NOTE: If a tuned engine detonates with this setting, the cause is low octane fuel or excessive carbon build-up in the combustion chamber. If these factors are not corrected, the timing should be retarded 2-1/2° from the specified settings. In areas that have an extra high octane, the timing may be advanced beyond the specified setting providing spark knock is not encountered.

4. Tighten the distributor clamp bolt and recheck timing to make sure distributor was not moved during tightening of bolt.

5. Remove tape and connect distributor vacuum advance line.

SLOW IDLE ADJUSTMENT

With the engine at normal operating temperature and air cleaner removed, adjust slow idle as

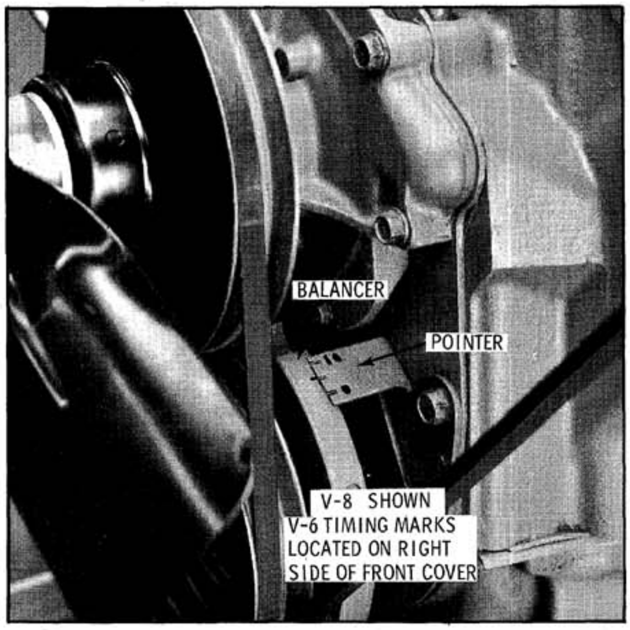


Fig. 5-3 Timing Marks

outlined in chart. Tool BT-1501 can be used to turn idle mixture adjusting screws.

After the idle rpm is stabilized, turn in or out each idle adjusting screw until the smoothest possible idle is obtained. This is normally accompanied by a higher manifold vacuum reading and/or an increase in idle rpm. Then turn out each needle 1/4 turn, at which time both vacuum and idle rpm will drop off slightly.

NOTE: It may be necessary to readjust idle speed and mixture after air cleaner is installed on car.

When setting idle speed and mixture on carburetors with an idle compensator (factory installed air conditioning only), make sure the idle compensator is closed by holding it down with a pencil or other suitable tool. If the idle speed increases when the air cleaner is installed, do not reduce idle speed setting since the idle compensator is open. If idle speed decreases, readjust to correct rpm.

ROAD TEST

Road test car thoroughly. Check engine performance at HIGH SPEED, LOW SPEED and IDLE. After road test is complete, inspect engine for oil and coolant leaks.

If car does not perform properly after the plugs and points have been serviced and the timing, idle mixture, slow and fast idle speed have been checked and adjusted, additional possible causes are as follows:

IGNITION SYSTEM DIAGNOSIS

If the engine does not run properly the ignition system may be at fault. Check for the following:

1. High resistance in spark plug cables.
2. Loose or faulty primary ignition wiring or connections.
3. High resistance in ignition system.
4. Distributor mechanical advance mechanism binding or sticking.
5. Distributor vacuum advance unit leaking vacuum.
6. There is no spark during cranking when a spark plug wire is held 1/4" from the engine.
7. The engine starts but immediately stops when the ignition switch is released from the "START" position.

If the above checks indicate that the ignition system is at fault, refer to Ignition System Diagnosis in the Electrical Section.

FUEL SYSTEM

1. Carburetor float level adjusted too low or too high or leak at float needle seat.
2. Dirt and/or corrosion in carburetor fuel or air passages.
3. Faulty fuel pump. (See ENGINE SECTION).
4. Plugged fuel filter.

Careful examination of the carburetor and fuel system should reveal defects if present. Always be ACCURATE with the carburetor adjustments.

VALVE SYSTEM

1. Sticking valve due to carbon and/or varnish deposits.
2. Broken or weak valve springs.
3. Warped, cracked or burned valve.
4. Valve not seating correctly.
5. Faulty hydraulic valve lifter.
6. Bent push rod, push rod worn excessively or push rod seat worn in rocker arm.
7. Incorrect valve timing.

COMPRESSION TEST

CAUTION: The ignition resistor is by-passed during cranking through a contact in the starter instead of through a contact in the ignition switch.

With this system, the starter must not be energized when the ignition switch is in the "off" or "lock" position. In these positions, the ignition system primary is grounded in the ignition switch. Energizing the starter will cause damage to the ground contact in the ignition switch and to the ignition contact in the starter solenoid.

To determine if the valves or pistons are at fault, a test should be made to determine the cylinder compression pressure. When checking cylinder compression, the throttle and choke should be open, all spark plugs removed, and the battery at or near full charge. The lowest reading cylinder should not be less than 80% of the highest, and no cylinder reading should be less than 100 pounds.

NORMAL	- Compression builds up quickly and evenly to specified compression on each cylinder.
PISTON RINGS	- Compression low on first stroke tends to build up on following strokes but does not reach normal. Improves considerably with addition of oil.
VALVES	- Low on first stroke does not tend to build up on following strokes. Does not improve much with addition of oil.

MISCELLANEOUS CAUSES

1. Restricted exhaust system.
2. Pre-ignition, due to carbon deposits in the combustion chamber.
3. Poor ground connection between engine and frame or body.
4. Malfunctioning manifold heat control valve. (Refer to ENGINE SECTION)

DISTRIBUTOR TEST SPECIFICATIONS

AUTOMOBILE		DISTRIBUTOR		BASED ON DISTRIBUTOR RPM			
SERIES	MODEL	PART NO.	VACUUM UNIT NO.	VACUUM ADVANCE PER INCH OF VACUUM		MECHANICAL ADVANCE PER DISTRIBUTOR RPM	
33 & 35	ALL	1110322	1116210	Start 8°	6 to 8 In. Hg. 14-1/2 to 15-3/4 In. Hg.	.5° to 2.5° 7° to 9° 12° to 14°	500 RPM 900 RPM 2100 RPM
34 & 36 38 52	ALL 55 & 65 with L 65	1111029	1116232	Start 9°	6 to 8 In. Hg. 15-1/2 to 19-1/2 In. Hg.	0° to 2° 7-3/4° to 9-3/4° 14° to 16°	400 RPM 1025 RPM 2000 RPM
38 52	27, 37 & 67 ALL Exc. L 65	1111048	1116232	Start 9°	6 to 8 In. Hg. 15-1/2 to 19-1/2 In. Hg.	0° to 2° 7-1/2° to 9-1/2° 12° to 14°	400 RPM 1000 RPM 2125 RPM
54 THRU 86 34, 36 & 38	ALL with L77 or L78	1111042	1116232	Start 9°	6 to 8 In. Hg. 15-1/2 to 19-1/2 In. Hg.	0° to 2° 6° to 8° 10° to 12°	400 RPM 900 RPM 2000 RPM
56 & 58 with L65		1111089	1116232	Start 9°	6 to 8 In. Hg. 15-1/2 to 19-1/2 In. Hg.	0° to 2° 13° to 15°	400 RPM 2000 RPM

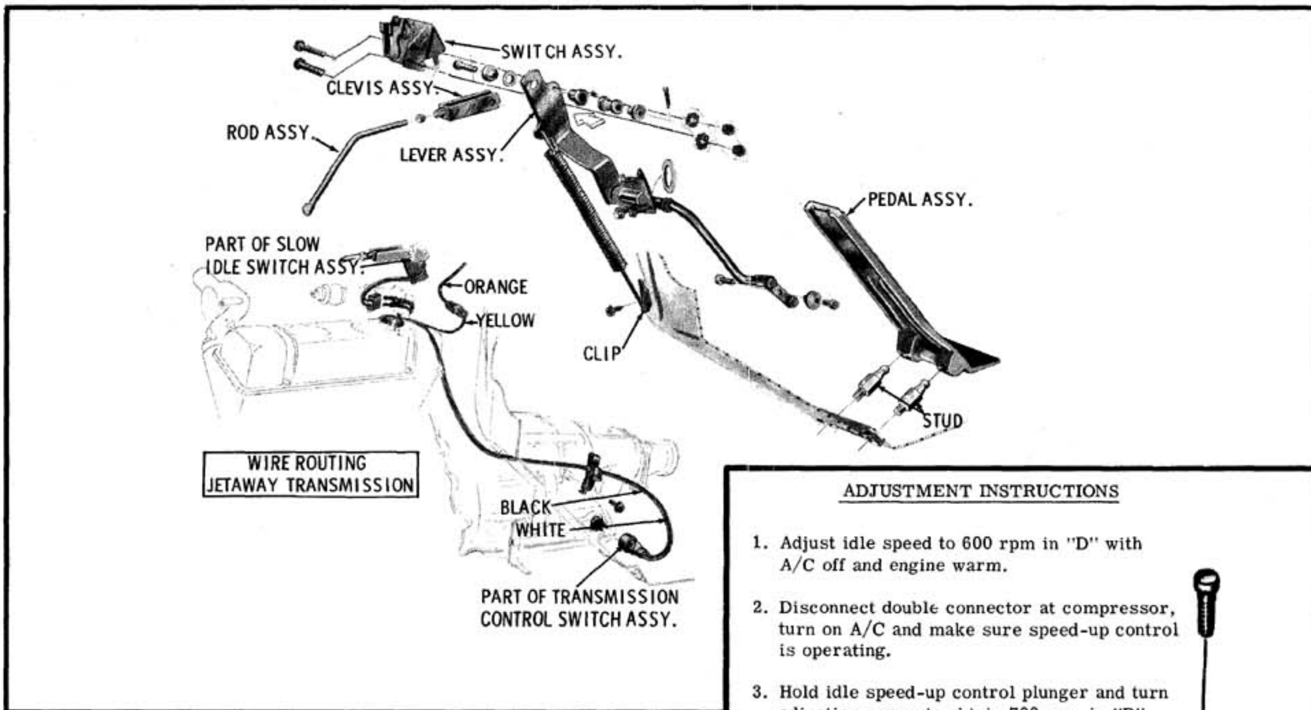
* ENGINE OPTIONS L74 AND L76 USE SAME DISTRIBUTOR AS 3827, 3837, 3867 AND ALL 52 SERIES.

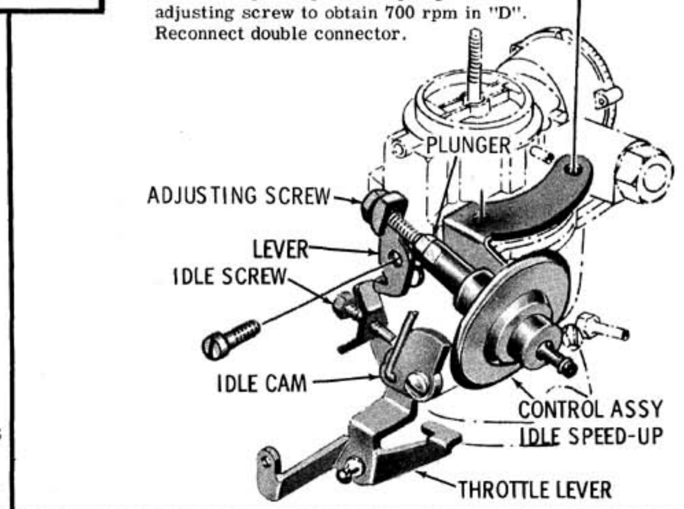
ENGINE TUNE-UP CHART

S.M.T. (In Neutral) Jetaway or Turbo Hydra-matic (In Drive)	Spark Plugs	Plug Gap	Set Dwell	Set Timing (Vacuum Disconnected)	Set Choke
225 Cu. In. - V-6 (1 Bbl.)	44S	.030"	30°	5° (550 RPM)	Index
330 Cu. In. - (2 Bbl. - L.C.)	45S	.030"	30°	7.5° (850 RPM)	Index
330 Cu. In. - (2 Bbl. - H.C.)	44S	.030"	30°	7.5° (850 RPM)	Index
330 Cu. In. - (4 Bbl. - H.C.)	44S	.030"	30°	7.5° (850 RPM)	Index
425 Cu. In. - (2 Bbl. - L.C.)	45S	.030"	30°	7.5° (850 RPM)	Index
**425 Cu. In. - (2 Bbl. - H.C.)	44S	.030"	30°	5° (850 RPM)	**Index
**425 Cu. In. - (4 Bbl. - H.C.)	44S	.030"	30°	5° (850 RPM)	**Index

**S.M.T. Set choke one notch lean.

ON CAR ADJUSTMENTS V-6





A. Idle Switch Adjustment - J. T. Cars Only
   1. Carburetor in closed throttle position and switch attaching screws loose.
   2. Move switch toward front of car until switch stop screw bottoms against plastic case of switch.
      NOTE: Do not adjust stop screw.

B. Transmission Control Switch Adjustment - J. T. Cars Only
   1. Carburetor in wide-open throttle position and switch plunger pushed in until it bottoms out.
   2. Adjust link until it will just slip over carburetor lever pin, then screw link into plunger 1-1/2 turns, tighten locknut and connect linkage.

C. Slow Idle Adjustment
   1. Engine warm, carburetor in slow idle position and idle switch properly adjusted.
   2. Adjust the slow idle screw to obtain 600 rpm with synchromesh in neutral and Jetaway in "D". If equipped with air conditioning, refer to adjacent illustration.

D. Accelerator Linkage Adjustment
   1. Slow idle properly adjusted and carburetor in slow idle position.
   2. Adjust swivel on carburetor rod to give 4-1/4" from centerline of swivel to top of well in dash.

E. Dashpot Adjustment - J. T. Cars Only
   1. Slow idle properly adjusted and carburetor in slow idle position.
   2. Engine off, dashpot plunger fully compressed, adjust dashpot plunger to obtain .060" clearance between dashpot plunger and throttle lever.

Fig. 5-4 On-the-Car Adjustments (V-6 Engines)

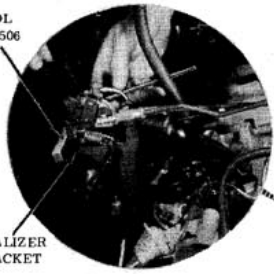
ON CAR ADJUSTMENTS V-8

1. EQUALIZER ROD ADJUSTMENT 52 - 86 SERIES

CONDITION - Carburetor rod disconnected

ADJUSTMENT - Adjust equalizer rod to obtain 1/2" clearance between equalizer bracket and dash.

NOTE - Second type linkage has a one-piece equalizer rod and does not require adjustment.

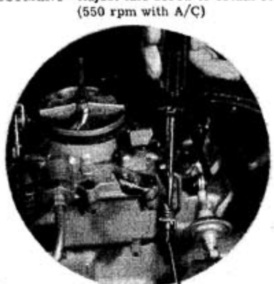


2. SLOW IDLE ADJUSTMENT

CONDITIONS - Parking brake applied, engine running and warm, carburetor in slow idle position, transmission in "DRIVE", A/C "OFF".

NOTE - Transmission stator must be in the high angle position (test lamp on)

ADJUSTMENT - Adjust idle screw to obtain 500 rpm (550 rpm with A/C)

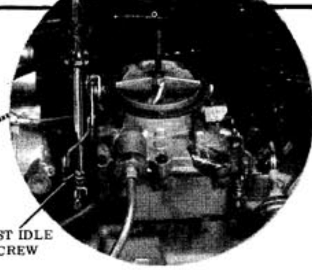


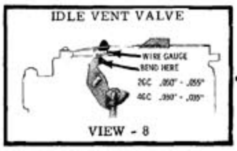
3. FAST IDLE ADJUSTMENT

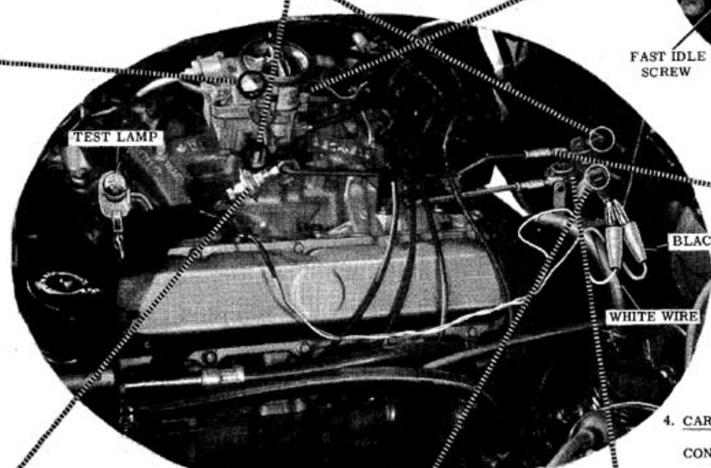
CONDITIONS - Engine warm, transmission in "NEUTRAL", fast idle screw on low step of fast idle cam and against shoulder of next step.

ADJUSTMENT - Adjust fast idle screw to obtain 900 rpm with 2-barrel carburetor and 1100 rpm with 4-barrel carburetor.

NOTE - This is a new specification for 4-barrel carburetors.



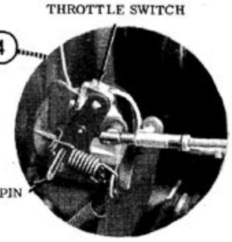




8. IDLE VENT ADJUSTMENT

CONDITIONS - Slow idle properly set, carburetor in slow idle position, engine off.

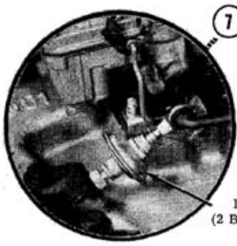
ADJUSTMENT - Adjust idle vent as shown in View 8. Gauge at largest opening between rubber seal and vent hole.



4. CARBURETOR ROD ADJUSTMENT

CONDITIONS - Slow idle properly adjusted and carburetor in slow idle position, engine off.

ADJUSTMENT - Adjust carburetor rod so that a 1/4" diameter pin can be freely inserted through hole in throttle switch lever and switch boss. (Test lamp on)



7. DASHPOT ADJUSTMENT 2GC CARBURETOR

CONDITIONS - Carburetor in correct SLOW idle position, engine off, dashpot fully compressed.

ADJUSTMENT - Adjust dashpot to obtain .060" clearance with throttle lever and tighten locknut.

ALTERNATE METHOD 2GC CARBURETOR

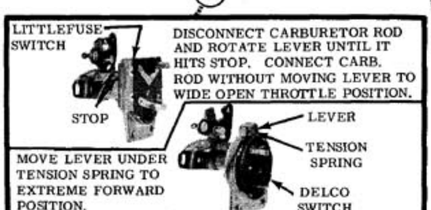
CONDITIONS - Fast idle set correctly, fast idle screw on highest step of Fast Idle Cam, engine off.

ADJUSTMENT - Adjust dashpot until plunger just contacts throttle lever, then extend dashpot two full turns and tighten locknut.

DASHPOT ADJUSTMENT 4GC

CONDITIONS - Fast idle set correctly, fast idle screw on highest step of Fast Idle Cam, engine off.

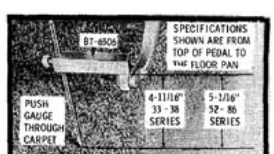
ADJUSTMENT - Adjust dashpot until plunger just contacts throttle lever, then tighten locknut.



6. THROTTLE SWITCH ADJUSTMENT

CONDITIONS - Slow idle, carburetor and accelerator rod properly adjusted, engine off.

ADJUSTMENT - Adjust switch as shown in View 6, then depress accelerator pedal through detent and release.



5. PEDAL HEIGHT ADJUSTMENT

CONDITIONS - Slow idle and carburetor rod properly adjusted and carburetor at slow idle, engine off.

ADJUSTMENT - Adjust accelerator lever rod to obtain pedal height dimension shown.

Fig. 5-5 On-the-Car Adjustments (V-8 Engines)

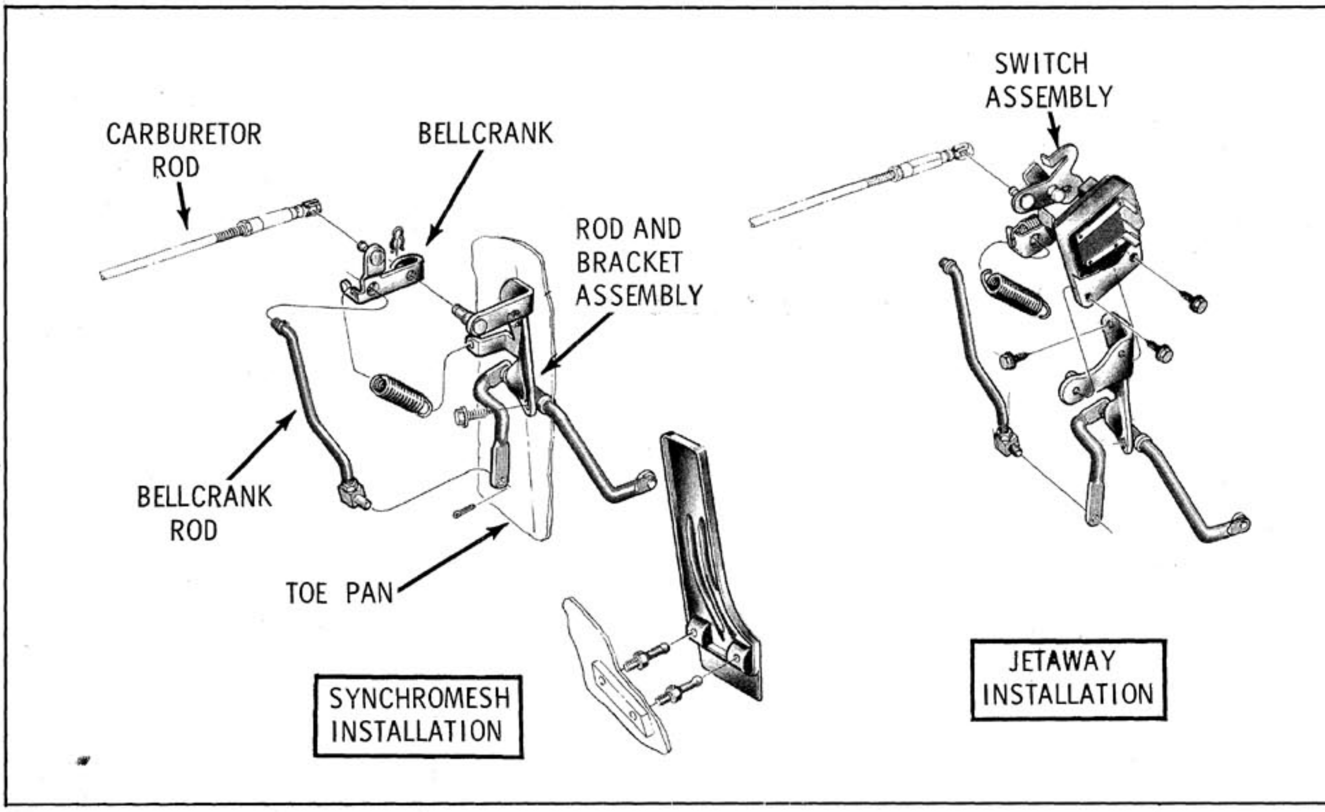


Fig. 5-6 34-36-38 and 52 Series Throttle Linkage

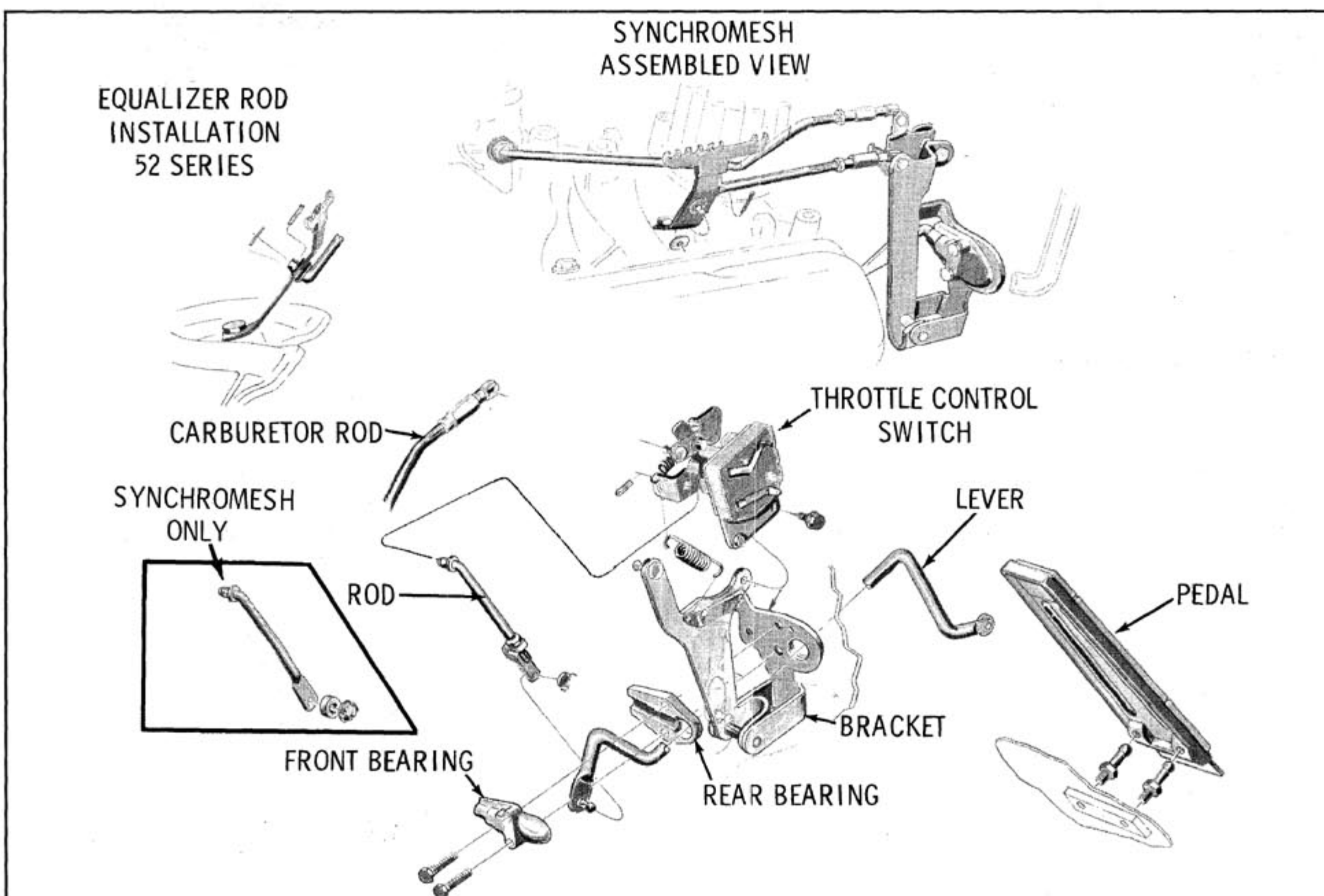


Fig. 5-7 54 through 86 Series Throttle Linkage

TURBO HYDRA-MATIC TRANSMISSION

54-56-58-66-84 & 86 SERIES

CONTENTS OF SECTION 6

PERIODIC MAINTENANCE

The fluid level should be checked at every engine oil change interval and should be changed at 24,000 mile intervals. The fluid level should be checked with the selector lever in "Park" position, the engine running at idle speed and the car on a level surface. The oil level indicator and filler tube are located under the hood at the right rear corner of the engine.

Approximately four quarts will be required to fill the transmission if the oil pan has been removed and drained at the same time that the fluid is changed. Approximately nine quarts are required after an overhaul.

When changing the transmission oil, add four quarts, start the engine, and add oil to bring fluid level to the "Full" mark on the oil level indicator.

Fluid only with the following identification on the container should be used: brand name, including the words ". . . . Fluid Type A, plus the mark "AQ-ATF" - number and a letter "A" embossed on the top of the can as follows: "AQ-ATF - number - A".

GENERAL DESCRIPTION

The Turbo Hydra-Matic transmission is a fully automatic unit consisting primarily of a three element hydraulic torque converter and a compound planetary gear-set. Three multiple-disc clutches, two sprag units, and two bands provide the friction elements required to obtain the desired function of the compound planetary gear-set.

The torque converter couples the engine to the planetary gears through oil and provides hydraulic torque multiplication when required. The compound planetary gear-set produces three forward speeds and reverse.

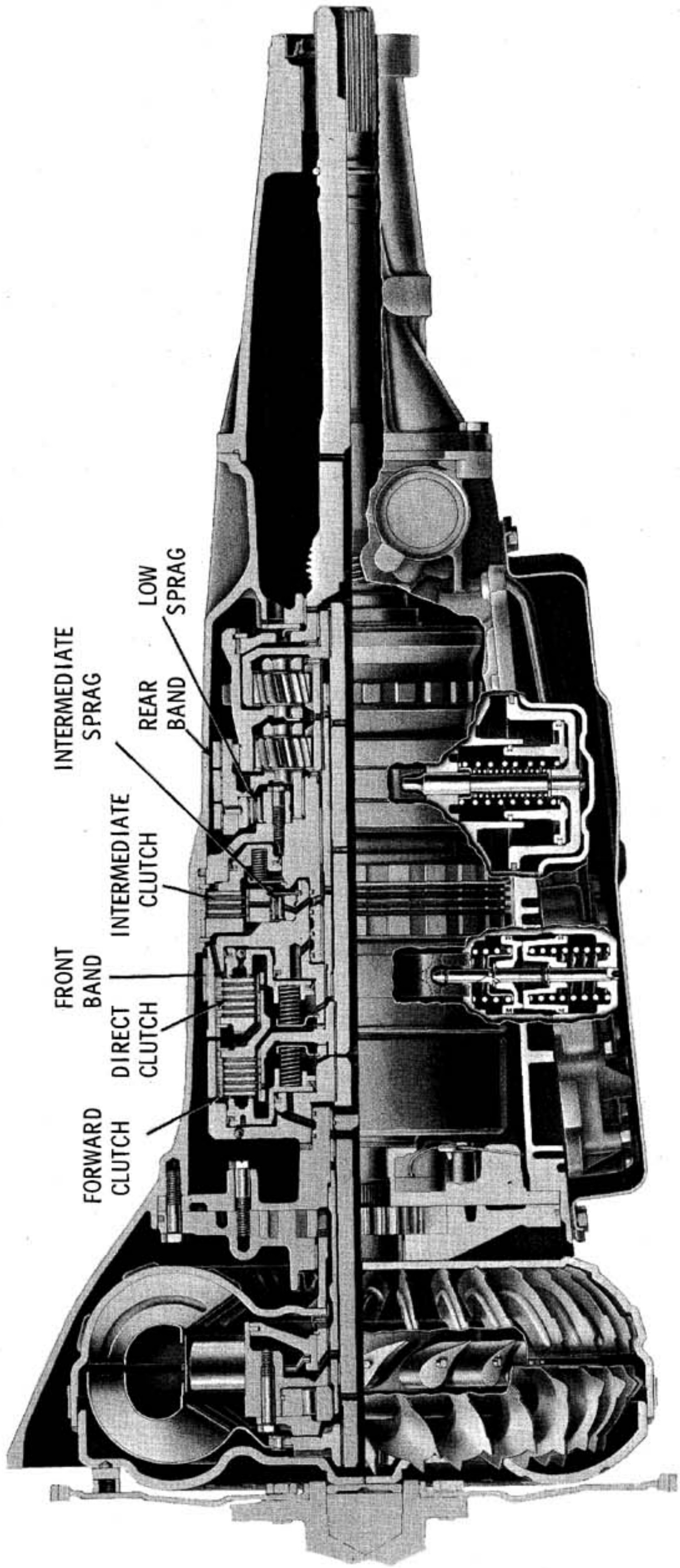


Fig. 6-1 Turbo Hydra-Matic Transmission

The three element torque converter consists of a pump or driving member, a turbine or driven member, and a stator assembly. The stator assembly is a two-stage stator which allows the stator blades to be operated in two different positions, maximum or high angle and minimum or low angle. The stator is mounted on a one-way roller clutch which allows the stator to turn clockwise but not counterclockwise. The purposes of the two-stage stator can best be explained by reviewing the operation of a torque converter.

The torque converter housing is filled with oil and is attached to the engine crankshaft by a flex plate. The converter pump is an integral part of the converter housing. The pump blades, rotating at engine speed, set the oil within the converter into motion and direct it to the turbine, causing the turbine to rotate.

As the oil passes through the turbine it is traveling in such a direction that if it were not redirected by the stator it would hit the rear of the converter pump blades and impede its pumping action. At low turbine speeds, the oil is redirected by the stator to the converter pump in such a manner that it actually assists the converter pump to deliver power, or multiply engine torque.

High stator blade angle means greater redirection of the oil and increased engine speed and torque multiplication for maximum performance. At engine idle it reduces the efficiency of the converter, reducing car "creep".

Low angle results in a more efficient converter for coupling operation.

As turbine speed increases, the direction of the oil leaving the turbine changes and flows against the rear side of the stator vanes in a clockwise direction. Since the stator is now impeding the smooth flow of oil, the roller clutch releases, and the stator revolves freely on its shaft. Once the stator becomes inactive, there is no further multiplication of engine torque within the converter. At this point, the converter is merely acting as a fluid coupling, as both the converter pump and turbine are being driven at approximately the same speed - or at a one-to-one ratio.

A gear-type pump provides the working pressure required to operate the friction elements and automatic controls.

External control connections to transmission are:

Manual Linkage	- To select the desired operating range.
Engine Vacuum	- To operate a vacuum modulator unit.
12-Volt Electrical Signal	- To operate an electrical detent solenoid and stator control solenoid.

Approximate gear or torque ratios of the transmission are as follows:

First	- 2.5 gear ratio x 2. converter stall ratio	= 5. :1
*Second	- 1.5 gear ratio	= 1.5:1
*Third	- 1. :1	
Reverse	- 2. :1 gear ratio x 2. converter stall ratio	= 4. :1

*Second and third are also multiplied.

A vacuum modulator is used to automatically sense any change in the torque input to the transmission. The vacuum modulator transmits this signal to the pressure regulator for line pressure control, to the 1-2 accumulator valve, and to the shift valves so that all torque requirements and shift speed requirements of the transmission are met and smooth shifts are obtained at all throttle openings.

The detent solenoid is activated by an electric switch on the carburetor. When the throttle is fully opened, the switch on the carburetor is closed, activating the detent solenoid and causing the transmission to downshift at speeds below approximately 70 mph.

The stator control solenoid is activated by a signal from a switch on the carburetor linkage at engine idle which changes the stator blade angle from low to high. It is also energized at 40° and over of carburetor opening by a switch on the carburetor linkage to change the stator blades from low angle to high angle.

The selector quadrant has six positions: Park, R, N, D, S, L.

Park - Park position positively locks the output shaft to the transmission case by means of a locking pawl to prevent the vehicle from moving in either direction. The engine may be started in park position.

R. - Reverse enables the vehicle to be operated in a reverse direction.

N. - Neutral position enables the engine to be started and run without driving the vehicle.

D. - Drive range is used for all normal driving conditions and maximum economy.

Drive range has three gear ratios, from the starting ratio to direct drive. Detent downshifts are available for safe passing by depressing the accelerator to the floor.

S. - Super range provides performance for congested traffic or hilly terrain. Super range has the same starting ratio as drive range, but prevents the transmission from shifting above second speed to maintain second speed acceleration when extra performance is desired. Super range can also be used for engine braking.

Super range can be selected at any vehicle speed, and the transmission will shift to second gear and remain in second until the vehicle speed or the throttle are changed to obtain first gear operation in the same manner as in "D" range.

L. - Low range can be selected at any vehicle speed, and the transmission will shift to second gear and remain in second until vehicle speed is reduced to approximately 40 mph, depending on axle ratio.

Low range position prevents the transmission from shifting out of low gear. This is particularly beneficial for maintaining maximum engine braking, when continuous low gear operation is desirable.

VALVES AND THEIR FUNCTION

PRESSURE REGULATOR (Fig. 6-2)

1. Regulates line pressure according to a fixed spring force and forces controlled by modulator and reverse pressures.

2. Controls the flow of oil that charges the torque converter, feeds the oil cooler and provides lubrication for the transmission.

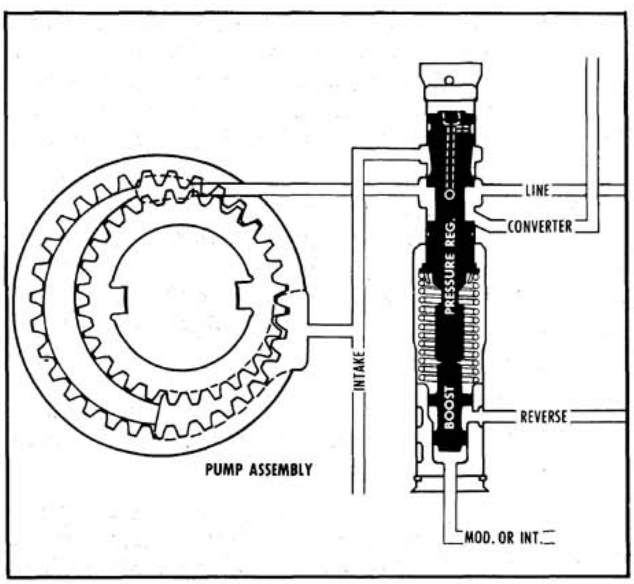


Fig. 6-2 Pressure Regulator Valve

MANUAL VALVE (Fig. 6-3)

Establishes the range of transmission operation, for Park, R, N, D, S, L.

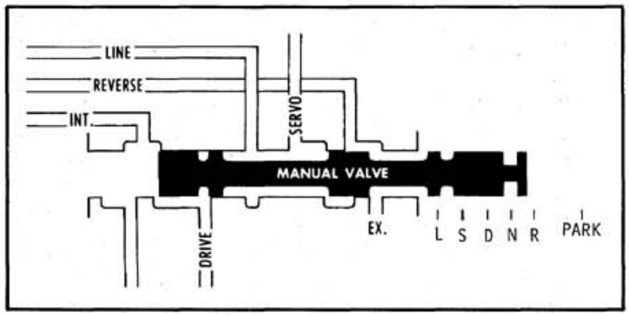


Fig. 6-3 Manual Valve

GOVERNOR ASSEMBLY (Fig. 6-4)

Generates a speed sensitive oil pressure that increases with output shaft or vehicle speed. Governor pressure is used to vary the shift points and modulator pressure regulation.

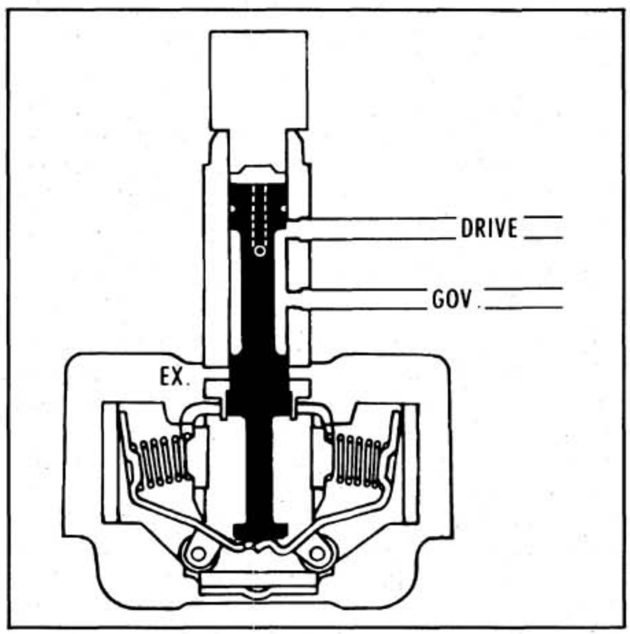


Fig. 6-4 Governor Assembly

MODULATOR VALVE (Fig. 6-5)

Regulates line pressure to a modulator pressure that varies with torque to the transmission. It senses forces created by:

1. The vacuum modulator bellows that increase modulator pressure.

2. Engine vacuum acting on a diaphragm to decrease modulator pressure.

3. Governor pressure which is generated by the governor assembly. Governor pressure tends to decrease modulator pressure.

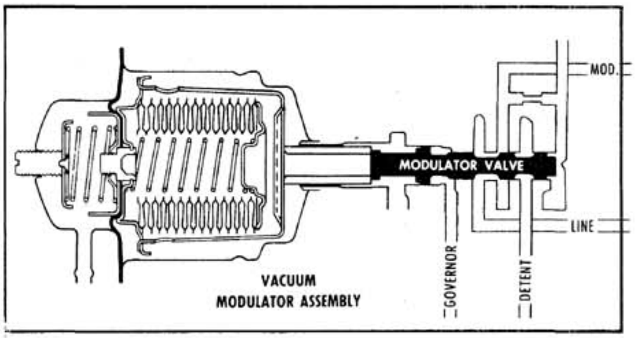


Fig. 6-5 Vacuum Modulator Assembly

1-2 SHIFT VALVE (Fig. 6-6)

Controls the oil pressure that causes the transmission to shift from 1-2 or 2-1. Its operation is controlled by governor pressure, detent pressure, modulator pressure, and spring force.

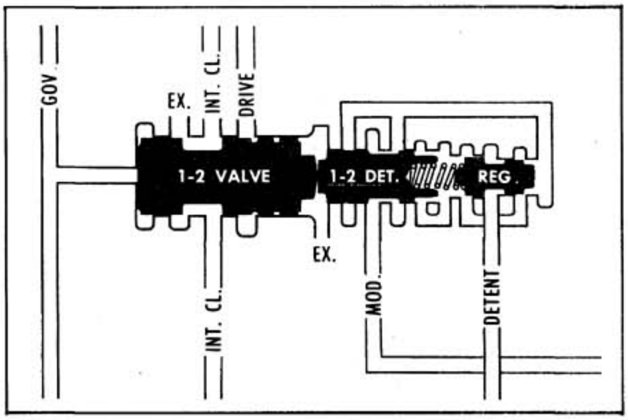


Fig. 6-6 1-2 Shift Valve

1-2 REGULATOR VALVE (Fig. 6-6)

Regulates modulator pressure to a pressure proportional to modulator pressure, tending to keep the 1-2 shift valve in the downshift position.

1-2 DETENT VALVE (Fig. 6-6)

Senses regulated modulator pressure tending to hold the 1-2 shift valve in the downshift position and provides an area for detent pressure for detent 2-1 shifts.

2-3 SHIFT VALVE (Fig. 6-7)

Controls the oil pressure that causes the transmission to shift from 2-3 or 3-2. Its operation is controlled by modulator, intermediate, governor and detent pressure as well as a spring force.

2-3 MODULATOR VALVE (Fig. 6-7)

Senses modulator pressure to apply a variable force proportional to modulator pressure which tends to hold the 2-3 shift valve downshifted.

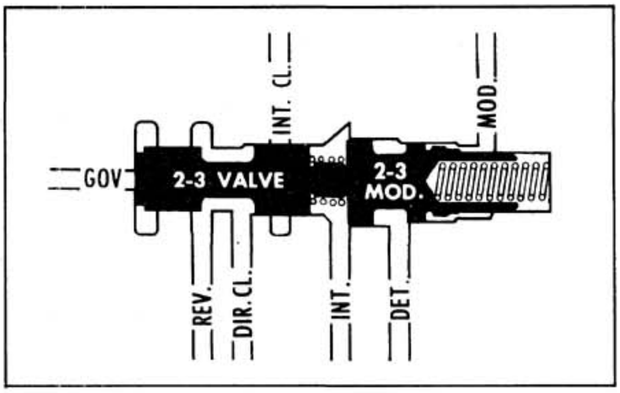


Fig. 6-7 2-3 Shift Valve

3-2 VALVE (Fig. 6-8)

Shuts off modulator pressure from acting on the shift valve trains after the direct clutch has been applied. This allows heavy throttle operation in third speed without downshifting. In third speed detent pressure can be directed to the shift valves to provide the downshift forces.

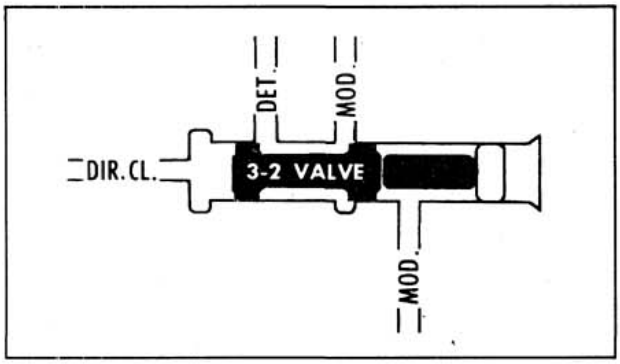


Fig. 6-8 3-2 Valve

1-2 ACCUMULATOR VALVE (Fig. 6-9)

Regulates drive pressure to a 1-2 accumulator pressure which increases as modulator pressure increases to control the intermediate clutch pressure during the 1-2 shift. Detent and low oil pressures increase 1-2 accumulator pressure.

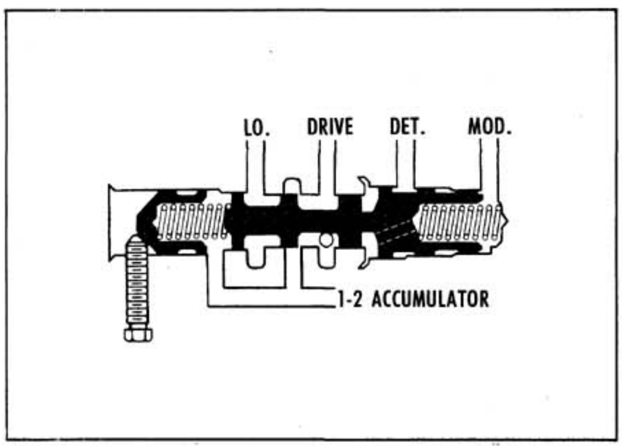


Fig. 6-9 1-2 Accumulator Valve

DETENT VALVE (Fig. 6-10)

Shifts when line oil is exhausted at the end of the valve when the detent solenoid is energized. This directs detent pressure to the 1-2 and 2-3 modulator valves, and also allows the detent regulator valve to regulate.

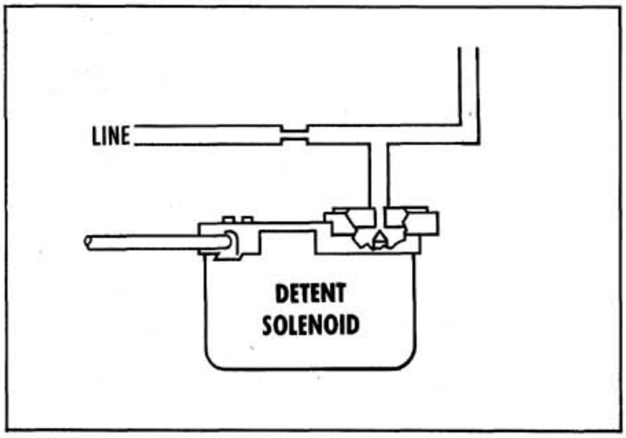


Fig. 6-10 Detent Valve

DETENT REGULATOR VALVE (Fig. 6-11)

When the detent valve shifts, the detent regulator is free to allow drive oil to enter the detent passage and thus becomes regulated to a value of 70 psi. Detent pressure will also flow into the modulator passage which flows to the shift valves. Low oil moves the detent regulator open to drive oil allowing drive oil to enter the modulator and detent passages.

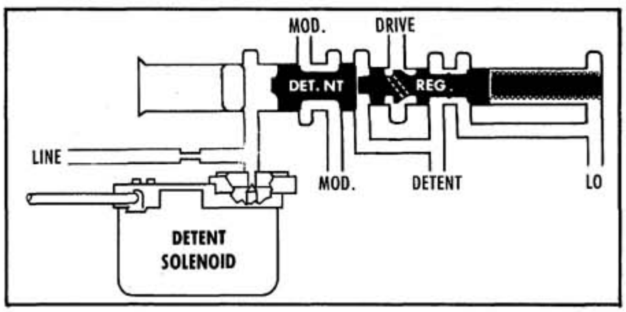


Fig. 6-11 Regulator Valve

STATOR VALVE (Fig. 6-12)

Shifts when line oil is exhausted at end of the valve when the stator control solenoid is energized. This exhausts oil from the variable stator piston and the stator blades change from low angle to high angle. When the solenoid is not energized, converter oil is directed to the stator piston and low angle is obtained.

REAR SERVO AND ACCUMULATOR ASSEMBLY (Fig. 6-13)

The rear servo and accumulator assembly serves three functions:

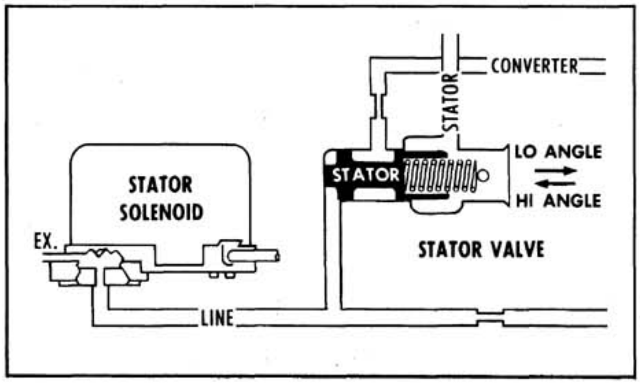


Fig. 6-12 Stator Valve

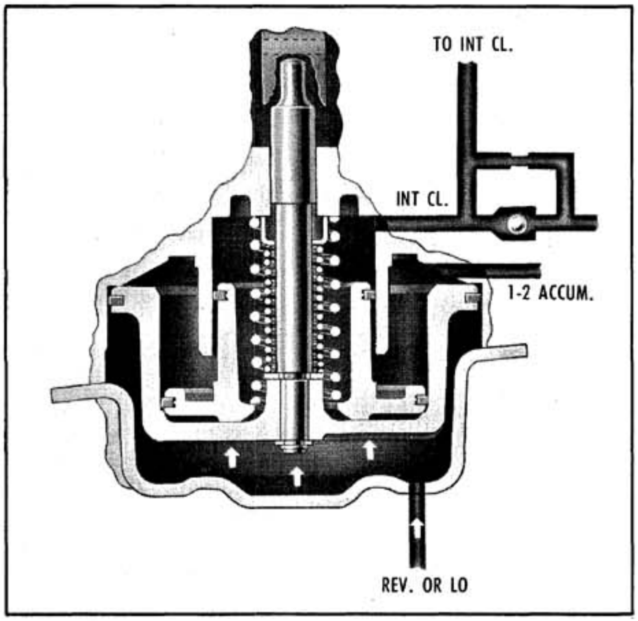


Fig. 6-13 Rear Servo and Accumulator Assembly

1. The band apply piston provides the band apply force to hold the rear band in reverse.
2. The band apply piston provides the band apply force for overrun band apply in low range first gear.

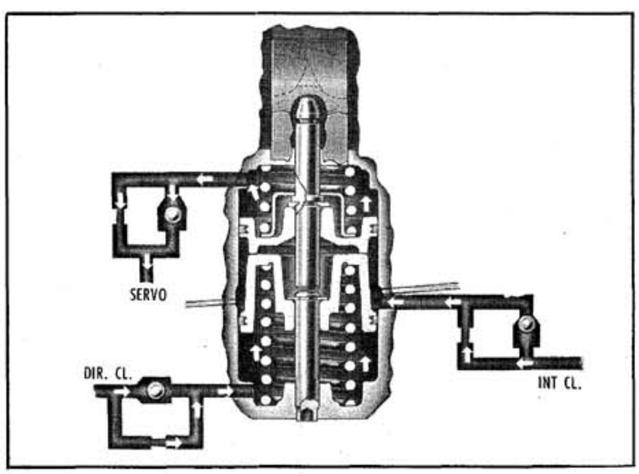


Fig. 6-14 Front Servo

3. The accumulator piston in conjunction with 1-2 accumulator oil provides the accumulator function for the apply of the intermediate clutch.

FRONT SERVO (Fig. 6-14)

The front servo serves two functions:

1. Intermediate clutch oil applies the front servo to apply the front band in second gear, intermediate and low range.

2. During a 2-3 shift, direct clutch oil utilizes the servo and accumulator pistons as the accumulator for direct clutch apply.

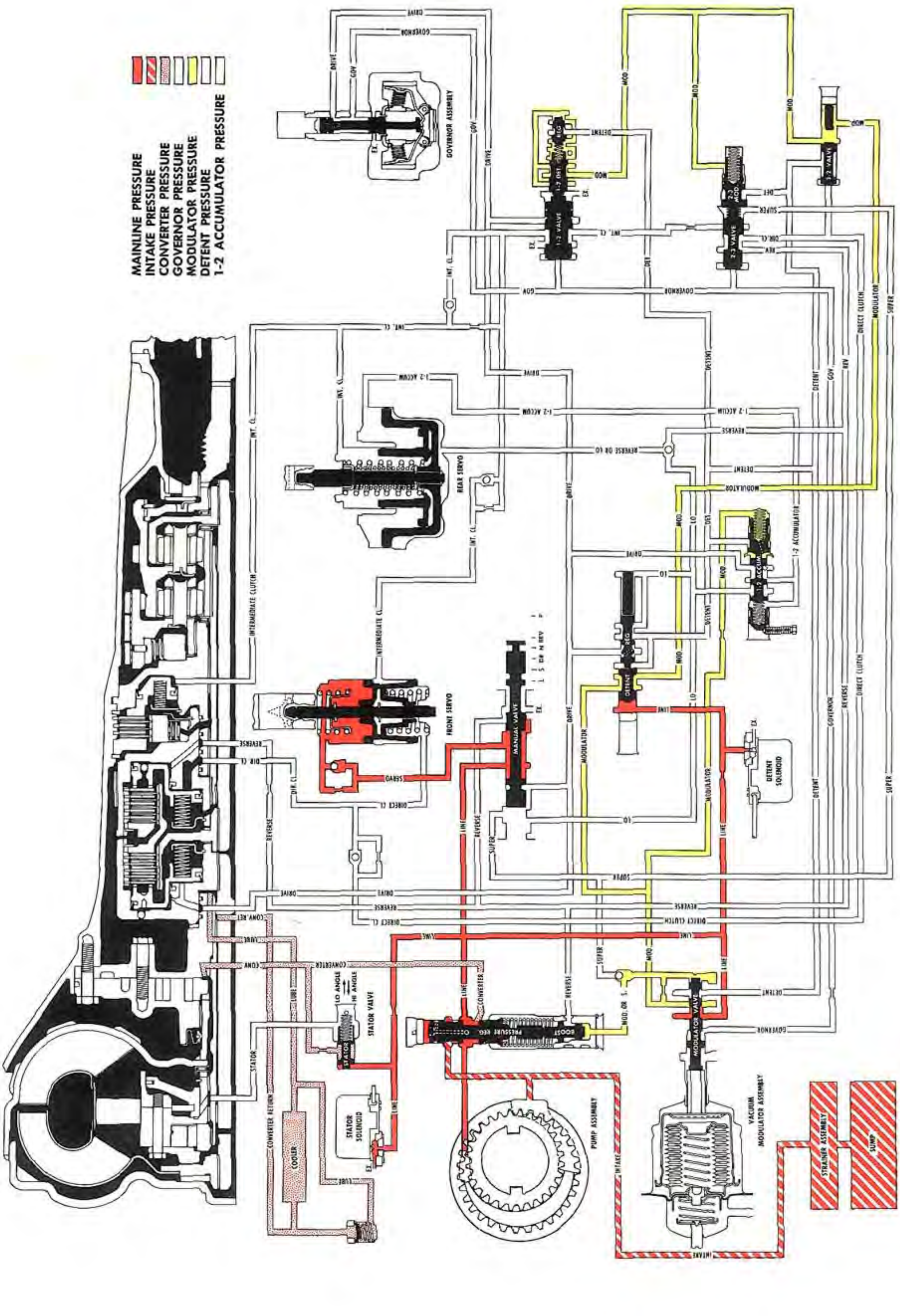


Fig. 6-15 Park or Neutral — Engine Running

OIL FLOW CIRCUIT (Fig. 6-15)

PARK OR NEUTRAL—ENGINE RUNNING

FORWARD CLUTCH - RELEASED
DIRECT CLUTCH - RELEASED

INTERMEDIATE CLUTCH - RELEASED
LO SPRAG - INEFFECTIVE

FRONT BAND - RELEASED
INTERMEDIATE SPRAG - INEFFECTIVE
REAR BAND - RELEASED

Whenever the engine is running at idle with the selector lever in "P" or "N", oil from the pump is directed to the:

1. Pressure Regulator Valve
2. Converter
    a. Oil Cooler
    b. Cooler By-Pass Valve
    c. Lubrication System
    d. Stator Valve
3. Manual Valve
4. Detent Valve
5. Detent Solenoid
6. Vacuum Modulator Valve
7. Front Servo (Neutral only)
8. Stator Solenoid and Valve

COOLING AND LUBRICATION

Oil flows from the pump to the pressure regulator valve which regulates the pump pressure. When the pump output exceeds the demand of line pressure, oil from the pressure regulator is directed to the converter feed passage to fill the converter and is directed to the stator valve. Oil from the converter, termed converter return oil, is directed to the transmission cooler and cooler bypass valve. Oil from the cooler is directed to the transmission lubrication system.

The cooler bypass valve permits oil to be fed directly from the converter to the lubrication circuit if the cooler becomes restricted.

Line pressure acts on the:

1. Manual Valve
2. Detent Valve
3. Detent Solenoid
4. Modulator Valve
5. Stator Valve
6. Stator Solenoid

Line pressure at the modulator valve is regulated to a pressure called modulator oil, which acts on the pressure boost valve, 1-2 accumulator and primary valves, and passes through the detent valve and 3-2 valve to the 1-2 and 2-3 valve trains.

STATOR BLADE ANGLE

Line oil at the stator valve and stator solenoid is exhausted through an orifice at the solenoid, when the solenoid switch is activated. (The switch is activated at idle.) This allows the stator valve spring to move the stator valve, cutting off converter oil and allowing stator oil to exhaust. This places the stator blades at high angle.

SUMMARY

The converter is filled, stator blades are at high angle, and all clutches and bands are released. The transmission is in Neutral.

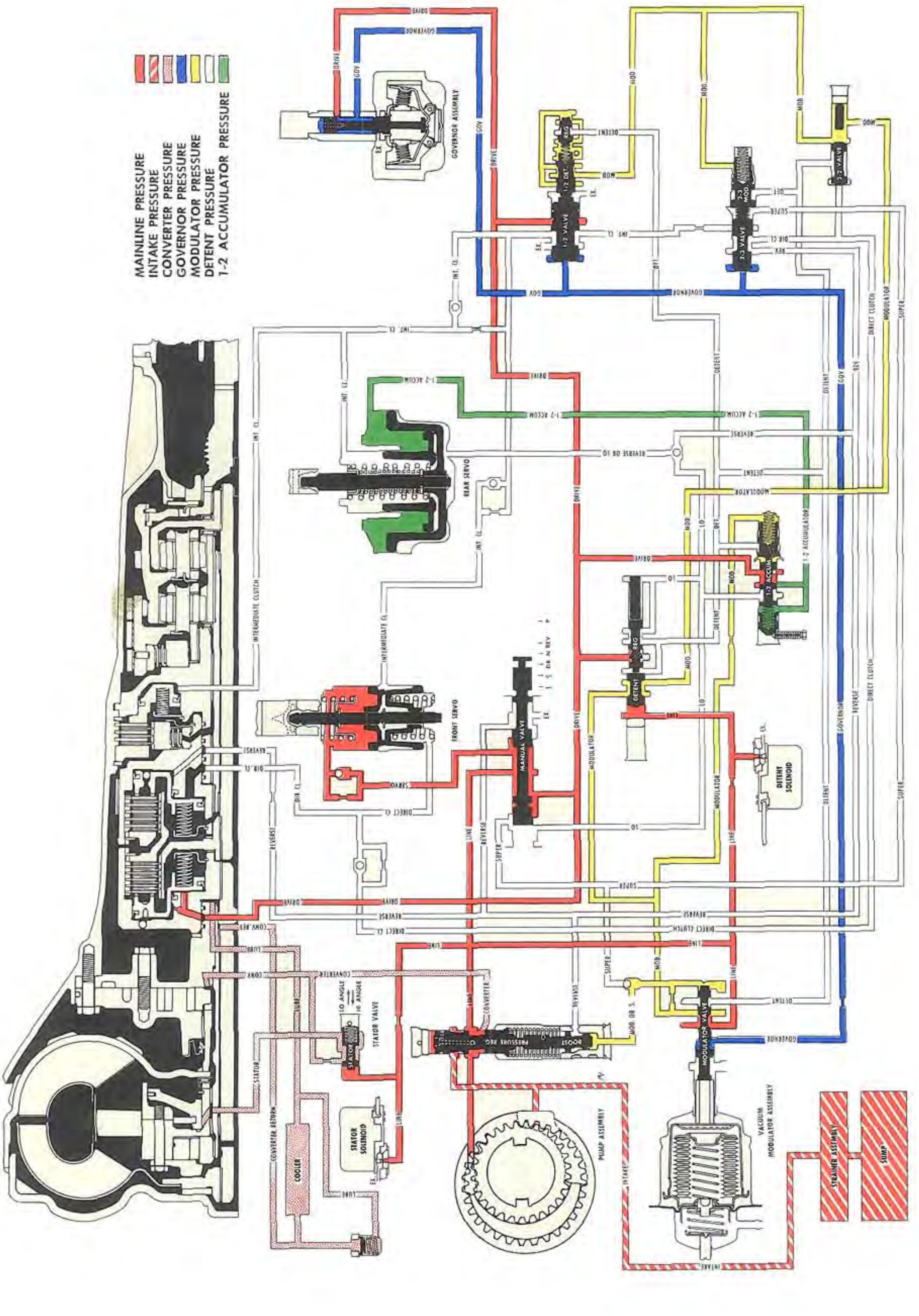


Fig. 6-16 Drive Range — First Speed

OIL FLOW CIRCUIT (Fig. 6-16)

DRIVE RANGE—FIRST SPEED

FORWARD CLUTCH - APPLIED
LOW SPRAG - EFFECTIVE

DIRECT CLUTCH - RELEASED
FRONT BAND - RELEASED

REAR BAND - RELEASED
INTERMEDIATE CLUTCH - RELEASED
INTERMEDIATE SPRAG - INEFFECTIVE

When the selector lever is moved to the "D" position, the manual valve is repositioned to allow line pressure to enter the drive circuit. Drive oil then flows to the:

1. Forward Clutch
2. 1-2 Shift Valve
3. Governor Assembly
4. 1-2 Accumulator Valve
5. Detent Regulator Valve

BASIC CONTROL

Drive oil is directed to the forward clutch where it acts on two areas of the clutch piston to apply the forward clutch. The first, or inner area, is fed through an unrestricted passage. The outer area is fed through an orifice to insure a smooth shift from Park, Neutral and Reverse to Drive.

Drive oil at the governor assembly is regulated to a variable pressure. This pressure, called governor oil, increases with vehicle speed and acts against the ends of the 1-2 and 1-3 shift valves and an area on the modulator valve.

Drive oil is also regulated to another variable pressure at the 1-2 accumulator valve. This pressure, called 1-2 accumulator oil, is controlled by modulator oil which is directed to the rear servo. 1-2 accumulator oil at the rear servo acts on the accumulator piston.

STATOR BLADE ANGLE

When at idle, the stator blades are at high angle. This is also true under heavy throttle operation due to the stator solenoid being activated.

At light or medium throttle, the solenoid is not activated. Line pressure then moves the stator valve against the spring, allowing converter oil to act on the stator piston, which puts the blades at low angle.

SUMMARY

The converter is filled and the stator blades are at high or low angle, depending upon throttle position. The forward clutch is applied. The transmission is in low gear.

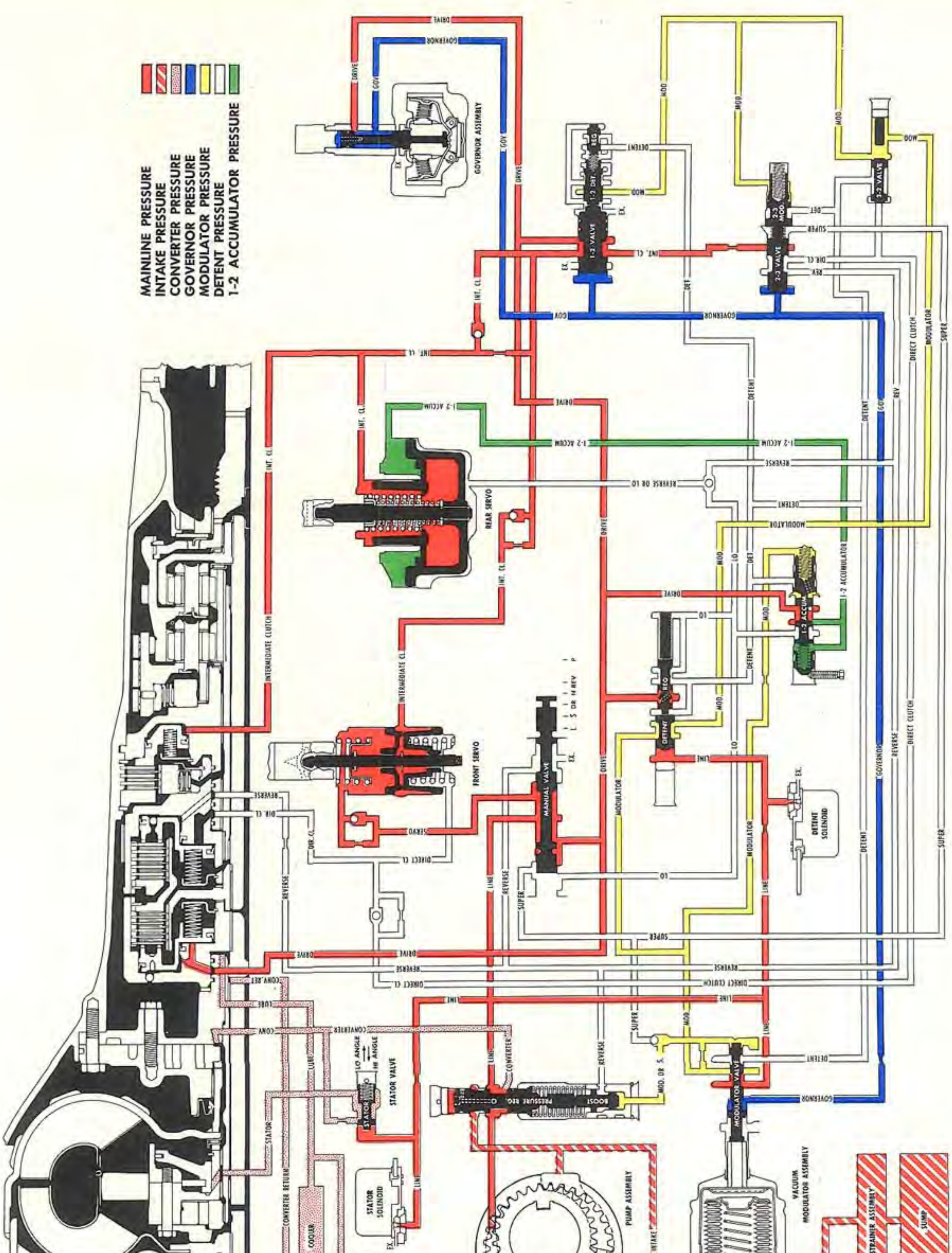


Fig. 6-17 Drive Range — Second Speed

OIL FLOW CIRCUIT (Fig. 6-17)

DRIVE RANGE—SECOND SPEED

FORWARD CLUTCH - APPLIED
LOW SPRAG - INEFFECTIVE

DIRECT CLUTCH - RELEASED
FRONT BAND - RELEASED
REAR BAND - RELEASED

INTERMEDIATE CLUTCH - APPLIED
INTERMEDIATE SPRAG - EFFECTIVE

As both car speed and governor pressure increase, the force of governor oil acting on the 1-2 shift valve will overcome the force of re-regulated modulator oil pressure. This allows the 1-2 shift valve to open, permitting drive oil to enter the intermediate clutch passage. Oil in this passage is called intermediate clutch oil.

Intermediate clutch oil from the 1-2 shift valve is directed to the:

1. Intermediate Clutch
2. Rear Servo
3. Front Servo and Accumulator Pistons
4. 2-3 Shift Valve

BASIC CONTROL

Intermediate clutch oil from the 1-2 shift valve seats a one-way check ball and flows through an orifice to the intermediate clutch piston to apply the intermediate clutch. At the same time, intermediate clutch oil moves the accumulator piston against the 1-2 accumulator oil and accumulator spring to maintain lower pressure in the clutch during a 1-2 shift for a smooth clutch apply. Intermediate clutch oil seats a second one-way check ball and flows to the front servo and accumulator pistons. Intermediate clutch oil is also directed to a land of the 2-3 shift valve.

SUMMARY

The forward and intermediate clutches are applied. The transmission is in second gear.

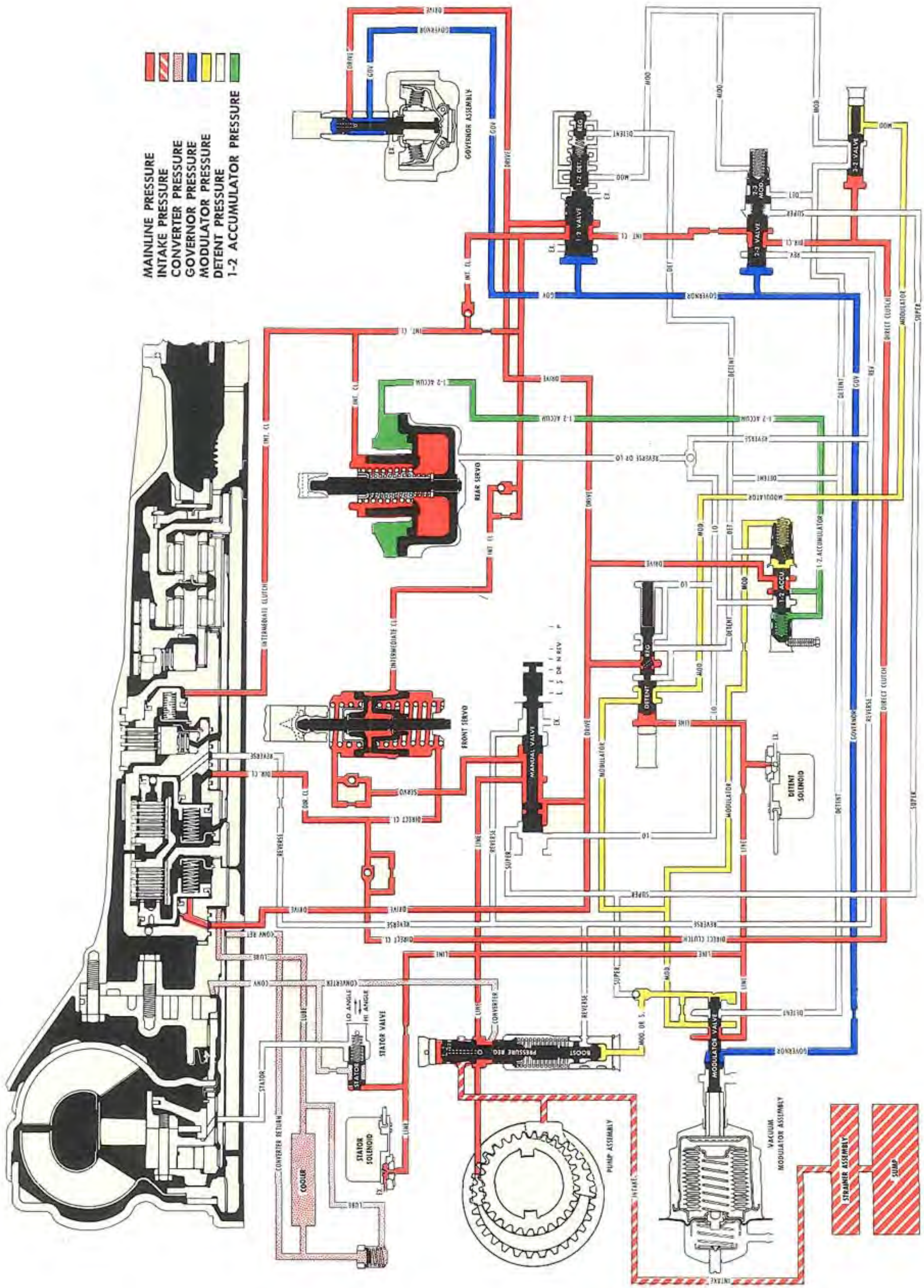


Fig. 6-18 Drive Range — Third Speed

OIL FLOW CIRCUIT (Fig. 6-18)

DRIVE RANGE—THIRD SPEED

FORWARD CLUTCH - APPLIED
LOW SPRAG - INEFFECTIVE

DIRECT CLUTCH - APPLIED
FRONT BAND - RELEASED
REAR BAND - RELEASED

INTERMEDIATE CLUTCH - APPLIED
INTERMEDIATE SPRAG - INEFFECTIVE

As car speed and governor pressure increase, the force of governor oil acting on the 2-3 shift valve overcomes the force of the 2-3 shift valve spring and modulator oil. This allows the 2-3 shift valve to move, feeding intermediate clutch oil to the direct clutch passage. This oil is termed direct clutch oil.

Direct clutch oil from the 2-3 shift valve is directed to the:

1. Direct Clutch

2. Front Accumulator Piston

3. 3-2 Valve

BASIC CONTROL

Direct clutch oil from the 2-3 shift valve flows past a one-way check valve to the inner area of the direct clutch piston to apply the direct clutch. Simultaneously, direct clutch oil is fed to the front accumulator piston. The pressure of the direct clutch oil, combined with the accumulator spring, moves the accumulator and servo pistons against servo oil. This acts as an accumulator for a smooth direct clutch apply.

Direct clutch oil is also supplied to the 3-2 valve to move the valve against modulator pressure. This cuts off modulator oil to the 1-2 regulator and 2-3 modulator valves and allows the transmission to utilize the torque multiplying characteristics of the variable pitch converter.

STATOR BLADE ANGLE

The degree of converter torque multiplication is dependent upon the angle of the stator blades (high or low angle) which is controlled by the stator solenoid. When activated, the line oil acting on the solenoid and stator valve is exhausted at the solenoid. The stator valve spring will move the stator valve, cutting off converter oil to the stator piston. The converter charge pressure will move the stator piston, putting the stator blades at high angle.

SUMMARY

The forward, intermediate and direct clutches are applied. The transmission is in third gear (direct drive).

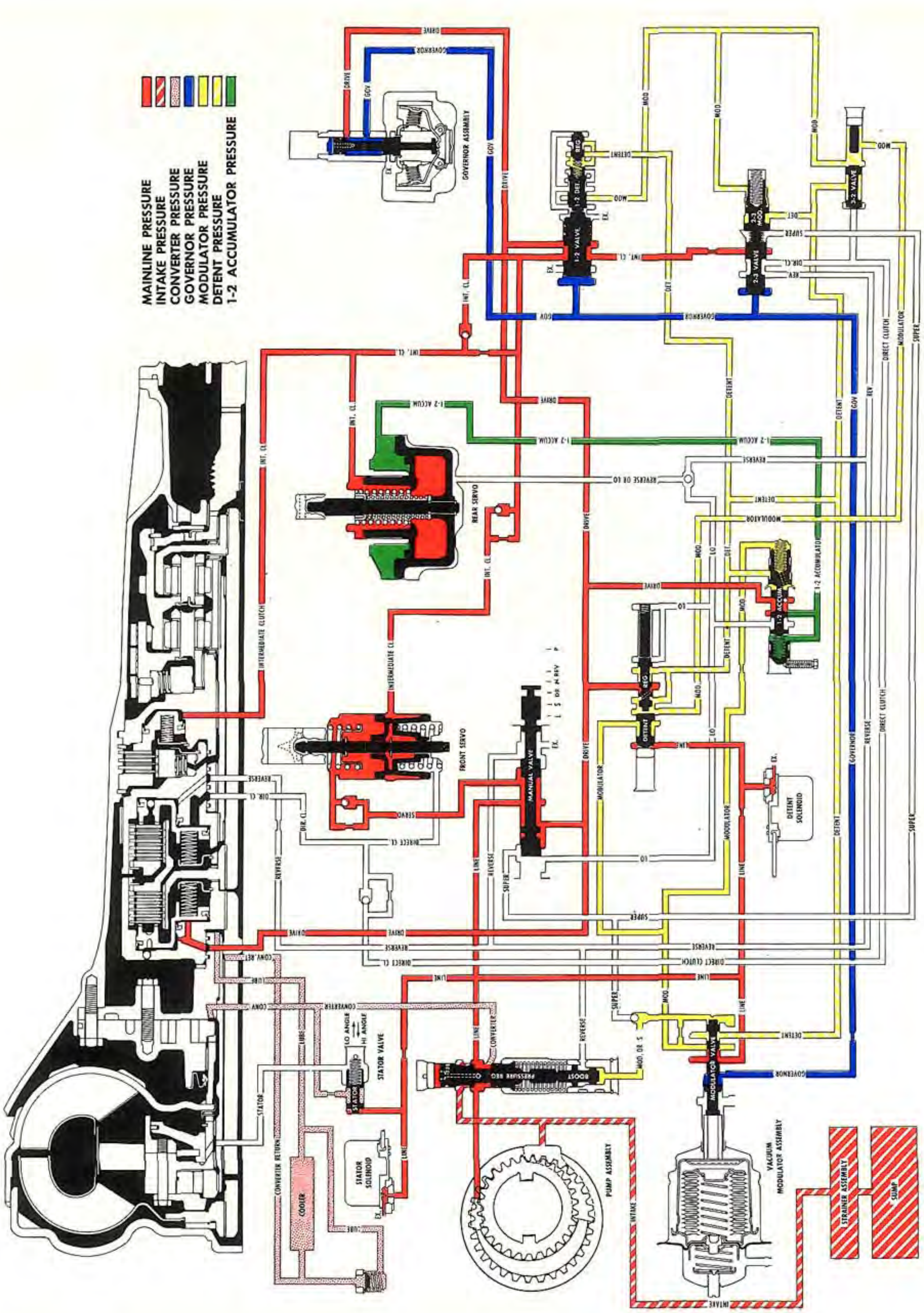


Fig. 6-19 Detent Downshifts

OIL FLOW CIRCUIT (Fig. 6-19)

DETENT DOWNSHIFTS

(Valves in Second Speed Position)

FORWARD CLUTCH - APPLIED
LOW SPRAG - INEFFECTIVE

DIRECT CLUTCH - RELEASED
FRONT BAND - RELEASED
REAR BAND - RELEASED

INTERMEDIATE CLUTCH - APPLIED
INTERMEDIATE SPRAG - EFFECTIVE

While operating at speeds below approximately 70 mph a forced or detent 3-2 downshift is possible by depressing the accelerator fully. This engages an electrically operated switch at the carburetor and actuates the detent solenoid. The detent solenoid opens an orifice that allows line oil at the detent valve to be exhausted, thus permitting the detent regulator valve to operate. Line oil acting on the detent valve and solenoid is supplied by a smaller orifice.

Drive oil on the detent regulator valve is then regulated to a pressure of approximately 70 psi and called detent oil. Detent oil is then routed to the:

1. Modulator Passage
2. 1-2 Regulator Valve
3. 2-3 Modulator Valve
4. 3-2 Valve
5. 1-2 Primary Accumulator Valve
6. Vacuum Modulator Valve

Detent oil in the modulator passage and at the 2-3 modulator valve will close the 2-3 shift valve below approximately 70 mph, shifting the transmission to second gear.

A detent 2-1 downshift can also be accomplished below approximately 20 mph because detent oil is directed to the 1-2 regulator valve, regulating or exhaust port. This allows detent oil to act on the 1-2 regulator and 1-2 detent valve to close the 1-2 shift valve, shifting the transmission to low gear.

To insure clutch durability during 1-2 upshifts under detent conditions, detent oil is directed to the 1-2 accumulator primary valve to increase 1-2 accumulator oil pressure acting on the rear servo accumulator piston.

Detent oil is also directed to the modulator valve to prevent modulator pressure from regulating below 70 psi at high speeds or at high altitudes.

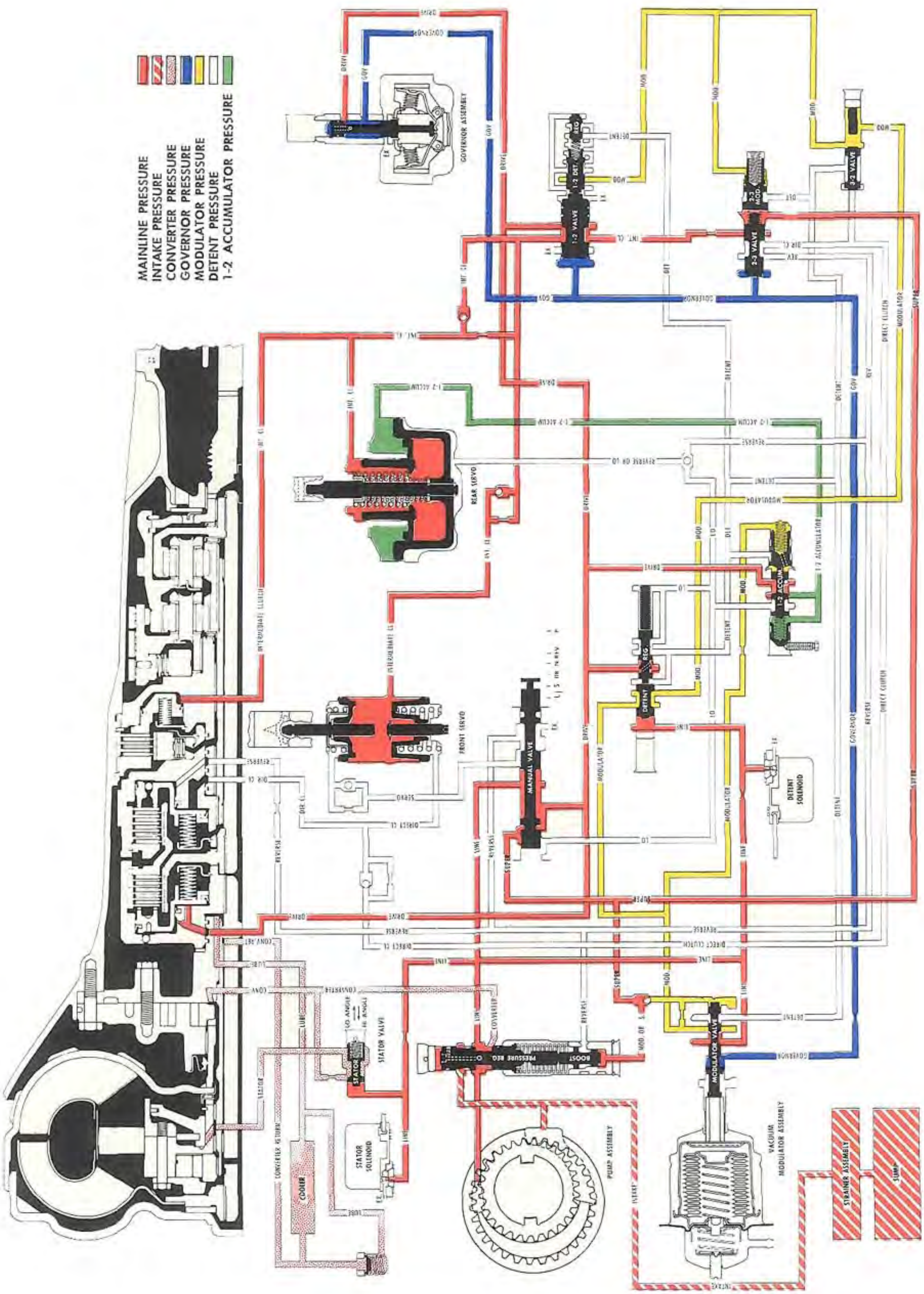


Fig. 6-20 Super Range

OIL FLOW CIRCUIT (Fig. 6-20)

SUPER

(Valves in Second Speed Position)

FORWARD CLUTCH - APPLIED
LOW SPRAG - INEFFECTIVE

DIRECT CLUTCH - RELEASED
FRONT BAND - APPLIED
REAR BAND - RELEASED

INTERMEDIATE CLUTCH - APPLIED
INTERMEDIATE SPRAG - EFFECTIVE

A 3-2 downshift can be accomplished by moving the selector lever from Drive to Super Range. When the selector lever is in "S", intermediate oil from the manual valve is directed to the:

1. Pressure Boost Valve

2. 2-3 Shift Valve

Intermediate oil at the boost valve will increase line pressure to 150 psi. This increased intermediate oil pressure at the 2-3 shift valve will close the 2-3 shift valve, regardless of car speed.

For engine braking the front band is applied by exhausting servo oil at the manual valve in Super range. This allows intermediate clutch oil, acting on the servo piston, to move the piston and apply the front band. Once the transmission is in second speed - Super range, it cannot upshift to third gear regardless of car speed.

SUMMARY

The forward and intermediate clutches and front band are applied. The transmission is in second gear - Super Range.

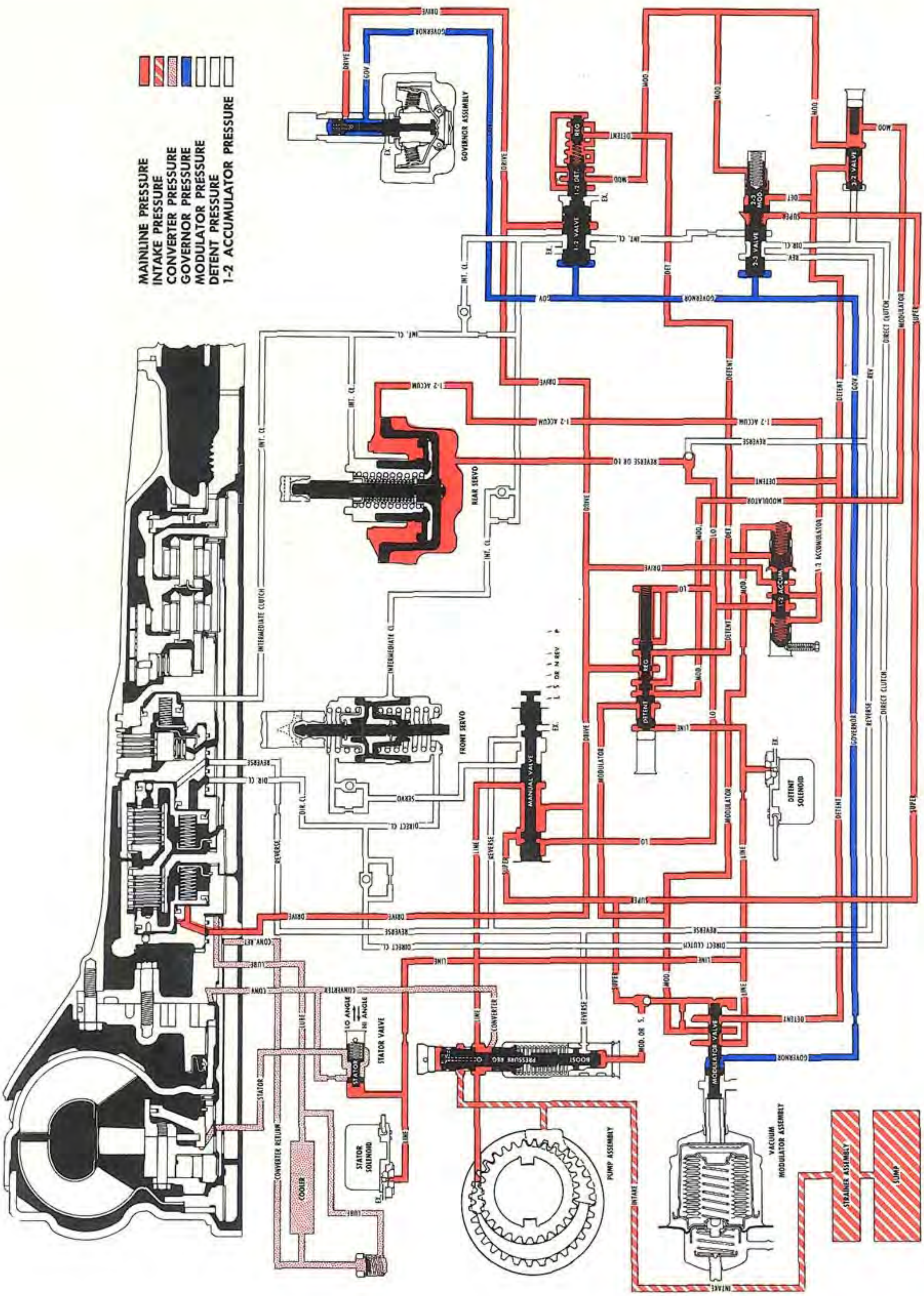


Fig. 6-21 Low Range — First Speed

OIL FLOW CIRCUIT (Fig. 6-21)

LOW RANGE—FIRST SPEED

(Valves in First Speed Position)

FORWARD CLUTCH - APPLIED
LOW SPRAG - EFFECTIVE

DIRECT CLUTCH - RELEASED
FRONT BAND - RELEASED
REAR BAND - APPLIED

INTERMEDIATE CLUTCH - RELEASED
INTERMEDIATE SPRAG - INEFFECTIVE

Maximum downhill braking can be attained at speeds below 40 mph with the selector lever in "L" position as this directs low oil from the manual valve to the:

1. Rear Servo
2. 1-2 Accumulator Valve
3. Detent Regulator Valve

BASIC CONTROL

Low oil flows past a ball check to the apply side of the rear servo piston and to the 1-2 accumulator valve to raise the 1-2 accumulator oil to line pressure for a smooth band apply.

Low oil acts on the detent regulator valve. Combined with the detent spring, low oil holds the detent valve against line oil acting on the detent valve, causing drive oil to flow through the detent regulator valve into the detent and modulator passages. Modulator and detent oil at line pressure acting on the 1-2 regulator and 1-2 detent valve overcomes governor oil on the 1-2 shift valve at any vehicle speed below approximately 40 mph and the transmission will shift to low gear.

With the transmission in first speed - Low Range, the transmission cannot upshift to second speed regardless of car or engine speed.

SUMMARY

The forward clutch and rear band are applied. The transmission is in first speed - Low Range.

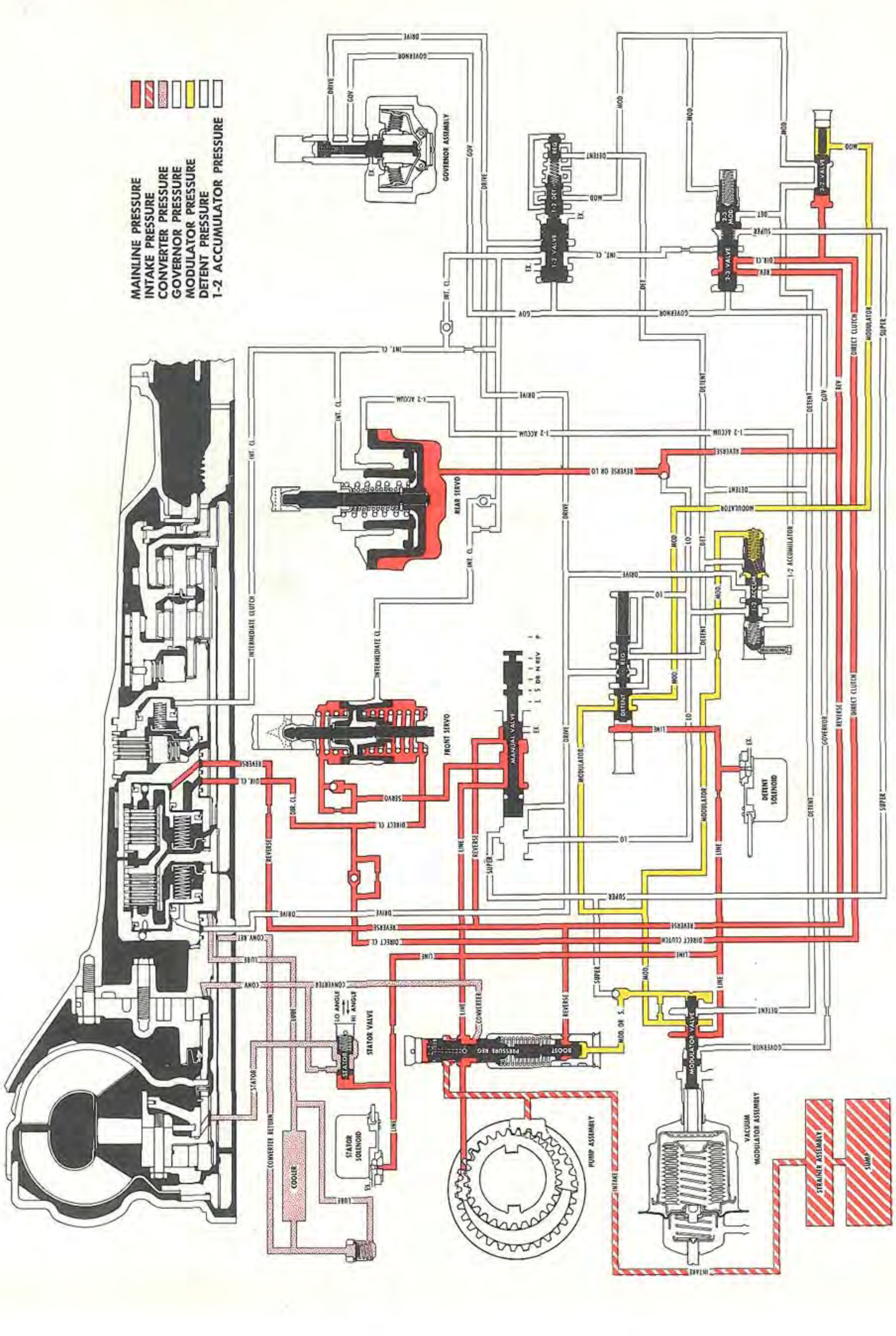


Fig. 6-22 Reverse

OIL FLOW CIRCUIT (Fig. 6-22)

REVERSE

FORWARD CLUTCH - RELEASED
LOW SPRAG - INEFFECTIVE

DIRECT CLUTCH - APPLIED
FRONT BAND - RELEASED
REAR BAND - APPLIED

INTERMEDIATE CLUTCH - RELEASED
INTERMEDIATE SPRAG - INEFFECTIVE

When the selector lever is moved to the "R" position, the manual valve is repositioned to allow line pressure to enter the reverse circuit. Reverse oil then flows to the:

1. Direct Clutch
2. 2-3 Shift Valve
3. Rear Servo Piston
4. Pressure Boost Valve

BASIC CONTROL

Reverse oil from the manual valve flows to the large area of the direct clutch piston and to the 2-3 shift valve. From the 2-3 shift valve, it enters the direct clutch passage and is directed to the small area of the direct clutch piston to apply the direct clutch.

Reverse oil flows to the rear servo and acts on the servo piston to apply the rear band. Reverse oil also acts on the pressure boost valve to boost line pressure.

SUMMARY

The direct clutch and the rear band are applied. The transmission is in reverse.

OPERATIONS NOT REQUIRING REMOVAL OF TRANSMISSION

Some of the parts and/or units can be removed from the transmission without removing the transmission assembly from the car. The procedures for such operations are not specifically outlined; however, the basic procedure and specifications as outlined under DISASSEMBLY OF THE TRANSMISSION and ASSEMBLY OF THE TRANSMISSION will apply.

UNITS OR PARTS THAT CAN BE READILY REMOVED FROM THE TRANSMISSION ARE:

Oil Pan and Gasket
Rear Bearing Retainer and/or Seal
Governor
Vacuum Modulator and Modulator Valve

UNITS OR PARTS THAT CAN BE REMOVED AFTER OIL PAN REMOVAL ARE:

Valve Body
Rear Servo and Accumulator
Front Servo and Accumulator
Governor Pipes
Detent Solenoid
Manual Linkage
Parking Linkage
Detent Spring and Roller Assembly
Pressure Regulator Valve
Solenoid Connector
Valve Spacer and Gaskets
Check Balls-Refer to Fig. 6-254 for correct location of check balls on spacer plate.

TRANSMISSION REMOVAL

1. Remove flywheel cover.

2. Remove torque converter attaching bolts.

   NOTE: Mark flywheel and converter so they can be installed in the same position.

3. Install Engine Support Bar BT-30-16. (Fig. 6-23).

4. Disconnect solenoid wires and manual shift linkage at side of transmission.

5. Disconnect oil cooler lines, vacuum modulator line and filler pipe.

6. Disconnect parking brake cable.

7. Remove propeller shaft assembly.

   NOTE: Scribe marks on drive shaft and companion flange for correct assembly.

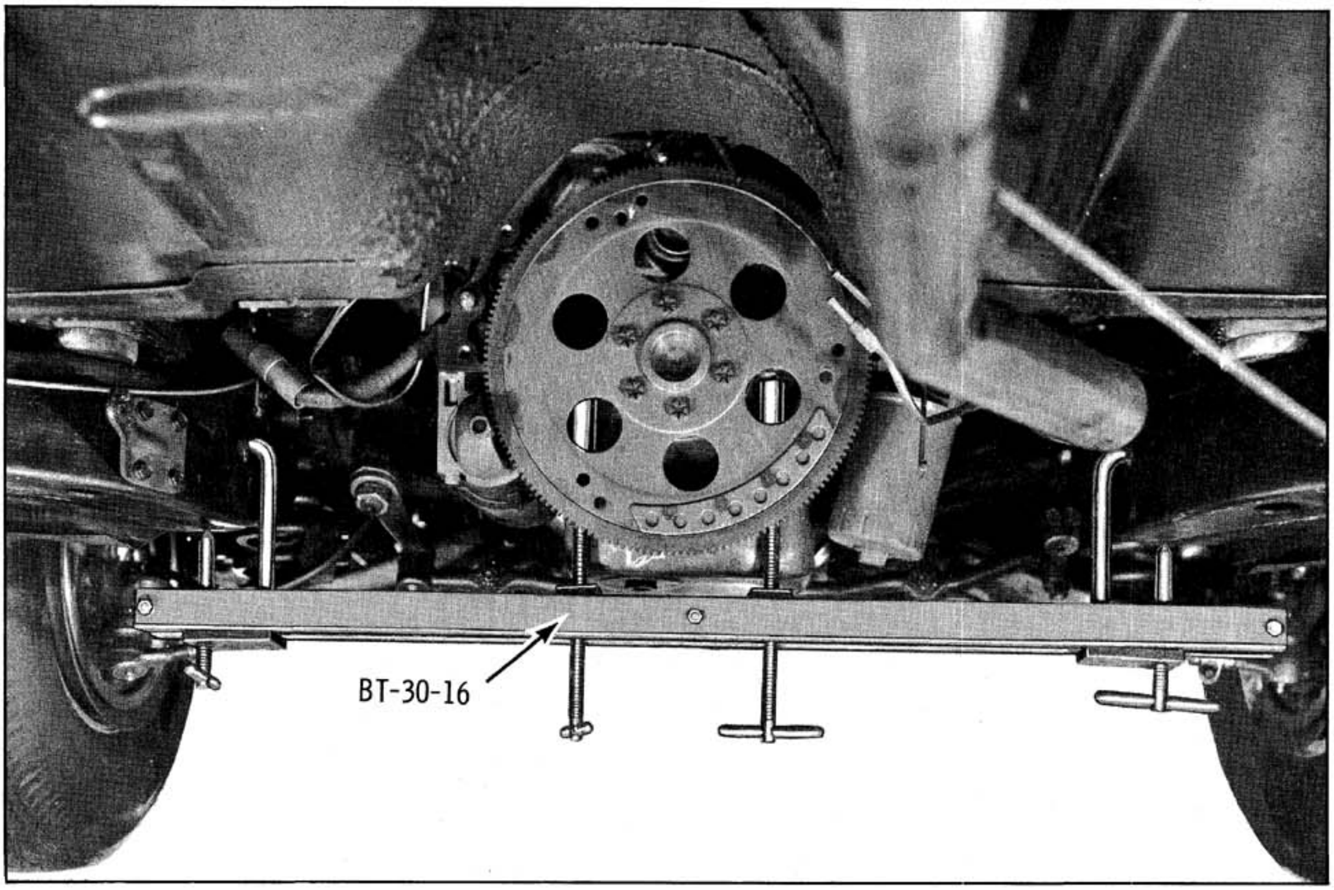


Fig. 6-23 Engine Support Bar

8. Disconnect exhaust pipe bracket at rear of crossmember.

9. Position transmission jack under transmission.

10. Remove crossmember.

11. Remove transmission to block attaching bolts.

12. Move transmission away from engine and install Tool J-21364 to hold converter in place. (Fig. 6-253)

13. Lower transmission and remove from car. (Fig. 6-24)

TRANSMISSION INSTALLATION

To install, reverse the removal procedure and include the following:

After transmission is installed, add four quarts of Hydra-Matic fluid if pan was removed. Set parking brake, place selector lever in "Park" position and start engine. Add enough fluid to bring level to the "Full" mark on the oil level indicator. Allow fluid to reach operating temperature and recheck fluid level.

NOTE: Transmission capacity: approximately four quarts (for oil change, pan removed). Approximately nine quarts (after complete overhaul).

Adjust manual control linkage.

MINOR SERVICE OPERATIONS

SERVICING THE OIL COOLER

The oil cooler is located in the side tank of the radiator and its purpose is to cool the oil in the event excessive temperature tends to develop. (Fig. 6-25)

In a major transmission failure, where particles of metal have been carried with the oil throughout the units of the transmission, it will be necessary to flush out the oil cooler and connecting lines. The oil cooler is a sealed container providing a passage for oil to flow from the inlet to the outlet. Clean solvent can be flushed through the cooler with air pressure. (An engine desludge gun may be used.) The cooler should be back-flushed first through the return line to remove all foreign material possible. Then flush through the inlet line and finish by flushing through the return line. Clean remaining solvent from cooler with compressed air applied to the return line and flush with Hydra-Matic oil.

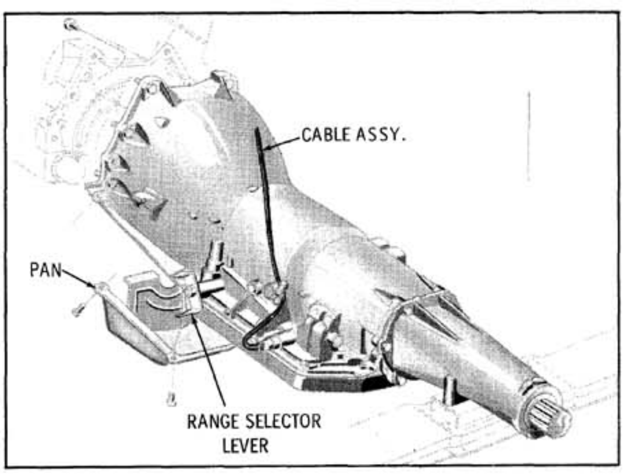


Fig. 6-24 Transmission Removal

THROTTLE LINKAGE ADJUSTMENTS (Refer to Engine Tune-Up, Section 5)

MANUAL LEVER ADJUSTMENT (WITHOUT CONSOLE)

The manual lever adjustment provides proper clearance between the "D" detent in the transmission and the stop for the manual shift lever in the upper steering column mast jacket. The adjustment is made as outlined in Fig. 6-26.

CONSOLE SHIFT LINKAGE

For linkage removal, refer to Fig. 6-27. To remove the shift lever or bracket assembly, the console must be removed.

MANUAL LEVER ADJUSTMENT (WITH CONSOLE)

The manual lever adjustment provides for proper clearance between the "D" detent in the transmission and the "D" stop for the selector lever in the console.

1. Place the selector lever in the "D" position.

2. Disconnect the manual rod from the transmission manual lever.

3. Place the transmission manual lever in the "D" detent position.

4. Loosen locknut on manual rod. With selector lever held against its stop in the "D" position and the transmission manual lever in the "D" detent position, adjust the manual rod until the manual rod enters the transmission manual lever.

5. Shorten manual rod three turns and check adjustment. Readjust if necessary.

6. Connect manual rod to transmission manual lever and install washer and cotter pin. Tighten locknut on manual rod.

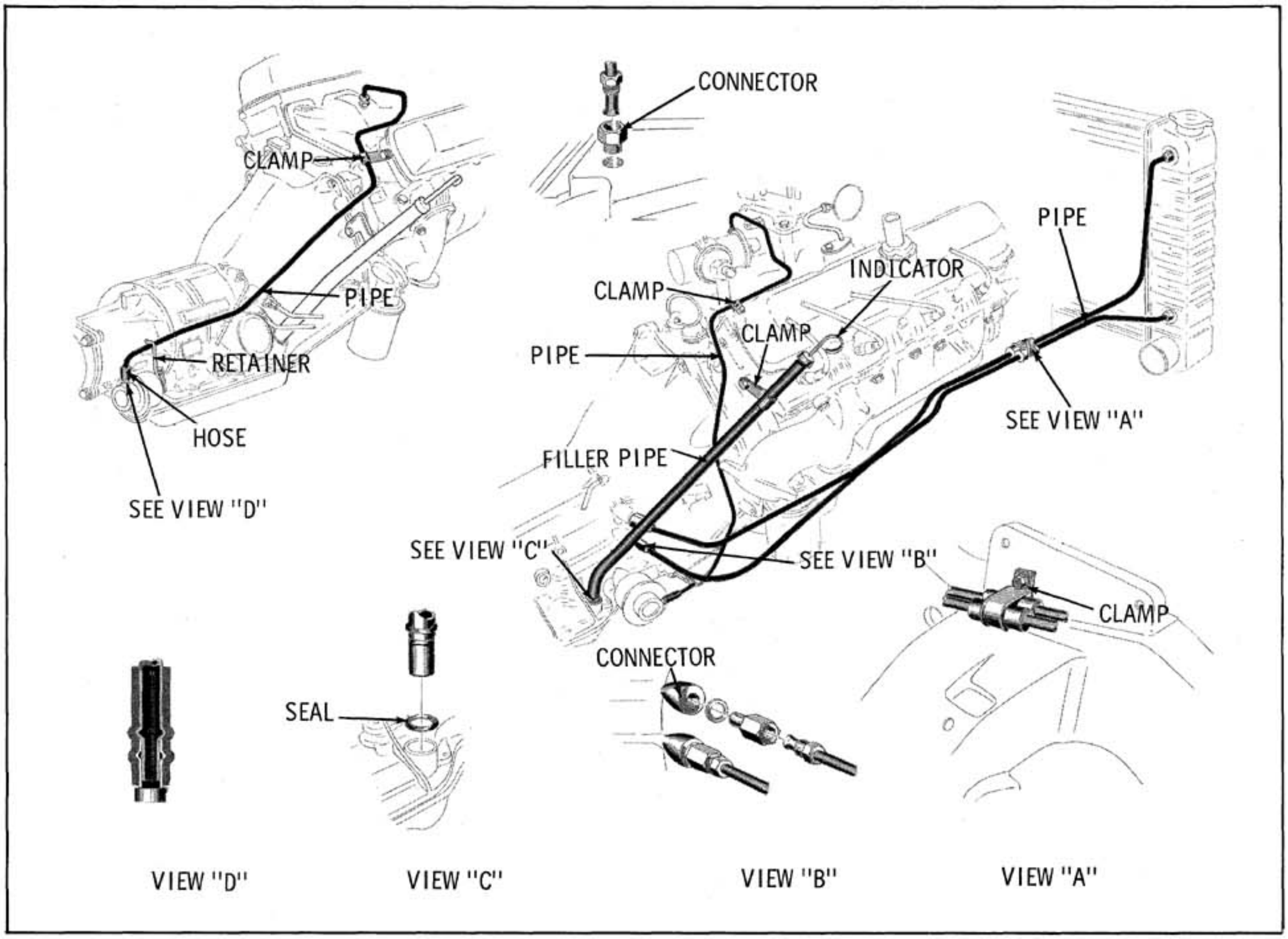


Fig. 6-25 Oil Cooler Lines

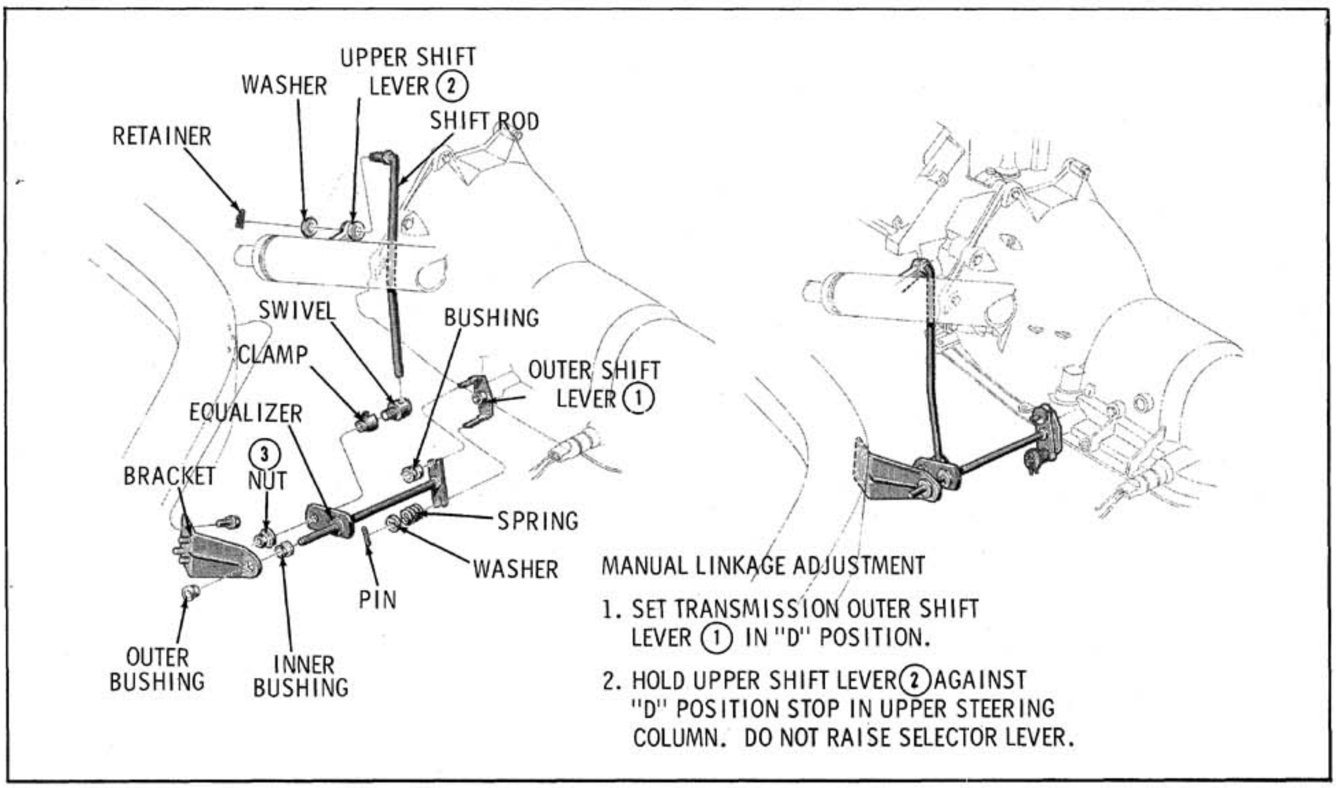


Fig. 6-26 Manual Linkage Adjustments (Column Shift)

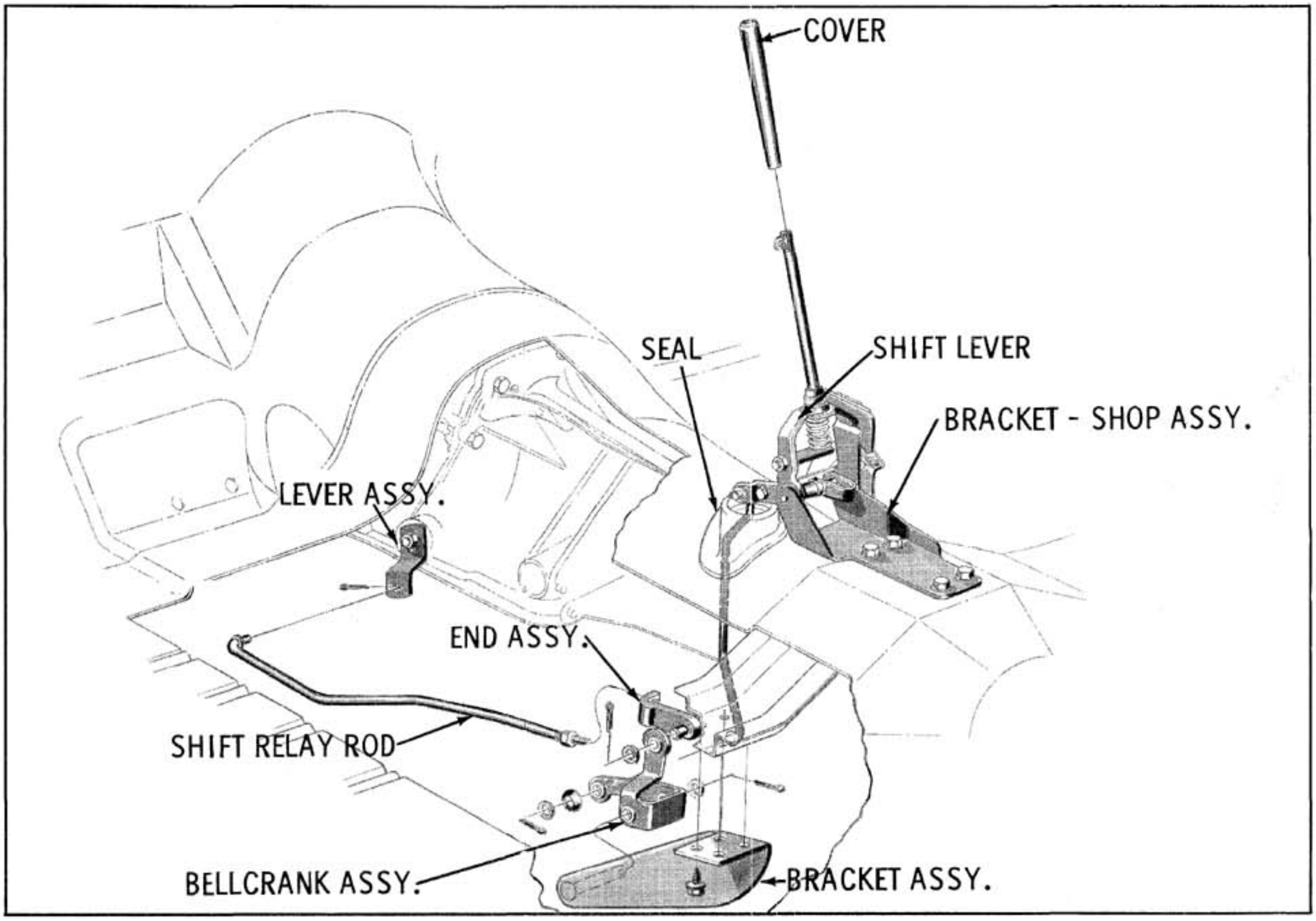


Fig. 6-27 Shift Linkage (Console Equipped)

GENERAL SERVICE PRECAUTIONS

When servicing the transmission, it is recommended that upon disassembly of a unit, all parts should be cleaned and inspected as outlined under CLEANING AND INSPECTION, then the unit should be reassembled before disassembly of other units to avoid confusion and interchanging of parts.

1. Before disassembly of the unit, thoroughly clean the exterior.

2. Disassembly and reassembly of the unit and the sub-assemblies must be made on a clean work bench. As in repairing any hydraulically operated unit, cleanliness is of the utmost importance; therefore, the bench, tools, and parts must be kept clean at all times.

3. Before installing cap screws into aluminum parts, ALWAYS DIP SCREWS INTO HYDRA-MATIC OIL to prevent cap screws from galling the aluminum threads and also to prevent the screws from seizing.

4. Always use a torque wrench when installing cap screws into aluminum parts to prevent the possibility of stripping the threads.

5. If taped threads in aluminum parts are stripped or damaged, the part can be made serviceable by the use of Heli-Coils.

6. Seal protecting tools must be used when assembling the units to prevent damage to the seals. The slightest flaw in the sealing surface of the seal can cause an oil leak.

7. The aluminum castings and the valve parts are very susceptible to nicks, burrs, etc., and care should be exercised while handling them.

8. The internal snap rings should be expanded and the external snap rings compressed if they are to be reused. This will insure proper seating when installed. DO NOT REUSE TRU-ARC SNAP RINGS.

9. Replace all "O" rings, gaskets and oil seals that are removed.

10. During assembly of each unit, all internal parts must be lubricated with Hydra-Matic oil.

PARTS CLEANING AND INSPECTION

After complete disassembly of a unit, all metal parts should be washed in a clean solvent and dried with compressed air. All oil passages should be blown out and checked to make sure that they are not obstructed. Small passages, should be checked with tag wire. All parts should be inspected to determine which parts are to be replaced.

The various inspections of parts are as follows:

1. Inspect linkage and pivot points for excessive wear.
2. Bearing and thrust surfaces of all parts should be checked for excessive wear and scoring.
3. Check for broken seal rings, damaged ring lands and damaged threads.
4. Inspect seals and "O" rings.
5. Mating surfaces of castings and end plates should be checked for burrs and irregularities. If a good seal is not apparent, burrs and irregularities may be removed by lapping the surface with crocus cloth. The crocus cloth should be held on a flat surface, such as a piece of plate glass.
6. Castings should be checked for cracks and sand holes.
7. Gear teeth should be checked for chipping, scoring, and excessive wear.
8. Valves should be free of burrs and the shoulders of the valves must be square. Any burrs or irregularities may be removed by honing. Valves should be free to slide in their respective bores.
9. Inspect composition clutch plates for damaged surfaces and loose facings. If flakes of facing material can be removed with the thumbnail, the plates should be replaced; however, composition plate discoloration is not an indication of failure.
10. Inspect steel clutch plates for scored surfaces.
11. Inspect springs for distortion or collapsed coils. Slight wear (bright spots) on the sides of the springs is permissible.
12. When inspecting bushings, fit the mating part into the bushing and observe the amount of looseness. Bushing clearance is excessive if more than .008" exists when checked with a wire feeler gauge.
13. If the transmission shows evidence that foreign material has circulated throughout the transmission or if the oil cleaner is dirty, the oil cleaner should be discarded and a new one installed upon assembly of the transmission.

TRANSMISSION DISASSEMBLY

CONVERTER AND MODULATOR

Remove

1. With transmission in cradle on portable jack, remove the converter assembly by pulling straight out.

   NOTE: The converter contains a large amount of oil.

2. Install Holding Fixture J-8763 on the transmission so that the modulator assembly will be located on the side of the holding fixture that is nearest the bench.

   NOTE: Do not overtorque holding screw.

3. Install Fixture and transmission into Holding Tool Base J-3289-20 with bottom pan facing up. (Fig. 6-28)
4. Remove modulator assembly attaching bolts and retainer. (Fig. 6-29)
5. Remove modulator assembly and "O" ring seal from case. (Fig. 6-30)
6. Remove modulator valve from transmission case.

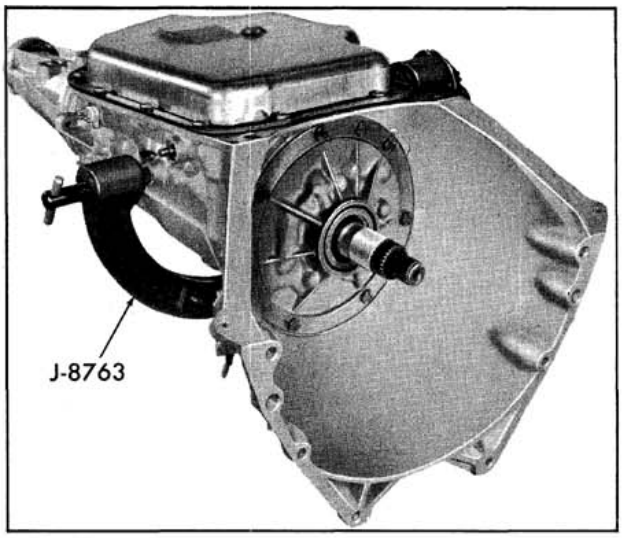


Fig. 6-28 Transmission in Holding Fixture

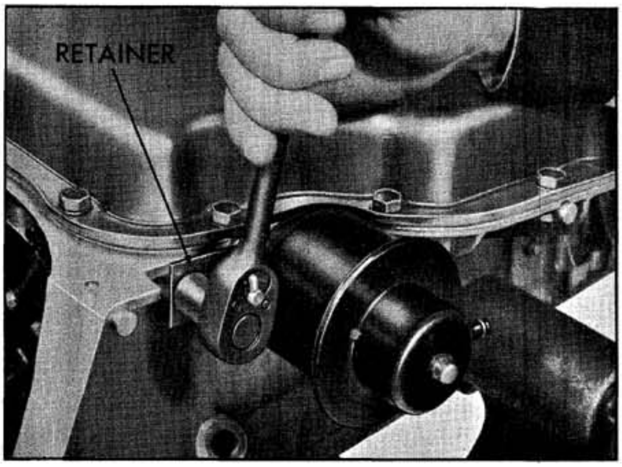


Fig. 6-29 Removing Modulator Retaining Bolt

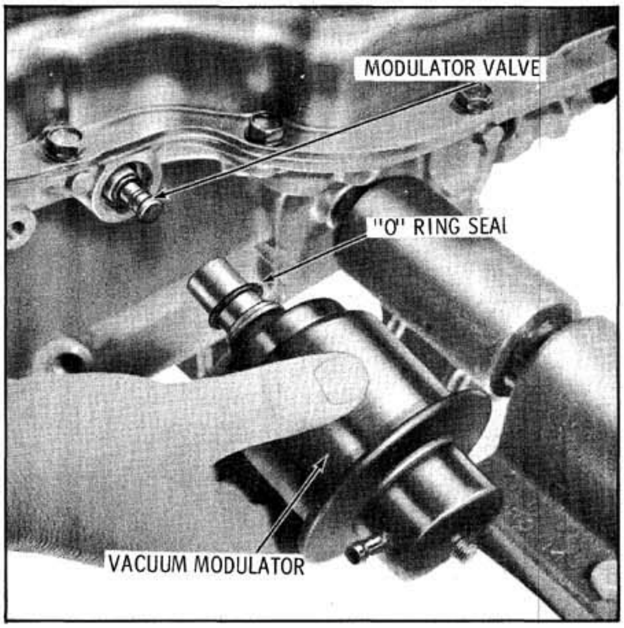


Fig. 6-30 Removing Modulator and Valve

GOVERNOR, PAN, STRAINER AND INTAKE PIPE

Removal

1. Remove attaching bolts, governor cover and gasket. (Fig. 6-31)
2. Withdraw governor assembly from case. (Fig. 6-32)
3. Remove pan attaching bolts.
4. Remove pan and gasket. (Fig. 6-33)
5. Remove the strainer assembly. (Fig. 6-34)
6. Remove the intake pipe to case "O" ring seal from the strainer assembly or case.

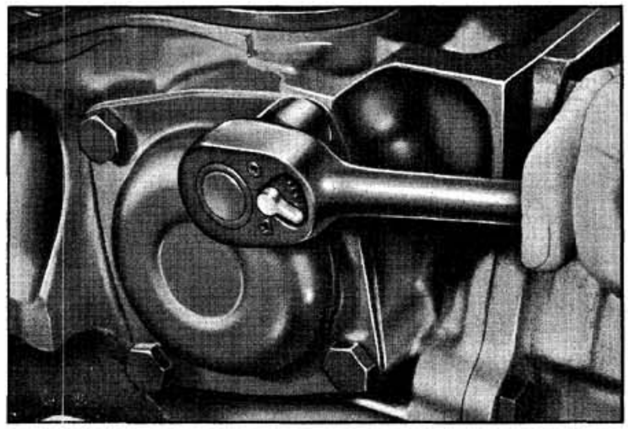


Fig. 6-31 Removing Governor Cover

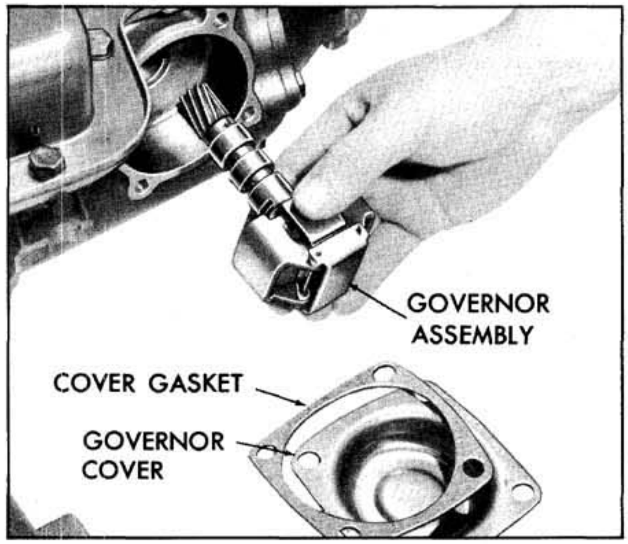


Fig. 6-32 Removing Governor

CONTROL VALVE ASSEMBLY, GOVERNOR PIPES AND DETENT SPRING ASSEMBLY

Removal

1. Remove the control valve body attaching bolts, detent roller spring assembly and clips. (Fig. 6-35)

   NOTE: Leave clips attached to wire and do not remove solenoid attaching screws.

2. Remove the control valve body assembly and governor pipes. (Fig. 6-36)

   NOTE: Do not allow manual valve to fall out of control valve assembly.

3. Remove the governor pipes from control valve assembly. (Fig. 6-37)
4. Remove the control valve assembly to spacer gasket. (Fig. 6-38)
5. Disconnect connector from case connector (Fig. 6-39)

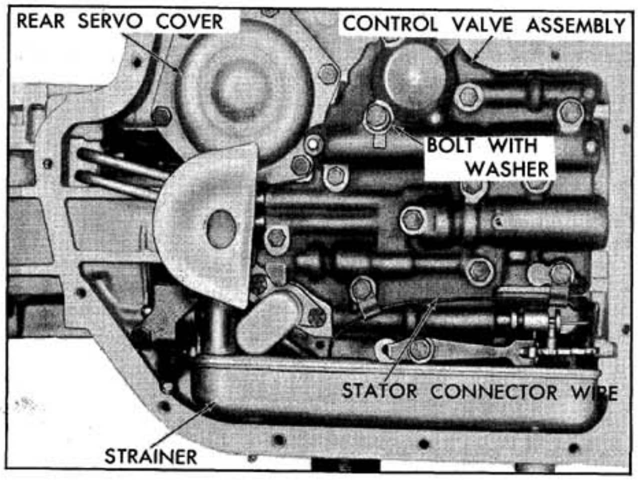


Fig. 6-33 Pan Removed

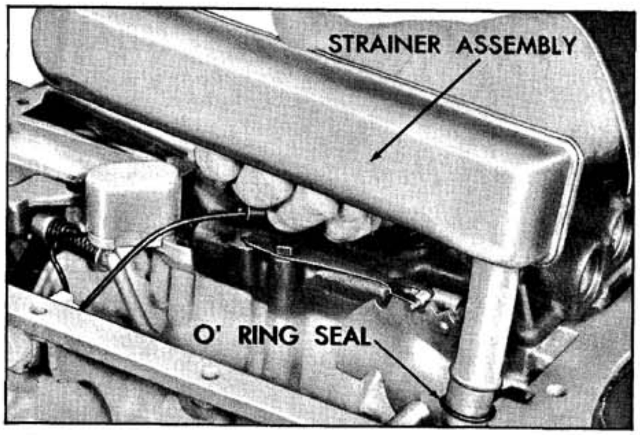


Fig. 6-34 Removing Strainer Assembly

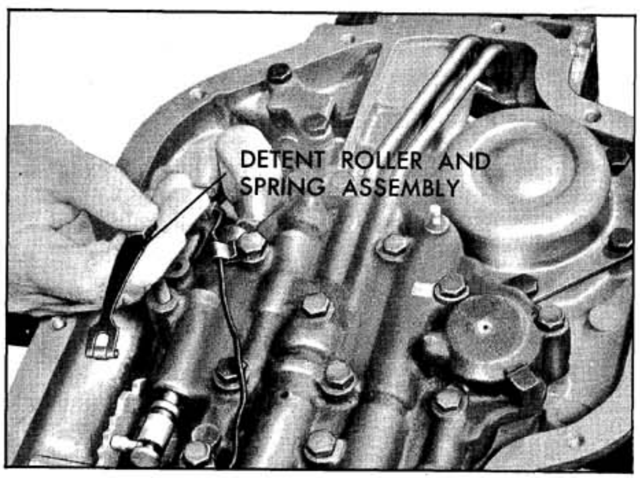


Fig. 6-35 Removing Detent Roller and Spring Assembly

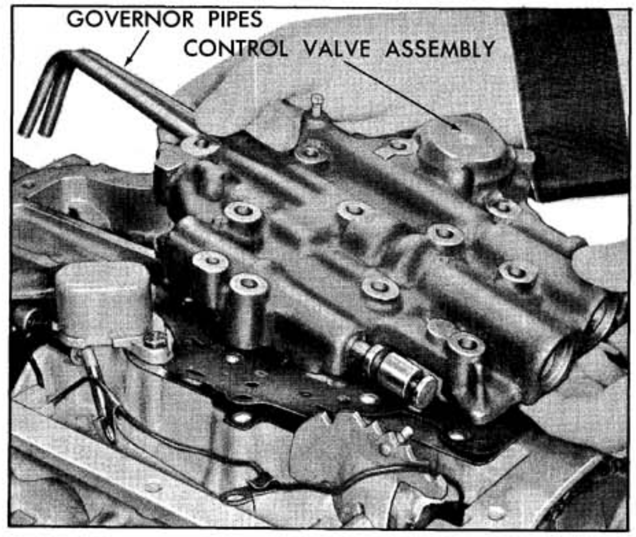


Fig. 6-36 Removing Control Valve Assembly

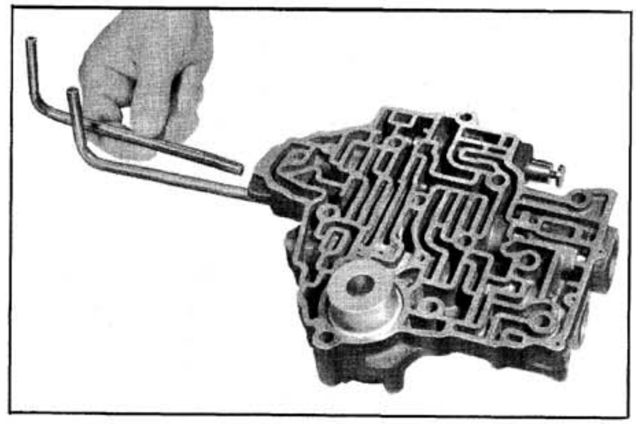


Fig. 6-37 Removing Governor Pipes

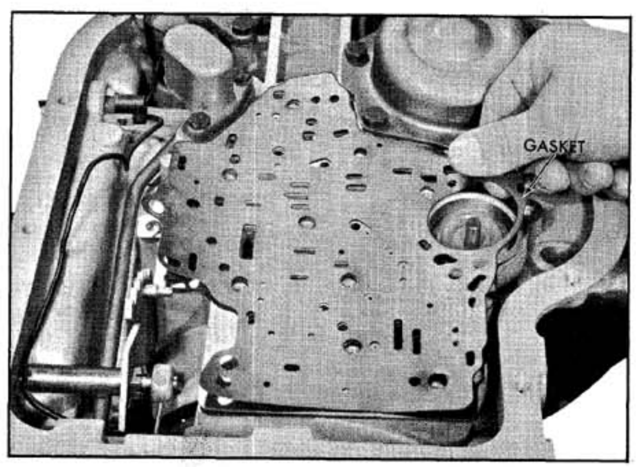


Fig. 6-38 Removing Spacer Gasket

6. Disconnect detent terminal from stator connector. (Fig. 6-40)

NOTE: Do not remove stator electric wire (long) from stator connector.

REAR SERVO, VALVE BODY SPACER, GASKET AND FRONT SERVO

Removal

1. Remove the rear servo cover attaching

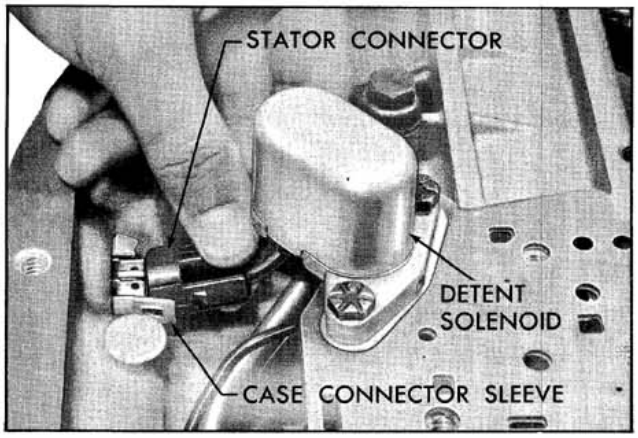


Fig. 6-39 Disconnecting Electrical Connector From Case Connector

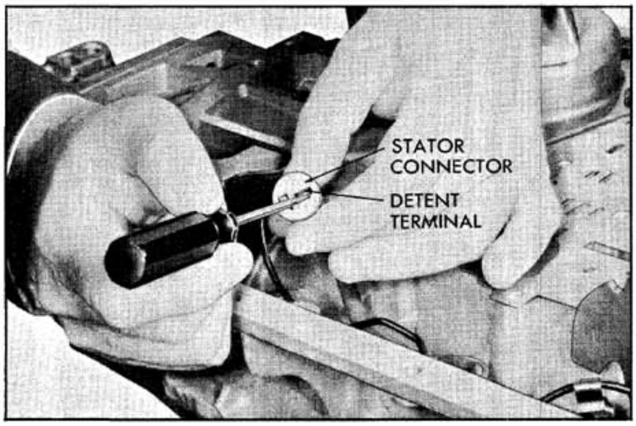


Fig. 6-40 Disconnecting Detent Terminal From Connector

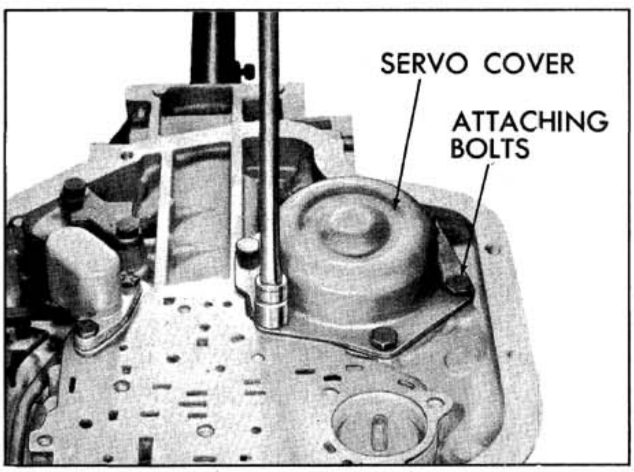


Fig. 6-41 Removing Rear Servo Cover Attaching Bolts

screws, the servo cover and gasket. Discard gasket. (Figs. 6-41 and 6-42)

2. Remove the rear servo assembly from the case. (Fig. 6-43)

3. Remove rear servo accumulator spring. (Fig. 6-44)

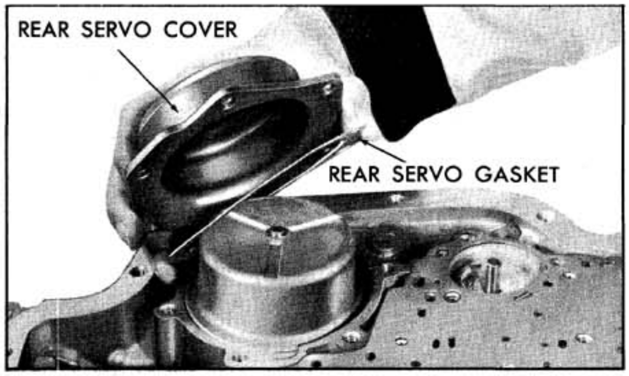


Fig. 6-42 Removing Servo Cover and Gasket

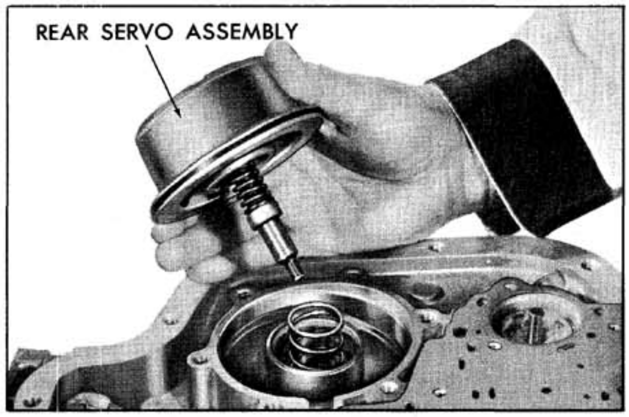


Fig. 6-43 Removing Rear Servo From Case

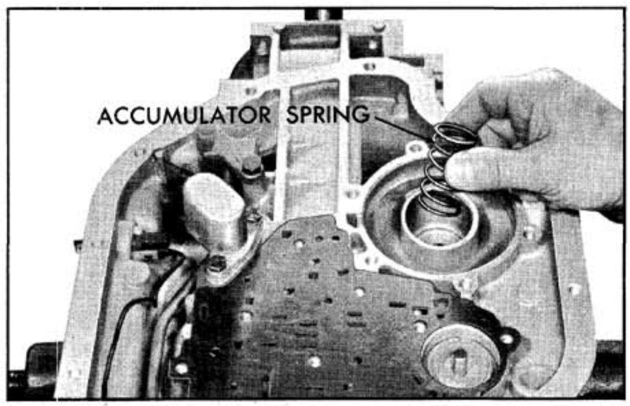


Fig. 6-44 Removing Rear Accumulator Spring

4. Make band apply pin selection check. (Fig. 6-45)

Band Apply Pin Selection

A. Attach the band apply pin selection Gauge J-21370, to the transmission case with attaching bolts.

B. Apply 25 ft. lb. torque and select proper pin to be used during assembly of transmission.

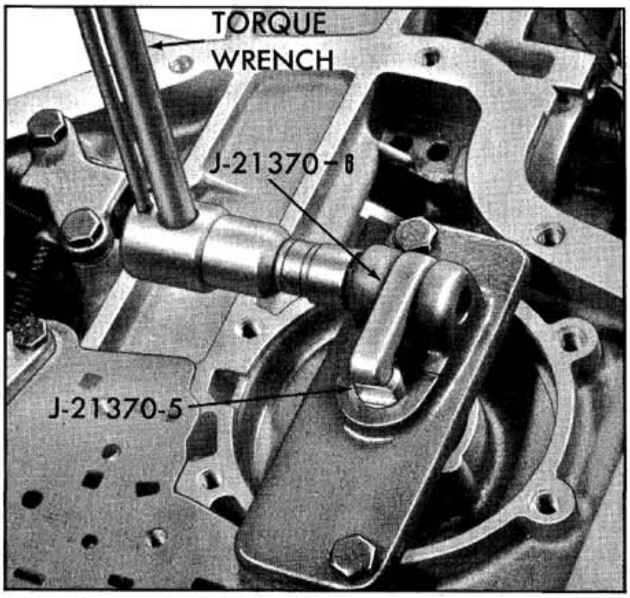


Fig. 6-45 Checking Rear Band Apply Pin

STEP LOCATION	PIN IDENT.	SIZE
TOP STEP OR ABOVE	TWO RINGS	LONG
THIS AREA	ONE RING	MED.
J-21370-5 LOWER STEP OR BELOW	NO RING	SHORT

The identification ring is located on the band lug end of the pin. Selecting the proper pin is the equivalent of adjusting the band.

5. Remove the solenoid attaching screws, solenoid assembly and gasket. (Fig. 6-46)

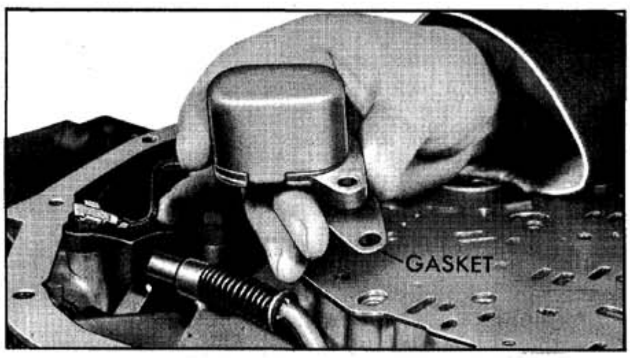


Fig. 6-46 Removing Detent Solenoid and Gasket

6. Withdraw case sleeve connector and "O" ring seal. (Fig. 6-47)

NOTE: Use an 11/16" box wrench to compress the connector tangs.

7. Remove the control valve assembly spacer plate and gasket. (Fig. 6-48)

8. Remove six check balls from cored passages in transmission case. (Fig. 6-49)

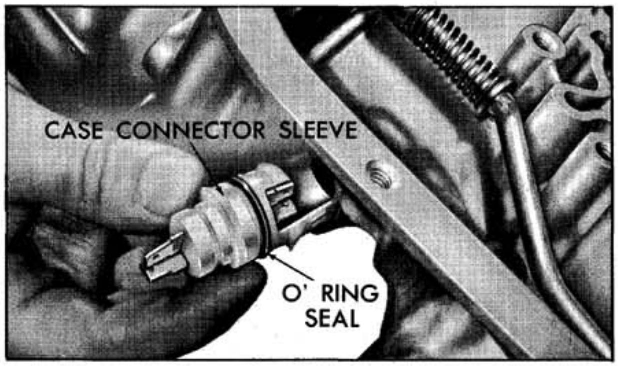


Fig. 6-47 Removing Case Connector

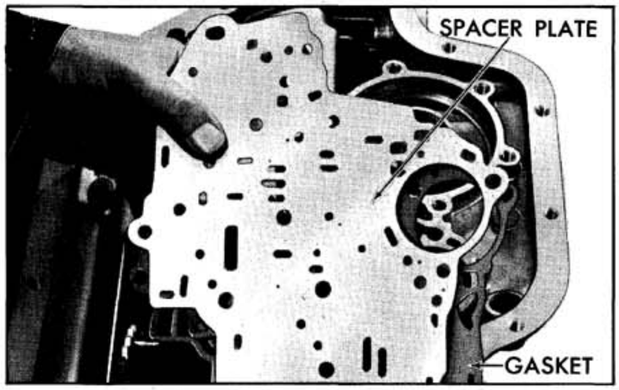


Fig. 6-48 Removing Spacer Plate and Gasket

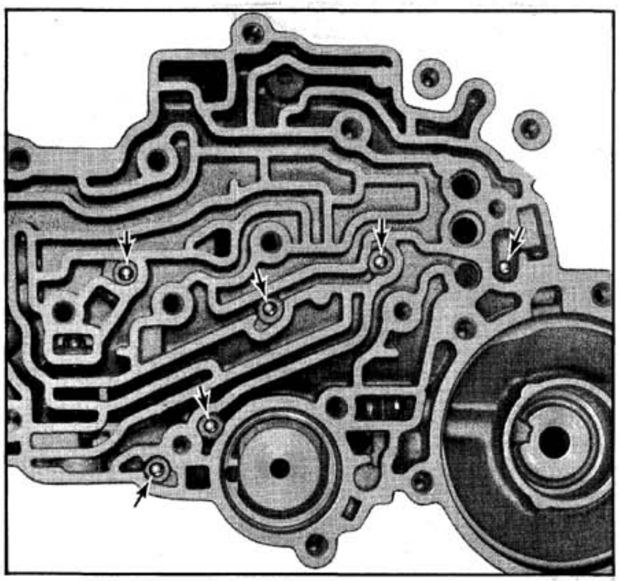


Fig. 6-49 Check Ball Location

9. Remove the front servo piston, washer, pin, retainer and spring from transmission case. (Fig. 6-50 and 6-51)

REAR OIL SEAL AND EXTENSION HOUSING

Removal

1. If necessary to replace, pry the rear oil seal from the extension housing. (Fig. 6-52)

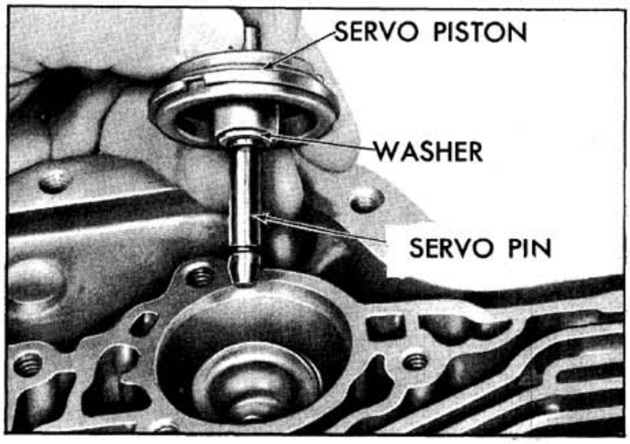


Fig. 6-50 Removing Front Servo

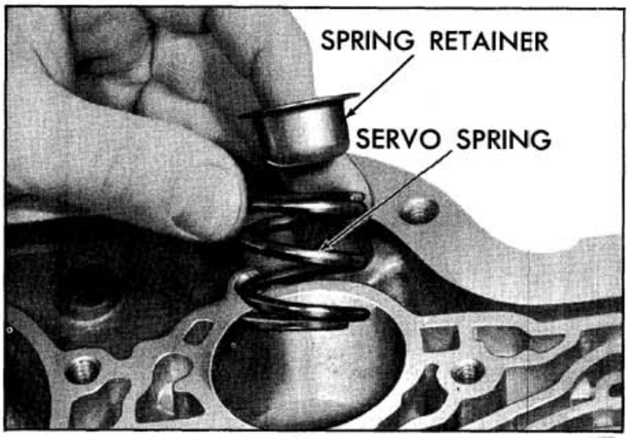


Fig. 6-51 Removing Front Servo Spring and Retainer

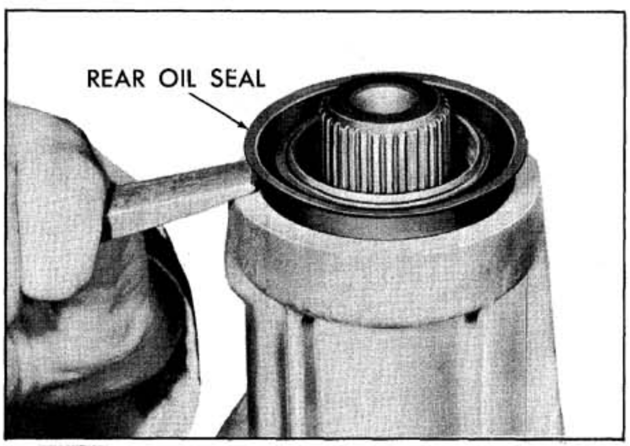


Fig. 6-52 Removing Rear Oil Seal

2. Remove the extension housing to case attaching bolts.

3. Remove the extension housing and extension housing to case seal. (Fig. 6-53)

4. Make front unit end play check as follows: (Fig. 6-54)

A. Remove one front pump attaching bolt, and bolt seal.

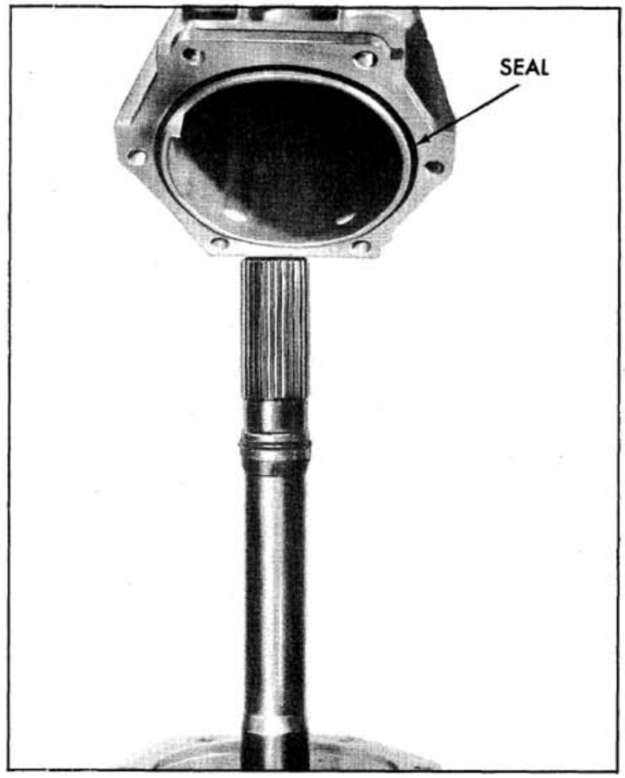


Fig. 6-53 Removing Extension Housing and Seal

B. Install a Slide Hammer Bolt into bolt hole in pump.

C. Mount a dial indicator on the rod and index indicator to register with end of turbine shaft.

D. Push on turbine shaft rearward.

E. Push output shaft forward.

F. Set dial indicator to zero.

G. Pull turbine shaft forward.

Read the resulting travel or end play which should be .003" to .024".

The selective washer controlling this end play is the phenolic resin washer located between the pump cover and the forward clutch housing. If more or less washer thickness is required to bring end play within specifications, select the proper washer from the chart below:

Thickness	Color
.060" to .064"	Yellow
.071" to .075"	Blue
.082" to .086"	Red
.093" to .097"	Brown
.104" to .108"	Green
.115" to .119"	Black
.126" to .130"	Purple

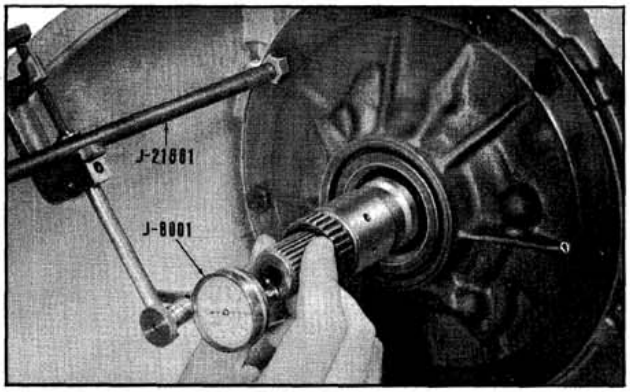


Fig. 6-54 Checking Front Unit End Play

NOTE: An oil soaked washer may tend to discolor so that it will be necessary to measure the washer for its actual thickness.

OIL PUMP

Removal

1. If necessary to replace, pry front seal from pump. (Fig. 6-55)

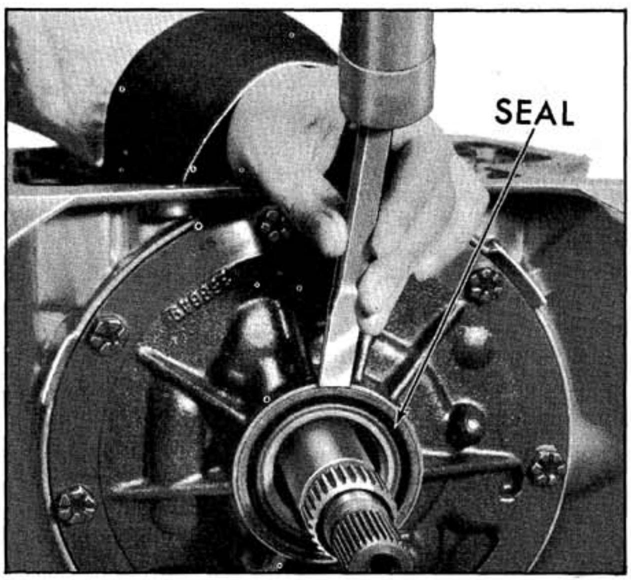


Fig. 6-55 Removing Front Seal

2. Remove the pump attaching bolts. Install bolts with Slide Hammers J-6125, into bolt holes in pump body and remove pump assembly. (Fig. 6-56)

   NOTE: As pump is removed, guide electrical wire and connector from transmission case.

3. Remove and discard pump to case seal "O" ring. (Fig. 6-57)

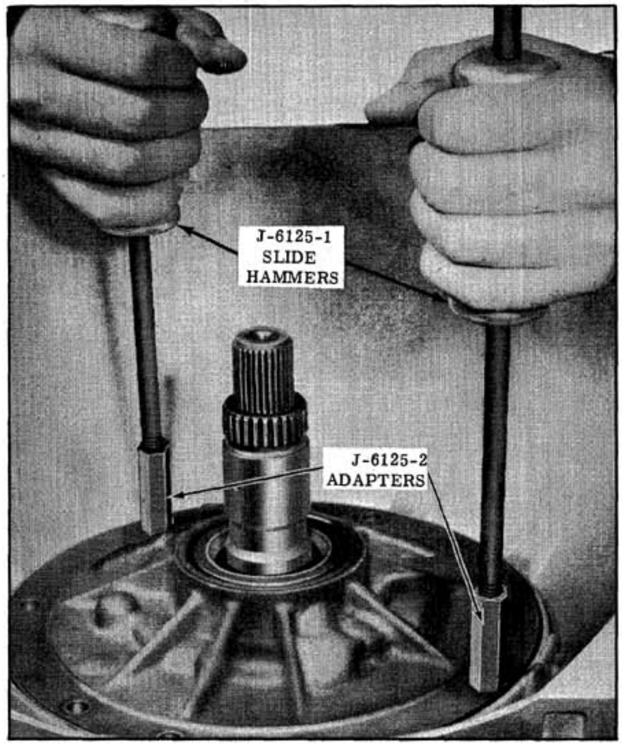


Fig. 6-56 Removing Front Pump

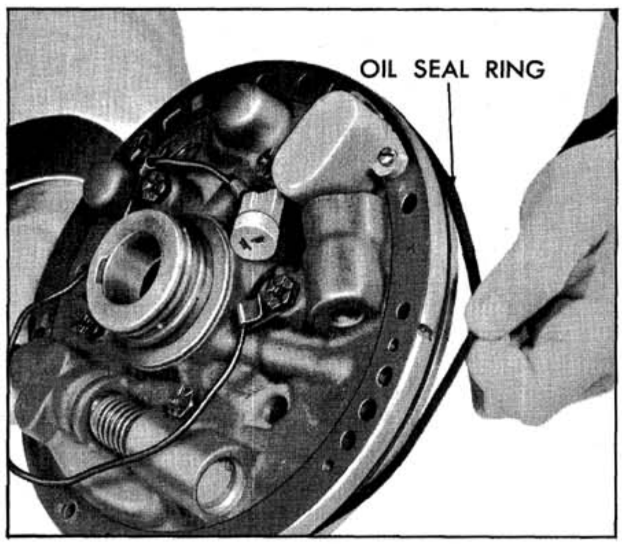


Fig. 6-57 Removing Front Pump "O" Ring

4. Remove forward clutch assembly and turbine shaft from transmission. (Fig. 6-58)
5. Remove forward clutch hub to direct clutch housing bronze thrust washer, if it did not come out with forward clutch housing assembly.
6. Remove the direct clutch assembly. (Fig. 6-59)
7. If necessary, remove manual linkage as follows:
   a. Unthread the jam nut holding detent lever to manual shaft. (Fig. 6-60)

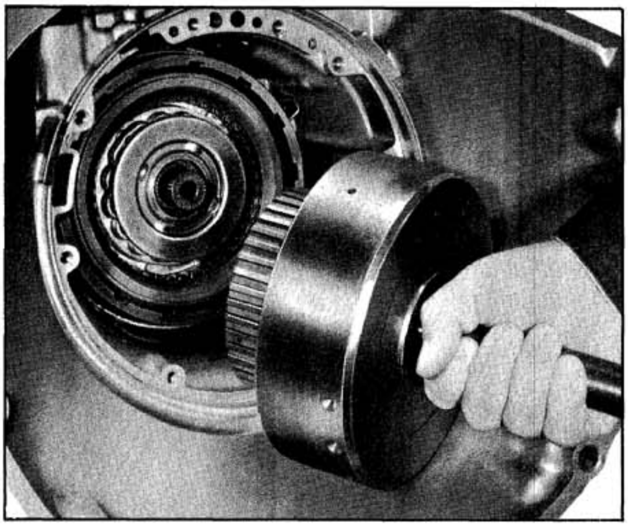


Fig. 6-58 Removing Forward Clutch Assembly

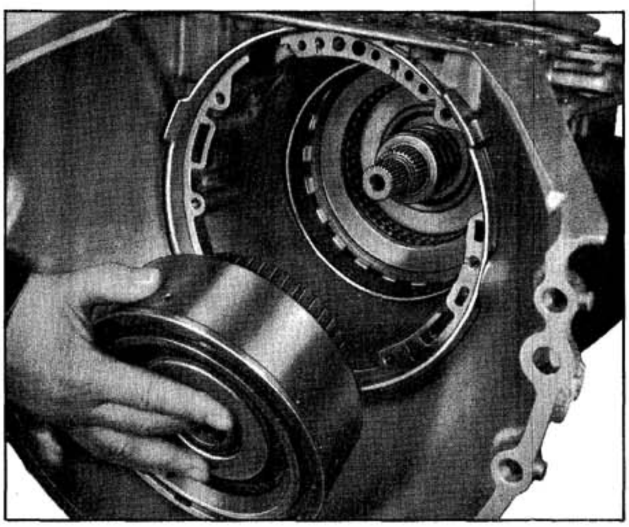


Fig. 6-59 Removing Direct Clutch Assembly

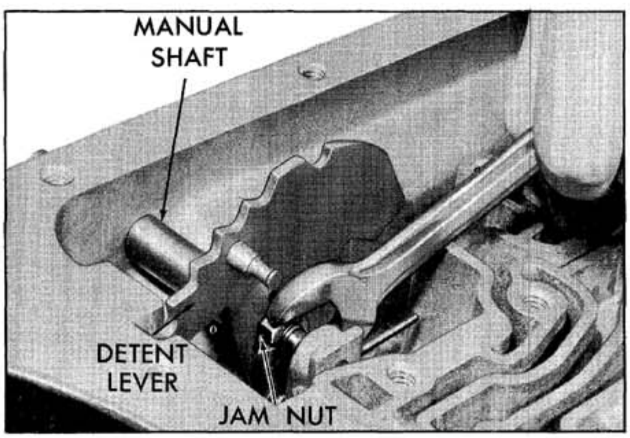


Fig. 6-60 Removing Manual Shaft Nut

CAUTION: Do not lose the jam nut as it becomes free from the manual shaft.

b. Remove manual shaft retaining pin from case. (Fig. 6-61)

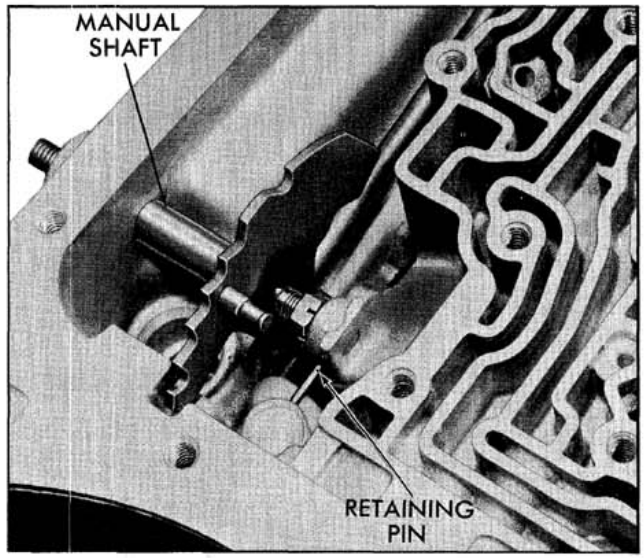


Fig. 6-61 Removing Retaining Pin

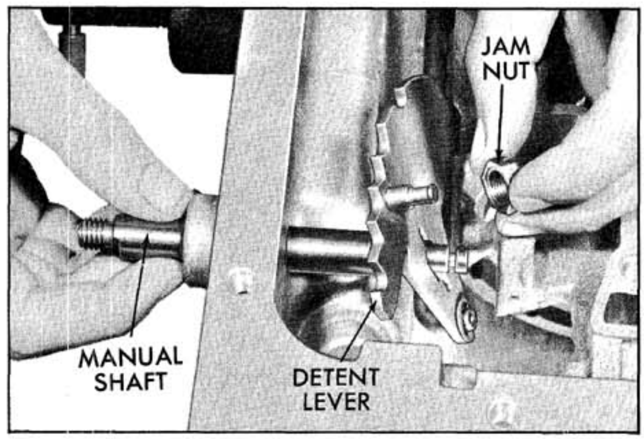


Fig. 6-62 Removing Detent Lever

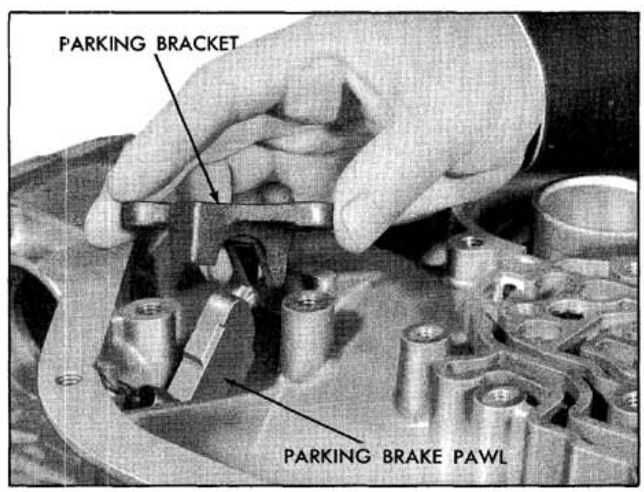


Fig. 6-63 Removing Parking Bracket

c. Remove the detent lever from the manual shaft. (Fig. 6-62)

d. Remove jam nut from manual shaft and manual shaft from case.

NOTE: If necessary to replace, pry the manual shaft seal out of case.

e. Remove parking actuator rod and detent lever assembly.

f. If necessary, remove the detent lever, retaining "E" ring and detent lever.

g. Remove attaching bolts and parking bracket. (Fig. 6-63)

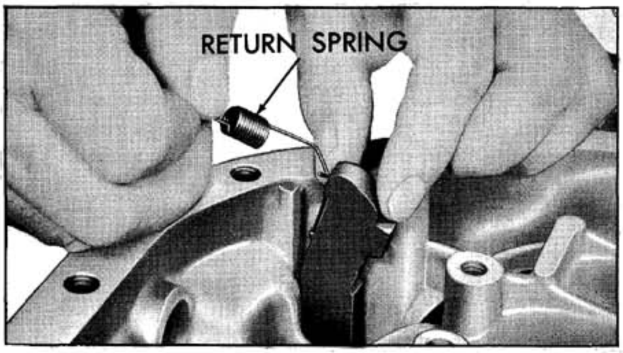


Fig. 6-64 Removing Parking Pawl Return Spring

h. Remove parking pawl return spring. (Fig. 6-64)

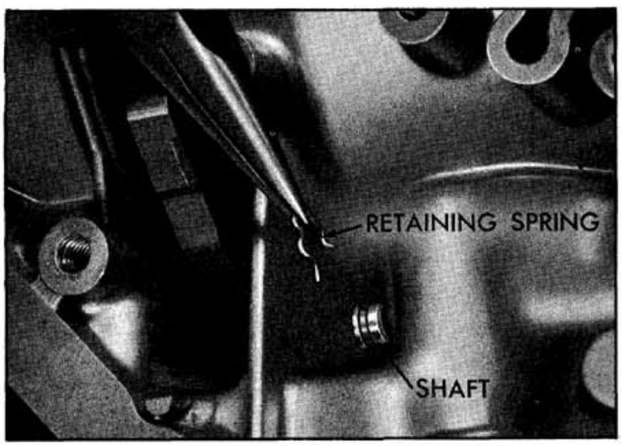


Fig. 6-65 Removing Retainer Spring Clip

i. Remove parking pawl shaft retainer. (Fig. 6-65)

j. Remove parking pawl shaft, "O" ring seal and parking pawl. (Fig. 6-66)

8. Remove the front band assembly. (Fig. 6-67)

9. Remove the sun gear shaft. (Fig. 6-68)

10. Check rear end play as follows: (Fig. 6-69)

a. Install J-21661 with 3/16" adapter into an extension housing attaching bolt hole.

b. Mount the Dial Indicator, J-8001, on the

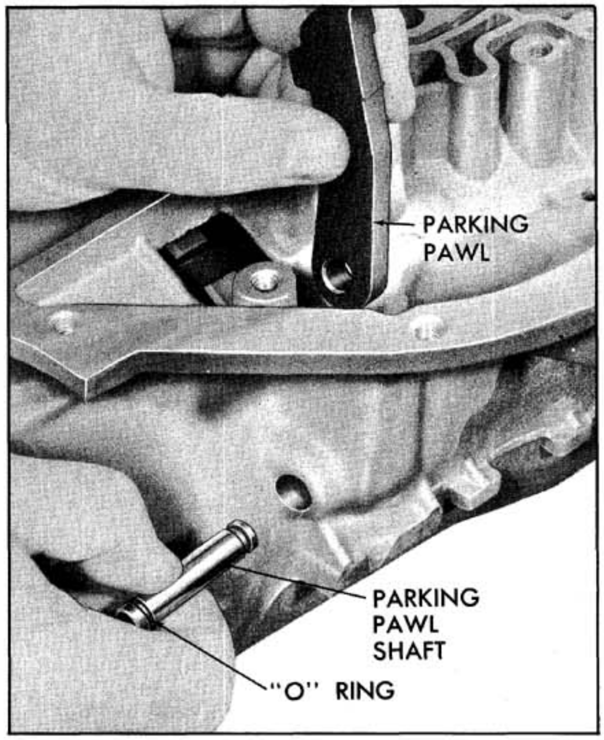


Fig. 6-66 Removing Parking Pawl

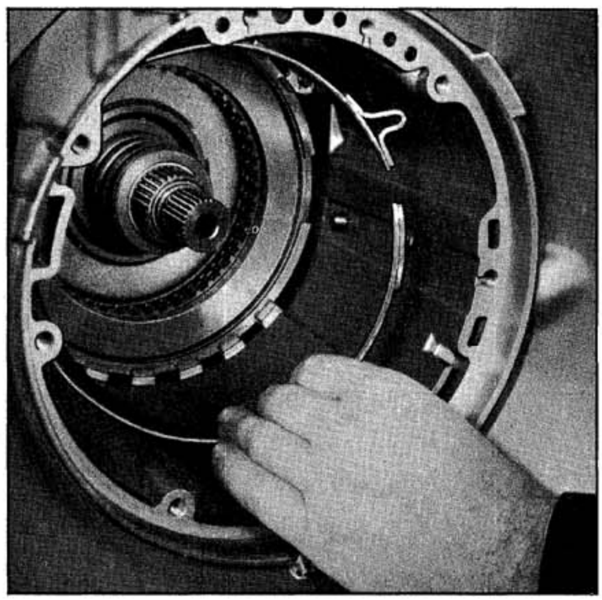


Fig. 6-67 Removing Front Band

rod and index with the end of the output shaft.

c. Move the output shaft in and out to read the end play. End play should be from .003" to .019". The selective washer controlling this end play is the steel washer having three lugs that is located between the thrust washer and the rear face of the transmission case.

If a different washer thickness is required to

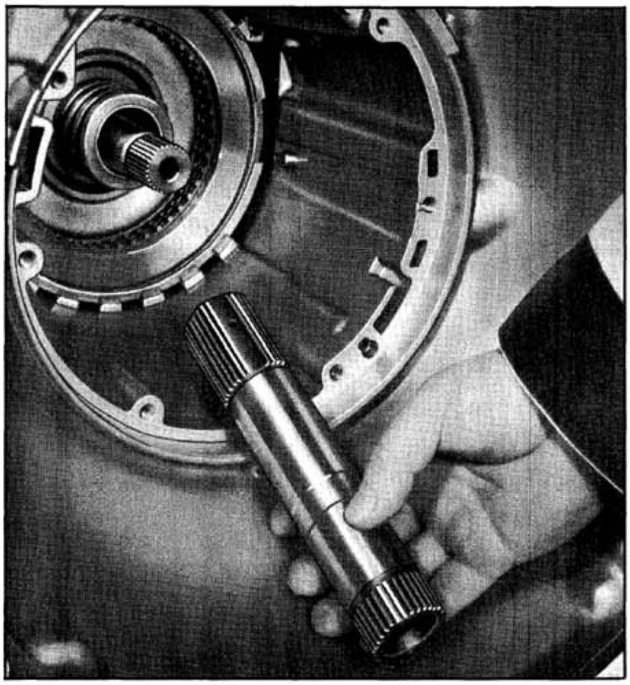


Fig. 6-68 Removing Sun Gear Shaft

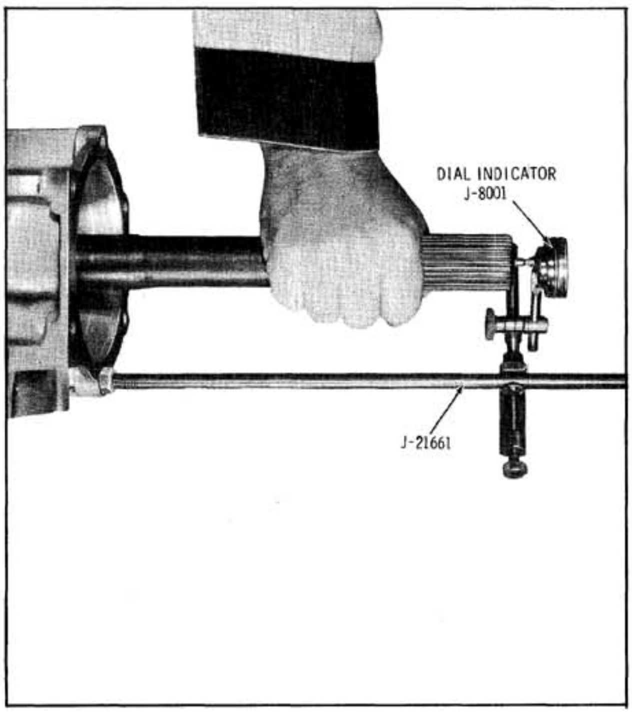


Fig. 6-69 Checking Rear Unit

bring the end play within specification, it can be selected from the following chart.

Thickness	Notches
.078" to .082"	None
.086" to .090"	1 Tab Side
.094" to .098"	2 Tab Side
.102" to .106"	1 Tab O.D.
.110" to .114"	2 Tabs O.D.
.118" to .122"	3 Tabs O.D.

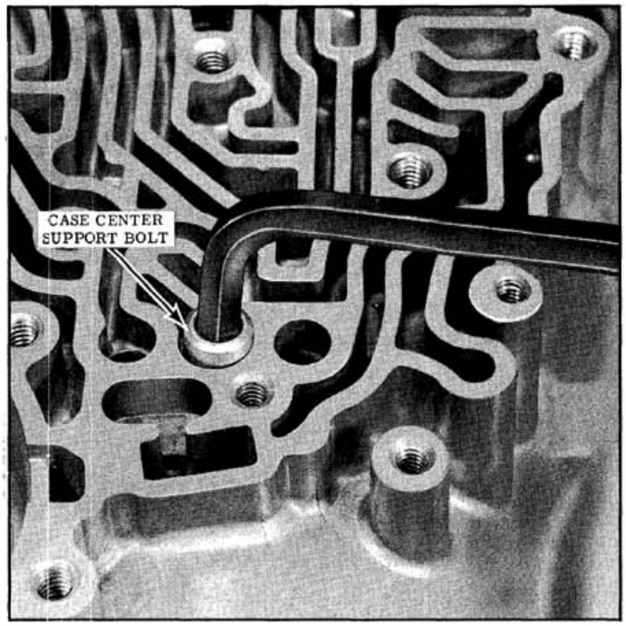


Fig. 6-70 Removing Case Center Support Bolt

11. Remove the case center support to case bolt. (Fig. 6-70)

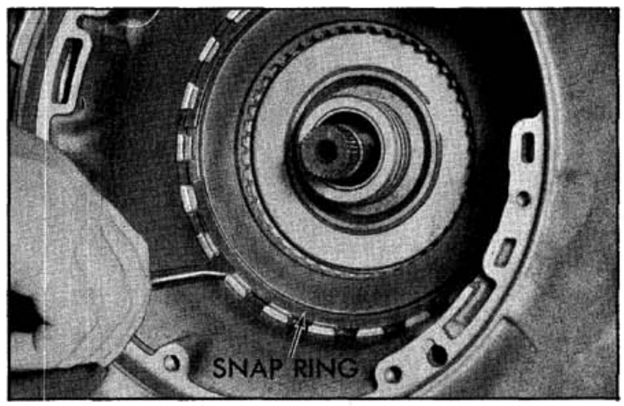


Fig. 6-71 Removing Snap Ring

12. Remove the intermediate clutch backing plate to case snap ring. (Fig. 6-71)

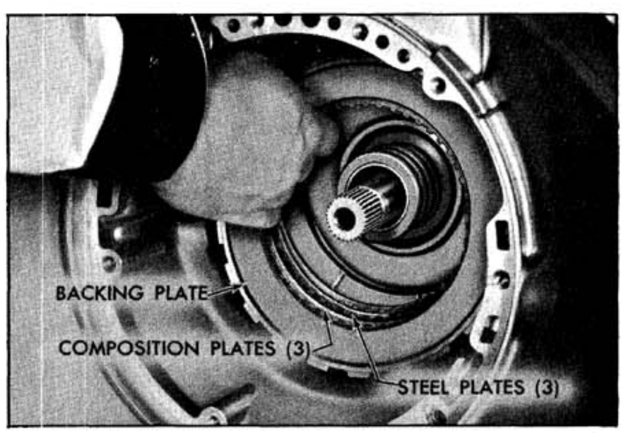


Fig. 6-72 Removing Clutch Plates

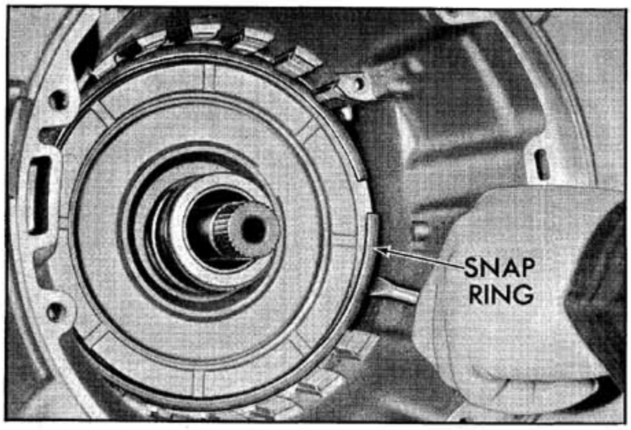


Fig. 6-73 Removing Snap Ring

13. Remove the intermediate clutch backing plate, three composition and three steel clutch plates. (Fig. 6-72)

14. Remove the center support to case retaining snap ring. (Fig. 6-73)

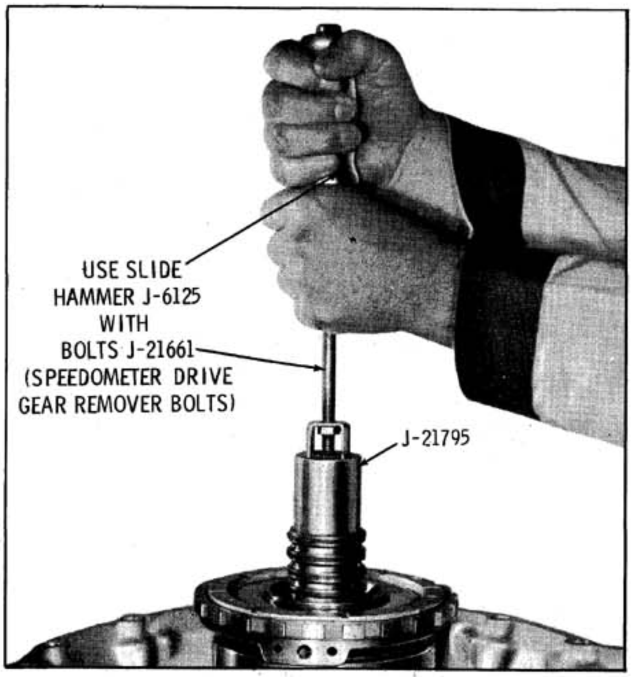


Fig. 6-74 Removing Gear Assembly

15. Remove the entire gear unit assembly by lifting with Gear Assembly Installing and Removing Tool J-21795 and J-6125 Slide Hammer. (Fig. 6-74)

16. Remove the output shaft to case thrust washer from the rear of the output shaft or inside the case. (Fig. 6-75)

17. Place the gear unit assembly with output shaft facing down in hole in work bench or Holding Fixture J-6116. (Fig. 6-76)

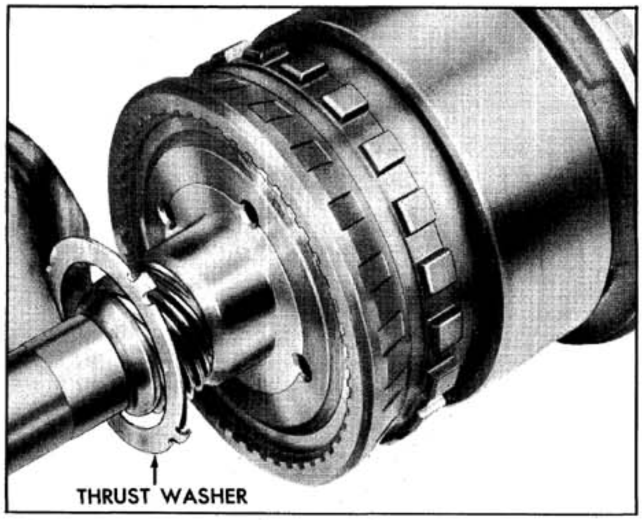


Fig. 6-75 Removing Thrust Washer

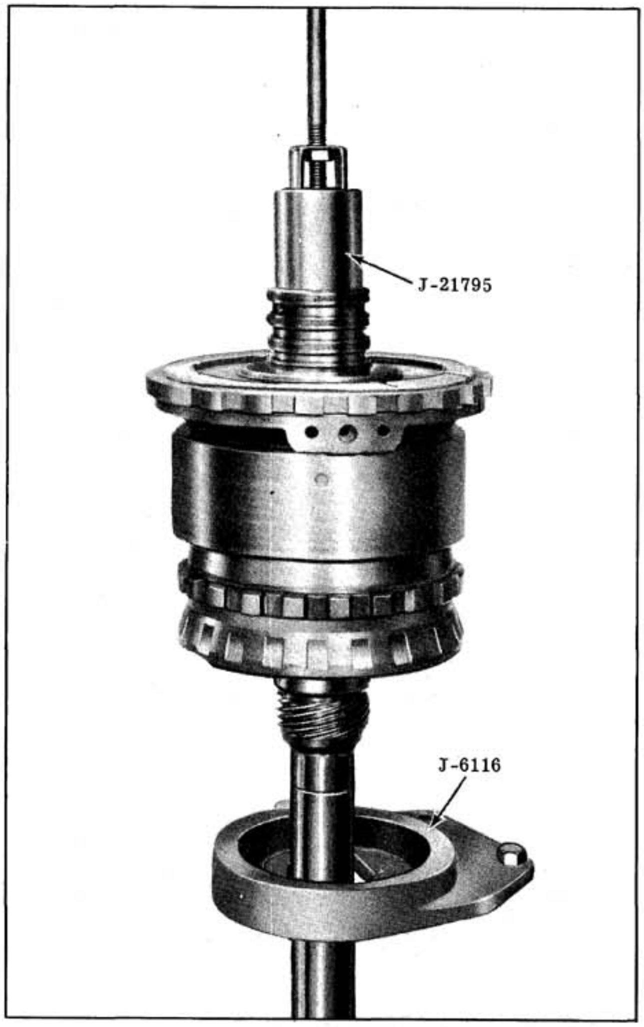


Fig. 6-76 Positioning Unit in Holding Fixture

18. Remove the rear unit selective washer from the transmission case. (Fig. 6-77)

19. Remove the rear band assembly. (Fig. 6-78)

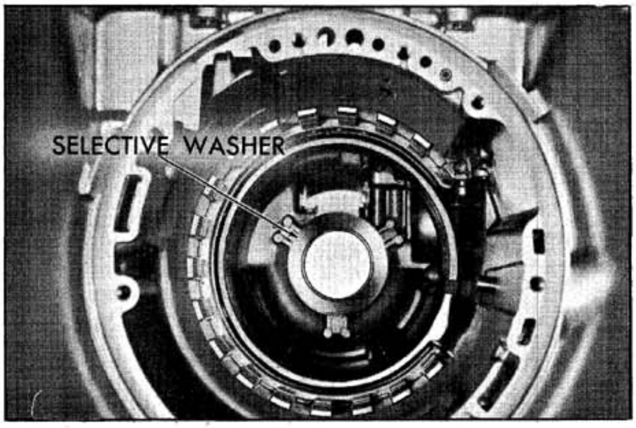


Fig. 6-77 Removing Selective Washer

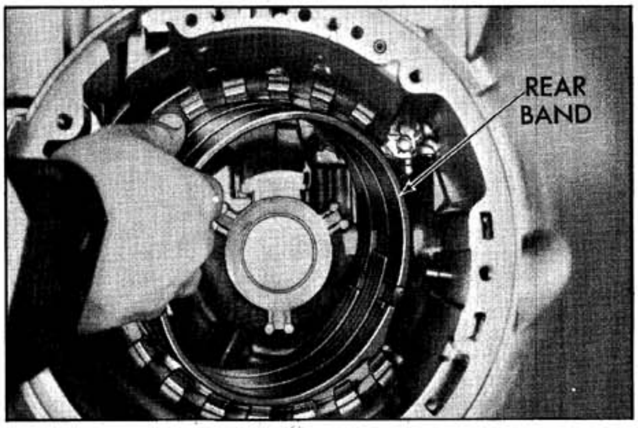


Fig. 6-78 Removing Rear Band

DISASSEMBLY AND ASSEMBLY OF INDIVIDUAL UNITS

GEAR UNIT

Disassembly

1. Remove the case center support assembly. (Fig. 6-79)

2. Remove the center support to reaction carrier bronze thrust washer. (Fig. 6-80)

3. Remove the center support to sun gear races and thrust bearing. (Fig. 6-81)

   NOTE: One of the races may have been removed with the center support.

4. Remove the reaction carrier and sprag assembly. (Fig. 6-82)

5. Remove front internal gear ring from output carrier assembly. (Fig. 6-83)

6. Remove sun gear. (Fig. 6-84)

7. Remove reaction carrier to output carrier thrust washer. (Fig. 6-85)

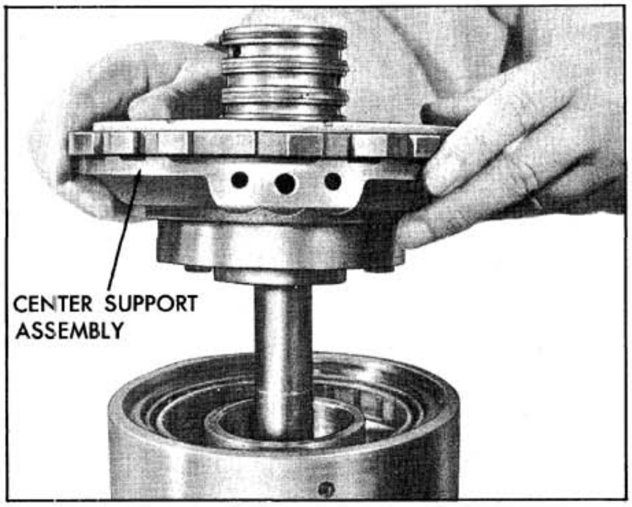


Fig. 6-79 Removing Case Center Support

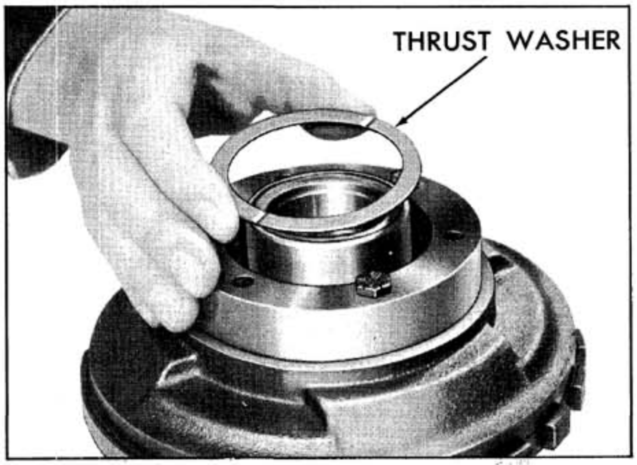


Fig. 6-80 Removing Thrust Washer

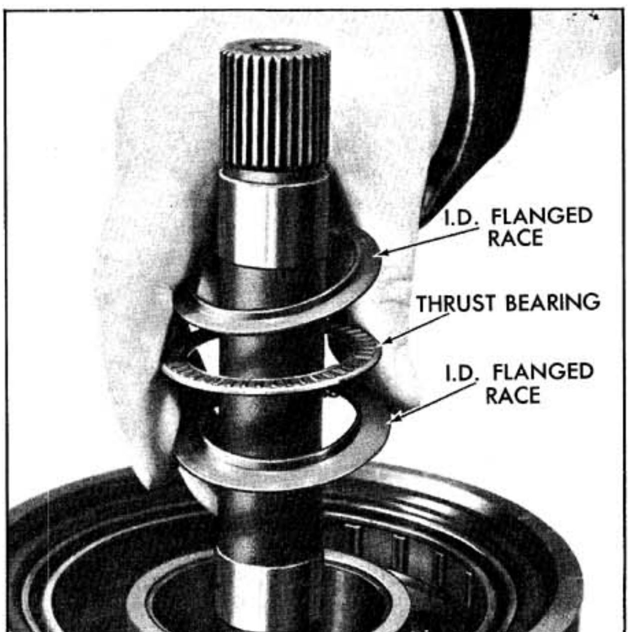


Fig. 6-81 Removing Sun Gear Races and Bearings

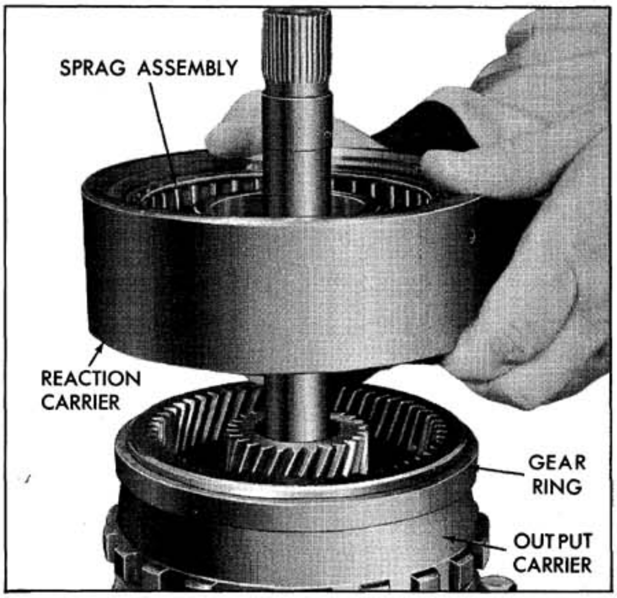


Fig. 6-82 Removing Reaction Carrier and Sprag

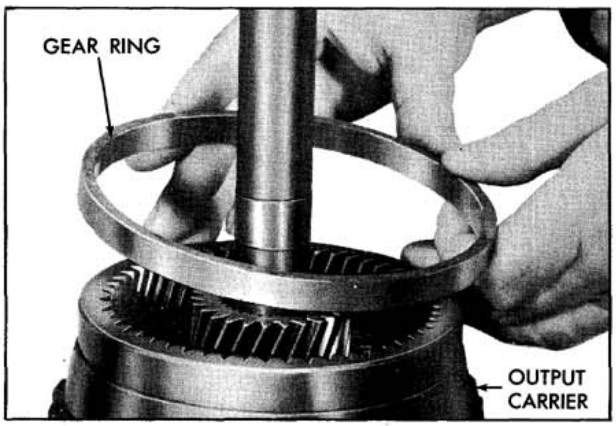


Fig. 6-83 Removing Gear Ring

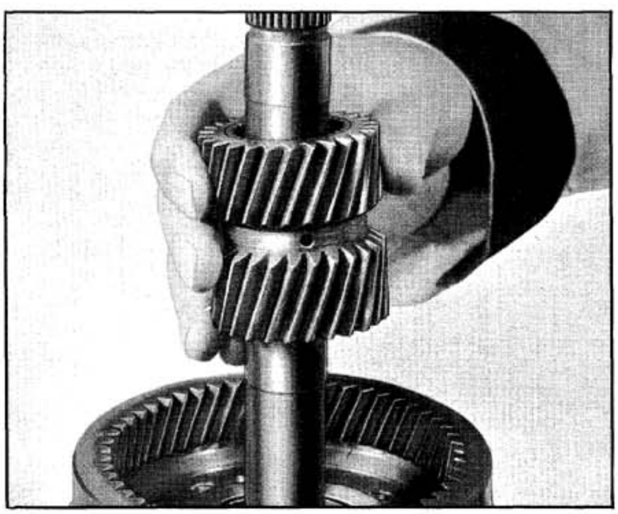


Fig. 6-84 Removing Sun Gear

8. Turn assembly over.

9. Remove output shaft to output carrier snap ring and remove output shaft. (Fig. 6-86)

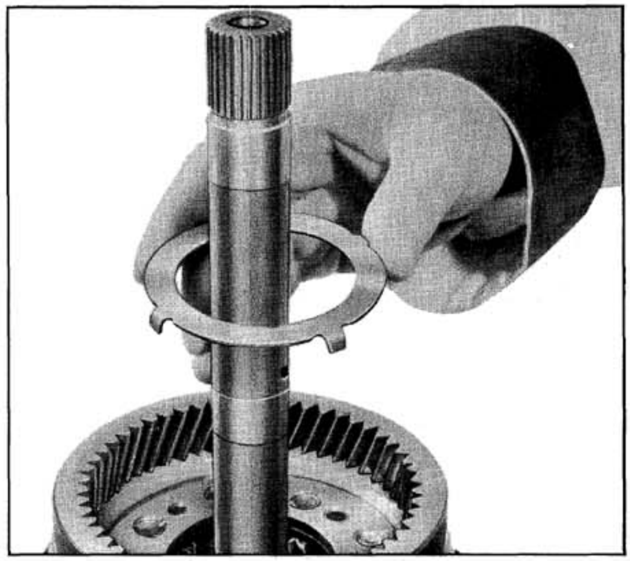


Fig. 6-85 Removing Thrust Washer

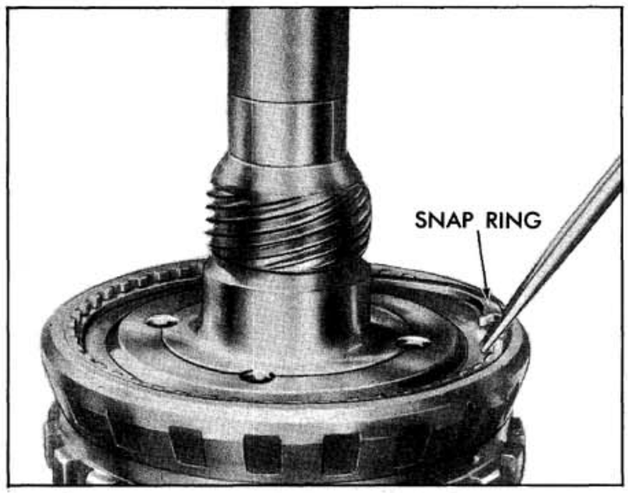


Fig. 6-86 Removing Snap Ring

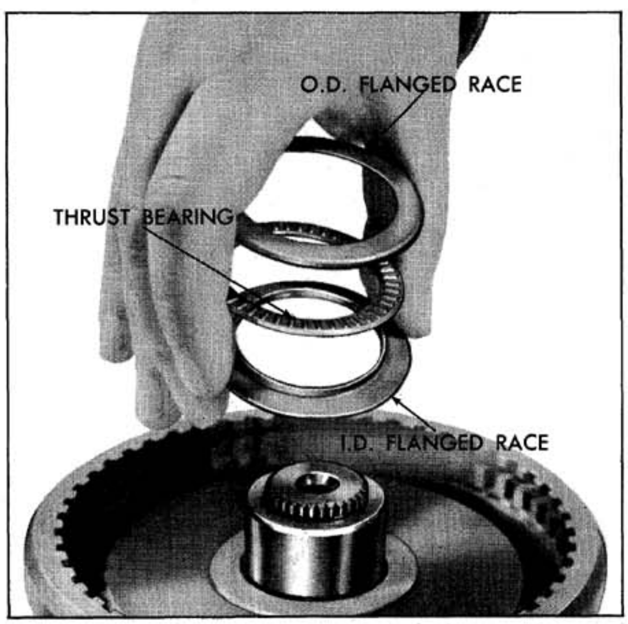


Fig. 6-87 Removing Thrust Washers

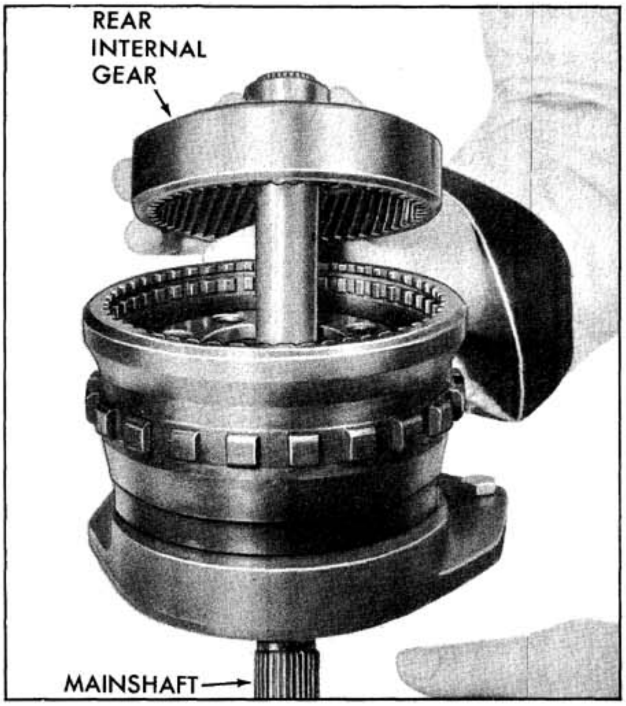


Fig. 6-88 Removing Rear Internal Gear and Mainshaft

10. Remove output shaft to rear internal gear thrust bearing and two races. (Fig. 6-87)

11. Remove the rear internal gear and main-shaft. (Fig. 6-88)

    NOTE: Do not drop bearings.

12. Remove the rear internal gear to sun gear thrust bearing and two races. (Fig. 6-89)

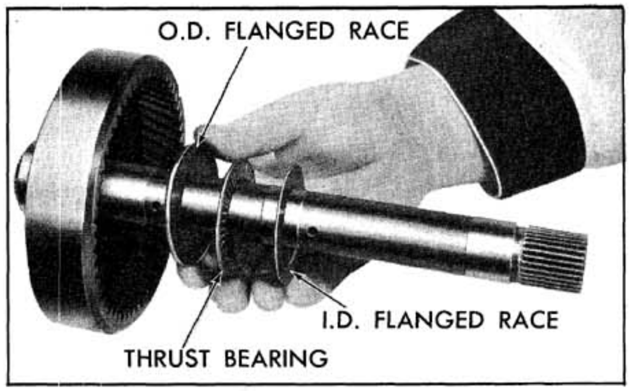


Fig. 6-89 Removing Thrust Bearing

13. If necessary, remove the rear internal gear to mainshaft snap ring, to remove the mainshaft.

GOVERNOR ASSEMBLY

All components of the governor assembly with the exception of the driven gear, are a select fit and each assembly is calibrated. The governor, including the driven gear, is serviced as a complete assembly.

FRONT SERVO (Fig. 6-90)

Inspection

1. Inspect servo pin for damage.

2. Inspect piston for damaged oil ring groove, check freedom of ring in groove.

3. Inspect piston for cracks or porosity.

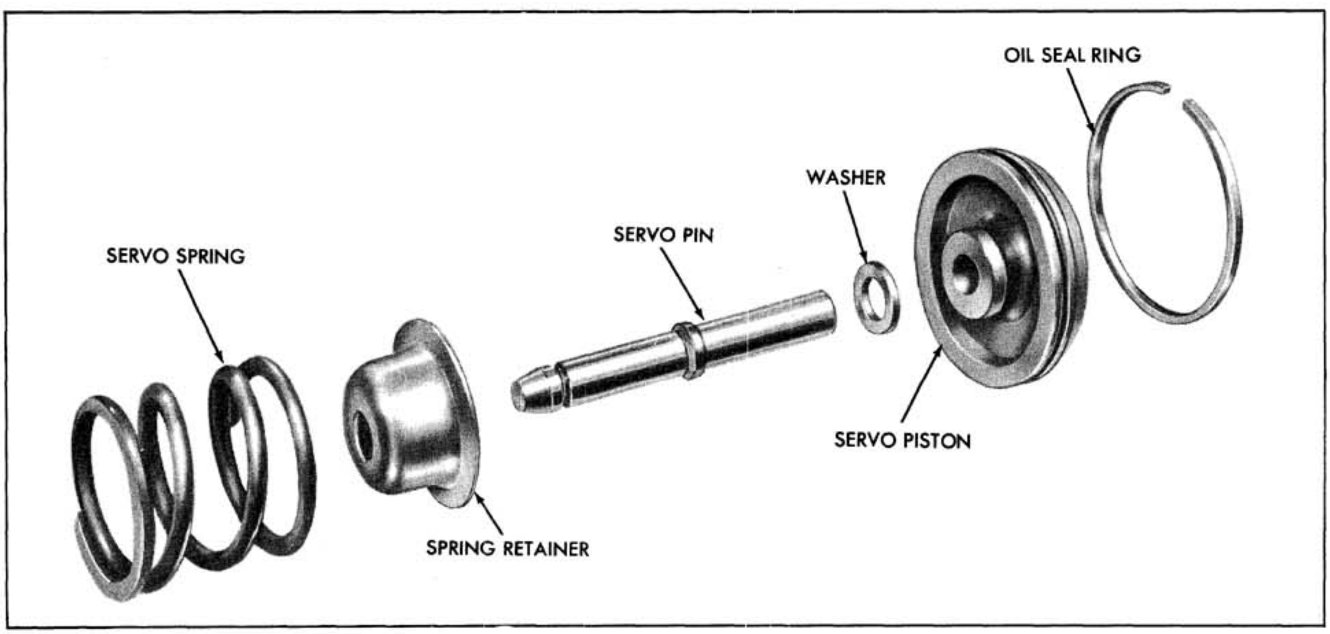


Fig. 6-90 Front Servo

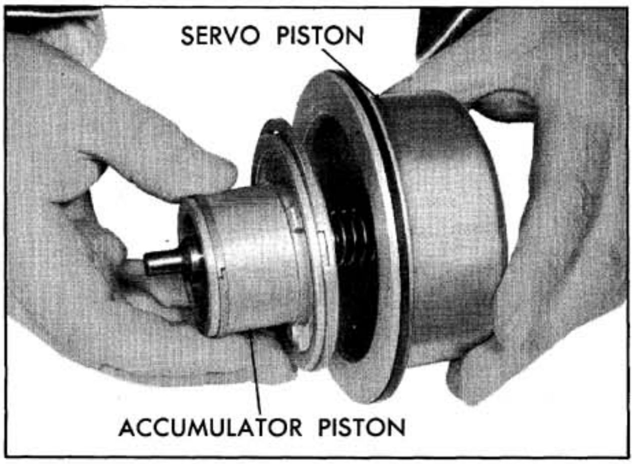


Fig. 6-91 Removing or Installing Accumulator Piston

4. Check fit of servo pin in piston.

REAR SERVO ASSEMBLY

Disassembly

1. Remove the rear accumulator piston from rear servo piston. (Fig. 6-91)
2. Remove "E" ring retaining rear servo piston to band apply pin. (Fig. 6-92)
3. Remove rear servo piston and seal from band apply pin. (Fig. 6-93)

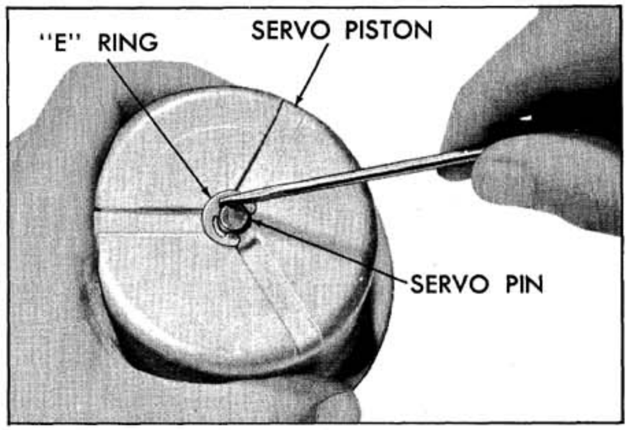


Fig. 6-92 Removing "E" Ring

4. Remove washer, spring, and retainer.

Inspection

1. Inspect freedom of accumulator ring in piston.
2. Inspect fit of band apply pin in servo piston.
3. Inspect band apply pin for scores or cracks.

Assembly

1. Install spring retainer, spring and washer on band apply pin. (Fig. 6-93)
2. Install band apply pin, retainer, spring and

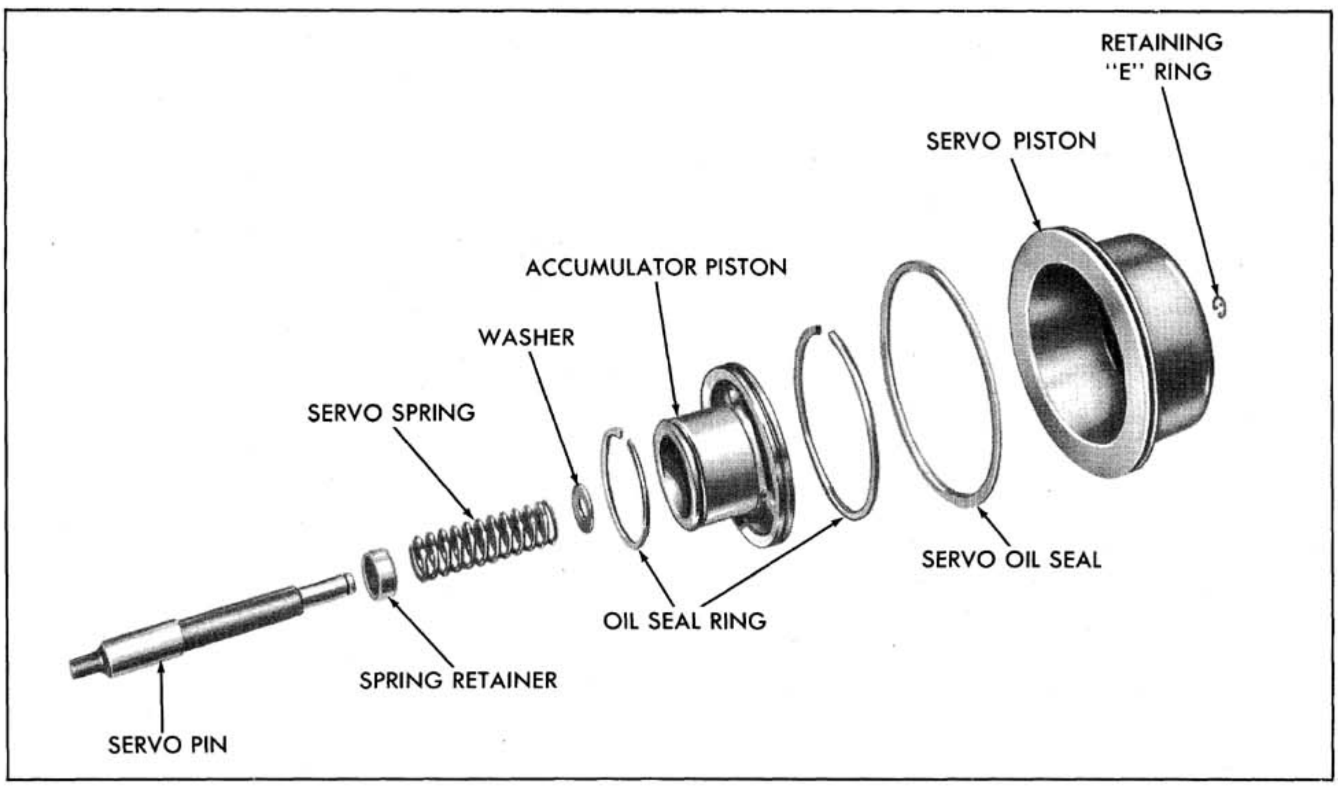


Fig. 6-93 Rear Servo and Accumulator Assembly

washer into bore of servo piston and secure with "E" ring.

3. Install oil seal ring on servo piston, if removed.

4. Install outer and inner oil rings on accumulator piston if removed and assemble into bore of servo piston. (Fig. 6-91)

CONTROL VALVE ASSEMBLY (Fig. 6-94)

Disassembly

1. Position control valve assembly with cored face up.

2. Remove manual valve from upper bore.

3. Remove the accumulator piston valve retaining ring as shown in Fig. 6-95.

4. Remove front accumulator piston and spring. (Fig. 6-96)

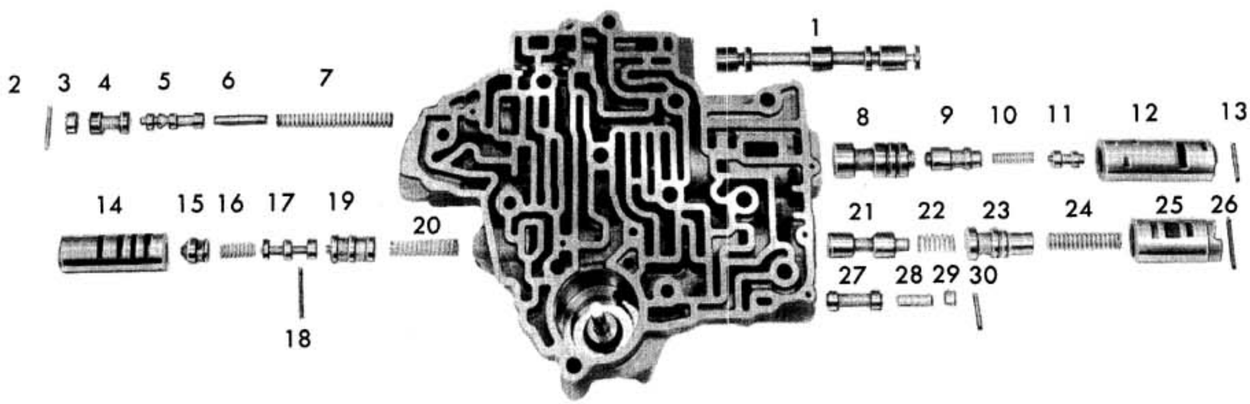
5. On the right side, top bore, remove the retaining pin, 1-2 modulator bushing, 1-2 regulator valve, and 1-2 regulator spring.

6. Remove the 1-2 detent valve and 1-2 valve.

7. From the next bore, remove the retaining pin and 2-3 valve spring, 2-3 modulator bushing valve, and 3-2 intermediate spring.

8. Remove the 2-3 valve.

9. From the next bore remove the retaining pin, bore plug, 3-2 valve, and spacer.



1. Manual Valve
2. Retaining Pin
3. Bore Plug
4. Detent Valve
5. Detent Regulator Valve
6. Spacer
7. Detent Spring
8. 1-2 Shift Valve
9. 1-2 Detent Valve
10. 1-2 Regulator Spring
11. 1-2 Regulator Valve
12. 1-2 Modulator Bushing
13. Retaining Pin
14. 1-2 Accumulator Valve Bushing
15. 1-2 Accumulator Plug
16. 1-2 Accumulator Valve Secondary Spring
17. 1-2 Accumulator Valve
18. Retaining Pin
19. 1-2 Accumulator Valve Primary
20. 1-2 Accumulator Valve Primary Spring
21. 2-3 Shift Valve
22. 3-2 Intermediate Spring
23. 2-3 Modulator Valve
24. 2-3 Valve Spring
25. 2-3 Modulator Valve Bushing
26. Retaining Pin
27. 3-2 Valve
28. Spacer
29. Bore Plug
30. Retaining Pin

Fig. 6-94 Valve Body Assembly

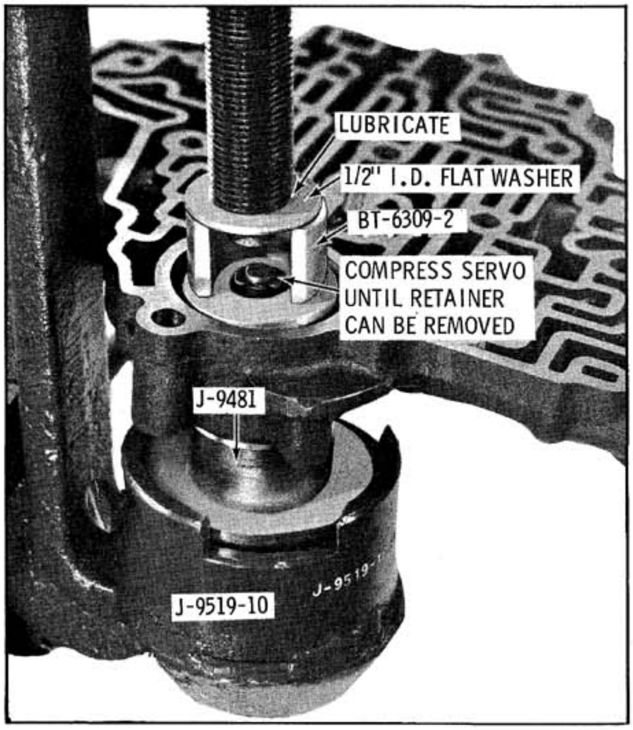


Fig. 6-95 Removing Front Accumulator

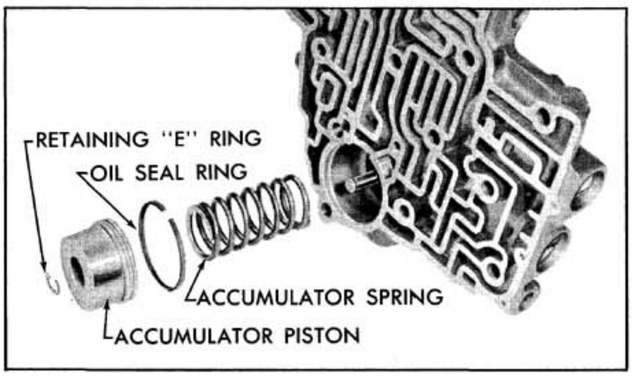


Fig. 6-96 Front Accumulator Piston and Spring

10. At the other end of the assembly, top bore, remove the retaining pin and bore plug.

11. Remove the detent valve, detent regulator valve, spring and spacer.

12. In the next bore, check the operation of the 1-2 accumulator valve train by compressing the valve against the springs.

    NOTE: The 1-2 accumulator valve is factory adjusted.

13. If removal is necessary, the exact position of the adjusting screw is determined before removal by using a 1" to 2" micrometer and measuring from the top of the adjusting screw (remove burrs from adjusting screw) to the machined surface of the valve body and remove the screw if necessary. (Fig. 6-97)

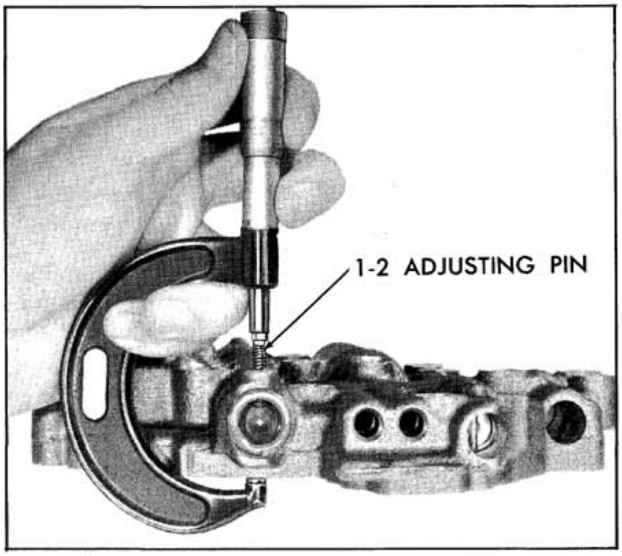


Fig. 6-97 Checking Accumulator Valve Adjusting Pin

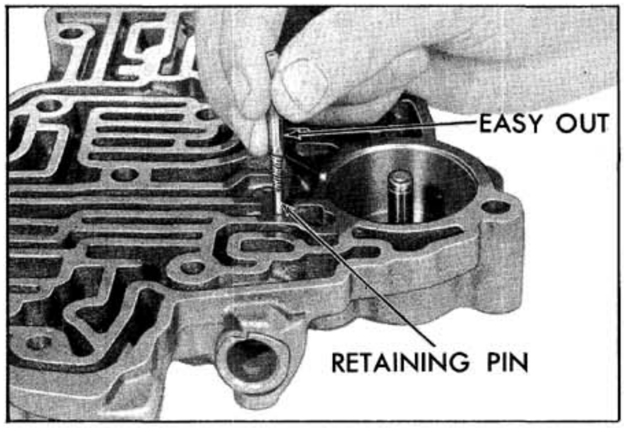


Fig. 6-98 Removing Retainer Pin From Bore

14. Remove the 1-2 accumulator valve retainer pin from the machined face of the valve body with an easy-out type extractor and the 1-2 accumulator plug. (Fig. 6-98)

15. Remove 1-2 accumulator bushing, secondary spring and valve.

16. From the same bore, remove the primary 1-2 accumulator valve and spring.

Inspection

1. Inspect all valves for scoring, cracks and free movement in their respective bores.

2. Inspect the bushing for cracks, scratches or distortion.

3. Inspect the body for cracks, or scored bores.

4. Check all springs for distortion or collapsed coils.

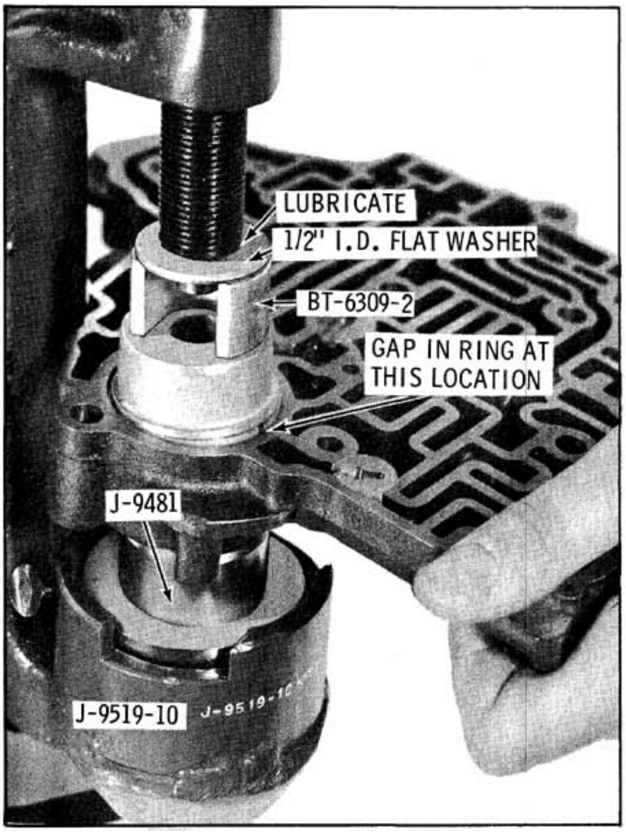


Fig. 6-99 Installing Front Accumulator

Assembly

1. Install front accumulator spring and piston into valve body.

2. Using tools as shown in Fig. 6-99, install the accumulator spring and piston and secure with retaining ring. While installing servo, jiggle valve body while rotating screw to prevent piston binding. Push in on sides of piston ring 90° from gap to start ring in bore.

3. If the 1-2 accumulator valve train was removed, install the 1-2 primary spring in the 1-2 primary valve, into bore using a retaining pin as a retractor to hold the spring and valve in its operating position, until bushing and 1-2 accumulator valve and spring is installed.

4. Install the 1-2 accumulator valve into the 1-2 accumulator bushing, wide land first.

5. Install the 1-2 accumulator valve bushing into the bore.

6. Install retaining pin to hold 1-2 accumulator valve.

7. Install the 1-2 accumulator valve secondary spring and 1-2 accumulator plug into the bushing.

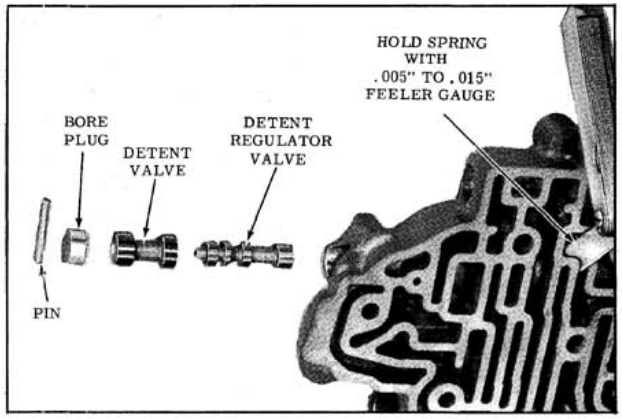


Fig. 6-100 Installing Detent Regulator and Valve

8. If adjusting screw was removed, install and relocate to the same position measured on removal.

9. Install the detent regulator spring and spacer. (Fig. 6-100)

   NOTE: Compress spring and retain in place using a .005" to .015" feeler gauge.

10. Install the detent regulator valve wide land first. (Fig. 6-100)

11. Install the detent valve, narrow land first.

12. Remove the feeler gauge, install bore plug, open end out, and install retaining pin.

13. In the lower right hand bore, install the 3-2 valve.

14. Install the spacer, bore plug with hole out and retaining pin.

15. In the next bore up, install the 2-3 valve, stem end out, and 3-2 intermediate spring.

16. Install the 2-3 modulator valve into the bushing and install both parts into the valve bore.

17. Install the 2-3 valve spring, and install the retaining pin.

18. In the next bore, install the 1-2 valve, stem end out.

19. Install the 1-2 regulator valve, spring and detent valve, into the bushing, aligning spring in bore of detent valve, and install parts into the valve bore.

20. Compress the bushing against the spring and install the retaining pin.

21. Install the manual valve with detent pin groove to the right.

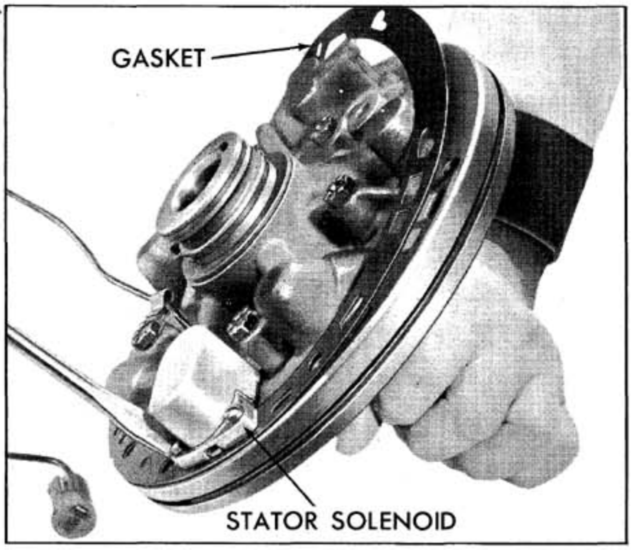


Fig. 6-101 Removing Stator Solenoid and Gasket

OIL PUMP

Disassembly

1. Remove stator solenoid attaching screws, stator solenoid and pump gasket. (Fig. 6-101)

2. Place pump assembly in hole in bench or Holding Fixture J-6116.

3. Compress the regulator boost valve bushing against the pressure regulator spring and remove the snap ring, using J-5403 Pliers. (Fig. 6-102)

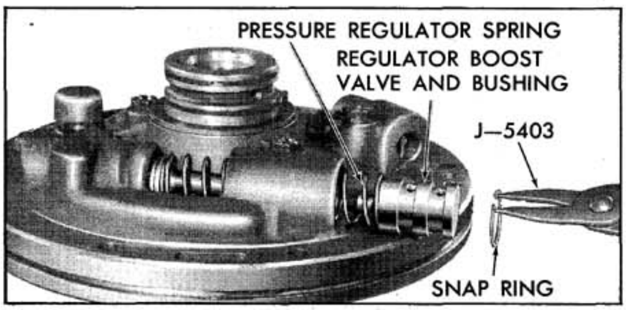


Fig. 6-102 Removing Snap Ring

4. Remove the regulator boost valve bushing and valve.

5. Remove the pressure regulator spring.

6. Remove the regulator valve, spring retainer and spacer(s) if present. (Fig. 6-103)

7. Remove pump cover to body attaching bolts and remove pump cover from body.

8. Remove the retaining pin and bore plug from the pressure regulator bore. (Fig. 6-104)

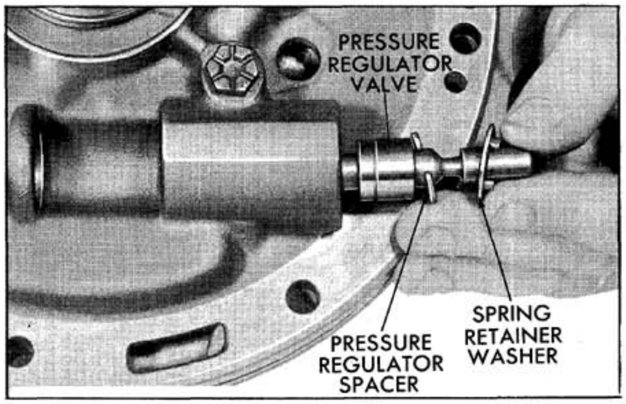


Fig. 6-103 Removing Valve Spacer and Retainer

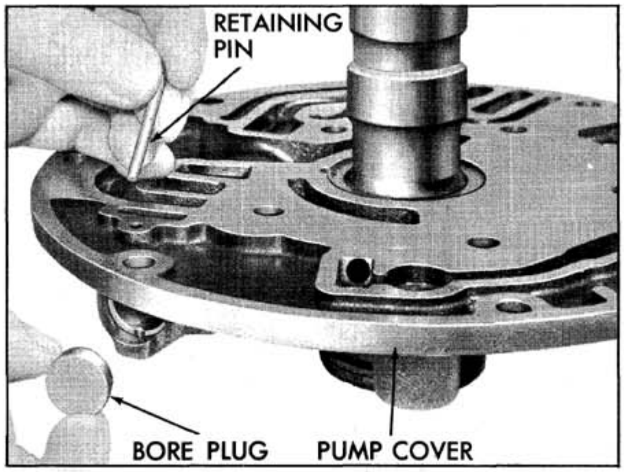


Fig. 6-104 Removing Pin and Bore Plug

9. Remove the retaining pin, stator valve spring and valve. (Figs. 105 and 6-106)

10. Remove the hook type oil rings from the pump cover. (Fig. 6-107)

11. Remove the pump to forward clutch housing selective washer (fiber).

NOTE: Do not remove the cooler bypass seat, unless replacement of the seat, valve or spring is necessary.

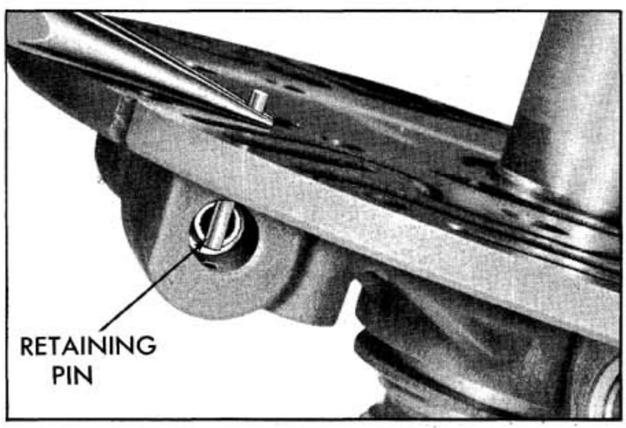


Fig. 6-105 Removing Retainer Pin

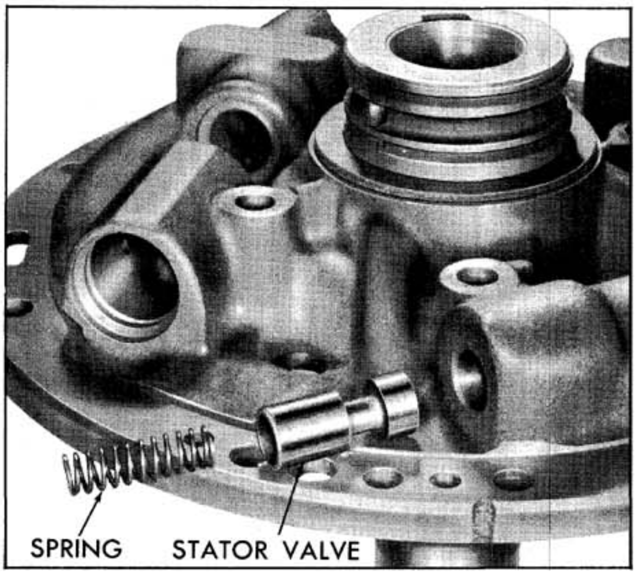


Fig. 6-106 Removing Stator Valve and Spring

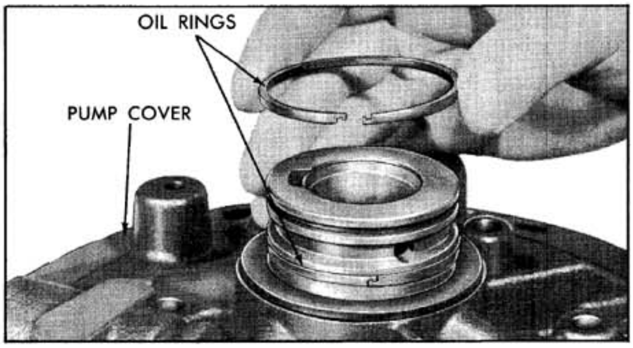


Fig. 6-107 Removing Oil Ring

12. If necessary, remove the check valve using Tool J-21361 attached to Slide Hammer J-6125, then remove seat. (Fig. 6-108)

13. Remove the bypass valve and spring.

14. Mark drive and driven gears for reassembly and remove drive gear. (Fig. 6-109)

15. Remove the driven gear from pump body. (Fig. 6-110)

Inspection

1. Inspect the gear pocket and crescent for scoring, galling or other damage.

2. Place pump gears in pump and check end clearance.

   Pump body face to gear face clearance should be .0008" to .0015". (Fig. 6-111)

3. Check face of pump body for scores or nicks.

4. Check oil passages.

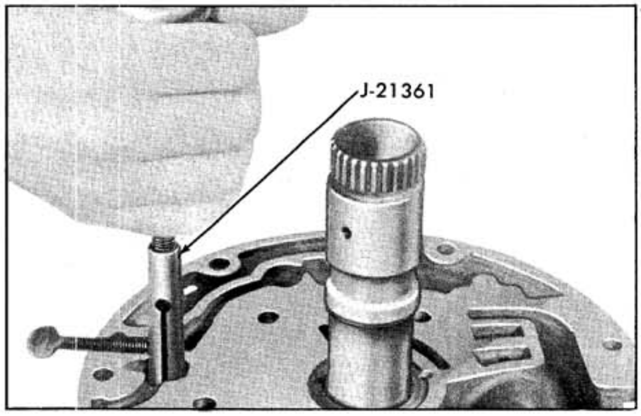


Fig. 6-108 Removing Valve Spring and Seat

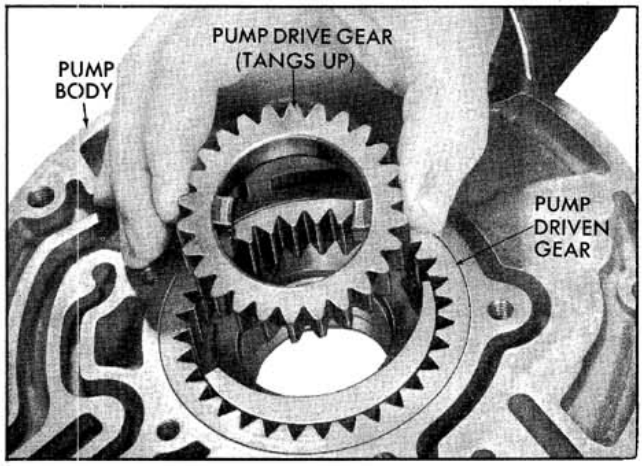


Fig. 6-109 Removing Drive Gear

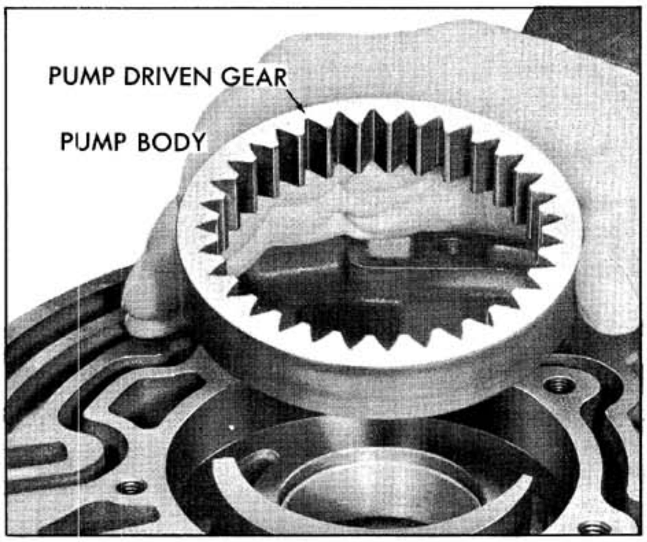


Fig. 6-110 Removing Driven Gear

5. Check for damaged cover bolt attaching threads.

6. Check for overall flatness of pump body face.

7. Check bushing for scores or nicks.

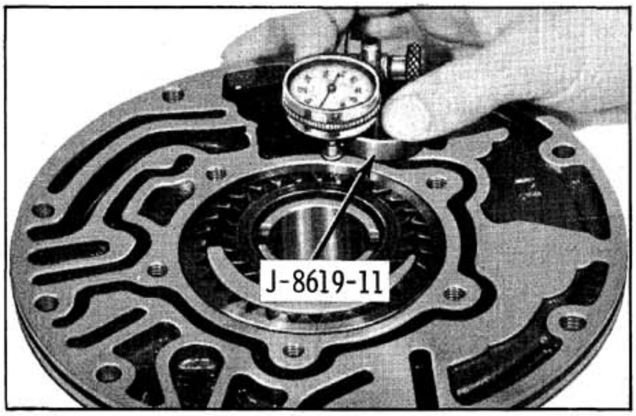


Fig. 6-111 Checking Clearance

8. Inspect the pump attaching bolt seals for damage, replace if necessary.

9. Inspect pump cover face for overall flatness.

10. Check for scores or chips in pressure regulator bore and stator valve bore.

11. Check that all passages are open and not interconnected.

12. Check for scoring or damage at pump gear face.

13. Inspect stator shaft for damaged splines or scored bushings.

14. Inspect oil ring grooves for damage or wear.

15. Inspect cooler bypass valve for free operation and proper sealing.

16. Inspect selective washer thrust face for wear or damage.

17. Inspect pressure regulator and boost valve for free operation.

Assembly (Fig. 6-112)

1. Install the drive and driven pump gears into the pump body with alignment marks up. (Figs. 6-113 and 6-114)

   NOTE: Install the drive gear with drive tangs up.

2. Protect stator shaft and install pump in vise.

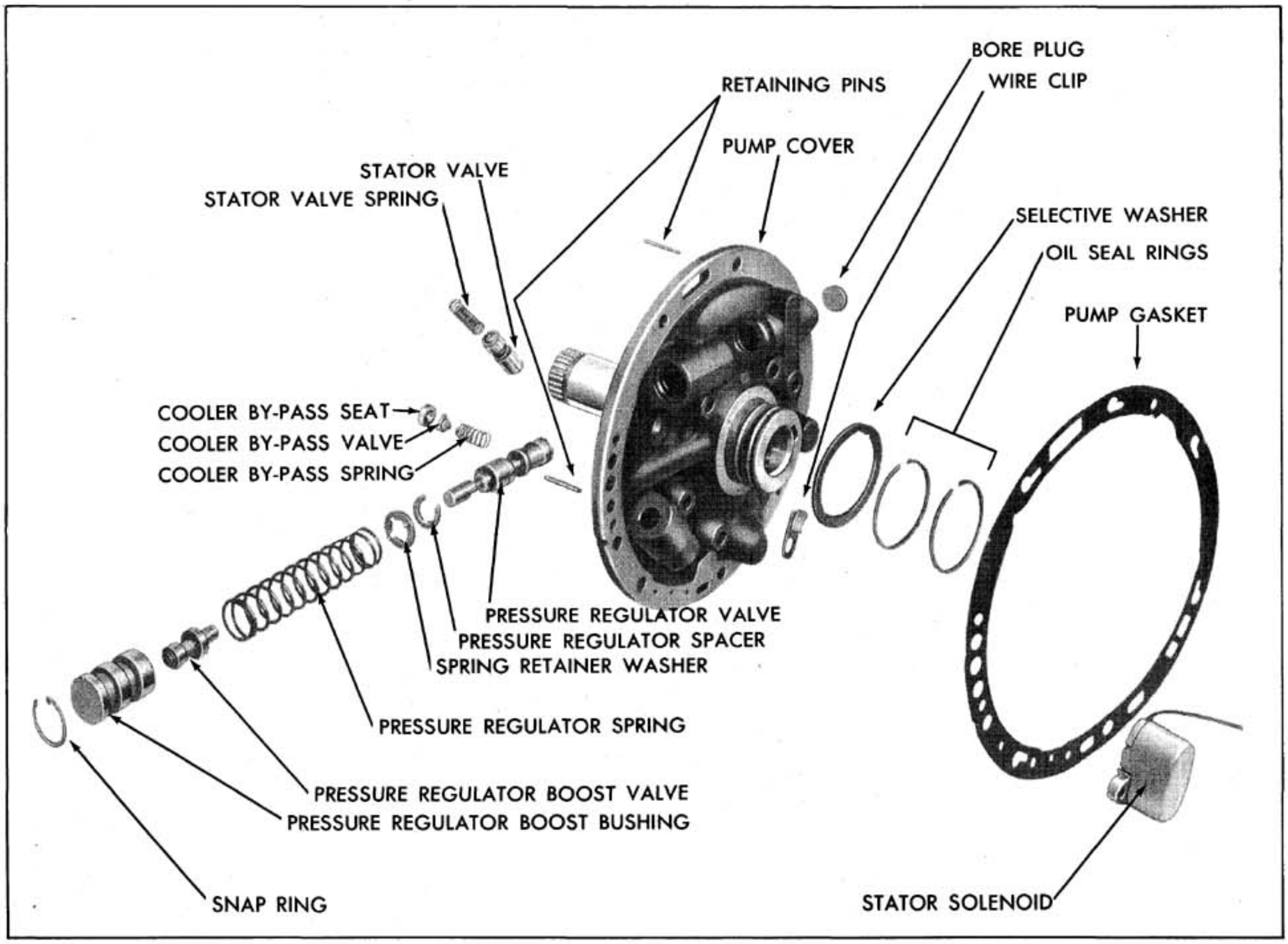


Fig. 6-112 Oil Pump Assembly

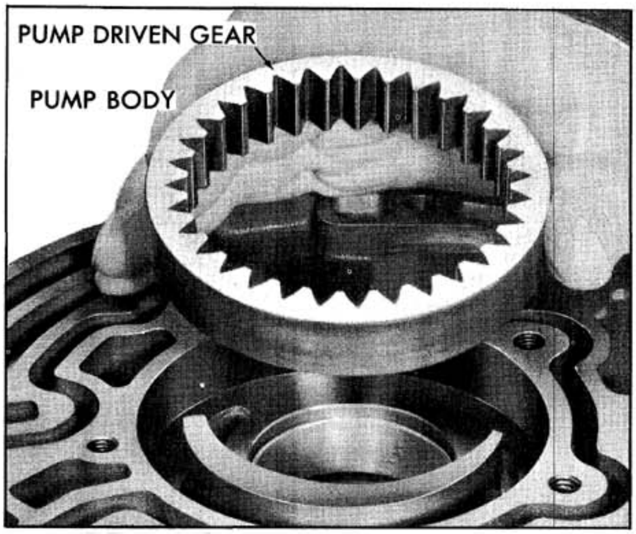


Fig. 6-113 Installing Driven Gear

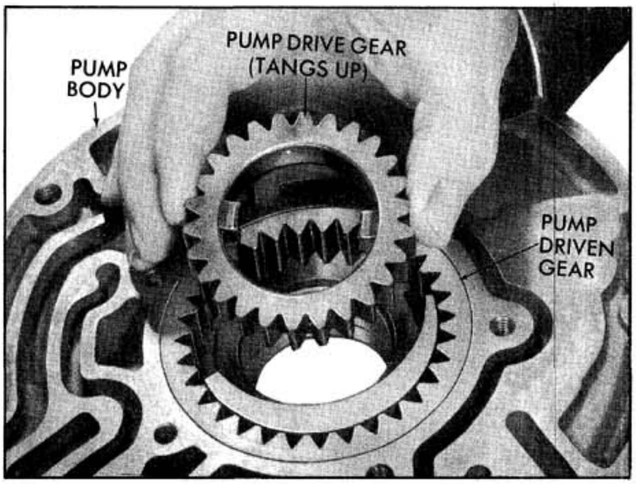


Fig. 6-114 Installing Drive Gear

3. Install the spacer(s) if used, retainer and spring, into the pressure regulator bore. (Fig. 6-115)

4. Install the pressure regulator valve from opposite end of bore, stem end first.

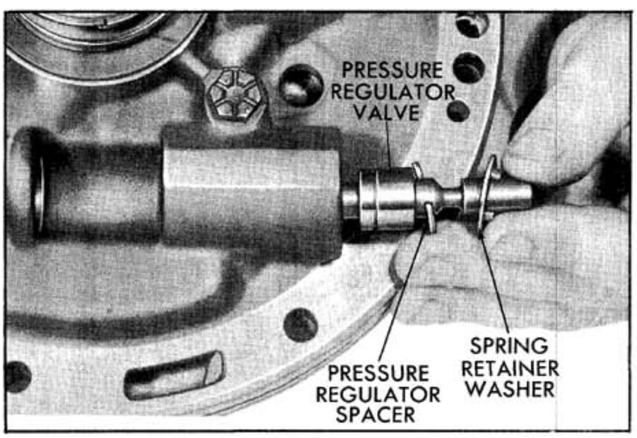


Fig. 6-115 Installing Pressure Regulator Valve

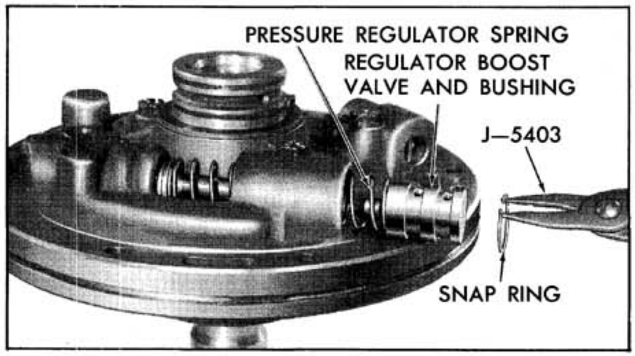


Fig. 6-116 Installing Snap Ring

5. Install the boost valve into the bushing, stem end out, and install both parts into the pump cover by compressing the bushing against the spring. Insert a small screwdriver between a spring coil and the bore of the boost valve to keep the spring compressed, so the retaining ring can be installed. (Fig. 6-116)

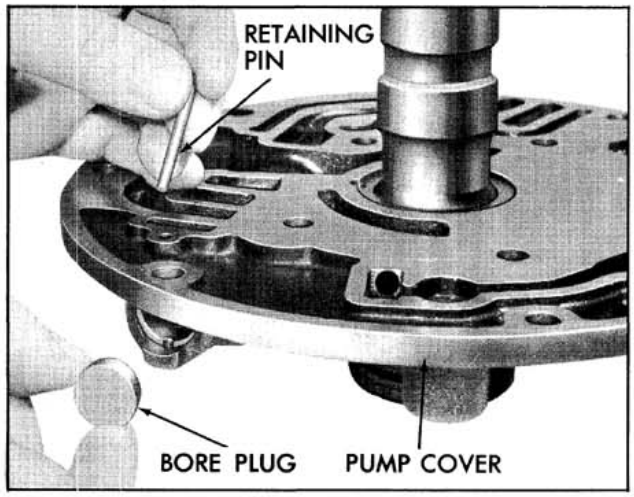


Fig. 6-117 Installing Bore Plug and Ring

6. Install the pressure regulator valve bore plug and retaining pin into opposite end of bore. (Fig. 6-117)

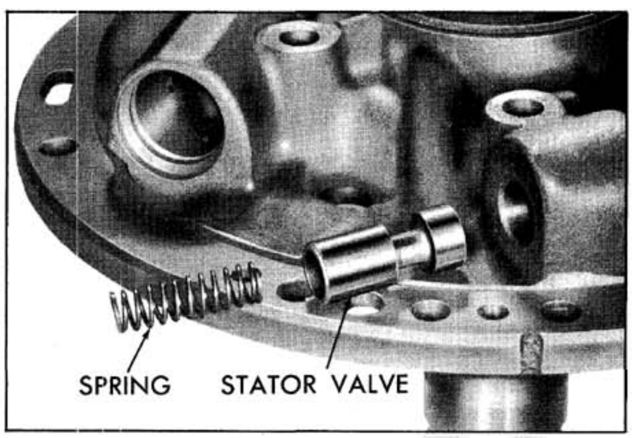


Fig. 6-118 Installing Valve and Spring

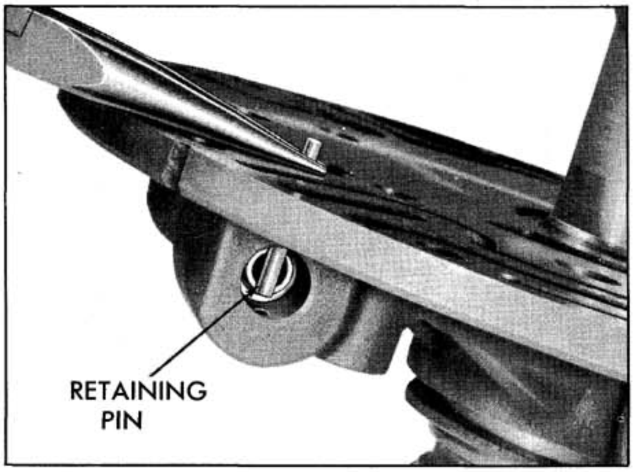


Fig. 6-119 Installing Retaining Pin

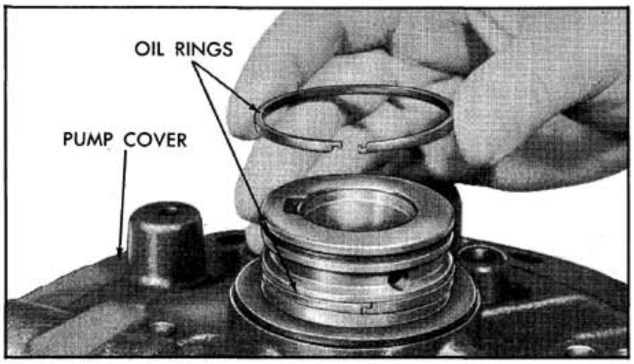


Fig. 6-120 Installing "O" Rings

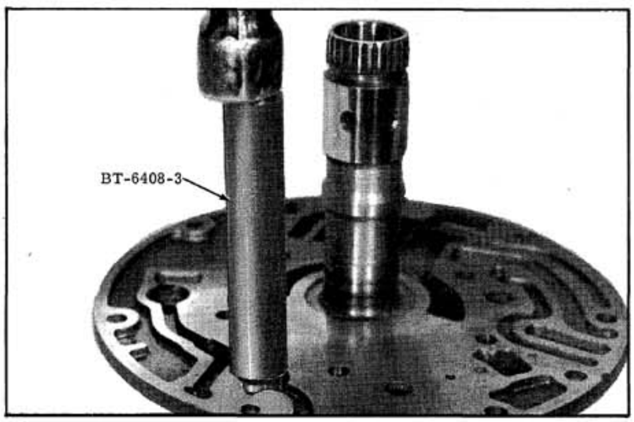


Fig. 6-121 Installing Valve Spring and Seat

7. Install stator valve and spring into bore of pump, then install retaining pin. (Figs. 6-118 and 6-119)
8. Install the previously selected front unit selective thrust washer (fiber) over the pump cover delivery sleeve.
9. Install two hook-type oil seal rings. (Fig. 6-120)
10. If removed, install bypass valve spring (large end first) valve and seat, using Tool

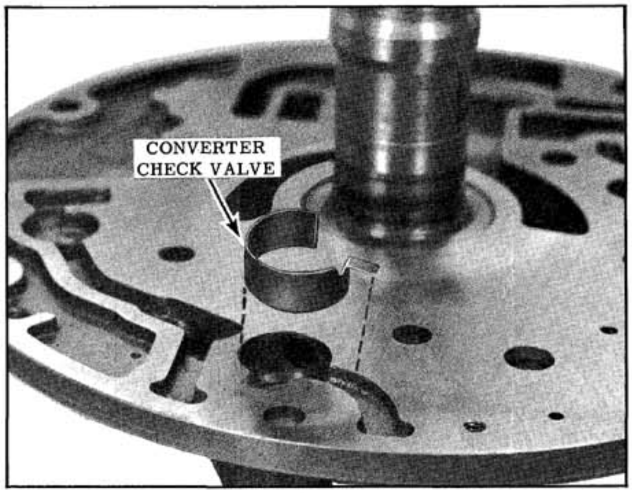


Fig. 6-122 Check Valve Installation

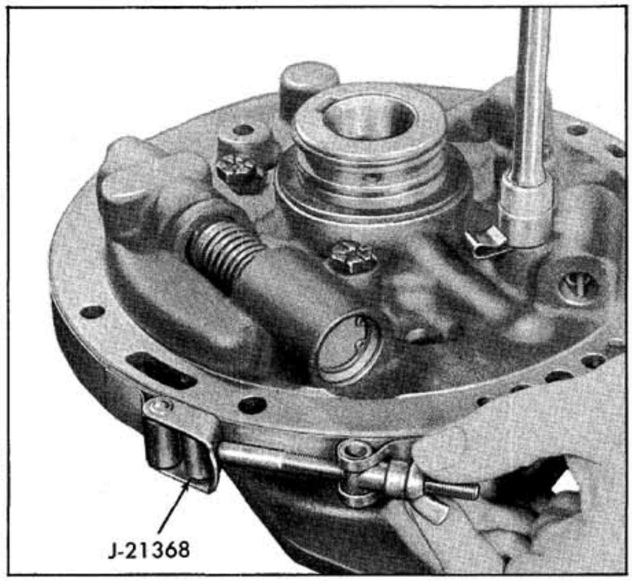


Fig. 6-123 Installing Pump Body

BT-6408-3, drive the seat to the stop. (Fig. 6-121)

11. Install the check valve. (Fig. 6-122)
12. Assemble pump cover to pump body with attaching bolts and clip adjacent to stator valve.

    NOTE: Leave the bolts one turn loose at this time.

13. Place Pump Aligning Strip, J-21368, over pump body and cover, and tighten tool. (Fig. 6-123)
14. Torque pump cover bolts to 20 ft. lbs.
15. Install and align pump to case gasket.
16. Attach stator solenoid with attaching screws. (Fig. 6-124)

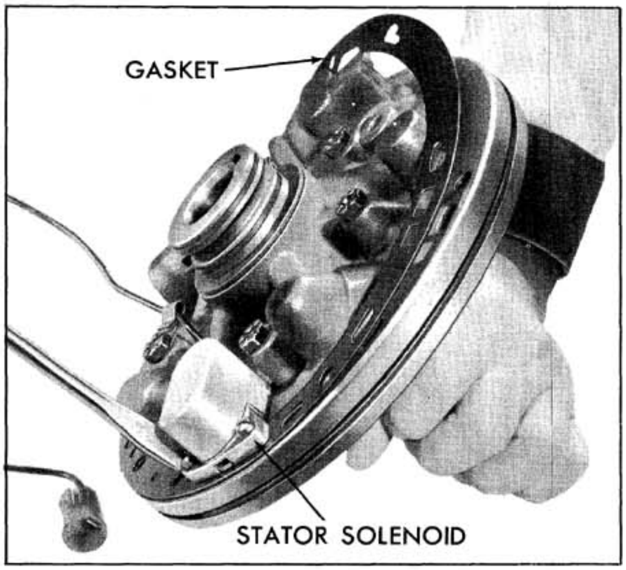


Fig. 6-124 Installing Solenoid and Gasket

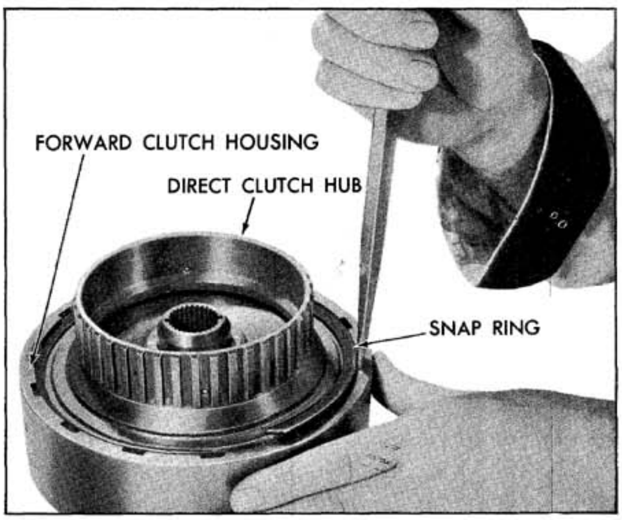


Fig. 6-125 Removing Snap Ring

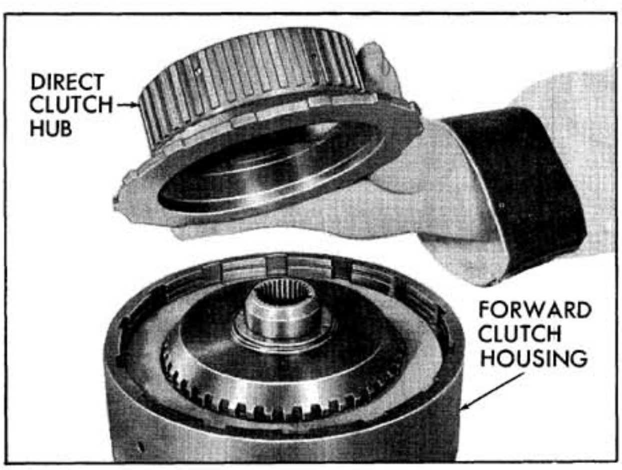


Fig. 6-126 Removing Direct Clutch Hub

17. Attach stator electric wire to clip.

18. Install the pump to case "O" ring seal.

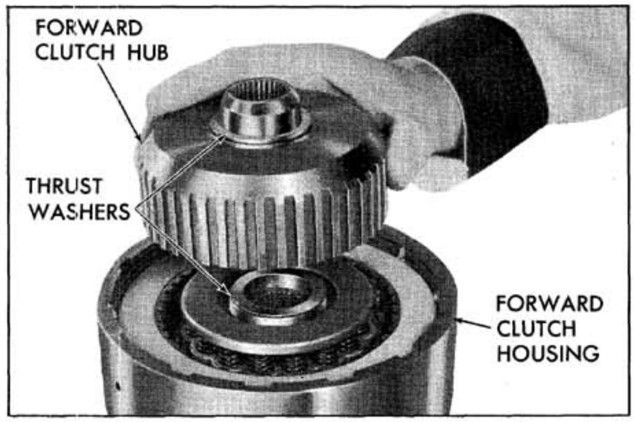


Fig. 6-127 Removing Forward Clutch

FORWARD CLUTCH

Disassembly

1. Place forward clutch and turbine shaft in hole in bench, or Holding Fixture J-6116, and remove the forward clutch housing to direct clutch hub snap ring. (Fig. 6-125)

2. Remove the direct clutch hub. (Fig. 6-126)

3. Remove the forward clutch hub and thrust washers. (Fig. 6-127)

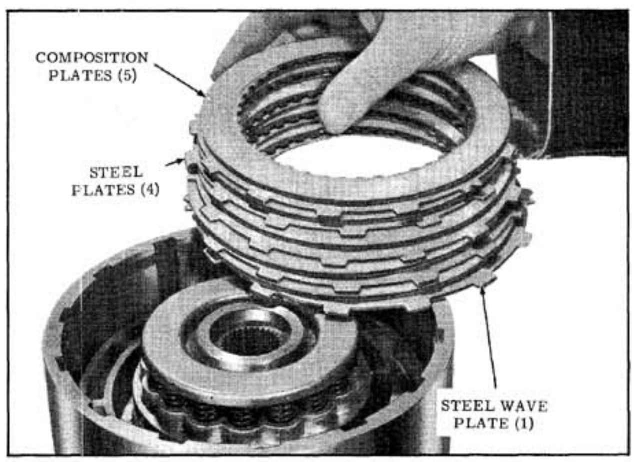


Fig. 6-128 Removing Clutch Plates

4. Remove five composition and five steel clutch plates. (Fig. 6-128)

5. Remove the turbine shaft and oil seal by installing in arbor press. (Fig. 6-129)

6. Using J-4670 Clutch Spring Compressor, with Adapters J-6129 and J-8765, compress the spring retainer and remove the snap ring. (Fig. 6-130)

7. Remove the tools, snap ring, spring retainer and 16 clutch release springs. (Fig. 6-131)

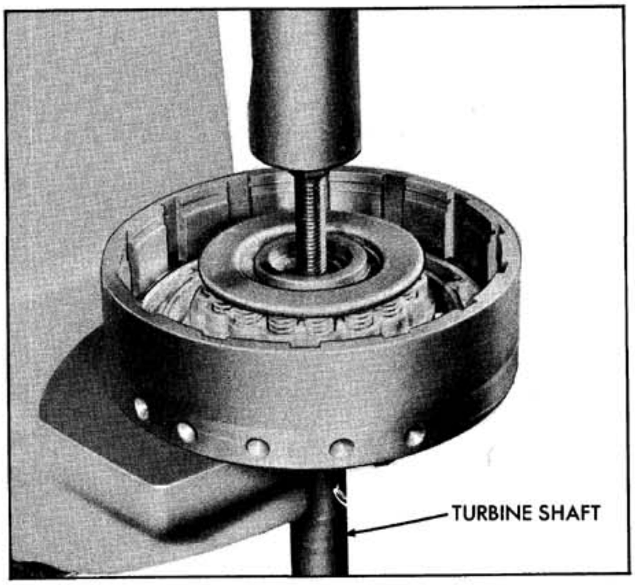


Fig. 6-129 Removing Turbine Shaft

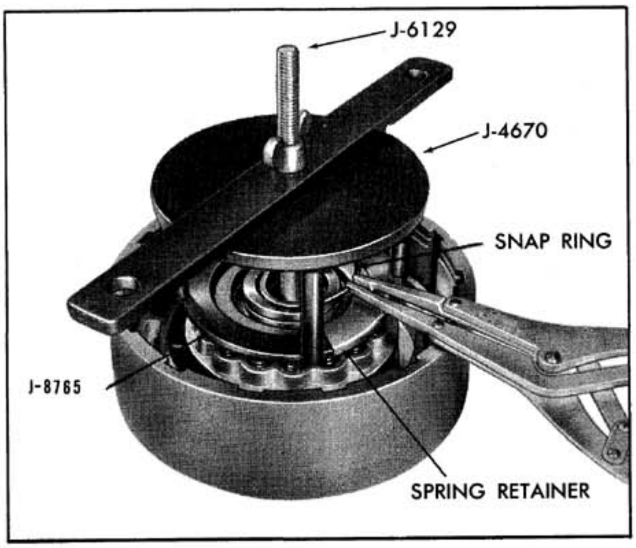


Fig. 6-130 Removing Snap Ring

8. Remove the forward clutch piston. (Fig. 6-132)

9. Remove the inner and outer clutch piston seals. (Figs. 6-133 and 6-134)

10. Remove the center piston seal from the forward clutch housing. (Fig. 6-135)

Inspection

1. Inspect the drive and driven clutch plates for signs of burning, scoring, or wear.

2. Inspect 16 springs for collapsed coils or signs of distortion.

3. Inspect the clutch hubs for worn splines, proper lubrication holes, thrust faces.

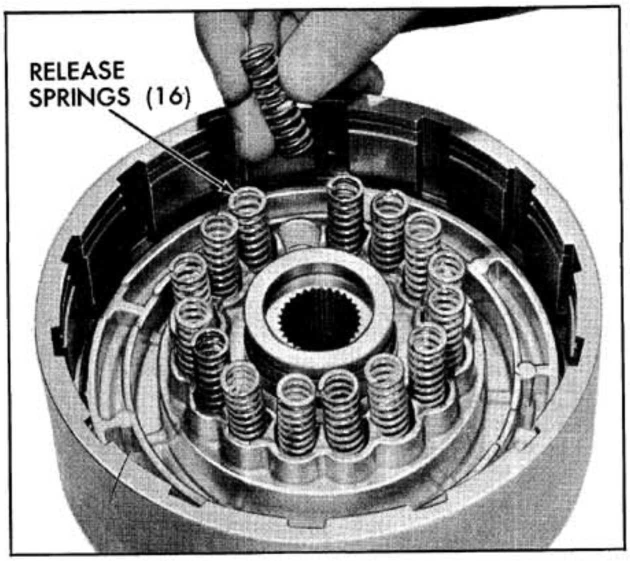


Fig. 6-131 Removing Release Springs

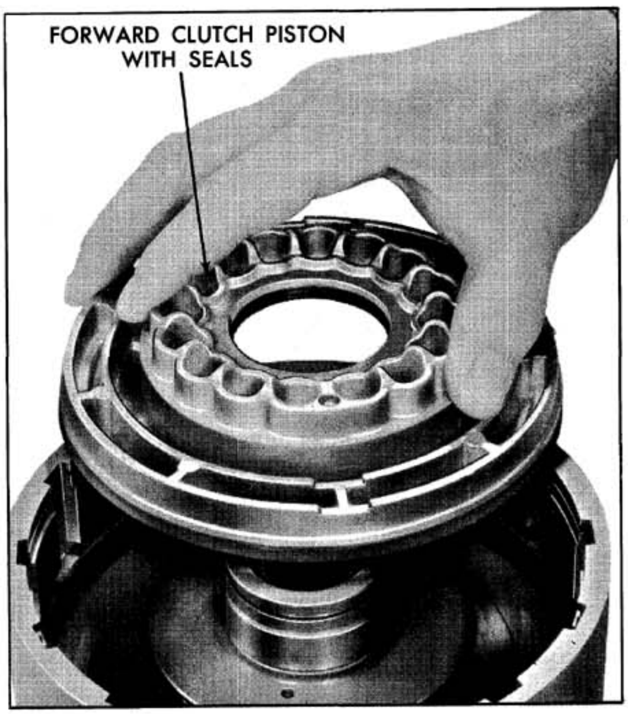


Fig. 6-132 Removing Forward Clutch Piston

4. Inspect the piston for cracks.

5. Inspect the clutch housing for wear, scoring, open oil passages and free operation of the ball check.

Assembly (Figs. 6-136 and 6-137)

1. Place new inner and outer oil seals on clutch piston, lips face away from spring pockets. (Figs. 6-138 and 6-139)

2. Place a new center seal on the clutch housing, lip faces up. (Fig. 6-140)

3. Place Seal Protector Tool J-21362 over clutch hub and install outer clutch piston Seal Protector J-21409, into clutch drum and install piston, rotating piston on drum until seated. (Fig. 6-141)

4. Install clutch release springs (blue) into pockets in piston. (Fig. 6-142)

5. Place spring retainer and snap ring on springs.

6. Compress springs using Clutch Compressor Tools J-4670, J-6129, and J-8765, and install snap ring. (Fig. 6-143)

7. If removed, install oil seal ring on turbine shaft and install in forward clutch housing, using arbor press. (Fig. 6-144)

8. Place clutch hub to clutch housing thrust washers on clutch hub. Retain with petrolatum.

9. Place forward clutch hub into forward clutch housing. (Fig. 6-145)

10. Oil and install five composition and four flat steel and one waved steel clutch plate (plate with notches), starting with the waved steel and alternating steel and composition. (Fig. 6-146)

11. Install the direct clutch hub and retaining snap ring. (Fig. 6-147)

12. Place forward clutch housing on pump delivery sleeve and air check clutch operation. (Fig. 6-148)

DIRECT CLUTCH AND INTERMEDIATE SPRAG

Disassembly

1. Remove sprag retainer snap ring and retainer. (Fig. 6-149)

2. Remove sprag outer race, bushings and sprag assembly. (Fig. 6-150)

3. Turn unit over and remove backing plate to direct clutch housing snap ring. (Fig. 6-151)

4. Remove direct clutch backing plate, five composition and five steel clutch plates. (Fig. 6-152)

5. Using Clutch Compressor Tool J-4670, J-6129, and J-8765, compress spring retainer and remove snap ring. (Fig. 6-153)

6. Remove retainer and 16 piston release springs. (Fig. 6-154)

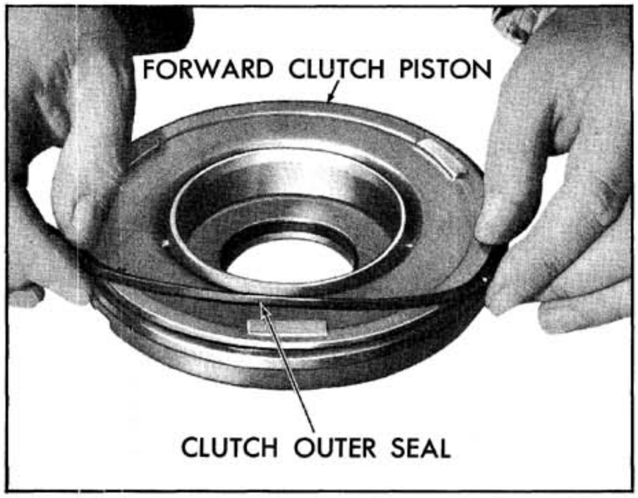


Fig. 6-133 Removing Outer Piston Seal

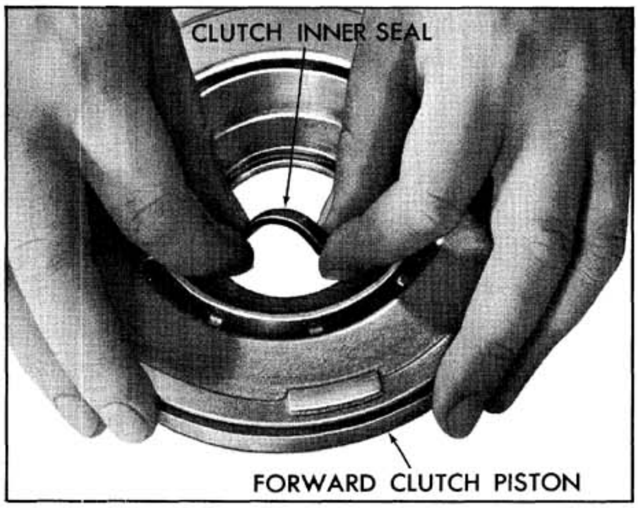


Fig. 6-134 Removing Inner Piston Seal

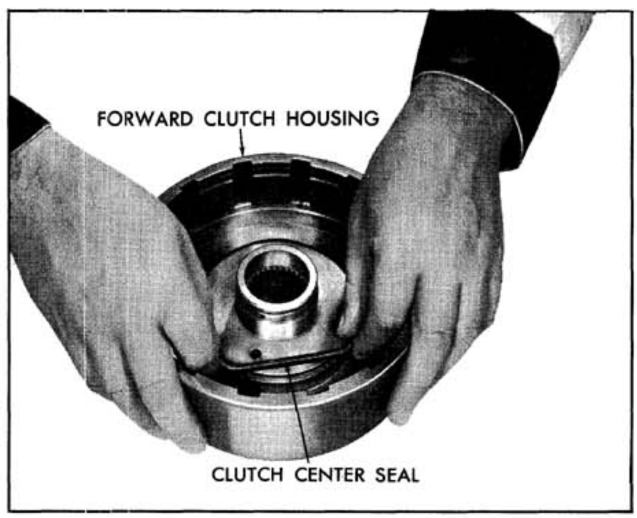


Fig. 6-135 Removing Center Seal

7. Remove the direct clutch piston. (Fig. 6-155)

8. Remove the outer seal from the piston. (Fig. 6-156)

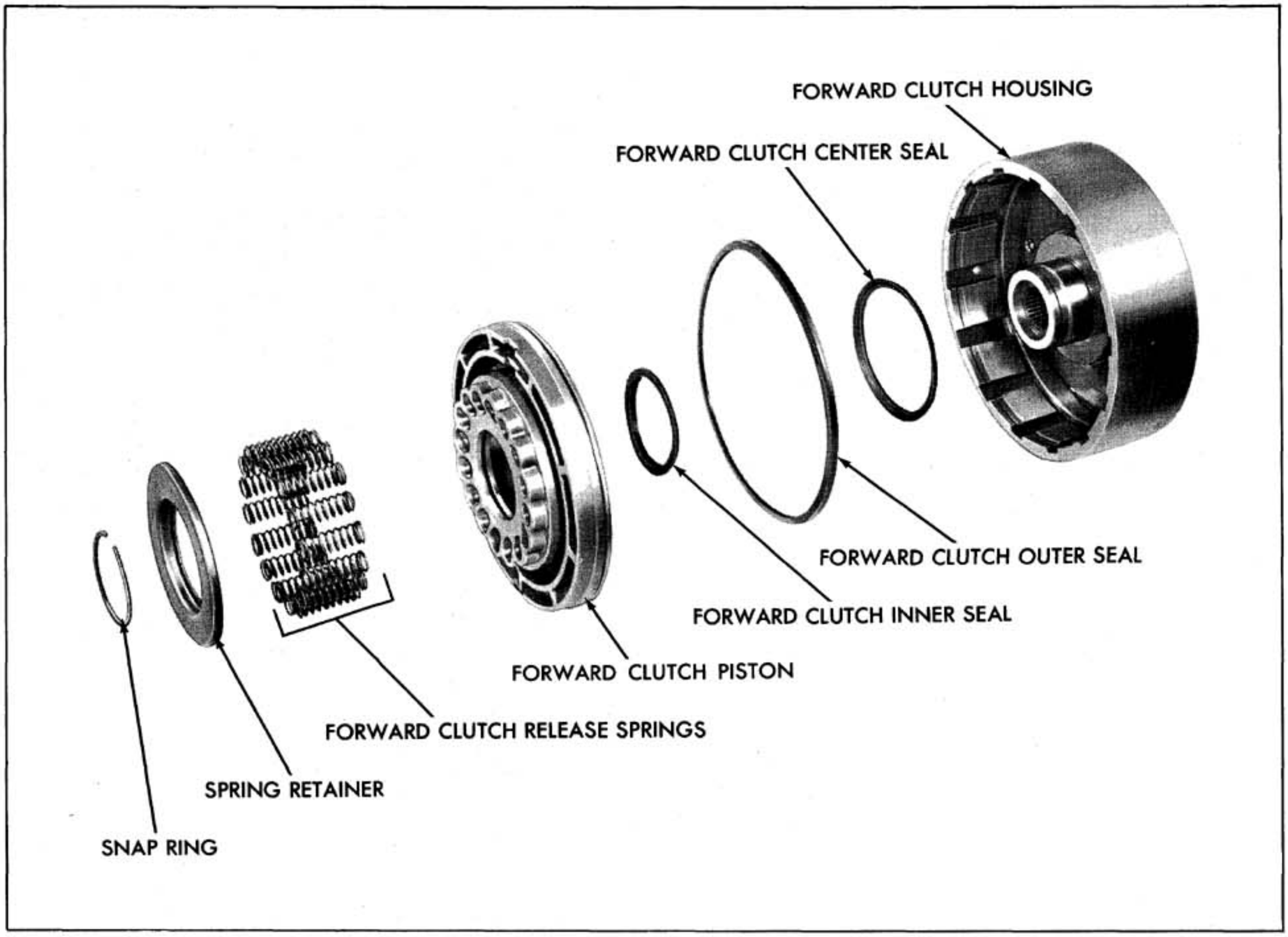


Fig. 6-136 Forward Clutch Piston Assembly

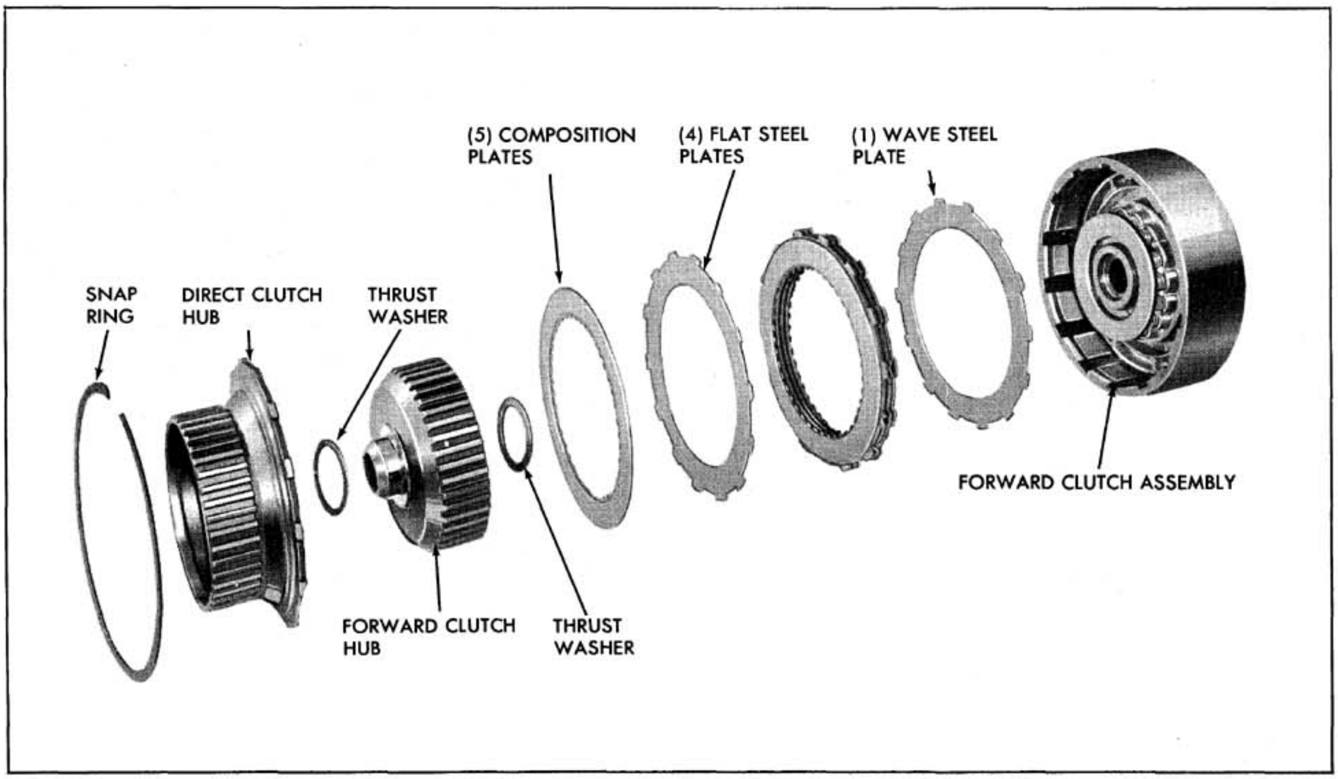


Fig. 6-137 Forward Clutch Assembly

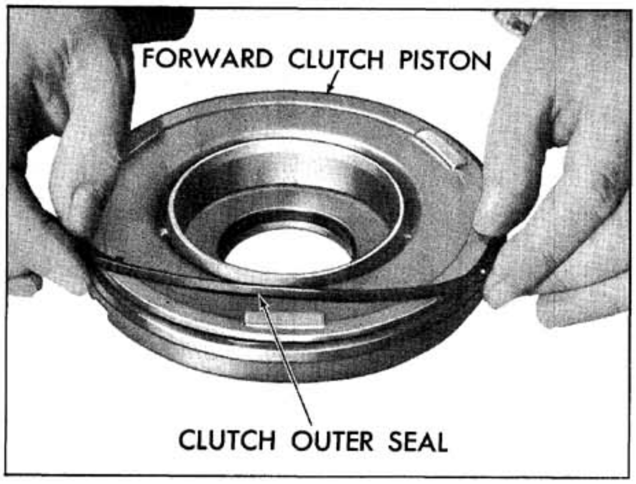


Fig. 6-138 Installing Piston Outer Seal

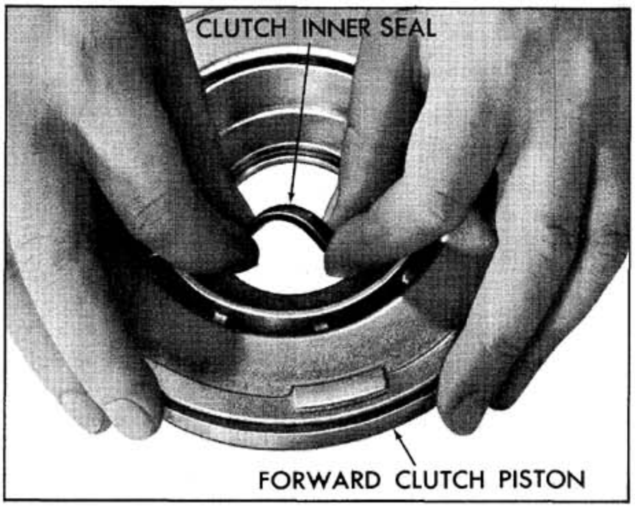


Fig. 6-139 Installing Piston Inner Seal

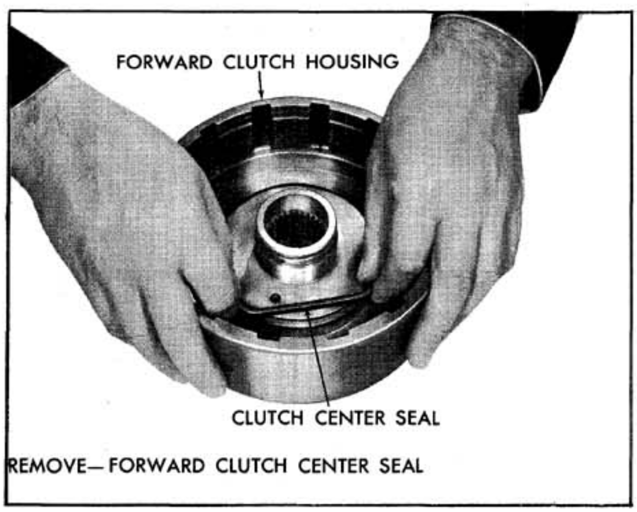


Fig. 6-140 Installing Piston Center Seal

9. Remove the inner seal from the piston. (Fig. 6-157)

10. Remove the center piston seal from the direct clutch housing. (Fig. 6-158)

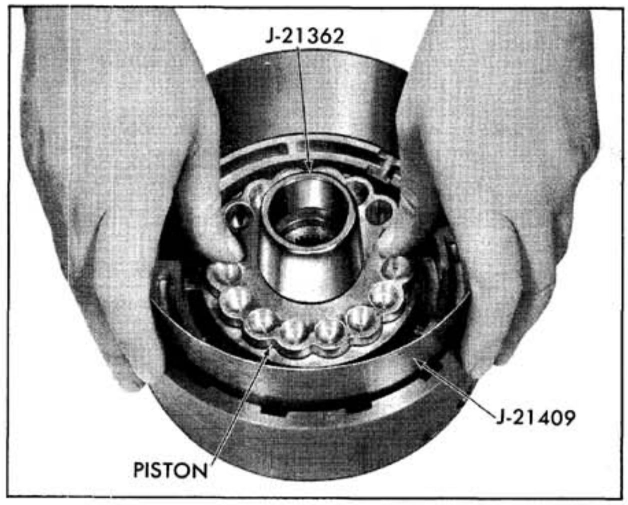


Fig. 6-141 Installing Clutch Piston

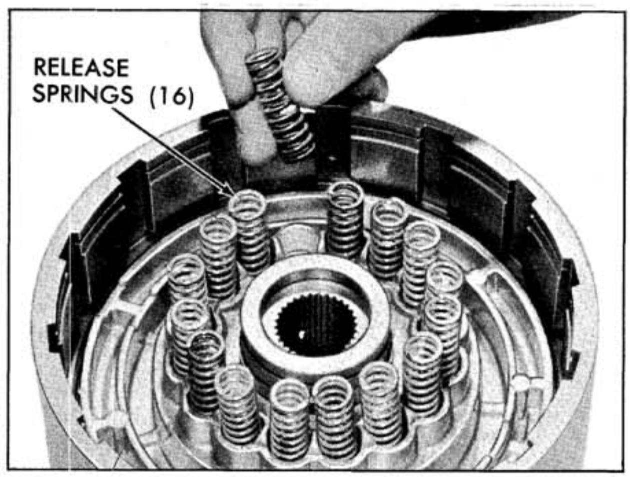


Fig. 6-142 Installing Released Springs

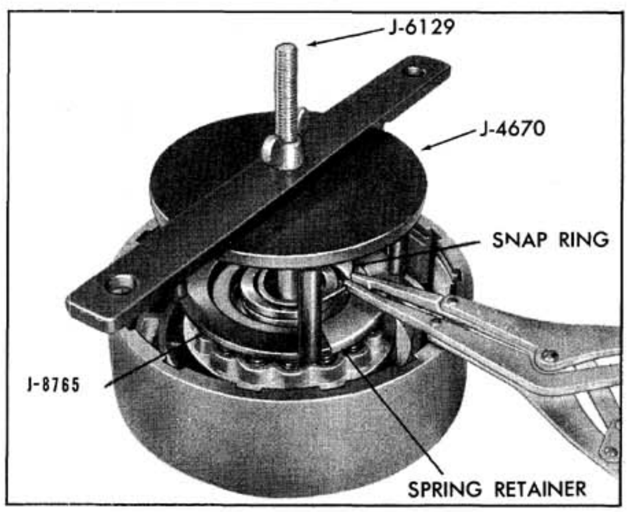


Fig. 6-143 Installing Snap Ring

Inspection

1. Inspect sprag assembly for popped or loose sprags.

2. Inspect sprag bushings for wear or distortion.

Fig. 6-144 Installing Turbine Shaft

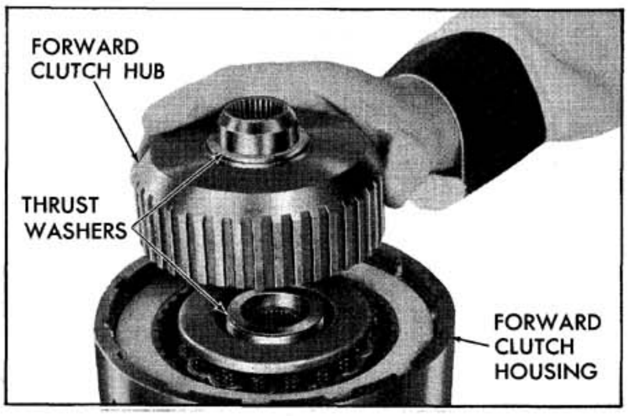


Fig. 6-145 Installing Forward Clutch Hub

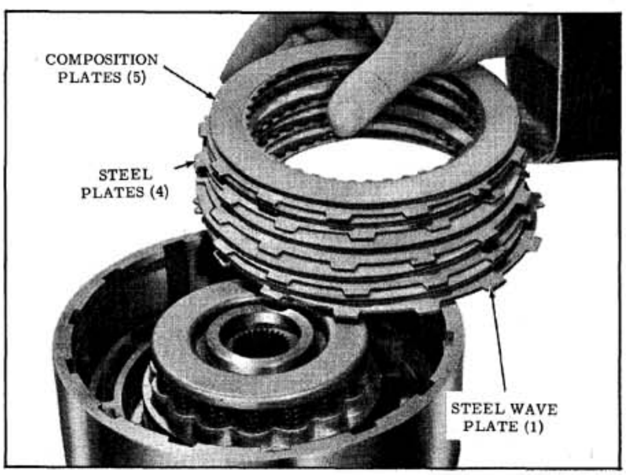


Fig. 6-146 Installing Forward Clutch Plates

3. Inspect the inner and outer races for scratches or wear.

4. Inspect the clutch housing for cracks, wear, proper opening of oil passages or wear on clutch plate drive lugs.

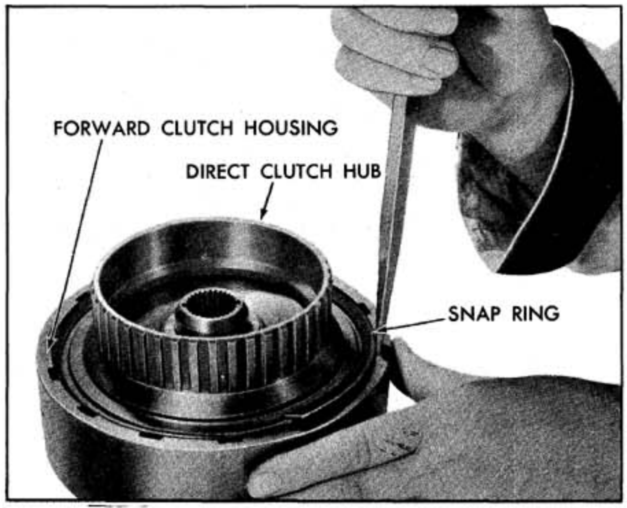


Fig. 6-147 Installing Snap Ring

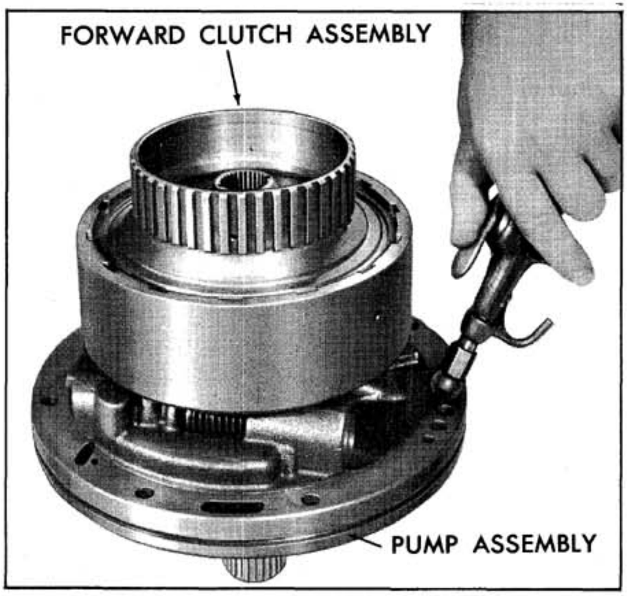


Fig. 6-148 Air Checking Forward Clutch

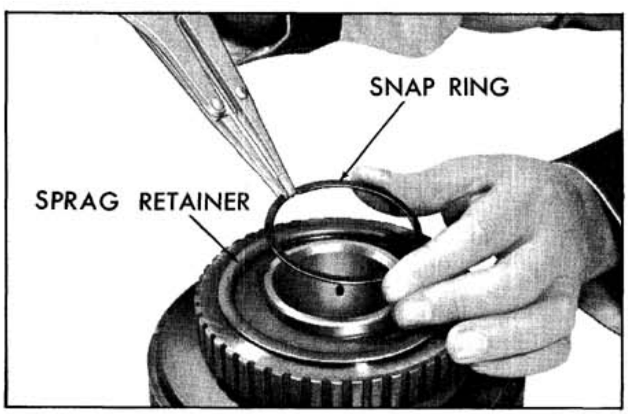


Fig. 6-149 Removing Snap Ring

5. Inspect the drive and driven clutch plates for sign of wear or burning.

6. Inspect the backing plate for scratches or other damage.

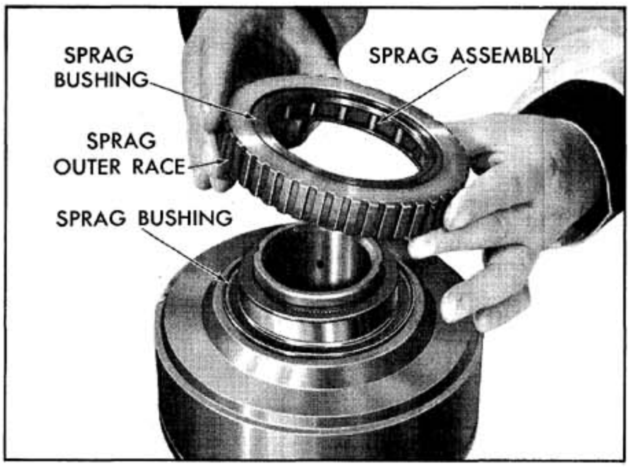


Fig. 6-150 Removing Intermediate Sprag

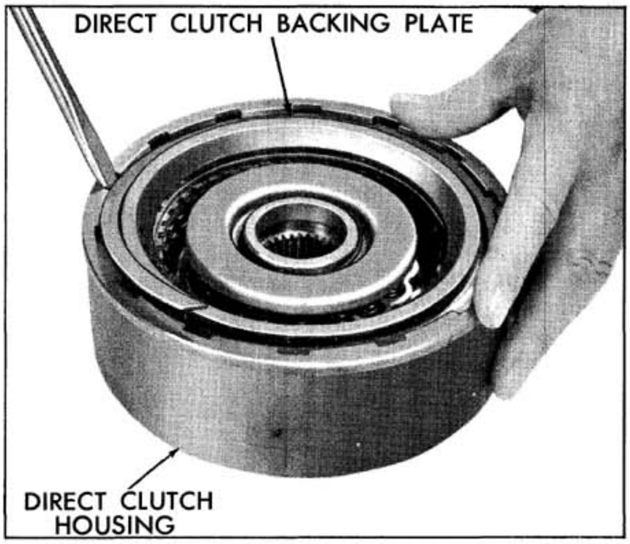


Fig. 6-151 Removing Snap Ring

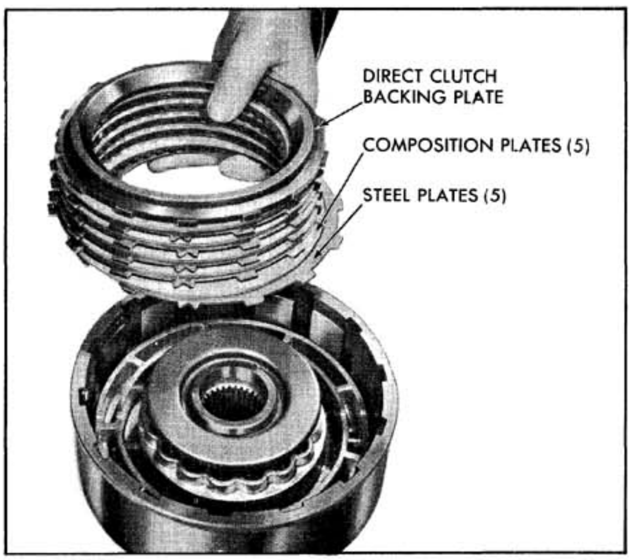


Fig. 6-152 Removing Direct Clutch Plates

7. Inspect the clutch piston for cracks and free operation of the ball check.

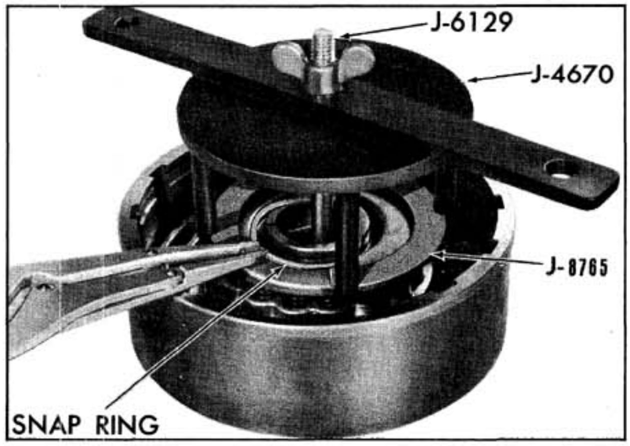


Fig. 6-153 Removing Snap Ring

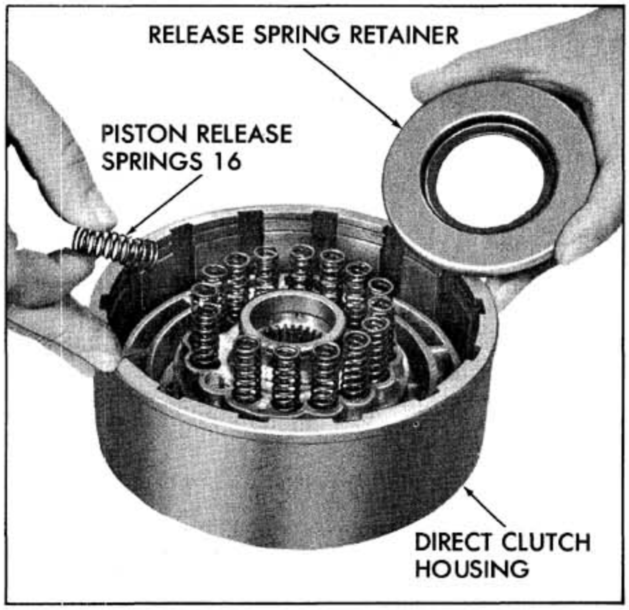


Fig. 6-154 Removing Release Springs

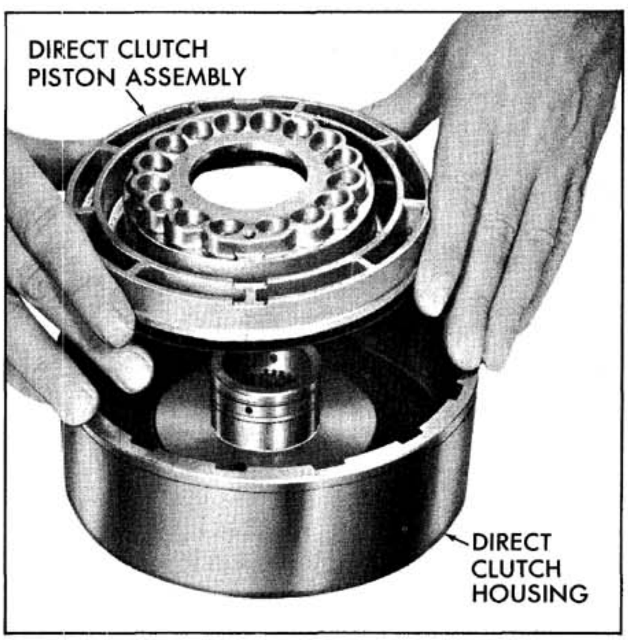


Fig. 6-155 Removing Direct Clutch Piston

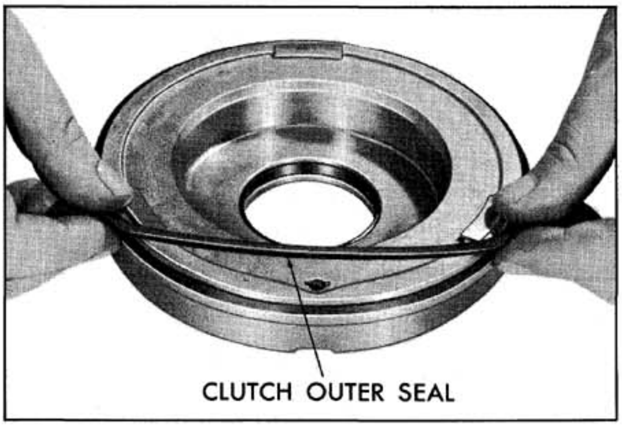


Fig. 6-156 Removing Piston Outer Seal

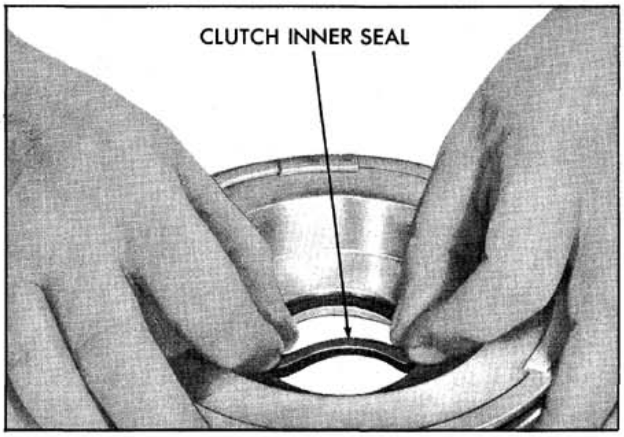


Fig. 6-157 Removing Piston Inner Seal

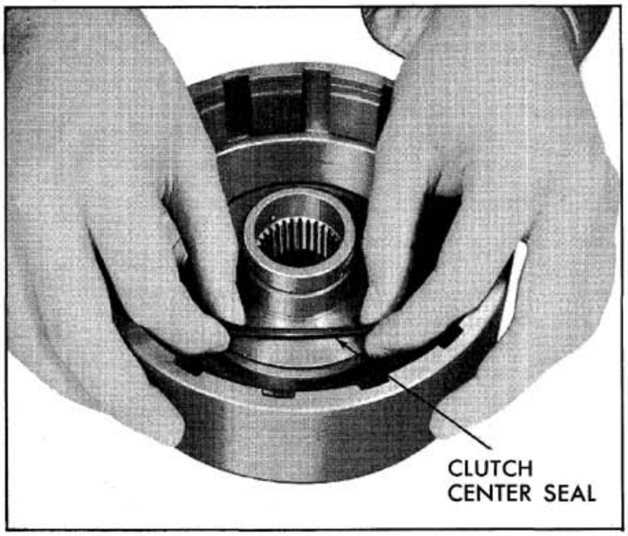


Fig. 6-158 Removing Piston Center Seal

Assembly (Figs. 6-159 and 6-160)

1. Install a new inner clutch piston seal on piston with lip facing away from spring pockets. (Fig. 6-161)
2. Install a new outer clutch piston seal. (Fig. 6-162)
3. Install a new center seal on clutch housing with lip of seal facing up. (Fig. 6-163)

NOTE: Apply Hydra-Matic oil to all seals.

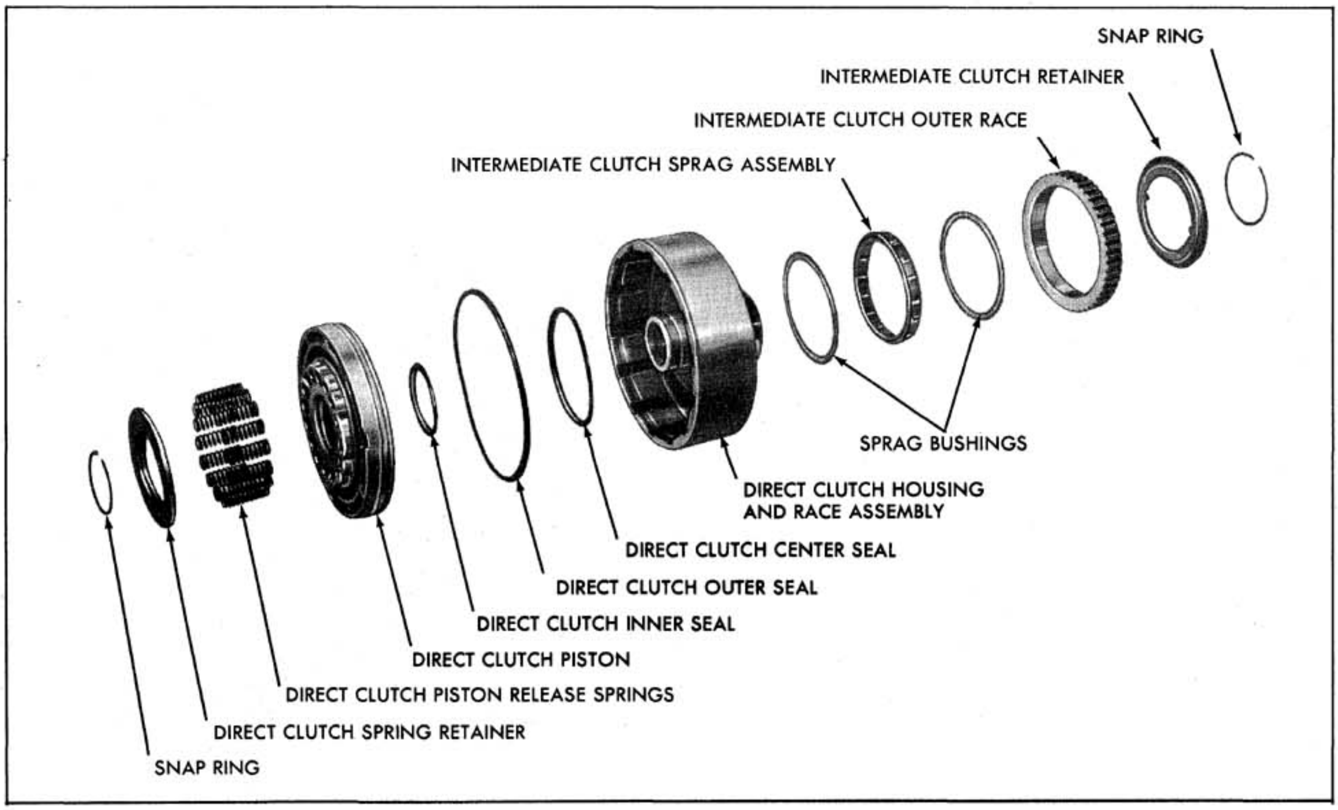


Fig. 6-159 Direct Clutch and Sprag Assembly

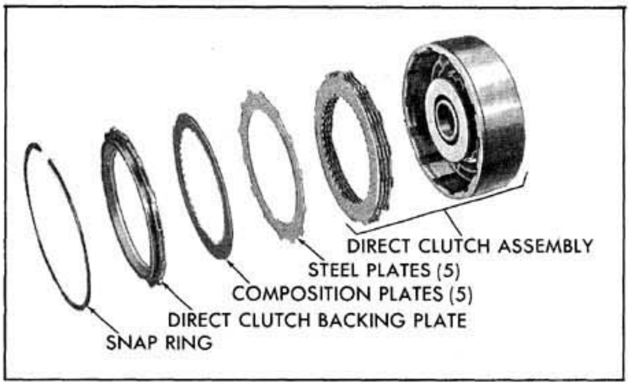


Fig. 6-160 Direct Clutch Assembly

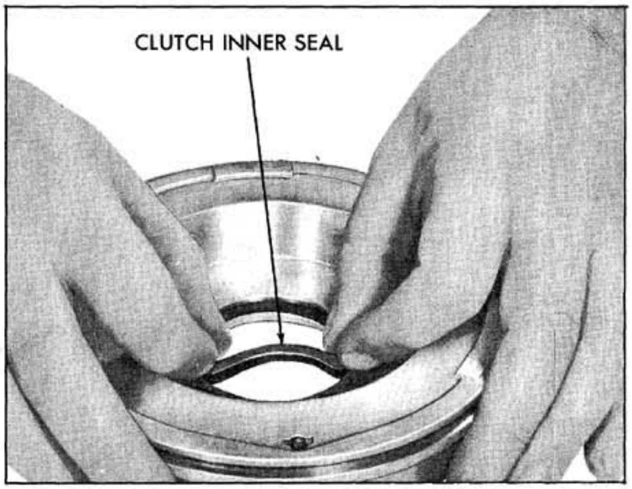


Fig. 6-161 Installing Piston Inner Seal

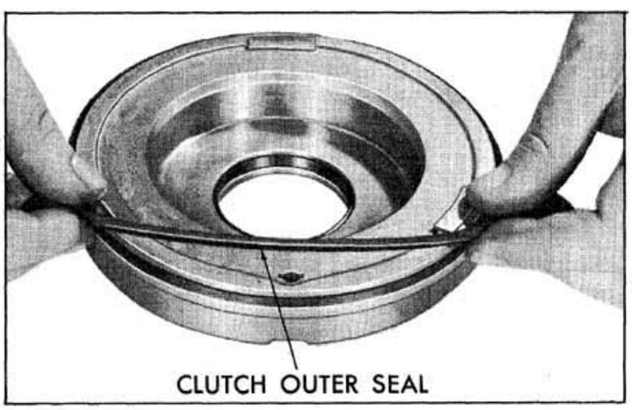


Fig. 6-162 Installing Piston Outer Seal

4. Place Seal Protectors, Tools J-21362-Inner, J-21409-Outer, over hub and clutch housing and install clutch piston with rotating motion. (Fig. 6-164)

5. Install 16 springs (black) into the piston. (Fig. 6-165)

6. Place spring retainer and snap ring on springs.

7. Using Clutch Compressor Tool J-4670, J-6129 and J-8765, install snap ring. (Fig. 6-166)

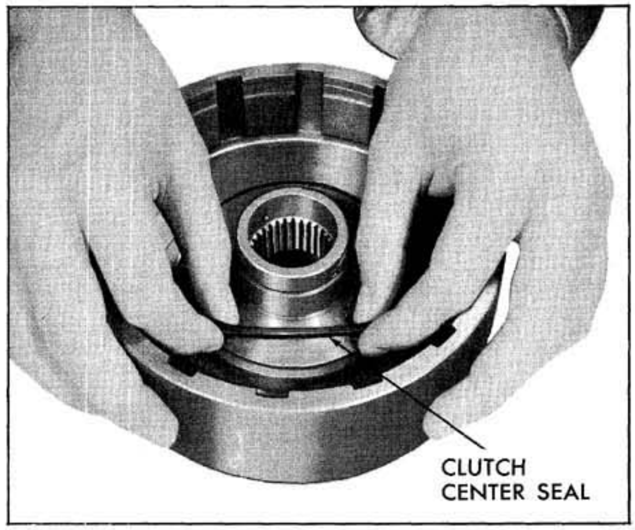


Fig. 6-163 Installing Piston Center Seal

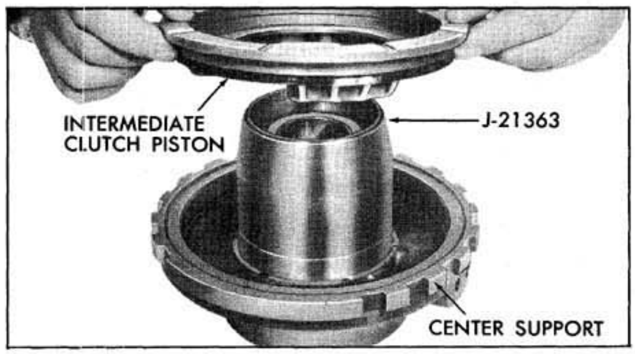


Fig. 6-164 Installing Direct Clutch Piston

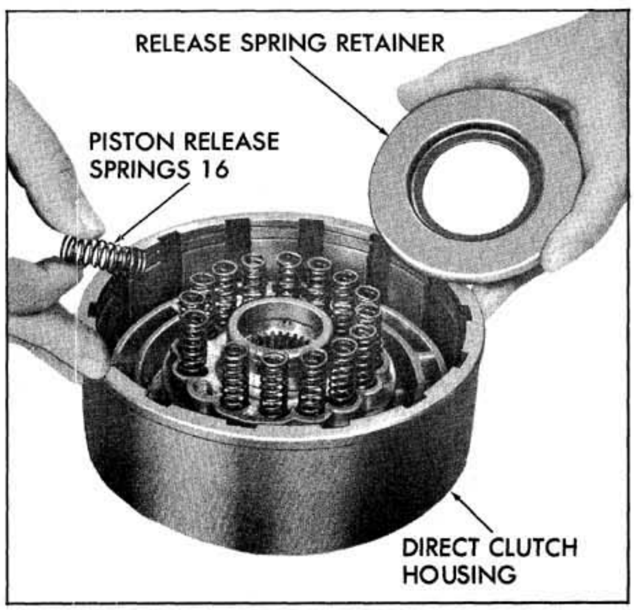


Fig. 6-165 Installing Release Springs

8. Install five composition and five steel clutch plates, starting with steel and alternating steel and composition. The steel plates must have the notches in the drive lugs one above the other. (Fig. 6-167)

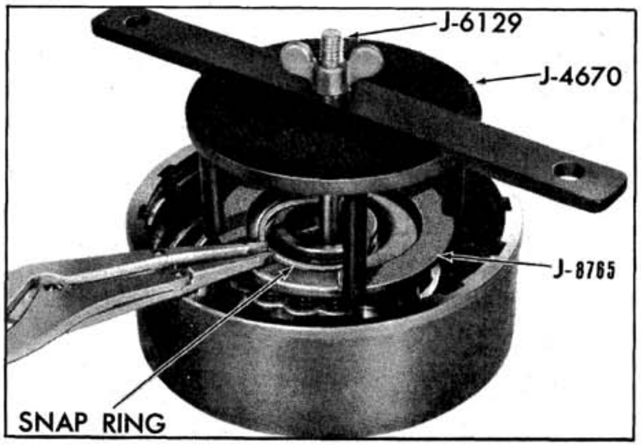


Fig. 6-166 Installing Snap Ring

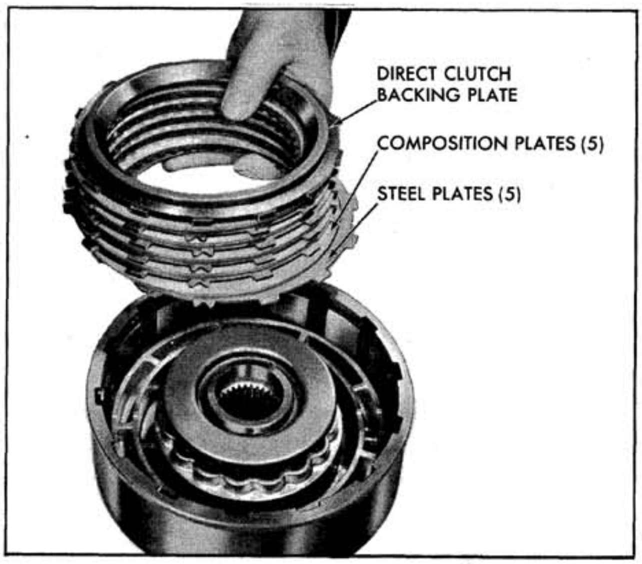


Fig. 6-167 Installing Direct Clutch Plates

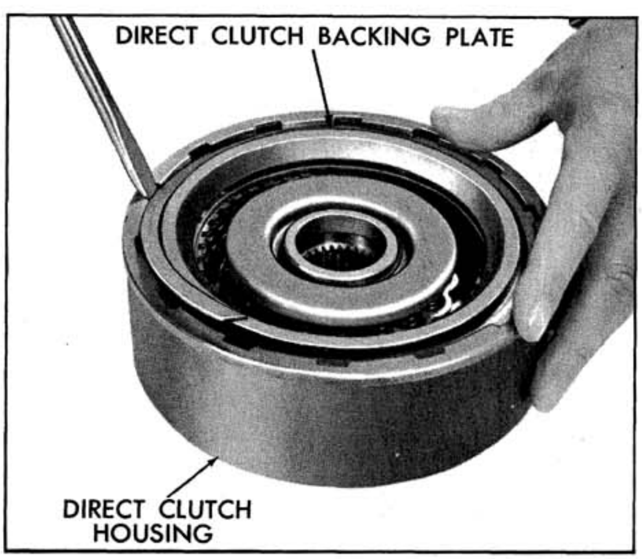


Fig. 6-168 Installing Snap Ring

9. Install the clutch backing plate and the backing plate retaining ring. (Fig. 6-168)

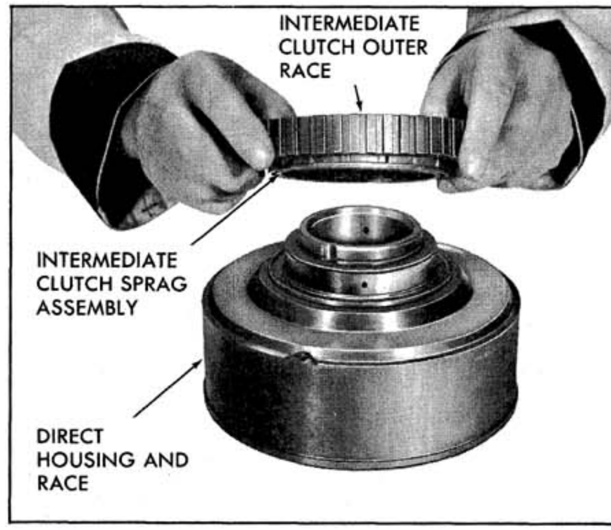


Fig. 6-169 Installing Intermediate Sprag

10. Turn unit over and install one sprag bushing, cup side up, over inner race.

11. Install sprag assembly into outer race.

12. With ridge or shoulder on inner cage down, start sprag and outer race over inner race with clockwise turning motion. (Fig. 6-169)

NOTE: Outer race should not turn counterclockwise.

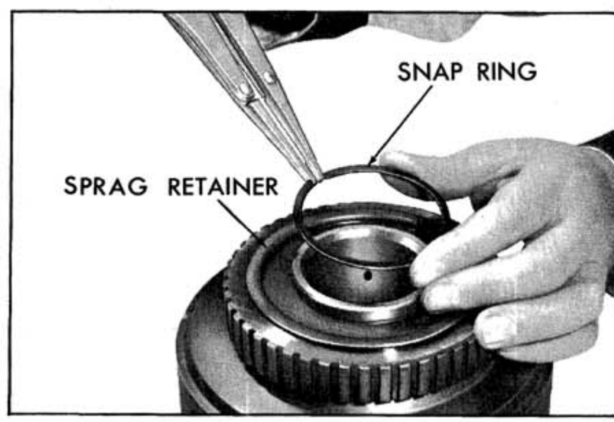


Fig. 6-170 Installing Snap Ring

13. Install sprag retainer over sprag, cup side down.

14. Install sprag retainer and snap ring. (Fig. 6-170)

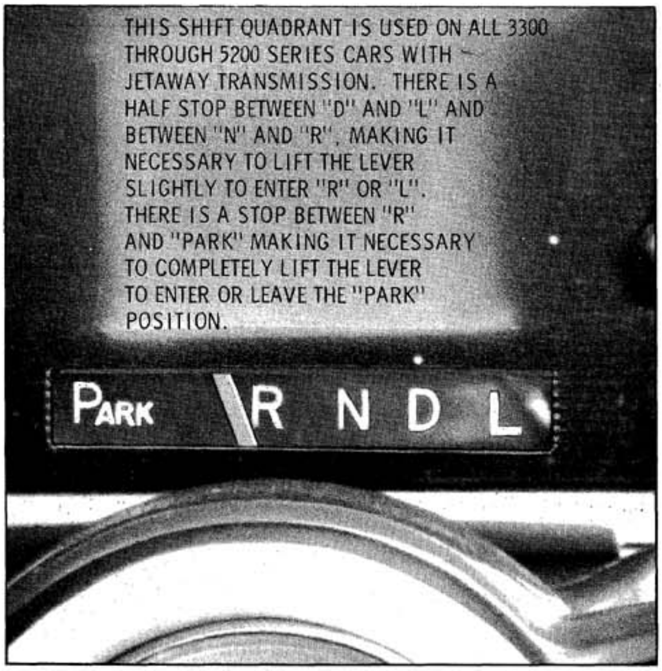
15. Place direct clutch assembly over center support and air check operation of direct clutch. (Fig. 6-171)

NOTE: If air is applied through reverse passage, it will escape from the direct clutch passage. This is normal.

JETAWAY

(33-34-35-36-38-52 SERIES)

CONTENTS OF SECTION 6



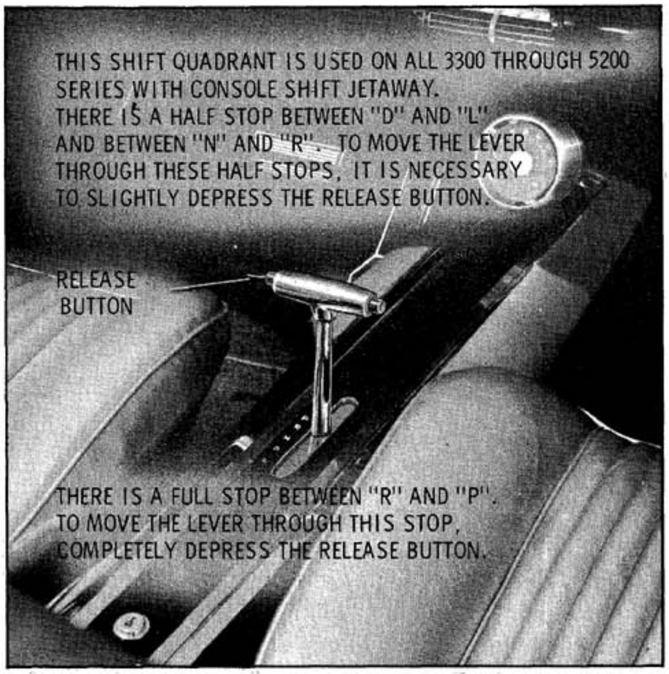


Fig. 6-301 Shift Quadrant

DESCRIPTION

The Jetaway transmission is a combination torque converter and planetary geared transmission. Torque multiplication is obtained hydraulically through the converter, and mechanically through a compound planetary gear set. The gear set, in combination with the torque converter, provides a high starting ratio for acceleration from a stop, up steep grades, etc. The torque converter provides torque multiplication for performance and exceptionally smooth operation. It functions as a fluid coupling at normal road load conditions and at higher speeds. Description of transmission is divided into six basic sections: (1) Torque Converter, (2) Oil Pump, (3) Planetary Gear Set and Controls, (4) Reverse Clutch, (5) Governor, (6) Valve Body.

TORQUE CONVERTER

The torque converter is connected to the engine flywheel and serves as a hydraulic coupling through which engine torque is transmitted to the input shaft. The torque converter steps up or multiplies engine torque whenever operating conditions demand greater torque than the engine alone can supply. The torque converter consists of three (3) basic sections: (a) Converter Pump, (b) Stator, (c) Converter Turbine.

Converter Pump (Fig. 6-302)

The function of the converter pump is to convert engine torque into an energy transmitting flow of oil to drive the converter turbine into which the oil is projected. The converter pump operates as a centrifugal pump, picking up oil at its center and discharging the oil at its rim. However, the converter is shaped to discharge the oil parallel to its axis in the form of a spinning hollow cylinder.

Stator (Fig. 6-303)

The stator is located between the converter turbine and the converter pump, and is supported by the stator shaft. The stator is equipped with an overrunning clutch assembly. When the clutch assembly is held stationary, it changes the direction of oil flow from the turbine to the proper angle for smooth entrance into the converter pump. As the turbine approaches pump speed the direction of oil flow changes until the stator no longer opposes pump rotation. The stator then free wheels so that it will not interfere with the flow of oil between the turbine and converter pump. For normal operation in Drive range the stator blades are set at low angle. For increased acceleration and performance, torque is obtained by setting the stator blades at high angle.

Converter Turbine (Fig. 6-304)

The function of the converter turbine is to absorb energy from the oil projected into it by the pump and convert the energy into torque and transmit that torque to the input shaft.

OIL PUMP (Fig. 6-305)

A positive displacement internal-external gear type oil pump is used to supply oil to fill the converter, for engagement of forward and reverse

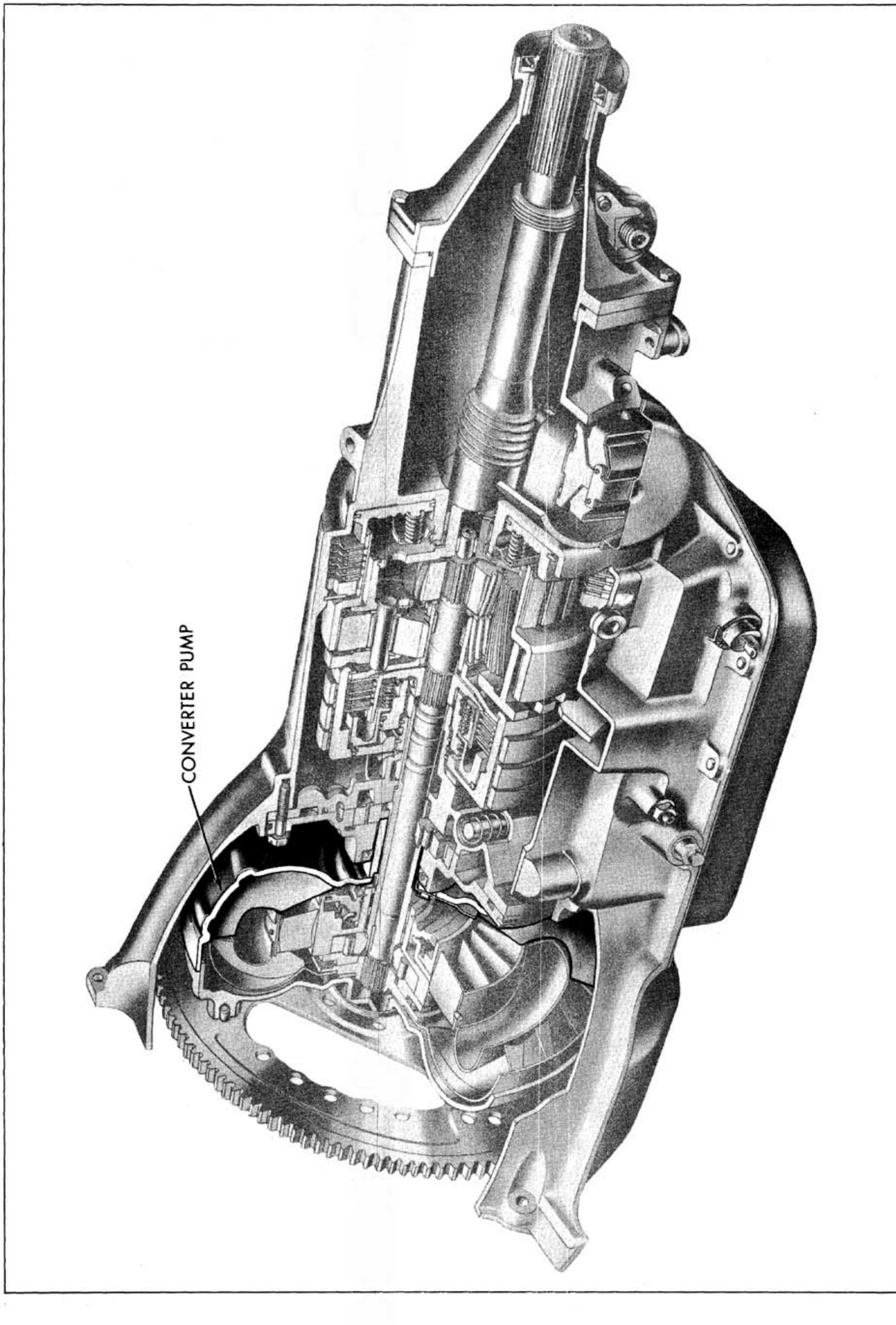


Fig. 6-302 Converter Pump

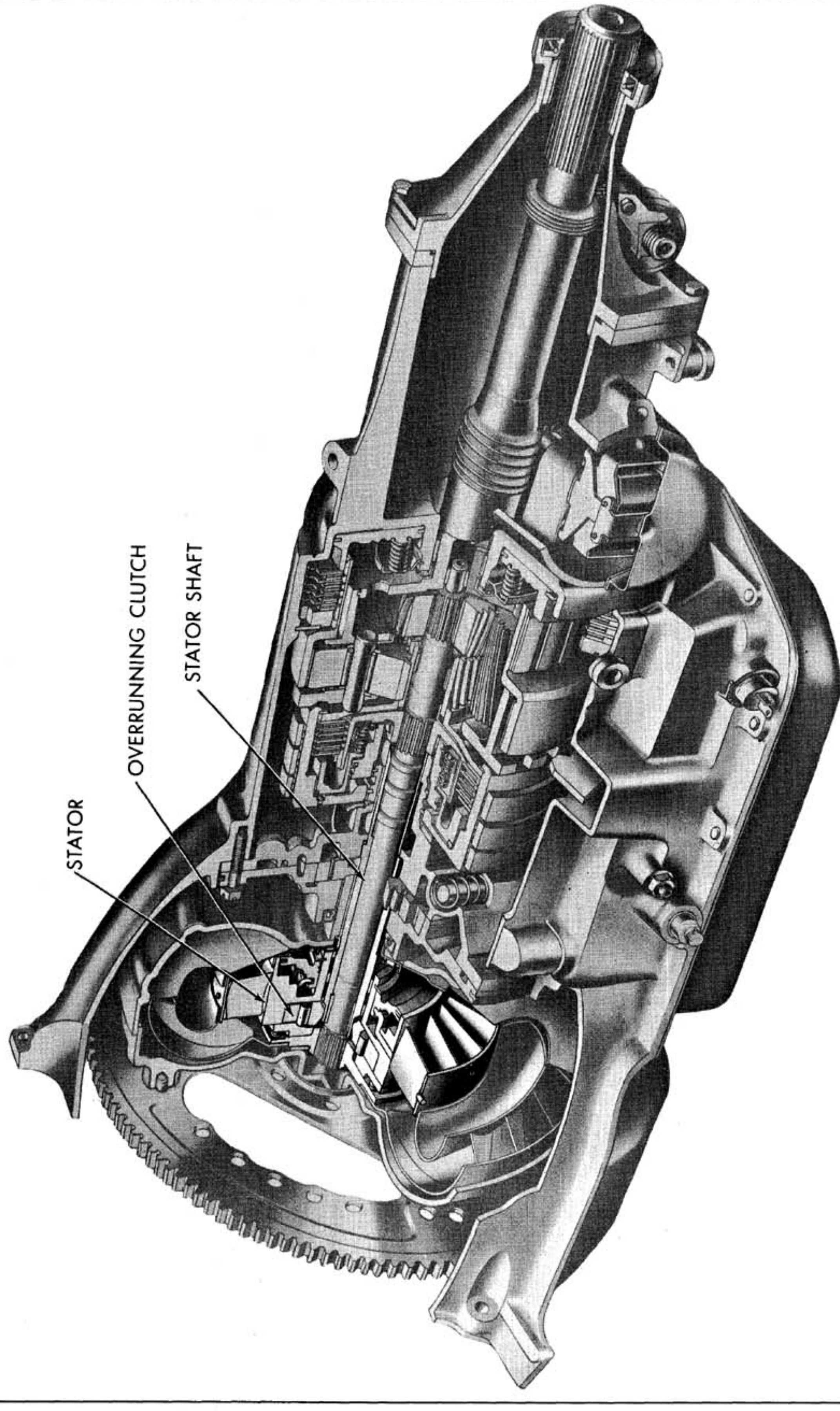


Fig. 6-303 Stator

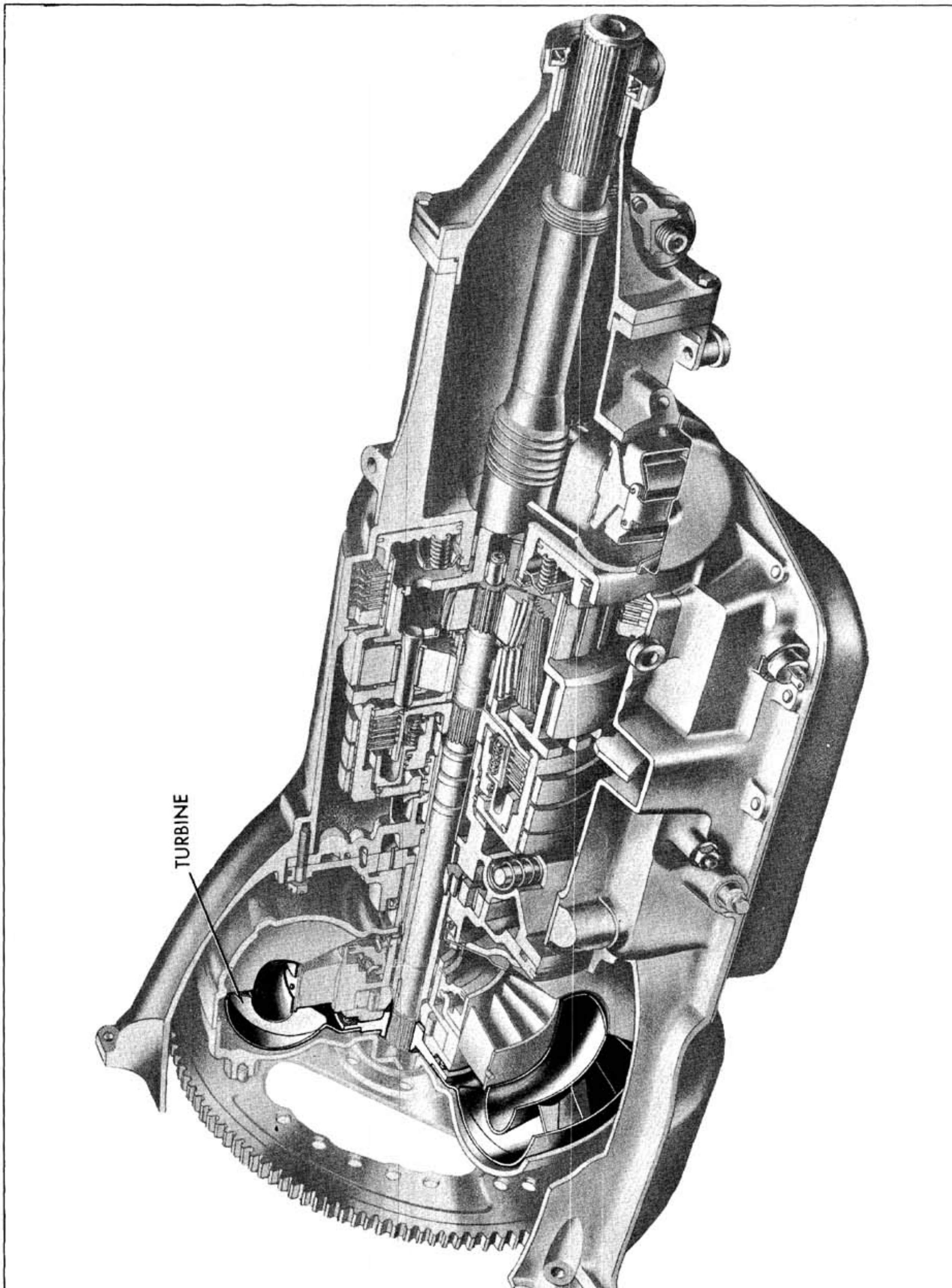


Fig. 6-304 Turbine

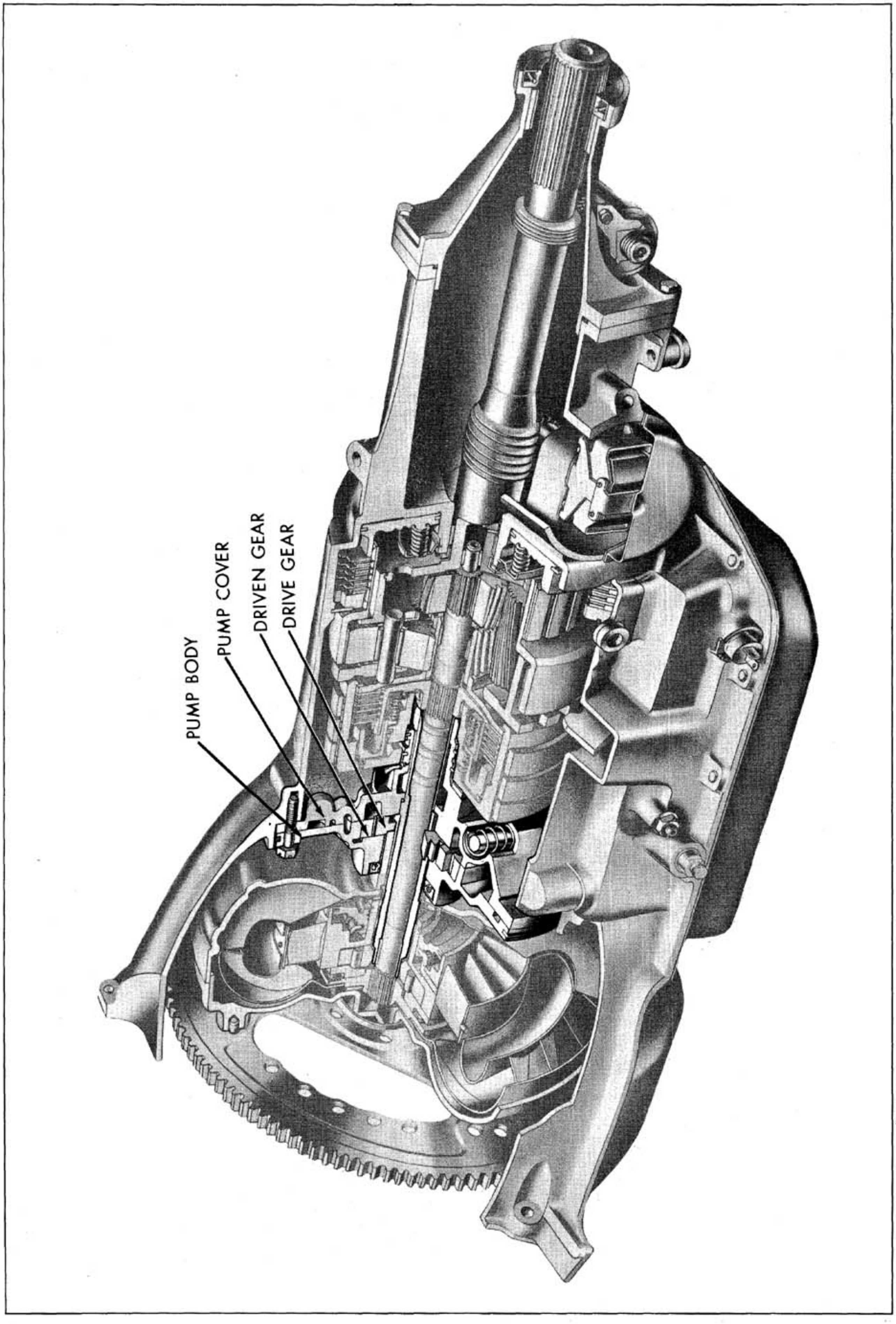


Fig. 6-305 Oil Pump

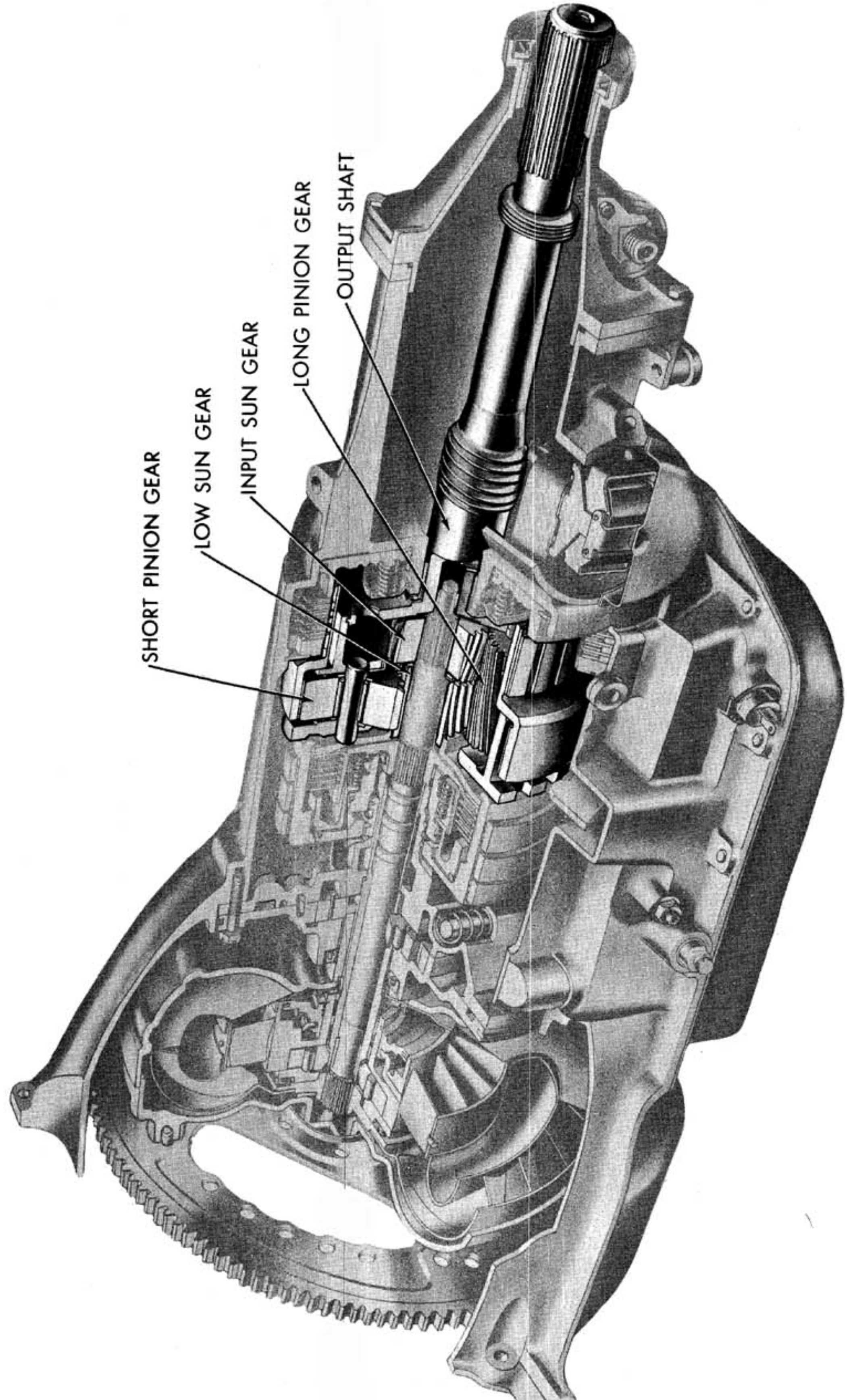


Fig. 6-306 Planetary Gear Set

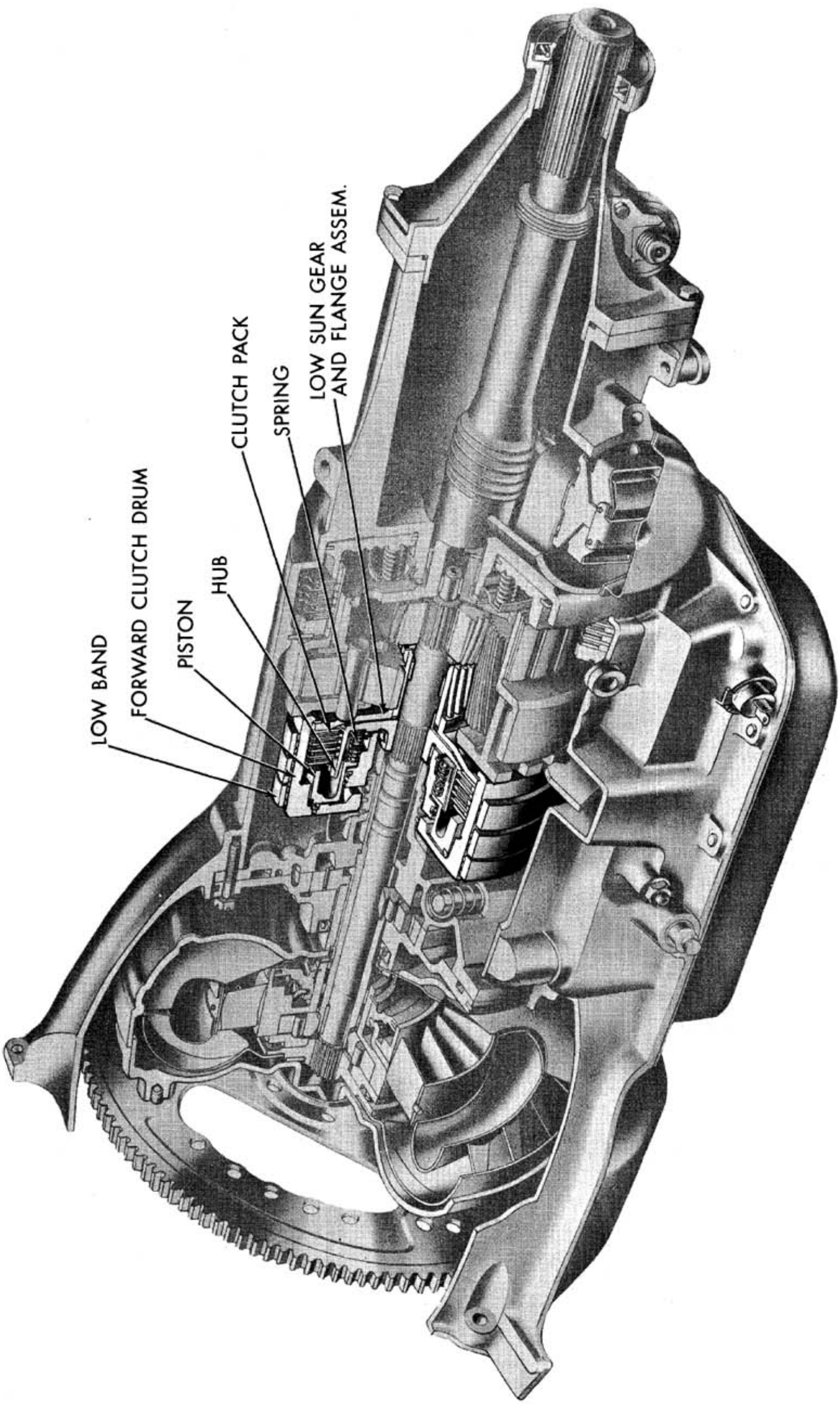


Fig. 6-307 Forward Clutch

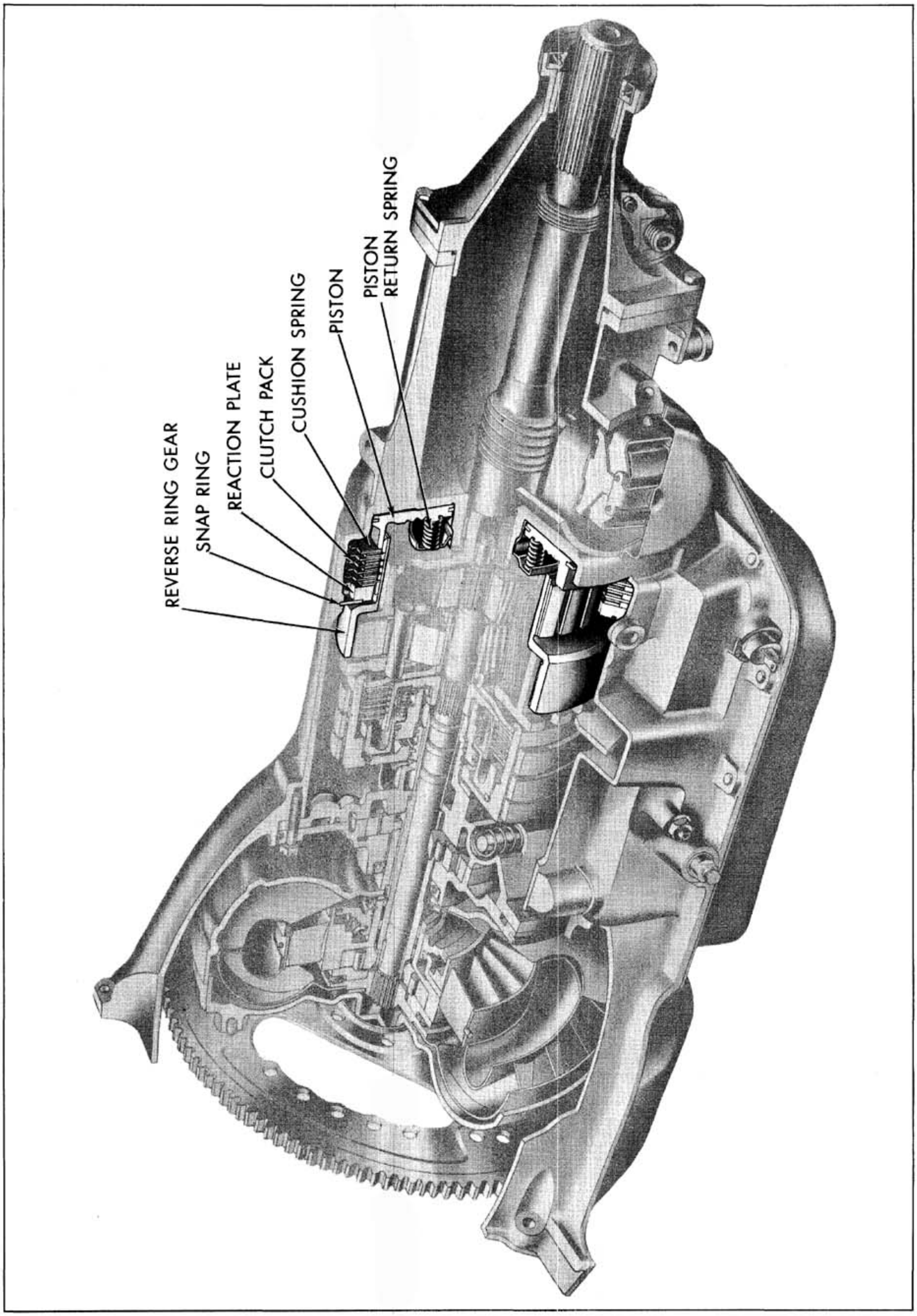


Fig. 6-308 Reverse Clutch

clutches, for application and release of the low band and to provide oil for lubrication and heat transfer.

PLANETARY GEAR SET (Fig. 6-306)

The planetary gear set consists of an input sun gear, low sun gear, short and long pinions, a reverse ring gear and a planet carrier. The input sun gear is splined to the input shaft. The low sun gear, which is part of the forward clutch assembly, may revolve freely until the low band is applied. The input sun gear is in mesh with three (3) long pinions and the long pinions are in mesh with three (3) short pinions. The short pinions are in mesh with the low sun gear and reverse ring gear. The input sun gear and short pinions always rotate in the same direction. Application of either the low band or the reverse clutch determines whether the output shaft rotates forward or backward.

Forward Clutch (Fig. 6-307)

The forward clutch assembly consists of a drum, piston, springs, piston seals, and a clutch pack. These parts are retained inside the drum by the low sun gear and the flange assembly and retainer ring. When oil pressure is applied to the piston, the clutch plates are pressed together connecting the clutch drum to the input shaft through the clutch hub. Engagement of the clutch causes the low sun gear to rotate with the input shaft.

Low Band (Fig. 6-307)

The low band is a double-wrap steel band faced with a bonded lining which surrounds the forward clutch drum. The band is hydraulically applied by the low servo piston, and released by spring pressure.

REVERSE CLUTCH (Fig. 6-308)

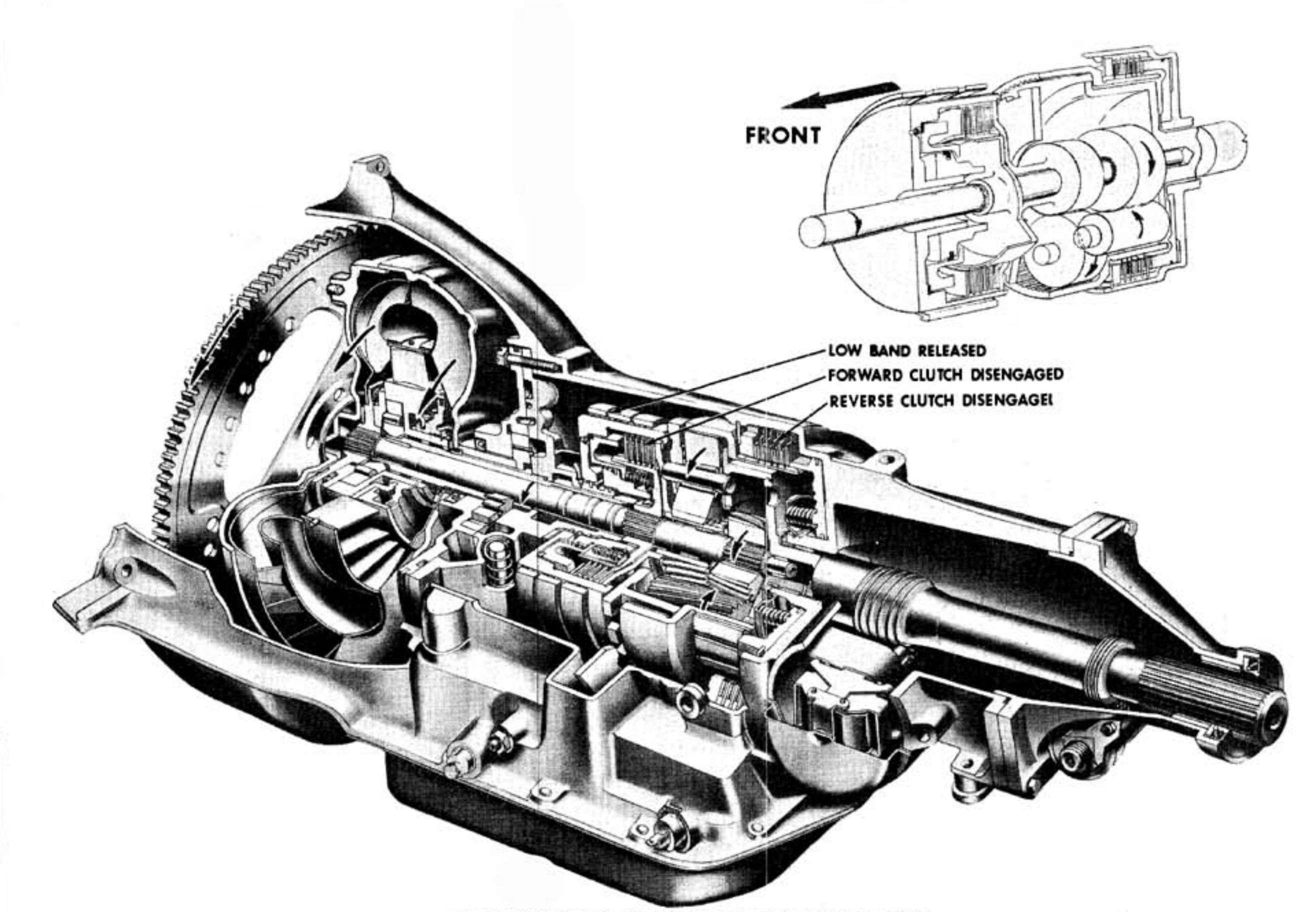
The reverse clutch assembly consists of a piston, inner and outer seal, cushion spring, coil springs, clutch pack, and reaction plate. These parts are retained inside the case by a retaining snap ring. When oil pressure is applied to the piston, the clutch plates are pressed together holding the reverse ring gear stationary. This engagement of the clutch causes reverse rotation of the output shaft.

GOVERNOR

The governor is located to the rear of the transmission case on the left side and is driven off the output shaft. The purpose of the governor is to generate a speed sensitive modulating oil pressure that increases up to a point with output shaft or car speed.

VALVE BODY

The valve body assemblies are bolted to the bottom of the transmission case and are accessible for service by removing the oil pan. The main valve body assembly consists of manual control valve, detent valve, shift valve, modulator limit valve, and high speed downshift timing valve. The stator valve body consists of a stator control valve.



OPERATION OF COMPONENTS IN NEUTRAL & PARK

Fig. 6-309 Neutral or Park

NEUTRAL OR PARK

FORWARD CLUTCH—DISENGAGED **REVERSE CLUTCH—DISENGAGED**

LOW BAND—RELEASED

Operation of Units in Neutral or Park

With the shift lever in "N" position, the output shaft remains stationary. The clutches and low band are released; therefore, there is no reaction member to provide positive drive. All gears are free to spin around their own axis, and no motion is imparted to the planet carrier.

In "P", a positive gear train lock is provided when the parking pawl is engaged with the heavy teeth spaced around the front face of the planetary carrier. The linkage is actuated by direct manual action, but the parking pawl is activated by spring action. If the pawl is in line with a tooth of the planet carrier, rather than a space between teeth, the linkage remains in the "P" position with the spring holding pressure against the pawl. Slight rotation of the planet carrier will immediately seat the pawl and lock the output shaft to the case.

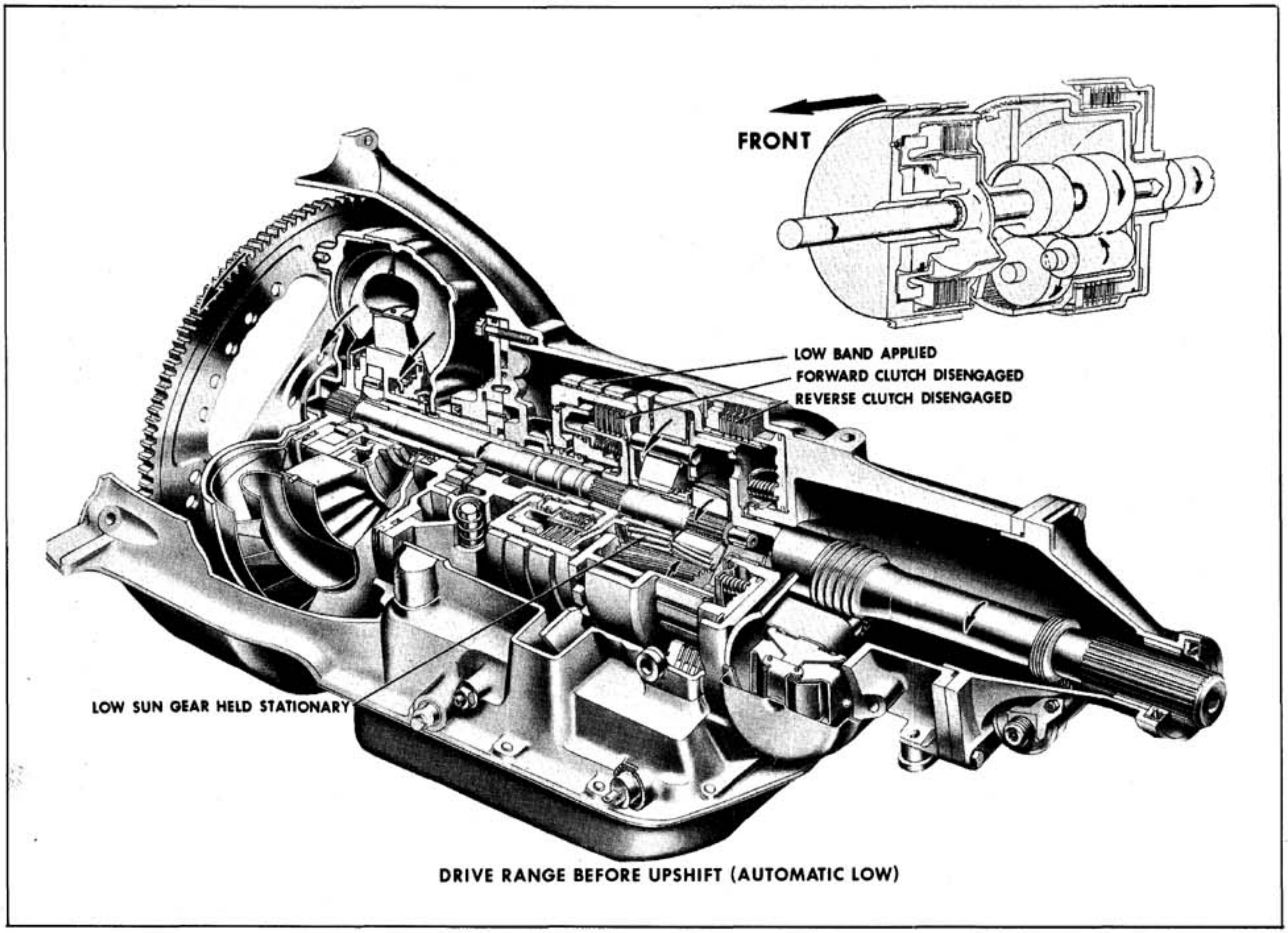


Fig. 6-310 Drive Range-Reduction and Low Range

DRIVE RANGE—REDUCTION AND LOW RANGE

FORWARD CLUTCH—DISENGAGED **REVERSE CLUTCH—DISENGAGED**

LOW BAND—APPLIED

Operation of Units in Drive Range—Reduction and Low Range

With the shift lever in "D" or "L" range, the transmission starts in reduction. The forward clutch is released and the low band is applied to the outside diameter of the forward clutch drum. With the low band applied, the low sun gear and flange assembly is held stationary. Drive is from the converter through the input shaft to the input sun gear in the planetary gear set. The input sun gear drives the long planet pinions which in turn drive the short planet pinions. The short pinions are in mesh with the low sun gear. With the low sun gear held stationary by the low band application, the short pinions will walk around the low sun gear. As they walk around the sun gear, they carry with them the planet carrier and the output shaft to which they are attached.

With the shift lever in "L", the transmission remains in reduction.

With the shift lever in "D", the upshift into direct drive is dependent upon car speed and throttle opening.

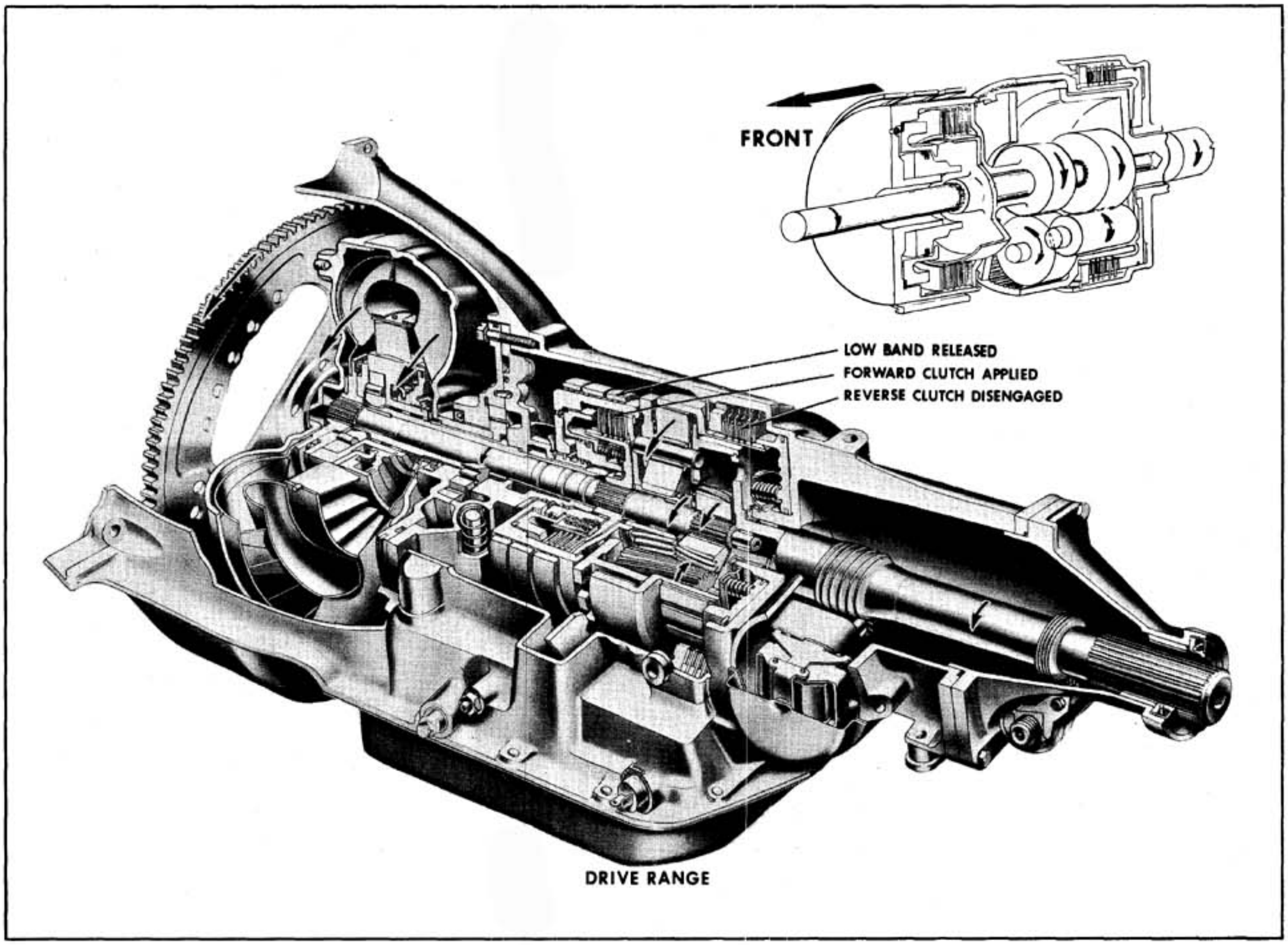


Fig. 6-311 Drive Range-Direct Drive

DRIVE RANGE—DIRECT DRIVE

LOW BAND—RELEASED **FORWARD CLUTCH—APPLIED**

REVERSE CLUTCH—DISENGAGED

Operation of Units in Drive Range—Direct Drive

In drive range the transmission starts in reduction.

The upshift into direct drive is dependent upon car speed and throttle opening. .When the shift occurs, the low band is released and the forward clutch is applied. Application of the forward clutch locks the planetary system causing it to rotate as a unit. With the clutch applied, the clutch hub which is splined to the input shaft is locked to the low sun gear and flange assembly through the clutch plates. The low sun gear is meshed to the short pinions, the short pinions are meshed with the long pinions, and the long pinions are meshed with the input sun gear; the sun gear is also splined to the input shaft. Since both the low sun gear and input sun gear are now locked to the input shaft, the entire planetary unit will revolve at input shaft speed.

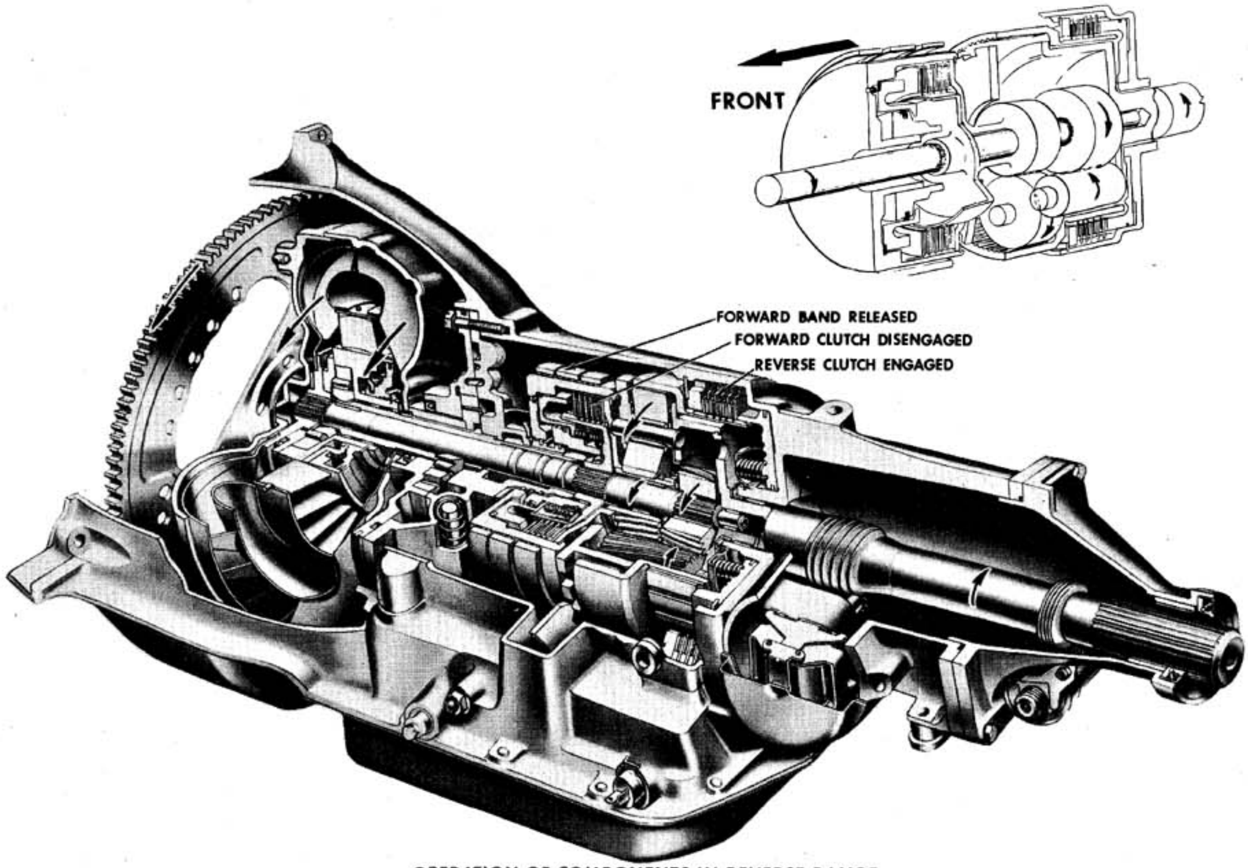


Fig. 6-312 Reverse

REVERSE

REVERSE CLUTCH—APPLIED **FORWARD CLUTCH—RELEASED**

LOW BAND—RELEASED

Operation of Units in Reverse

When the shift lever is in "R" position, the forward clutch and low band are released, and the reverse clutch is applied, holding the ring gear stationary.

Drive is through the input shaft and input sun gear to the long pinions and then to the short pinions. The short pinions mesh with the reverse ring gear which is held stationary by the reverse clutch. The short pinions walk around the inside of the ring gear in a reverse direction, turning the output shaft to which they are attached.

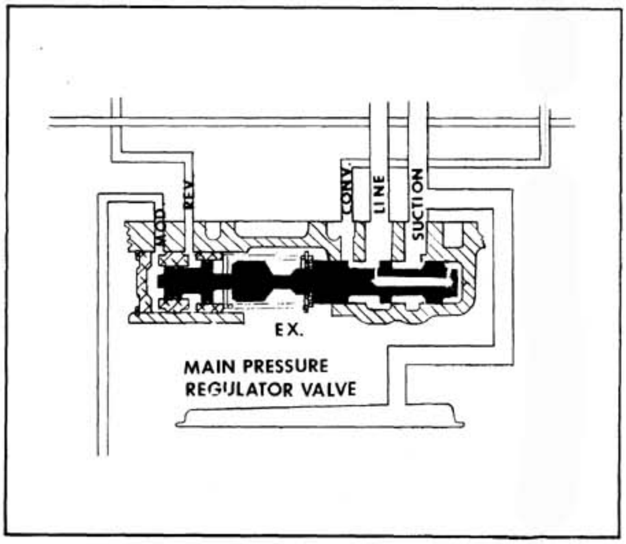


Fig. 6-313 First Stage Regulation

HYDRAULIC CONTROLS

OIL PUMP AND PRESSURE REGULATOR

A positive displacement internal-external gear-type oil pump is used to supply oil to fill the converter, engage the forward and reverse clutches, apply and release the low band, and furnish oil for lubrication and heat transfer.

The pressure regulator valve, located in the pump cover, is used as the basic control of hydraulic pressure within the transmission.

First Stage Regulation (Fig. 6-313)

When the engine is idling or has just been started, oil enters the main pressure regulator valve from the line passage and flows through the drilled passages in the valve to force the valve to the left against its spring to uncover the port which directs oil to the converter, oil cooler and transmission lubrication system.

Second Stage Regulation (Fig. 6-314)

As higher engine speeds are attained, the volume of oil leaving the pump increases until the valve moves to the position shown, which opens a port to allow main line oil to escape to the suction side of the pump to regulate pressure. Second stage regulation is only necessary during operation at high speeds or operation with cold oil.

Boost Valve

A boost valve at the spring end of the pressure regulator valve functions to raise line pressure, when necessary, by adding hydraulic pressure to the spring pressure on the main pressure regulator valve.

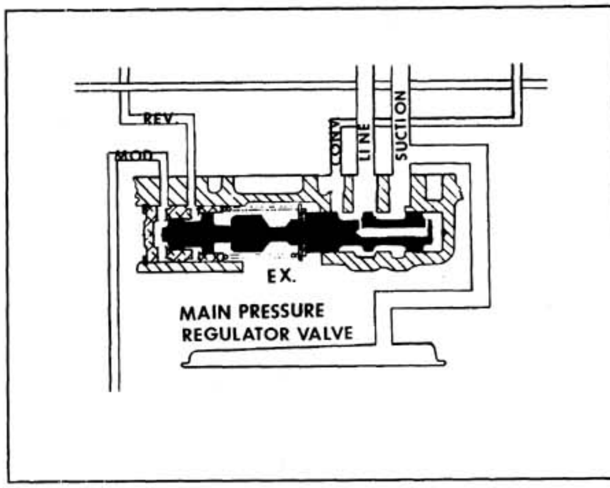


Fig. 6-314 Second Stage Regulation

Modulator Boost

With the manual shift control valve in "D" range, oil under pressure varied by operating conditions (load, car speed, grade, etc.) is directed through the modulator passage to assist the spring to force the valve to the right. Oil under pressure in this space has the same effect as increasing the spring pressure against the pressure regulator valve; that is, it increases main line oil pressure.

Reverse Boost

With the manual shift control valve positioned in "R" range, oil under pressure is directed through the reverse passage and acts on the boost valve. The boost valve acts on the spring end of the pressure regulator valve adding to the spring pressure of the valve, thus increasing main line oil pressure for operation in reverse range.

VALVES AND THEIR FUNCTIONS

MANUAL SHIFT CONTROL VALVE (Fig. 6-315)

The manual shift control valve in the valve body directs oil to the controlling devices that govern operation in "D", "L" (Mod. Bst.) and "R". In "N" and "P" ranges, the manual shift control

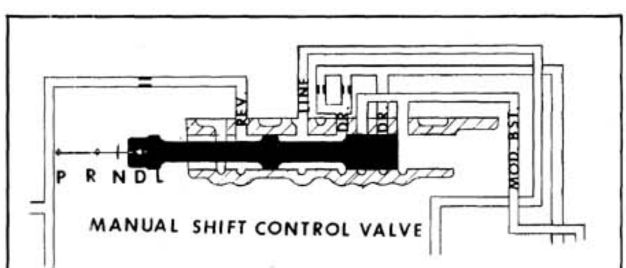


Fig. 6-315 Manual Shift Control Valve

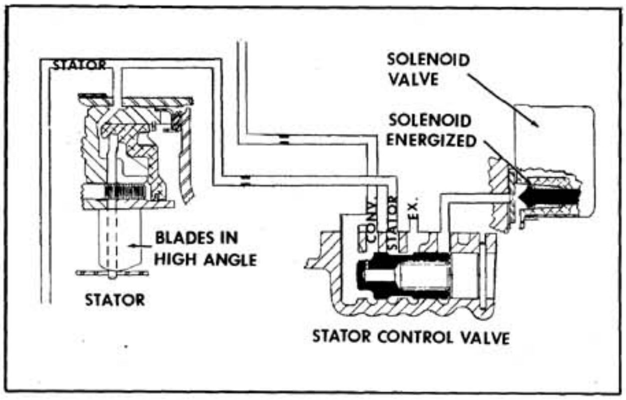


Fig. 6-316 Stator Blades in High Angle

valve cuts off oil pressure to the low servo and forward clutch ("D" passage). The manual shift control valve is connected by mechanical linkage to the manual control lever on the steering column.

STATOR CONTROL VALVE (Fig. 6-316)

The stator control valve is a spring loaded valve located in the stator control valve body. The function of this valve is to control high or low angle of the stator blades. See Figs. 6-316 and 6-317. The action of the valve is affected by spring force and a solenoid valve. When the stator control valve solenoid is energized, the valve plunger is retracted, uncovering an exhaust port through which oil may escape from the spring side of the stator control valve. Oil thus escaping, allows oil at converter charging pressure to move the valve against its spring. With the stator valve positioned against the valve plug, no oil is directed to the front of the stator blade piston and converter charging pressure then moves the piston (connected to the stator blade cranks) to shift the blades to high angle (high torque).

SHIFT VALVE AND SHIFT CONTROL VALVE (Fig. 6-318)

The shift valve and shift control valve are in the same bore in the main valve body. They react

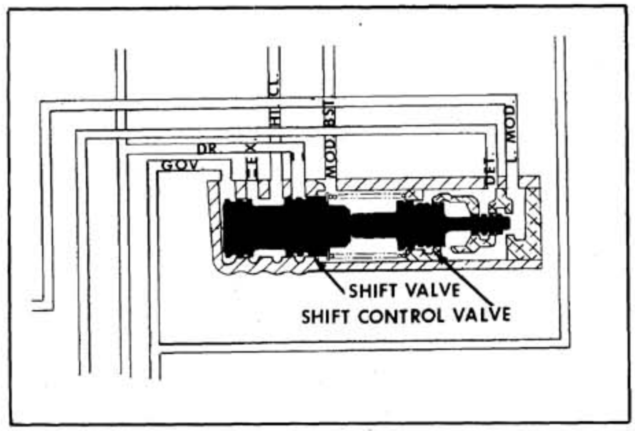


Fig. 6-318 Shift Valve and Shift Control Valve

to oil pressure from the governor valve and vacuum modulator valve to make the shift from reduction to direct drive or from direct drive to reduction.

Upshift From Reduction to Direct Drive (Fig. 6-319)

Before the upshift occurs, the shift valve and shift control valve are positioned as shown. The shift control valve is held against the end of its bore by spring force and L. Mod. pressure. With the shift valve in this position, the high clutch piston and spring side of the low servo piston are open to exhaust. The high clutch is released and the low band is applied; the transmission is in reduction.

When the proper relationship between car speed and throttle opening exists, governor oil pressure on the shift control valve will overcome spring force and limited modulator oil pressure and move both valves to the right as shown in Fig. 6-319.

With the valves thus positioned, oil under pressure is directed to the forward clutch piston and the spring side of the low servo piston to apply the clutch and release the band.

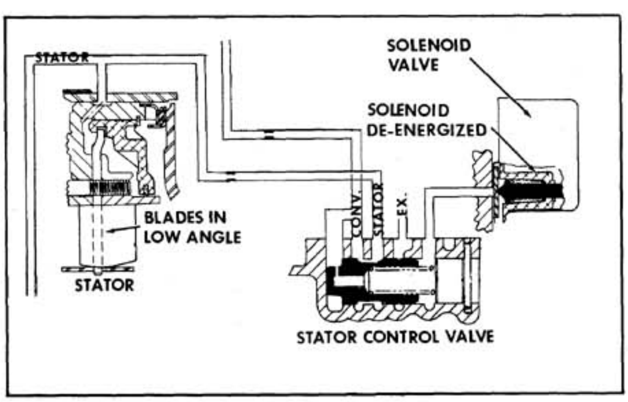


Fig. 6-317 Stator Blades in Low Angle

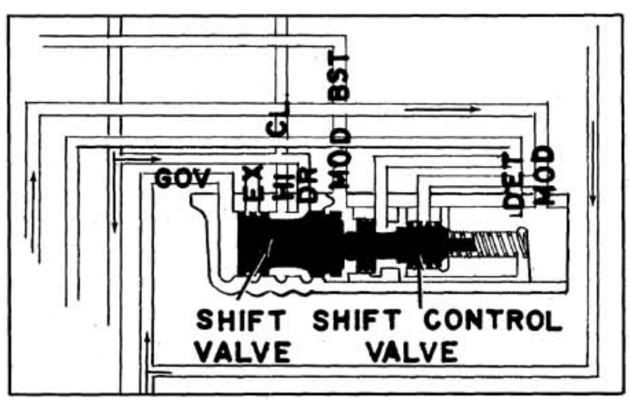


Fig. 6-319 Upshifted

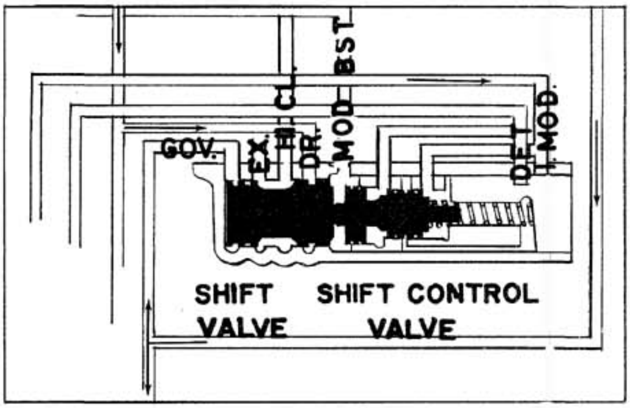


Fig. 6-320 Manual Low Range

Downshift From Drive To Reduction

When limited modulator pressure against the right end of the shift control valve, in combination with the shift valve spring, reaches a pressure sufficient to overcome governor valve pressure against the left end of the shift valve, both valves move to the left and the transmission is downshifted by cutting off oil pressure to the forward clutch and spring side of the low servo piston. See Fig. 6-318.

Low Range (Fig. 6-320)

With the manual shift control valve positioned in "L" range, Mod. Bst. pressure is directed to the space between the shift valve and the shift control valve. This pressure adds to the shift valve spring force and keeps the shift valve to the left. With the shift valve in this position, an upshift will not occur.

VACUUM MODULATOR AND VALVE (Fig. 6-321)

The vacuum modulator and valve assembly is a device to translate load (engine manifold vacuum),

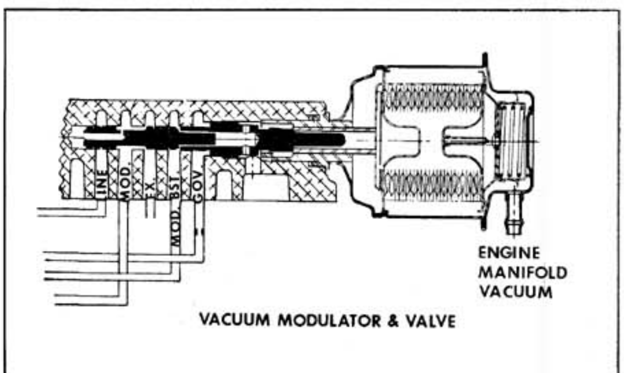


Fig. 6-321 Vacuum Modulator and Valve

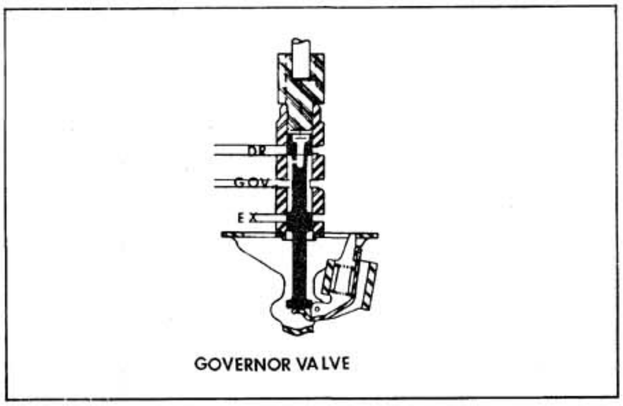


Fig. 6-322 Governor Valve

barometric pressure (altitude) and speed (governor valve oil pressure) into modulated oil pressures to regulate main line oil pressure to an efficient value.

Main line oil enters the valve through the drilled ports and is directed to the left end of the valve. This oil, when it reaches sufficient pressure, moves the valve against its spring to regulate the exhausting of modulator oil.

Manifold Vacuum Effect

The modulator valve spring is housed in a sealed container in such a way that engine manifold vacuum may act upon it to reduce the force of the spring against the valve and thus affect modulator oil pressure. Conditions of load or grade that lowers manifold vacuum increases modulator oil pressure, while high manifold vacuum decreases modulator oil pressure.

Altitude Or Barometric Pressure Effect

If the car is operated at high altitudes where barometric pressure is reduced, the aneroid device in the vacuum modulator housing expands and acts against the valve spring to reduce modulator oil pressure in proportion to the barometric pressure

At high altitudes, engine output is reduced. Comparable reduction in transmission main line oil pressure is necessary to accomplish smooth shifts under these conditions.

Governor

As car speed increases, governor valve oil pressure increases (up to the limit of the valve). Governor pressure acting on the vacuum modulator valve has the effect of reducing the spring

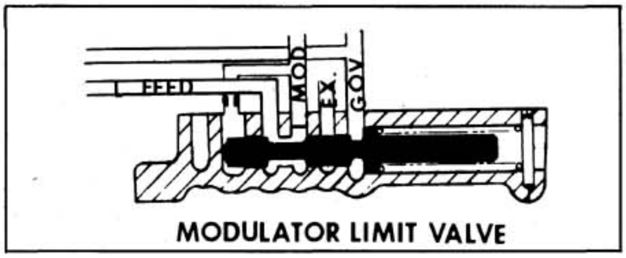


Fig. 6-323 Modulator Limit Valve (First Stage)

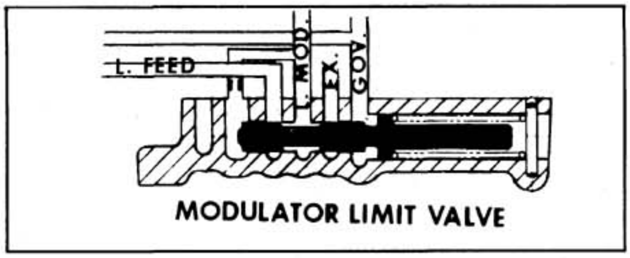


Fig. 6-324 Modulator Limit Valve (Second Stage)

force against the valve, thereby reducing modulator oil pressure as governor pressure (car speed) increases.

Modulator Boost Effect

With the manual shift control valve positioned in "L" range, main line pressure separates the two pieces of the modulator valve and tends to move the valve to the bottom of its bore. Thus, modulator oil under pressure is directed to the main line pressure regulator valve to provide an increase in main line oil pressure in low range, regardless of engine vacuum. If driving conditions result in low engine vacuum however, the vacuum modulator valve spring will move the two sections of the valve back together. Then both the valve spring and the pressure of main line oil at the line port of the valve will regulate modulator oil pressure.

GOVERNOR VALVE (Fig. 6-322)

The governor valve is a pressure regulator valve. Governor pressure is determined by car speed acting through the centrifugal force of a pair of dual weights; the inner pair of which is spring loaded.

As the car begins to move, the weight assemblies move outward to provide a regulating force against the valve through the springs between the primary and secondary weights. As car speed is further increased, regulating force against the valve is provided by the secondary weights moving outward. At approximately 35 mph, the primary weights have reached the limit of their travel and the force against the valve is then entirely through the secondary weights.

Thus, governor pressure is determined at very low speeds by the primary weights; at intermediate speeds, by the springs between the weights; and at higher speeds, by the secondary weights. In this manner, governor pressure is increased rapidly but smoothly from very low speeds to approximately 40 mph, where it levels off.

Regulated oil from the governor valve is channeled to the shift valve, vacuum modulator valve, modulator limit valve and high speed downshift timing valve.

MODULATOR LIMIT VALVE (Fig. 6-323)

The modulator limit valve is a pressure regulator valve that regulates the point at which a wide open throttle upshift will occur.

The valve regulates limited feed oil (main line pressure) to provide diminishing oil pressure acting at the L. Mod. port and on the shift control valve as car speed is increased. This decrease in oil pressure is accomplished by governor valve pressure directed through the governor port and on the valve to oppose spring force as car speed (governor pressure) increases. See Figs. 6-323 and 6-324.

The modulator limit valve is in operation only before the upshift during wide open throttle operation with the manual shift control valve in "D" position.

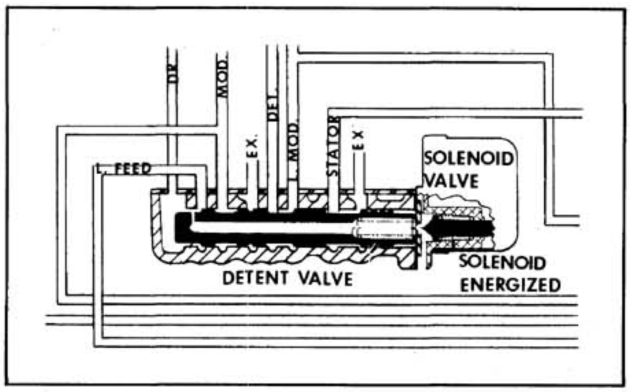


Fig. 6-325 Solenoid Energized

DETENT VALVE (Fig. 6-326)

The detent valve is a solenoid operated two-position valve that provides a downshift at wide open throttle, if car speed is low enough.

Electrical contacts on the carburetor linkage energize the detent solenoid as wide open throttle is reached. Energizing the solenoid retracts its plunger and allows oil from the center of the valve to flow to exhaust. Main line oil pressure at the drive port and left end of the valve moves the valve against its spring as shown.

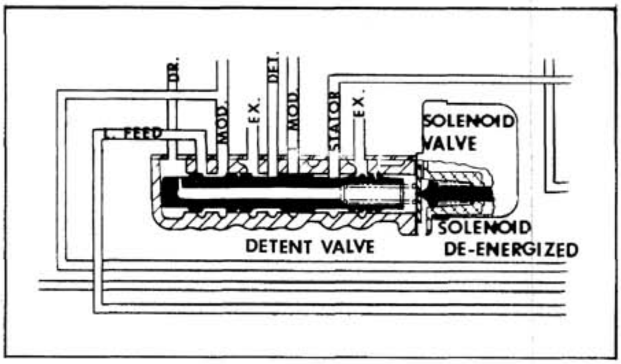


Fig. 6-326 Solenoid De-Energized

With the valve in this position, ports are opened to direct oil to the modulator limit valve and limited modulator oil to flow to the detent port of the shift control valve. When the solenoid is de-energized, the spring loaded plunger seals the port in the valve center. Oil at main line pressure then occupies the center of the valve and acts against the right end of the valve as well as the left end. The detent valve spring then moves the valve to the position shown, closing off the modulator, detent and limited modulator ports.

HIGH SPEED DOWNSHIFT TIMING VALVE (Fig. 6-327)

The high speed downshift timing valve is a spring loaded valve located in the main valve body. Its function is to control the rate of low servo application at high road speeds.

At sufficiently high road speeds, governor pressure against the left end of the valve overcomes spring force to move the valve to the position shown. With the valve in this position, oil for low servo application must pass two orifices as shown. At lower car speeds, governor valve pressure is not sufficient to overcome the spring pressure and low servo application is made through passages containing one orifice as shown in Fig. 6-328.

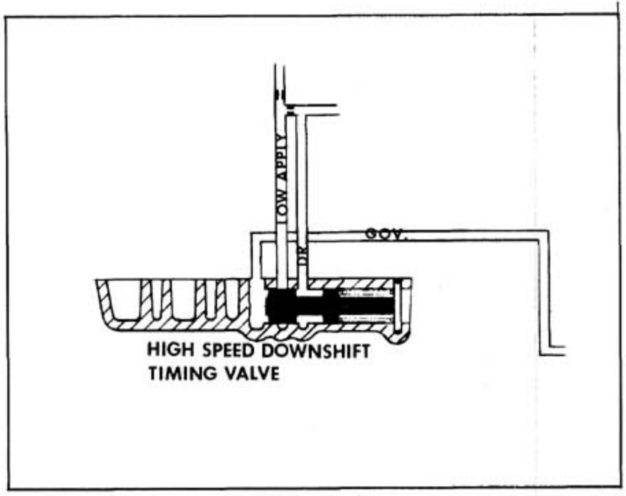


Fig. 6-327 High Speed Downshift Timing Valve

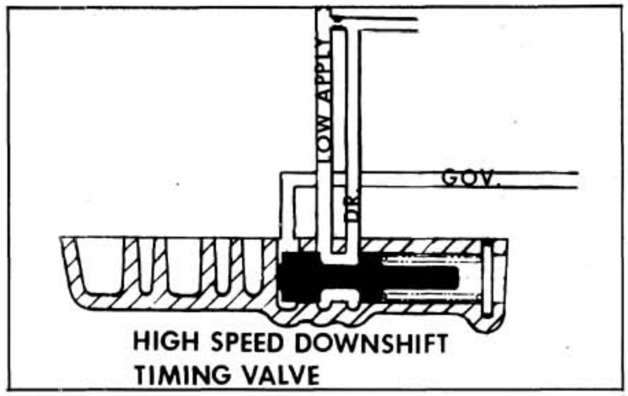


Fig. 6-328 High Speed Downshift Timing Valve Regulated

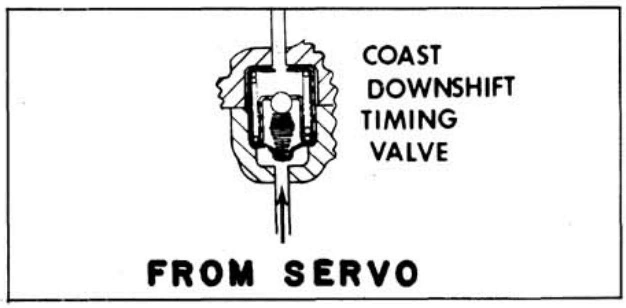


Fig. 6-329 Coast Downshift Timing Valve

COAST DOWNSHIFT TIMING VALVE (Fig. 6-329)

As the car is decelerating with closed throttle or very light throttle (such as when approaching a stop), governor valve pressure diminished to a point where spring force moves the shift valve to the downshift position. When this occurs, oil is exhausted from the band release chamber of the low servo through the coast downshift timing valve.

A rush of oil through the valve moves the ball retainer and ball, against light spring force, off its seat. Oil may then escape around the ball retainer and spring. This action cushions the initial engagement of the low band.

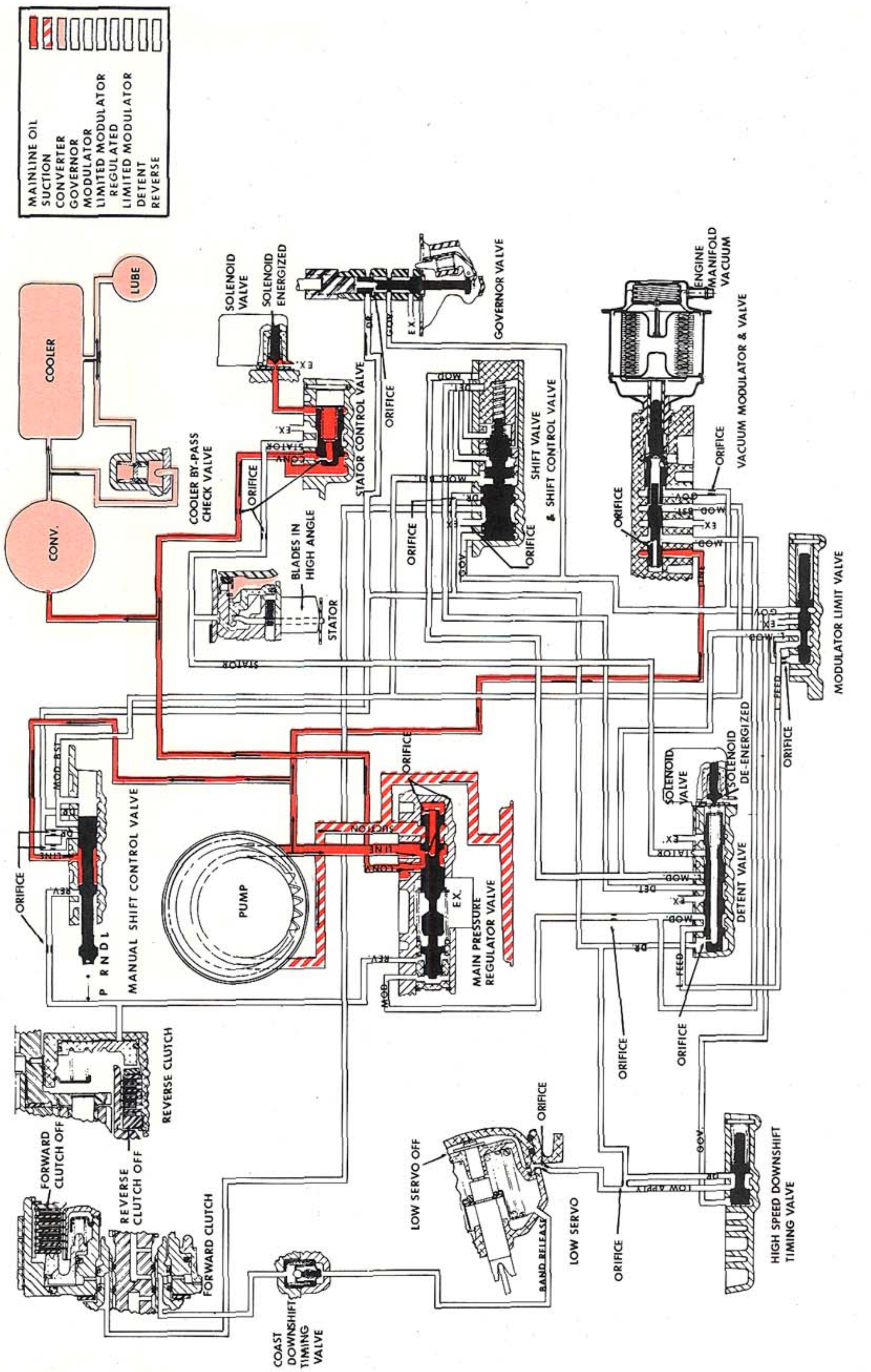


Fig. 6-330 Neutral (Closed Throttle)

OPERATION OF HYDRAULIC CONTROLS IN NEUTRAL

(CLOSED THROTTLE)

FORWARD CLUTCH—OFF **BAND—OFF** **REVERSE CLUTCH—OFF**

When the engine is started, the oil pump directs pressure to the hydraulic control system, converter, cooler and lubrication system. The converter remains pressurized in all ranges and speeds.

At any closed throttle condition, regardless of selector lever position, a switch at the carburetor will energize the stator control solenoid, switching the stator pitch to high angle. By switching the pitch to high angle, it will allow higher engine rpm in relation to turbine speed. With the solenoid energized, the valve will bottom in its bore allowing the stator oil pressure to exhaust. As stator oil pressure exhausts, converter oil pressure on the other side of the stator piston switches the pitch to high angle.

During operation in neutral, the manual shift control valve is positioned as shown. Main line oil is directed to the manual shift control valve and to the vacuum modulator valve.

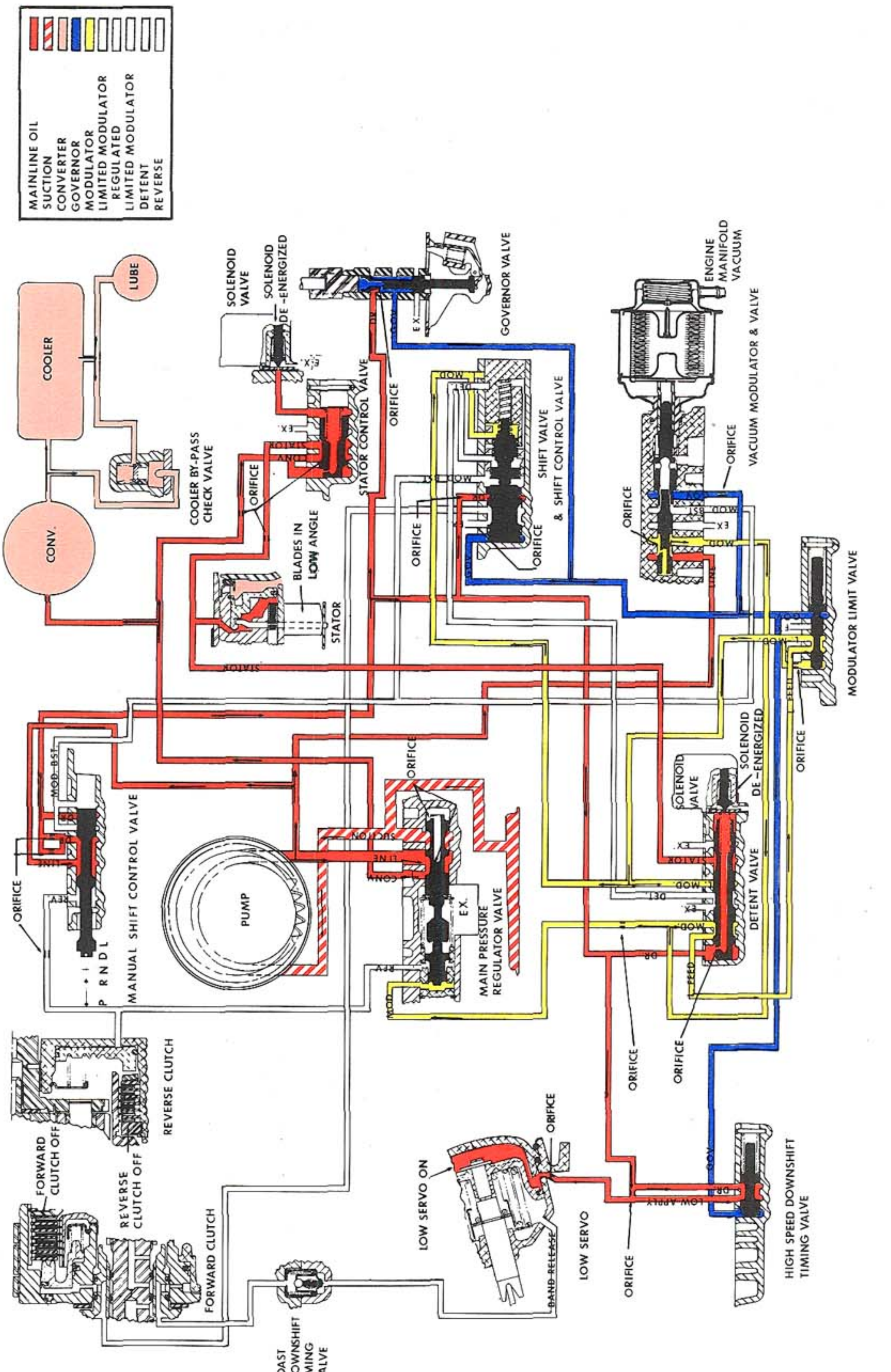


Fig. 6-331 Drive Range-Reduction

OPERATION OF HYDRAULIC CONTROLS IN DRIVE RANGE—REDUCTION

FORWARD CLUTCH—OFF **BAND—APPLIED** **REVERSE CLUTCH—OFF**

During operation in drive range, the manual shift control valve is positioned as shown. Main line oil is directed to the modulator valve and the manual shift control valve. Main line oil entering the manual shift control valve is directed into the drive oil passage and then to the governor valve, shift valve, detent valve, high speed downshift timing valve and low servo piston.

The low band is applied by drive oil directed through the open high speed downshift timing valve to the area behind the low servo piston.

Main line oil directed to the modulator valve enters between the lands. During part throttle acceleration, low engine vacuum at the vacuum modulator tends to keep the valve toward the bottom of its bore. In this position, oil is directed through a drilled passage in the valve to the space between the end of the valve and the valve body. Oil under pressure in this area, plus governor pressure on the land of the modulator valve, tends to move the valve against vacuum modulator spring force to regulate modulator oil pressure. Modulator oil leaves the modulator valve and is directed to the boost valve, detent valve, modulator limit valve and shift control valve. Modulator pressure applies a force to the space between the end of the boost valve and oil pump body causing it to move to the right. As the boost valve moves to the right, it contacts the pressure regulator valve. This hydraulic force, combined with normal spring force on the pressure regulator valve, results in higher main line pressure. Also, modulator pressure is directed through the detent valve and modulator limit valve to apply force between the lands of the shift control valve and the valve body.

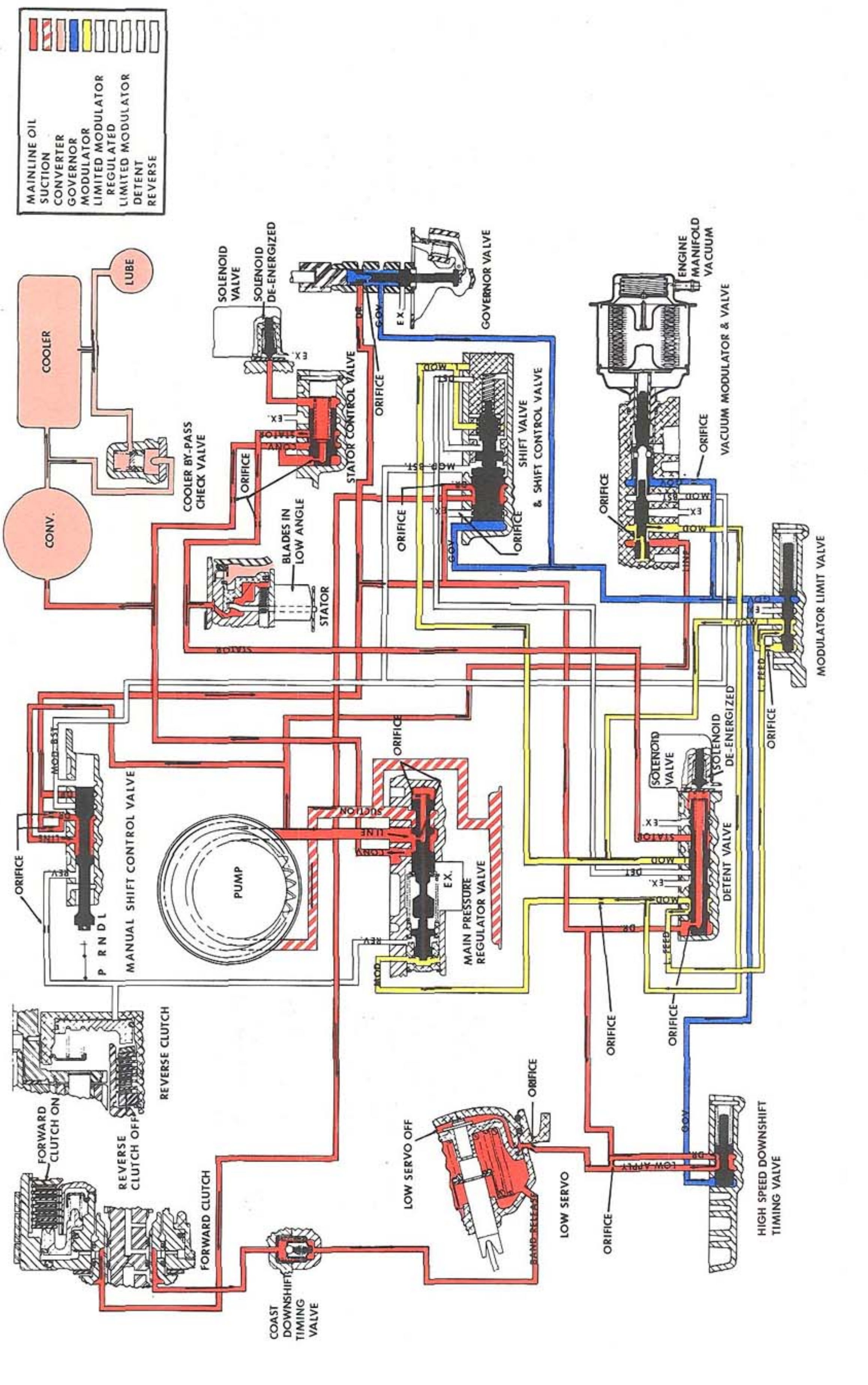


Fig. 6-332 Drive Range-Direct Drive (Part Throttle)

OPERATION OF HYDRAULIC CONTROLS IN DRIVE RANGE—DIRECT DRIVE (PART THROTTLE)

FORWARD CLUTCH—APPLIED **REVERSE CLUTCH—OFF** **BAND—OFF**

During operation in drive range, the manual shift control valve is positioned as shown. During part throttle acceleration, main line oil is directed to the modulator valve and manual shift control valve. Main line oil entering the manual shift control valve is directed into the drive oil passage and then to the governor valve, shift valve, detent valve, high speed downshift timing valve and low servo piston.

Main line oil directed to the modulator valve enters between the lands. At low engine vacuum, the vacuum modulator tends to keep the valve toward the bottom of its bore. In this position, oil is delivered through a drilled passage in the valve to the space between the end of the valve and the valve body. Oil under pressure in this area, plus governor pressure on the land of the modulator valve, tends to move the valve against the force of the vacuum modulator spring to regulate modulator oil pressure. Modulator oil leaves the modulator valve and is directed to the boost valve, detent valve, modulator limit valve and to the shift control valve. Modulator pressure directed to the boost valve moves it to the right. As the boost valve moves to the right, it contacts the pressure regulator valve. This hydraulic force combined with normal spring force on the pressure regulator valve results in higher main line pressure. Also, modulator pressure is directed through the detent valve and modulator limit valve to apply force to the shift control valve to oppose governor pressure on the other end of the valve.

When sufficient car speed has been obtained, governor pressure is directed to the left end of the shift valve, to the vacuum modulator valve, modulator limit valve and to the high speed downshift timing valve. As governor pressure increases on the modulator valve, it will tend to move the valve against the vacuum modulator spring, reducing modulator pressure.

When governor pressure reaches a high enough value, the shift valve will move to the right, allowing drive oil to apply the forward clutch and release the low band.

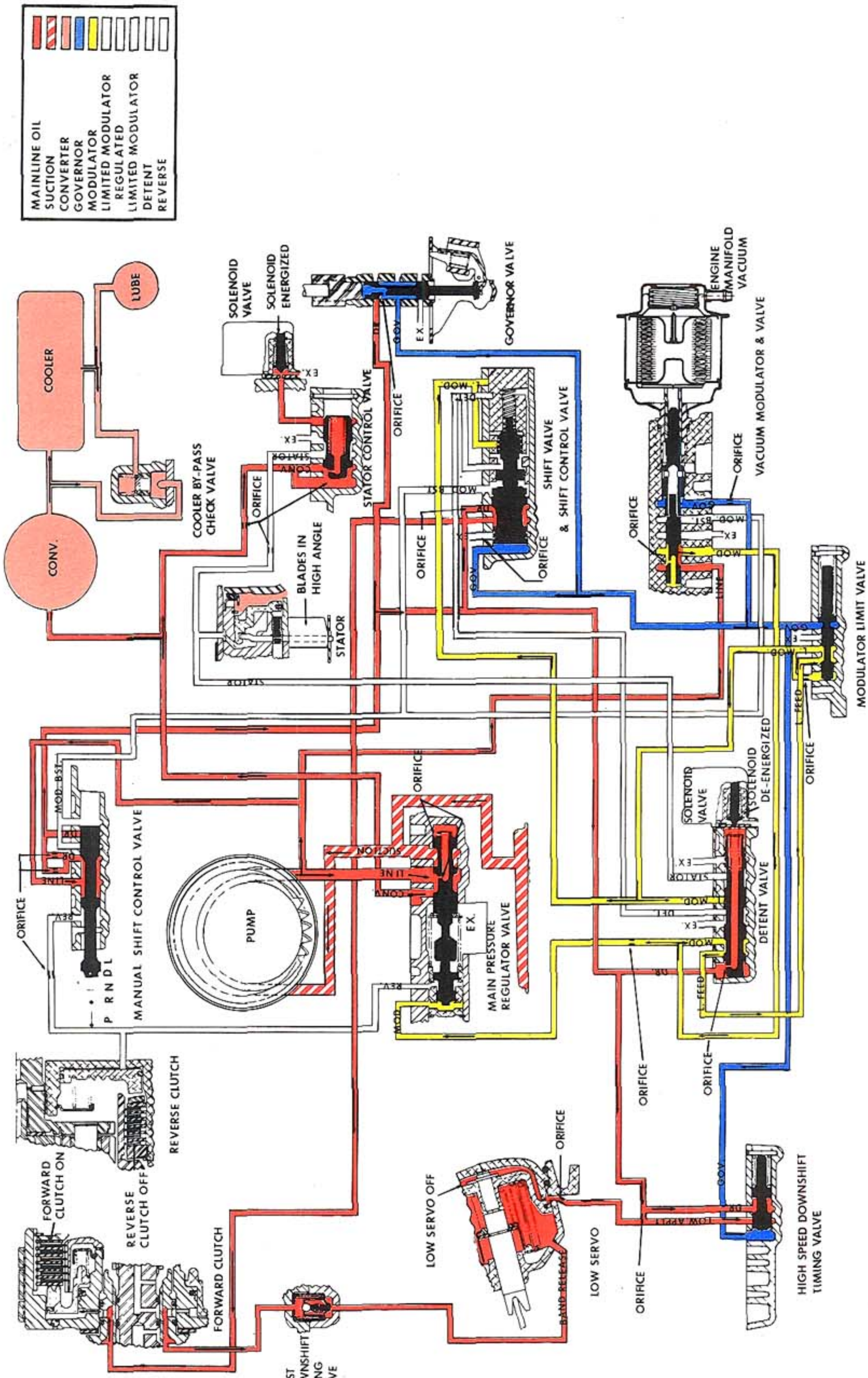


Fig. 6-333 Drive Range-Direct Drive-(Heavy Throttle)

OPERATION OF HYDRAULIC CONTROLS IN DRIVE RANGE

DIRECT DRIVE—(HEAVY THROTTLE)

REVERSE CLUTCH—OFF **FORWARD CLUTCH—APPLIED** **BAND—OFF**

During operation in drive range, at full throttle without detent (Switch pitch only), the stator control solenoid is energized.

Main line oil passes through the pressure regulator valve to the converter and stator control valve. Energizing the stator control solenoid allows oil from the center of the stator control valve to flow to exhaust. Pressure against the end of the stator control valve moves the valve against its spring until it bottoms in its bore. When the valve reaches the bottom of its bore, it will exhaust the stator oil, switching the blades to high angle.

With full throttle and the stator positioned for maximum torque, an increase in pump pressure is obtained as follows. When the throttle is opened, the resulting low vacuum at the vacuum modulator allows the vacuum modulator spring to move the valve to the bottom of its bore. This increases modulator pressure. This higher modulator pressure is directed to the boost valve, detent valve, modulator limit valve and the shift control valve. Modulator pressure applies a force to the space between the end of the boost valve and the oil pump body causing it to move to right. As the boost valve moves to the right, it contacts the pressure regulator valve. This hydraulic force combined with normal spring force on the pressure regulator valve results in a higher main line pressure. Also, limited modulator feed pressure is directed through the detent valve and to the modulator limit valve. Limited modulator pressure from the modulator limit valve is directed to the right end of the shift control valve.

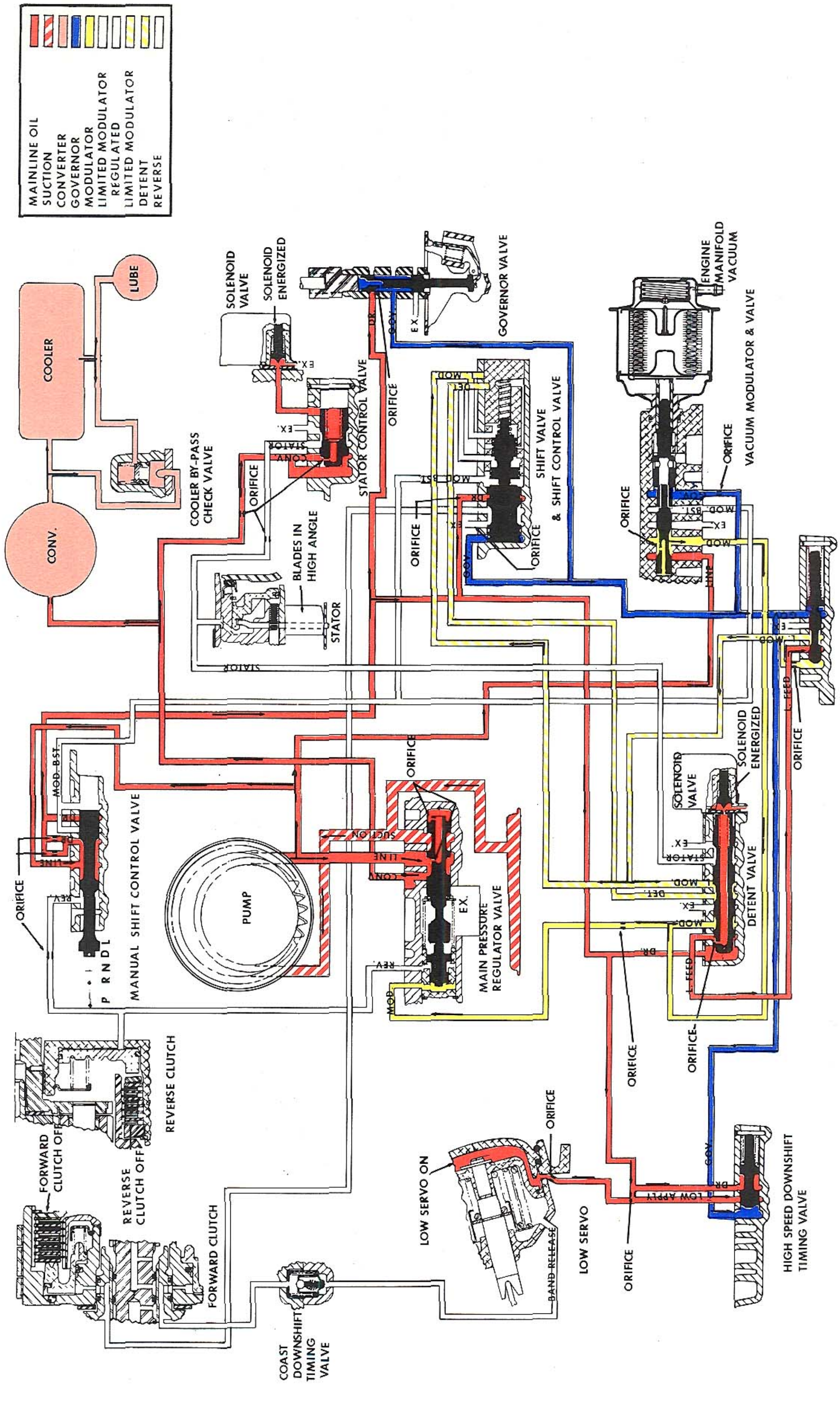


Fig. 6-334 Drive Range-Reduction (Detent Downshift)

OPERATION OF HYDRAULIC CONTROLS IN DRIVE RANGE—DIRECT DRIVE (DETENT DOWNSHIFT)

FORWARD CLUTCH—OFF **REVERSE CLUTCH—OFF** **BAND—APPLIED**

During full throttle acceleration, main line oil is directed to the modulator valve and manual shift control valve. Main line oil through the manual shift control valve is directed into the drive oil passage and then directed to the governor valve, shift valve, high speed downshift timing valve, low servo piston and detent valve. With the detent valve solenoid energized, drive oil pressure will enter into the limited feed line. When limited modulator pressure reaches a high enough value and exerts enough force to overcome spring force on the modulator limit valve, the valve will regulate, governing the limited modulator and detent pressure behind the shift control valve and moves it to the left, releasing the clutch and exhausting band release pressure. Governor pressure overcomes spring force and moves the high speed downshift timing valve to the right. This movement blocks the nonrestricted line, directing the servo apply oil through the restricted orifice. On a downshift, this restriction of flow causes the band apply to be delayed slightly and is thus timed to the forward clutch release for a smooth downshift.

Main line pressure is increased as follows. Main line oil directed to the modulator valve enters between the lands. At low engine vacuum, the vacuum modulator spring tends to keep the valve toward the bottom of its bore. In this position, oil is delivered through a drilled passage in the valve to the space between the end of the valve and the valve body. Oil pressure in this area, plus governor pressure on the land of the second modulator valve, tends to move the valve against the vacuum modulator spring to regulate oil pressure leaving the valve.

Modulator pressure applies force to the left end of the boost valve causing it to move to the right. As the boost valve moves to the right, it contacts the pressure regulator valve. This hydraulic force, combined with normal spring force on the pressure regulator valve, results in a higher main line pressure.

During operation in drive range, at full throttle through the detent, the stator control valve and detent valve solenoids are energized. The manual shift control valve is positioned as shown.

Main line oil passes through the pressure regulator valve to the converter and stator and detent valve. When the stator control valve solenoid is energized, it allows oil from the center of the valve to flow to exhaust. Oil that is applying force to the area between the valve body and the end of the valve moves the valve against its spring force to the bottom of its bore.

When the valve reaches the bottom of its bore, it will exhaust the stator oil, switching the pitch to high angle. Converter oil pressure applies force to the area between the valve body and the end of the valve, keeping it at the bottom of its bore as long as the solenoid is energized.

Energizing the detent solenoid allows oil from the center of the valve to flow to exhaust. Drive oil pressure in the area between the valve body and the end of the valve moves the valve against its spring force to the bottom of its bore.

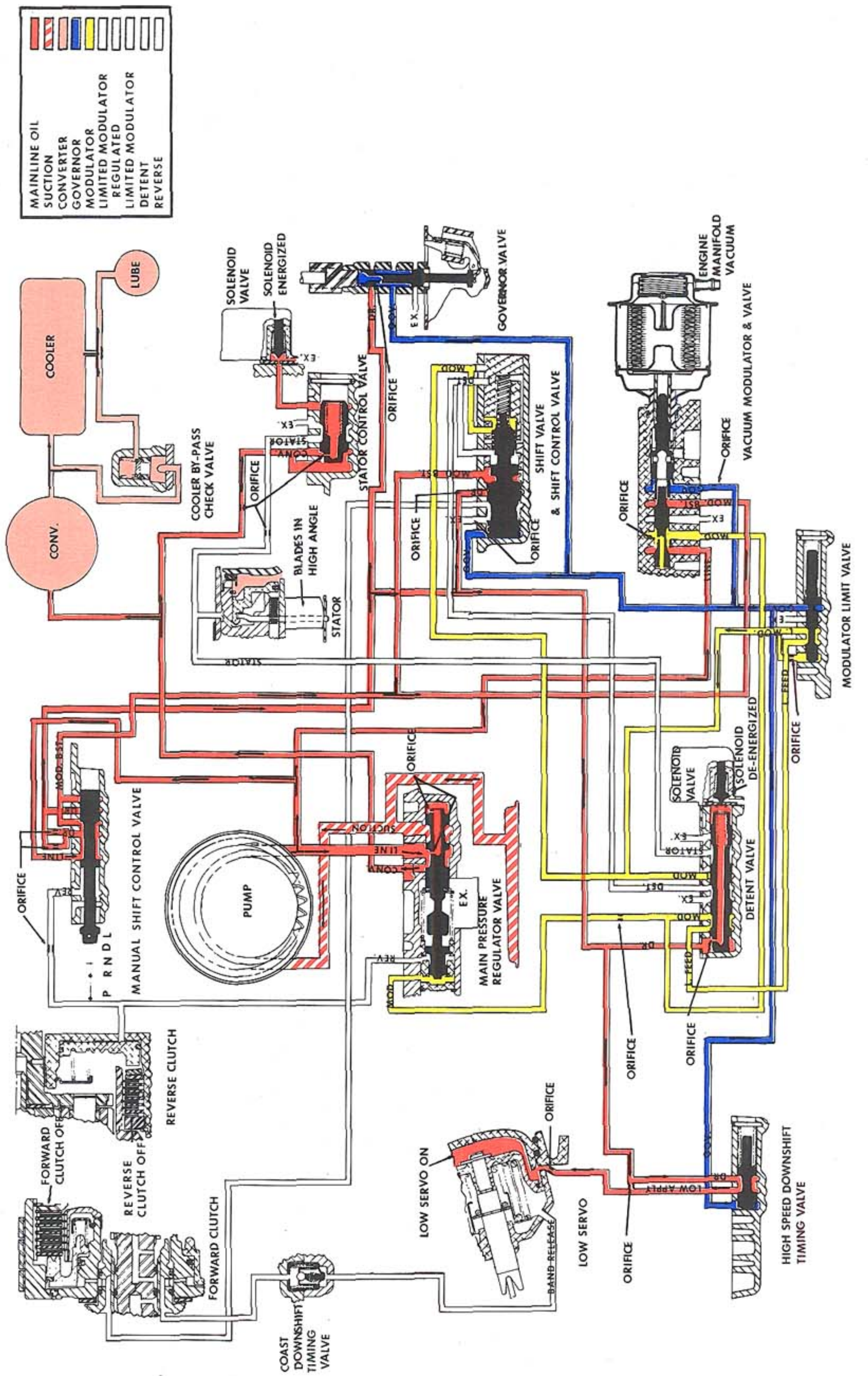


Fig. 6-335 Low Range-Reduction (Closed Throttle)

OPERATION OF HYDRAULIC CONTROLS IN LOW RANGE—REDUCTION (CLOSED THROTTLE)

FORWARD CLUTCH—OFF

BAND—APPLIED

During operation in low range, the manual shift control valve is positioned as shown. During closed throttle in low range, main line oil is directed to the modulator valve and manual shift control valve. Main line oil entering the manual shift control valve is directed into the drive oil passage and modulator boost passage. Oil in the drive oil passage is directed to the governor valve, shift valve, detent valve, high speed downshift timing valve and low servo piston. Oil in the modulator boost passage is directed to the shift valve and vacuum modulator valve.

Modulator boost oil separates the two pieces of the modulator valve and tends to move the valve to the bottom of its bore independent of the vacuum modulator spring. Modulator oil under pressure is directed to the main line pressure regulator valve to provide an increase in main line oil pressure in low range, regardless of engine vacuum.

Modulator boost oil enters the shift valve between the shift valve and the shift control valve, moving the shift valve to the left and holding it in the bottom of its bore, thus exhausting the forward clutch. Drive oil directed from the manual shift control valve will apply the low servo.

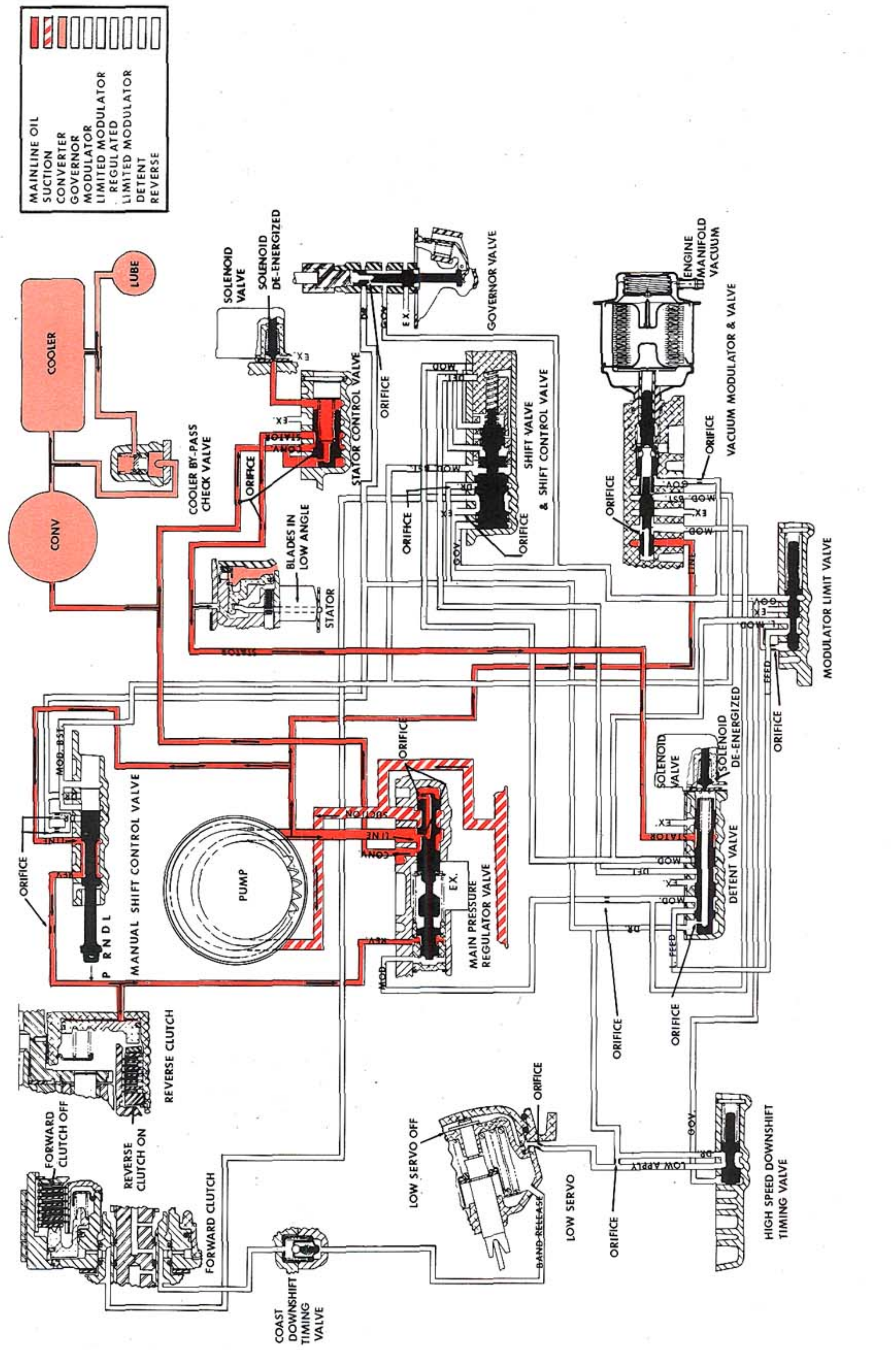


Fig. 6-336 Reverse

OPERATION OF HYDRAULIC CONTROLS IN REVERSE— (LIGHT THROTTLE)

REVERSE CLUTCH—APPLIED **BAND—OFF** **REVERSE CLUTCH—OFF**

During operation in reverse, the manual shift control valve is positioned as shown. Main line oil entering the manual shift control valve is directed to the reverse clutch and between the lands of the boost valve, causing it to move to the right. As the boost valve moves to the right, it contacts the pressure regulator valve. This hydraulic force combined with normal spring force on the pressure regulator valve results in a higher main line pressure. When the manual shift control valve is in reverse, the forward clutch and low servo are released and the reverse clutch is applied.

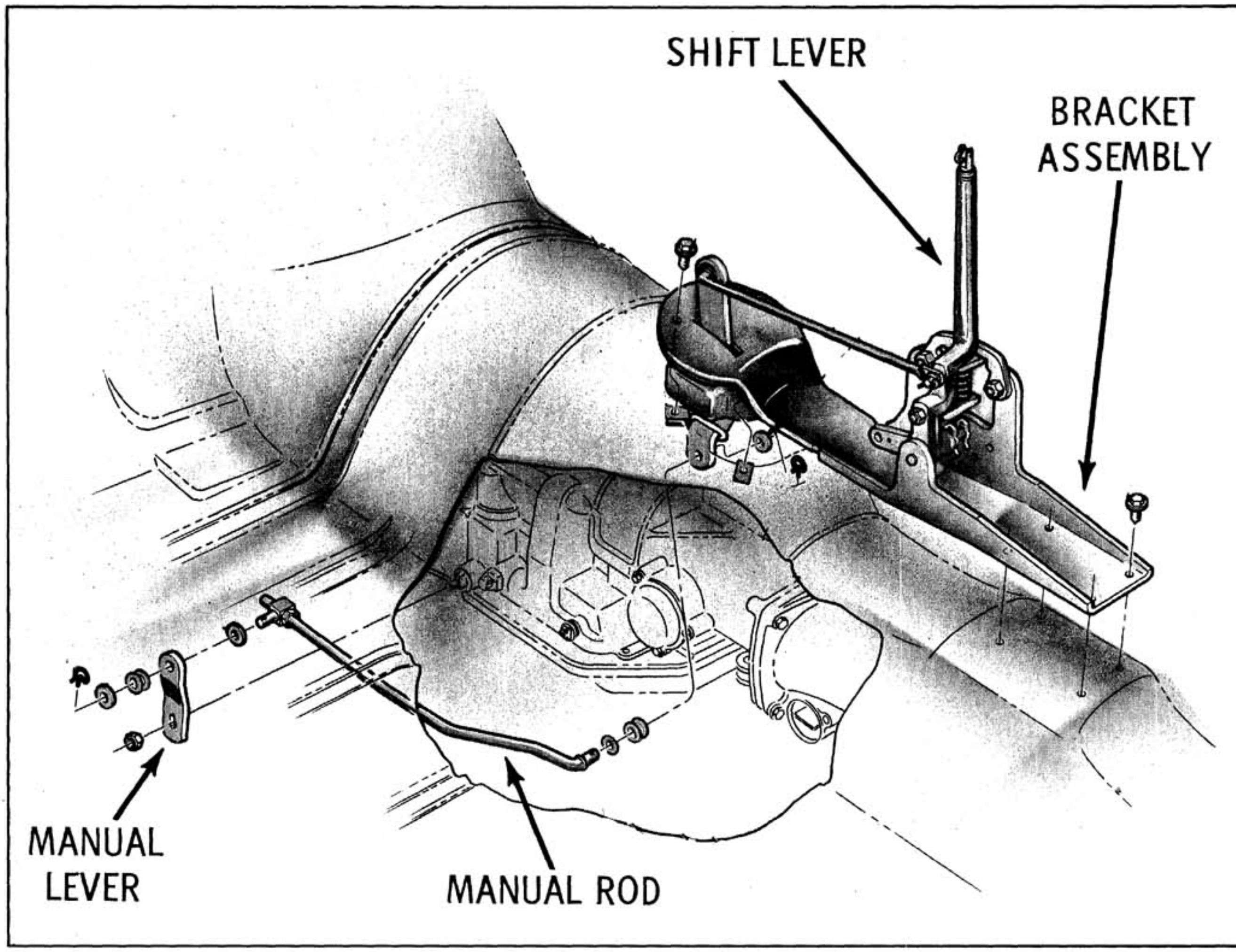


Fig. 6-337 Manual Rod

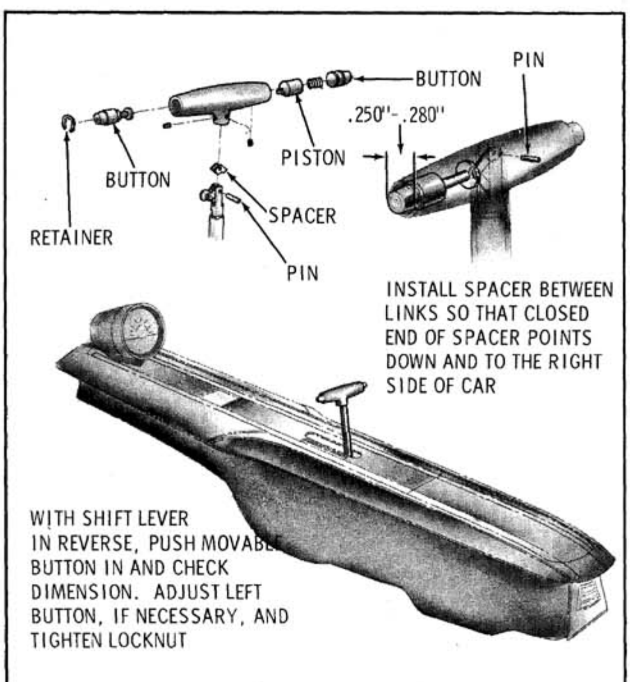


Fig. 6-338 Console Shift Lever

MANUAL SHIFT LINKAGE ADJUSTMENT (Figs. 6-337, 6-338 & 6-339)

The proper manual linkage adjustment is obtained by positioning the shift lever in "D" (Drive Range) against the stop and the manual lever in "D" detent, and adjusting the swivel to a free pin fit at the manual lever. On console models the rod should be adjusted one turn long from free pin position.

SHIFT INDICATOR ADJUSTMENT

The shift indicator can be adjusted by removing the snap-on cover and loosening the set screw.

ENGINE SUPPORT BAR (Fig. 6-342)

The engine support bar must be installed whenever the transmission assembly is removed from the car.

NOTE: Use Tool BT-6424-1 with Adapter BT-6424-2 for V-6 engine.

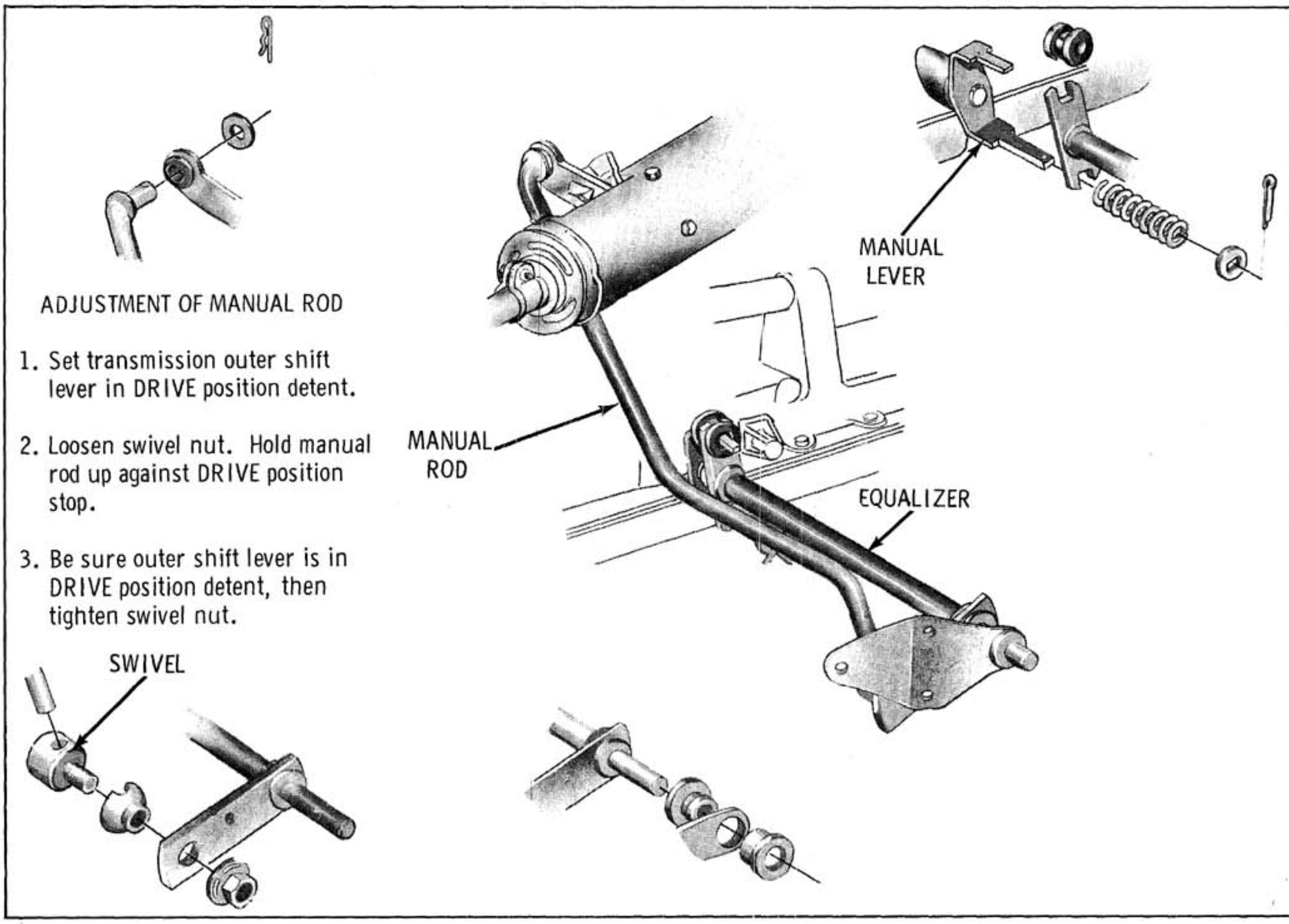


Fig. 6-339 Column Shift Linkage—V-6

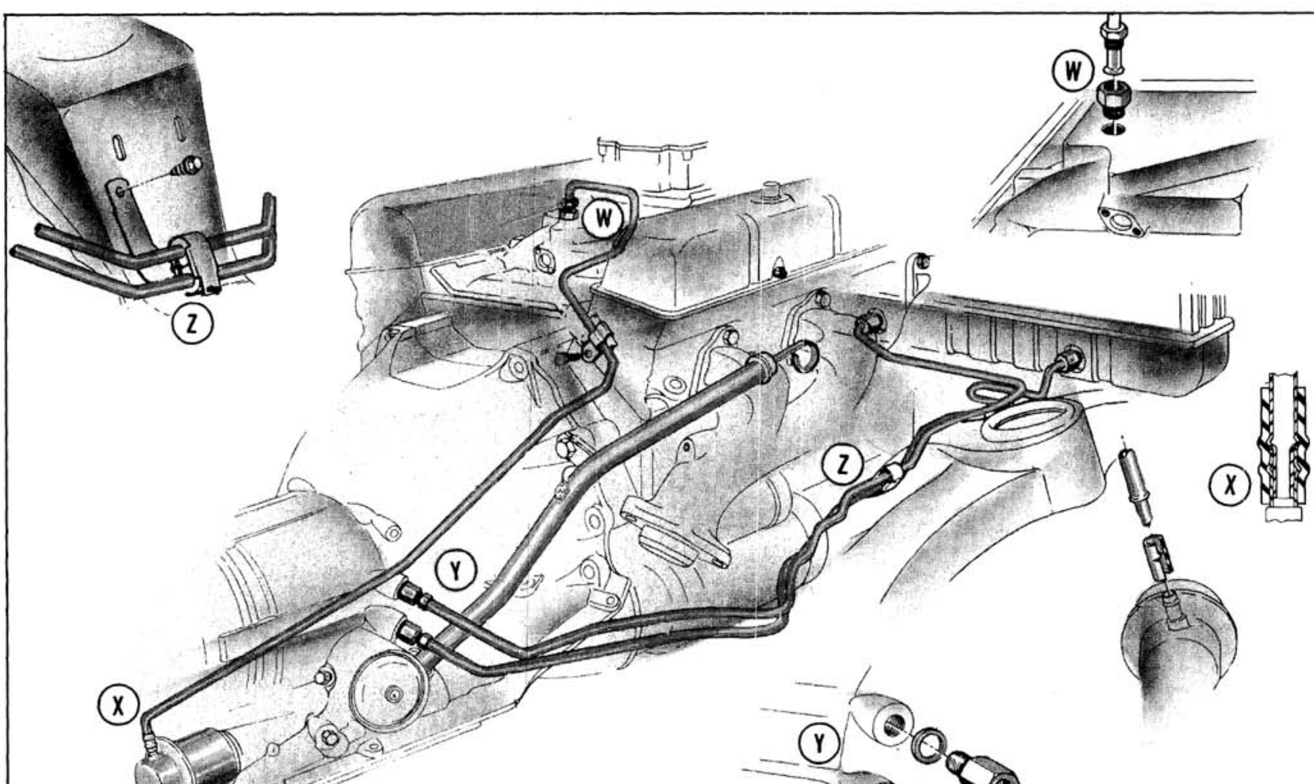


Fig. 6-340 Oil Cooler Lines—V-6

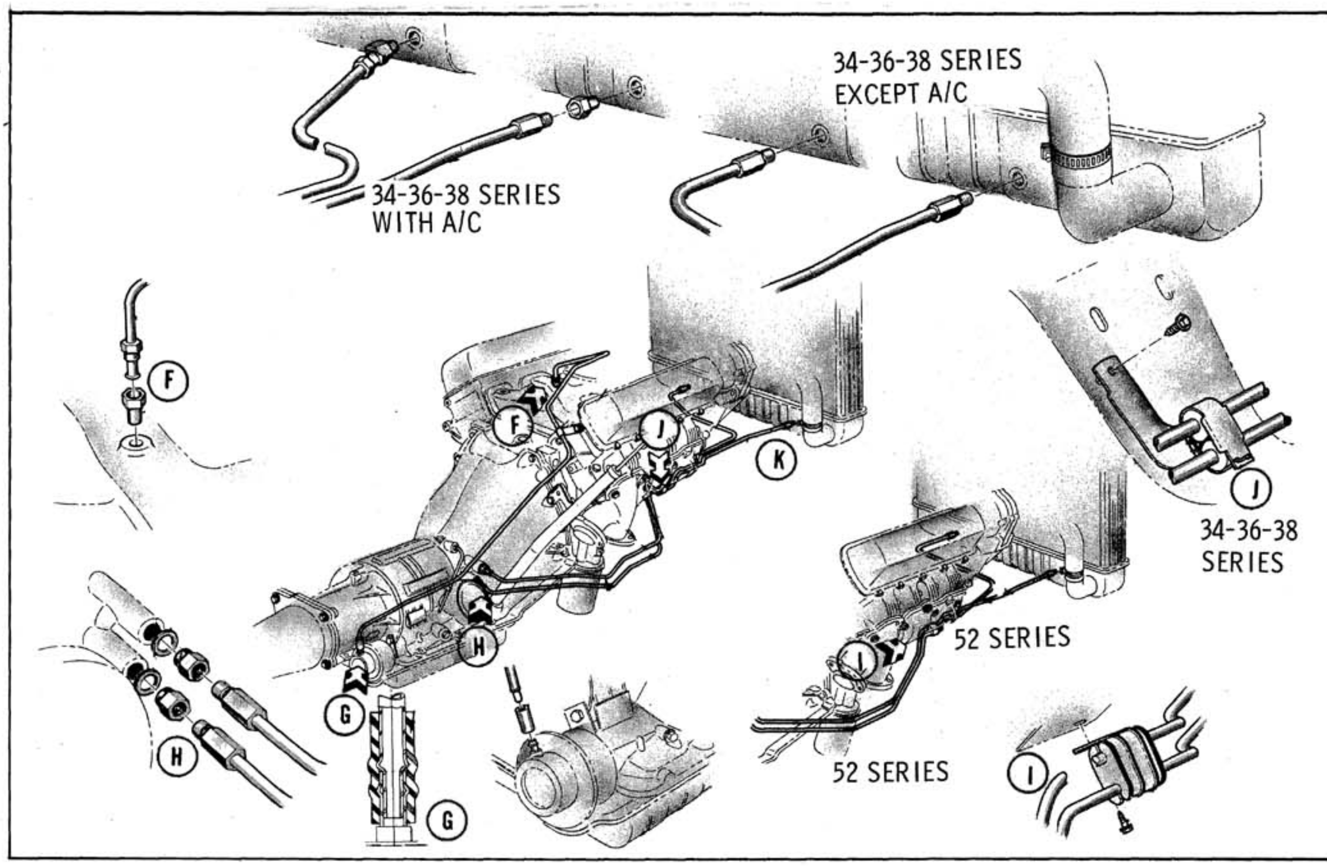


Fig. 6-341 Oil Cooler Lines—V-8

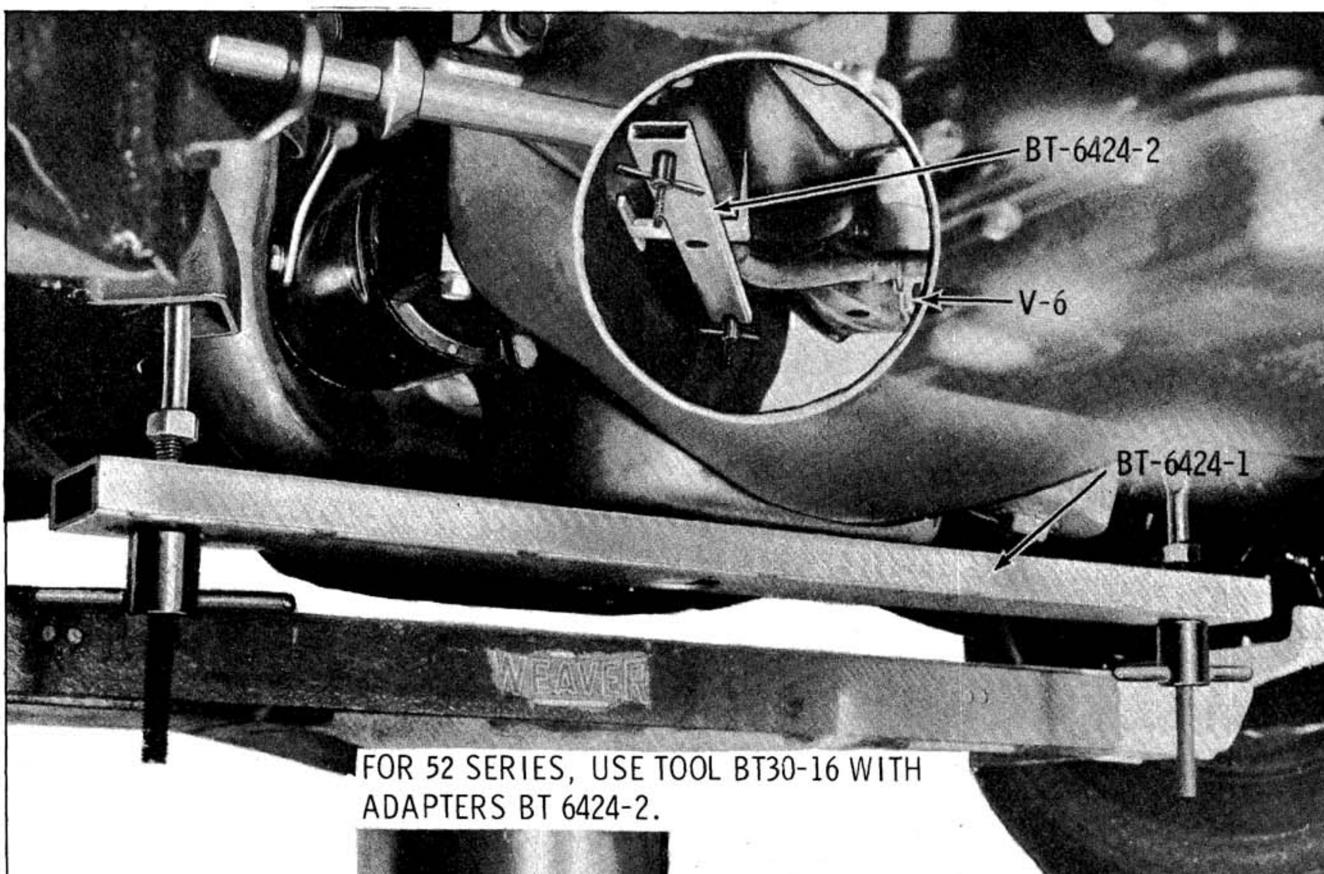


Fig. 6-342 Engine Support Bar

THROTTLE LINKAGE ADJUSTMENT

If improper part throttle or full throttle downshift is encountered, it will be necessary to adjust the throttle linkage. Refer to Engine Tune-Up Section 5.

OPERATIONS NOT REQUIRING TRANSMISSION REMOVAL

The following operations can be performed as outlined below without removing the transmission from the car.

1. Oil Pan

   Refer to Figs. 6-347, 6-540 and 6-541.

*2. Oil Filter

   Refer to Fig. 6-348.

3. Rear Bearing Retainer

   NOTE: It will be necessary to remove the propeller shaft.

   Refer to Figs. 6-365 through 6-369 and 6-520 through 6-527.

4. Vacuum Modulator

   Refer to Figs. 6-372, 6-373, 6-374, 6-544, 6-545 and 6-546.

*5. Valve Body

   Refer to Figs. 6-350 through 6-357, 6-395 through 6-401 and 6-528 through 6-535.

6. Governor
   Refer to Figs. 6-370, 6-371, 6-542 and 6-543.

*7. Low Servo

   Refer to Figs. 6-359, 6-360, 6-499, 6-500, 6-501 and 6-502.

*8. Selector and Parking Mechanism

   Refer to Figs. 6-385 through 6-392 and 6-481 through 6-486.

*9. Pressure Regulator Valve

   Refer to Figs. 6-423 and 6-424.

*These operations require the removal of the oil pan.

JETAWAY TRANSMISSION ASSEMBLY

To perform the following operations it is necessary to remove the transmission from the car; however, it is not necessary to remove the oil pan.

1. Oil Pump Removal
2. Forward Clutch and/or Low Band Removal
3. Planetary Gear Set and Output Shaft or Internal Ring Gear Removal
4. Reverse Clutch Removal

REMOVAL (Fig. 6-343)

1. Remove transmission filler pipe.
2. Raise car on hoist.
3. Disconnect transmission control wires at transmission.
4. Disconnect manual rod from transmission lever.
5. Remove propeller shaft assembly.
6. Remove flywheel dust cover.
7. Install Engine Support Bar BT-6424.
8. Remove transmission cross support bar to rear transmission mount attaching bolts.
9. Remove brace on right side of transmission on 55 and 65 styles.
10. Remove cross support bar to frame attaching brackets and remove cross support bar.

    NOTE: On models equipped with dual exhaust it may be necessary to disconnect the left hand exhaust pipe at the exhaust manifold to provide clearance.

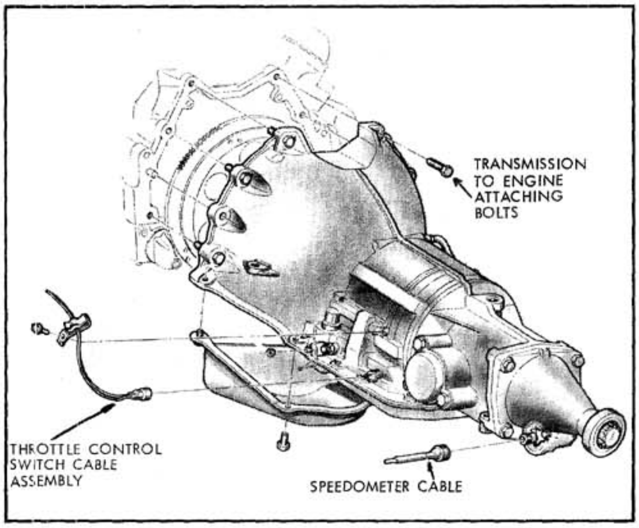


Fig. 6-343 Transmission Assembly

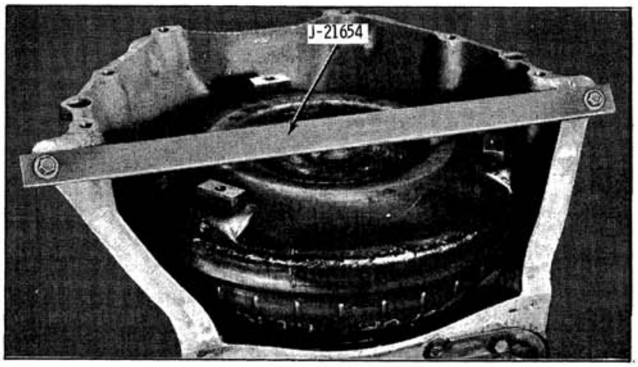


Fig. 6-344 Converter Holding Tool J-21654

11. Disconnect oil cooler lines and cap immediately.

12. Disconnect speedometer cable (or speed adapter, if so equipped) from speedometer driven gear.

13. Remove three flywheel to converter attaching bolts.

    NOTE: Mark flywheel and converter so they can be reassembled in the same relationship.

14. Install Converter Holding Tool J-21654. (Fig. 6-344)

15. Support transmission with unit lift and remove transmission to flywheel housing bolts.

    NOTE: It may be necessary to lower engine slightly to permit removal of transmission to flywheel housing upper bolts.

16. Carefully move transmission rearward and lower from car.

Installation

When installing transmission, tighten the attaching parts to the following specified torque ratings:

a. Transmission to flywheel housing . . . . .45 ft. lbs.
b. Flywheel to converter. . . . . . . .35 ft. lbs.
c. Cross support bar brackets to frame . . . . .40 ft. lbs.
d. Cross support bar to rear transmission mount. . . . . .45 ft. lbs.
e. Flywheel dust cover . . . . .7 ft. lbs.
f. Propeller shaft U-bolt nuts . . . . .16 ft. lbs.

Fill transmission as recommended in Periodic Maintenance - Section 2.

DISASSEMBLY

Before starting disassembly of the transmission it should be thoroughly cleaned externally to avoid getting dirt inside.

Place transmission on a CLEAN work bench and use CLEAN tools during disassembly. Provide CLEAN storage space for parts and units removed from transmission. An excellent working arrangement is provided by assembling the transmission to Holding Fixture J-8763. (Fig. 6-346)

The transmission contains parts which are ground and highly polished, therefore, parts should be kept separated to avoid nicking and burring surfaces.

When disassembling transmission carefully inspect all gaskets at times of removal. The imprint of parts on both sides of an old gasket will show whether a good seal was obtained. A poor imprint indicates a possible source of oil leakage due to gasket condition, looseness of bolts, or uneven surfaces of parts.

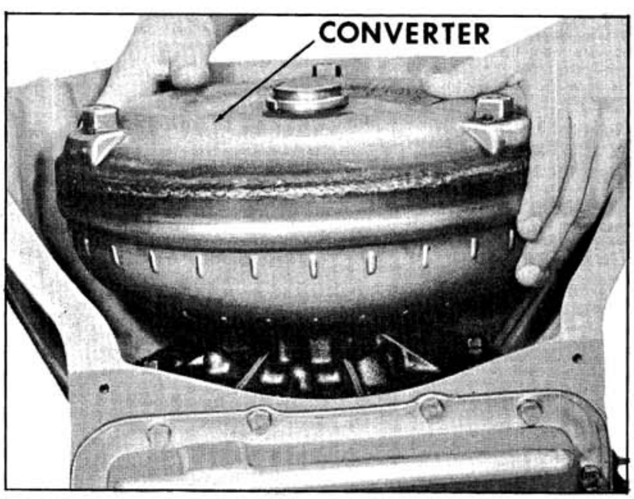


Fig. 6-345 Removing Converter

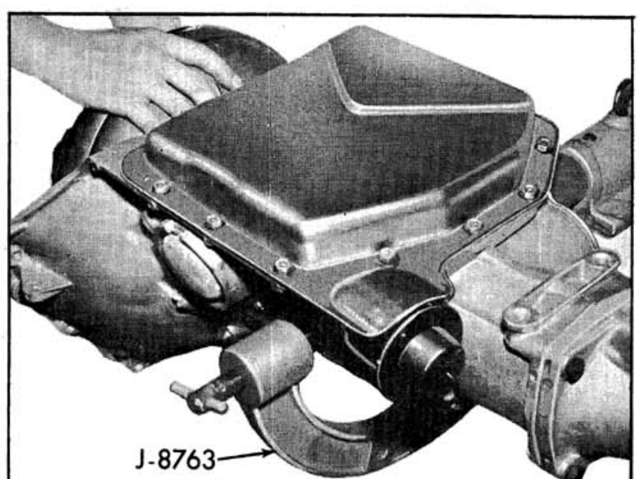


Fig. 6-346 Transmission Holding Tool J-8763

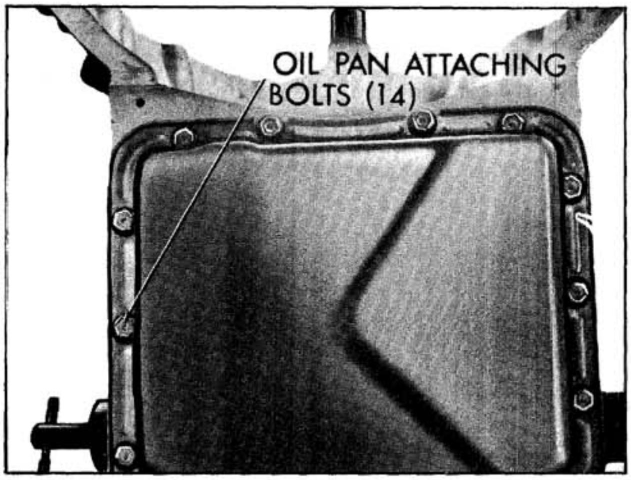


Fig. 6-347 Removing Oil Pan

None of the parts require forcing when disassembling or assembling transmission. Use a rawhide or plastic mallet to separate tight fitting cases - do not use a hard hammer.

Removal of Oil Pan

1. With transmission in horizontal position remove converter holding tool and pull converter from case. (Fig. 6-345)

2. Place transmission in Fixture J-8763. (Fig. 6-346)

3. Remove 14 oil pan attaching bolts using a 1/2" socket. (Fig. 6-347)

4. Remove oil pan and gasket from transmission.

Removal of Oil Filter and Pipe

1. Remove the filter (or strainer). (Fig. 6-348)

2. Lift oil filter pipe from transmission case.

3. Examine oil filter to case oil seal. If nicked, torn or worn, remove seal. (Fig. 6-349)

Fig. 6-348 Removing Oil Filter Attaching Bolt

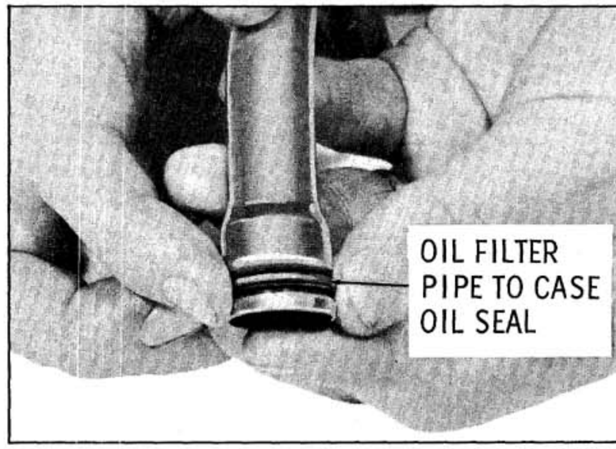


Fig. 6-349 Oil Filter Pipe to Case Oil Seal

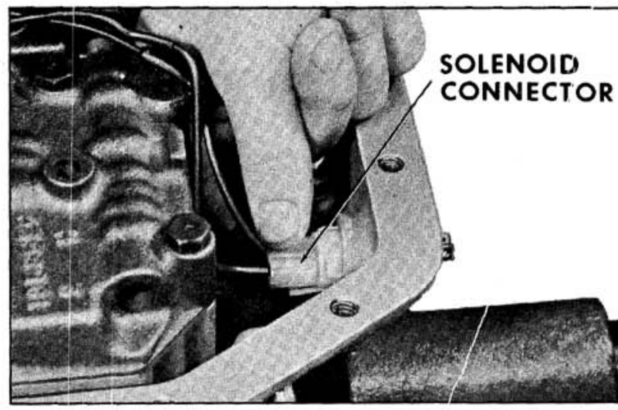


Fig. 6-350 Disconnecting Solenoid Connector

Removal of Valve Body

1. Disconnect solenoid connector from solenoid junction. (Fig. 6-350)

2. Remove solenoid junction from case. Inspect switch "O" ring. If nicked, torn or worn replace. (Fig. 6-351)

3. With a grease pencil mark stator control solenoid with an "S". This "S" will identify

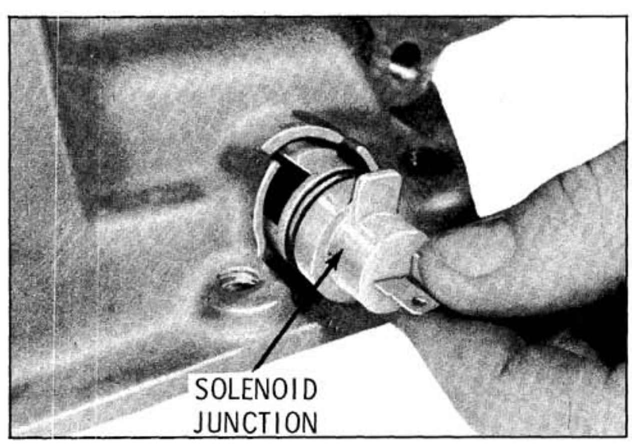


Fig. 6-351 Removing Solenoid Junction

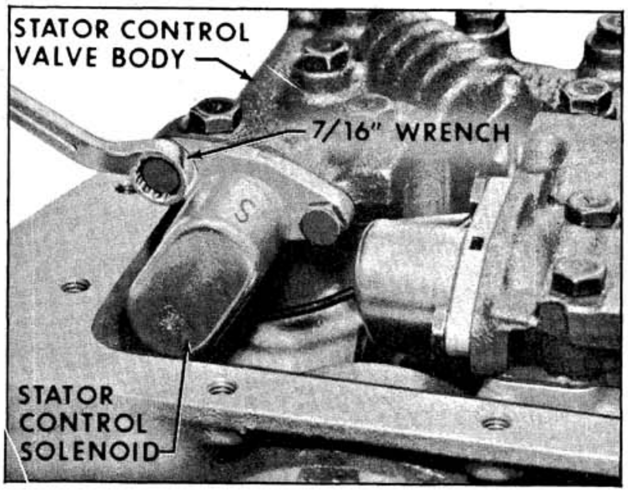


Fig. 6-352 Removing Solenoid

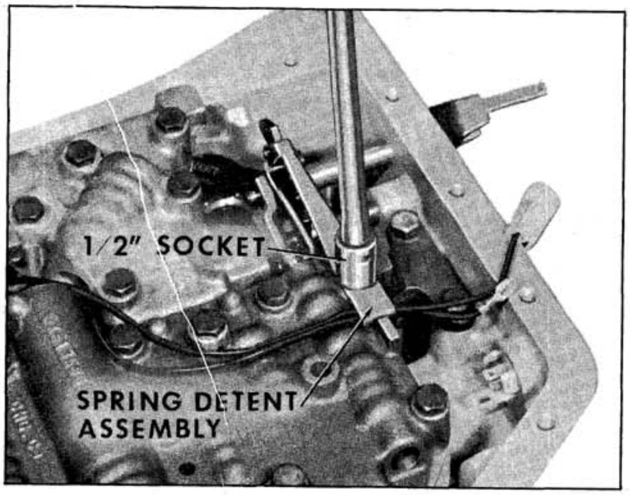


Fig. 6-353 Removing Spring Detent Assembly

stator control solenoid for reassembly. (Fig. 6-352)

4. Remove two solenoid to stator control valve body retaining bolts with 7/16" wrench. Remove stator control solenoid gasket. (Fig. 6-352)

5. Remove spring detent assembly bolt with a 1/2" socket. Remove spring detent assembly from valve body. (Fig. 6-353)

6. Remove seven bolts retaining stator control valve body to transmission case using a 1/2" socket. Remove stator control valve body. (Fig. 6-354)

7. Remove 11 valve body to case bolts. Do not remove valve body. (Fig. 6-355)

8. Remove manual control valve link by rotating valve body in a counterclockwise direction to remove link from Park lock and range selector inner lever. (Fig. 6-356)

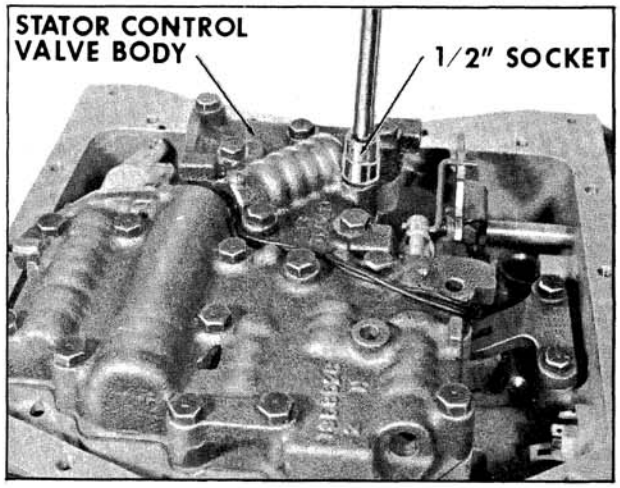


Fig. 6-354 Removing Stator Control Valve Body

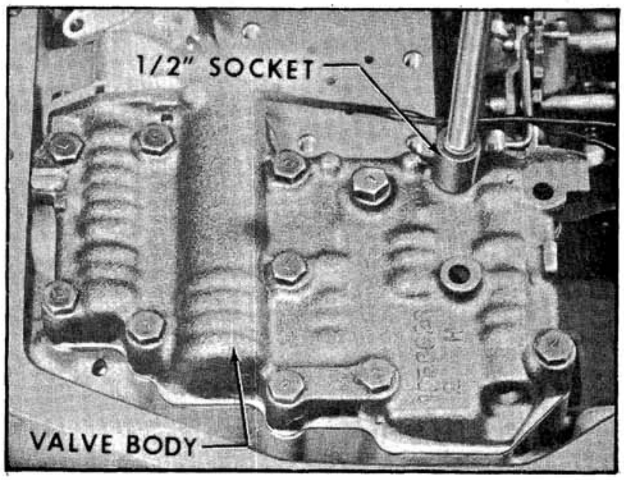


Fig. 6-355 Removing Valve Body

9. Remove manual control valve and link from valve body assembly. Remove valve body.

10. Remove valve body plate and gasket. (Fig. 6-357)

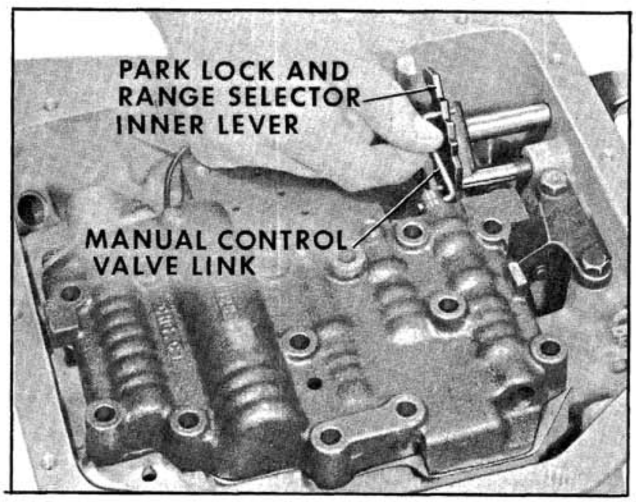


Fig. 6-356 Removing Inner Lever

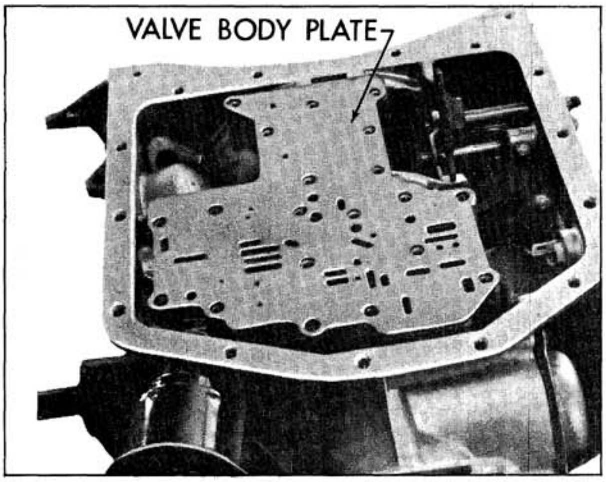


Fig. 6-357 Removing Valve Body Plate and Gasket

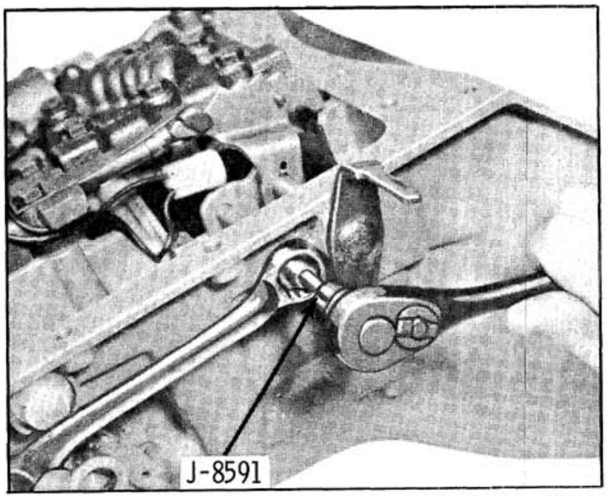


Fig. 6-358 Low Band Adjusting Screw

Removal of Low Servo Cover and Piston Assembly

1. Release tension on low band adjusting screw retaining nut. Release tension on low band by turning adjusting screw in a counterclockwise direction. Use a 7/32" Allen Wrench. (Fig. 6-358)

2. Remove low servo cover snap ring. Use Tool J-21495-1 to compress servo cover so snap ring can be removed. (Fig. 6-359)

3. Loosen thumb screw on tool, then remove Tool J-21495-1 from case. Remove low servo cover. NOTE: If necessary aid removal with screwdriver.

4. Inspect low servo cover seal. If nicked, torn, or worn, discard.

5. Remove low servo piston assembly from case. (Fig. 6-360)

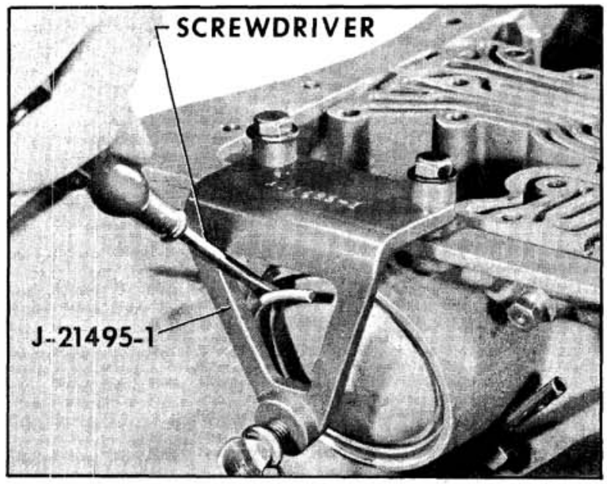


Fig. 6-359 Removing Low Servo Cover Snap Ring

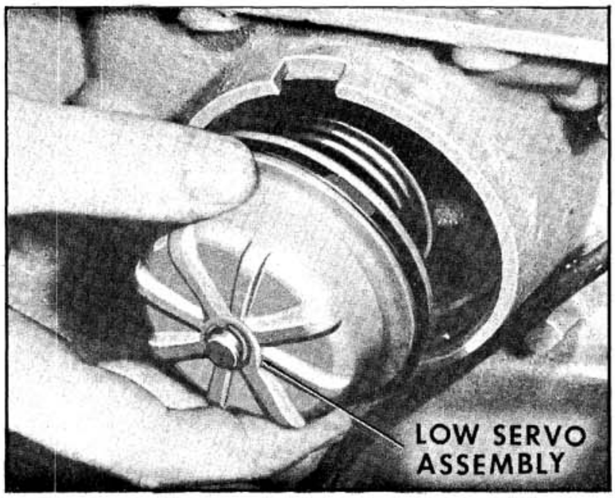


Fig. 6-360 Removing Low Servo Piston

Removal of Oil Pump

NOTE: Before removing oil pump assembly, check oil pump clearance as shown in Fig. 6-516 and record reading.

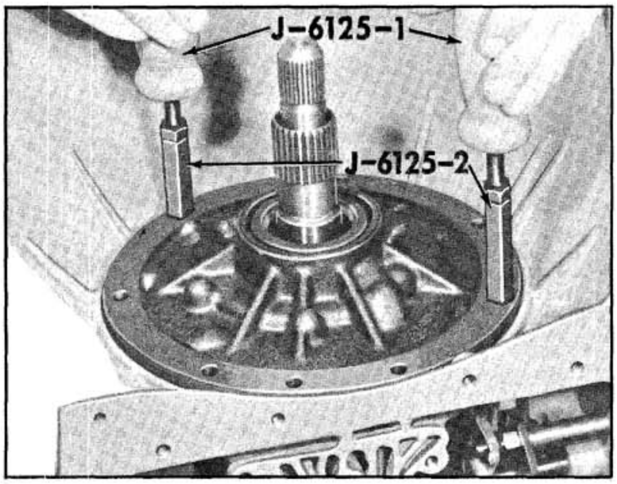


Fig. 6-361 Removing Oil Pump

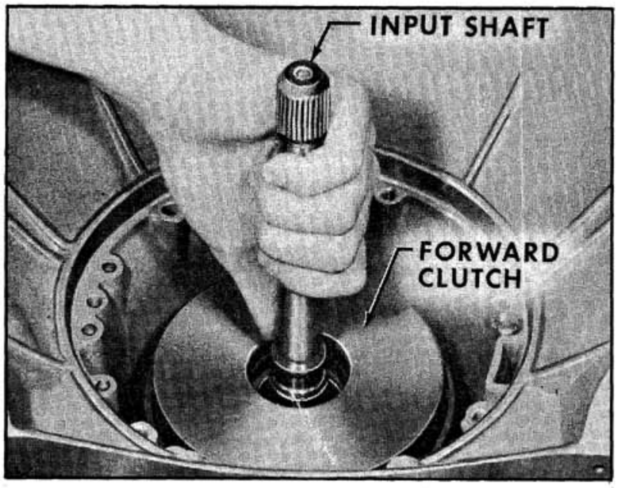


Fig. 6-362 Removing Input Shaft

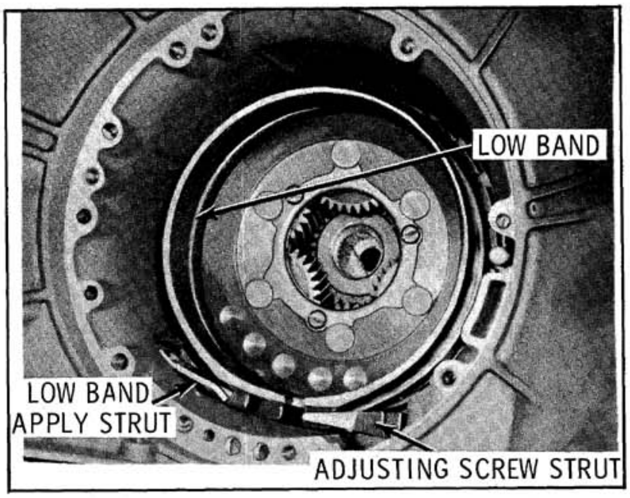


Fig. 6-364 Removing Low Band

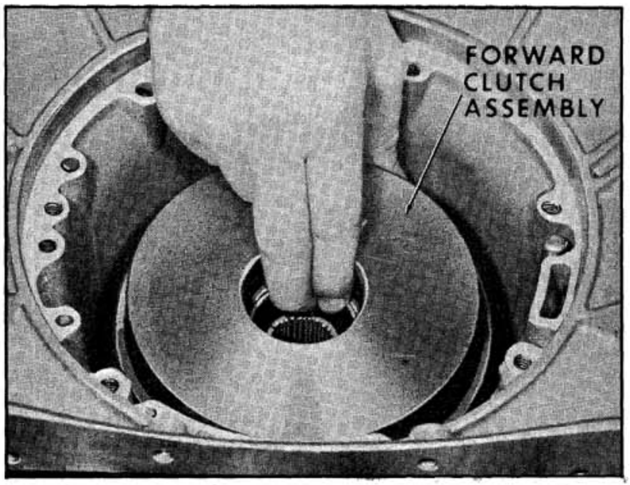


Fig. 6-363 Removing Forward Clutch

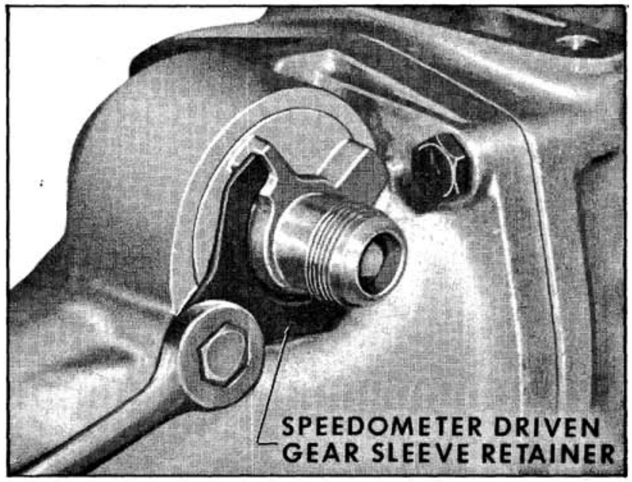


Fig. 6-365 Removing Speedometer Driven Gear Retainer

1. With transmission in vertical position, remove eight pump attaching bolts with "O" ring seals, then install Slide Hammers J-6125-1 with Adapters J-6125-2 into threaded holes in pump. Using slide hammers, loosen pump from case. Remove pump and gasket from case. (Fig. 6-361)

Removal of Forward Clutch

1. Remove input shaft from forward clutch drum. (Fig. 6-362)
2. Examine input shaft oil rings. If nicked or worn, remove rings.
3. Remove forward clutch assembly by pulling straight out of case. Make certain low band has been released before attempting to remove forward clutch. (Fig. 6-363)

Removal of Low Band

1. Remove low band and struts from inside the case. (Fig. 6-364)
2. Remove low band adjusting screw.

Removal of Speedometer Driven Gear (Exc. 52 Series)

1. With transmission in horizontal position, remove speedometer driven gear sleeve retainer. (Fig. 6-365)
2. Remove speedometer driven gear sleeve. If speedometer driven gear sleeve cannot be removed by hand, available Tool BT-6422 may be used as shown in Fig. 6-366.

Removal of Rear Bearing Retainer

1. Remove four rear bearing retainer bolts with a 9/16" socket. Remove rear bearing retainer from case. (Fig. 6-367)
2. Remove rear bearing retainer to case seal. (Fig. 6-368)

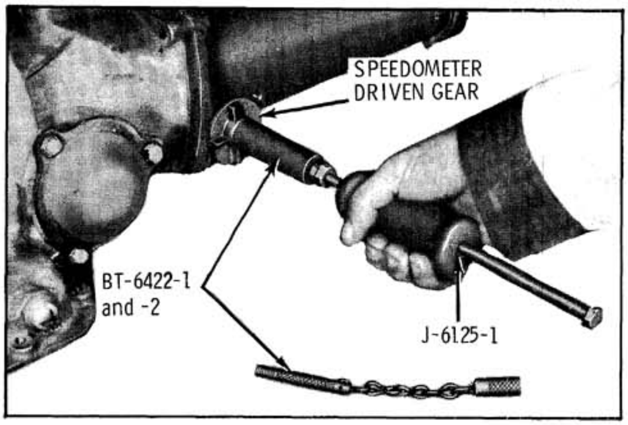


Fig. 6-366 Removing Speedometer Driven Gear

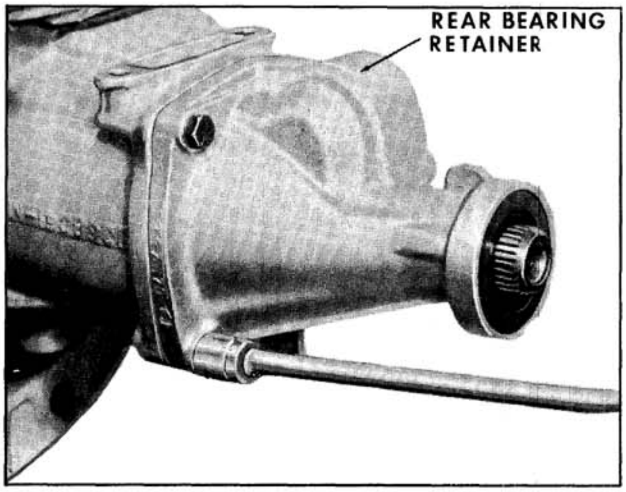


Fig. 6-367 Removing Rear Bearing Retainer

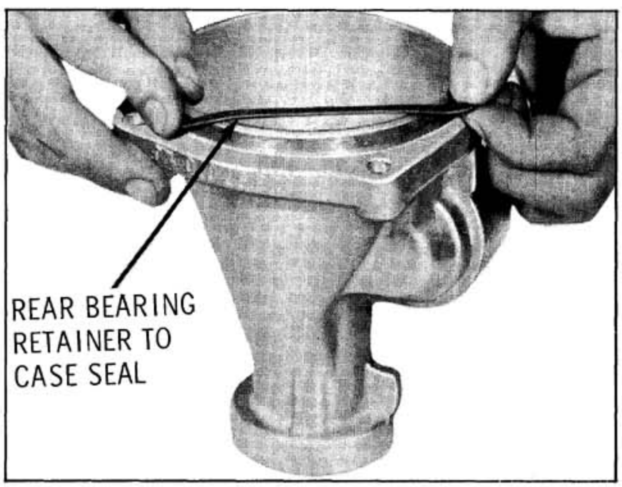


Fig. 6-368 Removing Rear Bearing Retainer to Case Seal

Removal of Speedometer Driving Gear (Exc. 52 Series)

1. Place transmission in "P" range, then remove speedometer driving gear with J-6123. (Fig. 6-369)

   NOTE: Use J-21985 threaded rods.

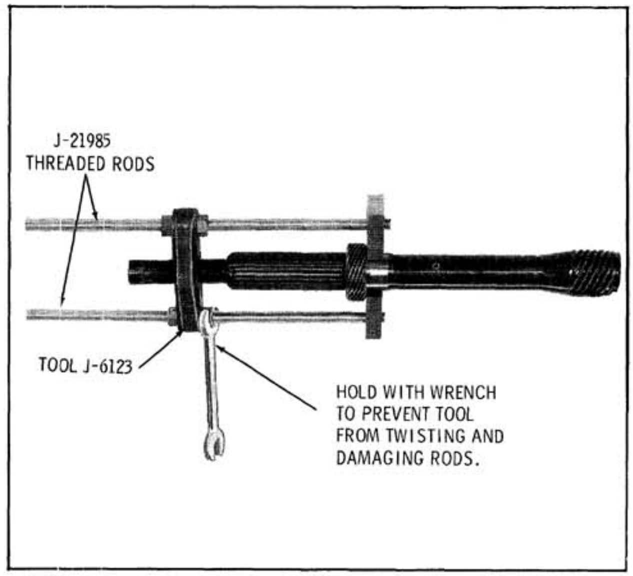


Fig. 6-369 Removing Speedometer Drive Gear

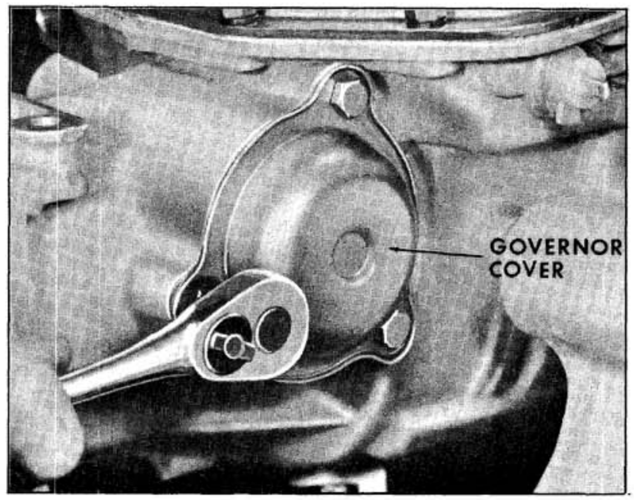


Fig. 6-370 Removing Governor Cover

Removal of Governor

1. Remove three attaching bolts retaining governor cover to case using a 1/2" socket. Remove cover and gasket. (Fig. 6-370)

2. With a twisting motion, slide governor assembly out of its bore in case. (Fig. 6-371)

Removal of the Vacuum Modulator Assembly

1. Remove vacuum modulator retainer bolt and retainer using a 1/2" socket. Remove vacuum modulator and valve assembly. (Figs. 6-372, 6-373 and 6-374)

2. Inspect and if necessary remove vacuum modulator to case oil seal. (Fig. 6-373)

Removal of Planetary Gear Set

1. Remove planet carrier assembly from case,

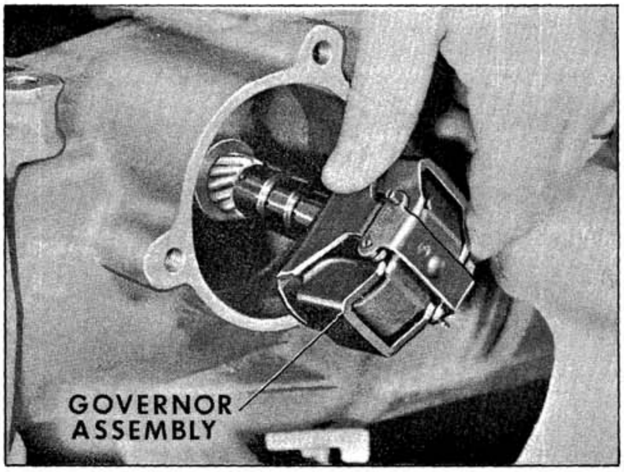


Fig. 6-371 Removing Governor

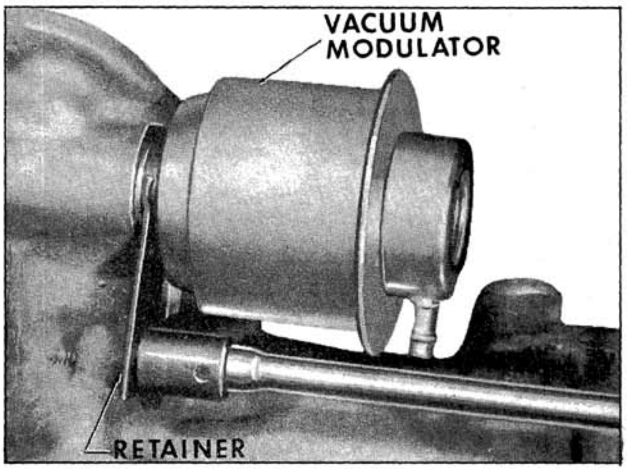


Fig. 6-372 Removing Vacuum Modulator Retainer

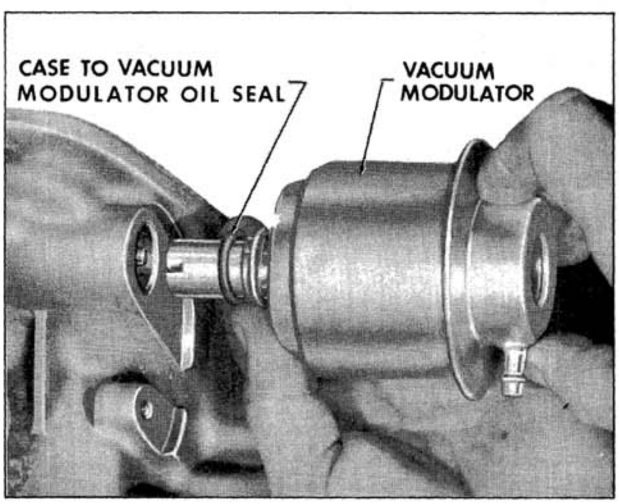


Fig. 6-373 Removing Vacuum Modulator

using care not to damage case bushing. (Fig. 6-375)

2. Remove needle bearing and two bearing races from rear of planet carrier. (Fig. 6-376)

   NOTE: Bearing assembly may stay in transmission when planet carrier is removed.

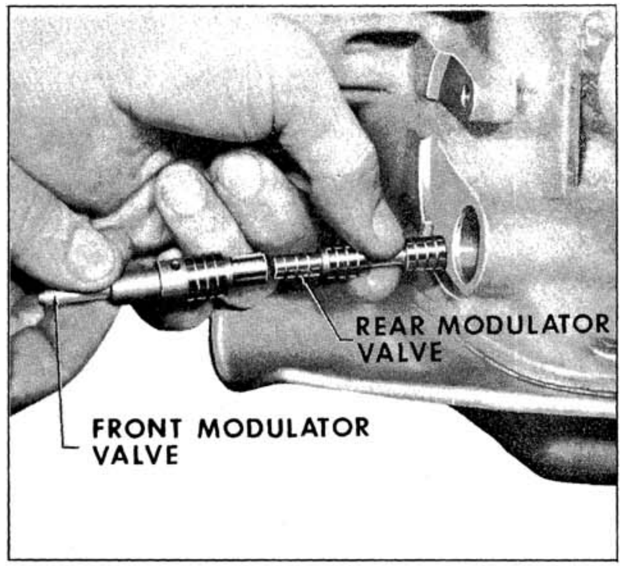


Fig. 6-374 Removing Vacuum Modulator Valve

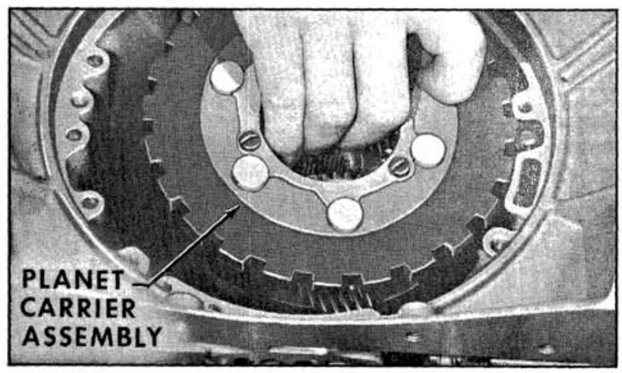


Fig. 6-375 Removing Planetary Gear Set

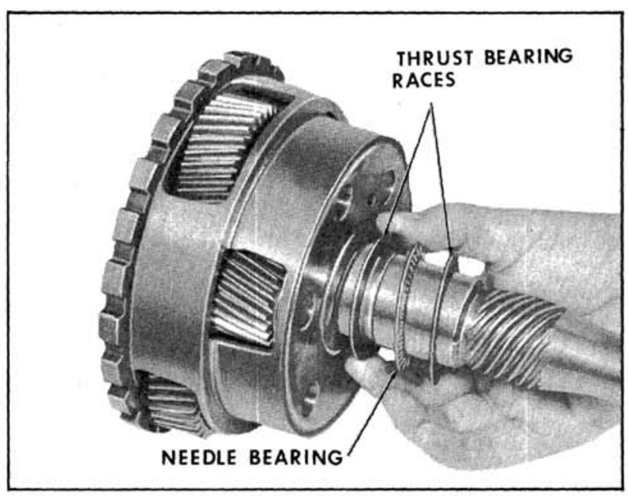


Fig. 6-376 Removing Planetary Gear Thrust Bearing

3. Remove reverse ring gear from case. (Fig. 6-377)

Removal of Reverse Clutch

NOTE: The Jetaway used with the V-6 engine has four steel reverse plates and four lined

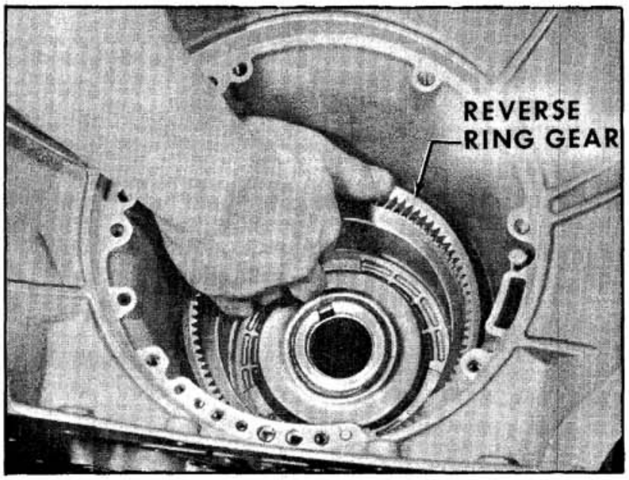


Fig. 6-377 Removing Reverse Ring Geai

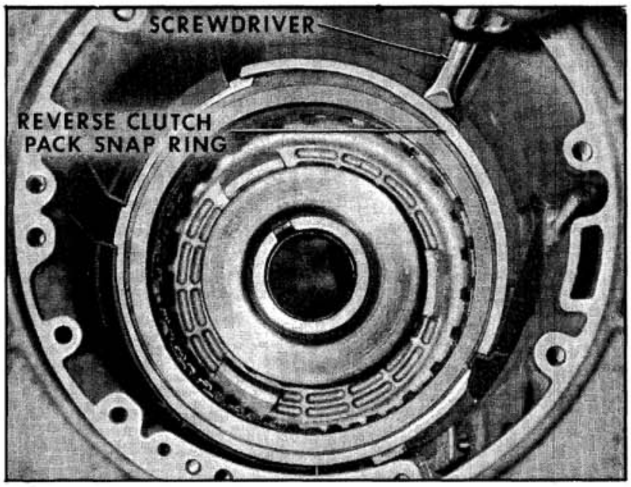


Fig. 6-378 Removing Reverse Clutch Snap Ring

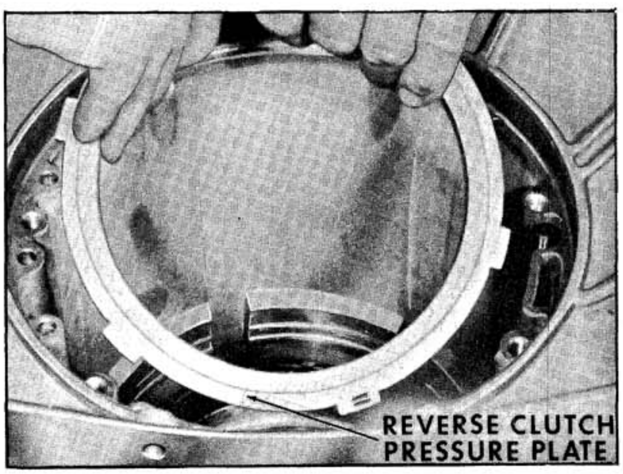
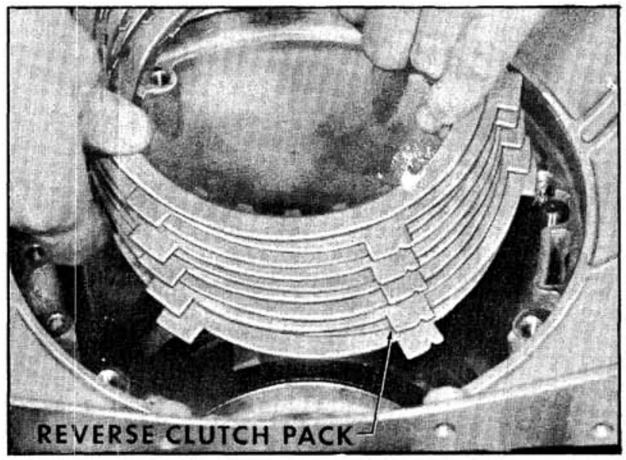


Fig. 6-379 Removing Reverse Clutch Pressure Plate

reverse plates. The V-8 engine requires one additional steel and one additional lined plate.

1. Place transmission in vertical position and remove reverse clutch pack snap ring with screwdriver. (Fig. 6-378)



. Fig. 6-380 Removing Reverse Clutch Pack

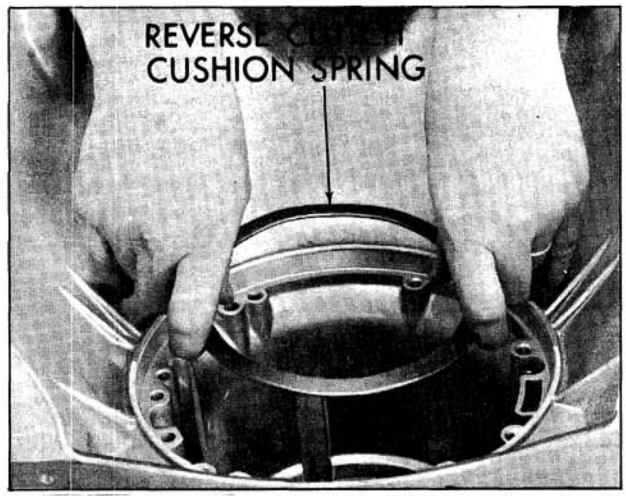


Fig. 6-381 Removing Reverse Clutch Cushion Spring

2. Lift reverse clutch 'pressure plate from transmission case. (Fig. 6-379)

3. Remove reverse clutch pack from transmission case. (Fig. 6-380)

4. Remove reverse clutch cushion spring. (Fig. 6-381)

5. To remove reverse piston, center Tool J-21420-1 on reverse piston return seat. Install Flat Plate J-21420-2 over threaded shaft at rear of case. Position webs of tool away from end of snap ring. Tighten nut to compress piston return seat; then remove snap ring with Pliers J-5586. (Fig. 6-382)

6. Remove Tool J-21420-1 & 2 being careful that piston return seat does not catch in snap ring groove. Remove piston return seat and remove 17 piston return springs. (Fig. 6-383)

7. Place transmission in a horizontal position and remove reverse clutch piston with compressed air. As air is applied to the rear surface of the piston, it will pop out far

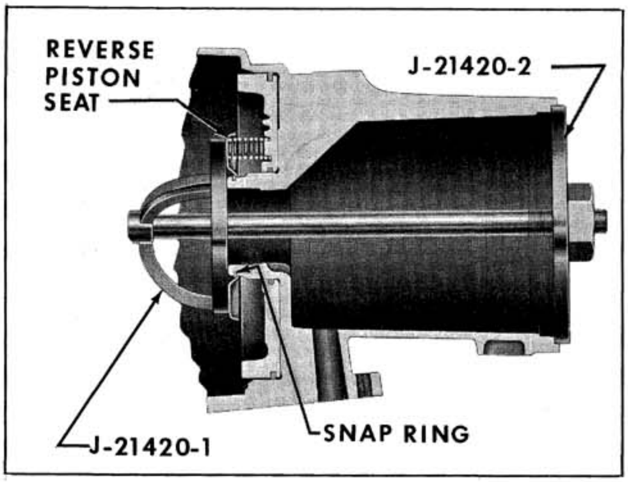


Fig. 6-382 Removing Reverse Clutch Piston

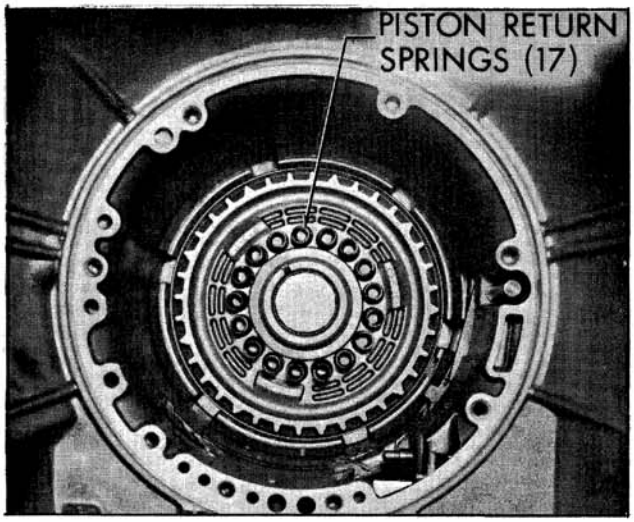


Fig. 6-383 Removing Reverse Clutch Piston Return Springs

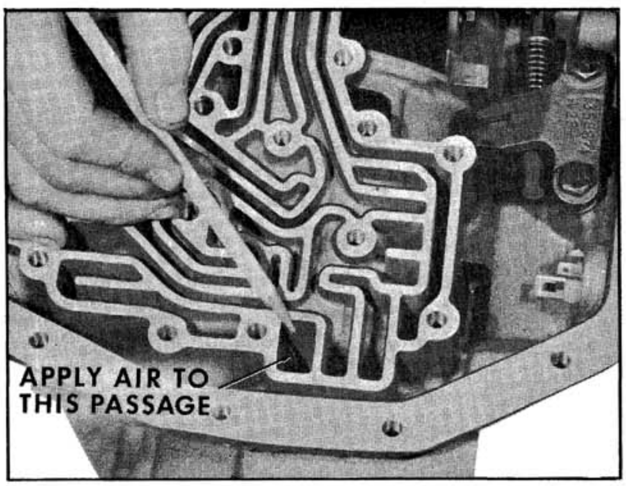


Fig. 6-384 Reverse Clutch Apply Passage

enough so it can be removed. Insert air nozzle to rear of case as shown in Fig. 6-384.

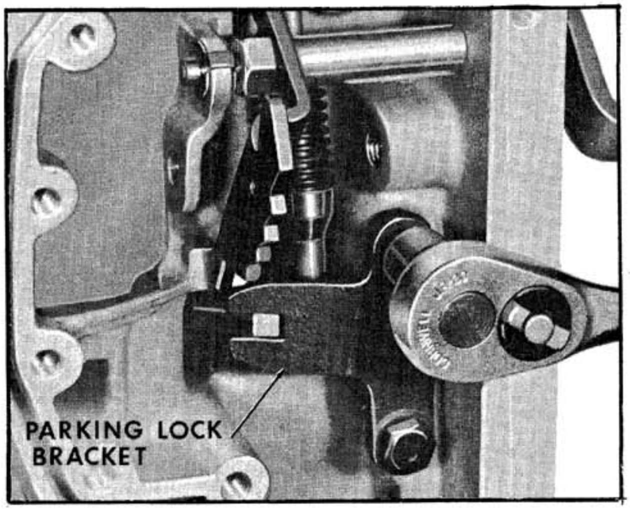


Fig. 6-385 Removing Parking Lock Bracket

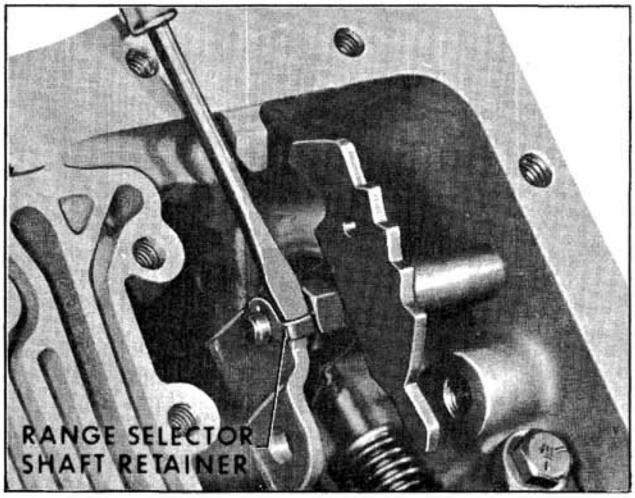


Fig. 6-386 Removing Selector Shaft Retainer

Removal of Range Selector Lever and Shaft, and Parking Lock Actuator

1. Remove two parking lock bracket bolts with 1/2" socket. Remove parking lock bracket. (Fig. 6-385)

2. Remove range selector shaft retainer. (Fig. 6-386)

3. With a 9/16" wrench, fully loosen nut that retains outer range selector lever to inner park lock and range selector lever. (Fig. 6-387)

4. Slide outer range selector lever out of case. Remove nut, inner park lock and range selector lever. (Fig. 6-388)

5. Remove retaining ring which holds inner park lock and range selector to park lock assembly. (Fig. 6-389)

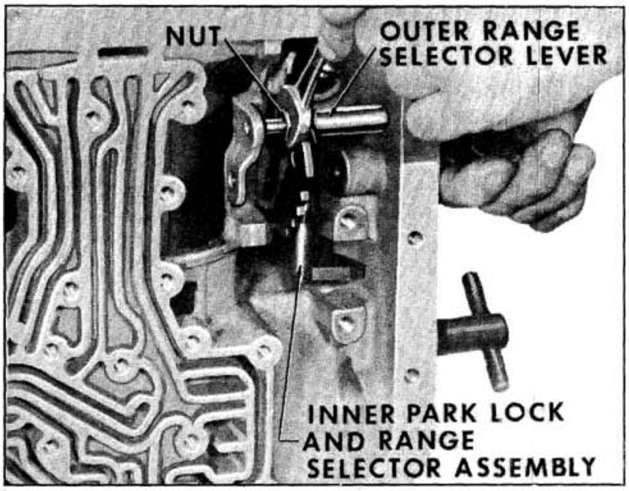


Fig. 6-387 Loosening Selector Lever Locknut

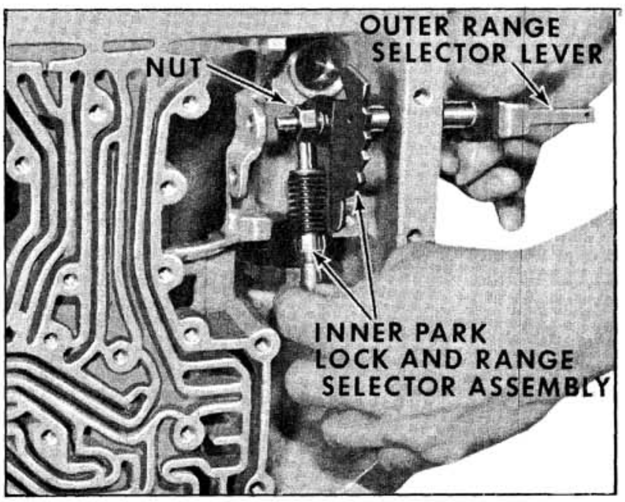


Fig. 6-388 Removing Outer Range Selector Lever

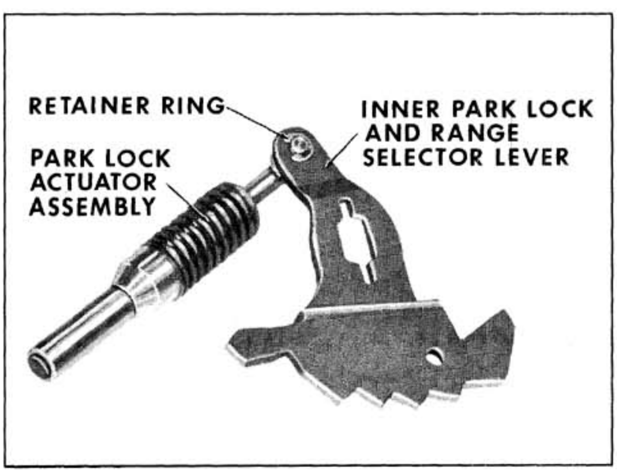


Fig. 6-389 Removing Park Lock Actuator

6. Disconnect parking lock pawl spring, then slide parking lock pawl shaft out of parking lock pawl. Remove parking lock pawl and spring. (Fig. 6-390)

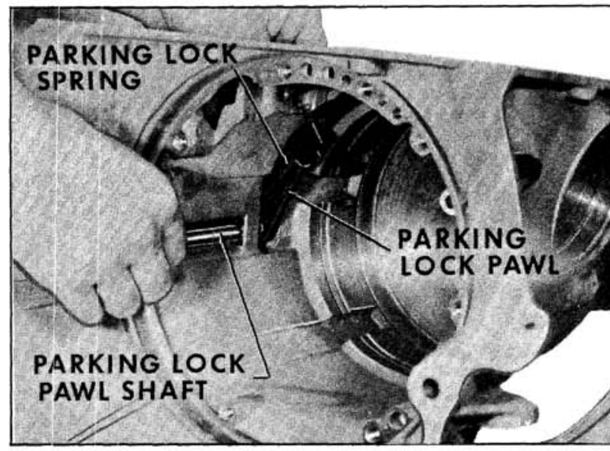


Fig. 6-390 Removing Parking Pawl

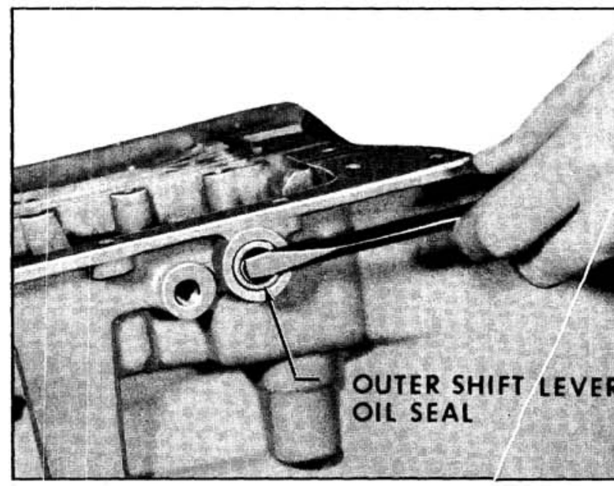


Fig. 6-391 Removing Outer Shift Lever Seal

REPAIR OF UNITS

At this point all of the main units have been removed from the transmission. The following pages cover the repair of each of these individual units.

OUTER SHIFT LEVER OIL SEAL

Examine outer shift lever oil seal. If nicked, torn, or worn, remove seal. (Fig. 6-391)

Install outer shift lever seal using J-8855-3. Make certain lip of seal points toward center of case. (Fig. 6-392)

Removal of Case Bushing

1. Inspect case bushing for nicks, scoring or excessive wear. If damaged, remove as follows: Place small punch or Tool J-8400-1 in notch in case, then tap with hammer to collapse bushing. (Fig. 6-393)

2. Install case bushing. (Fig. 6-394)

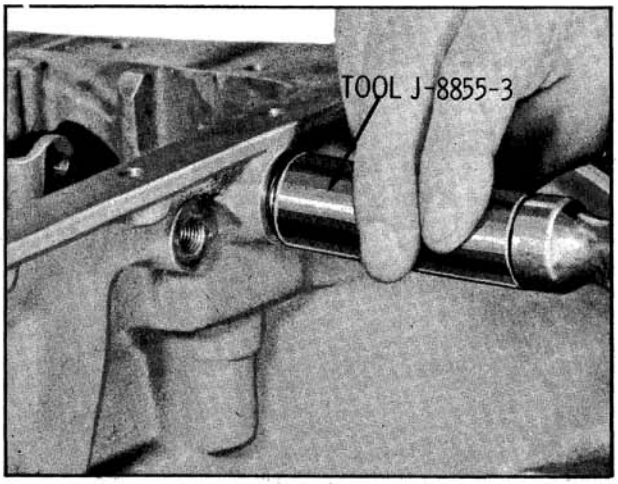


Fig. 6-392 Installing Outer Shift Lever Seal

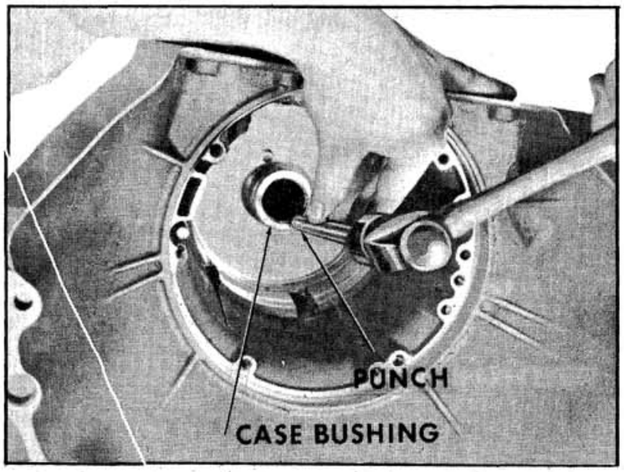


Fig. 6-393 Removing Case Bushing

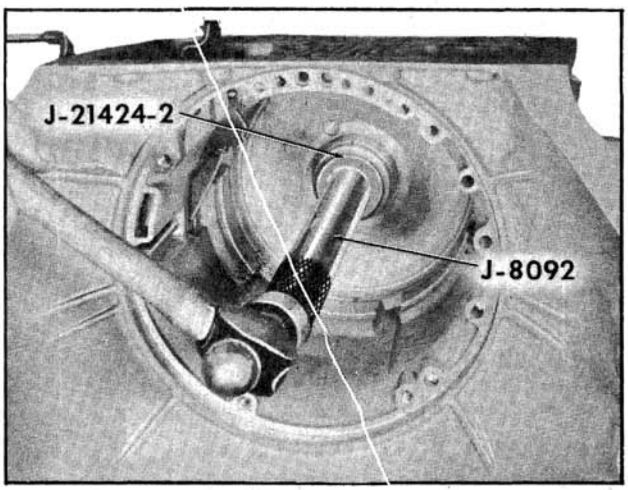


Fig. 6-394 Installing Case Bushing

VALVE BODY DISASSEMBLY INSPECTION AND REASSEMBLY

Disassembly

1. Remove two bolts attaching stator and detent solenoid valve. Remove the solenoid valve,

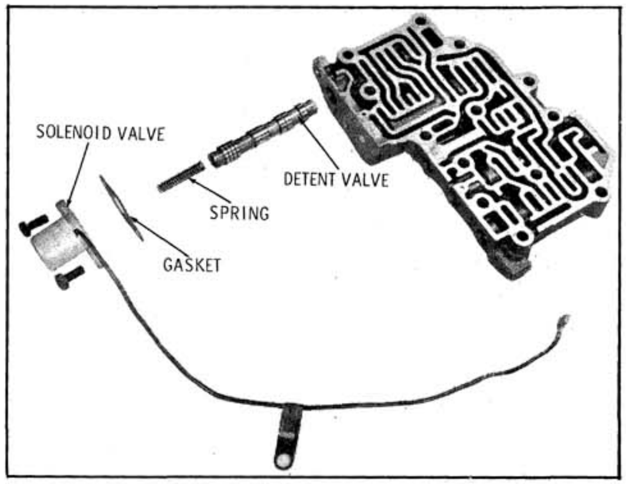


Fig. 6-395 Removing Detent Solenoid and Detent Valve

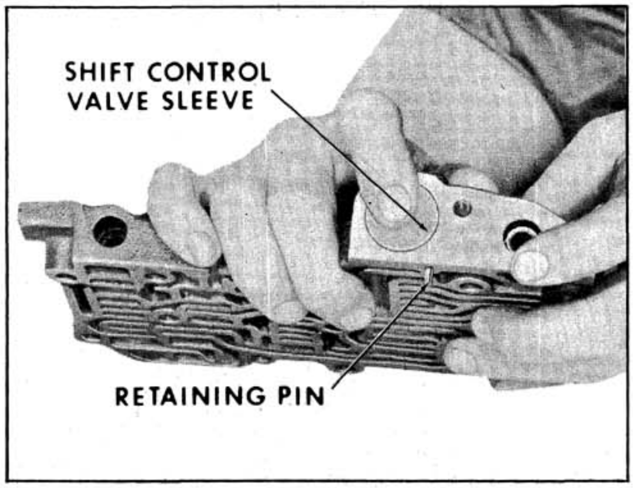


Fig. 6-396 Removing Shift Control Valve and Shift Valve

gasket, spring and stator and detent valve. (Fig. 6-395)

NOTE: Notice cutout notch on solenoid valve gasket.

2. Depress shift control valve sleeve and remove retaining pin by turning valve body over so pin will fall free. Remove shift control valve sleeve, shift control valve, spring, washer, and shift valve. (Fig. 6-396)

3. Depress modulator limit spring, turn valve body over and retaining pin will fall free. Remove spring and valve from body. (Fig. 6-397)

NOTE: Modulator limit spring is under moderate pressure. Care should be exercised in removal.

4. Depress high speed downshift timing valve plug and remove pin by turning valve body over so pin will fall free. (Fig. 6-398)

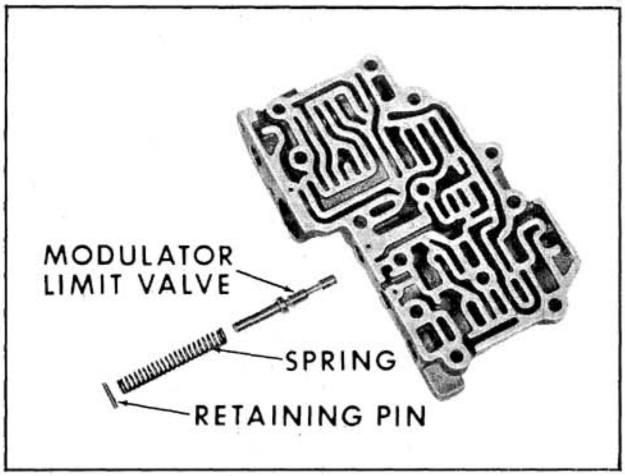


Fig. 6-397 Modulator Limit Valve

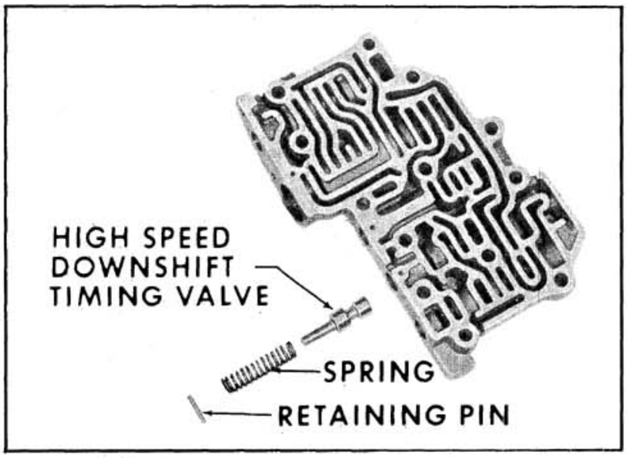


Fig. 6-398 Installing High Speed Downshift Timing Valve

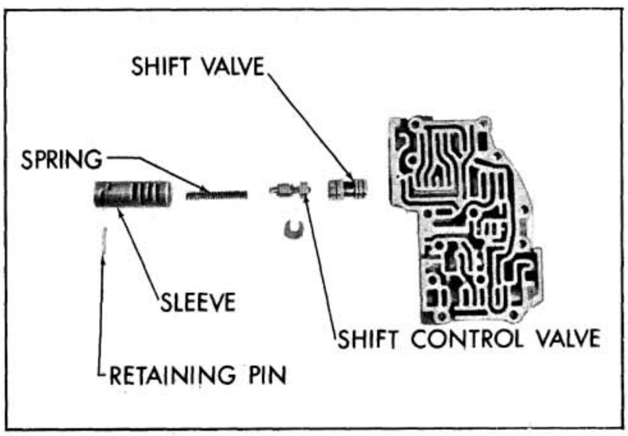


Fig. 6-399 Installing Shift Control Valve

Inspection

1. Thoroughly clean all valves and valve body in solvent. Inspect valves and valve body for evidence of wear or damage due to foreign material. Dry valve body and valves with clean air blast.

2. Test each valve in its bore. All valves must move freely of their own weight.

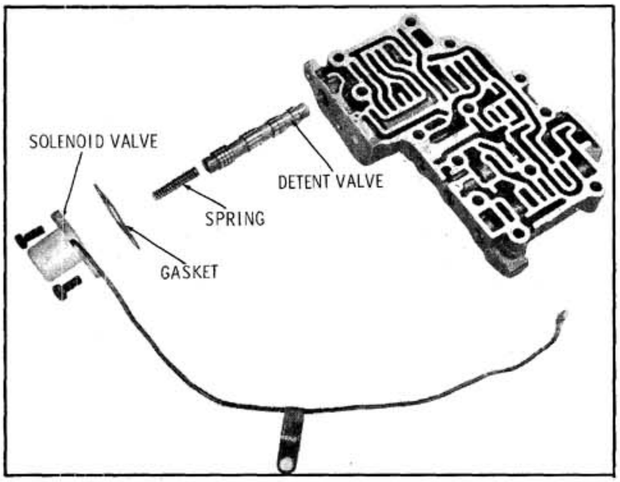


Fig. 6-400 Installing Detent Valve and Detent Solenoid

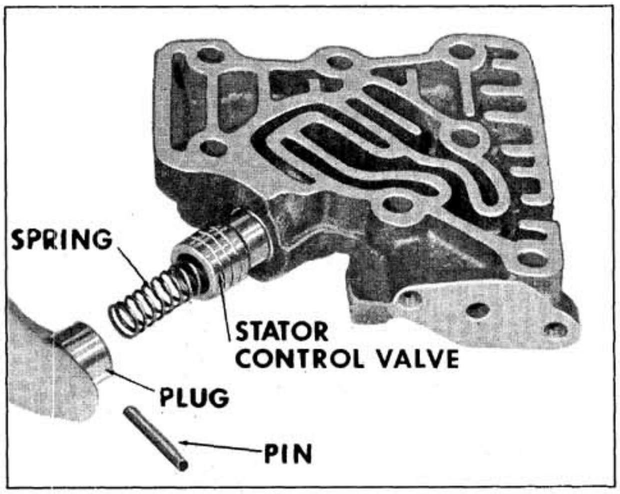


Fig. 6-401 Removing and Installing Stator Control Valve

Reassembly of Valve Body

1. Install high speed downshift timing valve, spring and plug. Depress plug with finger and install retaining pin. (Fig. 6-398)

2. Install modulator limit valve and spring into bore of valve body. Compress spring and install retaining pin. (Fig. 6-397)

3. Install shift valve, washer, spring, shift control valve and shift control valve sleeve. Depress shift control valve sleeve with thumb and install retaining pin. (Fig. 6-399)

4. Install detent valve and spring. Install gasket to solenoid with notch facing bottom of valve body. Install solenoid to valve body using two 7/16" bolts. (Fig. 6-400)

STATOR CONTROL VALVE BODY

Disassembly

1. Compress stator control valve plug. Turn valve body over and retaining pin will fall

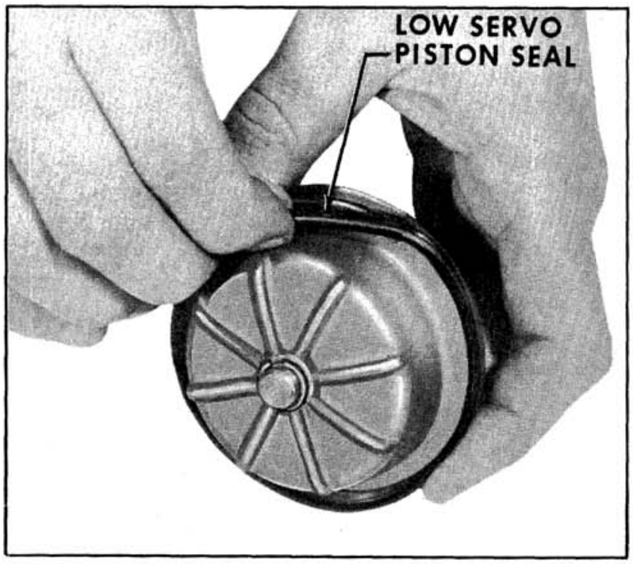


Fig. 6-402 Removing and Installing Low Servo Piston Seal

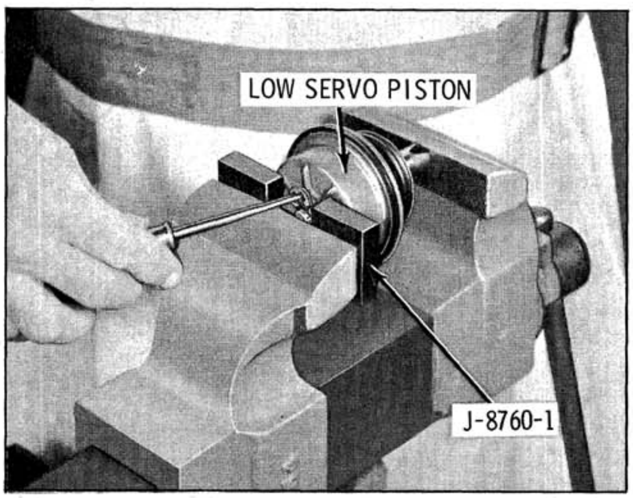


Fig. 6-403 Disassembly of Low Servo Assembly

free. Remove plug, spring and valve from body. (Fig. 6-401)

Reassembly

1. Install stator control valve, spring and plug into bore of valve body. Compress plug and install retaining pin. (Fig. 6-401)

LOW SERVO

Disassembly

1. Remove low servo piston seal. (Fig. 6-402)

2. Compress low servo piston and remove snap ring. EXTREME CAUTION MUST BE TAKEN WHEN THE LOW SERVO IS BEING COMPRESSED.

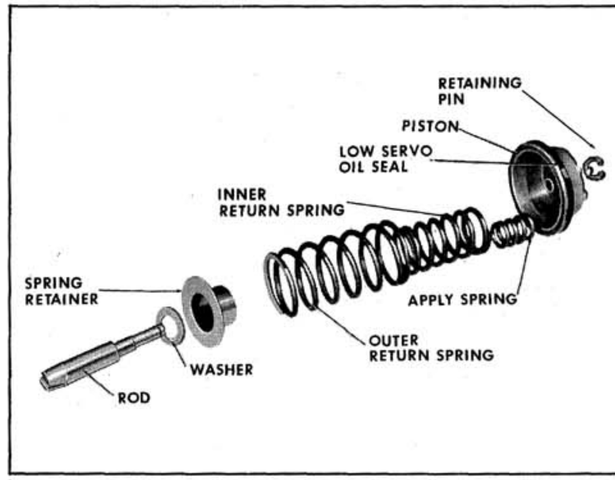


Fig. 6-404 Low Servo Piston Assembly (Exploded)

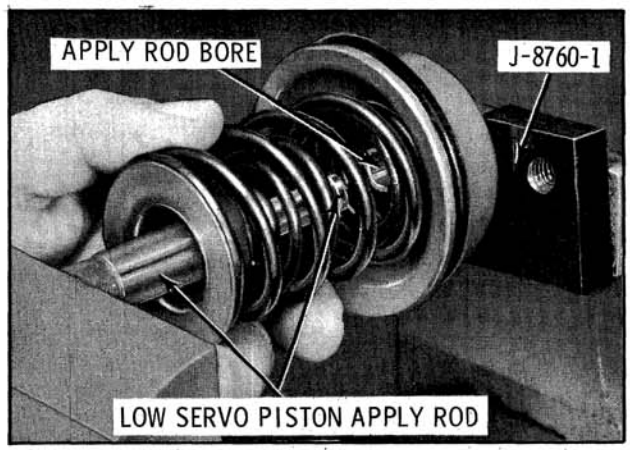


Fig. 6-405 Assembly of Low Servo Piston

NOTE: After snap ring has been removed, release vise very slowly. (Fig. 6-403)

3. After vise has been released, remove piston low servo supply piston inner spring, outer return springs, spring retainer, washer and piston apply rod. (Fig. 6-404)

Reassembly

1. Assemble the inner and outer return springs into the piston. Install spring retainer. (Fig. 6-404) Install this assembly into the vise as shown in Fig. 6-405.

2. Assemble tools on top of piston in same manner as removing. Center spring retainer and compress springs. Install piston apply rod and washer through hole in press plate and install snap ring.

CAUTION: BEFORE RELEASING VISE, MAKE CERTAIN SNAP RING IS PROPERLY INSTALLED.

Install low servo piston seal. (Fig. 6-402)

Fig. 6-406 Removing the Oil Seal Rings

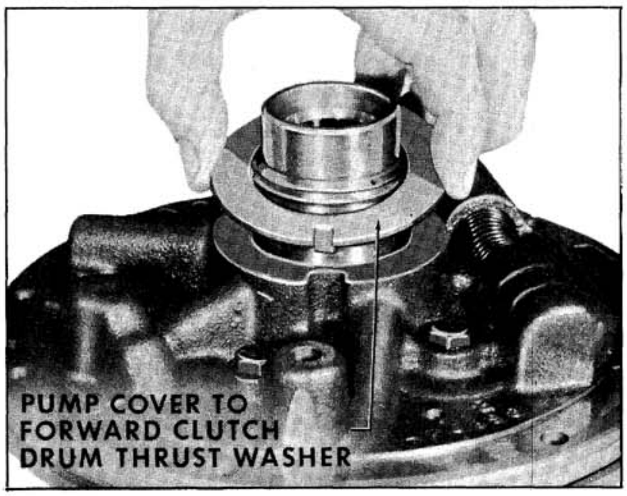


Fig. 6-407 Removing Thrust Washer

OIL PUMP

Disassembly

1. Remove the two lock-type oil sealing rings from pump hub. (Fig. 6-406)

2. Remove pump cover to forward clutch drum thrust washer. (Fig. 6-407)

3. Remove oil pump to case seal and discard. (Fig. 6-408)

4. Support oil pump on wood blocks. Remove five pump cover bolts with 1/2" socket. Remove pump cover. (Fig. 6-409)

5. Mark, but do not scar, gear faces so gears can be reassembled in same manner. (Fig. 6-410)

6. Remove oil pump drive gear. (Fig. 6-411)

7. Remove oil pump driven gear. (Fig. 6-412)

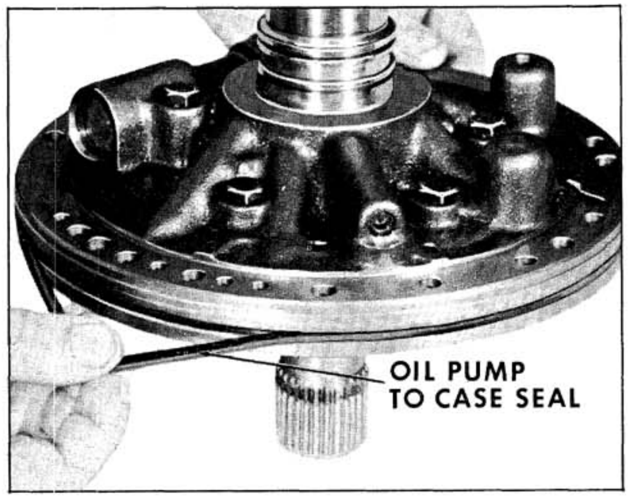


Fig. 6-408 Removing Oil Pump to Case Seal

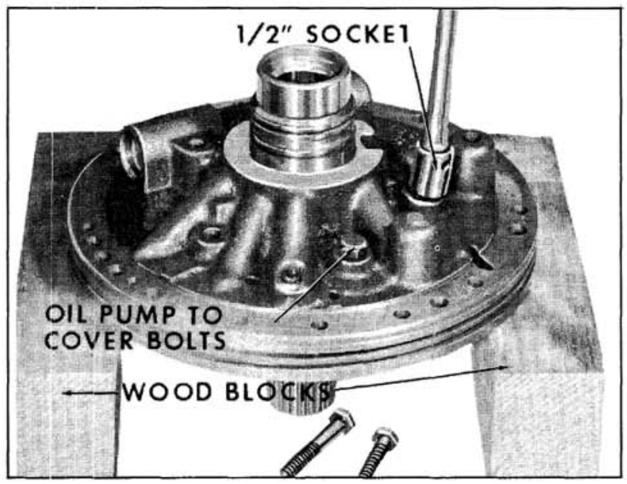


Fig. 6-409 Removing Oil Pump Cover Attaching Bolts

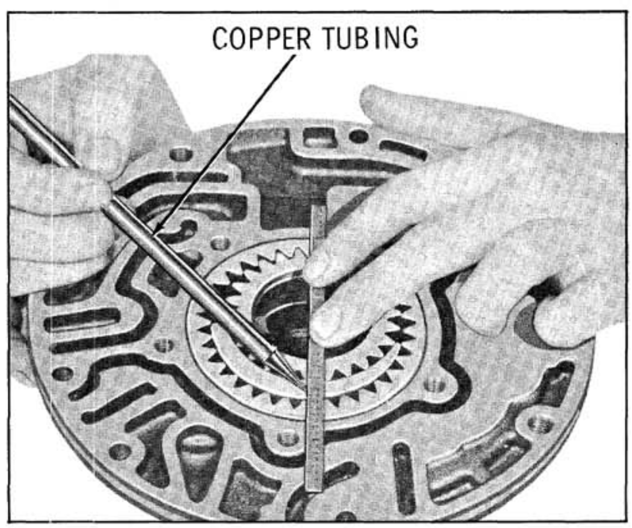


Fig. 6-410 Marking Oil Pump Gears

8. Remove seat, valve and spring from cooler bypass valve. Use Tool J-21361 attached to a slide hammer to remove seat from bore in pump cover. (Fig. 6-413)

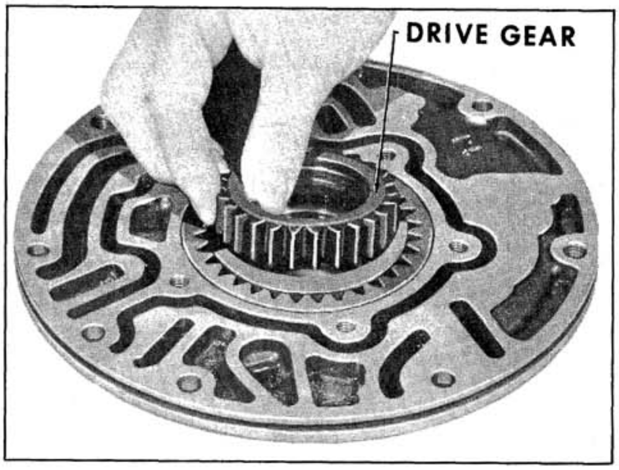


Fig. 6-411 Removing Oil Pump Drive Gear

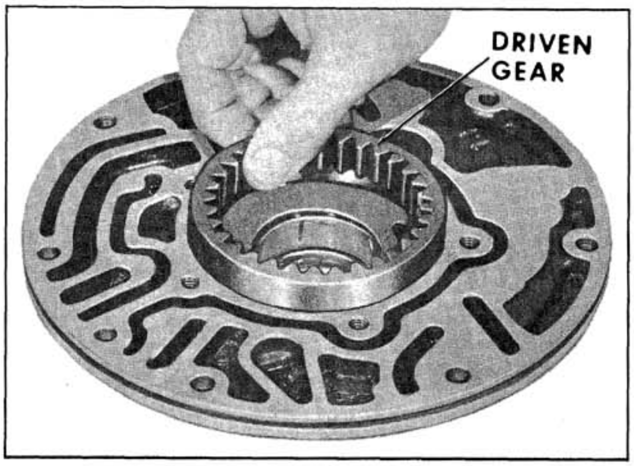


Fig. 6-412 Removing Oil Pump Driven Gear

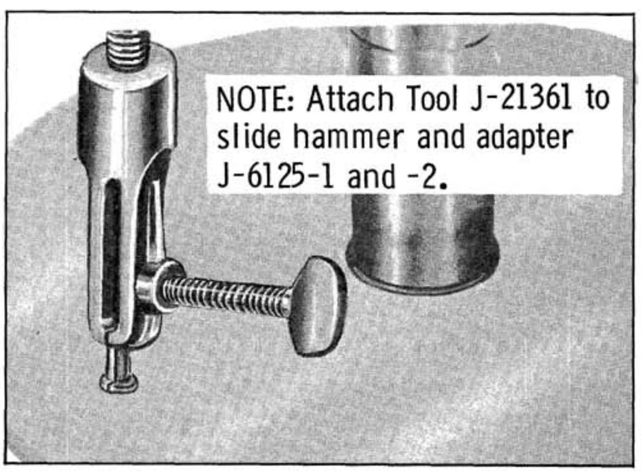


Fig. 6-413 Removing Cooler Bypass Valve

9. Remove coast downshift timing valve from the pump cover and inspect for damage. Carefully check to be sure the spring returns the ball to its seat. (Fig. 6-414)

NOTE: Do not attempt to remove pressure valve without removing the pump from the transmission.

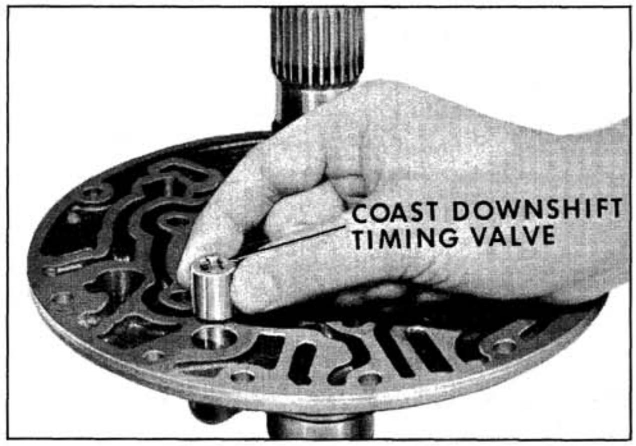


Fig. 6-414 Removing Coast Downshift Timing Valve

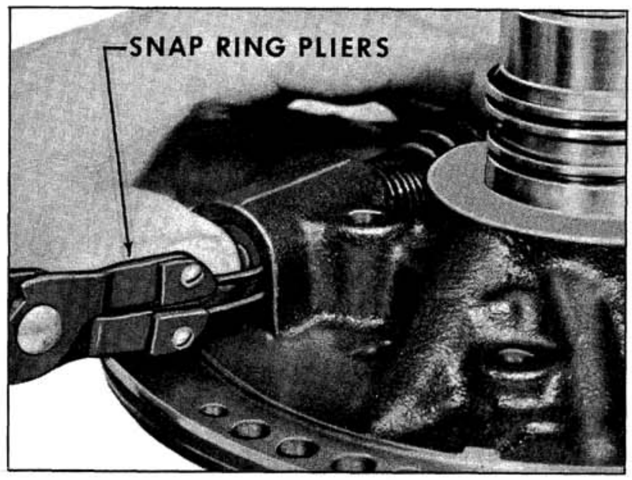


Fig. 6-415 Removing Snap Ring

10. Compress reverse and modulator boost valve with thumb and remove retaining snap ring. (Fig. 6-415)

CAUTION: Reverse and modulator boost valve sleeve is under extreme spring pressure. Extreme care should be taken after retaining snap ring has been removed.

11. After retaining snap ring has been removed, remove reverse and modulator boost valve sleeve and valve, spring, washer, and pressure regulator valve.

12. Examine oil pump seal. If nicked, torn or worn, remove seal as follows. Support oil pump body on wood blocks. Remove oil seal with a chisel and discard. (Fig. 6-416)

NOTE: If seal is being replaced with pump in transmission, pry under lip of seal.

13. Check oil pump bushing for nicks, severe scoring or wear. If bushing replacement is necessary, proceed as follows: Support oil pump on wood blocks. Using Tool J-21424-6 and Drive Handle J-8092 press bushing out of pump body.

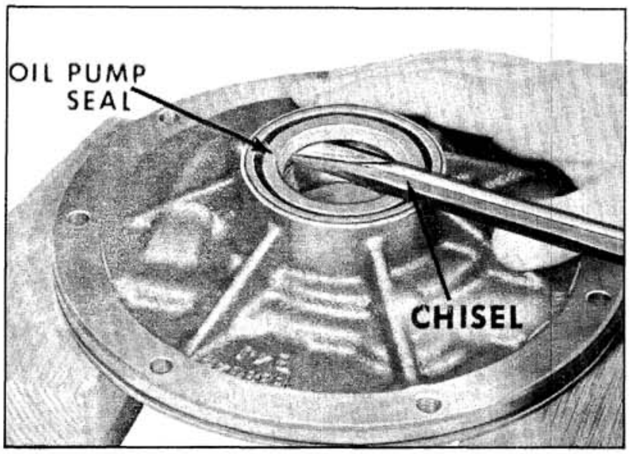


Fig. 6-416 Removing Oil Seal

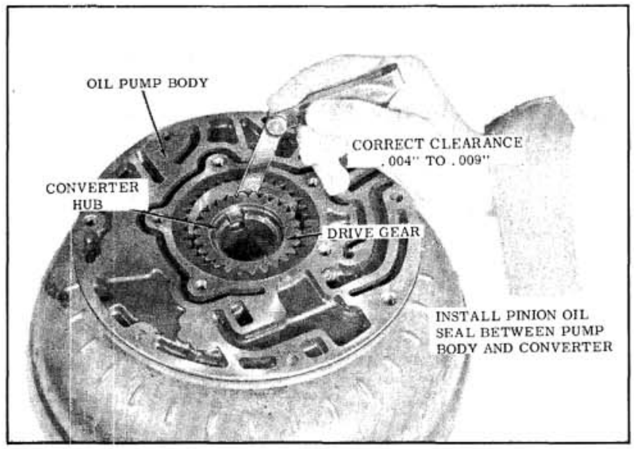


Fig. 6-418 Checking Clearance

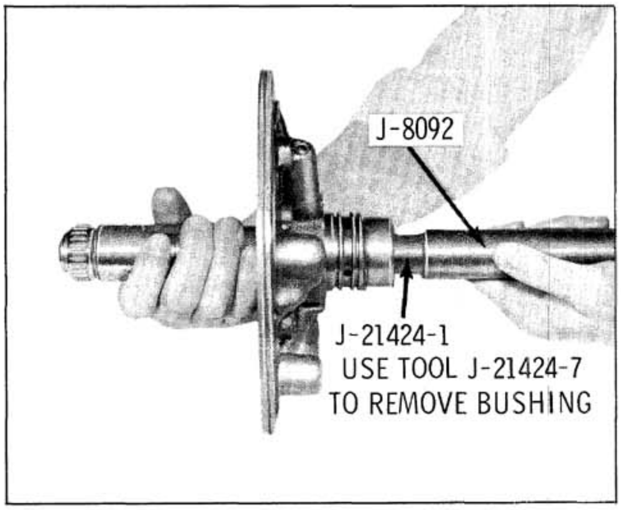


Fig. 6-417 Removing Stator Shaft Bushing

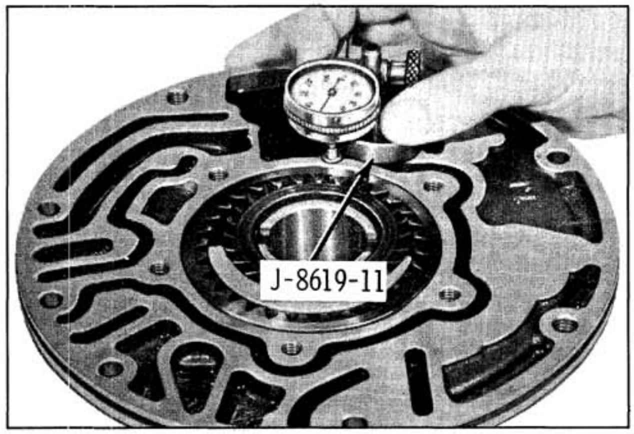


Fig. 6-419 Checking End Clearance

14. Check stator shaft bushing for nicks, severe scoring or wear. If bushing replacement is necessary, proceed as follows: Assemble Bushing Remover J-21424-7 to Extension J-21424-1. Assemble this assembly to Drive Handle J-8092. Holding stator shaft as shown in Fig. 6-417, drive out bushing.

Inspection

1. Wash all parts in a cleaning solvent and blow out oil passages with compressed air.
2. Inspect pump gears for nicks or damage.
3. Inspect pump body for nicks or scoring.
4. Check condition of bushing in oil pump body, if damaged replace.
5. With parts clean and dry, install pump gears, noting mark on gears for identification of the side that faces the pump cover. After gears have been installed, proceed as follows:
   a. Check clearance between oil pump drive gear and crescent. The clearance allowed is .004" to .009". (Fig. 6-418)

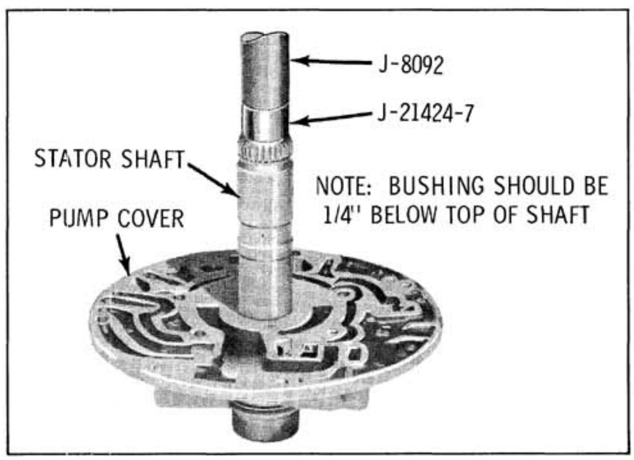


Fig. 6-420 Installing Stator Shaft Bushing

   b. With dial indicator set, check end clearance. The clearance allowed is .0008" to .0018". (Fig. 6-419)

Reassembly

1. Using Tool J-24426-6 press new bushing into pump body until it is flush with top of pump hub.

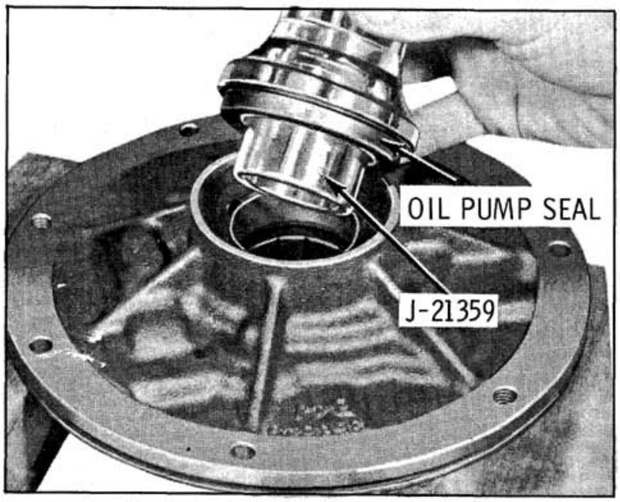


Fig. 6-421 Install Oil Seal

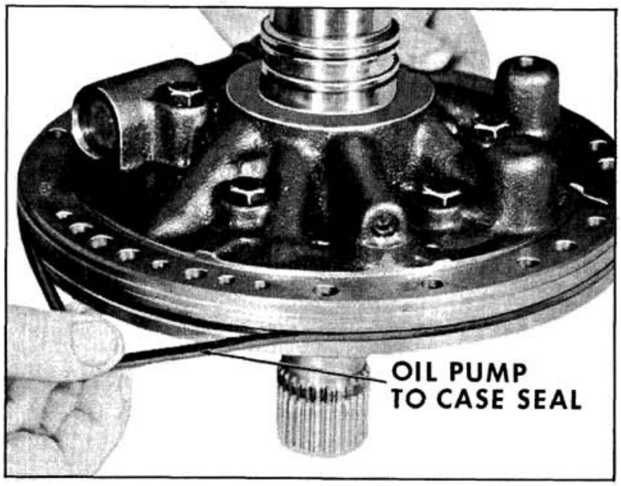


Fig. 6-422 Installing Oil Pump to Case Seal

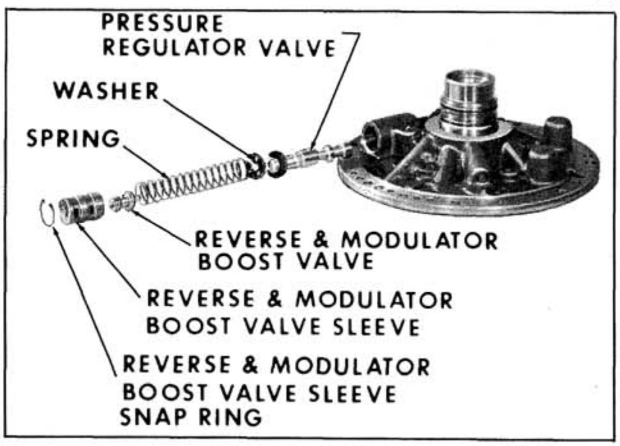


Fig. 6-423 Pressure Regulator Valve—Exploded View

2. Install stator shaft bushing as follows: Position bushing into the front end of stator shaft, using Installer J-21424-7 and Drive Handle J-8092, tap bushing into shaft as shown. (Fig. 6-420)
3. Using Installer J-21359, tap in new oil seal. (Fig. 6-421)

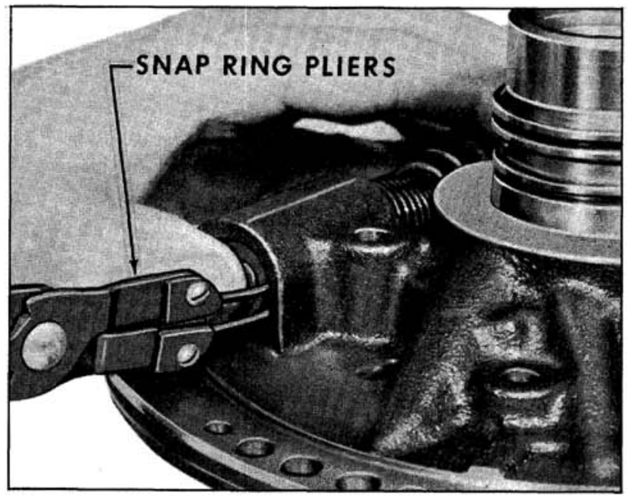


Fig. 6-424 Installing Snap Ring

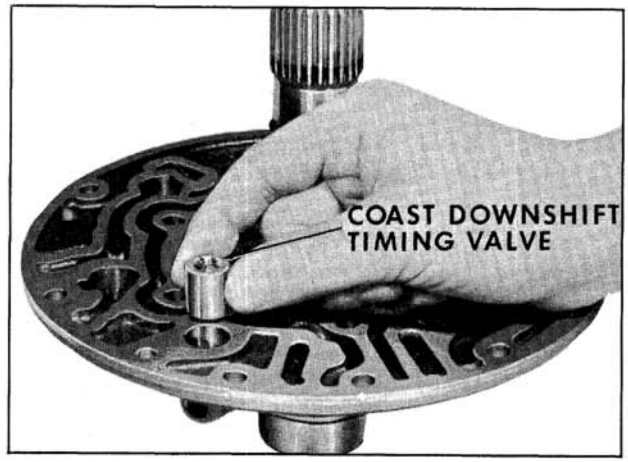


Fig. 6-425 Installing Coast Downshift Timing Valve

NOTE: Seal can be installed with pump in transmission.

4. Install new oil pump to case seal. (Fig. 6-422)

NOTE: Chamfer on corners of seal to be to the outside.

5. Assemble pressure regulator valve, washer, spring, reverse and modulator boost valve and sleeve. (Fig. 6-423)
6. Compress reverse and modulator boost valve with thumb, then install retaining snap ring. (Fig. 6-424)
7. Install coast downshift timing valve "button end" up in cover. (Fig. 6-425)
8. Install spring, valve and seat into cooler bypass valve. Using Tool J-21558 press seat into bore of pump body until tool bottoms on face of pump. (Fig. 6-426)

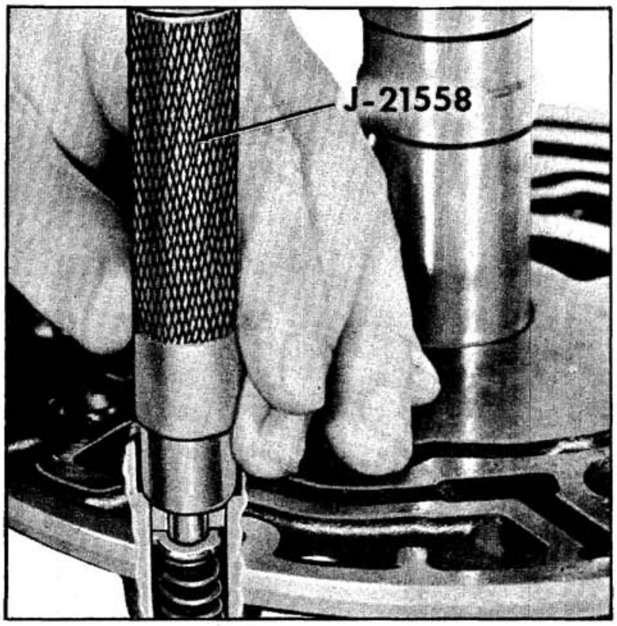


Fig. 6-426 Installing Cooler Bypass Valve

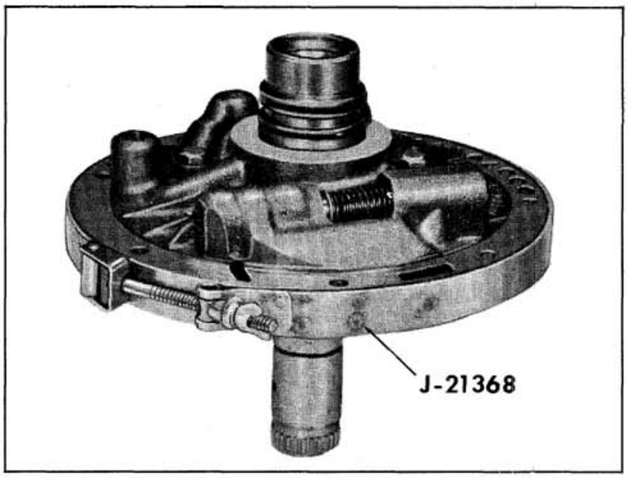


Fig. 6-427 Installing Pump Cover to Pump Body

NOTE: Thrust washer and oil pump sealing ring will be installed during later operation.

9. Install pump cover to pump body. Install five retaining bolts but do not tighten. Place Tool J-21368 around pump to obtain proper alignment. Tighten bolts 16 to 24 ft. lbs. (Fig. 6-427)

NOTE: The bolt location at the pressure regulator takes a longer bolt.

FORWARD CLUTCH

Disassembly

1. Remove low sun gear and flange assembly retainer snap ring. (Fig. 6-428)

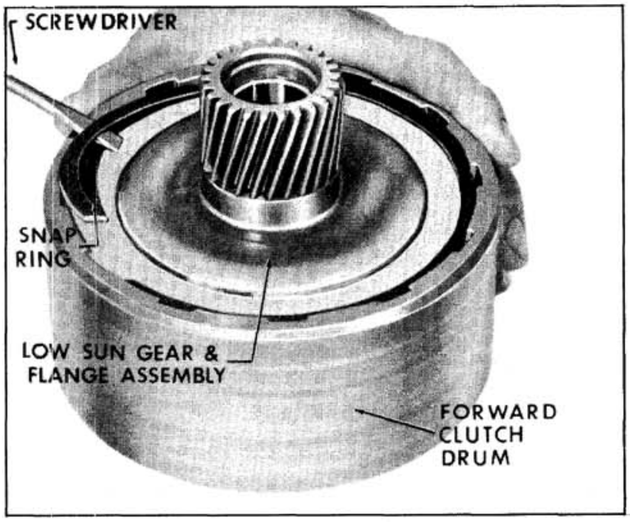


Fig. 6-428 Removing Snap Ring

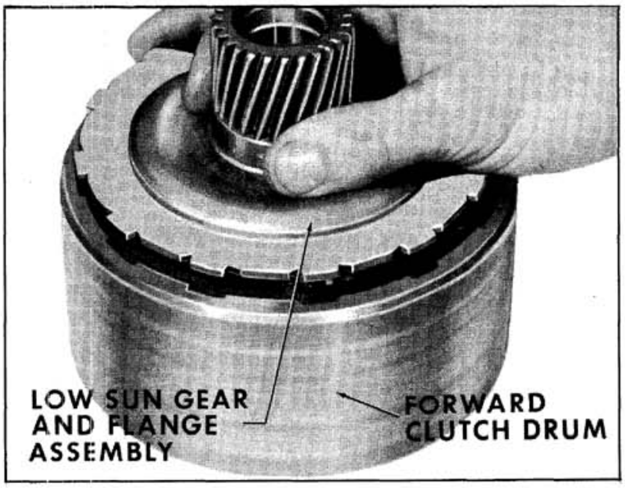


Fig. 6-429 Removing Low Sun Gear and Flange Assembly

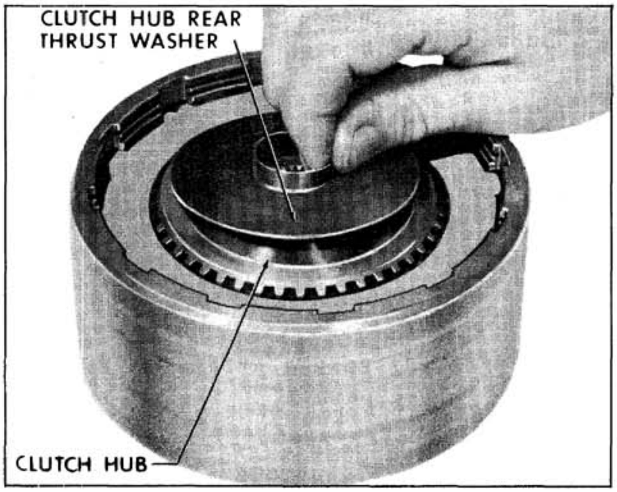


Fig. 6-430 Removing Thrust Washer

2. Remove low sun gear and flange assembly. (Fig. 6-429)
3. Remove clutch hub rear thrust washer. (Fig. 6-430)

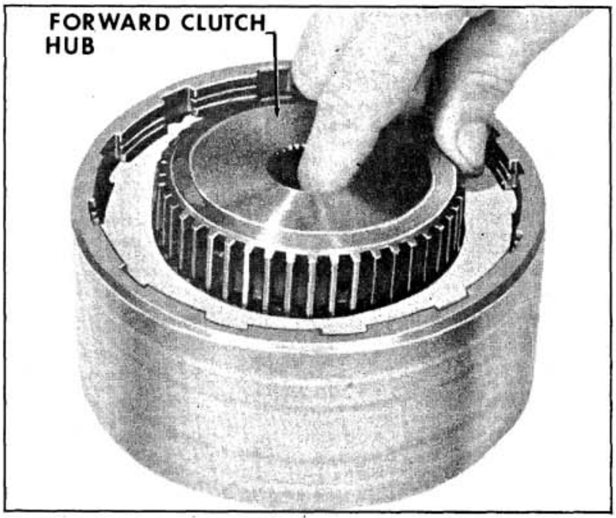


Fig. 6-431 Removing Clutch Hub

Fig. 6-432 Removing Thrust Washer

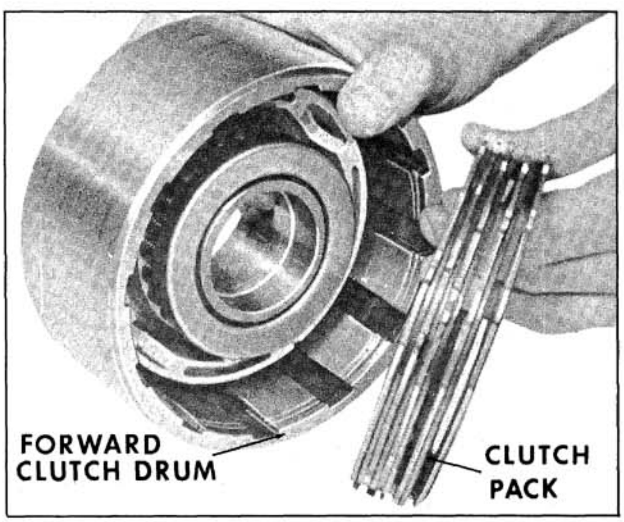


Fig. 6-433 Removing Clutch Pack

4. Lift forward clutch hub from clutch pack. (Fig. 6-431)

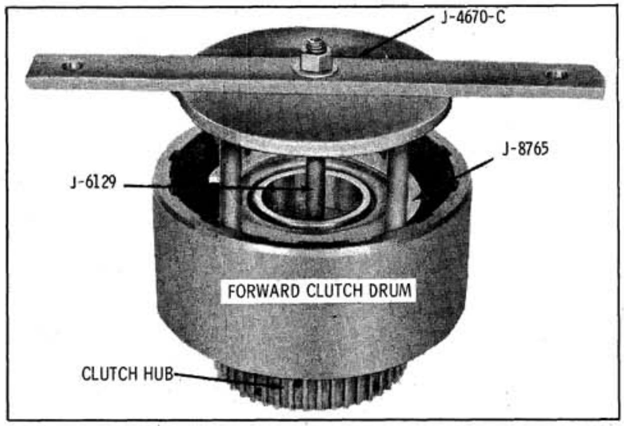


Fig. 6-434 Removing Snap Ring

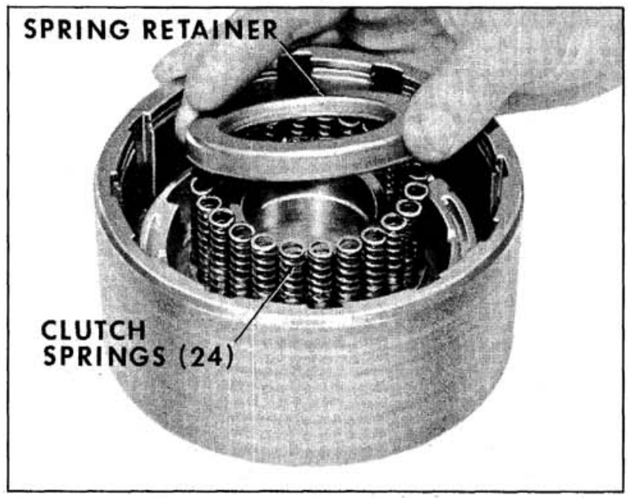


Fig. 6-435 Removing Spring Retainer and Springs

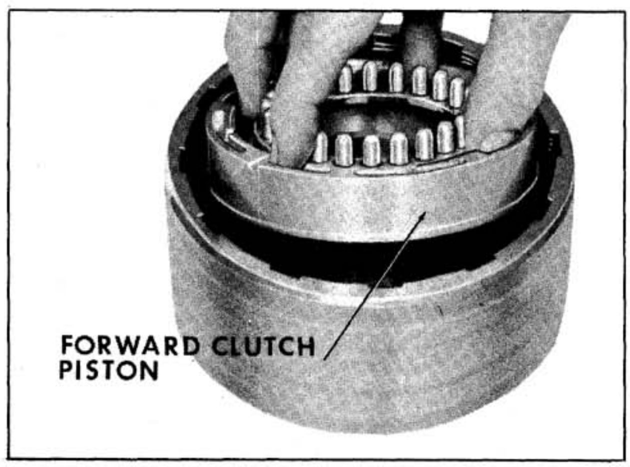


Fig. 6-436 Removing Forward Clutch

5. Remove clutch hub front thrust washer. (Fig. 6-432)
6. Remove clutch pack from forward clutch drum. (Fig. 6-433)
7. Using Tools J-4670-C, J-8765, and J-6129 compress spring retainer and remove snap

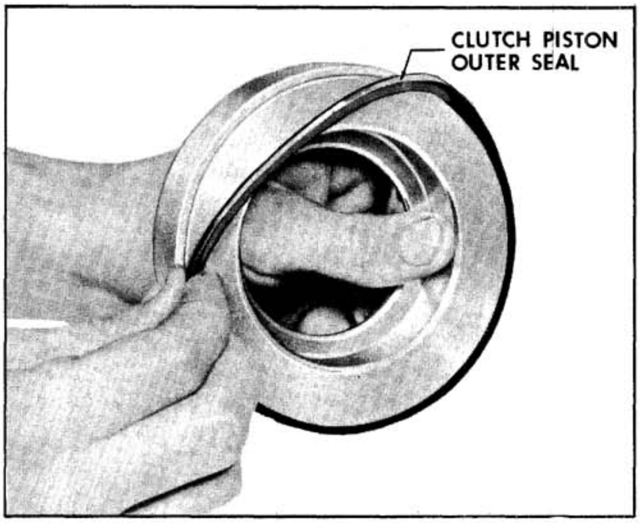


Fig. 6-437 Removing Outer Seal

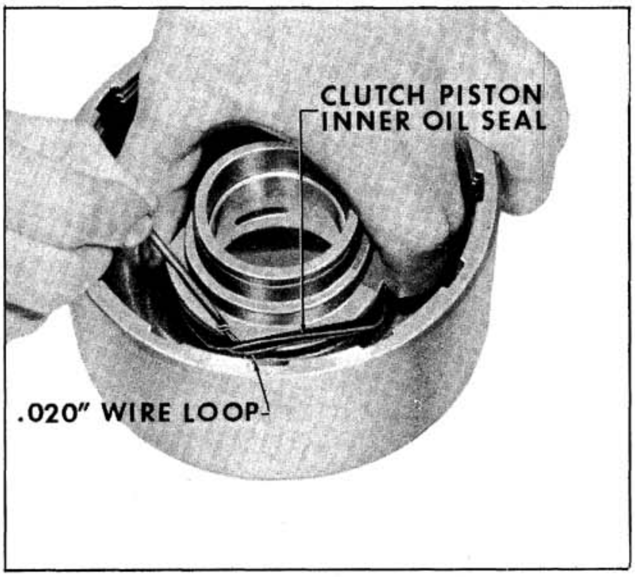


Fig. 6-438 Removing Inner Seal

ring. Remove tools and component parts, being careful that spring retainer does not catch in snap ring groove. (Fig. 6-434)

8. Lift off spring retainer and 24 clutch springs. (Fig. 6-435)

9. Lift up on forward clutch piston with a twisting motion and remove. (Fig. 6-436)

10. Examine forward clutch piston outer seal. If nicked, torn or worn, remove seal. (Fig. 6-437)

11. Examine forward clutch piston inner seal. If nicked, torn or worn, remove seal. (Fig. 6-438)

12. Check forward clutch drum bushing for nicks, severe scoring or wear. If bushing replacement is necessary, proceed as follows: Using

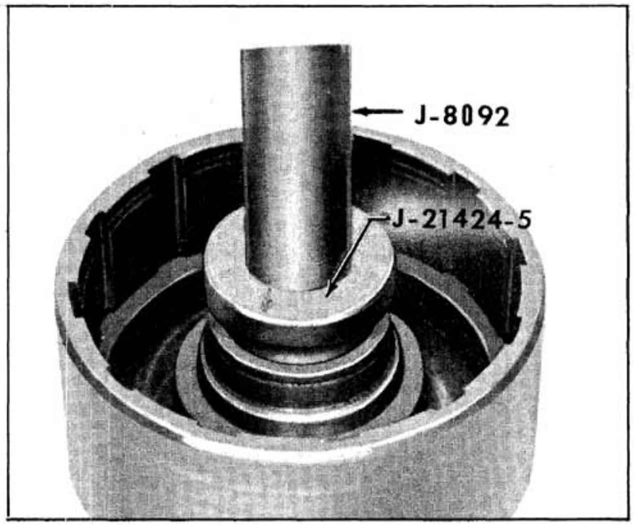


Fig. 6-439 Removing Clutch Drum Bushing

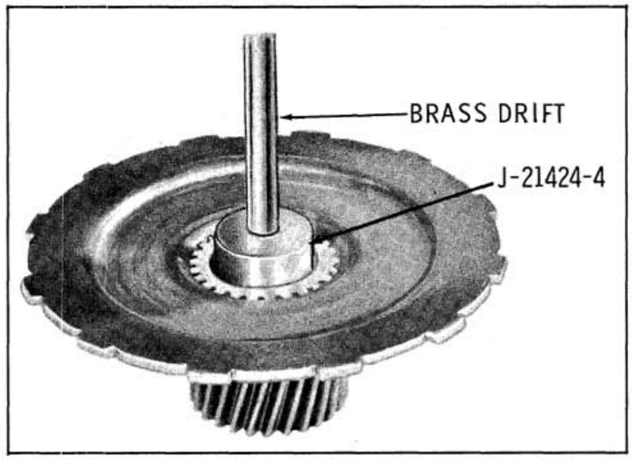


Fig. 6-440 Removing Low Sun Gear and Flange Assembly Bushing

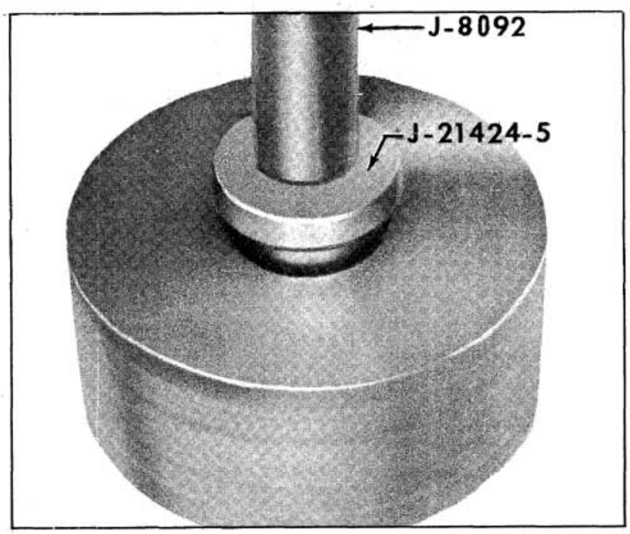


Fig. 6-441 Installing Clutch Drum Bushing

Tool J-21424-5, press damaged bushing from forward clutch drum. (Fig. 6-439)

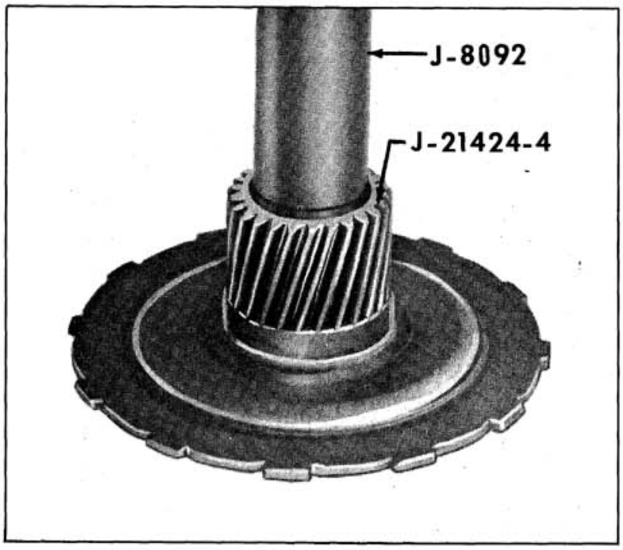


Fig. 6-442 Installing Low Sun Gear and Flange Assembly Bushing

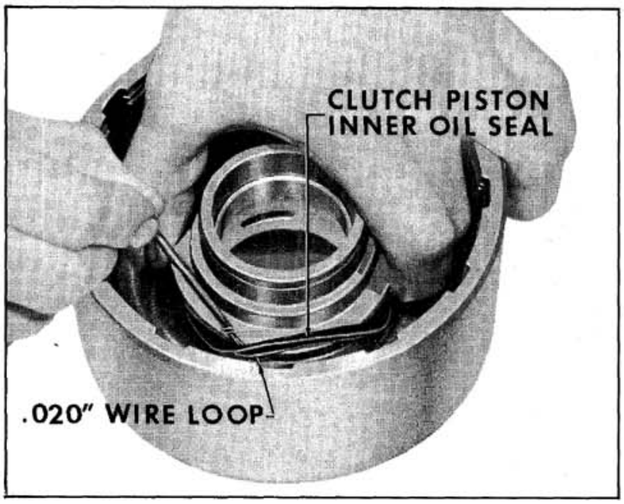


Fig. 6-443 Installing Inner Seal

13. Check low sun gear and flange assembly bushing for nicks, severe scoring, or wear. If bushing replacement is necessary, proceed as follows: Support flange assembly on wood blocks, use Tool J-21424-7 and brass drift to tap out bushing. (Fig. 6-440)

Inspection

1. Wash all parts in a suitable cleaning solvent. Use compressed air to dry.

2. Check steel ball in the forward clutch drum. Be sure it is free to move in hole and that orifice leading to front of clutch drum is open.

3. Check clutch plates for wear or scoring.

Reassembly

1. Install J-21424-5 in front of forward clutch drum. Using Drive Handle J-8092, press bushing into bore until Tool J-21424-5 bottoms on hub. (Fig. 6-441)

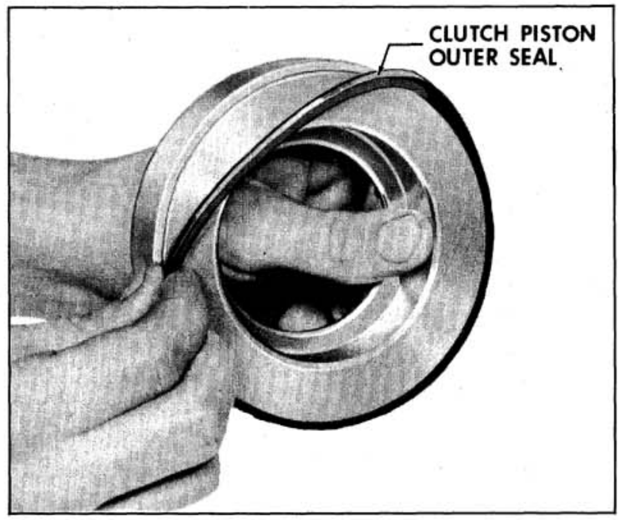


Fig. 6-444 Installing Outer Seal

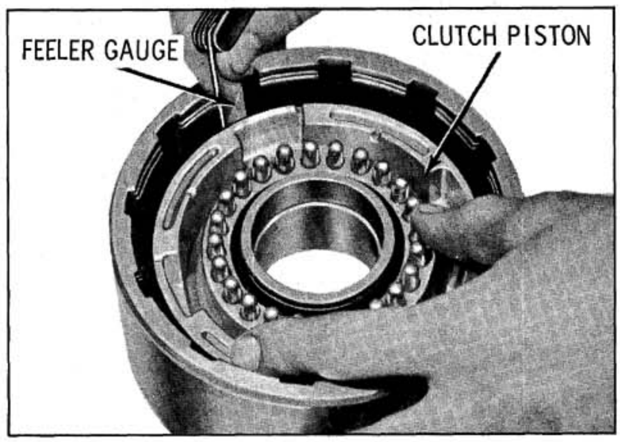


Fig. 6-445 Installing Clutch Piston

2. Install Tool J-21424-4 into low sun gear. Using Drive Handle J-8092, press bushing into low sun gear until bushing installer is flush with top of low sun gear. (Fig. 6-442)

3. Lubricate with transmission oil and install new forward clutch piston inner seal with seal lip pointing downward. (Fig. 6-443)

NOTE: Run hand around seal after it is installed to see if seal is fully in groove.

4. Lubricate with transmission oil and install new forward clutch piston outer seal in clutch piston. Seal lip must point down. (Fig. 6-444)

5. Install forward clutch piston into clutch drum using a .005" feeler gauge to start lip of seal into bore. (Fig. 6-445)

6. Carefully reassemble return springs, retainer and snap ring. (Fig. 6-446)

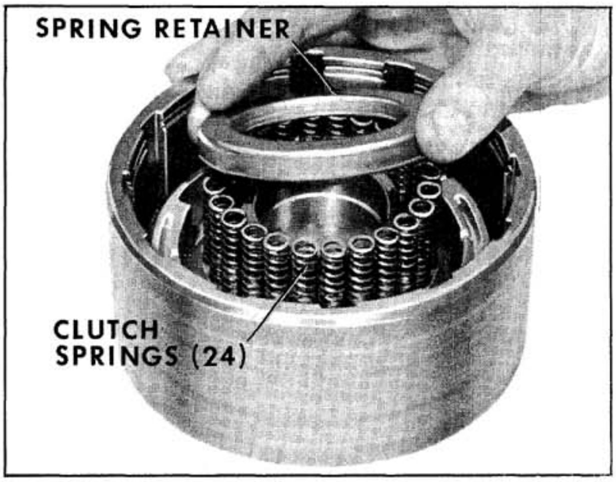


Fig. 6-446 Installing Springs and Retainer

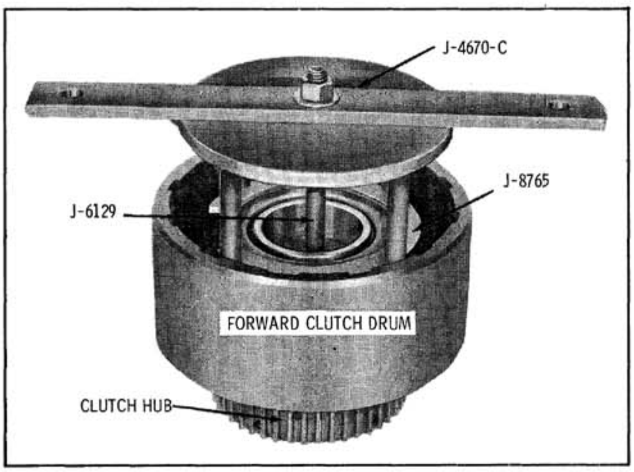


Fig. 6-447 Installing Snap Ring

7. With spring retainer in place, compress spring retainer with Tools J-4670-C, J-8765 and J-6129 far enough so the spring retainer snap ring can be installed. Make sure retainer doesn't catch in snap ring groove when compressing spring. (Fig. 6-447)

   NOTE: Place a piece of hard board between Tool J-2590-3 and forward clutch drum.

8. Install clutch hub front thrust washer to clutch hub (retain with grease) aligning tangs in clutch hub with grooves in thrust washer. Install clutch hub. (Fig. 6-448)

9. Align notches on steel driven plates. Install steel driven plates and lined drive plates alternately, beginning with a steel driven plate. (Fig. 6-449)

   NOTE: Cars equipped with V-6 engines have four drive plates and five driven plates. Cars equipped with V-8 engines have five drive plates and six driven plates.

10. Install clutch hub rear thrust washer with its flange toward low sun gear and flange assembly. (Fig. 6-450)

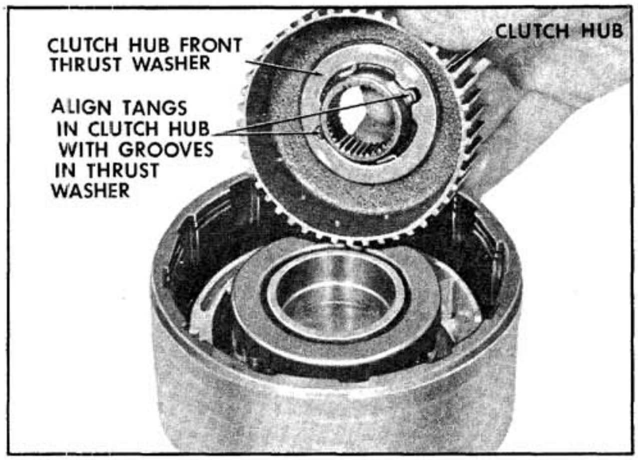


Fig. 6-448 Installing Clutch Hub

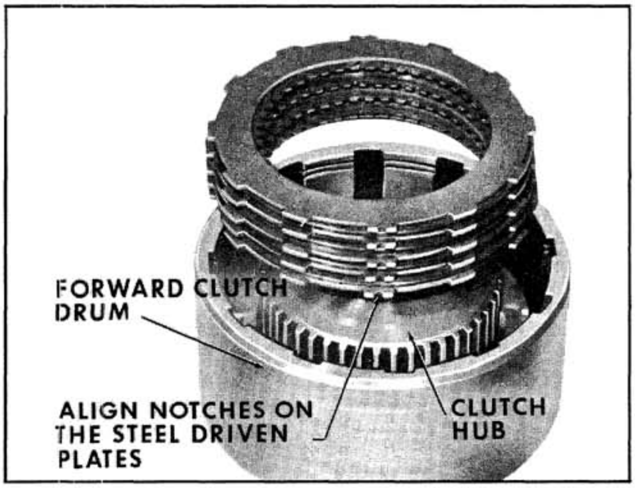


Fig. 6-449 Installing Clutch Pack

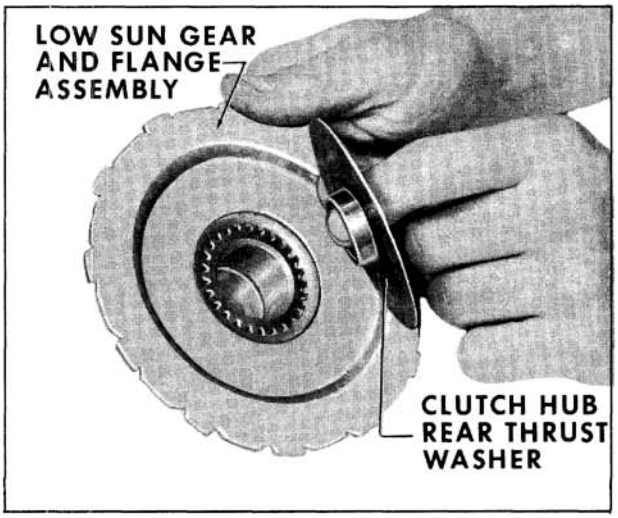


Fig. 6-450 Installing Thrust Washer

11. Install low sun gear and flange assembly. (Fig. 6-451)

12. Install low sun gear and flange assembly retaining ring. Position snap ring so gap is centered between slots in drum. (Fig. 6-452)

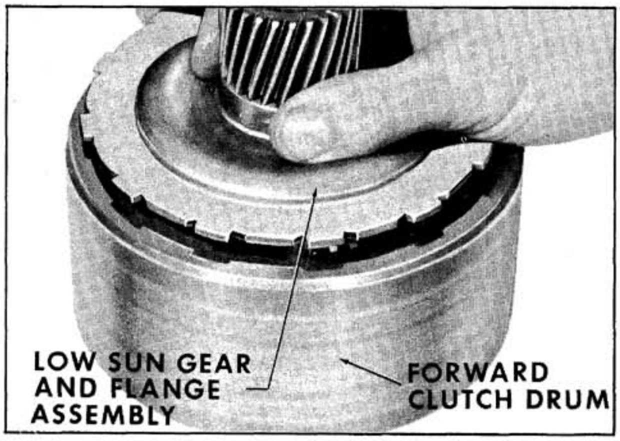


Fig. 6-451 Installing Low Sun Gear and Flange Assembly

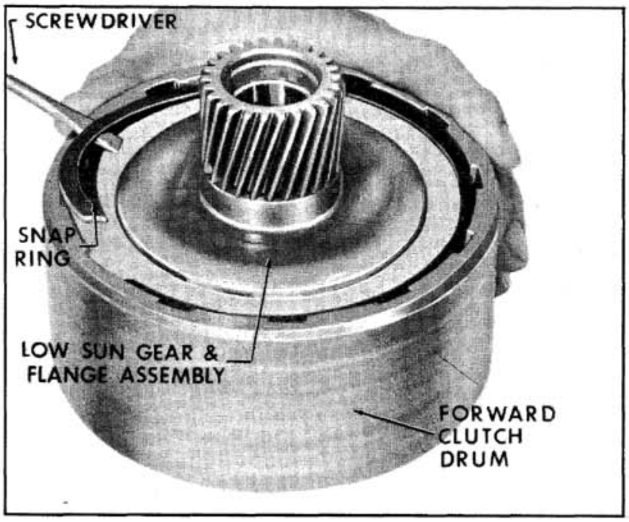


Fig. 6-452 Installing Snap Ring

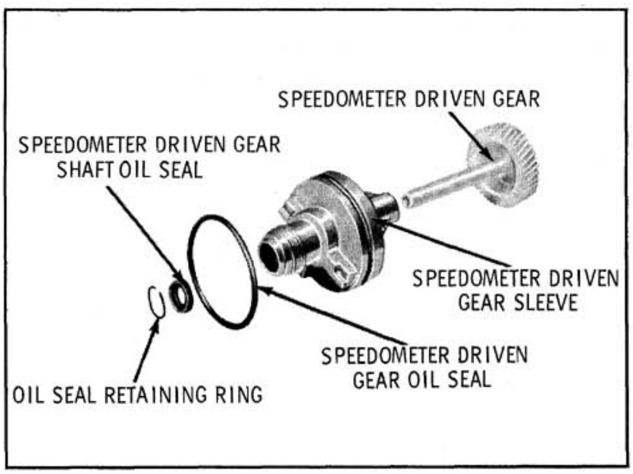


Fig. 6-453 Speedometer Driven Gear

SPEEDOMETER DRIVEN GEAR

Disassembly

1. Remove speedometer driven gear. (Fig. 6-453)

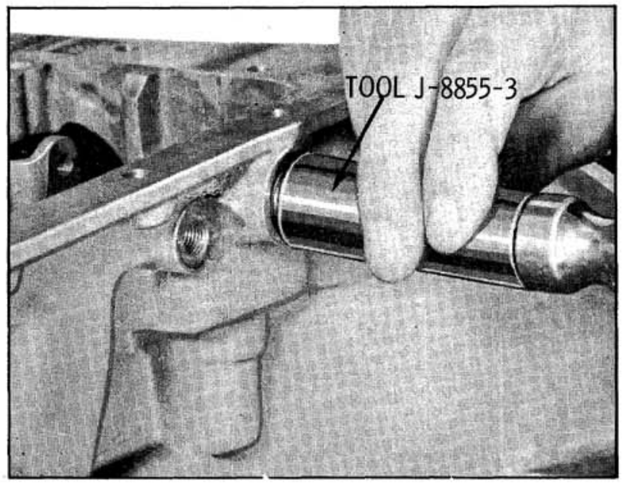


Fig. 6-454 Removing Lock Plate Screws

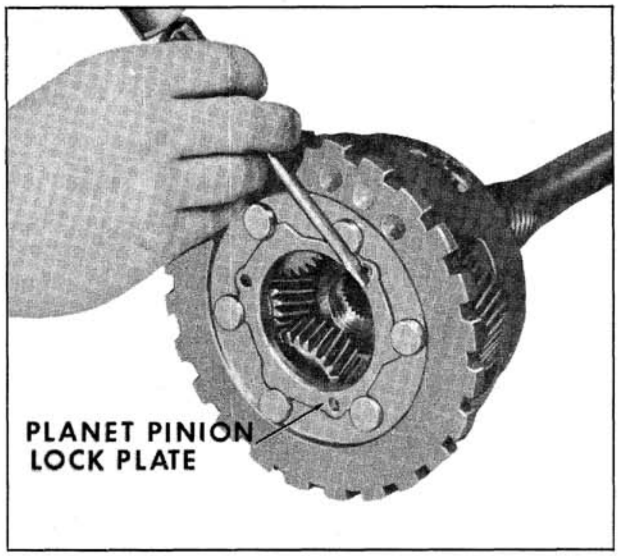


Fig. 6-455 Removing Lock Plate

2. Examine speedometer driven gear oil seal. If nicked, torn or worn, remove seal. (Fig. 6-453)

3. Examine speedometer driven gear shaft oil seal. If nicked, torn or worn, remove seal.

Reassembly

1. Install speedometer driven gear shaft oil seal with lip of seal pointing toward rear of speedometer gear sleeve. Install oil seal retaining ring.

2. Install speedometer driven gear oil seal. (Fig. 6-453)

3. Install speedometer driven gear.

GOVERNOR

NOTE: A defective governor will require the replacement of the governor assembly.

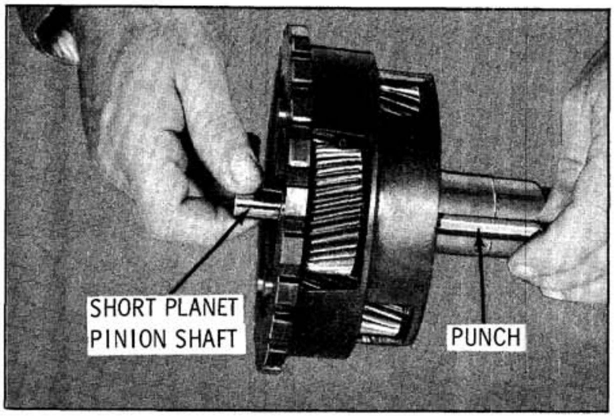


Fig. 6-456 Removing Short Planet Pinion Gear

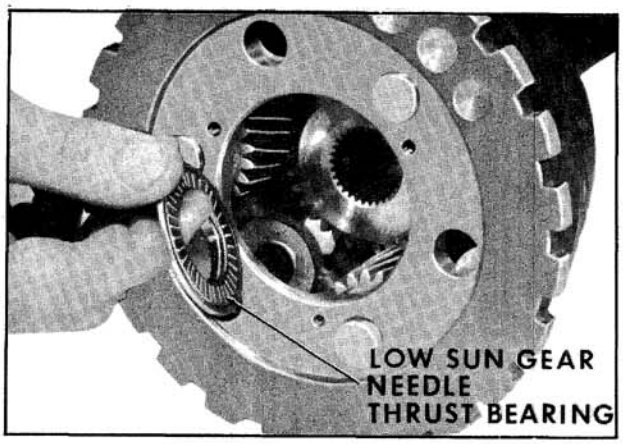


Fig. 6-457 Removing Low Sun Gear Thrust Bearing

PLANET CARRIER

Disassembly

1. Remove three planet pinion shaft lock plate screws and lockwashers. (Fig. 6-454)

2. Rotate planet pinion lock plate and remove. (Fig. 6-455)

3. Remove the short planet pinion shafts and short pinions. (Fig. 6-456)

4. Remove needle bearings and thrust washers from the short planet pinion gears.

5. Remove low sun gear needle thrust bearing. (Fig. 6-457)

6. Remove input sun gear. (Fig. 6-458)

7. Remove input sun gear thrust washer. (Fig. 6-459)

8. Remove the long planet pinion shafts and long planet pinion gears. (Fig. 6-460)

9. Remove front planet pinion thrust washer. (Fig. 6-460)

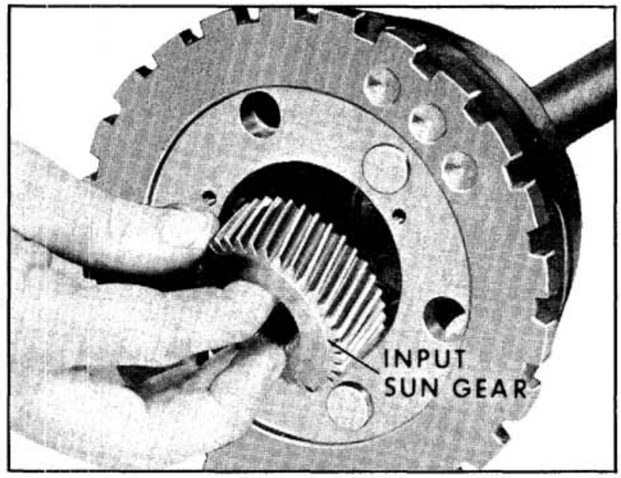


Fig. 6-458 Removing Input Sun Gear

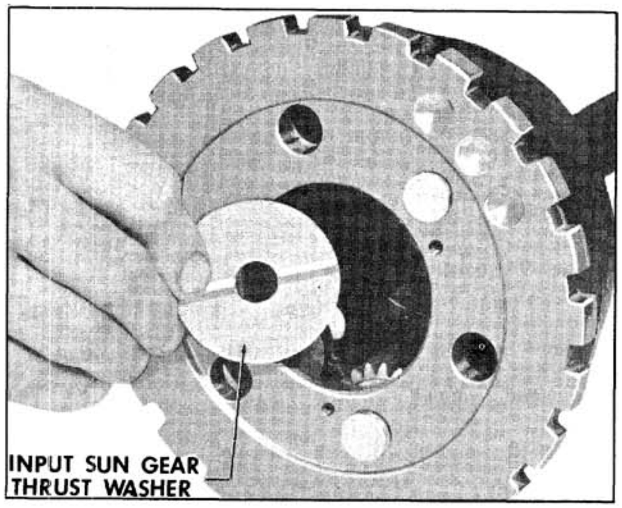


Fig. 6-459 Removing Front Thrust Washer

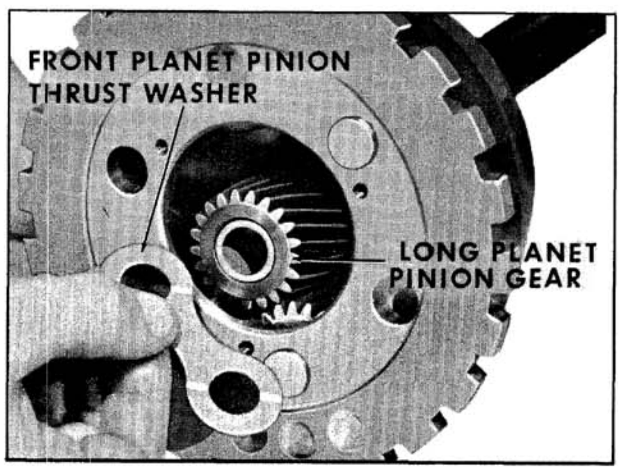


Fig. 6-460 Removing Long Planet Pinion Gear

10. Remove needle bearings, spacers and thrust washers from the long planet pinion gears.

11. Remove rear planet pinion thrust washer. (Fig. 6-461)

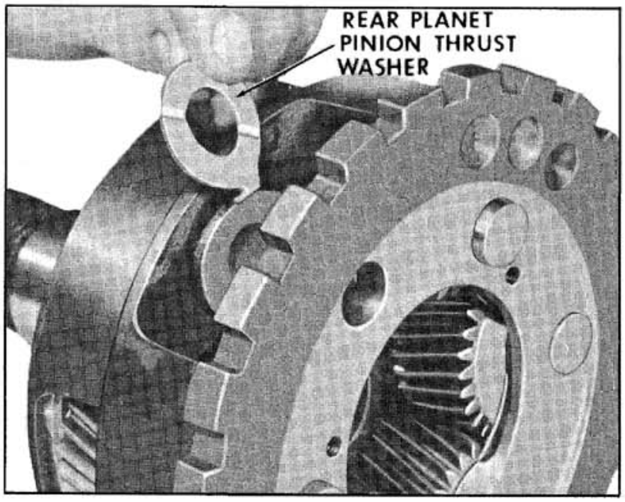


Fig. 6-461 Removing Rear Thrust Washer

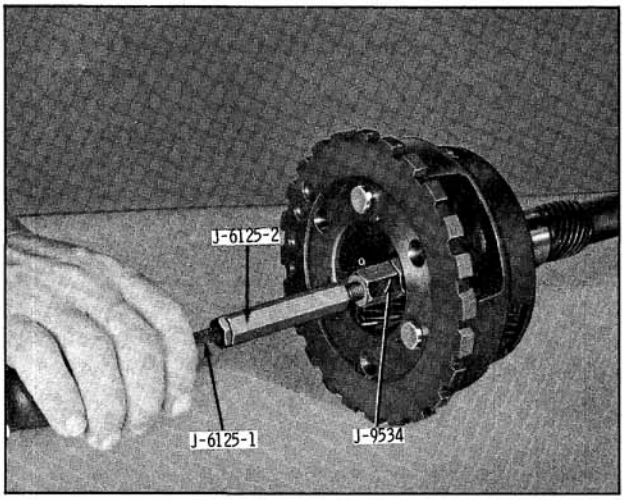


Fig. 6-462 Removing Output Shaft Bushing

12. Check output shaft bushing for nicks, severe scoring or wear. If bushing replacement is necessary, continue as follows. Install Bushing Remover J-9534 into bushing. Install Slide Hammer J-2619 into J-9534, and remove bushing from planet carrier. (Fig. 6-462)

Inspection of Planet Carrier Parts

1. Wash all parts in a cleaning solvent and air dry.

2. Check the planet pinion gears and input sun gear tooth for excessive wear.

3. Check the planet pinion thrust washers and input sun gear thrust washer.

4. Check planet pinion needle bearing. If bearings show excessive wear, all the needle bearings must be replaced.

5. Check the planet pinion shafts closely, if worn replace the worn shafts.

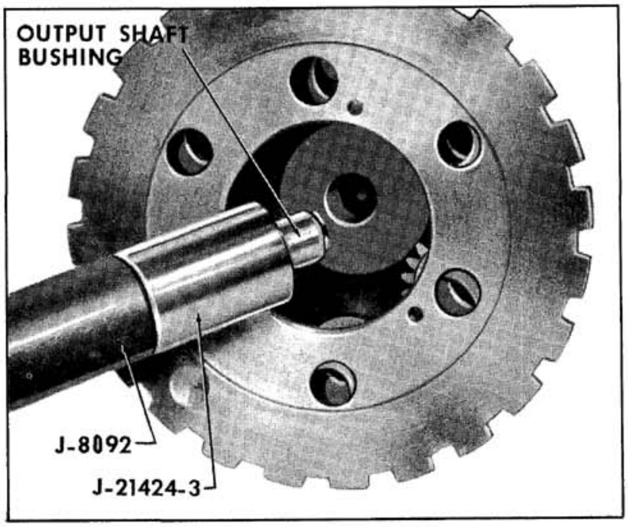


Fig. 6-463 Installing Output Shaft Bushing

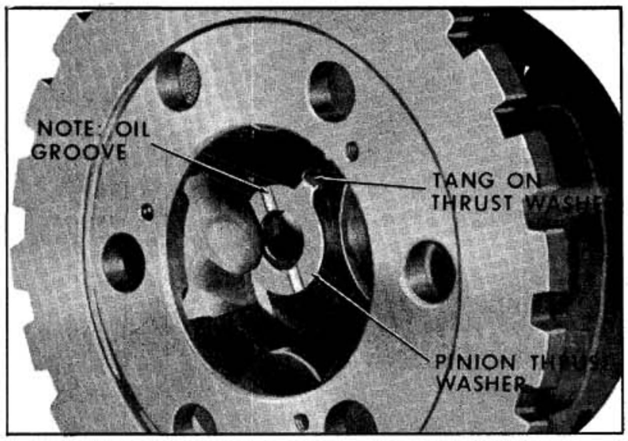


Fig. 6-464 Installing Rear Thrust Washer

6. Check the output shaft bushing, if worn replace.

Reassembly

1. Using Tool J-21424-3 and J-8592, press the new bushing in until J-21424-3 touches the machined surface of the planet carrier assembly. (Fig. 6-463)

2. Install the long planet pinion gears, then install the rear planet pinion thrust washers. Oil groove must be toward pinion gear. (Fig. 6-464)

3. Install front planet pinion thrust washer. Retain thrust washer to case with grease. Oil grooves on the thrust washer must be toward the pinion gears. (Fig. 6-465)

4. Install needle bearings, thrust washers and spacers. (Fig. 6-466) Refer to Figs. 6-467 and 6-468 and lock the needle bearings. On the long pinion, it will be necessary to lock both sets of needle bearings.

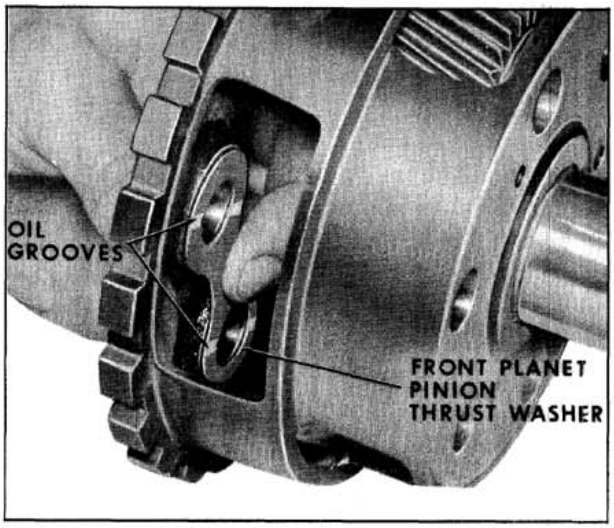


Fig. 6-465 Installing Front Thrust Washer

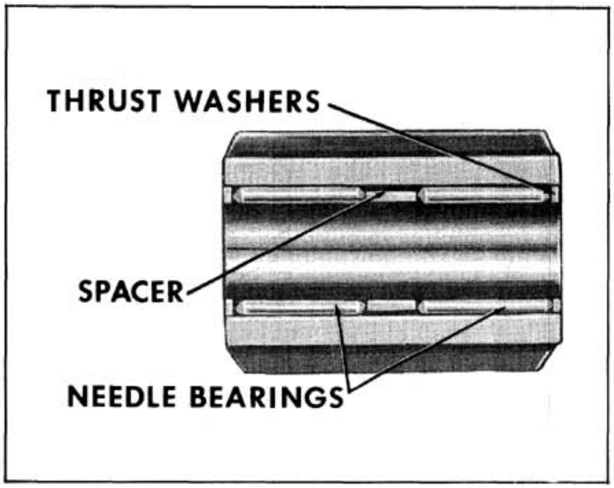


Fig. 6-466 Long Pinion Gear

5. Position the long planet pinions with the thrust washers at each end in the planet carrier. Install the pinion shafts from the rear of the carrier. As the shaft is being pushed in, make certain that it picks up the thrust washer. Turn the pinion shaft so the groove faces the center of the planet carrier. (Fig. 6-469)

6. Install the input sun gear thrust washer with the oil groove facing input sun gear. (Fig. 6-470)

7. Install input sun gear into planet carrier. (Fig. 6-471)

8. Install low sun gear needle thrust bearing. (Fig. 6-472)

9. Install the rear planet pinion thrust washer. Oil groove must be toward pinion gear. (Fig. 6-473)

   NOTE: The front thrust washer already installed with the long planet pinions also is used for the short planet pinions, as the two pinions are paired together on one set of thrust washers.

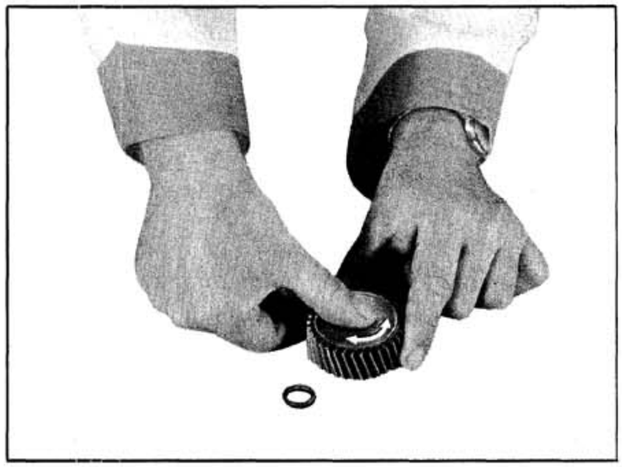


Fig. 6-467 Locking Needle Bearings

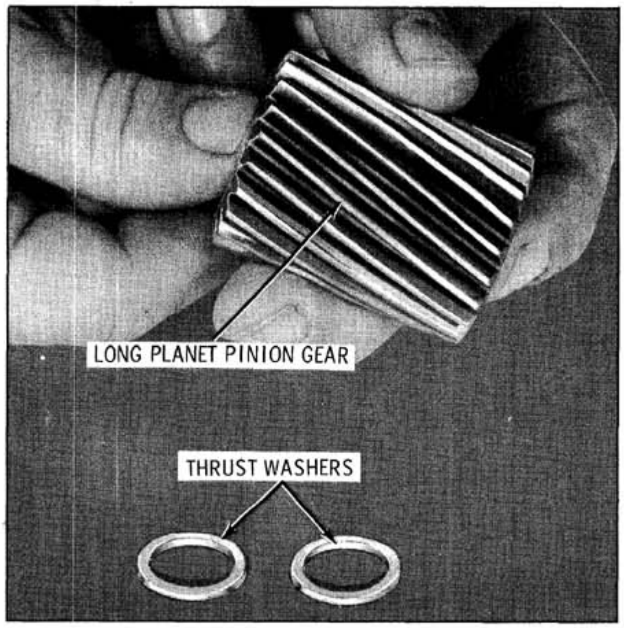


Fig. 6-468 Locking Second Row of Needle Bearings

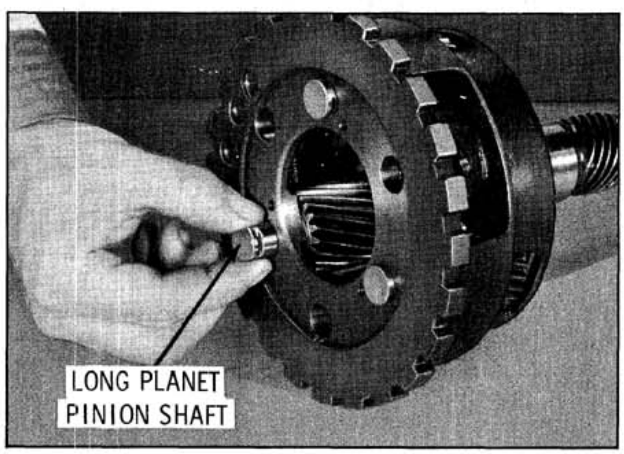


Fig. 6-469 Installing Long Pinion Gear Shaft

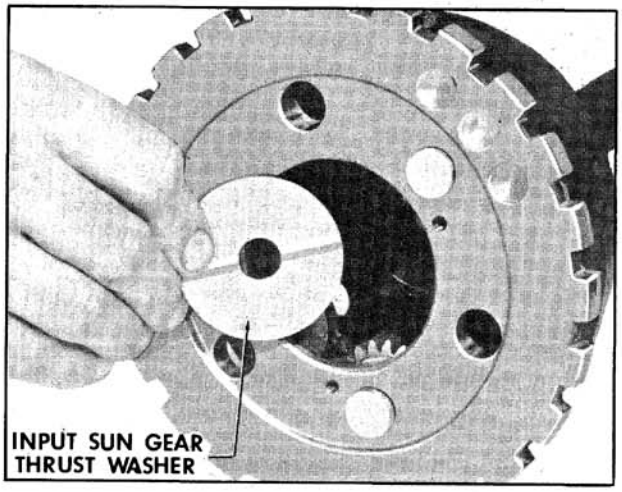


Fig. 6-470 Installing Thrust Washer

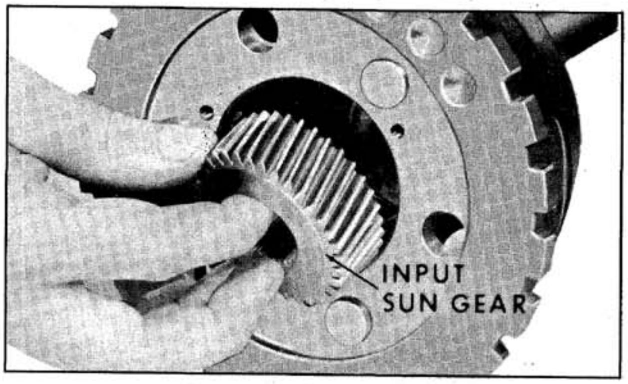


Fig. 6-471 Installing Input Sun Gear

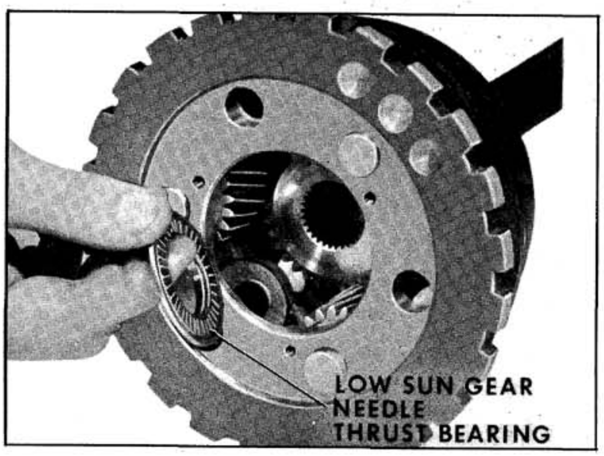


Fig. 6-472 Installing Thrust Bearing

10. Install 20 needle bearings and thrust washers. (Fig. 6-474) Lock needle bearings as shown in Fig. 6-467.

11. Position short planet pinions with thrust washers at each end of the planet carrier. Install pinion shafts from the rear of planet carrier. As the pinion shaft is being pushed in, make certain that it picks up the thrust washers. Turn the pinion shaft so the groove faces center of planet carrier. (Fig. 6-475)

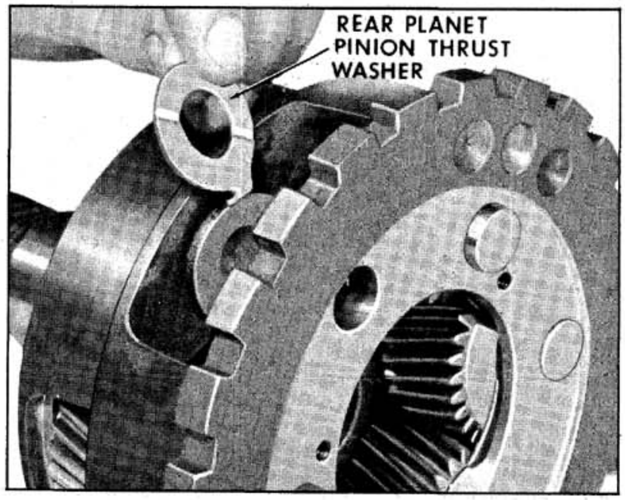


Fig. 6-473 Installing Rear Planet Pinion Thrust Washer

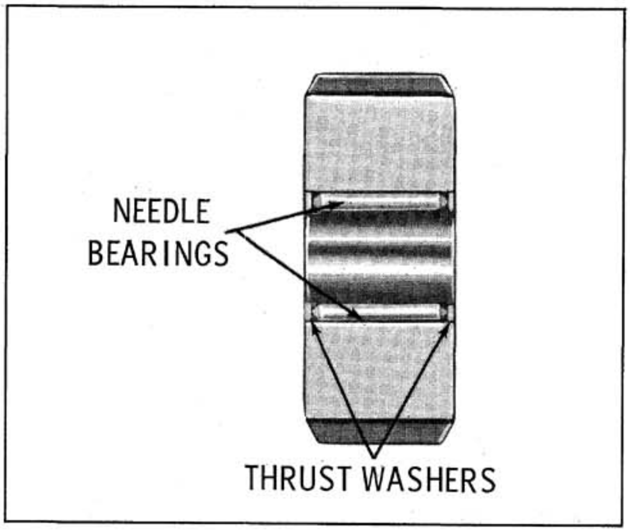


Fig. 6-474 Short Pinion Gear

12. Install planet pinion lock plate. Rotate plate so extended portions align with slots in planet pinion shafts and three attaching screw holes. (Fig. 6-476)

13. Install three planet pinion shaft lock plate screws and lockwashers. (Fig. 6-477)

REVERSE CLUTCH PISTON SEALS

1. Examine reverse clutch piston outer seal. If nicked, torn or worn, remove seal. (Fig. 6-478)

2. Lubricate with transmission oil and install reverse clutch piston outer seal. (Fig. 6-478)

3. Examine reverse clutch piston inner seal. If nicked, torn or worn, remove seal. (Fig. 6-479)

4. Lubricate with transmission oil and install reverse clutch piston inner seal. (Fig. 6-479)

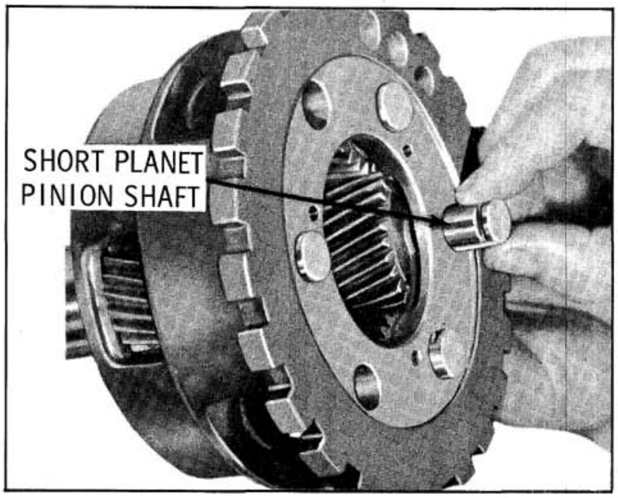


Fig. 6-475 Installing Short Pinion Gear

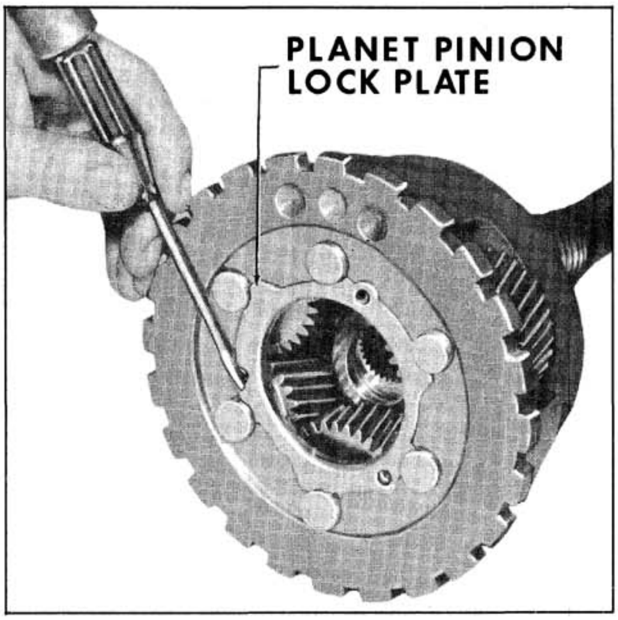


Fig. 6-476 Installing Lock Plate

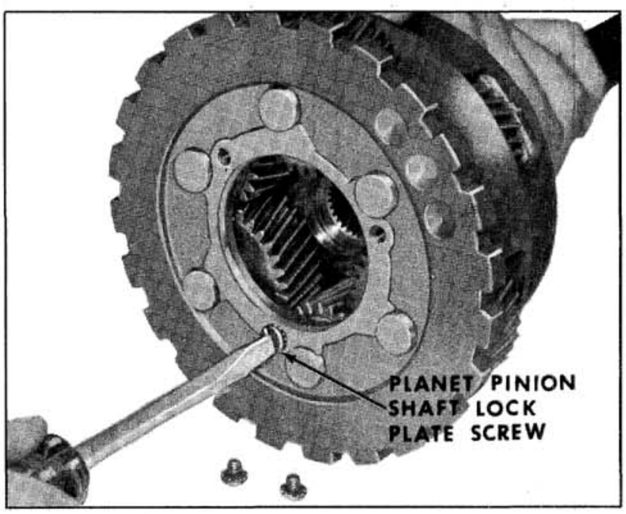


Fig. 6-477 Installing Lock Plate Screws

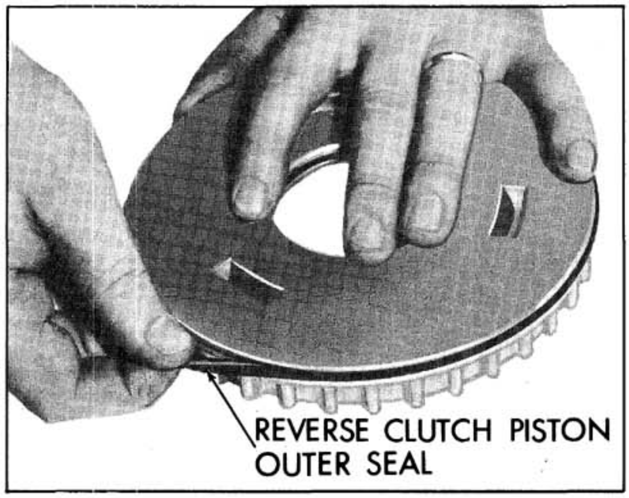


Fig. 6-478 Reverse Piston Outer Seal

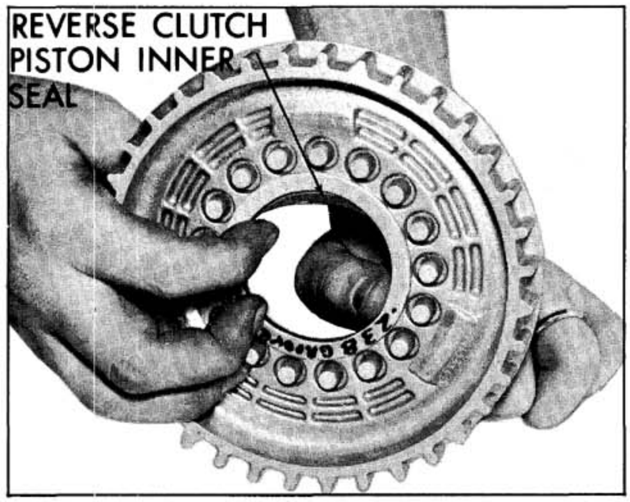


Fig. 6-479 Reverse Piston Inner Seal

Assembly

Before starting to assemble the transmission make certain that all parts are absolutely clean. Keep hands and tools clean to avoid getting dirt into assembly. If work is stopped before assembly is completed, cover all openings with clean cloths.

All moving parts should be given a light coating of transmission oil before installation. Thrust washers may be held in place with petroleum jelly, sparingly applied.

Replace all "O" rings, gaskets and oil seals that are removed.

Use care to avoid making nicks or burrs on parts, particularly at bearing surfaces and surfaces where gaskets are used.

5. It is extremely important to tighten all parts evenly and in proper sequence to avoid distortion of parts and leakage at gaskets and other joints. Use a reliable torque wrench to tighten all bolts and nuts to specified torque and in the specified sequence.

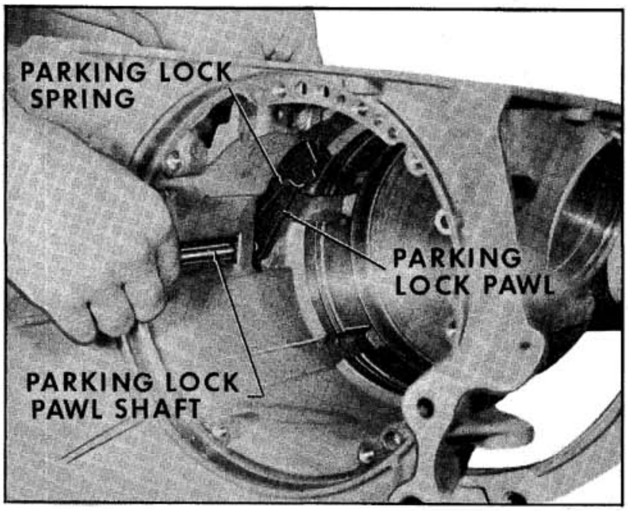


Fig. 6-480 Installing Parking Lock

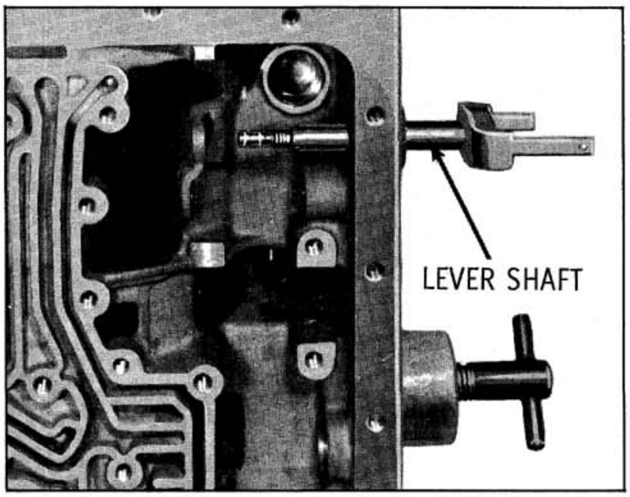


Fig. 6-481 Installing Selector Lever

Installing Range Selector Lever, Shaft and Parking Lock Actuator

1. Retain parking lock pawl and spring in case with parking lock pawl shaft. (Fig. 6-480)

   NOTE: Make certain parking pawl shaft is bottomed in its bore in case.

2. With a twisting motion, insert outer range selector lever into case. (Fig. 6-481) Use new seal.
3. Assemble park lock actuator assembly to inner park lock and range selector. (Fig. 6-482)
4. Install inner park lock and range selector assembly to outer range selector lever. Install nut on range selector lever. (Fig. 6-483)

   NOTE: Make certain longest end on range selector lever is to the bottom of transmission.

5. Slide outer range selector lever into case and tighten nut using a 9/16" wrench. (Fig. 6-484)

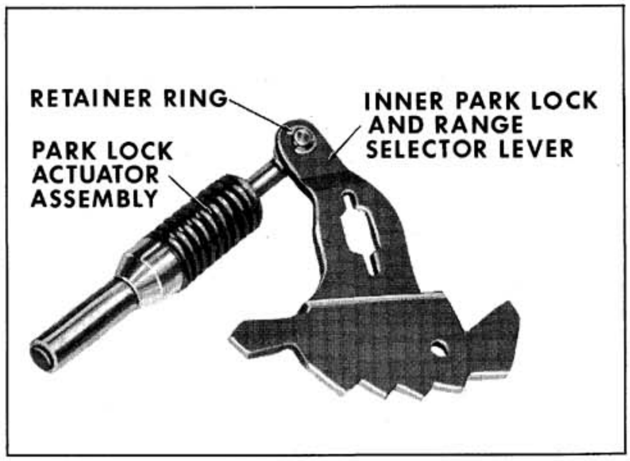


Fig. 6-482 Assembly Actuator

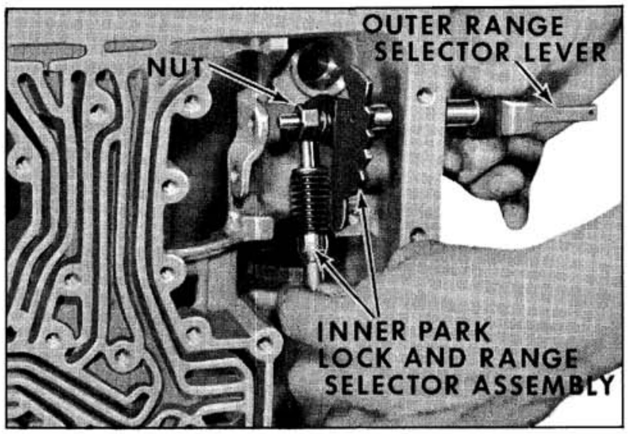


Fig. 6-483 Installing Actuator and Selector Assembly

6. Install range selector shaft retainer. (Fig. 6-485)
7. Install parking bracket to transmission case. Torque bolts 8 to 12 ft. lbs. (Fig. 6-486)

Installing Reverse Clutch

1. With transmission in vertical position, install the reverse clutch piston into case. Tap piston with hammer handle to make certain piston is seated in case. (Fig. 6-487)
2. Install 17 clutch piston return springs. (Fig. 6-488)
3. Position piston return seat on piston return springs. Place snap ring on return seat so that ring may be easily installed when seat is compressed with tool. (Fig. 6-489)
4. Using J-21420-1 and J-21420-2 compress piston return seat so snap ring may be installed with J-5586 Pliers. (Fig. 6-490)

   CAUTION: Make certain inner edge of seat does not hang up on snap ring groove while being compressed.

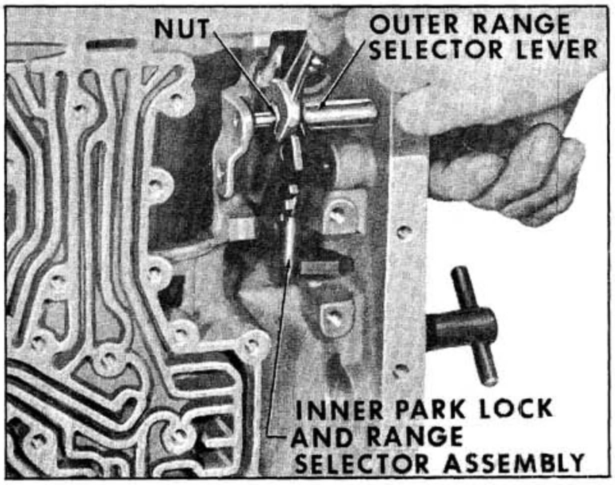


Fig. 6-484 Installing Outer Range Selector Lever

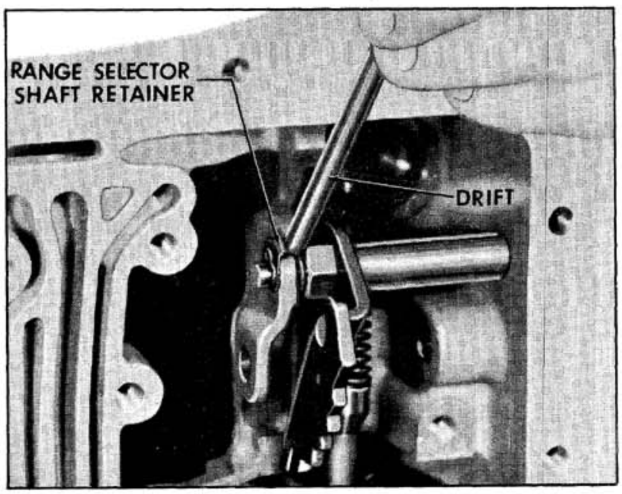


Fig. 6-485 Installing Retainer

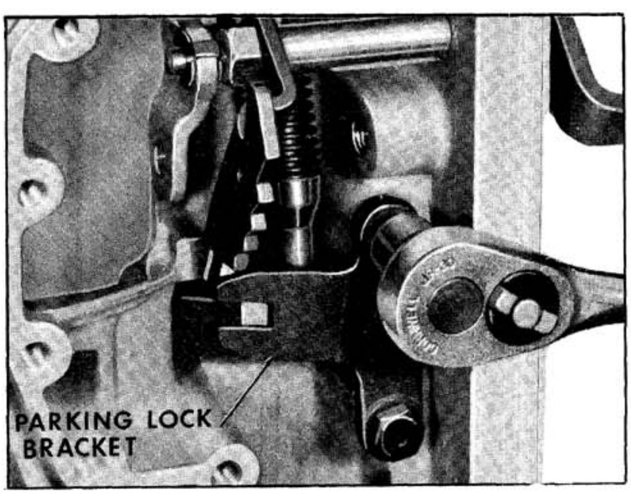


Fig. 6-486 Installing Parking Lock Bracket

5. Install reverse clutch cushion spring. Install the cushion spring with the dished or concave side up. (Fig. 6-491)

6. Align notches on the steel driven plates. Install the steel driven plates and lined drive

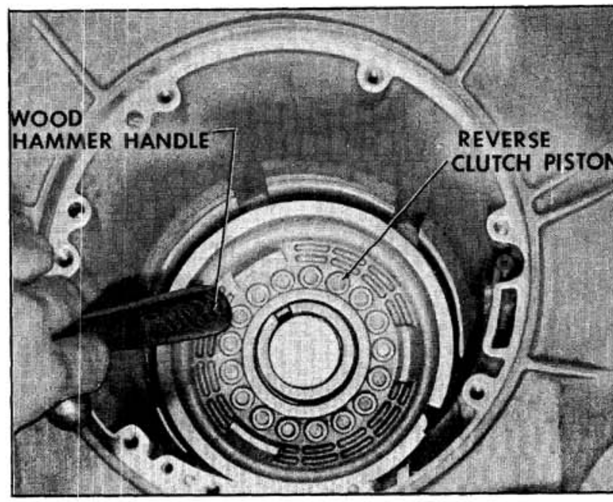


Fig. 6-487 Installing Reverse Clutch Piston

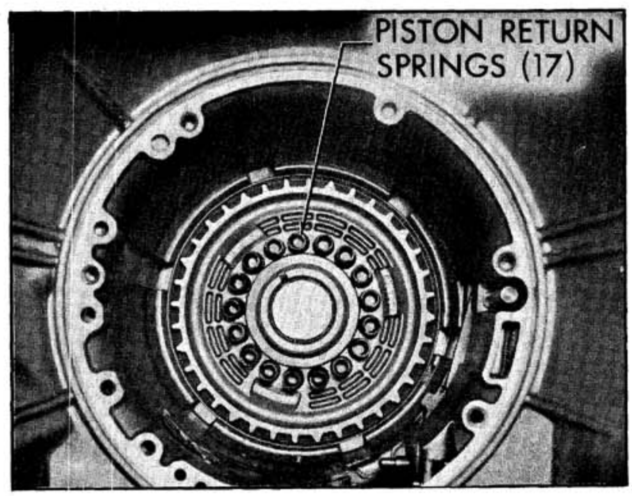


Fig. 6-488 Installing Return Springs

plates alternately, beginning with a steel driven plate. The notched lug on each driven plate goes in the five o'clock groove in case. (Fig. 6-492)

CAUTION: Steel plates are waved and should all face same direction. For this reason, notches are provided to indicate correct installation.

NOTE: Cars equipped with V-6 engines have four driven and four drive clutch plates. Cars equipped with V-8 engines have five driven and five drive clutch plates.

7. Install reverse clutch pressure plate with the identification mark being installed in the five o'clock groove in case. (Fig. 6-493)

8. Install reverse clutch pack snap ring. (Fig. 6-494)

9. Insert feeler gauge between any reaction plate and adjacent faced plate. (Fig. 6-495) Clearance for different reaction plates are shown as follows:

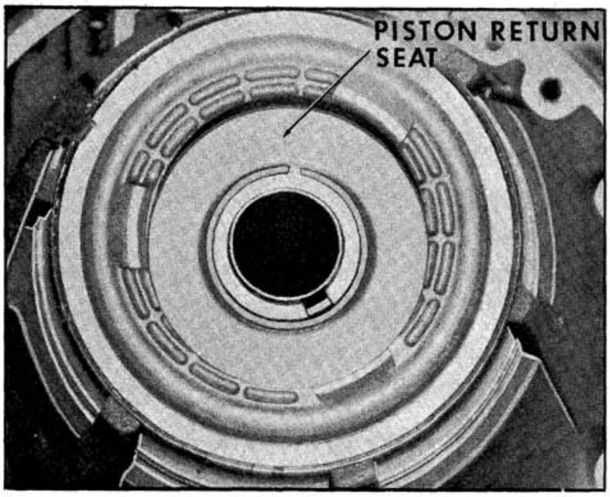


Fig. 6-489 Installing Return Seat

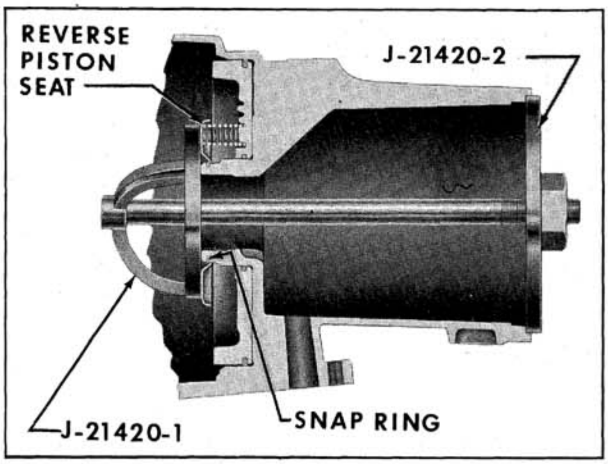


Fig. 6-490 Installing Snap Ring

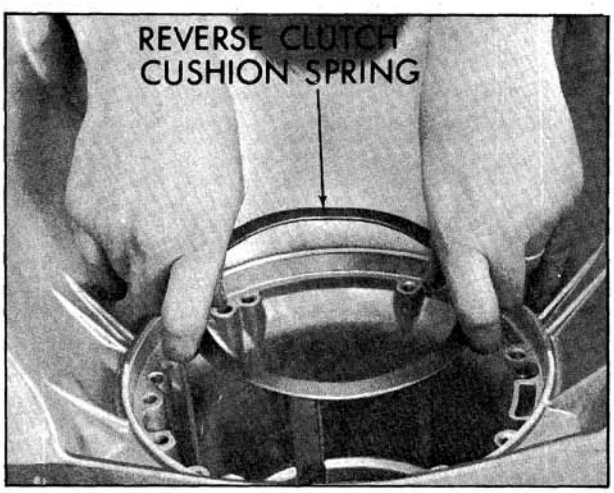


Fig. 6-491 Installing Cushion Spring

When the dimension between the reaction plate and adjacent plate is between .058" and .021" use the reaction plate with one identification mark. When the dimension is between .095" and .058" use plate with two marks. When clearance is between .133" and .095" use plate with three identification marks.

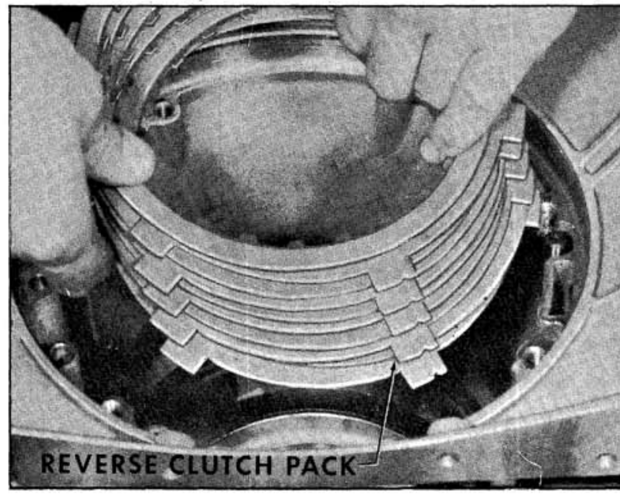


Fig. 6-492 Installing Reverse Clutch Pack

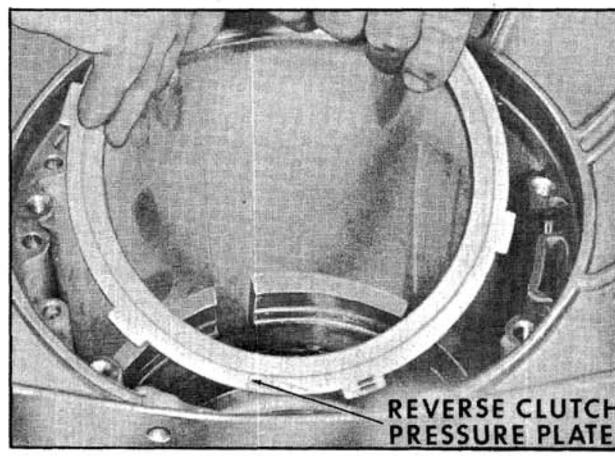


Fig. 6-493 Installing Pressure Plate

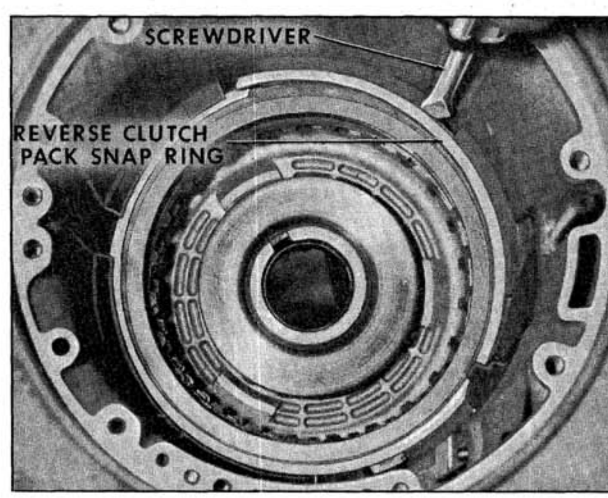


Fig. 6-494 Installing Snap Ring

Installing Planetary Gear Set

1. Install thrust bearing race with a lip, needle bearing and a second plain thrust bearing race to the rear face of the planetary gear set. Retain with grease. (Fig. 6-496)
2. Install reverse ring gear into case. (Fig. 6-497)

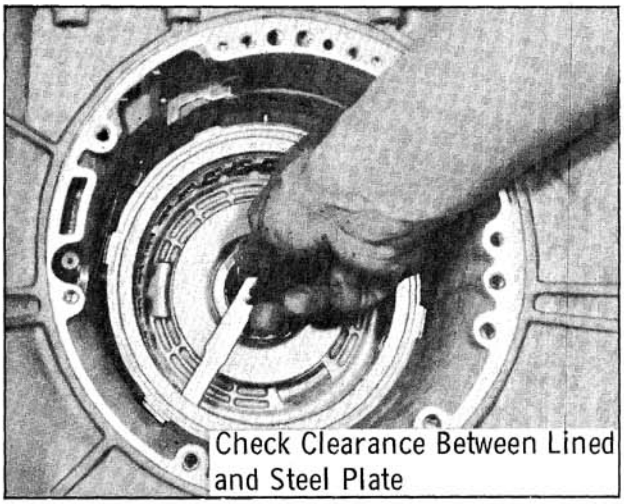


Fig. 6-495 Checking Clearance

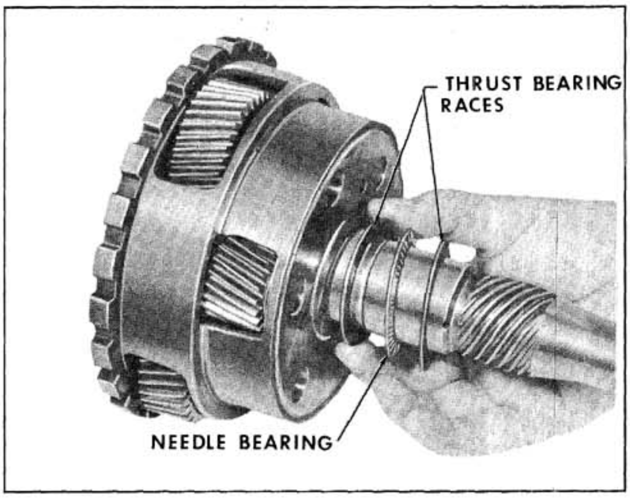


Fig. 6-496 Installing Thrust Bearing

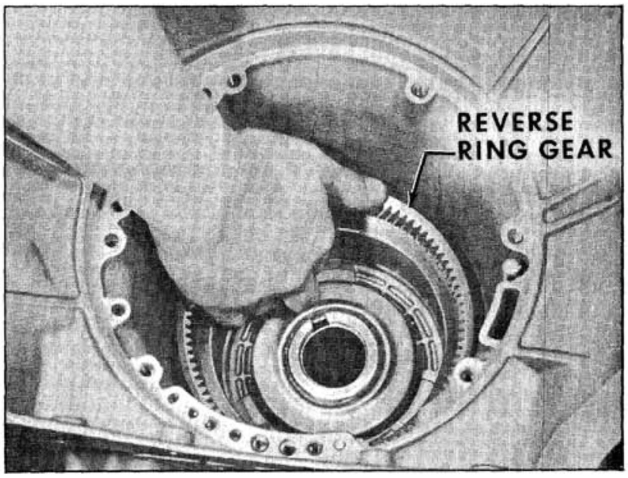


Fig. 6-497 Installing Reverse Ring Gear

3. Install planetary gear set into case. (Fig. 6-498)

Installing Low Servo

1. Install low servo piston assembly into case (Fig. 6-499)

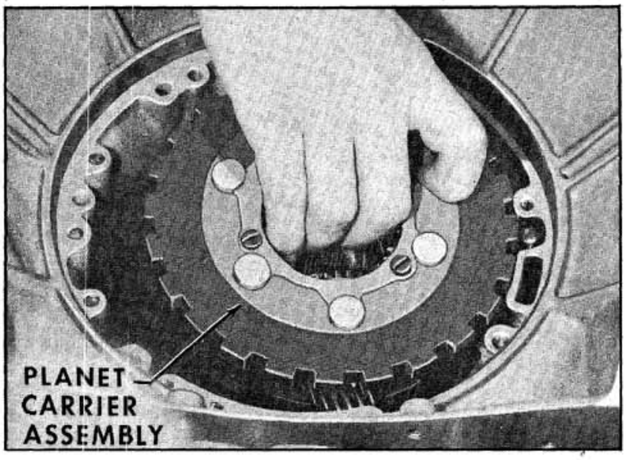


Fig. 6-498 Installing Planet Carrier

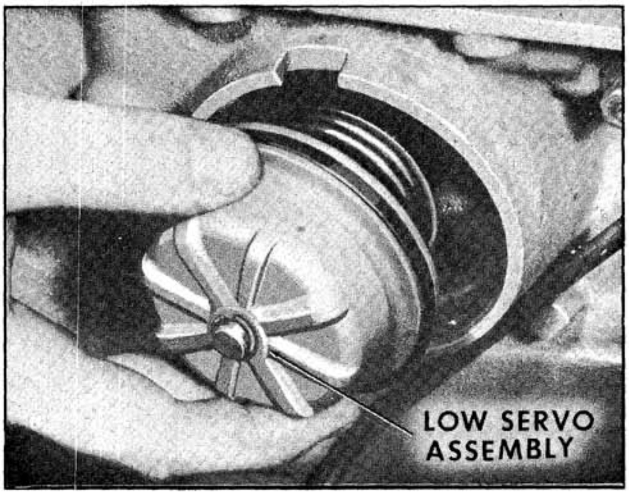


Fig. 6-499 Installing Low Servo

2. Install low servo cover oil seal. (Fig. 6-500)

3. Install low servo cover to case. (Fig. 6-501)

   NOTE: If a new servo cover is installed, transfer the information stamped on the original cover.

4. Compress low servo cover with J-21495-1 and install retaining snap ring. (Fig. 6-502)

Installing Low Band

1. With transmission in vertical position, install band adjusting screw into case. (Fig. 6-503)

2. Install low band into case. (Fig. 6-504)

3. Fig. 6-505 illustrates the proper positioning of the low band apply strut and band adjusting screw anchor strut.

4. Install low band apply strut and band adjusting screw strut. After both struts have been installed, tighten low band adjusting screw enough to prevent struts from falling out. (Fig. 6-506)

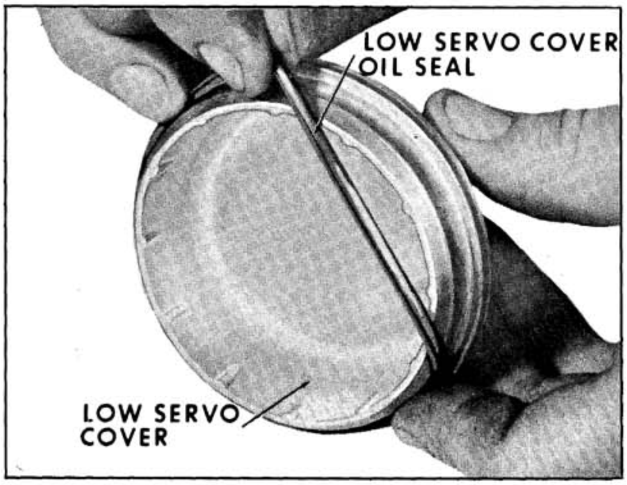


Fig. 6-500 Installing Low Servo Cover Oil Seal

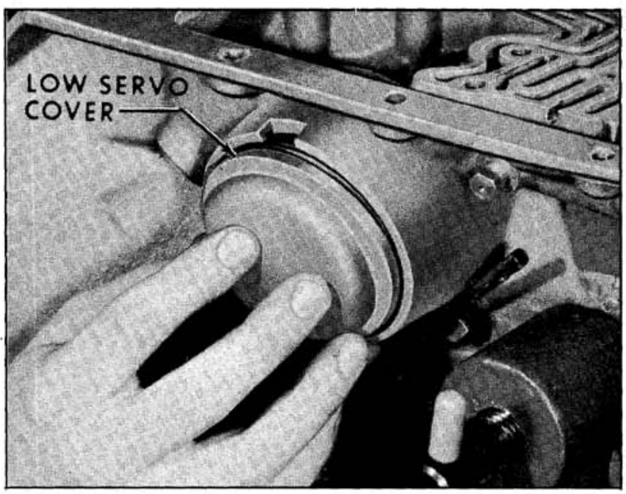


Fig. 6-501 Installing Low Servo Cover

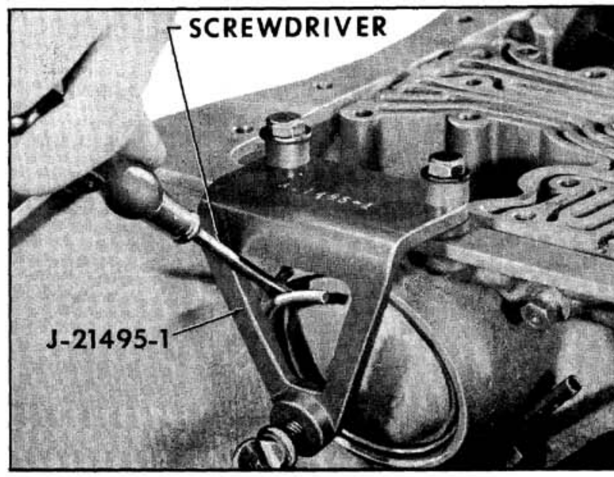


Fig. 6-502 Installing Snap Ring

Fig. 6-503 Installing Low Band Adjusting Screw

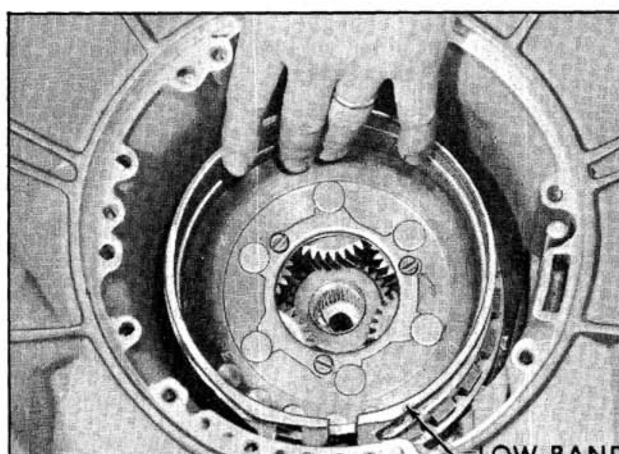


Fig. 6-504 Installing Low Band

Installing the Forward Clutch Assembly

1. Install forward clutch assembly turning slightly to engage low sun gear with planet pinions. (Fig. 6-507)

INSTALLING OIL PUMP GUIDE PIN, GASKET AND OIL PUMP ASSEMBLY

1. Install selective fit washer to pump cover hub. (Fig. 6-508)

2. Install two pump cover to clutch drum oil sealing rings. (Fig. 6-509)

3. Install oil pump to case seal. (Fig. 6-510)

4. Install new pump gasket and guide pins. (Fig. 6-511)

5. Install input shaft oil rings. (Fig. 6-512)

6. Install input shaft into oil pump; then install pump into case. Apply a thin coat of oil around edge of pump. (Fig. 6-513)

7. Remove guide pins and install eight retaining bolts (with new "O" rings under head). (Fig. 6-514)

8. Tighten bolts evenly and torque 16 to 24 ft. lbs. (Fig. 6-515)

9. Check forward clutch to oil pump clearance as follows:

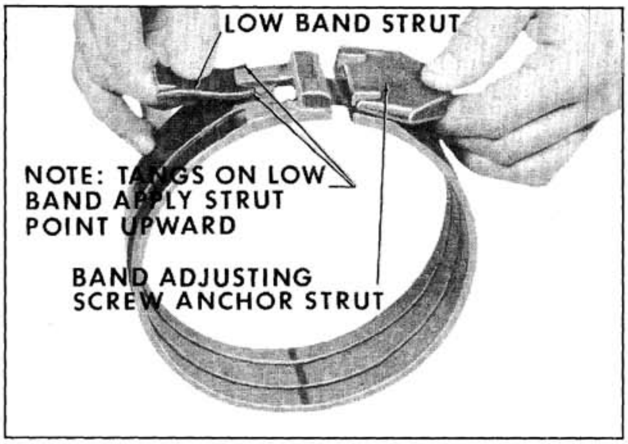


Fig. 6-505 Positioning Band Apply Strut

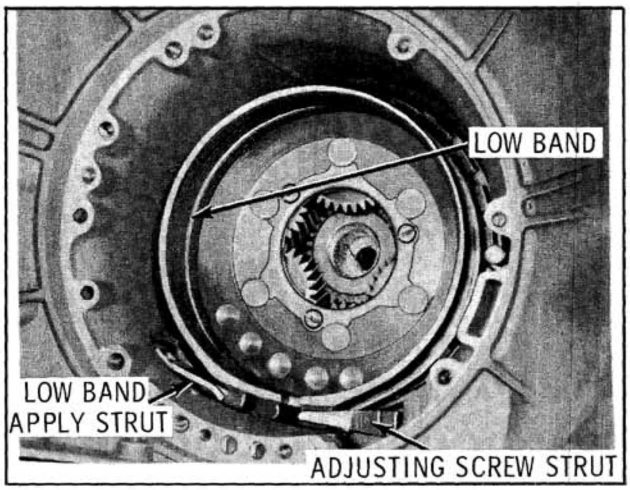


Fig. 6-506 Installing Band Apply Strut

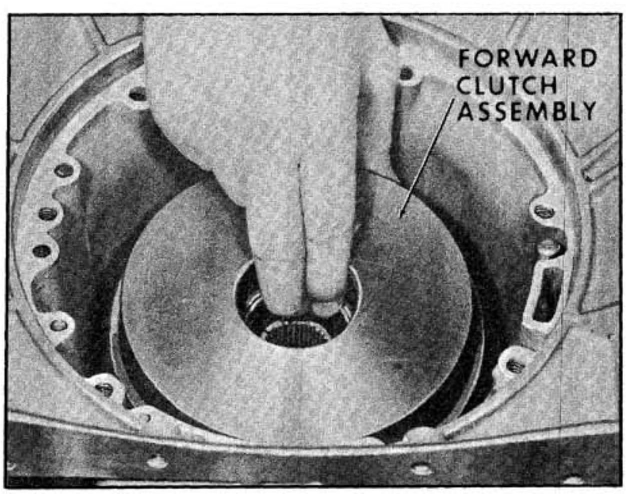


Fig. 6-507 Installing Forward Clutch

a. Position a dial indicator on the end of the input shaft. (Fig. 6-516)

b. Push the input shaft rearward and zero the dial indicator.

c. Pry the output shaft forward and read the

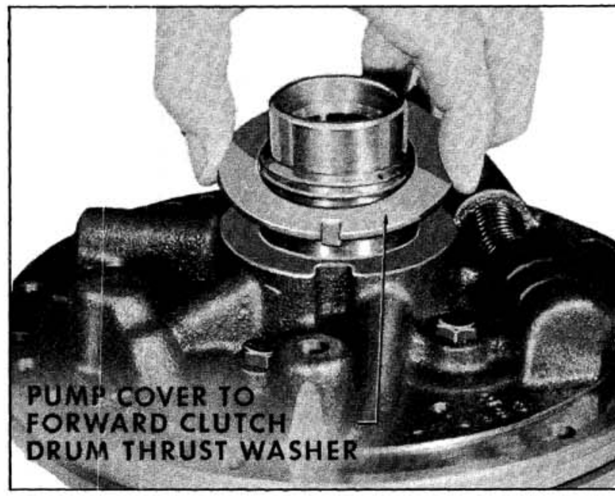


Fig. 6-508 Installing Selective Washer

Fig. 6-509 Installing Oil Sealing Rings

dial indicator. The reading should be between .007" and .051".

d. If the end play is not within specifications, remove the oil pump and with a micrometer determine the thickness of the selective thrust washer and replace with the proper selective thrust washer to bring it within specifications. Thrust washers are available in three sizes:

.059"-.063"
.077"-.081"
.095"-.099"

These washers have no identification other than the part numbers on the packages.

LOW BAND ADJUSTMENT

1. Adjust low band by first tightening adjusting screw to 40 in. lbs. torque. (Fig. 6-517)

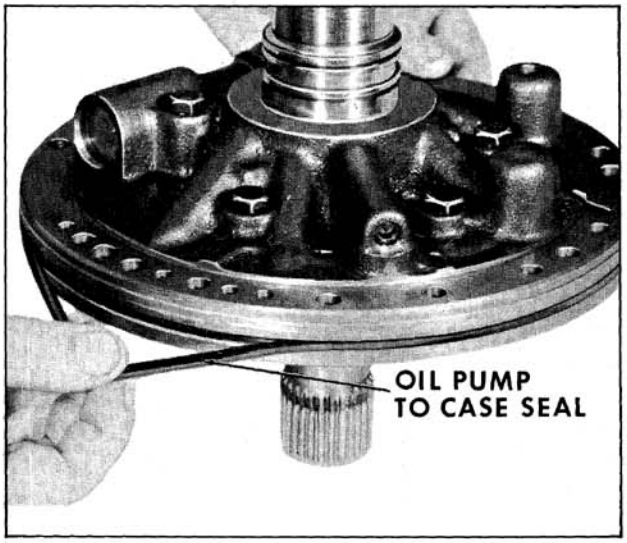


Fig. 6-510 Installing Oil Pump to Case Seal

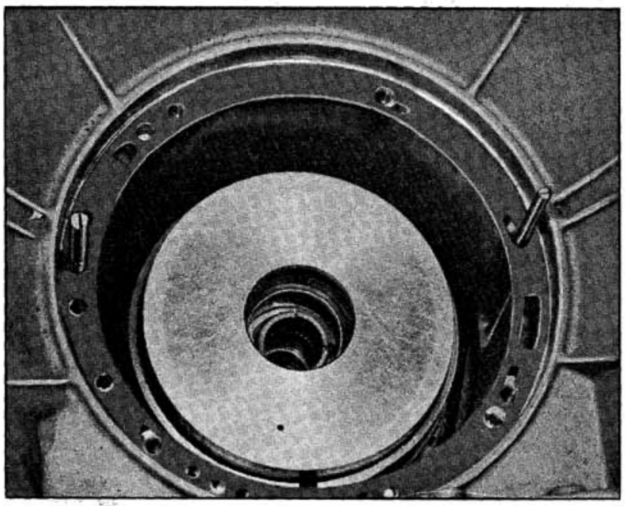


Fig. 6-511 Installing Oil Pump Gasket and Guide Pins

Fig. 6-512 Installing Oil Rings

2. Back off band adjusting screw four turns and lock nut.
3. Install adjusting screw cap. (Fig. 6-518)

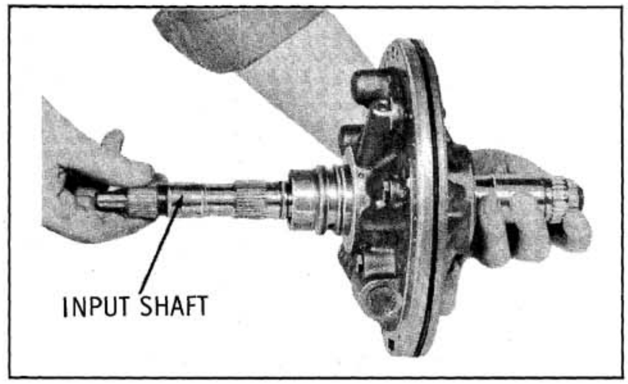


Fig. 6-513 Installing Input Shaft

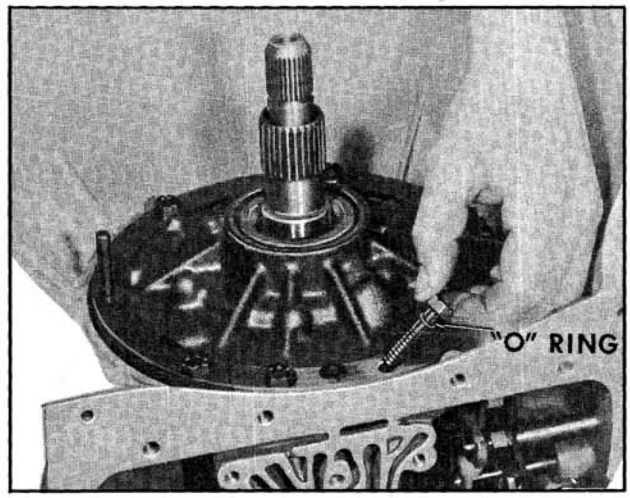


Fig. 6-514 Installing Pump

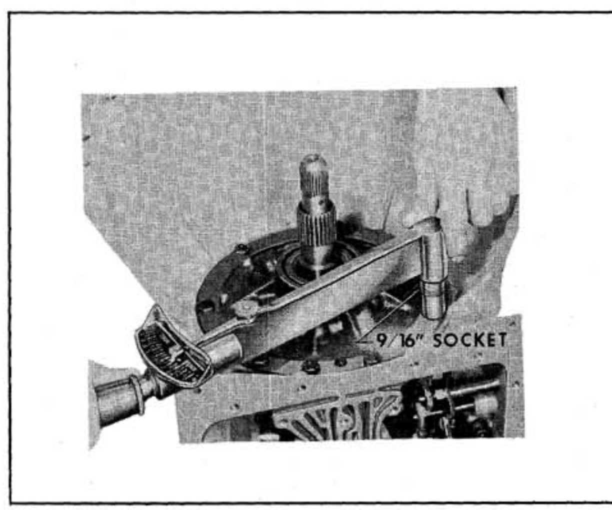


Fig. 6-515 Installing Pump Attaching Bolts

INSTALLING SPEEDOMETER DRIVING GEAR

1. With transmission in a horizontal position, position speedometer driving gear on output shaft. Place transmission in "Park" range. Using Tool J-21470 drive speedometer driving gear onto shaft. (Fig. 6-519)

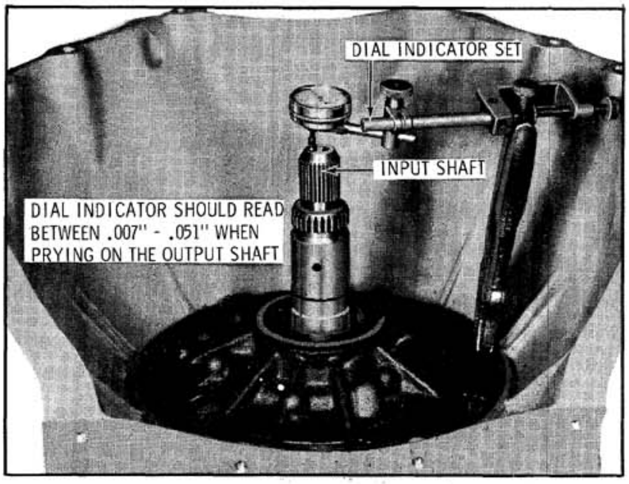


Fig. 6-516 Oil Pump End Play Check

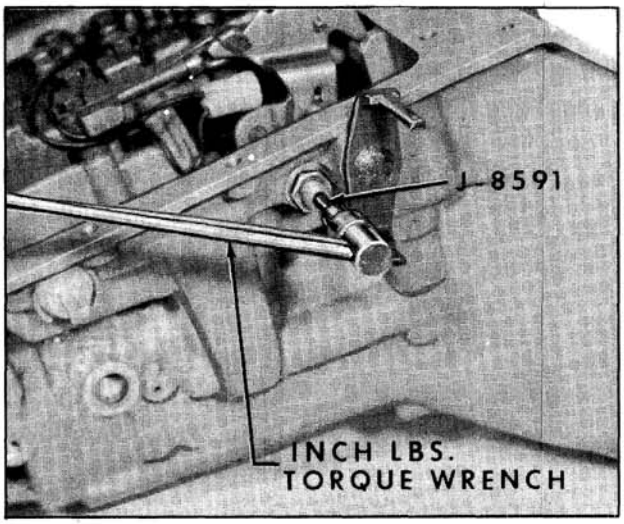


Fig. 6-517 Low Band Adjustment

REAR BEARING RETAINER OIL SEAL AND BUSHING

Removal and Installation

1. Remove the rear bushing as shown in Fig. 6-520.

2. Using Drive Handle J-8092 and Installer J-21424-9, install rear bearing retainer bushing. (Fig. 6-521)

3. Remove the rear bearing oil seal as shown in Fig. 6-522.

4. Install output shaft to rear bearing retainer oil seal using Installer J-21426. (Fig. 6-523)

Installing Rear Bearing Retainer

NOTE: An additional seal is used on the output shaft of 5200 Series.

1. Install rear bearing retainer to case oil seal. (Fig. 6-524)

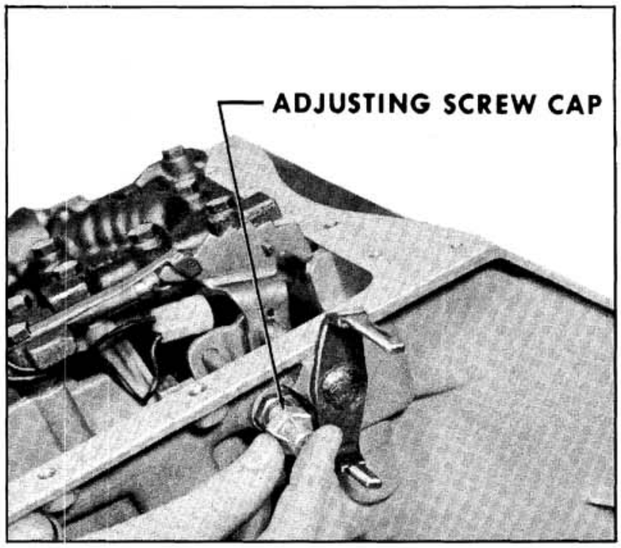


Fig. 6-518 Adjusting Screw Cap

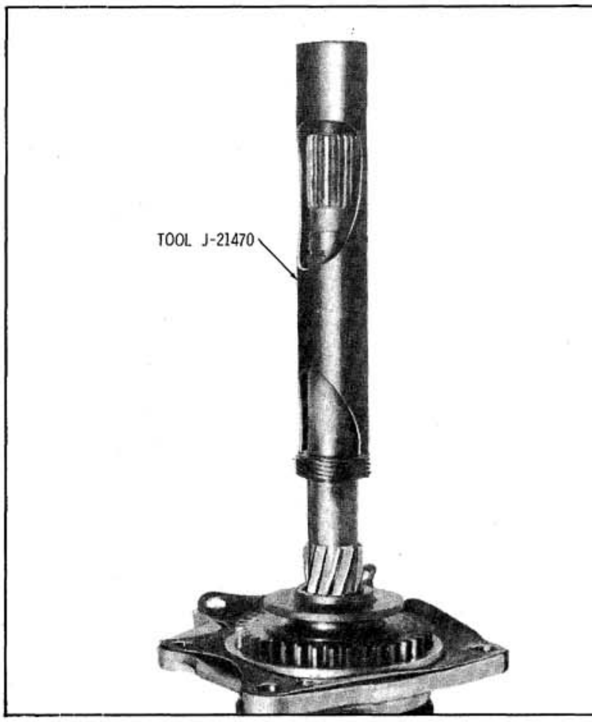


Fig. 6-519 Installing Speedometer Drive Gear

2. Install rear bearing retainer to case and install four retaining bolts, using a 9/16" socket. Torque bolts to 35 ft. lbs. (Fig. 6-525)

INSTALLING SPEEDOMETER DRIVEN GEAR ASSEMBLY

1. Install speedometer driven gear assembly into rear bearing retainer. (Fig. 6-526)

2. Install speedometer driven gear sleeve retainer. Torque bolt to 12 ft. lbs. (Fig. 6-527)

INSTALLING VALVE BODY

1. With transmission in horizontal position, install valve body to plate gasket. (Fig. 6-528)

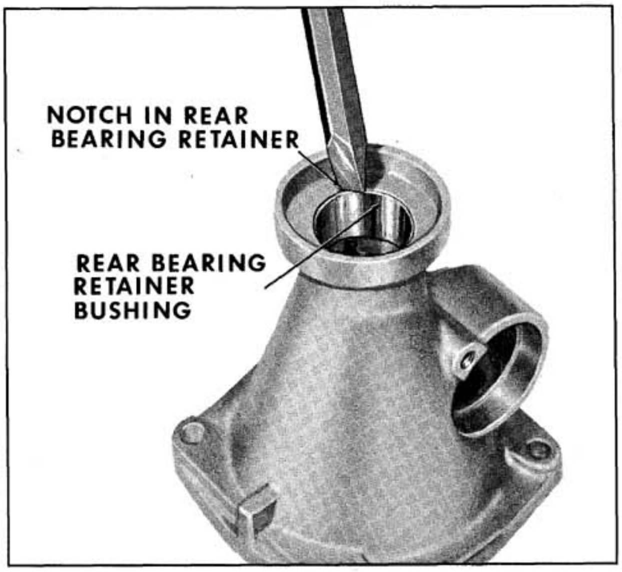


Fig. 6-520 Removing Rear Bearing Retainer Bushing

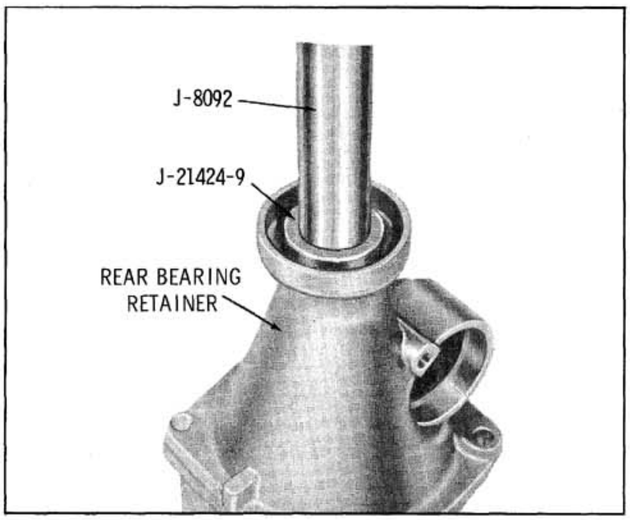


Fig. 6-521 Installing Rear Bearing Retainer Bushing

2. Install valve body plate. (Fig. 6-529)
3. Install manual control valve and link into valve body assembly. (Fig. 6-530)
4. Install manual control valve link into park, lock and range selector inner lever. (Fig. 6-531)
5. Install 11 valve body to case retaining bolts. Torque bolts to 12 ft. lbs. (Fig. 6-532)
6. Install the seven bolts retaining the stator control valve body. Torque bolts to 11 ft. lbs. (Fig. 6-533)
7. Install stator control solenoid and gasket to stator control valve body. Torque bolts to 12 ft. lbs. (Fig. 6-534)
8. Before installing spring detent assembly, note routing of solenoid wires. (Fig. 6-537) Install

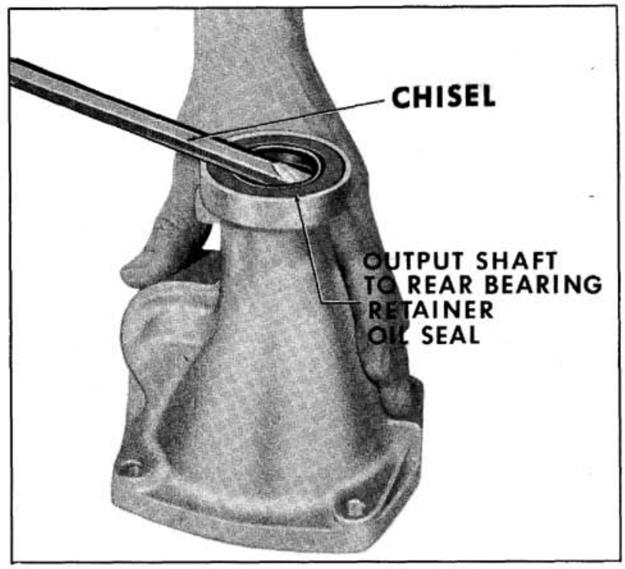


Fig. 6-522 Removing Oil Seal

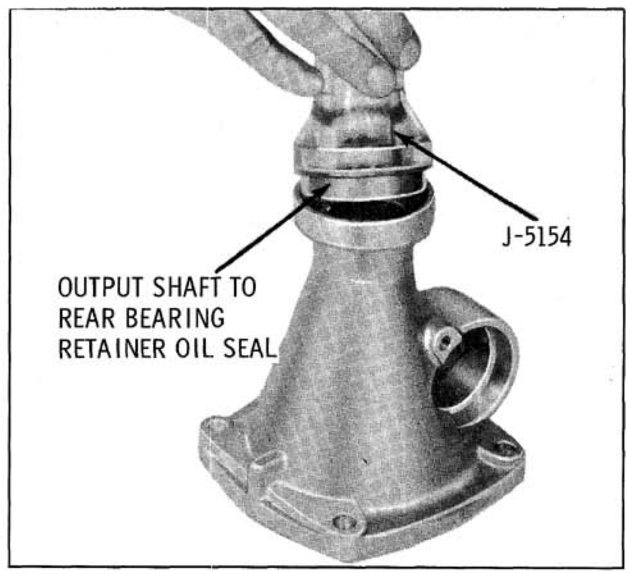


Fig. 6-523 Installing Oil Seal

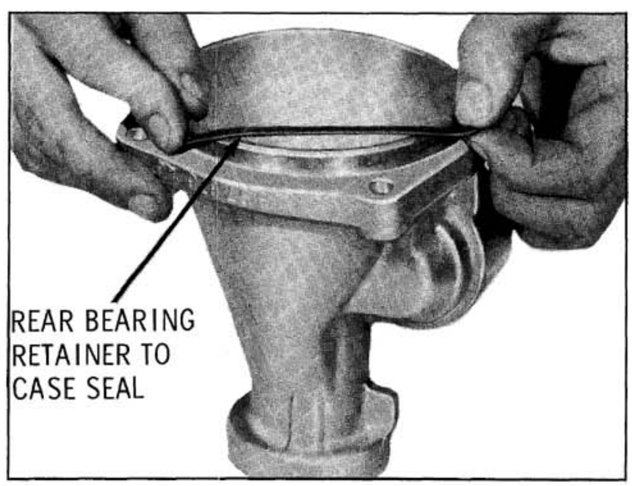


Fig. 6-524 Installing Rear Bearing Retainer to Case Oil Seal

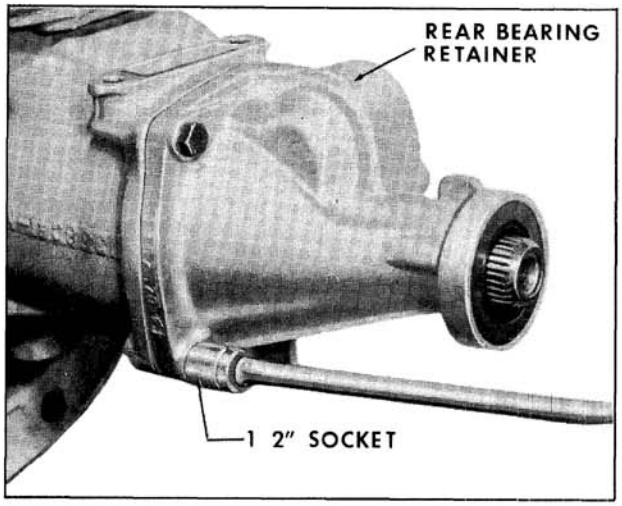


Fig. 6-525 Installing Rear Bearing Retainer

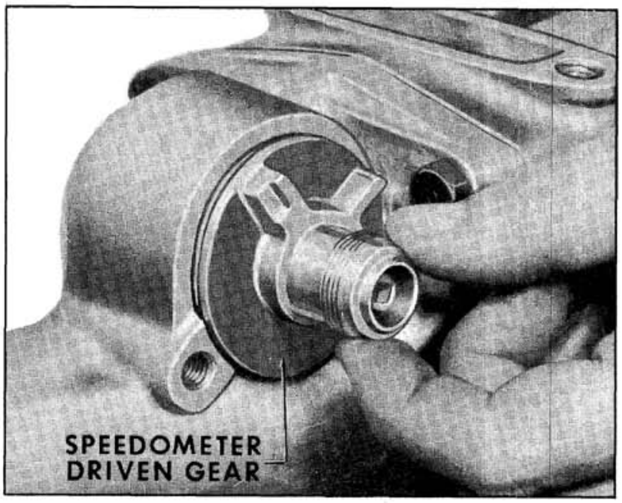


Fig. 6-526 Installing Speedometer Driven Gear

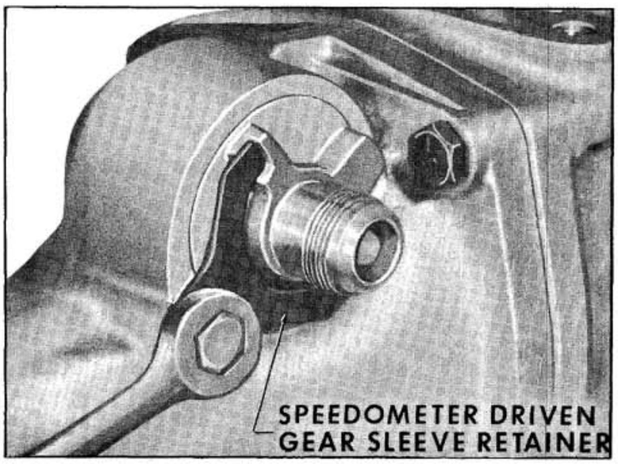


Fig. 6-527 Installing Speedometer Driven Gear Retainer

spring detent assembly. Torque bolt to 12 ft. lbs. (Fig. 6-535)

9. Install solenoid junction into case. (Fig. 6-536)

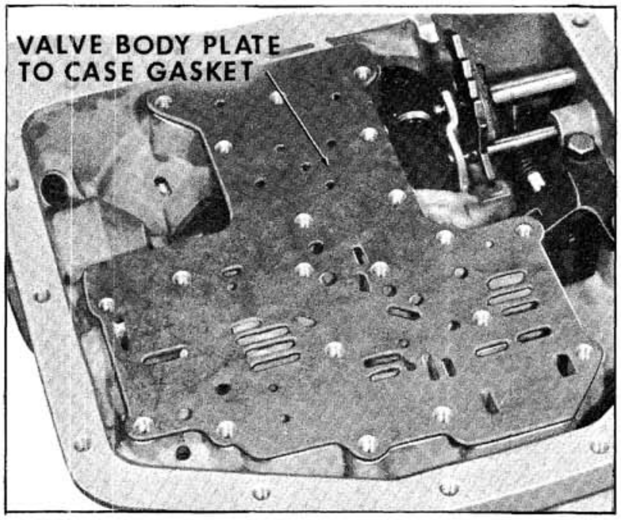


Fig. 6-528 Installing Valve Body Gasket

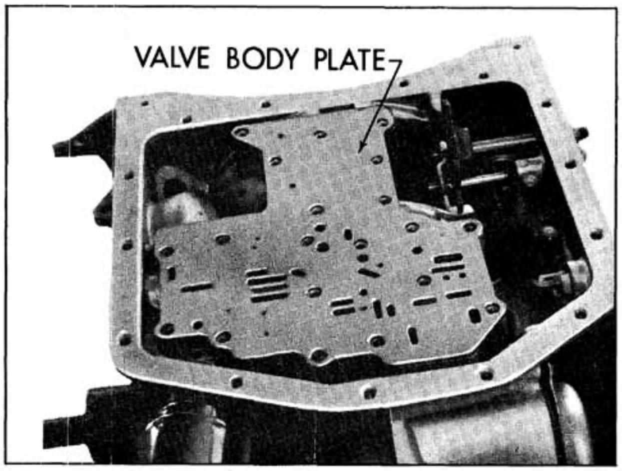


Fig. 6-529 Installing Valve Body Plate

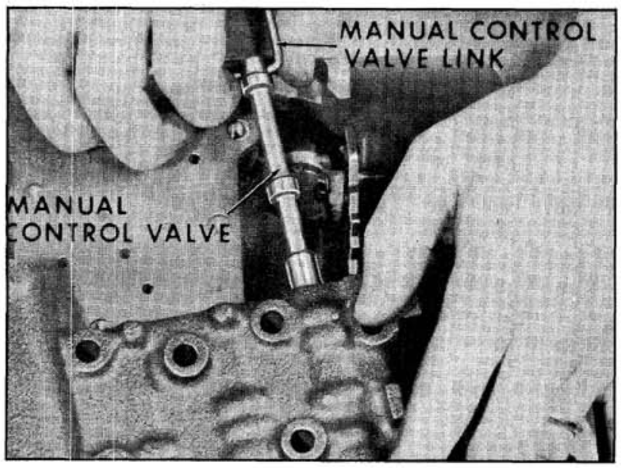


Fig. 6-530 Installing Valve Body

10. Install solenoid connector to solenoid junction. (Fig. 6-537)

11. Install oil filter pipe to case seal. (Fig. 6-538)

12. Install filter into transmission case. (Fig. 6-539)

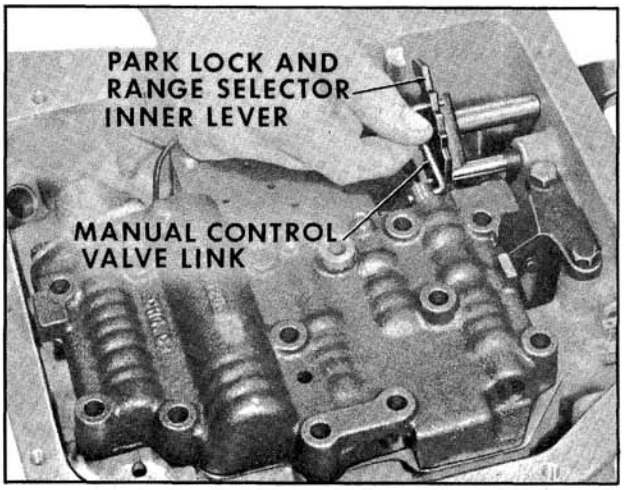


Fig. 6-531 Installing Link

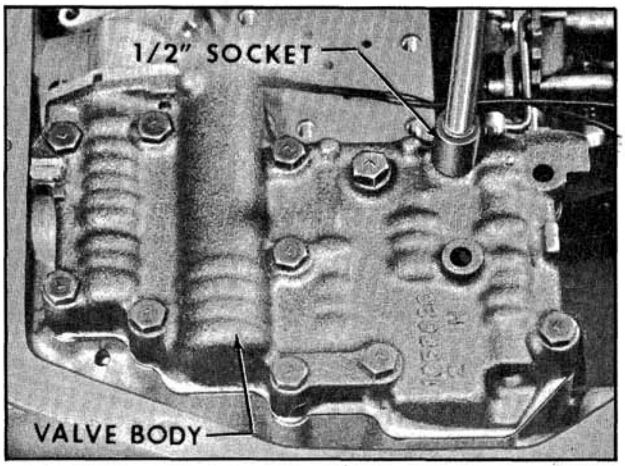


Fig. 6-532 Installing Valve Body Attaching Bolts

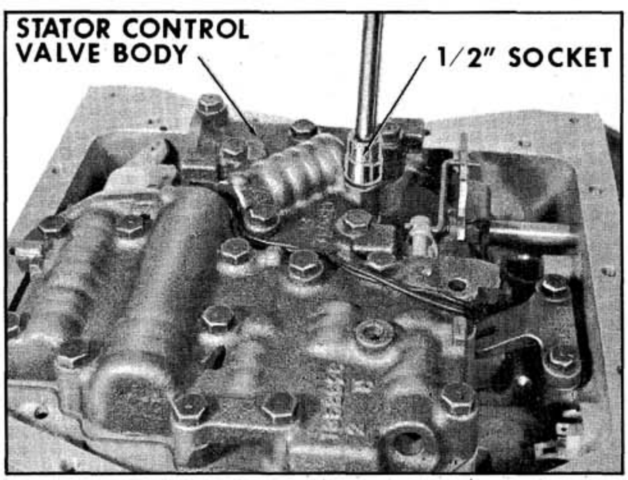


Fig. 6-533 Installing Stator Control Valve Body

13. Torque oil filter retaining bolt to 12 ft. lbs.

14. Install oil pan gasket and pan. (Fig. 6-540)

15. Install 14 oil pan attaching bolts. Torque bolts to 12 ft. lbs. (Fig. 6-541)

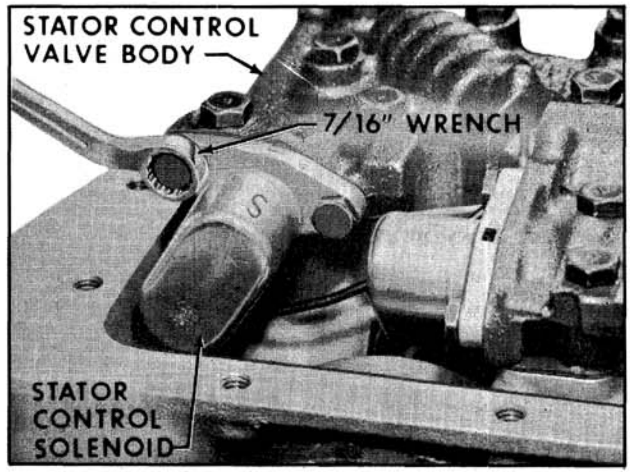


Fig. 6-534 Installing Stator Control Solenoid

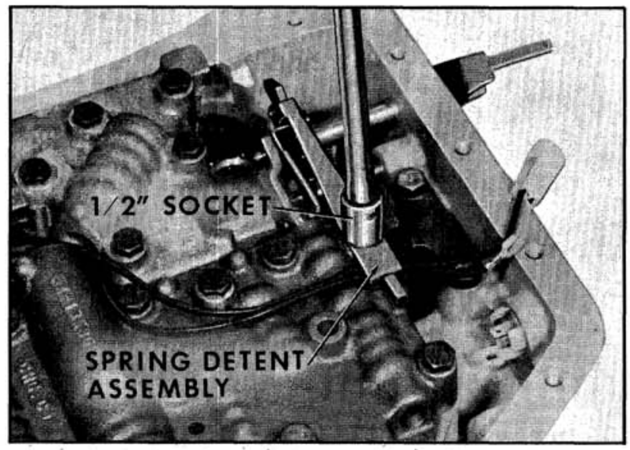


Fig. 6-535 Installing Spring Detent Assembly

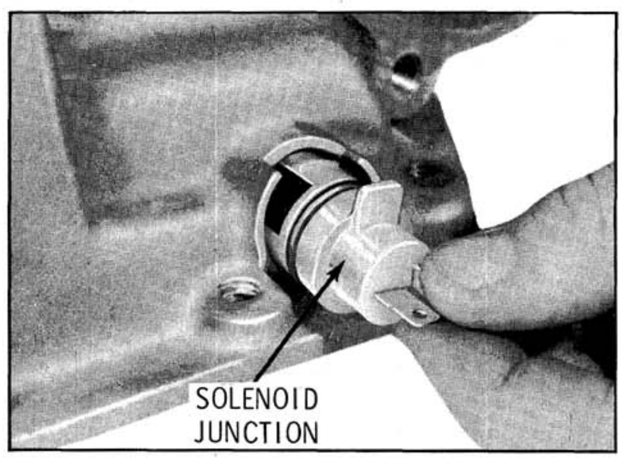


Fig. 6-536 Installing Solenoid Junction

Installing Governor

1. Slide governor into its bore in case. Turn governor assembly so teeth on governor gear engage teeth on output shaft. (Fig. 6-542)

2. Install governor gasket and cover to case. Torque bolts to 12 ft. lbs. (Fig. 6-543)

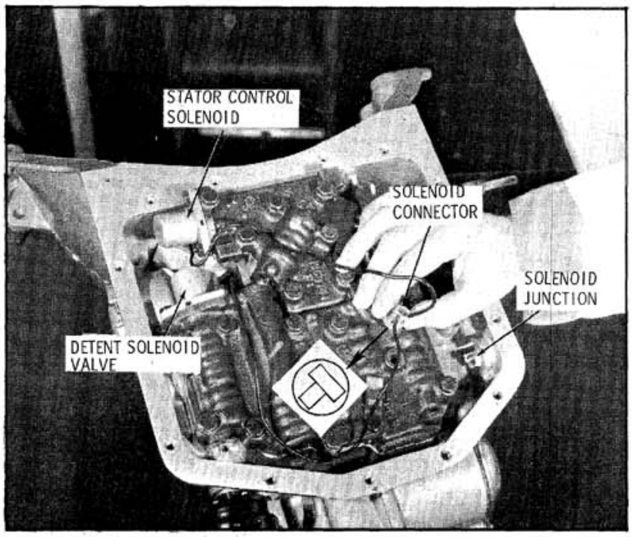


Fig. 6-537 Installing Solenoid Connector

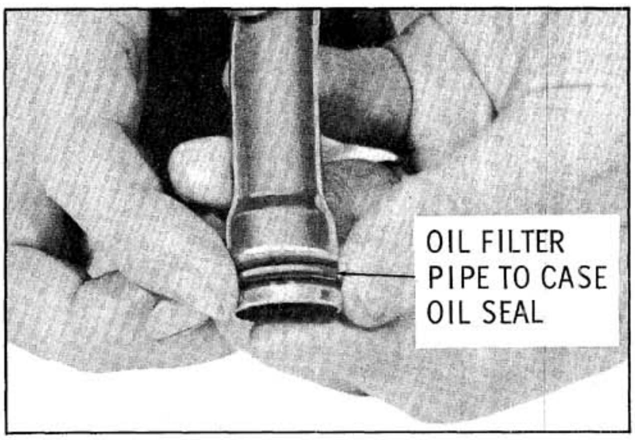


Fig. 6-538 Oil Filter Pipe to Case Oil Seal

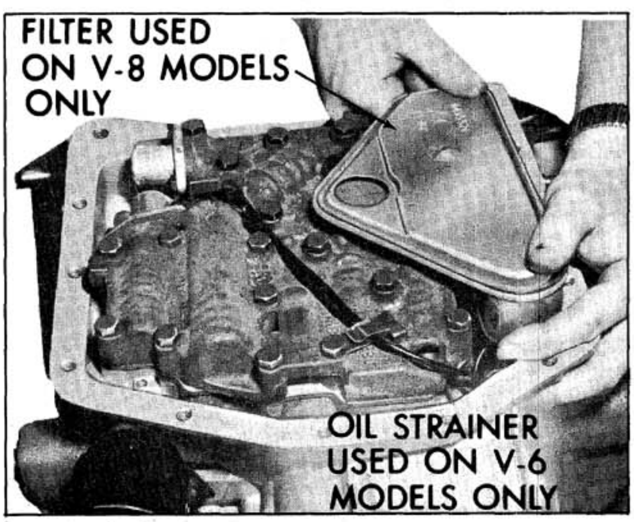


Fig. 6-539 Installing Oil Filter

Installing Vacuum Modulator

1. Slide rear modulator valve into front modulator valve, then install into bore in case. (Fig. 6-544)

2. Install case to vacuum modulator oil seal. Install modulator into case. (Fig. 6-545)

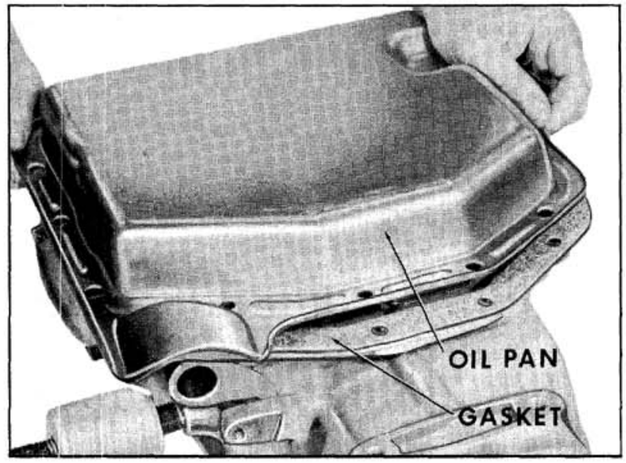


Fig. 6-540 Installing Oil Pan and Gasket

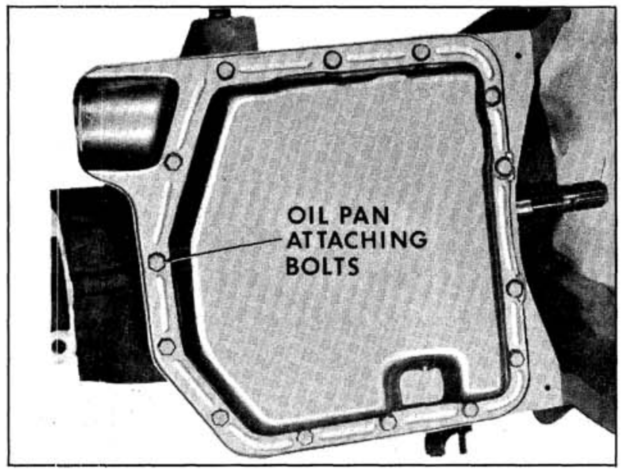


Fig. 6-541 Installing Oil Pan Attaching Screws

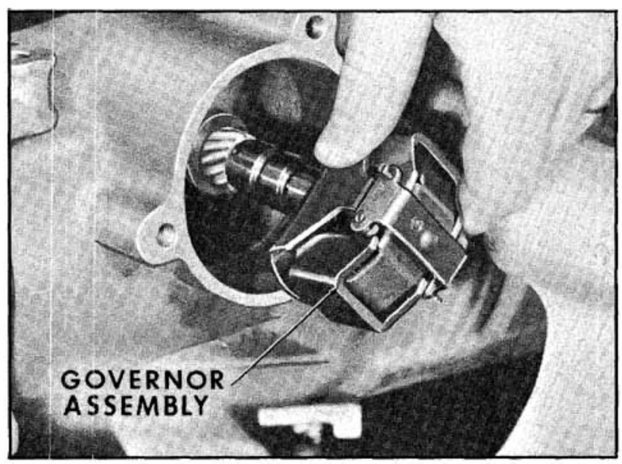


Fig. 6-542 Installing Governor Assembly

3. Install vacuum modulator retainer. Install retainer so tang points toward vacuum modulator. Torque bolts to 12 ft. lbs. (Fig. 6-546)

CHECKING CONVERTER

1. Check converter for leaks as follows:

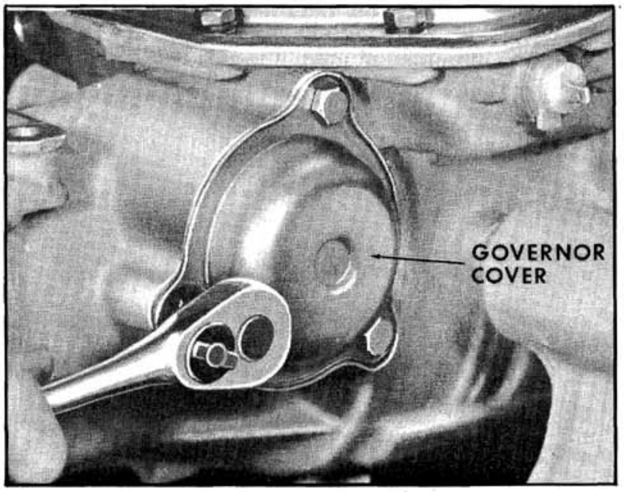


Fig. 6-543 Installing Governor Cover

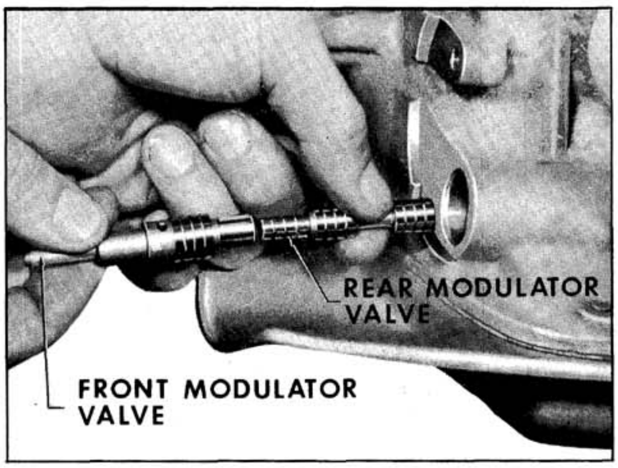


Fig. 6-544 Installing Modulator Valve

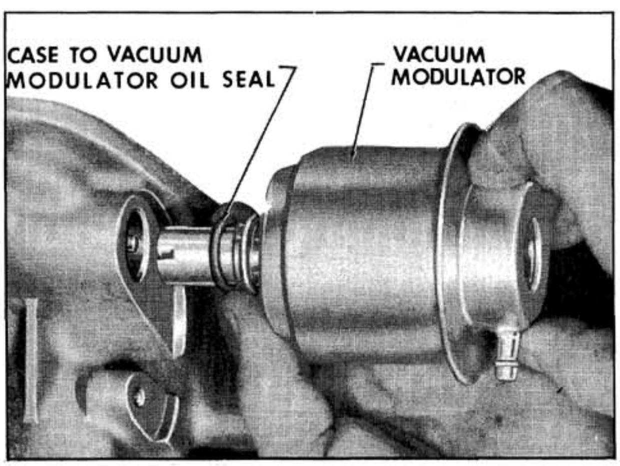


Fig. 6-545 Installing Vacuum Modulator

a. Install available Tool J-21369 and tighten. (Fig. 6-547)

b. Fill converter with air; 80 psi.

c. Submerge in water and check for leaks.

2. Check converter end clearance as follows:

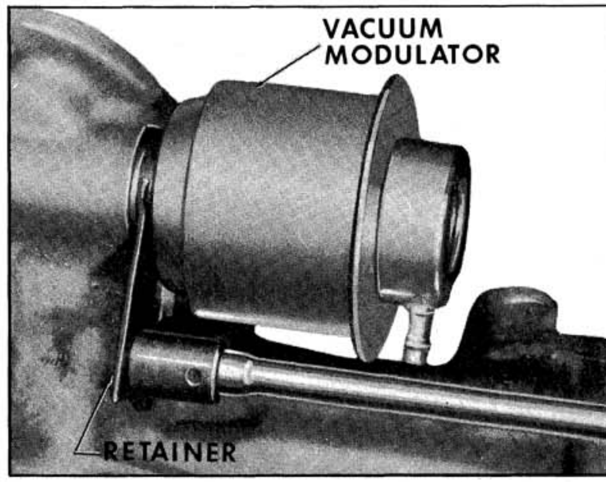


Fig. 6-546 Installing Vacuum Modulator Retainer

a. Install available Tool J-21371-8 and tighten brass nut. (Fig. 6-548)

b. Install available Tool J-21371-3 and tighten hex nut. (Fig. 6-549)

c. Install dial indicator set at zero.

d. Loosen hex nut. When nut is fully loosened, the reading obtained on the dial indicator will be converter end clearance. End clearance should be less than .050".

3. Install converter.

4. Install Converter Holding Tool J-21654. (Fig. 6-550)

TROUBLE DIAGNOSIS GUIDE (Figs. 6-551, 6-552, 6-553, 6-554, 6-555 & 6-556)

No Drive in Any Selector Position; Cannot load Engine

1. Low oil level.
2. Clogged oil filter or suction pipe loose.
3. Defective pressure regulator valve.
4. Front pump defective.
5. Input shaft broken.

Engine Speed Flares on Standstill Starts But Acceleration Lags

1. Low oil level.
2. Clogged oil filter.
3. Servo piston seal leaking.

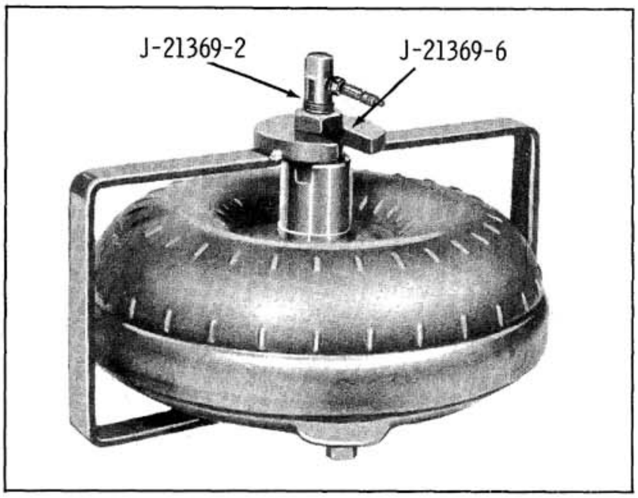


Fig. 6-547 Installing Tool J-21369

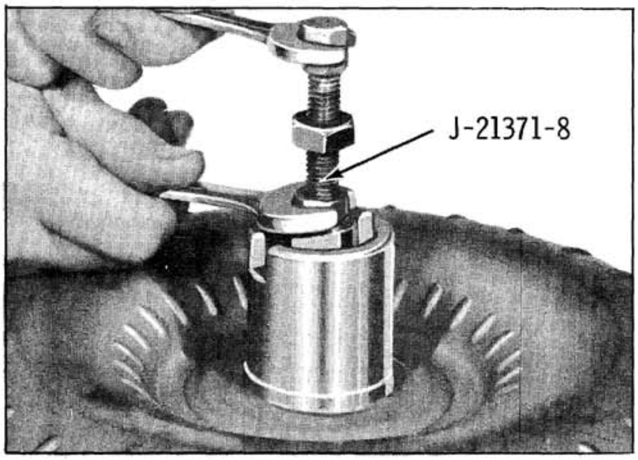


Fig. 6-548 Installing Tool J-21371-8

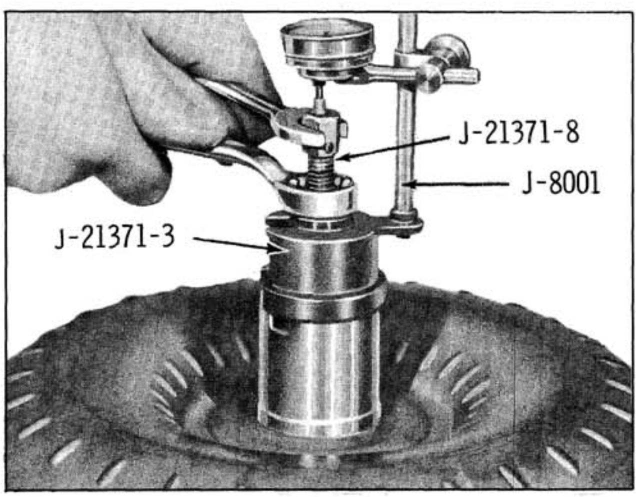


Fig. 6-549 Installing Tool J-21371-3

4. Band facing worn.
5. Low band apply struts disengaged or broken.

Engine Speed Flares on Upshifts

1. Low oil level.

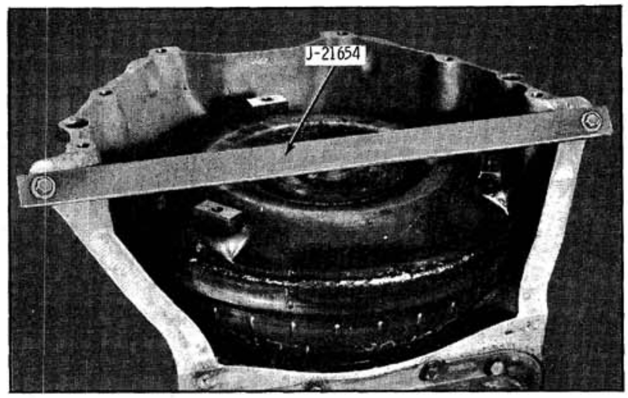


Fig. 6-550 Converter Holding Tool

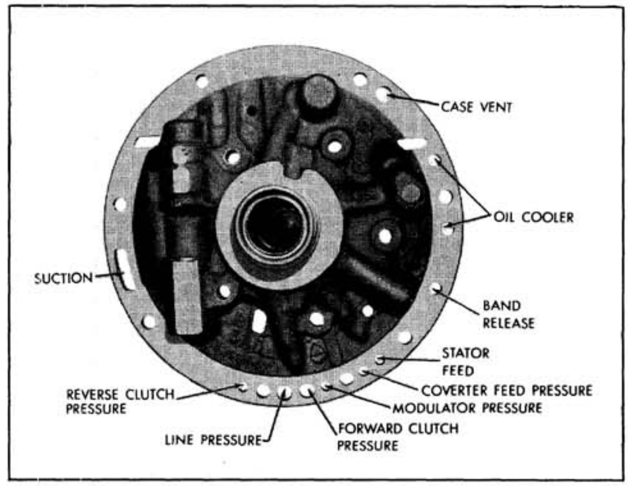


Fig. 6-551 Oil Passage Identification

2. Improper band adjustment.
3. Clogged oil filter.
4. Forward clutch partially applied.
5. Forward clutch plates worn.
6. Forward clutch piston hanging up.
7. Forward clutch drum relief ball not sealing.
8. Vacuum modulator.

Upshifts Harsh

1. Vacuum modulator line broken or disconnected.
2. Vacuum modulator diaphragm leaks.
3. Vacuum modulator valve stuck.

Closed Throttle (coast) Downshift Harsh

1. Improper low band adjustment.
2. High engine idle speed.

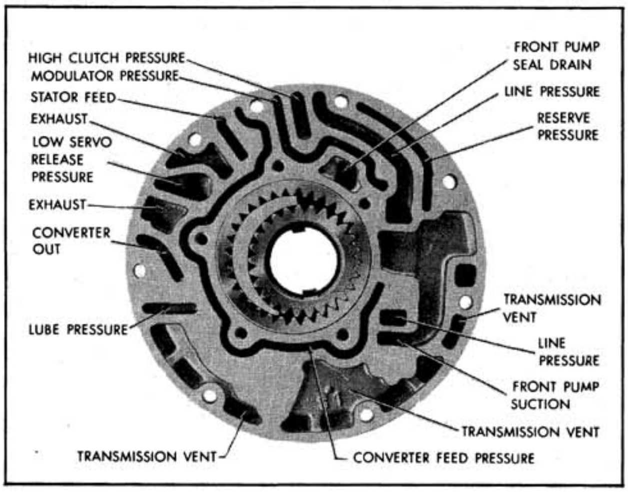


Fig. 6-552 Oil Passage Identification

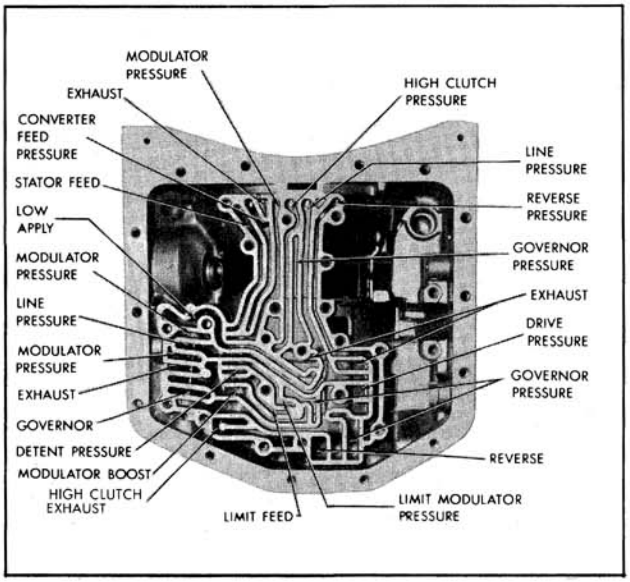


Fig. 6-554 Case Oil Passage Identification

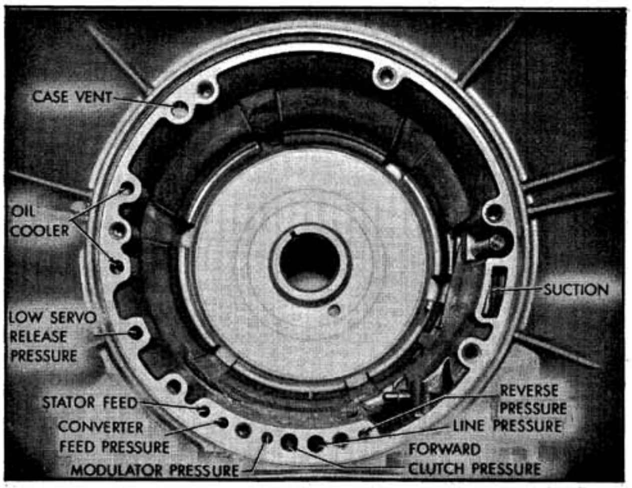


Fig. 6-553 Case Oil Passage Identification

3. Downshift timing valve malfunction.

4. High main line pressure. Check the following:

   a. Vacuum modulator line broken or disconnected.

   b. Modulator diaphragm ruptured.

   c. Sticking pressure regulator coast valve, pressure regulator valve or vacuum modulator valve.

Clutch Failure

1. Low band adjusting screw backed off more than specified.
2. Improper order of clutch plate assembly.
3. Extended operation with low oil level.
4. Forward clutch drum relief ball stuck.

Car Creeps Excessively in Drive

1. Idle speed too high.
2. Closed throttle stator switch improperly adjusted.

Car Creeps in Neutral

1. Forward clutch or low band not released.

No Drive In Reverse

1. Reverse clutch piston stuck.
2. Reverse clutch plates worn out.
3. Reverse clutch seal leaking excessively.
4. Blocked reverse clutch apply orifice.

Transmission Case and Extension Oil Seal Leaks

1. Extension oil seal.
2. Outer shift lever oil seal.
3. Speedometer driven gear fitting.
4. Oil cooler pipe connections.
5. Vacuum modulator assembly and case.

Oil Forced Out of Filler Tube

1. Oil level too high, foaming caused by planet carrier running in oil.
2. Water in oil.
3. Leak in pump suction circuits.

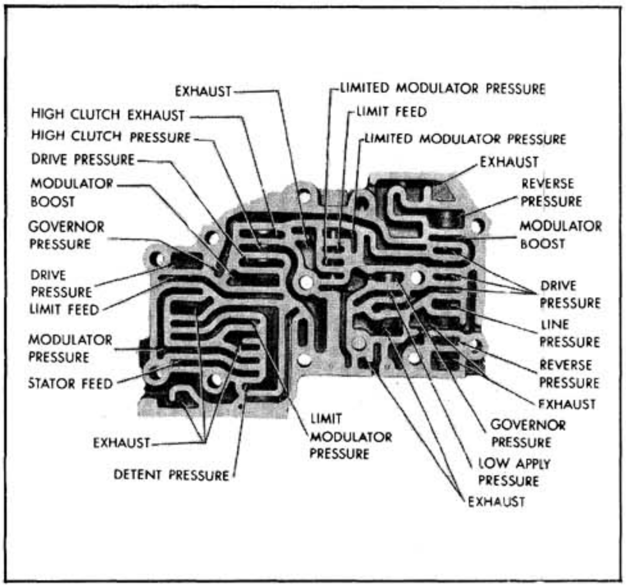


Fig. 6-555 Valve Body Oil Passage Identification

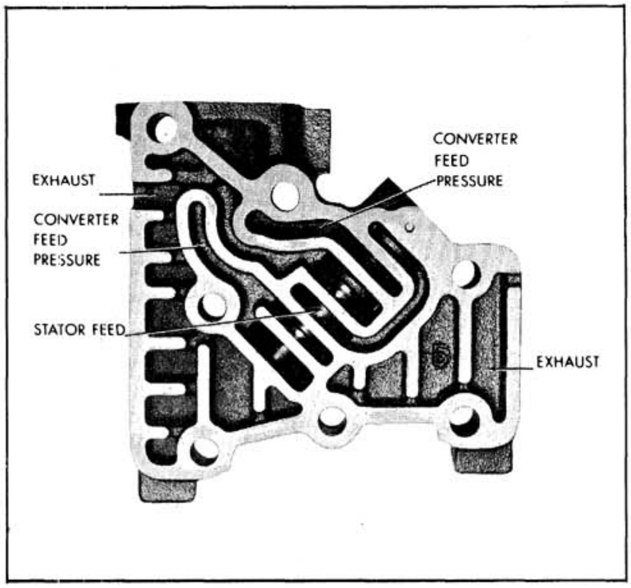


Fig. 6-556 Stator Control Valve Body Oil Passage Identification

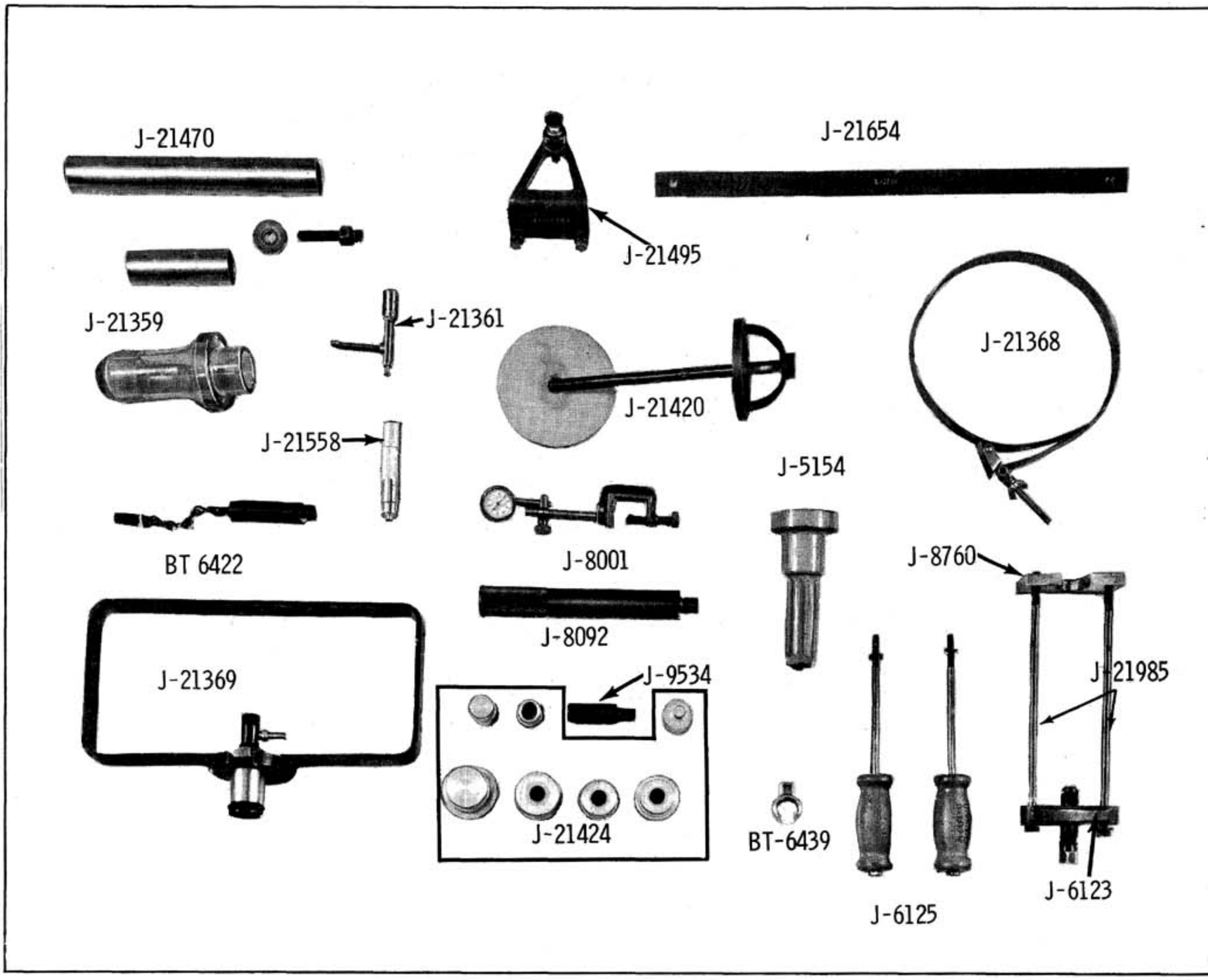


Fig. 6-557 Tools

J-5154	Rear Bearing Retainer Seal Installer	J-21368	Pump Body and Cover Alignment Band
J-6123	Speedometer Gear Puller	J-21369	Converter Leak Tester
J-6125	Slide Hammer	J-21420	Reverse Clutch Spring Compressor
J-8001	Dial Indicator Set	J-21424	Bushing Remover and Installer Tool Set
J-8092	Driver Handle	J-21470	Speedometer Drive Gear Installer
J-8760	Speedometer Gear Remover Adapter	J-21558	Check Valve Seat Installer
J-9534	Planet Carrier Bushing Remover	J-21985	Threaded Rods
J-21359	Oil Pump Seal Installer	BT-6422	Speedometer Driven Gear Puller
J-21361	Check Valve Seat Remover	BT-6439	Crowfoot (to hold transmission 23/32" oil cooler line)
J-21654	Converter Holding Strap		

TORQUE SPECIFICATIONS

Application	Ft. Lbs.
Case to Cylinder Block Bolt	40
Converter Cover Pan to Transmission Case	7
Cooler Lines to Transmission Case	30
Low Band Adjusting Screw Locknut	30
Pump Body to Pump Cover	24
Valve Body to Transmission Case	12
Solenoid Valve to Valve Body	12
Vacuum Modulator to Transmission Case	12
Pump Assembly to Transmission Case	24
Rear Bearing Retainer to Transmission Case	35
Oil Pan to Transmission Case	12
Speedometer Sleeve Retainer to Bearing Retainer	12
Governor Cover to Transmission Case	12
Flywheel to Converter	35

JETAWAY TRANSMISSION PRESSURES

MAXIMUM PRESSURE CHECKS – DISCONNECT MODULATOR VACUUM LINE – PLUG

ENGINE	V-6		REGULAR FUEL V-8		PREMIUM FUEL V-8	
RPM	750	1000	750	1000	750	1000
RANGE	P-N-D-L	R	P-N-D-L	R	P-N-D-L	R
*PRESSURE	135-143	207-219	142-150	223-235	146-154	226-238

*NOTE: Approximately 4 PSI less per 1000 feet elevation

MINIMUM PRESSURE CHECKS – MODULATOR VACUUM LINE CONNECTED
WITH VACUUM MODULATOR CONNECTED ELEVATION DOES NOT AFFECT PRESSURE

MINIMUM PRESSURE CHECKS
ALL SERIES – ALL ENGINES

	PSI AT 750 RPM
Park, Neutral or Drive	58 to 62
Low	86 to 94
Reverse	89 to 97

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SYNCHROMESH AND CLUTCH

33-34-35-36-38-52-54-56-58 & 66 SERIES

CONTENTS OF THIS SECTION

THREE-SPEED TRANSMISSION

33-34-35-36-38 & 52 SERIES

THREE-SPEED TRANSMISSION

54-56-58 SERIES

Refer to page 7-17

FOUR-SPEED TRANSMISSION

33-34-35-36-38-52-54-58 & 66 SERIES

Refer to page 7-31

CLUTCH

33-34-35-36-38 & 52 SERIES

Refer to page 7-45

CLUTCH

54-56-58 & 66 SERIES

Refer to page 7-51

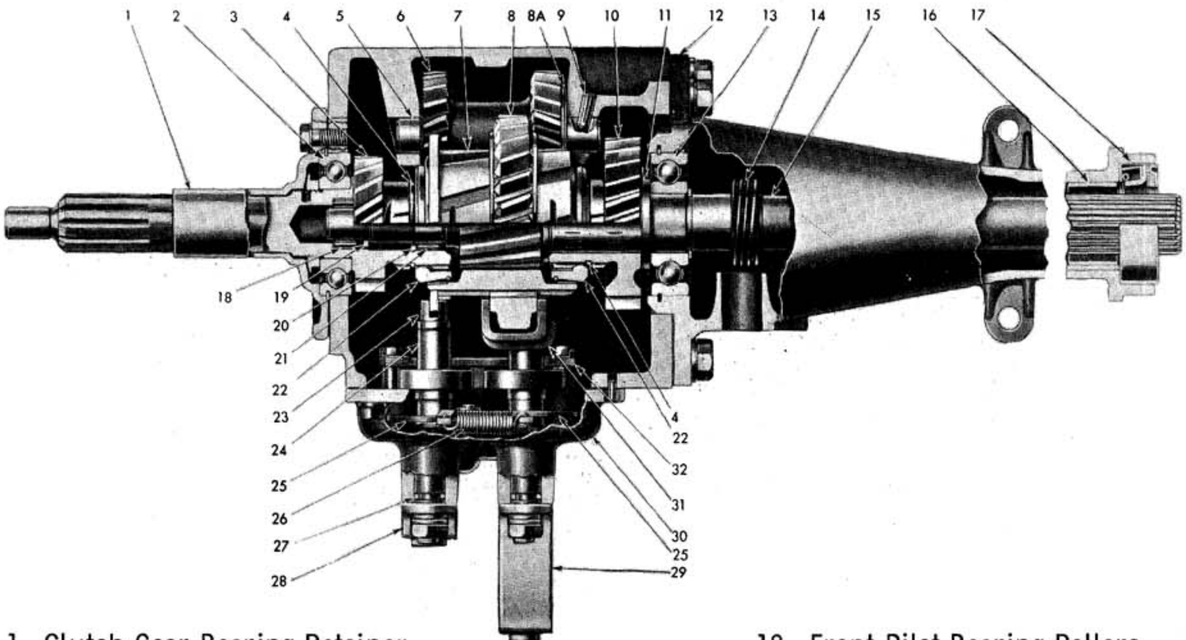
THREE-SPEED TRANSMISSION

GENERAL DESCRIPTION

A three-speed synchromesh transmission (Figs. 7-1 and 7-2) is used as standard equipment. This transmission incorporates all helical gears which are machined from drop forged steel gear blanks, heat treated and shot peened for strength and long life. The shafts are machined from high grade steel, heat treated and ground to close limits.

The rear end of the clutch gear is supported by a heavy-duty ball bearing at the front end of the transmission case and is piloted at its front end in an oil impregnated bushing mounted in the engine crankshaft. The front end of the mainshaft is piloted in a double set of roller bearings set into the hollow end of the clutch gear and the rear end is carried by a ball bearing.

The countergear is carried on roller bearings at both ends while thrust is taken on thrust washers located between each end of gear and the case. Roller bearing thrust washers are installed



1. Clutch Gear Bearing Retainer
2. Clutch Gear Bearing
3. Clutch Gear
4. Energizing Spring
5. Reverse Idler Shaft
6. Reverse Idler Gear
7. Second and Third Speed Clutch
8. First and Reverse Sliding Gear
8a. Thrust Bearing and Washer
9. Reverse Idler Shaft Pin
10. Second Speed Gear
11. Thrust Washer
12. Case Extension
13. Mainshaft Rear Bearing
14. Speedometer Drive Gear
15. Mainshaft
16. Bushing
17. Oil Seal
18. Front Pilot Bearing Rollers
19. Thrust Washer
20. Thrust Washer
21. Rear Pilot Bearing Rollers
22. Synchronizer Ring
23. Second and Third Shifter Fork
24. Second and Third Shifter Shaft
25. Detent Cam
26. Detent Cam Spring
27. "O" Ring Oil Seal
28. Second and Third Shifter Lever
29. First and Reverse Shifter Lever
30. Side Cover
31. First and Reverse Shifter Fork
32. Interlock Retainer
33. Speedometer Shaft Fitting
34. Lock Plate

Fig. 7-1 Three-Speed Synchromesh (Top View)

between the countergear thrust washers and the roller bearings.

The reverse idler gear is carried on needle bearings. Forward thrust of the gear is taken on a washer located between front of gear and the case, and rearward thrust is taken on a radial needle bearing and a washer located between rear of gear and case.

Gearshifting is manual through shift control rods to the transmission cover located on the side of the transmission. Shifting is accomplished by two rotating cranks which directly engage the gears to be shifted, thus affording a highly efficient mechanical action.

MAINTENANCE AND ADJUSTMENTS

SHIFT LINKAGE ADJUSTMENT (Fig. 7-3 through 7-7)

Refer to the appropriate Figures depending on how the car is equipped.

1. Loosen swivels and move both transmission shift levers until transmission is in neutral. Neutral detents in transmission cover must both be engaged to make this adjustment correctly. (To check, rotate propeller shaft with rear wheels raised).

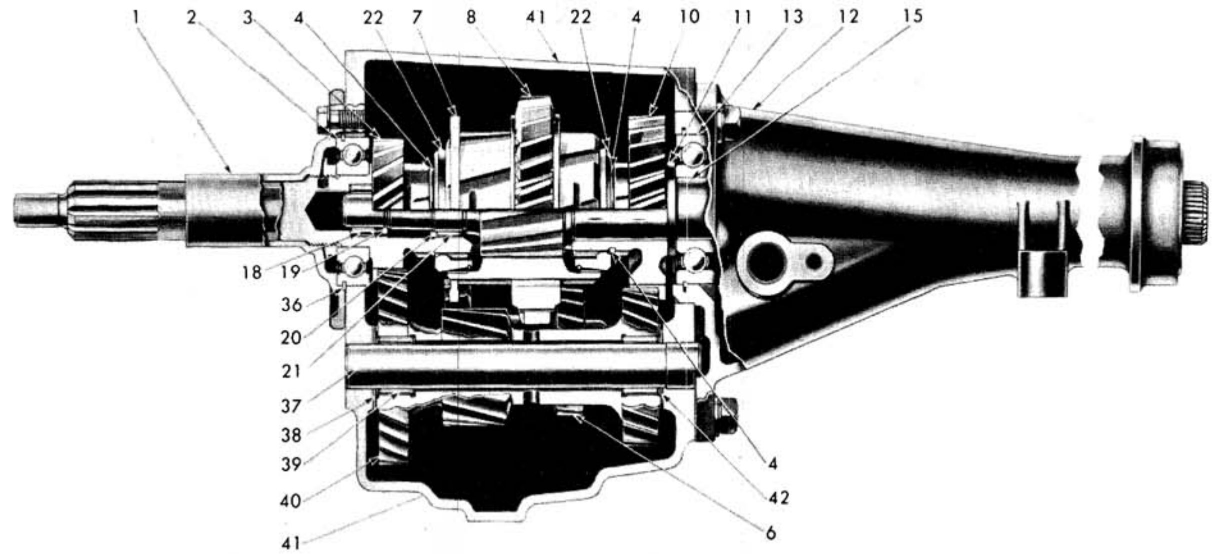


Fig. 7-2 Three-Speed Synchromesh (Side View)

1. Clutch Gear Bearing Retainer
2. Clutch Gear Bearing
3. Clutch Gear
4. Energizing Spring
6. Reverse Idler Gear
7. Second and Third-Speed Clutch
8. First and Reverse Sliding Gear
10. Second-Speed Gear
11. Thrust Washer
12. Case Extension
13. Mainshaft Rear Bearing
15. Mainshaft
18. Front Pilot Bearing Rollers
19. Thrust Washer
20. Thrust Washer
21. Rear Pilot Bearing
22. Synchronizer Ring
36. Snap Ring
37. Countershaft
38. Thrust Washer
39. Roller Bearing
40. Countergear
41. Transmission Case
42. Roller Thrust Washer

2. Move selector lever to neutral position. Align first and reverse shifter lever with the second and third shifter lever. (Fig. 7-7)

3. With shift levers and shifter levers properly aligned in neutral and the shift rods free to slide in the swivels, center the movement of the rods in the swivels and tighten the swivels.

4. Move selector lever through all positions to check adjustment and to insure overtravel in all positions.

   NOTE: If mast jacket lower dash clamp has been disturbed at its mounting on dash, its adjustment to the steering mainshaft should be checked as outlined in the procedure in Section 8 of this manual. Refer to Fig. 8-91.

SPEEDOMETER DRIVEN GEAR

Disconnect speedometer cable, remove lock plate to housing bolt and lockwasher and remove lock plate. Insert screwdriver in lock plate slot in fitting and pry fitting, gear and shaft from housing. Pry "O" ring from groove in fitting.

Install new "O" ring in groove in fitting. Coat "O" ring and driven gear shaft with transmission lubricant and insert shaft.

Hold the assembly so slot in fitting is toward lock plate boss on housing and install in housing. Push fitting into housing until lock plate can be inserted in groove and attach to housing.

REAR BEARING RETAINER OIL SEAL REPLACEMENT

1. Remove propeller shaft and disconnect any necessary items to obtain clearance.

2. Using a punch against exposed end of seal, drive seal out of extension.

3. Wash counterbore with cleaning solvent and inspect for damage.

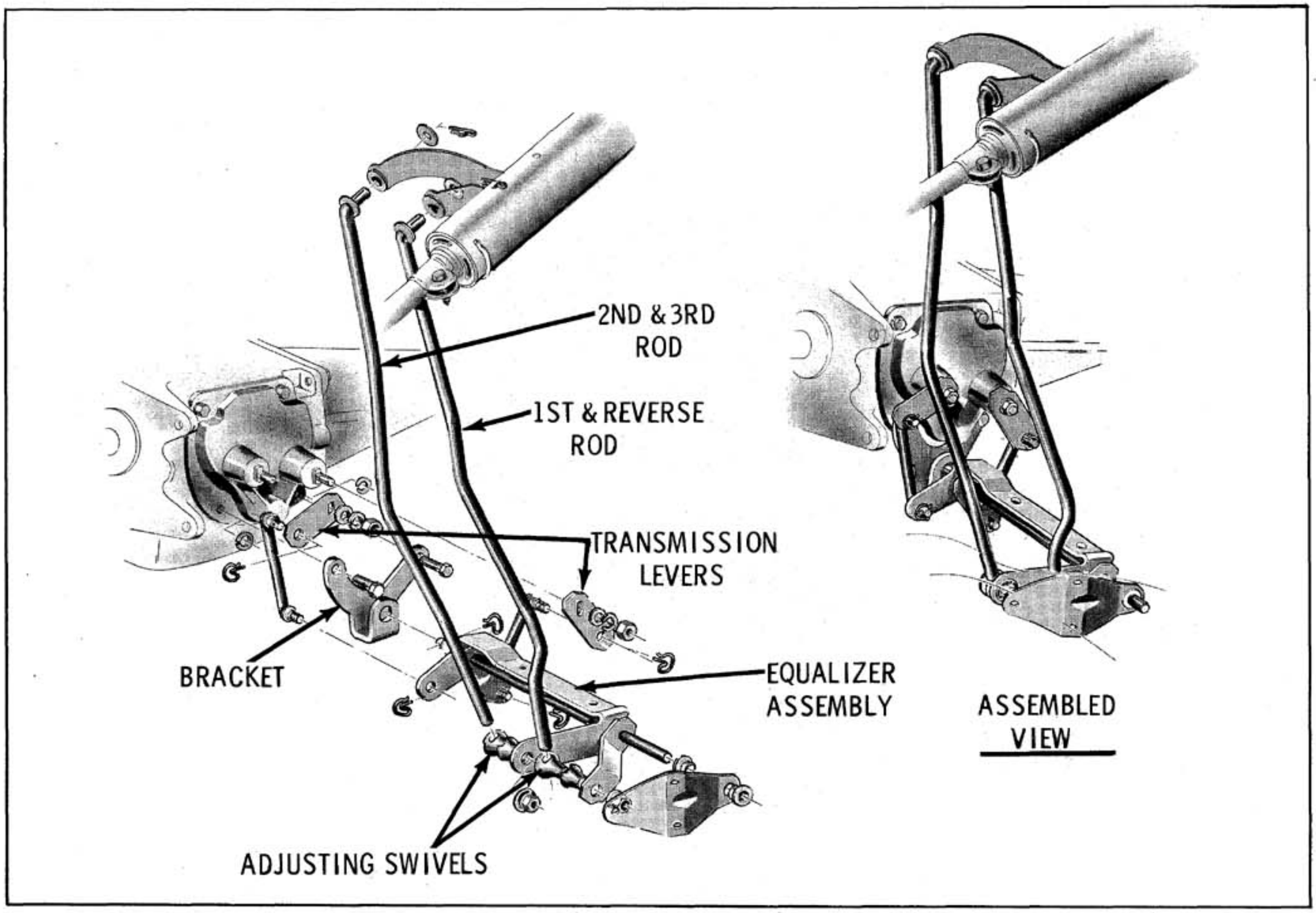


Fig. 7-3 V-6 Column Shift Linkage

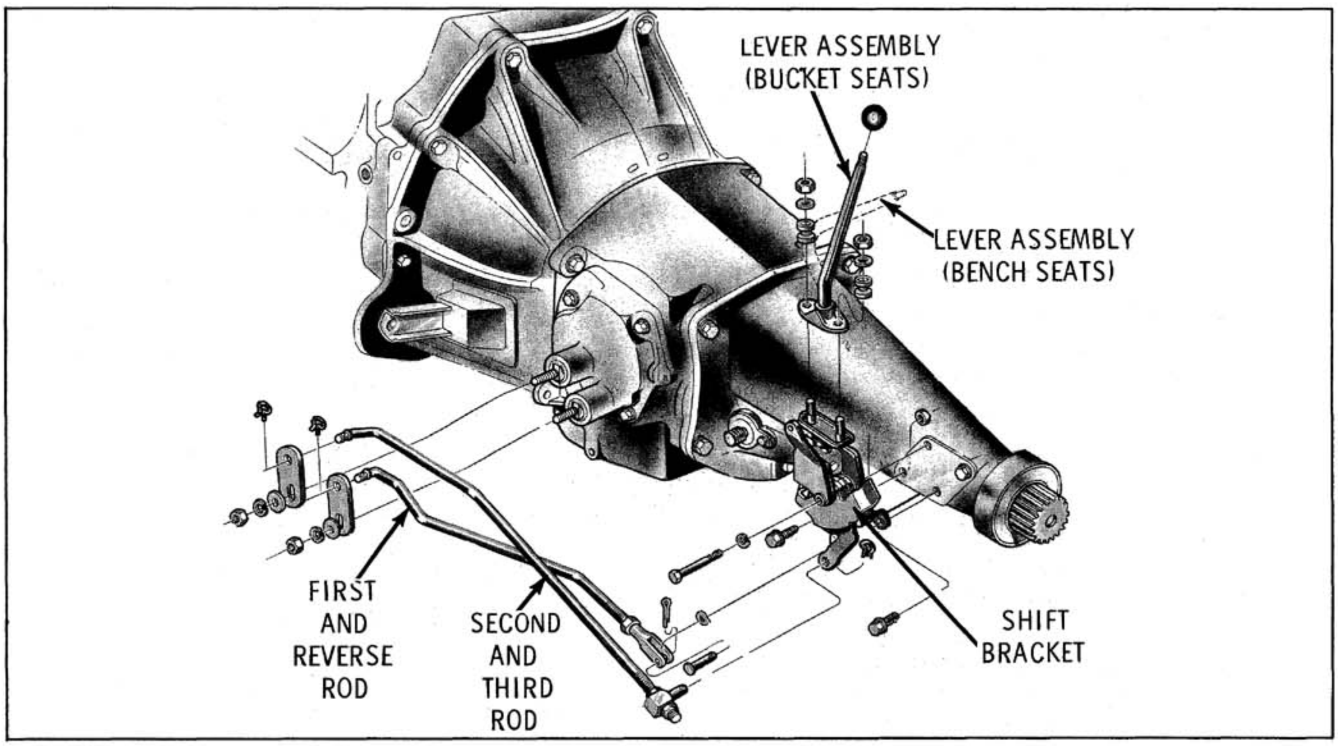


Fig. 7-4 33 Through 38 Series Floor Shift Linkage

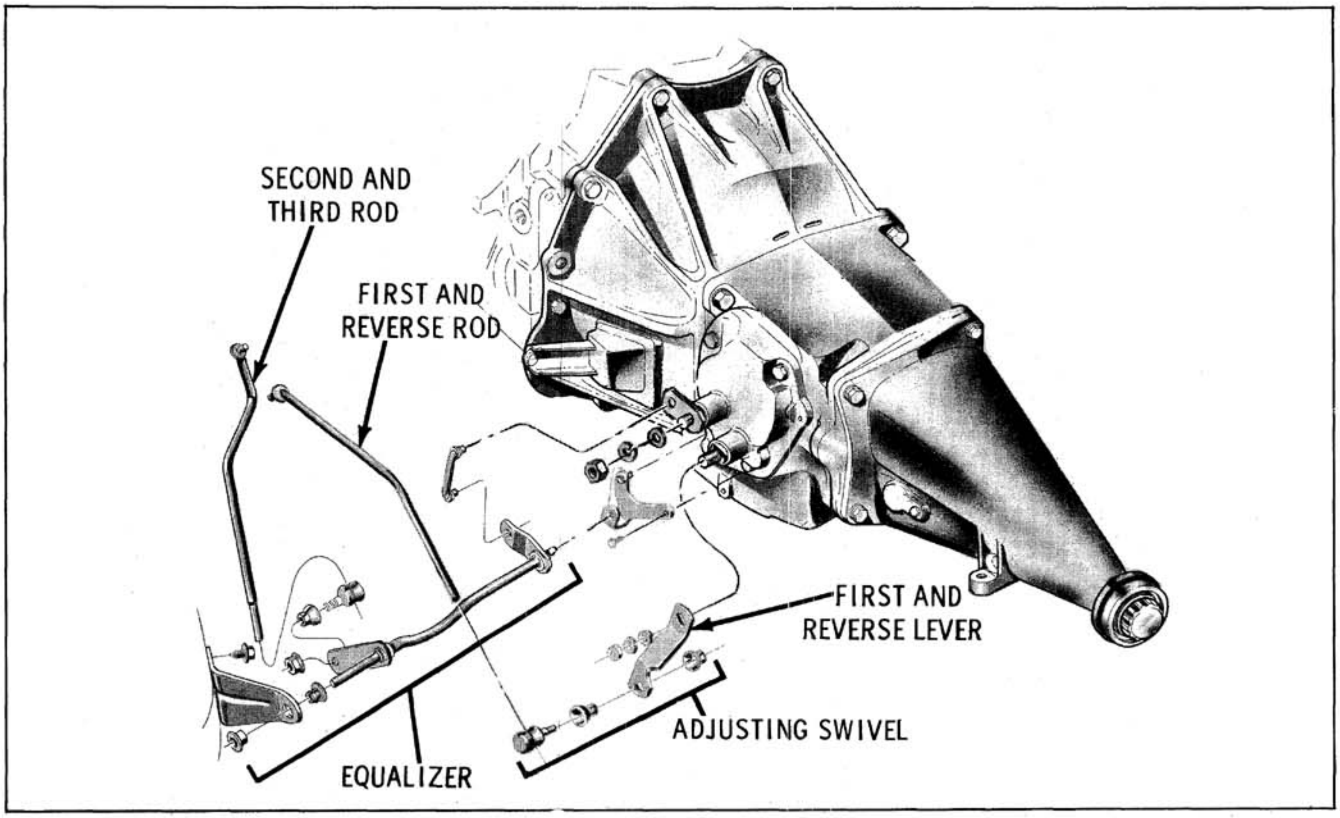


Fig. 7-5 V-8 (57 Series) Column Shift Linkage

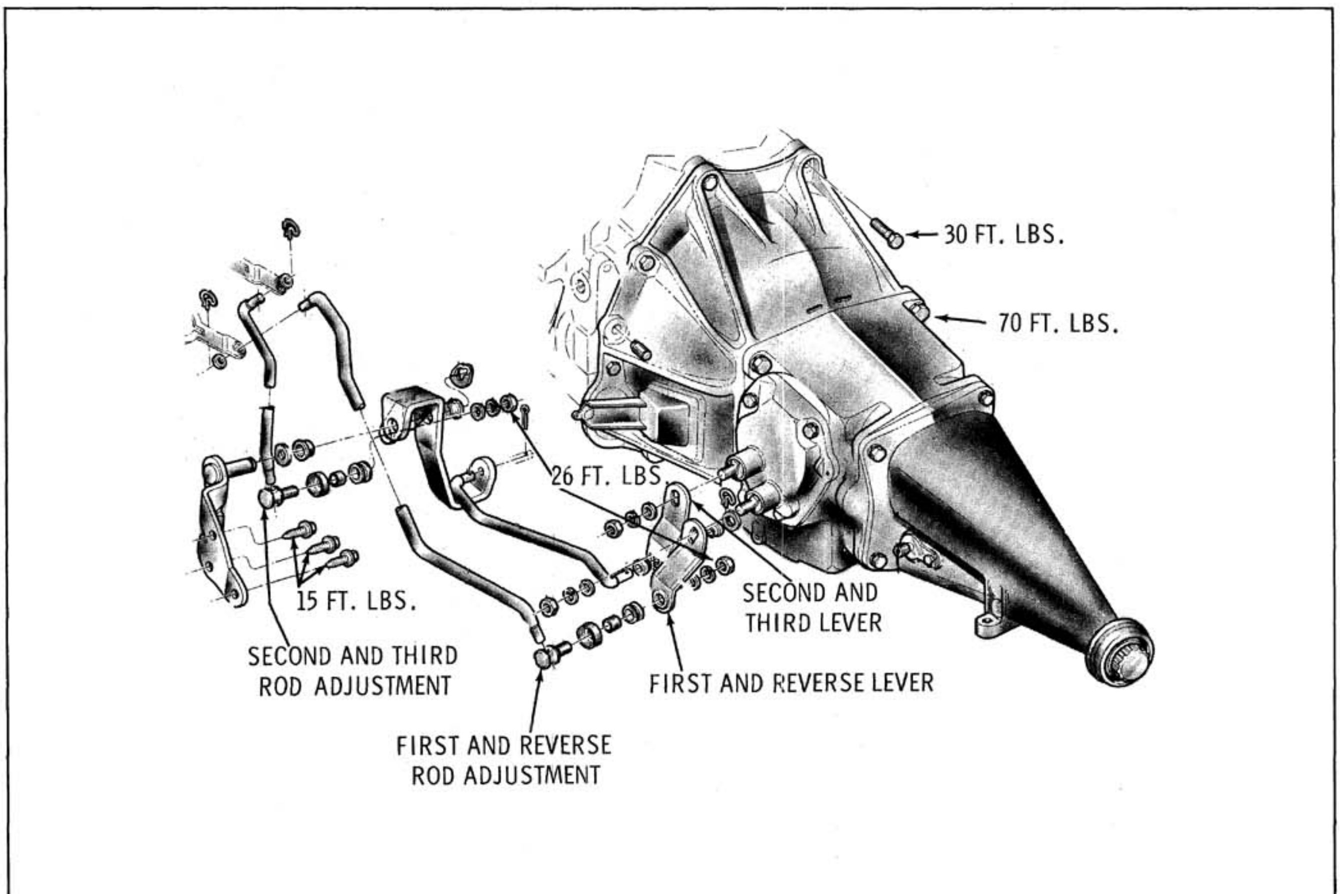


Fig. 7-6 V-8 (34-36 & 38 Series) Column Shift Linkage

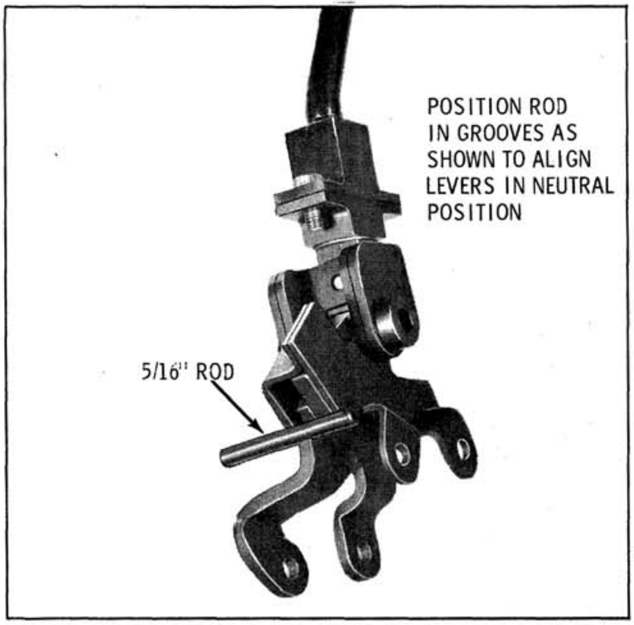


Fig. 7-7A Shift Lever Positioning

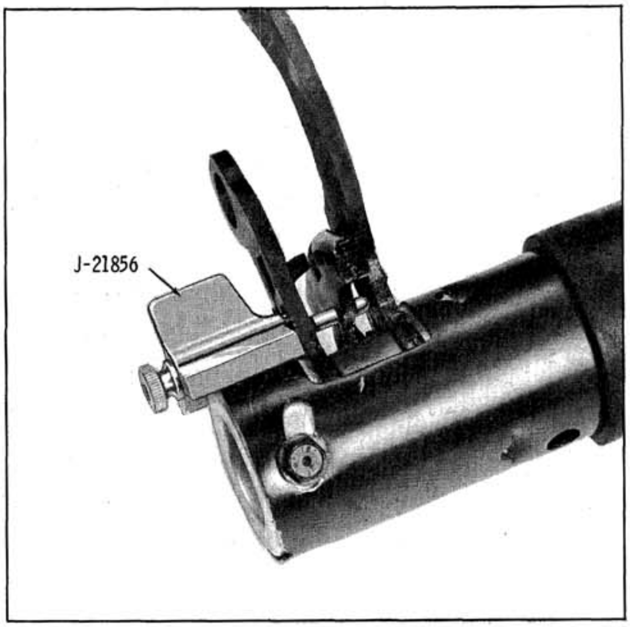


Fig. 7-7B V-6 Shifter Lever Positioning

Fig. 7-7 Shift Linkage Adjustment

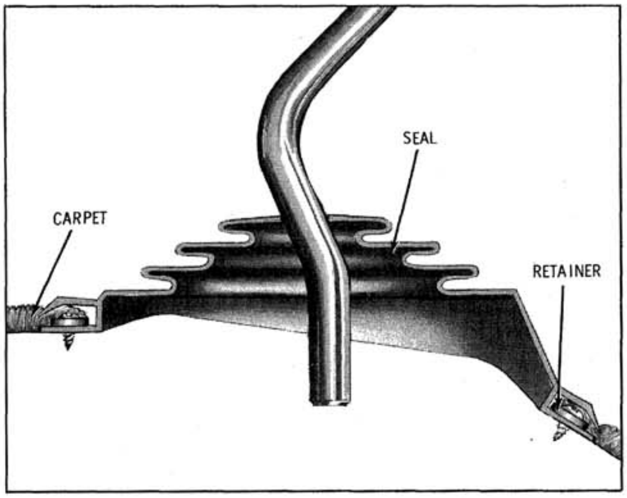


Fig. 7-8 Floor Shift Seal

4. Coat new seal with 1050026 Sealer or equivalent and start straight in bore in rear bearing retainer. Using Tool J-5154, tap seal into counterbore.

5. Reinstall propeller shaft and any items removed to obtain clearance.

TRANSMISSION SIDE COVER

Removal and Installation

1. Disconnect shift rods from levers.

2. Remove cover assembly from transmission case.

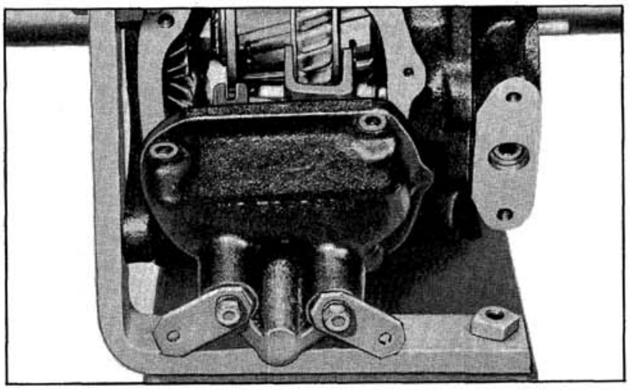


Fig. 7-9 Transmission Side Cover

3. Remove outer shifter lever retainer nuts and washers, and pull levers from shafts.

4. Remove nuts, locks and shifter interlock retainer. This will allow removal of shifter shaft, fork assembly and cam assembly, or interlock, from cover.

5. Replace necessary parts. Coat shifter shaft "O" ring seal with transmission lubricant before installing in cover. Install shifter interlock retainer and bend tabs on locks after installing nuts.

6. Install outer shifter levers, washers and retainer nuts.

7. With transmission gears in neutral and shifter forks in neutral, install cover to transmission using a new gasket. Coat screws with 1050026 Sealer or equivalent. Tighten remaining cap screws to 18 ft. lbs. torque.

NOTE: Hump on first and reverse shifter fork (Fig. 7-12) must be toward rear of transmission.

8. Attach shift rods to shifter levers.

9. Fill transmission with transmission lubricant as specified in Section 2 to level of filler plug.

MAJOR SERVICE OPERATIONS

Removal

1. Raise car.

2. Remove propeller shaft.

   a. Column Shift - Disconnect shift rods from shift levers.

   b. Floor Shift - Remove shift lever knob and disconnect back-up lamp wiring if so equipped.

3. Install Engine Support Bar BT-6424.

4. Remove cross support bar-to-rear transmission mount attaching bolts.

5. Disconnect parking brake cables from cross support and remove cross support bar.

   NOTE: If equipped with dual exhaust, it may be necessary to disconnect the left hand exhaust pipe at the exhaust manifold to provide clearance.

6. Disconnect speedometer cable (33 through 38 series).

7. Remove four transmission to engine attaching bolts.

8. Carefully slide transmission rearward and remove from car.

Installation

1. Inspect clutch pilot bushing and lubricate with wheel bearing grease.

2. Reverse removal procedure, using the following specified torque ratings for the attaching parts:

a. Transmission to engine	70 ft. lbs.
b. Shift lever assembly to extension housing	30 ft. lbs.
c. Exhaust pipe to exhaust manifold	18 ft. lbs.
d. Cross support bar brackets to frame	40 ft. lbs.
e. Cross support bar to rear transmission mount	45 ft. lbs.
f. Propeller shaft U-bolt nuts	16 ft. lbs.

Disassembly

1. Remove the capscrews from the transmission side cover and remove the cover and gasket.

   NOTE: Under ordinary circumstances it is not necessary to disassemble the cover assembly. Servicing of cover is outlined on the preceding page.

2. Remove extension to transmission case bolts and lockwashers and pull extension and mainshaft out of transmission case, leaving second and third-speed clutch assembly and first and reverse gear in case. Do not force mainshaft. Rotate mainshaft and second and third-speed clutch gear to obtain alignment of clutching teeth and splines. (Fig. 7-10)

3. Slide first and reverse gear from clutch sleeve, then remove them separately through side opening in transmission case.

4. Remove pilot bearing rollers from clutch gear.

5. Remove the four clutch gear bearing retainer screws, shakeproof washers and remove the retainer. Note the screw holes in the retainer are unevenly spaced so the retainer may be assembled to the case in only one position, matching up the oil return slot with the hole in the case.

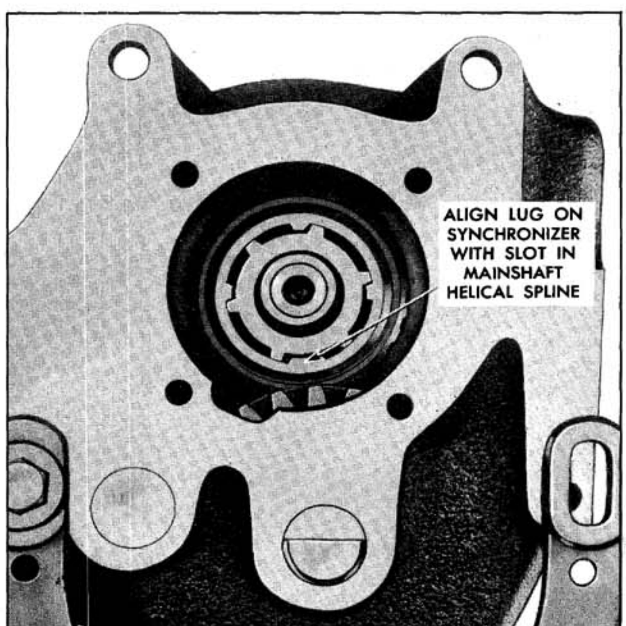


Fig. 7-10 Synchromesh Alignment

6. Remove the countershaft by driving it from front to rear of the case, using a soft steel drift. Lower the countergear to bottom of case.

   NOTE: It is necessary to lower the countergear before removing the clutch gear and bearing, otherwise the bearing will strike the countergear.

7. Remove clutch gear bearing snap ring. Tap end of shaft with soft hammer to move gear and bearing assembly into case and remove through rear of case.

8. Remove the countergear, rollers and thrust washers from case.

9. Drive the idler shaft lock pin into the shaft. This pin is shorter than the diameter of the shaft so the shaft may be slipped out when the pin is driven in.

10. Using a drift pin, tap rear of shaft to drive out plug ahead of shaft. Do not turn the shaft while removing, as the lock pin may drop down between the idler gear bushings.

11. Remove reverse idler gear, thrust washer, thrust bearing and bearing washer.

12. To remove mainshaft from extension, expand bearing snap ring and tap rear of shaft with a soft hammer to bring shaft, speedometer drive gear, second-speed gear and bearing, as an assembly, forward out of extension. (Fig. 7-11)

CLEANING AND INSPECTION

Bearings

1. Wash the bearings thoroughly in a cleaning solvent.

2. Blow out the bearings with compressed air.

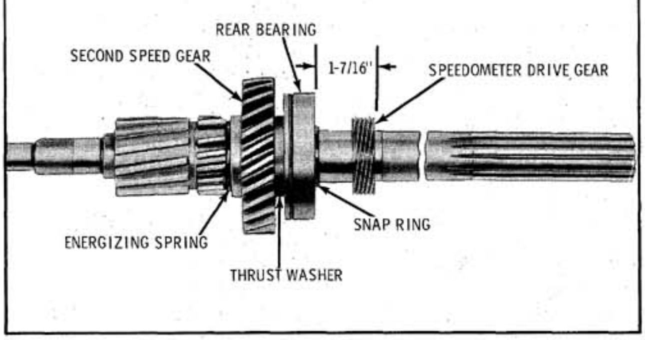


Fig. 7-11 Mainshaft Assembly

CAUTION: Do not allow the bearings to spin, but turn them slowly by hand. Spinning bearings will damage the race and balls.

3. After making sure the bearings are clean, lubricate them with light engine oil and check them for roughness. Roughness may be determined by slowly turning the outer race by hand.

Transmission Case and Extension

Wash the transmission case and extension inside and outside with a cleaning solvent and inspect for cracks. Inspect the faces for burrs and, if any are present, dress them off with a fine cut mill file. Inspect oil seal, bushing and snap ring in extension and, if worn or damaged, replace as outlined under REPAIRS.

Gears

1. Inspect all gears and, if necessary, replace any that are worn or damaged.

2. Check the first and reverse sliding gear to make sure it slides freely on clutch sleeve.

3. Check the clutch sleeve to see that it slides freely on mainshaft.

Reverse Idler Gear Bearings (Fig. 7-12)

Needle bearings are used between the idler gear and shaft. This insures the positive alignment of the gear and shaft, as well as proper meshing of the gears.

Inspect bearings and shaft for excessive wear and replace as necessary.

Countergear Needle Bearings

All countergear needle bearings should be inspected closely and, if excessive wear shows, they should all be replaced as well as the shaft.

REPAIRS

Mainshaft, Rear Bearing, Second-Speed Gear and Speedometer Drive Gears (Fig. 7-12)

1. Press speedometer drive gear off mainshaft, using suitable split plates in an arbor press.

2. Remove bearing to mainshaft snap ring and press bearing off shaft.

3. Remove second-speed gear thrust washer and second-speed gear.

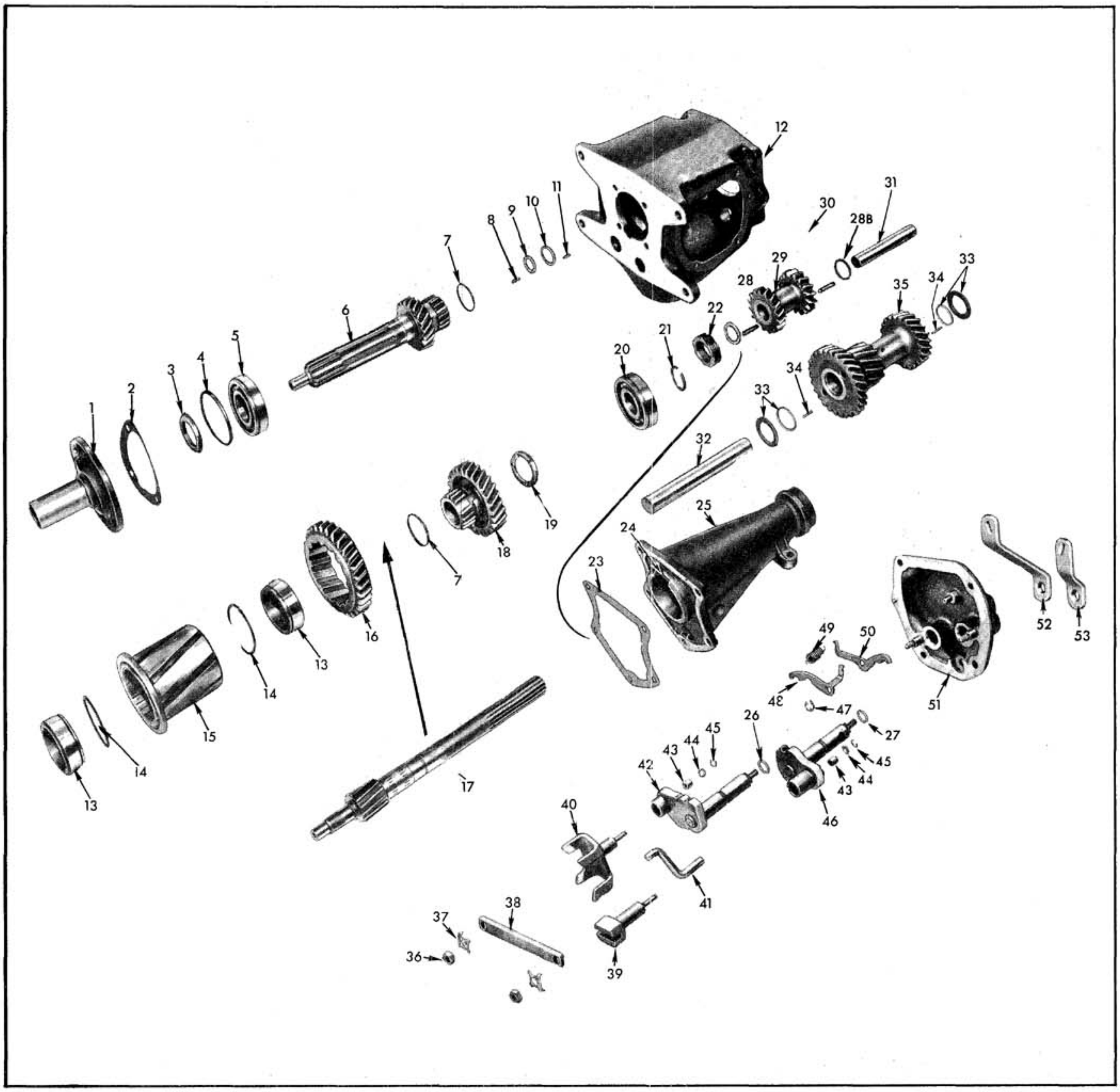


Fig. 7-12 Layout of Transmission Parts

1. Clutch Gear Bearing Retainer
2. Bearing Retainer Gasket
3. Bearing Nut and Oil Slinger
4. Bearing Snap Ring
5. Clutch Gear Bearing
6. Clutch Gear
7. Energizing Spring
8. Front Pilot Bearing Roller
9. Thrust Washer
10. Thrust Washer
11. Rear Pilot Bearing Rollers
12. Transmission Case
13. Synchronizer Ring
14. Snap Ring
15. Second and Third-Speed Clutch
16. First and Reverse Sliding Gear
17. Mainshaft
18. Second-Speed Gear
19. Thrust Washer
20. Mainshaft Rear Bearing
21. Snap Ring
22. Speedometer Drive Gear
23. Case Extension Gasket
24. Rear Bearing Snap Ring
25. Case Extension
26. First and Reverse Shifter Shaft "O" Ring
27. Second and Third Shifter Shaft "O" Ring
28. Thrust Washer
28a. Thrust Bearing
28b. Thrust Bearing Washer
29. Reverse Idler Gear
30. Reverse Idler Shaft Pin
31. Reverse Idler Shaft
32. Countershaft
33. Countergear and Roller Thrust Washers
34. Bearing Roller
35. Countergear
36. Shifter Interlock Retainer Stud Nut
37. Shifter Interlock Retainer Stud Nut Lock
38. Shifter Interlock Retainer
39. Second and Third Shifter Fork
40. First and Reverse Shifter Fork
41. Shifter Interlock Shaft
42. First and Reverse Shifter Shaft and Plate Assembly
43. Shifter Fork Spacer
44. Shifter Fork Washer
45. Shifter Fork Retainer
46. Second and Third Shifter Shaft and Plate Assembly
47. Detent Cam Retainer
48. First and Reverse Detent Cam
49. Detent Cam Spring
50. Second and Third Detent Cam
51. Side Cover
52. First and Reverse Shifter Lever (Outer)
53. Second and Third Shifter Lever (Outer)

4. Coat bore with transmission lubricant and slide second-speed gear on mainshaft and install thrust washer with oil grooves toward gear.

5. Install new rear bearing, groove in OD of bearing toward second-speed gear.

6. Select one of four available snap rings so end play of bearing on shaft is a maximum of .004". This may be easily determined by installing successively larger rings. Use the thickest ring that will enter snap ring groove on shaft.

7. Start speedometer drive gear on shaft with chamfered ID of gear toward bearing. Press gear on shaft until rear face of gear is 1-7/16" from face of bearing.

Clutch Gear Bearing

1. Place the clutch gear in a vise with soft jaws and remove the bearing retainer nut and oil slinger, using Tool J-0933. (Fig. 7-13) The retaining nut and oil slinger is a one-piece steel casting machined with a left-handed thread and is locked in place on the clutch gear shaft by being staked into a hole provided for that purpose. Drill out staking before removing nut.

2. Install gear and bearing in transmission case and install snap ring on bearing.

3. Support rear of case in arbor press as shown in Fig. 7-14 and press shaft from bearing. Tap bearing from case.

4. Using an arbor press, press the clutch gear bearing on the clutch gear with the locating ring groove toward the front of the gear shaft.

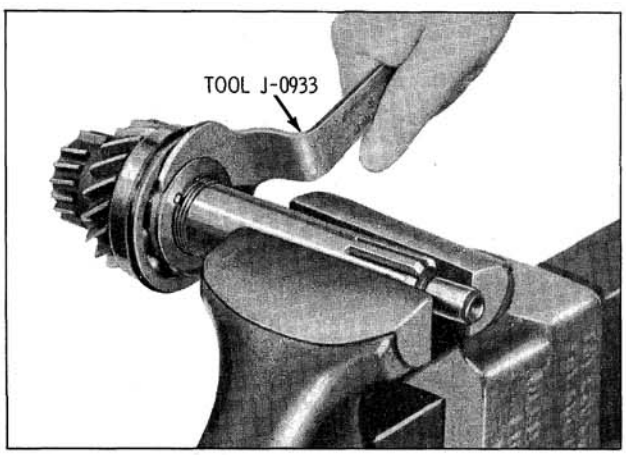


Fig. 7-13 Removing Bearing Retainer Nut and Oil Slinger

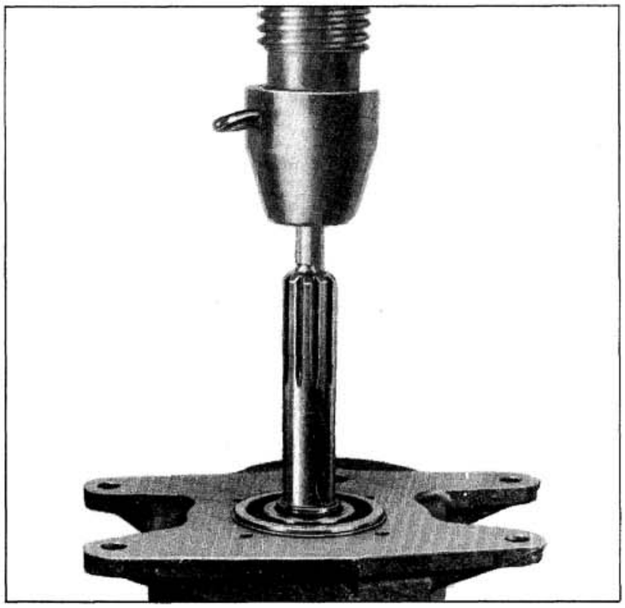


Fig. 7-14 Removing Clutch Gear from Bearing

5. Install the combination clutch bearing retaining nut and oil slinger on the clutch gear shaft and draw it up tight, using Tool J-0933.

6. Lock the retaining nut oil slinger in place by staking it into the hole with a center punch. Care must be used not to damage the threads on the shaft.

CAUTION: The bearing must turn as freely after it is installed to the shaft as it turned before being placed on the shaft.

Clutch Sleeve and Synchronizer Rings

1. Remove the first and reverse sliding gear.

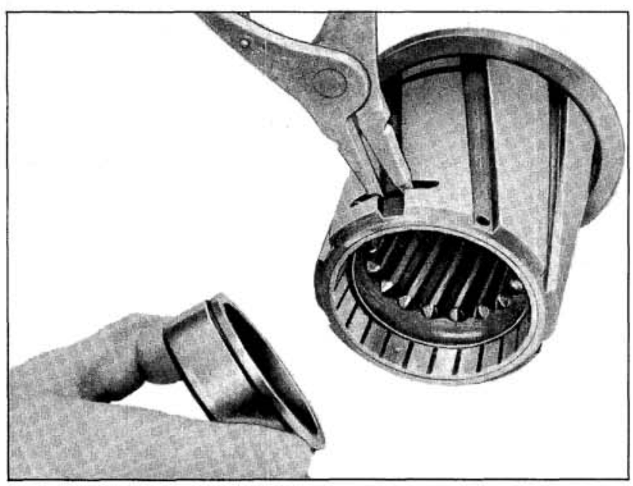


Fig. 7-15 Removing Synchronizer Ring

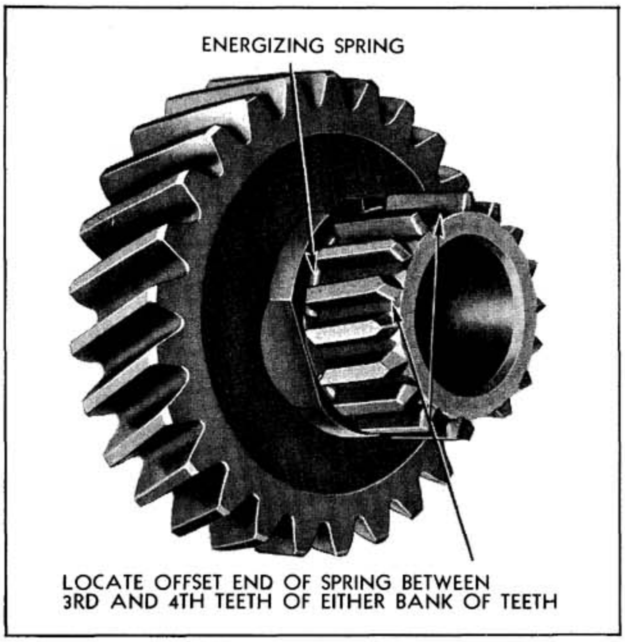


Fig. 7-16 Position of Energizing Spring

2. Turn the synchronizer ring in the clutch sleeve until the ends of the synchronizer ring retainer can be seen through the slot in the clutch sleeve.

3. Using Tool J-0932, expand the retainer into the counterbore in the clutch sleeve. This raises the retainer from the groove in the ring so ring may be easily slipped out. (Fig. 7-15)

4. Check the synchronizing cones for wear or for being loose in the clutch sleeve. If cones are damaged in any way, it will be necessary to replace the clutch sleeve assembly and both synchronizer rings.

5. Inspect the synchronizer rings for smoothness.

6. Place the synchronizer rings in the synchronizing cones and check with thumbs to see that rings do not rock. Excessive rocking indicates a poor fit between the rings and cone, which will not permit proper synchronizing of gears during shifting.

7. Install the synchronizer ring retainers in the counterbores in the ends of the clutch sleeve.

8. Using Tool J-0932 in slot in clutch sleeve, expand each retainer in the counterbore, lubricate each synchronizer ring with light oil and install in clutch sleeve.

   NOTE: Make sure retainers seat in groove all the way around the rings so rings will turn freely.

9. Install the first and reverse sliding gear on the clutch sleeve.

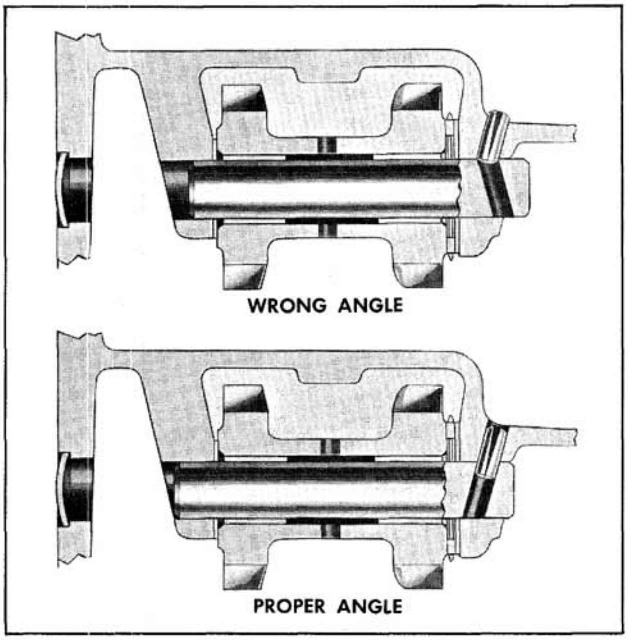


Fig. 7-17 Reverse Idler Gear Shaft and Lock Pin

Synchronizer Energizing Springs

1. It will be noticed upon examining these springs that one of the ends is slightly offset. Each spring must be assembled in its groove in the clutch gear and the second-speed gear with the offset or locking end between the third and fourth teeth of either of the two banks of teeth on these gears, thus keeping the spring from turning in its groove. (Fig. 7-16)

2. Under normal operation it should never be necessary to replace the energizing springs; however, should an energizing spring be removed for any reason, a new spring should be installed. The spring may be removed by slipping a thin blade under the spring and raising it sufficiently to slide it off over the gear teeth.

Transmission Case Extension Oil Seal, Bushing and Mounting Block

If bushing in rear of extension requires replacement, remove oil seal and use Tool J-5778 to drive bushing into case extension. Using the same tool, drive new bushing in from rear until end of bushing is slightly below counterbore for oil seal. Coat ID of bushing with transmission lubricant, then install new oil seal using Tool J-5154.

If extension or mounting block is to be replaced, remove mounting block to extension bolts and washers.

To install mounting block to extension, install two bolts and washers and tighten bolts.

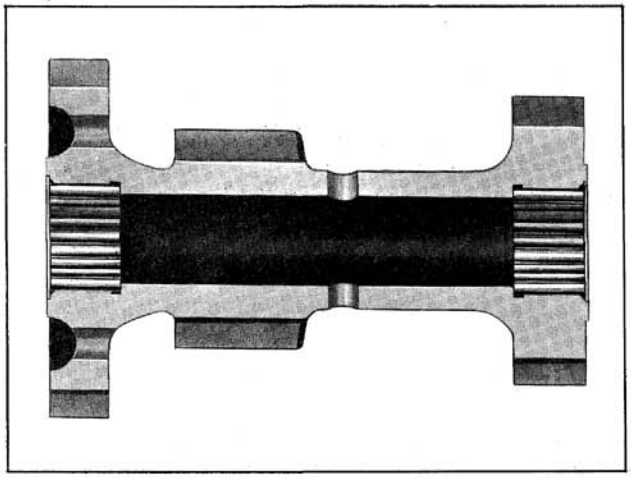


Fig. 7-18 Countergear and Rollers

Assembly

Reverse Idler Gear

1. Coat thrust washers and the needle thrust bearing with grease and position them on gear; needle bearing against end with chamfered gear teeth; large washer against bearing; small washer at opposite end of gear. (Fig. 7-17) Coat bushings with wheel bearing grease.
2. Place gear assembly in position in case so thrust bearing is toward rear.
3. Install the idler shaft, making sure the lock pin hole in the shaft lines up with the hole in the case at the same angle.
4. Use a new idler shaft lock pin, coat the pin with 1050026 Sealer and drive it in approximately 1/16" beyond flush with case; peen the hole slightly. This lock pin must be a tight fit in the case to prevent oil leaks.
5. Install 2 new idler shaft expansion plugs in the case.

Countergear and Clutch Gear

1. Place some cup grease in the roller bearing area of each end of the countergear and install the 25 rollers in each end. The grease will hold the rollers in place while installing. (Fig. 7-18)
2. Insert Tool J-5777 in countergear.
3. Apply grease to bearing thrust washers and countergear thrust washers and place one of each at each end of countergear.
4. Insert the countergear (with Tool J-5777) in transmission case and rest it on bottom of case.

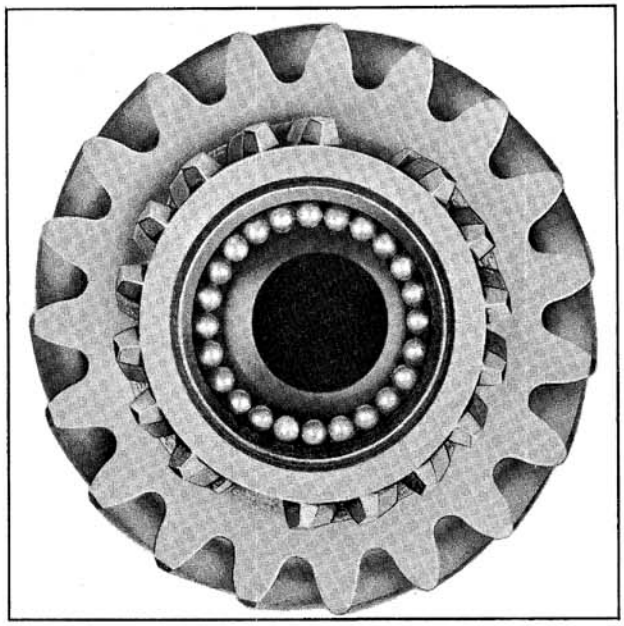


Fig. 7-19 Mainshaft Pilot Roller Bearings

5. Place some grease in the mainshaft pilot hole in the clutch gear and install the roller bearings. (Fig. 7-19) Install the 14 group and

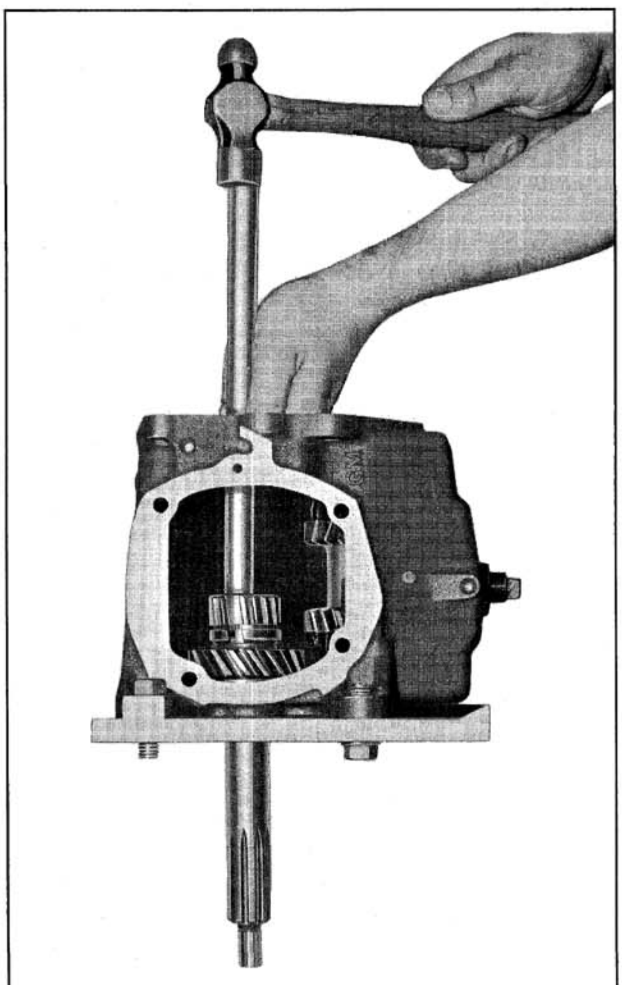


Fig. 7-20 Installing Clutch Gear and Bearing

small ID spacer, then the large ID spacer and the 24 group.

After being assembled in the pilot hole, care must be taken in handling to avoid misplacing rollers.

6. Insert clutch gear in case from inside case and using a brass drift, tap the outer race of the clutch gear bearing until the bearing locating ring groove is outside the front of the case, being careful to drive the assembly straight to prevent damage. (Fig. 7-20)

7. Install snap ring on bearing and tap clutch gear rearward until snap ring is firmly against case.

8. Install the clutch gear bearing retainer and gasket, making sure the oil slot in the retainer lines up with the oil slot in the front face of the transmission case. Do not allow the gasket to protrude beyond the edge of the retainer.

9. Coat the retainer screws with 1050026 Sealer and install in retainer, using the special shakeproof washers. Tighten the retaining capscrews 15 ft. lbs. torque.

10. Lubricate and insert countershaft in rear of case, align countergear with shaft and tap shaft through, pushing assembly tool out front of case. (Fig. 7-21)

11. Turn countershaft so flat on end of shaft is horizontal.

    NOTE: The flat on shaft must be horizontal at the bottom or the transmission case extension cannot be assembled to transmission case.

12. Make sure front end of shaft is in line with hole in front of case and drive shaft into case until flat on shaft is flush with rear of case.

Clutch Sleeve

Assemble first and reverse gear on the clutch assembly. Insert both pieces into the side opening of the case by tipping the front end of the assembly into the opening first. Align the lug of the synchronizing ring with the synchronizing slot of the clutch gear, and position the assembly on gear to receive the mainshaft.

Mainshaft

1. Install the mainshaft assembly in the transmission case extension.

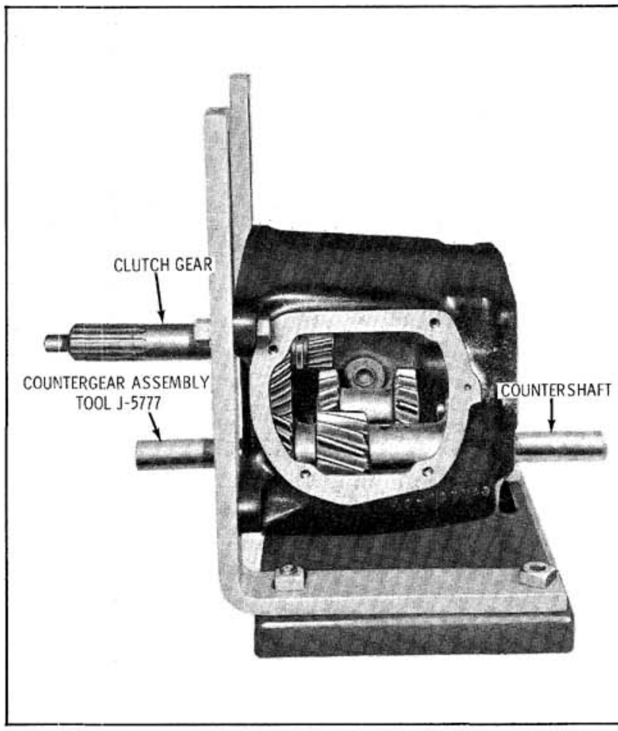


Fig. 7-21 Assembly of Countershaft

2. Install clutch gear rear roller spacer on mainshaft making sure chamfered ID is toward rear.

3. Install gasket on transmission case.

4. Align lugs on synchronizer rings with slots in mainshaft so lugs on the synchronizer rings slide in slots on gear. Check clutch gear to make sure rollers are still in position. Push the shaft into the clutch sleeve until transmission case extension is tight against case. Install bolts and lockwashers.

   NOTE: The extension lower bolt should be coated with 1050026 Sealer before installation. Torque to 45 ft. lbs.

   CAUTION: Keep mainshaft in line with clutch gear during installation to avoid disrupting rollers in clutch gear.

TRANSMISSION ALIGNMENT

If transmission slips out of high gear, particularly at 50 mph and up, after all other probable causes have been corrected as outlined under TROUBLES AND REMEDIES, the alignment of the engine crankshaft pilot, clutch housing bore and the transmission should be checked.

A special tool on which is mounted a dial indicator is necessary to check the transmission rear bearing bore alignment. This tool may be made from a new, or good used, clutch gear which has a good bearing surface on the crankshaft pilot and front main bearing.

The splines on the clutch gear shaft should be ground off so the shaft may be rotated in a clutch disc hub without interference when assembled in the car. Weld a piece of 1/4" rod 8" long in the mainshaft pilot bore. Assemble a good bearing on the shaft and secure it with clutch gear bearing nut.

Procedure

1. Remove the transmission from the car and completely disassemble as outlined.

   NOTE: In any case where the clutch gear pilot or pilot bearing is excessively loose or worn, the pilot bearing should be replaced before checking the transmission rear bearing bore alignment by the dial indicator method.

2. Install the case extension on the case and tighten the extension-to-case bolts securely.

3. Carefully install the special tool with the dial indicator into the transmission case with the face of the indicator and the tracing finger to the rear of the transmission. Secure in place with a clutch gear bearing retainer.

4. Carefully rotate the gear and make final adjustment of the indicator with the tracing finger of the indicator pointing to the rear and in the center of the rear bearing bore in the case extension.

5. Assemble the transmission case to the clutch housing and tighten the four transmission mounting bolts securely.

   NOTE: Be sure to clean off any paint or other foreign material on the mating faces of the clutch housing and transmission as any foreign material on these faces will change alignment; also, check carefully for dings or burrs on these mating surfaces and remove carefully as necessary.

6. Install transmission support and support to transmission mounting block bolts.

7. Remove the jack or other support from under the engine and let the weight of the engine rest on the transmission mounting in the normal position.

8. Dial indicate the transmission rear bearing bore and record the indicator readings in the 12, 3, 6 and 9 o'clock positions, with the weight on the transmission mounting as outlined above.

   NOTE: Start the reading at the 6 o'clock position then record the 9, 12 and 3 o'clock readings.

9. Install temporary shims between the transmission case and the clutch housing at the bolt locations as necessary to bring misalignment at the transmission rear bearing bore to a maximum of .010" indicator reading in either the vertical or horizontal plane.

   NOTE: Installation of a .002" shim between the transmission case and the clutch housing at two bolt locations opposite to the high indicator reading will change the transmission rear bore reading approximately .003" to .004".

10. After the position and quantity of shims has been determined and recorded, transmission case may be removed.

    NOTE: The clutch housing should then be marked, showing the position where shims are to be installed and the thickness of shims at each location.

11. Inspect the clutching teeth of the clutch gear. Inspect the second and third-speed clutch gear and the internal clutching teeth on the high gear (forward end). If the teeth of either gears are worn or tapered due to long continued previous disengagement, the gears should be replaced. Reassemble transmission.

12. Install the transmission assembly to the clutch housing, using the correct number of shims at the proper locations as previously determined.

DIAGNOSIS

CONDITION AND PROBABLE CAUSE

Slips Out of High Gear

Transmission loose in clutch housing.

Control rods interfere with engine mounts or check throw-out lever.

Slips Out of High Gear (Cont'd)

Control linkage does not work freely, binds. Torque reactions of engine should not cause the lever on transmission to move. The movement of transmission with respect to body and frame should be transferred to the control linkage.

Does not fully engage.

DIAGNOSIS (Cont'd)

Slips Out of High Gear (Cont'd)

Measure length of engagement pattern on clutching teeth. If less than 7/64", check for bent levers, shifter shafts, detent cam plates, control rods and other shift linkage.

Damaged mainshaft pilot bearing,

Clutch gear bearing retainer broken or loose.

Dirt between transmission case and clutch housing.

Misalignment of transmission. Refer to TRANSMISSION ALIGNMENT under MAJOR SERVICE OPERATIONS.

Slips Out of Low and/or Reverse

First and/or Reverse gears damaged from operating during partial engagement.

Determine cause, for example, worn shift fork and control lever or rod interference. Replace worn or bent parts.

Improper mated splines on inside of first and reverse gear and/or external spline on second and third clutch sleeve.

Replace second or third-speed clutch sleeve and/or first and reverse sliding gear. Possible correction is to change index of gear on clutch sleeve approximately 180° and/or turning the rear side of first and reverse gear to the front of the transmission.

Improperly adjusted linkage.

Noisy in All Gears

Insufficient lubricant.

Worn countergear bearings.

Worn or damaged clutch gear and countershaft drive gear.

Damaged clutch gear or mainshaft ball bearings.

Damaged speedometer gears.

Noisy in High Gear

Damaged clutch gear bearing.

Damaged mainshaft bearing.

Damaged speedometer gears.

Noisy in Neutral with Engine Running

Damaged clutch gear bearing.

Damaged mainshaft pilot bearing roller.

Noisy in All Reduction Gears

Insufficient lubricant.

Worn or damaged clutch gear or countergear.

Noisy in Second Only

Damaged or worn second-speed constant mesh gears.

Worn or damaged countergear rear bearings.

Noisy in Low and Reverse Only

Worn or damaged first and reverse sliding gear.

Damaged or worn countergear.

Worn or damaged reverse idler gear.

Worn reverse idler gear busings.

Damaged or worn reverse countergear.

Excessive Backlash in Second Only

Second-speed gear thrust washer worn.

Mainshaft rear bearing not properly installed in case.

Worn countergear rear bearing.

Excessive Backlash in All Reduction Gears

Worn countergear bearings.

Excessive end play in countergear.

Leaks Lubricant

Excessive amount of lubricant.

Loose or broken clutch gear bearing retainer.

Clutch gear bearing retainer gasket damaged.

Cover loose or gasket damaged.

Operating shaft seal leaks.

Idler shaft expansion plugs loose.

Countershaft loose in case.

Lack of sealant on bolts.

Worn extension oil seal.

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THREE-SPEED TRANSMISSION
54-56-58 SERIES

CONTENTS OF SECTION

SYNCHROMESH TRANSMISSION

PERIODIC MAINTENANCE

The lubricant level should be checked at each engine oil change interval and if found to be below the filler plug level, add SAE 80 (preferred) or SAE 90 Multi-Purpose Gear Lubricant. Periodic or seasonal change of lubricant is not recommended.

SHIFT LINKAGE

The shift linkage is attached as shown in Fig. 7-30. To adjust, proceed as follows:

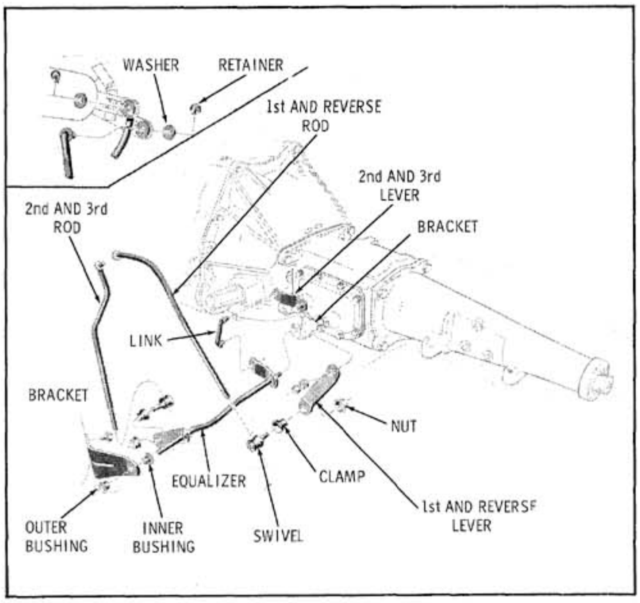


Fig. 7-29 Transmission Linkage (1st Type)

1. Position the transmission in neutral.

2. Loosen the swivel nuts on the shift rods at the transmission. Be sure shift rods are free to move in the swivels.

3. Loosen the knurled nut on Tool J-21856 and position base of tool in the slot provided in the mast jacket so that the alignment rod enters the holes in the first and reverse lever and the interlock pawl. (Fig. 7-31) Tighten the knurled nut.

4. With the transmission levers in the neutral position, tighten the swivel nuts to 26 ft. lbs. torque.

5. Loosen the knurled nut and remove Tool J-21856. Make sure the neutral positions between first and reverse and second and

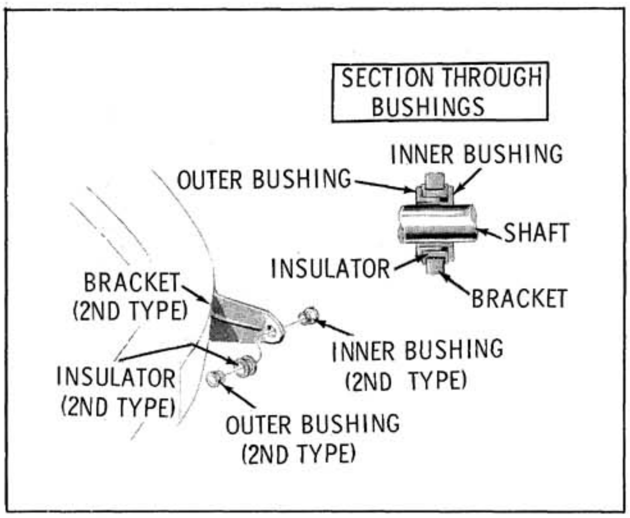


Fig. 7-30 Linkage Attachment (2nd Type)

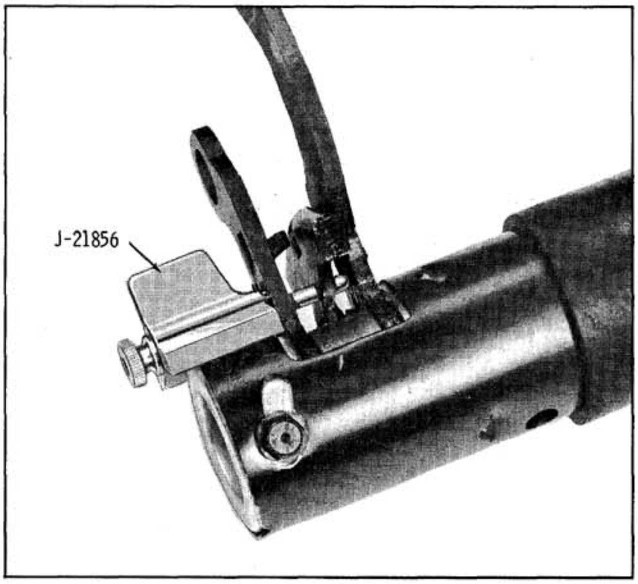


Fig. 7-31 Linkage Adjustment

third are exactly in line. If not, readjust one rod to bring them in line.

6. Check shift pattern with the engine OFF. Then start engine and recheck shift pattern.

REAR BEARING RETAINER OIL SEAL

Remove and Install (With Propeller Shaft Removed)

1. Remove oil seal by prying seal from bearing retainer.
2. Coat outside diameter of new seal sparingly with Sealer Part No. 1050026. Apply lubricant Part No. 1050169 to the sealing lip of seal.
3. Drive seal into the rear bearing retainer using Seal Installing Tool J-5154-A until seal is fully seated. (Fig. 7-32)

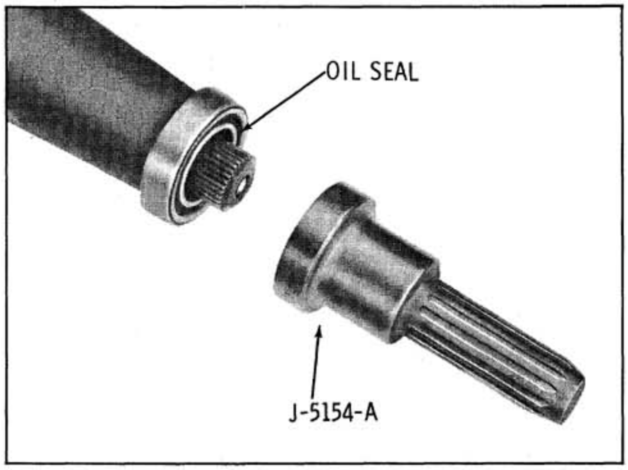


Fig. 7-32 Oil Seal Installation

TRANSMISSION SIDE COVER (Fig. 7-33)

Removal

1. Drain oil from transmission.
2. Disconnect shift control rods from levers.
3. Remove cover assembly from transmission case.

Disassembly

1. Remove the outer shift lever nuts, lockwashers and flat washers. Pull levers from shafts.
2. Remove shift forks from shifter shafts.
3. Remove inner shifter shafts, two steel poppet balls, poppet spring, interlock pin and interlock sleeve from cover.
4. Remove "O" ring seals from shifter shafts.
5. Wash parts in clean solvent and inspect.

Assembly

1. Apply Lubricant Part No. 1050169 to new "O" ring seals and install in grooves of shifter shafts.
2. Install first and reverse shift lever into cover.
3. Apply Lubricant Part No. 1050169 and assemble interlock sleeve, poppet ball, poppet spring, and interlock pin in cover, with ball engaging center detent in first and reverse shifter lever cam. Place other poppet ball against spring, depressing ball with a screwdriver, and install second and third shift lever in cover.
4. Position one lever in neutral (center detent) and the other lever into a gear position. Check clearance between end of interlock sleeve and shift lever cam. Clearance should be .002" to .008". (Fig. 7-34) Interlock sleeves are available in different lengths to provide a selection for proper clearance.

Installation

1. Position transmission gears and forks in cover into neutral. Place cover gasket on case.
2. Carefully position side cover into place, making sure the shift forks are aligned with their respective mainshaft clutch sliding sleeves.

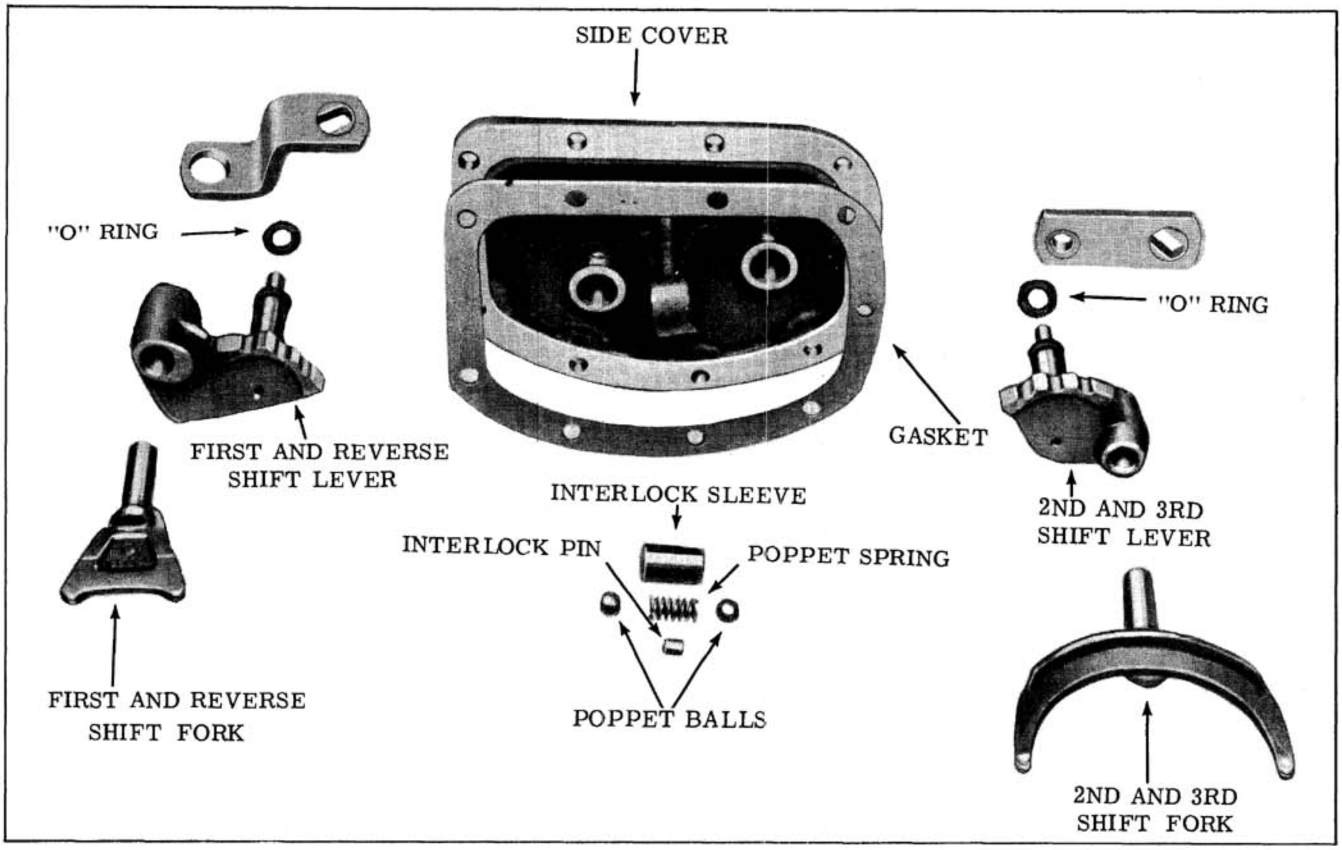


Fig. 7-33 Transmission Side Cover

Coat bolts with Sealer, Part No. 1050026. Tighten bolts to 18 ft. lbs.

3. Install drain plug.

4. Remove filler plug and add lubricant to level of filler plug hole.

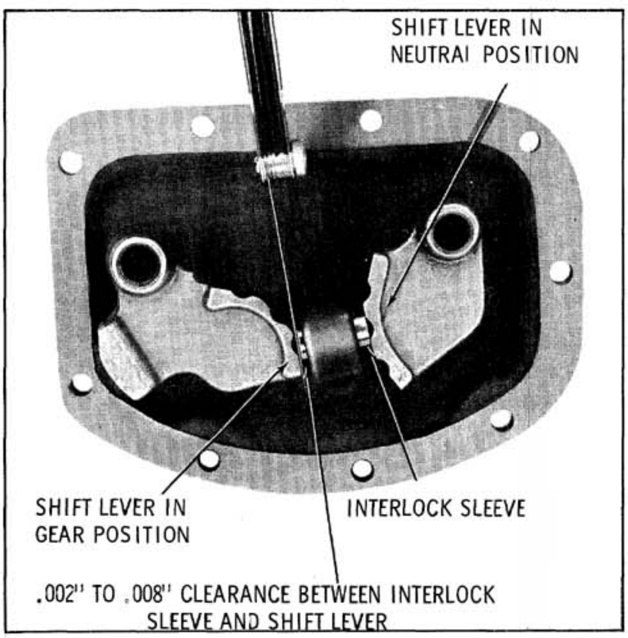


Fig. 7-34 Checking Interlock Sleeve Clearance

MAJOR SERVICE OPERATIONS

TRANSMISSION

Remove

1. Raise car.

2. Remove propeller shaft.

3. Disconnect shift rods from shift levers.

4. Disconnect equalizer shaft at side of transmission.

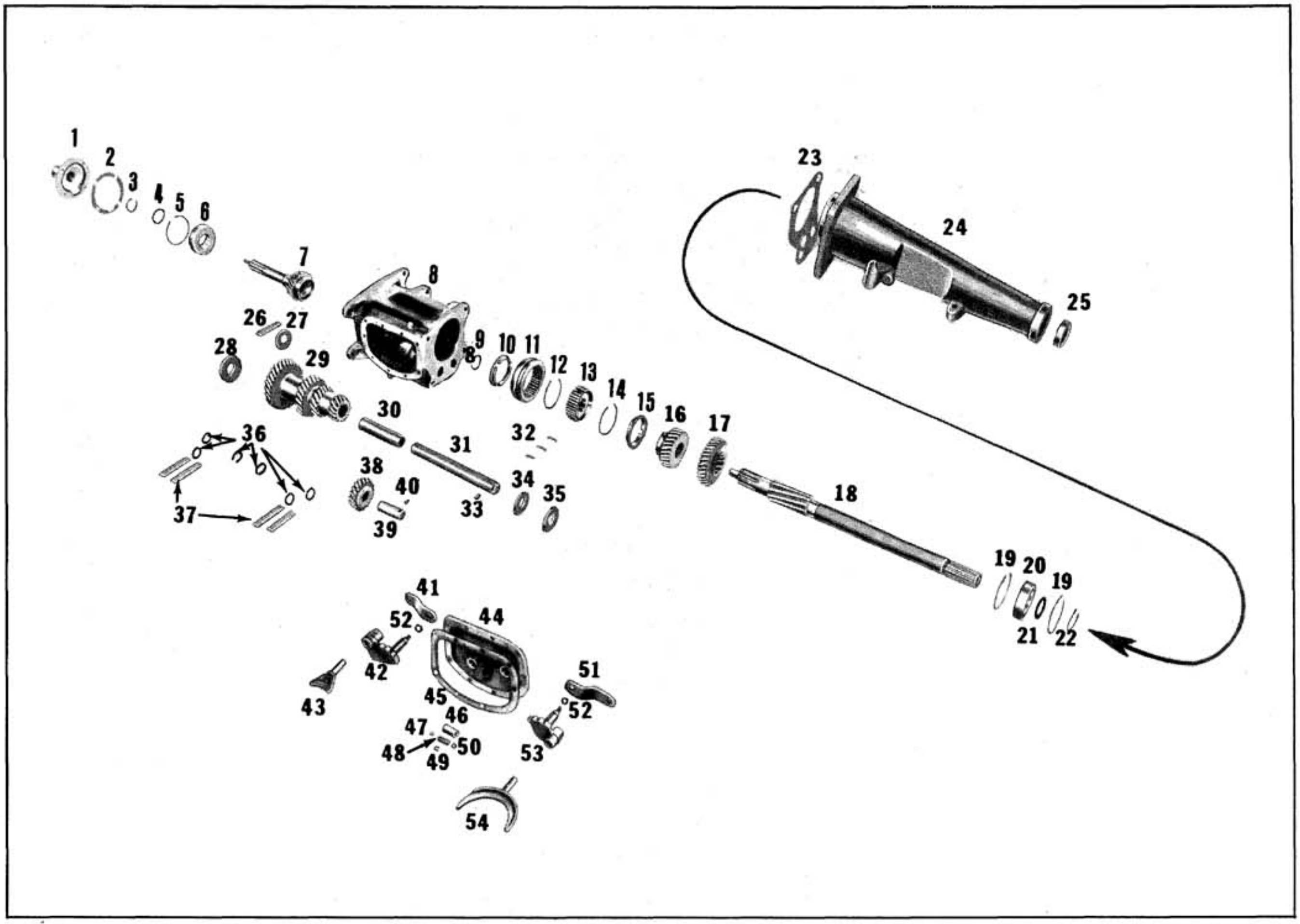
5. Install Engine Support BT-30-16. Refer to ENGINE Section.

6. Disconnect parking brake cable.

7. Remove cross support bar-to-rear transmission mount attaching bolts.

8. Remove cross support bar-to-frame attaching bracket and remove cross support bar.

   NOTE: It may be necessary to disconnect the left exhaust pipe at the exhaust manifold to provide clearance if equipped with dual exhaust.



1. Bearing Retainer
2. Gasket
3. Retaining Ring
4. Washer
5. Bearing Retainer
6. Main Drive Gear Bearing
7. Main Drive Gear
8. Transmission Case
9. Clutch Hub Retaining Ring
10.& 15. Synchronizing Ring
11. Second and Third Clutch Sleeve
12.&14. Second and Third Clutch Key Retainer
13. Second and Third Clutch Hub
16. Second Speed Gear
17. First and Reverse Sliding Gear
18. Mainshaft
19. Mainshaft Bearing Retaining Ring
20. Mainshaft Bearing
21. Washer
22. Mainshaft Bearing Retaining Ring
23. Gasket
24. Rear Bearing Retainer
25. Oil Seal
26. Mainshaft Pilot Roller Bearings
27. Bearing Spacer
28. Countergear Front Thrust Washer (Bronze)
29. Countergear
30. Bearing Spacer
31. Countershaft
32. Second and Third Clutch Keys
33. Lock Key
34. Countergear Rear Thrust Washer (Bronze)
35. Countergear Rear Thrust Washer (Steel)
36. Countergear Bearing Retainer Washers
37. Countergear Bearings
38. Reverse Idler Gear
39. Reverse Idler Gear Shaft
40. Lock Key
41. First and Reverse Shift Lever
42. First and Reverse Shifter Shaft
43. First and Reverse Shifter Fork
44. Side Cover
45. Side Cover Gasket
46. Interlock Sleeve
47.& 50. Interlock Balls
48. Interlock Spring
49. Interlock Spacer
51. Second and Third Shift Lever
52. "O" Ring
53. Second and Third Shifter Shaft
54. Second and Third Shifter Fork

Fig. 7-35 Transmission Disassembled

9. Remove transmission upper attaching bolts. Install aligning studs such as J-1126.

   CAUTION: Aligning studs must be used to support transmission to prevent distortion of the clutch driven plate hub when removing transmission.

10. Remove transmission lower attaching bolts.

11. Carefully slide transmission rearward and remove from car.

Installation

1. Inspect clutch pilot bushing and lubricate with wheel bearing grease.

2. Reverse removal procedure, using the following specified torque ratings for the attaching parts.

   A. Transmission to engine 70 ft. lbs.

   B. Exhaust pipe to exhaust manifold 18 ft. lbs.

   C. Cross support bar brackets to frame 40 ft. lbs.

   D. Cross support bar to rear transmission mount 45 ft. lbs.

   E. Propeller shaft "U" bolt nuts 16 ft. lbs.

3. Install linkage as shown in Fig. 7-30.

4. Adjust linkage as outlined under SHIFT LINKAGE.

Disassembly (Fig. 7-35) (Transmission Removed)

1. Clean the exterior of the transmission thoroughly.

2. Remove side cover and gasket.

   NOTE: If side cover is to be disassembled, refer to TRANSMISSION SIDE COVER DISASSEMBLY.

3. Remove bolts holding rear bearing retainer to case and move rear retainer away from case approximately 1/2". Then rotate rear bearing retainer to expose countershaft and lock key. (Fig. 7-36)

4. From front of transmission case, drive countershaft to rear using Countershaft Bearing Loader Tool J-21892.

   NOTE: When lock key in countershaft clears transmission case, remove lock key

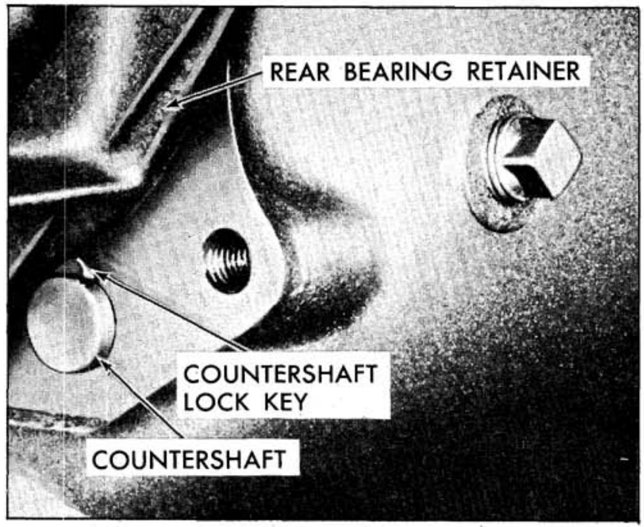


Fig. 7-36 Countershaft Location

to permit countershaft to clear rear bearing retainer.

5. Drive countershaft all the way out and leave Tool J-21892 in the countergear to retain the roller bearings in the countergear.

6. Lower countergear into bottom of case. Then remove rear bearing retainer, gasket and mainshaft assembly from the transmission case. (Fig. 7-37)

7. Remove bearing spacer, washer and 16 roller bearings from inside the main drive gear.

   NOTE: The bearing spacer washer may have remained on the mainshaft.

8. Remove the main drive bearing retainer and gasket. (Fig. 7-38)

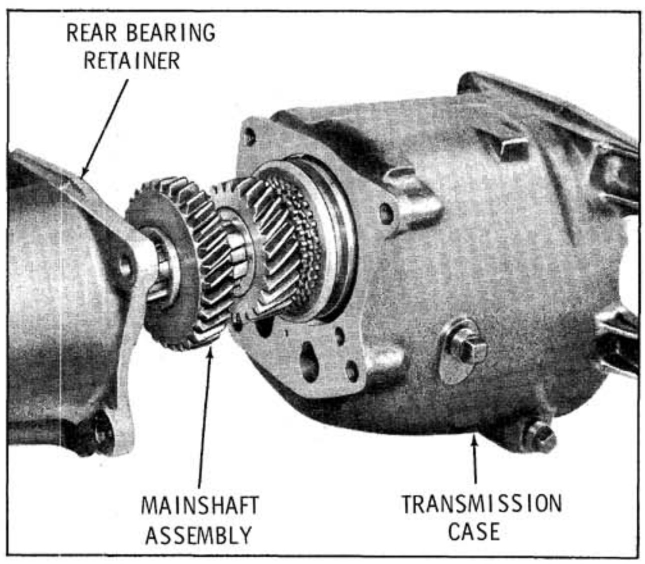


Fig. 7-37 Removing Rear Bearing Retainer and Mainshaft

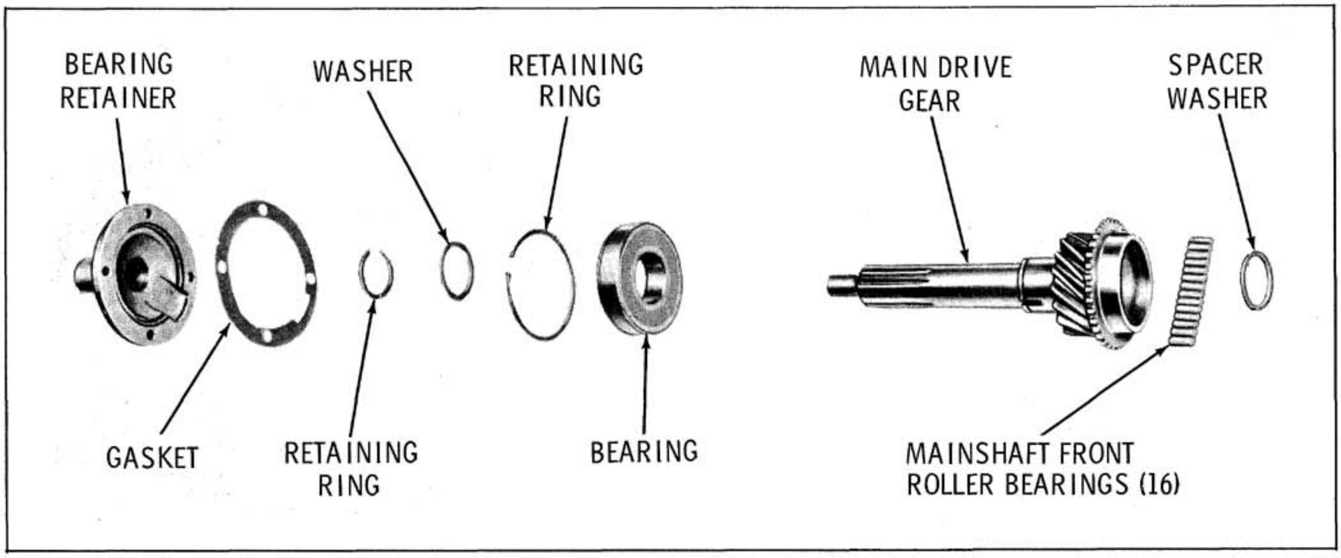


Fig. 7-38 Main Drive Gear

9. Remove main drive gear snap ring and washer. Position transmission case on end and press main drive gear out of bearing. Remove main drive gear from case through side cover opening.

10. Tap the main drive gear bearing out through front of case and remove outer snap ring from the bearing.

11. With a brass drift, drive the reverse idler gear shaft to the rear of transmission case and remove the lock key. Then drive shaft the rest of the way out and remove the reverse idler gear from the case.

12. Remove countergear assembly and thrust washers from the transmission case.

13. Remove Tool J-21892 from countergear and remove the 80 roller bearings, six bearing retainer washers, and bearing spacer from inside countergear. (Fig. 7-39)

MAINSHAFT AND TRANSMISSION REAR RETAINER

Disassembly

1. Remove synchronizing ring and clutch hub retainer snap ring from end of mainshaft. (Fig. 7-40)

2. Remove second and third speed clutch sleeve from clutch hub; then remove hub from mainshaft.

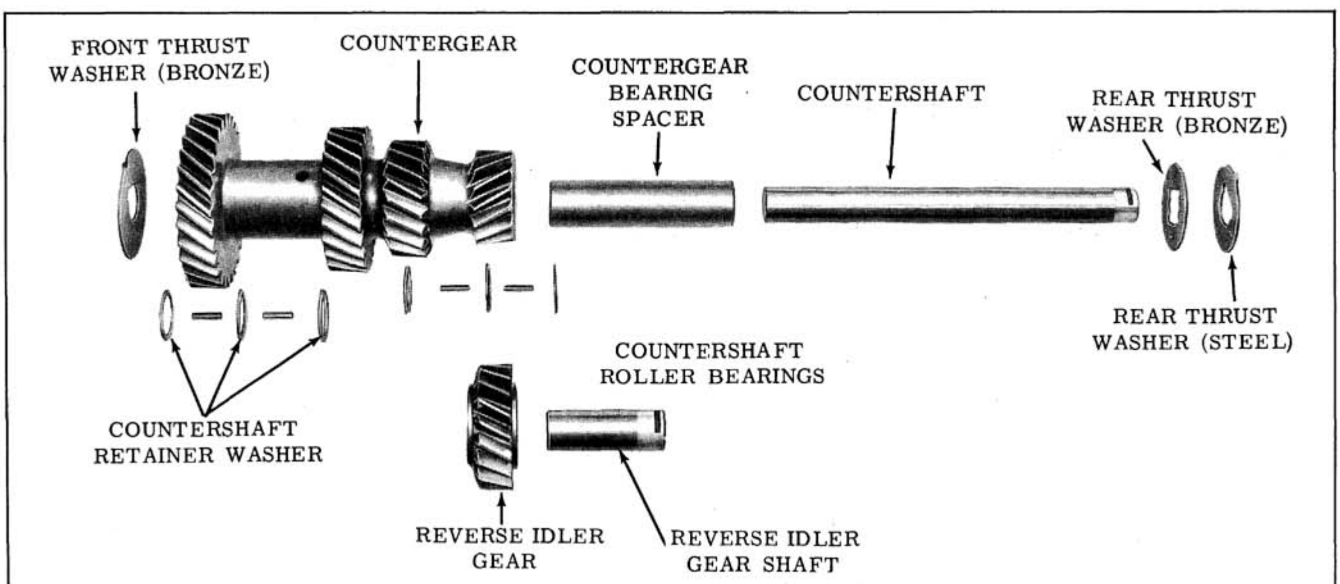


Fig. 7-39 Countergear and Reverse Idler Gear

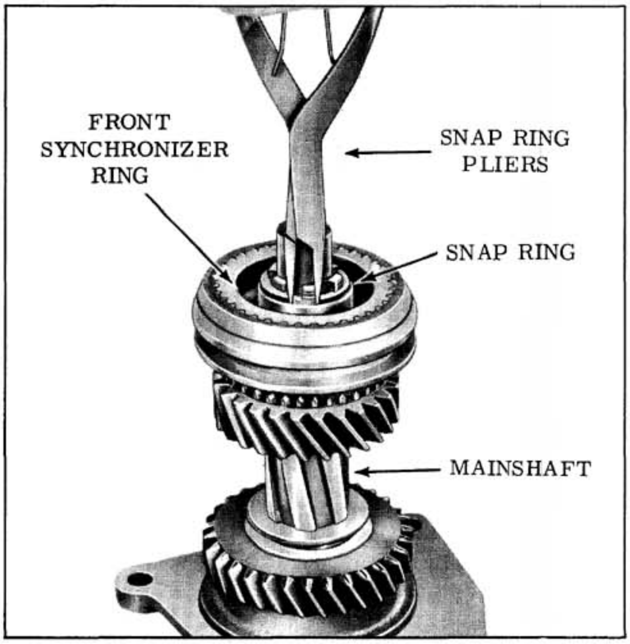


Fig. 7-40 Mainshaft Disassembly

NOTE: If relation of hub and sleeve is not marked, mark for assembly purposes.

3. Remove two clutch key springs and three clutch keys from clutch hub. (Fig. 7-41)

4. Remove synchronizing ring and second speed gear from mainshaft. (Fig. 7-42)

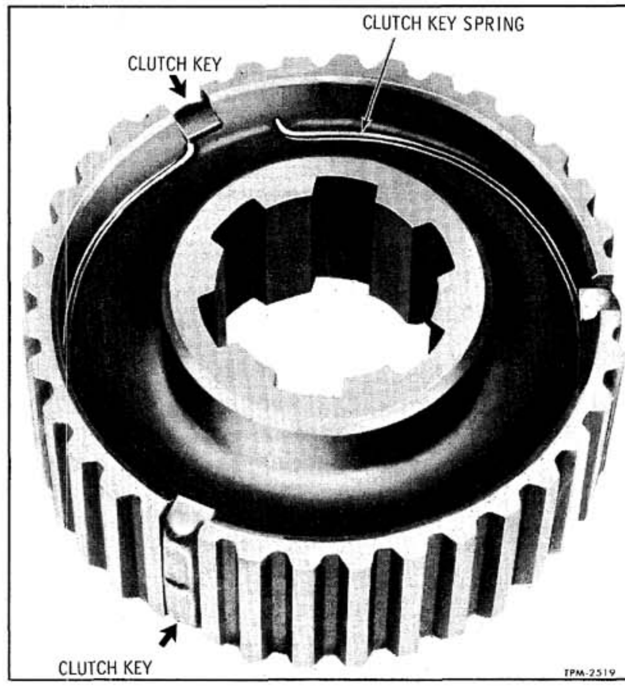


Fig. 7-41 Clutch Key and Spring Location

5. Remove low and reverse sliding gear from mainshaft.

6. Remove mainshaft rear bearing front snap ring from rear bearing retainer. Using a soft hammer, tap mainshaft and rear bearing out of the rear bearing retainer.

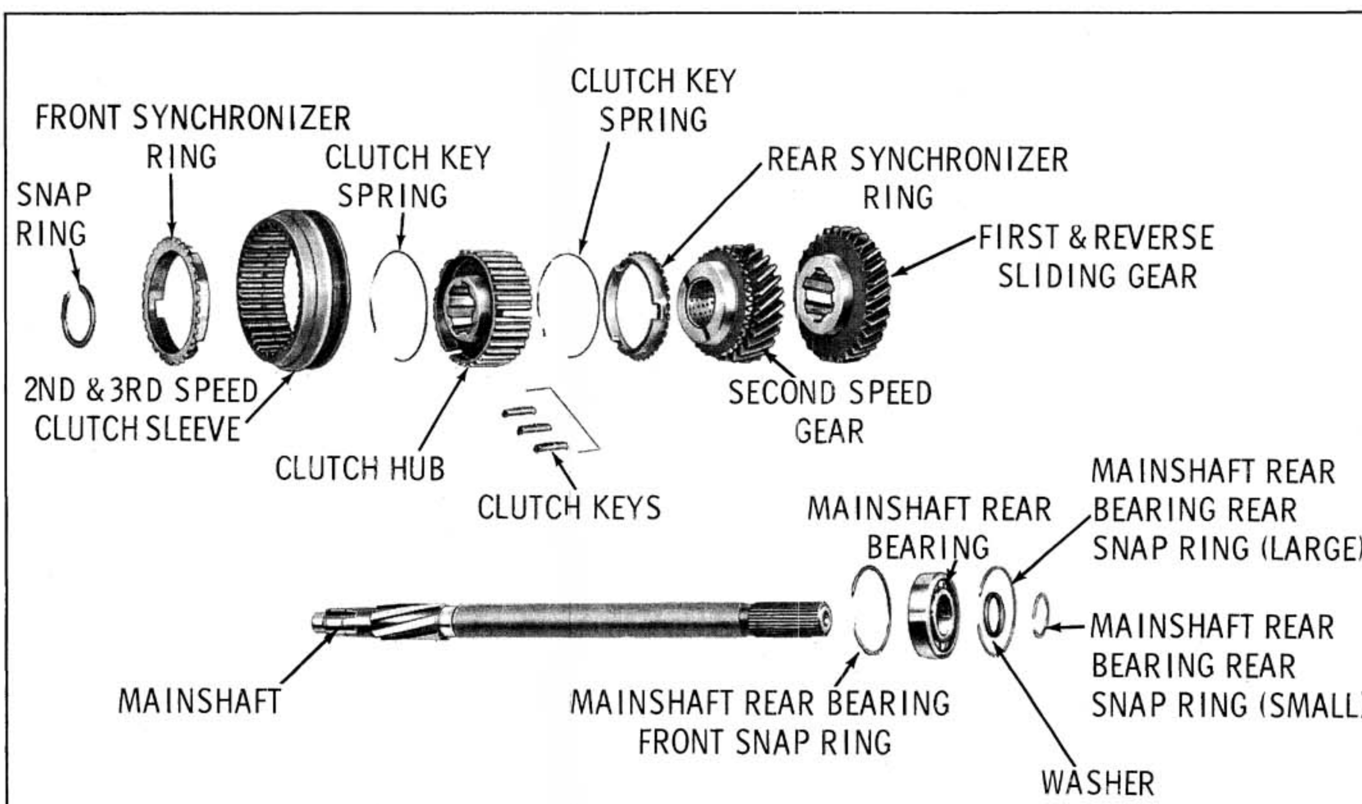


Fig. 7-42 Mainshaft Assembly

7. Remove the large rear bearing rear snap ring from the rear bearing retainer.

8. Remove the small rear bearing rear snap ring and washer.

9. Using an arbor press, press mainshaft rear bearing toward rear of shaft until loose. Then remove bearing.

10. Using a punch, loosen and remove the seal from the rear bearing retainer.

CLEANING AND INSPECTION

1. Wash all bearings thoroughly in clean solvent; then air dry. Lubricate bearings with light engine oil and check bearings for roughness.

2. Wash the transmission case thoroughly inside and out with cleaning solvent. Inspect case for cracks or burrs on the front or rear face of the case and for rough or damaged bearings or shaft bores.

3. Wash the rear bearing retainer thoroughly inside and out with cleaning solvent. Inspect retainer for cracks, roughness or scores in the bearing bore.

4. Inspect all gears for excessive wear, chips or cracks. Replace gears as necessary.

5. Inspect mainshaft and main drive gear splines for nicks or excessive wear.

6. Inspect companion flange for scores, nicks or excessive wear on the bearings or sealing surfaces. Any of these conditions require replacement of the flange.

7. Inspect the 16 mainshaft front roller bearings and the 80 countershaft roller bearings for excessive wear. If wear is indicated, replace the bearings.

8. Check the thrust washers for wear or distortion. Replace if necessary.

9. Inspect bushings in the second speed and reverse idler gears for wear or scoring. Replace gears if bushings are damaged.

10. Check the synchronizer rings for wear or roughness. Replace if damaged.

11. Check the clutch sleeve and hub for damage. Replace as necessary.

MAINSHAFT

Assembly (Fig. 7-42)

1. Position bearing on rear of mainshaft. Pressing on the inner race, press bearing into place.

2. Install washer and small rear bearing snap ring in groove on the mainshaft.

3. Install large rear bearing snap ring in the rear bearing retainer.

4. Install mainshaft into front of rear bearing retainer and with a soft hammer, tap front end of mainshaft until rear bearing clears front snap ring groove in retainer. Install snap ring.

5. Apply Sealer Part No. 1050026 to the outside of the seal and install new seal in the rear bearing retainer using Tool J-5154-A. (Fig. 7-43)

6. Install first and reverse sliding gear on the mainshaft. Shift hub toward the front of the transmission.

7. Install the second speed gear synchronizing hub toward the front of the transmission.

8. Install clutch key springs in second and third speed clutch hub, with one end of each spring positioned in the same slot and the other end free. Place the three clutch keys in their respective slots in the hub. (Fig. 7-41)

9. Install second and third speed clutch sleeve on the clutch hub, aligning the marks made during disassembly.

   NOTE: Beveled edge of sleeve must be positioned toward front of transmission.

10. Install synchronizing ring on rear or shoulder side of the sleeve and hub assembly. Make sure slots in synchronizing ring are aligned with clutch keys.

    NOTE: A light lubricant applied to the inner surface of the synchronizing rings will help prevent ring from locking up during final assembly.

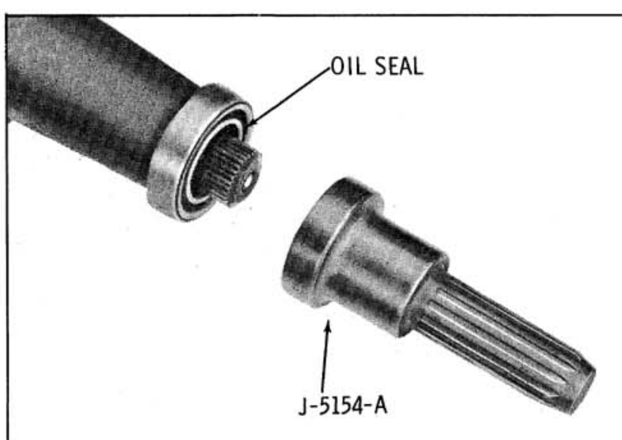


Fig. 7-43 Oil Seal Installation

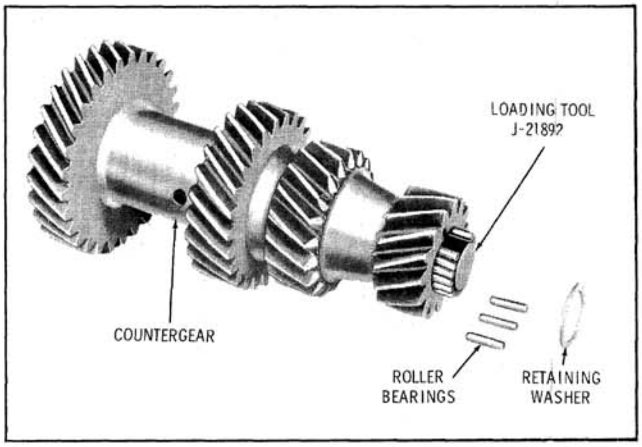


Fig. 7-44 Countergear Assembly

11. Install sleeve, hub and synchronizing ring assembly on mainshaft, clutch sleeve shoulder facing to rear. Install retaining snap ring. (Fig. 7-40)

COUNTERGEAR ASSEMBLY (Fig. 7-44)

1. Position countergear bearing spacer and countergear bearing Loader Tool J-21892 inside countergear.
2. Using Lubricant Part No. 1050169 to help hold roller bearings in place, install a retainer washer first then install 20 roller bearings into one end of countergear.
3. Install a bearing retainer washer; then install the second row of 20 roller bearings and install a bearing retainer washer on the outer end of the countergear.
4. Repeat procedure Steps 2 and 3 for installation of roller bearings at the other end of the countergear.
5. Using grease to hold washer in place, position the large bronze thrust washer at the front end of the countergear with the tangs facing out. Tangs must seat in grooves in the case.
6. Using grease to hold washer in place, position the small bronze thrust washer at the rear of the countergear. Tangs on washer must be positioned toward gear and seating in grooves in gear.
7. With large gear toward front of case, position countergear in the bottom of the case.
8. Position steel thrust washer at rear of countergear between the bronze washer and the case. Tangs on steel washer must seat in grooves in the rear of the case.

MAIN DRIVE GEAR

1. Using Tool J-6133-A, drive main drive gear bearing onto the main drive gear shaft.

   NOTE: Be sure snap ring groove on the bearing is to the front.

2. Install the main drive gear washer and retain with a snap ring.
3. Through side cover opening, place main drive gear into position. Tap into place with a soft hammer. Install snap ring on outer race of the bearing.

   NOTE: Make sure assembly is driven straight to prevent damage to the bearing.

4. Tap front of main drive gear back into case until snap ring seats firmly against case.
5. Install gasket and bearing retainer, making certain oil groove in retainer is lined up with outlet hole in case.
6. Apply Sealer Part No. 1050026 to the threads of the four bearing retainer bolts. Install bolts and torque to 15 ft. lbs.
7. Position reverse idler gear into rear of case, chamfer on teeth toward front of transmission. From the rear of case start idler shaft through case and gear.
8. Install lock key in notch in rear of idler shaft aligning key with keyway in the case. Using a soft hammer, drive shaft into case until key seats in the case and shaft is flush with case rear surface.
9. Coat the bore of the main drive gear with grease and install the 16 mainshaft roller bearings.
10. Install bearing spacer washer in main drive gear on top of the 16 roller bearings.
11. Lubricate inner surface of front synchronizing ring and install on hub of main drive gear. Position one clutch keyway so that it will be visible from side opening in case.
12. On top of second and third speed clutch sleeve, mark position of one clutch key and align mark with clutch sleeve slot in synchronizing ring.
13. Install rear bearing retainer gasket on case.
14. With transmission case standing on end, install mainshaft and rear bearing retainer assembly through opening in rear of case. Make sure front end of mainshaft enters pilot roller bearings in main drive gear and marks

on clutch sleeve line up with slot in synchronizing ring.

CAUTION: Care should be taken when installing the mainshaft to prevent the roller bearings from being forced out of position and dropping into the lubricant opening in the main drive gear.

15. Place transmission on its top side to assist in correctly positioning countergear and help align countergear with shaft opening in case.

NOTE: Rotating main drive gear back and forth will help in aligning countergear thrust washers with shaft opening in the case.

16. With rear bearing retainer rotated as shown in Fig. 7-45, insert countershaft through exposed shaft opening in rear of case. Make sure the shaft passes through both thrust washers before entering countergear.

17. With a soft hammer, tap countershaft through countergear opening, forcing Tool J-21892 out opening at front of case.

18. Install locking key into notch at rear of countershaft. Drive shaft until key seats into keyway of case and shaft is flush with rear of case.

19. Align the rear bearing retainer and gasket with the case.

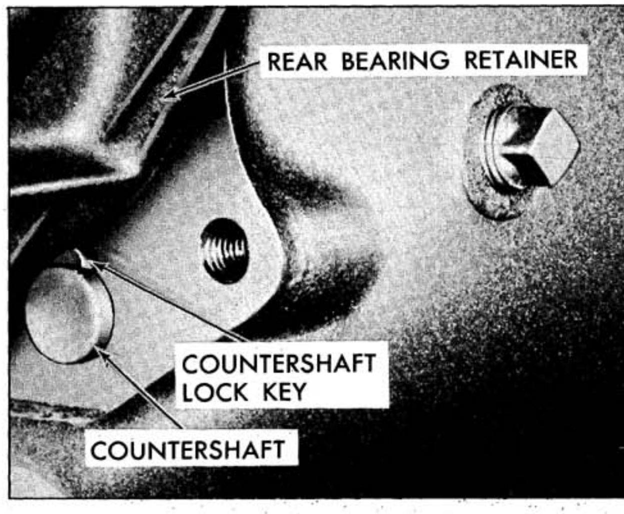


Fig. 7-45 Countershaft Installation

20. Apply Sealer Part No. 1050026 to the threads of bolts and install the rear bearing retainer bolts.

21. Check both synchronizing rings through side cover opening for freedom of movement and alignment.

22. Torque rear bearing retainer bolts to 60 ft. lbs.

23. Install side cover.

DIAGNOSIS

SLIPS OUT OF HIGH GEAR

CAUSE	CORRECTION
a. Transmission loose on clutch housing.	a. Tighten mounting bolts.
b. Shift rods interfere with engine mounts or clutch throw-out lever.	b. Replace or bend levers and rods to eliminate interference.
c. Shift linkage does not work freely; binds.	c. Adjust and free up shift linkage.
d. Damaged mainshaft pilot bearing.	d. Replace pilot bearing.
e. Main drive gear bearing retainer broken or loose.	e. Tighten or replace main drive gear bearing retainer.
f. Dirt between transmission case and clutch housing.	f. Clean mating surfaces.

DIAGNOSIS (Continued)

NOISY IN ALL GEARS

CAUSE	CORRECTION
a. Insufficient lubricant.	a. Fill to correct level.
b. Worn countergear bearings.	b. Replace countergear bearings and shaft.
c. Worn or damaged main drive gear and countergear.	c. Replace worn or damaged gears.
d. Damaged main drive gear or mainshaft bearings.	d. Replace damaged bearings or main drive gear.

NOISY IN HIGH GEAR

CAUSE	CORRECTION
a. Damaged main drive gear bearing.	a. Replace damaged bearing.
b. Damaged mainshaft bearing.	b. Replace damaged bearing.

NOISY IN NEUTRAL WITH ENGINE RUNNING

CAUSE	CORRECTION
a. Damaged main drive gear bearing.	a. Replace damaged bearing.

NOISY IN ALL REDUCTION GEARS

CAUSE	CORRECTION
a. Insufficient lubricant.	a. Fill to correct level.
b. Worn or damaged main drive gear or countergear.	b. Replace faulty or damaged gears.

NOISY IN SECOND ONLY

CAUSE	CORRECTION
a. Damaged or worn second speed constant mesh gears.	a. Replace damaged gears.
b. Worn or damaged countergear rear bearings.	b. Replace countergear bearings and shaft.

DIAGNOSIS (Continued)

NOISY IN LOW AND REVERSE ONLY

CAUSE	CORRECTION
a. Worn or damaged first and reverse sliding gear.	a. Replace worn gear.
b. Damaged or worn low and reverse countergear.	b. Replace countergear assembly.

NOISY IN REVERSE ONLY

CAUSE	CORRECTION
a. Worn or damaged reverse idler gear.	a. Replace reverse idler gear assembly.
b. Worn reverse idler bushings.	b. Replace reverse idler gear assembly.
c. Damaged or worn reverse countergear.	c. Replace countergear assembly.

EXCESSIVE BACKLASH IN SECOND ONLY

CAUSE	CORRECTION
a. Second speed gear thrust washer worn.	a. Replace thrust washer.
b. Mainshaft rear bearing not properly installed in case.	b. Replace bearing, lock or case as necessary.

EXCESSIVE BACKLASH IN ALL REDUCTION GEARS

CAUSE	CORRECTION
a. Worn countergear bearings.	a. Replace bearing.
b. Excessive end play in countergear.	b. Replace countergear thrust washers.

DIAGNOSIS (Continued)

LEAKS LUBRICANT	
CAUSE	**CORRECTION**
a. Excessive amount of lubricant in transmission.	a. Drain to correct level.
b. Loose or broken main drive gear bearing retainer.	b. Tighten or replace retainer.
c. Main drive gear bearing retainer gasket damaged.	c. Replace gasket.
d. Side cover loose or gasket damaged.	d. Tighten cover or replace gasket.
e. Rear bearing retainer oil seal leaks.	e. Replace seal.
f. Countershaft loose in case.	f. Replace case.

SPECIFICATIONS

CAPACITY	3-3/4 Pints
GEAR RATIOS	
Low	2.49 to 1
Second	1.59 to 1
Third	Direct
Reverse	3.15 to 1

TORQUE SPECIFICATIONS

NOTE: Specified torque is for installation of parts only. Checking of torque during inspection may be 15% below that specified.

APPLICATION	FT. LBS.
Side Cover Bolts	18
Transmission to Engine Bolts	70
Cross Support Bar Brackets to Frame	40
Transmission Mount to Cross Support Bar	45
Propeller Shaft U-Bolt Nuts	16
Bearing Retainer to Transmission Case Bolts	15
Rear Bearing Retainer to Transmission Bolts	60

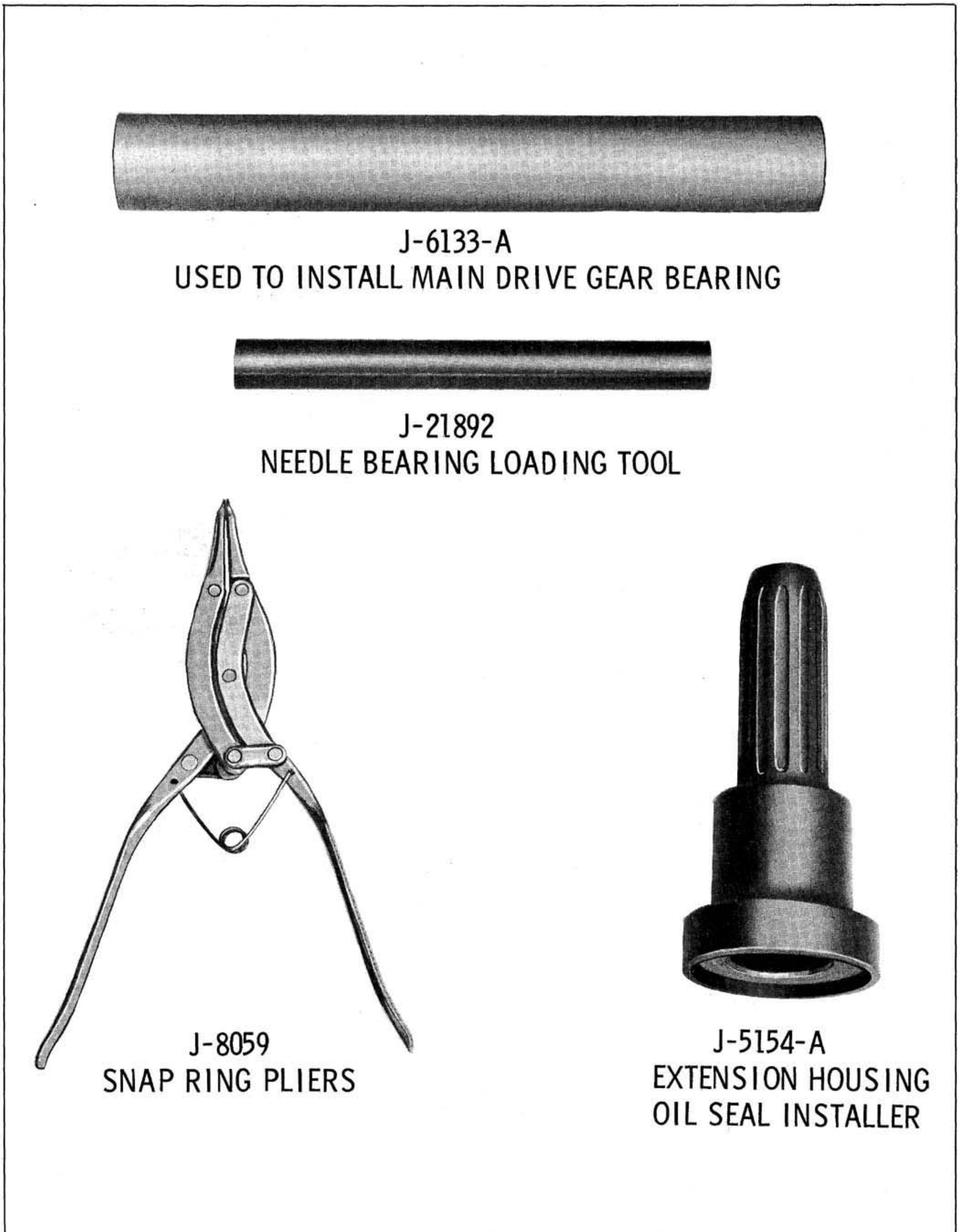
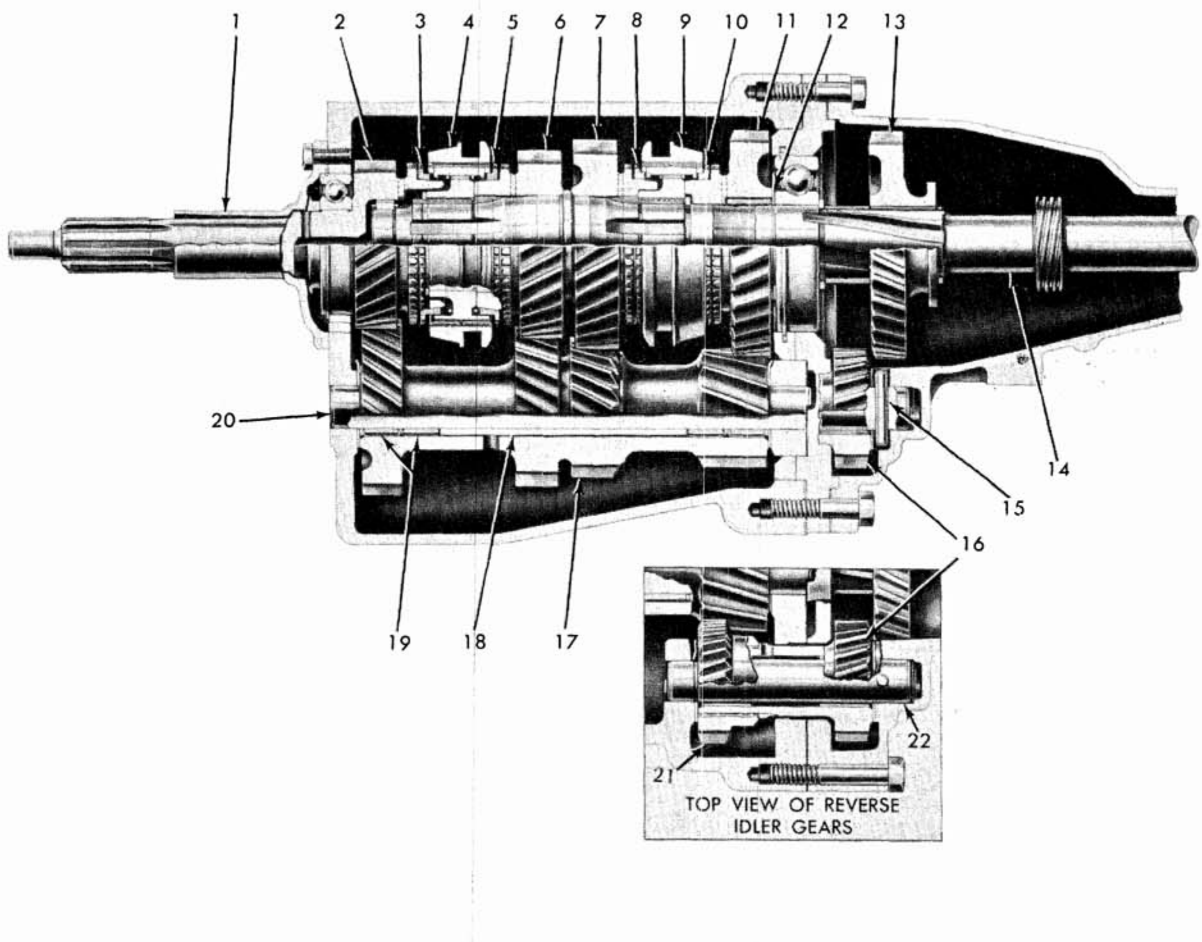


Fig. 7-46 Transmission Tools

FOUR-SPEED TRANSMISSION 33 THROUGH 66 SERIES



1. Bearing Retainer
2. Main Drive Gear
3. Fourth Speed Synchronizing Ring
4. Third and Fourth Speed Clutch Assembly
5. Third Speed Synchronizing Ring
6. Third Speed Gear
7. Second Speed Gear
8. Second Speed Synchronizing Ring
9. First and Second Speed Clutch Assembly
10. First Speed Synchronizing Ring
11. First Speed Gear
12. Thrust Washer
13. Reverse Gear
14. Mainshaft
15. Reverse Idler Shaft Roll Pin
16. Reverse Idler Gear (Rear)
17. Countergear
18. Countershaft Bearing Roller Spacer
19. Countershaft Bearing Roller
20. Countershaft
21. Reverse Idler Gear (Front)
22. Reverse Idler Shaft

Fig. 7-50 Four-Speed Transmission Cross Section

GENERAL DESCRIPTION

The same four-speed synchromesh transmission is available on all 33 through 66 Series. Two different extension housings and output shafts are used. The internal service procedures are the same for all models.

The four-speed synchromesh transmission (Fig. 7-50) incorporates helical gears throughout, specially designed to provide high torque capacity without additional weight, and gear teeth proportioned to operate at high speeds with neither excessive heat generation nor excessive frictional losses. Shafts, bearings, high capacity clutches and other precision parts are held to close limits, providing proper clearances necessary for durability during extended heavy usage.

The main drive gear is supported by a heavy duty ball bearing at the front end of the transmission case and is piloted at its front end in an oil impregnated bushing mounted in the engine crankshaft. The front end of the mainshaft is piloted in a row of roller bearings set into the hollow end of the main drive gear and the rear end is carried by a heavy-duty ball bearing mounted at the rear end of the transmission case in a retainer casting.

The countergear is carried on a double row of rollers at both ends while thrust is taken on thrust washers located between the ends of the gear and the thrust bosses in the case.

The two-piece reverse idler gear is carried on bronze bushings while thrust is taken on thrust washers located between the front of the gear and the back of the reverse idler thrust boss and between the rear of the gear and the reverse idler shaft boss in the case extension.

Gearshifting is manual through shift control rods to the transmission cover shifter levers for first through fourth gears, and to the reverse lever located in the case extension. The shifter lever to the rear of the transmission cover controls first and second gears while the lever to the front controls third and fourth gears. All four forward gears are fully synchronized. The transmission may be used as an aid in deceleration by downshifting in sequence without double clutching or gear clashing. Reverse is not synchronized, however it is a helical gear to insure quiet operation.

MAINTENANCE AND ADJUSTMENTS NOT REQUIRING TRANSMISSION REMOVAL

SHIFT LINKAGE ADJUSTMENT (Figs. 7-51, 7-51A, 7-52 & 7-53)

1. Place transmission levers in neutral.

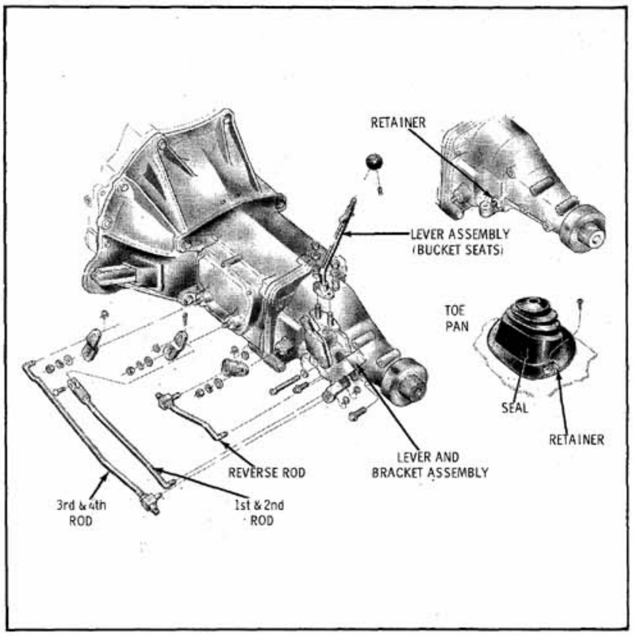
2. Using a 5/16" rod, align levers in neutral position as shown in Fig. 7-51.

3. Adjust swivels so as to obtain a "free pin" fit at the levers.

SPEEDOMETER DRIVEN GEAR AND OIL SEAL 33 through 38 Series

Replacement

Disconnect speedometer cable, remove re-



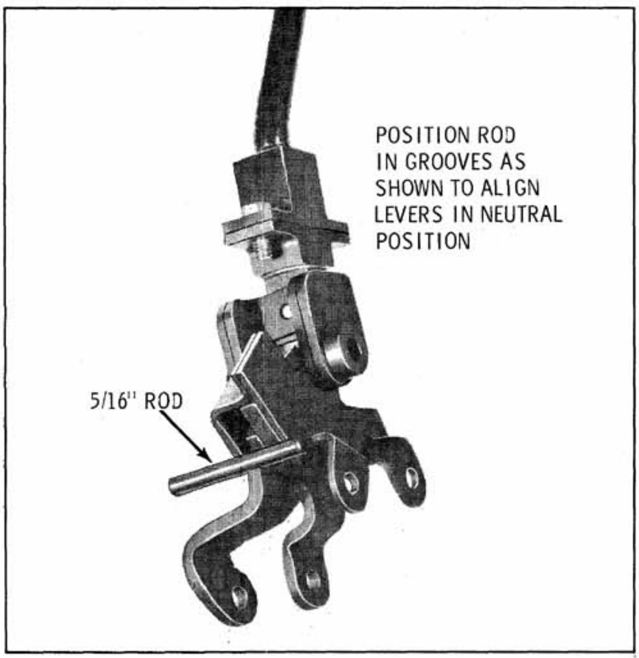
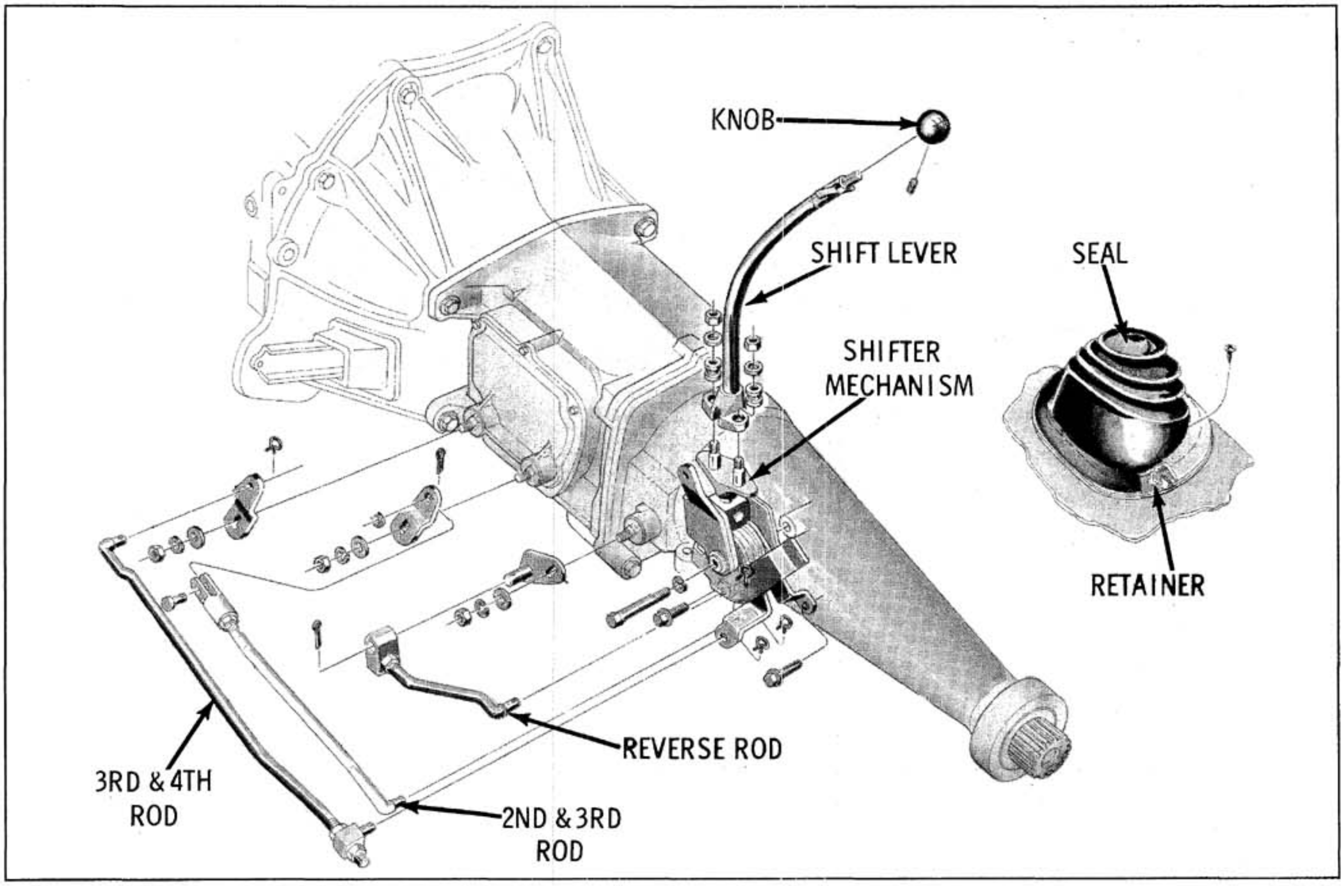


Fig. 7-51 Shift Lever



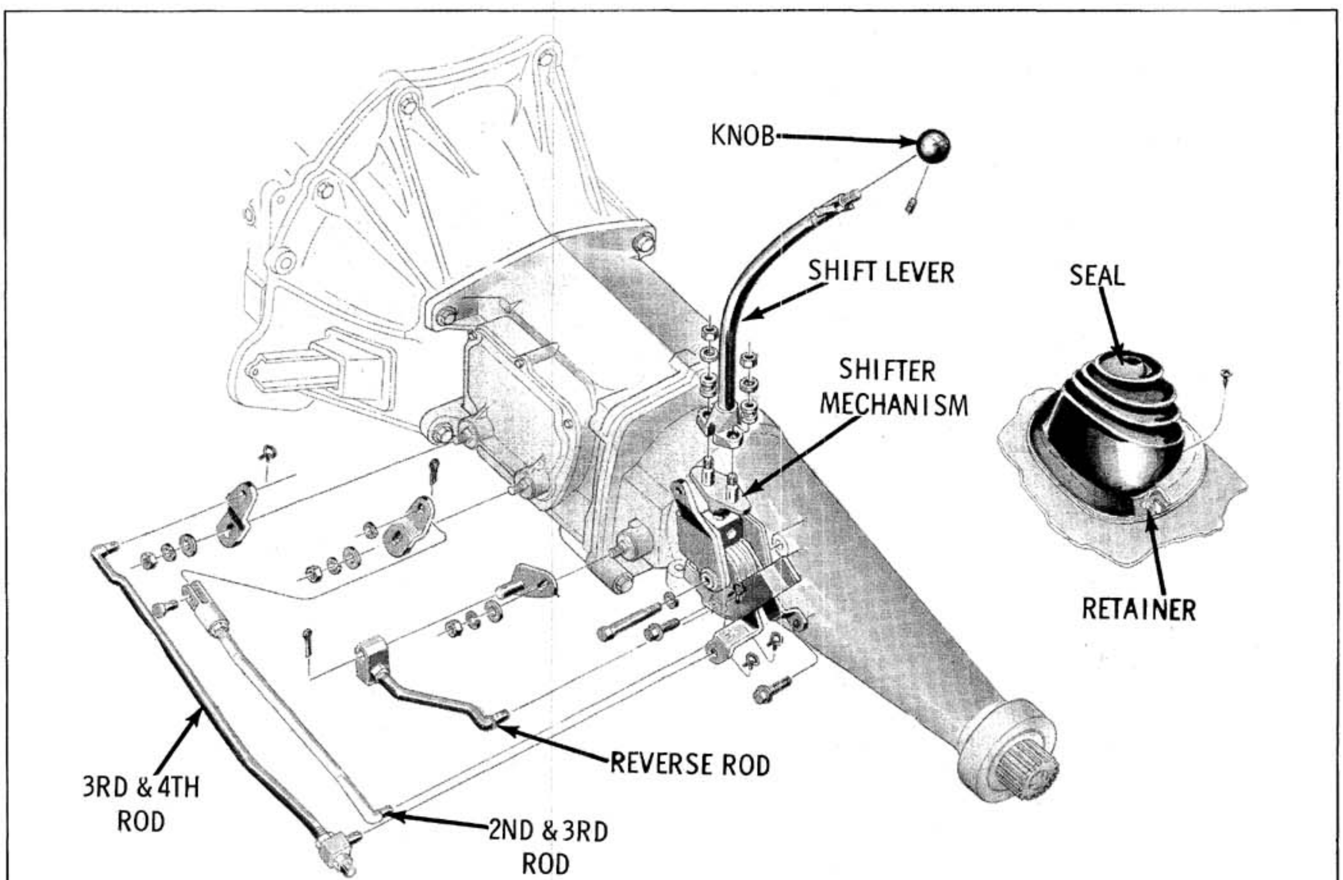


Fig. 7-52 Shift Linkage 52 Series

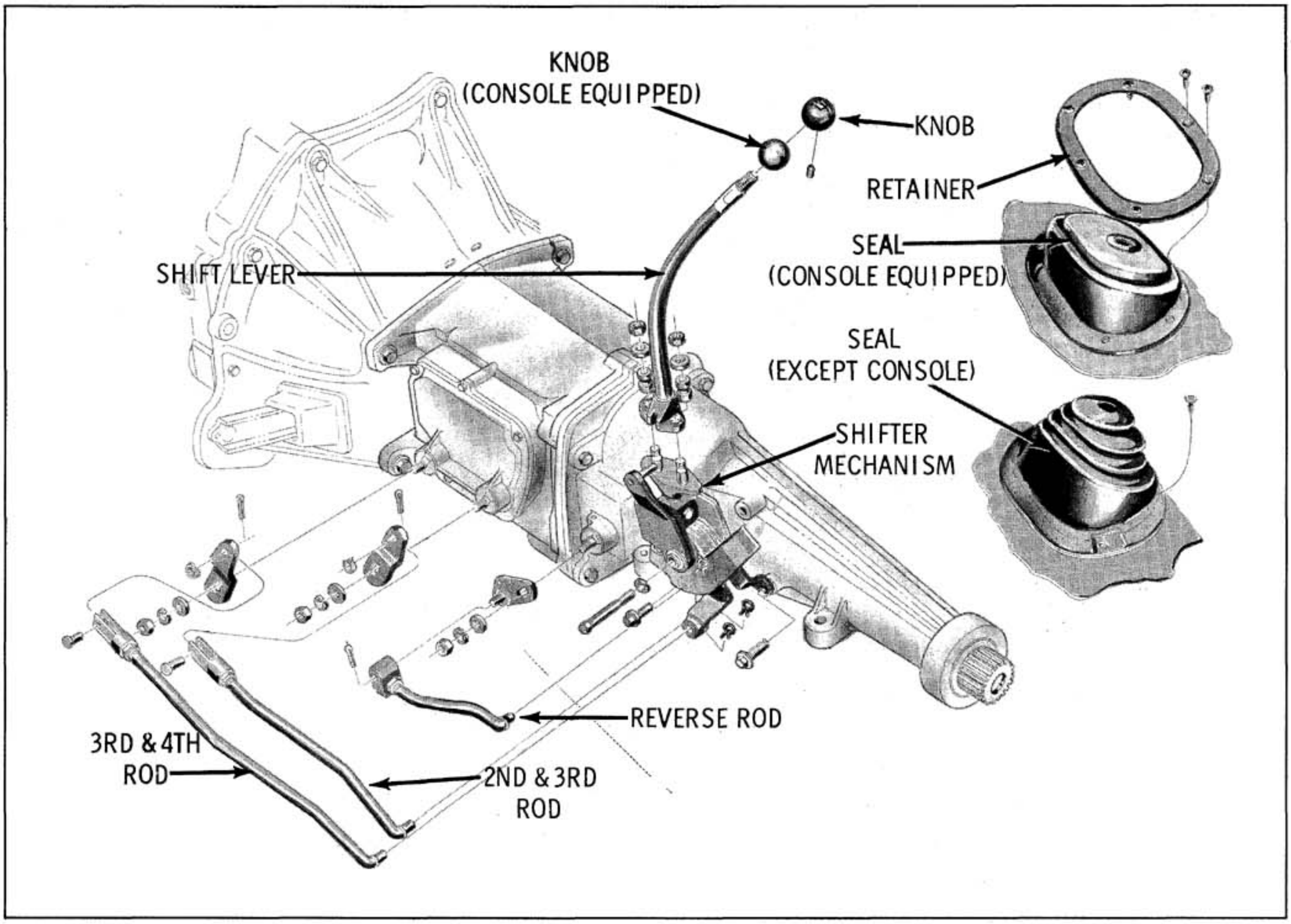


Fig. 7-53 Shift Linkage 54 through 66 Series

tainer to housing bolt and lockwasher and remove retainer. Insert screwdriver in slot in fitting and pry fitting, gear and shaft from housing. Pry "O" ring from groove in fitting.

Install new "O" ring in groove and insert shaft. Hold the assembly so slot in fitting is toward boss on housing and install in housing. Push fitting into housing until retainer can be inserted in groove and install retainer lockwasher and bolt.

TRANSMISSION SIDE COVER

Removal

1. Disconnect control rods from levers.
2. Shift transmission into second speed before removing cover by moving 1-2 (rear) shifter lever into forward detent position.
3. Remove cover assembly from transmission case carefully and allow oil to drain.

Disassembly (Fig. 7-54)

1. Remove the outer shifter lever nuts, lockwashers and flat washers. Pull levers from shafts.
2. Remove both shift forks from shifter shaft and detent plate assemblies. Remove both shifter shaft assemblies from cover. Lip seals in side cover may now be pryed out if replacement is required because of damage.

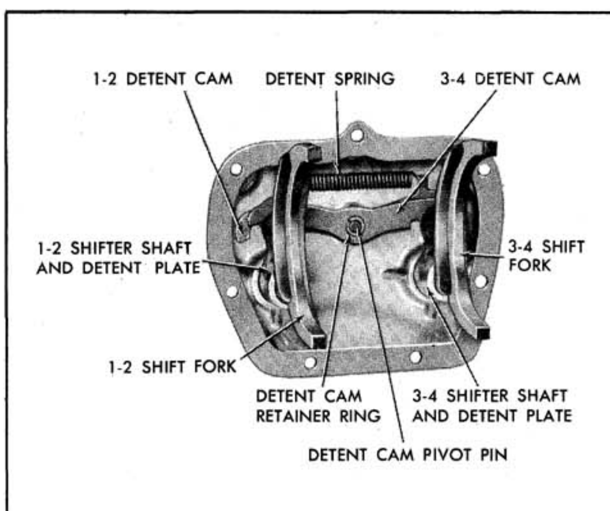


Fig. 7-54 Transmission Side Cover Assembly

3. Remove detent cam spring and pivot retainer "C" ring. Remove both detent cams.

4. Replace necessary parts.

Assembly (Fig. 7-54)

1. Install 1-2 detent cam to cover pivot pin first, then install 3-4 detent cam so the detent spring notches are offset or opposite each other. Detent cam notches must be facing downward.

2. Install detent cam retaining "C" ring to pivot shaft and hook spring into detent cam notches.

3. Install both shifter shaft assemblies in cover, being careful not to damage lip seals. Install both shift forks to detent plates, lifting up on detent cam to allow forks to fully seat into position.

4. Install outer shifter levers, flat washers, lockwashers and nuts.

Installation (Fig. 7-55)

1. Shift 1-2 shifter lever into second-speed (forward) position. Position cover gasket on case.

2. Carefully position side cover into place, making sure the shift forks are aligned with their respective mainshaft clutch sliding sleeves.

3. Install cover attaching bolts and tighten evenly to 20 ft. lbs. torque.

4. Remove filler plug and add lubricant to level of filler plug hole.

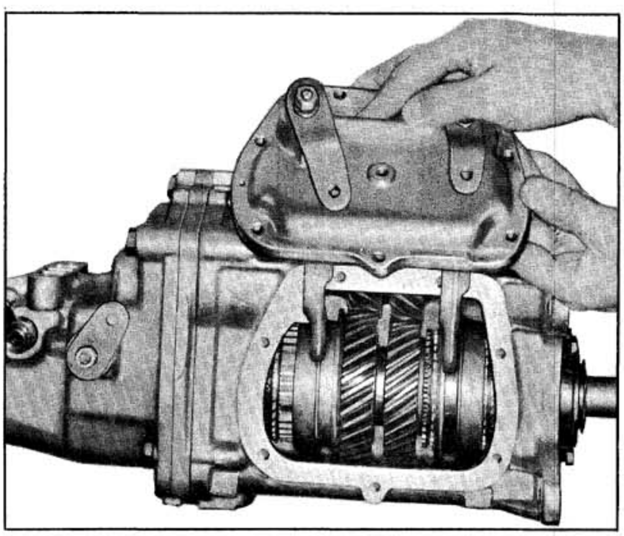


Fig. 7-55 Installing Side Cover Assembly

EXTENSION OIL SEAL

Replacement

1. Remove propeller shaft.

2. Pry out the extension oil seal.

3. Press new oil seal carefully into place in extension using J-5154 or similar tool.

CAUTION: Do not excessively force the seal against the seat in the extension.

TRANSMISSION ASSEMBLY

Removal

1. Raise car.

2. Remove propeller shaft.

3. Disconnect shift rods from shift levers.

4. Disconnect back-up lamp switch wires if so equipped.

5. On 33 through 38 Series install Engine Support Bar BT-6424. On 52 through 66 Series install Engine Support Bar BT-30-16. Use adapters BT-6424-2.

6. Remove cross support bar to rear transmission mount attaching bolts.

7. Disconnect parking brake cables from cross support and remove cross support bar.

NOTE: On models equipped with dual exhaust, it may be necessary to disconnect the left hand exhaust pipe at the exhaust manifold to provide clearance.

8. On 33 through 38 Series disconnect speedometer cable at transmission.

9. Remove three bolts that retain shift lever assembly to extension housing. If shift lever assembly removal is not required, it may be left hanging in floor seal.

10. Remove four transmission to engine attaching bolts.

11. Carefully slide transmission rearward and remove from car.

Installation

1. Inspect clutch pilot bushing and lubricate with wheel bearing grease.

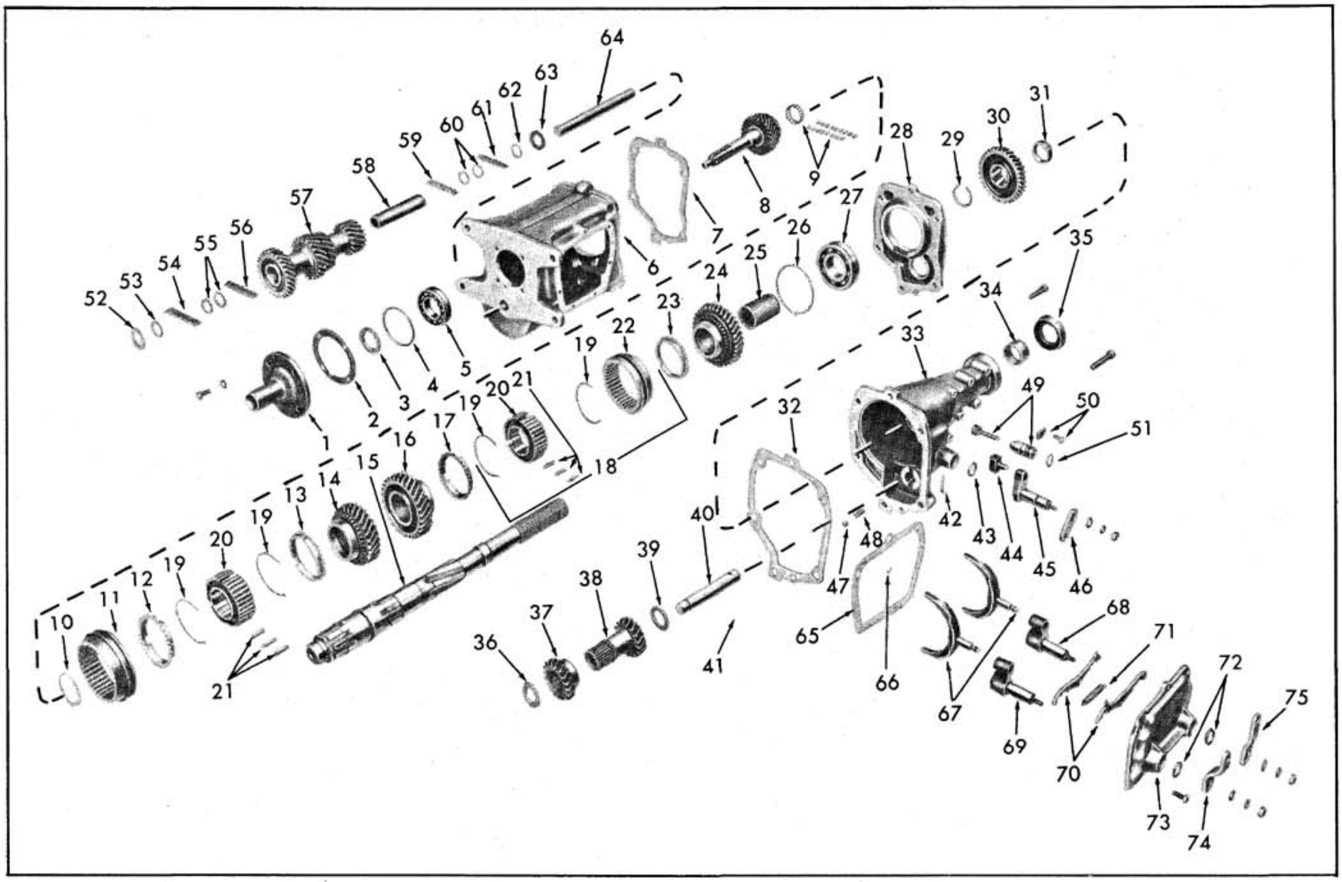


Fig. 7-56 Four-Speed Transmission—Exploded View

1. Bearing Retainer
2. Gasket
3. Bearing Retaining Nut
4. Bearing Snap Ring
5. Main Drive Gear Bearing
6. Transmission Case
7. Rear Bearing Retainer Gasket
8. Main Drive Gear
9. Bearing Rollers (17) and Cage
10. Snap Ring
11. Third and Fourth Speed Clutch Sliding Sleeve
12. Fourth Speed Gear Synchronizing Ring
13. Third Speed Synchronizing Ring
14. Third Speed Gear
15. Mainshaft
16. Second Speed Gear
17. Second Speed Gear Synchronizing Ring
18. First and Second Speed Clutch Assembly
19. Clutch Key Spring
20. Clutch Hub
21. Clutch Keys
22. First and Second Speed Clutch Sliding Sleeve
23. First Speed Gear Synchronizing Ring
24. First Speed Gear
25. Sleeve
26. Rear Bearing Snap Ring
27. Rear Bearing
28. Rear Bearing Retainer
29. Selective Fit Snap Ring
30. Reverse Gear
31. Speedometer Drive Gear
32. Rear Bearing Retainer to Case Extension Gasket
33. Case Extension
34. Extension Bushing
35. Rear Oil Seal
36. Reverse Idler Front Thrust Washer (Tanged)
37. Reverse Idler Gear (Front)
38. Reverse Idler Gear (Rear)
39. Flat Thrust Washer
40. Reverse Idler Shaft
41. Reverse Idler Shaft Roll Pin
42. Reverse Shifter Shaft Lock Pin
43. Reverse Shifter Shaft Lip Seal
44. Reverse Shift Fork
45. Reverse Shifter Shaft and Detent Plate
46. Reverse Shifter Lever
47. Reverse Shifter Shaft Ball
48. Reverse Shifter Shaft Ball Detent Spring
49. Speedometer Driven Gear and Fitting
50. Retainer and Bolt
51. "O" Ring Seal
52. Tanged Washer
53. Spacer (.050")
54. Bearing Rollers (20)
55. Spacers (2-.050")
56. Bearing Rollers (20)
57. Countergear
58. Countergear Roller Spacer
59. Bearing Rollers (20)
60. Spacers (2-.050")
61. Bearing Rollers (20)
62. Spacer (.050")
63. Tanged Washer
64. Countershaft
65. Gasket
66. Detent Cams Retainer Ring
67. Forward Speed Shift Forks
68. First and Second Speed Gear Shifter Shaft and Detent Plate
69. Third and Fourth Speed Gear Shifter Shaft and Detent Plate
70. Detent Cams
71. Detent Cam Spring
72. Lip Seals
73. Transmission Side Cover
74. Third and Fourth Speed Shifter Lever
75. First and Second Speed Shifter Lever

2. Reverse removal procedure using the following specified torque ratings for the attaching parts:

   a. Transmission to engine . . . . 70 ft. lbs.

   b. Shift lever assembly to extension housing . . . . 30 ft. lbs.

   c. Exhaust pipe to exhaust manifold . . . . 18 ft. lbs.

d. Cross support bar brackets to frame . . . . 40 ft. lbs.

e. Cross support bar to rear transmission mount . . . . 45 ft. lbs.

f. Propeller shaft U-bolt nuts . . . . 16 ft. lbs.

DISASSEMBLY

1. Remove transmission side cover as outlined under MAINTENANCE AND ADJUSTMENTS.

2. Remove four bolts from front bearing retainer and remove retainer and gasket.

3. Remove the main drive gear retaining nut (Fig. 7-57) using Tool J-0933, after locking up transmission by shifting into two gears. The retaining nut has a left handed thread and is staked in place. This staking must be removed before removing nut.

4. With transmission gears in neutral, drive lock pin from reverse shifter lever boss as shown in Fig. 7-58, and pull shifter shaft out about 1/8". This disengages the reverse shift fork from reverse gear.

5. Remove six bolts attaching the case extension to the case. Tap extension with soft hammer in a rearward direction to start. When the reverse idler shaft is out as far as it will go, move extension to left so reverse fork clears reverse gear and remove extension and gasket.

6. The rear reverse idler gear, shaft and flat thrust washer may now be removed.

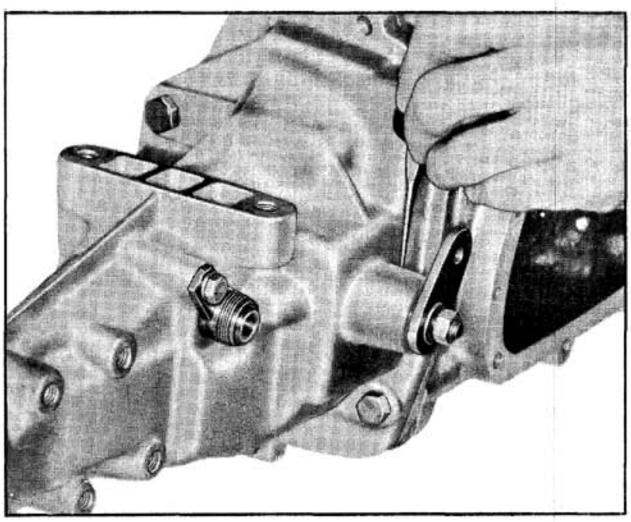


Fig. 7-57 Removing Main Drive Gear Retaining Nut

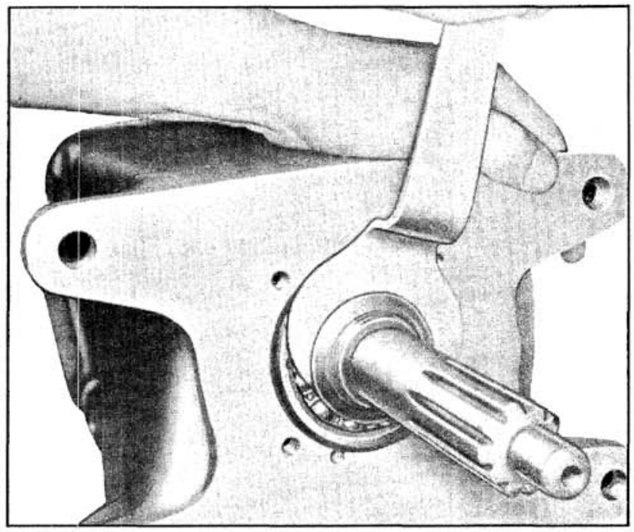


Fig. 7-58 Removing Reverse Shifter Shaft Lock Pin

7. Remove speedometer gear (if any) and reverse gear. The speedometer gear may be removed using Tool J-6123 as shown in Fig. 7-59.

   NOTE: Slide 3-4 synchronizer clutch sleeve to fourth-speed gear position (forward) before trying to remove mainshaft assembly from case. (Fig. 7-60)

8. Carefully remove the rear bearing retainer and entire mainshaft assembly from the case by tapping bearing retainer with a soft hammer.

9. Unload bearing rollers from main drive gear and remove fourth-speed synchronizer blocker ring.

10. Lift the front half of reverse idler gear and its tanged thrust washer from case.

11. Press main drive gear down from front bearing. (Fig. 7-61)

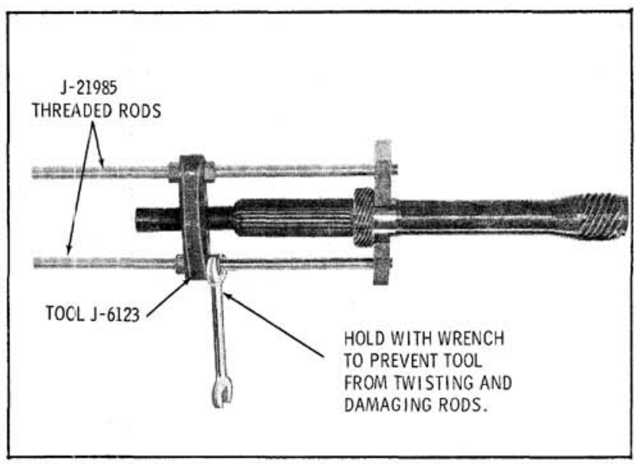


Fig. 7-59 Removing Speedometer Gear with J-6123

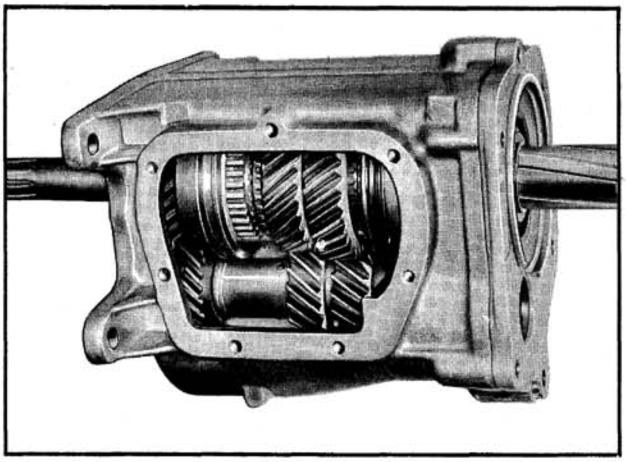


Fig. 7-60 Third and Fourth Speed Synchronizer Clutch Sleeve in Fourth Gear Position

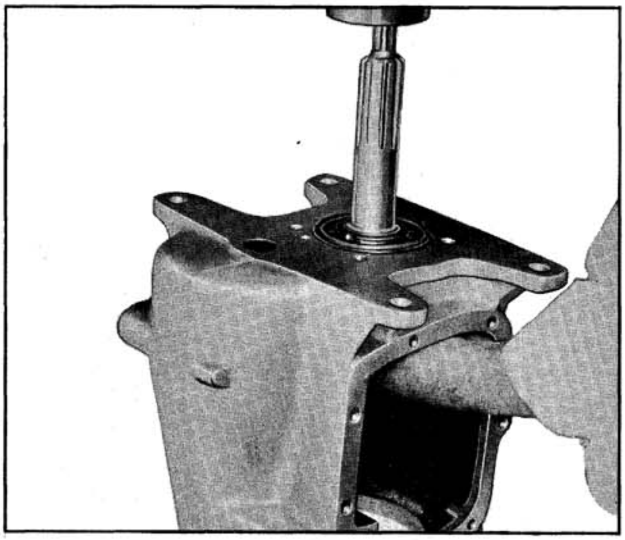


Fig. 7-61 Removing Main Drive Gear

12. From inside case, tap out front bearing and snap ring.

13. From the front of the case, press out the countershaft (Fig. 7-62) using Tool J-21629; then remove the countergear and both tanged washers.

14. Remove the 80 rollers, six .050" spacers and roller spacer from countergear.

15. Remove mainshaft front snap ring as shown in Fig. 7-63 and slide third and fourth-speed clutch assembly, third-speed gear and synchronizing ring from front of mainshaft.

16. Spread rear bearing retainer snap ring and press mainshaft out of the retainer. (Fig. 7-64)

17. Remove the mainshaft rear snap ring. Support first-speed gear as shown in Fig. 7-65 and press against rear of mainshaft to remove shaft from rear bearing, first-speed

Fig. 7-62 Removing Countershaft with J-21629

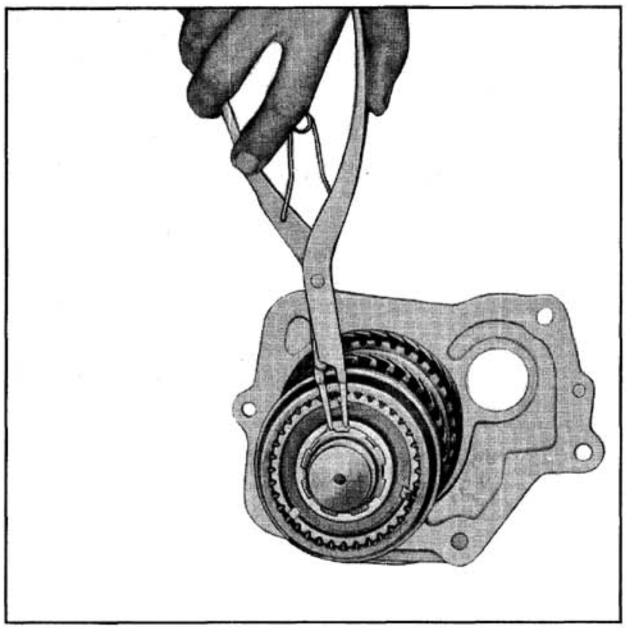


Fig. 7-63 Removing Mainshaft Front Snap Ring

gear thrust washer, first-speed gear and synchronizing ring.

18. Remove 1-2 speed synchronizer clutch assembly retaining sleeve (Fig. 7-66) and remove 1-2 synchronizer assembly, second-speed synchronizer ring and second-speed gear from mainshaft.

CLEANING AND INSPECTION

Transmission Case

Wash the transmission case inside and out with

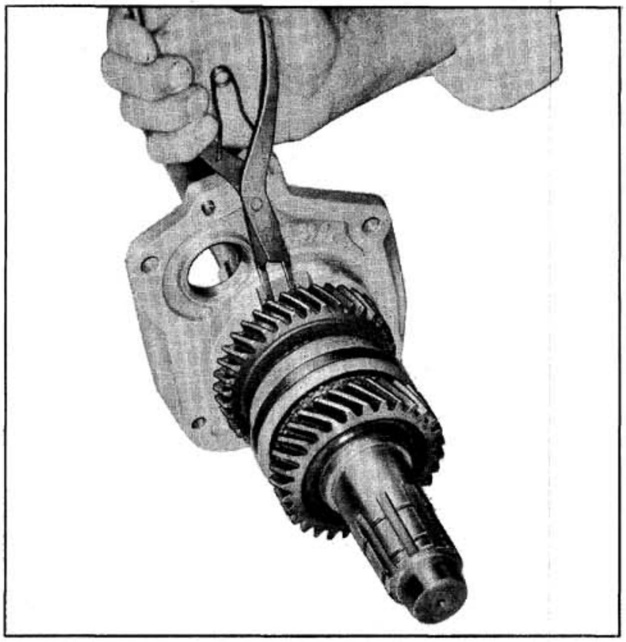


Fig. 7-64 Removing Rear Bearing Retainer

a cleaning solvent and inspect for cracks. Inspect the front face which fits against clutch housing for burrs and if any are present, dress them off with a fine cut mill file.

Front and Rear Bearings

1. Wash the front and rear bearings thoroughly in a cleaning solvent.

2. Blow out bearings with compressed air.

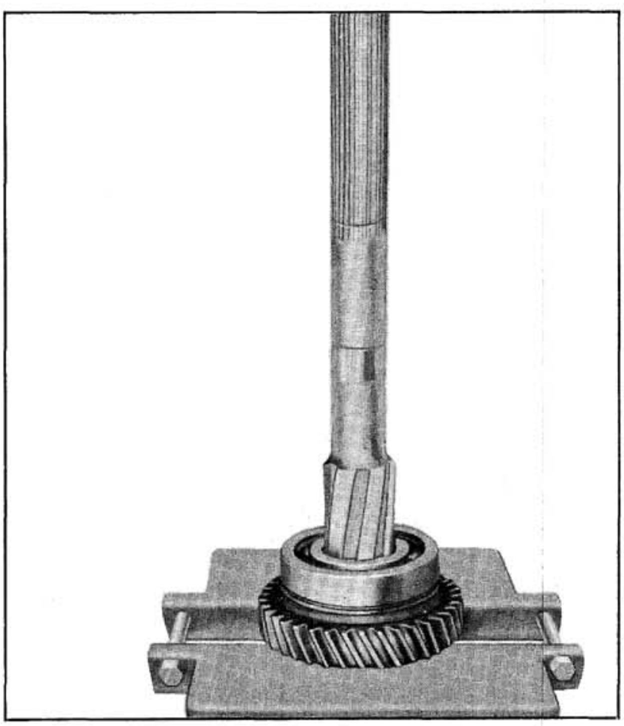


Fig. 7-65 Removing Mainshaft from Rear Bearing and First Speed Gear

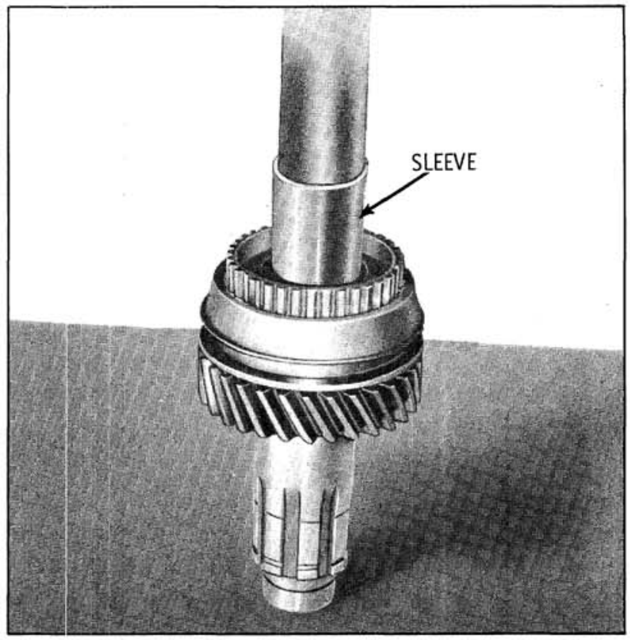


Fig. 7-66 Removing 1-2 Speed Synchronizer Clutch Assembly Retaining Sleeve

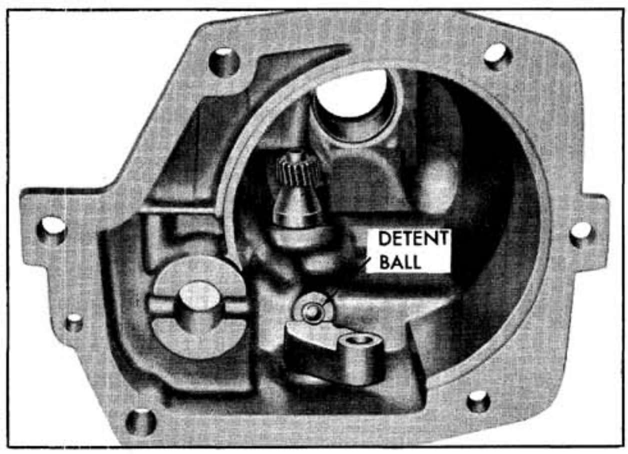


Fig. 7-67 Installing Reverse Shifter Shaft and Detent Ball

CAUTION: Do not allow the bearings to spin, but turn them slowly by hand. Spinning bearings will damage the race and balls.

3. Make sure bearings are clean, then lubricate them with light engine oil and check them for roughness. Roughness may be determined by slowly turning the outer race by hand.

Bearing Rollers and Spacers

All main drive gear and countergear bearing rollers should be inspected closely and replaced if they show wear. Inspect countershaft at the same time and replace if necessary. Replace all worn spacers.

Gears

Inspect all gears and replace all that are worn or damaged.

Reverse Idler

1. The bushings used in the idler gear are pressed into the gear, then peened into holes in the bores and are bored in place. This insures the positive alignment of the bushings and their shafts, as well as proper meshing of the gears. Because of the high degree of accuracy to which these parts are machined, the bushings are not serviced separately.

2. Check bushings for excessive wear by using a narrow feeler gauge between the shaft and the bushing or use a micrometer. The proper clearance is from .003" to .005".

REPAIRS

Reverse Shifter Shaft and Seal

Replacement

1. With case extension removed from transmission, the reverse shifter shaft lock pin will already be removed. (See Step 4 under DISASSEMBLY.)

2. Remove shift fork.

3. Carefully drive shifter shaft into case extension, allowing ball detent to drop into case. Remove shaft and ball detent spring.

4. Place ball detent spring into detent spring hole and from inside extension install shifter shaft fully into its opening until the detent plate is butted against inside of extension housing.

5. Place detent ball on spring (Fig. 7-67) and, holding ball down with your thumb or a suitable tool, push the shifter shaft back in away from case until it is directly over the ball and turn until the ball drops into detent on the shaft detent plate.

6. Install shift fork.

   NOTE: Do not drive the shifter shaft lock pin into place until the extension has been installed on the transmission case.

Extension Oil Seal or Bushing

If bushing in rear of extension requires replacement, remove oil seal and use Tool J-5778 to drive bushing into case extension. Using the same tool, drive new bushing in from the rear. Coat ID of bushing with transmission lubricant, then install new oil seal using Tool J-5154.

Clutch Keys and Springs

NOTE: The clutch hubs and sliding sleeves are a selected assembly and should be kept together as originally assembled, but the three keys and two springs may be replaced if worn or broken.

Replacement

1. Push the hub from the sliding sleeve. The keys will fall free and the springs may be easily removed.

2. Place the two springs in position (one on each side of the hub), so all three keys are engaged by both springs. Place the keys in position and, holding them in place, slide the hub into the sleeve.

ASSEMBLY

Mainshaft Assembly

1. From the rear of the mainshaft, assemble the second-speed gear (with hub of gear toward rear of shaft).

2. Install 1-2 synchronizer clutch assembly to mainshaft (sliding clutch sleeve taper toward the rear, hub to the front); together with a synchronizing ring on either side so their keyways line up with the clutch keys. (Fig. 7-68) Install synchronizer clutch assembly retaining sleeve.

3. Install the first-speed gear with hub toward front.

4. Using 1-5/8" ID pipe cut to a suitable length, press on the rear bearing with the snap ring groove toward the front of the transmission. (Fig. 7-69) Firmly seat the bearing.

5. Choose the correct selective fit snap ring (.091", .094", ,097", .100", or .104") and install it in the groove in mainshaft behind the rear bearing. With proper ring, maximum distance between snap ring and rear face of bearing will be from zero to .005".

   NOTE: Always use new snap rings when reassembling transmission and do not expand the snap ring further than necessary for assembly.

6. Install the third-speed gear (hub to front of transmission) and the third-speed gear synchronizing ring (notches to front of transmission).

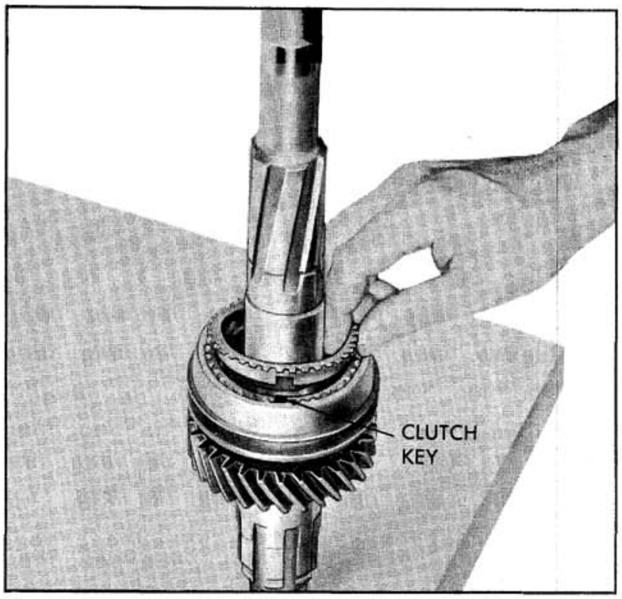


Fig. 7-68 Installing Synchronizing Ring

7. Install the third and fourth-speed gear clutch assembly (hub and sliding sleeve) with both sleeve taper and hub toward the front, making sure the keys in the hub correspond to the notches in the third-speed gear synchronizing ring.

8. Install snap ring in the groove in mainshaft in front of the third and fourth-speed clutch assembly with ends of snap ring seated behind spline teeth.

9. Install the rear bearing retainer. (Fig. 7-70) Spread the snap ring in the plate to allow the snap ring to drop around the rear bearing and press on the end of the mainshaft until the snap ring engages the groove in the rear bearing.

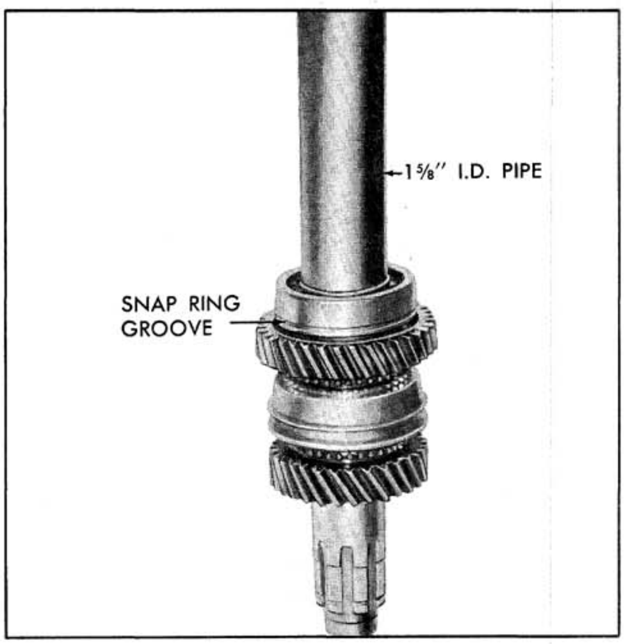


Fig. 7-69 Installing Rear Bearing

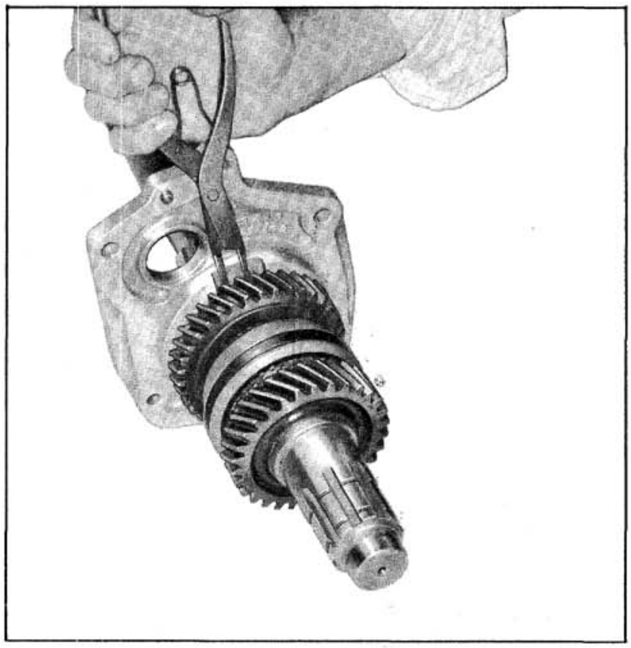


Fig. 7-70 Installing Rear Bearing

10. Install the reverse gear (shift collar to rear).

11. 33 through 38 Series - Press speedometer drive gear onto the mainshaft, using a suitable press plate such as J-1453. Position the speedometer gear to get a measurement of 4-5/16" from the forward side of the gear to the flat surface of the rear bearing retainer (Fig. 7-71) or until centered on the mainshaft speedometer drive gear boss.

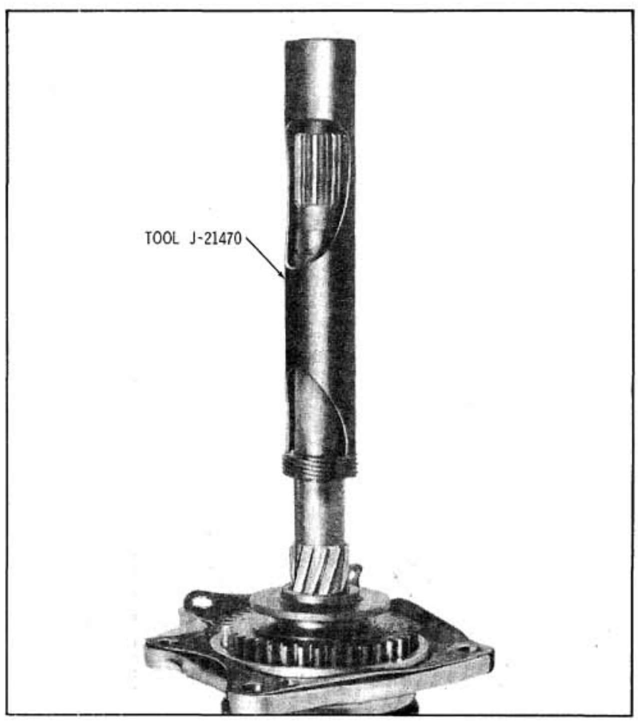


Fig. 7-71 Installing Speedometer Drive Gear

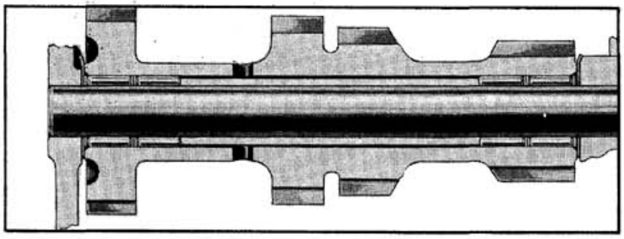


Fig. 7-72 Cross-Section of Countergear Assembly

Countergear Assembly

1. Install roller spacer in countergear.

2. Using heavy grease to retain the rollers, install 28 rollers in either end of the countergears, two .070" spacers, 28 more rollers, then one .070" spacer. Install in the other end of the countergear, 28 rollers, two .070" spacers, 28 more rollers and another .070" spacer. (Fig. 7-72)

3. Insert Tool J-21629 into countergear. Put countergear tanged thrust washers in place on countergear, retaining them with heavy grease.

Transmission Assembly

1. Rest the transmission case on its side with the side cover opening toward the assembler.

2. Set countergear in place in bottom of transmission case, making sure that tanged thrust washers are not knocked out of place.

3. Position the transmission case resting on its front face.

4. Lubricate and insert countershaft in rear of case. Turn countershaft so flat on end of shaft is horizontal and facing bottom of case.

   NOTE: The flat on shaft must be horizontal and toward the bottom to mate with rear bearing retainer when installed.

5. Align countergear with shaft in rear and hole in front of case and press countershaft into case (pushing assembly tool out front of case) until flat on shaft is flush with rear of case. Be sure thrust washers remain in place. (Fig. 7-73)

6. Attach a dial indicator as shown in Fig. 7-74 and check end play of the countergear. If end play is greater than .025", new thrust washers must be installed.

7. Install the 17 roller bearings into main drive gear, using heavy grease to hold the bearings and cage in place.

8. Install main drive gear and pilot bearings through the side cover opening and into position in transmission front bore.

9. Place gasket in position on front face of rear bearing retainer.

10. Install the fourth-speed synchronizing ring on main drive gear with the notches toward the rear of the transmission.

11. Position the reverse idler gear thrust washer (tanged) on the machined face of the ear cast in the case for the reverse idler shaft and hold with heavy grease. Position the front reverse idler gear next to the thrust washer, with the hub facing toward rear of the case.

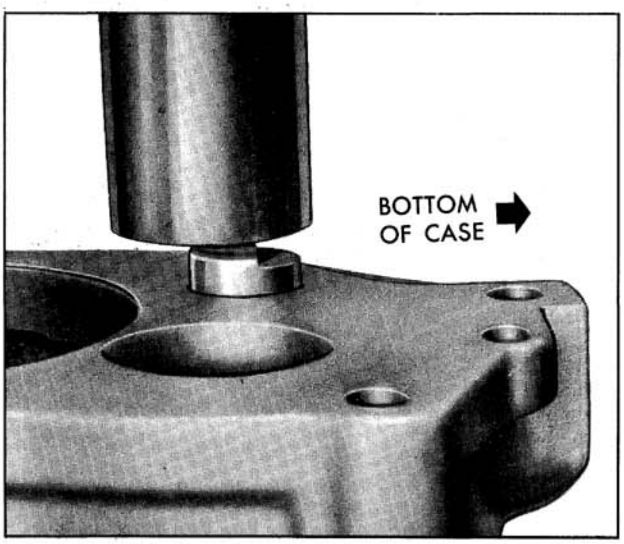


Fig. 7-73 Installing Countershaft

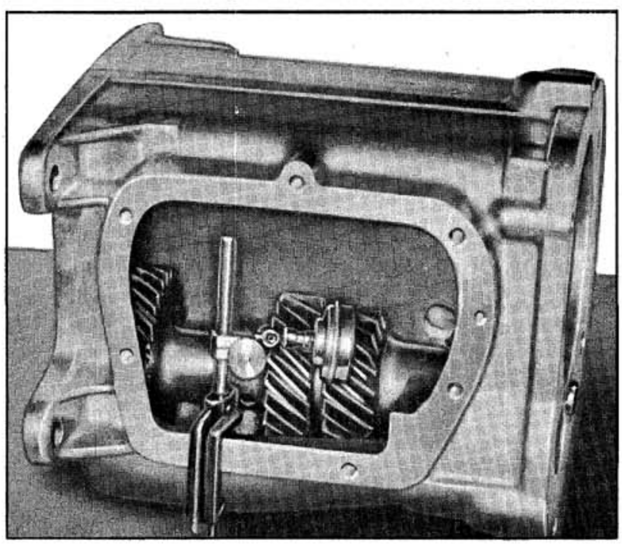


Fig. 7-74 Checking Countergear End Play

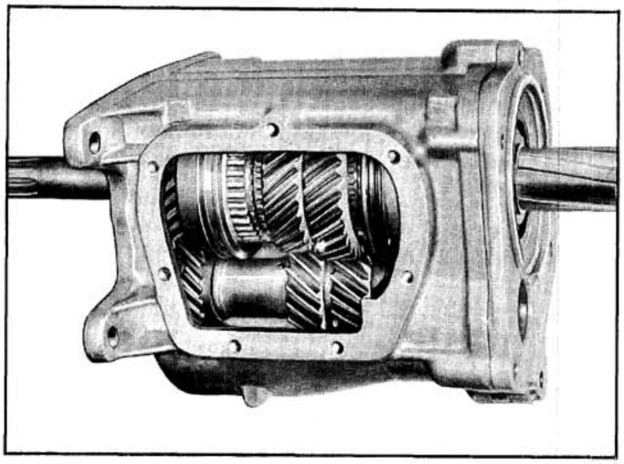


Fig. 7-75 Third and Fourth Speed Synchronizer Clutch Sleeve in Fourth Gear Position

CAUTION: Before attempting to install mainshaft assembly to case, slide the 3-4 synchronizing clutch sleeve forward into fourth-speed detent position. (Fig. 7-75)

12. Lower the mainshaft assembly into the case, making certain the notches on the fourth-speed synchronizing ring correspond to the keys in the clutch assembly. (Fig. 7-76)

13. With the guide pin in rear bearing retainer aligned with hole in rear of case, tap rear bearing retainer into position with a soft hammer.

14. From the rear of the case, insert the rear reverse idler gear, engaging the splines with the portion of the front gear inside the case.

15. Using heavy grease, place gasket in position on rear face of rear bearing retainer.

16. Install the remaining flat thrust washer on reverse idler shaft. If new idler shaft is being used, drive out the roll pin and press it into new shaft.

17. Install reverse idler shaft, roll pin and thrust washer into gears and front boss of case. Make sure to pick up front tanged thrust washer.

NOTE: Roll pin should be in a vertical position.

18. Pull reverse shifter shaft to left side of extension and rotate shaft to bring reverse shift fork forward in extension (reverse detent position). Start the extension onto the transmission case (Fig. 7-77), while slowly pushing in on the shifter shaft to engage the shift fork with the reverse gear shift collar; then pilot the reverse idler shaft into the extension housing, permitting the extension to slide onto the transmission case.

19. Install six extension and retainer to case attaching bolts. Torque upper three bolts to 25 ft. lbs.; lower three bolts to 35 ft. lbs.

20. Push or pull reverse shifter shaft to line up groove in the shaft with the holes in the boss and drive in the lock pin. Install shifter lever.

21. Press bearing onto main drive gear (snap ring groove to front) and into case until several main drive gear retaining nut threads are exposed.

22. Lock up transmission by shifting into two gears. Install main drive gear retaining nut on the gear shaft and draw it up tight using Tool J-0933. Be sure bearing fully seats against shoulder on gear. Torque retaining nut to 40 ft. lbs. and lock in place by staking

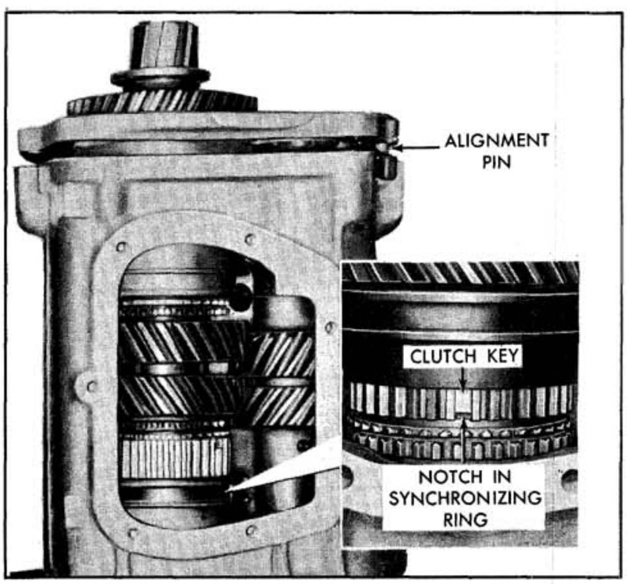


Fig. 7-76 Installing Mainshaft Assembly

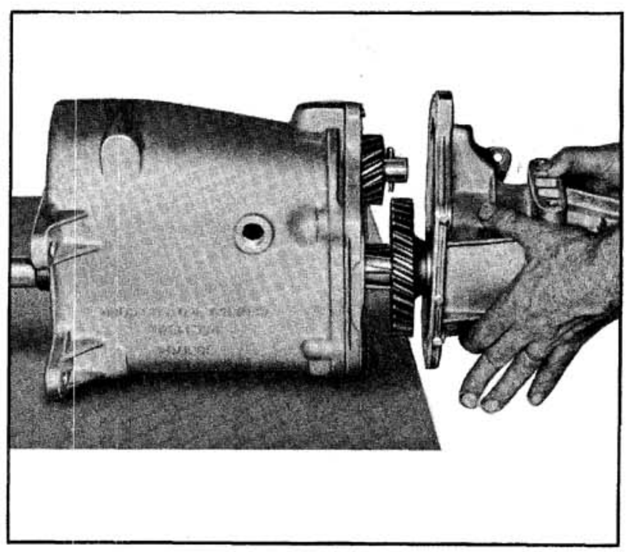


Fig. 7-77 Installing Case Extension

securely into main drive gear shaft hole with a center punch. Care must be used to avoid damaging the threads on the shaft.

23. Install the main drive gear bearing retainer, gasket and four attaching bolts using 1050026 Sealer on bolts. Torque to 20 ft. lbs.

24. Shift mainshaft 3-4 sliding clutch sleeve into neutral position and 1-2 sliding clutch sleeve into second gear (forward) detent position. Shift side cover 3-4 shifter lever into neutral detent and 1-2 shifter lever into second gear detent position.

25. Install side cover gasket and carefully position side cover into place. There is a dowel pin in the cover to assure proper alignment with the case. Install attaching bolts and tighten evenly to avoid side cover distortion. Torque to 20 ft. lbs.

DIAGNOSIS

CONDITION AND PROBABLE CAUSE

Shifts Hard

a. Clutch not releasing engine or slow to release.

b. Shift linkage binding or selector not properly adjusted.

Shifts Hard on Downshift

a. Downshifting at too high an engine speed.

b. Lubricant cold or too high viscosity.

Disengages from Gear

Improperly adjusted linkage.

Transmission loose at clutch housing.

Dirt between transmission case and clutch housing.

Clutch gear bearing retainer broken or loose.

Damaged mainshaft pilot bearing rollers.

Clutch teeth worn or defective and/or clutch hub spline worn.

Clutch housing misaligned with engine.

Noisy in All Gears

Insufficient lubricant.

Worn countergear bearings.

Worn or damaged clutch gear and countershaft drive gear.

Damaged clutch gear or mainshaft ball bearings.

Damaged speedometer gears.

Noisy in High Gear

Damaged clutch gear bearing.

Damaged mainshaft bearing.

Damaged speedometer gears.

Noisy in Neutral with Engine Running

Damaged clutch gear bearing.

Damaged mainshaft pilot bearing rollers.

Noisy in all Reduction Gears

Insufficient lubricant.

Worn or damaged clutch gear or countergear.

Noisy In One Gear Only

Damaged or worn mainshaft constant mesh gear.

Damaged or worn countergear teeth.

Excessive Backlash in All Reduction Gears

Worn countergear bearings.

Excessive end play in countergear.

Leaks Lubricant

Excessive amount of lubricant.

Loose or broken clutch gear bearing retainer.

Clutch gear bearing retainer gasket damaged.

Cover loose or gasket damaged.

Defective Seals

Countershaft loose in case.

Lack of sealer on bolts.

CLUTCH
33-34-35-36-38 & 52 SERIES

MAINTENANCE RECOMMENDATIONS

The clutch release bearing is a prepacked sealed unit which requires no periodic lubrication. The clutch linkage should be lubricated at each lubrication period with engine oil. The clutch pedal free travel should be checked whenever the car is in the service area. Free travel should be 3/4" to 1".

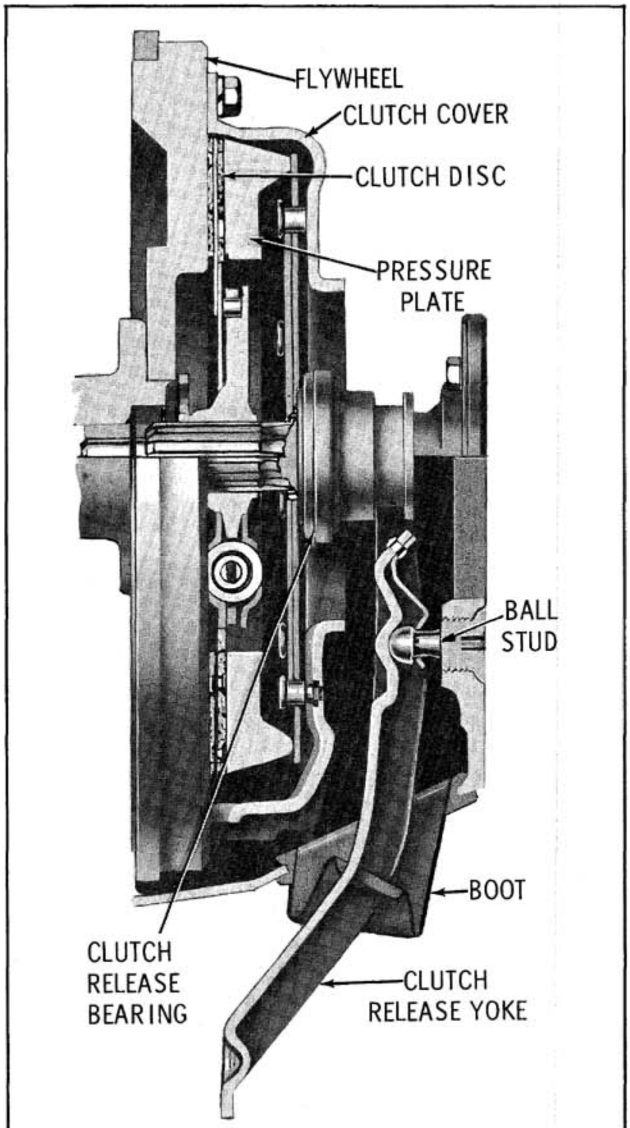


Fig. 7-80 Clutch Assembly

DESCRIPTION (Fig. 7-80)

A single plate, dry disc-type clutch is used on all 33 thru 52 Series cars with Synchromesh transmissions. The clutch assembly consists of the clutch driven plate assembly, the clutch cover and pressure plate assembly and the clutch release mechanism.

The driven plate for the V-6 and V-8 clutches differ from each other in plate size and damper spring calibration. Grooves on both sides of the clutch plate lining prevent the sticking of the plate to the flywheel and pressure plate due to vacuum between the members.

The driven plate incorporates a damper assembly in the hub to prevent the transmitting of vibration from engine to transmission.

The clutch pressure plate is of the disc spring type. The V-6, V-8, and V-8 special duty clutch pressure plates differ in size and spring load. There is an overcenter effect inherent in the action of the disc spring itself. This eliminates the need for an overcenter assist spring.

Pressure plate spring pressure forces the driven plate against the flywheel, thereby coupling the engine to the transmission.

The clutch release mechanism consists of a ball thrust bearing, appropriate levers and linkage to manually control the action of the bearing. When pressure is applied to the clutch pedal to release the clutch, the clutch release yoke pivots on its ball socket. The inner end then pushes the release bearing forward so that it presses against the inner ends of the clutch release levers, releasing the clutch. Pedal effort is transmitted by the pedal to the equalizer assembly and thence through the clutch release yoke.

CLUTCH LINKAGE ADJUSTMENT OR THE REMOVAL AND REPLACEMENT OF EACH PART OF LINKAGE

Fig. 7-81 V-6 Clutch Linkage (33 & 35 Series)
Fig. 7-82 V-8 Clutch Linkage (34, 36 & 38 Series)
Fig. 7-83 V-8 Clutch Linkage (52 Series)

1. Check for worn linkage, broken or discon-

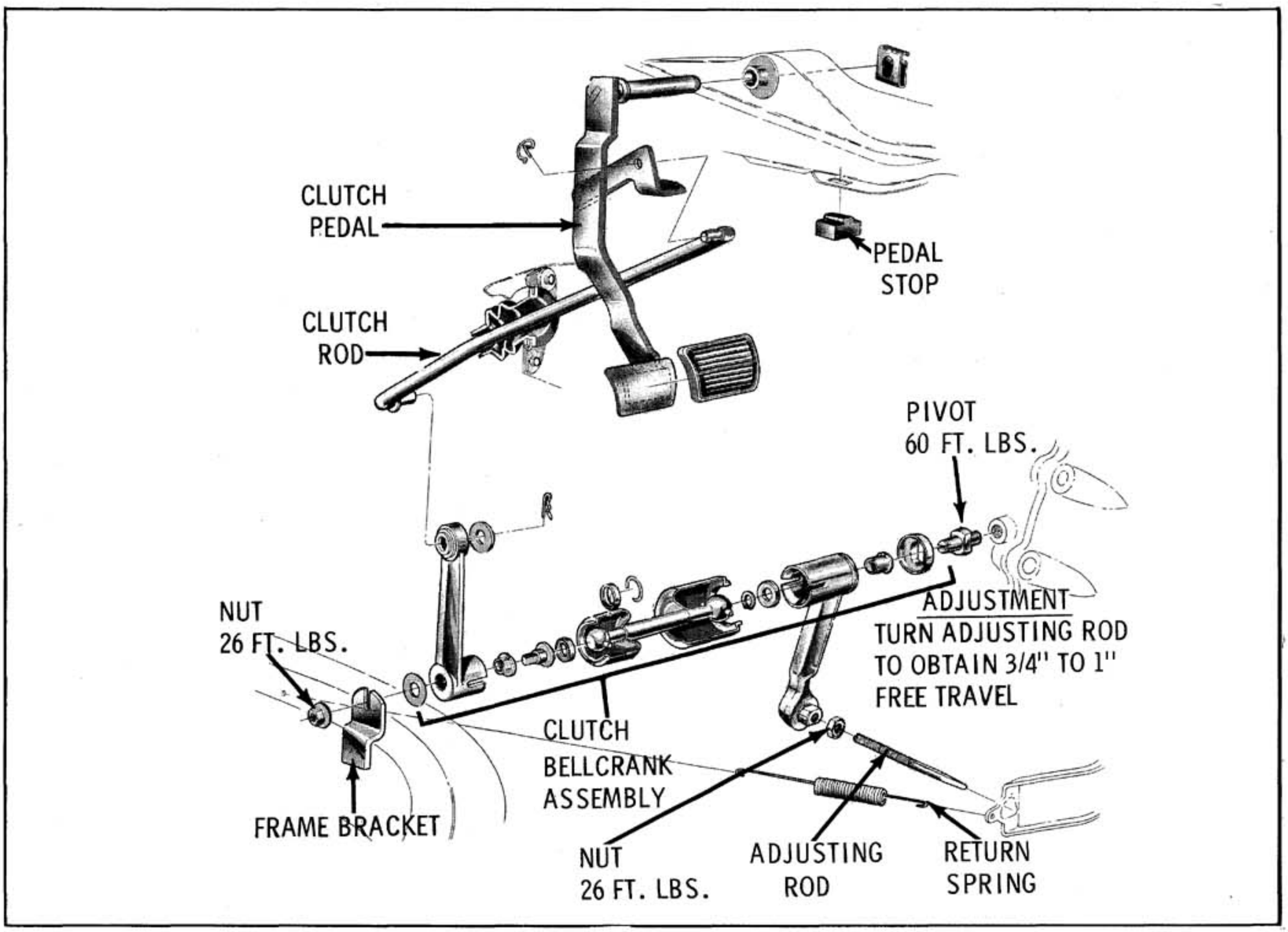


Fig. 7-81 V-6 Clutch Linkage

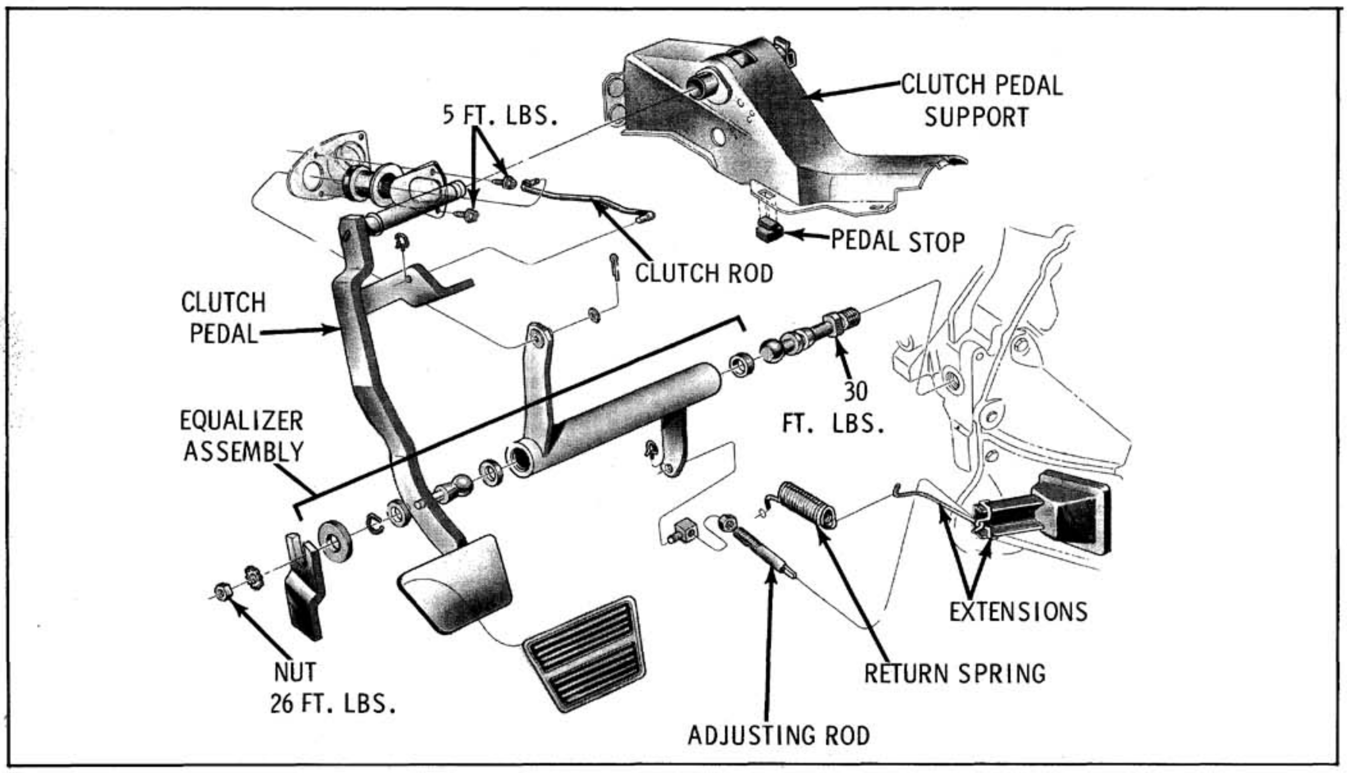


Fig. 7-82 34-36-38 Series Clutch Linkage

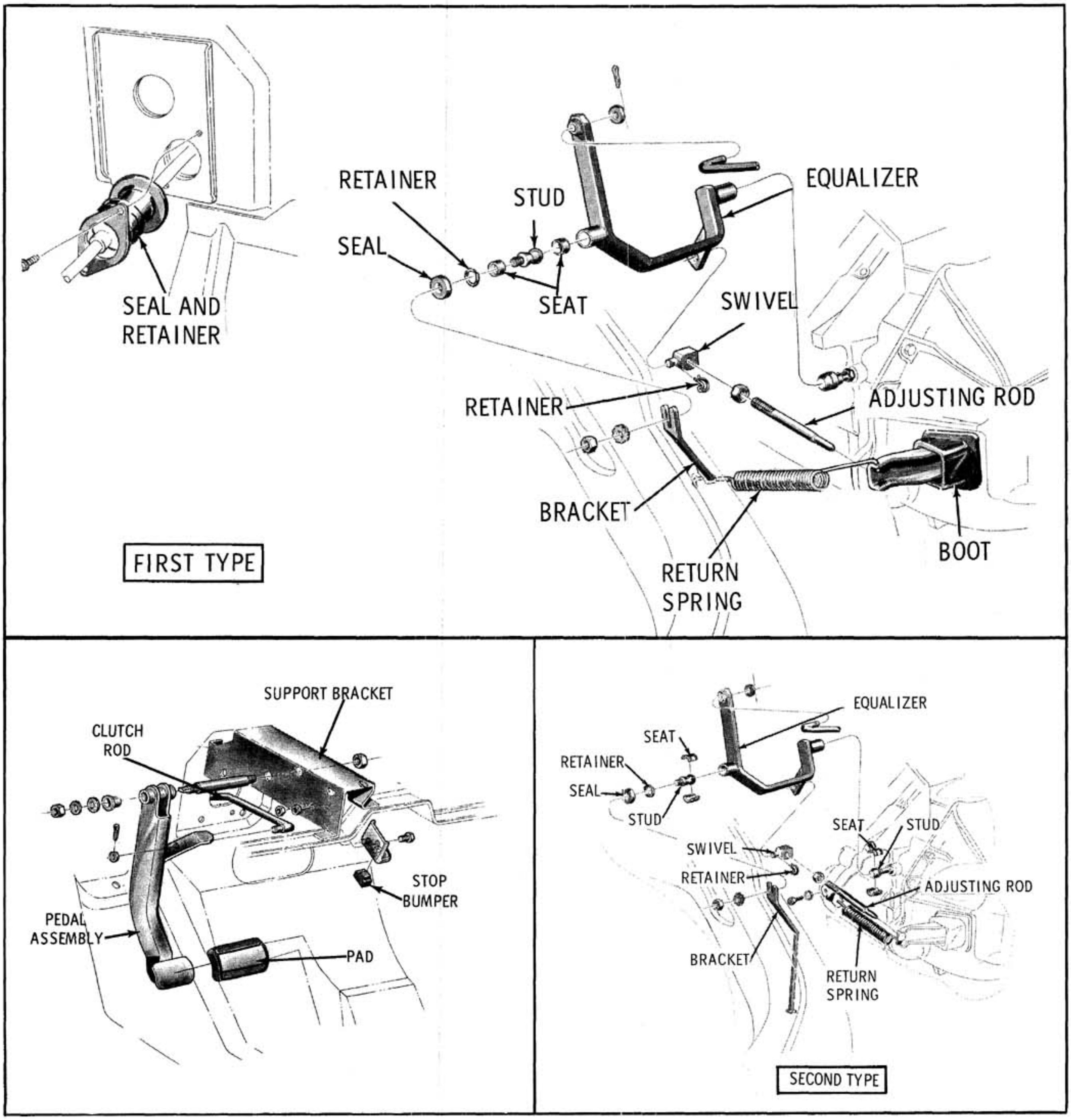


Fig. 7-83 52 Series Clutch Linkage

nected pedal return spring.

2. Lubricate with engine oil as required.

CLUTCH ASSEMBLY RELEASE BEARING, RELEASE YOKE, AND BALL STUD

Removal

1. Remove transmission.
2. Disconnect the clutch return spring and clutch rod assembly.
3. Remove the clutch release bearing.
4. Remove flywheel housing leaving starter attached to engine. Release yoke and ball stud will remain with housing. The clutch release yoke, boot and ball stud are accessible for service. (Fig. 7-85)
5. Scribe mark the clutch cover assembly to flywheel for correct reassembly. (Fig. 7-86)
6. Remove clutch cover assembly to flywheel

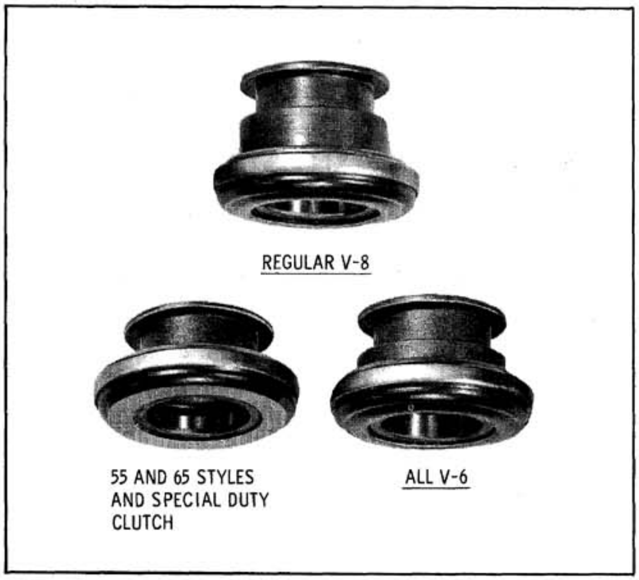


Fig. 7-84 Clutch Release Bearing Identification

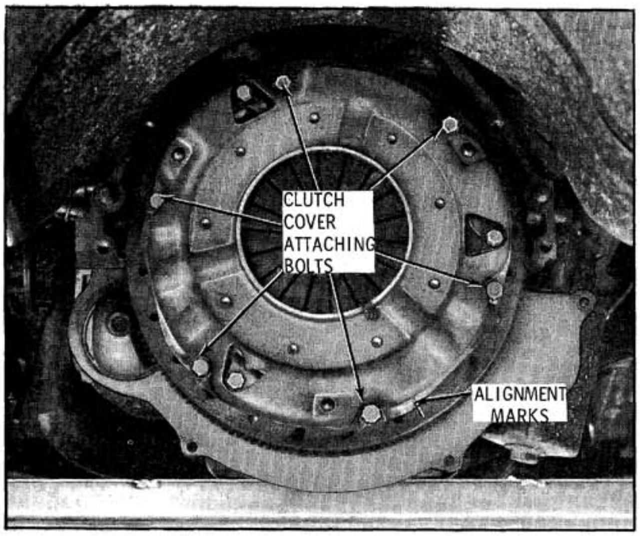


Fig. 7-86 Clutch Cover Alignment

attaching bolts and remove clutch cover and clutch disc. (Fig. 7-86)

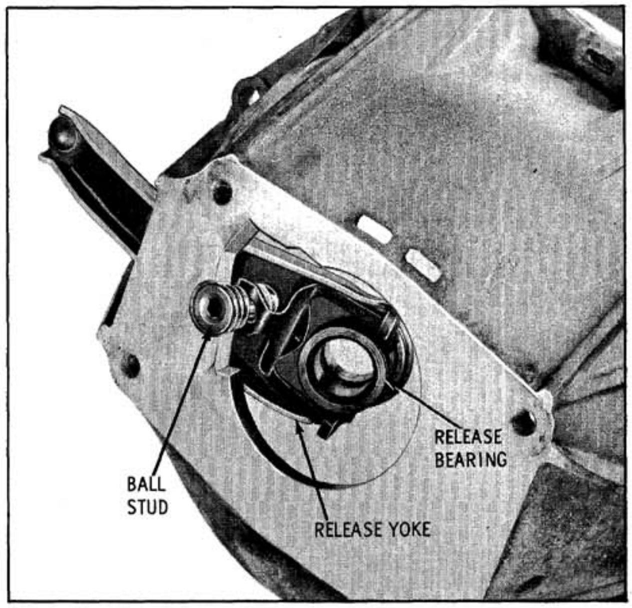


Fig. 7-85 Clutch Release Bearing

Installation

1. Lubricate pilot bearing with wheel bearing grease.
   NOTE: If necessary to replace pilot bearing, refer to ENGINE, Section 3 for procedure.
2. Install clutch disc and clutch cover assembly being careful to align scribe marks. Install attaching bolts but do not tighten.
3. Place an old drive gear in disc and into pilot bearing to align disc. Tighten clutch cover assembly attaching bolts alternately and torque to 17 ft. lbs.
4. Lubricate the internal groove of the release bearing and the release yoke ball stud with 1050169 lubricant and install bearing.
5. Remove old drive gear, install flywheel housing and transmission. Connect and adjust linkage.

CLUTCH SPECIFICATIONS

DISC FACINGS		
Diameter - Inside	V-6	6.12"
	V-8	6.50"
	V-8 55 & 65 Styles and Heavy Duty Clutch	6.50"
Diameter - Outside	V-6	9.12"
	V-8	10.40"
	V-8 55 & 65 Styles and Heavy Duty Clutch	11.00"
Number Used		2
Thickness		.135"

CLUTCH SPECIFICATIONS (Continued)

DRIVEN DISC ASSEMBLY

Overall Thickness (Clutch Engaged)	0.300"
Hub Dimensions	1-1/8" - 10 Spline

PEDAL FREE TRAVEL	3/4" - 1"

PRESSURE SPRING IS A SINGLE DISC SPRING

RELEASE BEARING

Type	Sealed Ball

CLUTCH PILOT BEARING

Type	Oil Impregnated Bushing

TORQUE SPECIFICATIONS

3-SPEED

APPLICATION	FT. LBS.
Seal and Retainer	1.5
Lock Plate to Rear Bearing Retainer	7
Bracket Assembly Shift Relay Lever to Frame(V-8)	15
Clutch Cover to Housing	17
Equalizer Bracket to Transmission (V-6)	20
Upper Lever Assembly to Lower Lever and Bracket Assembly	22
Shifter Levers to Transmission	20
Shift Lever and Bracket Assembly to Transmission	30
Shift Rods to Transmission Lever and Relay Lever	26
Shift Rods to Equalizer	15
Transmission Filler Plug	40

4-SPEED

APPLICATION	FT. LBS.
Seal and Retainer	1.5
Lock Plate to Rear Bearing Retainer	7
Clutch Cover to Housing	17
Upper Lever Assembly to Lower Lever and Bracket Assembly	22
Shifter Levers to Transmission	20
Shift Lever and Bracket Assembly to Transmission	30
Shift Rods to Transmission Lever and Relay Lever	26
Shift Rods to Equalizer	15
Transmission Filler Plug	40

TORQUE SPECIFICATIONS (Continued)

CLUTCH

APPLICATION	FT. LBS.
Retainer - Clutch Seal Release Rod to Dash	1.5
Clutch Cover to Flywheel	17
Flywheel Housing to Cylinder Block	30
Ball Stud Equalizer to Frame (V-8)	26
Rod to. Equalizer Lever	26
Flywheel to Crankshaft	95
Transmission to Flywheel Housing	70
Ball Stud Equalizer to Engine	30
Clutch Equalizer Lever to Cylinder Block	60
Clutch Release Fork Ball Stud	45

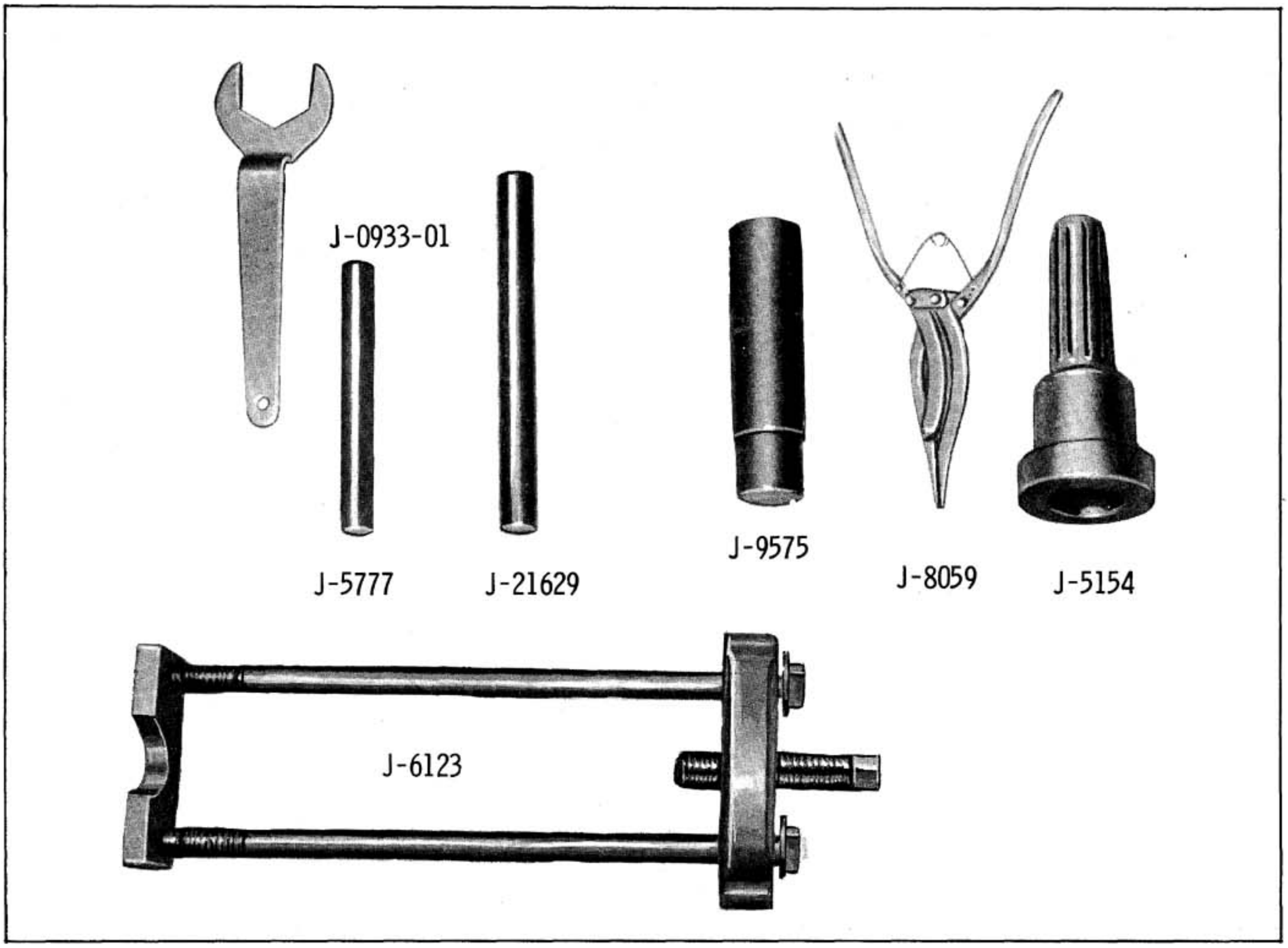


Fig. 7-87 Tools

J-5154	Extension Housing Seal Installer
J-5777	Countergear loading Tool (3-Speed Transmission)
J-6123	Speedometer Drive Gear Remover
J-8059	Retainer Snap Ring Pliers
J-9575	Extension Housing Bushing Remover and Installer
J-21629	Countergear Loading Tool (4-Speed Transmission)
J-0933-01	Clutch Gear Bearing Retainer Wrench

CLUTCH

54-56-58 & 66 SERIES

PERIODIC MAINTENANCE

The clutch release bearing is a prepacked sealed unit which requires no periodic lubrication. The clutch linkage should be lubricated at each oil change interval, with engine oil. The clutch pedal free travel should be checked whenever the car is in the service area. Free travel should be 3/4" to 1".

GENERAL DESCRIPTION

A single plate dry disc-type clutch is used on all 54 through 66 series with a Synchromesh transmission. The clutch assembly consists of the clutch driven plate assembly, the clutch cover and pressure plate assembly and the clutch release mechanism.

The clutch pressure plate is the coil spring type with three centrifugal rollers. As engine speed is increased, centrifugal force assists spring pressure in asserting pressure on the driven member.

The driven plate incorporates a damper assembly in the hub to prevent the transmitting of vibration from the engine to the transmission. Grooves on both sides of the clutch plate lining prevent the sticking of the plate to the flywheel and pressure plate due to vacuum between the members.

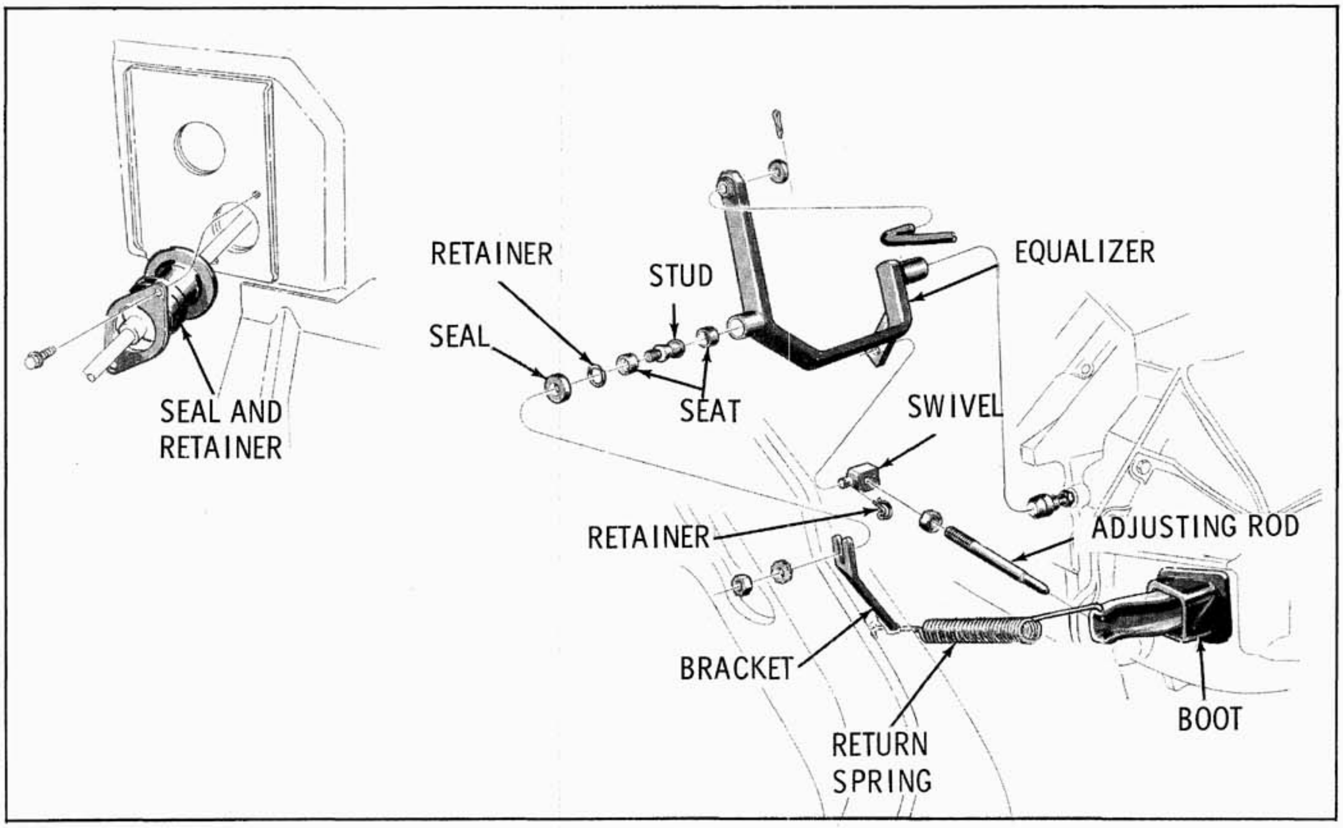


Fig. 7-90 Clutch Linkage (1st Type)

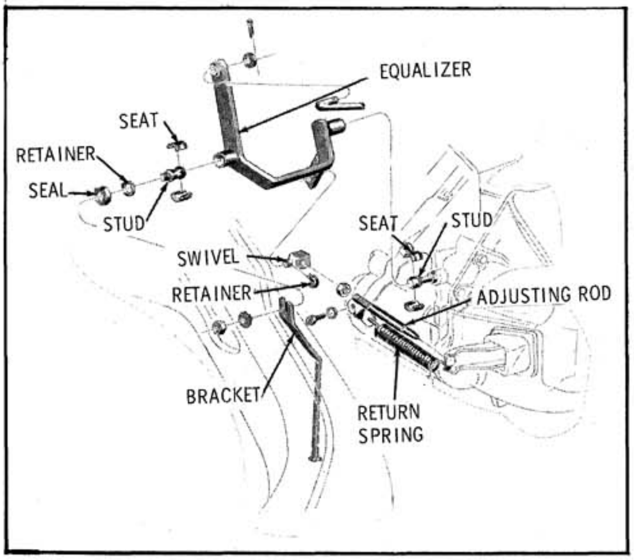


Fig. 7-91 Clutch Linkage (2nd Type)

The clutch release mechanism consists of a clutch release bearing (ball thrust), appropriate levers and linkage to manually control the action of the bearing. When pressure is applied, the clutch release yoke pivots on its ball socket. The inner ends then push the release bearing forward so that it presses against the inner ends of the clutch release levers, releasing the clutch. Pedal effort is transmitted by the pedal to the equalizer assembly and then through the clutch release yoke. (Figs. 7-90 and 7-91)

CLUTCH ASSEMBLY RELEASE BEARING, RELEASE YOKE AND BALL STUD

Remove

1. Remove transmission.

   NOTE: Refer to TRANSMISSION - Remove.

2. Disconnect the clutch return spring and clutch rod assembly.

   CAUTION: The clutch pedal uses high tension overcenter springs to help apply the clutch. When clutch linkage is disconnected, place a 4" x 4" block under the clutch pedal to hold pedal above the overcenter point.

3. Remove the clutch release bearing.

4. Remove flywheel housing, leaving starter attached to the engine. Release yoke and ball stud will remain with housing. The clutch release yoke, boot and ball stud are accessible for service.

5. Scribe mark the cover assembly to flywheel for correct assembly.

6. Remove clutch cover assembly to flywheel attaching bolts and remove clutch cover and disc.

Installation

1. Lubricate pilot bearing with wheel bearing grease.

   NOTE: If necessary to replace pilot bearing, refer to ENGINE Section for procedure.

2. Install clutch disc and clutch cover assembly, being careful to align scribe marks. Install attaching bolts but do not tighten.

3. Place an old drive gear in disc and into pilot bearing to align disc. Tighten clutch cover assembly attaching bolts evenly, turning each about one turn at a time, and torque to 17 ft. lbs.

4. Lubricate the internal groove of the release bearing and the release yoke ball stud with 1050169 Lubricant and install bearing.

5. Remove old drive gear and install flywheel housing and transmission.

6. Position clutch pedal in the applied position and connect linkage and adjust.

CLUTCH PEDAL FREE TRAVEL ADJUSTMENT

1. Check the free travel of clutch pedal. If necessary to adjust, proceed as follows:

   a. Loosen locknut on adjusting rod and remove swivel retainer.

   b. Adjust swivel to obtain proper clutch pedal free travel of 3/4" to 1".

      CAUTION: Install retainer in swivel before checking the pedal free travel.

2. Tighten swivel locknut and recheck adjustment.

MINOR SERVICE OPERATIONS

CLUTCH PEDAL AND/OR SPRING

Remove

1. Turn back floor mat.

2. Disconnect the clutch rod at the clutch pedal.

3. Disconnect the clutch and brake pedal bracket from the cowl and instrument panel.

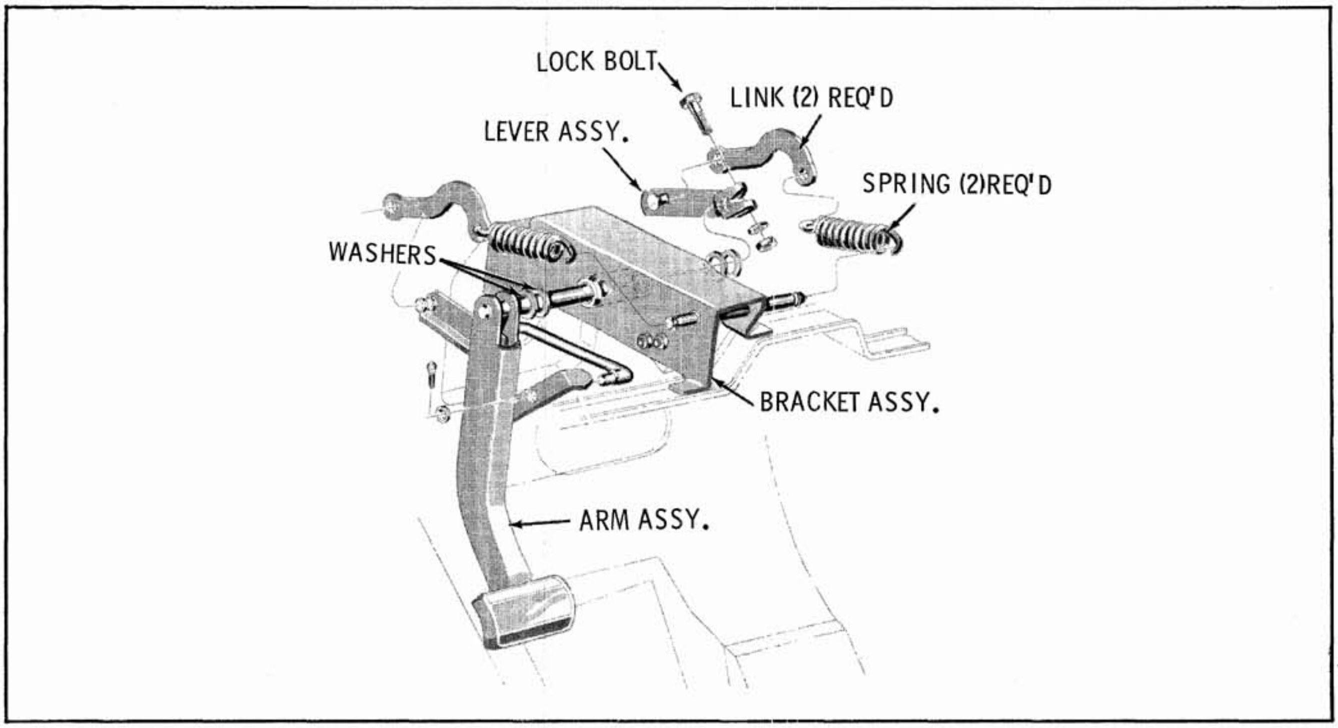


Fig. 7-92 Clutch Pedal Attachment

4. Tip the forward end of the clutch and brake pedal bracket downward to allow greater travel of the clutch pedal.

5. Carefully push the clutch pedal against the toe pan, keeping fingers from beneath the clutch pedal.

6. With the clutch pedal fully depressed, disconnect the overcenter springs and links. Note position of springs so that they can be installed in their original position.

7. Loosen the lock bolt and remove the lever and two washers from the clutch pedal pivot bolt.

8. Slide the clutch pedal two washers and shaft assembly from the bracket.

9. Remove the washers from the pivot shaft.

Install

1. Install two washers on the clutch pivot shaft.

2. Slide the clutch pedal and shaft into the clutch bracket.

3. Install two washers on the clutch pedal shaft, then install the lever on the clutch pedal and retain with the locking bolt.

   NOTE: The lever and pivot shaft are serrated and can be assembled in only one position.

4. Assemble the springs and links and install as shown in Fig. 7-92.

5. With springs and links attached, pull clutch pedal upward.

6. Attach the mounting bracket to the cowl and instrument panel.

7. Connect clutch rod to the clutch pedal.

8. Check and adjust clutch pedal free travel if necessary.

CLUTCH SPECIFICATIONS

1. Disc Facing
   - A. Diameter - Inside . . . . 6-1/2"
   - B. Diameter - Outside . . . . 10-1/2"
   - C. Number Used 2
   - D. Thickness Inside Disc . . . . .125"
   - E. Thickness Outside Disc . . . . .135"
2. Driven Disc Assembly
   - Overall Thickness (Clutch Engaged) . . . . .290"
3. Pedal-Free Travel . . . . 3/4" to 1"
4. Pressure Springs
   - A. Number Used 12
   - B. Color . . . . 6 Springs White
6 Springs Plain
5. Release Bearing
   - A. Type . . . . Sealed Ball

TORQUE SPECIFICATIONS

NOTE: Specified torque is for installation of parts only. Checking of torque during inspection may be 15% below that specified.

APPLICATION	FT. LBS.
Clutch Cover	17
Flywheel Housing to Block	30
Ball Stud Equalizer to Engine	30
Ball Stud Equalizer to Frame	26
Clutch Release Fork Ball Stud	45
Cross Support Bar Brackets to Frame	45
Transmission Mount to Cross Support Bar	45
Shift Equalizer Rod to Transmission	18
Propeller Shaft U-Bolt Nuts	16
Clutch Pedal Pivot Bolt Nut	15

STEERING

(ALL SERIES)

CONTENTS OF SECTION 8

PERIODIC MAINTENANCE

Power Steering gear lubrication is accomplished by the oil supplied through the gear by the power steering pump. Regular or seasonal changes are unnecessary. Refer to PERIODIC MAINTENANCE, Section 2, for steering linkage lubrication requirements.

STEERING LINKAGE (Fig. 8-1 & 8-2)

GENERAL INFORMATION

The only steering linkage adjustment is at the tie rod sleeves for the setting of steering wheel spoke alignment and front wheel toe-in.

SUSPENSION AND STEERING LINKAGE CHECK

1. Raise car on one side at frame torque box located directly behind the front wheel so that tire is approximately one inch off the floor.
2. Position dial indicator as shown in Fig. 8-3.
3. Grasp front wheel as shown in Fig. 8-3. With wheels in straight ahead position, move wheel back and forth without moving steering wheel. Gauge reading should not exceed .180".
4. If gauge reading is not within specifications, a check should be made of all suspension and linkage parts.

STEERING GEAR LASH CHECK

1. With the front wheels on the floor and in the straight ahead position, move steering wheel in both directions without moving the front wheels.

NOTE: If car is equipped with power steering, the engine must be running.

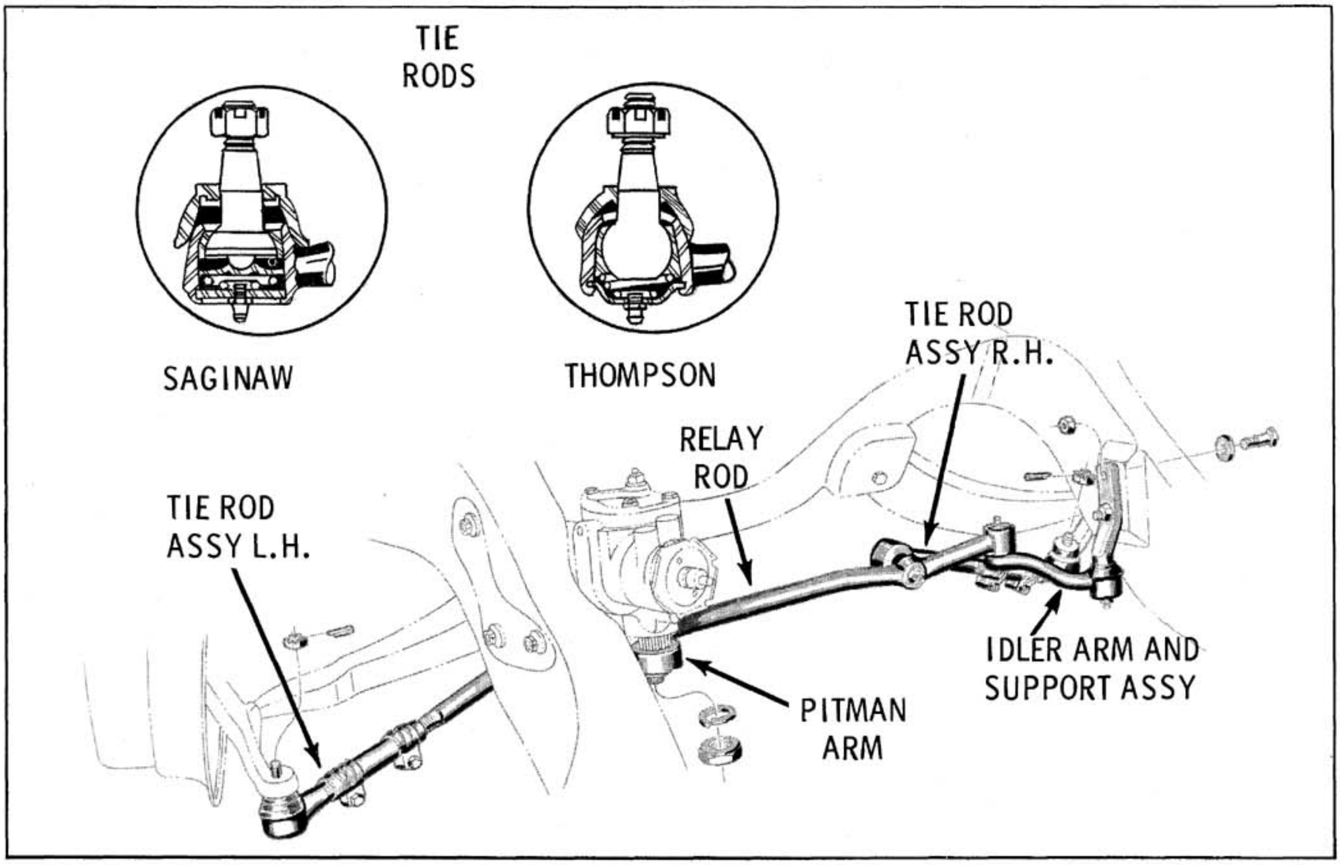


Fig. 8-1 Steering Linkage (52 through 86 Series)

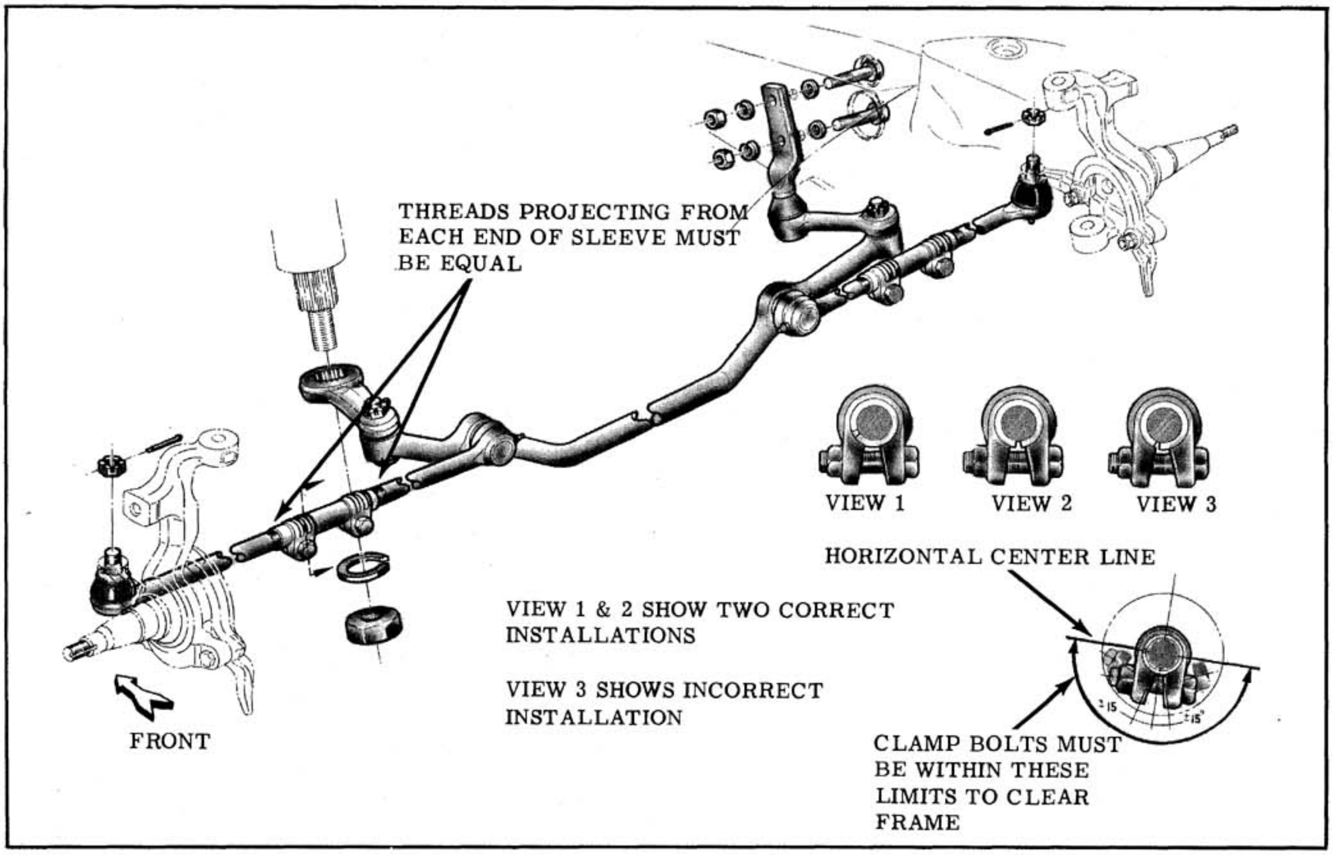


Fig. 8-2 Steering Linkage (33 through 38 Series)

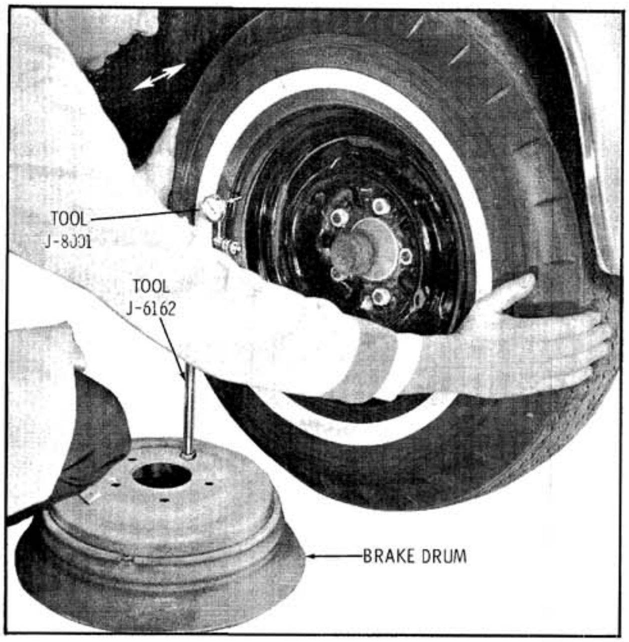


Fig. 8-3 Suspension and Linkage Check

2. If steering gear lash exceeds two inches maximum and/or the gear binds when turning steering wheel from lock to lock, the gear must be adjusted or the cause of the bind corrected.

REPLACEMENT OF STEERING LINKAGE PARTS

PITMAN ARM

To disconnect the pitman arm from the pitman shaft use Tool J-5504-B or a similar puller. Upon assembly, install the pitman arm with the front wheels in the straight ahead position and with the steering wheel at the center of its travel. Torque pitman shaft nut to 150 ft. lbs.

LINKAGE JOINTS

IMPORTANT: When disconnecting a linkage joint, no attempt should be made to disengage the joint by driving a wedge between the joint and the attached part.

Tie rod joints should be disconnected from the relay rod, after removing the attaching nut, by using Tool J-5504-B. (Fig. 8-4) To disconnect the outer end of a tie rod, remove the tie rod to plain arm attaching nut, then tap the END of the PLAIN ARM with a hammer to free the tie rod from the plain arm. Tool BT 6320 can be used to remove the tie rod ends, however the seal must be cut before the tool can be used. Use new seals on assembly. (Fig. 8-5) Upon re-assembly, the linkage joint nuts should be torqued to 50 ft. lbs. To remove the pitman arm or idler arm from the relay rod, the steering

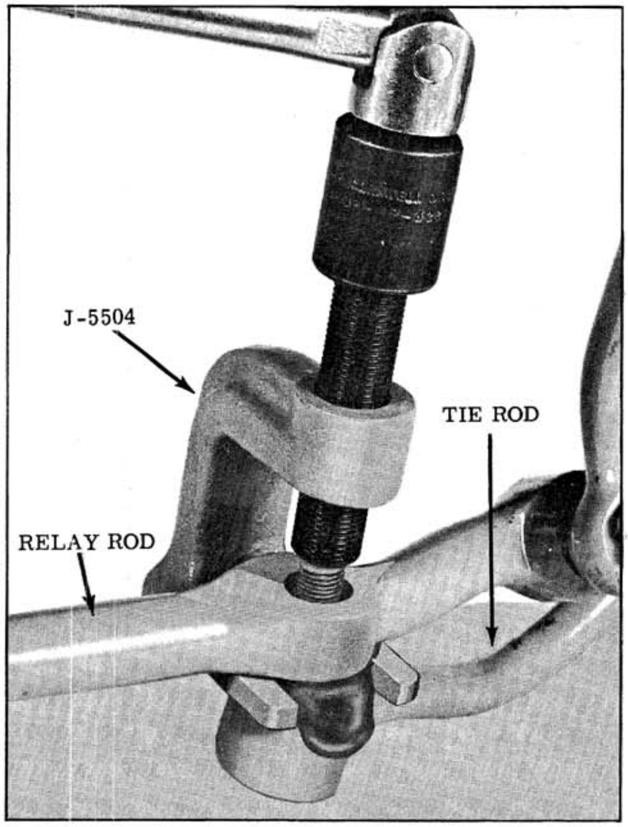


Fig. 8-4 Disconnecting Linkage Joint

linkage should be removed from the car. After removing the nut, the relay rod can be clamped in a vise or supported so that the joint can be driven out of the relay rod.

IDLER ARM AND SUPPORT ASSEMBLY

The idler arm and support is serviced as an assembly and no adjustments are required. When

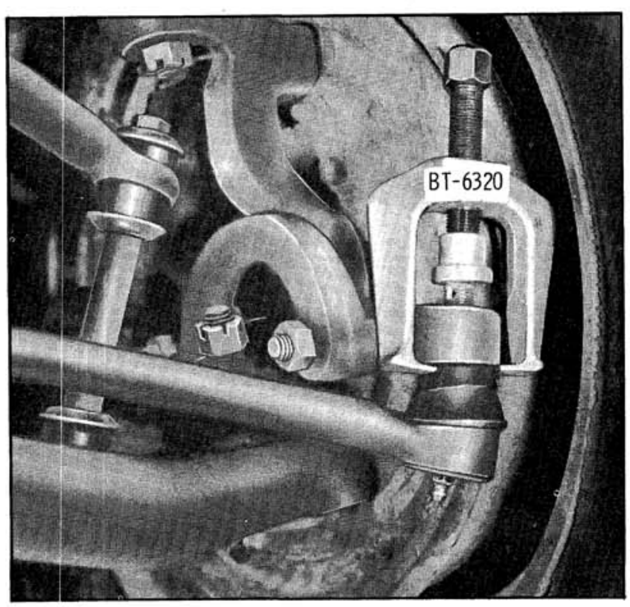


Fig. 8-5 Disconnecting Linkage Joint

installing the support to the frame bracket, torque the bolts to 35 ft. lbs.

TIE RODS

Whenever the tie rod end is assembled to the tie rod and prior to assembling the tie rod end to the plain arm, make certain that an equal number of tie rod and tie rod end threads are exposed at each end of the tie rod sleeve.

LINKAGE ADJUSTMENT

Toe-in and steering wheel spoke alignment is obtained by turning the adjusting sleeves on the tie rods which in turn lengthen or shorten the tie rod assemblies. Refer to WHEEL ALIGNMENT. After adjusting toe-in, make certain that the sleeve clamps are positioned as shown in Fig. 8-2 or 8-6.

MANUAL STEERING (Fig. 8-7)

ADJUSTMENTS (ON CAR)

Before any adjustments are made to the steering gear in an attempt to correct such conditions as shimmy, hard or loose steering, or road shock, a careful check should be made to determine that front end alignment, shock absorbers, wheel balance, and tire pressure are correct.

There are two adjustments on the manual steering gear:

a. WORM BEARING PRE-LOAD ADJUSTMENT

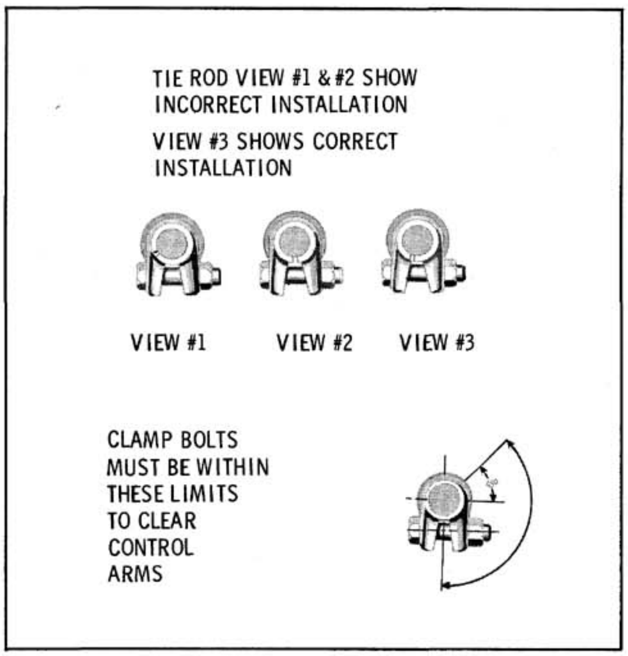


Fig. 8-6 Tie Rod Clamp Positioning (52 through 86 Series)

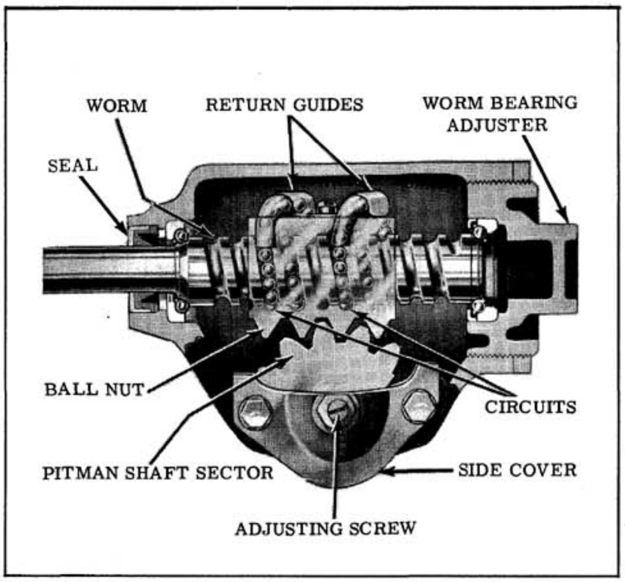


Fig. 8-7 Manual Steering Gear

b. OVER-CENTER ADJUSTMENT

IMPORTANT: The worm bearing preload adjustment must be checked and corrected if necessary before the over-center adjustment is made. Failure to follow the proper sequence may result in damage to the steering gear.

WORM BEARING PRE-LOAD ADJUSTMENT

1. Disconnect the pitman arm from pitman shaft using Tool J-5504-B or a similar puller.
2. Loosen pitman shaft adjusting screw locknut and loosen adjusting screw a few turns. (Fig. 8-7)

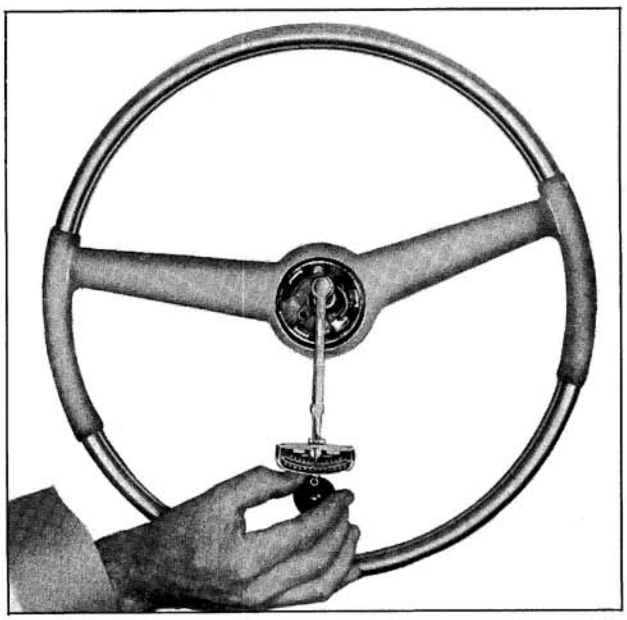


Fig. 8-8 Checking Worm Bearing Pre-load

3. Using an inch pound torque wrench measure the torque which is required to keep the wheel in motion at about 30° off straight ahead position. (Fig. 8-8)

4. The torque required should be between 4 and 7 inch pounds. If it is not, it will be necessary to loosen the worm bearing adjuster locknut with a brass drift (Fig. 8-9) and turn the worm bearing adjuster the required amount to bring the torque within limits.

5. When adjustment is correct, retighten locknut to 100 ft. lbs. and recheck pre-load.

OVER-CENTER ADJUSTMENT

1. After making the worm bearing adjustment, the pitman shaft adjusting screw should be tightened until a pull of 4 to 10 inch pounds in excess of worm bearing pre-load is required to turn the wheel through the center range. (Approximately 2-7/8 turns from either end of travel on car or 3-1/8 turns for bench adjustment) (Fig. 8-10) Tighten the locknut to 27 ft. lbs. and recheck the over-center adjustment.

2. After adjustments have been made, assemble pitman arm to pitman shaft with front wheels and steering wheel in the straight ahead position so that splines will align properly. Torque pitman shaft nut to 150 ft. lbs.

GEAR ASSEMBLY REMOVE AND INSTALL

1. Remove the two flex coupling flange attaching nuts and lockwashers.

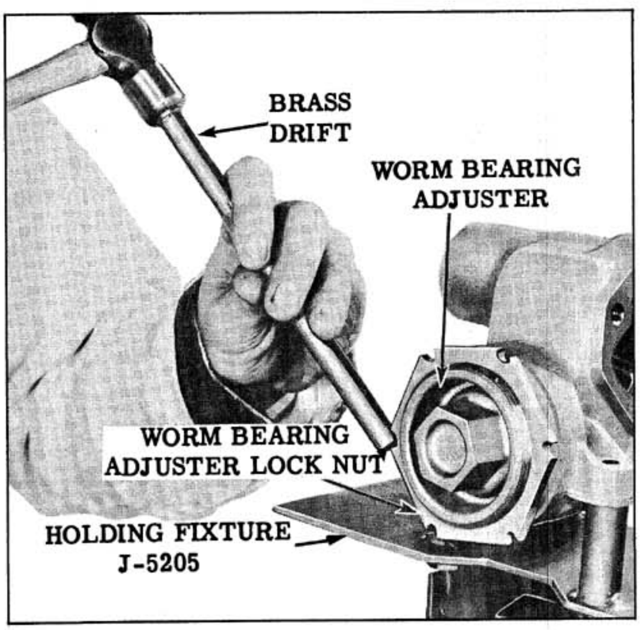


Fig. 8-9 Loosening Lock Nut

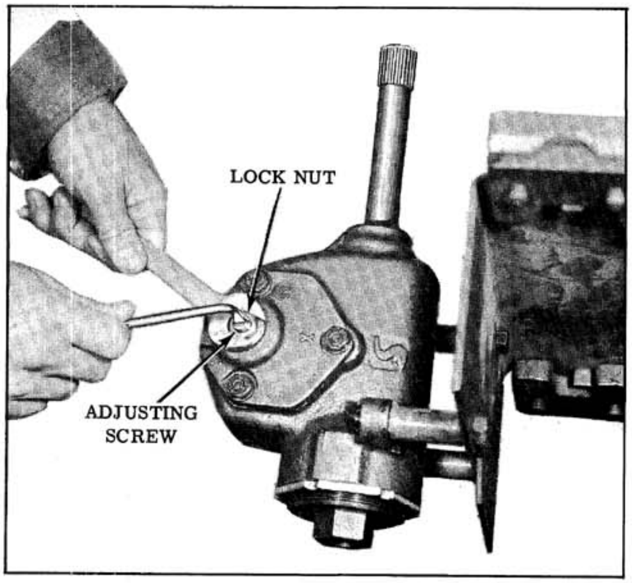


Fig. 8-10 Over-Center Adjustment

2. Hoist front of car and support car with floor stands under outer ends of lower control arms.

3. Remove pitman shaft nut and pull pitman arm from shaft using Tool J-5504-B or a similar puller.

4. Remove gear to frame bolts, position steering linkage and speedometer cable, if so equipped, out of the way and withdraw gear assembly from under car.

If necessary to remove the upper worm shaft seal with the gear assembled, punch a small hole in the seal and install a small metal screw approximately two turns. Then pry out the seal with a pair of side cutters. Drive new seal flush with housing with Tool J-21421.

To install gear, apply wheel bearing grease to the gear mounting pads to prevent gear to frame squeak, then reverse removal procedure. Torque steering gear to frame bolts to 80 ft. lbs. Torque pitman shaft nut to 150 ft. lbs.

DISASSEMBLY OF GEAR

1. Clamp gear in a vise.

2. Loosen the pitman shaft adjusting screw locknut.

3. Rotate worm shaft 3-1/8 turns from end of travel, then remove side cover and pitman shaft from steering gear housing.

4. Loosen worm bearing adjuster locknut with a brass drift, then remove locknut and adjuster assembly from gear housing.

5. Remove worm shaft assembly (with ball nut) out through bottom of housing. Remove upper worm bearing from steering shaft.

SERVICING INDIVIDUAL UNITS

PITMAN SHAFT AND SIDE COVER

Disassembly

1. Remove pitman shaft adjusting screw locknut.
2. Thread, adjusting screw through pitman shaft cover, then remove cover and gasket.
3. Wash all parts in clean solvent and dry with compressed air. Inspect parts.

If the bushing in the side cover is defective the side cover must be replaced as the bushing is not serviced separately.

Assembly

1. Check the end clearance of the adjusting screw in the slot of the pitman shaft. (Fig. 8-12) The screw should rotate freely but not have more than .002" clearance. If clearance exceeds .002", select the proper shim to bring the clearance to specification. (Shim thicknesses are .063", .065", .067", and .069")
2. Assemble the pitman shaft and adjusting screw (with proper shim) to side cover. Thread the adjusting screw through the side cover until the side cover bottoms on the pitman shaft.

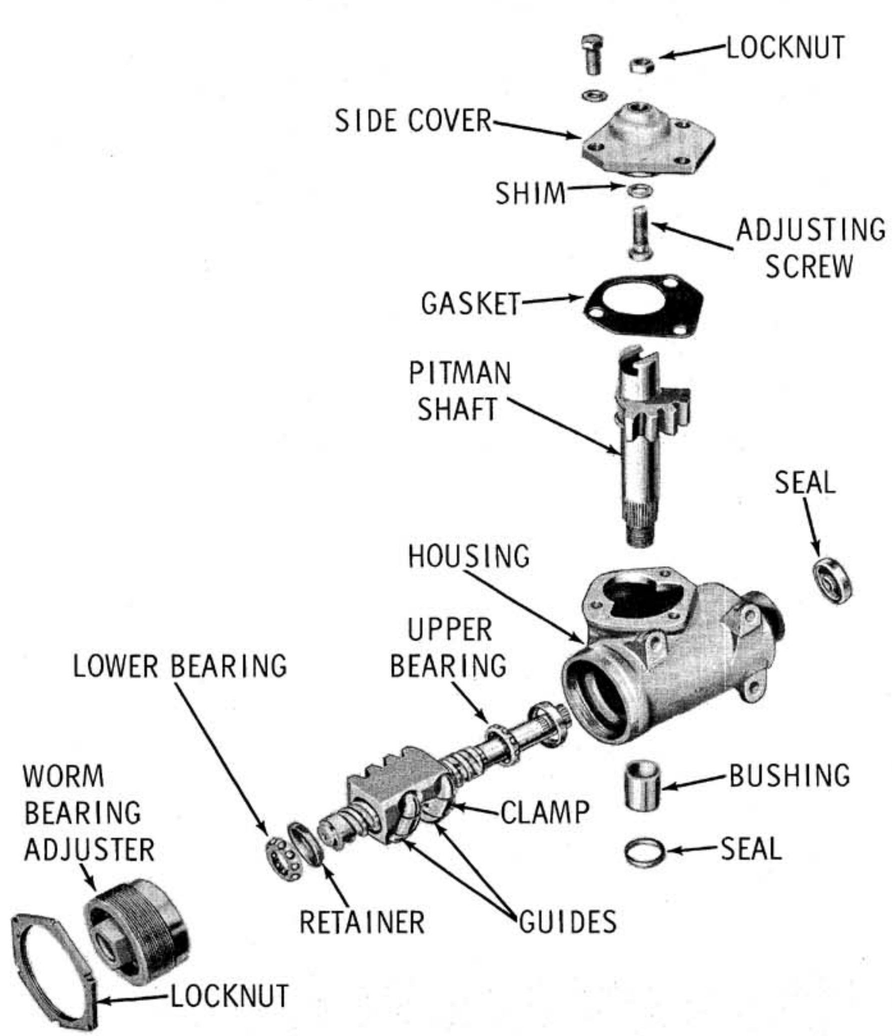


Fig. 8-11 Manual Steering Gear

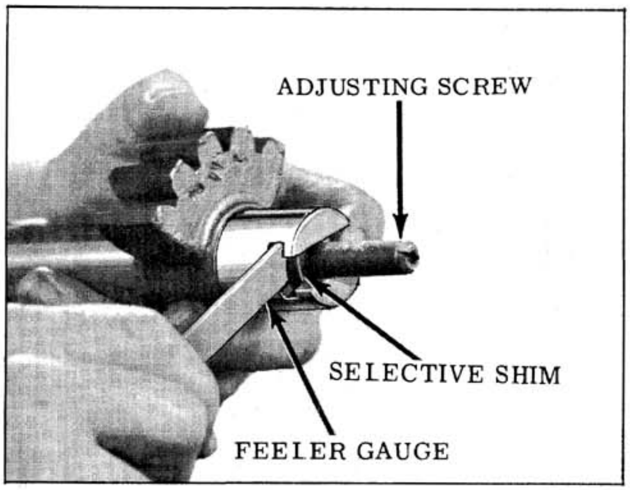


Fig. 8-12 Checking End Clearance

3. Install locknut but do not tighten.

HOUSING

Disassembly

1. If pitman shaft seal ONLY is to be replaced, use a small chisel to collapse the seal so it can be lifted from the housing. (Fig. 8-13)

2. If pitman shaft bushing is to be replaced, use Tool J-8810 with Driver Handle J-8092 to drive bushing and seal from housing. (Fig. 8-14)

3. The upper worm bearing race can be removed with a brass drift and installed with Tool J-8811.

4. Wash housing in clean solvent and dry with compressed air.

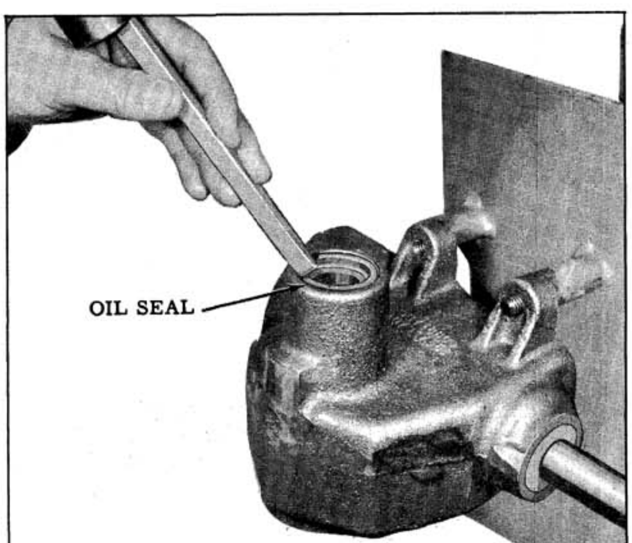


Fig. 8-13 Removing Pitman Shaft Seal

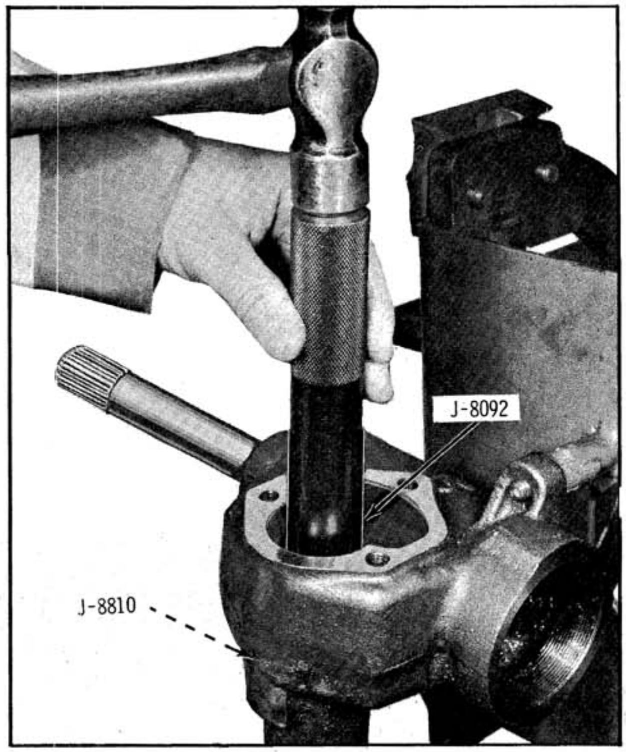


Fig. 8-14 Removing Bushing

Assembly

1. If pitman shaft bushing was removed, place a new bushing over end of Tool J-8810, then drive bushing into housing as shown in Fig. 8-15.

2. Place a new seal into housing with lip of seal facing inward. Drive seal in the housing until it bottoms against shoulder of counterbore, using Tool J-8811. (Fig. 8-16) Coat lip of seal with seal lubricant, Part No. 1050169.

WORM BEARING ADJUSTER

1. Pry lower worm bearing retainer from adjuster, then remove lower worm bearing.

2. Wash all parts in clean solvent and dry with compressed air. Inspect parts for wear.

Assemble

Pack lower worm bearing with water resistant E.P. grease, then place bearing on race and install retainer.

BALL NUT

Remove

1. Remove ball return guide clamp and guides from ball nut.

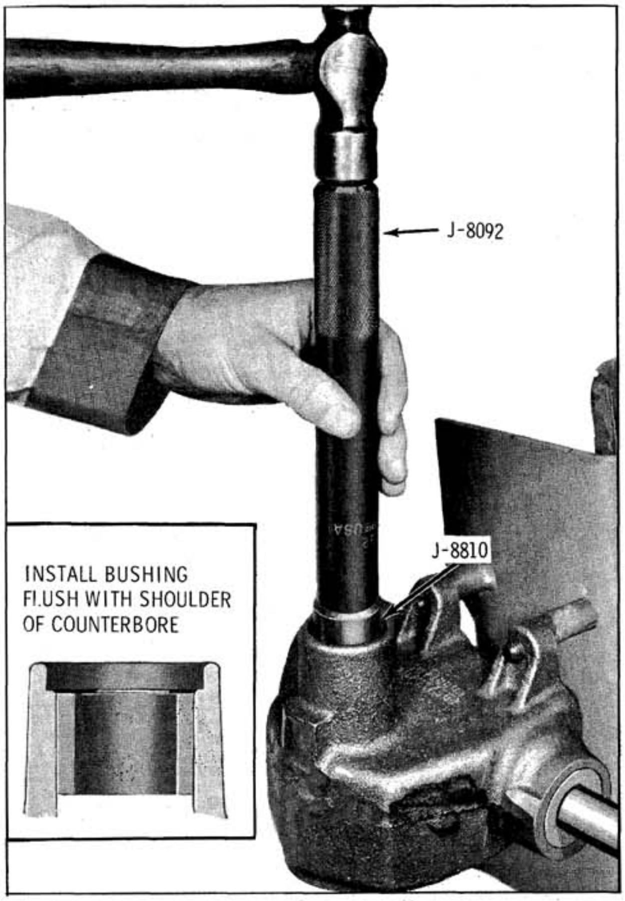


Fig. 8-15 Installing Pitman Shaft Bearing

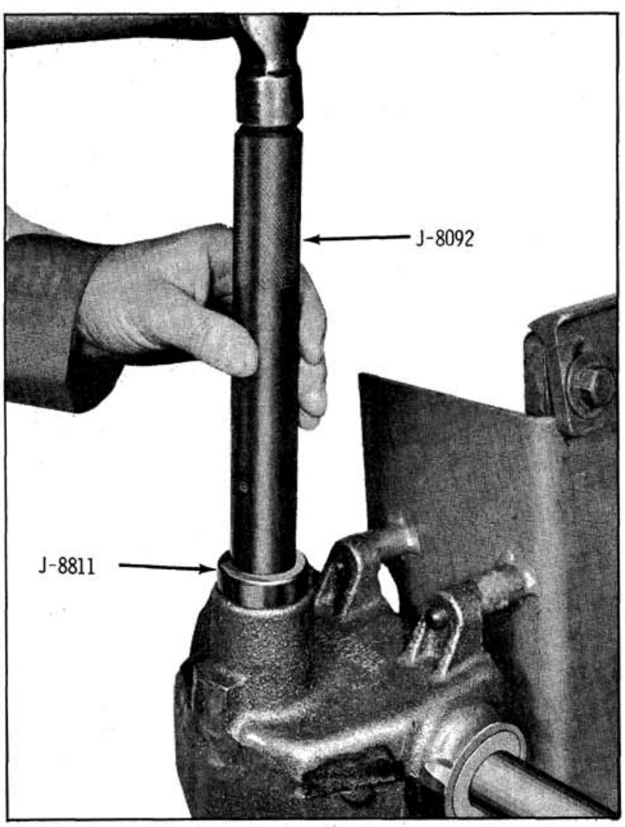


Fig. 8-16 Installing Pitman Shaft Seal

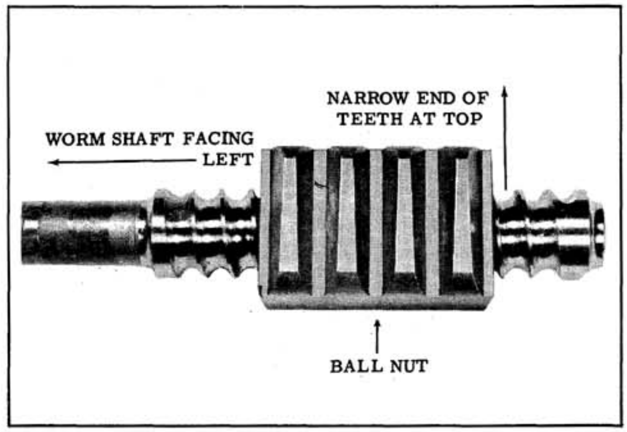


Fig. 8-17 Positioning Ball Nut

2. Rotate worm until all balls have dropped out of the nut, then remove nut from worm.

3. Wash all parts in clean solvent and dry with compressed air. Inspect parts for wear.

Install

1. Coat ball nut and worm with steering gear lubricant.

2. Slide ball nut over worm. (Fig. 8-17)

3. Position the ball return guides on the ball nut.

4. Install 25 balls into each circuit through the hole in the return guides. (Fig. 8-18)

5. Install the guide clamp.

ASSEMBLY OF STEERING GEAR

1. Pack the upper worm bearing with water resistant E.P. grease (Multi-Purpose Gear Lubricant), then slide upper worm bearing

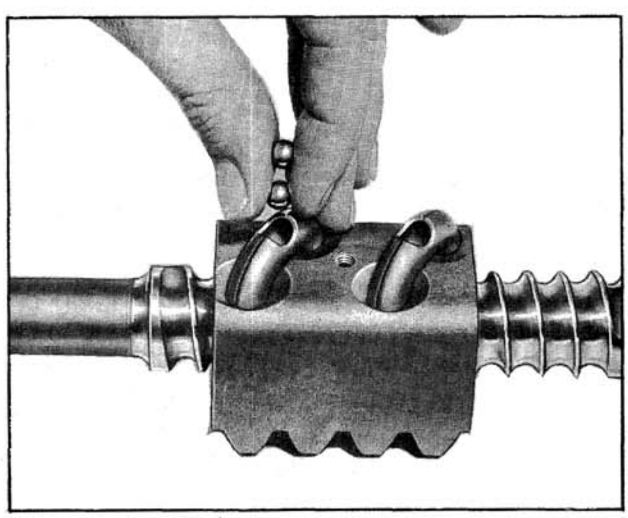


Fig. 8-18 Ball Installation

over worm shaft and position bearing against worm. Install grommet. Slide worm shaft, bearing and ball nut assembly into gear housing.

2. Install worm bearing adjuster into gear housing. Adjuster should be installed just tight enough to hold worm bearing in place. Final adjustment will be made later.

3. Install pitman shaft and side cover assembly and gasket, with sector and ball nut teeth centered as shown in Fig. 8-19. Torque side cover bolts to 22 ft. lbs.

4. Fill steering gear with water resistant E.P. grease.

5. Steering gear should be bench adjusted before it is installed in the car as follows:

   a. Attach Torque Wrench J-5853 to worm shaft and turn shaft to extreme right or left position.

   b. Turn worm bearing adjuster to obtain a reading of 4 to 7 inch pounds with worm shaft turning slowly. Worm bearing preload adjustment must be made within 1/2 turn of worm shaft from extreme position.

   c. Tighten worm bearing adjuster locknut and recheck reading.

   d. Turn worm shaft from one extreme to the other while counting turns, then turn back 1/2 the total number of turns. This places the steering gear on the "over-center" or "high point" position.

   e. Loosen pitman shaft lash adjuster locknut and turn lash adjuster until a reading of 4 to 10 inch pounds higher than worm bearing preload is obtained while rotating worm through the "over-center" range. Tighten locknut and recheck reading. Total "over-center" pull should not exceed 14 inch pounds.

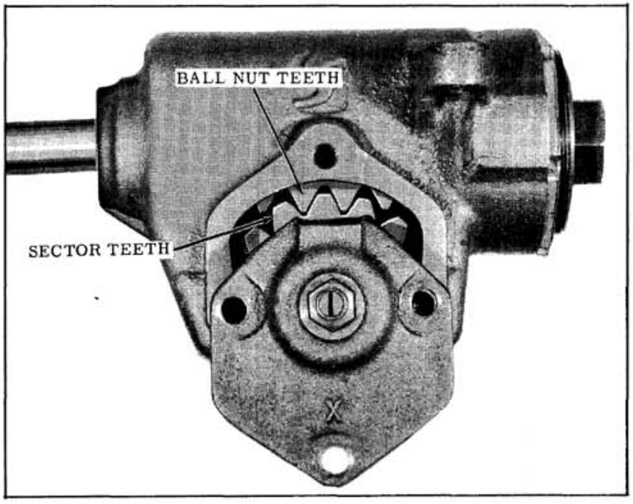


Fig. 8-19 Sector and Ball Nut Centered

POWER STEERING PUMP

OPERATION (Fig. 8-20)

Oil is supplied from the reservoir to the pumping chambers (composed of the cam ring, rotor, thrust plate and pressure plate) through passage A.. Oil discharged from the pumping chamber is discharged to cavity B. From the cavity B, oil passes through orifice C into the outlet passage and on through the flexible lines to the steering gear. Part of the oil in cavity B passes through openings D in the pressure plate to act on the inner edge of the ten vanes and assist centrifugal force in keeping the vanes out against the cam ring. The thrust plate has four blind cavities directly opposite these four openings in the pressure plate to prevent side thrust on the vanes.

When pump output exceeds the calibration of orifice C, a back pressure builds up behind the flow control valve at E which overcomes spring force and opens the valve to allow oil to return to the intake side of the pump and to the reservoir. (Inset, Fig. 8-20) Flow control is desirable to reduce power consumption which would otherwise result if the pump were allowed to circulate oil through the steering gear with no regulation when driving at high speed.

When steering conditions demand high pressure for power assist, the pump builds up sufficient pressure on the steering gear rack-piston to turn the pitman shaft. This pressure is also being exerted on the front end of the flow control valve through passage F. When extremely high pressure is built up in the steering gear (such as when holding the steering linkage against its stop) the pressure relief ball G is forced from its seat. Oil flowing past the ball, plus the normal internal leakage at the outer edge of the flow control valve, reduces the pressure on the forward side of the flow control valve. The flow control valve then opens, allowing oil to return to the intake side of the pump and to the reservoir.

When making a partial turn at low speed, the pressure requirements are normally well below maximum pressure, so the pressure relief ball will be closed. Also the pump output is less than system requirements so the flow control valve is closed.

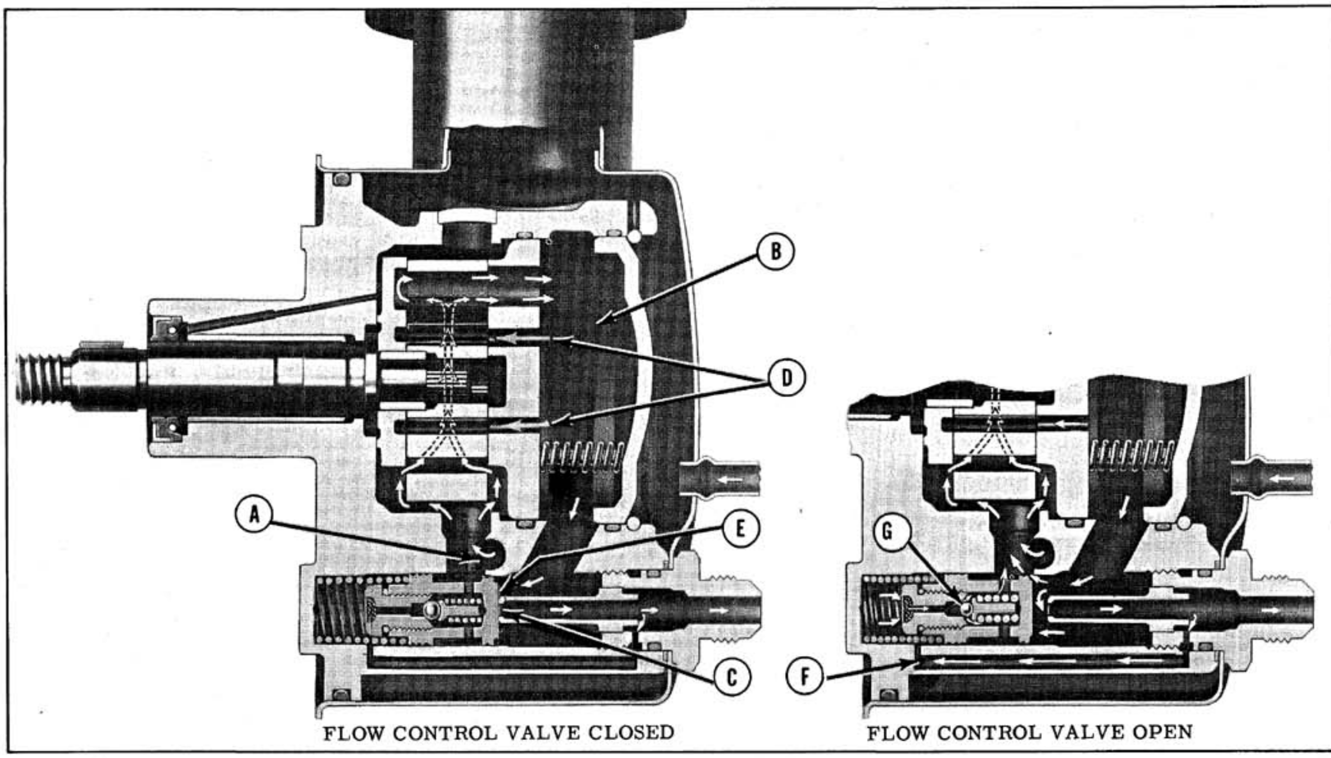


Fig. 8-20 Oil Flow at Low Speed

MINOR SERVICE OPERATIONS

PUMP BELT ADJUSTMENT

Checking

Position Gauge 33-70M on pump belt as shown in Fig. 8-21. If the pointer of tool does not index with correct mark, corresponding with the type of belt to be adjusted, the belt should be adjusted as follows:

Adjustment

With Gauge 33-70M positioned on pump belt, loosen the pump attaching bolts and adjust the belt tension by moving the pump away from engine.

SERVICING OF THE FLOW CONTROL VALVE (WITHOUT REMOVING PUMP ASSEMBLY FROM CAR)

1. Disconnect high pressure hose from pump union and drain oil.
2. Remove union and withdraw flow control valve and spring with a magnet.
3. For disassembly and assembly of flow control valve refer to step 13 under PUMP DISASSEMBLY and step 1 under PUMP ASSEMBLY.
4. To install reverse the above procedure and install a new "O" ring seal on the union.

PUMP SHAFT OIL SEAL REPLACEMENT (WITHOUT DISASSEMBLING PUMP)

The pump shaft oil seal can be replaced without disassembling the pump from the car as follows:

1. With the pump pulley removed, bend a piece of .005" shim stock (approximately 2-1/2" long) into a cylindrical shape, then push the shim stock past seal until it bottoms in pump body. (Fig. 8-22)

   NOTE: The use of seal protector Tool J-7132-1 will aid in pushing shim stock into pump body. The use of shim stock around the drive shaft will prevent damage to the machined surfaces of the shaft when removing seal.

2. Cut metal body of seal with a small chisel as shown in Fig. 8-22.
3. Tear metal body approximately 1" with diagonals. Force an awl between the pump body and the OD of seal to collapse the seal, then pry seal from pump body. (Fig. 8-23) Remove shim stock.
4. Apply special seal lubricant (Part No. 1050169) to the sealing lip of a new seal, then install seal over seal protector Tool J-7132-1 with metal side of seal against tool.
5. Slide Tool J-7132-1 (with seal) over drive shaft, then using Tool J-7132-2, drive seal into pump body. (Fig. 8-24)

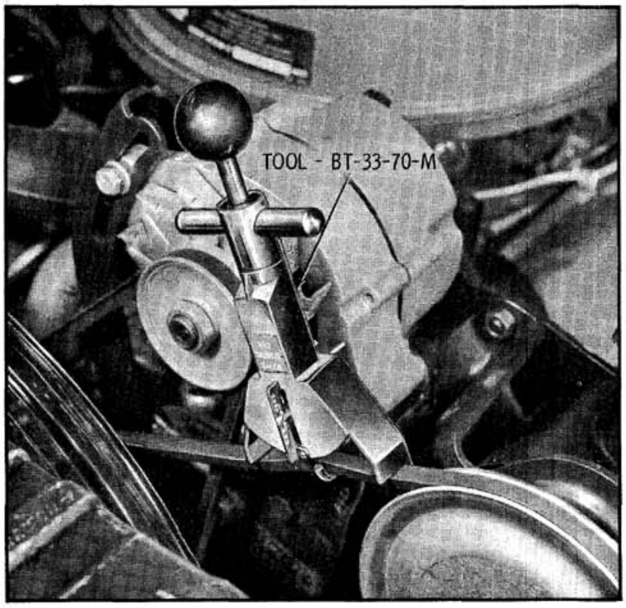


Fig. 8-21 Adjusting Power Steering Belts

6. Remove tools.

POWER STEERING PUMP

Removal and Installation

The power steering pump is attached as shown in Figs. 8-25 and 8-26. When removing the pulley nut do not loosen the belt tension as the belt tension will prevent the pulley from turning.

When disconnecting the hoses from the pump, secure the end of the hoses above the fluid level. Cap the pump fittings.

To install, reverse the removal procedure. Torque fastenings as illustrated in Fig. 8-25. Fill reservoir with Fluid, Part No. 1050017, then bleed pump by turning pulley counterclockwise until air bubbles cease to appear. Refill reservoir to proper. fluid level, if necessary. Adjust pump belt as outlined under PUMP BELT ADJUSTMENT.

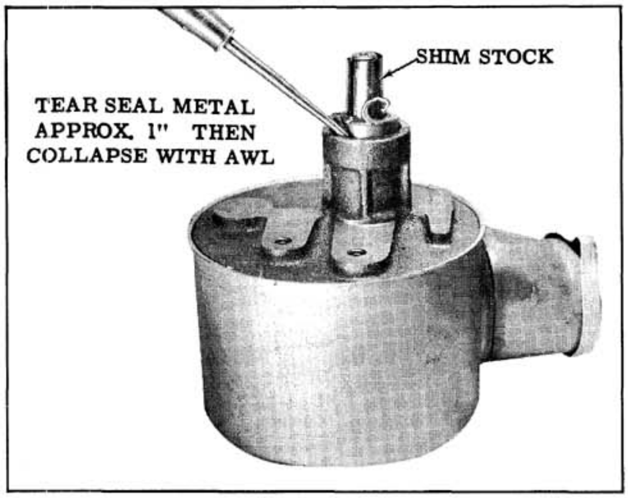


Fig. 8-23 Removing Pump Seal

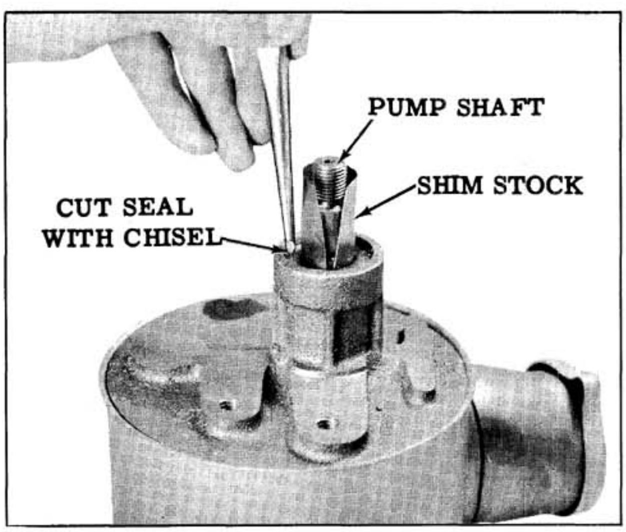


Fig. 8-22 Cutting Pump Seal

DISASSEMBLY (Fig. 8-28)

1. Clean the exterior of the pump and drain the reservoir. Lightly clamp the pump body in a vise so that the rear of the reservoir is facing up.

2. Remove the rear mounting stud and then remove the "O" ring seal. Discard the seal.

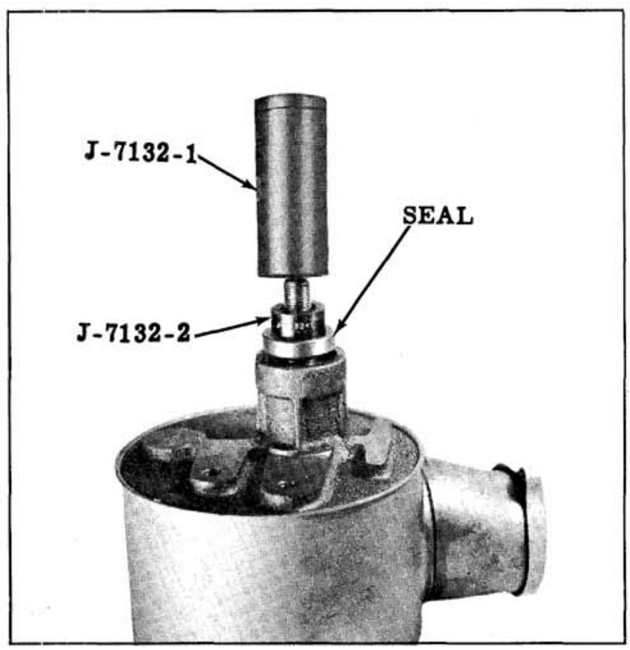


Fig. 8-24 Installing Pump Seal

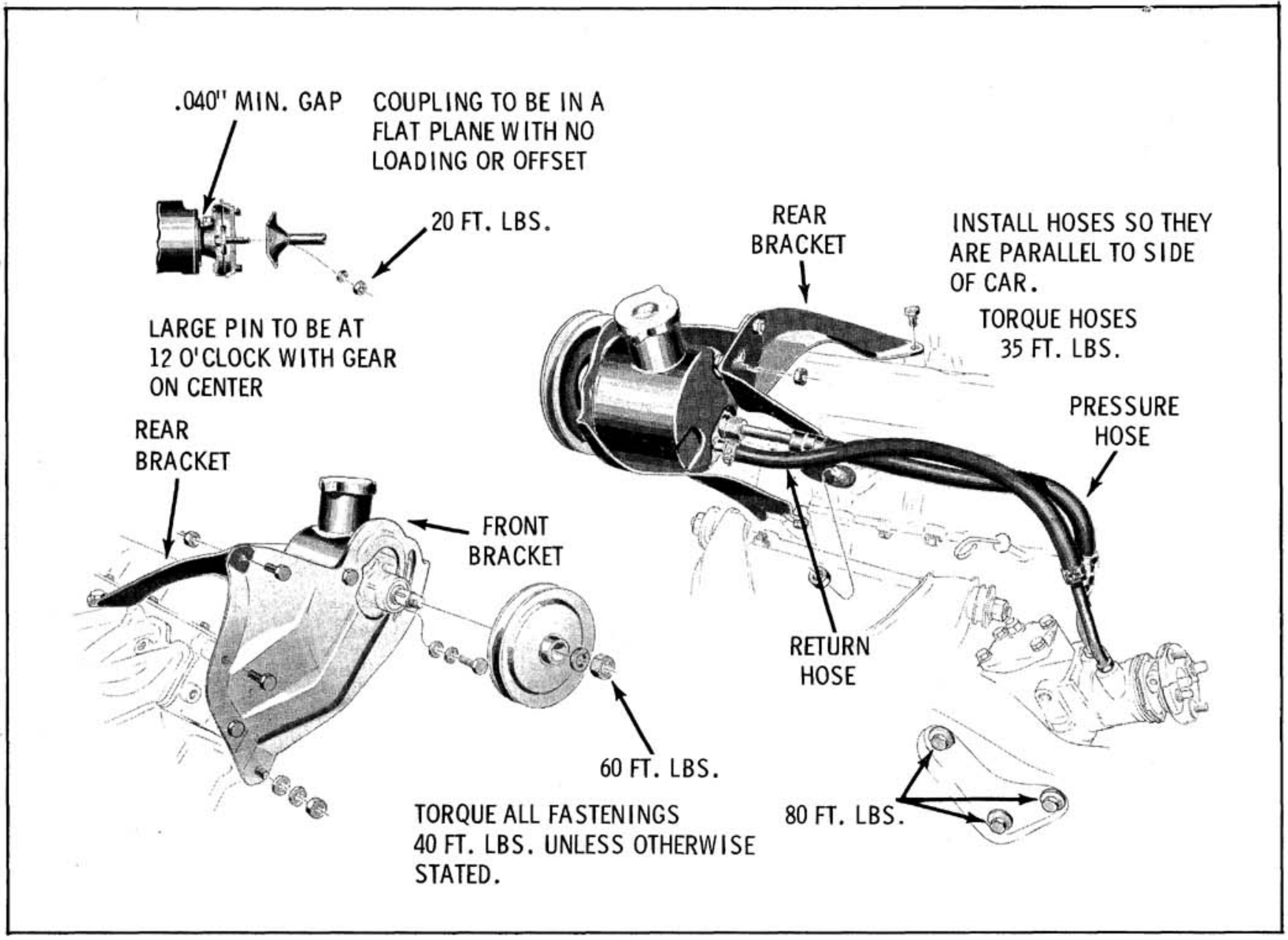
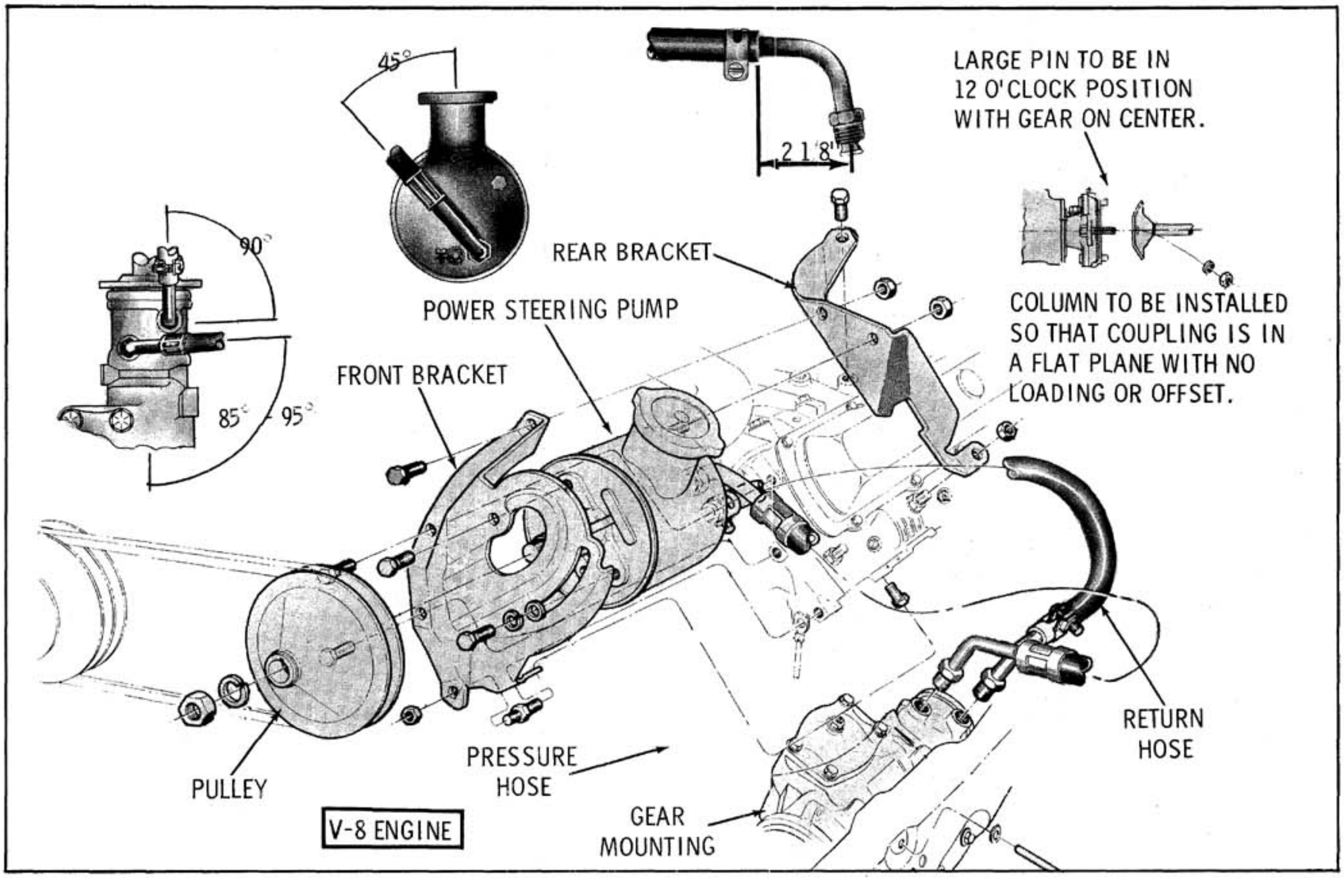


Fig. 8-25 Pump Mounting (52 through 86 Series)

3. Remove the union. Remove "O" ring seal from union and discard.
4. Remove the reservoir by rocking it while pulling upward. Remove pump body from vise.
5. Remove the "O" ring, flow control valve assembly and spring from the bore in the pump body.
6. Rotate the end cover retainer ring so that one end of the ring is over the hole in the side of body, then force end of ring from its groove and remove ring. (Fig. 8-27)
7. Remove end cover from pump body. If cover is cocked in pump body, tap plate with a soft hammer to free up.
8. Remove the two pressure plate springs from the dowel pins.
9. Remove the drive shaft key, then place the pump on a bench with the drive shaft up. Tap end of shaft with a soft hammer until it is free.
10. Lift the pump body off the shaft, then remove the drive shaft, thrust plate, dowel pins, cam ring, rotor, vanes and pressure plate.
11. Remove two inside and one outside "O" ring from the pump body.
12. Pry the drive shaft oil seal from the pump body with a screwdriver.
13. If necessary to disassemble the flow control valve, proceed as follows:
    a. Clamp the valve in a brass jawed vise.
    b. Remove the hex head plug and shims. (Fig. 8-29) Note the number of shim(s) on the plug so the same number of shim(s) can be reinstalled during assembly.
    c. Remove the pressure relief ball, guide and spring from the flow control valve.

CLEANING AND INSPECTION

1. Wash all parts in clean solvent, blow out all passages with compressed air and air dry.
2. Inspect the drive shaft for wear and see that the seal area of the shaft is smooth and free of nicks.
3. Check the fit of the vanes in the rotor slots. They must slide freely but snugly in the slots. Tightness may be relieved by thorough cleaning or by removal of irregularities with a fine stone. Replace the rotor and/or vanes if excessive looseness exists between the rotor and vanes.



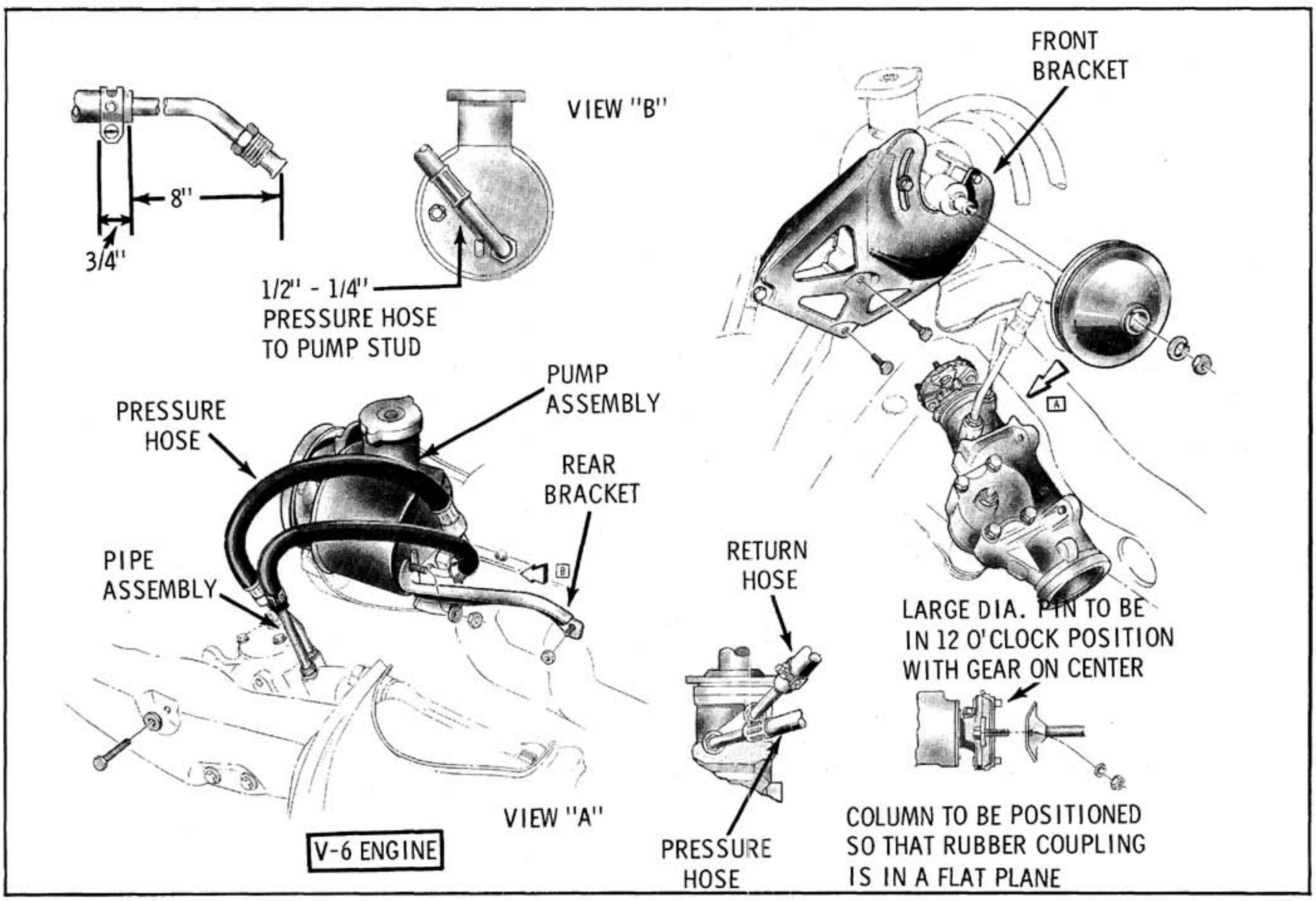


Fig. 8-26 Pump Mounting (33 through 38 Series)

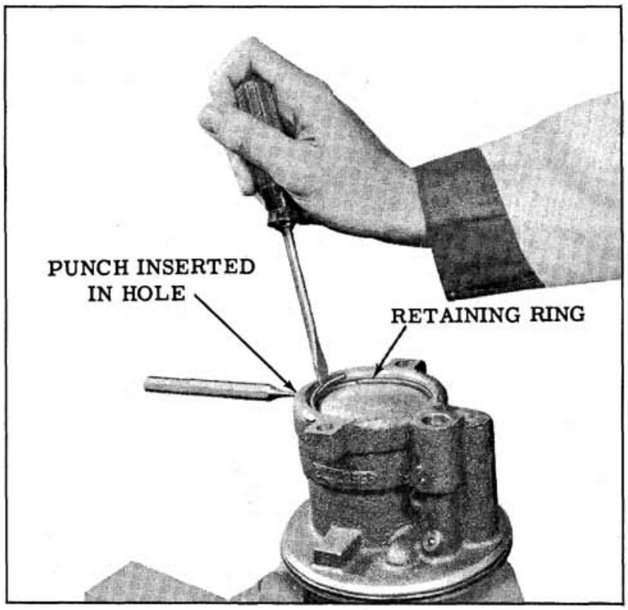


Fig. 8-27 Removing End Cover Retaining Ring

4. Inspect the flat surfaces on the thrust plate and pressure plates for scoring or irregular wear. Light scores can be smoothed by light lapping, after which all lapping compound must be thoroughly removed.
5. Inspect all ground surfaces of the cam ring for roughness or irregular wear. Light scores on the flat surfaces may be smoothed by lapping. Normal wear or scuff marks on the inner surface do not affect pump operation or cause excessive noise; however, if the wear consists of chatter marks or gouges, both the cam ring and vanes should be replaced.
6. Inspect the ground surfaces of the flow control valve and remove any slight irregularities with a fine stone. Install the flow control valve spring on the valve, insert the spring end of the valve in the pump body and check the fit of the valve by pushing it down into its operating position.
7. Check the end cover for nicks on the surface which contacts the "O" ring. Remove small nicks with a fine stone. Replace the cover if it is badly nicked or distorted.
8. Inspect the pump body bushing. If the bushing is scored or badly worn, replace the pump body and bushing as an assembly.
9. Inspect the reservoir for cracks, broken welds or distortion. If any of these conditions are present, replace the reservoir.

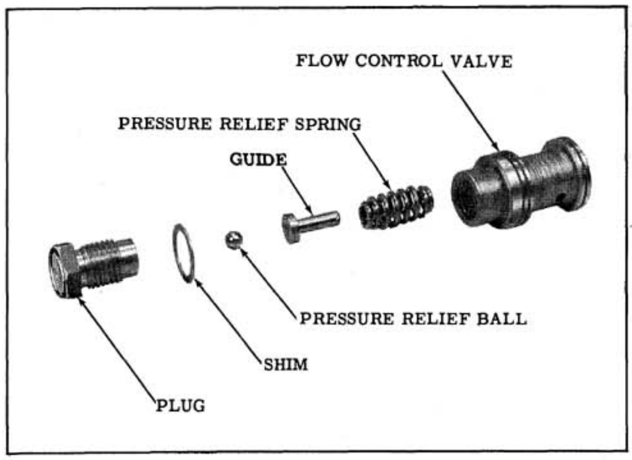


Fig. 8-29 Flow Control Valve

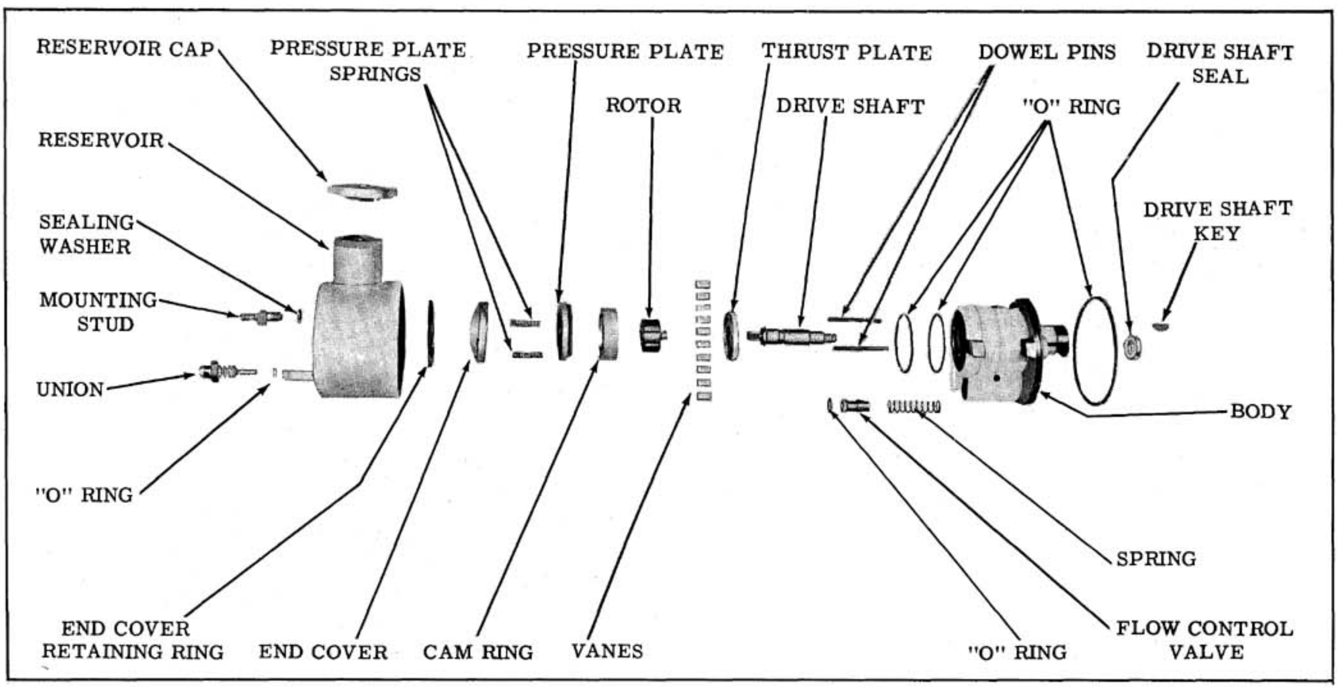


Fig. 8-28 Power Steering Pump

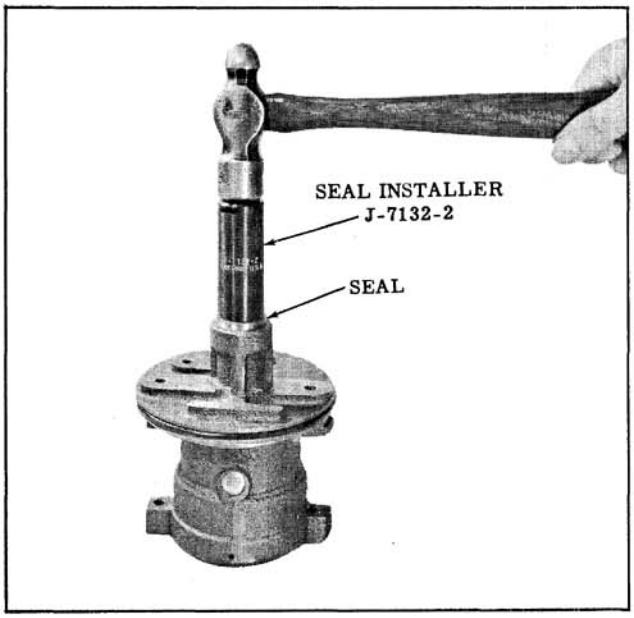


Fig. 8-30 Installing Pump Seal

ASSEMBLY

1. If the flow control valve was disassembled, assemble as shown in Fig. 8-29. Use the same number of shims removed, as altering shim thickness will change relief pressure. Tighten the plug to approximately 4 ft. lbs.
2. Apply Special Seal Lubricant (Part No. 1050169) to the sealing lips of a new drive shaft seal and drive the seal into the pump body using Tool J-7132-2. (Fig. 8-30) Remove tool.
3. Place Seal Protector J-7586 over the threaded end of the shaft, then install the shaft in the pump body. (Fig. 8-31) Remove protector
4. Lightly clamp body in a vise, cavity up.
5. Coat a new pressure plate to pump body "O" ring with petrolatum and install in the lower groove in the pump body.

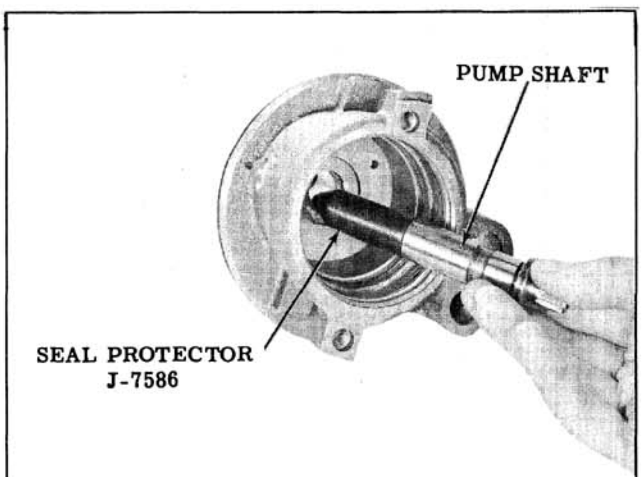


Fig. 8-31 Installing Pump Shaft

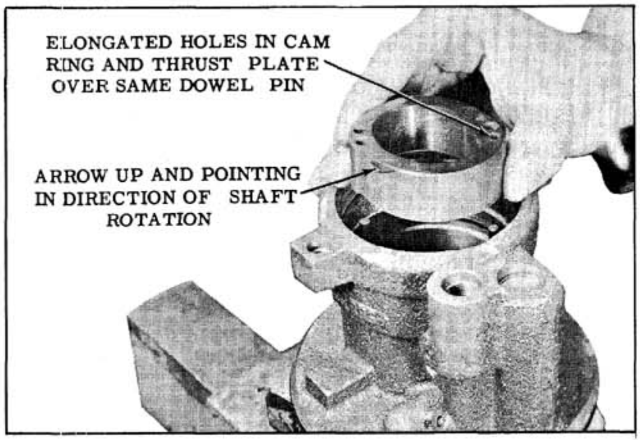


Fig. 8-32 Installing Cam Ring

NOTE: This "O" ring is slightly smaller in diameter than the end cover "O" ring.

6. Coat the end cover to pump body "O" ring with petrolatum and install in the upper "O" ring groove.
7. Install the two dowel pins in the holes at the bottom of the pump body cavity.
8. Install the thrust plate over the dowel pins with the oil ports up.

   NOTE: One of the dowel pin holes is slightly elongated in both the thrust plate and cam ring. These holes should be at the same dowel pin to minimize the possibility of pump noise. (Fig. 8-32)
9. Install the cam ring with the small holes over the dowel pins SO THAT THE ARROW ON THE OUTER SURFACE IS NEAR THE TOP OF THE CAM RING. (Fig. 8-32)
10. Install the rotor with the alignment sleeve down.
11. Install the vanes in the rotor slots with the radius edge of vanes outward.

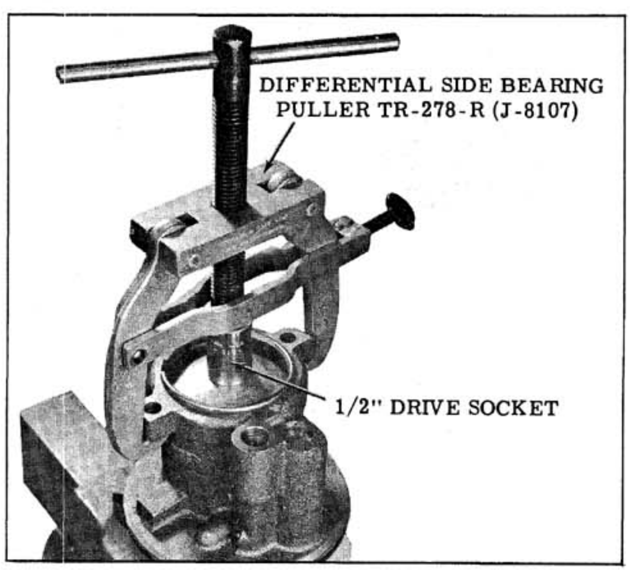


Fig. 8-33 Installing End Cover

12. Apply petrolatum to the outer circumference of the pressure plate, then, with the oil ports down toward the rotor, install the pressure plate over the dowel pins through the two smallest notches in the pressure plate until the pressure plate seats against the cam ring.
13. Install the two springs over the dowel pins.
14. Install the end cover and retaining ring as follows:
    a. Apply petrolatum to the outer circumference of the end cover and position the cover into the pump body.
    b. Install Differential Side Bearing Puller (J-8107), along with a 1/2" drive socket to press the end cover down beyond the retaining ring groove. (Fig. 8-33)
    c. Install the retaining ring in the pump body and remove the puller and socket.
15. Install flow control valve spring, flow control valve (hex head plug end down), and "O" ring seal into pump body bore.
16. Apply petrolatum to the reservoir to pump body "O" ring, then install the "O" ring on the pump body.
17. Place the reservoir over the pump body, align the holes, and push the reservoir down over the "O" ring.
18. Install the "O" ring seal on the short end of the mounting stud, then install the stud and tighten to 35 ft. lbs.
19. Install the "O" ring on the union, (groove next to hex head) then install union and tighten to 20 ft. lbs.
20. Install the drive shaft key while supporting the shaft on the opposite side.

POWER STEERING GEAR (Fig. 8-34)

OPERATION

NEUTRAL (STRAIGHT AHEAD POSITION) (Fig. 8-35)

When turning effort is not being applied at the steering wheel, the slots in the spool valve are

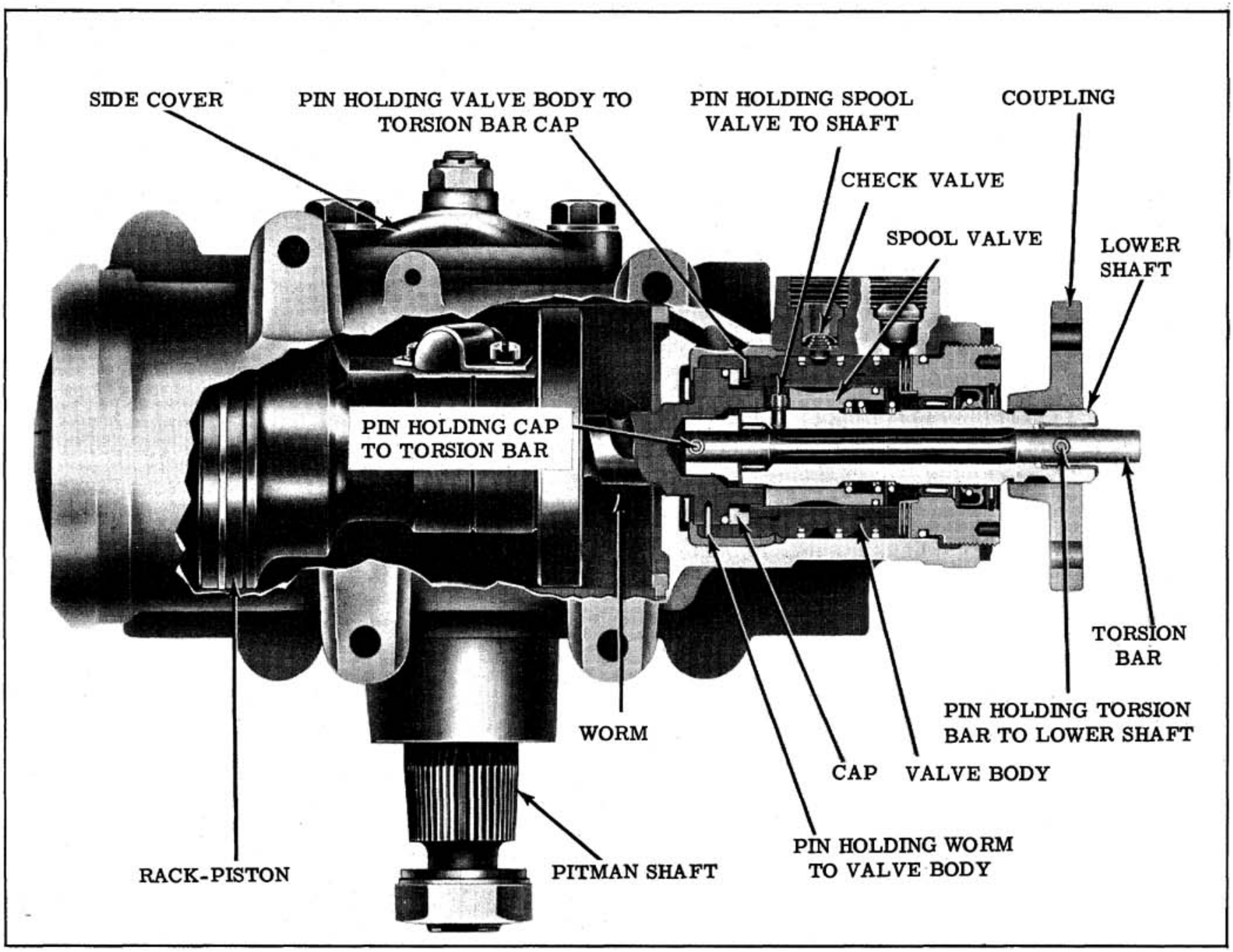


Fig. 8-34 Power Steering Gear

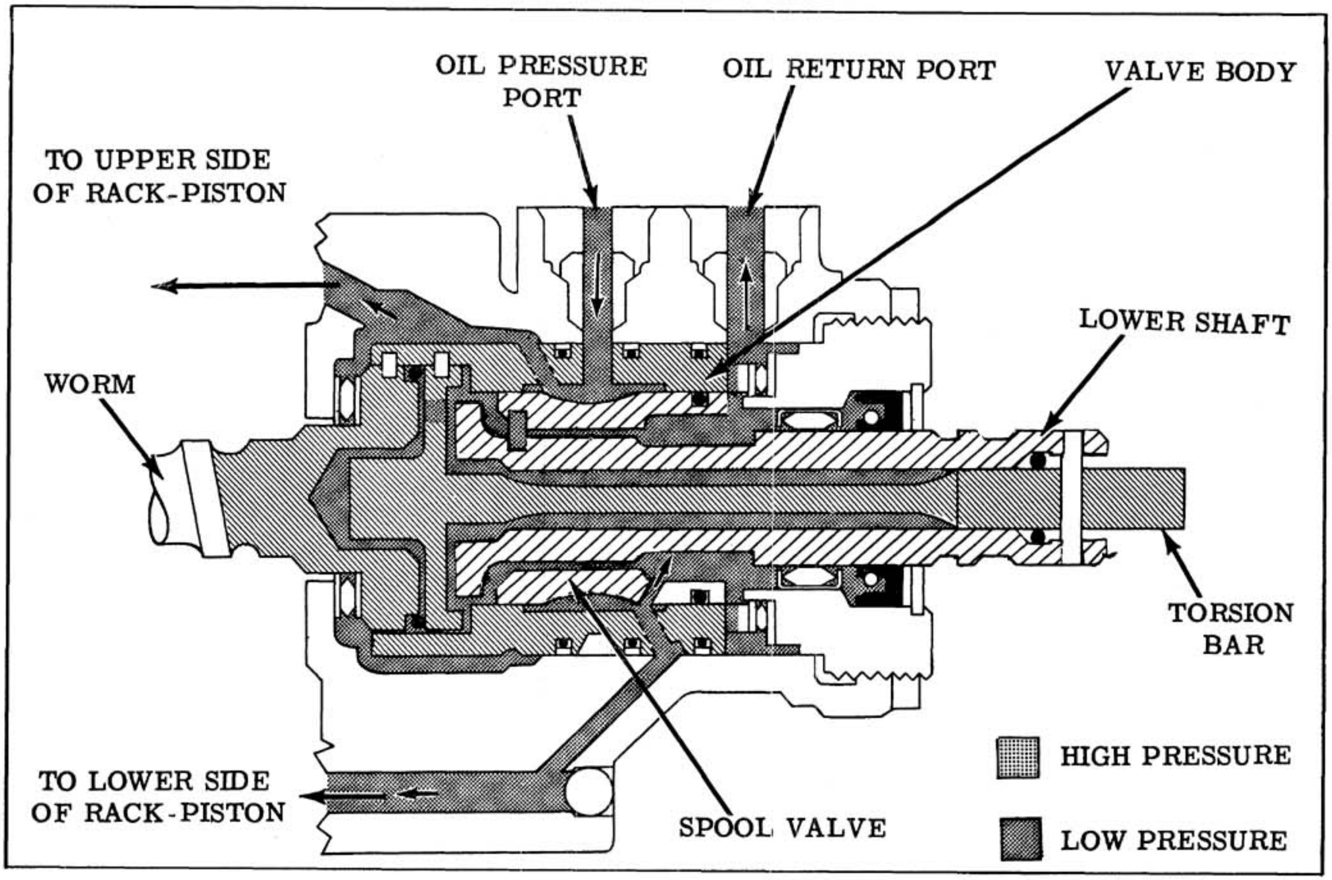


Fig. 8-35 Neutral Position

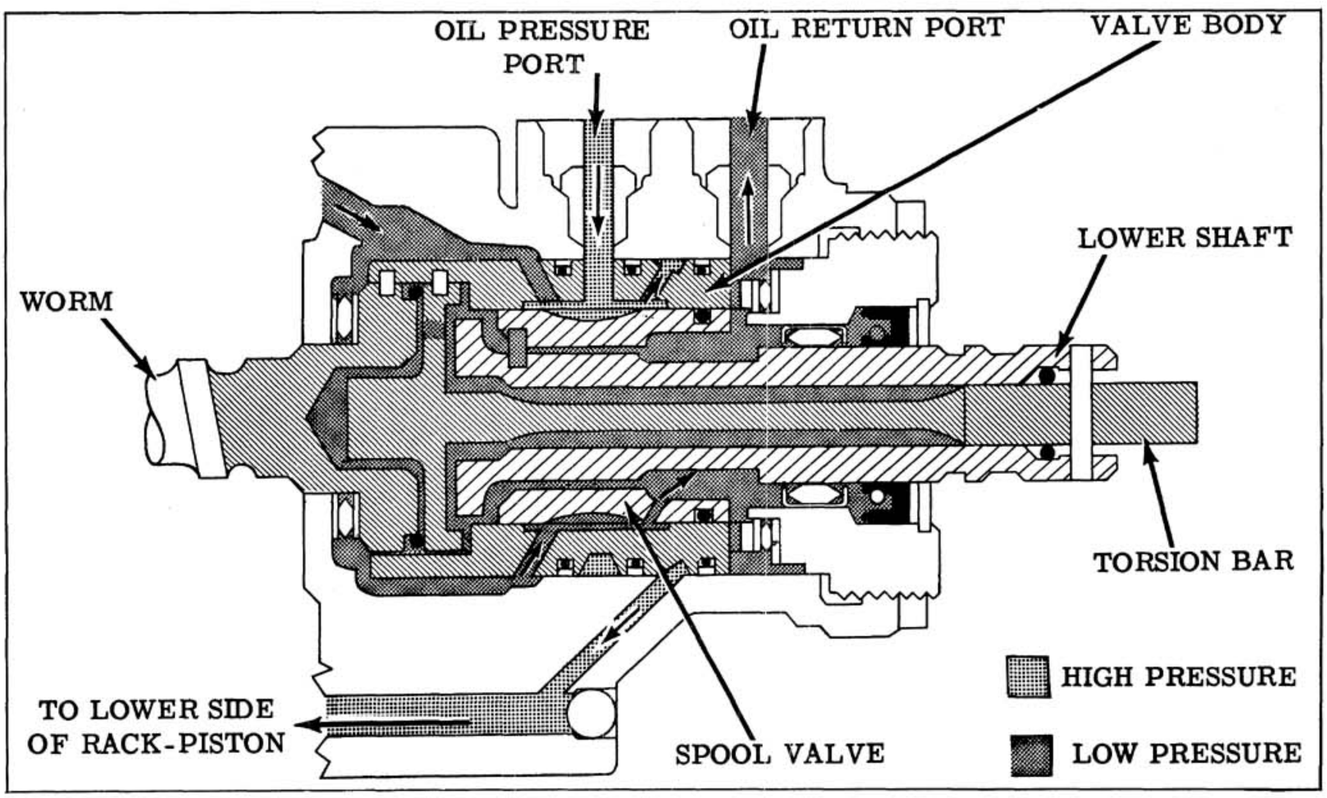


Fig. 8-36 Right Turn Position

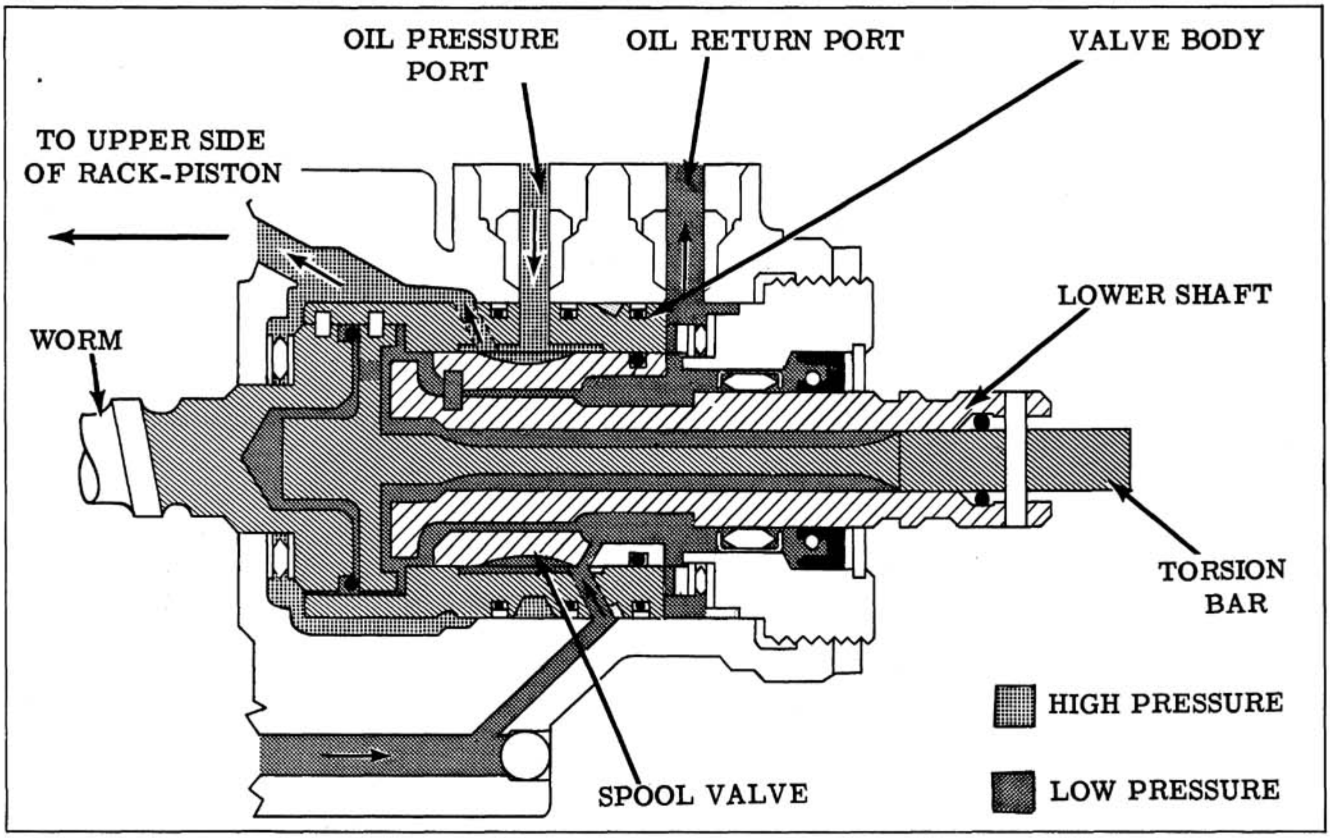


Fig. 8-37 Left Turn Position

positioned so that oil entering the valve body from the housing pressure port passes through the slots in the spool valve to the oil return port in the housing. The chambers at both ends of the rack-piston and around the pitman shaft are always full of oil, which acts as a cushion to absorb road shock so that they are not transferred to the driver. In addition, this oil lubricates all the internal components of the gear.

RIGHT TURN (Fig. 8-36)

When the steering wheel is turnea to the right, the worm resists being turned because of the resistance offered by the front wheels. The valve body also resists turning because it is pinned to the worm. Driver force exerted at the steering wheel turns the lower shaft and spool valve a slight amount which twists the torsion bar between the worm and the spool valve. This slight amount of turning of the spool valve is sufficient to position the slots in the valve body and spool valve for power assist.

The right turn slots in the spool valve are closed off from the return (wide) slots in the valve body and opened more to the pressure (narrow) slots in the valve body. The left turn slots in the spool valve are closed off from the pressure slots in the valve body and opened more to the return slots in the valve body.

Pressure immediately begins to build up against the lower end of the rack-piston, forcing it upward to apply turning effort to the pitman shaft. The oil in the chamber at the upper end of the rack-piston is then forced out through the valve body and spool valve through the oil return port to the pump reservoir.

The instant the driver stops applying turning effort to the steering wheel, the spool valve is forced back into its neutral position by the torsion bar. Oil pressure on the lower end of the rack-piston then decreases so that pressure is again equal on both sides of the rack-piston, and the front wheels return to the straight ahead position, when the car is moving.

Under normal driving conditions, oil pressure does not exceed 200 psi except when turning corners where it does not ordinarily exceed 600 psi. Oil pressure, when parking, ranges from 1,200 to 1,300 psi depending upon road conditions and weight of the car. The steering effort during normal driving, ranges from 1 to 2 lbs. and during parking from 2 to 3-1/2 lbs. again depending upon road conditions.

A check valve located under the high pressure connector seat (Fig. 8-34) hydraulically dampens the shock transmitted to the steering gear when driving on washboard roads.

LEFT TURN (Fig. 8-37)

When the steering wheel is turned to the left, the relationship between the spool valve slots and valve body slots is again changed through twisting of the torsion bar. Pressure immediately builds up against the upper end of the rack-piston, forcing it downward to apply turning effort to the pitman shaft. The oil in the chamber at the lower end of the rack-piston is forced out through the valve body and spool valve to the pump reservoir.

ADJUSTMENT (ON CAR)

OVER-CENTER ADJUSTMENT

The over-center adjustment is the only power steering gear adjustment which can be made on the car; however, in order to make this adjustment, it is also necessary to check the combined ball and thrust bearing pre-load.

1. Remove the pitman shaft nut, then disconnect the pitman arm from the pitman shaft using Puller J-5504-B or a similar puller.

2. Loosen the pitman shaft adjusting screw locknut and thread the adjusting screw out to the limit of its travel through the pitman shaft side cover.

3. Disconnect the horn wire at the relay, then remove the horn button or ornament from the steering wheel.

4. Count the number of turns of the steering wheel through its full travel to locate the steering wheel at its center of travel.

5. Check the combined ball and thrust bearing pre-load with an inch-pound torque wrench on the steering shaft nut by rotating through the center of travel. (Fig. 8-38) Note the highest reading.

6. Tighten the pitman shaft adjusting screw until the torque wrench reads 4 to 8 in. lbs. higher than the previous reading on the steering shaft. The total over-center pre-load should not exceed 16 in. lbs.

7. While holding the pitman shaft adjusting screw, tighten the locknut and recheck the adjustment.

8. Install the horn button or ornament and connect the horn wire. Connect the pitman arm to the pitman shaft. Torque pitman shaft nut to 150 ft. lbs.

REMOVAL AND INSTALLATION

1. Remove the coupling flange hub bolt. (Fig. 8-39)

2. Disconnect the hoses from the pump and cap the pump and hose fittings.

3. Hoist the car.

4. Remove the pitman shaft nut, then disconnect the pitman arm from the pitman shaft using Puller J-5504-B or a similar puller.

5. Remove the three bolts attaching the gear to the frame side rail, permit the lower shaft to slide free of the coupling flange then remove the gear with the hoses attached.

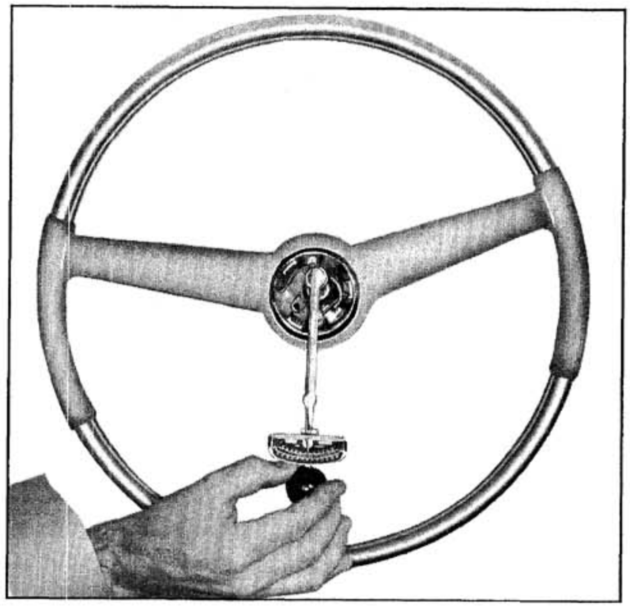


Fig. 8-38 Checking Worm Bearing Pre-Load

Before installing the steering gear, apply a sodium soap fine fiber grease to the gear mounting pads to prevent squeaks between the gear housing and the frame. Make sure the alignment pin on the gear housing enters the hole provided in the frame side rail. Make certain there is a minimum of .040" clearance between coupling hub and steering gear upper seal. Install the coupling flange hub bolt and torque to 25 ft. lbs. Before tightening the steering gear to frame bolts, shift the steering gear as necessary to place it in the same plane as the steering shaft so that the

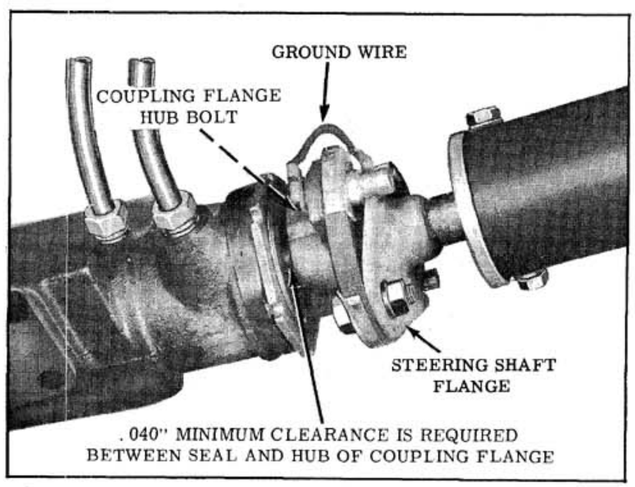


Fig. 8-39 Flex-Coupling

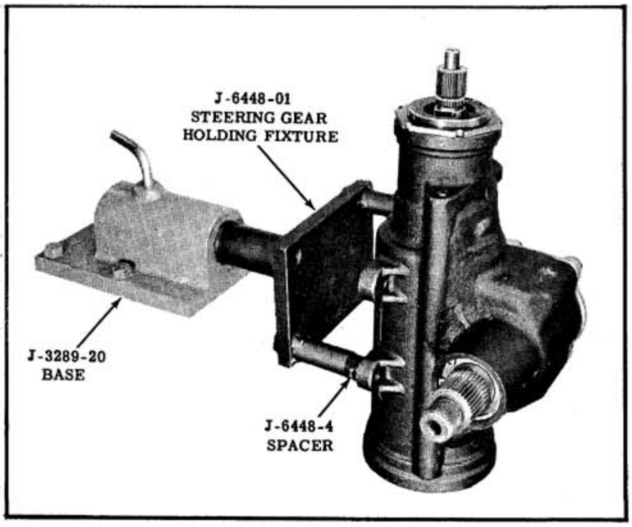


Fig. 8-40 Holding Fixture J-6448-01

flexible coupling is not distorted. Tighten the steering gear to frame bolts to 80 ft. lbs. and the pitman shaft nut to 150 ft. lbs.

After the hoses are connected to the pump, add Hydra-Matic oil as necessary to bring the fluid level to the full mark. Run engine at idle for 30 seconds, then run at fast idle for one minute before turning steering wheel. With the engine running, turn the steering wheel through its full travel two or three times to bleed air from the system. Recheck the oil level and add oil if necessary.

DISASSEMBLY

NOTE: In many cases, complete disassembly of the gear will not be necessary since most of the component parts can be removed without complete disassembly of the gear. The procedure for such operations are not specifically outlined; however, the following basic procedure and specifications will apply.

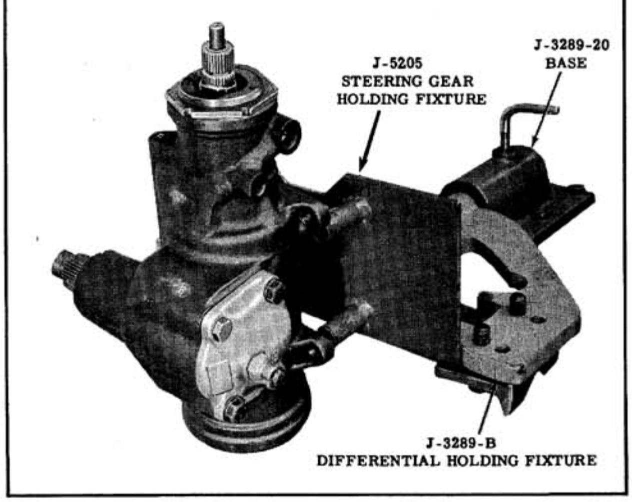


Fig. 8-41 Holding Fixture J-5205

To facilitate servicing of the gear, the gear should be mounted in Holding Fixture J-6448-01 (Fig. 8-40) or Holding Fixture J-5205. Holding Fixture J-5205 is designed to be used with Modified Differential Holding Fixture J-3289-B. (Fig. 8-41)

1. Rotate end cover retaining ring so that one end of the ring is over hole in side of housing then force end of ring from its groove and remove ring. (Fig. 8-43)

2. Turn coupling flange counterclockwise until rack-piston just forces end cover out of housing otherwise the worm may thread out of the rack-piston and the balls will fall out of their circuit. Remove cover and discard "O" ring.

3. Remove the rack-piston plug from rack-piston as shown in Fig. 8-44.

4. Remove the pitman shaft and side cover as follows:

   a. Loosen the over-center adjusting screw locknut and remove the four side cover attaching cap screws and three lockwashers.

   b. Rotate side cover until the rack-piston and pitman shaft teeth are visible, then turn the coupling flange until the pitman shaft teeth are centered in the housing opening. Tap pitman shaft with a soft hammer and remove the pitman shaft and side cover from the housing. Remove the side cover "O" ring and discard.

5. Remove the rack-piston as follows:

   a. Insert Ball Retainer Tool J-7539 into the rack-piston bore with pilot of tool seated in the end of the worm. (Fig. 8-45) Turn lower shaft counterclockwise while holding tool tightly against worm. The rack-piston will be forced onto the tool.

   b. Remove the rack-piston with Ball Retainer Tool J-7539 from gear housing.

6. Remove the adjuster plug as follows:

   a. Loosen the adjuster plug locknut with punch. (Fig. 8-46)

   b. Remove adjuster plug assembly with Spanner Wrench J-7624. (Fig. 8-47) Remove and discard the plug "O" ring.

7. Grasp the lower shaft and pull the valve and shaft assembly from the housing bore. Separate worm and shaft and remove the lower shaft cap "O" ring and discard.

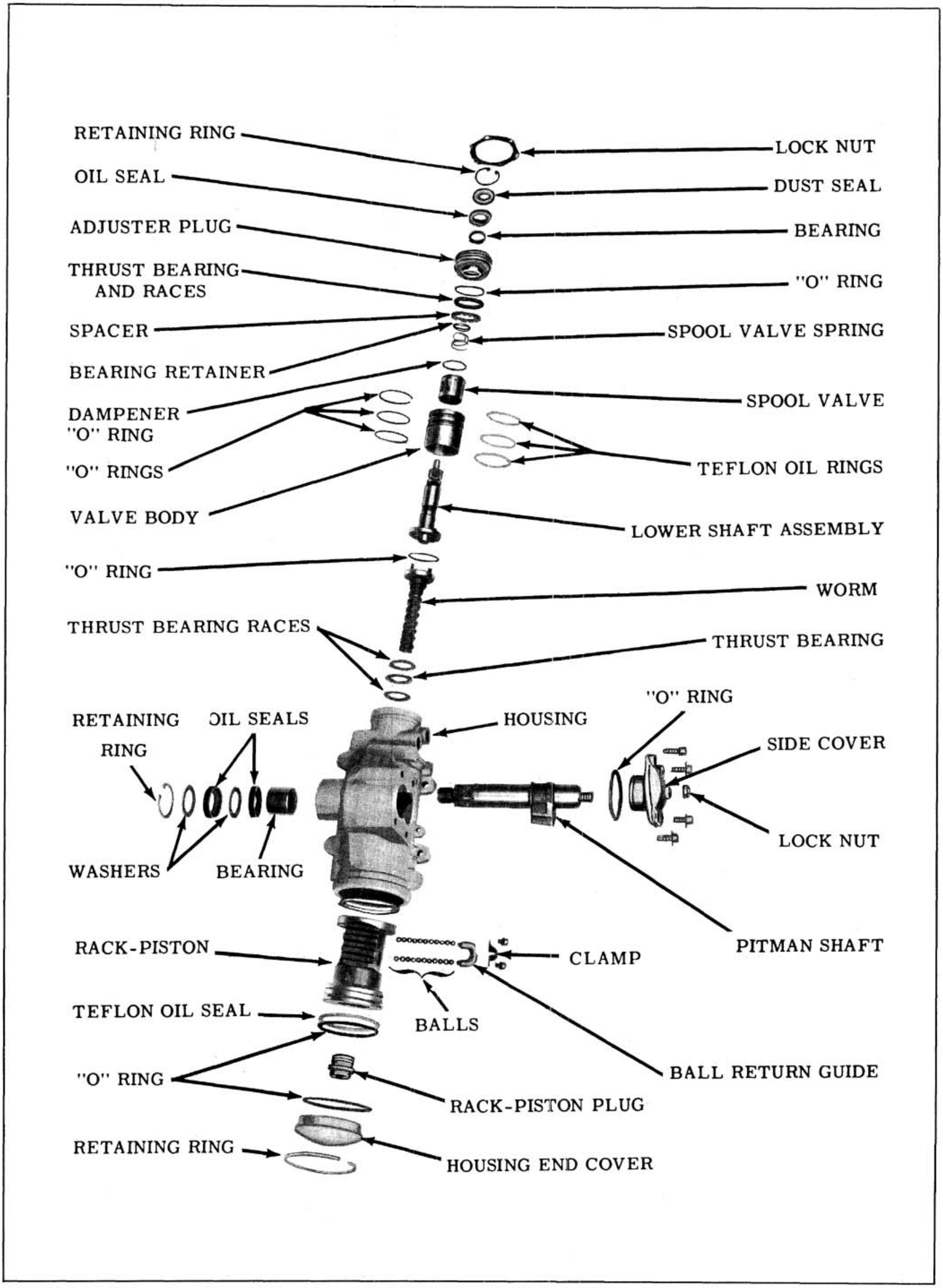


Fig. 8-42 Power Steering Gear

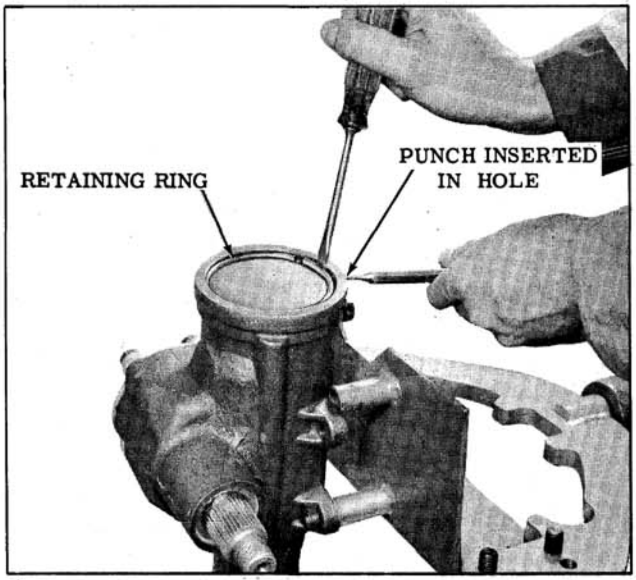


Fig. 8-43 Removing End Cover Ring

8. If the worm or lower thrust bearing and race(s) remained in the gear housing, remove at this time.

SERVICING INDIVIDUAL UNITS

ADJUSTER PLUG ASSEMBLY (Fig. 8-48)

Disassembly

1. Remove the thrust bearing retainer by prying at the two raised areas with an awl or small screwdriver, remove the thrust bearing spacer, thrust bearing and washers.

2. If the seal ONLY is to be replaced and not the bearing, remove the retaining ring with internal pliers, then remove the dust seal. Pry the seal from the bore of the adjuster plug. Discard seal.

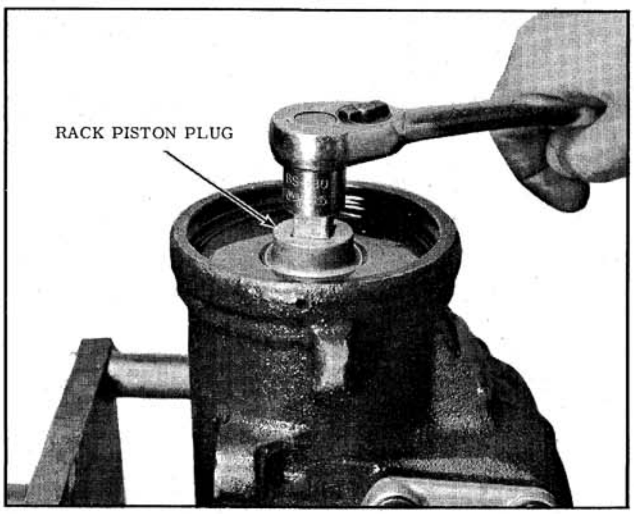


Fig. 8-44 Removing Rack-Piston Plug

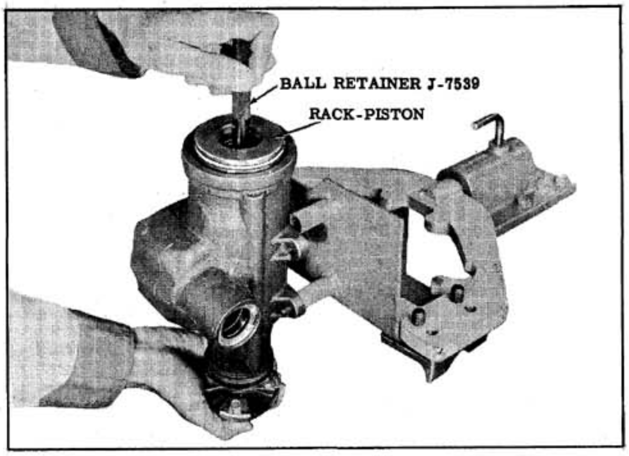


Fig. 8-45 Removing Rack-Piston

3. If the needle bearing is to be replaced, remove the retaining ring using internal pliers, then drive the dust seal, seal and bearings from the adjuster plug with Tool J-5254. (Fig. 8-49) Discard seal and bearing.

CLEANING AND INSPECTION

1. Wash all parts in clean solvent and dry parts with compressed air.

2. Inspect thrust bearing spacer for wear or cracks. Replace if damaged.

3. Inspect thrust bearing rollers and washers for wear, pitting or scores. If any of these conditions exists, replace the bearing and washers.

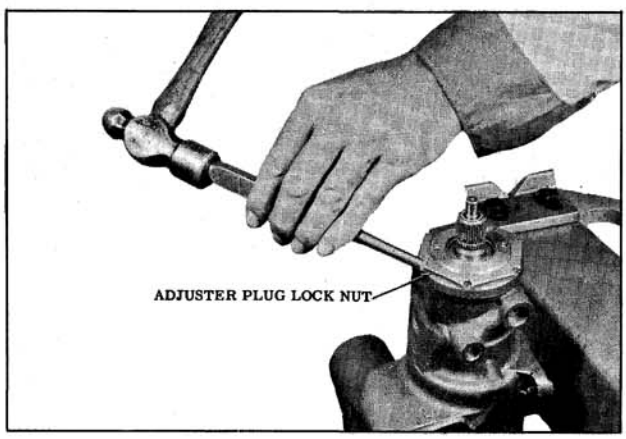


Fig. 8-46 Loosening Locknut

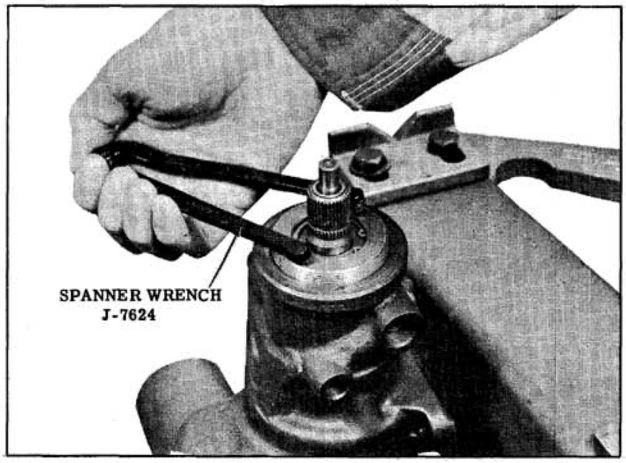


Fig. 8-47 Removing Adjuster Plug

Assembly

1. If the needle bearing was removed, place new needle bearing over Tool J-5254 with the manufacturer's identification against the tool and drive or press bearing until it is flush with the surface of the seal bore. (Fig. 8-50)

2. If seal was removed, temporarily install the adjuster plug in the gear housing and place dust seal and a new oil seal on Tool J-5254 (lip of seal away from tool). Lubricate seal with oil, Part No. 1050017 and drive or press seal into adjuster plug just far enough to provide clearance for the retaining ring. (Fig. 8-51) Tool J-5254 must be free of burrs that could scratch the seal.

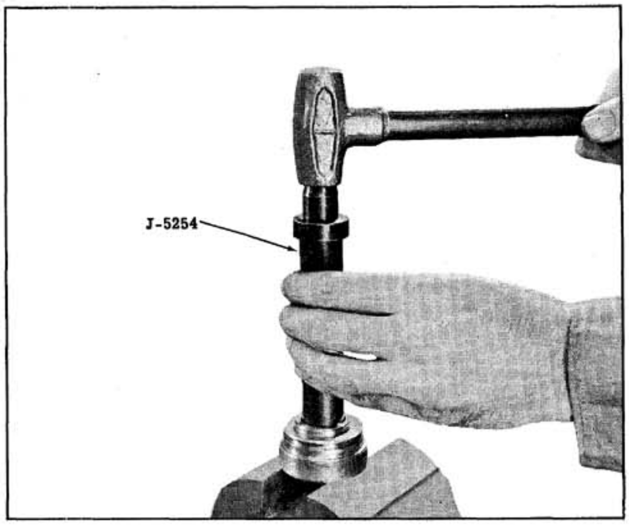


Fig. 8-49 Seal and Bearing Removal

3. Install retaining ring with internal pliers, then remove the adjuster plug from the housing.

4. Lubricate the thrust bearing assembly with oil, Part No. 1050017. Place the large thrust bearing washer on the adjuster plug hub, then install the upper thrust bearing, small bearing washer and spacer (grooves of spacer away from bearing washer).

5. Install a new bearing retainer on the adjuster plug by carefully tapping on the flat surface of the retainer. (Fig. 8-52)

NOTE: The projections must not extend beyond the spacer when the retainer is seated. The spacer must be free to rotate.

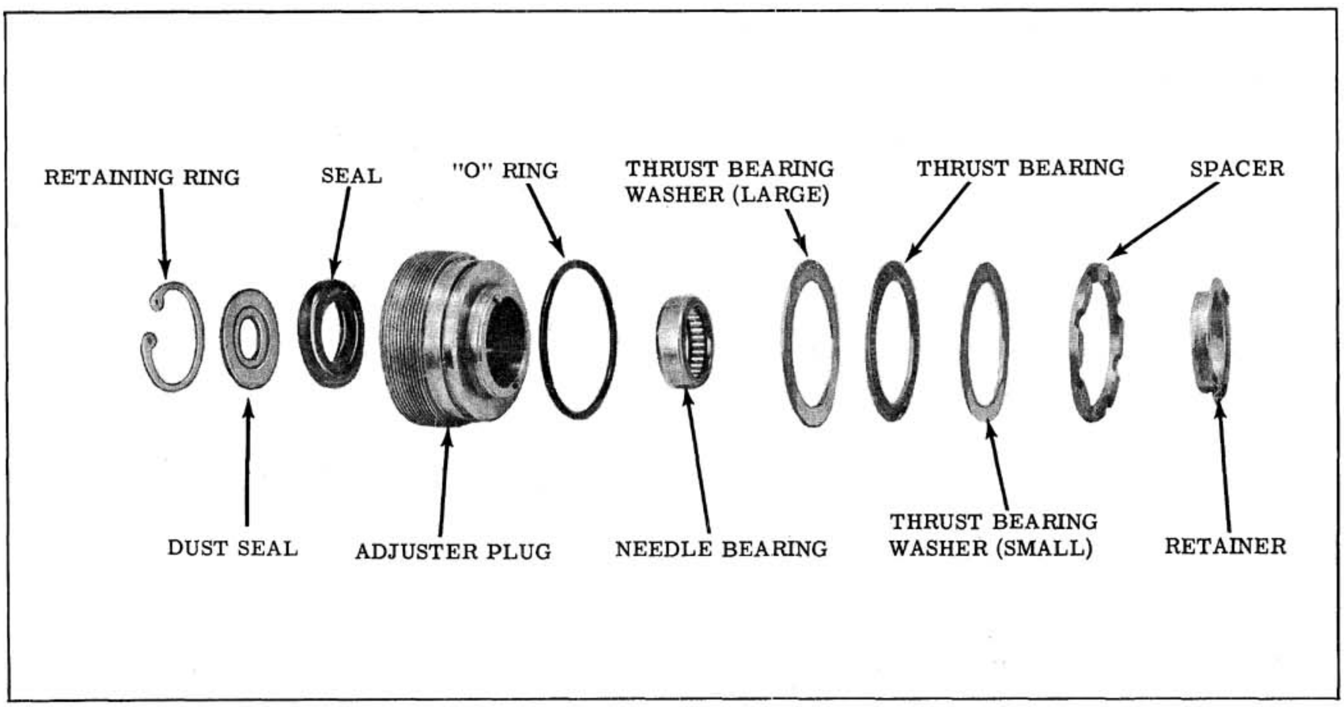


Fig. 8-48 Adjuster Plug Assembly

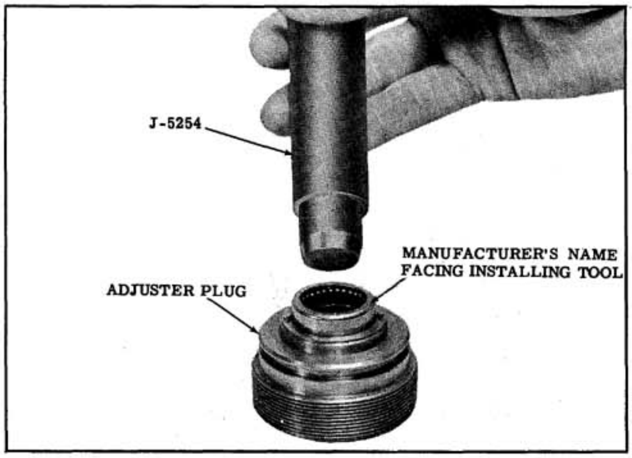


Fig. 8-50 Installing Bearing

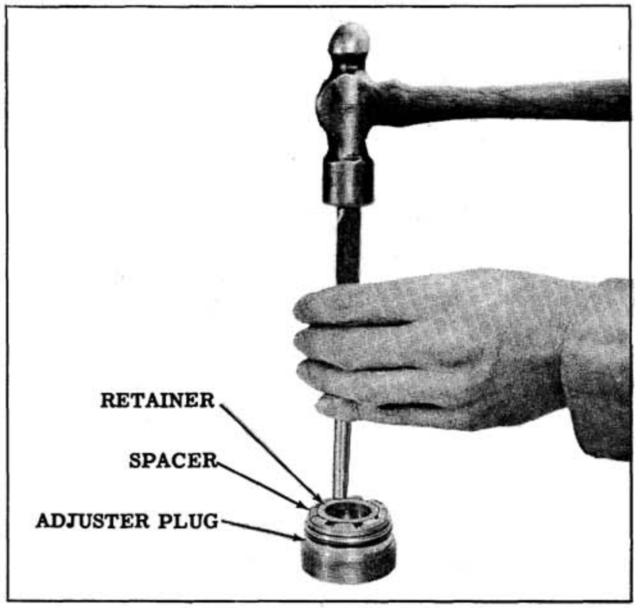


Fig. 8-52 Installing Bearing Retainer

VALVE AND LOWER SHAFT ASSEMBLY (Fig. 8-53)

Disassembly

1. Remove the spool valve spring by carefully prying top coil out of groove in the lower shaft, then slide the spring from the shaft.

2. To remove the lower shaft assembly from the valve body, proceed as follows:

   a. While holding the assembly (lower shaft down), lightly tap the lower shaft against the bench until the shaft cap is free from the valve body. (Fig. 8-54) The spool valve should be held in the valve body while tapping the shaft.

   b. Carefully remove the lower shaft assembly so as not to cock the spool valve in the valve body.

3. Push the spool valve out of the flush end of the valve body until the dampener "O" ring is exposed, then carefully pull the spool from the valve body while rotating the valve. (Fig. 8-55) If the spool valve becomes cocked, reverse the withdrawal procedure, then again attempt to remove the valve.

   IMPORTANT: Do not attempt to force the spool valve in or out of the valve body. If the spool is cocked in the valve body, straighten the spool by tapping with a plastic or rawhide mallet, then push the spool back into the body and repeat the removal procedure.

4. Remove the dampener "O" ring from the spool valve and discard.

5. If the teflon oil rings are to be replaced, cut the three teflon oil rings and "O" rings from the valve body and discard.

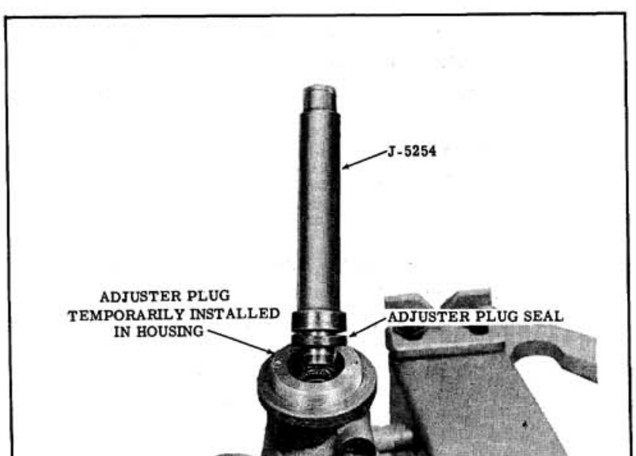


Fig. 8-51 Installing Seal

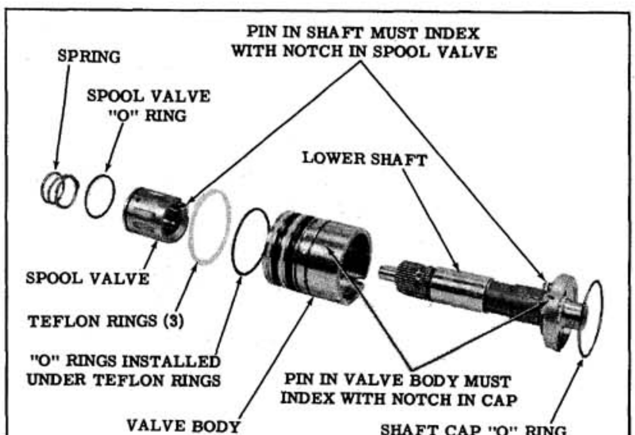


Fig. 8-53 Valve and Lower Shaft Assembly

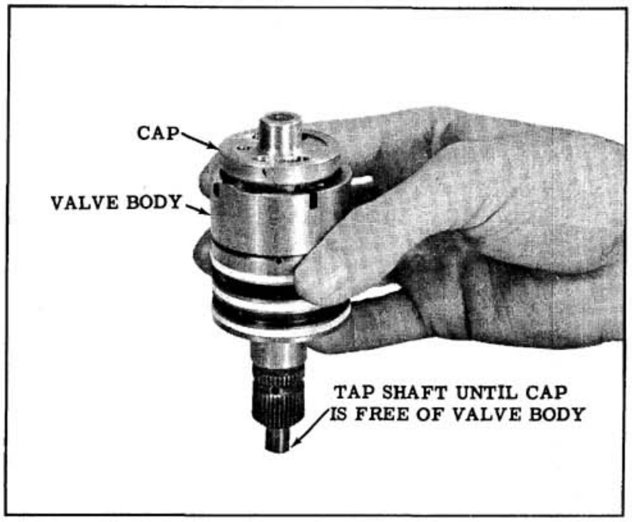


Fig. 8-54 Freeing Shaft Cap

Cleaning and Inspection

1. Wash all parts in clean solvent and blow out all oil holes with compressed air.

2. If the drive pin in the lower shaft or valve body is cracked, excessively worn or broken, replace the complete valve and shaft assembly.

3. If there is evidence of leakage between the torsion bar and the lower shaft, or scores, nicks, or burrs on the ground surface of the lower shaft that cannot be cleaned up with crocus cloth, the entire valve and shaft assembly must be replaced.

4. Check the OD of the spool valve and the ID

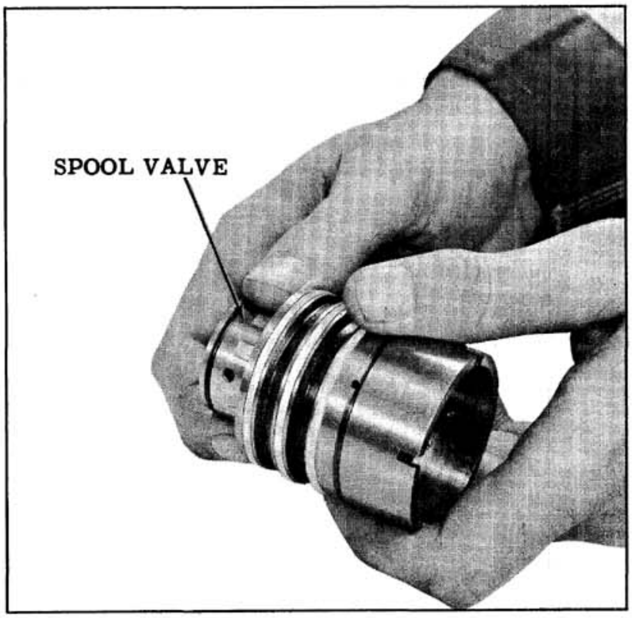


Fig. 8-55 Removing Spool Valve

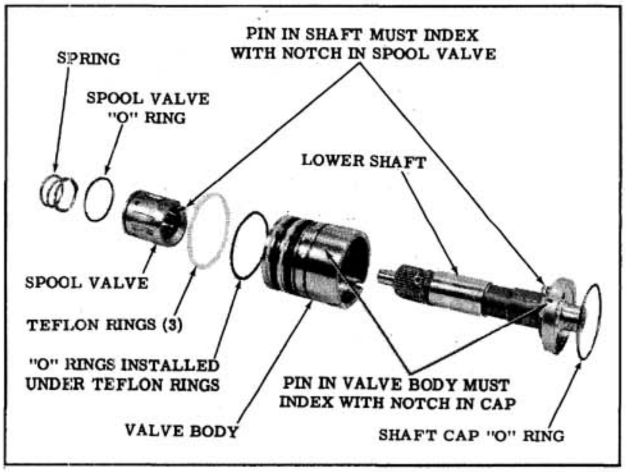


Fig. 8-56 Valve and Lower Shaft Assembly

of the valve body for nicks, burrs, or bad wear spots. If the irregularities cannot be cleaned up by the use of crocus cloth, the complete valve and shaft assembly will have to be replaced.

5. If the small notch in the skirt of the valve body is excessively worn, the complete valve and shaft assembly will have to be replaced.

6. Lubricate the spool valve with Hydra-Matic fluid and check the fit of the spool valve in the valve body (with the spool valve dampener "O" ring removed). If the valve does not rotate freely without binding, the complete valve and shaft assembly will have to be replaced.

7. Check the overall length of the spool valve spring. The spring should be approximately 3/4". If it is less than 11/16", replace the spring.

ASSEMBLY (Fig. 8-56)

1. Install the three valve body "O" rings in the oil ring grooves and lubricate with Hydra-Matic oil.

2. Lubricate the three teflon oil rings with petrolatum and install in grooves over "O" rings.

   NOTE: The oil rings may appear to be distorted, but the heat of the oil during operation of the gear will straighten them out.

3. Assemble the lower shaft assembly in the valve body so the notch in the lower shaft cap engages with the pin in the valve body. (Fig. 8-56) If necessary, tap the shaft cap with a plastic hammer until cap is seated in the valve body.

4. Install the spool valve as follows:

   a. Lubricate the spool valve dampener "O" ring with petrolatum and install over spool valve.

   b. Lubricate the spool valve with Hydra-Matic oil and slide the valve over the lower shaft (notch in spool towards the valve body). Rotate the spool valve while pushing the valve into the valve body until the notch in the spool engages the pin in the lower shaft.

   c. Carefully crowd the dampener "O" ring into its groove until the spool valve can be pushed all the way in the valve body. The spool valve is properly seated when it is flush with the top of valve body.

   NOTE: Exercise extreme caution during this operation so the "O" ring will not be cut.

5. Slide the valve spring over the lower shaft and down into the spool valve until the top coil of the spring is in the shaft groove.

PITMAN SHAFT AND SIDE COVER (Fig. 8-57)

Disassembly

Remove the locknut and side cover from the adjusting screw. Do not attempt to disassemble pitman shaft. Discard locknut.

NOTE: The power steering gear is equipped with a self-adjusting type of pitman shaft which automatically keeps the over-center adjustment within specifications for a limited mileage (up to approximately 10,000 miles), regardless of the wear of the rack-piston and related parts. This is accomplished by the use of a wear washer and a heavy spring in the pitman shaft assembly. The wear washer is calibrated to wear at the same rate as the other components of the gear. Replacement pitman shafts do not have this feature and adjusting screw torque is zero.

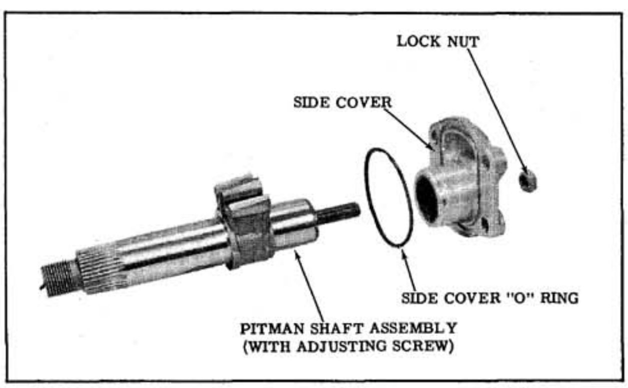


Fig. 8-57 Pitman Shaft and Side Cover

In cases where gear chucking or "clunk" cannot be corrected by performing the over-center adjustment (See POWER STEERING GEAR ADJUSTMENT-ON CAR), the trouble may be due to excessive wear in the pitman shaft or a broken spring in the pitman shaft.

To check the pitman shaft for excessive wear or a broken spring:

1. With the side cover removed from the pitman shaft, clamp the shaft in a vise and thread two 7/16" SAE nuts on the adjusting screw. Tighten nuts so they are locked on the shaft.

2. Using a 5/8" socket and an inch-pound torque wrench, measure the torque required to turn the adjusting screw. (Fig. 8-58) Torque reading should be 1 to 15 in. lbs.

3. If the reading is not within this range, the complete pitman shaft assembly must be replaced. DO NOT ATTEMPT TO CORRECT READING BY DISASSEMBLING THE PITMAN SHAFT.

4. Remove the torque wrench and the two 7/16" nuts from the adjusting screw.

Cleaning and Inspection

1. Wash all parts in clean solvent and dry parts with compressed air.

2. Check pitman shaft bearing surface in the side cover for scoring. If badly worn or scored, replace the side cover.

3. Check the sealing and bearing surfaces of the pitman shaft for roughness, nicks, etc. If minor irregularities in surface cannot be cleaned by use of crocus cloth, replace the pitman shaft.

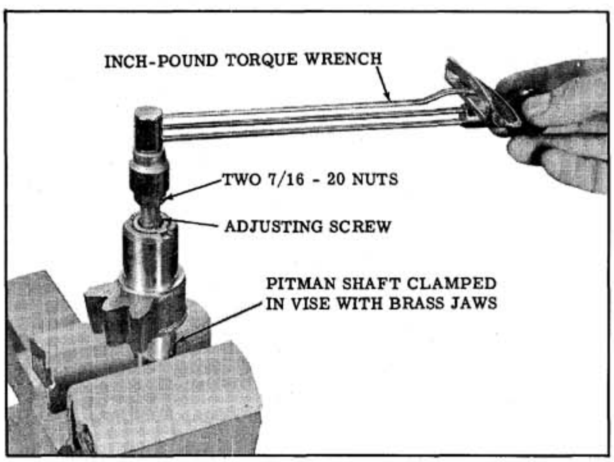


Fig. 8-58 Checking Adjusting Screw Torque

4. Replace pitman shaft assembly if teeth are damaged or if the bearing surfaces are pitted or scored.

Assembly

Thread the side cover onto the pitman shaft adjusting screw until it bottoms. Install, but do not tighten, a new adjusting screw locknut.

RACK-PISTON

Disassembly

1. Check the ball pre-load as follows:
   a. Lightly clamp the rack-piston assembly in a brass jawed vise with Tool J-7539 still in place.
   b. Thread worm into rack-piston while holding Tool J-7539 tightly against worm so the balls will not fall out of the rack-piston. When the worm is in place, remove Tool J-7539.
   c. Clamp rack-piston (flanged end of worm up) in vise, then install the valve and lower shaft assembly so that the small notch in the valve body engages the drive pin in the worm. Locate the over-center position of the worm by slowly turning the worm and noting the area where the turning effort is highest. DO NOT THREAD THE WORM OUT TOO FAR SINCE THIS MAY CAUSE SOME OF THE BALLS TO DROP OUT OF THE RACK-PISTON.
   d. Using a torque wrench and a 3/4" 12 point socket, check the pre-load while rotating the torque wrench in a 120° arc. The reading should be 1/16 to 5 in. lbs. (Fig. 8-59)

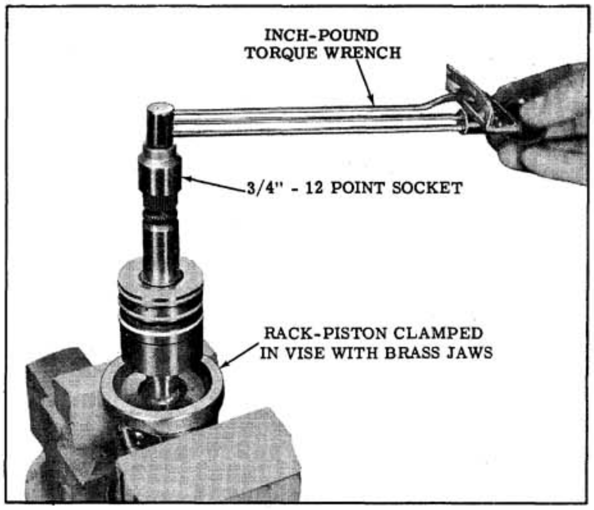


Fig. 8-59 Checking Pre-load

   e. If the pre-load is not within limits, a new set of balls must be installed upon re-assembly. Install the next size larger balls to increase the pre-load or the next size smaller balls to decrease the pre-load, black balls need not be replaced unless they are defective. A change of one ball size will change the pre-load approximately 1 in. lb.

      NOTE: Standard ball size is number 7.

   f. Remove the torque wrench and valve and shaft assembly.
2. Thread the worm out of the rack-piston, remove ball return guide clamp, guide valves and balls.
3. If necessary to replace the teflon oil seal and "O" ring, remove at this time.

Cleaning and Inspection

1. Wash all parts in clean solvent and dry with compressed air.
2. Inspect the worm and rack-piston grooves and all the balls for scoring. If either the worm or rack-piston needs replacing, both must be replaced as a matched assembly.
3. Inspect ball return guide halves, making sure that the ends where the balls enter and leave the guides are not damaged.
4. Inspect lower thrust bearing and washers for scores or excessive wear. If any of these conditions are found, replace the thrust bearing and washers.
5. Inspect rack-piston teeth for scores or excessive wear. Inspect the external ground surfaces for wear, scoring or burrs.
6. Inspect the rack-piston stop ring (inside of housing) and replace if damaged.

Assembly

1. If the teflon oil seal and "O" ring were removed, install a new "O" ring and seal, lubricated with oil, Part No. 1050017 in the groove of the rack-piston.
2. Slide the worm all the way into the rack-piston. It is not necessary to have the thrust bearing assembly on the worm at this time.

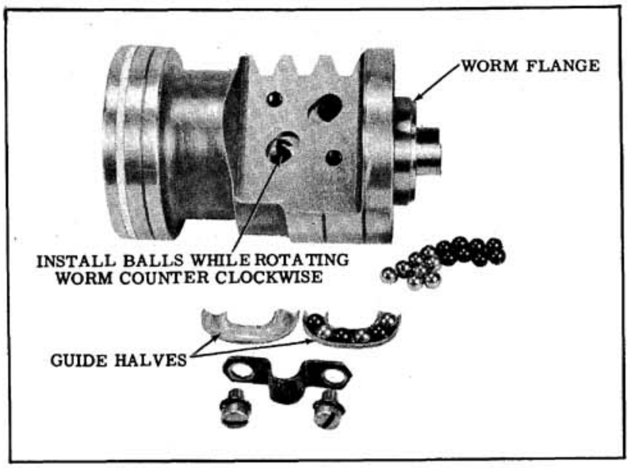


Fig. 8-60 Installing Balls in Rack-Piston

3. Turn the worm until the worm groove is aligned with the lower ball return guide hole. (Fig. 8-60)

4. Lubricate the balls with 1050017 oil, then feed 16 balls into the rack-piston while slowly rotating the worm counterclockwise.

   IMPORTANT: The black balls are .0005" smaller than the silver balls. The black and silver balls must be installed alternately into the rack-piston and return guide.

5. Alternately install six balls into the return guide and retain with petrolatum. Install the return guide assembly onto the rack-piston. Install the return guide clamp and tighten the two clamp screws to 12 ft. lbs.

6. Check the ball pre-load if it was necessary to install a new set of balls to correct the pre-load. Refer to RACK-PISTON - DISASSEMBLY (Step 1).

7. Insert Bearing Retainer Tool J-7539 into the rack-piston, then while holding tool tightly against end of worm, thread worm out of the rack-piston.

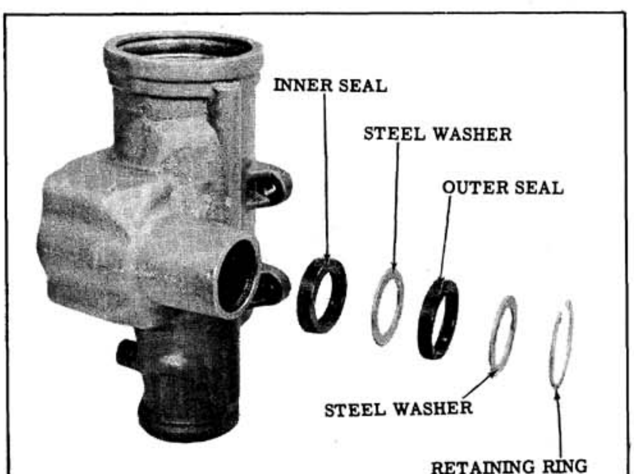


Fig. 8-61 Pitman Shaft Seals

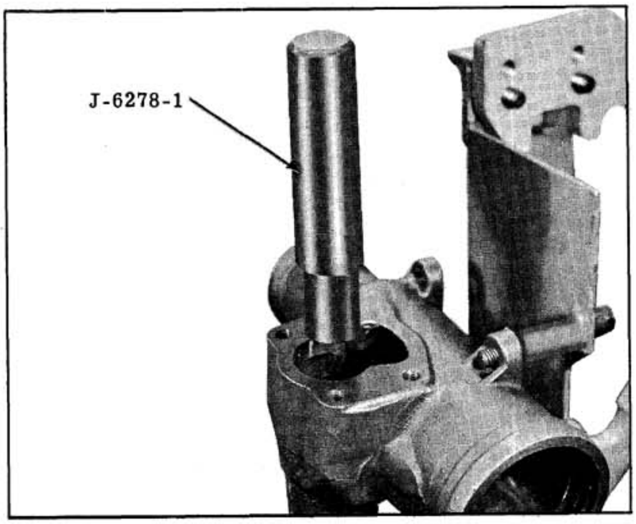


Fig. 8-62 Needle Bearing and Seal Removal

PITMAN SHAFT NEEDLE BEARING AND SEALS (Fig. 8-61)

Remove

1. If pitman shaft seals ONLY are to be replaced, remove the seal retaining ring and outer steel washer, then pry out the outer seal. Remove the inner steel washer, then drive out the inner seal.

2. If pitman shaft needle bearing replacement is necessary, remove the seal retaining ring, outer steel washer, then drive needle bearing, seals and inner washer out with Tool J-6278-1. (Fig. 8-62)

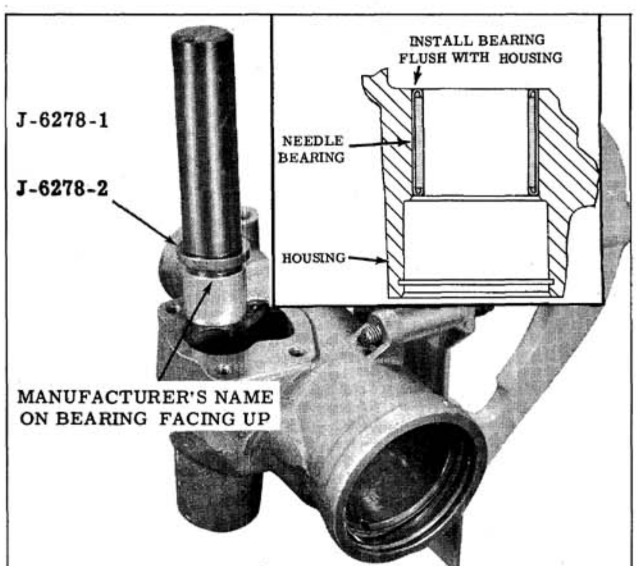


Fig. 8-63 Installing Needle Bearing

Install

1. If the pitman shaft needle bearing was removed, place Adapter J-6278-2 over Tool J-6278-1; slide the new needle bearing on the tool with the manufacturer's identification against the adapter and drive the bearing into the housing until adapter bottoms in housing. (Fig. 8-63)

2. Coat the lips of the oil seals with special lubricant, Part No. 1050169.

3. Install the pitman shaft oil seals as follows:

   a. Place Adapter J-6278-2 over Tool J-6278-1; then install the outer seal, inner steel washer, and inner seal with the lips on the seals facing away from the adapter.

   b. Drive the seals into the housing until the top of Adapter J-6278-2 is flush with the housing. (Fig. 8-64)

   c. Remove the tool and adapter, then install the outer steel washer and seal retaining ring. The retaining ring will not seat in the groove at this time.

   d. Reinsert Tool J-6278-1 with Adapter J-6278-2 and continue driving the seals until the retaining ring seats in its groove (inset, Fig. 8-64), then remove the tool and adapter.

HOSE CONNECTORS

Remove

If the hose connections were leaking at the connector seats in the housing, remove one or both connector seats as follows:

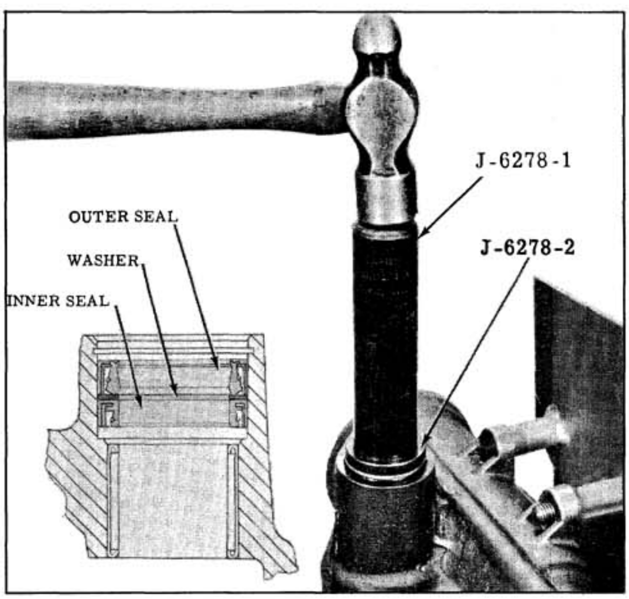


Fig. 8-64 Installing Oil Seals

1. Thread a nut and place a washer on a 5/16"-18 tap.

2. If the connector seat is being removed from an assembled gear, coat the end of the tap with petrolatum to prevent chips from entering the passage while tapping the seat.

3. With the steering gear in a vertical position, thread the tap into the connector seat not more than three turns. (Fig. 8-65)

4. Tighten the nut to remove the seat.

   NOTE: A check valve and spring is located below the high pressure connector seat and can be replaced when seat is removed.

Install

To install a new connector seat, use Tool J-6217 to seat it in the housing. (Fig. 8-66)

STEERING GEAR ASSEMBLY

1. Install the worm as follows:

   a. Lubricate the worm, lower thrust bearing and the two thrust washers with Hydra-Matic oil, then install one thrust washer, the bearing, and the other thrust washer over the end of the worm.

   b. With the valve bore end of gear housing down, insert the worm and thrust bearing assembly into the housing. While holding the worm in place, turn the gear housing so the valve bore end of the housing is up.

2. Install the valve and lower shaft assembly as follows:

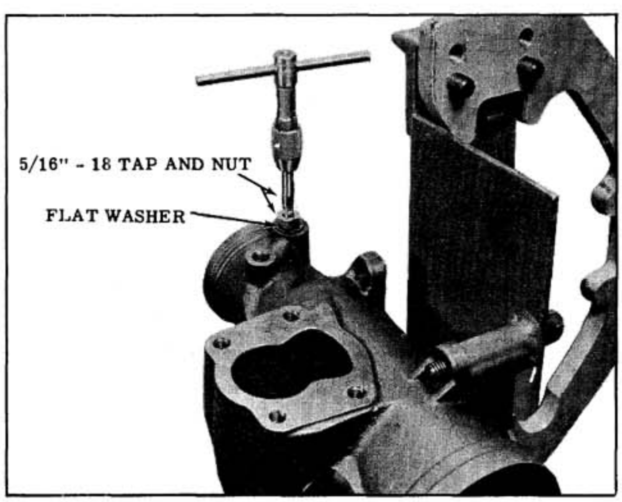


Fig. 8-65 Removing Connector Seal

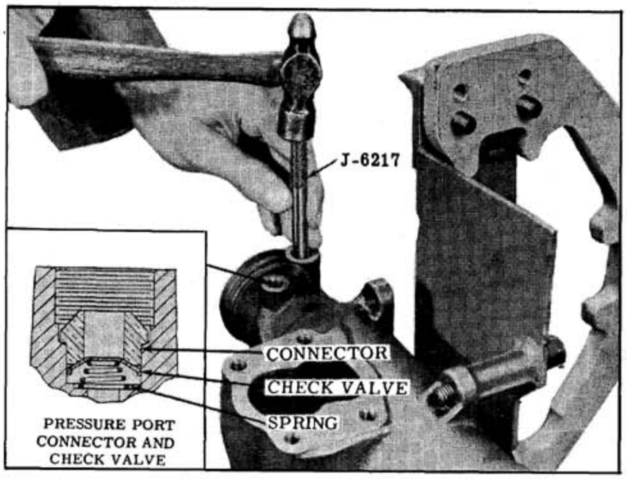


Fig. 8-66 Installing Connector Seat

a. Lubricate the valve body teflon rings and a new lower shaft cap "O" ring with petrolatum. Install the lower shaft cap "O" ring in the valve body so it is seated against the lower shaft cap. Align the NARROW NOTCH in the valve body with the pin in the worm, then install the valve and shaft assembly in the gear housing. (Fig. 8-67) Apply pressure to the VALVE BODY when installing. If pressure is applied to the lower shaft during installation, the shaft may be forced out of the valve body.

IMPORTANT: The valve body is properly seated when the oil return hole in the housing is entirely uncovered. (Fig. 8-68)

3. Lubricate a new adjuster plug "O" ring with petrolatum and install in groove on adjuster plug. Place Seal Protector J-6222 over lower shaft, then install the adjuster plug assembly in the housing until it seats against the valve body. (Fig. 8-69) Remove Seal Protector. Do not adjust the thrust bearing pre-load at this time.

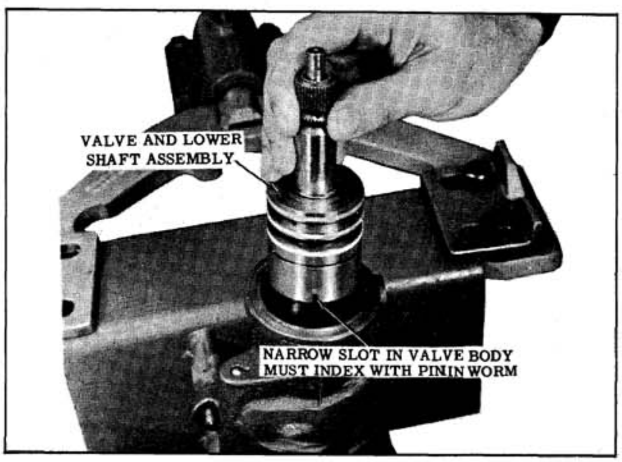


Fig. 8-67 Installing Valve and Lower Shaft Assembly

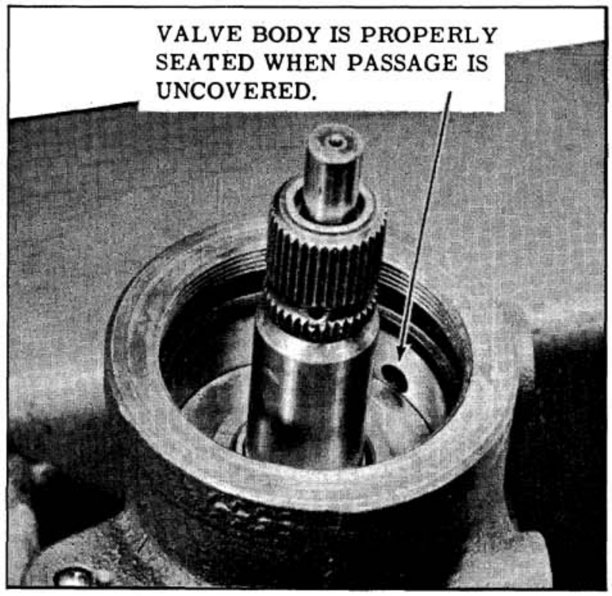


Fig. 8-68 Valve Body Properly Seated

4. Install the rack-piston as follows:

a. Lubricate the rack-piston teflon seal with petrolatum.

b. With the rack-piston bore of the housing facing up, position Seal Compressor J-7576 against the shoulder in the housing.

c. With Ball Retainer J-7539 in place in the rack-piston, push the rack-piston into the housing until Tool J-7539 contacts the worm. (Fig. 8-70)

d. Turn the lower shaft clockwise with a 3/4" 12-point socket or a replacement coupling flange to thread the rack-piston onto

Fig. 8-69 Installing Adjuster Plug

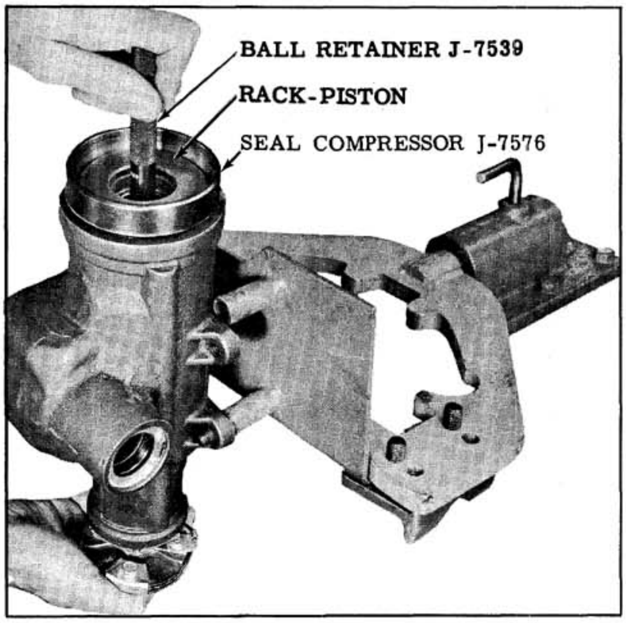


Fig. 8-70 Installing Rack-Piston

the worm while holding Tool J-7539 against the end of the worm.

e. When the rack-piston is completely threaded on the worm, remove Ball Retainer J-7539 and Seal Compressor J-7576.

5. Install the rack-piston plug in the rack-piston and torque to 65 ft. lbs.

6. Install a new housing end cover "O" ring and lubricate it with petrolatum, then install the end cover and retaining ring.

7. Install the pitman shaft and side cover as follows:

   a. Install a new "O" ring in the pitman shaft side cover and retain with petrolatum.

   b. Turn the lower shaft until the rack-piston teeth are centered in the pitman shaft opening, then install the pitman shaft and side cover so that the center tooth of the pitman shaft engages the center groove of the rack-piston.

   c. Install the four side cover bolts and three lockwashers and tighten to 30 ft. lbs. Refer to Fig. 8-71 for washer location.

8. Adjust the thrust bearing pre-load as follows:

   a. Turn the adjuster plug clockwise with Spanner Wrench J-7624 until it is tight, then loosen it 1/8 turn.

   b. Install an inch-pound torque wrench with a 3/4" 12-point socket on the lower shaft splines. (Fig. 8-71)

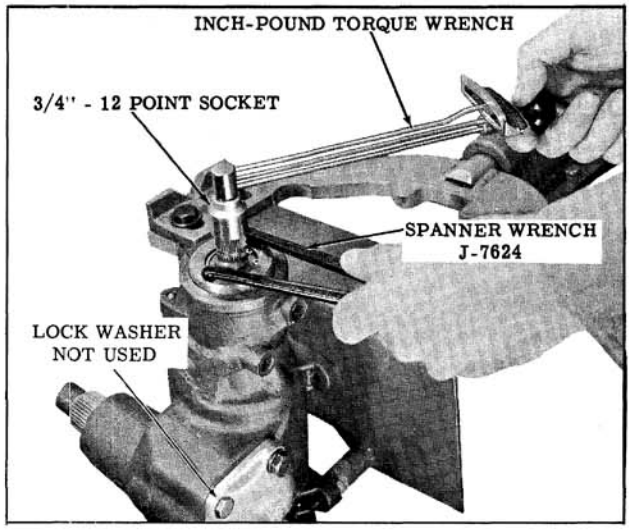


Fig. 8-71 Adjusting Thrust Bearing Pre-Load

   c. Rotate the torque wrench in a 45° arc and note the highest reading.

   d. Tighten the adjuster plug with Spanner Wrench J-7624 until the torque wrench reads 1 to 3 in. lbs. higher than the initial load reading.

   e. Install the adjuster plug locknut and tighten with Spanner Wrench J-972-A.

   f. Recheck the adjustment to be sure it is still only 1 to 3 in. lbs. higher than the initial load reading. If the adjustment changed when tightening the locknut, re-adjust the adjuster plug.

9. Adjust the over-center pre-load as follows:

   a. Make sure the over-center adjusting screw is backed all the way out.

   b. Install an inch-pound torque wrench with a

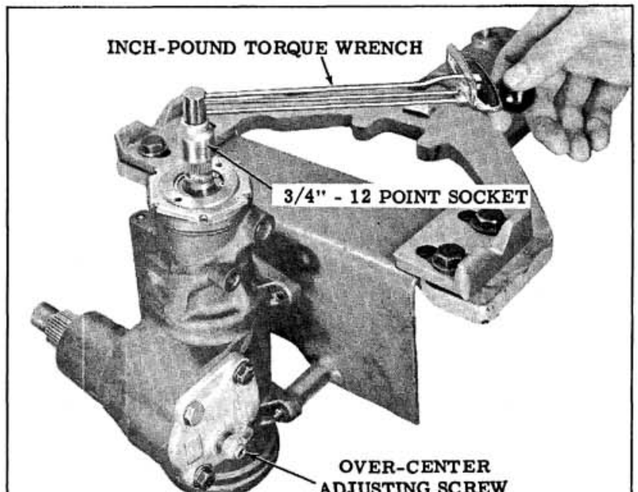


Fig. 8-72 Checking Over-Center Pre-Load

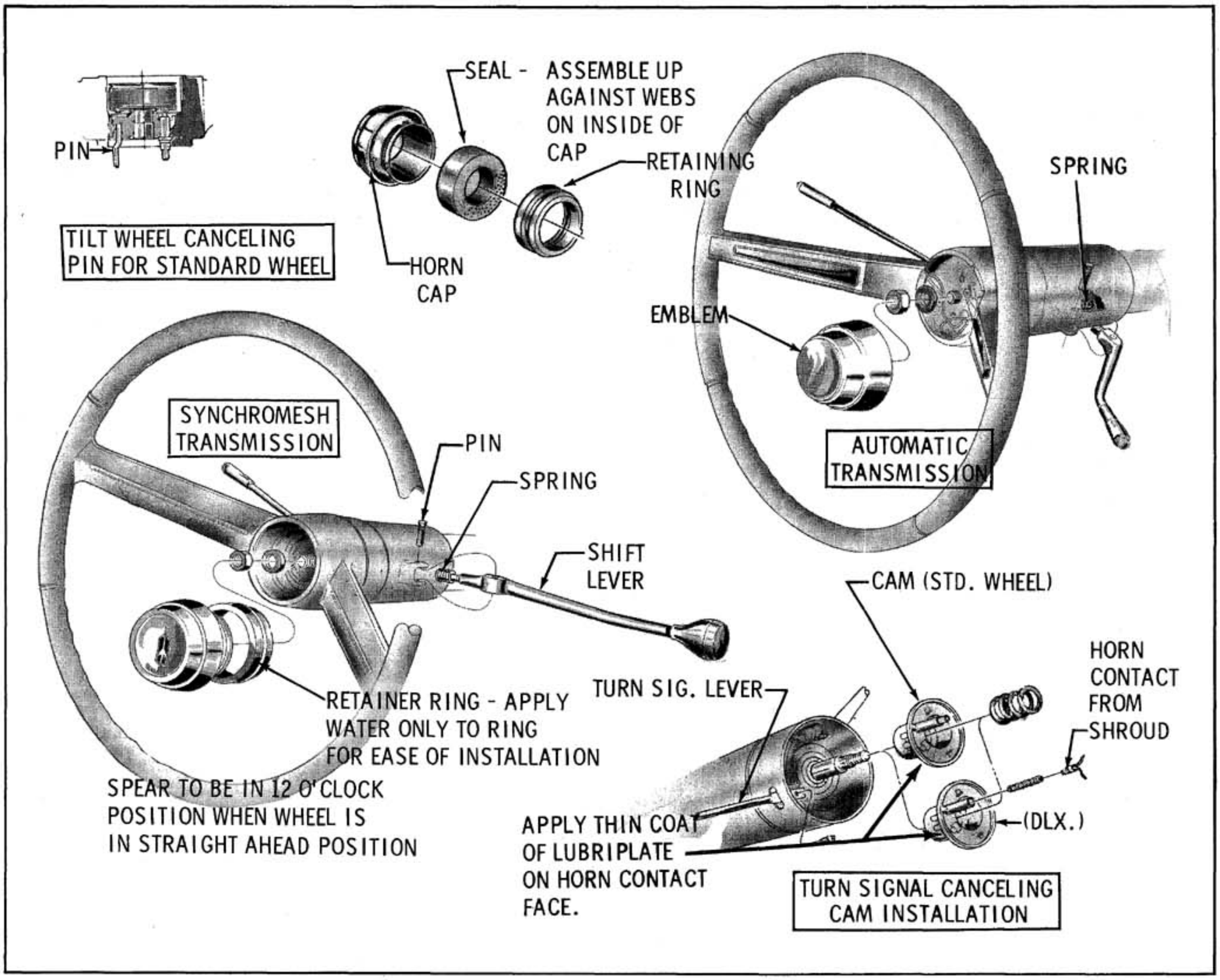


Fig. 8-73 Steering Wheel Attachment (52 through 86 Series)

3/4" 12-point socket on the lower shaft splines.

c. Rotate the lower shaft from one stop to the other to count the number of turns and locate the center of travel, then check the combined ball and thrust bearing pre-load by rotating the torque wrench through the center of travel. (Fig. 8-72) Note the highest reading.

d. Tighten the pitman shaft adjusting screw until the torque wrench reads 4 to 8 in. lbs. higher than the previous reading. The total reading should not exceed 16 in. lbs.

e. While holding the adjusting screw, tighten the locknut and recheck the adjustment.

10. Position the coupling flange onto the lower shaft, then install the flange attaching bolt and lockwasher. Position the flange so that there is a minimum of .040" clearance between the coupling hub and steering gear upper seal.

STEERING WHEEL AND HORN CONTACT

STEERING WHEEL

REMOVE (Figs. 8-73 and 8-74)

1. Disconnect the turn signal connector.

2. Standard wheel - Pull lens and bezel assembly from wheel.

3. Deluxe wheel - Carefully pry the cap and emblem assembly from the shroud. On 33 through 3800 Series, rotate cap clockwise to disengage locking tab.

4. Remove the steering wheel attaching nut and washer, then using a puller such as BT-61-9, remove the steering wheel from the steering shaft. (Fig. 8-75) Remove puller from steering wheel.

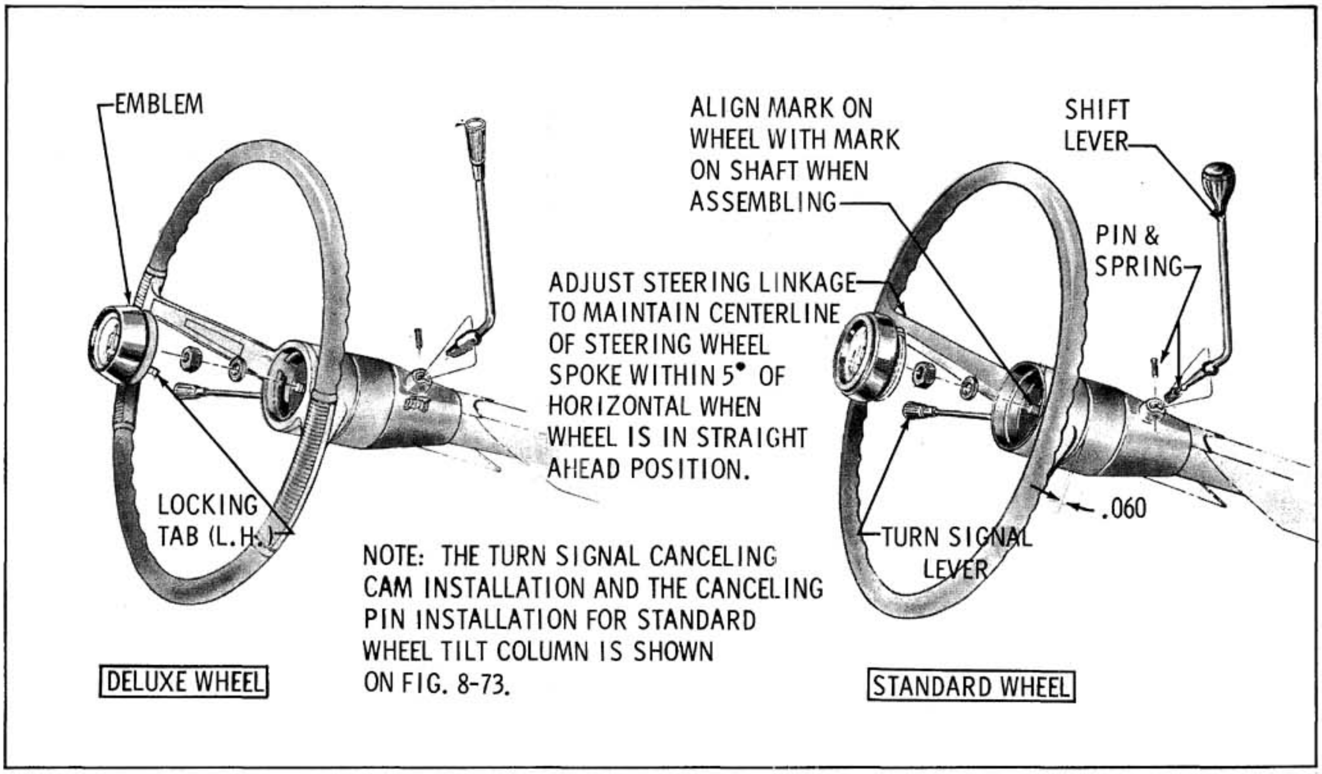


Fig. 8-74 Steering Wheel Attachment (33 through 38 Series)

Install

1. With the marks on the steering wheel and steering shaft aligned, install the wheel, flat-washer and nut.

   NOTE: When mark on steering wheel hub and steering shaft are lined up, wheel spokes should be horizontal as car is driven straight ahead.

   If spokes are not horizontal, it will be necessary to adjust the tie rod ends until steering wheel assumes its proper position. When a new steering gear is installed, it may be necessary to adjust steering wheel spoke alignment even though spoke alignment had been correct for the old gear.

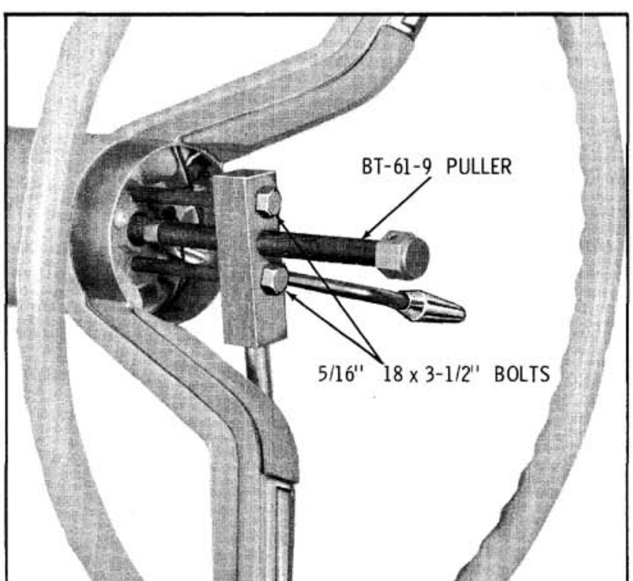


Fig. 8-75 Removing Steering Wheel

2. Torque the nut to 40 ft. lbs. On standard steering wheels, install lens and bezel assembly. Water may be used on bezel retainer ring to aid installation. DO NOT USE LUBRICANT ON RETAINER RING. On deluxe steering wheels, install cap and emblem assembly. On 33 through 3800 Series, position cap into slots and turn counterclockwise to lock.

3. Connect turn signal wiring connector.

HORN CONTACT OR SWITCH

The horn contact or switch is installed as shown in Figs. 8-76, 8-77, 8-78 and 8-79.

TURN SIGNAL SWITCH

Remove

1. Disconnect battery.

2. Remove steering wheel and turn signal lever.

   NOTE: Spring and turn signal cancelling cam will probably remain in hub of steering wheel.

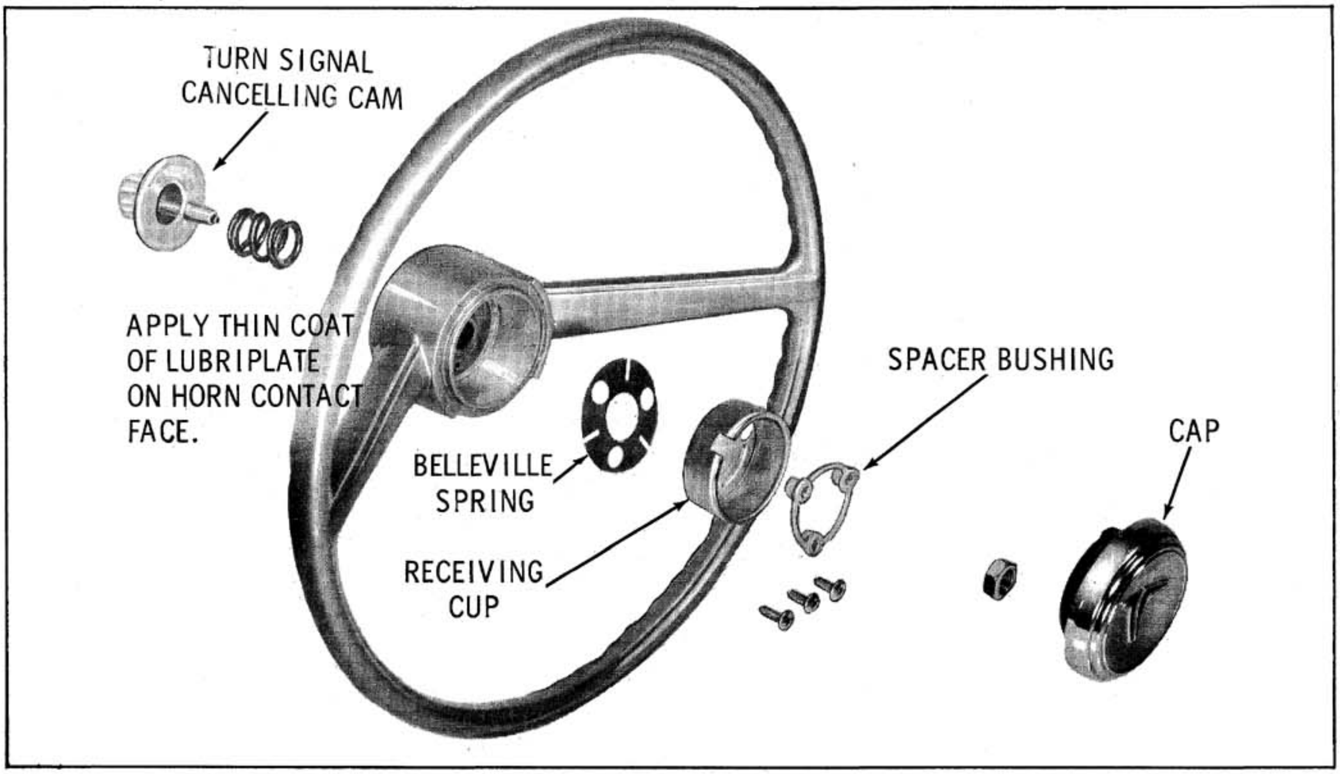


Fig. 8-76 Standard Steering Wheel (Typical All Series)

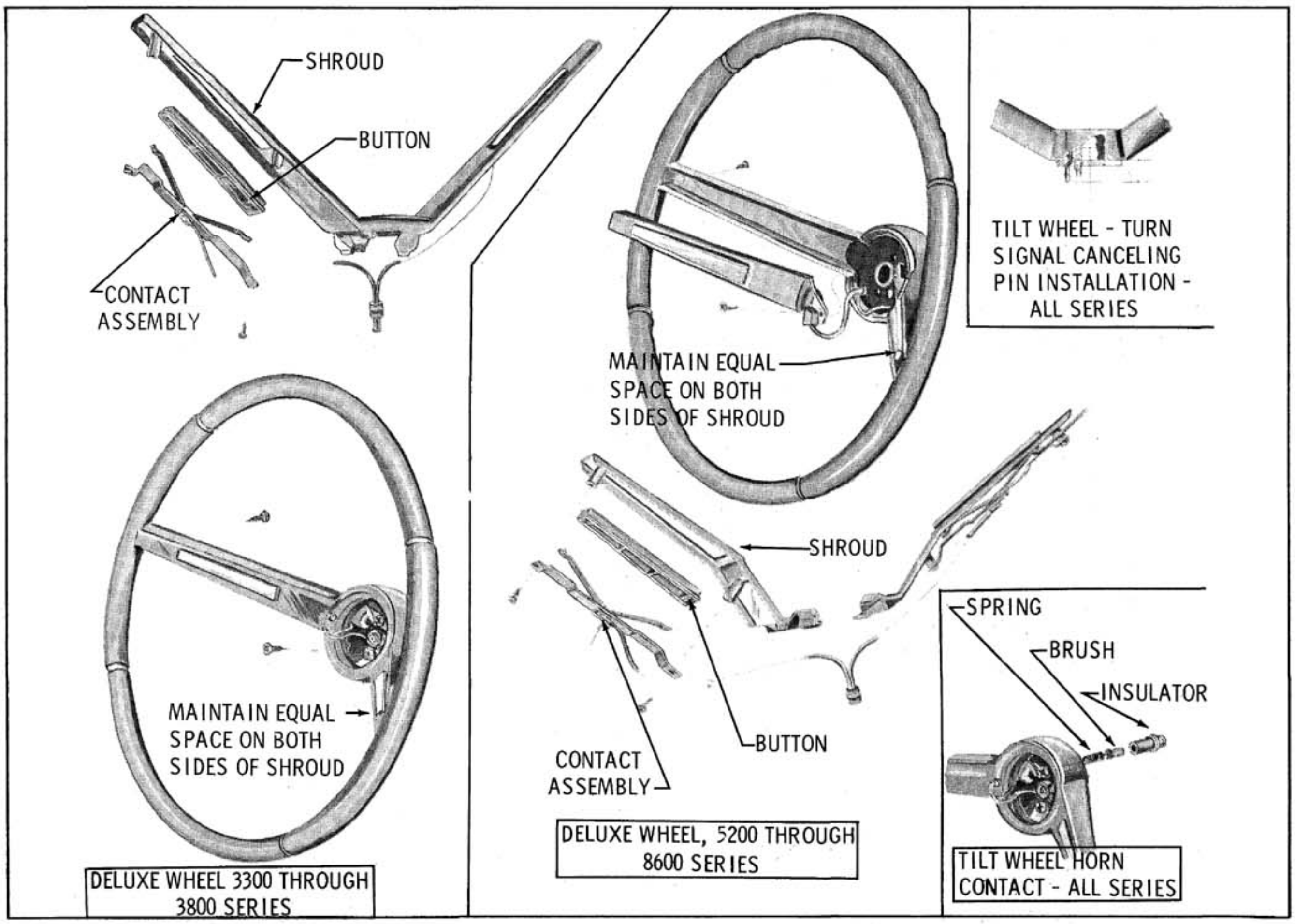


Fig. 8-77 Deluxe Steering Wheel

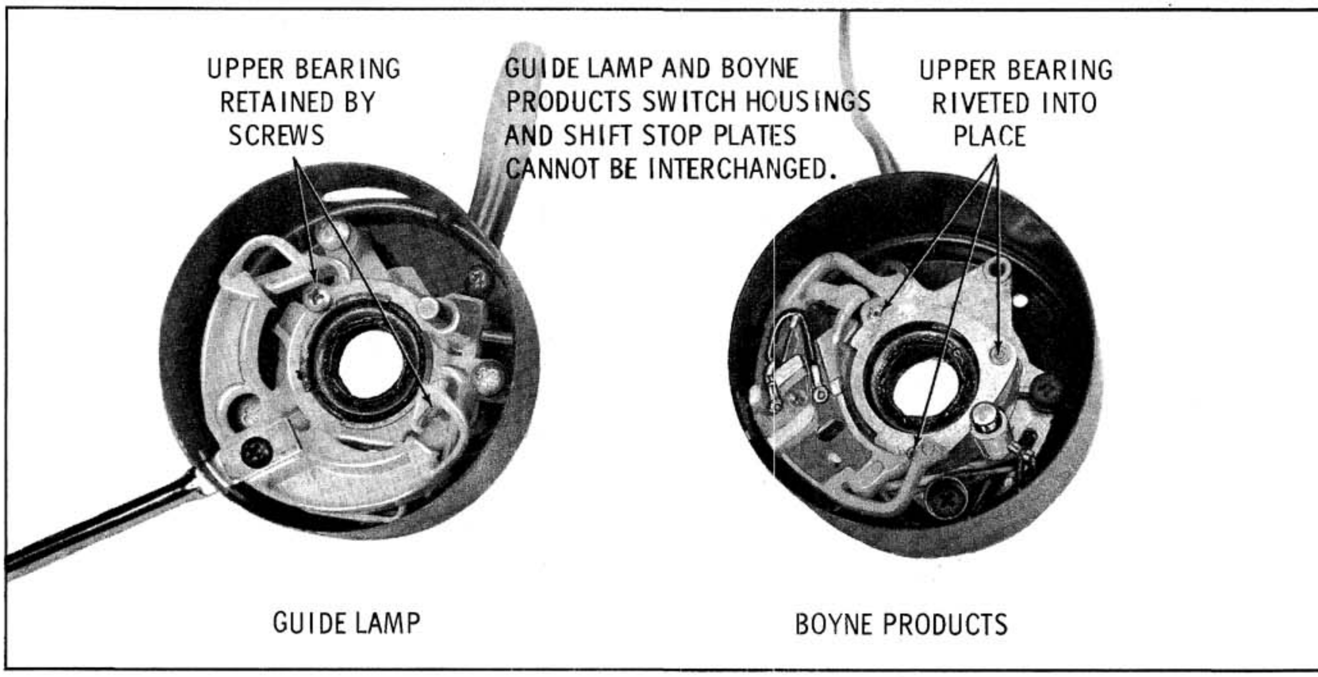


Fig. 8-78 Turn Signal Switch

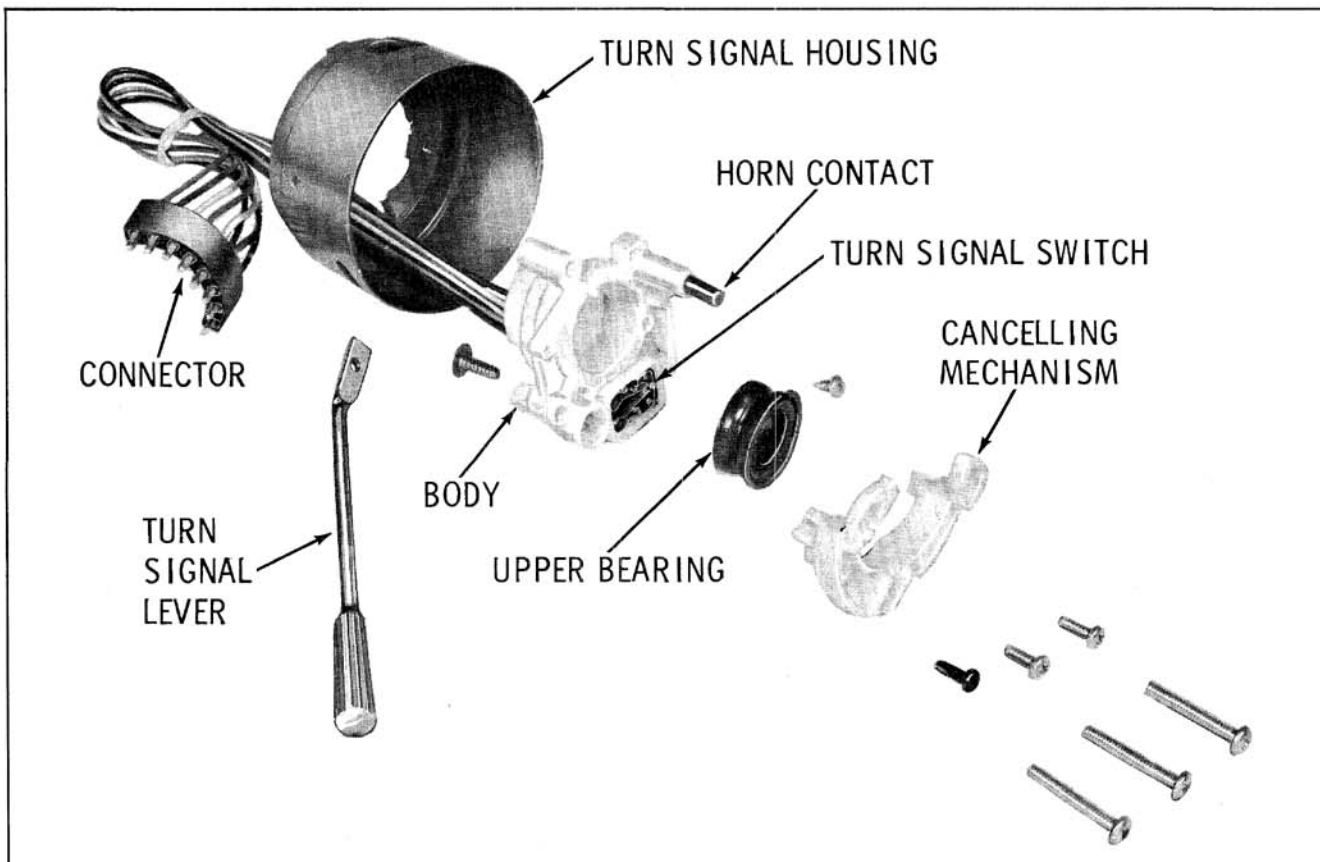


Fig. 8-79 Turn Signal Disassembled

3. Remove cover or trim cap and remove the steering column to instrument panel clamp to remove wires.

4. On 33 through 38 Series, remove cover concealing wires.

5. Disconnect wiring connectors.

6. Remove the three switch retaining screws, remove switch, switch housing and shift stop plate.

NOTE: Shift stop plate is not used on console equipped cars so the turn signal switch and shift bowl is bolted together.

Install

1. Position the turn signal switch into the switch housing so that the lever and the hole in the housing are aligned.

2. Position the shift stop plate so that the notches are down and on the opposite side of the turn signal housing.

   NOTE: If console equipped, the shift stop plate is not used.

3. Using the three screws, retain the switch by threading into the stop plate by one or two threads. Do not tighten the screws.

4. Thread the wiring harness down through the shift lever housing.

5. Position the switch housing down over the three tangs on the mast jacket and turn to the right.

6. Tighten the three switch retaining screws. (Fig. 8-78)

7. Connect wiring, replace wiring cover, steering column clamp and trim cover.

8. Replace turn signal lever and steering wheel, being sure to align marks on steering shaft and steering wheel.

9. Connect battery and check turn signal operation.

STEERING COLUMN (ALL SERIES)

REMOVE
(Figs. 8-80 and 8-81)

1. Disconnect battery, remove steering wheel, spring and turn signal cancelling cam.

2. Disconnect shift rods from shift levers at lower end of column.

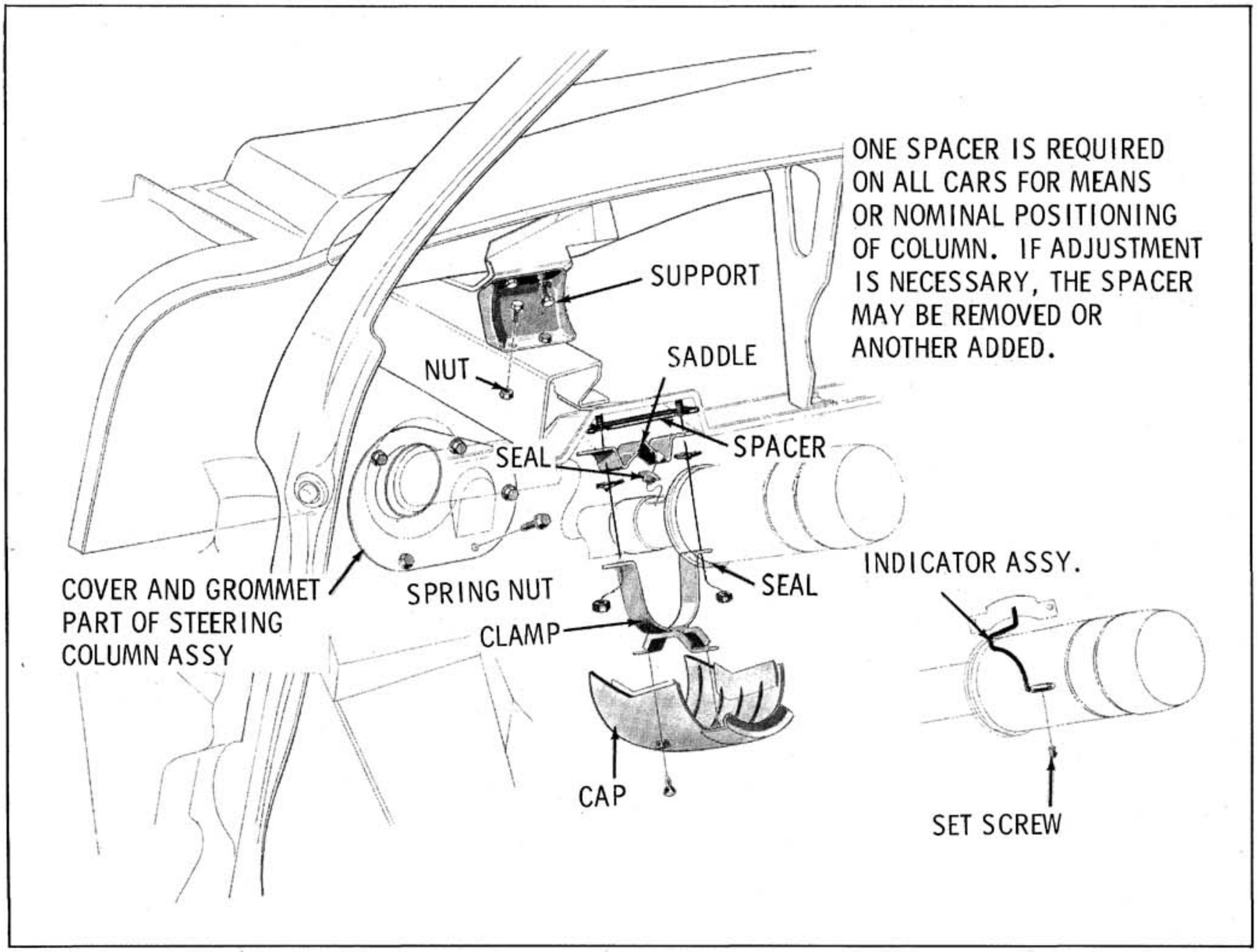


Fig. 8-80 Steering Column Installation (52 through 86 Series)

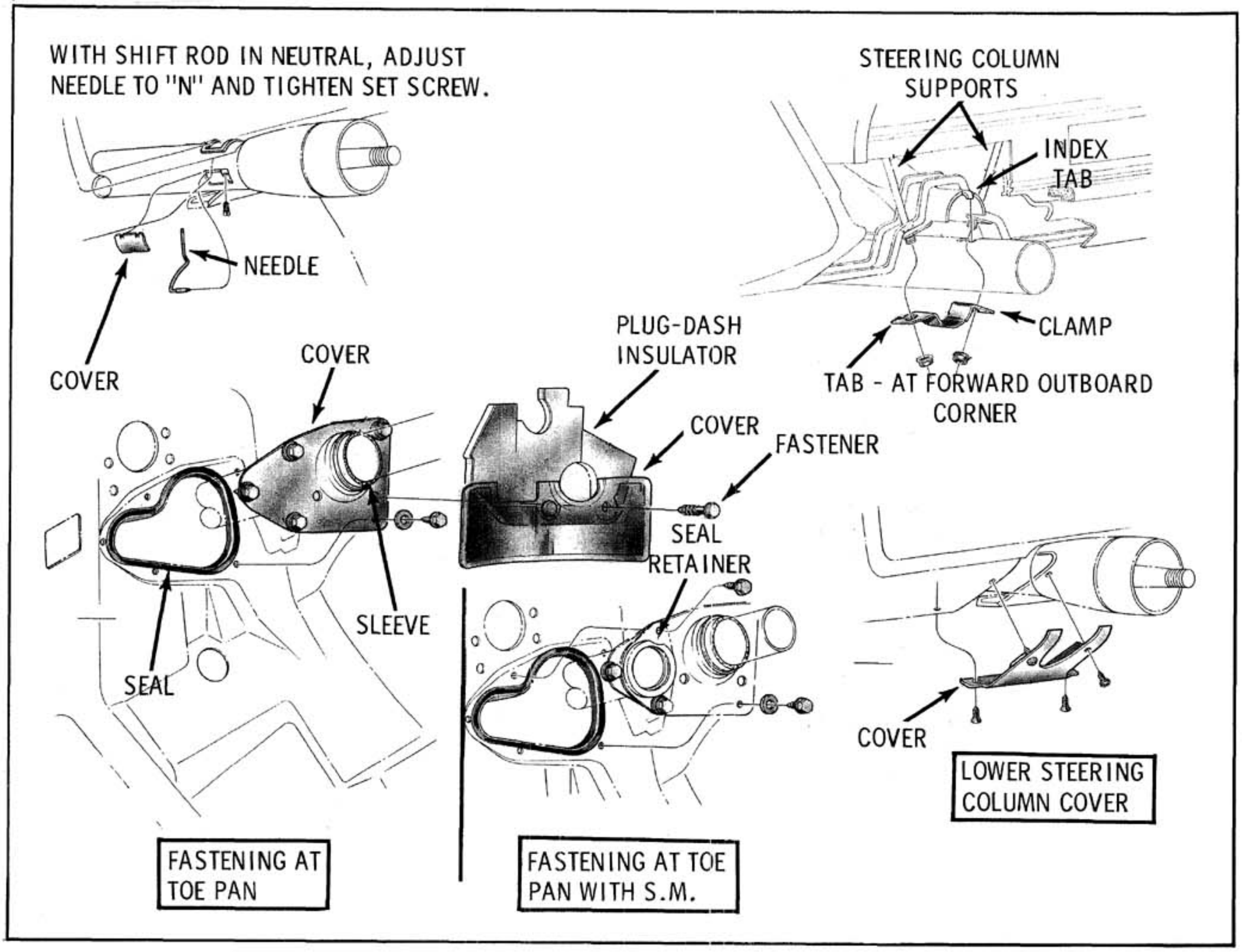


Fig. 8-81 Steering Column Installation (33 through 38 Series)

3. Remove plastic cover plate and insulation from around column and upper clutch rod.

4. Remove screws securing metal cover and sleeve to floor panel.

5. Disconnect all wiring connectors from column.

6. Disconnect steering shaft from gear at the flex coupling.

7. Disconnect transmission indicator needle from shifter tube.

8. Remove clamp securing column to instrument panel.

9. Remove column assembly with steering shaft still in column. It is not necessary to disturb clamp on steering shaft.

INSTALL (Figs. 8-80 and 8-81)

1. Position column into car and connect steering shaft at the gear.

2. Position mast jacket so that tab on instrument panel will fit into elongated hole in mast jacket.

   NOTE: Hole in mast jacket is elongated to allow up and down movement of the column in order to allow the flex-coupling to lie in a flat plane without a bind or twist.

3. Install the toe pan cover.

   NOTE: It may be necessary to shift the toe pan cover slightly to allow the steering shaft to be centered in the mast jacket.

4. Check steering shaft height (Fig. 8-92) and adjust lower clamp if necessary.

5. Install steering wheel; torque nut to 40 ft. lbs.

DISASSEMBLE (Figs. 8-82 and 8-83) (Without Tilt-Away Column)

NOTE: If console equipped, disregard references to shift tube, shift lever and spring and shift stop plate.

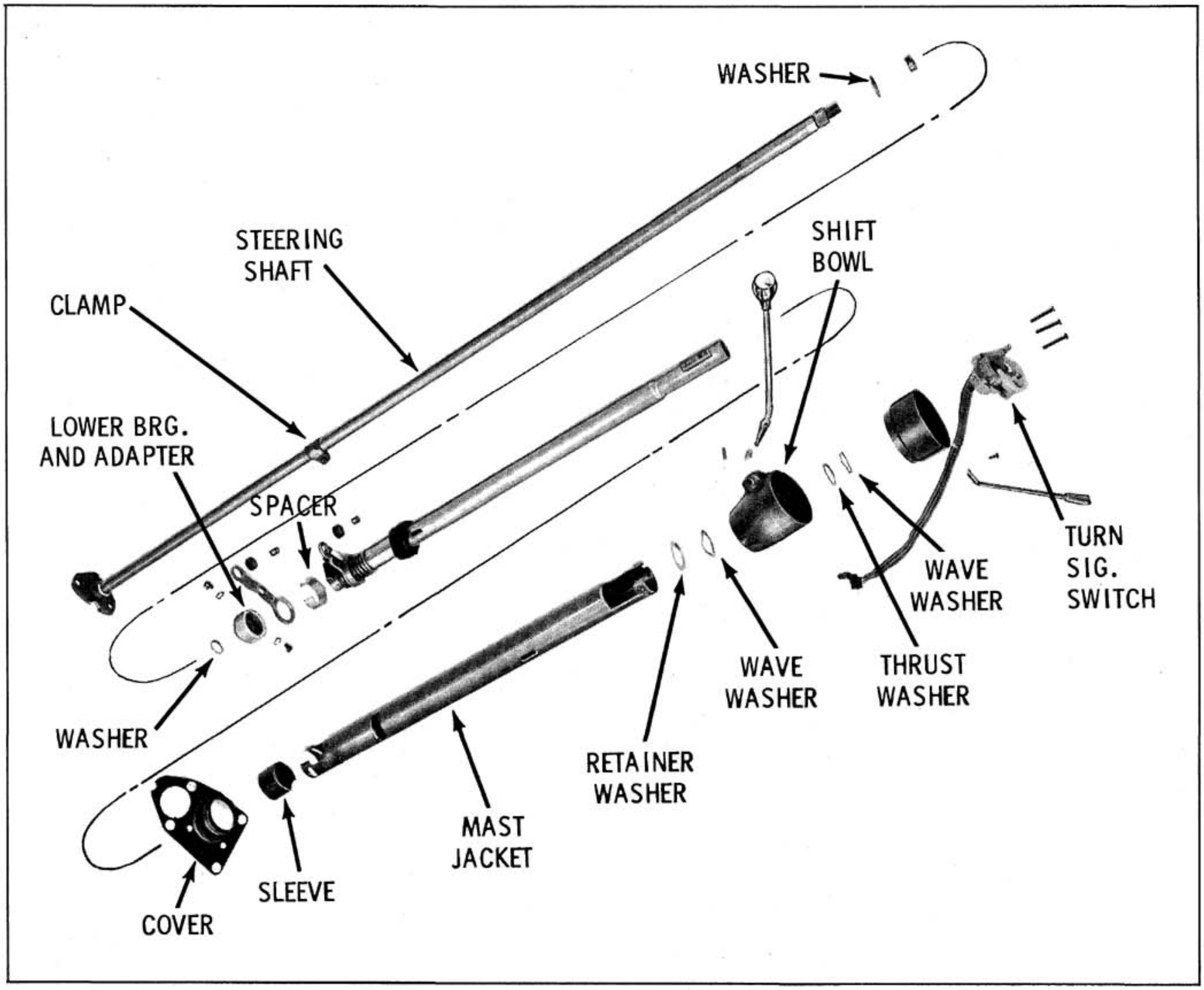


Fig. 8-82 Steering Column - Synchromesh

1. Remove neutral safety switch or synchromesh back-up light switch from the mast jacket.

2. Remove the three turn signal switch attaching screws and remove the parts shown in Fig. 8-84.

3. Synchromesh transmission: Remove parts shown in Fig. 8-85. It may be necessary to tap the shift tube from the mast jacket. (Fig. 8-86)

4. Automatic transmission: Remove parts shown in Fig. 8-87. It is not necessary to remove the clamp from the steering shaft.

ASSEMBLE—AUTOMATIC TRANSMISSION (Without Tilt-Away Column)

1. Install parts shown in Fig. 8-87.

2. Install lower bearing assembly. (Fig. 8-88)

3. Install retainer washer, wave washer, shift lever housing and thrust washer.

4. Position turn signal switch into the turn signal housing and just start the three switch retaining screws into the shift stop plate. (Fig. 8-89)

5. Observe the three tangs on the mast jacket and while guiding the turn signal wiring through the shift lever, align the slots in the signal housing and drop into position. Figs. 8-90 and 8-91 illustrate the tangs and the rotation of the housing to obtain a locked position.

6. After the turn signal housing is locked into the tangs, tighten the turn signal attaching screws.

7. Check turn signal housing to steering shaft clearance. (Fig. 8-92) Adjust steering shaft clamp if necessary. Torque clamp bolt to 70 in. lbs.

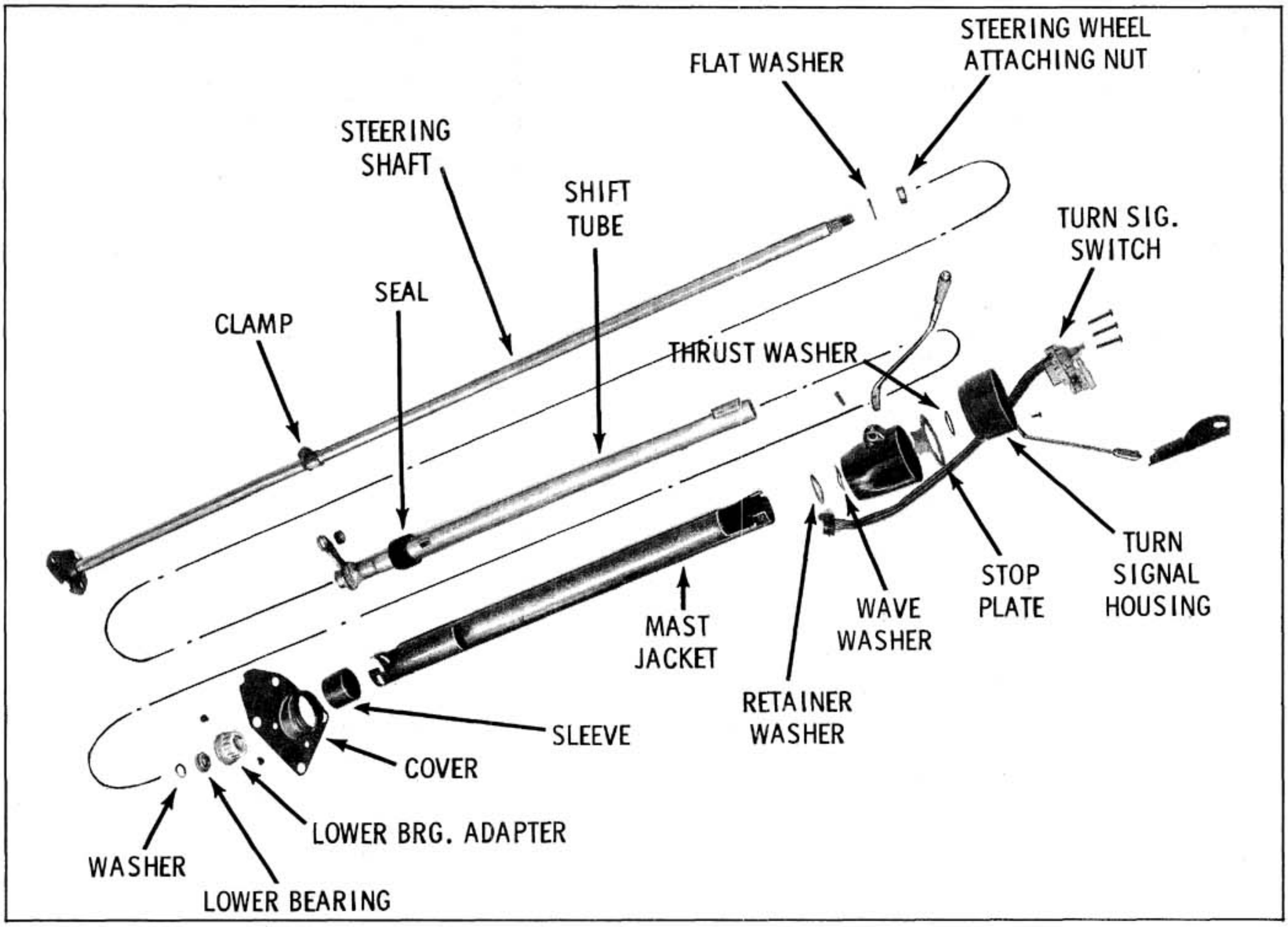


Fig. 8-83 Steering Column Automatic Transmission

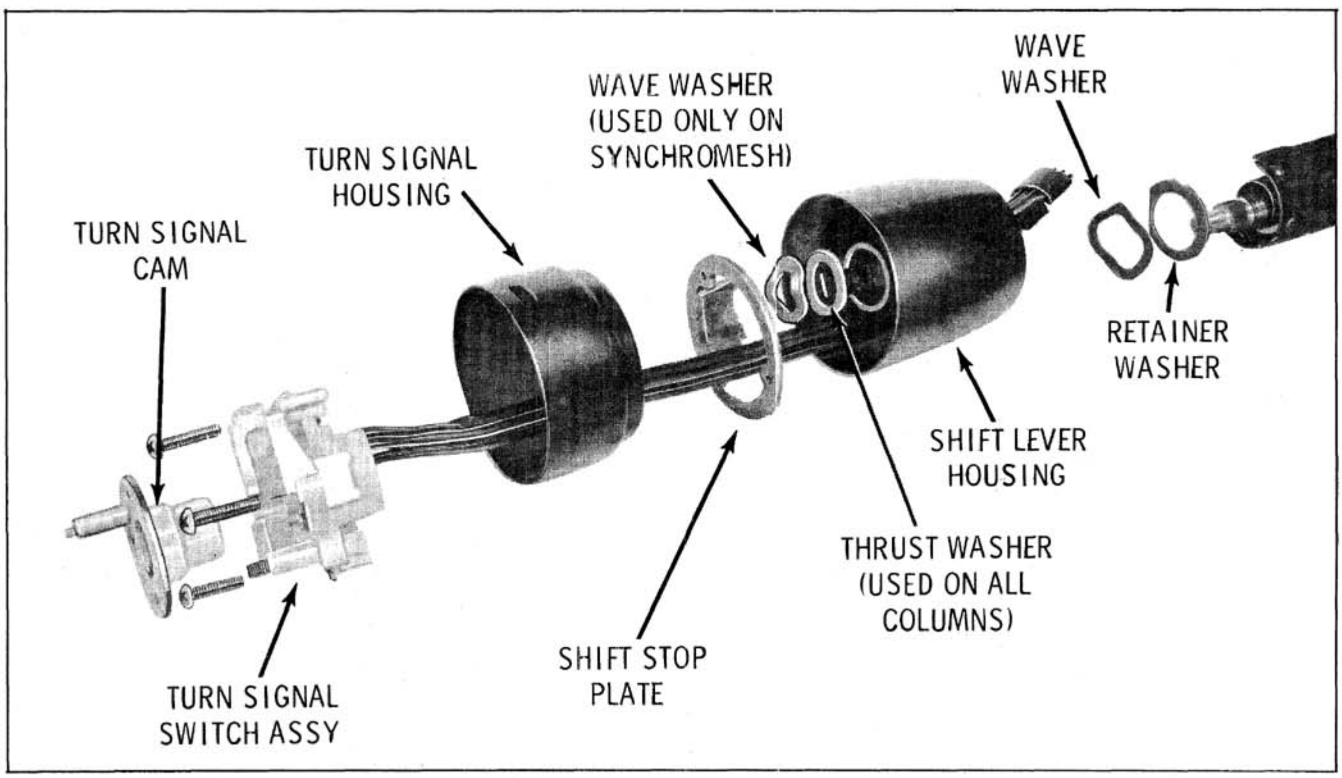


Fig. 8-84 Upper Column Parts

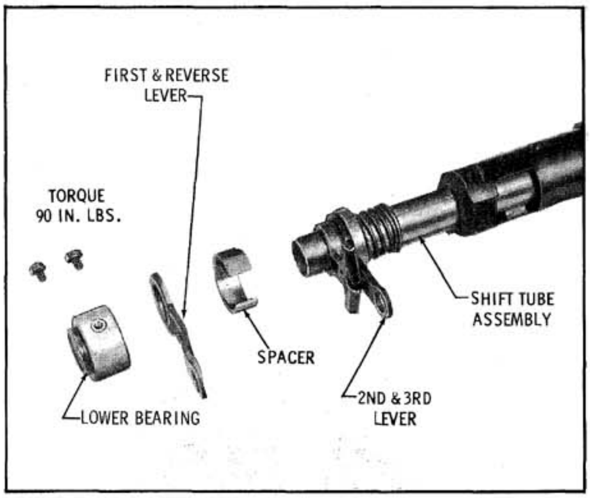


Fig. 8-85 Lower Column - Synchromesh

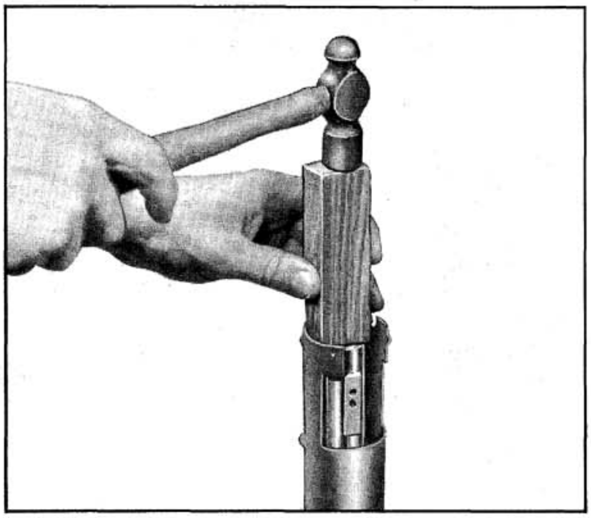


Fig. 8-86 Removing Shift Tube (Synchromesh)

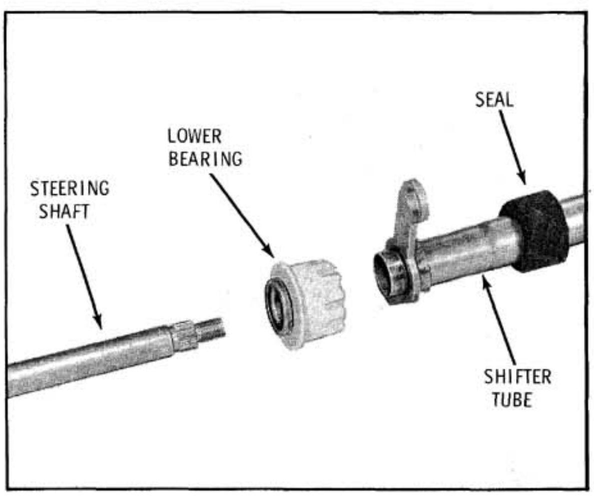


Fig. 8-87 Automatic Transmission Lower Column

NOTE: The shift lever can be replaced without removing or disassembling the column after removing the shift lever.

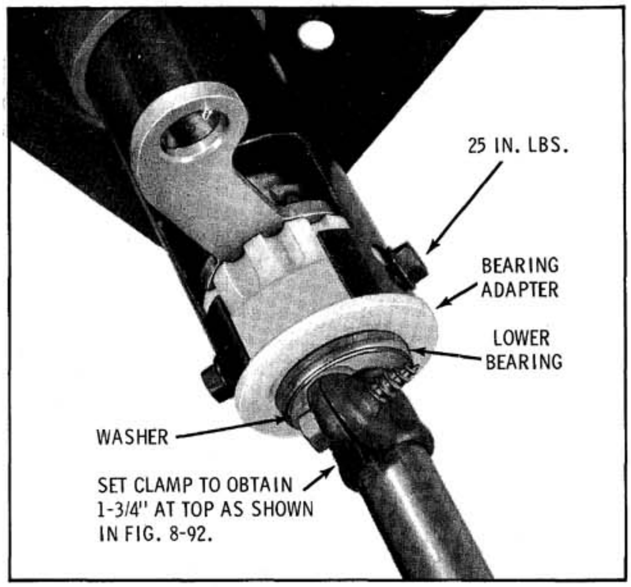


Fig. 8-88 Lower Bearing Assembly

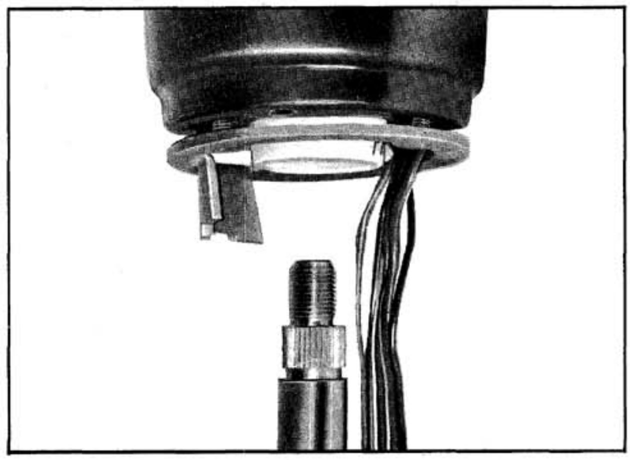


Fig. 8-89 Attaching Turn Signal Housing

ASSEMBLE—SYNCHROMESH TRANSMISSION

1. Install parts shown in Fig. 8-85.

2. Attach turn signal switch and housing to the shift stop plate by just starting the screws. (Fig. 8-89)

3. Install retainer washer, wave washer, shift lever housing, upper thrust washer and wave washer. (Fig. 8-84)

4. Position turn signal switch housing over the tangs on the mast jacket and rotate clockwise to lock under the tangs and tighten the turn signal switch attaching screws.

5. Elongated slots in the mast jacket allow the lower bearing to rotate to obtain shift lever clearance, loosen screw and adjust as necessary. (Fig. 8-93)

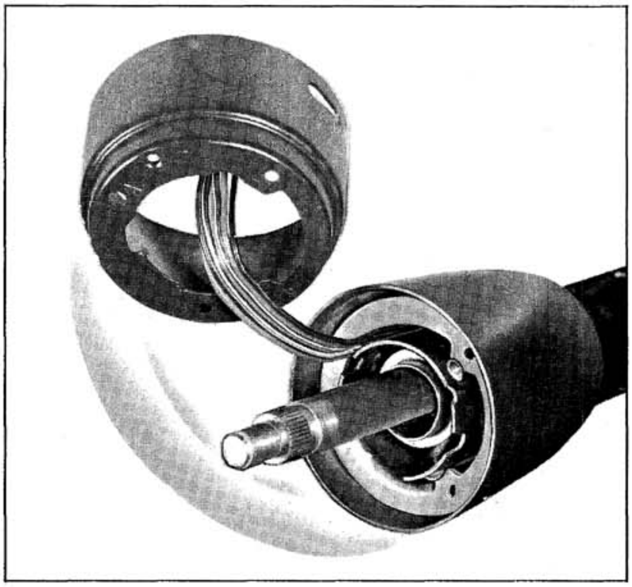


Fig. 8-90 Shift Stop Plate Under Tangs

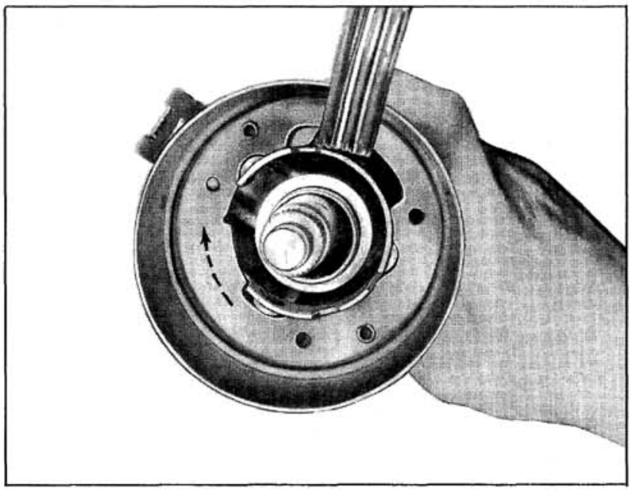


Fig. 8-91 Locking Turn Signal Housing Under Tangs

6. Adjust steering shaft clamp to obtain dimension in Fig. 8-92. Torque clamp bolt to 70 in. lbs.

TILT-AWAY STEERING WHEEL COLUMN DISASSEMBLY

The following disassembly procedure is applicable for all Tilt-Wheel steering columns. If the steering column is from a car that has a console, disregard reference to the shift tube and the safety switch.

TURN SIGNAL AND NEUTRAL SAFETY SWITCH REMOVAL

1. Remove the two turn signal switch attaching screws and lift switch from column.

2. Remove cable clamp attaching screw and lift looped end of cable off from the switch pin.

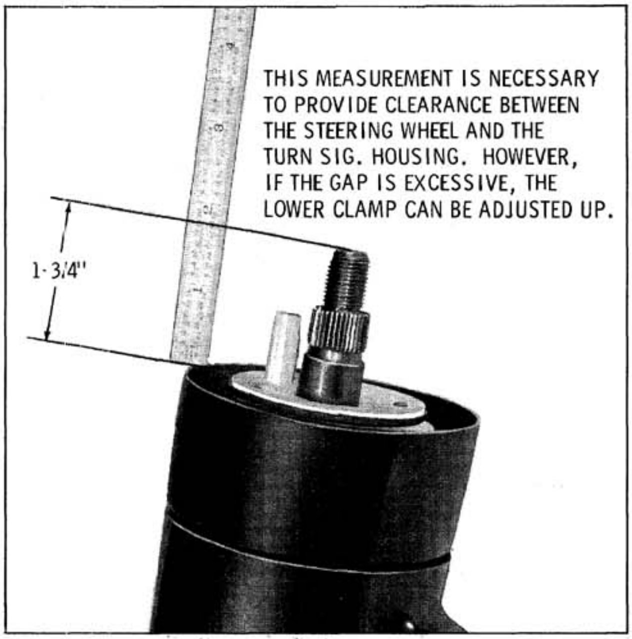


Fig. 8-92 Checking Steering Shaft Height

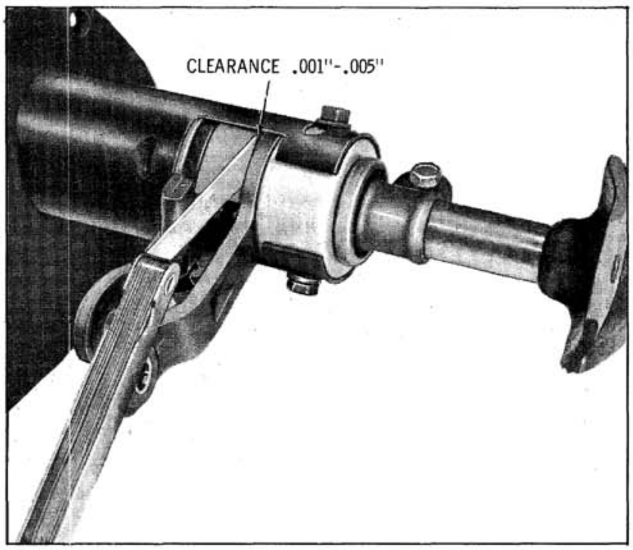


Fig. 8-93 Shift Lever Clearance

3. Remove the neutral safety switch from the mast jacket.

ACTUATOR HOUSING REMOVAL

1. With column in center position, remove the turn signal lever and the tilt lever.

2. Remove the turn signal cover. (Fig. 8-95)

3. Straighten lock tabs on retainer, remove nut and retainer.

NOTE: Do not re-use lock retainer.

4. Remove the turn signal switch detent spring,

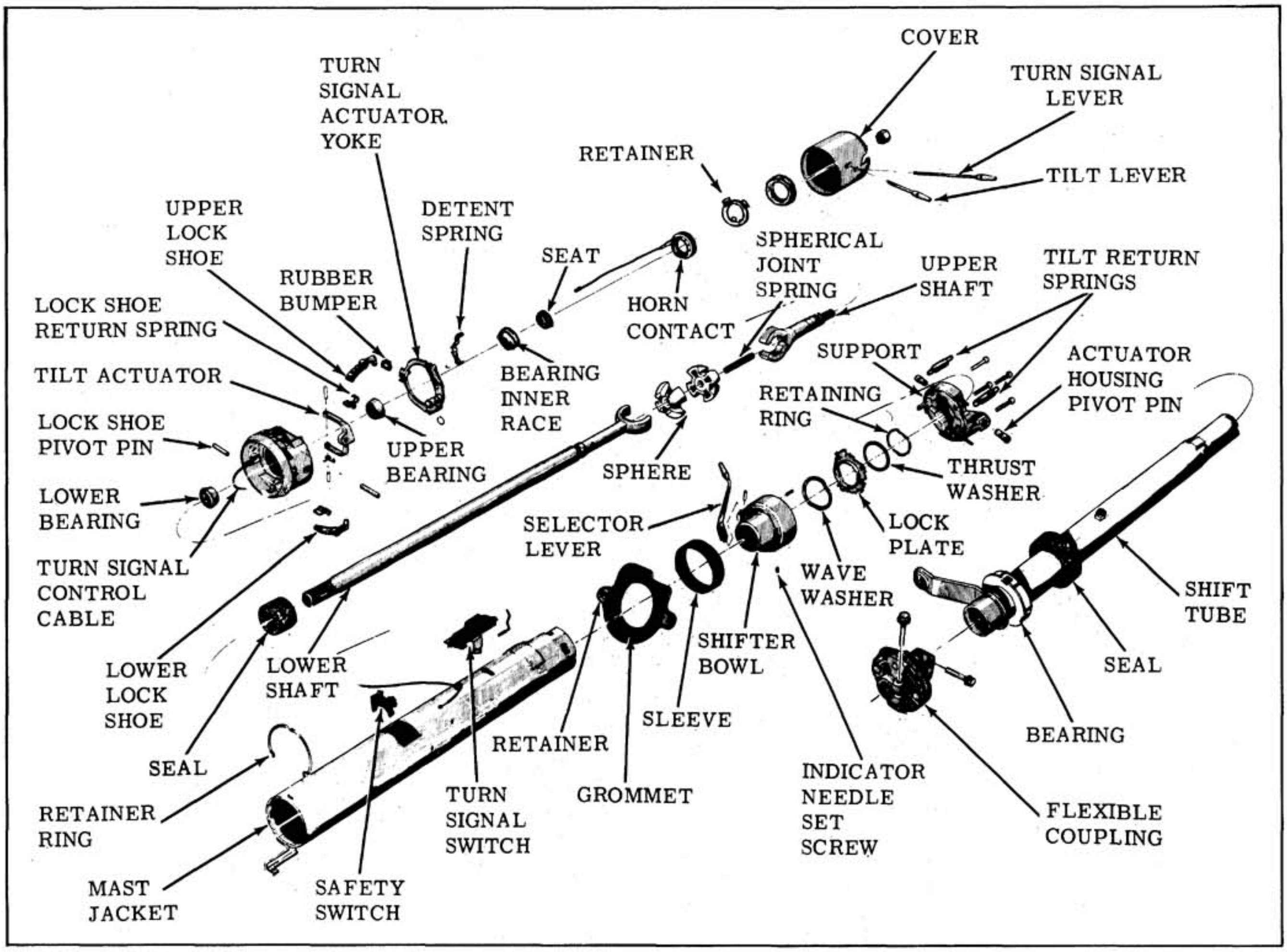


Fig. 8-94 Tilt-Away Steering Column (Typical)

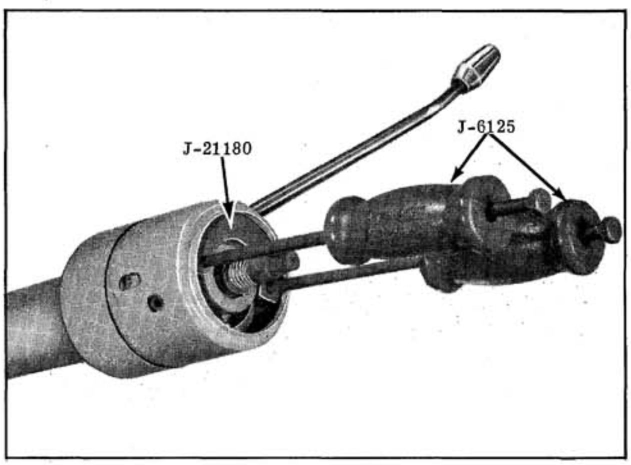


Fig. 8-95 Removing Turn Signal Cover

then remove the actuator yoke from the housing.

5. Remove horn contact. (Fig. 8-96)

6. Remove upper bearing inner race seat, upper bearing inner race and upper bearing. (Fig. 8-97)

7. With column in full up position, unhook return springs. (Fig. 8-98)

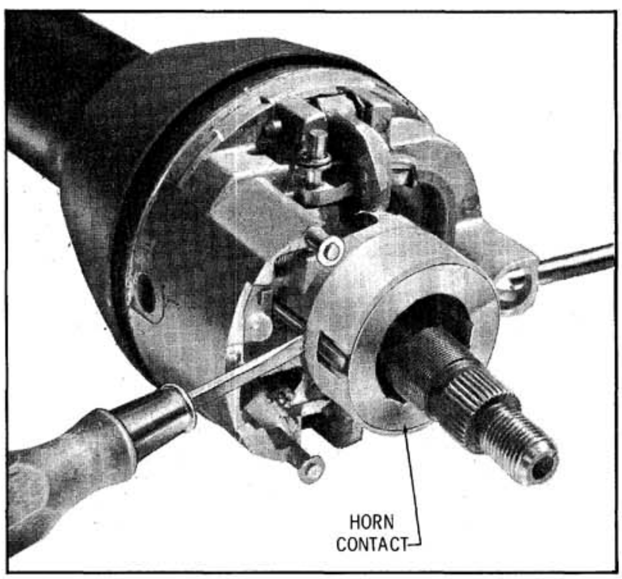


Fig. 8-96 Removing Horn Contact

8. Remove pivot pins. (Fig. 8-98)

9. Slightly lift the tilt lever to disengage the

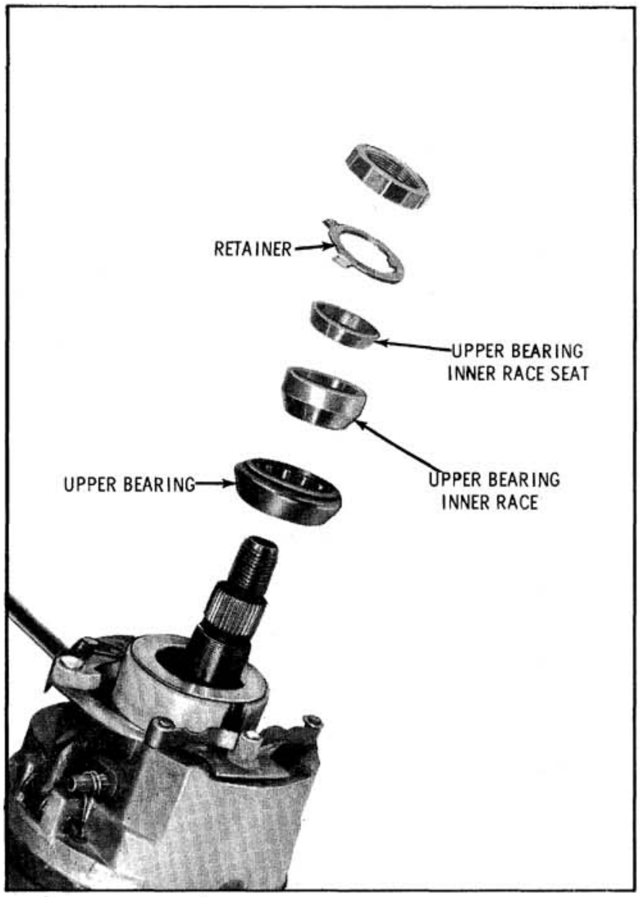


Fig. 8-97 Removing Upper Shaft Parts

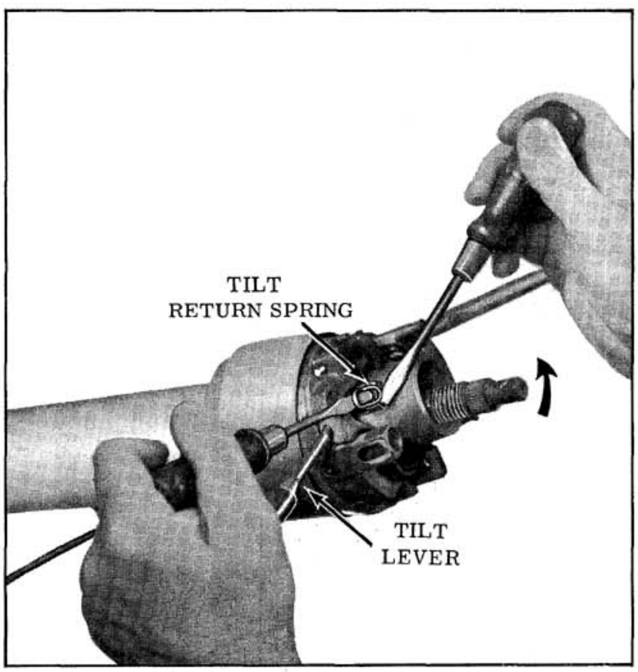


Fig. 8-98 Removing Tilt Return Springs

lock shoes from the pins and remove the actuator housing; then remove the tilt return springs and the upper shaft lower bearing. (Fig. 8-100)

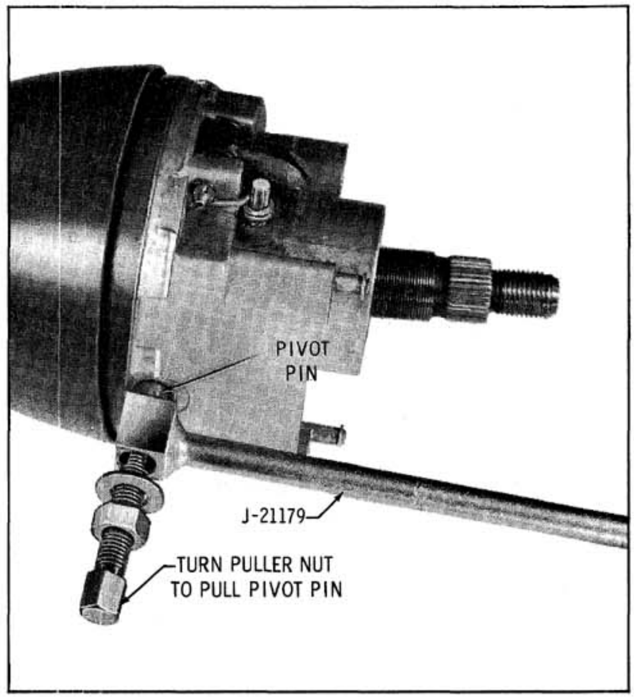


Fig. 8-99 Removing Actuator Housing Pivot Pins

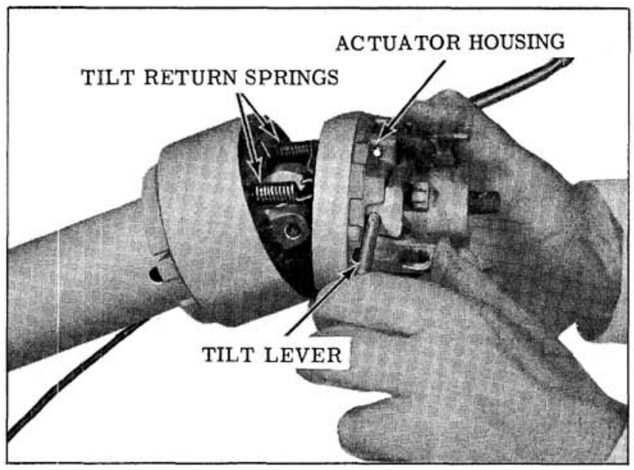


Fig. 8-100 Removing Actuator Housing

ACTUATOR HOUSING DISASSEMBLY

1. Back up the lock shoe pivot pin boss in the actuator housing, with a suitable tool, inboard of the pivot pins. (Fig. 8-101)

2. Drive the upper and lower lock shoe pivot pins from the actuator housing with an 1/8" straight punch.

3. Remove the lock shoes and springs by pushing the upper end of the lock shoe through the openings in the actuator housing. (Fig. 8-102)

4. Remove the turn signal switch control cable from the turn signal bellcrank by removing

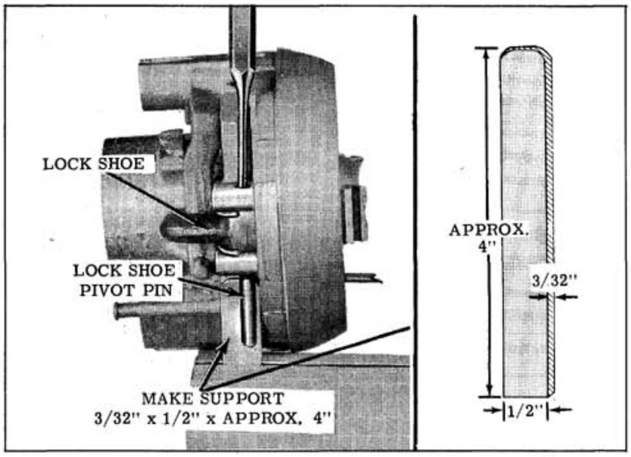


Fig. 8-101 Removing Lock Shoe Pivot Pins

the retaining screw at the top of the housing and disconnecting from the bellcrank. Remove the cable through the top of the actuator housing.

STEERING SHAFT DISASSEMBLY

1. Loosen clamp at lower end of steering shaft and pull the shaft upward and out of the mast jacket.

2. Clamp the steering shaft in brass jawed vise.

3. Move the upper shaft fully from center line of lower shaft.

4. Using a narrow bladed screwdriver through the coils of the spring, compress spring enough to remove the upper end from the upper seat. (Fig. 8-103)

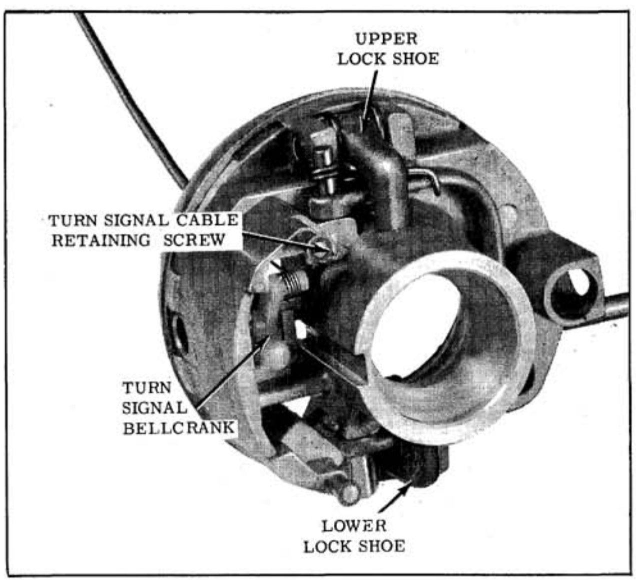


Fig. 8-102 Actuator Housing (Top View)

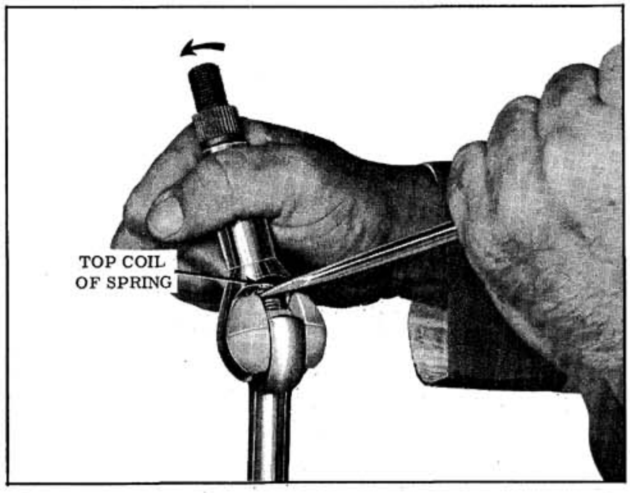


Fig. 8-103 Removing Spherical Joint Spring

5. Move the upper shaft to the opposite side and allow the spring to snap out of the opening between the shaft and the sphere.

6. Remove the spring.

7. Turn the upper shaft 90° from the center line of the lower shaft and remove the upper shaft and sphere from the lower shaft. (Fig. 8-104)

8. Remove the sphere from the upper shaft by rotating so flats on sphere align with socket.

SHIFT TUBE AND SHIFTER BOWL REMOVAL

1. Remove the four support screws, then lift the support from the mast jacket. (Fig. 8-105)

   NOTE: Support may have to be tapped slightly to loosen.

2. Remove the shift tube retainer ring and washer from the top of the shift tube. (Fig. 8-106)

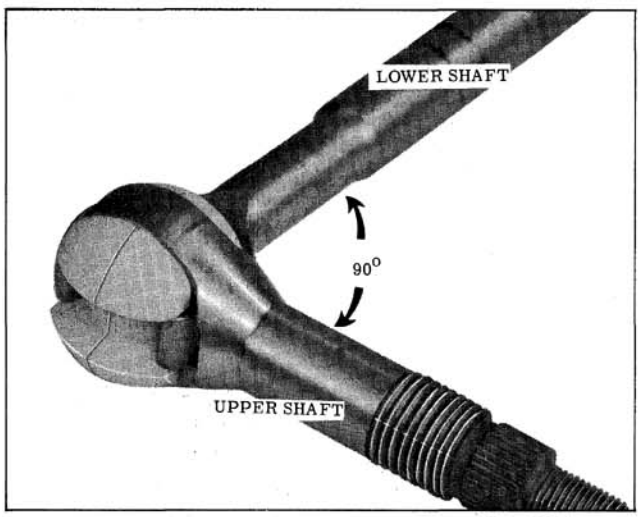


Fig. 8-104 Removing Sphere and Upper Shaft

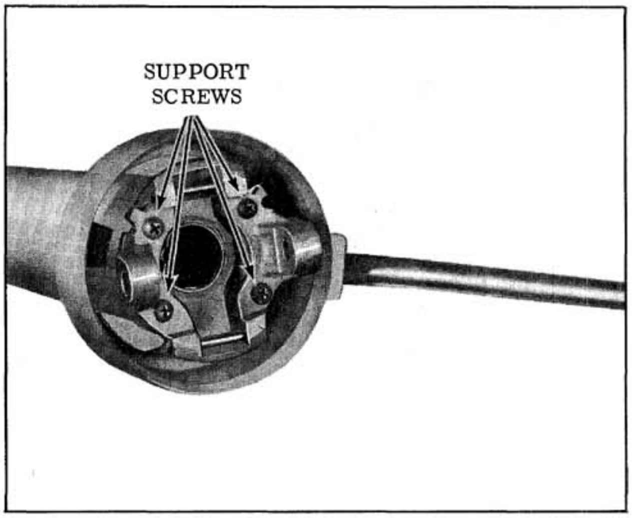


Fig. 8-105 Support Screw Location

3. Remove the shift tube bearing retainer from the lower end of the mast jacket. On the 33 through 38 series, remove the adapter assembly.

4. Remove the shift tube from the lower end of the mast jacket using Tool J-21180 and two Slide Hammers J-6125. (Fig. 8-107) On 33 through 38 series, the shift tube can be removed by tapping the shift lever with a plastic hammer.

5. Remove the lock plate, wave washer and shifter bowl from upper end of the mast jacket. It may be necessary to slide the bowl toward the shift lever to remove the lock plate.

6. Drive the shift lever pivot pin from the bowl.

7. Remove the anti-rattle grommet from the shift lever.

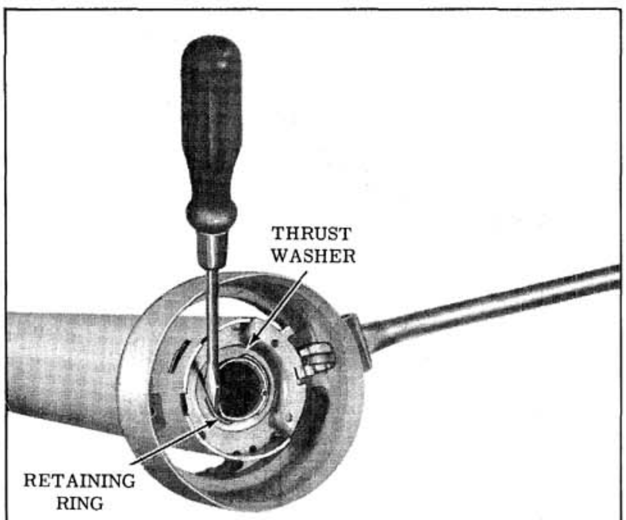


Fig. 8-106 Removing Shift Tube Upper Retaining Ring

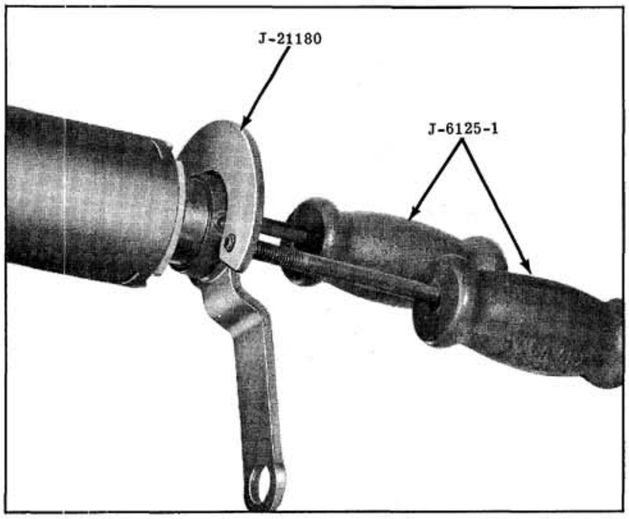


Fig. 8-107 Removing Shift Tube

ASSEMBLY OF TILT-AWAY STEERING COLUMN

When assembling the steering column, apply a thin coat of Multi-Purpose Chassis Lubricant. Use a new retainer whenever a column is disassembled.

SHIFT TUBE AND SHIFTER BOWL ASSEMBLY

1. Install the anti-rattle grommet on the shift lever, if removed.

2. Place shift lever spring and lever in bowl, then install the pin.

3. Place the shifter bowl on the mast jacket with the shift lever on the right side of the column.

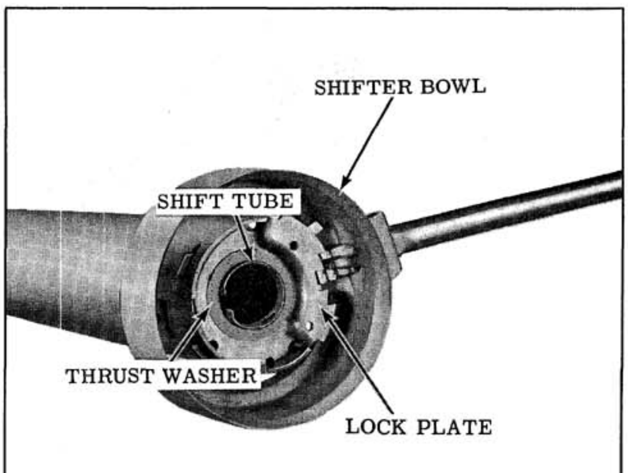


Fig. 8-108 Lock Plate Location

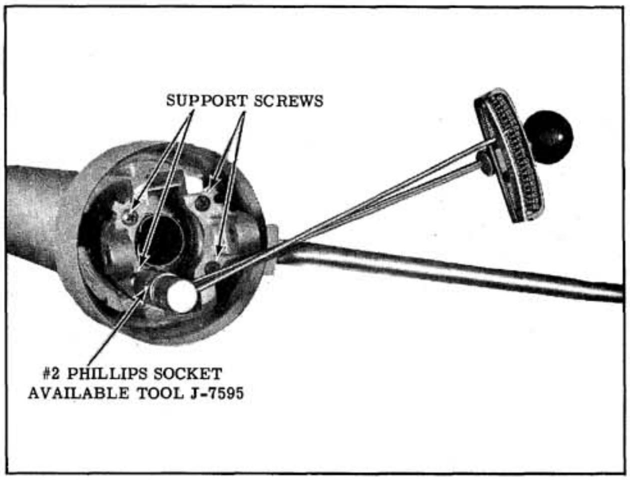


Fig. 8-109 Installing Support Screws

4. Insert the shift tube and felt dust seal assembly into the lower end of the mast jacket. Guide the shift tube into the shifter bowl aligning the key in the bowl with the keyway in the tube. Hold the shifter bowl and tap the lower end of the shift tube until the upper end of the tube is flush with the inner portion of the shifter bowl.

5. Position the lower mast jacket bushing flange against the lower end of the mast jacket, align the slots in the bushing with the holes in the mast jacket and install the retaining ring.

6. Place the wave washer on the lower side of the lock plate, retain with ball joint lubricant, then slide the lock plate into position through the opening in the mast jacket. (Fig. 8-108)

7. Align the lock plate and wave washer with the end of the shift tube, then tap the lower end of the tube to fully seat it in the jacket.

8. Install the thrust washer and retaining ring on the upper end of the shift tube.

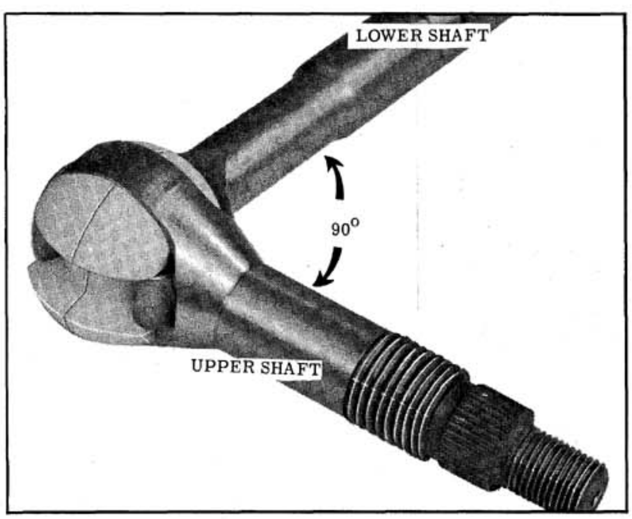


Fig. 8-110 Installing Sphere and Upper Shaft

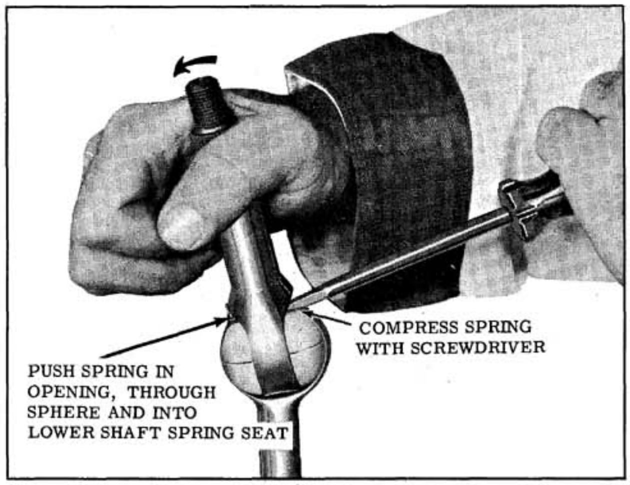


Fig. 8-111 Installing Spherical Joint Spring

9. Install the support on the upper end of the mast jacket with the long leg aligned with the notch in the low side of the lock plate, then install the four attaching support screws. (Fig. 8-109) Torque the two larger (left) screws first, 20 to 25 ft. lbs., then torque the right two screws 20 to 25 ft. lbs. using a No. 2 Phillips Socket, J-7595.

STEERING SHAFT ASSEMBLY

1. Lubricate the grooves of the centering sphere with Multi-Purpose Chassis Lubricant, then place the sphere in the upper shaft socket.

2. Turn the sphere so the lower shaft can be installed over the flat area of the sphere (Fig. 8-110) approximately 90° from center line of lower shaft, then, install lower shaft socket over the sphere and straighten the shaft.

3. Install the pre-load spring through the centering sphere and into the spring seat in the lower shaft. Compress the spring into the opening between the sphere and the upper shaft, then move upper shaft to hold spring. With a screwdriver, inserted through the coils from the opposite side of the shaft, compress the spring so the upper end will snap into the spring seat in the upper shaft. (Fig. 8-111)

4. Install the steering shaft assembly into the mast jacket from the upper end.

5. Install the steering shaft felt seal on lower end of steering shaft. On 33 through 38 series, install the adapter assembly.

ACTUATOR HOUSING ASSEMBLY

1. Install the lock shoe return springs on the upper and lower lock shoes as follows:

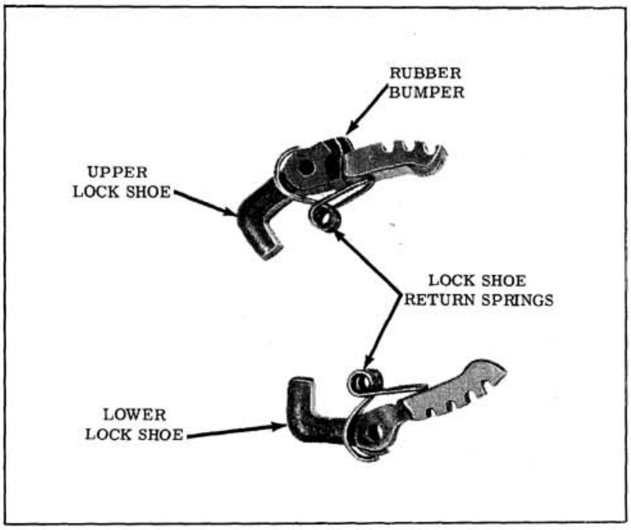


Fig. 8-112 Lock Shoes and Spring

NOTE: The upper lock shoe has three notches and a rubber bumper, whereas, the lower shoe has four notches. (Fig. 8-112)

a. Place the actuator housing on the bench with the lower side up and the turn signal and tilt lever openings on the right side. (Fig. 8-113)

b. Install the upper shoe in the upper opening of the housing by pushing on the rubber bumper and the end of the shoe.

c. Turn the housing around and insert the lower shoe as in Step "B".

d. Install the pivot pins in the actuator and through the lock shoes making certain that the pins are centered.

2. From the top of the actuator housing, install the turn signal switch control cable on the plastic bellcrank with the cable loops facing

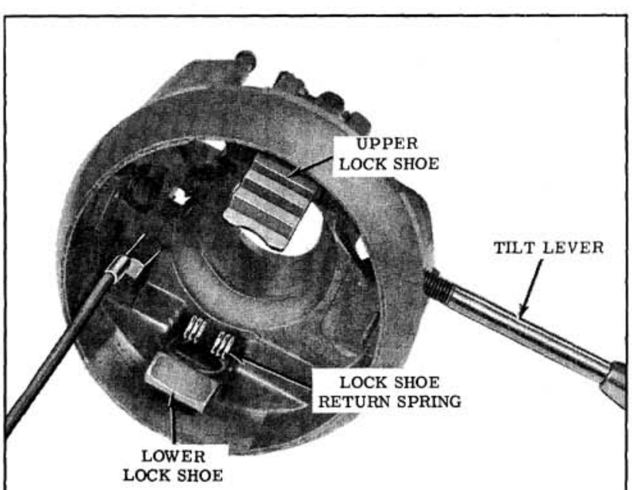


Fig. 8-113 Actuator Housing (Bottom View)

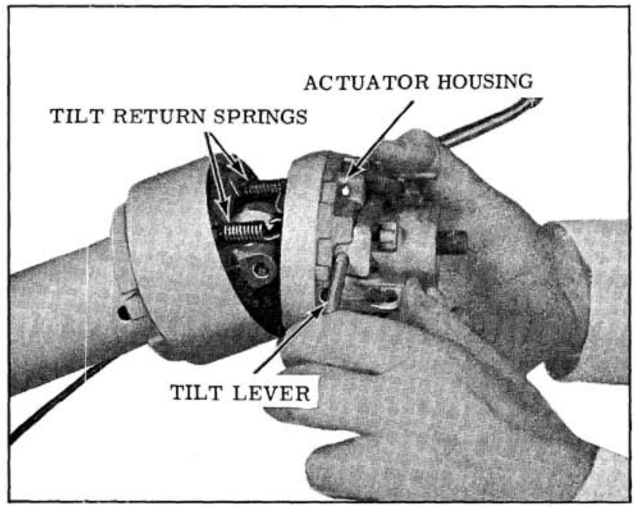


Fig. 8-114 Installing Actuator Housing

toward the center of the actuator, then install the cable bracket screw.

3. Install the horn contact wire through the keyway in the actuator housing. Do not install the contact at this time.

4. Install upper shaft lower bearing with rollers down.

5. Install the lower ends of the two return springs on the support spring anchors.

NOTE: The loops on the upper ends of the springs must have the opening toward the top of the column. (Fig. 8-114)

6. Install the tilt lever in the actuator.

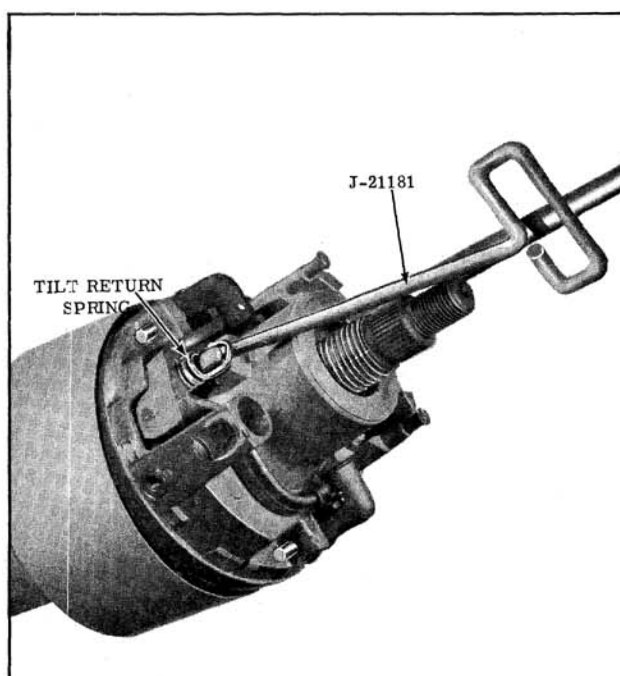


Fig. 8-115 Installing Tilt Return Springs

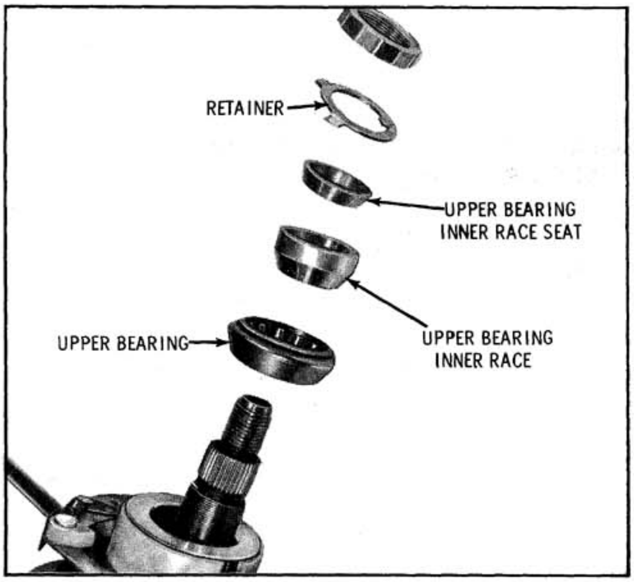


Fig. 8-116 Installing Upper Shaft Parts

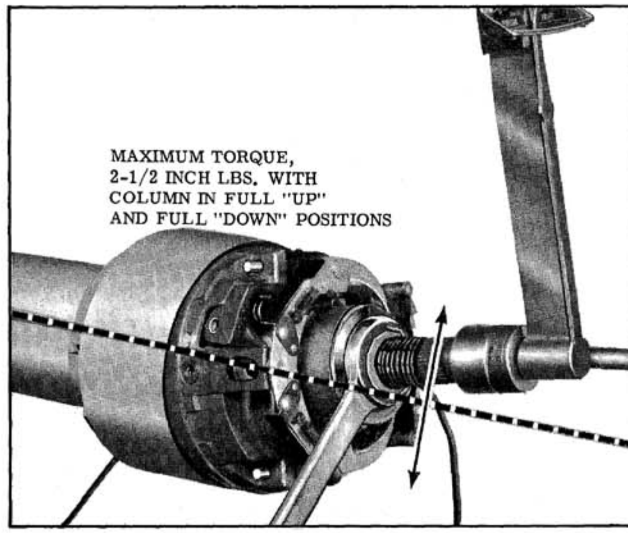


Fig. 8-117 Checking Steering Shaft Torque

ACTUATOR HOUSING INSTALLATION

1. Raise the tilt lever up slightly to prevent the lock shoes from engaging the pins, then install the actuator while guiding the turn signal cable and horn wire through the shift bowl.
2. Align the actuator assembly pivot pin holes with the holes in the support assembly, then install the pivot pins using a brass drift to fully seat the pins. Steering shaft may have to be slightly raised to have lock shoes clear socket.
3. Raise the tilt lever and lift the upper steering column to full up position.
4. Install the upper ends of the two tilt return springs with Tool J-21181. (Fig. 8-115)
5. Install the turn signal actuator yoke assembly.
6. Install the upper bearing, bearing inner race and inner race seat. (Fig. 8-116)
7. Install the retainer and nut. NOTE: Do not tighten nut. Refer to CHECKING STEERING SHAFT TORQUE for proper torque.

CHECKING THE STEERING SHAFT TORQUE

1. Install the steering wheel nut on the upper shaft.
2. Tighten the upper bearing nut while rotating the steering shaft with the column in the full up and down position until a torque reading of 2-1/2 in. lbs. is obtained. (Fig. 8-117)

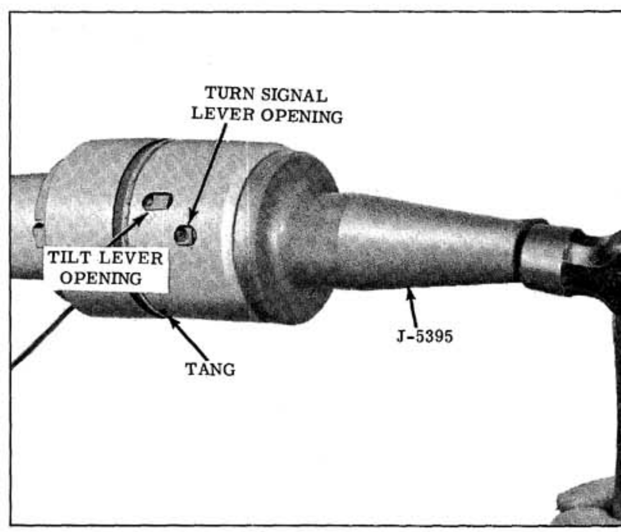


Fig. 8-118 Installing Turn Signal Cover

3. Bend up tabs of retainer to lock the nut.

NOTE: Do not loosen or tighten the nut in an effort to have the retainer tabs engage the flat sides of the nut. When the correct torque reading is obtained, bend up the lock tabs even if it is on the corners of the nut.

TURN SIGNAL COVER

1. Install the turn signal cover with Tool J-5395, pinion seal installer, aligning the openings for the tilt and turn signal levers, and with the small tang on the lower edge of the cover in line with the groove in the actuator housing. (Fig. 8-118)
2. Install the tilt and turn signal levers.

TURN SIGNAL SWITCH INSTALLATION AND ADJUSTMENT (Figs. 8-119 and 8-120)

1. Check to see that the turn signal lever is in the neutral position.

2. Place the loop of the control cable over the switch pin and install cable clamp bolt.

3. Position the switch on the column and secure with the two screws leaving a minimum amount of slack in the control cable.

NEUTRAL SAFETY SWITCH AND BACK-UP LIGHT SWITCH

Install and adjust as outlined in the ELECTRICAL section.

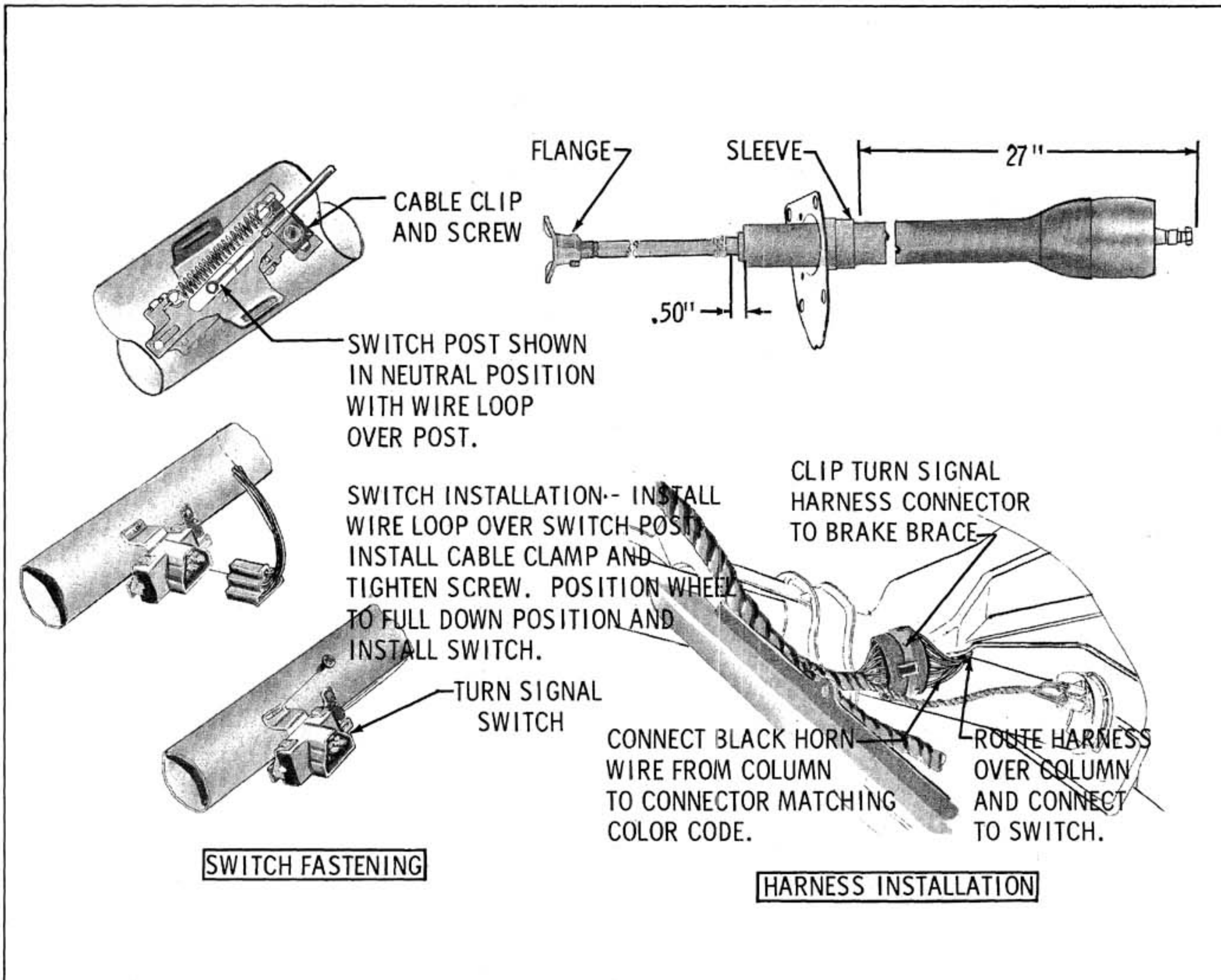


Fig. 8-119 Turn Signal (33 through 38 Series)

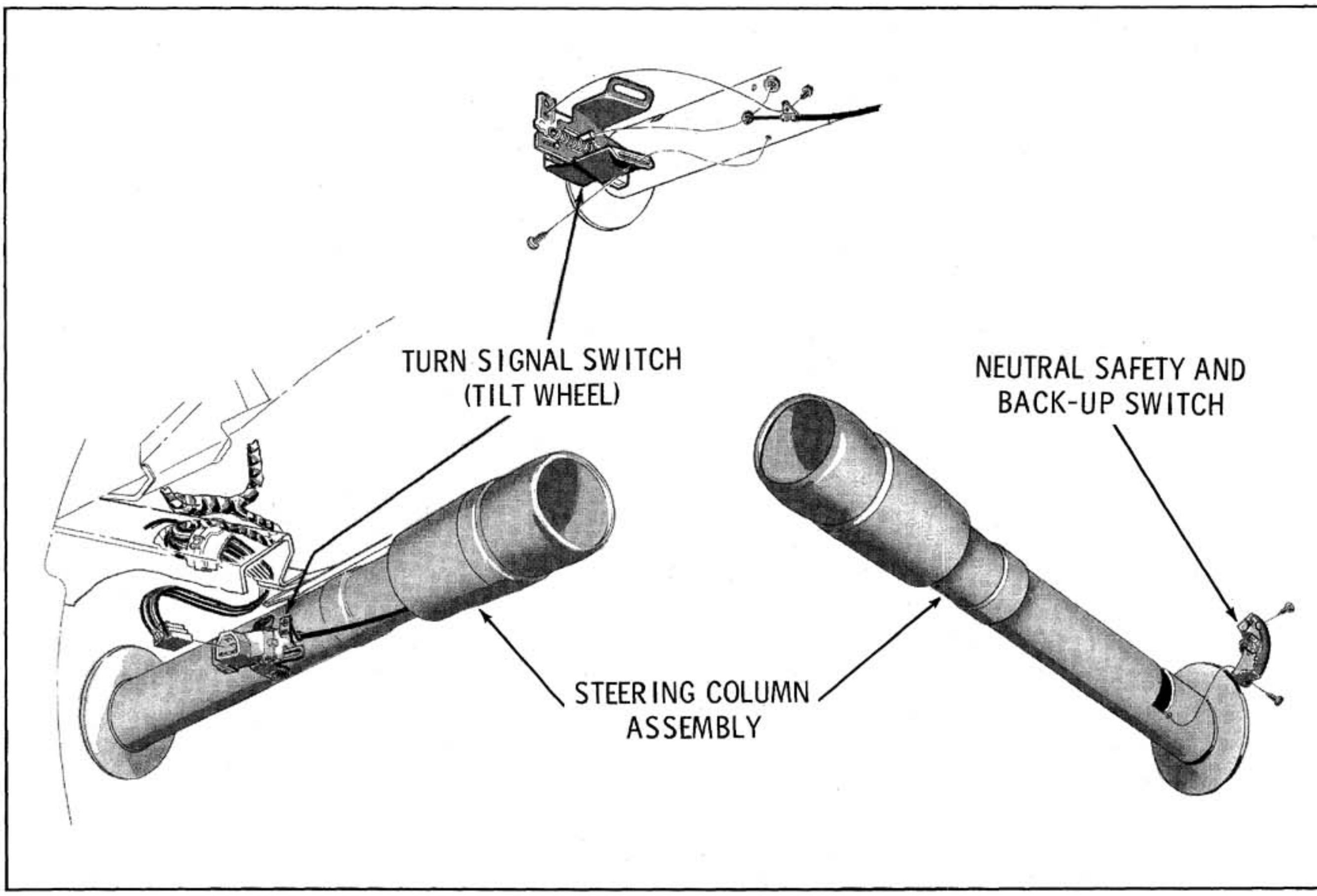


Fig. 8-120 Turn Signal (52 through 86 Series)

DIAGNOSIS GUIDE FOR TILT-AWAY STEERING WHEEL

TURN SIGNAL NOT CANCELLING FROM EITHER TURN POSITION

CAUSE	CORRECTION
Turn signal cancelling pin incorrect distance from centerline of steering shaft: 1 (Fig. 8-121)	Bend pin outward to 1-1/32" from centerline of steering shaft.
Turn signal cancelling pin not pressed in to correct dimension: 1 (Fig. 8-121)	Press pin to 1" from hub of wheel to end of pin.

DIAGNOSIS GUIDE (Cont'd.)

TURN SIGNAL MALFUNCTIONS

CAUSE	CORRECTION
Clamps at either end of Bowden cable are loose or pulled off. 2 (Fig. 8-121)	Install new Bowden cable.
Bowden cable wire loops are uncoiled. 2 (Fig. 8-121)	Install new Bowden cable.
Override spring on actuator yoke is bent, allowing plastic trigger to pass over top and possibly bind on the spring. 3 (Fig. 8-121)	Install new yoke assembly.
Trigger spring is broken or unattached. 4 (Fig. 8-121)	Install new trigger spring or attach trigger spring.
Channel stamping on underside of yoke is not engaging ball end of bellcrank. 5 (Fig. 8-121)	Engage ball by lifting yoke and repositioning.
Detent spring deformed to a point where switch will not remain indexed. 6 (Fig. 8-121)	Install new detent spring.
Turn signal binds, preventing cancellation. Caused by wire ring on yoke pilot being installed with open ends out of position. 7 (Fig. 8-121)	Reinstall with open ends in hole for the signal switch lever.
Dimples in actuator yoke improperly formed (not large enough) allowing the override spring to pivot out of position. 8 (Fig. 8-121)	Replace yoke.
Mounting legs are bent on column signal switch. 9 (Fig. 8-121)	Install new signal switch.
Failure of switch to index in RT position only. Bowden cable mounted incorrectly in the actuator casting. 10 (Fig. 8-121)	Remove cable from upper plastic lever and install with coils inward toward base of post.

TURN SIGNAL NOT OPERATING IN SOME OF THE TILT POSITIONS

CAUSE	CORRECTION
Turn signal switch is mounted incorrectly on jacket. 11 in (Fig. 8-121)	Readjust signal switch to correct location.

DIAGNOSIS GUIDE (Cont'd.)

TURN SIGNAL NOT OPERATING IN SOME OF THE TILT POSITIONS (Cont'd.)

CAUSE	CORRECTION
Centerline distance from flag clamp to Bowden wire loop is incorrect (first type cable). 12 in (Fig. 8-121)	Install new Bowden cable.

HORN SHORTING

CAUSE	CORRECTION
Horn cable brittle from too high paint baking temperature, causing insulation fractures. 14 in (Fig. 8-121)	Install new horn cable.
Turn signal cancelling pin incorrect distance from centerline of steering shaft. 1 in (Fig. 8-121)	Bend pin outward to 1-1/32" from centerline of steering shaft. (All tilt columns use an offset cancelling pin)
Lock retainer washer contacting horn contact.	Bend lock tab tight against the nut.

TURN SIGNAL ACTUATOR SCRAPING ON BOWL

CAUSE	CORRECTION
End of jacket not square with centerline, shroud portion of bowl is not concentric with hub or lockplate tab holes in jacket are improper width. 16 in (Fig. 8-121)	Replace parts with jacket, lockplate and bowl.

STEERING WHEEL LOOSE

CAUSE	CORRECTION
Excessive clearance between pivot pin and holes in support. 18 in (Fig. 8-121)	Replace support and pivot pins.
Bearing nut backed off or loose.	Adjust steering shaft torque and replace retainer washer.

DIAGNOSIS GUIDE (Cont'd.)

STEERING WHEEL LOOSE EVERY OTHER TILT POSITION

CAUSE	CORRECTION
If looseness prevails in 15° and 5° above center and 5° and 15° below, the lower shoe is faulty. At 10° above, 10° below and on center, the upper shoe is faulty. 20 in (Fig. 8-121)	Install new shoe pivot pin and shoe indicated.

STEERING WHEEL NOT LOCKING IN EVERY OTHER TILT POSITION

CAUSE	CORRECTION
Fault lies with shoes as above. The shoe may have seized on its pivot pin or weld flash is between the shoe and the support. 21 in (Fig. 8-121)	Install new shoe pivot pin and shoe, remove grease from support and shoe (weld flash is embedded in grease) and re-grease.

STEERING WHEEL FAILS TO RETURN FREELY TO TOP TILT POSITION

CAUSE	CORRECTION
Pivot pins are bound up. 22 in (Fig. 8-121)	Remove pivot pins and check holes for burrs. Install new pivot pins.
Wheel tilt springs are defective. 23 in (Fig. 8-121)	Install new springs.

NOISE WHEN STEERING WHEEL RETURNS TO TOP TILT POSITION

CAUSE	CORRECTION
Tilt wheel stop bumper on upper shoe has failed. 24 in (Fig. 8-121)	Install new upper shoe assembly.

DIAGNOSIS GUIDE (Cont'd.)

POOR RETURNABILITY OF STEERING WHEEL

CAUSE	CORRECTION
Deformed felt seal between steering shaft and jacket in floor shift cars. Deformed felt seal between steering shaft and shift tube and/or between shift tube and jacket in columns with gearshift. 25 in (Fig. 8-121)	Disassemble and install new seal.
Too much bearing pre-load. 26 in (Fig. 8-121)	Adjust steering shaft torque and replace retainer washer.

GEARSHIFT LEVER FAILS TO INDEX TRANSMISSION

CAUSE	CORRECTION
The weld of the lower gearshift lever to the shift tube has failed. 27 in (Fig. 8-121)	Install new shift tube assembly.
Key for shift tube sheared off shift bowl. 28 in (Fig. 8-121)	Replace shift bowl.

HIGH EFFORT IN GEARSHIFT MECHANISM

CAUSE	CORRECTION
Undersize ID on lockplate. 29 in (Fig. 8-121)	Install new lockplate.

NOISE IN GEARSHIFT MECHANISM

CAUSE	CORRECTION
Oversize lockplate ID. 29 in (Fig. 8-121)	Install new lockplate.
Key for shift tube sheared off shift bowl. 28 in (Fig. 8-121)	Install new shift bowl.
Wave washer damaged or omitted. 30 in (Fig. 8-121)	Install new wave washer.
Bowl driven too far on shift tube. 31 in (Fig. 8-121)	Install new shift tube.

DIAGNOSIS GUIDE (Cont'd.)

NOISE IN STEERING SHAFT

CAUSE	CORRECTION
Column improperly aligned when installed in car (steering shaft must be mounted in the center of shift tube). 32 in (Fig. 8-121)	Relocate toe pan cover on floor board, aligning steering shaft properly.
Flexible coupling flange not tightened on steering shaft. 33 in (Fig. 8-121)	Torque flange bolt to 35 ft. lbs.

DUST ENTERING THROUGH COLUMN

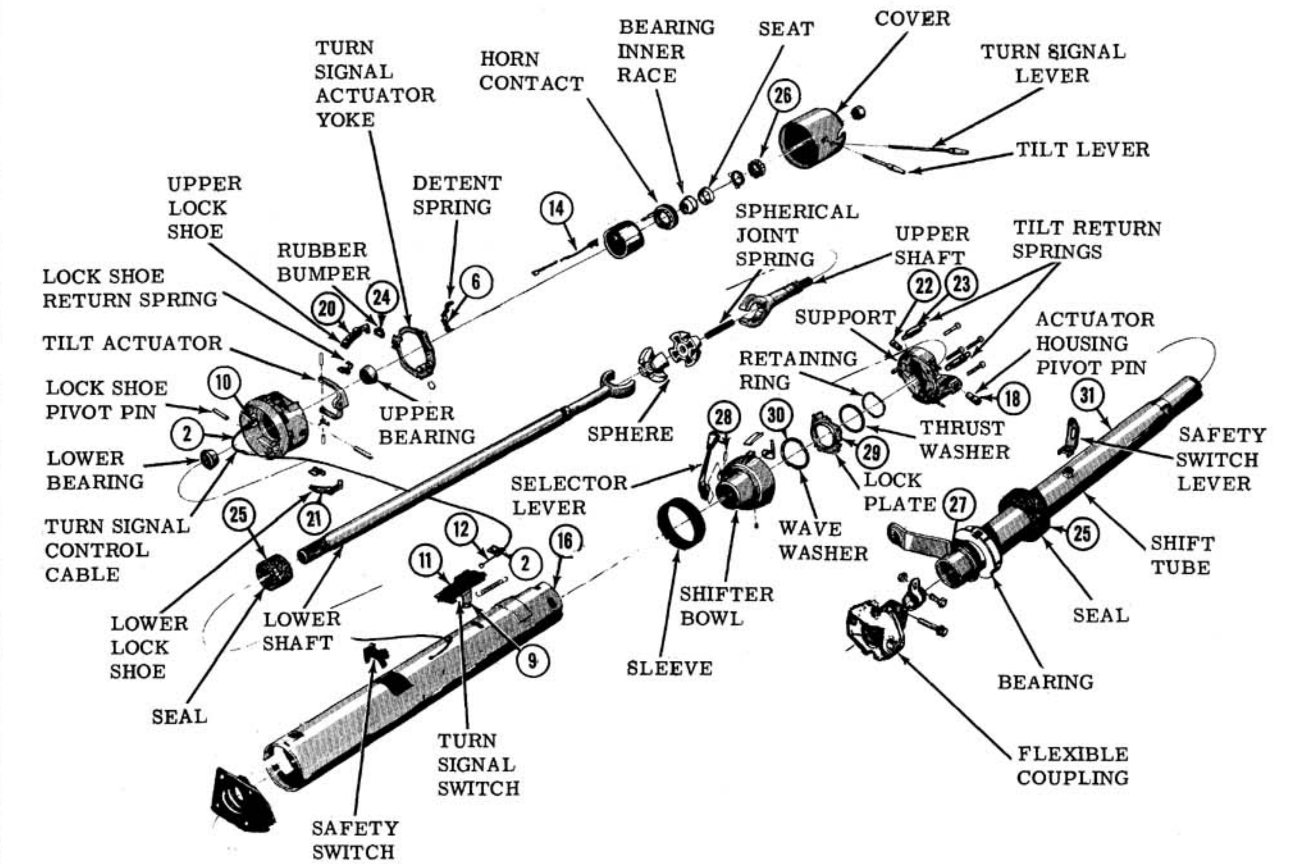
CAUSE	CORRECTION
Felt seals between steering shaft and jacket and/or shift tube are deformed or out of position. 25 in (Fig. 8-121)	Install new seals.

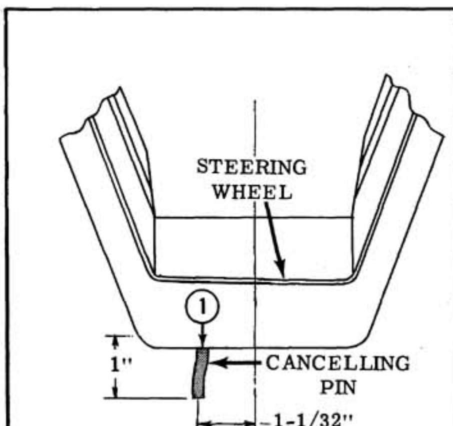
DIAGNOSIS OF MANUAL AND POWER STEERING

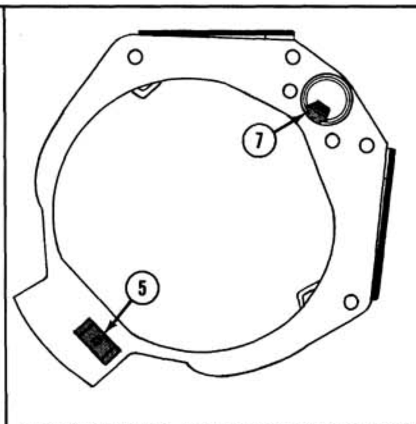
NOTE: Items identified by (M.S.) apply to manual steering only and items identified by (P.S.) apply to power steering only. All items not identified by (M.S.) or (P.S.) apply to both units.

HARD STEERING WHILE DRIVING OR POOR RETURN OF STEERING TO CENTER

CAUSE	CORRECTION
1. Tight steering shaft bearings.	1. Replace bearings.
2. Lower coupling flange rubbing against adjuster plug. (P.S.)	2. Loosen bolt and reposition for clearance.
3. Steering wheel rubbing against turn signal collar.	3. Adjust mast jacket endwise.
4. Tires not properly inflated	4. Inflate to specifications.
5. Steering linkage tie-rod joints misaligned.	5. Loosen tie-rod sleeve and center ball joint.
6. Steering gear misaligned.	6. Align at frame.
7. Tight over-center adjustment.	7. Adjust in car to specifications.
8. Thrust bearing adjustment too tight.	8. Adjust to specifications.
9. Ball preload too tight. (P.S.)	9. Remove gear and change ball size as required.
10. Sticky spool valve. (P.S.)	10. Remove and clean valve or replace valve assembly.
11. Sticking pump flow control valve. (P.S.)	11. Remove valve and clean.







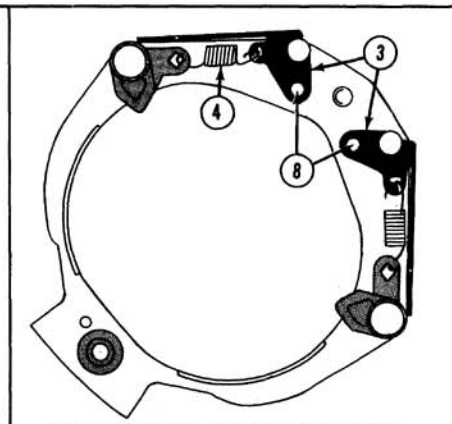


Fig. 8-121 Tilt-Wheel Diagnosis

DIAGNOSIS OF MANUAL AND POWER STEERING (Cont'd.)

CAR LEADS TO ONE SIDE OR THE OTHER

CAUSE	CORRECTION
1. Front end misaligned.	1. Adjust to specifications.
2. Worn or damaged valve shaft assembly. (P.S.) NOTE: If this is the cause, steering effort will be very light in direction of lead and heavy in opposite direction.	2. Replace valve and shaft assembly.

MOMENTARY INCREASE IN EFFORT WHEN TURNING WHEEL FAST TO THE RIGHT OR LEFT (P.S.)

CAUSE	CORRECTION
1. Low oil level in pump.	1. Check oil level in pump reservoir.
2. Pump belt slipping.	2. Tighten or replace belt.
3. Excessive internal leakage.	3. Replace rack-piston teflon seal and "O" ring and/or replace spool valve.

EXTERNAL OIL LEAKS (WIPE GEAR THOROUGHLY AND MAKE SURE SOURCE OF LEAKAGE IS DETERMINED)

CAUSE	CORRECTION
1. Loose hose connections. (P.S.)	1. Tighten.
2. Damaged hose. (P.S.)	2. Replace.
3. Side cover "O" ring seal. (P.S.)	3. Replace seal.
4. Pitman shaft seals.	4. Replace seals.
5. Housing end cover "O" ring seal. (P.S.)	5. Replace seal.
6. Adjuster plug seals. (P.S.)	6. Replace seals.
7. Torsion bar seal. (P.S.)	7. Replace valve and shaft assembly.

GEAR NOISE (RATTLE, CREAK OR CHUCKING)

CAUSE	CORRECTION
1. Loose over-center adjustment. NOTE: A slight rattle may occur on turns because of the increased lash off the "high point". This is normal and the lash must not be reduced below the specified limits to eliminate this slight rattle.	1. Adjust to specification.

DIAGNOSIS OF MANUAL AND POWER STEERING (Cont'd.)

GEAR NOISE (RATTLE, CREAK OR CHUCKING) (Cont'd.)

CAUSE	CORRECTION
2. Gear loose on frame.	2. Check gear to frame mounting bolts. Tighten bolts to specification.
GEAR NOISE ("HISSING" SOUND) (P.S.)	
There is some noise in all power steering systems. One of the most common is a "hissing" sound most evident at standstill parking. There is no relationship between the noise and performance of the gear. "Hiss" may be expected when steering wheel is at end of travel or when slowly turning at standstill.	Do not replace valve and shaft assembly unless "hiss" is extremely objectionable. Slight "hissing" is satisfactory and in no way effects steering. A replacement valve and shaft assembly may also exhibit slight noise and is not always a cure for the objection. Check clearance around safety drive bolts in flexible coupling. Be sure steering shaft and gear are aligned so the flexible coupling rotates in a flat plane and is not distorted as shaft rotates. Any metal to metal contact through the flexible coupling will transmit the valve "hiss" into the car.

LOOSE STEERING

CAUSE	CORRECTION
1. Lash in steering linkage.	1. Replace parts affected.
2. Air in system. (P.S.)	2. Add oil to pump reservoir.
3. Excessive lash between pitman shaft and rack-piston.	3. Make over-center adjustment.
4. Loose thrust bearing adjustment.	4. Adjust to specification.
5. Ball and worm pre-load incorrect. (P.S.)	5. Remove rack-piston and worm, and change balls to obtain specified pre-load.

STEERING WHEEL SURGES OR JERKS WHEN TURNING ENGINE RUNNING, ESPECIALLY DURING PARKING (P.S.)

CAUSE	CORRECTION
Loose pump belt.	Adjust to specification.

HARD STEERING WHEN PARKING

CAUSE	CORRECTION
Loose pump belt. (P.S.)	Adjust to specification.

DIAGNOSIS OF MANUAL AND POWER STEERING (Cont'd.)

HARD STEERING WHEN PARKING (Cont'd.)

CAUSE	CORRECTION
2. Low oil in reservoir. (P.S.)	2. Fill to proper level. If excessively low, check all lines and joints for evidence of external leakage.
3. Lack of lubricant in ball joints or steering linkage.	3. Add lubricant.
4. Tires not properly inflated.	4. Inflate to recommended pressure.
5. Insufficient oil pressure. (P.S.)	5. If all of the above checks do not reveal the cause of hard steering, make the following tests of oil pressure. a. Disconnect the pressure line at pump, then install Gauge Set J-5176-01. (Fig. 8-122) b. With engine at slow idle and gauge valve open, note the oil pressure on the gauge while turning steering wheel from one extreme position to the other. Especially note the maximum pressure which can be built up with the wheel held in either right or left extreme position. CAUTION: Do not hold wheel in extreme position for an extended period of time because it will drastically increase the oil temperature and will cause undue wear on the pump. c. With oil temperature between 150° F. and 170° F. (measured with a thermometer in the reservoir) oil pressure should not be less than 1,000 psi for satisfactory power steering operation. (Fig. 8-122) d. If the maximum oil pressure is less than 1,100 psi, it indicates trouble in the pump, hoses, steering gear, or a combination of these parts. To eliminate the hoses and gear, close the gauge valve and quickly test pressure of the pump only with the engine at slow idle, then open the valve to avoid increasing oil temperature. e. Comparing the maximum pressure obtained in these two tests will indicate source of trouble as follows: (1) First test (step b) pressure low, and second test (step d) pressure normal - indicates faulty hoses or steering gear.

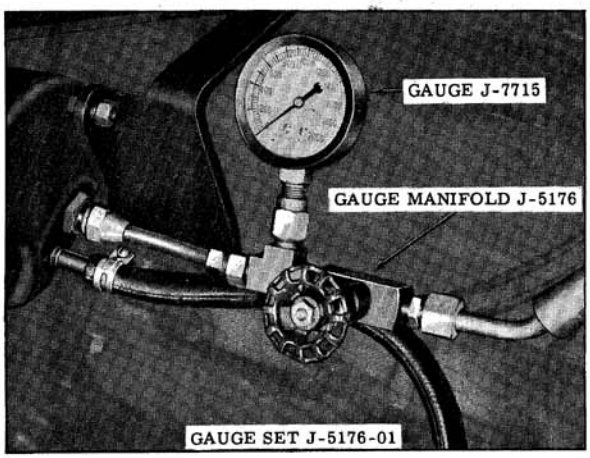


Fig. 8-122 Oil Pressure Gauge

DIAGNOSIS OF MANUAL AND POWER STEERING (Cont'd.)

HARD STEERING WHEN PARKING (Cont'd.)

CAUSE	CORRECTION
	(2) First test (step b) and second test (step d) pressure equally low - indicates faulty oil pump.
6. Low oil pressure due to restriction in hose. (P.S.)	6. Clean or replace as required.
7. Low oil pressure due to steering gear. (P.S.)	7. Remove steering gear for disassembly.
a. Pressure loss in cylinder due to worn rack-piston seal, damaged "O" ring or scored housing bore.	a. Inspect rack-piston seal and "O" ring and housing bore.
b. Leakage at valve rings, valve body to worm seal.	b. Replace rings and seals.
c. Loose fit of spool in valve body or leaky valve body.	c. Replace valve and shaft assembly.

VALVE "SQUAWK" WHEN TURNING OR WHEN RECOVERING FROM A TURN (P.S.)

CAUSE	CORRECTION
1. Cut or worn dampener "O" ring on spool valve.	1. Replace dampener ring.
2. Loose or worn valve.	2. Replace valve and shaft assembly.

NO EFFORT REQUIRED TO TURN (P.S.)

CAUSE	CORRECTION
Broken torsion bar.	Replace valve and shaft assembly.

PUMP NOISE

CAUSE	CORRECTION
1. Loose belt.	1. Tighten belt.
2. Hose(s) touching other parts of car.	2. Adjust hose position.
3. Low oil level.	3. Fill reservoir.
4. Air in the oil.	4. Check oil level.
5. Excessive back pressure caused by hoses or steering gear.	5. Locate restriction and correct.
6. Scored pressure plate.	6. Lap away light scoring. Replace heavily scored part.
7. Vanes not installed properly.	7. Install properly.

DIAGNOSIS OF MANUAL AND POWER STEERING (Cont'd.)

PUMP NOISE (Cont'd.)

CAUSE	CORRECTION
8. Vanes sticking in rotor slots.	8. Free up by removing burrs or dirt.
9. Extreme wear of pump ring.	9. Replace part.
10. Face of thrust plate scored.	10. Lap away light scoring. Replace heavily scored part.
11. Scored rotor.	11. Lap away light scoring. Replace heavily scored part.

INOPERATIVE, POOR, OR NO ASSIST: (PUMP ASSEMBLY)

CAUSE	CORRECTION
1. Loose drive belt.	1. Tighten belt.
2. Low oil level.	2. Fill reservoir.
3. Air in the oil.	3. Add oil to pump reservoir.
4. Flow control valve stuck.	4. Remove burrs or dirt.
5. Vanes sticking in rotor slots.	5. Free up by removing burrs or dirt.
6. Faulty flow control valve assembly.	6. Clean and free up parts. Replace part(s) as necessary.

GENERAL SPECIFICATIONS

MANUAL STEERING
- RATIO 24:1
- LUBRICANT . . . . Water Resistant E.P. (Multi-Purpose Gear Lubricant)
- ADJUSTMENTS
  1. Worm Bearing Pre-load . . . . 4 to 7 in. lbs.
  2. Over-Center Adjustment . . . . 4 to 10 in. lbs. in excess of worm bearing pre-load (14 in. lbs. Max.)
  3. Pitman Shaft Adjusting Screw End Clearance. . . . . .002" Max.

POWER STEERING
- RATIO 17.5:1
- LUBRICATION
  4. Lubricant . . . . Power Steering Fluid Part No. 1050017
  5. Capacity - Complete System. . . . . 1-3/4 Qts.
  6. Capacity - Pump Only . . . . 1 Qt.
- ADJUSTMENTS
  7. Ball Pre-load. . . . . 1/2 to 5 in. lbs.
  8. Thrust Bearing Pre-load . . . . 1 to 3 in. lbs. in excess of initial load
  9. Over-Center Adjustment. . . . . 4 to 8 in. lbs. in excess of combined ball and thrust bearing pre-load

TORQUE SPECIFICATIONS

NOTE: Specified torque is for installation of parts only. Checking of torque during inspection may be 15% below that specified.

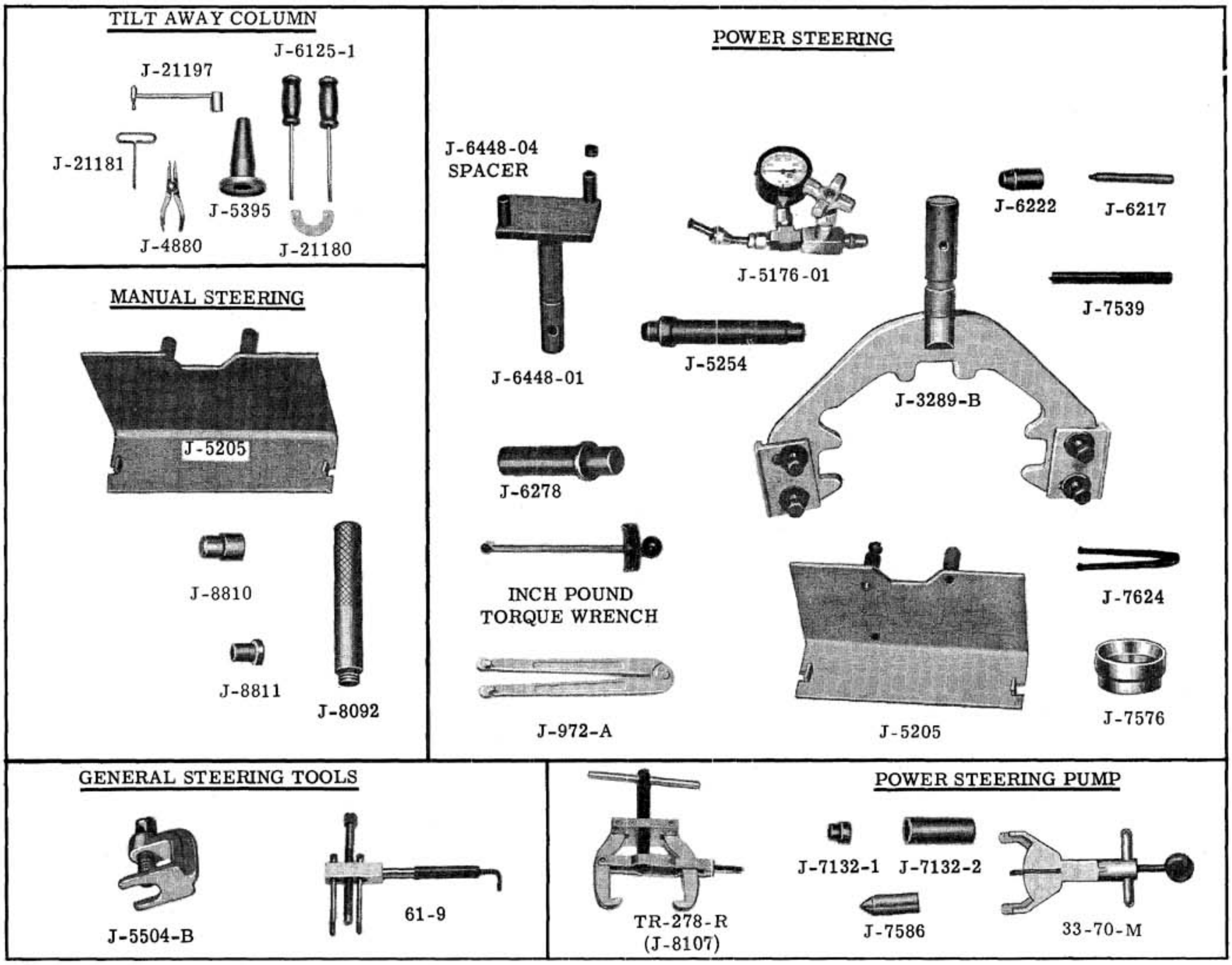
APPLICATION	FT. LBS.
STEERING LINKAGE	
Idler Arm Support to Frame Bolt	35
Tie Rod Clamp Bolts	25
Tie Rod to Plain Arm and Relay Rod Nuts	60
Steering Wheel Nut	40
Idler and Pitman Arm to Relay Rod	50*
Tie Rod to Relay Rod	50*
MANUAL STEERING GEAR	
Gear to Frame Bolts	80
Pitman Shaft Nut	150
Side Cover Bolts	35
Pitman Shaft Adjusting Screw Locknut	27
Bearing Pre-load Adjuster Locknut	100
Coupling Flange Bolts	20
POWER STEERING PUMP	
Pulley Nut	45
Pump Mounting Stud	35
Union	35
Flow Control Valve Plug	4
Pressure Hose	35

POWER STEERING PUMP BRACKETS

THREAD	TORQUE FT. LBS.
5/16-18	25
5/16-24	25
3/8 -16	35
7/16-14	50
7/16-20	50

APPLICATION	FT. LBS.
POWER STEERING GEAR	
Gear to Frame Bolts	80
High Pressure Line Fitting (At Gear)	35
Oil Return Line Fitting (At Gear)	35
Pitman Shaft Adjusting Screw Locknut	30
Side Cover Bolts	35
Adjuster Plug Locknut	110
Coupling Flange Bolt(s)	20
Return Guide Clamp Screws	12
Rack-Piston Plug	65

*Do not back off to insert cotter pin - turn to next hole.



61-9	Steering Wheel Puller
TR-278-R	(J-8107) Differential Side Bearing Puller (Used for Pump End Cover Installation)
J-544-A	Spring Scale
J-3289-B	Differential Holding Fixture (Used for Mounting Gear Holding Fixture J-5405)
33-70 M	Belt Tensioning Gauge
J-4880	No. 2 Snap Ring Pliers
J-5176-01	Pressure Testing Manifold (Used with Gauge J-7715)
J-5190-A	1955 Power Steering Gear End Casting Bearing Puller (Used for Side Cover Needle Bearing Puller)
J-5254	End Cover Seal and Needle Bearing Installer (Used for Removing and Installing Adjuster Plug Oil Seal and Needle Bearing)
J-5205	Steering Gear Holding Fixture
J-5395	Turn Signal Cover Installer (Pinion Seal Installer)
J-5504-B	Pitman Arm Puller
J-6125-1	Slide Hammer
J-6217	Hose Connector Installer
J-6222	End Cover Seal Protector (Used for Installing Adjuster Plug)
J-6278	Pitman Shaft Bearing Remover and Installer
J-6278-2	Adapter (Used with J-6278 for Installing Pitman Shaft Seals and Bearing)
J-6448-01	Power Steering Gear Holding Fixture
J-6448-04	Spacer (Used with J-6448-01)
J-7132-1	Seal Protector
J-7132-2	Seal Installer
J-7539	Ball Retainer
J-7576	Rack-Piston Teflon Ring Compressor
J-7586	Pump Oil Seal Protector
J-7624	Spanner Wrench (Used for Removing and Installing Adjuster Plug. Also used for Adjusting Thrust Bearing Preload)
J-7715	Pressure Testing Gauge (Used with Gauge Manifold J-5176)
J-8092	Drive Handle
J-8810	Pitman Shaft Bushing Installer
J-8811	Upper Bearing Race Installer and Pitman Shaft Oil Seal Installer
J-972-A	Differential Adjusting Nut Wrench (Used for Tightening Adjuster Plug Locknut)
J-21180	Turn Signal Cover and Shift Tube Remover
J-21181	Spring Installer
J-21197	Pivot Pin Remover and Snap Ring Installer

Fig. 8-123 Steering Tools

SUSPENSION

52-54-56-58-66-84 & 86 SERIES

CONTENTS OF SECTION 9

FRONT SUSPENSION

PERIODIC MAINTENANCE

For ball joint seal inspection and lubrication interval, refer to PERIODIC MAINTENANCE, Section 2.

A periodic front wheel bearing repack is not required. However, when major brake service is being performed, it is recommended that the front wheel bearings be cleaned and repacked with a sodium soap, fine fiber grease.

WHEEL BEARINGS

The proper functioning of the front suspension cannot be maintained unless the front wheel TAPER ROLLER BEARINGS are correctly adjusted. Cones must be a slip fit on the spindle and the inside diameter of cones should be lubricated to insure that the cones will creep. Spindle nut must be a free-running fit on threads.

ADJUSTMENT

1. While rotating hub and drum assembly, at least three times the speed of nut rotation, tighten nut to 30 ft. lbs.
2. Back off nut 1/2 turn.
3. Retighten nut finger tight and install retaining ring or cotter key if possible.

   NOTE: If unable to install retaining ring or cotter key, back off nut (not to exceed 1/24 of a turn) until tabs on clip align with serations in nut.

HUB AND DRUM ASSEMBLY

Remove (Wheel Removed)

1. Remove grease cap from hub.

   CAUTION: Use care when removing the left front cap which contains the front wheel speedometer drive coupling. Tool BT-6507 will easily remove the cap without distortion.

2. Remove cotter pin or retaining ring, nut and washer from spindle.
3. Carefully pull hub and drum assembly from spindle.

   NOTE: It may be necessary to back off the brake shoe adjustment before the hub and drum can be removed.

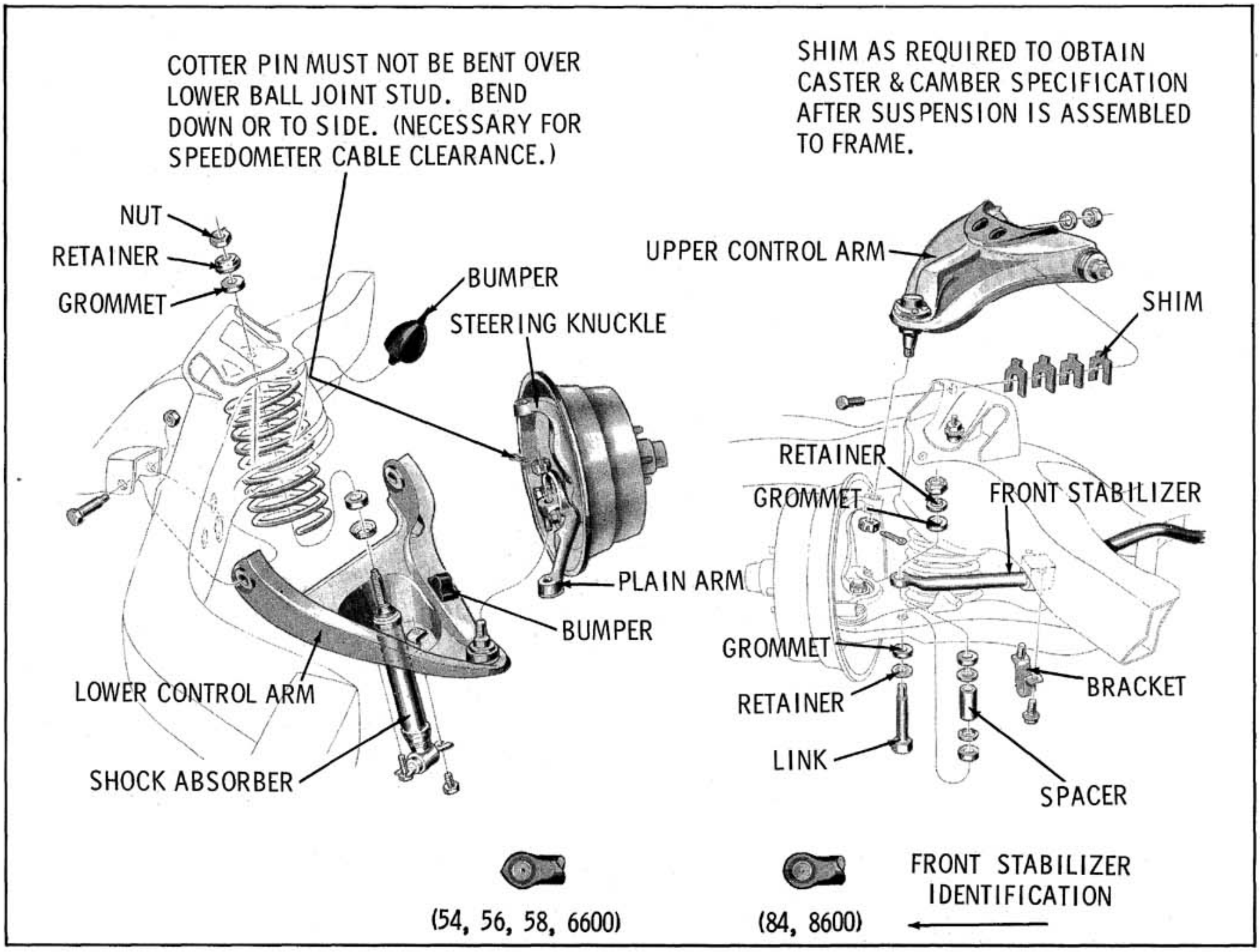


Fig. 9-1 Front Suspension Assembly

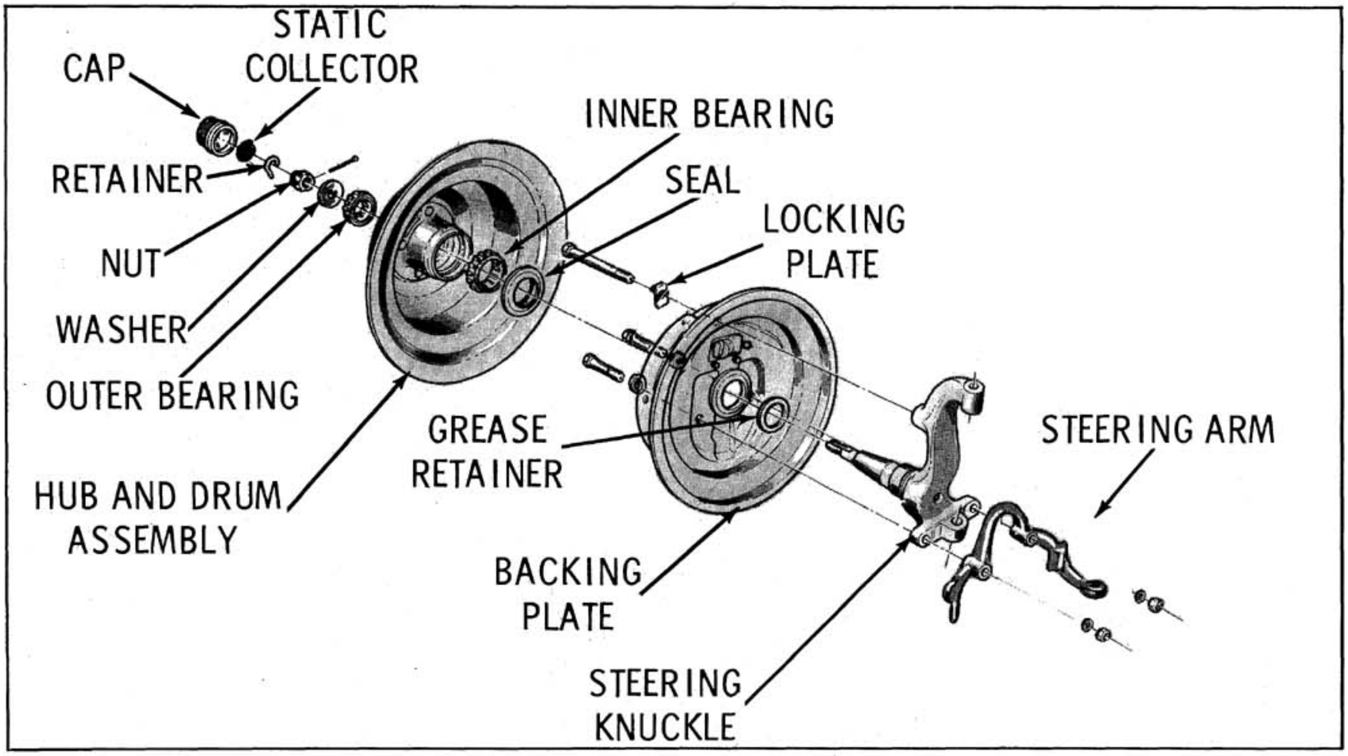


Fig. 9-2 Front Wheel Layout

BEARING AND SEAL REMOVAL

1. Remove washer retaining the roller and cage assembly in the hub.

2. Remove the outer bearing inner race and the roller and separator assembly from hub.

3. Pry seal from hub, then remove inner bearing, inner race and roller and separator assembly from hub.

4. If necessary to remove outer races, insert a brass drift into hub, indexing end of drift with notches in hub behind bearing outer race and tap with a hammer. (Fig. 9-3)

CLEANING AND INSPECTION

NOTE: For inspection of front drum, refer to BRAKE DRUMS, Section 11.

1. Wash all parts in clean solvent with the exception of the roller and separator assemblies and race and air dry. Roller and separator assemblies should be washed in gasoline.

2. Check bearings for cracked separators and worn or pitted rollers.

3. Check bearing races for cracks, scores or a brinelled condition.

BEARING AND SEAL INSTALLATION

1. If the outer races were removed, drive or press the races into the hub as shown in Figs. 9-4 and 9-5.

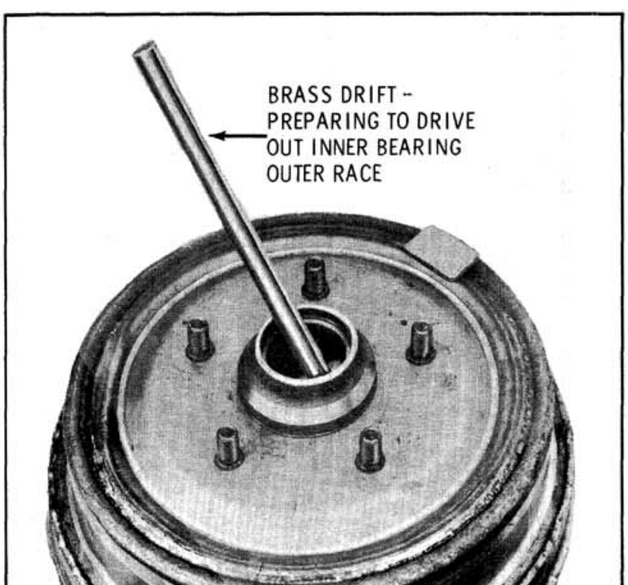


Fig. 9-3 Removing Inner Bearing Outer Race

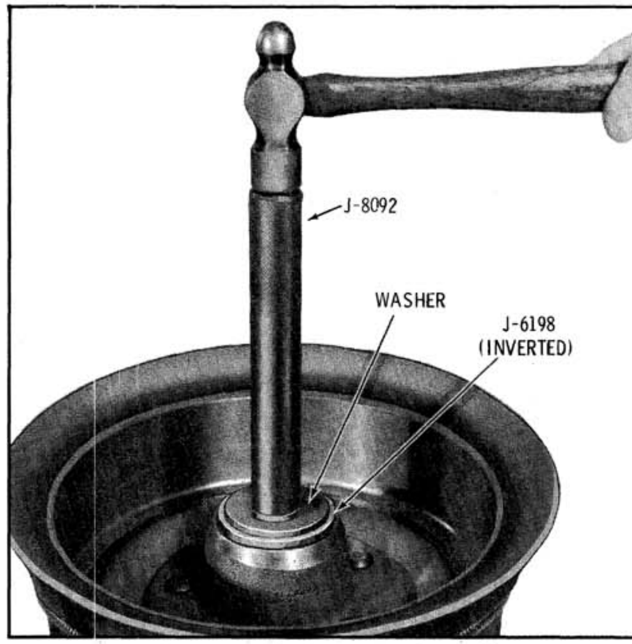


Fig. 9-4 Installing Inner Bearing Outer Race

2. Lubricate the bores of the inner races and fully pack the roller and separator assemblies with a sodium soap, fine fiber grease.

3. Install inner bearing roller and separator assembly into outer race, then install inner bearing inner race.

4. Carefully tap seal into hub.

5. Clean any traces of grease from brake linings and drum with fine sandpaper. If necessary to

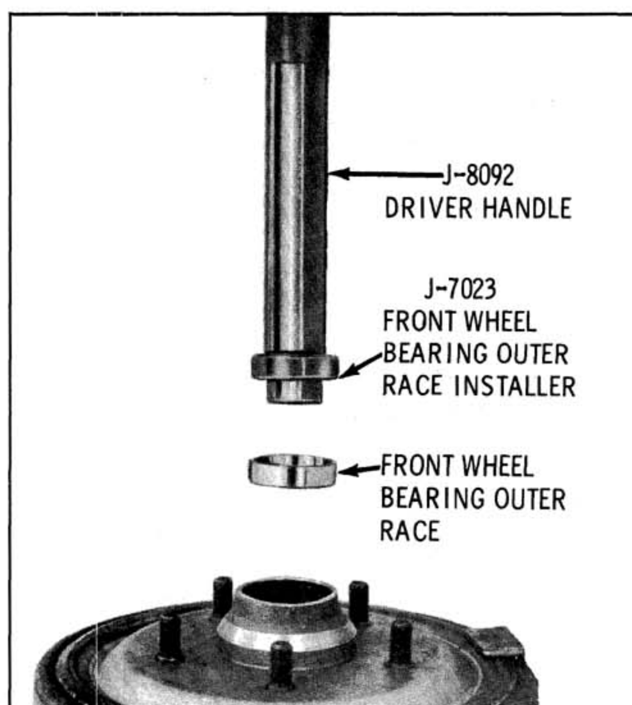


Fig. 9-5 Installing Outer Bearing Inner Race

adjust brake linings, refer to BRAKE LININGS - ADJUST, Section 11.

6. Position hub and drum assembly over spindle.

7. Install outer bearing roller and separator into hub.

8. Install outer bearing inner race over spindle, then install the washer and spindle nut. Draw spindle nut up snug and adjust bearings as outlined under WHEEL BEARING ADJUSTMENT.

9. Install dust cap. Tool BT-6507 can be used to install the dust cap without distortion.

HUB BOLT REPLACEMENT

1. With the hub and drum assembly removed, drill a 5/8" hole 1/4" deep into the head of the hub bolt.

2. Support hub and drum assembly and drive or press hub bolt out through the front of the hub and drum assembly.

3. Press a new hub bolt into the hub.

4. While supporting hub bolt, peen hub bolt into the countersunk area of drum with the use of Peening Tool J-544-18 until the drum is secure to the hub. (Fig. 9-6)

FRONT SHOCK ABSORBER

A slight amount of fluid may bleed by the rod seal in cold weather and deposit a light film on the upper area of the shock absorber. This condition will not impair operation and should be considered normal. A shock absorber should never be checked horizontally or with the rod extension down.

For a complaint of a noisy or defective shock absorber, first check the mounting torque. If mounting is satisfactory, disconnect the lower mountings and pump the shock absorber by hand in a vertical position. Compare both shock absorbers. If both shock absorbers respond the same, it is unlikely that a defective shock absorber exists.

THUMPING NOISE

A thumping noise usually occurs when a shock absorber is changing its direction of stroke.

1. The shock absorber should be pumped with a rapid change of stroke. If lag is felt when changing stroke, this unit will be noisy.

2. Completely extend the shock absorber and pull hard. If spring tension is felt, this shock absorber will be noisy and should be replaced.

SQUEAKY OR REED TYPE NOISE

Hand pump the shock absorber at different rates of speed. If noise is heard that changes from a deep grunt to a high-pitched squeak, the shock absorber needs replacement.

NOTE: A squeaking noise could be attributed to seals. This is particularly true if the shock

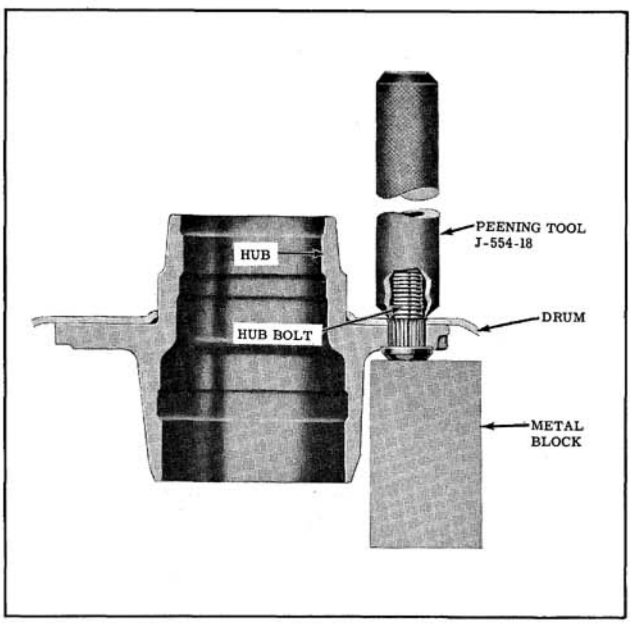


Fig. 9-6 Peening Hub Bolt

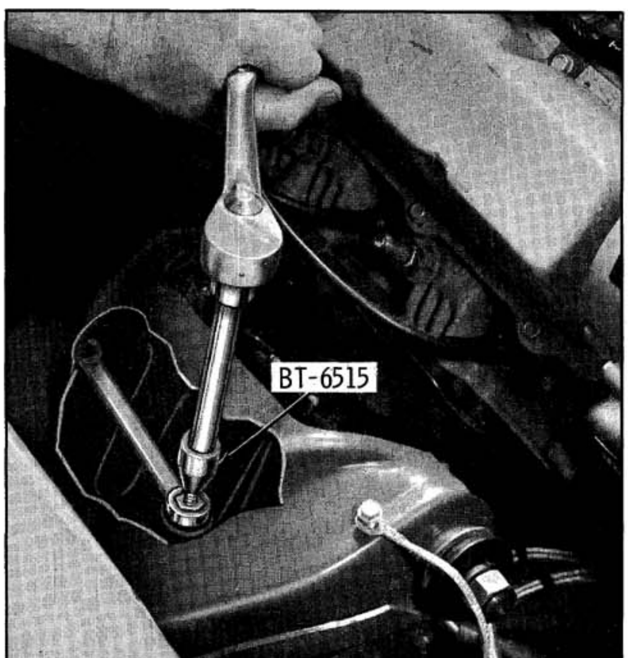


Fig. 9-7 Removing Shock Absorber Upper Attaching Nut

absorber has been inoperative for a period of time. This noise will disappear after a few strokes of the shock absorber and is not a cause for rejection.

Remove and Install

1. Remove the two bolts and lockwasher attaching shock absorber to the lower control arm.

2. Remove upper nut, retainer and grommet from shock absorber. (Fig. 9-7)

   NOTE: Use a special socket such as BT-6515 to aid in removal of the shock absorber. Hold the nut with a short box wrench, turn the shock absorber with the special socket and remove shock absorber from the car.

To install shock absorber, reverse sequence of operations. Torque the upper nut to 20 ft. lbs. and the lower bolts to 24 ft. lbs.

STABILIZER

Remove and Install (Fig. 9-8)

1. Disconnect each side of stabilizer linkage by removing nut from link bolt, pull bolt from linkage and remove retainer, grommets and spacer.

2. Remove crankshaft pulley and one wheel and tire assembly.

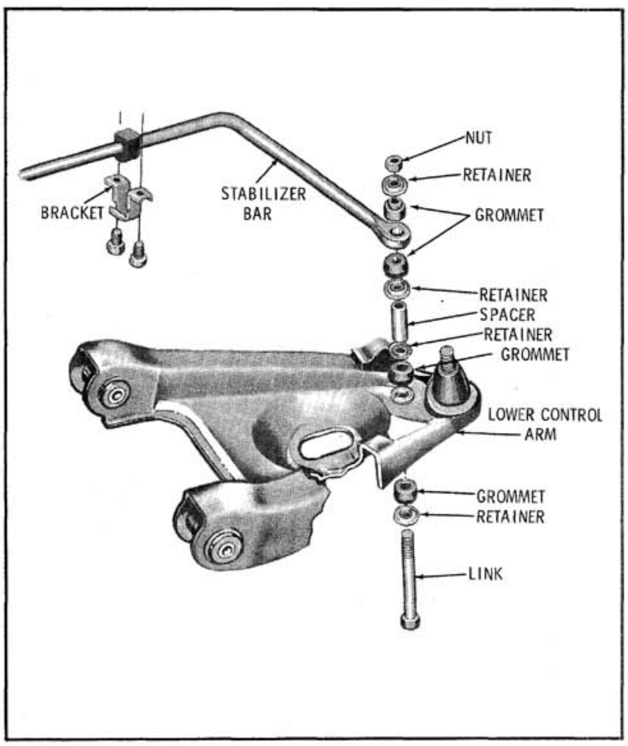


Fig. 9-8 Stabilizer Bar and Linkage

3. Remove bracket to frame bolts, and remove stabilizer bar, rubber bushings and brackets.

4. Remove stabilizer bar from car.

5. To install, reverse sequence of operations. The rubber bushings should be positioned squarely in the brackets with the slit in the bushings facing the front of the car. Torque stabilizer link nut and the bracket bolts to 15 ft. lbs. with weight of car on wheels.

   IMPORTANT: Never lubricate stabilizer bar rubber bushings as they are dependent upon a bonding of the rubber to the bar for proper stabilizer action.

BALL JOINTS

BALL JOINT LUBRICATION

For ball joint seal inspection and lubrication interval, refer to PERIODIC MAINTENANCE, Section 2.

BALL JOINT CHECKS

NOTE: Before checking ball joints, the wheel bearings must first be properly adjusted. To check the steering linkage and steering gearlash, refer to STEERING, Section 8.

VERTICAL CHECK

1. Raise the car and position floor stands under the left and right lower control arm as near as possible to each lower ball joint. Car

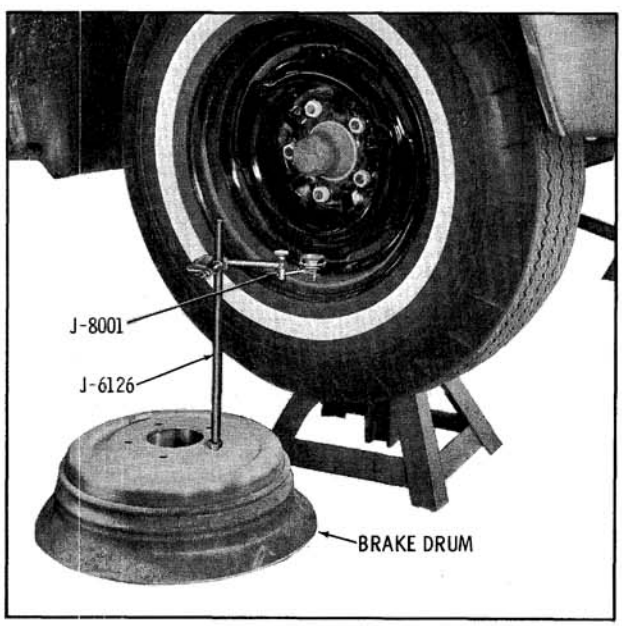


Fig. 9-9 Ball Joint Vertical Check

must be stable and should not rock on the floor stands.

2. Position dial indicator as shown in Fig. 9-9.

3. ALL SERIES--Place a 2 x 4 (approx. 6") vertically on the lower control arm and pry on the upper end of the steering knuckle as shown in Fig. 9-10.

4. Move pry bar gently up and down and observe vertical deflection on dial indicator. Reading must not exceed .125".

5. Repeat Steps 2, 3 and 4 on opposite ball joint.

HORIZONTAL CHECK

1. Place car on floor stands as outlined in Step 1 of the Vertical Check.
2. Position dial indicator as shown in Fig. 9-11.
3. Grasp front wheel as shown in Fig. 9-11 and push in on bottom of tire while pulling out at the top. Read gauge, then reverse the push-pull procedure. Horizontal deflection on gauge should not exceed .125" at the wheel rim. This procedure checks both the upper and lower ball joints.
4. Repeat Steps 2 and 3 on the opposite ball joint.

UPPER CONTROL ARM ASSEMBLY

Removal

1. Raise front of car and support lower control arm with floor stands.

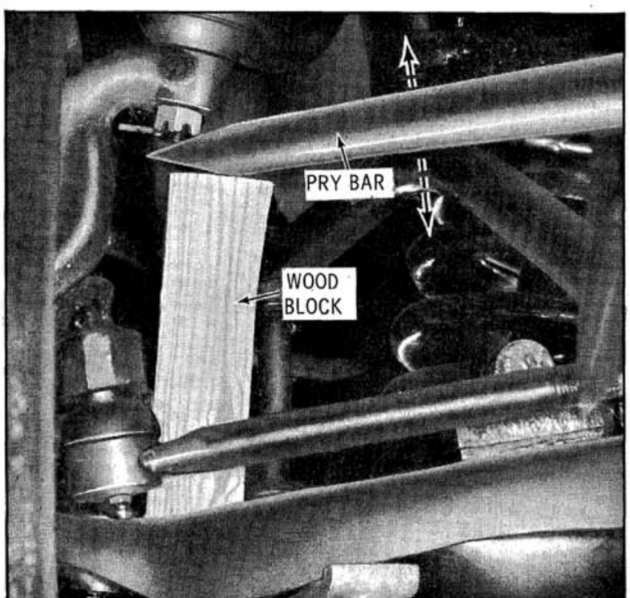


Fig. 9-10 Pry Bar Installation

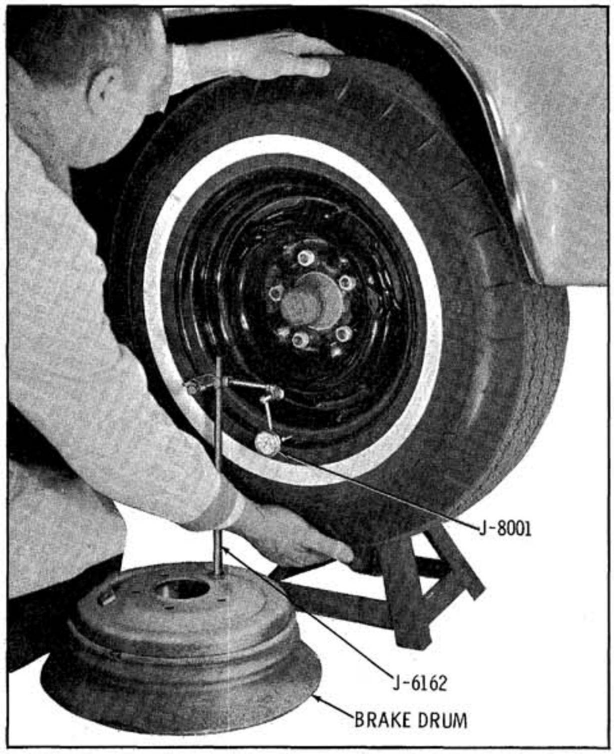


Fig. 9-11 Ball Joint Horizontal Check

NOTE: Since the weight of the car is used to relieve spring tension on the upper control arm, the floor stands must be positioned between the spring seats and ball joints of the lower control arms for maximum leverage.

2. Remove wheel and front wheel speedometer cable from knuckle if so equipped, then loosen the upper ball joint from the steering knuckle as follows:

a. Remove the cotter pin from the upper ball joint stud and clean threads of stud.

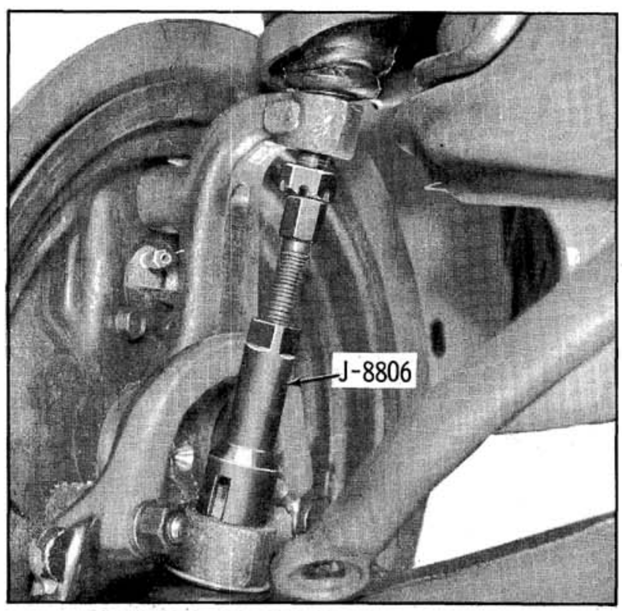


Fig. 9-12 Loosening Upper Ball Joint

b. Loosen the upper ball joint nut and install Tool J-8806 as shown in Fig. 9-12.

NOTE: It may be necessary to grind about 3/32" off of Tool J-8806 where tool contacts the steering arm. It may be necessary to remove cotter pin so tool can be positioned correctly after grinding.

c. Apply pressure on stud by expanding the tool until the stud breaks loose.

d. Remove Tool J-8806 and upper ball joint nut, then pull stud free from knuckle. Support the hub and drum to prevent weight of the assembly from damaging the brake hose.

3. Disconnect ground strap from control arm.
4. Loosen pivot shaft to frame attaching nuts and remove alignment shims.

NOTE: Alignment shims are to be installed in the same position from which they were removed.

NOTE: It is necessary to remove the upper control arm attaching bolts to allow clearance to remove upper control arm assembly. The attaching bolts are splined into the frame, to remove proceed as follows:

a. Tap bolt down as shown in Fig. 9-13.

b. Using a box wrench, pry bolt up.

c. Remove nut and using a suitable pry bar and block of wood, pry bolts from the frame as shown in Fig. 9-14.

5. Remove control arm from the car.

Install

1. Position attaching bolts loosely in the frame and install pivot shaft on the attaching bolts.

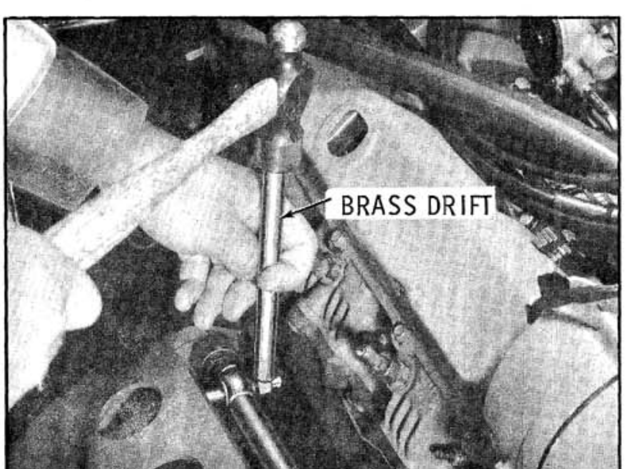


Fig. 9-13 Loosening Upper Control Arm Bolts

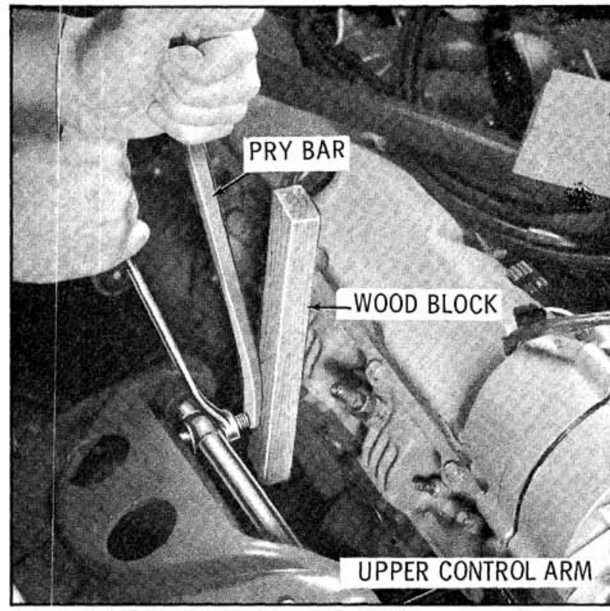


Fig. 9-14 Removing Upper Control Arm Bolts

2. Install lockwashers and nuts.
3. Using a hammer and brass drift, drive attaching bolts into the frame.
4. Install alignment shims between the pivot shaft and frame on their respective bolts. Torque nuts to 75 ft. lbs.
5. Remove the temporary support from the hub and drum, then connect ball joint to steering knuckle. Torque nut to 40 ft. lbs. (minimum) and install cotter pin. Attach ground strap to control arm.
6. Install speedometer cable and wheel, then check wheel alignment and adjust if necessary.

UPPER CONTROL ARM PIVOT SHAFT BUSHING REPLACEMENT

1. Remove upper control arm assembly from the car.
2. Remove nuts and washers from ends of pivot shaft. (Fig. 9-15)
3. Position control arm assembly and tools in a press as shown in Fig. 9-16 and press bushing out of control arm.
4. Repeat Step 3 on other bushing.
5. To install bushings, place pivot shaft in control arm and press new bushing into control arm and over end of pivot shaft. (Fig. 9-17)
6. Repeat Step 5 on other bushing.

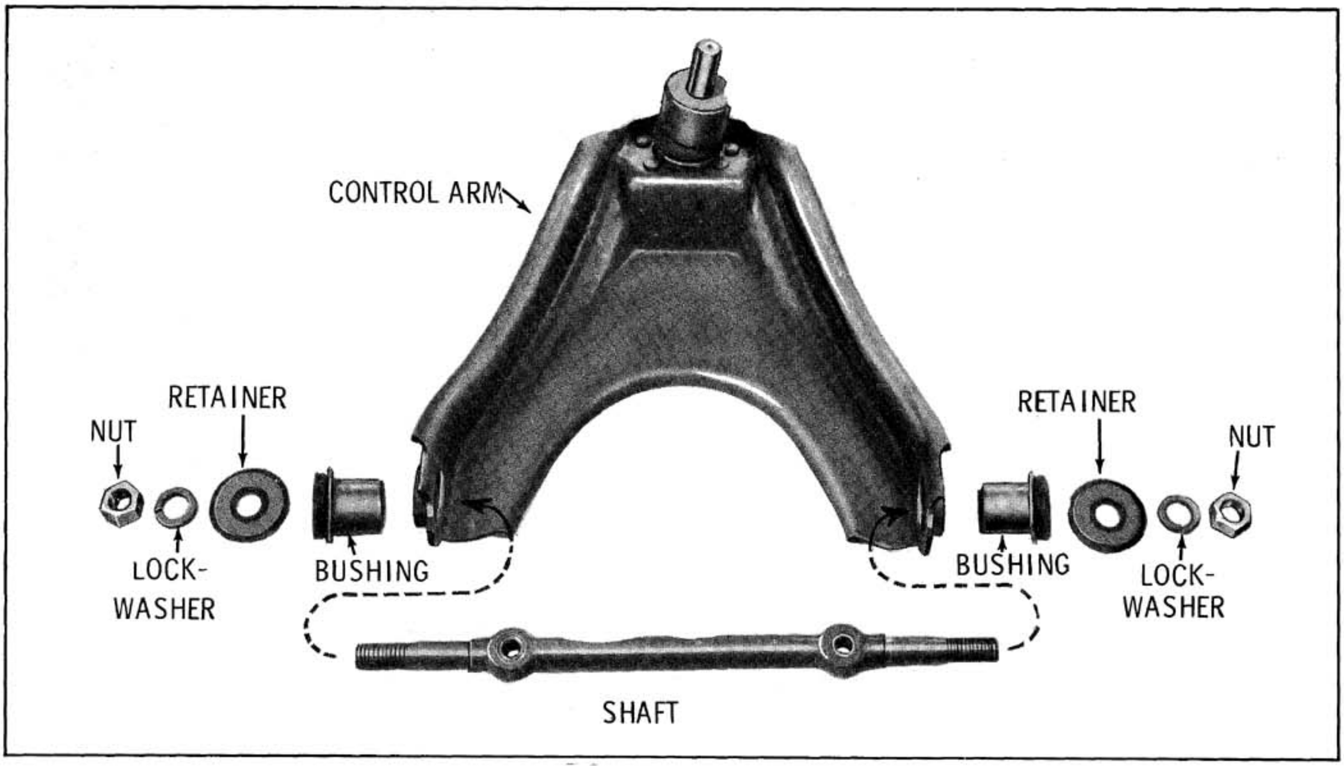


Fig. 9-15 Upper Control Arm Assembly

7. Assemble nuts and washers to ends of pivot shaft.

8. Install the upper control arm assembly on the car. With weight of car on the wheels torque pivot shaft nuts to 60 ft. lbs. Check front end alignment and adjust if necessary.

UPPER CONTROL ARM BALL JOINT AND/OR SEAL (CONTROL ARM REMOVED)

Remove and Install

1. Using a 1/8" drill, drill a hole 1/4" deep in the center of the rivets. (Fig. 9-18A)

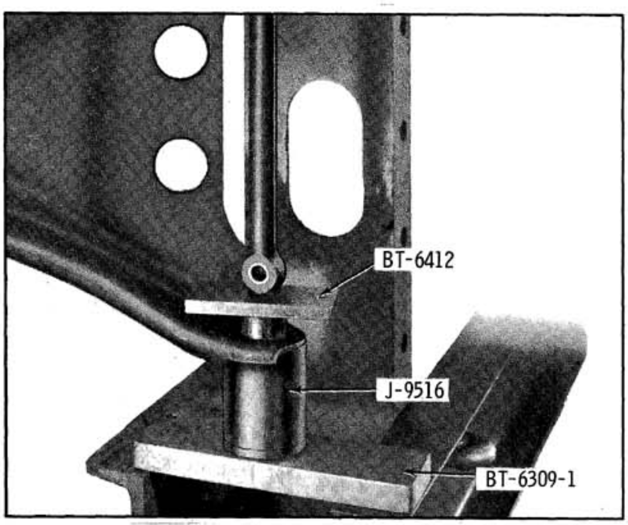


Fig. 9-16 Removing Upper Control Arm Bushings

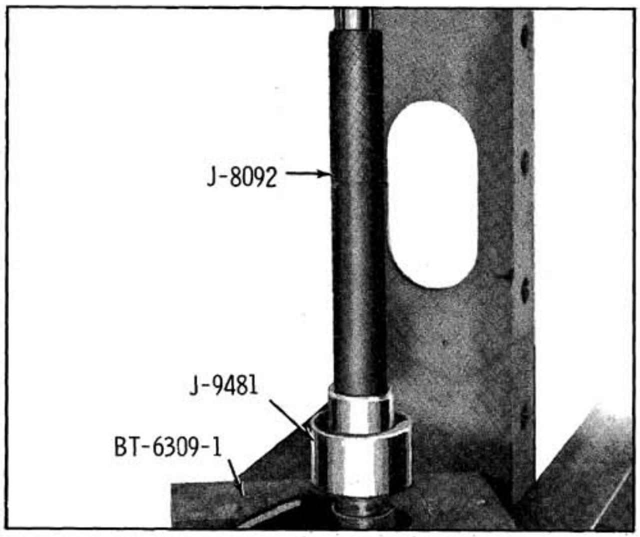


Fig. 9-17 Installing Upper Control Bushings

2. Using a 1/2" drill, drill the rivet heads just deep enough to remove the rivet head. (Fig. 9-18B)

3. Drive out the rivet.

4. Install a new ball joint and seal assembly into the control arm. Fasten with the bolts and nuts supplied with the parts package. Install bolts from bottom side of control arm. Torque nuts to 8 ft. lbs. (Fig. 9-19)

5. Install upper control arm on the car. Check front end alignment and adjust if necessary.

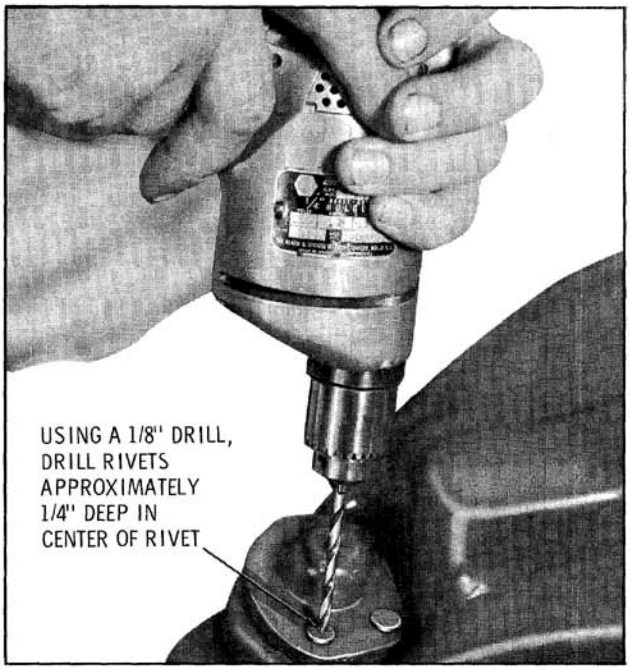


Fig. 9-18A Drilling Ball Joint Attaching Rivets

LOWER CONTROL ARM OR COIL SPRING

Removal

1. Raise front of car and support at frame with floor stands.
2. Remove wheel and tire assembly.
3. Disconnect stabilizer link.
4. Remove shock absorber.
5. Disconnect tie-rod end from steering arm.
6. Install Tool BT-6505 as shown in Fig. 9-20 and compress spring slightly to permit removal of lower control arm bushing bolts.

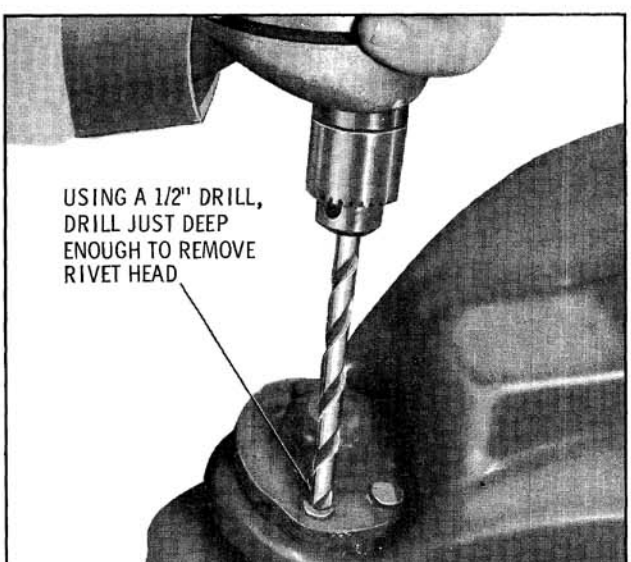


Fig. 9-18B Drilling Ball Joint Attaching Rivets

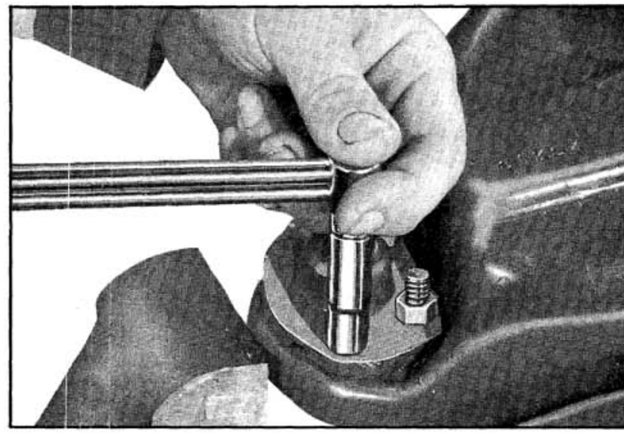


Fig. 9-19 Installing Upper Ball Joint

Leave ball joints connected to steering knuckle.

7. Release spring tension by slowly unwinding tool. After tension is released, remove tool, then remove spring from control arm.
8. If lower control arm is to be removed, proceed as follows:
   a. Remove the cotter pin from the ball joint stud and clean the threads of the stud.
   b. Loosen the lower ball joint nut and loosen ball joint with Tool J-8806.
   c. Expand Tool J-8806 until the stud breaks loose from the knuckle.
   d. Remove tool and nut, then remove lower control arm from the car.

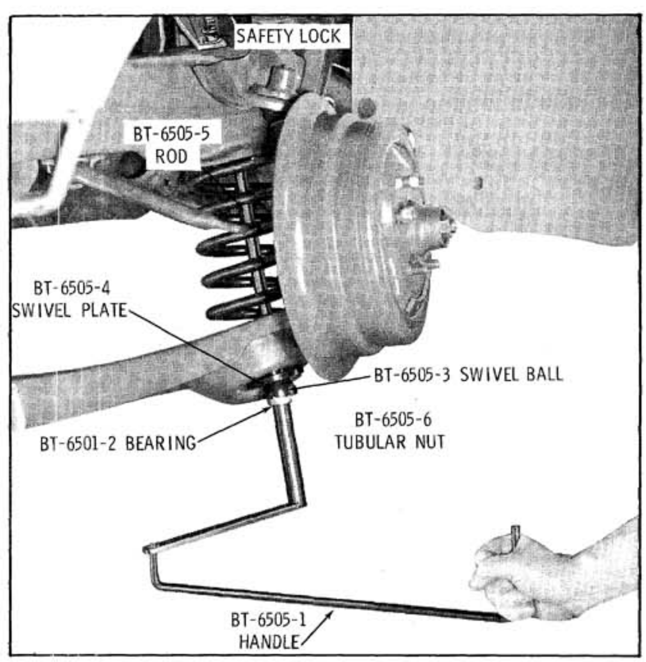


Fig. 9-20 Front Coil Spring Compressor

IMPORTANT: The left and right coil springs should not be interchanged. The coil spring part number is taped on the top coil of the spring.

Installation

NOTE: If lower control arm was removed, install control arm ball joint stud in steering knuckle and torque to 70 ft. lbs. (minimum) and install cotter pin. Tighten further if necessary to install cotter pin. Bend cotter pin to side of nut, not over top so it will not contact speedometer cable.

1. Position spring against pilot in frame and in lower control arm.
2. Install Tool BT-6505 and compress spring until lower control arm bushing bolts can be installed. (Fig. 9-20)

   NOTE: Do not torque bolts at this time. Bolts are to be torqued with weight of car on the wheels.

3. Remove tool and install shock absorber, stabilizer link, tie-rod end and wheel and tire assembly.
4. Remove floor stands and lower car.
5. Torque lower control arm bushing bolts and nuts to 85 ft. lbs.

LOWER CONTROL ARM BUSHING REPLACEMENT

Remove and Install

1. Raise front of car and support by frame with floor stands.
2. Remove wheel and tire assembly.
3. Disconnect stabilizer link.
4. Disconnect tie-rod end from steering arm.
5. Remove shock absorber.
6. Install Tool BT-6505 as shown in Fig. 9-20 and compress spring slightly to permit removal of lower control arm bushing bolts. Leave ball joint connected to steering knuckle.
7. Relax spring tension by slowly removing Tool BT-6505 until lower control arm is low enough to install Bushing Removing Tool J-21474-16. Remove bushing as shown in Fig. 9-21. Install bushing as shown in Fig. 9-22.

   NOTE: Bushings should bottom against control arm.

8. Reverse disassembly procedure to install control arm.

   NOTE: Lower control arm bushing bolts must be torqued with weight of car on wheels.

BALL JOINT SEALS (LOWER REPLACEMENT)

The ball joint seals can be installed with the control arm either on or off the car.

1. Raise car and support with floor stands under lower control arm between spring seat and ball joint. Remove wheel assembly.
2. Clean exterior of ball joints.
3. For Saginaw joints, cut seal retaining ring from ball joint. For Inland joints, pry seal off ball joint and discard seal assembly. (Figs. 9-23A and 9-23B)

   NOTE: Saginaw ball joint seals use a keystone clamp retainer to hold the ball joint seals in place.

   CAUTION: Exercise care while performing the following operations to prevent entry of dirt into the ball joints.

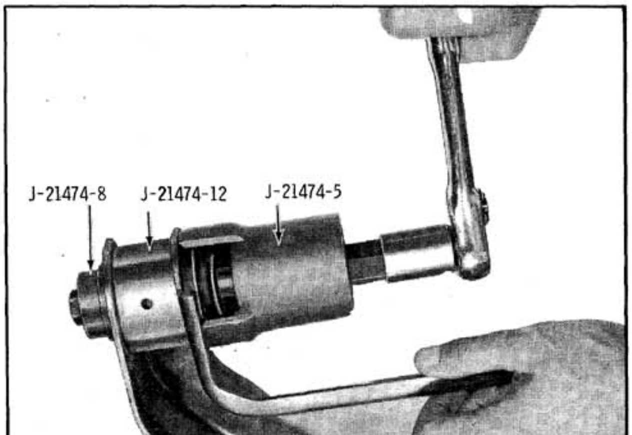


Fig. 9-21 Removing Lower Control Arm Bushings

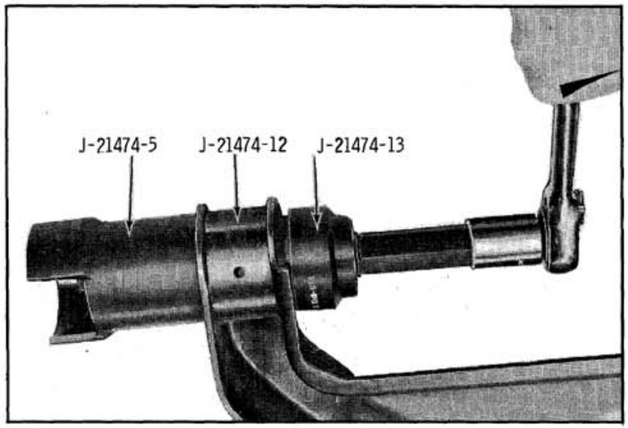


Fig. 9-22 Installing Lower Control Arm Bushings

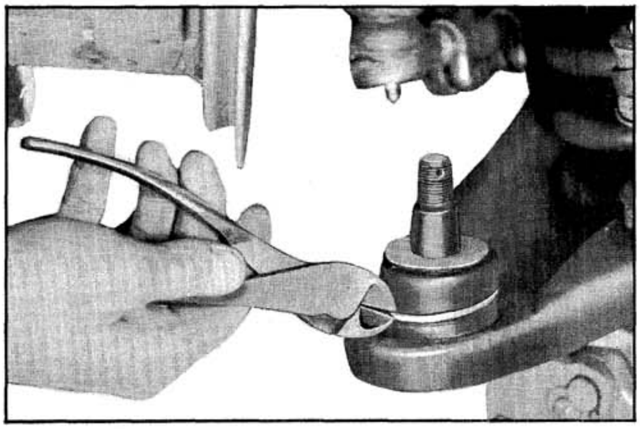


Fig. 9-23A Removing Ball Joint Seal Clamp

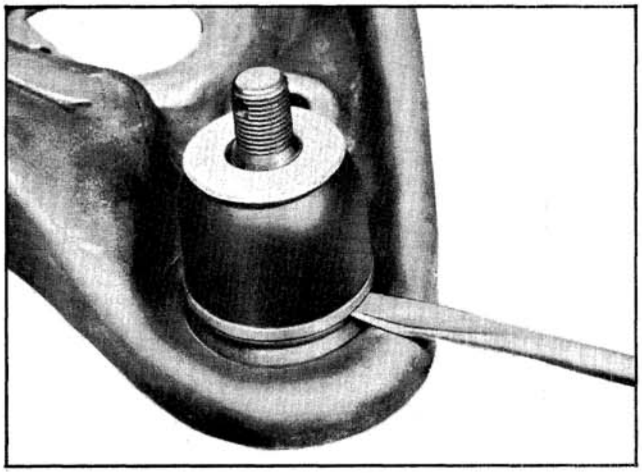


Fig. 9-23B Removing Ball Joint Seal

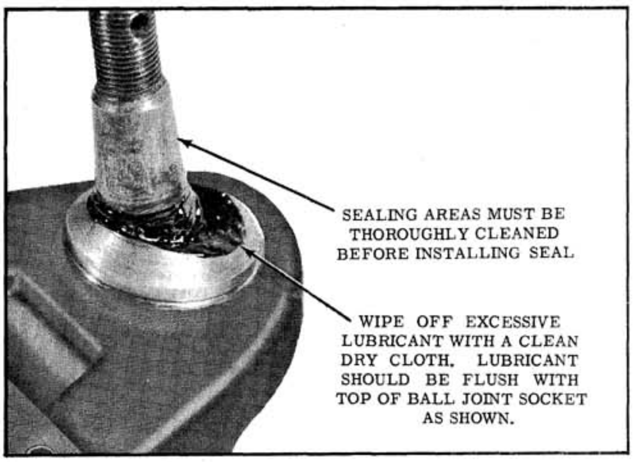


Fig. 9-24 Ball Joint Prior to Seal Installation

4. Clean joint pivot and stud thoroughly and wipe out as much old grease as possible.

5. Remove plug from ball joint and install grease fitting.

6. Lubricate ball joint with Multi-Purpose Chassis Lubricant until clean grease completely fills the ball joint reservoir. (Figs. 9-24 and 9-25)

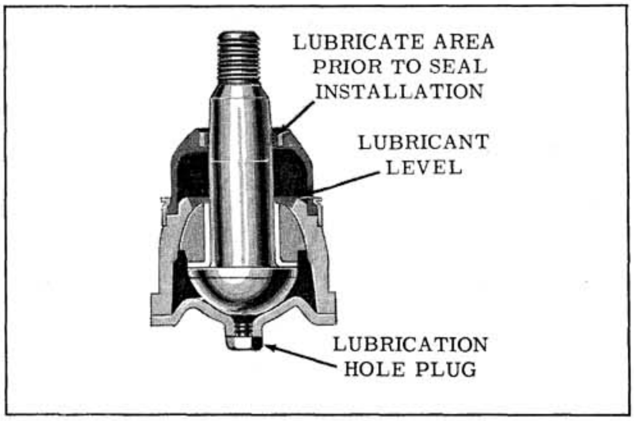


Fig. 9-25 Ball Joint Assembly

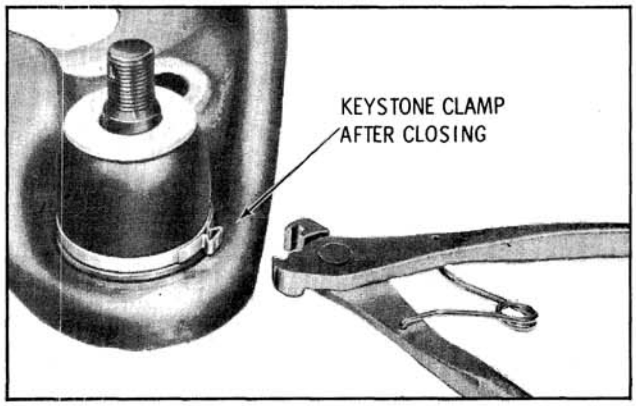


Fig. 9-26 Keystone Clamp Installation

7. Remove grease fitting and install plug in ball joint. Clean grease from ball joint stud and sealing area of joint with a clean dry cloth. (Fig. 9-24)

8. Apply a thin film of grease to outside area of new Inland seal to aid in installation of Tool J-8761 when installing Inland seal.

9. The saw-tooth area of the seal that fits around the ball stud should be coated with grease. (Fig. 9-25)

10. For installation of Saginaw type seal, place seal on ball joint and install keystone clamp as shown in Fig. 9-26.

    For installation of Inland type seal, place seal inside of Seal Installing Tool J-8761, then drive seal onto ball joint as shown in Fig. 9-27. Make sure that seal is driven on squarely without cocking.

11. Connect the lower ball joint to the steering knuckle.

12. Torque lower stud nut to 70 ft. lbs. and install cotter pin. Tighten further, if necessary, to install cotter pin. Bend cotter pin to side of nut, not over top so it will not contact speedometer cable.

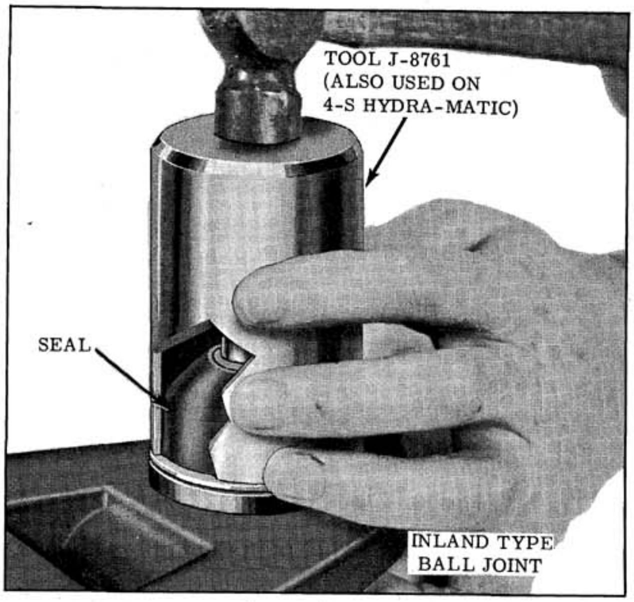


Fig. 9-27 Installing Inland Type Seal

13. Install wheel assembly and remove floor stands.

LOWER CONTROL ARM BALL JOINT REPLACEMENT

1. Raise front of car, support outboard end of lower control arm with floor stand and remove wheel assembly.

2. Disconnect lower ball joint from steering knuckle using Tool J-8806.

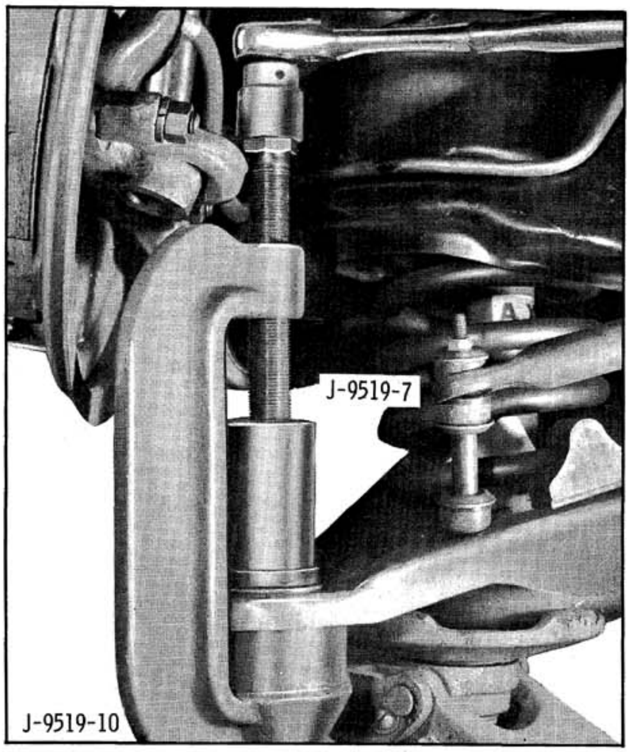


Fig. 9-28 Removing Lower Ball Joint

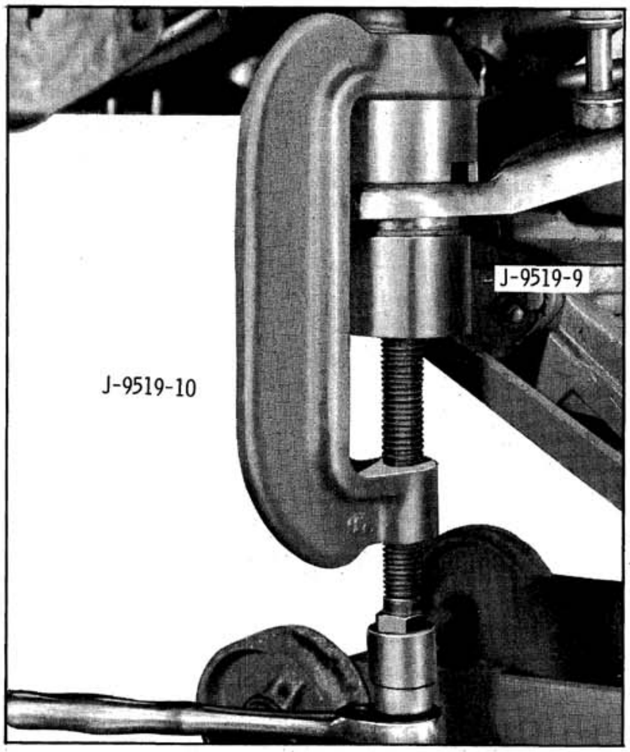


Fig. 9-29 Installing Lower Ball Joint

3. Block steering knuckle, backing plate and hub and drum assembly away from the lower control arm to obtain accessibility.

4. Remove ball joint seal and press ball joint from control arm as shown in Fig. 9-28.

5. Install new ball joint assembly as shown in Fig. 9-29.

6. Reassemble suspension and torque ball joint stud nut to 70 ft. lbs. (minimum) and install cotter pin. Bend cotter pin to side of nut, not over top.

STEERING KNUCKLE

Remove

1. Raise front of car and support lower control arms with floor stands.

   NOTE: Since the weight of the car is used to relieve the spring tension from the knuckle, the floor stands must be positioned between the spring seats and ball joint of the lower control arm for maximum leverage.

2. Remove front wheel, hub and drum assembly.

3. Disconnect speedometer cable from steering knuckle, if so equipped.

4. Remove backing plate without disconnecting brake hose. Leave steering arm connected to tie-rod end.

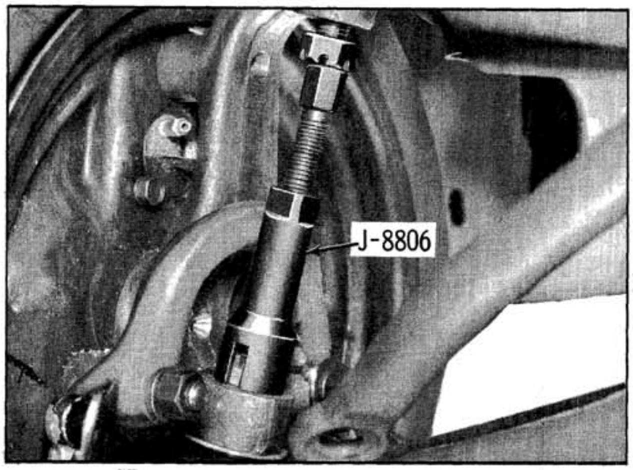


Fig. 9-30 Loosening Upper Ball Joint

NOTE: Support the backing plate assembly out of the way to avoid any strain on the brake hose.

5. Disconnect the control arm ball joints from the steering knuckle as outlined under CONTROL ARM REMOVAL. (Fig. 9-30)

6. Remove steering knuckle from car.

Install

1. Connect the upper and lower ball joints to the steering knuckle.

2. Torque upper stud nut to 40 ft. lbs., lower stud nut to 70 ft. lbs. and install cotter pins. Tighten further, if necessary, to install cotter pin.

   NOTE: A screwdriver slot is provided in the lower ball stud as a means of preventing the stud from turning when tightening ball joint stud. Bend cotter pin to side of nut, not over top, so there is room for speedometer cable.

3. Install a new backing plate gasket on the steering knuckle.

4. Install backing plate and steering arm to steering knuckle. Use new locking plate and torque backing plate anchor pin bolt to 145 ft. lbs. on all except 52 series and 105 ft. lbs. on 52 series. Torque backing plate to arm and knuckle nuts to 140 ft. lbs.

5. Connect speedometer cable to steering knuckle, if so equipped.

6. Install wheel and hub and drum assembly. Refer to WHEEL BEARING ADJUSTMENT for correct procedure.

7. Lower car.

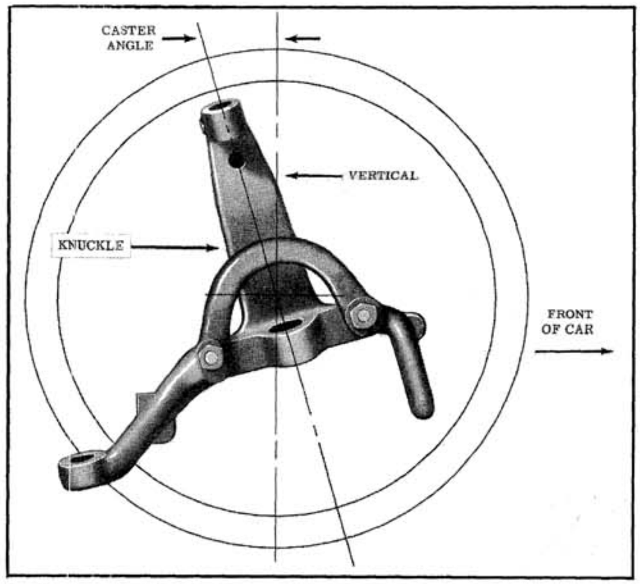


Fig. 9-31 Front Wheel Caster

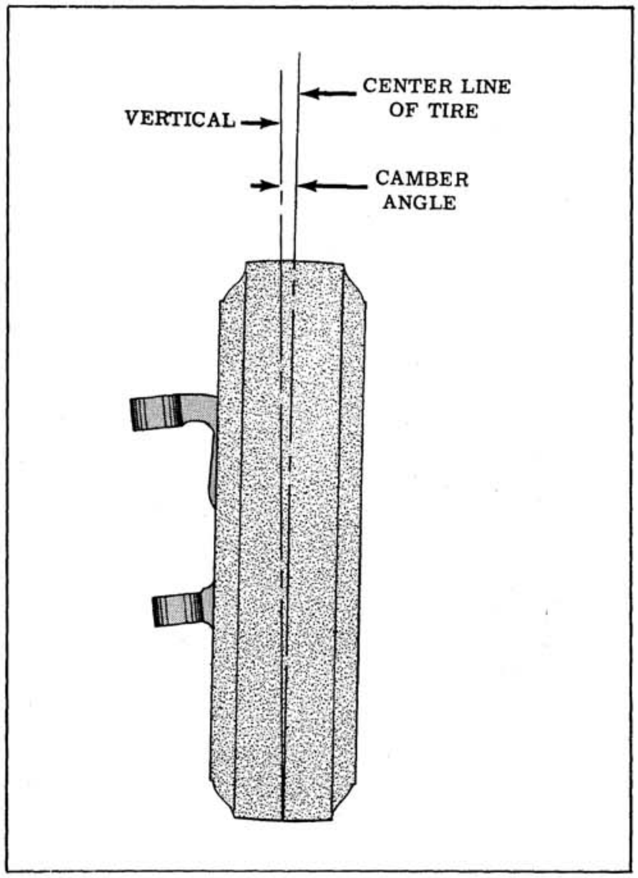


Fig. 9-32 Front Wheel Camber

8. Check camber, caster and toe-in and adjust if necessary.

WHEEL ALIGNMENT

The front wheel alignment factors are:

1. CASTER (Fig. 9-31)

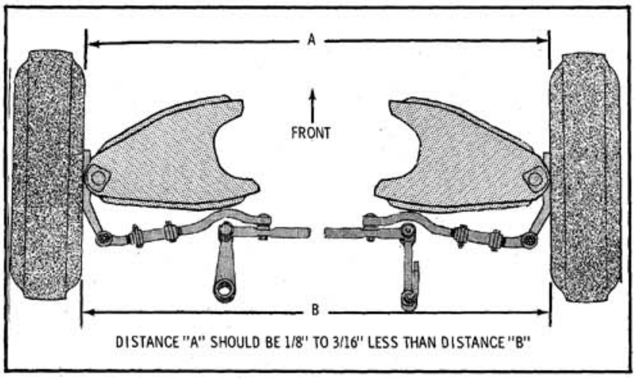


Fig. 9-33 Front Wheel Toe-In

2. CAMBER (Fig. 9-32)

3. TOE-IN (Fig. 9-33)

4. TOE-OUT (STEERING GEOMETRY) (Fig. 9-34)

Before any attempt is made to check or correct caster, camber, toe-in or toe-out, the following preliminary checks and necessary corrections should be made on those parts which influence the steering of the car.

1. Inflate tires to recommended pressure.

2. Check front wheel bearings and steering gear for proper adjustments.

3. Check front wheel and tire assemblies for radial and lateral runout.

4. Grasp front bumper in center and raise and lower front end several times to allow car to come to its normal level. Check for erratic shock absorber action.

The method of checking alignment will vary depending on the type of equipment being used. The instructions furnished by the manufacturer of the equipment should be followed.

NOTE: Check front wheel alignment without passengers or load in or on car and with car doors closed, as the addition of load or shifting of weight will result in incorrect alignment. Camber angle of the right and left wheels should be within 1/2° of each other for best handling characteristics.

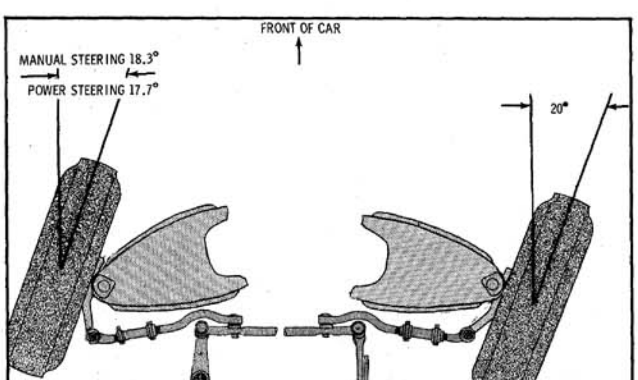


Fig. 9-34 Front Wheel Toe-Out

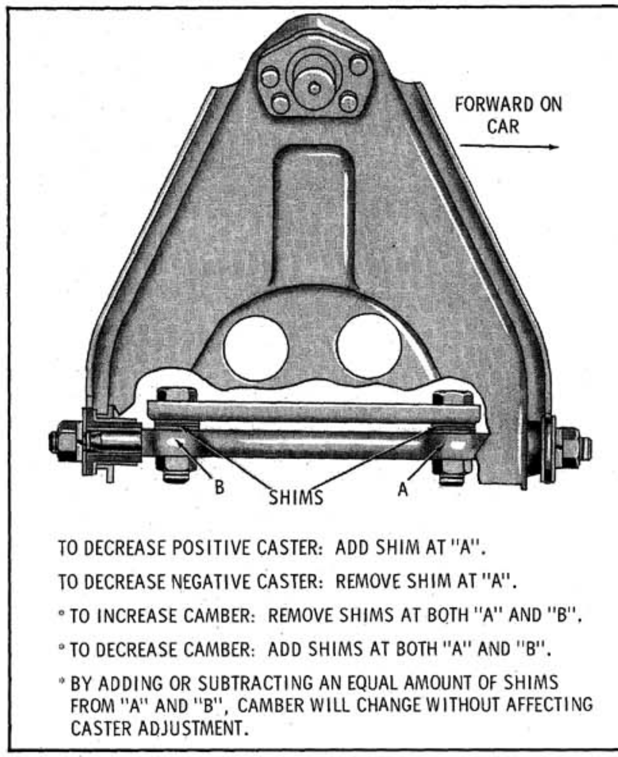


Fig. 9-35 Caster and Camber Adjustments

CASTER AND CAMBER ADJUSTMENT (Caster—½° to—1½°) (Camber—¼° to+½°)

Camber and caster are adjusted by shims placed between the upper pivot shafts and the frame. (Fig. 9-35) Both caster and camber adjustments can be made at the same time after the wheel alignment checks have been completed.

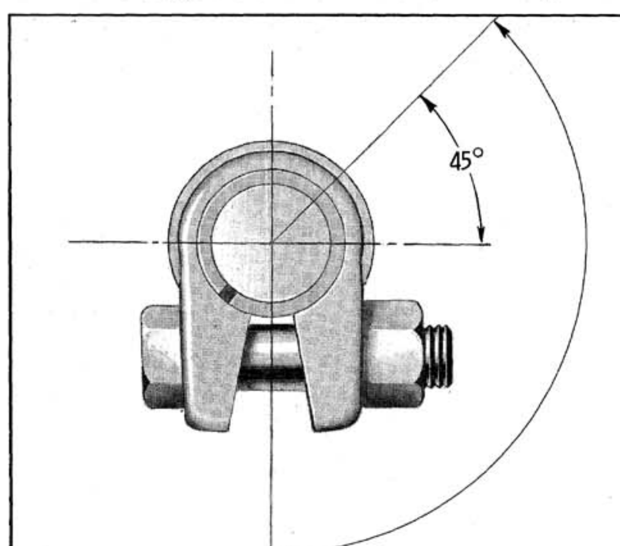


Fig. 9-36 Tie Rod Clamp Positioning

Loosen the pivot shaft to frame nuts. In order to remove or install shims, do not remove weight from the front wheels. The attaching bolts are splined into the frame and should not be turned.

Refer to the shim chart to determine the amount of shims necessary to correct the adjustment. After the correct number of shims have been installed, torque the pivot shaft mounting nuts 75 ft. lbs. and recheck caster and camber.

Shim Thickness	One shim added to or subtracted from BOTH BOLTS will change camber	One shim added to or subtracted from FRONT BOLT ONLY will change caster
.030"	1/8°	1/8°
.060"	5/16°	7/16°
.120"	5/8°	7/8°

TOE-IN ADJUSTMENT (⅛" to 3/16") (Fig. 9-33)

1. Loosen the clamp bolts at each end of the steering tie-rod adjustable sleeves.

2. With steering wheel set in straight ahead position, turn tie-rod adjusting sleeves to obtain the proper toe-in adjustment.

3. When adjustment has been completed according to the recommended specification, and tie-rod and ball studs are riding squarely in their seats, position inner clamps as shown in Fig. 9-36.

TOE-OUT (STEERING GEOMETRY) (Fig. 9-34)

To check, turn wheels to right until right wheel has been turned 20° from straight ahead position. Left wheel setting should be 18.3° without power steering and 17.7° with power steering. Then follow same procedure with wheels turned to the left.

Errors found are usually due to bent steering arms or incorrect caster, camber or toe-in. If error is due to bent steering arm, replacement with new arm should be made. When replacements of this kind are made, it is important that other front end parts are checked and front wheels realigned.

DIAGNOSIS

WHEEL BEARING NOISE

Wheel bearing noise may be confused with rear axle noise; however, front wheel bearing noise does not change when comparing "pull" and "coast". A bad bearing will cause a knock or click approximately every two revolutions of the wheel. To determine which wheel bearing is noisy, hoist the car and spin each wheel while listening at the hub cap.

HARD STEERING

Cause:

1. Low or uneven tire pressure.

2. Steering gear adjusted too tight.

3. Insufficient or incorrect steering gear lubricant used.

4. Improper caster.

5. Upper or lower control arms bent.

6. Frame bent or broken.

7. Steering knuckle bent.

EXCESSIVE PLAY OR LOOSENESS IN STEERING SYSTEM

Cause:

1. Steering gear adjusted too loosely or worn linkage.

2. Control arm ball joints worn.

3. Front wheel bearings worn or incorrectly adjusted.

4. Loose front stabilizer link or worn bushings.

ERRATIC STEERING ON APPLICATION OF BRAKE

Cause:

1. Low or uneven tire pressure.

2. Incorrect or uneven caster.

3. Steering knuckle bent.

4. Loose steering linkage or suspension.

5. Dirt or grease on brake lining.

FRONT WHEEL SHIMMY

Cause:

1. Uneven tire pressure.

2. Steering linkage worn.
3. Front wheel bearings worn or incorrectly adjusted.
4. Shock absorbers worn or inoperative.
5. Control arm ball joints worn.
6. Toe-in incorrect.
7. Incorrect or uneven caster.
8. Steering knuckle bent.
9. Wheels, tires or brake drums out-of-balance.
10. Excessive runout of wheels or tires.

CAR PULLS TO ONE SIDE

Cause:

1. Low or uneven tire pressure.
2. Rear wheels not tracking equally with front wheels.
3. Shock absorbers worn or inoperative.
4. Toe-in incorrect.
5. Incorrect or uneven caster or camber.
6. Frame or framemember bent or broken.

WORN TIRE TREAD EDGES

Cause:

1. Improper front end alignment.
2. High speed driving on curves.
3. Steering knuckle bent.
4. Steering plain arm bent.
5. Low tire pressure.

SCUFFED TIRES

Cause:

1. Tires improperly inflated.
2. Wheels or tires out-of-true.
3. Control arm ball joints worn.
4. Toe-in incorrect.
5. Uneven caster.
6. Incorrect toe-out on turns.
7. Steering gear incorrectly adjusted.
8. Eccentric or bulged tires.

FRONT OR REAR WHEEL TRAMP

Cause:

1. Wheels, tires or brake drums out-of-balance.
2. Shock absorbers worn or inoperative.
3. Loose or worn front wheel bearings.

CAR WANDERS

Cause:

1. Low or uneven tire pressure.
2. Steering gear adjusted too loosely or worn linkage.

REAR SUSPENSION

DESCRIPTION (Fig. 9-37)

The rear suspension is of the link-type with coil springs. It uses four suspension arms that attach the rear axle assembly to the frame. A bracket on the axle supports the coil spring, the top of which is positioned under the frame rail. The upper arms are attached to the top of the differential and extend forward to the frame. Two shock absorbers are attached to the frame and to brackets on the axle housing.

REAR SHOCK ABSORBER

A slight amount of fluid may bleed by the rod seal in cold weather and deposit a light film on the upper area of the shock absorber. This condition will not impair operation and should be considered normal. A shock absorber should never be checked horizontally or with the rod extension down.

For a complaint of a defective or noisy shock absorber, first check the mounting torque. If mounting is satisfactory, disconnect the lower mountings and pump the shock absorber by hand in a vertical position. Compare both shock absorbers. If both shocks respond the same, it is unlikely that a defective shock absorber exists.

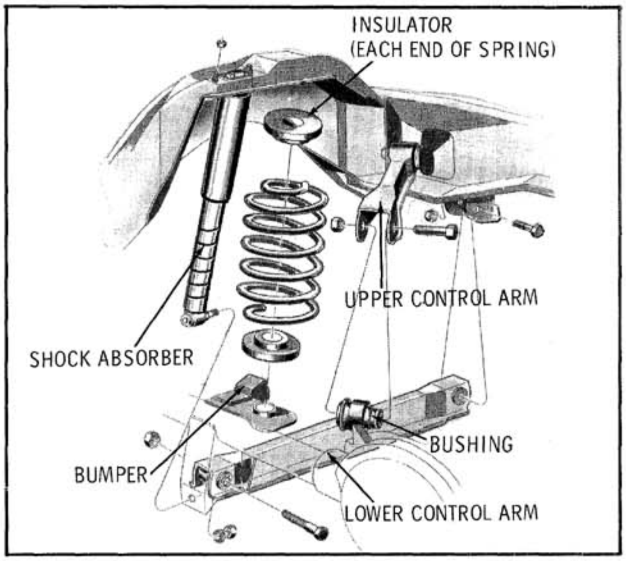


Fig. 9-37 Rear Suspension

THUMP NOISE

A thumping noise usually occurs when a shock absorber is changing its direction of stroke.

1. The shock absorber should be pumped with a rapid change of stroke. If lag is felt when changing stroke, this unit will be noisy.
2. Completely extend the shock absorber and pull hard. If spring tension is felt, this shock absorber will be noisy and should be replaced.

SQUEAKY OR REED TYPE NOISE

Hand pump the shock absorber at different rates of speed. If noise is heard that changes from a deep grunt to a high-pitched squeak, the shock absorber needs replacement.

NOTE: A squeaking noise could be attributed to seals. This is particularly true if the shock has been inoperative for a period of time. This noise will disappear after a few strokes of the shock absorber and is not a cause for rejection.

Remove and Install

1. Remove shock absorber lower mounting nut at axle housing lower suspension arm bracket.
2. Remove shock absorber upper attaching bolts from frame and remove shock absorber.

To install, loosely assembly shock absorber at both ends; then torque lower stud nut to 60 ft. lbs. and the upper bolts and nuts to 24 ft. lbs.

UPPER SUSPENSION ARMS

Removal

1. Remove nut from rear arm to differential housing bolt and while rocking differential remove the bolt.
2. Remove front rear arm attaching nut and bolt.
3. Remove suspension arm and inspect bushing for damage.

Installation

To install, reverse removal procedure. Torque bolt and nuts to 85 ft. lbs.

CAUTION: Whenever a suspension arm is installed, torque the attaching bolts to 85 ft. lbs. with the car resting at normal carrying height.

LOWER SUSPENSION ARM

1. Raise car and support under axle housing.
2. Remove rear arm to axle housing bracket bolts.
3. Remove front arm to bracket bolts and remove lower control arm.

Installation

To replace arm, reverse the removal sequence of operations. Torque arm attaching bolts and nuts to 85 ft. lbs. with the weight of the car on the rear springs.

BUSHINGS

The bushings in the differential carrier are replaceable. The bushings in the suspension arms can only be serviced by replacing the complete arms.

The bushing in the differential carrier can be replaced as follows:

1. Raise car and support under frame, lower axle housing until proper clearance is obtained.
2. Disconnect upper arm at differential and hold it up and out of the way.
3. Position tools as shown in Fig. 9-38 and remove bushing.
4. To install the bushing, reverse the tool as shown in Fig. 9-39 and pull bushing into position. Connect the upper suspension arms. Install bolt and torque nut to 85 ft. lbs.

COIL SPRINGS

Removal

1. Disconnect shock from lower bracket.

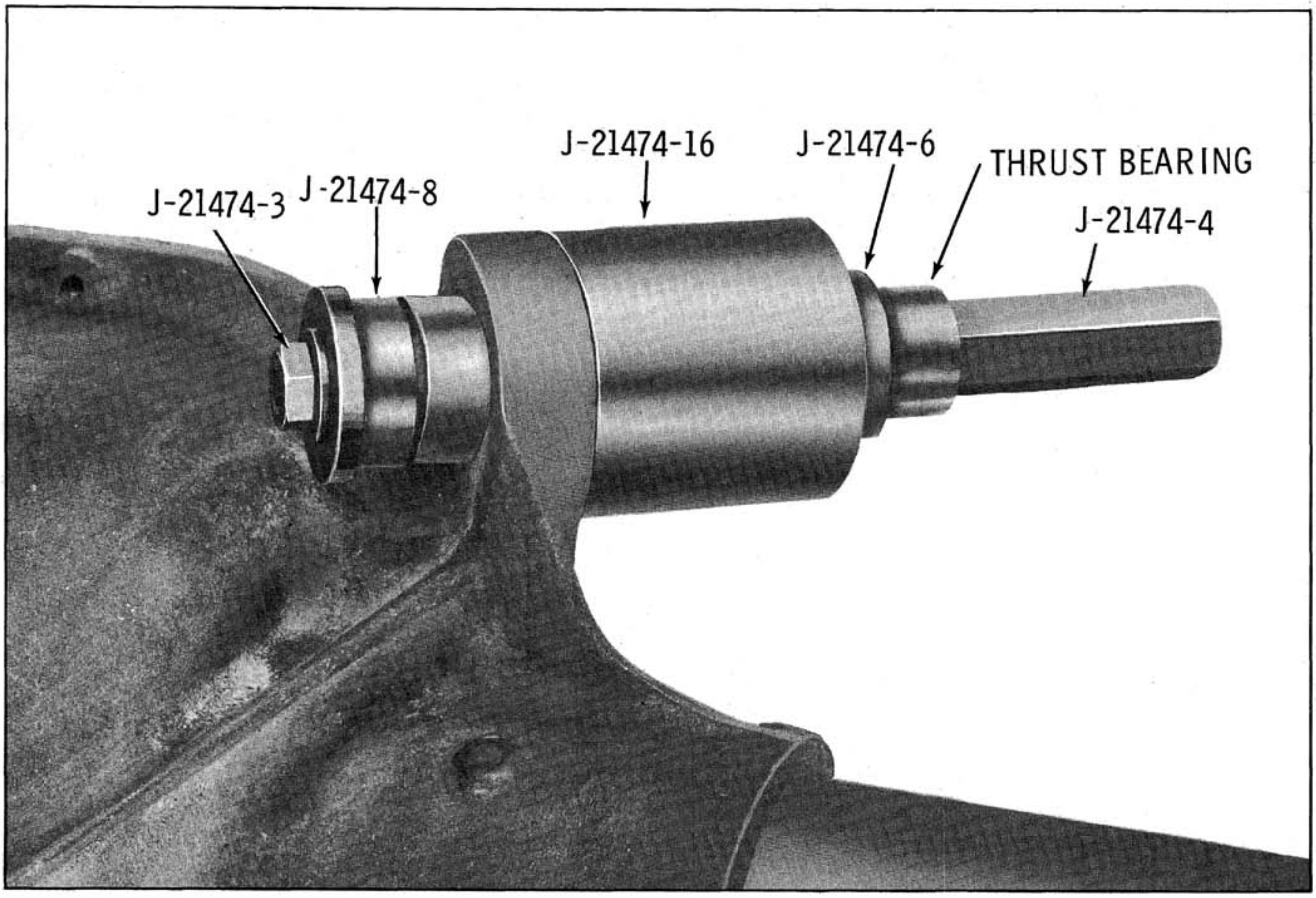


Fig. 9-38 Removing Upper Arm Rear Bushing

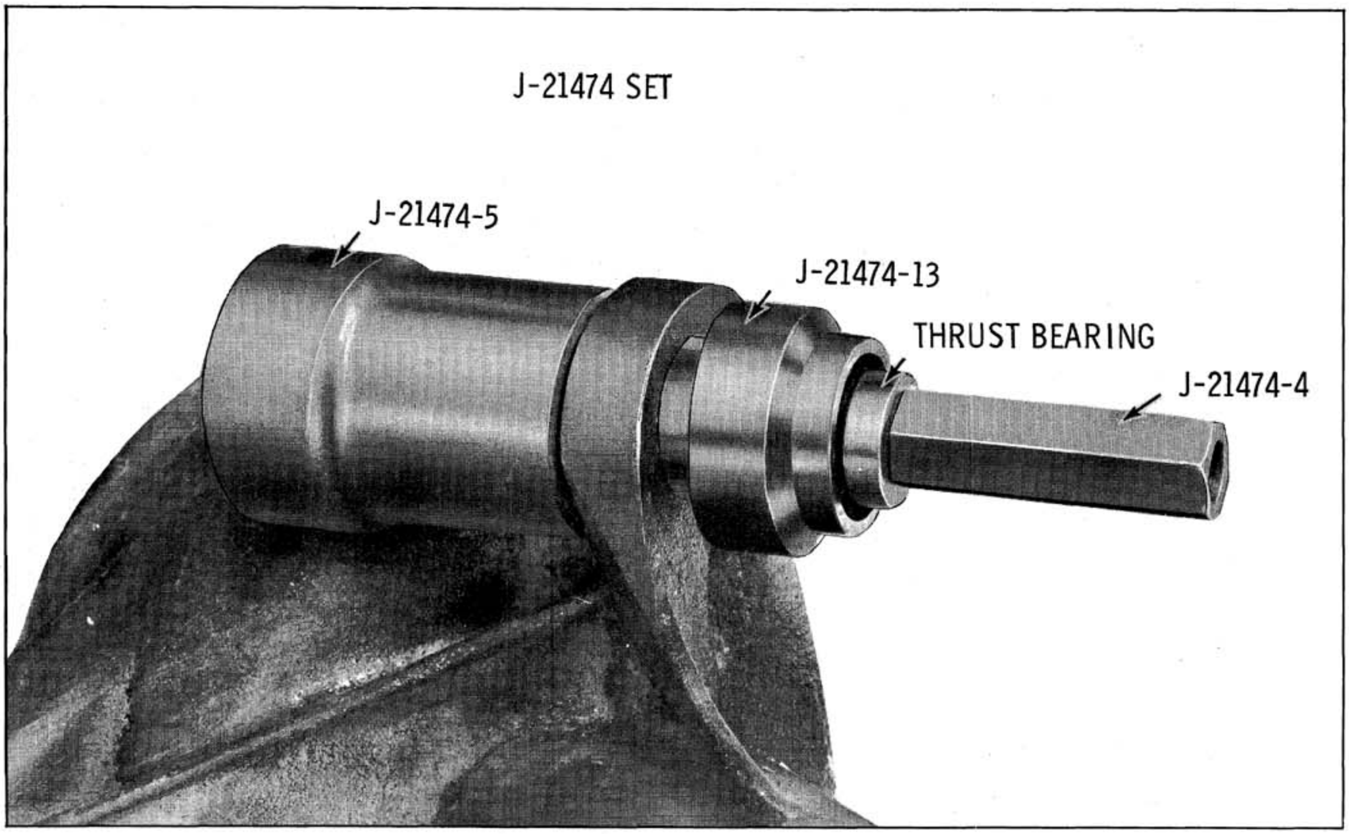


Fig. 9-39 Installing Upper Arm Rear Bushing

2. Lift car at rear by frame rail. This will allow suspension to drop far enough to remove the spring.

CAUTION: DO NOT STRETCH BRAKE HOSE.

Installation

1. Place coil spring in position. Be sure spring insulators are centered on pilots on axle housing and frame.

2. Lower car sufficiently to attach shock absorber to lower bracket. Torque shock absorber nut to 60 ft. lbs.

AXLE HOUSING

Removal

1. Disconnect shock absorber from lower bracket.

2. Disconnect propeller shaft, brake line and parking cable equalizer. Compress parking brake cable housing clamp and pull housing through lower suspension arm mounting bracket.

3. Slowly raise car at rear end and remove coil springs.

4. Disconnect the upper suspension arm from the differential and the lower suspension arms from the brackets on the axle housing.

This will separate housing assembly from the frame. If replacing the housing, the components may be changed following the procedure outlined for such units in their respective sections.

Installation

1. To install, reverse removal procedure. After installing the assembly, it will be necessary to bleed the rear wheel brake cylinders, check brake and parking brake adjustment.

BUMPER

The rear axle bumper is located on the top of the axle housing and is attached by snapping into a bracket on the axle housing. If found deteriorated or damaged, it must be replaced.

AXLE HOUSING ALIGNMENT

If rear tire wear indicates that the axle housing may be bent, the alignment can be checked as follows.

1. Back the car squarely onto an alignment machine.

2. Compensate for wheel runout the same as for checking front wheel toe-in.

3. Check camber reading which should be 1/4° negative to 1/2° positive.

4. Check the amount of toe-out which should be 0" to 1/16".

NOTE: Due to the fact that the car is backed onto an alignment machine, the actual toe-out will be read on the scale as toe-in. However, if the toe-out is checked with a tram gauge, disregard the aforementioned.

5. If a tram gauge is used for checking toe-out, it will still be necessary to perform Steps 1 and 2 in order to check camber.

The necessary straightening operations may be performed using frame straightening equipment without removing the axle housing from the car. This procedure will allow checks during the straightening operation to determine when the housing is within the prescribed limits.

WHEELS AND TIRES

DISMOUNTING TIRES

1. With wheel assembly removed, remove valve cap and core to deflate tires.

2. Use commercial type bead breaker to loosen tire sealing beads from rim.

CAUTION: DO NOT use tire irons for breaking beads from rim as this may damage beads.

3. After beads have been loosened, remove the outside bead from the rim with two tire irons.

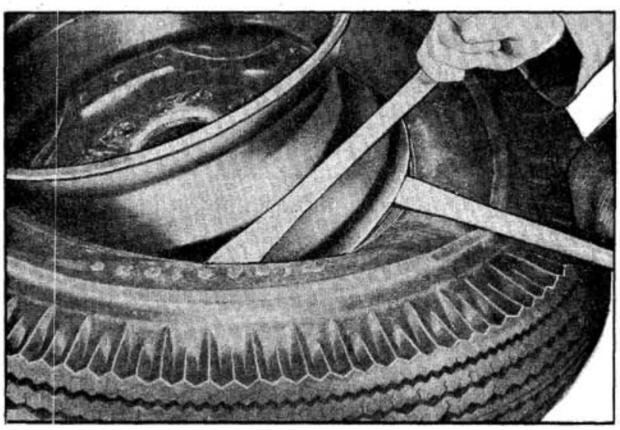


Fig. 9-40 Removing Tire

4. Turn the tire over and again use tire irons, one between the rim and bead to pry the rim out, the other to pry outward between the tire bead and rim as shown in Fig. 9-40.

VALVE REMOVAL AND REPLACEMENT (Tire Removed)

To remove a rubber snap-in valve from rim, force a small screwdriver blade between valve and edge of hole. Then, while prying on valve to start groove out of edge of hole, push the valve back through the rim.

IMPORTANT: To insure against air leaking around the valve, always use a new valve once a valve is removed from the rim.

The one piece snap-in type rubber valve is installed as follows:

1. Clean all particles of foreign matter from around the area and the edges of the valve hole in the rim with steel wool.

2. Lubricate the outside of the valve with water or a very light film of tire lubricating soap.

   IMPORTANT: DO NOT USE GREASE OR DRY SOAP AS IT WILL DETERIORATE THE RUBBER.

3. Insert the snap-in type rubber valve through the hole in rim as far as it will go, then pull the valve through the hole with a tire valve fishing tool until the valve snaps into position. (Fig. 9-41)

   NOTE: Do not attempt to drive the valve into position with a hammer or pull the valve with pliers as damage to the valve may result.

MOUNTING TIRES

Tire mounting machines or tire irons can be used, however, extreme care must be exercised to prevent injury to the sealing bead and circumferential bead when forcing tire over rim.

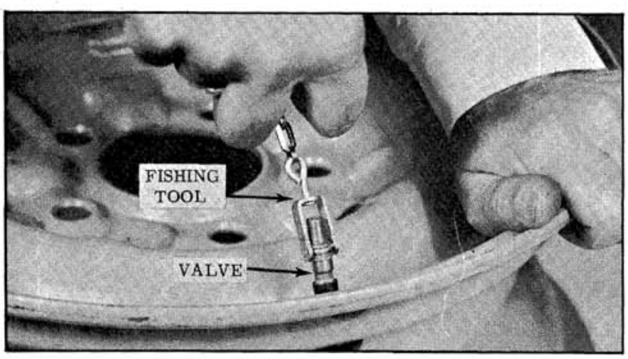


Fig. 9-41 Installing Valve

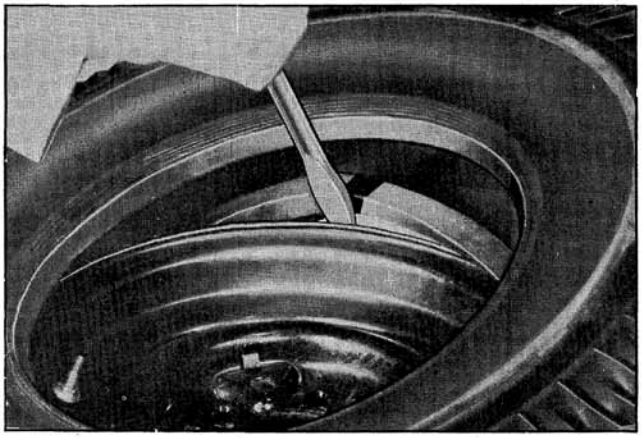


Fig. 9-42 Mounting Tire

1. If a new tire is to be mounted, remove the cardboard spacer.

2. Apply a light film of tire lubricating soap to sealing beads of tire.

   NOTE: DO NOT use excessive lubricant as this may lead to rim slippage and subsequent breakage of air seal.

3. Carefully mount inner bead in usual manner. If tire irons are used, take small "bites" around rim being careful not to injure the tire bead. (Fig. 9-42)

   CAUTION: DO NOT use a hammer, as damage to bead will result.

4. Install outer bead in the same manner.

Fig. 9-43 illustrates a tire mounting band slipped around the outside of the tire to compress center of tire tread to force bead out against the rim seat. A sash cord winched around a jack handle will serve the same purpose.

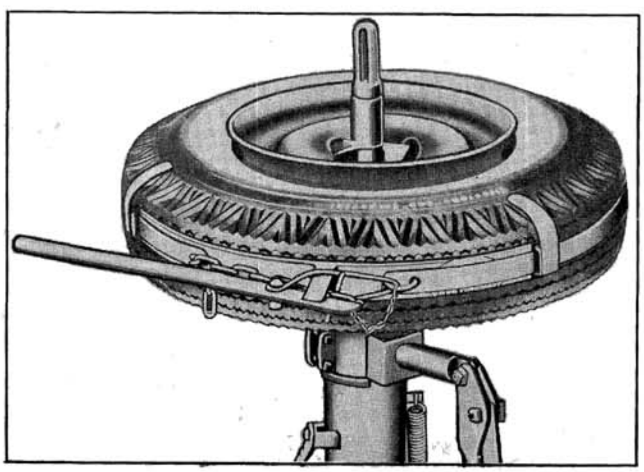


Fig. 9-43 Tire Mounting Band

5. While holding the tire in upright position, press against the outside of the wheel. This will start the outside bead onto the bead set.

6. Next, lean the tire so the weight of the wheel will help seat the inside bead.

7. Give a few quick "shots" of air to seat the tire beads on the bead seats.

   CAUTION: KEEP HANDS AWAY FROM TIRE BEAD RIM DURING THIS OPERATION.

8. Inflate tire to 40 pounds.

9. Check to be sure that the bead positioning rib (outer ring of tire) is visible evenly just above the rim flange all the way around tire, both sides.

10. Deflate to recommended air pressure.

TIRE INFLATION

Maintaining the correct inflation pressure is one of the most important elements in tire care.

For recommended tire pressure (tires cold) refer to chart in GENERAL INFORMATION section.

Too great a tire pressure is detrimental, but not so much as under inflation. Higher inflation pressure than recommended will cause:

1. A harder riding car.
2. A tire more susceptible to various types of bruises.
3. Tire chatter, resulting in uneven wear.
4. Excessive wear at the center of the tire tread.

Even when a tire is properly inflated, it is flat where it contacts the road so that the car at all times is in effect being pushed up hill. This condition is exaggerated on an under-inflated tire.

Inflation pressures lower than recommended will result in:

1. Higher gasoline consumption.
2. Rapid and uneven wear on the edges of the tire tread.
3. A tire more susceptible to rim bruises and various types of rupture.
4. Increased cord fatigue or broken tire cords.
5. Hard steering.

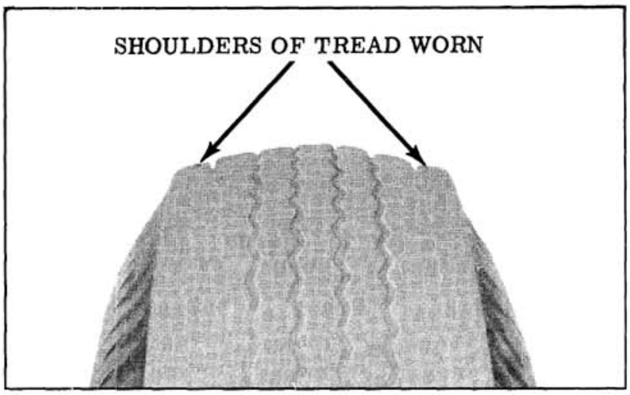


Fig. 9-44 Under Inflation Wear

6. High tire temperatures.
7. Car roll on sharp curves.
8. Tire squeal on curves.

TIRE NOISE

Complaints of axle noise are more frequently caused by tires than by differential gears, bearings, etc.

Tire noise is frequently diagnosed as axle noise. Tire noise is relative directly to the speed of the car and the road surface. Tests made for drive, float, and coast noise as used for differential testing will have little or no effect on noise level if tires are the cause.

VARIOUS TYPES OF TIRE WEAR

Under Inflation Wear

Under inflation results in abnormal wear of the tread shoulder, caused by the tires rolling on the shoulders with a wiping action. (Fig. 9-44)

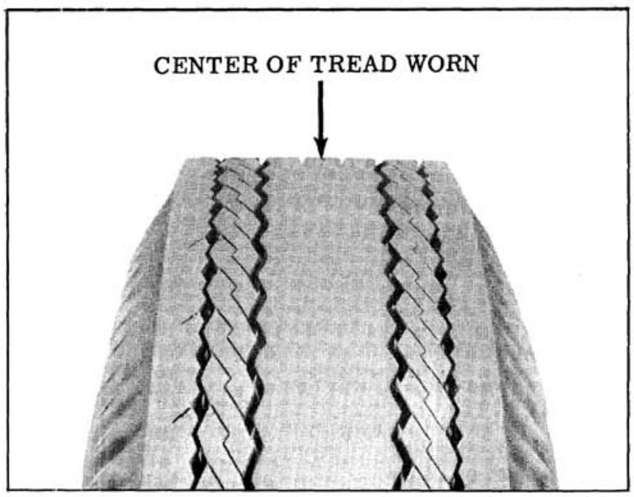


Fig. 9-45 Over Inflation Wear

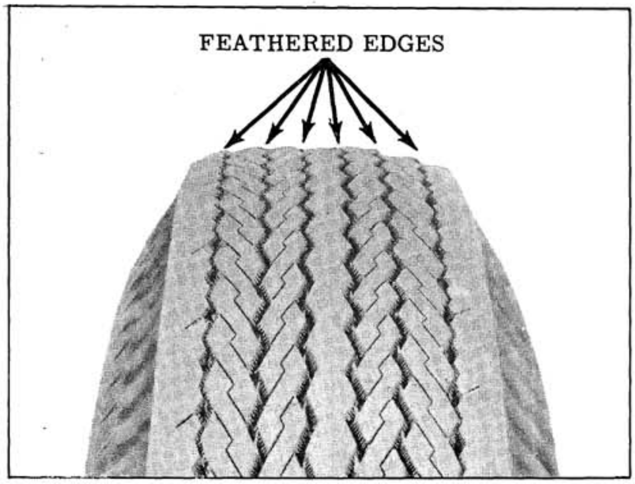


Fig. 9-46 Toe-In Wear

In addition, under-inflated tires are subjected to continual flexing, causing high internal temperatures and cracking of the sidewall.

Over Inflation Wear

Over inflation causes the center section of the tread to receive excessive driving and braking, therefore, the center section is worn more than the shoulders. (Fig. 9-45) An over-inflated tire is subject to breaks in the fabric from severe impacts and is more easily cut or punctured

Toe-in or Toe-out Wear

Excessive toe-in or toe-out has the effect of dragging the tires sideways down the road, which results in feathering the raised portions of the tread.

Improper toe-in is indicated by feather edges on the inner side of the tread. (Fig. 9-46) Toe-out is indicated by the feather edges on the outer side of the tread.

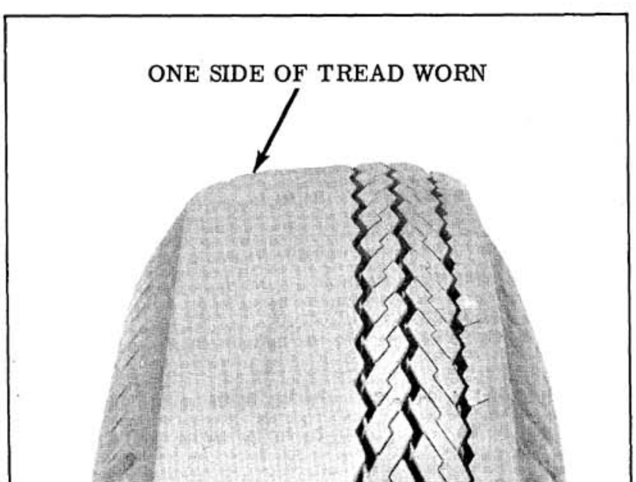


Fig. 9-47 Camber Wear

Camber Wear

Excessive positive camber will cause wear on the outer side of the tread. (Fig. 9-47) Excessive negative camber will cause wear on the inner side of the tread. Camber wear may also be evident if the car is driven continually on highly crowned roads.

Wear Due to Driver Habits

Owner driving habits may cause cornering wear, rear tire inside wear, and front tire heel and toe wear even though all wheel alignment factors are within specifications and tires are properly inflated.

Cornering wear, caused by high speeds on turns, is identified by the rounded shoulders of the tire and small rough abrasions and fins raised by cornering friction against the road. (Fig. 9-48)

Rear tire inside wear is caused by rapid acceleration which causes the axle to bend slightly in a horizontal plane to toe-in the rear tires. This results in excessive wear on the inner shoulders of the rear tires and is similar in appearance as camber wear. (Fig. 9-47)

Wear Due to Mechanical Conditions

Loose parts of the front suspension system such as worn ball joints, mountings of the upper and lower control arms, inoperative shock absorbers and unbalanced wheels and tires, will cause flat spots, cups, gouges and wavy wear. (Fig. 9-49)

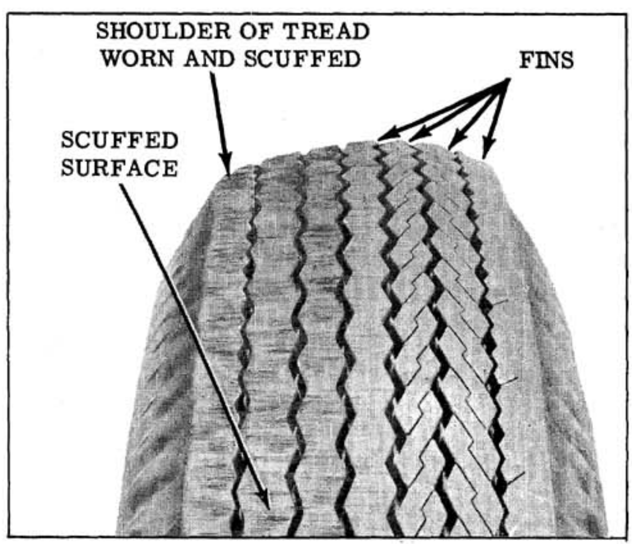


Fig. 9-48 Cornering Wear

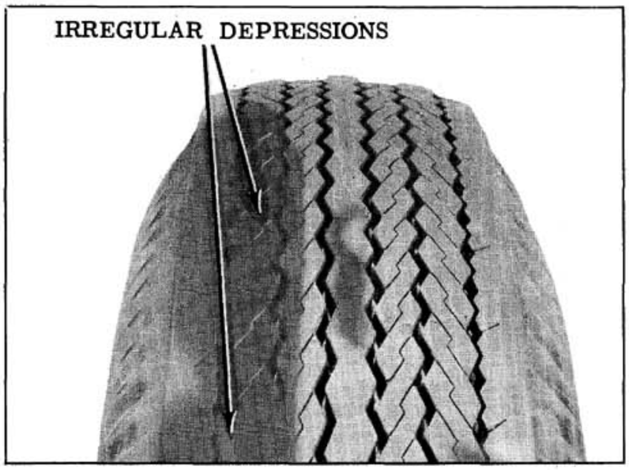


Fig. 9-49 Wear Due to Mechanical Conditions

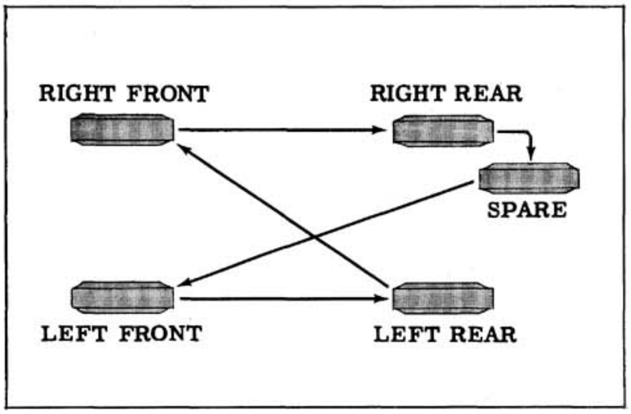


Fig. 9-50 Tire Rotation

TIRE ROTATION

In order to obtain maximum tire tread life and keep the spare tire from deteriorating due to lack of use, tires should be rotated at 6,000 mile intervals as shown in Fig. 9-50.

TIRE AND WHEEL RUNOUT

Wheel and tire assemblies may be checked for runout with a dial indicator at points shown in Fig. 9-51. Runout should not exceed the following limits:

Tire Runout:	Radial	.080"
	Lateral	.100"
Wheel Runout:	Radial	.035"
	Lateral	.045"

NOTE: Tire runout should be checked as soon as possible after car has been driven to avoid false readings due to the tendency of tires to take a temporary "set" after standing for a few hours.

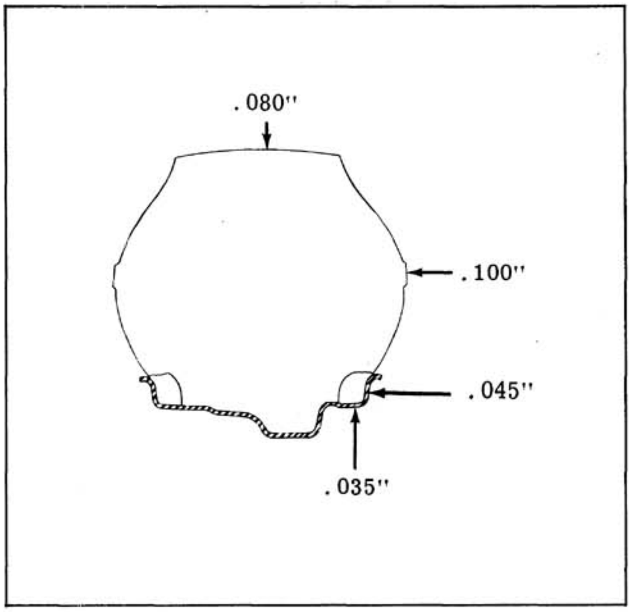


Fig. 9-51 Wheel and Tire Runnout Specifications

WHEEL AND TIRE BALANCE

Wheel, tire, and brake drum balance must be maintained within certain limits; otherwise, wheel tramp and high speed shimmy will result.

Front wheel tramp and front wheel shimmy are two entirely different conditions. Front wheel tramp, which usually occurs at high speed, is a wheel hop caused from an unbalanced condition of wheels, loose linkage in the front end, or improperly operating shock absorbers.

Shimmy may occur at the lower speeds and is a wobbly condition of the front wheels caused from an unbalanced condition, loose front end linkage, loose steering gear parts, or faulty steering gear adjustment. Tramp and shimmy will be felt in the whole car, however, shimmy can also be felt at the steering wheel. Shimmy is a front wheel condition entirely, whereas it is possible to have tramp in front or rear wheels.

Due to the irregularities in tread wear caused by sudden brake application, misalignment, low inflation pressure, or tire repair, etc., a wheel and tire assembly may lose its original balance. Consequently, if front end instability develops, the tire and wheel assembly should be checked for static and dynamic balance.

SPECIFICATIONS

FRONT SUSPENSION

1. Caster Angle (Degrees)	-1/2° to -1-1/2°
2. Camber (*Degrees)	-1/4° to +1/2°
3. Toe-In	1/8" to 3/16"
4. Toe-Out on Turns	
Manual Steering	20° = 18.3°
Power Steering	20° = 17.7°
5. Ball Joint Inclination	11°
6. Tread Width, Front Wheels**	
52 Series	61.36"
54 through 86 Series	62.50"

*Maximum camber variation between either side of the car should not exceed 1/2°.
**Measured from center of tires.

REAR SUSPENSION

1. Rear Axle	
a. Tread*	63"
b. Road clearance at differential - 54 through 86 Series	7.5"
Road clearance at differential - 52 Series	7.0"
c. Allowable out-of-true of housing on the vertical (at rear wheels)	1/4° neg. to 1/2° pos. camber
d. Allowable out-of-true of housing on the horizontal (at rear wheels)	1/16" to 3/16" toe-out
2. Carrying Height	(Refer to Fig. 9-52)

*Measured from center of tires.

WHEELS AND TIRES

1. Wheel Base	
a. 52 through 66 Series	123"
b. 84 through 86 Series	126"
2. Wheels	
a. Rim diameter	14"
b. Rim width	6"
c. Radial runout*	.035" Max.
d. Lateral runout*	.045" Max.
3. Tires	
a. Radial runout*	.080" Max.
b. Lateral runout*	.100" Max.

*Total indicator reading.

SPECIFICATIONS (Contd.)

TIRE SIZES

Series	Standard	Optional
52 Series without Factory Installed Air Conditioning	7.75x14	8.25x14
52 Series with Factory Installed Air Conditioning	8.25x14	8.25x14
54 through 58 & 6657 Series without Factory Installed Air Conditioning	8.25x14	8.55x14
54 through 58 & 6657 Series with Factory Installed Air Conditioning	8.55x14	8.55x14
84 through 86 & 6667 Series without Factory Installed Air Conditioning	8.55x14	8.85x14
84 through 86 & 6667 Series with Factory Installed Air Conditioning	8.85x14	8.85x14

TORQUE SPECIFICATIONS

NOTE: Specified torque is for installation of parts only. Checking of torque during inspection may be 15% below that specified.

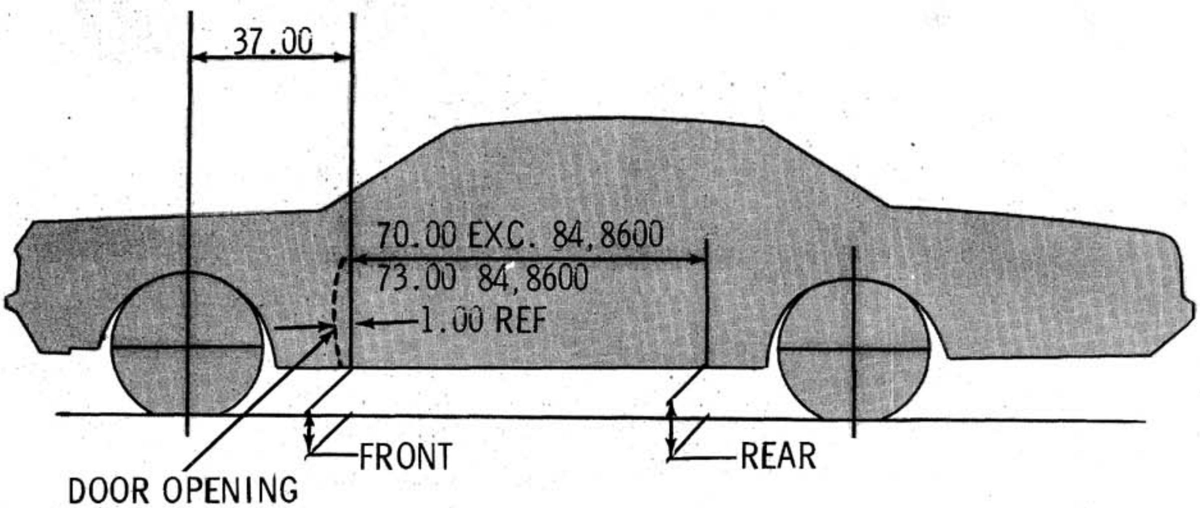
APPLICATION	FT. LBS.
FRONT SUSPENSION	
Stabilizer	
Stabilizer Link Nut	15
Stabilizer Bar Bracket to Frame Bolts & Nuts*	15
Shock Absorber	
Shock Absorber Upper Attaching Nut	20
Shock Absorber to Control Arm Bolts	24
Control Arms	
Upper Control Arm to Frame Attaching Bolts & Nuts	75
Lower Control Arm to Frame Attaching Bolts & Nuts*	85
Upper Arm Bushing Nuts*	60
Ball Joints	
Service Ball Joints to Upper Control Arm	8
Ball Joints to Steering Knuckle Nuts - Lower	70 Min.
- Upper	40 Min.
Steering Knuckle	
Backing Plate to Steering Knuckle (anchor bolt) (52 Series Only)	105
Backing Plate to Steering Knuckle (anchor bolt) (54 through 86 Series)	145
Steering Arm to Steering Knuckle to Backing Plate Bolts	140
Wheel Bearing Adjustment Nut (Refer to WHEEL BEARING ADJUSTMENT)	

TORQUE SPECIFICATIONS (Contd)

REAR SUSPENSION

Shock Absorbers	
Upper Attaching Bolts and Nuts	24
Lower Stud Nut	60
Suspension Arms	
Upper Control Arms to Frame Attaching Bolts & Nuts*	85
Upper Control Arms to Differential Attaching Bolts & Nuts*	85
Lower Control Arms to Frame Attaching Bolts & Nuts*	85
Lower Control Arms to Rear Axle Bracket Attaching Bolts & Nuts*	85
Backing Plate	
Backing Plate Attaching Bolts	55
Miscellaneous	
Wheel Nuts - 52 Series	75
Wheel Nuts - 54 through 86 Series	85

*Set to specified torque with weight of car resting on wheels.

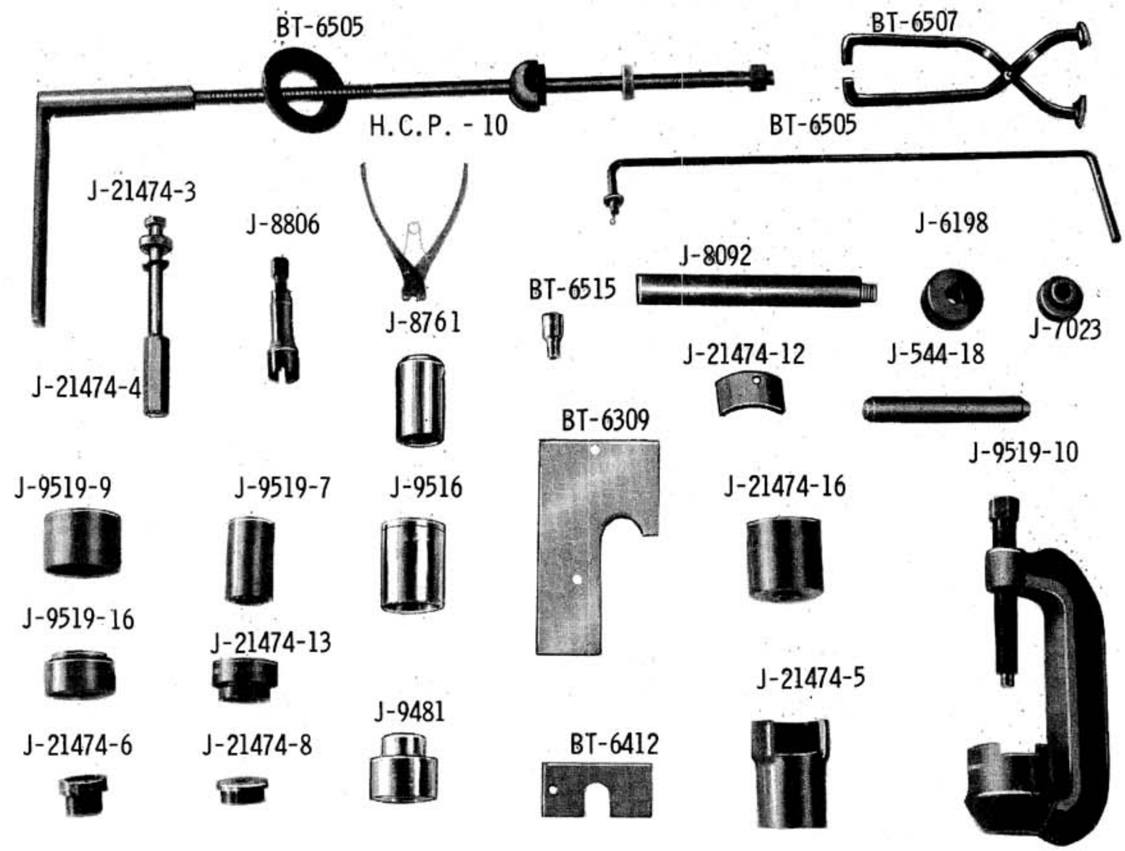


MODEL	* FRONT	* REAR	POSITION
5200, 5600	10.00	10.00	CURB
8400, 8600	10.30	10.30	CURB
5400, 6600	9.50	9.50	CURB

* Tolerances +.50
-1.00

ALL DIMENSIONS ON ANY CAR MUST BE WITHIN 1/2" OF EACH OTHER.

Fig. 9-52 Carrying Heights



H.C.P.-10	Keystone Clamp Pliers (Cornwell Tool)
J-544-18	Hub Bolt Peening Tool
J-6198	Front Pinion Bearing Cup Remover (Used to Install Inner Bearing Outer Race)
BT-6309-1	Pivot Shaft Bushing Press Plate
BT-6412	Back-Up Plate
BT-6505	Front Suspension Coil Spring Compressor
BT-6507	Dust Cap Remover and Installer
BT-6515	Socket (Used for Front Shock Absorber Removal)
J-7023	Pitman Shaft Oil Seal Installer (Used to Install Outer Bearing Inner Race)
J-8092	Driver Handle
J-8761	Front Pump Seal Installer (Used to Install Inland Ball Joint Seal)
J-8806	Ball Joint Remover
J-9481	Pivot Shaft Bushing Installer
J-9519-7	Ball Joint Remover
J-9519-9	Ball Joint Installer
J-9519-10	Ball Joint Fixture
J-21474-3	Special Bolt and Thrust Bearing Assembly
J-21474-4	Special Nut
J-21474-5	Receiver Tool
J-21474-6	Axle Housing Bushing Remover & Installer
J-21474-8	Front and Rear Lower Control Arm Bushing Remover
J-21474-12	Front Lower Control Arm Bushing Installer Spacer
J-21474-13	Front and Rear Lower Control Arm Bushing Installer
J-21474-16	Rear Control Arm Bushing Receiver

Fig. 9-53 Special Tools

SUSPENSION

33-34-35-36-38 SERIES

CONTENTS OF SECTION

FRONT SUSPENSION

REAR SUSPENSION

FRONT SUSPENSION

MAINTENANCE RECOMMENDATIONS

For lubrication information, refer to PERIODIC MAINTENANCE, Section 2.

During an oil change, the ball joint seals should be observed for cracks or cuts. If a seal is damaged, it can be replaced by referring to FRONT SUSPENSION BALL JOINT.

Periodic lubrication of the front wheel bearings is not required; however, when brake maintenance requires removal of the front drums, the bearings should be cleaned and repacked with a high melting point wheel bearing grease.

WHEEL BEARINGS (Fig. 9-103) (Includes 52 Series)

The proper functioning of the front suspension cannot be maintained unless the front wheel TAPER ROLLER BEARINGS are correctly adjusted. Cones must be a slip fit on the spindle and the inside diameter of cones should be lubricated to insure that the cones will creep. Spindle nut must be a free-running fit on threads.

Adjustment

The adjustment of front wheel bearings should be made WHILE REVOLVING THE WHEEL AT LEAST THREE TIMES THE SPEED OF NUT ROTATION when taking the torque readings as follows:

1. Tighten adjusting nut with a torque wrench 25 to 30 ft. lbs. to insure that all parts are properly seated and threads are free.

2. Back off nut 1/2 turn. Retighten nut finger tight.

3. If unable to install cotter (or retainer on 52 Series) pin at finger tight position, back off to first notch and install cotter pin (or retainer.)

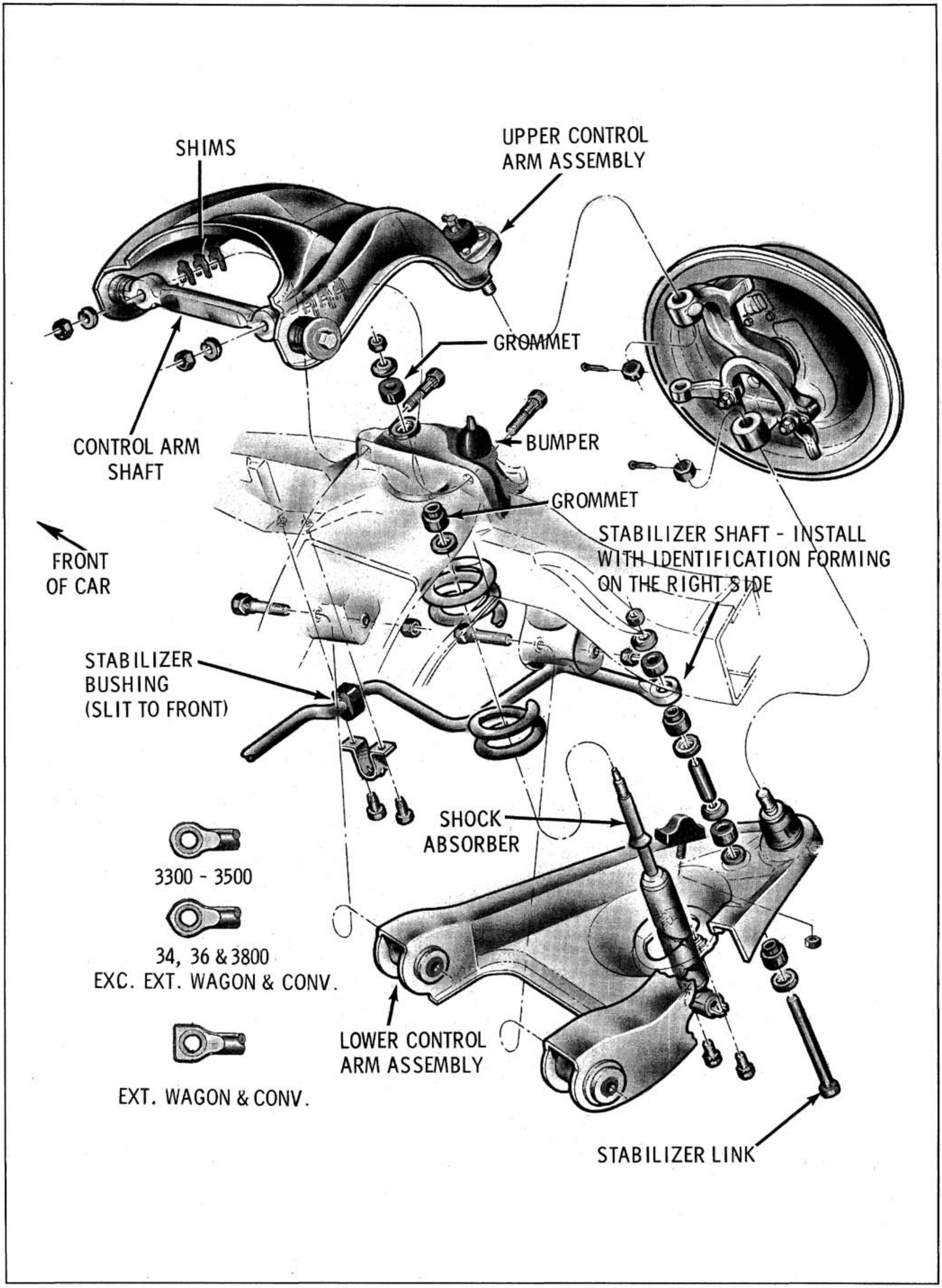


Fig. 9-101 Front Suspension—Exploded View

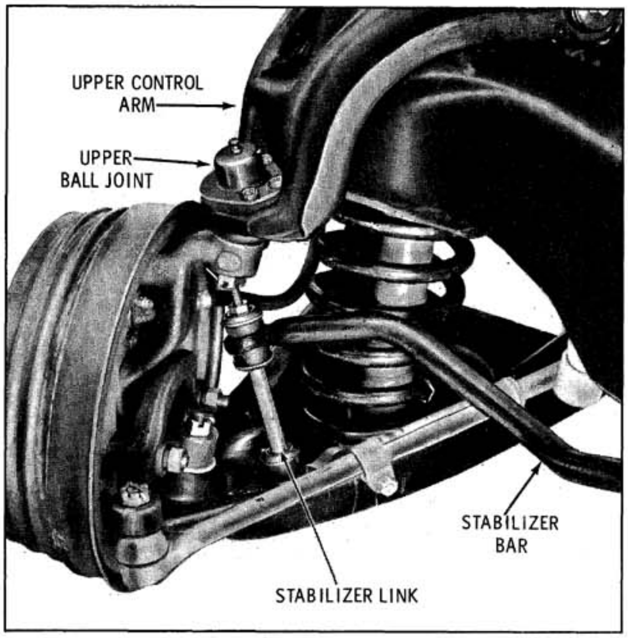


Fig. 9-102 Front Suspension Assembly

HUB AND DRUM ASSEMBLY (Figs. 9-103 & 9-104) (Includes 52 Series)

REMOVAL (WHEEL REMOVED)

1. Remove cap from hub.
2. Remove cotter pin (retainer on 52 Series) nut and washer from spindle.
3. Re-install cap and carefully pull hub and drum assembly from spindle.

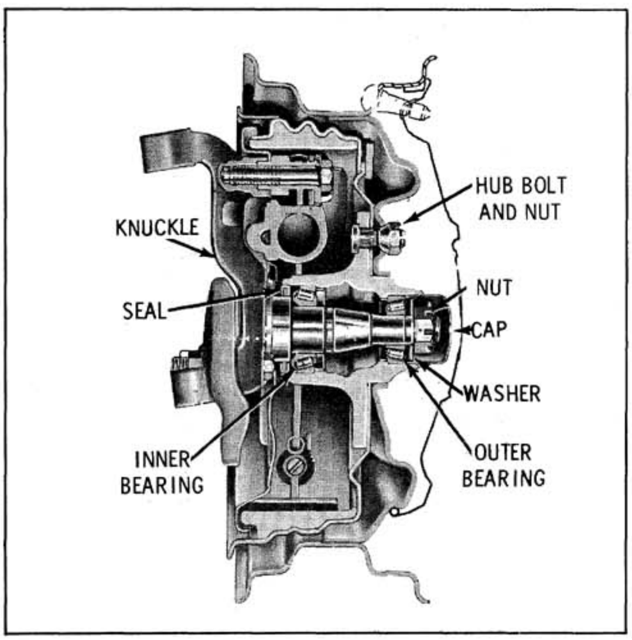


Fig. 9-103 Front Hub and Drum Assembly

NOTE: It may be necessary to back off the brake shoe adjustment before the hub and drum can be removed.

BEARING AND SEAL REMOVAL

1. Remove cap and remove the outer bearing inner race and the roller and separator assembly from hub.
2. Pry seal from hub, then remove inner bearing inner race and roller and separator assembly from hub.
3. If necessary to remove outer races, insert a brass drift into hub, indexing end of drift with notches in hub behind bearing outer race and tap with a hammer. Tap alternately on each side of bearing race. (Fig. 9-105)

CLEANING AND INSPECTION

NOTE: For inspection of front drums, refer to BRAKE DRUMS, Section 11.

1. Wash all parts in clean solvent with the exception of the roller and separator assemblies and races and air dry. Roller and separator assemblies and races should be washed in gasoline.
2. Check bearings for cracked separators and worn or pitted rollers.
3. Check bearing races for cracks, scores or a brinelled condition.

BEARING AND SEAL INSTALLATION

1. If the outer races were removed, drive or press the races into the hub as shown in Figs. 9-106 and 9-107.
2. Lubricate the bores of the inner races and fully pack the roller and separator assemblies with a high melting point wheel bearing grease.
3. Install inner bearing roller and separator assembly into outer race, then install inner bearing inner race.
4. Carefully tap seal into hub.
5. Clean any traces of grease from brake lining and drum with fine sandpaper. If necessary to adjust brake linings, refer to BRAKE LINING - Adjust, Section 11.
6. Position hub and drum assembly over spindle.
7. Install outer bearing roller and separator into hub.
8. Install outer bearing inner race over spindle, then install the washer and spindle nut. Draw spindle nut up snug and adjust bearing as outlined under WHEEL BEARING ADJUSTMENT.

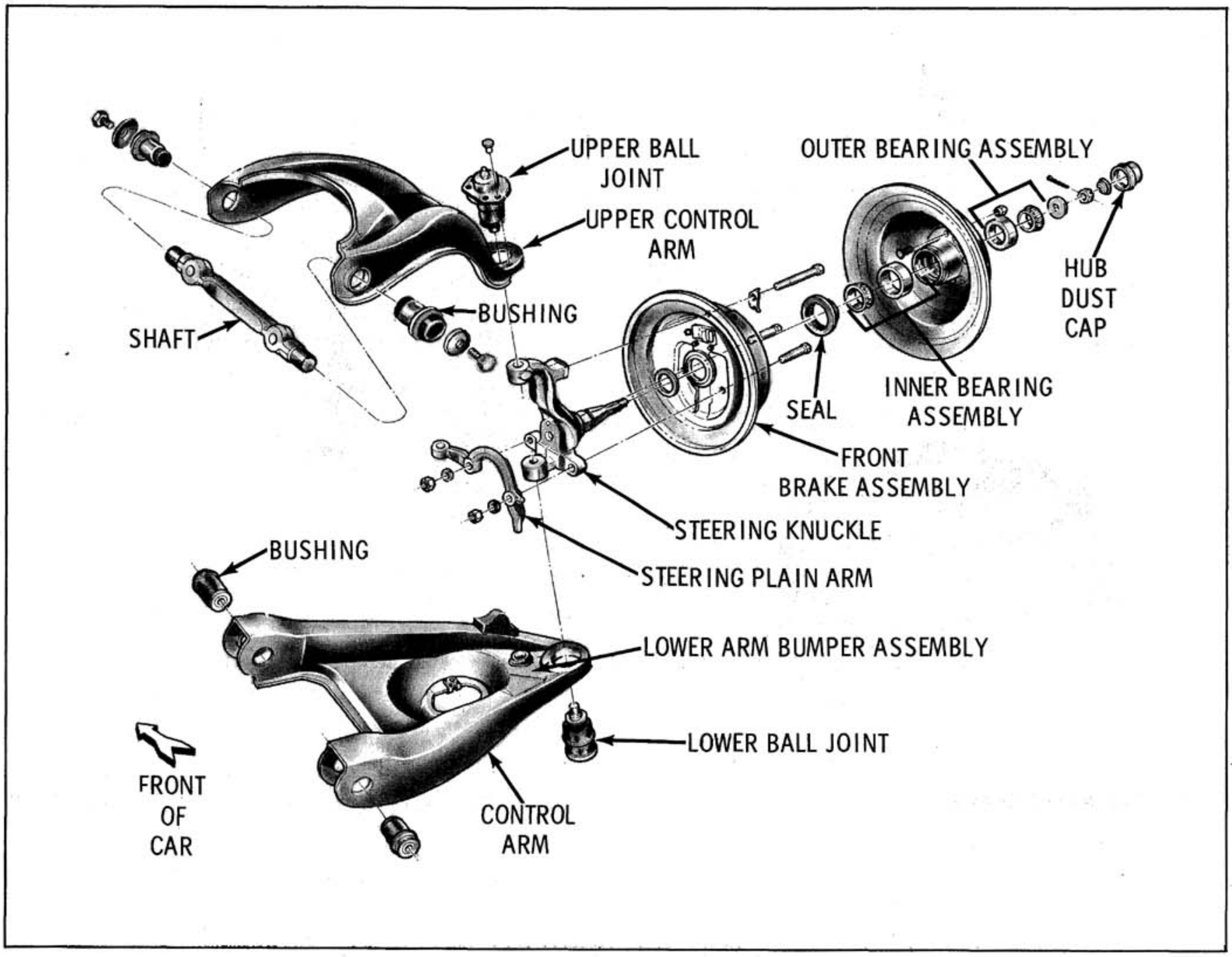


Fig. 9-104 Front Suspension—Exploded View

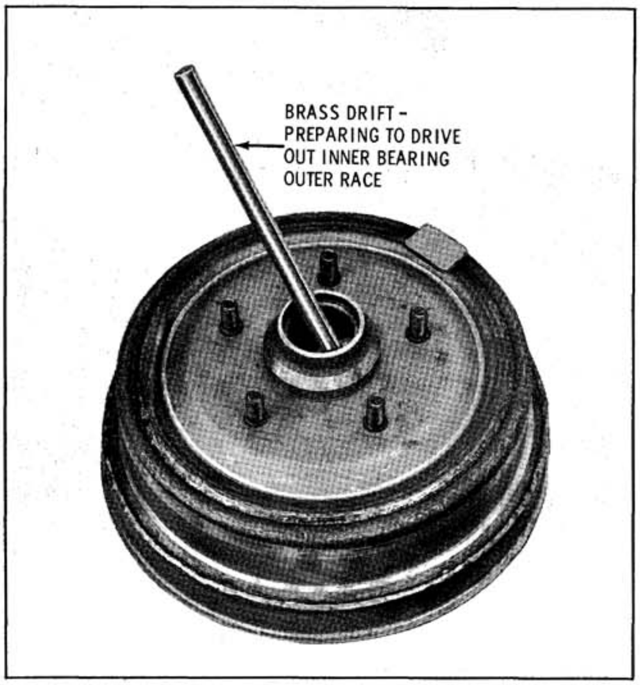


Fig. 9-105 Removing Wheel Bearing Races

Fig. 9-106 Installing Inner Bearing Race

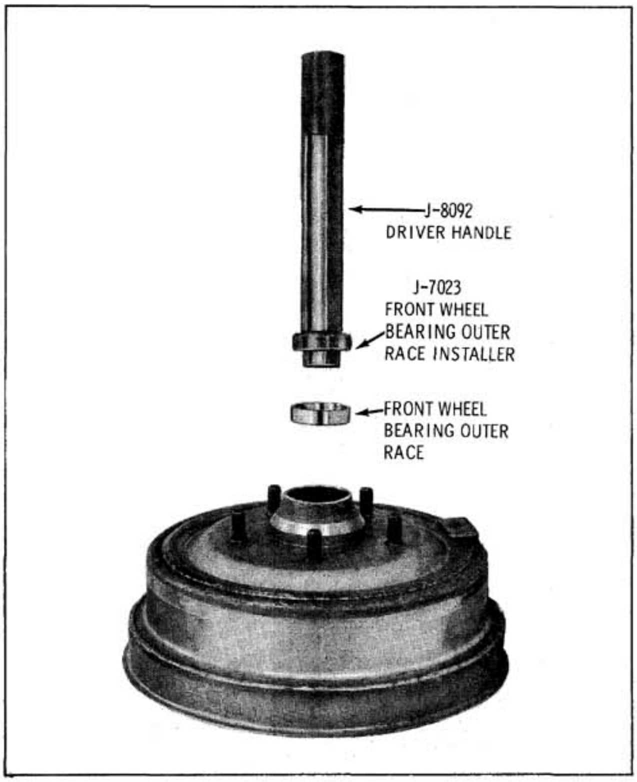


Fig. 9-107 Installing Outer Bearing Race

HUB BOLT REPLACEMENT

1. With the hub and drum assembly removed, drill a 5/8" hole 1/4" deep into the head of the hub bolt.

2. Support hub and drum assembly and drive or press hub bolt out through the front of the hub and drum assembly.

3. Press a new hub bolt into the hub.

4. While supporting hub bolt, peen hub bolt into countersunk area of drum with the use of Peening Tool J-554-13 until the drum is secure to the hub. (Fig. 9-108)

SHOCK ABSORBERS

A slight amount of fluid may bleed by the rod seal in cold weather and deposit a light film on the upper area of the shock absorber. This condition will not impair operation and should be considered normal. A SHOCK ABSORBER SHOULD NEVER BE CHECKED HORIZONTALLY OR WITH THE ROD EXTENSION DOWN.

For a complaint of a noisy or defective shock absorber, first check the mounting torque. If mounting is satisfactory, disconnect the lower mountings and pump the shock absorbers by hand in a vertical position. Compare both shock absorbers. If both shocks respond the same, it is unlikely that a defective shock absorber exists.

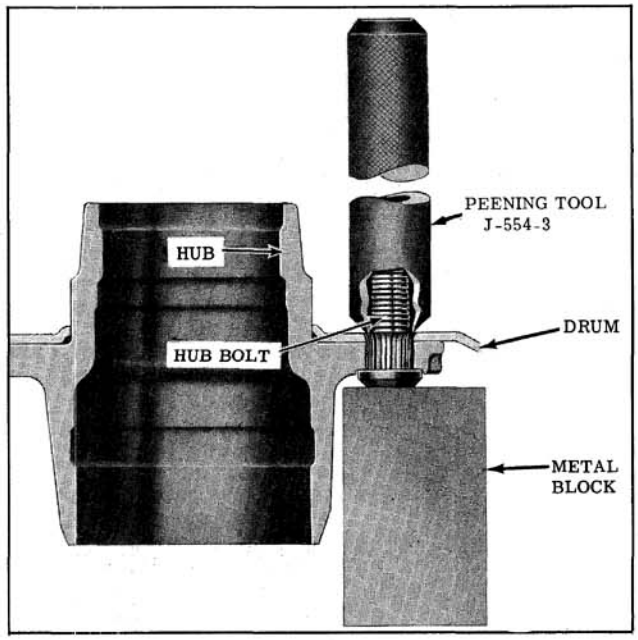


Fig. 9-108 Peening Hub Bolt

THUMPING NOISE

A thumping noise usually occurs when a shock absorber is changing its direction of stroke.

1. The shock absorber should be pumped with a rapid change of stroke. If lag is felt when changing stroke, this unit will be noisy.

2. Completely extend the shock absorber and pull hard. If spring tension if felt, this shock absorber will be noisy and should be replaced.

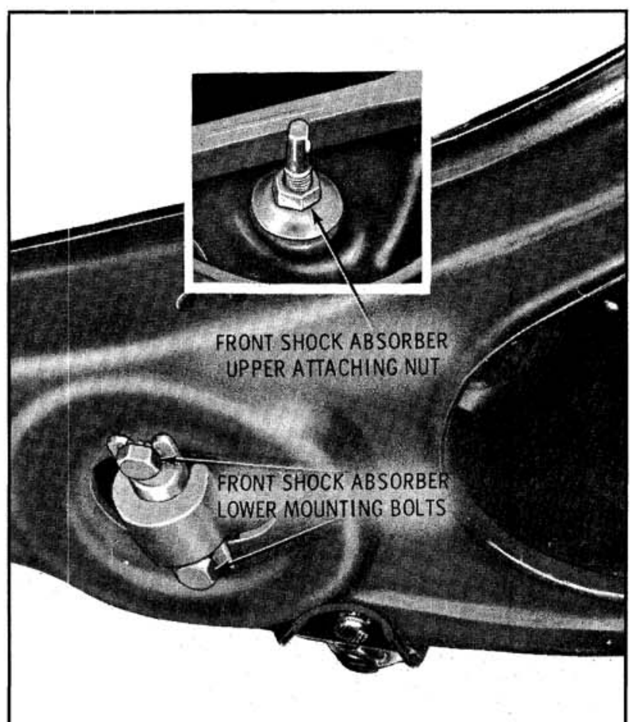


Fig. 9-109 Front Shock Absorber Attaching

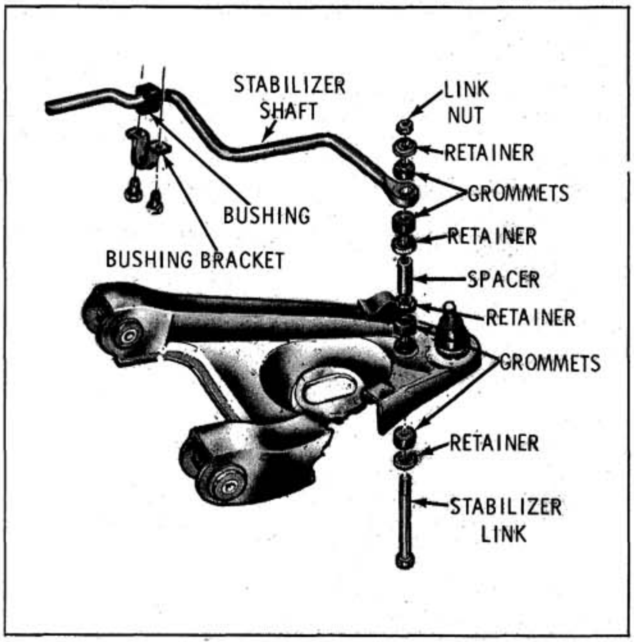


Fig. 9-110 Stabilizer Bar Attachment

SQUEAKY OR REED TYPE NOISE

Hand pump the shock absorber at different rates of speed. If noise is heard that changes from a deep grunt to a high-pitched squeak, the shock absorber needs replacement.

NOTE: A squealing noise could be attributed to seals. This is particularly true if the shock has been inoperative for a period of time. This noise will disappear after a few strokes of the shock absorber and is not a cause for rejection.

FRONT SHOCK ABSORBERS

REMOVE AND INSTALL (Fig. 9-109)

1. Remove upper attaching nut, retainer and grommet from the shock absorber.

   NOTE: Tool BT 65-15 will aid in removing upper nut.

2. Remove the two bolts attaching shock absorber to lower control arm and remove shock absorber.

   To install shock absorber, position grommet and retainer over shock and slide shock up through spring and frame. Install and torque the upper attaching nut to 20 ft. lbs. or until nut is to end of threads on stud, and the lower cap screws to 24 ft. lbs.

   NOTE: The part number of each shock absorber is stamped on the outer casing.

STABILIZER BAR

REMOVE AND INSTALL (Fig. 9-110)

1. Disconnect each side of stabilizer linkage by removing nut from link bolt, pull bolt from linkage and remove retainers, grommets and spacer.

2. Remove bracket to frame bolts and remove stabilizer bar, rubber bushings and brackets.

3. To replace, reverse sequence of operations being sure to install with the identification forming on the right side of the car. The rubber bushings should be positioned squarely in the brackets with the opening in the bushings facing the front of car. Torque stabilizer link nut to 15 ft. lbs. and bracket bolts to 15 ft. lbs. If 5/16" production bracket bolt strips, it can be replaced with a 3/8" service bolt.

   IMPORTANT: Never lubricate stabilizer bar rubber bushings, as they are dependent upon friction between the rubber and the bar for proper stabilizer action.

STEERING KNUCKLE (Figs. 9-103 & 9-104)

Removal

1. Raise front of car and support with floor stands under frame.

   NOTE: Spring tension is needed to assist in breaking ball joint studs loose from steering knuckle. Do not place stands under lower control arm.

2. Remove front wheel and hub and drum assembly.

3. Remove backing plate without disconnecting brake hose. Leave plain arm connected to tie rod end.

   NOTE: Support the backing plate assembly out of the way to avoid any strain on brake hose.

4. Place floor jack under lower control arm.

5. Disconnect the control arm ball joints from the steering knuckle by:

   a. Removing cotter pins from ball joint studs.

   b. Remove the upper and lower joint nuts to clean the threads. REPLACE THE NUT, LEAVING IT APPROXIMATELY TWO TURNS LOOSE. Lower floor jack slightly, then tap knuckle with a brass drift at ball joint stud. This will loosen stud from steering knuckle. Tool J-8806 can be

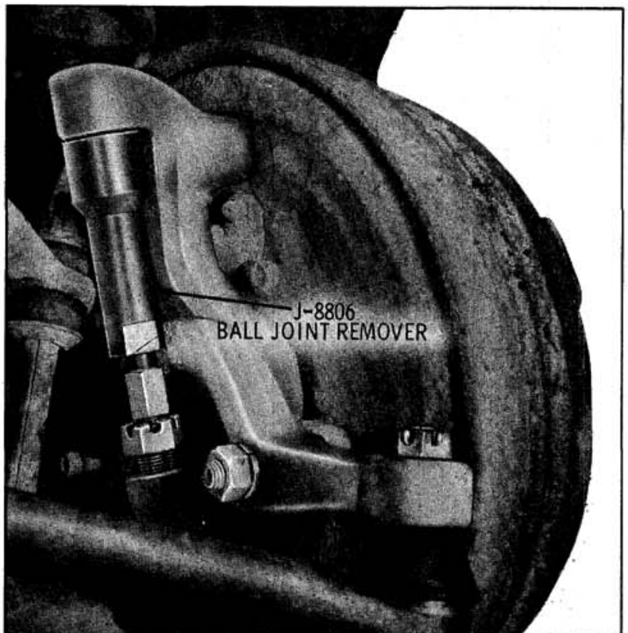


Fig. 9-111 Disconnecting Ball Joint

used as shown in Fig. 9-111 to break ball joints loose from knuckle.

NOTE: After stud breaks loose from steering knuckle, raise floor jack and relieve spring tension. This will permit removal of ball joint nut.

6. Lift upper control arm and remove steering knuckle from car.

CAUTION: Lower control arm must be supported while knuckle is disconnected.

Installation

1. Connect the upper and lower ball joints to the steering knuckle.

2. Torque stud nuts 40 ft. lbs. (min.) and install cotter pins. Tighten further, if necessary, to install cotter pin.

3. Install backing plate and plain arm to steering knuckle. Torque nuts to 55 ft. lbs. Torque anchor bolt to 105 ft. lbs.

4. Install wheel and hub and drum assembly. Adjust wheel bearings.

5. Check camber, caster and toe-in and adjust if necessary.

COIL SPRING

Removal

1. Raise front of car and support by frame with floor stands.

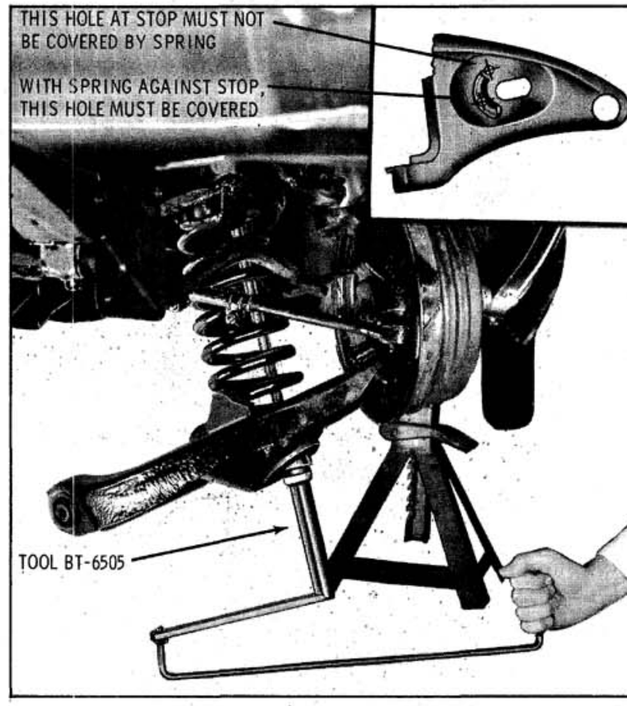


Fig. 9-112 Front Spring

2. Remove wheel and tire assembly.

3. Disconnect stabilizer link.

4. Remove shock absorber.

5. Install Tool BT-6505 as shown in Fig. 9-112 and compress spring slightly to permit removal of lower control arm inner bushing bolts. Leave ball joints connected to steering knuckle.

6. Relax spring tension by slowly removing Tool BT-6505. Completely remove tool and remove coil spring.

Installation

1. Position spring against pilot in frame and in lower control arm. (Fig. 9-112)

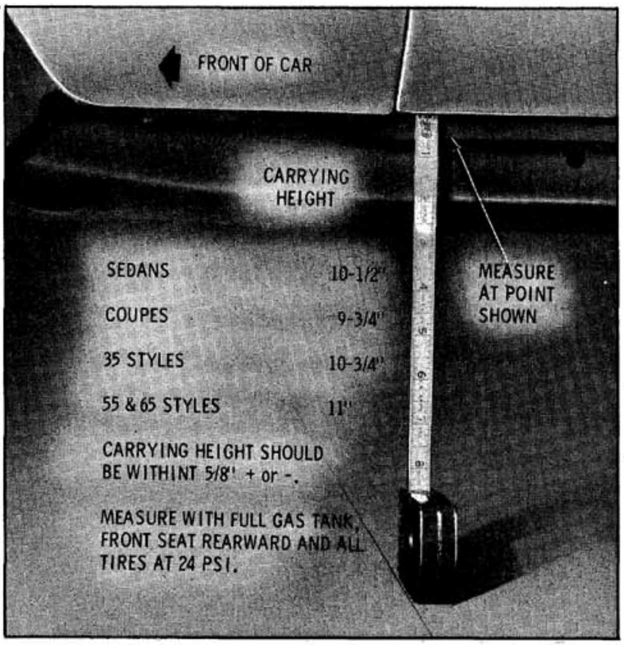
2. Install Tool BT-6505 and compress spring until lower control arm inner bushing bolts can be installed. Do not torque bolts at this time.

3. Remove tool and install shock absorber, stabilizer link and wheel and tire assembly.

4. Install shock absorber. Torque upper mounting nut to 20 ft. lbs. and lower attaching bolts to 24 ft. lbs.

5. Connect stabilizer link to lower control arm. Torque nut to 15 ft. lbs.

6. Install wheel and tire assembly and lower the car. With weight of car on wheels, torque bolts to 85 ft. lbs.



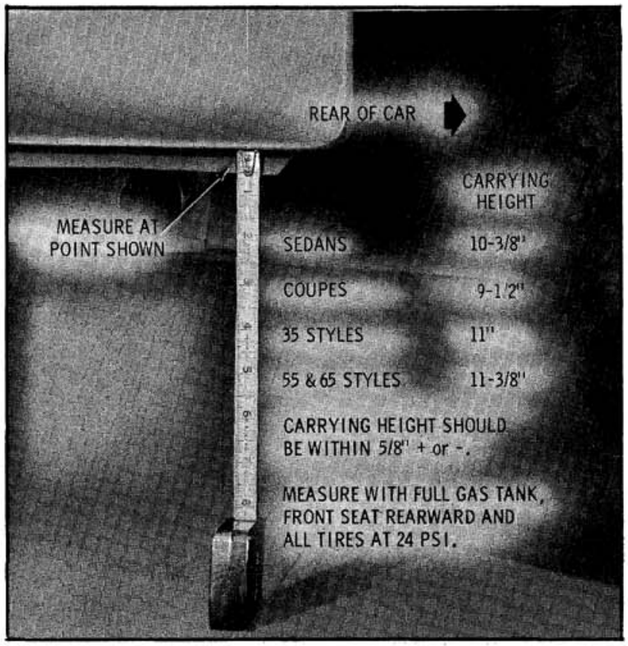


Fig. 9-113 Checking Spring Carrying Height

SPRING CARRYING HEIGHT

Spring carrying height is controlled by the spring length and spring rate and may be checked as indicated in Fig. 9-113.

LOWER CONTROL ARM (Figs. 9-101 & 9-102)

Removal

1. To remove the lower control arm, all the steps in COIL SPRING - Removal, must be performed. After completing these, proceed as follows.

2. Remove control arm-to-frame attaching bolts and nuts and remove control arm.

Installation

1. Position control arm and install control arm to frame attaching bolts.

2. Replace coil spring as outlined under COIL SPRING - Installation.

LOWER CONTROL ARM BUSHINGS

Use of Spring Compressor BT-6505 will allow the replacement of the lower control arm bushings without removing the control arm from the car. However, it may be desirable to remove the control arm and replace the bushings on the bench as illustrated.

FRONT BUSHING

Remove bushing as shown in Figs. 9-114 and 9-115.

Install bushing as shown in Figs. 9-116 and 9-117. Bushing should bottom against control arm.

REAR BUSHING

Remove bushing as shown in Fig. 9-118.

Install bushing as shown in Fig. 9-119. Bushing should bottom against control arm.

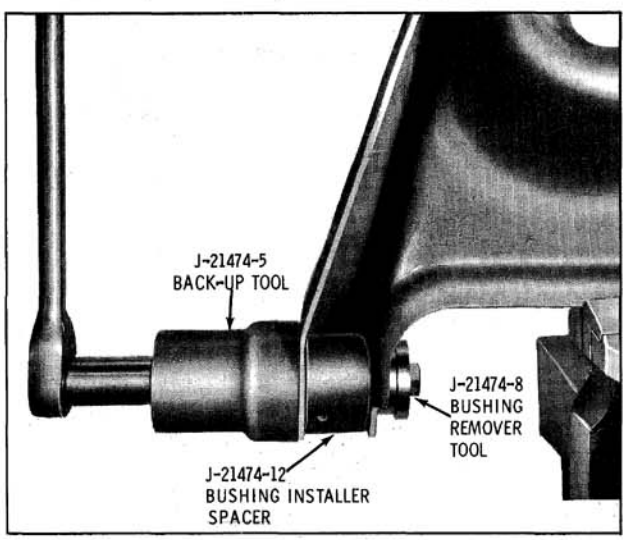


Fig. 9-114 Removing Front Bushing

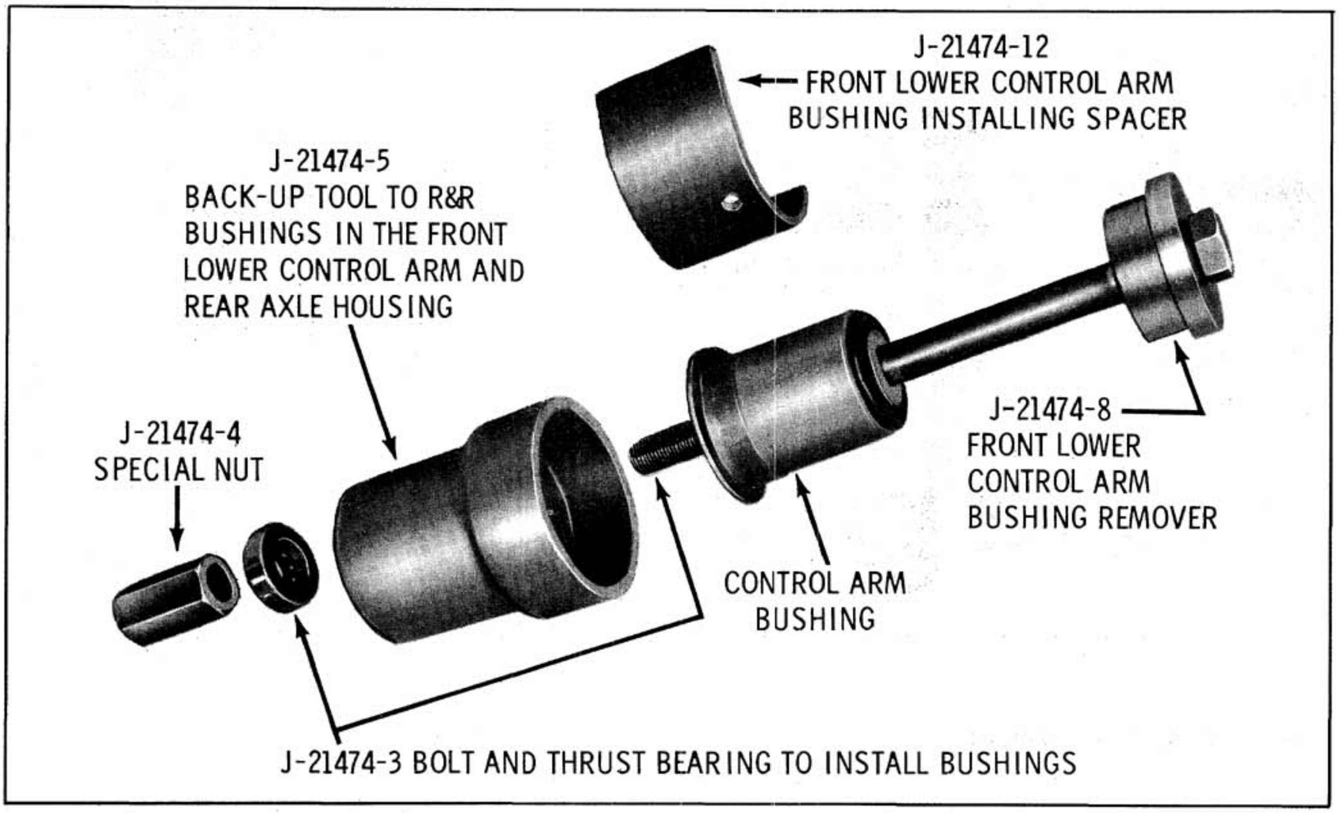


Fig. 9-115 Removing Front Bushing

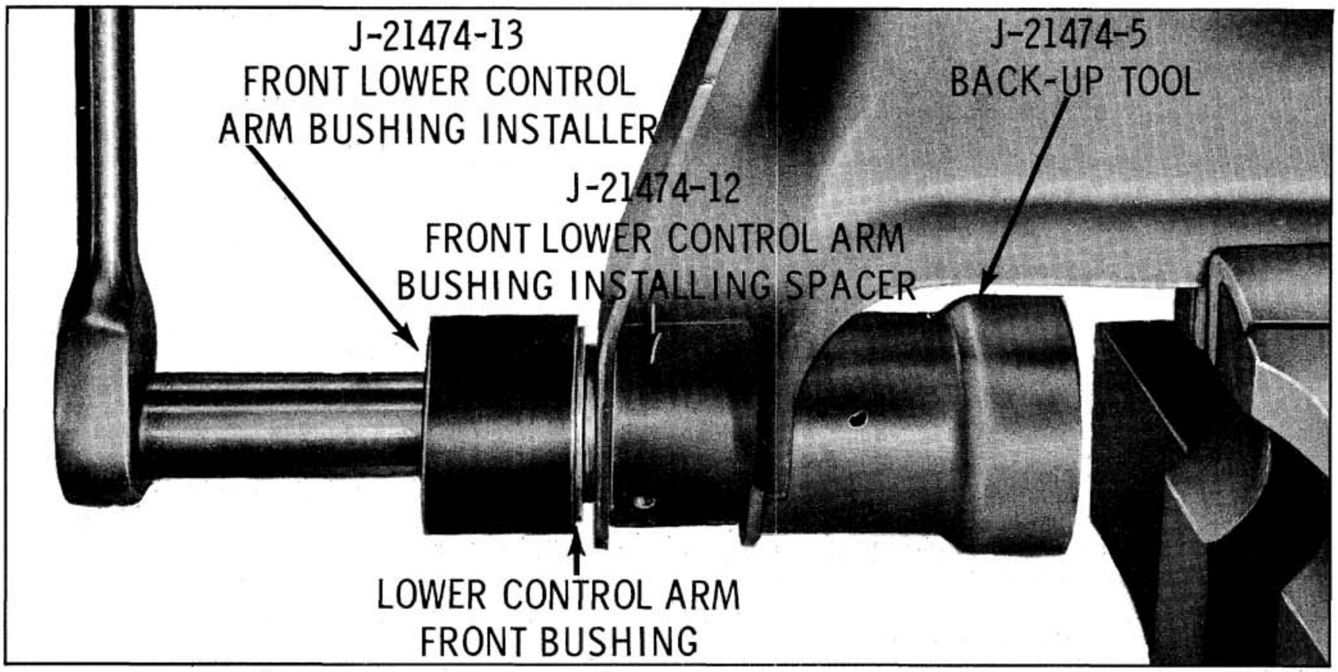


Fig. 9-116 Installing Front Bushing

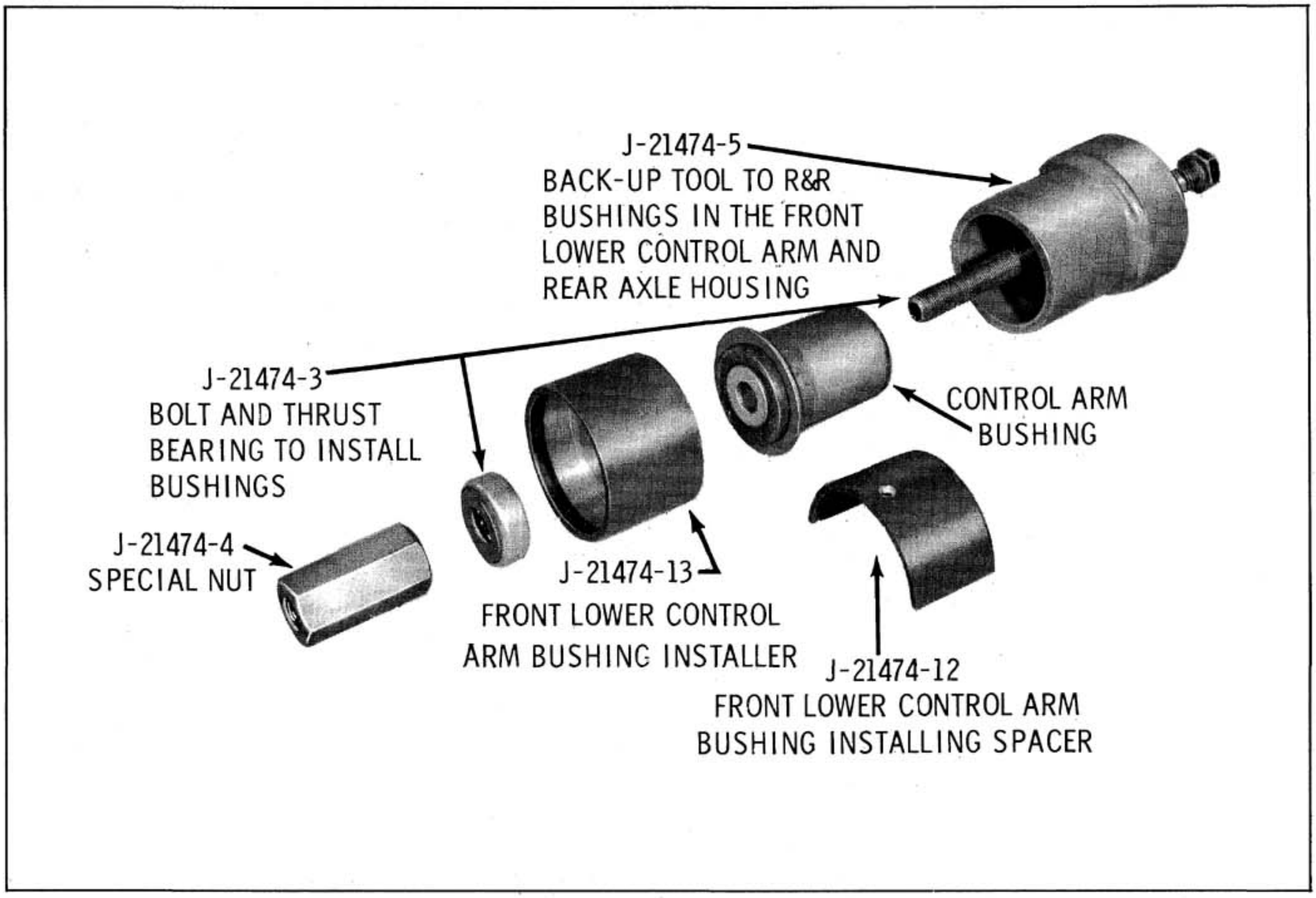


Fig. 9-117 Installing Front Bushing

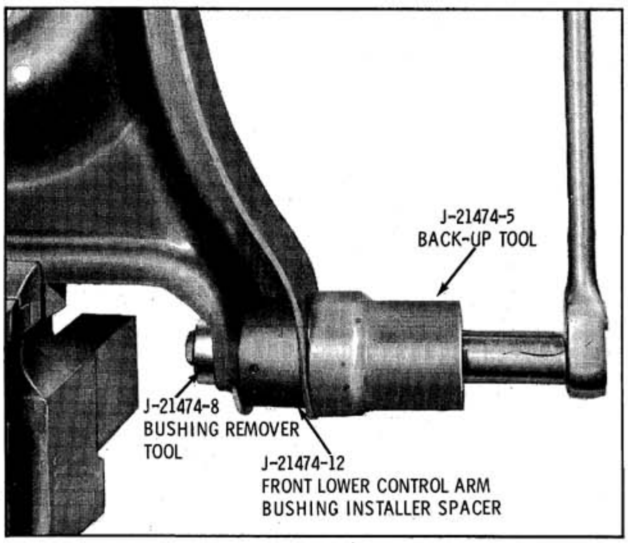


Fig. 9-118 Removing Rear Bushing

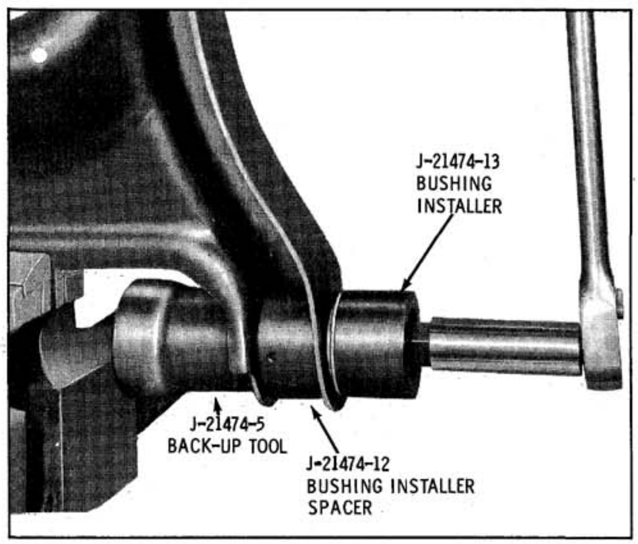


Fig. 9-119 Installing Rear Bushing

BALL JOINTS (Figs. 9-120 & 9-121)

The upper and lower ball joints can be replaced if checking indicates they are worn. The ball joint and front suspension checking procedure is covered in the 52 through 86 series SUSPENSION, Section 9.

REMOVAL—LOWER

1. Raise car, support with floor stands under frame.
2. Remove tire and wheel assembly.
3. Place floor jack under control arm spring seat.

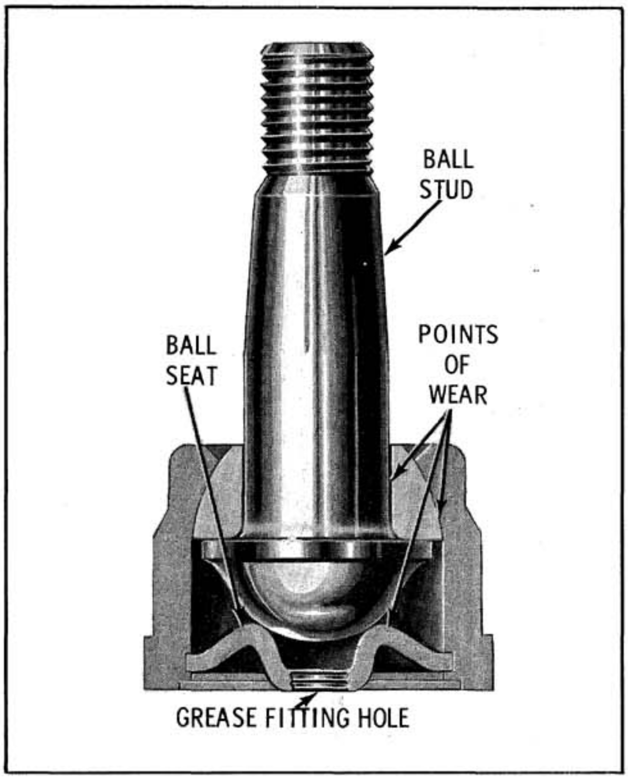


Fig. 9-120 Saginaw Lower Ball Joint

4. To disconnect the lower control arm ball joint from the steering knuckle:

   a. Remove the cotter pin from ball joint stud.

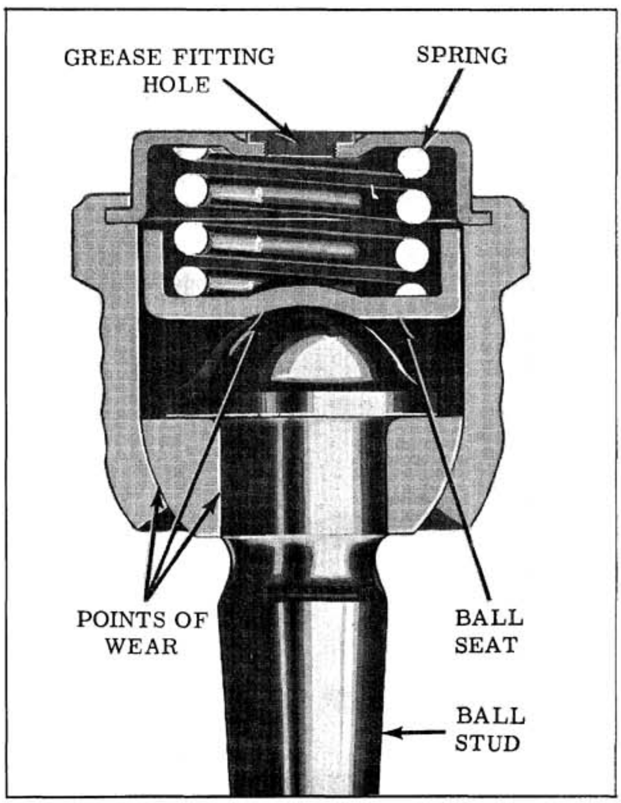


Fig. 9-121 Saginaw Upper Ball Joint

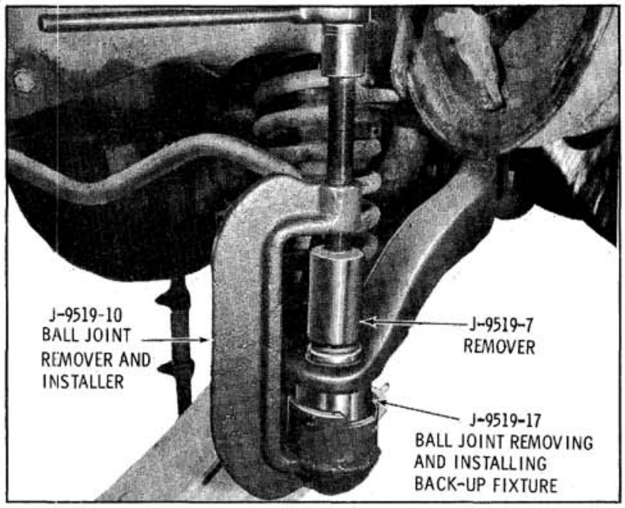


Fig. 9-122 Removing Lower Ball Joint

   b. Remove the nut to clean the threads. REPLACE THE NUT, LEAVING IT APPROXIMATELY TWO TURNS LOOSE. Lower floor jack slightly, then tap knuckle with a brass drift at ball joint stud. This will loosen stud from steering knuckle. Tool J-8806 can be used as shown in Fig. 9-111 to break the ball joint loose from knuckle.

      NOTE: After studs break loose from steering knuckle, raise floor jack and relieve spring tension. This will permit removal of ball joint nut.

5. After stud breaks loose, raise control arm to relieve spring tension, then remove stud nut.

   NOTE: If interference is encountered between the ball joint and the backing plate, it

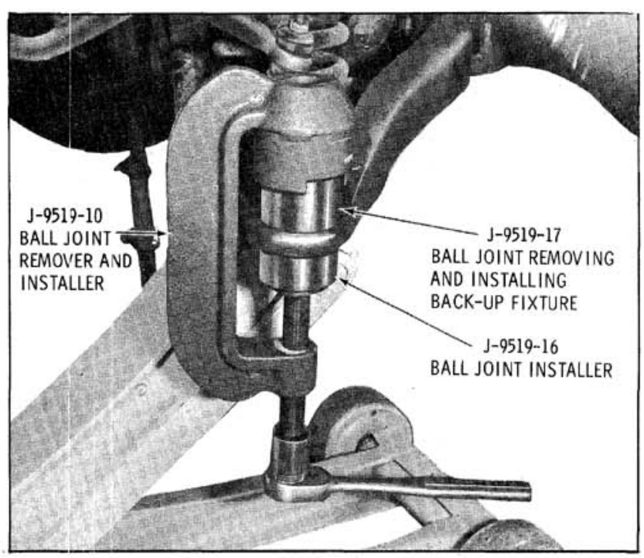


Fig. 9-123 Installing Lower Ball Joint

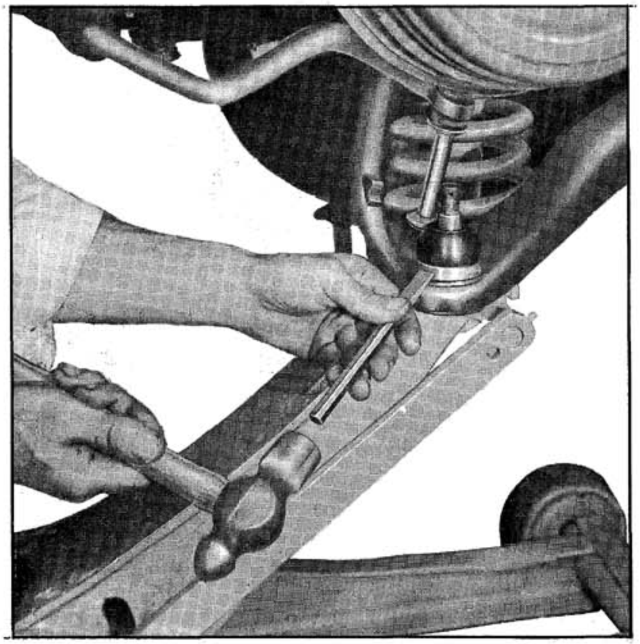


Fig. 9-124 Removing Lower Ball Joint Seal

will be necessary to loosen the backing plate slightly to obtain the necessary clearance.

6. Block brake drum out of the way by placing a wooden block between frame and upper control arm.

Remove ball joint seal by prying off retainer with a screwdriver or driving off with a chisel as shown in Fig. 9-124 or 9-125.

7. Remove grease fitting, then install tools as shown in Fig. 9-122 and press out ball joint.

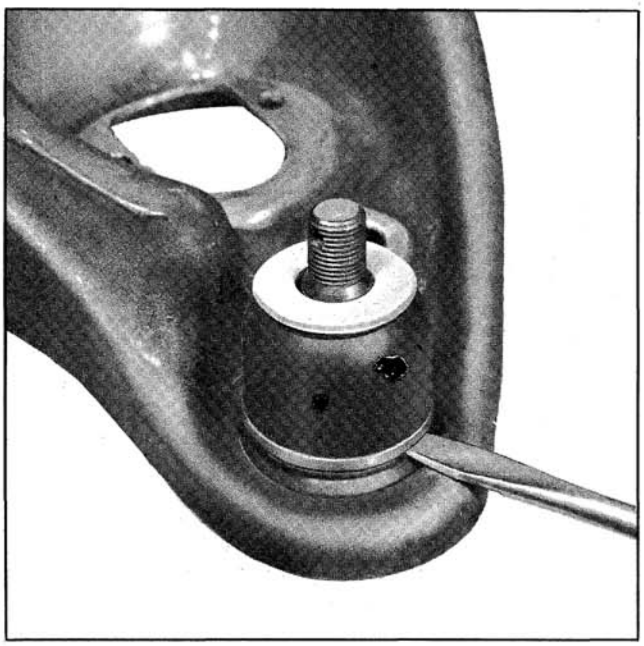


Fig. 9-125 Removing Lower Ball Joint Seal

Fig. 9-126 Installing Ball Joint Seal

INSTALLATION—LOWER

1. Position ball joint into lower control arm and press in until it bottoms on the control arm using tools as illustrated in Fig. 9-123.

2. Install new ball joint seal and retainer as shown in Fig. 9-126 and Fig. 9-127.

3. Install ball joint stud into steering knuckle. Torque nut 40 ft. lbs. (min.) and install cotter pin.

   NOTE: Tighten backing plate attaching bolts if necessary.

4. Install and lubricate ball joint fitting until grease appears at the seal.

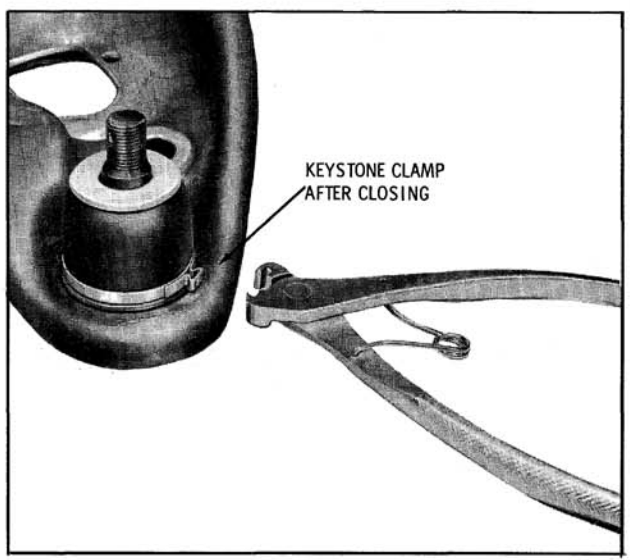


Fig. 9-127 Installing Ball Joint Seal

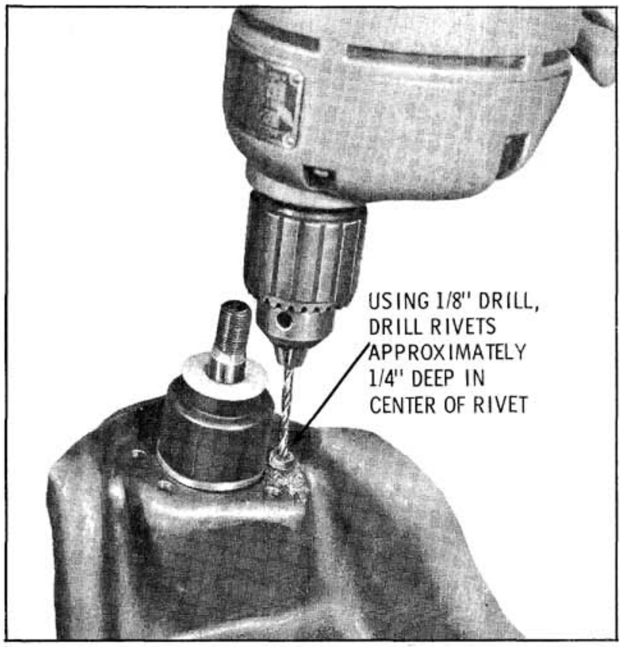


Fig. 9-128 Drilling Upper Ball Joint Attaching Rivets

5. Install tire and wheel assembly.

REMOVAL—UPPER

1. Refer to UPPER CONTROL ARM - Removal, and remove upper control arm.

2. Clamp control arm in a vise and drill four rivets 1/4" deep using an 1/8" diameter drill. (Fig. 9-128)

3. Drill off rivet heads using a 1/2" diameter drill. (Fig. 9-129)

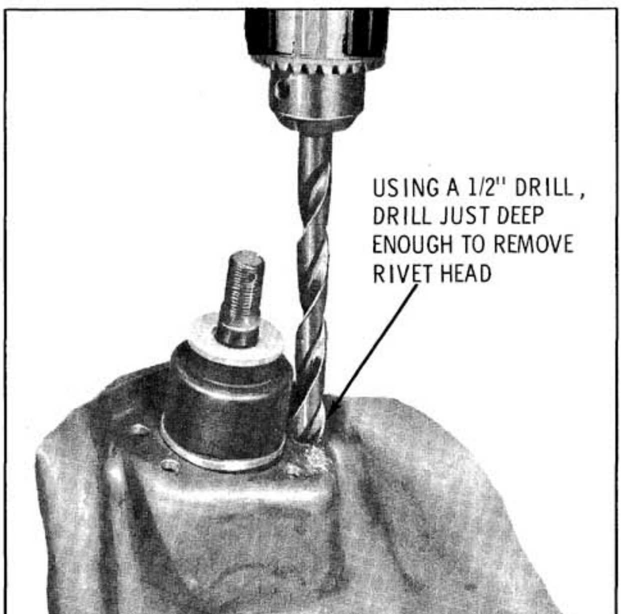


Fig. 9-129 Drilling Upper Ball Joint Attaching Rivets

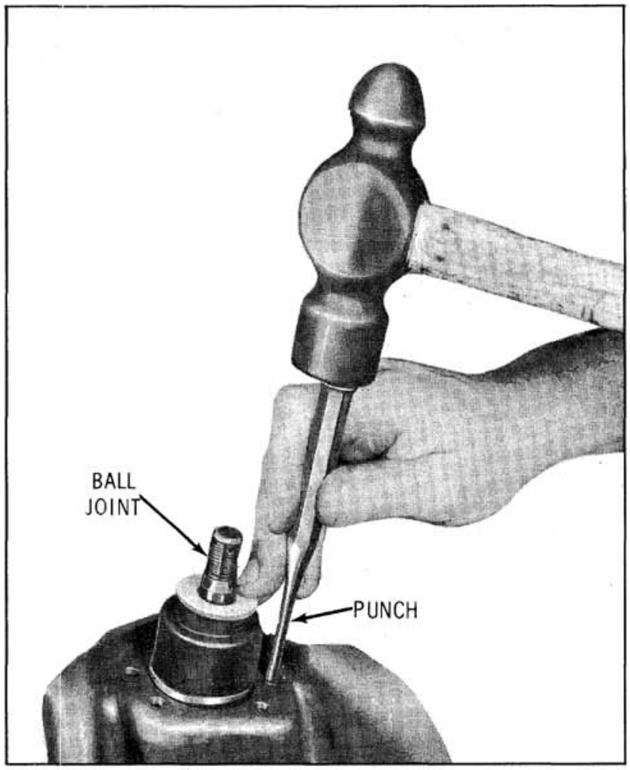


Fig. 9-130 Removing Upper Ball Joint

4. Punch out rivets using a small punch and remove ball joint. (Fig. 9-130)

INSTALLATION—UPPER (Fig. 9-131)

1. Position new ball joint in control arm and install the four attaching bolts. Torque nuts to 8 ft. lbs.

2. Refer to UPPER CONTROL ARM - Installation, and install upper control arm.

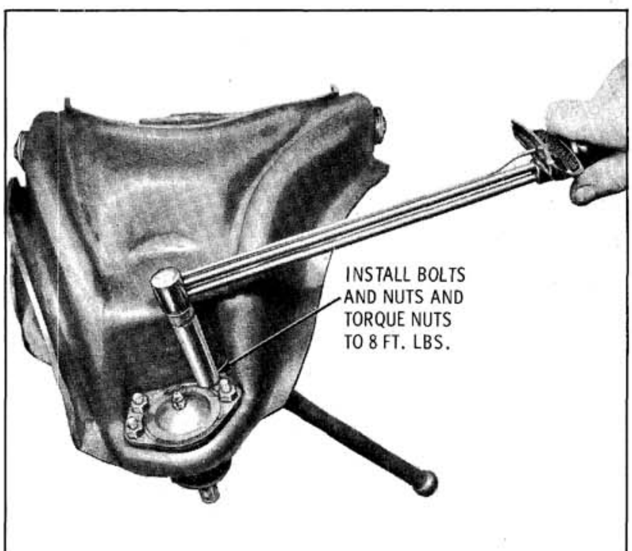


Fig. 9-131 Installing Upper Ball Joint

BALL JOINT SEALS (UPPER AND LOWER)

The ball joint seals can be installed with the control arm either on or off the car and both upper and lower are replaceable. All service ball joint seals use a keystone clamp retainer.

Removal

1. Raise car, support with floor stands under frame.
2. Remove tire and wheel assembly.
3. Place floor jack under control arm.
4. Remove cotter pin and remove the nut to clean the threads. (REINSTALL THE NUT, LEAVING IT APPROXIMATELY TWO TURNS LOOSE.)
5. Remove ball joint stud from steering knuckle as shown in Fig. 9-111 and described under BALL JOINTS - Removal.
6. Remove the seal by prying off retainer with a screwdriver or driving it off with a chisel. (Fig. 9-124)
7. Wipe grease from ball joint and stud.

Installation

1. Position new seal and retainer squarely over the ball joint stud and install as shown in Figs. 9-126 and 9-127.
2. Install the ball joint stud through the steering knuckle. Install ball joint nut. Torque nut 40 ft. lbs. (min.) and install cotter pin.
3. Lubricate the ball joint fitting until grease appears at the seal.
4. Install tire and wheel assembly.

UPPER CONTROL ARM

The upper control arm is attached to the frame by a cross shaft and bushings on the inner end and a ball joint on the outer end which is attached to the steering knuckle.

Removal

1. Raise car and place floor stands under frame.
2. Remove tire and wheel assembly.
3. Place floor jack under lower control arm spring seat.
4. Remove ball joint stud from steering knuckle as shown in Fig. 9-111 and described under BALL JOINTS - Removal.
5. Support hub assembly, and remove upper control arm assembly by sliding shaft off end of bolts.

NOTE: Alignment shims are to be installed in the same position from which they were removed.

Installation

1. Attach arm assembly to frame using original shims. Torque bolts to 75 ft. lbs.
2. Install ball joint stud into the steering knuckle. Torque nut 40 ft. lbs (min.) and install cotter pin.
3. Lubricate ball joint fitting until grease appears at the ball joint seal.
4. Install hub and drum assembly and tire and wheel assembly.

UPPER CONTROL ARM SHAFT AND BUSHING SERVICE

The upper control arm bushings or shaft and bushings may be replaced. The shaft cannot be replaced without replacing the bushings.

Removal

1. Refer to UPPER CONTROL ARM - Removal, and remove upper control arm.

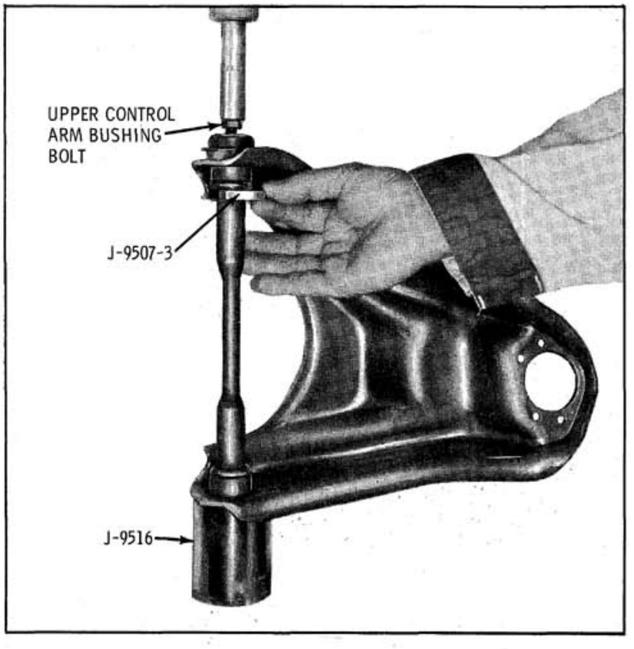


Fig. 9-132 Installing "C" Washer

2. Remove bushing bolts and retainers. Set up arm in press as shown in Fig. 9-132. Press on bolt (upper control arm bushing bolt which has been partially threaded into shaft) until "C" Washer J-9507-3 can be inserted.

3. Remove arm from press, remove bushing bolt, partially thread bolt into opposite end of shaft and set up arm in press as shown in Fig. 9-133. The bushing can now be removed by pressing it into the Back-Up Tool J-9516.

4. To remove the other bushing, set up arm as shown in Fig. 9-134 and press bushing into the Back-Up Tool J-9516.

Installation

1. Place arm in press as shown in Fig. 9-135, using J-21474-3 and 4 as a spreader to prevent distorting the control arm.

2. Press bushing in until it bottoms on control arm.

3. Turn arm over and install the other new bushing in the same manner.

   NOTE: After installing the retainers and bolts, lower the car so that the weight is resting on all four wheels and torque the bolts to 45 ft. lbs.

4. Install the bushing retainers and bolts.

5. Refer to UPPER CONTROL ARM - Installation and install control arm.

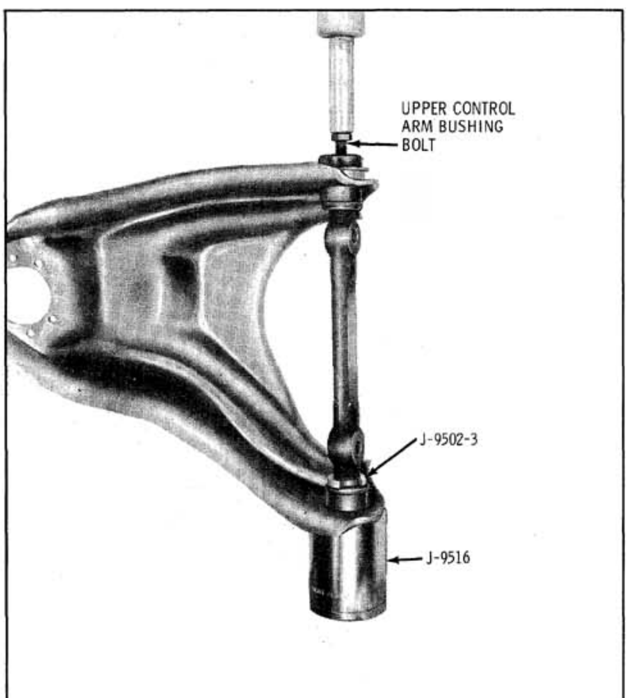


Fig. 9-133 Bushing Removal

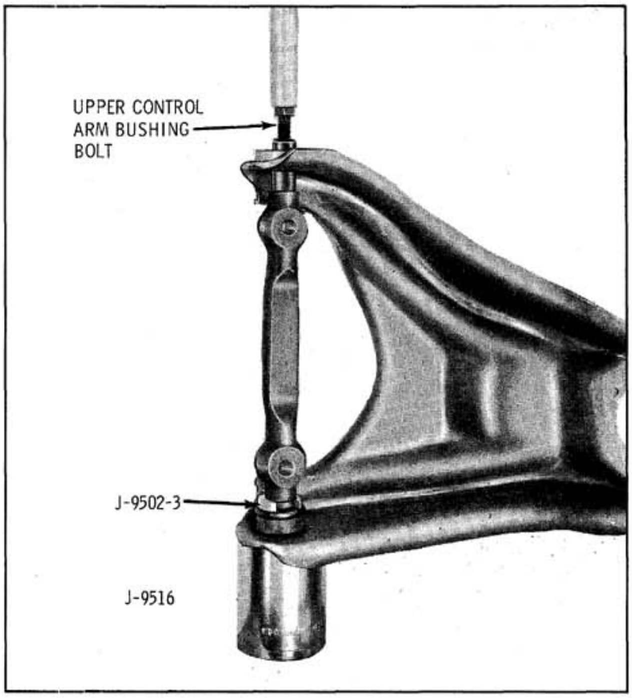


Fig. 9-134 Bushing Removal

WHEEL ALIGNMENT

Front wheel alignment is the mechanics of adjusting all the interrelated factors affecting the running and steering of the front wheels of the automobile. Incorrect alignment of front wheels will result in hard steering and abnormal tire wear.

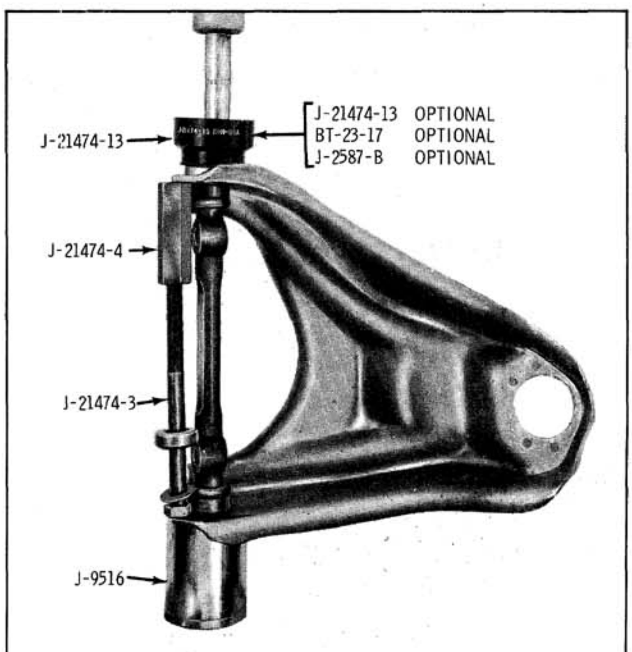


Fig. 9-135 Bushing Installation

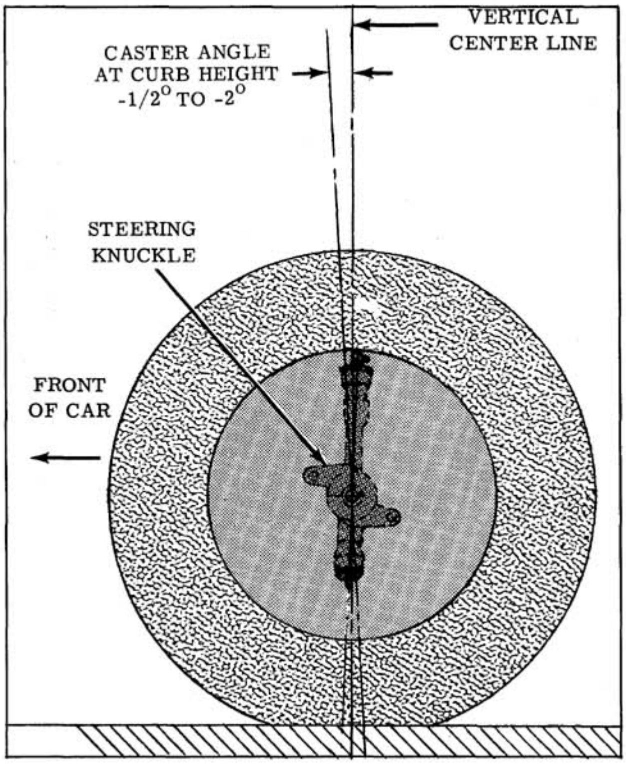


Fig. 9-136 Front Wheel Caster

The front wheel alignment factors are:

1. CASTER (Fig. 9-136)
2. CAMBER (Fig. 9-137)
3. TOE-IN (Fig. 9-138)
4. TOE-OUT (STEERING GEOMETRY) (Fig. 9-139)

Before any attempt is made to check or correct caster, camber, toe-in or toe-out, the following preliminary checks and necessary corrections should be made on those parts which influence the steering of the car:

1. Inflate tires to recommended pressure.
2. Check front wheel bearings and steering gear for proper adjustments.
3. Check front wheel and tire assembly for radial and lateral runout.
4. Grasp front bumper in center and raise and lower front end several times to allow the car to come to its normal level. Check for erratic shock absorber action.

The method of checking alignment will vary depending on the type of equipment being used. The instructions furnished by the manufacturer of the equipment should be followed.

NOTE: Check front wheel alignment without passengers or load in or on car. Camber and caster angle of the right and left wheel should be within 1/2° of each other for best handling characteristics.

CASTER AND CAMBER ADJUSTMENT

CASTER - 1/2° to -2°
CAMBER - 1/4° to +1/2°

Camber and caster are adjusted by shims placed between the upper pivot shafts and the frame. (Fig. 9-140) Both caster and camber adjustments can be made at the same time after the wheel alignment checks have been completed.

In order to remove or install shims, loosen the pivot shaft to frame bolts.

Refer to the Shim Chart to determine the approximate thickness necessary to correct the adjustment. After the correct number of shims have been installed, torque the pivot shaft mounting nuts 75 ft. lbs. and recheck caster and camber. camber.

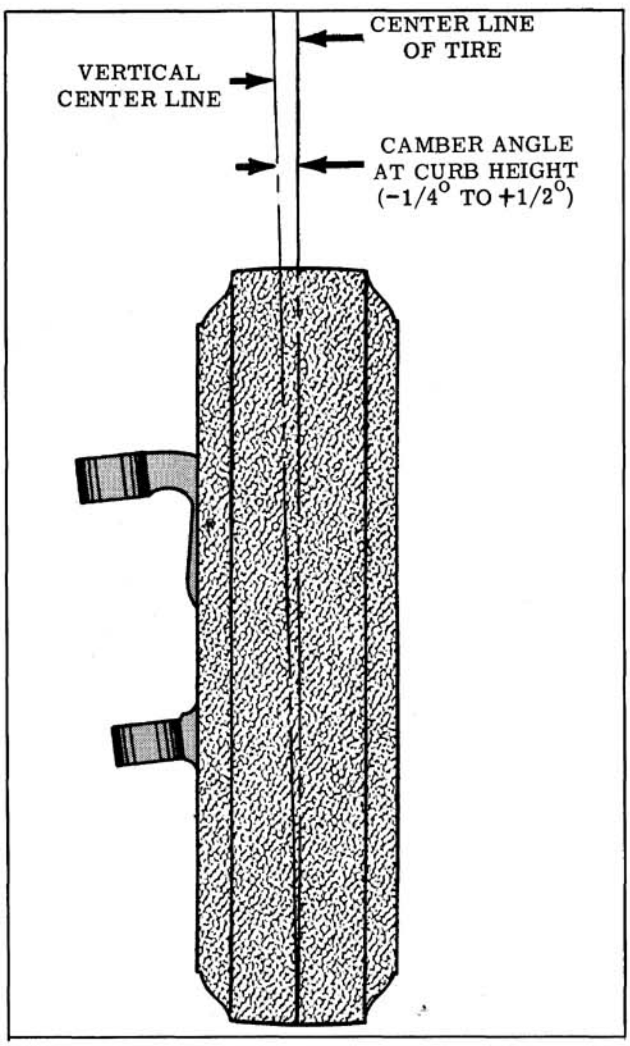


Fig. 9-137 Front Wheel Camber

Shim Thickness	One shim added to or subtracted from BOTH BOLTS will change CAMBER	One shim added to or subtracted from FRONT BOLT ONLY will change CASTER
.030"	3/16°	1/4°
.060"	3/8°	1/2°
.120"	3/4°	1°

TOE-IN ADJUSTMENT (Fig. 9-138)

Toe spec. ⅛" to 3/16" In

1. Loosen the clamp bolts at each end of the steering tie rod adjustable sleeves.

2. With steering wheel set in straight ahead position, turn tie rod adjusting sleeves to obtain the proper toe-in adjustment at curb load. (Fig. 9-138)

3. When adjustment has been completed according to the recommended specification, position inner clamps so that entire bolt is below centerline of tie rod. Torque nut 12 to 20 ft. lbs.

TOE-OUT (STEERING GEOMETRY) Fig. 9-139

Toe out is the mechanics of keeping the front wheels in proper relative alignment as the wheels are turned right or left. When turning, the wheels go into a toe-out position (further apart at the front of the tire than they are at the back). This condition increases with the increase of the turn.

To check, turn wheels to right until right wheel has been turned 20° from the straight ahead position. Left wheel setting should be 18.6° on all models. Follow the same procedure with wheels turned to left. Errors found are usually due to bent plain arms or incorrect caster, camber or toe-in. If error is due to bent plain arm, replacement with new arm should be made. When replacements of this kind are made, it is important

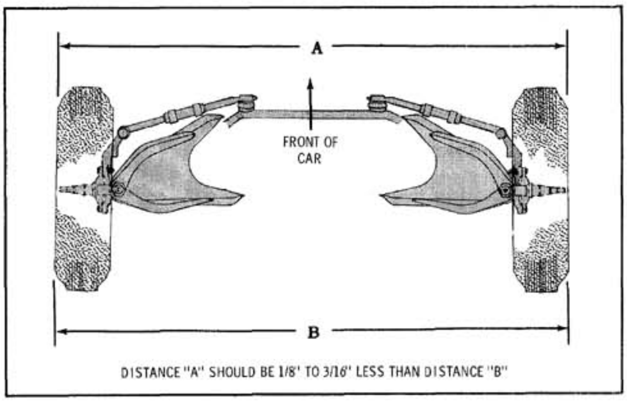


Fig. 9-138 Front Wheel Toe-In

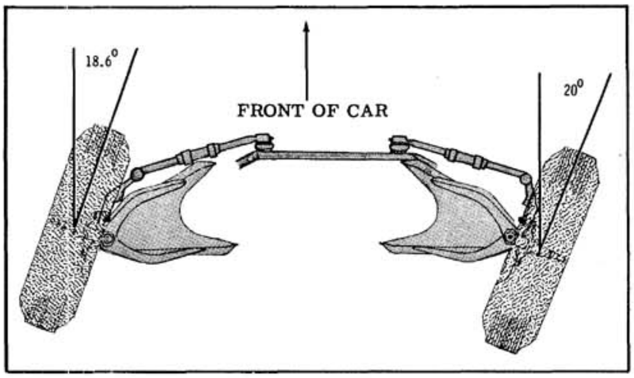


Fig. 9-139 Front Wheel Toe-Out

that other front end parts are checked and front wheels aligned.

DIAGNOSIS

WHEEL BEARING NOISE

Wheel bearing noise may be confused with rear axle noise; however, front wheel bearing noise does not change when comparing "pull" and "coast". A bad bearing will cause a "knock" or "click" approximately every two revolutions of wheel since the bearing rollers do not travel at the same speed as the wheel. To determine which wheel bearing is noisy, hoist the car and spin each wheel while listening at the hub cap.

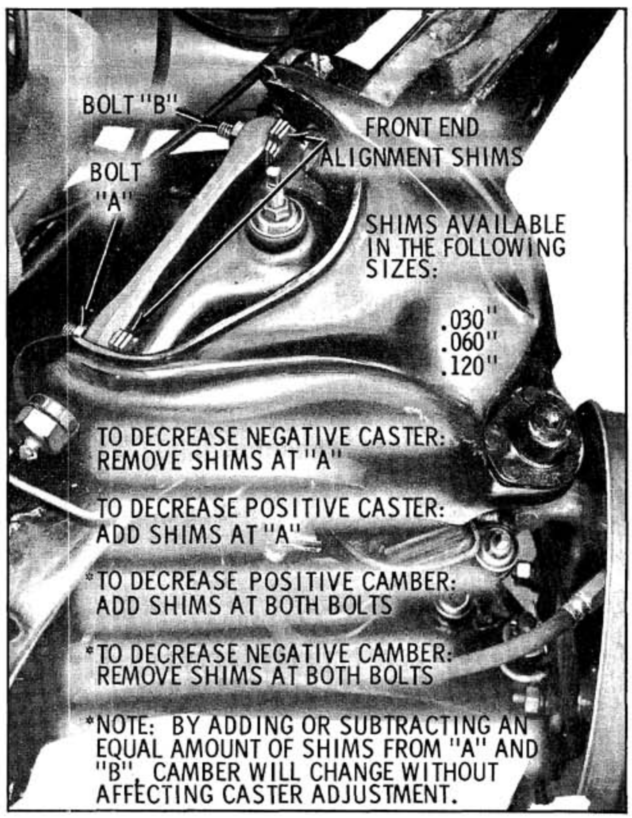


Fig. 9-140 Front Wheel Alignment Shims

HARD STEERING

Cause:

1. Low or uneven tire pressure.
2. Steering gear or linkage adjusted too tight.
3. Insufficient or incorrect lubricant used.
4. Improper caster.
5. Upper or lower control arms bent.
6. Frame bent or broken.
7. Steering knuckle bent.

EXCESSIVE PLAY OR LOOSENESS IN STEERING SYSTEM

Cause:

1. Steering gear or linkage worn.
2. Control arm ball joints worn.
3. Front wheel bearings worn or incorrectly adjusted.
4. Loose front stabilizer.

ERRATIC STEERING ON APPLICATION OF BRAKE

Cause:

1. Low or uneven tire pressure.
2. Brakes incorrectly or unevenly adjusted.
3. Incorrect or uneven caster.
4. Steering knuckle bent.
5. Loose steering linkage or suspension.
6. Dirt or grease on brake lining.

FRONT WHEEL SHIMMY

Cause:

1. Uneven tire pressure.
2. Steering linkage worn or incorrectly adjusted. Loose adjusters on tie rods.
3. Front wheel bearings worn or incorrectly adjusted.
4. Shock absorbers inoperative or leaking.
5. Control arm ball joints worn.
6. Toe incorrect.
7. Incorrect or uneven caster.
8. Steering knuckle bent.
9. Wheels, tires or brake drums out-of-balance.
10. Excessive runout on wheels or tires.

CAR PULLS TO ONE SIDE

Cause:

1. Uneven tire pressure.
2. Rear wheels not tracking with front wheels.
3. Brakes incorrectly or unevenly adjusted.
4. Shock absorbers worn or inoperative.
5. Toe incorrect.
6. Incorrect or uneven caster or camber.

WORN TIRE TREAD EDGES

Cause:

1. Improper front end alignment.
2. High speed driving on curves.
3. Steering knuckle bent.
4. Steering plain arm bent.
5. Low tire pressure.

SCUFFED TIRES

Cause:

1. Tires improperly inflated.
2. Wheels or tires out-of-true.
3. Control arm ball joints worn.
4. Toe incorrect.
5. Uneven caster.
6. Incorrect toe-out on turns.
7. Steering gear incorrectly adjusted.
8. Eccentric or bulged tires.

FRONT OR REAR WHEEL TRAMP

Cause:

1. Wheels, tires or brake drums out-of-balance.
2. Shock absorbers inoperative.
3. Loose or worn front wheel bearings.

CAR WANDERS

Cause:

1. Low or uneven tire pressure.
2. Steering gear or linkage worn.

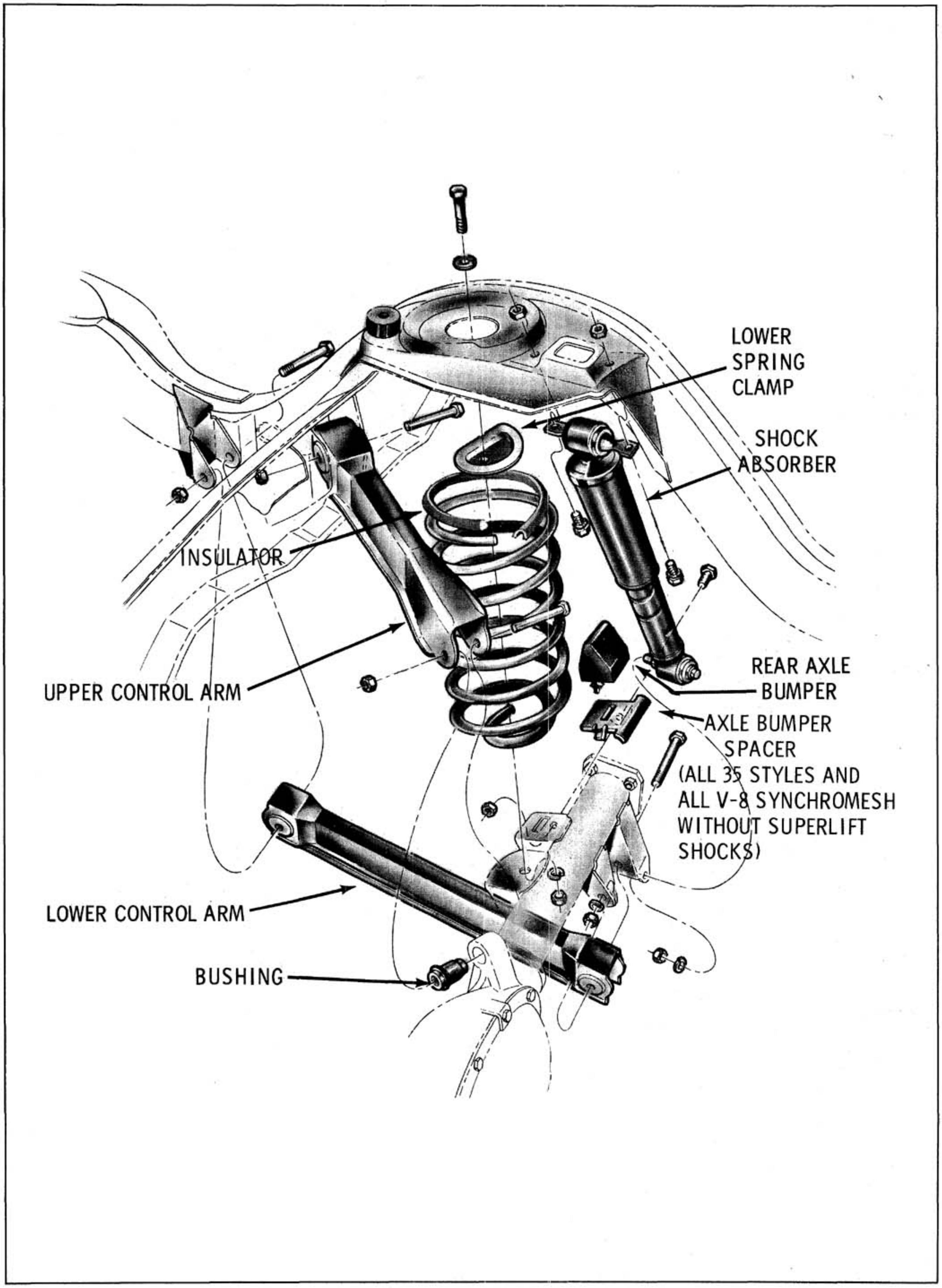


Fig. 9-141 Rear Suspension—Exploded View

REAR SUSPENSION

DESCRIPTION (Figs. 9-141 & 9-142)

The rear suspension is of the link-type with coil springs. It uses four suspension arms that attach the rear axle assembly to the frame. A bracket on the axle supports the coil spring, the top of which is positioned under the frame rail. The upper arms are attached to the top of the differential and extend forward to the frame. The shocks are attached to the frame and to brackets on the axle housing.

UPPER SUSPENSION ARMS

Removal

1. Remove nut from rear arm to differential housing bolt. (Fig. 9-142)
2. Remove rear bolt by rocking differential.
3. Front nut and bolt may now be removed.
4. Inspect bushings for damage.

Installation

Upper arms on SMT cars are to be installed in upper holes of frame crossbar on V-8, Sedans, Coupes and 67 styles.

To install, reverse removal procedure. Before torquing nuts, the car should be lowered so that the weight is resting on all four wheels; then torque nuts 65 ft. lbs.

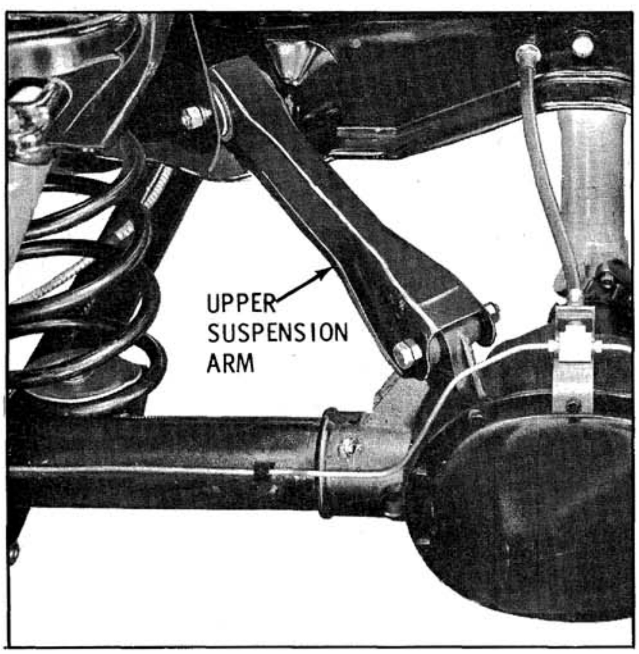


Fig. 9-142 Rear Suspension Assembly

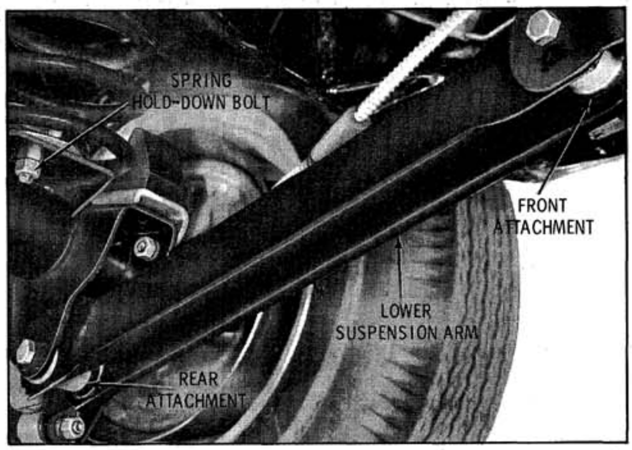


Fig. 9-143 Lower Suspension Arm

LOWER SUSPENSION ARMS (Fig. 9-143)

Removal

1. Raise car and support under axle housing.
2. Remove rear arm to axle housing bracket bolt.
3. Remove front arm to bracket bolt.

Installation

To replace arm, reverse the above sequence of operations. Torque arm attaching bolts and nuts to 65 ft. lbs. with car at curb height.

BUSHINGS (Figs. 9-144 & 9-145)

The bushings for the upper suspension arms through the differential carrier are replaceable. The remaining bushings can only be serviced by replacing the complete arm.

The rear bushing in the upper suspension arm can be replaced as follows:

1. Raise car and support under frame so axle housing hangs down.
2. Disconnect upper arm at differential and hold it up and out of the way.
3. Position tools as shown in Fig. 9-144 and pull bushing out.
4. To install, the bushing, reverse the tool as shown in Fig. 9-145 and pull bushing into position. Connect the upper suspension arm. Install bolt and torque nut 65 ft. lbs.

COIL SPRINGS

Removal

1. Disconnect shock from lower bracket. (Fig. 9-147)

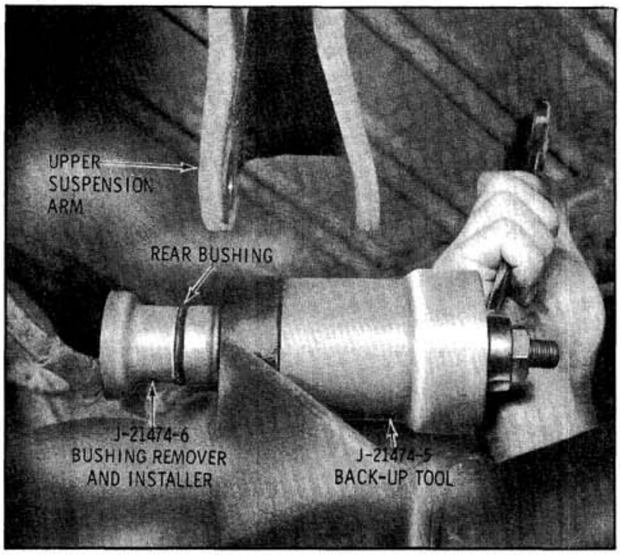


Fig. 9-144 Upper Arm Rear Bushing - Removal

2. Lift car at rear by frame rail. This will allow suspension to drop far enough to remove the spring.

CAUTION: DO NOT STRETCH BRAKE HOSE.

3. Remove spring hold-down clamp and remove spring.

Installation

1. Install spring insulator on top of spring.
2. Place coil spring in position so that spring tail is positioned against step in upper spring seat.
3. Install spring hold-down clamp. (Fig. 9-146) Torque nut to 30 ft. lbs.

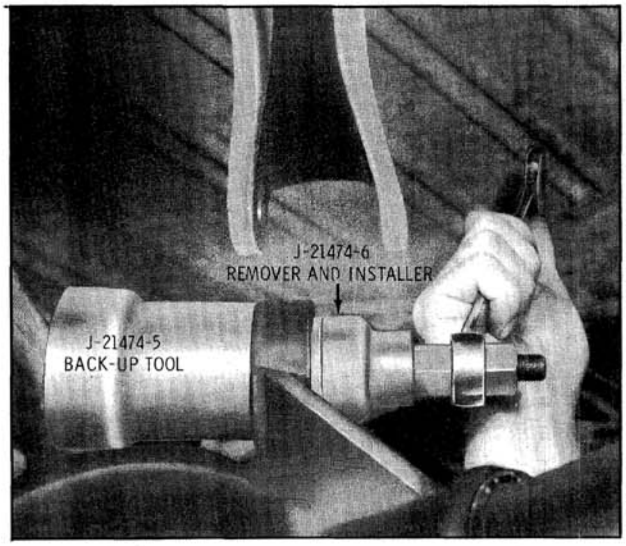


Fig. 9-145 Upper Arm Rear Bushing - Installation

Fig. 9-146 Coil Spring

4. Lower car sufficiently to attach shock to lower bracket. Torque shock nut to 60 ft. lbs.

SHOCK ABSORBERS

The double action shock absorbers are mounted by two bolts through the frame at the top and to a bracket welded on the axle housing. (Fig. 9-147)

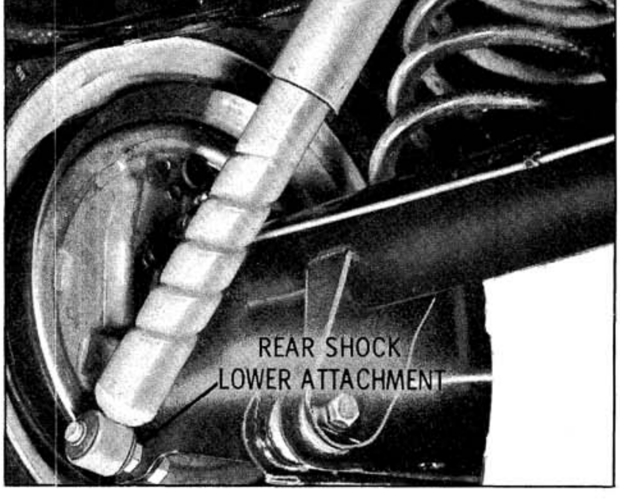


Fig. 9-147 Rear Shock Absorber (Exc. Ext. Wagon)

To thoroughly check shock absorbers, refer to FRONT SUSPENSION SHOCK ABSORBERS.

NOTE: If noisy rear shock absorbers are encountered, the attaching bolts should be retorqued. If this does not correct the noise, further checking will be necessary. If found necessary to replace, raise car and support rear axle. The lower end has a stud which is an integral part of the shock. Remove the nut and tap shock free from bracket. To disconnect the shock at the top, on all models except extended station wagons, remove the two bolts, nuts and lockwashers. On extended station wagons remove the nut, retainer and grommet.

Installation

Loosely attach shock at both ends before tightening nuts. Torque lower stud nut to 60 ft. lbs. and on all models except extended station wagons torque upper mounting bolts to 24 ft. lbs. On extended station wagon torque upper mounting mounting nut to 20 ft. lbs. or until nut is to end of threads on stud.

AXLE HOUSING

ALIGNMENT

Rear tire wear may indicate that the axle housing is out of alignment. It can be checked as follows:

1. Back the car squarely onto an alignment machine.
2. Compensate for wheel runout the same as for checking front wheel toe-in.
3. Check camber readings which should be: 1/4° negative to 1/2° positive.
4. Check the amount of toe-out, which should be: 3/64" to 5/32".

   NOTE: Due to the fact that the car is backed onto an alignment machine, the actual toe-out will be read on the scale as toe-in. However, if the toe-out is checked with a tram guage, disregard the aforementioned.

5. If a tram gauge is used for checking toe-in, it will still be necessary to perform Steps 1 and 2 in order to check camber.

The necessary straightening operations may be performed using frame straightening equipment without removing the axle housing from the car. This procedure will allow checks during the straightening operation to determine when the housing is within the prescribed limits.

REMOVAL

1. Disconnect shock from lower bracket.
2. Disconnect propeller shaft, brake line and parking cable equalizer. Compress parking brake cable housing clamp and pull housing through lower suspension arm mounting bracket.
3. Slowly raise car at rear end and remove coil springs.
4. Disconnect the upper suspension arm from the differential and the lower suspension arms from the brackets on the axle housing.

This will separate housing assembly from the frame. If replacing the housing with another, the components may be changed following the procedures outlined for these units in their respective sections.

INSTALLATION

After installing the assembly, it will be necessary to bleed the rear wheel brake cylinders, check brake and parking brake adjustment.

BUMPER (Fig. 9-141)

The rear axle housing bumper is located on the top of the axle housing and is attached by snapping into a bracket on the axle housing. If found deteriorated or damaged, it must be replaced.

WHEELS AND TIRES

MAINTENANCE RECOMMENDATIONS

For tire inflation and rotation recommendations, refer to TIRE INFORMATION, GENERAL INFORMATION.

TIRE AND WHEEL RUNOUT

Inflate tires to recommended pressure. Tires should be checked as soon as possible after car has been driven to avoid false readings due to the tendency of tires to take a temporary "set" after standing for a period of time.

Wheels and tires can be checked for runout at points indicated and should not exceed the following limits. (Fig. 9-148)

Tire & Wheel Assembly	-Radial	.063"
	Lateral	.081"
Wheel	-Radial	.035" or .022" in any 45° arc
	Lateral	.045" or .029" in any 45° arc

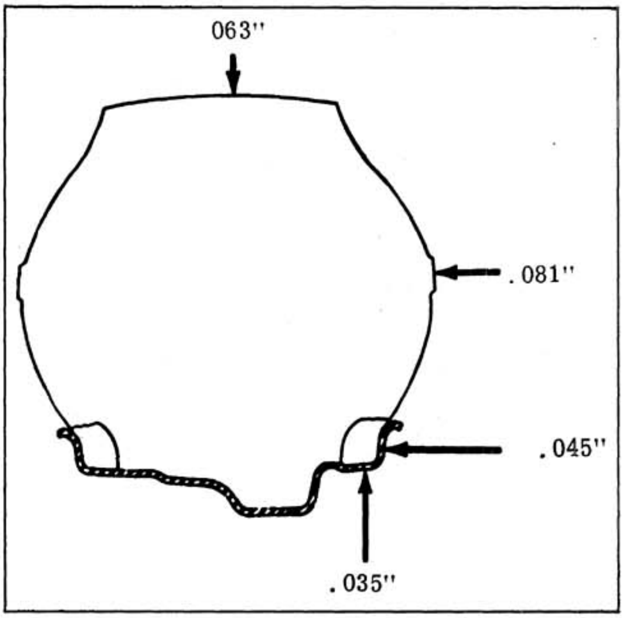


Fig. 9-148 Tire and Wheel Runout

WHEEL AND TIRE BALANCE

Wheel, tire and brake drum balance must be maintained within certain limits, otherwise, wheel "tramp" and high speed "shimmy" will result.

NOTE: When installing wheel weights on cars with wheel discs, use a weight of such size that it will not interfere with disc.

Front wheel "tramp" and front wheel "shimmy" are two entirely different conditions. Front wheel "tramp", which usually occurs at high speed, is a wheel "hop" from an unbalanced condition of wheels, loose linkage in the front end or improperly operating shock absorbers.

"Shimmy" may occur at the lower speeds and is a wobbly condition of the front wheels caused from an unbalanced condition, loose front end linkage, loose steering gear parts or faulty steering gear adjustment. "Tramp" and "shimmy" will be felt in the whole car; however, "shimmy"

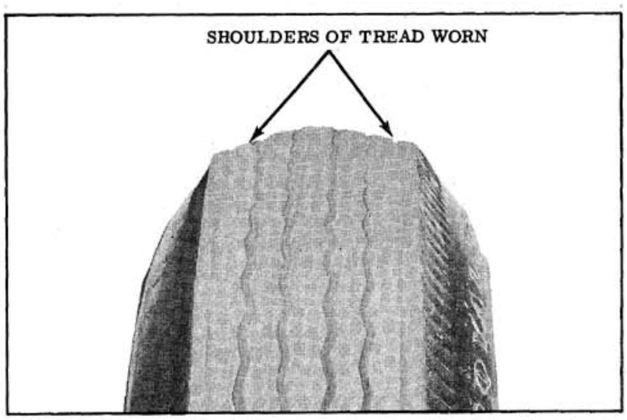


Fig. 9-149 Under Inflation Wear

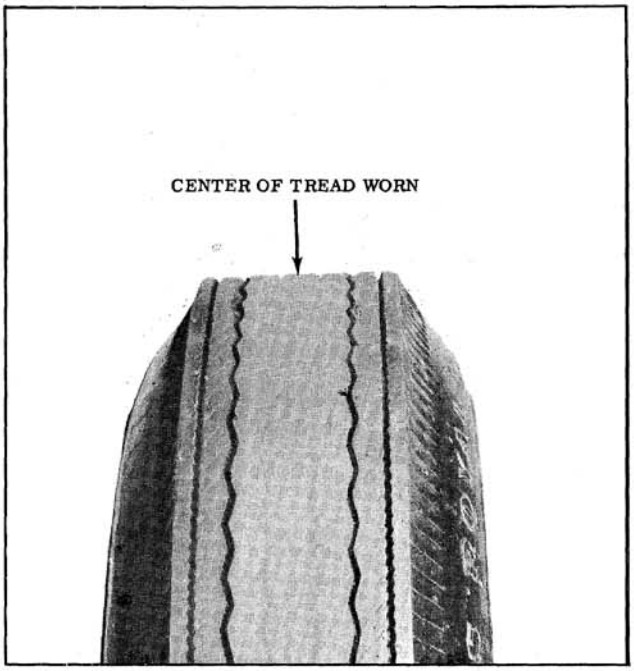


Fig. 9-150 Over Inflation Wear

can also be felt at the steering wheel. "Shimmy" is a front wheel condition entirely, whereas, it is possible to have "tramp" in front and rear wheels.

Due to irregularities in tread wear caused by sudden application, misalignment, incorrect inflation pressure or tire repair, etc., a wheel and tire may lose its original balance. Consequently, if front end instability develops, the tire and wheel assembly should be checked for static and dynamic balance.

DISMOUNTING AND MOUNTING

Several types of bead breakers are available to loosen tire from rim.

DO NOT USE TIRE IRONS AS THIS MAY DAMAGE SEALING BEADS.

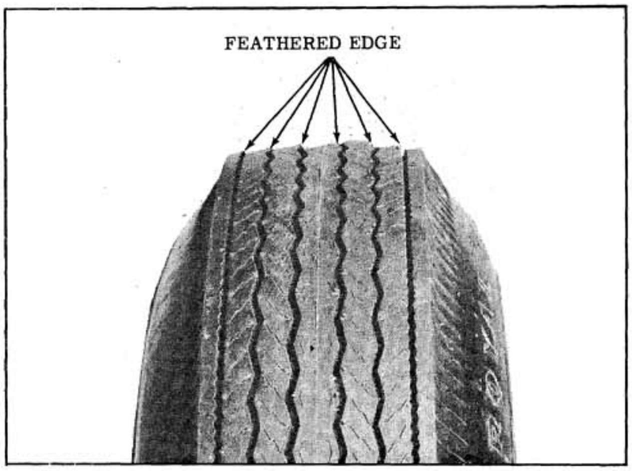


Fig. 9-151 Toe-In Wear

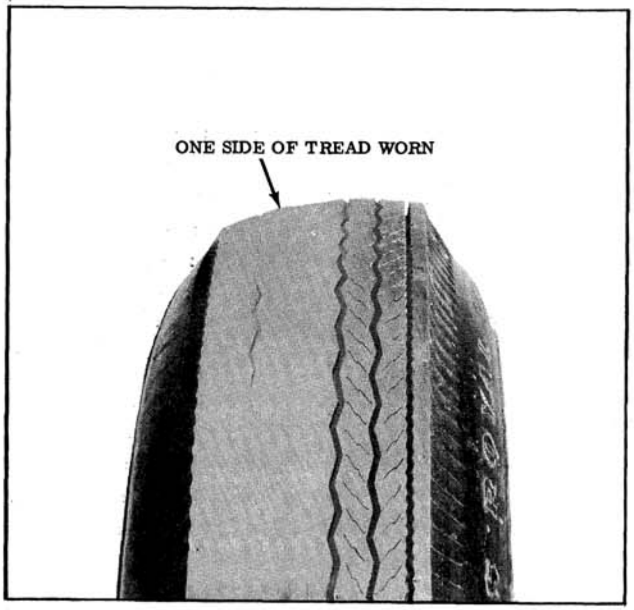


Fig. 9-152 Camber Wear

Tire mounting machines may be used to mount tires, but extreme care must be taken not to damage sealing beads.

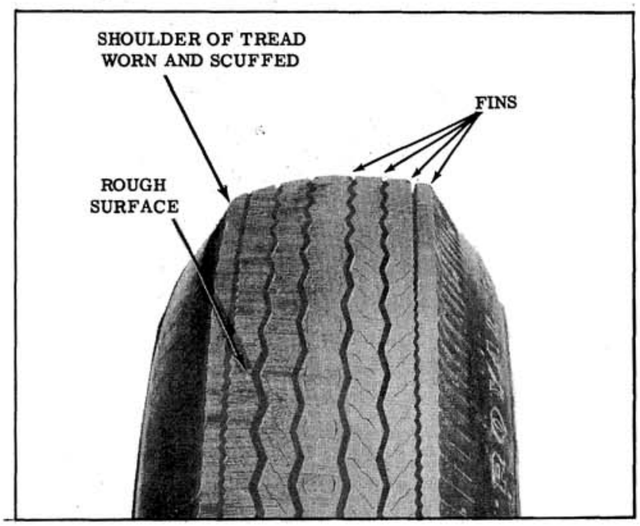


Fig. 9-153 Cornering Wear

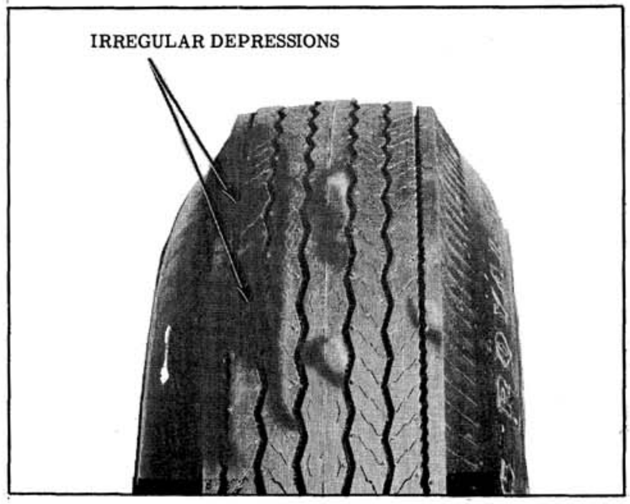


Fig. 9-154 Mechanical Condition Wear

Tire lubricating soap should be used on beads, but an excessive amount may cause tire slippage on wheel.

Inflate tire to approximately 40 psi to seat sealing beads. Be sure bead position is even all around, then deflate to recommended pressure.

TIRE REPAIRING

There are several methods of repairing tubeless tires. Oldsmobile recommends the "hot patch of self-vulcanizing method".

These methods are not recommended for punctures over 3/16" diameter. For repairs larger than this, consult the tire manufacturer's recommendations.

TIRE WEAR

Several illustrations are shown that reveal common tire wear patterns generally resulting from conditions noted. (Figs. 9-149 thru 9-154)

TIRE CHART

Styles	69		27		35		37	67	55 65
All Except A/C	V-6	V-8	V-6	V-8	V-6	V-8	V-8	V-8	V-8
6-95 x 14	Std.	N.A.	Std.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
7.35 x 14	O.S.	Std.	O.S.	Std.	Std.	Std.	Std.	Std.	N.A.
7.75 x 14	N.A.	O.S.	N.A.	O.S.	O.S.	O.S.	O.S.	O.S.	Std.
With A/C									
6.95 x 14	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
7.35 x 14	Std.	N.A.	Std.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
7.75 x 14	N.A.	Std.	N.A.	Std.	Std.	Std.	Std.	Std.	Std.

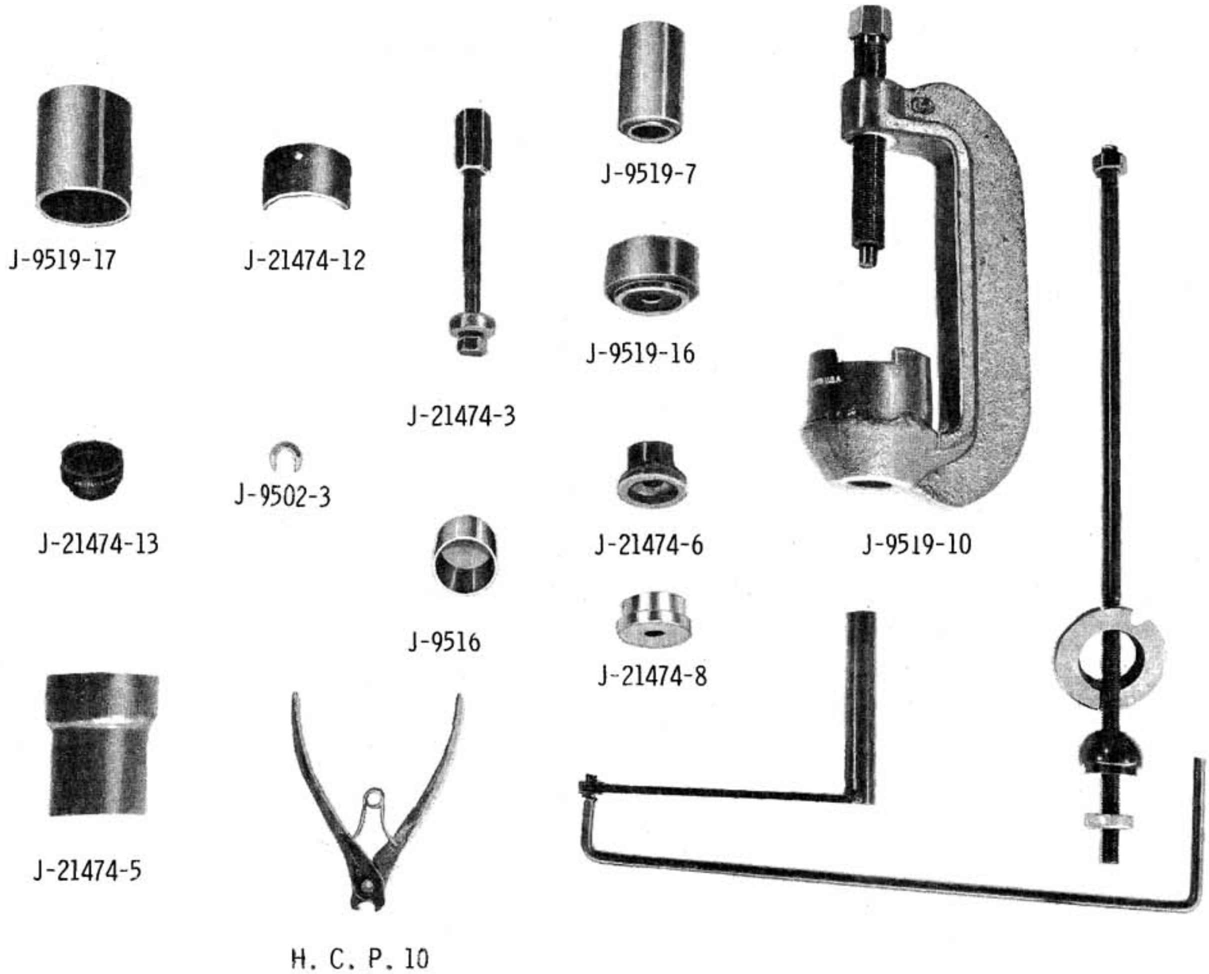
N.A. - Not Available
Std. - Standard
O.S. - Oversize

All 15" wheels use - 7.75 x 15 tire (not available on 67 styles)
Heavy duty (4 ply-8 ply rated) tire available in one size only - 7.75 x 14

TORQUE SPECIFICATIONS

Application	Ft. Lbs.
*Upper Arm to Frame - Rear Suspension	85
*Upper Arm to Differential	85
*Lower Arm to Frame - Rear Suspension	85
*Lower Arm to Differential	85
Bumper to Lower Control Arm - Front Suspension	15
*Upper Control Arm Bushing Bolts - Front Suspension	45
Front and Rear Wheel Nuts	75
Front Hub Bolts	75
Rear Hub Bolts	75
Front Shock Absorber Lower Mounting	24
Front Shock Absorber Upper Mounting	20
Front Stabilizer Link	15
Stabilizer Bracket to Frame	15
Rear Shock Absorber Upper Mounting (Exc. Ext. S.W.)	24
Rear Shock Absorber Upper Mounting (Ext. S.W.)	20
*Lower Control Arms to Frame - Front Suspension	85
Spring Clamp - Rear Suspension	30
Shock Absorber Lower Mounting - Rear Suspension	60
Anchor Bolt - Backing Plate to Knuckle	105
Ball Joint Stud Nuts	40 Min.
Upper Control Arm Shaft to Front Frame Bracket	75
Bumper Spacer to Axle Housing Bracket	55
Backing Plate to Knuckle	82
Backing Plate to Axle Housing	40

*Torque with weight of car on wheels.



J-21474-3	Special Bolt and Thrust Bearing Assembly	BT-6505	Front Spring Compressor
J-21474-4	Special Nut	J-9502-3	Front Upper Control Bushing Remover
J-21474-5	Receiver Tool	J-9519-10	Ball Joint Installing Tool
J-21474-6	Axle Housing Bushing Installer	J-9519-16	Ball Joint Fixture
J-21474-8	Front and Rear Lower Control Arm Bushing Remover	J-9519-17	Ball Joint Remover Back-Up Tool
J-21474-12	Front Lower Control Arm Bushing Installer Spacer	H.C.P. 10	Keystone Clamp Pliers (Cornwell Tool)
J-21474-13	Front and Rear Lower Control Arm Bushing Installer	J-9519-7	Ball Joint Remover
BT-23-17 J-2587-B	Not Shown - Can be used for bushing replacement in place of J-21474-13		

Fig. 9-155 Tools

DIFFERENTIAL AND PROPELLER SHAFT

ALL SERIES

CONTENTS OF SECTION 10

PERIODIC MAINTENANCE

Periodic or seasonal lubricant changes are not recommended. The lubricant level should be checked at each oil change interval. If lubricant addition is required, add:

Conventional Differential: Special Lubricant, Part No. 1050081, or S.A.E. 90 Hypoid Gear Lubricant meeting the requirements of military specifications MIL-L-2105B.

Anti-Spin Differential: Only Special Lubricant, Part No. 1050081.

IMPORTANT: Use of other than the above mentioned type of lubricant in the Anti-Spin Differential may cause chatter. If the wrong type of lubricant is used in the Anti-Spin, it will require draining the differential and installing the recommended lubricant, Part No. 1050081. It may be necessary to drive Anti-Spin equipped cars for distances of 50 miles or more to allow the new lubricant to work through the unit before the chatter will disappear.

MINOR SERVICE OPERATIONS

PINION OIL SEAL REPLACEMENT

1. Mark the propeller shaft and companion flange so they can be reassembled in the same position.

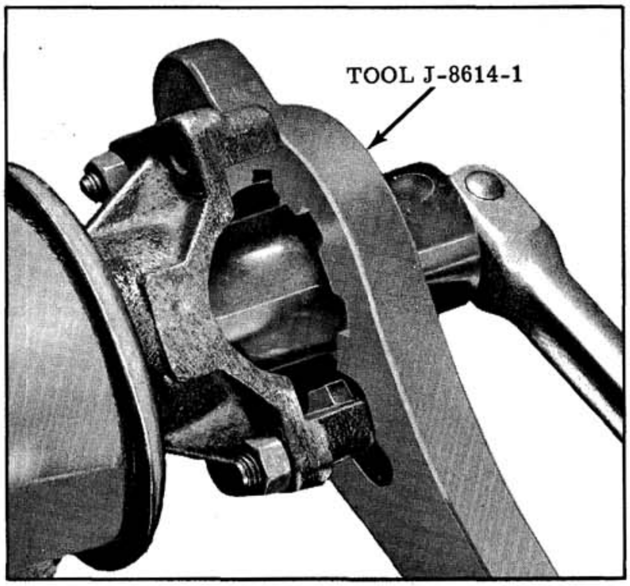


Fig. 10-1 Removing Companion Flange Nut

2. Disconnect propeller shaft from differential companion flange and support shaft up in body tunnel by wiring propeller shaft to the exhaust pipe. If U-joint bearings are not retained by a retainer strap, use a piece of wire to hold bearings on their journals.

3. Mark the position of the companion flange, pinion shaft and nut so that they can be reinstalled in the same position.

4. Remove companion flange nut, using Tool J-8614-01 to hold flange. (Fig. 10-1) Remove washer.

5. Remove companion flange using Puller J-8614-02. (Fig. 10-2)

6. Remove oil seal by driving it out of carrier with a blunt chisel.

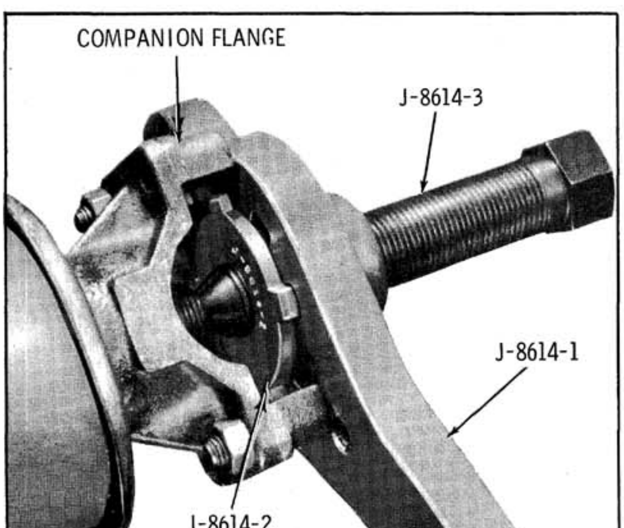


Fig. 10-2 Removing Companion Flange

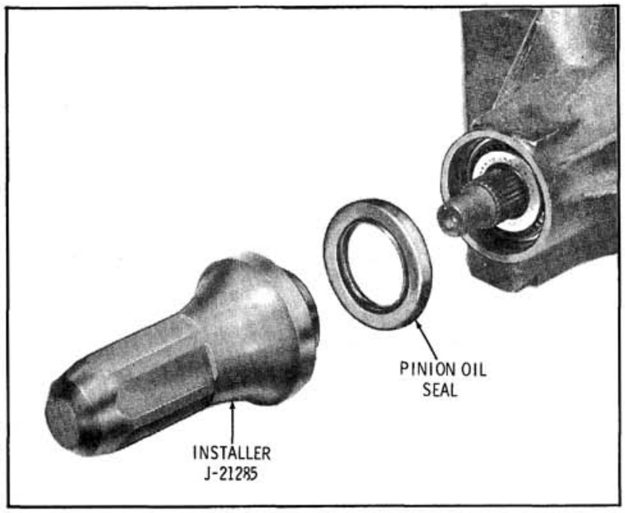


Fig. 10-3 Installing Pinion Oil Seal (54 through 86 Series)

7. Examine surface of companion flange for tool marks, nicks, or damaged surface. If damaged, replace flange as outlined under COMPANION FLANGE REPLACEMENT.

8. Examine carrier bore and remove any burrs that might cause leaks around the OD of the seal.

9. Coat outside diameter of new seal sparingly with sealer, Part No. 1050026 and install seal as shown in Figs. 10-3 or 10-4 to properly locate seal in carrier.

10. Apply Special Seal Lubricant, Part No. 1050169, to the OD of the companion flange and sealing lip of new seal.

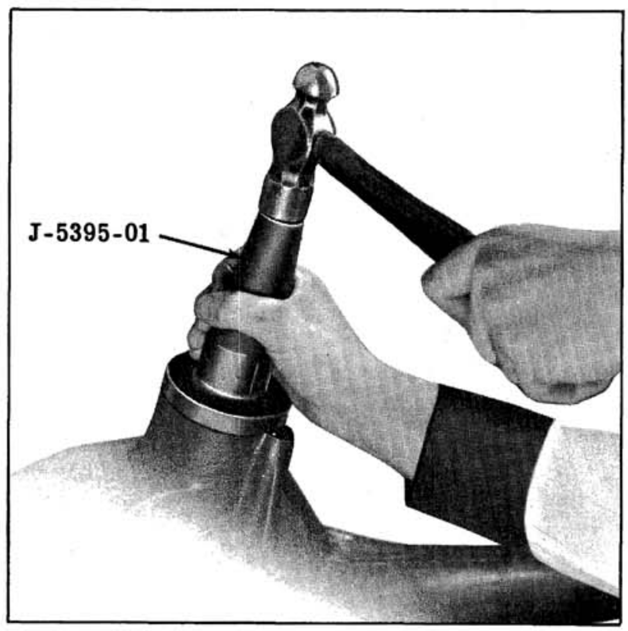


Fig. 10-4 Installing Pinion Oil Seal (33 through 52 Series)

11. Install companion flange and tighten nut to the same position as marked in Step 2. While holding companion flange with Tool J-8614-01, tighten nut 1/16" beyond alignment marks.

COMPANION FLANGE REPLACEMENT

1. Remove both rear wheels and brake drums.

2. Remove both axle shafts BEING CAREFUL NOT TO DRAG THE AXLE SHAFTS ACROSS THE SEALS.

3. Mark propeller shaft and companion flange then disconnect rear universal joint and support propeller shaft by tying propeller shaft to exhaust pipe. If U-joint bearings are not retained by a retainer strap, use a piece of wire to hold bearings on their journals.

4. Remove companion flange nut using Holding Tool J-8614-01 to hold flange. (Fig. 10-1)

5. Remove washer then remove companion flange using Puller J-8614-02. (Fig. 10-2)

6. Apply Special Seal Lubricant, Part No. 1050169, to the OD of the new companion flange, then install companion flange, washer and companion flange nut finger tight.

7. While holding companion flange with Tool J-8614-01, tighten the nut a little at a time and turn drive pinion several revolutions after each tightening to seat the rollers. Check the pre-load of bearings each time with an inch pound torque wrench until pre-load is 10 to 15 inch pounds.

   NOTE: The bearing pre-load should never exceed 25 inch pounds if the differential has been in use.

8. Connect rear universal joint to differential companion flange.

9. Install axle shafts carefully to avoid dragging shafts across seals. Torque attaching nuts to 28 ft. lbs.

10. Install drums and wheels.

REAR AXLE HOUSING

REMOVAL AND INSTALLATION

It is not necessary to remove the rear axle housing for differential repairs. However, if the housing is damaged, it may be removed and installed following procedure given in Section 9, SUSPENSION.

AXLE SHAFT

DESCRIPTION

Design allows for axle shaft end play up to .035" loose. This end play can be checked with the wheel and brake drum removed by measuring the difference between the end of the housing and the axle shaft flange while moving the axle shaft in and out by hand.

End play over .035" is excessive. Compensating for all of the end play by inserting a shim inboard of the bearing in the housing is not recommended, since it ignores the end play of the bearing itself and may result in improper seating of the gasket or backing plate against the housing. If the end play is excessive, the axle shaft and bearing assembly should be removed and the cause of the excessive end play determined and corrected.

Remove

1. Remove wheels.

2. Remove brake drums.

3. Remove nuts holding retainer plates to brake backing plates. Pull retainers clear of bolts and reinstall two lower nuts finger tight to hold brake backing plate in position.

4. Pull out axle shaft assemblies as shown in Fig. 10-5.

   CAUTION: While pulling axle shaft out through oil seal, support shaft carefully to avoid cutting seal lip.

AXLE SHAFT BEARING

Remove and Install

1. Nick bearing retainer in three or four places with a chisel, deep enough to spread ring. Retainer will then slip off. (Fig. 10-6)

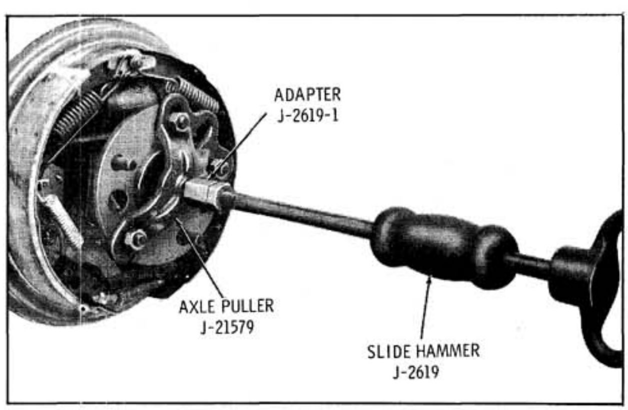


Fig. 10-5 Removing Axle Shaft

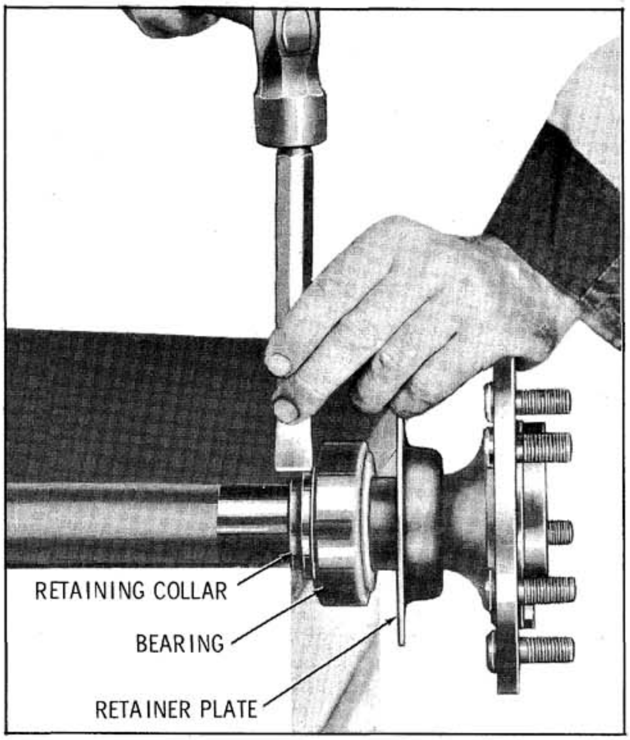


Fig. 10-6 Removing Bearing Retainer

2. Press axle shaft bearing from the axle shaft as shown in Figs. 10-7 or 10-8.

3. Retainer plate which retains bearing in the axle housing must be installed on the axle shaft before the bearing is installed; retainer gasket can be installed over the bearing.

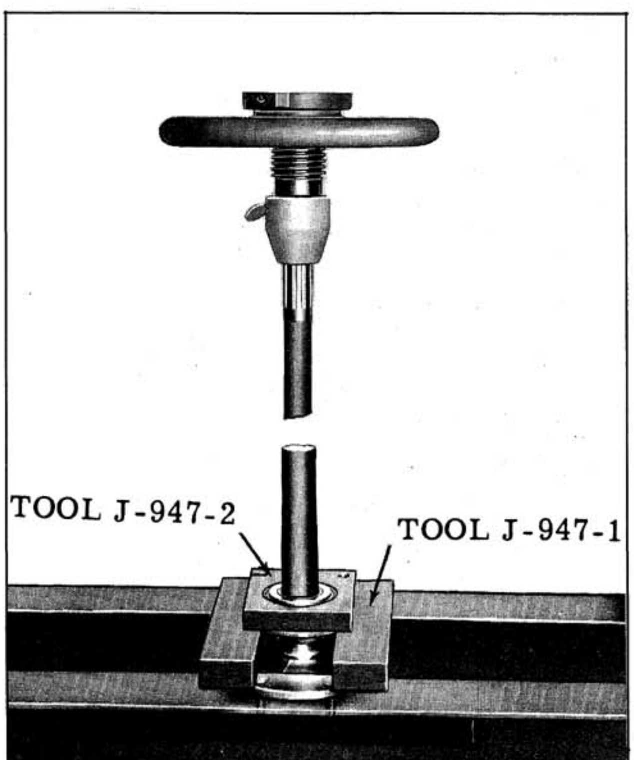


Fig. 10-7 Removing Axle Bearing (54 through 86 Series)

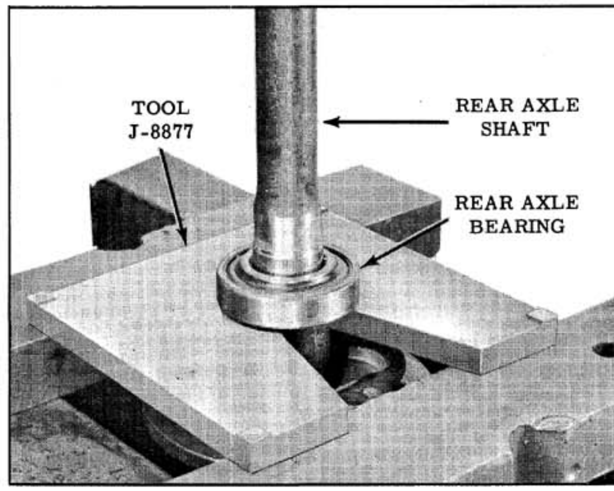


Fig. 10-8 Removing Axle Bearing (33 through 52 Series)

Press new axle shaft bearing and retainer against shoulder on axle shaft as shown in Figs. 10-9 or 10-10.

AXLE SHAFT FLANGE BOLT

Remove and Install

1. To remove and install an axle shaft flange bolt, the axle shaft assembly must be out of car. Remove bolt by pressing from axle flange.

2. Install new bolt by pressing through axle flange. Support bolt head and peen bolt with Peening Tool J-554-18 (54 through 86 series) and Peening Tool J-554-3 (for 33 through 52 series).

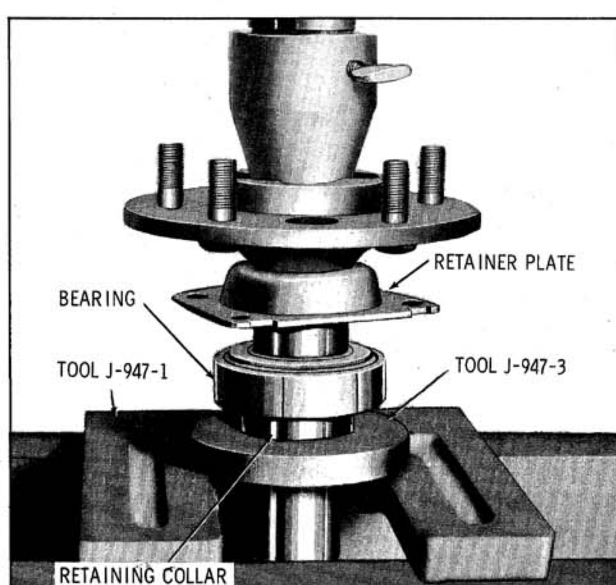


Fig. 10-9 Installing Axle Bearing (54 through 86 Series)

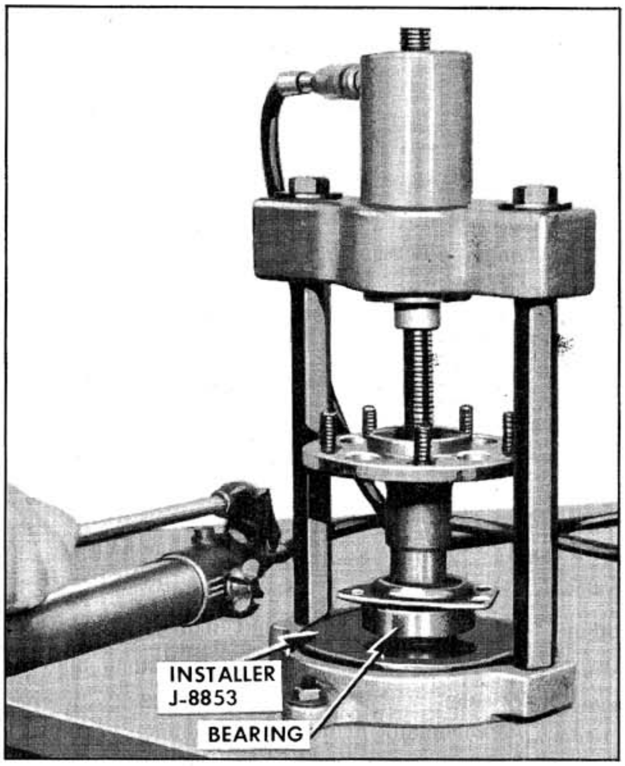


Fig. 10-10 Installing Axle Bearing (33 through 52 Series)

AXLE SHAFT SEAL

Remove and Install

1. Remove the axle shaft.

2. Remove the axle shaft seal as shown in Fig. 10-11.

3. Apply Sealer Part No. 1050026 to the OD of the new seal.

4. Install seal as shown in Fig. 10-12. Make sure seal is fully seated.

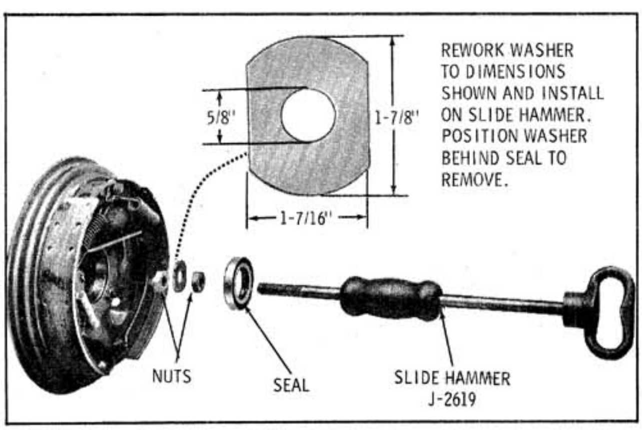


Fig. 10-11 Removing Axle Shaft Seal

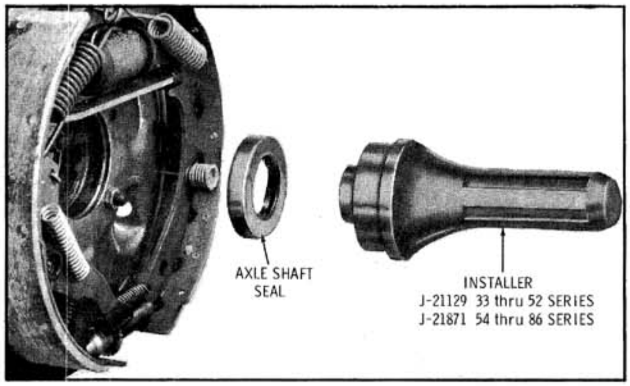


Fig. 10-12 Installing Axle Shaft Seal

AXLE SHAFT

Install

1. Apply a coat of wheel bearing grease in bearing recesses of housing. Install new outer retainer gaskets. To help prevent damage to the lip of the axle shaft seal when installing axle shaft and to insure lubricant on the seal lip during the first few miles of operation, the axle shaft should be lightly lubricated with axle lubricant from the sealing surface to approximately six inches inboard of the shaft. Insert axle shaft assemblies carefully until shaft splines engage in differential to avoid damage to seals.

2. Drive axle shaft assemblies into position.

3. Place gasket and retainer over studs and install nuts. Torque nuts to 40 ft. lbs.

4. Install brake drums over wheel bolts.

5. Install wheels and tighten wheel nuts.

DISASSEMBLY OF DIFFERENTIAL ASSEMBLY

Most differential service repairs can be made with the assembly in the car by disconnecting the shock absorbers and supporting the car by the frame with the axle housing lowered to its lowest maximum travel.

Lubricant may be drained by backing out all cover bolts and breaking cover loose at the bottom.

If the differential housing is removed for any reason, differential service can be performed on the bench by using the fixtures shown in Fig. 10-13.

DIFFERENTIAL CASE (Fig. 10-14)

Remove

1. Before removing the differential from the housing, ring gear to pinion backlash should

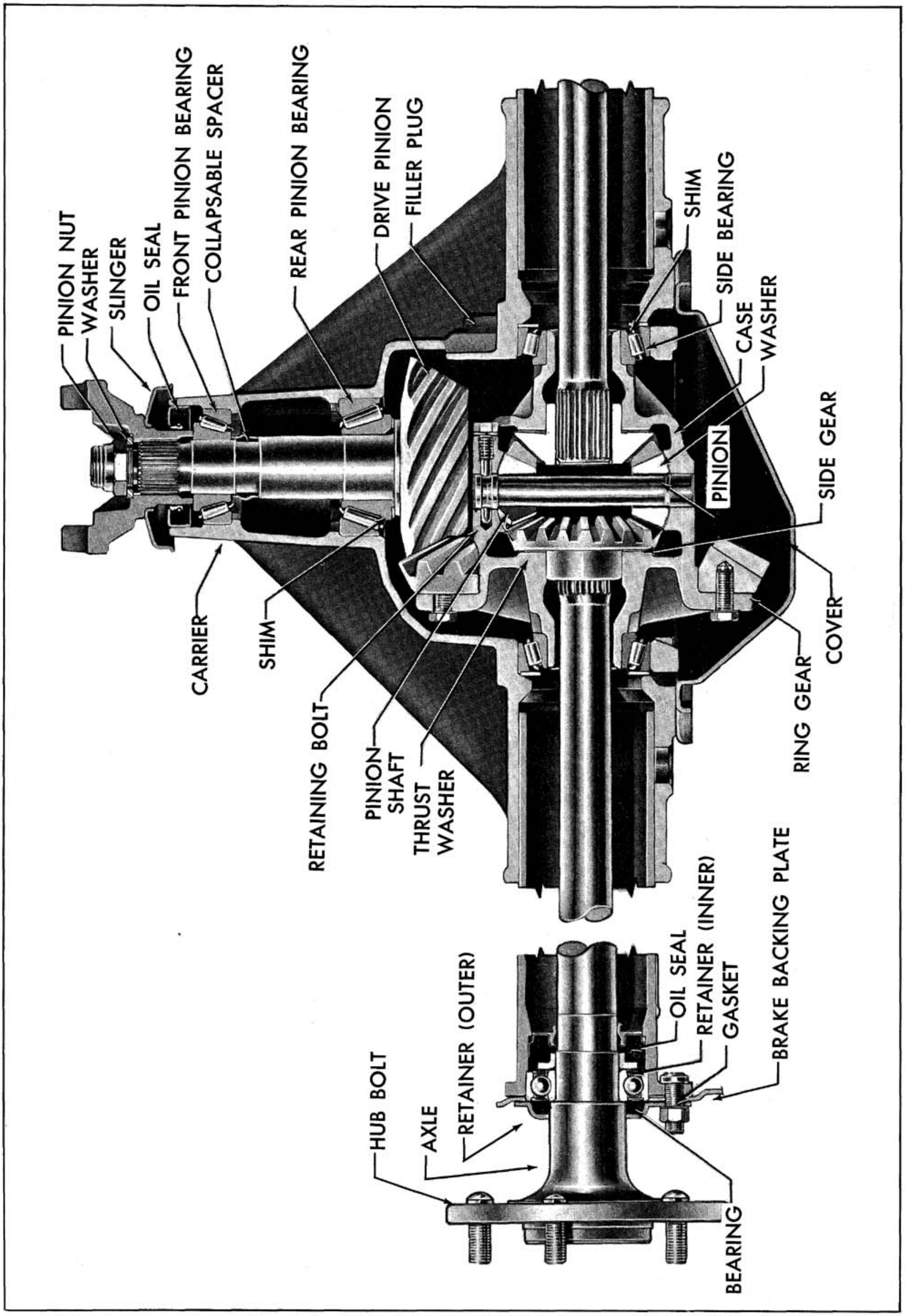


Fig. 10-14 Differential Assembly

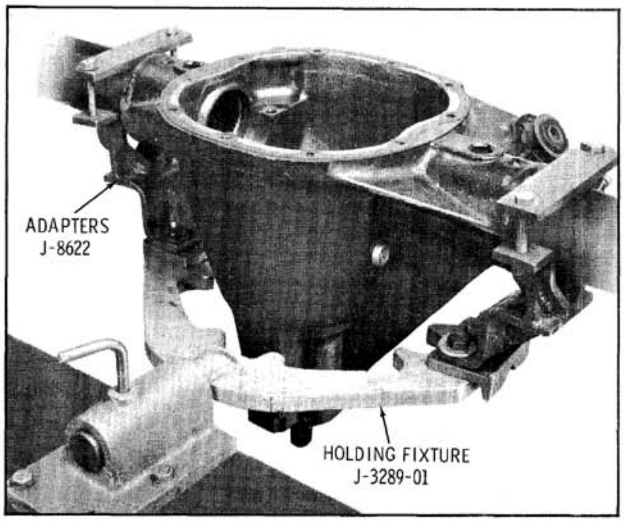


Fig. 10-13 Differential Holding Fixture

be checked. This will indicate gear or bearing wear or an error in backlash or pre-load setting which will help in determining cause of axle noise. (Fig. 10-15)

2. Remove differential bearing cap bolts. Bearing caps should be marked "R" and "L" to make sure they will be reassembled in their original location.

3. Remove two ring gear retaining bolts from differential case and install Ring Gear and Case Remover J-21322 with slide hammer as shown in Fig. 10-16. Remove the case assembly and place right and left bearing outer races and shims in sets with marked bearing caps so that they can be reinstalled in their original positions.

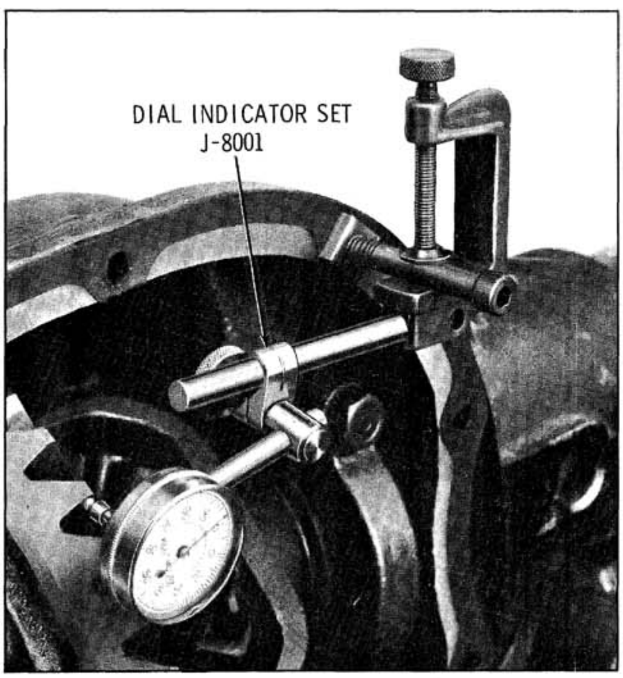


Fig. 10-15 Checking Backlash

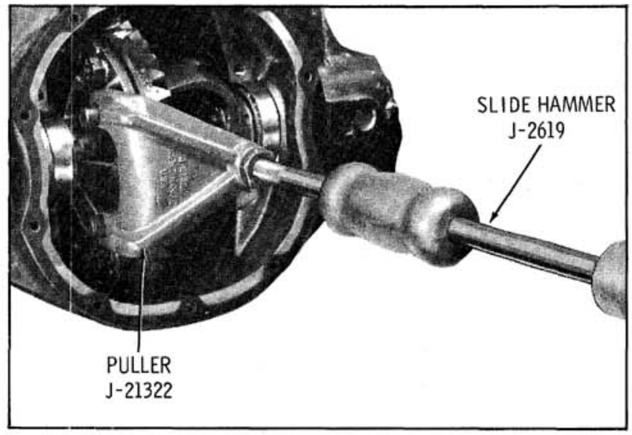


Fig. 10-16 Removing Case Assembly

NOTE: Ring gear attaching bolts on 54 through 86 series have LEFT hand threads. (33 through 52 have RIGHT hand threads)

Disassembly

1. If differential side bearings are to be replaced, they can be removed as shown in Fig. 10-17.

2. Remove bolt that retains differential pinion

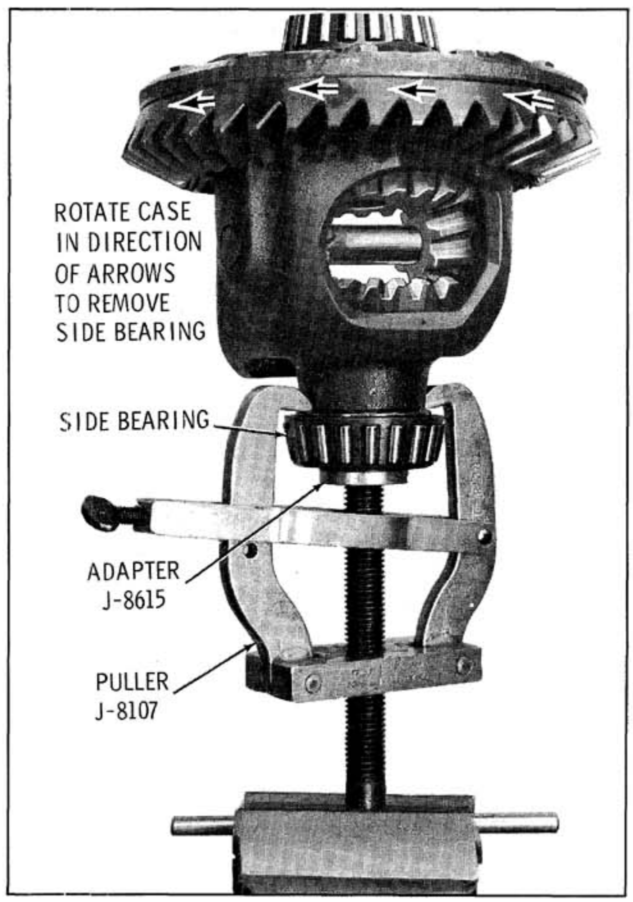


Fig. 10-17 Removing Side Bearing

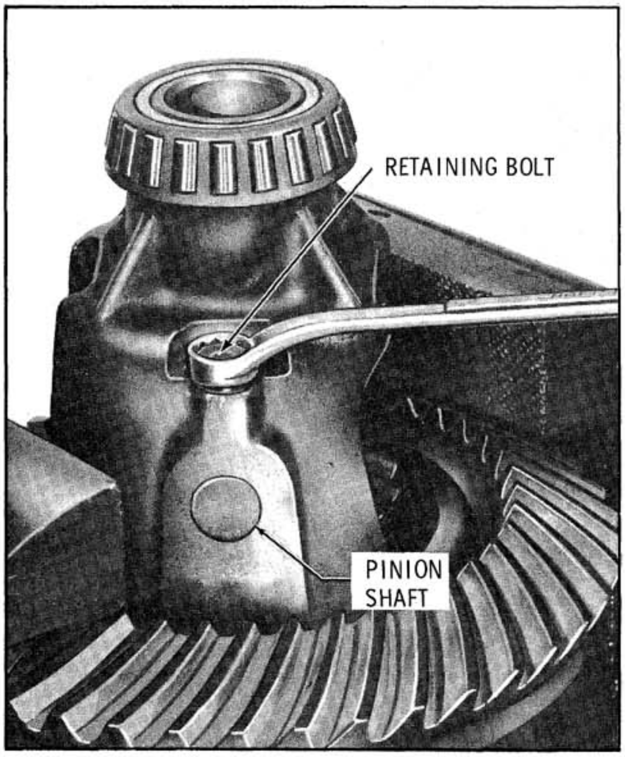


Fig. 10-18 Removing Retaining Bolt

shaft. (Fig. 10-18) Remove differential pinions, side gears and thrust washers from case.

3. If ring gear is to be replaced and it is tight on case after removing bolts, tap it off using a soft hammer. Do not pry between ring gear and case.

DRIVE PINION

Remove

1. Check drive pinion bearing pre-load. If there is no pre-load reading, check for looseness of pinion assembly by shaking. Looseness indicates need for bearing replacement. If differential was operated for an extended period with very loose bearings, the ring gear and pinion will also require replacement.

2. Install Holder J-8614-01 on companion flange by using two 5/16" x 2" bolts with flat washers. Remove pinion nut and washer. (Fig. 10-1)

3. Pull companion flange from pinion using Puller J-8614-02 in Holder J-8614-01. To install puller, back out puller screw, insert puller through holder and rotate 1/8 turn. (Fig. 10-2)

4. Remove drive pinion assembly. If necessary, tap pinion out with soft hammer while being careful to guide pinion with hand to avoid damage to bearing outer races.

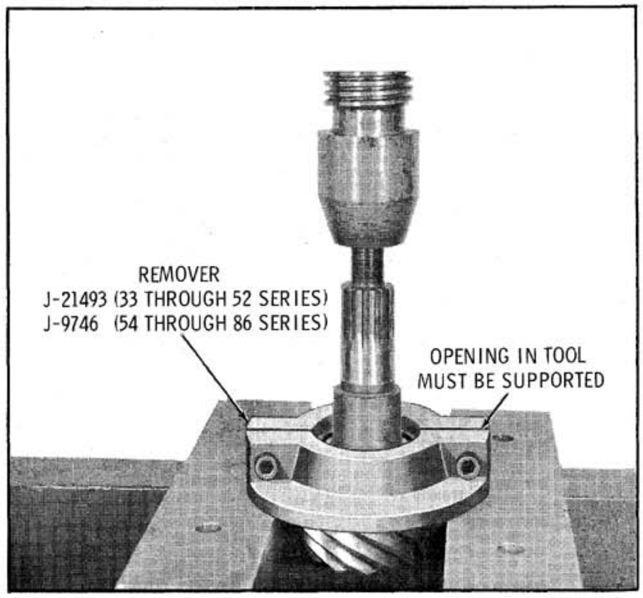


Fig. 10-19 Removing Pinion Bearing

Disassembly

The rear pinion bearing must be removed when it becomes necessary to change the pinion depth adjustment.

1. With drive pinion removed from carrier, press bearing from the pinion gear as shown in Fig. 10-19.

2. Pry pinion oil seal from carrier and remove front pinion bearing. If this bearing is to be replaced, remove outer race from carrier as shown in Fig. 10-20.

3. If rear pinion bearing is to be replaced, remove outer race from carrier using a punch in slots provided for this purpose as shown in Fig. 10-21.

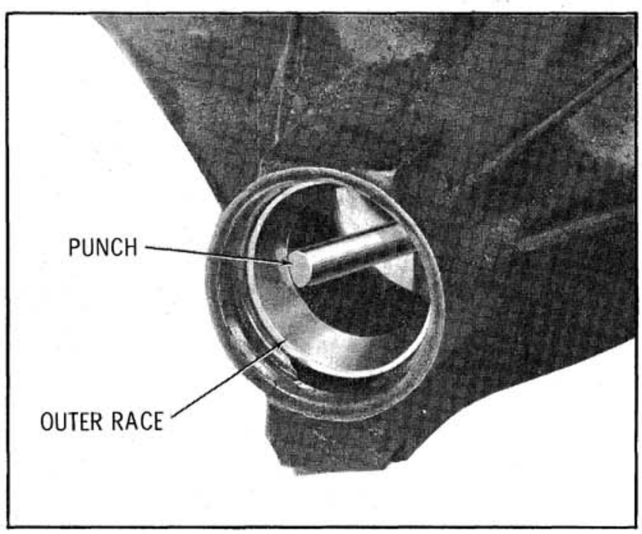


Fig. 10-20 Removing Pinion Front Bearing Outer Race

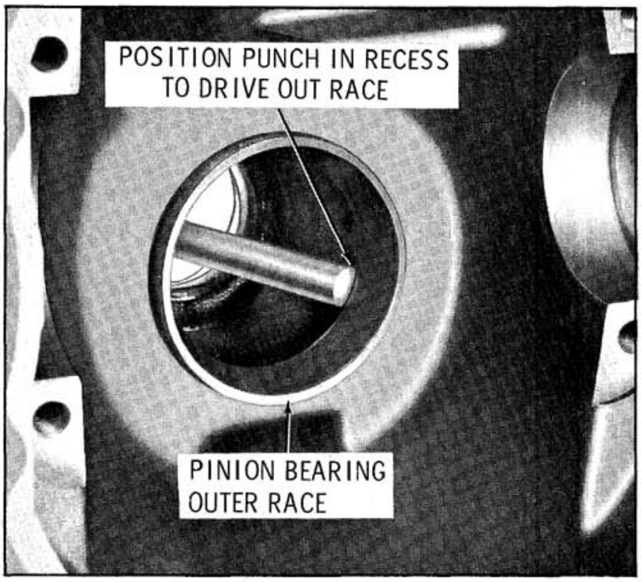


Fig. 10-21 Removing Pinion Rear Bearing Outer Race

CLEANING AND INSPECTION

1. Clean all differential bearings thoroughly in clean solvent (do not use a brush). Examine bearings visually and by feel. All bearings should feel smooth when oiled and rotated while applying as much hand pressure as possible.

   NOTE: Minute scratches and pits that appear on rollers and races at low mileage are due to the initial pre-load, and bearings having these marks should not be rejected.

2. Examine sealing surface of companion flange for nicks, burrs, or rough tool marks which would cause damage to the seal and result in an oil leak. Replace if damaged.

3. Examine carrier bore and remove any burrs that might cause leaks around the OD of the seal.

4. Examine the differential ring gear and drive pinion teeth for excessive wear and scoring. Any of these conditions will require replacement of the gear set.

5. Inspect the differential pinion gear shaft for unusual wear; also check the pinion and side gears and thrust washers.

6. Check the press fit of the side bearing inner race on the differential case hub by prying against the shoulder at the puller recess in the case. Side bearings must be a tight press fit on the hub.

7. Diagnosis of a differential failure such as: chipped bearings, loose (lapped-in) bearings, chipped gears, etc., is a warning that some foreign material is present; therefore, the axle housing must be cleaned.

DRIVE PINION

Assembly

1. If a new rear pinion bearing is to be installed, install new outer race as shown in Fig. 10-22.

2. If a new front pinion bearing is to be installed, install new outer race as shown in Fig. 10-23.

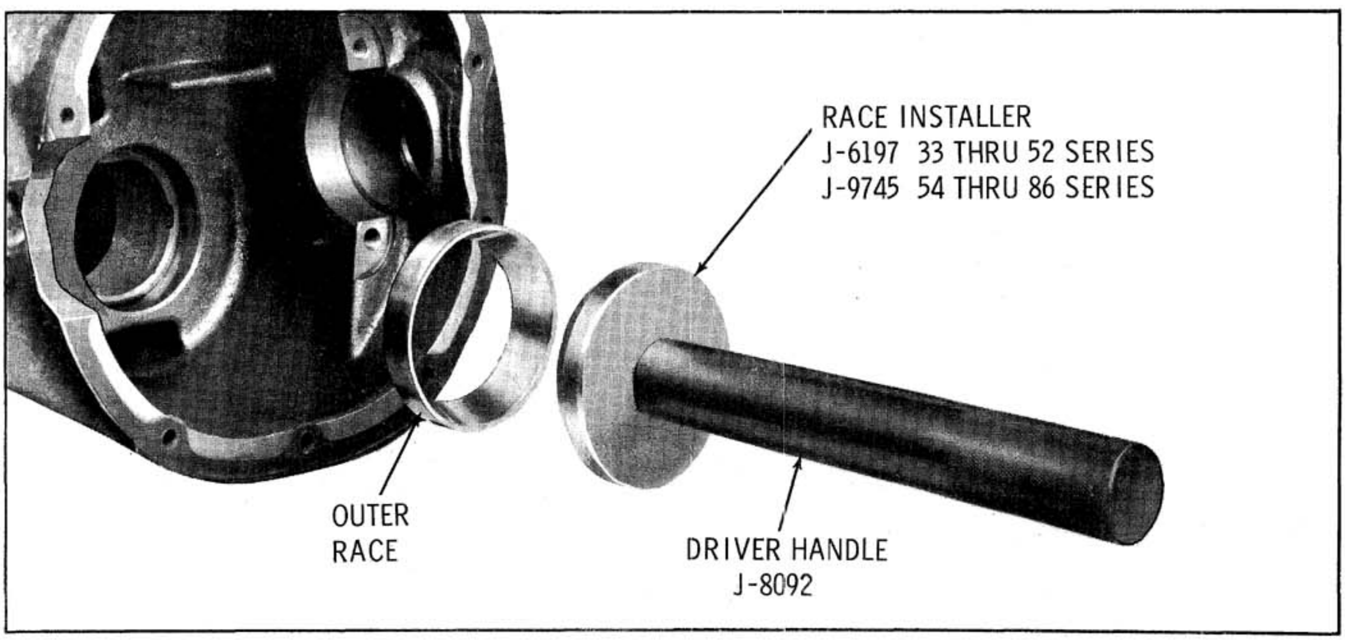


Fig. 10-22 Installing Pinion Rear Bearing Outer Race

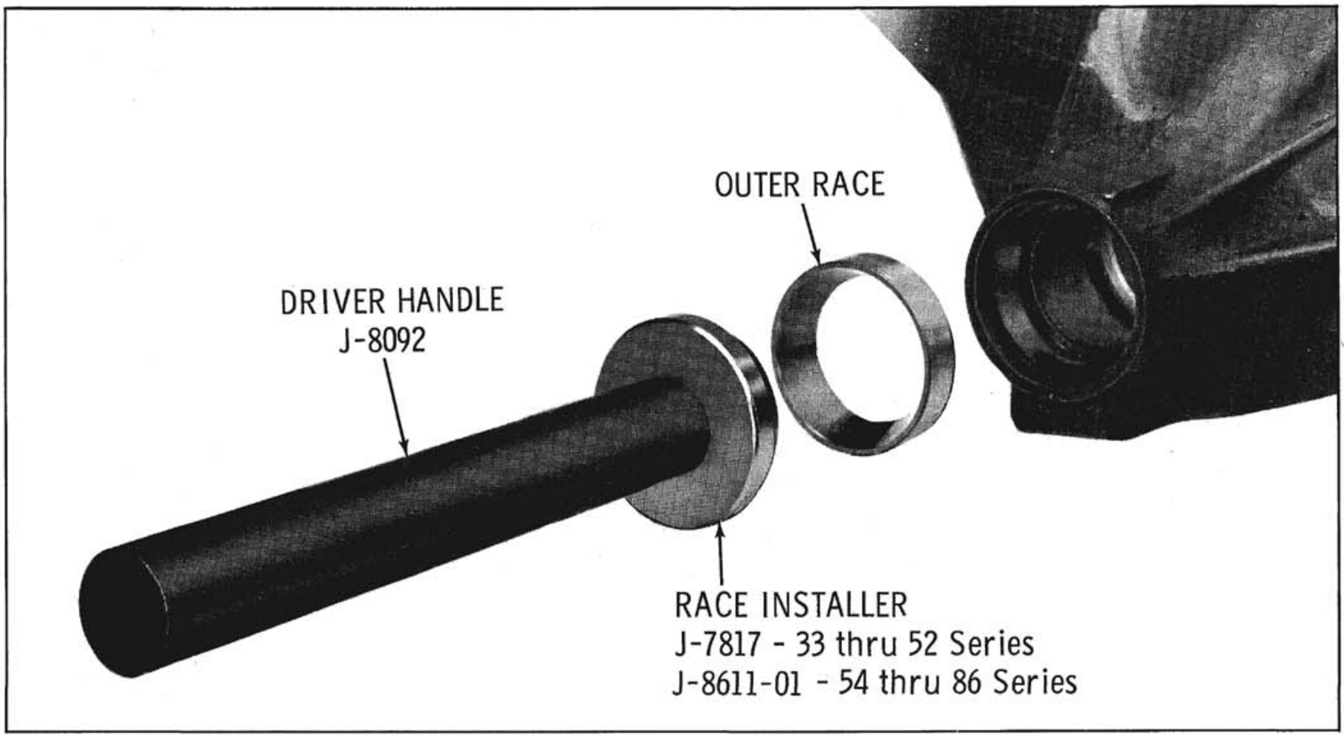


Fig. 10-23 Installing Pinion Front Bearing Outer Race

Adjusting Pinion Depth

Pinion depth is set with Pinion Setting Gauge J-21777. The pinion setting gauge provides in effect, a "nominal" or "zero" pinion as a gauging reference.

1. Make certain all of the gauge parts are clean.
2. Lubricate front and rear pinion bearings liberally with differential lubricant, Part No. 1050081.
3. While holding bearings in position, install Gauge Plate J-21777-2, Pilot J-21777-8 (54 through 86 series only), Stud J-8619-13 and Washer J-8619-12 and Nut as shown in Figs. 10-24 or 10-25.
4. Hold stud stationary with a wrench positioned over the flats on the ends of stud and tighten nut to 20 in. lbs. torque. Rotate gauge plate assembly several complete revolutions to seat the bearings. Then tighten nut until a torque between 15 and 25 in. lbs. is required to keep the gauge plate in rotation.

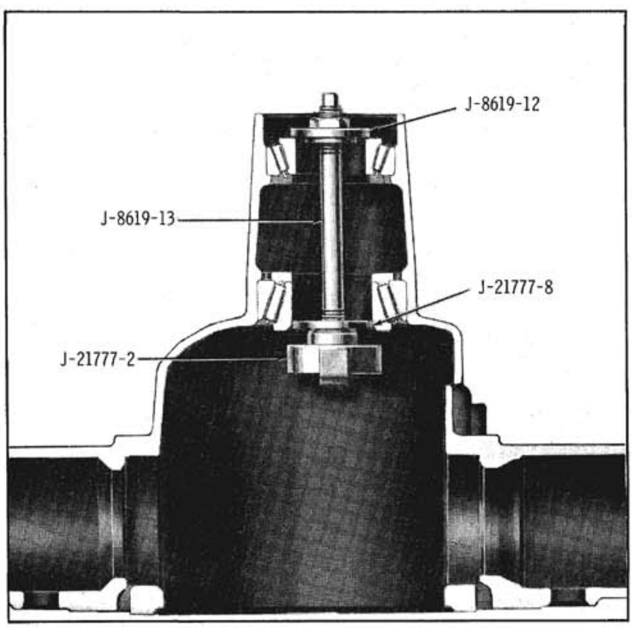


Fig. 10-24 Installing Gauge Plate (54 through 86 Series)

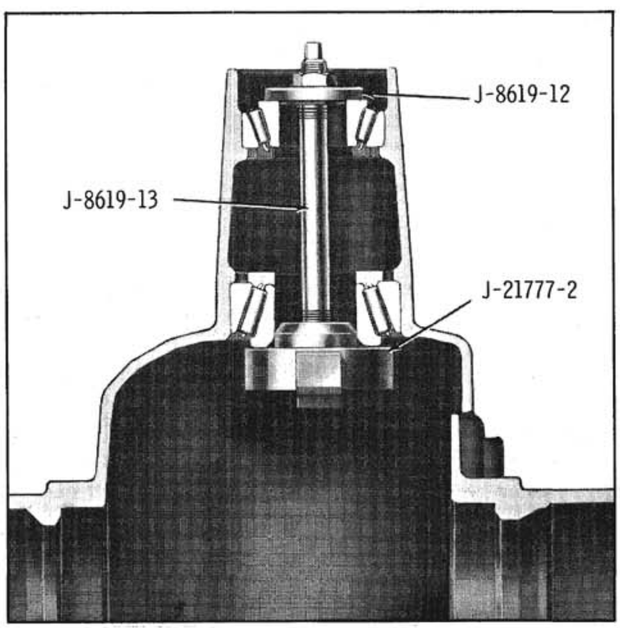


Fig. 10-25 Installing Gauge Plate (33 through 52 Series)

5. Rotate the gauge plate until the gauging areas are parallel with the discs.

   NOTE: The gauging area marked "B" is used with Discs J-21777-3 and the gauging area marked "A" is used with Discs J-8619-10. (Fig. 10-26)

6. Make certain differential side bearing support bores are clean and free of burrs.

7. Install the correct discs on the gauge shaft.

8. Position the dial indicator, J-8001 on the mounting post of the gauge shaft with the contact button touching the indicator pad. Set the dial indicator on ZERO, then depress the dial indicator until the needle rotates 3/4 turn clockwise. Tighten the dial indicator in this position.

9. Position the gauge shaft assembly in the carrier so that the dial indicator contact rod is directly over the gauging area of the gauge block, and the discs seated fully in the side bearing bores. (Fig. 10-27)

10. Position gauge shaft so that the dial indicator rod contacts the gauging area. Rotate gauge shaft slowly back and forth until the dial indicator reads the greatest deflection. At the point of greatest deflection, set the dial indicator to ZERO. Repeat rocking action of gauge shaft to verify the ZERO setting.

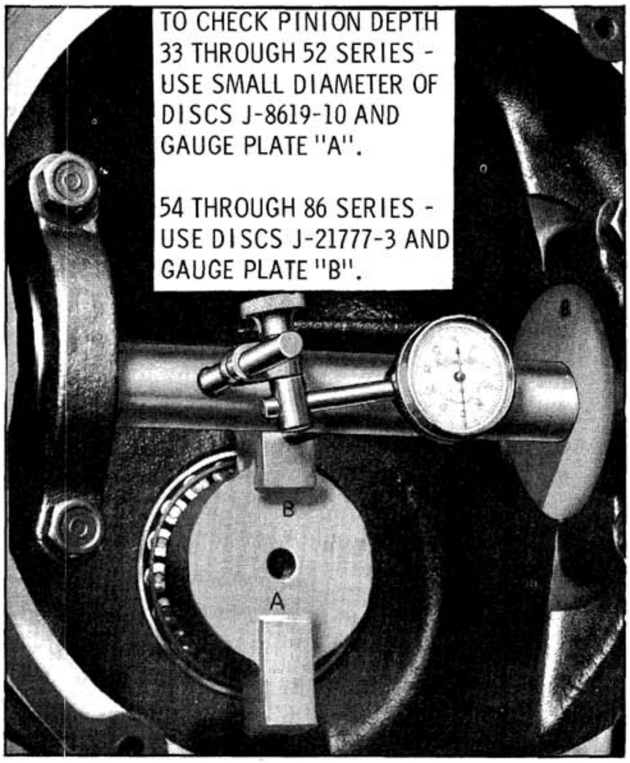


Fig. 10-26 Pinion Depth Checking Gauge Installed

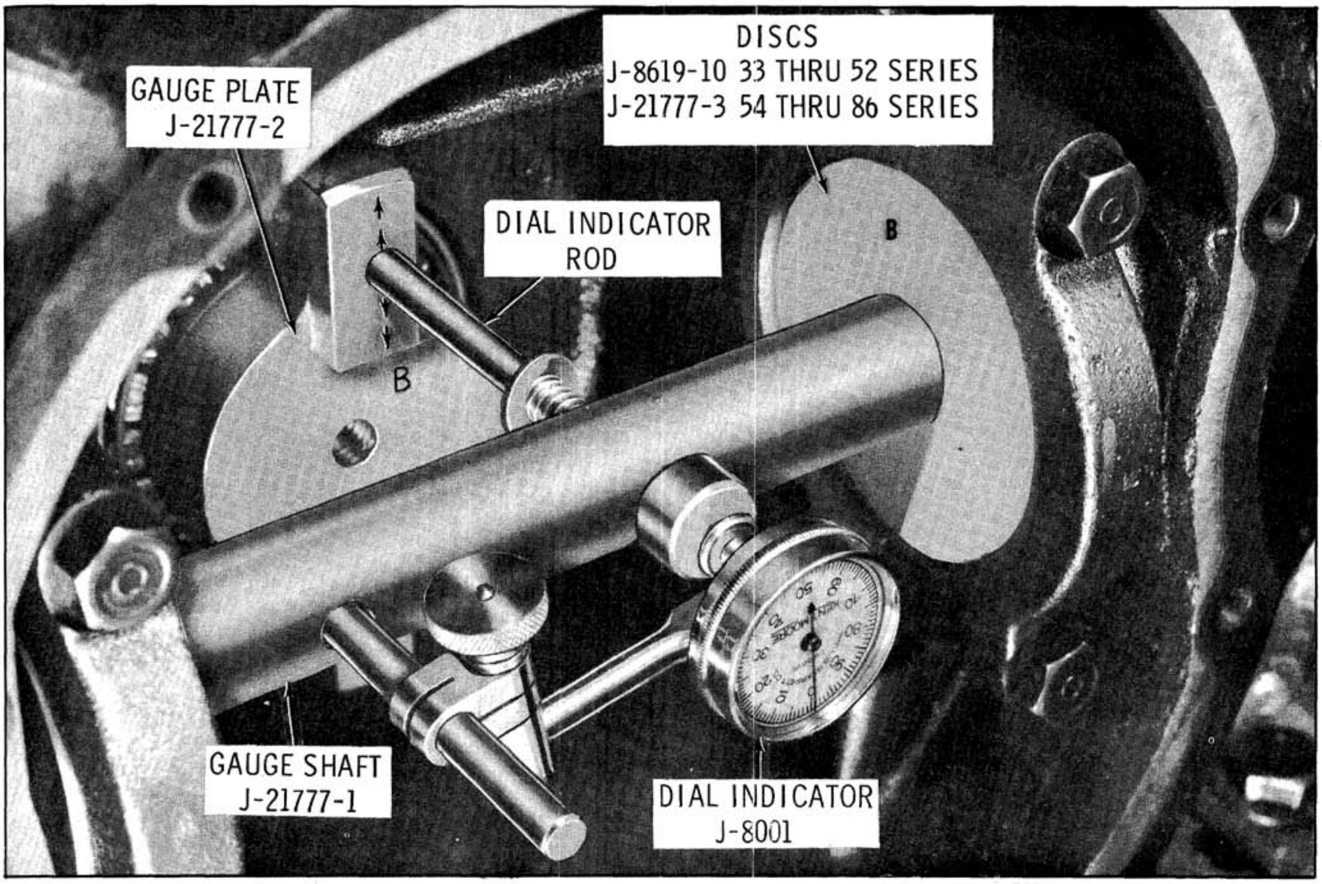


Fig. 10-27 Checking Pinion Depth

11. After the ZERO setting is obtained, rotate gauge shaft until the dial indicator rod does not touch the gauging area. The dial indicator will read the pinion depth directly.

12. Select the correct pinion shim to be used during pinion reassembly on the following basis:

33 Through 86 Series

a. If a service pinion is being used, or a production pinion with no marking, the correct shim will have a thickness equal to the indicator gauge reading found in Step 11.

b. If a production pinion is being used and it is marked "+" or "-", the correct shim will be determined as follows:

33 Through 52 Series

(1) Pinions stamped with Part Numbers 1358139, 1358150, 1358152, 1358154, 1358166 or 1365995, and marked "+" (plus), the shim thickness indicated by the dial indicator on the pinion setting gauge must be DECREASED by the amount etched on the pinion.

If the pinion is marked "-" (minus), the shim thickness indicated by the dial indicator on the pinion setting gauge must be INCREASED by the amount etched on the pinion.

33 Through 86 Series

(2) Pinions not stamped with part numbers and marked "+" (plus) the shim thickness indicated by the dial indicator on the pinion setting gauge must be INCREASED by the amount etched on the pinion.

If the pinion is marked "-" (minus) the shim thickness indicated by the dial indicator on the pinion setting gauge must be DECREASED by the amount etched on the pinion.

13. Loosen Stud J-8619-13 and remove Gauge Plate J-21777-1, Washer J-8619-12 and both bearings from carrier.

14. Position correct shim on drive pinion and install the drive pinion rear bearing as shown in Fig. 10-28.

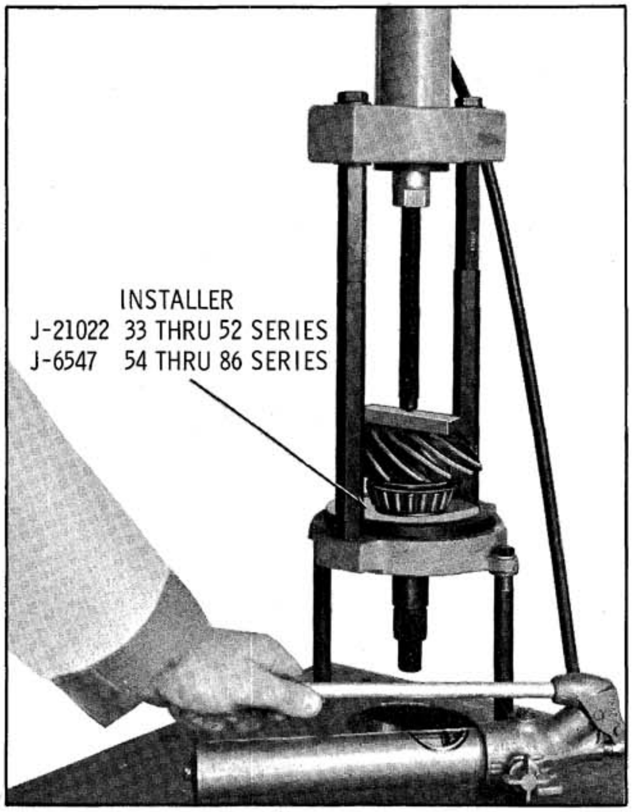


Fig. 10-28 Installing Pinion Rear Bearing

DIFFERENTIAL CASE

Assembly

Before assembling the differential case, lubricate all parts with Lubricant Part No. 1050081.

1. Place side gear thrust washers over side gear hubs and install side gears in case. If same parts are reused, replace in original sides.

2. Position one pinion (without washer) between side gears and rotate gears until pinion is directly opposite from loading opening in case. Place other pinion between side gears so that pinion shaft holes are in line; then rotate gears to make sure holes in pinions will line up with holes in case.

3. If holes line up, rotate pinions back toward loading opening just enough to permit sliding in pinion thrust washers.

4. Install pinion shaft. Install pinion shaft retaining bolt. Torque to 28 ft. lbs.

5. After making certain that mating surfaces of case and ring gear are clean and free of burrs, thread two bolts into opposite sides of ring gear; then install ring gear on case. (Fig. 10-29) Install NEW ring gear attaching bolts just snug. NEVER REUSE OLD BOLTS.

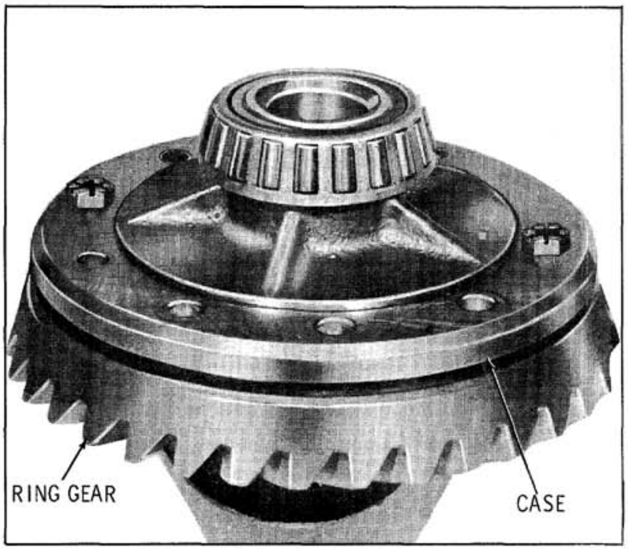


Fig. 10-29 Installing Ring Gear

Torque bolts alternately in progressive stages to 60 ft. lbs. for 33 through 52 series, and 80 ft. lbs. for 54 through 86 series.

6. If differential side bearings were removed, install bearings as shown in Fig. 10-30.

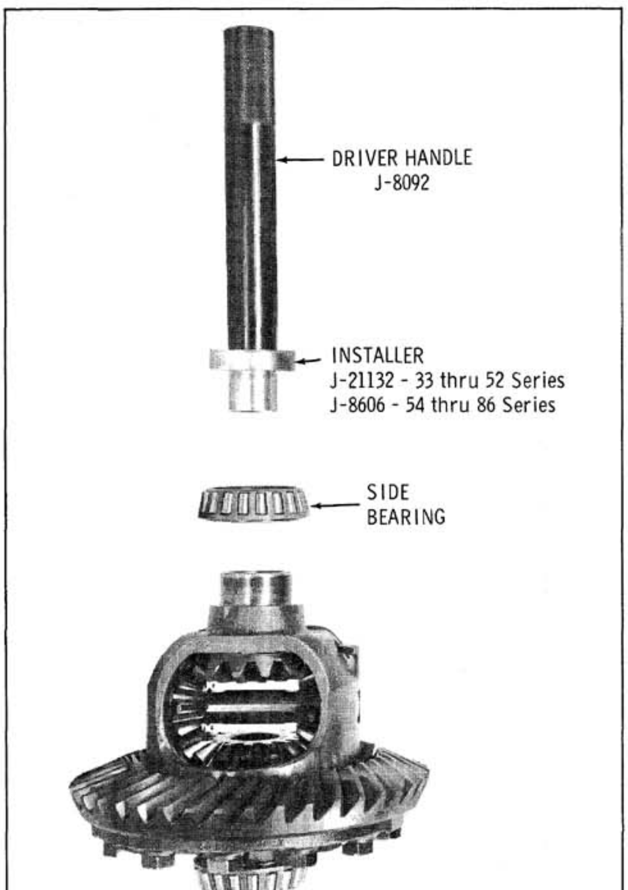


Fig. 10-30 Installing Side Bearings

SIDE BEARING PRE-LOAD ADJUSTMENT

NOTE: The side bearing pre-load adjustment is to be made before installing pinion.

Differential side bearing pre-load is adjusted by changing the thickness of both the right and left shims by an equal amount. By changing the thickness of both shims equally, the original backlash will be maintained. Steel differential adjusting shims are available from .040" to .082" in increments of .002".

If the differential side bearing shims consist of two cast-iron shims (one each side), it will be necessary to discard these cast-iron shims and replace them with .170" service spacers; then obtain sufficient steel shims to adjust the side bearing pre-load.

1. Before installation of the case assembly, make sure that side bearing surfaces in the carrier are clean and free of burrs. Side bearings must be oiled with Lubricant Part No. 1050081 and if the same bearings are being reused, they must have the original outer races in place.

2. Place differential case and bearing assembly in position in carrier. Slip left shim in position at left bearing, then drive right shim carefully into position as shown in Fig. 10-31.

3. As a safety precaution, install bearing caps and bolts. Do not tighten bolts.

4. Rotate differential case several complete turns to seat bearings. Check bearing pre-load using an inch pound torque wrench connected at a ring gear attaching bolt. With wrench projecting approximately straight out, bearing pre-load should read 30 to 40 in. lbs. with new bearings, or 20 to 30 in. lbs. with

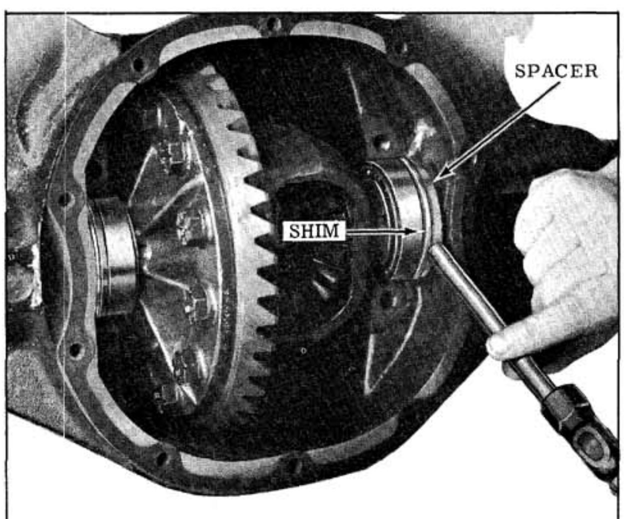


Fig. 10-31 Installing Shim

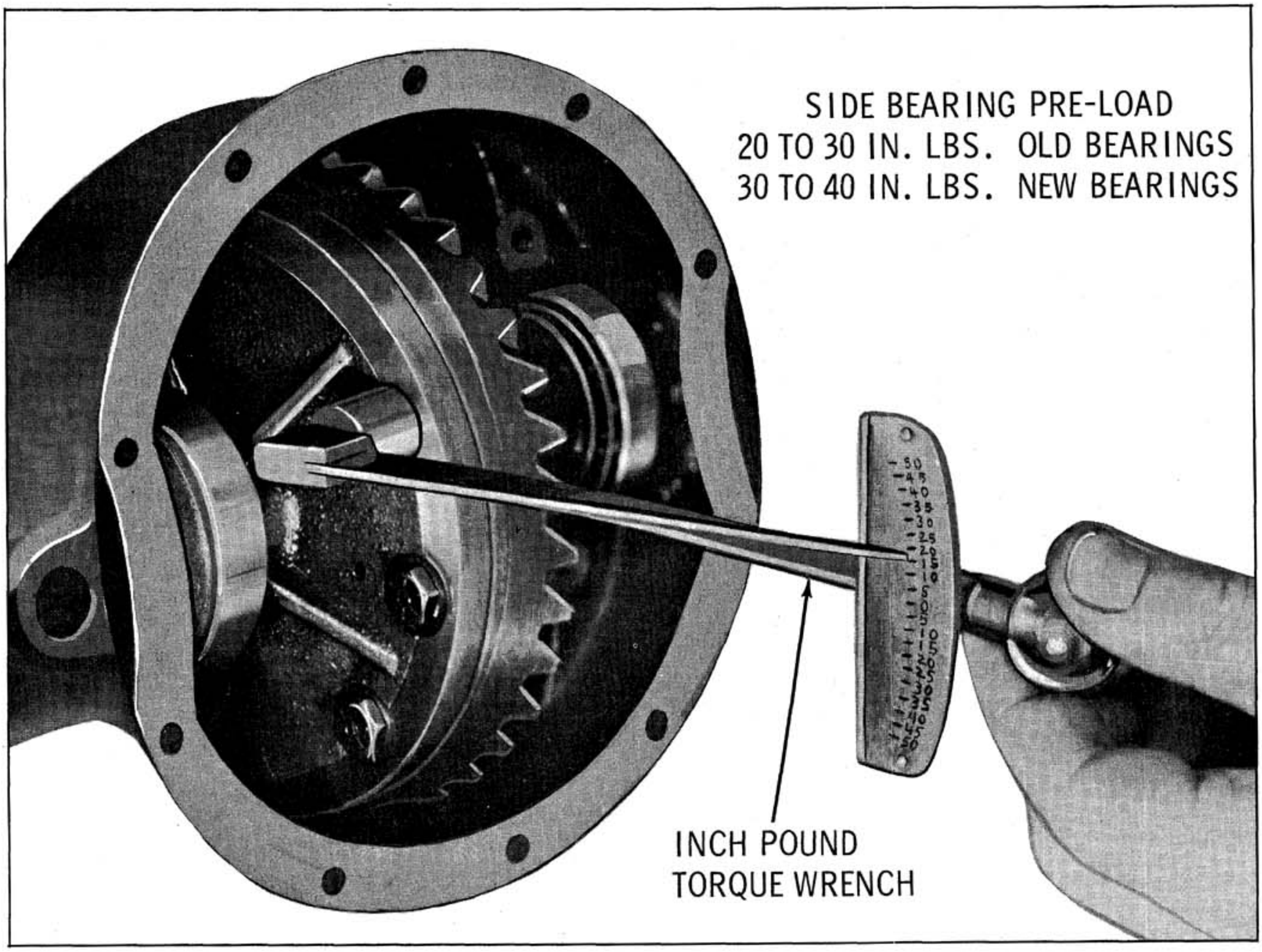


Fig. 10-32 Checking Side Bearing Pre-load

used bearings. (Fig. 10-32) If pre-load is not according to these specifications, increase shim thickness on each side, .002" for each additional 10 in. lbs. pre-load desired, or decrease shim thickness .002" on each side for each 10 in. lbs. pre-load to be subtracted.

5. When pre-load is correctly adjusted, remove bolts and caps and remove case assembly. Note shim location and thickness.

DRIVE PINION INSTALLATION

NOTE: Lubricate pinion bearings with Lubricant Part No. 1050081 before installing pinion.

1. Position pinion assembly in carrier and install collapsible spacer as shown in Fig. 10-33.

2. Place front pinion bearing in position on pinion. Hold pinion fully forward and position bearing over pinion until seated.

3. Position pinion oil seal in carrier. Install seal as shown in Figs. 10-34 or 10-35.

4. Coat lips of pinion oil seal, seal surface of pinion flange with Lubricant, Part No. 1050169. Install companion flange on pinion by tapping with a soft hammer until a few pinion threads project through flange.

5. Install pinion washer and nut. Hold companion

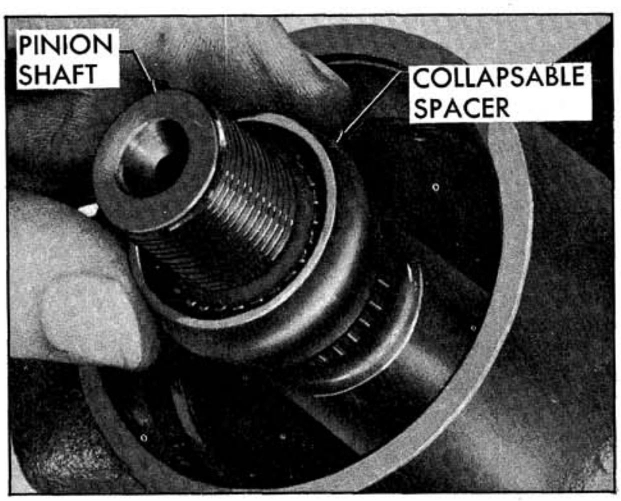


Fig. 10-33 Installing Collapsible Spacer

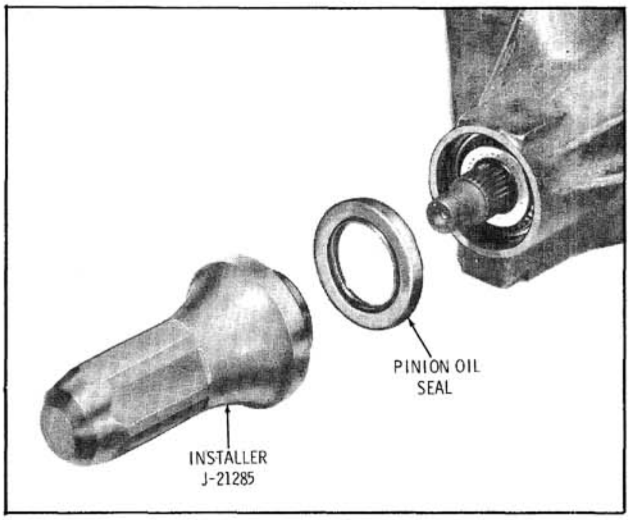


Fig. 10-34 Installing Pinion Oil Seal (54 through 86 Series)

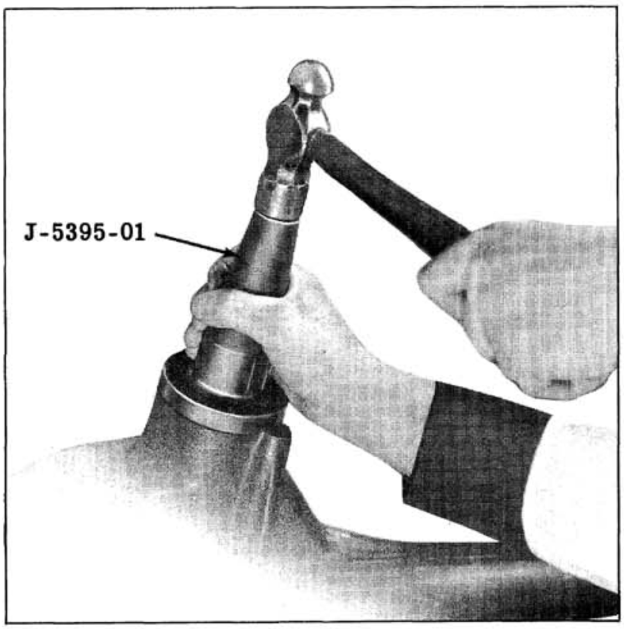


Fig. 10-35 Installing Pinion Oil Seal (33 through 52 Series)

flange with Holder J-8614-01. While intermittently rotating pinion to seat bearings, tighten pinion nut until end play begins to be taken up. (Fig. 10-36)

CAUTION: When no further end play is detectable and when Holder J-8614-01 will no longer pivot freely as pinion is rotated, pre-load specifications are being approached. No further tightening should be attempted until the pre-load has been checked.

6. Check pre-load by using an inch pound torque wrench as shown in Fig. 10-37.

CAUTION: After pre-load has been checked, final tightening should be done very cautiously. For example, if when checking,

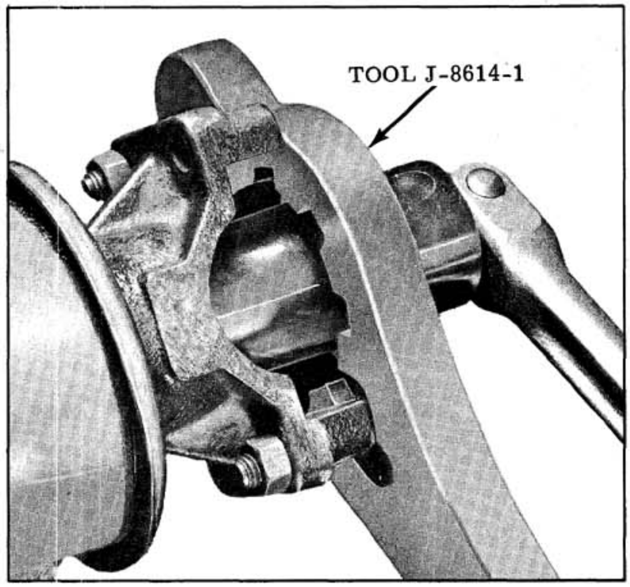


Fig. 10-36 Installing Companion Flange Nut

pre-load was found to be 5 in. lbs., any additional tightening of the pinion nut can add many additional inch pounds of torque. Therefore, the pinion nut should be further tightened only a little at a time and the pre-load should be checked after each slight amount of tightening. Exceeding pre-load specifications will compress the collapsible spacer too far and require the installation of a new collapsible spacer.

7. While observing the preceding caution, carefully set pre-load at 20 to 30 in. lbs. on new bearings or 12 to 20 in. lbs. on used bearings.

8. Rotate pinion several times to assure that bearings have been seated. Check pre-load again. If pre-load has been reduced by rotating pinion, reset pre-load to specifications.

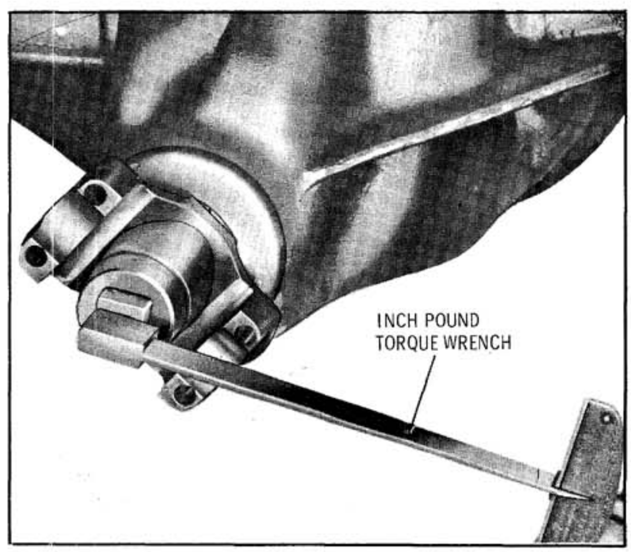


Fig. 10-37 Checking Pinion Pre-load

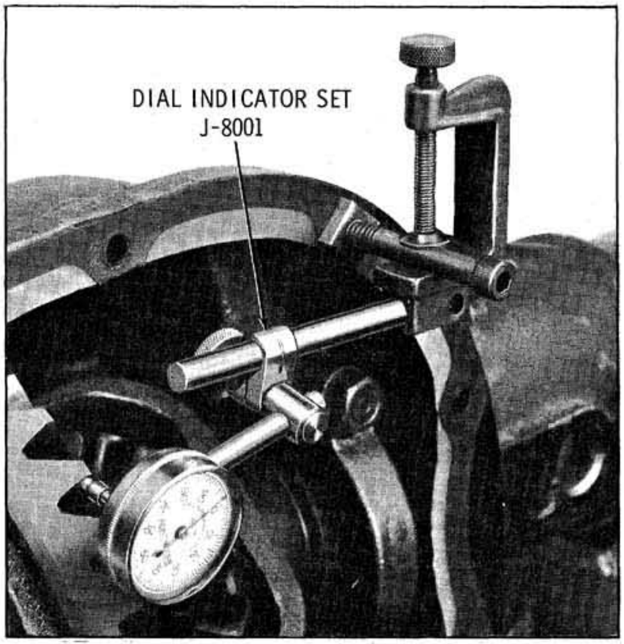


Fig. 10-38 Checking Ring Gear To Pinion Backlash

DIFFERENTIAL BACKLASH ADJUSTMENT

1. Install differential case into carrier, using shims as determined by the side bearing pre-load adjustment.

2. Rotate differential case several times to seat bearings, then mount dial indicator as shown in Fig. 10-38. Use a small button on the indicator stem so that contact can be made near heel end of tooth. Set dial indicator so that stem is in line as nearly as possible with gear rotation and perpendicular to tooth angle for accurate backlash reading.

3. Check backlash at three or four points around ring gear. Lash must not vary over .002" around ring gear.

   NOTE: Pinion must be held stationary when checking backlash.

   If variation is over .002" check for burrs, uneven bolting conditions or distorted case flange and make corrections as necessary.

4. Backlash at the point of minimum lash should be between .007" and .009" for all new gears.

5. If backlash is not within specifications, correct by increasing thickness of one differential shim and decreasing thickness of other shim the same amount. This will maintain correct differential side bearing pre-load.
   For each .001" change in backlash desired, transfer .002" in shim thickness. To decrease backlash .001", decrease thickness of right shim .002" and increase thickness of left shim .002". To increase backlash .002", increase thickness of right shim .004" and decrease thickness of left shim .004".

6. When backlash is correctly adjusted, torque bearing cap bolts to 65 ft. lbs.

7. Install new gasket on housing. Install cover. Torque cover bolts to 25 ft. lbs.

8. Fill differential to proper level with the specified lubricant.

ANTI-SPIN DIFFERENTIAL (33 THROUGH 52 SERIES)

DESCRIPTION (Fig. 10-39)

The Anti-Spin differential is available as optional equipment. With a conventional differential, when one wheel is on a slippery surface, its pulling power is limited by the wheel with the lowest traction. With the Anti-Spin differential, the locking action is controlled by the wheel having the best traction.

The Anti-Spin differential has cone brakes positioned behind the side gears. These brakes are spring pre-loaded to provide an internal resistance to the differential action within the case itself. This pre-load assures an adequate amount of pull when extremely low traction such as wet ice, mud or snow are encountered at one rear wheel. It also provides smooth transfer of torque when traveling over alternating tractive conditions at both rear wheels.

OPERATION

The Anti-Spin differential operates in reverse and deceleration as well as forward speeds. Torque is applied by the drive pinion to the ring gear which is bolted to the case assembly thereby causing it to rotate. The pre-load force from the springs plus the separating force between the pinion gears and side gears, as the case rotates, forces the clutch cones against the case assembly. Since the clutch cones are splined to the axle shafts, the shafts are in effect, locked together, and rotate with the case assembly.

When turning corners, the torque created by differential action overcomes the calibrated spring load on the clutch cones allowing them to overrun.

When the rear wheels are under extremely unbalanced tractive conditions, such as one wheel

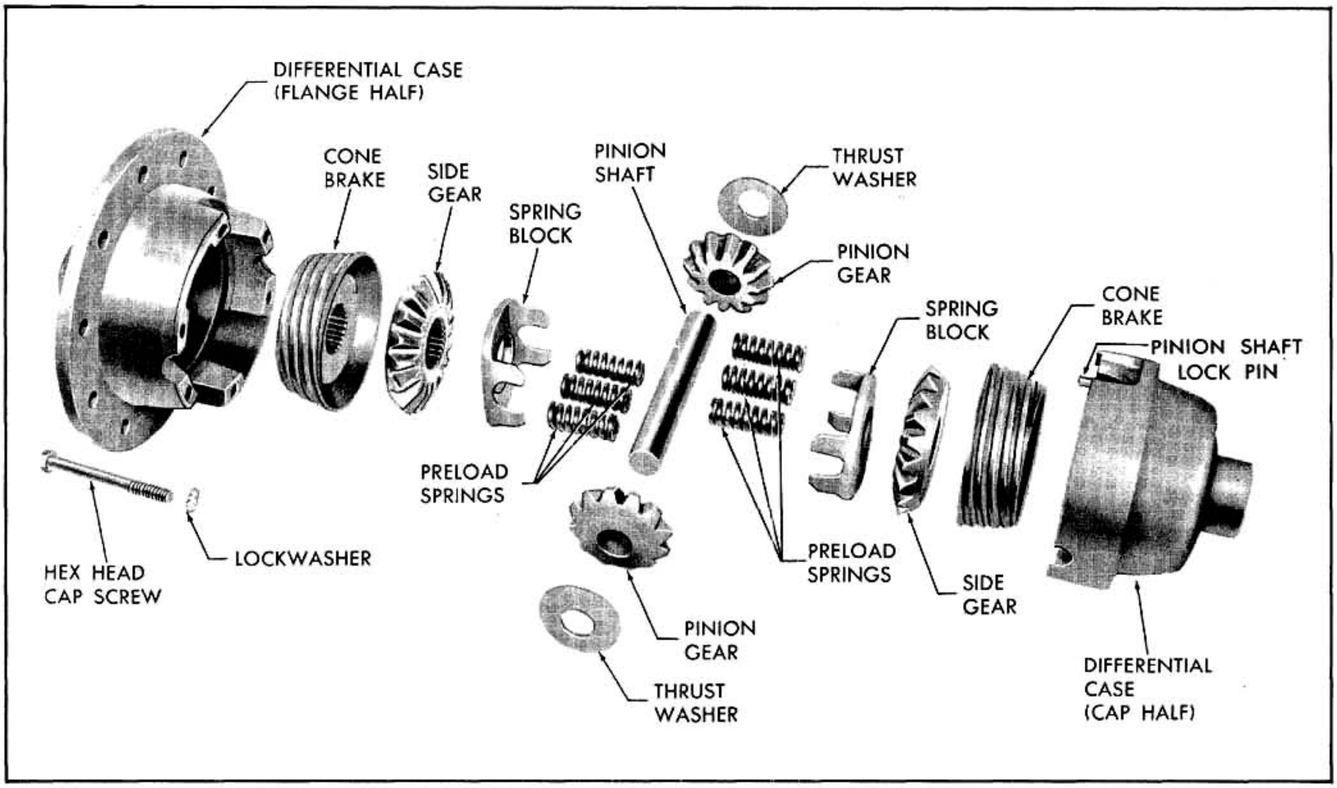


Fig. 10-39 Anti-Spin Differential

on dry pavement and the other on ice, wheel spin can occur if over-acceleration is attempted. However, even when wheel spin does occur, the major driving force is directed to the non-spinning wheel.

NOTE: Continued spinning may cause a whirring sound. Such a condition or sound does not indicate failure of the unit.

CAUTION: When working on a car with Anti-Spin differential, never raise one rear wheel and run the engine with the transmission in gear. The driving force to the wheel on the floor could cause the car to move.

Also "on the car" type wheel balancers, should not be used on the rear wheels unless both wheels are off the floor.

PERIODIC MAINTENANCE

The lubricant level should be checked at every oil change interval. Maintain level between the bottom of the filler plug opening and 1/4" below the opening by adding lubricant Part No. 1050081.

IMPORTANT: Use of other than the above mentioned type of lubricant in the Anti-Spin differential may cause chatter. If the wrong type of lubricant is used in the Anti-Spin, it will require draining the differential and installing the recommended lubricant Part No. 1050081.

NOTE: For Anti-Spin identification, refer to the GENERAL INFORMATION SECTION.

ANTI-SPIN DIFFERENTIAL SERVICE PROCEDURES

All differential service procedures are the same in the Anti-Spin differential as in a conventional differential, except for servicing the internal parts of the differential case. All rear

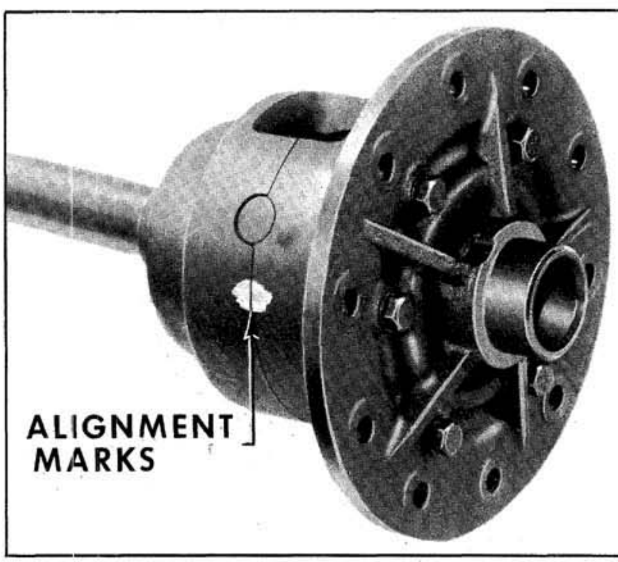


Fig. 10-40 Alignment Marks

axle parts outside of the differential case assembly such as the ring gear, differential side bearings and axle shafts, are the same in either differential assembly.

ANTI-SPIN CONVERSION INFORMATION

The case assembly (less ring gear and side bearings) is available for converting a conventional differential to Anti-Spin. The ring gear and side bearings of the conventional differential, if in good condition, can be used with the Anti-Spin case assembly. The proper assembly must be ordered for the particular gear ratio with which it will be used.

DIFFERENTIAL CASE

Disassembly

1. If ring gear or differential case is to be replaced, remove ring gear from case.

2. If a differential side bearing is to be replaced, remove bearing as described in the CONVENTIONAL DIFFERENTIAL Section.

3. Clamp case assembly in a brass jawed vise by ring gear or by case flange.

4. Mark flange half of case and cover half with a center punch or paint to provide alignment for reassembly. (Fig. 10-40)

5. Loosen six bolts holding cover half of case to cap half. Remove assembly from vise, place on bench with bolt heads up and remove bolts.

6. Lift cap half of case from flange half. Remove cap half, cone brake, pre-load springs, spring block and side gear shims, if provided, from assembly so that they can be reinstalled in their original positions.

7. Remove corresponding parts from flange half of case and keep with flange half.

Cleaning and Inspection of Parts

1. Make certain all parts are clean and dry.

2. Inspect pinion shaft, pinion and side gears, brake cone surfaces and corresponding cone seats in the case. The cone seats in the case should be smooth and free of any excessive scoring and not worn to the point that the cones have bottomed out in the case. Slight grooves or scratches indicating passage of foreign material are permissible and normal. The land surface on the heavy spirals of the male cones will duplicate the case surface condition. Replace any parts which are excessively scored, pitted or worn. Both halves of case must be replaced if one half is damaged or worn.

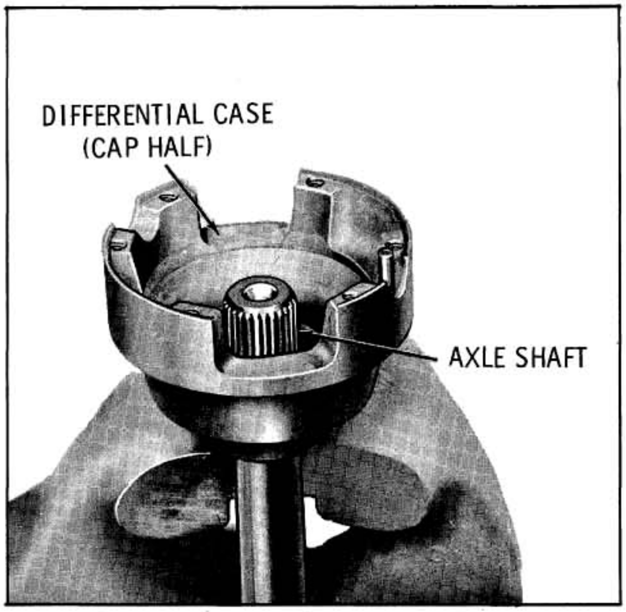


Fig. 10-41 Assembling Cap Half of Case

Assembly

CAUTION: When assembling the case, use axle shafts as mounting tools to insure proper gear and cone spline alignment. Do not ignore this procedure as it will be impossible to install shafts at final assembly and attempting to force the shafts into position may result in damage to the spring thrust blocks.

1. Clamp an axle shaft in a vise allowing three inches to extend above vise jaws; then place the cap side of differential case over the extended axle shaft with interior of case facing up. (Fig. 10-41)

2. Install proper cone over axle shaft splines, seating it into position in cap half of case.

   NOTE: Be certain that each cone is installed in proper case half since tapers and surfaces become matched and their positions should not be changed.

3. If unit was originally assembled with shims located between side gears and cones for backlash adjustment, reinstall side gear with shim so that gear may seat on shim. If unit was originally assembled without shims, reassemble the same way.

4. Position a thrust block on side gear face in alignment with the pinion shaft grooves. Install the pinion gears and thrust washers

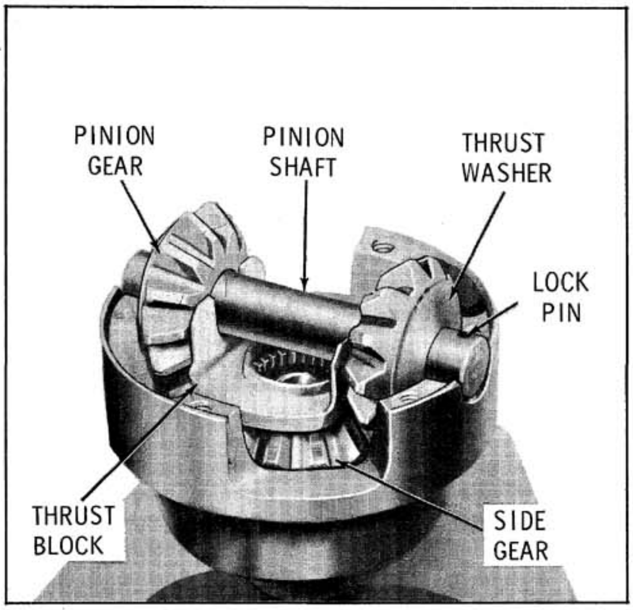


Fig. 10-42 Installing Thrust Block

on the pinion shaft; then position the pinion shaft into the cap half of the differential case so that the lock pin enters the pinion shaft. (Fig. 10-42)

5. Insert springs into the thrust block that is already installed into the case, then place second thrust block over springs. (Fig. 10-43)

   NOTE: The legs on the thrust blocks are offset. During reassembly, be sure to position the legs as shown in Fig. 10-44.

6. Install second side gear, face down on spring thrust block, so that side gear will mesh with the pinion gears.

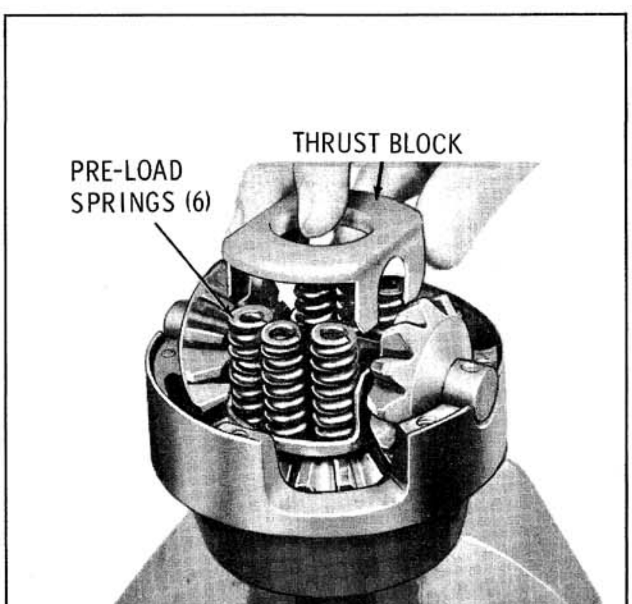


Fig. 10-43 Installing Pre-load Springs

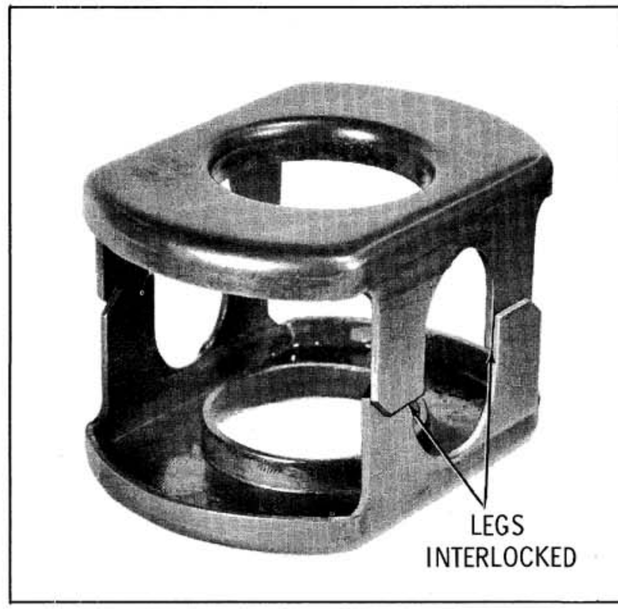


Fig. 10-44 Thrust Blocks

7. Place shim, if provided, and remaining cone over side gear.

8. Install flange side of differential assembly over cone in proper position to match alignment marks; insert two bolts finger tight 180° apart. (Fig. 10-45)

9. Install other axle shaft through flange half of differential case rotating axle to enter the cone and side gear splines. Leave the axle shaft in this position, then insert the remaining bolts. Torque to 18 ft. lbs. (Fig. 10-46)

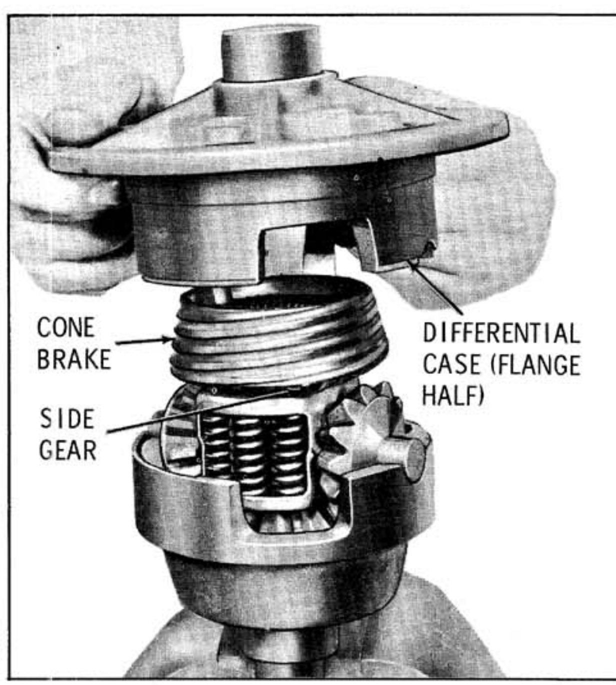


Fig. 10-45 Assembling Case

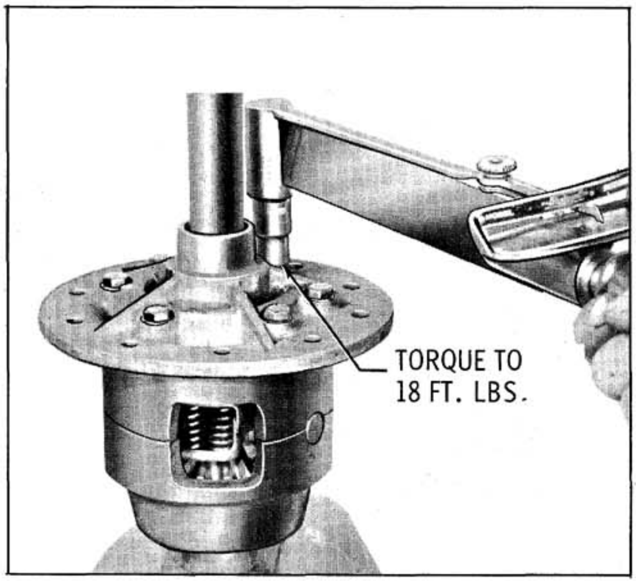


Fig. 10-46 Torquing Case Bolts

10. Remove axle shafts.
11. Install unit into differential carrier following instructions given in the CONVENTIONAL DIFFERENTIAL Section.

    CAUTION: After unit is installed in the carrier, do not attempt to rotate one axle shaft until both are in position. Rotation of one shaft without the other installed will result in misalignment of cone and side gear splines and may prevent entry of second shaft, necessitating disassembly of the case.

    A slight tapping on the shafts with a soft hammer may be necessary to align the splines during assembly. The shafts can then be readily reinstalled without spline interference during final assembly.

ANTI-SPIN DIFFERENTIAL (54 THROUGH 86 SERIES)

DESCRIPTION

The conventional differential divides the driving force equally to both rear wheels. The driving force is limited by the wheel which has the least amount of traction; therefore, if one wheel is on snow or mud, the wheel will spin and the driving force is lost.

The Anti-Spin differential (optional on all series) through the use of clutch plates directs the driving force to the wheel with the best traction thus improving the ability of the car to pull out of mud or snow.

NOTE: For Anti-Spin identification, refer to the GENERAL INFORMATION SECTION.

CAUTION: ON CARS EQUIPPED WITH ANTI-SPIN DIFFERENTIALS, DO NOT RUN ENGINE WITH ONE REAR WHEEL OFF THE GROUND AND TRANSMISSION IN GEAR. Also, "on the car" type wheel balancers should not be used on the rear wheels unless both rear wheels are off the floor.

OPERATION

The Anti-Spin differential transmits torque from the drive pinion gear to the ring gear and to the case in the same manner as the conventional differential. In addition, the Anti-Spin differential incorporates the use of clutch plates which tend to lock the axle shafts to the case, or in effect, to each other.

When driving force is applied at the differential case, the pinion shaft, pinion gears and side gears (splined to the axle shafts) begin to rotate as an assembly in the same direction as the case. Although traction at the rear wheels may not not be equal, their resistance to turning allows the pinion gears to bear against the side gears (splined to the axle shaft and the clutch plates) to apply the clutches, and to lock the axle shafts to the case. This allows both rear wheels to turn at an equal speed and the driving force is not lost by the wheel with poor traction.

When turning a corner, the action is essentially that of a conventional differential.

ANTI-SPIN CONVERSION INFORMATION

The case assembly (less ring gear and side bearings) is available for converting a conventional differential to Anti-Spin. The ring gear and side bearings of the conventional differential, if in good condition, can be used with the Anti-Spin case assembly.

DIFFERENTIAL CASE

Disassembly (Fig. 10-47)

1. If side bearings are to be removed, they can be removed as outlined in the CONVENTIONAL DIFFERENTIAL Section.
2. If the ring gear or differential case is to be replaced, remove ring gear from case.
3. Remove pinion shaft lock screw and lock-washer, then remove pinion shaft from case.
4. Remove the pre-load spring retainer and springs from the case. (Fig. 10-48)
5. Rotate side gears until the pinions are in the open area of the case. Remove the pinions and thrust washers.

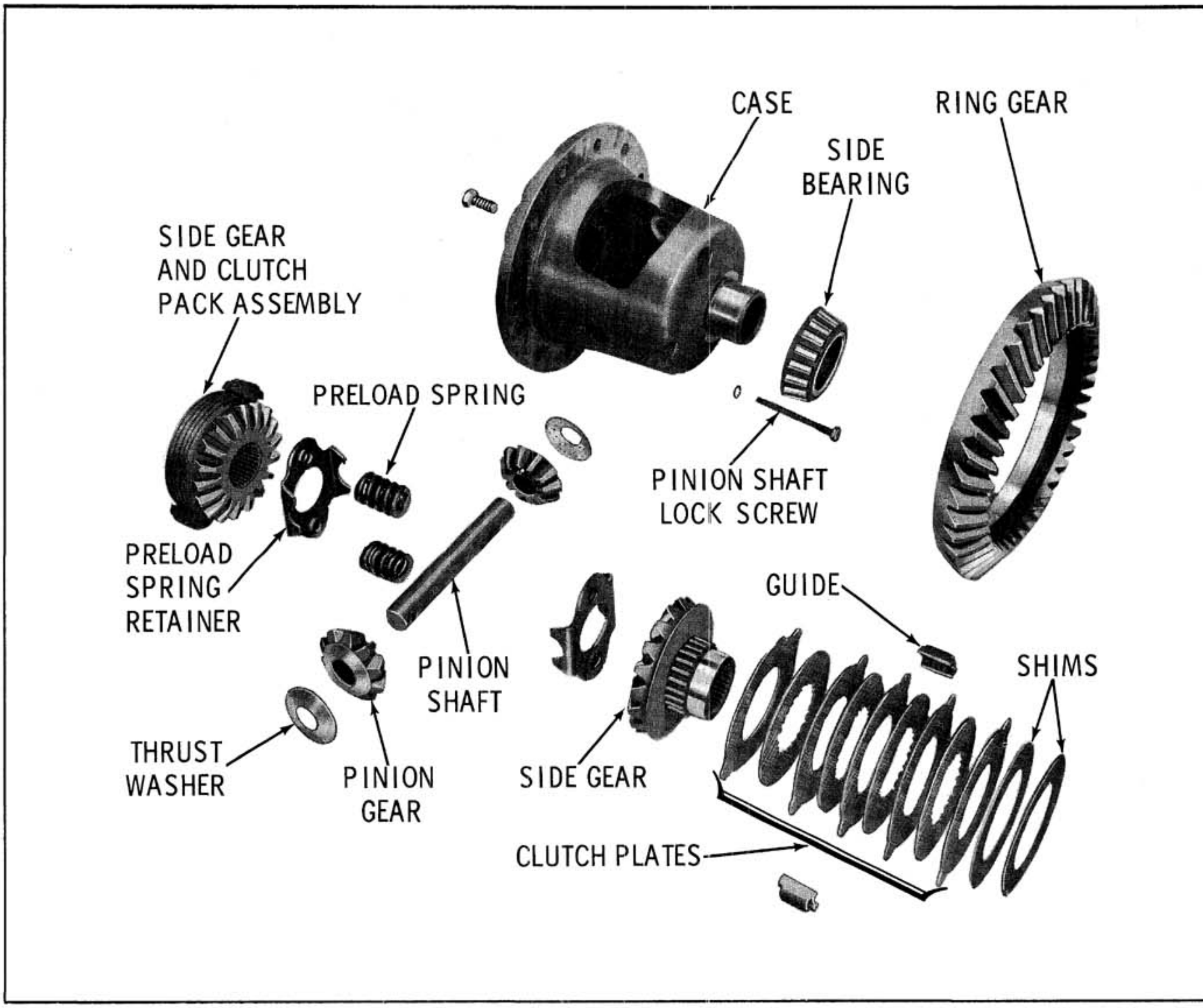


Fig. 10-47 Anti-Spin Differential

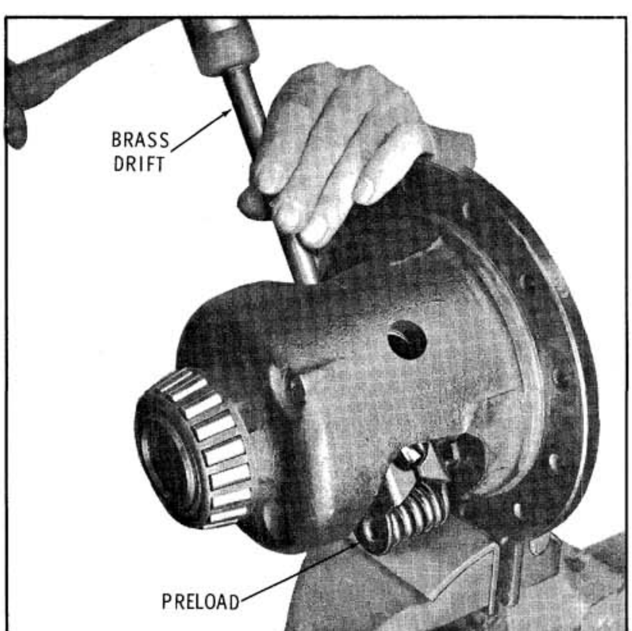


Fig. 10-48 Removing Pre-load Springs

6. Remove a side gear, clutch pack and shims from the case, noting its location in the case to aid in reassembly. Remove the side gear clutch pack and shims from the opposite side.

   NOTE: If a side gear or clutch pack cannot be readily removed from the case, drive it out with a brass drift. (Fig. 10-49)

7. Remove the clutch plate guides and separate the shims and clutch plates from the side gears.

   NOTE: Keep the clutch plates in their original location in the clutch pack.

Cleaning and Inspection of Case

1. Clean side bearings thoroughly in clean solvent (do not use a brush). Examine bearings visually and by feel. Bearings should feel smooth when oiled and rotated while applying as much hand pressure as possible.

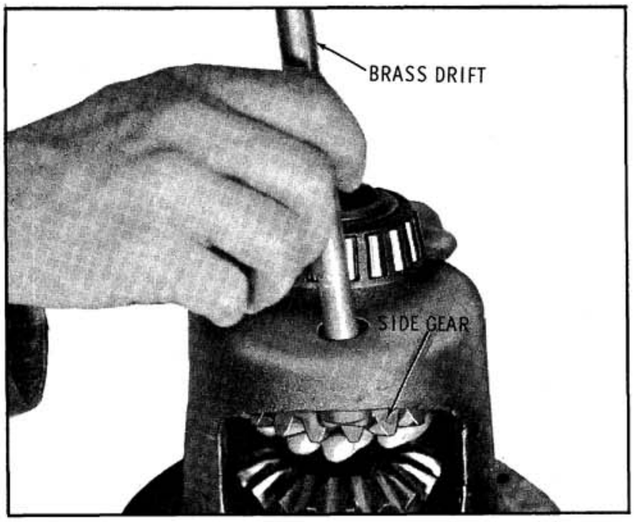


Fig. 10-49 Removing Side Gear

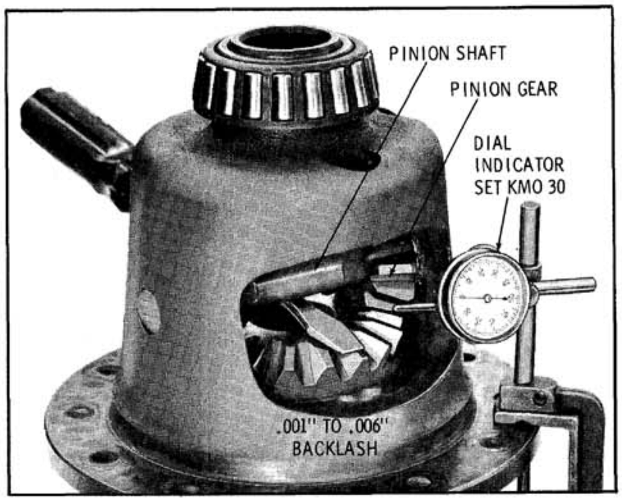


Fig. 10-50 Checking Side Gear To Pinion Backlash

NOTE: Minute scratches and pits that appear on rollers and races at low mileage are due to the initial pre-load, and bearings having these marks should not be rejected.

2. Examine the ring gear and drive pinion teeth for nicks, burrs, or scoring. Any of these conditions will require replacement of the gear set.

3. Inspect pinion shaft, pinions and side gears. Replace if parts are excessively scored, pitted or worn.

4. Check the press fit of the side bearing inner race on the differential case. Side bearings must be a tight press fit on the hub.

5. Inspect clutch plates for scored, worn, cracked or a distorted condition. If any of these conditions exist, new clutch plates must be installed.

DIFFERENTIAL CASE

Assembly

1. If the ring gear was removed, position the gear on the case flange and install new attaching bolts. Tighten the attaching bolts evenly and alternately across the diameter in progressive stages. Torque to 80 ft. lbs.

2. If side bearings were removed, lubricate the bearings and install on case hubs as outlined in the CONVENTIONAL DIFFERENTIAL Section.

3. Apply Special Lubricant, Part No. 1050081, to the clutch plates.

4. Assemble the clutch packs as follows:

   a. Alternately position nine clutch plates on the side gear, starting and ending with a clutch plate with the external lugs.

   b. Install the two clutch guides over the clutch plate lugs.

   c. Install the same shims which were removed or an equal amount on the clutch plate.

   d. Repeat Steps a, b, and c on the other clutch pack.

5. Check the pinion to side gear clearance as follows:

   a. Install one side gear with clutch pack and shims in the case.

   b. Position the two pinion gears and thrust washers on the side gear and install the pinion shaft.

   c. Compress the clutch stack by inserting a screwdriver or wedge between the side gear and the pinion shaft.

   d. Install Dial Indicator J-8001 with the contact button against the pinion gear. (Fig. 10-50)

   e. Rotate pinion gear. Clearance should be .001" to .006".

   f. If clearance is more than .006", add shims between clutch pack and case. If clearance is less than .001", remove shims. A .002" shim will change clearance approximately .001". Recheck clearance after adding or subtracting shims.

   g. Remove side gear and repeat procedure with opposite clutch pack, on opposite side of case.

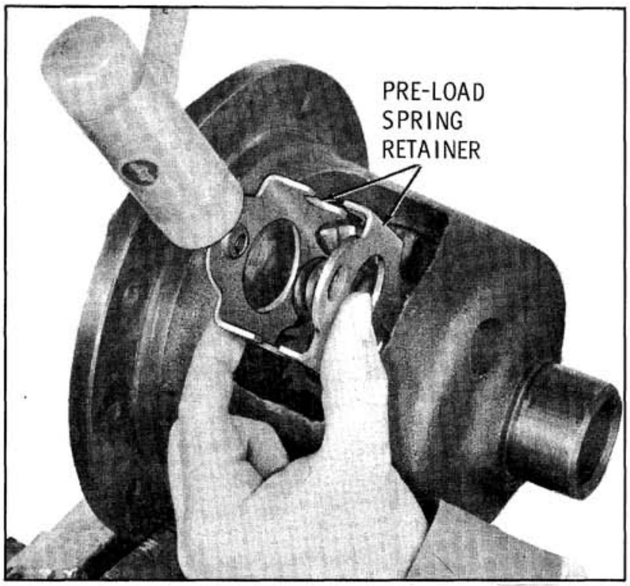


Fig. 10-51 Installing Pre-load Spring and Retainer

6. Remove pinion shaft, pinions and thrust washers.

7. Install the remaining side gear and clutch pack with correct shims in the case.

8. Place the pinion gears on the side gears and rotate into correct position.

9. Assemble the retainer and one pre-load spring. Drive the pre-load retainer and spring between the side gears until the open ends of the retainer just start to come together. (Fig. 10-51)

10. Install the remaining pre-load spring and finish driving the retainer and springs into position. (Fig. 10-52)

11. Insert the thrust washers behind the pinion gears.

Fig. 10-52 Installing Pre-load Spring

12. Install the pinion shaft and retain with the lock bolt. Torque lock bolt to 28 ft. lbs.

13. Check the side gear splined hole to be certain it is in line with the hole in the pre-load spring retainer. The spring retainer can be moved slightly to correct misalignment.

DIAGNOSIS (All Series)

ANTI-SPIN OPERATION

If an Anti-Spin differential is suspected of not providing positive traction to the non-slipping wheel, the condition can be checked as follows:

1. Place the transmission in neutral.

2. Raise one wheel off the floor and place a block at the front and rear of the opposite wheel.

3. Remove hub cap or wheel disc and apply a torque wrench as shown in Fig. 10-53.

4. Disregard breakaway torque and observe only the torque required to continuously turn the wheel smoothly.

If the torque reading is less than 40 ft. lbs., the unit should be disassembled and the case assembly repaired as necessary.

DIFFERENTIAL NOISE

When a differential assembly is suspected of being noisy, a thorough road test should be made to make sure that the noise is not being caused by tires, road surface, wheel bearings, engine, transmission, muffler, body or propeller shaft.

TIRE NOISE

Different types of road surfaces will affect tire noise but will not affect differential noise. For road testing, select a level tarvia or asphalt road,

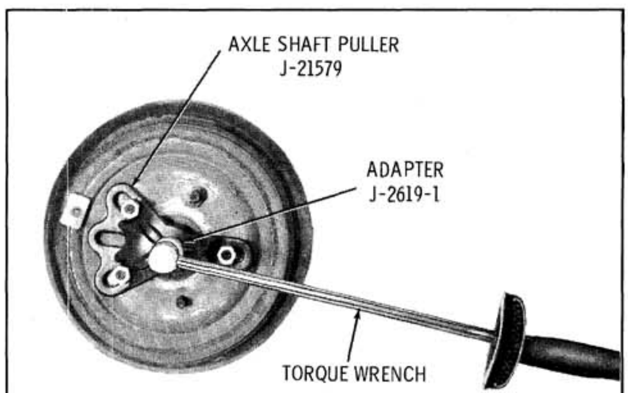


Fig. 10-53 Checking Anti-Spin

as this type road surface practically eliminates tire noise. For test purposes only, inflating all tires to approximately 50 lbs. pressure will materially alter noise caused by tires, but will not affect noise caused by the differential. Differential noise usually ceases when coasting with transmission in neutral at speeds under 30 mph, however, tire noise continues with lower tone as car speed is reduced. Differential noise always changes when comparing "pull" and "coast", but tire noise remains about the same.

WHEEL BEARING NOISE

Wheel bearing noise may be confused with differential noise; however, a rough rear axle bearing produces a vibration or growl which continues with car coasting with transmission in neutral. A bad bearing may cause a knock or click approximately every two revolutions of the wheel since the bearings do not travel at the same speed as the rear axle shaft. To determine which front wheel bearing is noisy, hoist the car and spin each wheel while listening at the hub cap. To determine which rear axle bearing is noisy, hoist car and start engine. With transmission in gear use a piece of rubber hose or stethoscope BT-37 at the axle housing to locate the noise.

ENGINE AND TRANSMISSION NOISE

Note speed at which noise occurs, and with car standing and transmission in neutral, accelerate the engine to approximate speed where noise was noticed. If a similar noise is produced with the car standing, it cannot be due to the differential.

DIFFERENTIAL SIDE AND PINION GEAR NOISE

Differential side gears and pinions seldom cause noise because their movement is negligible on straight ahead driving.

RING GEAR AND PINION GEAR NOISE

These generally show up as drive noise, coast noise, or float noise. Drive noise is most pronounced on constant acceleration through the speed range. Coast noise is most pronounced when the car is allowed to coast through the speed range while in gear. Float noise is most pronounced while holding the car speed constant at various speeds.

DRIVE PINION BEARING AND SIDE BEARING NOISE

Rough or brinnelled bearings produce a continuous whine starting at a relatively low speed. The noise is most noticeable with a light pull between 18 to 25 miles per hour.

DIFFERENTIAL CLUTCH CHATTER

Anti-Spin Only

Improper lubricant can cause the clutch plates or cones to grab and release intermittently resulting in chatter when the car is turning a corner slowly. Special Lubricant, Part No. 1050081, MUST be used for initial fill of the differential and for any additions.

SPEEDOMETER GEAR INFORMATION
33 through 38 Series

Transmission	Axle Ratio	Tire Size	Speedometer Gears			Adapter-If Used	
			Drive	Driven	Color	Ratio	Color
6 Cyl. Automatic	3.08	6.95-14	16	40	Black		
		7.35-14		39	Brown		
		7.75-14		38	Blue		
		7.75-15		37	Red		
	3.23	6.95-14	16	42	Green		
		7.35-14		41	Yellow		
		7.75-14		40	Black		
		7.75-15		39	Brown		
	3.55	6.95-14	16	43	Purple		
		7.35-14		43	Purple		
		7.75-14		43	Purple		
		7.75-15		42	Green		
	3.90	6.95-14	16	43	Purple	.8653	Blue
		7.35-14		43	Purple	.8653	Blue
		7.75-14		41	Yellow	.8653	Blue
		7.75-15		40	Black	.8653	Blue
8 Cyl. Automatic	2.78	7.35-14	17	37	Red		
		7.75-14		36	White		
		7.75-15		36	White		
	3.08	7.35-14	17	41	Yellow		
		7.75-14		40	Black		
		7.75-15		39	Brown		
	3.23	7.35-14		43	Purple		
		7.75-14		42	Green		
		7.75-15		41	Yellow		
	3.55	7.35-14	17	41	Yellow	.8653	Blue
		7.75-14		40	Black	.8653	Blue
		7.75-15		39	Brown	.8653	Blue
	3.90	7.35-14	17	40	Black	.7692	Yellow
		7.75-14		39	Brown	.7692	Yellow
		7.75-15		38	Blue	.7692	Yellow
	4.11	7.35-14	17	42	Green	.7692	Yellow
		7.75-14		41	Yellow	.7692	Yellow
		7.75-15		40	Black	.7692	Yellow
	4.33	7.35-14	17	43	Purple	.7692	Yellow
		7.75-14		43	Purple	.7692	Yellow
		7.75-15		42	Green	.7692	Yellow
3 Speed SMT & 4 Speed SMT (Std. Ratio)	3.08	6.95-14	8 (28 pitch)	20	Blue		
		7.35-14		19	Natural		
		7.75-14		19	Natural		
		7.75-15		18	Brown		
3 Speed SMT & 4 Speed SMT (Std. Ratio)	3.23	6.95-14	8 (28 pitch)	21	Red		
		7.35-14		20	Blue		
		7.75-14		20	Blue		
		7.75-15		19	Natural		
3 Speed SMT & 3 Speed Fully Synchronized	3.55	6.95-14	8 (28 pitch)	20	Blue	.8653	Blue
		7.35-14		19	Natural	.8653	Blue
		7.75-14		19	Natural	.8653	Blue
		7.75-15		18	Brown	.8653	Blue
	3.90	6.95-14	8 (28 pitch)	19	Natural	.7692	Yellow
		7.35-14		19	Natural	.7692	Yellow
		7.75-14		18	Brown	.7692	Yellow
		7.75-15		18	Brown	.7692	Yellow

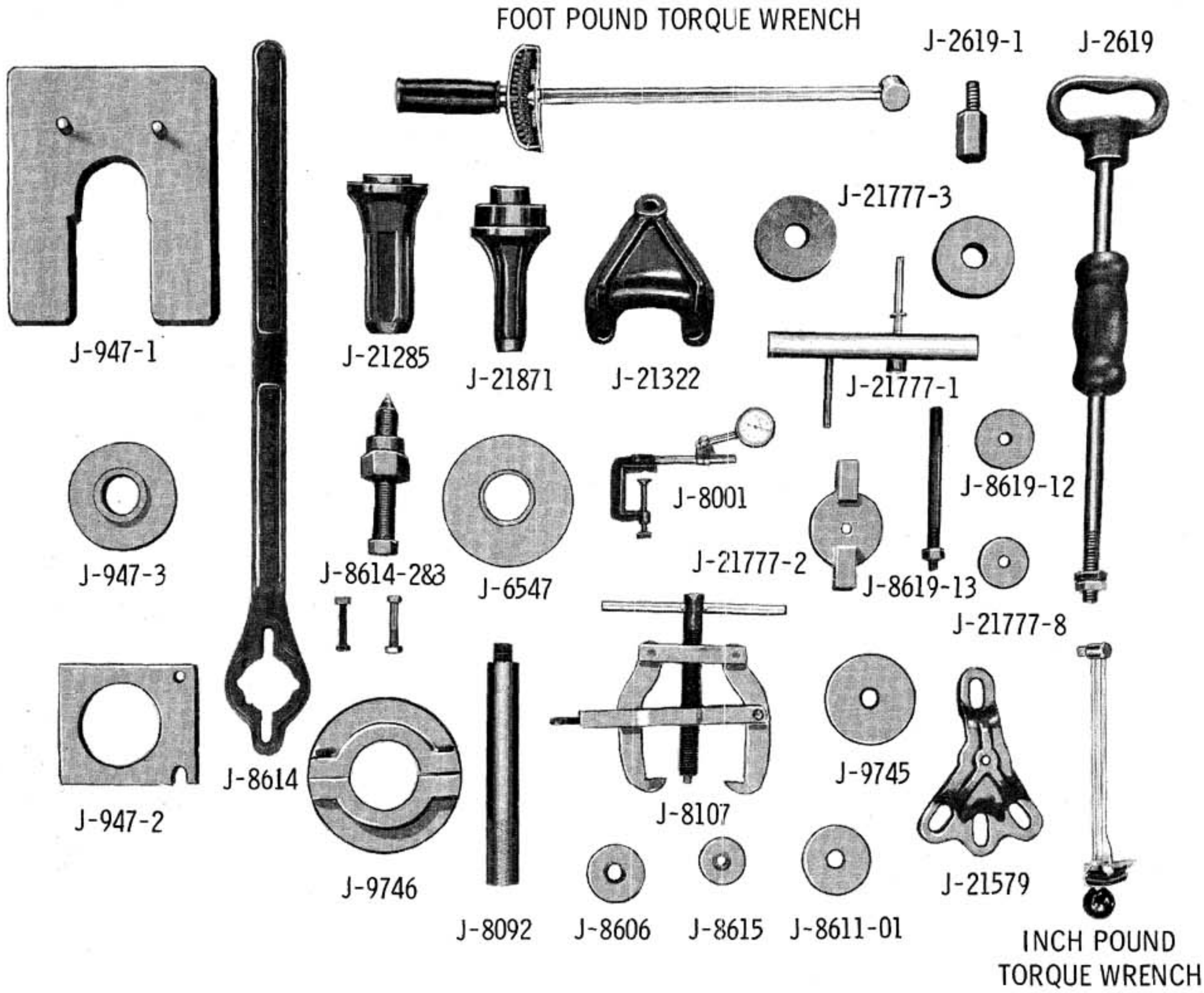
SPEEDOMETER GEAR INFORMATION
33 through 38 Series (Cont'd.)

Transmission	Axle Ratio	Tire Size	Speedometer Gears			Adapter-If Used	
			Drive	Driven	Color	Ratio	Color
3 Speed SMT & 3 Speed Fully Synchronized (Continued)	4.11	7.35-14 7.75-14 7.75-15	8 (28 pitch)	20 19 19	Blue Natural Natural	.7692 .7692 .7692	Yellow Yellow Yellow
	4.33	7.35-14 7.75-14 7.75-15	8 (28 pitch)	21 20 20	Red Blue Blue	.7692 .7692 .7692	Yellow Yellow Yellow
4 Speed SMT (Close Ratio)	3.55	6.95-14 7.35-14 7.75-14 7.75-14	8 (30 pitch)	23 22 22 22	Black Green Green Green		
	3.90	6.95-14 7.35-14 7.75-14 7.75-15	8 (30 pitch)	25 24 24 23	Orange Yellow Yellow Black		
	4.11	7.34-14 7.75-14 7.75-15	8 (30 pitch)	25 25 24	Orange Orange Yellow		
	4.33	7.35-14 7.75-14 7.75-15	8 (30 pitch)	25 25 25	Orange Orange Orange		

Note: Speedometer adapter ratio is stamped on the adaptor housing.

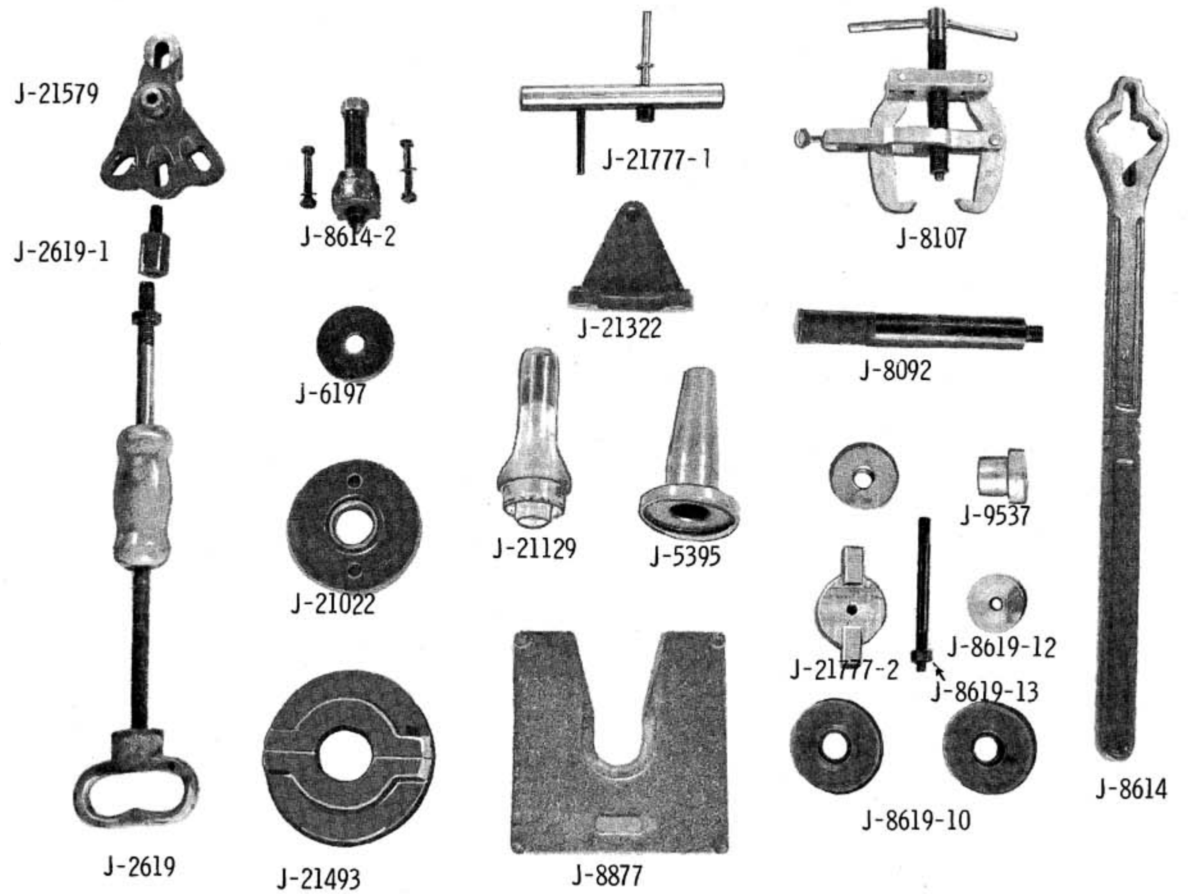
AXLE RATIOS
52 through 86 Series

Series	Transmission	Ratio	Gear Ratio	Code		Remarks
				Conventional	Anti-Spin	
52	SM & FS	3.23	42:13	RE	RF	Standard
52	JT	3.08	40:13	RC	RD	Standard, Except A/C
52	JT	3.23	42:13	RE	RF	A/C or Light Trailer
52	All	3.55	39:11	RG	RH	Heavy Trailer
54	All	3.23	42:13	QG	QH	Standard
54	All	3.42	41:12	QI	QJ	Trailer
56 & 58	SM & FS	3.23	42:13	QG	QH	Standard
56 & 58	AT	2.93	41:14	QC	QD	Standard
56 & 58 & 66	All	3.42	41:12	QI	QJ	Trailer
56 & 58	AT	2.73	41:15	QA	QB	Plains or L.C. Engine
56 & 58	AT	3.08	40:13	QE	QF	H.C. 4 bbl. Engine
56 & 58	AT	3.42	41:12	QS	QT	Police
58	AT	3.23	42:13	QG	QH	Starfire Engine
66	All	3.23	42:13	QG	QH	Standard
84 & 86	AT	3.08	40:13	QM	QN	Standard
84 & 86	AT	3.42	41:12	QQ	QR	Trailer
84 & 86	AT	2.73	41:15	QK	QL	Plains
84 & 86	AT	3.23	42:13	QO	QP	Starfire Engine
9860	All	3.42	41:12	QQ	QR	Standard (Short Sill Cowl)



J-947-1	PRESS PLATE	J-8615	BEARING PULLER ADAPTER
J-947-2	BEARING SHIELD	J-8619-12	PILOT WASHER
J-947-3	REAR AXLE BEARING INSTALLER	J-8619-13	STUD ASSEMBLY
J-2619	SLIDE HAMMER ASSEMBLY	J-9745	REAR PINION BEARING OUTER RACE INSTALLER
J-2619-1	SLIDE HAMMER ADAPTER	J-9746	REAR PINION BEARING REMOVER
J-6547	PINION BEARING INSTALLER	J-21285	REAR AXLE DRIVE PINION OIL SEAL INSTALLER
J-8001	DIAL INDICATOR SET	J-21322	RING GEAR AND CASE REMOVER
J-8092	DRIVER HANDLE	J-21579	AXLE SHAFT REMOVER
J-8107	DIFFERENTIAL SIDE BEARING PULLER	J-21777-1	BODY AND PINION ASSEMBLY
J-8606	BEARING INSTALLER	J-21777-2	GAUGE PLATE
J-8611-01	PINION BEARING CUP INSTALLER	J-21777-3	TWO DISCS
J-8614	COMPANION FLANGE HOLDER	J-21777-8	CENTERING WASHER
J-8614-2&3	COMPANION FLANGE REMOVER	J-21871	REAR AXLE OIL SEAL INSTALLER

Fig. 10-54 Tools (54 through 86 Series)



J-2619	SLIDE HAMMER ASSEMBLY
J-2619-1	SLIDE HAMMER ADAPTER
J-5395	PINION SEAL INSTALLER
J-6197	FRONT PINION BEARING CUP INSTALLER
J-8092	DRIVER HANDLE
J-8107	DIFFERENTIAL SIDE BEARING PULLER
J-8614	COMPANION FLANGE HOLDER
J-8614-2	COMPANION FLANGE REMOVER
J-8619-10	PINION SETTING GAUGE
J-8619-12	PINION SETTING GAUGE SPECIAL WASHER
J-8619-13	PINION SETTING GAUGE STUD ASSEMBLY
J-8877	AXLE BEARING PULLER PLATE
J-9537	SIDE BEARING INSTALLER
J-21022	REAR PINION BEARING INSTALLER
J-21129	AXLE SHAFT OIL SEAL INSTALLER
J-21322	RING GEAR AND CASE REMOVER
J-21493	REAR PINION BEARING REMOVER
J-21579	AXLE SHAFT REMOVER
J-21773-1	BODY AND PIN ASSEMBLY
J-21773-2	GAUGE PLATE

Fig. 10-55 Tools (33 through 52 Series)

PROPELLER SHAFT
33-34-35-36-38 & 52 SERIES

PERIODIC MAINTENANCE

The propeller shaft slip yoke does not require a scheduled lubrication interval. Universal joints, under both hot and cold weather conditions, do not require a scheduled lubrication interval.

On 52 series with high mileage a stickiness might develop at the slip yoke. If so, it should be lubricated with one ounce of Seal Lubricant, Part No. 1050169.

DESCRIPTION

The rear yoke shaft on Jetaway equipped 33-34-35-36 & 38 series cars and all 52 series cars, is bonded in rubber to the inside of the propeller shaft tube and cannot be removed for service. The shaft for a synchromesh is one piece.

The propeller shaft assembly is a balanced unit and should be kept free of undercoating or other material which could upset the balance.

Remove and Install (Fig. 10-60)

1. Mark the companion flange and propeller shaft so they can be reinstalled in their original position.
2. Remove the four nuts and lockwashers from the U-bolts at the differential companion flange.
3. If the companion flange U-joint bearings are not retained with a metal retaining strap, use a piece of wire or tape to hold bearings on their spider journals.
4. Lower the rear of the shaft and slide rearward.

To install, apply one ounce of Seal Lubricant, Part No. 1050169, to the splines of the slip yoke (Jetaway and 52 series) and reverse removal procedure. Torque U-bolt nuts 16 ft. lbs.

UNIVERSAL JOINT BEARINGS REMOVAL (Fig. 10-61)

1. With propeller shaft removed from the car, remove all bearing retaining rings.

   NOTE: Mark both yoke and shaft so that the units may be reassembled in their original position in order to maintain the original balance.

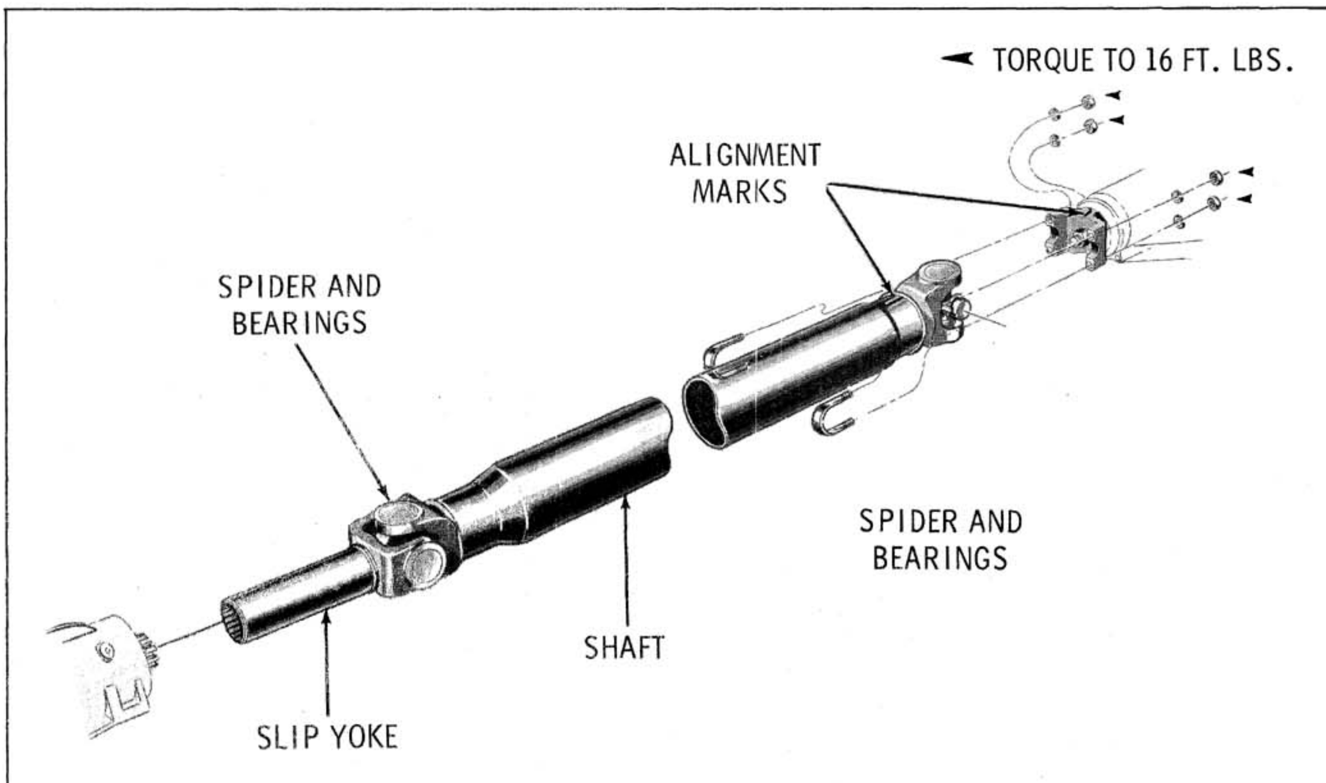


Fig. 10-60 Propeller Shaft Installation

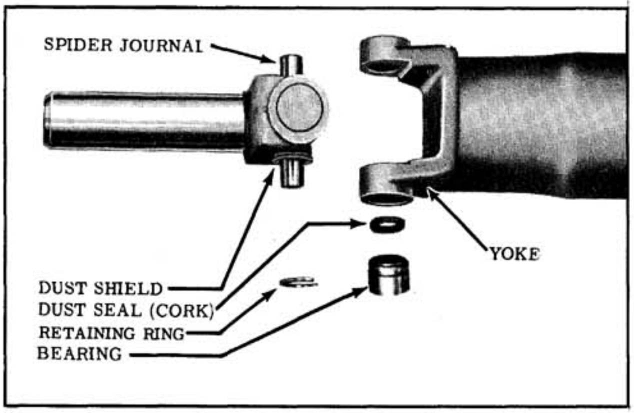


Fig. 10-61 Universal Joint Bearings

2. Position the slip yoke end of propeller shaft on a vise so that the shaft yoke rests on top of the vise jaws. The slip yoke must be free to move vertically between jaws of vise.

3. Apply force on yoke around bearing. (Fig. 10-62) This will drive the slip yoke down, causing spider to force bearing partially out of the yoke.

4. Clamp the partially exposed bearing in a brass jawed vise, then tap yoke until bearing

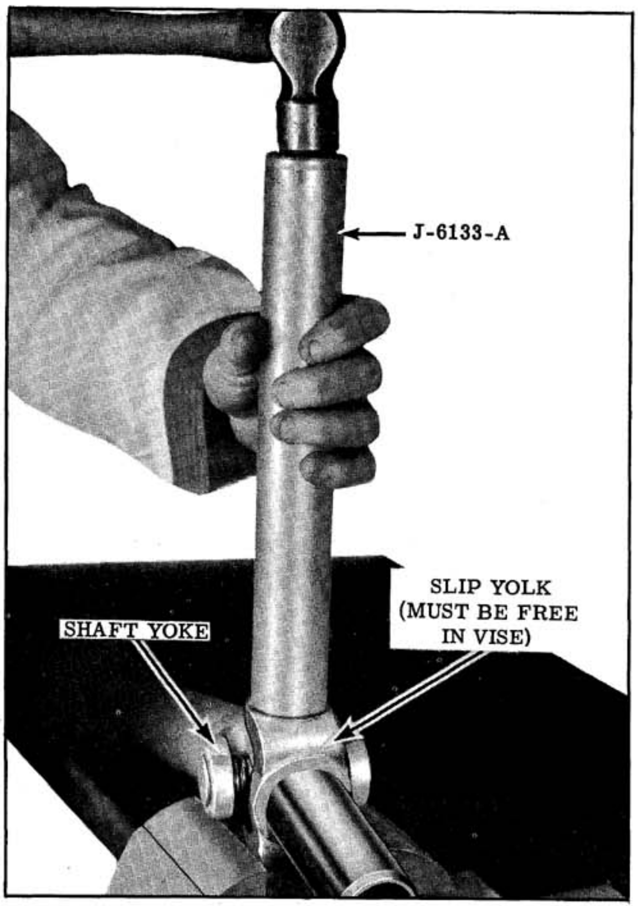


Fig. 10-62 Partial Bearing Removal

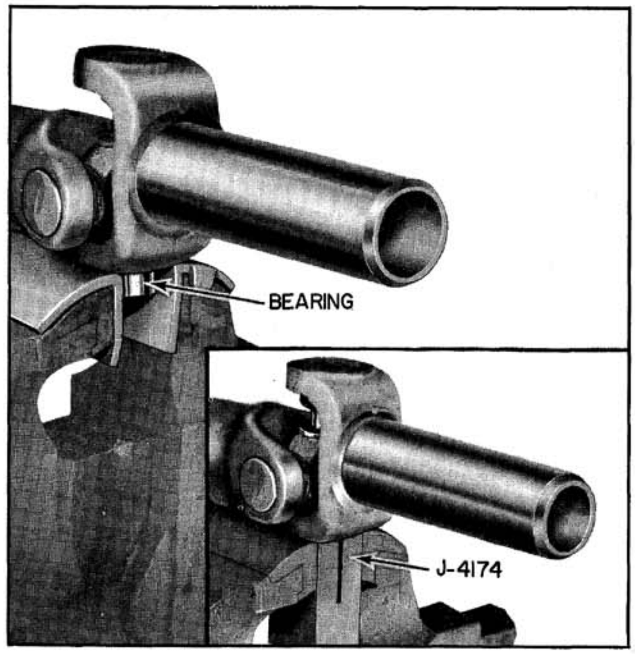


Fig. 10-63 Bearing Removal

is removed. (Fig. 10-63) Remove bearing from vise.

NOTE: The use of Tool J-4174 will facilitate removal of bearings. (Inset, Fig. 10-63)

5. Remove slip yoke from spider.

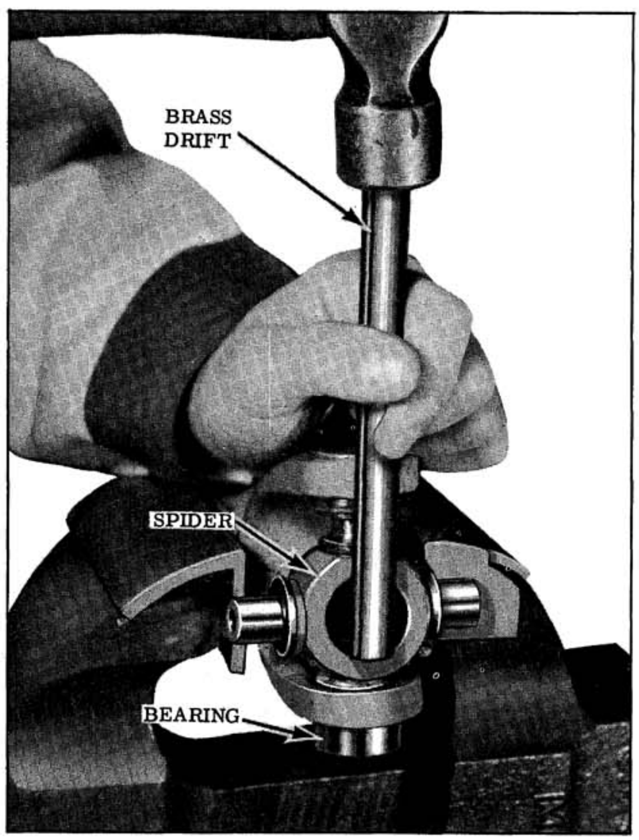


Fig. 10-64 Partial Bearing Removal

6. Clamp shaft yoke in vise.

   NOTE: Do not clamp the propeller shaft tube in a vise.

7. Drive on spider until bearing is partially forced out of yoke. (Fig. 10-64)

8. Clamp partially exposed bearing in a brass jawed vise and tap on yoke until bearing is removed.

9. To remove opposite bearing, repeat Steps 7, 8 and 9.

10. Remove spider from shaft yoke.

11. Remove spider and bearings.

Installation

1. Press dust seal into recess.

2. If new dust shields are to be installed, install at this time.

3. Position a spider journal in a shaft yoke.

4. Press a bearing into one side of yoke until retaining ring can be installed. (Fig. 10-65)

5. Install retaining ring. Retaining rings must be installed with the gap toward the yoke.

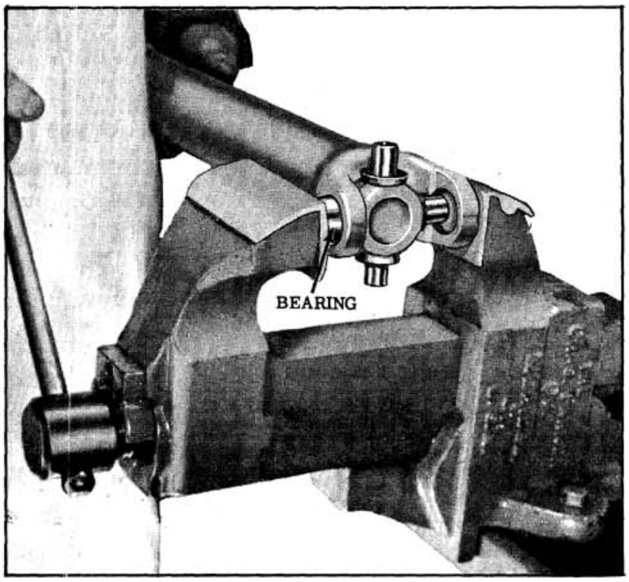


Fig. 10-65 Installing Bearings

6. Repeat Steps 4 and 5 on opposite bearing. As the bearing is installed, align spider journal with the bearing.

7. To install the slip yoke, position the yoke over the spider journal with scribe marks aligned and repeat Steps 4, 5 and 6.

8. Position bearings which attach to a companion flange onto the spider journals and retain with wire or tape.

PROPELLER SHAFT

54 THRU 86 SERIES

PERIODIC MAINTENANCE

The propeller shaft slip yoke does not require a scheduled lubrication interval. However, if at high mileage a tendency for stickiness should develop at the slip yoke, it should be lubricated with Seal Lubricant, Part No. 1050169, until lubricant appears at the vent hole. Universal joints, under both hot or cold weather conditions, do not require a scheduled lubrication interval.

DESCRIPTION (Fig. 10-70)

The rear yoke shaft is bonded in rubber to the inside of the propeller shaft tube and cannot be removed for service.

Both Saginaw and Spicer propeller shaft assemblies are used. Refer to Fig. 10-71 for identification.

The propeller shaft assembly is a balanced unit and should be kept free of undercoating or other material which could upset the balance.

Remove and Install

1. Mark the companion flange and the propeller shaft so that they can be reinstalled in their original location.

2. Remove the nuts and lockwashers from the four U-bolts and remove the U-bolts from the differential companion flange.

3. If the companion flange U-joint bearings are not retained with a metal retaining strap, use a piece of wire or tape to hold bearings on their spider journals.

4. Lower the rear of the shaft and slide rearward.

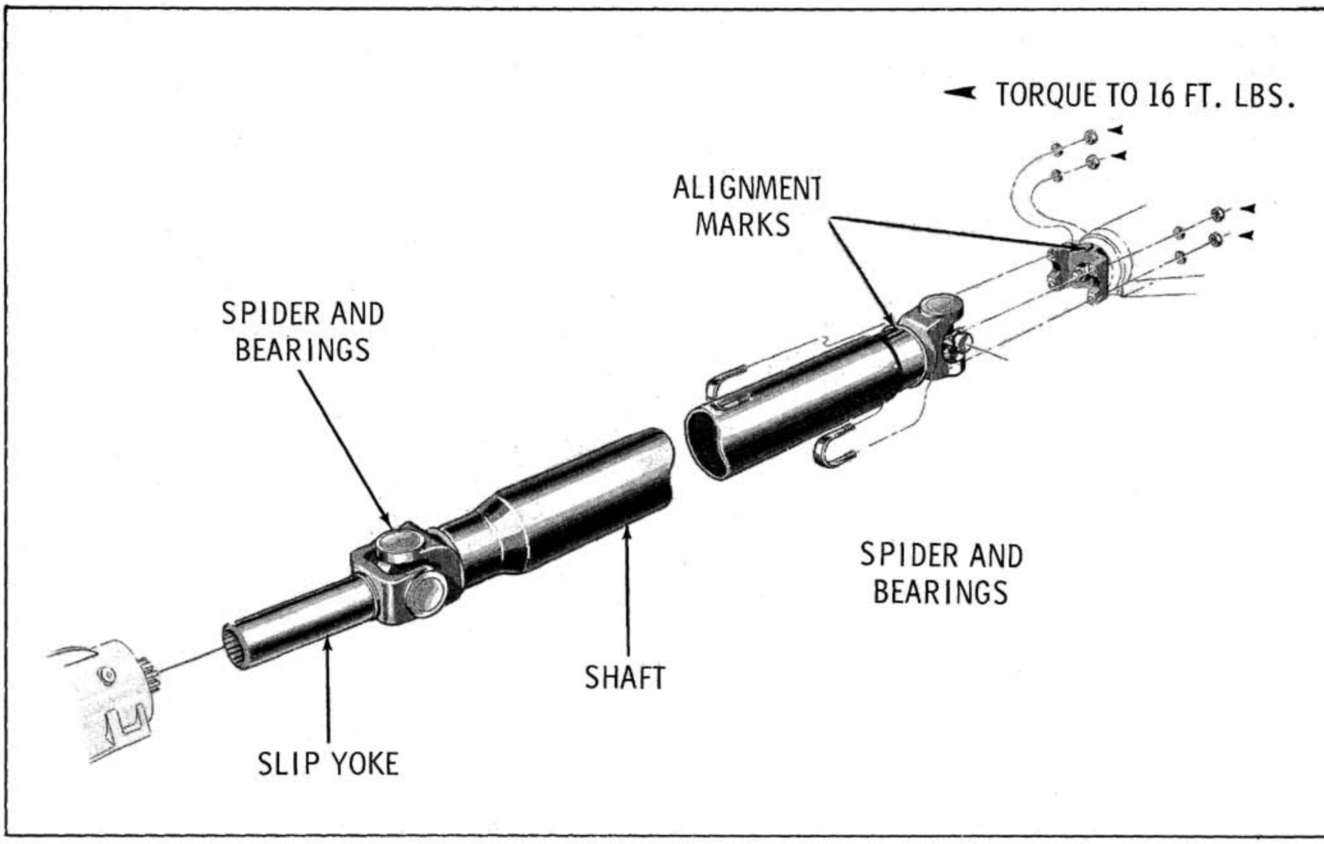


Fig. 10-70 Propeller Shaft Installation

To install, apply one ounce of Seal Lubricant, Part No. 1050169, to the splines of the slip yoke (Automatic Transmission only) and reverse removal procedure. Torque U-bolt nuts to 16 ft. lbs.

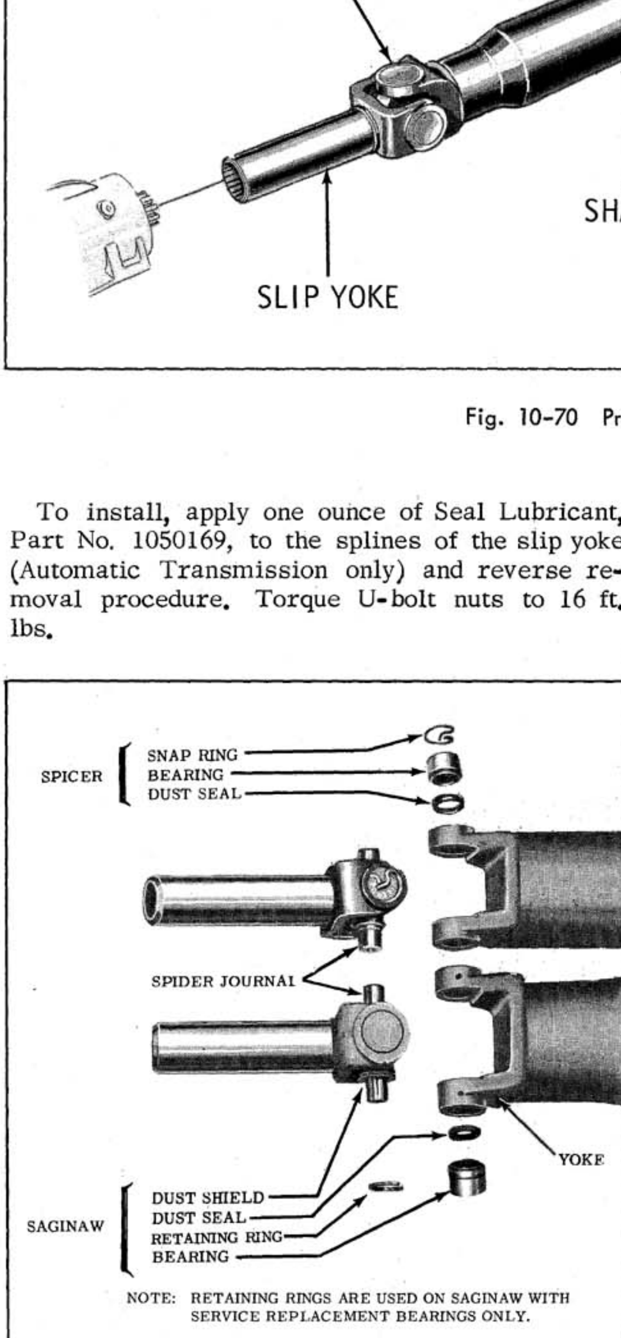


Fig. 10-71 Propeller Shaft Identification

UNIVERSAL JOINT BEARINGS—REMOVE

Saginaw Type (Fig. 10-71)

Production Saginaw propeller shafts use an internally molded nylon retainer to retain the universal joints bearings to the yoke. When servicing this type of bearing, the molded nylon retainer is sheared when the bearing is disassembled and new bearings with metal retaining rings must be reinstalled.

1. With propeller shaft removed from the car, remove all bearing retaining rings if so equipped.

   NOTE: Mark both yoke and shaft so that the units may be reassembled in their original position in order to maintain the original balance.

2. Support splined yoke on a press bed with the rear of the propeller shaft on a stand so shaft is horizontal. Be sure the weight is evenly distributed on each side of the splined yoke and that the fixed yoke half of the U-joint is free to move downward. (Fig. 10-72)

3. Using a piece of pipe or similar tool with a diameter sufficiently large to encircle bearing (slightly larger than 1-1/8 inches), apply force on fixed yoke until nylon retainer

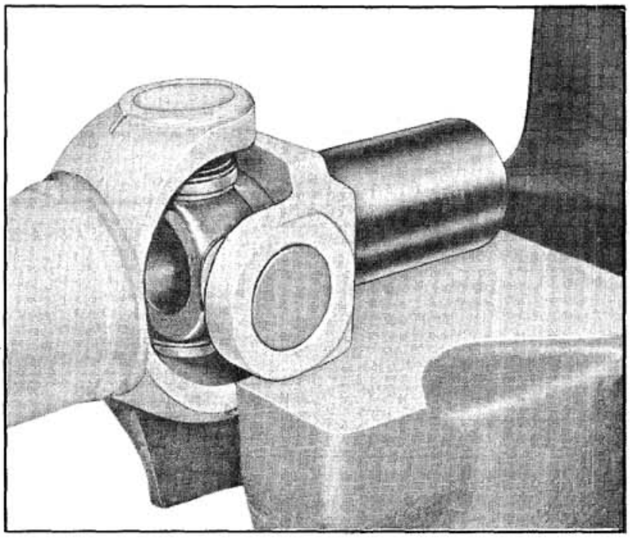


Fig. 10-72 Supporting Propeller Shaft

breaks. (Fig. 10-73) Continue to apply force until the downward movement of the yoke and the stationary position of the journal forces the bearing almost completely out of yoke. (Fig. 10-74)

4. Rotate the propeller shaft 180° and repeat Step 3 to partially remove opposite bearing.

5. Completely remove bearings by tapping around circumference of exposed portion with a hammer. (Fig. 10-75)

6. Remove splined yoke and journal from fixed yoke.

7. Remove bearings and journal from splined yoke.

8. Remove bearings and journal from fixed yoke in a similar manner.

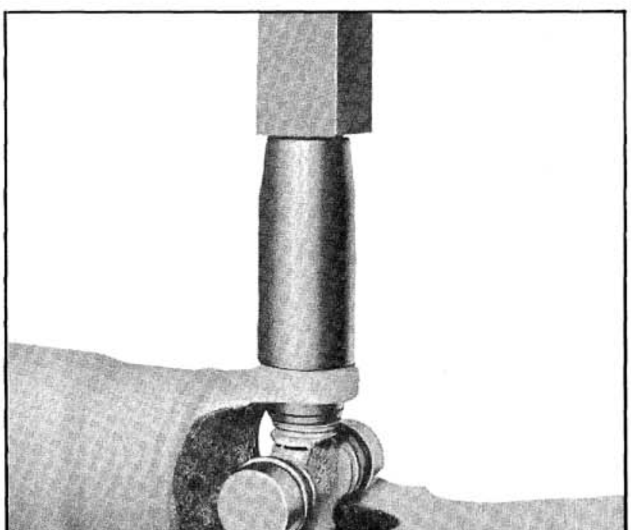


Fig. 10-73 Pressing Out Bearings

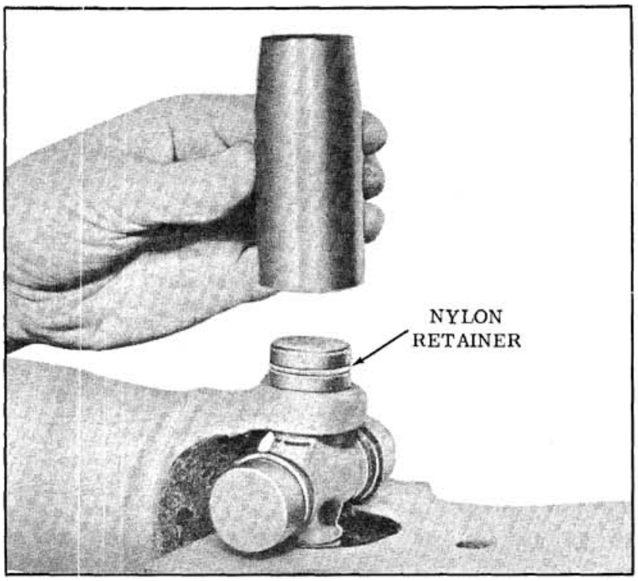


Fig. 10-74 Partial Bearing Removal

Spicer Type (Fig. 10-71)

1. With propeller shaft removed, remove all retaining rings that retain bearings in the yoke.

   NOTE: Mark the slip yoke and fixed yoke, so that the units may be reassembled in their original position to maintain original balance.

2. Press the bearings from the yoke as shown in Fig. 10-76. Continue pressing until bearing which is pushed by the 9/16" socket clears inner side of yoke.

3. Remove propeller shaft and sockets from vise.

4. If exposed bearing on the outer side of yoke is still tight, clamp bearing in a brass jawed vise and tap yoke until bearing is free.

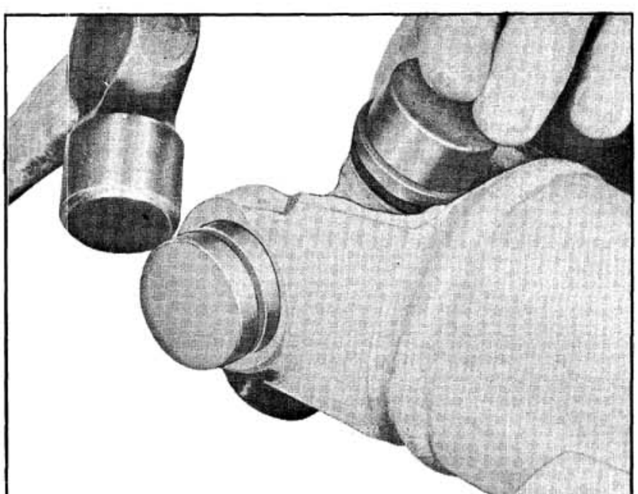


Fig. 10-75 Removing Bearing

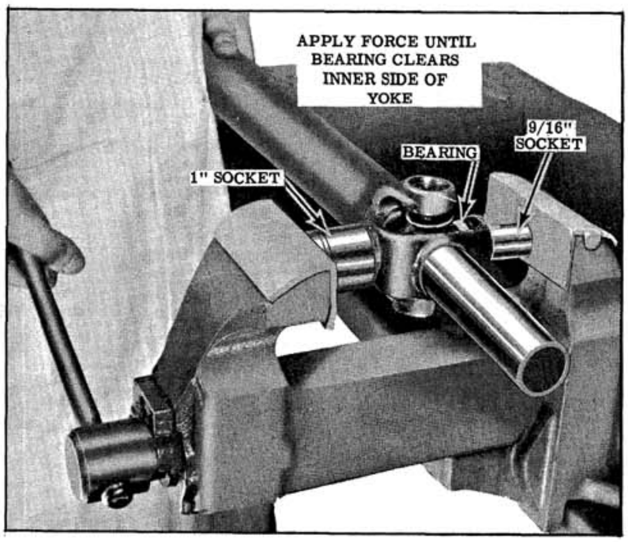


Fig. 10-76 Pressing Bearing From Yoke (Spicer)

5. Remove slip yoke from spider. Remove bearing from spider journal.

6. To remove bearings from the fixed yoke, repeat Step 2.

7. Clamp exposed bearing in a brass jawed vise and tap yoke until bearing is free.

8. Remove spider from the fixed yoke.

9. The bearings can be removed from the rear fixed yoke in a similar manner.

UNIVERSAL JOINT BEARINGS—INSTALL

Saginaw and Spicer

1. Install neoprene dust seals on the bearings.

2. Install dust shields on Saginaw spiders.

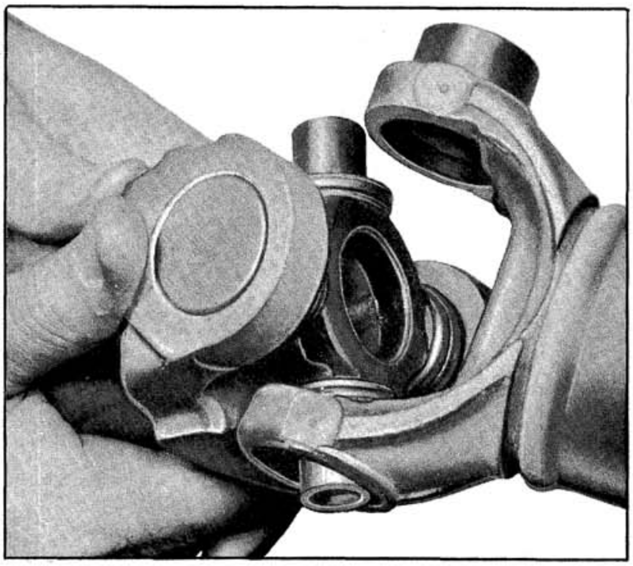


Fig. 10-77 Installing Spider Journal

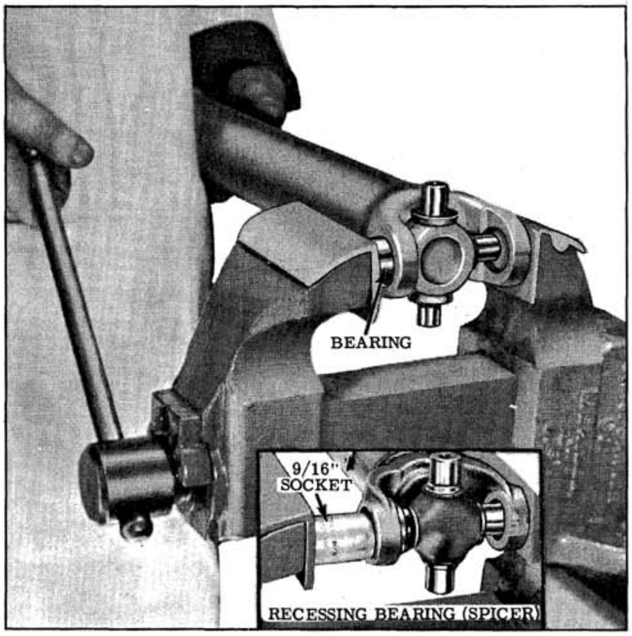


Fig. 10-78 Installing Bearings

3. Position a spider journal in a shaft yoke. (Fig. 10-77)

4. Press a bearing into one side of yoke until retaining ring can be installed. (Fig. 10-78).

NOTE: On Spicer units, the bearing must be recessed into the yoke so that the retaining ring can be installed. The bearing can be recessed with a 9/16" socket and vise. (Inset, Fig. 10-78).

Install retaining rings. Retaining rings on Saginaw units must be installed with the gap toward the yoke. (Fig. 10-79)

Repeat Steps 4 and 5 on opposite bearing. As the bearing is installed, align spider journal with the bearing.

To install the slip yoke, position the yoke over the spider journal with scribe marks aligned and repeat Steps 4, 5 and 6.

Position bearings which attach to a companion flange, onto the spider journals and retain with wire or tape.

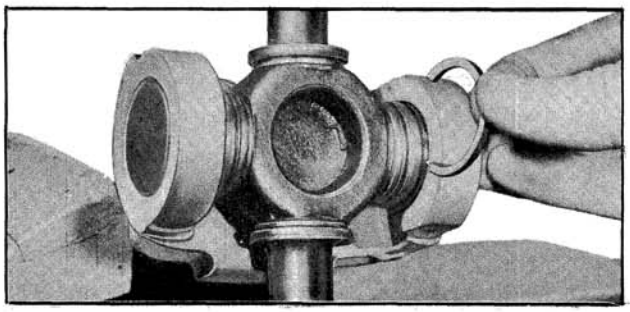


Fig. 10-79 Installing Retaining Rings (Saginaw)

TORQUE SPECIFICATIONS

(All Series)

NOTE: Specified torque is for installation of parts only. Checking of torque during inspection may be 15% below that specified.

APPLICATION	FT. LBS.
DIFFERENTIAL	
Filler Plug	30
Axle Housing Cover to Carrier	25
Ring Gear Bolts (33 through 52 Series)	60
Ring Gear Bolts (54 through 86 Series)	80
Side Bearing Cap Bolts	65
Pinion Gear Shaft Retaining Bolt	28
Case Cover to Case Bolts (33 through 52 Series Anti-Spin)	18
AXLE SHAFT	
Axle Bearing Retainer to Housing	55
Wheel to Axle Shaft Nuts	75
PROPELLER SHAFT	
Propeller Shaft to Companion Flange	16

SPECIFICATIONS

(All Series)

DIFFERENTIAL	
LUBRICATION	
Capacity	
33 through 52 Series	3 Pts. Approx.
54 through 86 Series	4-3/4 Pts. Approx.
Replenish (Conventional)	S.A.E. 90 Multi-Purpose Gear Lubricant Meeting Military Specification MIL-L-2105B
Replenish (Anti-Spin)	Special Lubricant Part No. 1050081
ADJUSTMENTS	
Backlash	.007" to .009"
Drive Pinion Bearing Pre-load	
New Bearings	20 to 30 in. lbs.
Old Bearings	12 to 20 in. lbs.
Side Bearing Pre-load	
New Bearings	30 to 40 in. lbs.
Old Bearings	20 to 30 in. lbs.
PROPELLER SHAFT	
Length (from center line of front U-joint to center line of rear U-joint)	
33 through 38 Series (three and four-speed Synchromesh, except 55 and 65 Styles)	60.00"
33 through 38 Series (A.T. and 55 and 65 Styles with three and four-speed Synchromesh Transmission)	65.04"
52 Series (Synchromesh Transmission)	59.50"
54 through 66 Series (Synchromesh Transmission)	58.56"
54 through 66 Series (Automatic Transmission)	58.37"
84 and 86 Series (Automatic Transmission)	61.37"

BRAKES

(ALL SERIES)

CONTENTS OF SECTION 11

PERIODIC MAINTENANCE

Each time the car is in the service department, the brake pedal height should be observed. If the brake pedal travel from the released to the fully applied position (engine running, power brakes) exceeds 1-7/8" on power brakes or 4" on standard brakes, the car should be driven alternately forward and backward, and the brakes applied moderately each time to operate the self-adjuster until the proper pedal height is obtained. If brake pedal travel cannot be reduced in this manner, the drums should be removed and the self-adjusting mechanism inspected for the cause of inoperation.

The adjusting screws should be cleaned and lubricated with brake lubricant, Part No. 1050110.

The fluid in the master cylinder reservoir should be checked at every engine oil change interval. Fluid level should be no more than 1/4" below the reservoir opening. Replenish as necessary with Brake Fluid, Supreme No. 11.

Brake hoses and pipes should be inspected for chafing, deterioration or other damage.

Brake linings should be periodically inspected for wear. The frequency of this inspection depends upon driving conditions such as traffic or terrain, and also the driving techniques of individual owners.

DESCRIPTION

The braking system consists of hydraulically operated brakes that apply the brake shoes simultaneously at all four wheels, and a mechanically operated parking brake that applies the brake shoes at the rear wheels only.

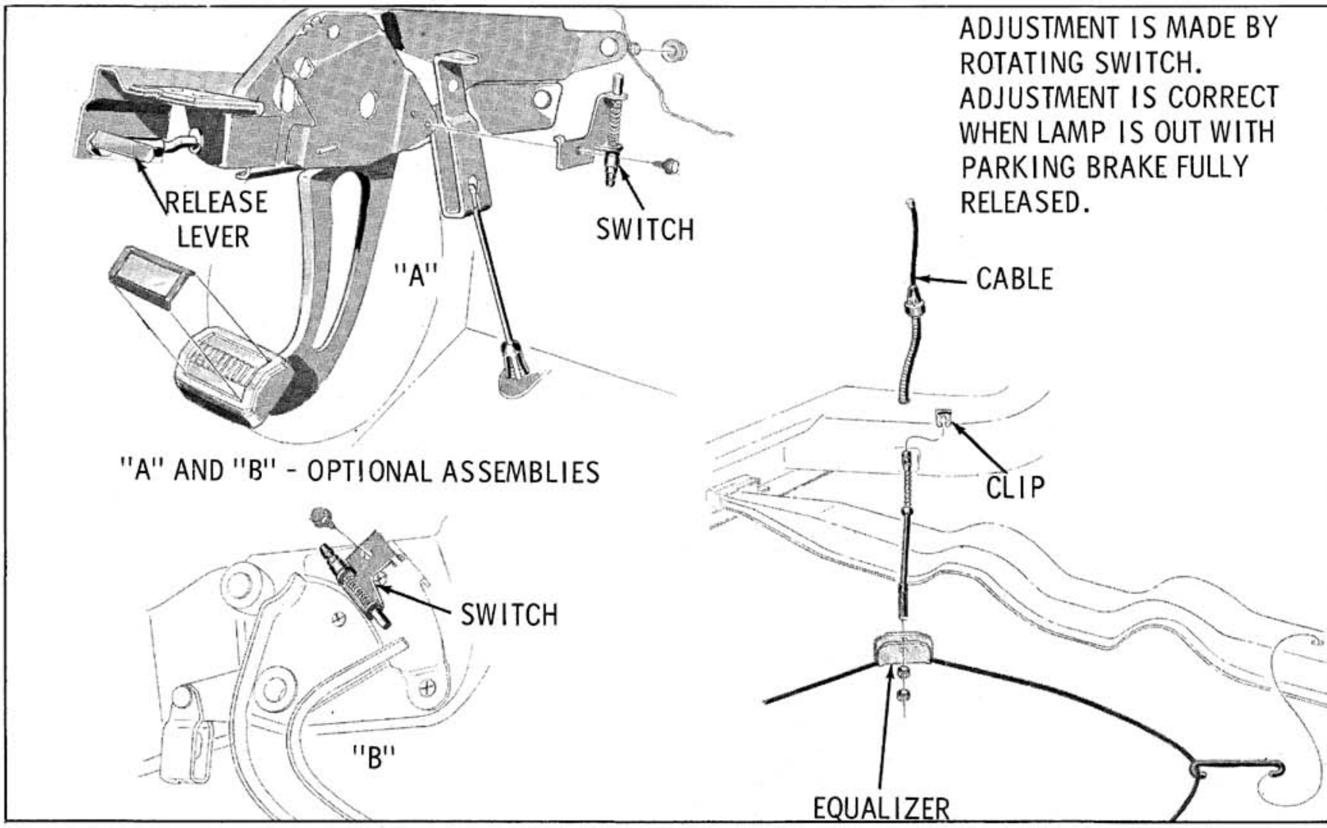


Fig. 11-1 Parking Brake

HYDRAULIC BRAKE

When the hydraulic brake pedal is depressed, the piston in the master cylinder forces fluid under pressure to a wheel cylinder at each wheel, which in turn, push the brake shoes against the brake drum. As the shoes contact the drum, the friction between the shoes and the rotating drum moves the primary shoe downward against the adjusting screw which acts as a link to transmit the force of the primary shoe to the lower end of the secondary shoe. With the upper end of the secondary shoe being held by the stationary anchor pin, the secondary shoe is wedged against the drum. This wedging action, due to frictional force, imparts the self-energizing action to the braking effort and thereby decreases the effort required by the driver to stop the car.

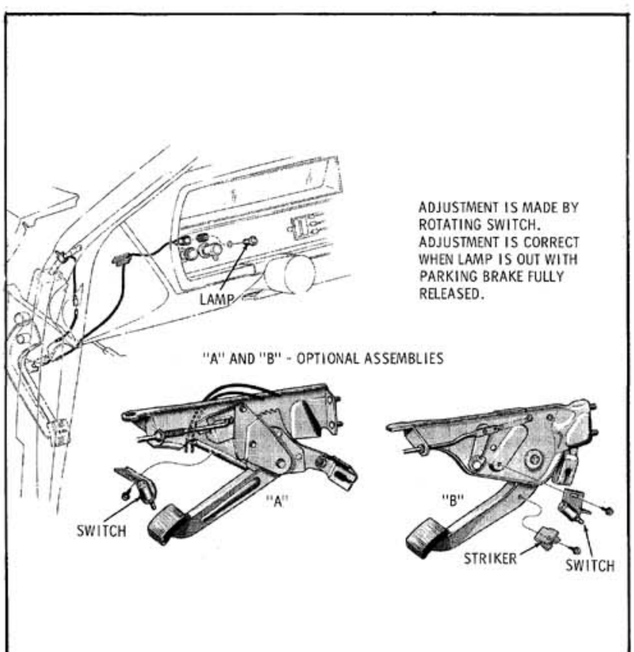


Fig. 11-2 Parking Brake

PARKING BRAKE (Figs. 11-1 & 11-2)

The parking brake applies the rear brakes through cable and linkage by means of a foot operated parking brake pedal mounted below the instrument panel. The parking brake is released by pulling the release handle.

SELF-ADJUSTING BRAKE

General Description

All cars are equipped with self-adjusting brakes. The self-adjusting brake mechanism consists of an actuating link, adjuster lever, adjuster lever return spring, override spring and override pivot.

Operation (Fig. 11-3)

The self-adjusting brake mechanism operates only when the brakes are applied while the car is

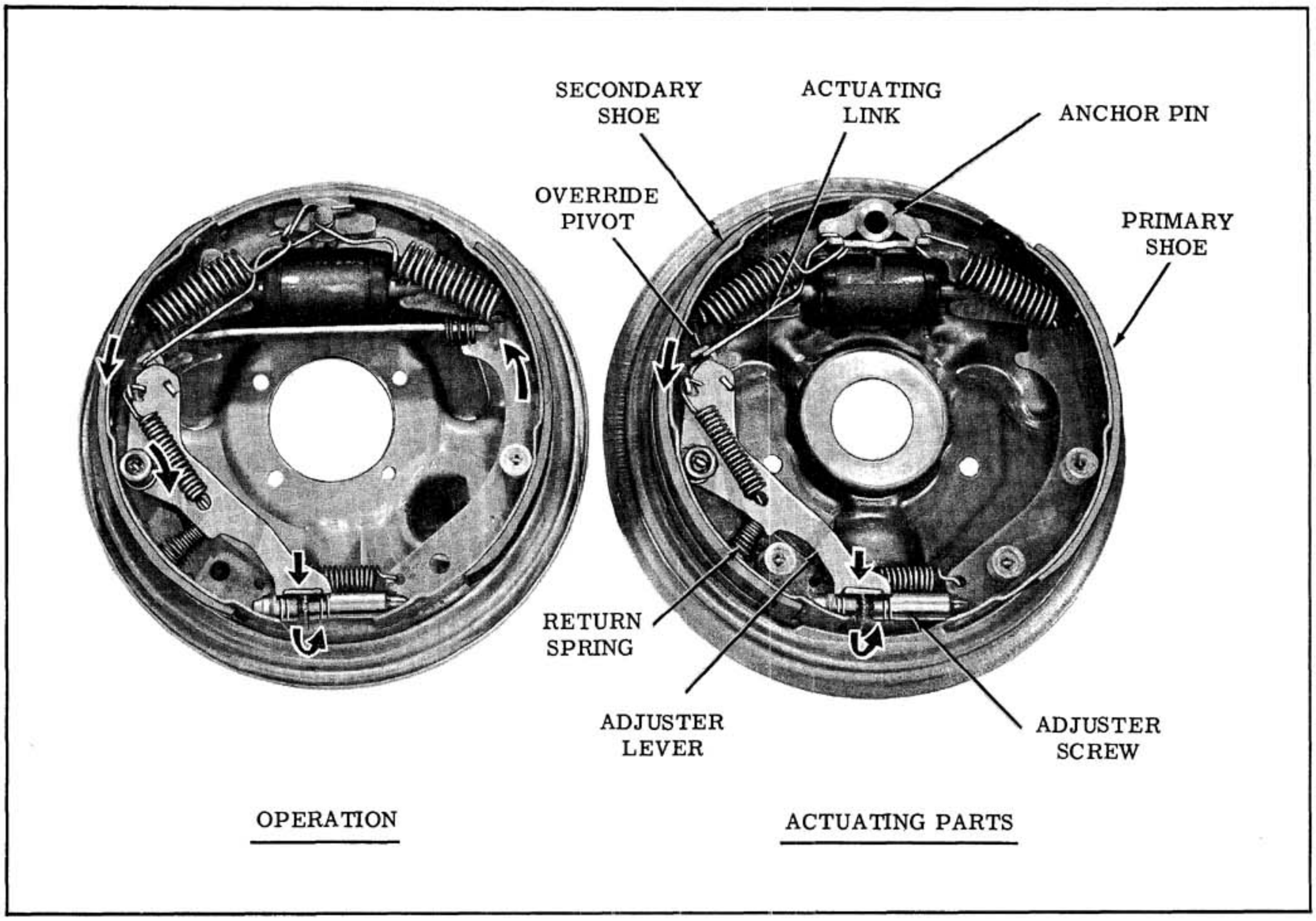


Fig. 11-3 Self-Adjusting Brake

moving rearward and only when the secondary shoe moves a pre-determined distance toward the brake drum.

As the car moves rearward and the brakes are applied, friction between the primary shoe and the drum forces the primary shoe against the anchor pin. Hydraulic pressure in the wheel cylinder forces the upper end of the secondary shoe away from the anchor pin. As the secondary shoe moves away from the anchor pin, the upper end of the adjuster lever is prevented from moving by the actuating link. This causes the adjuster lever to pivot on the secondary shoe forcing the adjuster lever against the adjusting screw sprocket. If the brake linings are worn enough to allow the secondary shoe to move the pre-determined distance, the adjuster lever will turn the adjusting screw sprocket one or two teeth, depending on lining wear. If the secondary shoe does not move the pre-determined distance, movement of the adjuster lever will not be great enough to rotate the adjusting screw sprocket.

When the brakes are released, the adjusting lever return spring will move the adjuster lever into the adjusting position on the sprocket.

An override feature is built into the self-adjusting brake which allows the secondary shoe to be applied in reverse in the event the adjusting screw becomes "frozen" preventing the self-adjuster from operating.

When the car is moving forward and the brakes are applied, the upper end of the secondary shoe is forced against the anchor pin due to the self-energizing action of the brakes, and the self-adjuster does not operate.

ADJUSTMENTS

PARKING BRAKE LAMP SWITCH

The parking brake lamp switch is bolted to the pedal mounting bracket and is actuated by the parking brake pedal arm.

To adjust switch, refer to Figs. 11-1 & 11-2.

STOP LAMP SWITCH

The stop lamp switch is attached to the brake pedal bracket and is actuated by the brake pedal arm.

Adjustment (All Series)

1. With the brake pedal height correctly adjusted, insert switch into tubular clip until switch body seats on tube clip.

2. Pull brake pedal rearward until it contacts the brake pedal stop. This moves the switch in the tubular clip providing proper adjustment.

3. Check stop lamp switch operation by applying and releasing the brake, making certain that the stop lamps go off when the brake pedal is in the fully released position.

BRAKE SHOE

A brake shoe adjustment is required only when new linings are installed or whenever the length of the brake shoe adjusting screw has been manually changed.

1. With the brake drums removed, position the drum end (inside diameter measuring caliper) of the Brake Drum and Shoe Gauge, Tool J-21177, to the inside diameter of the drum and tighten clamp screw. (Fig. 11-4)

2. Position the brake shoe end (outside diameter measuring caliper) of Tool J-21177 over the brake shoes as shown in Fig. 11-5. Rotate gauge slightly around shoes to insure that gauge contacts the linings at the largest diameter. Adjust brake shoes until gauge is a snug fit on linings at the point of largest lining diameter.

   NOTE: If it is necessary to back off the brake shoe adjustment, it will be necessary to hold the adjuster lever away from the sprocket.

3. Remove the gauge.

STANDARD BRAKE PEDAL ADJUSTMENT (52, 54, 56, & 58 Series)

An incorrectly adjusted brake pedal can hold the master cylinder piston from fully returning to its released position, which will result in brake drag or lock-up.

1. Remove the pedal return spring and the master cylinder push-rod clevis pin.

2. Turn back floor mat and check pedal height (from floor pan to top of pedal pad). If dimension is not 7-15/16" ± 1/8", loosen locknut and adjust stop screw. (Fig. 11-6) Tighten locknut and recheck adjustment.

3. To adjust the master cylinder push-rod, lightly push the master cylinder push-rod until it contacts the hydraulic piston.

4. Loosen locknut and adjust push-rod until clevis pin can be freely installed into the brake pedal, then shorten push-rod one turn for proper free play.

5. Tighten locknut and connect push-rod to brake pedal.

   NOTE: Whenever the brake pedal height has been changed, the stop lamp switch adjustment should be checked and adjusted if necessary.

33, 34, 35, 36, & 38 Series

1. Turn back floor mat and check pedal height (from floor pan to the top of the pedal pad

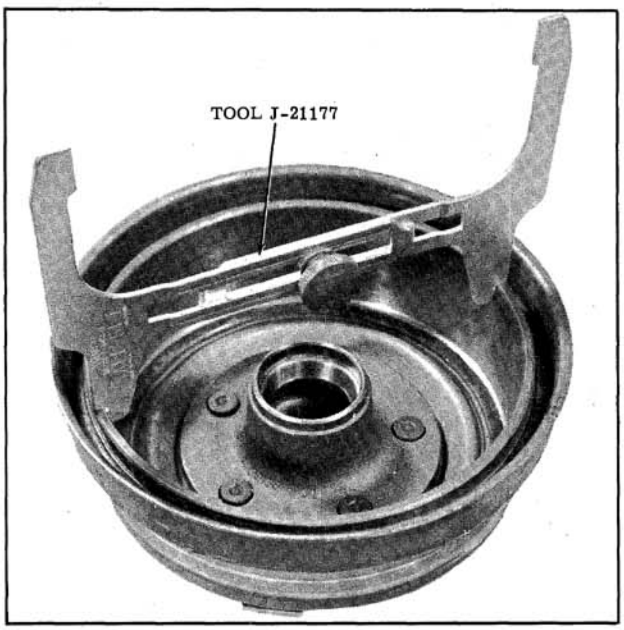


Fig. 11-4 Checking Brake Drum

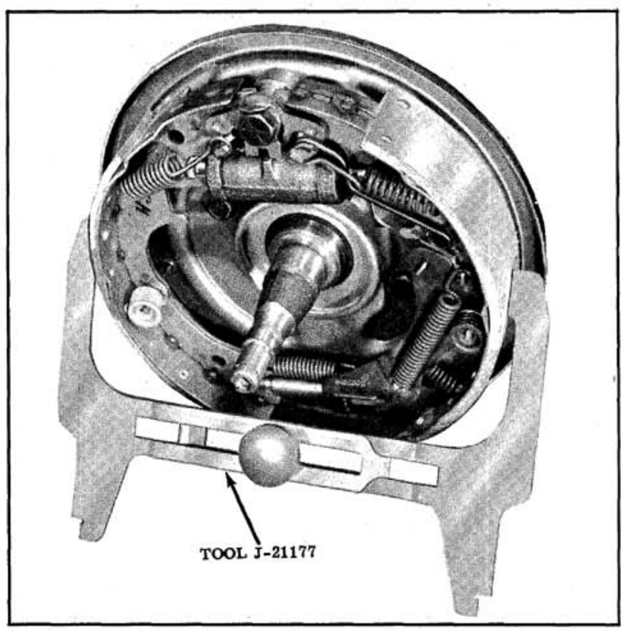


Fig. 11-5 Checking Lining

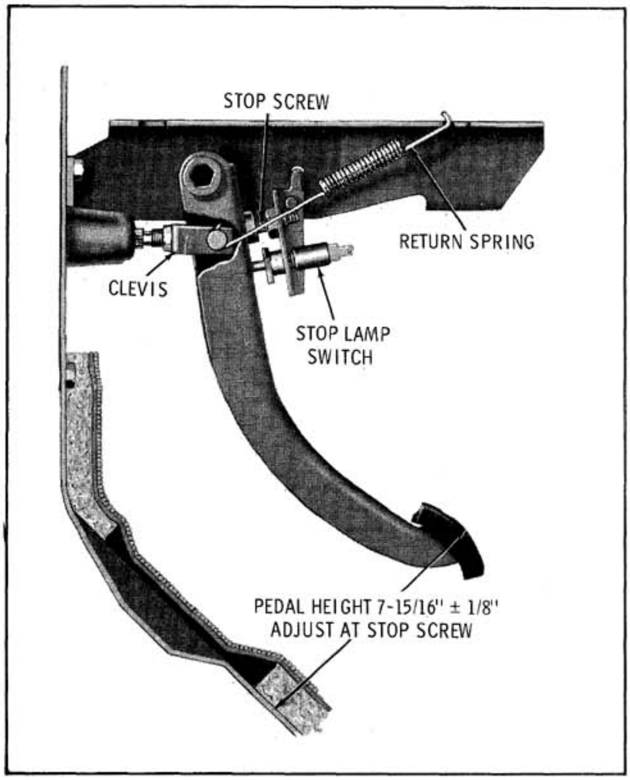


Fig. 11-6 Brake Pedal Adjustment

at the center). Dimension should be 7-1/2" ± 1/8". (Fig. 11-7)

2. If dimension is incorrect, remove the master cylinder push-rod clevis pin. Loosen clevis locknut and adjust clevis until correct pedal height is obtained.

3. If car is equipped with Synchromesh transmission, adjust brake pedal height to match the clutch pedal height, within 1/8".

4. Tighten locknut on clevis and connect the push-rod to the brake pedal.

NOTE: Whenever the brake pedal height has been changed, the stop lamp switch adjustment should be checked and adjusted if necessary.

PARKING BRAKE ADJUSTMENT (ALL SERIES)

1. Release parking brake.
2. Be sure the hydraulic brake pedal travel is within specifications before adjusting parking brake.
3. Adjust cables by first tightening equalizer adjusting nut until a heavy resistance is felt

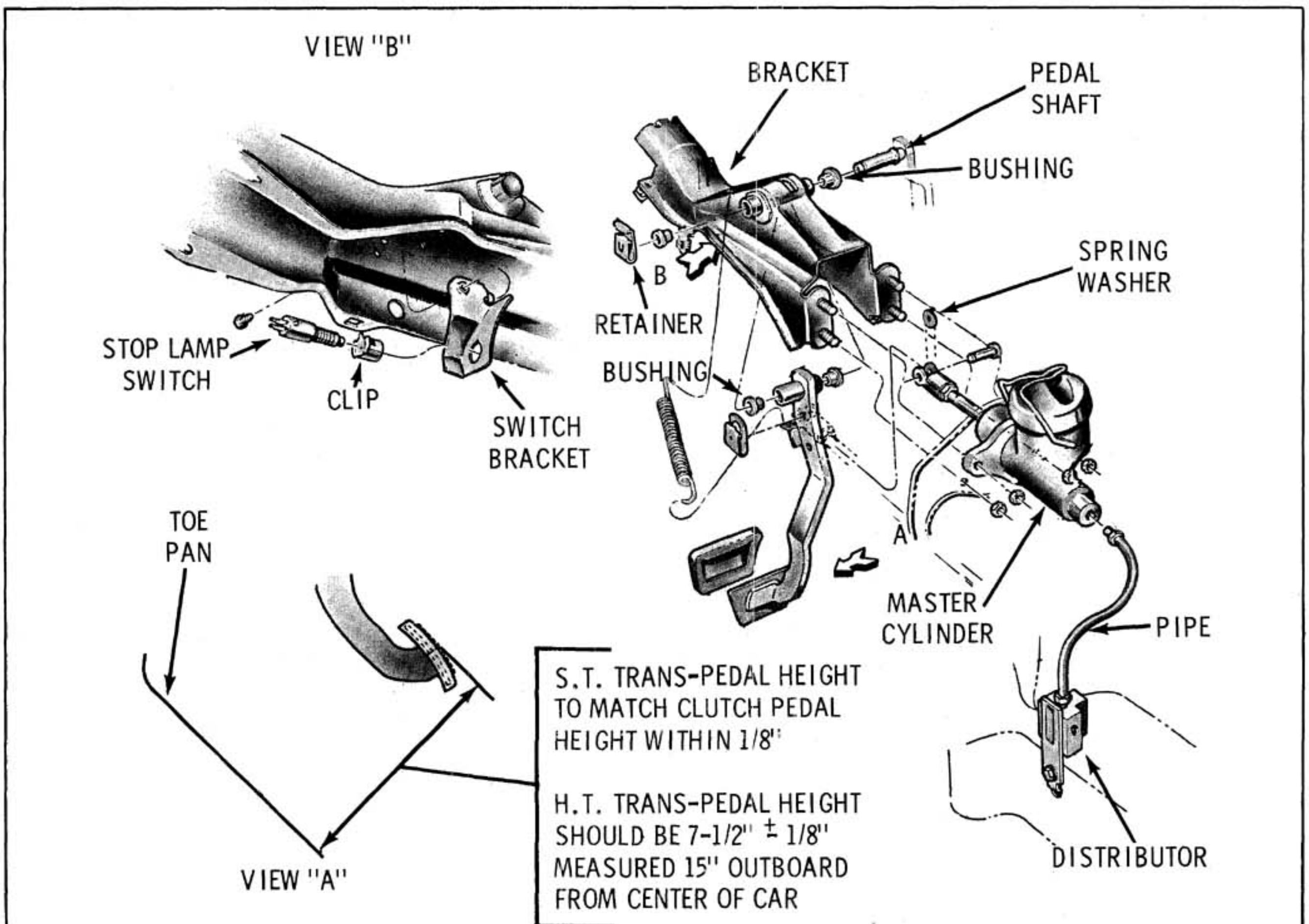
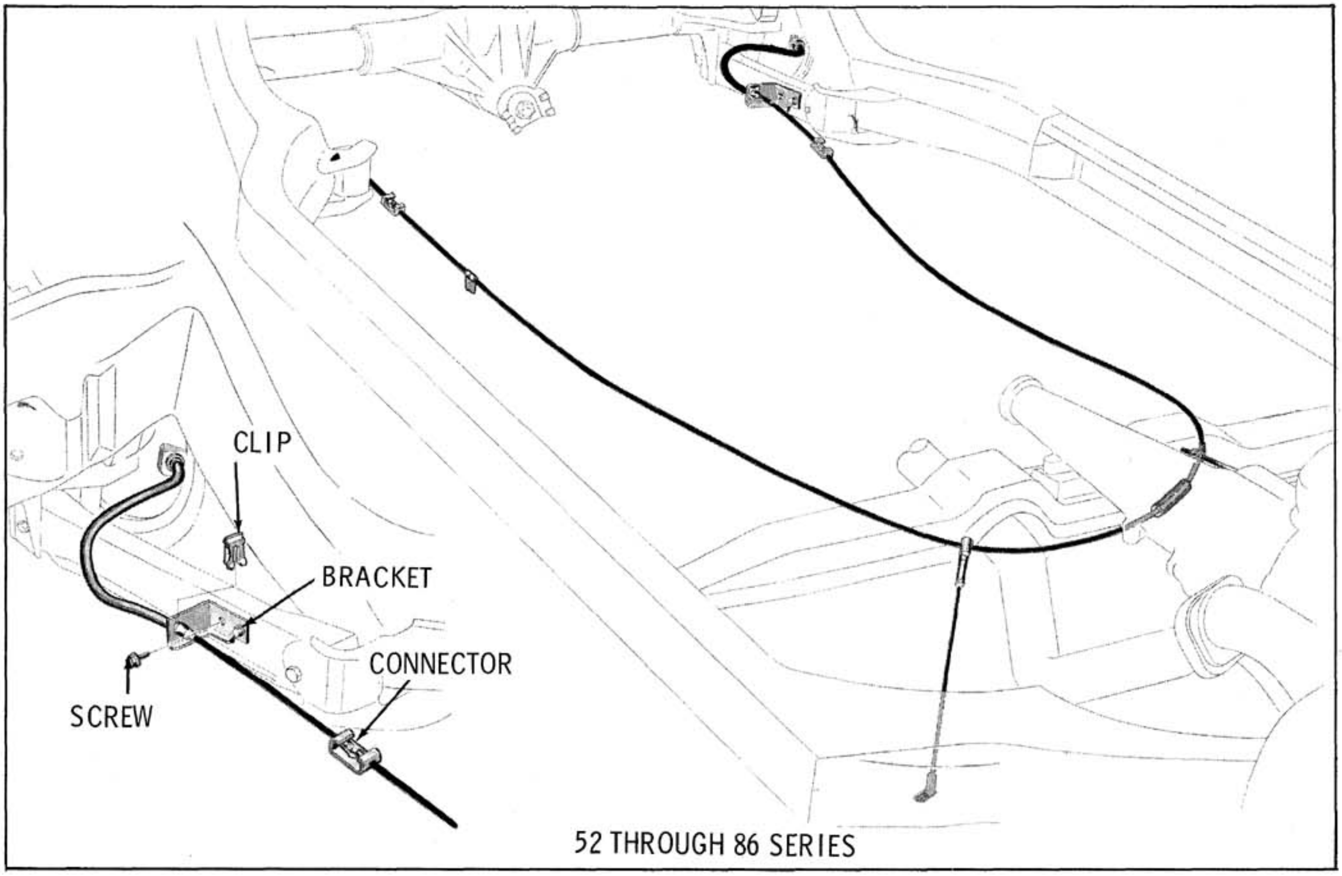


Fig. 11-7 Brake Pedal Adjustment



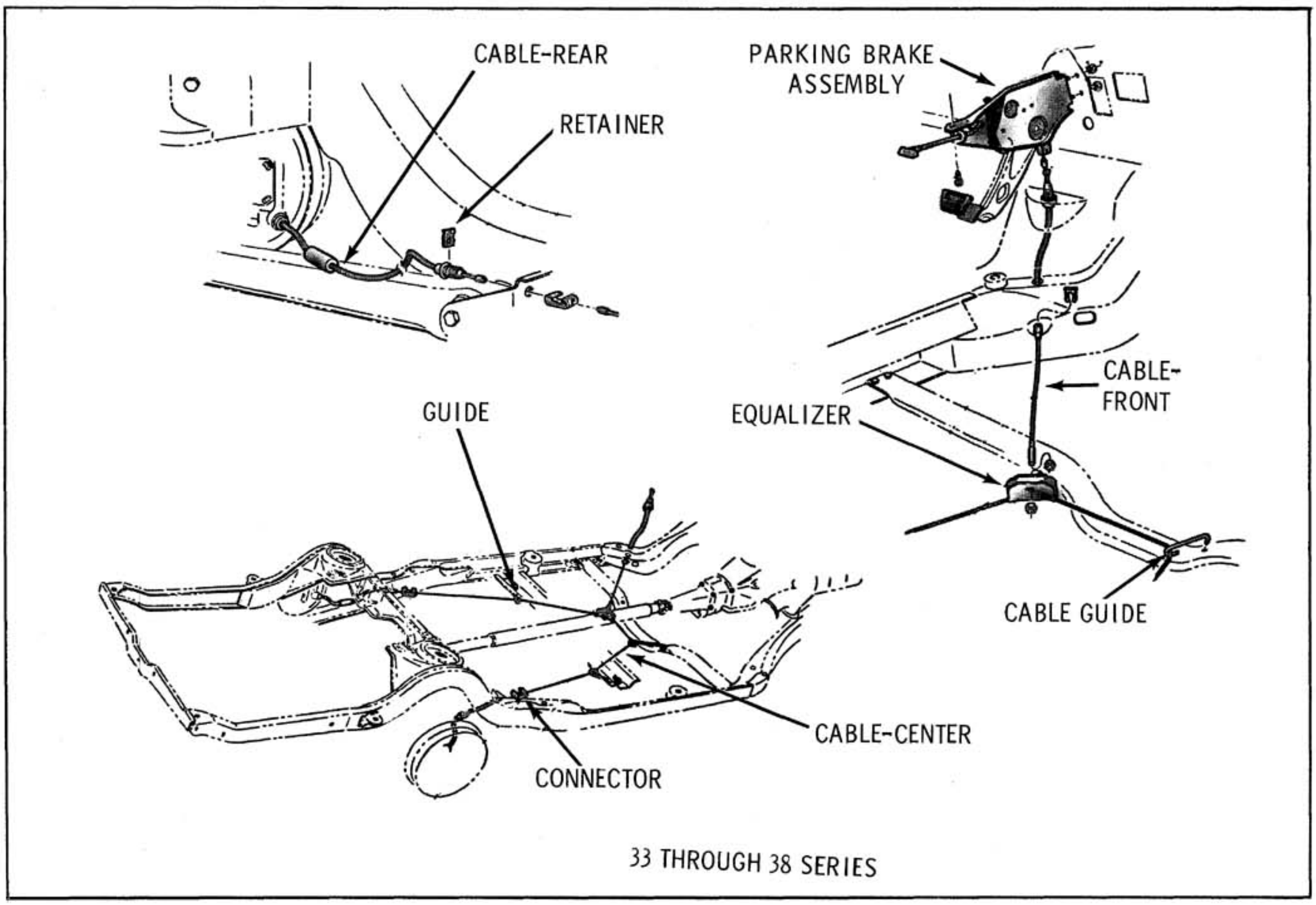


Fig. 11-8 Parking Brake Layout

when rotating rear wheels forward, then loosen equalizer adjusting nut seven full turns. (Fig. 11-8)

MINOR SERVICE OPERATIONS

BRAKE PEDAL AND BRACKET (STANDARD BRAKES)

The brake pedal is suspended from a mounting bracket under the instrument panel. Nylon bushings between the pivot bolt and the pedal eliminates periodic lubrication. The pedal is connected to the master cylinder push-rod by a clevis. The brake pedal or bracket can be removed as shown in Figs. 11-7 and 11-9. (Refer to CLUTCH SECTION for clutch pedal spring removal)

Before installation, lubricate inside of bushings, clevis pin and stop lamp switch bolt head with lubricant, Part No. 1050169. Torque pivot pin nut, on 54, 56 and 58 series, to 18 ft. lbs. Adjust brake pedal as outlined under STANDARD BRAKE PEDAL ADJUSTMENT.

HYDRAULIC SYSTEM

BLEEDING OF LINES

Whenever a line is disconnected from any wheel, it is necessary that the wheel cylinder be bled. If the hydraulic line is disconnected from the master cylinder or the brake pedal has a spongy feeling, each wheel cylinder must be bled to expel air from the system.

NOTE: Power brakes can be bled in the same manner as a standard brake system. If pressure bleeding equipment is not available, DO NOT use the vacuum assist. With the engine shut off, the vacuum reserve should be depleted by applying the brakes several times before starting the bleeding procedure.

The system can be bled manually or by using pressure bleeding equipment.

To bleed the system, the following procedure is recommended.

The correct sequence for bleeding is left front, right front, left rear, right rear. If the master cylinder is equipped with a bleeder valve, bleed the master cylinder first.

1. If brakes are to be bled manually, fill the brake reservoir with Brake Fluid, Supreme No. 11 and KEEP AT LEAST ONE-HALF FULL OF FLUID DURING THE BLEEDING OPERATION.
2. If brakes are to be bled with pressure equipment, connect the tank to the brake reservoir and raise the pressure in the brake system to 20 to 30 psi.
3. Attach Bleeder Tube J-7779-2 to bleeder valve. (Fig. 11-10) THE TUBE MUST HANG SUBMERGED IN A CLEAN CONTAINER PARTIALLY FILLED WITH BRAKE FLUID, SUPREME NO. 11 DURING THE BLEEDING OPERATION.

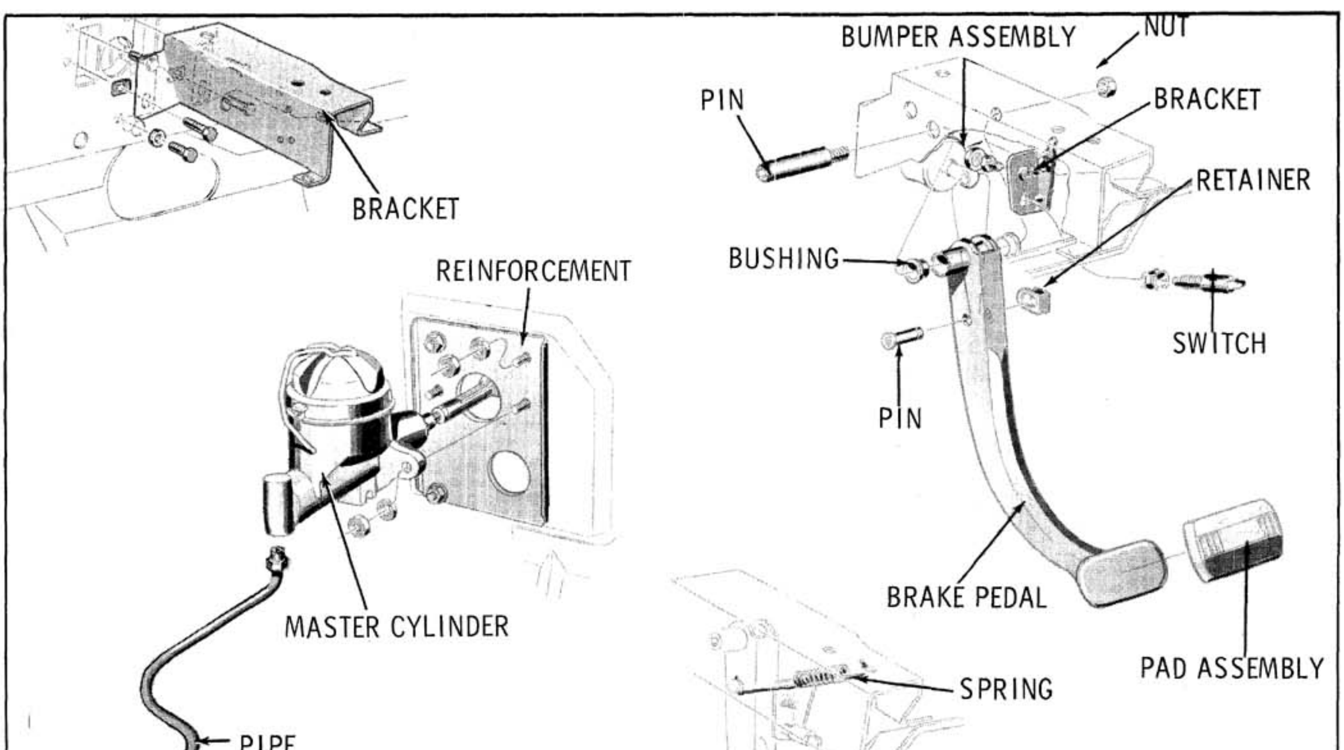


Fig. 11-9 Standard Brake Layout (52 through 58 Series)

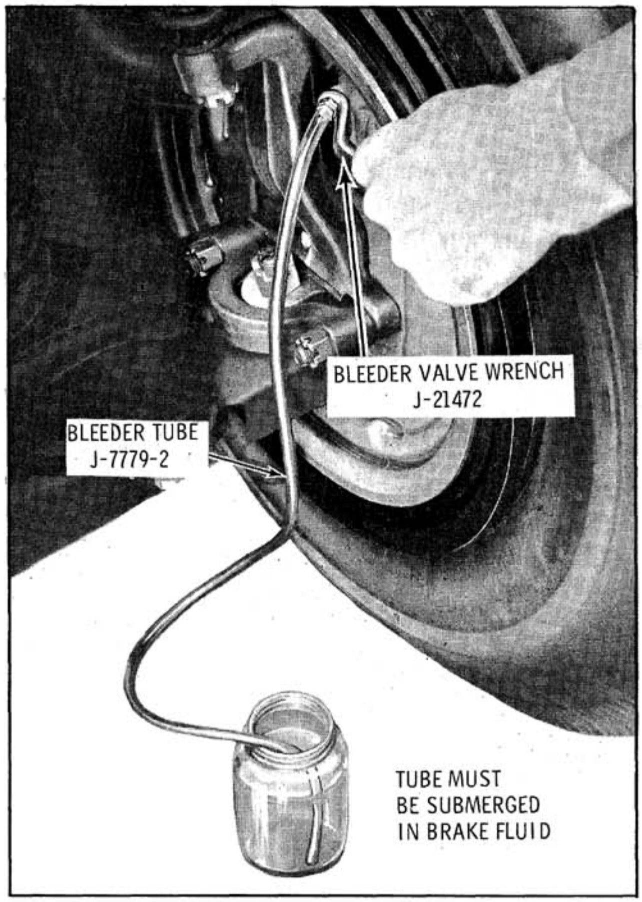


Fig. 11-10 Bleeding Brakes

4. Unscrew bleeder valve three-quarters of a turn with a wrench such as J-21472 and watch flow of fluid from bleeder tube. When all air bubbles cease to appear and fluid is clear, close bleeder valve.

   NOTE: If brakes are bled without the aid of pressure equipment, the brake pedal must be operated during this operation to force the fluid from the bleeder hose. To do this, open the bleeder valve, fully depress the brake pedal, then slowly release pedal until it is in the fully released position. Continue operating pedal until fluid, containing no air bubbles, emerges from bleeder tube. Close bleeder valve.

5. Remove bleeder tube.

6. Repeat steps on the remaining wheel cylinders if the entire system is to be bled.

7. If the brakes were bled manually, check fluid in the reservoir and replenish if necessary, after the bleeding operation has been completed.

FLUSHING HYDRAULIC SYSTEM

Whenever mineral oil has been introduced into the hydraulic system, the entire system must be thoroughly flushed with alcohol and all rubber parts must be replaced. The alcohol is introduced into the master cylinder reservoir and expelled at each wheel cylinder in the same manner as the bleeding operation (See BLEEDING OF LINES).

When flushing is completed, bleed the hydraulic system with Brake Fluid, Supreme No. 11 until all flushing fluid and air is expelled from the lines.

MASTER CYLINDER

STANDARD AND POWER

The standard and power brake master cylinders are a sealed type, consisting of a flexible diaphragm located between the fluid reservoir and the vented filler cover. This allows the brake fluid in the system to be sealed from outside air and dust while maintaining normal atmospheric pressure on the fluid in the fluid reservoir.

A Bendix master cylinder is used on the Bendix power brake and can be identified by the screw type master cylinder cover. A Moraine master cylinder is used with all standard and Moraine or Kelsey-Hayes power brakes and can be identified with the bail-type master cylinder cover.

Remove

The standard brake master cylinder, on 52, 54, 56 and 58 series, can be removed without disconnecting the push-rod and clevis. The hydraulic master cylinder, on all series equipped with power brakes, can be removed and serviced without removing the vacuum cylinder from the car.

1. Be sure the area around master cylinder is clean, then disconnect the hydraulic lines at the master cylinder. Plug or tape end of line to prevent entrance of dirt, or loss of brake fluid.

2. On 33, 34, 35, 36 and 38 series, remove the push-rod to brake pedal clevis pin.

3. Remove master cylinder by removing the attaching nuts.

4. Drain master cylinder.

Install

1. To install the standard brake master cylinder on 52, 54, 56 and 58 series:

   a. Lubricate push-rod with a light film of lubricant, Part No. 1050169 to facilitate positioning of rubber boot on push-rod after master cylinder has been installed.

b. Position master cylinder against cowl, push boot onto push-rod and guide push-rod into master cylinder piston cavity.

c. Install the attaching nuts and lockwashers. Torque nuts to 27 ft. lbs.

d. From inside car, pull boot along push-rod toward clevis until boot is fully extended. Check brake pedal as outlined under BRAKE PEDAL ADJUSTMENTS (Standard Brake).

2. To install the standard brake master cylinder on 33, 34, 35, 36 and 38 series:

a. Position the master cylinder against cowl and install the attaching nuts. Torque nuts to 28 ft. lbs.

b. Install the push-rod to brake pedal clevis pin.

3. To install the power brake master cylinder:

a. Position a new filter on the flange of the master cylinder. (Moraine or Kelsey-Hayes Power Brake Only)

b. Position master cylinder so that push-rod enters cavity in master cylinder piston.

NOTE: If a new push-rod was installed, adjust push-rod as outlined under PUSH-ROD ADJUSTMENT.

c. Install master cylinder attaching nuts and lockwashers. Torque to 27 ft. lbs.

4. Install hydraulic line to master cylinder.

5. Fill master cylinder reservoir with Brake Fluid, Supreme No. 11 and bleed all wheel cylinders as outlined under BLEEDING OF LINES.

Disassembly (Figs. 11-11 & 11-12)

1. Standard brake - remove boot from master cylinder.

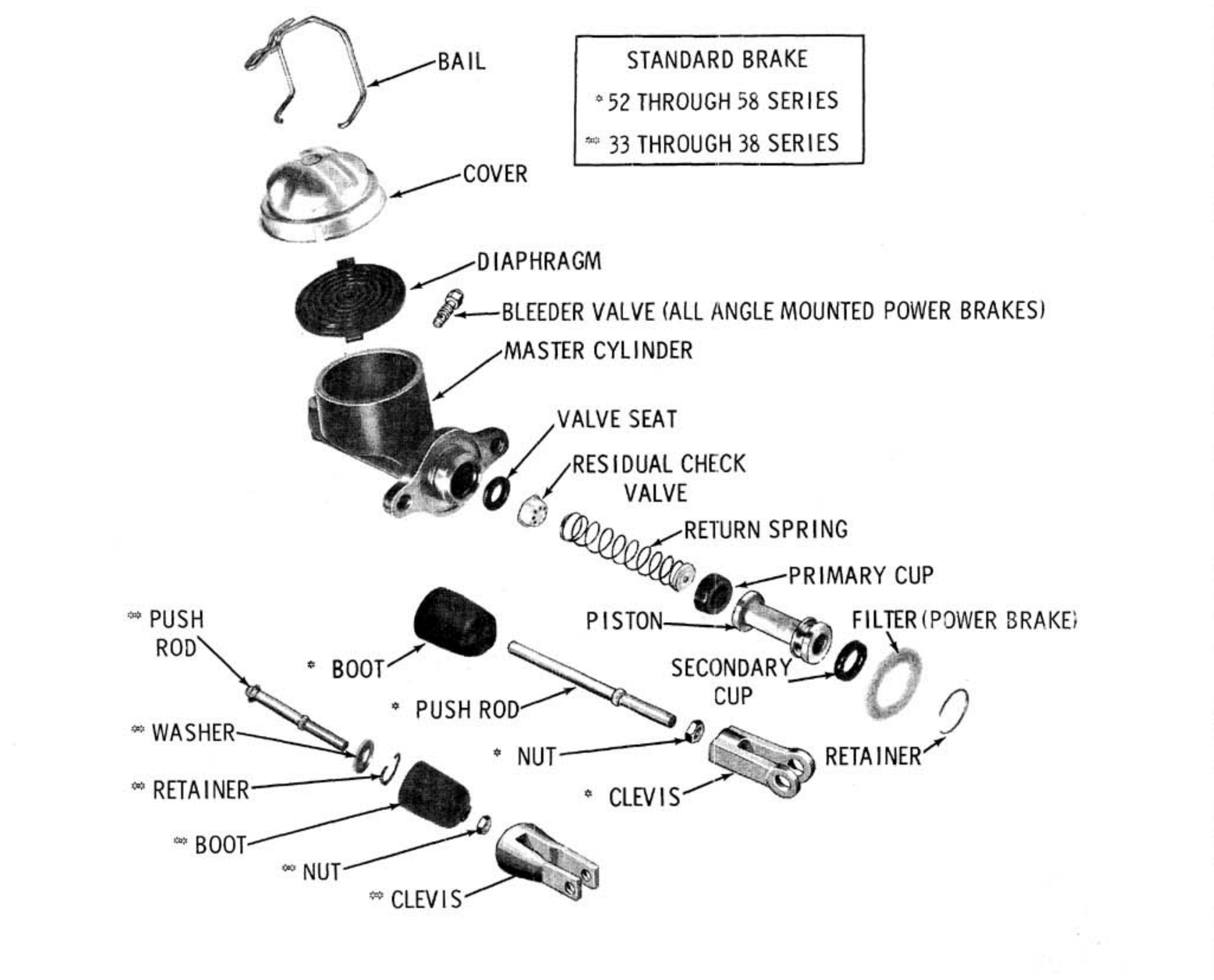


Fig. 11-11 Master Cylinder (Moraine)

2. Remove the retaining ring from the bore of the master cylinder. On 33, 34, 35, 36 and 38 series, remove the push-rod.

3. Remove the piston primary cup, spring and residual check valve from bore of master cylinder.

4. On Moraine power and standard master cylinder, remove the rubber valve seat washer from cylinder bore with a wire hook.

5. Power brake - remove filter from flange of master cylinder.

6. Power brake - remove the bleeder valve, if so equipped.

CLEANING AND INSPECTION

1. Wash all parts in alcohol fluid and blow out all passages with compressed air. Be sure compensating port is open.

2. Inspect cups, residual check valve, valve seat washer and secondary seal for a swelling or distorted condition. Replace if damaged. If such a condition exists, the entire system should be flushed (See FLUSHING HYDRAULIC SYSTEM) and all rubber parts in the wheel cylinders replaced.

3. Inspect the master cylinder bore for scores, rust, pits or etches. If any of these conditions exist, the complete master cylinder must be serviced as an assembly.

   CAUTION: Do not attempt to hone the master cylinder bore as a means of salvaging the cylinder assembly. Reconditioning of the bore leaves the walls sufficiently rough to cause premature failure of the rubber cups. It also enlarges the bore to the extent that the standard size piston and seals will not fit properly.

Assembly (Figs. 11-11 & 11-12)

1. Lubricate master cylinder bore and all rubber parts with Brake Fluid, Supreme No. 11.

2. Install check valve rubber washer against the shoulder inside the master cylinder bore.

3. Install large end of spring over residual check valve, then install the assembly into the bore (check valve end first).

4. Install primary cup over end of spring (dish side toward spring).

5. On all except 33 through 38 series (manual brake) install piston into bore and while compressing spring, install retaining ring.

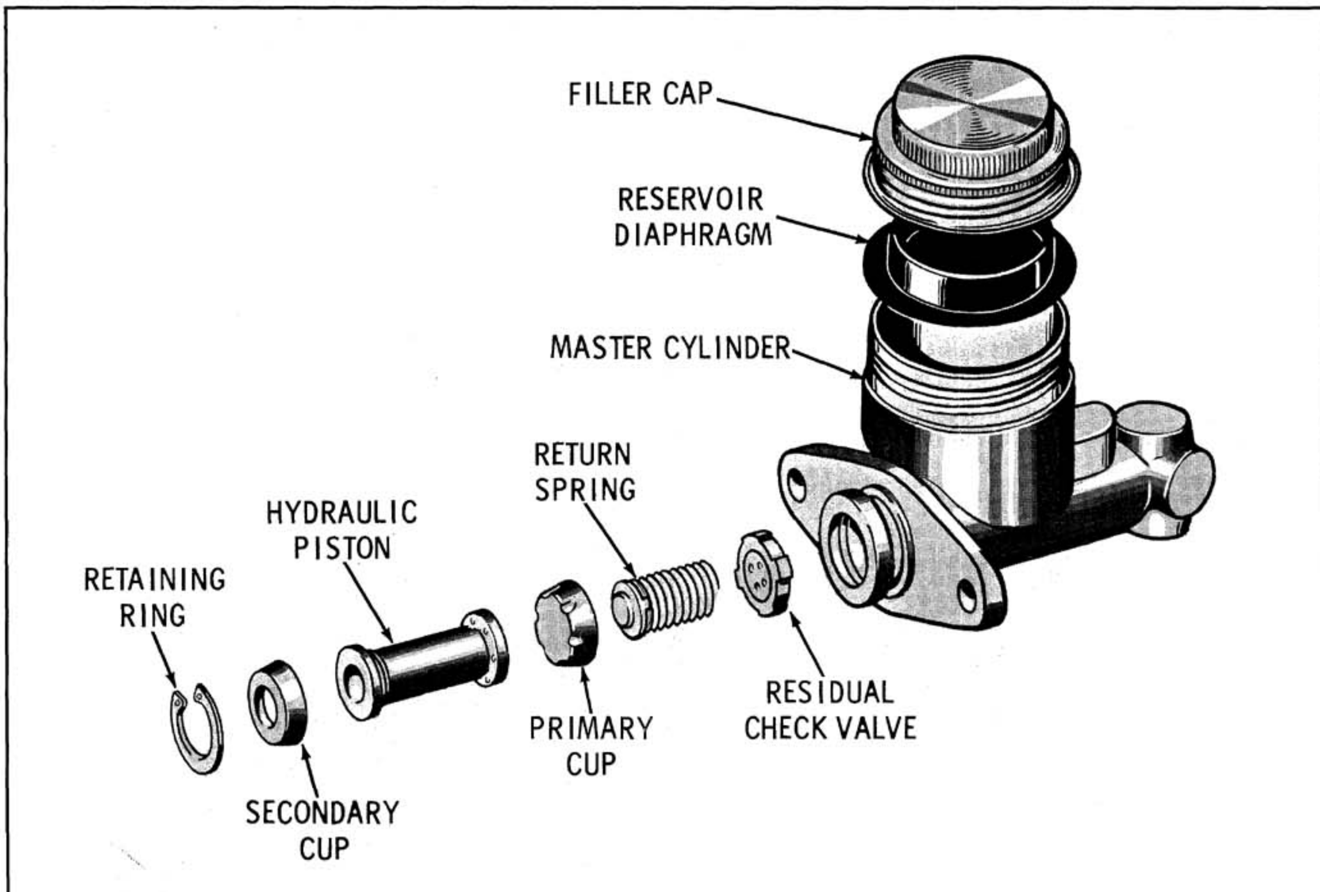


Fig. 11-12 Master Cylinder (Bendix)

6. On 33 through 38 series, manual brake, install piston and push-rod and while compressing spring, install retaining ring.

7. Standard brake - install boot over lip of master cylinder casting.

8. Install bleeder valve if so equipped.

WHEEL CYLINDERS

REMOVE AND INSTALL

1. Remove brake drums and shoes as outlined under DRUM AND BRAKE ASSEMBLIES, REMOVE.

2. Front wheel cylinder:

   a. Remove brake line from brake hose.

   b. Remove the brake hose retainer clip at the frame bracket.

   c. Remove brake hose from wheel cylinder.

3. Rear wheel cylinder - remove the brake line from the wheel cylinder.

4. Remove the wheel cylinder to backing plate attaching bolts and remove wheel cylinder.

To install, reverse the removal procedure, torque wheel cylinder to backing plate bolts to 16 ft. lbs. and bleed the lines. (See BLEEDING OF LINES).

DISASSEMBLY (Fig. 11-13) (33 Through 52 Series)

The internal wheel cylinder boots should be disassembled only when they are visibly damaged or leaking fluid.

Wheel cylinders having torn, cut, or heat cracked boots should be completely overhauled.

Inspection for leakage may be accomplished at the boot center hole after removal of the link pin. Fluid coatings on the piston within the cylinder and on the end of the link pin are normal, as the cylinder contains a porous piston which is impregnated with a corrosion inhibiting fluid. Fluid spilling from the boot center hole, after the link pin is removed, indicates cup leakage and the necessity of completely overhauling the cylinder.

1. Pull boots from cylinder ends with pliers and discard boots.

2. Remove and discard pistons and cups.

CLEANING AND INSPECTION

1. Inspect cylinder bore. Check for staining or corrosion. It is best to discard a corroded cylinder.

   NOTE: Staining is not to be confused with corrosion. Corrosion can be identified as pits or excessive bore roughness.

2. Polish any discolored or stained area with crocus cloth by revolving the cylinder on the cloth supported by a finger. Do not slide the cloth in a lengthwise manner under pressure. Do not use any other form of abrasive or abrasive cloth.

3. Rinse the cylinder in Declene or brake fluid.

4. Shake excess cleaning fluid from the cylinder. Do not use a rag to dry the cylinder as lint from the rag cannot be kept from the cylinder bore surfaces.

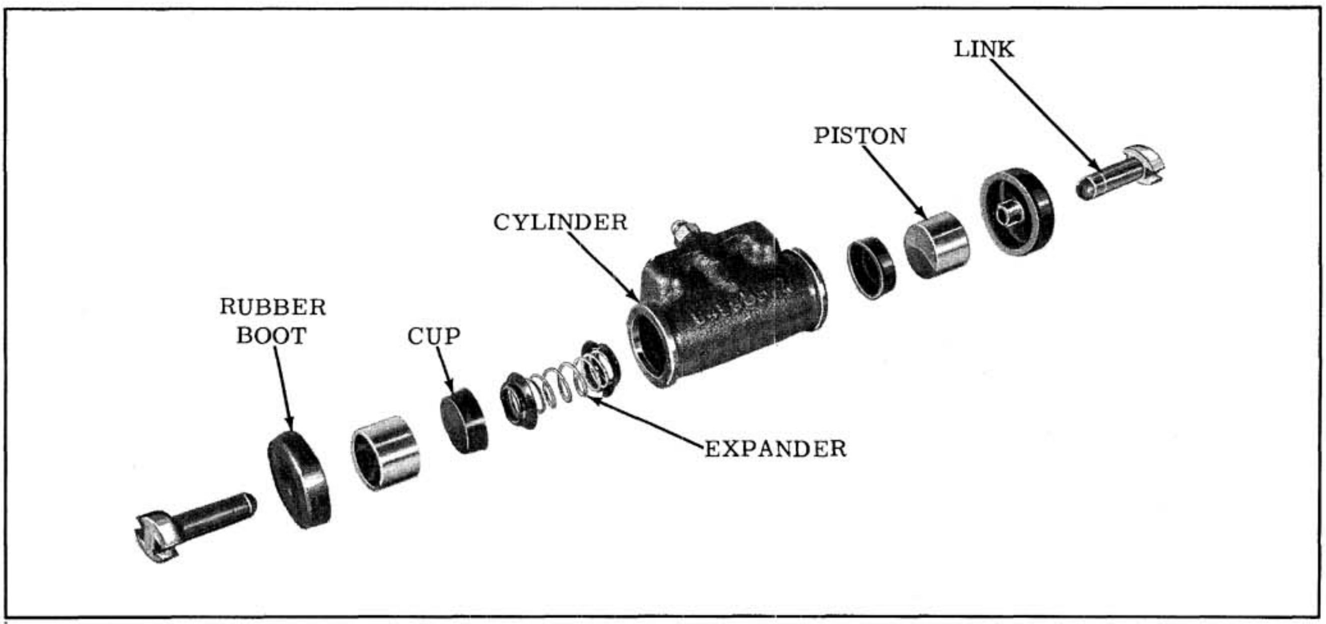


Fig. 11-13 Wheel Cylinder (33 through 38 Series)

ASSEMBLY

1. Lubricate the cylinder bore and counterbore with brake fluid and insert spring-expander assembly.
2. Install new cups. (Be sure cups are lint and dirt free.) Do not lubricate cups prior to assembly.
3. Install new pistons as they are received in the parts package. Do not lubricate pistons with brake fluid.
4. Press new boots into cylinder counterbores by hand. Do not lubricate boots prior to assembly.

DISASSEMBLY (54 Through 86 Series)

1. Remove links and rubber boots.
2. Remove pistons, cups, expanders and spring from wheel cylinder bore.

CLEANING AND INSPECTION

1. Wash all metal parts in brake flushing fluid and blow out all passages with compressed air.
2. Inspect cups for a swelling or distorted condition, replace if damaged. If a swelling condition exists, the entire hydraulic system should be flushed (see FLUSHING HYDRAULIC SYSTEM) and all the rubber parts in the hydraulic system should be replaced.
3. Inspect the wheel cylinder bore for scores, rust, pits or etches. If any such conditions exist, the complete wheel cylinder will have to be replaced as an assembly.

   CAUTION: Do not attempt to recondition a wheel cylinder bore as a means of salvaging the cylinder. Reconditioning of the bore leaves the walls sufficiently rough to cause premature failure of the rubber cups. It also enlarges the bore to the extent that the standard size pistons and seals will not fit properly.

ASSEMBLY

Lubricate the bore of the wheel cylinder with Brake Fluid, Supreme No. 11 and assemble as shown in Fig. 11-14.

DRUMS AND BRAKE ASSEMBLIES

INSPECTION

Whenever brake drums are removed, they should be inspected for scores, deep grooves, cracks and out-of-round.

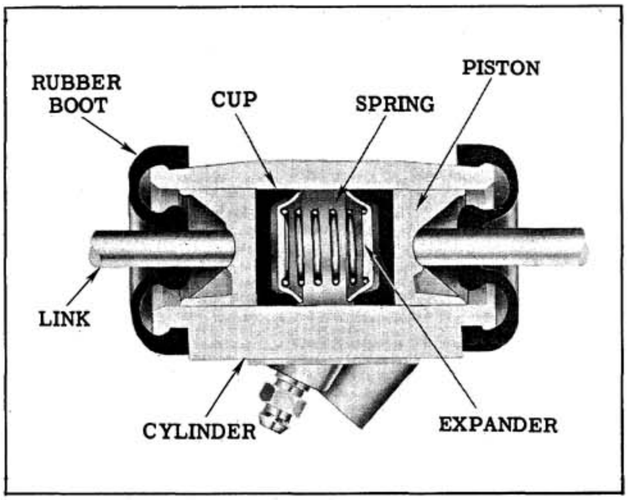


Fig. 11-14 Wheel Cylinder (54 through 86 Series)

Cracked drums must be replaced. However, cracks running circumferentially at the back corner of drum where the cast iron blends into the steel portion of the drum are of no consequence and drums should not be replaced.

NOTE: Grooves extending around the entire braking surface of the brake drum are permissible providing the edges of the grooves that contact the shoes are smooth.

Drum out-of-round can be measured with a dial indicator and extension rod. Out-of-round measurements exceeding .005" front drum and .006" rear drum, (total indicator reading) require turning or replacement of drum.

TURNING DRUMS

If irregularities in the braking surface of the drum cannot be removed with emery cloth or out-of-round exceeds .005" front drum and .006" rear drum (total indicator reading), the drum should be turned to .060" greater than the original inside diameter; that is, after being turned, the diameter should be 11.060" for all except 33 through 52 series, or 9.560" on 33 through 52 series. Oversize brake linings must be used with turned drums.

REPLACING DRUMS

Whenever new drums are to be installed, the braking surface of the drum must be thoroughly cleaned with lacquer thinner to remove the rust-proof coating.

BRAKE LINES

When replacing a damaged brake line, the damaged section should be cut off and repaired with steel brake tubing, listed under Group 8.964 in the Chassis Parts Book. Flare connections must be a double lap. Follow Flaring Tool Manufacturer's instructions for proper flaring of the double lap flare.

Refer to Figs. 11-15 and 11-16 for brake line routing and attachment.

BRAKE LINING

If linings are worn nearly flush with the rivets, new linings should be installed.

When brake lining replacement is necessary, it is recommended that both front or both rear linings be replaced at the same time.

PARKING BRAKE CABLE CONDUIT

Remove and Install

The parking brake cable conduit can be removed as follows:

1. Disconnect the cable at the connector.
2. Remove the retainer which holds the conduit to the bracket.
3. Remove the rear wheel and brake drum.
4. Disconnect the cable from the operating lever.
5. Install a Corbin type hose clamp over the conduit retainer fingers as shown in Fig. 11-17.
6. Tap the conduit lightly to remove from the backing plate.

To install, reverse the removal procedure. Adjust the parking brakes.

FRONT BRAKE SHOES AND BACKING PLATE

Remove (Figs. 11-18 & 11-19)

1. Hoist car.
2. Remove the hub and drum assembly and the inner bearing race from the steering knuckle.

NOTE: It may be necessary to back off the brake shoe adjustment before the brake drum can be removed. To back off the brake shoe adjustment, refer to Figs. 11-20 and 11-21.

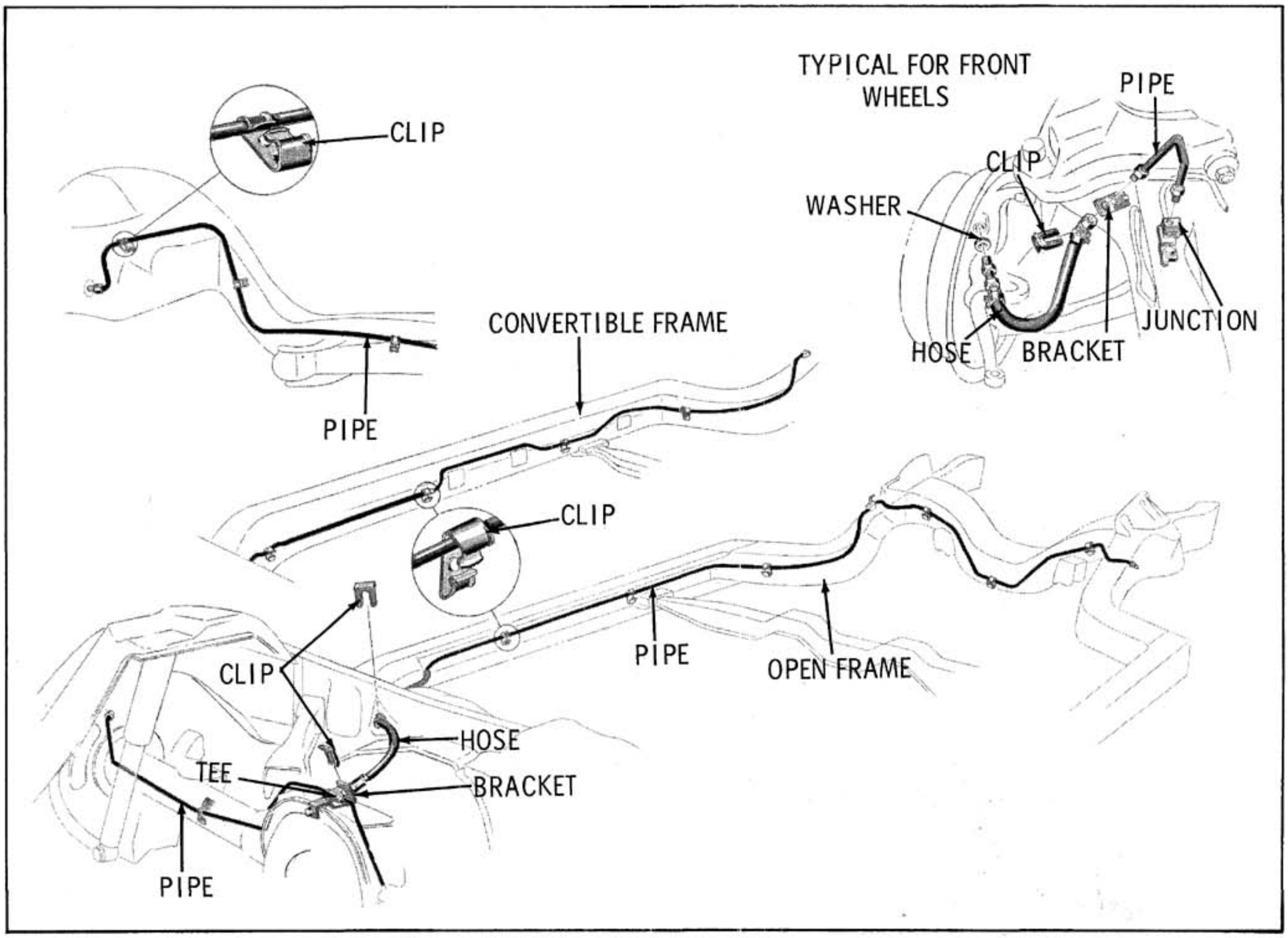


Fig. 11-15 Hydraulic Brake Lines (52 through 86 Series)

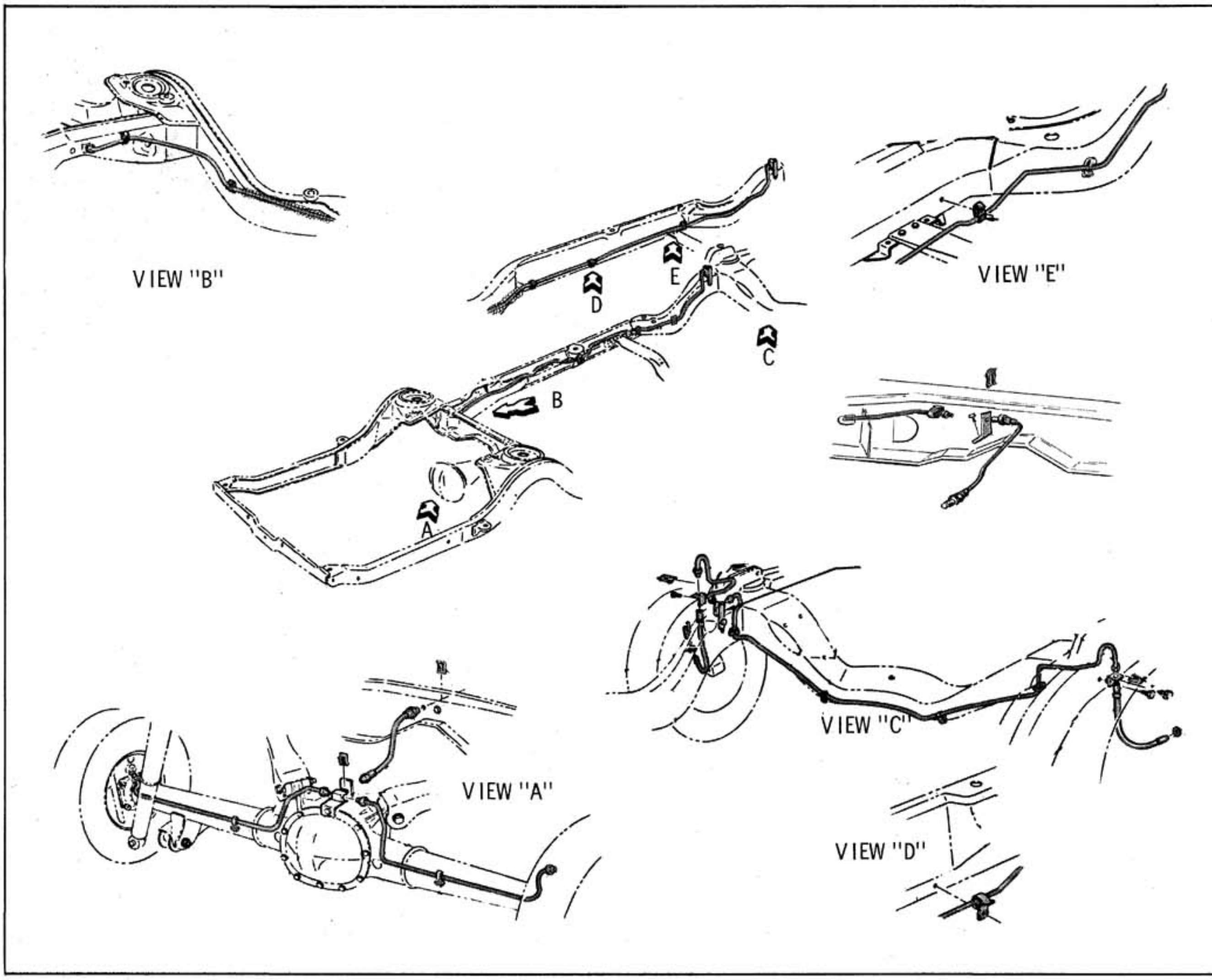


Fig. 11-16 Hydraulic Brake Lines (33 through 38 Series)

3. Remove the primary and secondary shoe return springs and the actuating link.

4. Remove brake shoe hold-down springs, pins and washers and the adjuster lever and return spring.

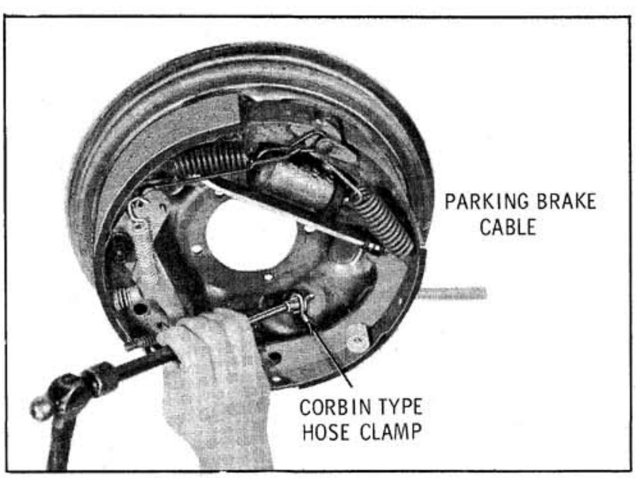


Fig. 11-17 Removing Parking Brake Cable

5. Spread shoes to clear wheel cylinder links, then remove the primary and secondary shoes as an assembly.

6. Remove the primary to secondary shoe spring and the adjusting screw.

7. If the front backing plate is to be removed, proceed as follows:

   a. Loosen lock tab from anchor pin, then remove the anchor pin bolt.

   b. Remove the brake hose from the brake line.

   c. Remove the wheel cylinder and brake hose from the backing plate.

   d. Remove the steering arm to steering knuckle to backing plate bolts and nuts, then remove the backing plate.

REAR BRAKE SHOES AND BACKING PLATE

Remove

1. Hoist car, remove wheel and brake drum.

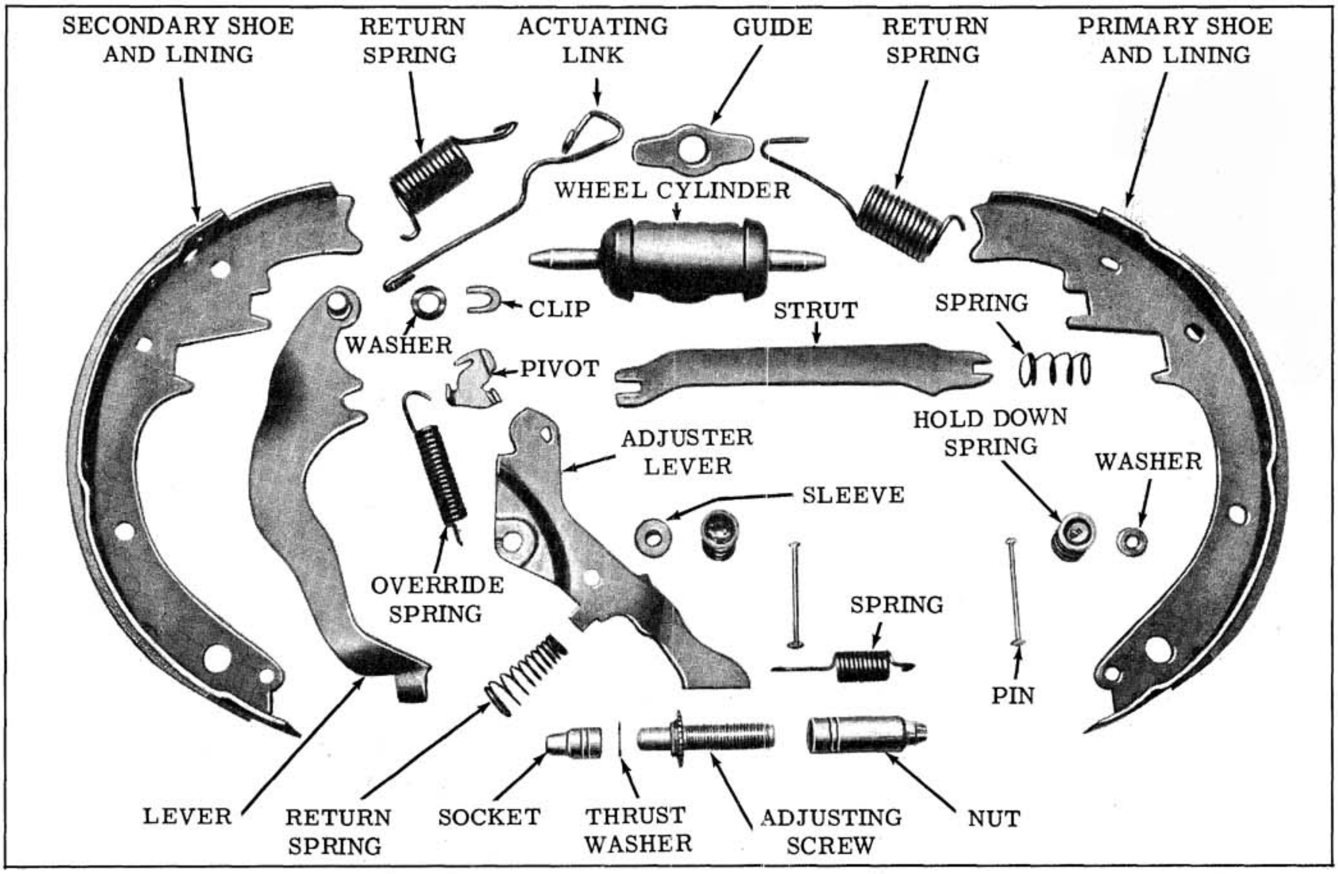


Fig. 11-18 Brake Assembly (54 through 86 Series)

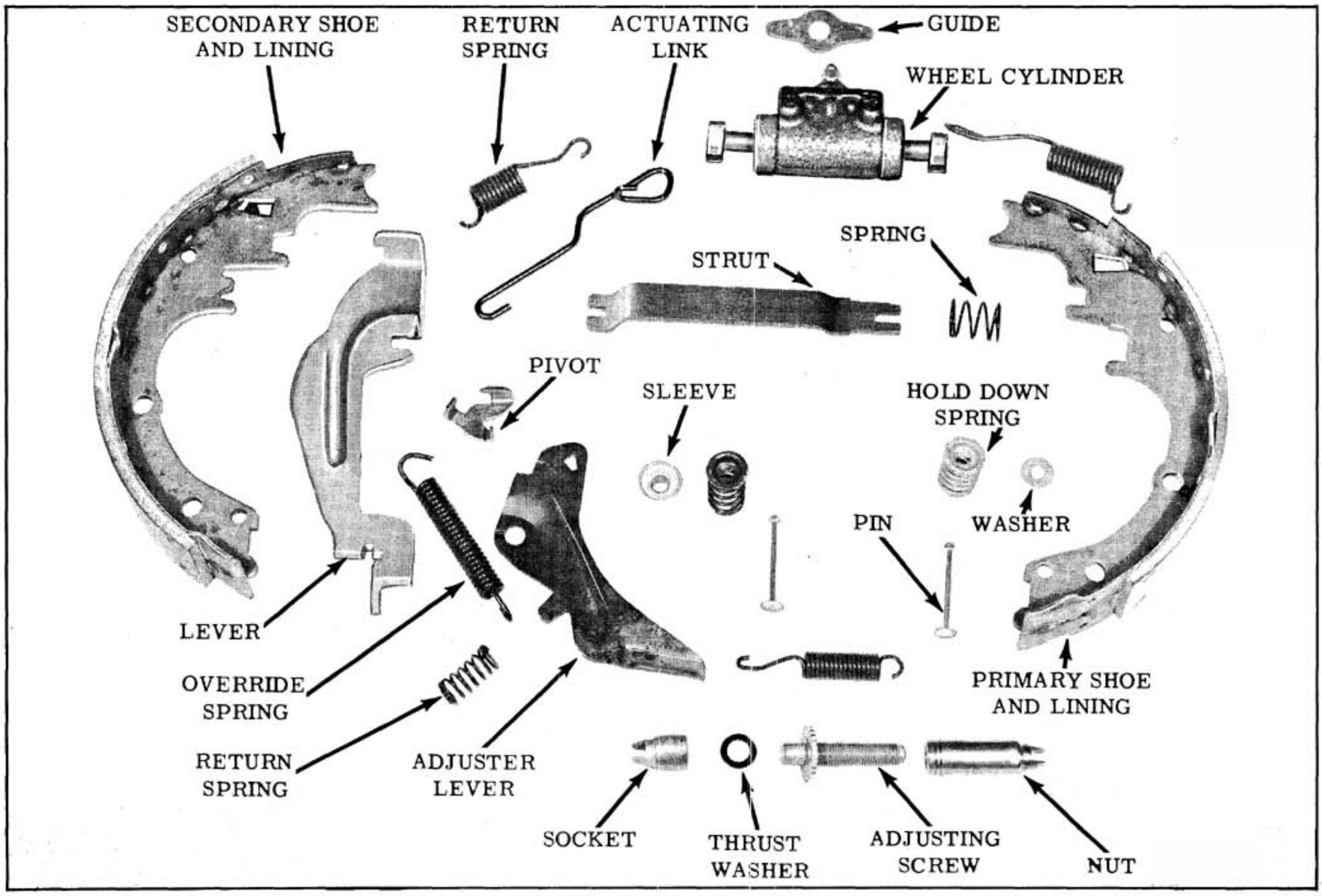


Fig. 11-19 Brake Assembly (33 through 38 Series)

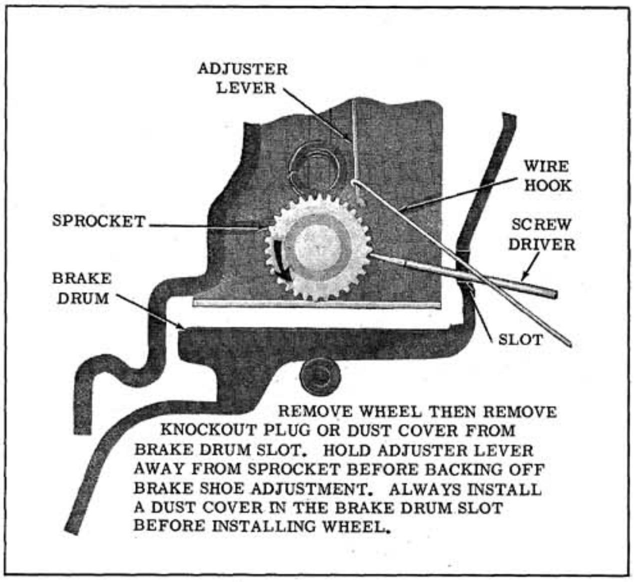


Fig. 11-20 Backing Off Brake Shoe Adjustment (54 through 86 Series)

NOTE: It may be necessary to back off the brake shoe adjustment before the brake drum can be removed. To back off brake shoe adjustment, refer to Figs. 11-20 and 11-21.

2. Remove the brake shoe return springs, actuating link and guide.

3. Remove the brake shoe hold-down springs, the adjuster lever and return spring and the parking brake lever strut and spring.

4. Spread shoes to clear wheel cylinder links, then remove the brake shoes as an assembly.

5. Disconnect the parking brake cable from the operating lever.

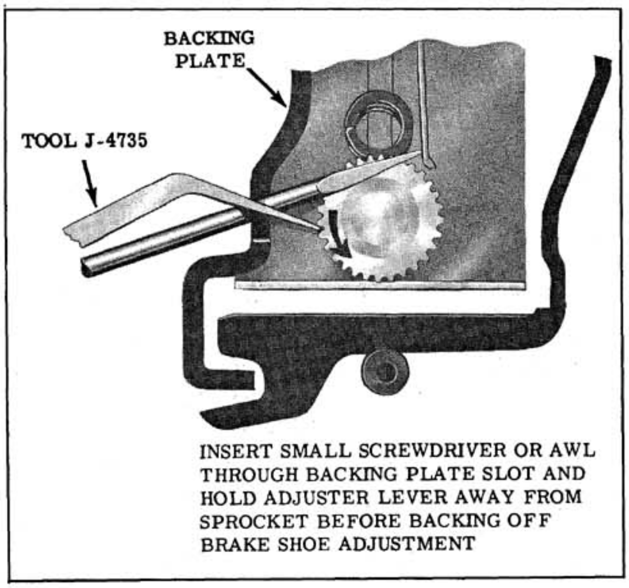


Fig. 11-21 Backing Off Brake Shoe Adjustment (33 through 38 Series)

6. If necessary to remove the rear backing plate, proceed as follows:

   a. Remove the axle shaft.

   b. Remove brake line from wheel cylinder, remove wheel cylinder from backing plate.

   c. Disconnect the parking brake cable from the backing plate.

   d. Remove the backing plate.

CLEANING AND INSPECTION

1. Inspect linings for wear. If linings are worn nearly flush with rivets, new linings should be installed.

2. Check wheel cylinder for leakage by loosening the boot on 54, 56, 58, 66, 84 and 86 series or by removing the link on 33, 34, 35, 36, 38 and 52 series. If leak exists, remove wheel cylinder for service or replacement.

3. Clean inner surfaces of brake backing plates and all shoe contacting points.

4. Clean exposed portions of parking brake cables.

5. Disassemble the adjusting screw assembly. Clean and inspect as follows:

   a. Check thrust washer and mating surfaces for burrs or excessive wear.

   b. Inspect teeth on sprocket for wear.

   c. Remove all foreign material from adjusting screw and nut. Nut must rotate freely on threads.

6. Check the foot of the adjuster lever for wear. Replace if necessary.

7. Check the override pivot for wear or deformed parts.

8. Check brake drum for build-up of rust and dirt at outer circumference. Remove build-up so that drums can be installed over pre-adjusted linings. Check drum for cracks and an out-of-round condition.

FRONT BRAKE AND BACKING PLATE

Install

1. If the front backing plate was removed, install as follows:

   a. Position the backing plate on the steering knuckle. Install the two steering arm to steering knuckle to backing plate bolts and nuts. Torque nuts to 140 ft. lbs. on 54 through 86 series and 82 ft. lbs. on 33 through 52 series.

b. Install the wheel cylinder. Torque attaching nuts to 16 ft. lbs. Connect brake hose to brake line. Tighten brake line fittings to 12 ft. lbs.

c. Install the brake hose retainer.

d. Position a new lock tab over the anchor pin bolt and install bolt.

e. Align the slot in the lock tab with the boss on the wheel cylinder. Torque anchor pin bolt to 145 ft. lbs on 54 through 86 series, to 105 ft. lbs. on 33 through 52 series. Bend lock tab down until it contacts the anchor pin bolt head.

2. Lubricate the adjusting screw threads, thrust washer mating surfaces and backing plate ledges with brake lubricant, Part No. 1050110.

3. Assemble the adjusting screw.

4. Attach the primary to secondary shoe spring to the shoes, and install the adjusting screw. The primary to secondary shoe spring must not contact the adjusting screw sprocket.

IMPORTANT: THE RIGHT FRONT ADJUSTING SCREW HAS LEFT HAND THREADS AND CAN BE IDENTIFIED BY TWO FLAT GROOVES IN THE ADJUSTING SCREW NUT. THE LEFT FRONT ADJUSTING SCREW HAS RIGHT HAND THREADS AND CAN BE IDENTIFIED BY TWO "V" GROOVES IN THE ADJUSTING SCREW NUT.

5. Position shoe assembly on the backing plate. Be sure wheel cylinder links are properly positioned in the shoe notches.

6. Position the upper end of the actuating link on the brake shoe guide.

7. Engage the actuating link with the override pivot then position the adjuster lever and return spring on the secondary shoe. Fasten with the hold-down spring assembly.

NOTE: The front brake on 54 through 86 series uses four hold-down springs identified with the numeral "1" stamped on the outer face. The 33 through 52 series uses two hold-down springs identified with the numeral "4" stamped on the outer face.

8. Install the remaining hold-down springs.

9. Install the primary and secondary brake shoe return springs.

10. Adjust brake shoes as outlined under ADJUSTMENTS - BRAKE SHOE.

11. Install the front hub and drum assembly. Adjust wheel bearings as outlined under WHEEL BEARING ADJUSTMENT, Section 9.

12. If wheel cylinder was removed, bleed brakes.

13. Check fluid level in master cylinder. Fluid level should be no more than 1/4" below the reservoir opening.

14. Check brake pedal travel to be sure it is within specifications, then road test car for proper operation of the brake system.

REAR BRAKE AND BACKING PLATE

Install

1. If the backing plate was removed, install as follows:

a. Install wheel cylinder on backing plate. Torque attaching bolts to 12 ft. lbs.

b. Position backing plate on axle housing and install the axle shaft. Torque the backing plate to axle housing nuts to 30 ft. lbs.

c. Install the parking brake cable on the backing plate.

2. Lubricate the adjusting screw threads, thrust washer mating surfaces and backing plate ledges with brake lubricant, Part No. 1050110.

3. Pull parking brake cables forward and rearward through conduits, lubricate freely with Lithium Soap Grease and return cable to normal position. Remove any excess lubricant.

4. Install the parking brake lever to the secondary shoe.

5. Assemble the adjusting screw.

6. Attach the primary to secondary shoe spring to the shoes, and install the adjusting screw. The primary to secondary shoe spring must not contact the adjusting screw sprocket.

IMPORTANT: THE RIGHT HAND REAR ADJUSTING SCREW HAS LEFT HAND THREADS AND CAN BE IDENTIFIED BY TWO FLAT GROOVES IN THE ADJUSTING NUT. THE LEFT REAR ADJUSTING SCREW HAS RIGHT HAND THREADS AND CAN BE IDENTIFIED BY TWO "V" GROOVES IN THE ADJUSTING SCREW NUT.

7. Position shoe assemblies on the backing plate. Be sure wheel cylinder links are properly

positioned in the shoe notches. Install the parking brake strut and spring.

8. Position the upper end of actuating link over the anchor pin.

9. Engage the actuating link with the override pivot, then position the adjuster lever and return spring on the secondary shoe. Fasten with the hold-down spring assembly.

   NOTE: The rear brake uses two hold-down springs. The retaining pins for all except 33 through 52 series have the numeral "8" stamped on the face. 55 and 65 styles have the numeral "1" stamped on the face. All other 33 through 52 series have the numeral "2" stamped on the face.

10. Install the remaining hold-down spring.

11. Install the parking brake cable on the parking brake lever.

12. Install the primary and secondary brake shoe return springs.

13. Adjust brake shoes as outlined under AD-MENTS - BRAKE SHOE.

14. Install the rear brake drums and wheels.

15. Adjust the parking brake.

16. If the wheel cylinder was removed, bleed brakes.

17. Check fluid level in master cylinder. Fluid level should be no more than 1/4" below the reservoir opening.

18. Check brake pedal travel to be sure it is within specifications, then road test car for proper operation of the brake system.

POWER BRAKES

DESCRIPTION

Power brakes are available on all series, including 33 through 66 series equipped with three or four-speed synchromesh transmissions.

Four different power brake units are used. The 33 through 38 series use a Moraine or a Kelsey-Hayes brake. The 52 through 86 series use a Moraine or a Bendix brake.

The Moraine vacuum units are identical, with the exception of the mounting and the operating rod assembly, and service procedures for both units will be covered under one write-up.

Internally, all units differ in construction but all units are designed to seal off atmospheric pressure when the pedal is in the released position. The hydraulic master cylinder on the power brake units are similar in construction and service to the standard brake master cylinder. For removal and service of the power brake master cylinder, refer to MASTER CYLINDER.

A vacuum check valve traps vacuum inside the power brake unit, at the highest manifold vacuum available, making possible brake application after the engine has been shut off for several hours or more. If the engine should stall, several applications of the brakes can still be made with vacuum assist. After the vacuum supply is exhausted, brake applications can still be made; however, more effort is required due to the lack of vacuum assist.

MINOR SERVICE OPERATIONS

BRAKE PEDAL OR BRACKET

Remove and Install

The power brake pedal and mounting bracket is attached as shown in Fig. 11-22 or Fig. 11-23.

NOTE: On cars equipped with Power Brakes and Synchromesh Transmission, refer to the CLUTCH Section for clutch pedal removal.

On installation, lubricate nylon bushings and clevis pin with lubricant, Part No. 1050169. Torque pivot pin nut on 52 through 86 series to 18 ft. lbs. On 33 through 38 series, check and adjust brake pedal height if necessary. Check and adjust stop lamp switch if necessary.

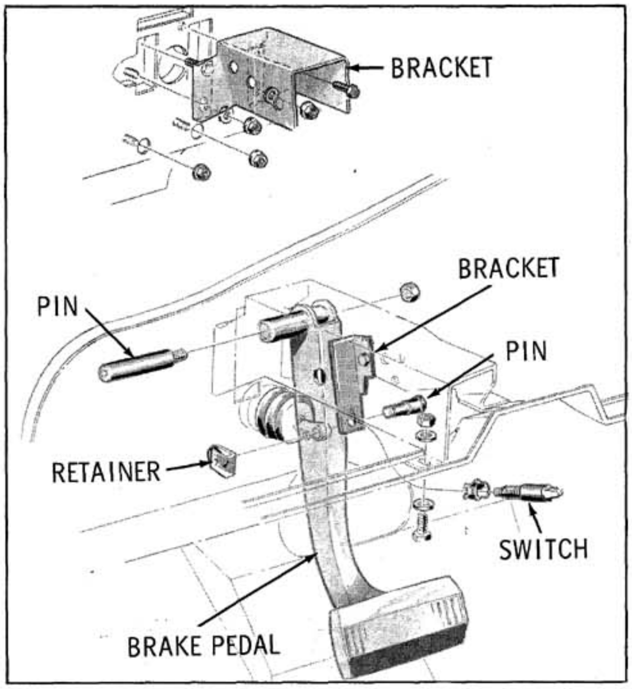


Fig. 11-22 Brake Pedal Mounting (52 through 86 Series)

POWER BRAKE UNIT

Remove and Install (Fig. 11-24 or 11-25)

1. Disconnect hydraulic line. Plug or tape line to prevent dirt from entering the hydraulic system.

2. Disconnect the vacuum line from the vacuum check valve.

3. Disconnect the operating rod from the power brake pedal.

4. Remove the four vacuum cylinder unit to cowl attaching nuts.

5. To install, reverse removal procedure. Torque the vacuum cylinder to cowl bolts to 27 ft. lbs. Fill master cylinder with Brake Fluid Supreme No. 11 and bleed entire system. (See BLEEDING OF LINES) On 33 through 38 series, check and adjust brake pedal height, if necessary.

MORAINE POWER BRAKE

PRINCIPLES OF OPERATION

Released Position (Fig. 11-26)

In the released position, both sides of the vacuum piston are open to vacuum. This allows the vacuum piston to be held in the released position by the vacuum piston return spring. This is accomplished as follows:

In the released position, the air valve is seated on the floating valve. Air, under atmospheric pressure, is shut off at the air valve. The floating valve is held away from the valve seat in the power piston. Vacuum, which is present at all times at the forward side of the vacuum piston, evacuates any existing air at the rear of the vacuum piston. This air is drawn through two small passages in the vacuum piston over the valve seat to the forward side of the vacuum piston.

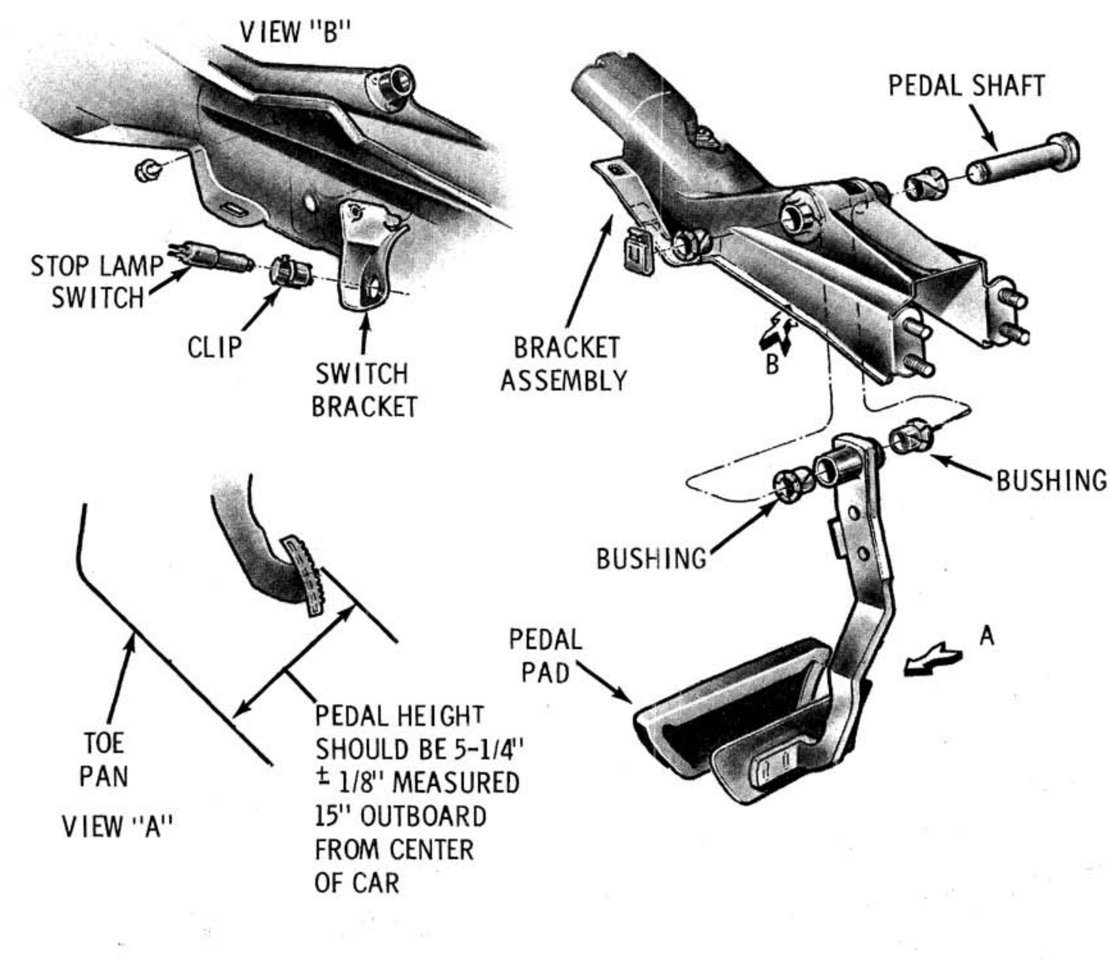


Fig. 11-23 Brake Pedal Mounting (33 through 38 Series)

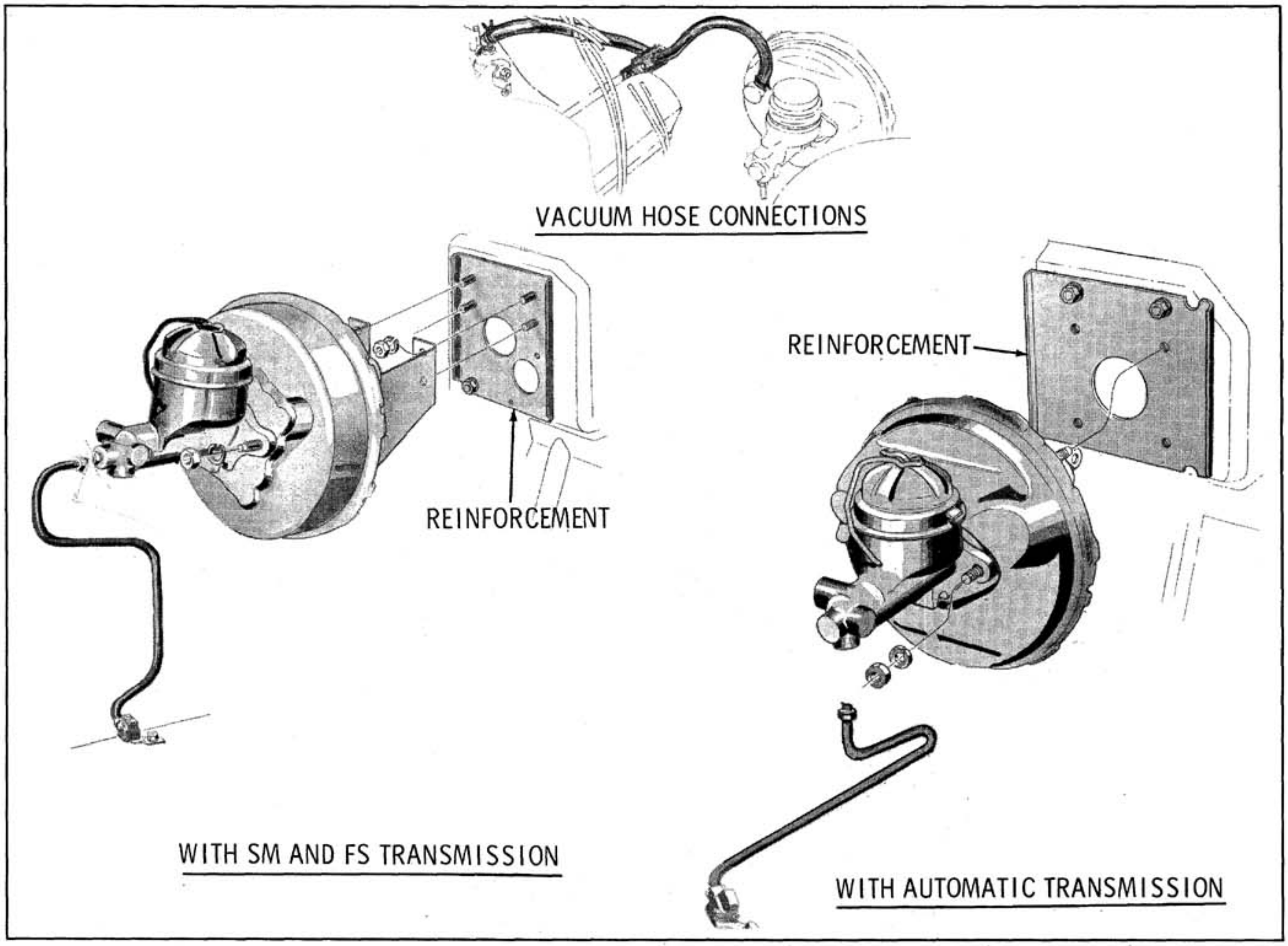


Fig. 11-24 Power Brake Mounting (52 through 86 Series)

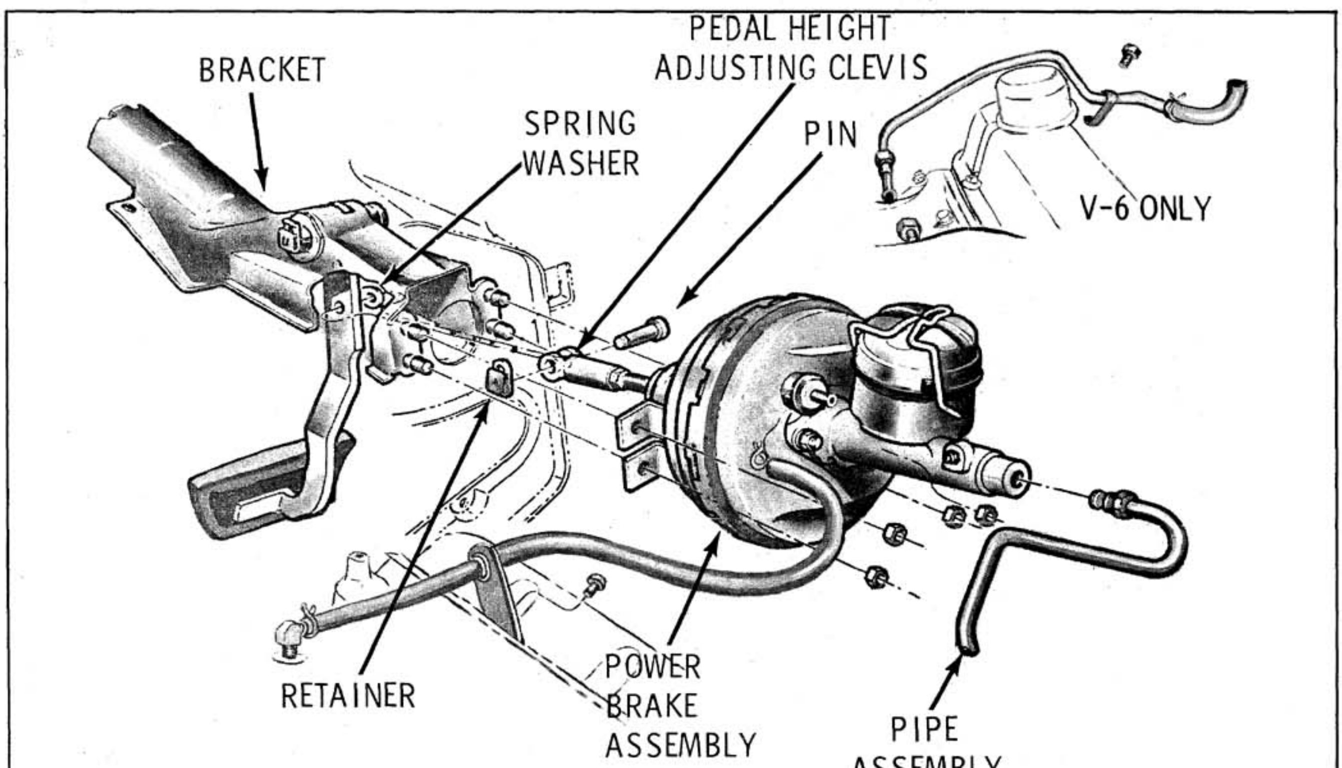


Fig. 11-25 Power Brake Mounting (33 through 38 Series)

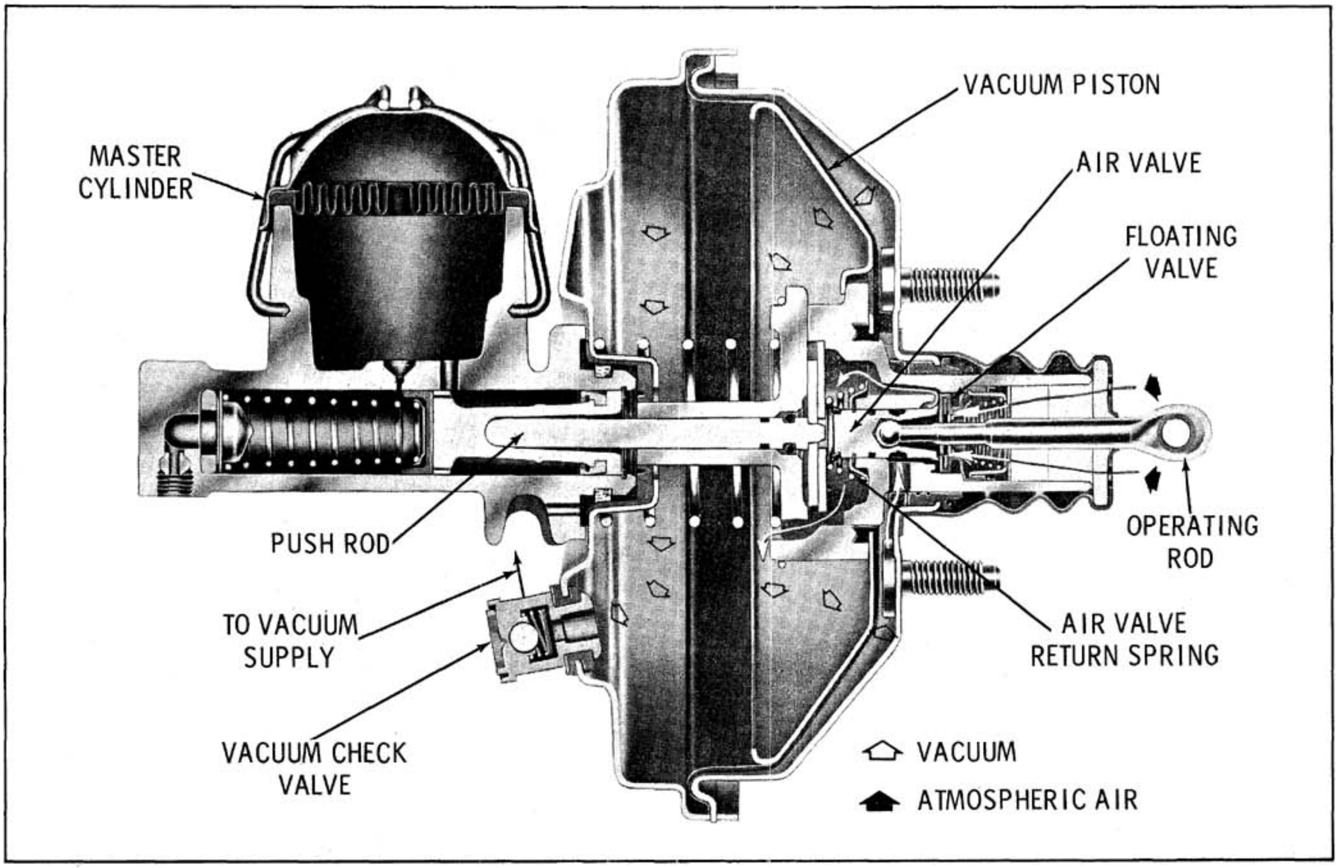


Fig. 11-26 Released Position

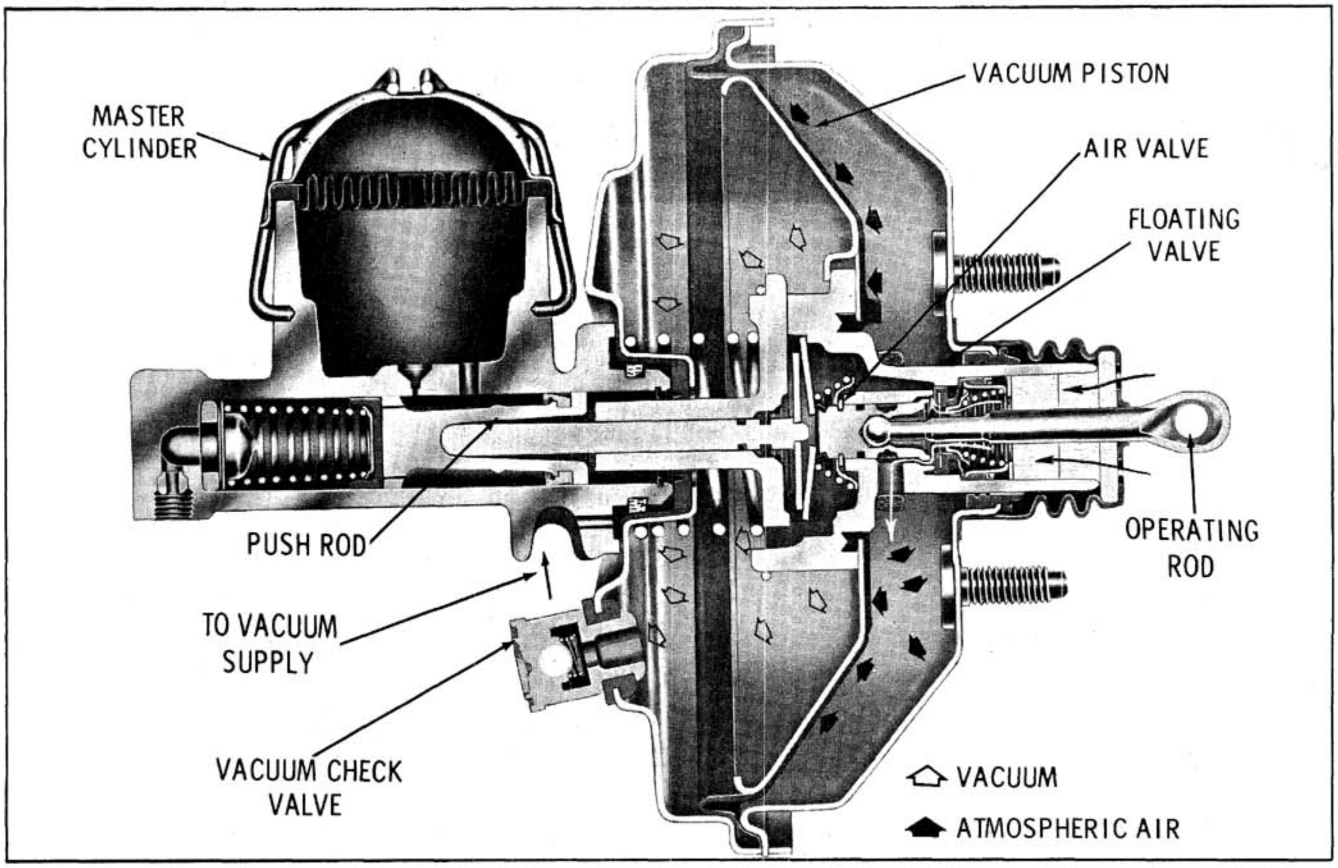


Fig. 11-27 Applying Position

The master cylinder piston push-rod, being attached to the vacuum piston assembly, is also held in the released position by the vacuum piston return spring. In the released position, the compensating port is open and fluid can flow in either direction between the master cylinder and the fluid reservoir. A slight pressure is maintained in the lines by the residual check valve.

Applying (Fig. 11-27)

As the pedal is depressed, the operating rod carries the air valve away from the floating valve. Further movement allows the floating valve to contact a seat in the vacuum piston, shutting off the vacuum to the rear of the vacuum piston. Air, under atmospheric pressure, can now enter through the air filter, travels past the air valve seat and through two passageways to the rear of the vacuum piston. With vacuum on the forward side and atmospheric pressure at the rear, a force is developed which moves the vacuum piston and the master cylinder piston push-rod in the apply direction.

The initial movement of the master cylinder piston in the apply direction closes the compensating port, sealing off the fluid reservoir from the master cylinder. Further movement of the master cylinder piston in the apply direction increases pressure in the master cylinder, forcing fluid past the residual check valve, through the lines and into the wheel cylinders to apply the brakes.

As the pressure in the master cylinder increases, the force on the end of the master cylinder piston causes the piston push-rod reaction plate to move away from its stop and press against the reaction levers. The levers in turn, pivot and press against the end of the air valve and operating rod assembly. This allows approximately 30% of the load to be transferred back through the reaction system to the brake pedal. This gives the driver brake feel.

Holding (Fig. 11-28)

When the desired brake pedal pressure is obtained, the vacuum piston continues to move forward until the floating valve, which is still seated on the power piston, again seats on the air valve. The vacuum piston will remain stationary until pressure is applied or released at the brake pedal.

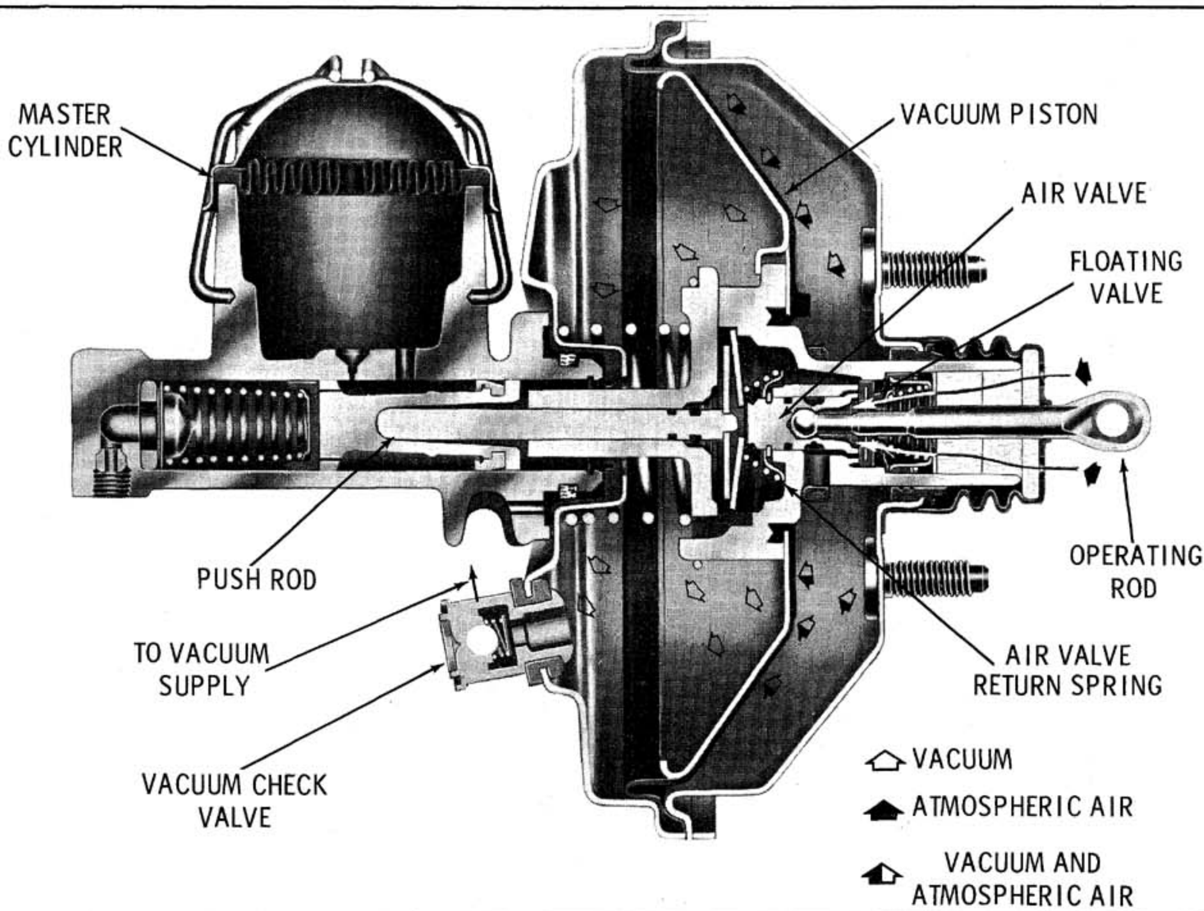


Fig. 11-28 Holding

Releasing (Fig. 11-26)

As the pressure on the brake pedal is released, the air valve spring forces the air valve back until the snap ring contacts the vacuum piston. Further movement of the air valve unseats the floating valve from the vacuum piston. As the air valve seats on the floating valve, it shuts off the supply of air under atmospheric pressure. As the floating valve unseats from the vacuum piston, it opens the area to the rear of the vacuum piston to vacuum.

With vacuum on both sides of the vacuum piston, the vacuum piston return spring returns the vacuum piston together with the master cylinder piston push-rod into the released position. Brake fluid, under pressure, in the lines now flows back through the residual check valve and into the master cylinder reservoir.

DISASSEMBLY OF MORAINE POWER BRAKE (Fig. 11-29 or 11-30)

NOTE: Use extreme care to keep mineral oil or grease from coming in contact with hydraulic parts.

1. Deplete vacuum supply, then clean the outside of the power brake unit. Remove filler cap then empty brake fluid from master cylinder reservoir.

2. Clamp master cylinder in a vise with the operating rod up. Scribe an alignment mark on the top center of the front and rear housing.

3. Rotate the rear housing counterclockwise to separate the two housings. If the rear housing cannot be readily loosened, tap the rear housing lightly with a plastic hammer. (Fig. 11-31 or 11-32)

   NOTE: When separating housings, maintain pressure on the rear housing as it is under spring tension.

4. Remove the rear housing and vacuum piston assembly from the front housing.

5. On units without a mounting bracket, remove the rubber boot from the rear housing. Remove the filter from inside the boot.

6. On units with a mounting bracket, remove the plastic boot from between the mounting brackets. Remove the retaining ring, clevis

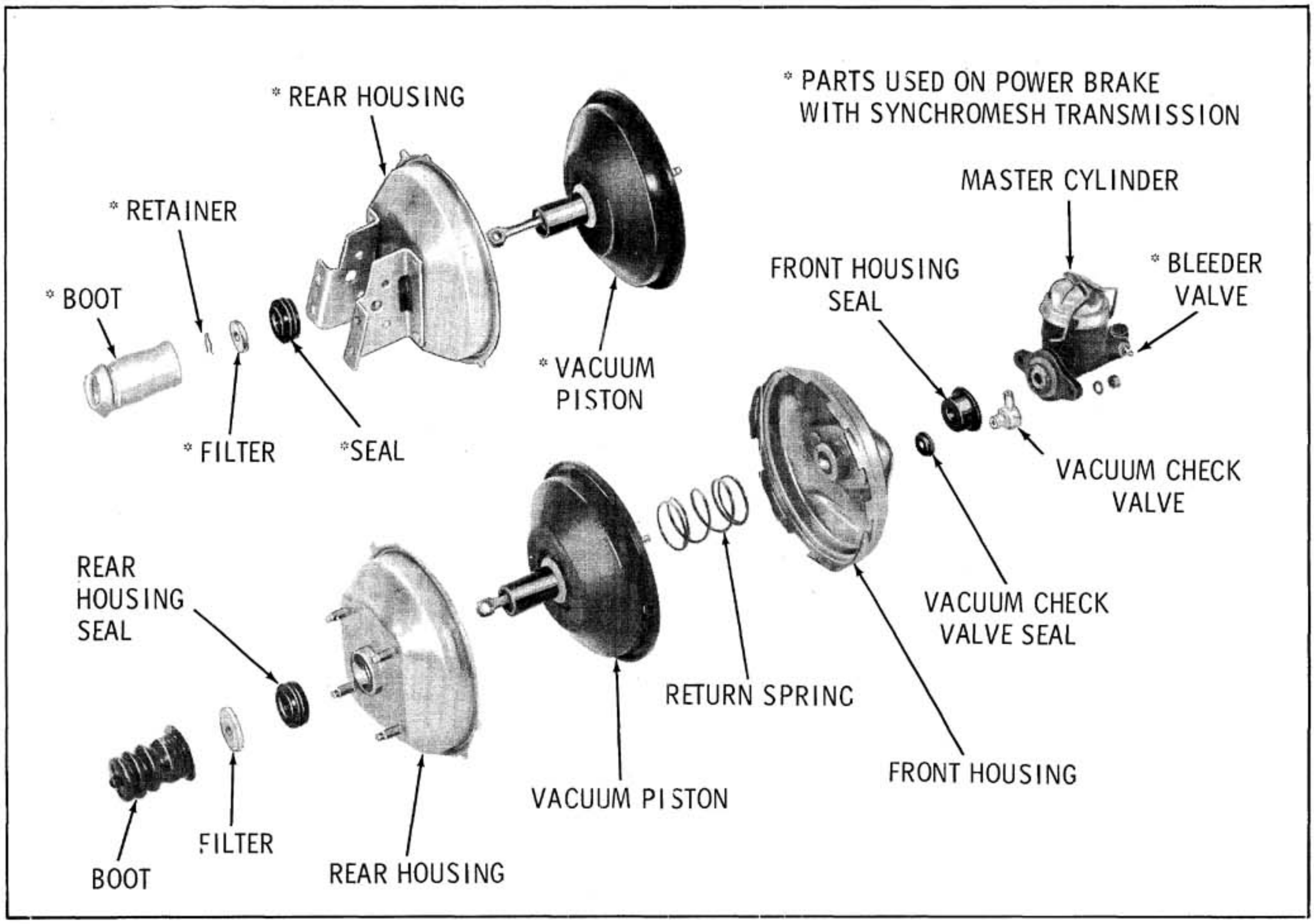


Fig. 11-29 Moraine Power Brake Assembly (52 through 86 Series)

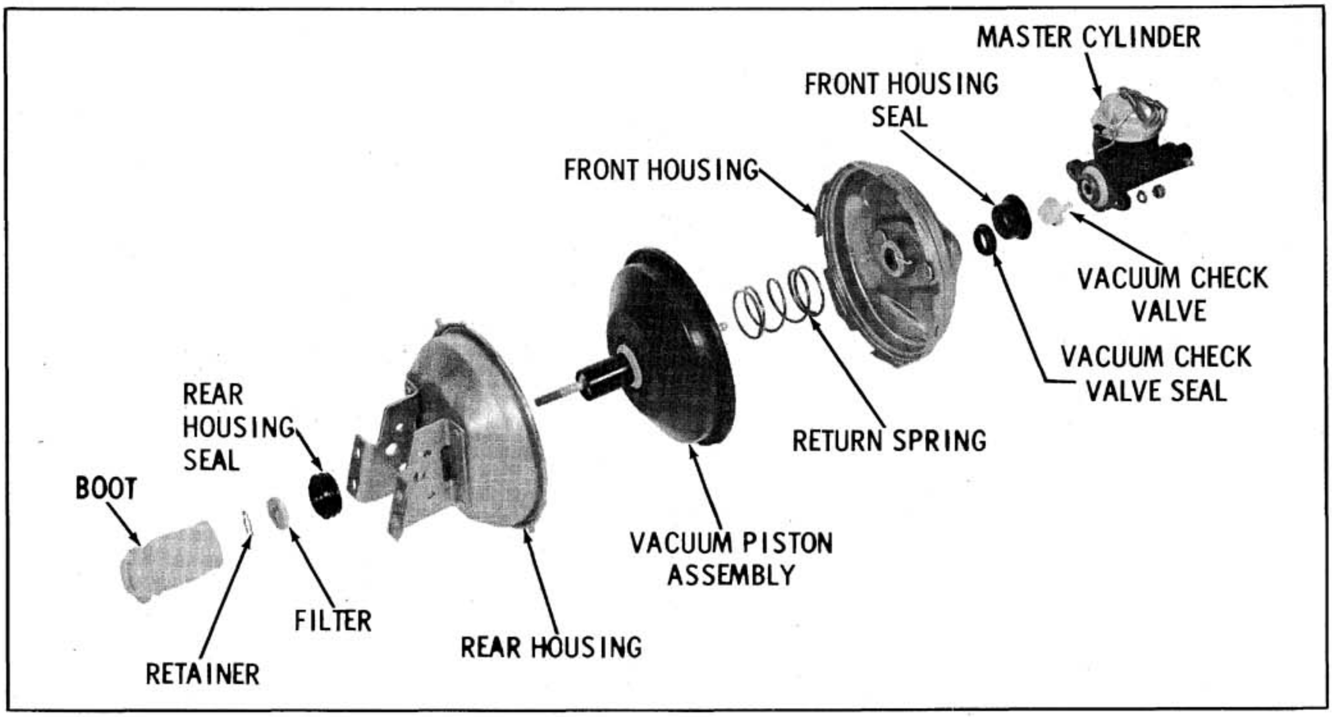


Fig. 11-30 Moraine Brake Assembly (33 through 38 Series)

and locknut, then remove the filter from the operating rod.

7. Remove the vacuum piston assembly from the rear housing.

8. Remove the seal from the rear housing.

9. Remove the master cylinder to front housing attaching nuts and remove the master cylinder from the front housing.

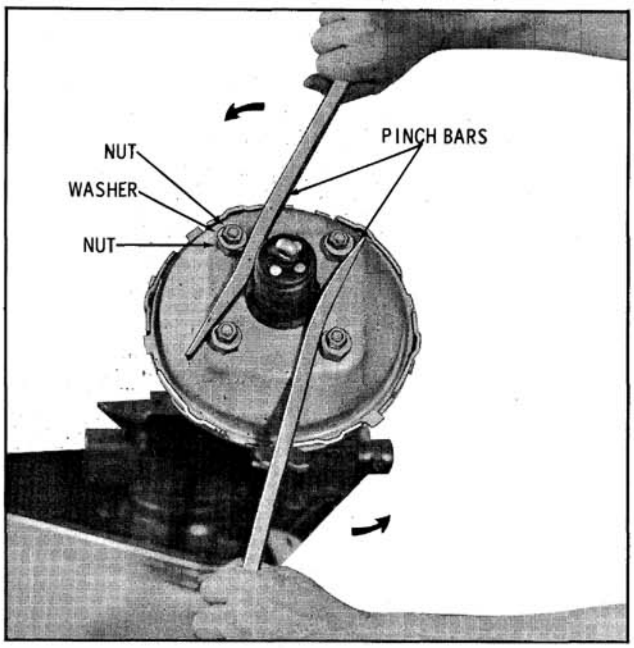


Fig. 11-31 Separating Housing (without a Mounting Bracket)

10. Remove the front housing seal and the vacuum check valve and seal from the front housing.

DISASSEMBLY OF VACUUM PISTON (Fig. 11-33)

1. Remove the lock ring from the vacuum piston by prying one of the ends out from under the large divided locking lug.

2. Remove the reaction retainer and push-rod,

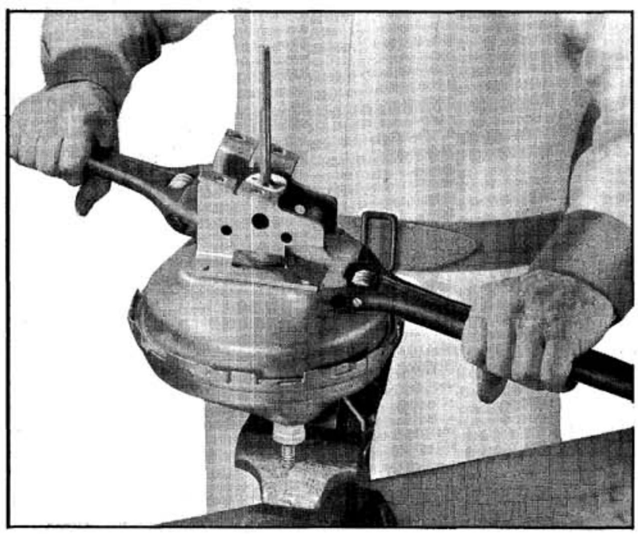


Fig. 11-32 Separating Housings (with a Mounting Bracket)

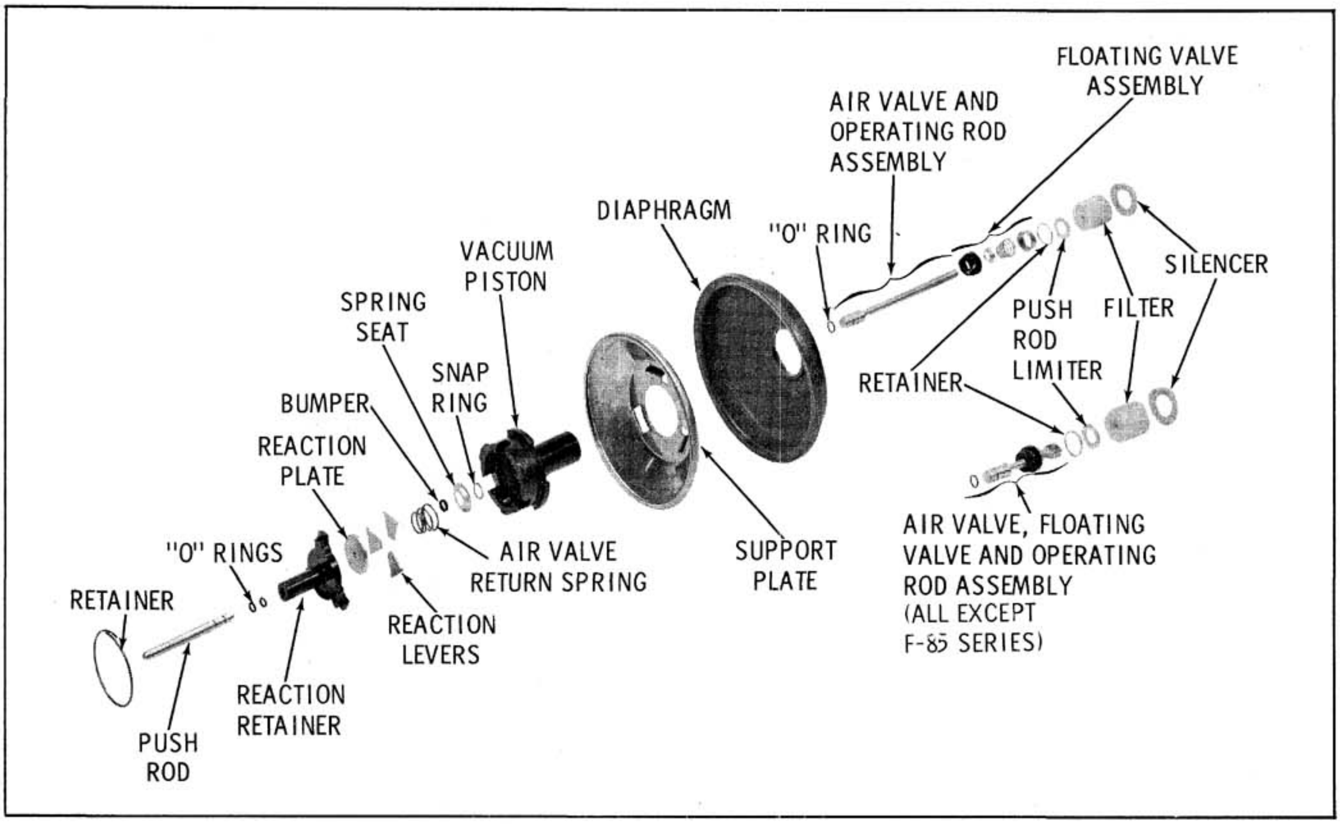


Fig. 11-33 Vacuum Piston Assembly

reaction plate, reaction levers and air valve spring. Also, remove the small reaction bumper and the air valve spring seat from the air valve.

3. Install Tool J-21524 in a vise. Position the vacuum piston assembly on Tool J-21524 so that the three lugs on the tool fit into the three notches in the vacuum piston. (Fig. 11-34)

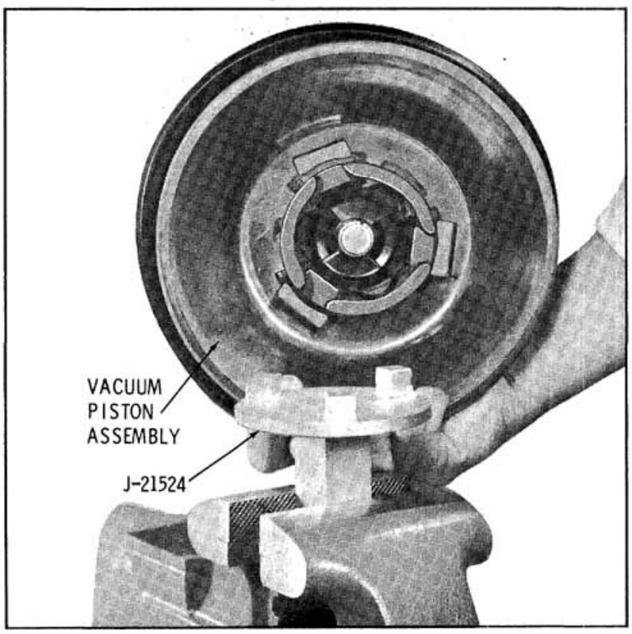


Fig. 11-34 Positioning Vacuum Piston on Tool J-21524

4. Fold the diaphragm away from the support plate so that the hands can grip the steel support plate and rotate support plate counterclockwise until the support plate separates from the vacuum piston. (Fig. 11-35)

5. Remove the diaphragm from the support plate.

6. Remove the silencer from the neck of the vacuum piston tube.

7. Position the vacuum piston in a vise padded

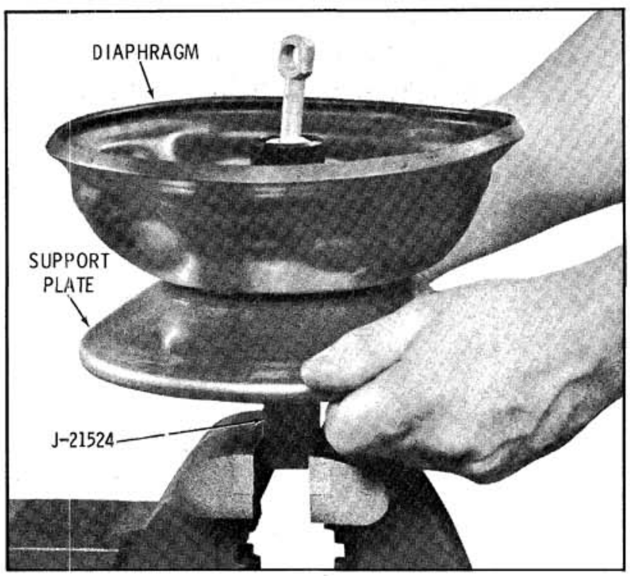


Fig. 11-35 Removing Support Plate

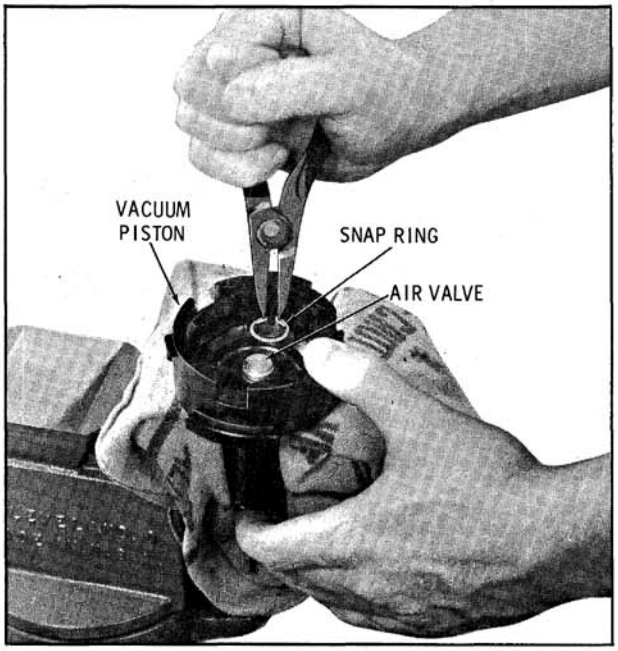


Fig. 11-36 Removing Snap Ring

with shop towels. Do not clamp vise on tube. Using Truarc pliers J-4880, remove the snap ring on the air valve. (Fig. 11-36)

8. Place the vacuum piston, tube down, in a press. Using a rod not exceeding 1/2" in diameter, press the air valve assembly from the vacuum piston. (Fig. 11-37)

   NOTE: On all series except 33 through 38, it is necessary to service the complete air valve, floating valve and operating rod assembly. On 33 through 38 series, the air valve and operating rod do not have to be replaced if they are not defective. However, a new floating valve must be installed on the assembly.

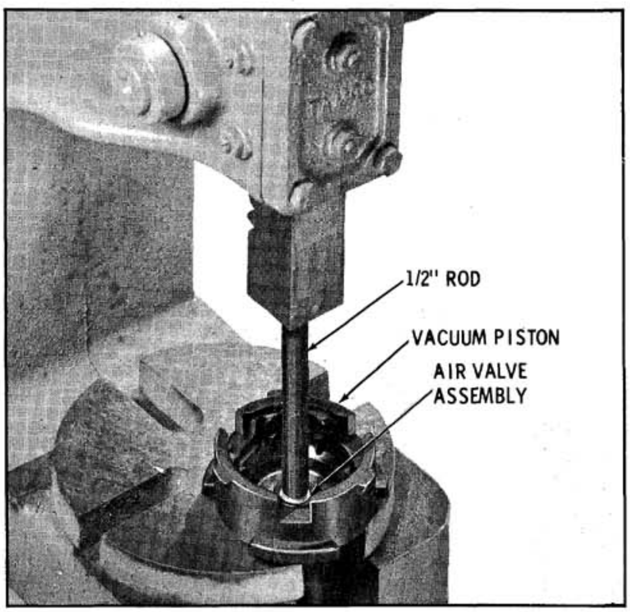


Fig. 11-37 Removing Air Valve

9. Remove the limiter washer and air filter from the operating rod.

10. Remove the master cylinder push-rod from the reaction retainer. Remove the two "O" rings from the push-rod.

CLEANING AND INSPECTION

1. Thoroughly wash all parts in alcohol, blow out all passages and air dry. Place parts on clean paper.

2. Inspect front and rear housings for scoring, pitting, dents or nicks. Small imperfections may be smoothed out with fine crocus cloth. Check housings for loose studs. Replace housings if they cannot be repaired.

3. Inspect vacuum piston diaphragm for deterioration or abrasions. Replace if damaged.

4. 33 through 38 Series—Inspect air valve and operating rod assembly for scratches, nicks distortion or corrosion. Check seat for smoothness. Operating rod should move freely in air valve but should not pull out. Replace assembly if worn or damaged.

5. Check vacuum piston support plate and reaction retainer for cracks, distortion damaged reaction lever seats or rough and uneven floating valve seat. Be sure all openings and passages are clean.

6. Check reaction levers for distortion. Replace if damaged.

7. Replace air filters and silencer if dirty or torn.

ASSEMBLY OF MORAINE POWER BRAKES

For assembly of master cylinder refer to MASTER CYLINDER - ASSEMBLY.

Vacuum Piston

NOTE: During assembly, when a lubricant is specified, use either the lubricant furnished with the repair kit or Seal Lubricant Part No. 1050169.

1. Install two new "O" rings, coated with lubricant on the push-rod.

2. Insert the push-rod so that the round end of the piston protrudes from the end of the tube of the reaction retainer.

3. Wipe a film of lubricant on the large OD of

the floating valve and on the "O" ring on the air valve. On 33 through 38 series, install a new "O" ring on the air valve.

4. Position a new air valve and operating rod assembly, air valve first, into the tube of the vacuum piston. On 33 through 38 series, install the new floating control valve, so that the flat face of the valve seats against the air valve.

5. Position the floating valve retainer over the push-rod so that the flat side seats on the floating control valve.

6. Using Tool J-21601, press the floating valve until it seats in the vacuum piston. Line on tool will be flush with top of vacuum piston when floating valve is fully seated. (Fig. 11-38)

7. Position the operating rod limiter washer over the operating rod and down onto the floating valve.

8. Position the large ID air silencer over the neck of the vacuum piston. Install the small ID filter inside the neck of the vacuum piston over the operating rod.

9. Install Tool J-21524 in a vise. Position vacuum piston on the tool so that the three lugs fit into the notches in the vacuum piston.

10. Install the vacuum piston diaphragm on the diaphragm support plate, on the side opposite the locking tangs. The inner lip of the diaphragm must fit over the edge of the center hole of the support plate.

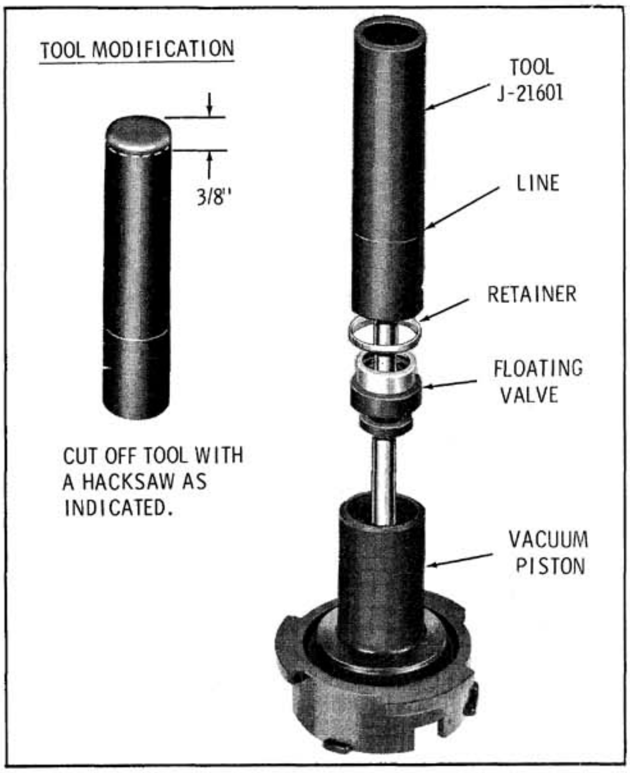


Fig. 11-38 Installing Floating Valve

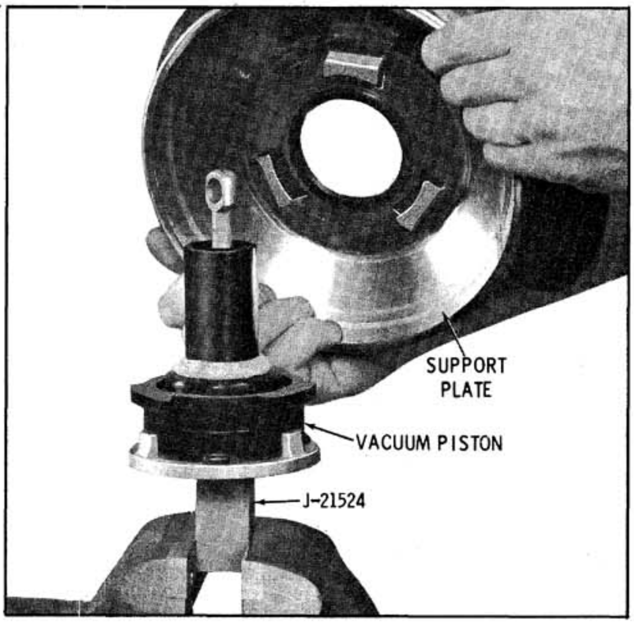


Fig. 11-39 Positioning Support Plate on Vacuum Piston

11. Coat the entire inner lip of the diaphragm with lubricant.

12. Position the support plate and diaphragm over the tube of the vacuum piston. The flange of the diaphragm fits into the groove on the power piston. (Fig. 11-39)

13. Press down and rotate the support plate clockwise until the lugs on the power piston rest against the stops on the support plate.

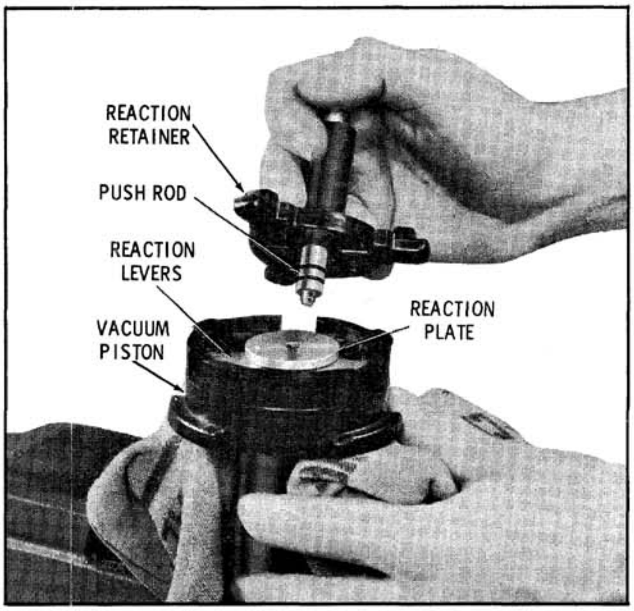


Fig. 11-40 Installing Reaction Retainer

14. Position the vacuum piston assembly in a padded vise, tube down. Do not clamp tube. Using Truarc pliers J-4880, install the snap ring into the groove in the air valve. (Fig. 11-36)

15. Install the air valve spring seat, dished side down, so it seats on the snap ring. Install the reaction bumper into the groove in the end of the air valve.

16. Install the air valve return spring so that the large end seats on the spring seat.

17. Install the three reaction levers in the slots in the vacuum piston.

18. Position the reaction plate, numbered side up, on top of the reaction levers. Press down on the reaction plate until the reaction levers pop up.

19. Position the reaction retainer and push-rod as shown in Fig. 11-40. While retaining pressure on the reaction retainer, install the lock ring as shown in Fig. 11-41.

ASSEMBLY OF POWER BRAKE UNIT

1. Coat the rear housing seal with lubricant and install in the rear housing with the large flange of the seal on the same side as the mounting studs.

2. Apply lubricant to the tube of the vacuum piston and insert the tube of the vacuum piston through the seal of the rear housing.

3. Coat the vacuum check valve seal with lubricant and install with the beveled side of the seal toward the inside of the front housing.

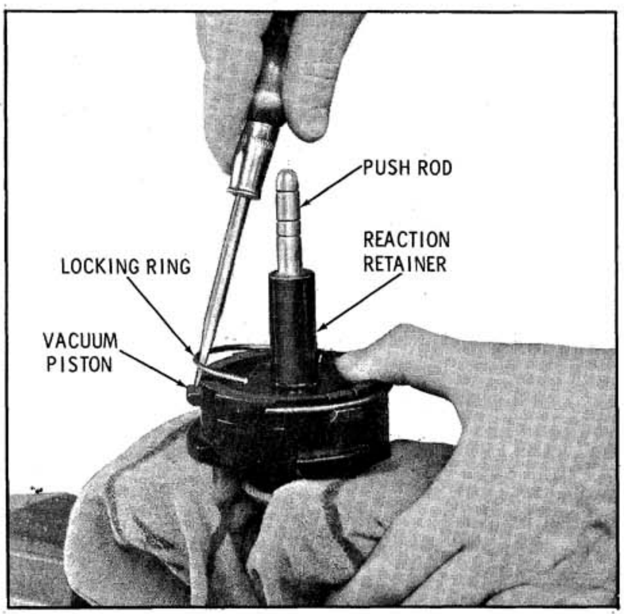


Fig. 11-41 Installing Locking Ring

4. Install the vacuum check valve in the front housing.

5. Install the front housing seal and the master cylinder on the front housing. Torque master cylinder attaching nuts to 20 ft. lbs.

6. Clamp the master cylinder in a vise. Position the vacuum piston return spring over the hub of the front housing.

7. Position the rear housing over the front housing so that the scribe marks will be aligned when housings are assembled.

8. Depress and rotate rear housing clockwise until the front and rear housings are locked.

9. All series except 33 through 38—Install the felt filter into the last fold of the rubber boot and install the boot over the operating rod.

10. 33 through 38 Series—Install the felt filter over the operating rod and install the retaining key. Install the plastic boot over the operating rod so that the projections locate in the holes of the bracket. Install the locknut and clevis on 33 through 38 series.

11. Check the push-rod adjustment as outlined under PUSH-ROD ADJUSTMENT.

PUSH-ROD ADJUSTMENT (Fig. 11-42)

The push-rod adjustment is important because the compensating port in the master cylinder must be open when the vacuum piston is in the released position.

The push-rod adjustment can be checked as follows:

1. With the vacuum unit assembled and the master cylinder and front housing seal removed, position Gauge J-7723-01 over the push-rod with the legs of the gauge resting on the front housing of the vacuum cylinder.

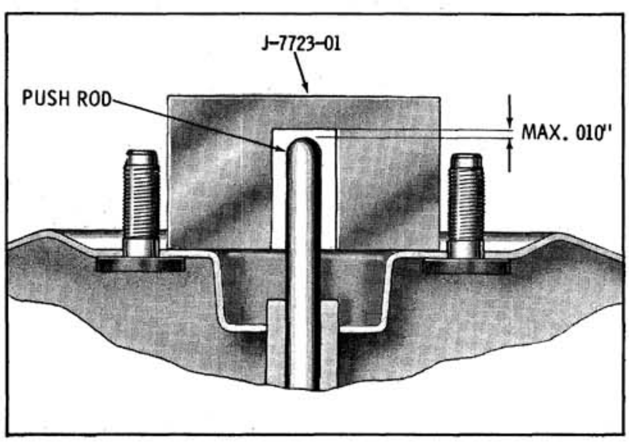


Fig. 11-42 Checking Push-Rod Adjustment

2. The adjustment is correct if the gauge just contacts the tip of the push-rod or if the tip of the push-rod is no more than .010" below the gauge.

3. If the push-rod is not within specifications, and the push-rod does not have an adjusting screw, a new service adjustable push-rod must be installed and adjusted to specification. If the push-rod, being checked, has an adjusting screw, adjust the push-rod to specification.

BENDIX POWER BRAKE

PRINCIPLES OF OPERATION

Released Position (Fig. 11-43)

With no pressure applied to the brake pedal, the air valve and operating rod are held in the released position by the air valve return spring. This closes the atmospheric port and opens the vacuum port to the rear of the vacuum piston. With vacuum on both sides of the vacuum piston, the vacuum piston return spring holds the vacuum piston in the released position.

Applying Position (Fig. 11-44)

As the brakes are applied, the operating rod and air valve move forward in the vacuum piston to close the vacuum port. Further movement in the applied direction allows the air valve to unseat the floating valve and open the atmospheric port. With vacuum at the forward side and atmospheric pressure at the rear of the vacuum piston, a force is developed which moves the vacuum piston, push-rod and the hydraulic piston in the apply direction.

As fluid pressure increases in the master cylinder, a reaction force is transmitted through the push-rod to the reaction disc to apply a pressure on the air valve. This reaction force moves the air valve slightly rearward in relation to the vacuum piston to close off the atmospheric port. The reaction force is in proportion to the fluid pressure in the hydraulic system and balances the force exerted on the operating rod, providing the driver with brake "feel".

In the fully applied position, maximum atmospheric pressure is allowed to enter at the rear of the vacuum piston. Any additional increase in hydraulic pressure beyond this point must be supplied by physical effort of the driver.

Holding Position (Fig. 11-45)

During brake application, the reaction against

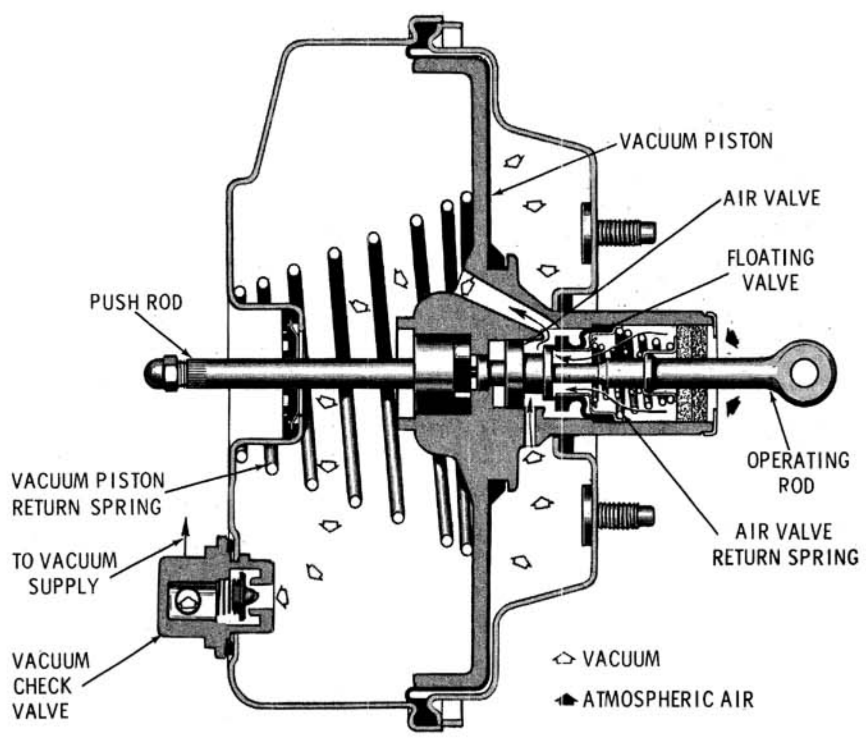


Fig. 11-43 Released Position

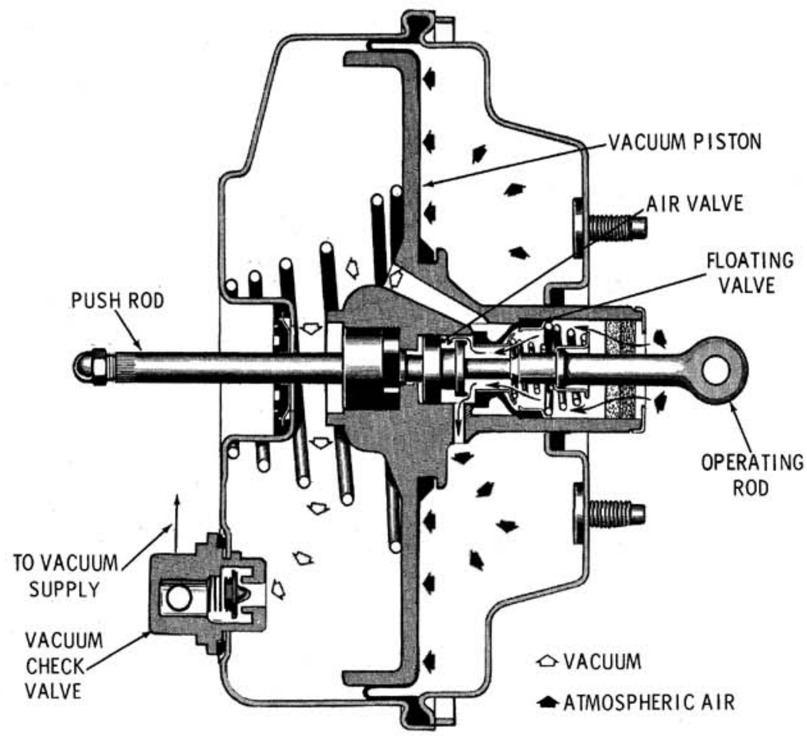


Fig. 11-44 Applied Position

the air valve works against pedal pressure to close the atmospheric port. With the vacuum and atmospheric ports closed, the brake is in the hold position. The brake remains in this position until pressure is either increased or decreased on the brake pedal.

DISASSEMBLY OF BENDIX POWER BRAKE (Fig. 11-46)

NOTE: Use extreme care to keep mineral oil or grease from coming in contact with hydraulic parts.

1. Deplete vacuum supply, then clean the outside of the power brake unit. Remove the filler cap, then empty brake fluid from master cylinder reservoir.

2. Clamp the master cylinder in a vise with the operating rod up. Remove the nylon bellows retainer and bellows from the rear housing.

3. Scribe a line across the front and rear housings and the master cylinder to facilitate reassembly.

4. Brush locking tangs of front and rear housings liberally with seal lubricant. Rotate rear housing so that cut-outs in rear housing line up with tangs of the front housing. Tap rear housing lightly with a plastic hammer to assist in removal. (Fig. 11-47)

   NOTE: Loosen rear housing carefully as it is spring-loaded.

5. After transferring the rear housing, piston return spring and push-rod to the bench, remove the return spring and push-rod from the rear housing.

6. Remove the master cylinder to front housing attaching nuts and separate the master cylinder from the front housing.

7. Remove the front housing seal.

8. Remove the vacuum check valve from the front housing if valve is defective.

9. Pry off the filter retainer and remove the felt and foam rubber filters. Use care not to chip the plastic housing when removing the filter retainer.

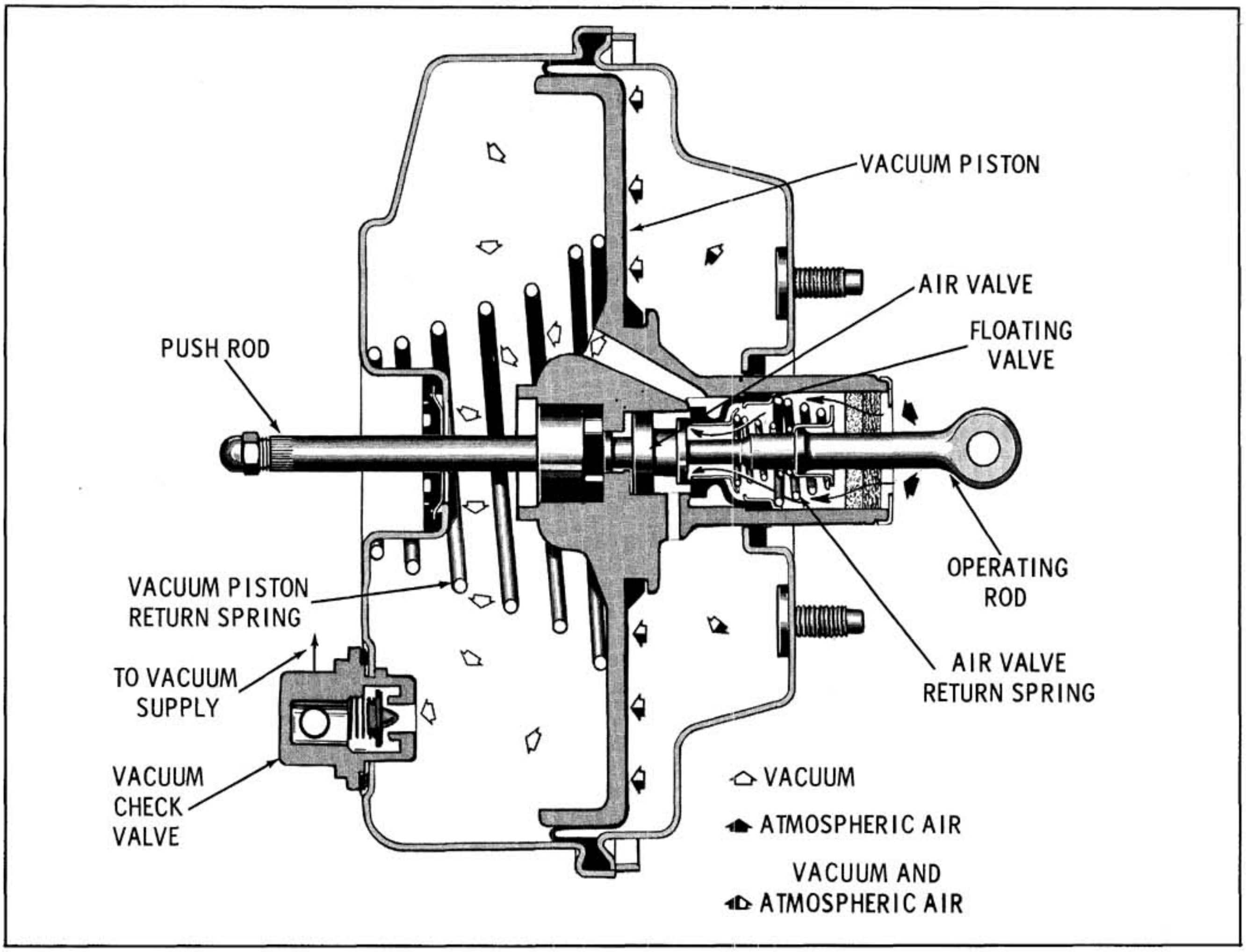


Fig. 11-45 Holding Position

10. Remove the vacuum piston from the rear housing.

11. Remove the vacuum diaphragm from the vacuum piston.

12. While holding the vacuum piston and operating rod parallel to the bench and with the air valve retainer facing down, depress the operating rod slightly to release the air valve retainer.

13. Remove the air valve assembly from the vacuum piston. Remove the reaction disc from the vacuum piston with a blunt tool. Do not disassemble the air valve assembly.

14. Remove the rear housing seal. (Fig. 11-48)

CLEANING AND INSPECTION

1. Thoroughly wash all metal parts in cleaner. Use ONLY alcohol or brake flushing fluid on the plastic or rubber parts. Blow out all passages and air dry. Place parts on clean paper.

2. Inspect front and rear housings for scoring, pitting, dents, nicks or loose mounting studs. Small imperfections may be smoothed out with fine crocus cloth. Replace housing if damaged.

3. Inspect air valve for scratches, nicks, or breakage. Check seat for smoothness and flatness. Valve should have a free sliding fit when inserted in the vacuum piston bore. Check floating valve for distortion of metal parts and deterioration or abrasions of rubber parts. Replace complete air valve, floating valve and operating rod assembly if any parts are damaged.

4. Check vacuum piston for cracks or rough or uneven floating valve seat. Be sure all openings and passages are clean.

5. Replace air filter element if dirty.

NOTE: When overhauling a unit, use all the parts furnished with the parts kit. Discard all old rubber parts.

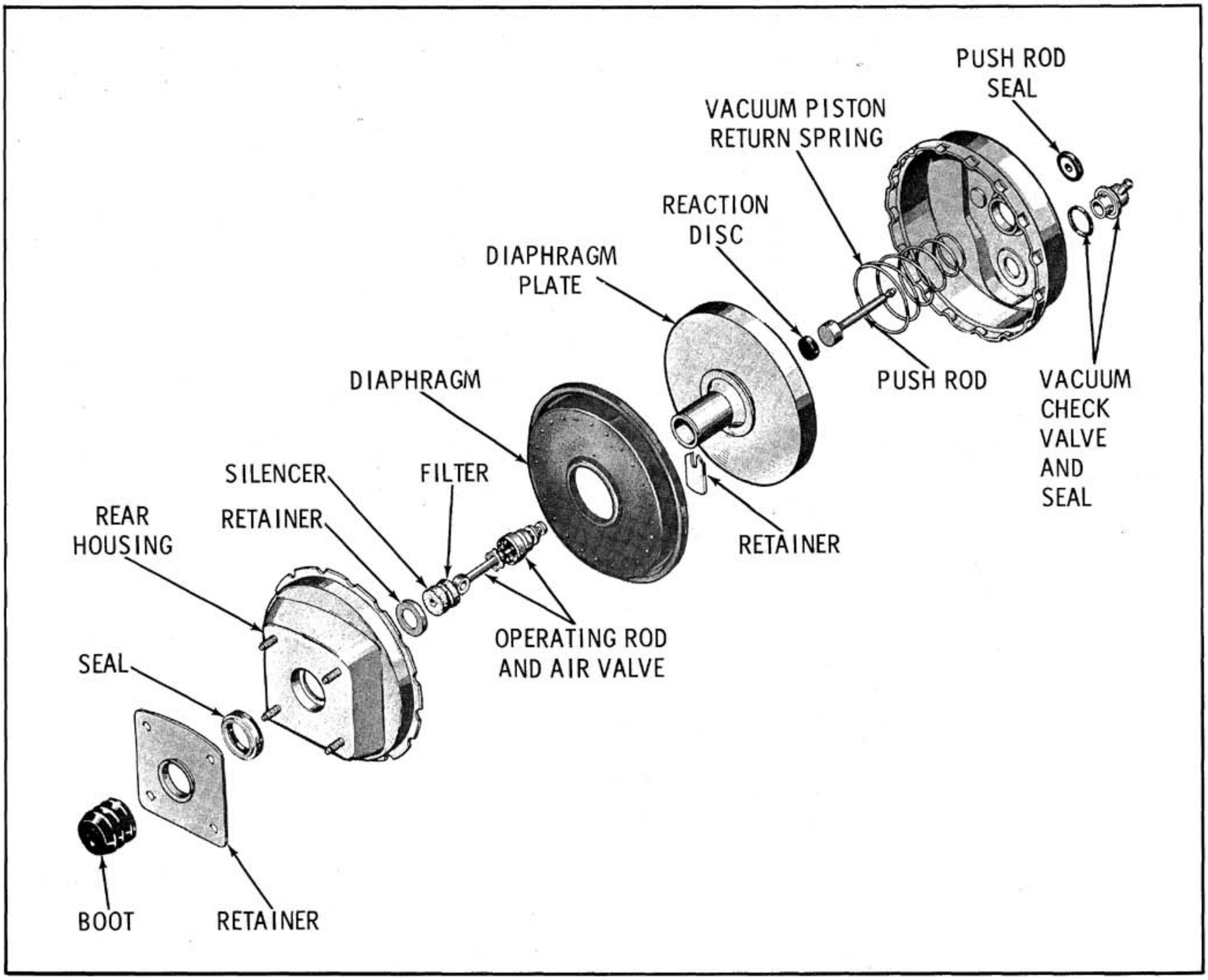


Fig. 11-46 Bendix Power Brake Assembly

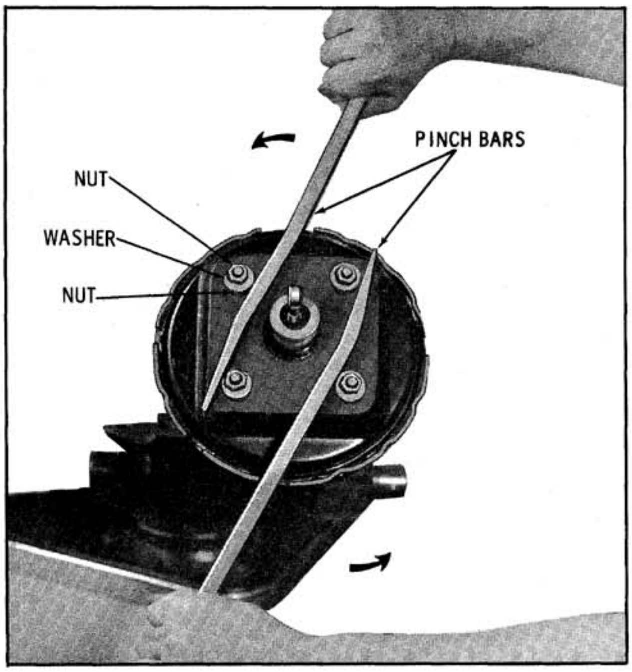


Fig. 11-47 Separating Housings

ASSEMBLY OF BENDIX POWER BRAKE (Figs. 11-49 & 11-50)

For assembly of master cylinder, refer to MASTER CYLINDER - ASSEMBLY.

NOTE: On assembly, if a lubricant is specified, use Seal Lubricant Part No. 1050169.

1. Coat a new rear housing seal with lubricant and install with Tool J-8761. (Fig. 11-51)

2. Coat the floating valve with lubricant and install in the vacuum piston. Depress the operating rod and insert the air valve retainer.

3. Install the vacuum diaphragm on vacuum piston. Inner lip of diaphragm must fit inside flange on vacuum piston.

4. Install the reaction disc into the vacuum piston with tip of the disc toward the air valve.

5. Install the foam rubber filter, then the felt

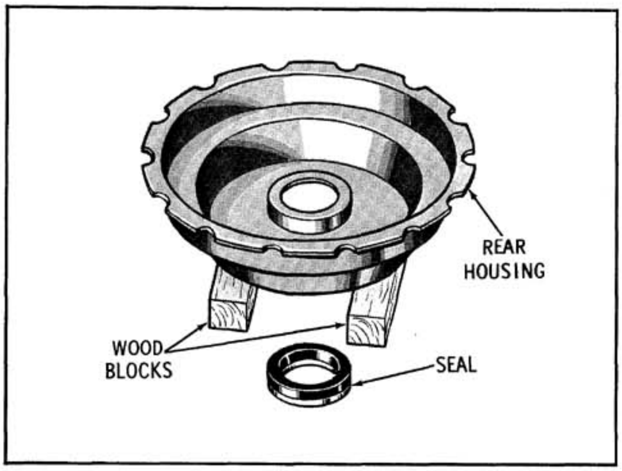


Fig. 11-48 Removal of Bearing Seal from Rear Housing

filter over the operating rod. Install the filter retainer.

6. Coat a new front housing seal with lubricant and install into the front housing. The metal side of the seal faces toward the inside of the front housing. Install a new vacuum check valve if the old one was removed.

7. Install the master cylinder on the front housing. Torque nuts to 20 ft. lbs.

8. Position the master cylinder in a vise with the front housing up. Install the vacuum piston return spring in the front housing with small ID of the spring over the hub in the front housing.

9. Insert the vacuum piston into the rear housing. Coat the large OD of the push-rod with lubricant and install piston into vacuum piston.

10. Position the rear housing over the front housing. Compress the return spring. While maintaining pressure on the rear housing, rotate the rear housing clockwise to lock the housings together.

11. Check push-rod adjustment as outlined under PUSH-ROD - ADJUSTMENT.

PUSH-ROD ADJUSTMENT (Fig. 11-52)

The push-rod incorporates a self-locking adjusting screw to provide a means of maintaining correct relationship between the vacuum piston and the master cylinder piston. The relationship between the pistons is important because the compensating port must be open when the vacuum piston is in the released position.

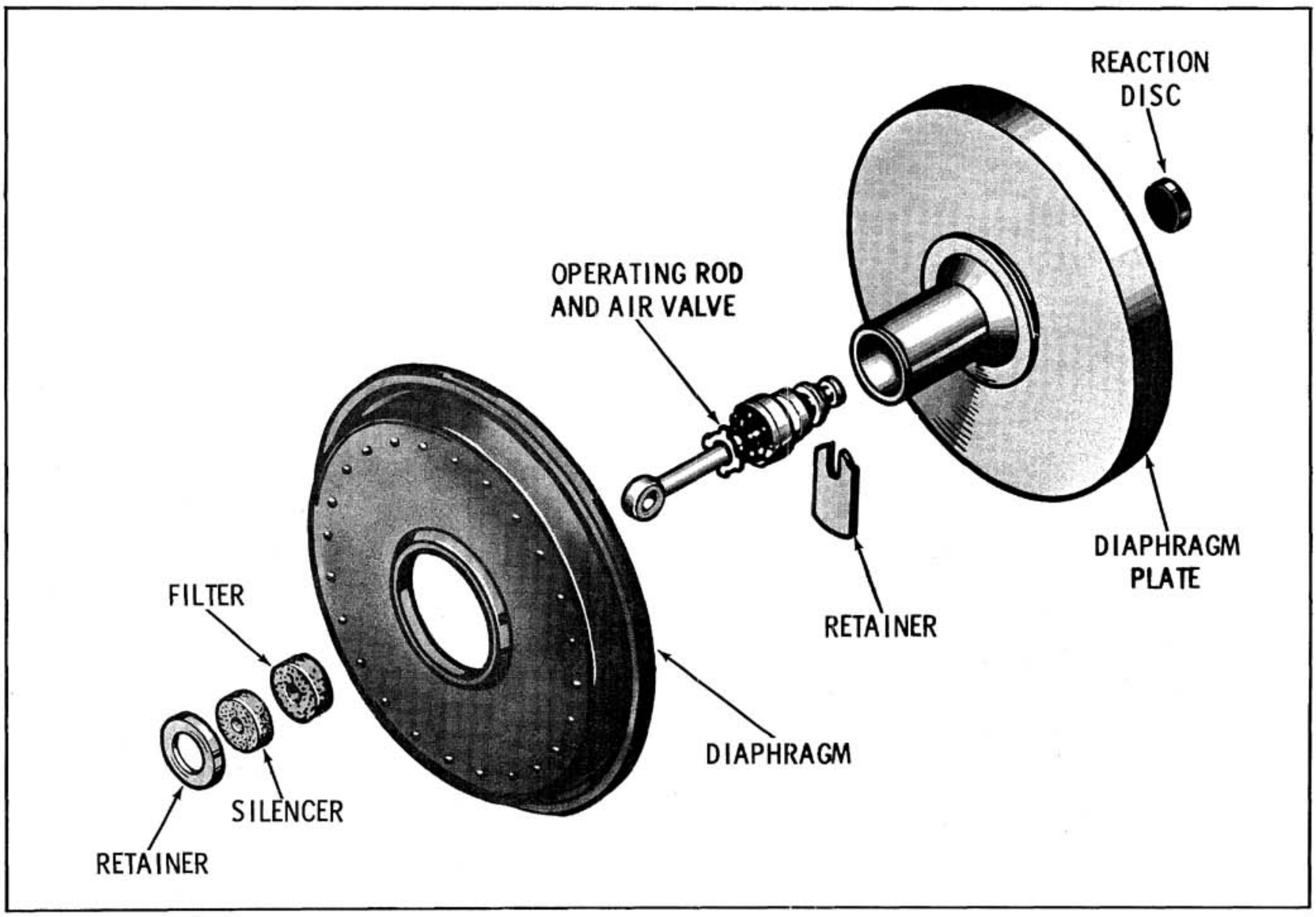


Fig. 11-49 Disassembly of Air Valve and Diaphragm

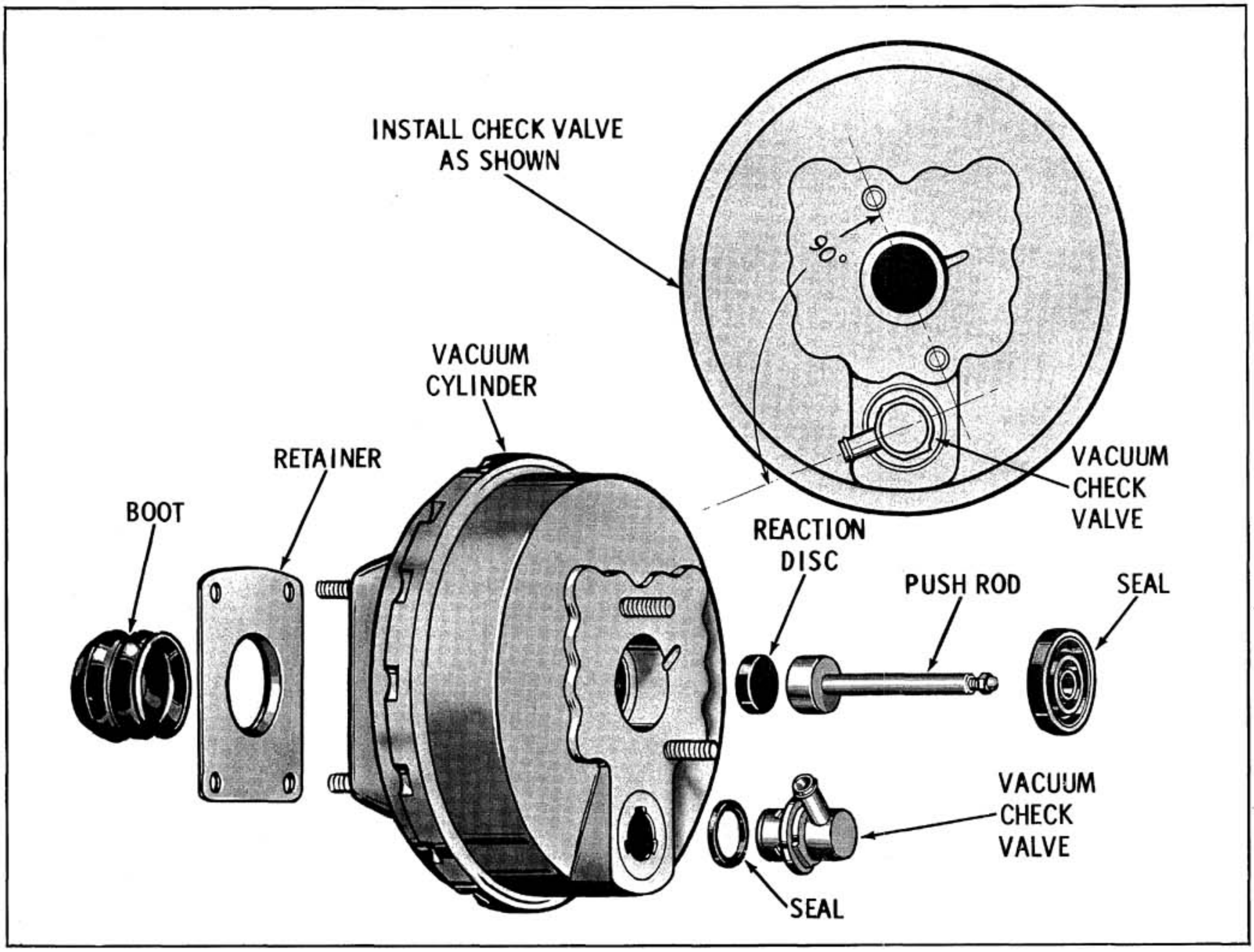


Fig. 11-50 Front and Rear Housing Assembly

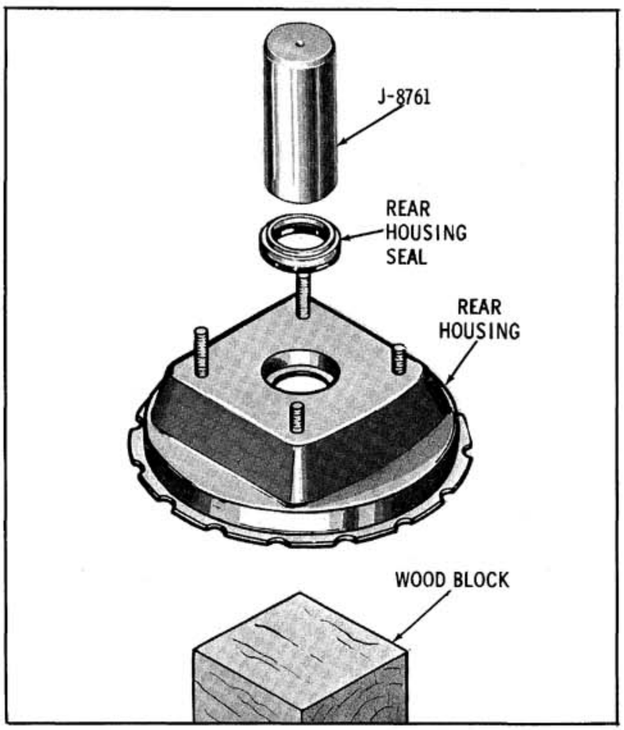


Fig. 11-51 Installing Rear Housing Seal

Under normal service conditions, the push-rod does not require any attention, provided the adjustment has not been changed and the push-rod remains in the original vacuum unit.

When a new push-rod is used or the push-rod is transferred to another unit, the push-rod adjustment must be checked as follows:

1. With the vacuum unit assembled, position Gauge J-7723-01 over the push-rod with the

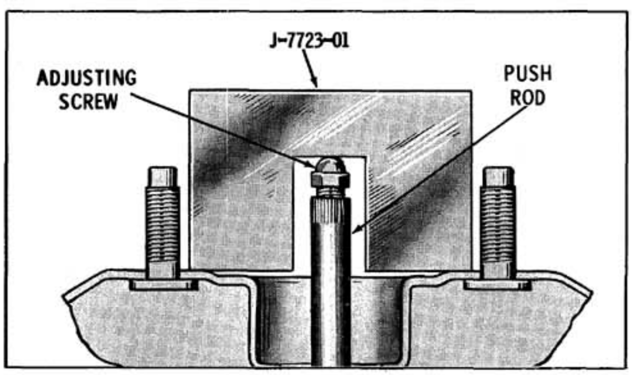


Fig. 11-52 Checking Push-Rod Adjustment

legs of the gauge resting on the front housing. The push-rod adjusting screw should just touch the gauge.

2. If necessary to adjust, rotate the adjusting screw until the adjusting screw just touches the gauge.

KELSEY-HAYES POWER BRAKE

PRINCIPLES OF OPERATION

Released Position (Fig. 11-53)

With no pressure applied to the brake pedal, the air valve and operating rod are held in the released position by the air valve return spring. This closes the atmospheric port and opens the vacuum port to the rear of the vacuum piston. With the vacuum on both sides of the vacuum piston, the vacuum piston return spring holds the vacuum piston in the released position.

Applying Position (Fig. 11-54)

As the brakes are applied, the operating rod and air valve move forward in the vacuum piston to close the vacuum port. Further movement in the applied direction allows the air valve to unseat the floating valve and open the atmospheric port. With vacuum at the forward side and atmospheric pressure at the rear of the vacuum piston, a force is developed which moves the vacuum piston, push-rod and the hydraulic piston in the apply direction.

As fluid pressure increases in the master cylinder, a reaction force is transmitted through the push-rod to the reaction insert to apply a pressure on the air valve. This reaction force moves the air valve slightly forward in relation to the vacuum piston to close off the atmospheric port. The reaction force is in proportion to the fluid pressure in the hydraulic system and balances the force exerted on the operating rod, providing the driver with brake "feel".

In the fully applied position, maximum atmospheric pressure is allowed to enter at the rear of the vacuum piston. Any additional increase in hydraulic pressure beyond this point must be supplied by physical effort of the driver.

Holding Position (Fig. 11-55)

During brake application, the reaction valve against the air valve works against pedal pressure to close the atmospheric port. With the vacuum

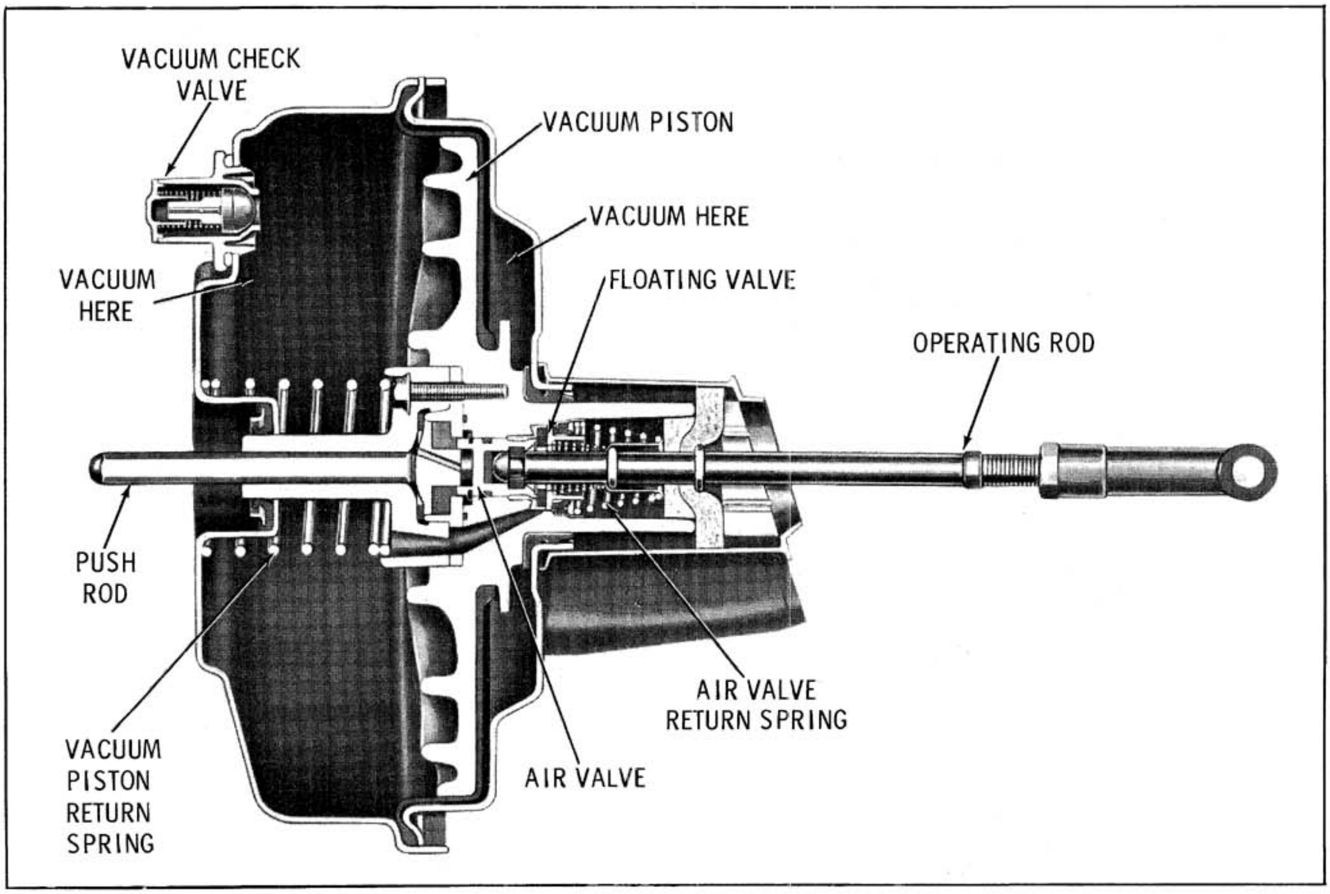


Fig. 11-53 Released Position

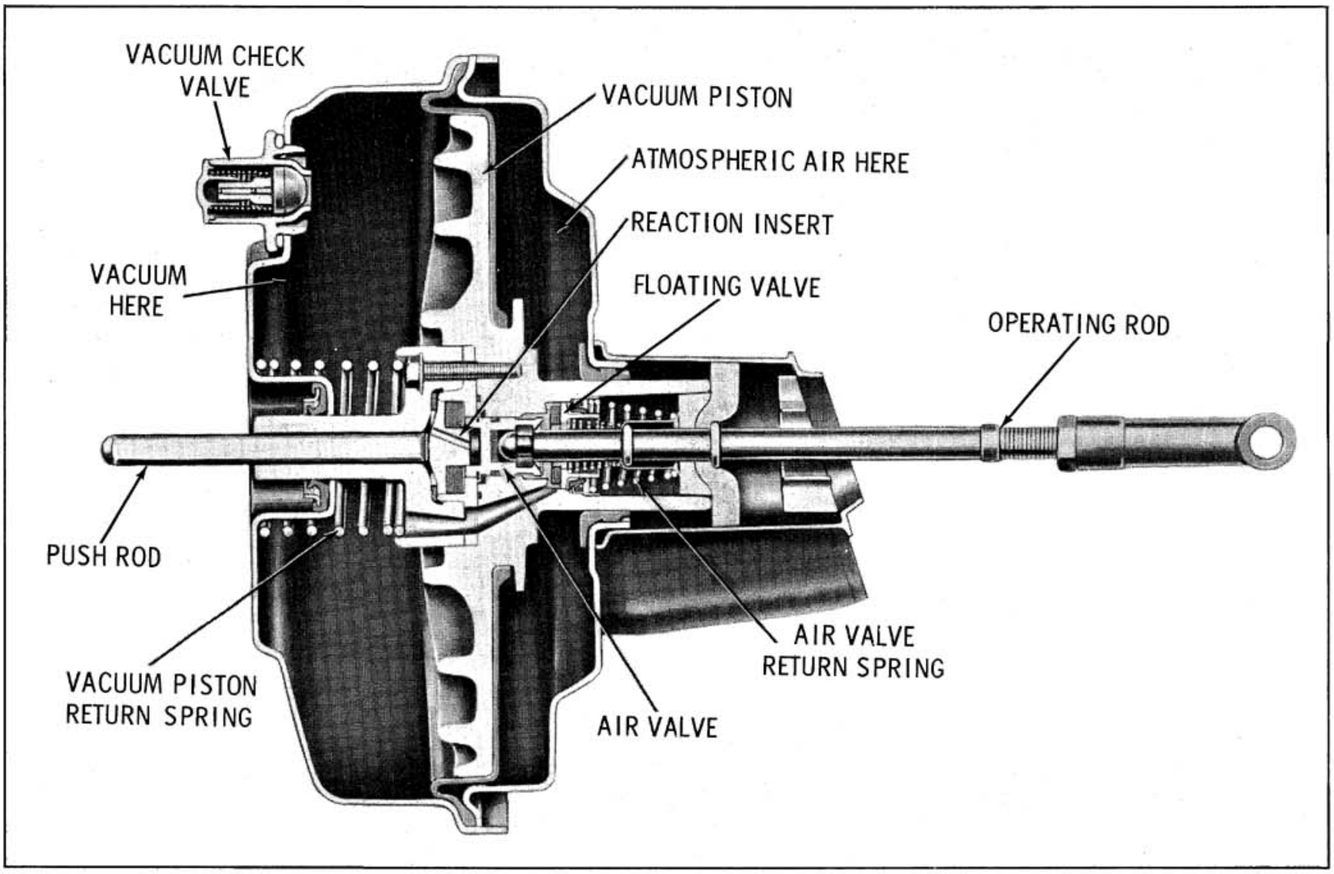


Fig. 11-54 Applying Position

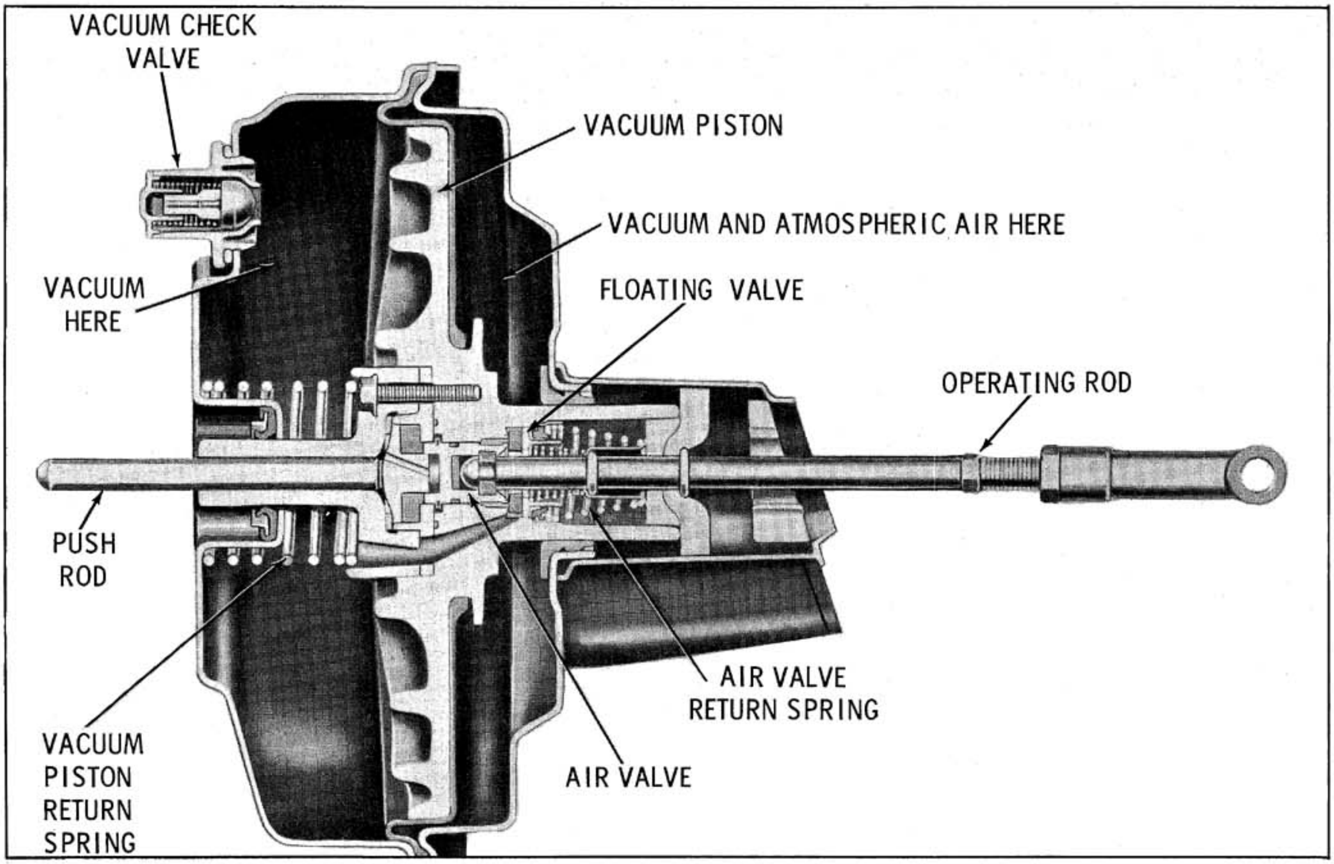


Fig. 11-55 Holding Position

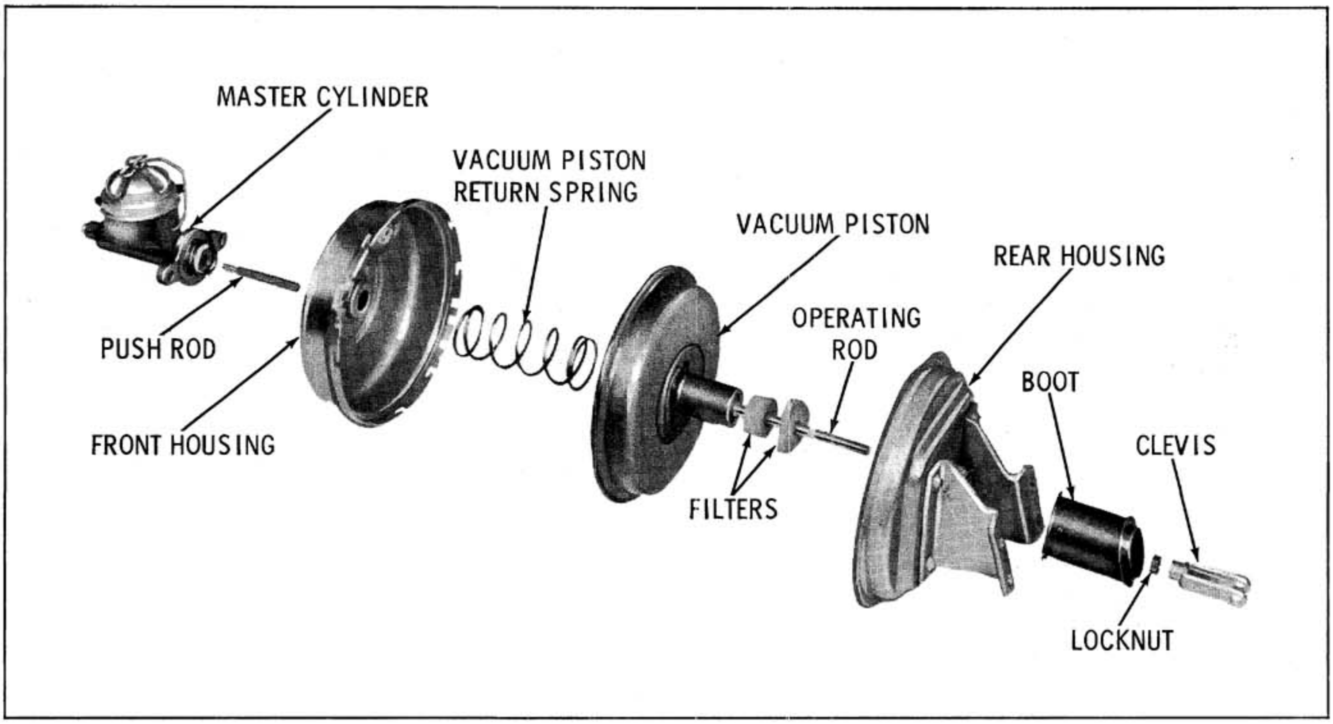


Fig. 11-56 Kelsey-Hayes Power Brake

and atmospheric ports closed, the brake is in the hold position. The brake remains in this position until pressure is either increased or decreased on the brake pedal.

DISASSEMBLY (Figs. 11-56 and 11-57)

NOTE: Use extreme care to keep mineral oil or grease from coming in contact with hydraulic parts.

1. Deplete vacuum supply, then clean the outside of the power brake unit. Remove filler cap, then empty brake fluid from the master cylinder reservoir.
2. Clamp the master cylinder in a vise with the operating rod up.
3. Loosen the locknut on the operating rod, then remove the clevis, locknut, plastic boot and the air filters.

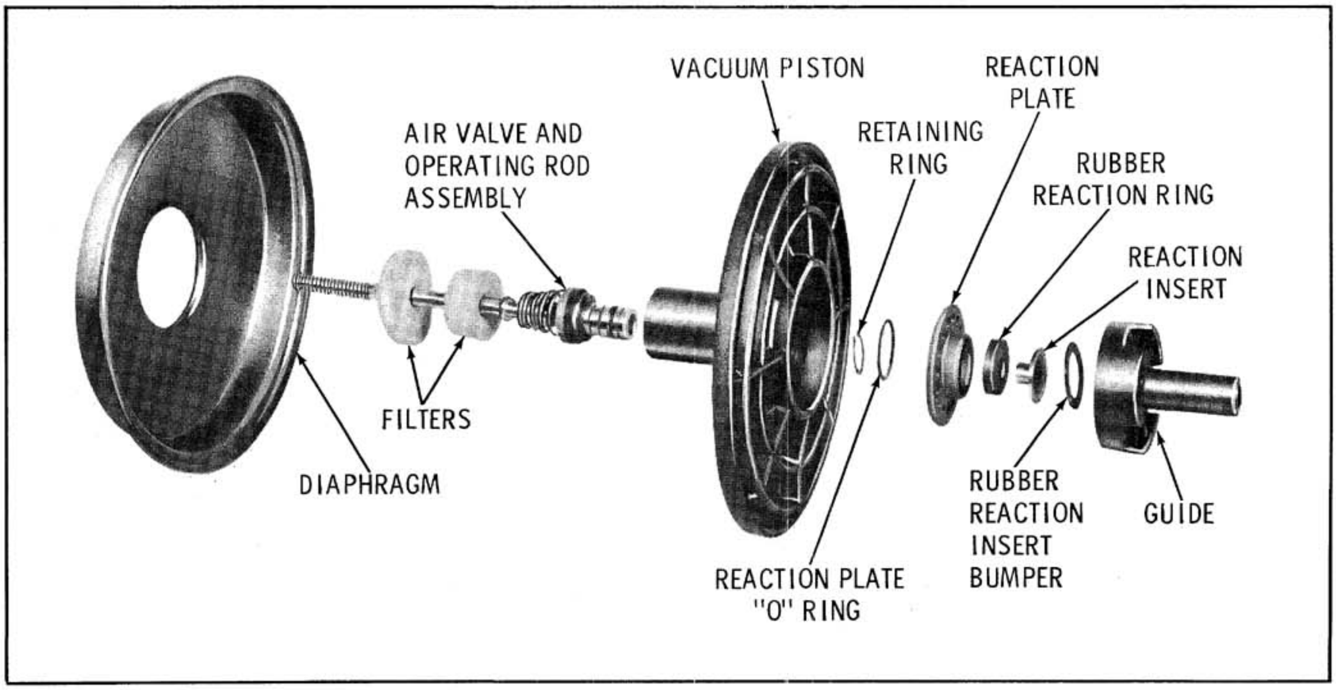


Fig. 11-57 Vacuum Piston Assembly

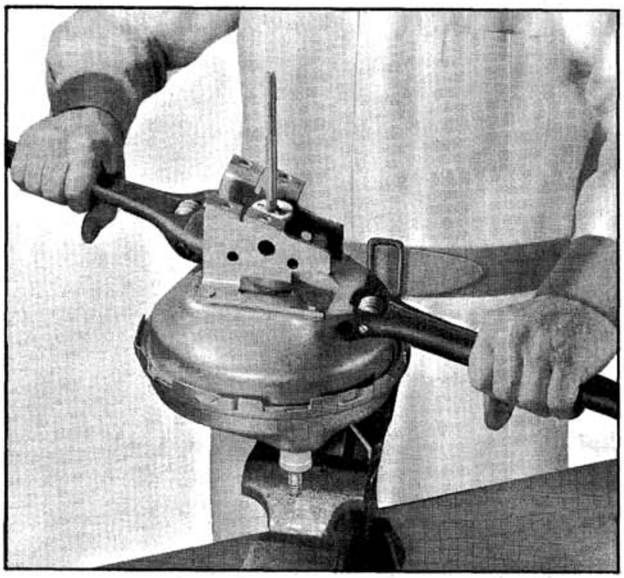


Fig. 11-58 Removing Rear Housing

4. Scribe a line across the front and rear housings and the master cylinder to facilitate reassembly.

5. Remove the front to rear housing retainer, noting its location.

6. Brush locking tangs of front and rear housings liberally with seal lubricant. Rotate rear housing to separate the housings. Tap rear housing lightly with a plastic hammer to assist in removal. (Fig. 11-58)

   NOTE: Loosen rear housing carefully as it is spring-loaded.

7. Transfer the rear housing to the bench.

8. Remove the vacuum piston return spring and the push-rod from the front housing.

9. Remove the master cylinder from the front housing.

10. Remove the vacuum check valve and "O" ring from the front housing.

11. Remove the front housing seal. (Fig. 11-59)

12. Remove the vacuum piston from the rear housing.

13. Remove the seal from the rear housing. (Fig. 11-60)
14. Remove the diaphragm from the vacuum piston.
15. Loosen the three guide attaching screws and remove the guide. Remove the rubber reaction bumper from the guide. (Fig. 11-61)

16. Depress operating rod and remove the reaction plate. Remove the reaction insert and

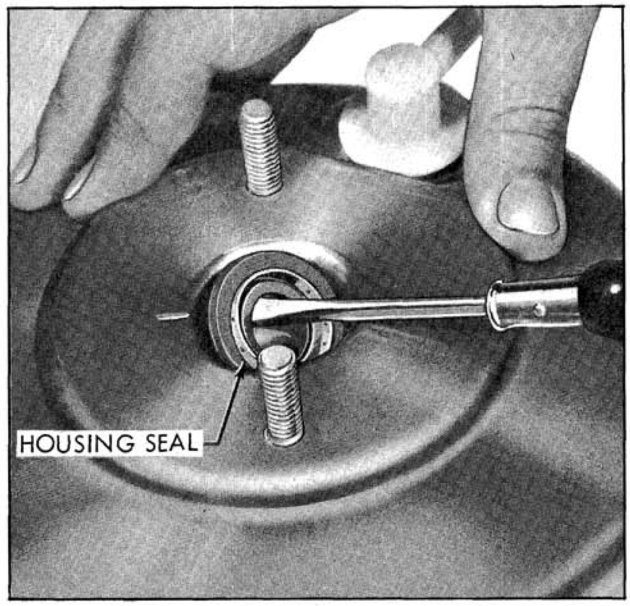


Fig. 11-59 Removing Seal

the rubber reaction ring from the reaction plate.

17. Remove the reaction plate "O" ring from the vacuum piston.

18. Depress operating rod and remove the retaining ring from the air valve. (Fig. 11-62)

19. Remove the air valve, floating valve and operating rod assembly from the vacuum piston.

CLEANING AND INSPECTION

1. Thoroughly wash all metal parts in cleaner. Use ONLY alcohol or brake flushing fluid on plastic or rubber parts. Blow out all passages and air dry. Place parts on clean paper.

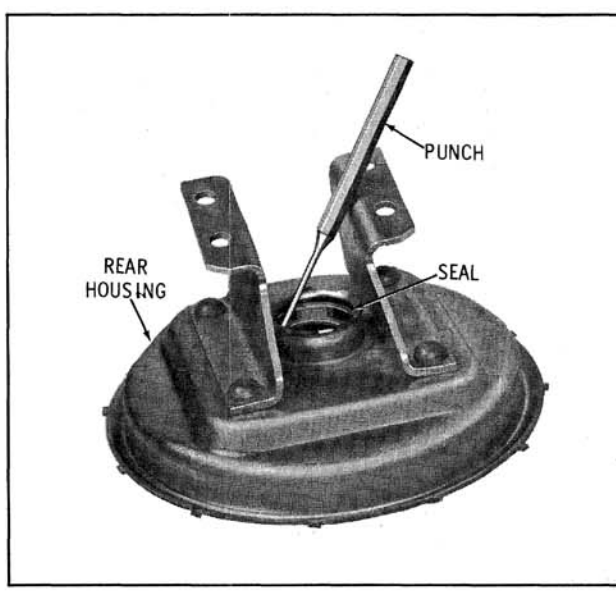


Fig. 11-60 Removing Rear Housing Seal

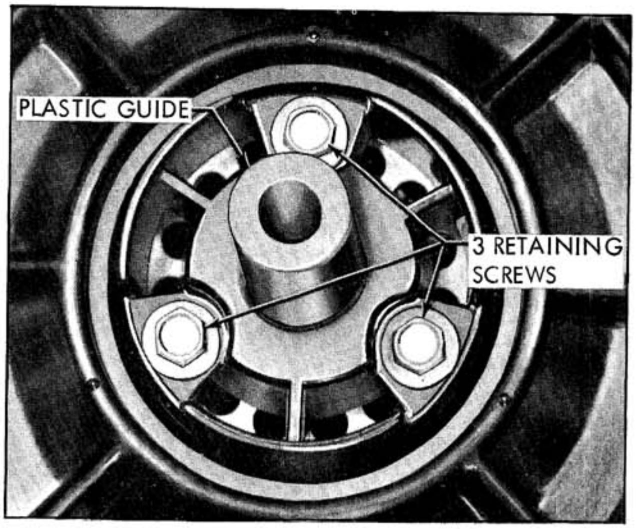


Fig. 11-61 Location of Guide Screws

2. Inspect front and rear housings for scoring, pitting, dents, nicks or loose mounting studs. Small imperfections may be smoothed out with fine crocus cloth. Replace housing if damaged.

3. Inspect air valve for scratches, nicks or breakage. Check seat for smoothness and flatness. Valve should have a free sliding fit when inserted in the vacuum piston bore. Check floating valve for distortion of metal parts and deterioration or abrasions of rubber parts. Replace complete air valve, floating valve and operating rod assembly, if any parts are damaged.

4. Check vacuum piston for cracks or rough or uneven floating valve seat. Be sure all openings and passages are clean.

5. Replace air filter elements if dirty.

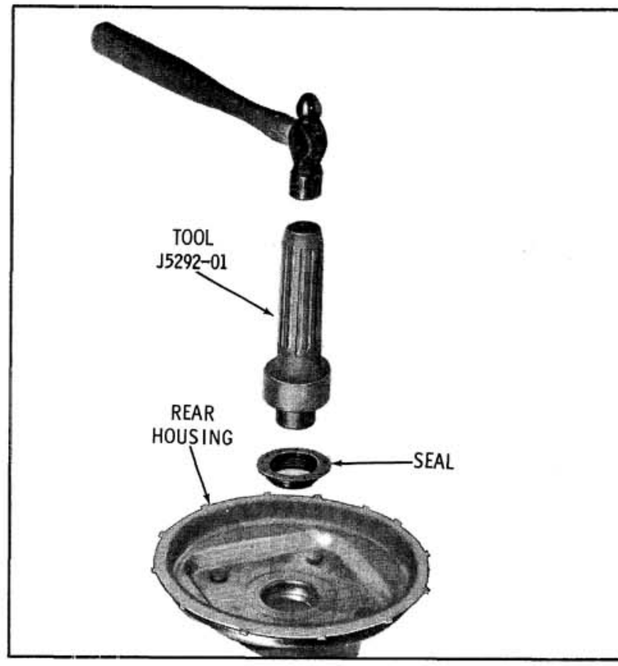


Fig. 11-63 Installing Rear Housing Seal

NOTE: When overhauling a unit, use all the parts furnished with the parts kit. Discard all old rubber parts.

ASSEMBLY
(Figs. 11-56 & 11-57)

For assembly of master cylinder, refer to MASTER CYLINDER - ASSEMBLY.

NOTE: On assembly, if a lubricant is specified, use Seal Lubricant, Part No. 1050169.

1. Coat a new rear housing seal with lubricant and install as shown in Fig. 11-63.

2. Coat the floating valve and the "O" ring on

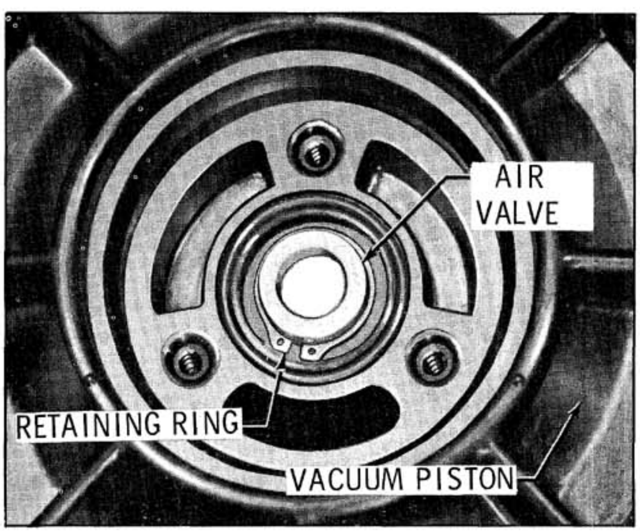


Fig. 11-62 Retaining Ring Location

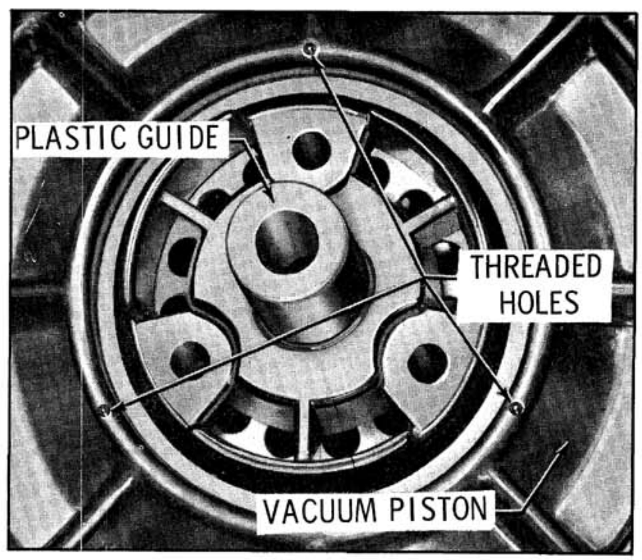


Fig. 11-64 Aligning Vacuum Piston and Guide

the air valve with lubricant and install the operating rod assembly into the vacuum piston. Install the retaining ring. (Fig. 11-62)

3. Install the reaction plate "O" ring on the vacuum piston.

4. Position the reaction plate on the vacuum piston, aligning three of the holes with the threaded holes in the vacuum piston. (Fig. 11-64)

5. Install the rubber reaction ring and the reaction insert into the reaction plate.

   NOTE: Coat the outer diameter of the reaction insert with lubricant. Do not lubricate the rubber reaction ring.

6. Coat the reaction insert bumper with lubricant and install into the guide.

7. Position the guide on the vacuum piston. Retain with three screws. Torque screws to 100 in. lbs.

8. Install the diaphragm on the vacuum piston making sure the diaphragm is seated in the groove of the vacuum piston.

9. Apply lubricant to the ID of the rear housing seal, then insert the vacuum piston into the rear housing.

10. Apply lubricant to a new front housing seal and install seal in the front housing, metal ridge of seal up. (Fig. 11-65)

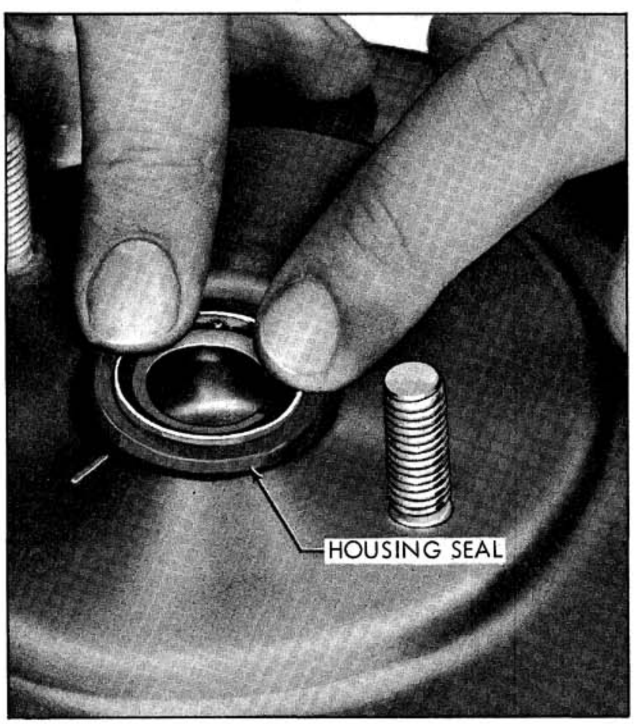


Fig. 11-65 Installing Housing Seal

11. If the vacuum check valve was removed, install a new check valve and "O" ring into the front housing.

12. Position master cylinder on the front housing. Torque attaching nuts to 20 ft. lbs.

13. Clamp master cylinder in a vise with the front housing up.

14. Insert the push-rod into the master cylinder piston with the adjusting screw toward the master cylinder.

15. Position the vacuum piston return spring over the hub of the front housing.

16. Apply lubricant to both sides of the outer edge of the diaphragm.

17. Position the rear housing over the front housing, noting the alignment marks. Depress rear housing and rotate until the housings are locked. Install the front to rear housing retainer.

18. Install the air filters over the operating rod, small diameter filter first.

19. Install the plastic boot over the operating rod. Compress the sides of the boot so that the projections on the boot enter the holes in the mounting bracket.

20. Install the locknut and the clevis on the operating rod.

21. Adjust push-rod as outlined under PUSH-ROD ADJUSTMENT.

PUSH-ROD ADJUSTMENT (Fig. 11-66)

Under normal service conditions, the push-rod

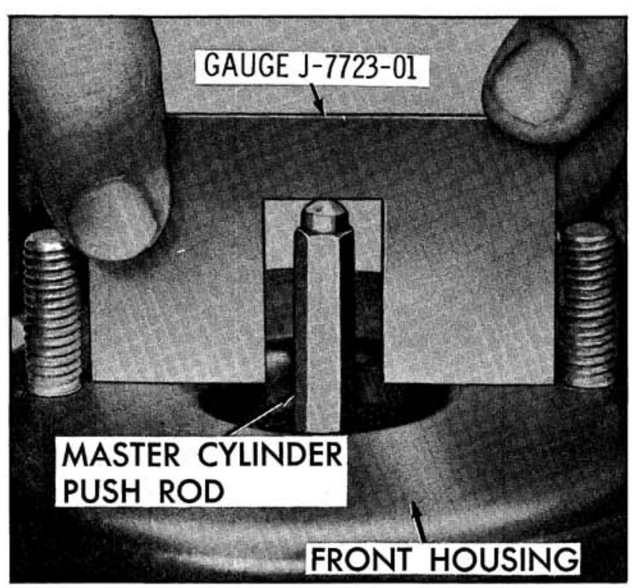


Fig. 11-66 Measuring Push-Rod Height

does not require any attention provided the push-rod remains in the original vacuum unit.

When a new push-rod is used or the push-rod is transferred to another unit, the push-rod must be checked as follows:

1. With the vacuum unit assembled, position Gauge J-7723-01 over the push-rod with the legs of the gauge resting on the front housing. The push-rod should just touch the gauge.
2. If the push-rod is high, grind the end of the push-rod until it just touches the gauge.
3. If the push-rod is low, a new service push-rod must be installed and ground down until adjustment is correct.

POWER BRAKE TESTING

Road test the brakes by making a brake application at about 20 mph to determine if the car stops evenly and quickly. If the pedal has a spongy feel, when applying the brakes, air is present in the hydraulic system. Bleed the system at each wheel cylinder.

With the engine stopped and the transmission in neutral, apply the brake several times to exhaust all vacuum in the system. While depressing the brake pedal, start the engine. If the vacuum system is operating, the pedal will tend to move away under foot pressure, and less pressure will be required to hold the pedal in the applied position. If no action is felt, the vacuum system is not functioning.

Stop the engine and again exhaust all vacuum in the system. Without starting the engine, depress the brake pedal and hold foot pressure on the pedal. If the pedal gradually falls away under foot pressure, the hydraulic system is leaking.

To check the vacuum check valve, start the engine and accelerate to 20 mph and turn off the ignition. Immediately close the throttle to build up the vacuum supply. Wait at least 90 seconds and apply the brakes. If not vacuum assisted, the vacuum check valve or vacuum cylinder is leaking.

BRAKE DIAGNOSIS

The following diagnosis applies to both power brakes and standard brakes unless otherwise specified.

1. Hard Pedal Feel May Be Caused By:

   A. Power brake vacuum failure due to:

      (1) Faulty vacuum check valve or seal.

      (2) Collapsed vacuum hose to manifold.

      (3) Plugged or loose vacuum hose or fitting.

      (4) Leaks in front or rear housing.

   B. Bound-up pedal mechanism.

   C. Grease on brake drum or linings.

   D. Power brake unit trouble due to:

      (1) Jammed air valve.

      (2) Vacuum leak past the vacuum diaphragm.

      (3) Leak in vacuum cylinder.

      (4) Restricted air filter.

      (5) Malfunctioning air valve.

      (6) Leaking past floating or air valve.

2. "Grabby" or Severe Brakes Caused By:

   A. Grease or brake fluid on linings.

   B. Scored drums.

   C. Burned linings.

   D. Power brake unit trouble due to:

      (1) Sticking air valve.

      (2) Binding master cylinder piston.

3. Pedal Goes to Floor (or almost to floor) Caused By:

   A. Self-adjuster not operating.

   B. Air in hydraulic system.

   C. Hydraulic leak in line or at wheel cylinders.

   D. Low fluid level in master cylinder reservoir.

   E. Leak at primary cup.

   F. Sand hole or crack in master cylinder.

   G. Worn brake linings.

4. Brake Lock-Up Caused By:

   A. Restricted compensator port.

   B. Incorrect push-rod adjustment (Power).

   C. Incorrect pedal free travel (Standard).

   D. Faulty hydraulic check valve.

   E. Sticking air valve.

5. Excessive Lining Wear Rear Brakes

   Parking brake improperly adjusted.

GENERAL SPECIFICATIONS

BRAKE ASSEMBLIES AND DRUMS

LINING AREA

1. 33, 34, 35, 36, 38 and 52 Series (Except 55 and 65 Styles) . . . . 156.3 Sq. In.
2. 55 and 65 Styles . . . . 174.0 Sq. In.
3. 54, 56, 58 and 66 Series . . . . 208.6 Sq. In.
4. 84 and 86 Series . . . . 229.2 Sq. In.

RATIO (Percentage of Braking Effect)

1. 33, 34, 35, 36, 38 and 52 Series (Except 55 and 65 Styles)
   A. Front 59.6%
   B. Rear 40.4%
2. 55 and 65 Styles
   A. Front 53%
   B. Rear 47%
3. 54, 56, 58, 66, 84 and 86 Series
   A. Front 56%
   B. Rear 44%

DRUMS

1. 33, 34, 35, 36, 38 and 52 Series
   A. Inside Diameter . . . . 9.50"
   B. Out-Of-Round (Total Indicator Reading)
      (1) Front . . . . .005" Max.
      (2) Rear . . . . .006" Max.
2. 54, 56, 58, 66, 84 and 86 Series
   A. Inside Diameter . . . . 11.00"
   B. Out-Of-Round (Total Indicator Reading)
      (1) Front . . . . .005" Max.
      (2) Rear . . . . .006" Max.

LININGS

1. 33, 34, 35, 36, 38 and 52 Series
   A. Length - Primary . . . . 7-1/2"
   B. Length - Secondary . . . . 9-7/8"
   C. Width - Front . . . . 2-1/2"
   D. Width - Rear
      (1) 33, 34, 35, 36, 38 and 52 Series (Except 55 and 65 Styles) . . . . 2"
      (2) 55 and 65 Styles . . . . 2-1/2"
   E. Thickness
      (1) Primary . . . . 3/16"
      (2) Secondary . . . . 1/4"
2. 54, 56, 58, 66, 84 and 86 Series
   A. Length - Primary . . . . 9-3/8"
   B. Length - Secondary . . . . 12"
   C. Width - Front . . . . 2-3/4"
   D. Width - Rear
      (1) 54, 56, 58 and 66 Series . . . . 2"
      (2) 84 and 86 Series . . . . 2-1/2"
   E. Thickness
      (1) Primary . . . . 1/4"
      (2) Secondary . . . . 5/16"

GENERAL SPECIFICATIONS
(Cont'd)

HYDRAULIC SYSTEM

FLUID TYPE . . . . Supreme No. 11

FLUID LEVEL (Power or Standard) . . . . 1/4" ± 1/8" Below Master Cylinder Opening

MASTER CYLINDER BORE

A. All Except 52 Series with Power Brake . . . . 1.0"
B. 52 Series with Power Brake . . . . 7/8"
C. All Series with Heavy Duty Brakes, Except 52 Series . . . . 7/8"
D. 52 Series with Heavy Duty Brakes . . . . 1.0"

WHEEL CYLINDER BORE

1. 33, 34, 35, 36, 38 and 52 Series (Except 55 and 65 Styles)
   A. Front . . . . 1-1/16"
   B. Rear . . . . 15/16"
2. 55 and 65 Styles
   Front . . . . 1-1/16"
   Rear . . . . 1"
3. 54, 56, 58, 66, 84 and 86 Series
   A. Front . . . . 1-1/8"
   B. Rear . . . . 1.0"

ADJUSTMENTS

BRAKE SHOE (Standard and Power) . . . . Self-Adjusting

PEDAL HEIGHT (Floor Pan to Center of Pedal Pad)

1. 33, 34, 35, 36 and 38 Series

   A. Standard . . . . 7-1/2" ± 1/8"
   B. Power . . . . 5-1/4" ± 1/8"

2. 52, 54, 56 and 58 Series (Standard) . . . . 7-15/16" ± 1/8"

MAXIMUM ALLOWABLE BRAKE PEDAL TRAVEL (BEFORE ADJUSTMENT)

1. Standard . . . . 4.0"
2. Power . . . . 1-7/8"

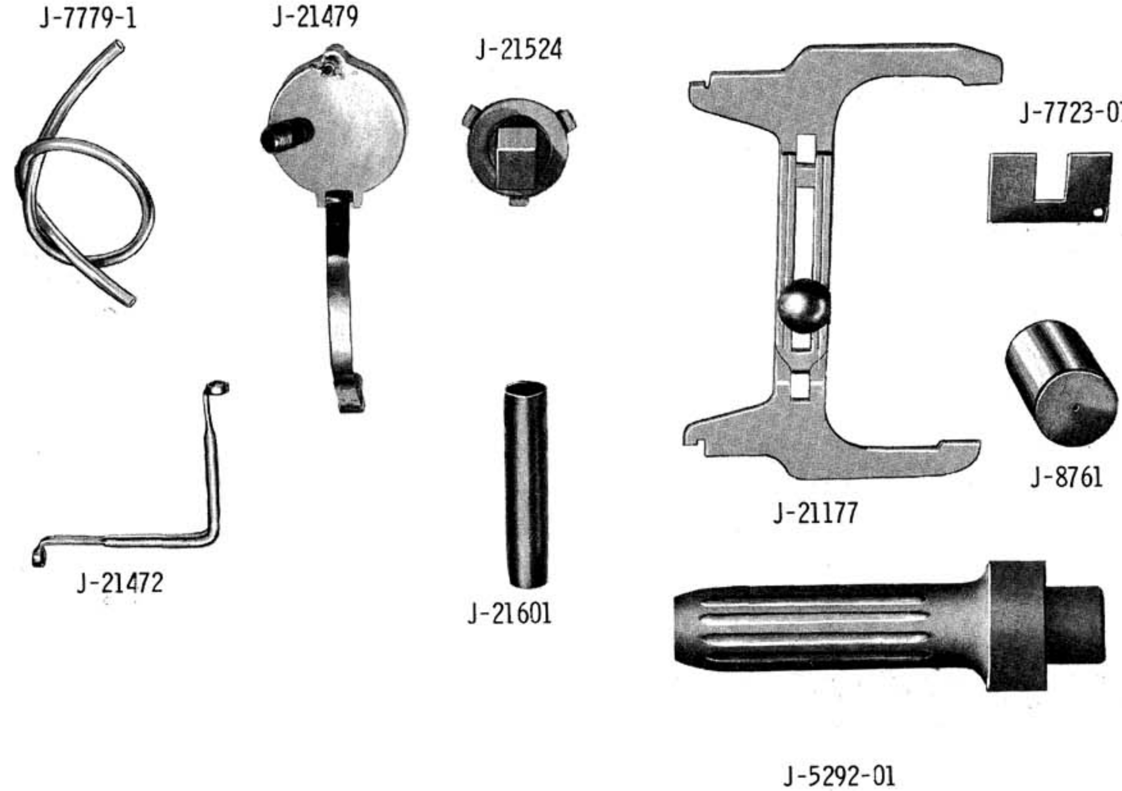
PARKING BRAKE (Adjust with parking brake released)

Equalizer . . . . Tighten equalizer adjusting nut until heavy drag is felt at rear wheels, then loosen nut seven turns.

TORQUE SPECIFICATIONS

NOTE: Specified torque is for installation of parts only. Checking of torque during inspection may be 15% below that specified.

Application	Ft. Lbs.
Front Brake Hose To Wheel Cylinder	35
Rear Brake Hose to Junction Block	28
Anchor Pin To Steering Knuckle Bolt	
54, 56, 58, 66, 84 and 86 Series	145
33, 34, 35, 36, 38 and 52 Series	105
Steering Arm To Steering Knuckle To Backing Plate Bolts and Nuts	
54, 56, 58, 66, 84 and 86 Series	140
33, 34, 35, 36, 38 and 52 Series	82
Backing Plate to Axle Housing Nuts	55
Wheel Cylinder To Backing Plate Cap Screws	16
Wheel Nuts	
33, 34, 35, 36, 38 and 52 Series	75
54, 56, 58, 66, 84 and 86 Series	85
Parking Brake Lever To Cowl	
33, 34, 35, 36, and 38	22
52 through 86 Series	7
Parking Brake Lever To Instrument Panel Cap Screws	7
Pedal Mounting Bracket To Instrument Panel Cap Screws	7
Pedal Mounting Bracket and Master Cylinder Bolts To Cowl	27
Pedal Pivot Bolt Nut	18
Master Cylinder Reservoir Cap (Bendix)	Finger Tight
Master Cylinder To Front Housing	27
Rear Housing To Cowl	27
Master Cylinder To Cowl	27



J-7779-1	Bleeder Hose	J-21177	Brake Drum and Shoe Gauge
J-21479	Pressure Bleeder Cap	J-8761	Hydra-Matic Front Pump Seal Installer (Used to Install Rear Seal in Kelsey-Hayes Power Brake)
J-21524	Vacuum Piston and Support Plate Remover and Installer	J-5292-01	Differential Side Bearing Installer (Used to Install the Rear Seal in the Kelsey-Hayes Power Brake)
J-7723-01	Push Rod Gauge		
J-21472	Bleeder Valve Wrench		
J-21601	Floating Valve Retainer Installer (Moraine)		

Fig. 11-67 Tools

INSTRUMENT PANEL AND ACCESSORIES

(52-54-56-58-66-84 & 86 SERIES)

CONTENTS OF SECTION 12

INSTRUMENT PANEL

The instrument panel lower section is a removable panel and is retained by bolts and sheet metal screws. All instruments and units can be removed without removing the instrument panel lower section, with the exception of the safety pad and the speedometer trim ring.

Remove and Install

1. Disconnect battery.
2. Remove windshield side garnish moldings.
3. Remove steering column clamp.
4. If equipped with air conditioning, remove manifold and hoses to gain access.
5. Remove shift indicator needle.
6. Disconnect following electrical leads at:
   a. Wiper switch.
   b. Main light switch.
   c. Fuel gauge.
   d. Printed circuit.
   e. Clock.
   f. Lighter.
   g. Ignition switch light.

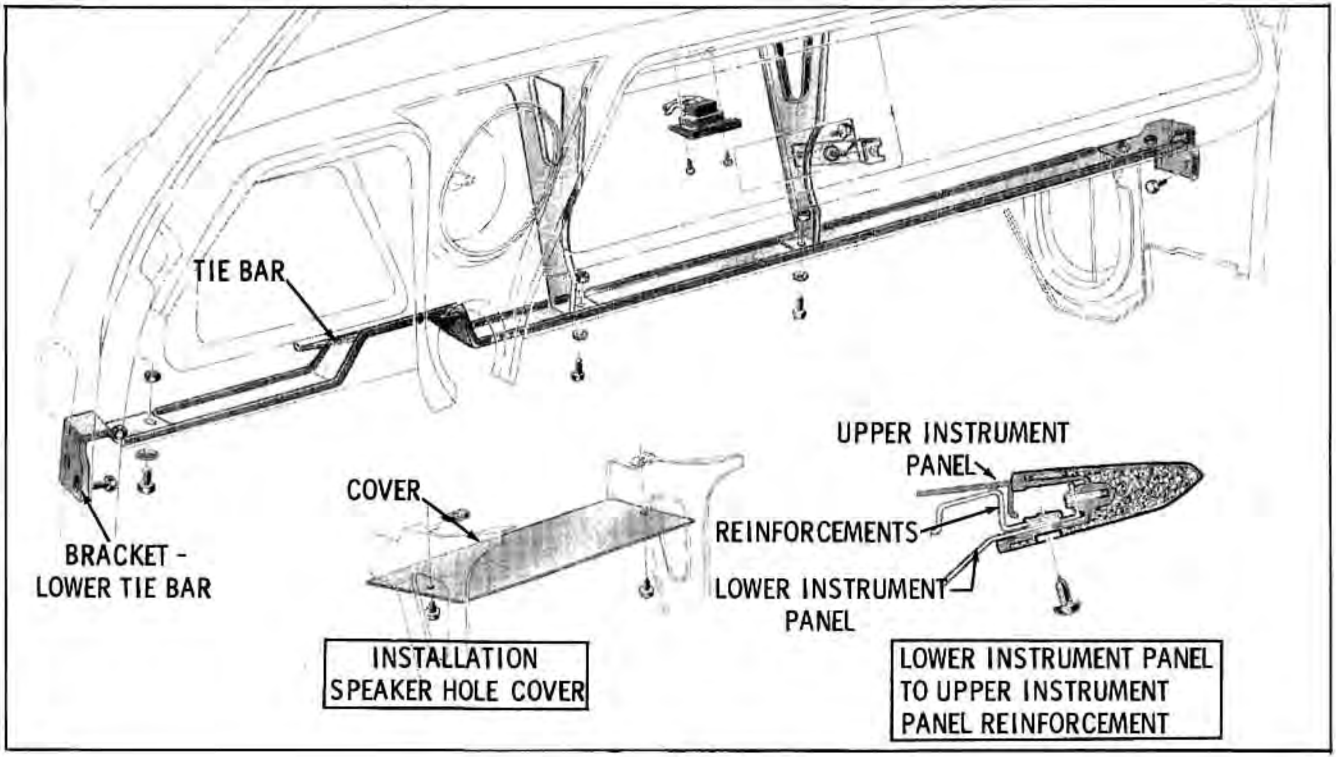


Fig. 12-1 Instrument Panel Attachment

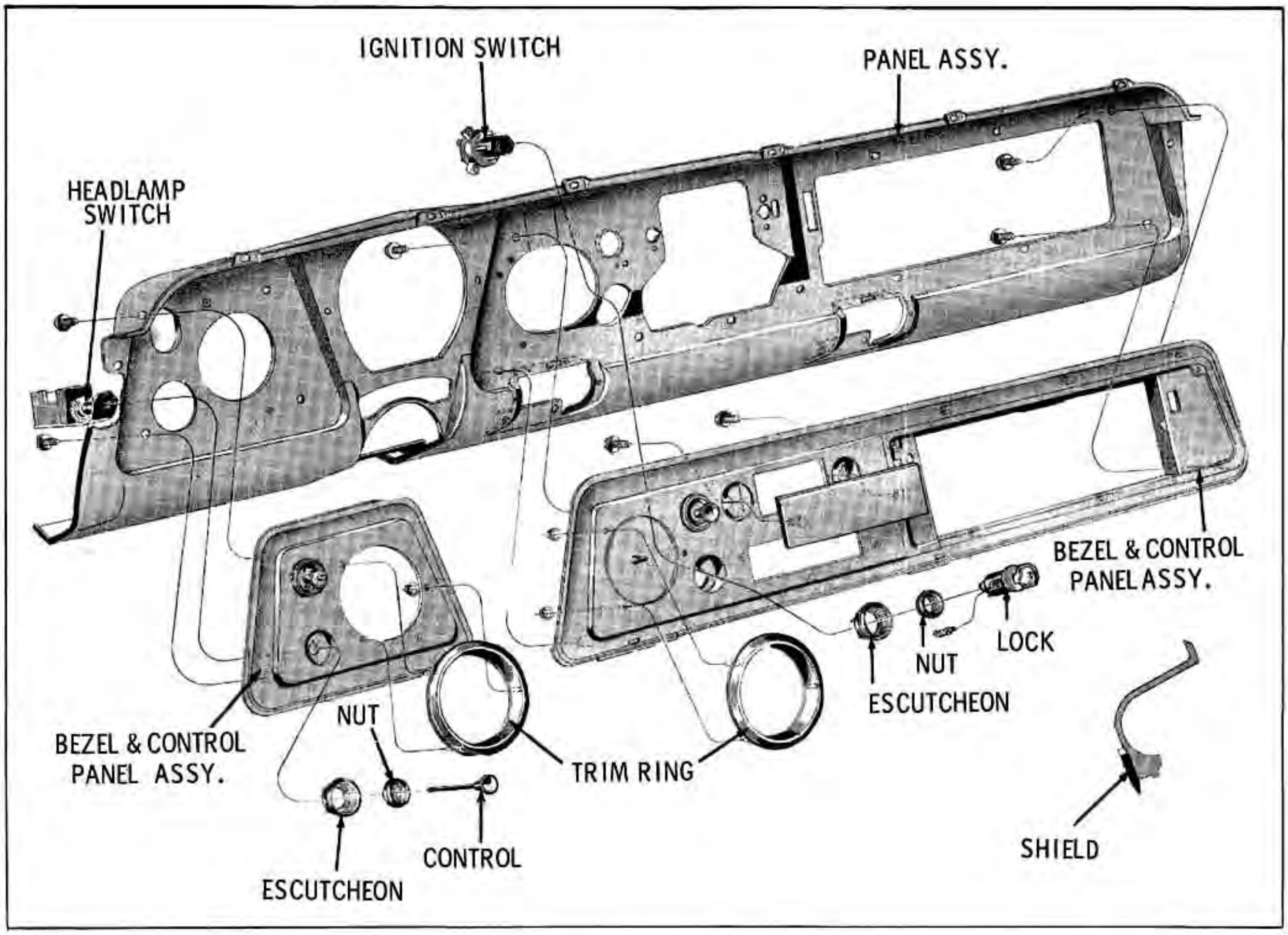


Fig. 12-2 Instrument Panel Attachments

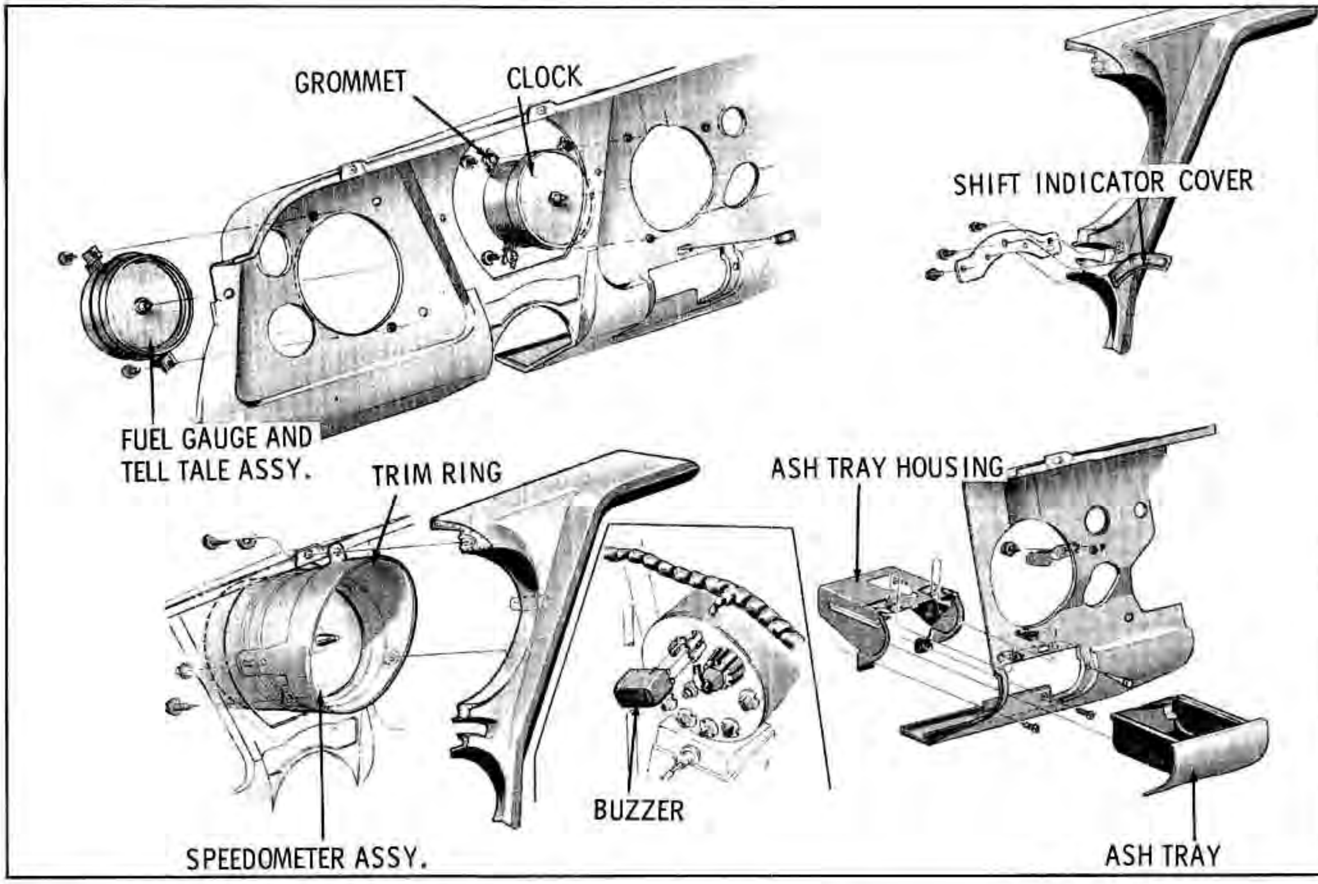


Fig. 12-3 Instrument Panel Attachments

h. Guide-Matic lead at amplifier.

i. Radio.

j. Courtesy light.

7. Remove the following from the panel but do not disconnect.

   a. Cruise Control head.

   b. Ignition switch.

   c. Temperature control assembly.

8. Remove instrument panel attaching screws and remove panel assembly.

9. To install the lower panel assembly, reverse the removal procedure.

INSTRUMENTS

All the instruments are electrically operated, except the speedometer and Hydra-Matic indicator which are mechanically operated. A speed warning device (Safety Sentinel) is offered as optional equipment on all models. A knob on the speedometer cluster allows the driver to pre-set his desired speed. When this speed is reached, a light goes on and a buzzer sounds.

The generator, temperature, and oil pressure indicators use colored lights to warn the driver of conditions other than normal when the engine is operating at speeds above idle or is at normal operating temperature.

When removing an instrument cluster light bulb, the bulb must be pulled straight out of the socket. Before installation of the bulb, be sure bulb wires are parallel with the center line of the bulb to prevent a short or open circuit. (Fig. 12-7)

FUEL GAUGE AND TELLTALE ASSEMBLY

Removal and Installation

1. Disconnect battery.

2. If equipped with Cruise Control, it may be necessary to loosen the control switch mounting bracket to gain access.

3. If equipped with air conditioning, remove L.H. hose.

4. Disconnect printed circuit plug.

5. Remove the two assembly attaching screws.

To install the assembly, reverse the removal

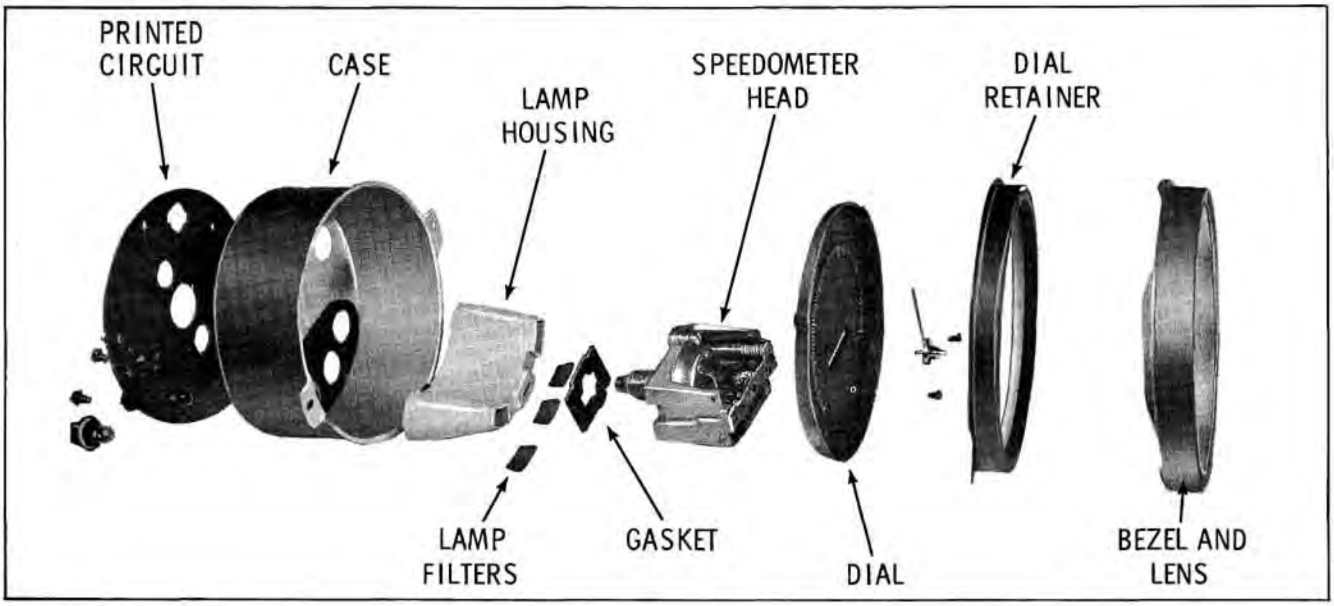


Fig. 12-4 Speedometer Cluster

procedure. For disassembly of the telltale assembly, refer to Fig. 12-6.

SPEEDOMETER CLUSTER

Removal and Installation

1. Disconnect battery.
2. If equipped with air conditioning, remove manifold and L.H. hose.
3. Disconnect speedometer cable and printed circuit plug.
4. Remove the two assembly attaching nuts.
5. To install, reverse the removal procedure.

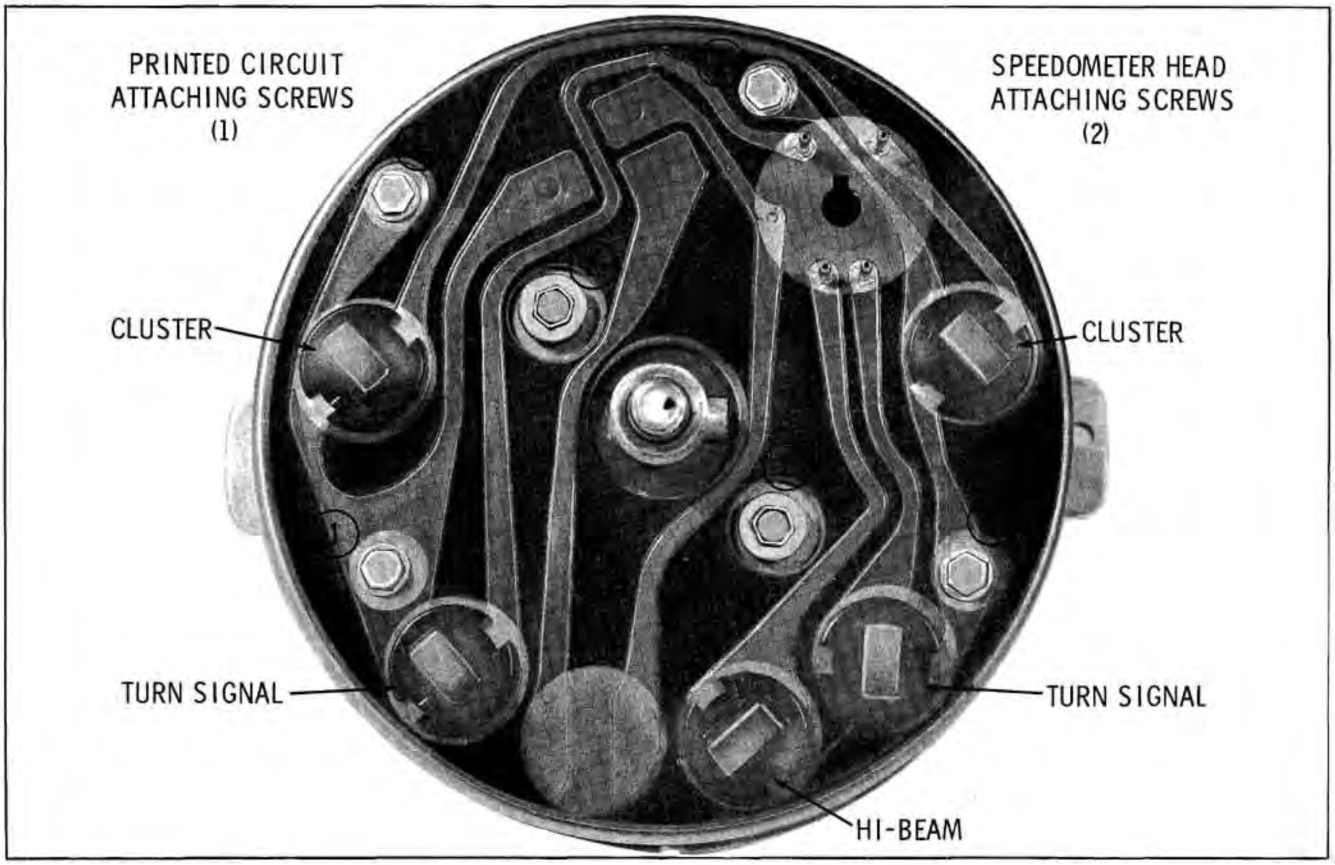


Fig. 12-5 Rear View of Speedometer Cluster

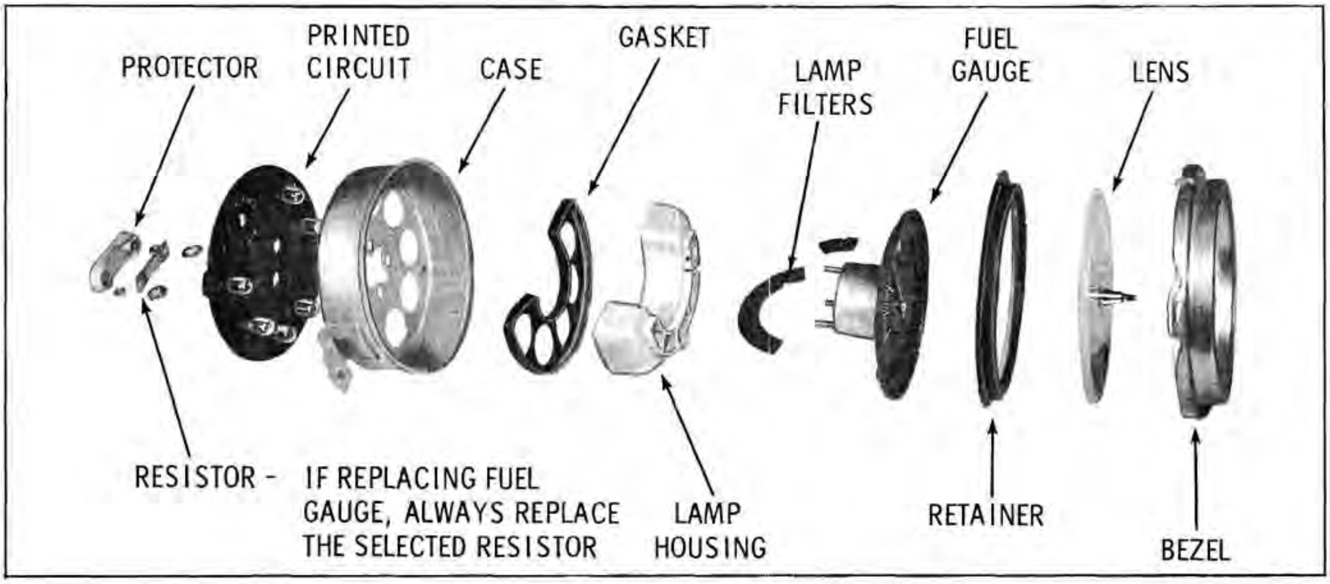


Fig. 12-6 Fuel Gauge and Telltale Assembly

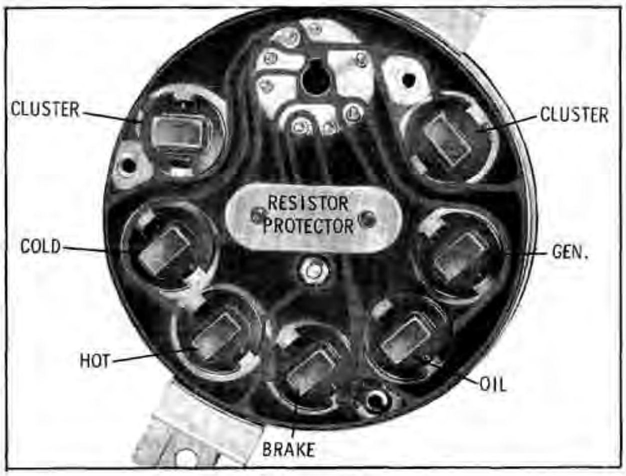


Fig. 12-7 Rear View of Fuel Gauge and Telltale Assembly

For disassembly of the cluster, refer to Fig. 12-4.

CLOCK (Fig. 12-3)

Removal and Installation

1. Disconnect battery.
2. If equipped with air conditioning, remove manifold.
3. Disconnect feed wire and remove lightbulb socket.
4. Remove the three attaching screws.
5. To install, reverse the removal procedure.

INSTRUMENT PANEL COMPONENTS

INSTRUMENT PANEL BEZELS

The bezels are attached to the instrument panel by screws, all accessible from the rear side without removing the instrument panel assembly.

L.H. Bezel—Removal (Fig. 12-9)

1. Disconnect battery.
2. Remove fuel gauge and telltale assembly.
3. Remove light switch.
4. Remove windshield wiper switch.
5. Remove the four attaching screws and remove bezel and control panel.

R.H. Bezel—Removal (Fig. 12-9)

1. Disconnect battery.
2. If equipped with air conditioning, remove manifold and hoses.
3. Remove the defroster manifold.
4. Remove clock.
5. Remove lighter.
6. Remove ignition switch.
7. Remove temperature control assembly.
8. Remove radio.
9. Remove glove box, glove box door and light assembly.
10. If equipped with Guide-Matic, disconnect amplifier.
11. Remove the twelve bezel attaching screws and remove bezel and control panel.

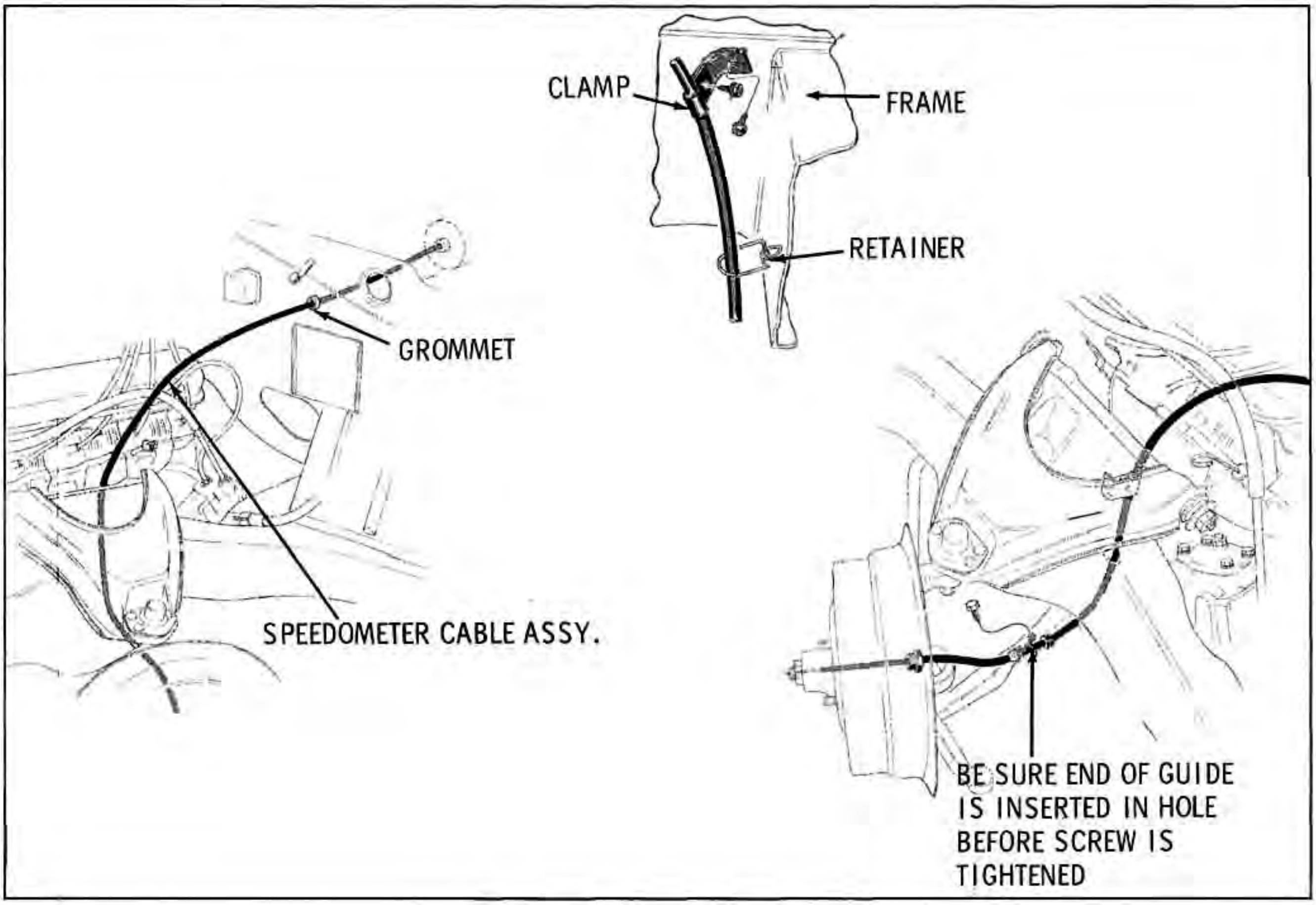


Fig. 12-8 Speedometer Cable

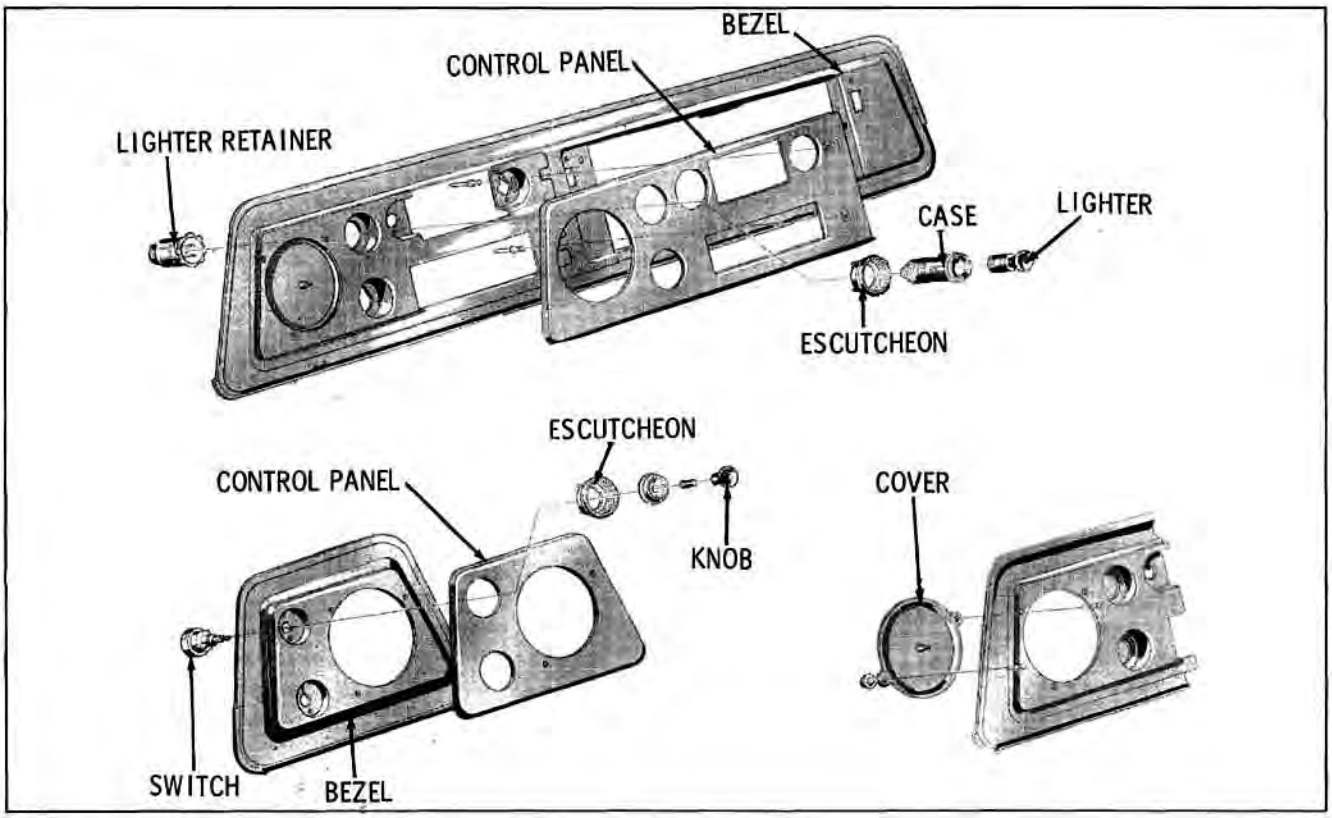


Fig. 12-9 Instrument Panel Components

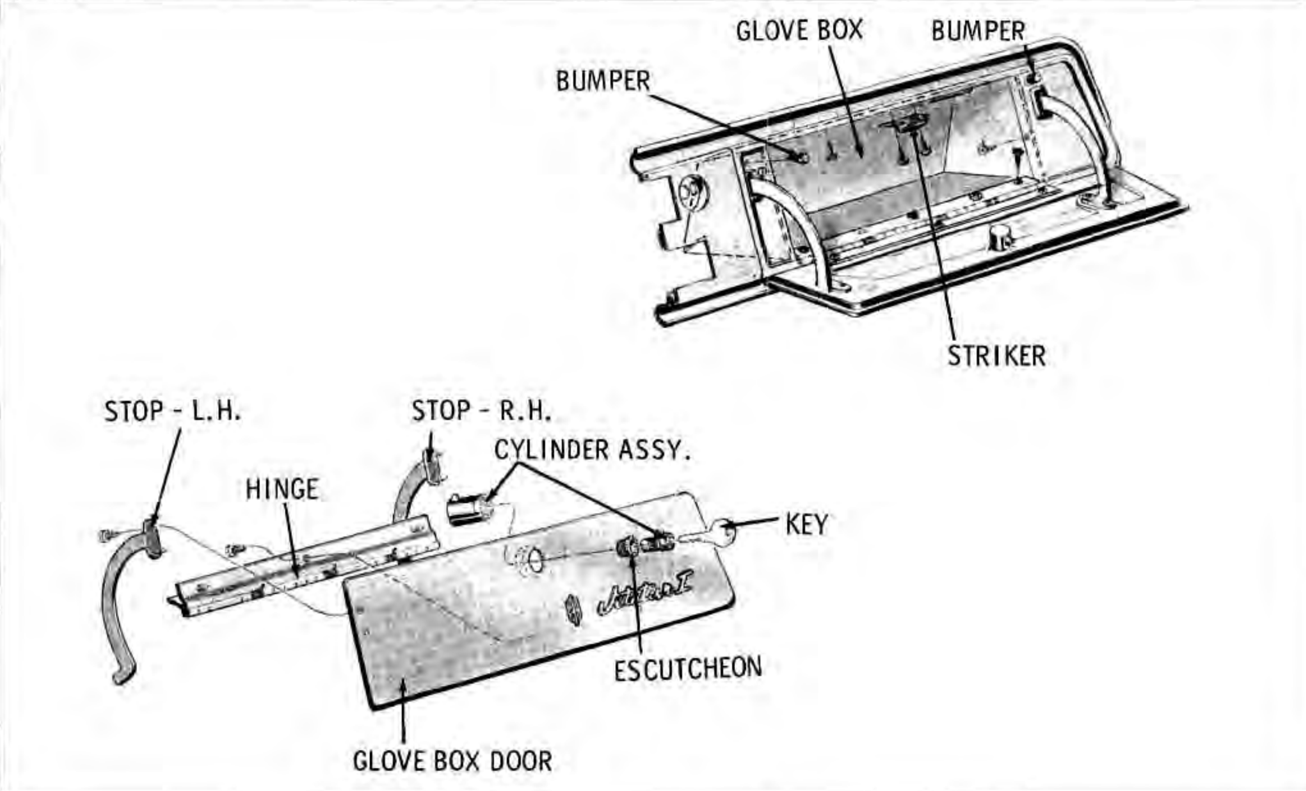


Fig. 12-10 Glove Box Assembly

Installation

To install, reverse the removal procedure. Replace all anti-squeak material as shown in Fig. 12-12.

CONTROL PANELS

The control panels are serviced separately. To replace the left hand bezel, it is necessary to remove only the escutcheons and the fuel gauge and telltale assembly to gain access to the trim ring. To gain access to the right hand bezel, it is necessary to remove the right hand bezel assembly.

SPEEDOMETER CABLE

Removal and Installation (Fig. 12-8)

1. Disconnect cable from speedometer head.
2. Remove the speedometer cable clamp.
3. Remove the grommet from the cowl and withdraw cable.
4. Loosen the cable housing retaining nut at the knuckle, then thread the cable through the guide.
5. To install, reverse removal procedure.

NOTE: If the cable housing retaining nut cannot be readily started into the knuckle, the cable is not indexed with the dust cap. Rotate wheel or drive cable slightly to index drive cable.

MISCELLANEOUS PANEL COMPONENTS

The various instrument panel components are attached as shown in Fig. 12-2, 12-3 and 12-9.

CONSOLE

NOTE: Tachometer - refer to Instrument Panel 33 through 38 Series.

The console is assembled in three sections: console body, safety pad (LH) and safety pad (RH). The tachometer or vacuum gauge can be removed by removing one screw at the rear of tachometer housing. Hydra-Matic indicator components, neutral safety and back-up lamp switch can be serviced after removing the selector handle and control panel. For detailed disassembly and assembly, refer to Figs. 12-14, 12-15, 12-16, 12-17, 12-18, 12-19 and 12-20.

ACCESSORIES

RADIO (Figs. 12-22 and 12-23)

Three types of radios are available: Deluxe, Super Deluxe and AM-FM. The receiver circuit

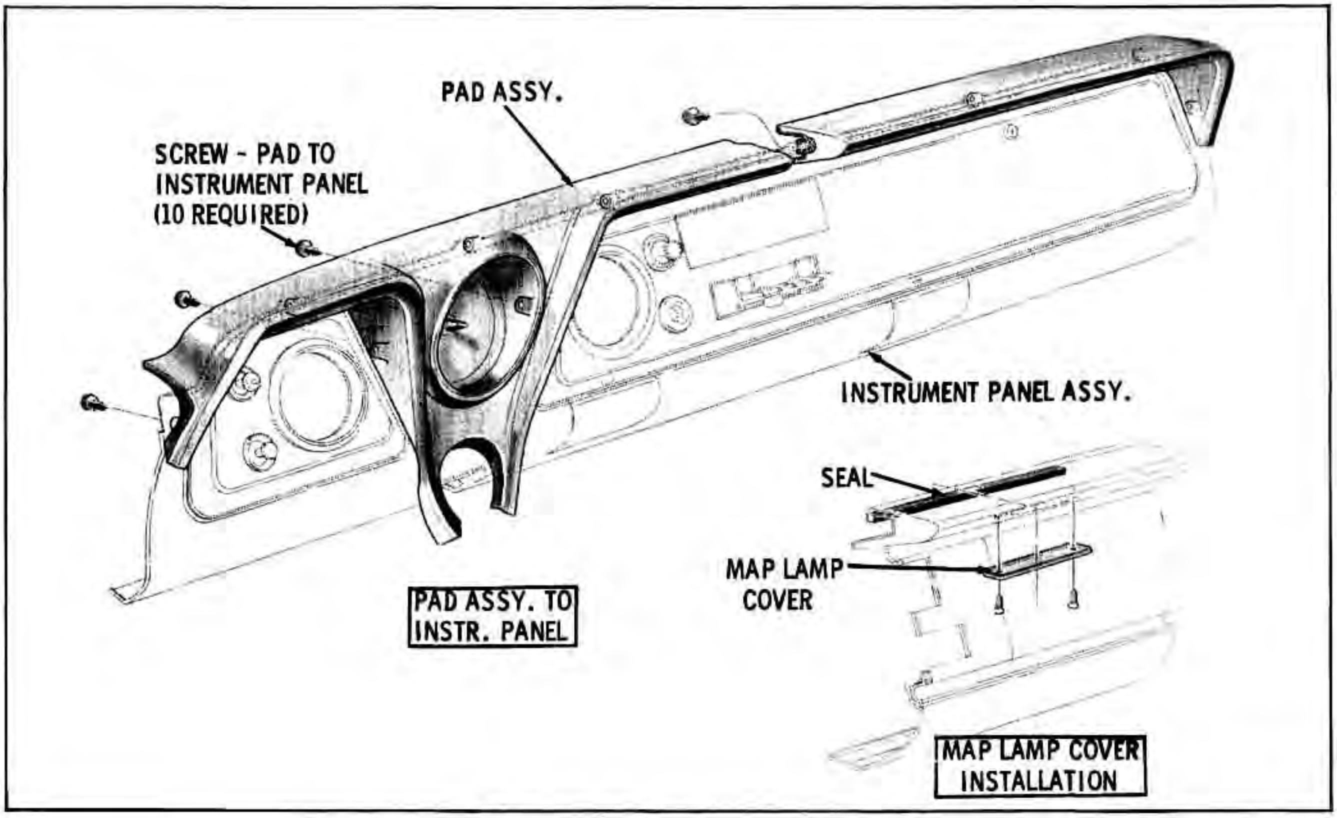


Fig. 12-11 Safety Pad Attachment

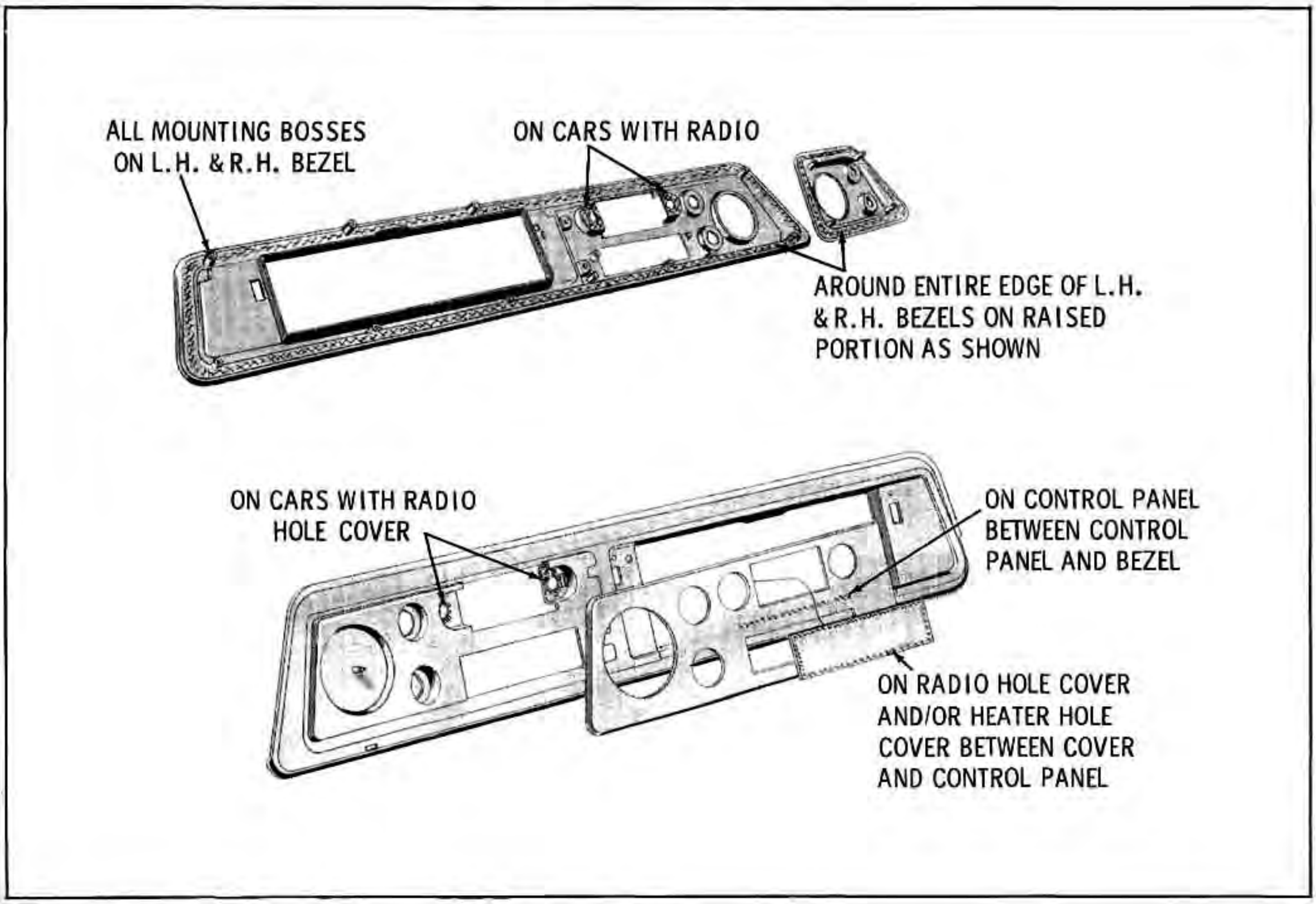


Fig. 12-12 Anti-Squeak Application

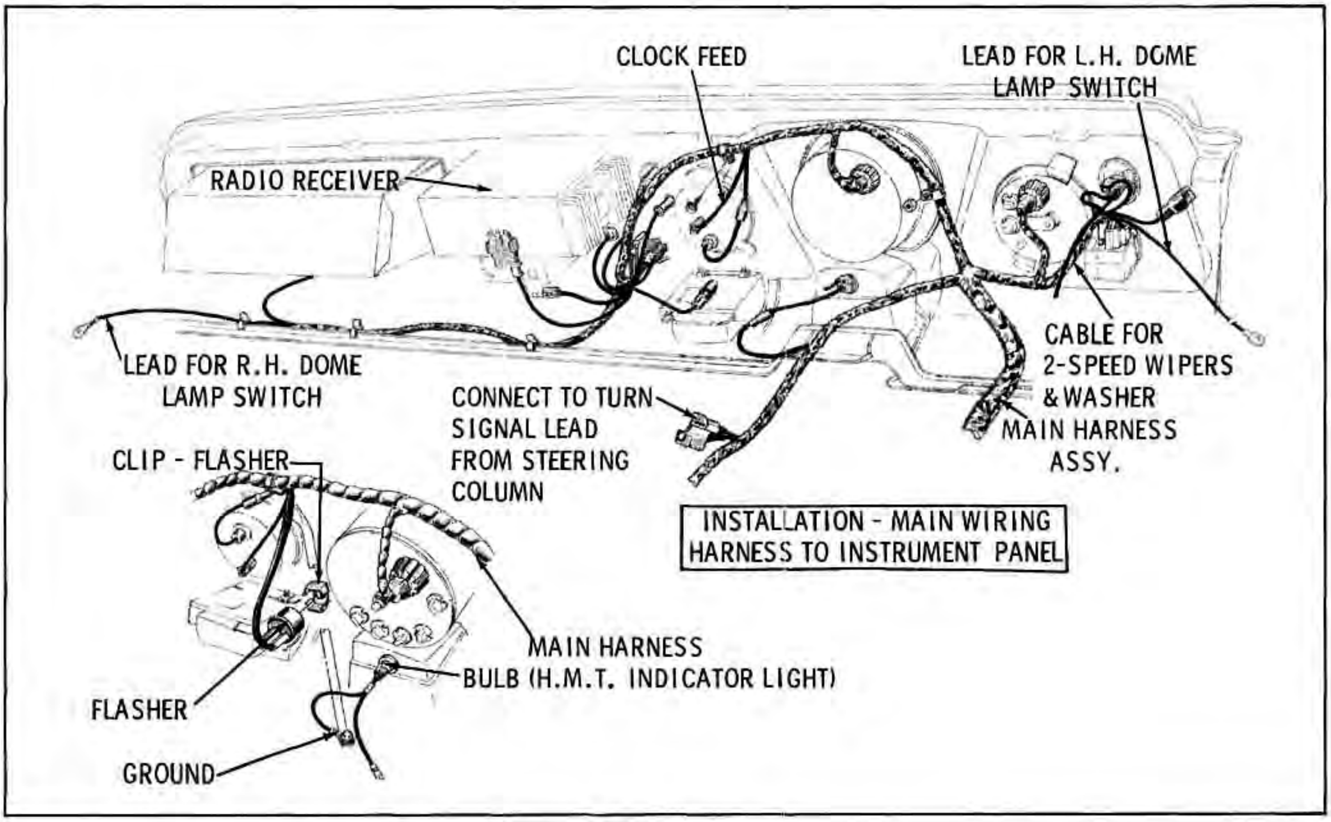


Fig. 12-13 Instrument Panel Wiring

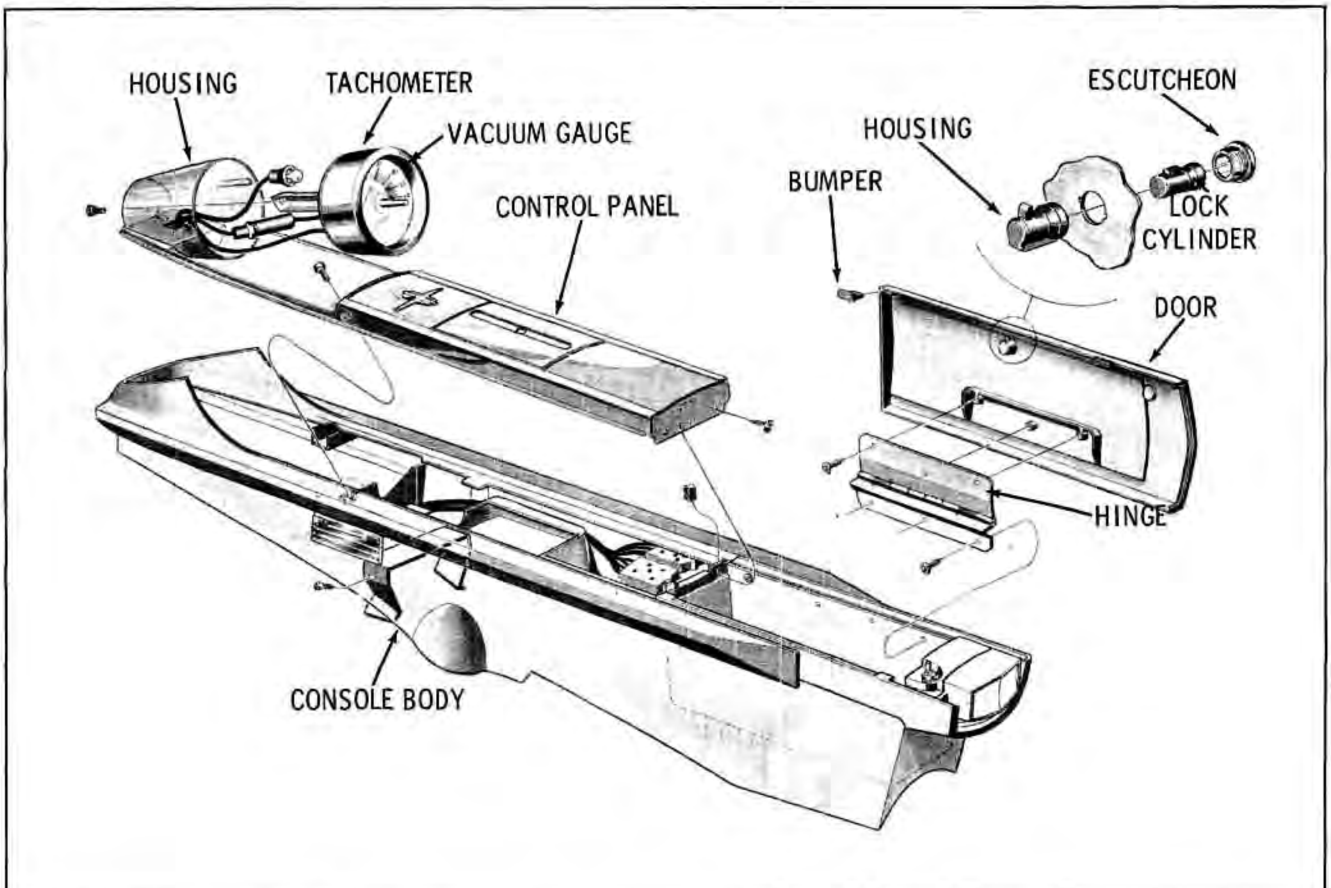


Fig. 12-14 Console Components

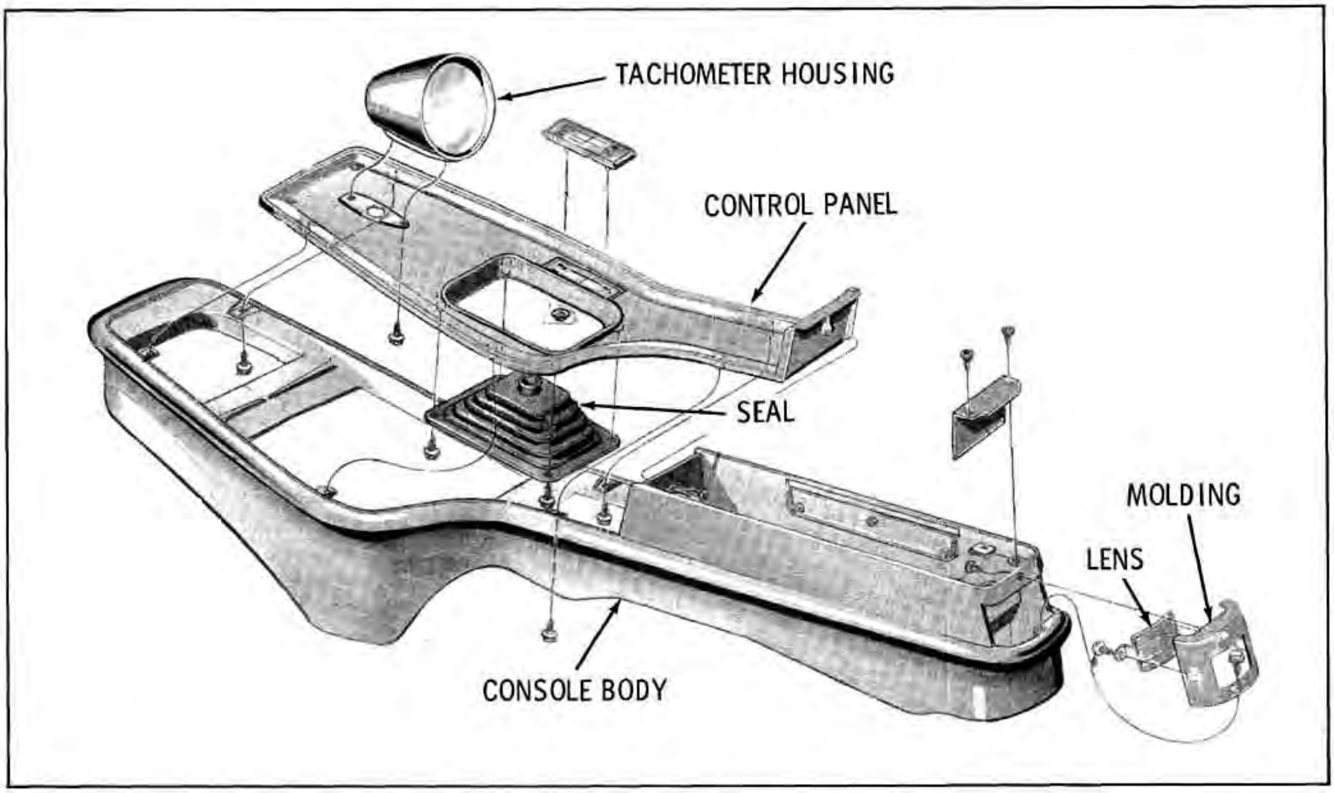


Fig. 12-15 Synchromesh Console

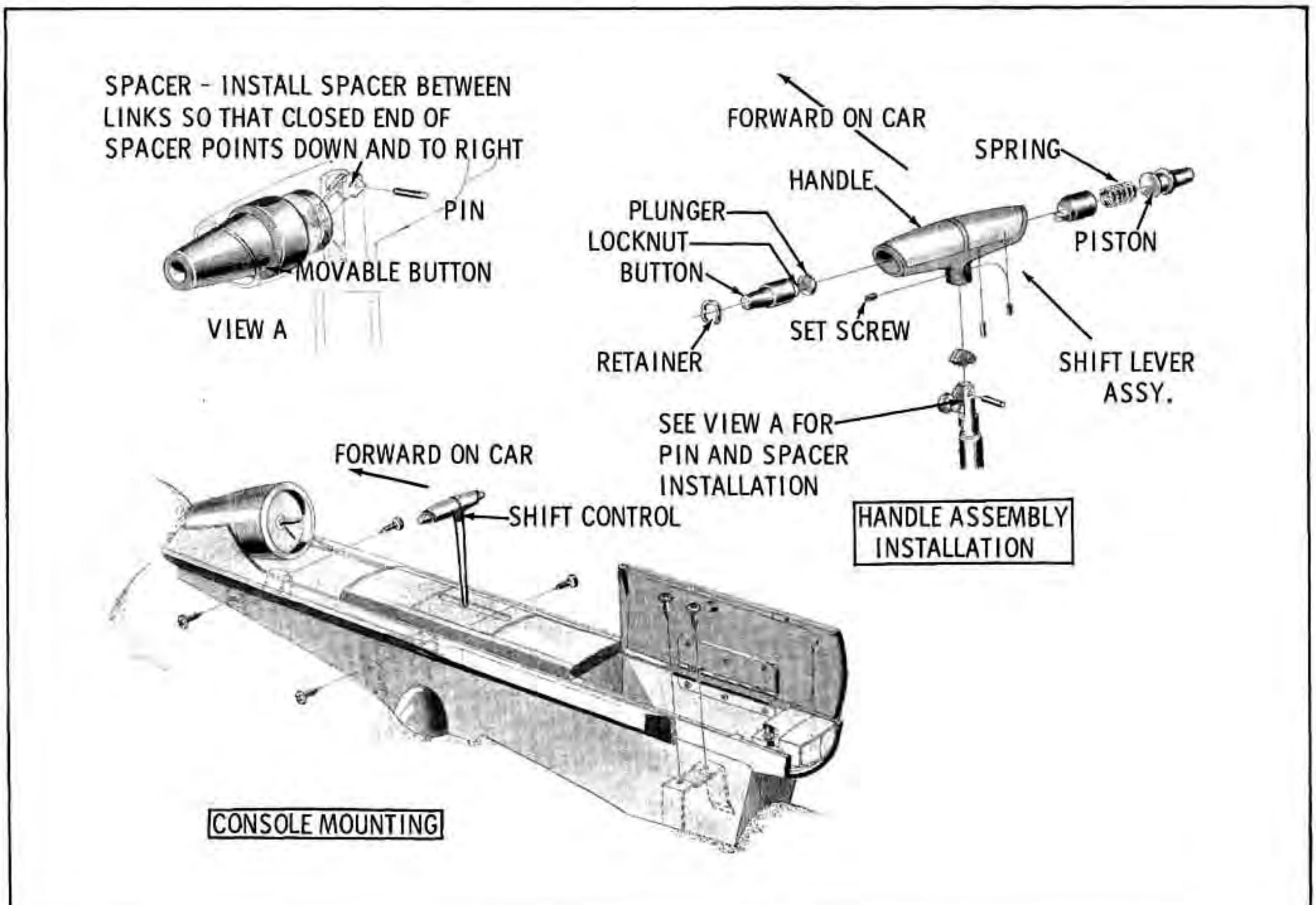


Fig. 12-16 Shift Control Installation

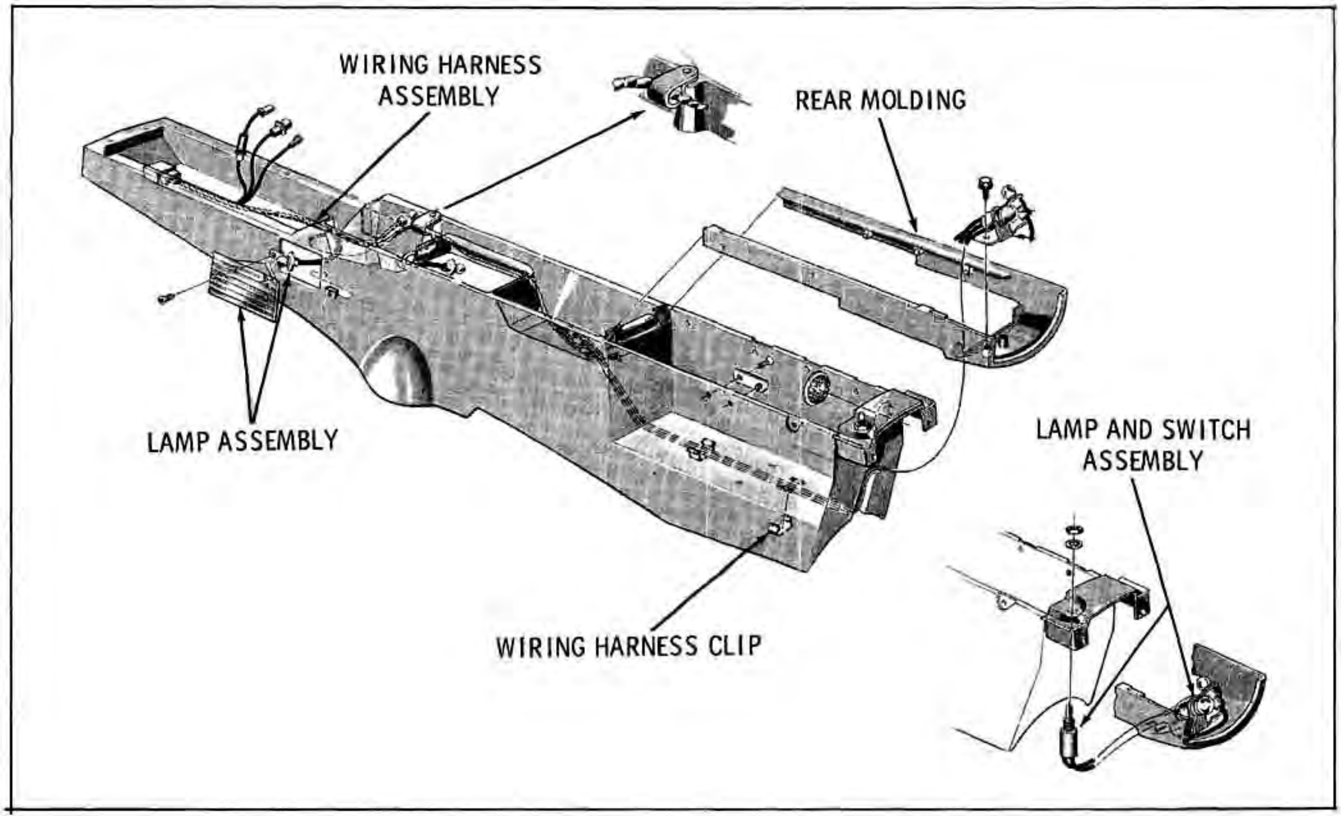


Fig. 12-17 Console Wiring

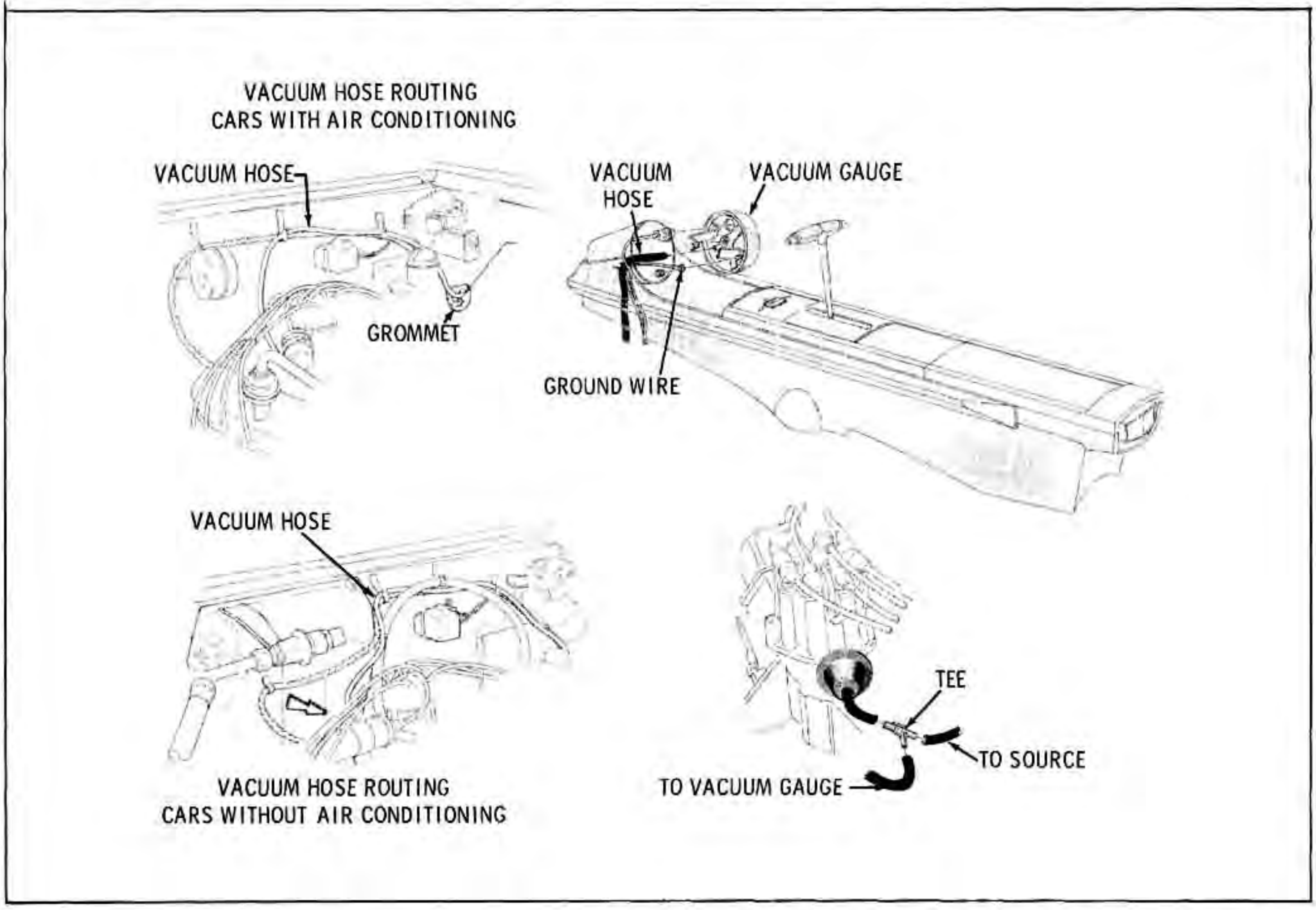


Fig. 12-18 Console Vacuum, Gauge

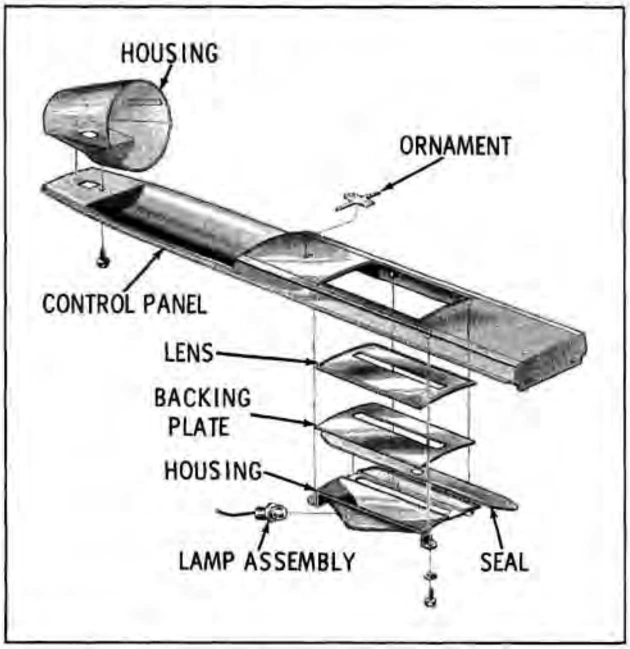


Fig. 12-19 Control Panel Attachment

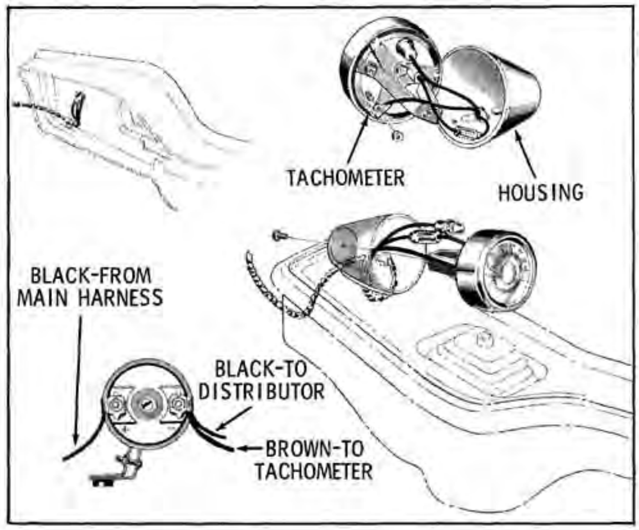


Fig. 12-20 Tachometer Attachment (Synchromesh Console)

in all radios is transistorized. The outer left knob operates the On-Off switch and volume control, while the inner left knob operates the tone control. The right hand outer knob controls manual tuning of the radio.

On cars equipped with a rear seat speaker, a variable type control located behind the manual tuning knob modulates both the front and rear speakers simultaneously. As the control is turned counterclockwise, the volume of the front speaker increases while the volume of the rear speaker decreases. As the control is turned clockwise, the volume of the front speaker diminishes while the volume of the rear speaker increases. After the desired speaker modulation is obtained, the volume of both speakers can be regulated by the volume control knob.

All radios have five pushbuttons for touch tuning, which mechanically tunes the radio to preselected stations, and a control knob for manual selection of stations.

In addition to pushbutton tuning, the Super Deluxe model features automatic tuning. Depressing

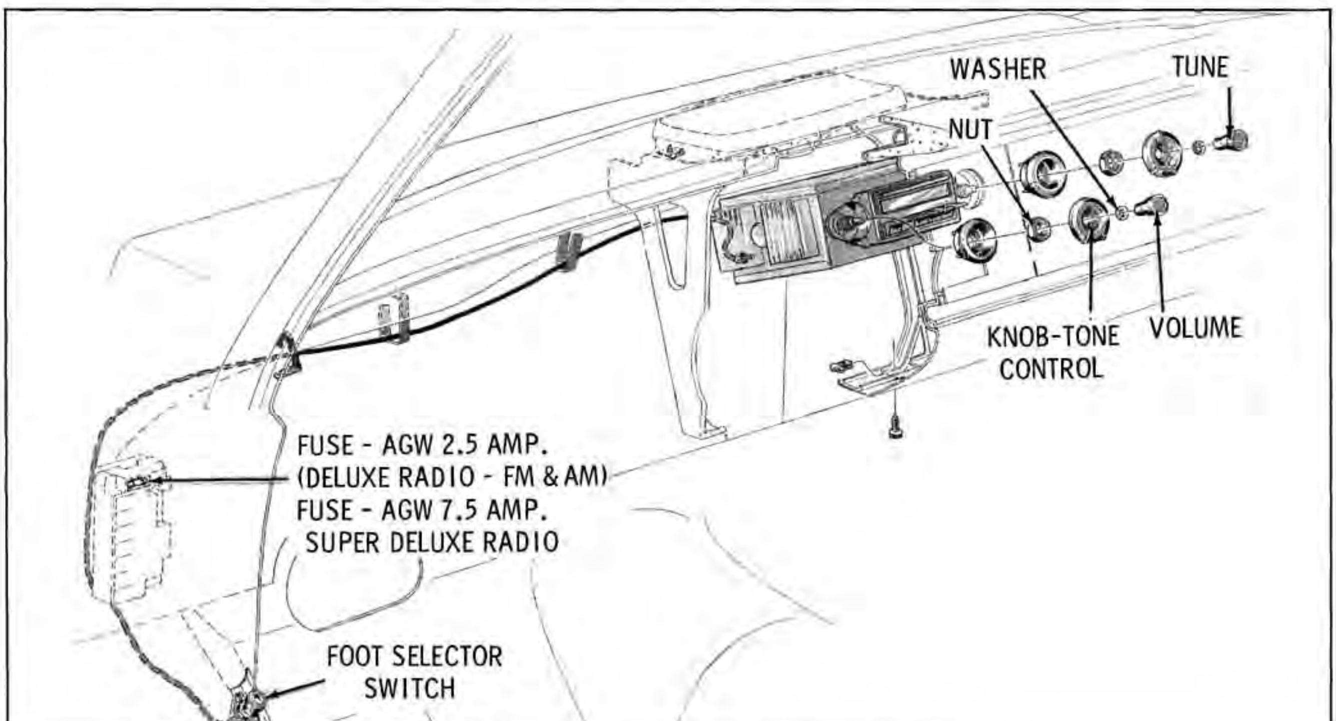


Fig. 12-21 Radio Installation

Fig. 12-22 Super Deluxe Radio

Fig. 12-23 AM-FM Radio

the foot selector switch (Fig. 12-21) or the center push bar, rejects any station previously selected and automatically selects and tunes the next available station.

The sensitivity of the automatic tuning mechanism can be increased or decreased by the sliding lever located under the bar. The lever has three positions. When the lever is to the left, only the stronger or local stations will be received. The sensitivity can be increased by moving the lever to the middle or extreme right position.

Remove and Install (Fig. 12-21)

1. Disconnect battery.
2. If equipped with air conditioning, remove manifold.
3. Remove defroster manifold.
4. Remove radio knobs, washers or rear seat speaker control.
5. Remove radio attaching nuts and escutcheons.
6. Disconnect all wiring and antenna lead-in.
7. Remove lower radio support bracket attaching screw.
8. Remove radio from the rear of the instrument panel.

To install, reverse removal procedure.

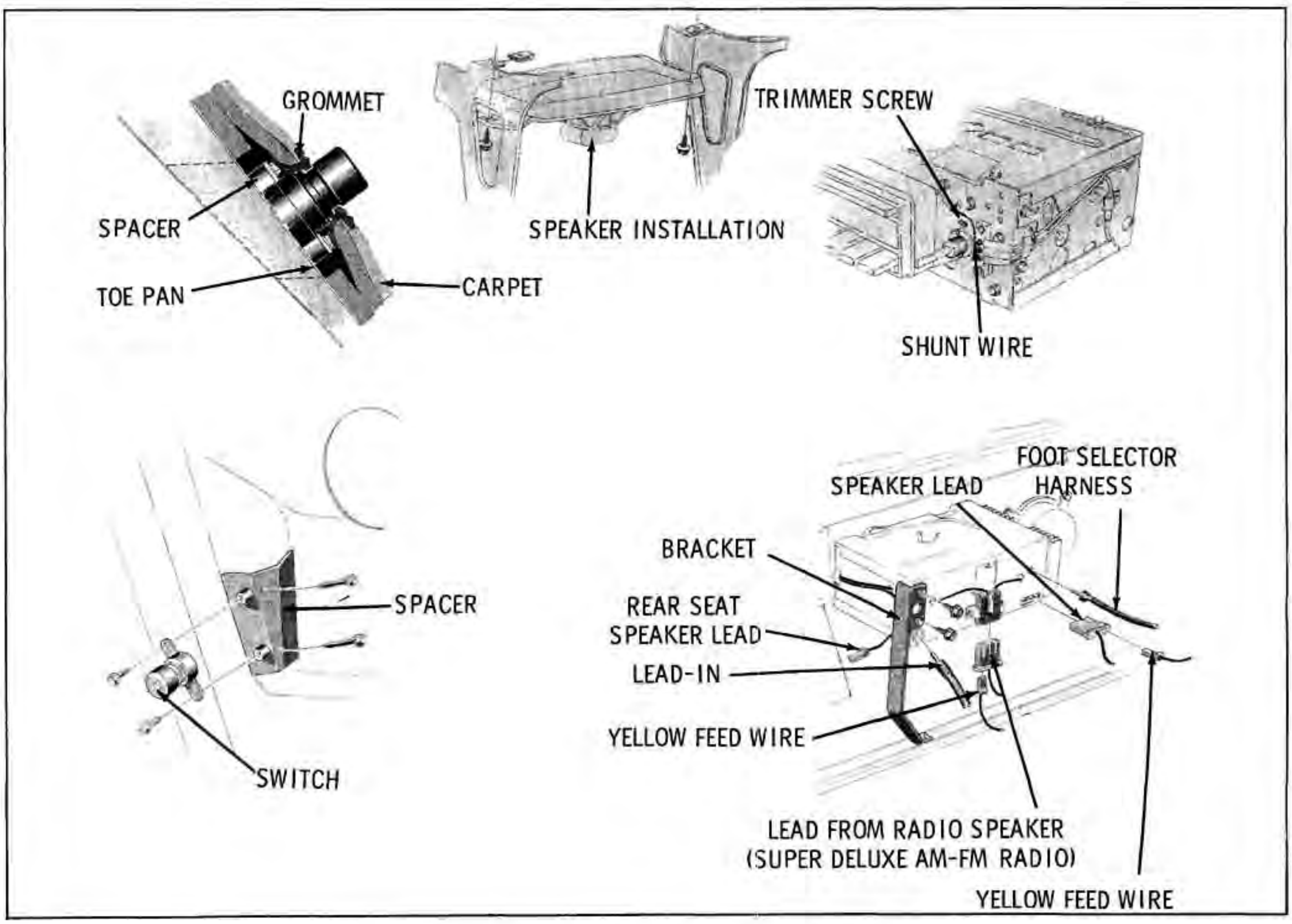


Fig. 12-24 Radio and Speaker Attachment

PUSHBUTTON ADJUSTMENT

Adjustment of the mechanical pushbutton tuning system on the Deluxe, Super Deluxe and AM-FM models is the same.

1. Turn on the receiver.
2. Select a pushbutton for desired station. Pull the button slightly to the left and then out as far as it will go.
3. Tune in the desired station manually.
4. Push the selected button to its maximum in position. This is the locking operation.
5. Proceed in the same manner for the remaining stations.
6. After all the buttons have been adjusted, recheck the settings. Push each button, then see if the station can be tuned in more accurately manually. If so, repeat Step 2 and reset the station manually.

   NOTE: Any single pushbutton on the AM-FM radio may be adjusted for either AM or FM reception. When a push button is adjusted for FM, it cannot be used for selecting a station on AM without first readjusting the pushbutton for AM.

AM-FM RADIO (Fig. 12-23)

AM or FM radio broadcasts may be selected by sliding the control switch located above the radio dial, to the right or left. The letters AM or FM will appear in the upper left or right corners of the control panel, indicating the type of broadcast being received.

Normal FM reception will be almost noise-free unless the radio is tuned to a weak station in a fringe area. It may be necessary, while driving, to manually retune FM stations slightly to maintain peak reception. The average FM station coverage is approximately 20 to 30 miles.

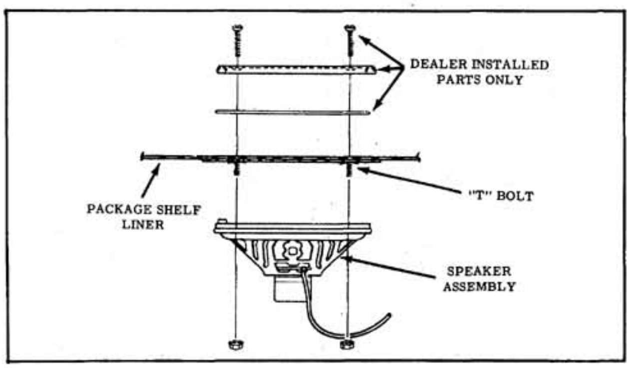


Fig. 12-25 Rear Seat Speaker

NOTE: Maximum FM reception is obtained with the antenna extended approximately 30 inches.

TRIMMER ADJUSTMENT (Fig. 12-24)

1. Extend antenna to approximately 30 inches.

   NOTE: AM-FM radio must be set on the AM band.

2. Remove the manual tuning knob and escutcheon or rear seat speaker fader control, if so equipped.
3. If car is equipped with a rear seat speaker, insert a shunt wire as shown in Fig. 12-24.

   NOTE: Do not turn on radio unless shunt wire is installed.

4. Turn the volume control full on and tune the receiver to a weak station at approximately 1400 kilocycles.
5. With a small screwdriver, adjust the antenna trimmer until loudest signal is received.
6. Turn off radio. Remove shunt wire, if equipped with a rear seat speaker.

RADIO DIAL LIGHT

The radio dial light on the Deluxe AM-FM and Super Deluxe radios is located on top of the receiver and can be removed after removing the radio.

FOOT SELECTOR SWITCH—REMOVAL (Fig. 12-22) (Super Deluxe Radio)

1. Fold floor mat to expose foot switch and remove attaching screws.
2. Remove foot switch wiring lead from clips along upper side of dash, then remove plug-in connector from the rear of the radio receiver.

To install switch, reverse the removal procedure.

SPEAKERS

Rear Speaker Removal

The rear seat speaker is mounted under the parcel shelf and is accessible through the rear compartment. To remove speaker:

1. Disconnect lead from terminal.

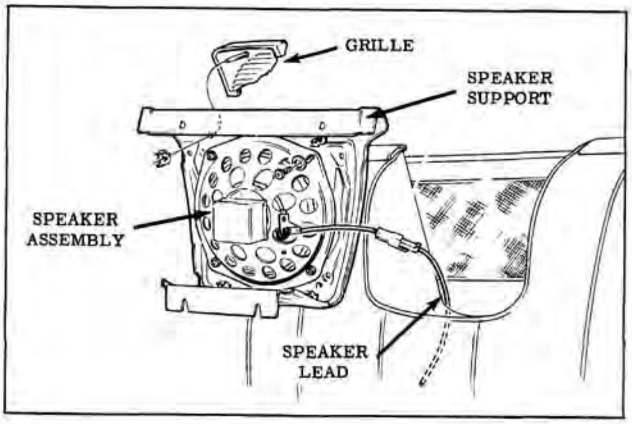


Fig. 12-26 Rear Seat Speaker (67 Style)

2. Remove four mounting locknuts while supporting speaker to prevent it from dropping. (Fig. 12-25)

To install, reverse removal procedure, being careful to avoid damaging the speaker cone while aligning the speaker assembly over the mounting screws.

CONVERTIBLES

The rear seat speaker on convertibles is

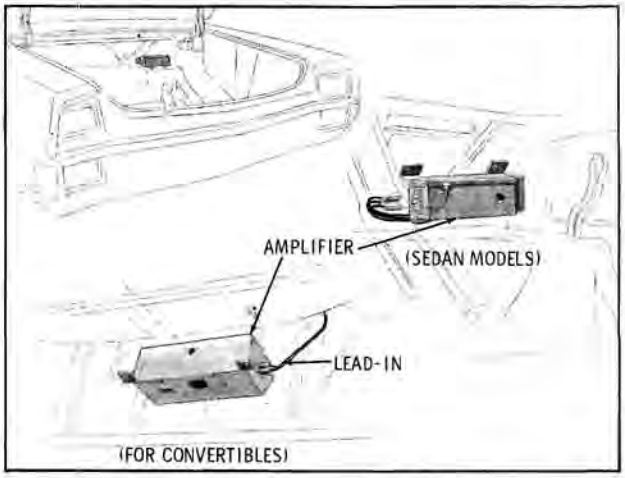


Fig. 12-28 Amplifier Location

mounted on the rear seat back. To remove speaker, proceed as follows:

1. Remove rear seat cushion.
2. Remove the upper two body to seat back attaching screws, accessible from the rear compartment.
3. Remove the two lower seat back attaching screws and tip seat back forward.

NOTE: Place protective covering on floor panel to prevent soiling of seat back.

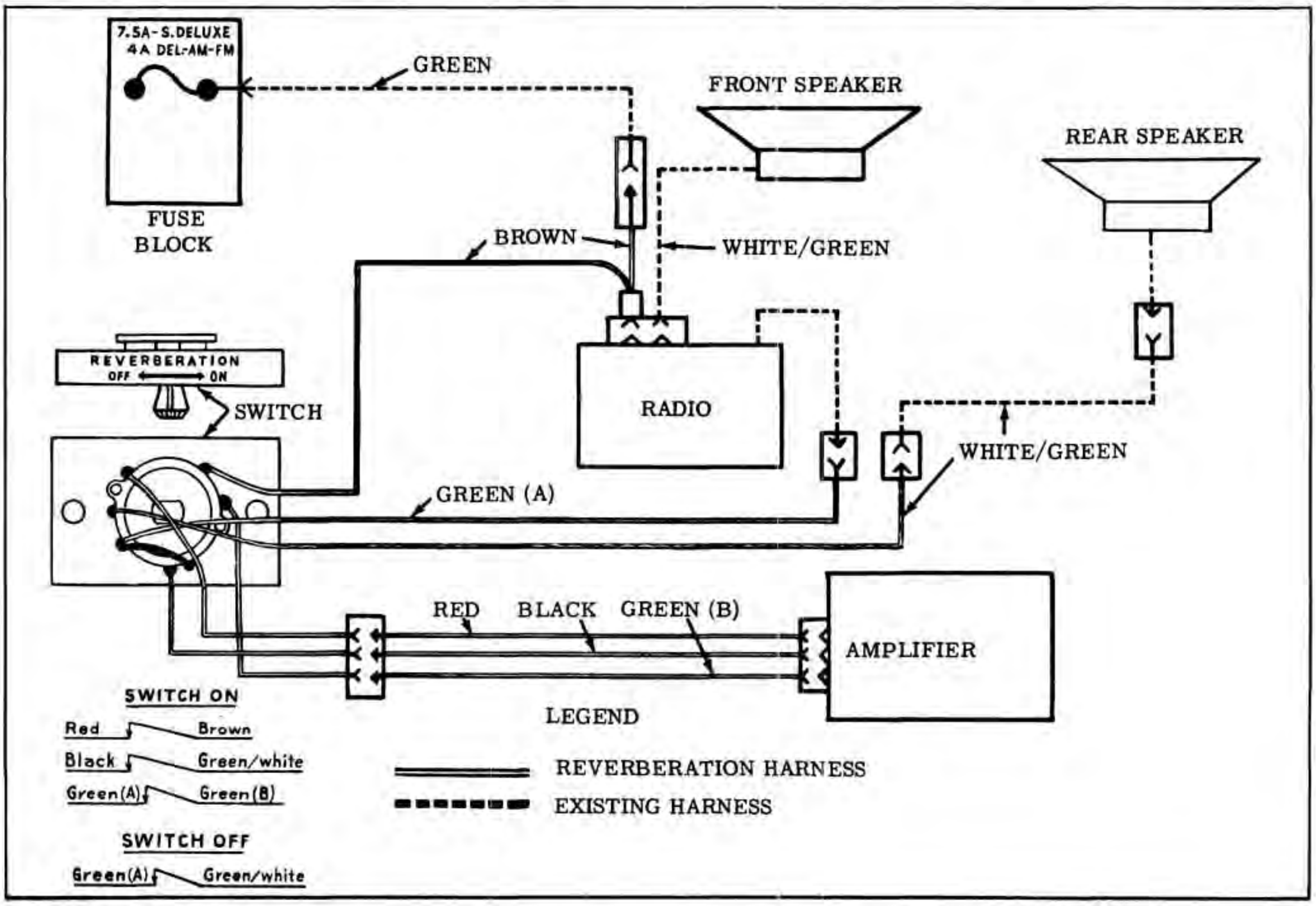


Fig. 12-27 Reverberation Schematic

4. Remove four speaker assembly to seat back attaching screws.

5. Disconnect lead wire from speaker. Remove the four speaker attaching screws and remove speaker. (Fig. 12-26)

6. If speaker grille is to be replaced, it can be removed by removing the four self-threading attaching nuts.

7. To install, reverse removal procedure.

REVERBERATOR REAR SEAT SPEAKER

REVERBERATION SCHEMATIC (Fig. 12-27)

Amplifier

The location and installation of the reverberator amplifier is shown in Fig. 12-28.

Wiring

The location of the instrument panel wiring is shown in Fig. 12-29.

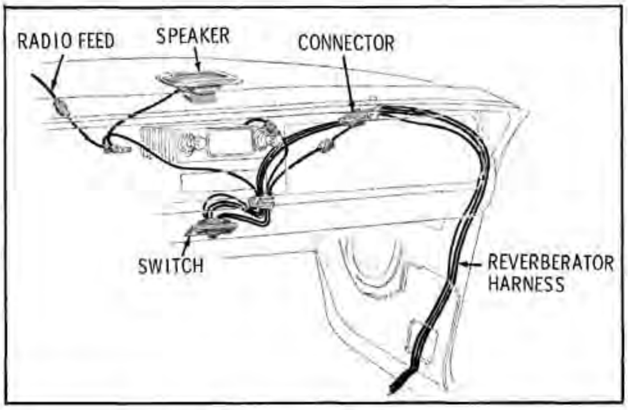


Fig. 12-29 Reverberation Wiring

ANTENNA

Manual

The manual antenna is installed as shown in Fig. 12-30. The manual antenna can be removed without removing the cowl trim pad.

Power

Power antennas are installed as shown in Fig. 12-31. When replacing the lead-in or wiring, use

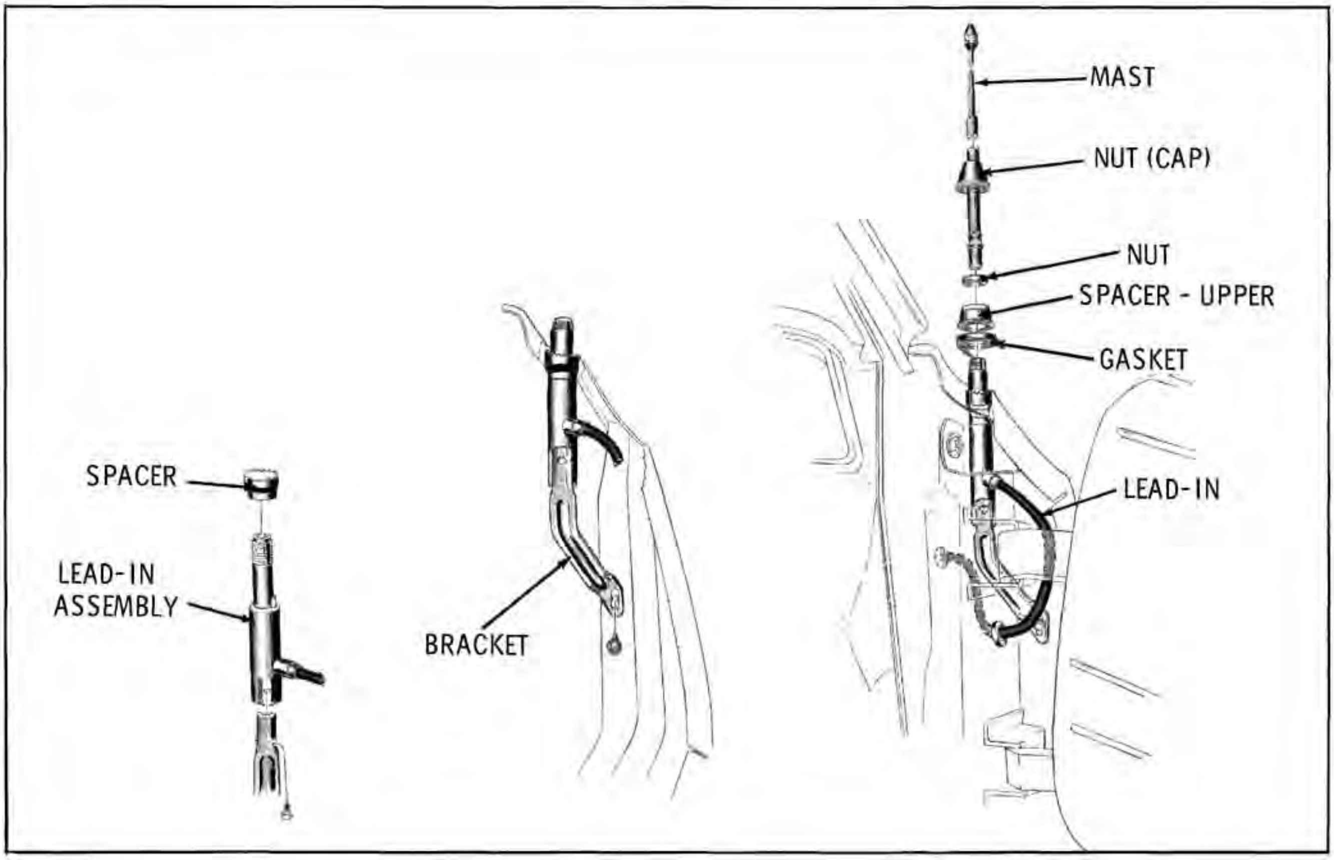


Fig. 12-30 Manual Antenna Mounting

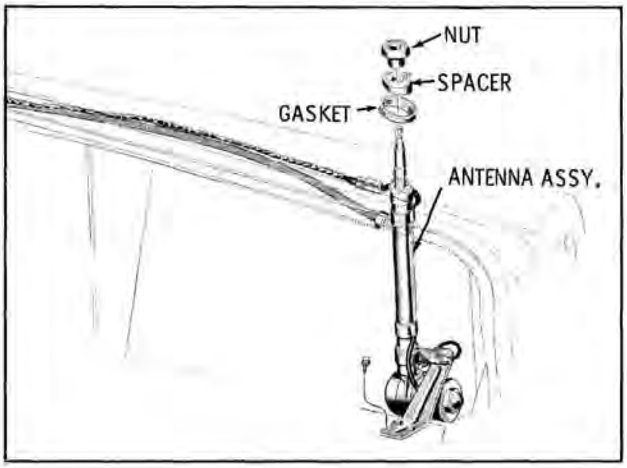


Fig. 12-31 Power Antenna Mounting

the existing harness to route the new harness through body panels. See Fig. 12-32 for typical cable and wire routing for sedans and convertibles.

Disassembly (Fig. 12-33)

The following parts of the power antenna are serviceable: Drive Assembly, Mast Assembly and Support Tube Assembly. To service any of these parts, proceed as follows:

1. Remove the two connector to support tube screws and remove connector.

2. Unsolder hook-up wire at pin and remove pin and insulator assembly.

   NOTE: Do not overheat pin by slow soldering as the pin insulator will be destroyed.

3. Remove the three support tube to drive assembly screws.

4. While applying a back and forth rotary motion, pull until support tube is removed from antenna.

5. If the drive assembly or mast assembly is to be replaced, proceed as follows:

   a. While applying a rocking motion, pull on mast until insulator bushing is removed from the drive assembly tubular fitting.

   b. Energize motor until entire length of nylon cord is expelled from drive assembly. To prevent a kink or bend in nylon cord, keep it taut by pulling on mast.

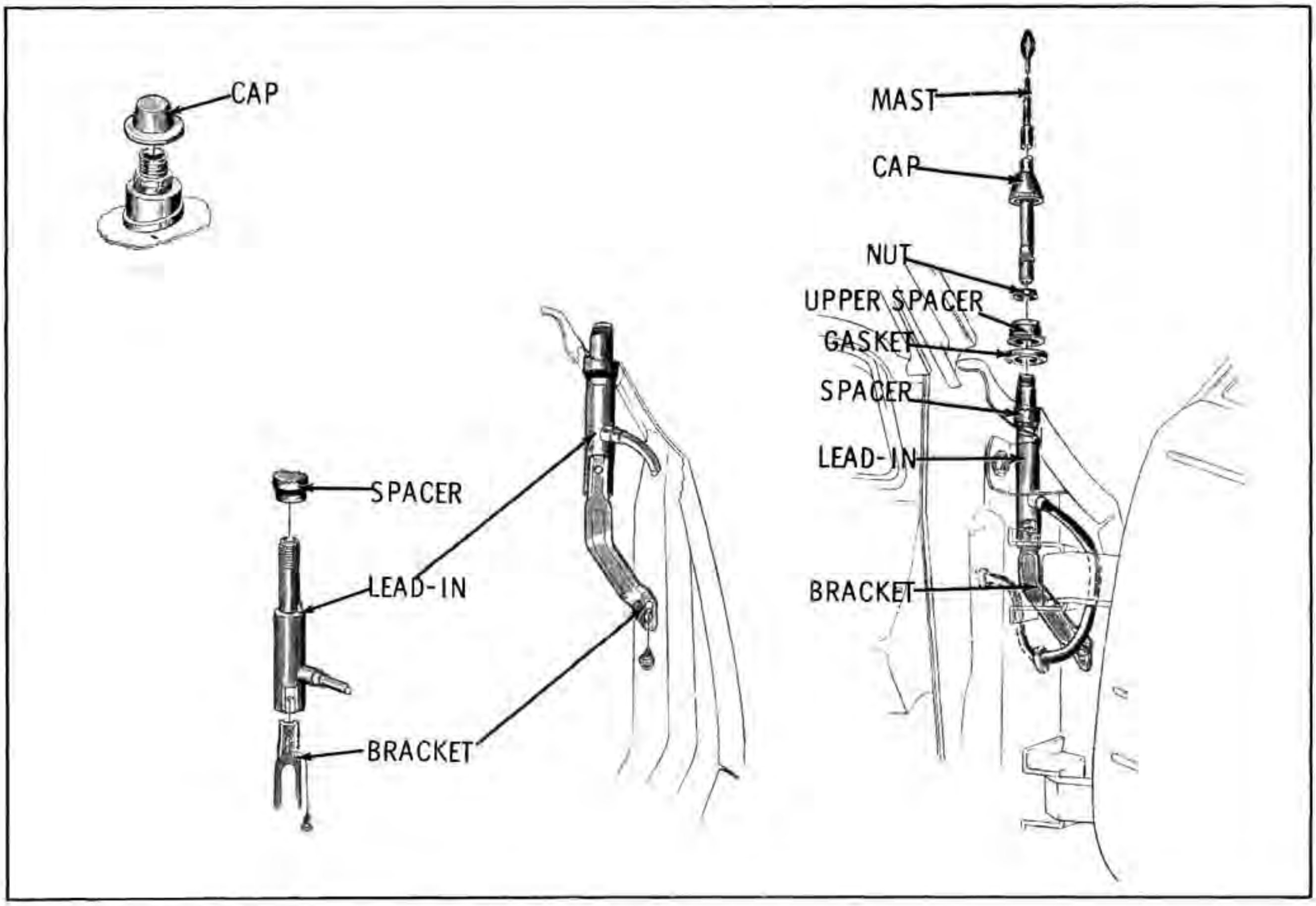


Fig. 12-32 Antenna Lead-In Routing

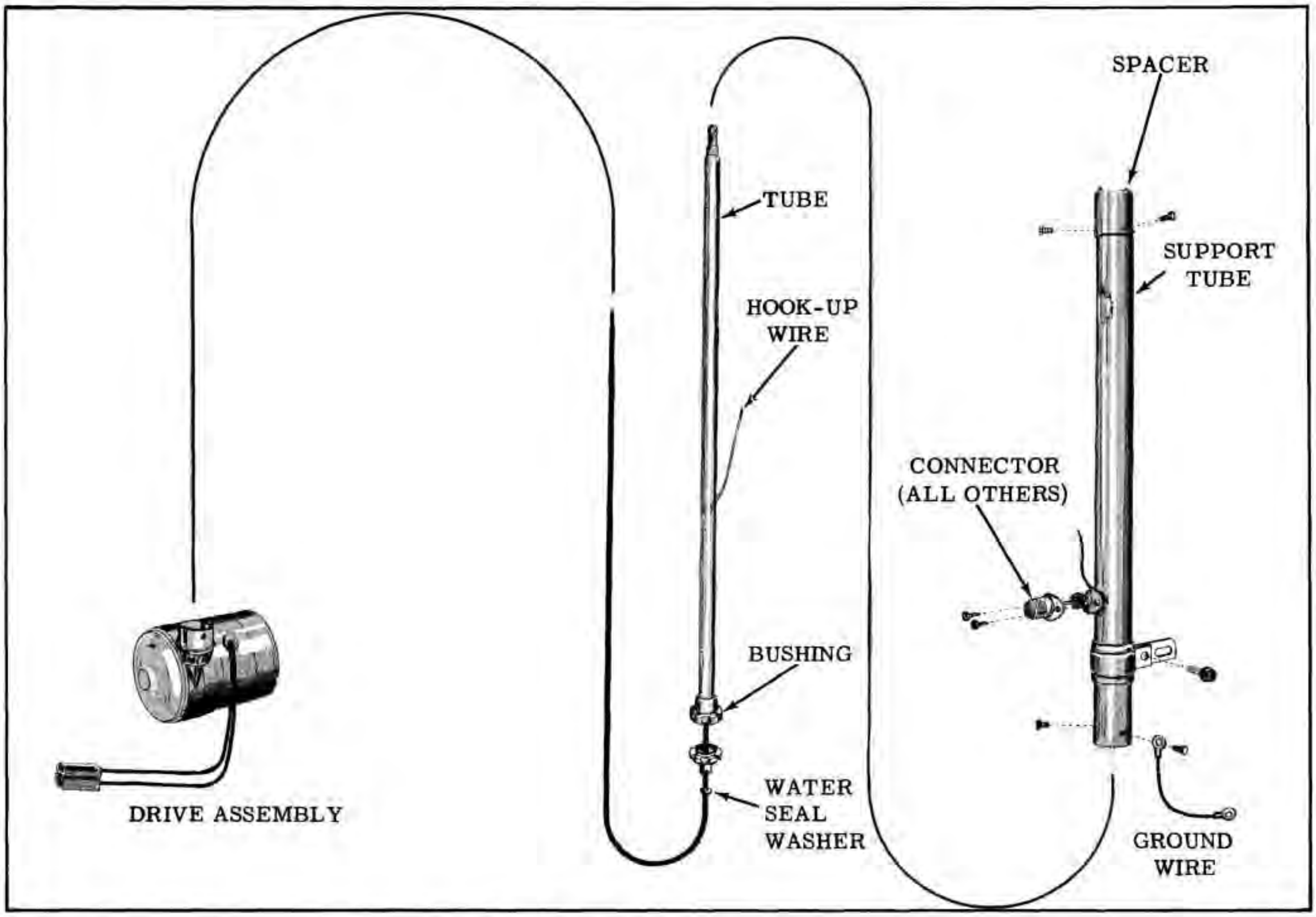


Fig. 12-33 Power Antenna Disassembled

NOTE: If motor is inoperative, it will be necessary to manually remove the nylon cord from the drive assembly as follows:

c. Place the assembly in a vise so that the normal plane of the nylon cord is parallel with the floor.

d. Pull on nylon cord until it is completely expelled from the drive assembly.

CAUTION: No attempt should be made to disassemble antenna further than Step 5-D.

Assembly

1. Thread nylon cord through bottom insulator, (small diameter end down) and water seal washer.

2. Energize motor and feed nylon cord into drive assembly. Do not allow nylon cord to bend or kink.

NOTE: Push water seal washer and bottom insulator all the way down into tubular fitting (make sure that keyways in bottom insulator are rotated to key position) before nylon cord completely disappears into drive assembly.

3. Push mast assembly into tubular fitting making sure that the upper edge of the insulator bushing is below the center of the three support tube to drive assembly screw holes.

4. Install support tube over mast assembly, making sure hook-up wire is extended through proper hole in support tube. Line up three holes in support tube and install the three screws.

5. Solder hook-up wire to pin and insulator assembly, being careful not to overheat.

6. Install connector over pin and insulator assembly and install two screws.

Diagnosis

If antenna fails to operate properly, check the following possible sources of trouble.

1. Excessive tightening of cap nut on quarter panel will result in excessive operating noise in the car.

2. A stalled or slowly operating mast may be caused by bent or dirty mast sections. If dirty, wipe with oily cloth.

3. See that fuse is not burned out.

4. See that ground wire is tight.

5. To determine whether fault is in the antenna or the control circuit, disconnect the leads coming from antenna. Connect a jumper wire from a known hot source and touch jumper wire to each of the terminals of the wires coming from the drive assembly. If antenna does not operate, the fault is in the antenna drive assembly. If antenna does operate, the fault is in the control circuit.

6. If trouble is in the control circuit:

    a. Examine electrical connections at switch, making sure they are securely connected.

    b. Check wiring at switch with lamp or motor.

If antenna lead-in is suspected of being bad, check radio operation using an antenna lead-in known to be good.

NOTE: If excessive static is encountered, check suppressors and static eliminators for proper installation. (Fig. 12-34)

DIAGNOSING RADIO PROBLEMS

Because radio service problems are mainly corrected by authorized Warranty Repair Stations, the tendency for many dealer servicemen is to remove the set when a problem is reported, without any preliminary diagnosis. A large number of sets are being reported to be standard when received by the Warranty Repair Stations. This indicates that the trouble is frequently correctable without removal of the radio.

The inconvenience to an owner of having to drive without a radio while his set is being serviced at a Warranty Station can frequently be avoided if the following quick checks are used to eliminate "outside" conditions before removing the set for repairs.

NOTE: If possible, attempt to determine from the owner the exact nature of the radio problem as an aid to diagnosis. Knowing whether the condition is intermittent or constant, whether it occurs with engine off or running, with car stationary or moving, will help to pinpoint the problem.

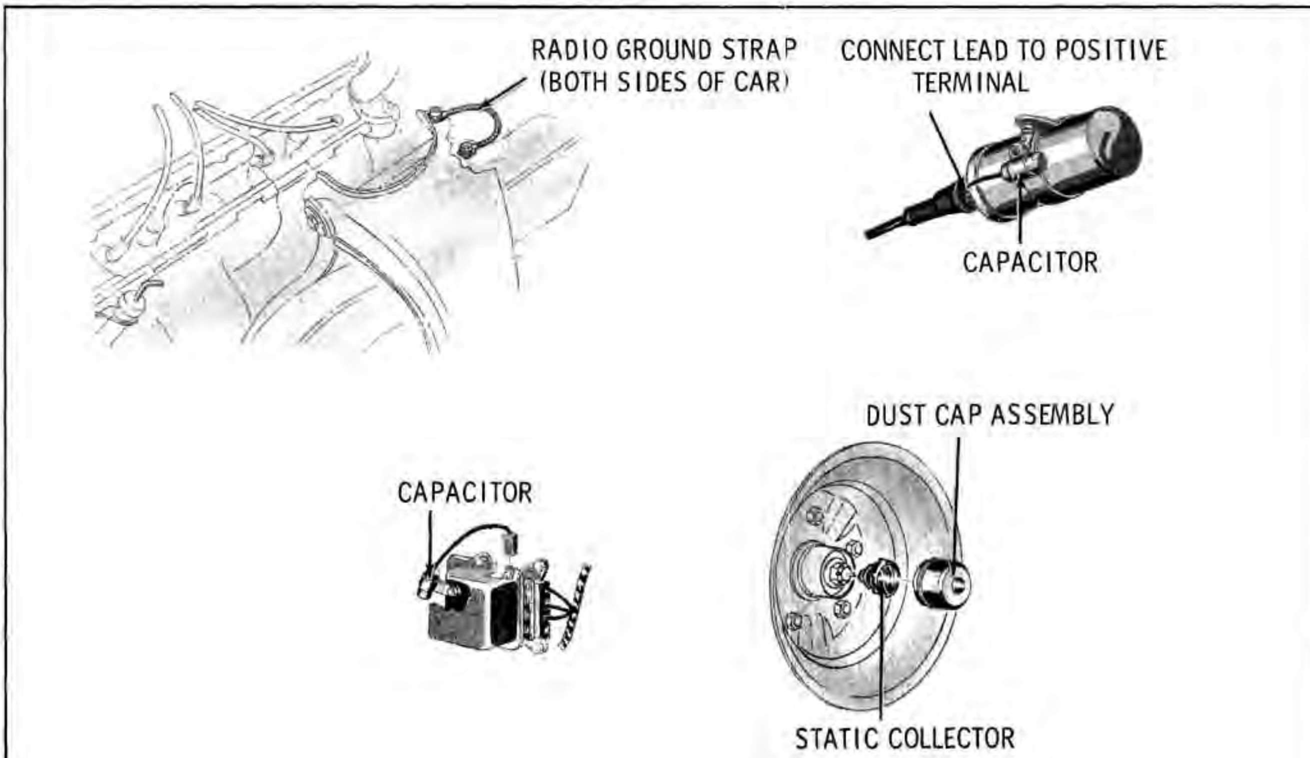


Fig. 12-34 Static Eliminators and Suppressors

RADIO DIAGNOSIS

CONDITION	QUICK CHECK	POSSIBLE CAUSE
Radio Dead	Turn radio on, listen for thump in speaker.	1. If no thump is heard, check the following: Fuse - replace with known good fuse.
		2. Check speaker and power supply connections to radio and/or speaker.
	Rotate fader control to rear seat speaker.	3. Defective Speaker - Use a test speaker. If car is equipped with rear seat speaker, use rear speaker as the test speaker.
		4. If a thump is heard, check the following: Antenna - Use a test antenna held outside the car.
Radio Intermittent	Tap antenna mast. Tap speaker or move connectors.	1. Loose antenna connection.
		2. Loose speaker or power supply connectors.
		3. Defective speaker.
		4. Defective antenna lead-in - Use test antenna.
Radio Signal Weak	1. Tune radio to strong local station.	1. Weak signal or distant station - explain to owner.
	2. Check antenna height.	2. Antenna not extended.
		3. Antenna trimmer not adjusted.
		4. Poor antenna connections.
		5. Defective antenna - Use test antenna.

RADIO DIAGNOSIS (Cont'd.)

CONDITION	QUICK CHECK	POSSIBLE CAUSE
Noisy Operation 1. Brake light, turn signal, window lift noise. 2. Static (when driving). 3. Engine ignition noise. 4. Crackling noise with cruise control engaged. 5. Whining (increases with engine speed).	Check to see that rear antenna connection is very tight (not just finger tight). Check installation of condensers.	1. Antenna - poor connections, lead-in defective, antenna mounting loose. 2. Check suppression and static eliminators. 3. Electrical wires too close to ignition cables. 4. Check condenser in Cruise Control regulator. 5. Regulator or Delcotron condenser loose or defective.
Poor tone.	Rotate fader control to test front and rear speaker.	Defective speaker - use test speaker.

CRUISE CONTROL

DESCRIPTION

The automatic lock-in Cruise Control is a driver-operated speed regulation device that may be used either as a speed reminder or as an automatic speed control for any car speed between 25 mph and 85 mph.

The major components of the automatic lock-in Cruise Control are: the regulator assembly mounted in the engine compartment and the selector control assembly, located on the lower left side of the instrument panel.

The regulator is driven by a flexible drive cable from the left front wheel. The drive cable also drives the speedometer cable that runs from the regulator to the speedometer. The selector control assembly is connected to the regulator by means of a bowden cable. Mechanical linkage connects the regulator to the accelerator and carburetor throttle rod.

The selector control assembly is shown in Fig. 12-36. Speed settings are secured by use of a calibrated thumb wheel. The selector dial is numbered with speed markings from 30 mph to 80 mph, in increments of 5 mph. The numbers on the dial are illuminated for night driving. The switch located to the left of the selector dial turns the unit on and off, and activates the unit for automatic control. An indicator light, located in the escutcheon above the selector dial, glows whenever the unit is set for automatic control.

When the switch is in the OFF position, the unit has no effect at any car speed. Once the switch has been moved to the ON position, the unit is on and accelerator back pressure will be felt as a warning at the speed the selector dial is set for. Depressing the pushbutton momentarily activates an automatic relay switch in the regulator and the indicator light will glow indicating the unit is set for automatic control. Once the unit is set for automatic control, the unit will lock in automatically, whenever back pressure is felt on the accelerator pedal at the speed the selector dial is set for.

The complete electrical circuit for the Cruise Control is shown in Fig. 12-37. A reversible electric motor in the regulator actuates the mechanical linkage between the regulator and the carburetor. Motor feed points for forward and reverse energizing of the motor are closed and opened by a governor, under control of a governor spring that is compressed or relaxed to calibrated positions, corresponding to selected speeds by the bowden cable leading to the selector control.

SPEED REMINDER OPERATION

Move the switch to ON position and rotate the selector dial to the desired speed setting, with

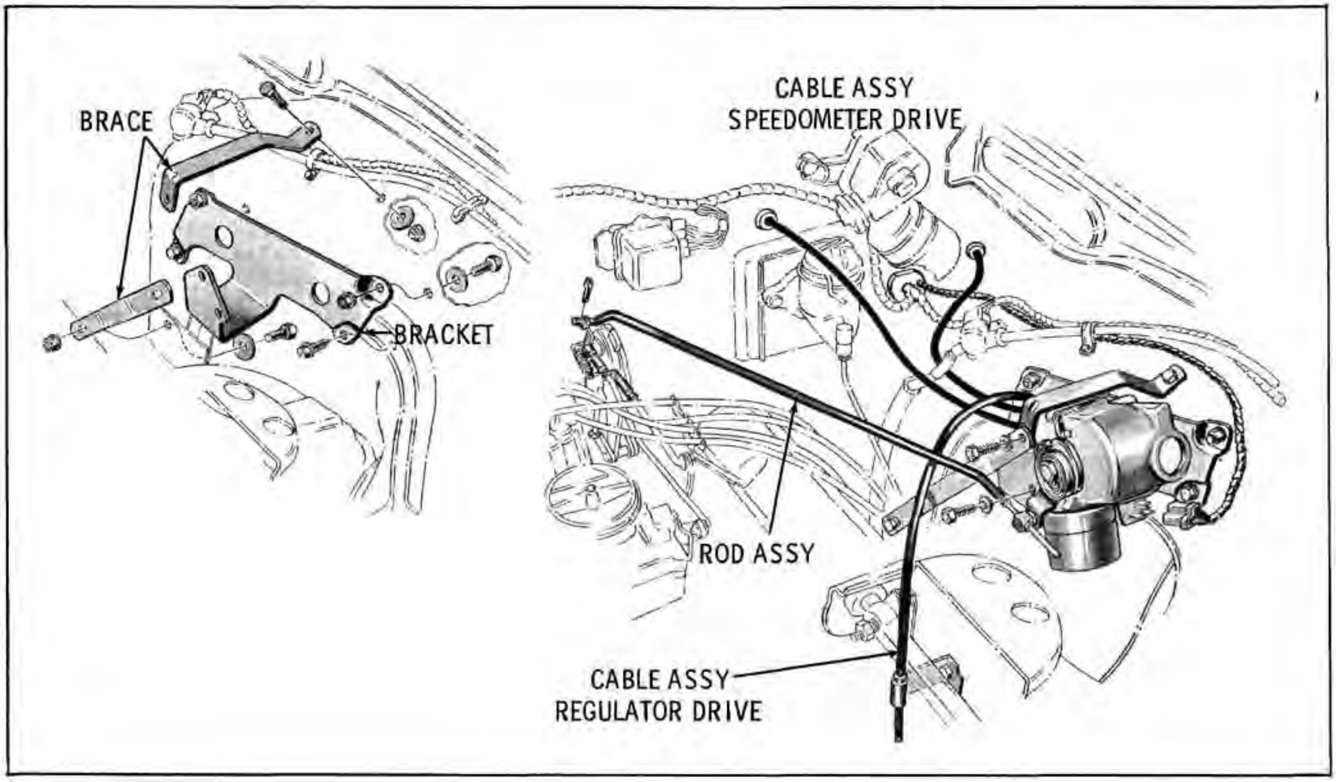


Fig. 12-35 Regulator Installation

speed setting lined up with the indicator on the bezel. The Cruise Control will then function as a speed reminder by exerting back pressure on the accelerator pedal whenever the speed setting is reached. The unit will function in the same way whenever the speed setting is changed.

Cruise Control does not interfere with normal acceleration up to the selected speed setting. Further acceleration may be obtained above that speed by pressing the accelerator pedal past the warning back pressure position.

AUTOMATIC SPEED CONTROL OPERATION

For automatic speed control, move the switch to the ON position and depress the button. The indicator light will glow. Rotate selector dial to

Fig. 12-36 Speed Selector Control

the desired speed setting. The unit is now set for automatic control and will lock-in automatically when back pressure is felt on the accelerator at the speed the selector dial is set for. The car will now maintain the selected speed automatically and the driver may remove his foot from the accelerator pedal if desired. Selected speed will be maintained regardless of road terrain, within limits of engine performance.

When the unit is in automatic control, car speed can be changed by slowly rotating the selector dial to the left to increase speed or to the right to decrease speed.

The car speed can be increased at any time by pushing the accelerator through the back pressure. When the pressure on the accelerator pedal is released, the car will return to the selected speed.

CAUTION: When increasing car speed during automatic control, always rotate dial slowly, to prevent sudden acceleration.

Automatic control is disengaged when the brake pedal is depressed. It can be re-engaged by accelerating until back pressure is felt. It is not necessary to depress the pushbutton to re-engage automatic control. The unit can be disengaged by moving the switch to the OFF position and cancelled completely by turning off the ignition switch.

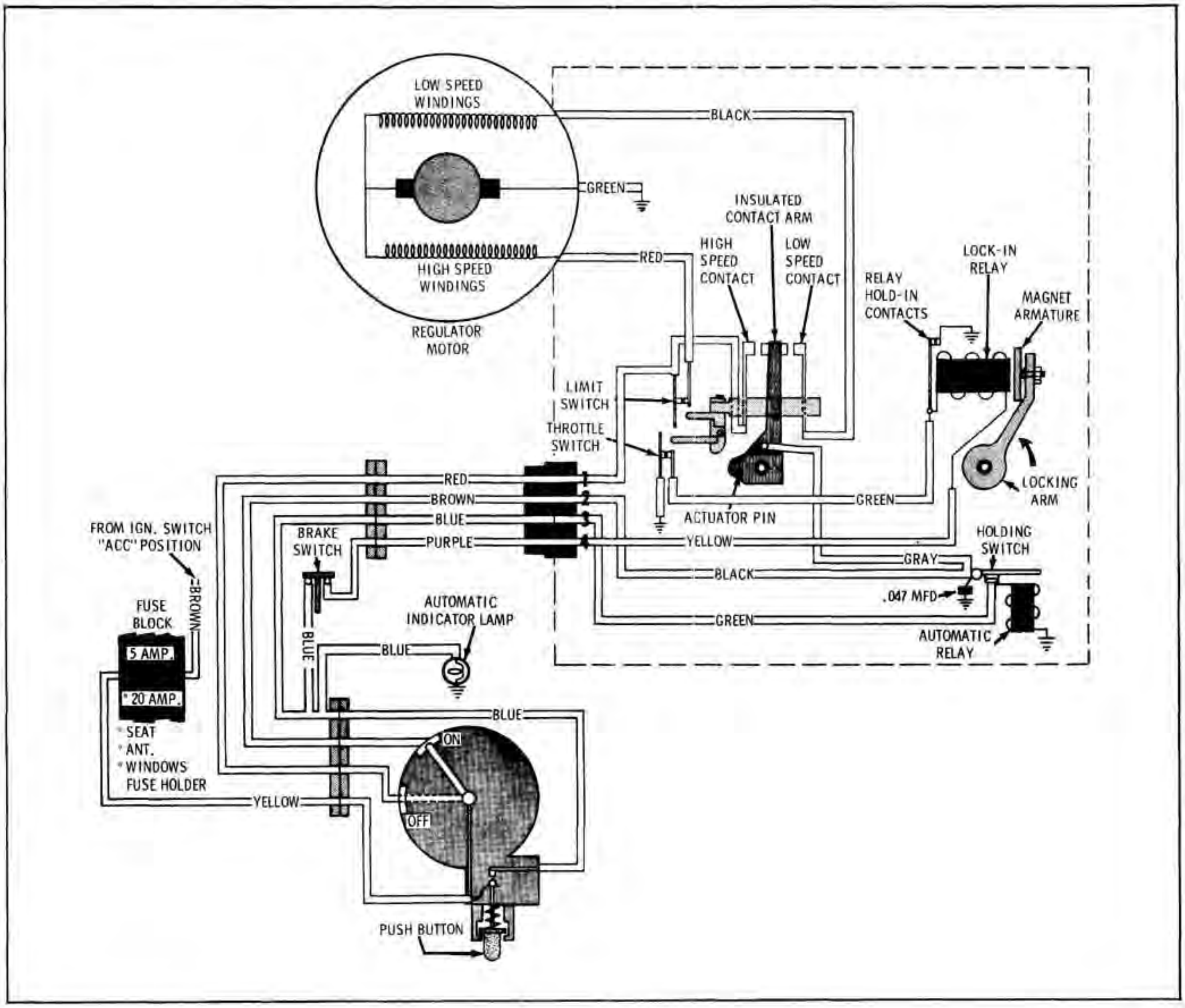


Fig. 12-37 Cruise Control Schematic

PRELIMINARY ELECTRICAL CHECKS

It is not always necessary to remove and disassemble the regulator in cases of an inoperative Cruise Control. The following checks should be performed as part of the diagnosis to determine the cause and correction of Cruise Control trouble and to eliminate unnecessary service work on the regulator.

1. Disconnect multiple connector at regulator.
2. Turn ignition switch to accessory position.
3. Move switch to OFF position.
4. Using a test lamp, ground one test lamp lead and touch other lead to terminal No. 1. Test lamp should light. If lamp fails to light, check for blown fuse, defective car wiring, or defective wiring in selector control assembly.
5. Ground one test lamp lead, touch other lead to terminal No. 2 and move switch to ON position. Test lamp should light. If lamp fails to light, check for defective wiring in selector control assembly.
6. Ground one test lamp lead and touch other lead to terminal No. 3. Depress pushbutton momentarily. Test lamp and indicator light should light while pushbutton is depressed and then should go out when pushbutton is released. If test lamp and indicator light fails to operate as described, check for defective wiring in selector control assembly or burned out indicator bulb.
7. Ground one test lamp lead and touch other lead to terminal No. 4 wire. Depress pushbutton and keep depressed while depressing brake pedal 1/4". Test lamp should go out and then come on when brake pedal is released. If lamp fails to operate as described, check for improperly adjusted brake release switch or defective wiring in selector control assembly. Release pushbutton.

8. Connect multiple connector to regulator.

9. Ground one test lamp lead and touch other lead to terminal No. 3. Depress pushbutton, then release. Test lamp should light when pushbutton is depressed and remain lit when button is released. If test lamp fails to operate as described, check for loose connections at the relay switch or a defective relay switch.

10. Remove test lamp, turn ignition switch and Cruise Control switch OFF.

11. If the electrical checks in Steps 4 through 9 fail to correct the Cruise Control trouble, check the following adjustments before removing the regulator for service work.
    a. Selector control cable adjustment.
    b. Accelerator linkage adjustment.
    c. Selector dial adjustment.
    d. Motor feed points adjustment.
    e. Limit switch and throttle switch points adjustment.

SELECTOR DIAL ADJUSTMENT

NOTE: Do not attempt to adjust selector dial until control cable is properly adjusted.

1. Perform control cable adjustment.
2. Rotate selector dial to high speed position against its stop.
3. Move switch to ON position.
4. Operate car at a steady speed of 50 mph, as indicated on speedometer.

   CAUTION: This adjustment must be performed on highway. Do not perform on hoist or jack stands in the service area.

5. Move selector dial to right until back pressure is felt on accelerator pedal, then lock in Cruise Control by depressing pushbutton.
6. With car speed at 50 mph, as indicated on speedometer, the numeral 50 on selector dial should be lined up with indicator on the bezel. Observe reading on dial; then move switch to OFF position. Do not rotate selector dial.
7. If reading on selector dial agrees with reading on speedometer, selector dial is properly adjusted.
8. If readings do not agree, adjust selector dial as follows:
   a. With switch in OFF position rotate selector dial either left (if dial reading is on the low side) or right (if dial reading is on the high side) against its stop. Then rotate dial by hand beyond its stop, the necessary amount of travel as observed in Step 6 to correct the selector dial setting.

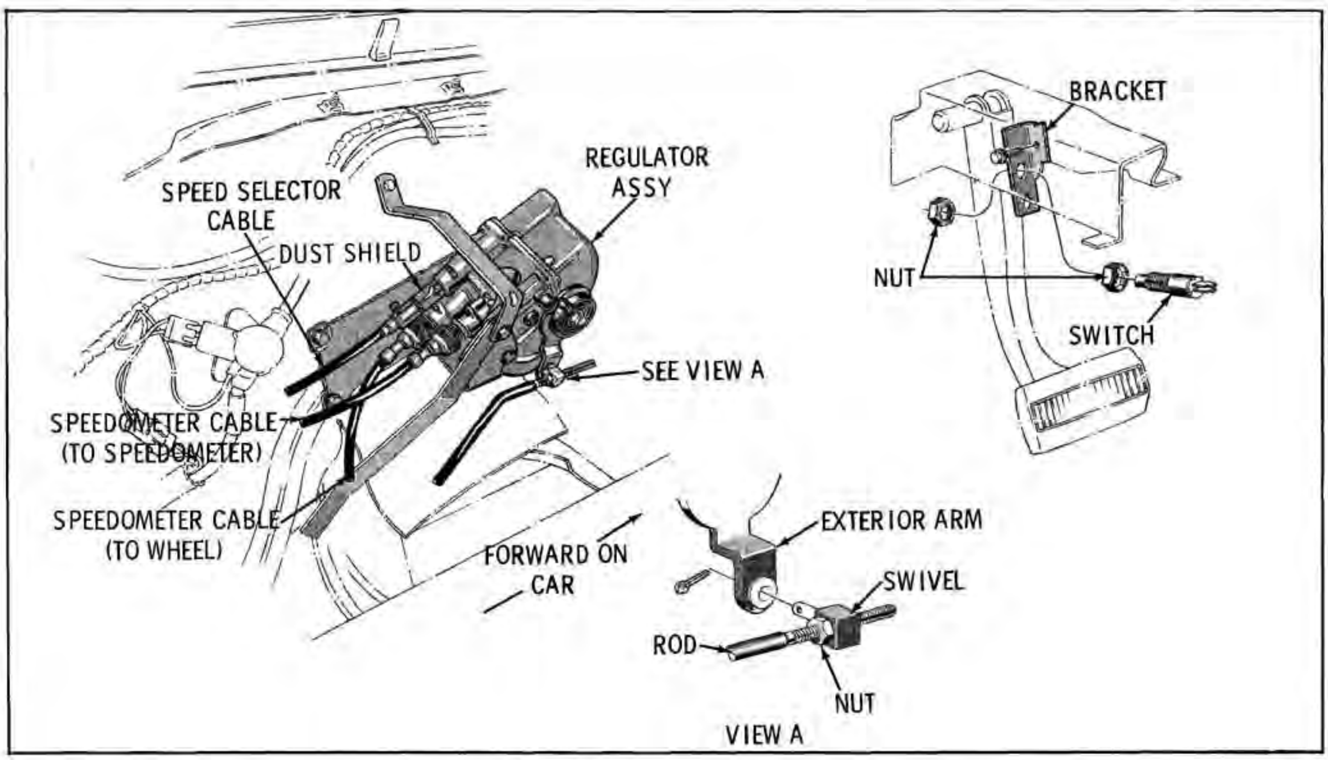


Fig. 12-38 Cable Installation

b. Repeat adjustment procedure until reading on selector dial agrees with reading on speedometer.

CONTROL CABLE ADJUSTMENT

1. Rotate selector dial to the right as far as it will turn without forcing.
2. Loosen set screw on dust shield, Fig. 12-38. (This screw retains control cable in dust shield.)
3. Again try to rotate selector dial to the right in order to make certain it is against the stop.
4. Push in lightly on control cable at dust shield, making certain that cable is against stop.

   CAUTION: Do not force cable beyond stop.

5. Hold cable against stop and tighten set screw on dust shield securely.

LINKAGE ADJUSTMENT

1. Adjust throttle rod.
2. Start engine and operate at slow idle with transmission in PARK.
3. Remove cotter pin securing accelerator linkage to exterior arm; then remove washer and separate linkage from exterior arm.
4. Insert Locking Arm Gauge J-7652 over stop stud to check alignment.
5. Adjust trunnion so that when it is installed through exterior arm, the stop stud will be aligned with the locating notch and the throttle valves will be closed.
6. Install washer on trunnion and secure trunnion to exterior arm with cotter pin.

BRAKE RELEASE SWITCH ADJUSTMENT

1. Turn ignition switch to Accessory position.
2. Depress pushbutton until indicator light glows.
3. Using a test lamp, ground one test lamp lead and touch other lead to terminal No. 4.
4. Adjust release switch so that lamp will light when brake pedal is fully released, and will go out when brake pedal is depressed approximately 1/4 inch.
5. If switch cannot be adjusted, it is defective

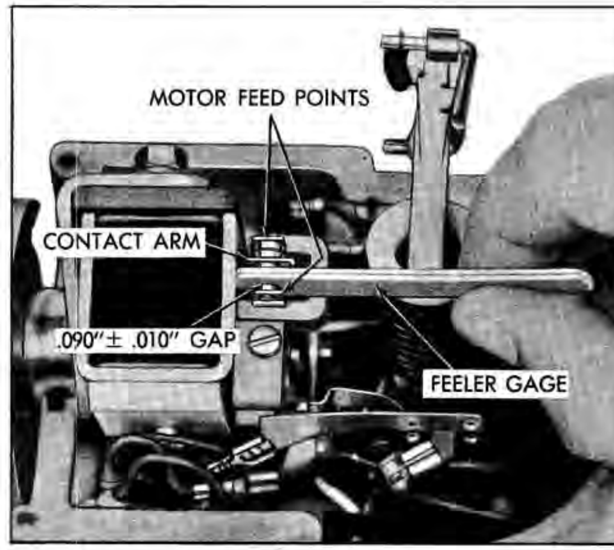


Fig. 12-39 Checking Motor Feed Points

and should be replaced. Install new switch and repeat Step 4.

6. Remove test lamp, turn ignition switch and Cruise Control switch off.

MOTOR FEED POINTS ADJUSTMENT (ON CAR)

There are two sets of electrical motor feed points that operate the Cruise Control motor in the forward and reverse direction. The motor feed point on the motor side of the magnet controls acceleration, while the other motor feed point on the locking arm side of the magnet controls deceleration.

The center contact arm is energized and any grounding resulting from contact with a screwdriver or similar tool can cause a short or blow a fuse.

The motor feed points are still operative when blackened or pitted. Do not replace for this condition.

1. Remove four screws that hold cover to regulator and remove cover.
2. Disconnect drive cable at base of regulator.
3. Move contact arm against either motor feed point and use a feeler gauge to measure the full gap between contact arm and other point, Fig. 12-39. This gap must be .090" ± .010". If gap is not within specifications, carefully bend either motor feed point on point adjuster assembly until proper gap is obtained.
4. Insert Locking Arm Gauge J-7652 over stop stud. Turn ignition switch to Accessory position and turn Cruise Control switch on.
5. Move contact arm against motor feed point on

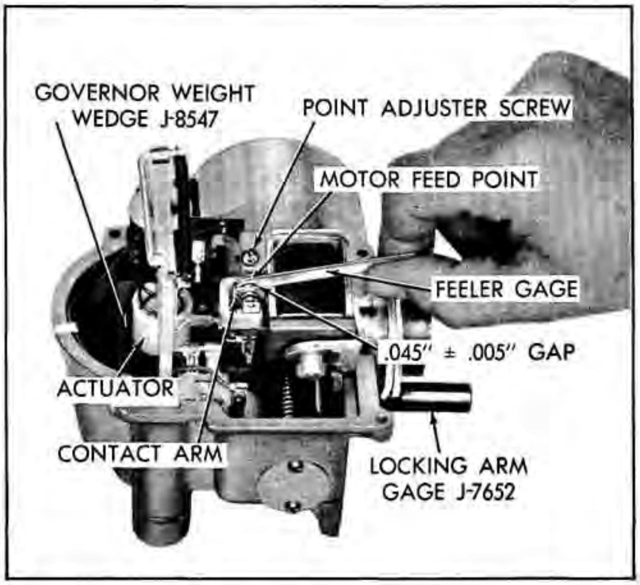


Fig. 12-40 Checking Motor Feed Point

locking arm side of magnet. When magnet is in low speed position, disconnect plug from terminal block on regulator while still holding contact arm against point. Do not use a screwdriver to turn drive screw to move magnet to low speed position.

6. Turn governor weights until they are parallel with drive screw, then place Governor Weight Wedge, J-8547, between governor weights, pressing down lightly on wedge until weights are held out to their stop position.

7. Use a feeler gauge to measure gap between contact arm and either motor feed point on point adjuster assembly, Fig. 12-39. This gap should be approximately one-half of the full gap measurement in Step 3. If gap is not within specifications, contact arm is not centered properly. Loosen screw on point adjuster assembly, Fig. 12-40, and move point adjuster until contact arm is centered between the two motor feed points on point adjuster. Then tighten point adjuster screw and recheck gap.

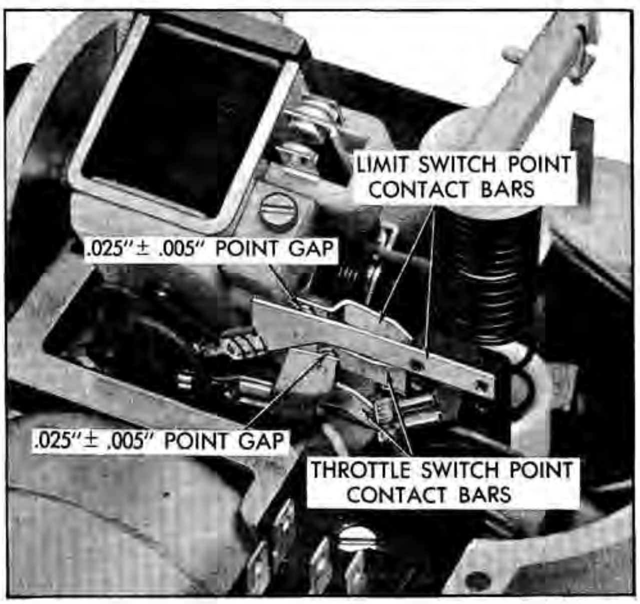


Fig. 12-41 Checking Limit and Throttle Switch

8. Remove Locking Arm Gauge and Governor Weight Wedge.

9. Connect multiple connector at regulator.

10. Turn ignition switch and Cruise Control switch off.

11. Connect drive cable to base of regulator.

12. Install cover, making certain that rubber seal and felt seal are properly seated in grooves of cover and housing. Secure cover with four screws.

LIMIT SWITCH AND THROTTLE SWITCH POINTS ADJUSTMENT (ON CAR)

1. Remove four screws that hold cover to housing and remove cover.

2. Turn ignition switch to Accessory position and move Cruise Control switch to OFF position.

   NOTE: This will move magnet assembly to wide-open throttle position and open points of limit switch.

3. Turn ignition switch OFF.

4. Using a feeler gauge, measure gap opening between points of limit switch, Fig. 12-41. This gap must be .025" ± .005". If gap is not within specifications, bend inboard point contact bar of limit switch until proper gap is obtained and points are aligned.

5. Turn ignition swich to Accessory position and move Cruise Control switch to the ON position.

6. Turn ignition switch OFF.

7. Using a feeler gauge, measure gap opening between points of throttle switch, Fig. 12-41. This gap must be .025" ± .005". If gap is not within specifications, bend inboard point contact bar of throttle switch until proper gap is obtained and points are aligned.

8. Turn ignition switch to Accessory position and move Cruise Control switch to the ON position.

9. Hold contact arm against motor feed point on locking arm side of magnet assembly until

magnet reaches low speed position; then disconnect multiple connector from regulator.

10. With magnet assembly in low speed position, check to see that both sets of points are closed, using a powered test lamp. If points are closed, limit switch and throttle switch are properly adjusted.

11. If either set of switch points are opened, lightly bend inboard point contact bar until points are closed. Then recheck point gap openings with magnet assembly at wide-open throttle position to be sure gap openings are still within specifications. Readjust if necessary.

12. Turn ignition switch and Cruise Control switch to OFF position.

13. Connect multiple connector to regulator and install cover.

CHECKING MOTOR OPERATION

1. Turn ignition switch to the Accessory position.

2. Momentarily depress pushbutton to set unit for automatic control.

3. Remove four screws securing regulator cover and remove cover.

4. Check accelerator linkage adjustment.

5. Move locking arm against magnet, simulating automatic control.

6. Move contact arm to touch motor feed point on locking arm side of magnet. Motor should rotate drive screw and close the throttle through the accelerator linkage. Motor should move magnet to wide-open throttle position when contact arm is released.

7. If motor will not open or close throttle through accelerator linkage, motor may be binding. Check alignment of motor with housing. To check motor for binding, loosen motor from housing without disconnecting motor leads and disengage motor shaft from drive screw. Move contact arm against motor feed point on motor side of magnet assembly to check reverse operation, and against motor feed point on locking arm side of magnet assembly to check forward operation. If motor does not run free, replace motor. If motor does run free, stall test motor.

8. The drive screw or carburetor linkage may also be binding. To check drive screw for binding, disengage motor shaft from drive screw, insert screwdriver in slotted end of drive screw and check for free rotation. If drive screw does not rotate freely, it is defective and should be replaced. If motor and drive screw operate satisfactorily, then adjust carburetor linkage.

9. Turn ignition switch and Cruise Control switch to OFF position and install regulator cover.

MOTOR STALL TEST

1. Disconnect multiple electric connector at regulator.

2. Remove regulator cover.

3. Connect red lead of an ammeter tester to positive battery terminal.

4. Insert Locking Arm Gauge J-7652 over stop stud to limit travel of locking arm and prevent rotation of drive screw.

5. Connect black lead of tester to terminal No. 2 on front of regulator.

6. Hold contact arm against motor feed point on locking arm side of magnet, and observe reading on ammeter. If reading on ammeter indicates more than seven amps, motor is drawing too much current and should be replaced.

7. Disconnect tester leads, remove Locking Arm Gauge, install cover and connect multiple connector.

CHECKING FOR DAMAGED CABLES AND GEARS

1. Raise left front wheel of car.

2. Remove speedometer cable at regulator, rotate wheel and check to see if nylon gear is turning. This will determine if cable from transmission to regulator is turning and if gear is operating.

3. If nylon gear is turning, cable to speedometer is broken or speedometer is inoperative.

4. If nylon gear is not turning, disconnect cable at the regulator.

5. If cable is turning, gears are stripped inside the regulator.

6. If cable is not turning, check for a broken cable or stripped speedometer drive mechanism.

7. Replace parts as required.

REGULATOR

Removal

Whenever a regulator is removed, the car can be driven with the speedometer operating by removing the regulator cables from the speedometer and left front wheel and installing a standard speedometer cable and housing assembly.

1. Disconnect multiple electric connector at regulator.
2. Disconnect drive cable and speedometer cable at regulator.
3. Loosen set screw at lower end of control cable dust shield.
4. Remove dust shield from housing, then slide dust shield down cable and disconnect end of of control cable from compressor rod and spring assembly.
5. Disconnect accelerator linkage at exterior arm on regulator.
6. Remove two bolts securing regulator to mounting bracket and remove regulator, leaving mounting bracket attached to the frame.

Installation

1. Position regulator on mounting bracket and secure to bracket with two bolts.
2. Connect accelerator linkage to exterior arm. Adjust linkage.
3. Connect end of control cable to compressor rod and spring assembly.
4. Install dust shield in housing. Dust shield has bayonet type retention. Push in end; turn clockwise. Do not tighten set screw on end of dust shield until control cable is properly adjusted.
5. Adjust control cable.
6. Connect drive cable and speedometer cable to regulator.
7. Connect multiple electric connector at regulator.

Disassembly (Fig. 12-42)

1. Remove four screws that hold cover to housing and remove cover, being careful not to lose rubber seal or felt seal in cover grooves.
2. Remove governor spring and plastic cap.
3. Remove locknut from lower end of compressor rod and spring assembly, and remove compressor rod and spring assembly from housing.
4. Disconnect red and black wires from terminals on point adjuster assembly.
5. Disconnect three red wires from terminals on limit switch and remove red jumper lead.

   NOTE: The limit switch prevents motor from running when magnet assembly is in wide-open throttle position.
6. Disconnect the two wires from terminals on throttle switch.

   NOTE: The throttle switch prevents automatic engagement before selected speed is obtained.
7. Remove spring retainer securing terminal black wires to side of housing.
8. Disconnect gray, green and black wires from terminals on automatic relay switch.
9. Disconnect yellow and green wires from terminals on magnet assembly and remove green jumper lead.
10. Remove screw securing automatic relay switch to housing and remove relay switch from housing.
11. Remove screw securing terminal block to housing and remove terminal block from housing.
12. Disconnect torsion spring from exterior arm and remove spring and exterior arm.
13. Remove locking arm stop stud and washer and two screws and washers that hold pintle to housing.
14. Lift magnet and pintle assembly out of housing, disengaging contact arm from actuator. Be careful not to lose felt seal in groove of housing.
15. Remove locking arm and wave washer from pintle shaft.
16. Remove screw and washer that hold point adjuster assembly to point adjuster bracket and remove point adjuster assembly.
17. Remove snap ring and fabric washer from end of pintle shaft and remove contact arm from pintle shaft.
18. Remove pintle from magnet assembly.

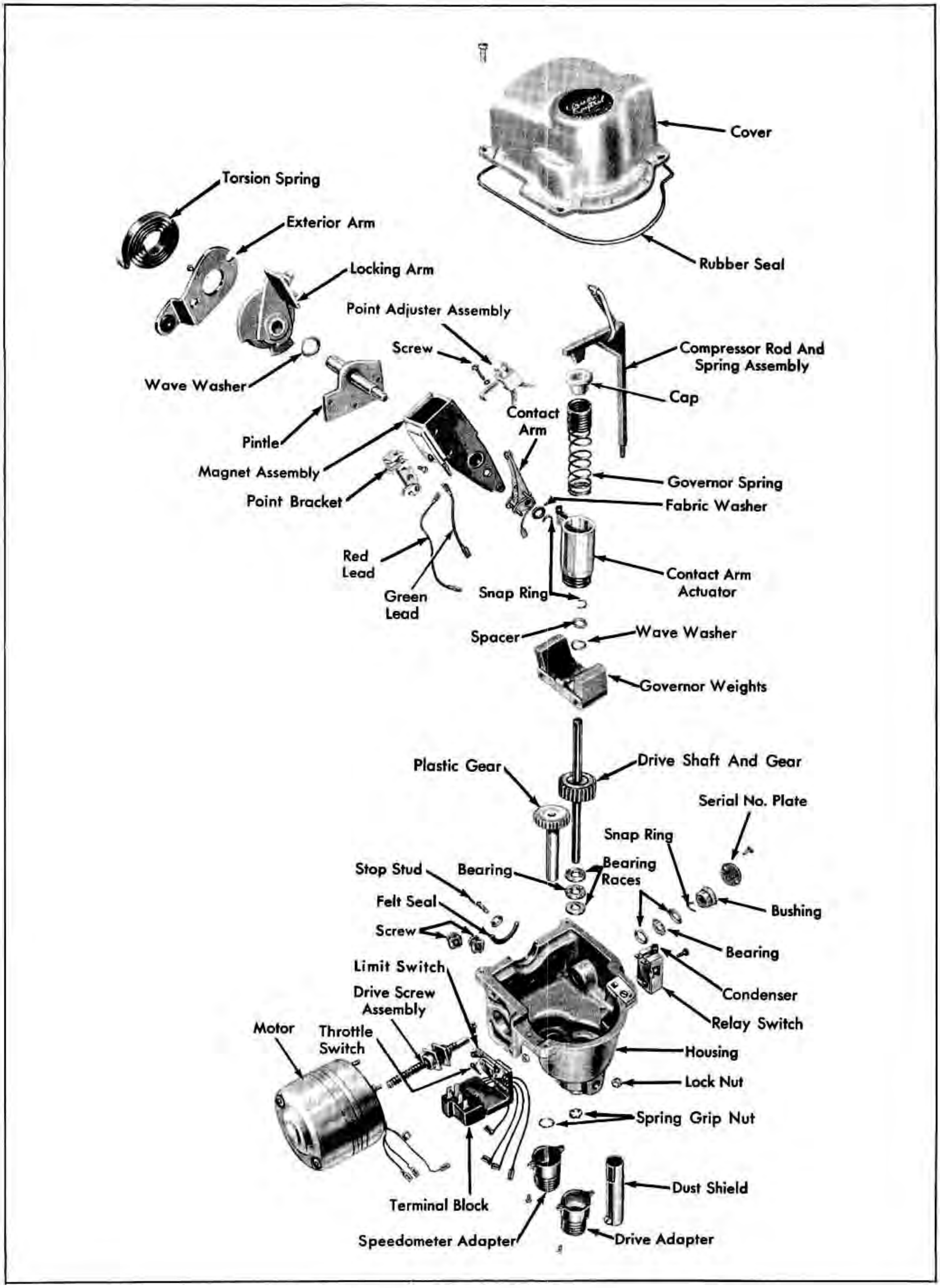


Fig. 12-42 Regulator Assembly

19. Remove two screws that hold point adjuster bracket to magnet assembly and remove point adjuster bracket with stop attached.

    NOTE: The magnet assembly and holding switch are serviced as a single unit.

20. Lift contact arm actuator off governor drive shaft.

21. Remove two nuts that hold motor to housing and remove motor from housing.

    NOTE: One nut is located on inside of housing.

22. Remove two screws that hold unit serial number plate to housing and remove plate from housing.

23. Remove bushing from end of drive screw.

24. Remove snap ring, outer bearing race, bearing and inner bearing race from end of drive screw. Then remove drive screw and nut assembly from motor end of housing. Discard snap ring.

    CAUTION: When handling drive screw assembly, keep parts clean, as dirt particles can become wedged between the small ball bearings on end of drive screw, or in drive screw nut, and cause drive screw to stick.

25. Remove two screws that hold governor drive adapter to housing and remove adapter.

26. Remove spring grip nut securing governor drive shaft and gear assembly to housing and remove drive shaft and gear assembly. Discard spring grip nut.

27. Remove outer bearing race, bearing and inner bearing race from lower end of governor drive shaft and gear assembly.

28. Remove snap ring, spacer, wave washer and governor weight assembly from governor drive shaft. Discard snap ring.

29. Remove two screws that hold speedometer adapter to housing and remove adapter.

30. Remove spring grip nut securing plastic speedometer gear in housing and remove gear. Discard spring grip nut.

Assembly (Fig. 12-42)

1. Lubricate plastic gear with cam and bearing lubricant. Then install plastic gear in housing.

2. Secure plastic gear in housing with new spring grip nut.

3. Install speedometer adapter on bottom of housing and secure with two attaching screws.

    NOTE: The drive adapter and speedometer adapter are interchangeable.

4. Install governor weight assembly, wave washer and spacer on governor drive shaft and secure with new snap ring.

5. Install inner bearing race, bearing, and outer bearing race on lower end of governor drive shaft and gear assembly. Then install governor drive shaft and weight assembly in housing meshing drive gear with plastic gear.

    NOTE: Hold housing upside down when installing governor drive shaft and gear assembly to prevent ball bearing and races from falling out of opening in bottom of drive gear.

6. Secure governor drive shaft and weight assembly in housing with new spring grip nut.

7. Install governor drive adapter on bottom of housing and secure with two attaching screws.

8. Lubricate drive screw assembly sparingly with cam and bearing lubricant and install through motor end of housing.

9. Insert bearing end of drive screw through boss in housing and install inner bearing race, bearing, outer bearing race and new snap ring on end of drive screw.

10. Install bushing over end of drive screw in opening in housing.

11. Install unit serial number plate on housing and secure with two attaching screws.

12. Install motor on housing, threading wires through upper hole in housing. Make certain that end of motor shaft engages in slot of drive screw.

13. Connect green motor wire to inside housing motor mounting stud and secure motor to housing with two attaching nuts.

    NOTE: Do not tighten nuts on motor end cover as this may result in binding of the motor bearings.

14. Install point adjuster bracket on magnet assembly and secure with two attaching screws.

15. Insert pintle in magnet assembly, through side opposite motor feed points.

16. Install contact arm on end of pintle shaft with actuator pin facing away from magnet assembly and install fabric washer. Secure contact arm to pintle shaft with new snap ring.

17. Install point adjuster assembly on point adjuster bracket, positioning contact arm between motor feed points and loosely install attaching screw and washer.

18. Install wave washer and locking arm on pintle shaft.

19. Position drive screw nut in center of drive screw.

20. Attach actuator assembly on contact arm and install complete assembly in housing, positioning actuator over governor drive shaft, and align bracket tangs on bottom of magnet assembly with grooves in drive screw nut. Press down on complete assembly until it seats itself in housing.

21. Install locking arm stop stud and lockwasher and two screws and lockwashers that hold pintle to housing.

22. Install exterior arm on locking arm shaft.

23. Install torsion spring on exterior arm. Using a pair of pliers, tighten spring one complete turn before connecting to stud on locking arm.

24. Install terminal block on housing and secure with attaching screw.

25. Install automatic relay switch on housing and secure with attaching screw.

26. Connect green terminal block wire (No. 3) to terminal on side of relay switch; connect gray wire to inboard terminal on front of relay switch; connect black terminal block wire (No. 2) to outboard terminal on front of relay switch.

    CAUTION: Be careful when routing wires so they will not come into contact with any moving parts.

27. Secure gray, green and black wires to side of housing with retainer clip.

28. Connect red terminal block wire (No. 1) to outside terminal on outboard contact bar of limit switch.

29. Connect red motor wire to terminal on inboard contact bar of limit switch.

30. Route black motor wire under pintle shaft between legs of magnet and connect to terminal of motor feed point on locking arm side of magnet.

31. Route green jumper wire from terminal on inboard contact bar of throttle switch over and under pintle shaft between legs of magnet and connect to terminals of magnet and holding switch.

32. Route red jumper wire from terminal of motor feed point on motor side magnet, under and over pintle shaft between legs of magnet, and connect to inside terminal on outboard contact bar of limit switch.

33. Route yellow terminal block wire (No. 4) under pintle shaft between legs of magnet, and connect to terminal on magnet on locking arm side.

34. Connect green motor wire to terminal on outboard contact bar of throttle switch.

35. Lubricate compressor rod with cam and bearing lubricant, install compressor rod through guide into housing and loosely install locknut on threaded end of compressor rod.

36. Install governor spring with plastic cap into actuator assembly.

37. Move magnet assembly to wide-open throttle position (magnet away from locking arm). This must be done to prevent pre-loading of the governor spring by the contact arm before adjusting the compressor rod.

38. Hold housing in an upright position and adjust locknut on end of compressor rod until lower edge of compressor rod arm rests against plastic cap without exerting pressure against governor spring. Then back off locknut two complete turns. This will provide the correct low speed calibration for the regulator.

39. Adjust motor feed points.

40. Adjust limit switch.

41. Adjust throttle switch.

42. Install cover, making certain that rubber seal and felt seal are properly seated in grooves of cover and housing. Secure cover with four screws.

CRUISE CONTROL DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	REMEDY
Speedometer Noise.	Cables bent or kinked.	Straighten or replace cables.
	Lack of cable lubrication.	Lubricate.
	Noisy speedometer head assembly.	Repair.
Blowing Fuses.	Short or ground in wiring circuit.	Perform electrical checks.
	Improper linkage adjustment.	Adjust accelerator linkage.
	Defective motor.	Check operation of motor.
	Locked drive screw.	Check drive screw for binding.
No Cruise Control Response.	Accelerator linkage broken or disconnected.	Connect or replace linkage and adjust.
	Drive cables broken or disconnected.	Connect or replace cables.
	Blown fuse.	Perform electrical checks.
	Loose connections or broken wires (internal or external).	Perform electrical checks. Repair wires or tighten wiring connections as required.
No Automatic Control When Unit is Set For Automatic Lock-in.	Driver riding the brake pedal or driver does not accelerate to selected speed.	Instruct owner.
	No current at #2 terminal.	Perform electrical checks.
	Improper throttle switch adjustment.	Adjust throttle switch.
Constant Pressure on Accelerator Pedal Regardless of Dial Setting.	Blown fuse.	Perform electrical checks.
	No current at #1 terminal.	Perform electrical checks.
	Control cable improperly adjusted.	Adjust control cable.
	Control cable defective.	Replace selector control assembly.
	Inoperative motor or locked drive screw.	Check operation of motor and/ or drive screw.
	Improper limit switch adjustment.	Adjust limit switch.

CRUISE CONTROL DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	REMEDY
Automatic Control Engages at Selected Speed Without Unit Set for Automatic Lock-in.	Shorted relay switch.	Perform electrical test.
Automatic Control Remains Engaged When Brake Pedal is Depressed.	Improper brake release switch adjustment.	Adjust brake release switch.
	Inoperative switch.	Replace switch.
Unit Does Not Remain Inoperative in the "Off" Position.	Limit switch not properly adjusted.	Adjust limit switch points.
Pulsating Accelerator Pedal.	Speedometer cable or drive cable kinked or lack of lubrication.	Lubricate or replace cables if necessary.
	Improper accelerator linkage adjustment.	Adjust accelerator linkage.
	Improper motor feed points adjustment.	Adjust motor feed points.
Carburetor Does Not Return to Normal Idle.	Improper carburetor or accelerator linkage adjustment.	Adjust throttle control rod and accelerator linkage.
	Weak or disconnected throttle return spring.	Replace spring.
Unit Does Not Control at Selected Speed.	Improper control cable adjustment.	Adjust control cable.
	Improper selector dial adjustment.	Adjust selector dial.
	Improper accelerator linkage adjustment.	Adjust accelerator linkage.
Speedometer Does Not Register.	Speedometer drive defective.	Replace drive.
	Broken drive cable from left front wheel to regulator.	Replace drive cable.
	Damaged drive gear or nylon gear in regulator.	Replace nylon gear. If metal drive gear is damaged, replace housing assembly.
	Broken speedometer cable.	Replace speedometer cable.

GUIDE-MATIC POWER HEADLIGHT CONTROL

The Guide-Matic Power Headlight Control consists of: the phototube, amplifier unit, power relay, and a combination override and foot dimmer switch. (Fig. 12-43)

The phototube unit picks up light from an approaching car and operates the amplifier unit.

The amplifier unit supplies voltage to the phototube unit and operates the power relay in response to a signal from the phototube unit. It is mounted under the instrument panel above the glove box.

The power relay is mounted on the cowl, below the fuse block, and switches the headlamps between high and low beam. The power relay also operates when the "Guide-Matic" switch is off.

The phototube unit has a sensitivity control knob which enables the driver to adjust the sensitivity for conditions such as heavy snow or fog. The knob has a FAR and NEAR at the extreme ends of the adjustment range and a detent position midway in the range for the normal setting. Adjustment toward the FAR (clockwise) position increases the sensitivity for driving during foggy weather conditions when light penetration from oncoming cars is poor. Adjustment toward the NEAR position (counterclockwise) decreases the sensitivity for driving during heavy snowstorms or similar conditions when there is abnormal light reflections.

REMOVAL AND INSTALLATION

NOTE: If diagnosis indicates that the phototube unit must be removed for repair by an authorized warranty repair dealer, the amplifier unit should also be removed and sent with the phototube unit. If the amplifier unit must be removed for repair, the phototube unit need not be sent with it if diagnosis indicated it was operating satisfactorily.

Phototube Unit

1. Disconnect the phototube unit harness plug from the amplifier. (Fig. 12-43)
2. Remove the pivot pin from the right side of the phototube unit base, (Fig. 12-45), then lift off the mounting plate and remove the phototube unit and wiring.

To install, reverse the removal procedure, check vertical and horizontal aim, and the Dim and Hold sensitivity adjustment. (See ADJUSTMENTS AND TESTS)

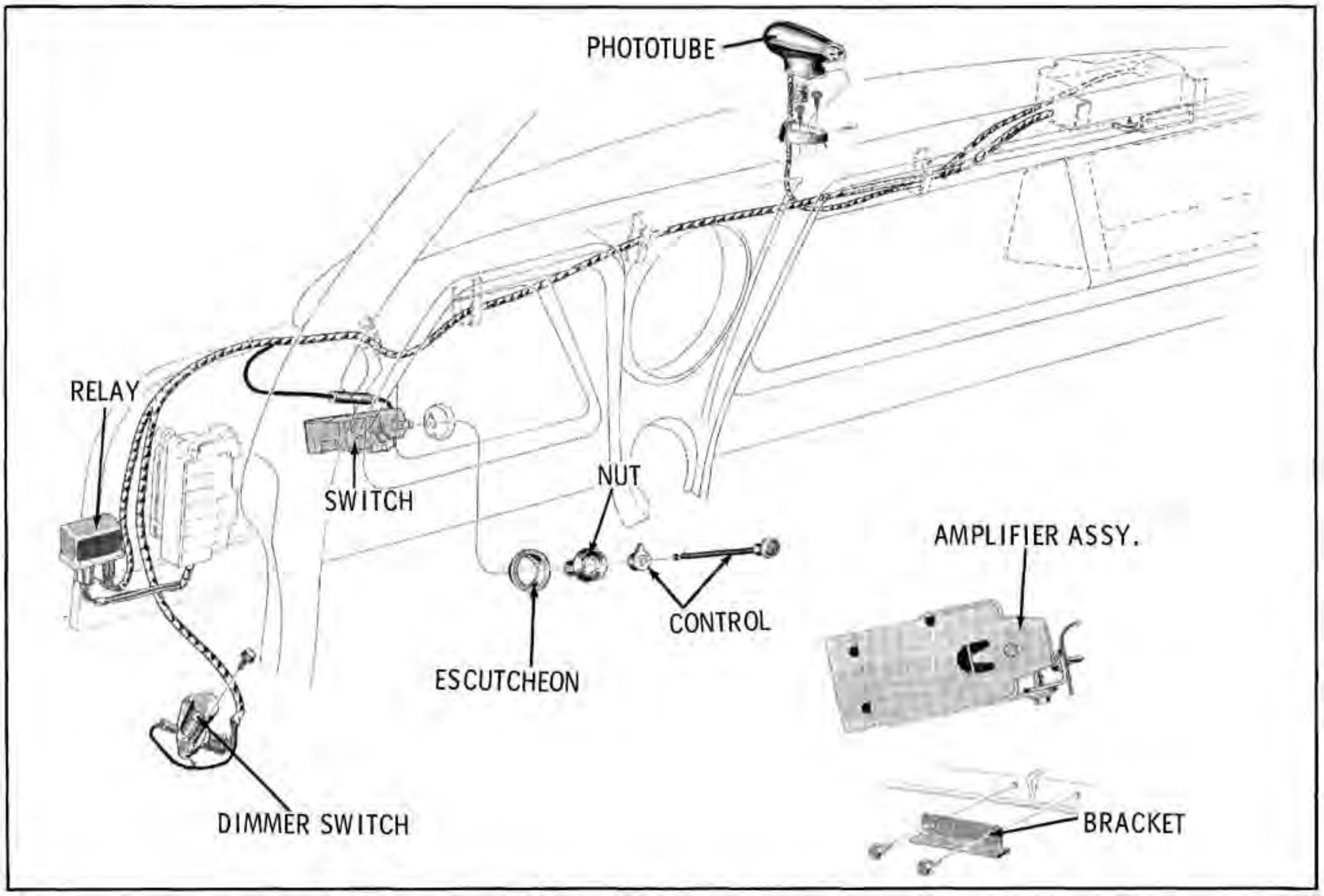


Fig. 12-43 Guide-Matic Installation

Amplifier Unit

1. Disconnect the fuse connector from the Guide-Matic "off-on" switch terminal on the headlight switch. (Fig. 12-43)

2. Lift floor carpet and remove the two connectors from the foot switch.

3. Remove the dual connector from the power relay.

4. Remove the amplifier attaching screws and remove the amplifier.

To install, reverse the removal procedure. After installing the amplifier unit, check the Dim and Hold sensitivity adjustment. (See ADJUSTMENTS AND TESTS)

ADJUSTMENTS AND TESTS

GUIDE-MATIC TESTING EQUIPMENT

Level J-8465-20 and a test lamp, are required for the aiming and sensitivity adjustments, and must be used in conjunction with the AE-2 Tester. The test lamp and adapter are identified by tool number J-8662.

Vertical Aiming Adjustment

1. Phototube unit aiming should be done with the car unloaded, trunk empty except for spare tire, gas tank at least half full, and with correct tire pressure.

2. Position car on a level floor. Floor must be level within 1/4" fore and aft of car.

3. Rock car gently sideways to equalize springs.

4. Set the Level J-8465-20 on top of phototube unit as shown in Fig. 12-44.

   NOTE: The three points on aiming device must be resting on top of phototube unit and the aiming device must touch front of phototube unit.

5. Observe number stamped on driver control knob. Adjust aiming dial until corresponding number is under pointer.

6. Adjust vertical aim screw until bubble is centered in level.

   NOTE: If the phototube unit is aimed too low, back reflections from the headlights of the car, on which the Guide-Matic is installed, will hold its own headlights on the lower beam. Also, the phototube unit must be aimed as low as possible to provide the maximum tolerance for car loading.

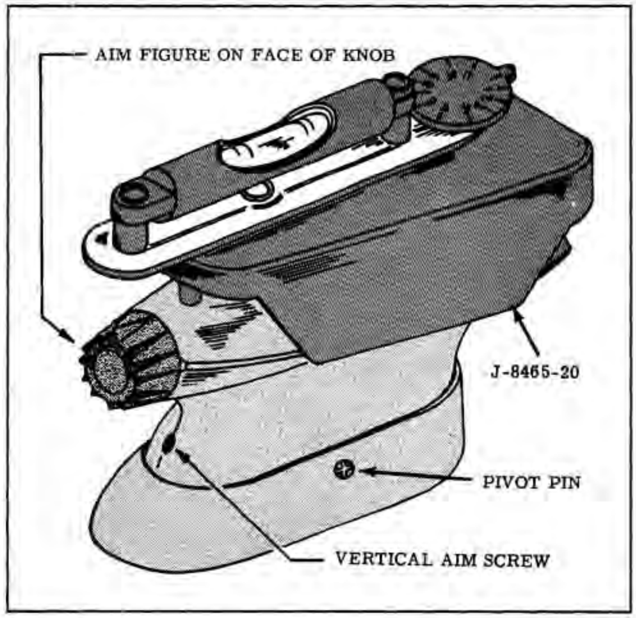


Fig. 12-44 Level Installation

Horizontal Aiming Adjustment (Fig. 12-45)

NOTE: If the phototube unit has been removed for service, it must be aimed parallel to the centerline of the car after the installation is made.

1. Place two pieces of tape or chalk marks 8-1/2" apart on a wall or screen at hood level height.

2. Line up the center of the hood with the right hand tape or chalk mark. The car must be positioned perpendicular to and 25 feet from the wall or screen.

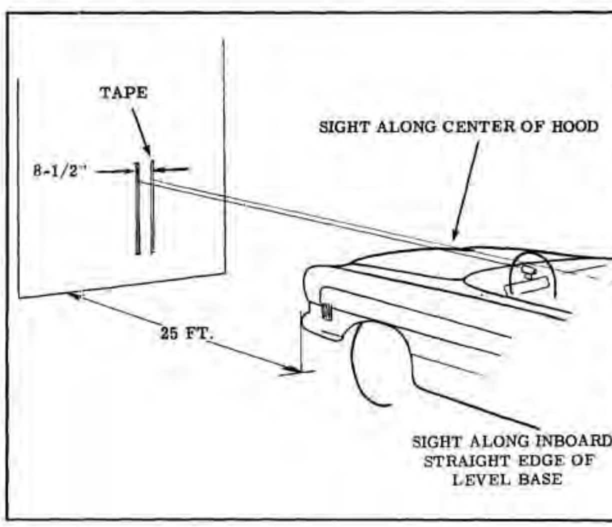


Fig. 12-45 Horizontal Aim

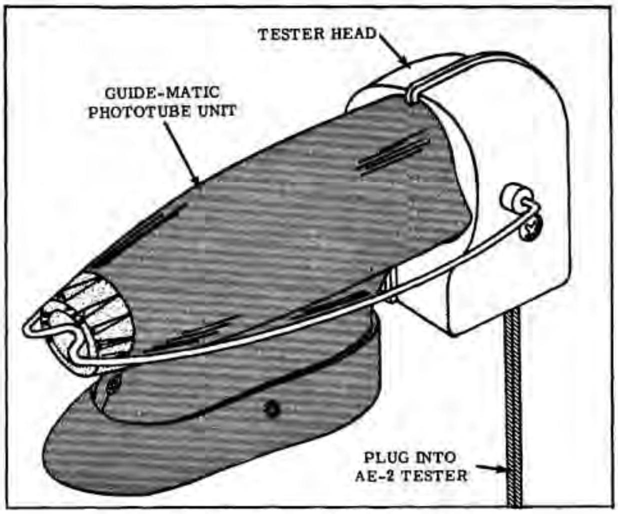


Fig. 12-46 Tester Head Installation

3. With Level J-8465-20 installed on phototube unit, sight along inboard straight edge of level base to the left hand tape or chalk mark.

   NOTE: If the unit is aimed more than four inches to the right or left of the left hand tape, horizontal aim must be readjusted by removing phototube base and elongating forward screw hole as necessary to aim phototube.

Hold Sensitivity Test

1. Place tester head against front of phototube unit and position bail into place over sensitivity control knob. Plug tester head into modified AE-2 tester. (Fig. 12-46)
2. Turn on headlights, and with Guide-Matic switch on, WAIT AT LEAST FIVE MINUTES for amplifier to stabilize. Set standard foot dimmer switch to Automatic position. Upper beam will then be on.

   IMPORTANT: SENSITIVITY CONTROL ON PHOTOTUBE UNIT MUST BE IN CENTER (DETENT) POSITION WHILE TESTING AND ADJUSTING HOLD SENSITIVITY.

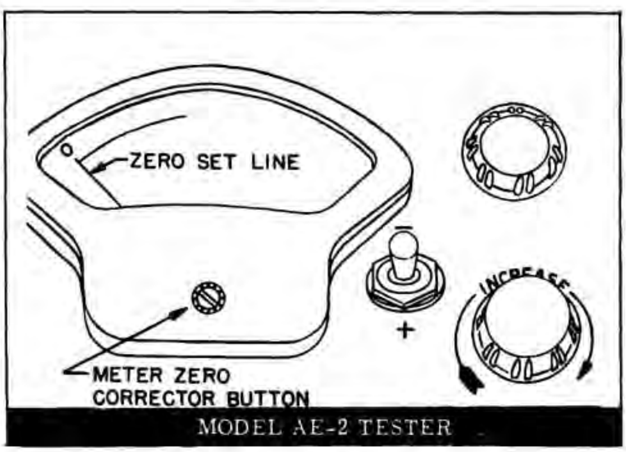


Fig. 12-47 Setting Zero Corrector

3. Turn Zero Corrector on face of tester until meter pointer is on zero set line. (Fig. 12-46)
4. Turn Intensity Rheostat of tester counter-clockwise.
5. Insert tester connector of Model AE-2 tester into cigar lighter receptacle.
6. Operate engine at fast idle while making sensitivity tests and adjustment.
7. Turn Tester Selector Switch to dim position. Be sure to use proper dim position for clear or tinted windshield.
8. Turn Intensity Rheostat all the way clockwise to turn headlights on lower beam.

   NOTE: If lights do not switch to lower beam, the dim control in the amplifier must be turned completely clockwise and then re-adjusted after hold adjustment is correct.
9. Turn Tester Selector to hold position.
10. Slowly turn Intensity Rheostat counterclockwise just to point where headlamps switch to upper beam. The meter pointer should now read in the Hold Sensitivity Adjustment Bar on the meter scale. (Fig. 12-48)

If Hold Sensitivity is not properly adjusted, proceed with HOLD SENSITIVITY ADJUSTMENT.

Hold Sensitivity Adjustment

The hold and dim adjusting controls are located in the amplifier unit and can be adjusted with a screwdriver through holes in the top of the glove box.

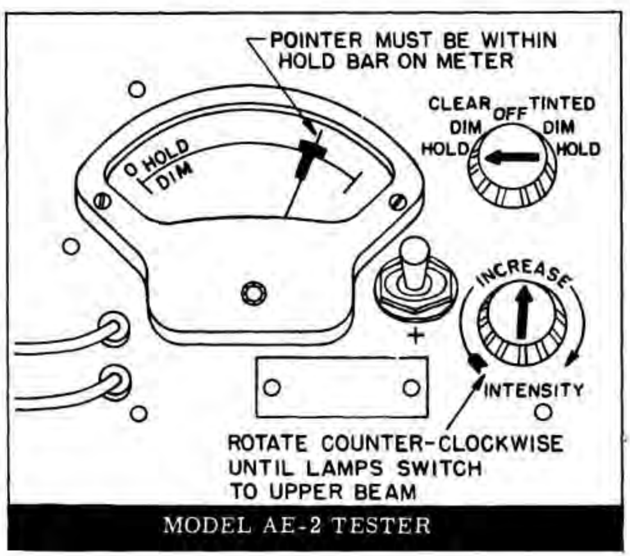


Fig. 12-48 Hold Sensitivity Test

THE SENSITIVITY ADJUSTMENT MUST NOT BE MADE UNTIL AFTER THE HOLD SENSITIVITY IS CORRECTLY ADJUSTED.

1. Turn hold control clockwise to end of adjustment.

2. Rotate Intensity Rheostat all the way clockwise.

3. Turn Selector switch momentarily to dim position to switch lights to lower beam, then switch back to hold position.

   NOTE: If lights do not switch to lower beam, the amplifier dim control must be turned completely clockwise and then readjusted after hold adjustment is correct.

4. Adjust tester Intensity Rheostat until meter pointer is at center of Hold Sensitivity bar. (Fig. 12-48)

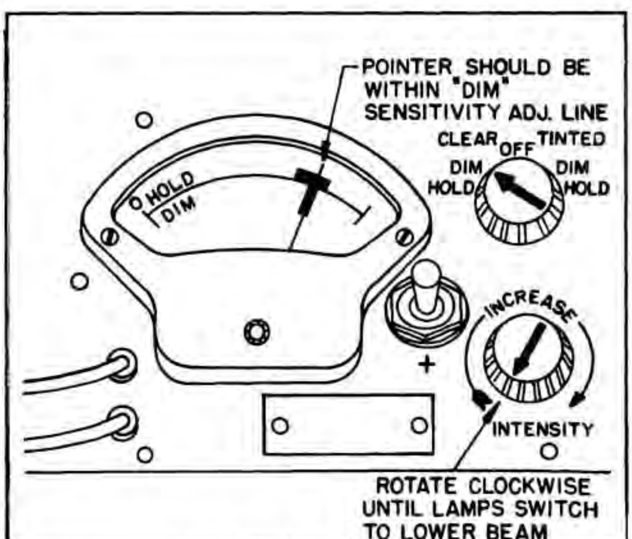
5. Turn the hold control counterclockwise SLOWLY just to the point where headlights switch to upper beam.

6. Rotate tester Intensity Rheostat clockwise to end of travel, then turn Selector Switch momentarily to dim position and back to hold. (Headlights should now be on lower beam.)

7. Recheck hold adjustment by turning Intensity Rheostat SLOWLY counterclockwise just to point where headlights switch to upper beam. Meter pointer should now read in the hold adjustment green bar if adjustment is correct. If not, repeat procedure starting with Step 1.

Dim Sensitivity Test

IMPORTANT: SENSITIVITY KNOB ON PHOTOTUBE UNIT MUST BE IN CENTER (DETENT) POSITION WHILE TESTING AND ADJUSTING DIM SENSITIVITY.



MODEL AE-2 TESTER

Fig. 12-49 Dim Sensitivity Test

1. Rotate tester Intensity Rheostat completely counterclockwise. (Fig. 12-49)

2. Turn Selector Switch momentarily to hold position, then back to dim position. Headlights should now be on upper beam.

3. Turn Intensity Rheostat SLOWLY clockwise stopping at the exact point where the headlights switch to lower beam. Meter pointer should read within the Dim Sensitivity Adjustment Line.

If Dim Sensitivity is not properly adjusted, proceed with DIM SENSITIVITY ADJUSTMENT.

Dim Sensitivity Adjustment

NOTE: DIM SENSITIVITY SHOULD NOT BE ADJUSTED UNTIL AFTER HOLD SENSITIVITY IS PROPERLY ADJUSTED.

1. Rotate dim control completely counterclockwise.

2. Momentarily turn tester off, then back to dim position. Headlights should now be on upper beam.

3. Adjust Intensity Rheostat until meter pointer is at the Dim Sensitivity Adjustment Line.

4. SLOWLY rotate dim control clockwise just to point where headlights switch to lower beam. DO NOT GO BEYOND THIS SETTING.

5. Turn tester Intensity Rheostat completely counterclockwise, then momentarily turn tester to hold and back to dim to place headlights on upper beam.

6. Rotate tester Intensity Rheostat SLOWLY clockwise just to point where headlights switch to lower beam. Meter will read within Dim Sensitivity Line if adjustment is correct. If not, repeat Steps 1 through 6.

7. Turn off headlights and remove tester.

GUIDE-MATIC DIAGNOSIS

IMPORTANT: Check the four amp fuse in fuse connector near headlight switch if Guide-Matic is inoperative.

Lights Stay On Low Beam

1. With the headlight switch on and the Guide-Matic switch off, operate the dimmer switch

to see if lights can be switched from low to upper beam.

a. If lights change beams when dimmer switch is operated, then the power relay and dimmer switch are functioning. Leave dimmer switch in upper beam (automatic) position, then proceed with Step 2.

b. If the lights stay on low beam, the dimmer switch, power relay or wiring at these units is at fault.

2. With headlight switch and Guide-Matic switch on, wait at least a minute for the amplifier to warm up, then cover the phototube unit with a dark cloth.

a. If lights go to upper beam, system is operating but requires adjustment.

b. If the lights stay on low beam, position the amplifier hold control in approximately the center of its travel to eliminate the possibility of complete misadjustment locking the headlights on low beam. If the headlights still stay on low beam when the phototube unit is again covered, the amplifier or phototube unit is defective. Proceed with Step 1.

(1) Disconnect the phototube unit from the amplifier.

(a) If the lights go to upper beam, the phototube unit is at fault. Remove the cover and substitute the phototube and pre-amplifier tube assembly with a known good tube assembly. (Remove attaching screw and unsolder wire from cap of tube.) If the condition still exists remove the phototube unit and amplifier unit for testing and repair by an authorized warranty repair dealer.

(b) If the lights stay on low beam, the amplifier unit is at fault. Substitute known good tubes. If the condition still exists, remove the amplifier unit only for repair by an authorized warranty repair dealer.

Lights Stay On Upper Beam

1. With the headlight switch on and Guide-Matic switch off, operate the dimmer switch to determine if lights can be switched from upper beam to low beam.

a. If lights go to low beam, the power relay and dimmer switch are functioning. Leave the dimmer switch in upper beam (automatic) position, then proceed with Step 2.

b. If lights stay on upper beam, the dimmer switch, the power relay or wiring at these units is at fault.

(1) Check 4 amp fuse in holder at headlight switch.

(2) Remove the two-way connector from the power relay and place on the dimmer switch. If headlights change beams, trouble is in the relay. If not, trouble is in dimmer switch harness wires or connectors.

2. With headlight switch and Guide-Matic switch on, wait at least a minute for the amplifier to warm up, then remove the phototube unit control knob, C ring, cover screws and cover. Ground the white wire terminal in phototube unit.

a. If the lights go to lower beam, trouble is in the phototube unit. Substitute the phototube and pre-amplifier tube assembly with a known good tube assembly. (Remove attaching screw and unsolder wire from switch.) If condition still exists, remove the phototube unit and amplifier for testing and repair by an authorized warranty repair station.

b. If the lights stay on upper beam when the white wire terminal in the phototube unit is grounded, the amplifier unit or dimmer switch is at fault.

(1) Remove red wire from dimmer switch, if headlights go to low beam, the dimmer switch is at fault.

(2) If headlights remain on upper beam, disconnect dimmer switch harness and amplifier harness. Connect car harness to dimmer switch. If headlights change from upper beam to lower beam, trouble is in the amplifier. Substitute known good tubes. If condition still exists, remove amplifier unit for testing and repair by an authorized warranty repair station.

SAFETY SENTINEL (Fig. 12-50)

A speed warning device (Safety Sentinel), is available as factory installed optional equipment. A knob on the instrument panel can be turned by the driver to adjust the sentinel dial in the cluster face to any desired speed setting between 25 and 100 mph. When car speed is equal to, or exceeds the setting on the sentinel dial, a warning light and buzzer warn the driver that he is exceeding his desired speed.

The circuit is complete when a hair spring on

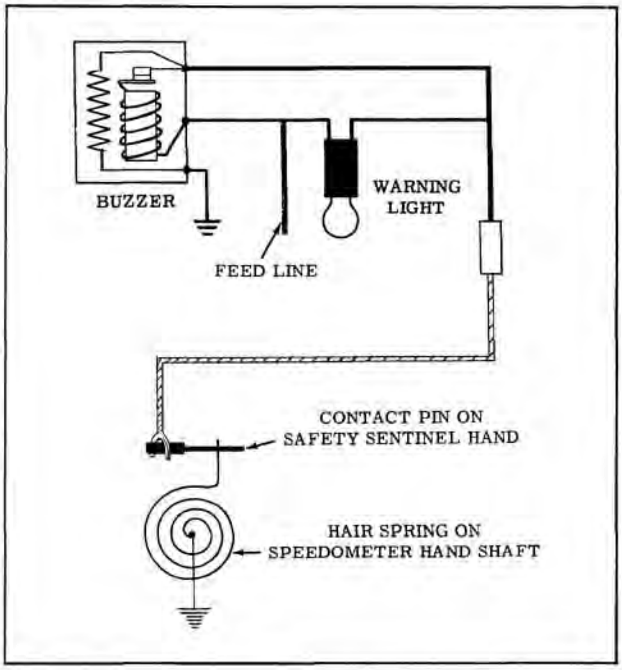


Fig. 12-50 Safety Sentinel Circuit

the speedometer hand shaft contacts an insulated pin on the safety sentinel hand. The hair spring is grounded and the insulated pin is connected to the buzzer and warning light. If speed is increased further, the hair spring remains in contact with the pin on the safety sentinel hand and is wound up by the speedometer hand.

CHECKING THE SAFETY SENTINEL

1. Check the nine ampere fuse in the fuse block. The parking brake lamp, back-up lamps, temperature, generator and oil pressure warning lamps, and fuel gauge are also on this fuse.

2. Raise the car so that the left front wheel is off the floor.

3. Adjust the Safety Sentinel to 30 mph.

4. Using a wheel spinner on the left front wheel, rotate wheel until speedometer reads approximately 32 mph. The buzzer and light should operate.

5. If the buzzer operates and light does not, remove the bulb from the rear of the speedometer head assembly and install a new one.

6. If the light comes on and the buzzer does not sound, remove the buzzer and replace with one known to be working.

7. If the buzzer and light do not operate, but other panel units in the same circuit operate, check Safety Sentinel circuit connection to the printed circuit. If connection is good, remove the speedometer head for repair by an authorized warranty repair dealer.

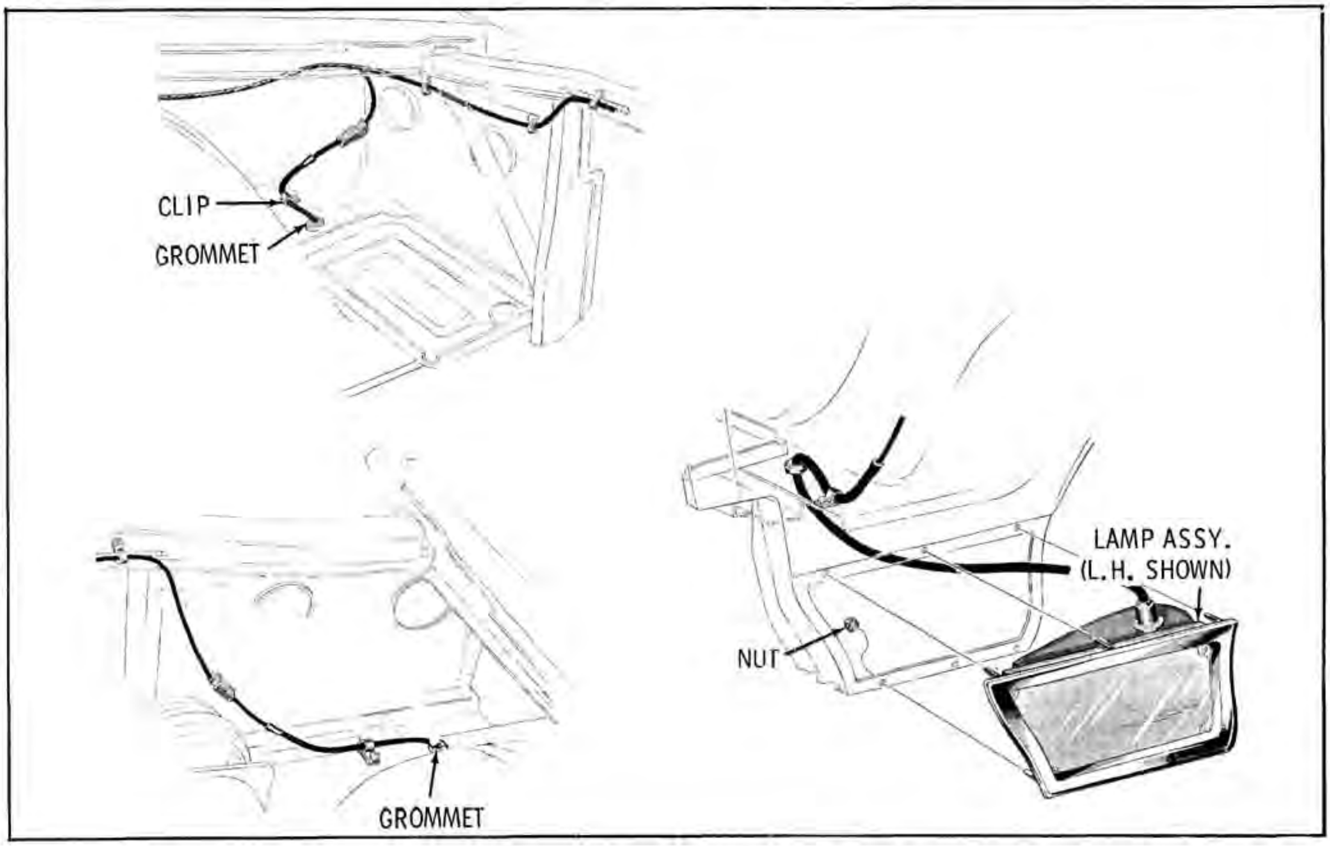


Fig. 12-51 Cornering Lamps

CORNERING LAMPS (Fig. 12-51)

The cornering lamps are located in the side of the front fenders. The switch that operates the cornering lamp is integral with the directional signal switch. When either turn signal is operating with the headlamps or parking lamps ON, the corresponding cornering lamp will light continuously. After the turn is completed, the return of the steering wheel to the straight ahead position automatically turns off the cornering lamps.

ACCESSORY LAYOUTS

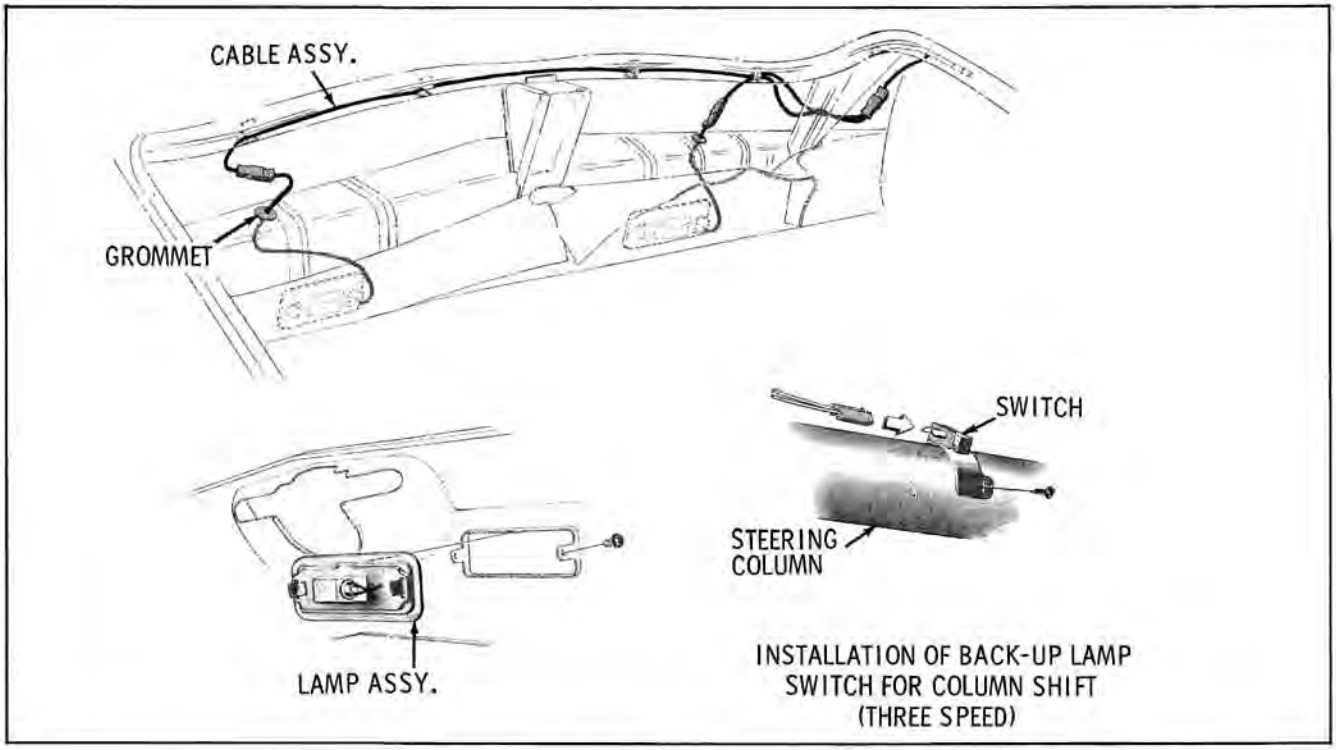


Fig. 12-52 Back-Up Lamps

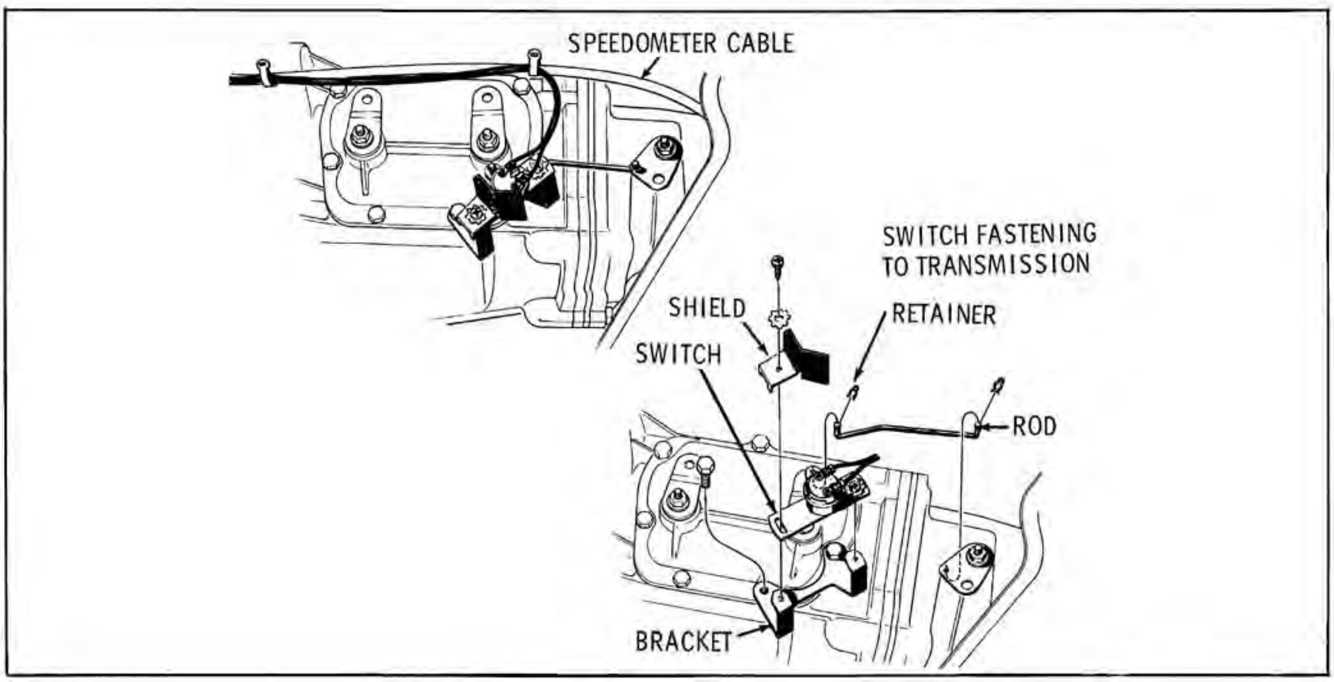


Fig. 12-53 Back-Up Lamp Switch (Four Speed Synchromesh Transmission)

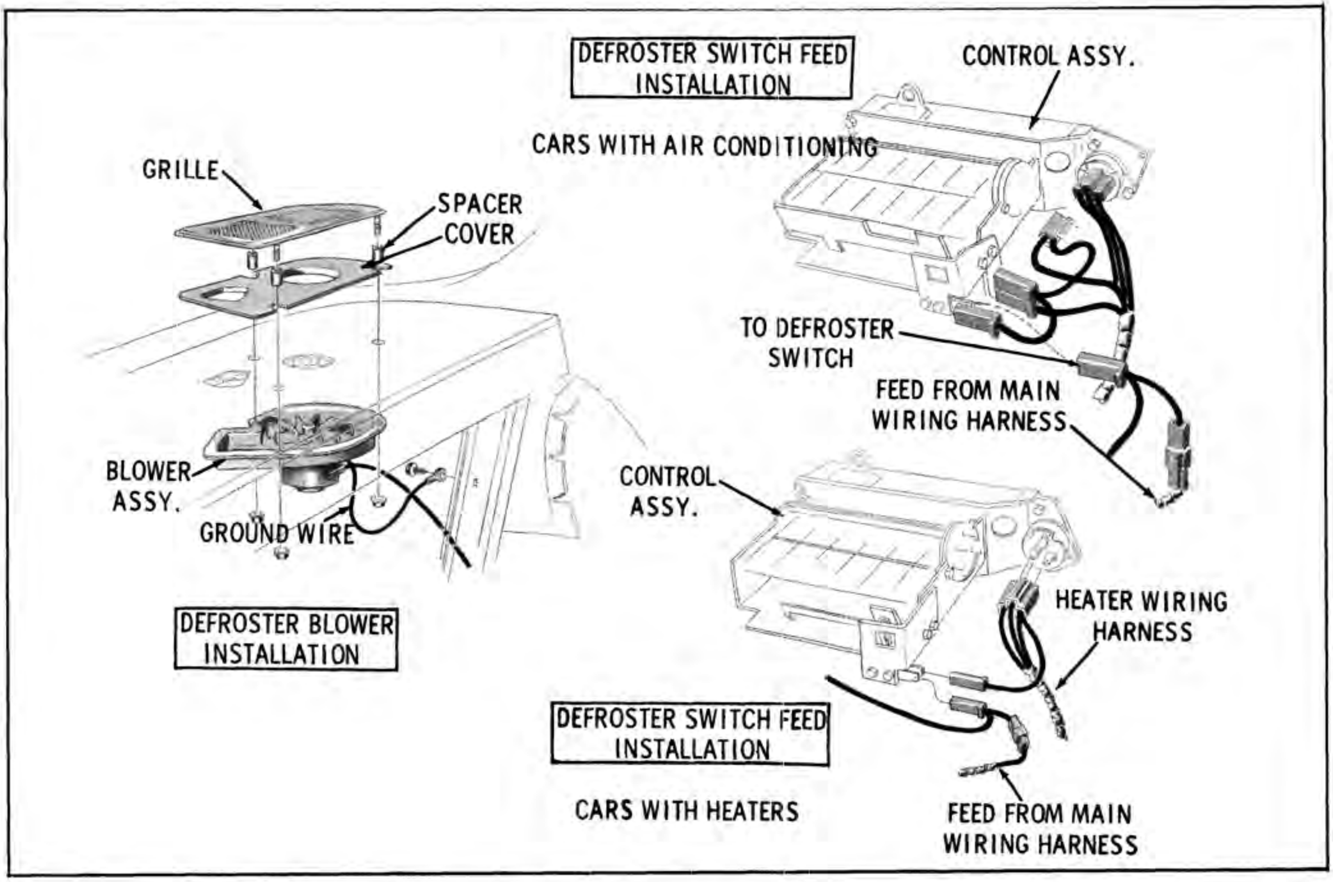


Fig. 12-54 Rear Window Defroster Installation

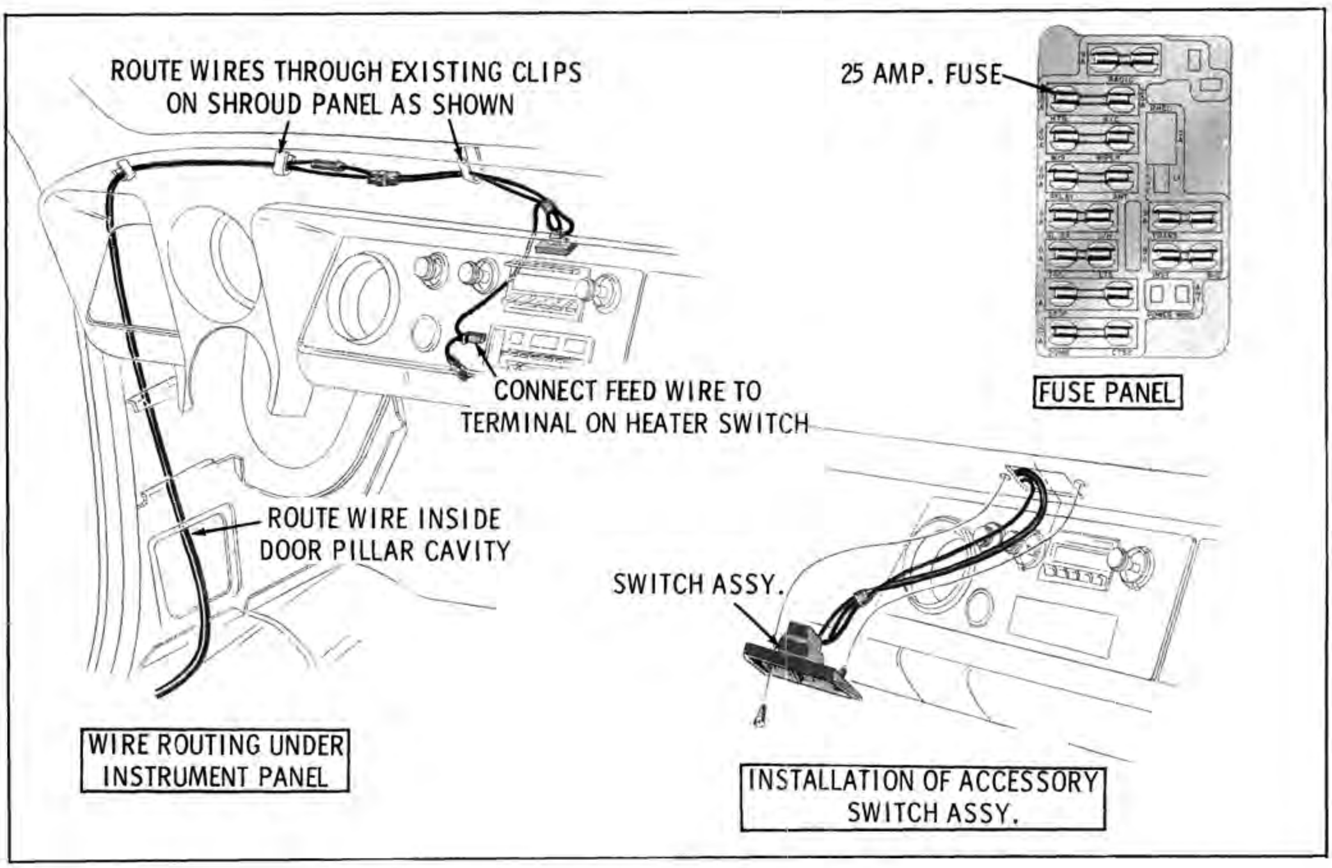


Fig. 12-55 Rear Window Defroster Wiring

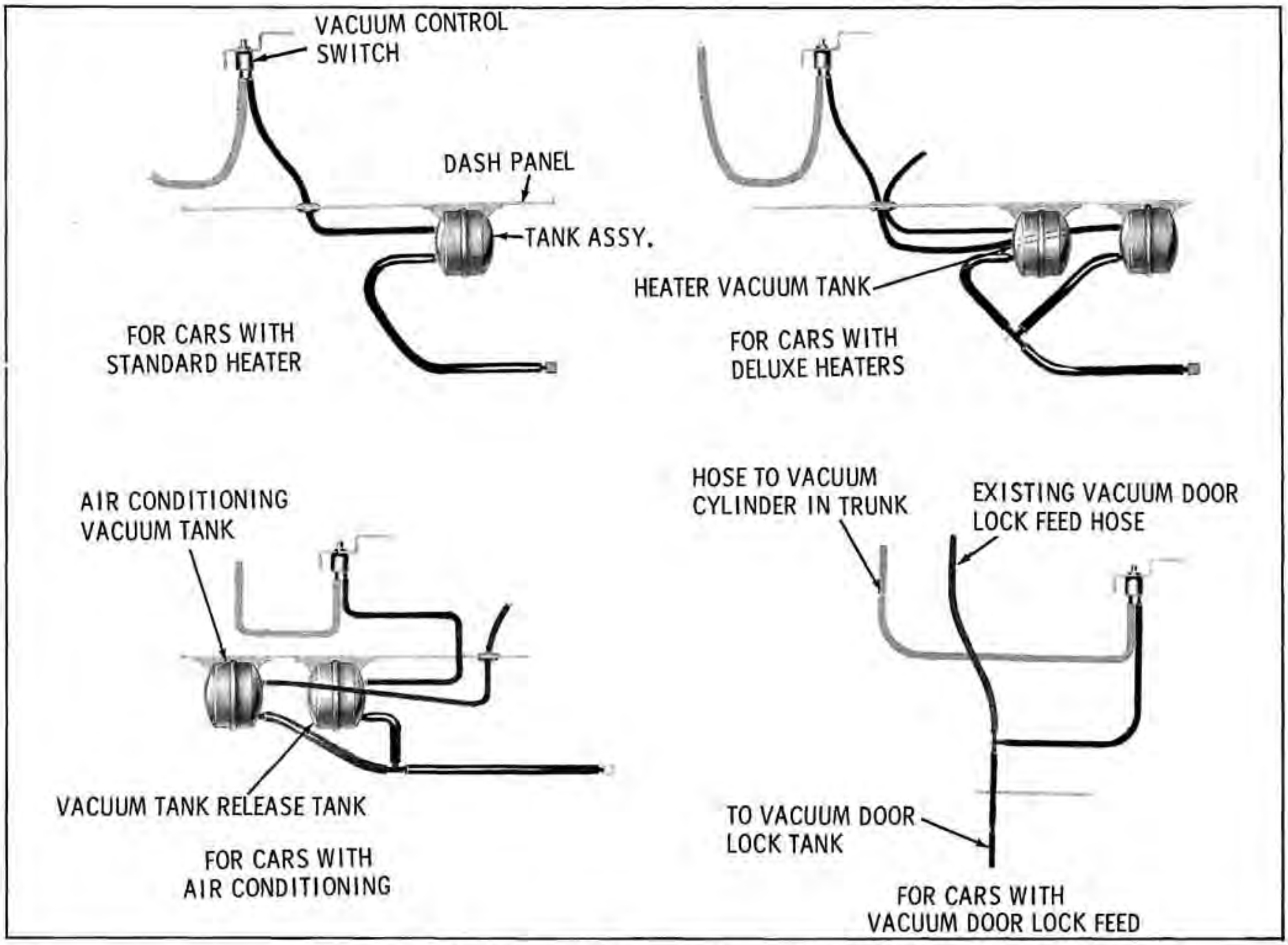


Fig. 12-56 Vacuum Trunk Lock (Vacuum Hose Routing)

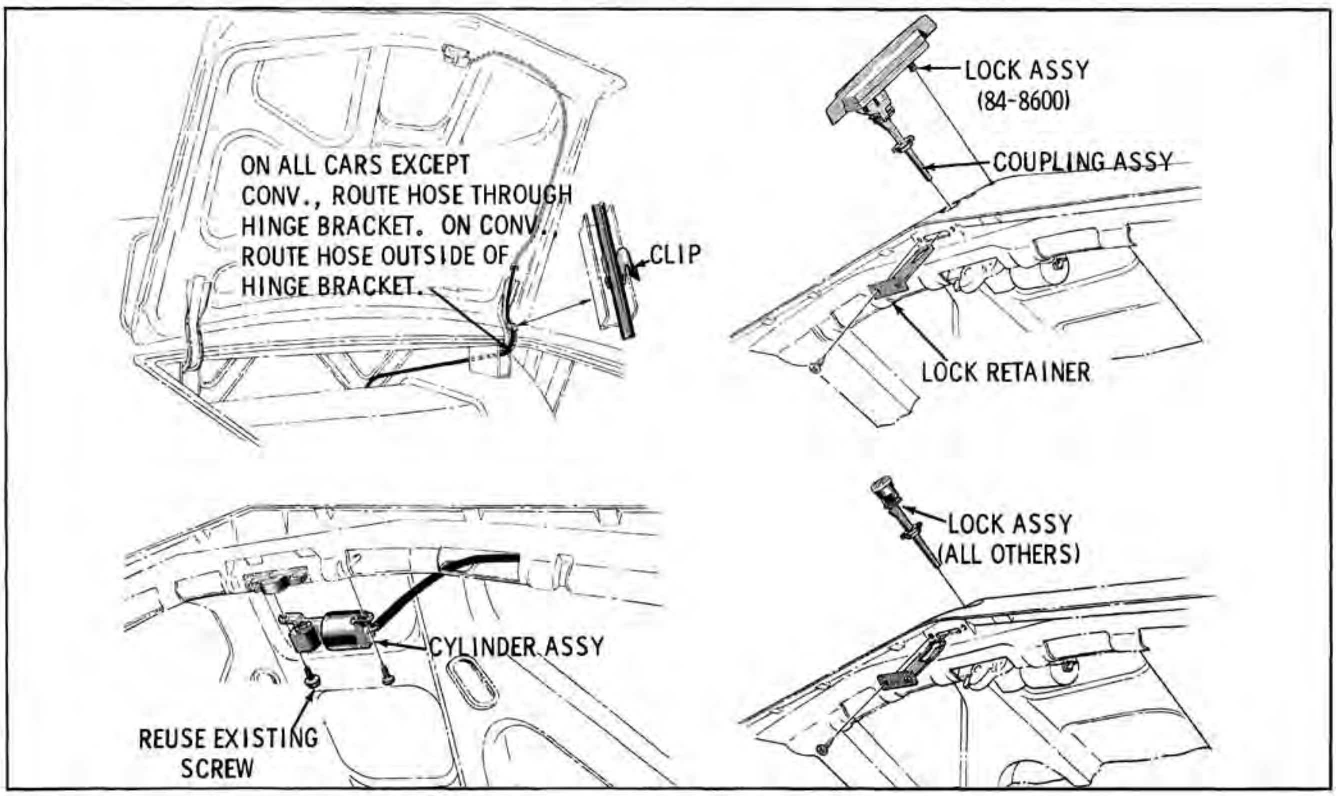


Fig. 12-57 Vacuum Cylinder and Lock Installation

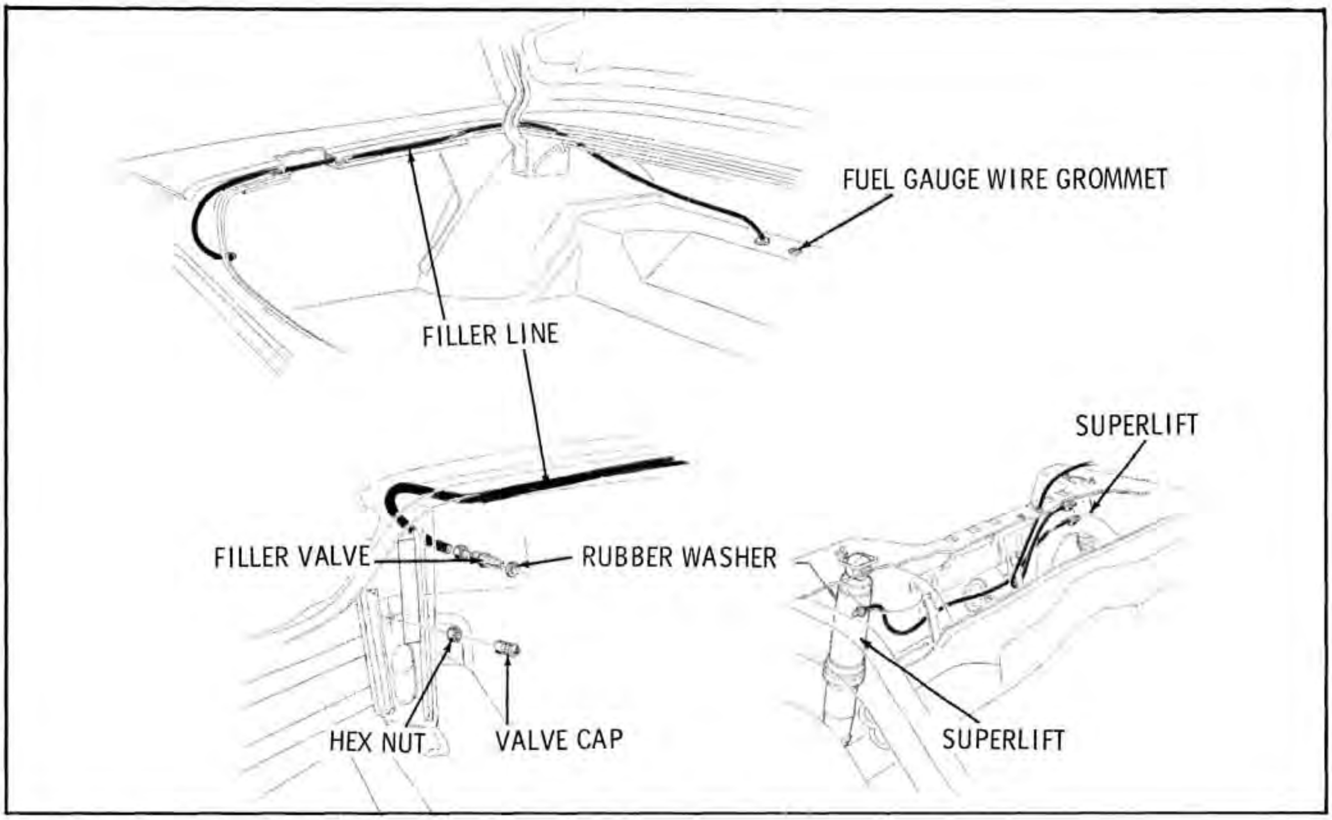


Fig. 12-58 Super Lift Shock Absorber Installation

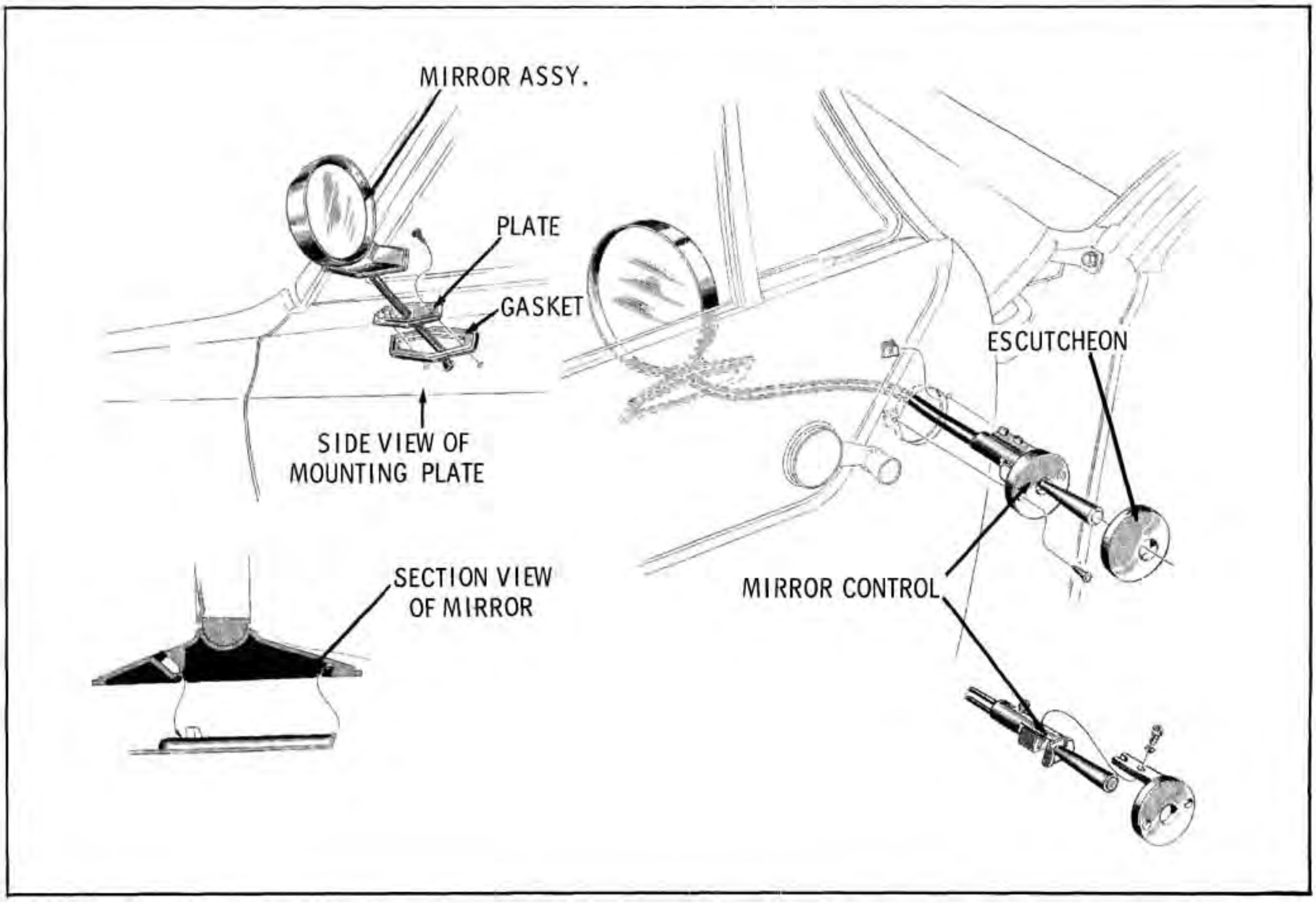


Fig. 12-59 Remote Control Mirror Installation

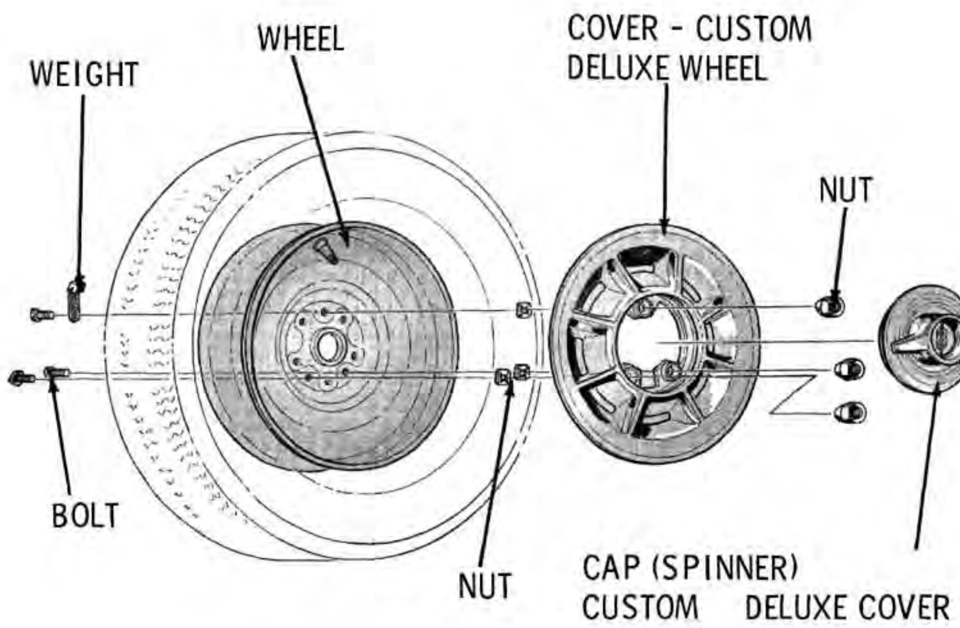


Fig. 12-60 Deluxe Wheel Cover

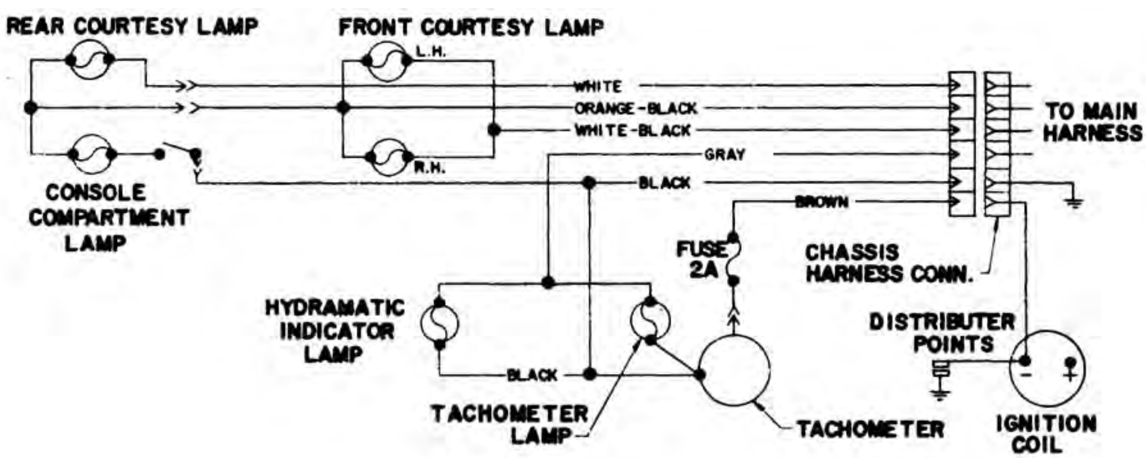


Fig. 12-61 Console Wiring

INSTRUMENT PANEL AND ACCESSORIES

33-34-35-36 & 38 SERIES

CONTENTS OF SECTION 12

DESCRIPTION

The instruments and controls are mounted in a control panel assembly which is bolted to the instrument panel. The control panel assembly can be removed from the instrument panel in a single unit with all controls, instruments and accessories attached to the panel, however it is not necessary to remove the complete panel to service individual units. (Fig. 12-101)

All the instruments are electrically operated, except the speedometer and Jetaway indicator, which are mechanically operated. The generator, temperature and oil pressure indicators use colored lights to warn the driver of conditions other than normal when the engine is operating at speeds above idle, or when the engine is operating at normal operating temperature.

The lamp sockets used in the printed circuit board can be removed by turning the socket 1/8 of a turn counterclockwise. The lamp bulb can then be removed from the socket by simply pulling the bulb straight out of the socket.

The instruments and lamps are of the printed circuit type and they are connected to the chassis wiring harness by a multiple connector plug on the printed circuit board.

CONTROL PANEL ASSEMBLY

Removal

1. Disconnect battery cable.
2. Disconnect speedometer cable, remove the wiring harness clip from the lower cluster mounting stud and the rear of the heater

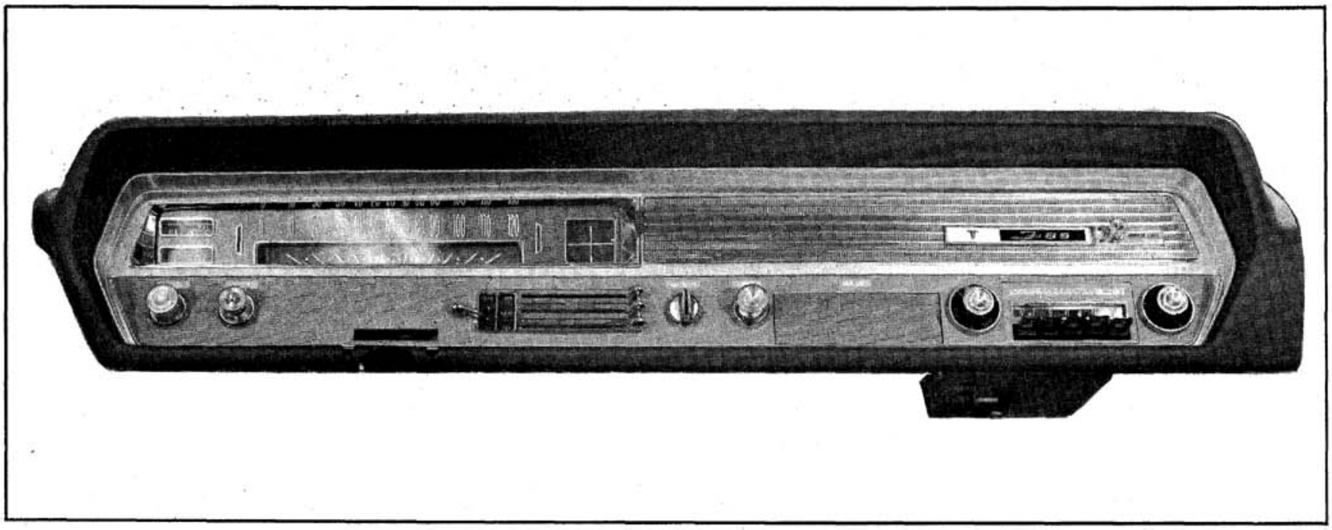


Fig. 12-101 Control Panel Assembly

control, disconnect the printed circuit connector, headlamp connector, heater control, clock, rear seat speaker wire, cigarette lighter, parking brake light and ignition switch.

If equipped with air conditioning, disconnect cables and vacuum hoses, remove center outlet bezel and duct assembly and remove manifold to gain access.

3. Remove the screws securing steering column to instrument panel.

4. Remove the nuts securing steering column clamp and lower column.

5. Remove the control panel to instrument panel attaching nuts (Fig. 12-202) and remove the control panel with all controls attached.

TRIM PANEL OR TRIM PAD

The trim panel is attached to the control panel as shown in Fig. 12-103. To replace the trim

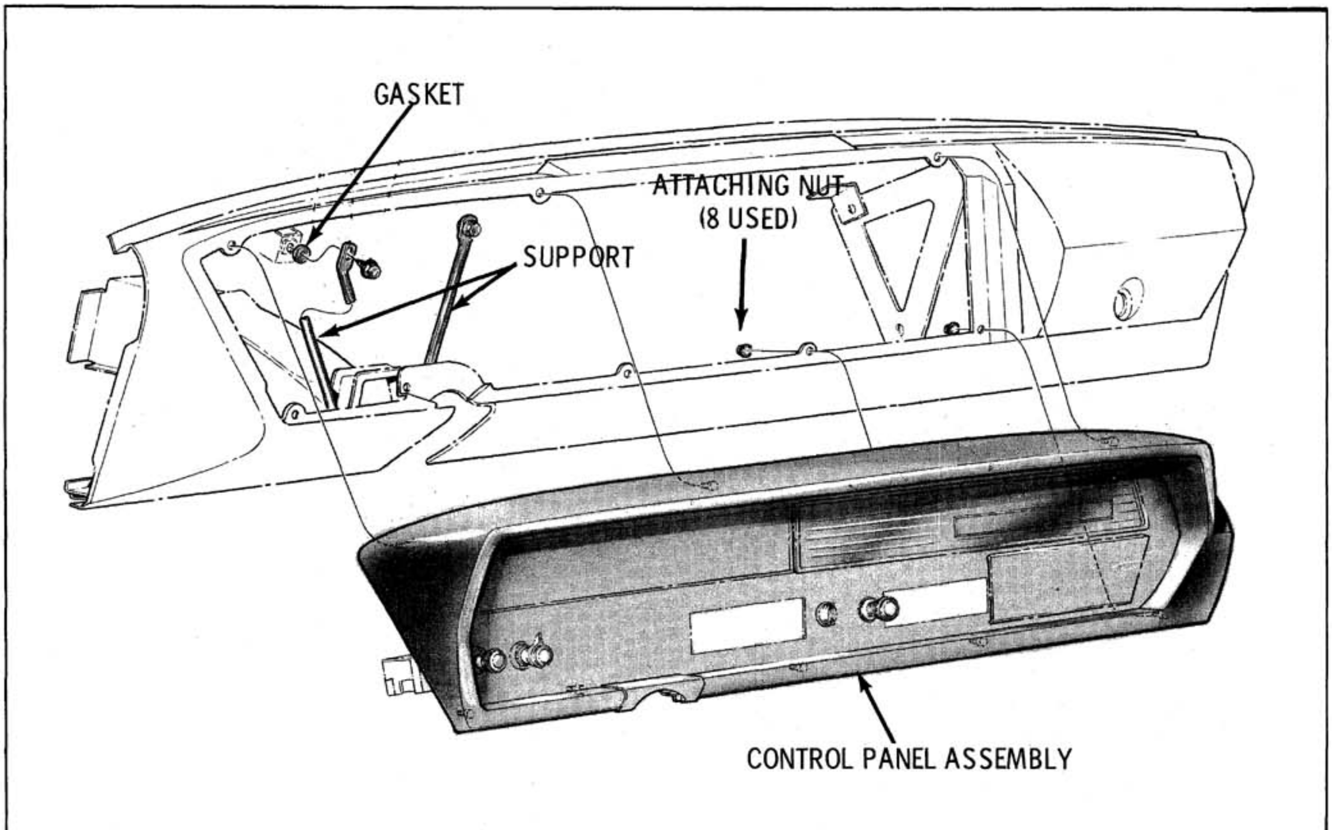


Fig. 12-102 Control Panel Attachment

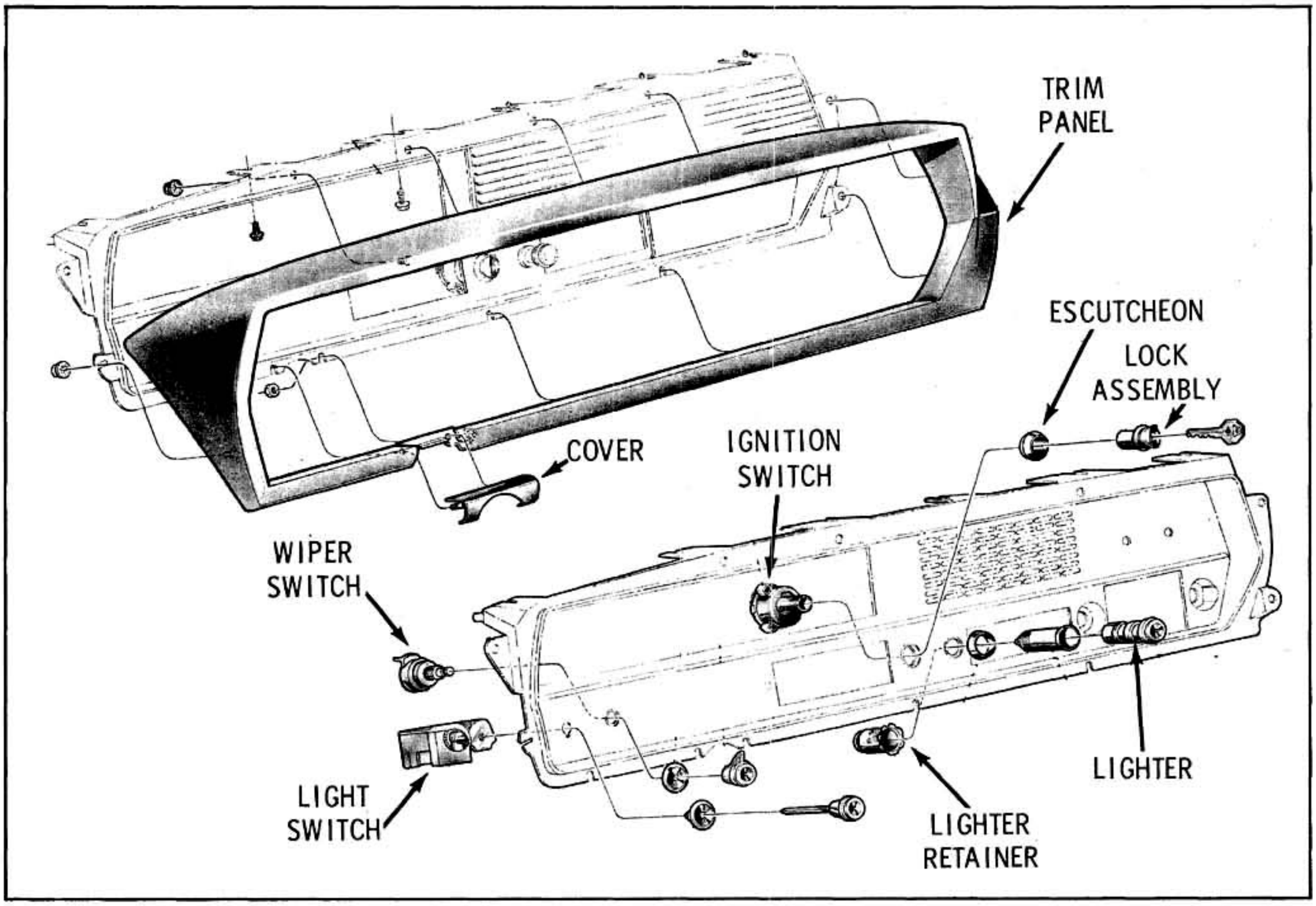


Fig. 12-103 Trim Panel Attachment

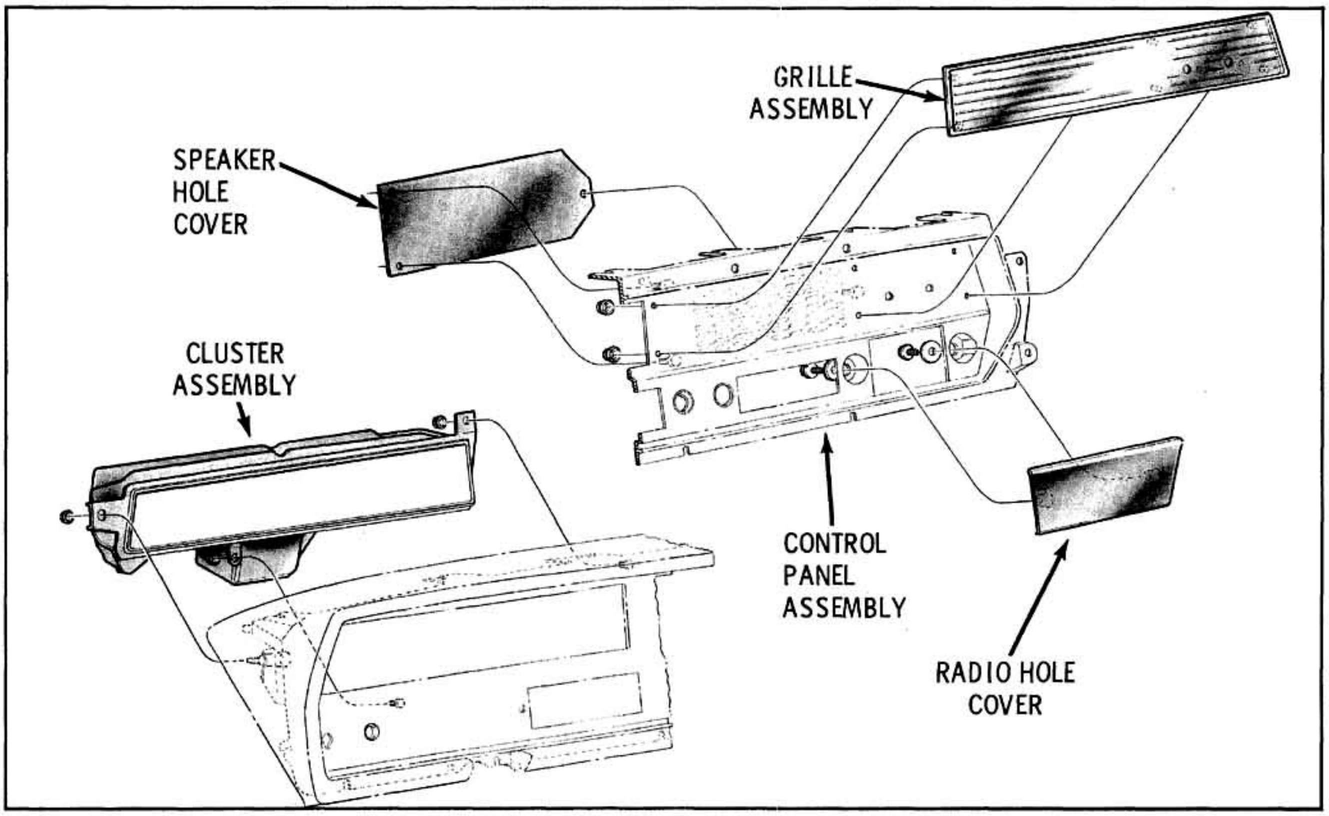


Fig. 12-104 Instrument Panel Hole Covers

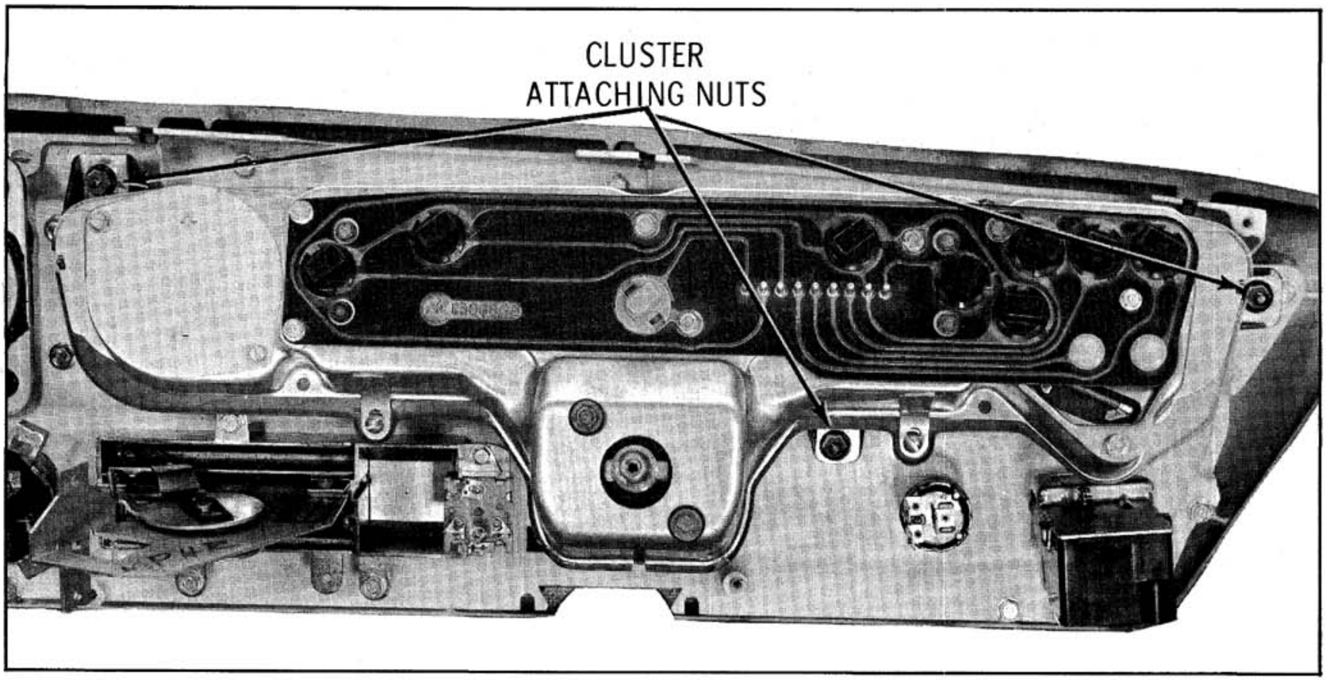


Fig. 12-105 Instrument Cluster

panel, it is necessary to remove the complete control panel assembly.

INSTRUMENT PANEL HOLE COVERS
(Refer to Fig. 12-104)

INSTRUMENT CLUSTER

Removal

1. Disconnect speedometer cable.
2. Disconnect printed circuit connector plug.
3. If equipped with clock, disconnect wiring.
4. Remove L. H. instrument panel brace, three cluster attaching nuts and wiring harness clip, then remove cluster assembly.

Fig. 12-106 illustrates printed circuit installed. If necessary to disassemble the cluster assembly, refer to Fig. 12-107.

HEADLIGHT SWITCH

All connections in the headlight switch are

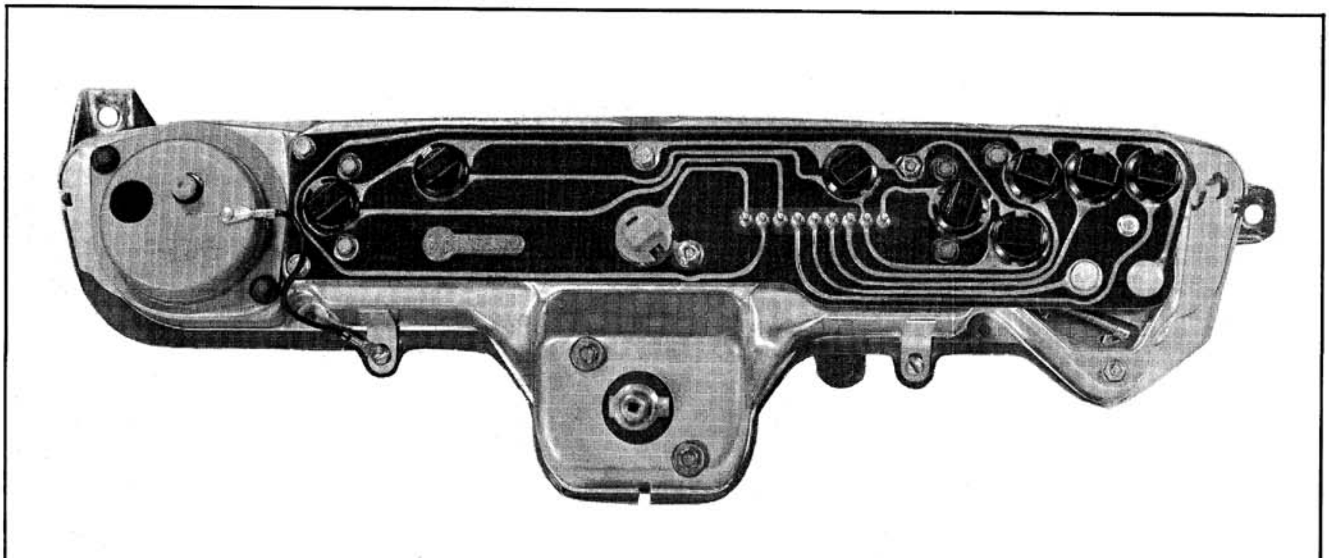


Fig. 12-106 Printed Circuit Installed

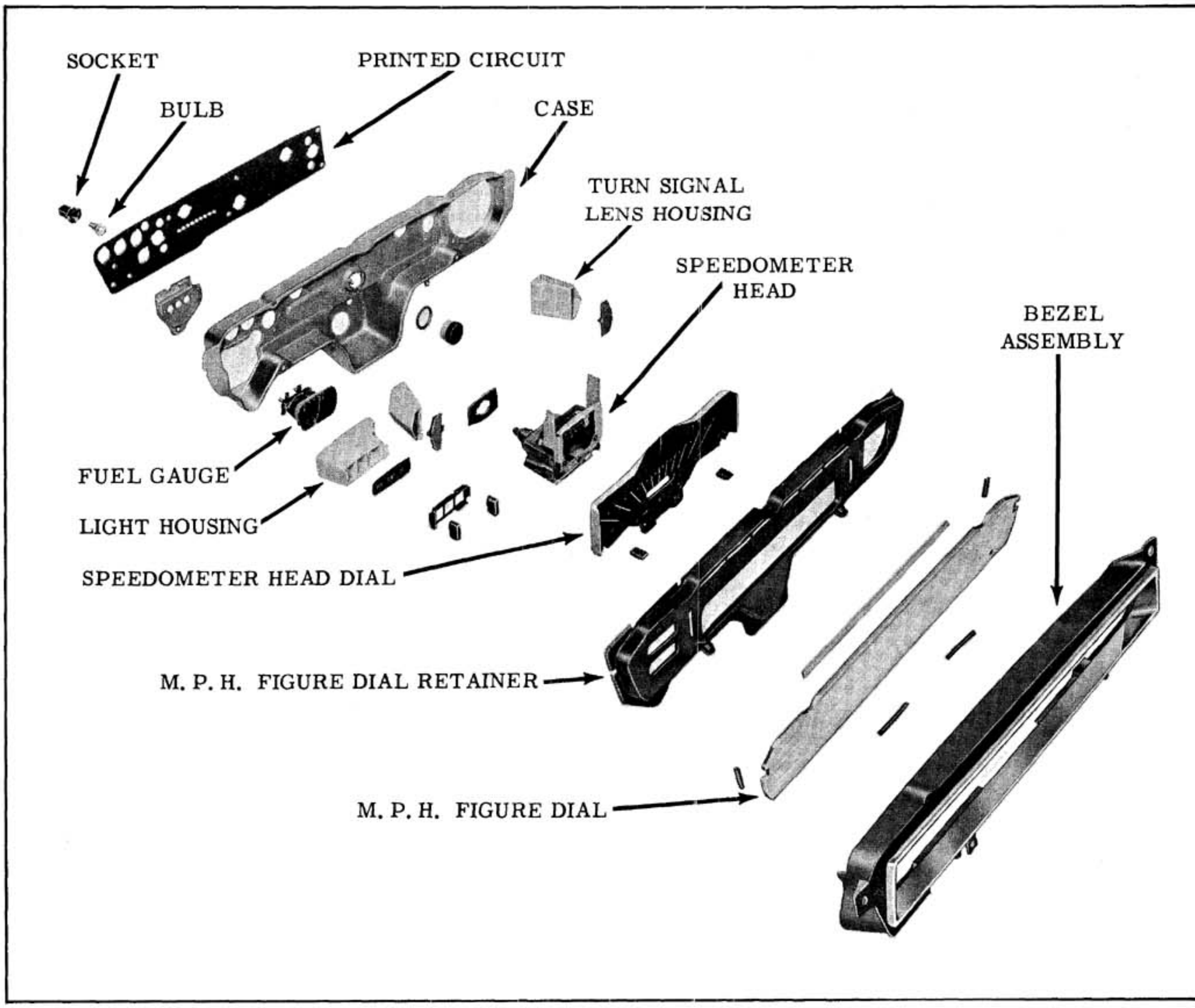


Fig. 12-107 Exploded View of Instrument Cluster

connected as a group by a multiple connector.

The brightness of the instrument panel lights is controlled through a variable resistor unit by turning the light switch knob right or left. Rotating the knob fully counterclockwise will cause the dome lamp to light.

Removal

1. Disconnect wiring from light switch.

2. Remove knob by first pulling knob out to the HEADLIGHT position, then depress the spring loaded button on switch body and pull knob out of switch assembly.

3. Remove escutcheon nut using Tool BT 6411. (Fig. 12-108)

4. Remove headlight switch from rear of instrument panel.

To install, reverse removal procedure and check switch operation.

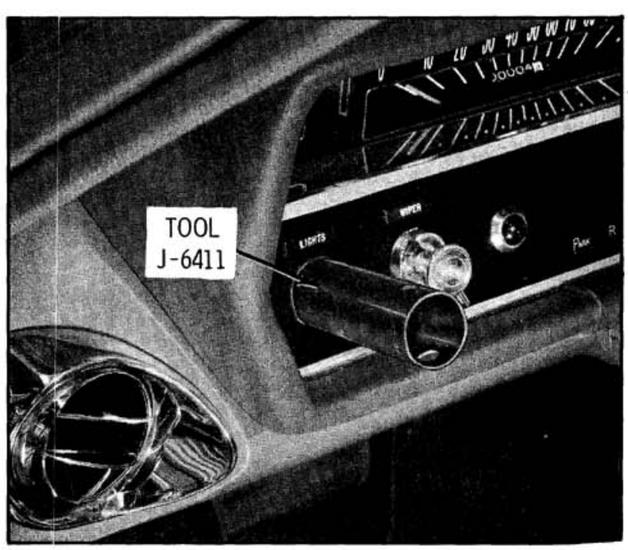


Fig. 12-108 Removing Light Switch

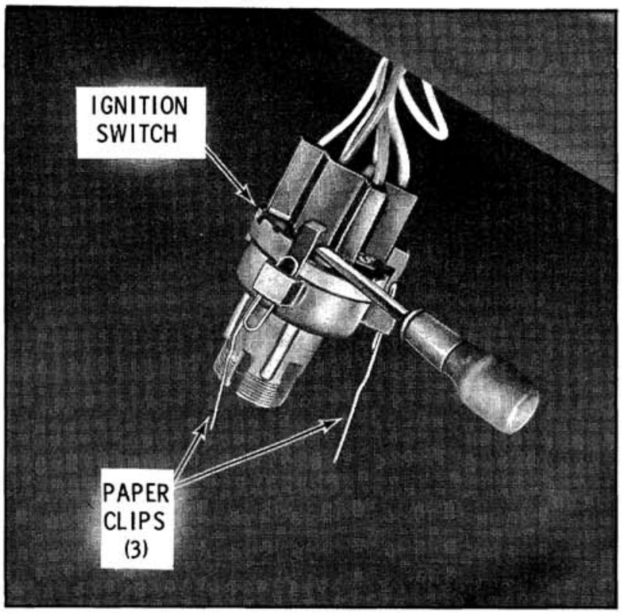


Fig. 12-109 Disconnecting Ignition Switch

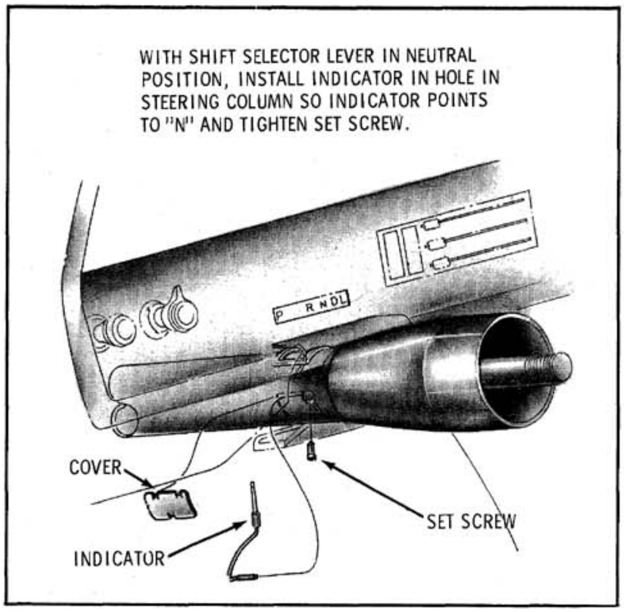


Fig. 12-110 Jetaway Shift Indicator

WIPER CONTROL

Removal

1. Disconnect switch wiring harness.
2. Remove wiper control knob set screw and remove knob.
3. Remove escutcheon nut using Tool BT 6429 and remove switch from rear of the instrument panel.

IGNITION SWITCH

Removal

1. Turn switch to ACCESSORY position.
2. Insert a paper clip into the small hole in the front side of the switch and depress, while turning the key counterclockwise, the lock will then pop out.
3. Remove the escutcheon using Tool BT 6411.
4. Drop the switch down behind the instrument panel to remove the wiring connector. (Fig. 12-109)

   NOTE: If equipped with air conditioning, remove the center outlet and the upper outlet duct, slide the lower outlet duct rearward and pull wiring and switch through center outlet opening to disconnect the wiring connector.

CIGAR LIGHTER (Fig. 12-103)

From beneath the instrument panel, disconnect the wiring connector and unscrew the retainer from the lighter case.

If equipped with air conditioning, remove the center outlet and upper outlet duct to gain access.

JETAWAY INDICATOR

For installation and adjustment, refer to Fig. 12-110.

CLOCK

For removal and installation refer to Fig. 12-111.

ASH TRAY (Fig. 12-112)

Removal

1. Disconnect speaker lead from radio.
2. Remove the three nuts securing radio speaker and remove the speaker.
3. Remove the pivot pin retainer.
4. Lift pin upward while observing the spring washers.
5. The ash tray door can now be removed.

The ash tray lamp bulb located above the radio speaker, can be replaced by removing the radio speaker and the lamp attaching screw. The lamp bulb is No. 1445.

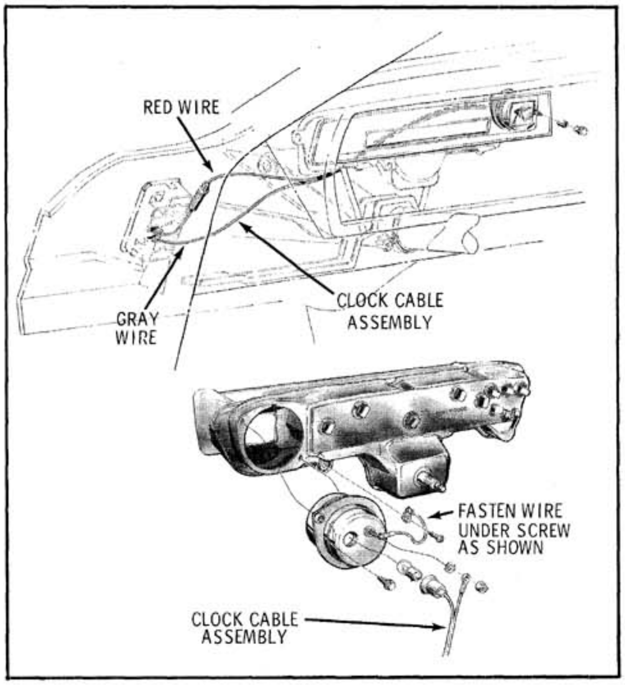


Fig. 12-111 Clock Installation

If equipped with air conditioning, access to the speaker can be made by removing the center outlet bezel and upper duct. The lower duct can be shifted rearward to allow access.

CONSOLE ASSEMBLY (Jetaway)

Removal

1. Remove two screws from each side securing console to brackets. (Fig. 12-113)
2. Open console door and remove two screws from bottom of map case.
3. Loosen set screw from bottom right side of handle assembly, remove button and spring. (Fig. 12-114)

   NOTE: Piston will usually stay in the handle.

4. Loosen two set screws on the shank of the handle, depress the left button and remove the handle.
5. Lift the rear of the console and shift to the side to disconnect the wiring connector.

REAR COURTESY AND GLOVE BOX LAMP

The lamp assembly is retained to the console

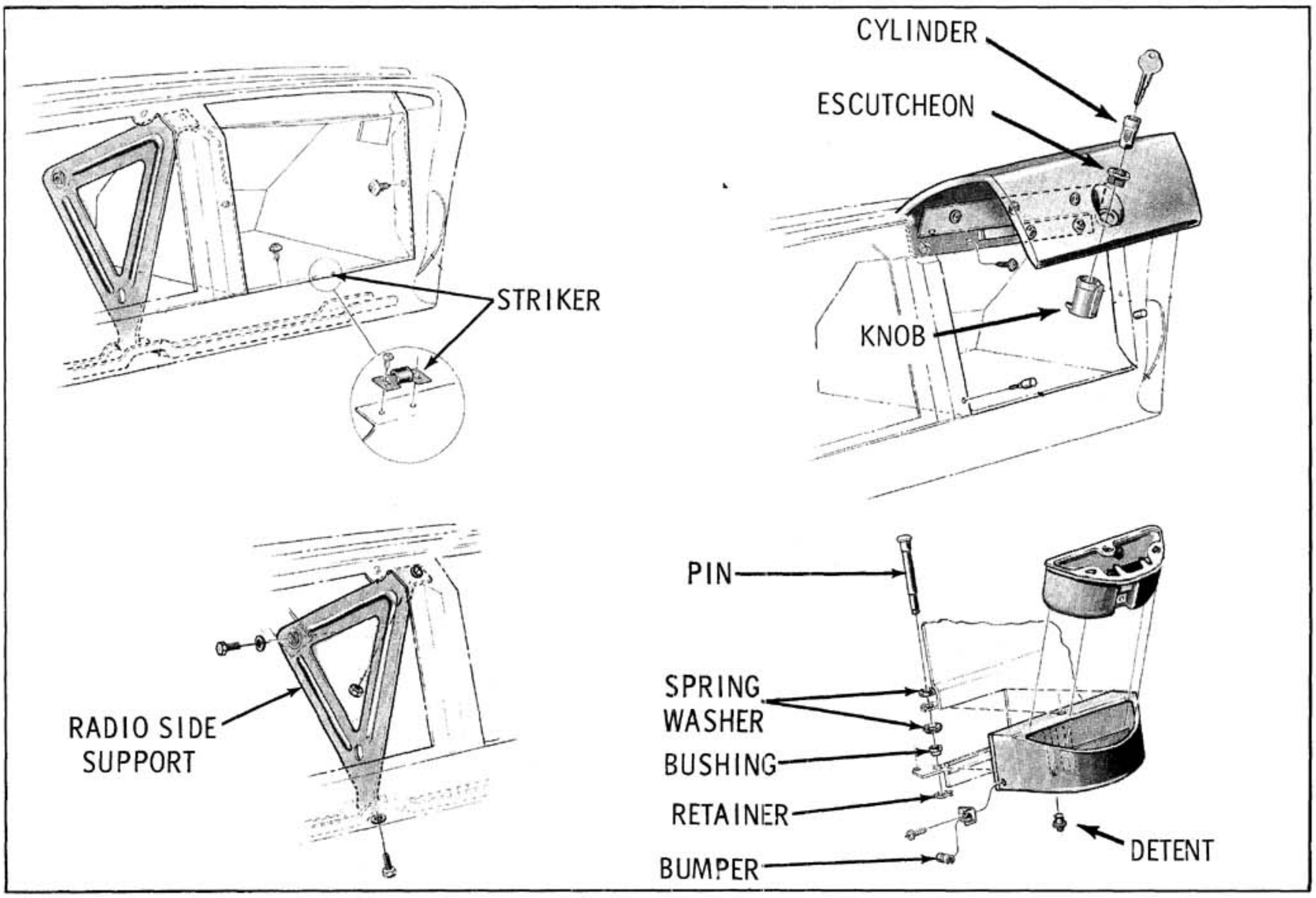


Fig. 12-112 Ash Tray, Glove Box and Support

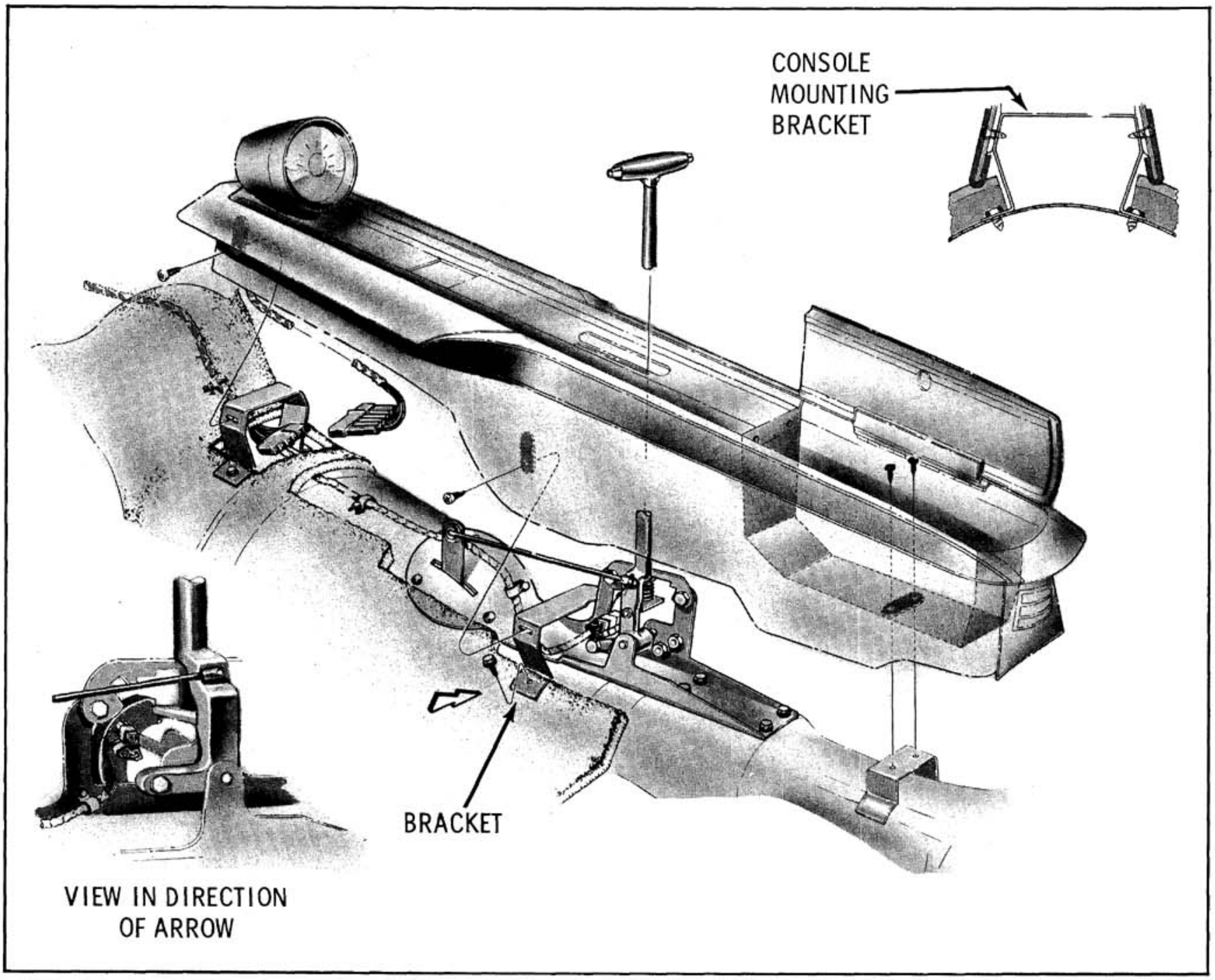


Fig. 12-113 Console Mounting (Jetaway)

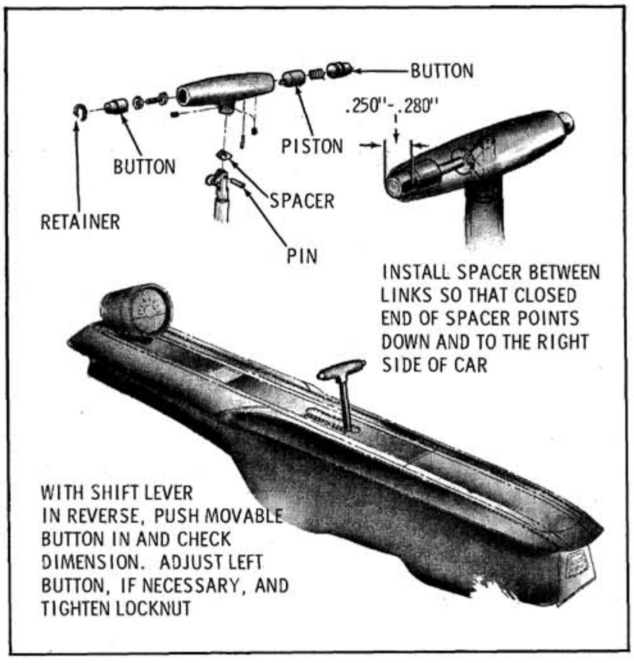


Fig. 12-114 Handle Assembly

body by two screws accessible inside of the glove box. To change either bulb it is necessary to remove the two screws retaining the lamp assembly. (Fig. 12-115) The glove box lamp bulb is the snap-in type and the rear courtesy lamp bulb is the depress and turn type.

To change the rear courtesy lamp lens, it is necessary to remove the two screws retaining the lamp assembly from inside the glove box. Position lamp assembly out of the way to gain access to the lower console rear molding attaching nut and remove the nut. Remove the rear screws retaining side moldings (Fig. 12-116) to rear molding and remove the rear molding. The lens can then be removed by removing the attaching screw.

SHIFT SEAL, INDICATOR, LENS AND INDICATOR HOUSING (Fig. 12-115)

1. Remove handle assembly.
2. From inside the glove box, remove two screws securing console panel to console body.

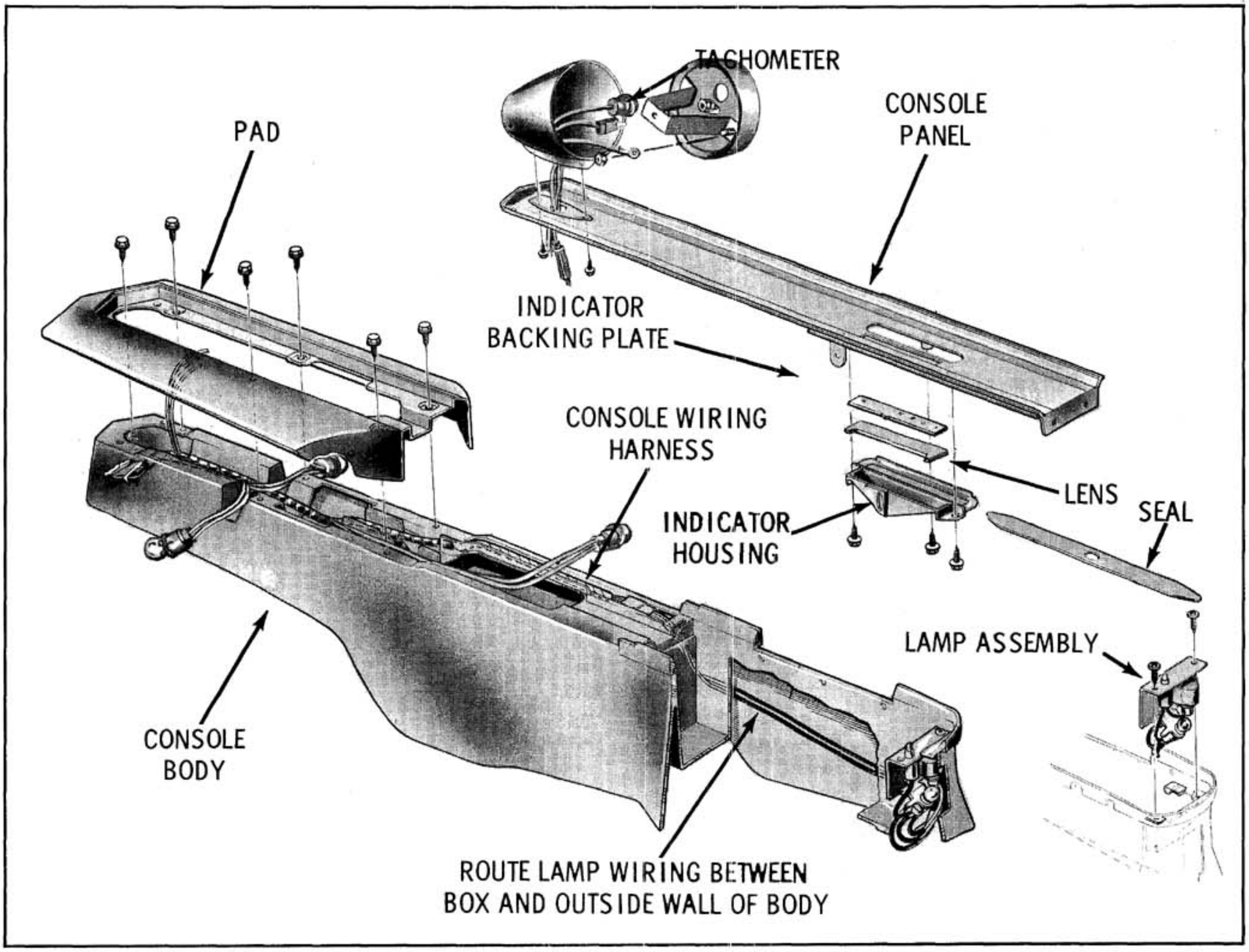


Fig. 12-115 Console Assembly - Jetaway

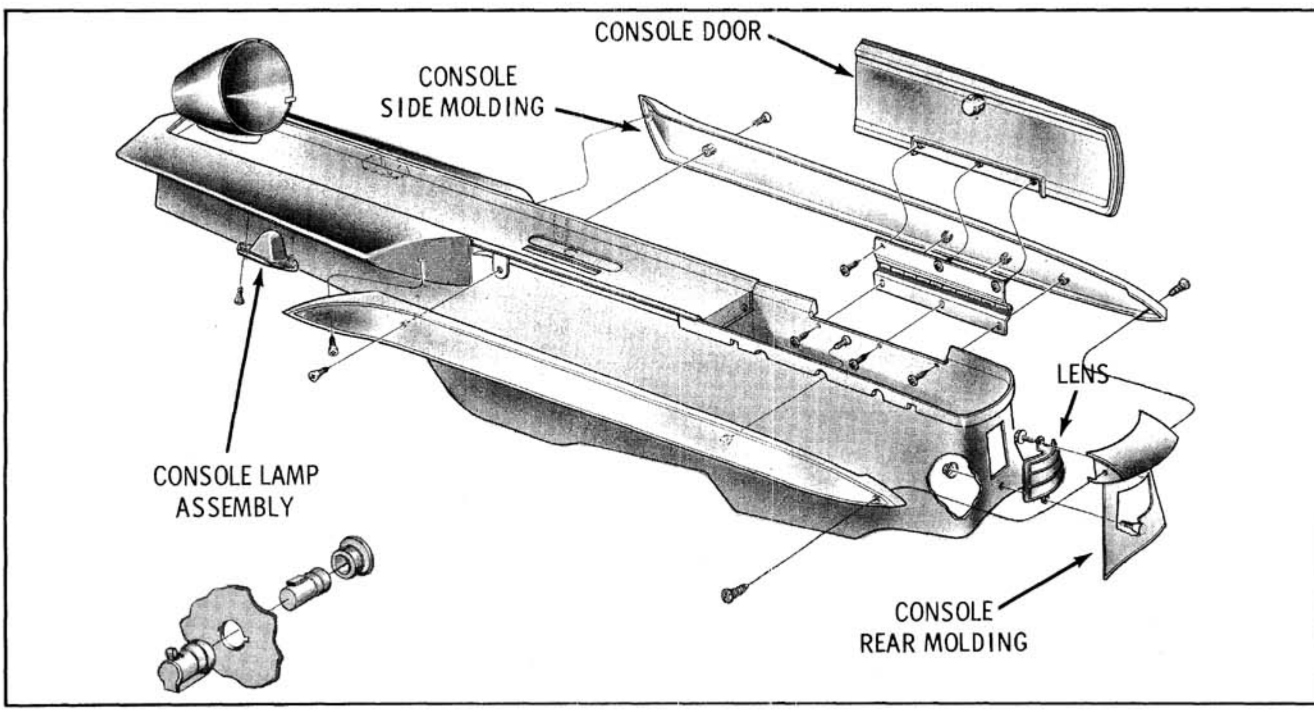


Fig. 12-116 Console Moldings - Jetaway

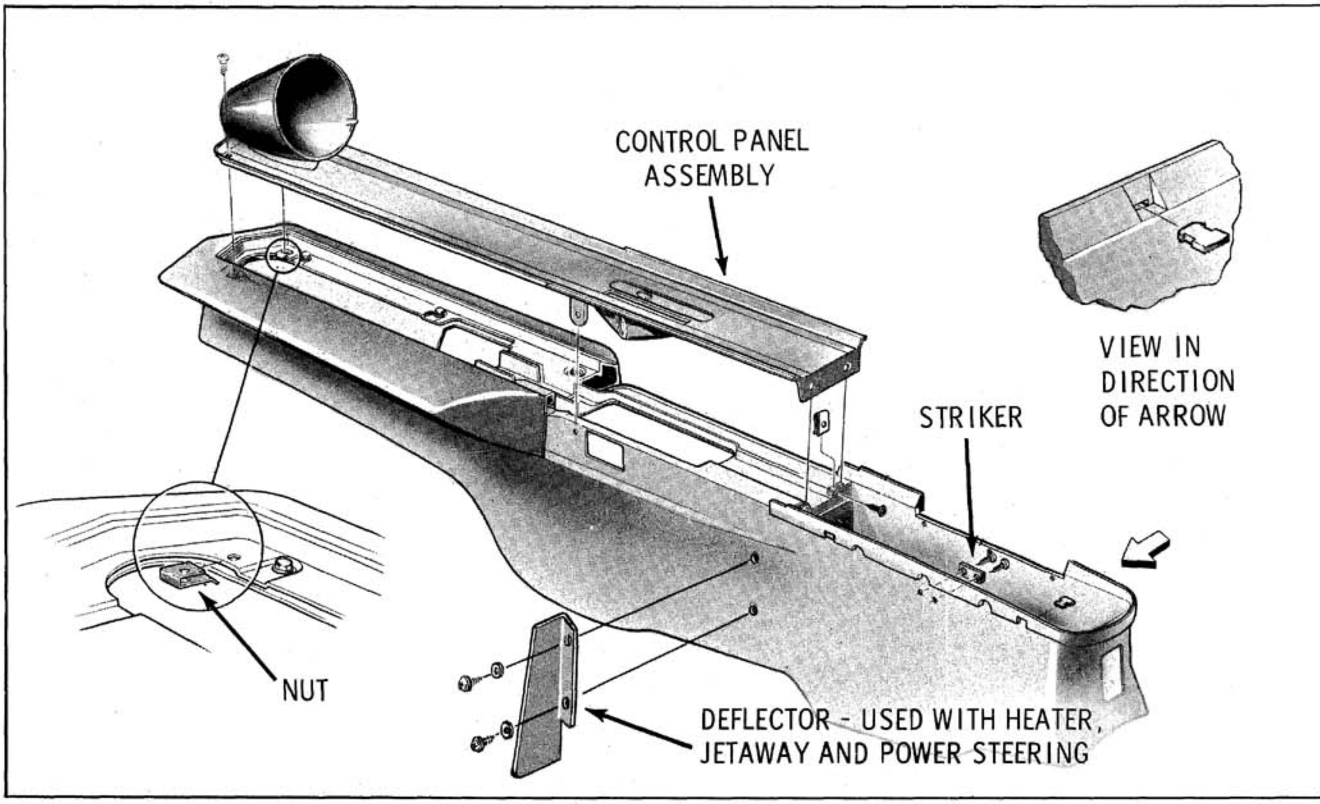


Fig. 12-117 Control Panel to Console Attachment (Jetaway)

3. From the top of the console panel, remove the two retaining screws.

4. Remove the two forward side molding attaching screws from each side.

5. Loosen the console door hinge attaching screws.

6. Spread the console side moldings apart and lift off the console control panel. (Fig. 12-117)

   NOTE: It is not necessary to disconnect the tachometer.

7. Remove the three screws securing the shift indicator housing to the console panel and remove the plate and lens. (Fig. 12-115)

   The shift lever seal can be replaced after removing the console panel by sliding the seal forward.

TACHOMETER— 33 Through 86 Series (Synchromesh and Jetaway)

The tachometer can be removed for service by removing the bezel retaining screw located at the rear of the tachometer housing. After removing the attaching screw, pull the tachometer outward to disconnect the bulb, feed and ground wire.

Before replacing a tachometer, the following tests should be performed:

INOPERATIVE TACHOMETER (33 through 86 Series)

1. Check the tachometer ground connection by connecting a jumper wire to a good ground and holding the other end against the tachometer bezel. If the tachometer will now operate, a defective ground is indicated and must be corrected.

2. Check for loose connections or broken wire from the ignition coil to the console. Repair if necessary.

3. Check the tachometer fuse located inside the console by replacing it with a known good fuse. (2 amp.)

4. If the tachometer is still inoperative, remove it from the console. After removal, inspect the connector and ground wire at the back of the tachometer for loose connections. Repair if necessary.

5. Connect a jumper wire between the terminal of the tachometer and the negative side of

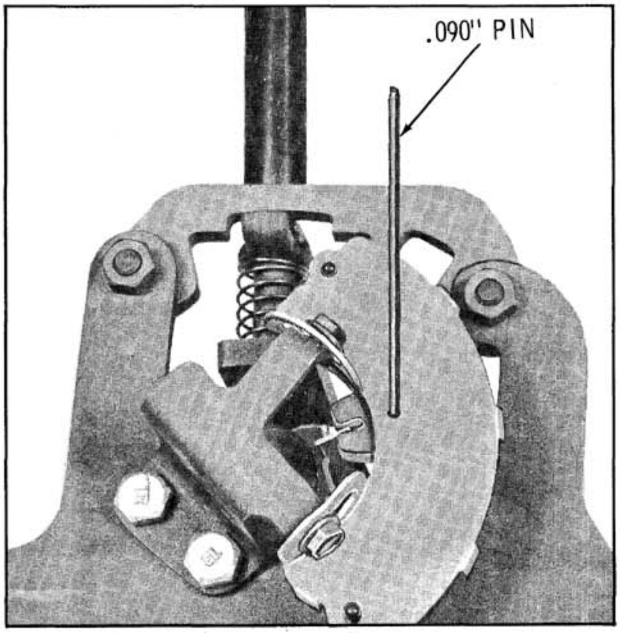


Fig. 12-118 Adjusting Switch

the coil. Connect another jumper between the tachometer ground and a good ground on the car. Start the engine and observe tachometer operation. If the tachometer now operates, the trouble is not in the tachometer assembly and Steps 1 through 3 must be rechecked to locate the trouble.

INACCURATE TACHOMETER (33 through 86 Series)

If the tachometer is inaccurate, it must be calibrated against a known accurate tachometer, such as one used in engine tune-up work. Calibration is performed as follows:

1. Remove tachometer from console.
2. Remove calibration hole cover (brass plug or tape) from back of tachometer case.
3. Connect jumper wire between the terminal of the tachometer and the negative side of the ignition coil. Connect another jumper between the tachometer ground and a good ground on the car.
4. Start the engine.
5. Accelerate engine to 2000 rpm indication on the tune-up tachometer.
6. Insert a small screwdriver through the hole and into the adjusting slot, turn the screwdriver slowly until the tachometer reading agrees with the tune-up tachometer.
7. Vary engine rpm from idle to 2000 rpm. Electronic tachometer indication should be smooth throughout range of operation and comparable to the test tachometer.
8. Replace the hole cover.
9. Turn off engine, disconnect jumpers and install tachometer. Make sure all connections are tight and electrically secure.

HANDLE ASSEMBLY

Refer to Fig. 12-114 for assembly and adjustments.

NEUTRAL SAFETY AND BACK-UP LAMP SWITCH

The neutral safety switch mounted inside the console and attached to the shift lever bracket prevents the starting of the car with the transmission in gear. The engine may be started in NEUTRAL or PARK position only.

Adjustment

1. Remove console.
2. Loosen the switch attaching screws.
3. Set shift lever in "D" position within .020" of stop.
4. Position the switch so that a .090" gauge pin can be inserted into the hole as indicated in Fig. 12-118.
5. Tighten the switch retaining screws and remove the gauge pin. Recheck adjustment.

MANUAL LEVER ADJUSTMENT

The manual lever adjustment provides for proper clearance between the neutral detent in the transmission and the stop for the selector lever in the console.

1. Place selector lever in "D" position.
2. Remove the retainer from the manual rod and disengage rod from the manual lever. (Fig. 12-119)

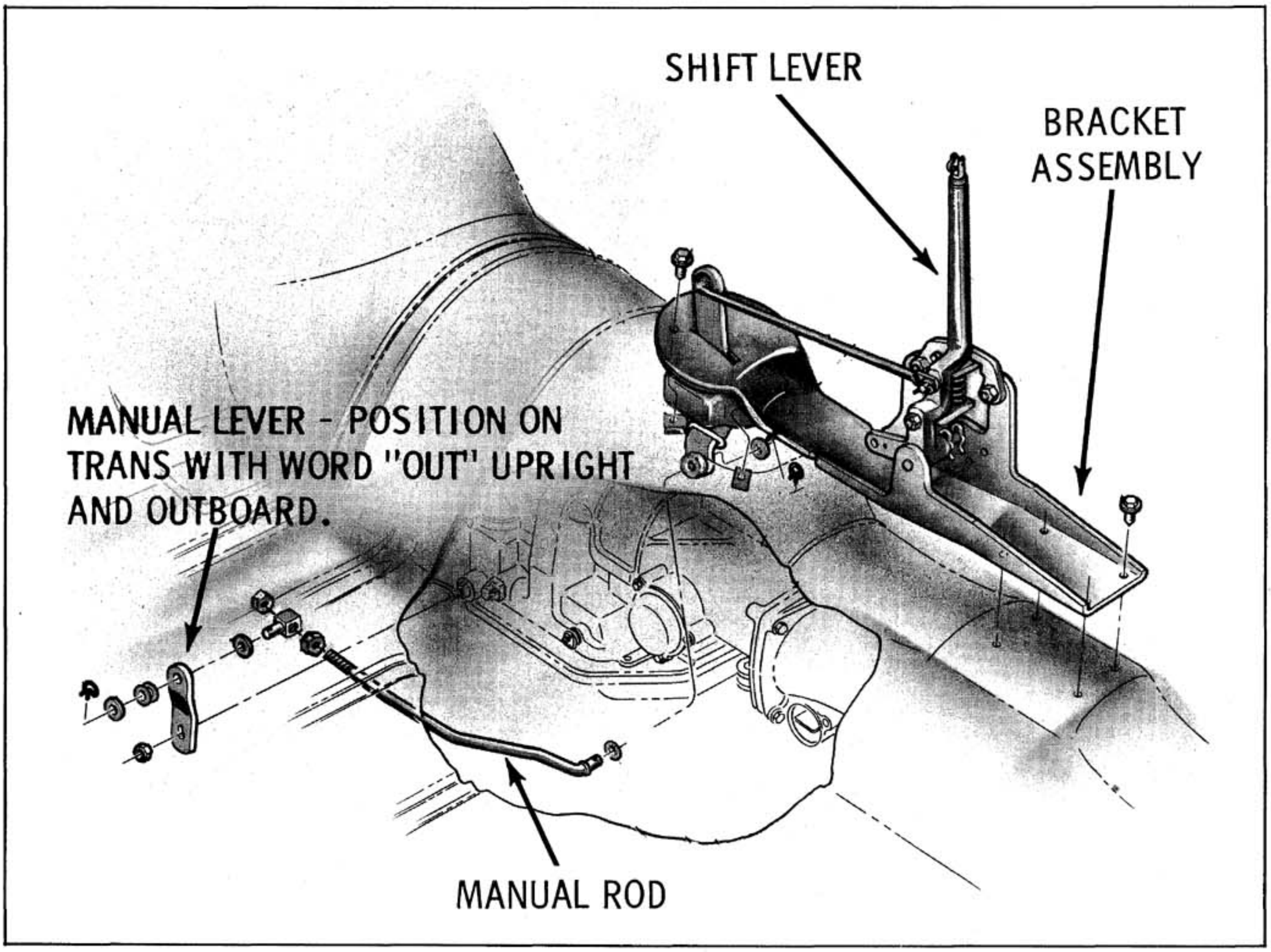


Fig. 12-119 Manual Rod

3. Position manual lever in "D" detent. (Fig. 12-120)

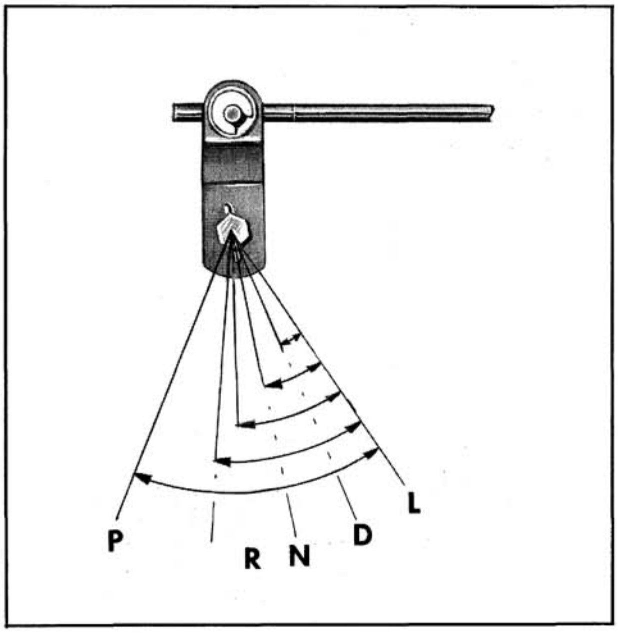


Fig. 12-120 Manual Lever

4. Adjust the swivel on the manual rod to free pin, then lengthen one turn.

5. Tighten swivel locknut.

6. Install washers and retainer.

PAD ASSEMBLY (Fig. 12-115)

To replace the pad assembly it is necessary to remove the side moldings and console panel to gain access to the six pad attaching screws.

CONSOLE ASSEMBLY (Synchromesh)

The console assembly is attached to three mounting brackets by six screws. Four screws are accessible inside the glove box and two screws are located at the rear of the trim panel on the top surface. (Fig. 12-121) To remove the

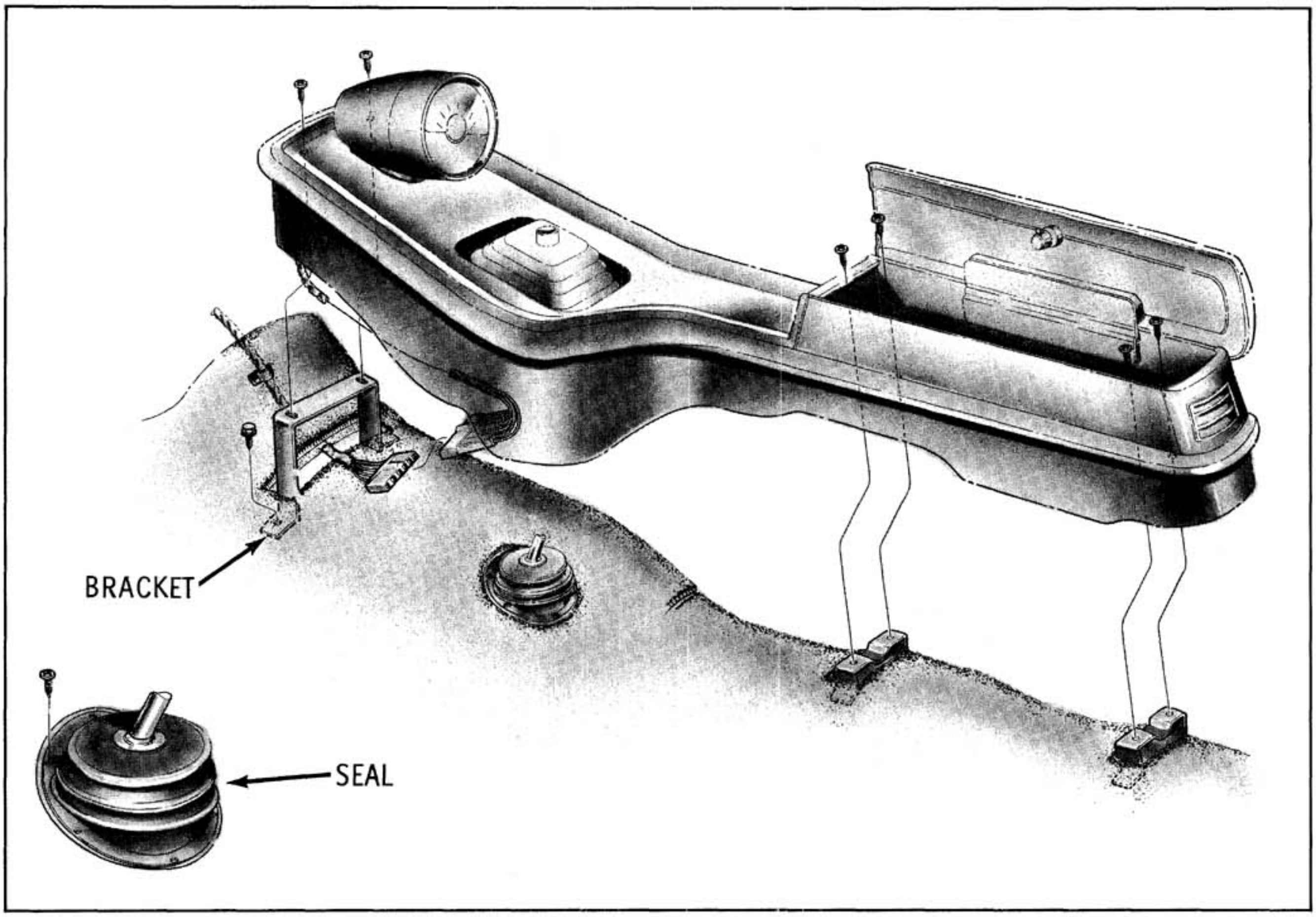


Fig. 12-121 Console Mounting - Synchromesh

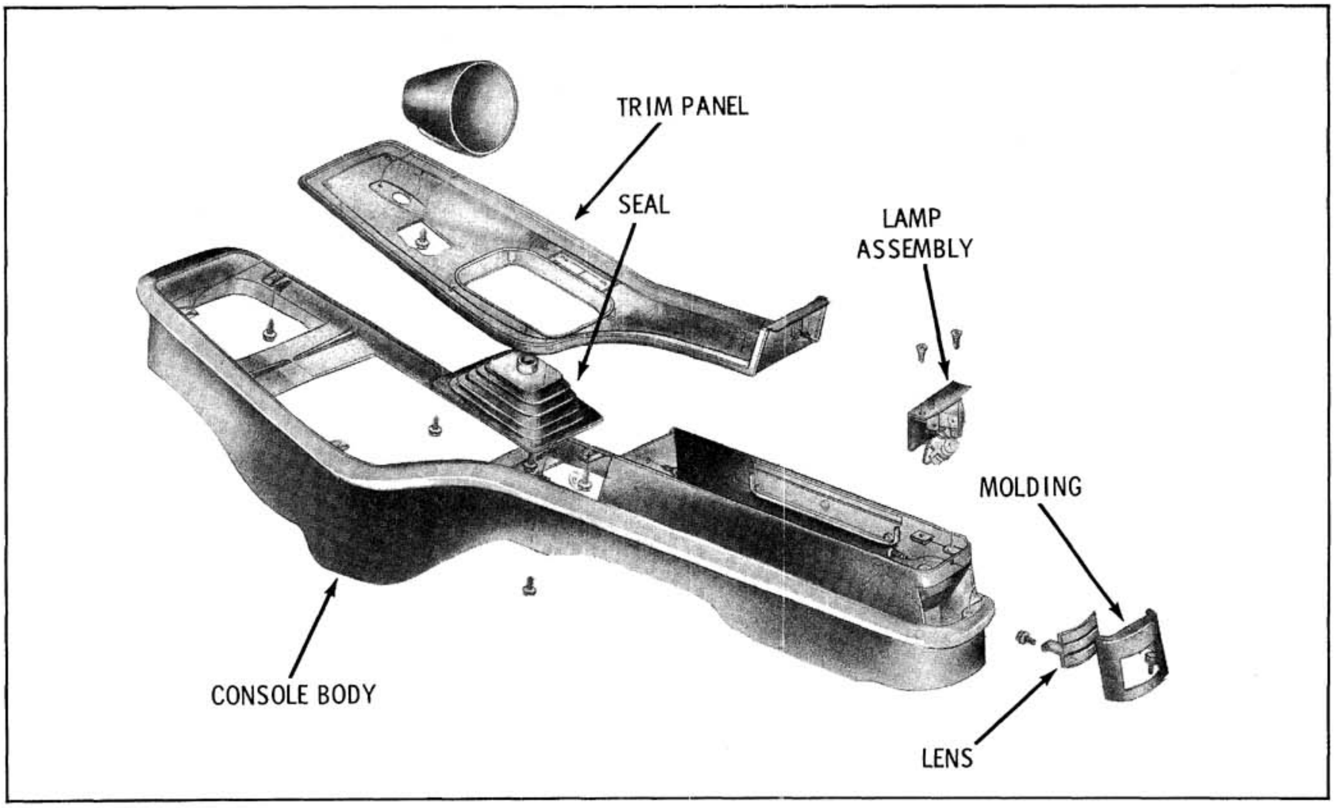


Fig. 12-122 Console Assembly - Synchromesh

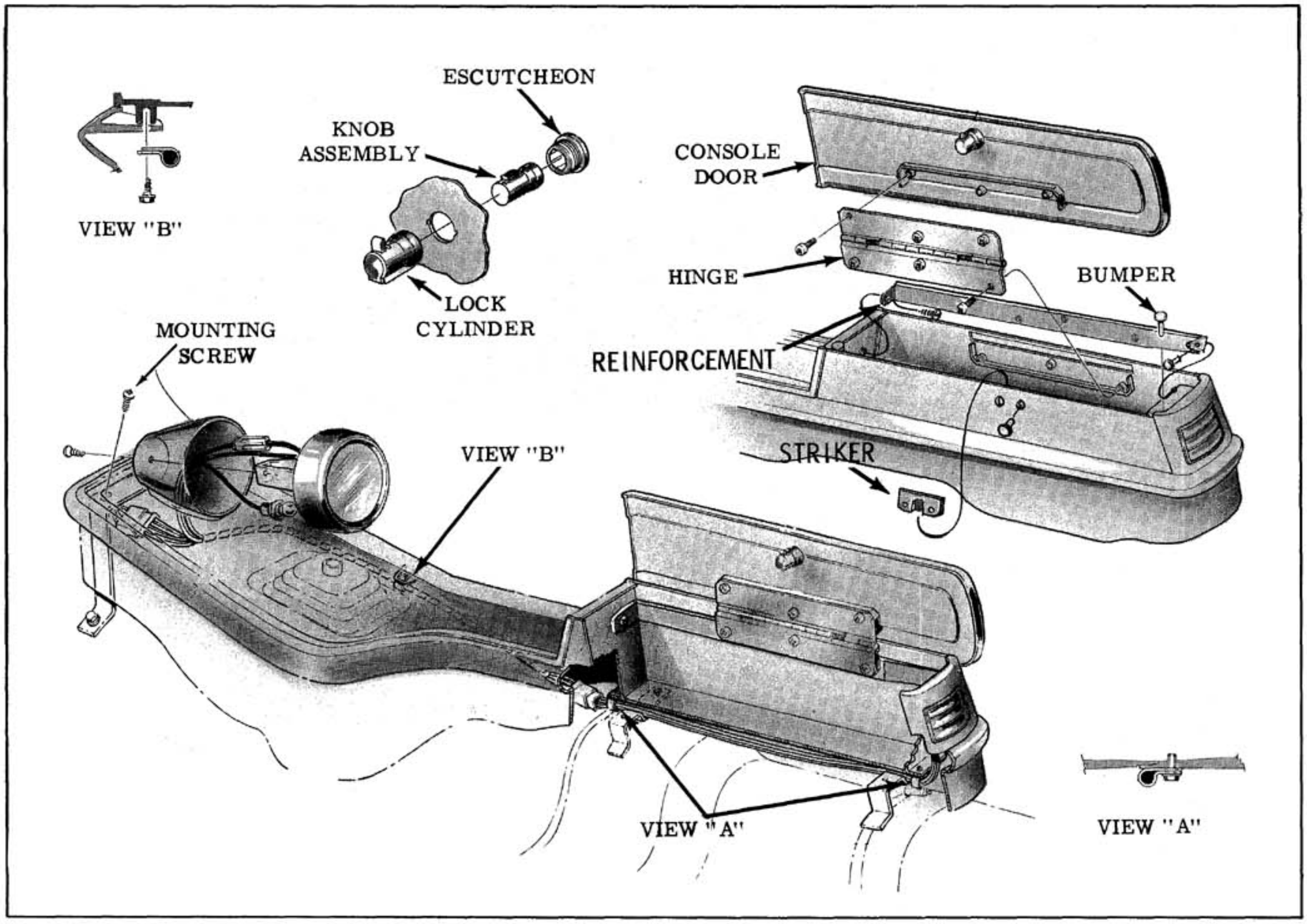


Fig. 12-123 Console Wiring and Mounting

console, remove shift lever knob, remove the six attaching screws and lift the console to disconnect the wiring connector.

TRIM PANEL (Fig. 12-122)

The trim panel is attached to console body by seven screws. Six of the attaching screws are accessible from the button side and can be removed after removing the console. One attaching screw is accessible inside the glove box.

TACHOMETER

Refer to Fig. 12-123 for removal and installation. For checking procedures, refer to TACHOMETER - JETAWAY CONSOLE.

SHIFT LEVER SEALS

Refer to Fig. 12-121 and Fig. 12-122.

COURTESY LAMP

Refer to Fig. 12-122.

CONSOLE WIRING (Jetaway and Synchromesh)

For wiring schematic refer to Fig. 12-124. Console wiring under the instrument panel is illustrated in Fig. 12-125 and tachometer wire routing in the engine compartment is illustrated in Fig. 12-126.

FLOOR SHIFT SEAL

For floor shift lever seal and retainer installation refer to SYNCHROMESH and CLUTCH 33 through 38.

RADIO

The radio consists of the receiver unit and the speaker unit. The serial number plate on the radio is located on the RH side of the receiver chassis and it can be seen by removing the glove box.

The radio receiver has five push buttons for touch tuning. By depressing a push button, the

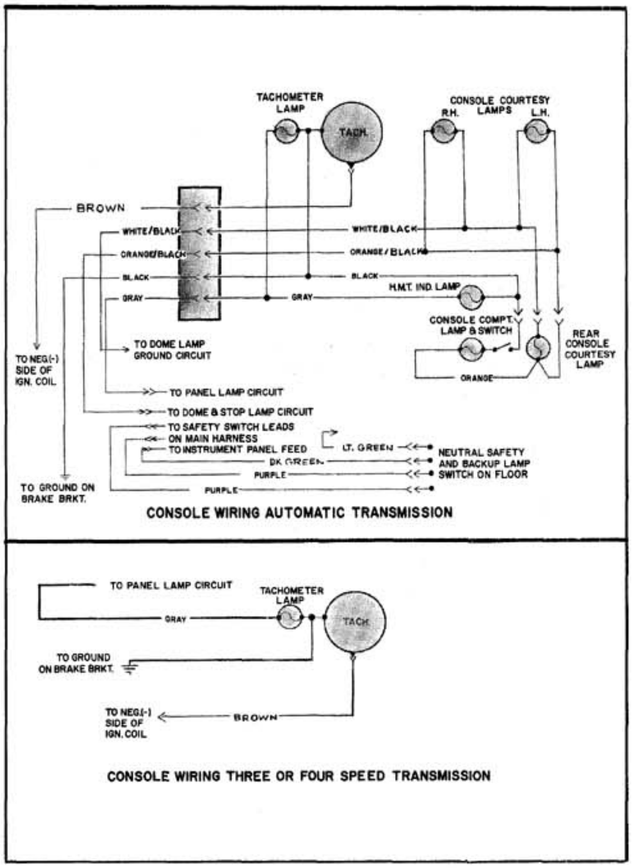


Fig. 12-124 Console Wiring

receiver can be mechanically tuned to a pre-selected station. The RH control knob can be selected normal manual selection of stations. The LH control knob is the ON-OFF volume control switch. The tone control knob is stacked on the left hand shaft behind the ON-OFF volume control knob.

On cars equipped with a rear seat speaker, a variable resistor control located behind the manual tuning knob (RH knob) modulates both the front and rear speakers simultaneously. As the control is rotated clockwise, the volume of the front speaker increases while the volume of the rear speaker decreases. As the control is rotated counterclockwise, the volume of the front speaker decreases while the volume of the rear speaker increases. After the desired speaker modulation is obtained, the volume of both speakers can be simultaneously regulated by the volume control knob.

Pushbutton Adjustment

1. Allow the receiver to warm up for a few minutes.
2. Select a pushbutton for the desired station. Holding the button to the left, pull the button out to the extreme position.
3. Tune in the desired station manually.
4. Push the selected button to its maximum IN position. The button will then be locked on the selected station.

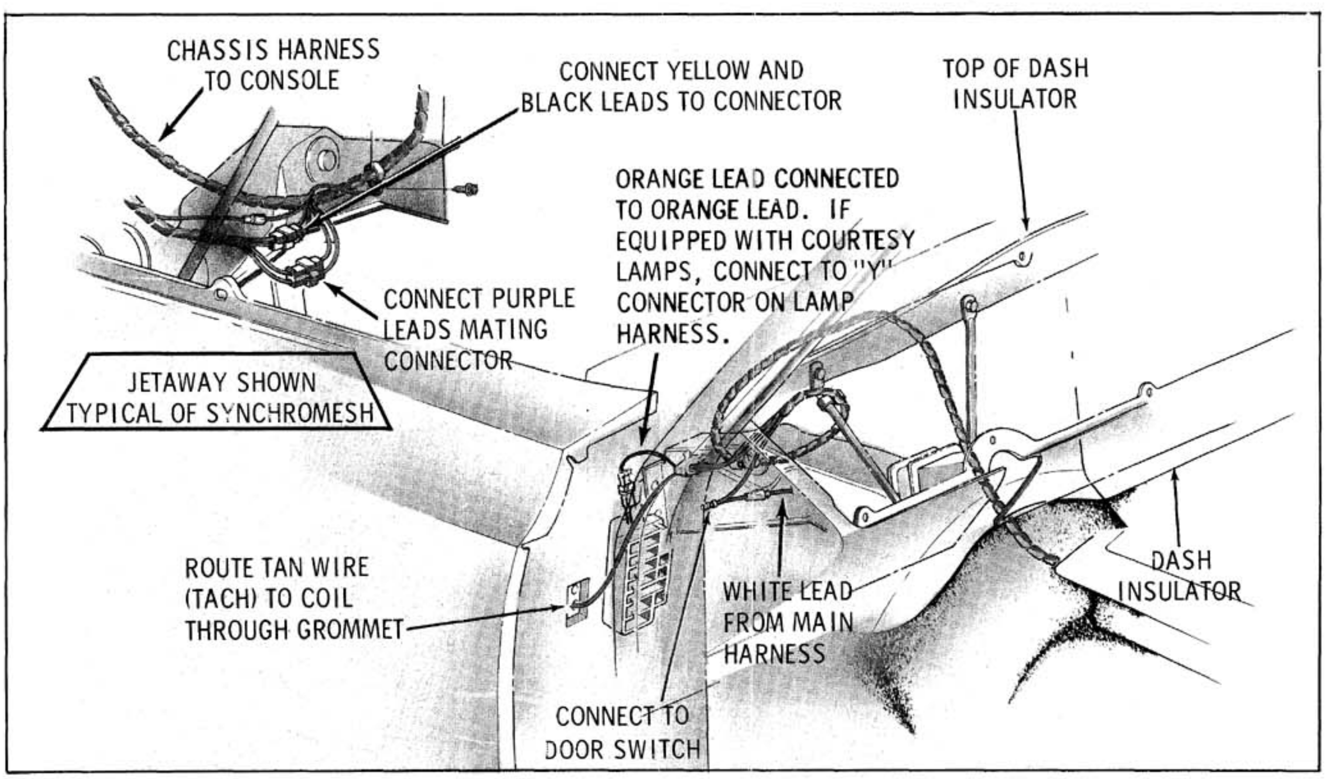


Fig. 12-125 Console Wiring Under Instrument Panel

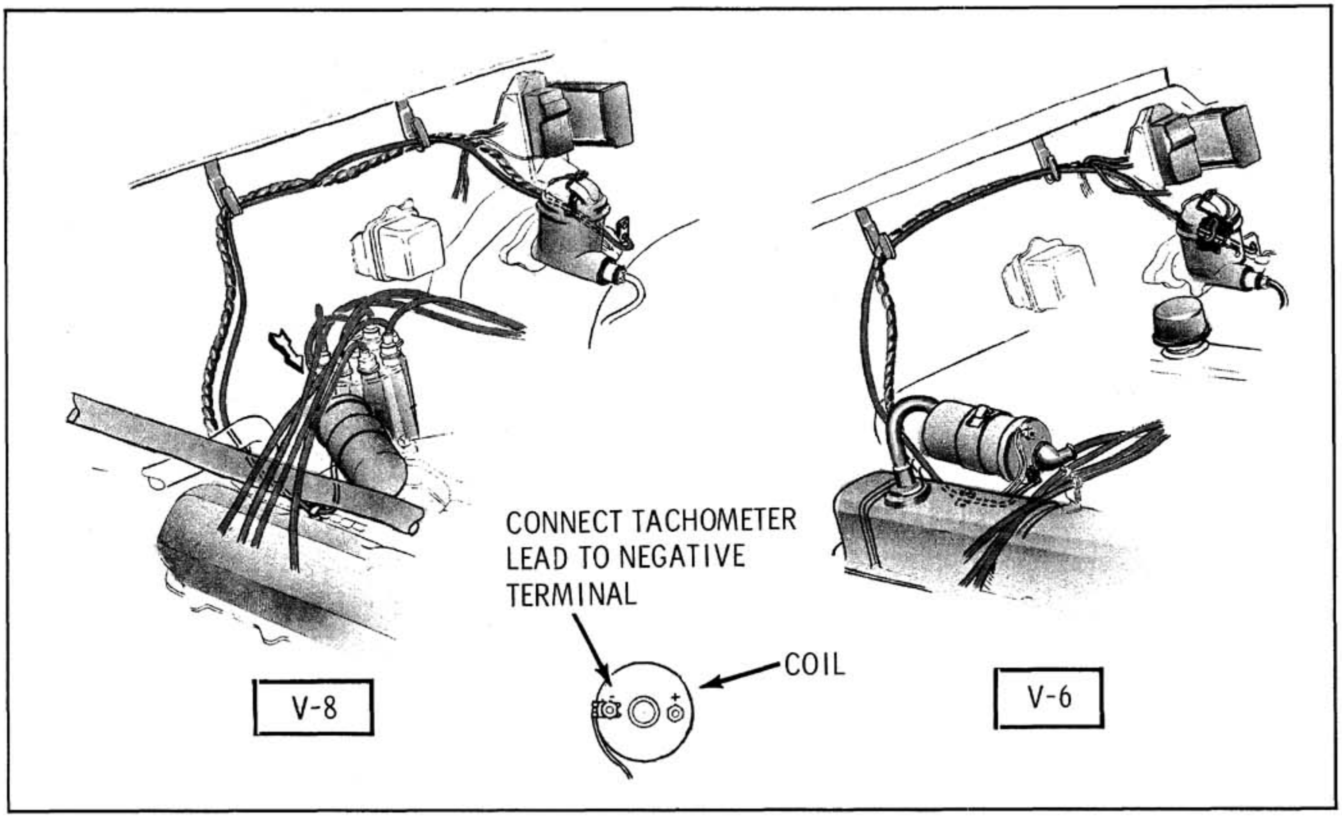


Fig. 12-126 Tachometer Wire Routing

5. Proceed in the same manner to set the remaining pushbuttons.

6. After all the buttons have been adjusted, recheck the settings. Push each button, then see if the station can be tuned in more accurately manually. If so, repeat Steps 2, 3 and 4.

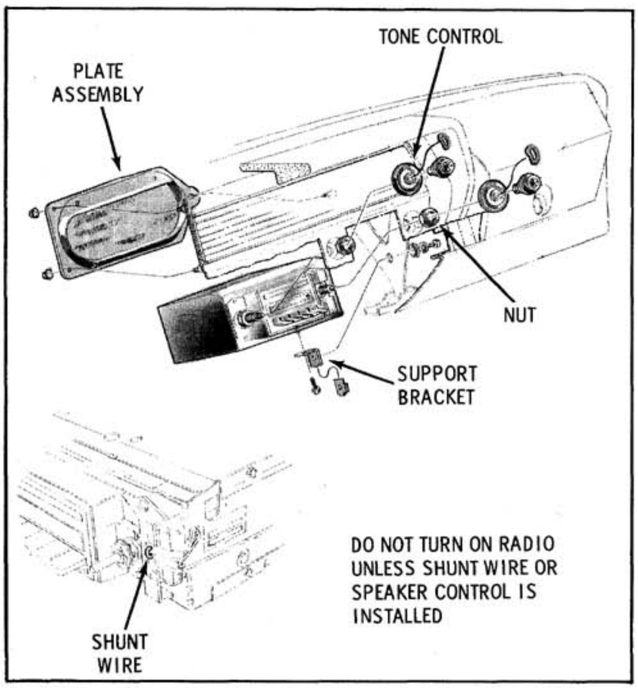


Fig. 12-127 Radio Mounting

RECEIVER

Removal and Installation

1. Disconnect antenna lead.

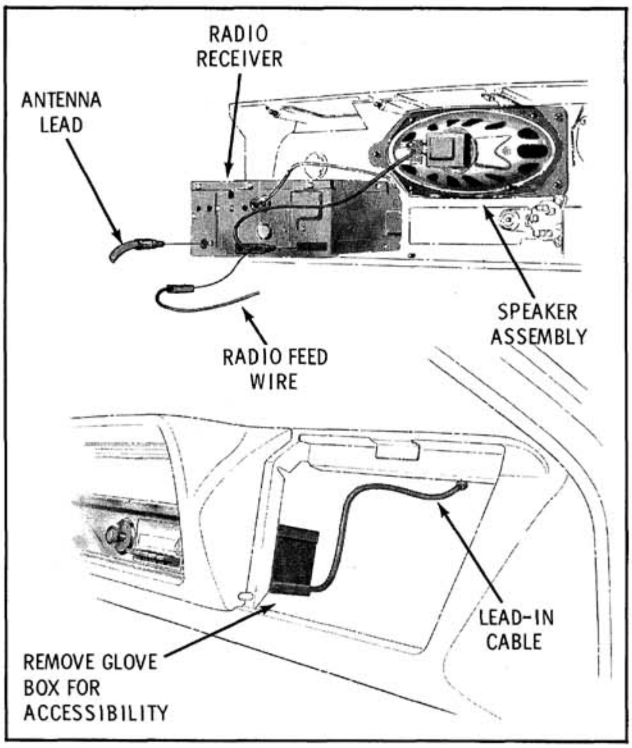


Fig. 12-128 Speaker Attachment

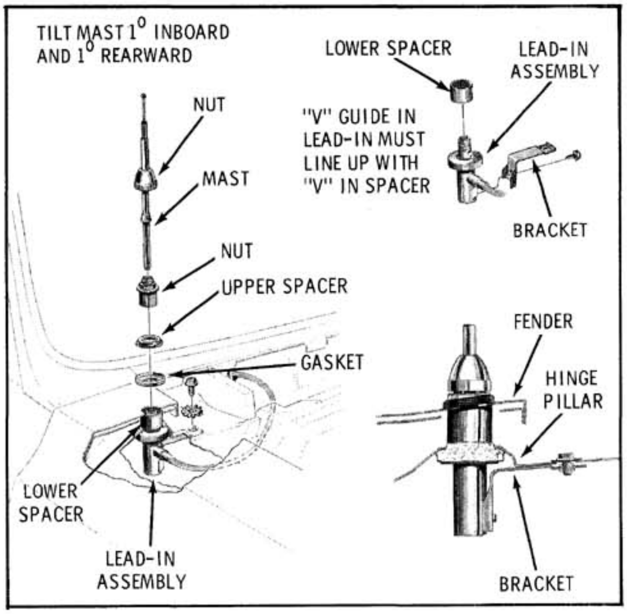


Fig. 12-129 Manual Antenna

2. Disconnect front speaker connection and rear speaker wire if so equipped.
3. Remove bolt securing bracket to RH instrument panel support.
4. Remove both knobs.
5. While supporting radio, remove both nuts securing radio to instrument panel. (Fig. 12-127)

If equipped with air conditioning, it will be necessary to remove the manifold to gain removal clearance.

To install, reverse the removal procedure. Check radio operation.

SPEAKER

The speaker is attached to the instrument panel by three nuts as illustrated in Figs. 12-127 and 12-128. The speaker can be removed for service without removing the receiver.

RADIO DIAL LAMP

The radio dial lamp plugs into the top side of the receiver. It is not necessary to remove the receiver to replace the bulb, however, if car is equipped with air conditioning, it will be necessary to remove the glove box to gain access.

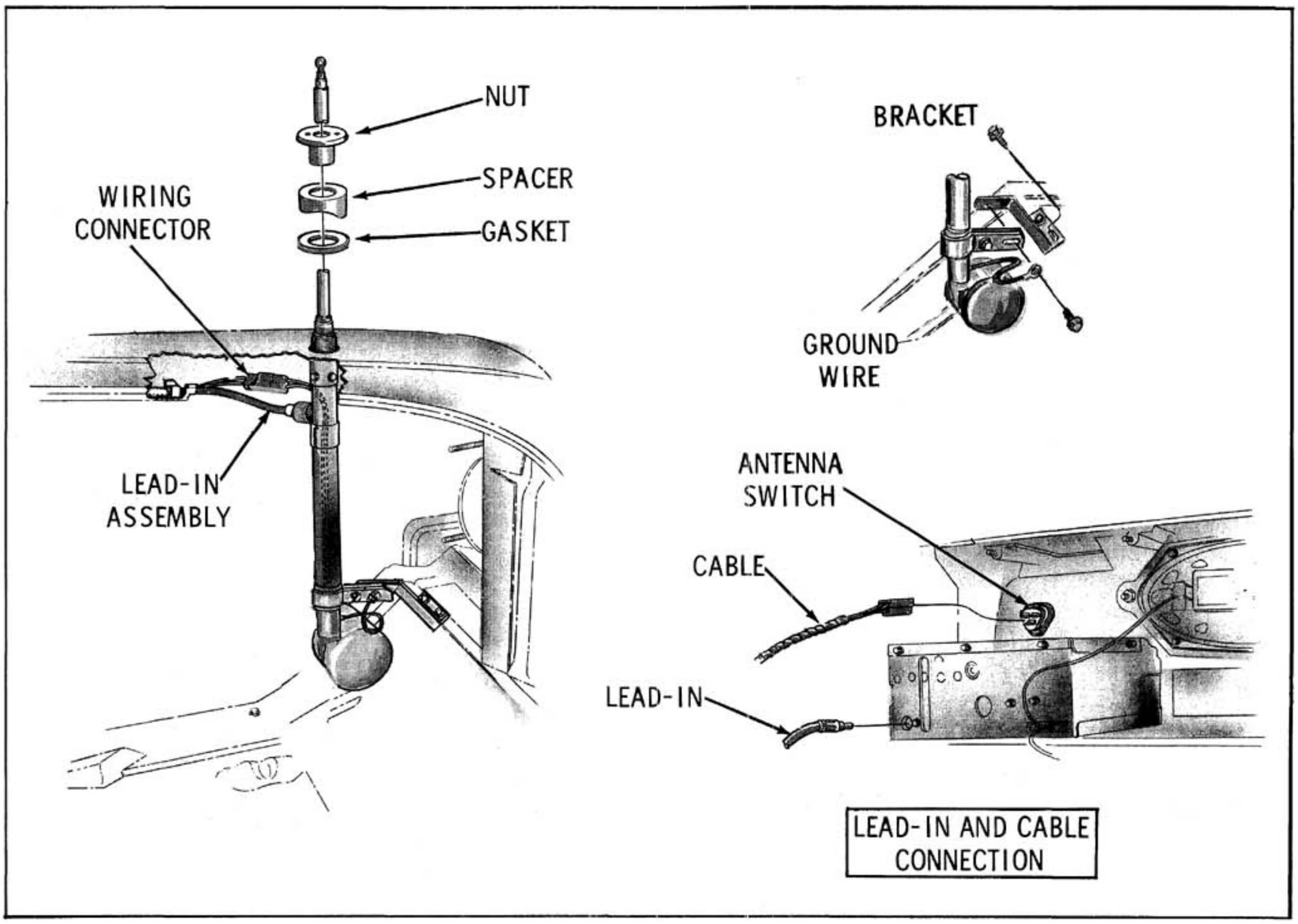


Fig. 12-130 Power Antenna (Sedan)

ANTENNA

TRIMMER ADJUSTMENT (Manual or Power)

1. Remove the right hand knob, trimmer screw is accessible through the hole in the control panel.

   NOTE: If car is equipped with rear seat speaker, install a shunt wire as illustrated in Fig. 12-127. If radio is operated without the shunt wire, damage will result to the output power transistor.

2. With antenna extended 31", turn the radio on.
3. Tune the radio to a weak station between 1350 kc and 1450 kc with volume full on. Adjust trimmer screw until the maximum volume is obtained for that station.
4. If a shunt wire was used, remove the shunt and replace the knob.

CHECKING ANTENNA (Manual or Power)

To check antenna for partial short, remove lead-in from rear of radio and check resistance from lead-in connector to a good ground using an ohmmeter. Resistance should be three megohmes or more.

Removal—Manual

To remove the antenna mast, loosen the antenna cap nut and lift the mast out of the socket. To remove the lead-in assembly, proceed as follows:

1. Remove windshield wiper arms.
2. Remove vent grille and screen.
3. Disconnect lead-in from radio and pull the cable through the hole in the plenum chamber.
4. Remove lead-in nut, upper spacer and gasket. (Fig. 12-129)
5. Remove the lead-in bracket attaching screw and washer.
6. Remove lead-in assembly and lower spacer by reaching through the plenum chamber.

When installing, be sure to align the lower spacer to the lead-in as illustrated in Fig. 12-129.

Removal—Power

Power antennas are installed as illustrated in Figs. 12-130 and 12-131. The lead-in cable is routed in the body channel and behind the dash insulator.

Disassembly (Fig. 12-132)

The following parts of the power antenna are serviceable: Drive Assembly, Mast Assembly and Support Tube Assembly. To service any of these parts, proceed as follows:

1. Remove the two connector-to-support tube screws and remove connector.
2. Unsolder hook-up wire at pin and remove pin and insulator assembly.

   NOTE: Do not overheat pin by slow soldering as the pin insulator will be destroyed.

3. Remove the three support tube-to-drive assembly screws.
4. While applying a back and forth rotary motion, pull until support tube is removed from antenna.
5. If the drive assembly or mast assembly is to be replaced, proceed as follows:

   a. While applying a rocking motion, pull on mast until insulator bushing is removed from the drive assembly tubular fitting.

   b. Energize motor until entire length of nylon cord is expelled from drive assembly. To prevent a kink or bend in nylon cord, keep it taut by pulling on mast.

   NOTE: If motor is inoperative, it will be necessary to manually remove the nylon cord from the drive assembly as follows:

   c. Place the assembly in a vise so that the normal plane of the nylon cord is parallel with the floor.

   d. Pull on nylon cord until it is completely expelled from the drive assembly.

   CAUTION: No attempt should be made to disassemble antenna further than Step 5-D.

Assembly

1. Thread nylon cord through bottom insulator, (small diameter end down) and water seal washer.
2. Energize motor and feed nylon cord into drive assembly. Do not allow nylon cord to bend or kink.

   NOTE: Push water seal washer and bottom insulator all the way down into tubular fitting (make sure that keyways in bottom insulator are rotated to key position) before nylon cord completely disappears into drive assembly.

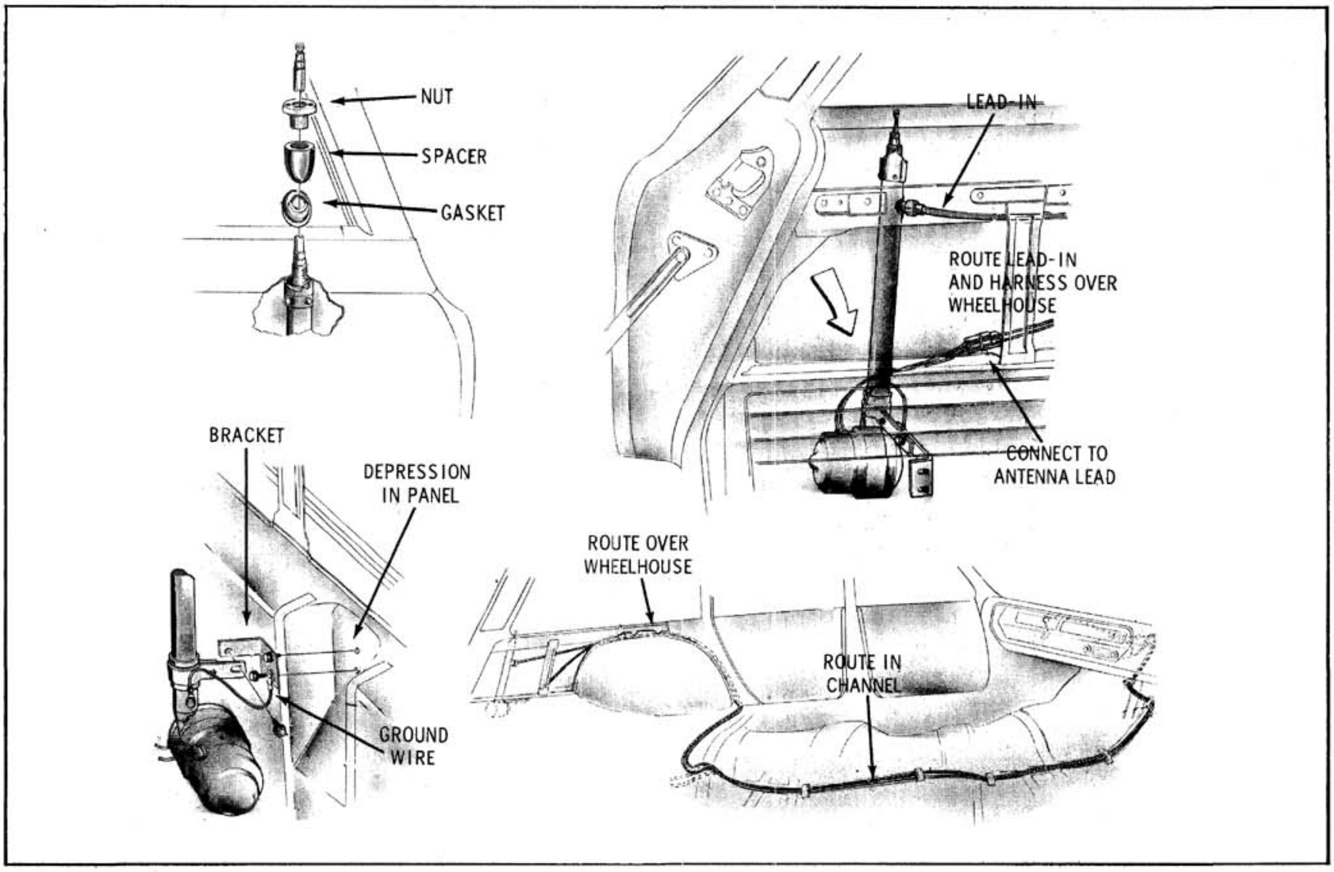


Fig. 12-131 Power Antenna - Station Wagon

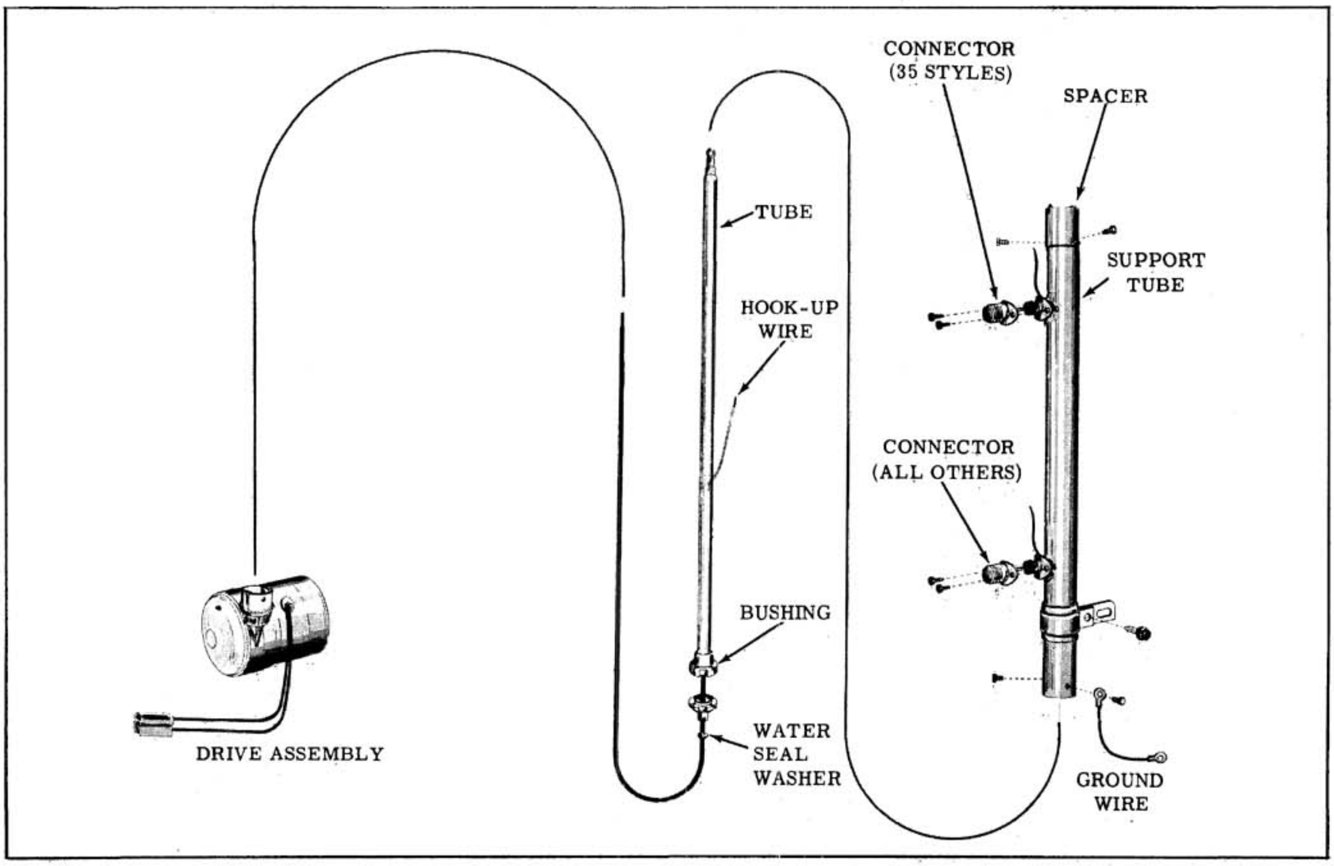


Fig. 12-132 Antenna Assembly

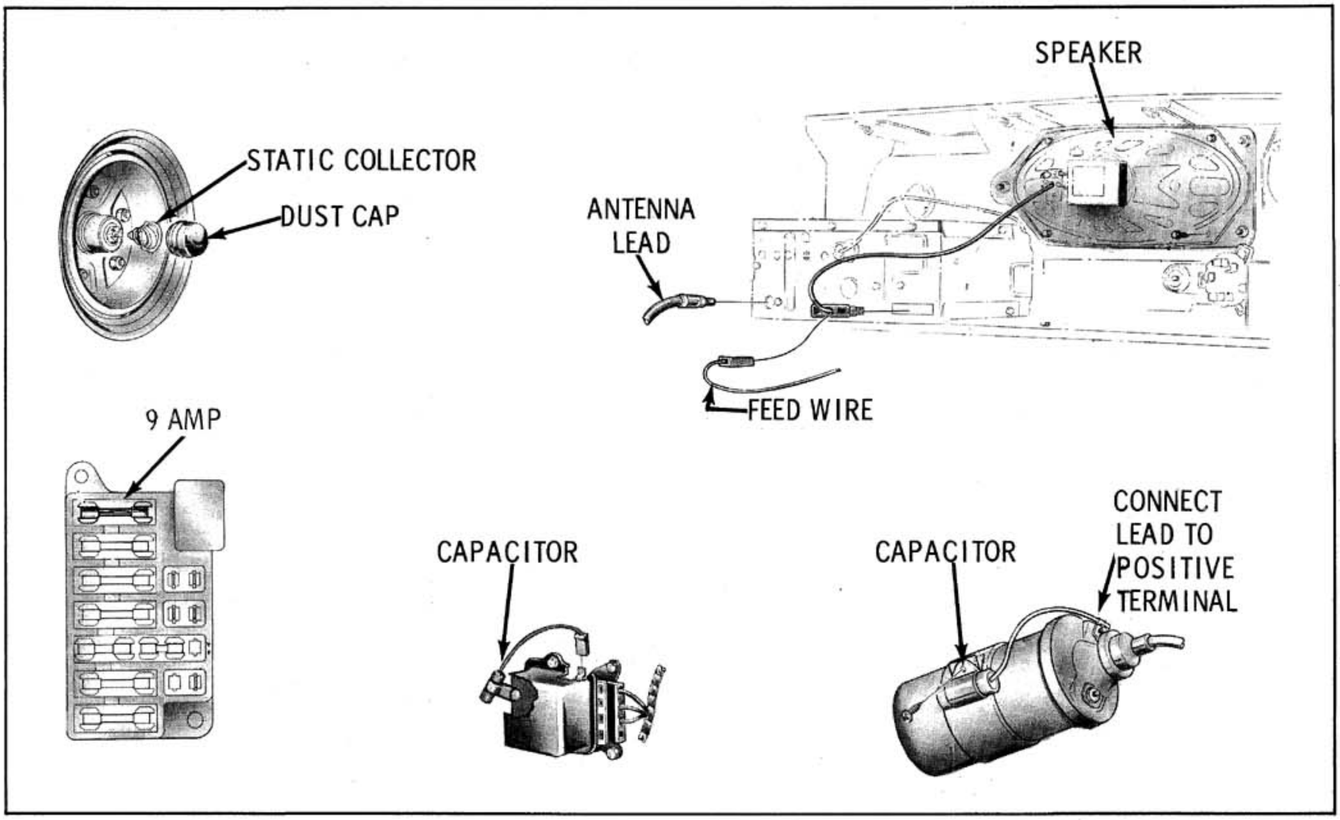


Fig. 12-133 Static Eliminators and Suppressors

3. Push mast assembly into tubular fitting, making sure that the upper edge of the insulator bushing is below the center of the three support tube-to-drive assembly screw holes.

4. Install support tube over mast assembly, making sure hook-up wire is extended through proper hole in support tube. Line up three holes in support tube and install the three screws.

5. Solder hook-up wire to pin and insulator assembly being careful not to overheat.

6. Install connector over pin and insulator assembly and install two screws.

Diagnosis

If antenna fails to operate properly, check the following possible sources of trouble:

1. Excessive tightening of cap nut on quarter panel will result in excessive operating noise in the car.

2. A stalled or slowly operating mast may be caused by bent or dirty mast sections. If dirty, wipe with oily cloth.

3. See that fuse is not burned out.

4. See that ground wire is tight.

5. To determine whether fault is in the antenna or the control circuit, disconnect the leads coming from antenna. Connect a jumper wire from a known hot source and touch jumper wire to each of the terminals of the wires coming from the drive assembly. If antenna does not operate, the fault is in the antenna drive assembly. If antenna does operate, the fault is in the control circuit.

6. If trouble is in the control circuit:

a. Examine electrical connections at switch, making sure they are securely connected.

b. Check wiring at switch with lamp or motor.

If antenna lead-in is suspected of being bad, check radio operation using an antenna lead-in known to be good.

NOTE: If excessive static is encountered, check suppressors and static eliminators for proper installation. (Fig. 12-133)

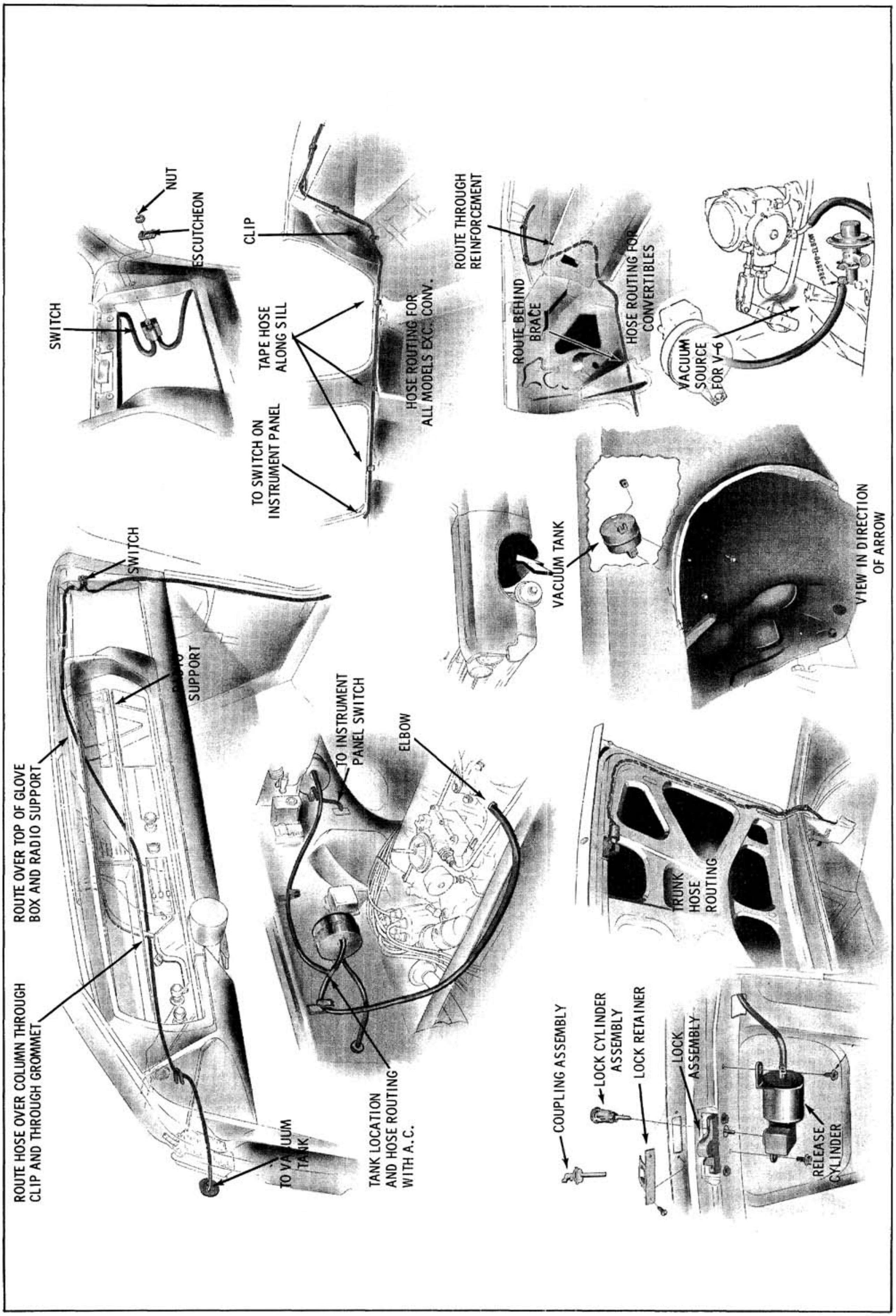


Figure 12-134 Vacuum Lid Latch

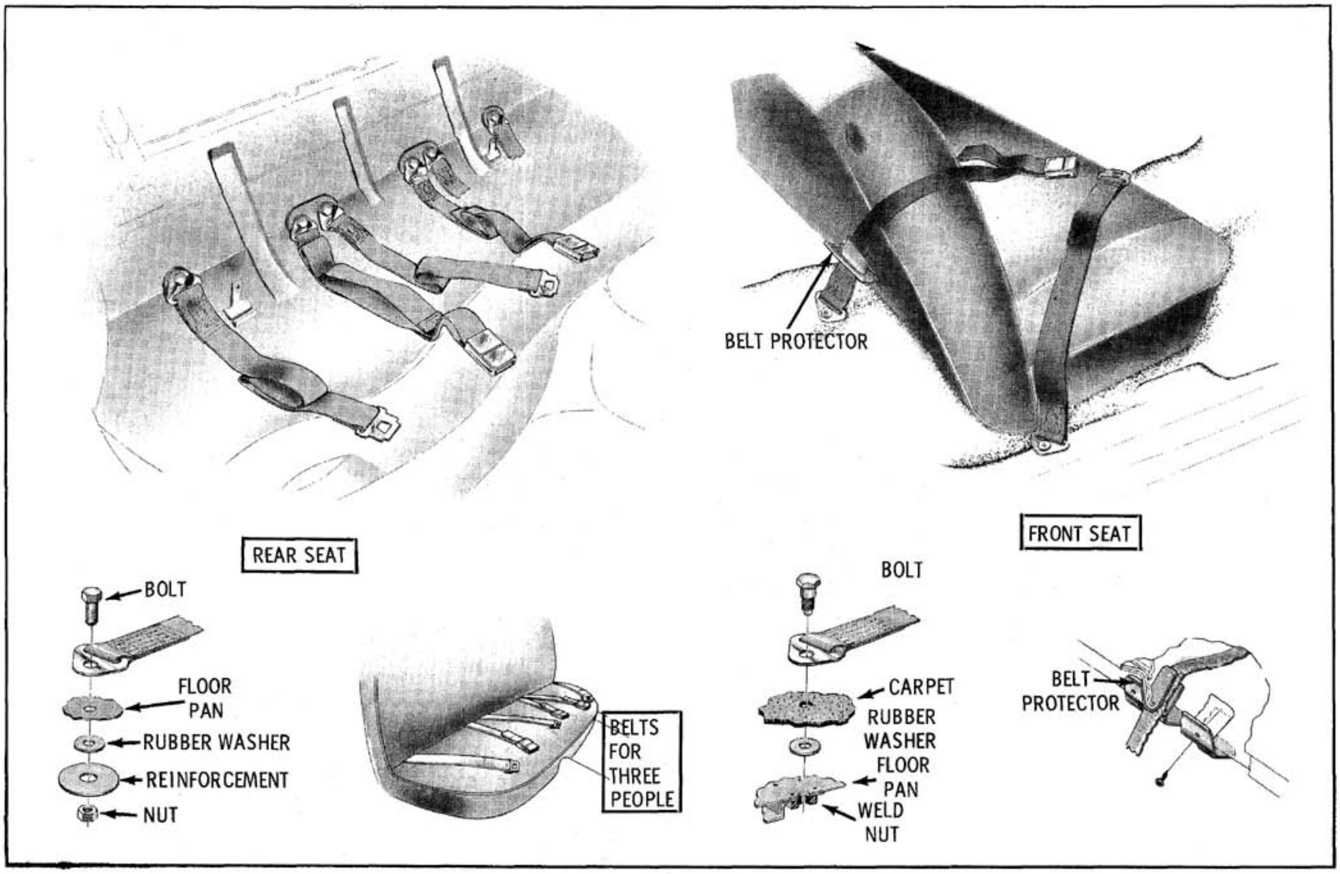


Fig. 12-135 Seat Belt Installation

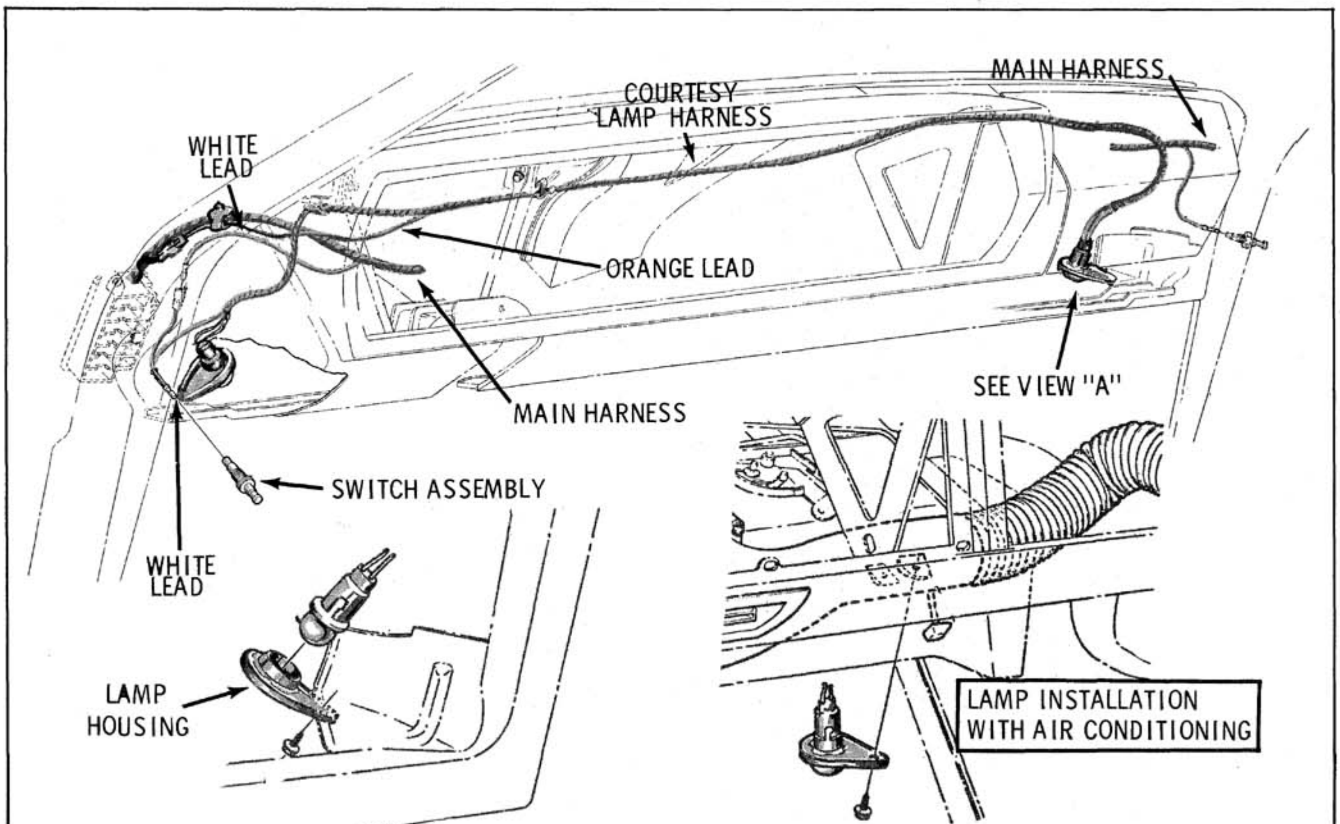


Fig. 12-136 Courtesy Lamp Installation

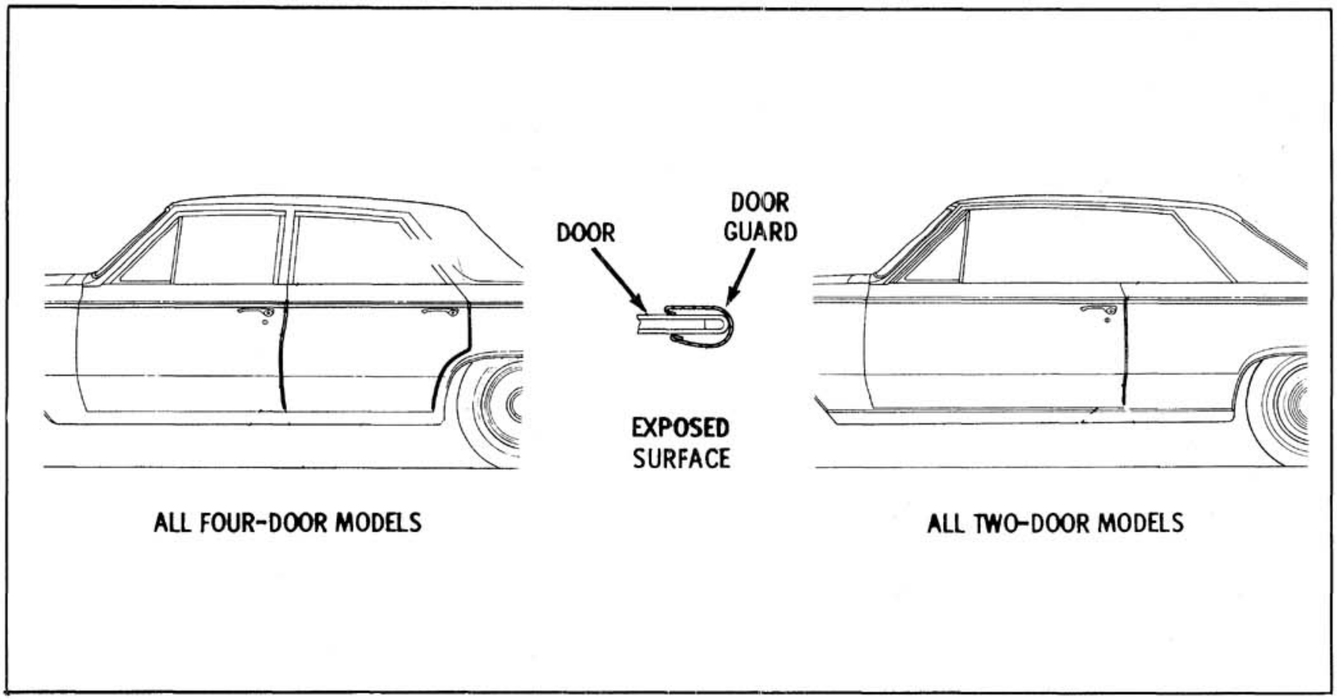


Fig. 12-137 Door Guards

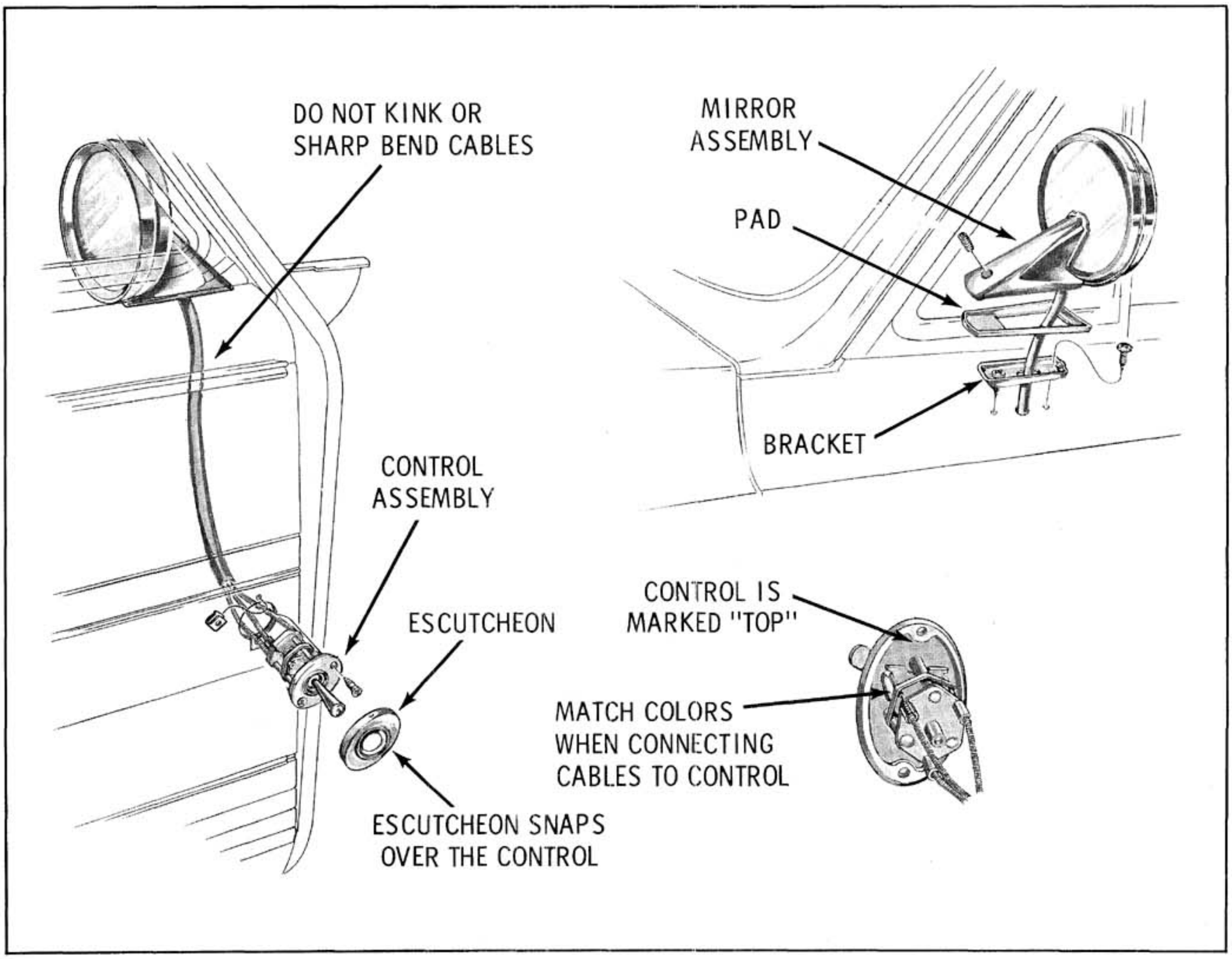


Fig. 12-138 Remote Controlled Mirror

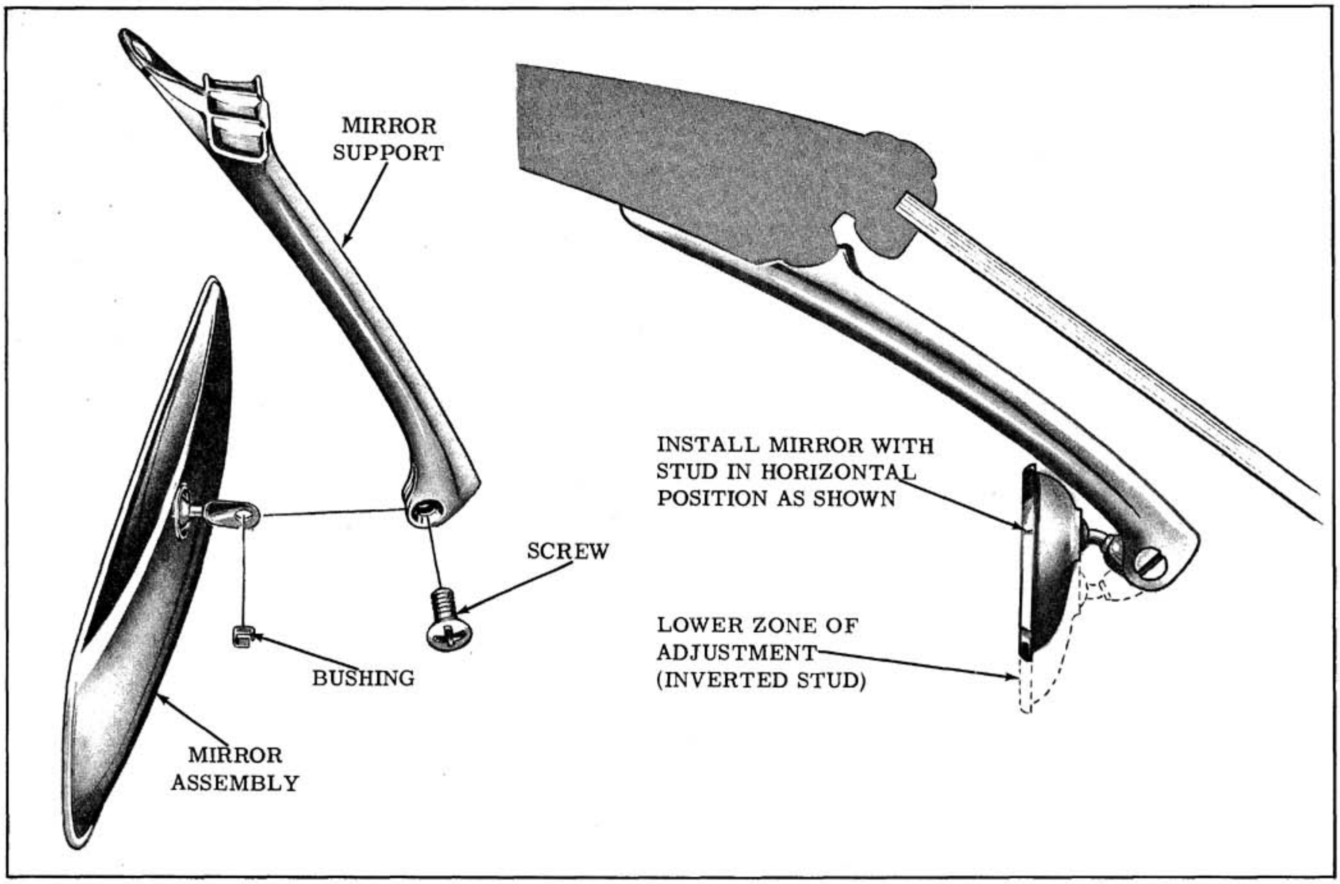


Fig. 12-139 Rear View Mirror

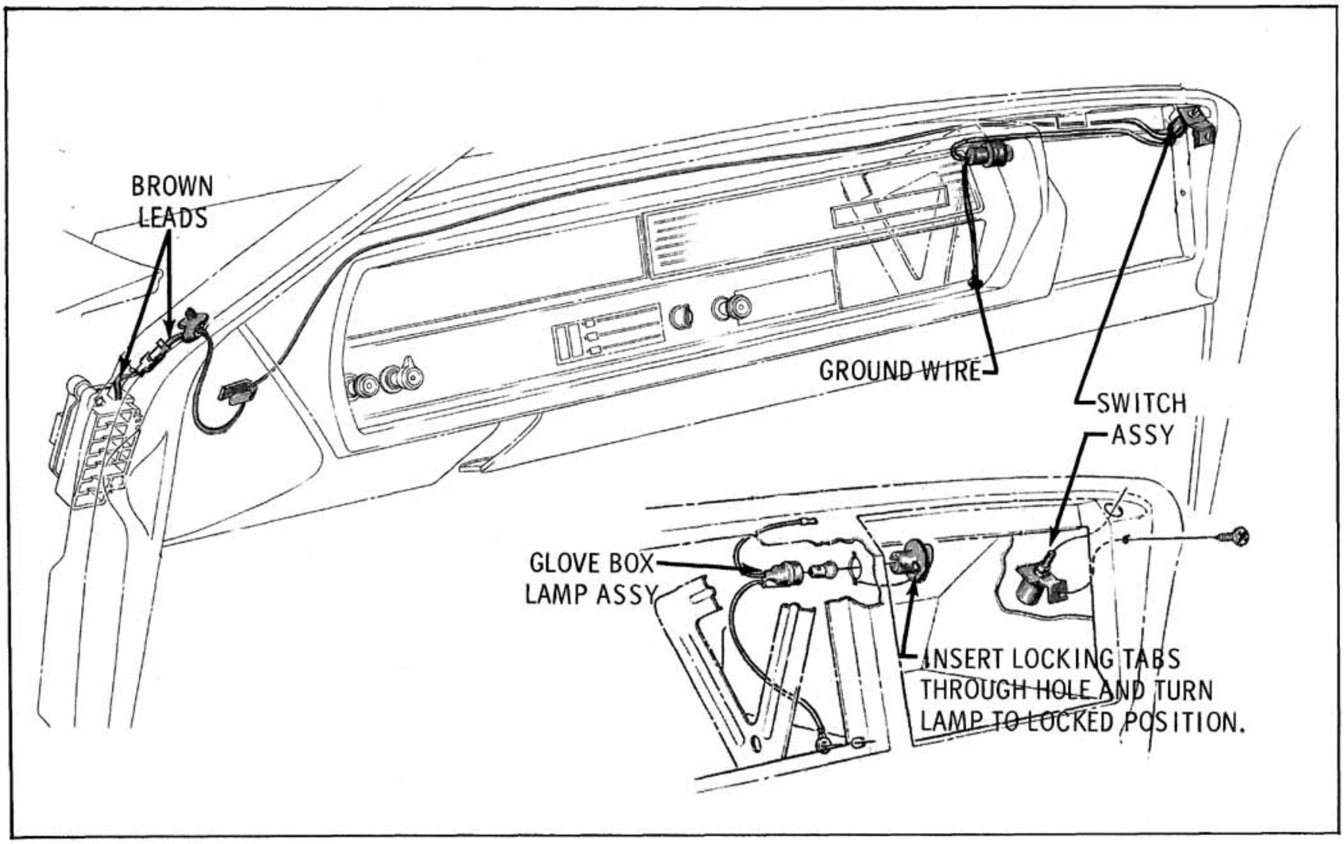


Fig. 12-140 Glove Box Lamp Installation

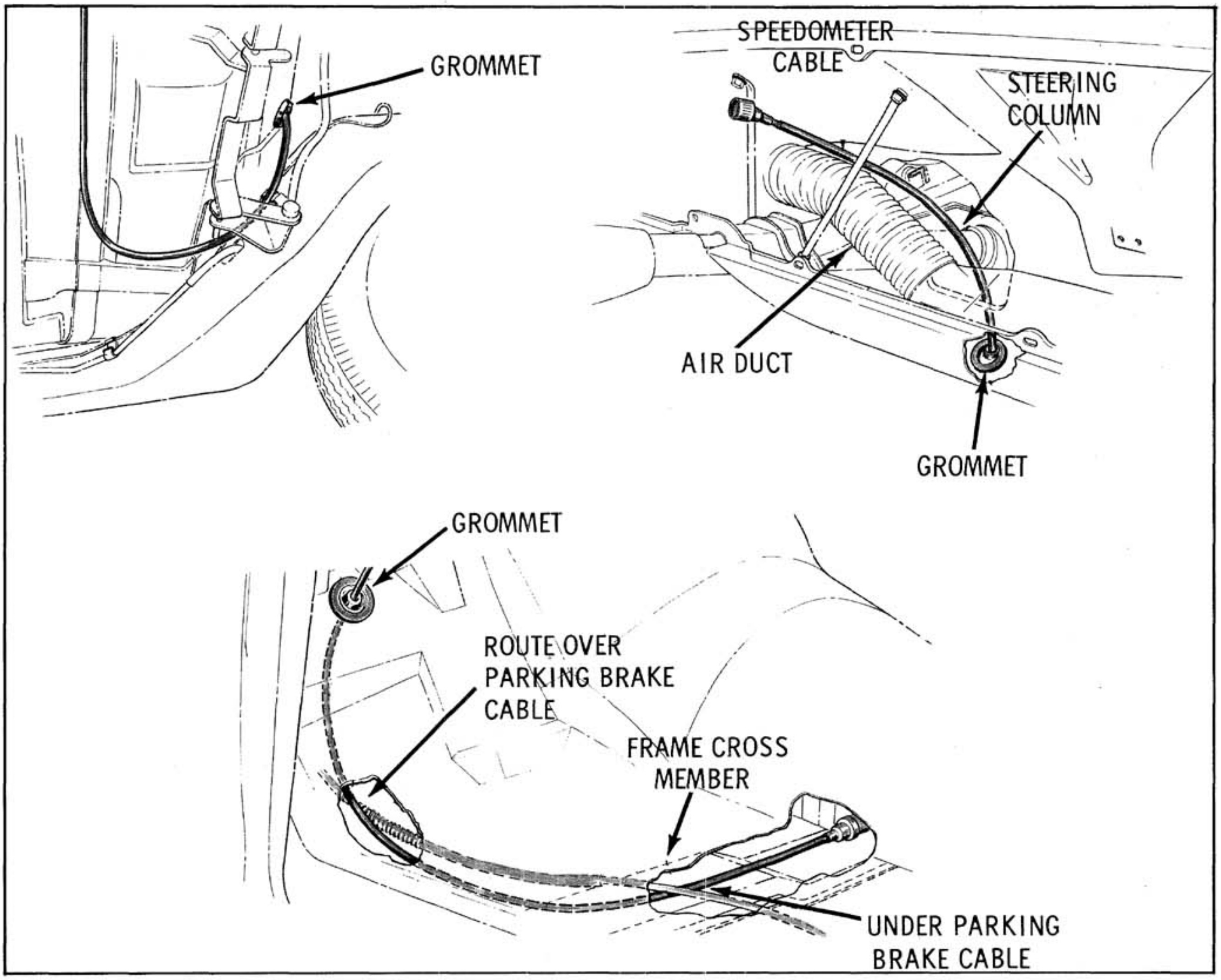


Fig. 12-141 Speedometer Cable Routing

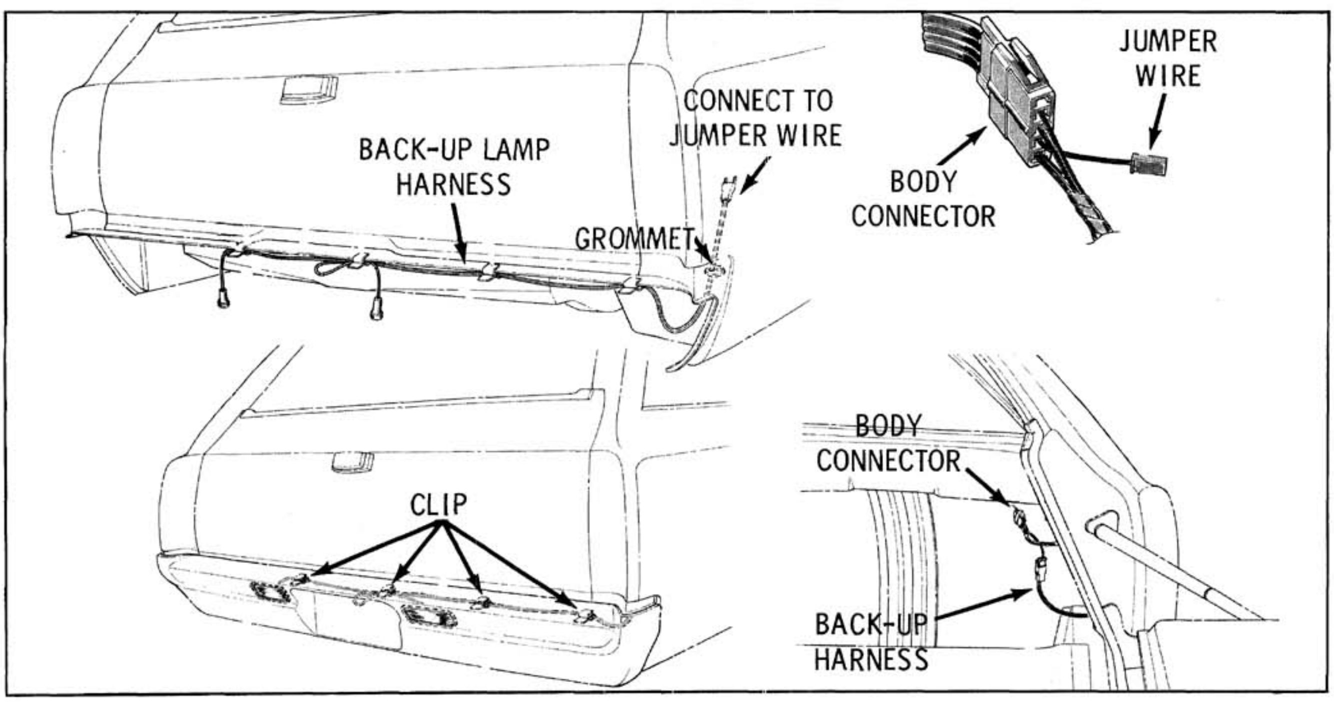


Fig. 12-142 Back-Up Lamp Installation (S.W.)

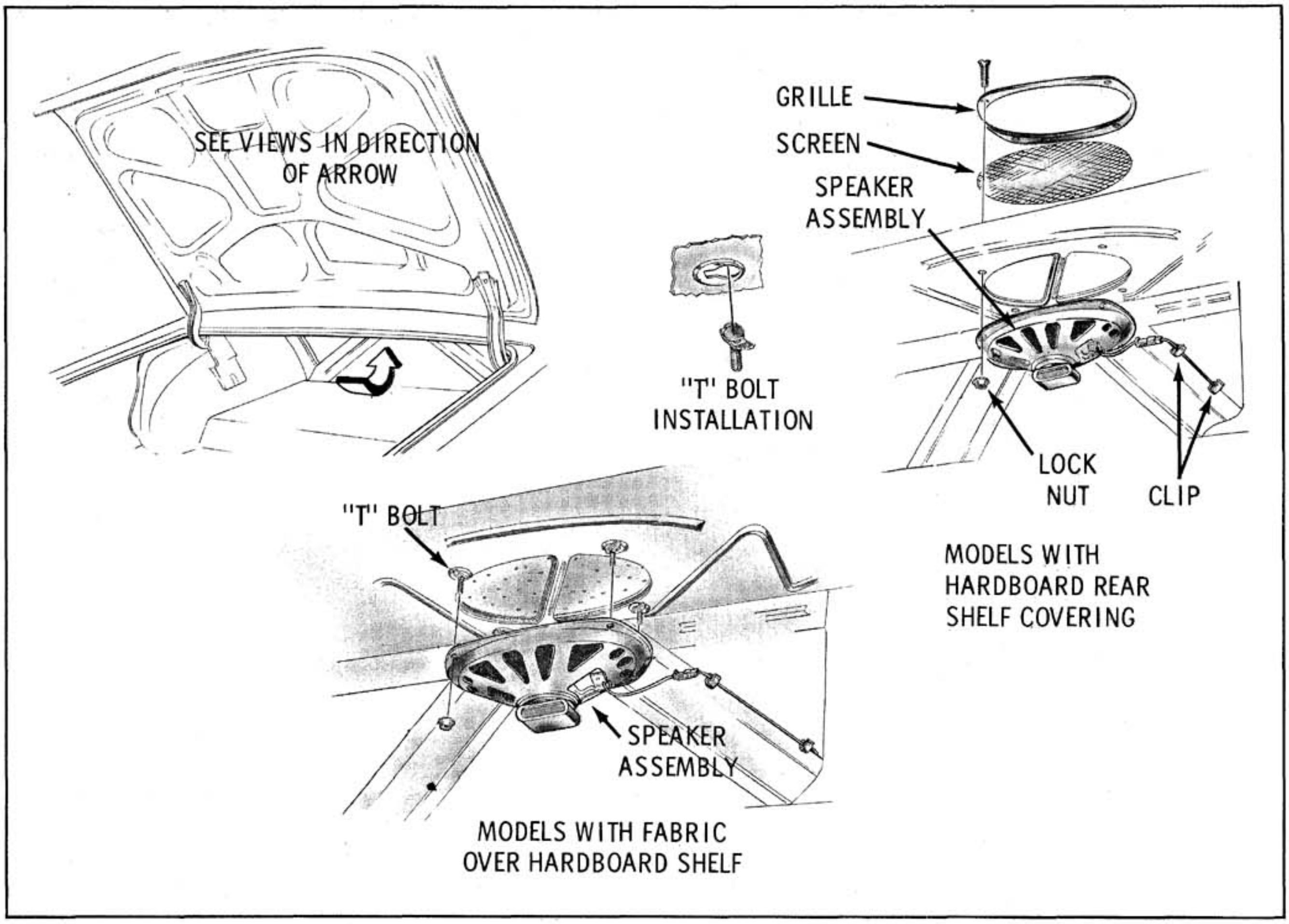


Fig. 12-143 Rear Seat Speaker Installation

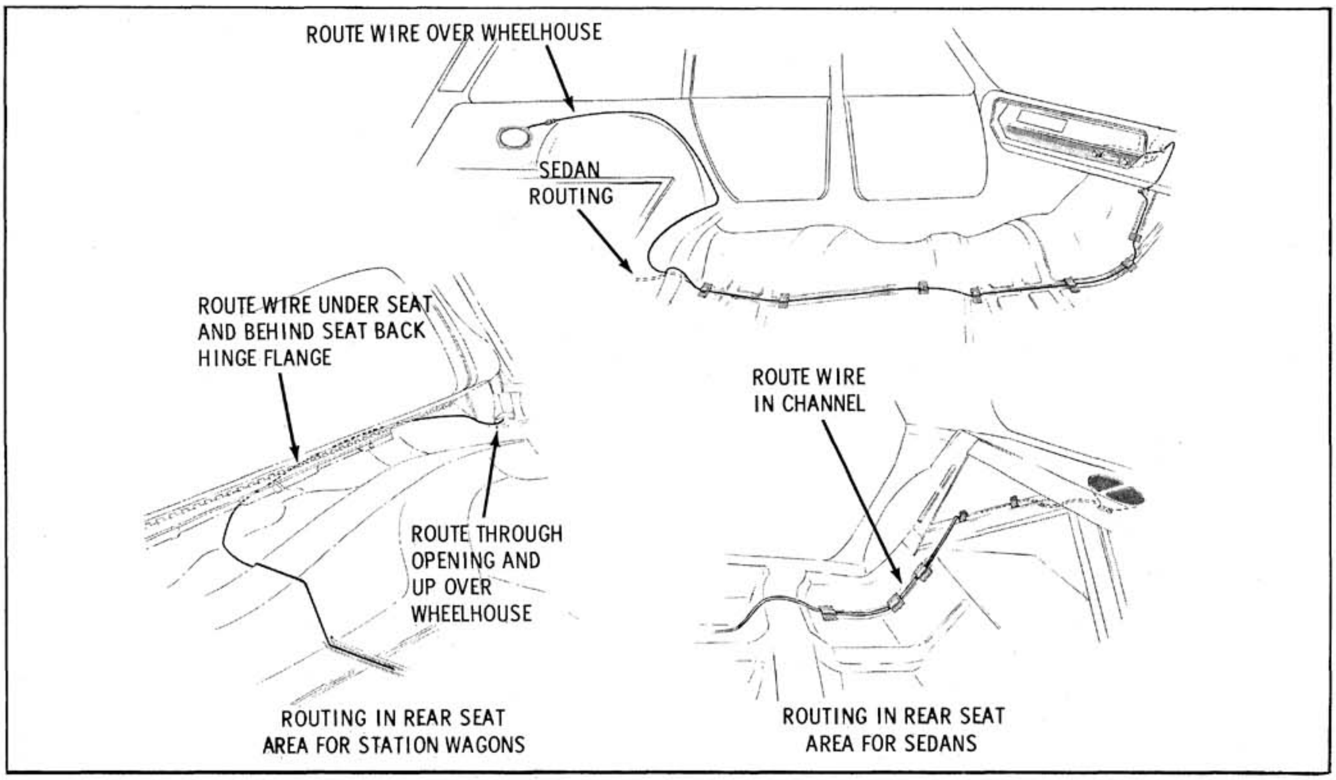


Fig. 12-144 Rear Seat Speaker Lead Routing

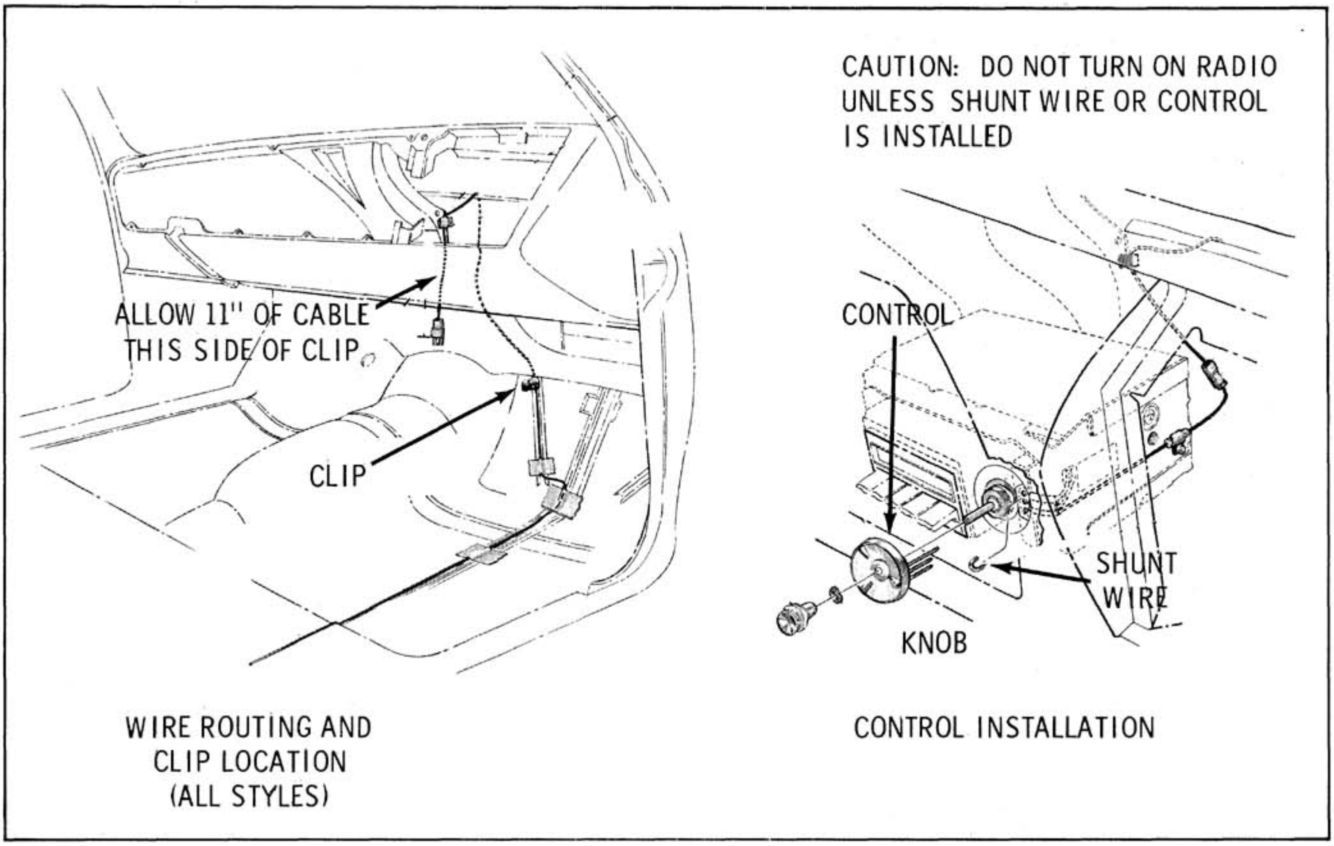


Fig. 12-145 Rear Seat Speaker Control and Wiring

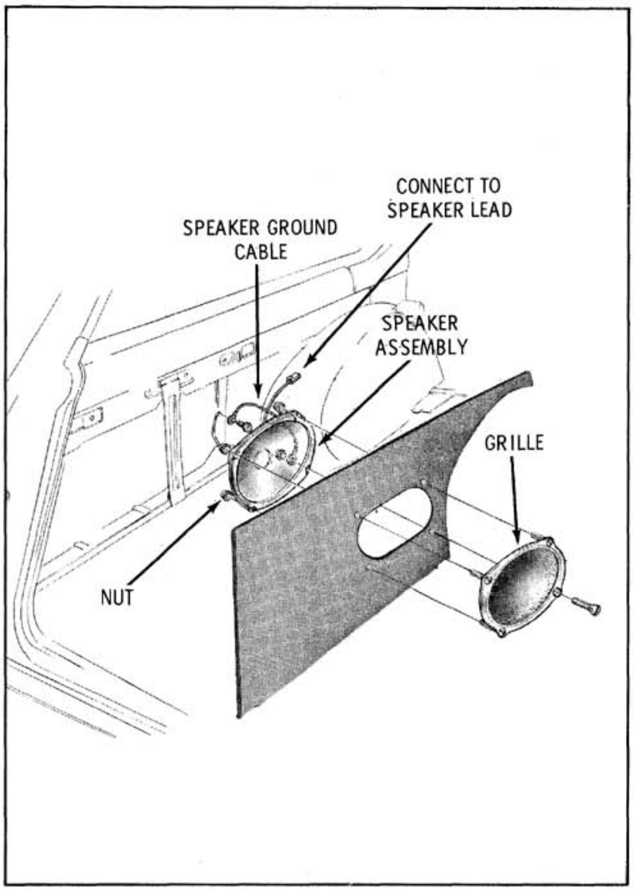


Fig. 12-146 Speaker Installation (S.W.)

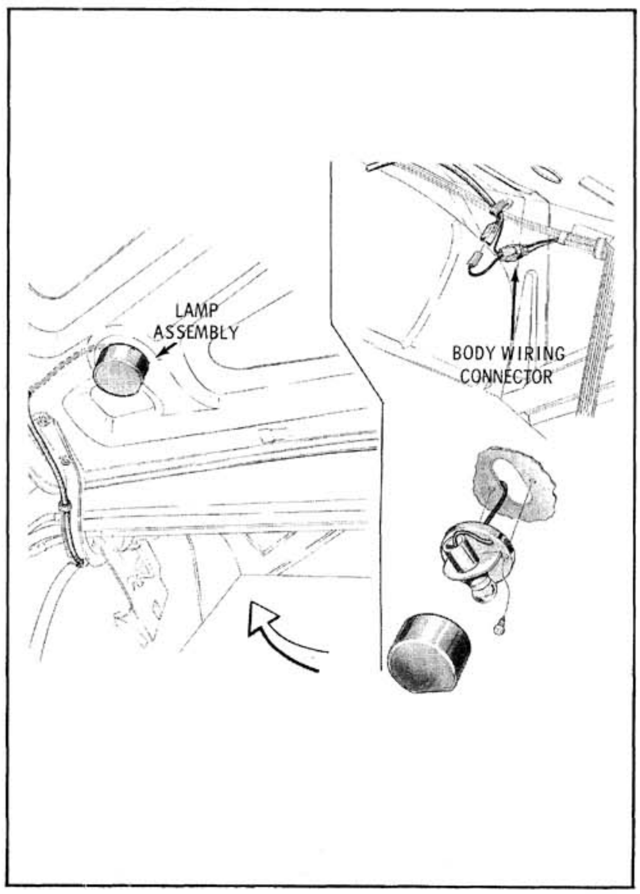


Fig. 12-147 Trunk Lamp Installation

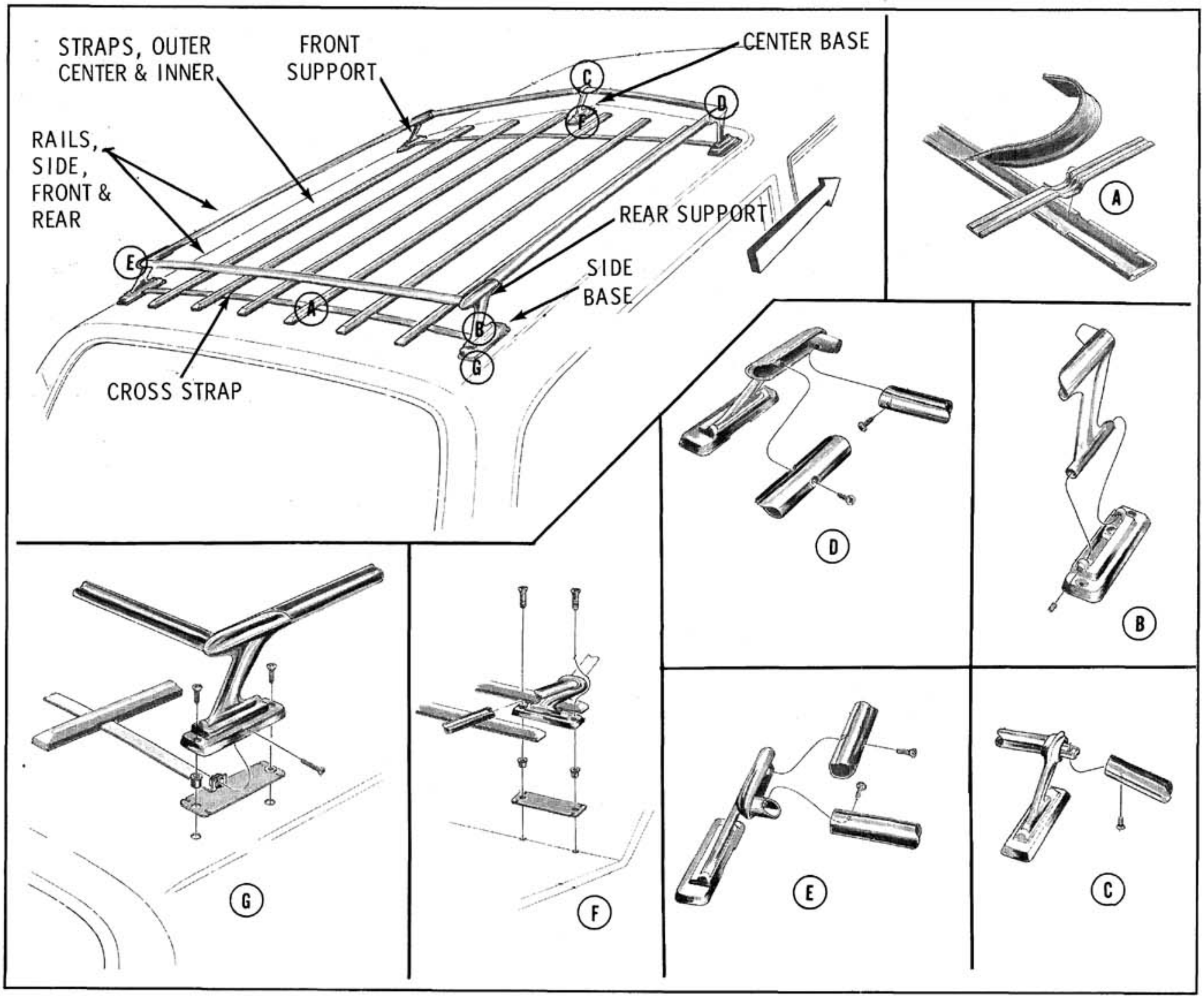


Fig. 12-148 Station Wagon Cargo Carrier

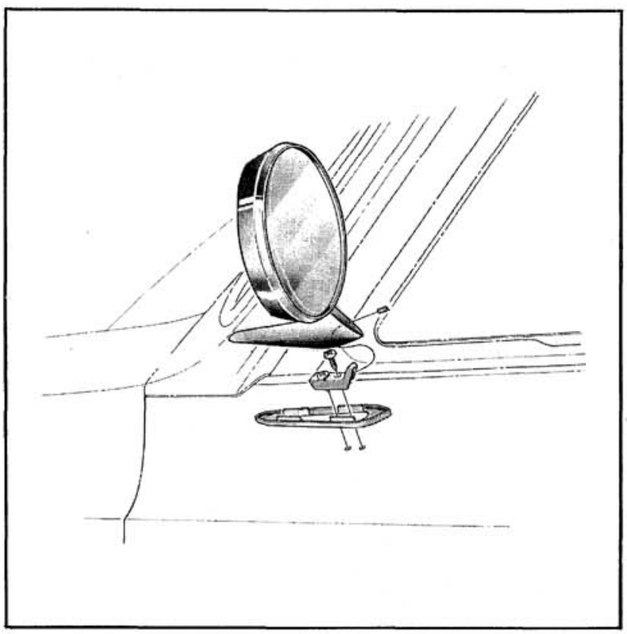


Fig. 12-149 Outside Mirror

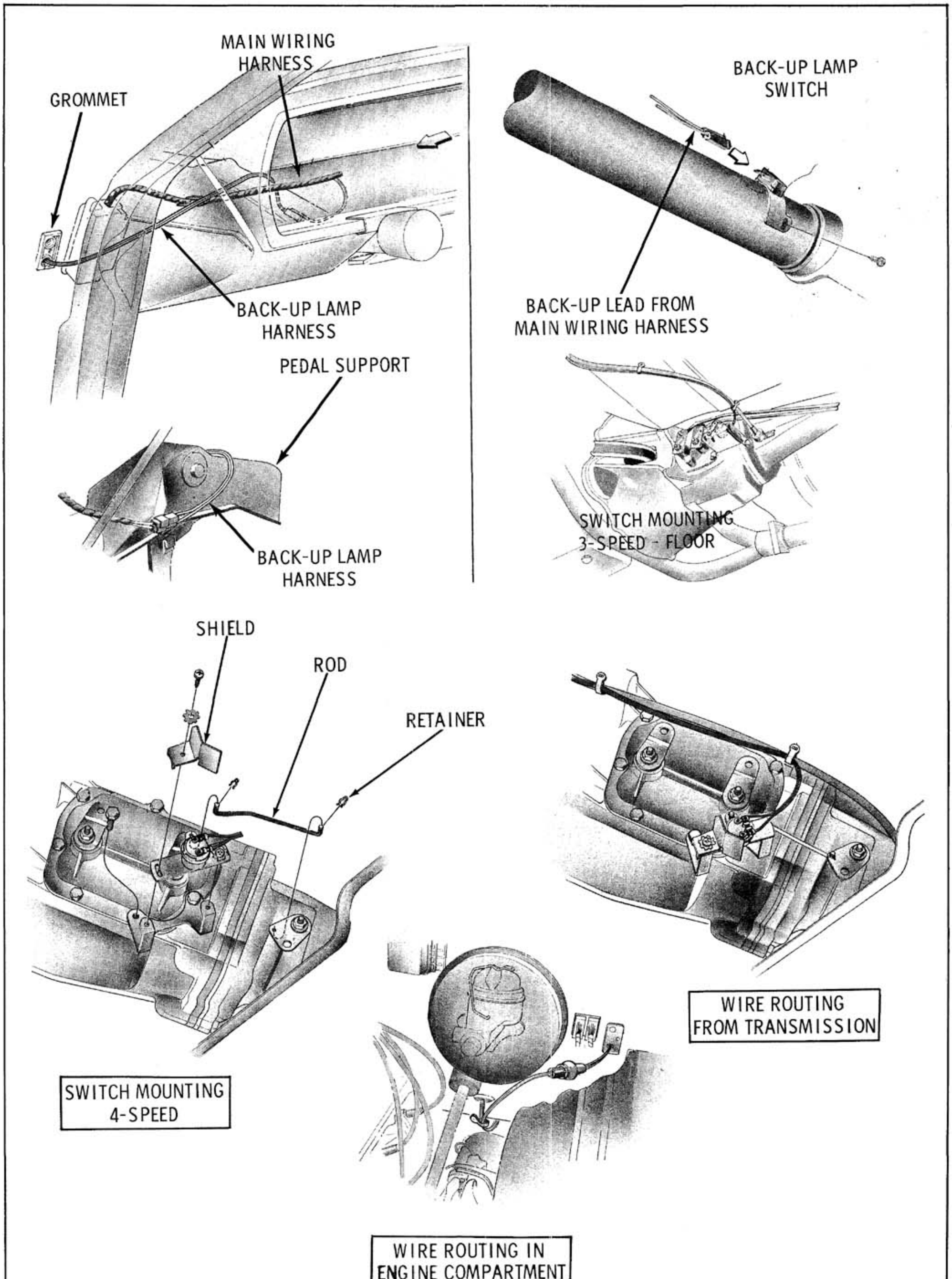


Fig. 12-150 Back-Up Lamp Wiring and Switches (Floor and Column Shift)

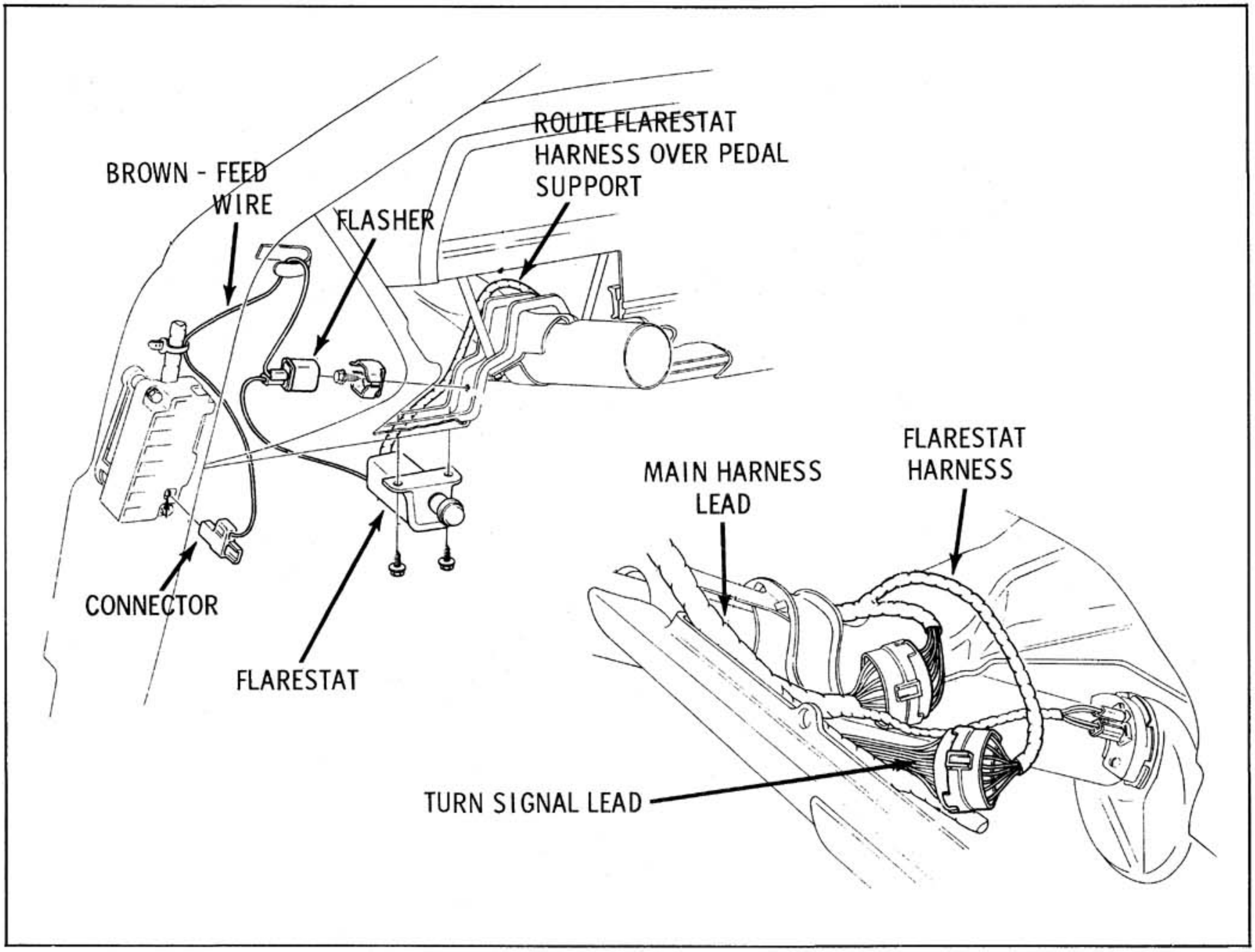


Fig. 12-151 Flarestat Installation

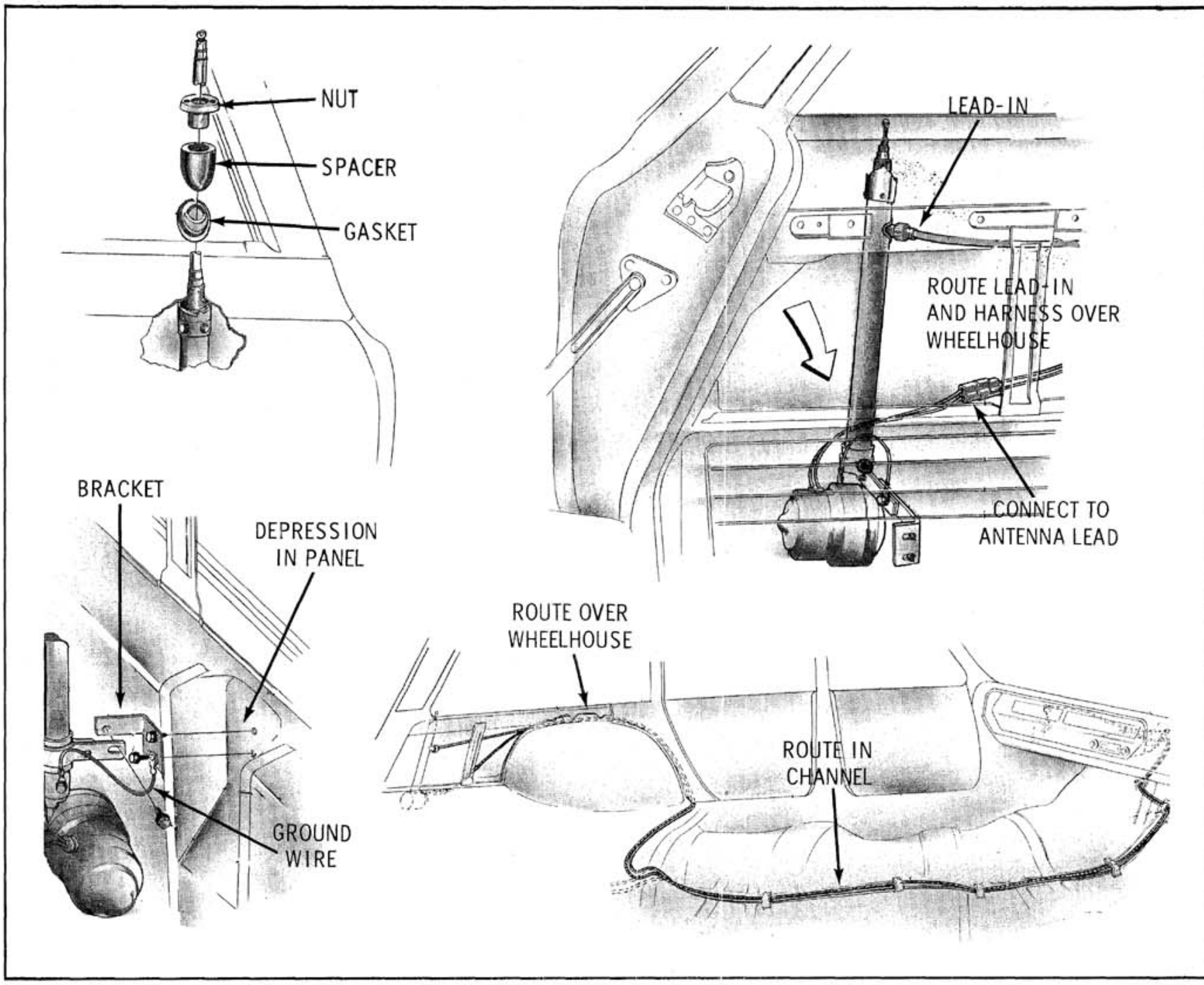


Fig. 12-152 Power Antenna Installation S.W.

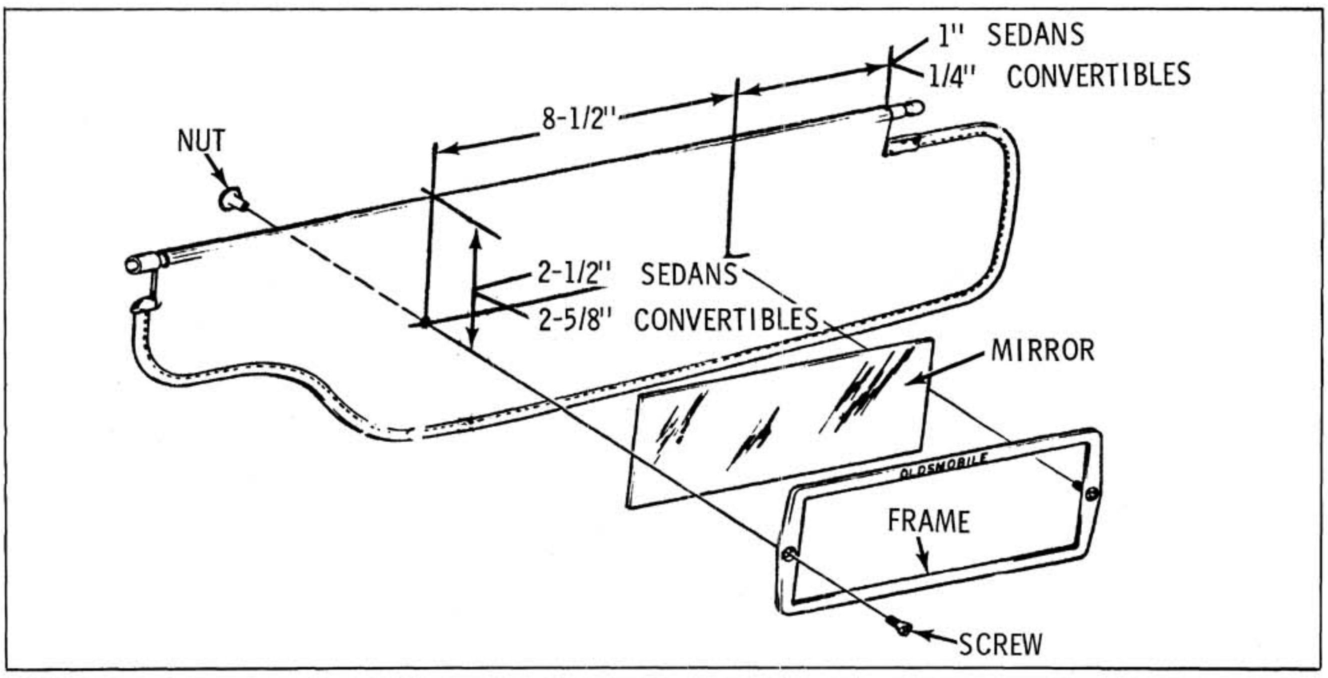


Fig. 12-153 Sunshade Vanity Mirror

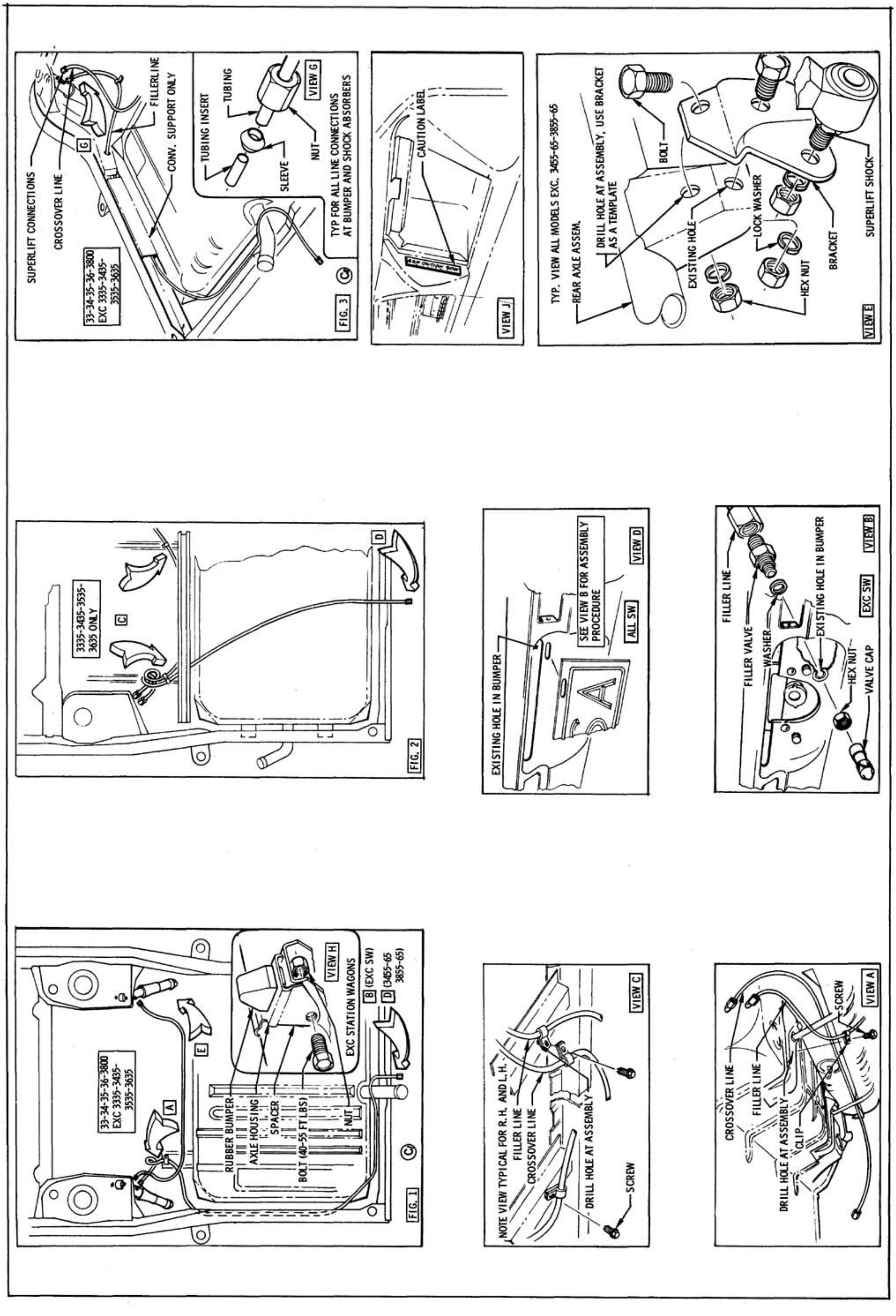


Fig. 12-154 Super Lift Shock Absorber Installation

Fig. 12-155 Wheel Disc

ELECTRICAL

(ALL SERIES)

CONTENTS OF SECTION 13

PERIODIC MAINTENANCE

BATTERY

1. Check battery liquid level at each engine oil change, once a month or more often (when refueling) in hot weather. Level should reach the bottom of the vent well. DO NOT OVERFILL.

   CAUTION: HYDROGEN GAS IS PRODUCED BY THE BATTERY. A FLAME OR A SPARK NEAR THE BATTERY MAY CAUSE AN EXPLOSION. BATTERY LIQUID IS HIGHLY ACIDIC. AVOID SPILLING ON FABRICS, PAINTED, PLATED OR BRIGHT SURFACES.

2. Clean top of battery and terminals every 12,000 miles and check tightness of battery hold-down bolt. To properly clean battery:

   a. Make sure vent plugs are installed tight.

   b. Remove battery cables from battery.

   c. Clean battery and battery cable clamps with a diluted ammonia or soda solution and a brush. When the solution stops foaming, rinse with clear water.

   d. Apply a thin coating of petrolatum to terminals and clamps after installing clamps.

DELCOTRON GENERATOR

The generator belt tightness should be checked with Tool 33-70M and adjusted if necessary. No periodic lubrication is required on the generator.

DISTRIBUTOR

The distributor requires periodic inspection of the cap, rotor, wiring, contact points and timing.

When replacing the contact point assembly,

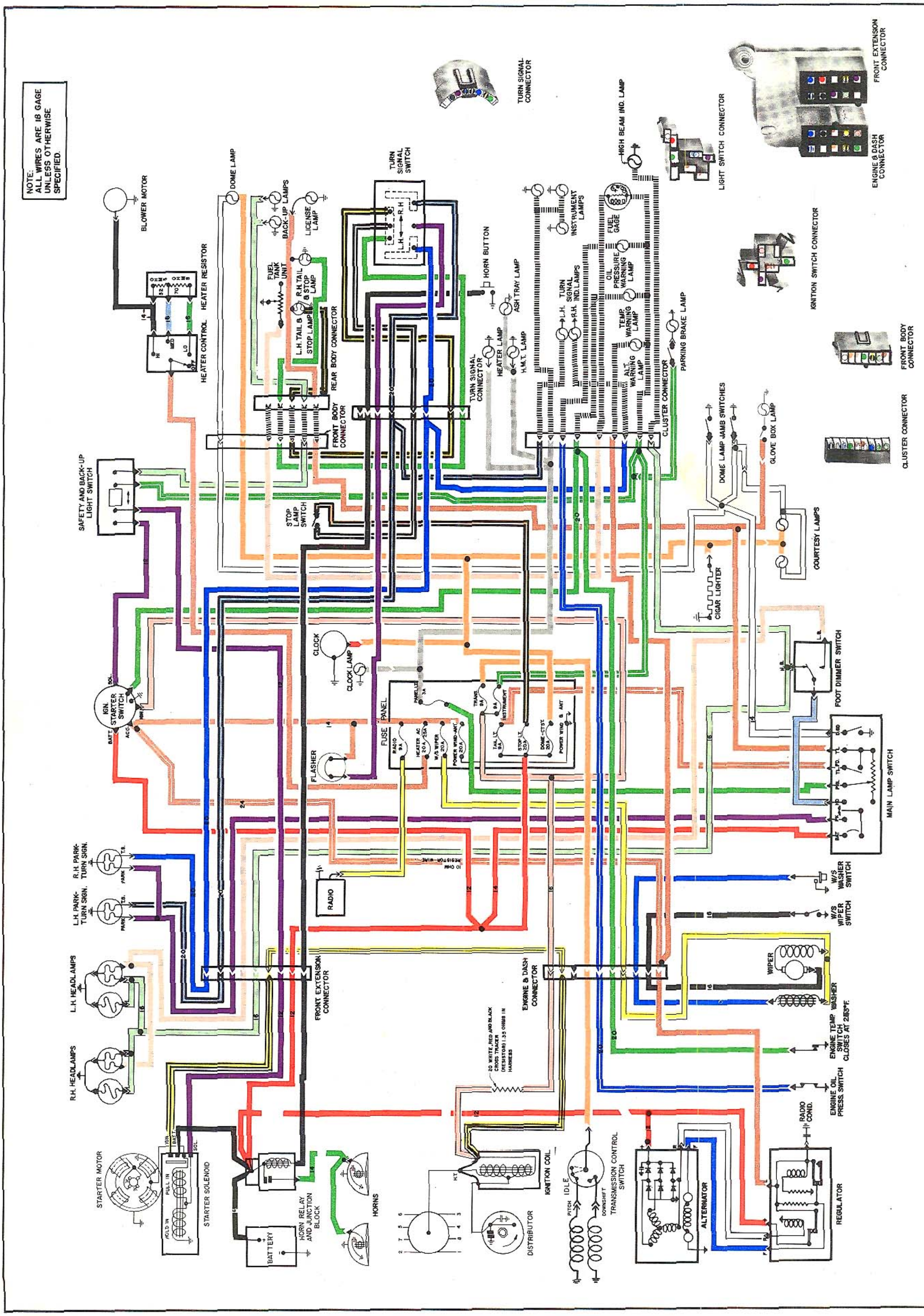


Fig. 13-1 Wiring Diagram (34, 36 and 38 Series V-8)

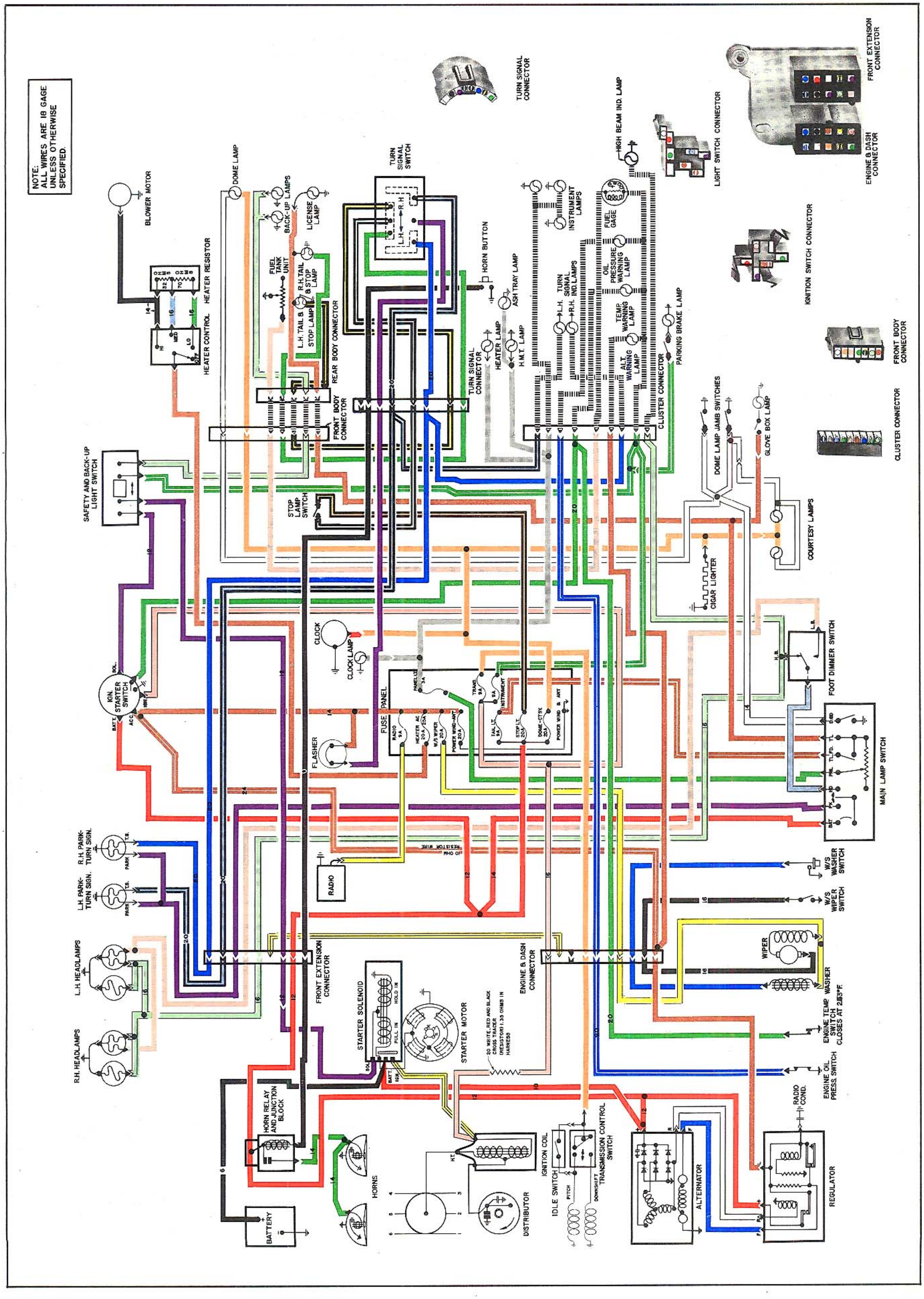


Fig. 13-2 Wiring Diagram (33 and 35 Series V-6)

apply a small amount of ball bearing lubricant or equivalent to the breaker cam. No other lubrication is required.

WIRING CIRCUIT

A combination junction and fuse block is mounted on the cowl under the instrument panel. Each wire from the fuse panel is color coded to simplify servicing. (Figs. 13-1, 13-2 and 13-4)

On 33 through 38 Series the chassis wiring, in the engine compartment, plugs into the rear of the fuse block.

The wiring harness installation under the instrument panel is shown in Figs. 13-3 and 13-5.

The wiring harness installation in the engine compartment is shown in Figs. 13-6, 13-7 and 13-8.

The fuse block, fuse size and location are shown in Figs. 13-9 and 13-10.

FUSE HOLDER OR CONNECTOR TERMINAL REPLACEMENT

The fuse holders and connector terminals can be removed by compressing the small tangs on both sides of the holder while applying pressure to the holder. A tool to compress the tangs can be made with a cotter pin, or by using a small screwdriver or awl. (Fig. 13-11)

CHARGING CIRCUIT (Fig. 13-12)

The charging circuit consists of the battery, Delcotron generator, regulator, and the warning light. Cars without air conditioning are equipped with a 42 ampere generator. Cars with factory installed air conditioning are equipped with a 55 ampere generator.

DESCRIPTION

With the ignition switch on, before the engine has started, the indicator lamp lights to indicate the generator is not charging. Current flows from the battery to the BAT terminal on the switch, through the indicator lamp and resistor, which is in parallel, and then through the voltage regulator contacts. It continues to flow through the generator field winding to ground, completing the circuit. Current through this circuit energizes the field windings sufficiently to insure voltage build-up in the stator windings when the engine starts. The voltages generated in the stator windings are then changed or rectified by the six generator diodes to a DC voltage which appears at the BAT or output terminal on the generator. The resistor, in parallel with indicator lamp, allows more

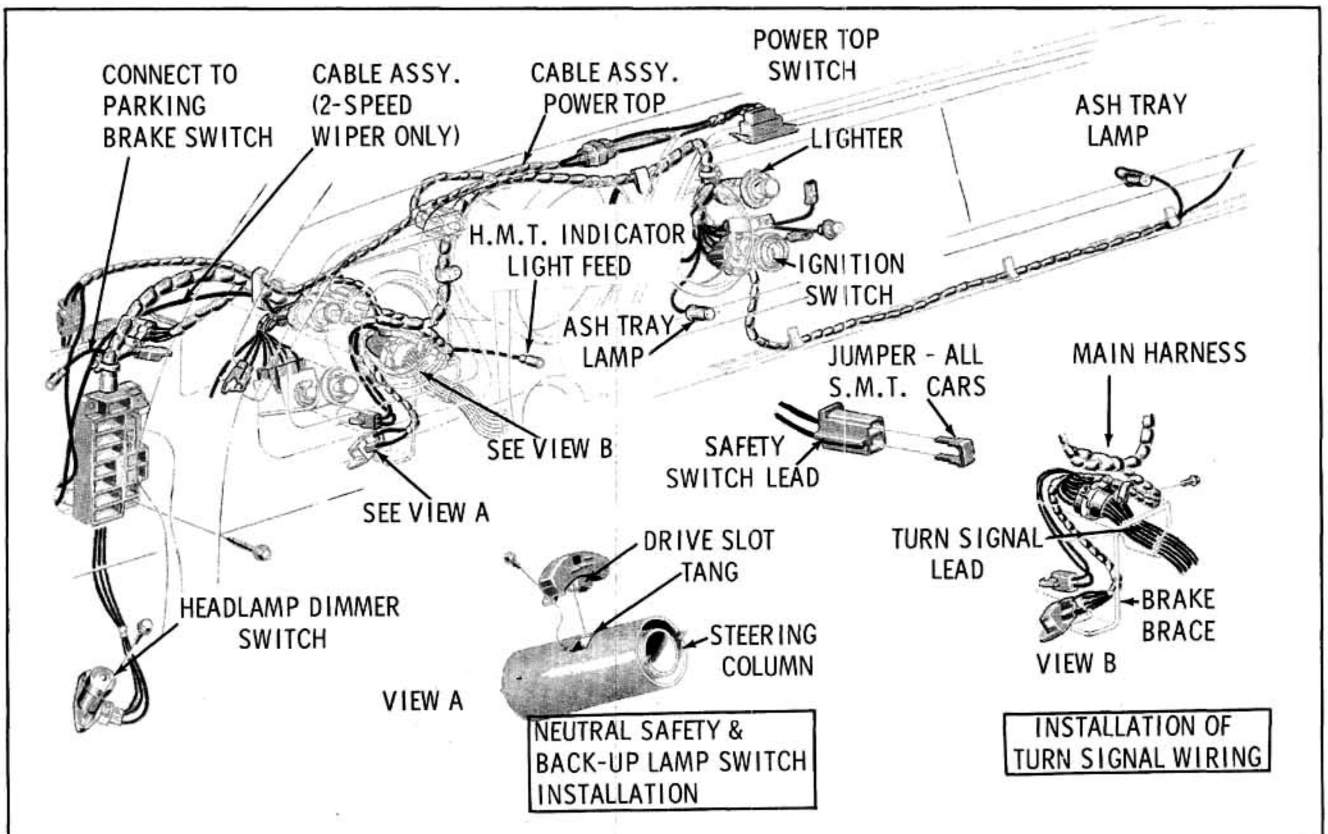


Fig. 13-3 Instrument Panel Wiring (52 through 86 Series)

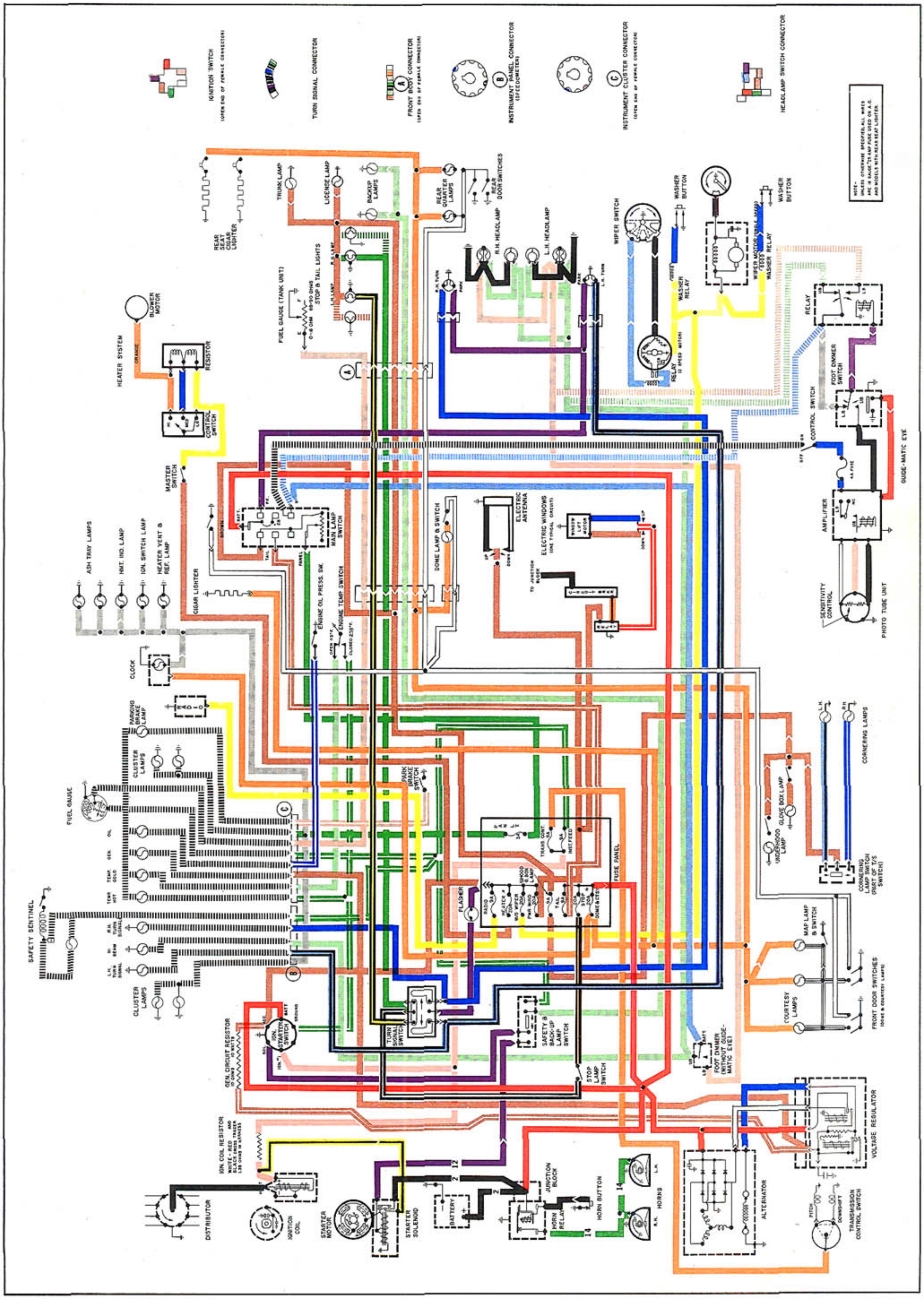


Fig. 13-4 Wiring Diagram (52 through 86 Series)

current to flow through the field winding to insure voltage build-up in the stator windings.

As the generator begins to operate, voltage from the "R" terminal is impressed through the regulator No. 2 terminal across the field relay winding, causing the relay contacts to close. This connects the regulator No. 4 terminal directly to the battery through the field relay contacts, causing the indicator lamp to go out. Generator field current then flows from the battery to the regulator No. 3 terminal and then through the field relay contacts and voltage regulator lower or series contacts to the field winding.

As the speed of the generator increases, the voltage at the BAT terminal of the generator also increases. This impresses a higher voltage through the field relay contacts and across the voltage regulator shunt winding. The increased magnetism, created by this higher voltage across the winding, causes the lower or series contacts of the relay to separate. Field current then flows through a resistor which reduces the field current. This reduced field current causes the generator voltage to decrease; thereby decreasing the magnetic pull of the voltage regulator shunt winding. Consequently the spring causes the contacts to reclose. This cycle repeats many times per second to limit the generator voltage to a pre-set value.

As the generator speed increases even further, the resistor, connected across the contacts, is not of sufficiently high value to maintain voltage control on the contacts. Therefore, the voltage increases slightly causing the upper or "shorting" contacts to close. When this happens, the generator field winding is shorted and no current passes through the winding. With no current in the field winding, the generator voltage decreases which also decreases the magnetism in the shunt winding and the upper contact points open. With these points open, field current flows through the resistor and the field winding. As the voltage increases, the contacts reclose. This cycle then repeats many times per second to limit the generator voltage to a pre-set value at high generator speeds. The voltage regulator unit thus operates to limit the value of generator voltage throughout the rpm range. Consequently the electrical accessories are protected from excessive voltage which would cause damage.

BATTERY

For battery usage, refer to the BATTERY CHART.

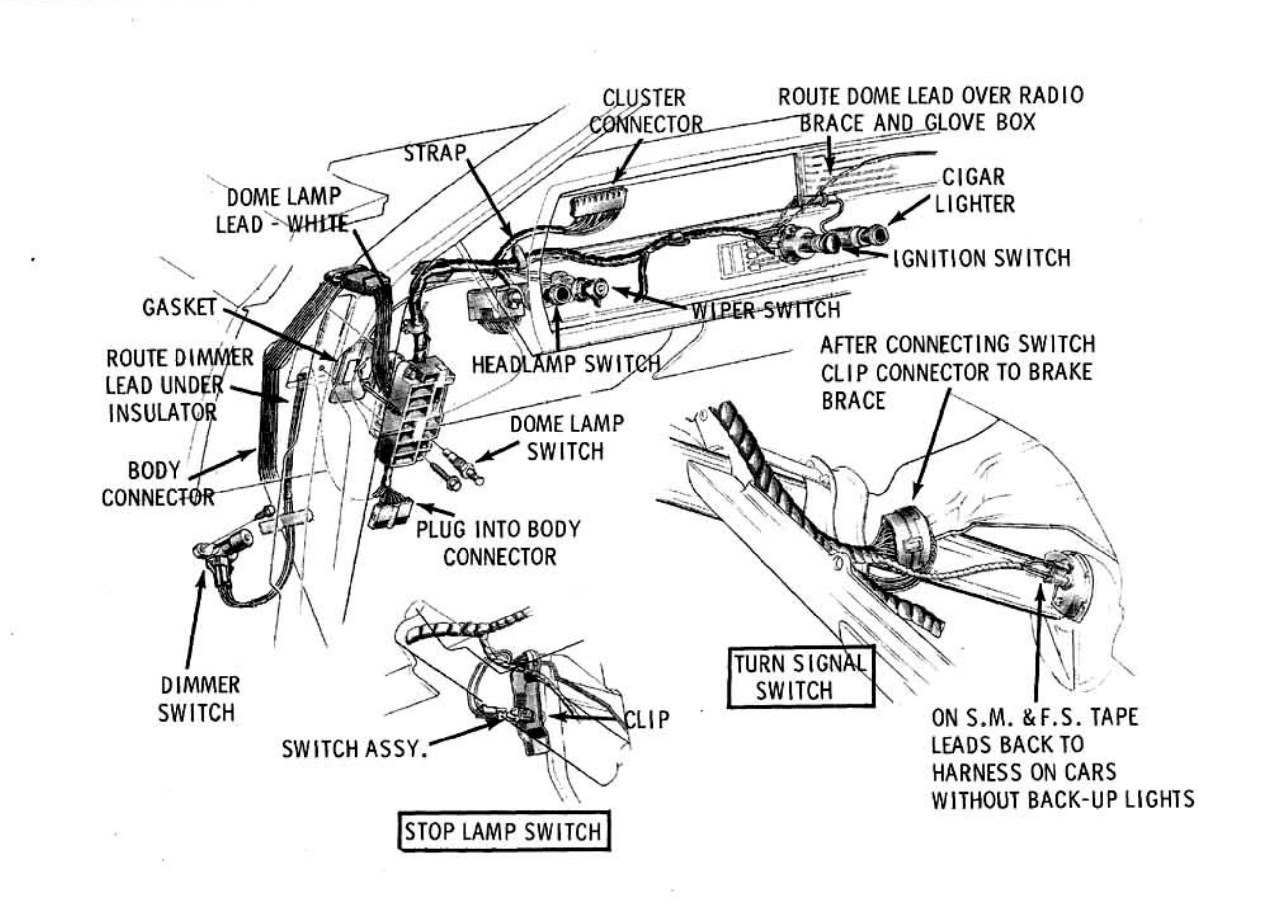


Fig. 13-5 Instrument Panel Wiring (33 through 38 Series)

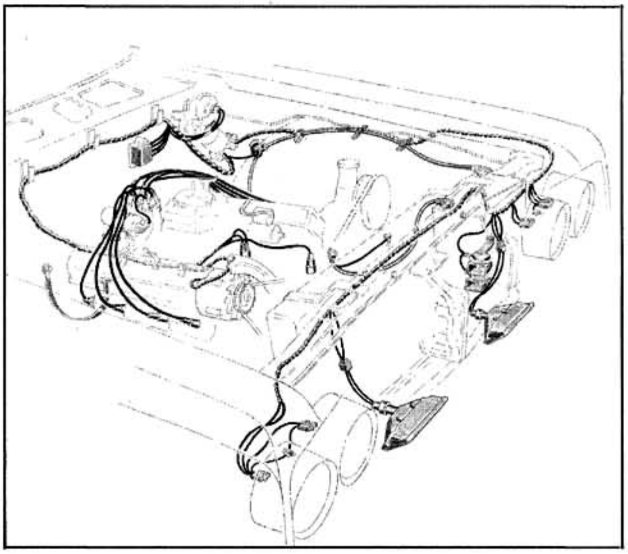


Fig. 13-6 Chassis Wiring Harness (52 through 86 Series)

BATTERY CHART			
Series	Engine	Amp. Hr.	Plates
33 & 35	V-6	61	66
34, 36, 38 & 52	V-8	61	66
54, 56, 58, 66 84 & 86	V-8 A.M.T.	73	78
54, 56, 58 & 66	V-8 S.M.T.	70	66

DELCOTRON GENERATOR

The generator consists of a rotor, a stator, two brushes and slip rings and six diode rectifiers. (Fig. 13-13)

The brushes and slip rings allow battery current to flow through the rotor creating a magnetic field. The stator consists of three sets of windings, each set containing seven coils, alternately spaced around the stator ring. The magnetic field produced by the rotor induces an AC voltage in the stator windings. This AC voltage is then directed to diode rectifiers.

A diode rectifier is an electrical device which resists current flow in one direction but allows it to flow in the other. Six diode rectifiers are used in the generator. Three of the diode rectifiers are positive and three are negative and are arranged so that the AC voltage produced by the generator is changed to a DC voltage. This DC voltage is used to charge the battery and operate electrical accessories.

REGULATOR

The regulator contains a voltage regulator and a field relay. (Fig. 13-14) A current regulator is not required because the generator is capable of self-regulating the current at a given speed and voltage. A cut-out relay is not required because the action of the diode rectifiers prevent battery voltage from discharging through the generator.

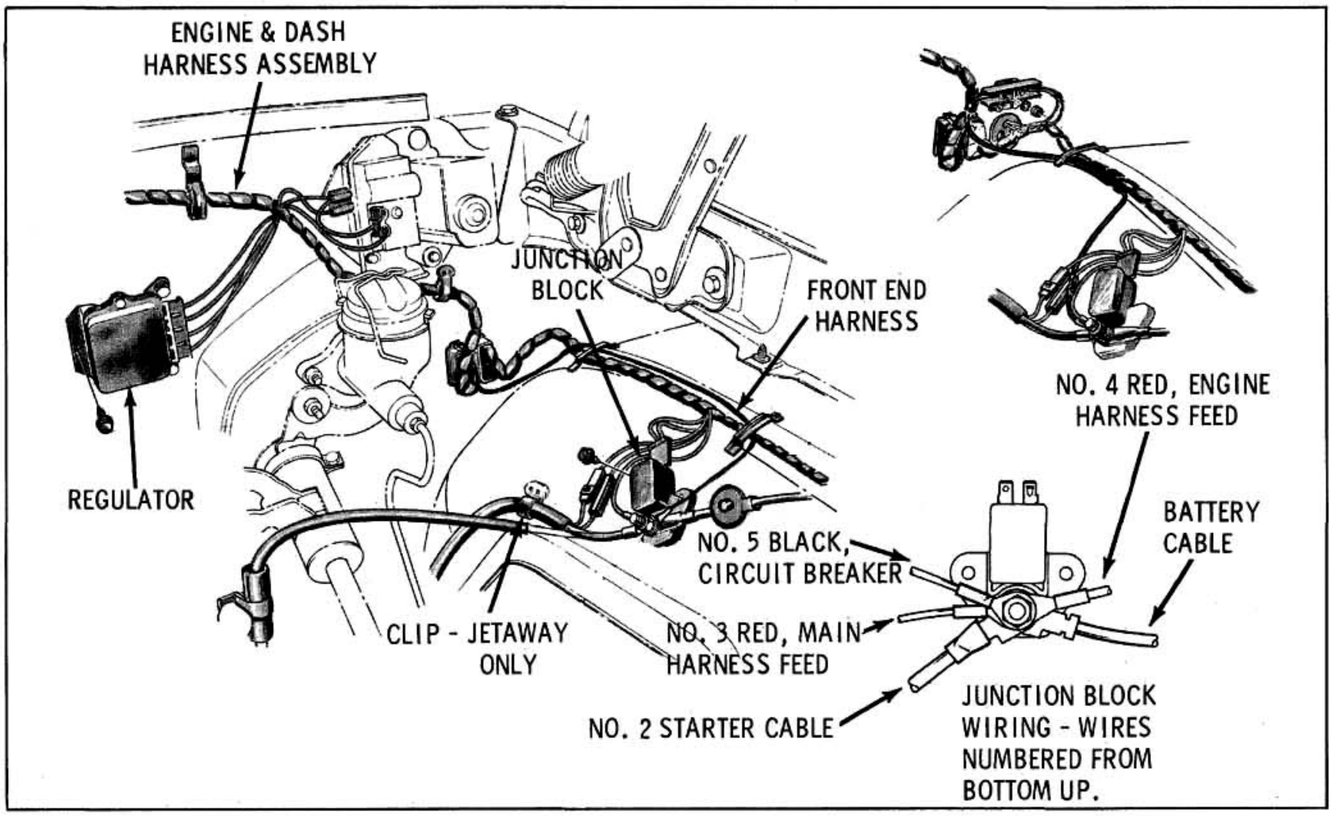


Fig. 13-7 Chassis Wiring Harness (34, 36 and 38 Series V-8)

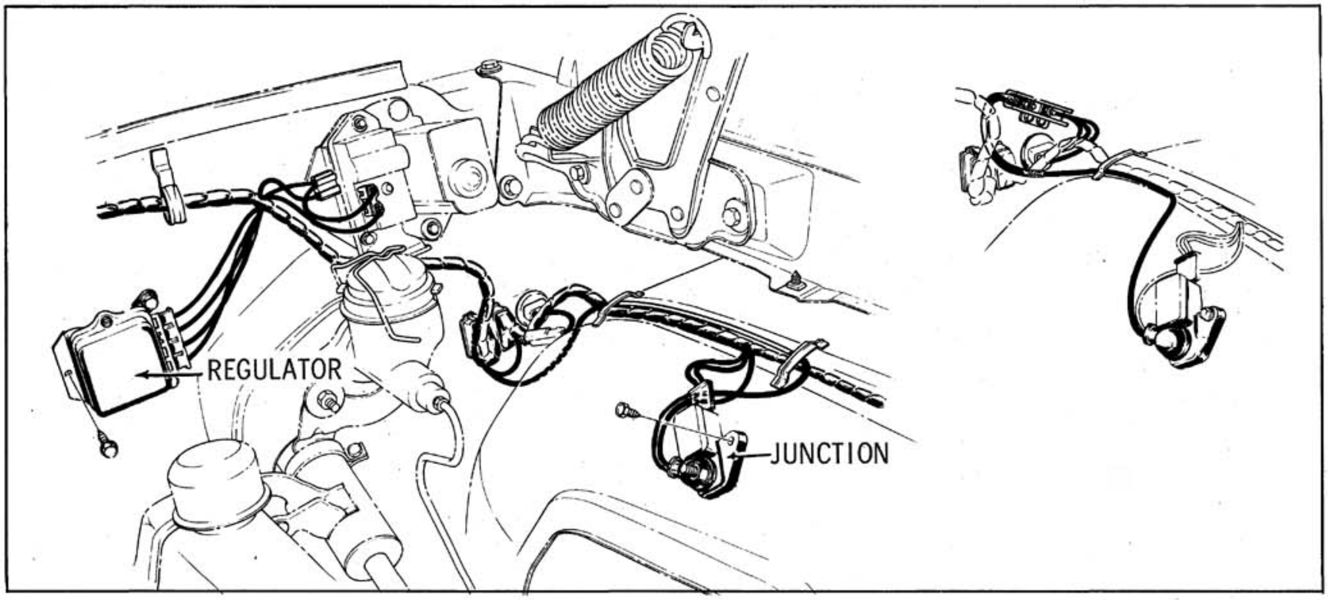


Fig. 13-8 Chassis Wiring Harness (V-6 Engine)

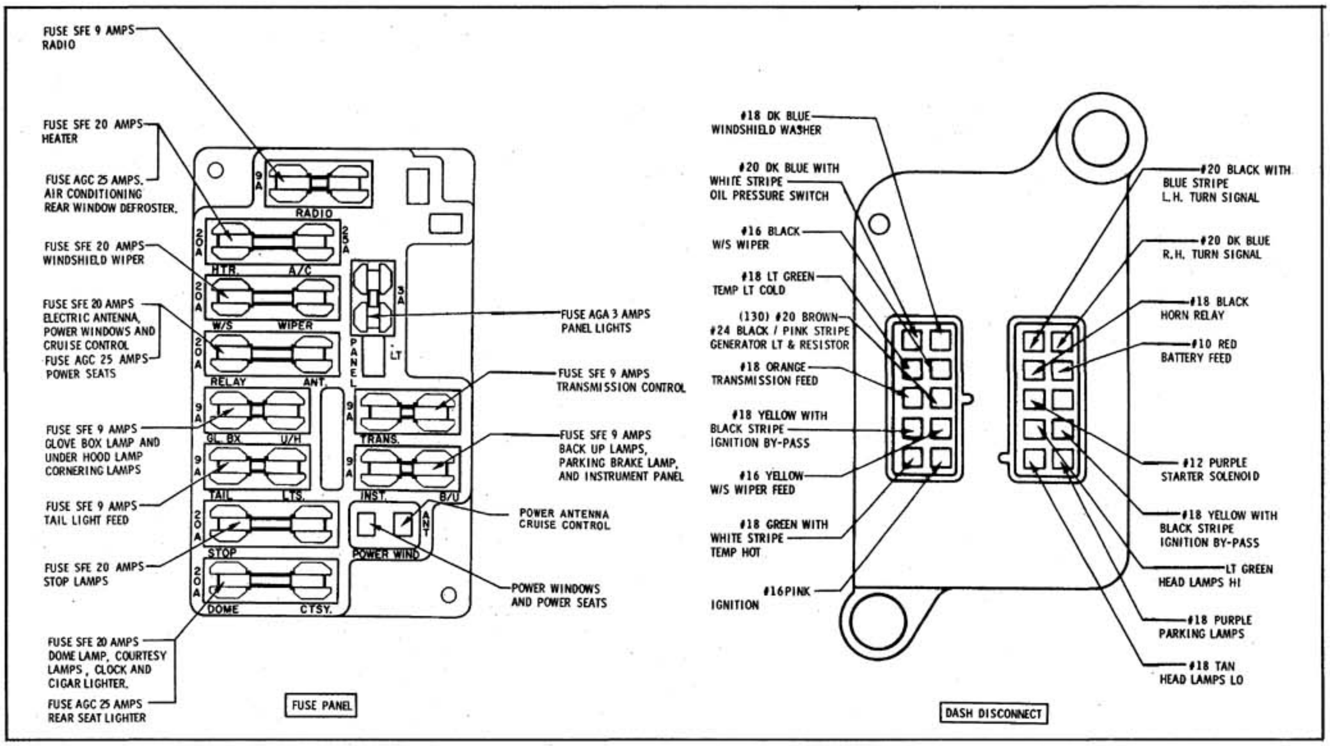


Fig. 13-9 Fuse Block (52 through 86 Series)

Voltage Regulator

The voltage regulator limits the voltage of the electrical system to a safe maximum. The contacts of the voltage regulator oscillate at a high speed, opening and closing the points. This action intermittently introduces resistance into the field circuit, thereby reducing voltage.

The voltage regulator has a double set of contacts to regulate voltage. The lower set of contacts limits voltage at low generator rpm. Vibration of the lower contacts intermittently inserts a resistance in the field circuit. This resistance is satisfactory at low rpm; however, when the rpm is increased the lower set of points can no longer control the voltage and the upper contacts close. A vibrating action takes place on the upper set of contacts which intermittently grounds the field to control voltage to a safe value.

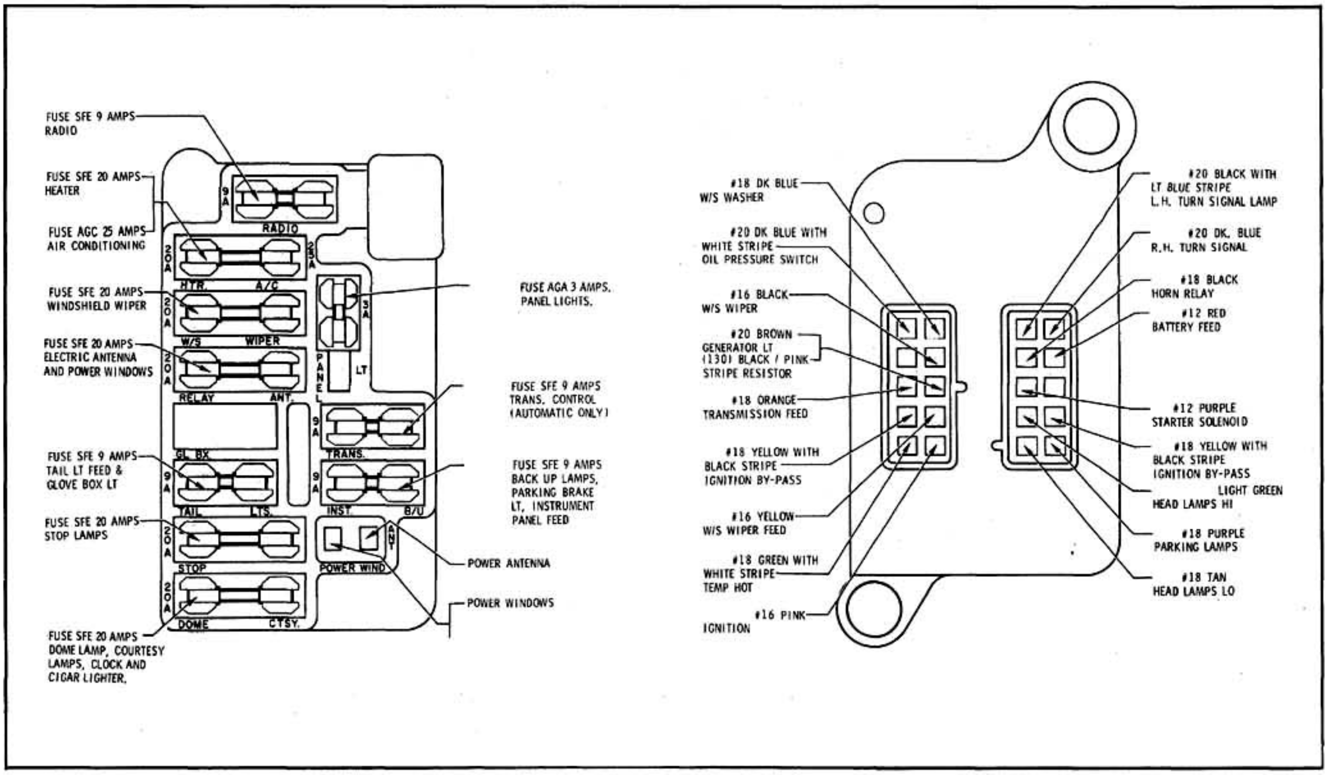


Fig. 13-10 Fuse Block (33 through 38 Series)

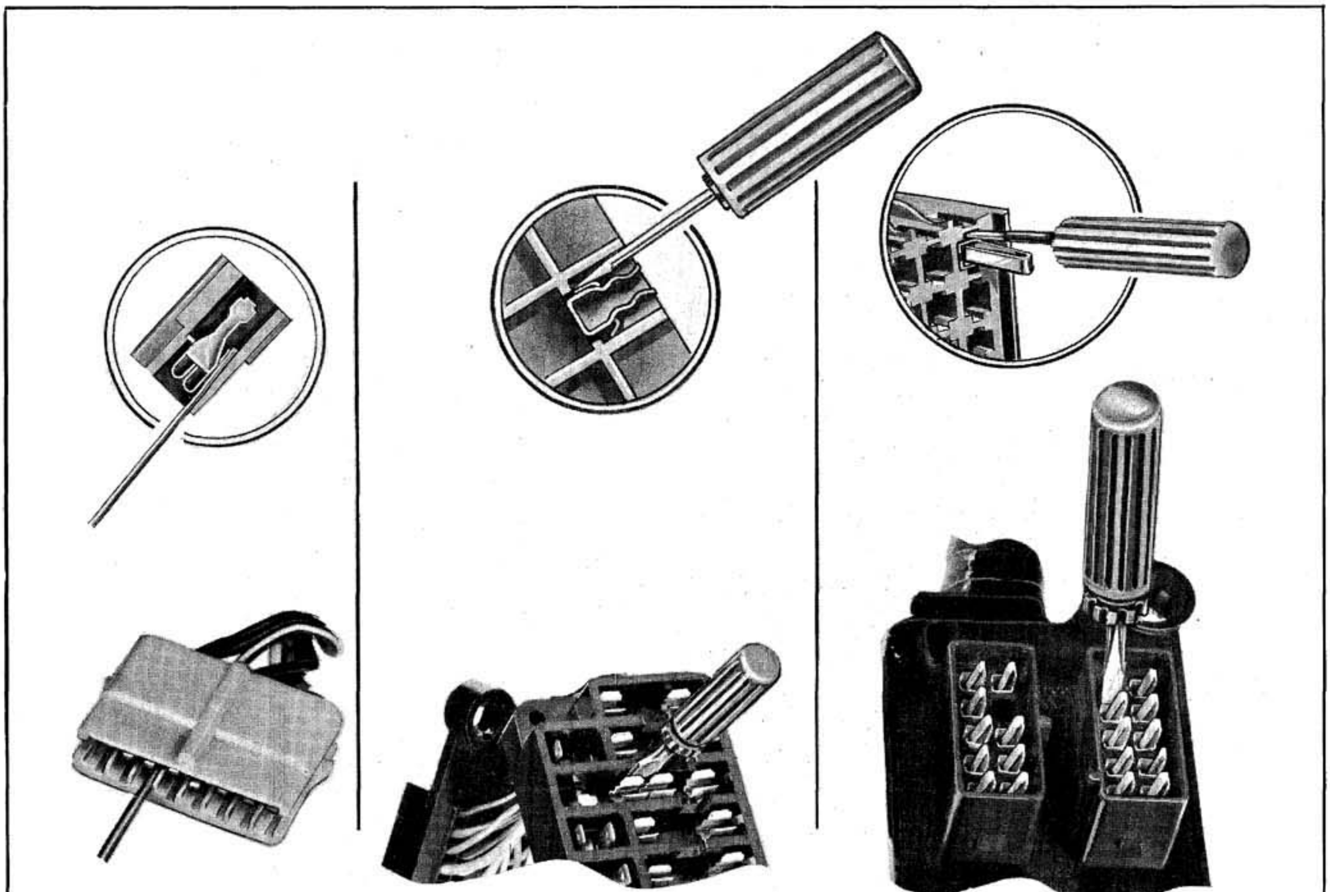


Fig. 13-11 Electrical Terminal Removal

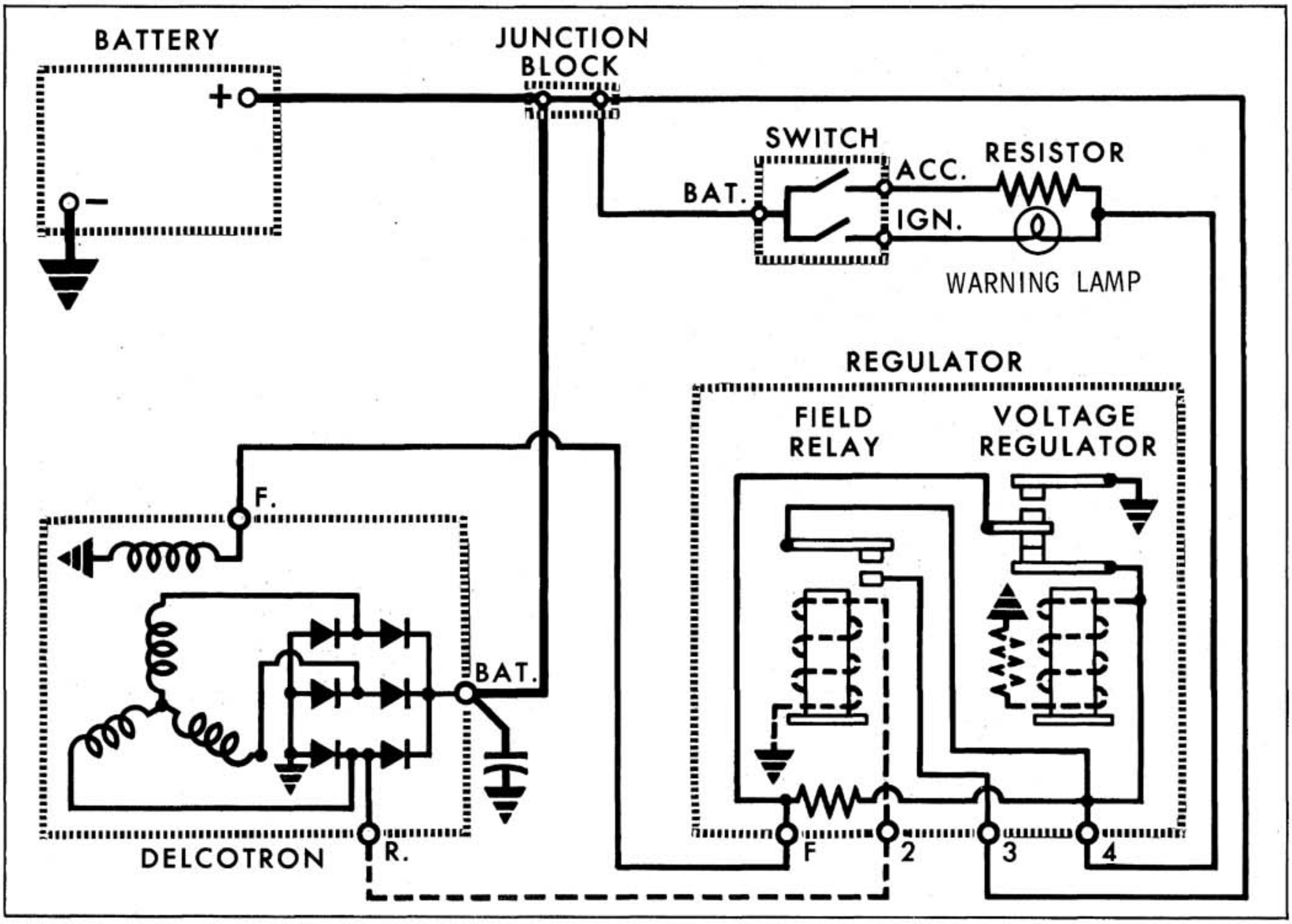


Fig. 13-12 Charging Circuit

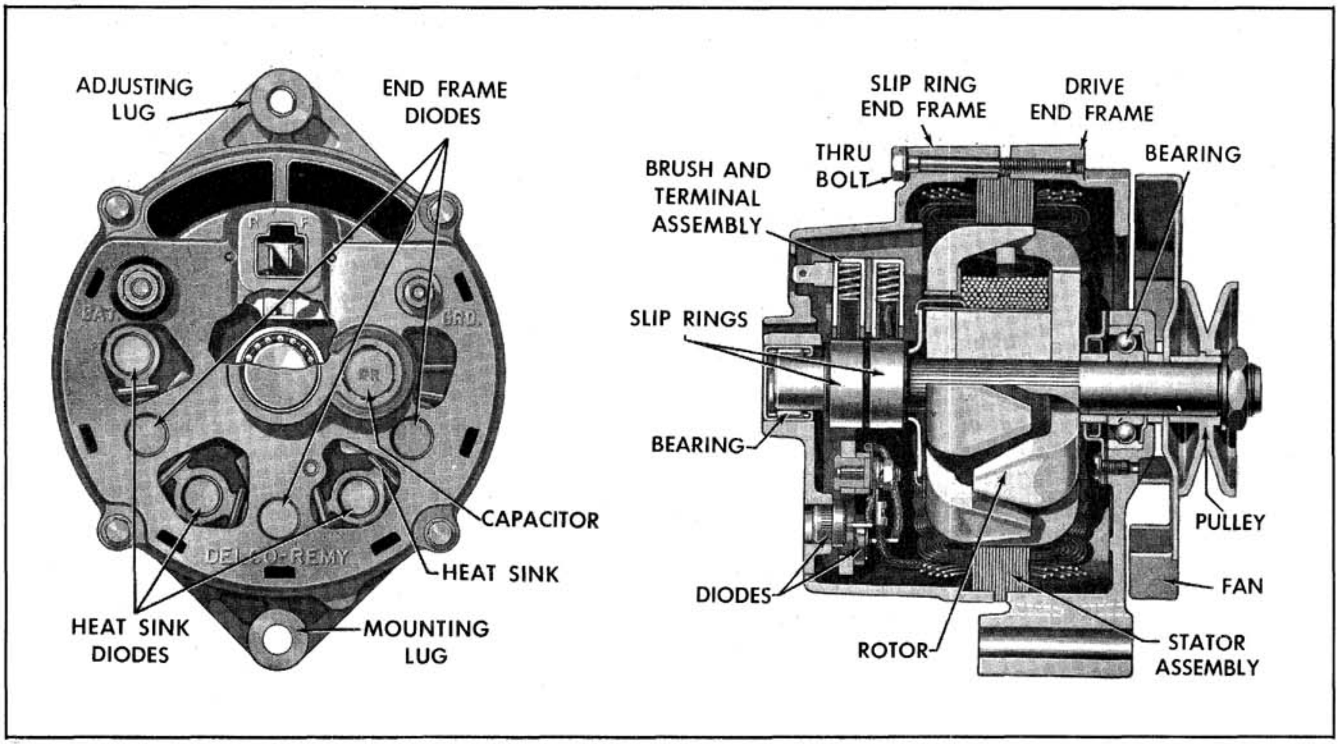


Fig. 13-13 Delcotron Generator

Field Relay

The field relay acts as an "on-off" switch between the field winding and the battery.

When the ignition switch is closed, the field relay winding is connected to the battery. Current from the battery creates magnetism in the relay winding and closes the contact points. Current from the battery can now flow from the battery through the closed relay points, through the closed voltage regulator points, to the field windings in the generator.

WARNING LIGHT

The red warning light located in the instrument panel should light when the ignition key is turned on and the engine is not running. When the engine is started, the light will go out indicating that the generator is operating. If the light remains on with the ignition key in the Off position, it indicates a shorted positive diode in the generator.

NOTE: The warning light will light dimly with the ignition key in the Accessory position, with the radio or other accessory operating. This condition is normal.

SERVICE PRECAUTIONS

The following precautions must be observed when servicing the charging circuit to prevent serious damage to the electrical equipment:

1. When installing a battery, using jumper cables, a booster battery or connecting a charger, the negative terminals of the battery or charger must be connected to the ground side of the system and the positive terminals of the battery or charger, to the positive side of the system. Failure to observe polarity will result in the battery being directly shorted through the diodes and could result in a burned wiring harness or damaged diodes.
2. Never operate the generator with any of the wires or connectors disconnected or loose. Operating the generator with disconnected or loose connections could result in development of extremely high voltages.
3. Do not short across or ground any of the terminals on the generator or regulator as damage to these units could result.
4. Do not attempt to polarize the generator or regulator as these units could be damaged. Polarization is not required with this type of charging circuit.
5. When removing the generator from the car or working in the engine compartment near the generator, always disconnect the battery negative cable first; as the red wire connected to the BAT terminal on the generator is connected to battery voltage.

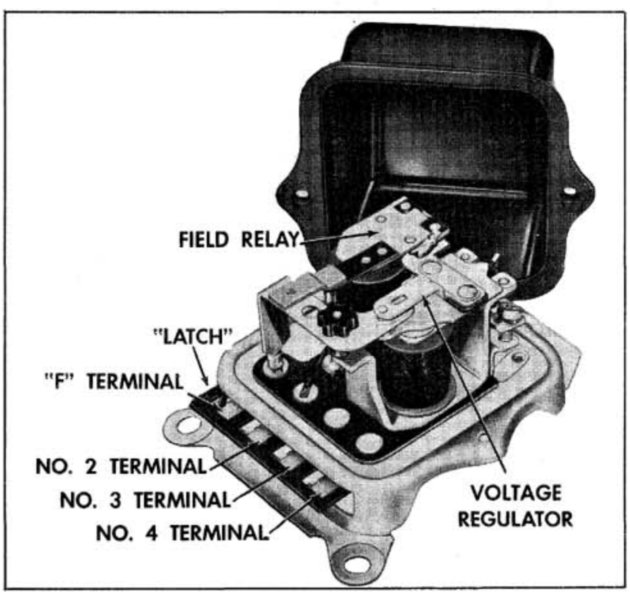


Fig. 13-14 Voltage Regulator

CHECKS AND ADJUSTMENTS OF THE CHARGING CIRCUIT

Trouble in the charging circuit will usually show up as faulty warning light operation or by an undercharged or overcharged battery. Before attempting any checks and adjustments, be sure that all wiring connections are clean and tight and that the battery is in satisfactory condition.

WARNING LIGHT CIRCUIT AND FIELD RELAY CHECK (Fig. 13-15)

If the warning light fails to light when the ignition switch is turned on, engine not running, check for a burned out bulb or fuse, then check the field relay. If the light stays on with the ignition switch off, check for a shorted positive diode in the generator.

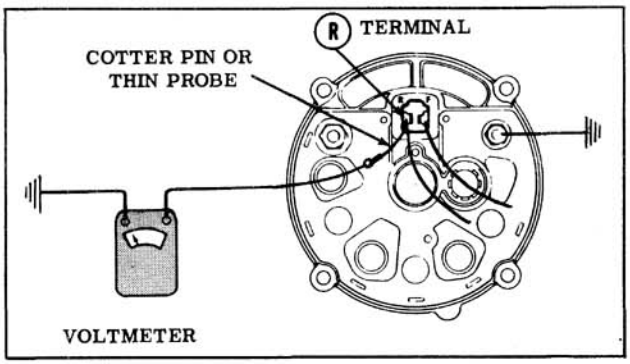


Fig. 13-15 Field Relay Check

If the warning light fails to go out with the generator in operation, the trouble is in either the field relay or the generator. Check the field relay first, as follows:

1. Insert a cotter key into the "R" terminal on the generator.
2. Connect the positive lead of a voltmeter to the cotter key and the other lead to ground.
3. Start the engine and run at fast idle. Observe the voltmeter reading.
4. If the voltmeter reading is 5 volts or above, and the warning light fails to go out, either the warning light relay is defective and must be replaced, or the wire from the "R" terminal on the generator to the relay is open. The wire can be checked for continuity with an ohmmeter or test light.
5. If the voltmeter reading is below 5 volts, the trouble is in the generator. Proceed with the generator output check.
6. Shut off engine.

GENERATOR OUTPUT CHECK (Fig. 13-16)

1. Disconnect the battery.
2. Remove the red wire from the BAT terminal on the generator. Connect one lead of an ammeter to the red wire and the other lead to the BAT terminal on the generator.
3. Connect a voltmeter across the battery terminals.
4. Remove the "F" and "R" terminal connector from the generator.
5. Install the test adapter connector J-21053 on the "F" terminal of the generator. Attach the alligator clip to the BAT terminal.
6. Connect the negative battery cable. Load the battery with a carbon pile rheostat or by turning on the lights and accessories to prevent excessive voltage.
7. Start the engine and while observing the ammeter, gradually raise engine rpm until output is reached. Do not run engine faster than the specified rpm, as the regulator is by-passed and excessive voltage could be built up.

   NOTE: Variations in engine rpm are necessitated by differences in pulley ratios.

   CAUTION: Do not allow the output voltage to exceed the regulator setting.

8. If output is not within specifications, it will be necessary to disassemble and test the components within the generator.

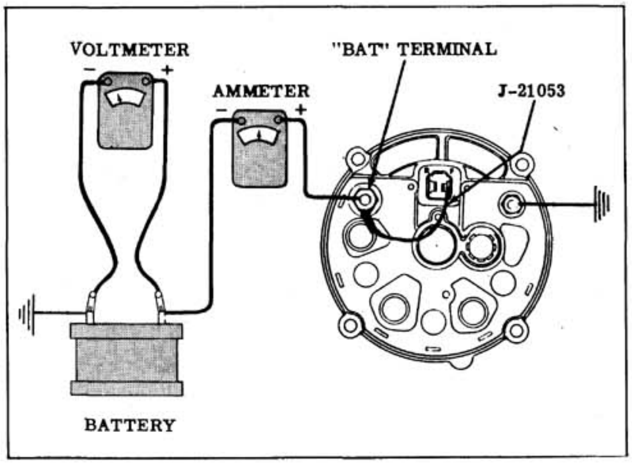


Fig. 13-16 Checking Generator Output

9. Stop engine and disconnect battery.
10. Disconnect the test adapter, ammeter and voltmeter.
11. Install the connector on the "F" and "R" terminals and the red wire to the BAT terminal of the generator.
12. Install the battery cable.

OUTPUT CHART

Unit Tested	Engine rpm	Amp. Output
1100699 (42 Amp.)	850 2150	23 to 30 37 to 44
1100704 (37 Amp.)	850 2150	20 to 27 32 to 39
1100686 or 1100700 (55 Amp.)	750 1850	29 to 36 50 to 57
1100705 (37 Amp.)	900 2200	20 to 27 32 to 39
1100710 (55 Amp.)	800 1950	29 to 36 50 to 57
*1100696 (42 Amp.)	850 (V-8 2150 Engine)	23 to 30 37 to 44
*1100696 (42 Amp.)	900 (V-6 2200 Engine)	23 to 30 37 to 44
**1100705 (37 Amp.)	800 1950	20 to 27 32 to 39

* Service Replacement for 37 Amp. Gen.
** V-6 Engine - Dealer Installed Air Conditioning.

VOLTAGE REGULATOR ASSEMBLY

The voltage regulator contacts should not be cleaned unless the electrical performance indicates it is necessary. A sooty or discolored condition of the contacts is normal after a relatively short period of operation and is not an indication that cleaning is necessary. However, if the voltage fluctuates as evidenced by an unsteady voltmeter reading when checking the voltage setting, the contacts may have excessive resistance or be sticking and should be cleaned.

CAUTION: Before cleaning contacts, make sure the unsteady voltage is not being caused by loose connections or high resistance elsewhere in the system.

The contacts on the voltage regulator unit are of a soft material and must not be cleaned with a file. A strip of No. 400 silicon carbide paper or equivalent folded over and then pulled back and forth between the contacts is recommended as a satisfactory method of cleaning. After cleaning, the contacts should be washed with alcohol to remove any residue. If the voltage control has not improved, repeat the cleaning and washing process.

To clean the field relay contacts, use a thin, fine-cut, flat file. Remove only enough material to clean the points.

Never use emery cloth or sandpaper to clean contact points.

Voltage Regulator

Three checks and adjustments can be performed on the double contact voltage regulator. They are voltage setting, point opening and air gap. The only time the point opening and air gap should be checked is when the correct voltage setting cannot be made.

Voltage Setting

Before making any voltage adjustments, position a mercury type glass thermometer within 1/4" of the regulator cover. This measures the surrounding temperature of the regulator. After the temperature is known, the voltage settings can be made in relation to the temperature.

1. Check battery and charge, if necessary, as the voltage setting must be made with a fully charged battery, to limit the Delcotron output to 10 amperes or less. Correct voltage settings cannot be made if the Delcotron output is greater than 10 amperes.

   If the battery is suspected of being defective, a LIGHT LOAD TEST should be performed to determine the condition of the battery.

AMBIENT TEMPERATURE	VOLTAGE SETTING
65	13.9 to 15.0
85	13.8 to 14.8
105	13.7 to 14.6
125	13.5 to 14.4
145	13.4 to 14.2
165	13.2 to 14.0
185	13.1 to 13.9
205	13.0 to 13.8

Fig. 13-17 Temperature - Voltage Chart

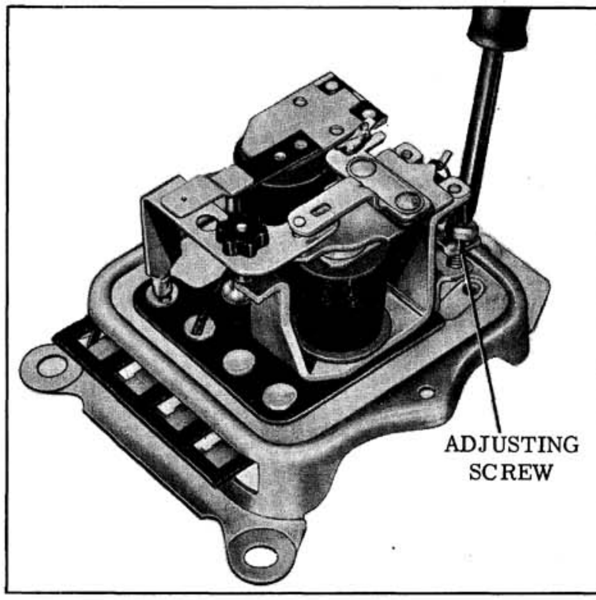


Fig. 13-18 Adjusting Voltage Setting

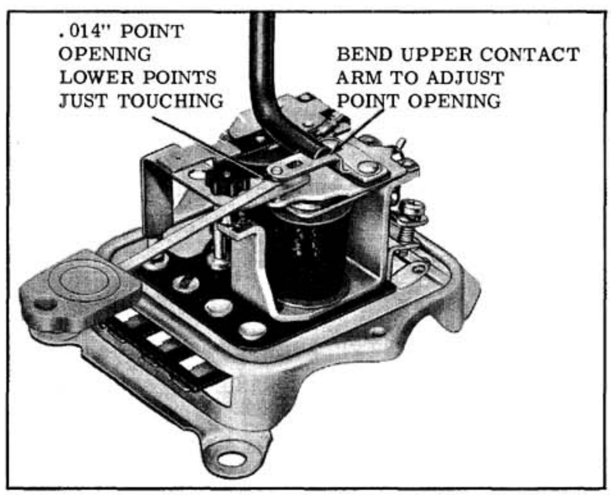


Fig. 13-19 Checking Point Opening

2. Connect a voltmeter across the battery terminals.

3. Position the bulb of a glass mercury type

thermometer, such as J-5421, within 1/4" of the regulator cover.

4. Start the engine and run for 15 minutes at approximately 1200 rpm. Leave the cover on the regulator to establish operating temperature. All accessories and lights must be turned off.

5. After the 15-minute warm-up, cycle the generator by shutting off the engine, removing the regulator cover and restarting.

6. Raise engine speed to 2200 rpm. The regulator should be operating on the upper contacts. This can be visually observed in the regulator. Note the voltage reading on the voltmeter. The voltage reading should be within the voltage specifications as indicated by the temperature voltage chart. (Fig. 13-17)

7. If the voltage does not fall within the normal specification range, the voltage can be adjusted by turning the adjusting screw. (Fig. 13-18)

   CAUTION: Always make final setting by turning the screw clockwise. This insures that the spring holder will be against the head of the screw. If it is necessary to turn the screw head counterclockwise, turn it until the screw head is approximately 1/8" above the adjusting bracket, then pry holder up against screw head, then turn screw clockwise to make setting.

8. Cycle the generator and recheck voltage reading. Readjust if necessary.

9. Turn on the lights and accessories to operate the voltage regulator on the lower set of contact points. Run the engine at 2200 rpm and note the voltage reading. The voltage should be .1 to .3 volts lower than the reading obtained in Step 8.

10. If necessary to adjust, turn the nylon nut counterclockwise to increase the difference and clockwise to decrease the difference between the upper and lower points. After making the adjustments, it is necessary to recheck the voltage setting on both upper and lower contact points.

11. Install the regulator cover and remove the voltmeter. Avoid contact with the regulator units when installing the regulator cover.

Point Opening (Fig. 13-19)

1. Remove the electrical connector from the regulator.

2. With the lower contacts touching, measure the point opening between the upper contact points. Clearance should be .014".

3. If necessary to adjust, bend the upper contact arm, being careful not to bend the hinge.

Air Gap (Fig. 13-20)

1. With the electrical connector removed, measure the air gap between the armature and core with the lower contact points touching. Clearance should be .060".

2. If necessary to adjust, rotate the nylon nut on the contact support.

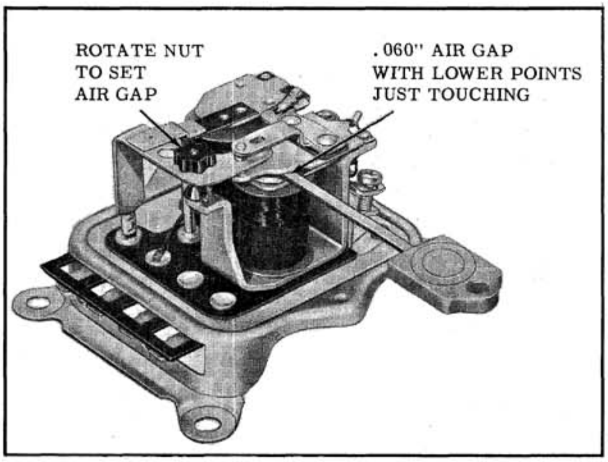


Fig. 13-20 Checking Air Gap

NOTE: The .060" air gap adjustment is only an initial setting. Final adjustment must be made with the engine running, so that the voltage reading, when operating on the lower contacts, is .1 to .3 volts less than the voltage reading when operating on the upper contacts.

Field Relay

The two checks required on the field relay are air gap and point opening.

1. Disconnect the electrical connector from the regulator.

2. Remove the regulator cover.

3. Check clearance between the armature and core with the points just touching. Air gap should be .015". (Fig. 13-21)

4. If necessary to adjust, bend the contact support.

5. To check point opening, insert a feeler gauge between the contact points. Clearance should be .030". (Fig. 13-22)

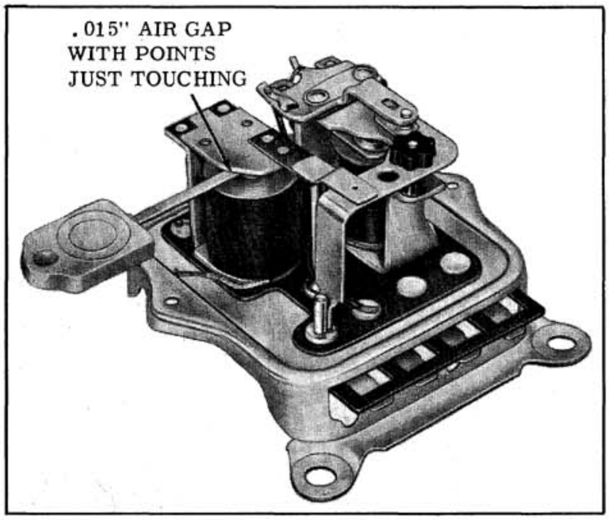


Fig. 13-21 Checking Field Relay Air Gap

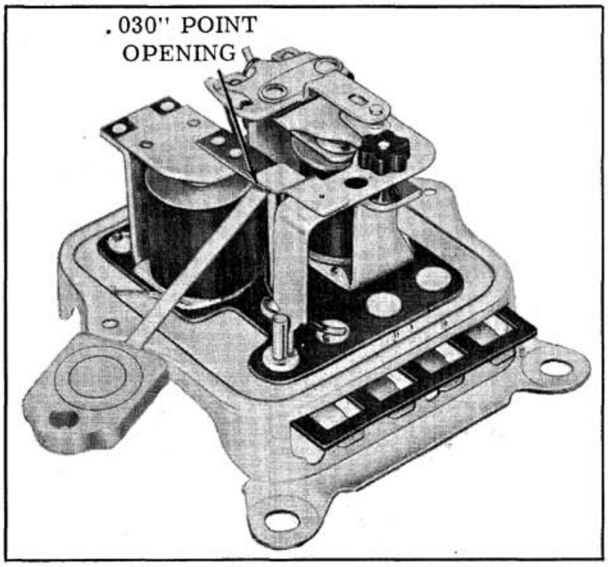


Fig. 13-22 Checking Field Relay Point Opening

6. If necessary to adjust, bend the armature stop.
7. Install the regulator cover and electrical connector.

TAILORING THE VOLTAGE SETTING

The voltage setting for one type of operating condition may not be satisfactory for a different type of operating condition. Vehicle underhood temperatures, operating speeds, and the amount of night-time driving are factors which determine the proper voltage setting. The proper voltage setting is attained when the battery remains fully charged with a minimum use of water.

If no circuit defects are found, yet the battery remains undercharged, raise the voltage setting by .3 volt, and then check for an improved battery condition over a service period of reasonable length. If the battery remains overcharged, lower the setting by .3 volt, and then check for an improved battery condition.

BATTERY

A hydrometer test will indicate the state of charge of a battery unless water has recently been added to the battery or the battery has been recently fast charged. A good hydrometer reading does not necessarily indicate that the battery will perform its normal functions. (See LIGHT LOAD TEST IN SERVICING OF UNITS IN THE CHARGING CIRCUIT.)

Specific gravity of the electrolyte varies .004 units for every 10° difference between the temperature of the electrolyte and 80°F. The hydrometer reading must be corrected to 80°F.

Examples:

a. Hydrometer gravity reading	1.235
Electrolyte temperature 110°F	
Correction (4 x 3)	+ .012
Corrected gravity reading	1.247
b. Hydrometer gravity reading	1.250
Electrolyte temperature 0°F	
Correction (4 x 8)	- .032
Corrected gravity reading	1.218

A battery with a corrected specific gravity reading of 1.215 is half charged. A battery with a specific gravity reading of 1.270 ± .010 at 80°F is fully charged.

If the corrected specific gravity of the electrolyte is less than 1.215 or varies more than .025 between cells, the battery should be removed for a slow charge and a light load test.

SERVICING OF UNITS IN THE CHARGING CIRCUIT

BATTERY

Removal and Installation

The batteries are installed as shown in Figs. 13-23 and 13-24. When installing batteries, tighten the battery retainer nuts 1.5 to 2.5 ft. lbs.

IN-THE-CAR BATTERY TEST AND CHARGING

INSPECTION

Check outside of battery for damage or signs of serious abuse such as broken case or covers.

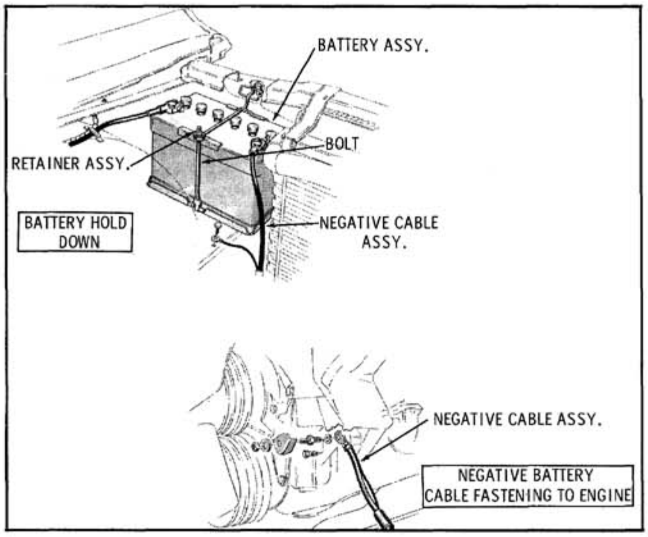


Fig. 13-23 Battery Installation (52 through 86 Series)

Check electrolyte level. If electrolyte level is low, bring it up to the split ring by adding distilled water.

If battery shows signs of serious damage or abuse, it should be replaced. If not, make a light load test.

LIGHT LOAD TEST

1. Place load on battery by holding starter switch on for three seconds. It makes no difference whether starter turns engine or not. However, if engine starts, turn off ignition immediately.

2. Turn on headlamps (low beam) for one minute. With headlamps still on, read individual cell voltages of battery with voltmeter (.01 volt division). Compare readings with the following:

A. Uniform Readings

If any cell reads 1.95 volts or more and the difference between the highest and lowest cell is less than .05 volt, battery is good. (Fig. 13-25) If any cell reads less than 1.95 volts, battery should be fully recharged for good performance. (Fig. 13-26) See CHARGING AFTER LIGHT LOAD TEST.

B. Non-Uniform Readings

If any cell reads 1.95 volts or more and there is a difference of .05 volt or more

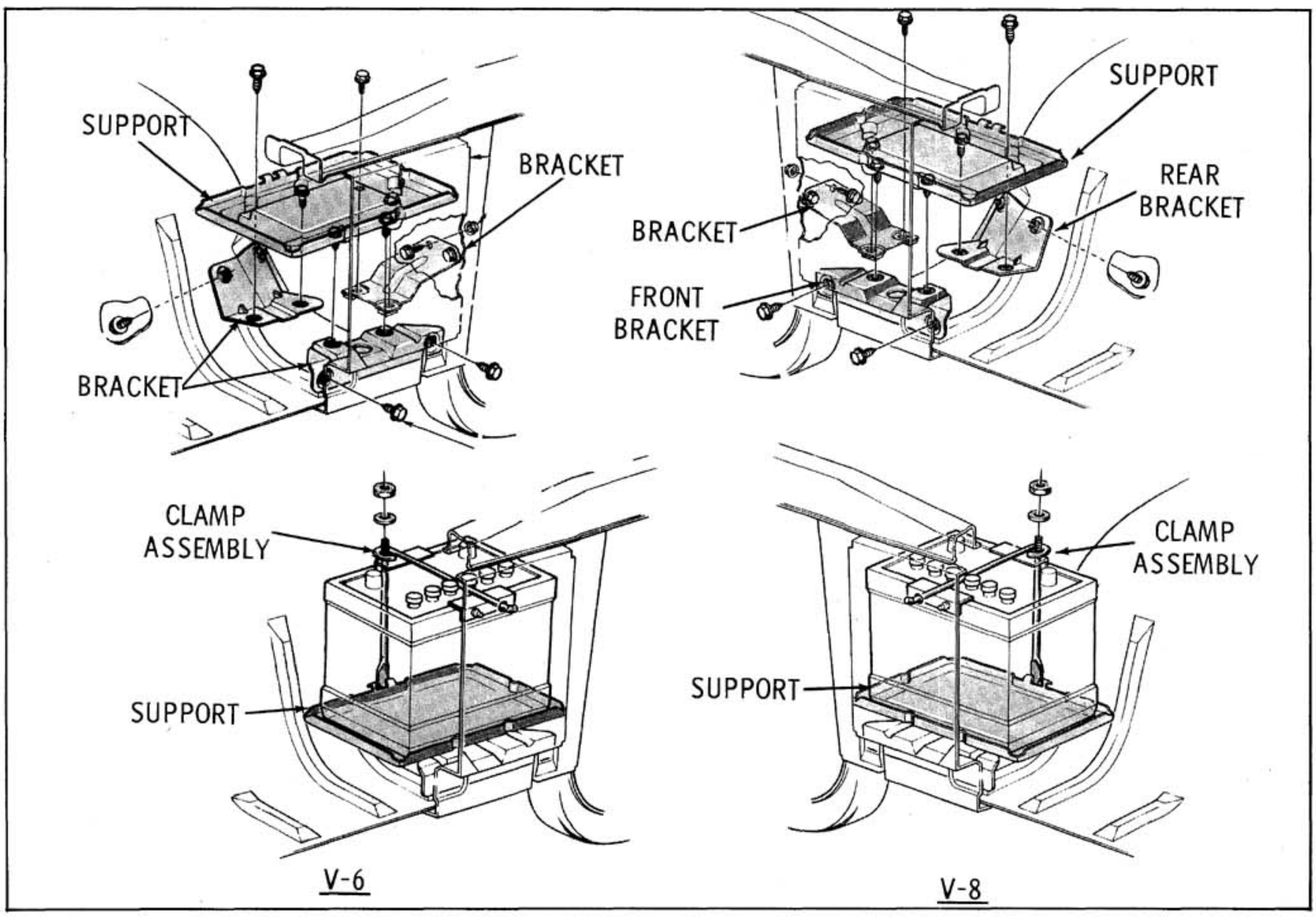


Fig. 13-24 Battery Installation (33 through 38 Series)

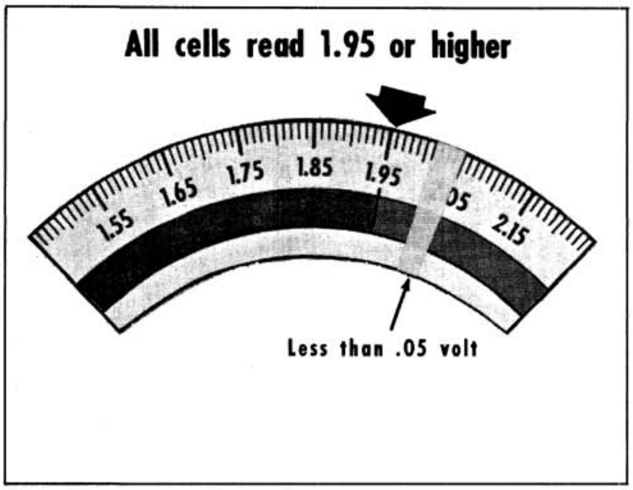


Fig. 13-25 Good Battery (Sufficiently Charged)

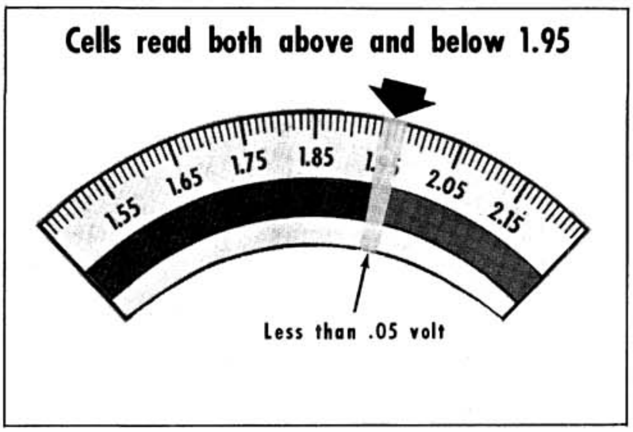


Fig. 13-26 Good Battery (Requires Charging)

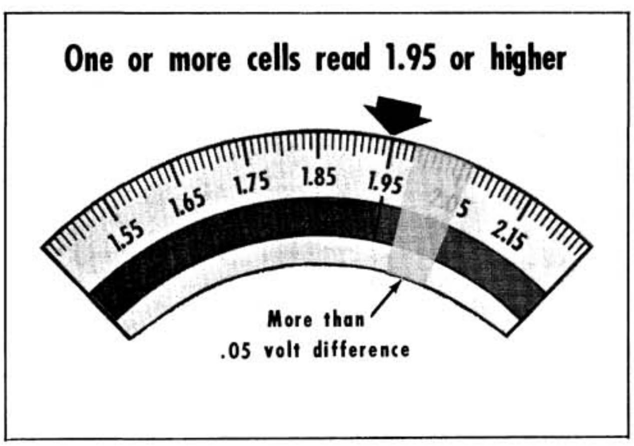


Fig. 13-27 Replace Battery

between the highest and lowest cell, the battery should be replaced. (Fig. 13-27)

C. Low Readings

If all cells read less than 1.95 volts, battery is too low to test properly. (Fig. 13-28) FAILURE OF THE METER TO REGISTER ON ALL CELLS DOES NOT

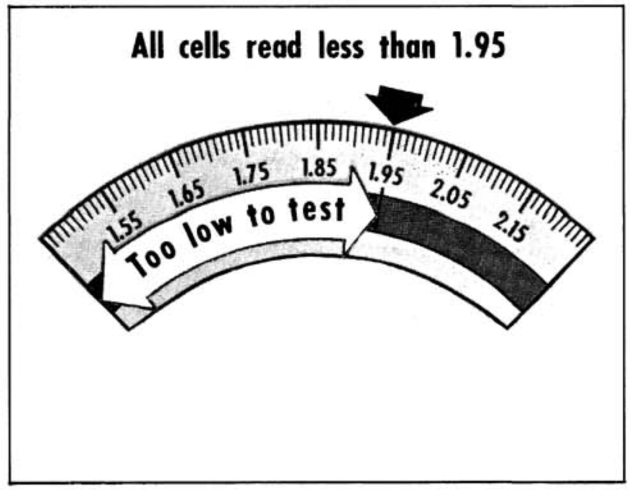


Fig. 13-28 Charge Battery and Retest

INDICATE A DEFECTIVE BATTERY. Boost charge battery and repeat Light Load Test. (See BOOST CHARGING FOR LIGHT LOAD TEST.) If battery is found to be good after boosting, it should be fully recharged for good performance.

If none of the cells come up to 1.95 volts after the first boost charge, the battery should be given a second boost. Batteries which do not come up after the second boost charge should be replaced.

BOOST CHARGING FOR LIGHT LOAD TEST

Boost 12-volt batteries at 50 amperes for 20 minutes (50 x 20 = 1000 ampere minutes). If charger will not give this rate, charge for an equal number of ampere minutes at best rate available. For purposes of light load test, do not boost battery more than the amount indicated.

CHARGING AFTER LIGHT LOAD TEST

1. For best performance, a good battery should be fully charged before being returned to service.

2. If batteries are to be fully charged by means of a quick charger, the charge rate must be "tapered" (reduced to a safe limit) when the electrolyte temperature reaches 125°F or when gassing becomes excessive. Failure to do so may harm the battery.

SLOW CHARGING

Batteries removed from the car for charging should be charged continuously at a low rate. Batteries may be safely slow-charged at a rate in amperes equal to 7% of the battery's ampere-hour capacity. This is called the "Normal" charge rate.

Although the slow-charge method is recommended for charging all batteries, discharge batteries in otherwise good condition, may be given a "boost" with a fast charger if time does not permit complete slow-charging. When using a fast charger, it must be remembered that the battery is only receiving a partial charge and that the battery electrolyte temperature must not be allowed to exceed 125°F. If the battery heats excessively, quick charging must be discontinued.

Batteries removed from the car for further checking, in order to determine whether or not the unit should be replaced, should first be brought to a fully-charged condition by slow charging. Badly sulfated batteries may require a continuous slow-charging for 48 hours or more before a rise in gravity reading occurs. If the specific gravity reading of any cell fails to reach 1.215 (corrected to 80°F) or if there is a variation of more than 25 points between cells after thorough slow charging, replace the battery.

REGULATOR (Figs. 13-29 and 13-30)

Removal and Installation

1. Disconnect electrical connector from regulator by lifting the connector retainer.

2. Remove the regulator attaching screws and remove regulator. To install, reverse the removal procedure. DO NOT ATTEMPT TO POLARIZE THE GENERATOR.

GENERATOR

Removal and Installation

The generator is attached as shown in Figs. 13-31 and 13-32. Before removing the generator, disconnect the battery negative cable.

After installing the generator, tighten the belt using Tool 33-70M.

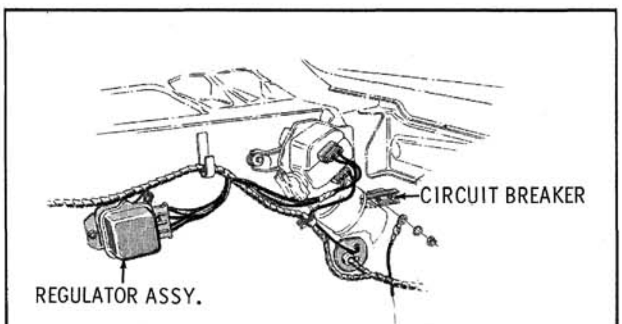


Fig. 13-29 Regulator Installation (52 through 86 Series)

Disassembly (Fig. 13-33)

1. Scribe alignment marks on the end frames, then remove the four through-bolts.

2. Separate the drive end-frame and rotor assembly from the stator assembly by prying at the stator slot.

3. Position the rotor in a vise and tighten only enough to permit loosening of the shaft nut. Avoid excessive tightening to prevent distortion of the rotor. Tool BT-6317 will easily remove the pulley nut without clamping the rotor in a vise.

4. Remove the shaft nut, wave washer, pulley, fan and collar. Separate the drive end-frame and spacer from the rotor shaft.

5. If necessary to remove the bearing from the drive end-frame, proceed as follows:

   A. Remove the staking from around the bearing retainer screws then remove the screws, bearing retainer and gasket.

   B. Back-up the bearing housing with Tool J-7584-1 (Front Cover Seal Installer).

   C. Drive out bearing with Tool J-5158-2 (Valve Guide Installer).

6. Remove the three stator winding to diode attaching nuts and separate the stator from the slip ring end-frame.

7. Remove the two brush holder attaching screws and remove the brush holder assembly from the end-frame.

   NOTE: The brush holder, brushes, springs and connectors are serviced as an assembly.

8. Remove the condenser to heat sink attaching screw and fiber washer.

9. Remove the BAT and GRD terminal nuts, bolts and washers; then remove the heat sink.

10. If necessary to remove the condenser, it can be removed by pushing it out to the rear of the end-frame.

Cleaning and Inspection

1. Check roller bearing in slip ring end-frame. If bearing has sufficient lubricant and shows no sign of damage, protect the bearing opening with masking tape to prevent entrance of foreign material, and clean end-frame with compressed air. If bearing shows roughness or lack of lubricant, the bearing should be replaced as follows:

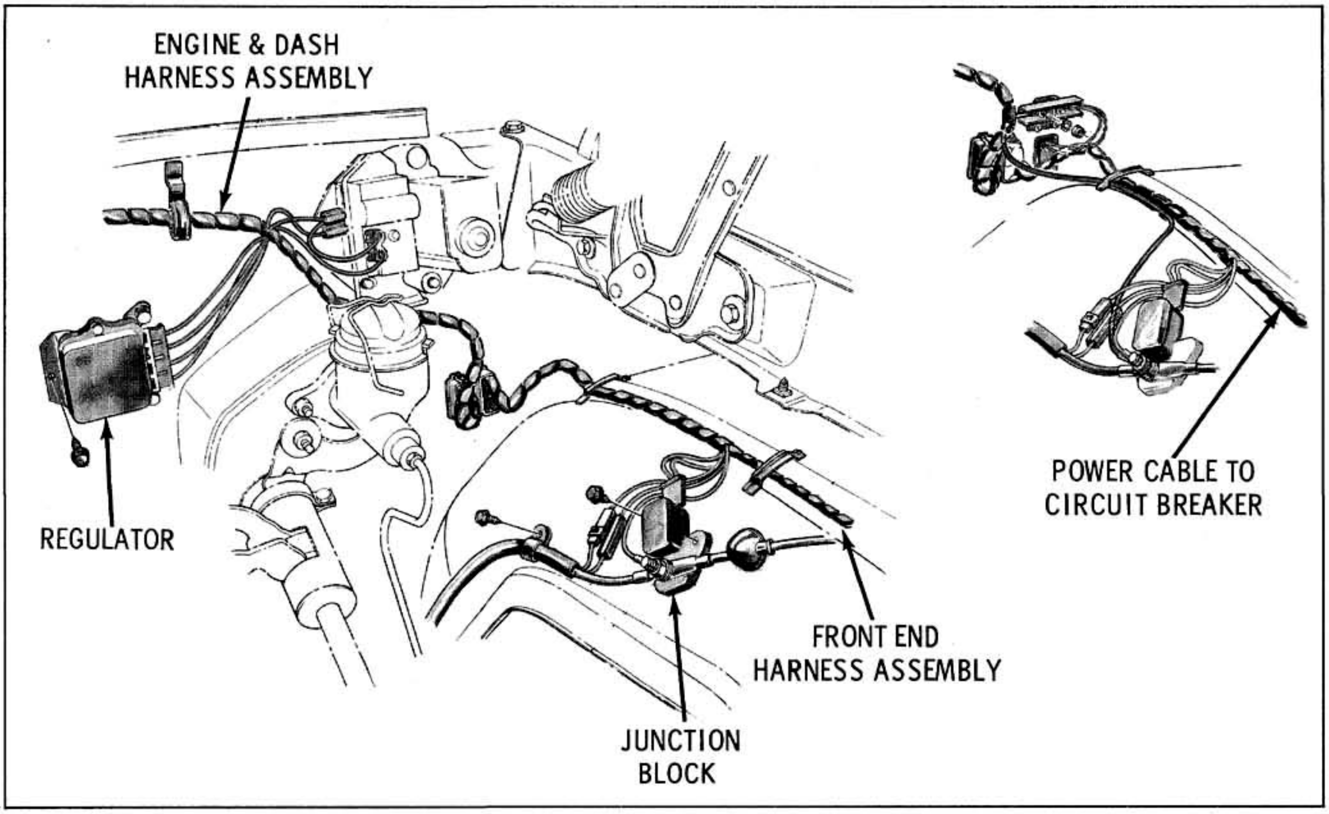


Fig. 13-30 Regulator Installation (33 through 38 Series)

A. Position end-frame on the open jaws of a vise so that the jaws support the area around the bearing.

B. Using Valve Guide Installer J-5158-2, press bearing rearward out of end-frame. Clean end-frame in cleaning solvent.

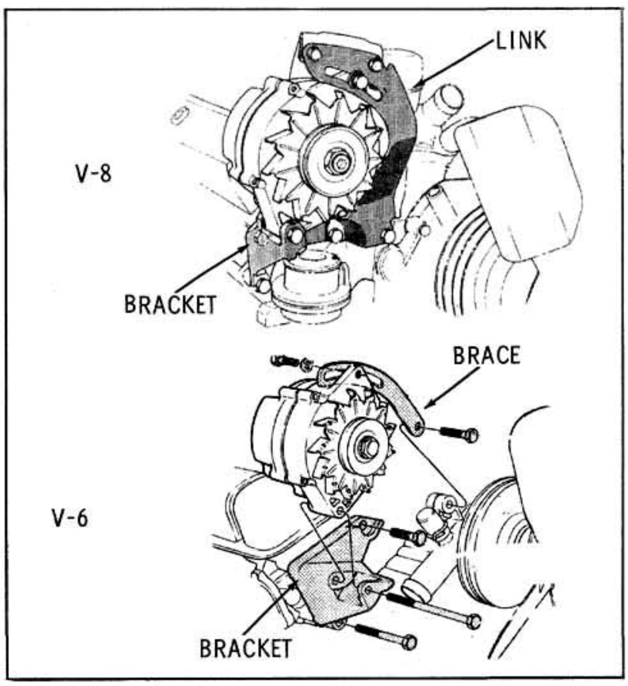


Fig. 13-31 Generator Installation (33 through 52 Series)

C. To install new bearing, back up the inside area of the end-frame surrounding the bearing with Tool J-8810.

D. Press on closed end of needle bearing until bearing is flush with the end-frame housing.

E. Install a new retainer and felt washer with J-5158-2 until retainer seats against bearing.

2. Wash metal parts except stator and rotor in

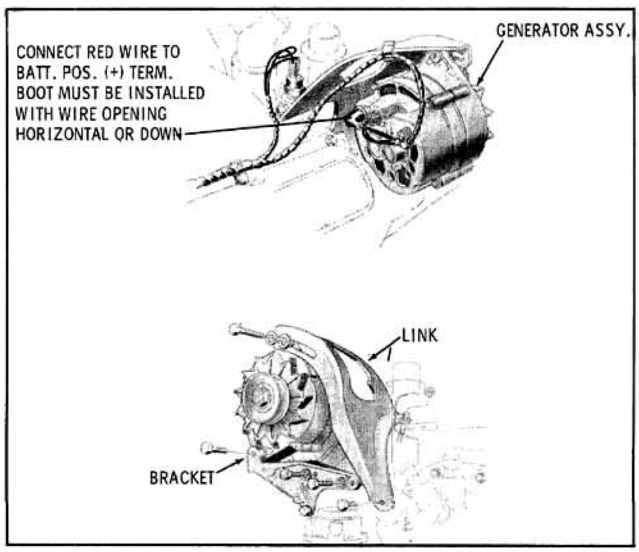


Fig. 13-32 Generator Installation (54 through 86 Series)

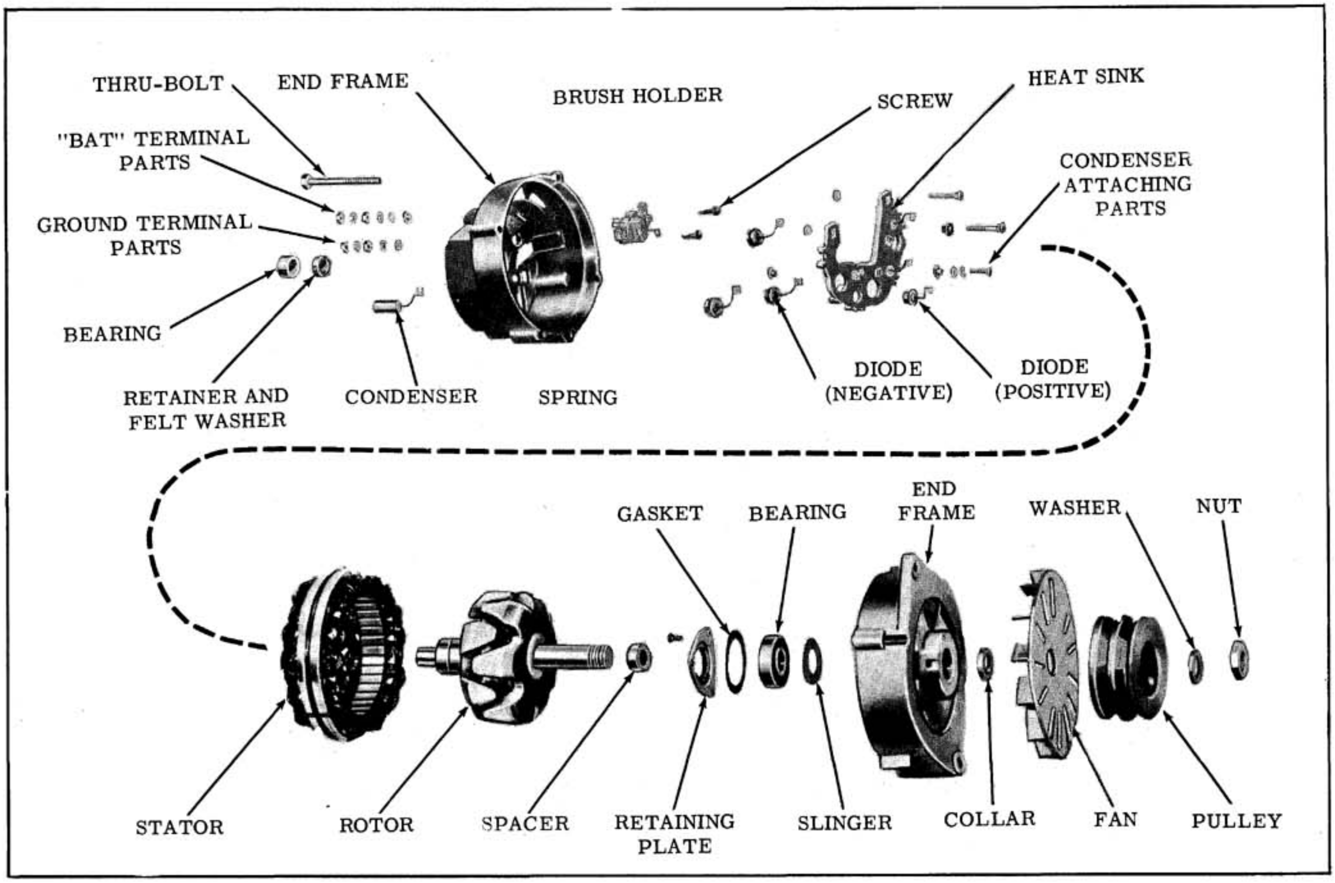


Fig. 13-33 Generator Assembly

cleaning solvent. Degreasing solvent will damage the rotor and stator insulation. The rotor and stator should be cleaned with compressed air.

3. Check the rotor as follows:

A. To check rotor for grounds, connect a 12-volt test lamp or a ohmmeter from either slip ring to the rotor shaft or poles. If the lamp lights or the ohmmeter reading

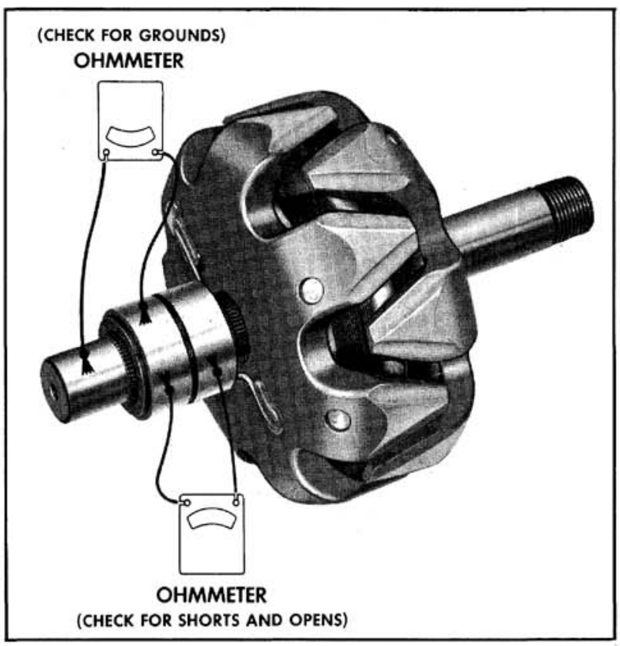


Fig. 13-34 Checking Rotor

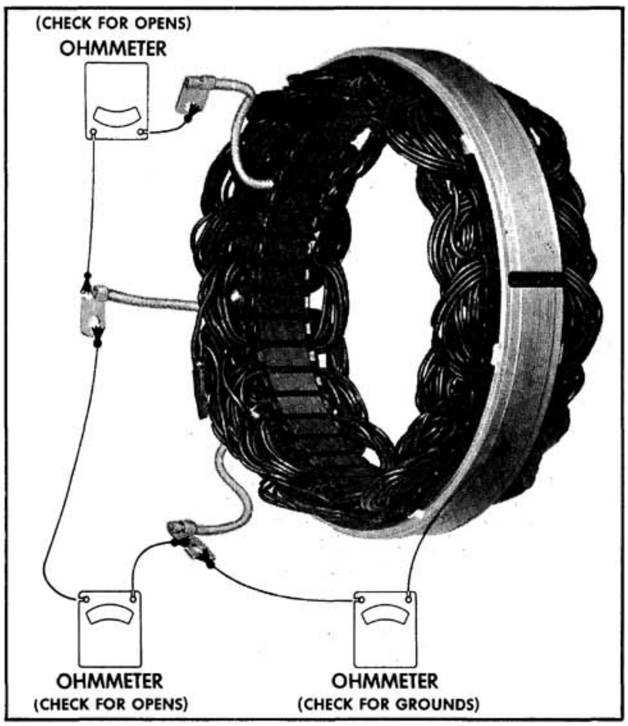


Fig. 13-35 Checking Stator

is low, the field winding is grounded and the rotor must be replaced. (Fig. 13-34)

B. To check rotor for opens, connect the test lamp or an ohmmeter lead to each slip ring. If the test lamp does not light or no reading can be obtained on the ohmmeter, the field winding is open and the rotor must be replaced. (Fig. 13-34)

C. To check rotor for short circuits, connect a 12-volt battery and an ammeter in series with the two slip rings. The ammeter should read 2.2 to 2.6 amps. If ammeter reading is higher than specified, the field windings are shorted and the rotor must be replaced.

D. The slip rings on the rotor can be cleaned with 400 grain or finer polishing cloth. When cleaning slip rings, the rotor must be rotating to prevent flat spots on the slip rings which could cause brush noise.

Slip rings which are rough or out-of-round should be trued in a lathe with a .002" maximum indicator reading. After turning slip rings in a lathe, polish with 400 grain or finer polishing cloth. Thoroughly clean away all dust particles.

4. The stator can be checked as follows:

A. Connect a 12-volt test lamp or an ohmmeter from a stator lead to the stator frame. If the lamp lights or the ohmmeter reading is low, the winding is grounded and the stator must be replaced. If lamp does not light or no ohmmeter reading can be obtained, repeat procedure on the other two stator leads. (Fig. 13-35)

B. Connect a 12-volt test lamp or an ohmmeter between each pair of stator leads. If the lamp fails to light or the ohmmeter reading is high between any pair of leads, the stator winding is open and the stator must be replaced. (Fig. 13-35)

C. A short circuit in the stator windings is difficult to locate without special test equipment due to the low resistance of the windings. However, if all other electrical checks are normal and the Delcotron fails to supply rated output, it is an indication that the stator windings are shorted.

5. Check each diode for a shorted or open condition. Refer to diode checking.

6. Inspect the drive end frame bearing for roughness.

7. Inspect brushes and brush springs. Brushes, springs, connectors and brush holder are serviced as an assembly.

8. Inspect drive end-frame bearing retainer plate felt. If felt is hard or worn, the retainer plate should be discarded.

Diode Checking

The positive diodes, located in the heat sink, are checked as follows:

A. Attach the positive test lamp lead to a diode lead.

B. Attach the negative test lamp lead to the heat sink; the lamp should light indicating a good positive diode.

C. Check the other two positive diodes in the same manner.

D. Reverse the test lamp leads and again check the three positive diodes. The lamp should not light, indicating a good positive diode.

The negative diodes, located in the slip ring end-frame are checked as follows:

A. Attach the negative test lamp lead to a diode lead.

B. Attach the positive test lamp lead to the slip ring end frame, the lamp should light, indicating a good negative diode.

C. Check the other two negative diodes in the same manner.

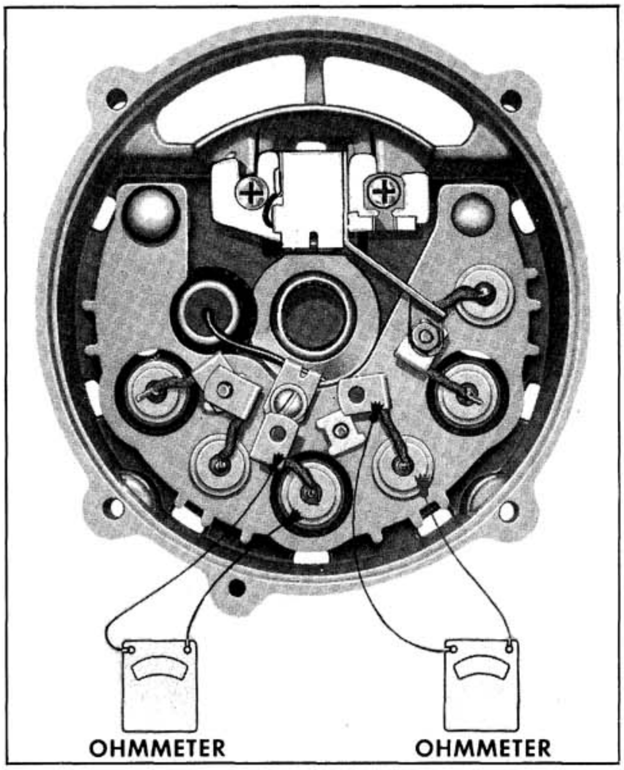


Fig. 13-36 Checking Diodes

D. Reverse the test lamp leads and again check the three negative diodes. The lamp should not light, indicating a good negative diode.

If the lamp lights in both checks of each diode, or fails to light in both checks, the diode is shorted or open and must be replaced. This procedure can also be used to determine the polarity of a new diode. If necessary to replace a diode, refer to DIODE - Remove and Install.

Ohmmeter Method (Fig. 13-36)

The lowest range scale on the ohmmeter should be used and the ohmmeter should have a 1-1/2 volt battery. To determine the cell voltage, turn the selector to the lowest scale, and then connect the ohmmeter leads to a voltmeter. The voltmeter will indicate the cell voltage.

Check the diode in the heat sink by connecting one of the ohmmeter leads to the heat sink, and the other ohmmeter lead to the diode lead and note the reading, then reverse the ohmmeter lead connections and note the reading. If both readings are very low, or if both readings are very high, the diode is defective. A good diode will give one low reading and one high reading. Check the other two diodes in the heat sink in the same manner.

To check a diode mounted in the end-frame, connect one of the ohmmeter leads to the end frame, and the other ohmmeter lead to the diode lead and note the reading, then reverse the ohmmeter lead connections, and note the reading. If both readings are very low, or if both readings are very high, the diode is defective. A good diode will give one low reading and one high reading. Check the other two diodes in the end-frame in the same manner.

Special Tester Method

Special testers are available for checking diodes. To use these testers, follow the tester manufacturer's recommendations.

DIODE

Remove

1. With the generator disassembled and the stator removed, position Tool J-9617-1, J-9617-2 and the slip ring end-frame in a vise as shown in Fig. 13-37.

   NOTE: Diodes can be removed from either the end frame or the heat sink without removing the heat sink.

2. Operate vise until the defective diode is removed from the end-frame or heat sink.

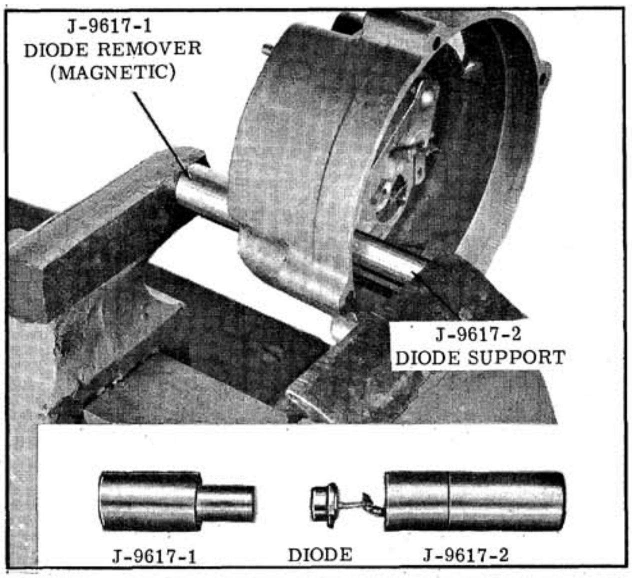


Fig. 13-37 Diode Removal

3. Remove tools, diode and end-frame from the vise.

Install

1. Insert a diode into Tool J-9600 as shown in inset, Fig. 13-38.

   NOTE: The positive diode rectifiers are located in the heat sink and the negative diode rectifiers are located in the end-frame.

2. Position Tools J-9617-1, J-9600 (with diode) and end-frame as shown in Fig. 13-38.

3. Operate vise until the diode shoulder bottoms against the end-frame or heat sink.

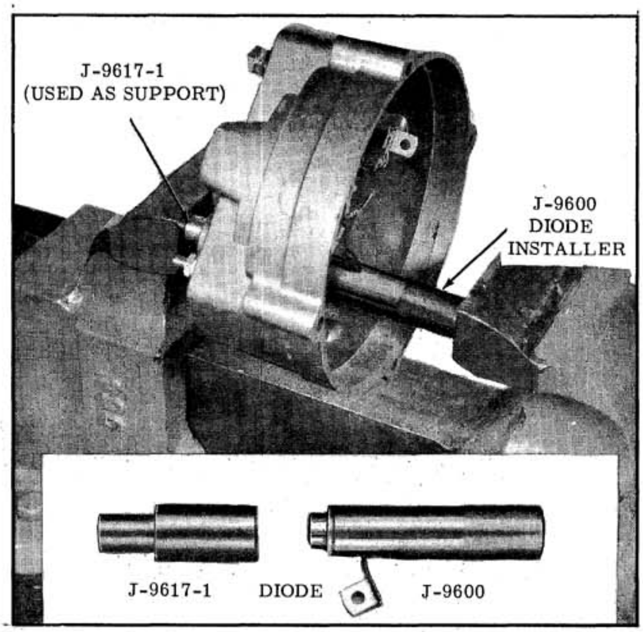


Fig. 13-38 Diode Installation

4. Remove tools and end-frame from vise.

Generator Assembly

NOTE: If a new slip ring end-frame is to be installed, stamp the last three numbers of the old end-frame on the new end-frame as shown in Fig. 13-39.

1. If the capacitor was removed, install from the inside of the end-frame until the capacitor is flush with capacitor housing.
2. Install the heat sink, making sure insulated washers are installed as shown in Fig. 13-40.
3. Install the capacitor to heat sink lead.
4. If the original brushes are re-used, install the brush springs and brushes into the brush holder and retain with a straight piece of wire inserted through the hole in the brush holder. (Fig. 13-41)
5. Install the brush holder assembly into the end frame and retain with the two attaching screws.
6. Position the stator into the slip ring end frame with the stator leads aligned with the stator and diode lead attaching studs. Before installing the attaching nuts, position the relay lead over the diode lead attaching stud. Tighten all nuts. (Fig. 13-42)
7. If the bearing in the drive end-frame is to be re-used, it should be re-packed one-quarter full of lubricant, Part No. 1948791. Install the bearing into the drive end-frame as follows:

   A. Position drive end-frame on a flat surface.

   B. Retain grease slinger to the bearing with grease.

   C. Using Tool J-6133 (Speedometer Gear Installer) press bearing into position.

   D. Install bearing retainer. Tighten screws to 36 in. lbs. torque and peen flange of retainer against screw heads.
8. Position the rotor in a vise. Tighten vise only enough to permit tightening the shaft nut.
9. Install the spacer, drive end-frame, collar, fan, pulley, wave washer and rotor nut. Tighten nut to 60 ft. lbs.
10. Assemble the two end-frames with scribe marks aligned and install the through-bolts.
11. Remove the brush retaining wire. The brushes will seat on the slip rings.

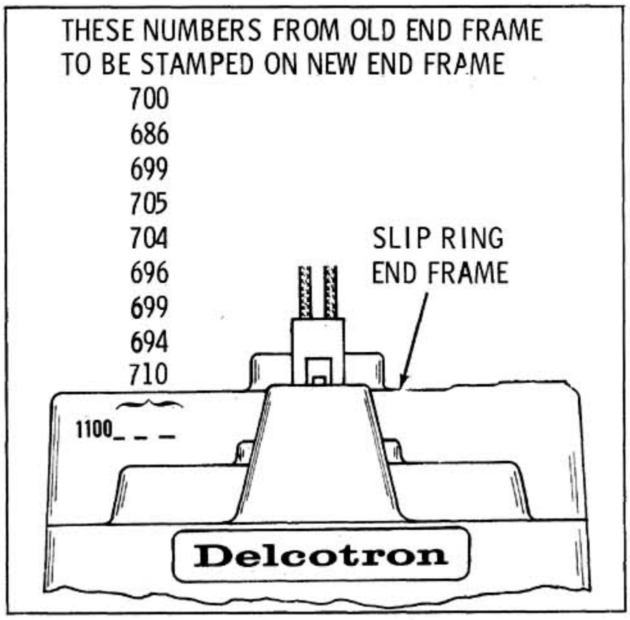


Fig. 13-39 Generator Part Numbers

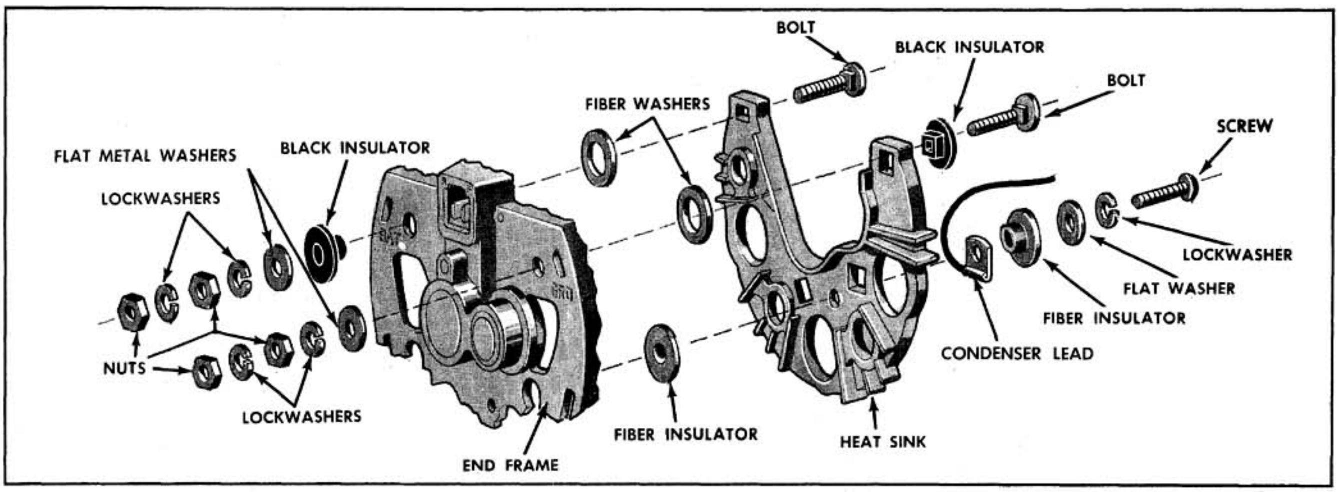


Fig. 13-40 Slip Ring End Frame

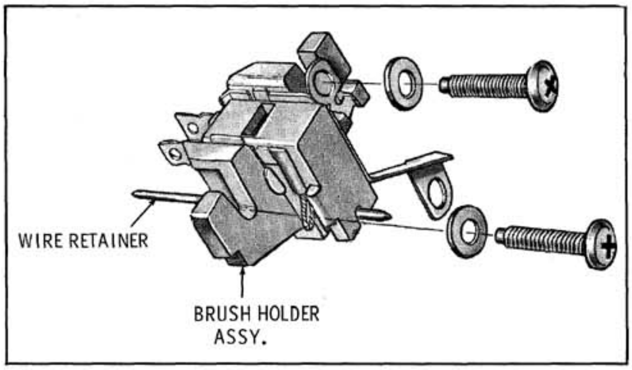


Fig. 13-41 Brush Holder Assembly

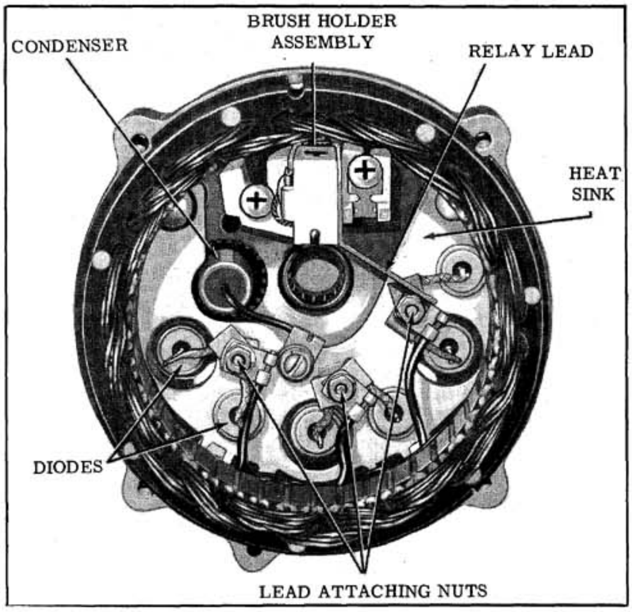


Fig. 13-42 Stator and Diode Leads

STARTING CIRCUIT

STARTING MOTOR ASSEMBLY (Fig. 13-43)

The starting motor is a 12-volt extruded frame type unit, having four poles and a compound field. The starting motor used on the V-6 engine (Fig. 13-44) has four field coils connected in series between the terminal, and one shunt coil connected to ground.

The starting motor used on V-8 engines (Fig. 13-45) has heavier armature and field windings, and has two field coils in series with the armature circuit and in parallel to each other. The other two field coils are in parallel with each other and are connected from the field terminal to ground.

The armature rotates in bushings at both ends. An overrunning clutch drive is used to engage the cranking motor pinion with the flywheel. The overrunning action of the clutch protects the cranking motor armature from excessive speed when the engine starts.

A solenoid switch, integral with the solenoid assembly, operates the overrunning clutch drive by means of a linkage to the shift lever. When the ignition switch is turned to the starting position, the solenoid is energized, moving the cranking motor pinion into mesh with the flywheel. The solenoid switch contacts are then closed so that battery current is delivered to the cranking motor.

To provide full battery voltage to the coil, the ignition resistor is by-passed during cranking. The resistor is by-passed at the "R" terminal on the starting motor.

The armature shaft and clutch have spiral splines which prevent full cranking power until the clutch pinion is fully engaged in the flywheel ring gear. A pinion stop, consisting of a snap ring retainer and thrust collar assembled on the armature shaft, takes all the end thrust.

STARTER

Removal

1. Disconnect battery.
2. Noting position of wires, disconnect starter wiring.
3. If equipped with synchromesh remove four screws securing flywheel housing cover and remove cover.
4. Remove upper support attaching bolt.
5. Remove two mounting bolts and remove starter.

   NOTE: If car is equipped with dual exhaust, the L.H. exhaust pipe may have to be disconnected to provide clearance.

To install, reverse the removal procedure.

Disassembly (Fig. 13-46)

1. Disconnect the field coil connector from the motor solenoid terminal.
2. Remove through-bolts, then remove commutator end frame and leather washer.
3. Remove field frame assembly, armature, and clutch assembly from drive gear housing.
4. If necessary to remove overrunning clutch from armature shaft, proceed as follows:

   a. Remove thrust collar from armature shaft. (Fig. 13-47)

   b. Slide a standard half-inch pipe coupling or

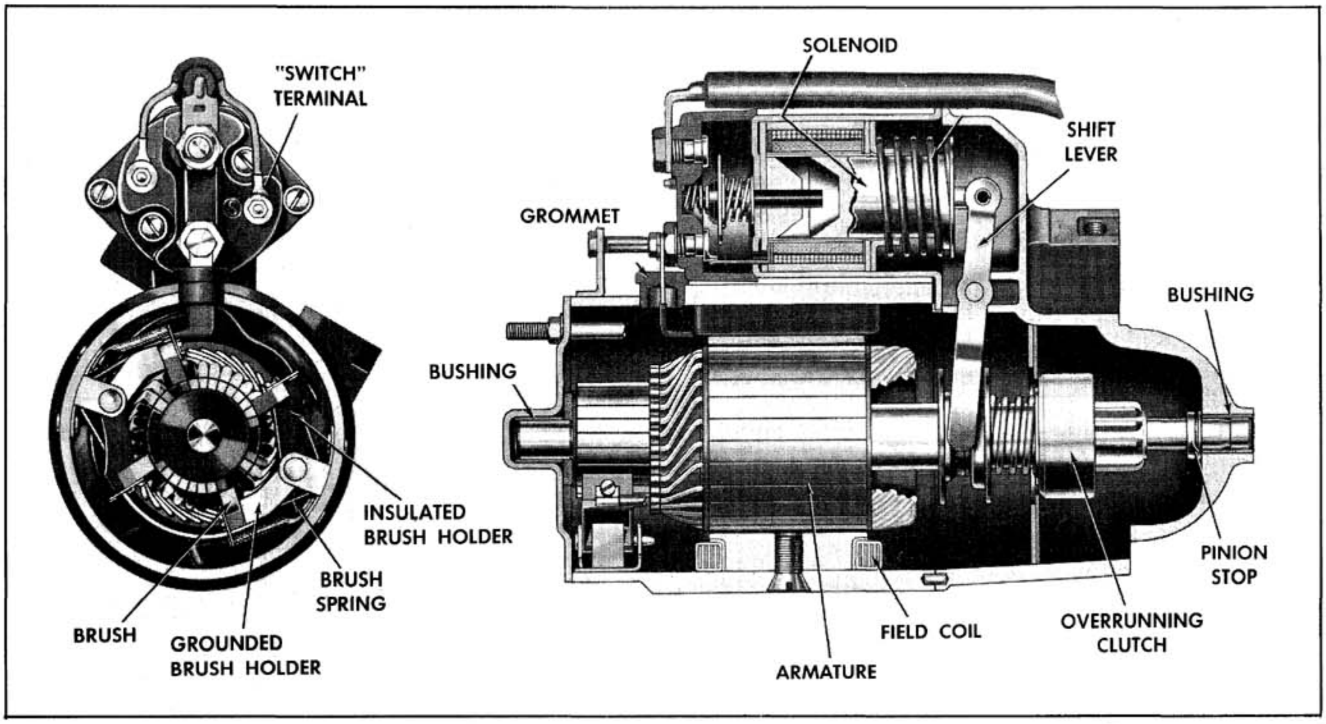


Fig. 13-43 Starter Motor

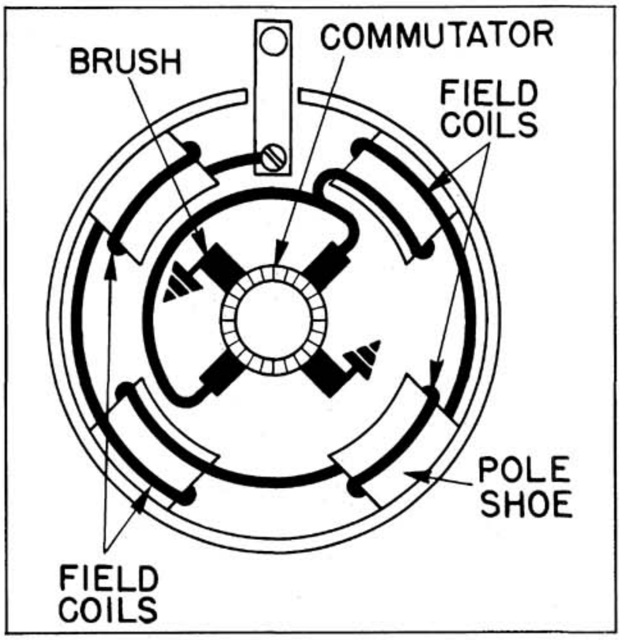


Fig. 13-44 Field Windings (V-6 Engine)

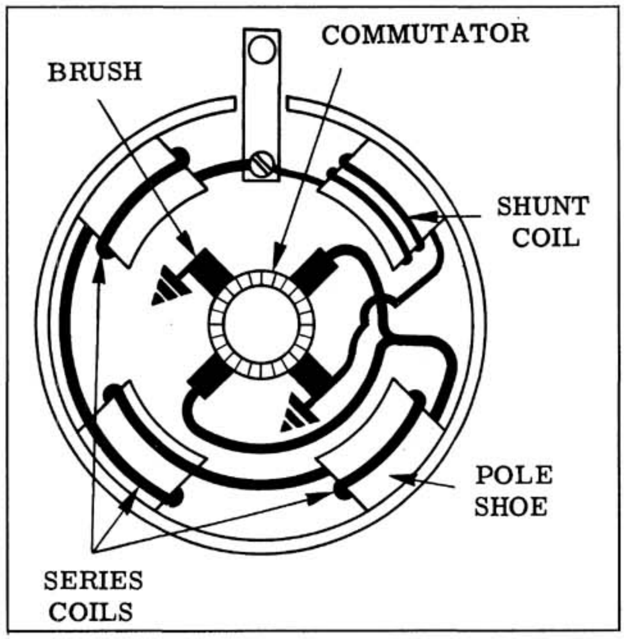


Fig. 13-45 Field Windings (V-8 Engine)

other metal cylinder of suitable size (an old pinion can be used if available) over shaft against retainer to be used as a driving tool. (Fig. 13-48) With armature shaft supported on wood block, tap end of driving tool until retainer clears snap ring.

c. Remove snap ring from groove in shaft using pliers or other suitable tool. If the snap ring is distorted during removal, it will be necessary to use a new one upon reassembly.

d. Remove retainer and clutch assembly from armature shaft.

5. If necessary to replace brush holding parts, refer to Fig. 13-49, then proceed as follows:

a. Remove brush holder pivot pin which positions one insulated and one grounded brush.

b. Remove brush spring.

c. Replace brushes as necessary.

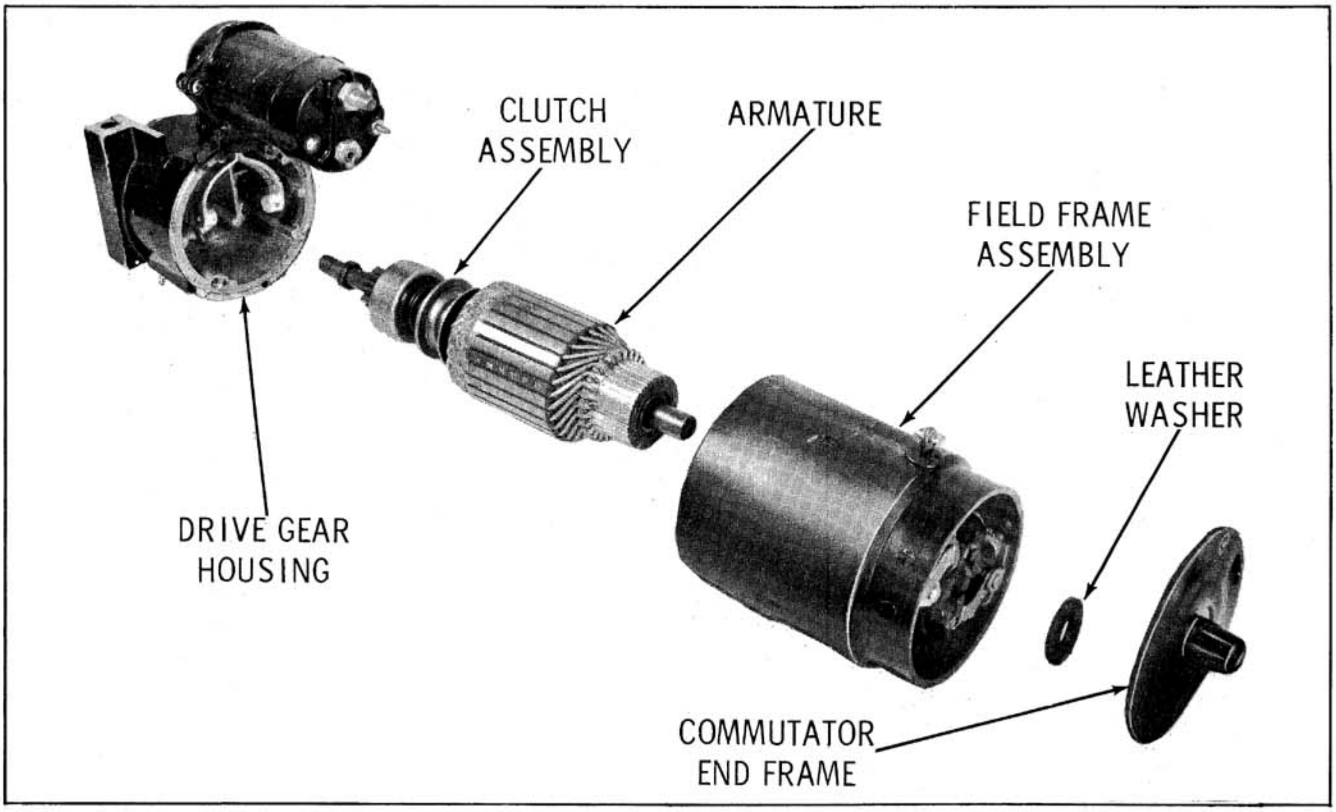


Fig. 13-46 Starter Motor

To assemble, reverse removal procedure.

6. If necessary to remove solenoid assembly or shift lever, proceed as follows:
   a. Remove solenoid to drive gear housing attaching screws, then remove solenoid assembly. (Fig. 13-50)
   b. To remove shift lever and/or plunger, remove shift lever pivot bolt. (Fig. 13-51)
   c. Disassemble shift lever from plunger.

Cleaning, Inspection and Tests

1. Clean all starting motor parts, but DO NOT USE GREASE DISSOLVING SOLVENTS FOR CLEANING THE OVERRUNNING CLUTCH, ARMATURE, AND FIELD COILS, since such solvent would dissolve the grease packed in the clutch mechanism and would damage armature and field coil insulation.

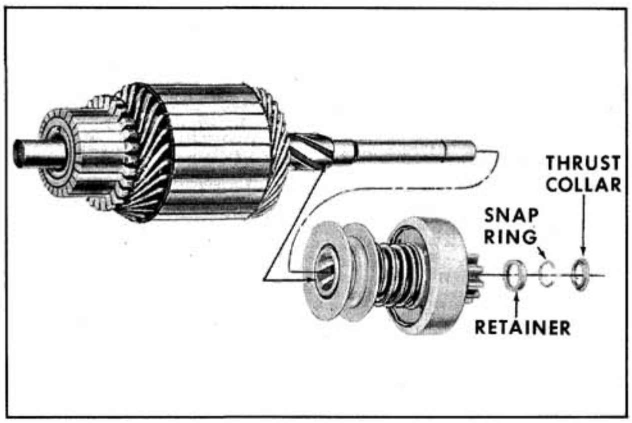


Fig. 13-47 Overrunning Clutch

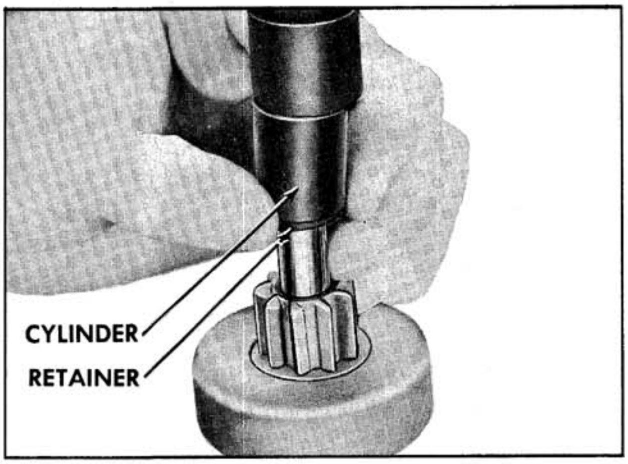


Fig. 13-48 Removing Pinion Retainer

2. Test overrunning clutch action. The pinion should turn freely in the overrunning direction. Check pinion teeth to see that they have not been chipped, cracked, or excessively worn. Replace assembly if necessary.
3. Check brush holders to see that they are not deformed or bent, but will properly hold brushes against the commutator.

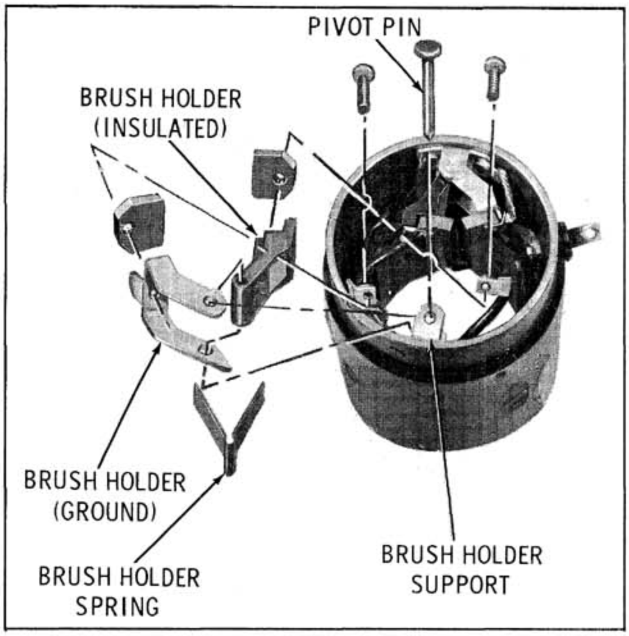


Fig. 13-49 Brush Installation

4. Check fit of armature shaft in bushing of drive housing. Shaft should fit snugly in the bushing. If the bushing is worn, it should be replaced.

5. Inspect armature commutator. If commutator is rough or out-of-round, it should be turned down and the mica undercut 1/32". Inspect the points where the armature conductors join the commutator bars to make sure they have a good connection. A burned commutator bar is usually evidence of a poor connection.

6. If test equipment is available:

   a. Check the armature for short circuits by placing on growler and holding hack saw blade over armature core while armature is rotated. If saw blade vibrates, armature is shorted. Recheck after cleaning between the commutator bars. If saw blade still vibrates, replace the armature.

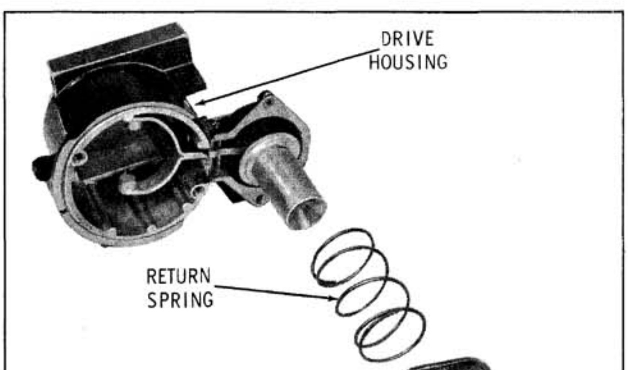


Fig. 13-50 Solenoid Installation

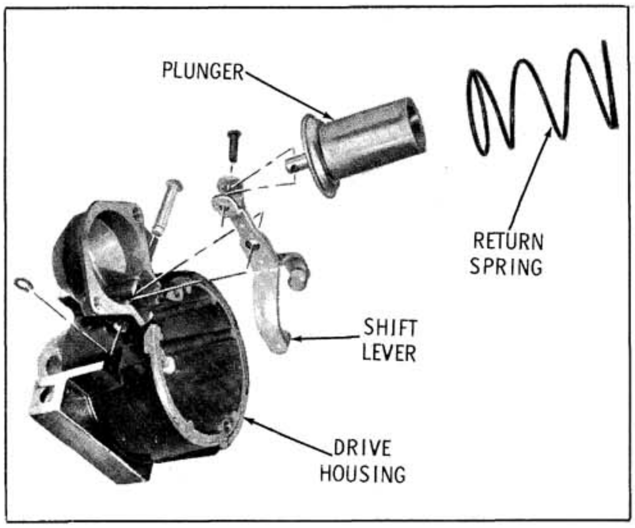


Fig. 13-51 Shift Lever Assembly

   b. Using a 110-volt test lamp, place one lead on each end of the field coils connected in series. (Fig. 13-52) If the lamp does not light, the field coils are open and will require repair or replacement.

   c. Using a 110-volt test lamp, place one lead on the connector strap and the other on the field frame. (Fig. 13-53) Disconnect the shunt coil or coil ground before this check is made. If the lamp lights, the field coils are grounded and the defective coils will require repair or replacement.

   d. Using a 110-volt test lamp, place one lead on each end of the shunt coil or coils. (Fig. 13-54) Disconnect the shunt coil

Fig. 13-52 Checking Field Coil for Open

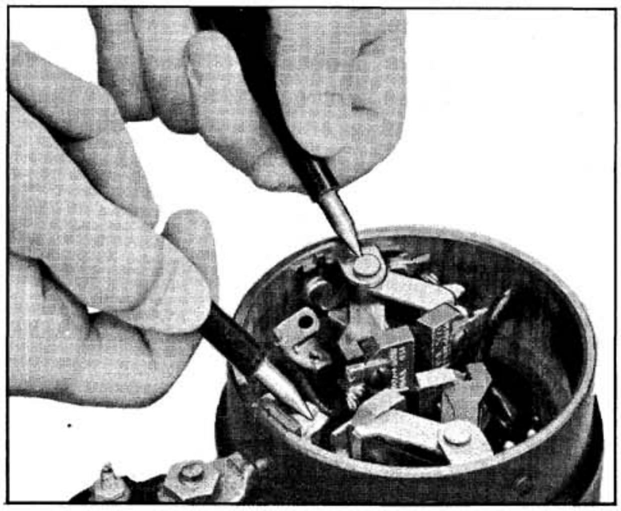


Fig. 13-53 Checking Field Coil for Ground

grounds before this check is made. If the lamp does not light, the shunt coil is open and will require replacement.

e. Check the current draw of the solenoid winding as follows: (Fig. 13-55)

If solenoid is not removed from starting motor, the connector strap must be removed from the terminal on the solenoid before making these tests. Complete tests in a minimum of time to prevent overheating of the solenoid.

To check hold-in winding, connect an ammeter and a variable resistance in series with a 12-volt battery and the "switch" terminal on the solenoid. Connect a voltmeter to the "switch" terminal and to ground. Adjust the voltage to 10 volts and note the ammeter reading. It should be 10.5 to 12.5 amperes for starting motors used with the V-6 engine and 15.5 to 17.5 amperes for starting motors used with V-8 engine.

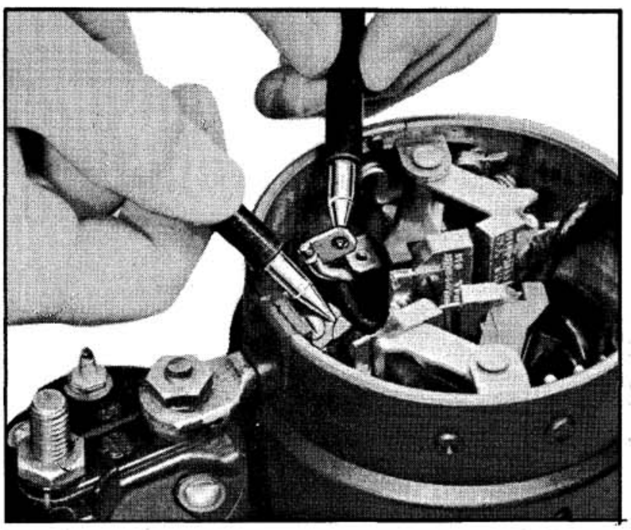


Fig. 13-54 Checking Shunt Coil for Open

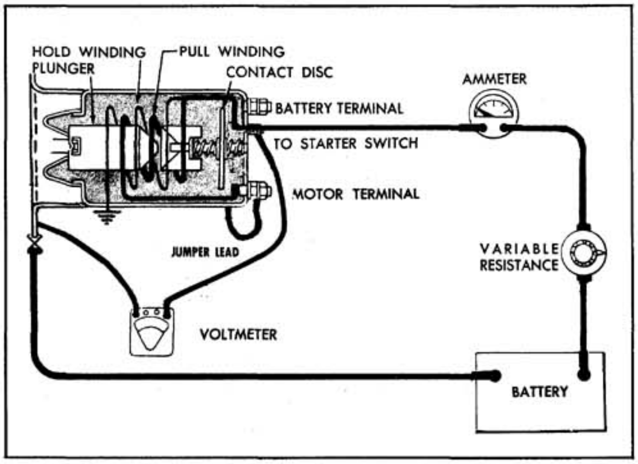


Fig. 13-55 Checking Solenoid Windings

To check both windings, connect the ammeter, variable resistance and voltmeter as for previous test. Ground the solenoid "motor" terminal. Adjust the voltage to 10 volts and note the ammeter reading. It should be 42 to 49 amperes for starting motors used with V-6 engine, and 47 to 54 amperes for starting motors used on the V-8 engine.

Current draw readings that are over specifications indicate shorted turns or ground in the windings of the solenoid, and the solenoid should be replaced. Current draw readings that are under specifications indicate excessive resistance. Check connections, then replace solenoid if necessary. (Fig. 13-56)

Assembly

1. If the solenoid assembly or shift lever was removed, proceed as follows:

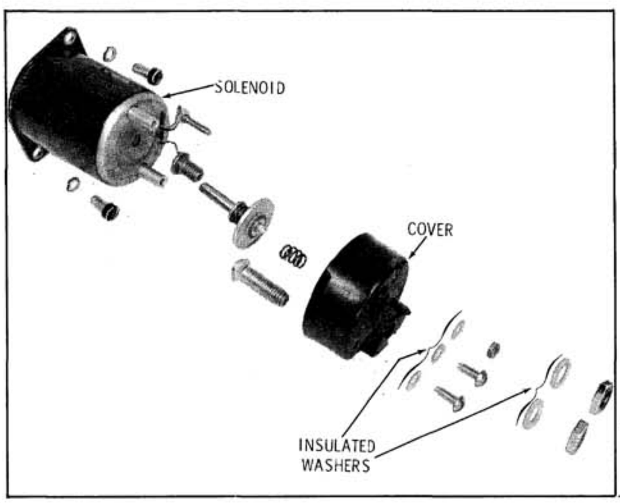


Fig. 13-56 Solenoid Assembly

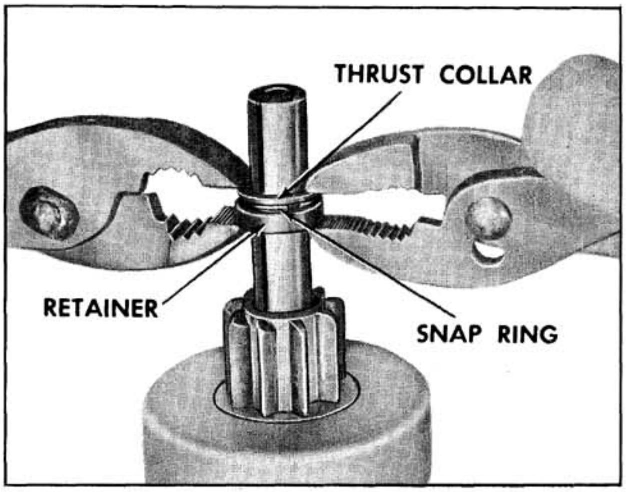


Fig. 13-57 Installing Retainer and Snap Ring

a. Assemble shift lever and plunger.

b. Position shift lever and plunger assembly in drive gear housing and install lever pivot bolt. (Fig. 13-51)

c. Install solenoid assembly to drive gear housing. (Fig. 13-50)

2. If the overrunning clutch was removed from the armature shaft, assemble as follows:

a. Lubricate drive end of armature shaft with SAE 10W-30.

b. Slide clutch assembly onto armature shaft with pinion away from armature. (Fig. 13-47)

c. Slide retainer onto shaft with cupped surface facing away from clutch assembly.

d. Install snap ring into groove on armature shaft.

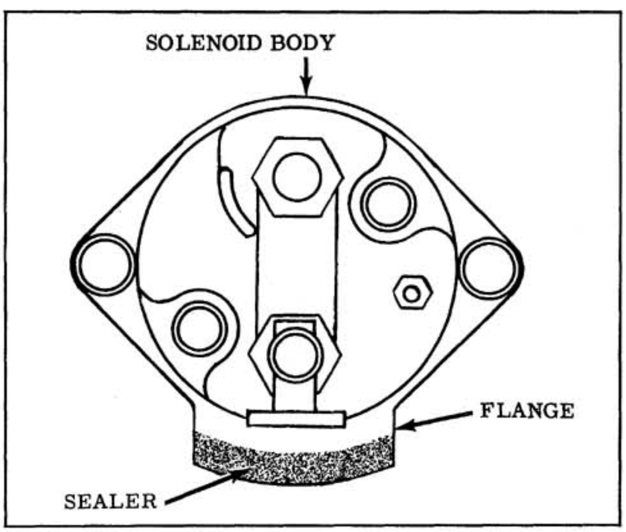


Fig. 13-58 Sealing Solenoid Housing

e. Assemble thrust collar onto shaft with shoulder next to snap ring.

f. Position retainer and thrust collar next to snap ring. Using two pliers, grip retainer and thrust collar and squeeze until snap ring is forced into retainer and is held securely in groove in armature shaft. (Fig. 13-57)

3. Lubricate drive gear housing bushing with four or five drops of SAE 10W-30.

4. With thrust collar in place against snap ring and retainer, slide armature and clutch assembly into drive gear housing and engage clutch with shift lever yoke.

5. Apply sealer, Part No. 1050026 on solenoid flange as shown in Fig. 13-58.

6. Position field frame against drive gear housing using care to prevent damage to brushes.

7. Lubricate commutator end-frame bushing with four or five drops of SAE 10W-30.

8. Install leather washer on armature shaft and slide end frame onto shaft, then install and tighten through-bolts.

9. Connect the field coil connector to the motor solenoid terminal.

10. Check pinion clearance as outlined under PINION CLEARANCE.

Pinion Clearance

Whenever the cranking motor has been disassembled or the solenoid has been replaced, it is necessary to check the pinion clearance. Pinion clearance must be correct to prevent the buttons on the shift lever yoke from rubbing on the clutch collar during cranking.

To check, connect a voltage source of approximately 6 volts between the solenoid switch terminal and ground.

CAUTION: If a 6-volt battery is not available, a 12-volt battery may be used PROVIDING ONLY THREE CELLS ARE CONNECTED IN SERIES. TO PREVENT MOTORING, CONNECT A HEAVY JUMPER LEAD FROM THE SOLENOID MOTOR TERMINAL TO GROUND.

Energize the solenoid to shift the clutch, push the pinion back as far as possible to take up any movement, and check the clearance with a feeler gauge. (Fig. 13-59) The clearance should be .010" to .140".

Means for adjusting pinion clearance is not

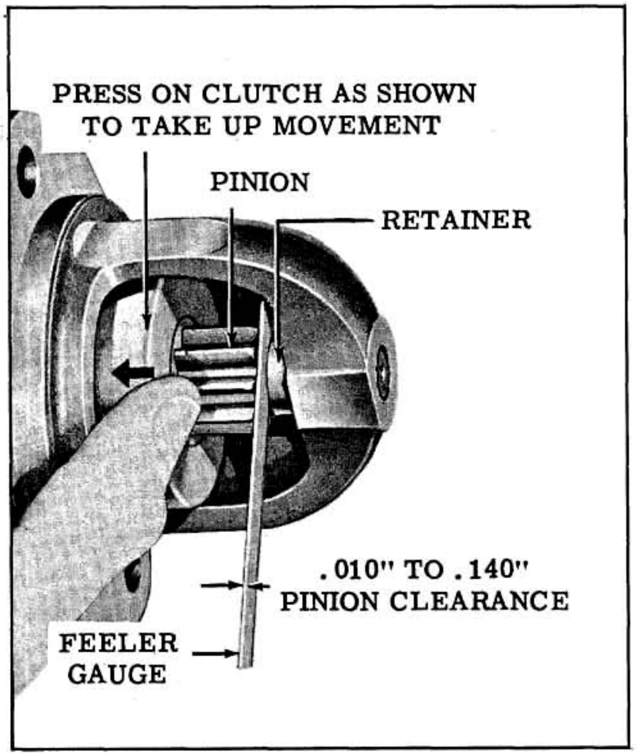


Fig. 13-59 Checking Pinion Clearance

provided on the starter motor. If the clearance does not fall within limits, check for improper installation and replace all worn parts.

CHECKING STARTING CIRCUIT RESISTANCE

Whenever the starter motor turns over slowly or not at all, or the solenoid fails to engage the starter with the flywheel, excessive resistance of the starter circuit may be the cause.

The following checks for excessive resistance can be performed with the starter motor on the car:

1. Test battery and charge if necessary.

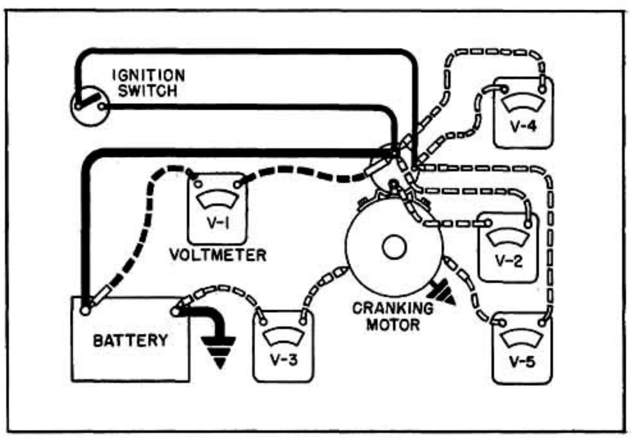


Fig. 13-60 Checking Starter Circuit Resistance

CAUTION: To prevent the engine from firing during the following checks, ground the distributor primary lead.

2. Measure the voltage drop (V1) during cranking between the positive battery post and the "battery" terminal of the solenoid. (Fig. 13-60)

3. Measure the voltage drop (V2) during cranking between the "battery" terminal of the solenoid and the "motor" terminal of the solenoid.

4. Measure the voltage drop (V3), during cranking between the negative battery post and the starter motor frame.

If the voltage drop for any one of the above three checks exceeds 0.2 volt, excessive resistance is indicated in that portion of the starting circuit being checked. Locate and eliminate the cause for any excessive voltage drop in these circuits in order to obtain maximum efficiency of the starting system.

If the solenoid fails to pull in, the trouble may be due to excessive voltage drop in the solenoid circuit. To check for this condition, measure the voltage drop (V4) during cranking, between the "battery" terminal of the solenoid and the "switch" terminal of the solenoid. If the voltage drop exceeds 2.5 volts, the resistance is excessive in the solenoid circuit.

If the voltage drop does not exceed 2.5 volts and the solenoid does not pull in, measure the voltage (V5) available at the "switch" terminal of the solenoid. The solenoid should pull in with 8.0 volts at temperatures up to 200°F. If not, remove the starter motor and test the solenoid.

IGNITION CIRCUIT

The ignition circuit includes the distributor, ignition coil, ignition resistor wire, ignition switch, spark plugs, and battery. For servicing of the battery, see CHARGING CIRCUIT.

DISTRIBUTOR (Fig. 13-61)

Description

The distributor cap has a window for adjusting point opening (dwell angle) while the cap is mounted and the engine is running. The contact point set is replaced as one complete assembly. The service replacement contact set has the BREAKER LEVER SPRING TENSION AND POINT ALIGNMENT pre-adjusted. Only the POINT OPENING requires adjusting after replacement.

Under part throttle operation, the intake manifold vacuum actuates the vacuum control diaphragm, thus advancing the spark and increasing

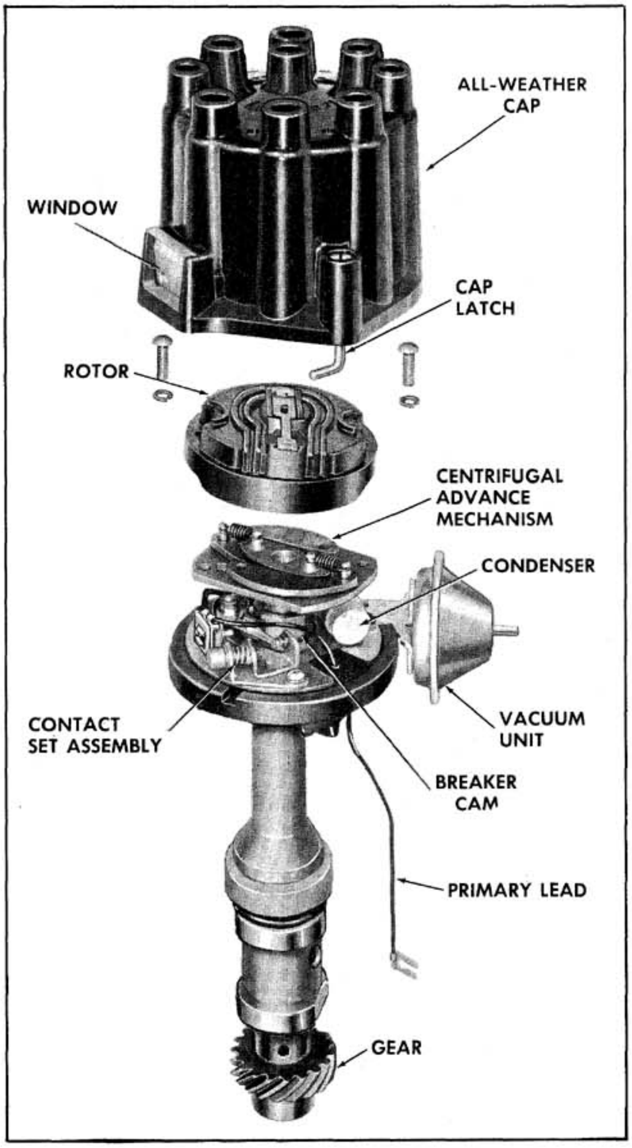


Fig. 13-61 Distributor (V-8 Shown)

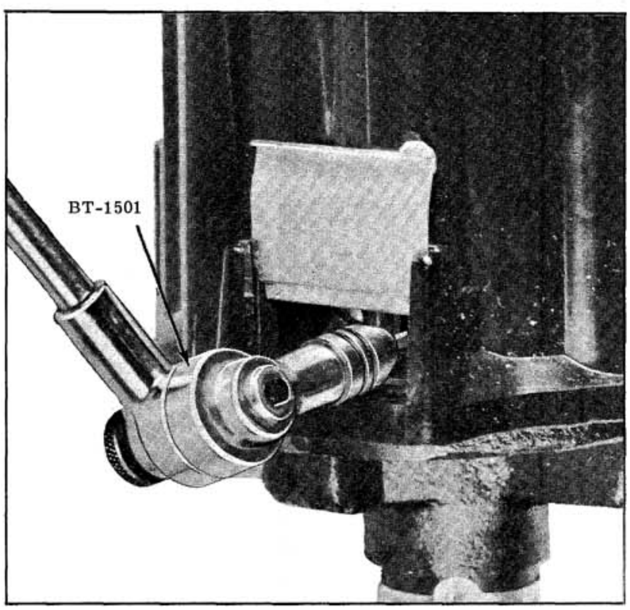


Fig. 13-62 Adjusting Dwell Angle

fuel economy. During fast acceleration or when the engine is pulling heavily, the vacuum is not sufficient to actuate the diaphragm; therefore, the movable breaker plate is held so that the ignition timing is retarded.

The centrifugal advance mechanism consists of a cam actuated by two centrifugal weights controlled by springs. As the speed of the distributor shaft increases with engine speed, the centrifugal advance weights move outward which advances the cam, causing the contact points to open earlier, thus advancing the spark.

Adjustment of Distributor Dwell Angle (On Car)

1. Remove the distributor cap and inspect contact points; clean if necessary. Lubricate cam with cam and bearing lubricant. Install cap.

2. Connect a dwell meter to the primary distributor lead terminal on the coil and a suitable ground.

3. Raise window on side of distributor cap.

4. With the engine running at idle speed, insert Dwell Adjusting Tool BT-1501 into the head of the adjusting screw as shown in Fig. 13-62 and adjust dwell angle to 30°.

   NOTE: If the dwell angle reading is erratic, check the contact points and condenser.

The dwell angle variation should not exceed 3° at engine speeds between idle and 1750 rpm. Excessive variation indicates distributor wear.

Removal

1. Disconnect the distributor wire from coil.

2. Remove distributor cap as shown in Fig. 13-63.

   NOTE: If necessary to remove secondary wires from cap, mark position on cap tower for lead to No. 1 cylinder. This will aid in re-installation of leads. (Figs. 13-64 and 13-65)

3. Remove vacuum hose line from vacuum advance unit.

4. Remove distributor clamp screw and hold-down clamp.

5. Note position of rotor, then pull distributor up until rotor just stops turning counterclockwise and again note position of rotor.

To install, reverse removal procedure.

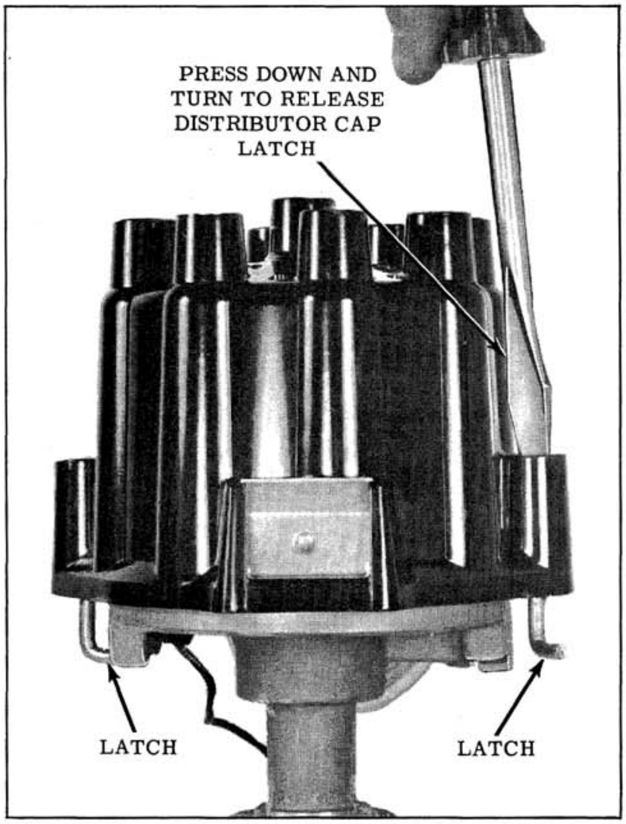


Fig. 13-63 Removing Distributor Cap

IMPORTANT: To insure correct timing of the distributor, the distributor must be INSTALLED with the rotor correctly positioned as noted in Step 5.

If the engine has been turned after the distributor was removed, it will be necessary to install a jumper wire and crank engine until the saw slot on the harmonic balancer indexes with the 0° timing mark on the engine front cover. If both valves of the No. 1 cylinder are closed, the piston will be on top dead center of the firing stroke and the distributor can be installed with the rotor pointing to the No. 1 spark plug terminal in the distributor cap. If not, crank engine one complete revolution, then install distributor.

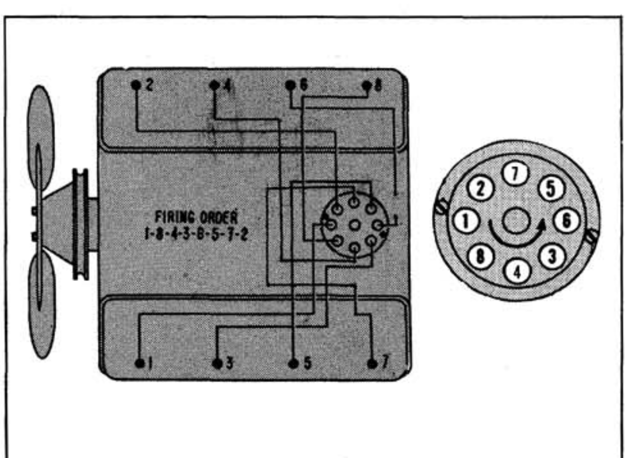


Fig. 13-64 Spark Plug Wiring (V-8)

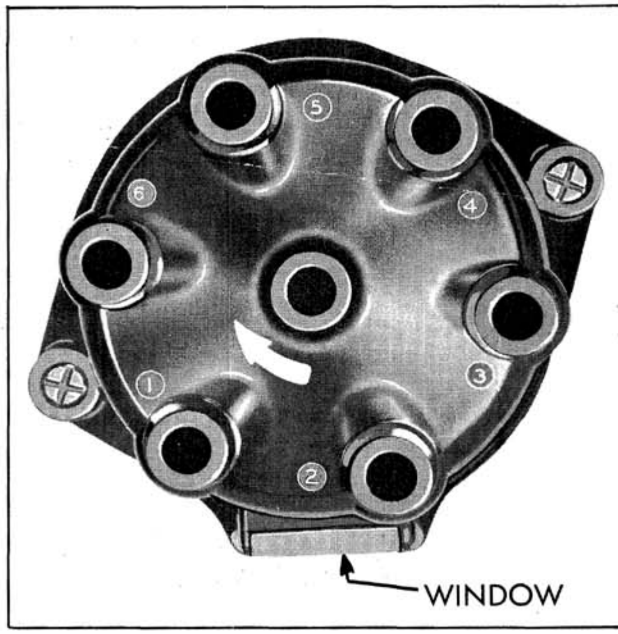


Fig. 13-65 Spark Plug Wiring (V-6)

Tests (Distributor Removed from Car)

With the distributor removed from the car, place the distributor in a distributor testing machine. When mounting distributor in tester, first secure the gear in the drive mechanism, then push distributor housing down toward the gear to take up end play between the gear and housing, and finally secure the housing in the tester. Test the distributor for variation of spark, correct centrifugal and vacuum advance (See SPECIFICATIONS), and condition of contact points. This test will give valuable information on the distributor condition and indicates parts replacement which may be necessary.

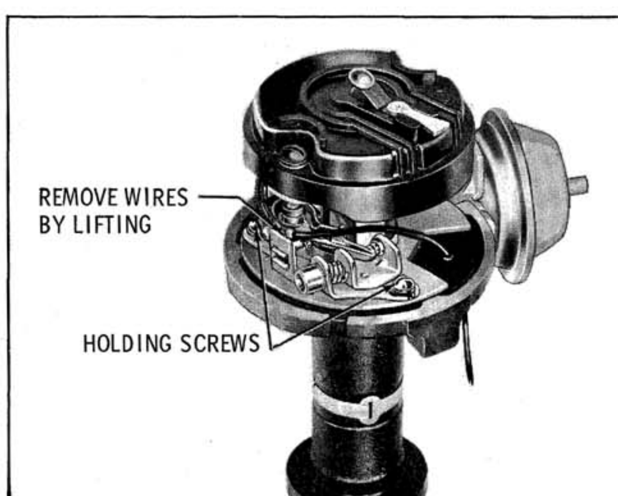


Fig. 13-66 Removing Contact Point Set

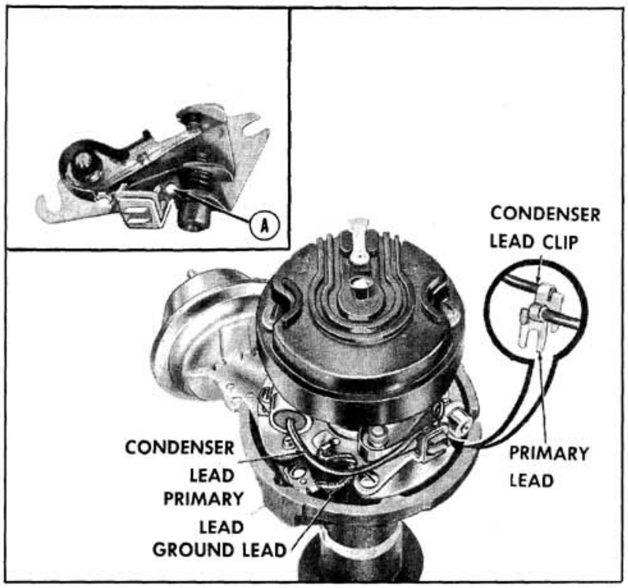


Fig. 13-67 Installing Contact Point Set

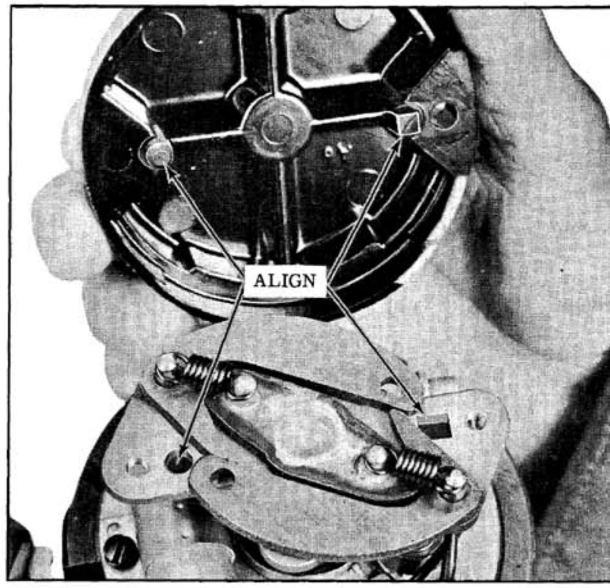


Fig. 13-68 Installing Rotor

Replacing Distributor Contact Set

1. Remove distributor cap.
2. Loosen the two attaching screws which hold the base of contact set, turn and lift out the assembly. (Fig. 13-66)
3. Upon reassembly, make sure that hole "A" in the contact set is centered over the dowel on the distributor plate and install the primary leads as shown in Fig. 13-67. Leads must be properly located to eliminate lead interference between cap, weight base, and breaker advance plate.
4. Apply a film of cam and ball bearing lubricant, or equivalent, to the breaker cam.

Adjusting Distributor Dwell Angle

1. With distributor mounted in distributor testing machine, connect the dwell meter to the distributor primary lead.
2. Turn the adjusting screw to set the dwell angle at 30°.

If a distributor tester is not available, the dwell angle may be adjusted as follows:

1. Mount distributor in a vise.
2. Connect a testing lamp between the primary lead and ground.
3. Rotate the shaft until one of the breaker cam lobes is under the center of the rubbing block on the moveable point.
4. Turn the adjusting screw clockwise until the lamp lights, then give the wrench one-half turn in the opposite direction.

When distributor has been installed in car, point opening must be reset by connecting a dwell meter to the primary distributor lead terminal on the coil and a suitable ground. The dwell angle must be set at 30° with the engine running at idle speed.

Rotor

The rotor is retained by two screws and is provided with round and square lugs which engage with the mechanical advance plate so that the rotor may be installed in only one position. (Fig. 13-68)

Mechanical Advance

The mechanical advance weights and springs are accessible by removing the rotor. The mechanical advance plate is assembled to the breaker cam. In order to remove the breaker cam and advance plate, follow the procedure for DISTRIBUTOR-DISASSEMBLY and ASSEMBLY.

VACUUM ADVANCE UNIT

Removal

1. Remove the two vacuum advance attaching screws. (Fig. 13-69)
2. Turn the breaker plate clockwise and push the rod end of the vacuum advance down so that it will disengage and clear the breaker plate. Remove vacuum advance unit.

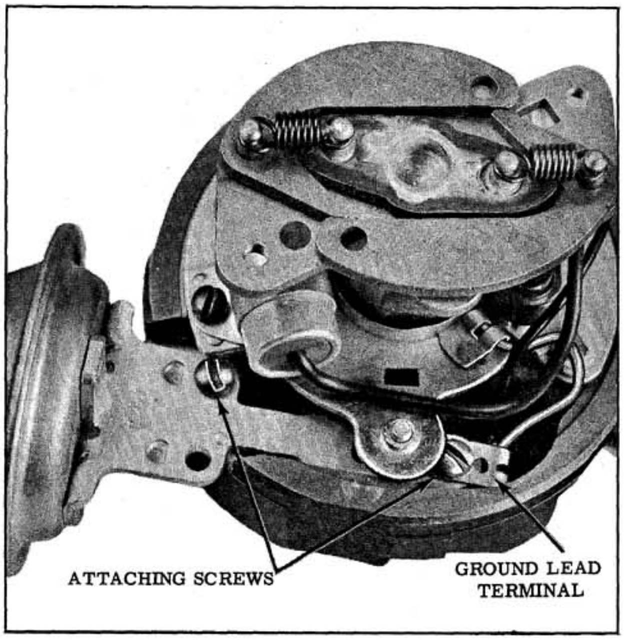


Fig. 13-69 Vacuum Advance Unit

Installation

1. Position the rubber sleeve over the rod end of the vacuum advance.
2. Insert the rod end of the unit between the housing and the breaker plate.
3. Turn the breaker plate clockwise so that the rod end can be inserted into the hole in the breaker plate.
4. Install the attaching screws with the ground lead terminal under the inner mounting screw. (Fig. 13-69)

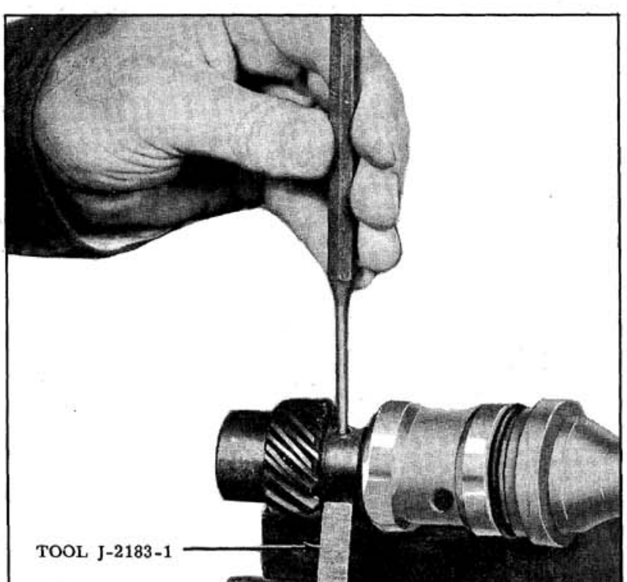


Fig. 13-70 Removing Roll Pin

DISTRIBUTOR

DISASSEMBLY

1. Mark distributor shaft and gear so that they may be reassembled in the same position.
2. Drive out the roll pin. (Fig. 13-70)
3. Pull the distributor assembly from the gear and pull the distributor shaft and breaker cam from the housing.
4. Remove the retaining ring from the upper bushing and lift the breaker plate and felt wick from the bushing. (Fig. 13-71)
5. Remove the two retaining screws and the vacuum advance.

ASSEMBLY

1. Install the vacuum advance with the ground lead terminal under the inner mounting screw. (Fig. 13-72)
2. Place the felt wick on the upper bushing, then place the breaker plate over the upper bushing and vacuum advance link.
3. Install the retaining ring on the upper bushing.
4. Slide the distributor shaft through housing bushings.
5. Push the driven gear onto the distributor shaft with the holes aligned.
6. Install the roll pin.
7. Check and adjust dwell angle, vacuum advance, and mechanical advance. Refer to ELECTRICAL SPECIFICATIONS (Distributor).

IGNITION COIL and IGNITION RESISTOR

The ignition resistor, connected in series with the primary circuit between the battery and coil, limits the primary current at low speeds and allows the coil to operate at maximum efficiency at road speeds. The resistor is by-passed during cranking, thereby connecting the ignition coil directly to the battery. This makes full battery voltage available at the coil and keeps ignition voltage as high as possible during cranking. The by-passing of the resistor during cranking is accomplished at the "R" terminal of the starter solenoid.

IGNITION AND STARTING SWITCH

The ignition and starting switch is key-operated

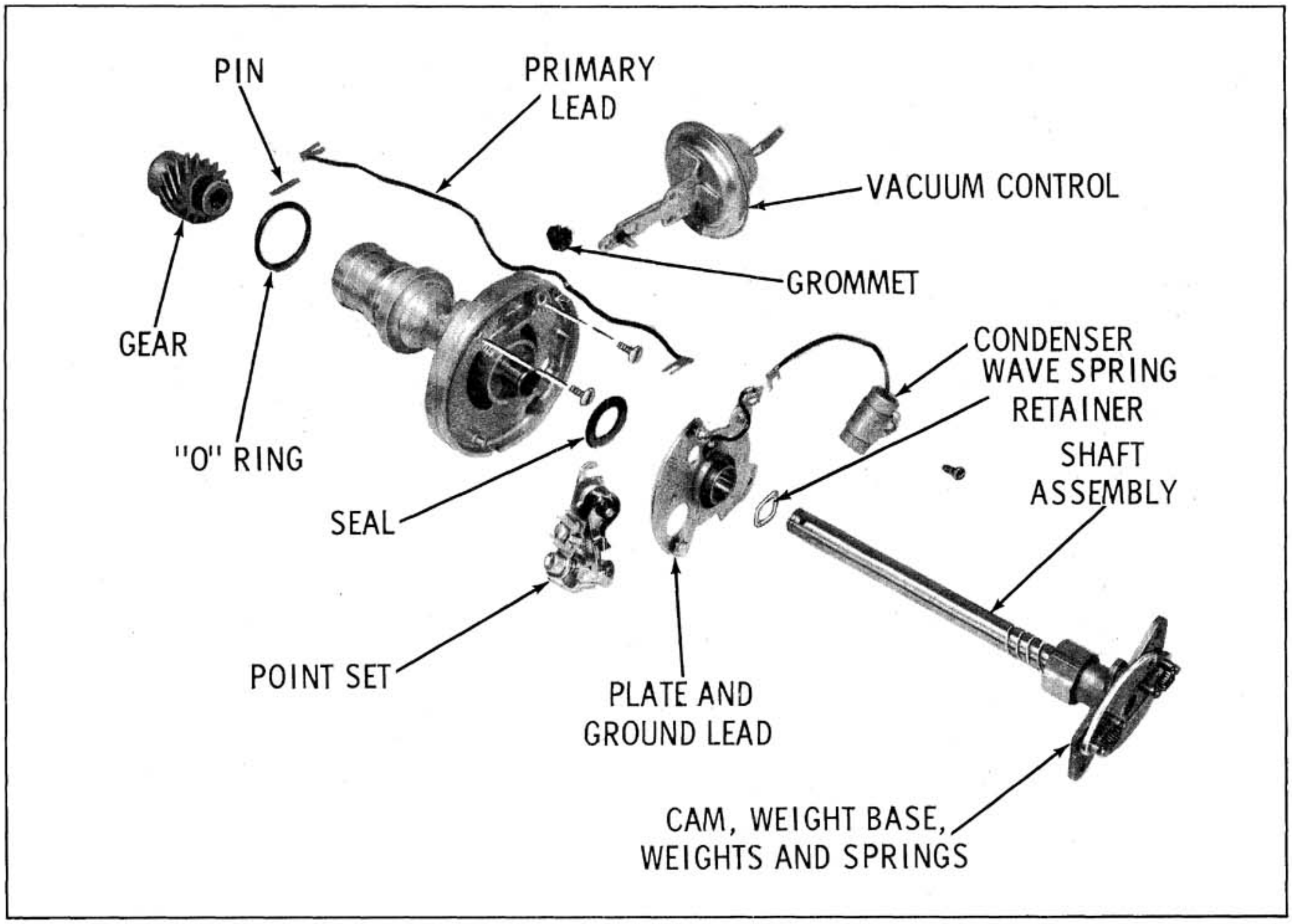


Fig. 13-71 Distributor Disassembled

to close the ignition primary circuit and to energize the solenoid for cranking. The ignition key must be turned to the extreme clockwise position to energize the starter solenoid. Spring tension returns the key to the normal ignition position when it is released.

CAUTION: The ignition resistor is by-passed during cranking through a contact in the starter instead of through a contact in the ignition switch.

With this system, the starter must not be energized when the ignition switch is in the "off" or "lock" position. In these positions, the ignition system primary is grounded in the ignition switch. Energizing the starter will cause damage to the ground contact in the ignition switch and to the ignition contact in the starter solenoid.

Accessories may be used when the engine is not running if the ignition key is turned counterclockwise.

REMOVE AND INSTALL

1. Disconnect battery.

2. Insert key into ignition switch and turn fully clockwise. While holding the key in the clockwise position, depress the lock cylinder retainer, with a thin wire, through the small hole in the face of the lock cylinder.

3. Remove the key and lock cylinder.

4. Remove the ignition switch escutcheon.

5. After removing the ignition switch from the

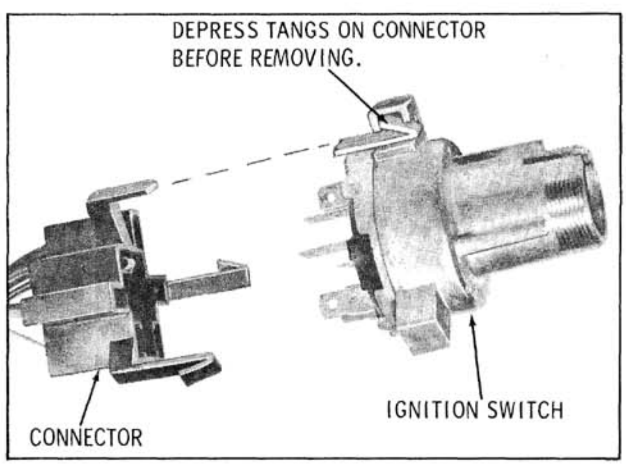


Fig. 13-72 Ignition Switch (All Series)

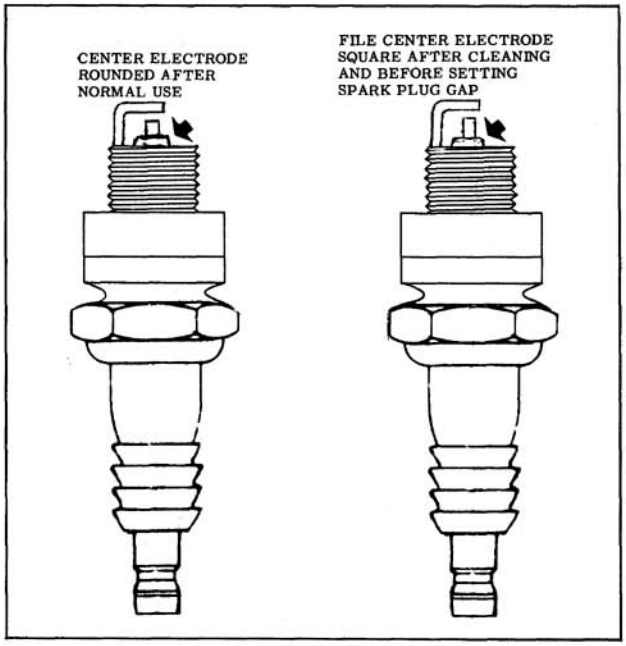


Fig. 13-73 Filing Center Electrode

instrument panel, the connector can be removed as shown in Fig. 13-72.

To install, reverse the removal procedure.

SPARK PLUGS

Whenever spark plugs are removed from the car and cleaned, the following precautionary steps should be followed:

1. The center electrode should be filed flat before the gap setting is made. (Fig. 13-73) Spark plug gap should be .030".

   NOTE: Do not file electrodes when setting gap on new plugs.

2. Any traces of paint or dirt should be cleaned from the spark plug procelain.

3. All plugs should be checked for cracks in the porcelain. These cracks are not always visible because they may be hidden by the steel body. Use a spark plug tester to test plugs. If the spark plug porcelain is cracked, a new spark plug must be installed.

SPARK PLUG CHART	
Engine	Spark Plug
V-8 L.C.	45S
V-8 H.C.	44S
V-6	44S

IGNITION SYSTEM DIAGNOSIS

If the engine does not run, the ignition system may be at fault if:

1. There is no spark during cranking when a spark plug wire is held 1/4" from the engine.

2. The engine starts but immediately stops when the ignition switch is released from the "START" position.

If the above checks indicate that the ignition system is at fault, the following checks may be made to help locate the difficulty, or locating trouble in the ignition system if the car runs, but not satisfactorily. (Fig. 13-74 and IGNITION SYSTEM CHECK CHART) All checks are to be made with the lights and accessories off and in the sequence shown.

MILLIAMP TEST

The milliamp test will indicate the presence of faulty ignition cables, cracked distributor cap, or burned rotor. Refer to Figs. 13-75 and 13-76 for spark plug wire routing.

NOTE: When making a milliamp test, use the indicated reading values as furnished by the testing equipment manufacturers.

1. Connect tachometer, start engine, and set engine speed according to the directions on the test equipment.

2. Set meter knob to secondary efficiency position.

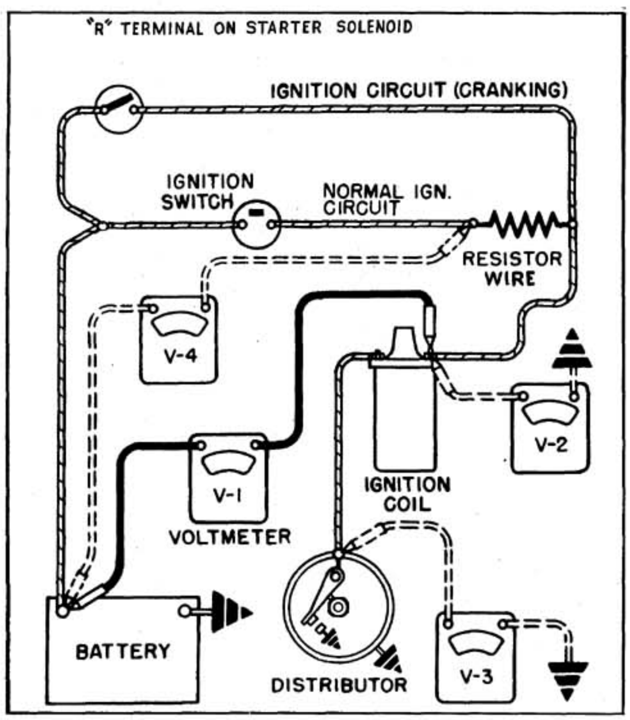


Fig. 13-74 Ignition System Tests

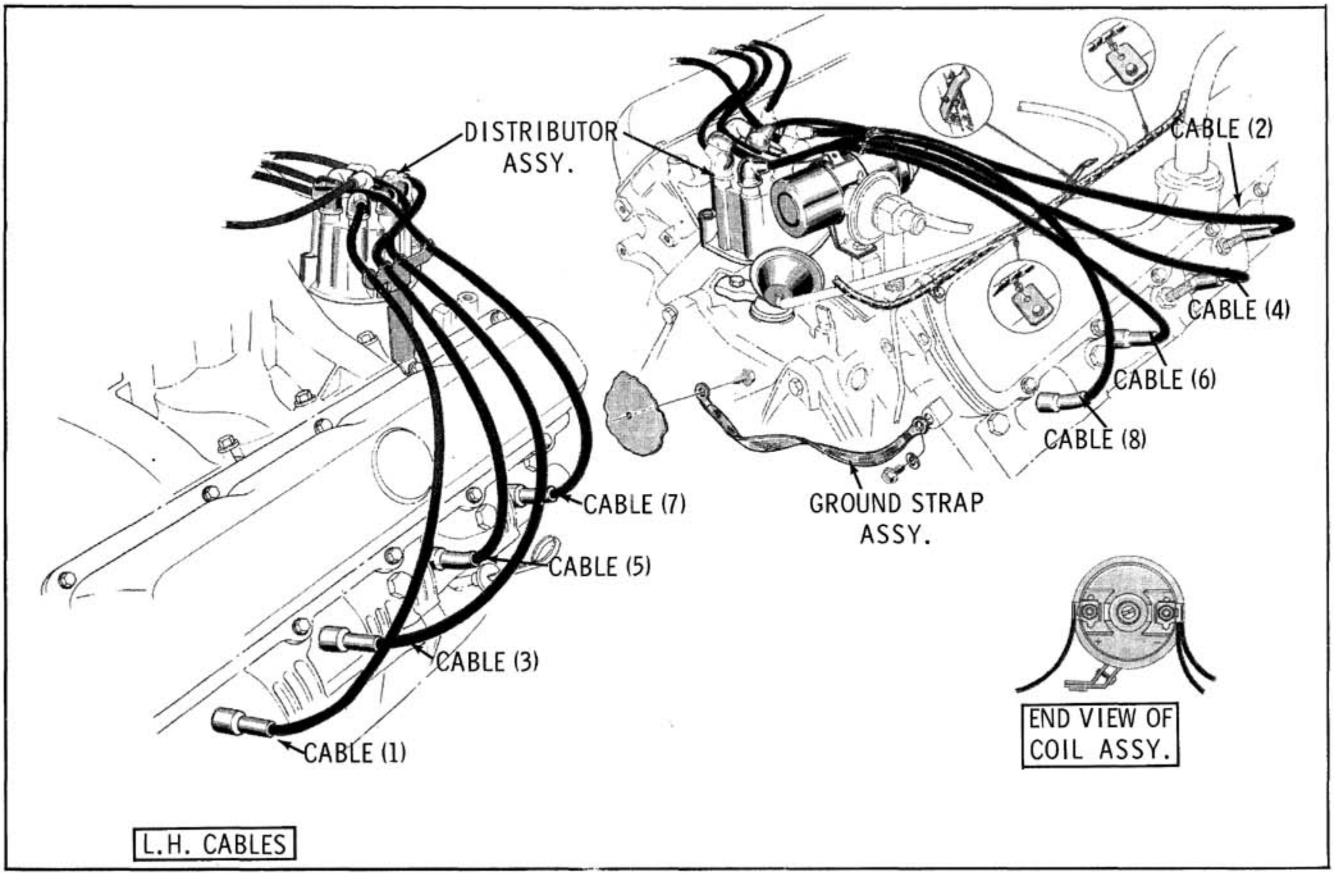


Fig. 13-75 Spark Plug Wiring (54 through 86 Series)

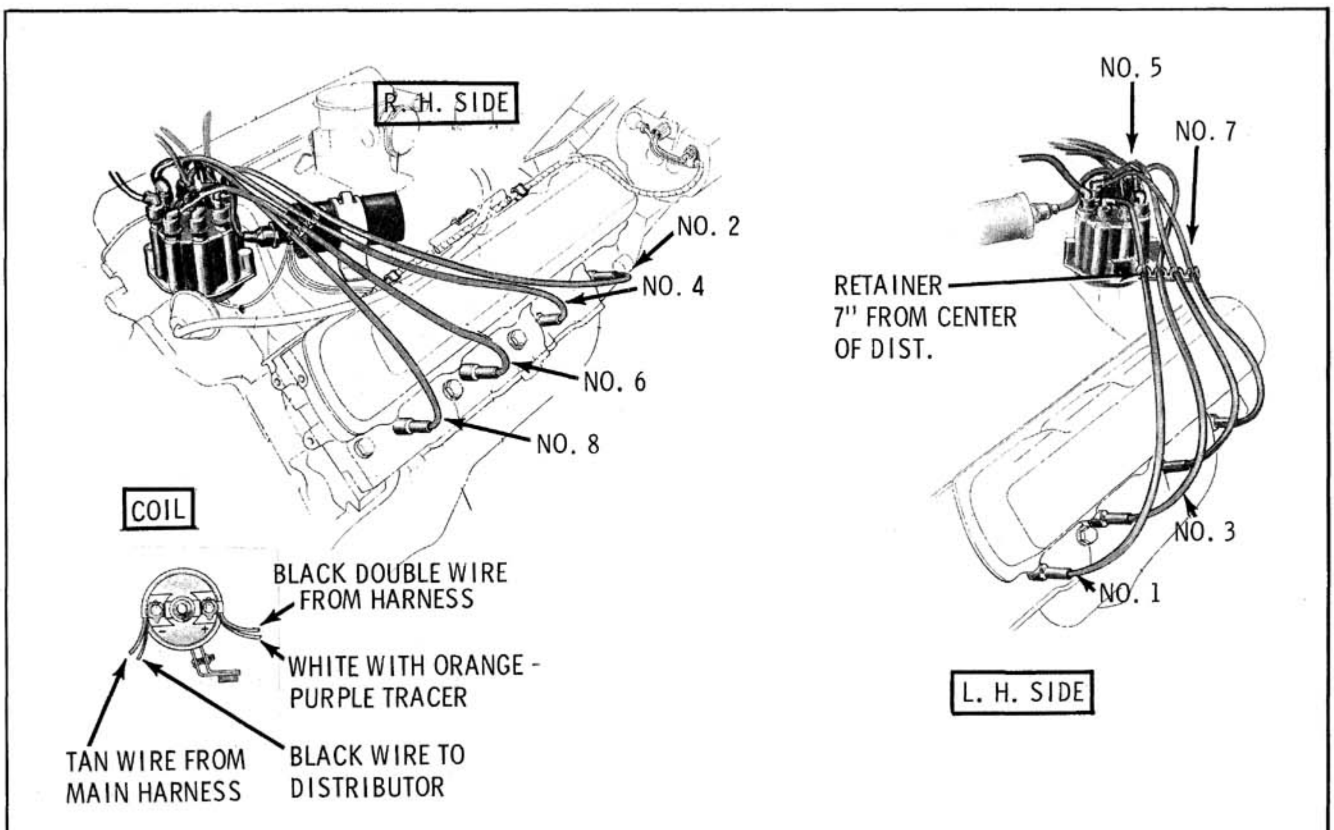


Fig. 13-76 Spark Plug Wiring (33 through 52 Series)

3. Ground positive lead.

4. Check each spark plug lead by connecting the positive lead of the meter directly to the cable. A variation of five graduations between plugs is allowable.

5. A low reading indicates high resistance in the circuit. If a low reading is encountered, disconnect the cable from the spark plug and check the reading again. If the reading increases, the spark plug is partially shorted.

6. A low reading with the cable disconnected from the spark plug indicates:

   a. Poor connection on either end of the cable.

   b. Burned or corroded connector inside the distributor cap.

   c. Damaged or broken cable.

   Clean and inspect the distributor cap terminals on both ends. Check cable insulation for cracks, pinholes, or an oil-soaked condition. DO NOT attempt to shorten, rework, or repair cables.

   NOTE: If the milliamp reading is still unsatisfactory, carefully check the distributor cap and rotor for leakage or cracks. Test the coil, condenser, and primary circuit, including starter solenoid connections, ignition switch and terminals, as well as the coil and distriburor terminals.

7. A low reading on all cables indicates:

   a. Burned or broken rotor.

   b. Faulty distributor cable.

   c. Weak coil.

   d. Cables not tight in distributor cap.

   e. Excessively burned rotor or distributor cap terminal electrodes.

   f. Spring button not contacting carbon brush in distributor cap.

   g. Incorrect contact point tension. (19 to 23 oz.)

HORNS

The horns are mounted as shown in Figs. 13-77 and 13-78. When installing a new horn, the horn service replacement package also contains two mounting brackets. Use the correct bracket which will allow the horn to be mounted in the same position and location as the original.

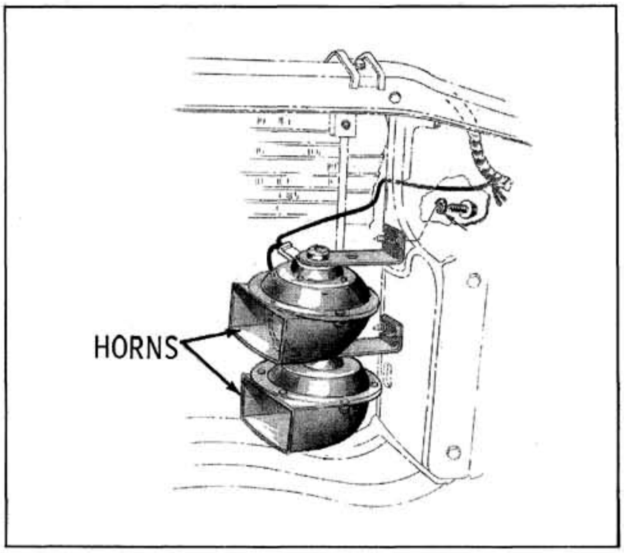


Fig. 13-77 Horn Mounting (52 through 86 Series)

QUICK CHECKS FOR HORN TROUBLE

When horn trouble is encountered, the difficulty may be in the horn relay, wiring, or the horn itself. Quick checks to determine cause for trouble may be made as follows:

1. Hold the horn button down to energize horn.

2. While energized, tap horn lightly. If horn fails to blow after tapping, see Step 7. If horn should start to blow after tapping, proceed to Step 3.

3. Release horn button so that the horn will stop blowing.

4. Hold horn button down again. If the horn blows normally, a particle of foreign material between the contact points caused the trouble and no adjustment is needed. If the horn still fails to blow until tapped again, proceed with Step 5.

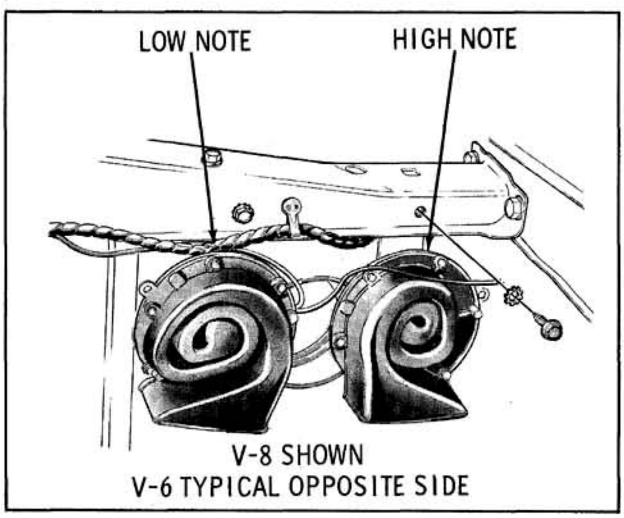


Fig. 13-78 Horn Mounting (33 through 38 Series)

IGNITION SYSTEM CHECK CHART

Step No.	Operation	Specification	Possible Trouble
1	Check all connections in Primary and Secondary circuit		
2	Remove secondary lead from distributor cap. Hold 1/4" from engine while cranking and observe if spark occurs.		IF SPARK OCCURS: Distributor cap Rotor Spark plug wiring
3	Check Voltage V1 while cranking	1 volt Max.	Open circuit from battery side of coil to IGN, on ignition switch. Ignition switch not closing ignition circuit in start position. Ground in circuit from coil terminal to IGN, on ignition switch. Ground in coil.
4	Check Voltage V2 ignition switch "On", points open	Normal Battery	Low battery Points not open Ground in circuit from coil to distributor Ground in distributor Ground in coil Ground in circuit from coil to ignition switch or to resistor
5	Check Voltage V2 ignition switch "On", points closed	5 to 7 Volts	IF UNDER 5 VOLTS: Loose connection from resistor through ignition switch circuit to battery. Loose connection between resistor and coil. Resistor is open or has too much resistance. IF OVER 7 VOLTS: Loose connection between coil and distributor. Resistor out of circuit due to shorted or incorrect wiring. Resistor has too little resistance Coil primary is open
6	Check Voltage V3 ignition switch "On", points closed	0.2 Volt Max.	Contacts not closed Loose connection in distributor Distributor not grounded to engine Faulty contacts
7	Check Voltage V4 ignition switch "On", points closed	0.7 Volt Max.	Loose connection from resistor through ignition switch circuit to battery
8	If these checks fail to find cause of trouble - remove distributor and coil from engine and check to specifications. Also check wiring harness and ignition resistor.		

5. To adjust horns which blow only when tapped, turn adjustment screw one full turn counterclockwise.

   CAUTION: This adjustment is sensitive. Do not turn screw more than one full turn or in the wrong direction. Misadjustment will require removing the horn for adjustment on the bench.

6. Check horn for normal operation and if still inoperative, remove for a bench check.

7. For horns that will not blow after tapping, check to make sure that voltage is available at the horn terminal or for a poor ground connection at the horn mounting. If no trouble is located during these checks and horn is inoperative, remove for a bench check.

Bench Checks

1. No current may indicate a broken connection or an open circuit due to a broken lead or overheating. Most horn failures are caused by horns being operated continuously which develops sufficient heat to melt the wires in the winding causing an open circuit. Overheating is accompanied by a burned odor which indicates that the horn should be replaced.

2. No current can also indicate that the contact points are open and a current adjustment is required.

3. High current over 20 amperes indicates an overheated winding or shorted horn which should be replaced.

4. A reading of approximately 18 amperes for a 12-volt horn indicates a condition in which the contact points are not opening. A current adjustment is required.

HORN CURRENT ADJUSTMENT

Connect an ammeter and a voltmeter as shown in Fig. 13-79. With horn operating, the current draw should be 4.5 to 5.5 amperes at 11.5 volts.

Current adjustment is made by turning the adjusting screw counterclockwise to increase the current or clockwise to decrease the current until the specified current is reached. Care must be taken not to turn the adjusting screw too far. Turn only 1/4 of a turn at one time. If adjustment loosens the screw excessively, it may be staked with punch.

Other Horn Problems

A. Poor Tone

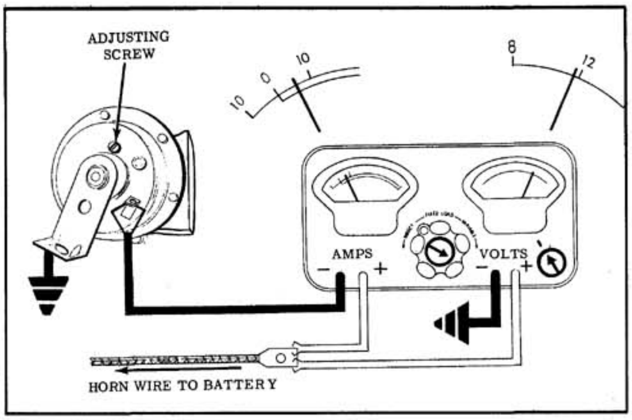


Fig. 13-79 Checking Current Draw

1. Harsh tone - caused by loose bolts in sheet metal mounting area.

2. Low pitch roar - sounds like a "moo-ing" and is caused by too high a current. Horn needs adjusting.

3. Weak tone - caused by too low a current. Horn needs adjusting.

4. Weak strained tone - foreign body in horn trumpet that should be shaken out or removed.

5. Harsh vibration - caused by horn touching sheet metal, bend bracket to provide clearance.

B. Horn Blows Constantly

1. This can be caused by a sticking horn relay.

2. Horn relay can be energized by grounded or shorted wiring.

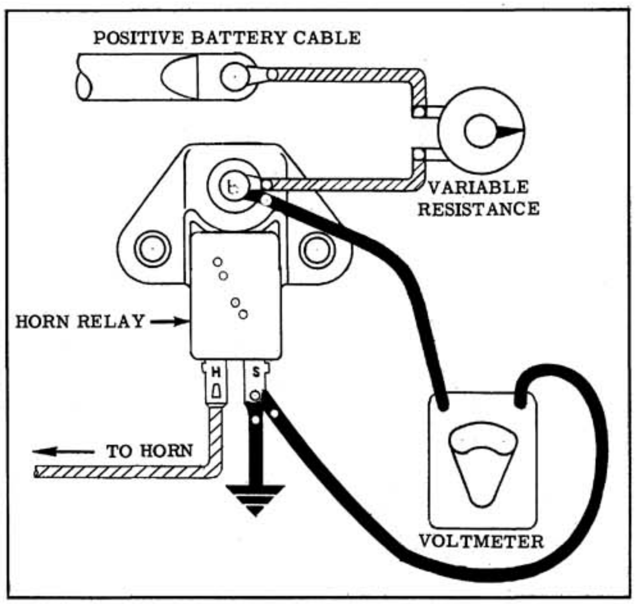


Fig. 13-80 Checking Horn Relay Closing Voltage

3. Horn button can be grounded by sticking closed.

NOTE: Most horns with burned open windings are caused by one of the above malfunctions. Before replacing a horn with open windings, check to make sure that none of the above conditions exist which would cause a repeat failure.

HORN RELAY CHECKS

Closing Voltage

1. Disconnect positive battery cable from "B" terminal of horn relay.
2. Connect a variable resistance of at least 10 ohms in series between battery cable and "B" terminal. (Fig. 13-80)
3. Connect a voltmeter across the "S" terminal and the "B" terminal of the horn relay. Ground the "S" terminal.
4. Slowly decrease the resistance until horn relay points close. Closing voltage should be 1.5 to 9.5 volts. If voltage is outside this range, the horn relay should be replaced.

TURN SIGNAL

The turn signal circuit consists of the switch, flasher, two pilot lamps in the instrument panel, the stop lamp filaments in the rear lamps, and the turn signal filaments in the parking lamps. (Fig. 13-81)

See SECTION 8 for servicing of turn signal switch.

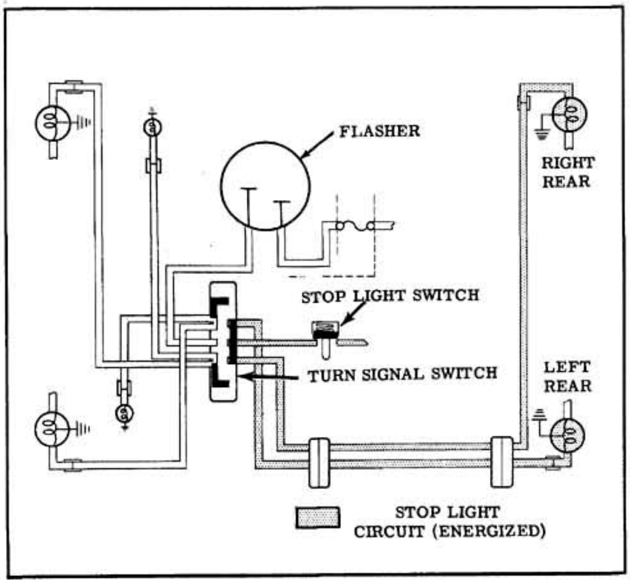


Fig. 13-81 Turn Signal Circuit (Off Position)

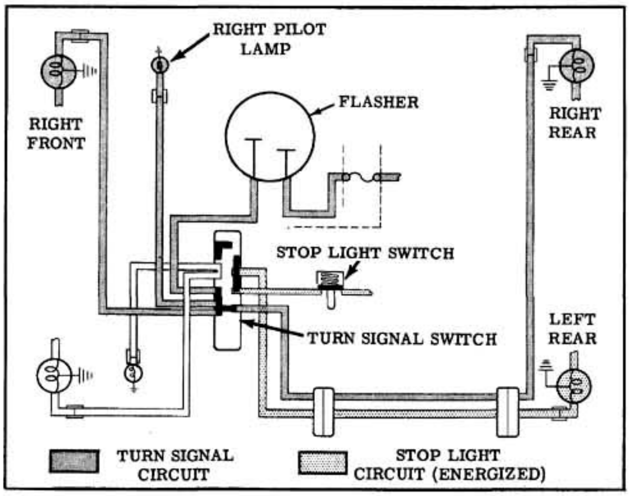


Fig. 13-82 Right Turn Position

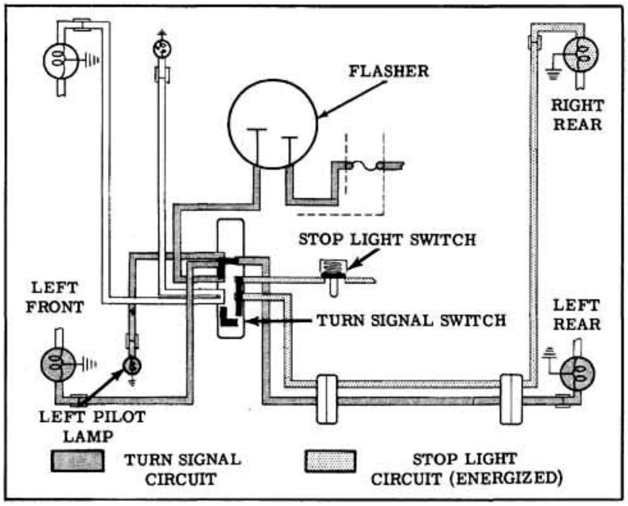


Fig. 13-83 Left Turn Position

TURN SIGNAL DIAGNOSIS (FIGS. 13-82 AND 13-83)

The turn signal wiring diagrams indicate the stop light circuit and the turn signal circuit energized at the same time in order to show how the stop light circuit is changed to a turn signal circuit when the turn signal switch is actuated.

1. PILOT LIGHT REMAINS ON

   A. Right turn - right rear or right front turn signal filaments burned out, light bulb base not grounded or an open in the front or rear turn signal circuit.

   B. Left turn-left rear or left front turn signal filaments burned out, light bulb base not grounded or an open in the front or rear turn signal circuit.

   C. Flasher inoperative.

2. ONE PILOT LIGHT INOPERATIVE

   A. Pilot light filament burned out.

B. Poor connection or a defective printed circuit.

3. ALL TURN SIGNAL LIGHTS INOPERATIVE

A. Fuse blown (If new fuse burns out, check for short circuit).

B. Flasher inoperative.

C. Defective turn signal switch.

D. Open circuit in the wire from fuse block to flasher or in the wire from flasher to turn signal switch.

TURN SIGNAL SWITCH (EXCEPT TILT WHEEL)

The turn signal switch is an electrically operated self-contained unit. No adjustments are required on the turn signal switch. However, if any malfunctions should occur, the switching mechanism should be checked for defective parts. For switch removal, refer to STEERING, Section 8.

Tilt Wheel Adjustment (Fig. 13-84) All Series

1. Check to see that the turn signal lever is in the neutral position.

2. Place the loop of the control cable over the switch pin and install cable clamp bolt.

3. Position the switch on the column and secure with the two screws leaving a minimum amount of slack in the control cable.

4. Check operation of turn signal switch.

TEMPERATURE INDICATOR

The engine temperature indicator lights are controlled by a thermal switch in the right front of the intake manifold.

If the engine cooling system is not functioning properly, the thermal switch will close the circuit to the red light when the engine temperature reaches 253°F. ± 2°F. The thermal switch does not require servicing. If it is defective, it should be replaced. (Figs. 13-85 and 13-86)

OIL PRESSURE INDICATOR

The engine oil pressure indicator light is controlled by a pressure operated switch. When the engine is running, the light operates only when

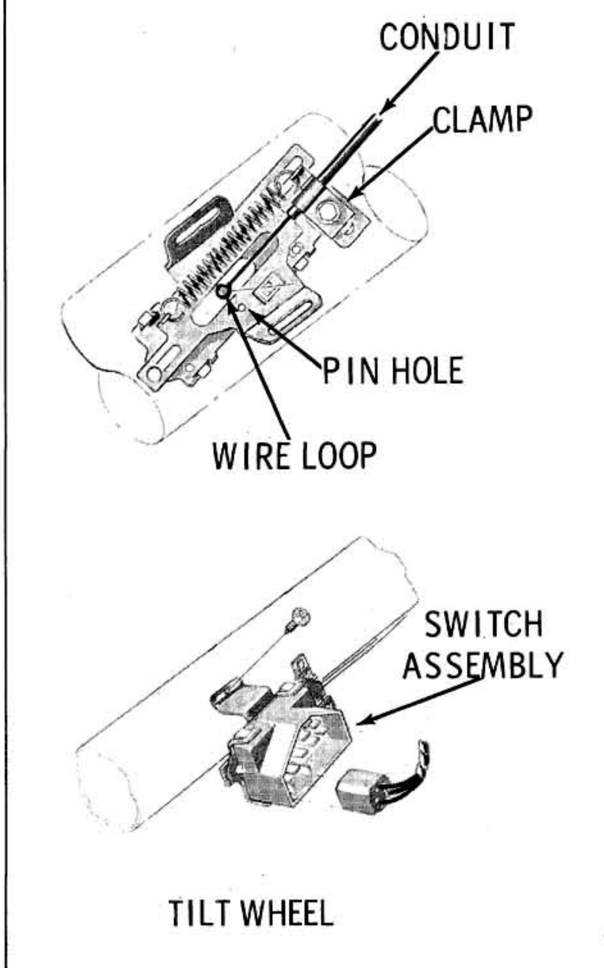


Fig. 13-84 Turn Signal Switch Adjustment (Tilt Wheel)

the oil pressure is not satisfactory. This light should come on when the ignition is turned on and the engine is not running. If the switch is defective it must be replaced. (Fig. 13-85 and 13-86)

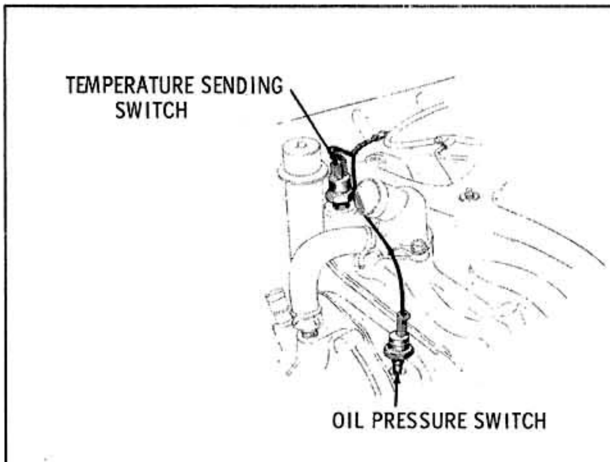


Fig. 13-85 Oil and Temperature Switches (V-8)

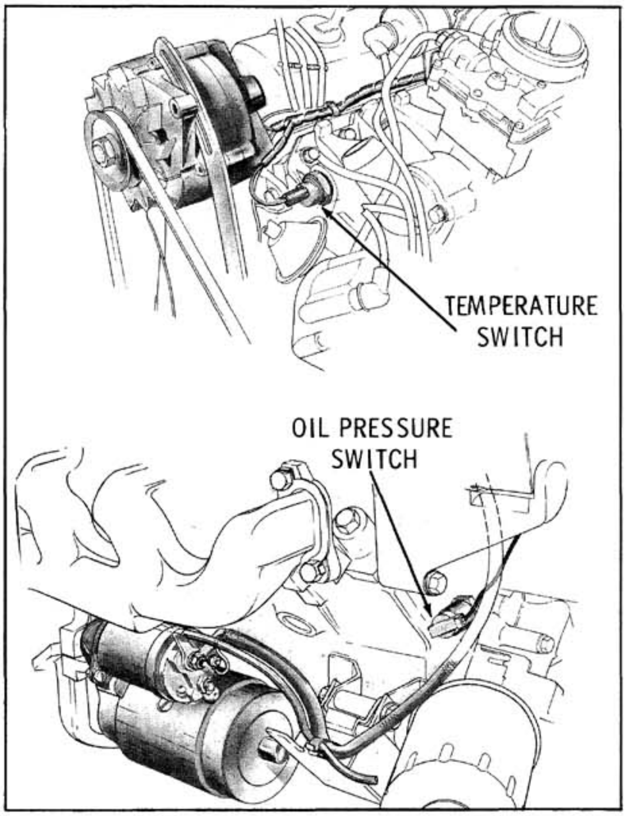


Fig. 13-86 Oil and Temperature Indicator Switches (V-6)

FUEL GAUGE

The fuel gauge circuit consists of an electrical indicator in the instrument panel and a float-controlled rheostat in the tank.

CHECKING FUEL GAUGE

Testing Fuel Gauge Circuit

IMPORTANT: Engine must be running when testing the fuel gauge to insure adequate operating voltage (14.5 volts) at the gauge.

When checking either at the trunk compartment or the instrument cluster, be sure that the correct sequence is followed to insure accurate readings. The checking procedure must be started with Tester BT-6508 on the "F" position, then moved to the "1/2" and "E" positions in that order. If checks are made in any other sequence, it will be necessary to stop the engine and restart it before taking each fuel gauge reading.

Fuel Gauge Check At Trunk Compartment

1. Set Tester BT-6508 on "F" position.

2. Disconnect the tank unit connector. Connect one lead of the tester to the tan wire from the instrument panel gauge and the other lead to ground.

3. Start the engine and run at idle. Gauge should read on the "F" graduation or above.

   NOTE: Most gauges will read above the "F" graduation.

4. Set the tester on "1/2" position. Gauge should read on the "1/2" graduation or 1/8" above or below the "1/2" graduation.

5. Set tester on "E" position. Gauge should read on "E" graduation or below. If gauge reads above "E" position, replace gauge.

If the gauge registers correctly during this test, the trouble is in the tank unit or the wire from the trunk compartment connector, to the tank unit. If the gauge registers full, regardless of the position of the tester, there is an open circuit in the wire from the instrument panel gauge to the trunk compartment connector.

When removing the tank unit for inspection, if it appears to be defective, check as follows:

1. Remove the fuel tank unit. Clean all dirt from around the tank unit terminal.

2. Connect an ohmmeter to the tank unit and check the resistance at top, bottom and mid-point of float arm travel.

3. Resistance at empty should be between 0 and .6 ohms. At mid-point, resistance should be 45 ohms plus or minus .1 ohm. At full, the resistance should be between 88 and 90 ohms. If ohmmeter check indicates that tank unit gauge reads within specifications, check for poor connections between tank gauge and body. Resistance between tank gauge and body should be less than .1 ohm.

4. If the tank unit is replaced, always check the new unit before installing it in the tank.

Fuel Gauge Check At Cluster

To determine whether the instrument panel gauge or wiring to the trunk compartment connector is at fault proceed as follows:

NOTE: With the printed circuit, it is not possible to disconnect the tank unit wire at the dash gauge. Disconnect tank unit in trunk. To check the dash gauge alone, disconnect the tank gauge in the trunk compartment.

1. Remove the plastic cap from the terminals of the dash gauge.

2. Connect one lead of tester to the left terminal of the gauge (as viewed from the rear of the instrument cluster) and the other lead to ground.

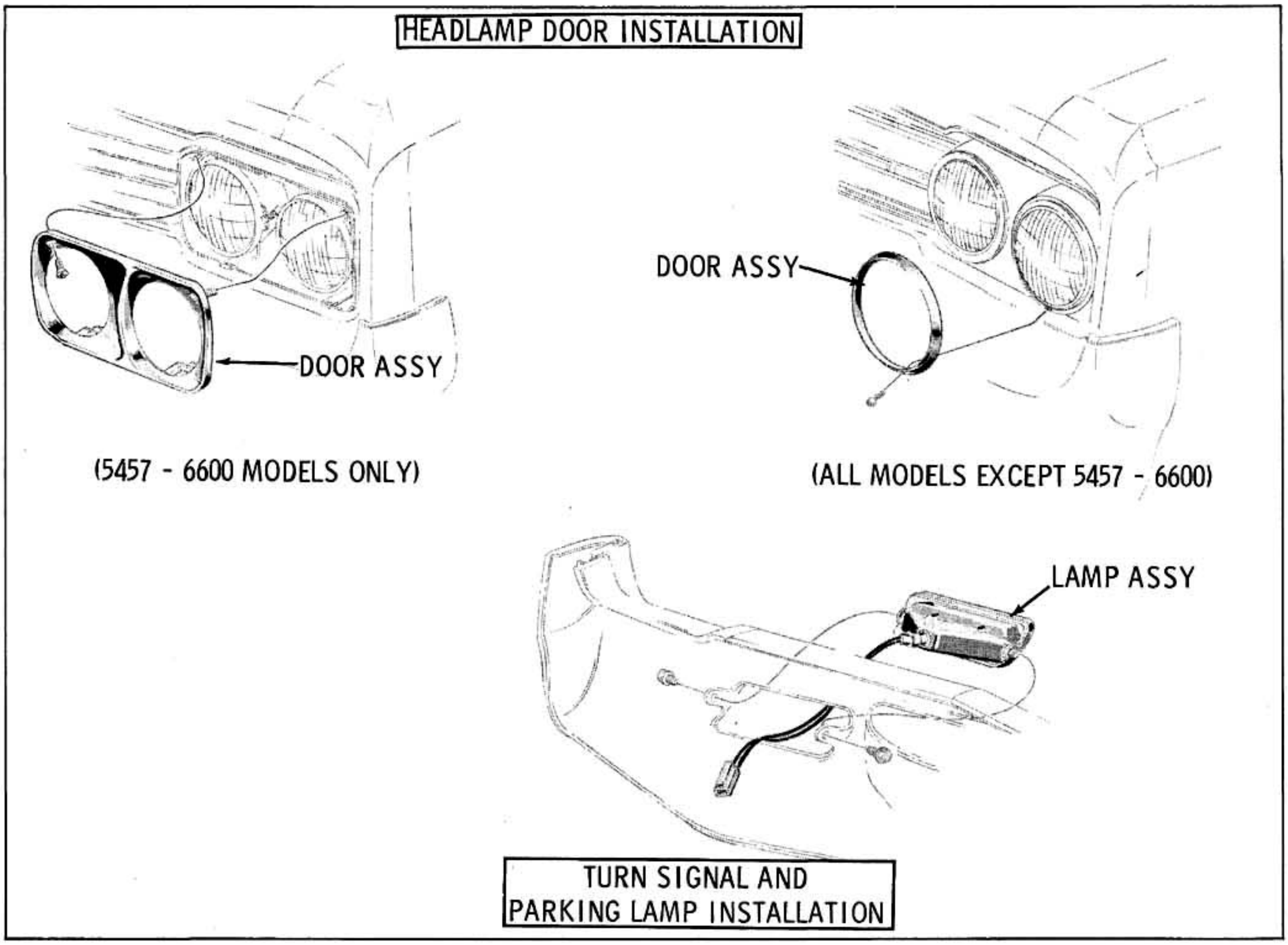


Fig. 13-87 Headlamps (52 through 86 Series)

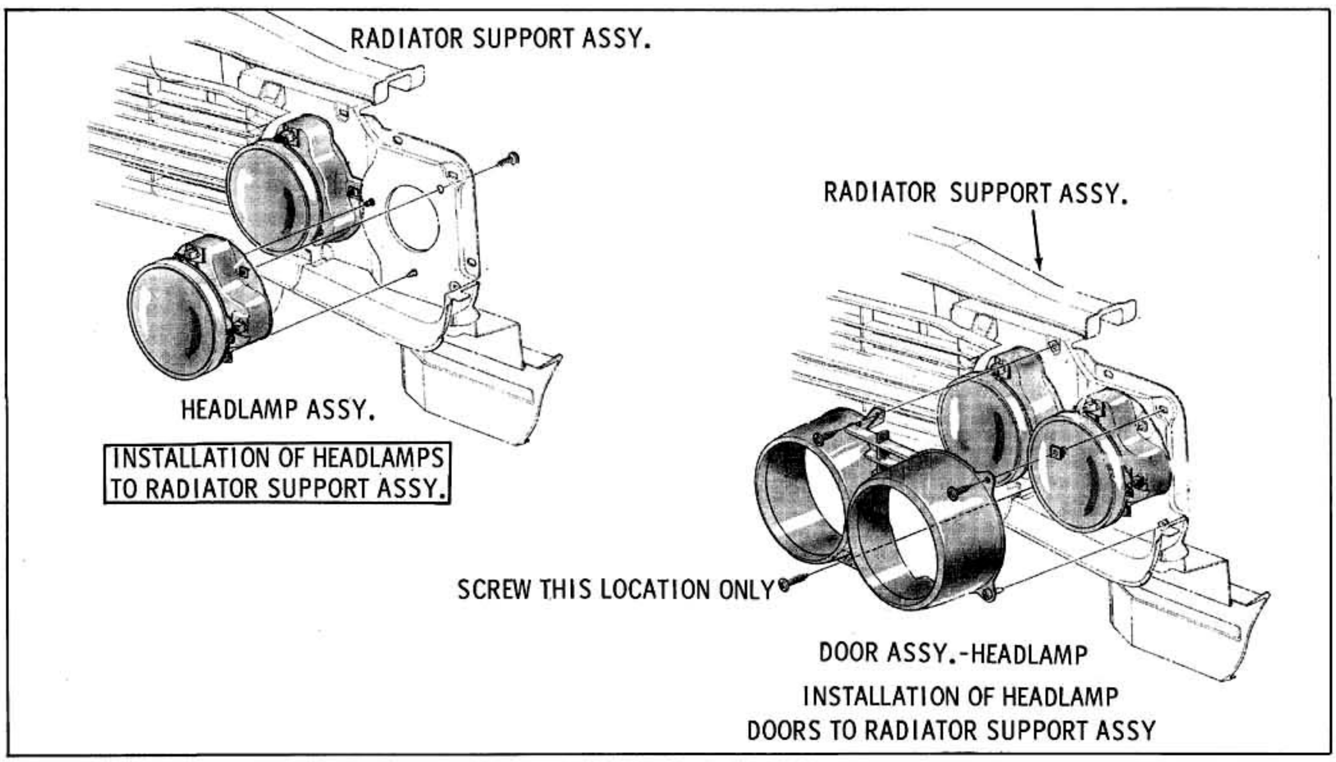


Fig. 13-88 Headlamps (33 through 38 Series)

3. Repeat Steps 3, 4 and 5 of Fuel Gauge Check At Trunk Compartment.

If the dash gauge does not register correctly, make a visual inspection of the printed circuit. Defects will show up in the form of blisters or breaks in the circuit. Shorts or breaks in the wiring can be isolated by making a continuity check of the wiring. If printed circuit is not defective, replace dash gauge. (Refer to the INSTRUMENT PANEL and ACCESSORY SECTION for gauge removal).

HEADLAMP

The dual headlight system consists of four headlights paired horizontally. Each pair of lights consists of a sealed beam unit (inner unit with No. 1 embossed on the lens) with one filament which provides an upper beam only, and a sealed beam unit (outer unit, with No. 2 embossed on the lens) with two filaments which provides both an upper and lower beam. The sub-body is also identified.

Since the No. 2 headlight lens is designed to provide maximum illumination on lower beam and the upper beam filament is not at the focal point of the No. 2 light, the major portion of the upper beam illumination is supplied by the No. 1 unit. Thus, the upper beam is supplied by all four headlights.

When the lower beam is desired, the No. 1 lights are turned off, the upper filament of the No. 2 lights are turned off and the lower filaments of the No. 2 lights are turned on.

SEALED BEAM UNIT

Remove and Install (Figs. 13-87 and 13-88)

1. Remove headlight rim.
2. Disengage the coil spring from the retaining ring, then pull the assembly out of the body and disconnect plug from rear of sealed beam unit.
3. Remove the two retaining ring attaching screws, then remove retaining ring and sealed beam unit and sub-body.

To install unit, reverse the removal procedure.

NOTE: The locating bosses on the back of the sealed beam units are designed so that the No. 1 and No. 2 units are not interchangeable.

HEADLIGHT AIMING

Aimers J-6663 meet the SAE specifications for mechanical headlight aimers.

1. Before proceeding with headlight aiming, the following items should be performed.
   a. Locate car on a known level surface or re-calibrate aimers for a selected unlevel area. (Refer to AIMING AREA)
   b. Check and equalize tires to recommended pressures.
   c. Car should not be loaded with passengers or have excess weight in rear compartment.
   d. Rock car sideways to stabilize springs.
   e. Turn on headlights, replace any units burned out.
2. Remove all the headlight rims.
3. Mount Aimers J-6663 on either the two outer or two inner headlights so that the cross arm of each aimer is horizontal and pointing inward.

   IMPORTANT: Guide points on sealed beam unit must contact inner ring of aimer.
4. Fasten string to RH aimer. Rotate aimers until string just clears "F" and "G". (Fig. 13-89)
5. Horizontal Aim.
   a. Loosen horizontal adjusting screw "A" of RH headlight and tighten until string is positioned directly over the center line of the RH aiming dial and point "G".
   b. Repeat adjustment on horizontal screw "A" of LH headlight until string is positioned directly over center line of the LH aiming dial at point "F".
   c. Recheck points "F" and "G" and readjust if necessary.
6. Vertical Aim.
   a. Loosen knob "O" on both aimers and move slide until numeral "2" appears in "down" view window. Tighten knobs. (Fig. 13-90)
   b. Loosen vertical adjusting screws "B" and tighten until bubbles are centered in level.
   c. Recheck horizontal string alignment at points "F" and "G" and readjust horizontal aim if necessary.
7. Remove aimers and repeat Steps 3 through 6 on other set of headlight units.
8. After headlight aiming is completed, install the headlight rims.

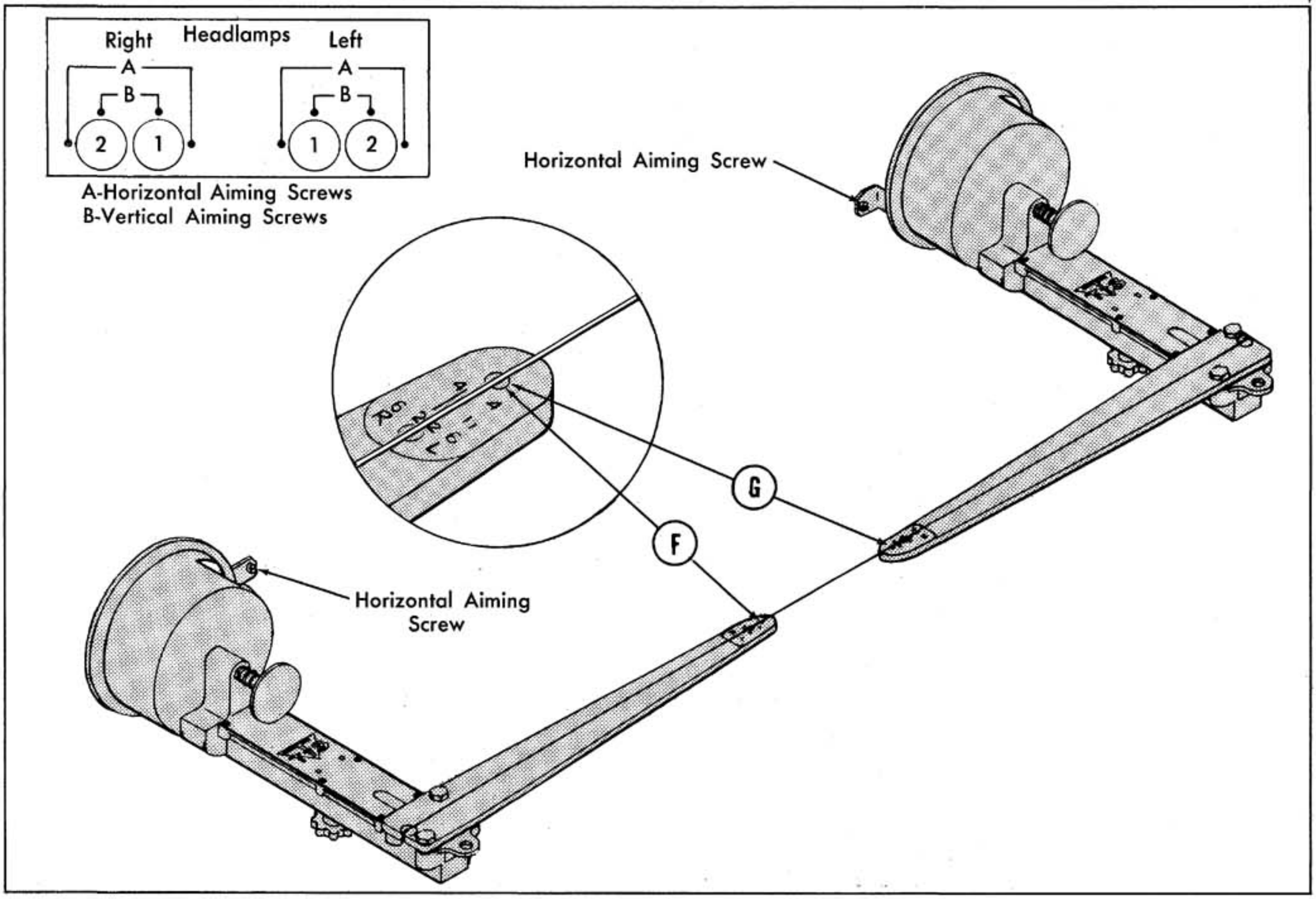


Fig. 13-89 Horizontal Aim

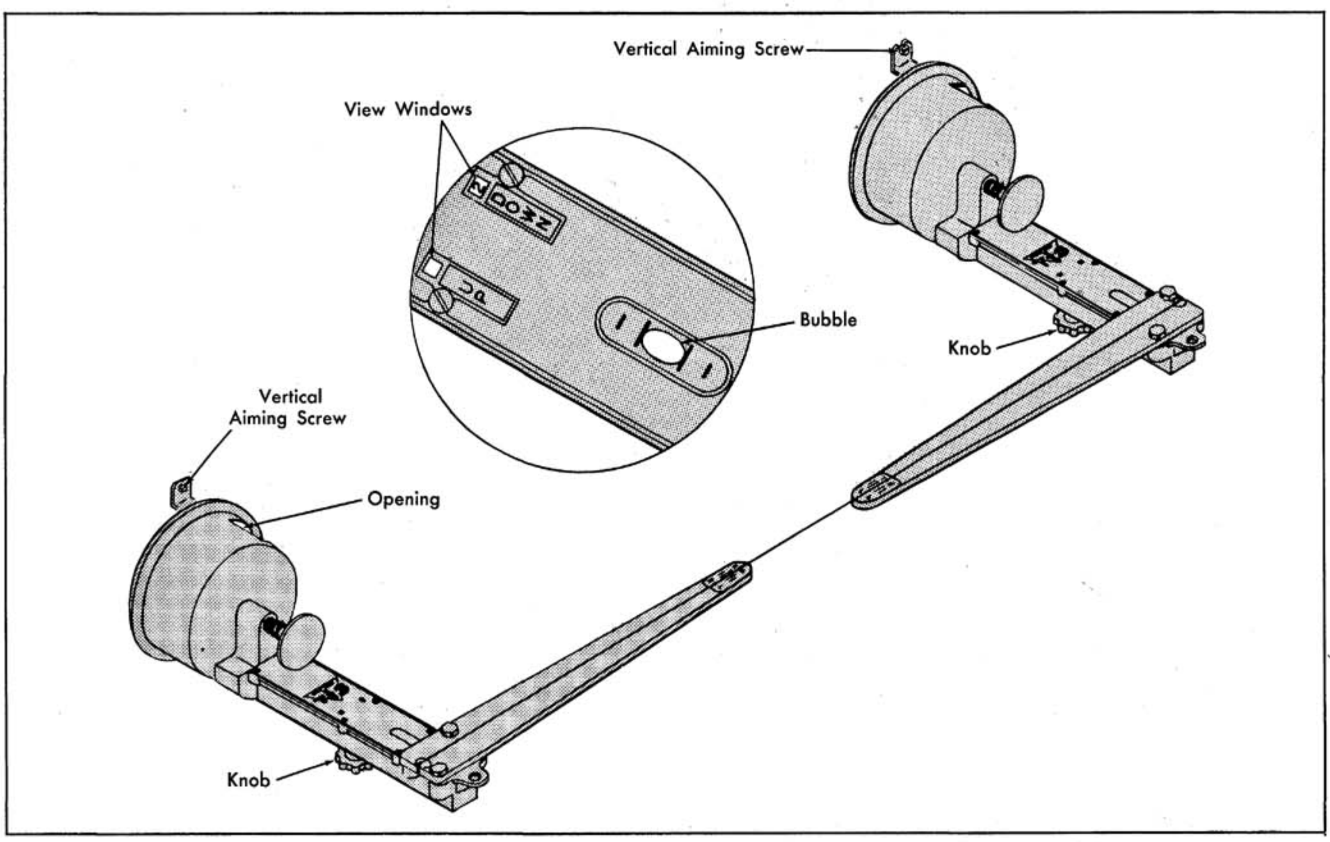


Fig. 13-90 Vertical Aim

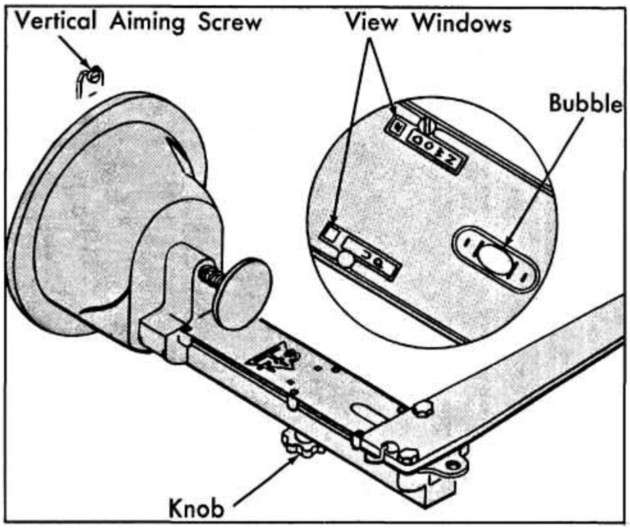


Fig. 13-91 Vertical Alignment

AIMING AREA

In order to obtain accurate headlight aim, the car must be either located on a known level surface, or the Aimers J-6663 must be calibrated to compensate for an unlevel surface.

Select an area which appears to be level. Drive car into that area and install aimers on either the two outer or the two inner lights so that both cross arms point toward the center of the car. Loosen knob on bottom of aimer and move slider until numeral 2 appears in "down" view window. (Fig. 13-91) Turn headlight vertical aiming screws to center the level bubbles. Mark the wheel positions on the floor, then turn car end for end making sure that all four wheels are positioned within the marks located on the floor. If the bubbles are still centered, (Fig. 13-92) the aiming area is level and the Aimers J-6663 can be used without further adjustments with the car in this area and position.

If the bubbles are not centered after turning

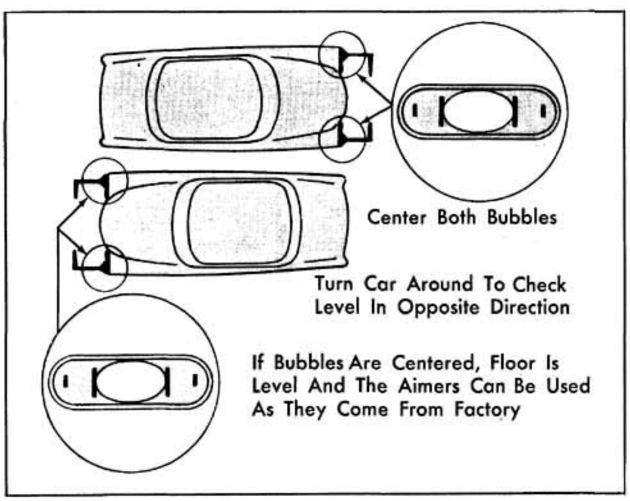


Fig. 13-92 Selection of Aiming Area

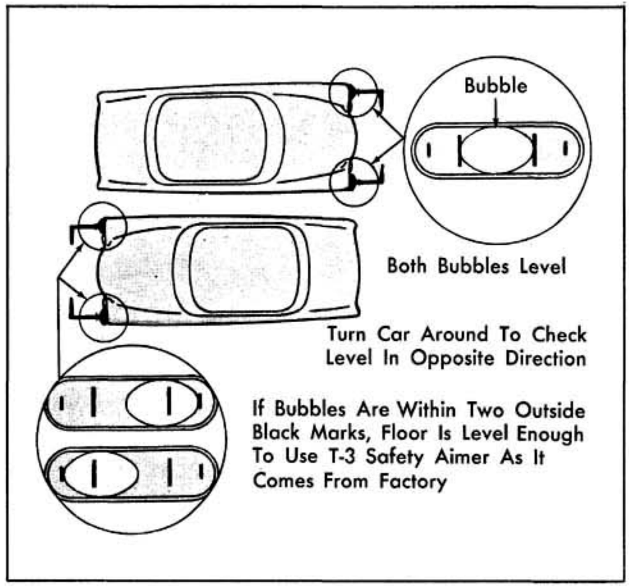


Fig. 13-93 Floor Level Limits

car end for end, (Fig. 13-93) the aimers must be recalibrated as follows:

1. Loosen knob on bottom of aimer and move slider until bubble is centered. Record numeral that now appears in the view window.
2. Move slider to a position half-way between the recorded number in Step 1 and the numeral 2 in the "down" view window.
3. Without moving the car, recalibrate aimers by turning the adjusting screw until bubble is centered. (Fig. 13-94)

The aimer is now calibrated for this specific area. Tire locations should be permanently marked so that all future headlight adjustments

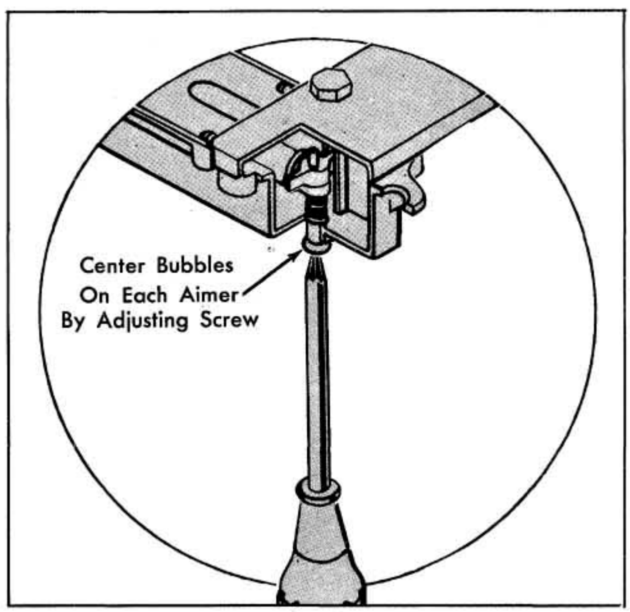


Fig. 13-94 Adjusting Aimer

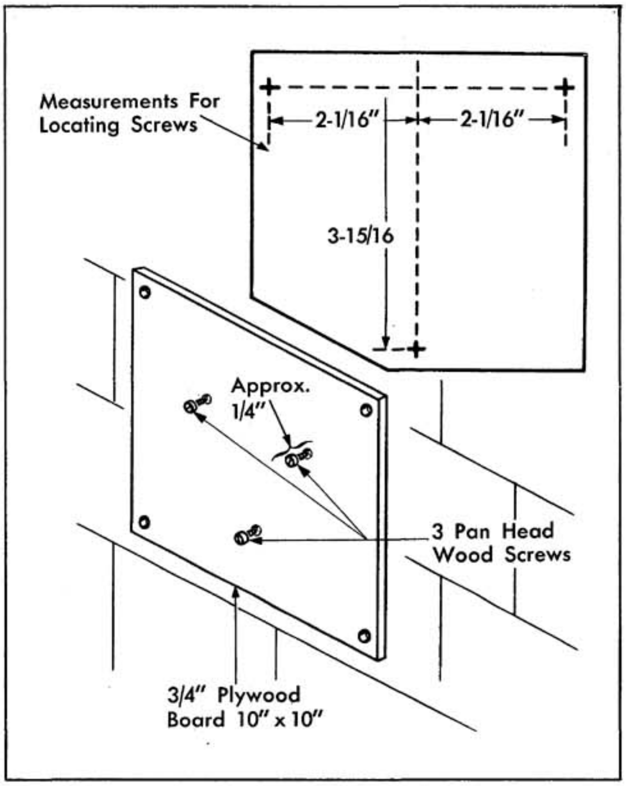


Fig. 13-95 Aiming Fixture

are performed with the car facing in the same direction and tires located in the same position.

AIMING FIXTURE

An easily constructed checking fixture can be made to correct aimer alignment according to original manufacturers specifications, after the aimers have been dropped or damaged. Since the manufactures calibration is required in making this fixture, care must be taken to use only an aimer that is known to be properly aligned.

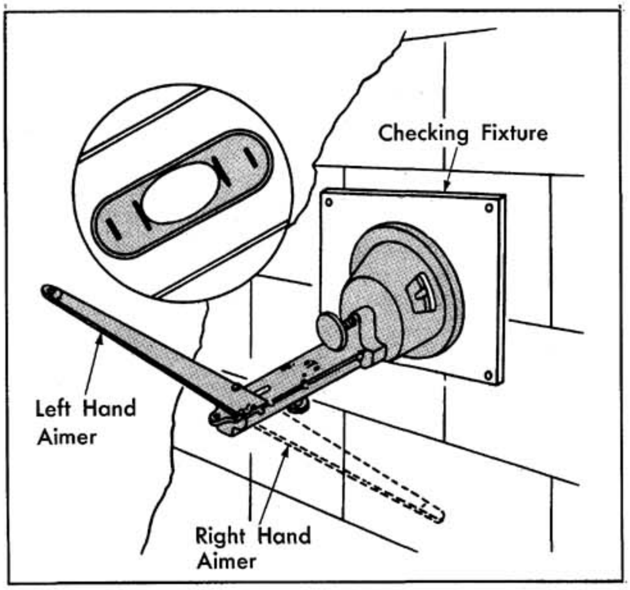


Fig. 13-96 Checking Vertical Calibration

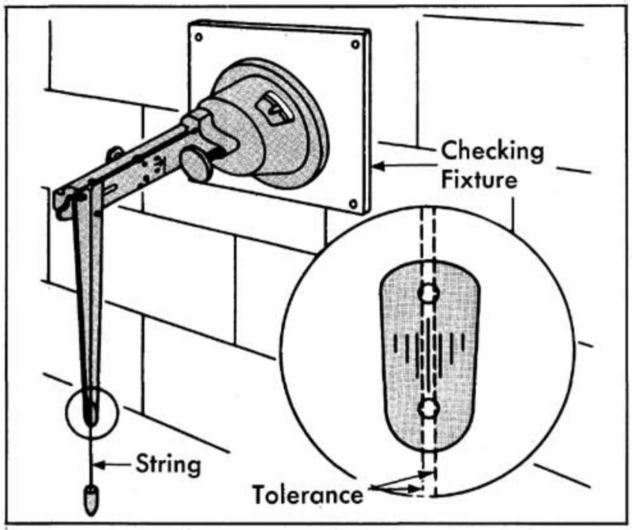


Fig. 13-97 Checking Horizontal Calibration

1. Mount a 10" x 10" square of 3/4" plywood in a vertical position on a wall.

2. Install three 1/2" No. 6 pan head wood screws on the board as shown in Fig. 13-95. The screw heads should be approximately 3/4" from board.

3. Place the aimer against the screws with the horizontal arm parallel to the floor and the numeral 2 in the "down" view window. Be certain the screw heads provide adequate clearance between the flange of the aimer and the board.

4. Adjust the three screws until the bubble in the aimer is centered. Screws should be left in this position.

5. After the checking fixture has been constructed and adjusted as outlined above, any aimer can be quickly and easily checked periodically and especially if it should be dropped or damaged in any way.

AIMER CALIBRATION

When an aimer has been dropped or damaged, the alignment should be checked as follows:

1. With the numeral 2 in the "down" window of the aimer, hold the aimer retaining ring against the three screws in the checking fixture and with the horizontal arm parallel to the floor as shown in Fig. 13-96. If the bubble is centered, the aimer is vertically calibrated.

2. If the bubble is not centered, adjust the screw on the bottom of the aimer, Fig. 13-94, until the bubble is centered. The aimer is now calibrated vertically.

3. The horizontal check of the aimer is made by

placing the aimer on the board as in the vertical check, except that the horizontal arm is pointing toward the floor as shown in Fig. 13-97. With a small weight or plumb bob on one end of a three-foot string, connect the opposite end of the string to the slot in the aimer arm. The string should fall as shown, inset, Fig. 13-97. If it falls outside the tolerances shown, the aimer should be replaced.

TAIL LAMPS

The tail light bulb is a double element bulb which acts as a stop light, tail light and turn signal light.

The tail light bulb on all models, except station wagons can be replaced from within the rear compartment by removing the socket from the tail light housing.

On station wagons it is necessary to remove the tail lamp lens to gain access to the bulb. When installing the socket, align the tang of the socket with the slot in the housing and push until socket snaps into place.

To remove the tail lamp housing assembly on 84 and 86 Series, install an extra nut on each mounting stud. Lock the nuts together and remove the studs from the housing. This allows the housing to be pulled straight upward without disconnecting the bumper. To remove the housing on 66 Series it will be necessary to loosen the rear bumper.

BACK-UP LAMP SWITCH
(REFER TO INSTRUMENT PANEL AND ACCESSORIES)

HEADLAMP SWITCH

The headlamp switch controls the headlamps, parking lamps, tail lamps, and instrument panel lamps. The dome lamps are actuated by turning the headlamp switch fully counterclockwise. These circuits are protected by a circuit breaker incorporated in the headlamp switch. In addition, the tail lamps and instrument panel lamps are protected by fuses located in the fuse block. The brightness of the instrument panel lamps is adjustable by means of a rheostat built into the headlamp switch. Turning the knob of the switch operates the rheostat.

The lamp switch used on cars with Guide-Matic has a separate ON-OFF switch for Guide-Matic actuation, and also incorporates a 4-amp fuse to protect the circuit.

HEADLAMP CIRCUIT BREAKER

The normal lighting load is not sufficient to cause the circuit breaker (located on the headlamp switch) to open. If a short occurs, the circuit breaker will cause the lights to flicker. This flickering will continue until the cause of the short is corrected. The circuit breaker is not adjustable.

DIMMER SWITCH

The foot dimmer switch is used to select high or low beam of the headlights as desired. Cars equipped with Guide-Matic have a combination override and dimmer switch. The override position of the switch is obtained by depressing the switch half-way, and is used to signal oncoming cars by switching momentarily to upper beam. The headlights return to automatic operation when the switch is released. The foot dimmer switch must be in the upper beam position before the Guide-Matic will operate.

NEUTRAL SAFETY SWITCH

A neutral safety switch, mounted on the steering column, or inside the console is employed as a safety factor on cars equipped with automatic transmission. The switch prevents starting of the engine with the transmission in gear. The engine may be started with the selector lever in "Neutral" or "Park" position.

CHECKING

1. Apply parking brake firmly.
2. Position selector lever into "D" range and turn ignition switch to "Start".
3. While holding ignition switch on "Start", slowly move selector lever toward "N" position until engine cranks and starts.
4. Without moving the selector lever after engine starts, depress accelerator pedal slightly to determine whether or not transmission is in gear. If neutral safety switch is properly adjusted, transmission will not be in gear.

   NOTE: If equipped with back-up lights, the lights should operate with the ignition on and the selector lever in reverse.

ADJUSTMENT

1. If equipped with console, remove the console.
2. Loosen the switch attaching screws.
3. With the ignition OFF, position the selector lever in "D".
4. Align the slot in the contact support with the

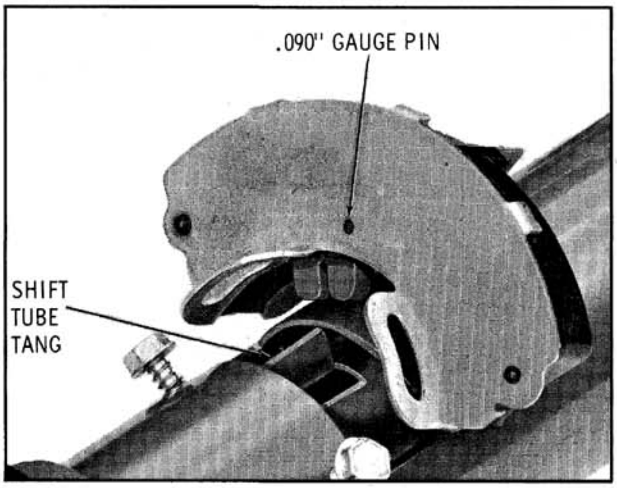


Fig. 13-98 Neutral Safety Switch (Column Shift)

hole in the bracket and insert a .090" pin. (Fig. 13-98 and 13-99)

5. Position the contact support drive slot over the shifter tube drive tang and tighten mounting screws.

6. Recheck adjustment.

ELECTRICAL CIRCUIT DIAGNOSIS PROCEDURE

CAUTION: The fuel tank gauge unit can be partially or completely damaged by a momentary surge of 12 volt current across the resistance coil in the tank gauge. To prevent damaging the tank unit resistance coil, it is recommended that the tank wires be disconnected before any electrical tests or repairs are made in the wiring harness. The above precaution should also be exercised whenever the chassis to body wiring connector plug has to be disconnected.

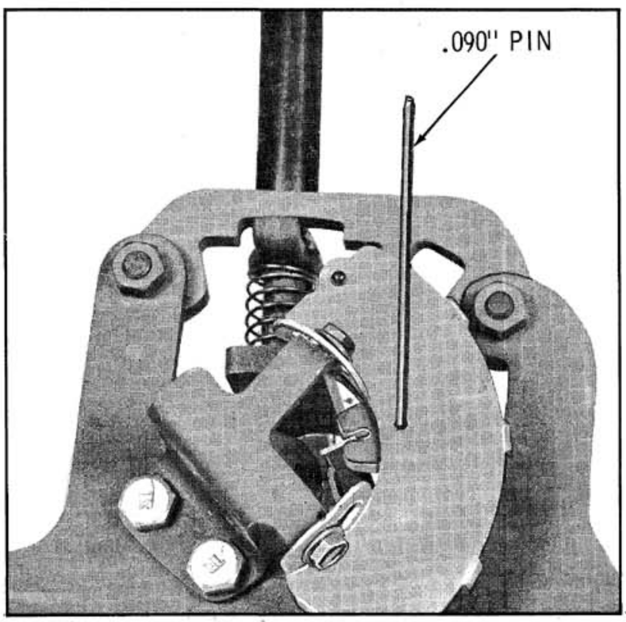


Fig. 13-99 Neutral Safety Switch (Floor Shift)

Failures in a circuit are usually caused by short or open circuits. Open circuits are usually caused by breaks in the wiring, faulty connections or mechanical failure in a component such as a switch or circuit breaker. Short circuits are usually caused by wires from different components of the circuit contacting one another or by a wire or component grounding to the metal of the body due to a screw driven through the wire, insulation cut through by a sharp metal edge, etc.

If a failure is encountered in one of the body circuits, the circuit diagrams should be thoroughly reviewed to become familiar with the circuit before performing an intensive checking procedure to determine the cause and location of the failure. The body circuit diagrams are located in the BODY SECTION. The following information may aid in locating and correcting a failure in the body wiring electrical system.

1. If a major portion of the electrical circuit becomes inoperative simultaneously, the failure may be due to improper connections between the front and rear harness, or between the front harness and the chassis wiring connector.

2. If only one of the circuits is inoperative, the failure is due to an open circuit or short in the affected circuit. Short circuits usually result in blown fuses or in the case of power equipment circuits, in the circuit breaker opening the circuit. If the fuse is not blown and the circuit affected is a lamp circuit, check the bulb before proceeding with any checking procedures.

3. The dome lamp and courtesy lamp circuits are designed so that the switches are in the "ground" side of the circuit. If a condition is encountered where the lamps remain "on" even though the jamb of courtesy lamp switches are not actuated, the failure is probably due to defective switches, or to the wire leading to the switches being grounded to the metal body.

TESTING WITH BT 11-20

If the preliminary checks have not located the cause of failure, Tester BT 11-20 can be used to isolate the defective circuit without the unnecessary removal of trim or hardware.

TESTING FOR SHORT CIRCUIT

CAUTION: If the turn signal fuse is blown, remove the flasher and install a jumper wire in its place before connecting test leads. Do not use BT 11-20 in the clock, radio or fuel gauge circuits.

1. Move detector switch to TEST.
2. Remove blown fuse and connect a test lead to each fuse clip. Move detector switch to SHORT.
3. Turn on all switches in the blown fuse circuit.
4. Observe each unit or light in shorted circuit. Units or lights that operate momentarily (when tester light is out) are not shorted.
5. Position meter over the shorted circuit, at the fuse block, with the base of the meter or arrows directly above the wiring. The meter needle will deflect AWAY from the direction of the short each time the tester completes the circuit. Note the amount of needle deflection.
6. Move meter progressively from the fuse block toward the unit that is not operating. The location of the short will be indicated by a reduction in needle deflection. If the needle ceases to deflect, the short circuit has been passed, the wrong circuit has been followed or the meter is not above the circuit.
7. After the short is located and repaired, remove the test leads and replace the fuse.

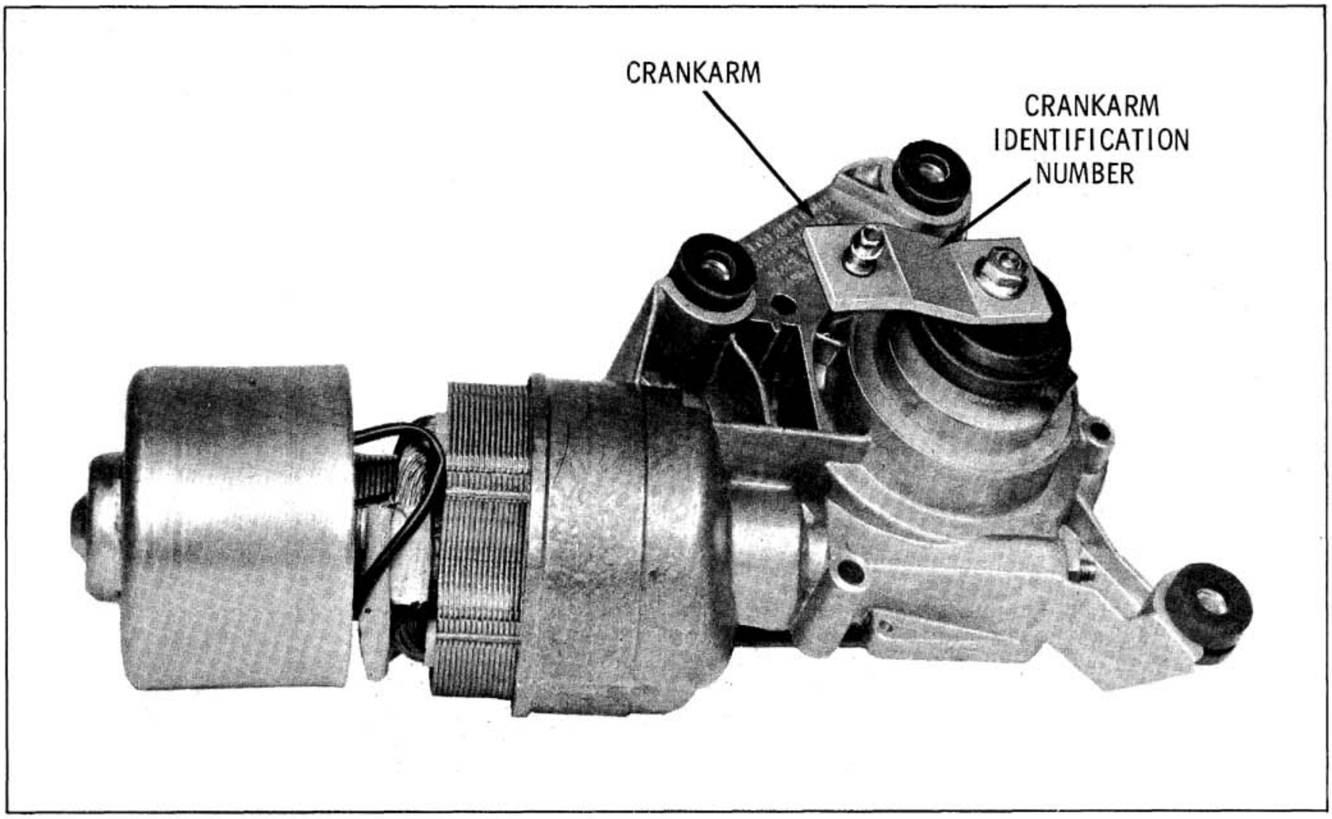


Fig. 13-100 Two-Speed Windshield Wiper Motor

WINDSHIELD WIPER SYSTEM

DESCRIPTION

33, 34, 35, 36 and 3800 Series - A single-speed, rectangular-shaped motor without windshield washers is standard equipment. A two-speed round-shaped motor equipped with windshield washer is optional. A washer pump accessory package is available for single-speed motors not equipped with a washer system. Both the single and two-speed motors have tandem wiping action using 15" blades.

52, 54, 56, 58, 66, 84, and 8600 Series - A single-speed, rectangular-shaped motor without windshield washers is standard equipment on the 52, 56 and 5800 series. The 54, 66, 84 and 8600 series are equipped with a two-speed, round-shaped motor with windshield washers as standard equipment. The two-speed round motor is optional on the 52, 56 and 5800 series. Both the single and two-speed motors have the overlap wiping action using 15" blades on the single-speed and 18" blades on all two-speed systems. A washer accessory package is available for the single-speed wiper motor not equipped with the washer system.

The single-speed, rectangular-shaped motor used on the 33, 34, 35, 36 and 3800 series and the single-speed, rectangular-shaped motor used on the 52, 56 and 5800 series are nearly physically the same except that the motor used on the 52, 56 and 5800 series incorporates a circuit breaker and a rectangular-shaped gear case while the gear case used on the 33, 34, 35, 36 and 3800 series is round. The diagnosis, servicing and operation of the motors is the same.

The optional two-speed, round-shaped motor

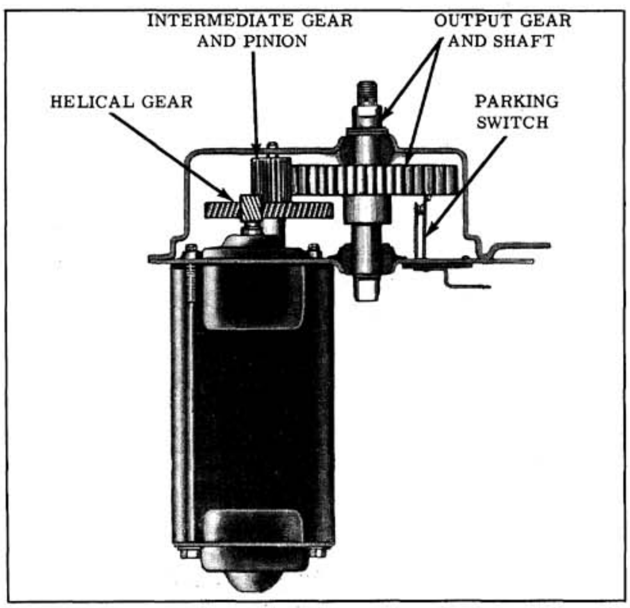


Fig. 13-150 Gear Train-Single Speed

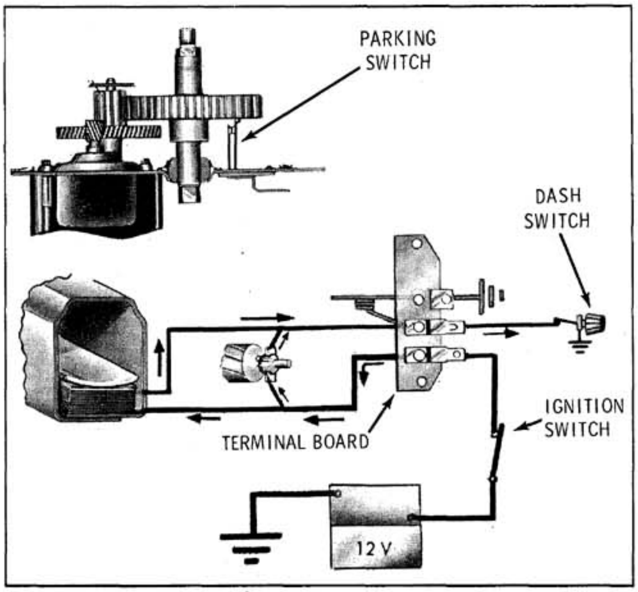


Fig. 13-151 "On" Position

used on the 33, 34, 35, 36 and 3800 series and the two-speed, round motor used on the 54, 66, 84 and 8600 series are essentially the same except for size and capacity of the motor. The diagnosis, servicing and operation of the motors is the same.

SINGLE-SPEED

DESCRIPTION

The single-speed system consists of a shunt wound rectangular-shaped motor attached to a gear box containing a parking switch in addition to the gear train. The gear train consists of a motor armature helical gearshaft which drives an

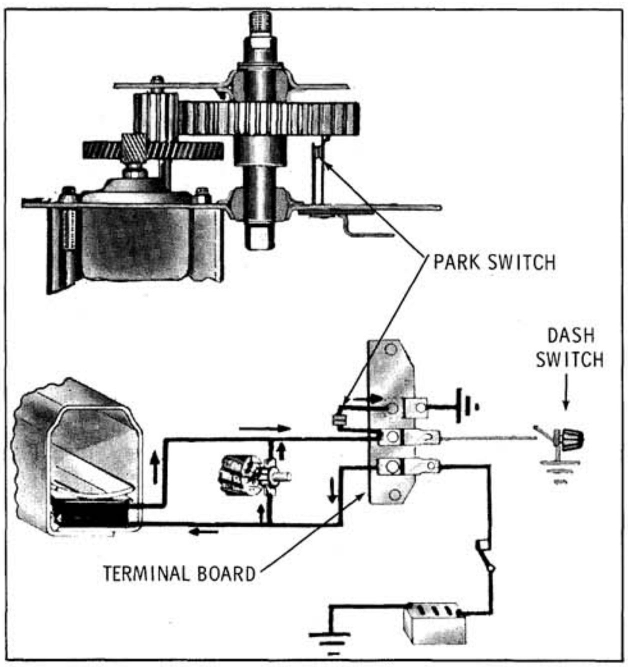


Fig. 13-152 "Off" Position

intermediate gear and pinion assembly. The pinion gear of the intermediate gear and pinion drives an output gear and shaft assembly. (Fig. 13-150)

OPERATION (IGNITION SWITCH ON)

With the wiper switch turned on at the dash switch, the motor circuit is completed to ground at the dash. As long as the dash switch is in the ON position, the parking switch has no effect on the wiper operation. (Fig. 13-151)

Turning the dash switch off, opens the wiper motor ground circuit. However, if the wiper blades and/or crankarm are in any position other than the park position (park position of blades is 1 - 1-1/2" above lower windshield molding), the wiper motor circuit is still completed to ground through the park switch. This allows the wiper to continue running until the blades reach the park position. When the park position is reached, a cam on the output gear opens the park switch contacts and the wiper is off. (Fig. 13-152)

DIAGNOSIS (WIPER ON CAR)

1. Visually and/or mechanically inspect the following items:
   a. Wiring harness is securely connected to wiper and dash switch.
   b. Wiper motor ground strap is securely connected to car chassis.
   c. Dash switch is securely mounted.
   d. Check fuse.
2. If items in Step 1 check out, try operating wiper, then turn wiper off. Blades should return to park position. If wiper fails to operate correctly, proceed to Step 3.
3. Disconnect wiring harness from wiper and try operating wiper as shown in Fig. 13-153.
   a. If wiper operates correctly independently of dash switch and car wiring, refer to DIAGNOSIS CHART - WIPER ON CAR.
   b. If wiper still fails to operate correctly in Step 3, remove body parts as required to disconnect wiper linkage from wiper crankarm and try operating wiper again. If wiper operates correctly independently of linkage, check linkage for cause of wiper malfunction.
   c. If wiper fails to operate correctly independently of linkage, remove wiper from car and refer to DIAGNOSIS CHART - WIPER OFF CAR.

DIAGNOSIS CHART—WIPER ON CAR

If wiper operated correctly independently of car wiring and dash switch, but original trouble was:	Possible Cause of Trouble (Terminal Numbers shown on Fig. 13-153)
Wiper inoperative	Check for 12 volts at wiper terminal No. 2. If no voltage reading is obtained, recheck for blown fuse and check for broken feed wire to wiper terminal No. 2. Loose dash switch mounting or defective dash switch. Wire from wiper terminal No. 1 to dash switch broken.
Wiper will not shut off.	Wire between wiper terminal No. 1 and dash switch grounded. Dash switch defective.
Intermittent and/or erratic operation.	Check for loose dash switch mounting. Loose wiring connections at wiper or dash switch.
Blades do not return to park position when wiper is turned off.	Recheck for loose wiper motor ground strap.

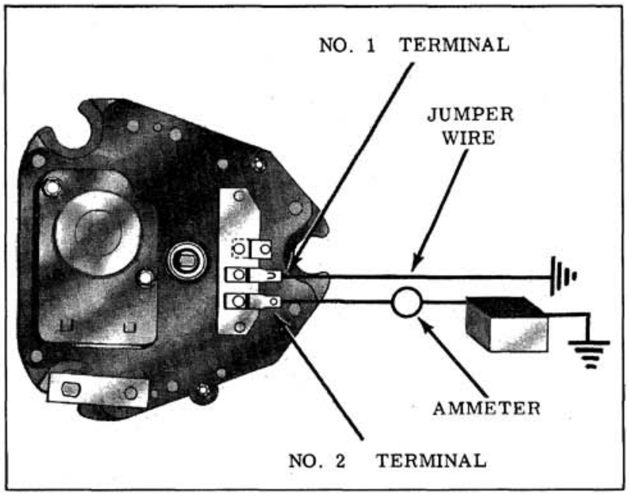


Fig. 13-153 Terminal Board Connections

WIPER MOTOR

Removal

1. Disconnect wiring terminals.

2. If equipped with washers, disconnect hoses.

3. On 33, 34, 35, 36 and 3800 series, depending upon other optional equipment, it may not be necessary to remove the cowl vent grille to gain access to remove the transmission to crankarm retainer. (Fig. 13-154)

4. On 52, 54, 56, 58, 66, 84 and 8600 series, an access hole is provided in the upper cowl area. Remove the hole cover and loosen. Do not remove the two transmission to crankarm attaching nuts until the arm drops off the crankarm. (Fig. 13-155)

5. Remove the three wiper mounting screws and remove the assembly.

Installation

1. Position wiper assembly to the dash and install the three mounting screws. Tighten the screws until the sleeves surrounding the screws bottom, to prevent motor floating.

2. Connect wiper motor and washer wiring.

3. Turn dash switch to ON and operate wipers through several cycles.

4. Turn dash switch to OFF.

5. Connect transmission to wiper crankarm.

6. Install cowl vent grille or access hole cover.

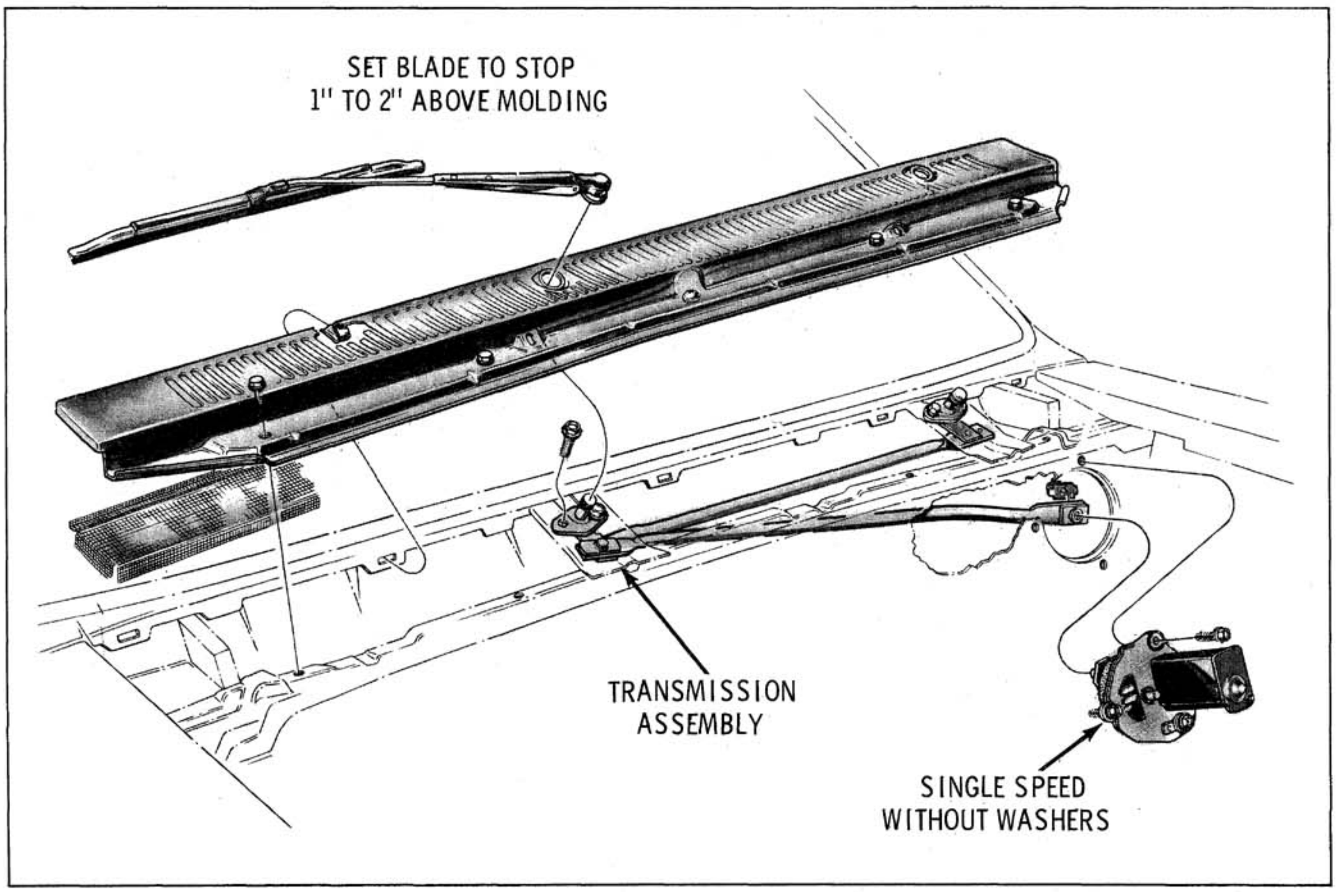


Fig. 13-154 Wiper Mounting (33 thru 3800 Series)

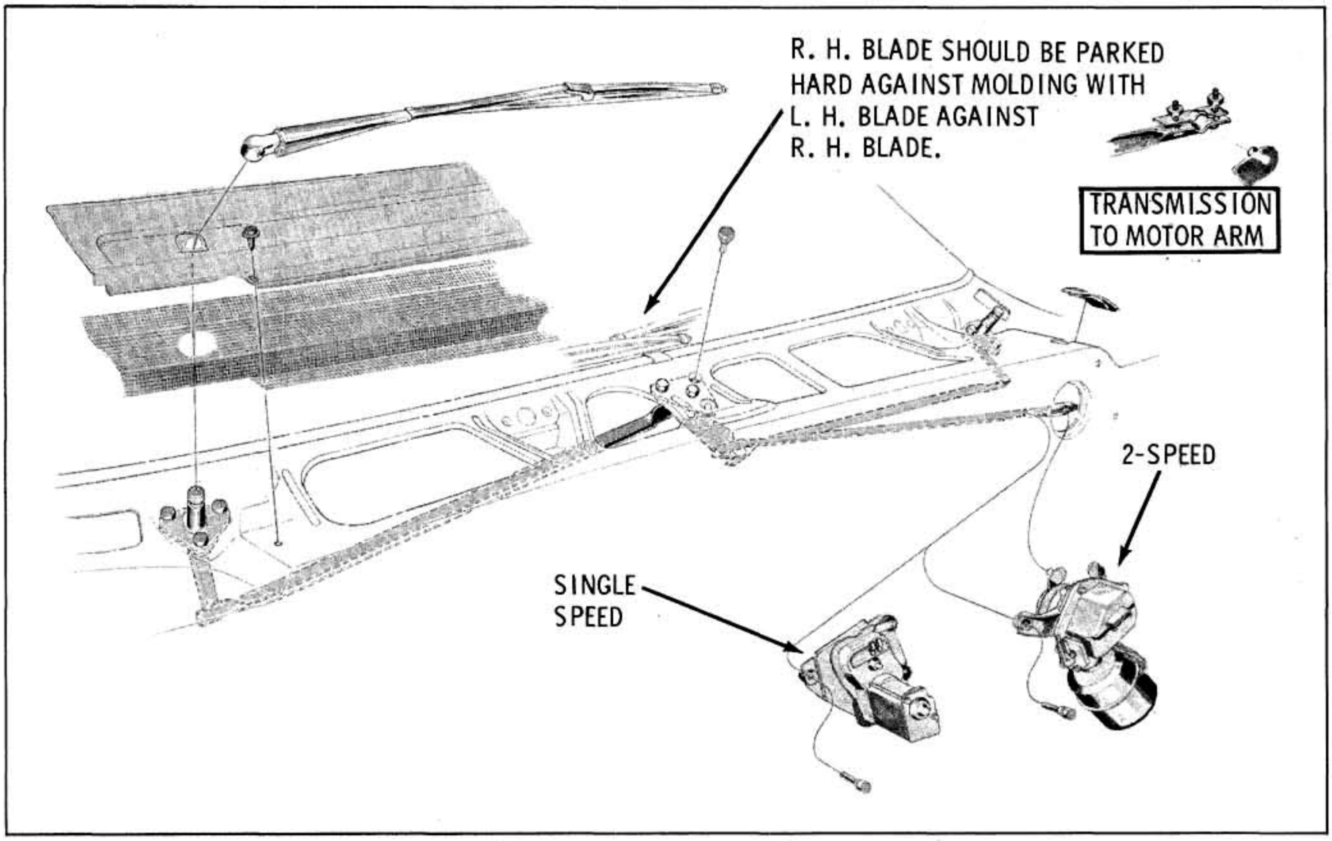


Fig. 13-155 Wiper Mounting (52 thru 8600 Series)

NOTE: If crankarm has been removed from the motor, it should be checked for correct position. (Fig. 13-157) When crankarm is correctly positioned to the motor and the motor is in Park position, the end of the crankarm will point outboard.

WIPER CONTROL, WIRING AND TRANSMISSION ASSEMBLY REFER TO (Fig. 13-156)

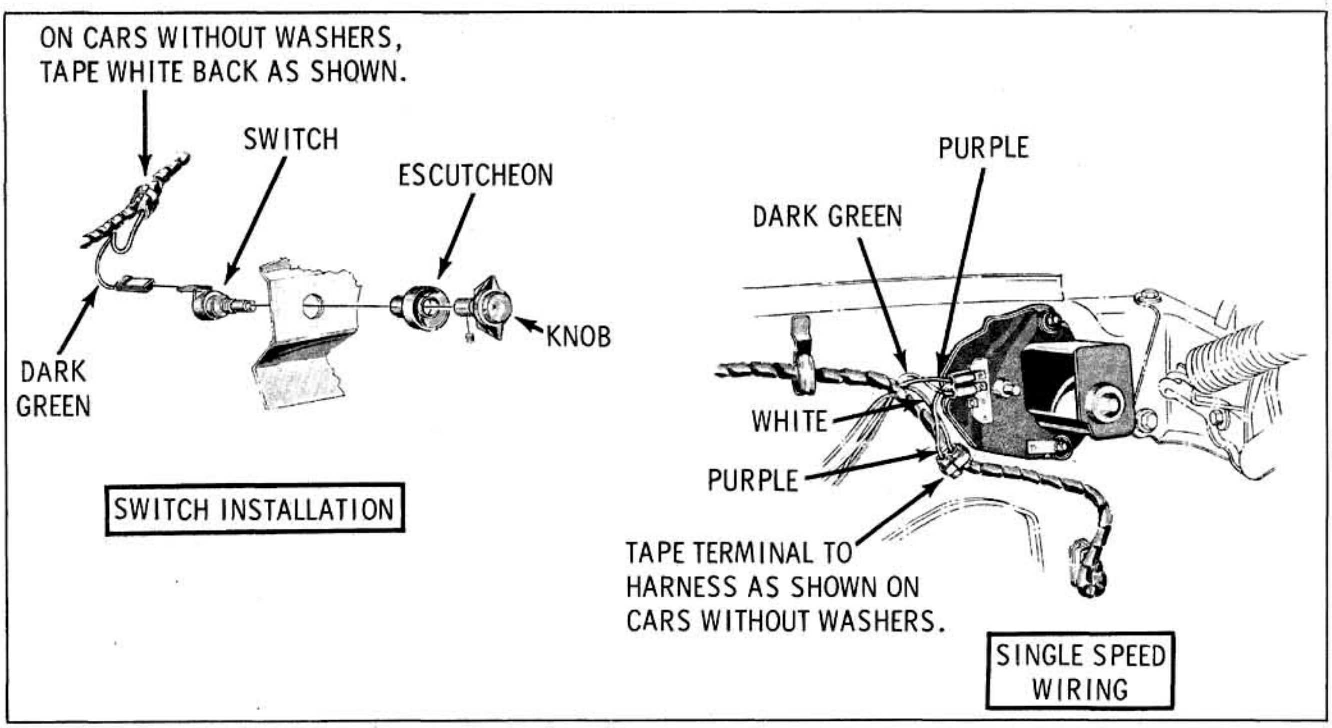


Fig. 13-156 Typical Single Speed

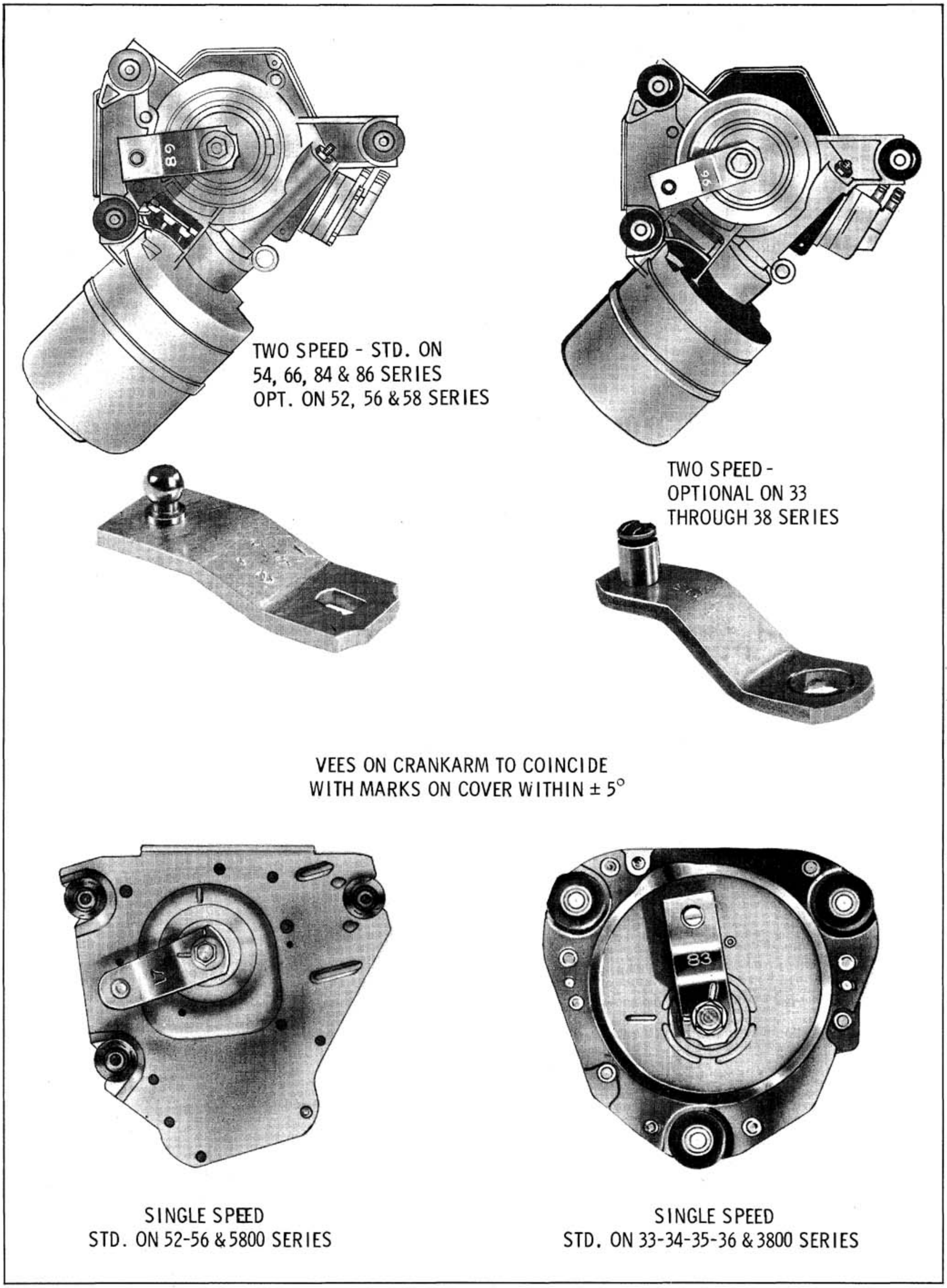
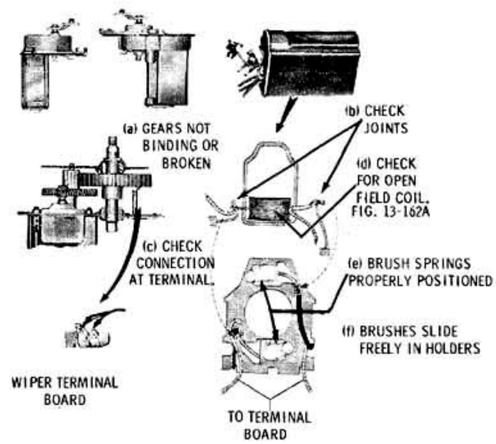
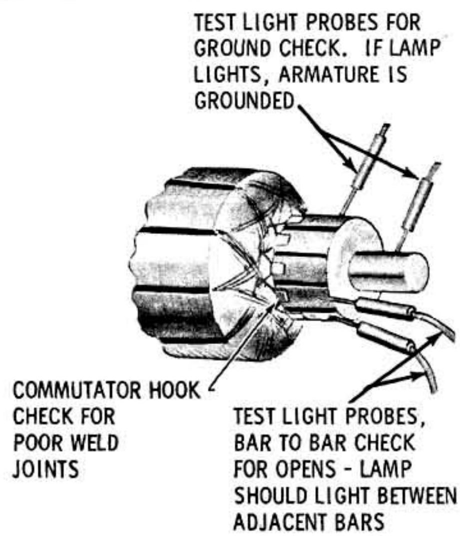
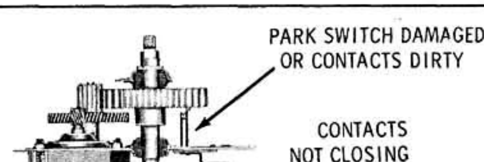
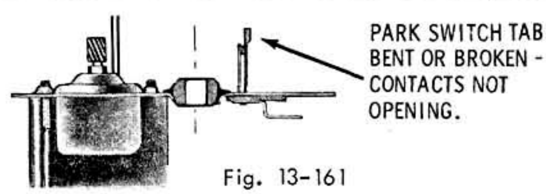


Fig. 13-157 Park Position

DIAGNOSIS CHART—WIPER OFF CAR

Before using chart, the wiper should be operated as shown in Fig. 13-162. Use an ammeter capable of reading at least 30 amperes in the feed wire circuit and observe current draw.

Type of Trouble	Possible Cause of Trouble
Wiper Inoperative a. Current Draw - 0 amps. Check items b, c b. Current Draw - 1.5 - 2.0 amps. Check items b, e, f c. Current Draw - 10 - 12 amps. Check items a, b, d	 Fig. 13-158
Wiper runs slow, vibrates, current draw 7 - 9 amps. Check Armature.	 Fig. 13-159
Wiper doesn't stop in park position. Stops immediately when jumper wire is disconnected. (Fig. 13-162)	 Fig. 13-160
Wiper will not shut off.	 Fig. 13-161

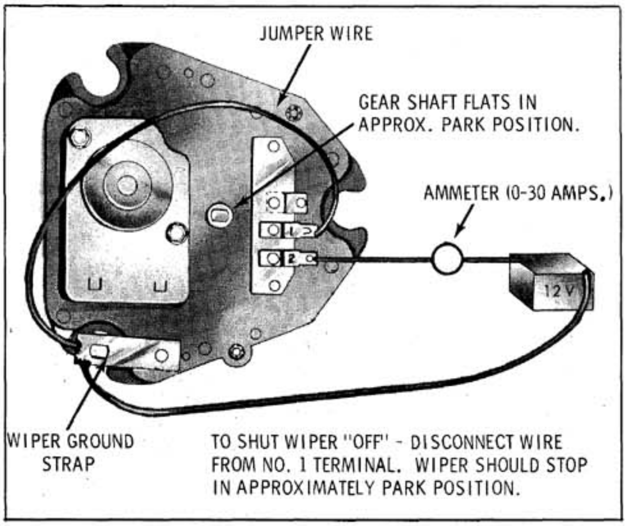


Fig. 13-162 Checking Wiper

DISASSEMBLY-ASSEMBLY PROCEDURE

The disassembly-assembly procedures for the wiper are broken down into two major areas: the motor section and gear box section.

GEAR BOX DISASSEMBLY

1. For wipers equipped with washer pump, remove washer pump as follows:

   a. Remove the two washer pump mounting screws (Fig. 13-163) and carefully lift the washer pump off the wiper.

   b. Remove the washer pump four lobe drive cam. The cam is a press fit on the wiper gear shaft and it may be necessary to use a small puller.

   c. On the 52, 56 and 5800 series, remove the two screws that secure the pump mounting bracket to the wiper gear case.

   d. Remove the felt lubricating washer from the wiper gear shaft.

2. Clamp crankarm in a vise and remove crankarm retaining nut.

   NOTE: Failure to clamp crankarm may result in stripping of wiper gears.

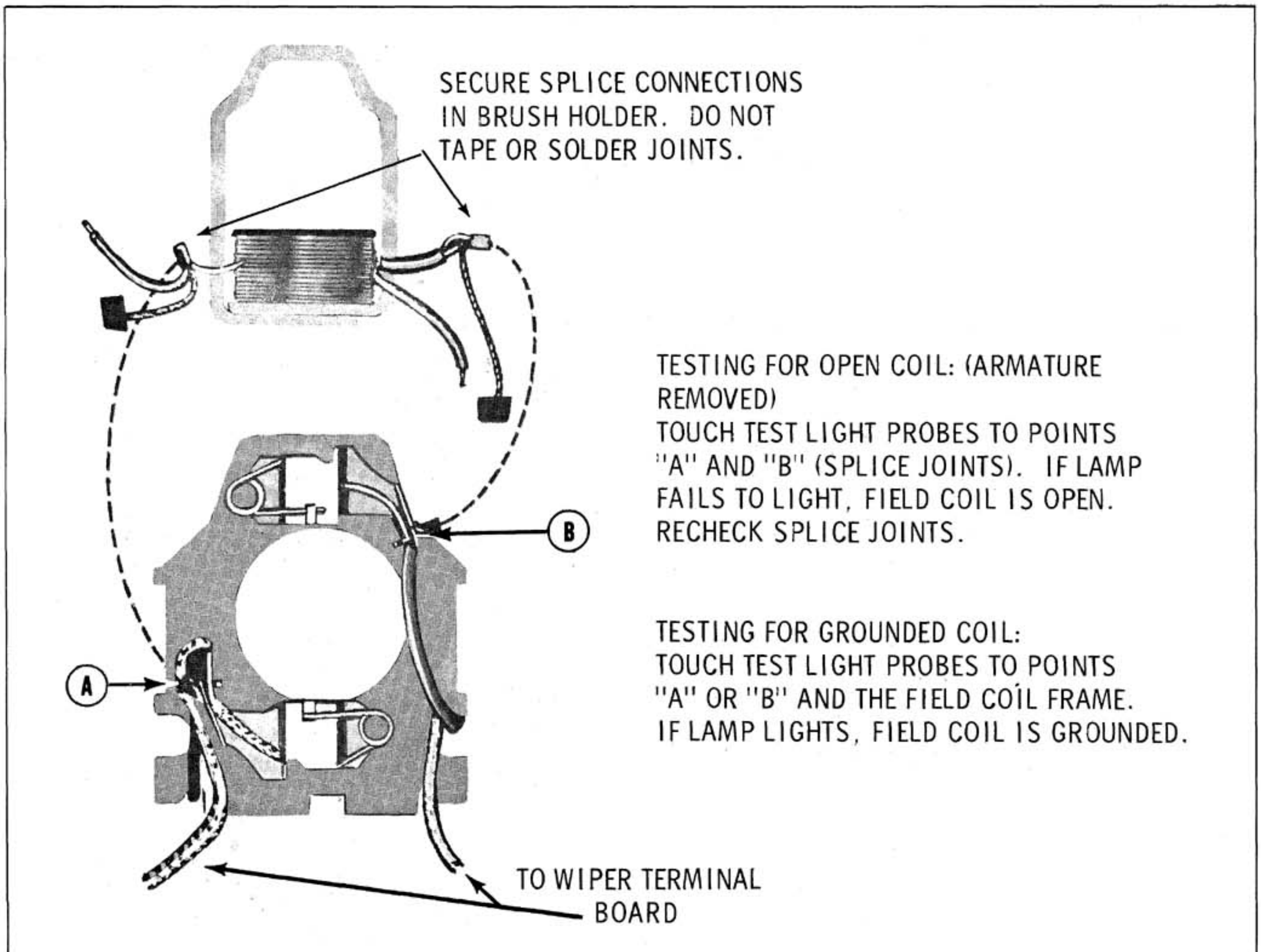


Fig. 13-162A Field Coil Tests

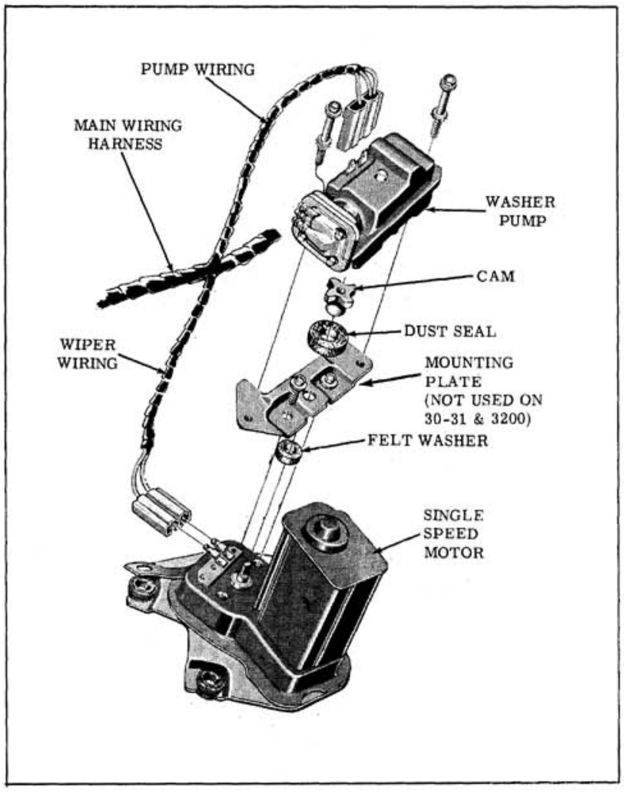


Fig. 13-163 Washer Mounting

3. Remove crankarm, seal cap, Tru-Arc retaining ring and end play washers. (Fig. 13-164)

NOTE: Seal cap should be cleaned and repacked with a waterproof type grease before reassembly.

4. Drill or punch out rivets that secure gear box cover.

CAUTION: Mark ground strap location and save ground strap for reassembly.

5. Remove output gear and shaft assembly, then slide intermediate gear and pinion assembly off shaft. (Fig. 13-164)

6. If required, remove terminal board and park switch assembly as follows:

   a. Note position of motor leads on terminals, then unsolder.

   b. Drill out rivets that secure terminal board and park switch ground strap to plate.

NOTE: Screws, nuts and washers for attaching a replacement terminal board park switch assembly are included with the replacement assembly.

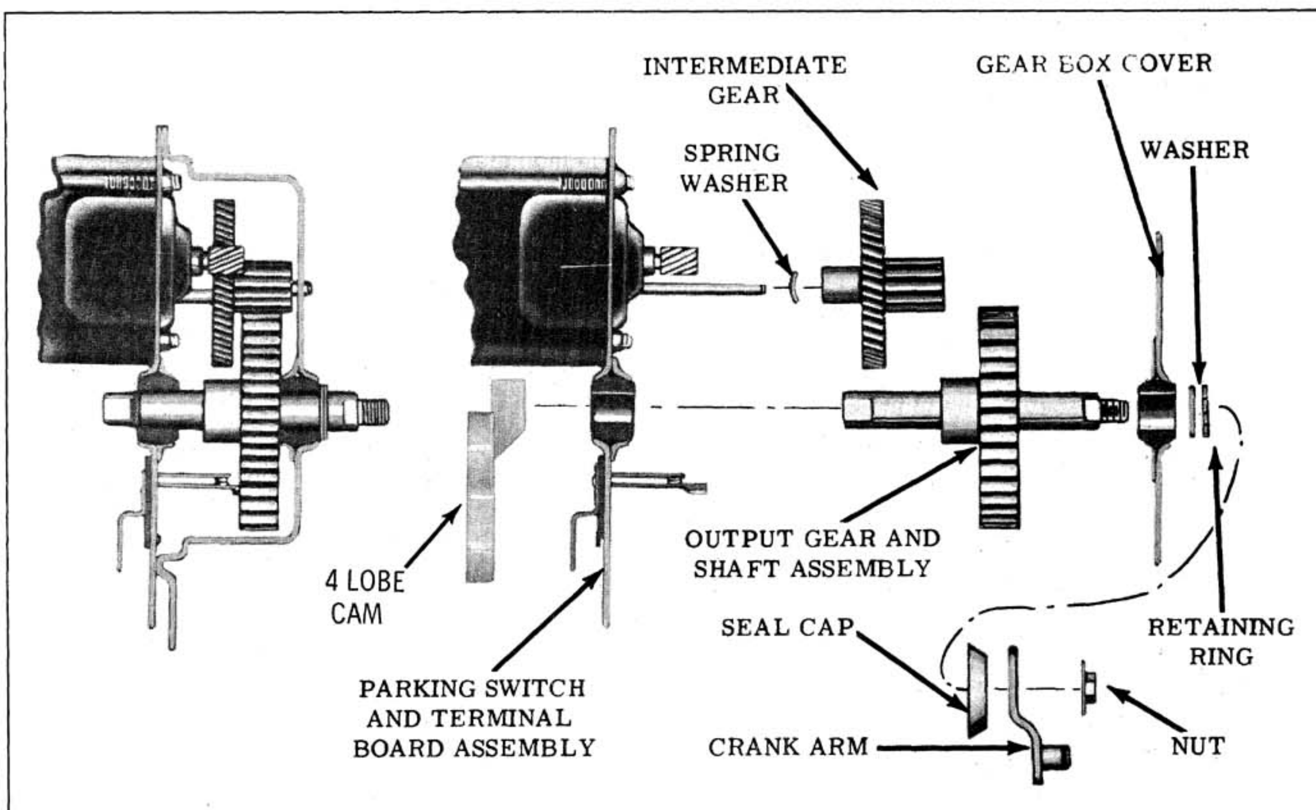


Fig. 13-164 Gear Box

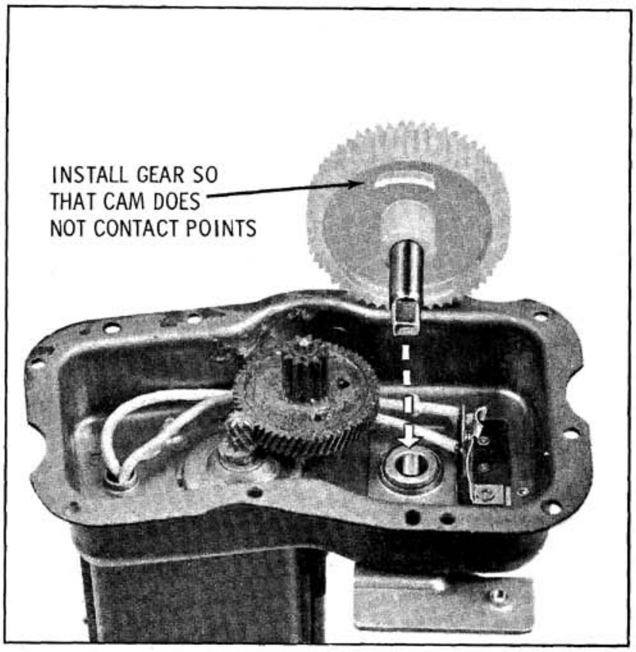


Fig. 13-165 Gear Installation

GEAR BOX REASSEMBLY

NOTE: Lubricate all gear teeth with Delco Cam and Ball Bearing Lubricant.

1. If park switch and terminal board assembly were removed, reinstall replacement assembly using the attaching screws and nuts included in the service package. Resolder leads to terminals. (Fig. 13-165)

2. Install wave washer and intermediate gear on immediate gear shaft.

3. Install output gear and shaft assembly with cam in position shown in Fig. 13-165.

4. Assemble gear box cover to wiper. Be careful to locate cover over locating dowels and intermediate gearshaft.

5. Secure cover to gear housing or plate. Be sure to reinstall ground strap.

   NOTE: Screws, nuts and lockwashers for reassembling cover to wiper are contained in a service repair package, Part No. 4910591.

6. Reassemble end play washers and retaining ring over output gear shaft. (Fig. 13-164) Use end play washers as required to obtain .005" maximum end play.

7. Install seal cap.

8. To reassemble crankarm in proper position, operate wiper to park or off position (Fig. 13-158) and install crankarm so that index

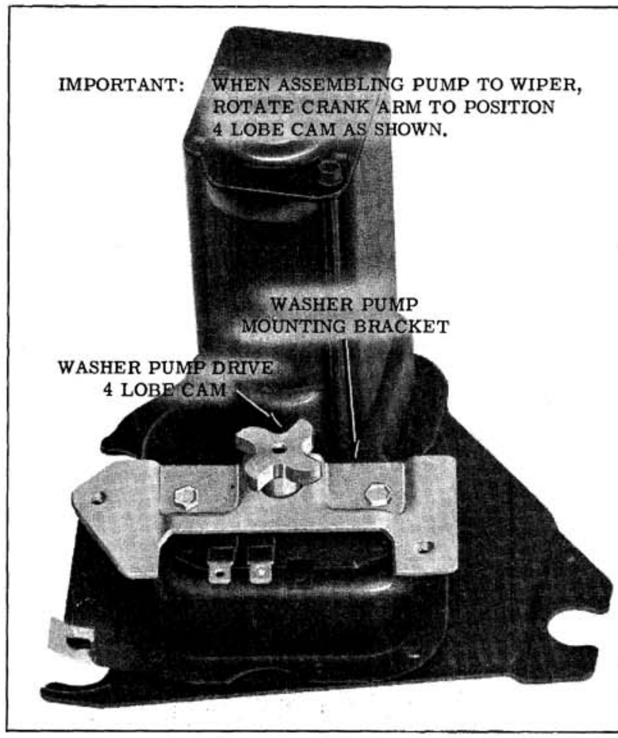


Fig. 13-166 Four Lobe Cam

marks on crankarm line up with those on the gear box cover. (Fig. 13-157)

CAUTION: Clamp crankarm in vise before securing the retaining nut.

9. Operate wiper (Fig. 13-158) and check performance per data in specification table.

10. Washer pump to wiper reassembly.

    Reassemble washer pump to wiper, reversing disassembly Steps 1 (a) through 1 (d). Observe precautions listed below.

    a. Support crankarm end of wiper output shaft (threaded end), and using a suitable mallet, drive the four lobe cam on the wiper output shaft until it bottoms against the shoulders of the shaft flats. (Fig. 13-163)

    b. Position four lobe cam as shown in Fig. 13-166. It may be necessary to manually rotate crankarm.

MOTOR DISASSEMBLY

1. Disassemble gear box as required to gain access to internal solder connections at wiper terminal board and unsolder motor leads from terminals.

2. Remove motor tie bolts. (Fig. 13-167)

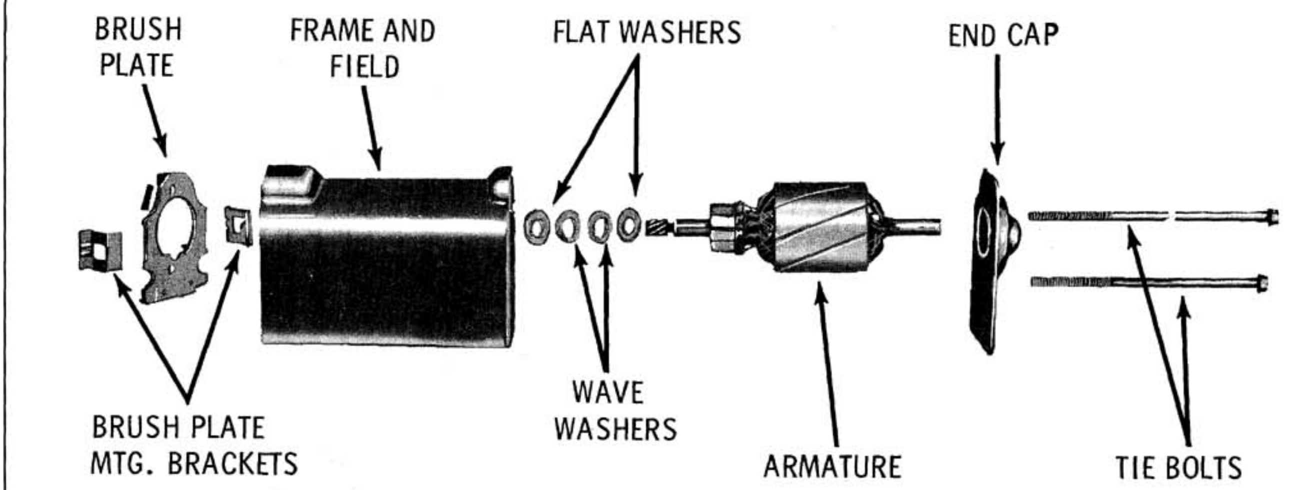


Fig. 13-167 Wiper Motor

3. Hold end cap against frame and field and disengage complete motor section from gear box.

4. Turn motor section as required to gain access to brush plate assembly and release brush spring pressure against brushes. (Fig. 13-168)

5. Move brushes away from armature commutator and remove armature and end cap from frame and field assembly.

6. Remove end cap from end of armature shaft.

   CAUTION: Be careful not to lose the plastic thrust plug in end of armature.

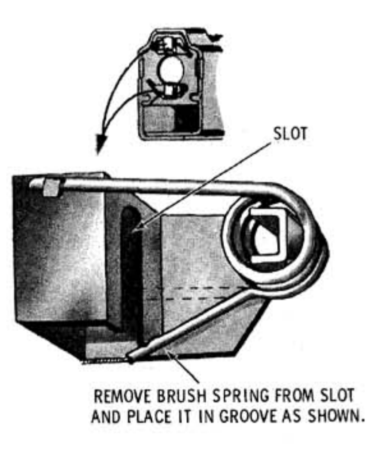


Fig. 13-168 Removing Brush Spring

7. Remove end play washers from commutator end of armature shaft. When reassembling armature in wiper, install washers as shown in Fig. 13-169.

8. To replace brushes, cut brush pigtail approximately 1/4" from splicing clip. Splice the new brush pigtail to the 1/4" of pigtail left from the original brush.

   NOTE: Splicing clips are provided in the replacement brush packages.

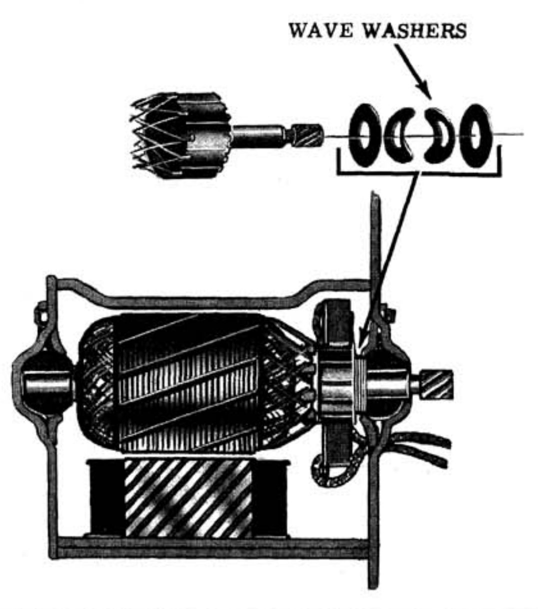


Fig. 13-169 Armature End Play Washers

MOTOR REASSEMBLY

Reverse disassembly Steps 1 through 7 and reassemble gear box. Lubricate all gear teeth with Delco Cam and Ball Bearing Lubricant and oil armature shaft and bearings with light machine oil.

SPECIFICATIONS

Current Draw (Amps.)

No Load	3 Max.
Dry Windshield	3.5 Max.
Stall	12 Max.

Usage	Gear Color	Gear Ratio	Crankarm Speed
			(RPMs)
52, 56 & 5800 Series	Green	36:1	43 Min. @ 12V
33, 34, 35, 36 & 3800 Series	Natural	40:1	41 Min. @ 12V

TWO-SPEED

DESCRIPTION

The two-speed round wiper motor, Fig. 13-170, is a compound wound 12-volt motor having external motor leads between the motor and gear box. A redesigned gear and clutch mechanism plus a new magnet switch-latch arrangement has been incorporated. (Fig. 13-171)

The gear train ratio used on the 33, 34, 35, 36 and 3800 series is 45:1 using white colored gears. The gear train ratio used on the 54, 66, 84 and 8600 series is 51:1 using green colored gears.

OPERATION

WIPER OFF

In the OFF position, the wiper gear drive pawl is located in a slot in the magnet switch assembly. (Fig. 13-171) In this position, it is pushing against a spring-loaded latch arm. The latch arm, in turn, is pushing against a flexible switch contact which holds the switch contacts open. Figure 13-171 shows the wiper gear mechanism in the park or off position.

TURNING THE WIPER ON (LO SPEED)

When the wiper is turned on at the dash switch, the circuit through the magnet switch assembly coil is completed to ground at the dash switch. The motor shunt field ground connection at the dash switch is maintained. (Fig. 13-172) With the magnet coil energized, the latch arm is attracted to the magnet coil. This action trips the latch arm away from the flexible switch contact which allows the switch contacts to close. When the contacts close, the 12-volt feed (black with pink stripe) to the wiper motor windings is completed and the wiper motor starts.

When the wiper motor first starts, only the gear rotates. The other gear assembly parts (drive pawl, lock pawl, drive plate and shaft, plus the crankarm) are unlocked from the gear and are prevented from rotating with the gear because the drive pawl extends into the magnet switch slot. (Fig. 13-171)

Since the gear rotates independently during this stage of the "start up", and since the crankarm or output shaft extends through the gear shaft off center (Fig. 13-173) a cam action results between the output shaft and gearshaft. This cam action causes the drive pawl to move out of the relay switch slot. After the gear has rotated

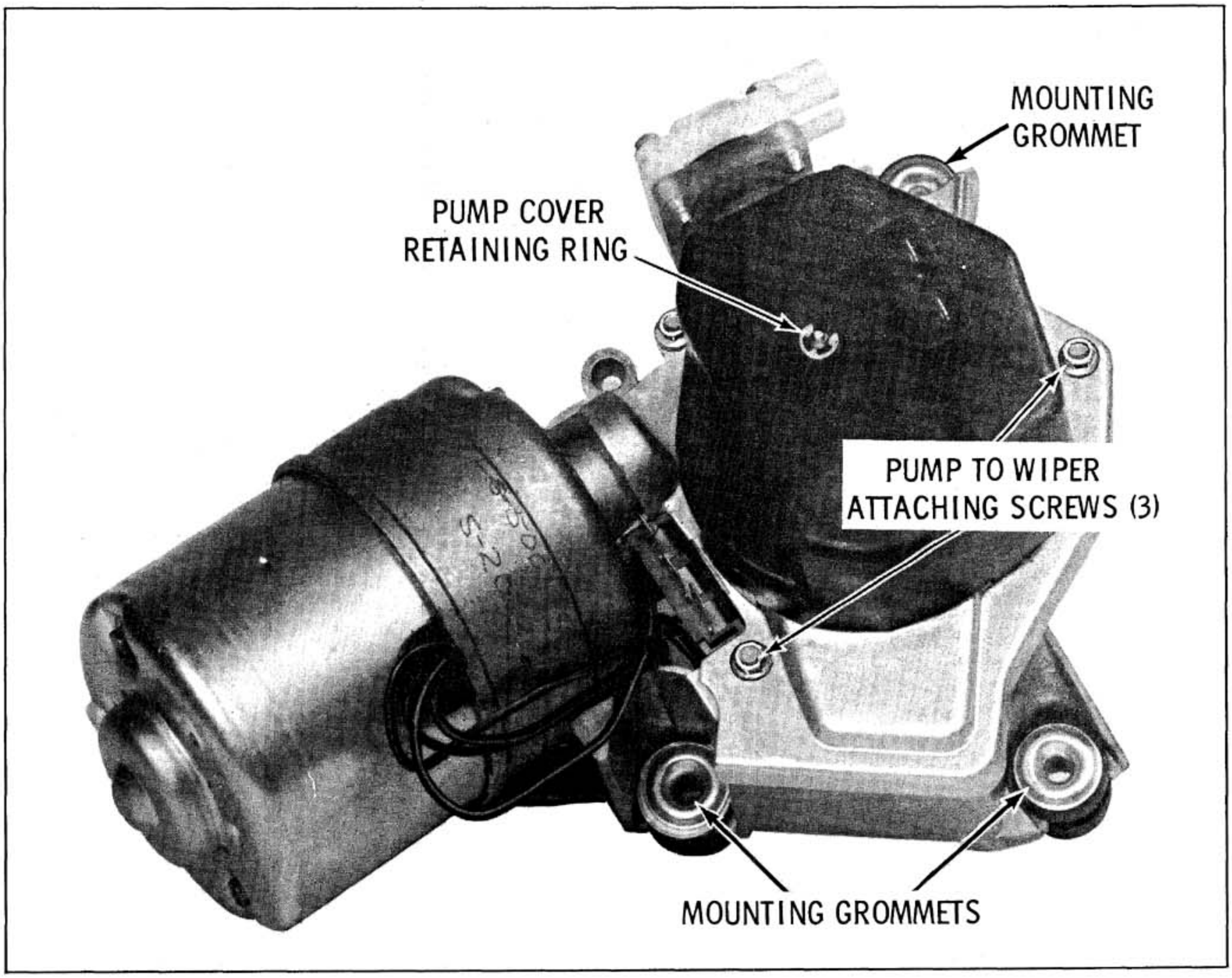


Fig. 13-170 Two Speed Wiper Assembly

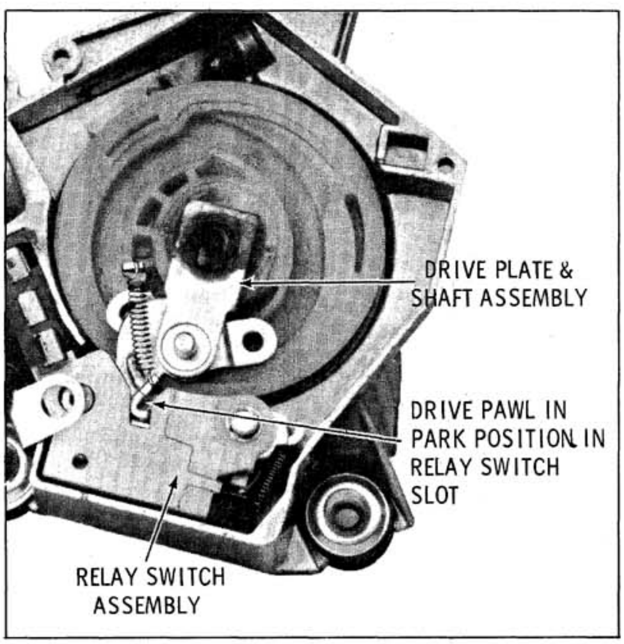


Fig. 13-171 Switch Latch Mechanism

approximately 180°, the spring-loaded drive and lock pawl guide pins snap into their respective pockets in the gear, locking the drive or output shafts and related parts to the gear. The complete gear mechanism is now in its normal run position (Fig. 13-174) and the gear, drive pawl, lock pawl, drive plate and shaft assembly and crankarm rotate as a unit.

SHUTTING THE WIPER OFF

Moving the dash switch to the OFF position opens the relay coil circuit to ground at the dash switch. With the relay coil circuit open, the spring-loaded relay latch arm moves out into the path of the gear assembly drive pawl. (Fig. 13-174)

The relay switch contacts are still closed at this stage of operation, so the circuit to the wiper motor is still completed. Thus the wiper motor and gear mechanism continues to run. The continuing rotation of the gear assembly causes the drive pawl to engage the latch arm. (Fig. 13-175) This action unlocks the drive pawl, lock pawl,

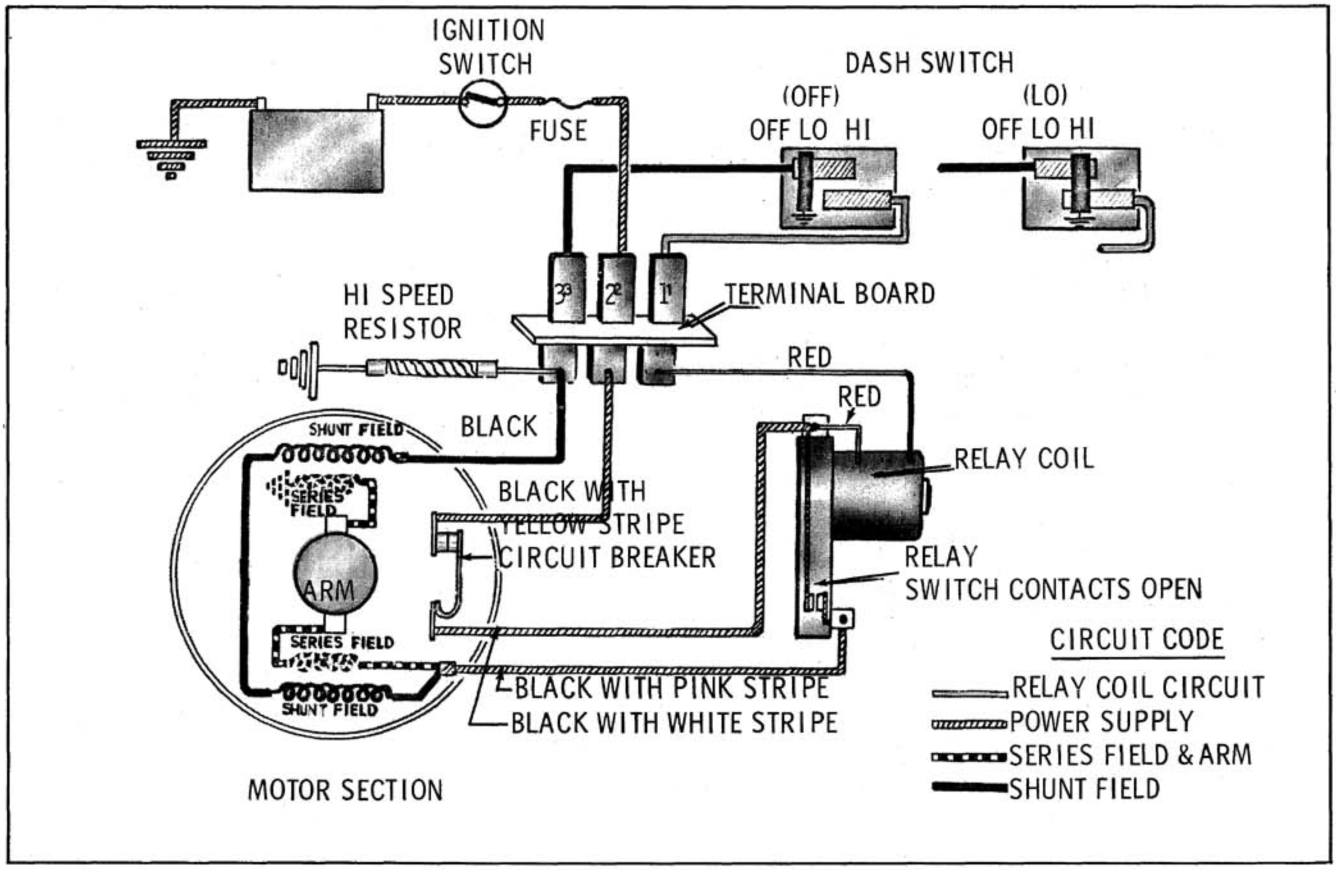


Fig. 13-172 Wiper Wiring

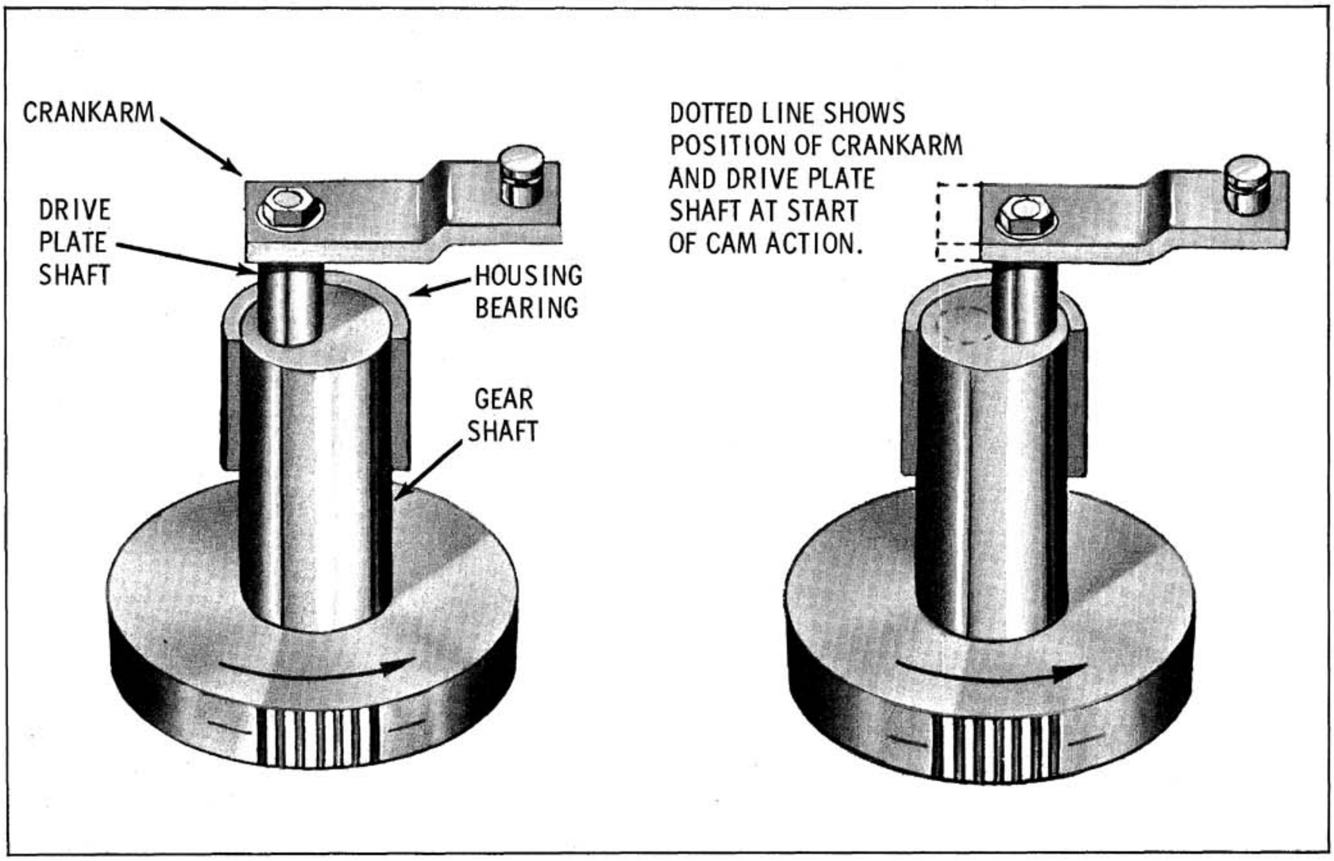


Fig. 13-173 Gear Cam Action

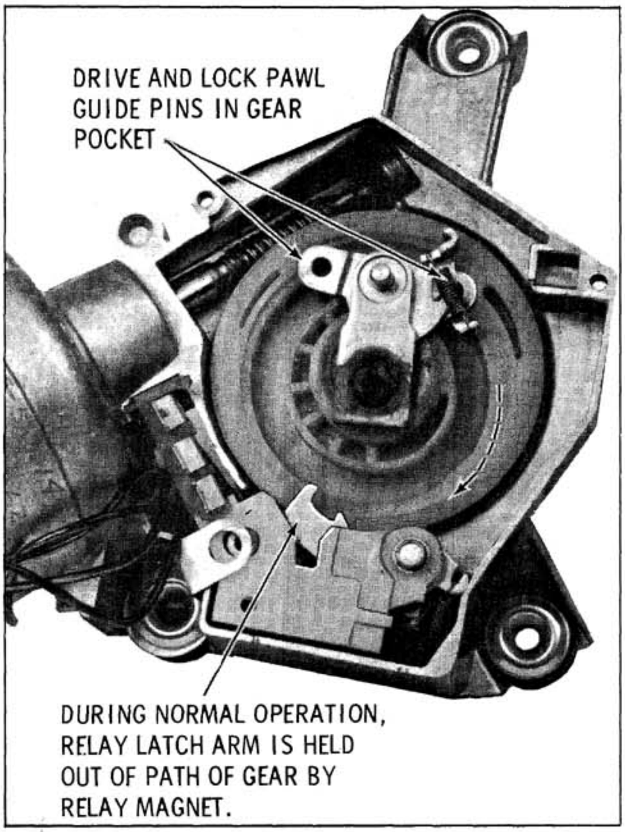


Fig. 13-174 Gear In Normal Run Position

drive plate and shaft assembly and crankarm from the gear which prevents them from rotating with the gear. However, since the relay switch contacts are still closed, the motor continues to run and the gear continues to rotate. Since the drive shaft extends through the gear shaft off center, a cam action results. (Fig. 13-173) The resulting cam action causes the drive pawl to move into the relay switch slot. (Fig. 13-175) As the drive pawl moves into the switch slot, it pushes against the latch arm which, in turn, opens the switch contacts. This action opens the circuit to the wiper motor and the wiper motor stops. Refer to Fig. 13-171 for wiper gear mechanism in full park or off position.

NOTE: Wipers must operate in lo speed range to shut off properly. Note that the shunt field circuit is connected to ground at the dash switch with the dash switch in the OFF position.

DIAGNOSIS—WIPER ON CAR

A. Preliminary Inspection

Check the following items:

1. Body wiring properly connected to wiper

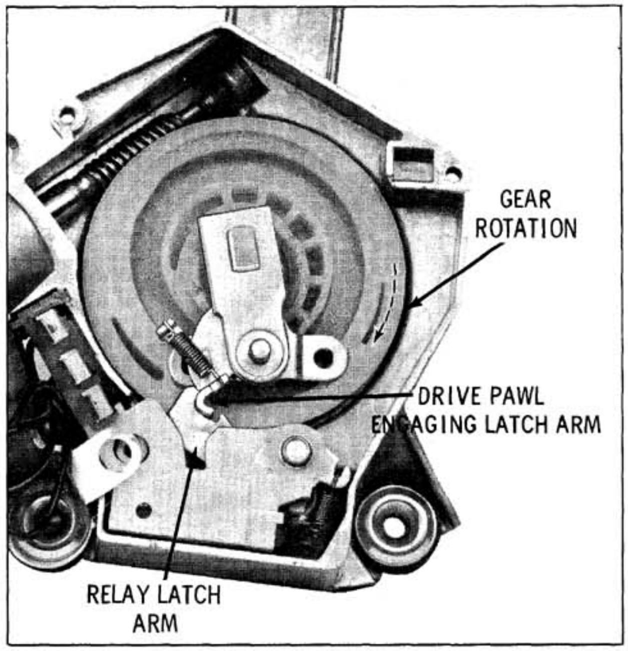


Fig. 13-175 Wiper Shutting Off

terminal board and dash switch.

2. Wiper to dash mounting screw tight.
3. Dash switch securely mounted.
4. Fuse.
5. With ignition switch turned on, there is a 12-volt supply at center terminal of wiper terminal board.

B. Checking Wiper Operation

Operate wiper independently of the car wiring or dash switch, as shown in Fig. 13-176. Check switch operation in OFF, LO and HI positions.

1. If wiper operates correctly, see DIAGNOSIS CHART.
2. If wiper still fails to operate correctly, disconnect wiper linkage from wiper motor and recheck for proper wiper motor operation.
   a. If wiper motor operates correctly in Step 2, check linkage for severe binding condition or breakage.
   b. If wiper fails to operate correctly in Step 2, remove wiper from car and check per instructions DIAGNOSIS - WIPER DETACHED.

DIAGNOSIS CHART—WIPER ON CAR

If wiper operated correctly independently of dash switch and car wiring, but original trouble was:	Check the Following Items
Wiper inoperative	Open lead wire from wiper terminal No. 1 to dash switch. Dash switch not securely mounted. Dash switch defective.
Will not shut off (Blades make full wipe stroke)	Grounded condition in lead from wiper terminal No. 1 to dash switch. Check for corroded wiper terminals. Clean terminals and spread a thin coat of waterproof grease over board. Defective dash switch.
Will not shut off (Blades move up and down about 15° from lower windshield molding)	Open in lead wire from wiper terminal No. 3 to dash switch. Dash switch mounting loose. Dash switch defective.
Has one speed, "Fast"	Lead wire from wiper terminal No. 3 to dash switch open. Dash switch defective.
Has one speed, "Slow"	Grounded condition in lead from wiper terminal No. 3 to dash switch. Defective dash switch.
Intermittent operation	Check for loose dash switch mounting.

WIPER MOTOR

Removal

1. Disconnect wiper and washer wiring terminals.
2. Disconnect washer hoses.
3. On 33, 34, 35, 36 and 3800 series, remove cowl vent grille and remove the transmission to crankarm retainer. (Fig. 13-177) On 52, 54, 56, 58, 66, 84 and 8600 series, an access hole is provided on the upper cowl area. Remove the hole cover and loosen - do not remove, the two transmission to crankarm attaching nuts until the transmission link drops off the crankarm. (Fig. 13-155)
4. Remove the three mounting screws and remove the wiper assembly.

Installation

1. Position wiper assembly to the dash and install the three mounting screws. Tighten the

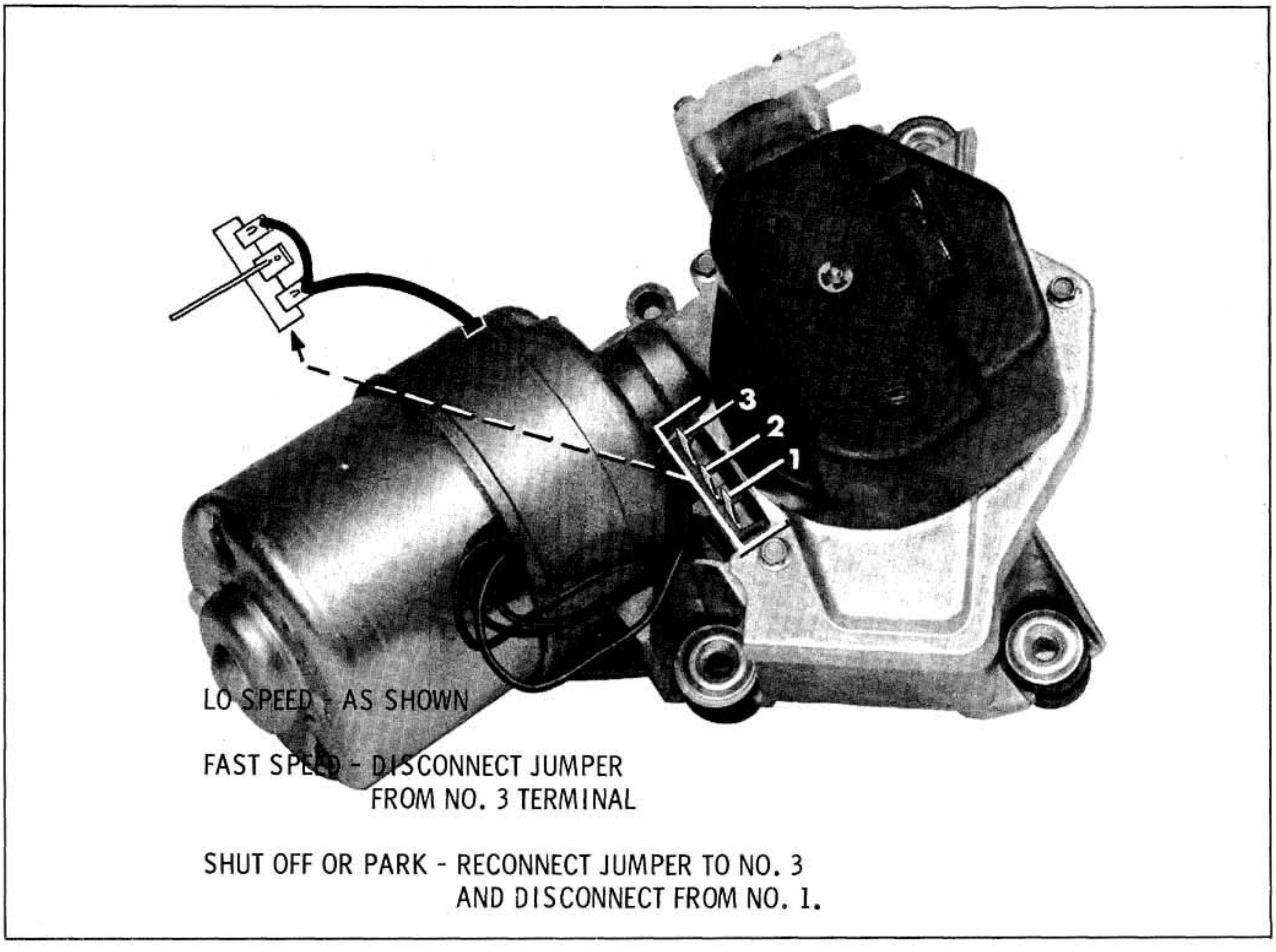


Fig. 13-176 Checking Wiper

screws until the sleeves surrounding the screws bottom, to prevent motor floating.

2. Connect wiper motor and washer wiring.
3. Turn dash switch to ON and operate wipers through several cycles.
4. Turn dash switch to OFF.
5. Connect transmission to wiper crankarm.
6. Install cowl vent grille or access hole cover.

NOTE: If crankarm has been removed from the motor, it should be checked for correct position. (Fig. 13-157) When crankarm is correctly positioned to the motor and the motor is in Park position, the end of the crankarm will point outboard.

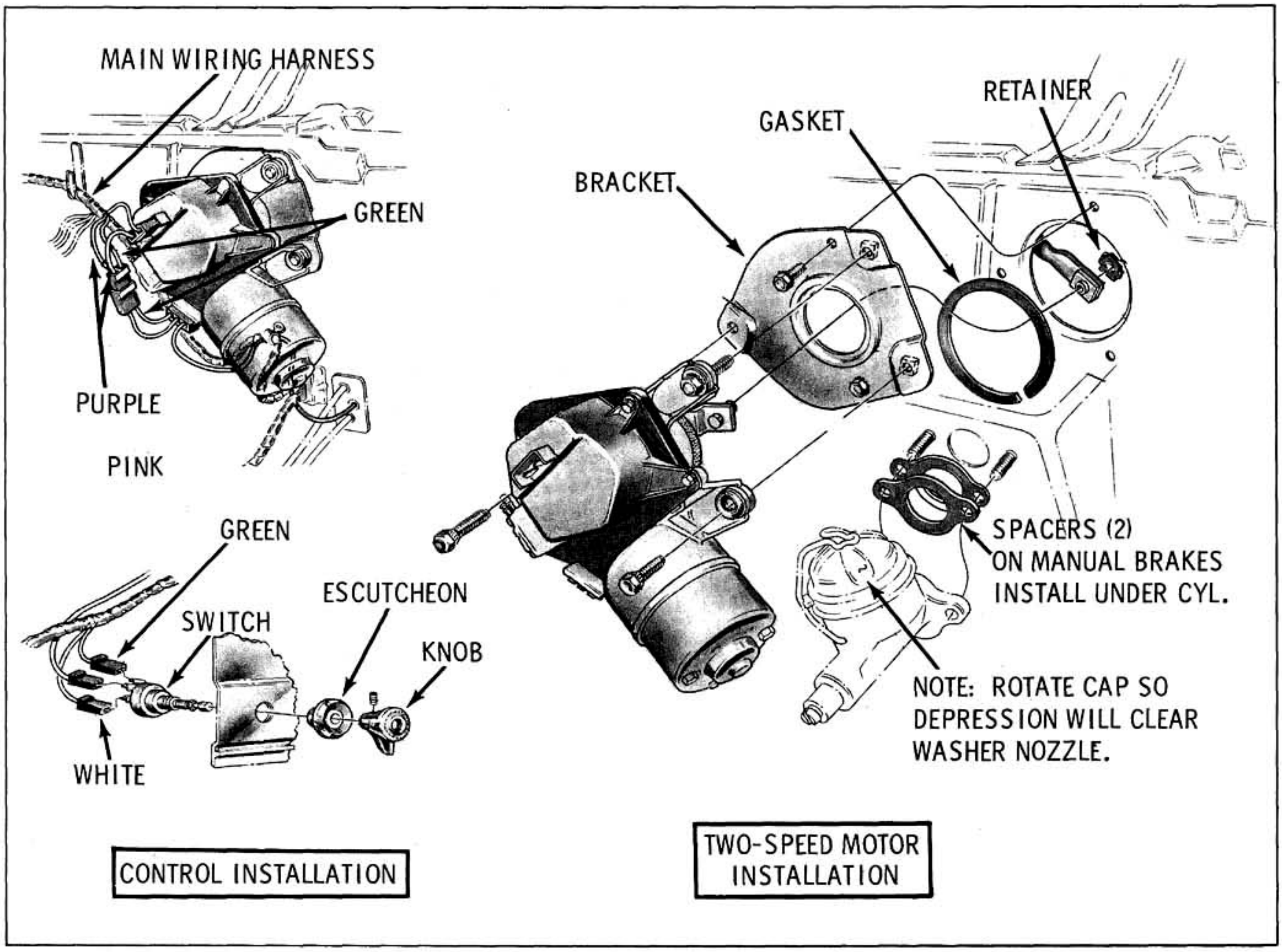


Fig. 13-177 Wiper Mounting (33-34-35-36 and 3800 Series)

DIAGNOSIS CHART—WIPER OFF CAR

Before using chart, try operating wiper as shown in Fig. 13-178. Check if wiper has "Lo" and "Hi" speeds and shuts off correctly. Match the trouble found with the trouble shown in the chart. Use checking procedure as indicated to locate cause of trouble.

Trouble	Possible Causes	Use Checking Procedure
Wiper Inoperative (Motor doesn't run)	Open relay coil Circuit breaker open Open armature Motor series field open Brushes sticking Defective solder joints-relay switch Binding condition-relay latch arm	A
Wiper will not shut off (Crankarm rotates through 360)	Relay coil-grounded Relay latch spring disconnected or broken Latch arm binding	B

DIAGNOSIS CHART—WIPER OFF CAR (Cont'd)

Trouble	Possible Causes	Use Checking Procedure
Wiper will not shut off (Crank-arm moves back and forth in a horizontal plane accompanied by a loud "klunk")	Relay switch contacts shorting together Drive pawl spring disconnected Wiper has one speed, "Fast," caused by open shunt field	C
Wiper has one speed, "Fast"	Shunt field open Defective soldering at terminal No. 3 on wiper terminal board	C
Wiper has one speed, "Slow"	Shunt field internally grounded Shunt field lead to terminal board (black) grounded Shorted armature	D
Wiper has excessive speed in "Hi"; "Lo" speed normal	Open speed resistor Poor resistor ground connection	E
Wiper stops at random (Crank-arm stops rotating immediately and does not return to full park position.	Relay switch contacts dirty or broken	Replace Relay Switch Assembly
Intermittent Operation	Defective circuit breaker (weak) Circuit breaker tripping because of shorted armature and/or fields causing motor to draw excessive current	F
No apparent trouble on bench test but fails occasionally on car	Armature end play tight Gear assembly end play tight Loose solder or weld joints	See Adjustments

PROCEDURE "A" (WIPER INOPERATIVE)

1. Remove wiper gear box cover or washer pump to gain access to relay switch assembly.

2. Connect 12-volt power source to wiper, hot side to center terminal, ground side to gear housing. (Fig. 13-179) Do not connect jumper to terminal 1 and 3.

3. To determine if wiper circuit breaker is okay, connect test light to relay switch terminal as shown in Fig. 13-179.

   a. Test Lamp Lights

   Circuit from terminal No. 2 through circuit breaker to relay switch okay.

   b. Test Lamp Doesn't Light

   Circuit breaker or solder connections at circuit breakers defective.

4. To determine if relay coil is open, connect test lamp to wiper terminal No. 1. (Fig. 13-179)

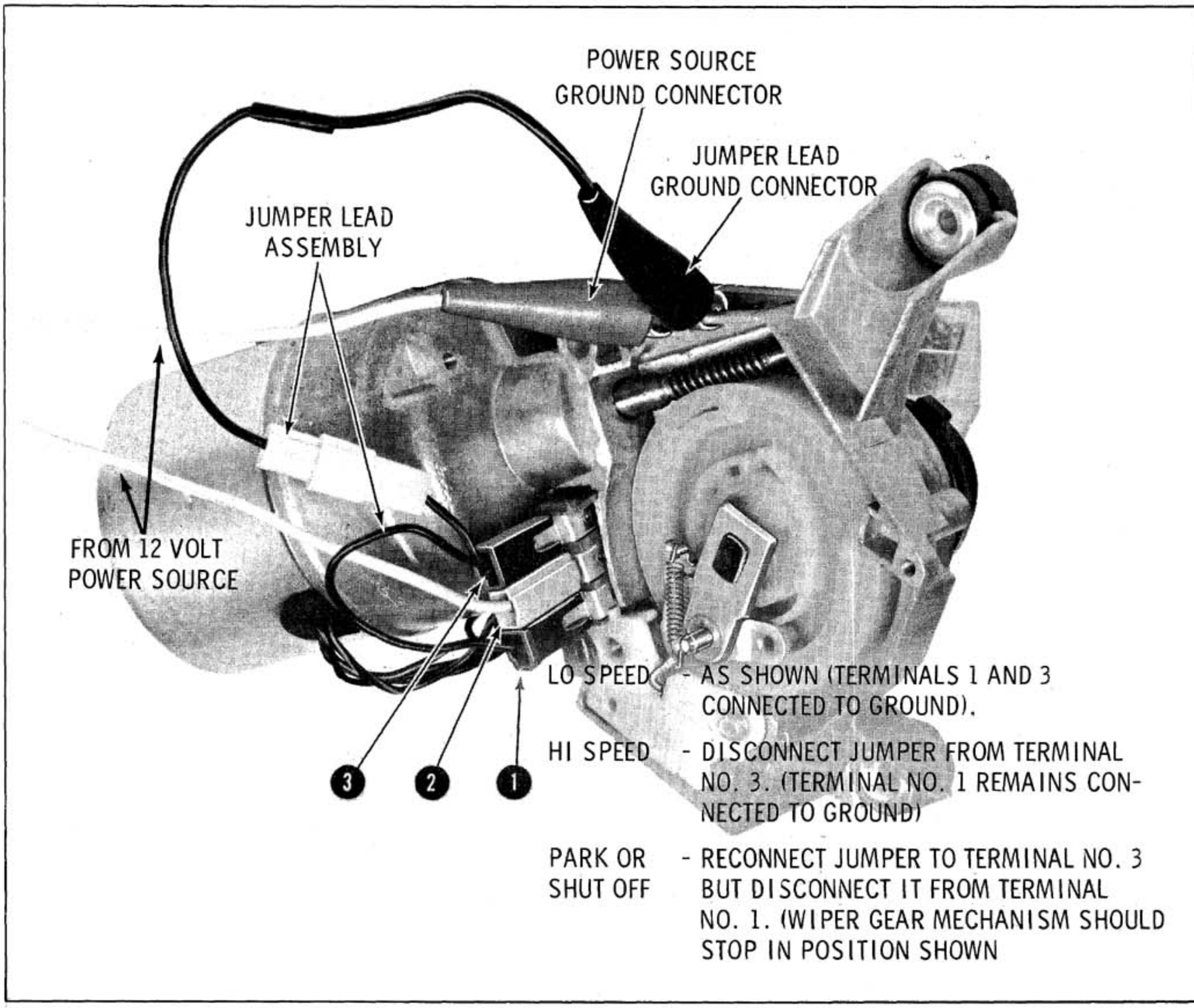


Fig. 13-178 Checking Wiper Operation

5. Test relay switch as follows:

   If gear mechanism is in full park position (Fig. 13-179), use a small screwdriver in the switch slot and push latch arm down toward relay coil. (Fig. 13-179) Next, remove a small amount of insulation from black lead with pink tracer and touch test lamp to exposed wire.

   a. Test lamp lights but motor doesn't run. Proceed to Step 6.

   b. Test lamp doesn't light, relay switch defective.

   NOTE: Cover exposed wire with tape after the test.

6. Disassemble motor section and check the following:

   a. Hung brush.

   b. Solder connections at brush holders.

   c. Splice joints at field coil connections to leads.

   d. Open armature.

   e. Series field ground connection on field lamina.

PROCEDURE "B" (WIPER WILL NOT SHUT OFF—CRANKARM ROTATES 360°)

1. Observe if relay latch arm spring is connected properly. (Fig. 13-180)

2. Manually operate latch arm to check it for possible binding condition.

3. If items in 1 and 2 check out, connect power source to wiper and connect jumper wire

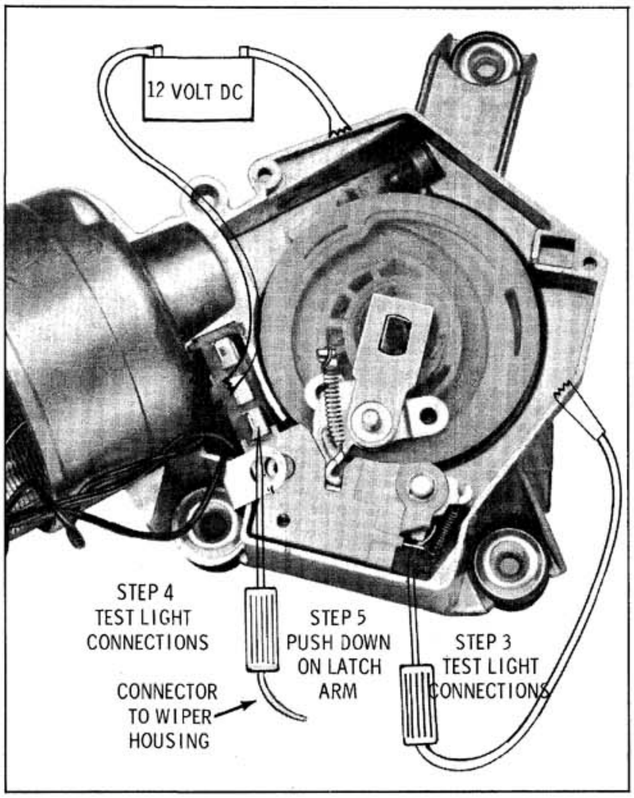


Fig. 13-179 Checking Connections

from terminal No. 3 to wiper housing. (Fig. 13-180) Do not make any connections from terminal No. 1. Manually actuate latch arm in direction of arrow (Fig. 13-180) and observe if it remains in energized position (inside plastic switch housing out of path of gear drive pawl). If it remains in energized position, check for grounded red lead from coil to terminal No. 1. If red lead is not grounded, coil is probably grounded internally and relay switch should be replaced.

PROCEDURE "C" (WIPER WILL NOT SHUT OFF—RECYCLES)

NOTE: Crankarm oscillates in a somewhat horizontal plane and is accompanied by a loud "knock" with each revolution of the gear.

1. Check that drive pawl and relay latch arm springs are properly connected. (Fig. 13-180)

2. Check wiper for "Lo" speed operation. (Fig. 13-178) If wiper has "Hi" speed only, check the following items:

   a. Solder joint at No. 3 wiper terminal.

   b. Splice joint - black lead with pink stripe to field coil leads.

   c. Splice joint - black lead to field coil.

3. Check relay switch as follows:

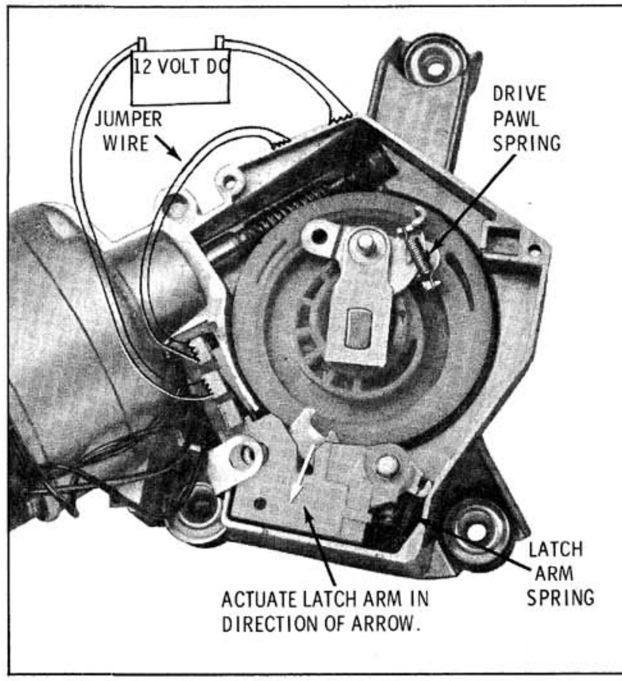


Fig. 13-180 Latch Mechanism

   a. Remove small amount of insulation from black lead with pink stripe and connect test light between exposed wire and wiper housing.

   b. Connect power source and jumper to wiper as shown in Fig. 13-180 and observe if test light goes out once for each revolution of gear or if light glows steady. If light glows steady, relay switch contacts are not opening and switch is defective. If light goes out each time drive pawl moves into relay switch slot, relay switch is functioning correctly.

PROCEDURE "D" (WIPER HAS ONE SPEED, "SLOW")

1. Check for grounded condition in the internal black lead that connects to wiper terminal No. 3. Refer to Fig. 13-180 for terminal No. 3 location.

2. Disassemble motor section of wiper and check for grounded field coil.

IMPORTANT: Occasionally the field coils are loose on the poles and this enables them to slide into a position where they short on the corners of the poles. Center the coils on the poles and wedge them in a fixed position.

PROCEDURE "E" (WIPER HAS EXCESSIVE SPEED IN "HI" BUT "LO" SPEED IS NORMAL)

(Crankarm rpm exceeds 70 at 12 volts)

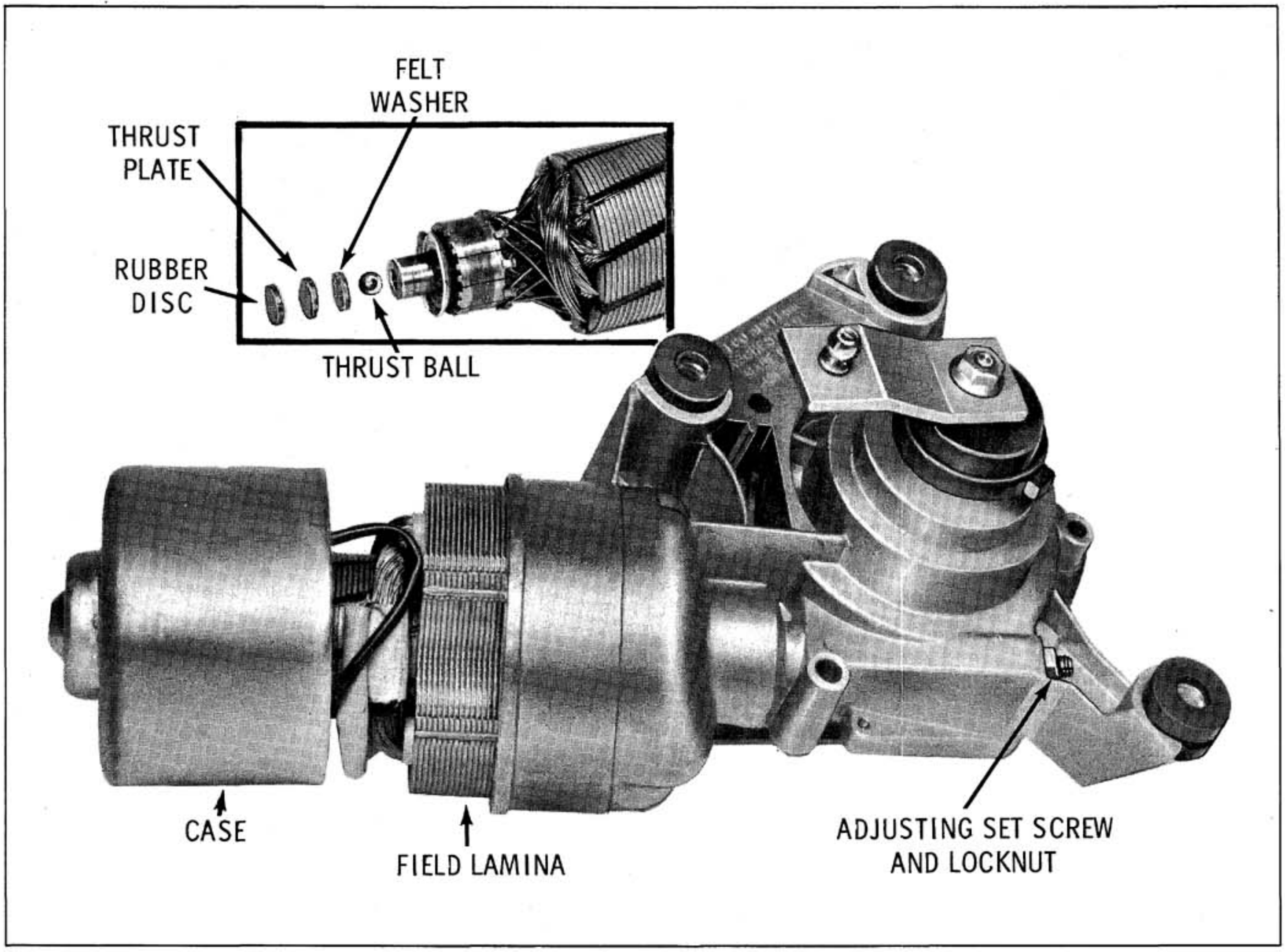


Fig. 13-181 Removing Armature

1. Check for open resistor and the resistor ground connection.

   33, 34, 35, 36 and 3800 series uses 38 ohm resistor (4" motor).

   52, 54, 56, 58, 66 and 8600 series uses 20 ohm resistor (4-1/2" motor).

PROCEDURE "F" (INTERMITTENT OPERATION)

1. Check solder connections at wiper terminal board.
2. Connect up wiper to operate in "Lo" speed. (Fig. 13-178) Connect ammeter (range 0 - 30 amps.) in feed wire circuit to wiper and observe current draw. Allow motor to run until it becomes hot.
   a. If current draw is normal (3.5 - 5 amps. max.) and wiper cycles on and off, a weak circuit breaker is indicated. Replace case and brush assembly.
   b. If current draw exceeds 5 amps., proceed to Steps 3, 4 and 5.
3. Adjust armature end play as required and recheck current draw.
4. Adjust gear assembly end play as required and recheck current draw.
5. If adjustments in Steps 3 and 4 fail to correct excessive current draw condition, disassemble motor section of wiper and check armature on growler for shorted or grounded condition.

DISASSEMBLY-ASSEMBLY PROCEDURE

The disassembly-assembly procedures for the wiper are broken down into two major areas: the motor section and gear box section. Each section may be serviced independently of the other.

MOTOR DISASSEMBLY

1. Remove the two motor tie bolts that attach steel case to gear housing.
2. Strike the steel case lightly with a mallet to partially loosen it from die cast housing and motor field.

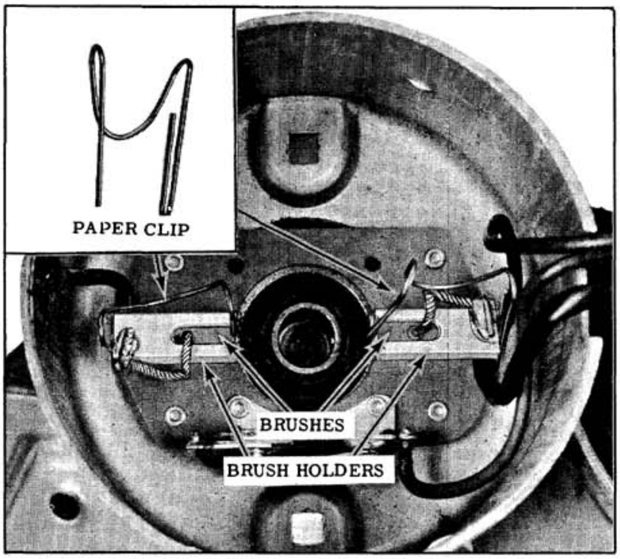


Fig. 13-182 Holding Brushes

3. Remove the armature end play adjusting screw and insert a tool through the armature adjusting screw opening. (Fig. 13-181) Push against the end of the armature shaft to back off the case. This will retain the armature commutator in position between the brushes until ready to separate the armature from the case.

4. To separate armature from case while still retaining the brush springs and brushes in place, fashion a spring similar to that shown in Fig. 13-182 and insert behind the brush leads as shown.

5. Pull the armature out of the case and install U-shaped brush retainer spring, Part No. 5096576, as shown in Fig. 13-182. Remove spring installed in Step 4.

6. Remove the felt washer, thrust plate and rubber thrust disc from the case assembly bearing as required.

7. The field assembly is pressed in the housing under light pressure and should be carefully checked prior to removal. If necessary, remove the field as follows:

   a. Cut the plain black and black and pink stripe leads that extend through the case assembly rubber grommet in a location convenient for splicing.

   b. Cut the internal field leads enclosed in black plastic tubing approximately two inches from the brush holder to which they are attached. Code them for reassembly.

   c. Scribe a reference line along the side of the housing and field for reassembly purposes.

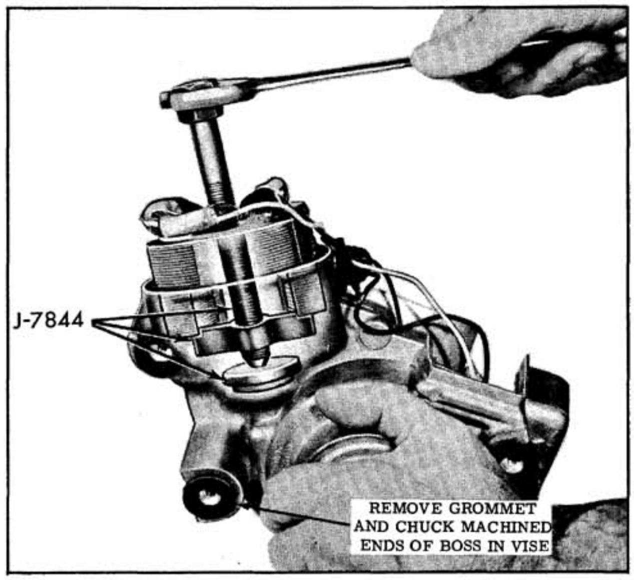


Fig. 13-183 Removing Field Coil

   d. Install Field Puller J-7844 in motor housing as shown in Fig. 13-183. Make certain puller screw base plate is installed flat side up and puller flanges straddle the field lamina.

   Turn the puller screw clockwise to remove field assembly.

MOTOR REASSEMBLY

1. Install field assembly as follows:

   a. Shorten as required and splice the replacement field leads to those leads cut in Steps 8a and 8b under MOTOR DISASSEMBLY.

   b. Scribe a reference line on the replacement field in the approximate same location as the one scribed on the original field (Step 8c under MOTOR DISASSEMBLY).

   c. Temporarily install tie bolts, then align the field and housing according to the reference lines and start the field in the housing.

   d. Using a suitable mallet, work the field back into the housing by striking alternately each side of the field lamina until the field bottoms against the machined ridge.

   CAUTION: Be very careful not to damage field coils or attaching leads.

2. Install rubber thrust disc, steel thrust plate and felt washer in the case assembly bearing in the order indicated. (Fig. 13-181)

3. Be sure steel ball is located in commutator

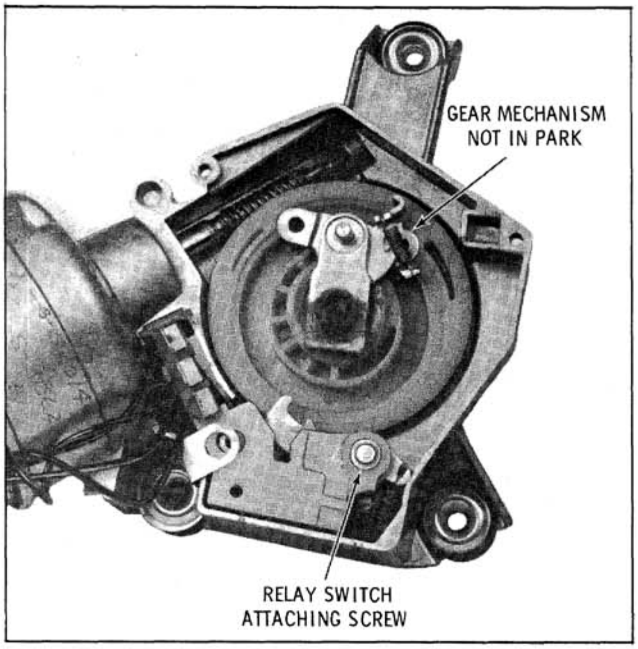


Fig. 13-184 Gear and Relay Switch

end of armature shaft, lubricate armature shafts and thrust ball with a high melting point grease and install armature shaft in case assembly bearing.

NOTE: Replacement armatures are NOT supplied with thrust ball. To remove thrust ball from original armature use a magnet.

4. Remove the brush retainer spring.

5. Maintaining the armature in its assembled position in the case, start the armature worm shaft through the field and housing bearing until it starts to mesh with the worm gear.

CAUTION: It may be necessary at this point to rotate armature slightly before the worm will engage with worm gear.

6. Rotate the case as required to align the holes in the case with those in the housing.

7. Being very careful not to pinch any of the motor leads between the case and edge of the field, push the case onto the field until it butts against the housing.

8. Secure the case to the housing with the two tie bolts.

9. Install end play adjusting screw and locknut and adjust end play as described in the ADJUSTMENT Section.

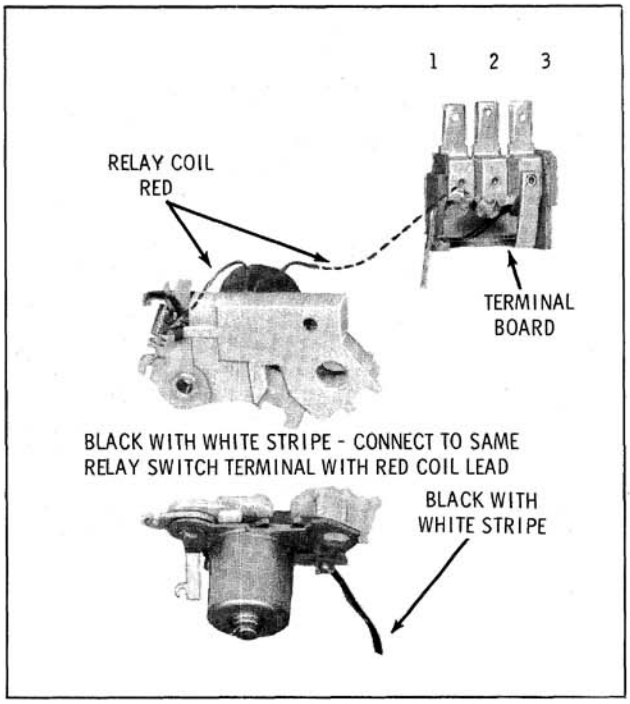


Fig. 13-185 Terminal Board

GEAR BOX

RELAY SWITCH-LATCH ASSEMBLY-TERMINAL BOARD REMOVAL

1. Remove gear box cover and/or washer pump. (Fig. 13-170)

2. If wiper gear drive pawl is in full park position (Fig. 13-179), remove gear assembly. (See GEAR ASSEMBLY - Removal)

   If wiper gear mechanism is not in park position (drive pawl away from latch arm Fig. 13-184), proceed to Step 3.

3. Remove relay switch attaching screw (Fig. 13-184) and carefully lift the relay switch assembly out of the gear box. Unsolder leads from switch terminals as required. Refer to Fig. 13-185 when resoldering leads.

4. To remove terminal board assembly, simply slide it out of housing and unsolder leads as required.

REASSEMBLY OF RELAY SWITCH-LATCH AND TERMINAL BOARD

1. Resolder red coil lead to wiper terminal board as required. (Fig. 13-185)

2. Slide terminal board into wiper housing being careful to position the terminal board resistor lead as shown in Fig. 13-186.

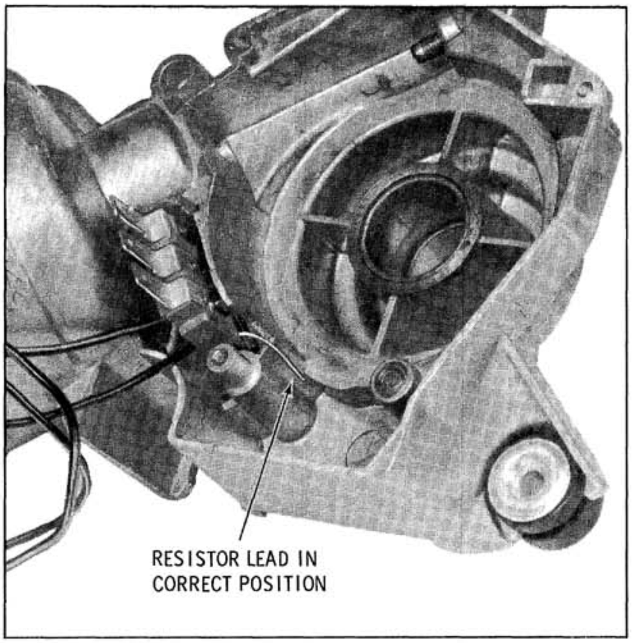


Fig. 13-186 Positioning Resistor Lead

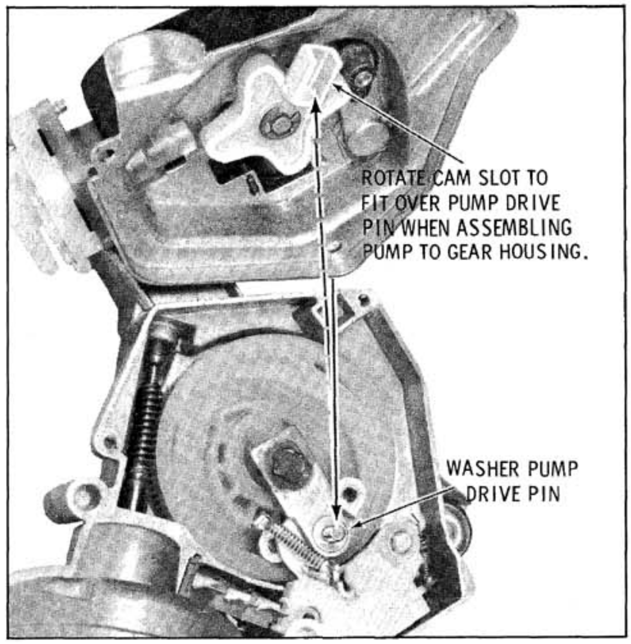


Fig. 13-187 Positioning Pump to Gear

NOTE: With the relay switch assembly replaced in the housing and washer pump or gear box cover reinstalled, the relay switch plastic housing applies pressure against the resistor lead to form a positive ground connection to the wiper housing.

3. Resolder leads to relay switch assembly as required. (Fig. 13-185)

4. Position relay switch assembly in housing.

CAUTION: Be very careful to route leads in such a manner as to avoid having them pinched between relay and wiper housing.

5. Install relay switch mounting screw. (Fig. 13-184)

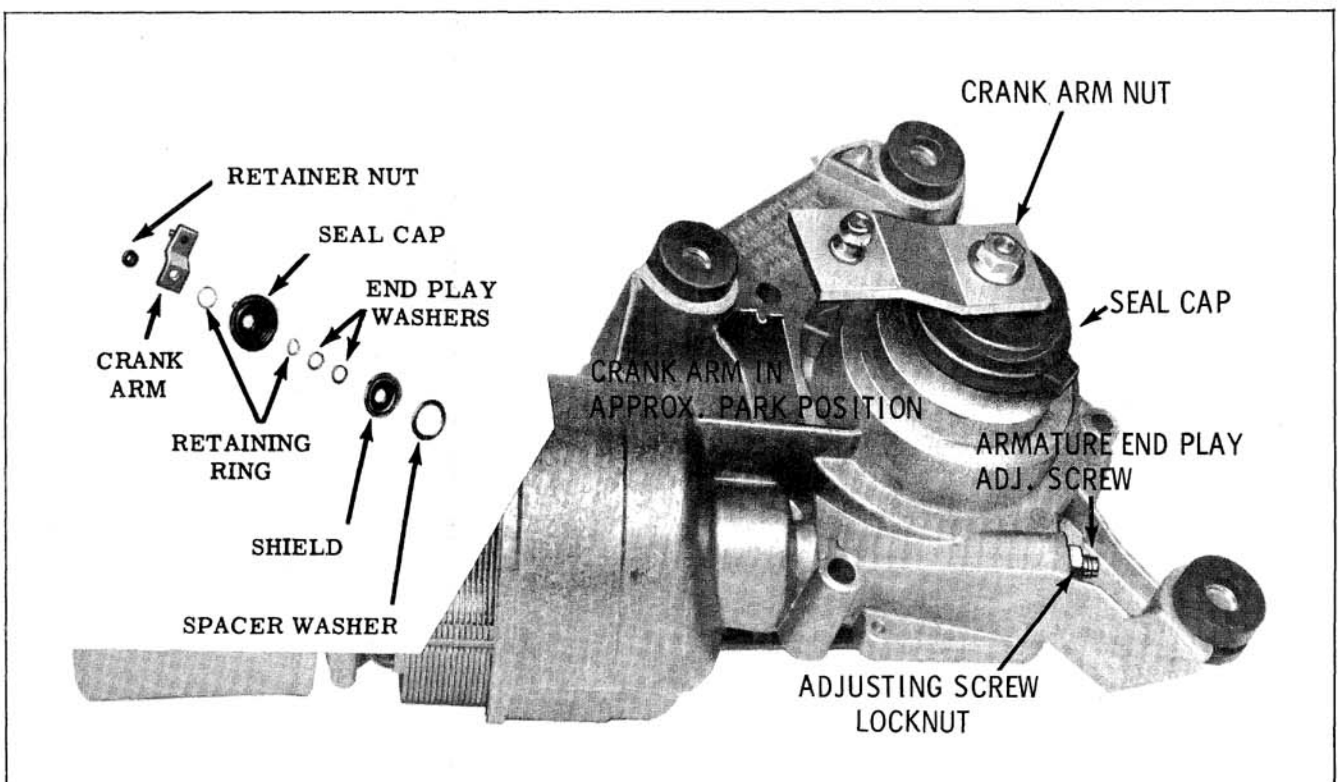


Fig. 13-188 Wiper Assembly

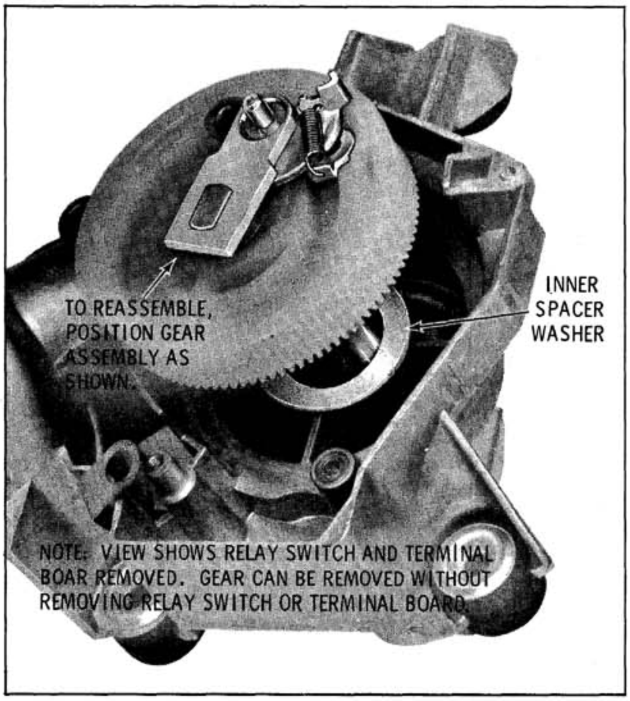


Fig. 13-189 Removing Gear

6. Assemble gear box cover and/or washer pump to wiper being careful that the ground strap is properly connected. Refer to Fig. 13-187 for assembly of washer pump to gear housing.

DRIVE GEAR DISASSEMBLY

1. Remove crankarm retaining nut, crankarm, rubber seal cap, retaining ring, shim washers, shield and spacer washer in the order indicated. (Fig. 13-188)

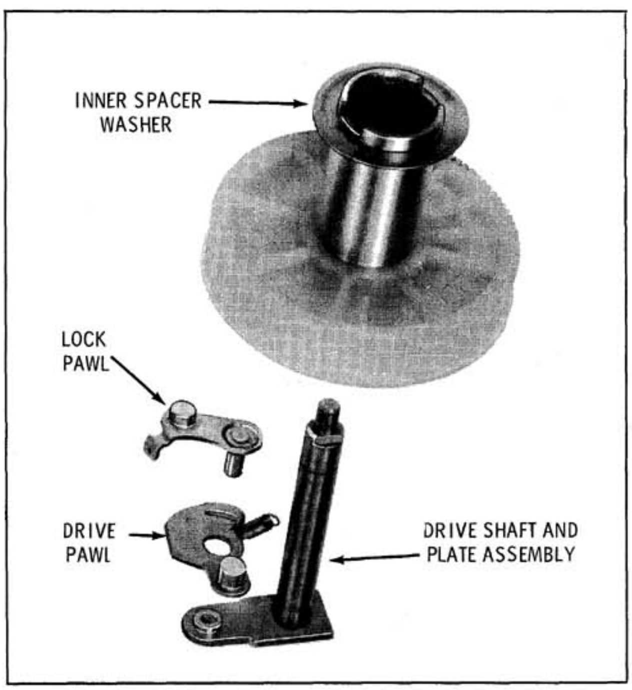


Fig. 13-190 Gear Removal

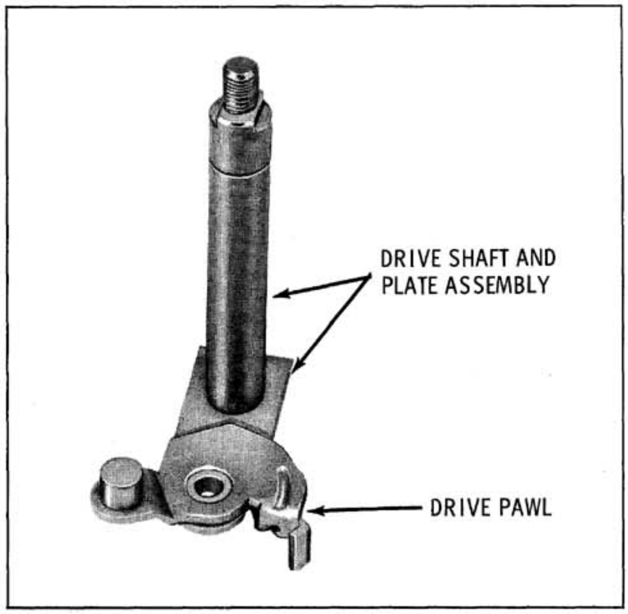


Fig. 13-191 Drive Pawl

2. Slide gear assembly out of housing. (Fig. 13-189)

3. Slide drive plate and shaft out of gear and remove the drive pawl, lock pawl and coil spring as required. (Fig. 13-190)

DRIVE GEAR REASSEMBLY

1. Position drive pawl on drive plate as shown in Fig. 13-191.

2. Assemble lock pawl over drive pawl as shown in Fig. 13-192.

3. Slide gear and tube over the drive shaft.

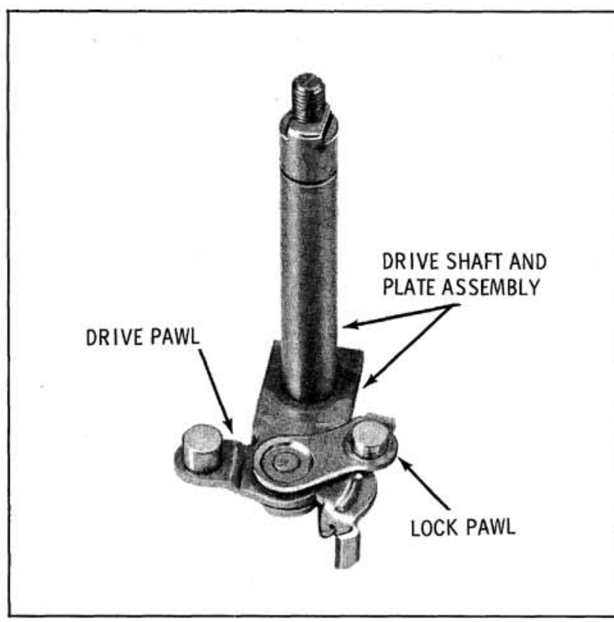


Fig. 13-192 Lock Pawl

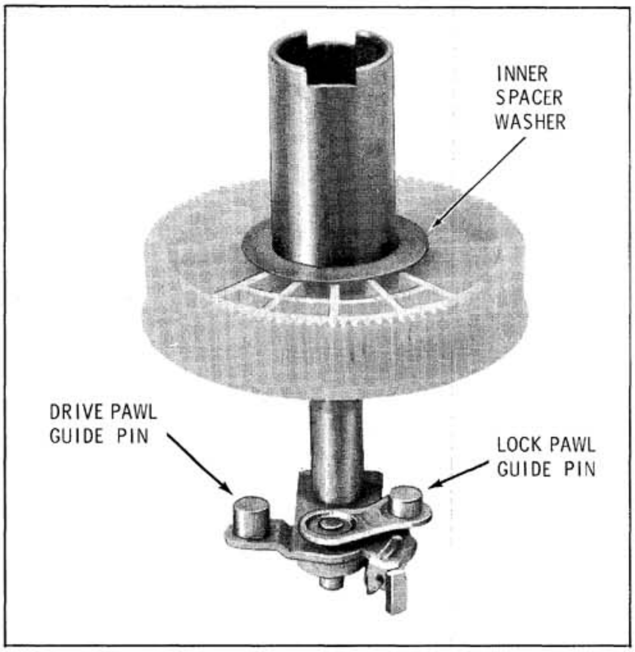


Fig. 13-193 Installing Gear

(Fig. 13-193) (Move drive and lock pawls as required to allow their respective pins to fit in the gear guide channel.)

4. Holding the gear, manually rotate the drive plate in the direction of the arrow until the drive and lock pawl guide pins snap into their respective pockets in the gear. (Fig. 13-194)

5. Reinstall coil spring between lock and drive pawls. (Fig. 13-194)

IMPORTANT: Be very careful to maintain lock and drive pawl guide pins in their respective pockets during Step 6.

6. Assemble inner spacer washer over gearshaft and assemble gear mechanism in housing so that it is positioned with respect to the housing in the approximate location shown in Fig. 13-189.

7. Reassemble the outer spacer washer, shield, shim washers, as required to obtain .005" maximum end play, snap ring and rubber seal cap in the order indicated. Refer to Fig. 13-188.

8. Operate wiper to park or off position (refer to Fig. 13-178) and install crankarm in the approximate position shown in Fig. 13-188.

9. Reassemble washer pump to wiper. (Fig. 13-187)

WIPER ADJUSTMENTS

ARMATURE END PLAY

1. Loosen adjusting screw locknut (Fig. 13-188) and tighten or loosen the adjusting screw as required until end of screw barely touches end of armature.

2. Back off set screw 1/4 turn and tighten locknut.

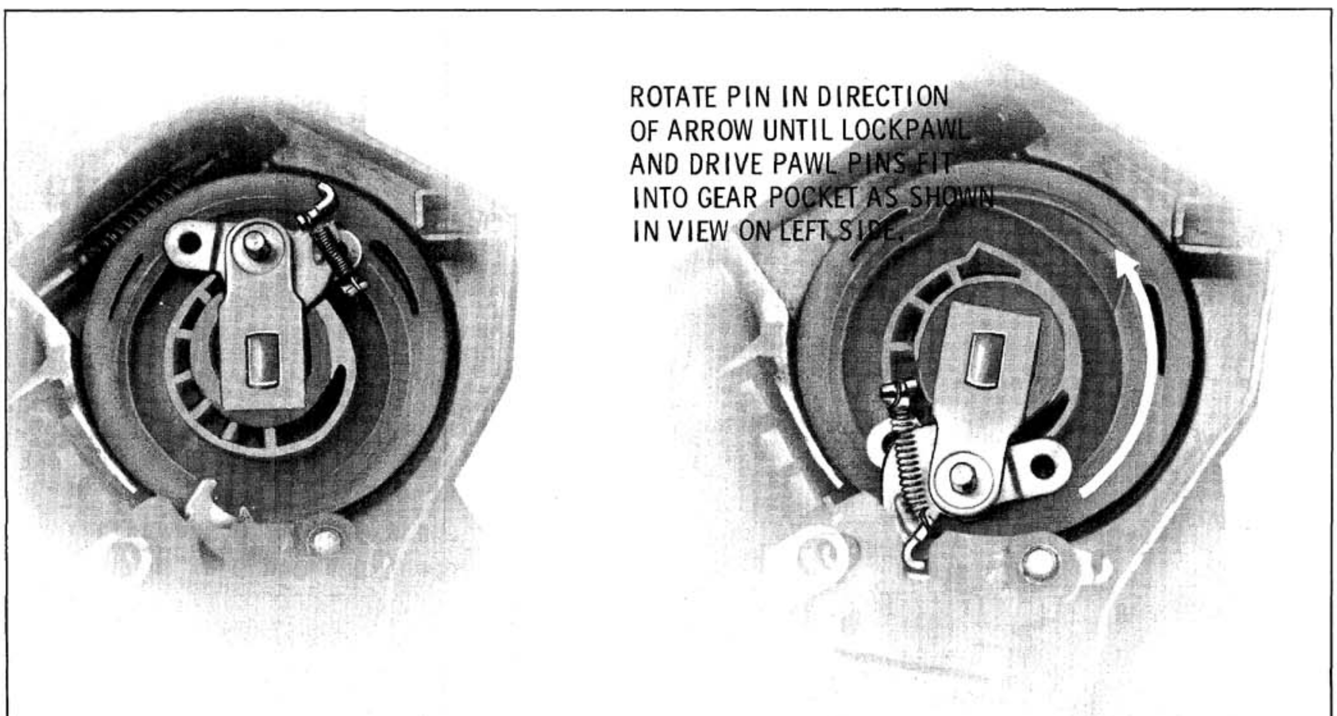


Fig. 13-194 Lock Pawl and Drive Pin Positioning

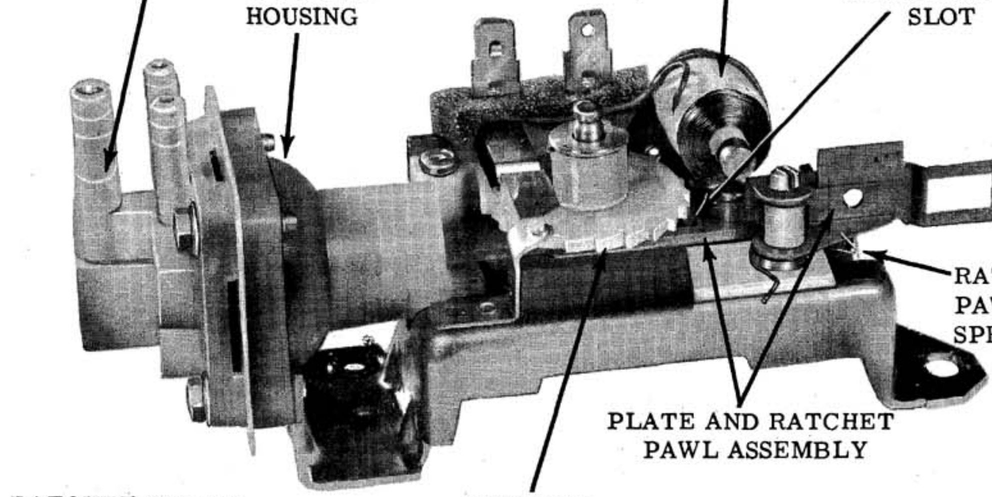


Fig. 13-195 Pump Assembly

GEAR ASSEMBLY END PLAY

1. Add or remove end play washers as required to obtain .006" minimum end play. (Fig. 13-188)

SPECIFICATIONS

LUBRICATION

Gear Teeth & Gear Clutch Mechanism Gearshaft Seal Cap (inside) Armature Worm	Delco Cam and Ball Bearing Lubricant

PERFORMANCE

Operating Voltage . . . . 12-14 VDC

Current Draw
- Bench Check (no load) . . . 3.1-4.5 amps.
- Installed in Car . . . . 3.5-5.0 amps.

Crankarm Rotation . . . . CCW

Crankarm Speed - RPM's
- Lo 40-50
- Hi 70-85

WASHER SYSTEM (Used on Rectangular Motor)

DESCRIPTION

The washer pump is a positive displacement type pump employing a small bellows, bellows spring and valve arrangement. The pump mechanism is actuated by a four lobe cam driven by the wiper.

OPERATION

The starting and completion of a wash cycle is accomplished electrically and mechanically by a relay assembly and ratchet wheel arrangement. (Fig. 13-195)

WIPER ON—WASHER OFF

With the washer pump mounted on the wiper, the four lobe cam actuates a spring-loaded plate and ratchet pawl assembly. (Fig. 13-196) Thus, with the wiper running, the four lobe cam rotates continuously actuating the plate and ratchet pawl assembly back and forth in a horizontal plane. A pin, attached to the plate and ratchet pawl assembly, extends through a slot in the bellows plunger arm. This pin moves freely back and

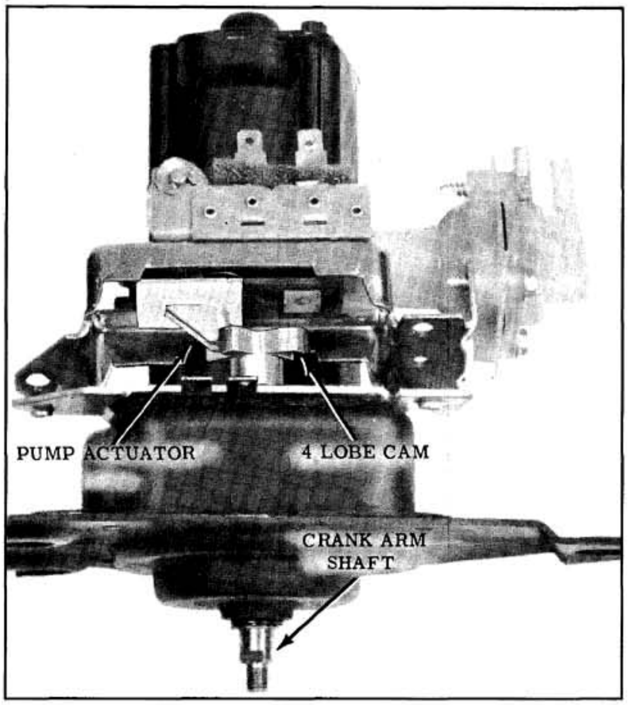


Fig. 13-196 Pump Actuator

forth in the slot while the pumping mechanism is in the "locked out" position and no pump action develops.

The pump is in the "lockout" position when the relay holding contacts are open and a tang on the plunger arm rests against the widest part of an eccentric ramp on the bottom of the ratchet wheel. The tang holds the bellows plunger arm

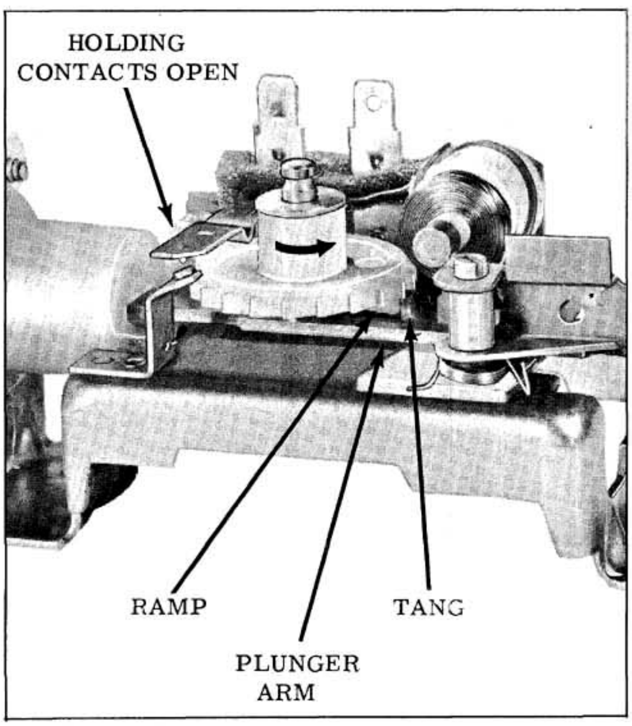


Fig. 13-197 Pump Lockout Position (Pump Parts Idling)

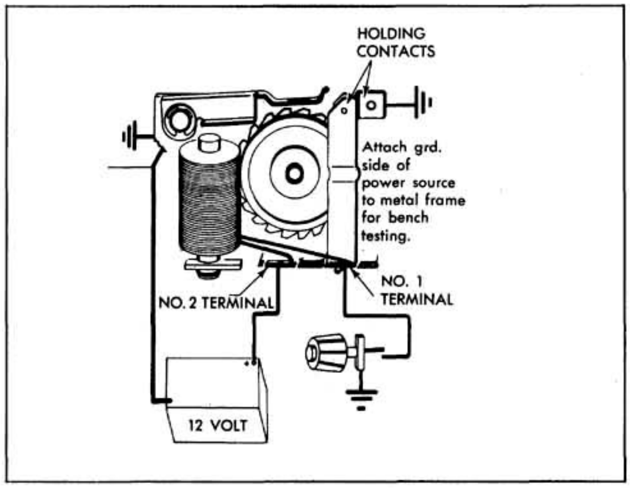


Fig. 13-198 Pump Wiring Circuit

in a retracted position (bellows spring compressed) allowing the plunger arm pin to move back and forth in the plunger arm slot preventing pumping action. (Fig. 13-197)

The ratchet pawl is spring-loaded to keep it from engaging the ratchet wheel until the pump relay is energized by the dash switch washer button.

WASHER ON

Depressing the dash washer button, closes the washer pump relay circuit to ground (if the wiper was off, the wiper switch is mechanically turned on by the washer button). (Fig. 13-198)

With the washer coil energized, the pawl, normally held away from the ratchet by spring force, is pulled towards the coil pole and engages the ratchet wheel. The ratchet pawl and plate assembly, which moves back and forth any time the wiper is on, now starts to rotate the ratchet wheel. (Fig. 13-199)

When the ratchet wheel has been rotated one tooth, two functions occur:

1. The eccentric ramp on the ratchet wheel is moved away from the plunger arm tang releasing the pump mechanism from its locked-out posiion. (Fig. 13-197)

2. A set of holding contacts close (Fig. 13-199) maintaining the coil circuit to ground. The contacts remain closed until the ratchet wheel is turned through 360°, at which time the ratchet wheel again opens the contacts.

PUMPING CYCLE

Exhaust Half of Pump Stroke

With the pumping mechanism released from

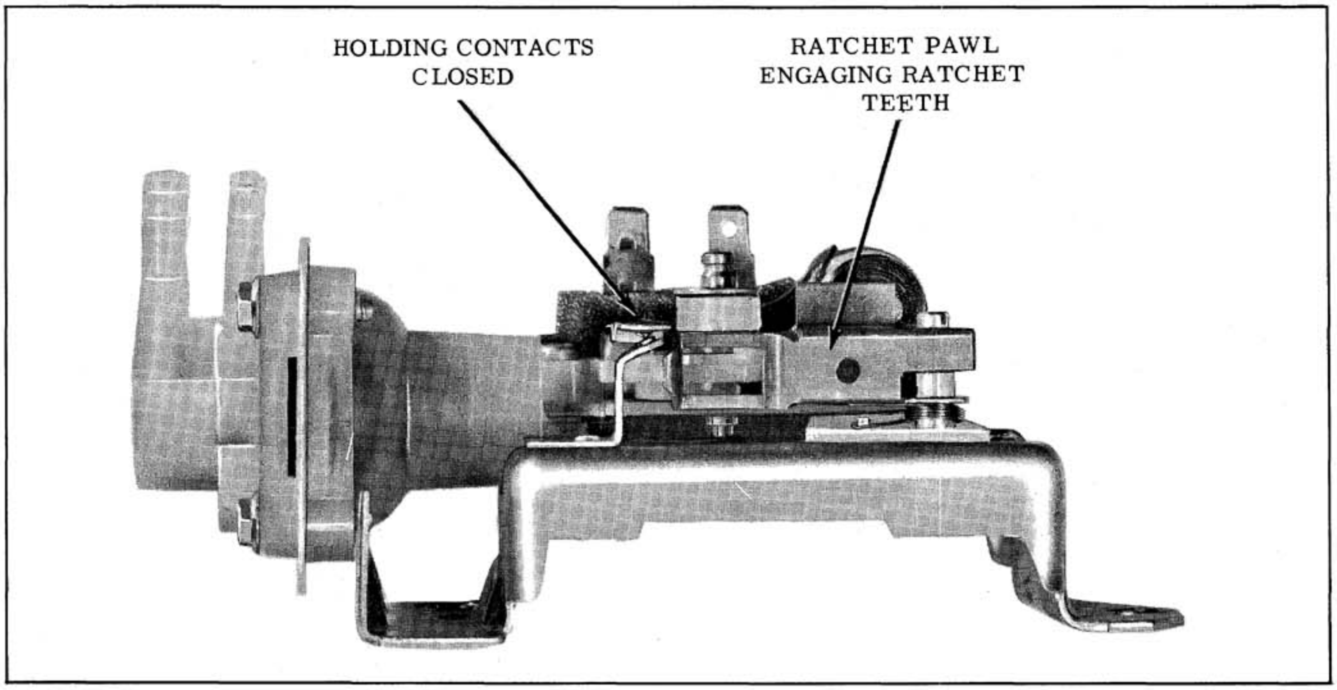


Fig. 13-199 Relay Coil Energized

the "lockout" position, the bellows spring expands collapsing the bellows forcing the water out through two outlet valves. (Fig. 13-200) The plunger arm, attached to the bellows, is pulled forward with the bellows and the back edge of the plunger arm slot moves up tight against the plunger arm actuator pin. The actuator pin, which was previously moving back and forth freely in the plunger arm slot, pulls the plunger arm back and compresses the bellows spring each time a lobe of the cam actuates the plate and ratchet assembly.

Intake Half of Pump Stroke

Pulling the plunger arm back compresses the bellows spring and water is drawn into the bellows through the intake valve. (Fig. 13-201) During the intake of water, the exhaust or outlet valves are drawn tight against their seats. During each intake stroke of the pumping mechanism, the ratchet wheel is rotated one tooth.

The wash cycle is completed when the electrical circuit to the relay coil is opened and the pumping mechanism reaches its "lockout" position. This is accomplished as follows.

When the ratchet wheel has been rotated through 360° or 21 teeth, the relay coil holding contacts are pushed open by a "hump" on the ratchet wheel. This opens the coil circuit and the spring

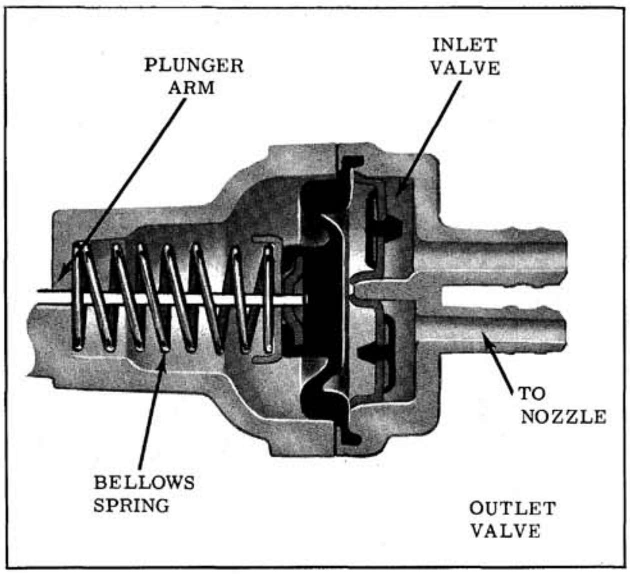


Fig. 13-200 Exhaust Half of Pump Stroke

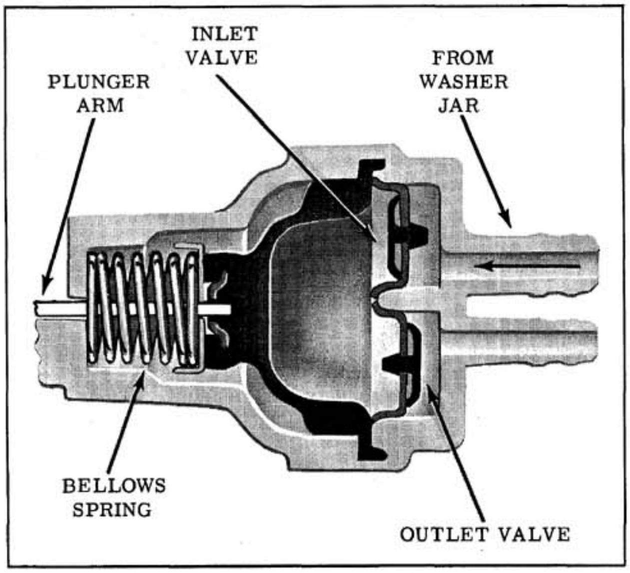


Fig. 13-201 Intake Half of Pump Stroke

loaded ratchet pawl moves away from the ratchet wheel preventing further rotation of the ratchet wheel.

As the ratchet wheel rotates, the tang on the bellows plunger arm starts to ride up the eccentric ramp on the lower surface of the ratchet wheel. The full "lockout" position of the pumping mechanism is reached when the tang is up on the widest part of the ramp. (Fig. 13-197) The tang reaches the "lockout" position at the same time the relay coil holding contacts open.

DIAGNOSIS (ON CAR)

Washer Inoperative

1. Check the following items:

   a. Jar had adequate quantity of water solution.

   b. Hoses are not damaged and hose connections are tight.

   c. Screen at end of jar cover hose is not plugged.

   d. Electrical connections to washer pump and dash switch.

   e. Nozzles are not plugged.

2. If all items in Step 1 check out, start wiper motor only, then push washer button and listen for "click" as washer relay pulls in. If no "click" is heard, check for 12 volts at terminal No. 2. (Fig. 13-202) No voltage indicates defective wiring. If "click" is heard, proceed to Step 4.

3. If correct voltage was found in Step No. 2, connect a jumper wire from terminal No. 1 to ground (Fig. 13-202) and operate wiper. If washer relay "click" is heard and pump functions correctly, a defective dash switch or an open circuit between washer pump and dash switch is indicated - "No Click" indicates an open relay coil.

4. If relay "click" is heard in Step 2, listen for the soft clicking as the pump ratchet wheel is rotated. If "soft clicking" is not heard, the pump mechanism is faulty and should be removed from the wiper motor and checked. If "soft clicking" is heard but no pumping action occurs, replace the valve assembly and recheck pump.

DIAGNOSIS (OFF CAR)

1. Remove washer pump cover and connect 12-volt power supply to washer pump as shown in Fig. 13-198. Connect jumper wire from terminal No. 1 to ground. Turn ratchet pawl to position shown in Fig. 13-198.

   Ratchet pawl should be pulled toward relay pole and engage ratchet teeth. Failure to do as described indicates an open relay coil.

2. If relay and ratchet pawl perform correctly in Step 1, manually actuate the washer pump to rotate the ratchet wheel one tooth. Observe if relay holding contacts close and the pump plunger arm is released from its "lockout" position. Figure 13-197 shows plunger in "lockout" position.

3. Disconnect jumper wire from terminal Number 1. Relay coil should remain energized and hold ratchet pawl against ratchet wheel. Failure to do so indicates open or dirty holding contacts.

4. If pump performs correctly in Step 3, continue to manually actuate the slide and ratchet pawl assembly until the ratchet wheel has been turned through 360° or 21 teeth. After the ratchet wheel has been rotated 21 teeth, the holding contacts should be opened by a "hump" on the wheel and the pump plunger arm should be in the "lockout" position. (Fig. 13-197)

Check Valve Assembly as Follows:

1. Attach a hose to the large or intake pipe. You should be able to blow through it but not draw through it.

2. Attach a hose individually to each of the small or exhaust pipes. You should be able to draw through them but not blow through them.

   If any of the three valves allow air to pass in both directions, the valve assembly is defective.

PUMP DISASSEMBLY—Refer to Fig. 13-195

Relay

1. Remove washer pump cover.

2. Unsolder coil leads from terminals. (Note: No coil polarity is necessary when resoldering coil leads.)

3. Remove coil retainer clip and slip coil assembly out of mounting bracket.

Ratchet Pawl

1. Remove washer pump cover.

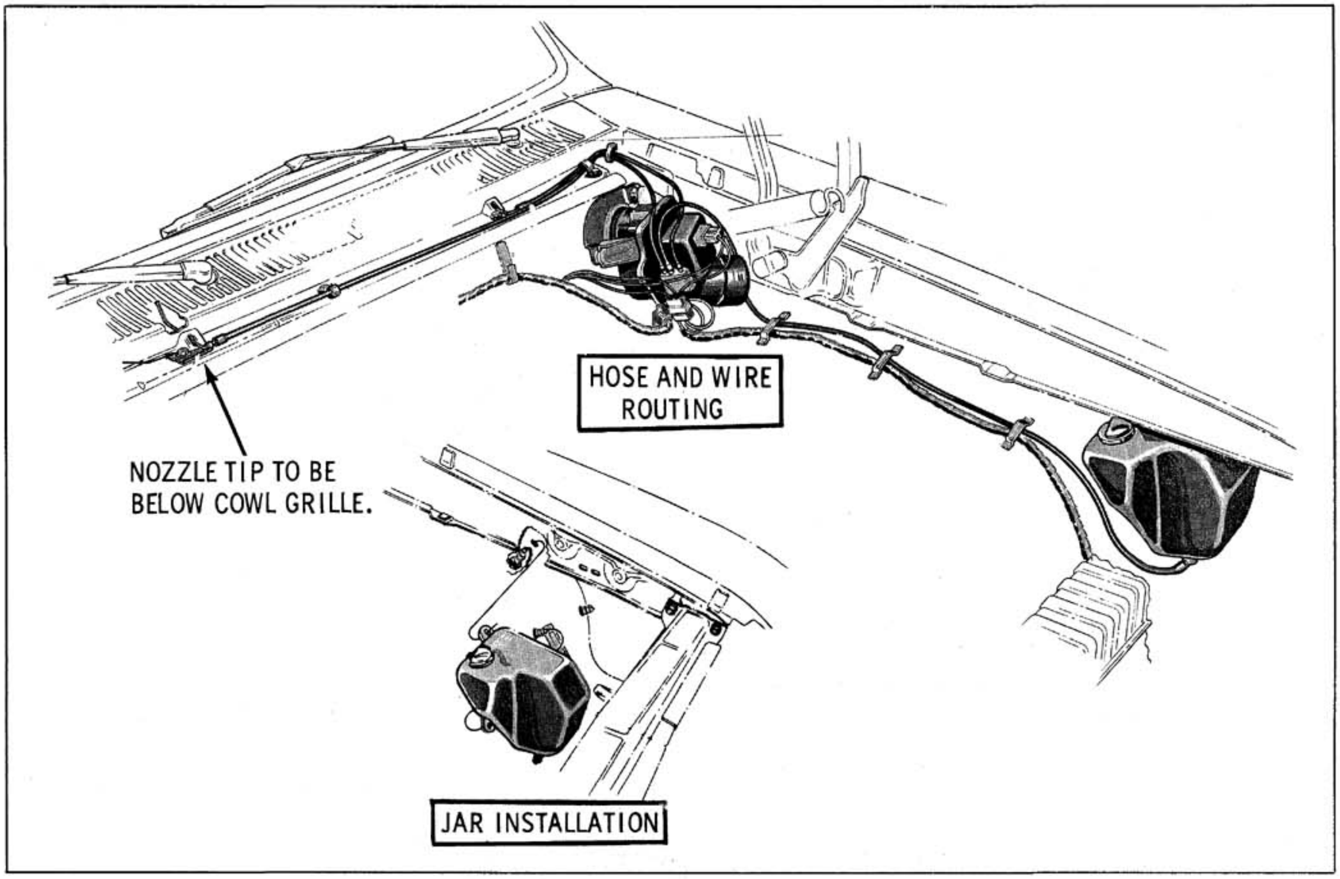


Fig. 13-203 Washer System (33 thru 3800 Series)

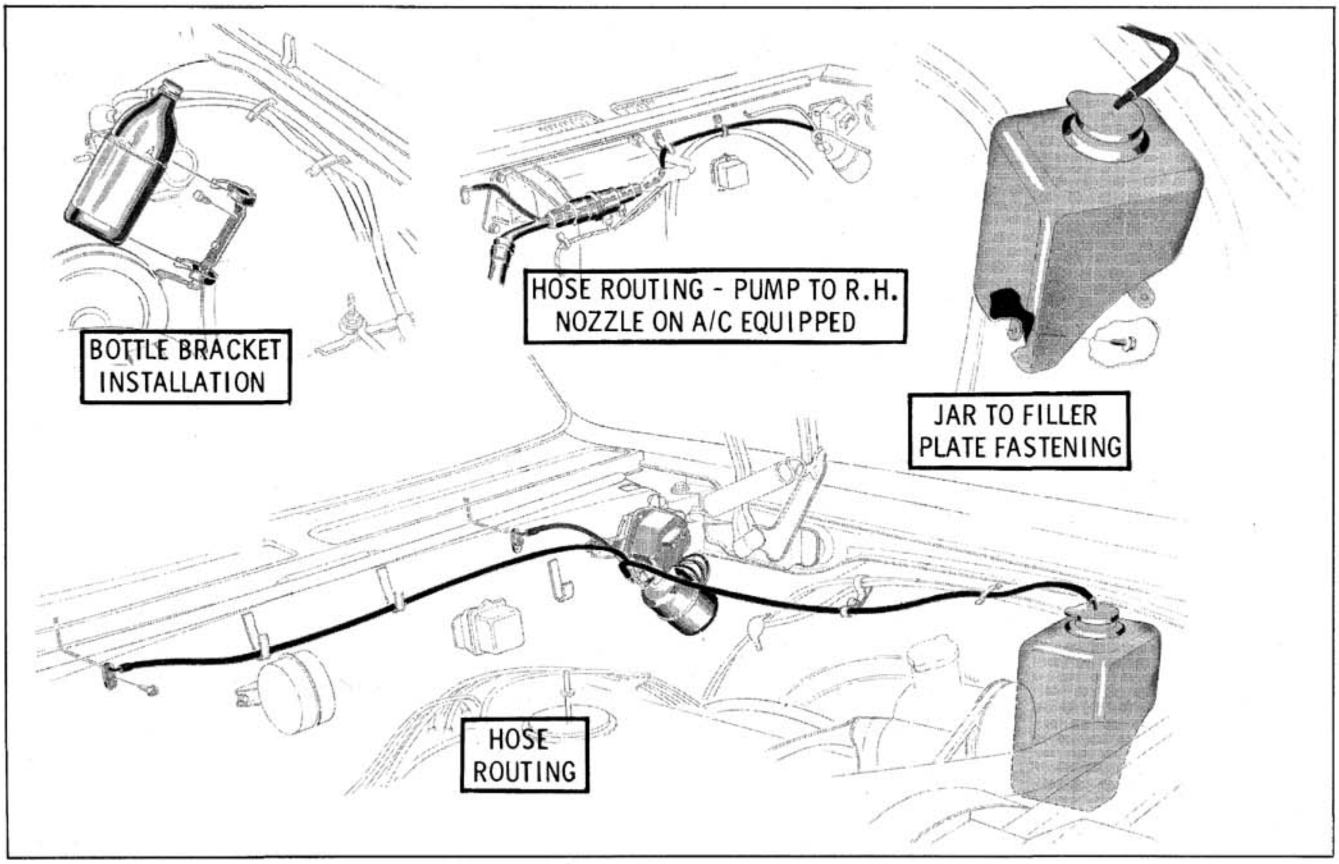


Fig. 13-204 Washer System (52 thru 8600 Series)

2. Disengage spring from ratchet pawl. (CAUTION: Be sure spring is properly assembled before replacing washer pump cover.)

3. Slide ratchet pawl off plastic shaft.

Valve Assembly

Remove the four screws that secure the valve assembly to the bellows housing.

CAUTION: It is sometimes necessary to carefully pry the bellows lip out of the valve body groove.

Bellows

1. Remove valve body.

2. Manually operate pump to release pump from "lockout" position (See "Checking Washer Pump Detached").

3. Hold bellows plunger arm from moving, then push in against bottom of bellows with thumb and twist bellows 90°. This should release bellows and bellows spring.

Assembly

To assemble the relay, ratchet pawl, valve assembly or bellows, reverse the disassembly procedure. For washer hose routing and jar installation see Figs. 13-203 and 13-204.

SPECIFICATIONS

Number of "squirts" at full pressure	12
Pressure (PSI)	11-15
Coil Resistance (ohms)	20

WASHER SYSTEM (Used With Round Motor)

The windshield washer pump consists of a relay, pump assembly, valve assembly and related parts assembled on a mounting plate attached directly to the wiper gear box.

OPERATION

Washer Off (Fig. 13-205)

When the wiper is operated, the rotor cam is always turning with the wiper gear. As the rotor cam rotates it actuates a spring-loaded lever (1) and pin (4) assembly to which a ratchet pawl (2) is attached.

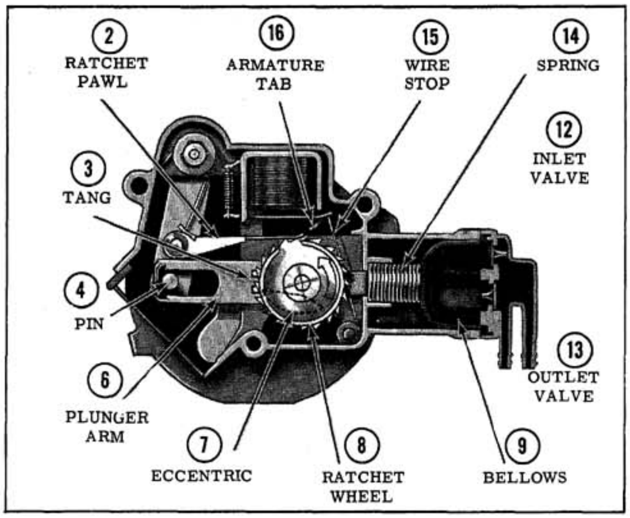


Fig. 13-205 Washer - OFF

The lever arm pin extends into the slot (5) of a spring-loaded plunger arm (6). The spring loaded plunger arm which is attached to the pumping bellows (9), is held in a retracted position (spring compressed) by an eccentric (7) on the ratchet wheel (8) when the pump is idling.

While the pumping mechanism is idling, the lever arm pin can move freely back and forth in the plunger arm slot and no pumping action occurs.

The ratchet pawl, which extends through an opening in the relay armature (10), is prevented from rotating the ratchet wheel by the relay armature.

Washer On (Fig. 13-206)

When the washer button on the instrument panel

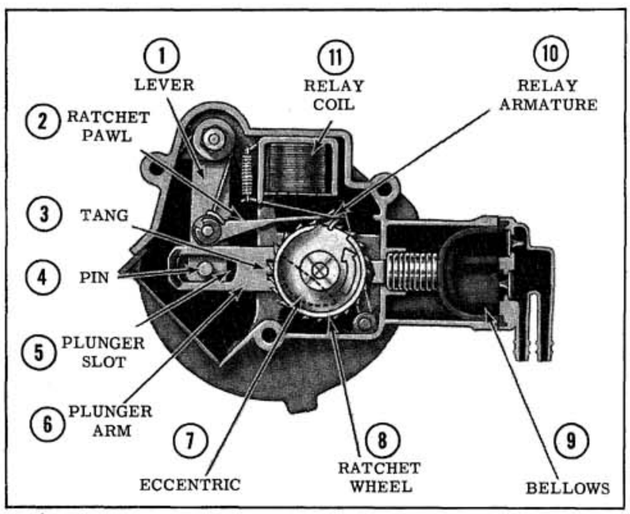


Fig. 13-206 Washer - ON

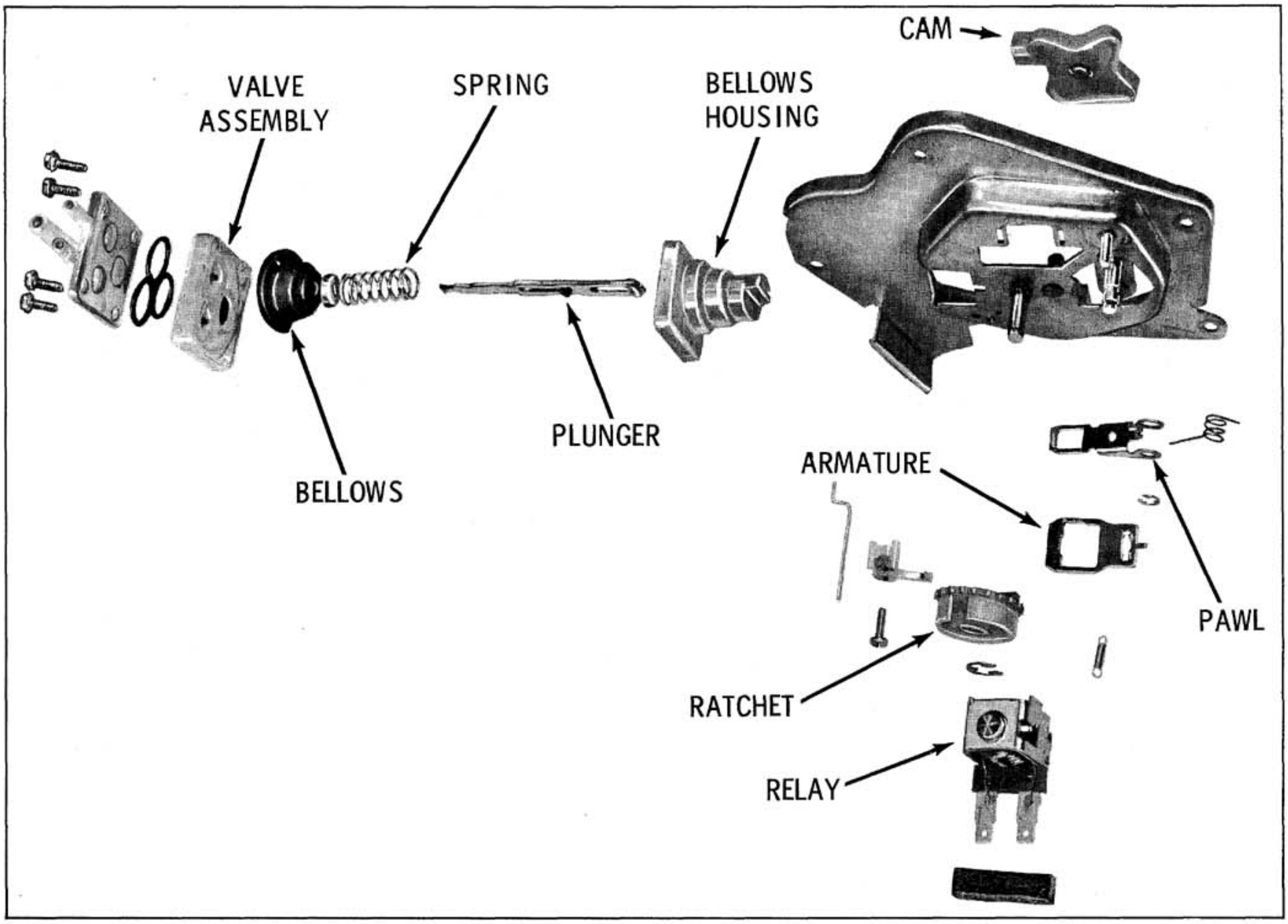


Fig. 13-207 Washer Assembly

is depressed, the circuit to the washer pump relay coil (11) is closed to ground. The relay is held in the energized position by a wire stop (15). The ratchet pawl (2), which previously was moving freely back and forth through the armature opening now drops out of the opening and engages the ratchet wheel (8).

As the ratchet wheel is rotated, the eccentric moves away from the plunger arm tang (3) releasing the plunger arm (6) for pumping action.

The plunger arm being spring loaded, now moves toward the bellows (9) and collapses the bellows forcing the water in the bellows out through the outlet valves (13) to the nozzles (exhaust stroke). At the same time the edge of the plunger arm slot moves up tight against the lever arm pin (4). As the rotor cam is turned, each of the four lobes actuate the lever arm which in turn pulls the plunger arm back compressing the spring (14). While the plunger arm is being pulled back (suction stroke) water is drawn in through the inlet valve (12). As the high point of each lobe is passed, the plunger arm spring pulls the plunger arm toward the bellows. This collapses the bellows and forces water out through the outlet valve (exhaust stroke).

For each revolution of the wiper gear and/or rotor cam, there are four pumping strokes. For each pumping stroke, the ratchet wheel is actuated or turned one tooth by the ratchet pawl. As the ratchet wheel turns, the eccentric pushes the wire stop out of the way of the relay armature. This allows the armature to partially drop so that the armature tab (16) rests against the edge of the ratchet wheel. After the ratchet wheel has been rotated about 12 teeth, the ratchet wheel eccentric starts to interfere with the plunger arm tang (3), resulting in shorter pumping strokes.

When the ratchet wheel has been turned through 360° or 21 teeth, two simultaneous functions occur as the wash cycle is completed:

A. The relay armature tab drops into the ratchet wheel slot allowing the ratchet pawl to enter the armature opening preventing further ratchet wheel rotation.

B. The ratchet wheel eccentric moves into a position which holds the plunger arm in a retracted position preventing further pumping action.

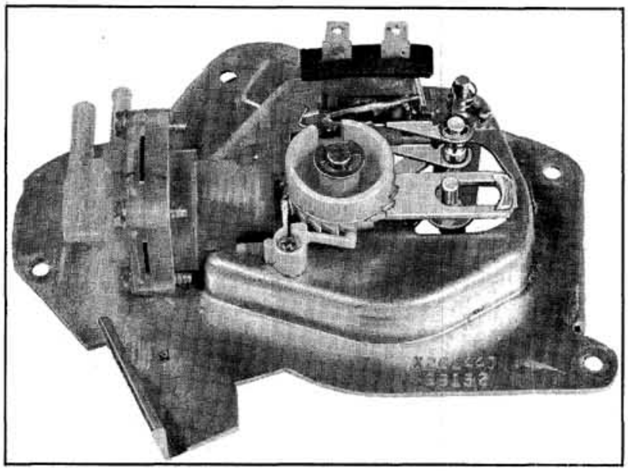


Fig. 13-208 Idling Position

Disassembly & Assembly (Fig. 13-207)

1. Remove washer cover.

2. Rotate cam until pump is in idling position. (Fig. 13-208)

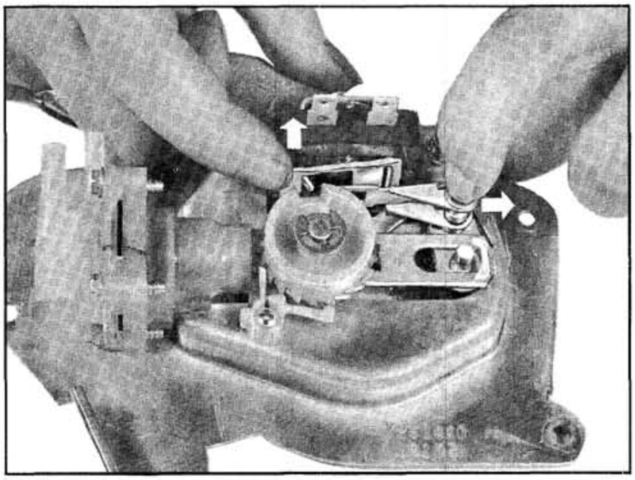


Fig. 13-209 Disengaging Pawl

3. Remove cam retainer and cam.

4. Move cam lever to the rear and lift up on armature as shown in Fig. 13-209.

5. Remove relay as shown in Fig. 13-210.

   NOTE: Armature is attached to the relay by a spring, do not lose spring.

6. Disengage spring from tang and pawl and remove spring.

7. Lift pawl from cam lever.

8. Remove valve assembly.

9. Rotate ratchet with thumb until bellows extends out of housing. (Fig. 13-211)

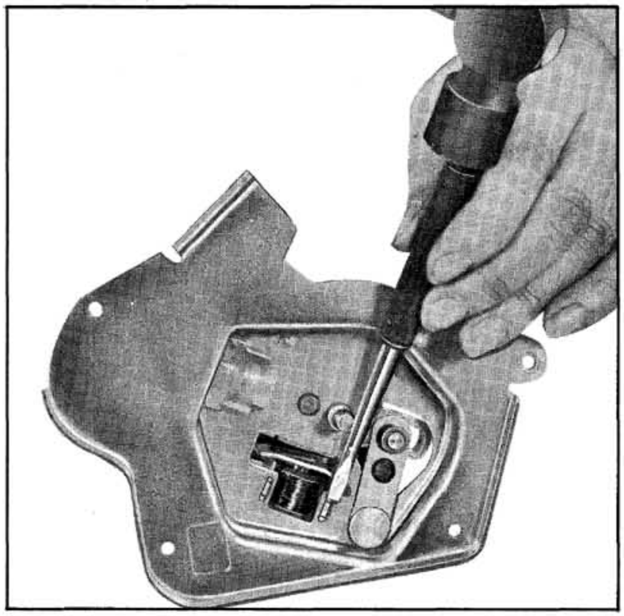


Fig. 13-210 Removing Relay

10. While holding the rear of the plunger, press in on bellows and turn approximately 90°. This will release the bellows from the plunger.

11. Remove bellows, retainer and spring.

12. Remove valve housing.

13. Remove ratchet retainer and remove ratchet.

14. Remove plunger with plastic bumper in place.

15. Remove white plastic ratchet stop and spring.

16. To assemble, reverse the disassembly produre. Apply Lubriplate or similar lubricant to the ratchet shaft and the bottom of the plunger where it contacts the housing. Also lubricate the bottom of the ratchet where it contacts the plunger.

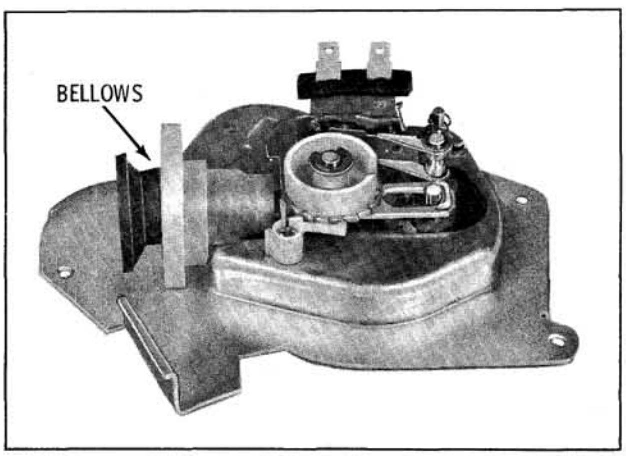


Fig. 13-211 Bellows Extended

WASHER DIAGNOSIS (ON CAR)

Washer Pump Inoperative

1. Inspect all washer hoses and hose connections. Inspect screen at end of jar cover tube for being plugged and for adequate supply of liquid in jar.

2. Start wiper motor first, then push washer button and listen for "click" as washer relay pulls in. If no "click" is heard, check power supply (12V) at washer pump wiring connector. No voltage indicates defective car wiring.

3. If correct voltage reading was obtained in Step 2, start wiper first, then connect 12 volt supply to one of washer terminals and ground the other. If washer relay "click" is heard, a defective instrument panel switch is indicated.

4. If washer relay "click" is not heard in Step 3, a defective washer pump relay coil is indicated.

5. If relay "click" is heard in Step 3, and pump still does not pump water, a defective valve assembly is indicated. (Note: Listen for soft clicking as washer pump ratchet wheel is rotated through a cycle.)

Washer Pump Will Not Shut Off When Wiper Is On

1. Disconnect wiring from washer pump. If pump shuts off, trouble is located in the wiring or switch.

2. If pump fails to shut off in Step 1, remove pump assembly from car for further checking (See WASHER DIAGNOSIS-OFF CAR).

WASHER DIAGNOSIS—OFF CAR

1. Connect 12-volt supply to one of washer terminals and ground the other. Manually rotate the rotor cam and observe if relay armature pulls in. Failure of relay to pull in indicates an open relay coil or poor solder connections.

2. If relay pulled in in Step 1, manually rotate the rotor cam (CCW looking at rotor) through a complete cycle (Ratchet wheel rotated 360° or 21 teeth) carefully observing if performance matches that as explained under washer operation. Binds or any other type of malfunction can usually be located in this manner.

GENERAL SPECIFICATIONS

STARTING MOTOR
- a. Make . . . . Delco-Remy
- b. Brush Spring Tension . . . . 35 oz. Min.
- c. Number of Brushes 4
- d. Number of Fields 4
- e. Rotation, Viewed From Drive End . . . . Clockwise
- f. Pinion Clearance . . . . .010" to .140"
- g. Free Speed (Model 1107330) 3800 to 6200 rpm at 10.6 volts . . . . . . 70 to 105 Amps.*
- h. Free Speed (Model 1107298) 3600 to 5100 rpm at 10.6 volts . . . . . . 65 to 100 Amps.*
- i. Free Speed (Model 1107260) 6200 to 9400 rpm at 10.6 volts . . . . 49 to 76 Amps.*

DELCOTRON GENERATOR
- a. Charging Rate - Refer to Output Chart.
- b. Field Current Draw at 12 Volts, 80°F. . . . . 2.2 to 2.6 Amps.

REGULATOR

Field Relay
- a. Air Gap . . . . .015"
- b. Point Opening . . . . .030"

Voltage Regulator
- c. Air Gap . . . . .060"
- d. Point Opening . . . . .014"
- e. Voltage Setting . . . . Refer to Fig. 13-17

BATTERY--12 VOLT

Series	Engine	Amp. Hr.	Plates
33 & 35 Series	V-6	61	66
34, 36, 38 & 52 Series	V-8	61	66
54 & 56 Series	V-8 L.C.	70	66
54, 56, 66, 84 & 86 Series	V-8 H.C.	73	78

Specific Gravity for Fully Charged Battery . . . . 1.270 ± .010 at 80°F.

COIL
- a. Primary Resistance . . . . 75°F. . . . 1.77 to 2.05 Ohms
- b. Secondary Resistance . . . . 75°F. . . . 6500 to 9500 Ohms

RESISTOR, IGNITION COIL (IN WIRING HARNESS)
- a. Resistance 80°F. . . . . 1.35 Ohms

DISTRIBUTOR (For Additional Specs., Refer to Tune-Up Section)
- a. Cam Angle Range . . . . 28° to 32° (Adjust to 30°)
- b. Contact Point Opening . . . . .016"
- c. Contact Arm Spring Tension . . . . 19 to 23 oz.
- d. Condenser Capacity . . . . .18 to .23 Mfd.

SPARK PLUGS - Refer to Tune-Up Section

HORNS
- a. Current Draw at 11.5 Volts . . . . 4.5 to 5.5 Amps.

HORN RELAY
- a. Closing Voltage . . . . 1.5 to 9.5 Volts.

*Includes Solenoid.

LAMP BULB NUMBERS
52 THROUGH 86 SERIES

Lamp	Bulb Number
Headlamps (inner) (#1) (Upper beam only)	L-4001
Headlamps (outer) (#2) (Lower & Upper Beam)	L-4002
Stop Lamps and Tail Lamps	1157A
Parking Lamps and Turn Signal Front	1157
Dome Lamp	1004
Door Lamp (2-Door Models and 98 Lux. Sedan)	212
License Lamp	97
Courtesy Lamp (Including Console Side) Side Roof or rear Quarter Lamp Arm Rest Map Lamp	90
Ignition Switch & Cigar Lighter Console Shift Indicator Lamp Ash Tray Lamp Cruise Control Lamp	1445
Heater, Ventilation and A/C Control Lamp Map Case Lamp, Console Tachometer or Performance Gauge Lamp Glove Box	1895
Parking Brake Warning Lamp Oil Pressure Warning Lamp Speedometer and Odometer Lamp Fuel Gauge Generator Warning Lamp Safety Sentinel Temperature Indicator Lamps Turn Signal Indicator Lamps High Beam Indicator	158 or 194
Cornering Lamp	1195
Underhood Lamp Rear Compartment Lamp	631
Back-Up Lamps	1156
Electric Clock Radio Dial Lamp Deluxe, Super Deluxe, AM & FM Shift Indicator (Panel)	1893

FUSE SPECIFICATIONS AND LOCATION
52 THROUGH 86 SERIES

APPLICATION	NAME OF FUSE CIRCUIT ON FUSE BLOCK	FUSE TYPE AND AMPERES
Radio (Deluxe) or AM-FM Radio (Super Deluxe)	Radio	SFE-9
Temperature Indicator Light Oil Pressure Light Generator Warning Light Fuel Gauge Parking Brake Light Back-Up Lights	Instru.-B/U	SFE-9
Tail Lights Trunk Lights License Light	Tail Lights	SFE-9
Clock Light Instrument Cluster Light Heater, Ventilation and Air Cond. Light Tachometer, Cruise Control Ash Tray Light Jetaway Indicator	Panel Light	AGA-3
Glove Box Lamp Underhood Lamp Cornering Lamp	Gl. Bx.-U/H	SFE-9
Heater Air Conditioning Rear Window Defroster	Heater-A/C	SFE-20 (With Heater Only) AGC-25 (With Air Cond. or with Heater & Rear Seat Defroster)
Electric Antenna Electric Windows Electric Seat Cruise Control	Relay-Antenna	SFE-20 (With Electric Antenna; Power Windows or Cruise Control) AGC-25 (With Electric Seat)
Windshield Wiper	W/S Wipers	SFE-20
Dome Lights Courtesy Lights Cigar Lighter Clock	Dome-Courtesy	SFE-20 (Except with Rear Seat Lighter use AGC-25)
Stop Lights	Stop	SFE-20
Transmission - Control	Transmission	SFE-9

The following circuits either employ circuit breakers or have fuses located as indicated.

Headlights	Circuit Breaker	Built-In Light Switch
Electric Seat, Window and/or Convertible Top Motors	Circuit Breaker	On Engine Side of Dash. Left Hand Side.

FUSE SPECIFICATIONS AND LOCATION 52 THROUGH 86 SERIES (Cont'd)

APPLICATION	NAME OF FUSE CIRCUIT ON FUSE BLOCK	FUSE TYPE AND AMPERES
Guide-Matic Power Headlight Control	SAE-4	In-Line Fuse Holder - Amplifier to Light Switch
Tachometer	SFE-2	At Tachometer Inside Console
Turn Signal Flasher		
Jetstar 88 Dynamic 88 Delta 88 Jetstar I Starfire	Part No. 383637	Behind Instrument Panel
Ninety-Eight	Part No. 383638	Behind Instrument Panel

FUSE SPECIFICATIONS AND LOCATIONS 33 THROUGH 38 SERIES

APPLICATION	NAME OF FUSE CIRCUIT ON FUSE BLOCK	FUSE TYPE AND AMPERES
Fuel Gauge Temperature Light Generator Light Oil Pressure Light Parking Brake Light Back-Up Lights	Instr. Back-Up	SFE-9
Tail Lights Trunk Glove Box Light License Light	Tail Lights	SFE-9
Transmission Control	Transmission	SFE-9
Clock Light Instrument Cluster Heater Control Light Air Conditioning Control Light Console Shift Indicator Light Jetaway Indicator Light	Panel Light	AGA-3
Stop Lights	Stop	SFE-20
Clock Dome Lights Cigar Lighter Courtesy Lights	Dome-Courtesy	SFE-20
Windshield Wiper Windshield Washer	W/S Wiper	SFE-20
Radio	Radio	SFE-9

FUSE SPECIFICATIONS AND LOCATIONS 33 THROUGH 38 SERIES (Cont'd)

Heater / Air Conditioning	Htr.-A/C	SFE-20	(AGC-25 with Air Condition.)
Electric Antenna & Power Windows	Relay-Antenna	SFE-20	

The following circuits either employ circuit breakers or have fuses located as indicated:

Tachometer	AGA-2	In-Line Fuse Behind Tachometer
Headlights	Circuit Breaker	Built-In Light Switch
Turn Signal Flasher	Part No. 383638	Behind Instrument Panel

LAMP BULB NUMBERS 33 THROUGH 38 SERIES

Courtesy Lamp (Including Console)	90
Dome	211
Electric Clock Radio Dial Glove Box	1893
Heater Control Parking Brake Warning Tachometer Console Compartment	1895
Shift Indicator Ash Tray	1445
Speedometer and Odometer Oil Pressure Warning Generator Warning Temperature Indicator Fuel Gauge Turn Signal Indicator High Beam Indicator	158 or 194
Parking Lamps and Turn Signal, Front Tail and Stop	1157
License	97
Back-Up	1156
Headlamp (Upper Beam Only)	L-4001
Headlamp (Upper and Lower Beam)	L-4002

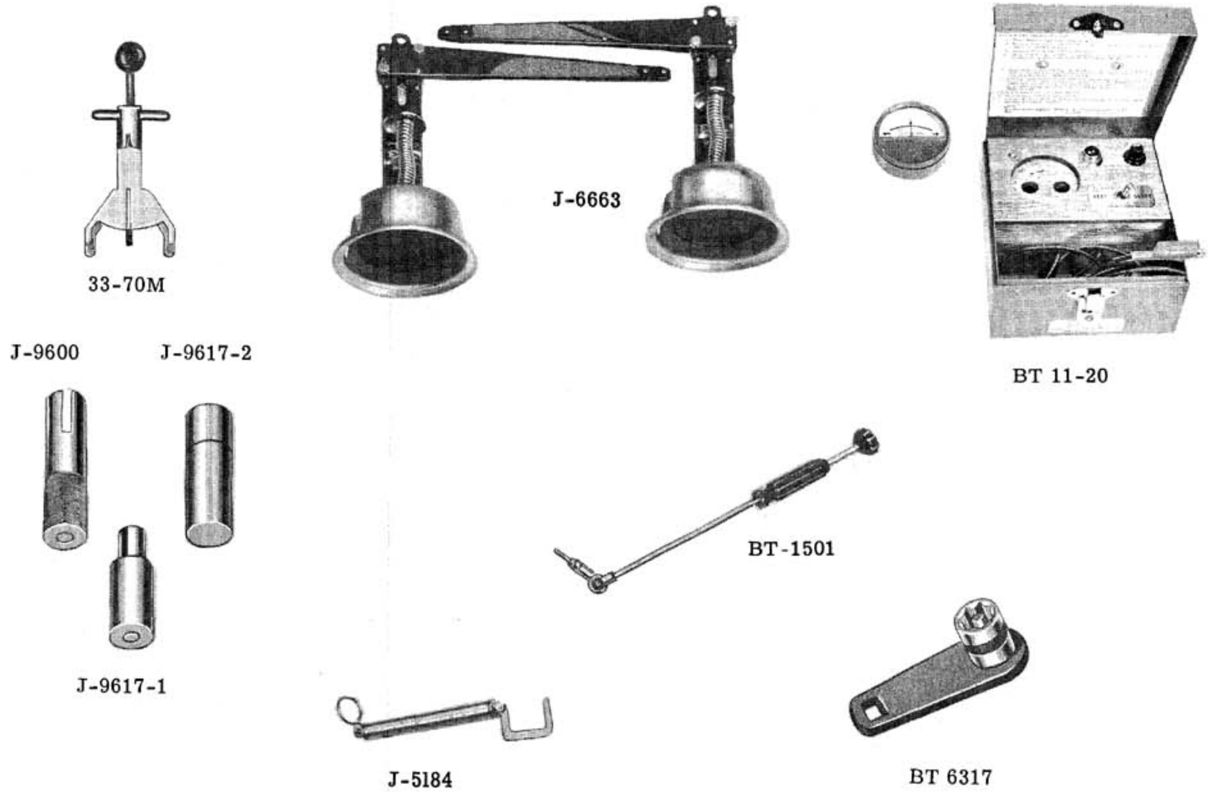
TORQUE SPECIFICATIONS

NOTE: Specified torque is for installation of parts only. Checking of torque during inspection may be 15% below that specified.

APPLICATION	Ft. Lbs.
Battery Hold Down Nuts	1.5 to 2.5
Distributor Clamp to Cylinder Block Bolt	14
Delcotron Mounting Brackets	

Thread	Torque Ft. Lbs.
5/16	25
3/8	35
7/16	50

APPLICATION	Ft. Lbs.
Spark Plugs	35
Starting Motor - 52 through 86 Series	
Starter to Cylinder Block	35
Brace to Cylinder Block	25
Brace to Starter Motor	15
Starting Motor - 33 through 38 Series	
Starter to Cylinder Block Bolts	40
Mounting Bracket to Cylinder Block Bolt	13
Mounting Bracket to Starter	13
Junction Block Nut	8 to 10
Solenoid Terminal Nuts	1 to 2
Ignition Coil Terminal Nuts	1 to 2
Coil to Manifold	15
Ground Strap to Cylinder Head Bolt	20



BT-11-20	SHORT DETECTOR	J-5184	ELECTRICAL TENSION CHECKING SCALE
BT-33-70-M	BELT TENSIONER GAUGE	J-6663	HEADLIGHT AIMERS
BT-1501	DISTRIBUTOR DWELL ANGLE ADJUSTING TOOL	J-9600	DIODE INSTALLER
BT-6317	DELCOTRON PULLEY NUT TOOL	J-9617-1	DIODE REMOVER
		J-9617-2	DIODE SUPPORT

Fig. 13-212 Tools

HEATER AND AIR CONDITIONER

(ALL SERIES)

CONTENTS OF SECTION 14

HEATER

(54 THROUGH 86 SERIES)

GENERAL DESCRIPTION (Fig. 14-1)

Air enters the ventilation and heater system at the cowl vent grille, travels through the plenum chamber and into the cowl air chamber. Air can now be directed into the passenger compartment by opening the right and left side cowl doors or by opening the heater inlet door. The doors are opened by vacuum operated diaphragms, actuated by pushbuttons, and closed by spring force.

The ventilation and heater control pushbuttons are in a single control unit located on the instrument panel on the right side of the steering column. The control also contains the blower speed switch and the temperature control slide lever.

Cars without heaters are equipped with hand operated cowl outlet doors for right and left side ventilation. (Fig. 14-2)

VENTILATION SYSTEM (Fig. 14-3)

When the "Left" button is depressed, air flows into the passenger compartment through the left vent door.

When the "Right" button is depressed, air flows into the passenger compartment through the right vent door.

When the "MAXIMUM" button is depressed, both the right and left cowl outlet doors are opened.

HEATER SYSTEM (Fig. 14-3)

For heating, the temperature control lever must be moved to the right, depending on the amount of heat desired.

OPERATION (Fig. 14-4)

Depressing the "HEAT" button opens the heater inlet air door and starts the blower motor.

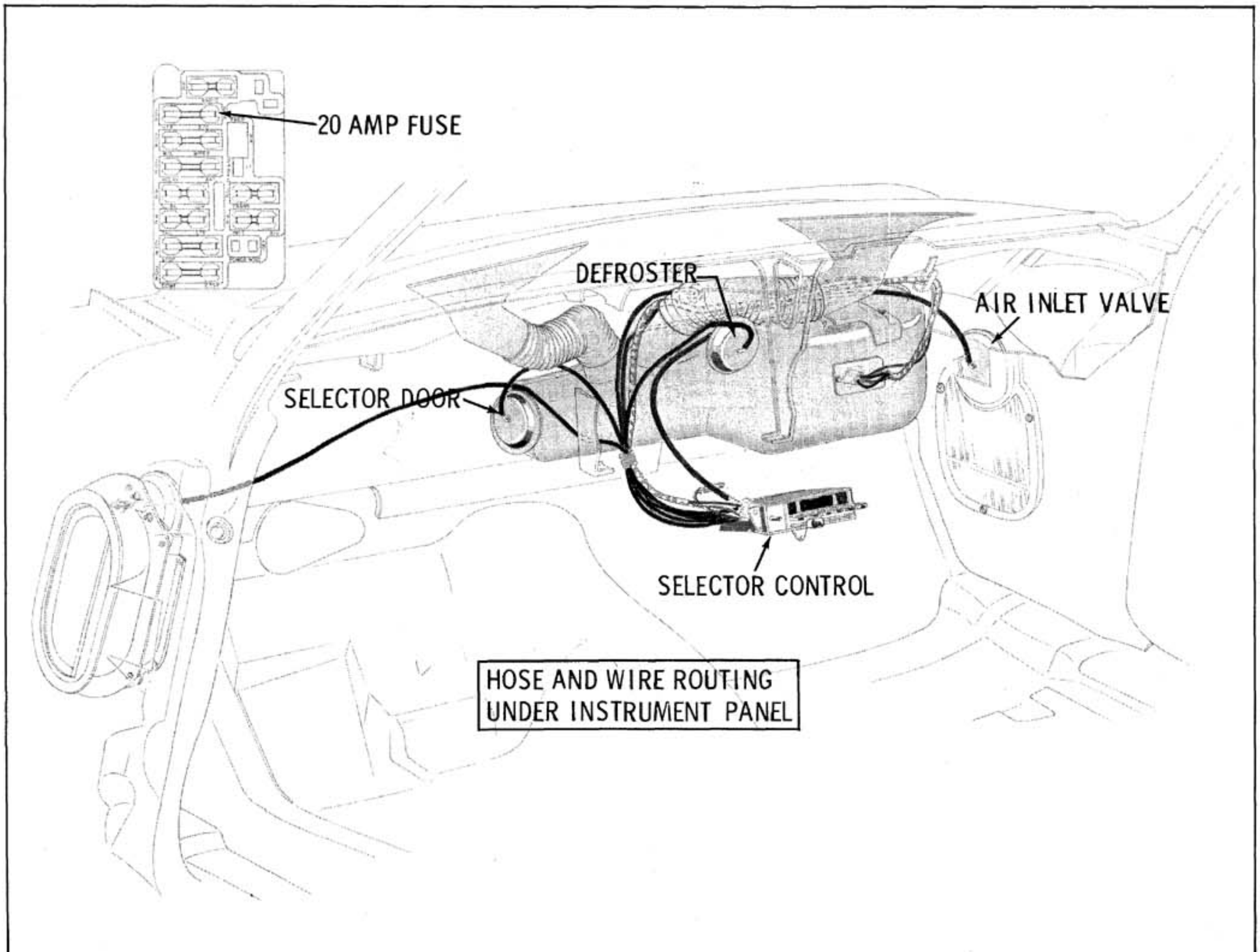


Fig. 14-1 Heater Control Layout

Outside air is drawn through the cowl air intake grille into the ventilation duct and into the heater blower and air inlet assembly. The heater blower then forces a portion of the outside air through the heater core and into the ducting system. The remaining air is forced directly into the ducting system. To obtain the desired discharge air temperature, the heater air then mixes with the unheated air in the necessary proportions.

The temperature lever operates the temperature door which controls the temperature of the discharged air by regulating the mixing of heated and unheated air. In the COOL position, the air flow from the heater core is completely blocked. As the lever is moved to WARM, the temperature door opens, admitting heated air into the ducting and progressively decreases the amount of unheated air. In the MAX. WARM position, the flow of unheated air is completely blocked directing all the air through the heater core, for maximum heating.

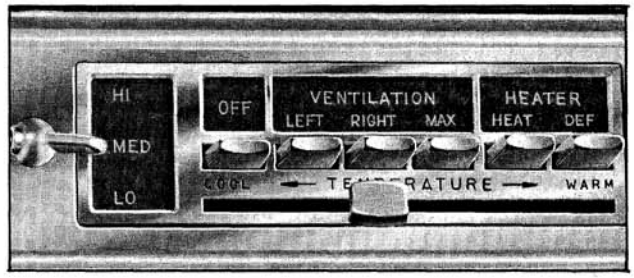


Fig. 14-3 Heater and Ventilation Control

Depressing the "DEF" button operates a vacuum operated diaphragm which opens the defroster door and air flows into the right and left defroster nozzles, diverting the air flow onto the windshield. Approximately 80% of the air flow is directed on the windshield. The balance of the air flow enters the passenger compartment through the heat outlet.

Rate of air flow on "HEAT" and "DEF" can be controlled by the blower speed switch.

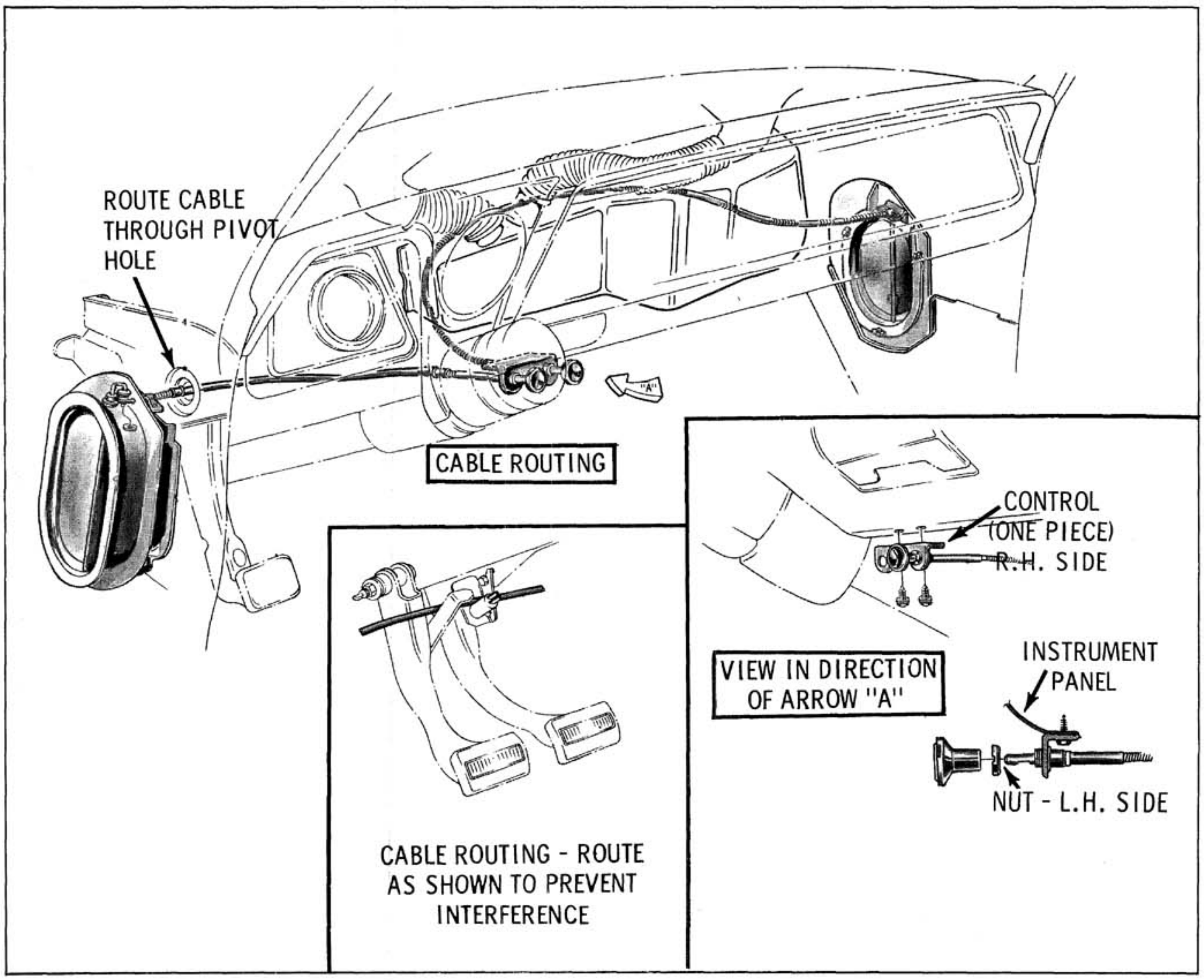


Fig. 14-2 Ventilation Without Heater (52 through 86 Series)

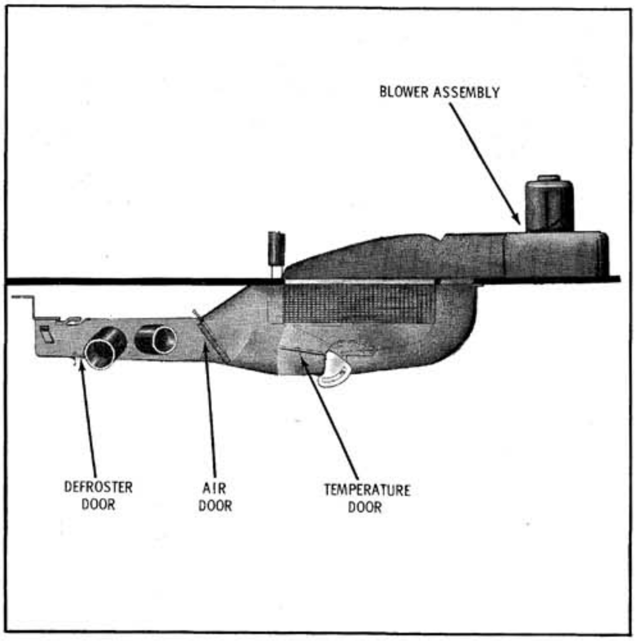


Fig. 14-4 Air Doors

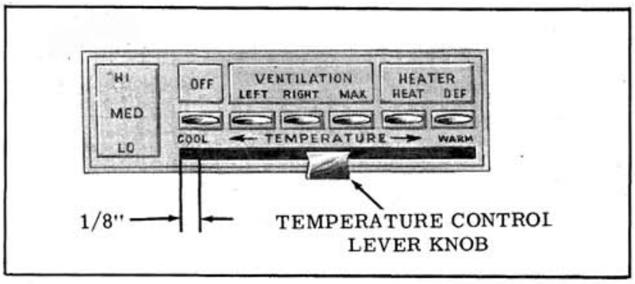


Fig. 14-5 Temperature Control Adjustment

ADJUSTMENTS

TEMPERATURE CONTROL CABLE

The cable is connected to a cam lock device that assures positive closing of the temperature door. To adjust, disconnect the cable and insert a 3/16" pin through the hole in the cam and cam support to lock the door in the full cold position. Attach cable to pin on cam and adjust it so that when lever is to the left side of the control, a clearance of 1/8" is obtained.

COWL OUTLET DOOR

Adjustment of the cowl outlet door and diaphragm linkage is provided at the diaphragm. (Fig. 14-6)

1. With cowl vent body removed, loosen set screw.

2. Pull diaphragm lever to its extreme stop, then push back 1/16".

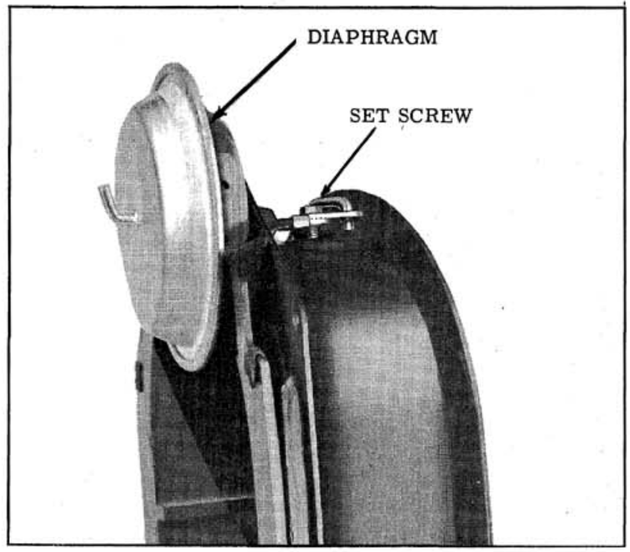


Fig. 14-6 Cowl Outlet Diaphragm Adjustment

3. While holding door closed, tighten set screw.

HEATER INLET DIAPHRAGM

1. Remove vacuum hose from diaphragm. (No vacuum must be applied to diaphragm when making adjustment.)

2. Loosen the set screw on the diaphragm arm.

3. With the inlet door held closed by spring force and diaphragm in the fully released position, tighten the set screw.

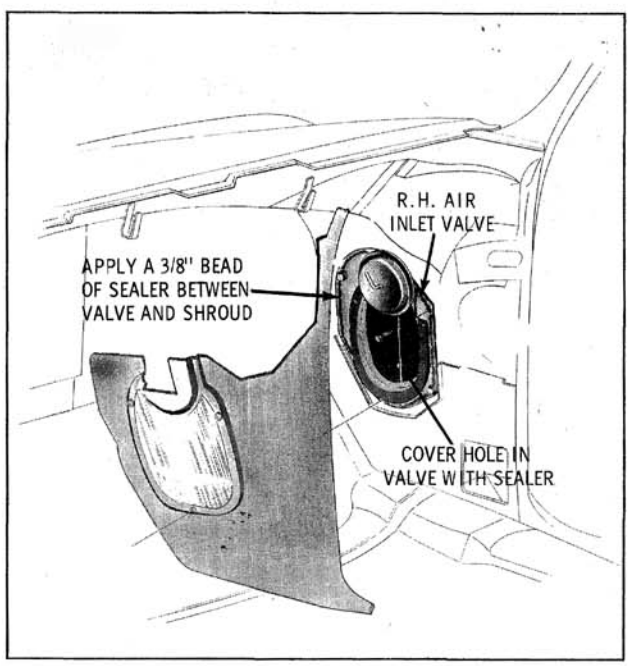


Fig. 14-7 Air Valve Installation

DEFROSTER DOOR DIAPHRAGM

1. With vacuum applied to the defroster diaphragm, loosen the set screw on the diaphragm arm.
2. Remove heater outlet. Pull defroster door down until it contacts the rubber stop, then tighten set screw.
3. Install heater outlet.

COWL VENT DOOR ASSEMBLY

REMOVE AND INSTALL (Fig. 14-7)

1. Remove cowl vent grille and trim pad.
2. Disconnect vacuum line from diaphragm.
3. Remove the air inlet valve assembly to cowl attaching screws and remove assembly. (Fig. 14-7)
4. If necessary the diaphragm can now be removed.

On installation, apply a 3/8" bead of caulking compound between the assembly and cowl, make sure water seal tape is installed over actuating wire rod hole in door body, then reverse removal procedure.

HEATER INLET ASSEMBLY (INCLUDES 5200 SERIES)

REMOVE AND INSTALL (Fig. 14-8)

1. Disconnect blower feed wire.
2. Remove upper sheet metal screw holding the blower to the dash by assembling approximately three feet of 3/8" extensions and a 7/16" socket through the opening between the fender filler plate and the fender forward of the right front wheel. Guide the socket onto the sheet metal screw and remove screw.

   NOTE: Use body sealing compound on socket to hold screw while removing or installing.
3. Remove remaining attaching nuts and screw.
4. Push heater case studs back until studs do not protrude through dash.
5. Remove the three rear fender attaching bolts so that the rear of the fender can be moved outward and upward slightly.
6. Rotate blower and inlet assembly and remove from car.

HEATER CASE AND CORE

REMOVE AND INSTALL (Fig. 14-9)

1. Remove glove box.

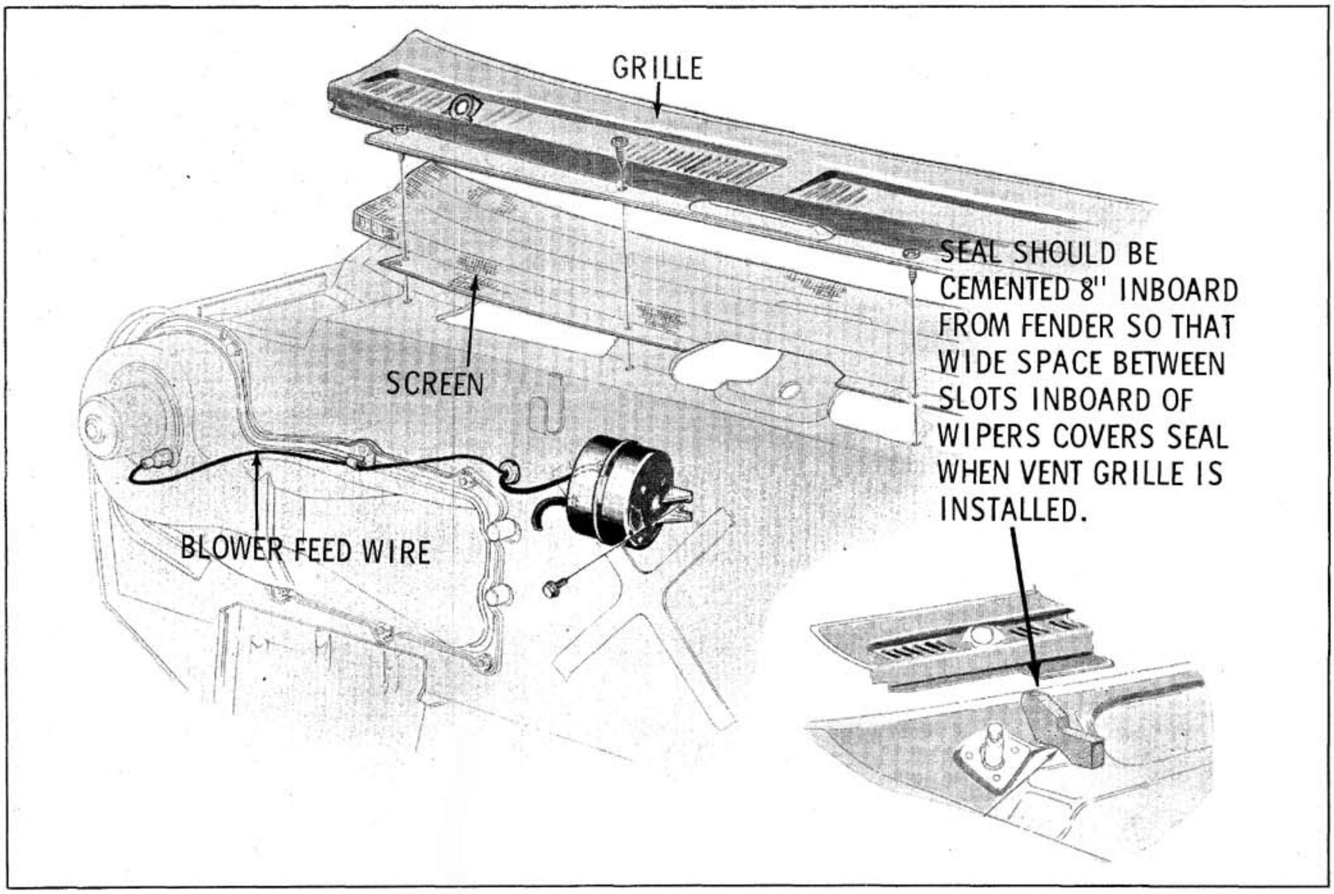


Fig. 14-8 Blower Duct Attachment

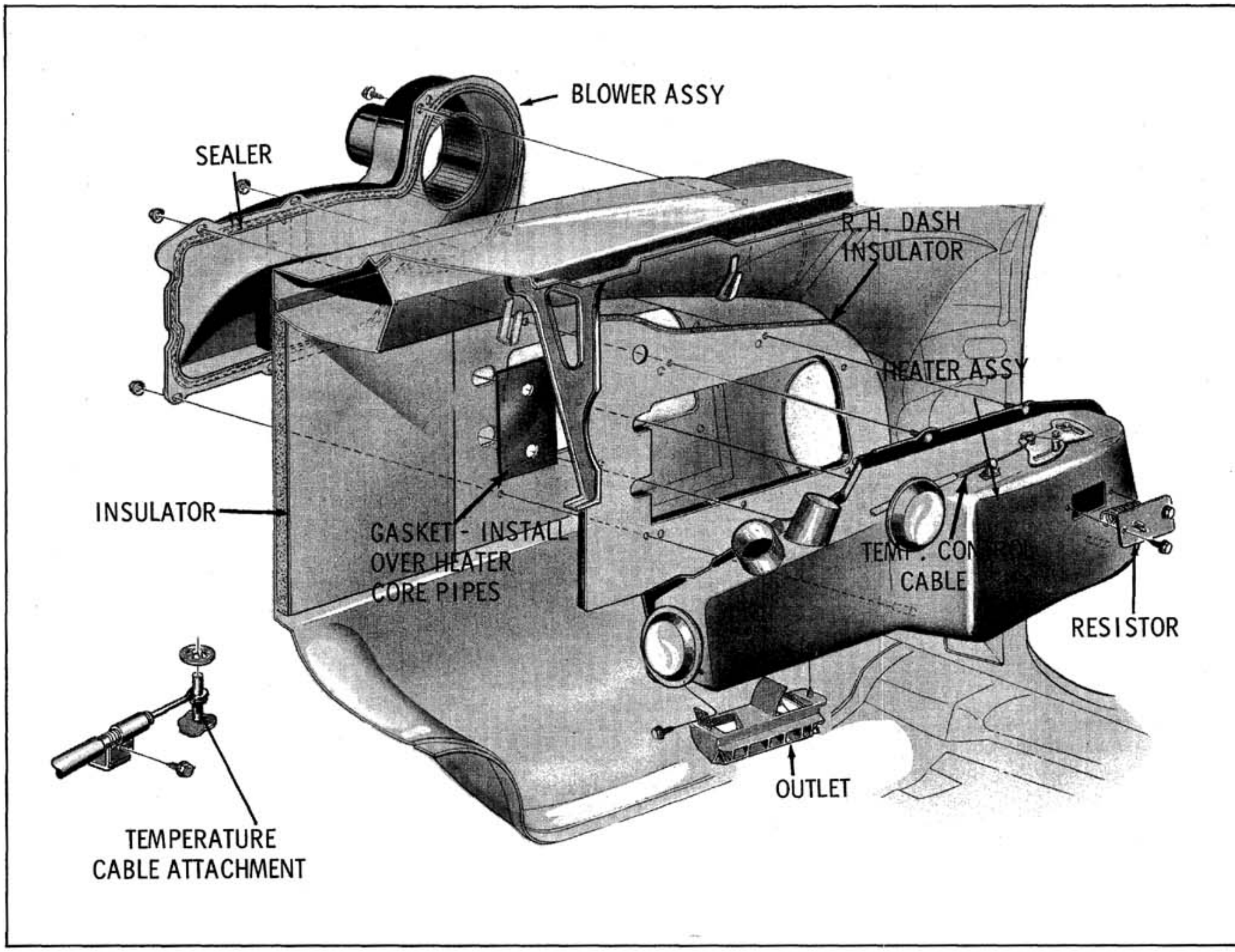


Fig. 14-9 Heater Case Attachment

2. Disconnect wiring, vacuum lines and defroster hoses from heater case.
3. Drain radiator below heater level, disconnect heater hoses and remove gasket. (Fig. 14-10)
4. Remove the blower assembly attaching screws and nuts.
5. From inside the car, remove the heater case.
6. Remove the heater core from the case.

To install, reverse the removal procedure applying sealer as shown.

VENTILATION AND HEATING CONTROL

REMOVE AND INSTALL (Fig. 14-11)

1. Disconnect all vacuum lines and wiring.
2. Disconnect temperature valve control cable.
3. Remove the attaching nuts and remove control from the rear of instrument panel.

To install, reverse removal procedure. Refer to schematic diagram (Fig. 14-12) for proper installation of hoses. Wiring and hoses must be properly routed and retained.

HEATER RESISTOR

REMOVE AND INSTALL (Fig. 14-9)

The heater resistor is mounted on the heater case with two sheet metal screws. To remove, disconnect wiring connector and remove attaching screws.

To install resistor, reverse removal procedure.

VACUUM TANK

A vacuum tank, located next to the heater inlet in the engine compartment, provides a constant supply of vacuum to operate the vacuum diaphragms. (Fig. 14-8) The vacuum tank is retained with two sheet metal screws.

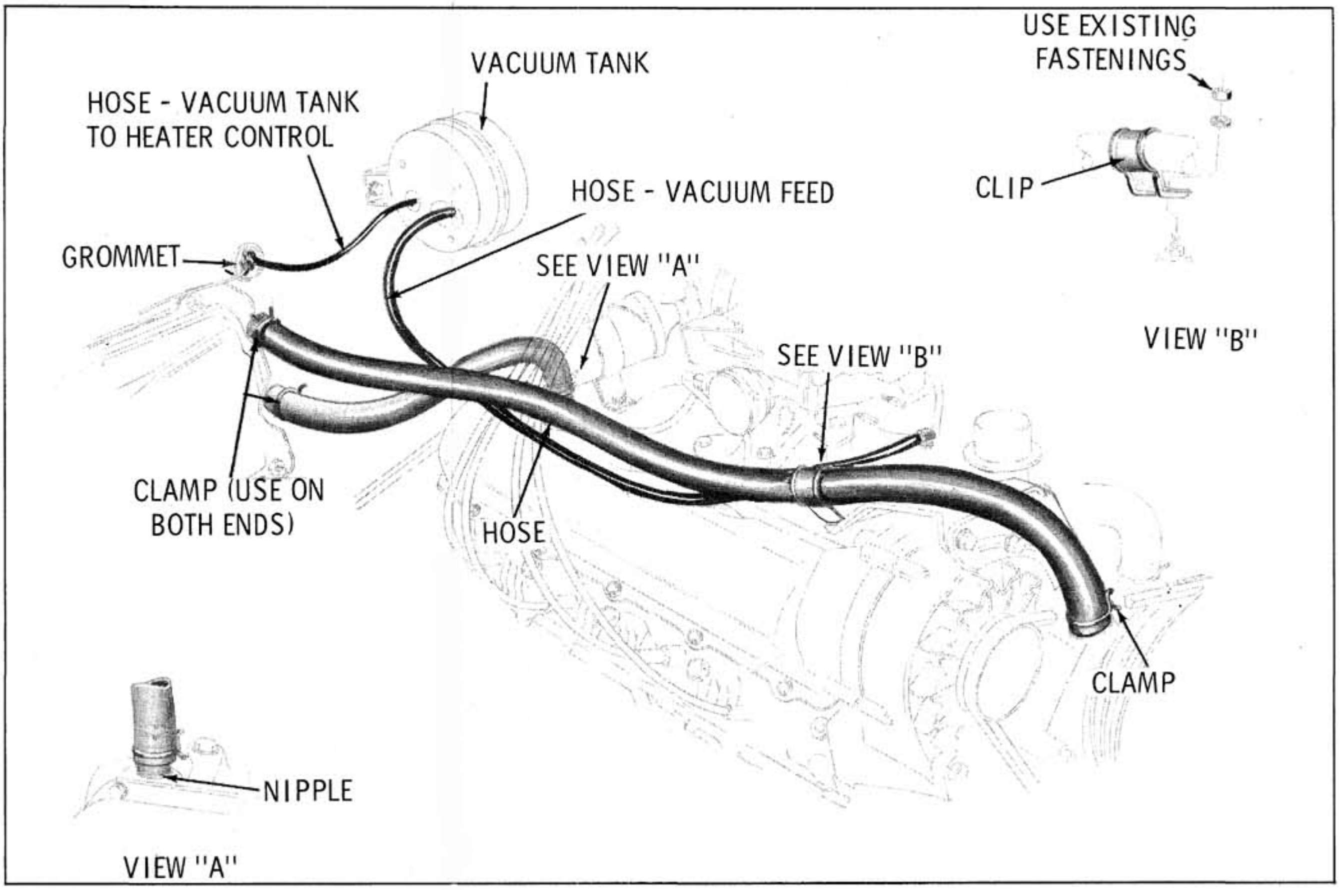


Fig. 14-10 Heater Hose Routing

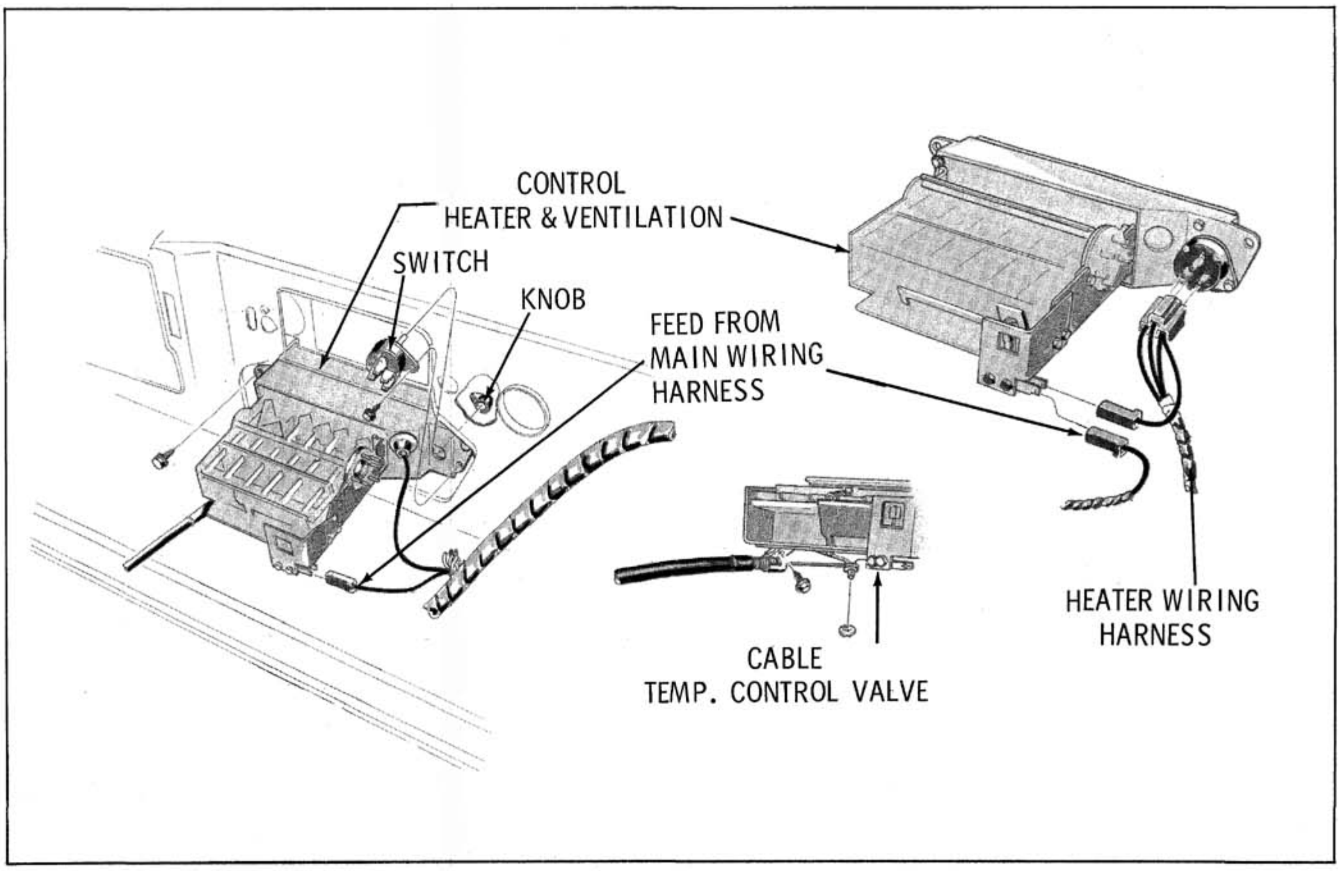


Fig. 14-11 Heater Control Attachment

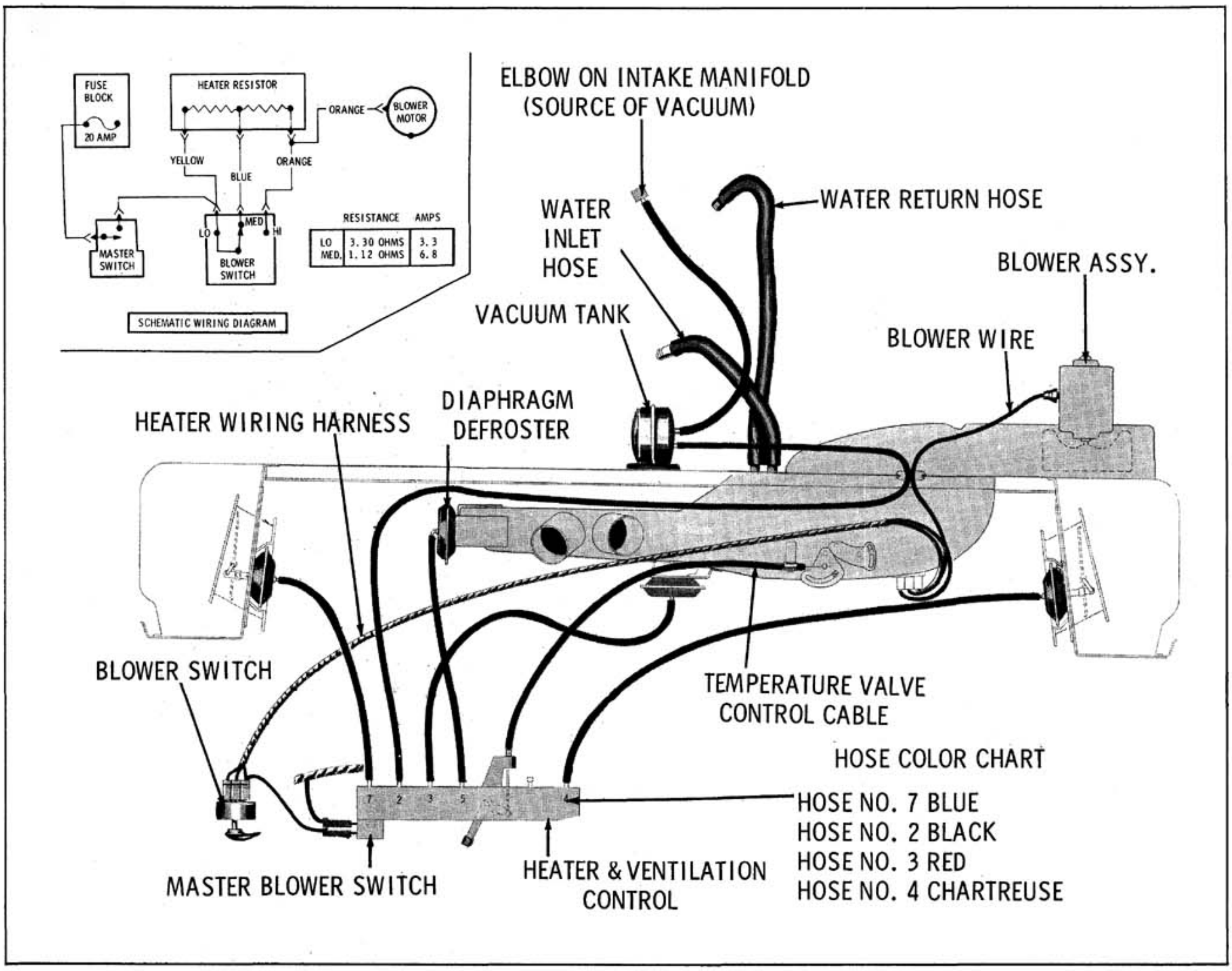


Fig. 14-12 Schematic Diagram of Heater and Ventilation

HEATER (33 THROUGH 52 SERIES)

DESCRIPTION

Air is supplied to the heater through the air intake grille and is blown into the air inlet assembly where its path is controlled by three different doors.

The heater operates on outside air only and does not have a water valve to control water circulation. Air passing through the core receives maximum heat at all times.

Heater output and operation is controlled by three bowden cable operated doors; temperature door, air door and defroster door. The temperature door can be adjusted so that all or any desired amount of air can be directed through the heater core. The heater output temperature is dependent upon the blending of heater air and ambient air controlled by the position of the temperature door. (Fig. 14-25) The air door must be open whenever the heater is in operation. The defroster door diverts the air that has passed through the air door either into the passenger compartment through the heater outlet or into the defroster duct up to the windshield for defrosting. The amount of air being diverted either place is controlled by the position of the door.

CONTROL ASSEMBLY (Fig. 14-26)

Removal

1. Disconnect the wiring connectors and pull out lamp socket.
2. Remove the spring nuts retaining the cables to the control levers.
3. Remove the three screws securing the cables to the control.
4. Remove the three screws securing control to instrument panel and remove control assembly.

Install

1. Position control assembly to instrument panel and retain with the three screws.

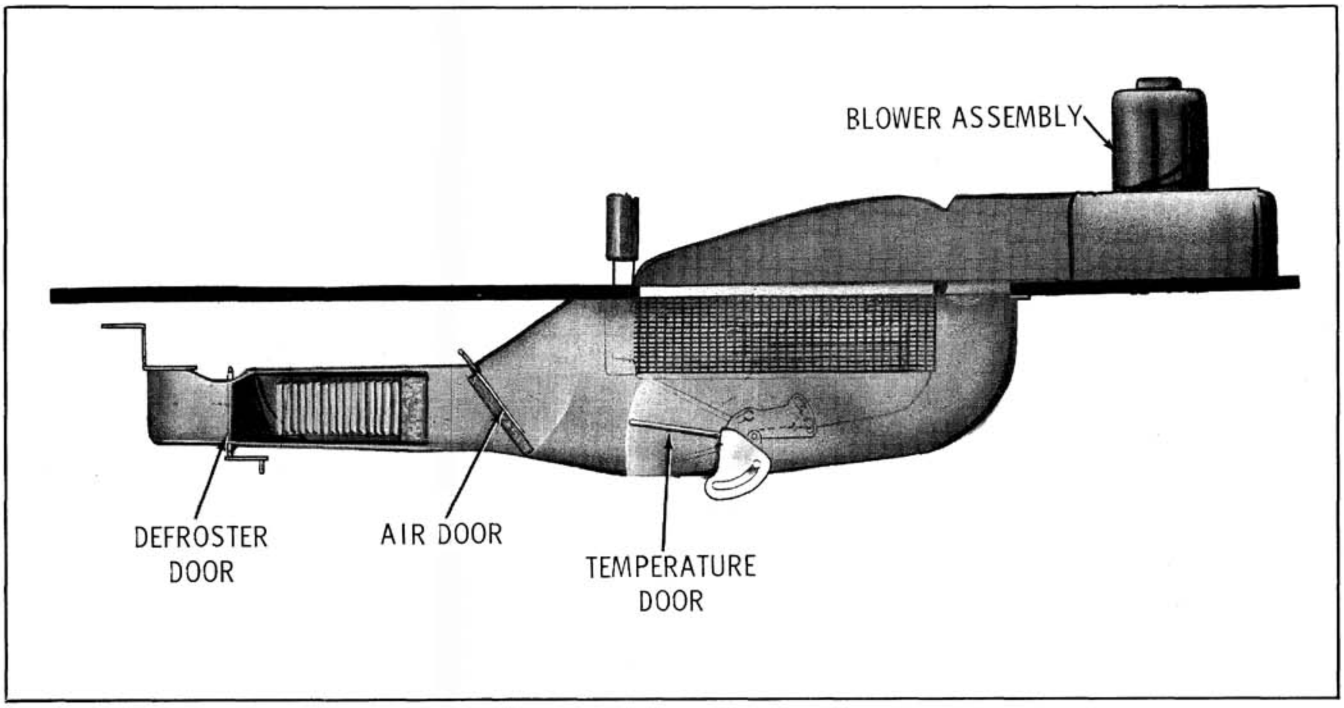


Fig. 14-25 Air Doors

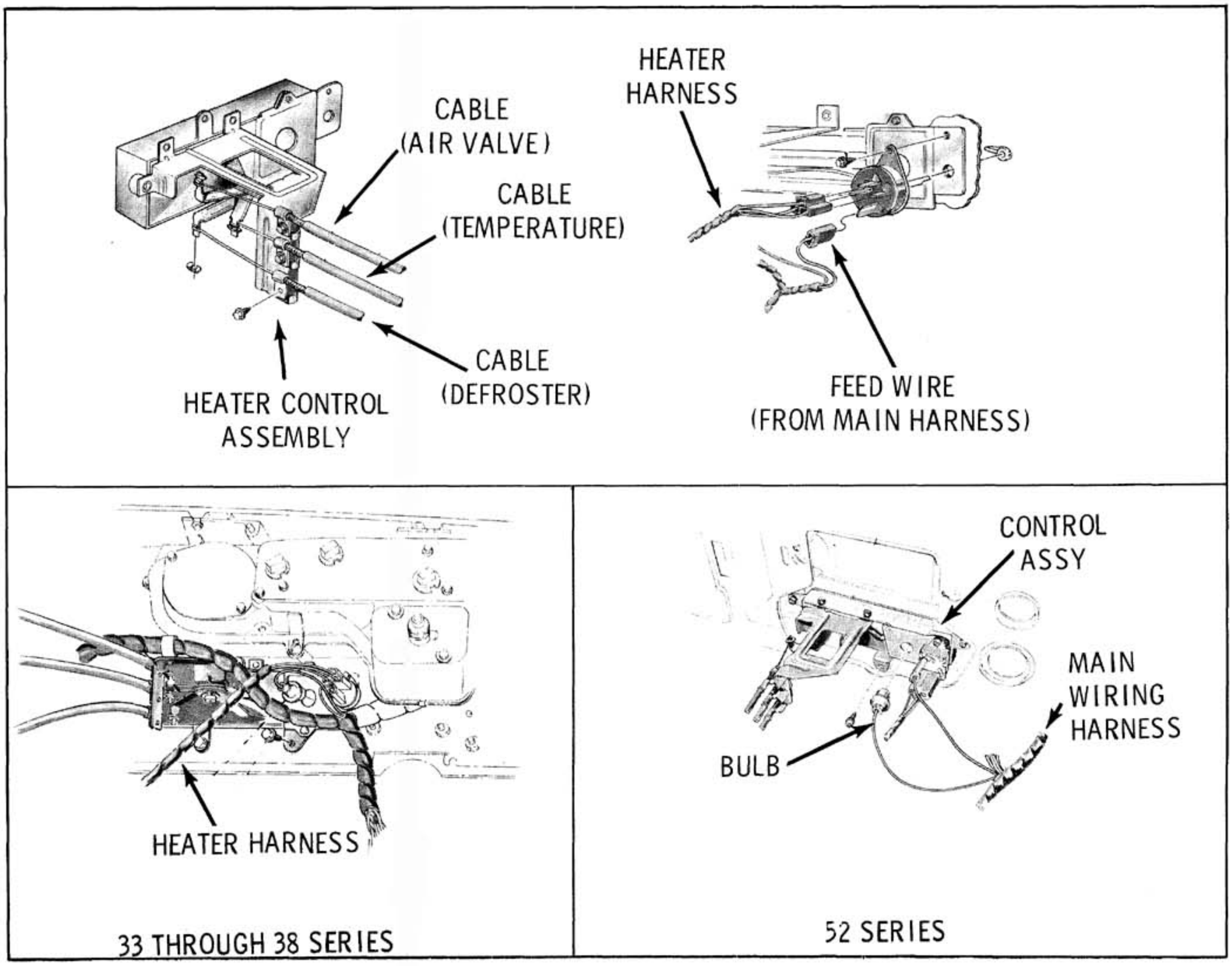


Fig. 14-26 Control Installation

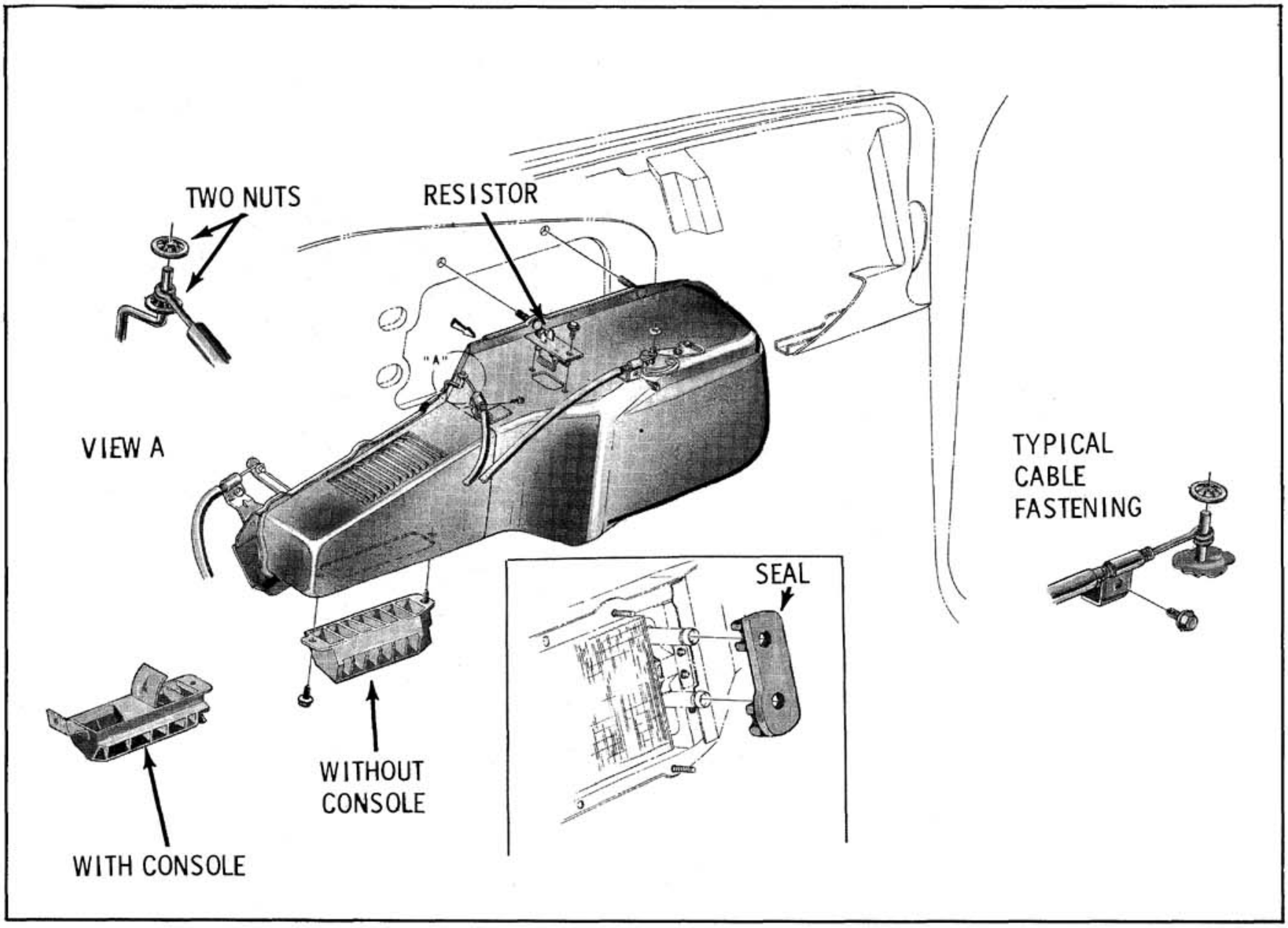


Fig. 14-27 Heater Assembly (33 through 38 Series)

2. Position the ends of the cables over the control levers and retain with the spring nuts.

3. Retain the cables to the control.

4. Install lamp socket and connect the two connectors.

   NOTE: If the control only is removed, it should not be necessary to adjust the cables. When the cables are properly adjusted, the levers should have 1/8" clearance when moved to the extreme left position. Cable adjustment is provided on the heater case end of the cable.

FAN SWITCH (Fig. 14-26)

Removal

1. Loosen the set screw retaining the switch knob and remove the knob.

2. Disconnect the two wiring connectors.

3. Remove the screw holding the switch to the heater control and remove the switch.

Install

1. Position the switch to the heater control assembly and install the retaining screw.

2. Connect the two wiring connectors.

3. Observe the flat on the switch shaft and install the knob so that the set screw contacts the flat.

RESISTOR

The resistor can be removed by disconnecting the harness and removing the two attaching screws. To install, on 33 through 38 series, position the resistor on the heater as shown in Fig. 14-27. Retain with the two screws and connect wiring. To install, on 52 series, refer to Fig. 14-28.

	Resistance	Amps
LO	3.30 OHMS	3.3
MED	1.12	6.8

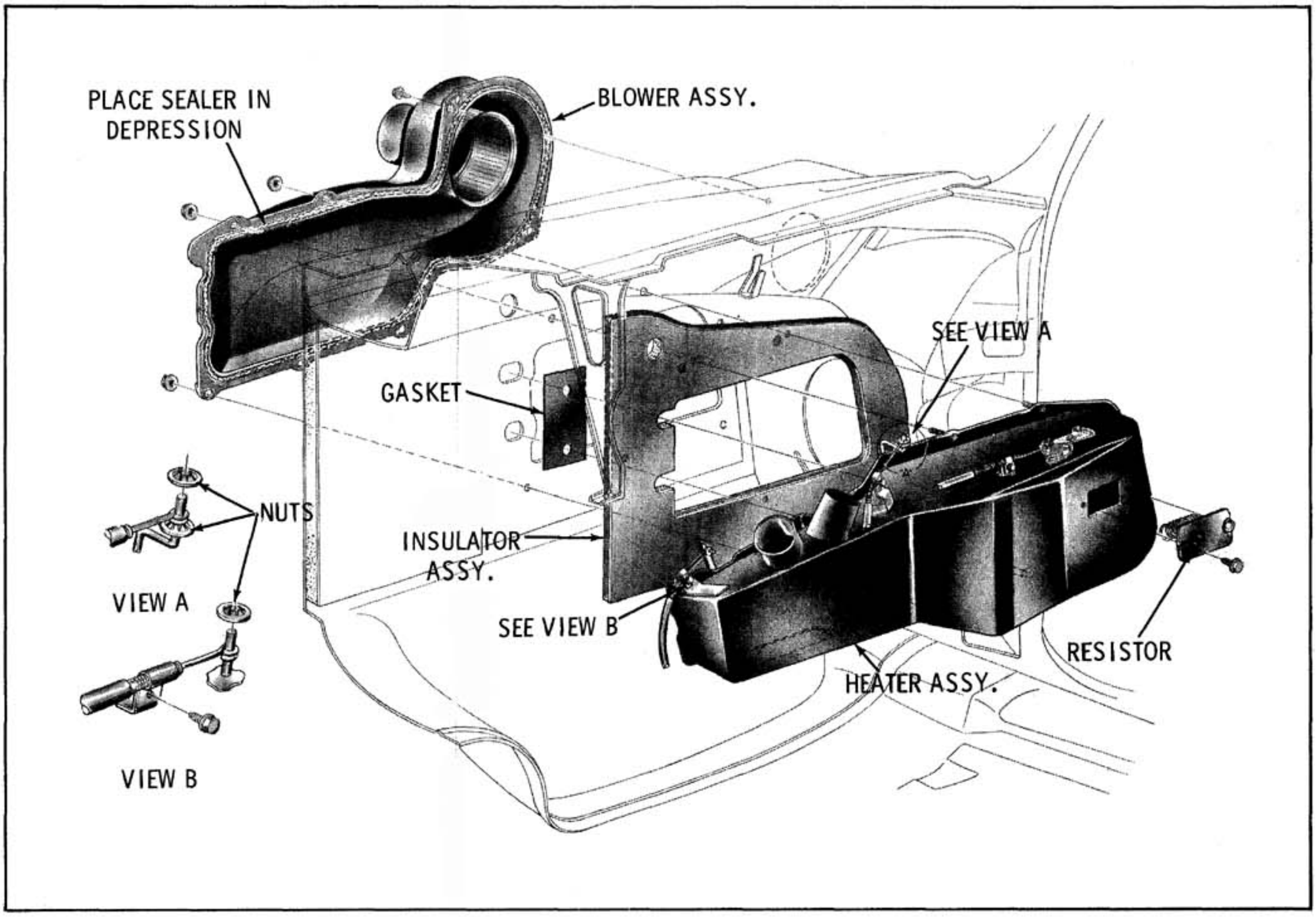


Fig. 14-28 Heater Assembly (52 Series)

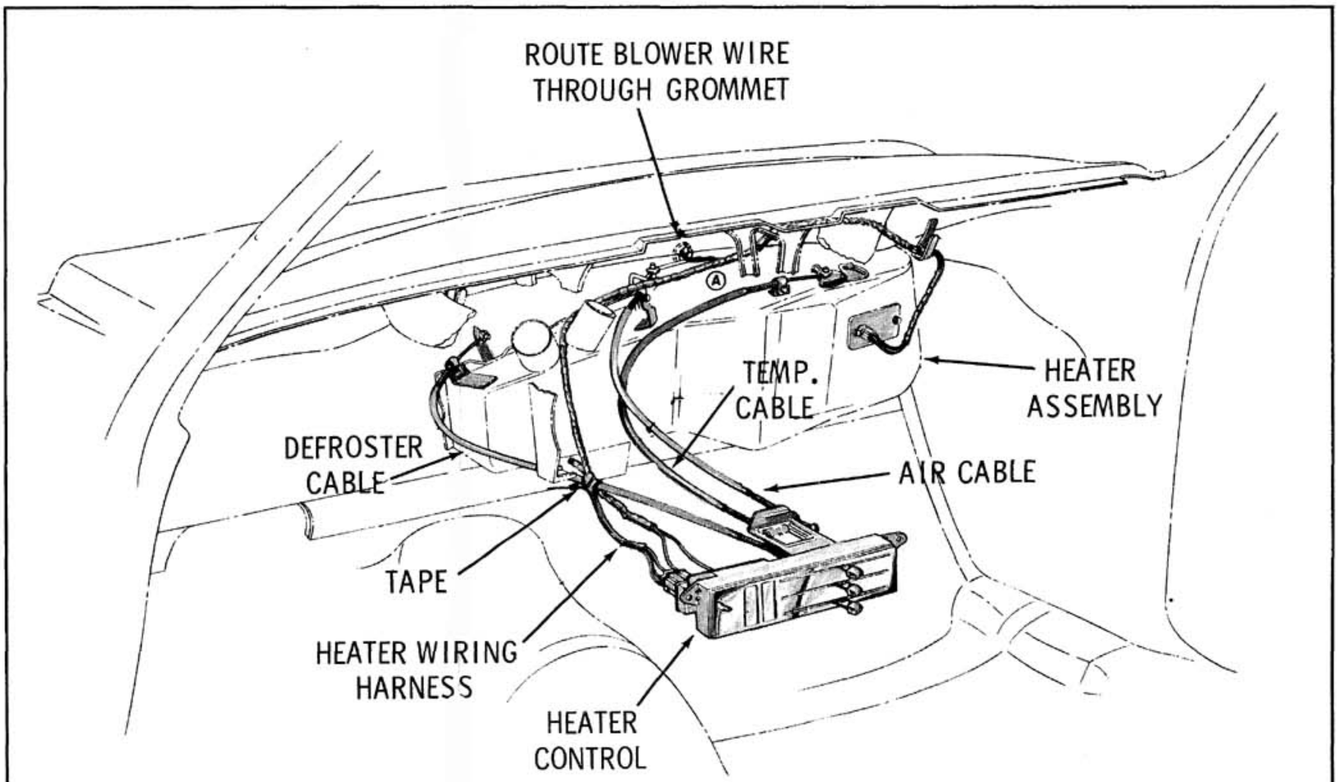


Fig. 14-29 Cable and Wire Routing (52 Series)

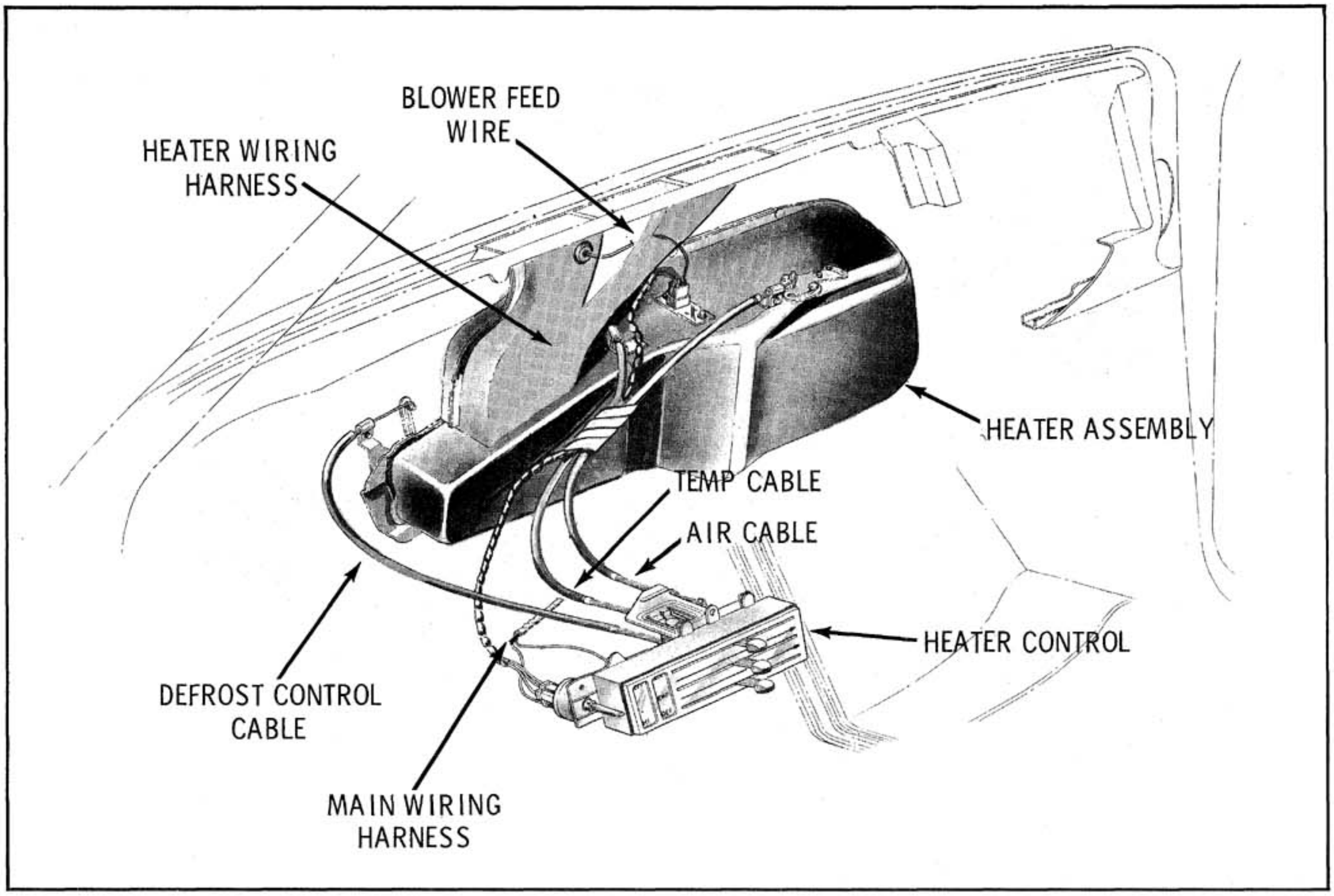


Fig. 14-30 Cable and Wire Routing (33 through 38 Series)

ADJUSTMENTS

Each cable assembly is provided with an elongated mounting bracket on the heater end of the cables. To adjust any of the three cables, it is only necessary to loosen the cable attaching screw and slide the cable in the necessary direction to obtain 1/8" clearance between the levers and the control assembly when the levers are moved to the left side of the control assembly. Fig. 14-29 and 14-30 illustrate cable and wiring routing.

DEFROSTER CABLE

The cable must be adjusted so that, when the lever is to the extreme left, the defroster door is in the closed position.

TEMPERATURE CABLE

The cable is connected to a cam lock device that assures positive closing of the temperature door. To adjust, disconnect the cable and insert a 3/16" pin through the hole in the cam and cam support to lock the door in the full cold position. Attach cable to pin on cam and adjust it so that when lever is to the left side of the control, a clearance of 1/8" is obtained.

AIR CABLE

Loosen the cable attaching screw and, with the door fully closed, tighten the cable attaching screw.

BLOWER MOTOR AND AIR INLET ASSEMBLY (Fig. 14-32) Refer to page 14-5 for 52 Series

1. Remove the right front wheel.
2. Disconnect blower motor wiring.
3. Remove the five nuts and two screws securing inlet assembly to dash.

   NOTE: The lower outboard nut can be removed by drilling a 3/4" hole through the fender filler panel at the dimple provided in the fender filler panel.

   After installing the core, plug the hole in the fender filler panel, using a 3/4" accessory hole grommet and body sealer.

4. Disengage the inlet assembly from the studs and remove from the car. The blower motor can be removed from the inlet assembly by removing the attaching screws. The fan is secured to the motor shaft by a nut and lockwasher.

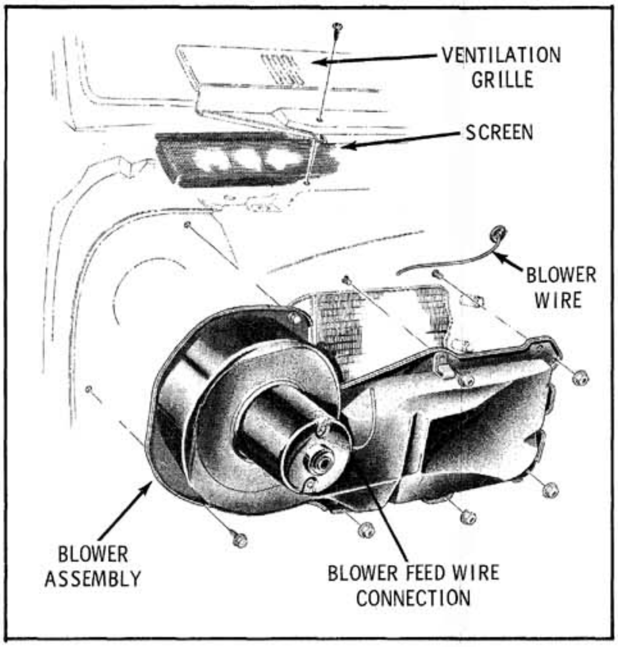


Fig. 14-31 Blower Installation

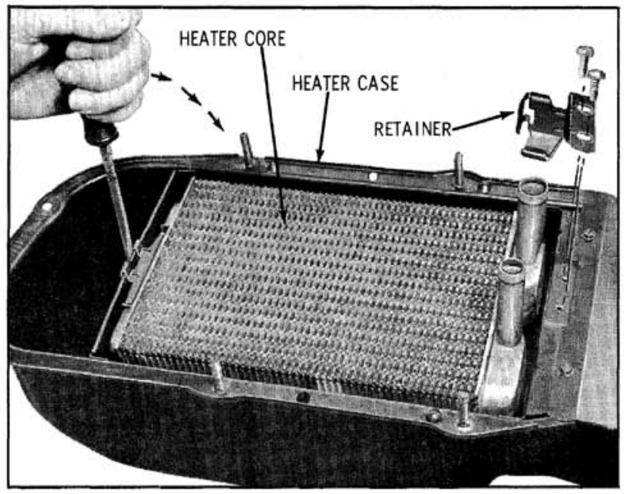


Fig. 14-34 Heater Core Sealing

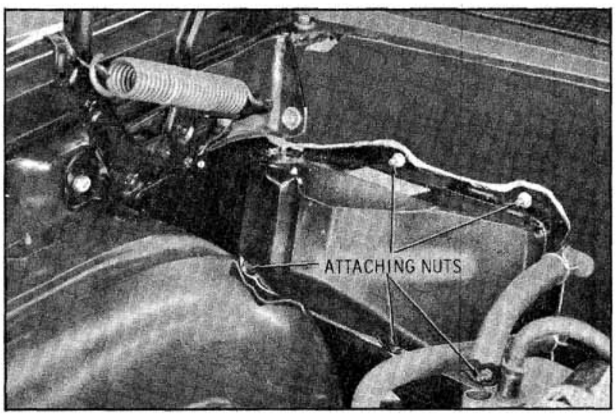


Fig. 14-32 Blower and Air Inlet Attachment

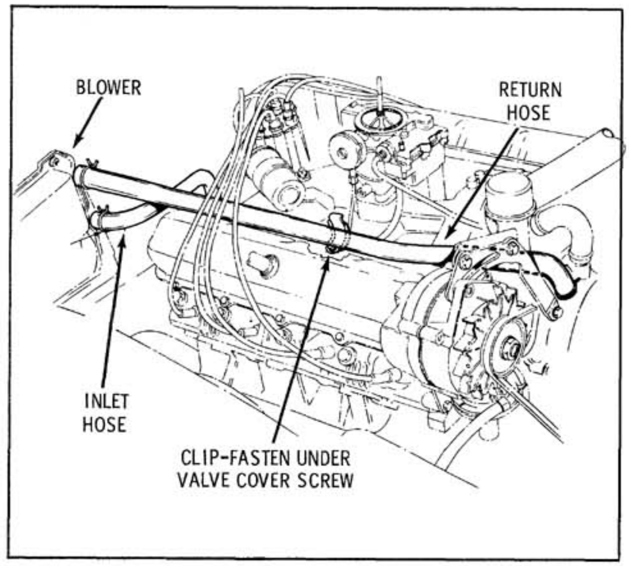


Fig. 14-35 Water Hose Routing

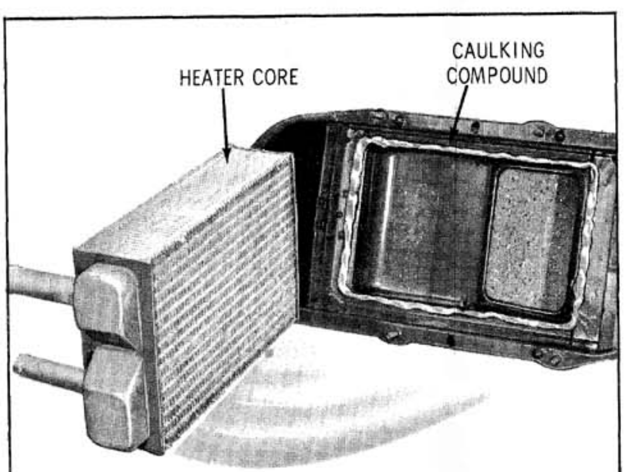


Fig. 14-33 Core to Case Attachment

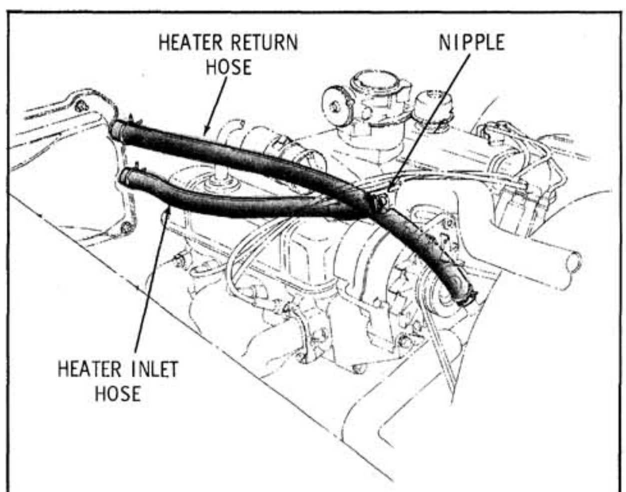


Fig. 14-36 Water Hose Routing (33 & 35 Series)

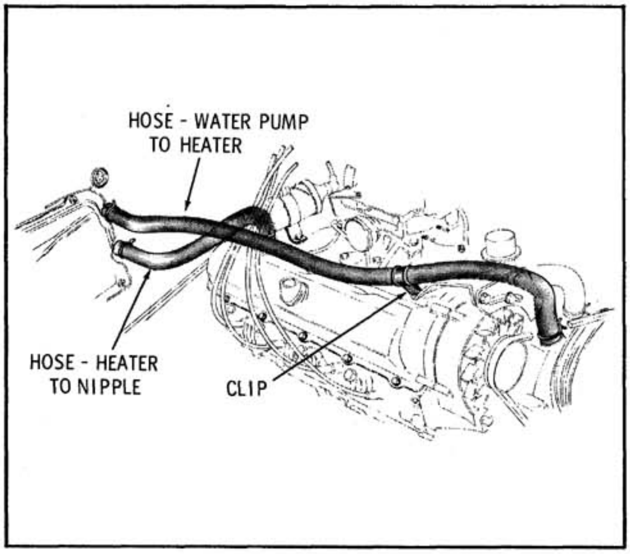


Fig. 14-37 Water Hose Routing (52 Series)

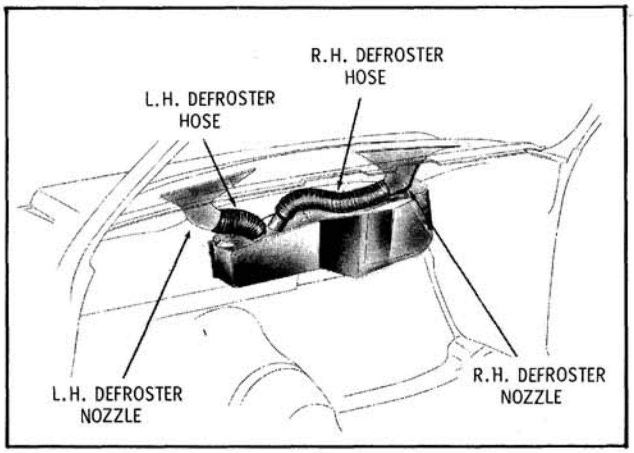


Fig. 14-38 Defroster Hose Routing (52 Series)

CORE ASSEMBLY

The heater core is located in and attached to the heater case. To remove the core, disconnect heater hoses and remove the five attaching nuts shown in Fig. 14-31. On 33 through 38 Series, the lower outboard nut can be removed by drilling a 3/4" hole through the fender filler panel at the dimple provided in the fender filler panel.

Disconnect the resistor wiring, the three control cables and remove the case assembly from the dash panel. The core can be removed from the case as illustrated in Fig. 14-33. When replacing the core in the case, use body sealer or caulking compound as indicated in Fig. 14-34.

After installing the core, plug the hole in the fender filler panel using a 3/4" accessory hole grommet and body sealer.

HEATER HOSE

The heater water hoses are routed and retained as shown in Figs. 14-35, 14-36 and 14-37. The

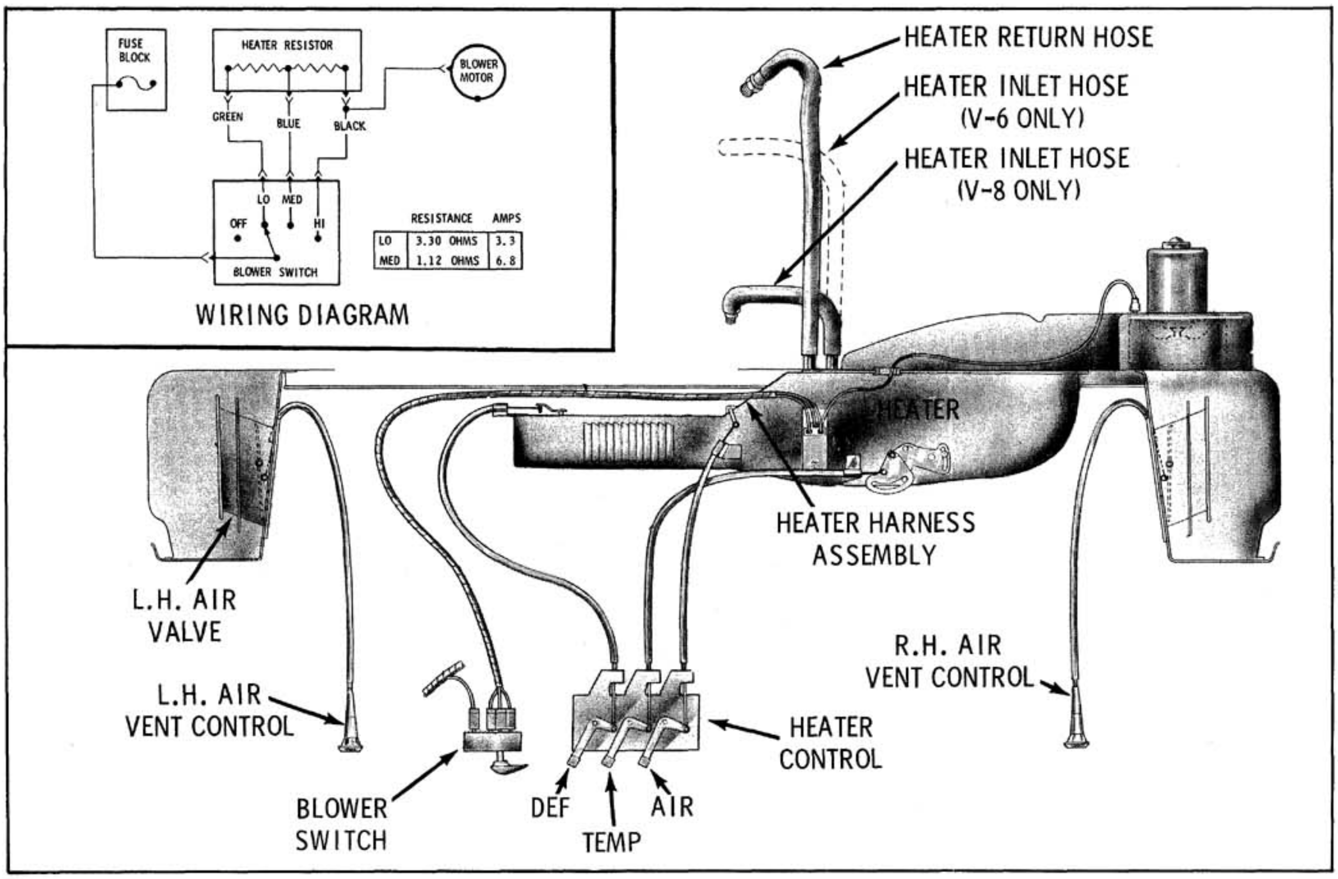


Fig. 14-39 Schematic Diagram of Heater (33 through 38 Series)

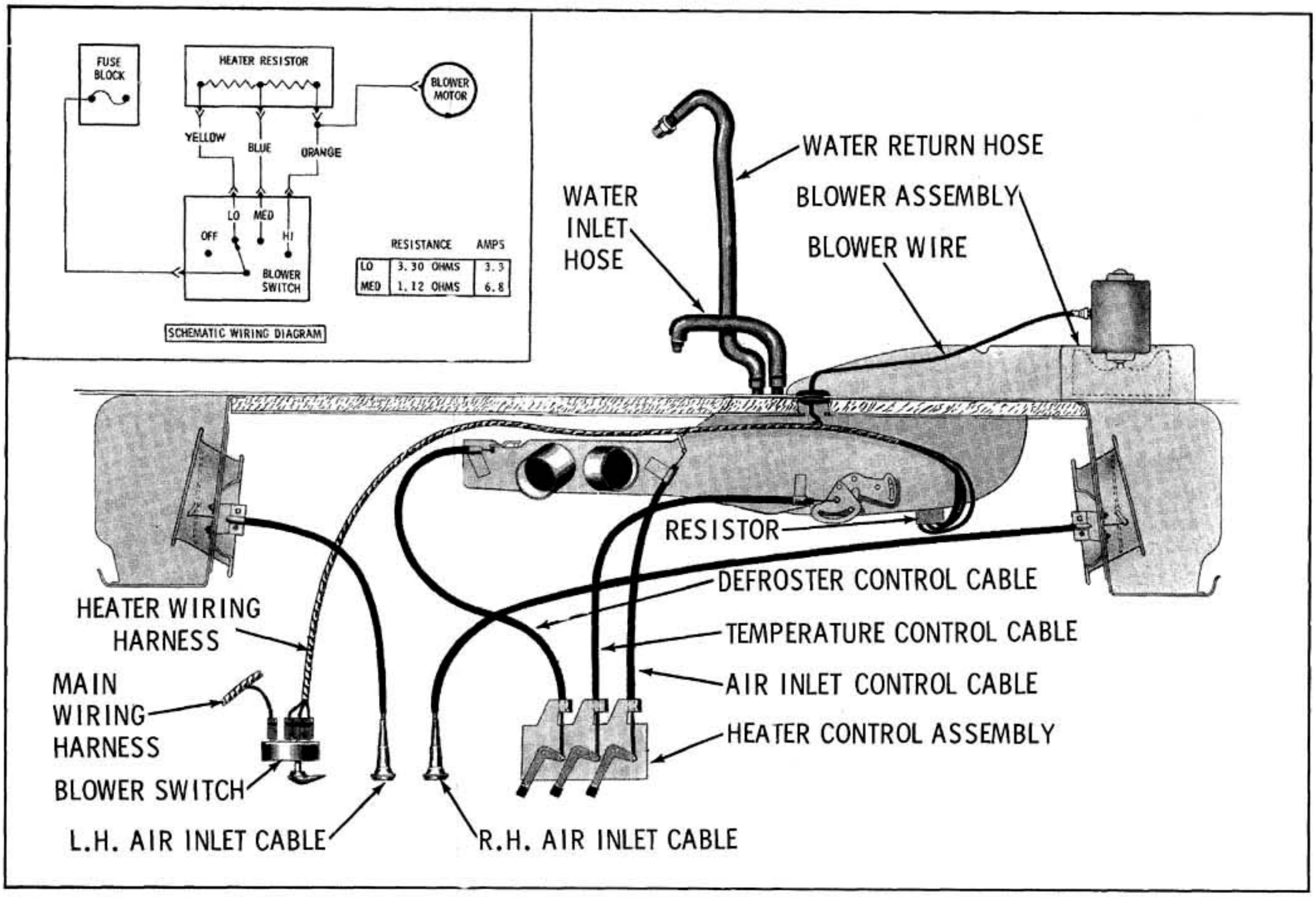


Fig. 14-40 Schematic Diagram of Heater (52 Series)

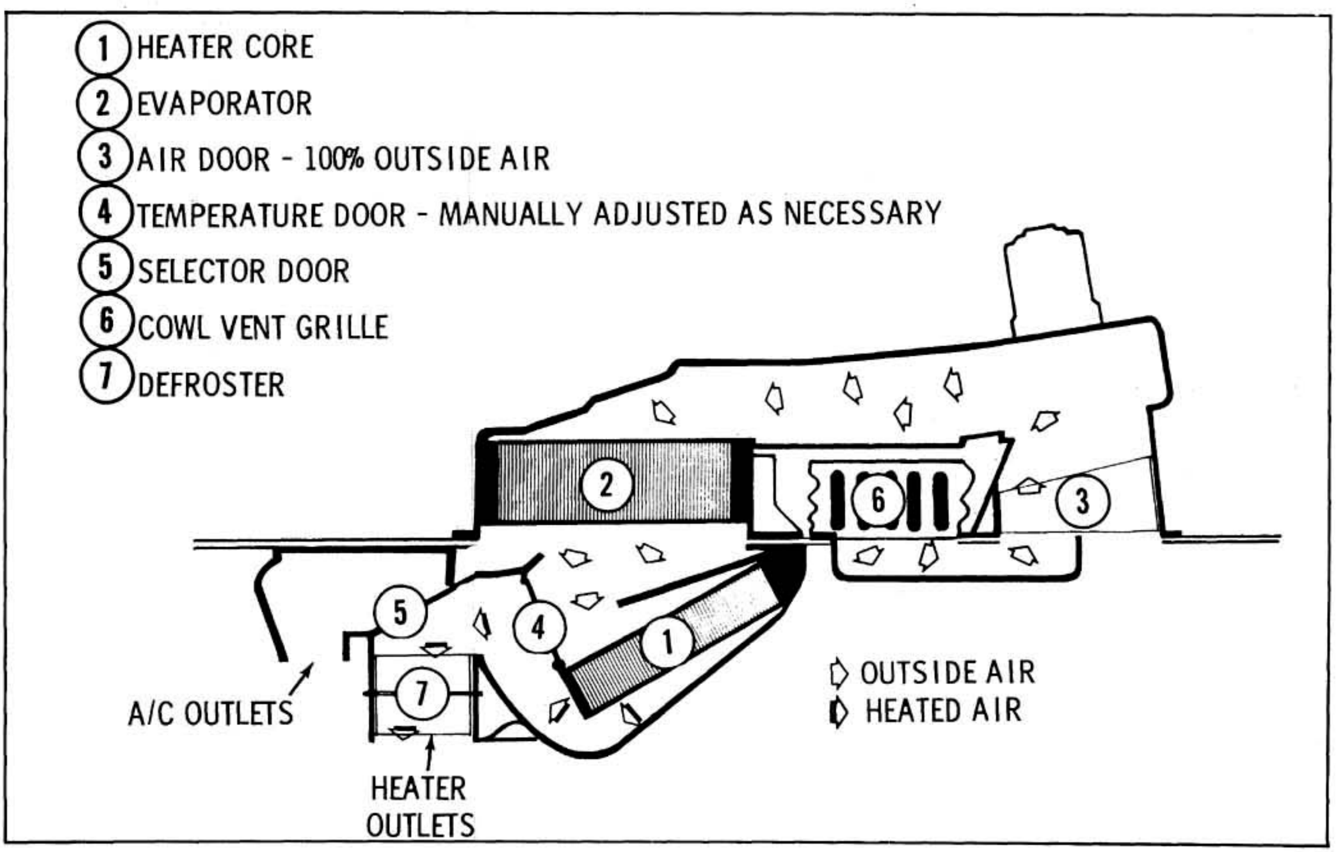


Fig. 14-46 A.C. OFF Heater ON (54 through 86 Series)

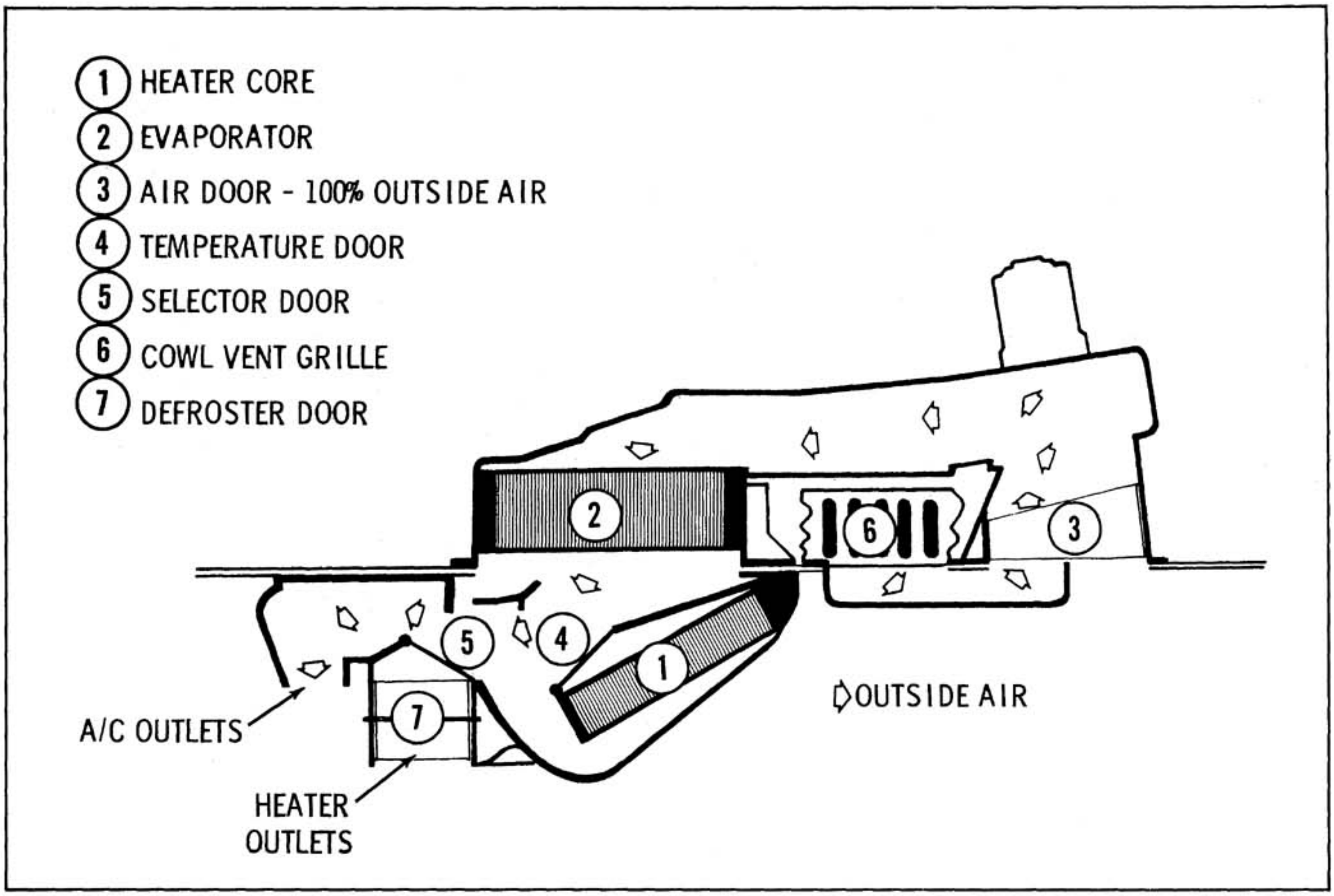


Fig. 14-47 A.C. OFF - Ventilation ON (52 through 86 Series)

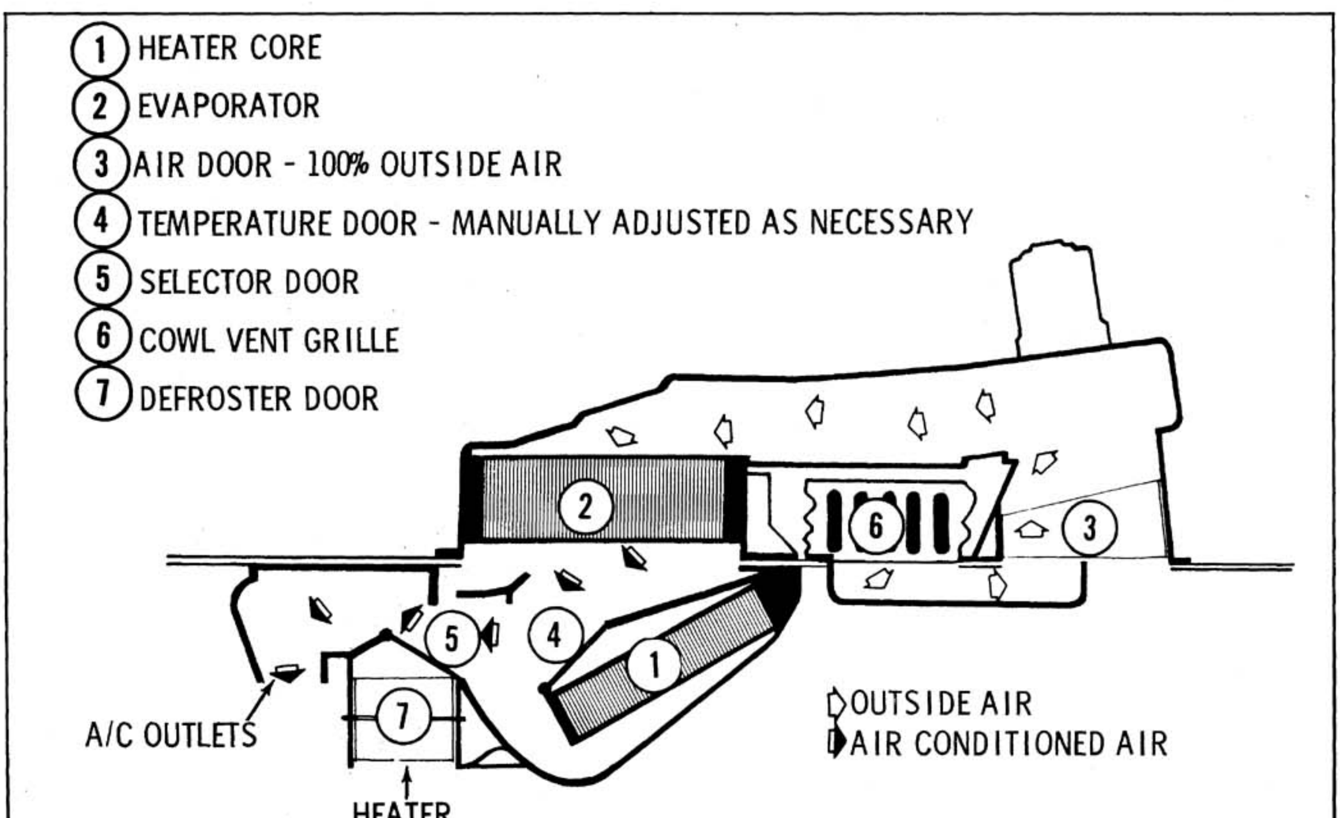


Fig. 14-48 A.C. - Normal Position (52 through 86 Series)

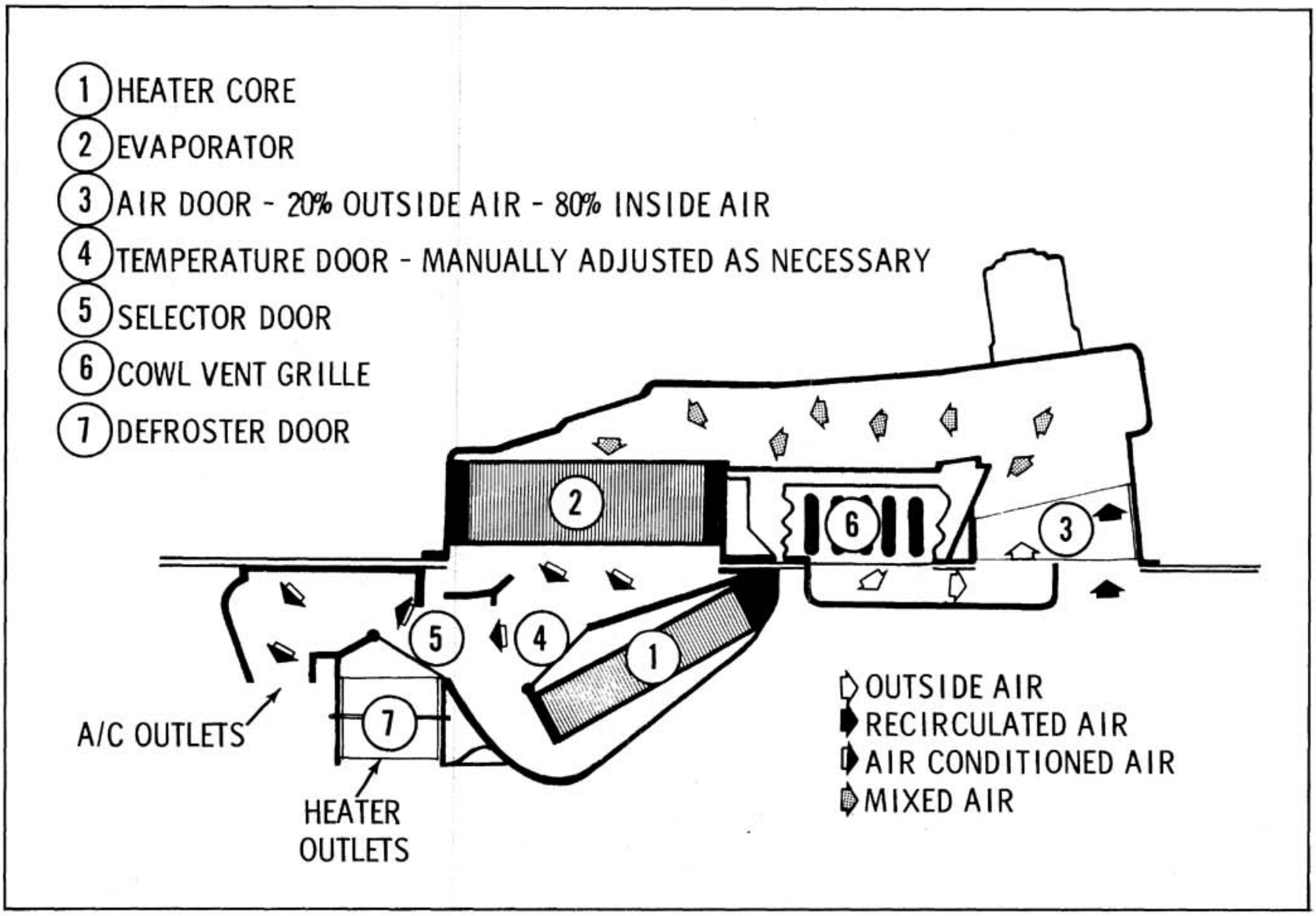


Fig. 14-49 A.C. ON - Recir Position (52 through 86 Series)

core inlet hose is 5/8" ID and the core outlet hose is 3/4" ID.

AIR CONDITIONER (ALL SERIES)

PERIODIC MAINTENANCE

Remove road accumulation from condenser at every engine oil change interval or as necessary.

Check and adjust compressor belt tension at each engine oil change interval.

The system should be operated for at least five minutes every two weeks.

Check refrigerant level and replenish as necessary at the start of every cooling season.

GENERAL DESCRIPTION

The air conditioning system provides refrigerated and dehumidified air to cool the car interior. The system uses both outside and recirculated air.

For normal cooling, A/C control set for "NORMAL", 100% outside air passes through the evaporator core. For maximum cooling, A/C control set for "RECIR", approximately 80% recirculated air and 20% outside air is directed through the evaporator core.

Air Outlets (Figs. 14-54 & 14-55)

Adjustable air outlets are located on either side of the instrument panel. The left and right air outlets may be adjusted to direct the air as desired. In addition, center outlets are provided to allow additional upper level cooling. All outlets are equipped with shut-off valves. Floor cooling is provided by discharging air directly to the floor from fixed openings in the air manifold located under the instrument panel.

The air condition control assembly is mounted in the instrument panel. A four-speed blower switch is located in the control assembly.

FAST COOL DOWN

To rapidly cool a car which has been standing for a period of time in the sun, open the center outlet, set A/C control on "NORMAL", slide temperature lever to the extreme left position and turn blower speed switch on "HI". Open car windows just long enough to expel hot air. After car has cooled, adjust temperature control lever position to suit individual comfort. Air flow can be directed by adjusting the side outlets. The recommended position of the air outlets, for best

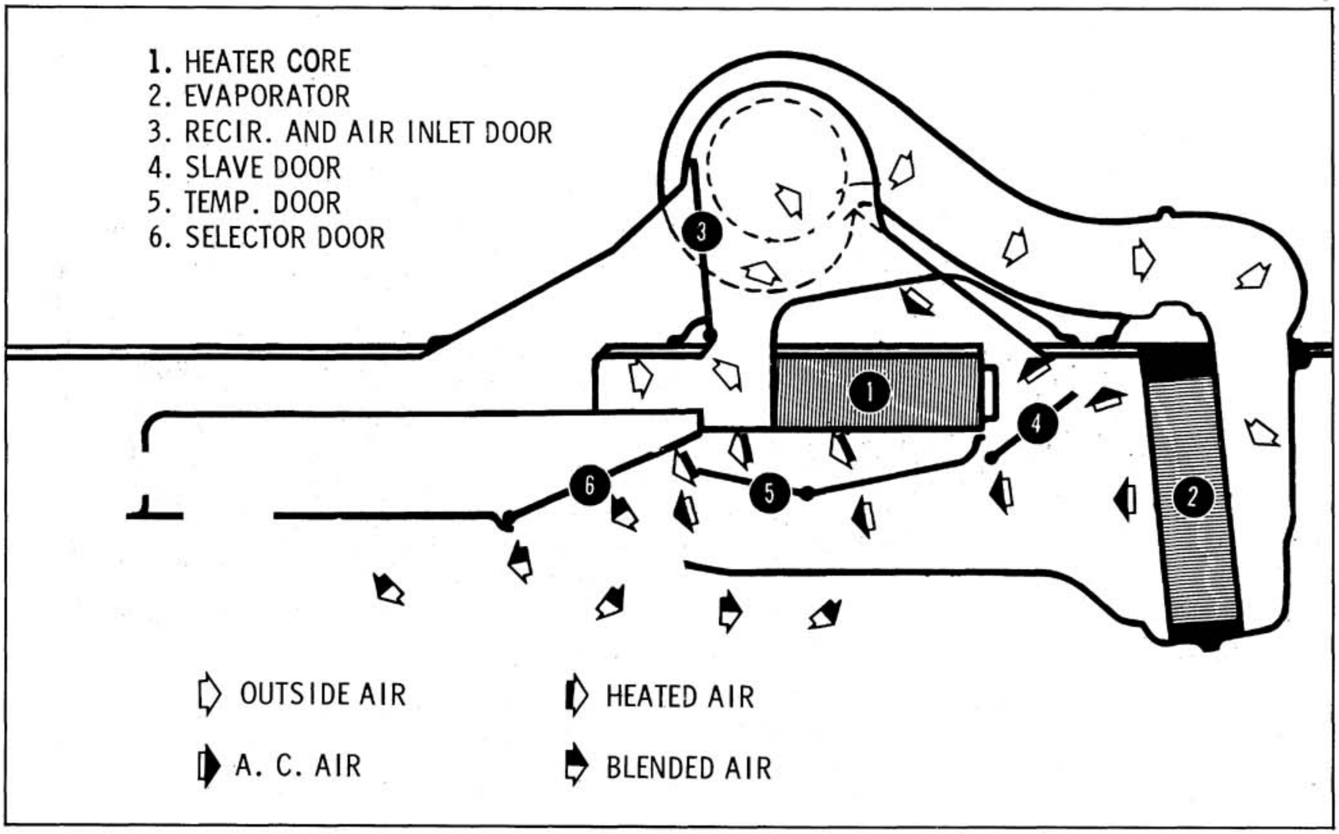


Fig. 14-50 A.C. ON - Mild Weather (33 through 38 Series)

over-all front and rear seat cooling, is when the side outlets are adjusted to direct the air flow along the inside roof line, and the auxiliary side and center outlets are open.

DRIVING CONDITIONS

For normal driving conditions, the driver may adjust the temperature of cool air by moving the control lever to suit individual comfort. Selection

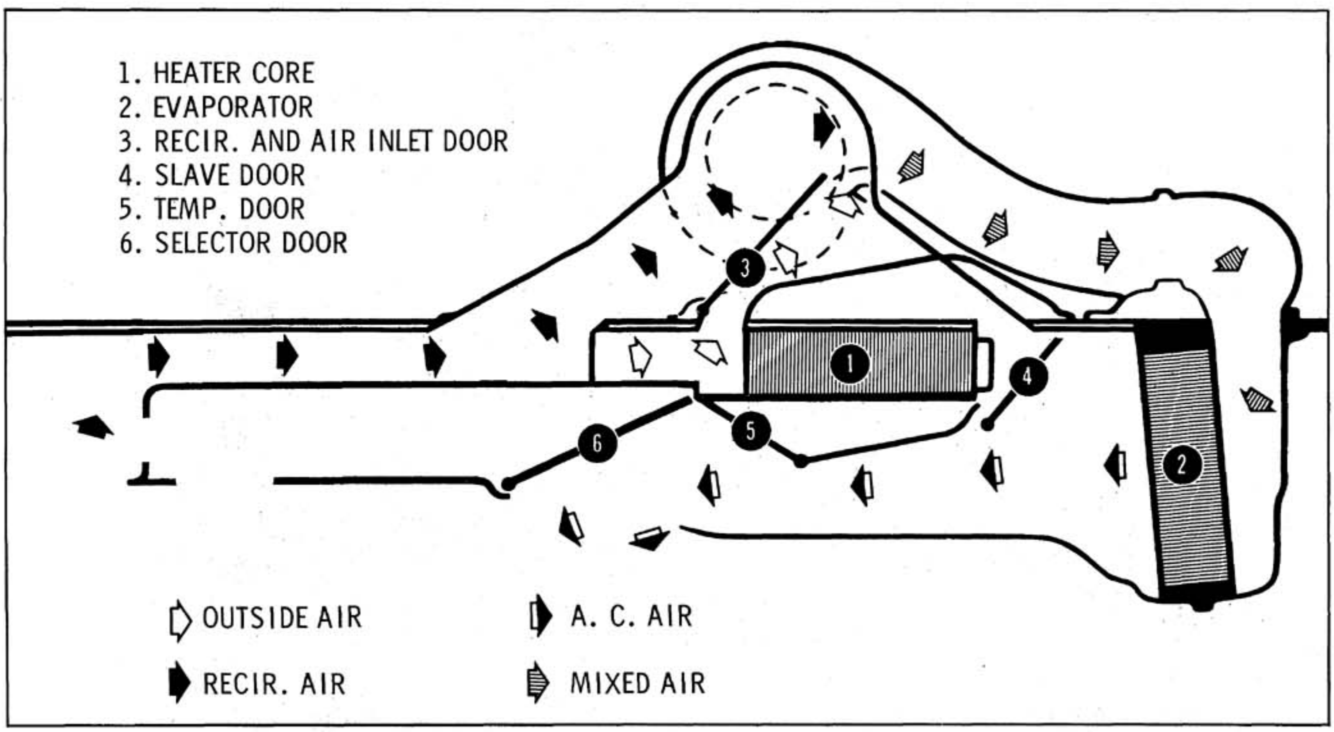


Fig. 14-51 A.C. ON - Hot Weather

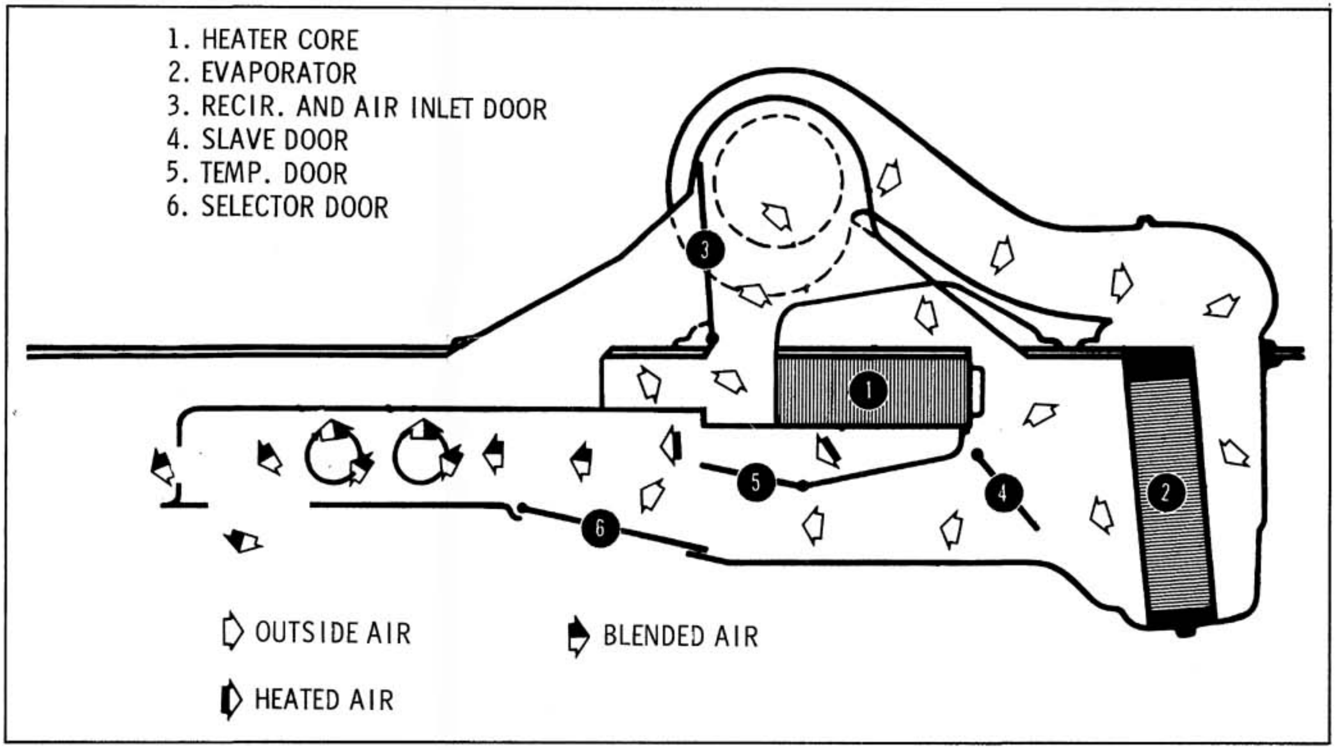


Fig. 14-52 A.C. OFF - Heater ON - Mild Weather

of blower speeds should be regulated according to the amount of air forced into the passenger compartment by the forward motion of the car.

When driving in heavy traffic, it may be desirable to set the blower speed switch on "HI".

At higher speeds, air will be forced by the forward motion of the car into the passenger compartment in greater volume, lessening the speed requirements of the blower motor. It then may be desirable to set the blower speed switch to suit individual comfort.

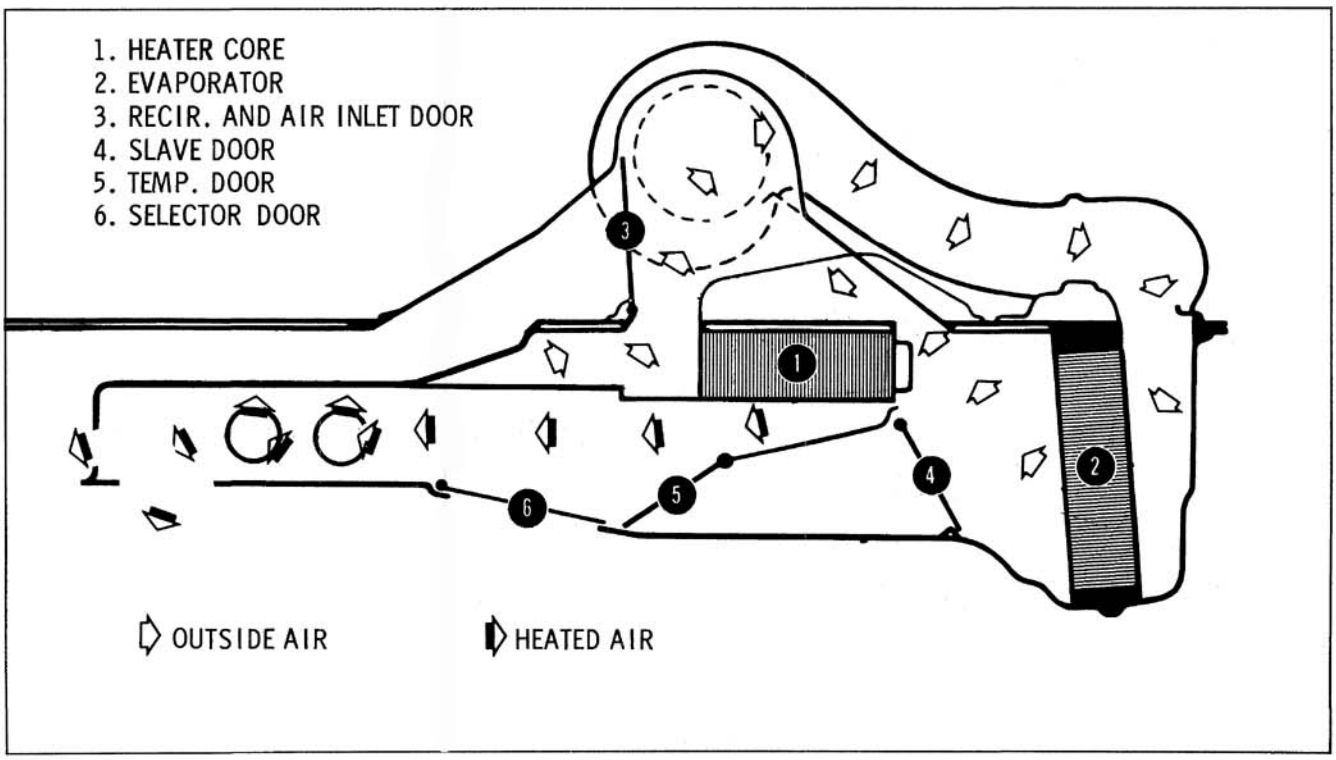


Fig. 14-53 A.C. OFF - Heater ON - Cold Weather

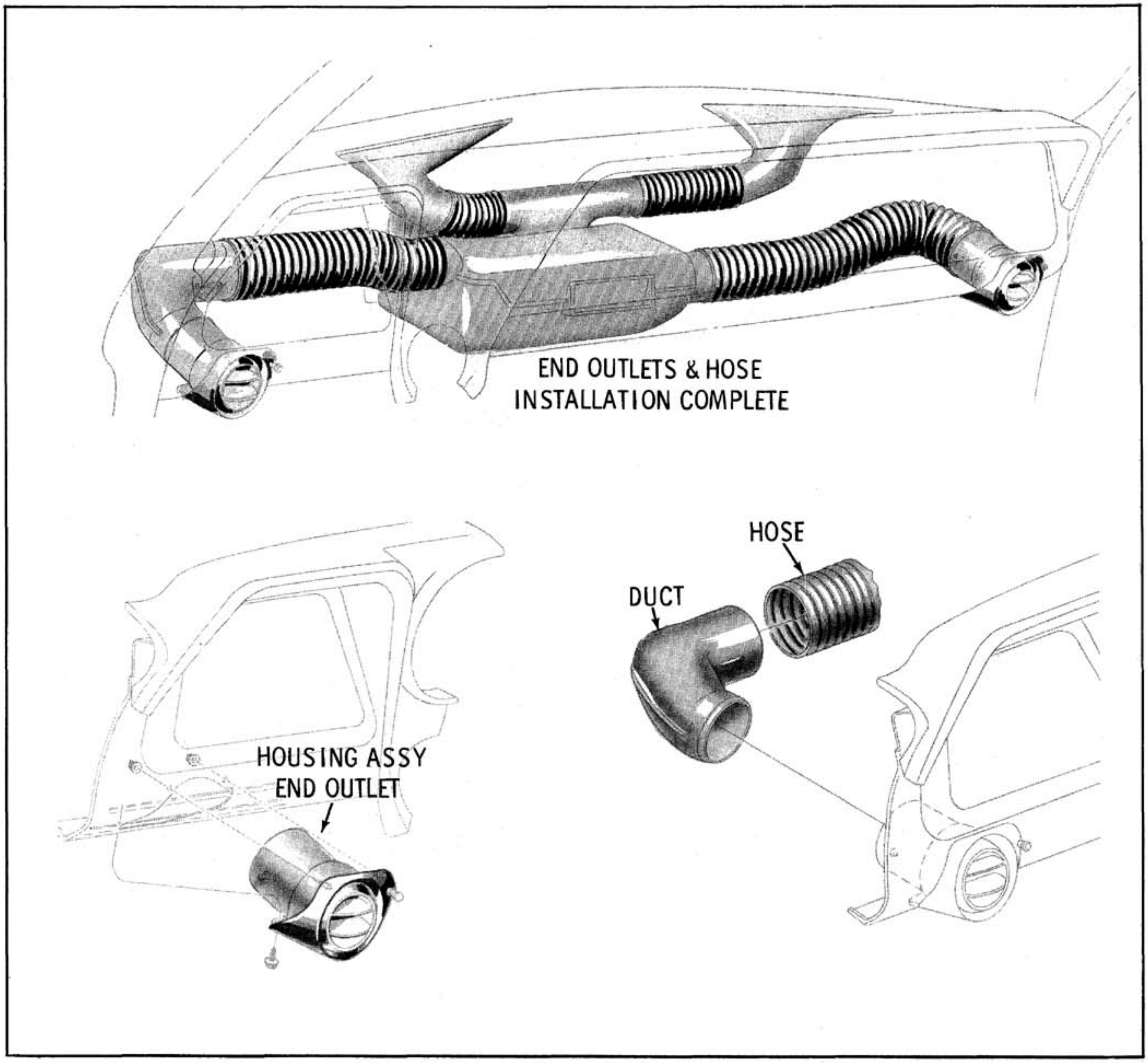


Fig. 14-54 Duct and Outlet Installation (52 through 86 Series)

OPERATION OF SYSTEM

COMPRESSOR

The refrigeration system uses a recirculating axial type six cylinder compressor, with intake and discharge valve reeds for each cylinder. These valve reeds cause the compressor to have a definite separation between the discharge (high) side and the suction (low) side. Oil is picked up by the refrigerant in the compressor and is pumped through the refrigeration system. A magnetic operated clutch pulley permits the compressor to run only when refrigeration is desired. The compressor is completely serviceable.

A serial number plate is attached to the top side of the compressor and includes the Serial Number and Model Number.

IMPORTANT: ALWAYS INCLUDE BOTH SERIAL NO. AND MODEL NO. ON REPORTS.

PRESSURE RELIEF VALVE

The compressor is equipped with a pressure relief valve which is placed in the system as a safety factor. Under certain conditions, the refrigerant on the discharge side may exceed a safe operating pressure. To prevent damage, the valve is designed to open automatically at approximately 440 psi. Any condition that causes this valve to open should be corrected, and the refrigerant oil and refrigerant should be replenished as necessary.

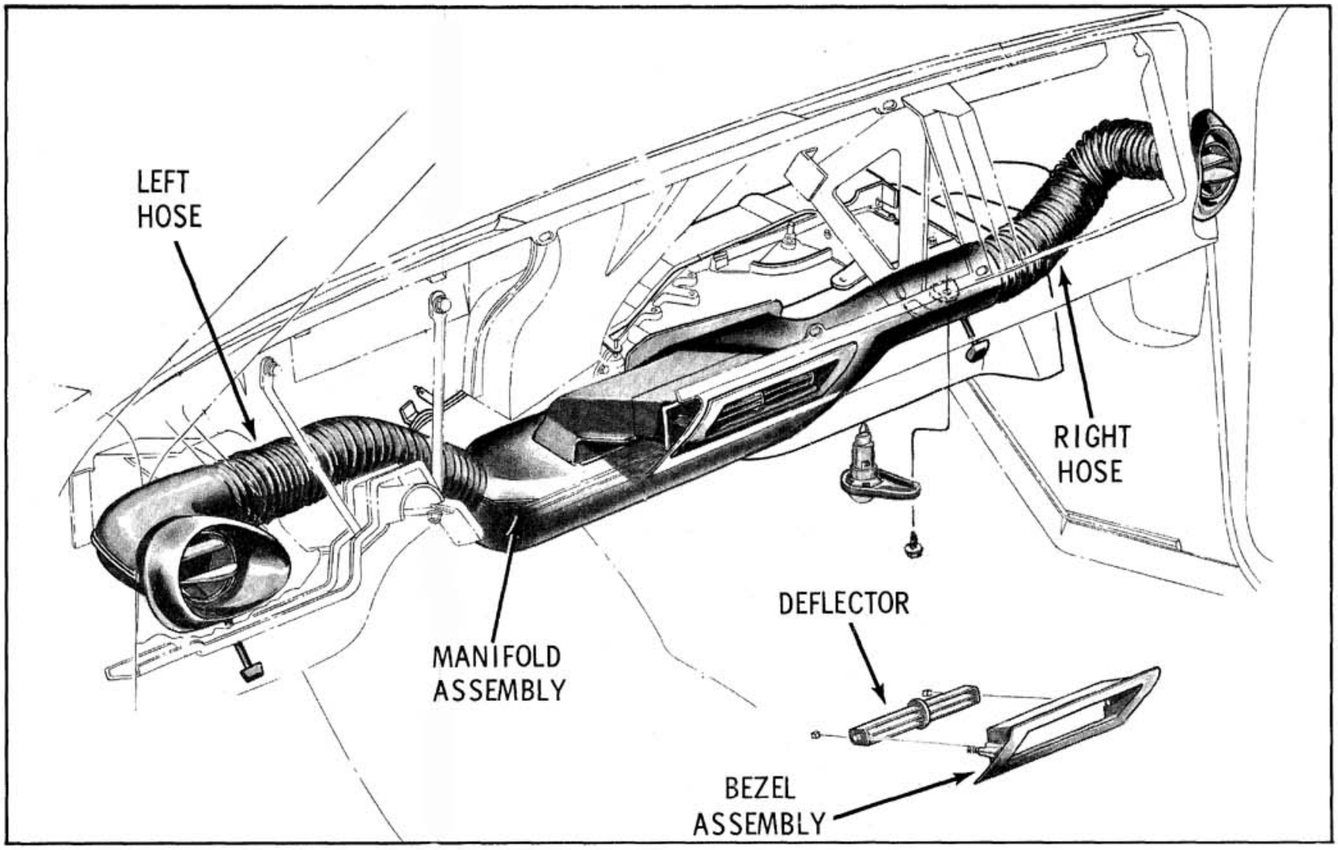


Fig. 14-55 Manifold and Duct Attachment (33 through 38 Series)

MUFFLER

Mufflers are used in the refrigerant system to reduce compressor noises and high pressure line vibrations. No repairs are to be made on the mufflers. If a muffler is defective, it should be

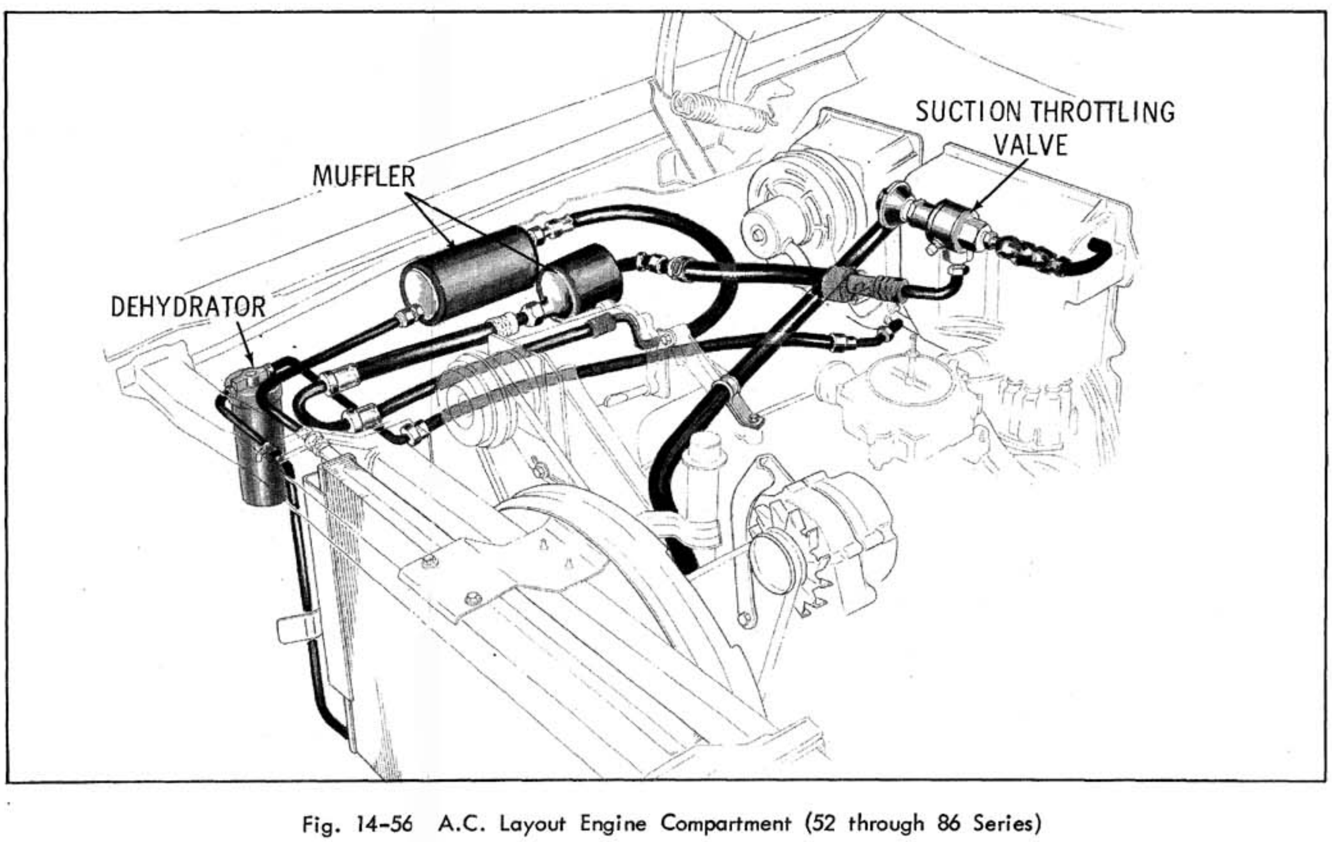


Fig. 14-56 A.C. Layout Engine Compartment (52 through 86 Series)

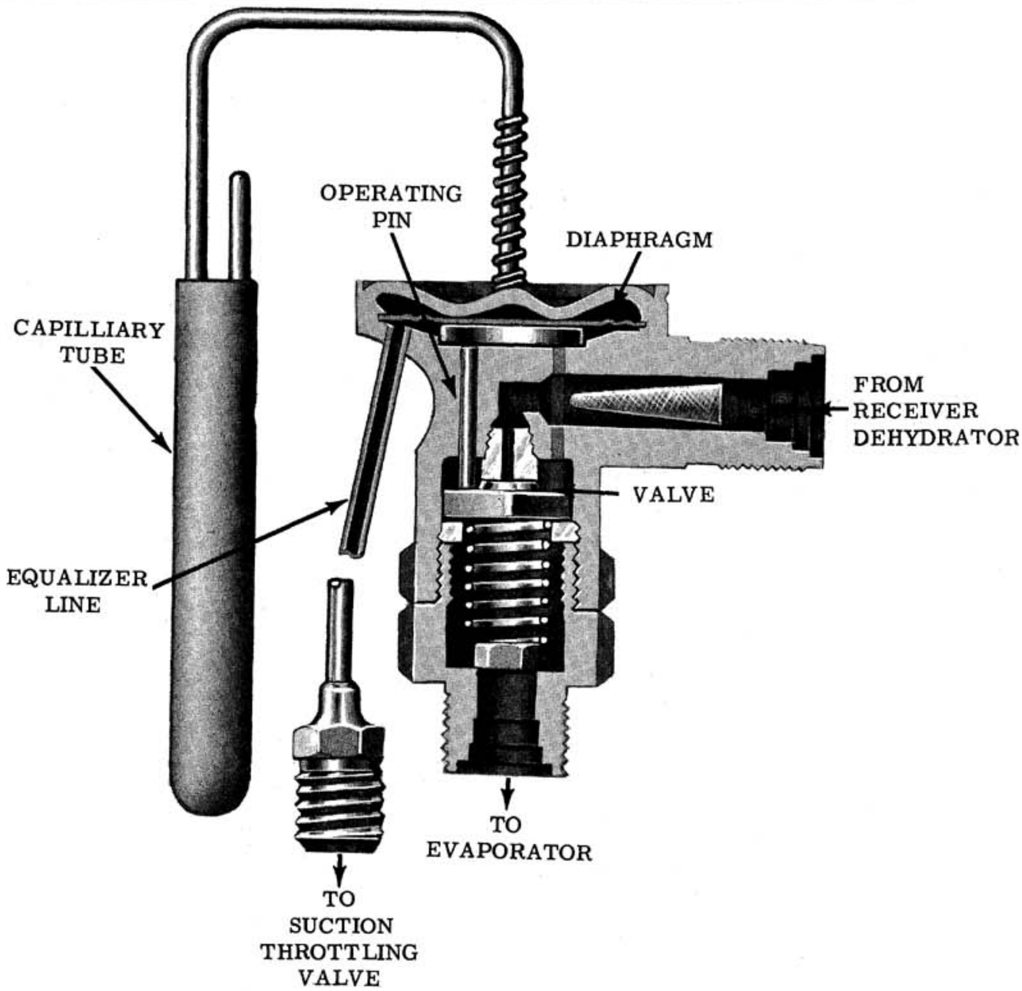


Fig. 14-57 Expansion Valve

replaced. Install the mufflers with the outlet side down to prevent trapping refrigerant oil.

CONDENSER

The condenser assembly is made up of coils which carry the refrigerant, and cooling fins which provide rapid transfer of heat. The condenser is located in front of the engine cooling system radiator so that it receives a high volume of air from the movement of the car and from the engine fan. The air passing through the condenser cools the high pressure refrigerant vapor, causing it to condense into a liquid.

SIGHT GLASS

The sight glass (at the top of the dehydrator receiver) is provided to aid in diagnosis, by permitting the refrigerant to be observed. The appearance of a steady flow of bubbles or foam, after the compressor has run long enough to stabilize, indicates a shortage of refrigerant, when checking in temperatures above 75°F.

DEHYDRATOR RECEIVER ASSEMBLY

The functions of this unit are to absorb any moisture that may be present in the system after assembly, and to insure a solid charge of liquid refrigerant in the line feeding the expansion valve, providing the system is properly charged. This unit is not serviceable, and should be replaced when there has been a leak in the suction side of the system which permitted air and moisture to be drawn into the system.

EXPANSION VALVE (Fig. 14-57)

The expansion valve, mounted outside the evaporator, is an externally equalized valve, controlling the flow of refrigerant into the evaporator.

Spring force moves the valve toward the seat restricting refrigerant flow into the evaporator. A capillary tube filled with carbon dioxide provides the temperature regulation of the expansion valve. Carbon dioxide in the tube increases the pressure on the diaphragm when it senses an increase in temperature on the evaporator suction line. Movement of the diaphragm downward forces the operating pins to move the valve away from the seat allowing liquid refrigerant to enter the evaporator to maintain the desired temperature.

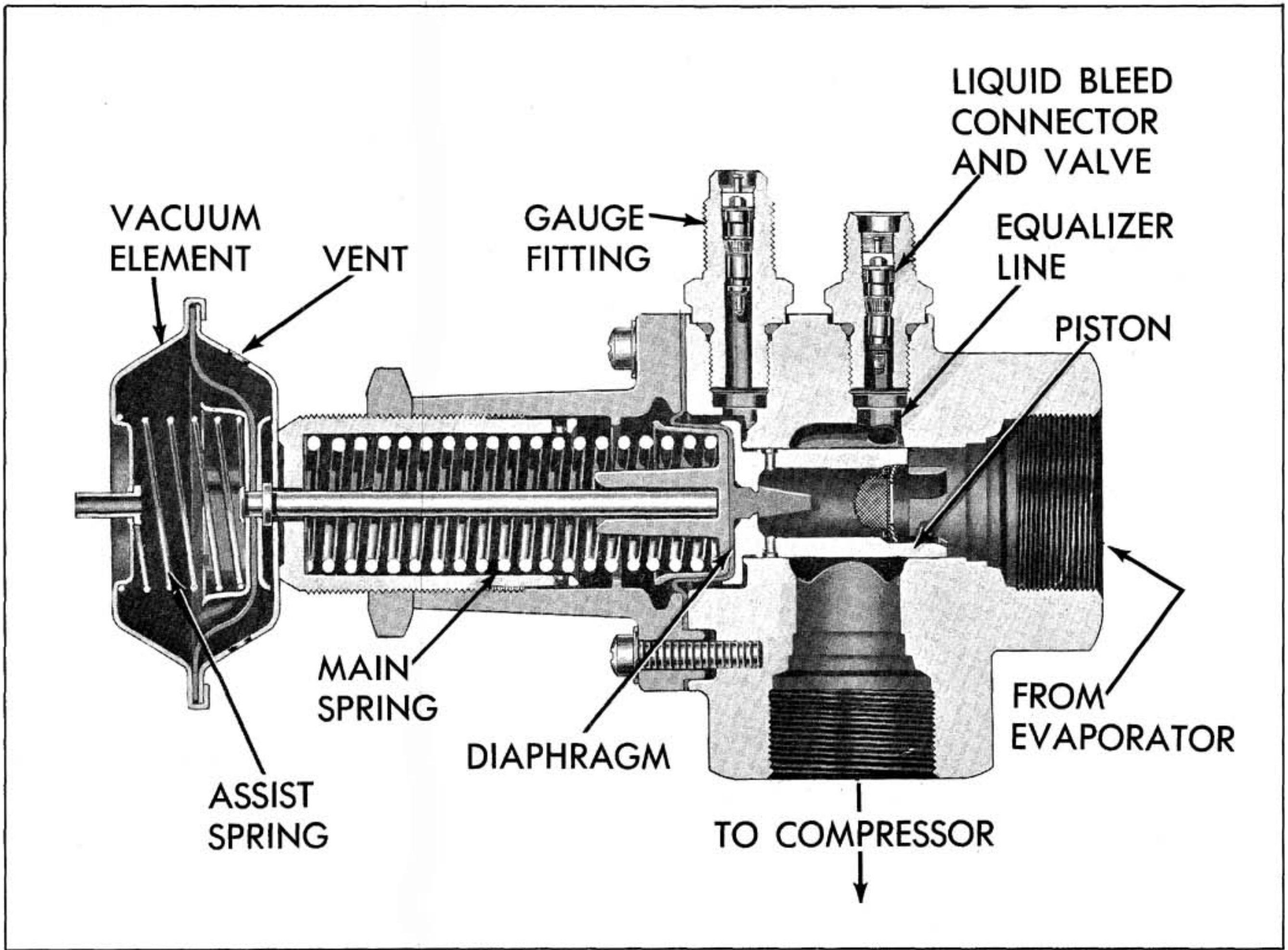


Fig. 14-58 Suction Throttling Valve

Equalizing pressure from the suction line is directed to the bottom side of the diaphragm and assists the spring in opposing pressure on the top of the diaphragm, and acts as a further control on the flow of refrigerant into the evaporator.

NOTE: It is important that the expansion valve capillary bulb be tightly clamped to the suction line at the evaporator. Both the suction line and the capillary tube should be clean at the points of contact.

CAUTION: Do not kink capillary tubes when removing or installing.

EVAPORATOR

The evaporator is a device which cools and dehumidifies the air before it enters the car. High pressure liquid refrigerant flows through the expansion valve into the low pressure area of the evaporator. This regulated flow of refrigerant boils immediately. Heat from the evaporator core surface is lost to the boiling and vaporizing refrigerant, which is cooler than the core, thereby cooling the core. The heat in the air passing through the evaporator core, loses its heat to the cooler surface of the core, thereby cooling the air. As the process of heat loss from the air to the evaporator core surface is taking place, any moisture (humidity) in the air condenses on the outside surface of the evaporator core and is drained off as water.

SUCTION THROTTLING VALVE (Fig. 14-58)

The suction throttling valve limits the evaporator minimum pressure to prevent "freeze-up" of the evaporator coils.

The valve controls minimum evaporator pressure by throttling the flow of refrigerant through the suction line. The evaporator pressure is maintained by a balance of spring force, above the diaphragm, and evaporator pressure below the diaphragm.

The suction throttling valve should be adjusted to maintain a minimum evaporator pressure of 29.5 psi.

To insure return of oil to the compressor, an oil bleed line connects the bottom of the evaporator and the suction line to the suction throttling valve. A valve core, located in the equalizer line fitting, opens at 5 to 12 psi pressure difference allowing oil to return to the compressor.

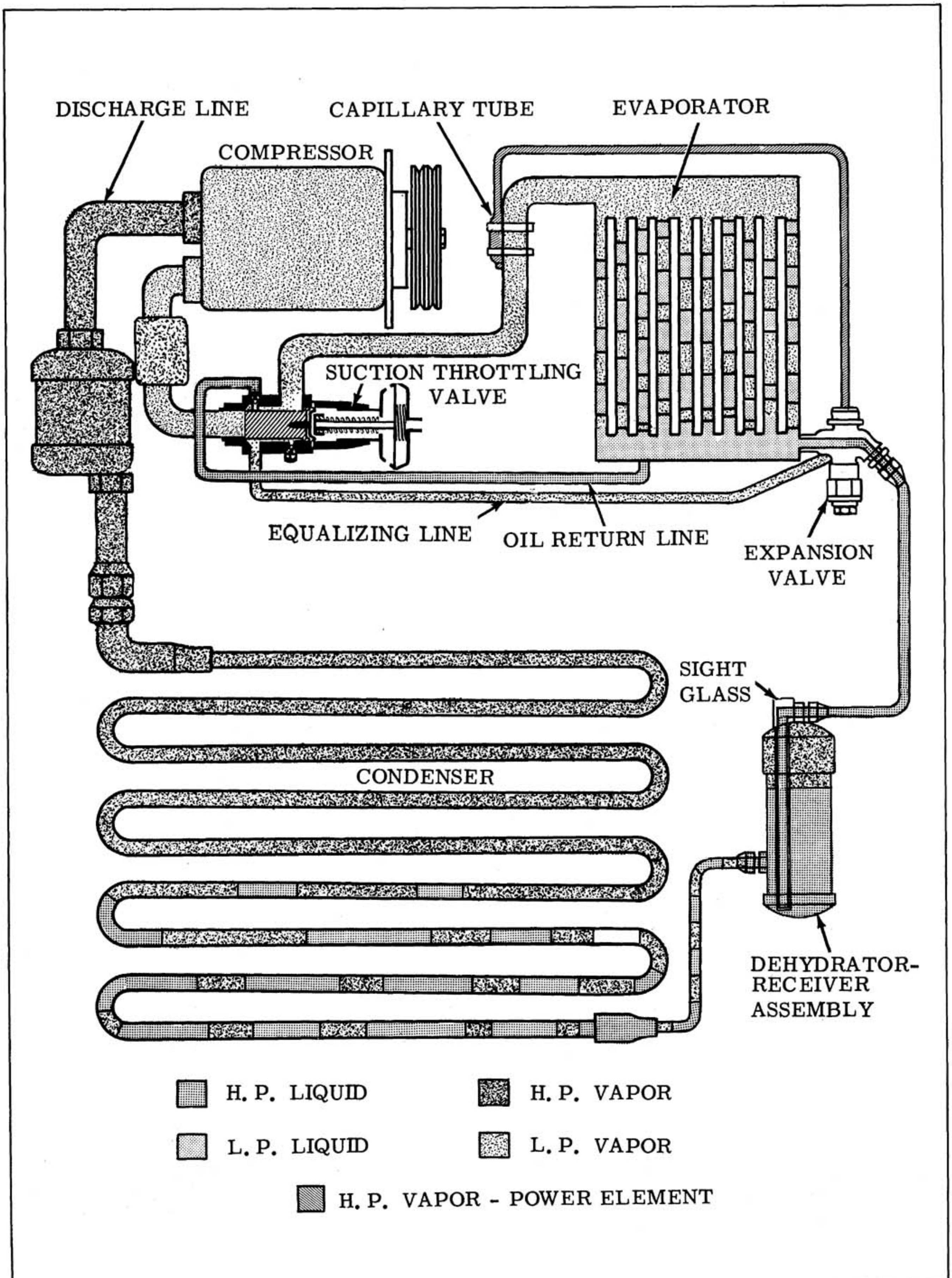


Fig. 14-59 Refrigeration Circuit

REFRIGERATION CIRCUIT (Fig. 14-59)

Heat laden, low pressure vapor refrigerant is drawn into the compressor and pumped from the compressor through the muffler to the condenser under high pressure. The vapor is heated as a result of the compression process. As it passes through the condenser, the high pressure - high temperature vapor is cooled, which causes the vapor to condense into liquid. The liquid refrigerant passes from the condenser into the dehydrator receiver which acts as a reservoir. The liquid in the receiver is still under high pressure.

Liquid refrigerant from the receiver now passes on to the expansion valve. The expansion valve meters refrigerant into the evaporator core. When the pressure in the evaporator is reduced, the liquid refrigerant immediately begins to boil at low temperature as it enters the evaporator. As the refrigerant passes through the evaporator, it continues to boil, absorbing heat from (and thereby cooling) the air passing through the evaporator core. By the time the refrigerant leaves the evaporator, it has completely vaporized and has warmed approximately 6°F.

Refrigerant returns from the evaporator through the suction pressure line to the compressor. When the evaporator pressure drops below 29.5 psi, the suction throttling valve restricts the flow of refrigerant to the compressor, thereby raising the evaporator pressure to prevent freezing of the core.

SAFETY PRECAUTIONS

Do Not Leave Refrigerant Drum Uncapped

All refrigerant drums have a metal screw cap. This cap protects the valve and safety plug from damage; therefore, the protective cap should always be replaced when the drum in not in use.

Do Not Subject Drum to High Temperature

The drum should not be exposed to the radiant heat of the sun, for the resulting increase in pressure may cause the safety plug on the drum to burst.

The refrigerant drum should never be subjected to excessive temperature when charging a system. The drum should be heated for charging purposes by placing in 125°F. water. Never heat above 125°F. or use a blow torch, radiator, or stove to heat the drum.

Do Not Weld or Steam Clean On or Near the System

Welding or steam cleaning of, or near, any of the refrigerant lines or components of the refrigerant system can build up dangerous pressures in the system.

Do Not Fill the Drum Completely

When filling a small drum from the larger one, always allow space above the liquid for expansion. If the drum were completely filled and the temperature increased, tremendous hydraulic force would develop.

Do Not Discharge Vapor Into Area Having Exposed Flame

Large quantities of refrigerant 12 should not be discharged into a closed room. The refrigerant may displace the oxygen in the air. Also, heavy concentrations of refrigerant 12 in contact with a live flame, such as a gas heater, or drawn into the intake of a running engine will produce a poisonous gas. This gas will also tarnish all bright metal surfaces.

Do Not Expose Eyes to Refrigerant

One of the most important precautions is protection of the eyes when handling refrigerant. Any liquid refrigerant which may accidentally escape is approximately 21.7°F. below zero. If any refrigerant comes in contact with the eyes, serious injury could result. Always wear goggles to protect the eyes when handling refrigerant.

If refrigerant should come in contact with the eyes:

1. DO NOT rub the eyes. Splash the eyes with cold water to gradually get the temperature above the freezing point.
2. Apply a protective film of an antiseptic oil over the eye ball to reduce the possibility of infection.
3. Consult a doctor or an eye specialist immediately.

Should liquid refrigerant come in contact with the skin, the injury should be treated the same as though the skin had been frostbitten or frozen.

MAINTAINING CHEMICAL STABILITY IN THE REFRIGERATION SYSTEM

The efficient operation of the air conditioning refrigeration system is dependent on the pressure-temperature relationship of pure refrigerant. As long as the system contains only pure

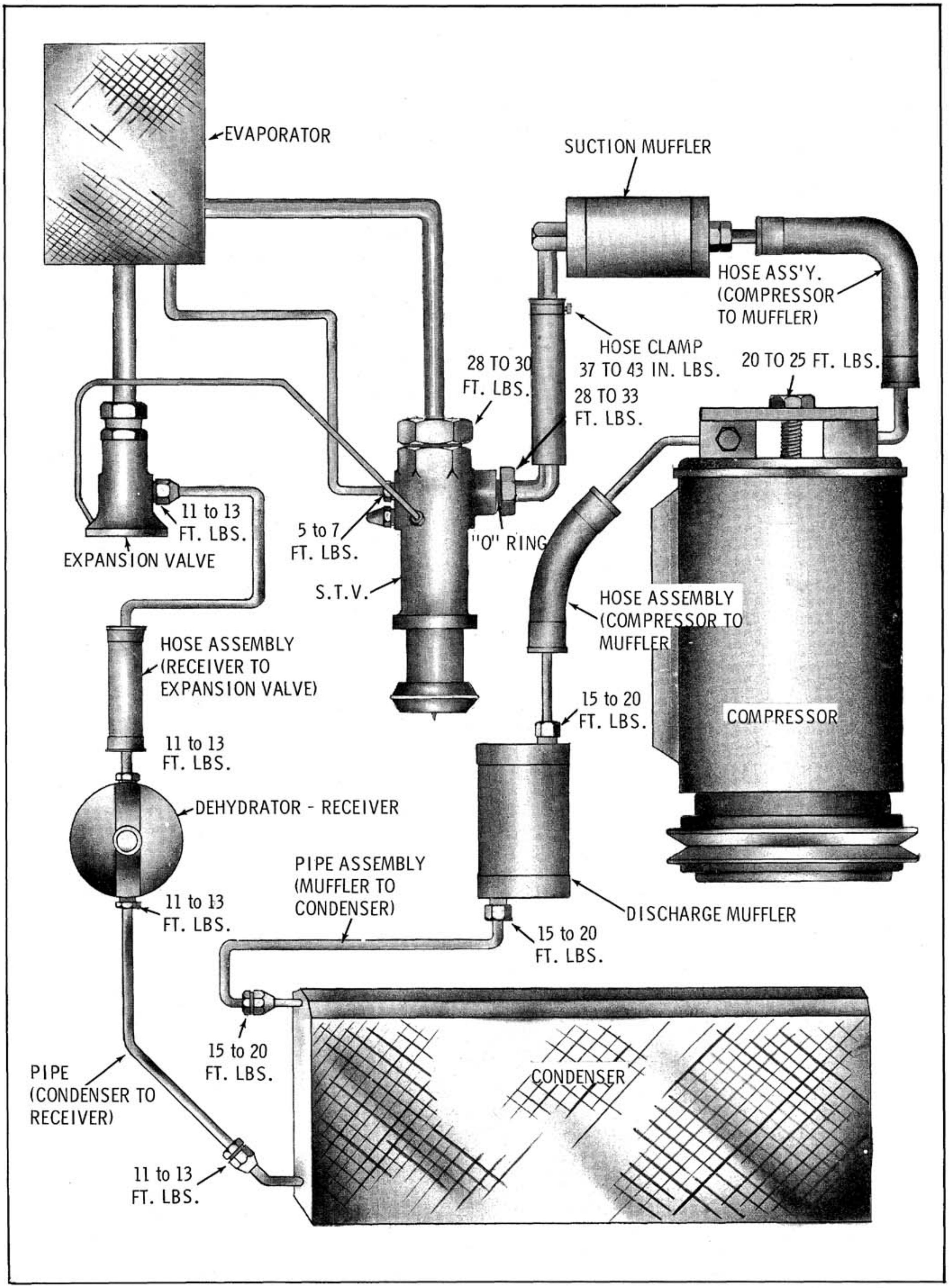


Fig. 14-60 A.C. Identification (52 through 86 Series)

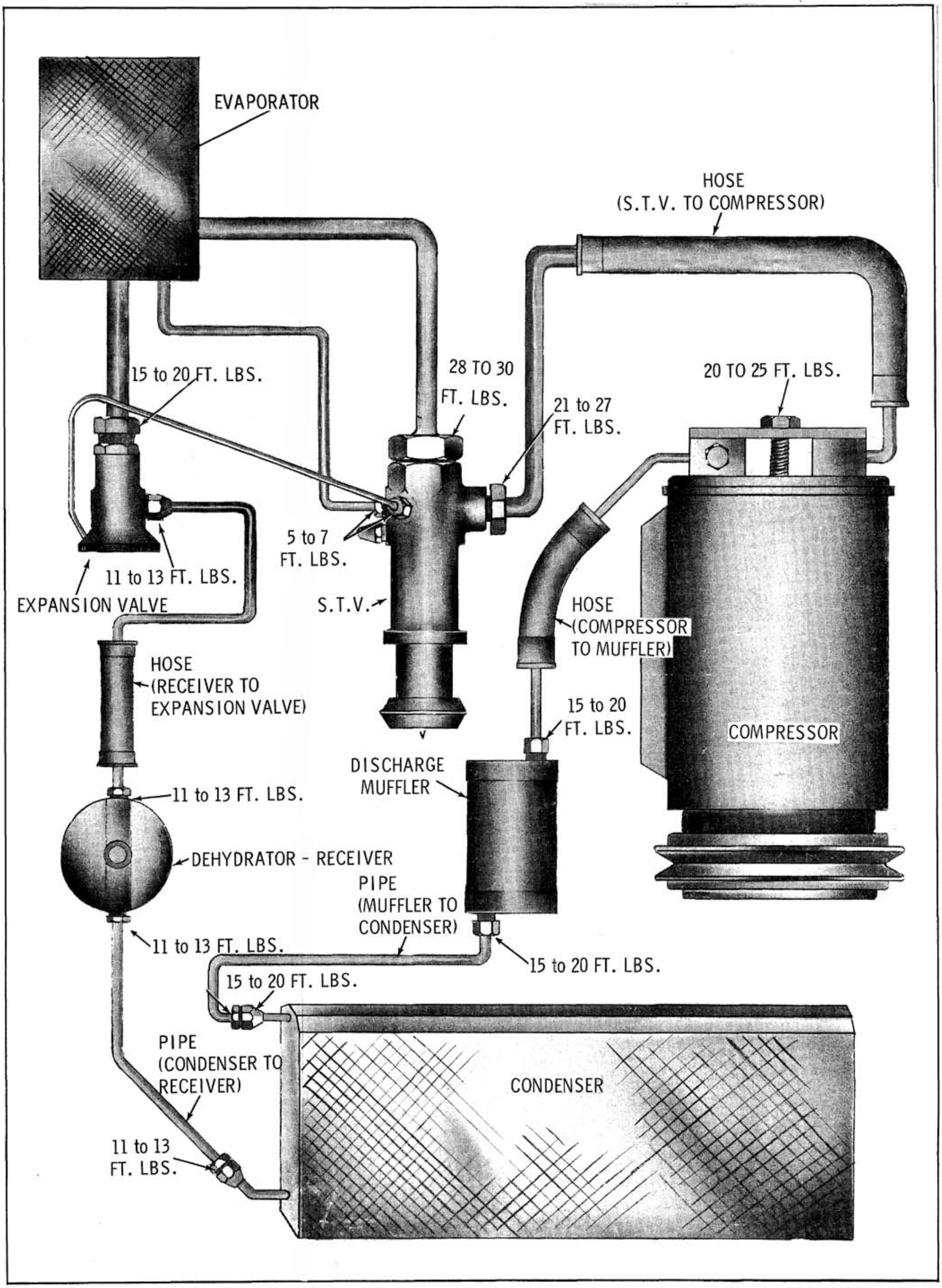


Fig. 14-61 A.C. Identification (33 through 38 Series)

refrigerant (plus a specified amount of compressor oil which mixes with the refrigerant), it is considered to be chemically stable.

When foreign materials, such as dirt, air or moisture are allowed to get into the system, they will affect chemical stability, resulting in the formation of acids or sludge which could cause the expansion valve to freeze up, and change the pressure-temperature relationship of the refrigerant. Thus, the system will no longer operate at the proper pressures and temperatures, and the efficiency will decrease and parts deteriorate.

The following general practices should be observed to insure chemical stability in the system:

Keep Lines Sealed

When disconnecting refrigerant lines, the lines should be at, near or above surrounding room temperature to prevent formation of condensation inside the lines. The lines should also be immediately capped to prevent entrance of dirt or foreign material.

Keep Tools Clean

Tools should be kept clean and dry. This includes the gauge set and replacement parts. Keep gauge lines plugged when not in use.

Use Clean Dry Oil Container

When adding oil to compressor, the container should be exceptionally clean and dry due to the fact that refrigeration oil is as moisture-free as possible; therefore, it will quickly absorb any moisture with which it comes in contact.

Keep Oil Container Capped

The oil container should not be opened until ready for use and should be capped immediately after use to reduce the possibility of the oil absorbing moisture and dirt entering the container.

Do Not Keep System Open Longer Than Five Minutes

PRECAUTION IN HANDLING LINES

All line connections use "O" rings for sealing. Replacement lines must be checked to see if they are completely sealed and dehydrated. Refrigerant lines must be free of kinks which would restrict the flow of refrigerant and cause noise.

Insulated clamps are used to reduce vibration and it is important to reinstall all the clamps when a line is replaced. Tightening connections is very important and the proper size wrenches should be used. The opposing fitting should always be held with a wrench to prevent distortion of connecting lines or components. This is especially important in tightening a hose connection as twisting a hose stiffens it and permits it to transmit more vibration. ALWAYS USE TWO WRENCHES WHEN TIGHTENING OR LOOSENING LINE FITTINGS. "O" rings should be coated with refrigeration oil and installed on the line before the line is inserted into the fitting, to prevent damaging the "O" ring. If leaks are encountered at couplings or connectors, no attempt should be made to correct the leaks by tightening the connections beyond the recommended torque. The "O" rings are designed to seal at the specified torque and over-tightening the connection does not result in a satisfactory permanently sealed connection. The connection must be disassembled and the cause of the leak (damaged "O" ring, defective pipes, etc.) corrected. Torque "O" ring fittings as outlined in chart. Refer to Figs. 14-60 and 14-61 for "O" ring location. Refer to Fig. 14-62 for use of Tool BT-6420.

TORQUE IN FT. LBS.

TUBE OD	SWIVEL NUT ON STEEL TUBE	SWIVEL NUT ON ALUMINUM TUBE
1/4"	10 to 15	5 to 7
3/8"	30 to 35	11 to 13
1/2"	30 to 35	15 to 20
5/8"	30 to 35	21 to 27
3/4"	30 to 35	28 to 33
For steel to aluminum connections, use the aluminum torque specifications.		

CAUTION: ALWAYS WEAR SAFETY GOGGLES WHEN OPENING REFRIGERANT LINES.

In the event any line is opened to atmosphere, it should be IMMEDIATELY capped to prevent entrance of moisture and dirt.

SPECIAL EQUIPMENT

REFRIGERATION GAUGE SET (Fig. 14-63)

The gauge set is used when discharging, evacuating, charging, or diagnosing trouble in the system. The low pressure gauge is graduated into pounds of pressure from 0 to 100 and in the opposite direction in inches of vacuum from 0 to

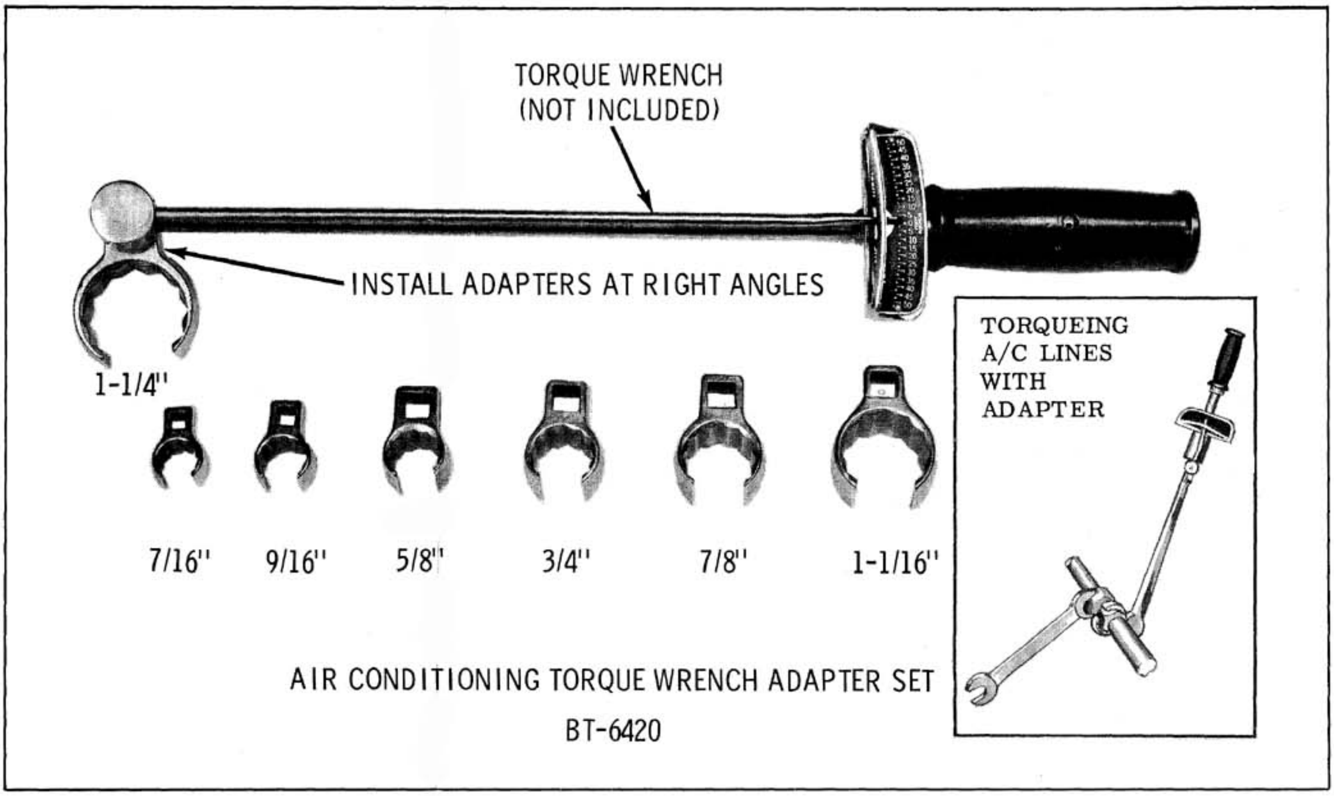


Fig. 14-62 Torque Wrench Adapter Set

30. The high pressure gauge is graduated from 0 to 300 pounds pressure. The center connection is common to both and is for the purpose of attaching a line for adding refrigerant or evacuating the system. When this connection is not required, it should be capped with a flare nut and cap.

The shut-off valves close each opening to the connector and to each other. They DO NOT open or close off pressure to the gauges.

LEAK DETECTOR J-6084

Leak Detector J-6084 is a gas operated torch type leak detector using a replaceable cylinder. It can also be used as a blowtorch by replacing the leak detector burner unit with Utility Torch Unit J-6085.

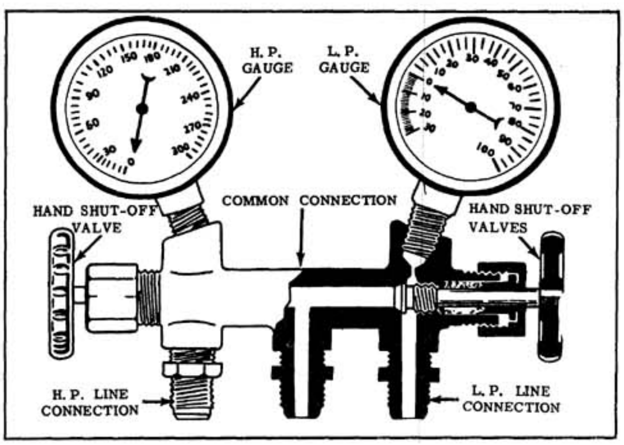


Fig. 14-63 Gauge Set

Assembling Unit

1. Remove dust cap from cylinder.
2. Close valve knob on detector unit.
3. Thread detector unit onto top of fuel cylinder. Tighten finger tight.

   NOTE: Do not use tool or wrench to tighten.

4. Attach search hose assembly to detector unit.

Lighting Detector J-6084

1. Open control valve until slight hiss of gas is heard, then light gas at opening in chimney.

   CAUTION: Do not use lighted detector in any place where combustible or explosive gases, dusts or vapors may be present.

2. Adjust the flame until the desired volume is obtained. A pale blue flame approximately 3/8" above the reaction plate is best for detecting leaks.

   NOTE: The reaction plate will be heated to a cherry red.

Correction For Yellow Flame

If the flame is yellow, insufficient air is being inspirated or the reaction plate is dirty. Insufficient air may be caused by:

1. Obstructed or partially collapsed suction tube.
2. Dirt or foreign substance in burner tube.
3. Dirty or partially clogged orifice.

Blowing air through the suction tube and back through the detector will usually clear dirt or foreign matter. If a yellow flame is caused by dirty reaction plate, allow the flame to burn for several minutes. This will usually burn the plate clean. If an oxide film appears on the reaction plate from continued use, it will reduce the sensitivity of the detector. This may be remedied by removing the plate and scraping the surface gently with a knife.

To Clean Orifice

1. Never attempt to clean orifice by passing anything through the hole.
2. Unscrew burner assembly from burner tube by applying wrench to hexagon part located immediately below search hose connection. Turn to left. This will expose orifice block which is inserted into the end of the tube.
3. Remove orifice block from tube.
4. Reverse orifice block and replace against burner tube; screw burner head onto burner tube (hand tight), then open valve quickly, admitting several short blasts.
5. To reassemble: unscrew burner head, insert orifice block into burner tube, and screw burner head onto burner tube with a wrench to form a gas-tight joint.

CHECKING FOR REFRIGERANT LEAKS

After the leak detector flame is adjusted, check for refrigerant leaks in an area having a minimum amount of air flow in the following manner:

Explore for leaks by moving end of hose or sampling tube around all connections and points where a leak may be. Check around bottom of connections, since Refrigerant-12 is heavier than air and will, therefore, be more apparent at bottom of fitting.

The color of the flame will turn to a yellow-green when a small leak is detected. Large leaks will be indicated by a change in color to brilliant blue or purple. When the suction hose is moved away from the leak the flame will clear to an almost colorless pale blue again.

CAUTION: Do not breathe the fumes and black smoke that are produced if the leak is a big one. They are poisonous! Any time an open flame is used near a car there is a certain amount of danger. Although the torch flame is small and well protected, it is recommended that a fire extinguisher be close at hand for any emergency that might arise.

LEAK DETECTOR (LIQUID)

There are a number of fittings and places throughout the air conditioning unit where leak detector solution (Part No. 564255) may be used to pinpoint leaks.

Apply the solution to the suspected area with a swab that is attached to the bottle cap. Bubbles will form within seconds if there is a large leak.

VACUUM PUMP

If a leaking system has been operated in a discharged condition, the receiver dehydrator assembly should be replaced and a vacuum pump used to thoroughly evacuate the system.

SERVICING OF INDIVIDUAL UNITS (NOT IN REFRIGERANT SYSTEM)

The following services and repairs concern parts of the air conditioning system which can be serviced without opening the refrigerant system.

COMPRESSOR BELT ADJUSTMENT

Tool 33-70M is used to check the compressor belt tension.

If belts require adjustment:

1. At rear of compressor, loosen bolt securing support to rear bracket.
2. Loosen bolt securing rear link to support.
3. At front of compressor, loosen bolt securing link to front bracket.
4. Loosen bolt securing adjusting link to front bracket.
5. Pivot the compressor evenly at the front and rear adjusting links until correct belt tension is obtained.

V-6 (33 and 35 Series)

1. Loosen bolt securing rear adapter to compressor mounting bracket.

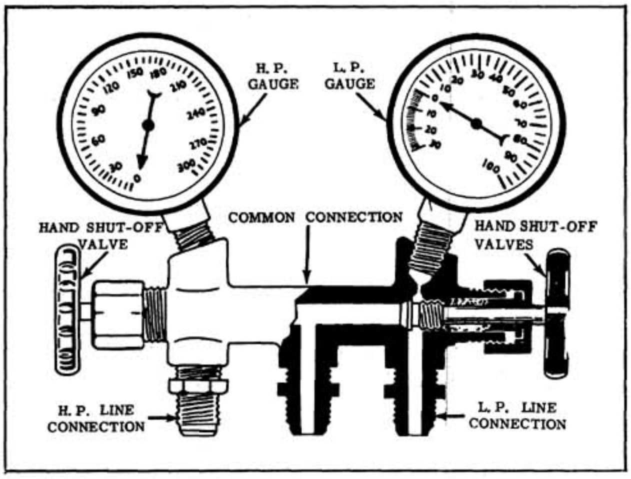


Fig. 14-63 Gauge Set

2. Loosen bolt securing rear adapter to rear brace.

3. Loosen bolt securing front adapter to compressor mounting bracket.

4. Loosen bolt securing compressor to front brace.

5. Pivot the compressor evenly at the front and rear brace until the correct belt tension is obtained.

V-8 (33 through 38 Series)

1. Loosen bolt securing rear pport to rear bracket.

2. Loosen bolt securing compressor to rear adjusting link.

3. Loosen bolt securing front adjusting link to upper pivot.

4. Loosen bolt securing adjusting link and lower strut to compressor front bracket.

5. Pivot the compressor evenly at the front and rear adjusting links until correct belt tension is obtained.

Check belt alignment and torque all bolts loosened to make belt adjustment.

Bolt Size	Torque Ft. Lbs.
5/16"	25
3/8"	35
7/16"	50

SIDE OUTLETS
Adjustment (Fig. 14-64 & 14-65)

Nozzles should be free to rotate but tight enough to remain in a set position. If adjustment is required refer to Fig. 14-64.

AIR OUTLETS

The air outlets are installed as shown in Figs. 14-65 and 14-66. Fig. 14-54 illustrates side outlet installation for 52 through 86 Series.

CONTROL ASSEMBLY

The control attachment and wiring connections are shown in Figs. 14-67, 68, 69 and 70.

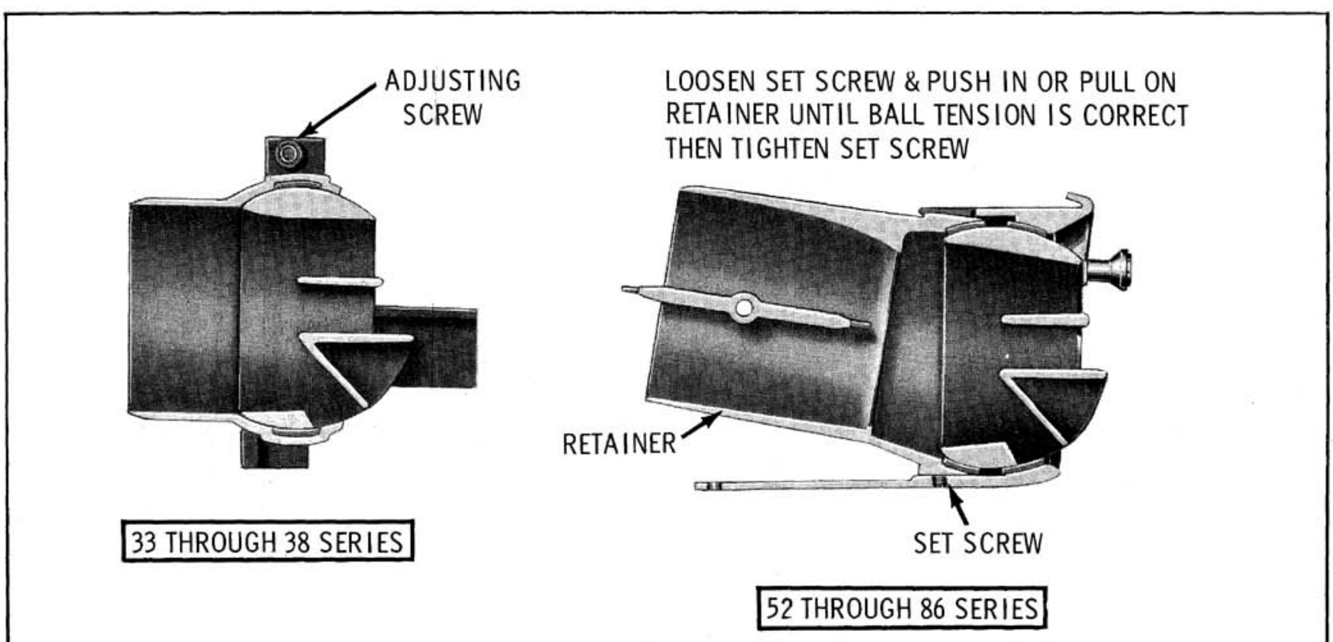


Fig. 14-64 Side Air Outlets

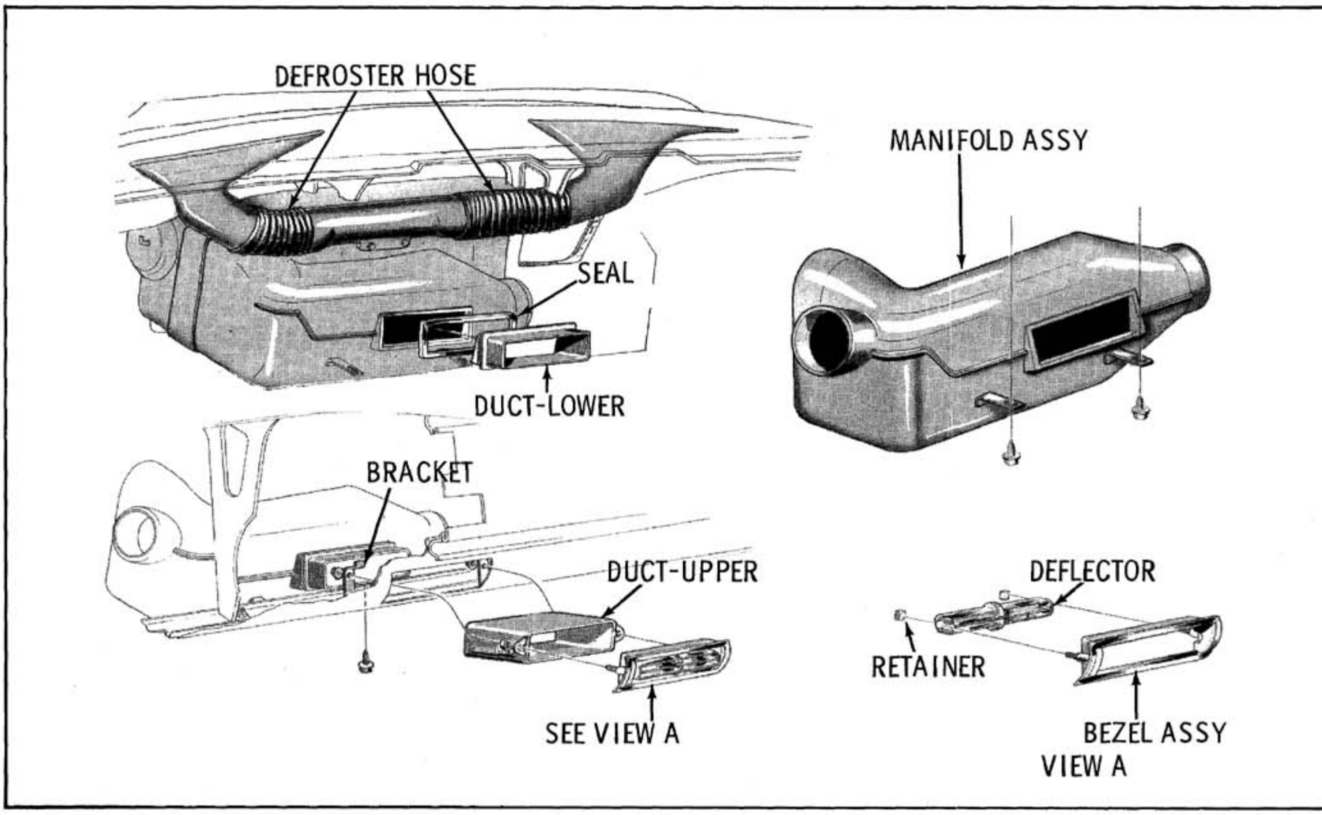


Fig. 14-65 Center Outlet (52 through 86 Series)

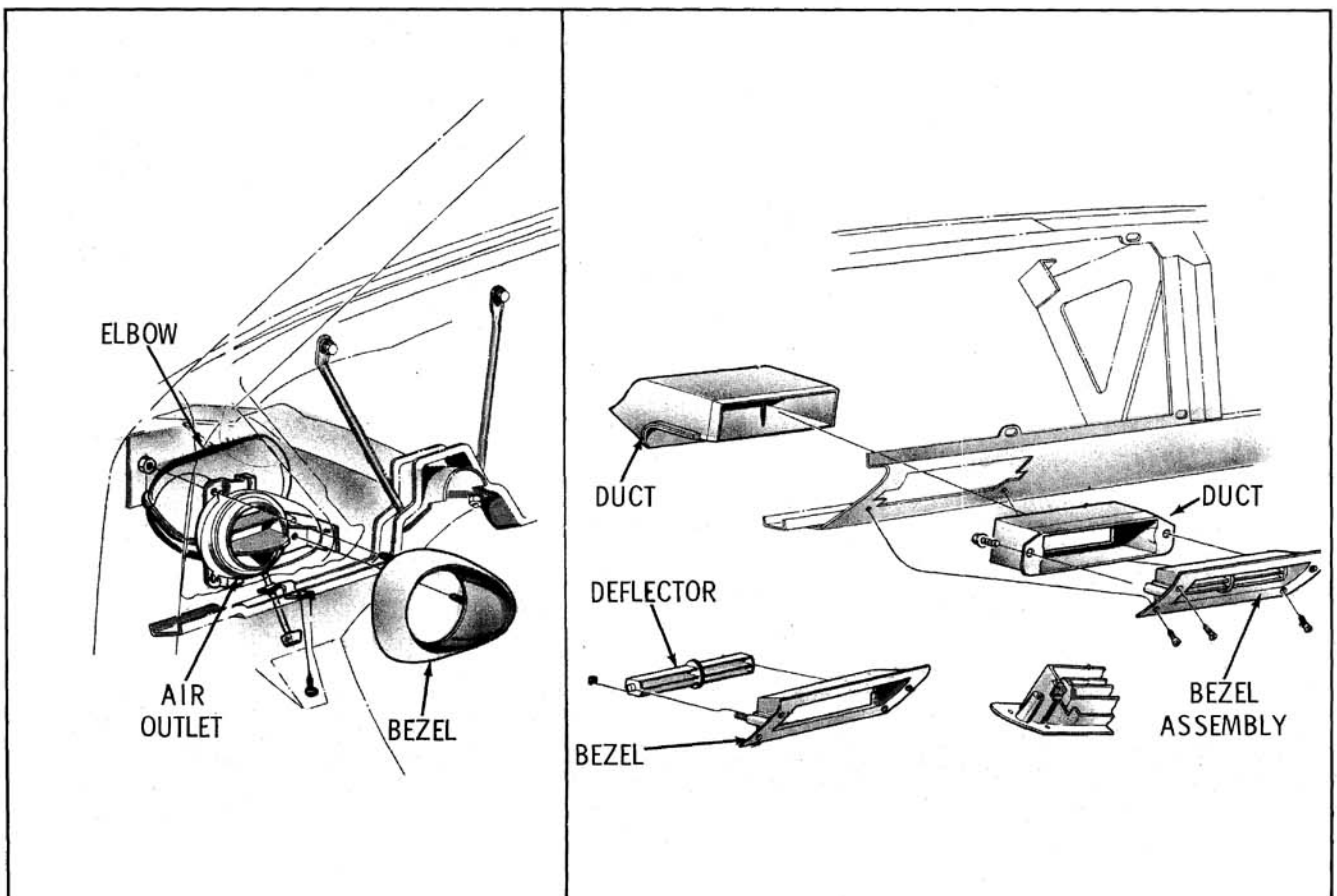


Fig. 14-66 Air Outlets and Controls (33 through 38 Series)

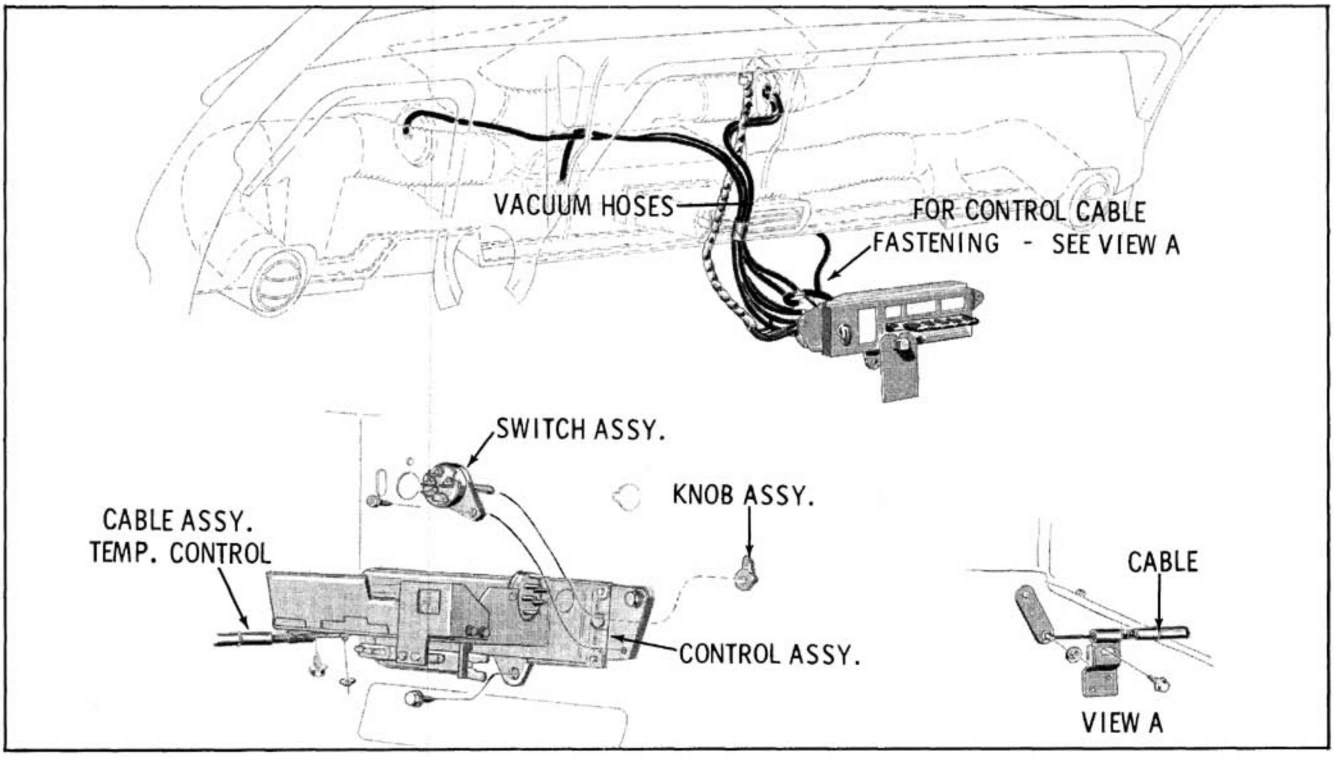


Fig. 14-67 A.C. Control (52 through 86 Series)

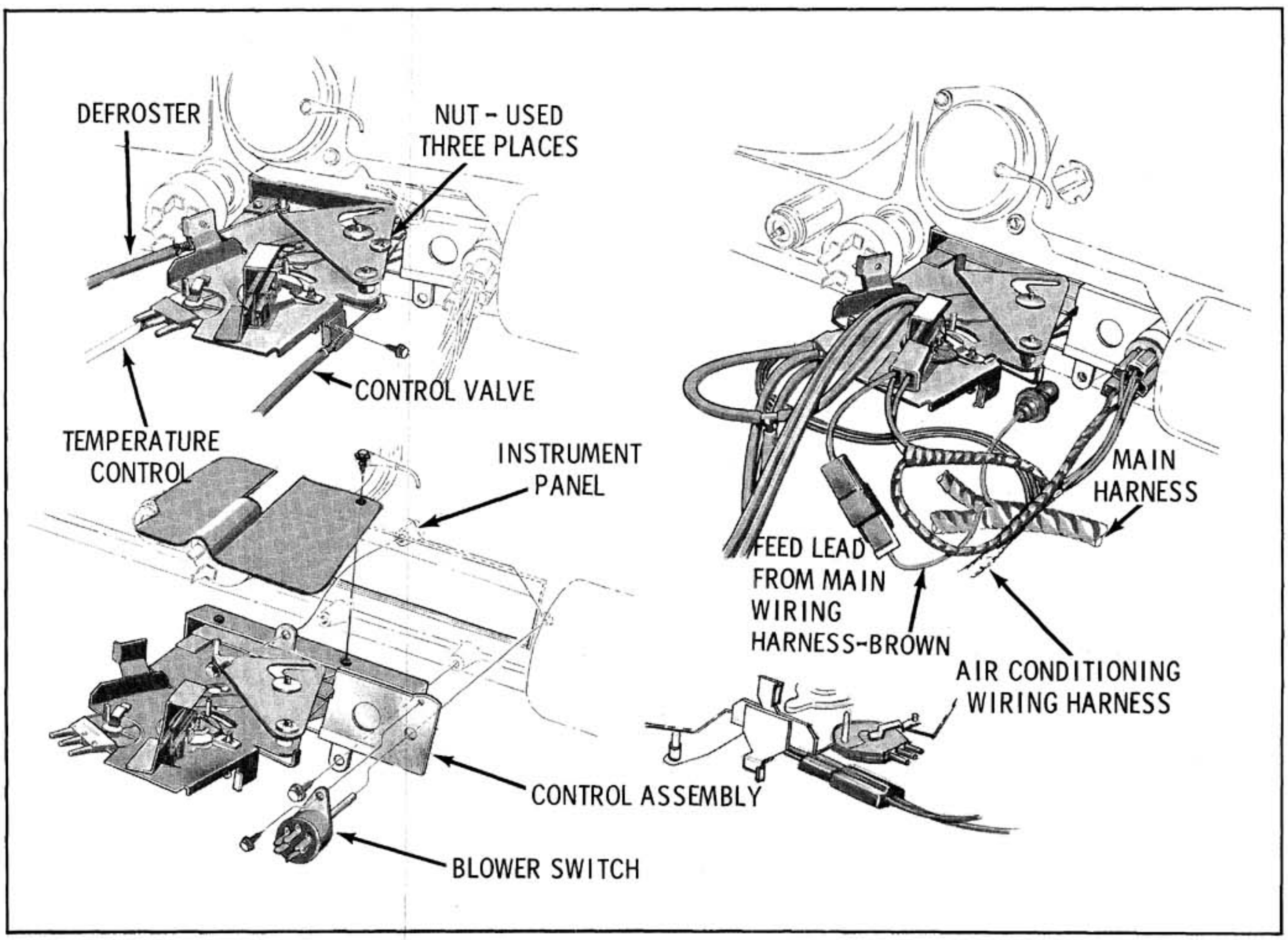


Fig. 14-68 A.C. Control (33 through 38 Series)

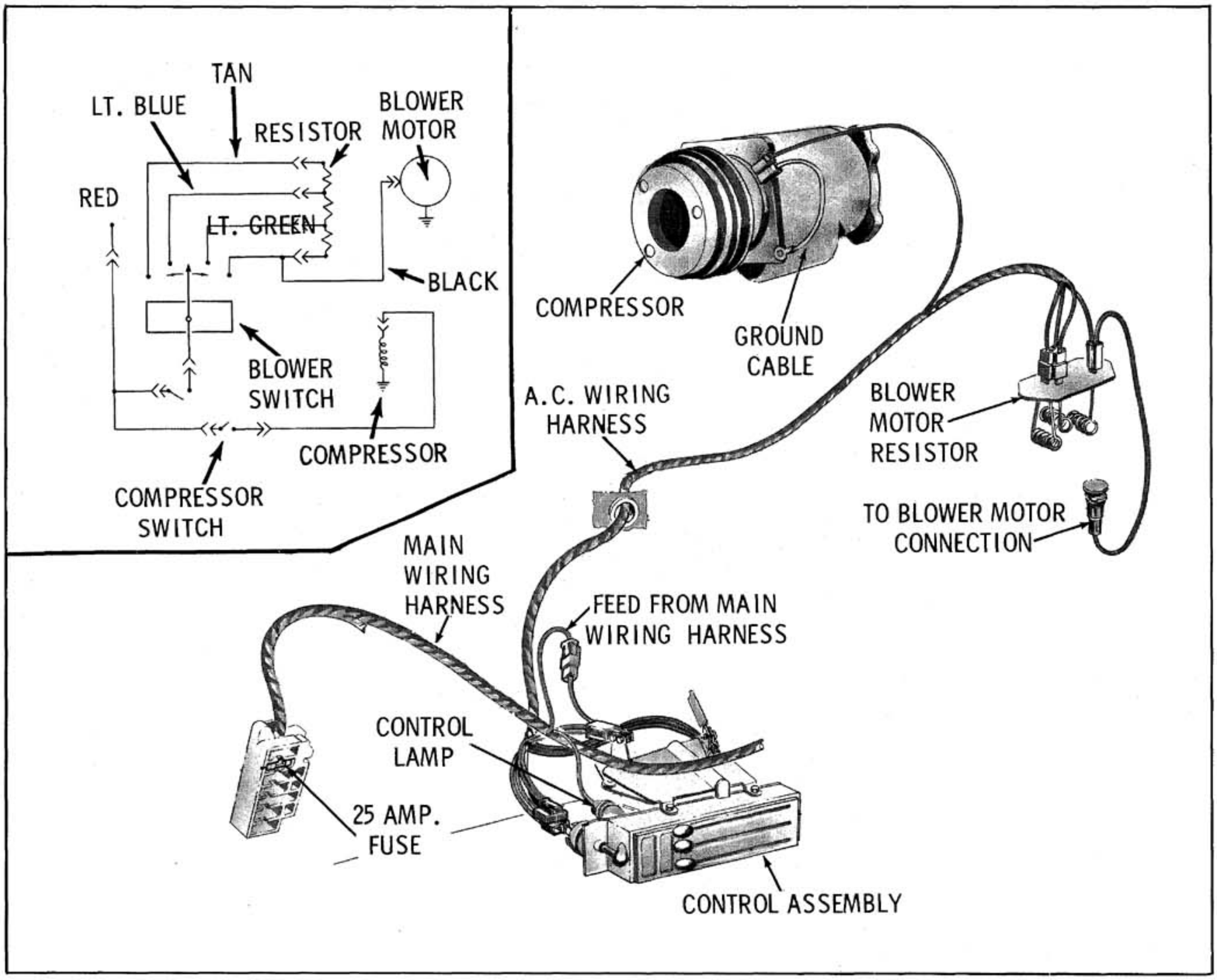


Fig. 14-69 Wiring Connections (33 through 38 Series)

BLOWER MOTOR AND EVAPORATOR

The blower motor, duct and evaporator is attached as shown in Figs. 14-71, 14-72 and 14-73. Fig. 14-74 illustrates evaporator to evaporator case attachment for the 52 through 86 Series which is similar to the 33 through 38 Series.

BLOWER MOTOR RESISTOR

The blower motor resistor is mounted on the blower duct and can be removed by removing the two attaching screws. Figs. 14-71 and 14-72.

HEATER CASE ASSEMBLY

The heater case assembly is installed as shown in Figs. 14-75 and 14-76. The heater core can be removed after removing the heater case assembly. Fig. 14-77 illustrates the core location on 52 through 86 Series.

VACUUM DIAPHRAGMS

Vacuum diaphragms are used to operate the air inlet and recirculate door on all series and also operate the defroster door and selector door on the 52 through 86 series. The air inlet and recirculate door diaphragm is a two-step diaphragm. When the A/C control is set for RECIRC., vacuum is applied to the upper port and the door opens a predetermined distance allowing 20% outside air and 80% inside air to be drawn through the evaporator. When the A/C control is set for NORMAL, vacuum is applied to both ports and 100% outside air is drawn through the evaporator.

ADJUSTMENTS

Recirculating Air Door

To adjust the recirculating air door the blower duct assembly must be removed from the car.

1. With vacuum applied to the upper port, the recirculating air door should be opened 11/32". Fig. 14-78 illustrates the adjustment on the 52 through 86 Series. Fig. 14-79 illustrates the adjustment on the 33 through 38 Series.

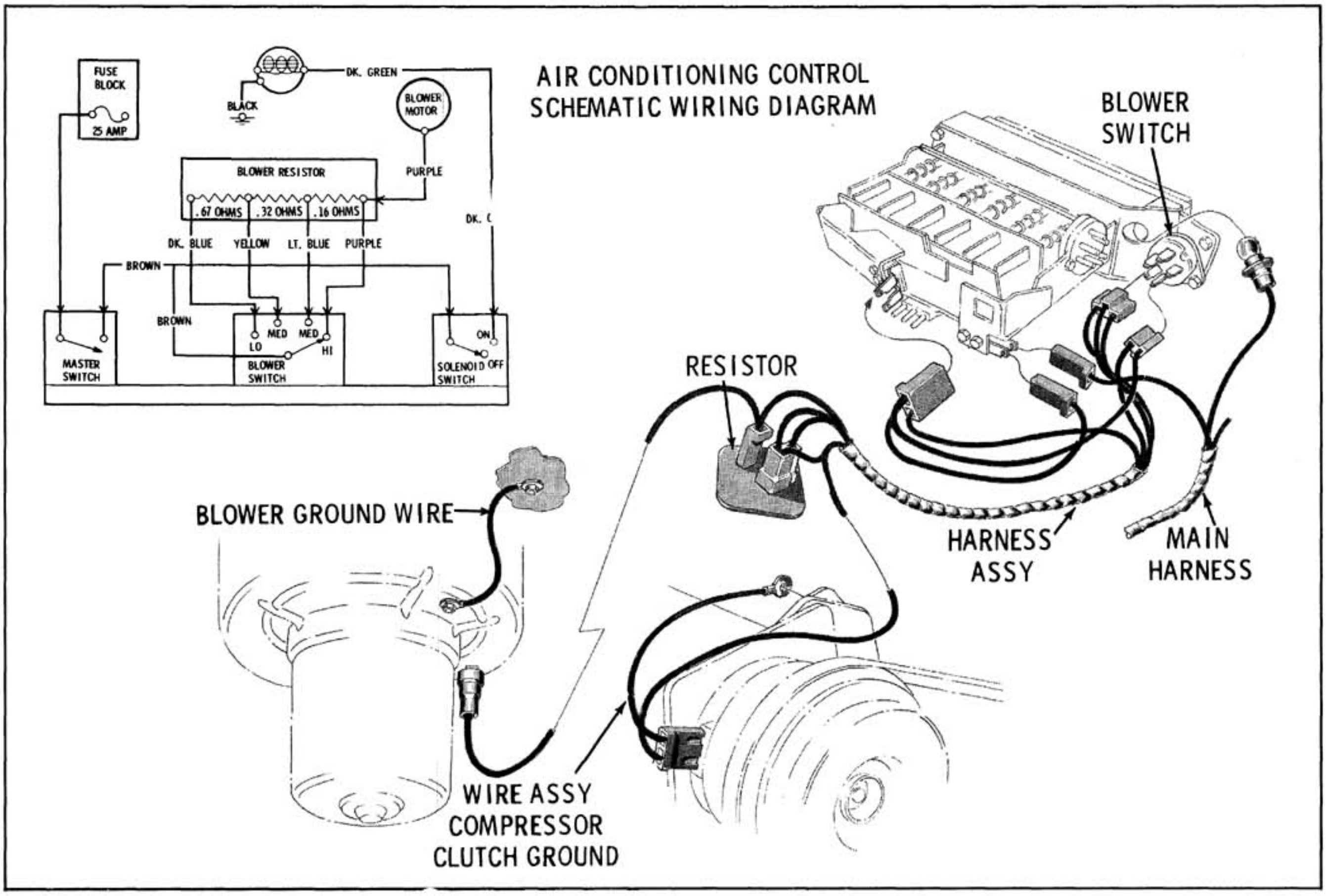


Fig. 14-70 Wiring Connections (52 through 86 Series)

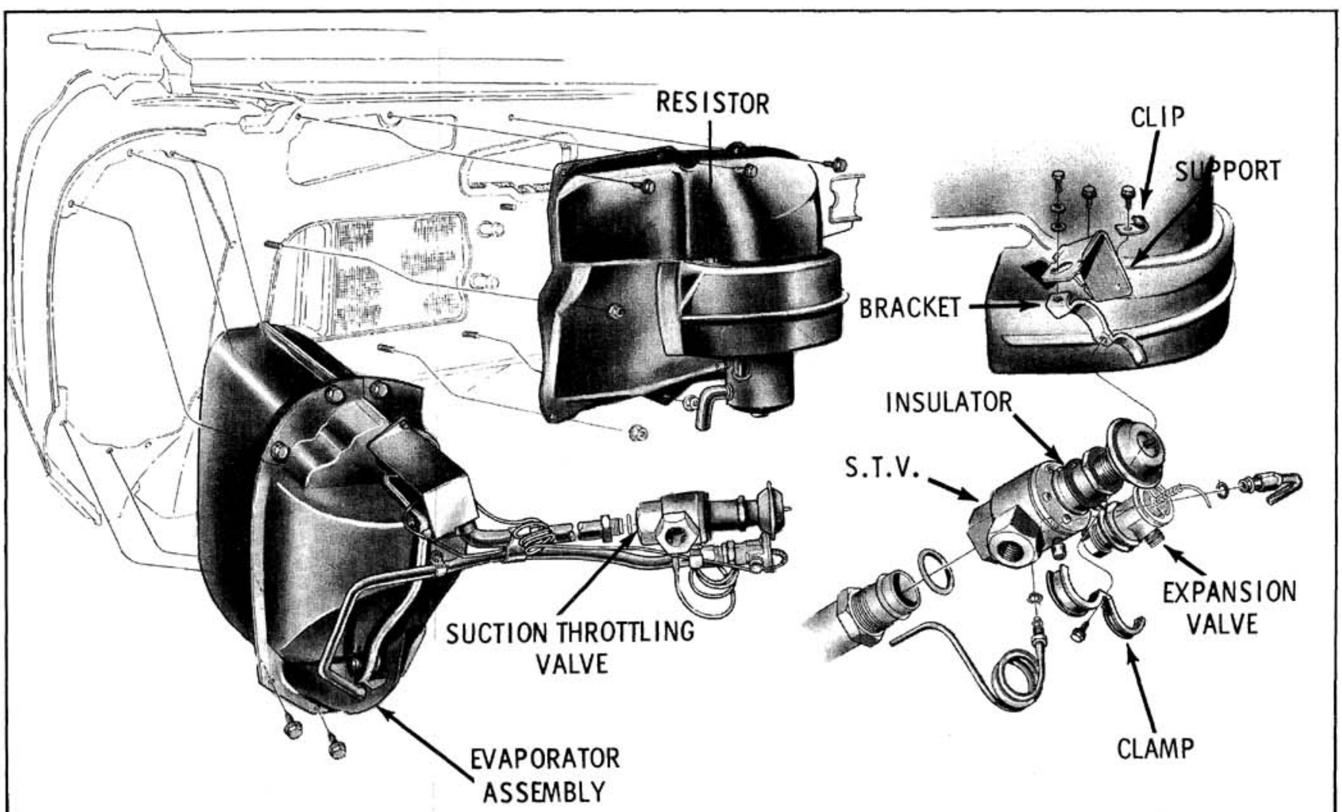


Fig. 14-71 Blower Motor and Evaporator (33 through 38 Series)

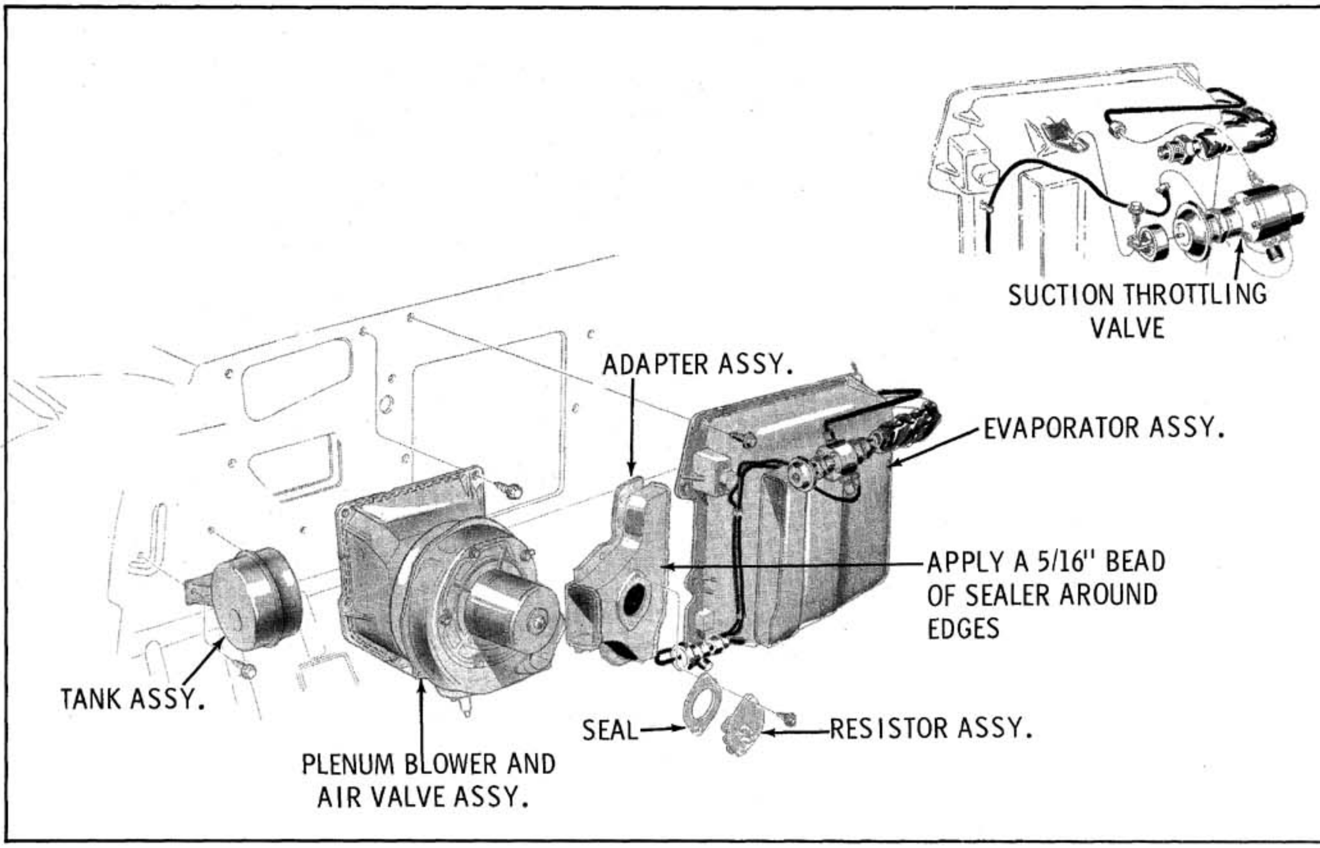


Fig. 14-72 Blower Motor and Evaporator (52 through 86 Series)

2. If necessary to adjust, loosen the set screw on the diaphragm link and move link until proper adjustment is obtained.
3. Recheck adjustment.

Selector Door (Fig. 14-80)

The selector door diaphragm is located inside the heater case. To remove the diaphragm the heater case must be removed.

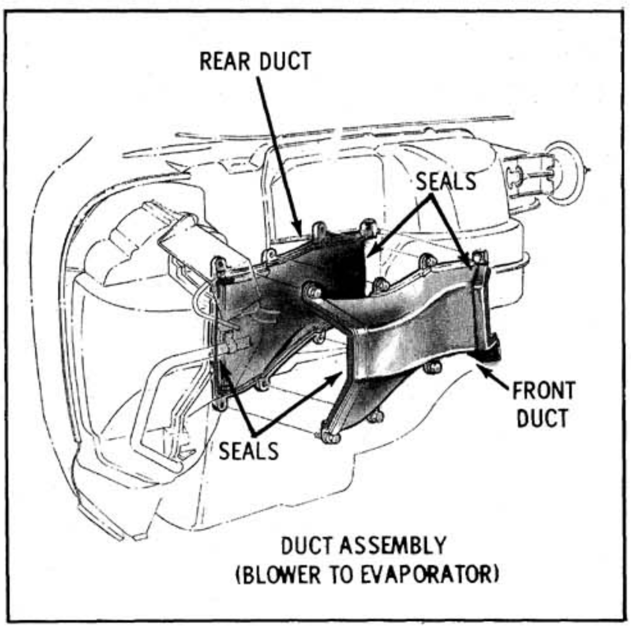


Fig. 14-73 Duct (33 through 38 Series)

1. Remove the metal plug at the bottom of the heater case.
2. Loosen the set screw on the diaphragm link to allow the spring to fully close the door.
3. Tighten set screw and install plug into heater case.

Defroster Door

1. With vacuum applied to the defroster diaphragm, loosen the set screw on the diaphragm arm.
2. Remove heater outlet. Pull defroster door down until it contacts the rubber stop, then tighten set screw.
3. Install heater outlet.

Selector Door Cable (33 through 38 Series)

1. Set the A/C control in the RECIRC or NORMAL position.
2. Loosen the cable attaching screw.
3. Hold the selector door fully open and tighten the cable attaching screw.

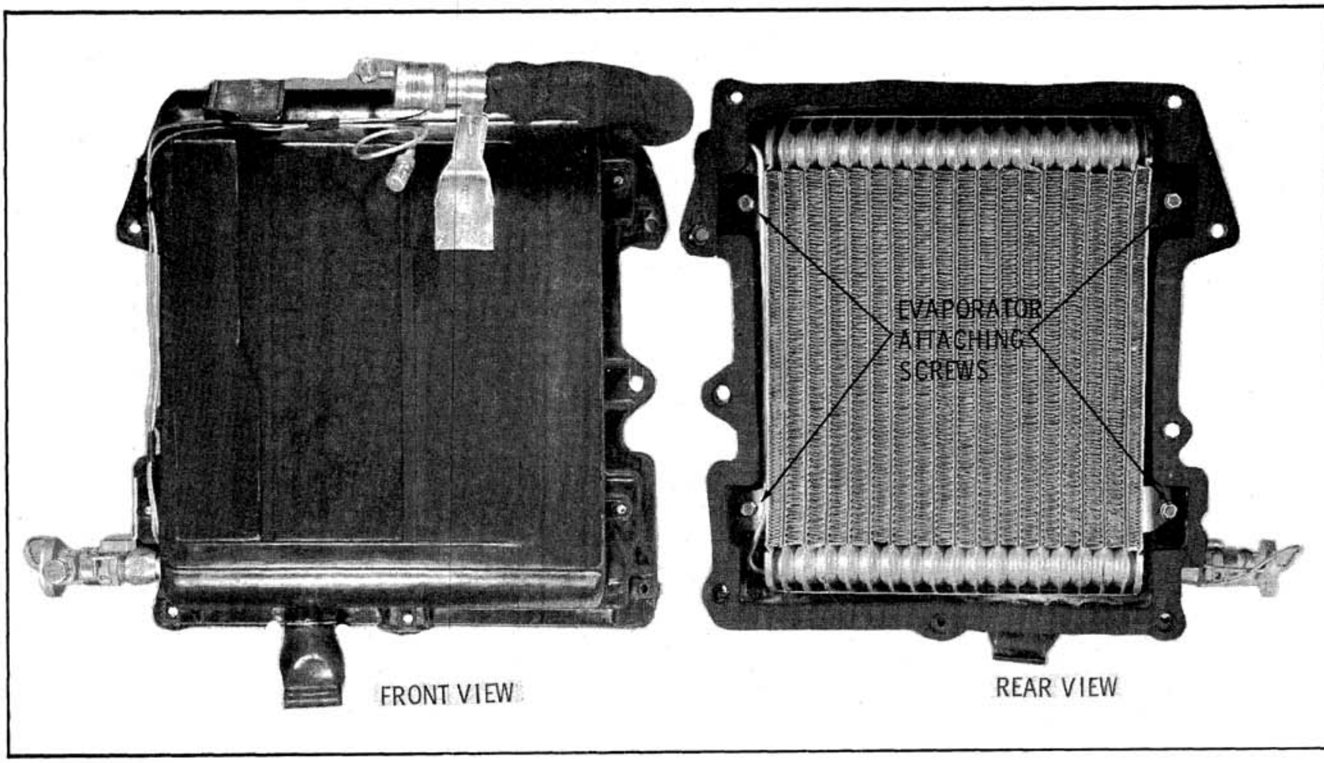


Fig. 14-74 Evaporator (52 through 86 Series)

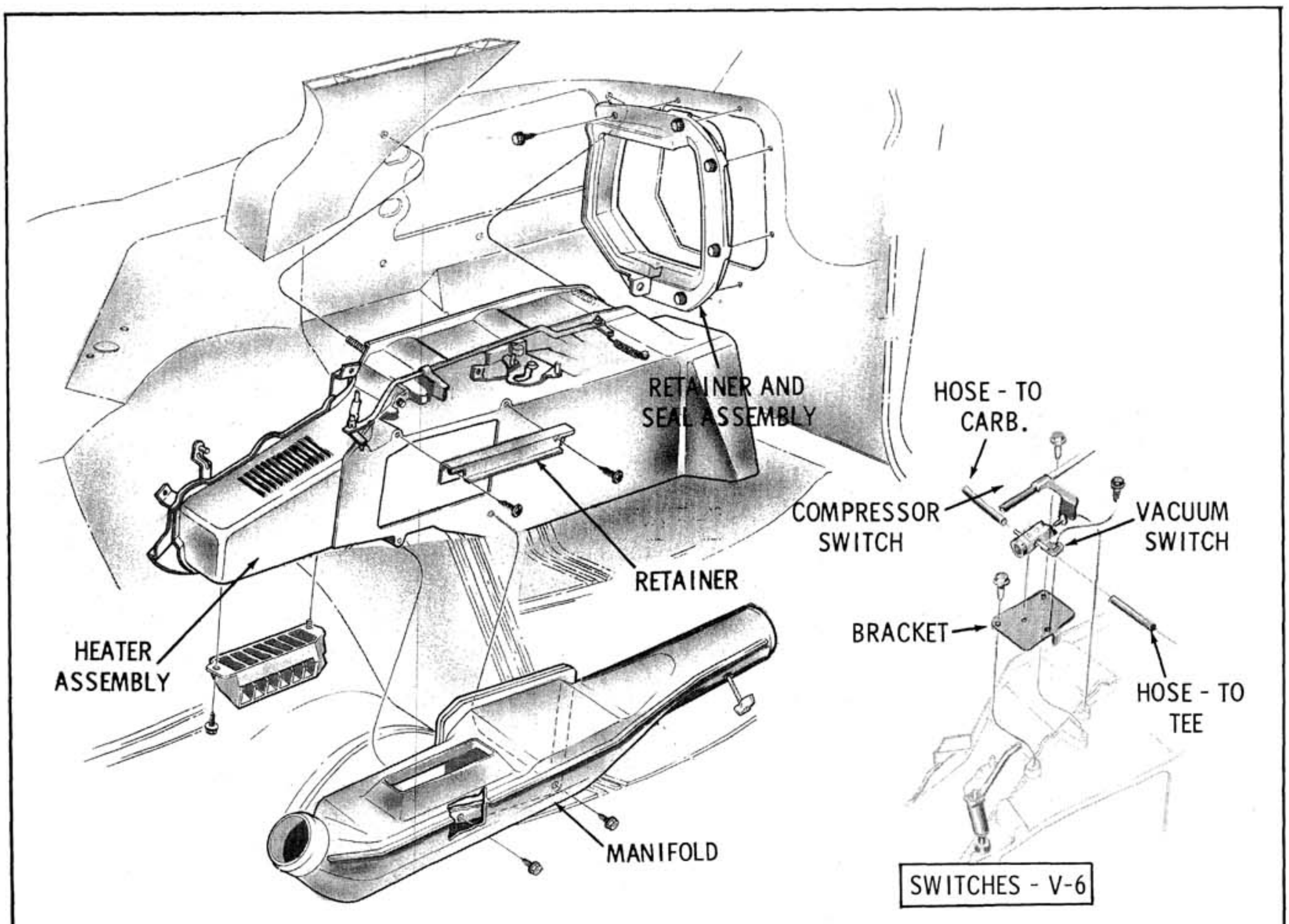


Fig. 14-75 Heater Case (33 through 38 Series)

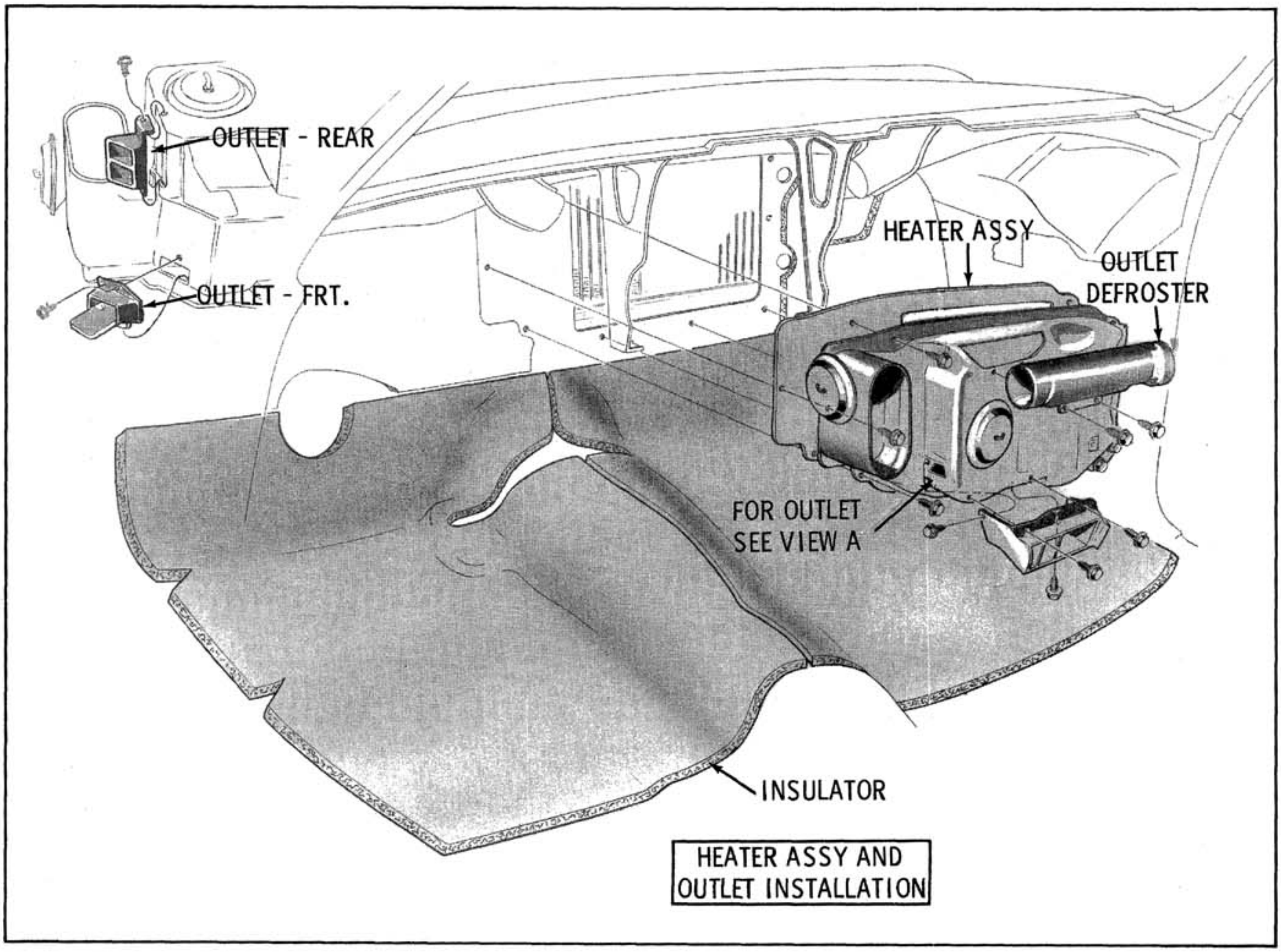


Fig. 14-76 Heater Case (52 through 86 Series)

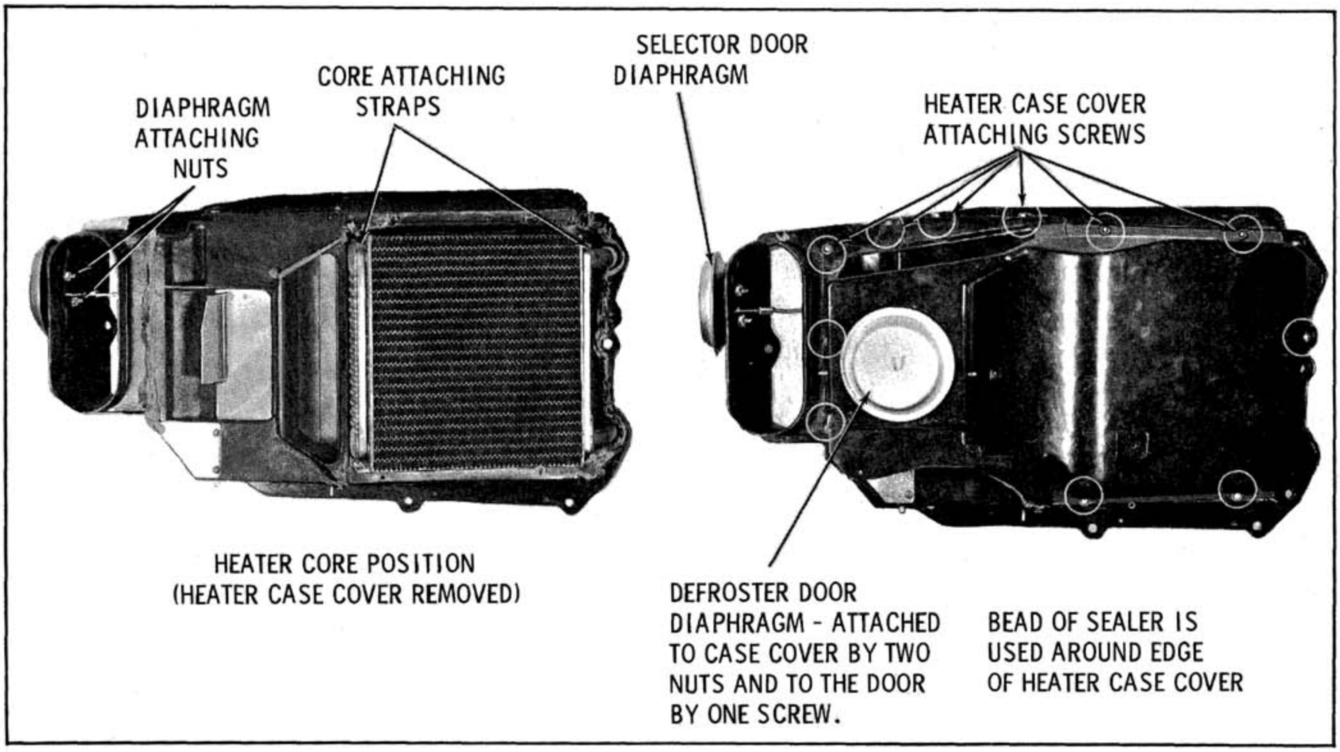


Fig. 14-77 Heater Core (52 through 86 Series)

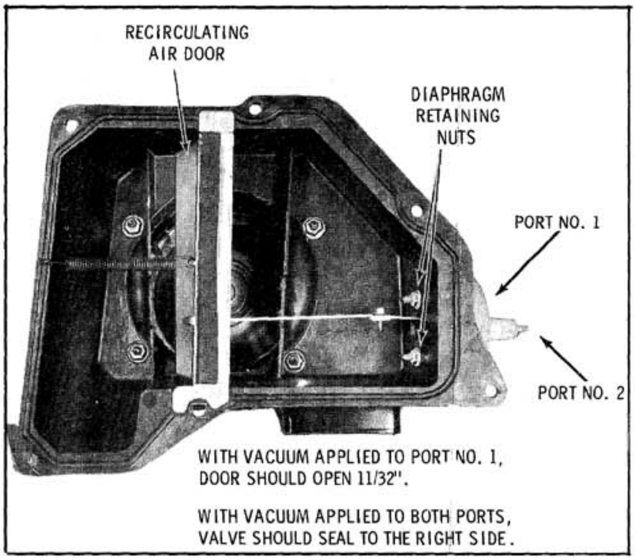


Fig. 14-78 Recirculating Air Door Adjustment (52 through 86 Series)

Control Cables

Cables are used to operate the temperature door on all series and are also used to operate the defroster and selector doors on the 33 through 38 Series.

ADJUSTMENTS

Temperature Cable (33 through 38 Series)

The cable is connected to a cam lock device that assures positive closing of the temperature door. To adjust, disconnect the cable and insert a 3/16" pin through the hole in the cam and cam support to lock the door in the full cold position. Attach cable to pin on cam and adjust it so that when lever is to the left side of the control, a clearance of 1/8" is obtained.

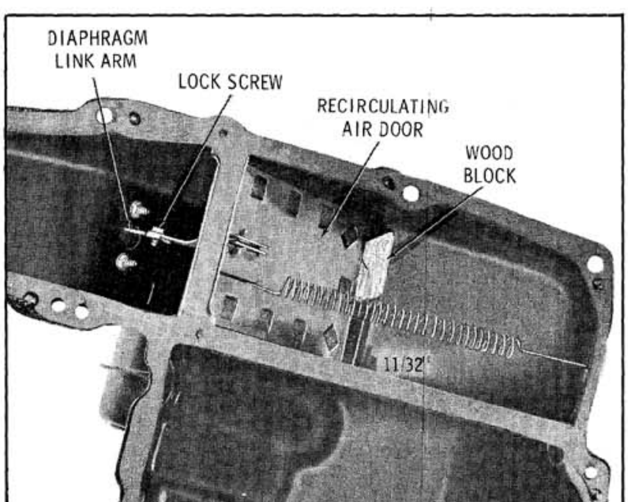


Fig. 14-79 Recirculating Air Door Adjustment (33 through 38 Series)

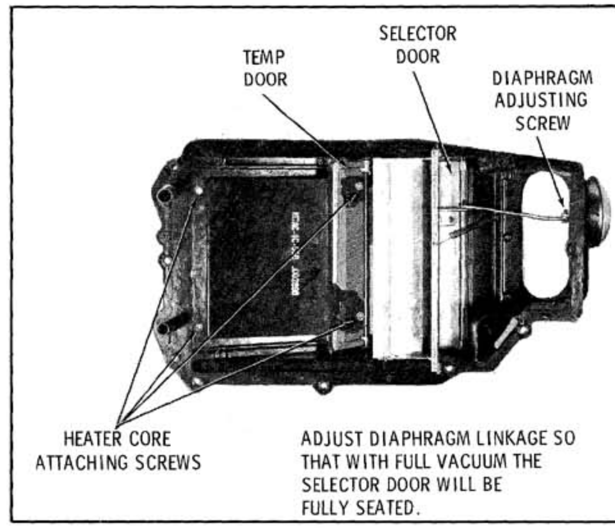


Fig. 14-80 Selector Door (52 through 86 Series)

Defroster Cable (33 through 38 Series)

1. Set HEAT control lever in the OFF position.
2. Loosen the cable attaching screw.
3. While holding the defroster door in the closed position, (all of the air coming out of the heater outlet), tighten the cable attaching screw.

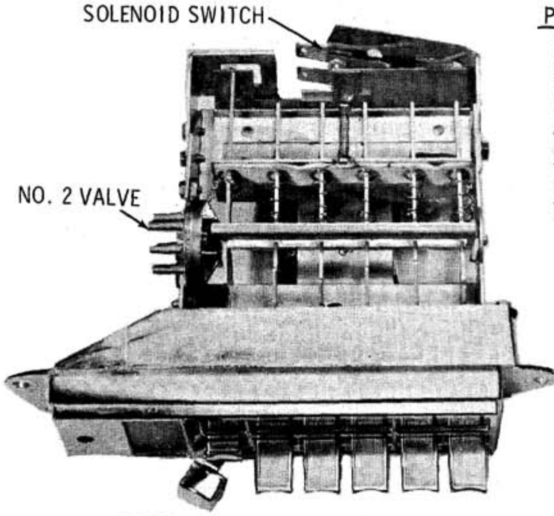
CLUTCH, PULLEY, AND COIL

The following procedures can be performed with the compressor either on or off the car. When working with the compressor on the car, the compressor should be disconnected from the mounting bracket and tipped upward to provide adequate working clearance.

DRIVEN PLATE

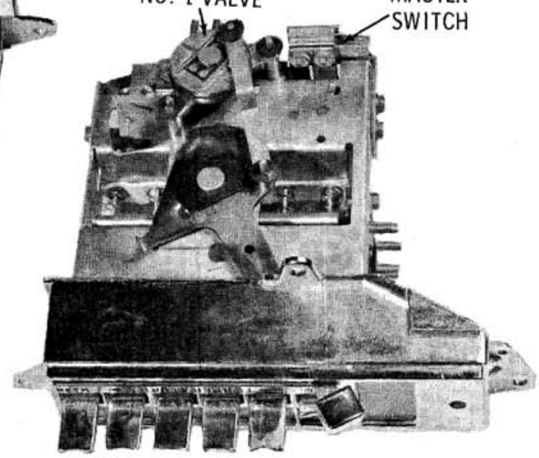
Removal

1. Using a thin wall socket, remove the locknut from the compressor shaft. Use Tool J-972-A to hold driven plate.
2. Install Puller J-9401 into hub of driven plate. Hold main body of tool and turn forcing screw clockwise to remove driven plate. (Fig. 14-82)
3. Remove tool from hub of driven plate.



#1 VALVE OPERATIONS

PORT	OFF	AC NORMAL	AC RECIRC	VENT	HEAT	DEF
1						
2	INPUT IN EACH POSITION					
3	VENT	VAC	VAC	VAC	VAC	VAC
4	VENT	VENT	VENT	VENT	VAC	VAC
5						
6	VENT	VAC	VENT	VAC	VAC	VAC
7	VENT	VENT	VENT	VENT	VENT	VAC



#2 VALVE

PORT	CONNECTION
1	INPUT
2	STV
3	WATER VALVE

TO OPERATE ON TEMPERATURE LEVER

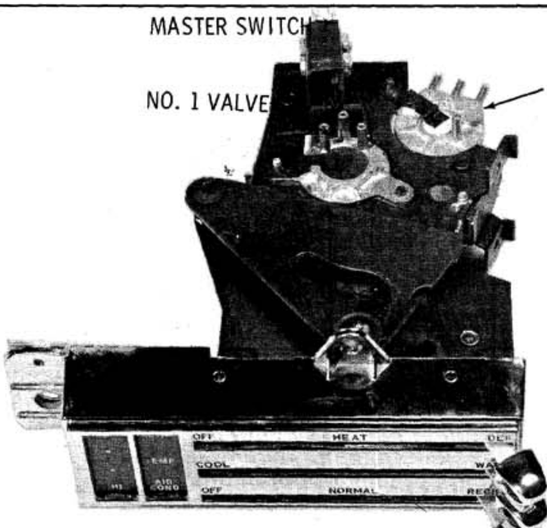
COOL WARM

1/4-1/2

STV | VAC ← VENT →

WV | VENT ← VAC →

Fig. 14-81A A.C. Control (52 through 86 Series)

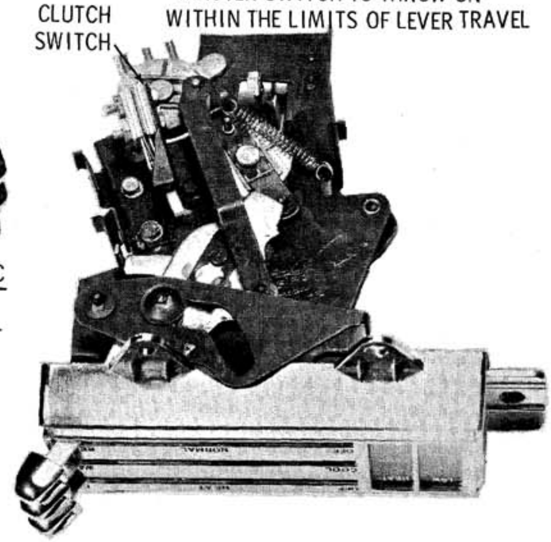


NOTE:
CLUTCH SWITCH SHALL CLOSE AS LEVER IS MOVED FROM "OFF" TO "NORMAL" AND OPEN WHEN LEVER IS MOVED FROM "NORMAL" TO "OFF".

OFF NORMAL RECIRC

←1-3/8 - 1-7/8→

MASTER SWITCH TO THROW ON WITHIN THE LIMITS OF LEVER TRAVEL



#1 VALVE

	OFF-OFF	HEAT	DEF	NORM	RECIRC
1. OUTSIDE AIR	VENT	VAC	VAC	VAC	VENT
2. INPUT	← INPUT →				
3. RECIRC	VENT	VAC	VAC	VAC	VAC

#2 VALVE

1. INPUT
2. STV
3. WATER VALVE

TO OPERATE TEMPERATURE LEVER

1/4" to 1/2" COOL WARM

STV | VAC ← VENT →

WV | VENT ← VAC →

Fig. 14-81B A.C. Control (33 through 38 Series)

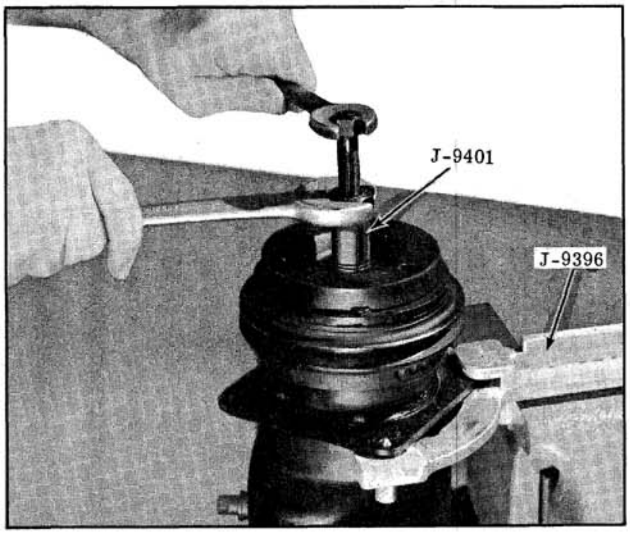


Fig. 14-82 Removing Driven Plate

4. Remove the retaining ring and spacer washer from inside the driven plate.

5. Remove key from either the compressor shaft or the driven plate.

6. Inspect driven plate for cracks or stresses in the resilient drive. Do not replace driven plate for a scoring condition. (Fig. 14-83).

Installation

1. Insert the square drive key into the hub of driven plate; allow it to project approximately 3/16" out of the keyway.

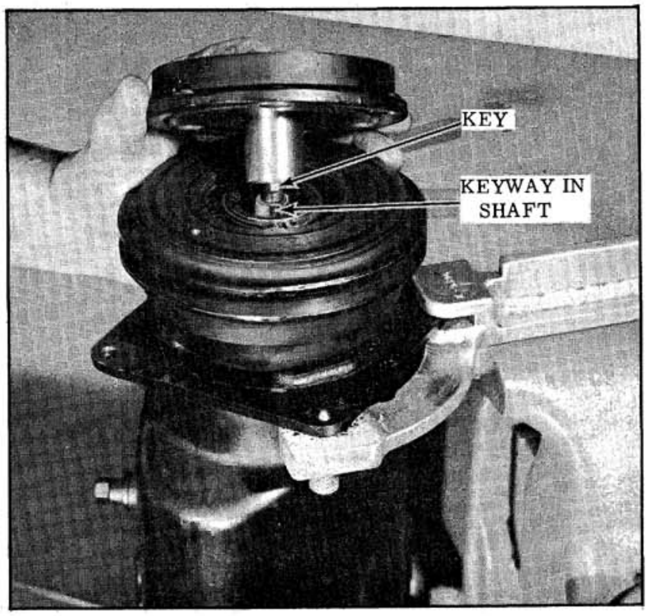


Fig. 14-84 Aligning Driven Plate Key

2. Line up the key in the hub with keyway in the shaft. (Fig. 14-84)

3. Position the Driven Plate Installing Tool J-9480 on the threaded end of the shaft. The "Free" Washer, J-9480-2, should be in place under the hex nut on the tool. This tool has a lefthand thread on the body. (Fig. 14-85).

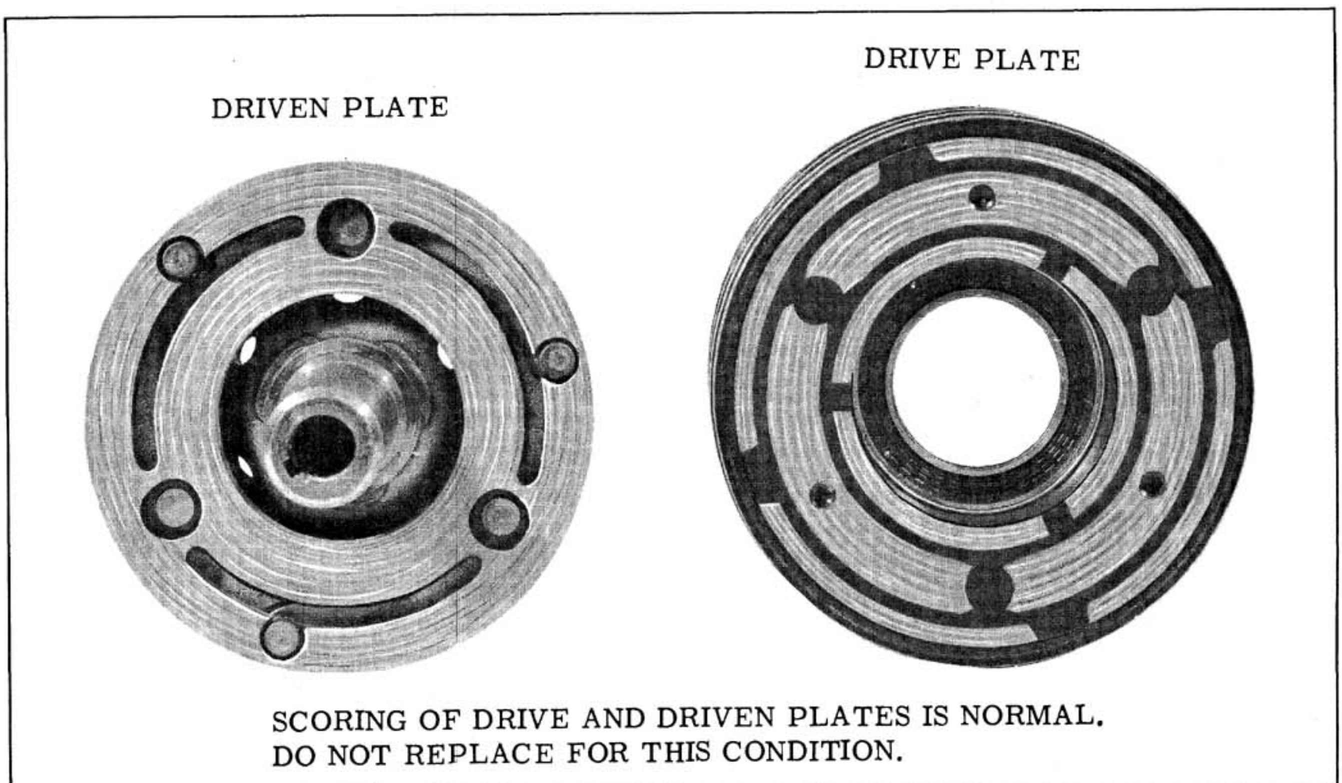


Fig. 14-83 Normal Clutch Plate Wear

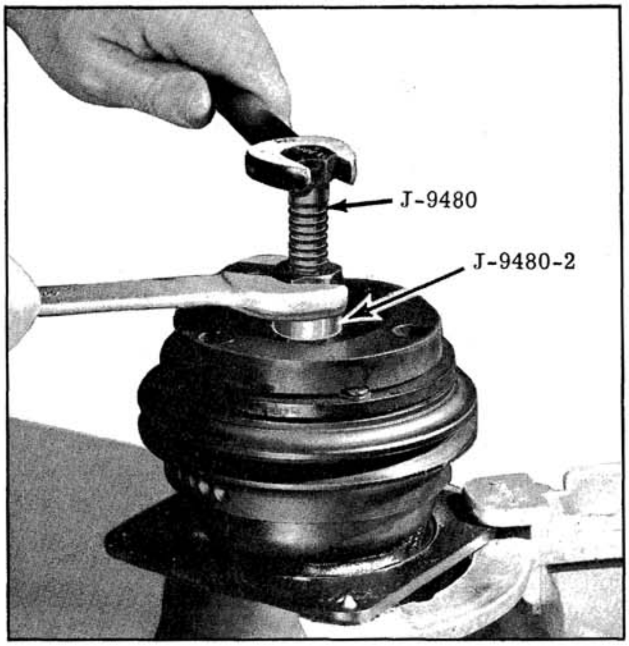


Fig. 14-85 Installing Driven Plate

4. Press the driven plate onto the shaft until there is approximately 3/32" space between the frictional faces of the clutch plates.

5. Remove installing tools.

6. Install hub spacer washer and snap ring.

7. Install the locknut, using a thin wall socket. Tighten 14 to 16 ft. lbs. torque. The air gap between the friction faces should now be between .022" to .057" clearance. (Fig. 14-86)

DRIVE PLATE AND PULLEY ASSEMBLY

Removal

1. With the driven plate removed, remove the pulley retaining ring with Tool J-6435. (Fig. 14-87)

Fig. 14-86 Checking Air Gap

Fig. 14-87 Removing Pulley Retaining Ring

2. Insert Pilot J-9395 over shaft then remove pulley with Puller J-8433. (Fig. 14-88)

3. If necessary to remove the pulley bearing, proceed as follows:

   a. Remove the bearing retaining ring.

   b. Drive out bearing with brass drift.

   c. Install new bearing as shown in Fig. 14-89 then install retaining ring.

Installation

1. Install the pulley and bearing assembly on the end of the compressor, with Tool J-9481. (Fig. 14-90) The pulley should rotate freely.

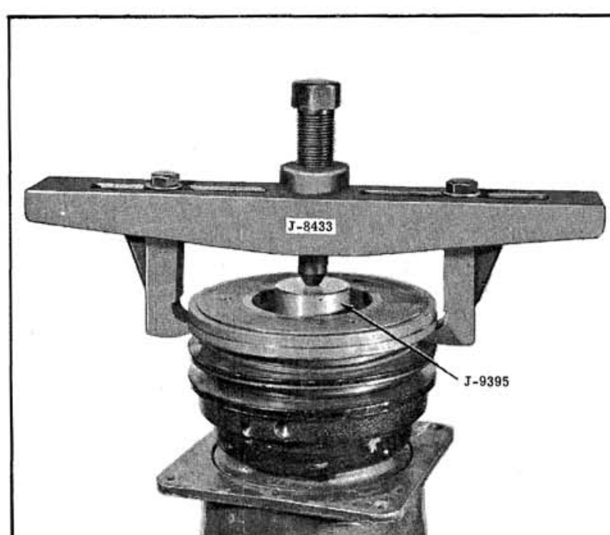


Fig. 14-88 Removing Pulley and Drive Plate

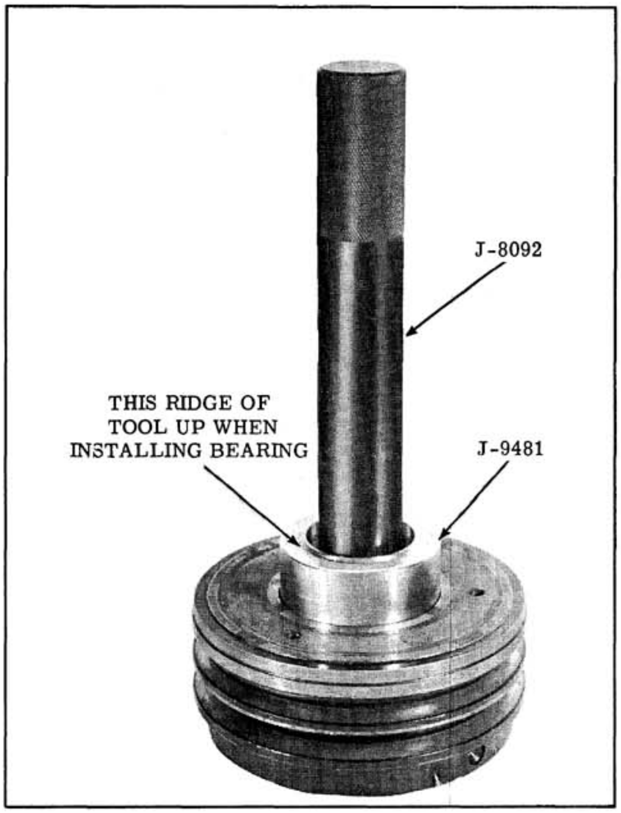


Fig. 14-89 Installing Pulley and Drive Plate Bearing

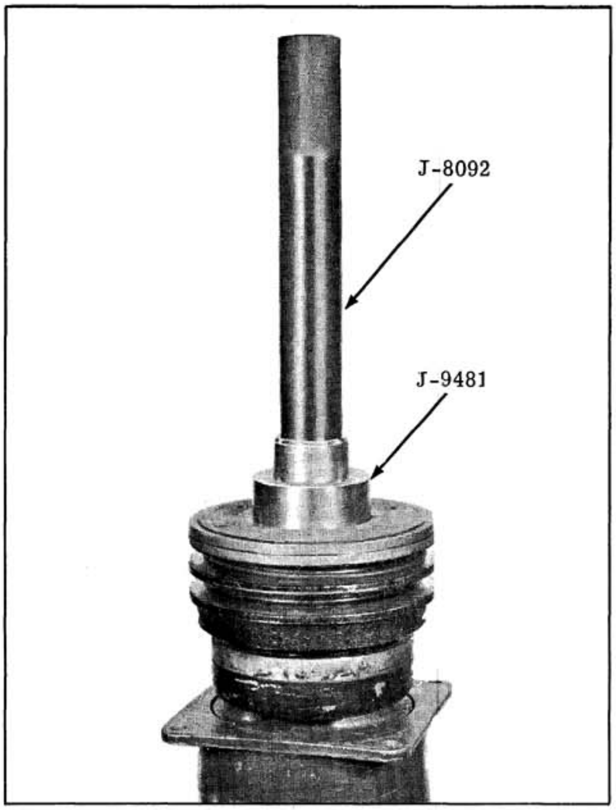


Fig. 14-90 Installing Pulley and Drive on Compressor

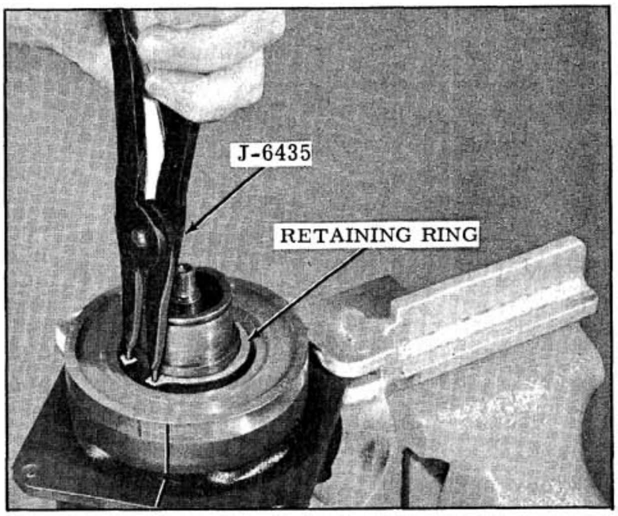


Fig. 14-91 Removing Coil Housing Retaining Ring

2. Install the pulley retaining ring with Tool J-6435.

CLUTCH COIL AND HOUSING

Removal

1. With the driven and drive plates removed, scribe the clutch coil housing and compressor housing.

2. Remove the clutch coil housing retaining ring with Tool J-6435. (Fig. 14-91)

3. Remove coil housing assembly.

Installation

1. With the scribe marks aligned, locate the extrusions on the coil housing with the holes in the front head.

2. Install the coil retainer ring with tool J-6435.

SERVICING OF THE REFRIGERANT SYSTEM

In removing and replacing any part of the refrigerant system, the following operation must be performed.

1. Discharge the system by releasing the refrigerant to atmosphere.

2. Remove and replace the defective part.

3. Evacuate the system of air and moisture.

4. Charge the system with refrigerant 12.

5. Leak test connections which were disconnected.

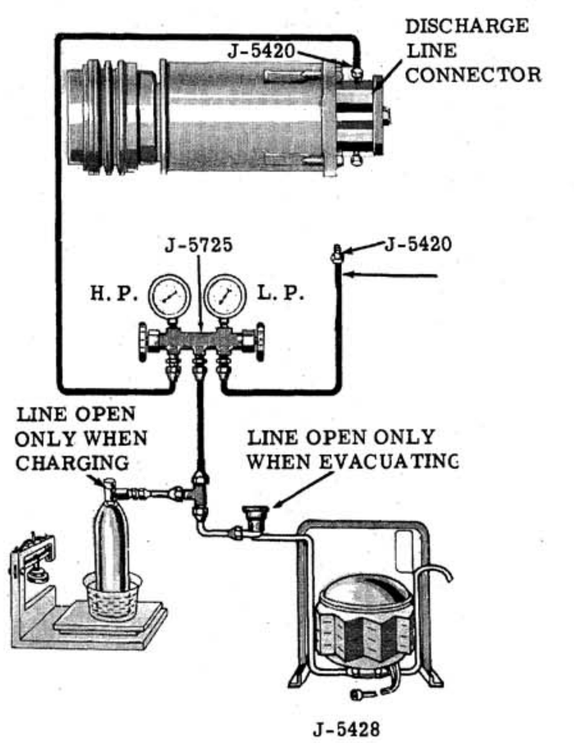


Fig. 14-92 Evacuating The System

DISCHARGING THE SYSTEM

1. With the engine stopped, remove protective caps from compressor discharge and suction Schrader valves.

2. Connect Gauge Set J-5725 with Schrader Valve Adapters J-5420 to the Schrader valve fitting at the compressor and suction throttling valve.

   CAUTION: When connecting the gauge set to the Schrader valve adapters, use a cloth as a guard to divert escaping refrigerant.

3. Crack open both high and low pressure gauge valves and allow refrigerant to escape through the center outlet of the gauge set.

   NOTE: Do not open valves beyond the cracking point, or compressor oil may be discharged with the refrigerant.

After the complete system has been discharged of refrigerant, any part of the refrigeration system can be serviced.

EVACUATING THE SYSTEM

NOTE: In the following procedure, the specification of 28 inches of vacuum is used. This figure is based on performing the operation at an elevation at or near sea level. For every 1000 ft. of elevation above sea level, the specification should be lowered one inch.

1. Connect the Gauge Set J-5725, vacuum pump and refrigerant charging drum as shown in Fig. 14-92. Use J-5420 Schrader Valve adapters to connect gauge lines to the Schrader valve fittings at the compressor and suction throttling valve.

2. Open gauge set high and low pressure valves and start vacuum pump. Pull a vacuum of 28". Close gauge set valves and vacuum pump valve. Shut off vacuum pump. If loss of vacuum exceeds 2" in five minutes, the system leaks. Check all system connections for proper tightness.

3. If system does leak, crack open refrigerant drum valve and the low pressure gauge valve and allow system to charge to drum pressure. Close drum valve. Using a refrigerant leak test torch, check system for leaks. Correct leaks and repeat procedure until leaks are eliminated.

4. When system no longer leaks, proceed to evacuate system:

   a. Discharge refrigerant from system then open both gauge set valves and start vacuum pump, then open vacuum pump valve.

      NOTE: DO NOT discharge refrigerant through vacuum pump.

   b. Allow pump to run for 15 minutes at a vacuum of 28". Close the high pressure gauge valve and vacuum pump valve, then stop vacuum pump. The system is now ready for charging.

CHARGING THE SYSTEM

REFRIGERANT DRUM METHOD

After the system is evacuated, leave the gauge set and refrigerant drum connected for the charging process. Also make sure the high pressure gauge valve is closed, the low pressure gauge valve is open, and the refrigerant drum valve is closed; then proceed as follows:

1. Place an auxiliary fan in front of condenser.

2. Place drum on scales and weigh accurately.

   NOTE: It may be necessary to place refrigerant drum in a pail of warm water to facilitate the charging process. Do not use water at a temperature in excess of 125°F. Weigh pail and water with refrigerant drum.

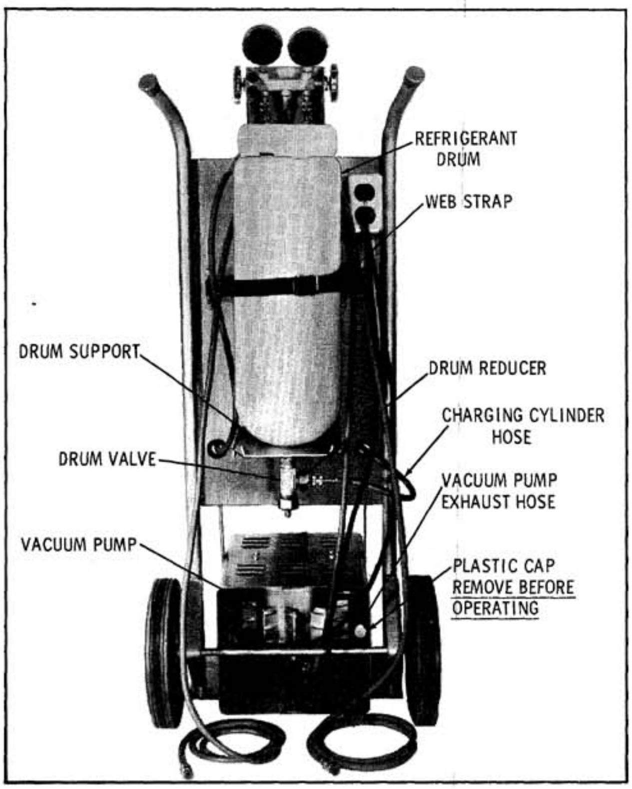


Fig. 14-92A Charging Station

3. Open refrigerant drum valve and allow system to charge to drum pressure.

4. With transmission in "neutral" ("park" if car has Automatic) and the parking brake

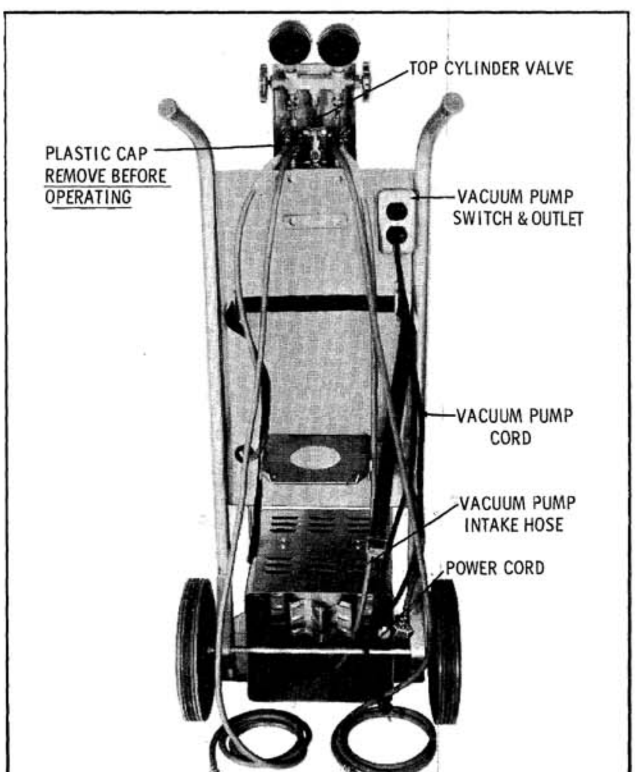


Fig. 14-92B Charging Station

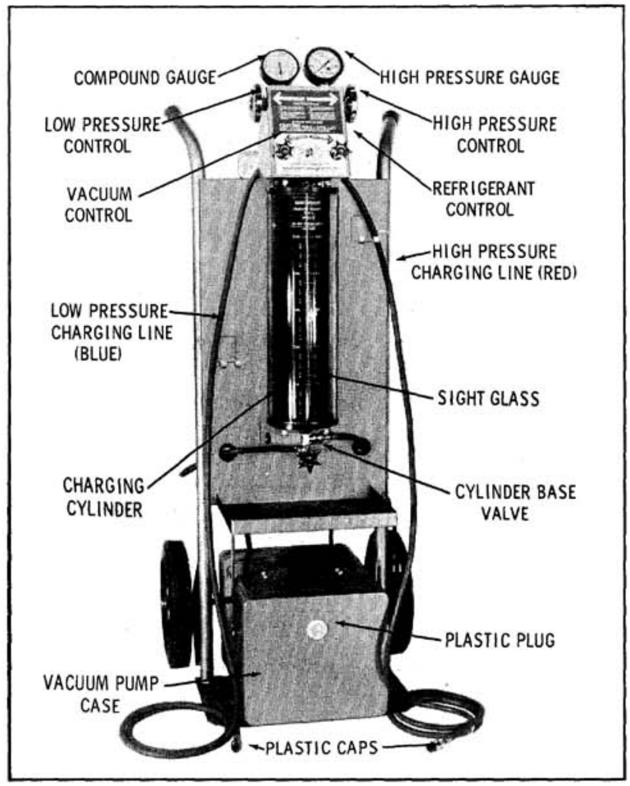


Fig. 14-92C Charging Station

applied, start engine and set speed at 2000 rpm.

5. Position A/C control on NORMAL, slide the temperature control fully to the left and turn blower speed switch to the high position.

6. Close low pressure valve in gauge set at frequent intervals to be certain pressure in low side of system is always maintained above 5 psi.

7. When 3-3/4 lbs. (33 through 38 Series) or 4 lbs. (52 through 86 Series) of refrigerant has entered the system, close the refrigerant drum valve and the low pressure gauge valve.

8. Remove the gauge set, install the protective caps on the Schrader valve and gauge fittings.

   CAUTION: When disconnecting Schrader valve adapters from system use a cloth as a guard to divert escaping refrigerant.

9. After the system is charged, a performance check should be made. Observe particularly for excessive head pressures.

CHARGING STATION METHOD (Figs. 14-92A, B and C)

Installing J-8393

1. Be certain all valves on charging station are closed.

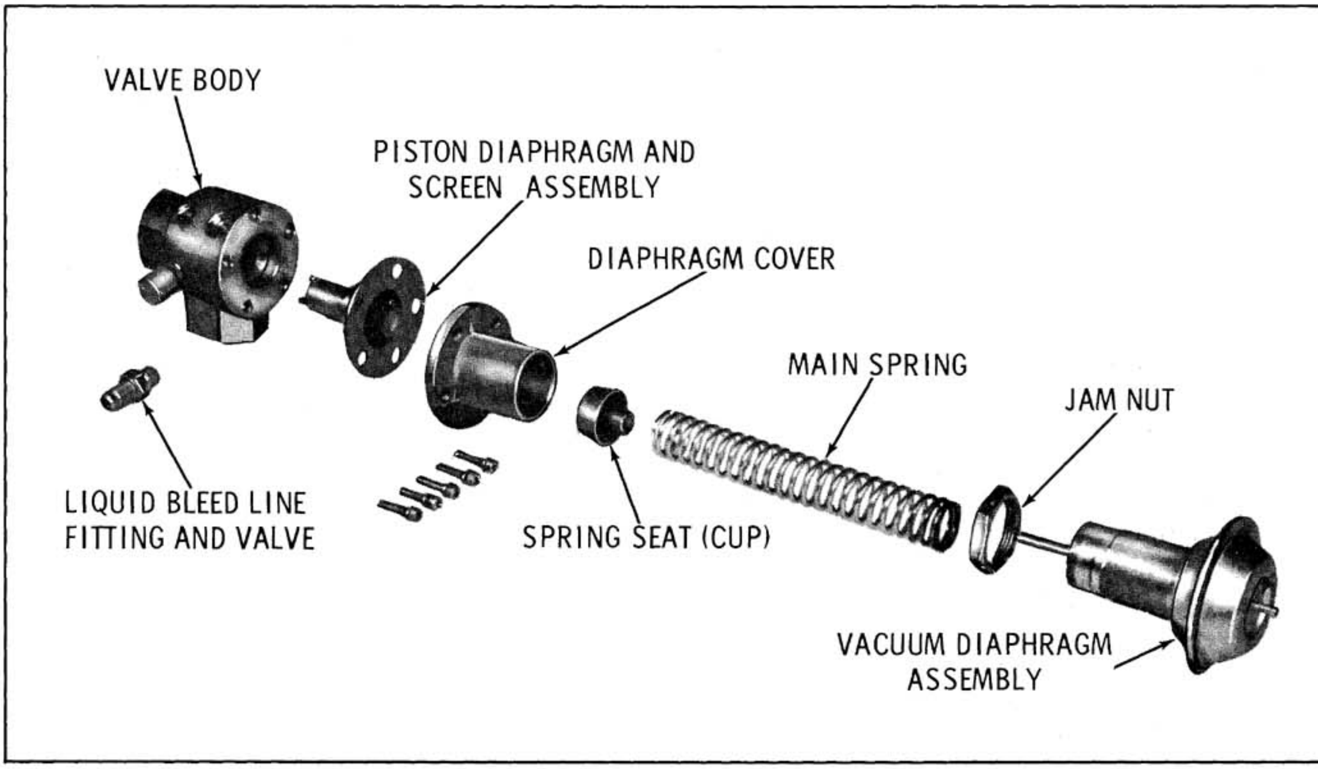


Fig. 14-93 Suction Throttling Valve

2. Connect high pressure gauge line (with Adapters J-5420 attached) to the compressor discharge Schrader valve fitting.

3. Turn high pressure control (2) one turn counterclockwise (open). Crack open low pressure control (1) and allow refrigerant gas to hiss from low pressure gauge line for three seconds, then connect low pressure gauge line (with Adapters J-5420) to low pressure gauge fitting on suction throttling valve.

Filling Charging Cylinder

1. Open control valve on refrigerant container.

2. Open valve on bottom of charging cylinder, allowing refrigerant to enter cylinder.

3. Bleed charging cylinder top valve (behind control panel) only as required to allow refrigerant to enter cylinder. When refrigerant reaches desired charge level (3-3/4 lbs. for 33 through 38 Series or 4 lbs. for 52 through 86 Series), close valve at bottom of charging cylinder and be certain cylinder bleed valve is closed securely.

NOTE: While filling the cylinder, it will be necessary to close the bleed valve periodically to allow boiling to subside so that refrigerant level in the charging cylinder can be accurately read.

Charging the System Using J-8393

1. With charging station installed as previously described, remove low pressure gauge line at the suction throttling valve.

2. Crack open high (No. 2) and low (No. 1) pressure control valves on station and allow refrigerant to purge from system. Purge slow enough so that oil does not escape from system along with refrigerant.

3. When refrigerant flow nearly stops, connect low pressure gauge line to suction throttling valve.

4. Turn on vacuum pump and open vacuum control valve (No. 3).

5. With system purged as above, run pump until 26 to 28 inches of vacuum is obtained. Continue to run pump for 15 minutes after the system reaches 26 to 28 inches vacuum.

NOTE: In all evacuating procedures, the specification of 26 to 28 inches of mercury vacuum is used. These figures are only attainable at or near sea level. For each 1000 feet above sea level where this operation is being performed, the specifications should be lowered by one inch.

6. If 26 to 28 inches vacuum (corrected to sea level) cannot be obtained, close vacuum control valve (No. 3) and shut off vacuum pump.

Open refrigerant control valve (No. 4) and allow some refrigerant to enter system. Locate and repair all leaks.

7. After evacuating for 15 minutes, add 1/2 pound of refrigerant to system as described in Step 6 above. Purge this 1/2 pound and re-evacuate for 15 minutes. This second evacuation is to make sure that as much contamination is removed from the system as possible.

8. Only after evacuating as above, the system is ready for charging. Note reading on sight glass of charging cylinder. If it does not contain a sufficient amount for a full charge, fill to the proper level.

9. Close low pressure valve on charging station. Fully open station refrigerant control valve (No. 4) and allow all liquid refrigerant to enter the system. When full charge of refrigerant has entered system (3-3/4 lbs. for 33 through 38 Series and 4 lbs. for 52 through 86 Series), turn off refrigerant control valve (No. 4).

10. If full charge of refrigerant will not enter system, close high pressure control and refrigerant control valves. Start engine and run at slow idle with compressor operating. Crack refrigerant control valve (No. 4) and low pressure control on station. Watch low side gauge and keep gauge below 50 psi by regulating refrigerant control valve. Closing valve will lower pressure. This is to prevent liquid refrigerant from reaching the compressor while the compressor is operating. When required charge has entered system, close refrigerant control valve and close low pressure control.

11. System is now charged and should be performance tested before removing gauges.

SUCTION THROTTLING VALVE (Fig. 14-93)

Disassembly

1. Discharge refrigerant system.

2. Remove the valve assembly from the car. Mark relative position of diaphragm cover, locknut and diaphragm.

3. Loosen vacuum diaphragm locknut, then remove vacuum diaphragm from valve assembly.

   NOTE: Diaphragm assembly is under spring tension. Apply pressure to diaphragm when removing.

4. Remove main spring.

5. Remove diaphragm cover attaching screws, then remove cover, retainer cup, diaphragm and piston.

6. Remove the capped Schrader valve fitting, and the oil return line Schrader Valve.

   NOTE: Do not interchange Schrader cores as the oil bleed line Schrader core has a special calibration.

7. Thoroughly clean valve body and piston with cleaning solvent and blow out all passages and screen with compressed air.

Assembly

1. Insert piston and diaphragm into valve body.

2. Position retainer cup into diaphragm, open end out, then install the diaphragm cover and retain loosely with the attaching screws.

3. Move piston back and forth several times to properly seat diaphragm, then tighten the attaching screws.

4. Position washer and spring into the vacuum diaphragm cavity.

5. Insert the vacuum diaphragm and spring into the diaphragm cover. Apply pressure to vacuum diaphragm and thread vacuum diaphragm into diaphragm cover.

6. Install the Schrader core(s) into the fitting(s).

   NOTE: To determine the correct position of the Schrader cores, depress the Schrader valves. The valve with the least spring resistance must be installed in the oil return line fitting.

7. Install the valve, then evacuate and charge the system.

8. Adjust suction throttling valve as outlined under SUCTION THROTTLING VALVE ADJUSTMENT.

SUCTION THROTTLING VALVE ADJUSTMENT

The suction throttling valve is adjusted to regulate evaporator pressure so that it will not fall below 29 to 30 psi. If it controls below 29 psi, the evaporator will "ice-up" and refrigeration capacity will be reduced. If the valve controls higher than this pressure, an undesirable loss of refrigeration will occur which will be especially noticeable in extremely hot weather. This is because for each pound in pressure higher than 30 psi, the discharge air temperature will be raised one degree. The controlling pressure of the valve can be checked and adjusted as follows:

1. Remove Schrader valve fitting cap at the suction throttling valve.

2. Install Adapter J-5420 on the low pressure gauge hose, and connect the adapter to the Schrader valve fitting on the suction throttling valve.

3. Purge the gauge and hose by opening the low pressure gauge valve for a few seconds.

4. Start engine and run at fast idle. Move temperature control lever to the extreme left position, turn blower speed on HIGH and set air conditioning control on RECIRC.

   NOTE: When adjusting the suction throttle valve after the system has been discharged, the temperature control lever must be moved back and forth 10 to 15 times to normalize the suction throttling valve diaphragm.

5. Allow system to operate a few minutes, then observe evaporator pressure on gauge. Continue to increase engine rpm until evaporator pressure no longer changes. If the stabilized evaporator pressure is not 29 to 30 psi, adjust valve as follows:

   a. Set temperature lever in full cold position, check for vacuum at suction throttling valve and see that hose is connected.

   b. Loosen locknut on diaphragm and rotate diaphragm clockwise to raise evaporator pressure or counterclockwise to lower evaporator pressure. Adjust so pressure is 29 to 30 psi.

   c. After pressure has been adjusted to specifications, tighten locknut.

6. Shut off engine and remove gauge assembly.

7. Install Schrader valve fitting cap.

SIGHT GLASS

Removal

1. Discharge the system as outlined under DISCHARGE THE SYSTEM.

2. Remove the sight glass retaining screw.

3. Lift out the sight glass with caulking compound.

4. Remove the "O" ring with a wire hook.

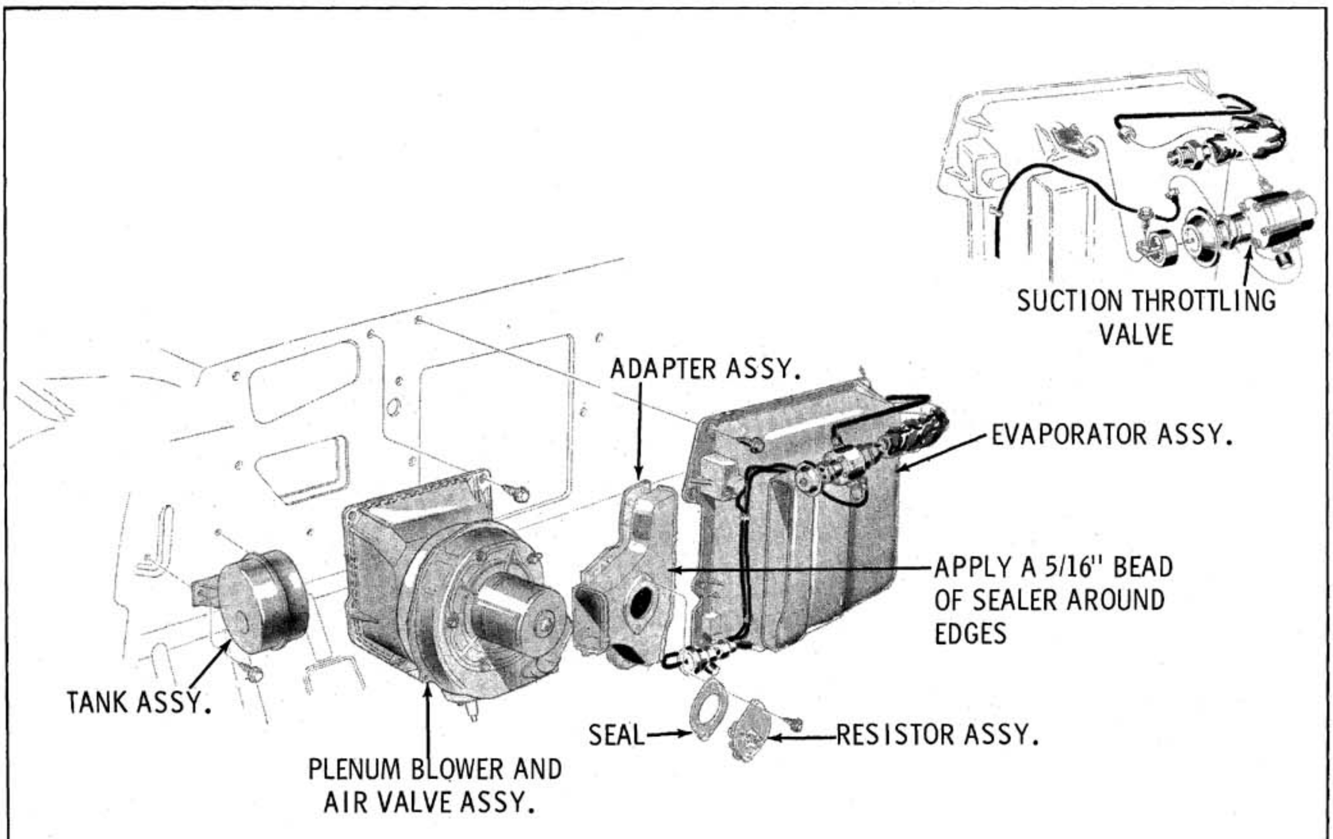


Fig. 14-94 Blower Motor and Evaporator (52 through 86 Series)

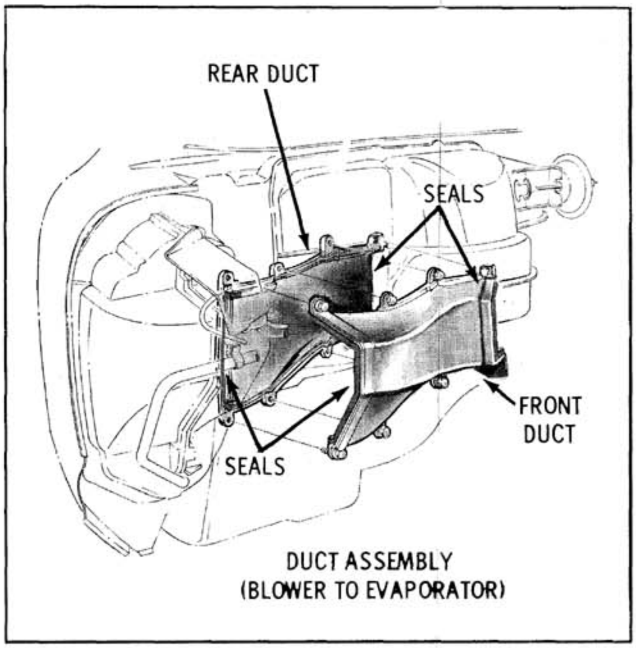


Fig. 14-95 Duct Assembly (Blower to Evaporator) 33 through 38 Series

CAUTION: When performing this operation, the system should not be left open longer than absolutely necessary as the dehydrator will absorb an excess of moisture. Refer to SERVICING OF THE REFRIGERANT SYSTEM.

To install, reverse the removal procedure and evacuate and charge the system.

EVAPORATOR ASSEMBLY

Removal (Figs. 14-94, 14-95 and 14-96)

1. Disconnect the battery.
2. Discharge the system as outlined under DISCHARGING THE SYSTEM.
3. For 33 through 38 Series, disconnect all parts that attach to the right-hand filler plate and remove the filler plate.
4. For 52 through 86 series, remove blower and housing assembly.

   NOTE: It is not necessary to remove the resistor from the duct or disconnect the wiring.

5. Disconnect refrigerant lines from suction throttling valve and expansion valve.

   NOTE: Cap fittings to prevent entrance of dirt and moisture.

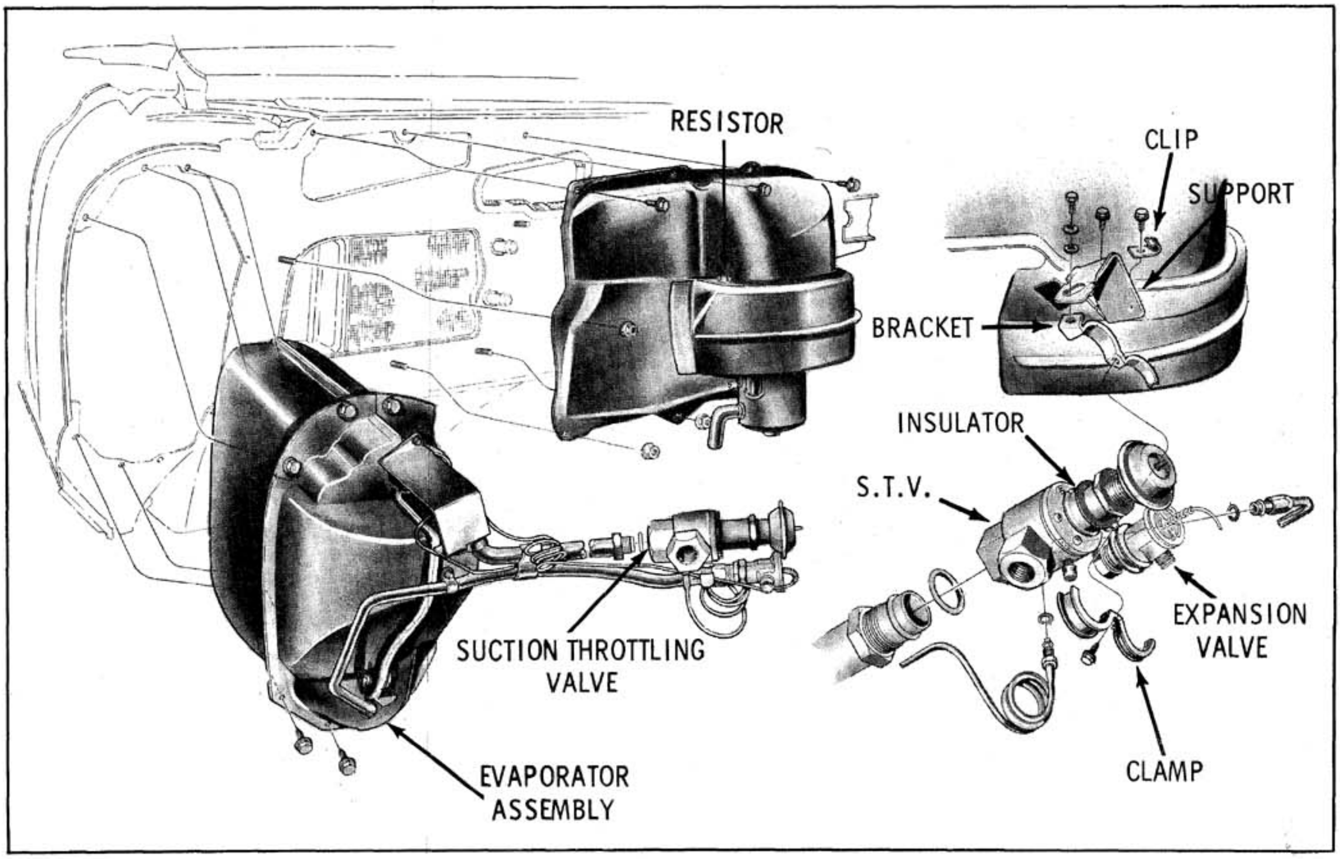


Fig. 14-96 Blower Motor and Evaporator (33 through 38 Series)

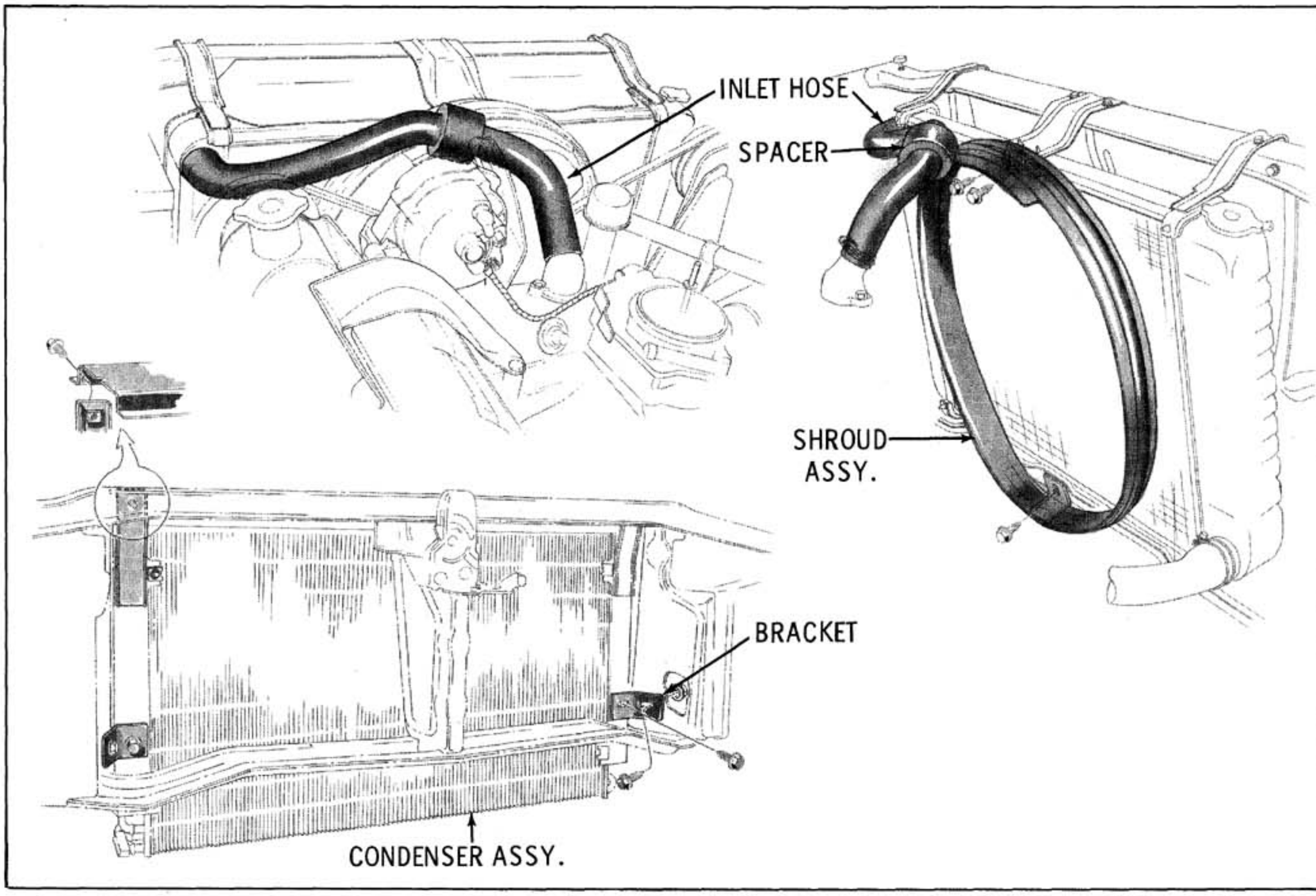


Fig. 14-97 Condenser and Shroud Installation (52 through 86 Series)

6. For 33 through 38 Series, remove screws securing evaporator to blower ducts and remove ducts; then remove the evaporator assembly attaching screws and remove the evaporator.

7. For 52 through 86 Series, fold back front floor carpet and remove the three heater assembly attaching screws. From the engine compartment, remove the evaporator attaching screws and remove the evaporator.

Disassembly

1. Remove mounting gasket and grommets around the outlets.

2. On bench, remove expansion valve.

   NOTE: Capillary bulb is retained by two clamps which are accessible after peeling back the insulating material.

3. Remove clamps securing expansion valve and evaporator pipe.

4. Disconnect all lines and remove suction throttling valve.

   NOTE: Tape or cap all valve openings to prevent entrance of dirt and moisture.

5. Remove screws securing evaporator core to case. (Fig. 14-74)

Installation

1. With gasket cemented to evaporator, position evaporator assembly to the dash and install retaining screws.

2. For 52 through 86 Series, install duct and blower assembly.

3. For 33 through 38 Series, install front and rear ducts.

4. Remove caps from lines, oil the fitting with Frigidaire 525 viscosity oil, then connect the lines.

5. For 33 through 38 Series, install the fender filler plate and all attaching parts.

6. Evacuate the system as outlined under EVACUATING THE SYSTEM.

7. Charge the system as outlined under CHARGING THE SYSTEM.

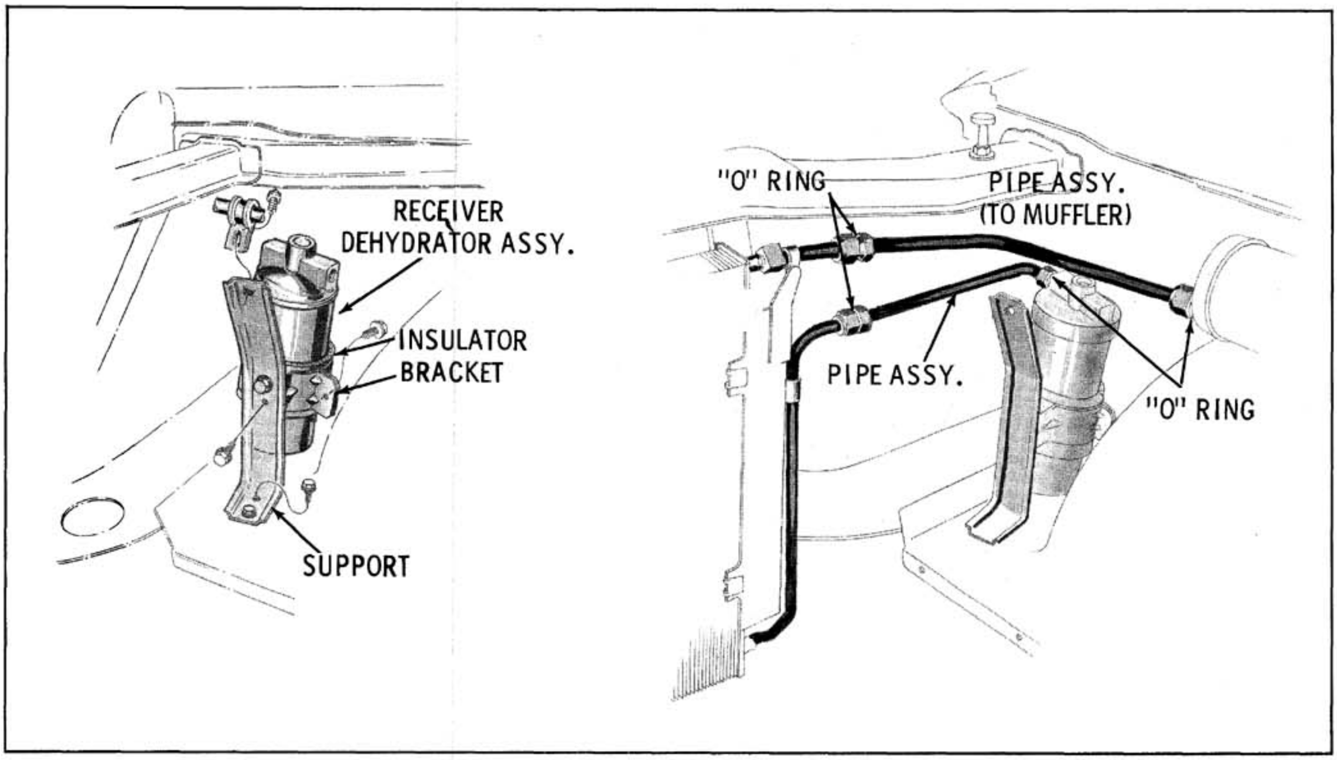


Fig. 14-98 Receiver Dehydrator (52 through 86 Series)

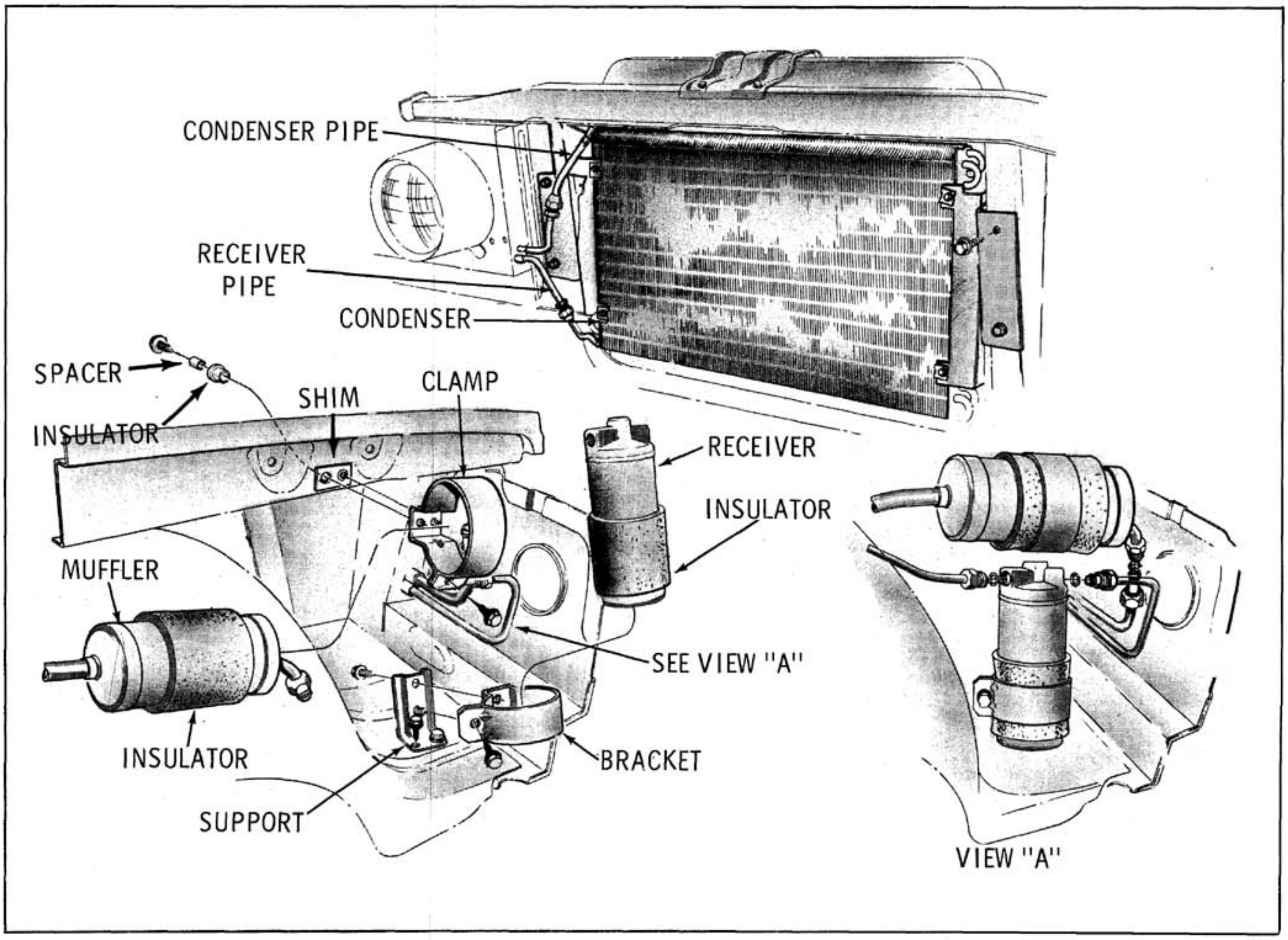


Fig. 14-99 Condenser and Receiver (33 through 38 Series)

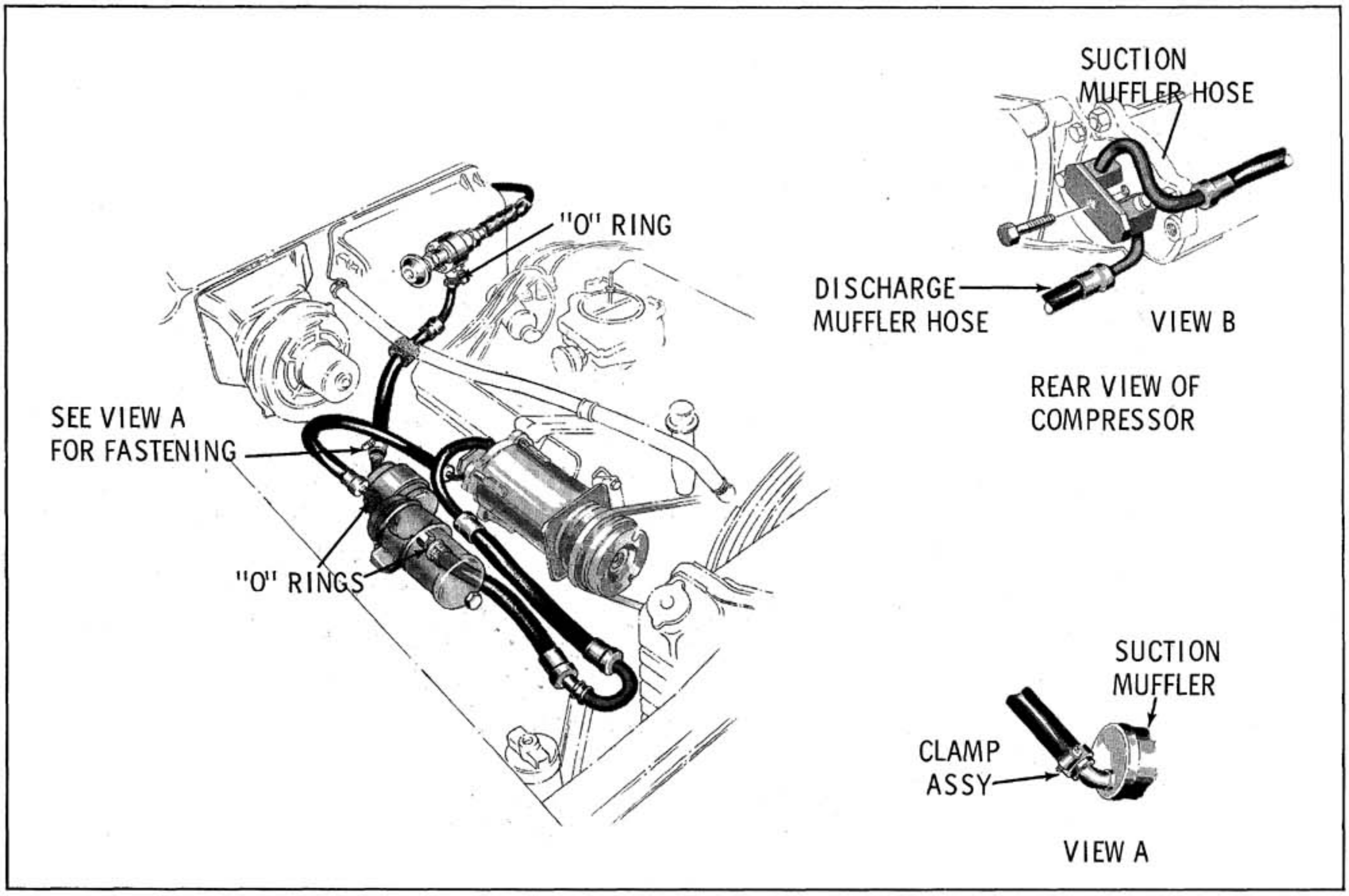


Fig. 14-100 Refrigerant Lines (52 through 86 Series)

8. Leak test all line fittings that were disconnected. Refer to LEAK DETECTOR.

   NOTE: It is important that the expansion valve capillary bulb be tightly clamped to the suction line at the evaporator. Both the suction line and the capillary tube should be clean at the points of contact.

   CAUTION: Do not kink capillary tubes when removing or installing.

CONDENSER AND RECEIVER

The condenser and receiver are mounted in front of the radiator. After discharging the system, the condenser or receiver can be removed as illustrated in Fig. 14-97, 14-98 and 14-99.

REFRIGERANT LINES

The refrigerant lines and mufflers are attached as shown in Figs. 14-100, 14-101, 14-102 and 14-103.

When installing lines, always use new "O" rings. Torque lines as outlined under PRECAUTION IN HANDLING LINES.

COMPRESSOR (Figs. 14-104, 14-105 and 14-106)

Removal

1. Discharge the refrigerant system.
2. Disconnect compressor clutch wire at compressor connector.
3. Remove belt from compressor pulley.
4. Remove the bolt holding the fittings connector to the compressor, then remove the assembly from the compressor. Tape lines and fittings to prevent entry of dirt and moisture.
5. Remove the compressor to bracket bolts, then remove the compressor assembly.

Installation

1. Position the compressor on the mounting bracket, then install and tighten the compressor to bracket bolts.
2. Connect compressor clutch wire.
3. Install two new "O" rings on the valve port openings and position the fittings connector

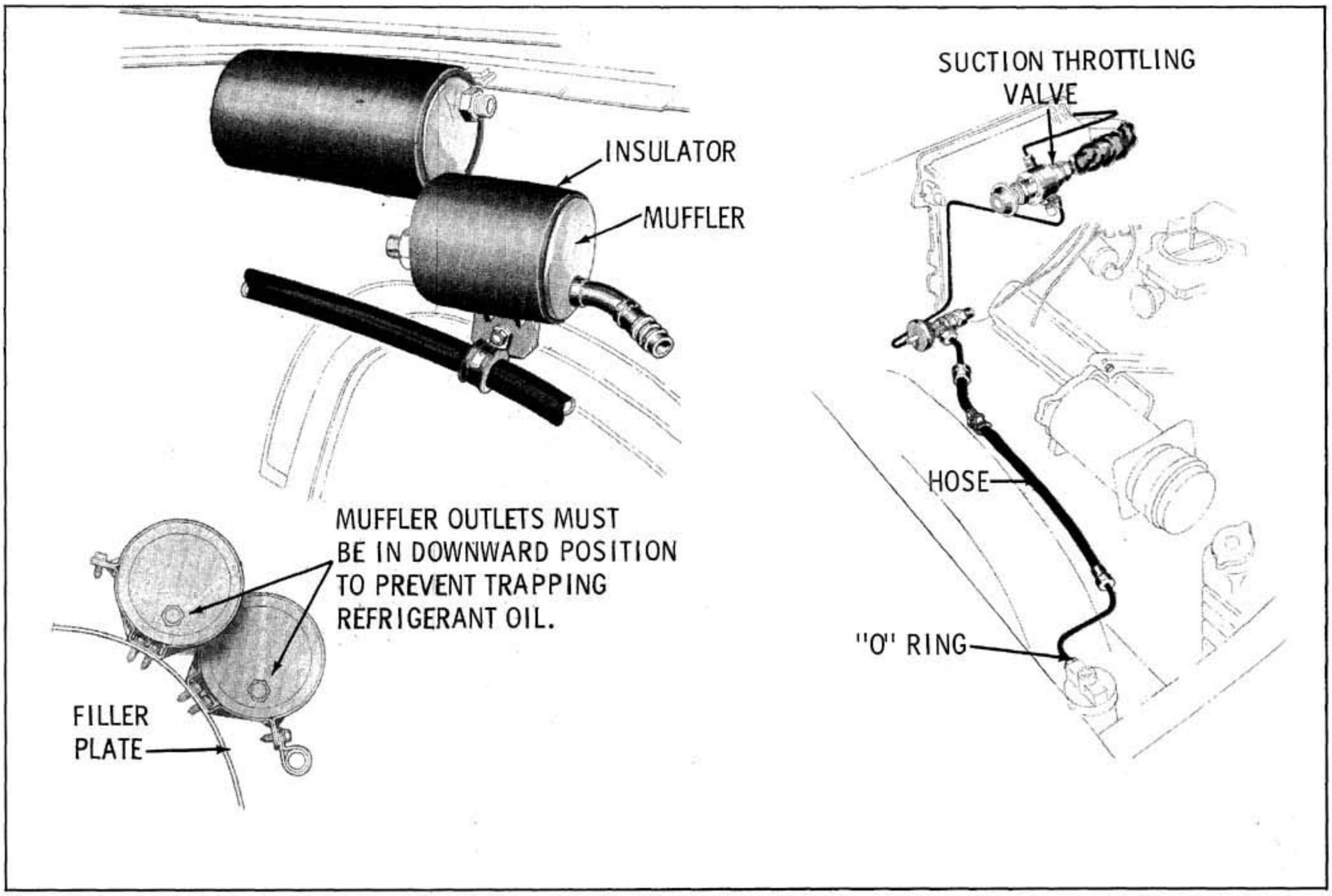


Fig. 14-101 Muffler Attachment (52 through 86 Series)

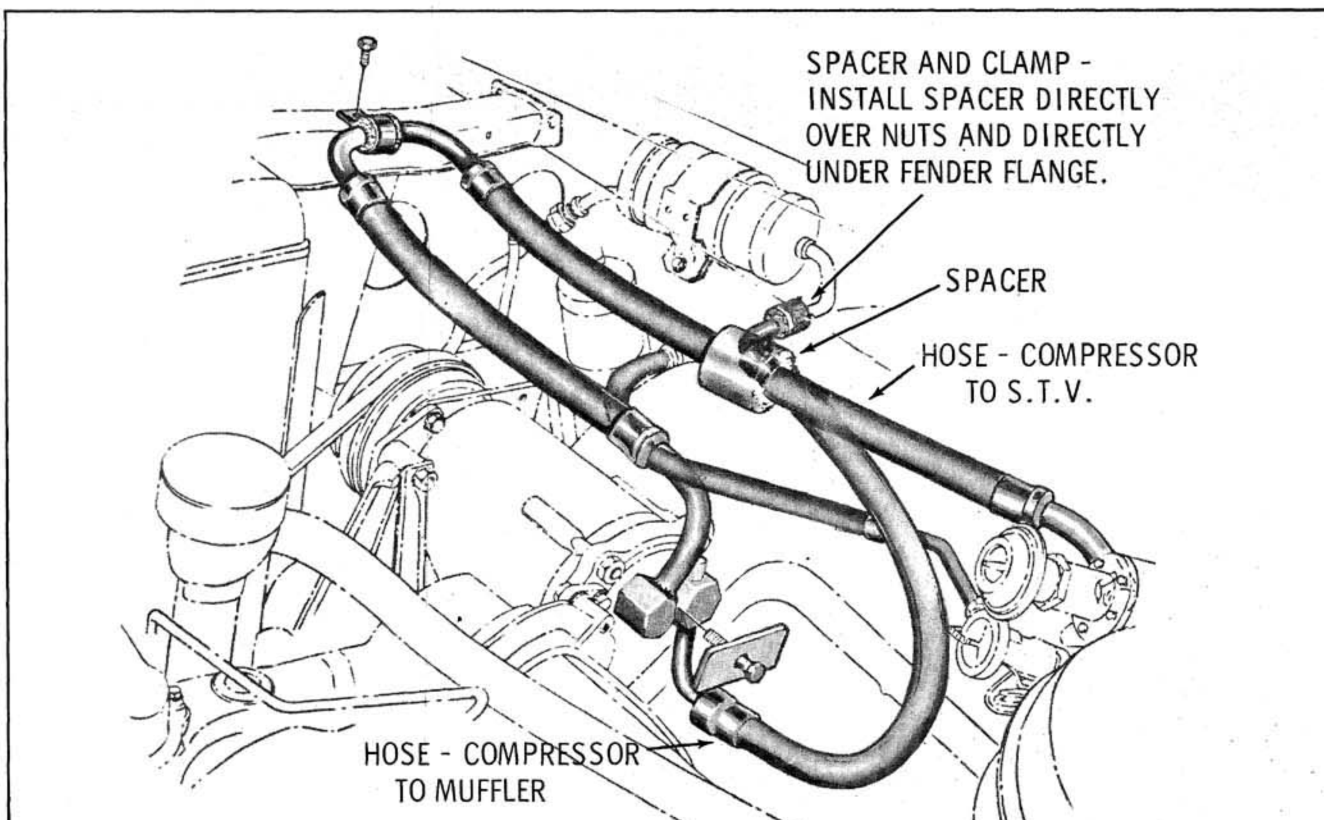


Fig. 14-102 Refrigerant Lines V-8 (33 through 38 Series)

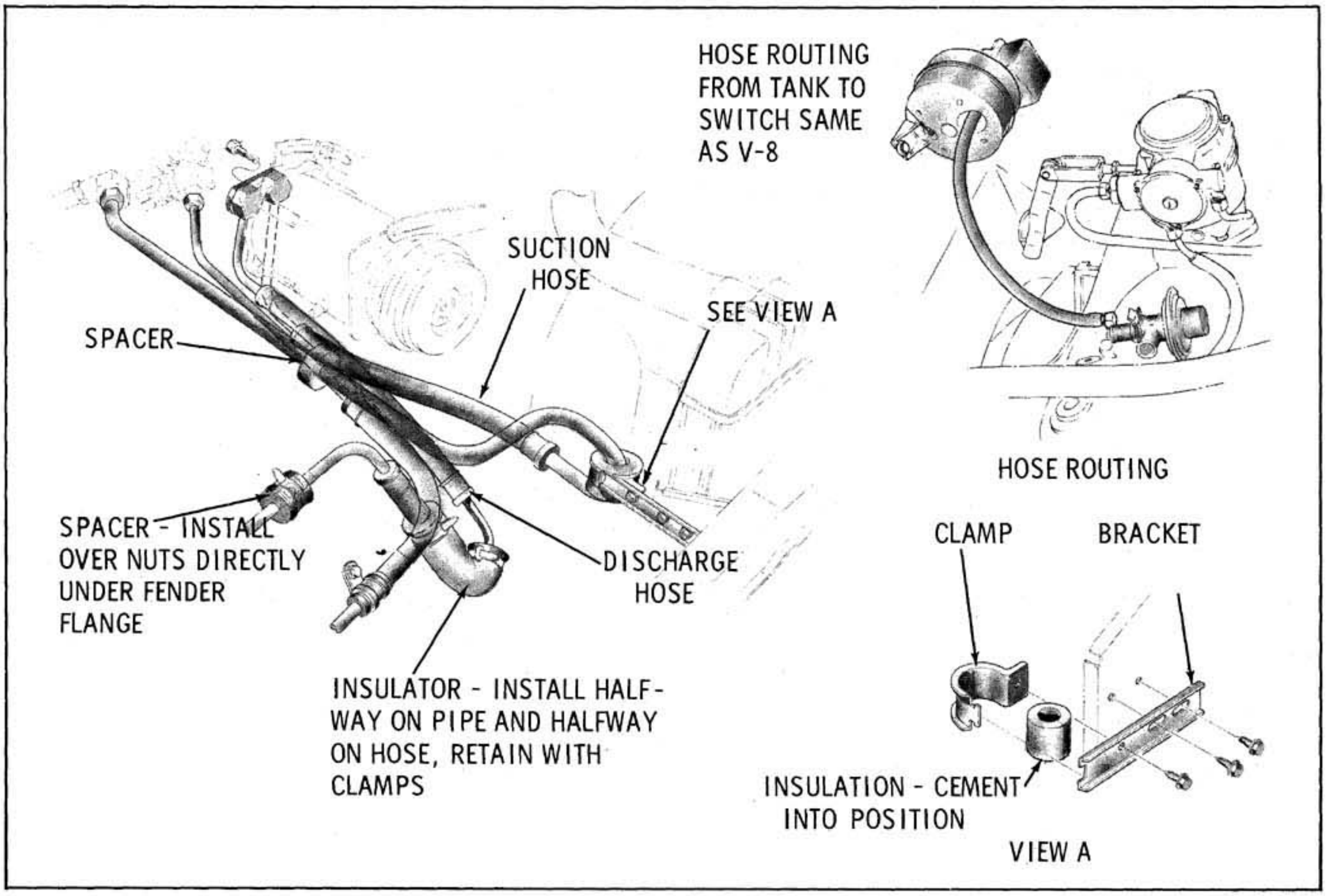


Fig. 14-103 Refrigerant Lines V-6 (33 and 35 Series)

on the compressor. Install the mounting bolt and tighten to 20-25 ft. lbs. torque.

4. Install belt and adjust tension using Tool 33-70M.

5. If compressor was removed for some internal malfunction and foreign material has circulated throughout the system, proceed as follows:

   a. Install a charging line to the compressor discharge Schrader valve and to a drum of refrigerant 12.

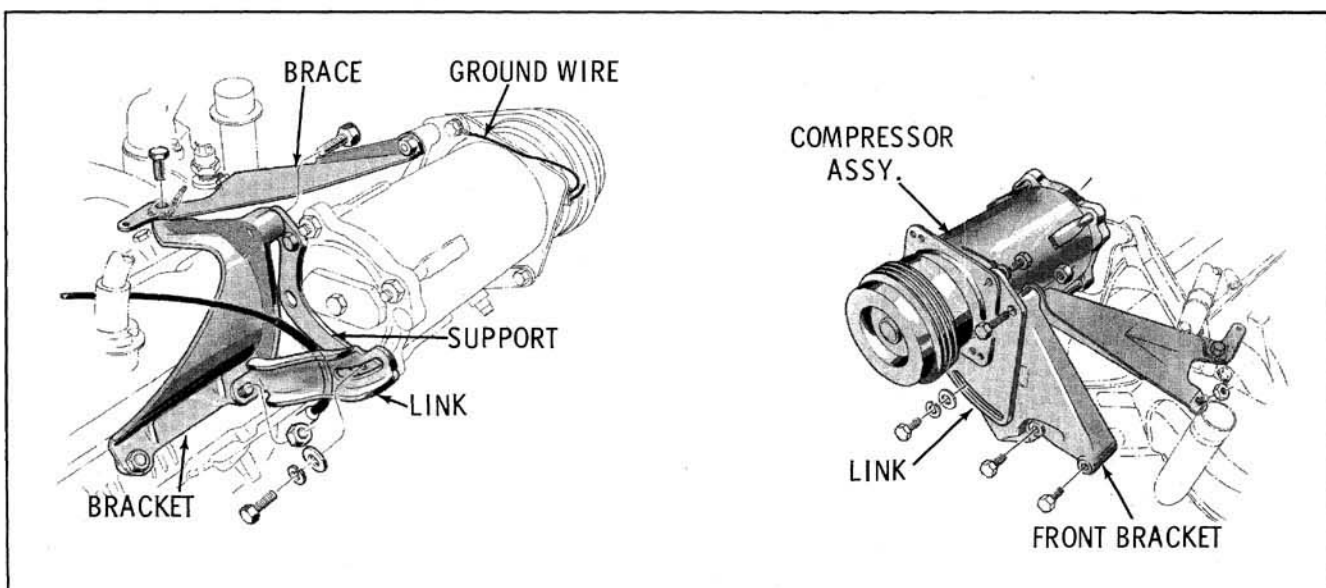


Fig. 14-104 Compressor Mounting (52 through 86 Series)

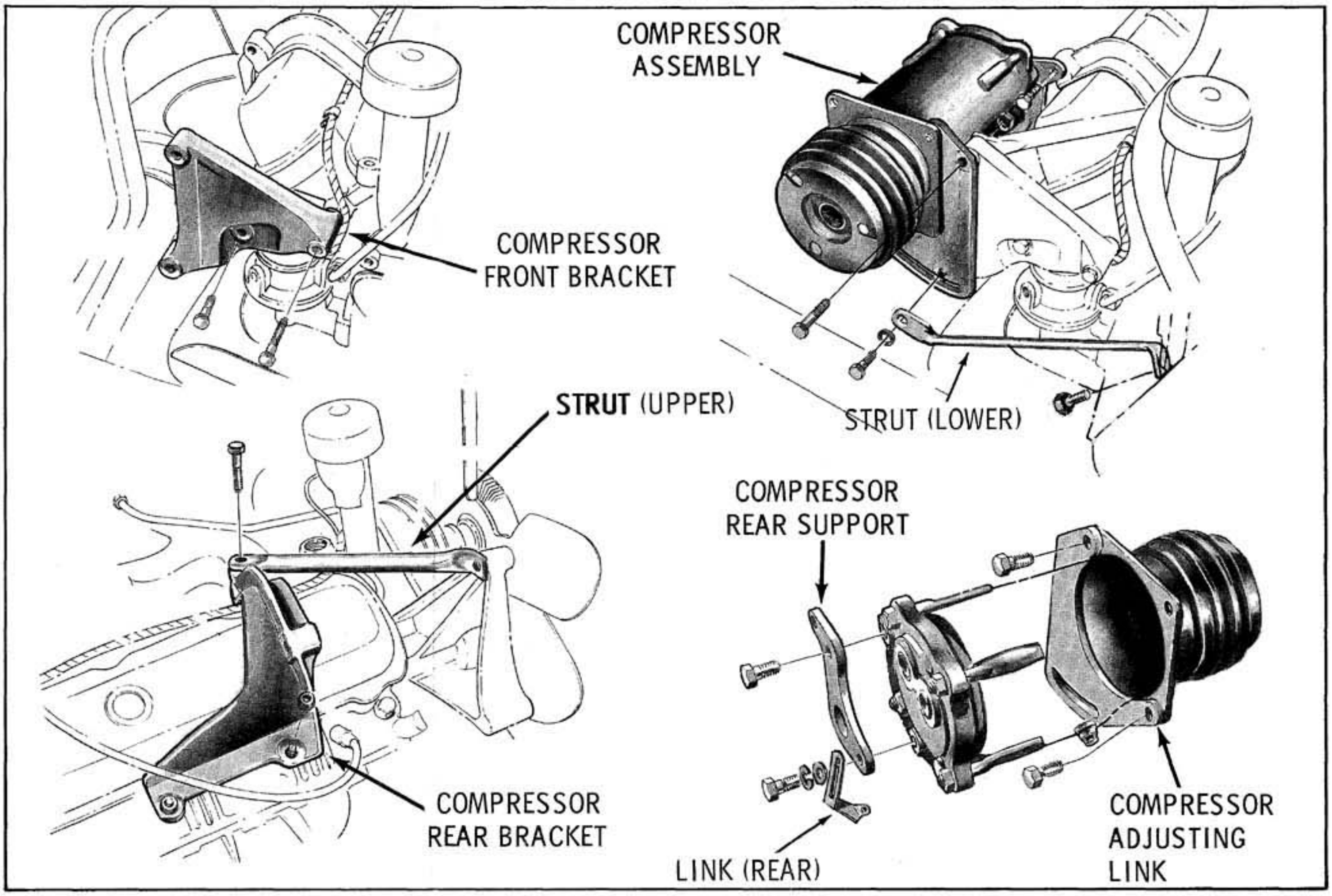


Fig. 14-105 Compressor Mounting V-8 (34, 36 and 38 Series)

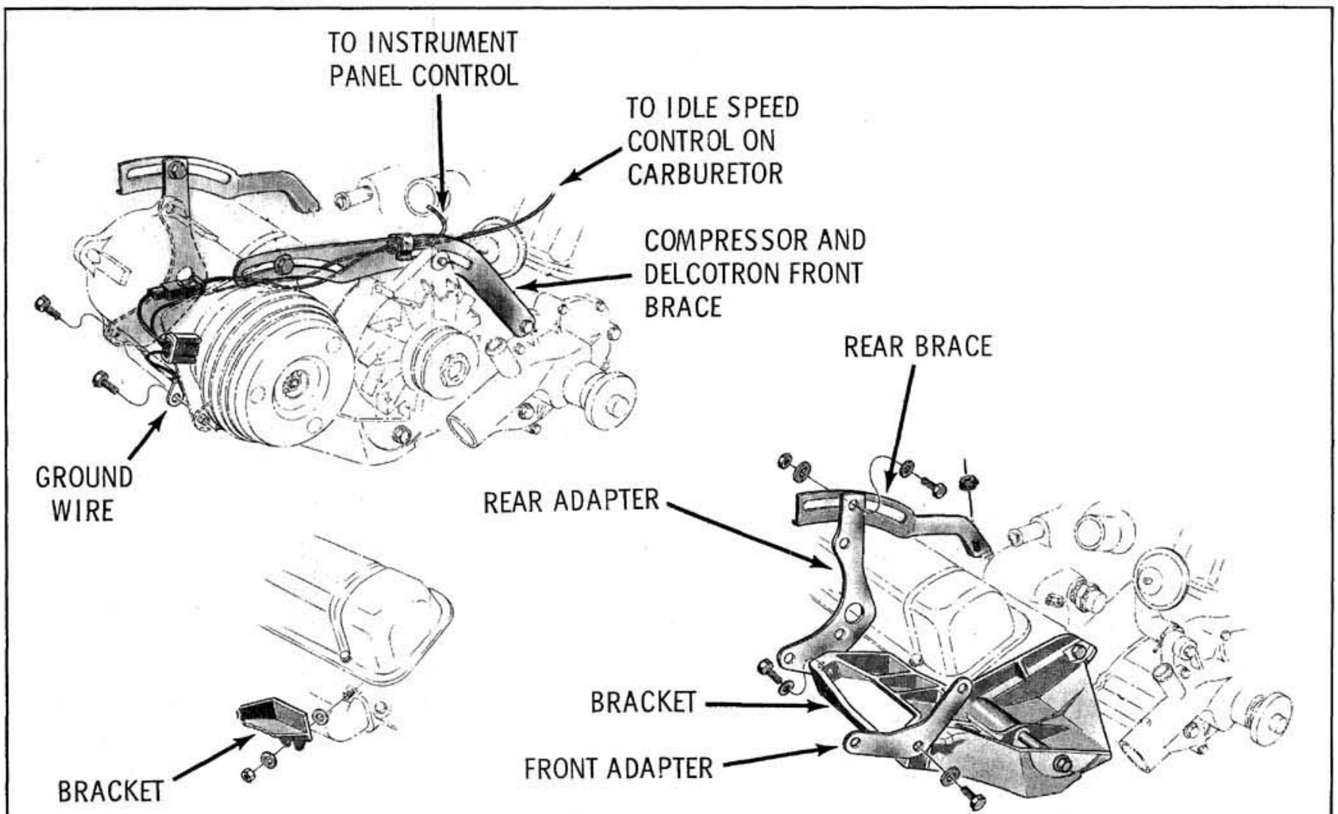


Fig. 14-106 Compressor Mounting V-6 (33 and 35 Series)

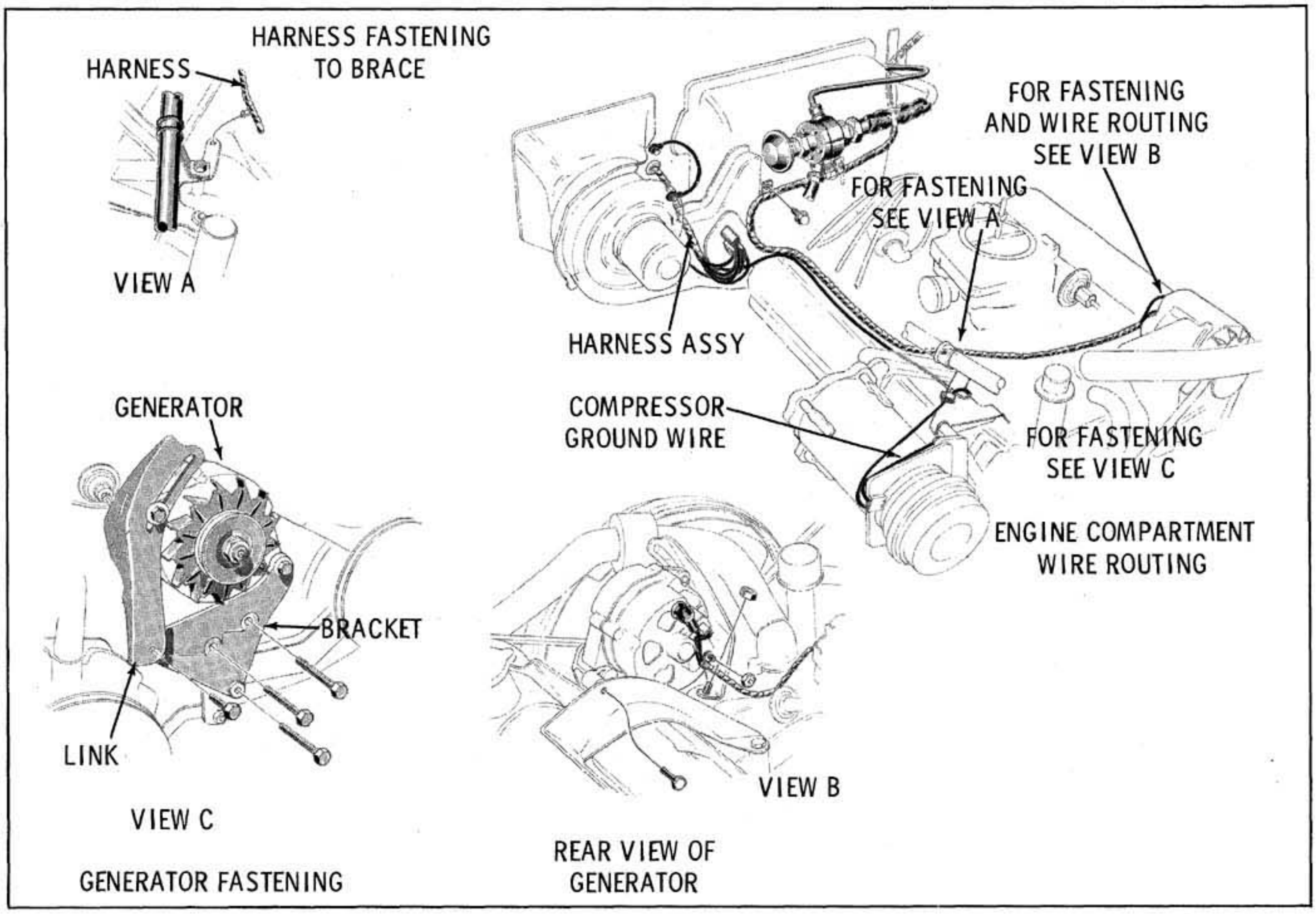


Fig. 14-107 Wiring - Engine Compartment (52 through 86 Series)

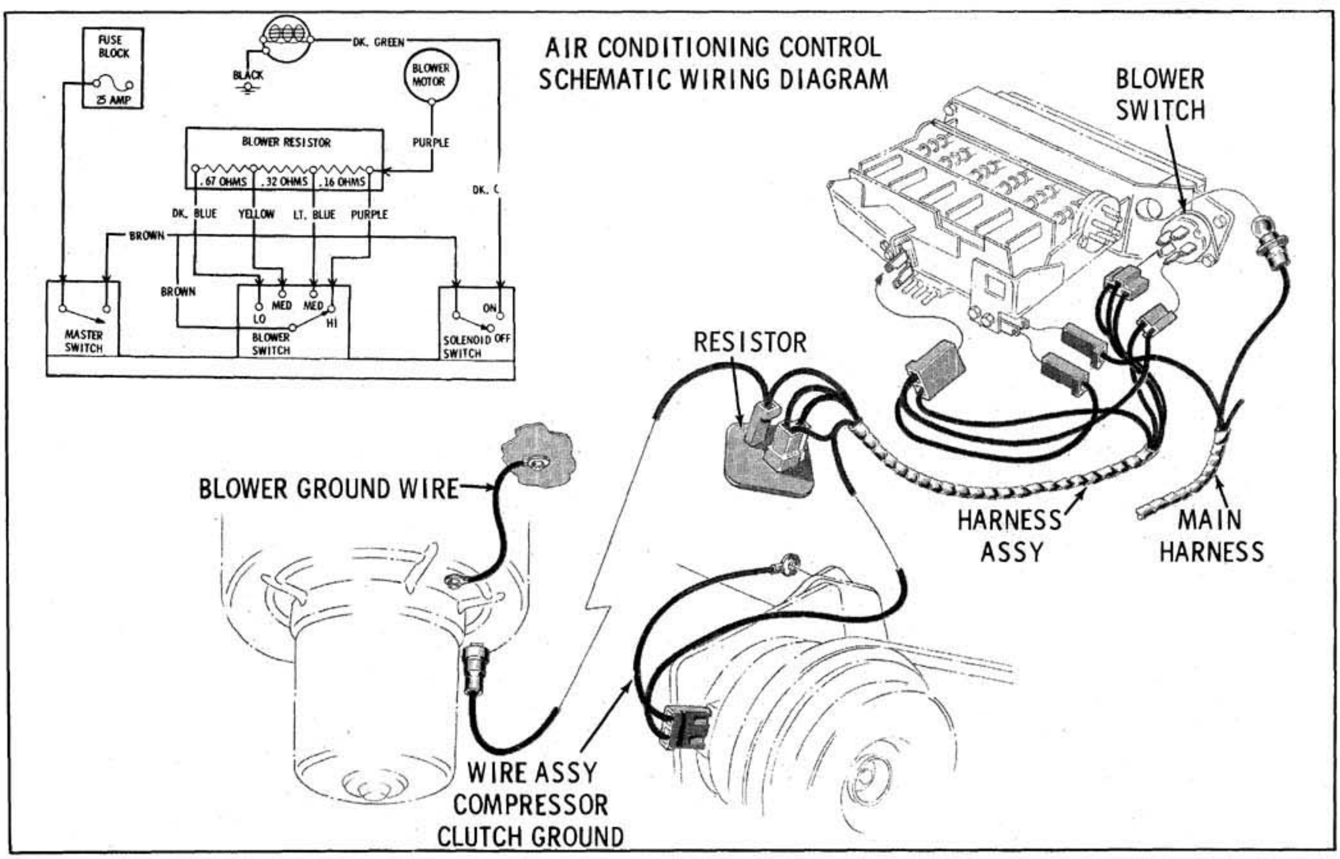


Fig. 14-108 Wiring - Passenger Compartment (52 through 86 Series)

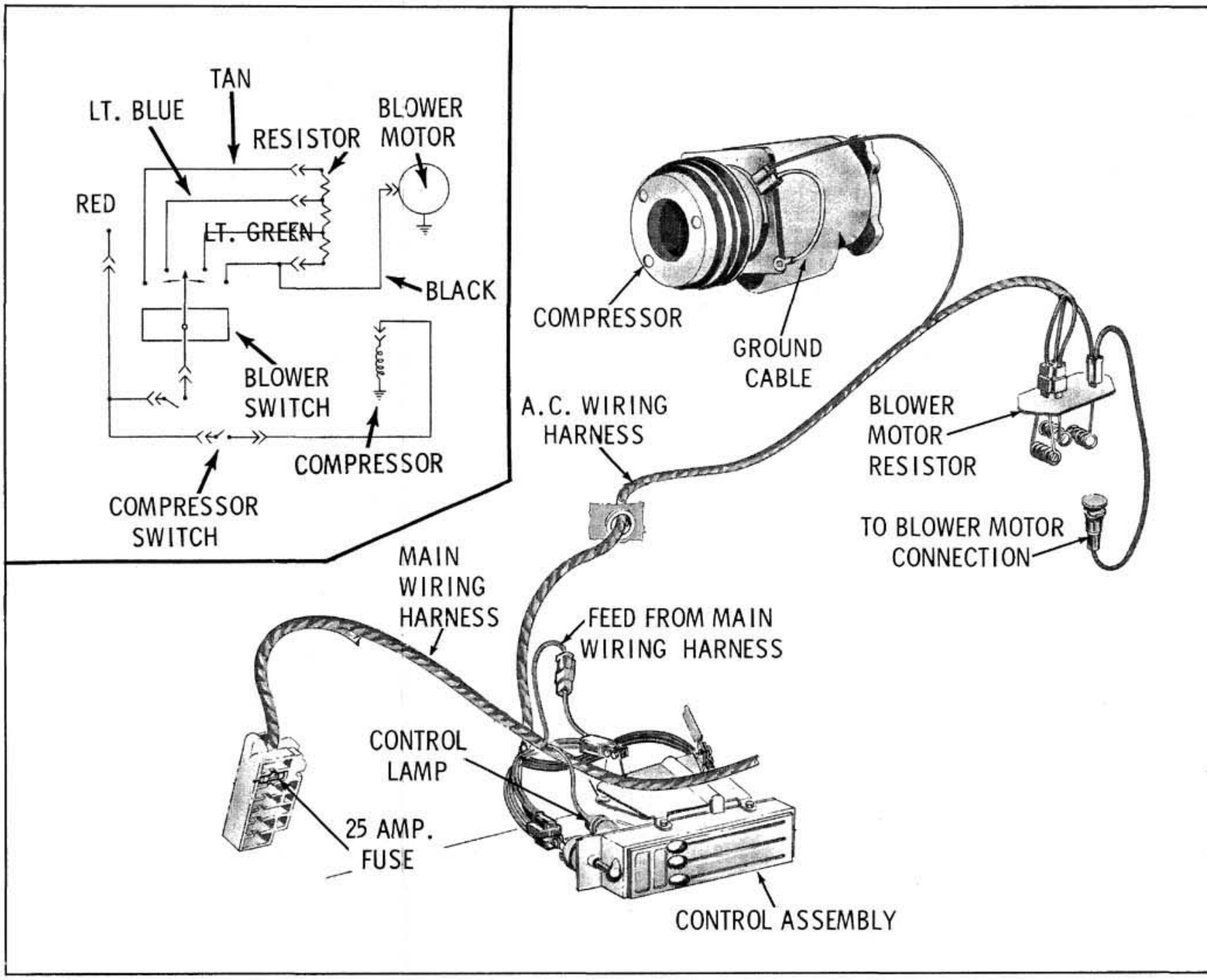


Fig. 14-109 Wiring (33 through 38 Series)

b. Disconnect the liquid line from the dehydrator receiver assembly on the inlet side, and cap the dehydrator receiver immediately.

c. Open the refrigerant drum valve and turn the drum upside down to allow liquid refrigerant to flush through the condenser and out the line. Use approximately 2 lbs. of refrigerant for this operation.

d. Close the drum valve and connect the dehydrator receiver assembly.

e. Remove the expansion valve screen and clean or replace as necessary.

f. Remove the charging line from the compressor, install the gauge set, and evacuate the entire system as outlined under EVACUATING THE SYSTEM.

g. Recharge the system as outlined under CHARGING THE SYSTEM.

WIRING AND HOSE ROUTING

For wire routing, refer to Figs. 14-107, 14-108 and 14-109. For heater hose routing, vacuum hose routing and water valve installation, refer to Figs. 14-110, 14-111 and 14-112.

COMPRESSOR SHAFT SEAL (Fig. 14-113)

Removal

1. Remove compressor from the car. Refer to COMPRESSOR - Removal.

2. Remove driven plate from compressor. Refer to DRIVEN PLATE - Removal.

3. Remove seal seat retaining ring with Tool J-5403.

4. Remove the seal seat with Tool J-9393 as shown in Fig. 14-114.

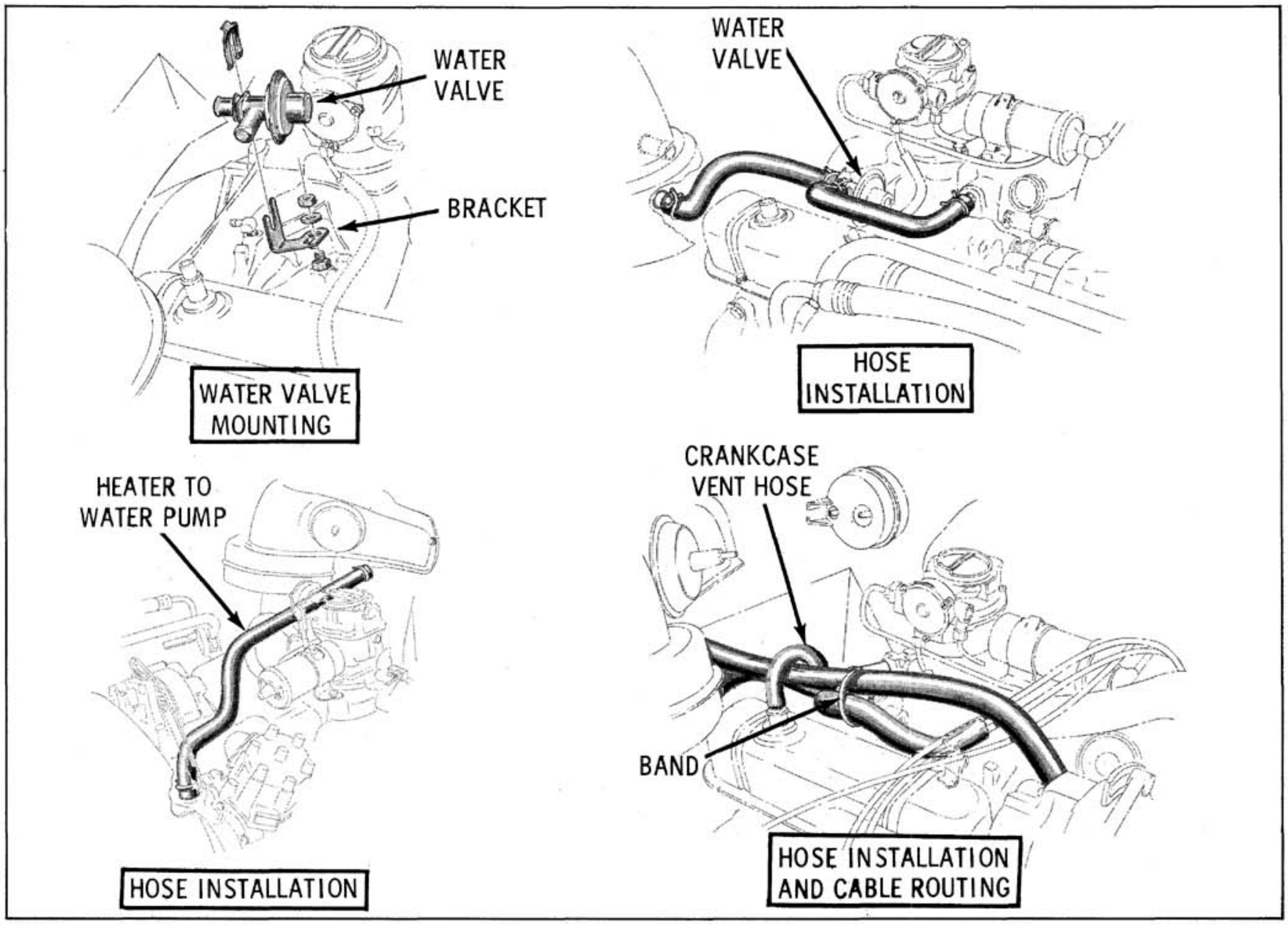


Fig. 14-110 Heater Hose V-6

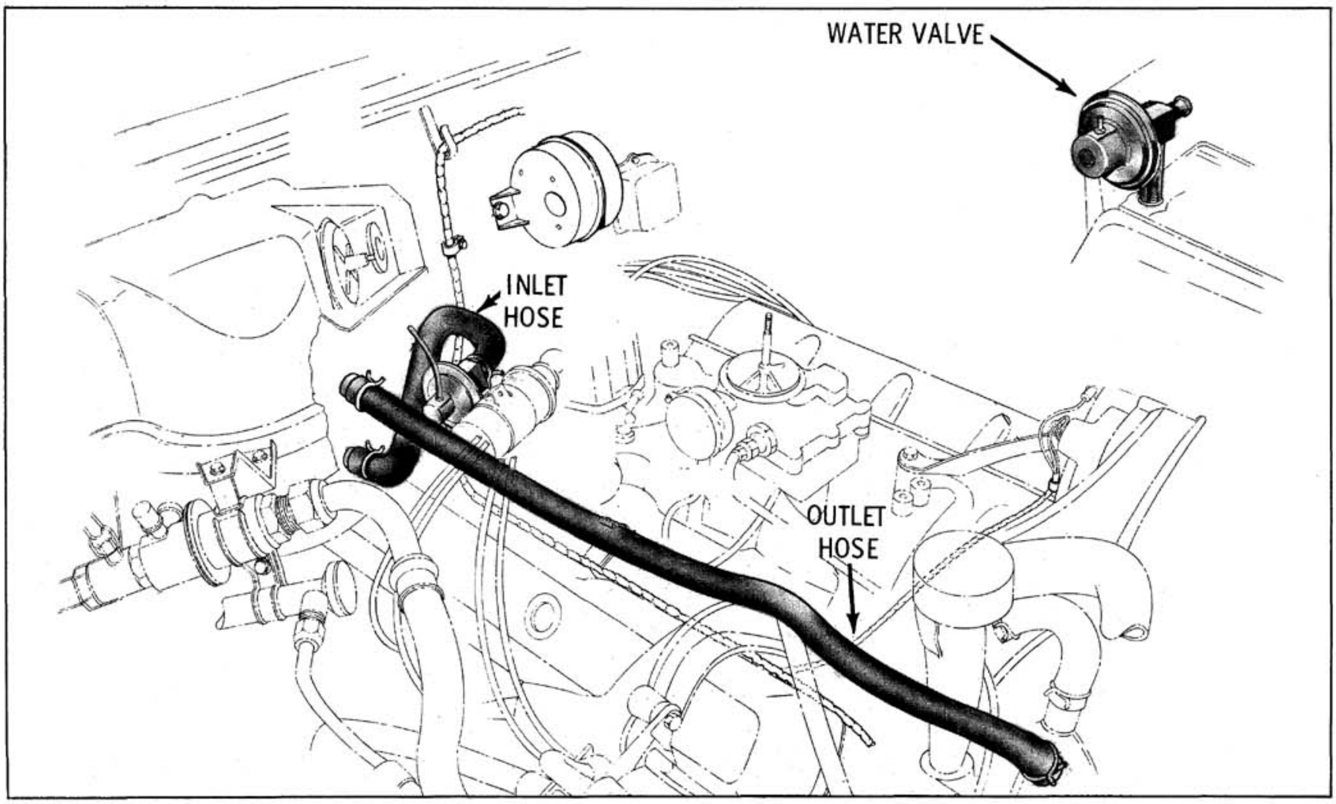


Fig. 14-111 Heater Hose V-8 (34, 36 and 38 Series)

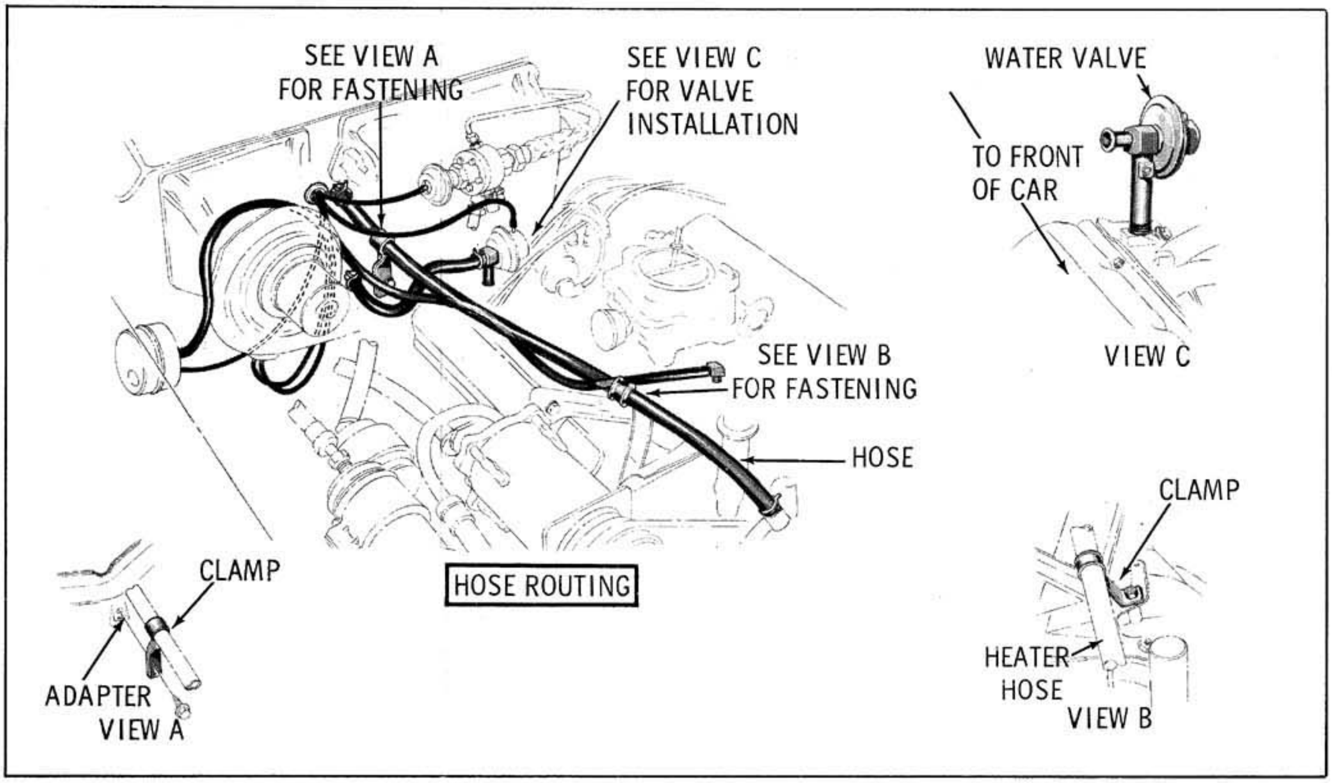


Fig. 14-112 Heater Hose (52 through 86 Series)

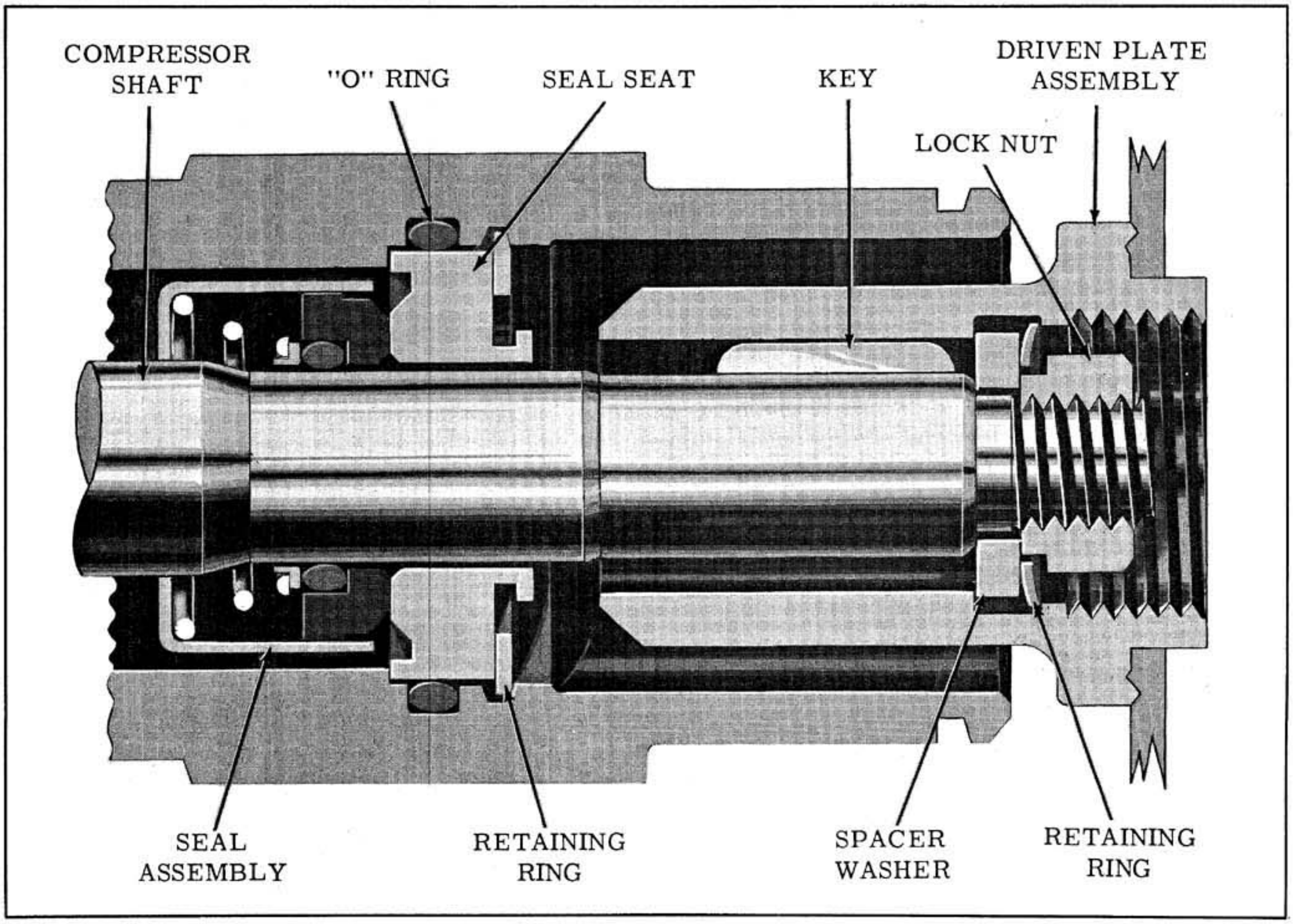


Fig. 14-113 Compressor Shaft and Seal

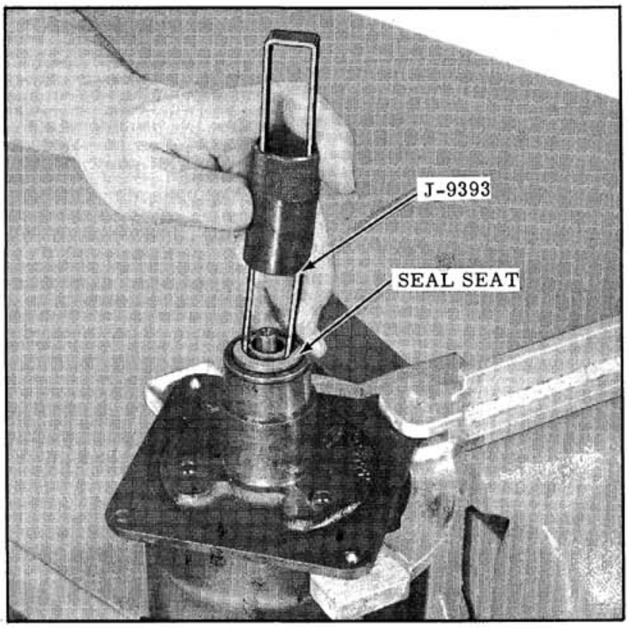


Fig. 14-114 Removing Seal Seat

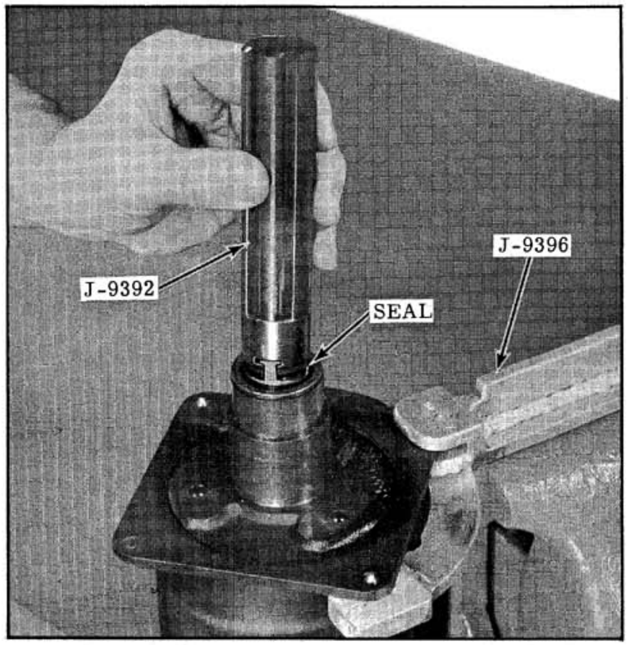


Fig. 14-115 Removing Seal

5. Remove the seal seat "O" ring from inside the housing.

6. Insert Tool J-9392 on top of seal. Rotate clockwise and force tool downward until tool engages tangs of seal. Remove seal by lifting tool out of housing. (Fig. 14-115)

Installation

1. Place the new seal seat "O" ring in the groove inside the neck of the compressor front head.

2. With Tool J-9392, install seal by rotating tool while applying a light pressure, until seal locks in place. Rotate tool counterclockwise slightly to release from seal, and remove tool.

3. Oil the interior of the seal cavity, shaft and seal, using clean Frigidaire 525 Viscosity Oil.

4. Grip the seal seat with Tool J-9393. Push it into place so as not to disturb the "O" ring in the groove and to also effect a seal with this "O" ring.

5. Install the seal seat retainer with J-5403.

6. With Tool J-9527 installed on compressor (Fig. 14-116), leak test the compressor as follows:

   a. Using the J-5725 Gauge Set, connect the center hose to the refrigerant drum and the high and low pressure Schrader valves.

   b. With the high pressure valve and the low pressure valve open, allow refrigerant to flow into the compressor.

   c. Open the oil plug fitting in the compressor housing and allow the air to exhaust until refrigerant starts to flow from the fitting.

   d. Close the oil plug fitting and allow the drum pressure to stabilize in the compressor.

   e. Check and correct any leaks that may exist.

   f. Remove gauge set, cap fittings on Tool J-9527 then add oil as outlined under CHECKING AND ADDING OIL.

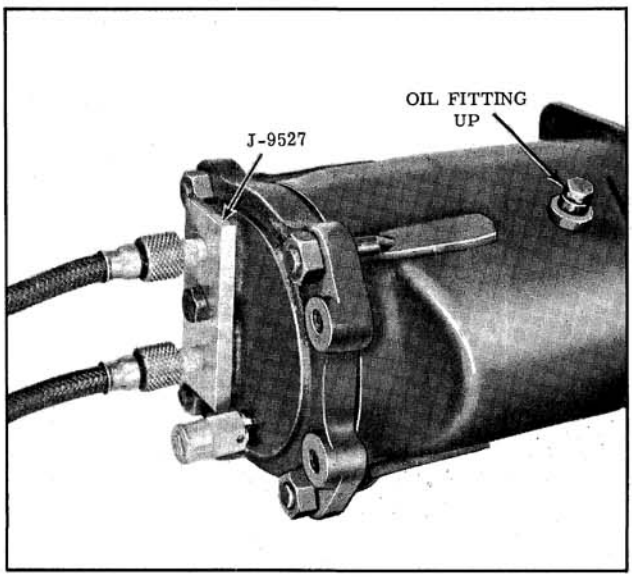


Fig. 14-116 Leak Testing Compressor

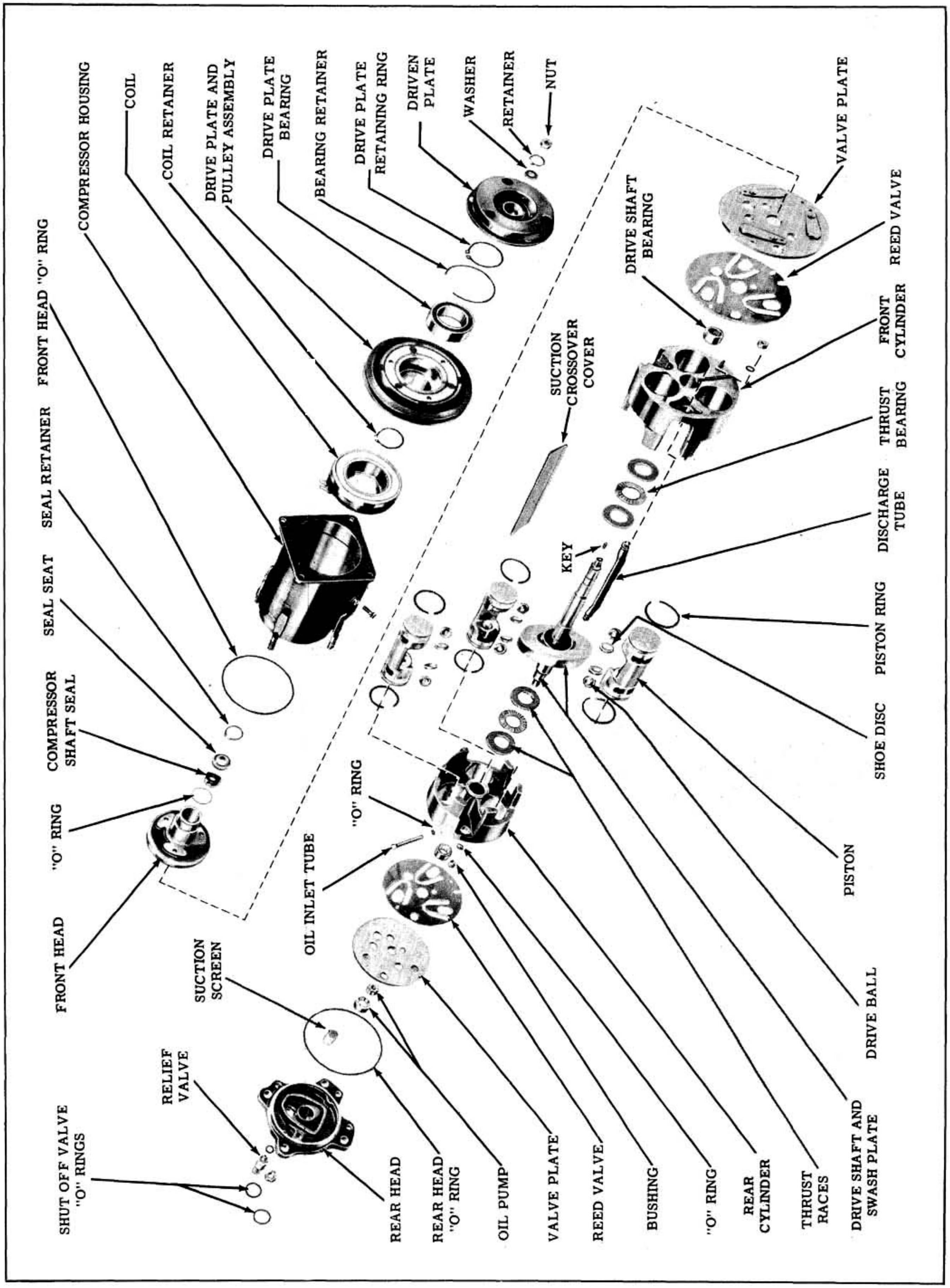


Fig. 14-117 Air Conditioning Compressor

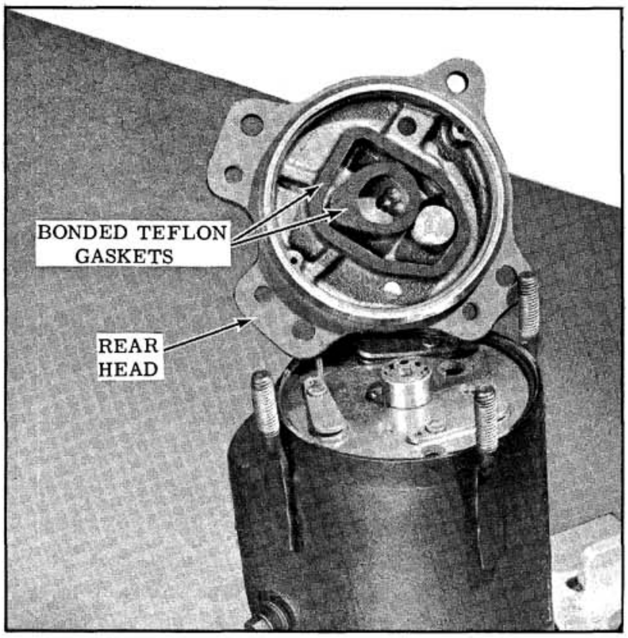


Fig. 14-118 Rear Head Removal

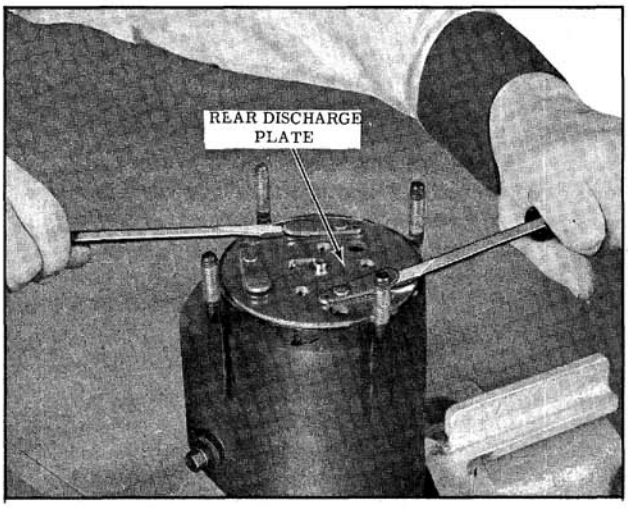


Fig. 14-119 Removing Rear Discharge Plate

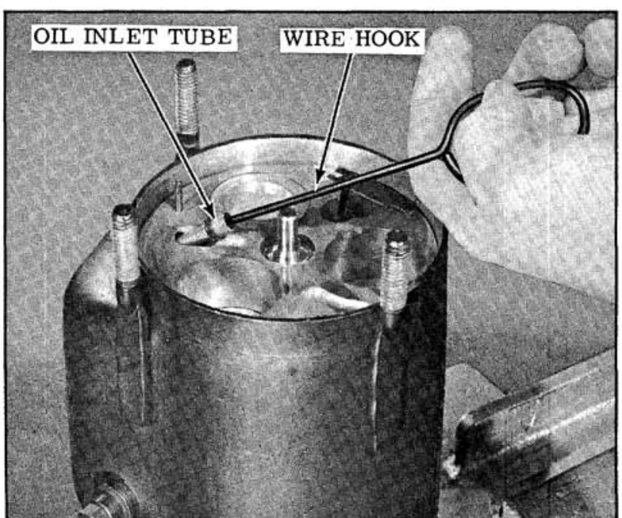


Fig. 14-120 Removing Oil Inlet Tube

7. Install driven plate on compressor.

8. Install compressor on car.

COMPRESSOR DISASSEMBLY (Fig. 14-117)

Before disassembling the compressor, remove the oil drain screw and allow all of the oil to drain from the compressor into a clean container. This is to determine the amount and condition of the oil.

REAR HEAD

1. With compressor mounted in a vise or in Holding Fixture J-9396, rear head up, scribe rear head and compressor housing.

2. Remove the four rear head to housing attaching nuts.

3. Remove the rear head, inspect teflon gaskets on the casting. If teflon gaskets are damaged, replace the rear head. (Fig. 14-118)

4. Remove the suction screen from the rear head.

5. Remove the oil pump gears. If gears are damaged, gears should be replaced.

6. Remove the rear head "O" ring and discard.

7. Remove the rear discharge valve plate and reed valve assembly. Separate the discharge valve plate and reed valve and inspect. (Fig. 14-119)

8. Remove the oil inlet tube and "O" ring. Discard "O" ring. (Fig. 14-120)

FRONT HEAD

1. Remove the cylinder assembly from the rear of the compressor housing by pushing on the compressor shaft. (Fig. 14-121)

2. Remove the front head by tapping it to the rear with a wood block. Discard "O" ring. Check teflon sealing surfaces of head.

3. Remove the front discharge valve plate and reed valve assembly. Separate discharge plate from reed valve and inspect. (Fig. 14-122)

CYLINDER

1. Remove the suction crossover cover. (Fig. 14-123)

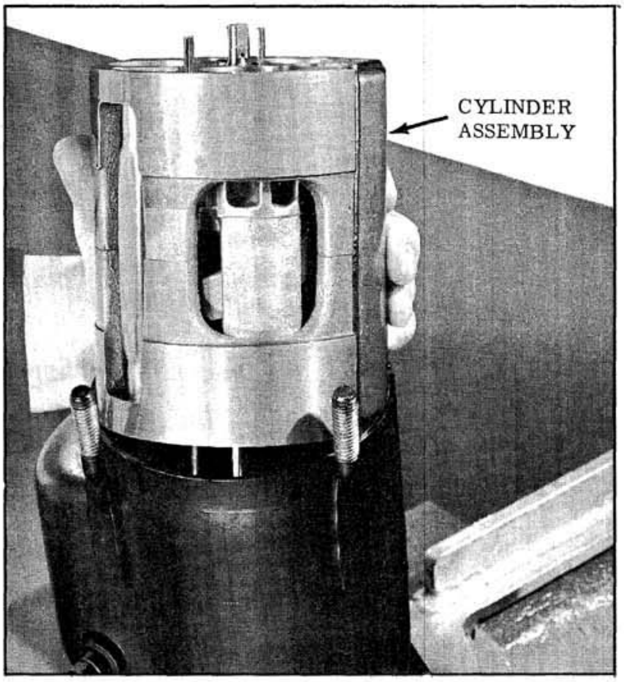


Fig. 14-121 Removing Cylinder From Housing

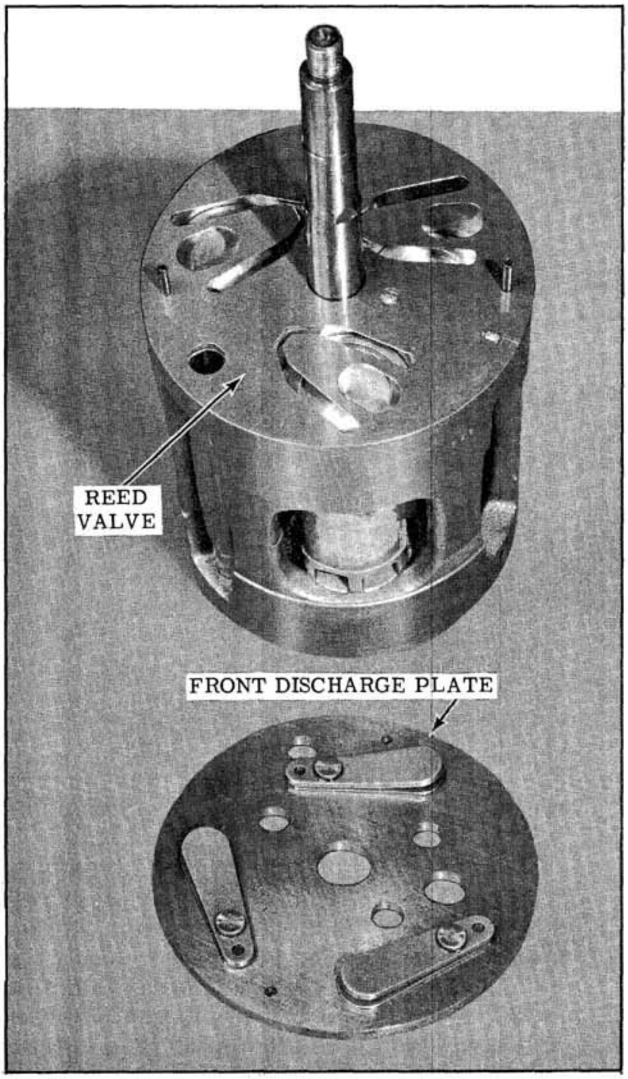


Fig. 14-122 Front Head Discharge Plate and Reed Valve

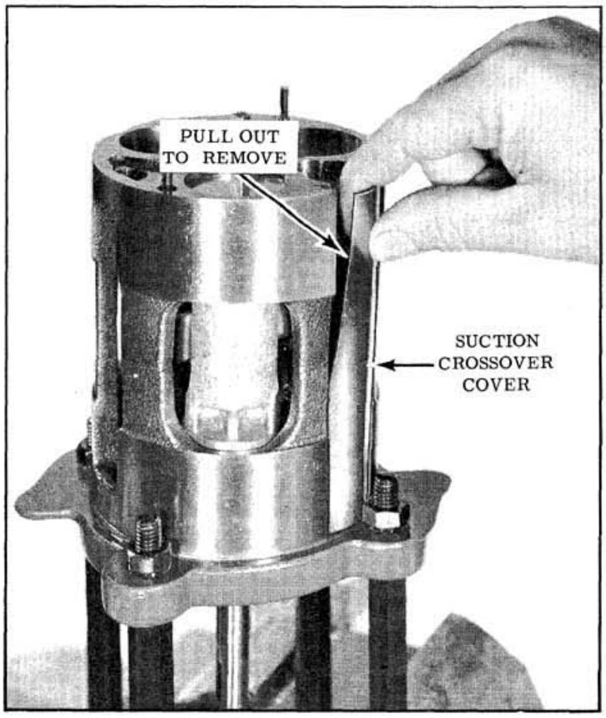


Fig. 14-123 Removing Suction Crossover Cover

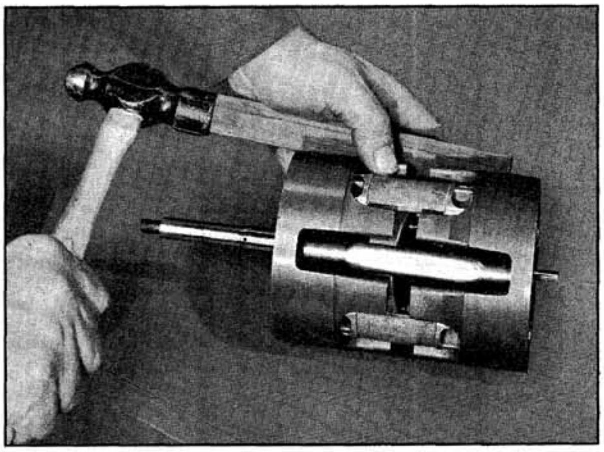


Fig. 14-124 Separating Cylinder Halves

2. Drive the cylinder halves apart using a wood block and hammer. (Fig. 14-124)

3. Remove the rear half of the cylinder from the pistons.

4. Remove and discard the discharge tube. (Fig. 14-125)

5. If necessary to remove the drive shaft bearing from the rear cylinder half, remove the bearing with a brass drift, then install a new bearing, with manufacturers name towards tool, as shown in Fig. 14-126.

6. Mark pistons with their respective cylinders, so that pistons can be reinstalled in their original position and location.

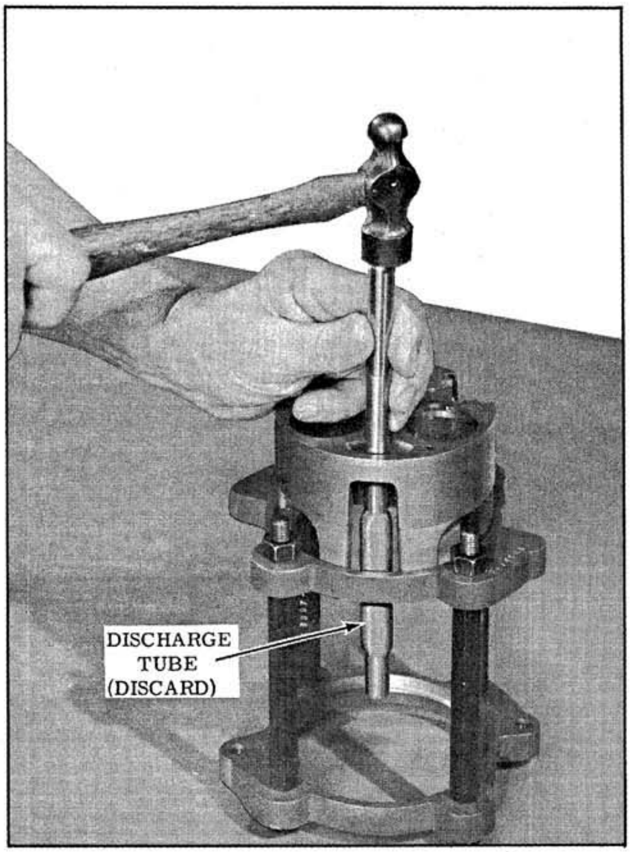


Fig. 14-125 Removing Discharge Tube

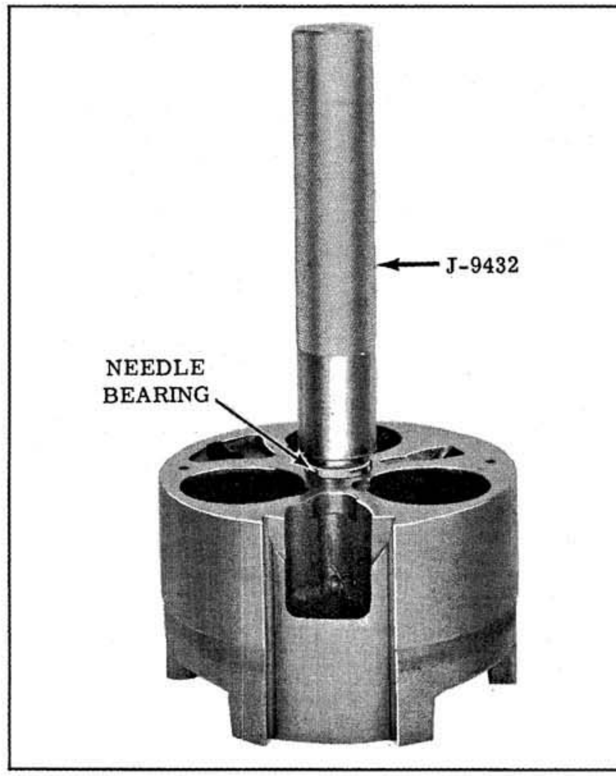


Fig. 14-126 Installing Drive Shaft Bearing

7. Rotate shaft until a piston is at its highest point. Push shaft away from head until the piston assembly can be removed. Separate the piston, piston drive balls, and piston rings and place in Tray J-9402, in compartments associated with proper end of piston. Discard all piston shoe discs.

8. Repeat procedure until all pistons are removed. (Fig. 14-127)

9. Remove shaft and swash plate assembly. Separate thrust bearings and races and discard. Inspect bearing surfaces of shaft and swash plate assembly.

10. If necessary to replace the front cylinder half drive shaft bearing, repeat Step 5.

11. Wash all parts to be reused in clean solvent (oleum). Dry with compressed air.

COMPRESSOR ASSEMBLY

CYLINDER

1. Position front half of cylinder on the Cylinder Assembly Fixture J-9558.

THRUST BEARING RACE CHART

Service *Part Number	Identification No. Stamped on Race
6556000	0
6556050	5
6556055	5-1/2
6556060	6
6556065	6-1/2
6556070	7
6556075	7-1/2
6556080	8
6556085	8-1/2
6556090	9
6556095	9-1/2
6556100	10
6556105	10-1/2
6556110	11
6556115	11-1/2
6556120	12

*The last three digits indicate identification number on race.

2. Position a zero thrust race, a thrust bearing and another zero thrust race over the front and rear ends of the compressor shaft. Retain bearings and thrust washers with clean petrolatum. Install shaft into front cylinder, threaded end of shaft down. (Fig. 14-128)

3. Apply a light smear of clean petrolatum to the ball pockets of each of the three pistons.

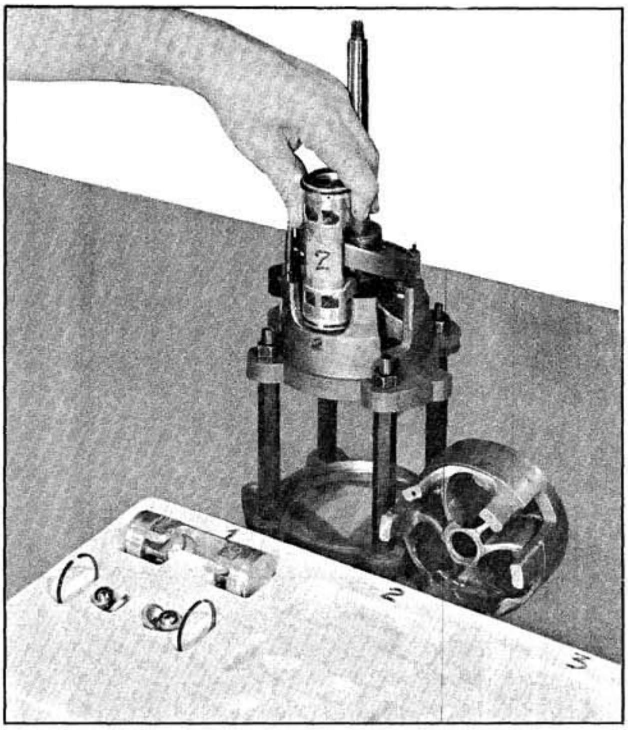


Fig. 14-127 Removing Piston

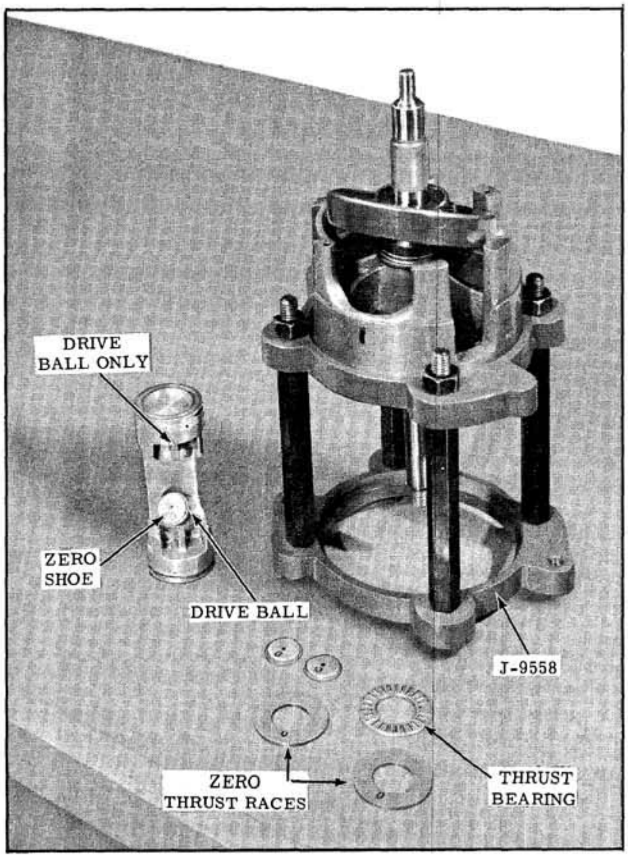


Fig. 14-128 Assembling Parts for Clearance Check

4. Place the balls in the piston pockets.

5. Apply a light smear of clean petrolatum to the cavity of three new zero shoe discs.

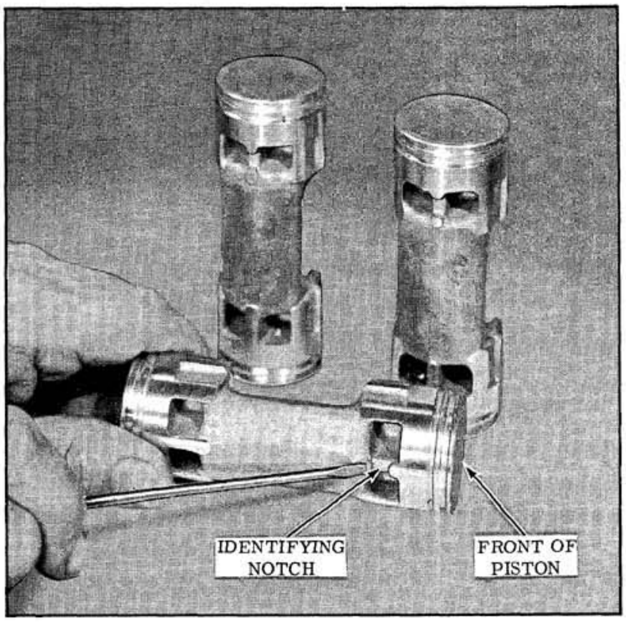


Fig. 14-129 Piston Identification

6. Place a zero shoe over each ball in the front end of the piston. The front end of the piston has an identifying notch in the casting web. (Fig. 14-129)

7. Place a ball only in the rear ball pocket of each of the three pistons.

   NOTE: Do not assemble any of the piston rings at this time.

8. Rotate the shaft and swash plate until the high point of the swash plate is over the piston cylinder bore, which has been identified as No. 1. Raise the shaft until the front end of the piston can be inserted in the cylinder bore, at the same time place the front ball and shoe and the rear ball only over the swash plate.

9. Repeat this operation for pistons No. 2 and No. 3.

   NOTE: The balls and shoes must adhere to the piston during this assembly.

10. Align the rear cylinder with the front cylinder. Tap into place, using a wood block and mallet.

11. Assemble the head ring of Tool J-9558 and nuts to the fixture, tighten the nuts to approximately 15 ft. lbs. torque.

12. Measure clearance between rear ball of No. 1 piston and swash plate, in following manner:

    a. Select a suitable combination of well-oiled feeler gauge leaves to fit snugly between ball and swash plate.

b. Attach a spring scale reading in 1 ounce increments to the feeler gauge. Distributor point checking scale J-5184 may be used.

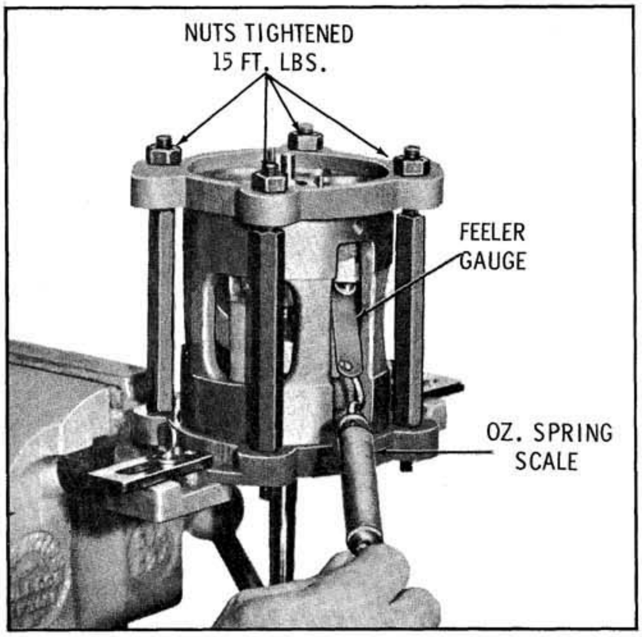


Fig. 14-130 Checking Drive Ball to Swash Plate Clearance

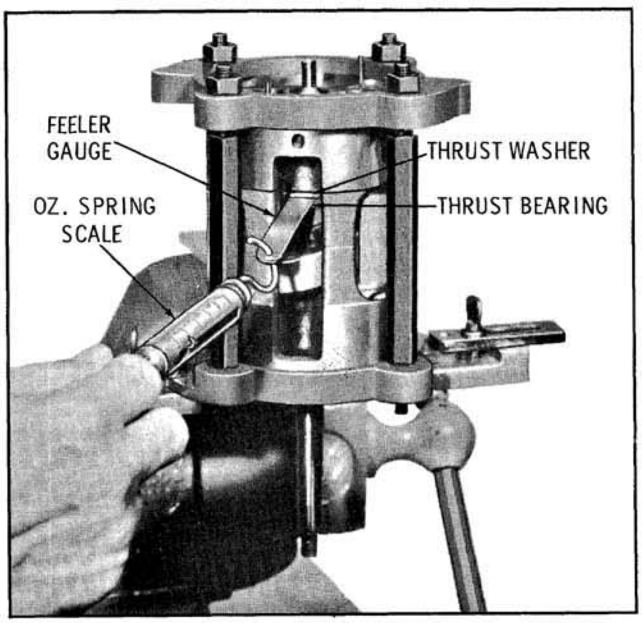


Fig. 14-131 Checking Drive Shaft End Play Clearance

c. Pull on spring scale to slide feeler gauge stock out from between ball and swash plate, and note reading on spring scale as feeler gauge is removed, Fig. 14-130. Reading should be between 4 and 8 ounces.

d. If reading in step (c) is under 4 or over 8 ounces, reduce or increase thickness of feeler gauge leaves and repeat steps (a) through (c) until a reading of 4 to 8 ounces is obtained. Record clearance between ball and swash plate that results in a 4 to 8 ounce pull on spring scale. Rotate the shaft approximately 120°, and make a second check with feeler gauge between the ball and plate. Rotate the shaft again approximately 120° and again check with a feeler gauge between the parts. Record the three readings. From the three checks, select a numbered shoe to correspond to the minimum feeler gauge reading for No. 1 piston (refer to SHOE CHART). Mark piston number on the shoe package. The shoe may be put in the assembly tray in the compartment corresponding to the piston number and rear ball pocket position. Repeat checking procedure for the remaining two pistons.

EXAMPLE

	Position 1	Position 2	Position 3	Select and Use Shoe No.
Piston #1	.019"	.0195"	.019"	19
Piston #2	.020"	.020"	.020"	20
Piston #3	.021"	.021"	.022"	21

SHOE CHART

SERVICE *PART NUMBER	IDENTIFICATION NO. STAMPED ON SHOE
6557000	0
6556175	17-1/2
6556180	18
6556185	18-1/2
6556190	19
6556195	19-1/2
6556200	20
6556205	20-1/2
6556210	21
6556215	21-1/2
6556220	22

*The last three digits indicate identification number on shoes.

13. To determine the clearance between the rear thrust bearing and the upper or outer-rear thrust race use a combination of feeler gauge leaves, so that 4 to 8 oz. of force is required to pull gauge free. (Fig. 14-131)

14. Select from stock a numbered thrust race that corresponds to the feeler gauge used. Mark the package "REAR" place it in the assembly tray corresponding to this position.

15. Loosen and remove the nuts and ring from the checking fixture. Remove the rear cylinder, pistons and rear outer thrust race.

16. Install the correct thrust race, determined in Step 14, over the compressor shaft. Apply a light smear of petrolatum to the thrust races to aid in holding them in place during assembly.

17. Assemble a piston ring, scraper groove toward the piston ball socket, to each end of the three pistons.

18. Apply a light smear of petrolatum to the numbered shoes and place them over the correct ball in the rear of the piston.

19. Rotate the swash plate so the high point is above cylinder bore No. 1. Carefully assemble piston No. 1, complete with ball and a zero shoe on the front end and ball and numbered shoe on the rear end, over the swash plate. Compress and enter the front piston ring into the front cylinder half. Repeat this operation for pistons No. 2 and No. 3.

20. Assemble one end of the service discharge crossover tube into the hole in the front cylinder. (Fig. 14-132)

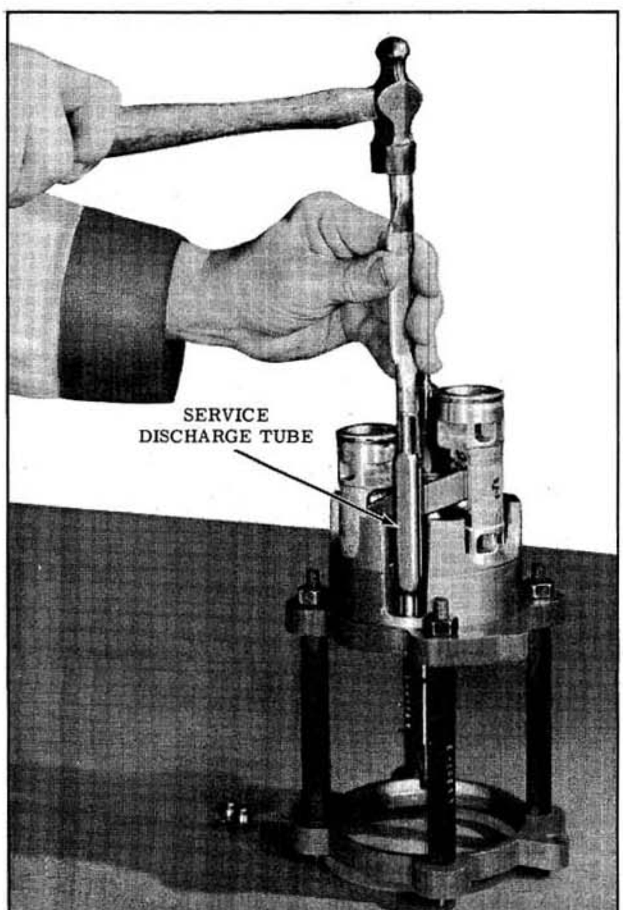


Fig. 14-132 Installing Discharge Tube

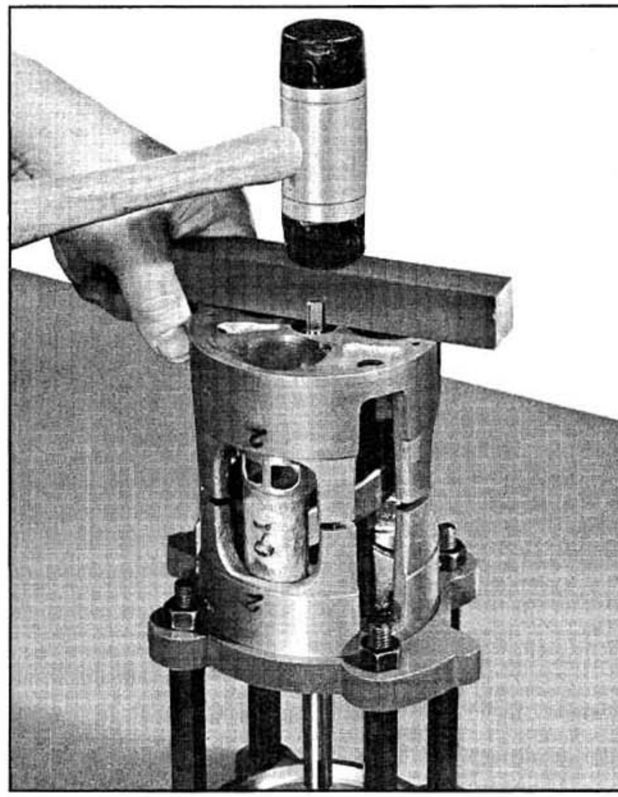


Fig. 14-133 Assembling Cylinder Halves

21. Rotate the shaft to position the pistons in a "stair step" arrangement. Place the rear half of the cylinder over the shaft and start the pistons and rings into the cylinder bores. When all parts are in proper alignment, tap rear cylinder with a wood block and mallet to seat the rear cylinder over the locating dowel pins. (Fig. 14-133)

22. Generously lubricate all moving parts with Frigidaire 525 Viscosity Oil. Check for the free rotation of the mechanism.

23. Remove cylinder assembly from fixture.

24. Install the suction crossover cover by flexing the cover sufficiently to engage the groove in the end of the "dove tail" slot of the rear cylinder head; then slide the cover down until it is flush with the cylinder head. (Fig. 14-134)

25. Install "O" ring and bushing over discharge tube. (Fig. 14-135)

26. Assemble the suction reed valve and the front discharge valve plate to the front end of the cylinder. Align the dowel pin holes, suction ports and oil return slot.

NOTE: The front discharge valve plate has a large diameter hole in the center.

27. Coat the teflon gasket surfaces on the webs of the front head with Frigidaire 525 Viscosity

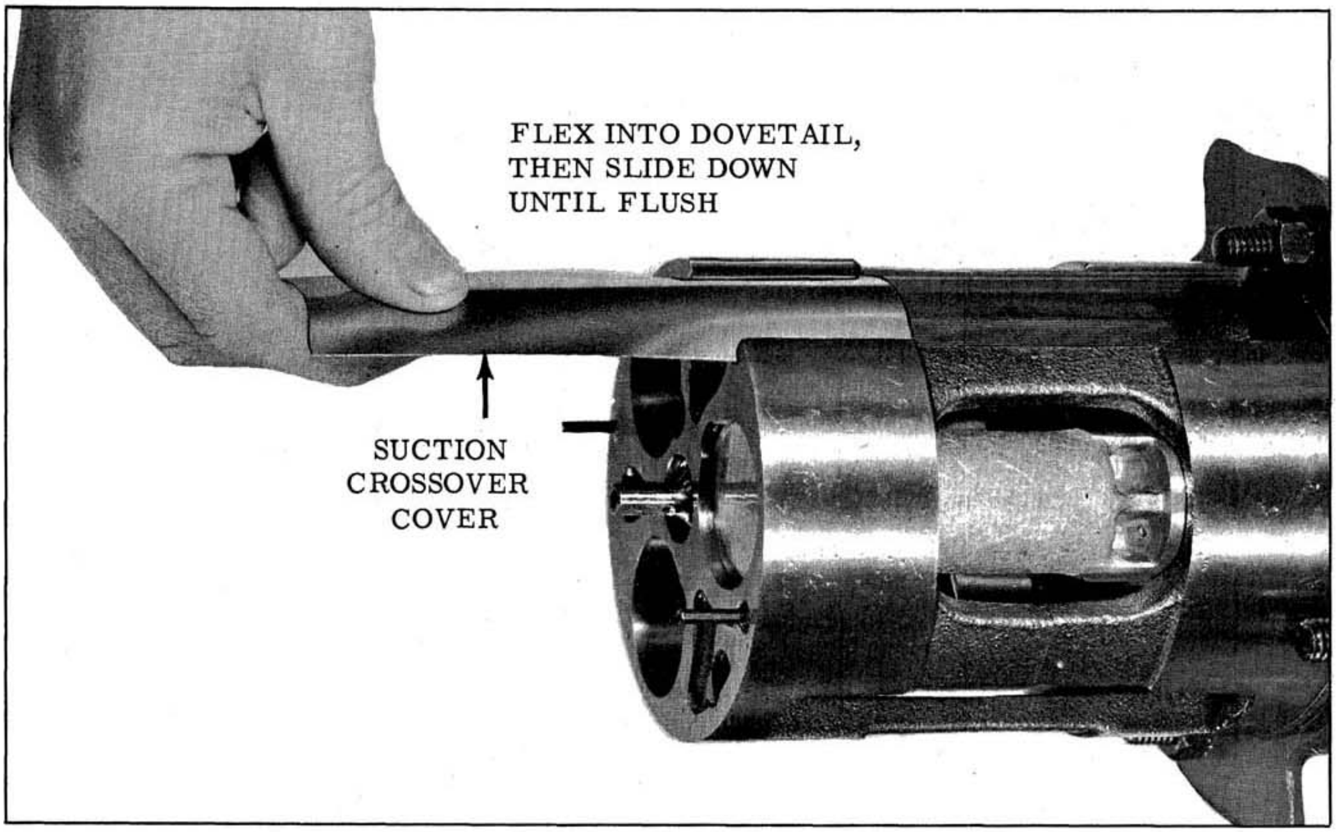


Fig. 14-134 Installing Suction Crossover Cover and Seal

Oil. Examine the location of the dowel pins and contour of the webs. Rotate so as to position it properly over discharge reed retainers. Use care to avoid damaging the teflon gasket surfaces. When in proper alignment, seat with light mallet taps.

28. Apply an ample amount of Frigidaire 525 Viscosity Oil around the angle groove at the lower edge of the head and to the "O" ring. Assemble the "O" ring in the groove.

29. Mount the compressor housing on the holding fixture, attaching bolts up.

30. Coat the inside machined surfaces of the housing with Frigidaire 525 Viscosity Oil. Install the cylinder assembly into the housing. Line up the oil sump with the oil intake tube hole.

31. Position a new "O" ring on the oil intake tube, apply oil to the cavity and "O" ring. Insert the tube and "O" ring, rotating the cylinder assembly to align the tube with the hole in the housing baffle.

32. Install "O" ring and bushing over discharge tube.

33. Position the rear suction reed valve and discharge valve assembly to align with the dowel pins, then slide it into place over pins.

34. Assemble the inner oil pump gear over the "D" shaped flat on the shaft. Place the outer oil pump gear into oil pump gear cavity in the head. Retain with petrolatum.

35. Generously oil the valve plate around the outer ends where the large "O" ring will be placed. Oil the valve reeds, oil pump gears, and the area where the teflon gasket will contact the valve plate.

36. Coat the rear head to housing "O" ring with Frigidaire 525 Viscosity Oil and place it on the valve plate in contact with the housing.

37. Place the suction screen in the rear head.

38. Assemble the rear head to the compressor housing, using care not to damage the teflon gasket.

NOTE: If oil pump gears do not mesh, a slight movement of the rear head or drive shaft will aid in meshing of the gears.

39. Assemble the nuts to the threaded housing studs. Tighten to 23 ft. lbs. torque.

40. Position two "O" rings in the cavity of the rear of the compressor.

41. Install Tool J-9527 on compressor (Fig. 14-116), then leak test the compressor as follows:

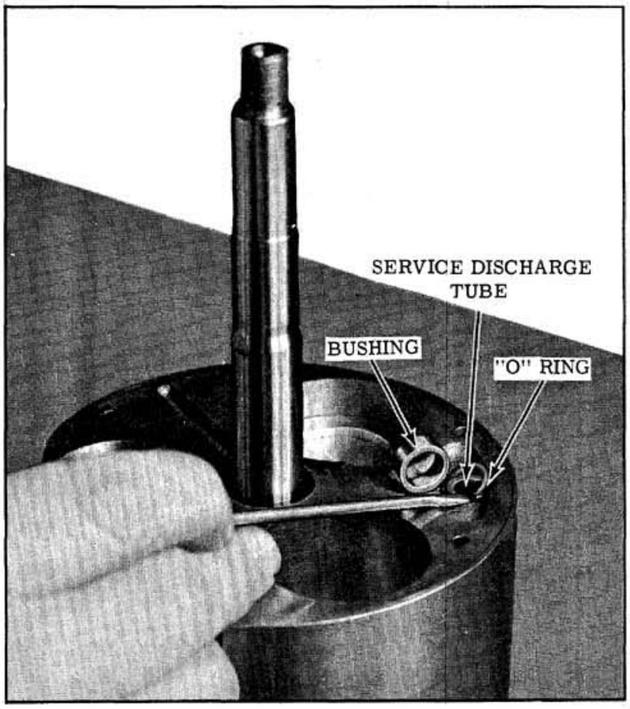


Fig. 14-135 Installing "O" Ring and Bushing

a. Using the J-5725 Gauge Set, connect the center hose to the refrigerant drum and the high and low pressure hoses to the compressor.

b. With the high pressure valve and the low pressure valve open, allow refrigerant to flow into the compressor.

c. Open the oil plug fitting in the compressor housing and allow the air to exhaust until refrigerant starts to flow from the fitting.

d. Close the oil plug fitting and allow the drum pressure to stabilize in the compressor.

e. Check and correct any leaks that may exist.

f. Release the pressure and remove gauge set.

g. Install caps on fittings of Tool J-9527.

42. Add oil to compressor as outlined under CHECKING AND ADDING OIL.

ADDING REFRIGERANT—PARTIAL CHARGE

The proper charge of refrigerant to insure a clear sight glass under operating conditions at various ambient temperatures is 4 lbs. for 52 through 86 Series and 3-3/4 lbs. for 33 through 38 Series. Since less than the specified amount will result in a clear sight glass under some load conditions, it is necessary to consider load effects when checking and adding refrigerant to the system. The load can be varied by changing the blower speed as listed in the following chart. Be sure to operate the system for at least five minutes before checking sight glass:

Ambient Temp. (Outside of Car	Blower Switch Position	Temperature Control Setting	Control Setting	Engine RPM
70° to 80°	High	Fully To Left	Normal	2000
80° to 90°	Medium	Fully To Left	Normal	2000
90° or above	Low	Fully To Left	Normal	2000

If the system is low on refrigerant, proceed as follows:

1. Turn off the ignition.

2. Remove protective caps from Schrader valve adapters.

3. Install gauge set as shown in Fig. 14-136.

4. Crack open both gauge valves to purge the gauge hoses through the center hose, and crack open the valve on the refrigerant drum or the "Fits-All" valve on a 15 oz. refrigerant can. While refrigerant is escaping from the center hose of the gauge set and the valve

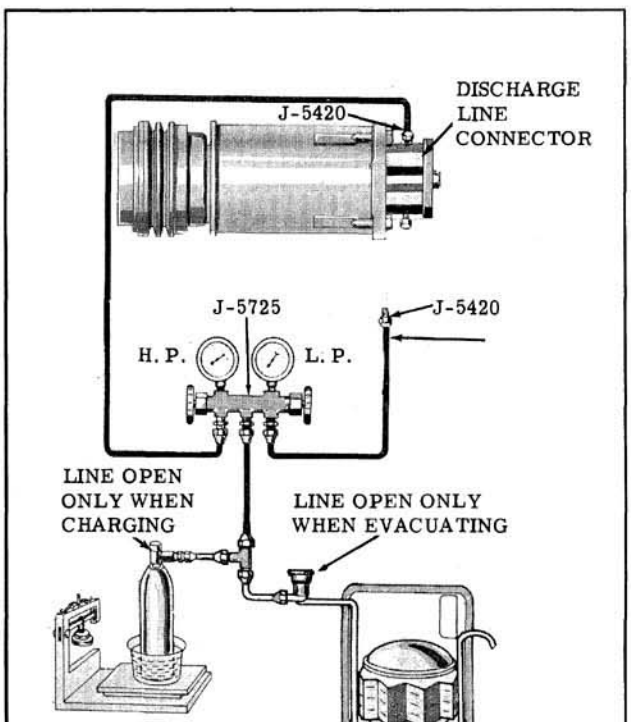


Fig. 14-136 Adding Refrigerant Partial Charge

fitting on the refrigerant container, connect the center hose to the refrigerant container.

5. Close the refrigerant container valve and both gauge valves.

6. Start the engine and make settings according to the preceeding chart.

7. Open valve on refrigerant container and the low pressure gauge valve to allow refrigerant to enter the system. When sight glass clears, close refrigerant container valve.

8. Wait two minutes, then check the sight glass. If vapor is still visible, open the refrigerant container valve and again allow refrigerant to enter the system. Add 1/4 lb. of refrigerant after sight glass clears.

9. Shut off engine, remove gauge set, and install all protective caps.

CHECKING AND ADDING OIL

The compressor was originally charged with 10.5 ounces of Frigidaire 525 Viscosity Oil. During normal operation, because of an affinity of refrigerant 12 for oil, a certain amount of oil will circulate throughout the system along with the liquid and vapor. If any major loss of oil has occurred, such as a severe compressor seal leak, line breakage, damaged condenser, etc., proceed as follows after making the necessary repairs.

1. Remove belt and compressor clutch lead.

2. Remove compressor.

3. Transfer compressor to bench and loosen the oil drain screw.

4. Allow all of the oil to drain from the compressor into a clean container. This is to determine the amount and condition of oil.

   NOTE: If the examination of the oil shows any foreign material; sludge, water, etc., flush the system as outlined under COMPRESSOR - Installation Step 6, and fill compressor with 10.5 ounces of oil.

5. If the condition of the oil indicates that the compressor is free of any contamination, position the compressor so that the oil test valve flange is on the top side and pour from a graduated bottle, new Frigidaire 525 Viscosity Oil into the compressor in the amount required as follows:

   a. If oil drained in Step 4 was more than 1-1/2 ounces, add to the compressor the amount drained in Step 4.

   b. If oil drained in Step 4 was less than 1-1/2 ounces and a major oil loss has occurred, add 6 ounces of oil to the compressor.

   c. If the compressor is overhauled, add 1 ounce in addition to the oil added in Steps 5a or 5b.

   d. If a new service compressor is to be installed, drain service compressor and fill with oil as indicated in Steps 5a or 5b.

   e. If refrigeration components are replaced, add oil as follows, in addition to the oil added in Steps 5a, 5b or 5c.

Evaporator	3 Fluid Ounces
Dehydrator Receiver	1 Fluid Ounce
Condensor-Dehydrator Receiver	3 Fluid Ounces

6. Tighten the oil drain screw.

7. Install compressor.

8. Evacuate the system to remove air and moisture, then charge the system with refrigerant.

PERFORMANCE TEST

The Performance Test should be made with the car doors open, the temperature control lever fully to the left, A/C control set at NORMAL, blower speed switch on "HI", all air outlets open, an auxiliary fan in front of the radiator, and the car hood up.

1. Remove Schrader valve fitting cap at the suction throttling valve.

2. Install Adapter J-5420 on the low pressure gauge hose, and connect the adapter to the Schrader valve fitting on the suction throttling valve, then momentarily open low pressure gauge valve to purge gauge hose.

3. Remove the compressor high pressure Schrader valve protective cap and install high pressure gauge hose with Adapter J-5420. Be sure high pressure gauge valve is closed.

4. Momentarily open high pressure gauge to purge the gauge and hose.

5. With transmission in PARK or NEUTRAL and parking brake applied, adjust engine speed to 2000 rpm.

6. After temperature and humidity have been determined, compare test results with the PERFORMANCE CHART.

7. When test is completed, disconnect gauge hoses, and install protective caps.

8. Install Schrader valve fitting cap on suction throttling valve.

DIAGNOSIS OF PERFORMANCE TEST RESULTS

CONDITION AND CAUSE	CORRECTION
EVAPORATOR PRESSURE TOO HIGH	
A. Defective or improperly adjusted suction throttling valve.	A. Adjust or repair as necessary.
B. Restriction in suction line.	B. Remove, inspect, and clean or replace.
C. Loose compressor drive belt.	C. Adjust as outlined.
D. Defective clutch or coil.	D. Check or replace as necessary.
E. Defective expansion valve.	E. Replace as necessary.
F. Expansion valve capillary tube not tight to evaporator suction line.	F. Check clamp for tightness.
G. Clutch slipping.	G. Refer to CLUTCH SLIPPAGE.
HIGH PRESSURE SIDE OF SYSTEM TOO HIGH	
A. Engine overheated.	A. Check engine cooling system.
B. Restricted air flow through condenser.	B. Remove foreign material from engine radiator and condenser.
C. Air in system or overcharge of refrigerant.	C. Momentarily discharge system on discharge side with engine not running; then, operate system and recheck pressure. Repeat as necessary. Check sight glass with system under load.
D. Restriction in condenser, dehydrator receiver assembly, or any discharge or liquid line.	D. Remove parts, inspect for restricted passage, and clean or replace.
E. Too much oil in compressor.	E. Drain oil and add correct amount.
NOZZLE DISCHARGE AIR TOO WARM (With Other Readings OK)	
A. Air hoses not properly connected.	A. Inspect air hoses and manifolds.
B. Defective or mispositioned evaporator drain hoses.	B. Replace or align as necessary.
C. Poor Seal - Evaporator to cowl.	C. Correct sealing.
CLUTCH SLIPPAGE	
A. Head pressure too high.	A. Discharge system until bubbles appear in sight glass and then add one pound of refrigerant.
B. Pulley wobbles.	B. Check and replace, if necessary, the pulley bearing. If pulley has been worn by bearing, replace pulley.

DIAGNOSIS OF PERFORMANCE TEST RESULTS (Cont'd.)

CONDITION AND CAUSE	CORRECTION
VELOCITY OF AIR AT DISCHARGE NOZZLES TOO LOW	
A. Restricted evaporator core in evaporator assembly.	A. Wash evaporator core. Restricted evaporator core caused by freezing. Adjust suction throttling valve.
B. Restricted air hoses.	B. Inspect and replace if necessary.
C. Defective blower motor.	C. Check and replace if necessary.
D. Defective switches.	D. Check and replace if necessary.
E. Poor wiring connection (Low voltage at blower.)	E. Correct wiring.
EVAPORATOR PRESSURE TOO LOW	
A. Insufficient Refrigerant charge.	A. Add refrigerant.
B. Restricted air flow through evaporator.	B. Check air flow.
C. Improperly adjusted suction throttling valve.	C. Adjust suction throttling valve.
WATER BLOWING OUT AIR DISCHARGE NOZZLE	
A. Plugged or kinked evaporator drain hose.	A. Clean or align as necessary.
INOPERATIVE CONTROLS	
A. Inadequate vacuum.	A. Check vacuum. All controls should move with 10° Hg. Check hoses.
B. Control cables improperly adjusted.	B. Adjust cables.

PRESSURE—TEMPERATURE RELATIONSHIP OF REFRIGERANT-12

Temp. °F	Pressure	Temp. °F	Pressure	Temp. °F	Pressure	Temp. °F	Pressure	Temp. °F	Pressure
-8	5.4	22	22.4	52	49.0	82	87.0	112	140.1
-6	6.3	24	23.9	54	51.0	84	90.1	114	144.2
-4	7.2	26	25.4	56	53.0	86	93.2	116	148.4
-2	8.2	28	27.0	58	55.4	88	96.4	118	153.0

PRESSURE—TEMPERATURE RELATIONSHIP OF REFRIGERANT-12 (Cont'd.)

Temp. °F.	Pressure	Temp. °F.	Pressure	Temp. °F.	Pressure	Temp. °F.	Pressure	Temp. °F.	Pressure
0	9.2	30	28.5	60	58.0	90	99.6	120	157.1
2	10.2	32	30.1	62	60.0	92	103.0	122	161.5
4	11.3	34	32.0	64	62.5	94	106.3	124	166.1
6	12.3	36	33.4	66	65.0	96	110.0	126	171.0
8	13.5	38	35.2	68	67.5	98	113.3	128	175.4
10	14.6	40	37.0	70	70.0	100	117.0	130	180.2
12	15.9	42	39.0	72	73.0	102	121.0	132	185.1
14	17.1	44	41.0	74	75.5	104	124.0	134	190.1
16	18.4	46	43.0	76	78.3	106	128.1	136	195.2
18	19.7	48	45.0	78	81.1	108	132.1	138	200.3
20	21.0	50	47.0	80	84.1	110	136.0	140	205.5

GENERAL SPECIFICATIONS

Engine Idle Speed	(Refer to Engine Tune-Up and/or Carburetion Section)
Fuse (at Fuse Block)	AGC 25 Amps.
Amount of Refrigerant 12 in System	4 Lbs. (52 through 86 Series) 3-3/4 Lbs. (33 through 38 Series)
Total Amount of Oil in Refrigerant System	10.5 Fluid Oz.
Type of Oil	Frigidaire 525 Viscosity

TORQUE SPECIFICATIONS

Application	Ft. Lbs.
*(Refer to Chart for Power Steering Pump, Delcotron and Compressor Mounting Brackets)	
Schrader Valve Adapter Fittings to Compressor Bolt	10 to 15
Driven Plate to Compressor Shaft Nut	14 to 16
Rear Head to Compressor Housing Nuts	19 to 23

*TORQUE CHART

Bolt Size	Torque Lb.-Ft.
5/16	25
3/8	35
7/16	50

PERFORMANCE CHART
(33 THROUGH 38 SERIES)

In Front Of Condenser		Evaporator Pressure	*2260 V-6	Discharge Air Temp. R.H. Nozzle	High Pressure (Discharge)
Relative Humidity	Air Temp. °F.	At Suction Throttling Valve PSI	Engine R.P.M.	±1 °F.	±10 PSI
20	60	29	2000*	38	145
	70	29		40	172
	80	29		40	198
	90	29		43 1/2	219
	100	33		50	263
	110	38		61	310
30	60	29	2000*	38	146
	70	29		40	173
	80	29		42	203
	90	29		47	227
	100	34 1/2		56	273
	110	43		69	330
40	60	29	2000*	38	148
	70	29		40	174
	80	29		42 1/2	206
	90	31		49	235
	100	38		63	290
	110	48		73	342
50	60	29	2000*	38 1/2	150
	70	29		40	175
	80	29		46	210
	90	33		55	245
	100	40		68	300
	110	50		78	352
60	60	29	2000*	39	158
	70	29		40	178
	80	31		49	215
	90	36		60	255
	100	46		72	310
70	60	29	2000*	39	168
	70	29		42	180
	80	32		52	220
	90	37		63	262
	100	48		76	320
80	60	29	2000*	39 1/2	175
	70	29		43	185
	80	34		54	223
	90	41		66	268
	100	53		80	330
90	60	29	2000*	40	183
	70	29		44	190
	80	30		56	225
	90	43		69	274
	100	54		84	342

PERFORMANCE CHART
(52 THROUGH 86 SERIES)

In Front Of Condenser		Evaporator Pressure		Discharge Air Temp. R.H. Nozzle	High Pressure (Discharge)
Relative Humidity	Air Temp. °F.	At Suction Throttling Valve PSI	Engine R.P.M.	±1 °F.	±10 PSI
20	70	29	2000	36 1/2	150
	80	29		37	155
	90	29		40 1/2	185
	100	29 1/2		43	208
	110	30		48	235
30	70	29	2000	37	155
	80	29		38 1/2	162
	90	29		42	190
	100	30		46	217
	110	31		52	245
40	70	29	2000	38	160
	80	29		39 1/2	167
	90	30		44	195
	100	31		49	222
	110	32		55	260
50	70	29	2000	38.5	165
	80	29		41	172
	90	32		46	200
	100	33		51	225
	110	36		59	275
60	70	29	2000	39	170
	80	29 1/2		42	177
	90	35		47 1/2	205
	100	39		54	232
70	70	29	2000	40	177
	80	29 1/2		43	182
	90	37 1/2		49	210
	100	45		57	239
80	70	29	2000	40 1/2	182
	80	30		45	187
	90	40		51	215
	100	50		59	244
90	70	29	2000	41 1/2	187
	80	31		46	192
	90	43		53	222
	100	54		62	250

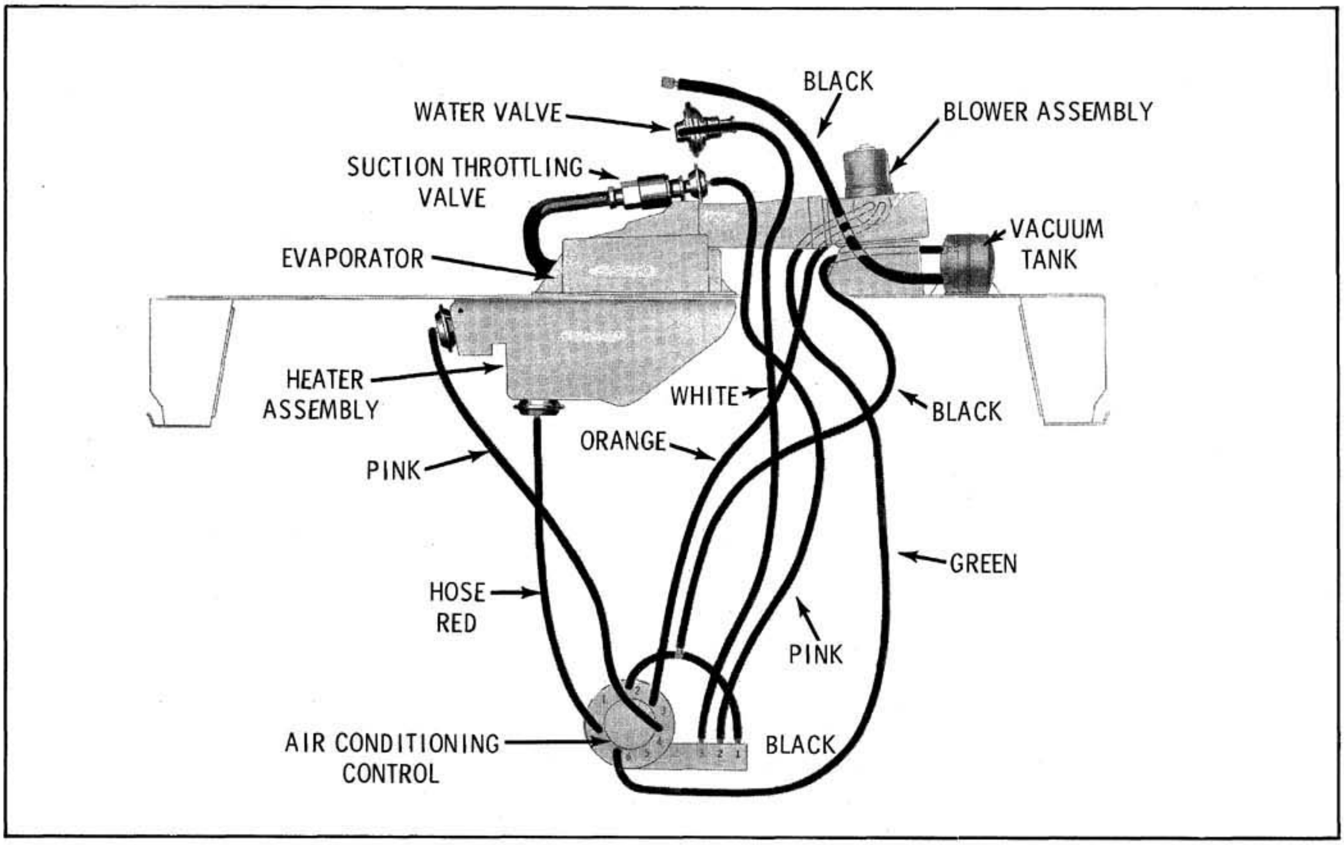


Fig. 14-137 Schematic Diagram of Air Conditioning and Heater Vacuum Hoses (52 through 86 Series)

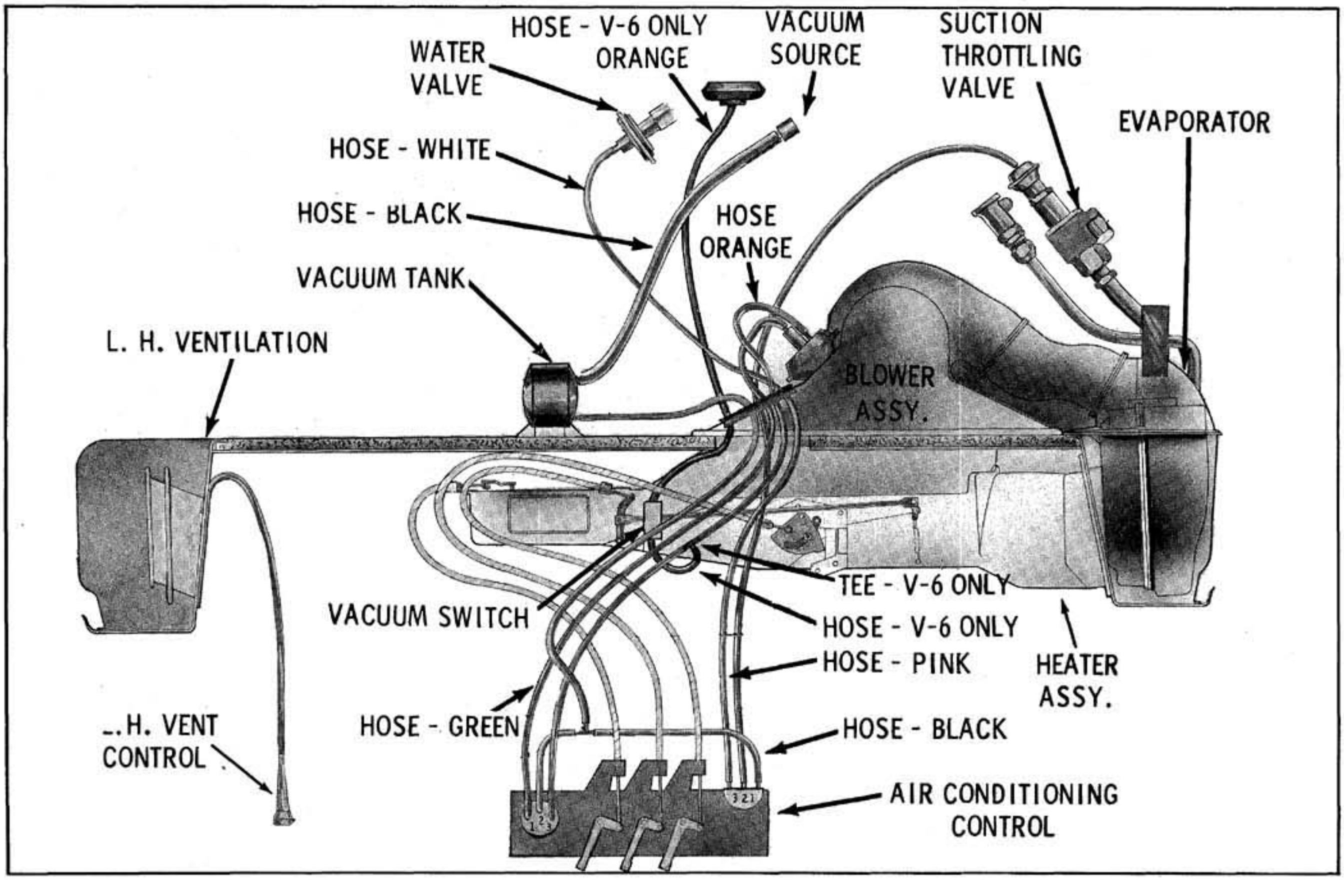
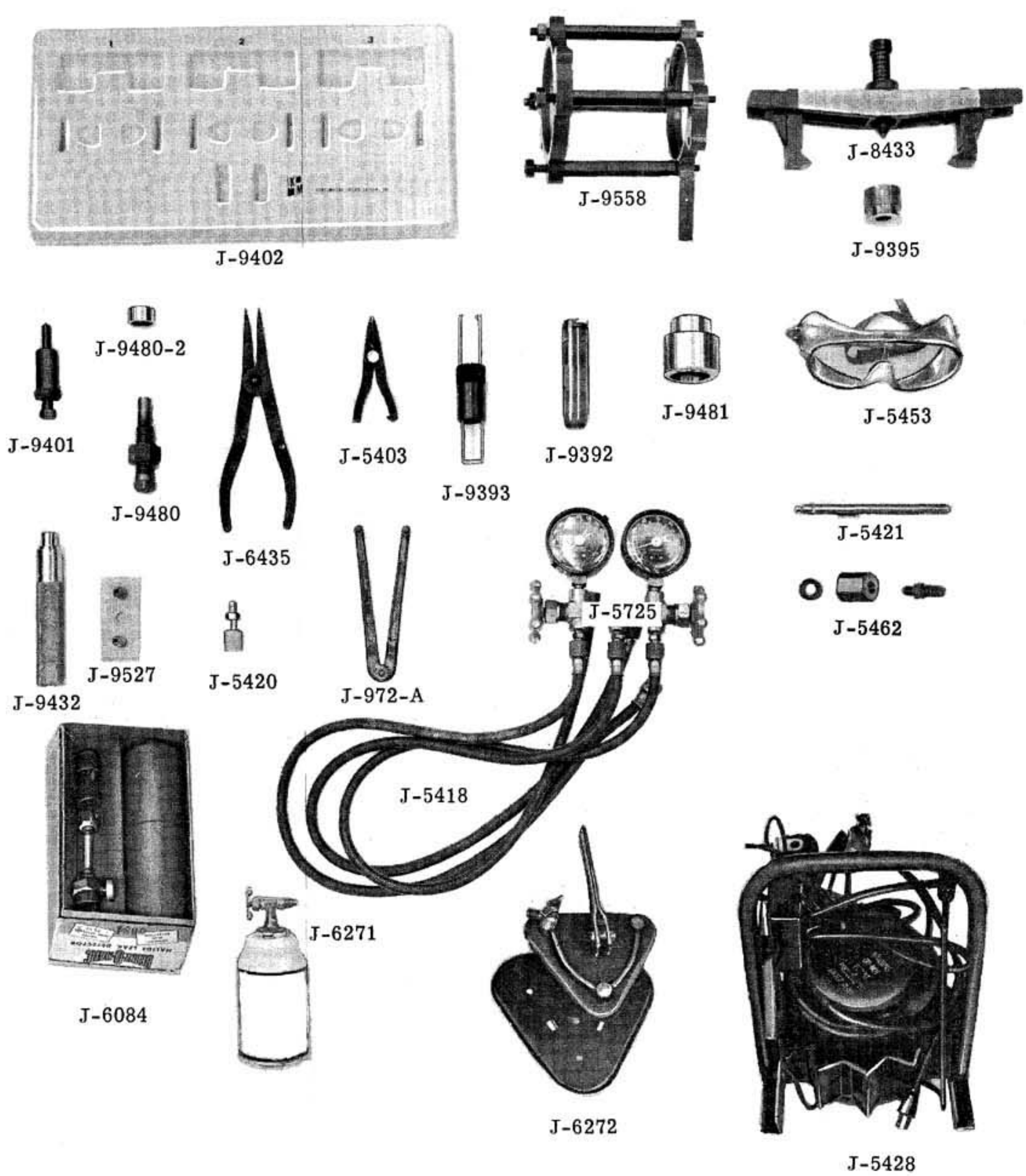


Fig. 14-138 Schematic Diagram of Air Conditioning and Heater Vacuum Hoses (33 through 38 Series)



J-972-A Spanner Wrench (Used for Holding Driven Plate)
J-5403 Snap Ring Pliers
J-5418 Gauge Charging Line
J-5420 Gauge Adapter
J-5421 Pocket Thermometer
J-5428 Vacuum Pump
J-5453 Goggles
J-5462 Refrigerant Drum Hook-Up Set
J-5725 Gauge Manifold Test Unit
J-6084 Leak Detector Kit
J-6271 Fits-All Valve
J-6272 #3 Multi-Opener
J-6435 Snap Ring Pliers
J-8433 Compressor Pulley Puller
J-9392 Seal Remover & Installer
J-9393 Seal Seat Remover & Installer
J-9395 Puller Pilot
J-9401 Hub & Drive Plate Assembly Remover
J-9402 Cylinder Assembly Tray
J-9432 Needle Bearing Remover & Installer
J-9480 Driven Plate Installer
J-9481 Pulley Bearing & Drive Plate Assembly Installer
J-9527 Leak Test Adapter
J-9558 Checking Fixture

Fig. 14-139 Tools

FRAME, BUMPERS AND CHASSIS SHEET METAL

(52 THROUGH 86 SERIES)

CONTENTS OF SECTION 15

FRAME

When supporting car on a floor jack or floor stands, the car should be supported at the suspension points only. Under no conditions should the car be supported at the extreme ends of frame or at the center of a frame side rail.

When using a frame contact hoist, the car should be lifted at the contact points as shown in Fig. 15-1.

CHECKING FRAME ALIGNMENT

The diagram shown in Fig. 15-2 can be used to check the alignment of a car frame that has been distorted.

The reference points indicated in the illustration are to be checked with a tram gauge. The dimensions between the various reference points will show where straightening operations are necessary.

NOTE: Corresponding measurements must be equal within 1/4".

1. Measure A-A. If not equal, rear end of frame is misaligned.
2. Measure B-B. If not equal, center portion of frame is misaligned.
3. Measure C-C. If not equal, then front suspension crossmember is misaligned.

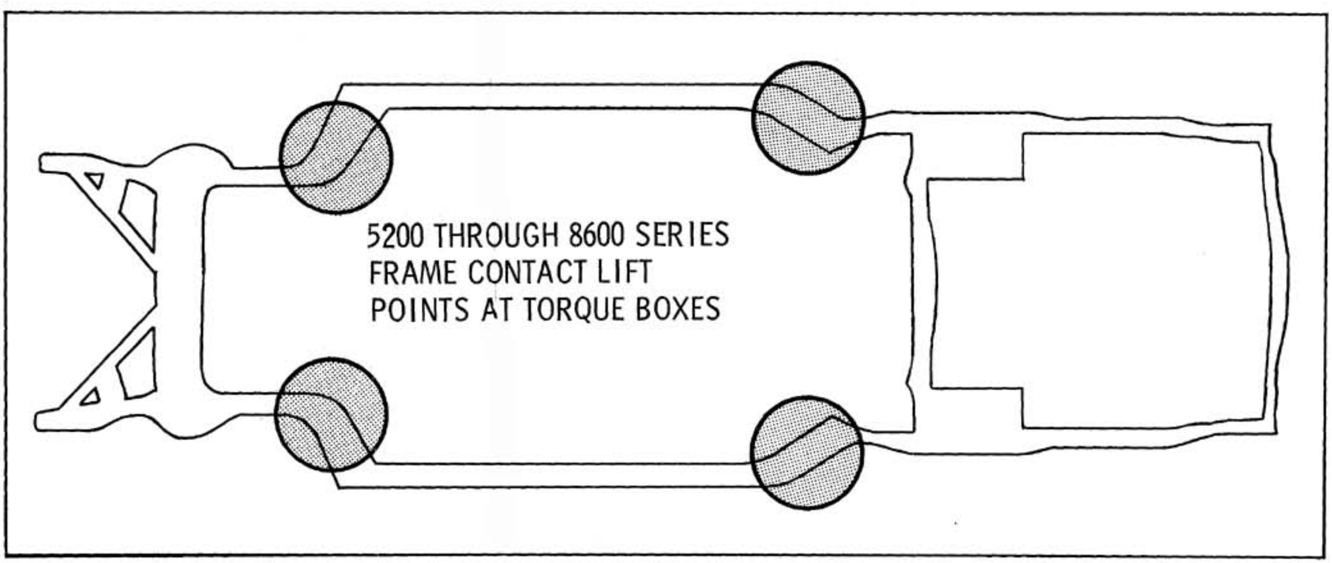


Fig. 15-1 Frame Lift Points

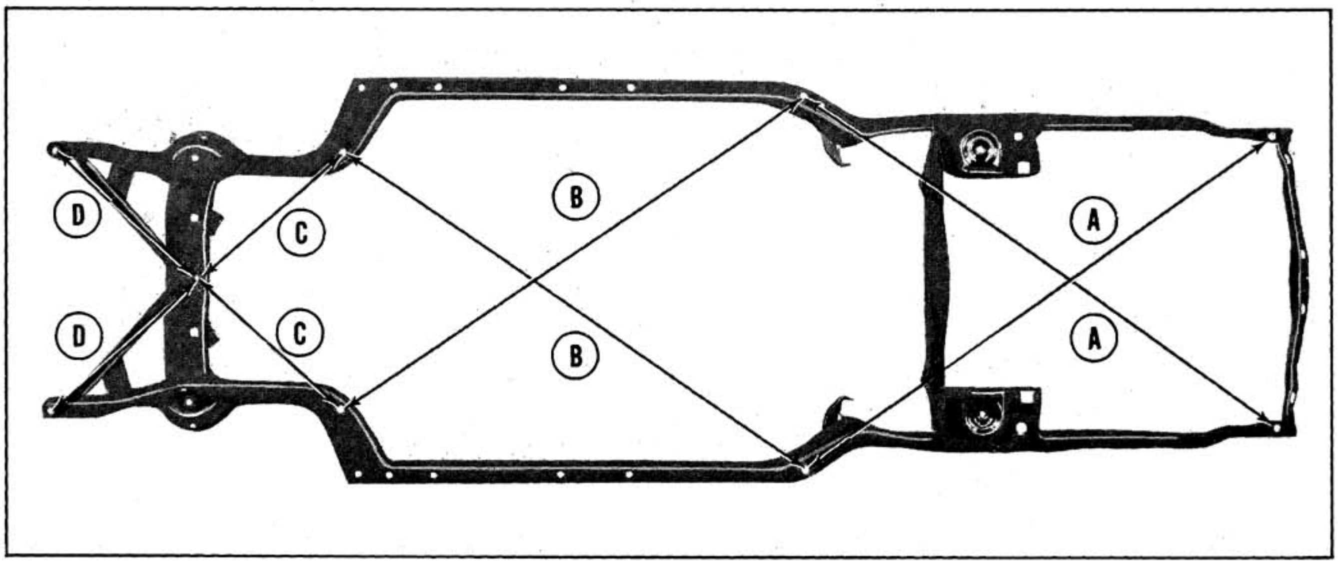


Fig. 15-2 Frame Alignment Diagram

4. Measure D-D. If not equal, the frame horns are misaligned.

STRAIGHTENING FRAME

In case of collision, frame members can often be satisfactorily straightened to the required limits. However, the front suspension cross-member is made to unusually close limits necessary for proper front wheel alignment; therefore, straightening of this unit may not be successful.

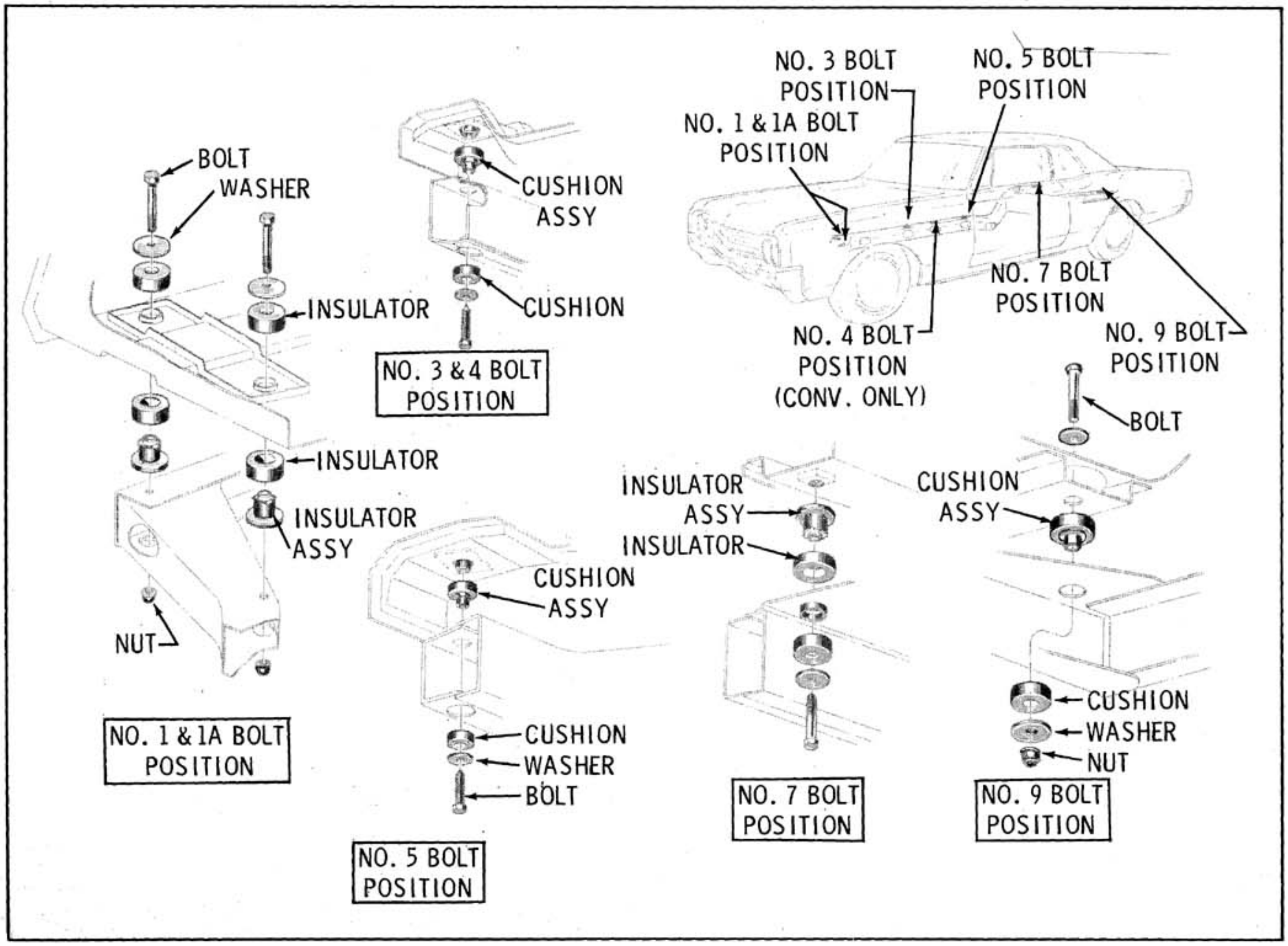


Fig. 15-3 Body Mounts

It is possible that the ordinary straightening methods will suffice for minor damage to the front suspension crossmember; however, in case of serious damage or fracture, the entire front suspension crossmember must be replaced. Before the member is replaced, it is essential that the frame alignment be checked, and corrected if necessary.

Whenever possible, frame members should be securely fastened with hot rivets. In case riveting equipment is not available, finished bolts snugly fitted in reamed holes may be used. The nuts should be securely tightened and lockwashers used, care being taken that washers do not spread. (Cold driven rivets are not recommended unless the heavy power press equipment necessary to make secure fastening is available).

After frame members are riveted or bolted securely, all welded joints and areas that were cut to permit removal of a frame member should be welded.

When the frame repair is completed and inspected, the various parts of the suspension may be assembled.

BODY MOUNTS

To minimize vibration and noise, the body mounts must be properly torqued. Body mounts which are not tightened sufficiently will cause body "chucking" and damage to the insulators. If body mounts are tightened excessively, the cushion effect of the insulators is impaired resulting in squeaks and body "drumming". Body mount bolts and studs must be torqued to 45 ft. lbs.

For installation of body mounts, refer to Fig. 15-3.

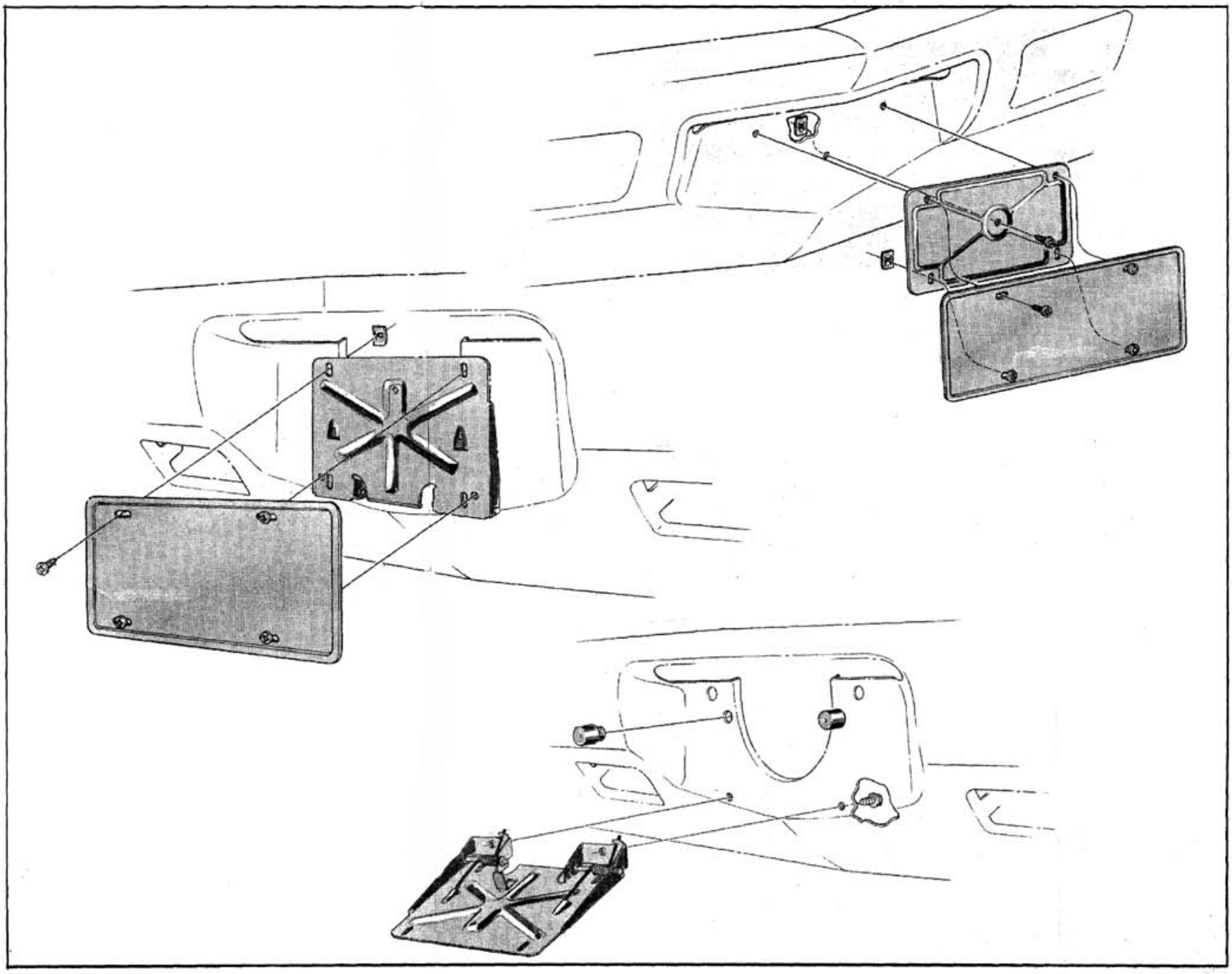


Fig. 15-4 License Plate Attachment

BUMPERS
(Figs. 15-5, 15-6, 15-7 and 15-8)

BUMPER ALIGNMENT

Vertical, horizontal, fore and aft, and angular alignment of the front and rear bumper assemblies is provided for through the use of elongated holes in the bumper to bracket and bracket to frame.

NOTE: The front bumper bracket to frame bolts are serrated. To make fore and aft adjustments, the nuts must be loosened and the bolt tapped until serrations are clear of frame and bracket. Then position bumper and tighten nuts.

To align bumpers, loosen bumper bolts and shift bumper to desired position. Make sure that bumpers are horizontal and clearance between bumper and fenders is even on both sides. Torque bolts as indicated under Torque Specifications.

CHASSIS SHEET METAL

HOOD ALIGNMENT

The hood hinge adjustment provides lateral and vertical alignment of the rear edge of the hood in relation to the cowl vent grille.

1. Raise hood and loosen hinge bracket to cowl bolts and the hinge bracket to fender bolt on each side of car. (Fig. 15-9) For fore or aft adjustment, loosen hood hinge to hood bolts.

2. Shift hood until clearances shown in Fig. 15-10 are obtained.

3. Tighten bolts and recheck alignment.

4. The rubber bumpers must be adjusted for alignment of the forward edge of the hood with the forward edge of the fenders. Vertical adjustment can be made by loosening the locknuts on the rubber bumpers and turning bumpers either up or down.

HOOD ASSEMBLY REMOVE AND INSTALL

1. Raise hood and install protective coverings over cowl and fender areas to prevent damage to paint and moldings when removing or installing hood.

2. Disconnect underhood lamp wire.

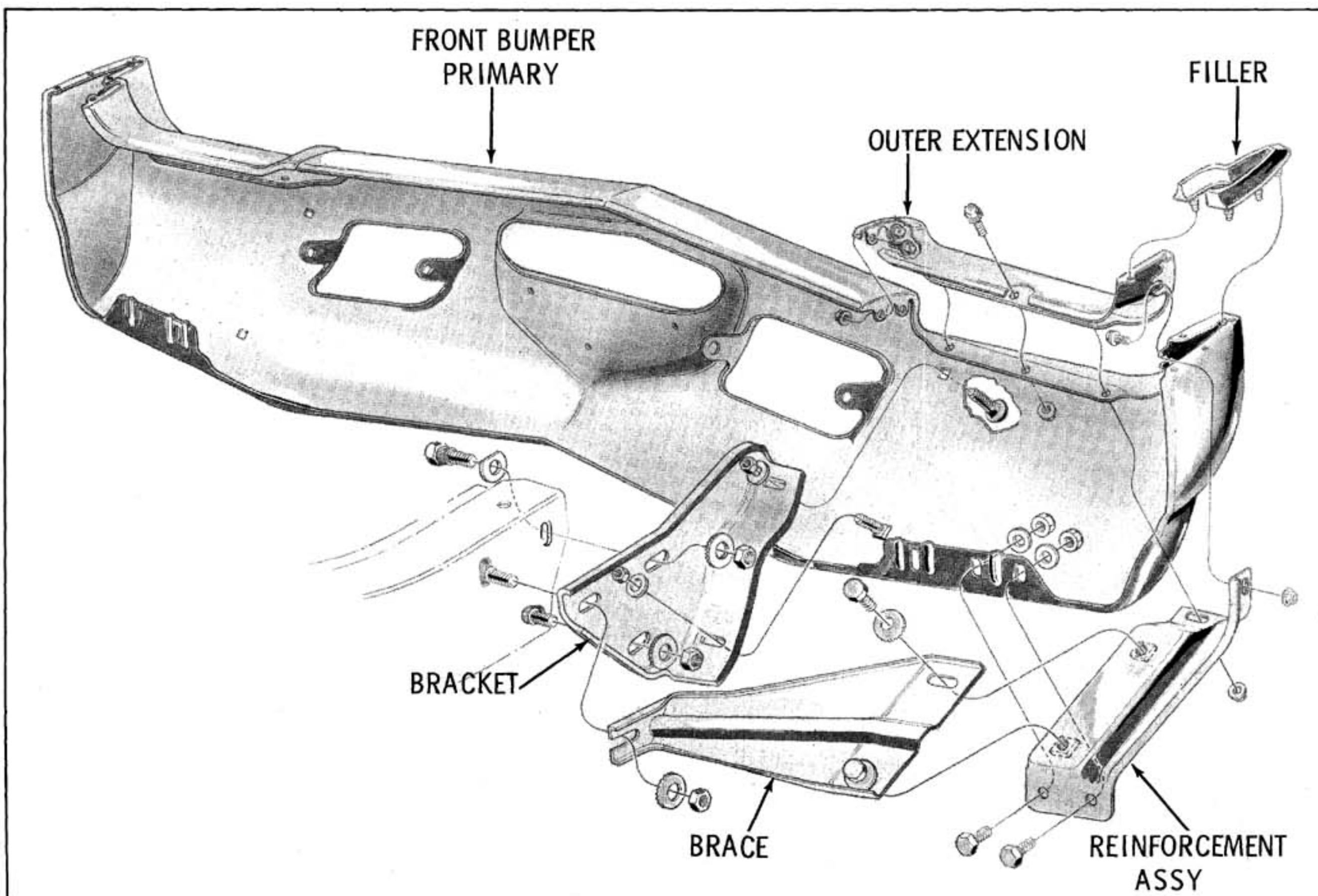


Fig. 15-5 Front Bumper

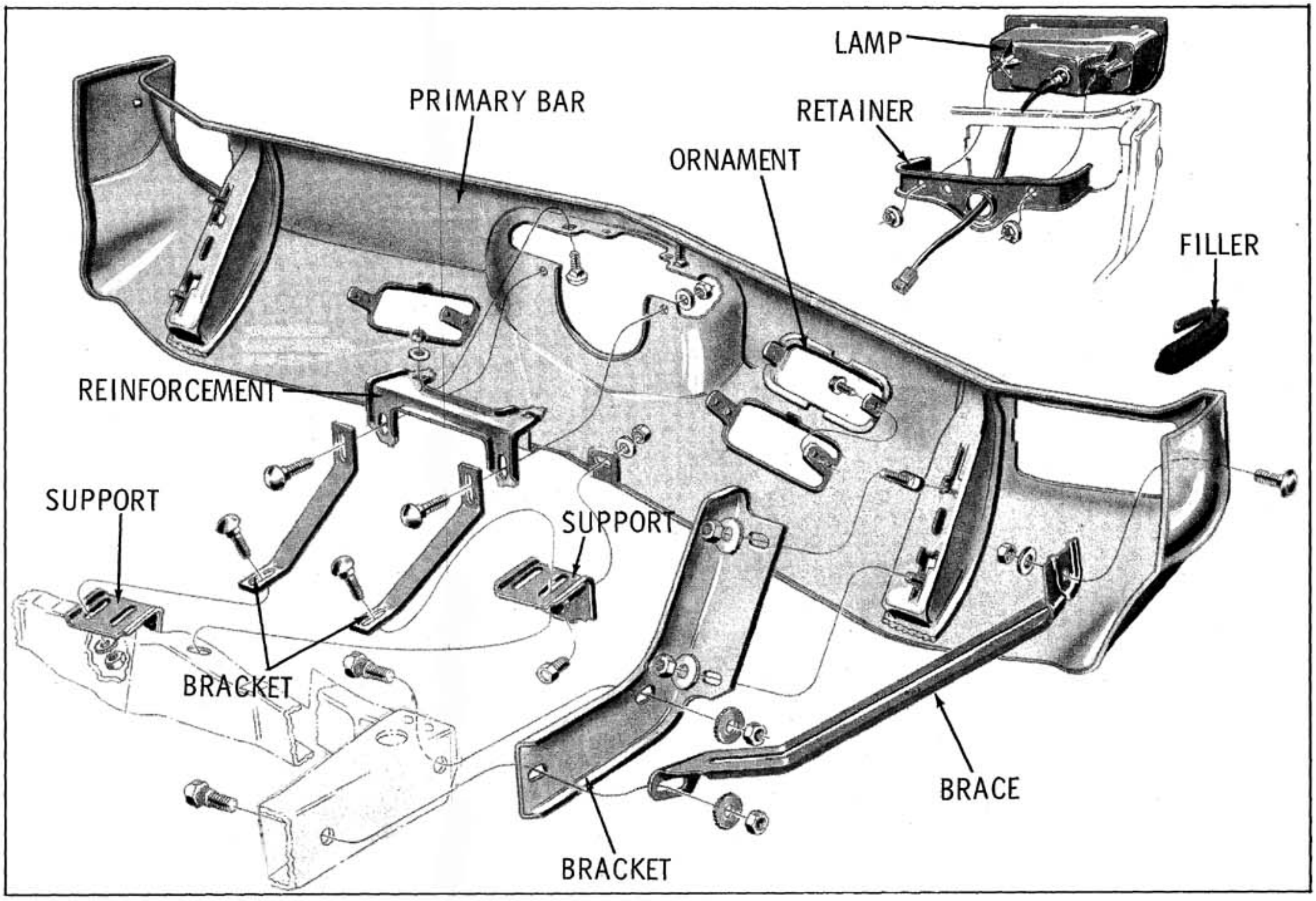


Fig. 15-6 Rear Bumper (52-54-56 and 58 Series)

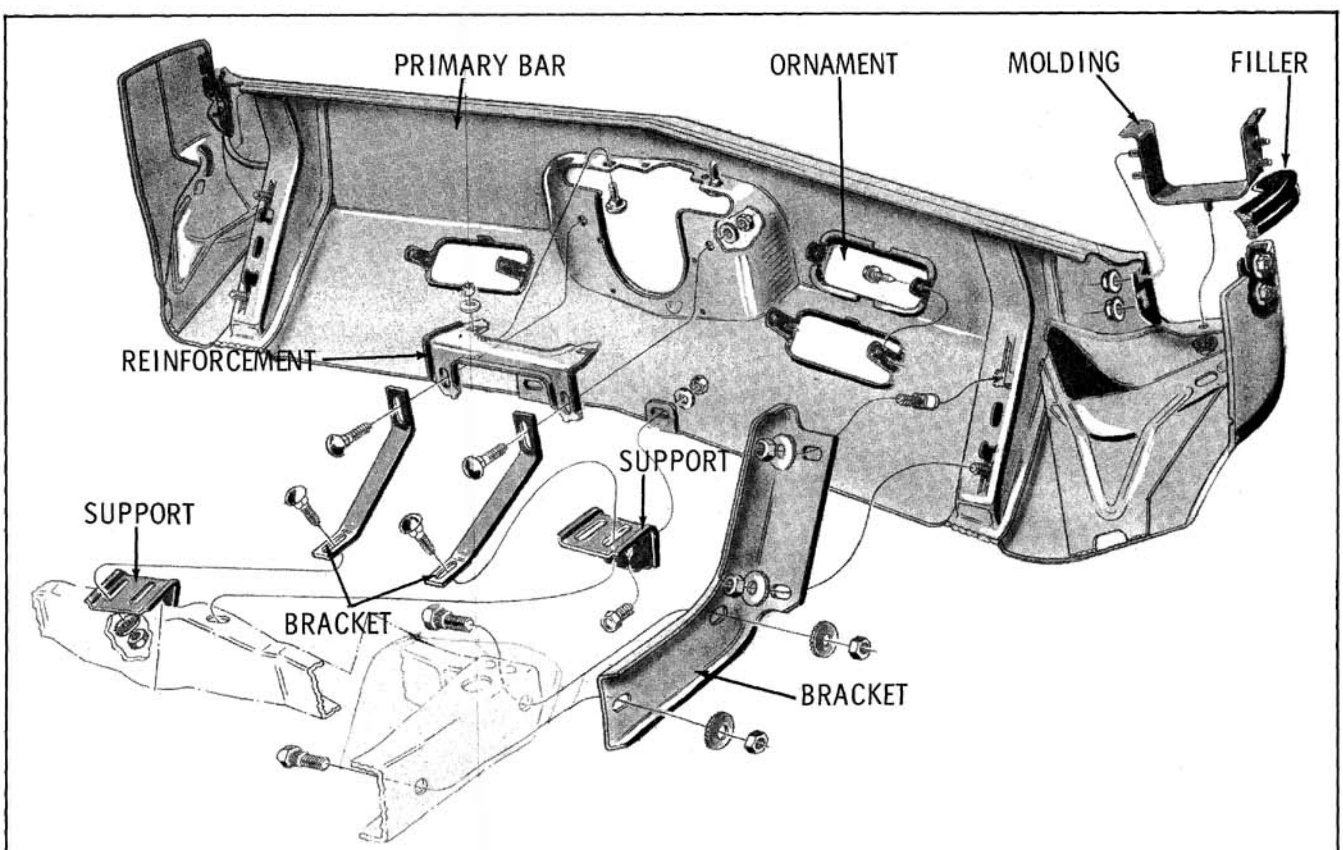


Fig. 15-7 Rear Bumper (84 and 86 Series)

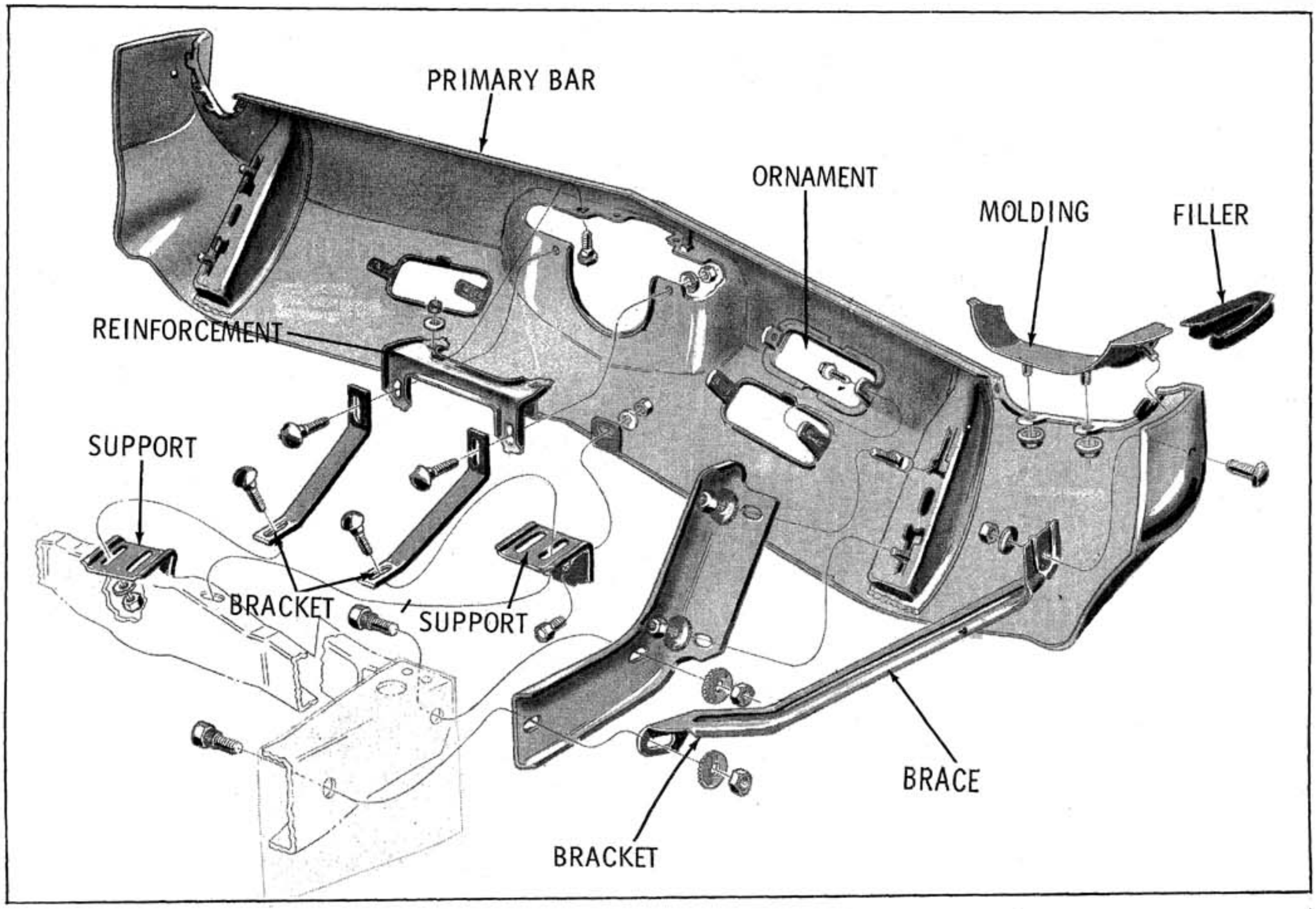


Fig. 15-8 Rear Bumper (66 Series)

3. Mark position of hinge on hood to facilitate alignment on installation.

4. Remove hinge to hood bolts on each side of hood. (Fig. 15-9)

5. While supporting hood, remove mounting stud nuts on each side of hood.

6. Remove hood assembly.

To install, reverse removal procedure and check hood alignment.

If necessary to install a new insulator, apply cement to within two inches of outer edges of insulator and install with smooth side exposed.

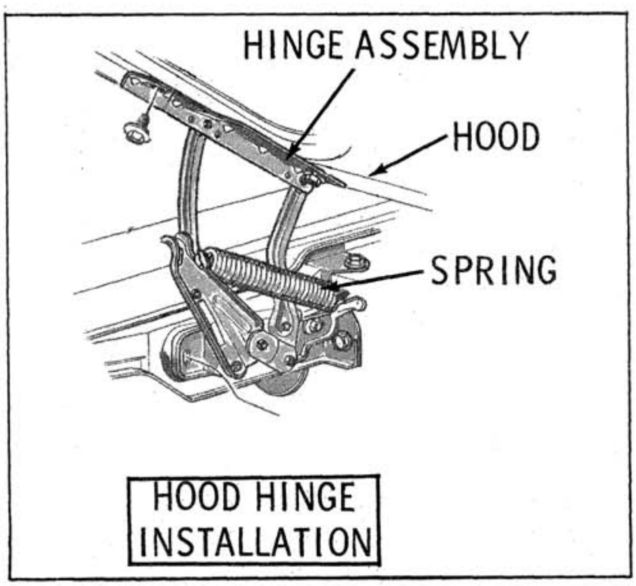


Fig. 15-9 Hood Hinge Attachment

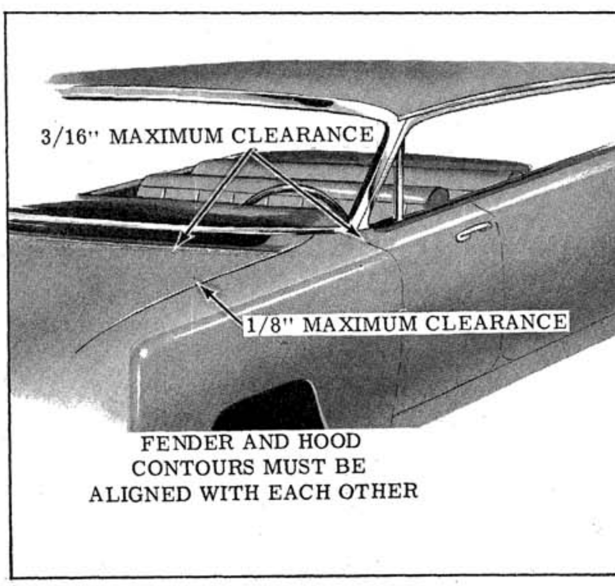


Fig. 15-10 Sheet Metal Clearances

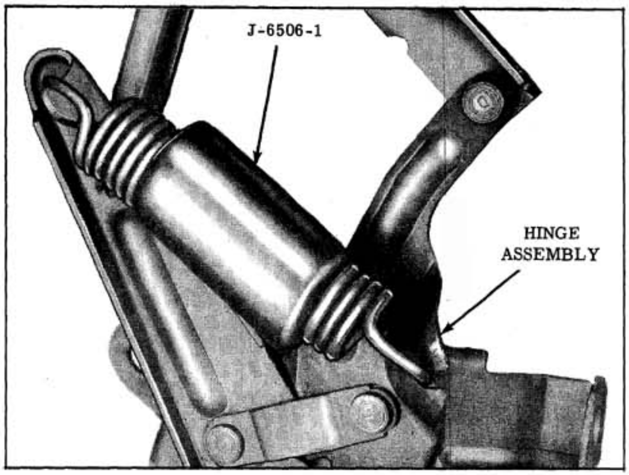


Fig. 15-11 Hinge Spring Tool in Position

NOTE: The mounting holes in the hood hinge bracket are enlarged to provide a slight fore and aft adjustment of the hood panel.

HOOD HINGE SPRING REMOVE AND INSTALL

1. Raise hood just enough to place Tool J-6506-1 over the spring. (Fig. 15-11)

2. Raise hood and remove spring.

   NOTE: When installing new spring, a suitable expander must be used to stretch the spring so that Tool J-6506-1 can be placed over the spring. (Fig. 15-12)

3. Position spring (with tool in place) on hinge.

4. Lower hood slightly to expand spring, then remove Tool J-6506-1.

HOOD HINGE REMOVE AND INSTALL (With Spring Removed)

1. Mark the hinge outline on the cowl to facilitate alignment on installation.

2. While supporting hood, remove the hinge to hood bolts and nut, then remove the hinge to cowl and fender bolts.

To install, apply auto body caulking compound around cowl bolt holes and reverse removal procedure. Align hood after hinge is installed.

HOOD MOLDINGS AND LETTERS

The hood moldings and letters are attached by self-threading nuts which are accessible from the underside of the hood.

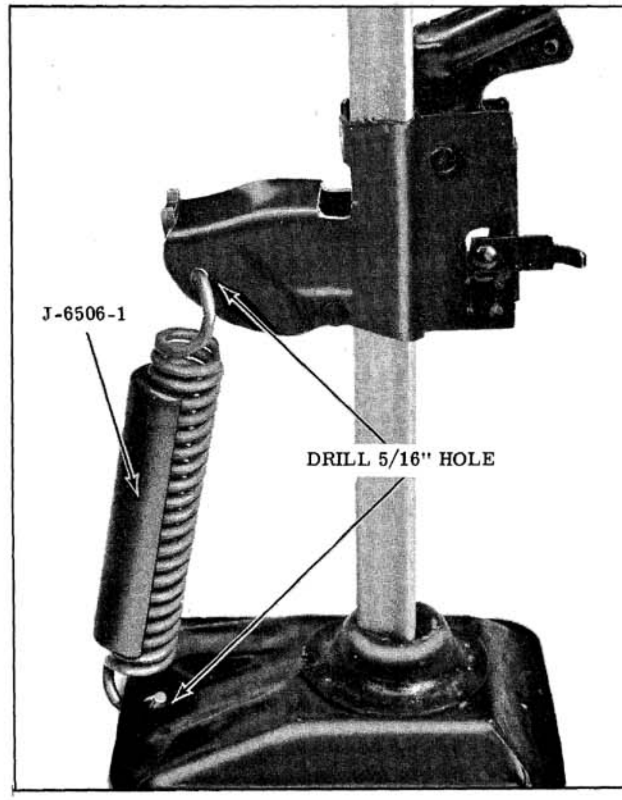


Fig. 15-12 Installing Hinge Spring Tool

COWL VENT GRILLE

REMOVE AND INSTALL

1. Remove windshield wiper arms.

2. Raise hood and remove five cowl vent grille to cowl screws.

3. Remove cowl vent grille.

To install, apply a medium-bodied sealer around vent grille attaching screw holes and vent grille tab slots in cowl, also be sure anti-squeak tape is installed on both ends of the grille. Then, carefully slide grille rearward to engage rear edge of grille between windshield lower reveal moldings and molding attaching clips and reverse removal procedure.

FENDER

REMOVAL (Fig. 15-13)

Before removing and installing a fender, painted areas and moldings adjacent to the fender should be covered for protection against scratches. When installing a fender, it is important that all anti-squeaks and seals be reinstalled. If the anti-squeaks and seals are damaged, they should be replaced.

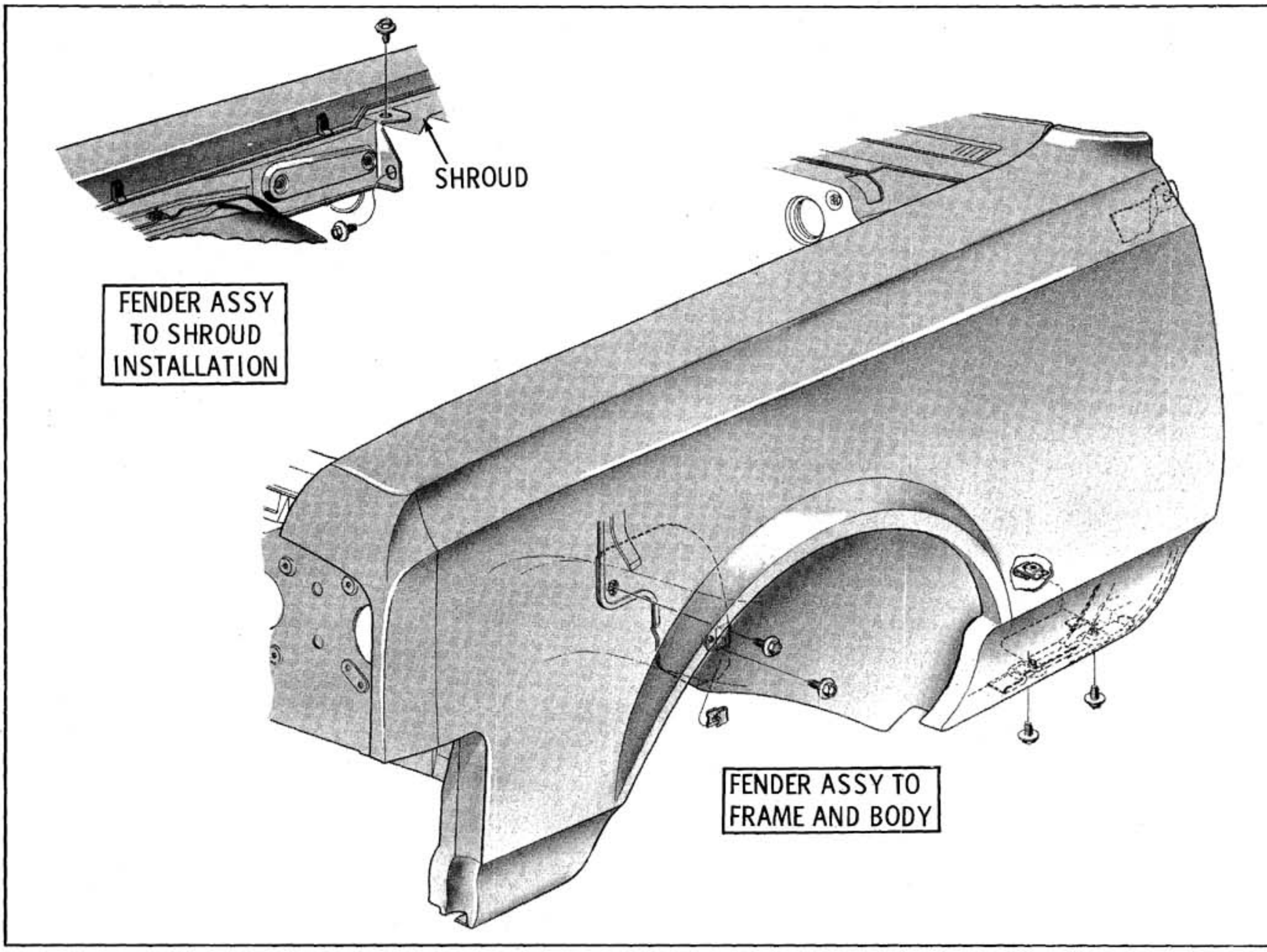


Fig. 15-13 Front Fender Attachment

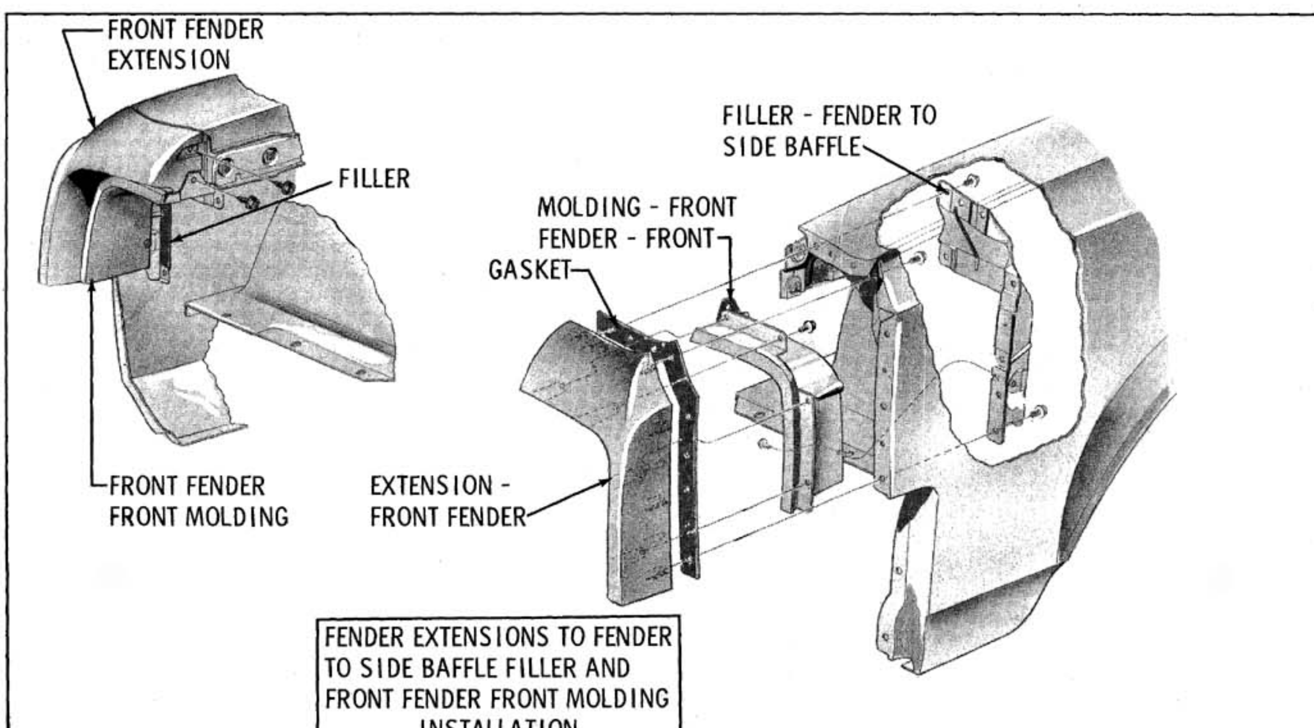


Fig. 15-14 Front Fender Extension Attachment

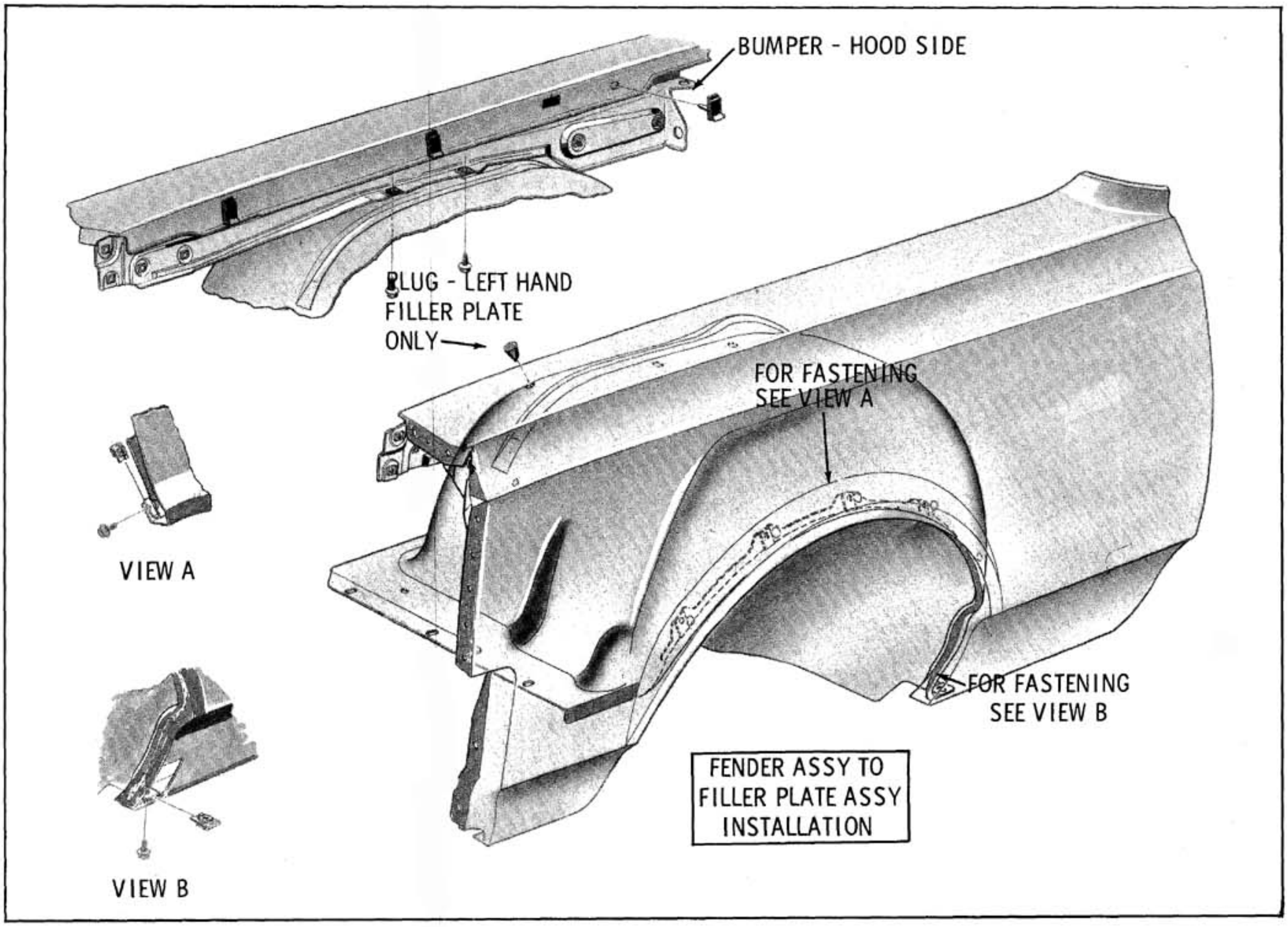


Fig. 15-15 Fender Filler Plate Installation

FENDER ALIGNMENT

The holes in the fenders are enlarged to permit adjustment. When making installation, fender should first be placed firmly into position, and before replacing any bolts, make sure the rear edge of the fender matches the contour of the door. (This adjustment is made by positioning fender in or out at upper and lower attachment by using shims as required.) After this contour adjustment, install and tighten all fender bolts just enough to permit shifting as required. After fender is properly positioned, tighten all attaching screws and bolts.

FENDER FILLER PLATE (Fig. 15-15)

All necessary wiring and parts should be disconnected or removed before removing the fender filler plate. It is important that all seals and anti-squeaks be checked and replaced, if necessary, before installing.

When removing a fender, the baffle assembly unless damaged, should be left attached to the fender filler plate. If the baffle has been damaged and a new fender and baffle plate is to be installed, alignment of mounting holes is made easier by attaching the baffle to the filler plate first. After the fender has been installed, the baffle plate can be bolted to the fender.

Fender Moldings and Script (Figs. 15-16, 15-17, 15-18, 15-19, 15-20, 15-21 and 15-22)

To remove the fender side molding(s), it is necessary to loosen the fender at the cowl, disconnect it at the lower bracket, then move fender outward to reach the rear molding attaching nuts.

NOTE: Brush a thick application of sealer over studs and nuts of moldings and scripts after assembly.

RADIATOR SUPPORT AND BAFFLES

For construction and assembly details, refer to Figs. 15-23, 15-24 and 15-25.

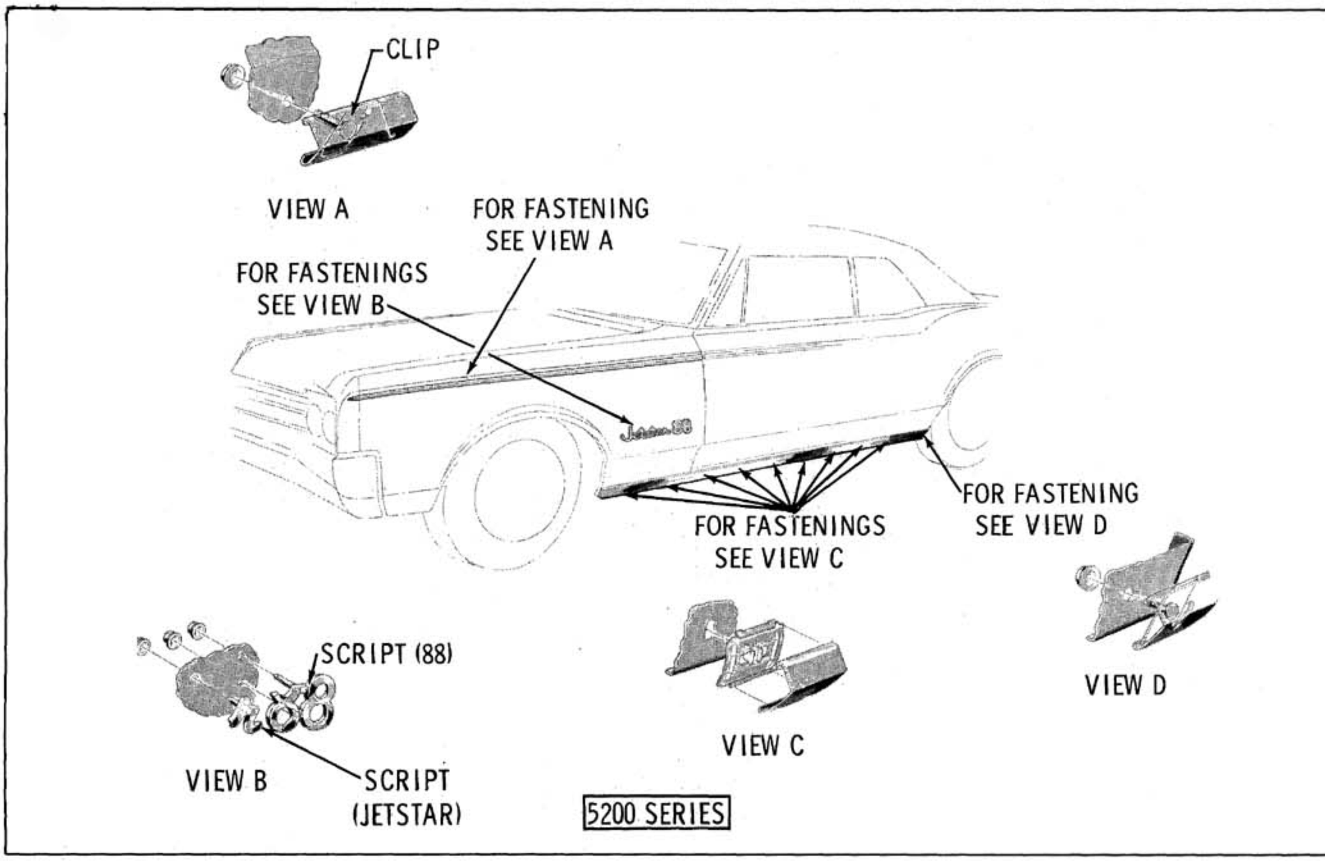


Fig. 15-16 Fender Moldings (52 Series)

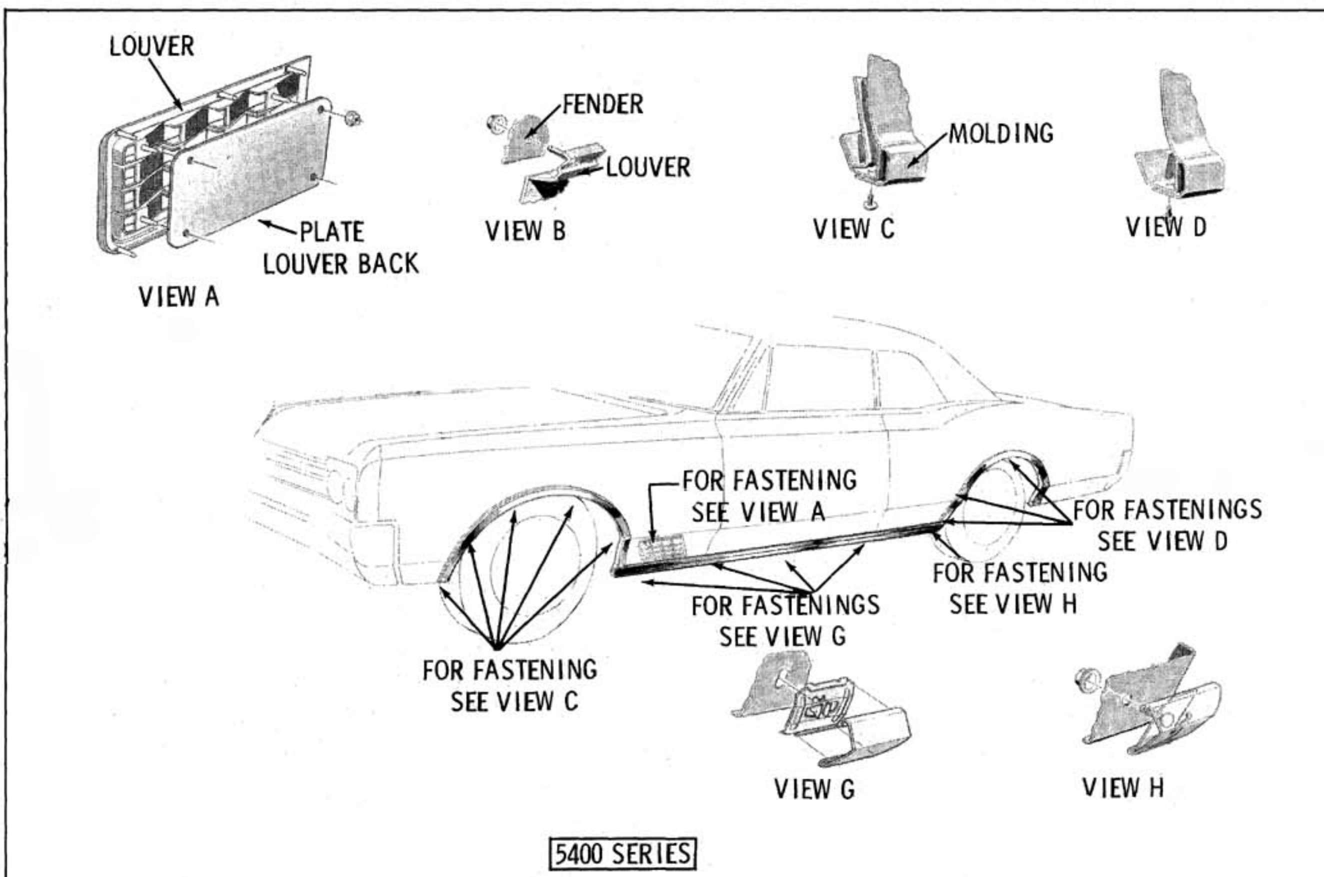


Fig. 15-17 Fender Moldings (54 Series)

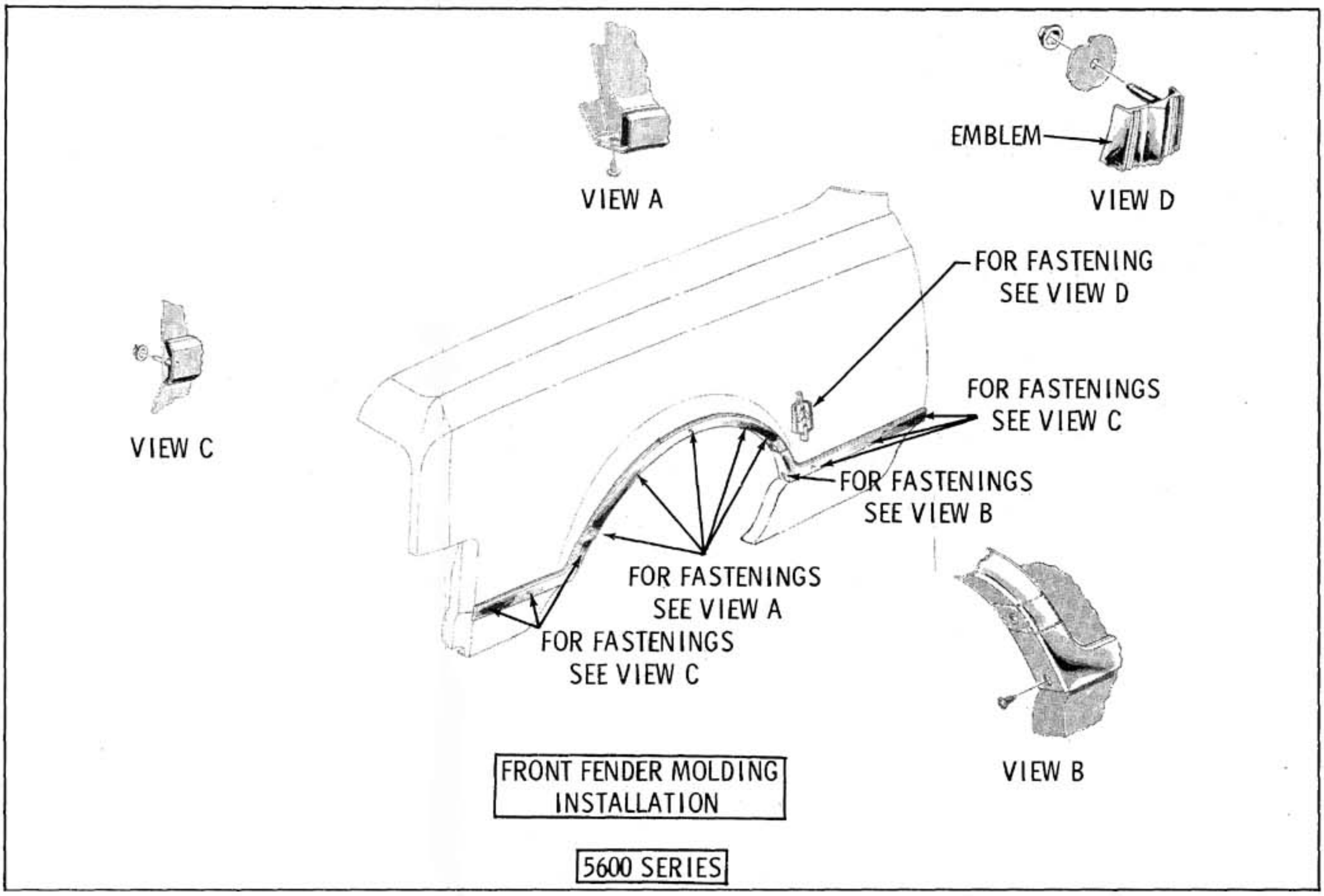


Fig. 15-18 Fender Moldings (56 Series)

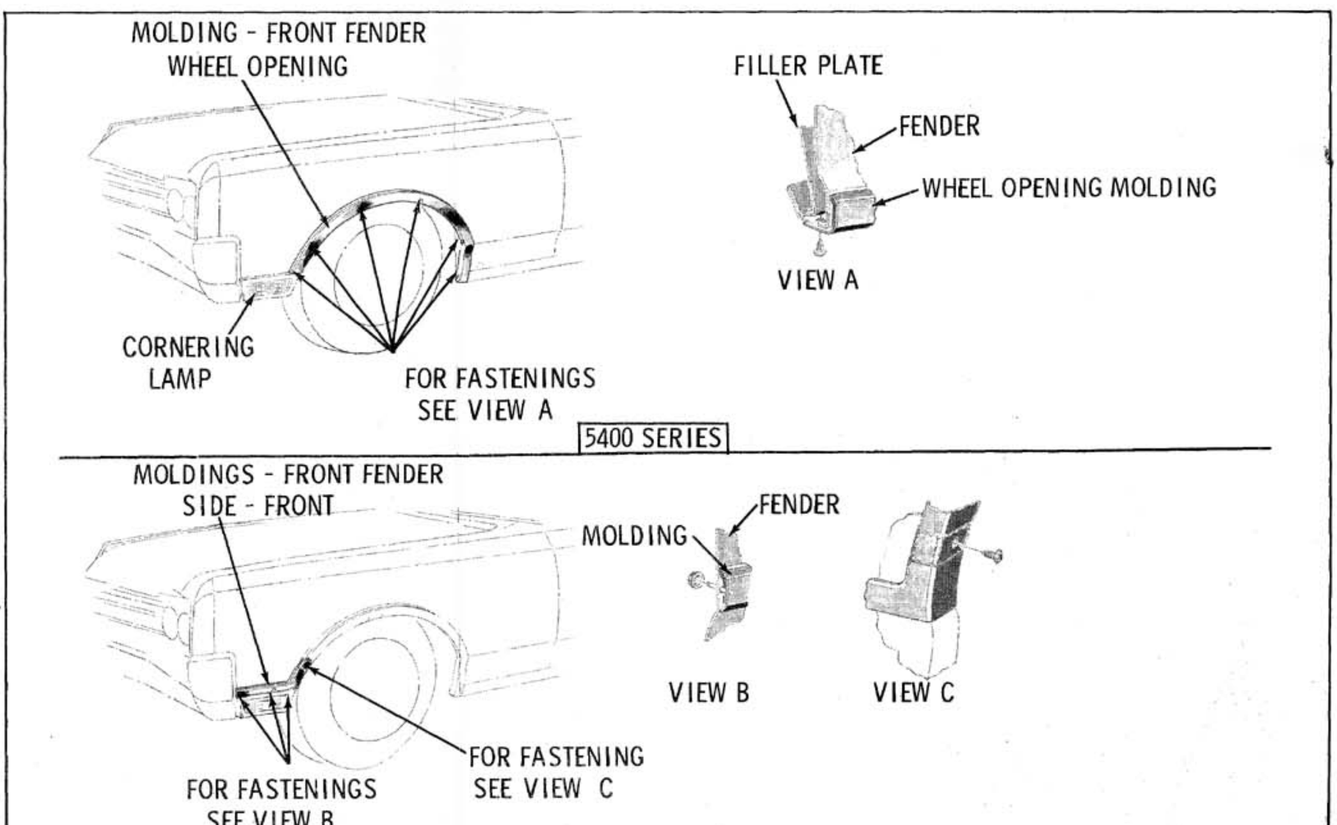


Fig. 15-19 Fender Moldings

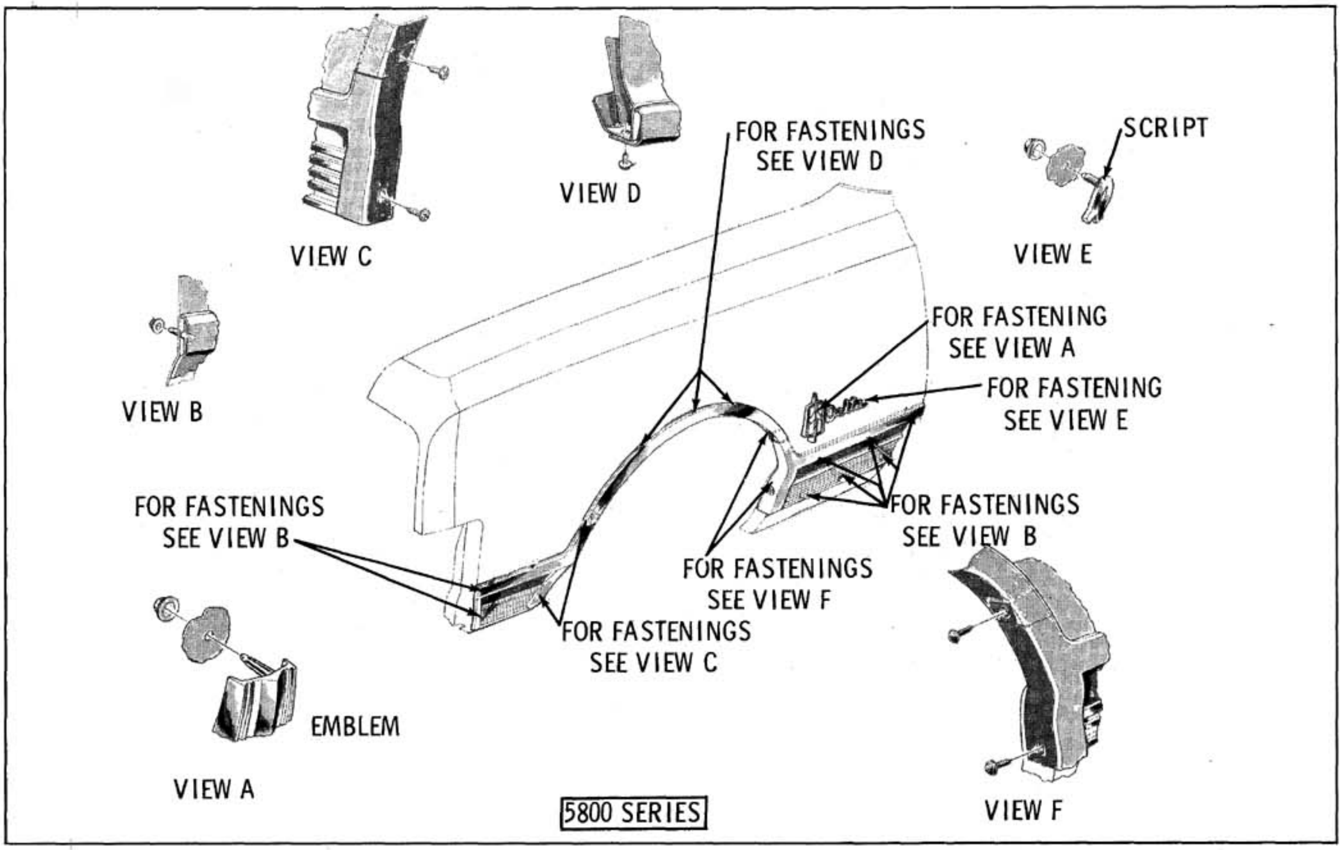


Fig. 15-20 Fender Moldings (58 Series)

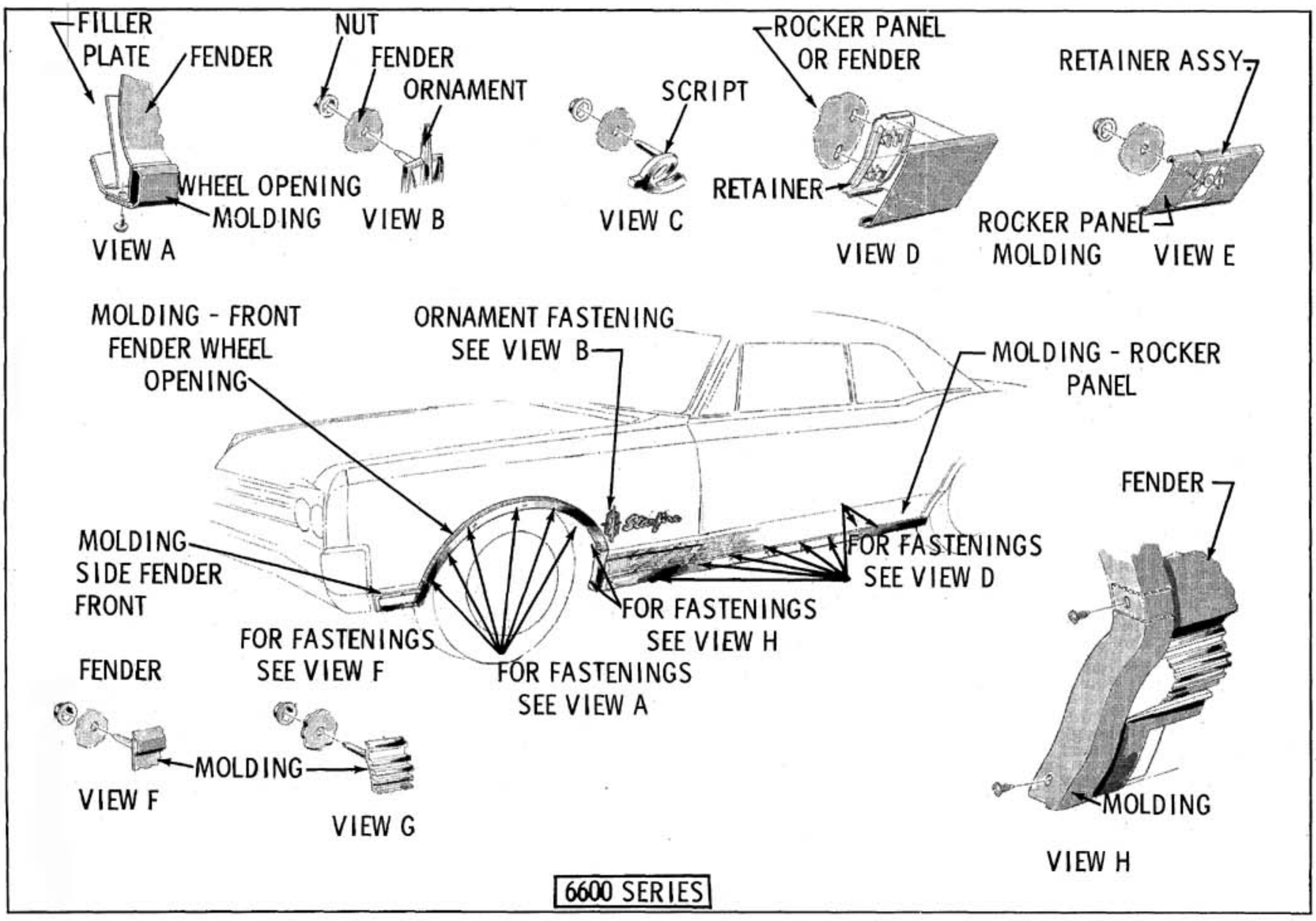


Fig. 15-21 Fender Moldings (66 Series)

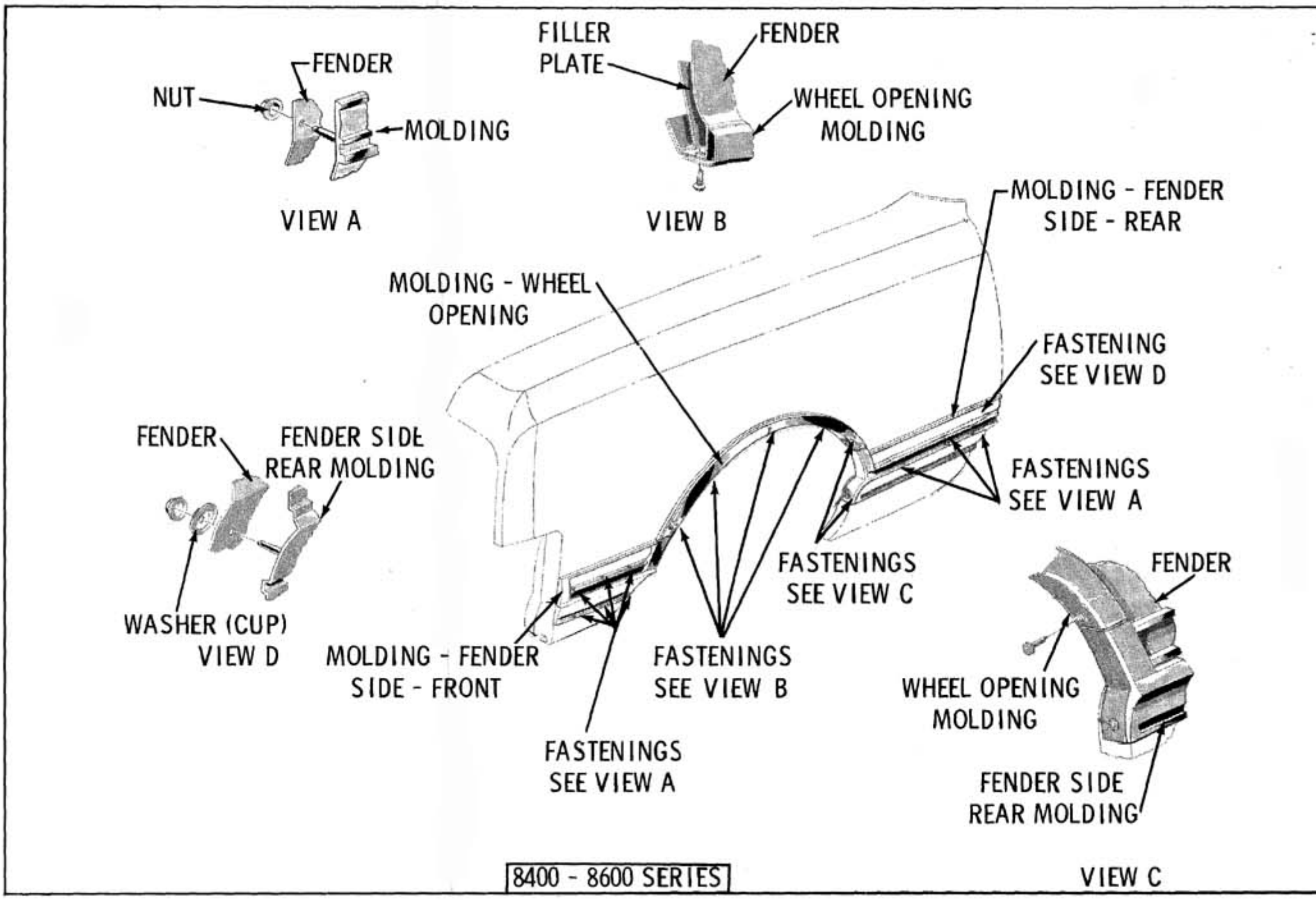


Fig. 15-22 Fender Moldings (84 and 86 Series)

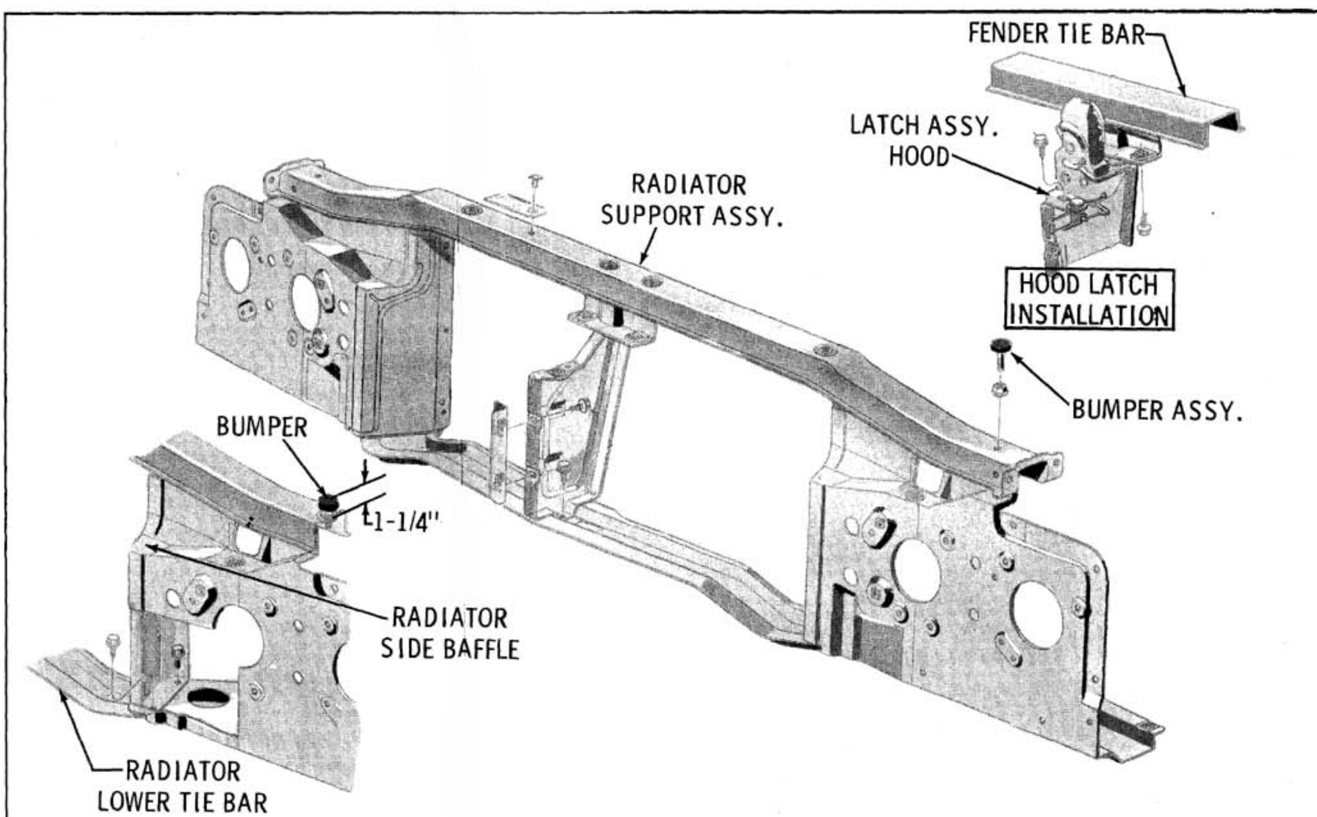


Fig. 15-23 Radiator Support

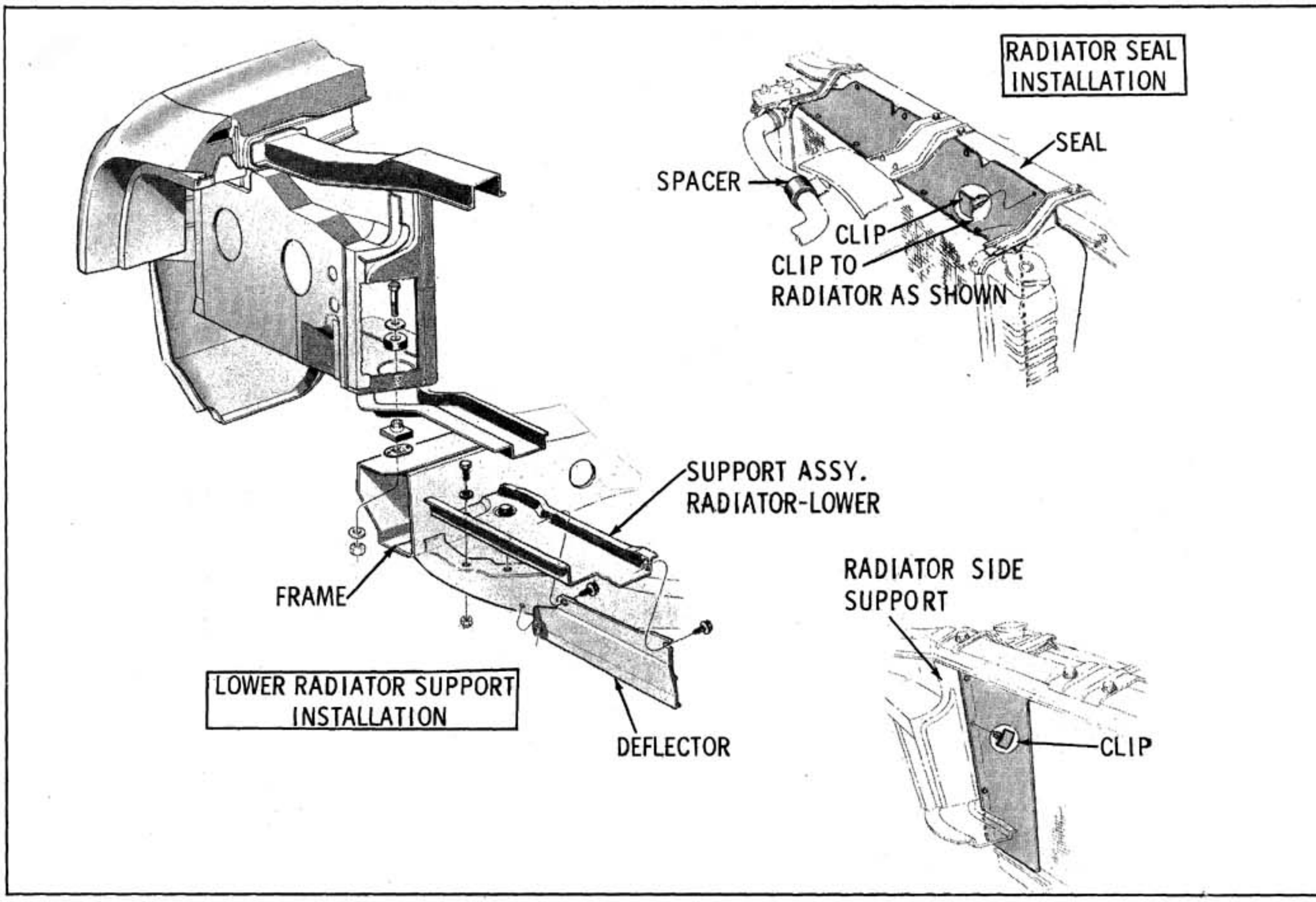


Fig. 15-24 Radiator Support

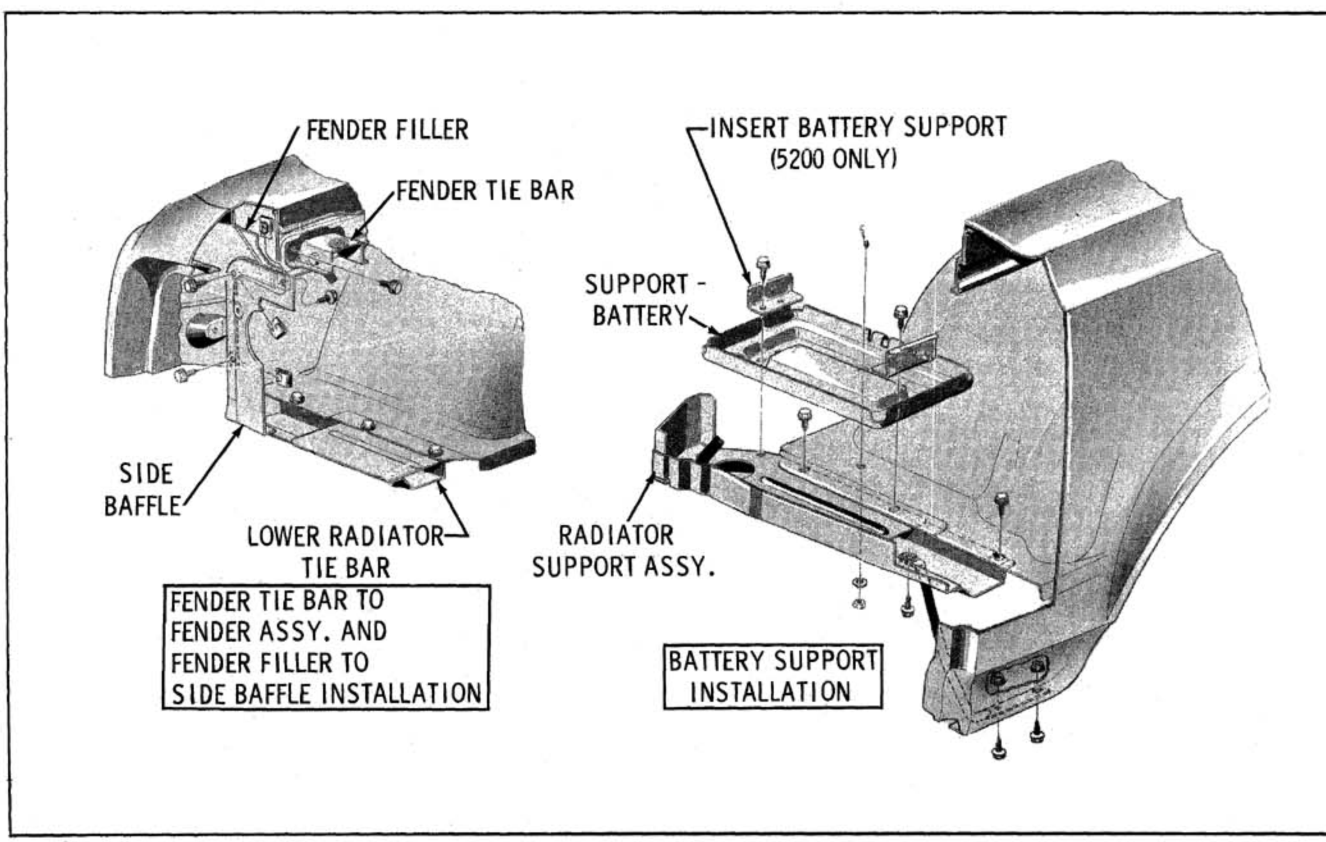


Fig. 15-25 Radiator and Battery Support

GRILLE ASSEMBLY

HEADLAMP HOUSINGS (Figs. 15-26, 15-27 and 15-28)

The headlamp housings are retained by self-tapping sheet metal screws. To remove housing it is not necessary to remove the headlamp assemblies.

To install, reverse removal procedure. Check headlamp aim and adjust if necessary.

GRILLE (Figs. 15-26, 15-27 and 15-28)

The grilles are of one-piece construction held in place by bolts.

HOOD INSULATOR AND MOLDING (Fig. 15-29)

ROCKER PANEL MOLDING

The moldings are retained by screws and clips which are accessible.

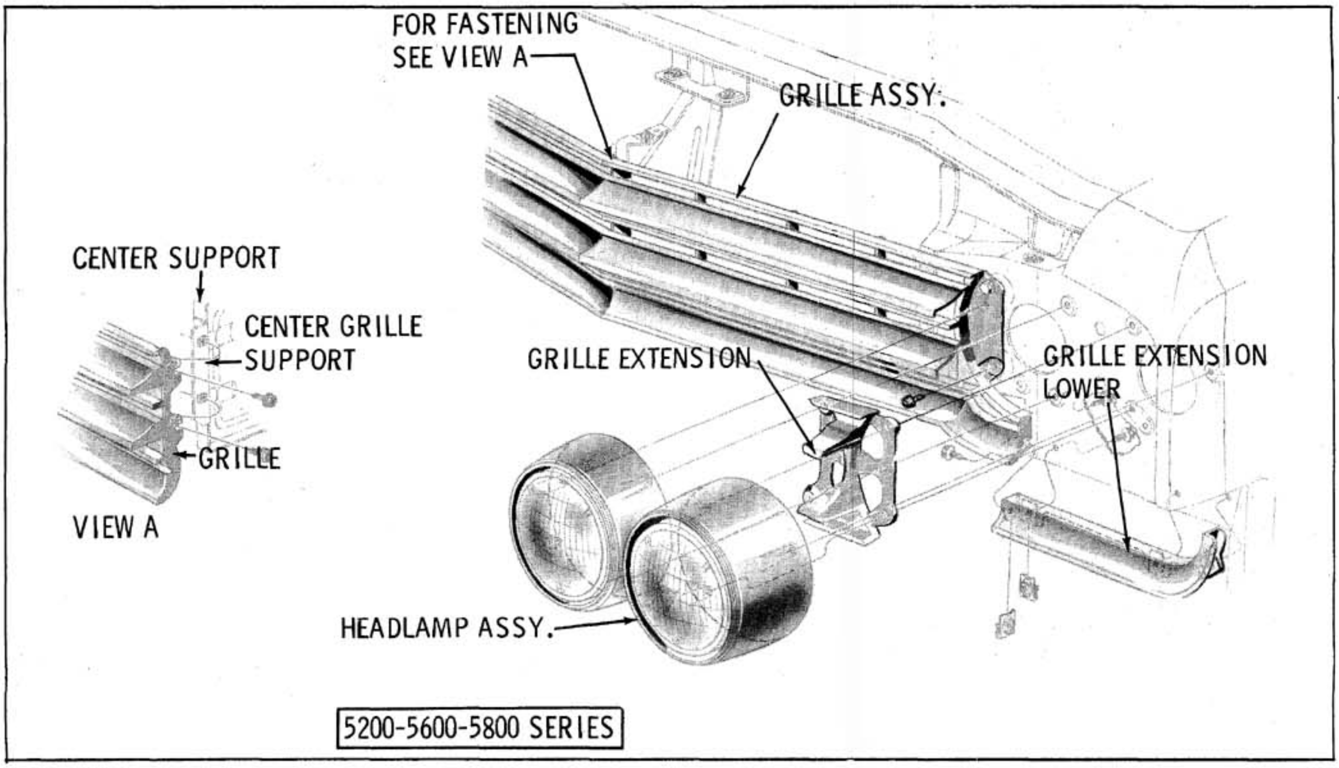


Fig. 15-26 Grille (52-56 and 58 Series)

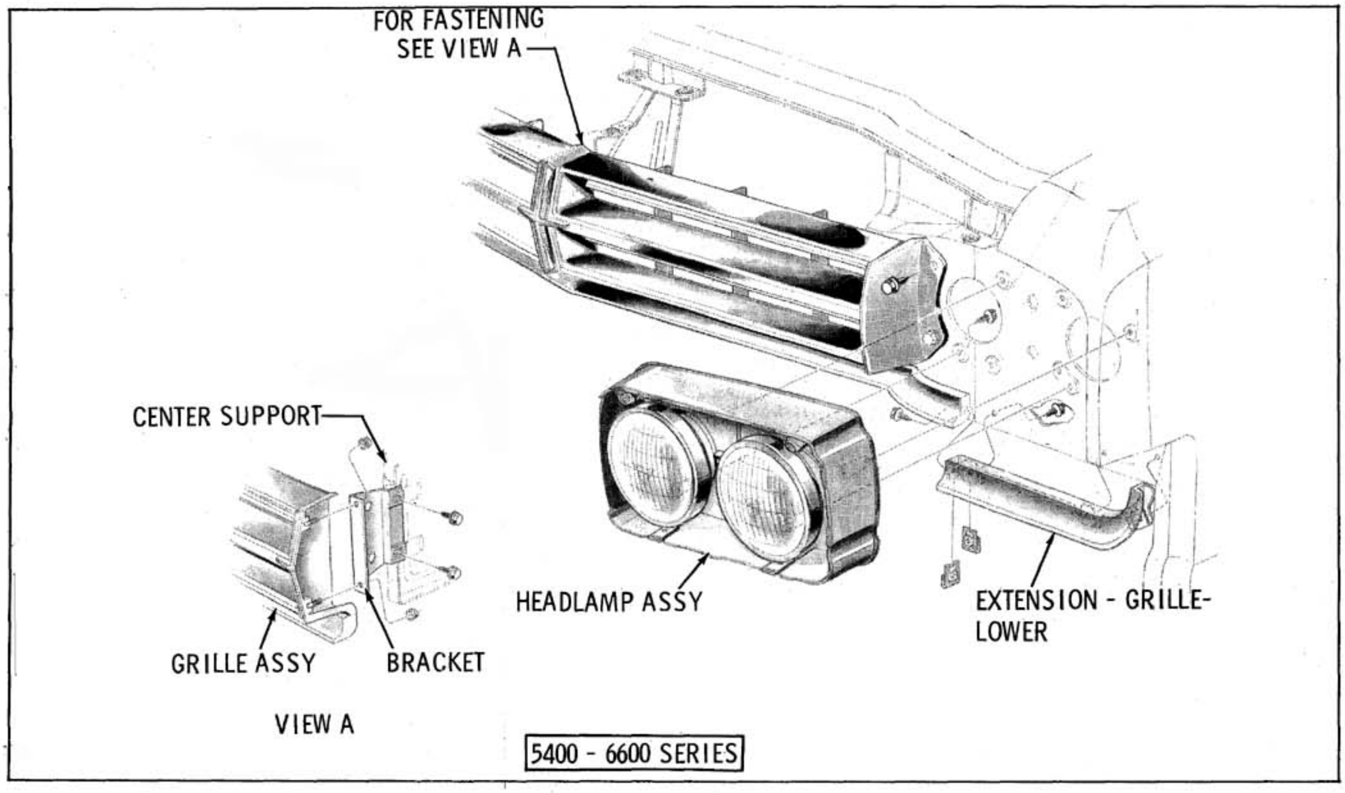


Fig. 15-27 Grille (54 and 66 Series)

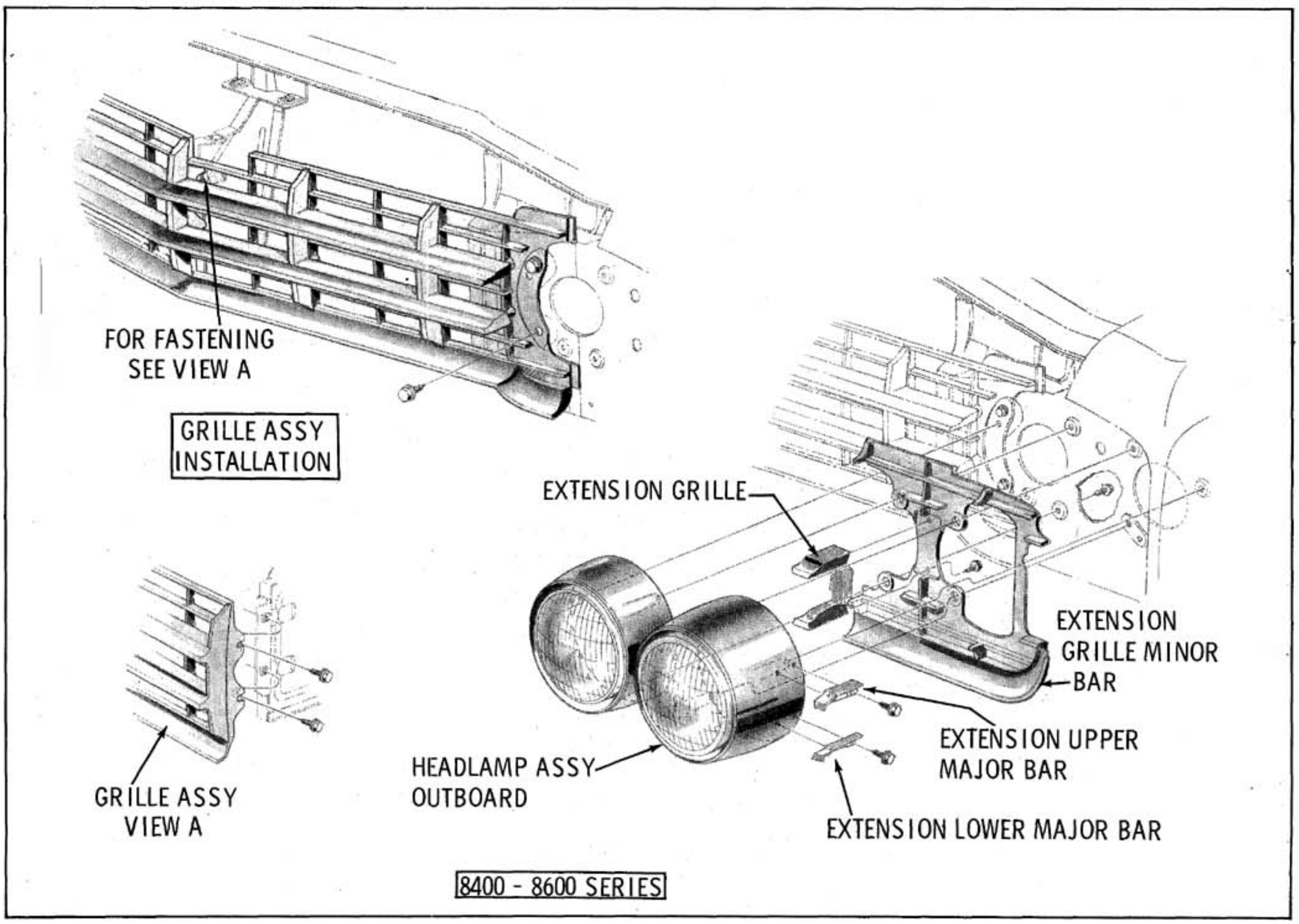


Fig. 15-28 Grille (84 and 86 Series)

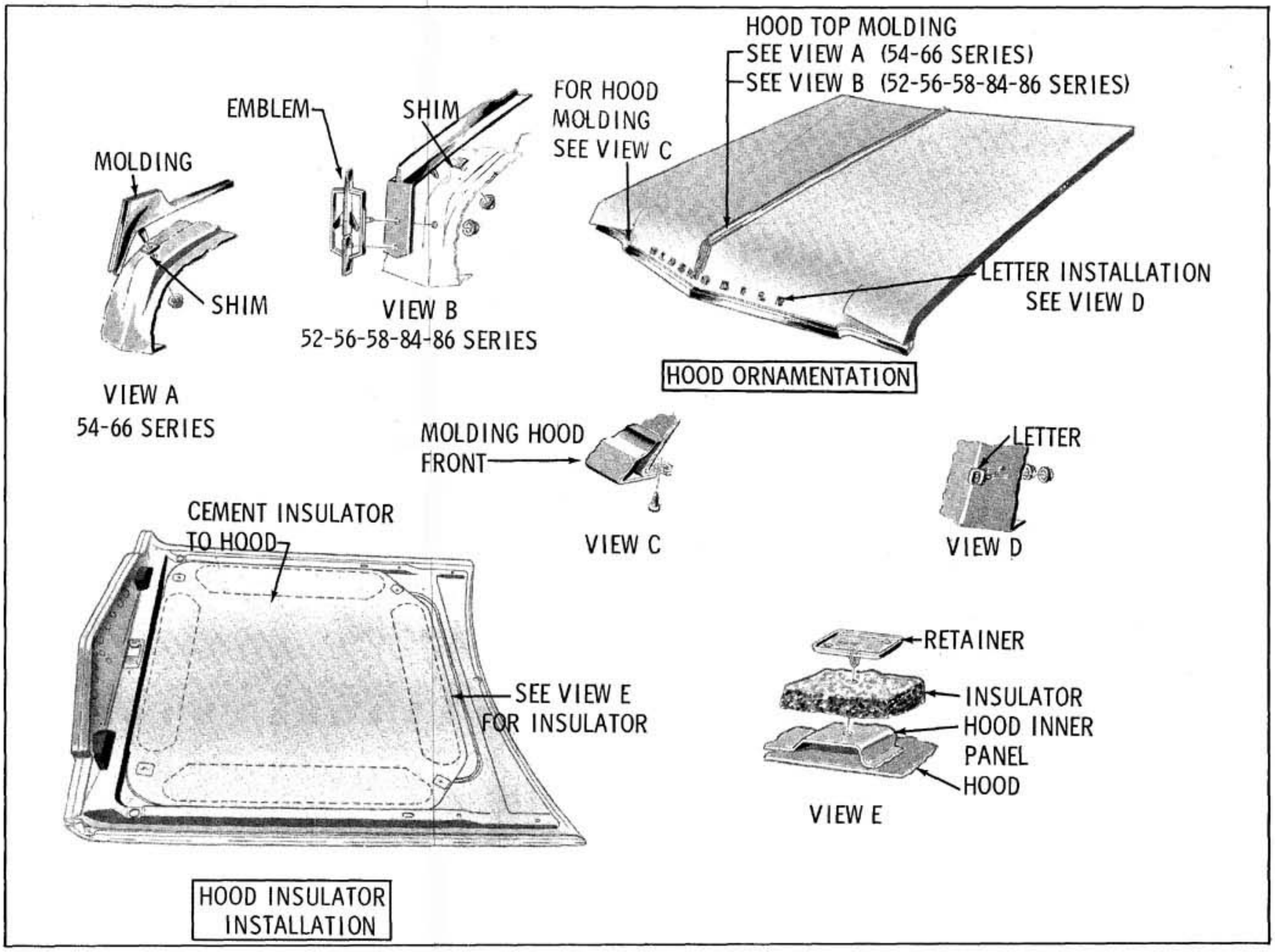


Fig. 15-29 Hood Insulator and Moldings

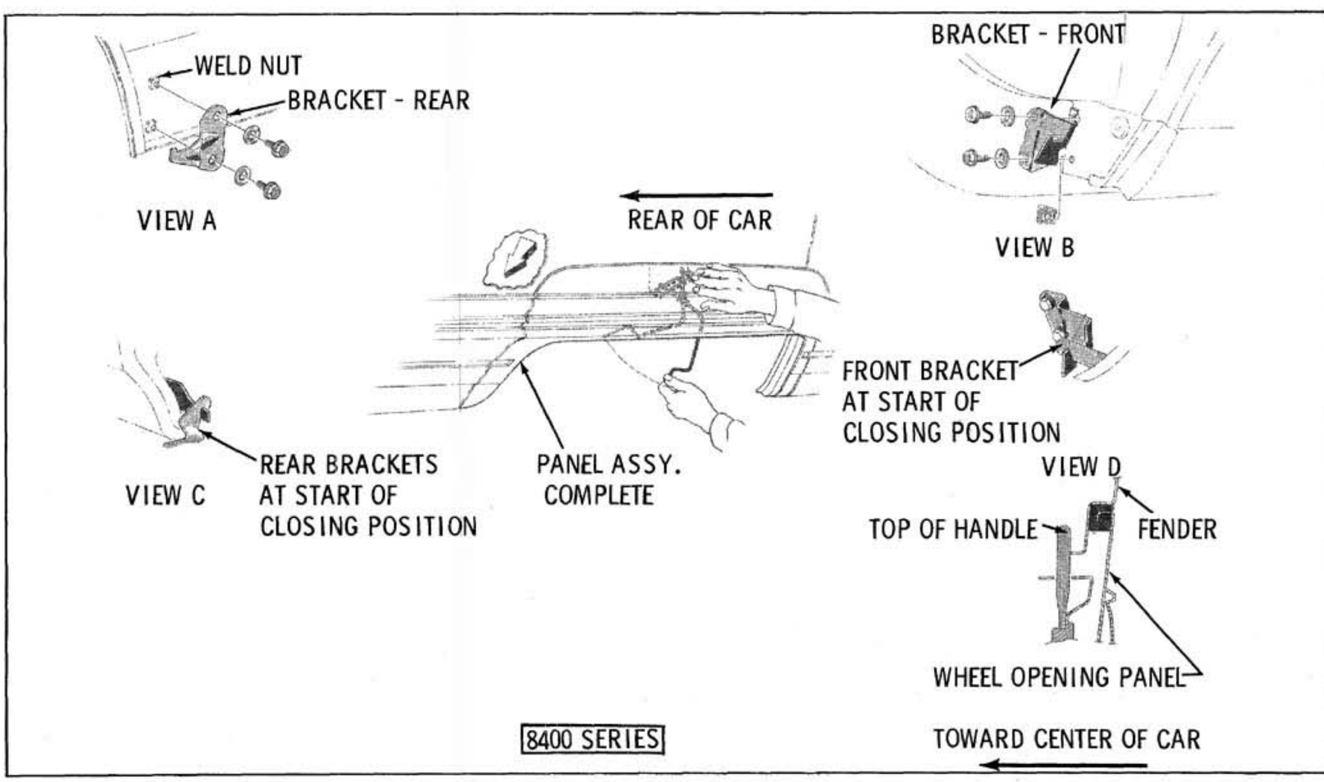


Fig. 15-30 Fender Panels (84 Series)

BUMPER TORQUE SPECIFICATIONS

NOTE: Specified torque is for installation of parts only. Checking of torque during inspection may be 15% below that specified.

Application	Ft. Lbs.
FRONT BUMPER	
Extensions to Primary Bar	28
Reinforcement to Bracket	80 Min.
Bracket to Frame	80 Min.
Outer Support to Primary Bar	80 Min.
REAR BUMPER	
Back-up Light or Ornament to Bumper	6 Max.
Bumper to Bracket	80 Min.
Bracket to Frame	80 Min.
Center Support to Frame and Inner Support	40

FRAME, BUMPERS AND CHASSIS SHEET METAL

33-34-35-36 & 38 SERIES

CONTENTS OF SECTION 15

FRAME

When supporting car on a floor jack or floor stands, the car should be supported at the suspension points only. Under no conditions should the car be supported at the extreme ends of frame or at the center of a frame side rail.

When using a frame contact hoist, the car should be lifted at the points indicated in Fig. 15-101.

CHECKING FRAME ALIGNMENT

The diagram shown in Fig. 15-101 can be used to check the alignment of a car frame that has been distorted.

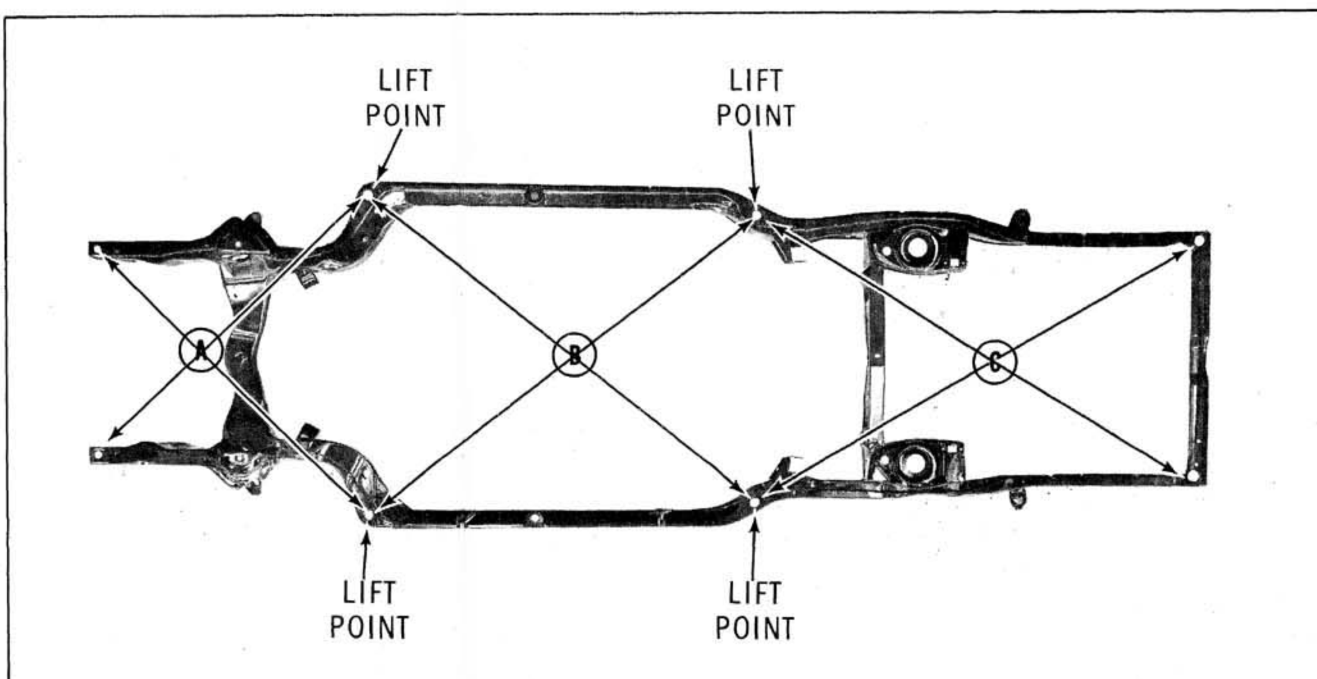


Fig. 15-101 Frame Alignment Diagram

The reference points indicated in the illustration are to be checked with a tram gauge. The dimensions between the various reference points will show where straightening operations are necessary.

NOTE: Corresponding measurements must be equal within 1/4".

1. Measure A-A. If not equal, front crossmember is misaligned.

2. Measure B-B. If not equal, center portion of frame is misaligned.

3. Measure C-C. If not equal, then rear end of frame is misaligned.

STRAIGHTENING FRAME

In case of collision, frame members can often be satisfactorily straightened to the required limits. However, the front suspension crossmember is made to unusually close limits necessary for proper front wheel alignment; therefore, straightening of this unit may not be successful.

It is possible that the ordinary straightening methods will suffice for minor damage to the front suspension crossmember; however, in case of serious damage or fracture, the entire front suspension crossmember must be replaced. Before the member is replaced, it is essential that the frame alignment be checked, and corrected if necessary.

Whenever possible, frame members should be securely fastened with hot rivets. In case riveting equipment is not available, finished bolts snugly fitted in reamed holes may be used. The nuts should be securely tightened and lockwashers used, care being taken that washers do not spread. (Cold driven rivets are not recommended unless the heavy power press equipment necessary to make secure fastening is available.)

After frame members are riveted or bolted securely, all welded joints and areas that were cut to permit removal of a frame member should be welded.

When the frame repair is completed and inspected, the various parts of the suspension may be assembled.

BUMPERS

FRONT (Fig. 15-102)

REMOVAL AND INSTALATION

Disconnect both parking lamps. Remove two bolts on each side retaining bumper brackets-to-frame and remove bumper assembly. Bumper alignment is provided for through the elongated

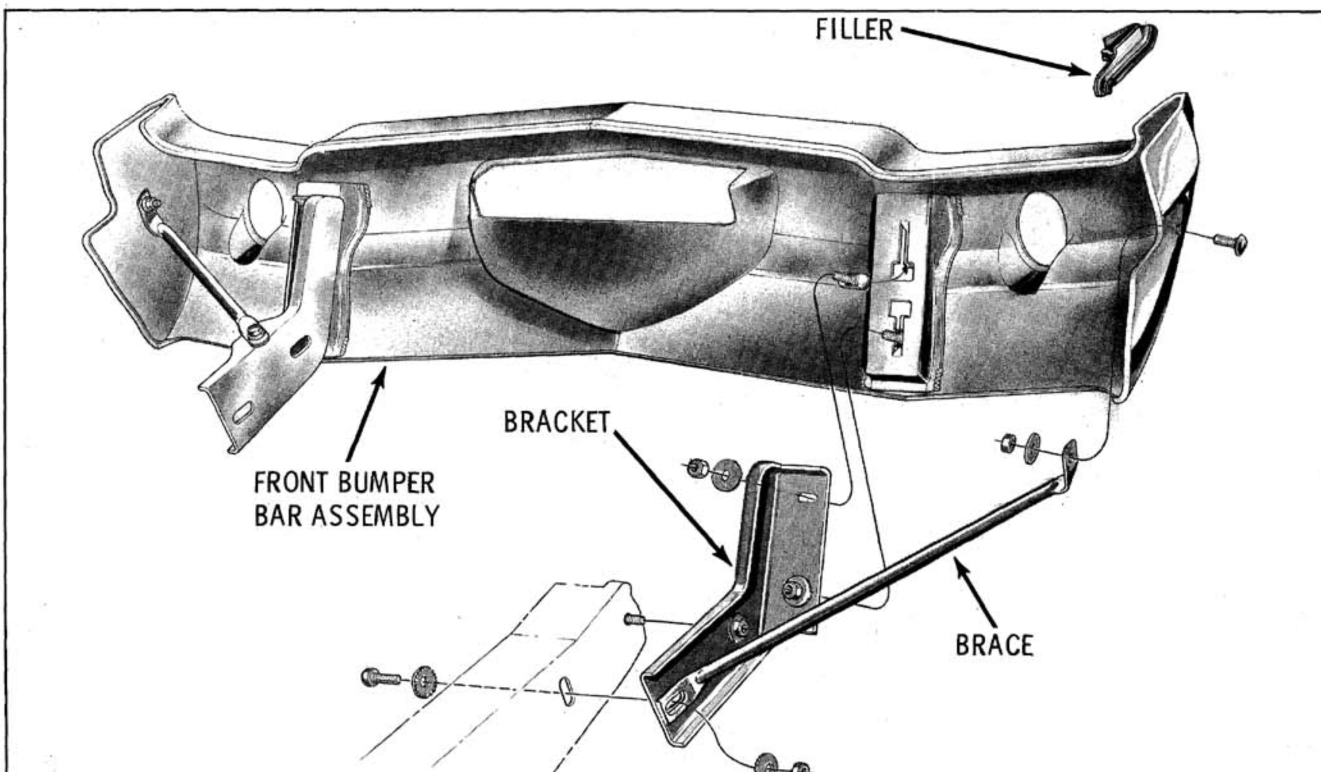


Fig. 15-102 Front Bumper

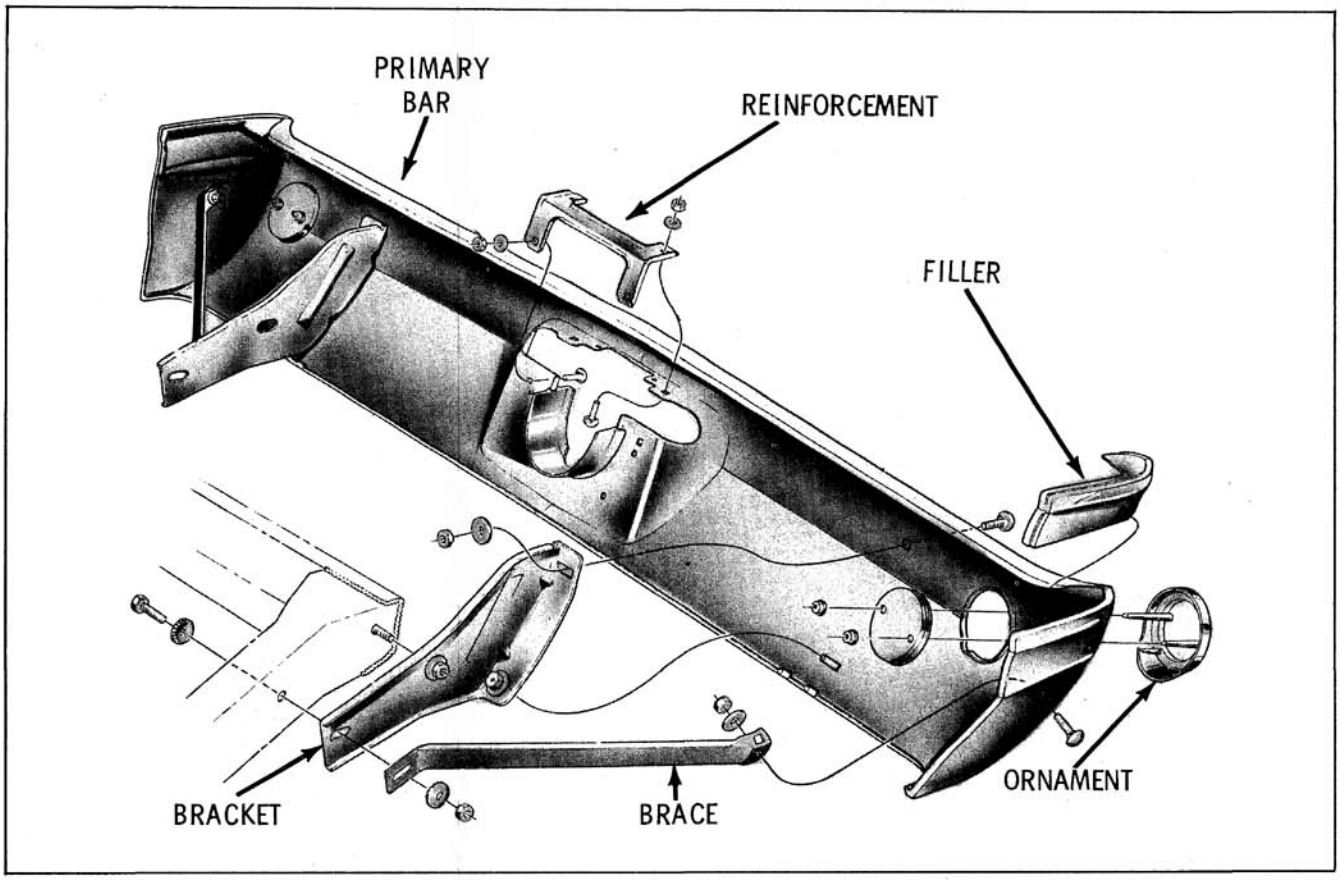


Fig. 15-103 Rear Bumper (Exc. S.W.)

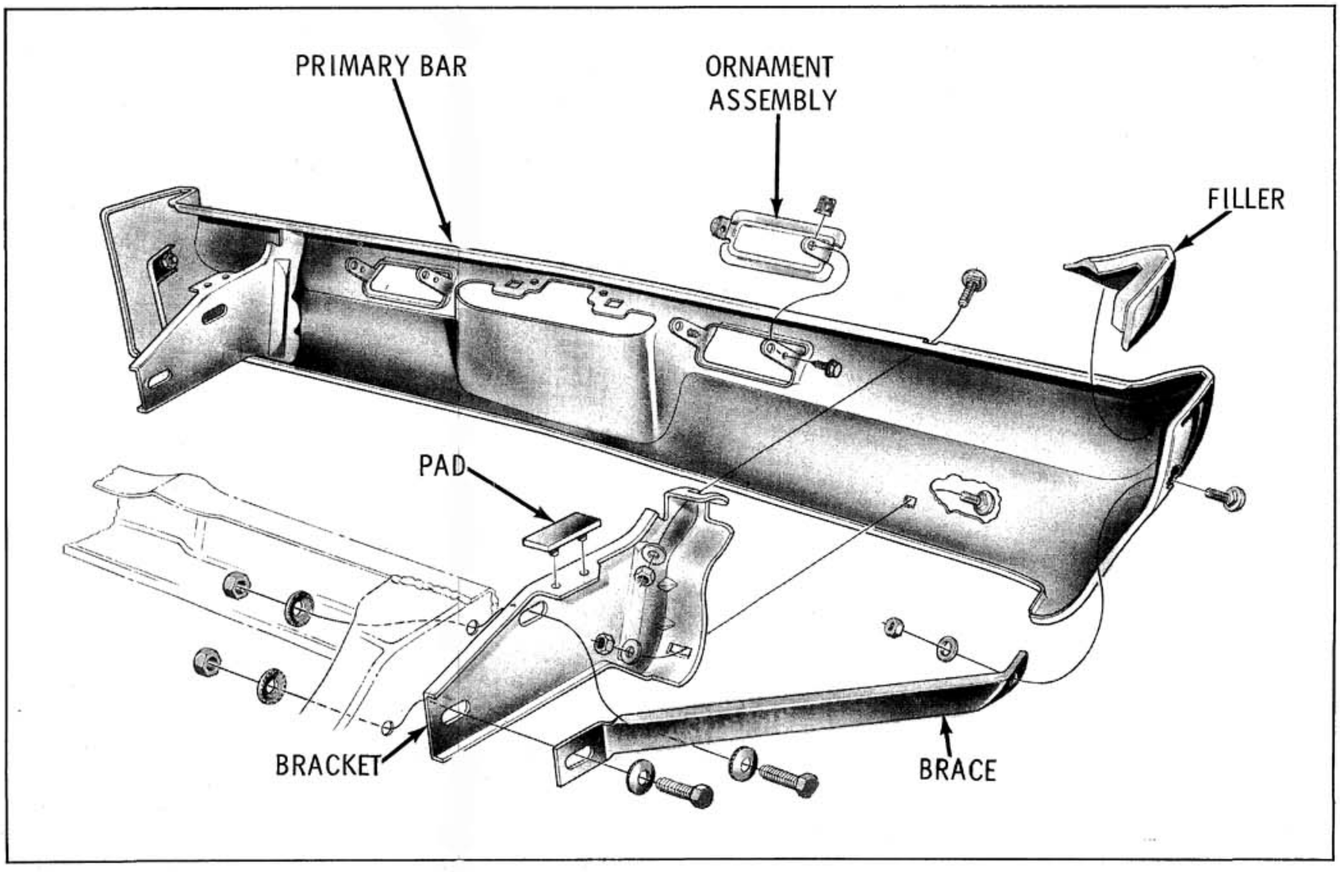


Fig. 15-104 Rear Bumper S.W.

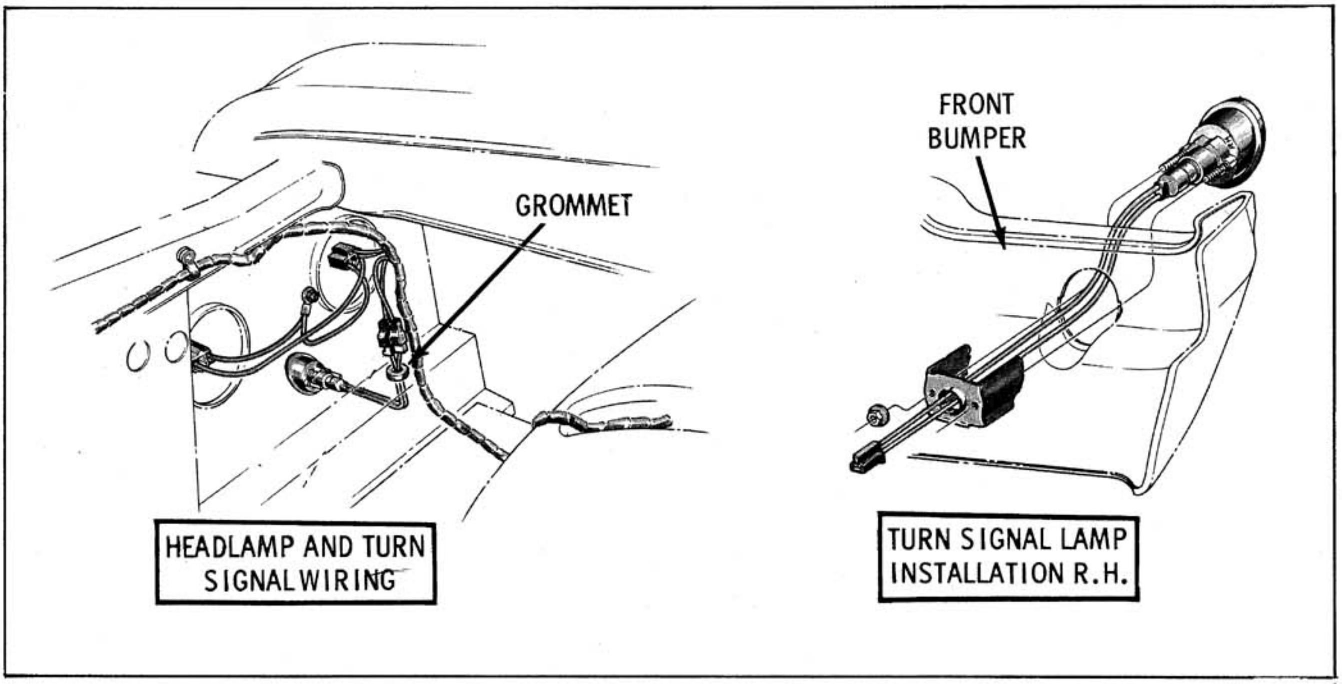


Fig. 15-105 Parking Lamp

holes in the reinforcements and brackets. When installing, tighten bolts just enough to permit shifting for proper alignment. Bumper should be horizontal and centered. Torque bolts as indicated under TORQUE SPECIFICATIONS.

REAR (Fig. 15-103 & 104)

REMOVAL AND INSTALLATION

Disconnect license lamp wire in trunk compartment; if equipped with back-up lamps, disconnect leads. Remove two bolts from each side securing brackets-to-frame and remove bumper with brackets and braces attached. To install, install the four attaching bolts and tighten just enough to permit shifting for proper alignment. Bumper should be aligned horizontally and centered. Connect electrical leads and check operation. Torque bolts as indicated under TORQUE SPECIFICATIONS.

PARKING LAMP ASSEMBLY (Fig. 15-105)

The parking lamp assembly is retained to the front bumper by nuts accessible from the rear side of the bumper. The bulb can be replaced by removing the two lens attaching screws.

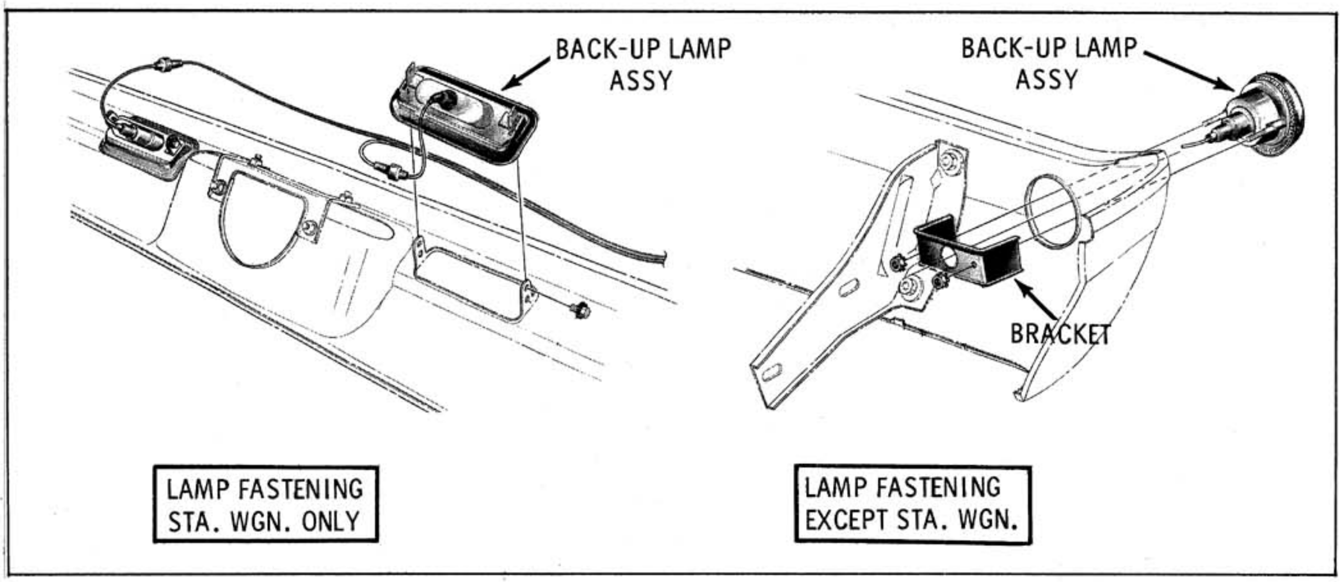


Fig. 15-106 Back-Up Lamp

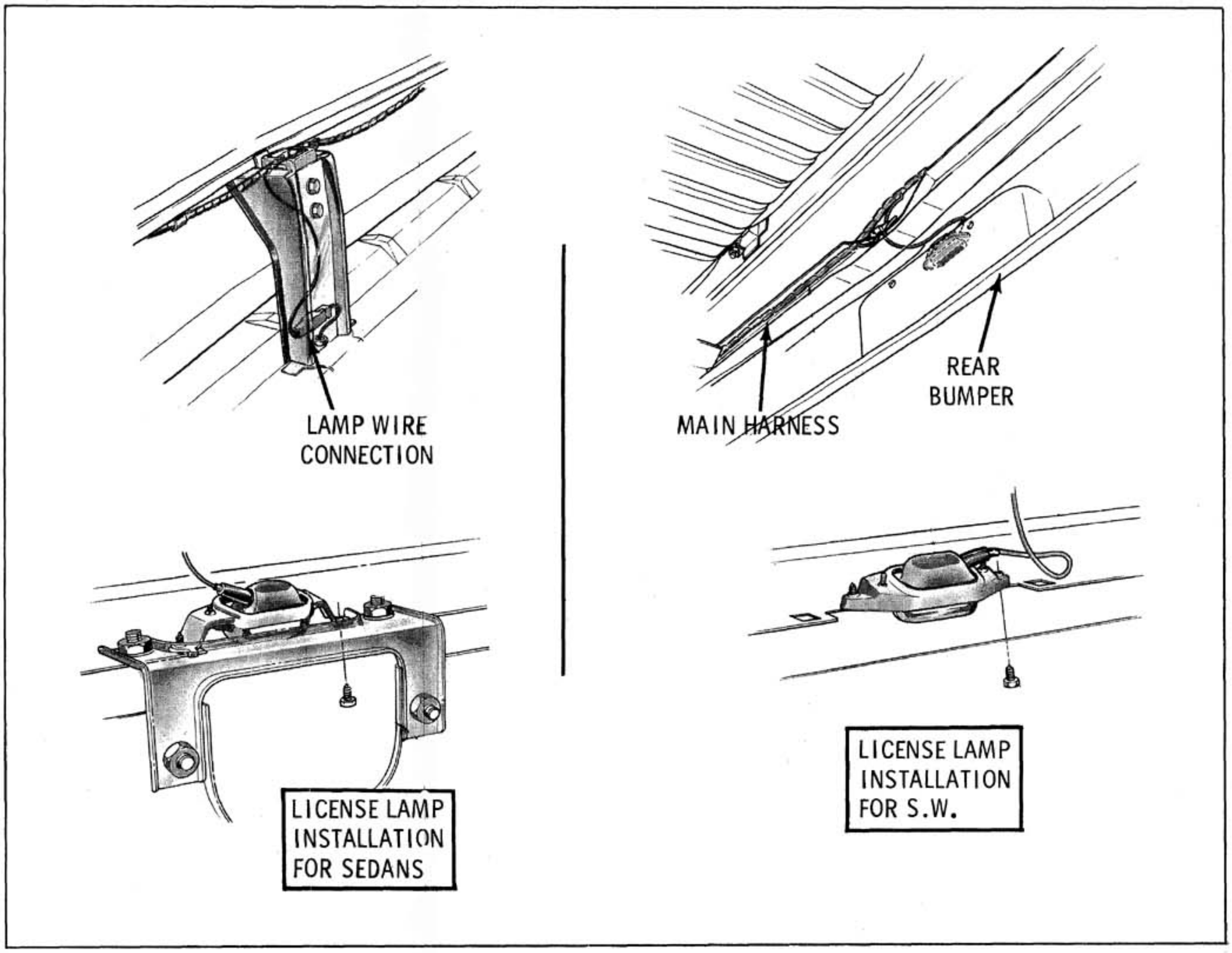


Fig. 15-107 License Lamp

BACK-UP LAMP ASSEMBLY (Fig. 15-106)

REMOVAL AND INSTALLATION

1. Disconnect wiring connector.
2. Loosen bumper bracket to frame bolts, both sides.
3. Pull bumper rearward.
4. Remove self-tapping screw from each side of lamp. (S.W. only)
5. Maneuver lamp up over top of bumper brackets and remove.

To install, reverse the removal procedure. The bulb can be replaced by removing the two lens attaching screws.

LICENSE LAMP (Fig. 15-107)

The license lamp assembly can be removed by disconnecting the wiring connector inside of trunk compartment, and removing the two attaching screws. The bulb can be replaced by removing the two lens attaching screws. For license attachment refer to Fig. 15-108.

FUEL FILLER DOOR (Fig. 15-109)

The fuel filler door is attached to the rear bumper by two screws. The mounting brackets, hinge pins and retainers and door springs are available as replacement parts and can be serviced by removing the two door attaching screws.

BUMPER TORQUE SPECIFICATIONS

APPLICATION	FT. LBS.
Brackets & Brace to Frame	70
Brace & Reinforcement to Bumper . . .	38

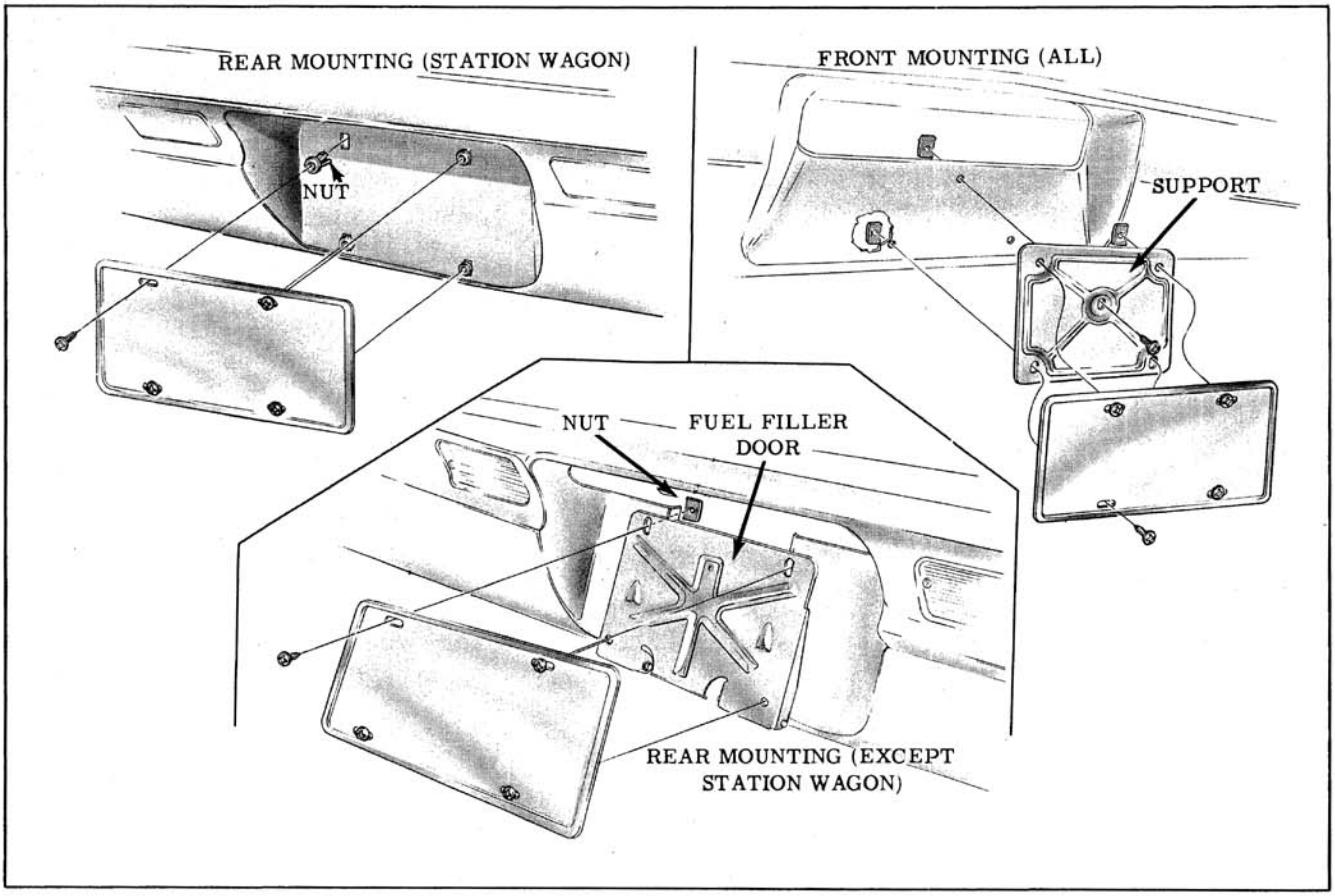


Fig. 15-108 License Mounting

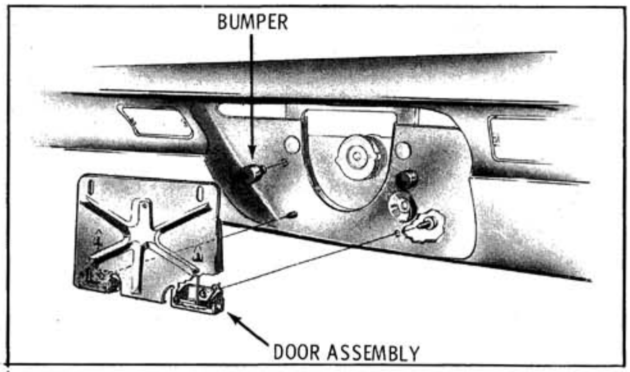


Fig. 15-109 Fuel Filler Door

TAIL LAMP ASSEMBLY

ALL EXCEPT STATION WAGON

The tail lamp assembly can be removed by removing the four attaching nuts from inside the trunk compartment. The tail lamp bulbs can be replaced by removing the snap-in socket on the bottom of the assembly. The lens can be replaced after removing the tail lamp assembly by removing the four studs.

STATION WAGON

To remove the tail lamp assembly, remove the four lens attaching screws, remove the lens and the two screws retaining the lamp assembly to the body. Pull the lamp rearward to gain access to the wiring connector and disconnect wiring. The lens or bulb can be replaced by removing the four lens attaching screws.

BODY MOUNTS

To minimize vibration and noise, the body mounts must be properly torqued. Body mounts which are not tightened sufficiently will cause body "chucking" and damage to the cushions. If body mounts are tightened excessively, the cushioning effect of the cushion is impaired, resulting in squeaks and body "drumming". Torque body mount bolts to 35 ft. lbs.

For installation of body mounts, refer to Fig. 15-110.

HOOD ASSEMBLY

REMOVAL AND INSTALLATION

Prior to removal of the hood, it is suggested that adjoining areas be covered to prevent damage.

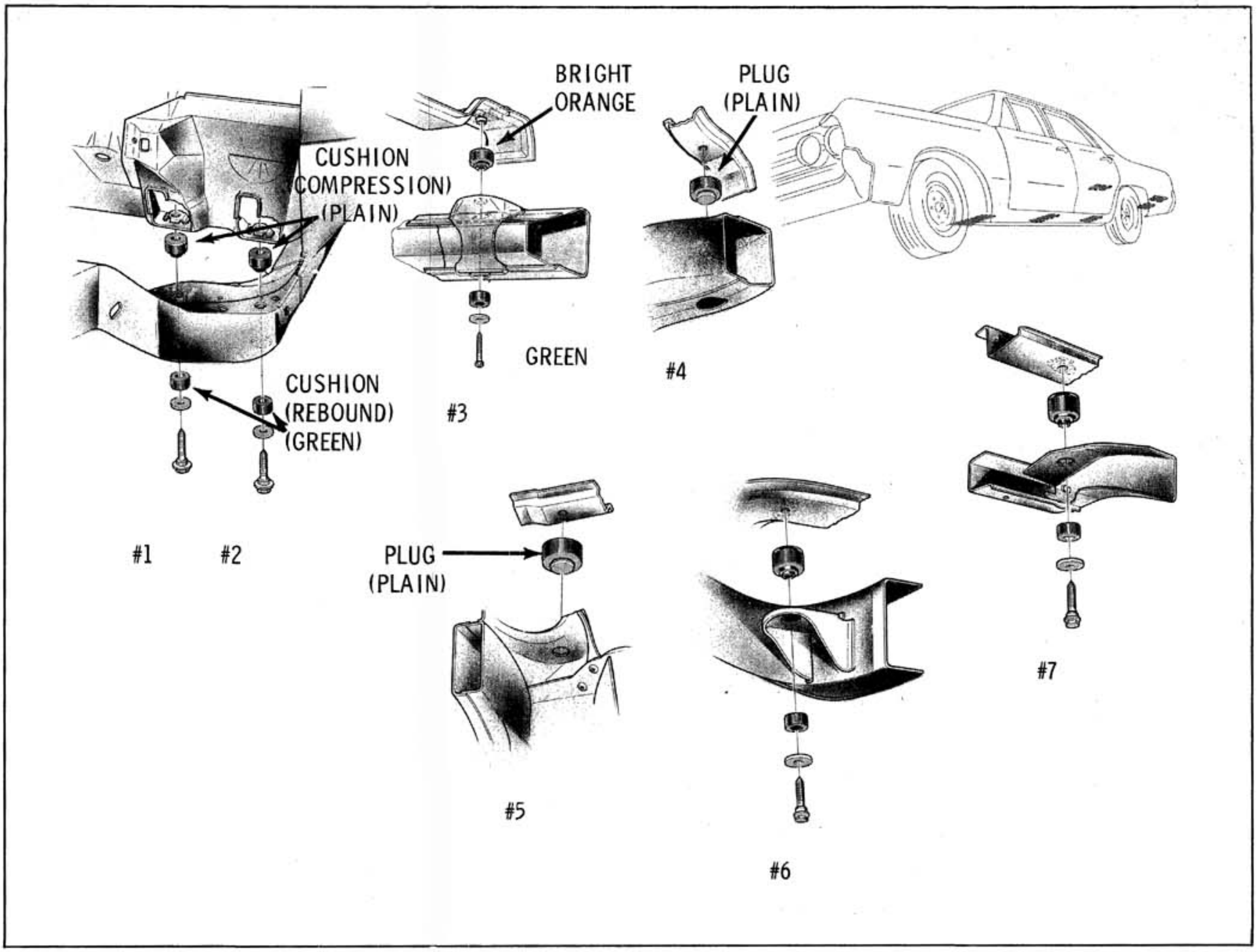


Fig. 15-110 Body Mounts

With the hood supported, scribe the hinge position on the hood reinforcement and remove the two hinge to hood screws from each hinge. (Fig. 15-111)

When installing hood, position the hood to the scribed lines, torque screws to 28 ft. lbs. If further adjustment is necessary, follow the hood and hinge alignment procedure. If necessary to install a new hood insulator, refer to Fig. 15-113.

HOOD HINGE SPRING

REMOVAL AND INSTALLATION

To remove the spring from the hood hinge, raise hood approximately 12" and place Tool J-8923-1 over the spring. (Fig. 15-111) Raise hood and the spring will unhook. Block hood in this position and remove spring.

When installing a new spring, stretch the spring and place Tool J-8923-1 over the spring. Position spring (with tool in place) on hinge. Lower hood slightly to expand spring, then remove tool.

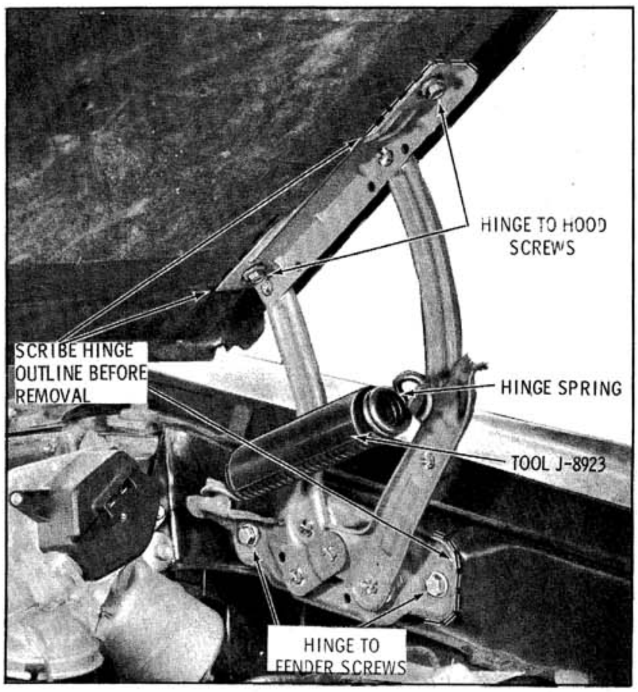


Fig. 15-111 Hood Hinge Spring Removal

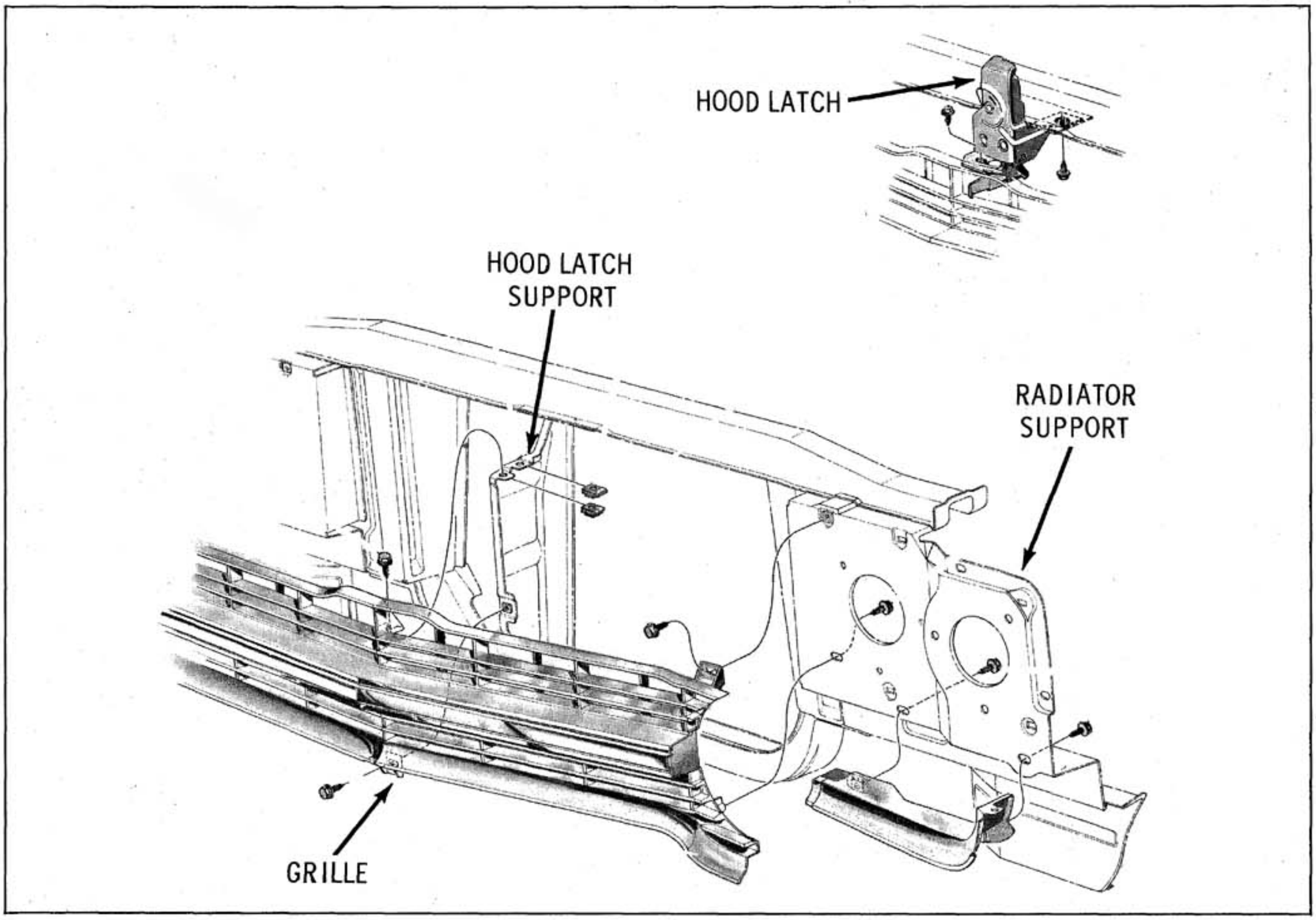


Fig. 15-112 Grille and Hood Latch

HOOD HINGE

REMOVAL AND INSTALLATION WITH SPRING REMOVED

Place protective covers on fender and grille at hinge area. Mark the hinge outline on fender and hood to facilitate alignment. (Fig. 15-111) Support the hood at front and rear and remove the two hinge-to-hood screws, then remove the hinge-to-fender screws.

Using the scribe marks as a guide, install the hinge to fender screws and torque to 28 ft. lbs. Torque hinge-to-hood screws to 28 ft. lbs. Check hood alignment after hinge installation. The hinge is provided with elongated holes for alignment and if necessary, shift hood to properly align.

HOOD LATCH ASSEMBLY

The hood latch assembly is bolted to the fender tie bar and the hood latch support. The two bolts retaining the latch assembly to the tie bar are accessible from the bottom side and the single bolt, retaining the latch assembly to the hood latch support, is accessible from the top. The three bolt holes are elongated for alignment purposes. The assembly should be lubricated periodically with lubriplate. (Fig. 15-112) Torque screws to 20 ft. lbs.

HOOD MOLDINGS, EMBLEM, INSULATOR AND BUMPERS

A hood emblem, top molding and front molding are used on all series. (Fig. 15-113) The top molding, front molding and emblem are all retained by nuts. Paper type shims are used between the hood top molding and the hood at each stud location to prevent paint damage. If hood top molding replacement is necessary on 35, 36 or 3800 series, removal of the hood insulator is not required, the nuts and studs can be located by pressing up on the underside of the insulator. The hood bumpers are attached as shown in Fig. 15-114. The hood insulator is installed as shown in Fig. 15-113.

RADIATOR SUPPORT ASSEMBLY (Figs. 15-114 & 115)

The radiator support assembly is a welded assembly consisting of four parts: two side baffles and upper and lower support. The radiator support assembly will be serviced as a complete

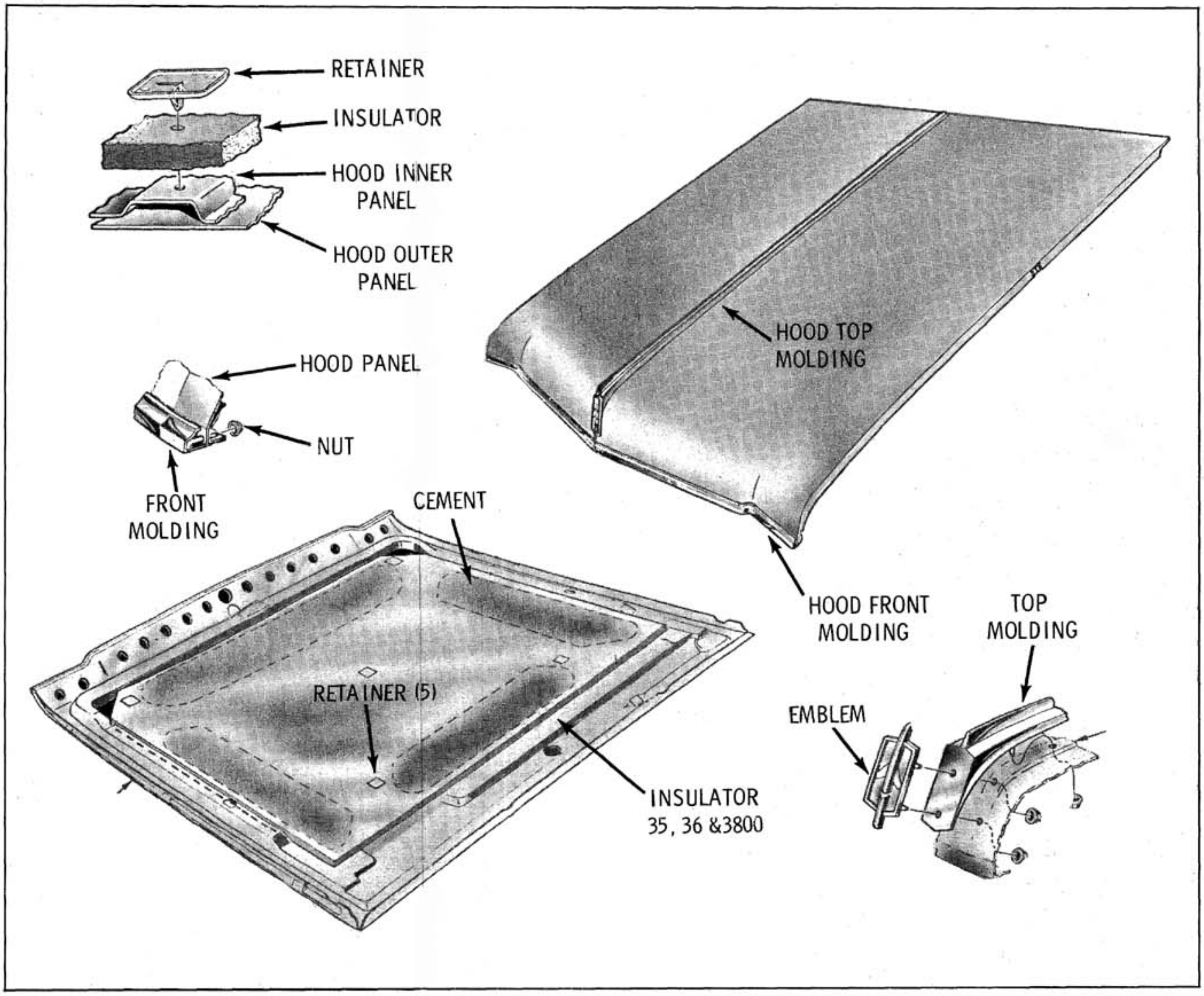


Fig. 15-113 Hood Assembly

assembly or individual pieces. If a side baffle only is to be replaced, the welds can be drilled out and sheet metal screws used to install new parts. Torque radiator support to frame nut to 38 ft. lbs.

FENDER ASSEMBLY

REMOVAL

1. Remove the screws indicated at shim points in Fig. 15-116.
2. Remove the screws shown in Fig. 15-115 and screw retaining fender to bumper baffle.
3. Remove upper fender attaching bolts.
4. Remove hood hinge to fender attaching screws and support hood.
5. For right fender, if equipped with manual antenna, it will be necessary to:
   a. Loosen plastic nut and remove mast assembly.
   b. Remove wiper arm and blade assemblies.
   c. Remove nozzle attaching screw from each side.
   d. Remove the five vent grille attaching screws and remove grille.
   e. Remove the lead-in assembly mounting nut, upper spacer and gasket.
   f. Push the lead-in assembly down through the fender and body and remove by reaching through the plenum chamber.
6. Along inner fender flange, remove two screws securing fender filler to fender. (Fig. 15-117)
7. Along edge of wheel opening, remove six screws securing fender filler to fender. On

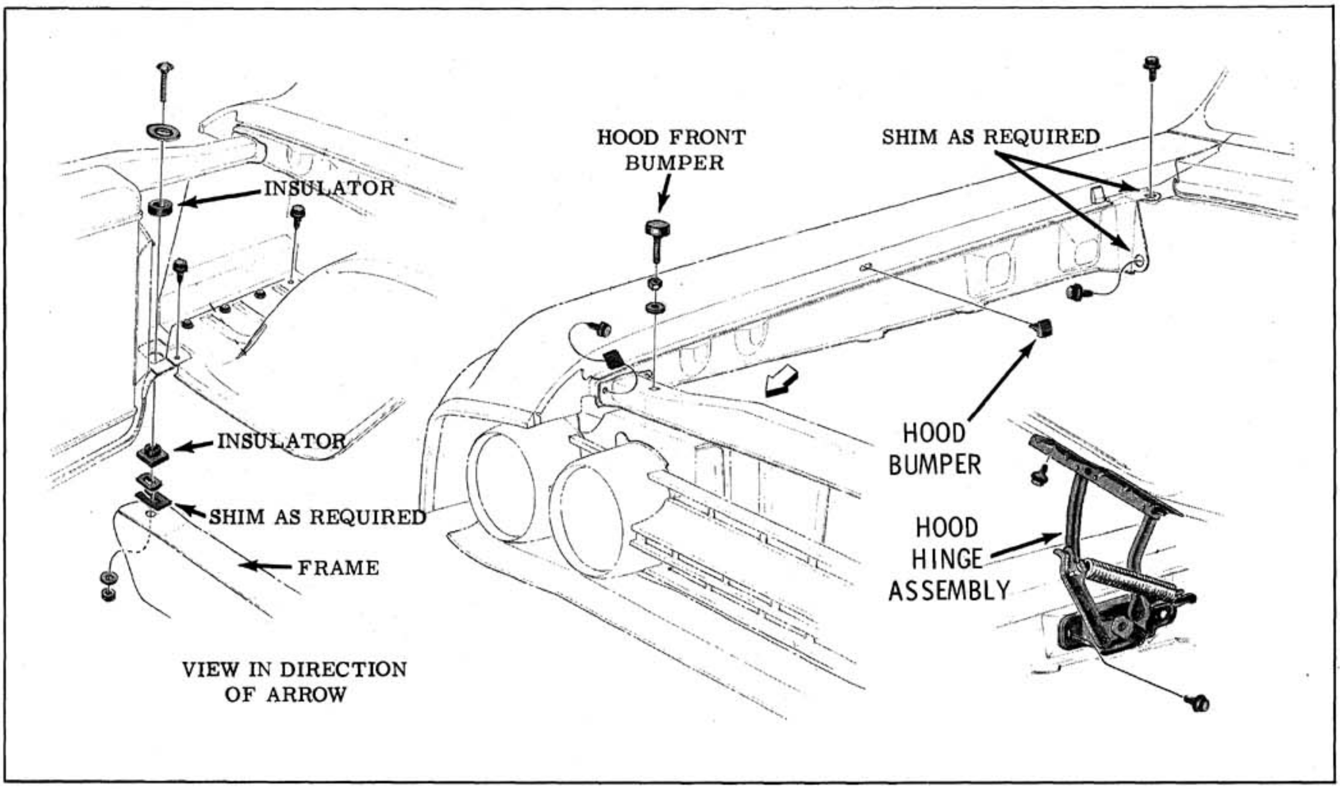


Fig. 15-114 Radiator Support Fastening

some models, it may be necessary to loosen wheel opening molding to gain access.

8. Remove two fender to tie bar attaching screws and remove fender. If equipped with air conditioning, remove two screws securing muffler before removing fender.

INSTALLATION

To install the fender, reverse the removal procedure. Refer to INSTRUMENT PANEL AND ACCESSORIES section for manual antenna installation. The fender attaching bolt holes are elongated to permit adjustment and, in addition, there are shims available to be used at five locations. Four of the shim locations are used to obtain alignment of the fender to the door; the other shim location is at the fender tie bar and is used to obtain fender to hood alignment. (Fig. 15-118)

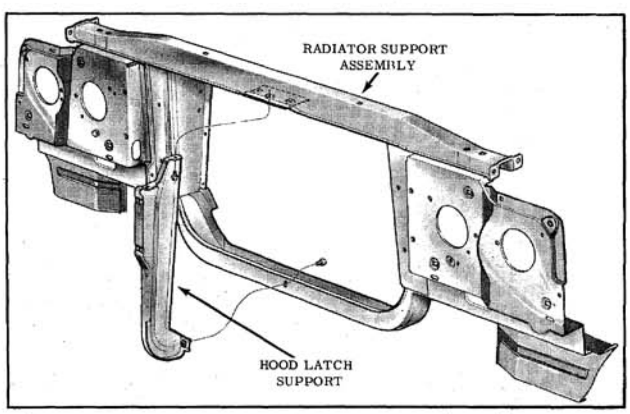


Fig. 15-115 Radiator Support Assembly

When installing a fender, tighten the attaching bolts just enough to permit shifting as required. After proper alignment is obtained, tighten all attaching screws and bolts. Torque fender to-body bolts to 28 ft. lbs. Torque remaining screws to 20 ft. lbs.

FILLER PLATE (Fig. 15-117)

REMOVAL

1. Raise car, support on floor stands, remove wheel assembly.

2. If equipped with wheel opening molding, remove molding.

3. If side being serviced has battery support attached, remove battery, battery support and battery support front bracket.

4. For left side, remove windshield washer jar.

5. Disengage wiring harness clips from filler plate.

6. For left side, disconnect wiring from horn relay block.

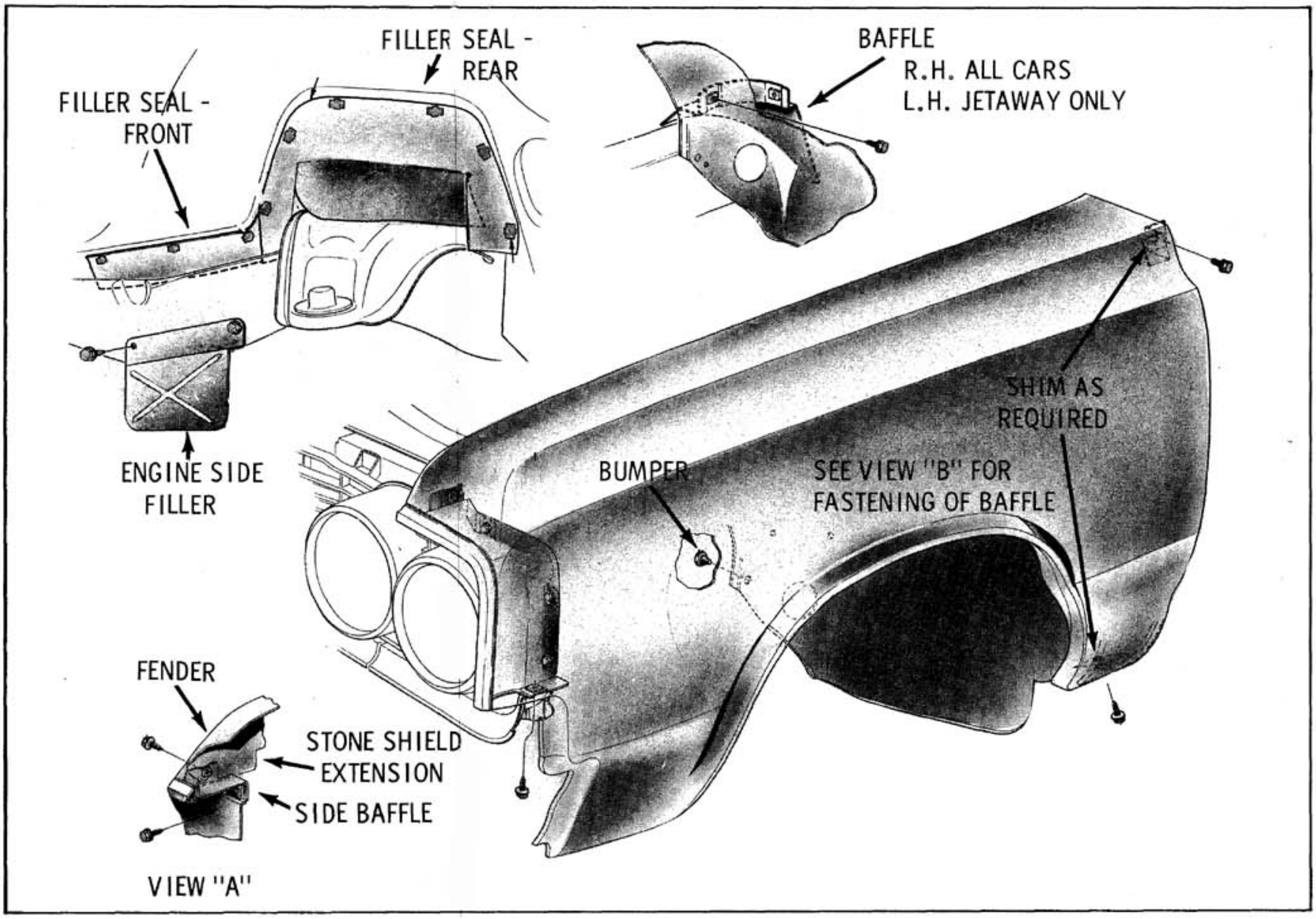


Fig. 15-116 Fender Mounting

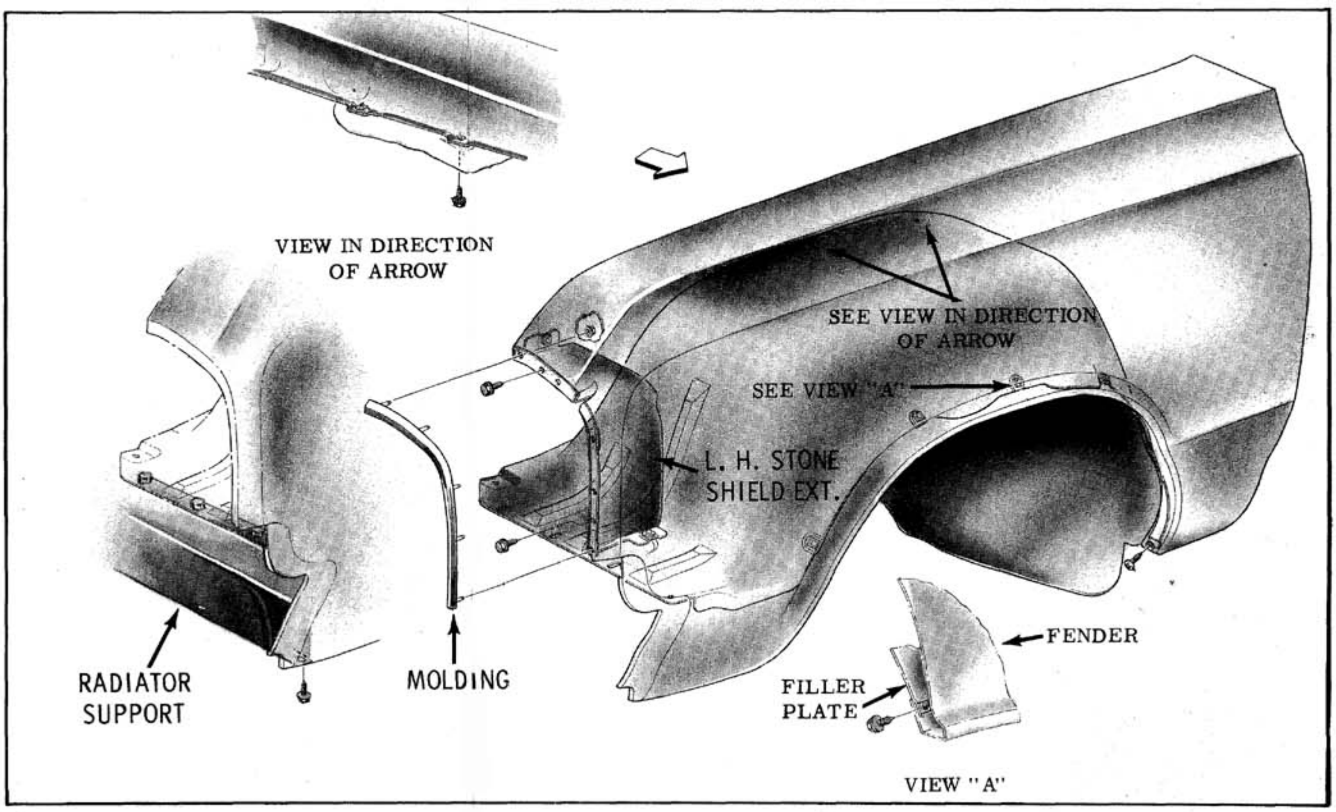


Fig. 15-117 Filler Plate

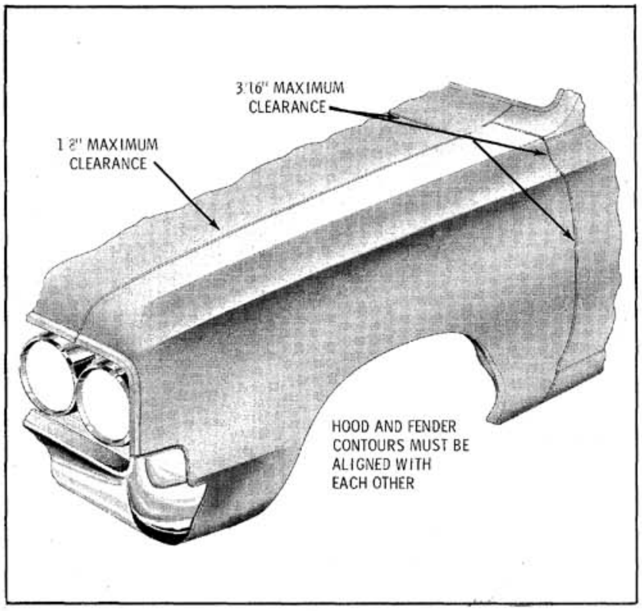


Fig. 15-118 Fender Clearances

7. Remove two screws securing filler plate to inner fender flange.

8. Remove screw securing filler plate to frame.

9. Remove six screws along inner edge of fender securing filler plate to fender.

If equipped with air conditioning for right side, remove two screws securing receiver-dehydrator bracket to filler plate. Torque all attaching screws to 20 ft. lbs.

MOLDINGS

ROCKER PANEL MOLDING (Fig. 15-119)

The rocker panel molding is secured to the front fender and rocker panel with clips and retainers. The molding slips in over the top of the clips and retainers and is fastened along the underside by screws. The molding can be removed by removing the lower attaching screws and lifting up to disengage the molding from the clips and retainer.

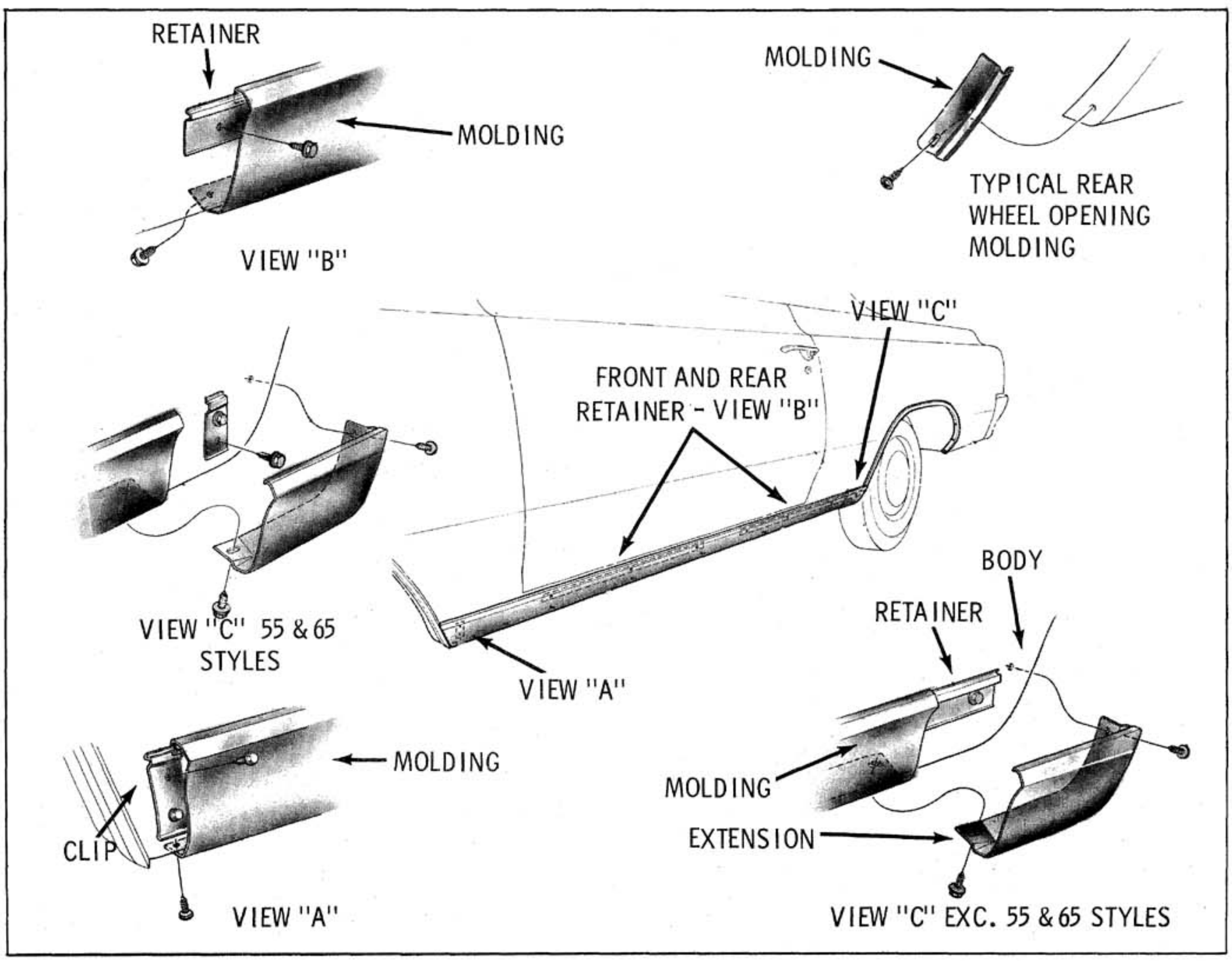


Fig. 15-119 Rocker Molding

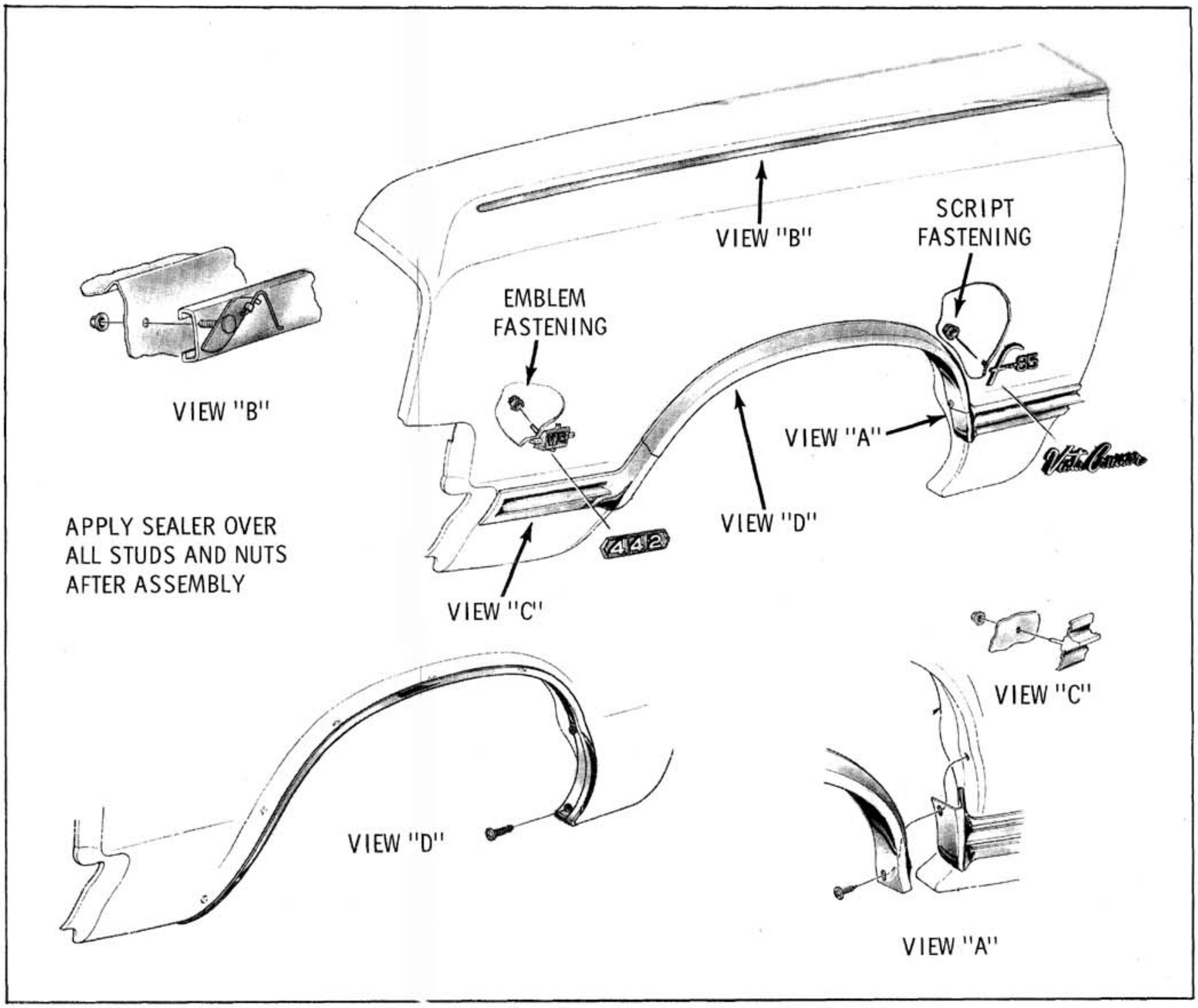


Fig. 15-120 Fender Ornamentation

WHEEL OPENING MOLDINGS (Fig. 15-120)

The wheel opening moldings are retained by screws along the inner flange of the opening and can be removed by removing the attaching screws.

FRONT FENDER MOLDING

The molding is retained by five nuts as shown in Fig. 15-119. To gain access, for V-8 left side, remove battery and washer jar. For V-6 left side, remove washer jar. For V-8 right side, it is not necessary to remove any parts to gain access. For V-6 right side, remove battery.

It is not necessary to disconnect air conditioning lines to gain access on the right side.

SCRIPT AND EMBLEM (Fig. 15-120)

REMOVAL AND INSTALLATION

1. Remove hood hinge to hood screws and support hood.
2. At the upper trailing edge of fender, remove the three attaching bolts.
3. At the lower trailing edge of fender, remove the attaching bolt.
4. If equipped with a rocker molding, it will be necessary to detach molding sufficiently to block out the fender.
5. Remove the script and/or emblem attaching nuts.

To install, reverse the removal procedure.

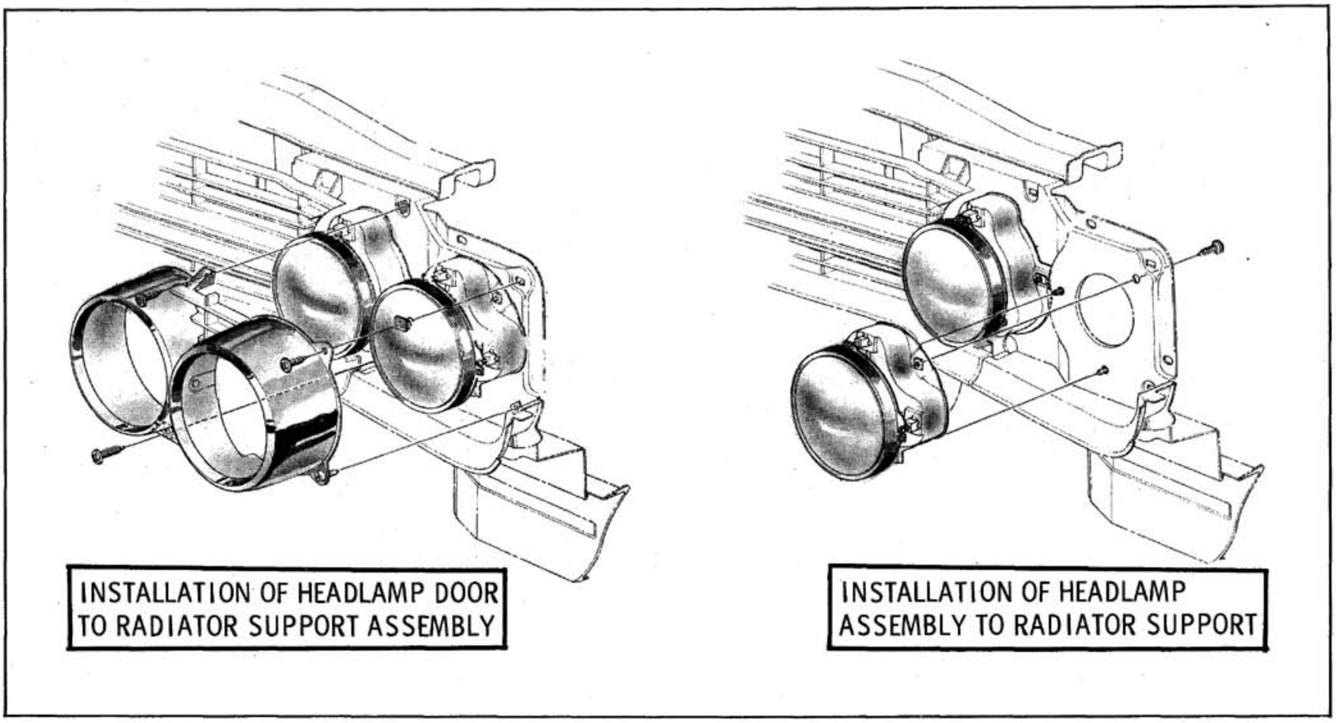


Fig. 15-121 Headlamp Assembly

Torque fender-to-body bolts to 28 ft. lbs; torque hood hinge-to-hood screws to 28 ft. lbs.

FRONT FENDER SIDE MOLDING (Fig. 15-120)

REMOVAL

It will be necessary on some series to remove the windshield washer jar and battery to gain access to the molding attaching nuts in addition to the regular procedure. An access hole is provided in the inner fender flange for one of the attaching nuts. The remaining nuts are accessible.

1. Remove hood hinge to hood screws and support hood.
2. At the upper trailing edge of fender, remove the three attaching bolts.
3. At the lower trailing edge of fender, remove the attaching bolt.
4. If equipped with a rocker molding, it will be necessary to detach molding sufficiently to block out the fender, to gain access to the molding rear attaching nuts.

STONE SHIELD

STONE SHIELD (Fig. 15-112)

The left and right stone shields are attached to the radiator support by screws, two of which are accessible on the back side of the radiator support and one at the extreme outboard end of the shield. Depending upon which stone shield is being replaced and which series, it may be necessary to remove the battery to gain access. It will be necessary to loosen the front bumper and grille, as the stone shields fit under the grille. Torque the retaining screws to 20 ft. lbs.

GRILLE ASSEMBLY

The grille assembly is retained to the hood latch support and radiator side baffles by six sheet metal screws. (Fig. 15-112) It will be necessary to remove the battery to gain access to the screws on the back side of the radiator support. Because of tolerances, it may be necessary to remove one headlamp door and loosen the bumper to remove the grille.

HEADLAMP ASSEMBLY (Fig. 15-121)

The headlamp door assembly is attached to the radiator side baffle by four screws accessible from the front side. The sealed beam units can be removed after removing the headlamp doors by disconnecting the spring located near the bottom of the unit, pulling sealed beam forward and disconnecting wiring connector. The sealed beam retaining ring can be removed by removing the two attaching screws. The headlamp assembly is retained to the radiator side baffle by three screws accessible from the back side of the side baffle. Depending upon which assembly is being

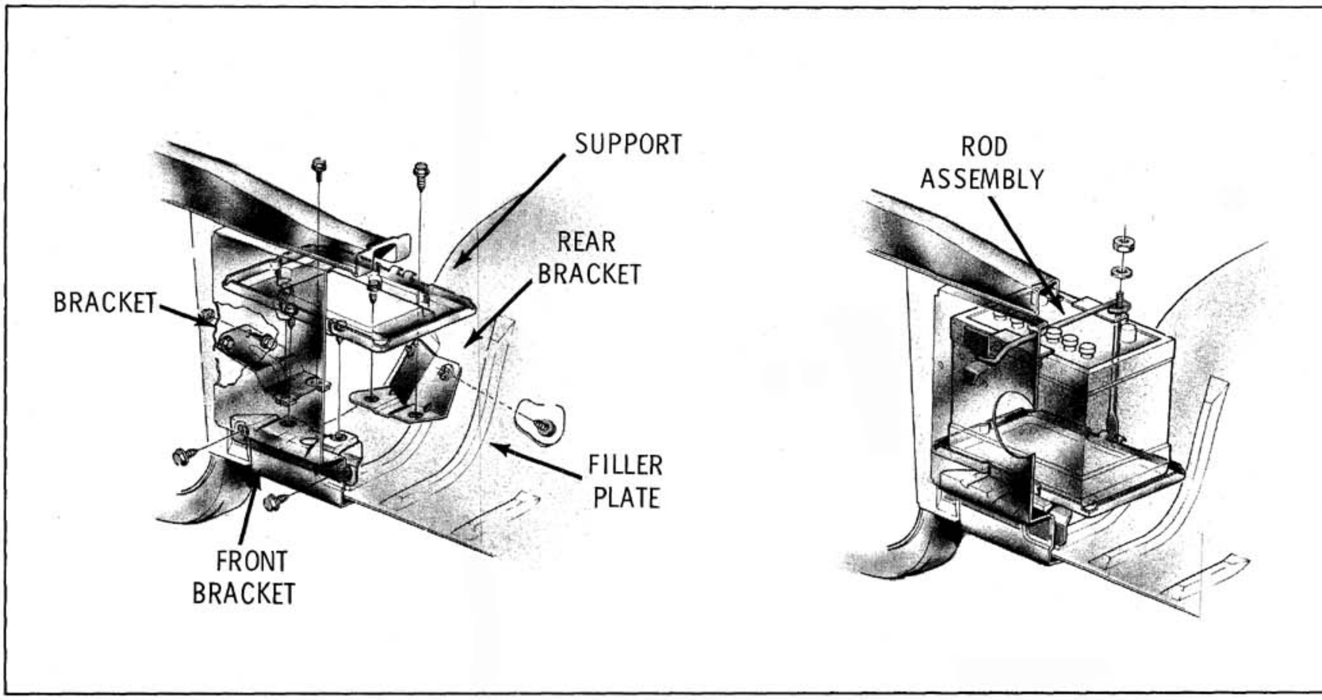


Fig. 15-122 Typical Battery Supports

replaced and whether it is a V-6 or V-8, it may be necessary to remove the battery to gain access. Torque headlamp to side baffle screws to 20 ft. lbs.

COWL VENT GRILLE

REMOVAL

1. Remove windshield wiper arms.
2. Raise hood and remove cowl vent grille to cowl screws.
3. Remove windshield washer nozzle attaching screws.
4. Remove cowl vent grille by lifting up forward edge and pulling away from windshield.

INSTALLATION

Apply caulking around vent grille attaching screw holes and vent grille tab slots in cowl, then carefully slide grille rearward to engage rear edge of grille between windshield lower reveal moldings and molding attaching clips. Install grille to cowl screws and washer nozzle attaching screws.

BATTERY SUPPORT

The battery is located on the left side with the V-8 engine and on the right side with the V-6 engine.

REMOVAL (Fig. 15-122)

1. Disconnect battery cables.
2. Remove battery.
3. Remove six screws securing battery support-to-brackets and remove support.

The support bracket can be removed after removing the battery and support. The rear bracket is secured to the fender filler by two screws accessible from the bottom side. The front and side bracket are secured to the radiator side baffle by screws accessible from the front side. Torque all bracket retaining screws to 18 ft. lbs.