1961
OLDSMOBILE

F85

SERVICE MANUAL
REVISED

1961

F-85

OLDSMOBILE

SERVICE MANUAL

PRICE $2.00

FOREWORD

This manual is compiled to provide as many service procedures, specifications and adjustments, available at the time of printing, for the 1961 Oldsmobile F-85. 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 Oldsmobile Dealer Service personnel in correctly maintaining and servicing Oldsmobile cars.

SERVICE DEPARTMENT

OLDSMOBILE DIVISION

GENERAL MOTORS CORPORATION

LANSING, MICHIGAN

Revised November, 1960

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GENERAL INFORMATION

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VEHICLE IDENTIFICATION NUMBER PLATE

The 1961 vehicle identification number plate is located on the left front door pillar as illustrated in Fig. 1-1. Each identification number is prefixed by three numbers and a letter. The first two numbers (61) indicate the year (1961). The third number designates the series.

0 - Standard F-85
1 - Deluxe F-85

The letter in the identification number indicates the assembly plant at which the car was built. "M" indicates a Lansing-built car, "C" a South Gate-built car.

The starting vehicle identification number at each plant is 01001.

NOTE: Always give complete vehicle identification number, engine number, body number, and transmission number (except Syncro-Mesh equipped cars) in all correspondence.

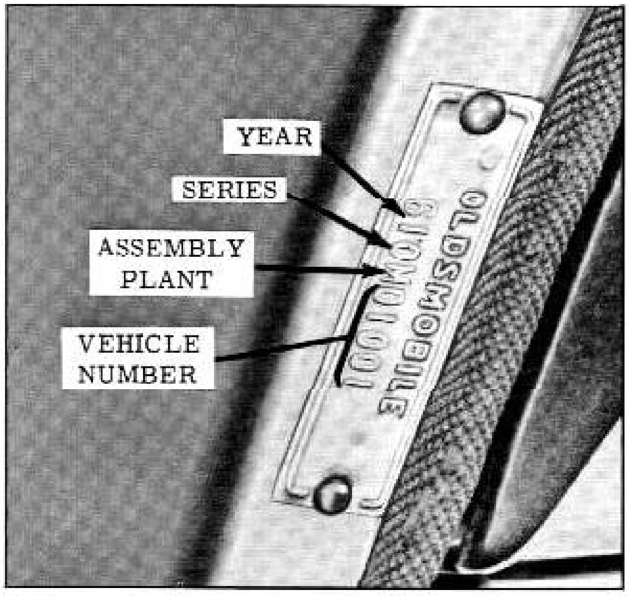

Fig. 1-1 Vehicle Identification Number Plate

MODEL IDENTIFICATION

A four digit number, called the car series and body style designation number, will identify the car. Reading from left to right, the digits represent the following.

First and second digits: Series designation.
Third and fourth digits: Body style.

Example: The number 3019 identifies a car as a standard F-85, four door sedan. Note that "30" identifies the car as a standard and that "19" represents a four door sedan regardless of the series.

1961 MODEL DESIGNATION

Series	Body Style	Series and Style Designation
3000 Standard F-85	4 Door Sedan	3019
	Station Wagon	3035
3100 Deluxe F-85	4 Door Sedan	3119
	Station Wagon	3135

BODY AND STYLE NUMBERS

The body and style numbers are stamped on a plate which is located under the hood and mounted on the cowl. (Fig. 1-2)

The plate contains: the year and style number of body, body number, trim number, and paint number (color specification number).

The Body Numbers are prefixed by letters indicating the plant at which the body was assembled.

LA - Lansing BC - South Gate

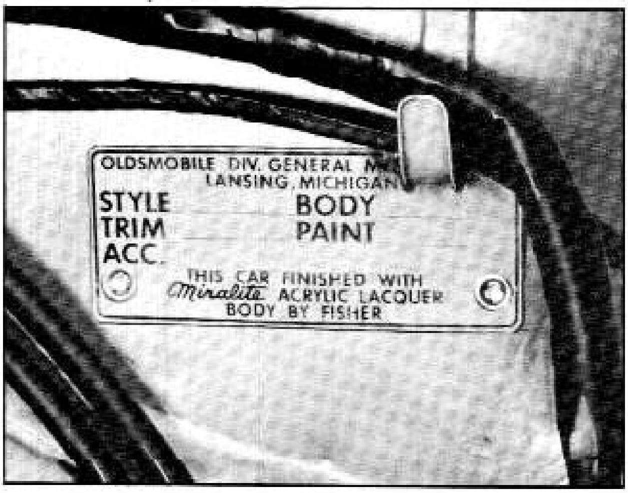

Fig. 1-2 Body and Style Number Location

NOTE: Always give complete vehicle identification number, engine number, body number, and transmission number (except Syncro-Mesh equipped cars) in all correspondence.

ENGINE UNIT NUMBER

The engine unit number is stamped on the front of the right cylinder head. (Fig. 1-3) The starting unit number is S-001001. The number on the engine block is a production number only.

Suffix "E" is used for an Export Low Compression engine option. Suffix "G" is used when engine is equipped with a 4 bbl. carburetor.

TRANSMISSION SERIAL NUMBER

The Hydra-Matic serial number plate (red) is riveted to the right side of the transmission case above the filler tube boss. (Fig. 1-4) A prefix of 0561 on a plate identifies the transmission as a 1961 F-85. A white plate is used when the engine is equipped with a 4-bbl carburetor and the serial number prefix is OD-561.

Fig. 1-4 Transmission Serial Number Location

NOTE: Always give complete vehicle identification number, engine number, body number, and transmission number (except Syncro-Mesh equipped cars) in all correspondence.

Syncro-Mesh transmissions do not have a serial number.

REAR AXLE RATIOS

Rear axle ratio code letters are stamped on the differential cover as shown in Fig. 1-5. They are A, B, and C followed by a number or numbers. The letters designate the ratio as follows A-3:08, B-3:23 and C-3:36.

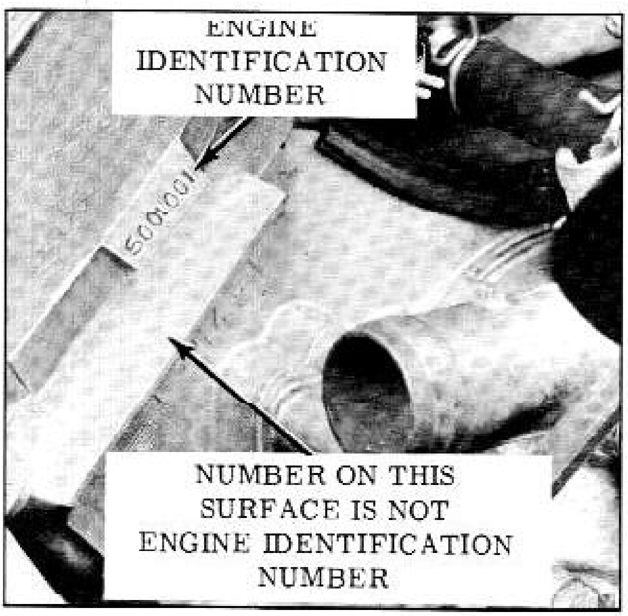

Fig. 1-3 Engine Unit Number Location

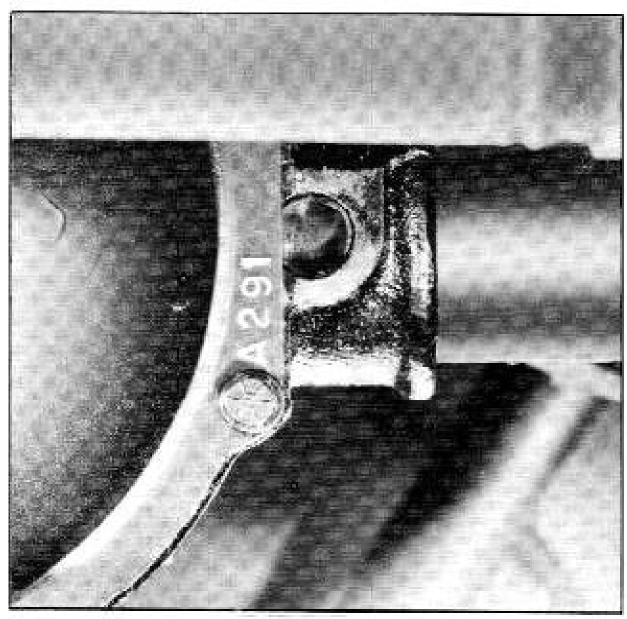

Fig. 1-5 Rear Axle Ratio Location

PUSHING CAR TO START ENGINE

Hydra-Matic

As a result of the Hydra-Matic transmission design, the engine cannot be started by pushing the car.

Syncro-Mesh

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 m.p.h., release the clutch pedal slowly.

TOWING PRECAUTIONS

Always place a rubber mat or other suitable protector between the bumper and the tow chains or cables. For FRONT end lift, place the chains or cables around the stabilizer mounting brackets against the frame rail at both sides. It is recommended that a 4" x 4" timber be located beneath the front or rear bumper lower edges to prevent damage from lift chains when towing the car with the wheels off the ground. All models can be towed without disconnecting the propeller shaft providing the transmission or propeller shaft is not damaged. If damaged, the propeller shaft must be disconnected from the differential and wired to the exhaust pipe or the car must be towed with the rear wheels off the ground.

If the propeller shaft is disconnected and the "U" joint bearing retaining strap is broken, wrap tape around the bearing caps to prevent loss. When towing with rear wheels off the ground, the steering wheel must be centered and held in position by a steering wheel holding clamp or by tying it to the window division channel.

Tire to ground clearance should not exceed six inches while towing the car AND SPEED SHOULD NOT EXCEED 30 M.P.H. Caution should be exercised if towing over rough roads.

FRAME CONTACT TYPE LIFTS

When using a frame contact type lift, position the contact pads to lift the frame rail at points as shown in Fig. 1-6.

OPERATION IN FOREIGN COUNTRIES

If an Oldsmobile is to be operated outside the continental limits of the United States or Canada, there is a possibility that the best fuels available are so low in octane quality that heavy detonation and serious engine damage may result from their use. To minimize this possibility, write to Oldsmobile Division, Service Department, Lansing, Michigan giving the country or countries in which the car is to be used. You will be furnished details of adjustments or modifications which should be made to the engine by an Oldsmobile dealer prior to departure. Fail-

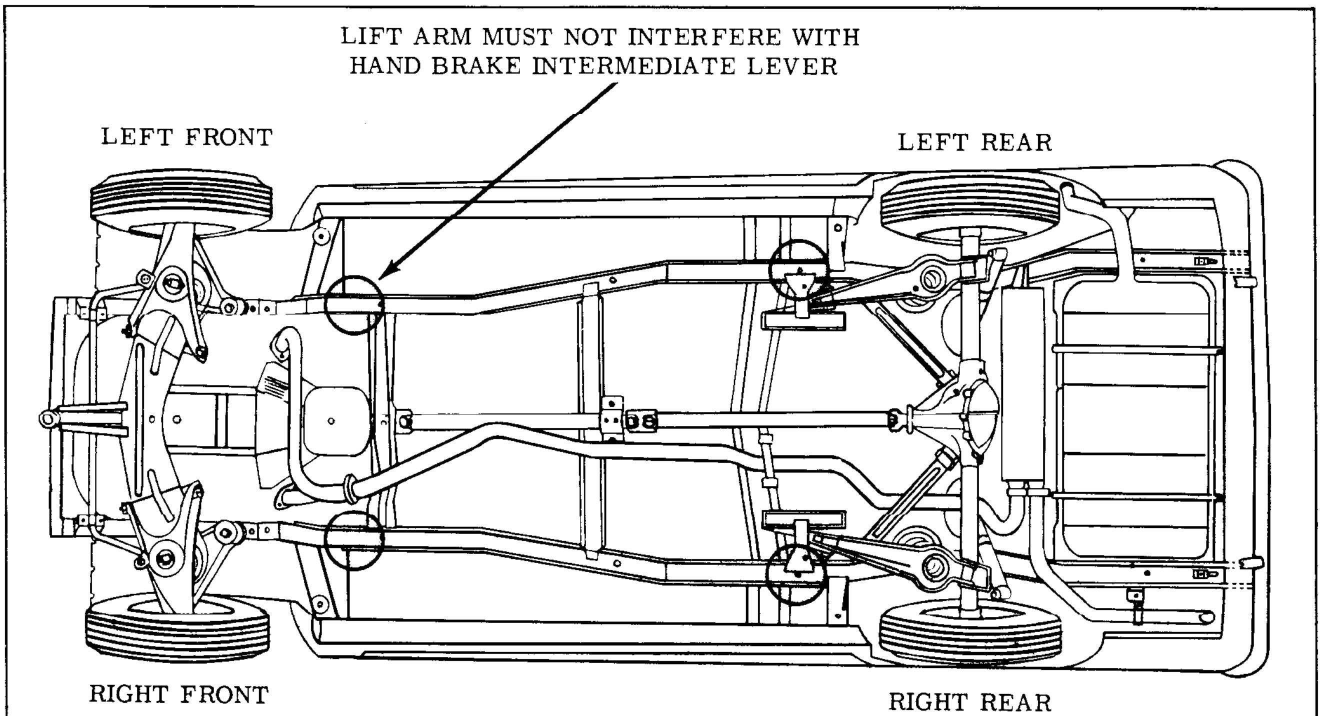

Fig. 1-6 Frame Contact Lift Points

ure to make the necessary changes to the car and subsequent operation under conditions of continuous or severe detonation is considered misuse of the engine.

After arriving in a foreign country, contact the nearest authorized General Motors Dealer for brand names of the best fuels available and advice as to where they may be purchased.

GENERAL SPECIFICATIONS

	ALL SERIES
Wheel Base	112"
Overall Length	188.2"
Overall Width	71.6"
Overall Height*	56"
Tread Width, Front and Rear	56"
Engine Displacement	215 Cu. In.
Bore	3.500"
Compression Ratio (2 Bbl. Carb.)	8.75:1
(4 Bbl. Carb.)	10.00:1
Horsepower 2 Bbl.	155
4 Bbl.	185
Tire Size (Standard)	6.50 x 13
Tire Size (Optional)	7.00 x 13

* With 4 Passenger Load - 6.50 x 13 Tires

CAPACITIES

ITEM	CAPACITY
Differential	2 Pts.
Engine Crankcase only, Drain and Refill	4 Qts.
Engine Crankcase, Drain and Refill and Filter Change	5 Qts.
Cooling System	
With Air Conditioning (Less Heater)	11 Qts.
Without Air Conditioning (Less Heater)	10-1/2 Qts.
For Heater, Add:	1-1/2 Qts.
Gasoline Tank	16 Gals.
Syncro-Mesh Transmission	2 Pts.
Hydramatic Transmission (Without Removing Pan)	4 Qts.
(With Pan Removed)	5 Qts.
(Complete Overhaul)	7 Qts.
Power Steering	
Complete System	Approx 1 Qt.
Pump Only	Approx 1 Pt.
Gear Only	Approx 1 Pt.

LUBRICATION

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OLDSMOBILE GUARDIAN MAINTENANCE SCHEDULE

MAINTENANCE SERVICE	MILEAGE IN THOUSANDS																			
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
Body and Chassis Lubrication	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Change Engine Oil and Clean Inlet Breather Cap	As Required - Refer to Page 2-5																			
Replace Oil Filter			•			•			•			•			•			•		
Clean and Oil non Disposable Type Air Cleaner (Service Oftener under Dusty Driving Conditions)			•			•			•			•			•			•		
Change Element in Disposable Type Air Cleaner (Service Oftener under Dusty Driving Conditions)								•								•				
Change Hydra-Matic Fluid													•							
Hydra-Matic Band Adjustment													•							
Repack Universal Joints (Service Oftener In Warm Climates or Under High Temp. Operating Conditions)										•										
Rotate Tires		•		•		•		•		•		•		•		•		•		•
Brake Adjustment	As Necessary - Refer to Page 7-2																			
Repack Front Wheel Bearings					•					•					•					•
Lubricate Slip Yoke				•				•				•				•				•
Spark Plugs - Clean and Gap					•					•					•					•
Distributor - Adjust Points & Set Timing					•					•					•					•
Carburetor - Adjust Idle Speed & Mixture					•					•					•					•
Clean Battery Cables and Terminals	Every 10,000 Miles or Once Each Year																			
Service Air Conditioning	Refer to Page 14-7																			
Liquid Glaze	As Necessary																			
Clean Crankcase Ventilation Inlet Breather	At Every Oil Change																			
Clean Crankcase Ventilation Check Valve					•					•					•					•

Fig. 2-1 Oldsmobile Guardian Maintenance Schedule

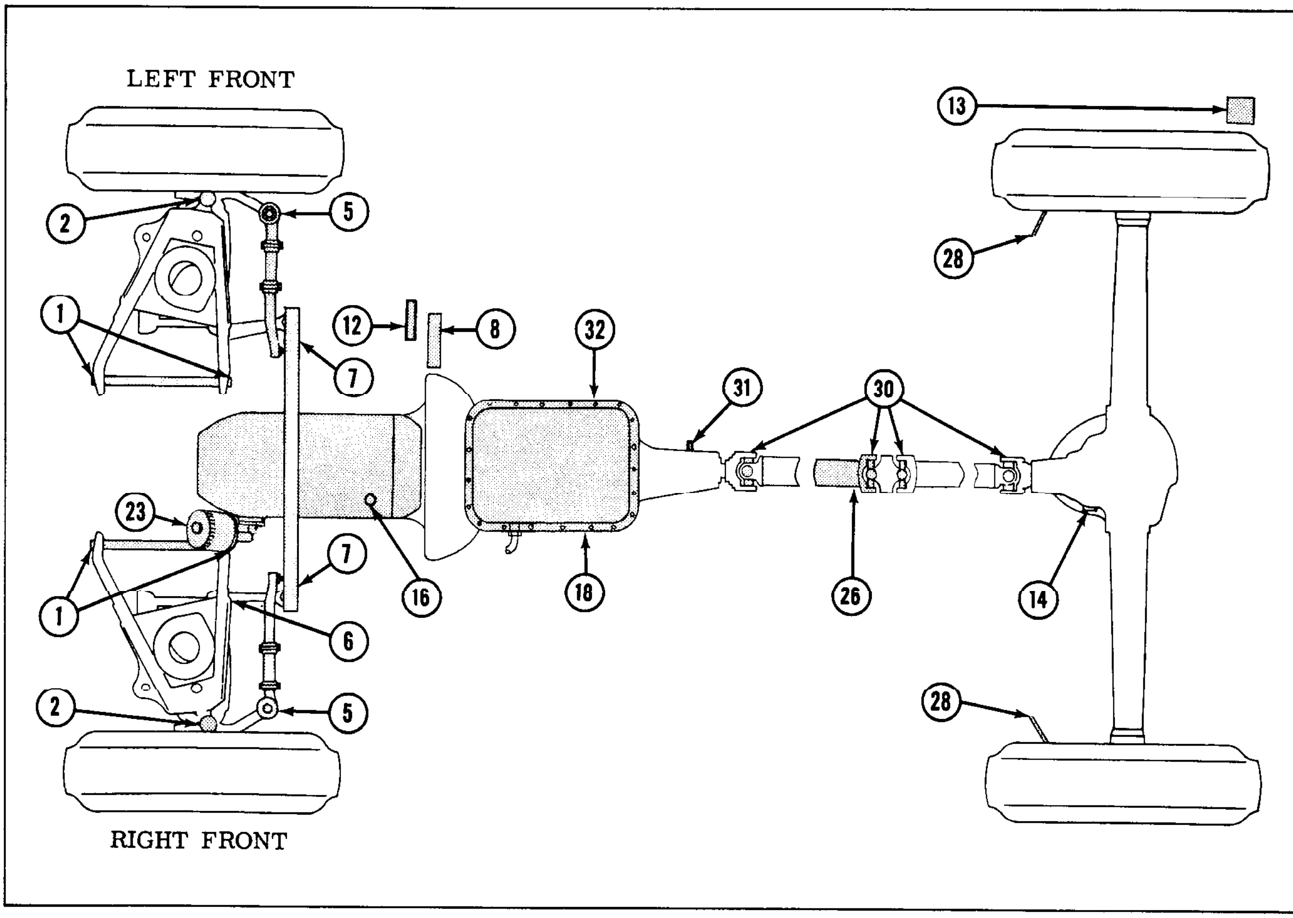

Fig. 2-2 Lubrication Points

EVERY 2,000 MILES

CHASSIS

1. Lower control arm pivot shafts . . . 4 points
2. Lower control arm ball joints . . . . 2 points
3. Upper control arm pivot shafts . . . . 4 points
4. Upper control arm ball joints . . . . 2 points
5. Tie rod ends . . . . 2 points
6. Steering idler arm bushing . . . . . . 1 point
7. Relay rod . . . . 2 points
8. Clutch equalizer . . . . 1 point
9. Generator oil cups . . . . . SAE 20 engine oil
10. Throttle and transmission linkage pivot points . . . . . SAE 20 engine oil
11. Parking brake linkage . . . SAE 20 engine oil
12. Syncro-Mesh clutch linkage (including felt washers at end of the clutch equalizer) . . . SAE 20 engine oil
13. Gas tank filler door hinge . SAE 20 engine oil

BODY LUBRICATION—CHECK—LUBRICATE AS REQUIRED

(Wipe Off Old Lubricant)

Door lock striker teeth-Light coat of stick type lubricant.

Rotary lock-Drop or two of SAE 20 oil on lock pivot. Light coat of stick type lubricant on surface of lock housing.

Door hinge and hold open assembly-Thin film of lubriplate on friction surfaces. A drop of oil on all pivot points.

Door jamb switch-Thin film of lubriplate 630 AAW or equivalent to end of plunger.

Hood hinges-SAE 20 oil at pivot points.

Hood latch-Thin film of lubriplate on friction surface. A drop of oil on all pivot points.

Rear compartment lid-Apply lubriplate 630 AAW to bolt at striker contact area.

Rear compartment lid hinges and torque rods-Apply lubriplate 630 AAW to hinges and torque rods at friction points. Apply lithium soap grease to torque rod silencer.

Weatherstrips, door bottom drain hole sealing strip, and door and hood bumpers-Thin film of Dow Corning 4X weatherstrip grease.

Seat adjuster-Thin film of lubriplate 630 AAW on seat tracks.

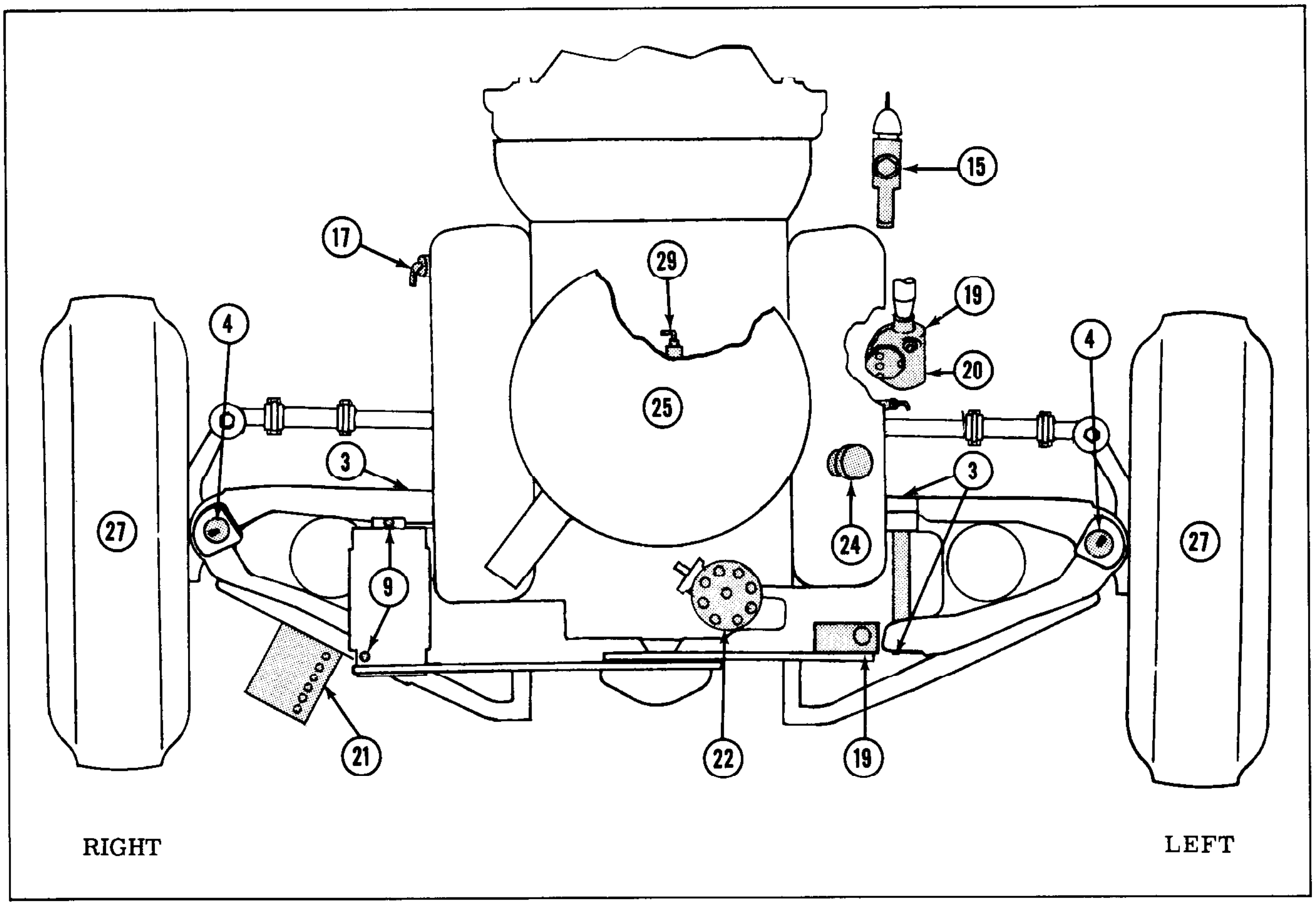

Fig. 2-3 Lubrication Points

CHECK FLUID LEVEL— ADD IF NECESSARY

14. Differential . . . . Special lubricant Part No. 531536. (Small amounts of SAE 90 Multi-Purpose Gear Lubricant may be used to replenish differential.)
15. Brake master cylinder . . . GM Brake Fluid No. 11.
16. Engine oil . . . . MS or DG oil of proper viscosity.
17. Hydra-Matic . . . . GM Hydra-Matic fluid.
18. Syncro-Mesh . . . . Syncro-Mesh Transmission Lubricant. Part No. 582840.
19. Steering gear and pump (Power) . . . . GM Hydra-Matic fluid.
20. Steering gear (Manual) . . . SAE 80 Multi-Purpose Gear Lubricant.
21. Battery . . . . Distilled water.

EVERY 6,000 MILES

16. Engine oil* -- Drain and refill with MS or DG oil of proper viscosity whenever oil filter is replaced. Refer to Change Interval Chart, Page 2-5.
22. Distributor -- Apply a film of Delco-Remy Cam and Ball Bearing Lubricant to the breaker cam.
23. Oil filter* -- Replace oil filter.
24. Crankcase inlet breather* -- Wash in solvent and re-oil with engine oil.
25. Air cleaner (non-disposable type)* - Wash in kerosene and re-oil with SAE 20 engine oil.

NOTE: The heavy duty disposable type air cleaner should be replaced every 16,000 miles. However in dusty areas it may require more frequent replacement.

*Severe driving conditions may necessitate more frequent attention.

EVERY 8,000 MILES

26. Slip yoke -- Lubricate with Seal Lubricant (Part No. 567196) until lubricant appears at slip yoke nut at rear of front propeller shaft.

EVERY 10,000 MILES

21. Battery -- Clean top of battery and cable terminals, apply a thin film of petrolatum to battery post and clamps.

27. Front wheel bearings -- Clean and pack with a sodium soap, fine fiber grease such as Marfax Heavy Duty Number 1.

28. Parking brake cables -- Lubricate with brake cable lubricant (Lithium soap grease).

29. Positive crankcase ventilator -- Clean check valve and line.

EVERY 16,000 MILES

25. Replace disposable air cleaner.

EVERY 20,000 MILES

30. Universal joints -- Disassemble, clean and repack with a sodium soap, fine fiber grease such as Marfax Heavy Duty Number 2.

EVERY 26,000 MILES

17. Hydra-Matic -- Drain and refill with GM Hydra-Matic fluid.

31. Speedometer cable -- Lubricate lower 2/3 with AC speedometer grease.

32. Adjust Hydra-Matic transmission band.

STEERING LINKAGE AND SUSPENSION

The front suspension and the steering linkage should be thoroughly lubricated with chassis lubricant at 2,000 mile intervals.

The rear suspension does not require lubrication.

DIFFERENTIAL

Periodic or seasonal changes are not recommended. The lubricant level should be checked at 2,000 mile intervals and if necessary, add lubricant to bring it up to the filler plug level. Small additions of SAE 90 Multi-Purpose Gear Lubricant may be used.

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

Capacity of the differential is approximately 2 pints.

BRAKES

The fluid level in the master cylinder should be checked every 2,000 miles. If necessary to add fluid, use GM Brake Fluid No. 11. Standard brake fluid level must be maintained at 1/2" below the master cylinder filler cap.

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

At time of brake overhaul, all rust should be cleaned from brake shoes, the inner surfaces of the brake backing plates, and all metal contact points at the brake shoe assembly. A film of four parts (volume) of Synthetic Oil Seal Lubricant (Part No. 567196) and one part (volume) of powdered graphite should be applied to the surfaces against which the shoes operate or adjacent brake parts contact. Care must be exercised to prevent any lubricant from getting on the braking surfaces of shoes or drums.

ENGINE CRANKCASE OIL

The TYPE of engine oil used will effect operation, wear, and combustion chamber deposits; the oil VISCOSITY will affect oil economy and ease of starting. It is, therefore, important that the recommendations made in this section regarding TYPE, VISCOSITY and OIL CHANGE INTERVAL be followed.

Type of Oil

ML - Not Recommended

This oil is designed for light service in engines not critically affected by sludge and varnish deposits.

MM - Not Recommended

This oil has additives to reduce sludge, varnish, and acids, but not in sufficient quantities to be recommended for use in the Oldsmobile engine.

MS and DG - Recommended

These oils are recommended for use in Oldsmobile engines as they have sufficient additives to minimize formation of sludge, varnish, and acids under normal driving conditions. These additives also give extreme pressure protection which prevents scuffing wear encountered under some types of driving conditions.

DS

This oil is specially compounded for use in diesel engines under severe operating conditions, and is not generally available. It can be used satisfactorily in Oldsmobile engines, but is not required. It contains a larger quantity of additives than the MS or DG oils.

Brands of Oil

In selecting a brand of engine oil, it is advisable to consider the reputation of the refiner and distributor, as they are responsible for the quality of the product and their reputation is the car owner's best indication of quality. To obtain maximum performance and satisfaction from the engine, it is important to use only crankcase oils that have been proven, in service, to be satisfactory in minimizing wear as well as sludge, varnish, and acidic deposits.

Even though designated "For Service MS" or "For Service DG", some commercial crankcase oils form the type of combustion chamber deposits that increase the tendency for detonation and pre-ignition; also, some are deficient in anti-wear characteristics and may contribute to rapid wear of engine' parts, such as camshaft, valve lifters, rocker arms, and piston rings.

Under adverse operating conditions where a greater concentration of additives is required, a High Detergency Concentrate which has been thoroughly tested and recommended is available under General Motors Part No. 582099.

The use of proprietary compounds, such as "break-in" oils, "tune-up" compounds, "tonics", "friction reducing" compounds, etc., are specifically not recommended.

Oil Viscosity

SAE viscosity numbers specify viscosity only and should not be confused with "Type of Oil". The lower viscosity of "thinner" oils, such as, SAE 5W, or SAE 10W are designed for use during cold weather to provide fast starting and instant lubrication. The higher viscosity or "thicker" oils, such as, SAE 20 or SAE 20W are designed for use during warm or hot weather to provide adequate lubrication under higher operating temperatures.

Several oil companies now market multiple viscosity oils, such as, SAE 5W-20, SAE 10W-20, SAE 10W-30, etc., which are designed to combine the fast starting and instant lubrication characteristics of the lower SAE number with the warm weather operating characteristics of the higher SAE number.

The proper oil viscosity to use depends upon the range in atmospheric temperatures that will be encountered during the period the oil remains in the crankcase. More than normal oil consumption will be encountered during warm or hot weather, particularly under high speed driving conditions, if the oil viscosity is too low. The following chart will serve as a guide to the proper oil viscosity to use under various atmospheric temperature conditions. It is not necessary to change oil for the unseasonably cold or warm days encountered during the fall or spring season.

Anticipated Lowest Atmospheric Temperature	Recommended SAE Viscosity Number When Single Viscosity Oils Are Used	Recommended SAE Viscosity Range When Multi/Viscosity Oils Are Used
32°F	SAE 20 or SAE 20W	SAE 10W-30 or SAE-10W-20
0°F	SAE 10W	SAE 10W-30 or SAE 10W-20
Below 0°F	SAE 5W	SAE 5W-20

NOTE: The SAE viscosity number should be plainly marked on the oil containers.

SAE 5W oils are not recommended for sustained high speed driving during warm weather. For sustained high speed driving when the prevailing daylight temperature is above 90°F, SAE 30 may be used.

SAE 5W and SAE 5W-20 oils are particularly advantegous during extremely low temperatures because the easy starting and quick flow characteristics of these oils greatly reduce the drain on the battery in cold weather.

Oil Change Interval

The crankcase of the engine was filled at the factory with MS or DG oil. If it is necessary to add oil before the first drain period, use oil of type and viscosity recommended in the preceding paragraphs on "Type of Oil" and "Viscosity". Break-in oils are entirely unnecessary and their use is not recommended.

When changing oil, drain the crankcase after the engine has reached normal operating temperature to insure complete removal of the old oil. Oil pan drain plug torque is 30-35 ft. lbs.

The initial oil change and subsequent changes should be made in accordance with the following recommendations:

Prevailing Daylight Temperature	Change Interval
Above 32° F.	*Every 3,000 miles or every 3 months, whichever occurs first.
Below 32° F.	*Every 3,000 miles or every 2 months, whichever occurs first.

* NOTE: If the car has been driven in a dust or sand storm, the engine oil should be changed as soon as possible. When the car is operated on dirt roads or under dusty conditions, it may be necessary to change the oil more frequently than indicated in the above recommended intervals which were predicted on paved road driving conditions.

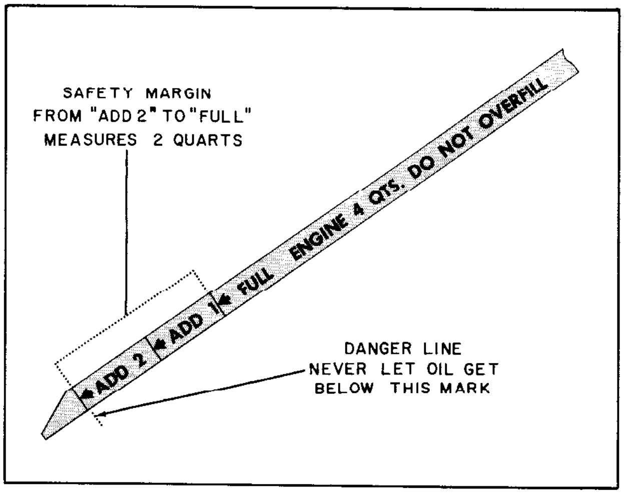

Fig. 2-4 Engine Oil Dipstick

Crankcase Capacity

Oil change only, 4 quarts.

Oil change and filter element change, 5 quarts.

Oil Level

The engine oil dipstick 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 when refueling. (Fig. 2-4)

HYDRA-MATIC TRANSMISSION

GM Hydra-Matic Fluid

This all-season fluid, designed for year-round operation, is available through authorized dealers.

Fluid for the Hydra-Matic unit is also available through most independent oil companies. Only fluid with the following identification on the container should be used: brand name, including the words ". . . . . Fluid Type "A", plus "AQ-ATF-number-A".

Checking Hydra-Matic Fluid Level

Fluid level should be checked every 2,000 miles. 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.

Draining Hydra-Matic Transmission

The Hydra-Matic fluid should be changed every 26,000 miles.

To drain the Hydra-Matic transmission oil:

1. Remove drain plug from transmission oil pan permitting fluid to drain, then replace the plug.
2. Raise hood and remove dipstick.
3. First add 3-1/2 quarts of HM fluid to the transmission.
4. 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 the dipstick.

NOTE: Approximately 4 quarts of oil are required to fill the Hydra-Matic transmission after the transmission has been drained. Approximately 5 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. AFTER FLUID HAS BEEN ADDED THE TRANSMISSION IS WARM, LEVEL SHOULD BE CHECKED TO MAKE SURE THAT IT IS AT THE "FULL" MARK ON THE OIL LEVEL DIPSTICK. Approximately 7 quarts are required after an overhaul.

BAND ADJUSTMENT

To adjust the band, remove the oil pan, loosen band adjusting screw lock nut and tighten screw to 100 inch lbs. Back screw off 2-1/4 turns and tighten lock nut. Install pan and add necessary oil.

Fig. 2-5 Hydramatic Transmission Oil Level Dipstick

SYNCRO-MESH TRANSMISSION

Remove the filler plug from the transmission case and fill to the level of the opening with Syncro-Mesh Transmission Lubricant, Part No. 582840. The lubricant level should be checked every 2,000 miles and if found low, the transmission should be checked for leaks, and the source of the leak corrected. Periodic or seasonal change of lubricant is not recommended:

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

Capacity of the unit overhauled is 2 pints.

POWER STEERING GEAR AND PUMP

Check every 2,000 miles and maintain oil level at "FULL" mark. Oil must be warm when checking oil level. Use Hydra-Matic Transmission Fluid. Power steering gear lubrication is accomplished by the oil supplied to the gear by power steering pump. Pump must be at maximum full mark.

MANUAL STEERING GEAR

Check steering gear lubricant level every 2,000 miles. The necessity for frequent addition of lubricant indicates leakage and the source of leakage must be found and corrected. Use SAE 80 Multi-Purpose Gear Lubricant. Regular or seasonal changes are unnecessary.

NOTE: THE FRONT WHEELS SHOULD BE TURNED TO THE EXTREME RIGHT TO ALLOW GREASE TO ENTER THE GEAR FREELY.

BATTERY

Check battery liquid level every 2,000 miles or once a month (more often in hot weather). Level should reach the bottom of the vent well.

CAUTION: DO NOT OVERFILL.

Service battery and terminals every 10,000 miles or once a year. Check tightness of battery hold-down bolts. To properly clean battery:

1. Make sure vent plugs are closed tight.
2. Brush battery with a diluted ammonia or soda and rinse with clear water. Apply a thin coating of petrolatum to terminals and clamps.

DISTRIBUTOR

The breaker cam should be lubricated with a thin film of Delco-Remy Cam and Ball Bearing Lubricant every 6,000 miles or whenever the contact assembly is replaced. No other lubrication is required. The movable breaker plate is lubricated by oil from the upper main shaft bushing.

GENERATOR

Hinge cap oilers are provided at both the commutator and drive ends. Every 2,000 miles the oilers should be filled to the cap with SAE 20 oil.

If the oil reserve in the commutator end frame becomes completely exhausted through failure to lubricate at regular intervals, it will require more than a simple filling to restore the reserve. In such case, oil cup should be filled three times consecutively, allowing time between fillings for the oil to soak down.

THROTTLE AND TRANSMISSION LINKAGE

Every 2,000 miles, remove road film from lubrication points, then apply engine oil to all friction and bearing surfaces on transmission control linkage and throttle linkage.

PARKING BRAKE LINKAGE

All the moving parts of the parking brake linkage should be lubricated with engine oil every 2,000 miles.

PARKING BRAKE CABLES

The parking brake cables leading to the rear wheels operate inside metal conduits through a portion of their length. Normal use of this type of cable will assist in keeping them in operating condition without periodic maintenance.

CLUTCH LINKAGE

Every 2,000 miles remove road film from lubrication points, then apply engine oil to all friction and bearing surfaces on the clutch linkage. The clutch equalizer should be lubricated with chassis lube.

FUEL FILTER

The fuel filter is located in front of the right cylinder head. The bowl and element should be cleaned when necessary. If the element cannot be cleaned satisfactorily, it should be replaced.

OIL FILTER

A full flow oil filter, provided as optional equipment on all models, filters 100% of the oil delivered by the oil pump. For this reason the interval of change is very important. The oil filter should be replaced every 6,000 miles. Operating conditions may require more frequent replacement.

The oil filter can be removed as follows:

1. Loosen filter with a wrench, then remove and discard filter.

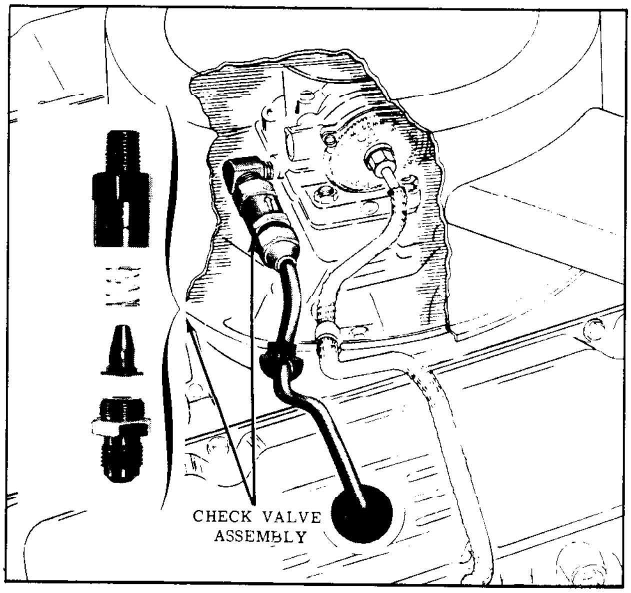

Fig. 2-6 Positive Crankcase Ventilator

2. Clean out filter body casting.

3. With new seal seated on face of new filter, install filter carefully, then torque 15-17 ft. lbs.

CRANKCASE BREATHER

At each engine oil change the crankcase inlet breather cap should be washed in solvent and re-oiled with SAE 20 oil. Operating conditions may require more frequent service.

POSITIVE CRANKCASE VENTILATOR

The positive crankcase ventilator check valve should be cleaned every 10,000 miles. (Fig. 2-6)

AIR CLEANER

Non-Disposable Type

The air cleaner element should be serviced every 6,000 miles. Operating conditions may require more frequent service.

The air cleaner should be serviced as follows:

1. Remove the filter element.

2. Wash accumulated dirt from the filter element by plunging it up and down several times in clean kerosene and wring dry.

3. Oil filter element with SAE 20 oil wring out excess oil and install.

Heavy Duty Disposable Element Type

The air cleaner incorporates a disposable air filter element. The outside surface of the element is covered with a coarse material for primary filtering of large particles. The inner surface is a less porous material for filtering fine particles. 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 16,000 miles under normal driving conditions, or under dusty driving conditions more frequently as required. Do not attempt to service the element.

The filter element should be replaced as follows:

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

2. Remove filter element from air cleaner.

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

4. Install air cleaner assembly on car.

SLIP YOKE

The slip yoke should be lubricated every 8,000 miles with Special Seal Lubricant (Part No. 567196) until lubricant appears at the rear of the front propeller shafts. A grease fitting plug is provided for lubrication of the slip yoke.

UNIVERSAL JOINTS

The needle bearings in the universal joints of the propeller shafts are prepacked with lubricant at the time of their manufacture; no attention need be given these bearings so far as lubrication is concerned for 20,000 miles.

When removing the propeller shaft, mark the shaft so it may be replaced in all places in the same position as when removed.

To lubricate, proceed as follows:

For Service of universal joints, refer to PROPELLER SHAFT Section 6.

1. If the propeller shafts were separated, thoroughly clean the slip yoke and lubricate with Special Lubricant (Part No. 567196).

FRONT WHEEL BEARINGS

Front wheel bearings should be lubricated every 10,000 miles with a sodium soap, fine fiber grease such as Marfax Heavy Duty Number 2. Long fibrous greases should be avoided because they throw out of bearings.

Pack the bearing assemblies full, but do not put grease in hub as excessive grease increases the chance of leakage into the brakes and prevents proper heat dissipation of the hub and drum assembly.

When it is found necessary to remove the front wheel bearings for cleaning, the bearings should be washed in clean gasoline (not light oil) and must be thoroughly dried before new grease is applied. If the bearings are washed in light oil, the grease will not adhere to the bearings and the bearings will run dry.

The adjustment of front wheel bearings should be made as follows:

1. Tighten adjusting nut 10-15 ft. lbs. to insure that all parts are properly seated and threads are free.
2. Back off nut 1/6 to 1/4 turn and install cotter pin.

SPEEDOMETER CABLE

The speedometer cable is lubricated at the time of assembly and should not require further lubrication, under normal conditions, for 26,000 miles. When a new speedometer cable is installed, it should be lubricated. To lubricate, all old grease must first be removed from the cable casing and then a coating of AC Speedometer cable grease should be applied 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.

Special care should be exercised that foreign material, etc. is not permitted to get into cable housing.

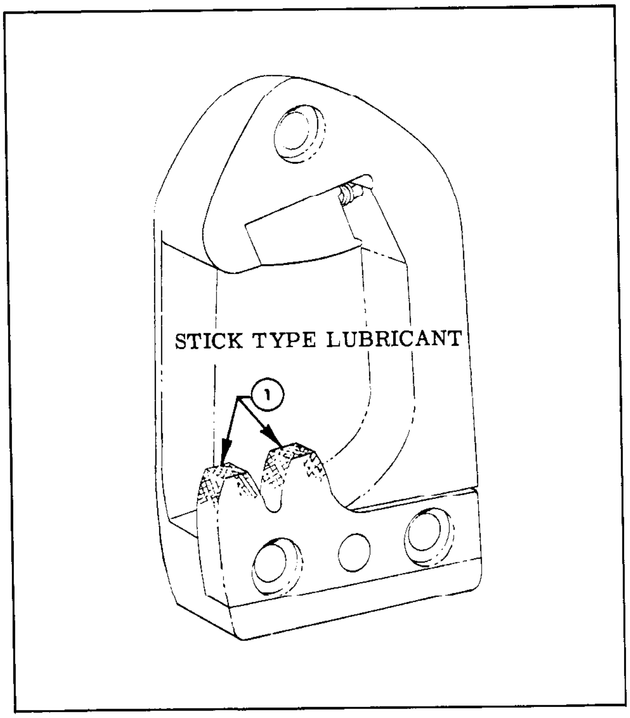

Fig. 2-7 Door Lock Striker

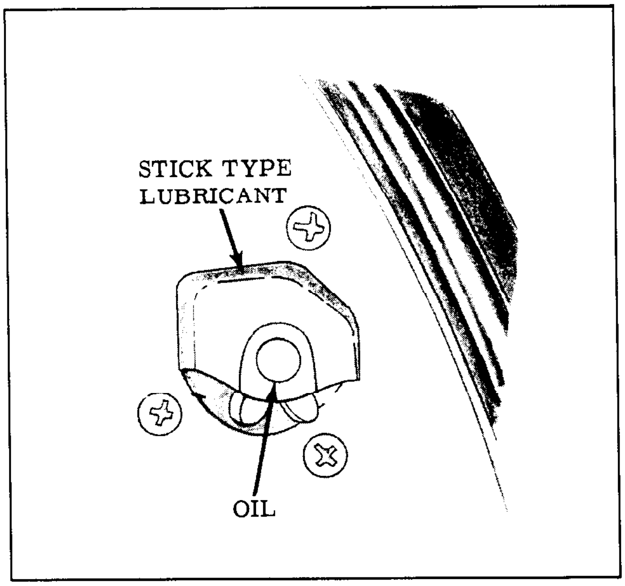

Fig. 2-8 Door Lock

BODY LUBRICATION

HOOD HINGES

SAE 20 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.

HOOD LATCH

Lubricate the latch pilot bolts and latch locking plates with a thin film of lubriplate. Use a light oil for pivot points.

DOOR LOCK STRIKER

Wipe off dirt and apply a thin coat of stick type lubricant to top surface of lock bolt striker teeth (Fig. 2-7) After lubrication, close door several times and remove excess lubricant along the side edge of teeth.

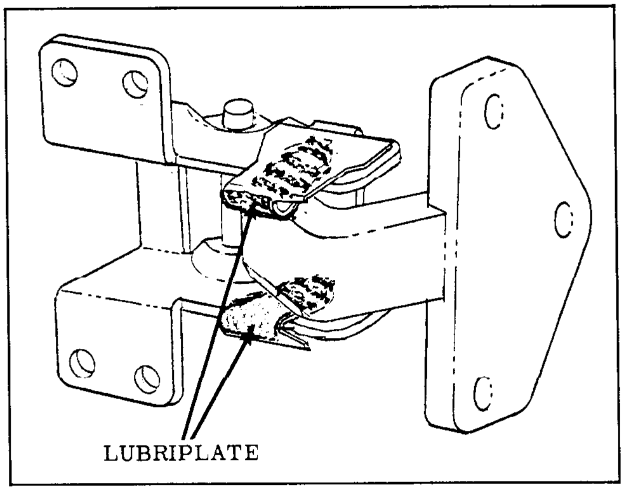

Fig. 2-9 Front Door Hinge and Hold Open Assembly

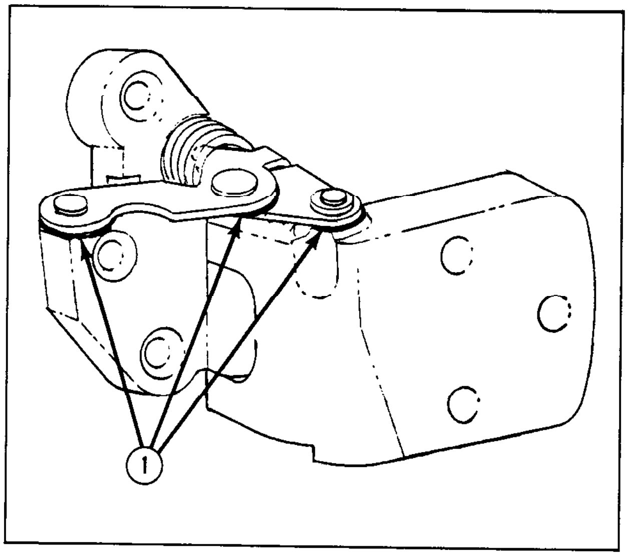

Fig. 2-10 Rear Door Hinge

DOOR LOCKS

Wipe off dirt and apply a thin coat of stick type lubricant on surface of lock housing. (Fig. 2-8)

Place a drop or two of SAE 20 oil on the rotary lock pivot.

DOOR HINGE AND HOLD OPEN ASSEMBLY

Wipe off dirt and apply a light coat of lubriplate 630 AAW or its equivalent at points indicated by number 1. (Fig. 2-9)

Place a drop of oil on hinge pins. Wipe off excess lubricant.

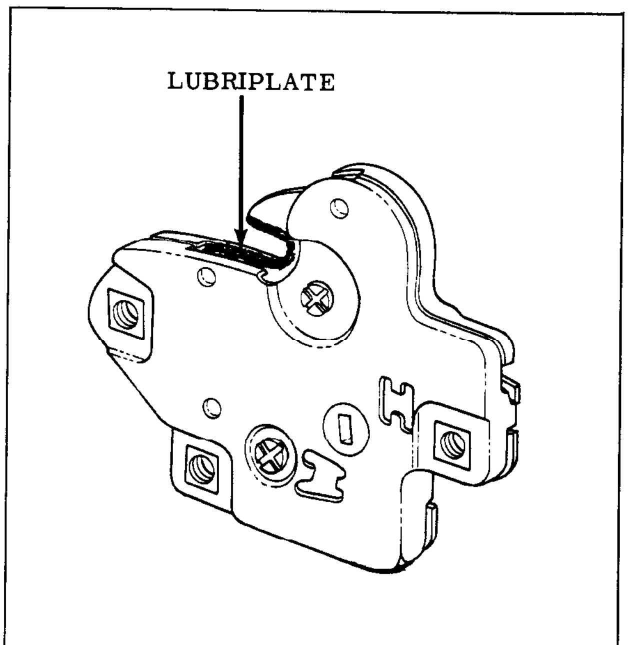

Fig. 2-11 Rear Compartment Lid Lock Bolt

REAR COMPARTMENT LID AND BACK DOOR LOCKS

On rear compartment lid locks, apply a thin film of Lubriplate 630 AAW or its equivalent. (Fig. 2-11)

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

DOOR AND REAR COMPARTMENT LOCK CYLINDERS

A small quantity of lock lubricant occasionally applied to the lock cylinders will prevent sticking.

REAR COMPARTMENT LID HINGES AND TORQUE RODS

Apply Lubriplate 630 AAW or equivalent to hinge and torque rods at friction points. Apply a thin coat of Lithium Soap Grease to torque rod silencer at area contacted by torque rod.

WEATHERSTRIP AND DOOR BUMPERS

A thin film of silicone lubricant should be used on all weatherstrips, door bumpers, hood and lacings to prevent squeaking.

FRONT SEAT ADJUSTER MECHANISM

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

GLOVE COMPARTMENT DOOR HINGE

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

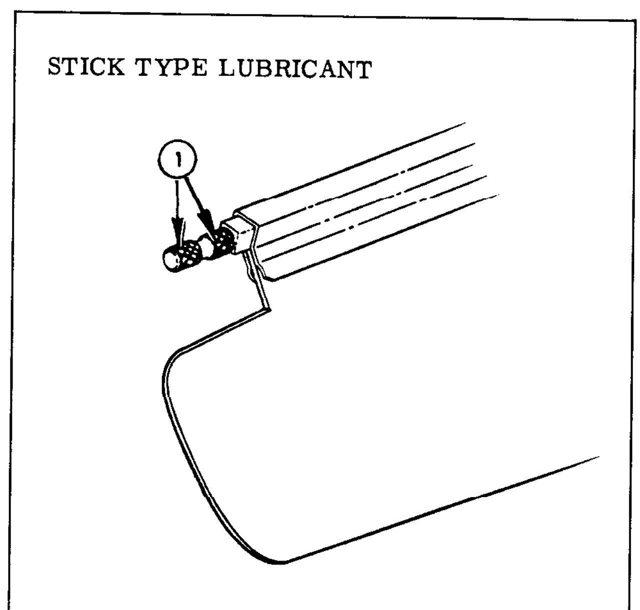

Fig. 2-12 Sunshade Rod

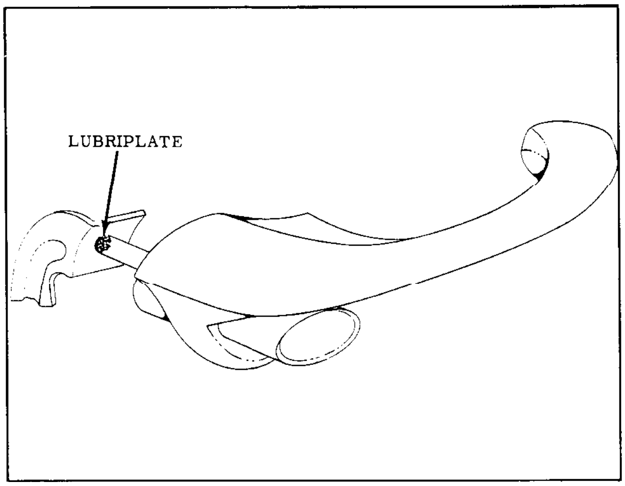

Fig. 2-13 Door Outside Handle

GAS TANK FILLER DOOR HINGE

Remove accumulated dirt away from spring.

Apply a few drops of dripless oil to frictional points of door hinge. Work door several times and wipe off excess lubricant.

SPARE TIRE COVER HINGE ASSEMBLY (35 Styles)

Wipe off dirt and apply a few drops of dripless oil to frictional areas. Work cover several times and wipe off excess lubricant.

SUNSHADE ROD

Remove sunshade from support and apply a thin film of stick type lubricant to end of sunshade rod. (Fig. 2-12)

THE FOLLOWING PARTS SHOULD BE LUBRICATED WHEN ACCESS TO PARTS IS AVAILABLE:

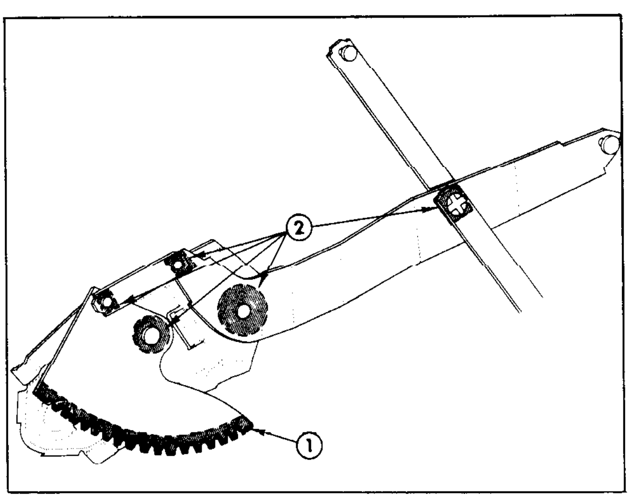

Fig. 2-14 Door Window Regulator

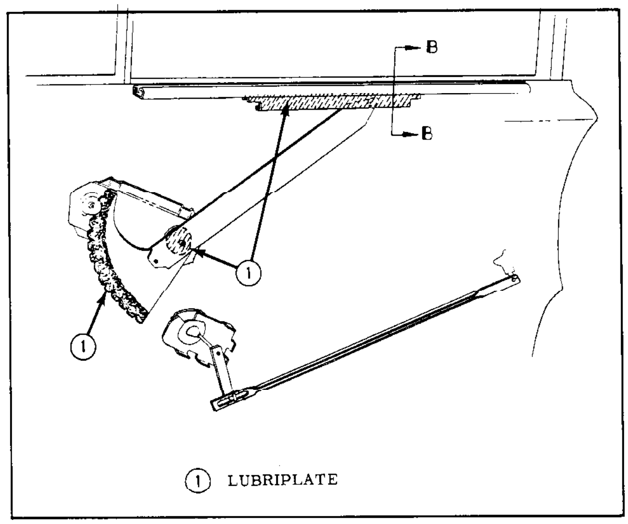

Fig. 2-15 Front Door Window Regulator Cams

DOOR LOCK OUTSIDE HANDLE

Apply a light coat of No. 630 AAW Lubriplate or equivalent to surface of lock cylinder shaft contacting bell crank. (Fig. 2-13)

DOOR WINDOW REGULATOR

Apply a coat of No. 630 AAW Lubriplate or equivalent to areas indicated by the numbers 1 and 2. (Fig. 2-14) Lubrication of front door window regulator is typical of lubrication of rear door regulators.

DOOR WINDOW CAMS

Apply a coat of No. 630 AAW Lubriplate or equivalent to channel portions of cams. (Fig.2-15)

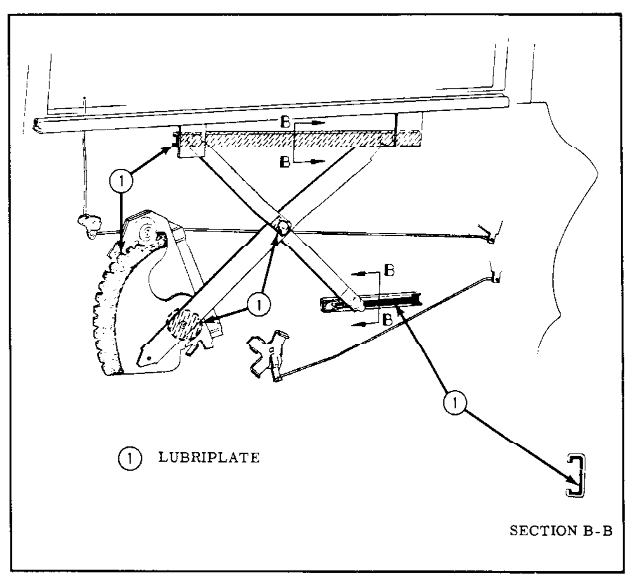

Fig. 2-16 Rear Door Window Regulator Cams

DOOR LOCK PARTS

Lubricate moving parts of door lock with No. 630 AAW Lubriplate or equivalent.

DOOR LOCKING MECHANISM

Apply No. 630 AAW Lubriplate or equivalent to pivot points at ends of all connecting rods.

BACK DOOR HINGES AND TORQUE RODS (35 Styles)

Wipe off dirt and apply dripless oil to frictional points; work door several times and wipe off excess lubricant.

HYDRA-MATIC

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MAINTENANCE RECOMMENDATIONS

The fluid level in the transmission should be checked every 2,000 miles and the fluid should be changed every 26,000 miles.

Check with the selector lever in the "Park" position, the engine running and on a level surface.

IT IS VERY IMPORTANT THAT THE FLUID LEVEL BE AT MAXIMUM AT ALL TIMES.

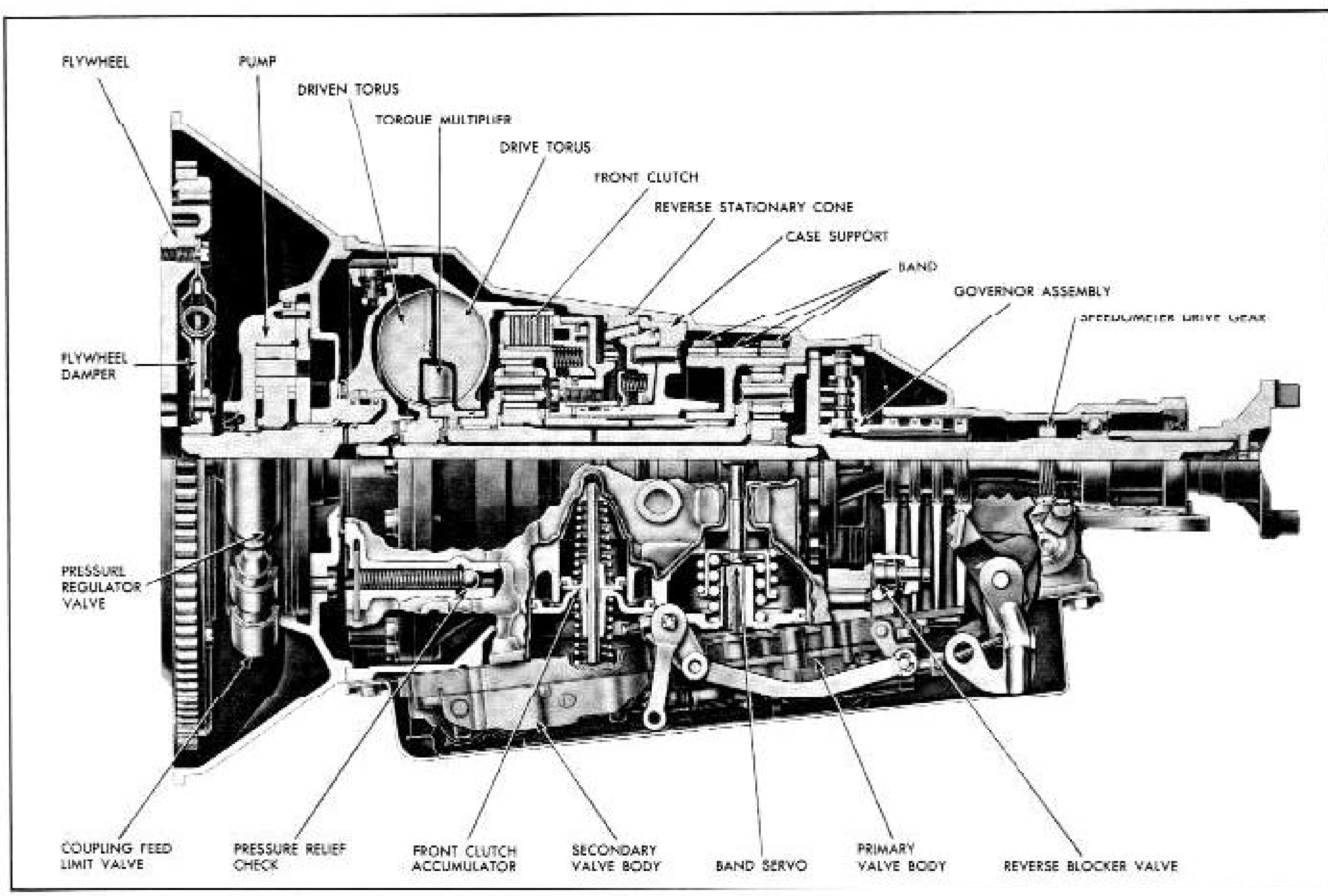

Fig. 3-1 Hydra-Matic Transmission

Approximately 4 quarts are required to fill the transmission after it has been drained, or 5 if the pan has been removed. Approximately 7 quarts are required after a complete overhaul.

When changing the oil, add 4 quarts, start the engine, and add oil to bring fluid level to the "Full" mark.

Only fluid 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".

There is a band adjustment required every 26,000 miles. Refer to "Adjustments" for correct procedure. It may be necessary to adjust the shift linkage should erratic shifting occur.

TOWING PRECAUTIONS

Complete towing instructions are covered in the General Information Section.

PUSHING CAR TO START ENGINE

As a result of the Transmission design, the engine cannot be started by pushing the car.

TRANSMISSION OPERATION

The transmission offers three selective drive ranges, "D", "S" and "L". In "D" range the transmission starts in first gear and shifts automatically to second and third.

With the selector lever in "S" range the transmission starts in first gear and shifts to second, and remains in second until approximately 60-65 m.p.h., regardless of throttle opening. This provides additional acceleration for long hills or traffic driving as well as engine braking power when descending long grades. When car speed reaches approximately 60-65 m.p.h. the transmission automatically shifts to third gear. If car speed decreases to approximately 60-65 m.p.h. the transmission will downshift to second gear.

With the selector lever in "L" range, the transmission will remain in first speed regardless of throttle opening or car speed. "L" range is designed for engine breaking when descending steep grades. It may also be used to hold the car in first speed for maximum pulling power.

PART THROTTLE DOWNSHIFT

Third to Second

A part throttle downshift can be made any time the transmission is in third gear and the car speed is below approximately 38 m.p.h. Since this downshift will occur at part throttle opening, the advantage of second gear power is obtained without a wide open throttle. This feature is desirable in traffic conditions where a wide open throttle would be unnecessary.

FORCED DOWNSHIFTS (Detent)

In "D" range the transmission can be downshifted third to second and second to first within set speed ranges.

In "S" range a third to second forced downshift can be made within a set speed range. A warning "feel" on the accelerator pedal makes it possible for the driver to obtain full throttle performance with or without downshift, as desired.

REVERSE

Reverse is accomplished through use of a friction clutch applied by oil pressure and designed for ease in "rocking" the car. A reverse blocker piston prevents movement of the selector lever to reverse position above 10 m.p.h.

PARKING

With the selector lever in the "Park" (P) position, a parking pawl engages with lugs on the reverse planet carrier and locks the output shaft to the transmission case. A detent in the steering column prevents accidental movement of the selector to the "Park" (P) position.

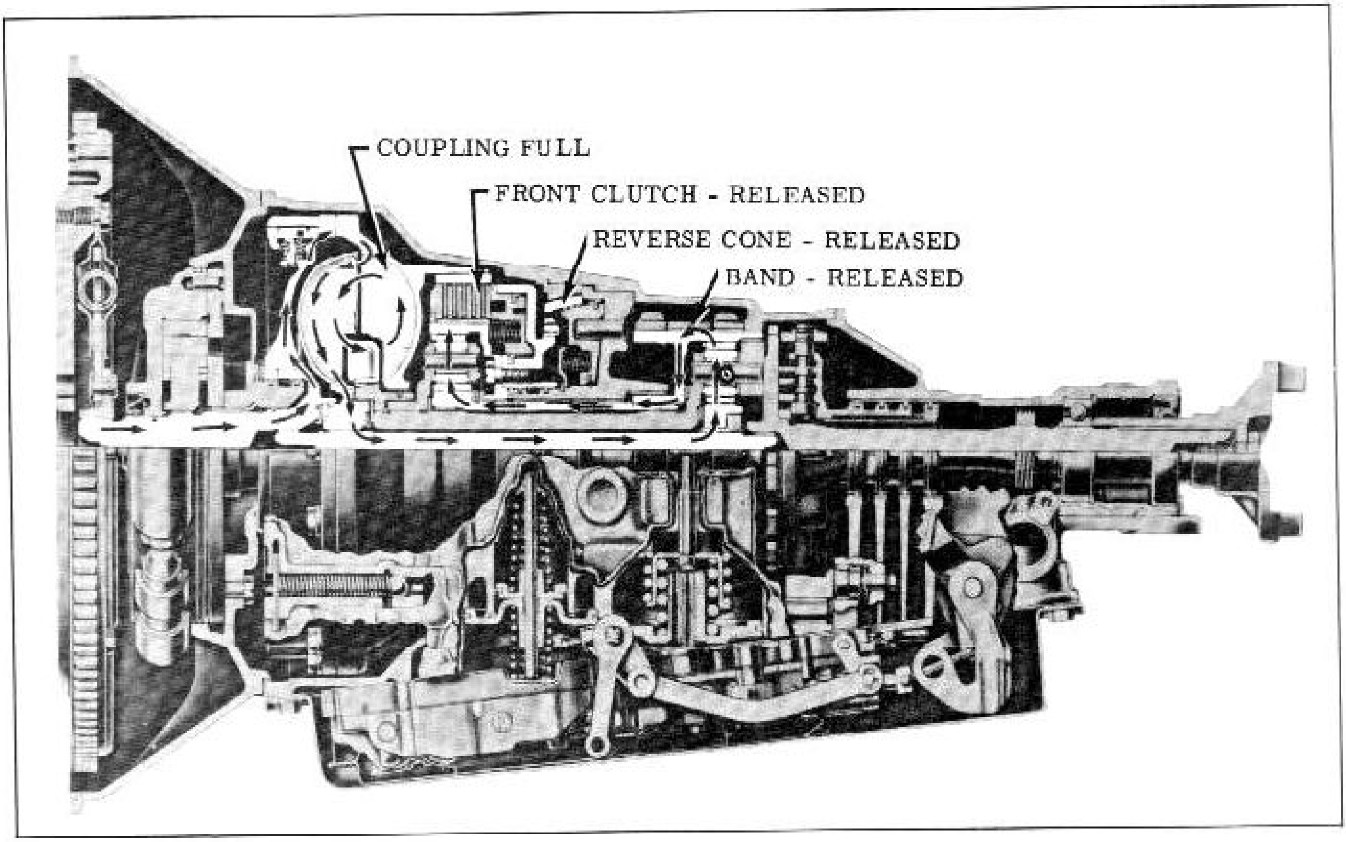

Fig. 3-2 Neutral - Engine Running

POWER FLOW (TORQUE MULTIPLIER DESIGN)

NEUTRAL ENGINE RUNNING

FLUID COUPLING—FULL

FRONT CLUTCH—RELEASED

BAND—RELEASED

REVERSE CLUTCH—RELEASED

Power from the engine (in a clockwise direction) is mechanically transmitted through the flywheel damper assembly and torus cover to the drive torus member. The drive member then directs the oil against the driven member causing it to turn the main shaft and rear unit sun gear clockwise.

In neutral the band is released and allows the rear unit internal gear to turn. Therefore, as the rear unit sun gear turns clockwise, the rear unit pinions turn counterclockwise driving the rear internal gear counterclockwise.

The front unit sun gear is mechanically connected to the rear internal gear and is also turning counterclockwise, this causes the front unit pinions to rotate clockwise on their pins. The clockwise motion of the front unit pinions then drives the front internal gear clockwise.

Because both the rear unit internal gear and the front unit internal gear are spinning freely, there is no transfer of torque from the front or rear units to the carriers or output shaft.

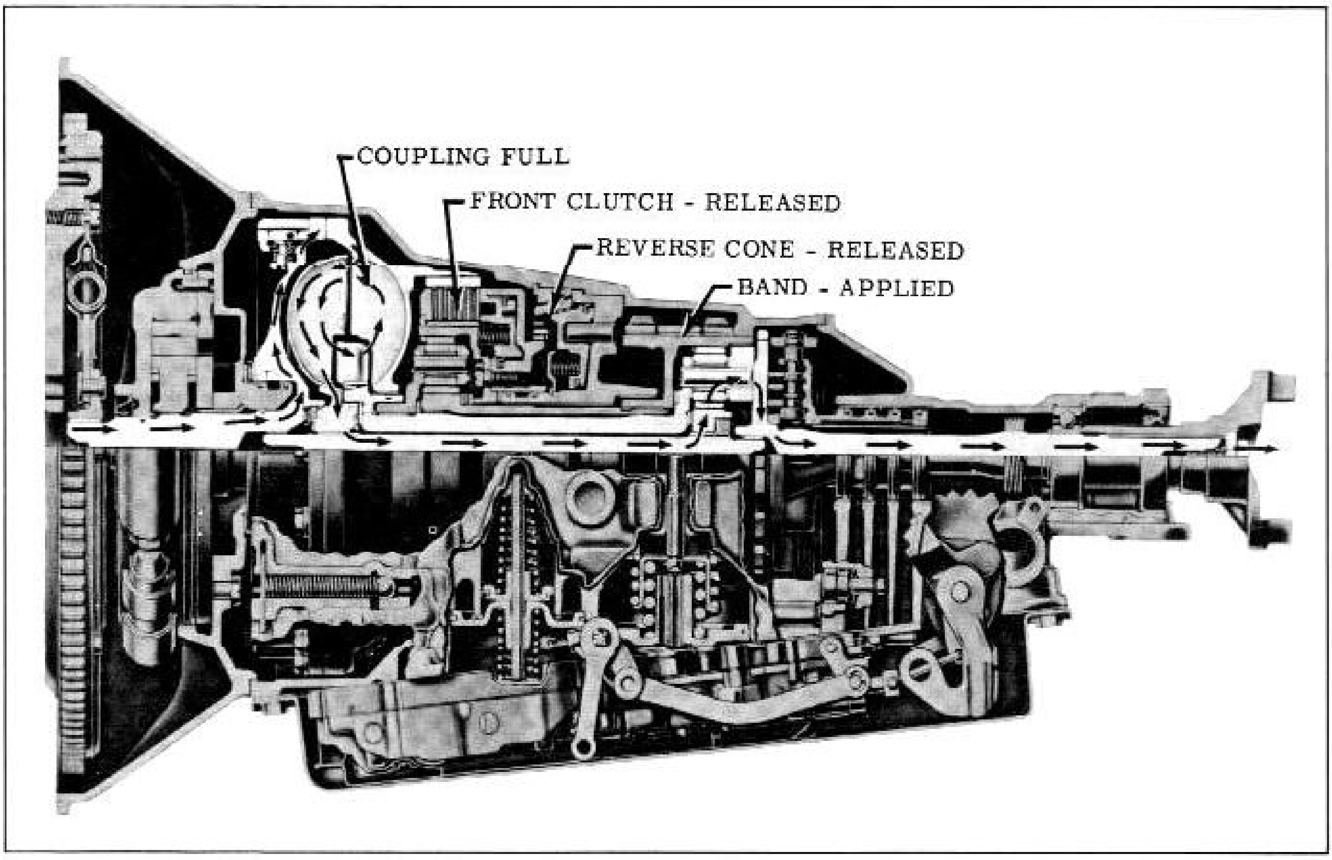

Fig. 3-3 First Speed

FIRST SPEED

FLUID COUPLING—FULL | **BAND—APPLIED**

FRONT CLUTCH—RELEASED | **REVERSE CLUTCH—RELEASED**

RATIO: 3.6394:1

Power from the engine is mechanically transmitted through the flywheel damper assembly and torus cover to the drive torus member. Engine torque is then hydraulically transmitted through oil to the driven torus member. Oil from the driven torus member is then directed against the torque multiplier which redirects the force of the oil back to the drive member in such a way as to assist in turning the drive member. Engine torque through the coupling is then multiplied and applied to the mainshaft and rear unit sun gear.

The band is applied locking the rear unit internal gear stationary. Coupling torque clockwise through the rear sun gear then attempts to drive the pinions and internal gear counterclockwise, however, because the band holds the internal gear stationary, the output shaft through the pinions is compelled to rotate clockwise within the internal gear at a reduced speed and with increased torque.

As the rear carrier and output shaft rotate clockwise at reduced speed the front carrier, which is mechanically connected to the rear carrier, also rotates clockwise at a reduced speed. Because the band is holding the front unit sun gear stationary, the carrier and pinions rotate the front unit internal gear clockwise at approximately one-half engine speed.

Because the front clutch is released, the reduction in first speed is due to the rear unit gear reduction times the coupling torque multiplication, less the .3 engine torque acting on the output shaft through the torque multiplier.

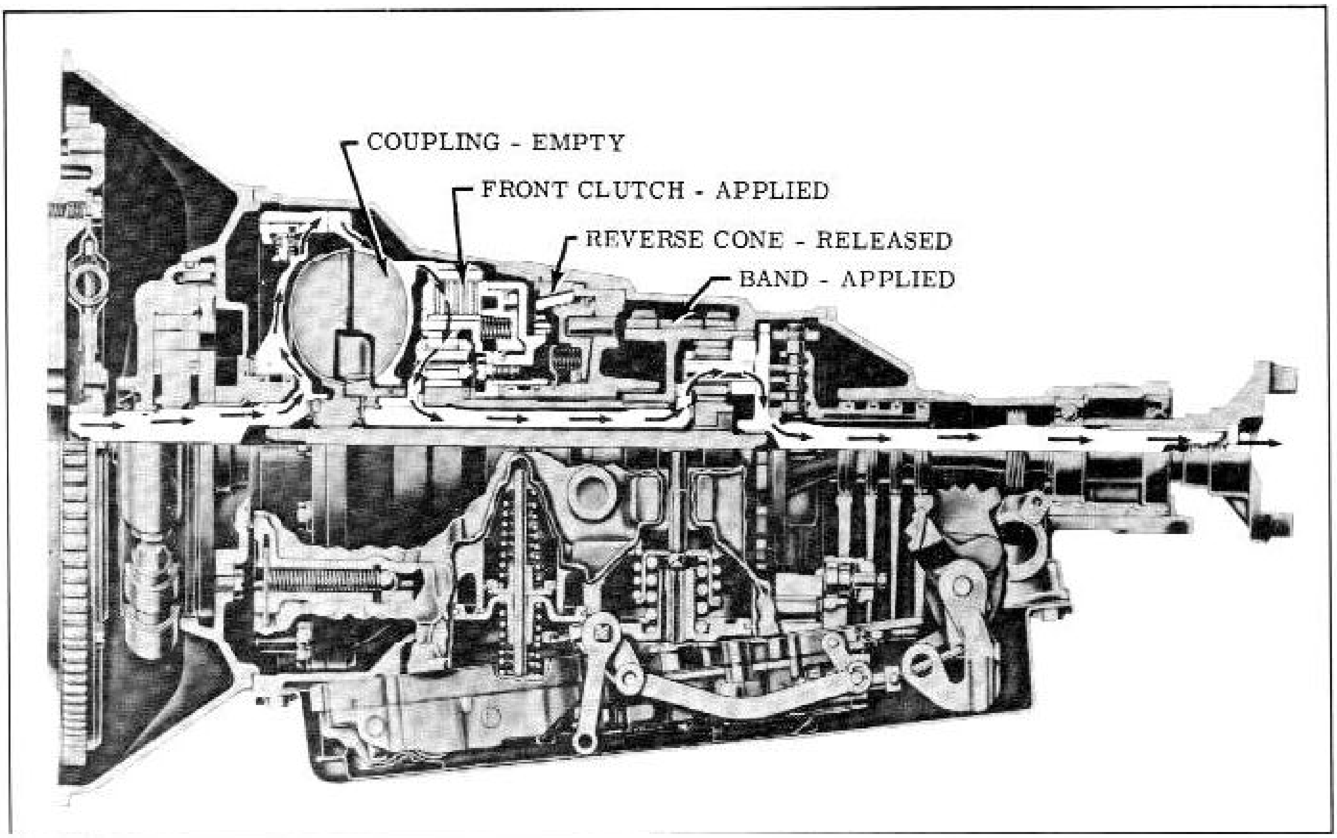

Fig. 3-4 Second Speed

SECOND SPEED

FLUID COUPLING—EMPTY **BAND—APPLIED**

FRONT CLUTCH—APPLIED **REVERSE CLUTCH—RELEASED**

RATIO: 1.5775:1

Power from the engine is mechanically transmitted through the flywheel, damper assembly and torus cover to the drive torus member. The front clutch is applied and the coupling is empty so engine torque is mechanically applied to the front unit internal gear.

The front unit sun gear assembly is splined to the rear unit internal gear and is prevented from turning counterclockwise when the band is applied. Engine torque at the front internal gear is then applied to the pinions, and because the sun gear cannot rotate counterclockwise the planet pinions and carrier are compelled to revolve clockwise around the sun gear in reduction. The front carrier is splined to the rear unit carrier and shaft assembly which in turn is bolted directly to the output shaft.

As the output shaft and rear unit carrier turns clockwise in reduction, the pinions will drive the rear unit sun gear and driven torus in a clockwise direction faster than engine speed. Because the coupling is empty no power is transmitted and all torque multiplication in second speed is due to the front unit gear ratio.

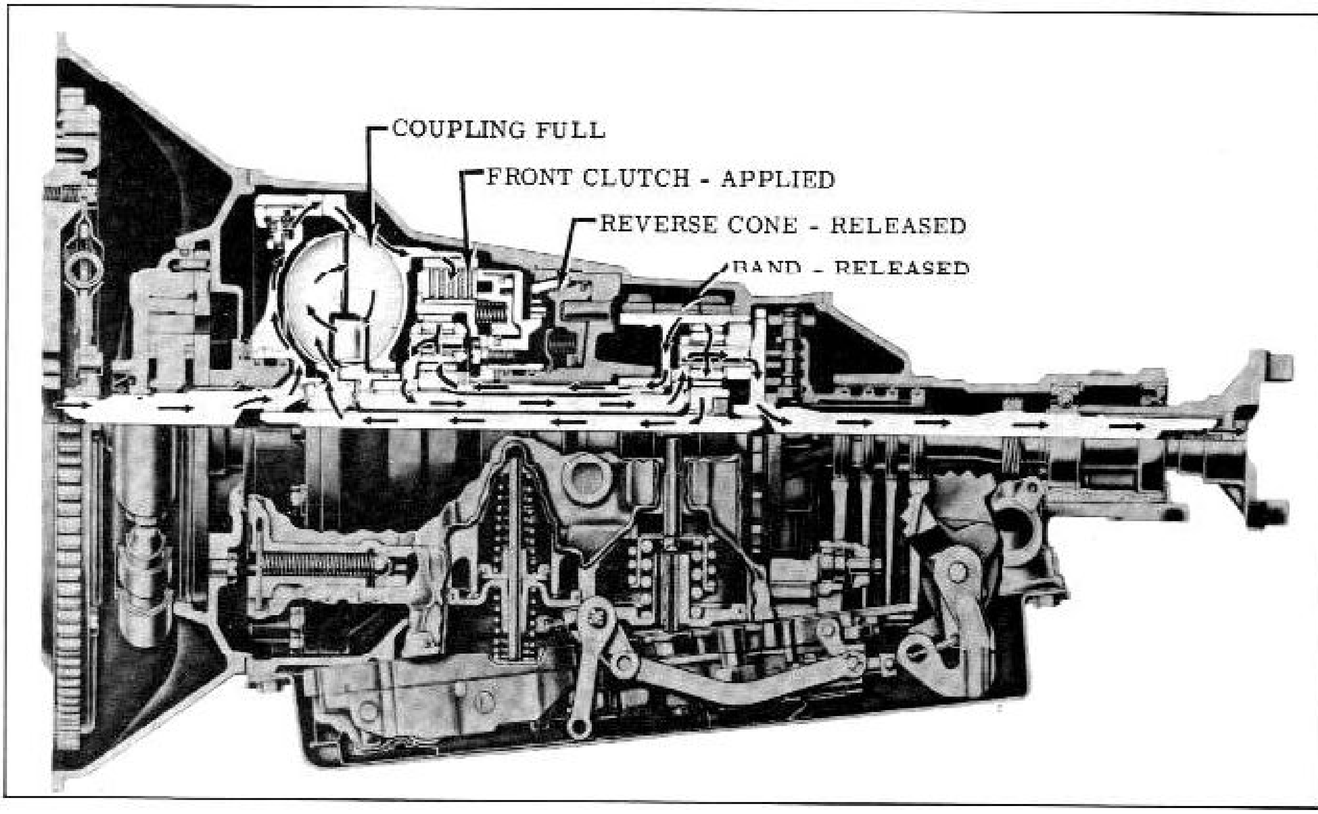

Fig. 3-5 Third Speed

THIRD SPEED

FLUID COUPLING—FULL

BAND—RELEASED

FRONT CLUTCH—APPLIED

REVERSE CLUTCH—RELEASED

RATIO: 1:1

Power from the engine through the flywheel, damper assembly and torus cover is applied through the front clutch to the front unit internal gear. The front internal gear then, through the pinions, tends to turn the front sun gear counterclockwise. This would cause the front carrier to run clockwise in reduction. The rear carrier, then, must also attempt to revolve clockwise in reduction. With the rear carrier rotating clockwise in reduction, and the rear internal gear tending to turn counterclockwise, the rear unit pinions attempt to rotate counterclockwise on their pins, thus driving the rear unit sun gear and driven torus clockwise faster than engine speed.

However, because the coupling is filled, the coupling driven member and rear unit sun gear cannot revolve faster than the drive torus which turns at engine speed. Therefore, the rear sun gear speed is slowed down to approximately engine speed. In so doing, the rear unit pinions are slowed down in their rotation on the pinion pins. The carrier and pinions then change the direction of load against the internal gear causing it to revolve clockwise with the carrier and sun gear at the same speed. Because the output shaft and carriers are connected to the torque multiplier in the coupling, the torque multiplier is also turning the same speed as the drive and driven member so that it has no effect in multiplying torque in the coupling.

Both carriers and the output shaft are common, the front sun gear and rear internal gear are common, and the front internal gear and rear unit sun gear are turning at approximately the same speed, thus the entire train must revolve as one common unit in direct drive.

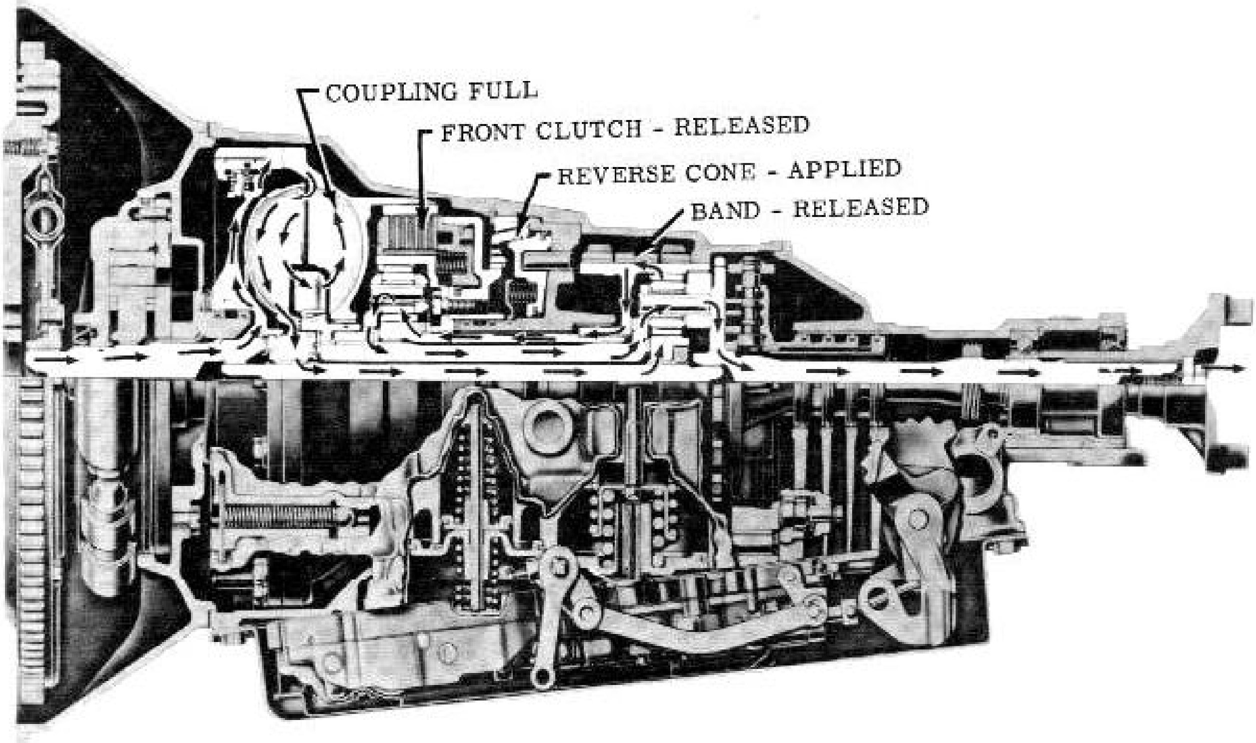

Fig. 3-6 Reverse

REVERSE

FLUID COUPLING—FULL

BAND—RELEASED

FRONT CLUTCH—RELEASED

REVERSE CLUTCH—APPLIED

RATIO: 2.5707:1

Power from the engine is mechanically transmitted through the flywheel, damper assembly and torus cover to the drive torus member. Engine torque is then hydraulically transmitted through oil to the driven torus member. Oil from the driven torus member is then directed against the torque multiplier which re-directs the force of the oil back to the drive member in such a way as to assist in turning the drive member. Engine torque through the coupling is then multiplied and applied to the mainshaft and rear unit sun gear.

The rear unit sun gear then drives the rear unit pinions as idlers which in turn drive the rear unit internal gear in a counterclockwise direction.

Because the rear unit internal gear is turning counterclockwise, the front unit sun gear is turning counterclockwise. The reverse cone is holding the front unit internal gear stationary so that the front unit pinions and carriers are compelled to walk around the front internal gear in counterclockwise direction in reduction. The output shaft is common with the front and rear carrier so the output shaft is turning counterclockwise or in reverse at a reduction.

The effect of the force of the oil in the coupling is such that the torque multiplier is imparting an additional .3 times engine torque to the carrier and output shaft in the reverse direction.

The total reduction in reverse is due to the 1.3 coupling torque ratio times the 2.5139 gear ratio plus the .3 engine torque acting on the torque multiplier and output shaft in the reverse direction.

VALVES AND THEIR FUNCTIONS

PRESSURE REGULATOR VALVE

Controls line pressure by regulating the output of the pump.

This valve is constructed with two areas where pressures can be applied to create forces which either add to or subtract from the pressure regulator spring force and thus either boost or drop the line pressure.

THROTTLE VALVE

A regulator valve which generates a pressure proportional to carburetor opening.

This valve senses carburetor opening through the throttle valve spring and T.V. plunger (band apply valve) which is operated mechanically by the throttle linkage.

The T.V. pressure increases 5 p.s.i. when the oil temperature reaches approximately 75°F. This is accomplished by a bimetal thermostatic element which contacts the throttle valve at temperatures less than 75°F. with a force that opposes the force of the regulator spring.

The T.V. plunger also functions as a band apply valve which provides an auxiliary band feed when the throttle is opened.

GOVERNOR

The governor contains two valves of different weight which rotate with the output shaft and thus generate two pressures proportional to the vehicle speed.

G-1 pressure senses the low speeds and G-2 pressure the higher speeds.

COMPENSATOR VALVES

The compensator valves generate a pressure that varies with T.V. pressure in a manner somewhat proportional to an engine torque curve.

MANUAL VALVE

The manual valve distributes pressures to place the transmission in either neutral, drive range, super range, lo range, or reverse. It is controlled mechanically through a linkage from the selector lever on the steering column.

1-2 SHIFT VALVE

The 1-2 shift valve initiates the 1-2 and 2-1 shifts by sensing a balance between T.V. and G-1 governor pressures.

2-3 SHIFT VALVE

The 2-3 shift valve initiates the 2-3 and 3-2 shifts by sensing a balance between T.V. and both G-1 and G-2 governor pressures.

COUPLING FEED LIMIT VALVE

This valve is located in the pump body and provides a direct feed to the coupling from the pump in first gear, reverse and third with light throttle. It is controlled by coupling signal pressure but opens only when coupling signal is greater than 90 p.s.i.

COUPLING EXHAUST VALVES

The coupling exhaust valves are located in the torus cover assembly and they seal the coupling exhaust ports whenever coupling signal pressure is directed to close them.

COUPLING TIMING VALVE

The coupling timing valve controls the dump and fill of the coupling.

It is controlled by front clutch pressure on 1-2 shift and delays the dump of the coupling until clutch capacity is sufficient to carry the drive load.

On a 2-3 shift it is controlled by 1st and 3rd pressure and shifts immediately after the 2-3 shift valve.

BAND RELEASE ACCUMULATOR VALVE

The band release accumulator is a safety device designed to release the band and prevent a locked transmission in the event the coupling timing valve should stick and not move during a 1-2 shift, or the band release valve should stick and not move during the 2-3 shift.

In the interval after the shift of the 1-2 valve and before the shift of the coupling timing valve, coupling pressure which is channeled through both the 1-2 shift and coupling timing valves starts to feed band release. If the coupling timing valve functions, it dumps the coupling and exhaust band release before the band release accumulator completes its stroke, and thus the band remains on. However, should the coupling timing valve stick, the band release accumulator valve would complete its stroke and allow coupling pressure to release the band.

During a 2-3 shift in the time interval after the shift of the 2-3 and coupling timing valves, and before the shift of the band release valve, coupling pressure starts to feed band release. If the band release valve functions properly it pressurizes the exhausted side of the band release accumulator valve and stops short its stroke and allows the band release pressure to build up and release the band at the proper time. However, if the band release valve sticks, the band release accumulator will complete its stroke and release the band.

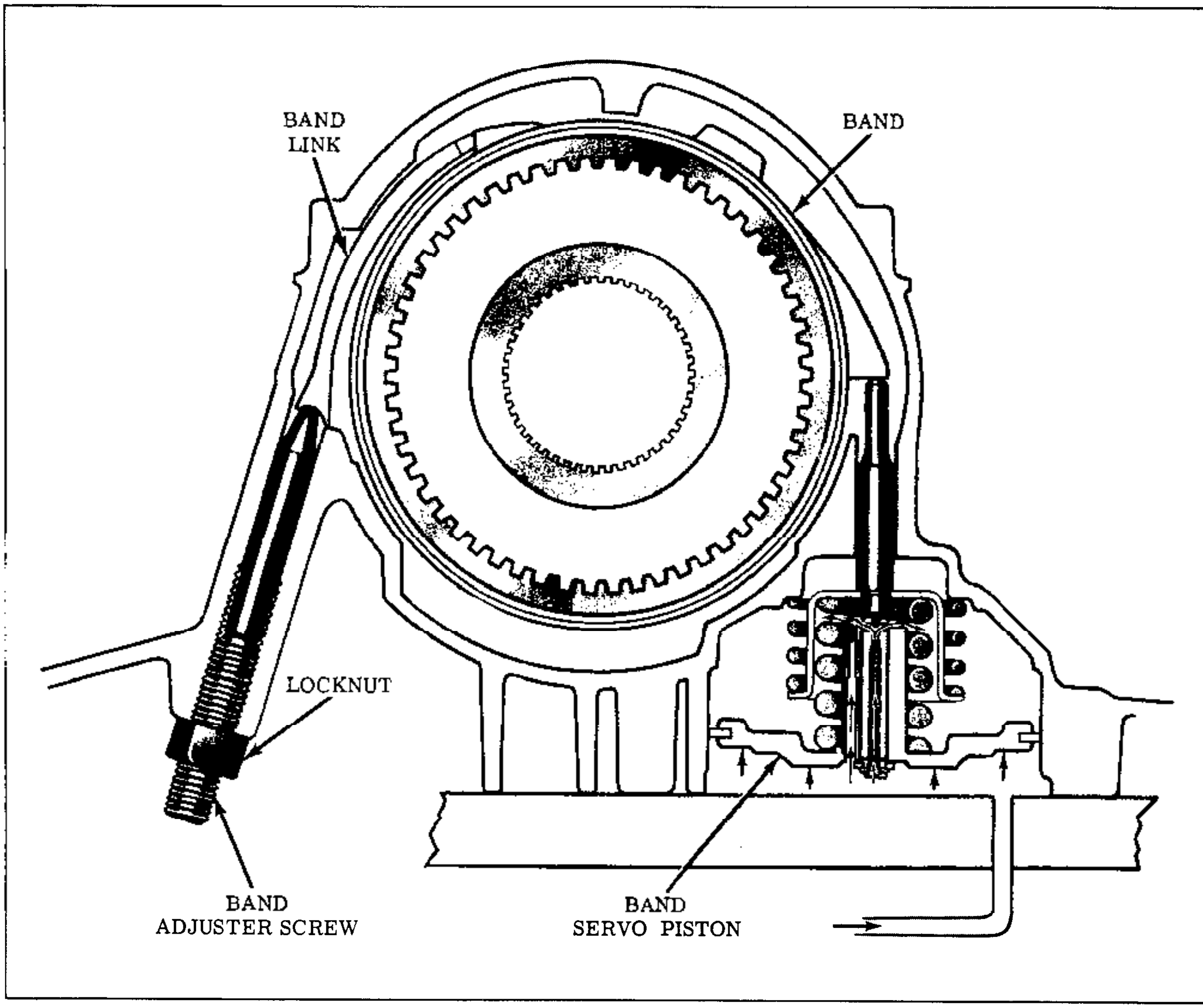

Fig. 3-7 Band Servo

PRESSURE BOOST VALVE

The pressure boost valve controls the flow to the line boost area of the pressure regulator valve. It is shifted by front clutch pressure and is timed to move after the clutch has assumed the drive.

PRESSURE DROP VALVE

The pressure drop valve controls the flow to the line drop area of the pressure regulator valve. It generates a varying pressure inversely proportional to T.V. pressure which results in a modulated line pressure.

LOW THROTTLE EXHAUST VALVE

The low throttle exhaust valve is a valve which senses drive conditions relative to overrun by shifting at 40 p.s.i. T.V. pressure. It provides an immediate band release on overrun 2-3 shifts and a rapid clutch exhaust on overrun 2-1 shifts.

2-1 DOWNSHIFT VALVE

The 2-1 downshift valve regulates the exhaust of the front clutch on throttle 2-1 downshifts. It is designed to allow the clutch to slip momentarily until the coupling is full enough to assume the drive without excessive engine flare.

FRONT CLUTCH EXHAUST VALVE

The front clutch exhaust valve controls the duration of front clutch slipping during a throttle 2-1 downshift. It provides a wide open clutch exhaust when coupling pressure is sufficient.

DETENT VALVE

The detent valve initiates the part throttle 3-2 and the detent 3-2 and 2-1 shifts. It is operated mechanically by the T.V. linkage.

REVERSE BLOCKER VALVE

The reverse blocker valve prevents a shift into reverse at speeds above 10 m.p.h. It is controlled by G-1 pressure and provides a mechanical stop for the manual linkage.

BAND RELEASE VALVE

The band release valve senses a balance between spring pressure and coupling feed and compensator pressure to control the flow of band release accumulator pressure in conjunction with coupling pressure.

2-3 BOOST VALVE

The 2-3 boost valve provides a momentary increase in pump pressure to fill the coupling on a light throttle 2-3 upshift.

T.V. PRESSURE

Under some conditions it is desirable to provide for greater acceleration and/or greater pulling power, such as climbing hills, etc. To accomplish this, higher shift speeds are required. This is accomplished by an oil pressure that will oppose the effect of governor pressure in opening the shift valves. This pressure, called T.V., is a regulated pressure and is directly proportional to throttle opening, which is regulated by the driver. Therefore, at the driver's option, the shift speeds can be raised or lowered to insure suitable shift speeds for operation under all driving conditions.

When the accelerator pedal is depressed, linkage connected with the carburetor and the accelerator pedal acts against T.V. plunger, opens the throttle valve and allows main line pressure to become regulated T.V. pressure.

T.V. pressure is directed to the shift valves to assist spring pressure to hold the shift valve closed against governor pressure. Governor pressure increases with car speed until it can overcome spring and T.V. pressure causing the shift valve to open and the shift to occur.

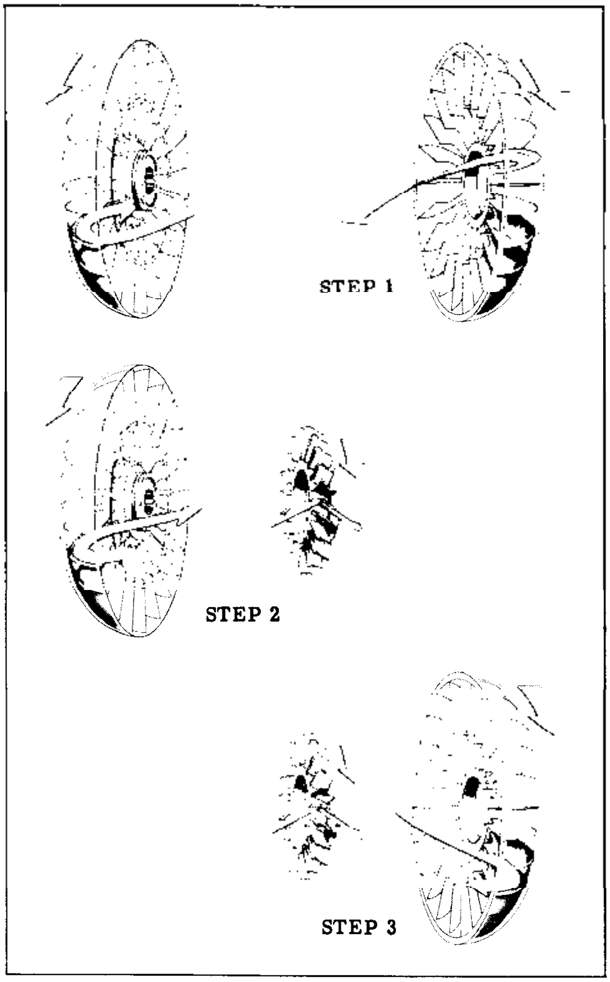

Fig. 3-8 Fluid Coupling and Torque Multiplier

FLUID COUPLING AND TORQUE MULTIPLIER

The fluid coupling and torque multiplier consists of three members located within an oil filled housing. The drive and driven members are shaped like halves of a split torus, having a series of radially arranged vanes within them. The torque multiplier consists of a series of curved blades mounted radially on a hub. The torque multiplier is located between the drive and driven coupling members.

The drive coupling member is connected to and driven by the engine, the driven coupling member is connected to the main shaft and rear unit sun gear, the torque multiplier is connected to the carrier shaft or output shaft.

OPERATION

Step 1. The engine turns the coupling drive member thus causing the drive member to force the oil against the vanes of the driven member, forcing the driven member to turn.

Step 2. After the oil has acted on the driven member the oil is routed to the torque multiplier.

Step 3. The oil flow rushing out of the curved blades of the torque multiplier is then directed back to the drive member in such a way as to impart an additional driving force to the back side of the drive member vanes. This additional driving force, plus the energy added to the flowing oil from engine power, allows an even greater force of oil to be directed against the vanes of the driven member.

This causes the torque on the driven member to be multiplied.

In first speed the fluid coupling and torque multiplier provide an increase of 1.3 times engine torque to the rear unit, thus increasing the over-all ratio.

In second speed the coupling is emptied and not used. Drive through the transmission is pure mechanical drive.

In third speed all three members of the fluid coupling are turning at approximately the same speed, therefore, the torque multiplier is no longer effective. Because of the over-all transmission

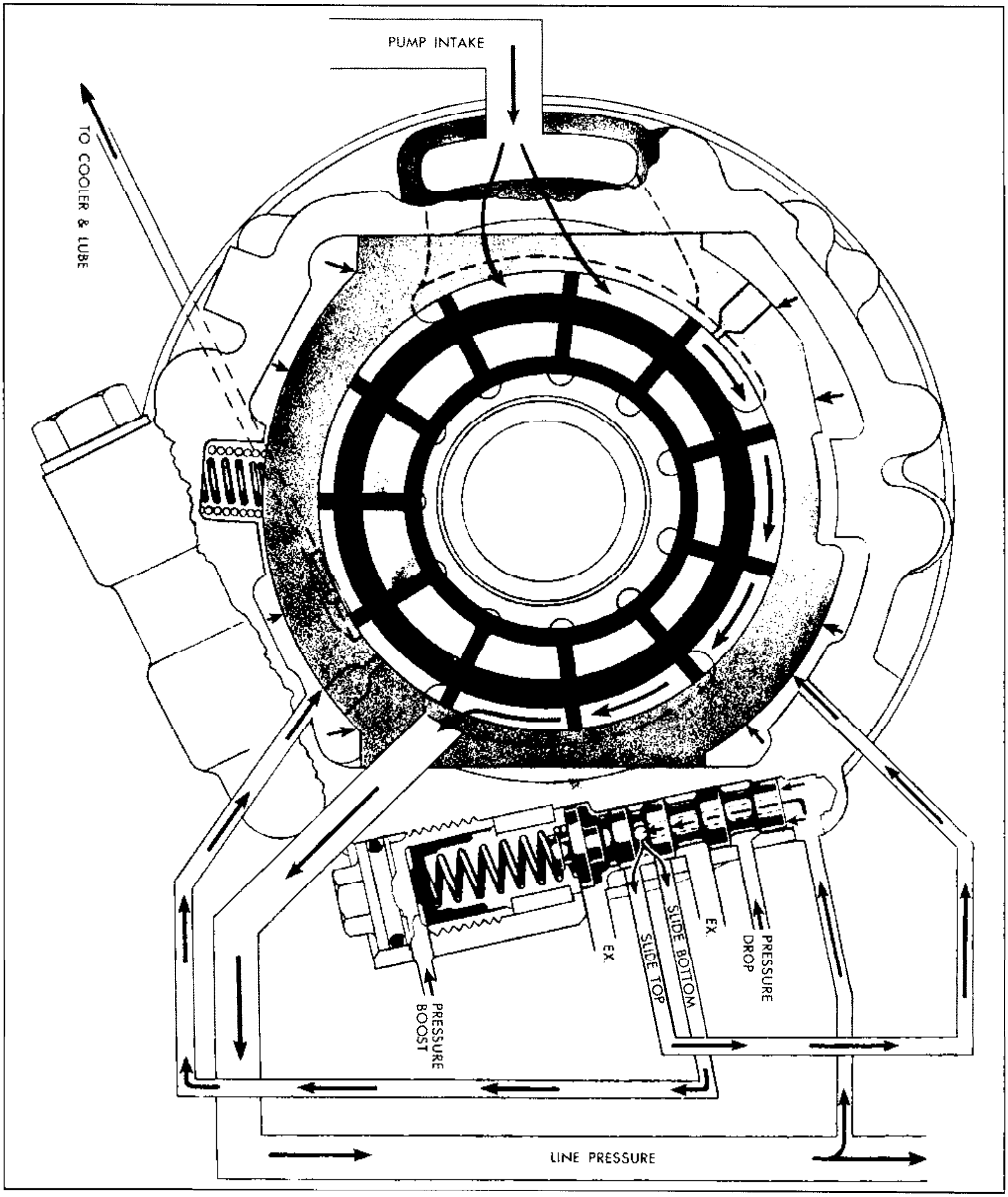

Fig. 3-9 Pump Operation

design the coupling is required to carry only 40% of the engine torque.

During reverse operation the coupling and torque multiplier is again capable of increasing torque output from the engine by 1.3.

OPERATION OF THE PUMP—

The transmission pump is of the variable displacement high capacity type and is engine driven.

A variable capacity type pump is one that will vary its output according to the oil flow and pressure requirements of the transmission. The effort required to drive the pump is only great when the demand for oil is great, consequently, large pumping capacity can be obtained at low pump speeds without having large pumping loads at high speeds.

The rotor of the pump is engine driven and carries vanes. Oil trapped between vanes at the suction or intake side is moved to the pressure side in greater quantity than oil from the pressure side is moved to the suction side.

Variable output of the pump is obtained in the following manner.

When the slide is in the up position maximum volume will be delivered. When the slide is in the middle "neutral" position no volume will be delivered.

Two springs are located on the bottom of the slide. The longer spring keeps the slide in the up or prime position so that the moment the engine is started the slide will be in the prime position and full output will be obtained.

The small spring or inner spring acts as a bumper keeping the slide from returning to a full exhaust position if the demand for oil falls quickly.

CONSTANT MAIN LINE PRESSURE

Main line oil pressure from the pump is directed to the end of the pressure regulator valve. The valve will then move against the pressure regulator spring. The pressure regulator spring, having a predetermined value, will then produce a constant pressure. The lands on the pressure regulator valve direct pressure to either the top or bottom of the pump slide. Pressure to the bottom will force the slide into the up or pumping position. Pressure to the top of slide will force the slide downward to the neutral position.

When line pressure drops the pressure regulator spring will move the pressure regulator valve against reducing line pressure, thereby moving the valve so that a feed hole in the valve indexes with a passage to the underside of the slide causing the slide to move upward to the prime position, thereby causing pump output to increase.

Conversely, if there is little or no oil demand from the transmission, pressure will increase and move the pressure regulator valve so that main line oil is directed to the top of the slide moving the slide to the down position reducing output.

Thus, it has been seen that the pressure regulator valve will produce consistent pressure determined by the pressure regulator spring.

HIGHER CONSTANT LINE PRESSURE

A higher pressure may be obtained by directing a pressure called line boost pressure behind the pressure boost plug, compressing the pressure regulator spring, which increases the spring load, thus raising pressure.

LOWER VARIABLE LINE PRESSURE

A lower pressure for certain types of operation may be obtained by directing line drop oil to the main line oil side of the pressure regulator valve. This will work against spring pressure sending line pressure to the top of the slide moving it toward the lower output position. This line drop oil will reduce main line pressure as the line drop pressure increases. Also, included in the pump is the coupling limit valve which is used to fill the coupling.

BAND SERVO OPERATION

A hydraulic servo assembly is used to apply and hold the band to the rear unit internal gear.

The band servo functionally consists of piston, piston pin, release spring, accumulator spring and spring retainer.

To provide for a smooth application of the band during a shift from Neutral to Drive or third speed to second speed, the band servo is designed to function in three stages.

STAGE 1

During the first stage of operation, some of the oil which is directed under the piston to apply the servo is allowed to leak or exhaust through the two orifices, (one orifice is located in the piston and one is located in the piston pin). This allows the pressure under the piston to build up slowly while the entire servo piston assembly moves up against the release spring positioning the band on the internal gear.

STAGE II

As the band continues to tighten about the rear internal gear, the piston pin encounters resistance and tends to stop its travel. The servo piston then continues to travel upward on the piston pin against the force of the large accumulator spring. The upward travel of the piston then seals off the orifice located in the piston, allowing pressure in the servo to build up at a faster rate.

STAGE III

As the piston continues to travel up on the piston pin, the piston compresses the accumulator spring further and applies a greater force to the piston pin. Finally, as the piston makes contact with the spring retainer, the second orifice becomes sealed off to permit an even faster build up of servo apply pressure. The piston is now in direct contact with the spring retainer and piston pin to apply the full final force of the applied pressure to the band.

FRONT CLUTCH ACCUMULATOR

The front clutch accumulator is a cushioning and timing device which enables the front clutch to apply smoothly under all throttle conditions. Regulation is necessary due to the varying torque loads that the front clutch is subjected to. For example, with light throttle conditions the front clutch will be applied slowly with a minimum of compensator pressure, conversely with full throttle operation the front clutch is applied quickly with greater compensator pressure required.

The accumulator body contains two opposed sets of springs and pistons. One is called the upper accumulator piston and spring and the other lower accumulator piston and spring, with each piston acting against spring pressure.

When the front clutch is engaging, front clutch apply oil is also directed to the front clutch accumulator. Front clutch oil compresses the pistons against spring pressure, causing the accumulator to absorb an amount of clutch apply oil. During the initial application of the front clutch piston, a comparatively small quantity of clutch apply oil is diverted tô the accumulator. When the clutch piston is stroked to its apply position, the accumulator pistons move against spring pressure and the amount of oil absorbed by the accumulator will increase, thereby, slowing the flow to the front clutch. Since the pistons moving against their springs meet increasing resistance to their motion, the oil pressure applying the front clutch increases gradually to provide a smooth application.

When the pistons reach the end of their strokes, the front clutch pressure rises to main line pressure to insure positive and complete engagement following the shift.

COMPENSATOR

Further control of front clutch pressure as produced by the accumulator is obtained by the primary and secondary compensator valves and springs, also a compensator limit valve and spring. The purpose of these valves and springs is to provide pressure to the accumulator to help the lower accumulator piston spring to resist piston motion, and thus further increase the front clutch pressure during shifting. T.V. pressure, along with spring pressure, acts against the primary compensator valve allowing drive oil to enter the compensator line and fill the accumulator. The compensator limit valve limits the maximum amount of compensator pressure under full and part throttle conditions.

When T.V. pressure is low, the compensator pressure is low, and the secondary compensator valve is held against its stop by the secondary compensator valve spring. When T.V. pressure is high the secondary compensator valve is pushed against the primary compensator valve by higher compensator pressure. It then moves with the primary compensator valve. When the front clutch oil is fed into the accumulator, compensator oil is forced over to the compensator valves where it pushes open the primary valve and discharges compensator oil to exhaust. The resistance of the compensator valves to permitting compensator oil

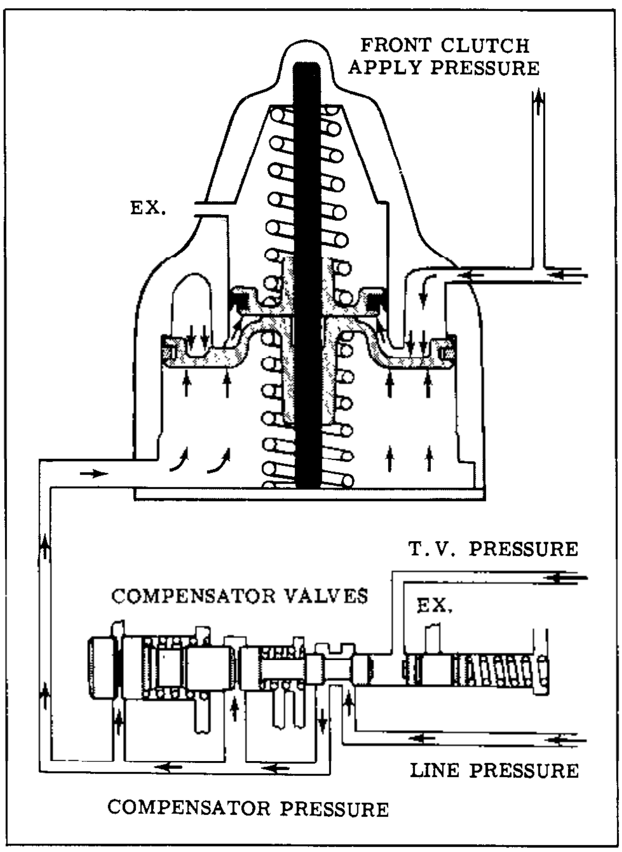

Fig. 3-10 Front Clutch Accumulator

to be exhausted controls the compensator pressure which helps to control the front clutch pressure during a shift.

GOVERNOR OPERATION

The governor is a centrifugal type, rotating with the transmission output shaft to generate two speed controlled oil pressures which are primarily used in the control valve assembly to initiate the shifts.

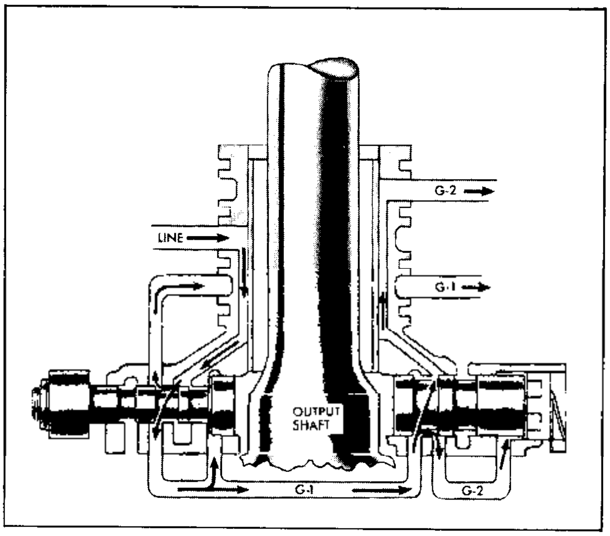

Fig. 3-11 Governor Operation

G-1 PRESSURE

As the governor rotates with the output shaft, centrifugal force acting on the G-1 or primary governor valve tends to throw the valve outward. Main line pressure to the governor is then ported into the G-1 passage where it can act on the large land of the G-1 valve to provide a force in the opposite direction to the centrifugal force. The G-1 valve will then move to close off the incoming line pressure and allow G-1 pressure to exhaust until the force of G-1 pressure acting against the centrifugal force is equal to the centrifugal force. The G-1 valve continues to regulate against centrifugal force so that G-1 pressure is directly proportional to output shaft speed.

G-2 PRESSURE

The second governor valve is called the G-2 or secondary governor valve. As centrifugal force throws the G-2 valve outward, G-1 pressure is admitted to the G-2 passage. G-2 pressure then acts against the large land of the G-2 valve to oppose the centrifugal force. G-2 pressure then regulates to a valve directly proportional to output shaft speed.

G-2 pressure is designed to be more sensitive at the higher car speeds.

OIL CONTROL CIRCUITS

OIL CIRCULATION DESCRIPTION

NEUTRAL—ENGINE RUNNING

COUPLING—FULL

FRONT CLUTCH—OFF

REVERSE CONE—OFF

BAND—OFF

Whenever the engine is running line pressure is always directed to the:

Pressure Regulator
Pressure Relief Valve
Coupling Signal Valve
Governor Assembly
2-3 Shift Valve (2 places)
Pressure Boost Valve
Throttle Valve
Manual Valve

BASIC CONTROL

Line pressure through the coupling signal valve is directed into the coupling signal passage. Signal oil closes the coupling exhaust valves to seal the coupling. Signal pressure to the coupling feed limit valve opens the limit valve to allow line pressure to feed the coupling. Line pressure at the 2-3 shift valve flows through the orifice to the third gear coupling fill passage which in turn flows through the coupling timing valve to become an additional source for coupling feed. The servo release spring holds the band servo in the released position.

PRESSURE CONTROL

The pressure relief valve provides for the exhaust of abnormally high pressures (above approximately 230 p.s.i.) if the pressure regulator or pump slide should stick.

Line pressure to the throttle valve is regulated to a variable pressure called T.V. pressure. The throttle valve, which regulates T.V. pressure, is controlled by the T.V. spring and band apply valve through adjustable linkage from the carburetor throttle. As the throttle is opened, the linkage depresses the band apply valve to increase the force of the T.V. spring, thus causing the throttle valve to regulate T.V. pressure to a higher value. T.V. pressure is designed to vary in proportion to throttle opening and is used throughout the control system to activate or control different valves at various times in relation to throttle opening.

With the manual valve in the neutral position, line pressure is directed into the line drop feed passage to the pressure boost valve to become line drop signal oil in second gear. Line pressure to the pressure boost valve is directed into the line drop signal passage and line boost passage. Line drop signal oil is then routed to the pressure drop valve. Throttle pressure acting on the pressure drop valve regulates line drop signal to a variable decreasing line drop pressure which is applied against the pressure regulator valve. Line boost oil is directed against the boost plug in the pressure regulator to compress the spring for higher line pressures.

At light throttle, line drop pressure is maximum, thus causing the greatest drop in line pressure. At full throttle, line drop pressure is regulated to exhaust resulting in high line pressure. Line pressure then is controlled to vary according to throttle opening from 122-170 p.s.i.

Line pressure to the governor will be regulated to become two variable governor pressures; G-1 and G-2. These pressures vary in proportion to output shaft or vehicle speed, G-1 being more sensitive at the lower speeds and G-2 being more sensitive at high vehicle speeds. Governor pressure is used to initiate the 1-2 and 2-3 shifts.

SUMMARY

The coupling is filled and the band is spring released, thereby causing the transmission to be in Neutral.

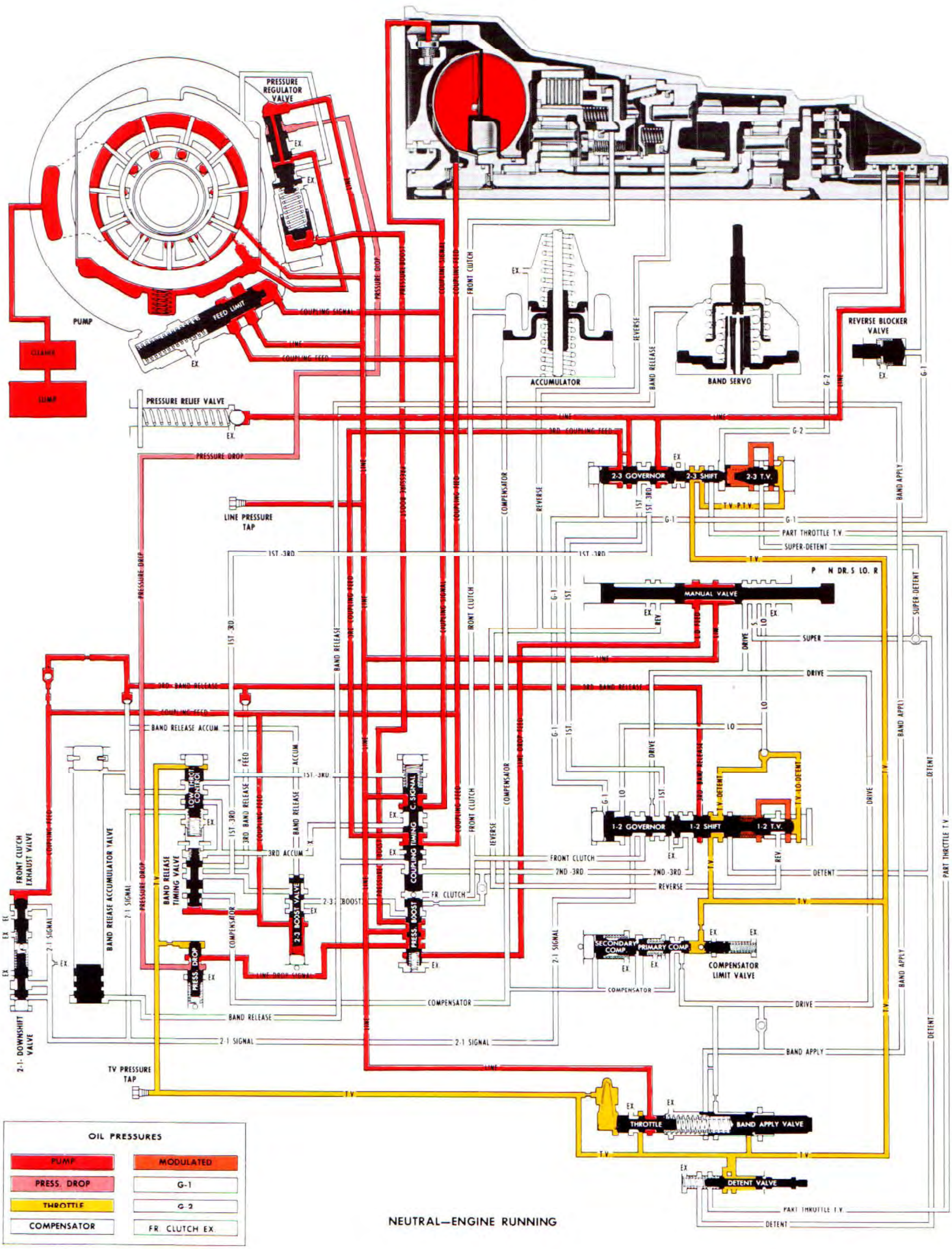

Fig. 3-12 Neutral - Engine Running

DRIVE RANGE—FIRST SPEED

COUPLING—FULL

FRONT CLUTCH—OFF

BAND—ON

REVERSE CONE—OFF

When the selector lever is moved to the Drive position, the manual valve is repositioned to allow line pressure to enter the drive oil circuit. Drive oil then flows to the following:

Band Servo
Band Apply Valve
1-2 Shift Valve
Primary Compensator Valve

BASIC CONTROL

Drive oil flowing through the orifice at the band apply valve is routed to apply the band servo. As the throttle is opened, the band apply valves opens to allow drive oil to flow at a faster rate to the band servo for quicker band application.

Coupling signal oil, acting on the coupling feed limit valve, opens the valve to allow line pressure to flow directly into the coupling feed passage for coupling fill.

Drive oil to the 1-2 shift valve flows through the valve to become first oil which in turn flows through the 2-3 shift valve to become first and third oil. First and third oil is routed against the end of the coupling signal valve to assist the spring in holding the valve open.

PRESSURE CONTROL

Pressure control in first speed is identical to Neutral.

TIMING CONTROL

First and third oil is routed to the low throttle control valve to become band release accumulator oil at T.V. pressure below approximately 40 p.s.i. Band release accumulator oil charges the band release accumulator for use during a 1-2 shift.

First and third oil is also directed to the band release timing valve and 2-3 boost valve for use during the 2-3 shift.

Drive oil to the primary compensator valve is regulated by T.V. pressure acting on the primary compensator valve to become compensator pressure. Compensator pressure is designed to vary in proportion to engine torque and is routed to the clutch accumulator and the band release valve for use during a 1-2 and 2-3 shift.

SUMMARY

The coupling is filled and the band is applied causing the transmission to be in first speed.

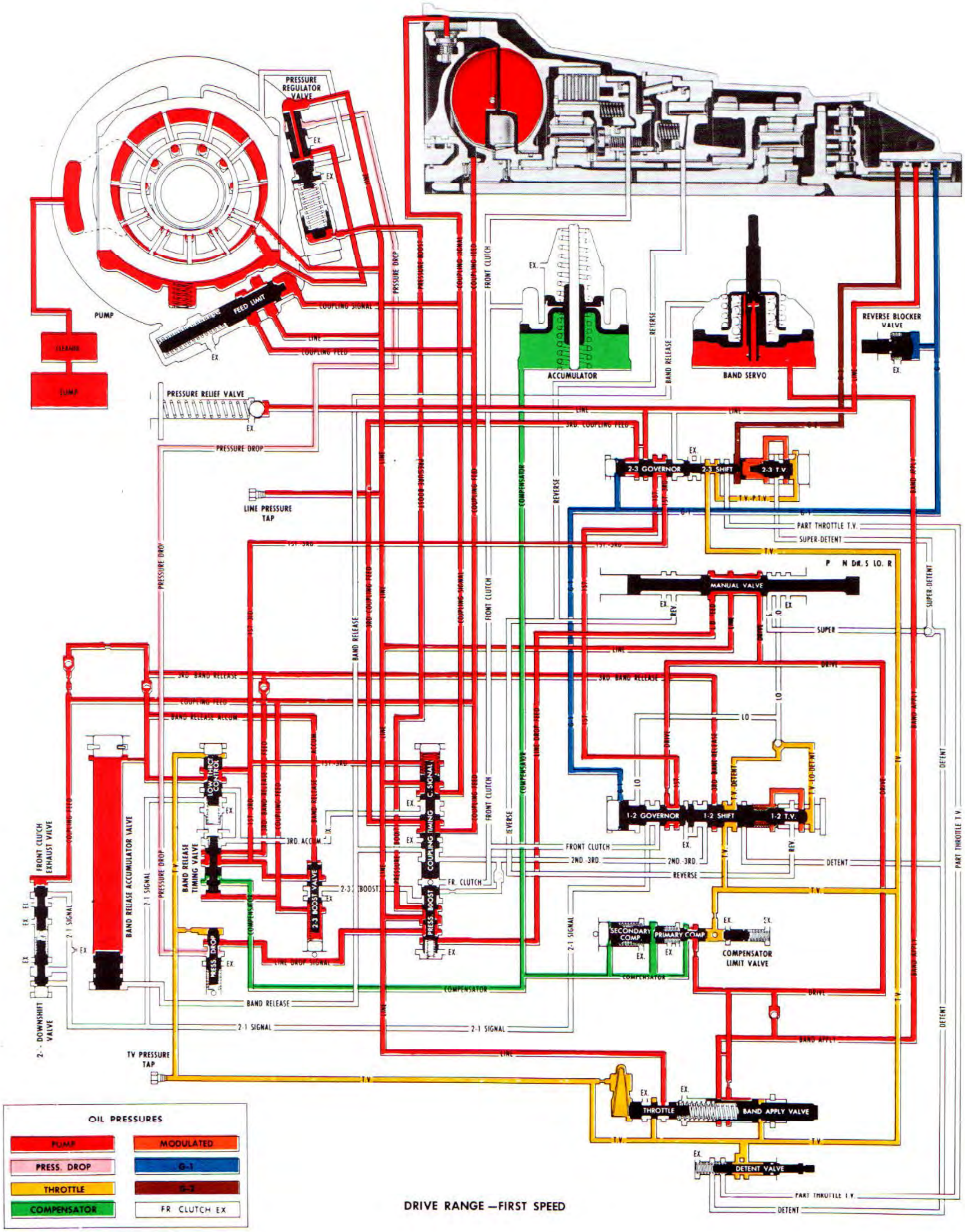

Fig. 3-13 Drive Range - First Speed

DRIVE—SECOND SPEED

COUPLING—EMPTY **REVERSE CONE—OFF**

FRONT CLUTCH—ON **BAND—ON**

With increased vehicle speed and G-1 pressure, the force of G-1 acting on the 1-2 governor valve will overcome the force of the 1-2 shift valve spring, 1-2 T.V. spring and modulated T.V. pressure. This causes the 1-2 shift valve to open, which allows drive oil to enter the front clutch apply passage. Simultaneously, shift T.V. to the 1-2 regulator valve is cut off at the 1-2 shift valve, and first gear oil which charged the band release accumulator, is exhausted through the 1-2 shift valve.

BASIC CONTROL

Front clutch oil from the 1-2 shift valve applies the clutch and repositions the coupling timing valve against the spring to cut off coupling signal oil and coupling feed oil. The coupling exhaust valves then open allowing the coupling to empty.

PRESSURE CONTROL

Front clutch oil repositions the pressure boost valve against line pressure and the spring. This cuts off line pressure from entering the line boost and line drop signal passages. Line drop feed line oil again enters the line drop signal passage. The result is a dropped line pressure which varies with throttle. (74-105 p.s.i.).

TIMING CONTROL

Front clutch oil to the front clutch accumulator is accumulated at varying rates and pressures depending on the amount of compensator pressure present in the accumulator. This in turn determines the time and pressure required to apply the front clutch smoothly for either a gentle application at light throttle or a firm application at heavy throttle.

Front clutch oil is used to reposition the pressure boost valve because it acts as a signal oil which notifies the pressure boost valve that sufficient clutch pressure is present to carry second gear torque before allowing line pressure to drop.

Also, it prevents line pressure from dropping in the band servo until the shift to second gear is completed, (torque on the band in first gear is greater than in second gear) thus preventing the band from slipping in first gear.

FAIL SAFE FEATURES

To provide a safety feature, coupling feed pressure in first gear is orificed and directed past a ball check into the third gear band release passage and brought against the 1-2 shift valve. With the 1-2 shift valve open, third gear band release oil enters the second and third gear passages. If for any reason, the coupling timing valve should remain in first gear position when clutch pressure is applied to it, second and third gear oil will flow through the coupling timing valve to the band release accumulator and will cause the accumulator to complete its stroke and allow pressure to build up on the release side of the band servo.

Band release accumulator oil which charged the band release accumulator is exhausted through the low throttle control valve into either the first and third oil passages or the third gear accumulator exhaust passage past the coupling timing valve.

This releases the band and shifts the transmission to third preventing the transmission from becoming locked up as it would be if the coupling were filled with the band and clutch on.

If the coupling timing valve moves as it should, the band release passage will exhaust at the coupling timing valve, and allow line fed third gear coupling feed oil through the coupling timing valve to recharge the release accumulator through low throttle control valve at T.V. pressure above approximately 40 p.s.i.

SUMMARY

The coupling is exhausted with the clutch and band applied, thus placing the transmission in second speed.

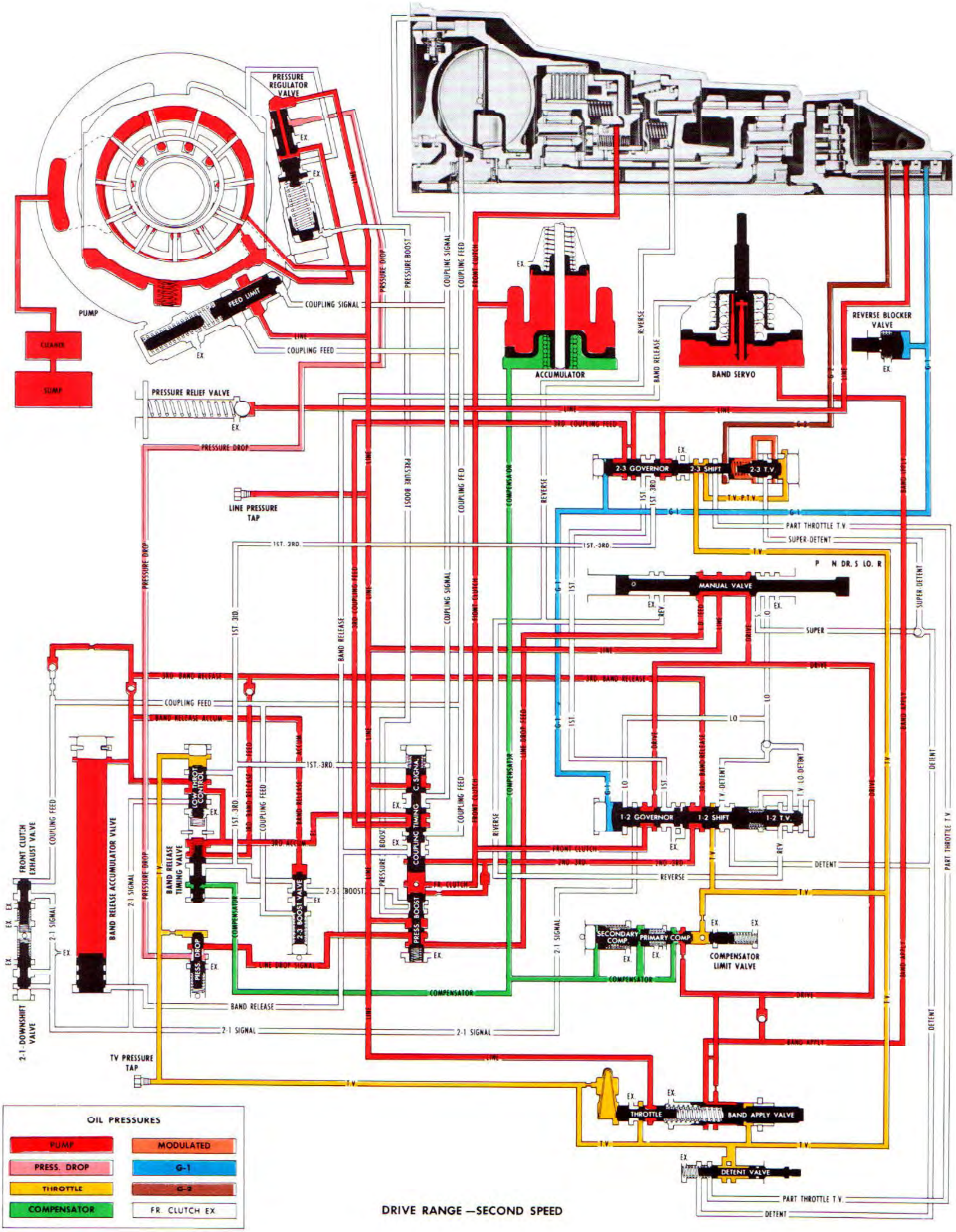

Fig. 3-14 Drive Range - Second Speed

DRIVE—THIRD SPEED

COUPLING—FULL

FRONT CLUTCH—ON

REVERSE CONE—OFF

BAND—OFF

As vehicle speed increases further, G-1, G-2 pressure and the 2-3 shift valve spring acting on the 2-3 shift valve train will overcome the force of the T.V. regulator spring and modulated T.V. pressure on the 2-3 shift valve. The shift valve will then open allowing line pressure to enter the first and third speed coupling fill passages. T.V. pressure is now cut off from entering the shift T.V. passage.

BASIC CONTROL

First and third oil will reposition the coupling timing valve against front clutch pressure to again allow coupling signal oil to close the coupling exhaust valves sealing the coupling. Third speed coupling fill oil enters the coupling feed passage to fill the coupling. Simultaneously, second and third gear oil flows through the coupling timing valve to become band release oil, which releases the band.

PRESSURE CONTROL

The normal operating pressure in third speed is the same as second speed except as discussed in the Timing Control Section.

TIMING CONTROL

During two to three throttle shifts the release of the band must be timed to the filling of the coupling.

THROTTLE OPENINGS BELOW 40 P.S.I. T.V. PRESSURE

During light throttle 2-3 upshifts, below 40 p.s.i. T.V. pressure, the low throttle control valve is positioned to allow first and third oil to flow into the band release accumulator passage immediately. Band release accumulator oil then performs two functions:

1. Band release accumulator oil repositions the 2-3 boost valve against the spring and allows first and third oil to flow into the first and third reverse passages to the pressure boost valve. This causes a boost in line pressure for a rapid fill of the coupling.

2. Band release accumulator oil also stops the band release accumulator valve and causes the ball check valve between the band release accumulator passage and third gear band release passage to open, thus giving a fast feed to second and third or band release oil. The band will then release quickly.

As coupling feed reaches the proper pressure it assists the spring in repositioning the 2-3 boost valve against band release accumulator oil. Line boost is then cut off allowing line pressure to return to its normal third speed value of 74-105 p.s.i.

THROTTLE OPENINGS ABOVE 40 P.S.I. T.V. PRESSURE

During heavy throttle 2-3 shifts the low throttle control valve is closed to first and third oil. First and third oil, however, is resting on the band release timing valve. In this condition the coupling fills under normal line pressures and when coupling pressure is sufficient it opens the band release timing valve allowing first and third oil to enter the third band release passage. This oil then opens a ball check and allows third band release to flow through the 1-2 shift valve to become second and third oil, which flows through the coupling timing valve to become band release oil to release the band.

Before the band release timing valve moves to the third gear position, band release accumulator oil will exhaust through the band release timing valve and coupling timing valve.

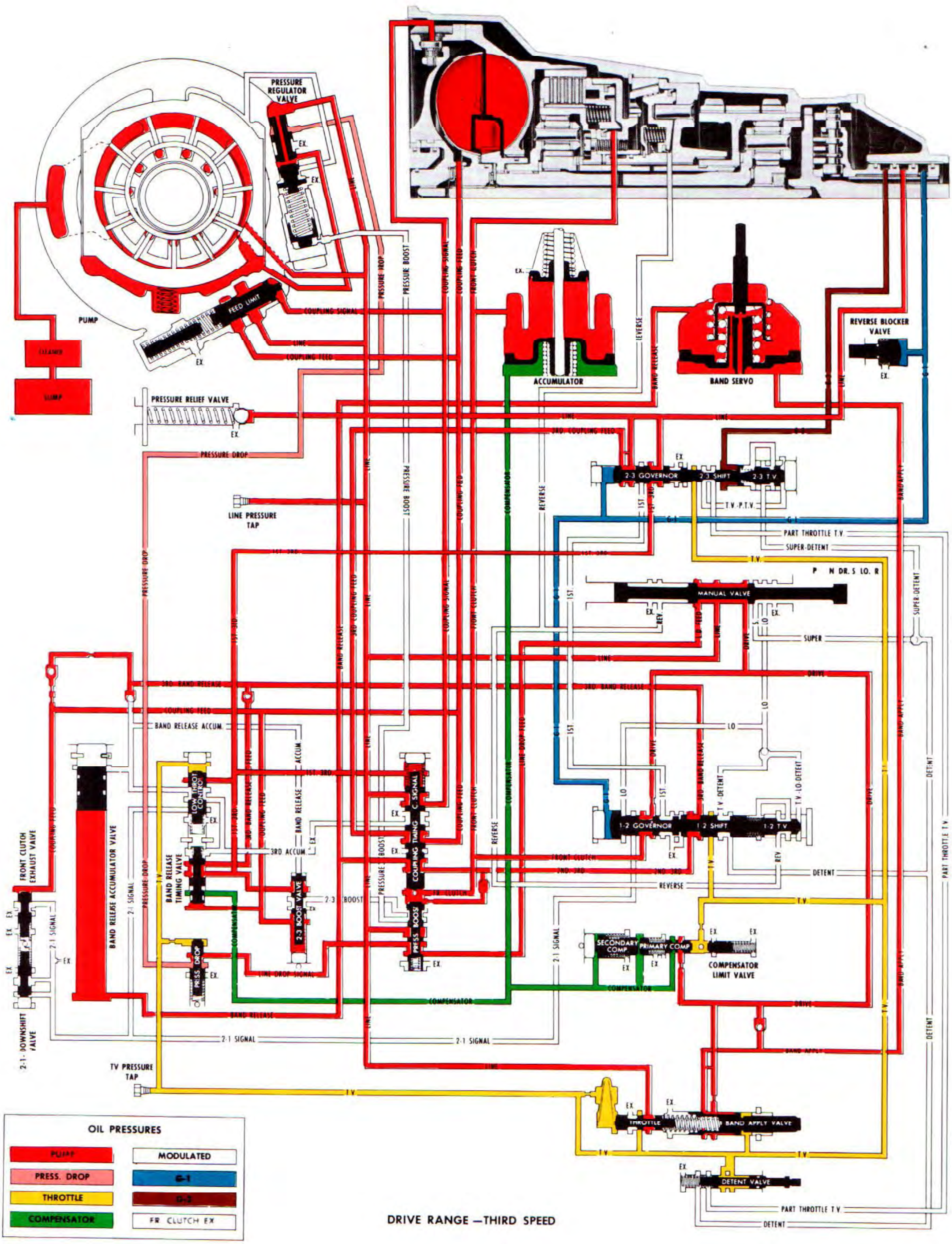

Fig. 3-15 Drive Range - Third Speed

DRIVE—DETENT—3-2 DOWNSHIFT

COUPLING—EXHAUSTING

BAND—APPLYING

While operating in third gear at speeds below approximately 57 m.p.h. a forced or detent 3-2 downshift is available. This is accomplished by depressing the accelerator fully.

As this is done, the detent valve is fully depressed exposing the detent passage to T.V. pressure. Detent pressure, which flows past the ball check is directed against the large land of the 2-3 shift valve.

The force due to this pressure and the part throttle pressure is then sufficient to overcome the force of G-1 and G-2 pressure and one spring acting in the opposite direction, thereby, causing the 2-3 shift valve to close. The transmission will then shift into second gear.

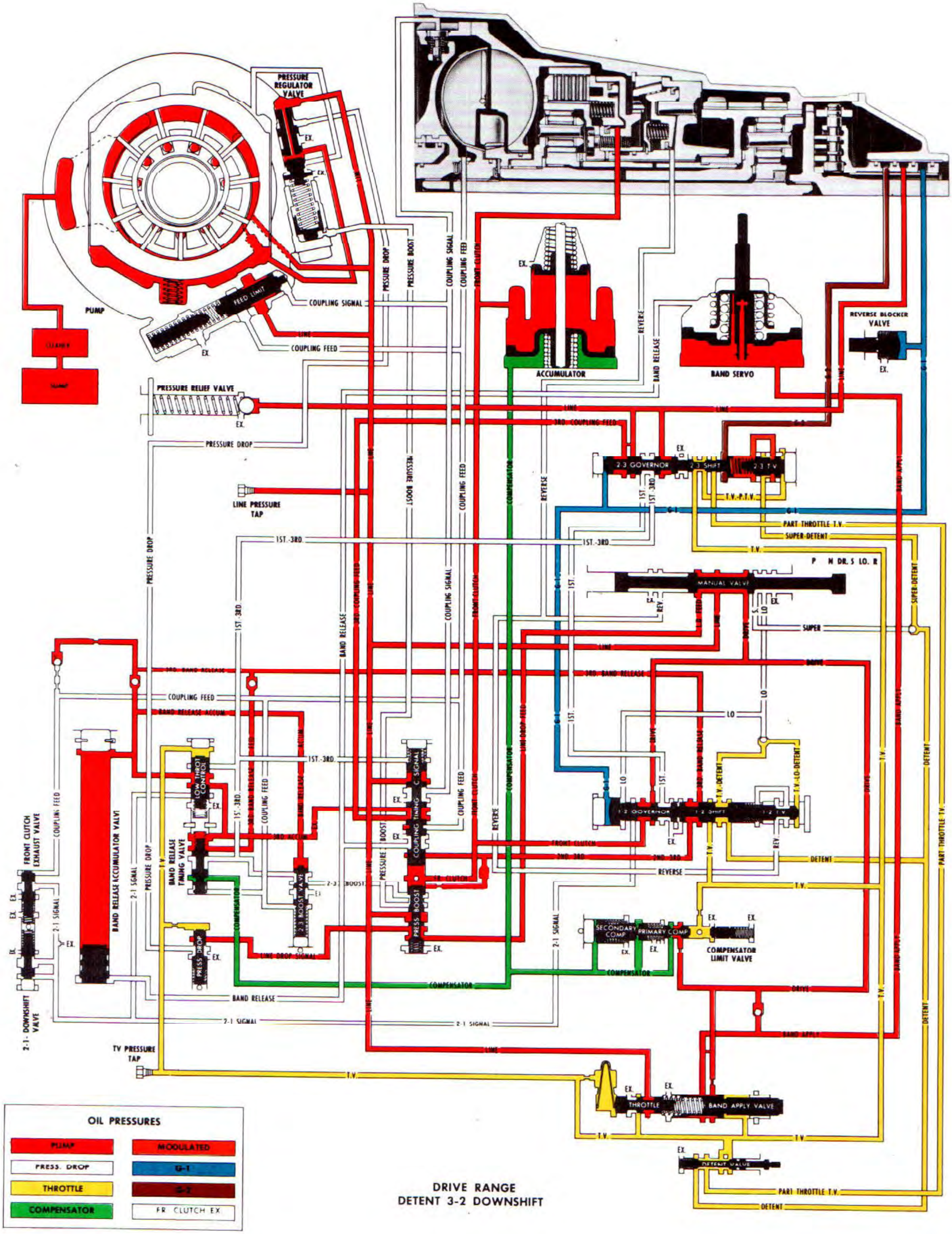

Fig. 3-16 Drive - Detent 3-2 Downshift

DRIVE—PART THROTTLE 3-2

COUPLING—EXHAUSTING

BAND—APPLYING

At vehicle speeds below approximately 37 m.p.h. a 3-2 downshift can be obtained by depressing the accelerator a given amount. When the detent valve is moved sufficiently, T.V. pressure is allowed to enter the part throttle T.V. passage. Because the 2-3 shift valve is open, part throttle T.V. enters the shift T.V. passage and acts against the large end of the 2-3 T.V. regulator valve which causes the 2-3 shift valve to close.

BASIC CONTROL

As the 2-3 shift valve closes, first and third oil and third speed coupling feed oil from the 2-3 shift valve are cut off, thereby, causing the coupling timing valve to move to second gear closed position which exhausts the coupling and band release oil. Drive oil applies the band, thus shifting the transmission into second gear.

PRESSURE CONTROL

The pressure system remains the same as in third speed.

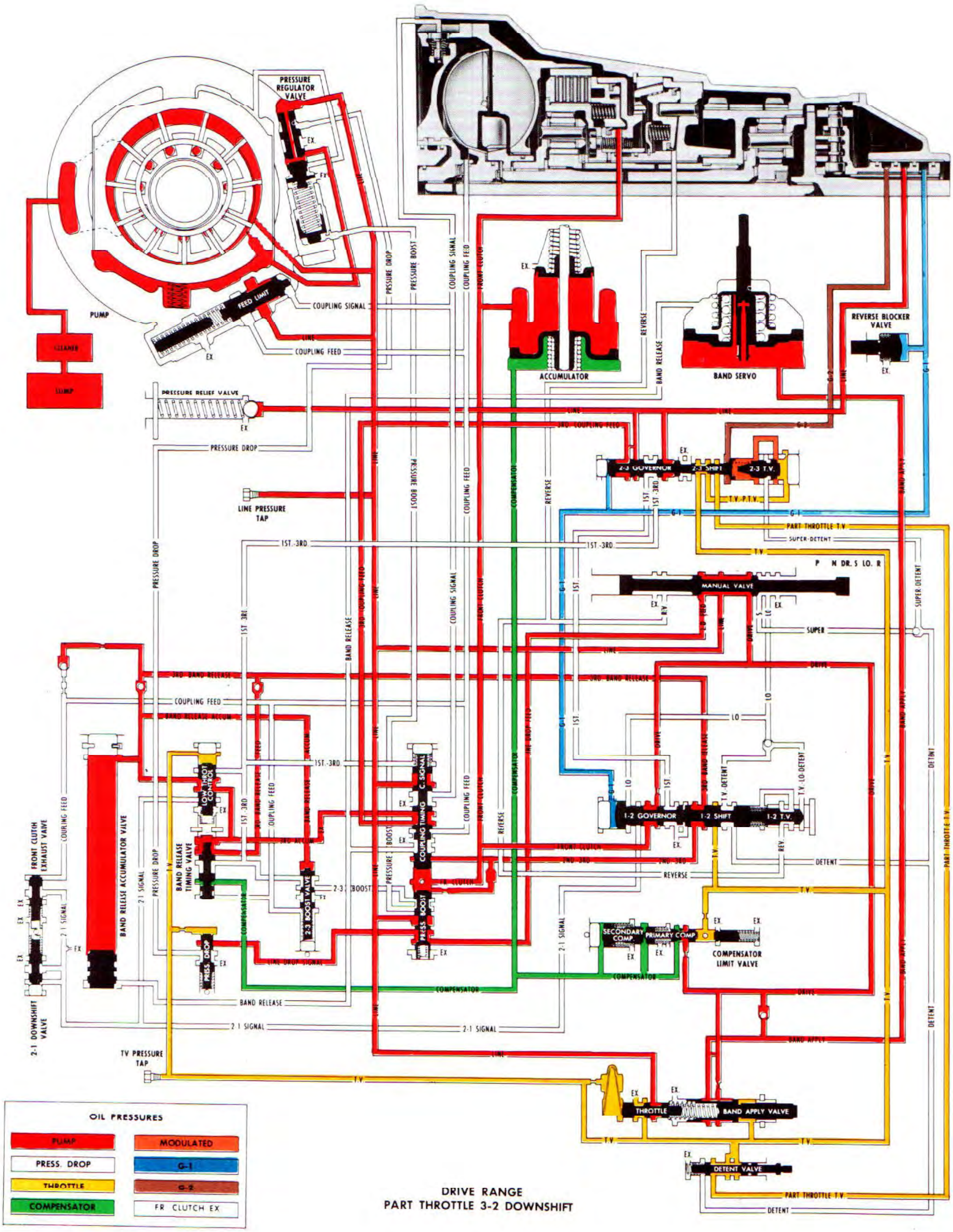

Fig. 3-17 Drive - Part Throttle 3-2

DRIVE—DETENT 2-1 DOWNSHIFT

COUPLING—FILLING

FRONT CLUTCH—RELEASING

At vehicle speeds below approximately 19 m.p.h. in second gear a forced or detent downshift can be obtained by depressing the accelerator fully past the detent. This causes the detent valve to open the detent passage to T.V. pressure. Detent pressure then enters the 1-2 shift T.V. pressure passage to act against the 1-2 T.V. valve. This causes the 1-2 shift valve to close against the force of G-1 pressure.

BASIC CONTROL

As the 1-2 shift valve closes, drive oil to the front clutch is cut off and all front clutch pressure in the front clutch and accumulator is compelled to exhaust into the 2-1 signal passage. Simultaneously, drive oil feeds first oil, which flows through the closed 2-3 shift valve, into the first and third passage to rapidly reposition the coupling timing valve for coupling fill.

TIMING CONTROL

Exhausting front clutch oil (2-1 signal oil) regulates to exhaust through the 2-1 downshift valve to a value that permits the front clutch to hold the front clutch torque in second speed but not in first speed.

This feature permits the front clutch to hold transmission torque in second gear until such time that first speed torque is obtained.

2-1 signal oil also rests against the front clutch exhaust valve until such time that coupling pressure attains a sufficient value to handle torque capacity in first gear. Coupling pressure then moves the front clutch valve to exhaust all remaining 2-1 signal or front clutch oil.

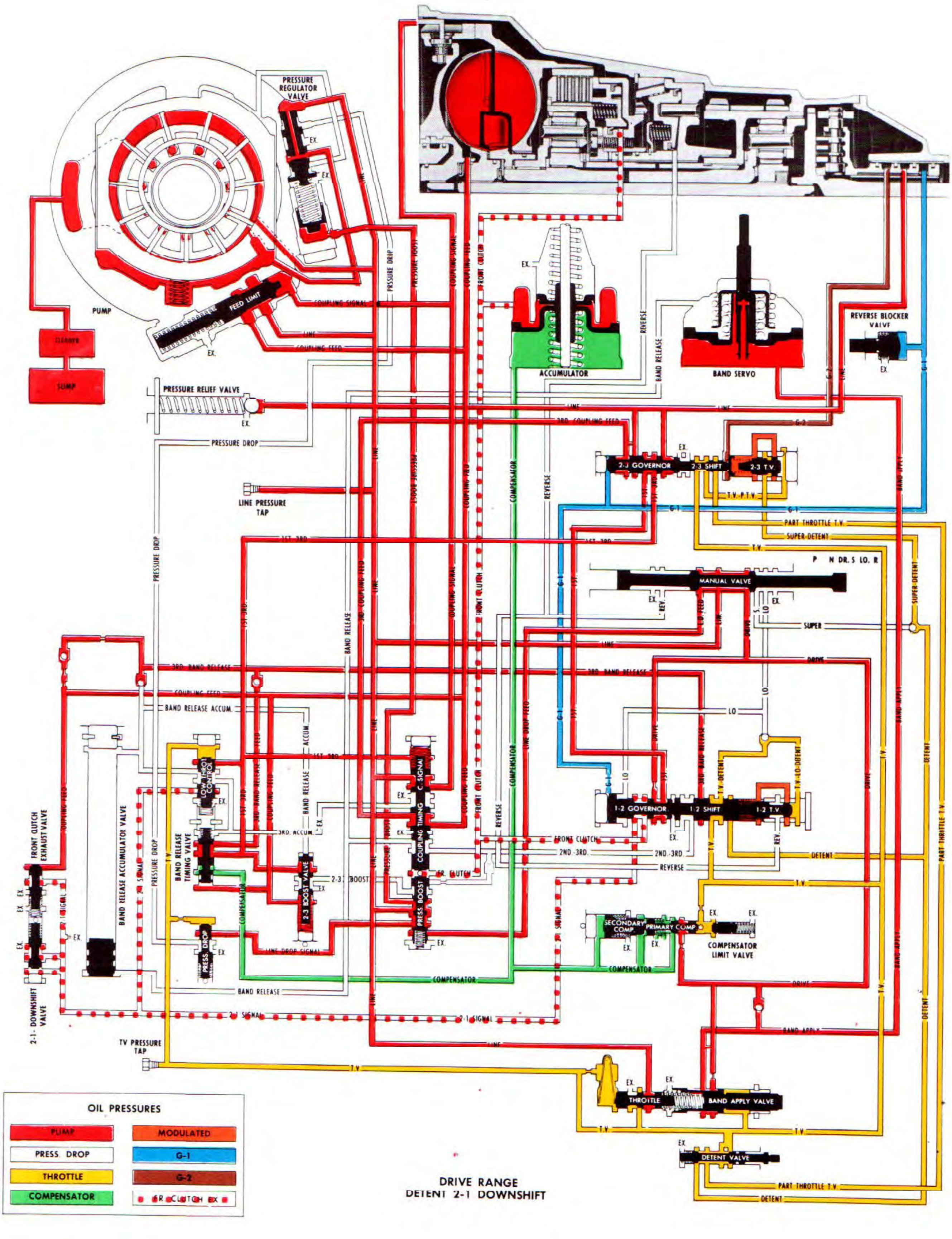

Fig. 3-18 Drive - Detent 2-1 Downshift

DRIVE RANGE—2-1 DOWNSHIFT—CLOSED THROTTLE

During a closed throttle 2-1 downshift, as the 1-2 shift valve closes, drive oil to the front clutch passage is cut off, however, all front clutch pressure in the system is exhausted into the 2-1 signal passage. Because T.V. pressure is slight with light throttle, the low throttle control valve is open to exhaust the 2-1 signal oil. This allows an immediate exhaust of front clutch oil.

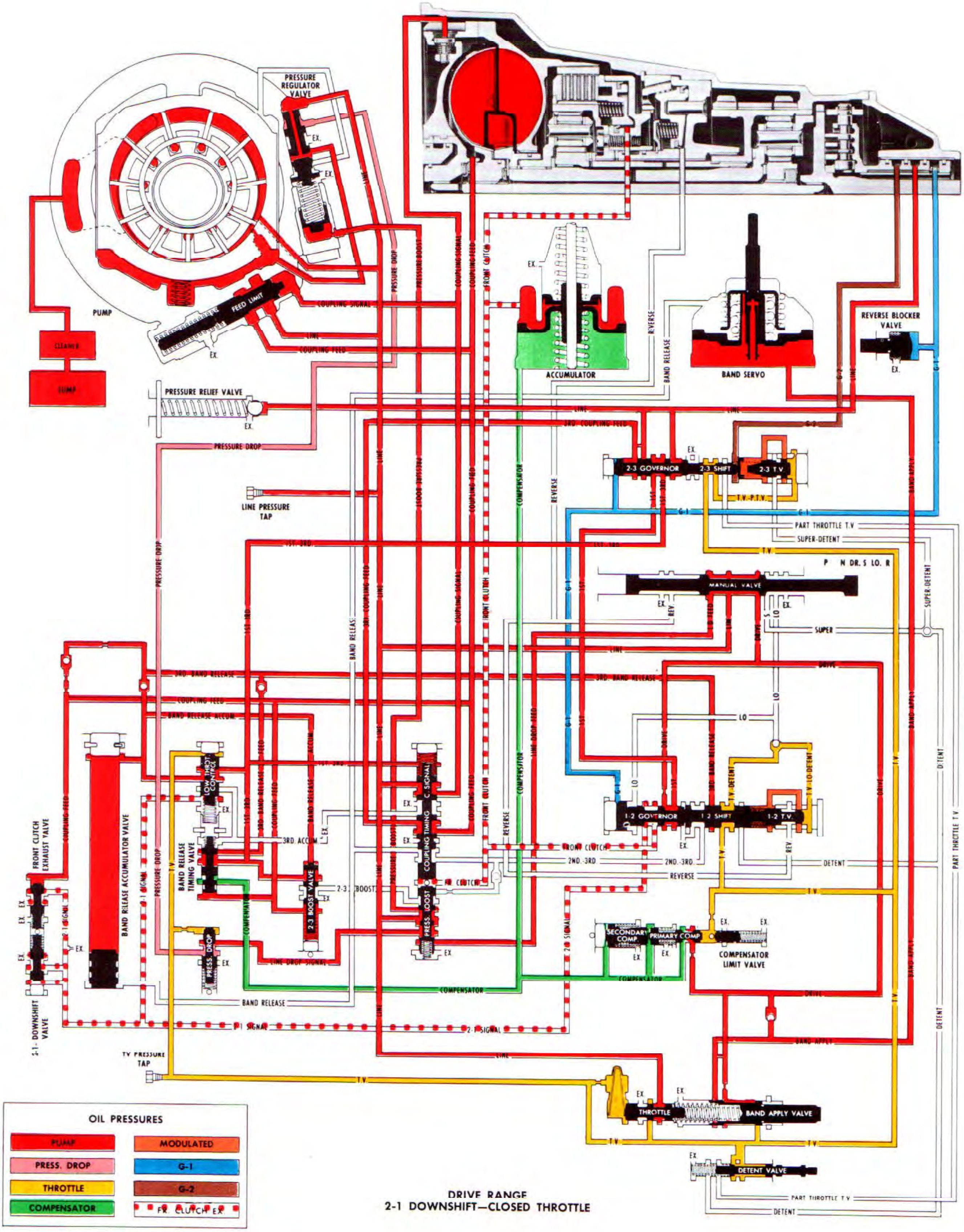

Fig. 3-19 Drive - 2-1 Downshift - Closed Throttle

SUPER RANGE—SECOND SPEED

COUPLING—EMPTY

FRONT CLUTCH—ON

REVERSE CONE—OFF

BAND—ON

Oil flow in super range second speed is primarily identical to that in drive range speed with the following exceptions.

BASIC CONTROL

Super range pressure from the manual valve is directed through the bail check against the large end of the 2-3 shift valve to prevent a 2-3 shift from normally occurring in the super range.*

*As a safety feature, it is possible to obtain a 2-3 upshift in the super range but only above the speed at which the normal drive range through detent 2-3 upshift occurs. (Approximately 60 m.p.h.).

PRESSURE CONTROL

When the manual valve is in the super position the line drop feed passage is cut off. This stops the source of line drop pressure so that line pressure is constant at approximately 105 p.s.i. regardless of throttle opening.

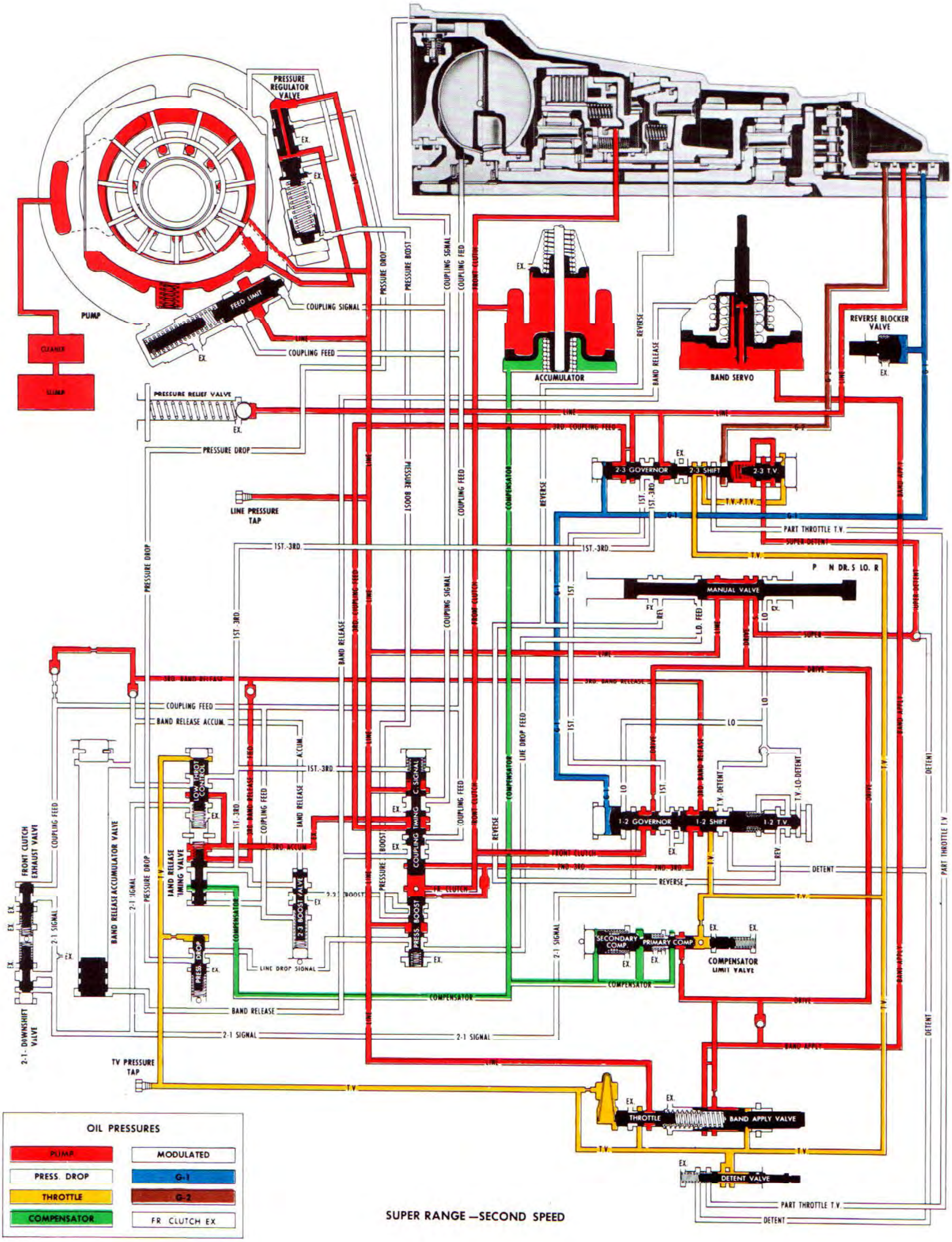

Fig. 3-20 Super Range - Second Speed

LO RANGE—FIRST SPEED

COUPLING—FULL

FRONT CLUTCH—OFF

REVERSE CONE—OFF

BAND—ON

When the selector lever is placed in the "Lo" position, the manual valve is moved to uncover an additional source of pressure, Lo Oil.

Lo Oil is directed to two locations:

1. Against the large end of the 1-2 governor valve to work against the force of G-1 pressure.
2. Through the ball check valve, past the 1-2 T.V. regulator valve to act against the 1-2 shift valve to further assist in keeping the 1-2 shift valve closed against G-1 pressure.

The transmission will never shift above first speed in the Lo Range.

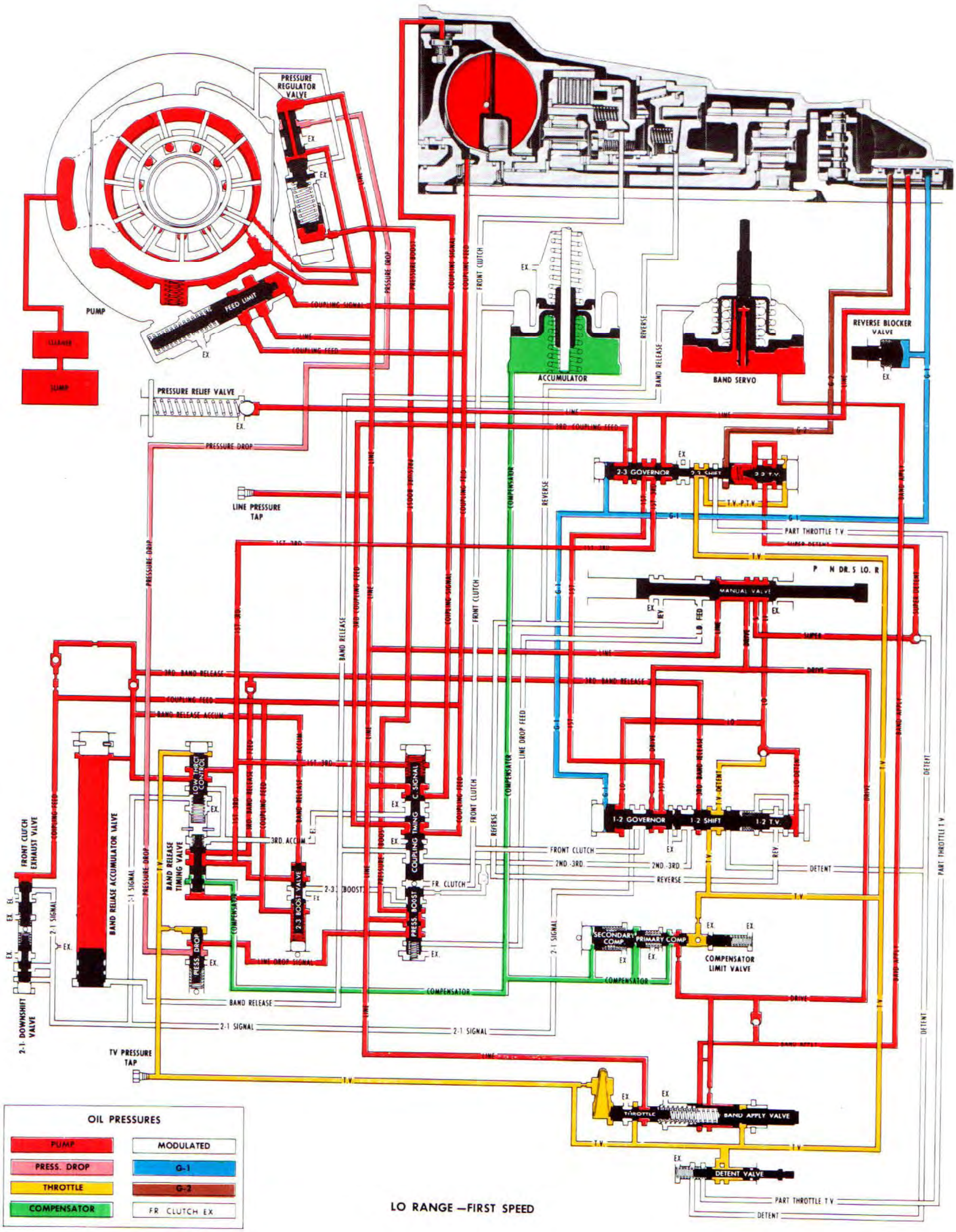

Fig. 3-21 Lo Range - First Speed

REVERSE

COUPLING—FULL

FRONT CLUTCH—OFF

REVERSE CONE—ON

BAND—OFF

In reverse the coupling is filled, the front clutch is released, the reverse cone applied, and the band is released.

Line pressure is directed to the:

1. Throttle Valve
2. Governor
3. Line Boost Valve
4. Manual Valve
5. Coupling Timing Valve
6. Pressure Regulator
7. Coupling Feed Limit Valve
8. 2-3 Shift Valve

Drive, Super and Lo Range oil is exhausted at the manual valve.

BASIC CONTROL

Line pressure, through the coupling timing valve, enters the signal passage to close the coupling exhaust valves and open the coupling feed limit valve for coupling fill.

Reverse pressure from the manual valve is directed to apply the reverse cone clutch, thus holding the front unit internal gear stationary.

PRESSURE CONTROL

Line pressure flows into the line boost and line drop signal passage to provide a variable line pressure similar to that obtained in first speed.

SUMMARY

The coupling is filled, the reverse cone is applied, thereby placing the transmission in reverse. Reverse pressure to the 1-2 T.V. valve directs reverse pressure behind the 1-2 shift valve to prevent the 1-2 shift valve from upshifting.

FAIL SAFE FEATURES

Reverse pressure is routed through the 2-3 boost valve and is directed to the pressure boost valve. Line drop feed is also directed to the pressure boost valve. These pressures will supply the source for boost pressure and line drop if for any reason the pressure boost valve becomes stuck in the second and third gear position.

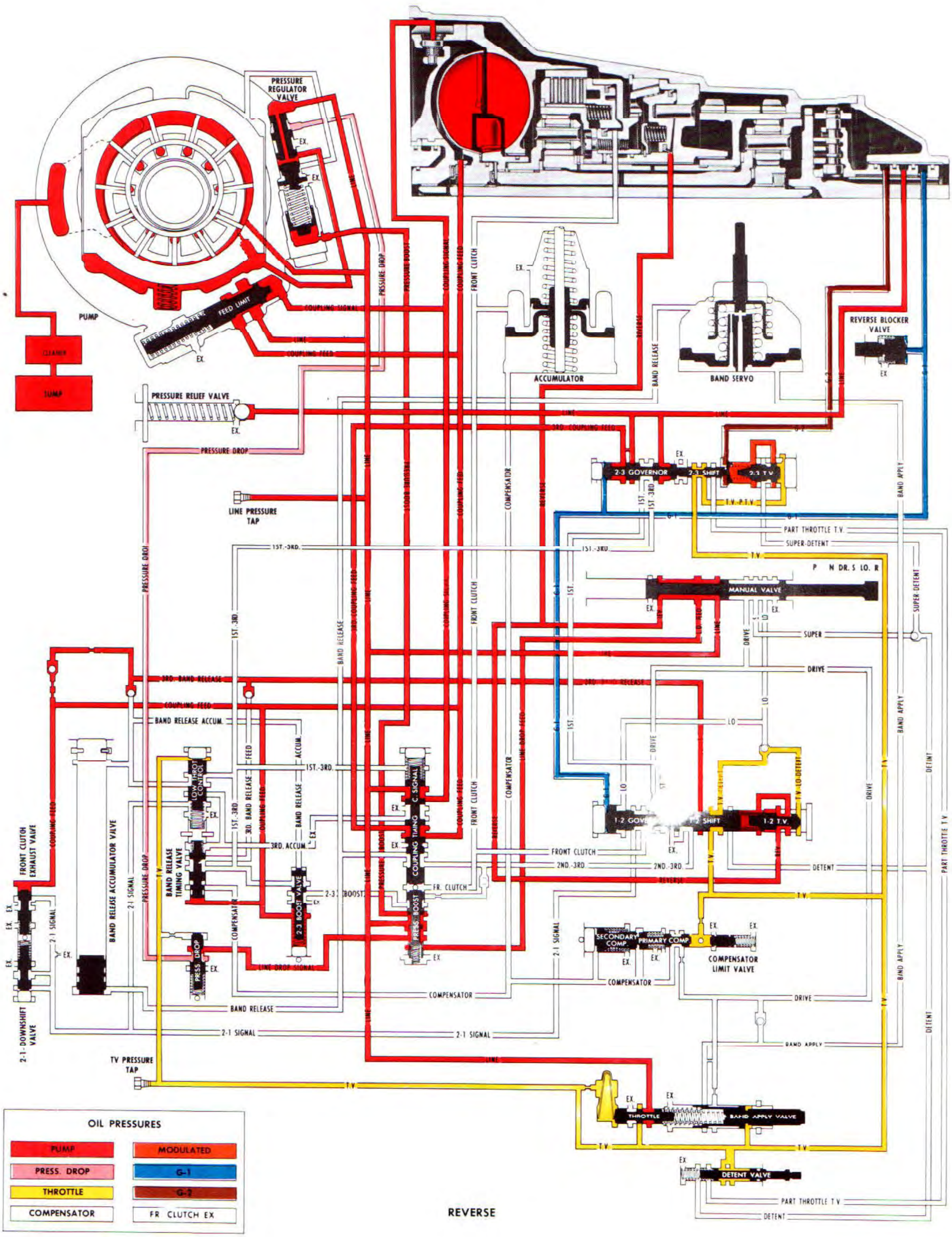

Fig. 3-22 Reverse

OPERATIONS NOT REQUIRING REMOVAL OF TRANSMISSION

Some of the component parts of the transmission can be removed without removing the transmission from the car. The procedures for such operations are not specifically outlined; however, the basic procedure and specifications outlined under "Disassembly of the Transmission" and "Assembly of the Transmission" will apply.

Units that may be readily removed from the transmission are:

Limit Valve

Pressure Regulator Valve

Companion Flange

Rear Oil Seal

Oil Filler Pipe

Oil Pan

Rear Bearing Retainer

Units that can be removed after oil pan removal are:

Control Valve Assembly

Parking Linkage

Channel Plate

Band Adjusting Screw & Nut

Accumulator-Servo

Throttle and Manual Control Levers, Shafts and/or Seals

Oil Cleaner, Oil Pump Intake Pipe, and "O" Ring Seals

Units that can be removed after extension housing removal are:

Speedometer Drive Gear

Governor

Reverse Blocker Valve

Rear Bearing

REMOVAL (TRANSMISSION ASSEMBLY)

1. Install Engine Support Tool J-8974.
2. Remove oil filler tube and breather tube.
3. Disconnect propeller shaft, shift and throttle linkage, cooler lines and speedometer cable.
4. Remove exhaust pipe and transmission rear cross support bar.
5. Place transmission lift in position and remove transmission to engine bolts.

INSTALLATION (TRANSMISSION ASSEMBLY)

When installing transmission, lubricate threads of transmission to engine block bolts with Part No. 980131 lubricant, and torque 30-35 ft. lbs. Refer to the torque specifications at the rear of this section for the balance of other nut torque specifications. Fill transmission with fluid and adjust linkage as outlined on Page 3-70.

NOTE: Use P.O.B. No. 3 Sealer on breather tube where it is installed in transmission.

GENERAL SERVICE PRECAUTIONS

Extreme care should be exercised in the cleaning and inspection of all transmission parts. All parts should be inspected on an individual basis for nicks, scratches, etc. It should be remembered that it is important to distinguish between parts that are simply worn in and those which are worn to a degree that complete replacement is necessary. Many of the transmission parts are made of aluminum; therefore, care should be exercised in their handling, both while as loose parts and during assembly and disassembly. Screws and bolts can become damaged through improper installation of bolts.

There are several self-locking bolts in the transmission which will be cadmium plated (bright color). These bolts should be tight fitting during the complete process of removal and installation. If these bolts are loose fitting then they should be replaced and if they are still loose then the mating or part into which they are installed should be replaced.

If the self-locking bolts are extremely difficult to install then they should be removed and lubricated. Also, any other bolt or screw that threads into aluminum should be installed carefully as cross-threading may result. If cross-threading is observed and the bolt or screw is loose or cannot be fully installed then the part should be repaired with a heli-coil.

It is important that the highest standards of cleanliness be observed in repair of a Hydra-Matic transmission as even a relatively small particle of dirt can cause a transmission malfunction. Wash all parts thoroughly before reassembly making certain that any small burrs or metal particles are completely removed.

Also, metal oil seal rings should be replaced after visual inspection indicates they are defective. All gaskets, seals, and washers should be replaced as indicated in the Disassembly and Assembly section.

Before disassembly of the unit, thoroughly clean the exterior.

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.

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 TRUARC SNAP RINGS.

During assembly of each unit all internal parts must be lubricated with Hydra-Matic oil.

Gears that may be installed either way should be installed the same as they were removed. If gears are not installed the same, the tooth contact would change which could result in noisy gears.

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. The small passages, such as in the front pump slide, should be checked with tag wire. All parts should be inspected to determine which parts are to be replaced.

The various inspection 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 threads.

4. 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.

5. Castings should be checked for cracks, sand holes and porosity.

6. Gear teeth should be checked for chipping, scoring, and excessive wear.

7. 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.

   Inspect torus members and torque multiplier for damaged vanes.

8. 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.

9. Inspect steel clutch plates for scored surfaces and damaged lugs. The equally spaced waves must be .008" to .012" and can be checked by placing the plates on a flat surface.

10. Inspect springs for distortion or collapsed coils. Slight wear (bright spots) on the sides of the springs are permissible.

11. 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.

12. If the transmission shows evidence that foreign material has circulated throughout the transmission or if the oil strainer is dirty it should be discarded and a new one installed.

Disassembly of Units from Transmission Case

1. Remove the transmission filler pipe "O" ring seal from side of transmission case before installing transmission in fixture. (Fig. 3-23)

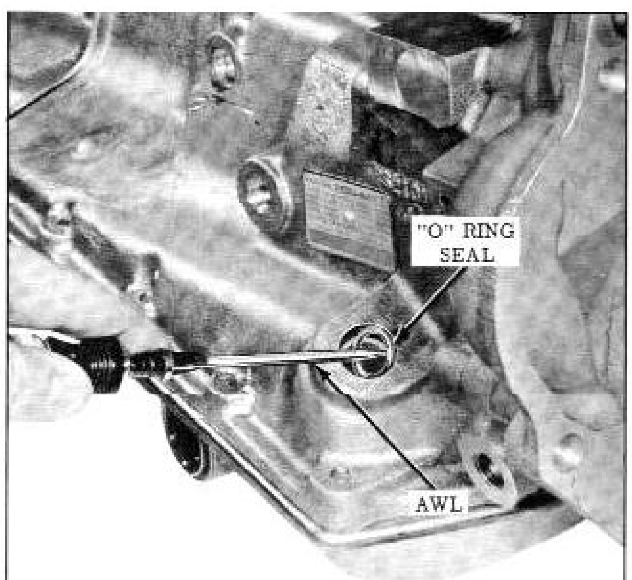

Fig. 3-23 Removing Filler Pipe "O" Ring Seal

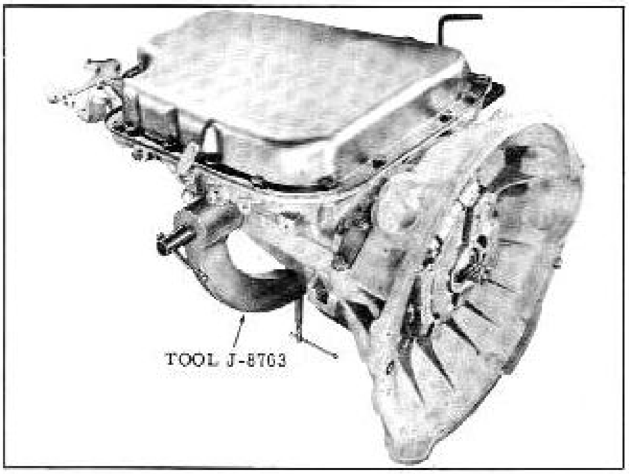

Fig. 3-24 Transmission Holding Fixture

2. Install transmission holding fixture as shown in Fig. 3-24.
3. Place transmission and holding fixture into bench support J-6115 with the oil pan up.
4. Remove oil pan and discard the gasket.
5. Remove cleaner assembly from transmission. Inspect "O" ring seal in case and replace if damaged. (Fig. 3-25).
6. If transmission is to be completely disassembled, check front unit end play as follows:

Front Unit End Play Check

a. Remove 1 case cover to case attaching bolt and install tools as shown. (Fig. 3-26)

b. Position a screw driver through case, behind the flange on the output shaft. (Fig. 3-26)

c. Gently pry forward on output shaft to position units forward. Be careful not to pry on governor weights.

d. At the same time move input shaft in or out and record end play.

e. End play should be .004" to .022".

f. Remove tools.

NOTE: End play is corrected by changing the selective thrust washer behind the case cover as shown in Figs. 3-78 and 3-79.

Fig. 3-25 Removing Cleaner Assembly

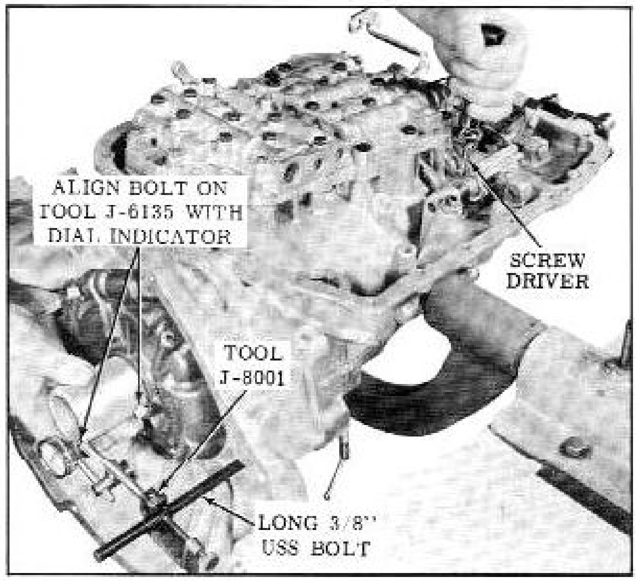

Fig. 3-26 Checking Front Unit End Play

SELECTIVE THRUST WASHER CHART

PART NO.	THICKNESS	COLOR IDENT.
8620697	.027"-.029"	Bright Metal
8620698	.036"-.038"	Copper
8620699	.045"-.047"	Black
8620700	.054"-.056"	Bright and Flats on Edge

7. Remove inside T.V. link from rear T.V. lever by removing the "E" retaining ring. (Fig. 3-27)

   CAUTION: Do not lose spacer from end of detent valve.

8. Remove outer T.V. lever, "O" ring and spacer as shown. (Fig. 3-28)
9. Remove front T.V. lever and link assembly.
10. To disengage linkage, remove "E" ring retaining front T.V. lever to inside T.V. link.

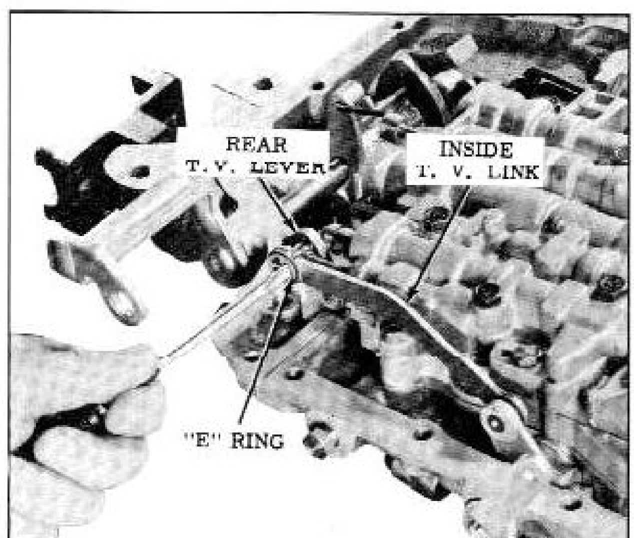

Fig. 3-27 Removing Inside T.V. Link

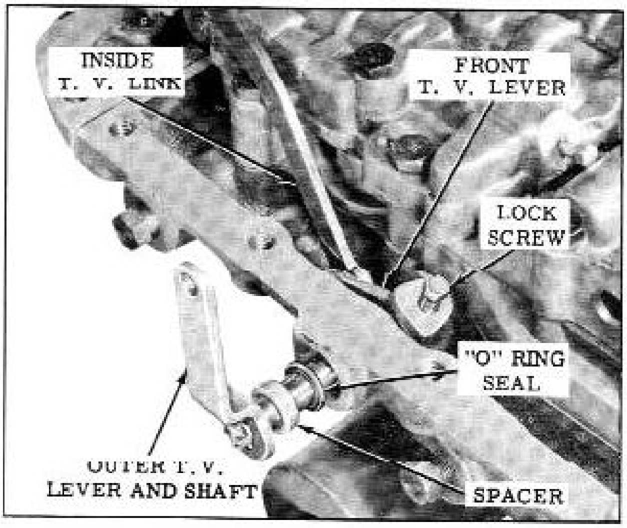

Fig. 3-28 Removing Outer T.V. Lever "O" Ring

11. Loosen inside manual and detent lever lock screw, and remove "E" ring from end of manual shaft.

12. Slide manual shaft out of retainer to remove valve link. (Fig.3-29)

13. Remove manual and detent lever assembly from rear bearing retainer, and remove the manual shaft "O" ring seal.

14. Remove control valve assembly to case attaching bolts.

15. Remove the control valve assembly from the transmission case.

CAUTION: Do not lose detent valve spacer.

16. Remove the servo and accumulator pistons and springs as shown in Fig. 3-30.

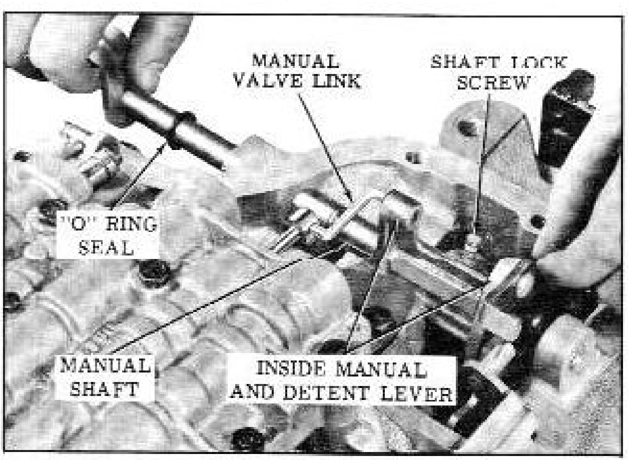

Fig. 3-29 Removing Manual Valve Link

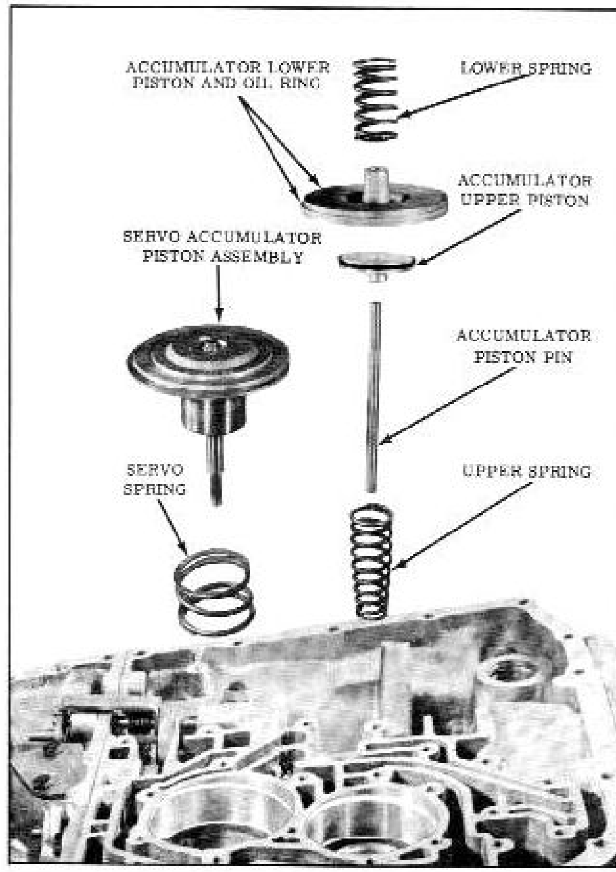

Fig. 3-30 Servo and Accumulator Pistons

17. Unhook parking pawl spring from parking lever. (Fig. 3-31)

18. Loosen band adjusting screw lock nut, and remove screw and nut. (Fig. 3-31)

NOTE: The band anchor pin is located under adjusting screw and will fall out when transmission is turned over.

19. Remove 2 case center support seal spring retainers, springs and seals.

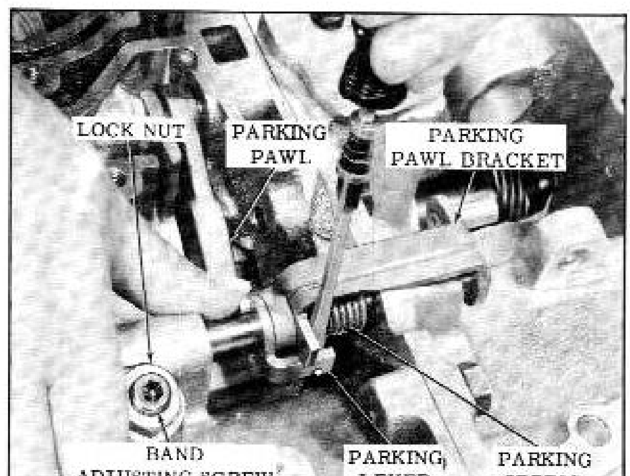

Fig. 3-31 Parking Pawl Spring

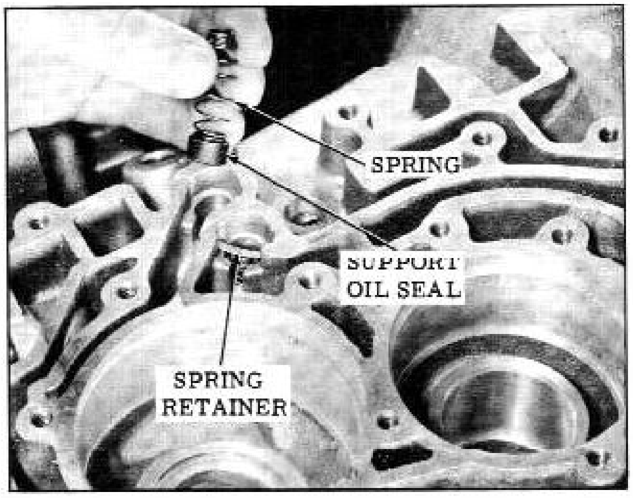

Fig. 3-32 Removing Case Support Oil Seals

CAUTION: Retainer is under spring pressure. (Fig. 3-32)

20. Remove the rear bearing retainer cover attaching bolts.

21. Engage the parking pawl to hold output shaft and remove the companion flange attaching bolt, and companion flange using Tool J-8614. (Fig. 3-33)

22. If replacement of the rear seal is necessary, remove the rear seal by driving around outer edge with a sharp punch and prying out of retainer.

23. Remove 3 internal and 5 external rear bearing retainer to case attaching bolts, remove

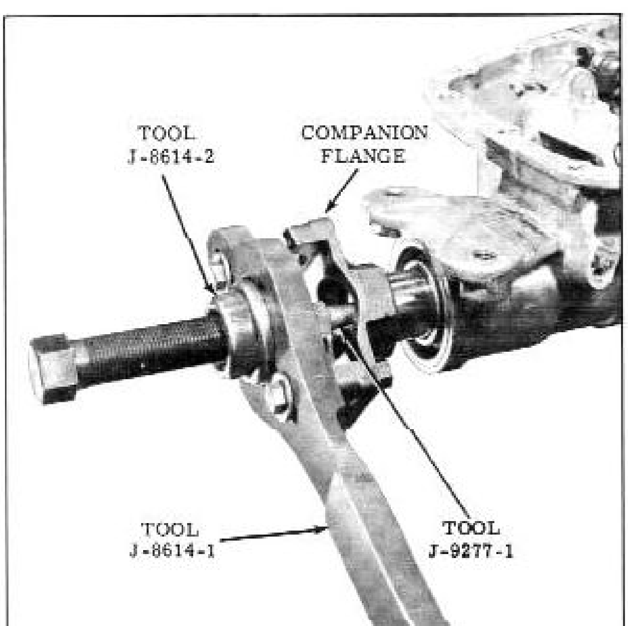

Fig. 3-33 Removing Companion Flange

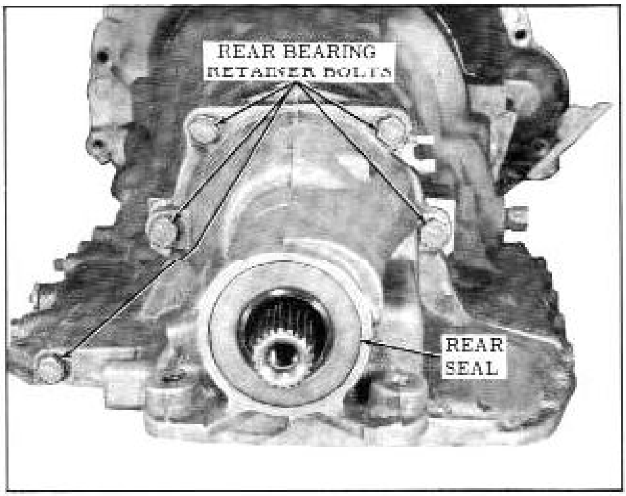

Fig. 3-34 Removing Rear Bearing Retainer

breather pipe clip, and remove retainer assembly with bearing and gasket. (Fig. 3-34)

24. Remove the rear bearing to output shaft snap ring. (Fig. 3-35)

25. With parking pawl engaged, remove the speedometer drive gear Tool J-8760 and J-6123. (Fig. 3-36)

26. Remove the 3 governor attaching bolts, and remove governor.

NOTE: Keep the parking pawl engaged, with one hand while breaking bolts loose. (Fig. 3-37)

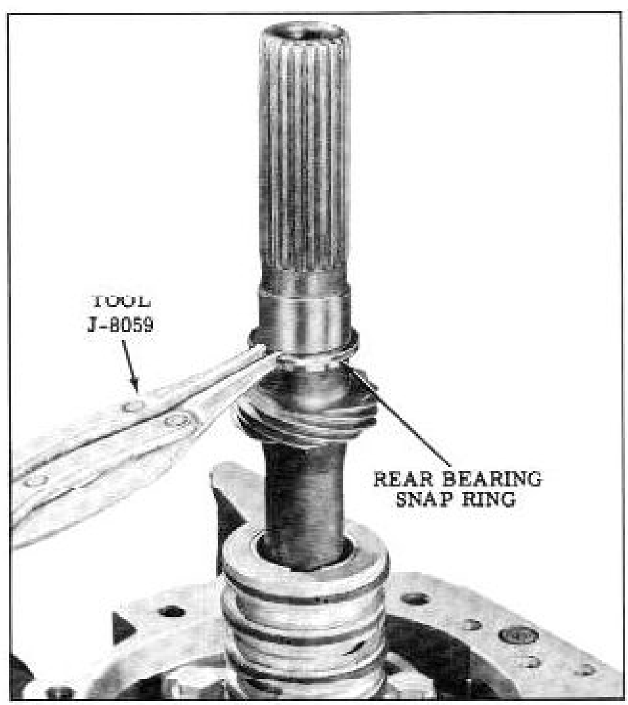

Fig. 3-35 Removing Rear Bearing Snap Ring

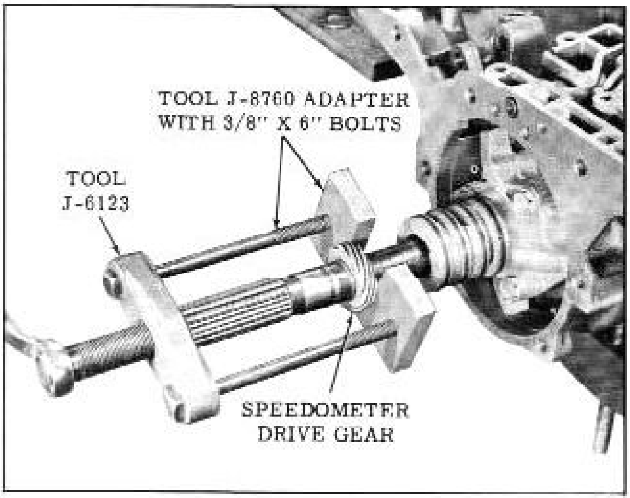

Fig. 3-36 Removing Speedometer Gear

27. Scribe mark on dowel of carrier and lug of output shaft for alignment on reassembly. (Fig. 3-38)

28. Remove the output shaft.

29. Remove the parking pawl assembly.(Fig. 3-39)

30. If replacement of pump seal is necessary, remove it as shown. (Fig. 3-40)

31. Rotate transmission pan side down to allow band anchor pin to fall free from case, then rotate transmission front end up.

32. Remove eight remaining case cover to case attaching bolts. If pump seal was not removed install seal protector J-8828 over input shaft. (Fig. 3-41)

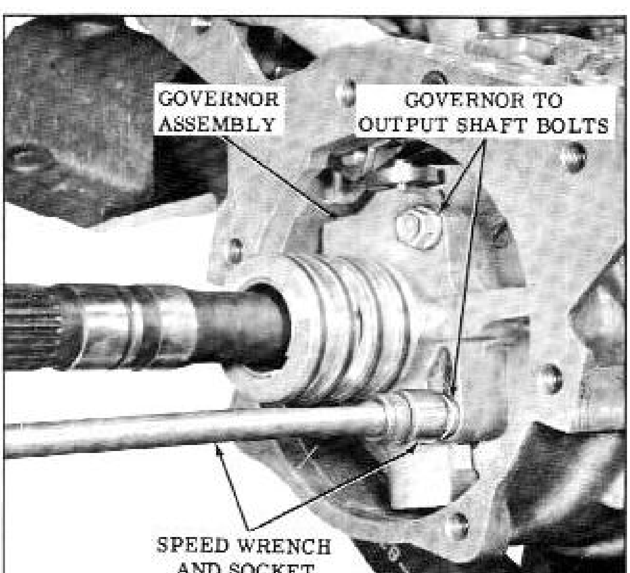

Fig. 3-37 Removing Governor

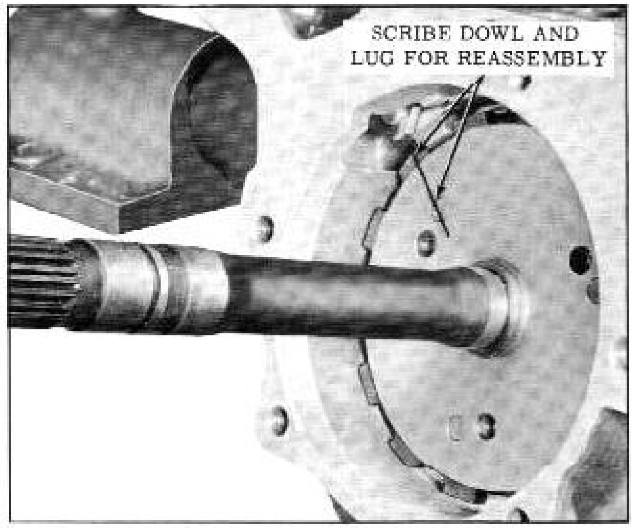

Fig. 3-38 Removing Output Shaft

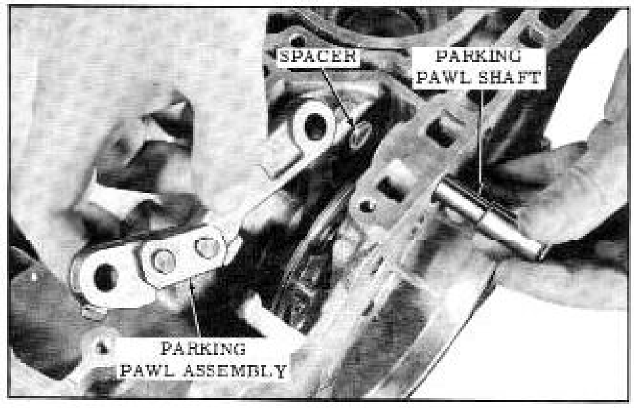

Fig. 3-39 Removing Parking Pawl

Fig. 3-40 Removing Pump Seal

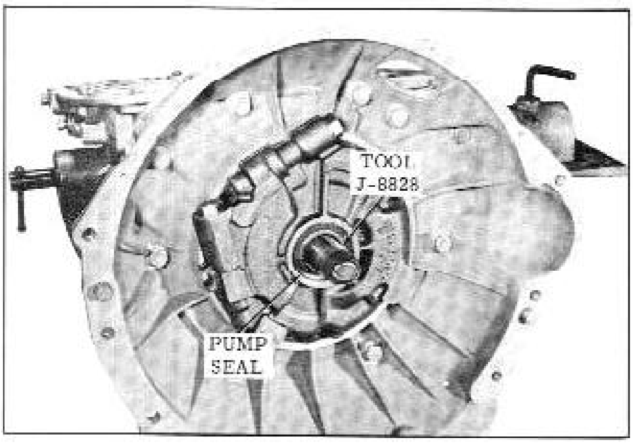

Fig. 3-41 Pump Seal Protector

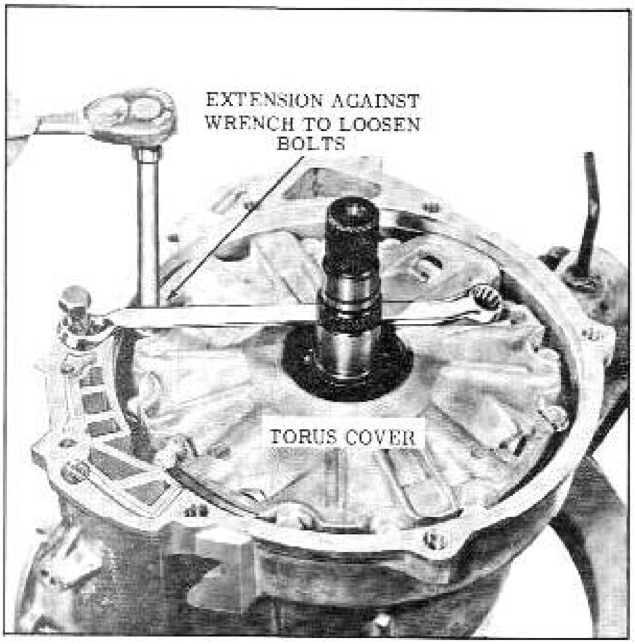

Fig. 3-42 Removing Torus Cover

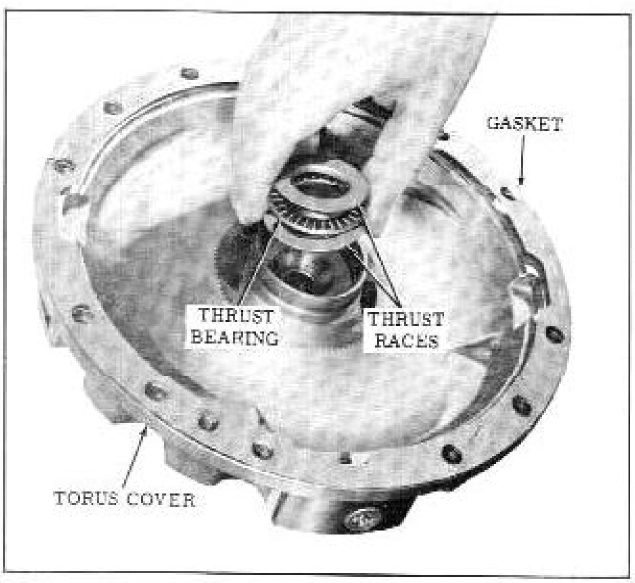

Fig. 3-43 Torus Cover Bearing

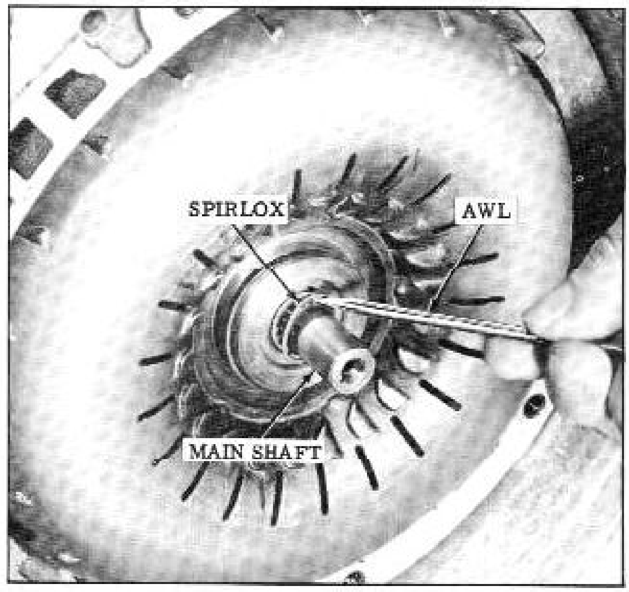

Fig. 3-44 Removing Retaining Ring

33. Remove case cover, case cover gasket, and pump assembly by lifting straight up.
34. Remove the seal protector.
35. Remove twelve torus cover attaching bolts, then remove the box wrench and case cover attaching bolt. (Fig. 3-42)
36. Remove the torus cover assembly by lifting straight up on input shaft.
37. Remove and DISCARD the metal torus cover to drive torus gasket. Remove the torus cover to driven member race, thrust bearing and race. (Fig. 3-43)
38. Rotate transmission with the pan side up and remove retaining ring (spirlox) with an awl or pointed tool. (Fig. 3-44)

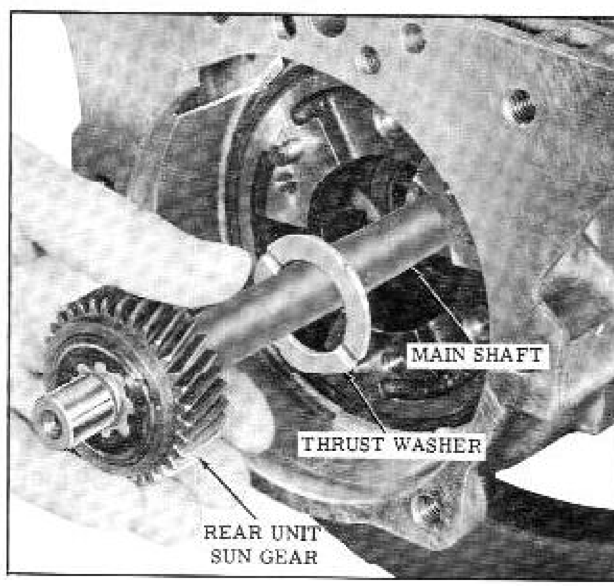

Fig. 3-45 Removing Mainshaft Sun Gear

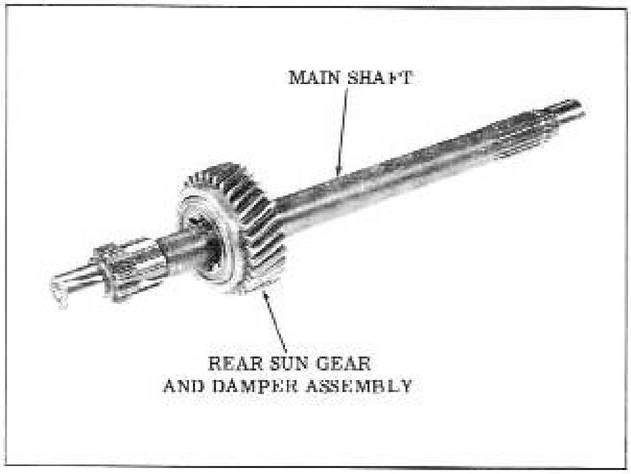

Fig. 3-46 Rear Sun Gear

39. Push mainshaft through driven torus and remove driven torus.
40. Remove the driven torus to torque multiplier race, thrust bearing and second race from multiplier.
41. Inspect and remove if necessary, two lock type oil rings from driven torus.
42. Remove the mainshaft sun gear and thrust washer from the rear of the transmission. (Fig. 3-45)
43. Remove the rear sun gear from the main shaft. (Fig. 3-46)
44. Remove the drive torus and torque multiplier as a unit. (Fig. 3-47)
45. Inspect and remove if damaged, one lock type oil ring from the torque multiplier.
46. Remove front carrier to rear carrier shaft snap ring. (Fig. 3-48)
47. Remove the front planet carrier assembly, bronze thrust washer, and front unit sun gear. (Fig. 3-49)

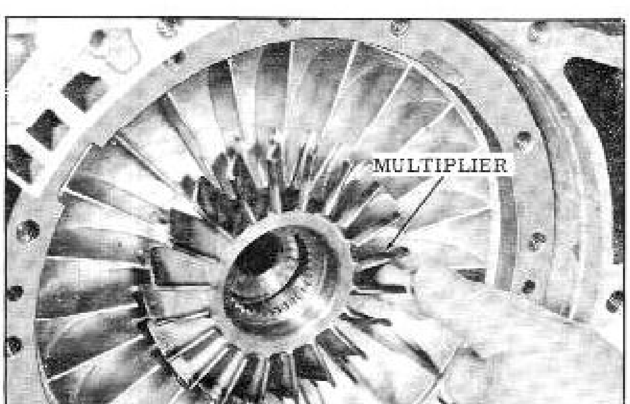

Fig. 3-47 Removing Drive Torus

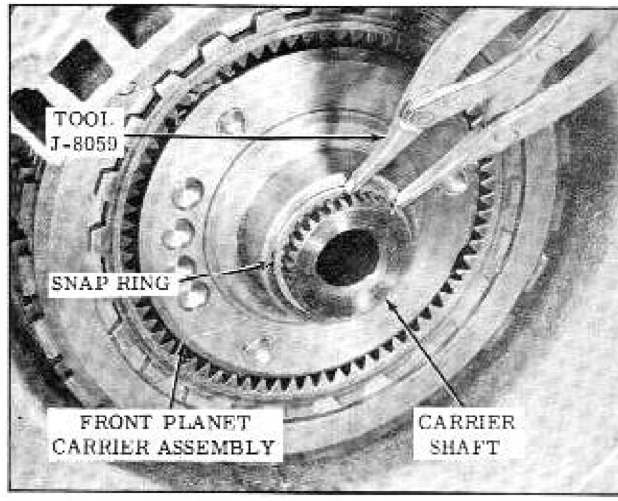

Fig. 3-48 Rear Carrier Snap Ring

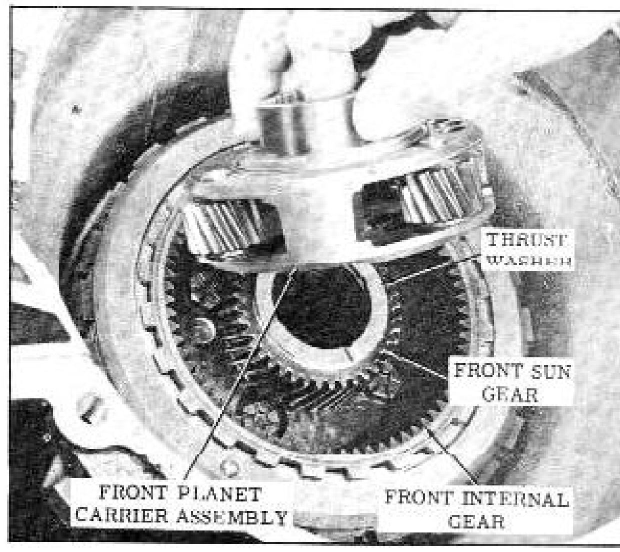

Fig. 3-49 Removing Front Unit Sun Gear

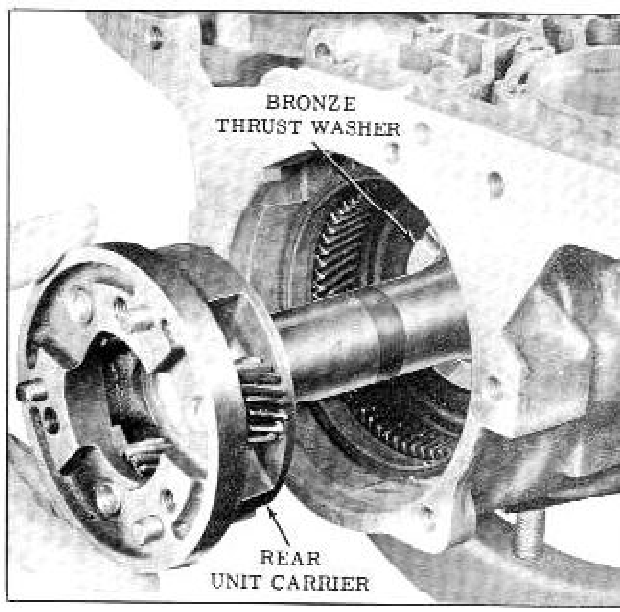

Fig. 3-50 Removing Rear Unit Carrier

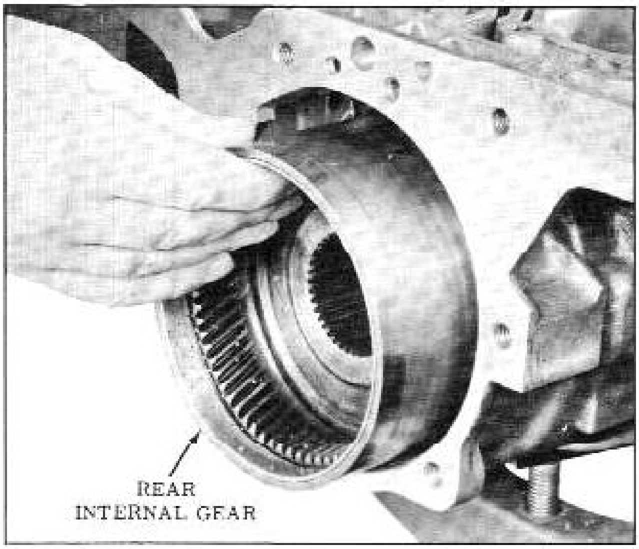

Fig. 3-51 Removing Rear Internal Gear

48. Remove the rear unit carrier assembly and internal gear bronze thrust washer from rear of transmission. (Fig. 3-50)

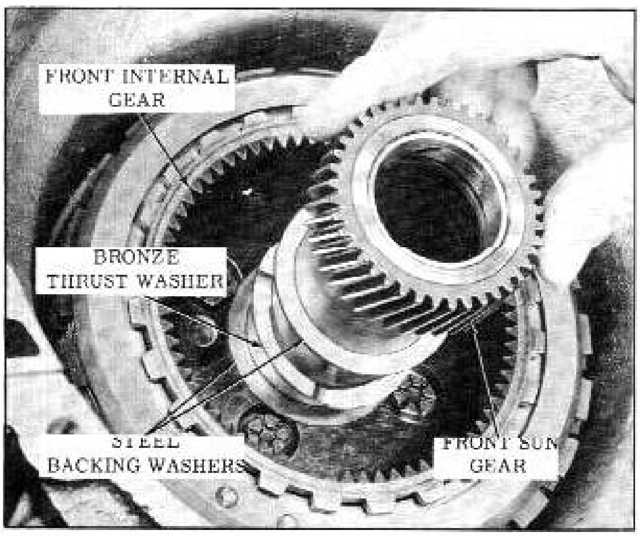

Fig. 3-52 Removing Sun Gear and Washers

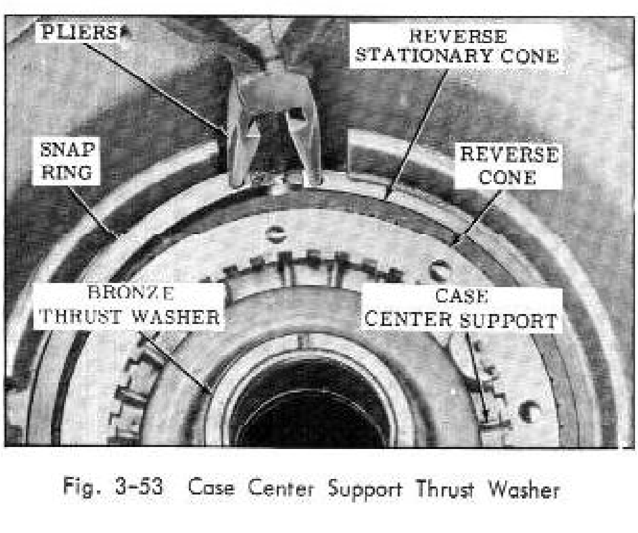

Fig. 3-53 Case Center Support Thrust Washer

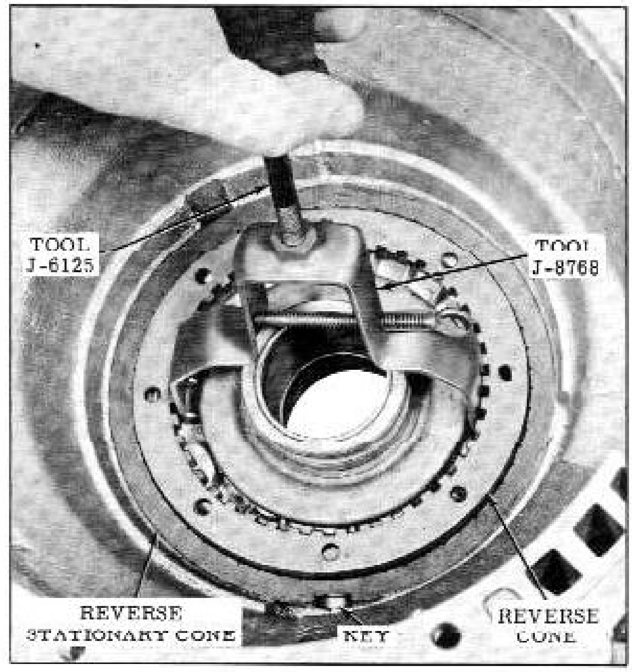

Fig. 3-54 Removing Reverse Cone

49. Remove the rear internal gear. (Fig. 3-51)

50. Rotate transmission front end up.

51. Remove the front sun gear and front internal gear backing washers and bronze thrust washer. (Fig. 3-52)

52. Remove the front unit internal gear and clutch housing assembly by lifting straight up.

53. Remove the front internal gear to case center support bronze thrust washer. (Fig. 3-53)

54. Remove the stationary cone to case snap ring.

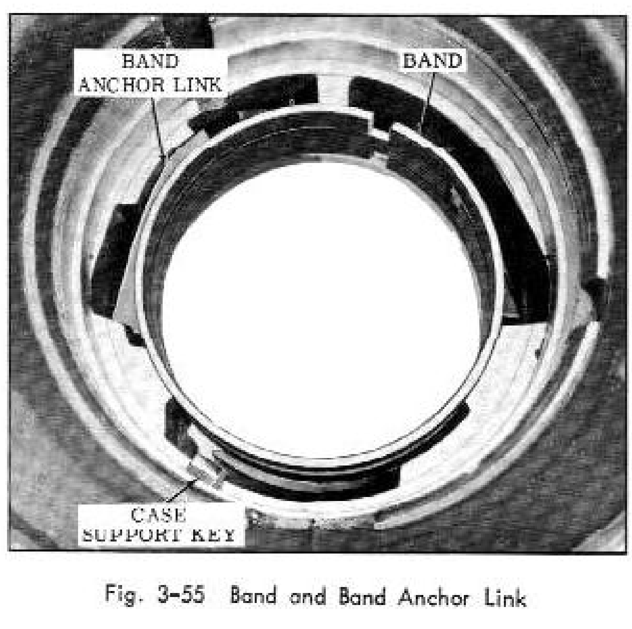

Fig. 3-55 Band and Band Anchor Link

55. Remove the reverse cone and stationary cone using Tool J-8768, Cone Remover. Slide hammer, Tool J-6125 may be used if reverse cone sticks. (Fig. 3-54)

56. Remove the reverse stationary cone key from transmission case by pressing from the bottom of the case.

57. Remove the case center support assembly. If unit does not remove easily, tap on the back of support with a brass drift. Remove the case center support key from the transmission case. (Fig. 3-55)

59. Lift the band and band anchor link out of case. (Fig. 3-55)

Disassembly and Assembly of Individual Units

TRANSMISSION CASE

Disassembly

1. If pressure leak was indicated on diagnosis, replacement of the pressure relief ball or spring may be necessary. Pull the tapered pin then remove spring and ball check valve. (Fig. 3-56)

CAUTION: The spring is under considerable tension so extreme care should be exercised during disassembly.

NOTE: Use a new pin on each assembly.

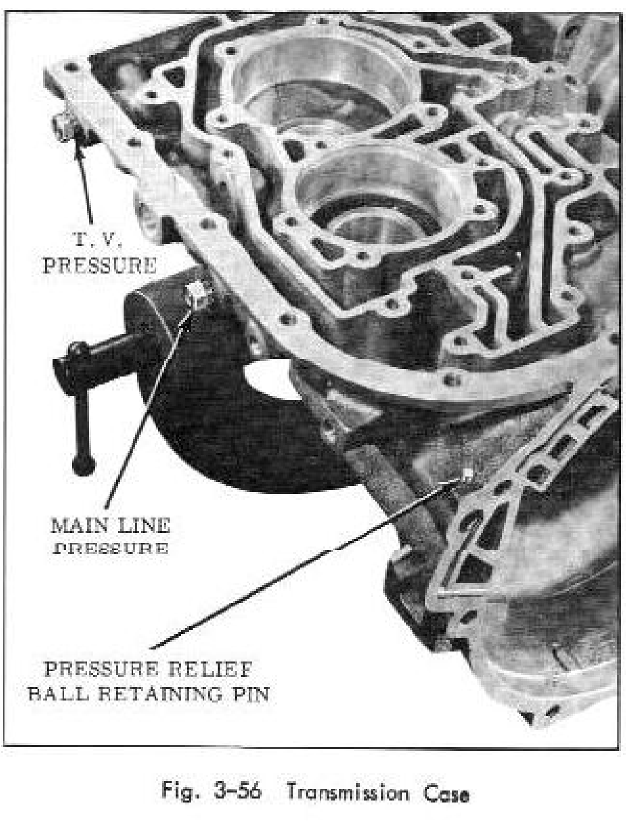

Fig. 3-56 Transmission Case

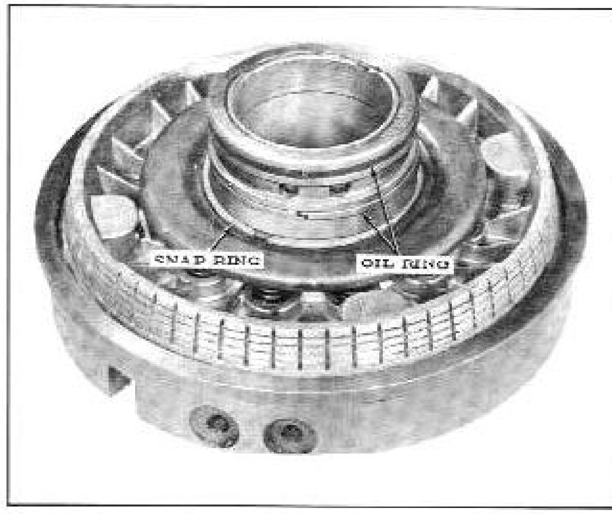

Fig. 3-57 Removing Case Support Oil Rings

2. Remove two pressure take-off pipe plugs from transmission case. (Fig. 3-56)

Assembly

1. Install two pressure take-off pipe plugs.

2. Install the ball check valve, spring and tapered pin.

CAUTION: Use extreme care when compressing spring and installing tapered pin.

Case Support

Disassembly

1. Remove two lock type oil rings from case support. (Fig. 3-57)

2. Remove snap ring as shown. (Fig. 3-58)

3. Remove tools.

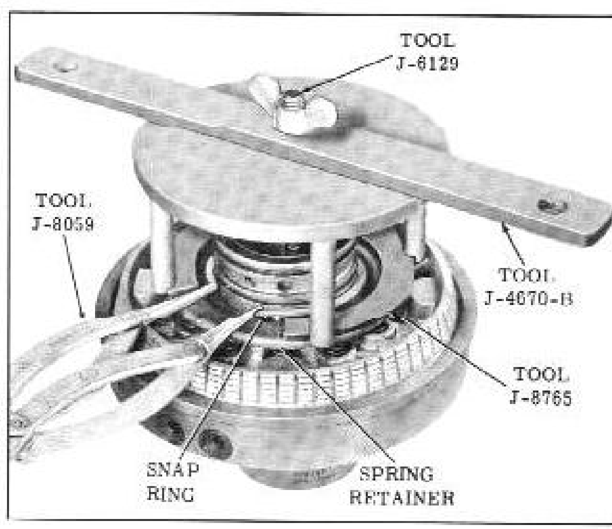

Fig. 3-58 Removing Case Support Snap Ring

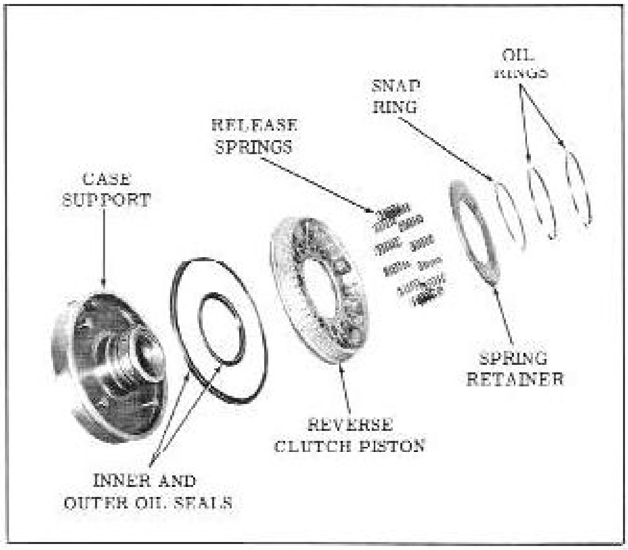

Fig. 3-59 Reverse Clutch Assembly

4. Remove the spring retainer, 12 reverse clutch release springs, and reverse clutch piston. (Fig. 3-59)

5. Remove the inner and outer reverse piston seals and discard.

Assembly

1. Install new inner and outer reverse piston seals so that lip of seals will face case support.

2. Install reverse piston inner seal protector J-8843 over oil delivery sleeve of case center support. (Fig. 3-60)

3. Install the reverse piston into the case center support guiding the outer piston seal into the support with a small screw driver. Piston will go on only two ways because of offset dowels. (Fig. 3-60)

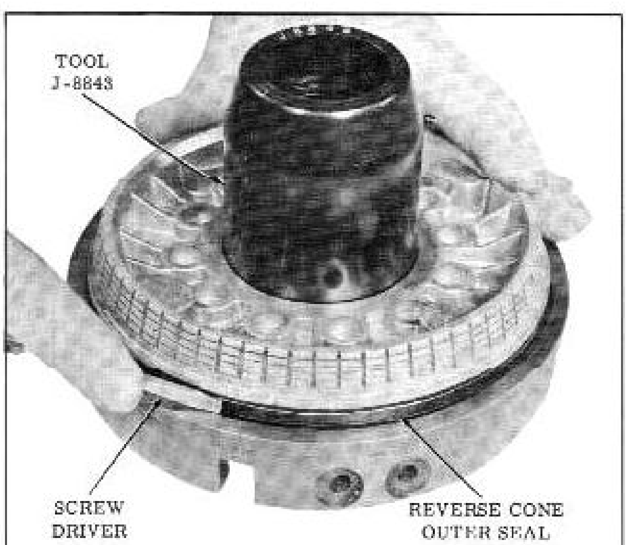

Fig. 3-60 Installing Outer Piston Seal

4. Remove seal protector, J-8843.

5. Install twelve reverse clutch release springs, and spring retainer. Be sure all release springs are properly seated in their pockets.

6. Place snap ring on case support and attach all spring compressing tools. (Refer to Fig. 3-58)

7. Install case support spring retainer snap ring and remove all tools.

8. Install two new lock type oil rings.

Front Internal Gear and Clutch Housing Assembly

Disassembly

1. Install Tool J-8938, (two studs) in dowel pin holes in clutch housing assembly and secure in vice. (Fig. 3-61)

2. Remove four front internal gear to clutch housing attaching bolts.

3. Remove assembly from dowel pins and place on bench. Separate the internal gear and clutch drum by tapping on assembly to free internal gear from dowel pins.

4. Remove front unit internal gear, backing plate, and discs. (Fig. 3-62)

5. Remove twenty clutch release springs, clutch piston and outer piston seal. Discard the seal.

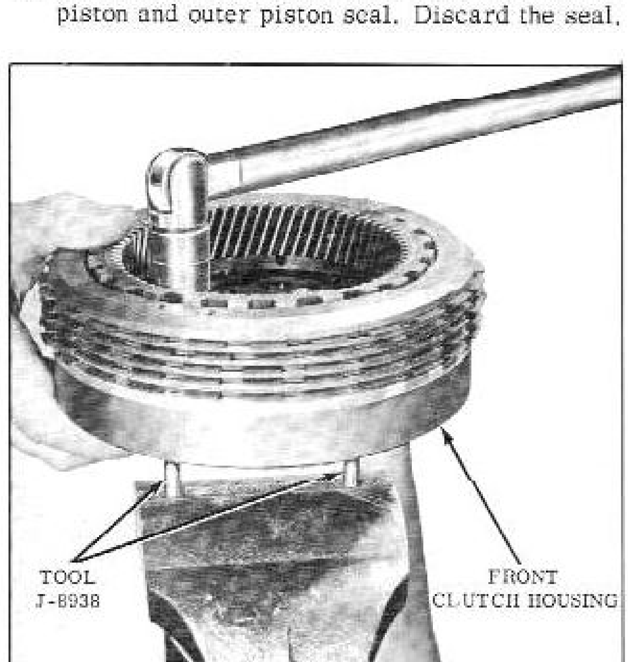

Fig. 3-61 Internal Gear Attaching Bolts

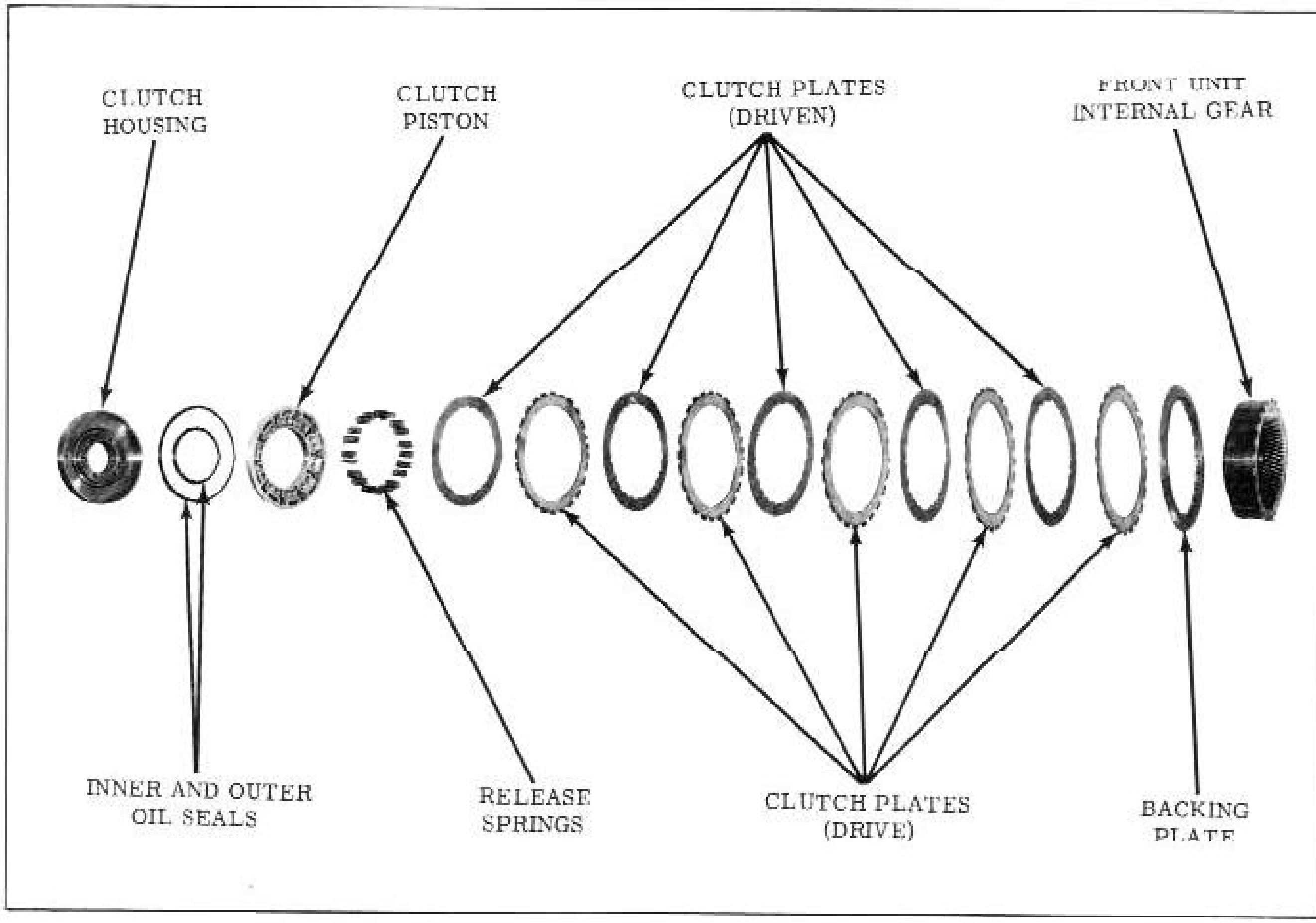

Fig. 3-62 Front Unit Clutch Assembly

6. Remove the inner clutch piston seal from the the clutch housing and discard.

Assembly

1. Install a new inner piston seal on the clutch housing, with lip of seal facing down.
2. Install a new outer piston seal on the clutch piston with lip of seal facing the flat side of piston and lubricate with No. 567196 Lubricant.
3. Install piston into clutch housing using small screw driver to guide outer seal into bore. (Fig. 3-63)
4. Install twenty clutch release springs into pockets in clutch piston.
5. Install the front clutch backing plate over front internal gear with counter bore facing tooth flange on front internal gear.
6. Install five composition drive and five steel driven front clutch plates alternately, nesting them as follows: (Fig. 3-64)
   a. Place a composition clutch plate over the front unit internal gear.
   b. Place a steel plate over the internal gear and notice the position of the slight half moon notch in the edge of the steel plate.
   c. Continue to install the composition and

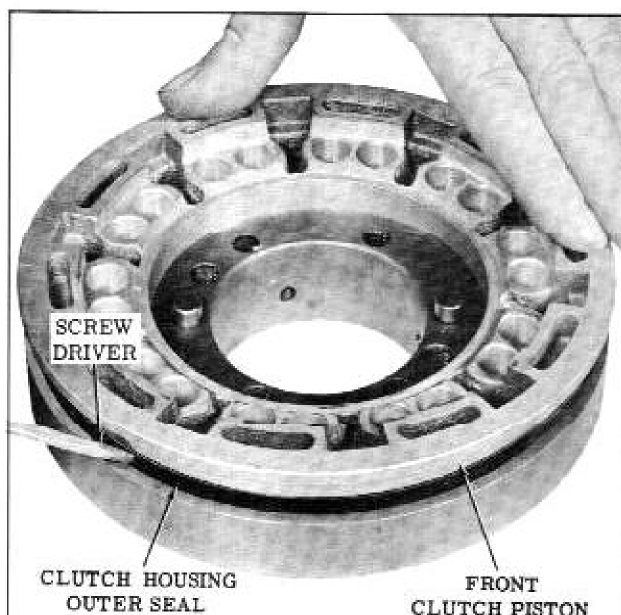

Fig. 3-63 Installing Outer Clutch Piston Seal

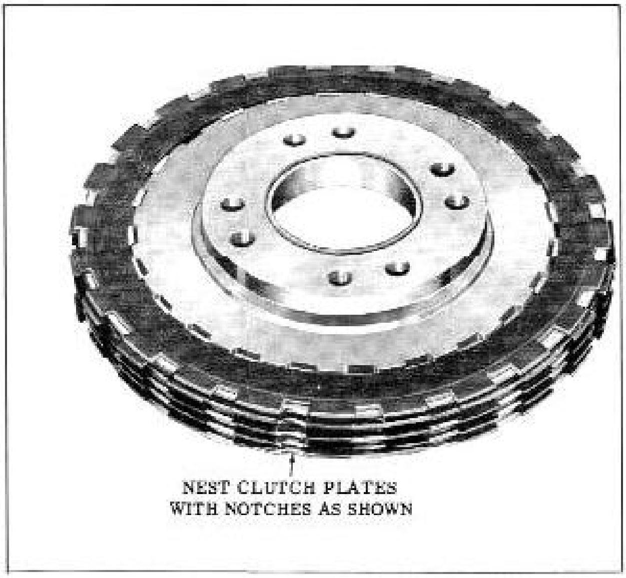

Fig. 3-64 Assembling Clutch Plates

steel plates alternately so that all steel plates have their notches one above the other.

7. Carefully, place the front unit internal gear backing plate and clutch plates over the front clutch housing, aligning the dowel pins and holes.

8. Install four front internal gear to clutch housing attaching bolts. Tighten bolts lightly and evenly using caution so as not to pinch bottom steel plate between internal gear and clutch piston.

9. Install Tool J-8938 (studs) in dowel pin holes in clutch housing assembly and secure in vise. (Fig. 3-65) Torque 22-27 ft. lbs.

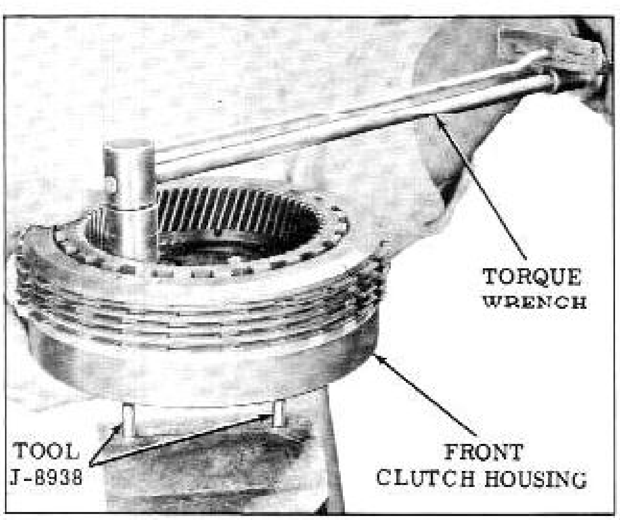

Fig. 3-65 Assembling Clutch Housing

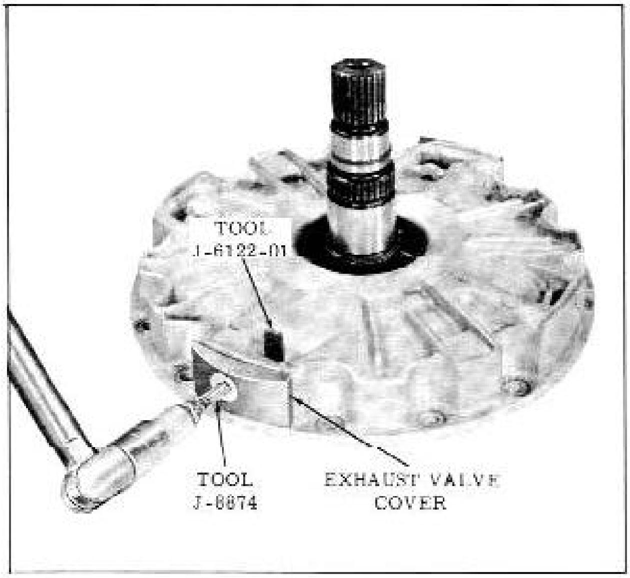

Fig. 3-66 Removing Exhaust Valve Covers

Torus Cover

Disassembly

1. Install Tools J-6122-01 Exhaust Valve Retainers, then remove the exhaust valve covers by removing the attaching screws, using Tool J-8874. (Fig. 3-66)

2. Remove the two steel torus exhaust valve cover gaskets and discard.

3. Remove the two exhaust valves and springs. (Fig. 3-67)

4. Inspect and remove, if necessary, two lock type oil rings from input shaft.

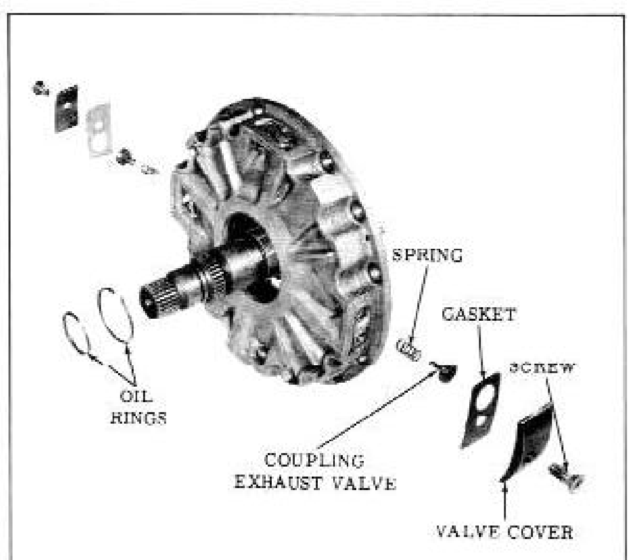

Fig. 3-67 Torus Cover Assembly

Assembly

1. Install two new lock type oil rings on input shaft, if removed.

2. Install exhaust valve springs and valves.

3. Retain the valves with Tools J-6122-01.

4. Replace torus cover exhaust valve covers. and new gaskets with attaching screw and Tool J-8874. Torque to 20-25 ft. lbs. (Fig. 3-68)

5. Remove Tools J-6122-01.

Rear Bearing Retainer (Fig. 3-69)

Disassembly

1. Remove the reverse blocker valve and spring by removing the "E" ring.

2. Remove the detent plunger and spring by holding plunger against spring tension while removing the retainer. (Fig. 3-70)

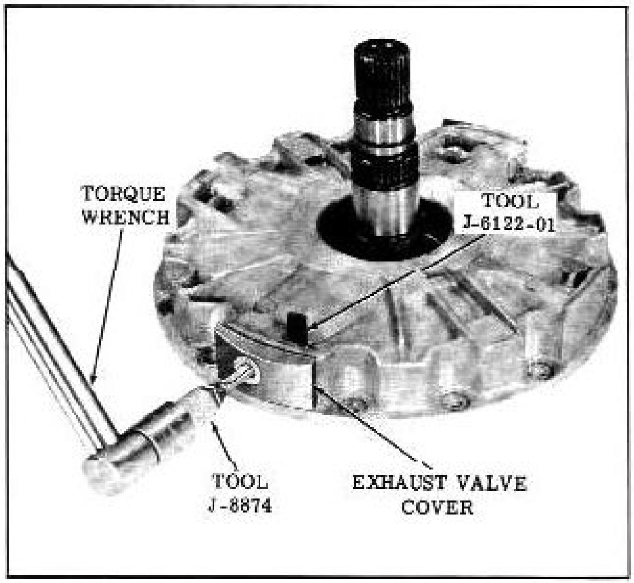

Fig. 3-68 Installing Exhaust Valve Cover

3. Remove rear bearing snap ring, and remove bearing. (Fig. 3-69)

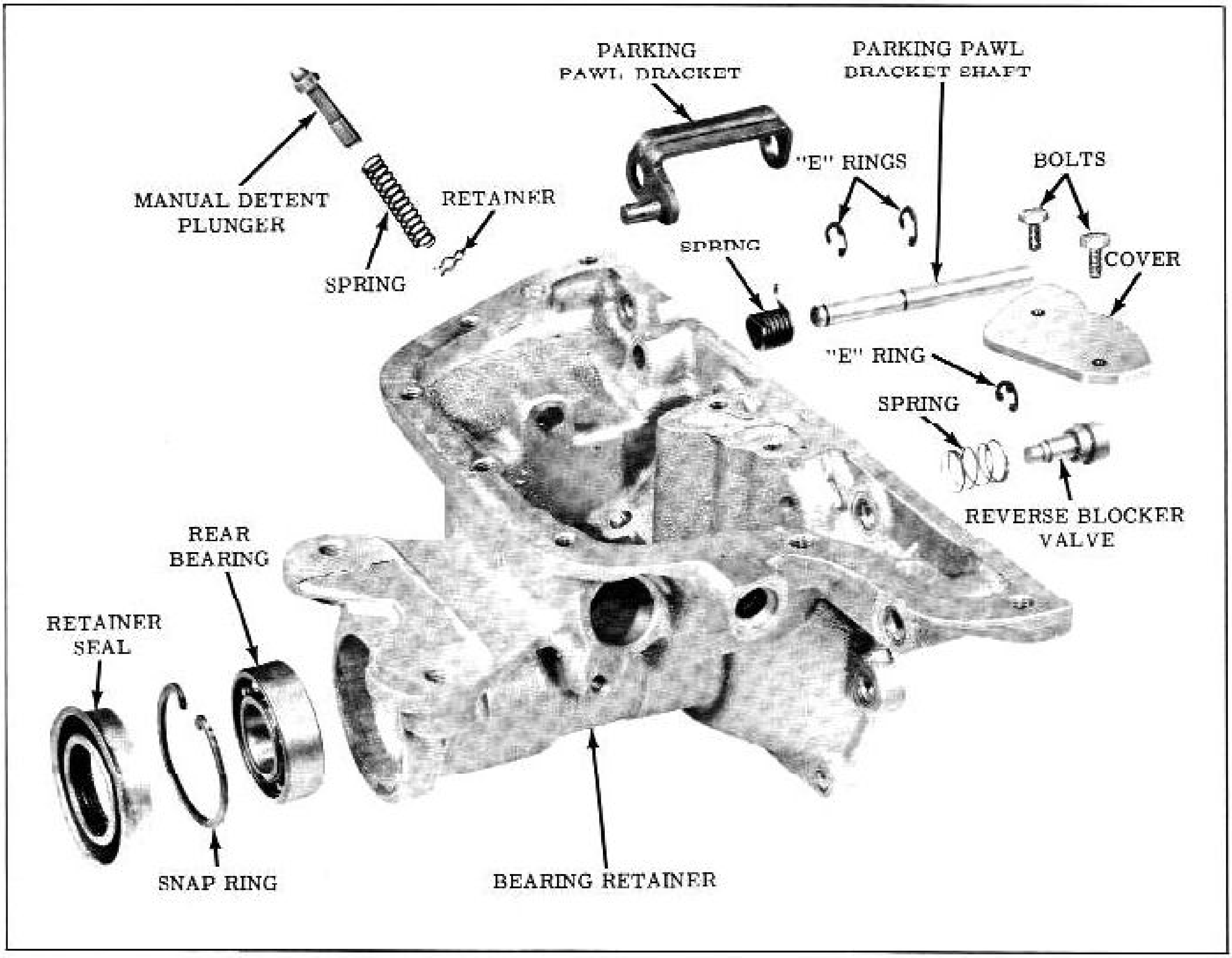

Fig. 3-69 Rear Bearing Retainer Assembly

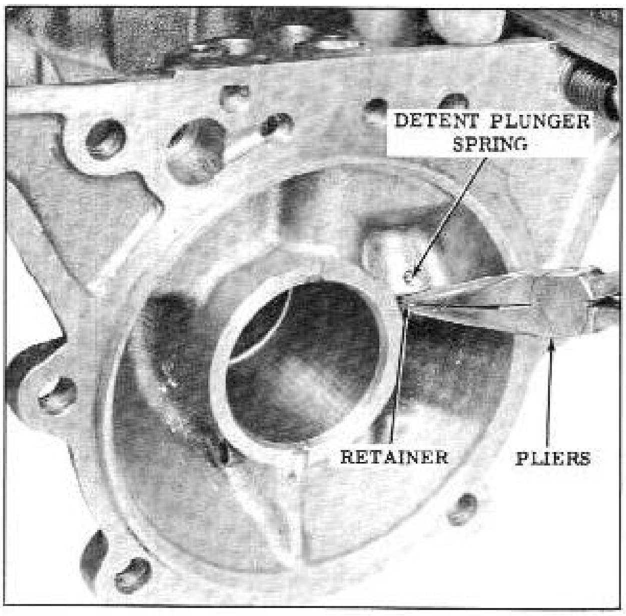

Fig. 3-70 Removing Detent Plunger

4. If necessary to remove parking pawl bracket shaft, remove two bracket shaft "E" rings. (Fig. 3-71)

Assembly

1. Install the rear bearing and snap ring.

2. Install the detent plunger and spring, compress the plunger and spring and install the retainer. (Fig. 3-70)

3. Install the reverse blocker valve and spring into the rear bearing retainer and secure with "E" ring.

4. Apply a coating of sealer such as Permatex #2, to outer diameter of the rear oil seal and install with Tool J-5154. (Fig. 3-72)

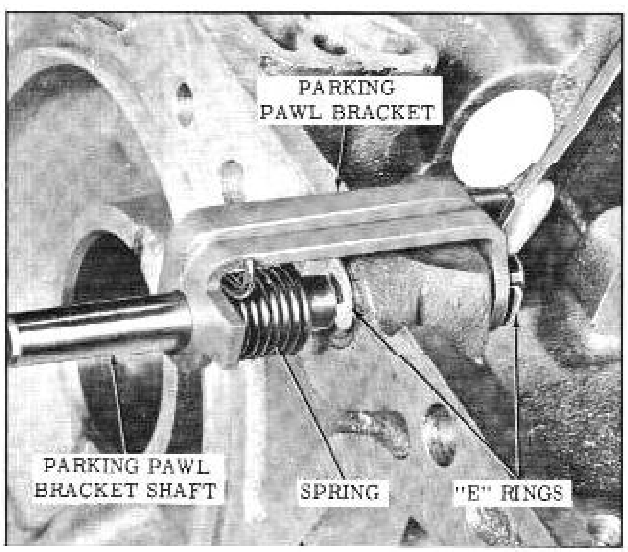

Fig. 3-71 Removing Parking Pawl Bracket

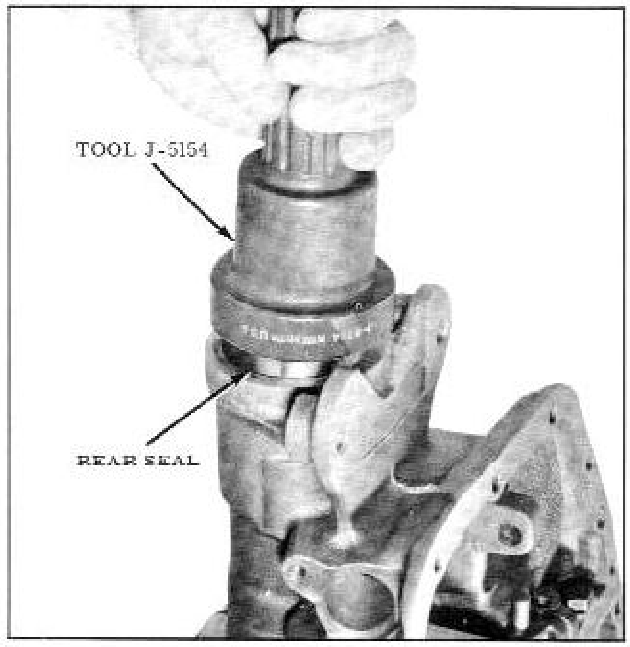

Fig. 3-72 Installing Rear Seal

5. Install the parking pawl bracket, shaft and spring into bearing retainer and install two "E" rings on shaft. (Fig. 3-73)

Governor

Disassembly

1. Inspect and remove, if necessary, 4 lock type oil rings. (Fig. 3-74)

2. Remove the G-2 valve retainer, plug and valve.

Assembly

1. Install the G-2 valve, stem end out.

2. Install the G-2 plug, cupped end first.

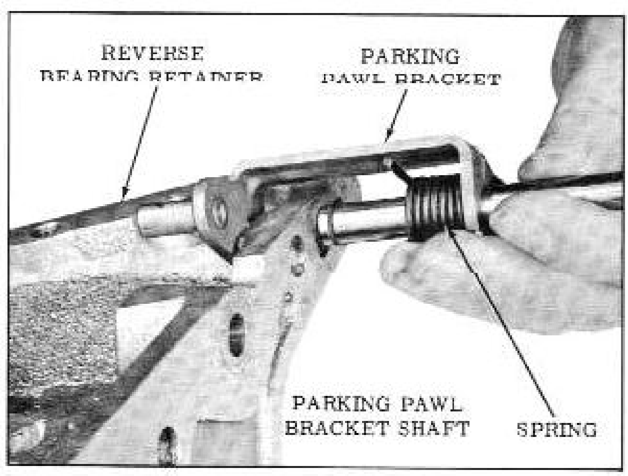

Fig. 3-73 Installing Parking Pawl Bracket

3. Install the G-2 valve plug retainer and 4 new lock type oil rings if removed.

Servo Piston

Disassembly

1. Place Tool J-8760 against servo piston, clamp in vise to remove retaining ring and washer. (Fig. 3-75)

2. Slowly open the vise and carefully, remove assembly from the vise.

3. Remove the servo piston, spring and retainer.

4. Inspect servo piston oil ring and replace if necessary. (Fig. 3-76)

Assembly

1. Install the spring retainer, spring and servo piston pin.

2. Place the assembled servo components into a vise and carefully compress the assembly to allow the flat washer and retaining ring to be installed. (Fig. 3-75)

3. Install the washer and snap ring.

4. Remove from vise and install new oil ring if removed.

Accumulator Piston

Disassembly

1. Remove and discard the lip seal from the upper accumulator piston, if necessary.

2. Inspect seal ring on lower accumulator piston and replace if necessary.

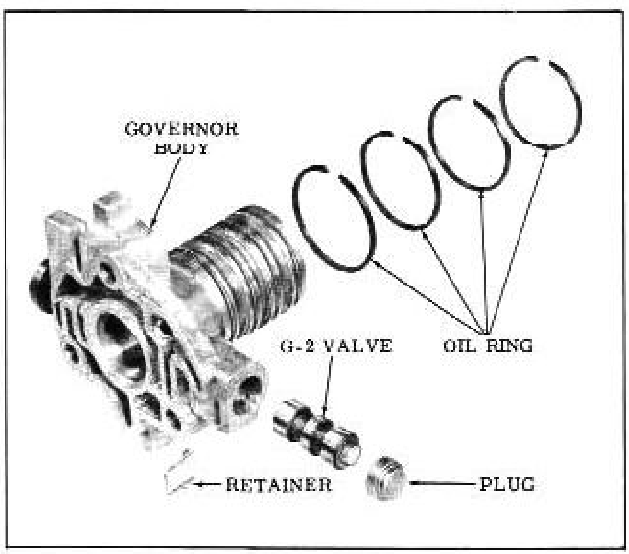

Fig. 3-74 Removing Governor Oil Rings

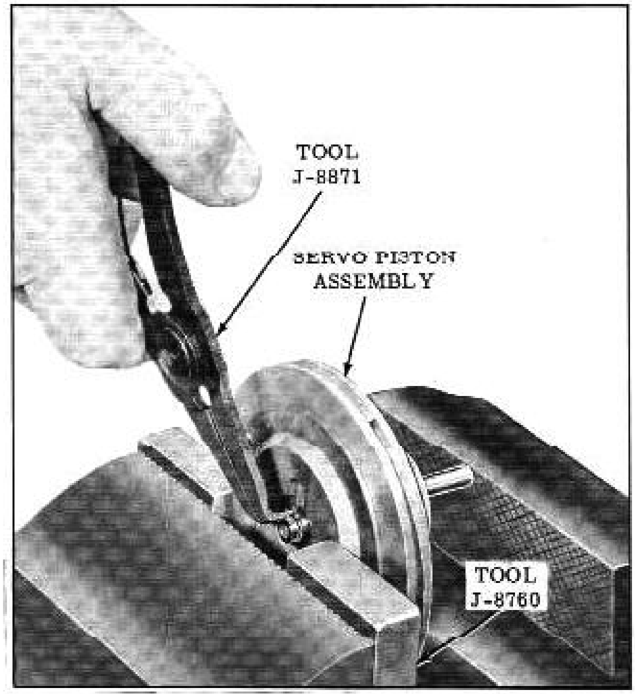

Fig. 3-75 Servo Piston Retaining Ring

Assembly

1. Install a new piston seal on the upper accumulator piston, lip facing flat side of piston and new ring on lower if removed.

Case Cover and Pump

1. Loosen the 6 case cover to pump attaching bolts, approximately 4 turns each.

2. Carefully, tap on the bolt heads to free the pump and "O" ring seal from the case cover assembly. (Fig. 3-77)

3. Remove the case cover to pump attaching bolts and remove the pump.

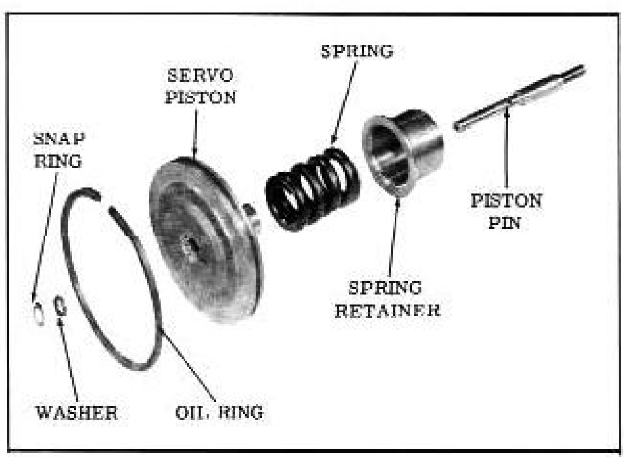

Fig. 3-76 Servo Piston Assembly

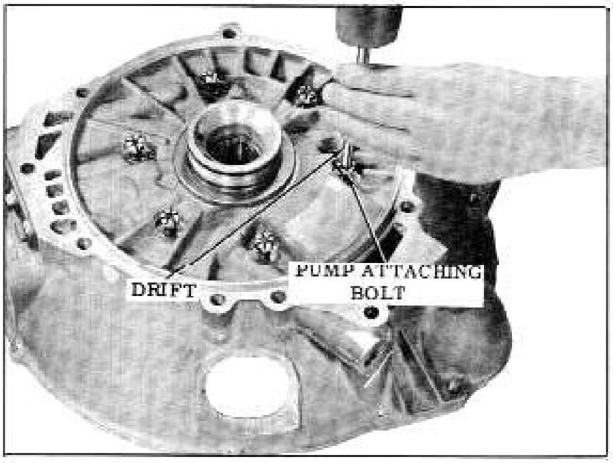

Fig. 3-77 Removing Pump

Case Cover

Disassembly

1. Remove two lock type oil rings from the case cover hub. (Fig. 3-78)
2. Remove cupped race, thrust bearing and the selective washer. (Fig. 3-79)
3. Remove the case cover plate and gasket by removing three bolts and bolt head seals.

Assembly

1. Install the case cover plate and gasket using the three attaching bolts and bolt head washer seals, torque 18-20 ft. lbs. (Fig. 3-78)
2. Install the predetermined selective washer over the hub of the case cover.

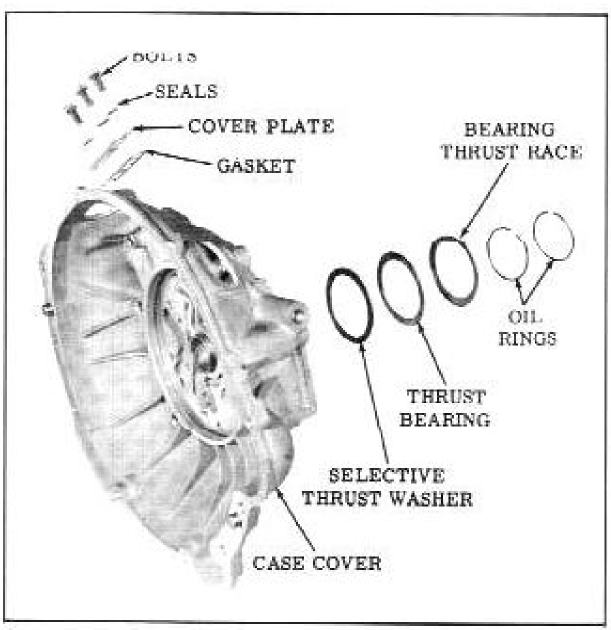

Fig. 3-78 Case Cover Assembly

3. Install the thrust bearing and cupped race with cover over bearing and two lock type oil rings.

Pump

Disassembly (Fig. 3-80)

1. Inspect and if condition indicates replacement is necessary, remove and discard pump to case cover "O" ring.
2. Remove the pump cover by removing one attaching screw. (Fig. 3-81)
3. Remove the upper vane ring, rotor, eleven vanes and the bottom vane ring.
4. Remove pump slide. (Fig. 3-82)
5. Remove the inner and outer priming springs.
6. Remove the coupling feed limit valve plug and "O" ring. Inspect and remove the "O" ring if necessary. (Fig. 3-83)
7. Remove the coupling feed limit valve spring, valve and pin. (Fig. 3-83)
8. Remove the pressure regulator plug, "O" ring seal and line boost plug. (The line boost plug is in the pressure regulator plug). Inspect and remove the "O" ring, if necessary.
9. Remove the pressure regulator spring, valve and line boost plug stop. (Fig. 3-83)
10. Do not remove the pressure regulator valve cushion unless replacement is necessary.

Assembly

1. Install a new pressure regulator valve cushion if replacement is necessary. (Fig. 3-83)

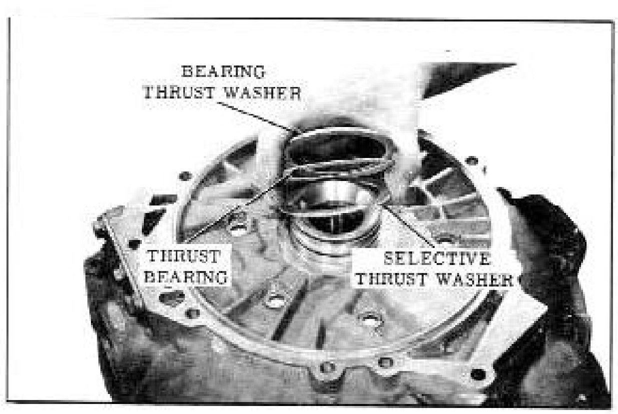

Fig. 3-79 Removing Case Cover Bearing

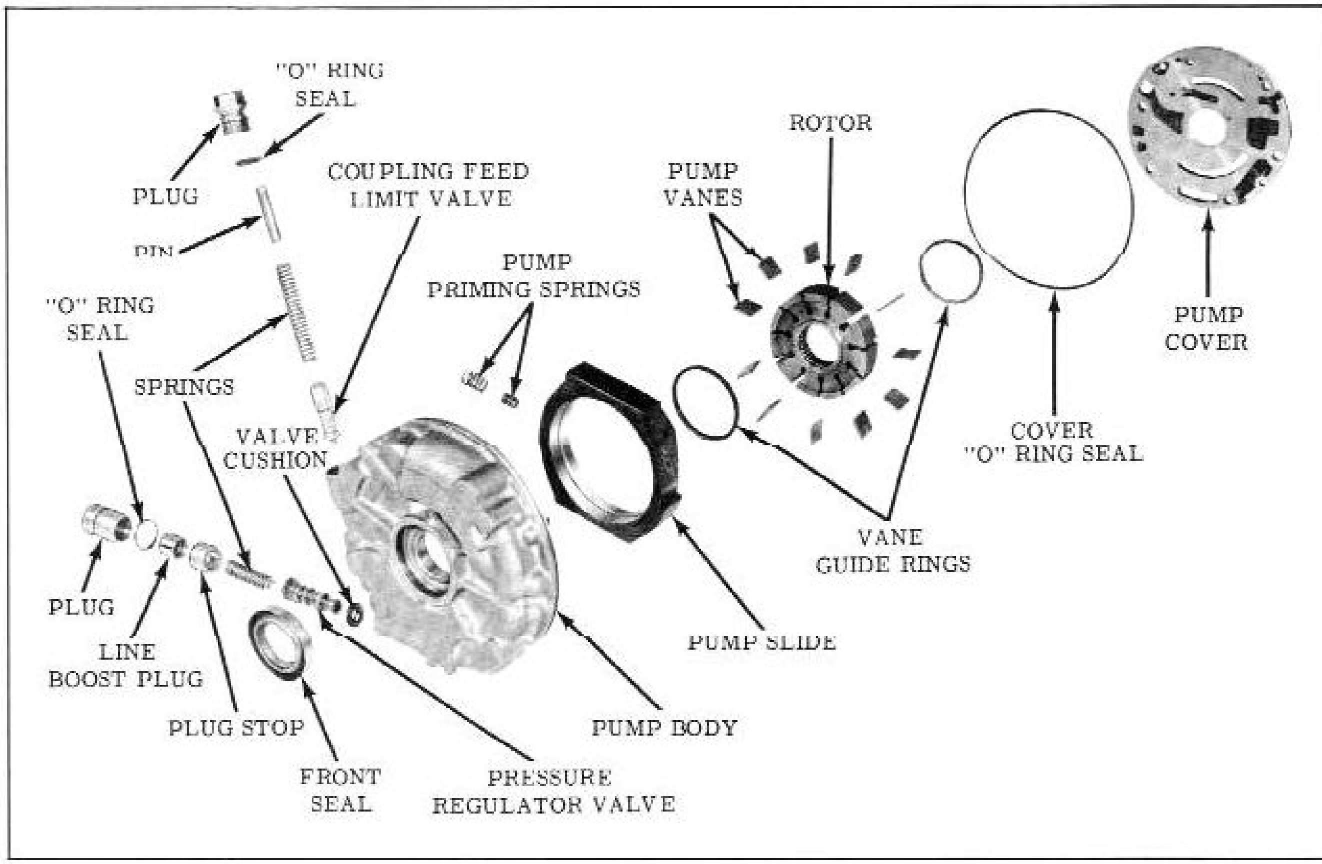

Fig. 3-80 Pump Assembly

2. Install the pressure regulator valve, spring, plug stop, boost plug, "O" ring and plug. Torque plug 15-20 ft. lbs. (Fig. 3-83)

3. Install the coupling feed limit valve spring, pin, "O" ring and plug. Torque 15-20 ft. lbs. (Fig. 3-83)

4. Install the inner and outer priming springs and slide. (Slide will only fit one way). (Fig. 3-82)

5. Install the lower vane guide ring into the pump body.

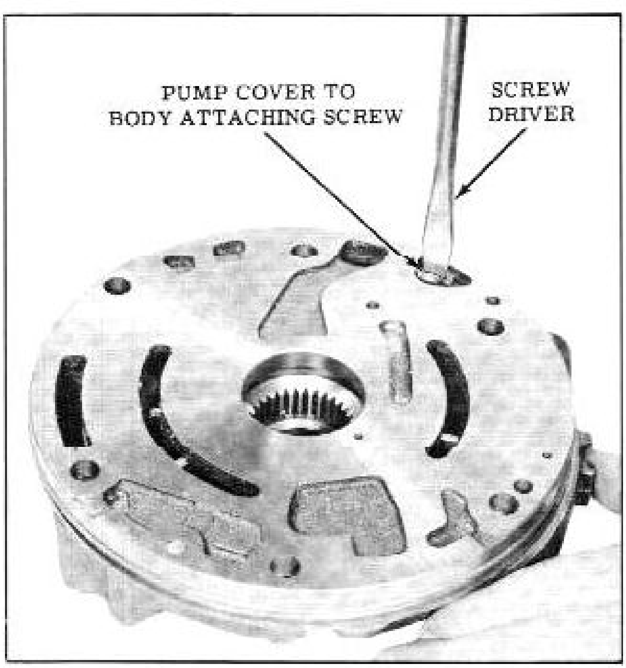

Fig. 3-81 Removing Pump Cover

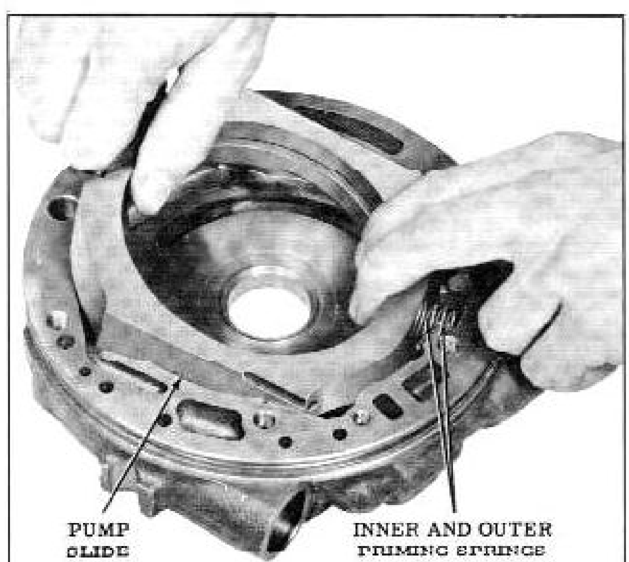

Fig. 3-82 Removing Pump Slide

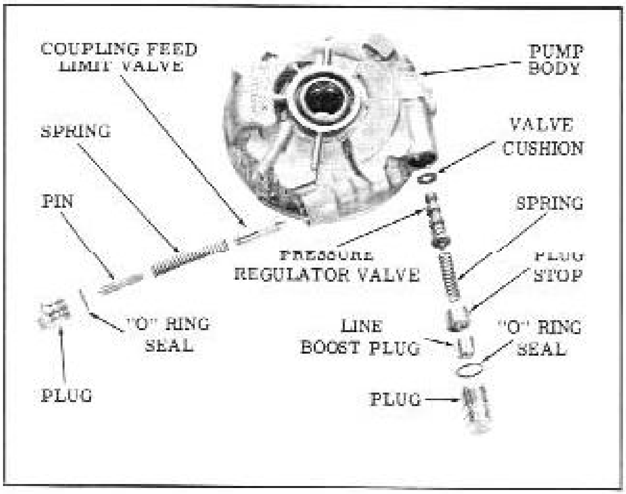

Fig. 3-83 Pump Valves

6. Install the pump rotor into the pump body, so that the shoulder on the rotor seats over the raised center portion of the pump body.

7. Install eleven vanes so the vane ring wear pattern on the edge of the vanes faces towards the vane rings. (Fig. 3-84)

8. Install the upper vane guide ring.

9. Install the pump cover by locating on pin and secure with one attaching screw. Torque 6-8 ft. lbs.

10. Install pump body to case cover "O" ring seal, if removed.

Assembly of Pump to Case Cover

1. Support pump assembly on convenient support

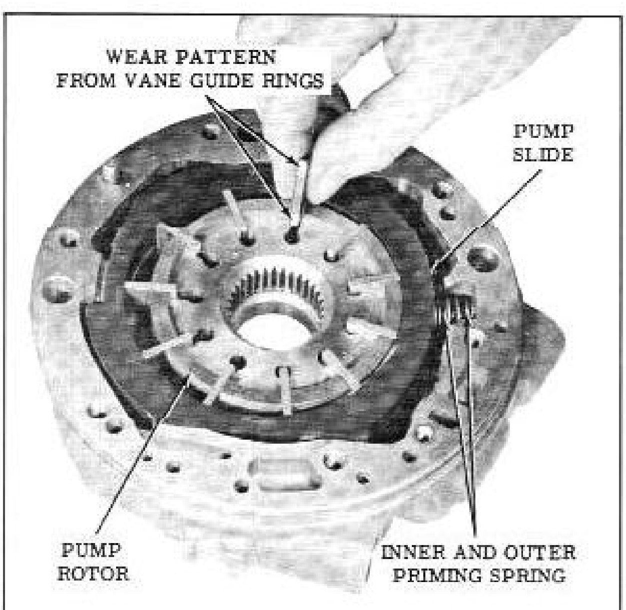

Fig. 3-84 Installing Pump Vanes

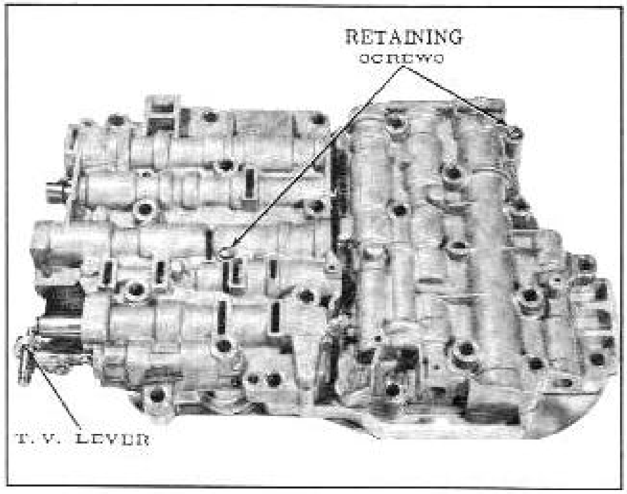

Fig. 3-85 Control Valve Assembly

to raise the pump above the work bench enough to allow the case cover to fit against the pump.

2. Align the case cover to pump bolt holes and position the case cover on the pump. Holes will only align in one position.

3. Install six case cover to pump attaching bolts, drawing the bolts up evenly to properly seat the "O" ring seal in the case cover. Torque 20-25 ft. lbs.

CONTROL VALVE

Disassembly of Complete Control Valve

1. Place control valve assembly on a CLEAN surface with the channel plate to case spacer down and the rear T.V. lever located in the lower left hand corner. (Fig. 3-85)

2. Remove the one retaining screw from each valve body.

3. Turn the control valve assembly over so rear T.V. lever is located in the upper left hand corner. (Fig. 3-86)

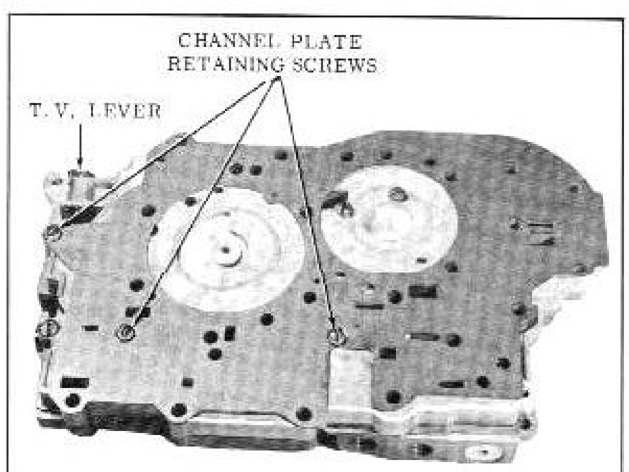

Fig. 3-86 Control Valve Assembly

4. Remove three screws retaining the channel plate to case spacer plate, and remove spacer plate. (Fig. 3-86)

5. Remove 4 ball checks from channel plate, and three channel plate to valve body attaching screws. (Fig. 3-87)

6. Remove the manual valve, from the primary valve body.

7. Remove the channel plate and rear T.V. lever from valve bodies.

8. Remove the sleeve, detent valve and spring from the primary valve body.

9. Remove the 3 exposed ball checks, then the channel plate to valve body spacer. (Fig. 3-88)

10. Place the secondary valve body aside temporarily.

Channel Plate

Rear T.V. lever may be removed from channel plate by removing "E" ring.

Disassembly of the Primary Valve Body

1. Remove the band apply valve bushing retainer from the cored face of the primary body.

2. Remove the band apply valve and bushing from the throttle valve bore.

3. Remove the band apply valve spring, throttle valve spring and valve.

4. Remove the retaining pin from the cored face of the 1-2 valve bore while holding 1-2 T.V. bushing.

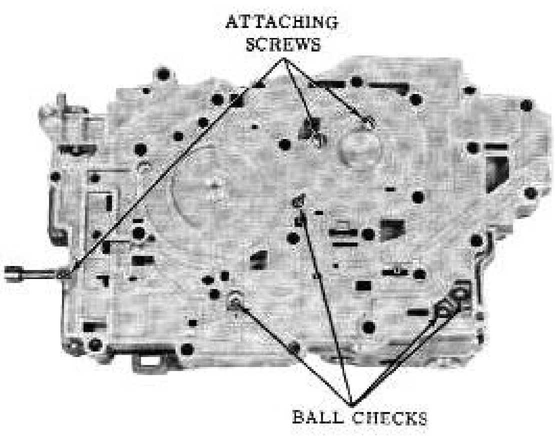

Fig. 3-87 Channel Plate Ball Checks

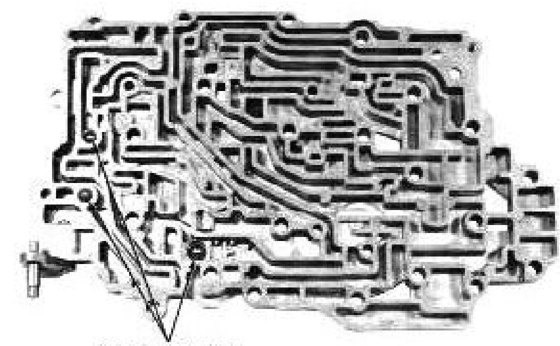

Fig. 3-88 Channel Plate Ball Checks

5. Remove the 1-2 T.V. bushing and 1-2 T.V. valve.

6. Remove the 1-2 T.V. valve spring, the 1-2 shift valve spring and shift valve.

7. Remove the 2-3 bore plug retainer and bore plug.

NOTE: Most of the valve bore plugs are tapped to allow an attaching screw to be threaded in for disassembly purpose.

8. Remove the 2-3 T.V. valve bushing and 2-3 T.V. valve.

9. Remove the 2-3 T.V. valve from the bushing.

10. Remove the 2-3 T.V. valve spring.

11. Remove the 2-3 shift valve.

12. Remove the bore plug retainer and bore plug from the other end of the 2-3 shift valve bore.

13. Remove the 2-3 governor valve.

14. Remove the bore plug retainer and bore plug from the 1-2 valve bore.

15. Remove the 1-2 governor valve.

16. Remove the bore plug retaining pin from the cored face of the compensator bore while holding the bore plug.

17. Remove the compensator bore plug and secondary compensator valve and spring.

18. Remove the primary compensator valve and spring.

19. Remove the compensator limit valve retainer pin by compressing limit valve spring with a brass rod.

20. Remove the compensator limit valve and spring.

NOTE: Do not tamper with the thermostatic T.V. element adjusting screw.

Assembly of Primary Valve Body (Fig. 3-89)

1. Install the compensator limit valve spring and valve.
2. Install the limit valve retaining pin by compressing the limit valve spring with a brass rod.
3. Install the primary compensator valve spring, and valve, small land first.
4. Install the secondary compensator valve spring and valve, small land first.
5. Install the compensator bore plug, tapped hole out, and install the bore plug retaining pin.
6. Install the 1-2 governor valve and bore plug, large end first into the 1-2 valve bore.
7. Install the bore plug retainer.
8. Install the 2-3 governor valve and bore plug, large end first, into the 2-3 valve bore.
9. Install the bore plug retainer.
10. Install the 2-3 shift valve, small land first, into the other end of the 2-3 shift valve bore.
11. Install the 2-3 T.V. valve spring in the spring pocket of the shift valve.
12. Install the 2-3 T.V. valve in the 2-3 T.V. bushing so that it completely enters the bushing.
13. Install the 2-3 valve and bushing tapered end first.
14. Install the bore plug threaded end out, and install retainer, flat side out.

NOTE: Install all flanged bore plug retainers with flat side out.

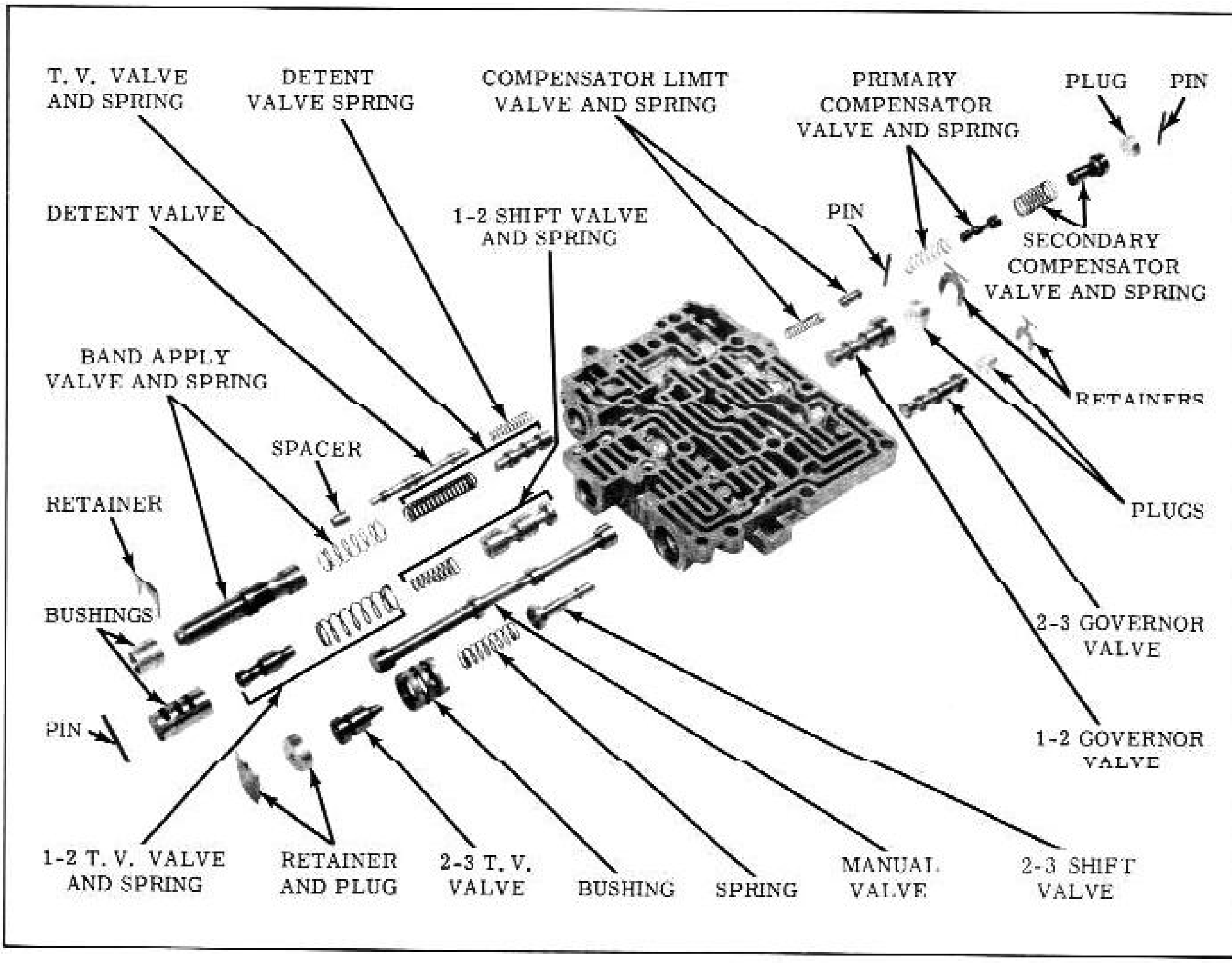

Fig. 3-89 Primary Valve Body

15. Install the 1-2 shift valve in the 1-2 bore, small land first.

16. Install the 1-2 shift valve spring and the 1-2 T.V. valve spring.

17. Install the 1-2 T.V. valve into the 1-2 T.V. valve bushing, land end first.

18. Install the 1-2 T.V. valve and bushing.

19. Install the retaining pin while holding the springs compressed.

20. Install the throttle valve in the T.V. bore, stem end out,

21. Install the band apply valve spring and the throttle valve spring.

22. Install the band apply valve, spring pocket first.

23. Install the band apply valve bushing on the band apply valve.

24. Install the band apply valve retainer while compressing the valve and bushing.

NOTE: Do not install the manual valve and detent valve train at this time.

Disassembly of the Secondary Valve Body (Fig. 3-90)

1. Remove the band release accumulator bore plug retainer from cored face.

2. Remove the bore plug from the accumulator bore (large bore).

3. Remove the band release accumulator valve.

4. Remove the low throttle control valve bore plug retainer from the next bore.

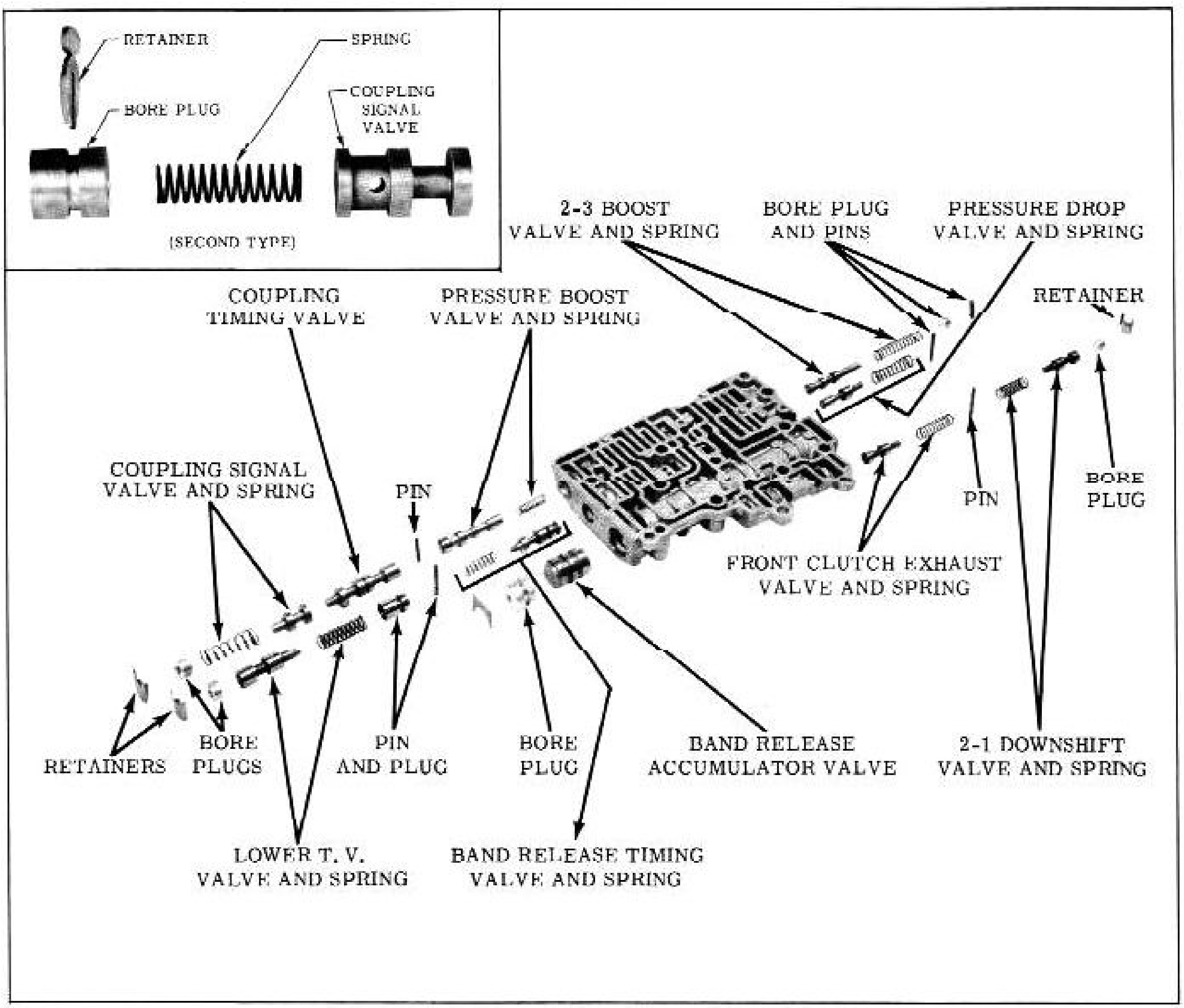

Fig. 3-90 Secondary Valve Body

5. Remove the bore plug, low throttle control valve and spring.

6. Remove the band release timing valve plug retaining pin from the cored face.

7. Remove the band release timing valve plug and spring.

8. Remove the band release timing valve.

9. Remove the coupling signal valve bore plug retainer from the next bore.

10. Remove the bore plug and coupling signal valve spring.

11. Remove the coupling signal valve and the coupling timing valve.

12. Remove the pressure boost valve retaining pin from the cored face while compressing the valve with a brass rod.

13. Remove the pressure boost valve and spring.

14. Remove the 2-3 boost valve retaining pin from the cored face while compressing bore plug.

15. Remove the bore plug, 2-3 boost valve spring and valve.

16. Remove the pressure drop valve retaining pin while holding the drop valve spring compressed.

17. Remove the pressure drop valve and spring.

18. Remove the 2-1 downshift valve bore plug retainer and bore plug.

19. Remove the 2-1 downshift valve and spring.

20. Remove the front clutch exhaust valve retaining pin from cored face while holding spring compressed.

21. Remove the front clutch exhaust valve spring and valve.

Assembly of Secondary Valve Body

NOTE: All attaching screws are to be torqued 2.5-3.5 ft. lbs.

1. Install the front clutch exhaust valve, stem out.

2. Install the front clutch exhaust valve spring, compress spring and install retaining pin.

3. Install the 2-1 downshift valve spring and valve, stem first.

4. Install the bore plug and retainer.

5. Install the pressure drop valve, stem last.

6. Install the pressure drop valve spring, compress the spring and install retaining pin.

7. Install the 2-3 boost valve, stem end last, then valve spring.

8. Install the bore plug, compress plug and install the retaining pin (short).

9. Install the pressure boost valve spring.

10. Install the pressure boost valve, hollow end first.

11. Install the retaining pin by compressing the pressure boost valve with a brass rod.

12. Install the coupling timing valve, stem end last.

13. Install the coupling signal valve, stem end last.

14. Install the coupling signal valve spring, bore plug, compress and install retaining clip.

15. Install the band release timing valve, stem end last, into the next bore.

16. Install the band release timing valve spring and plug, short land first, compress and install retaining pin.

17. Install the low throttle control valve spring.

18. Install the low throttle control valve, stem end first, bore plug and retainer.

19. Install the band release accumulator valve, bore plug and retaining clip.

Assembly of Complete Control Valve (Fig. 3-91)

1. Install 2 medium and one large ball checks into the ball check seats in channel plate. (Fig. 3-88)

2. Install channel plate to valve body spacer over channel plate.

3. Install detent spring and valve, long stem first, into the primary valve assembly. (Fig. 3-89)

4. Install the T.V. valve sleeve on the detent valve.

5. Install the primary valve assembly on the spacer plate, while compressing the T.V. sleeve and the band apply valve. Install one attaching screw, leave screw loose at this time.

6. Install the secondary valve assembly on the spacer plate and install one attaching screw, leave screw loose at this time.

7. Turn the assembly over and install two small and two large check balls into their pockets in the channel plate. (Fig. 3-87)

8. Install the manual valve, land with the hole out.

9. Install the channel plate to case spacer plate and install all attaching screws, leaving screws loose.

10. Install a 1/4 inch drill in an attaching bolt hole to align the primary valve assembly to the channel plate.

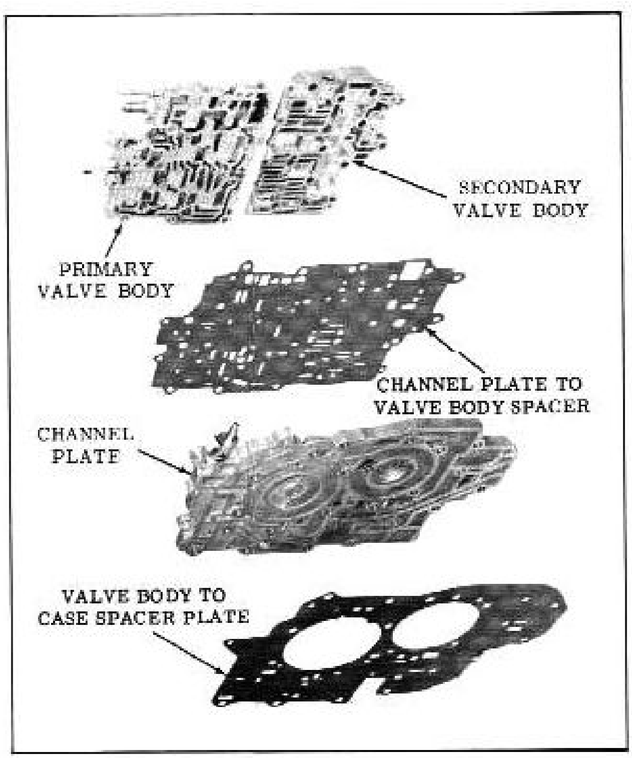

Fig. 3-91 Complete Control Valve

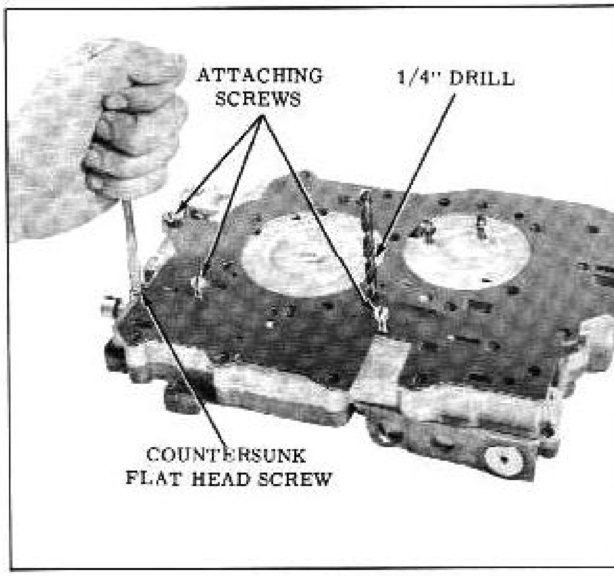

Fig. 3-92 Assembling Valve Bodies

11. Tighten the countersunk flat head screw. (Fig. 3-92)

12. Install the secondary valve body to case attaching screws for guides and tighten all valve body attaching screws.

13. Remove the attaching screws and the 1/4 inch drill.

Installation of Units into Transmission Case

1. Install transmission case into holding fixture J-8763 with front end up.

2. Install band with a single ear facing servo side of case. (Fig. 3-93)

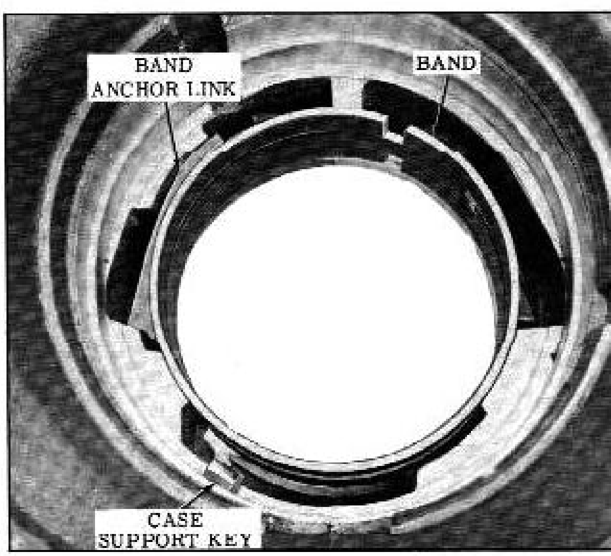

Fig. 3-93 Installing Band

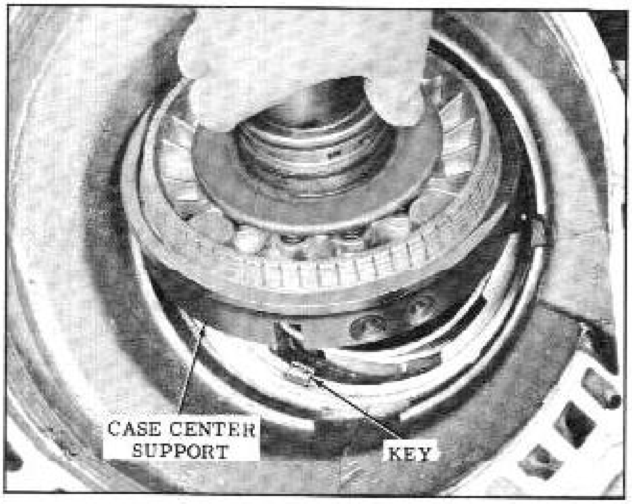

Fig. 3-94 Installing Case Center Support

3. Install band anchor link between band and case with cupped end of link against band adjusting stop pin hole.

4. Install the case center support key, bevel up.

5. Install the case center support assembly aligning keyway in support with key. (Fig. 3-94)

6. Install the reverse stationary cone key into case. (Fig. 3-95)

7. Install the reverse cone over the reverse piston.

8. Install the reverse stationary cone aligning the key slot with the key.

9. Install the reverse stationary cone retaining snap ring with ring gap at open section of ring groove.

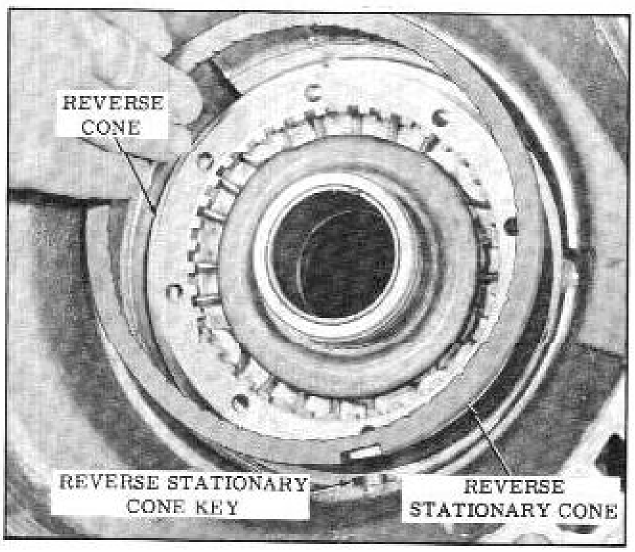

Fig. 3-95 Installing Case Center Support Key

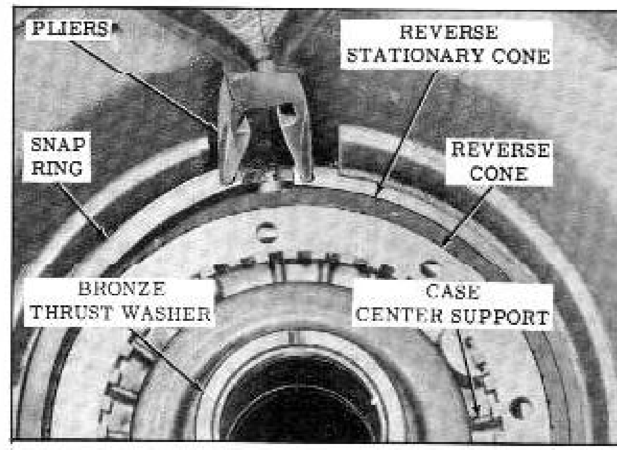

Fig. 3-96 Case Center Support Thrust Washer

10. Install case center support to front internal gear bronze thrust washer into the front clutch housing. Retain with petrolatum. (Fig. 3-96)

11. Install front internal gear and clutch assembly over splines of reverse cone. Rotate transmission, bottom side up.

CAUTION: DO NOT ROTATE OVER 1/4 TURN OR CLUTCH ASSEMBLY WILL FALL OUT.

12. Install the rear internal gear into the rear of transmission. (Fig. 3-97)

13. Install steel backing washer, bronze thrust washer, steel backing washer and sun gear on front sun gear shaft. (Fig. 3-98)

14. Install rear carrier to rear internal gear bronze thrust washer over carrier shaft. (Fig. 3-99)

15. Install rear carrier from rear of transmission.

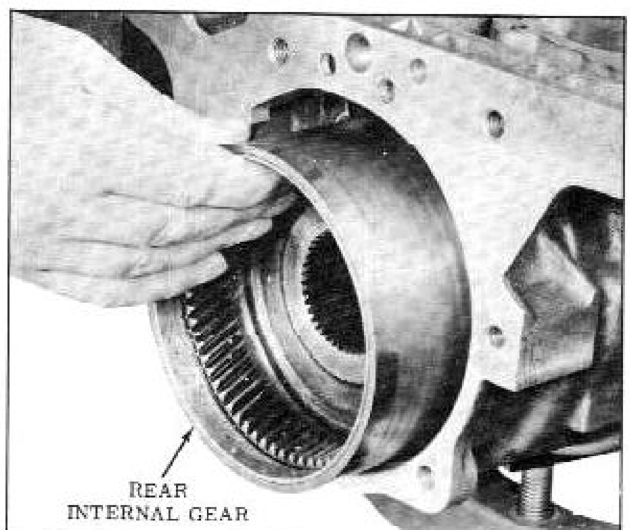

Fig. 3-97 Rear Internal Gear

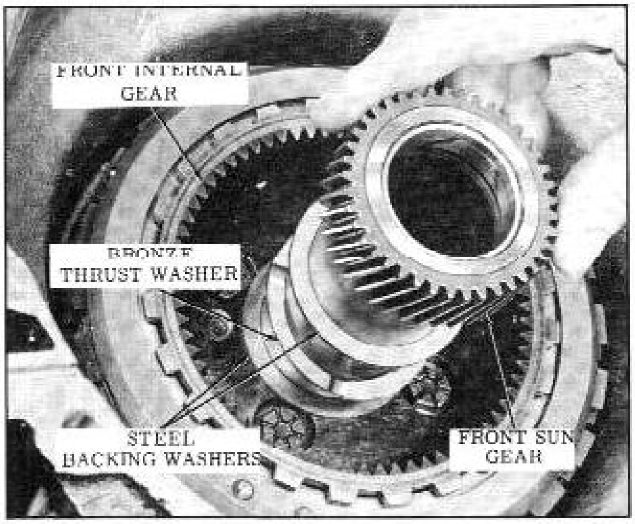

Fig. 3-98 Sun Gear Washers

16. Install front sun gear to front carrier bronze thrust washer over carrier shaft and retain with petrolatum. (Fig. 3-100)

17. Install the front carrier assembly and retain with snap ring. (Fig. 3-101)

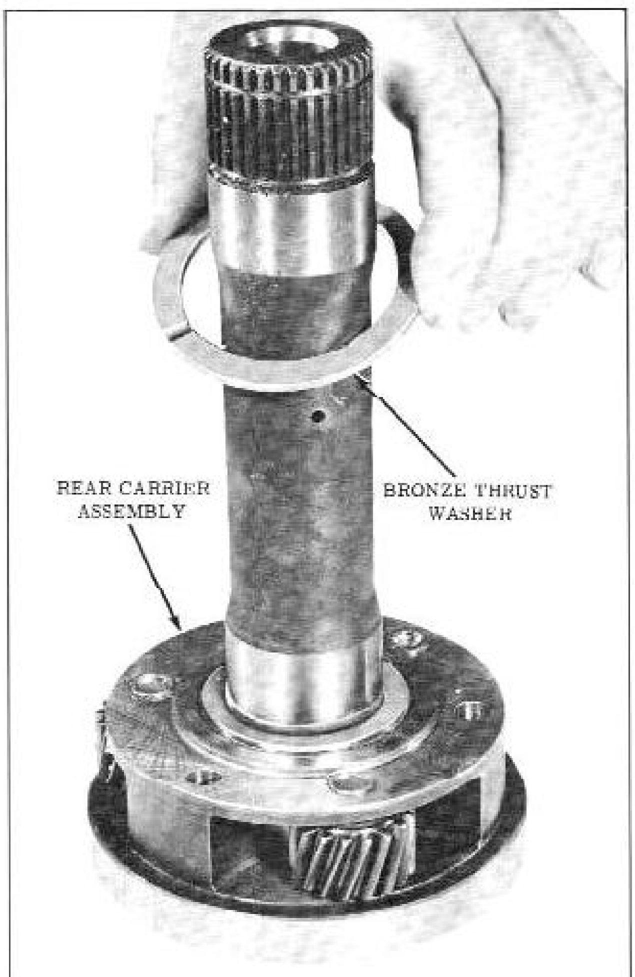

Fig. 3-99 Rear Carrier Thrust Washer

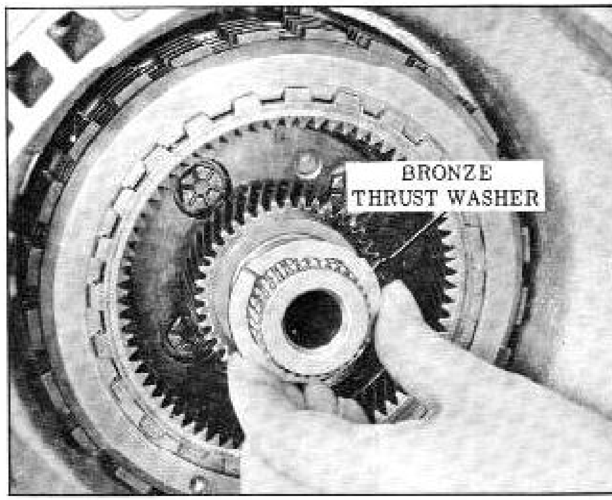

Fig. 3-100 Front Sun Gear Thrust Washer

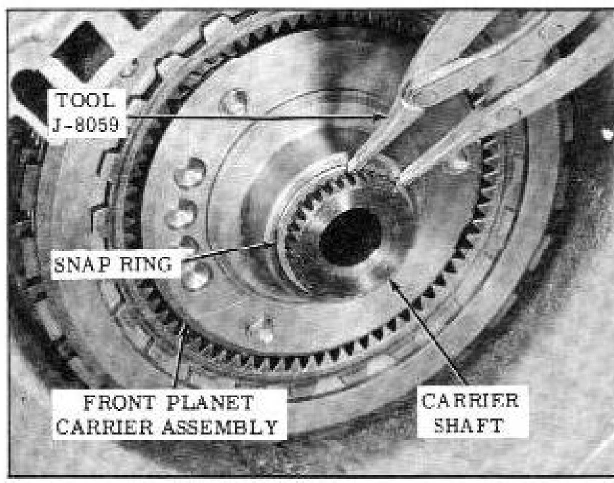

Fig. 3-101 Rear Carrier Snap Ring

18. Rotate transmission rear end up.

19. Install rear sun gear on mainshaft. (Fig. 3-102)

20. Install the rear carrier to sun gear bronze thrust washer into rear carrier and install mainshaft. (Fig. 3-103)

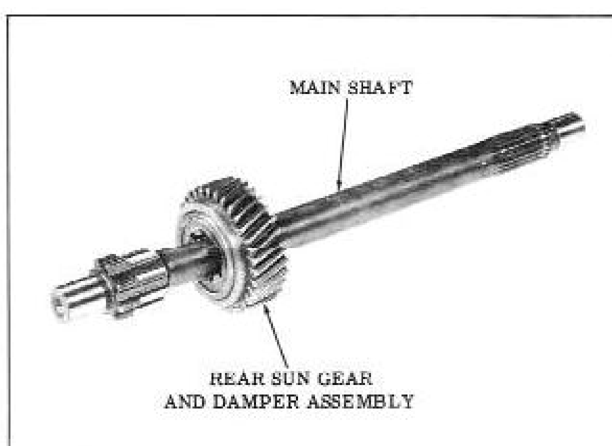

Fig. 3-102 Rear Sun Gear

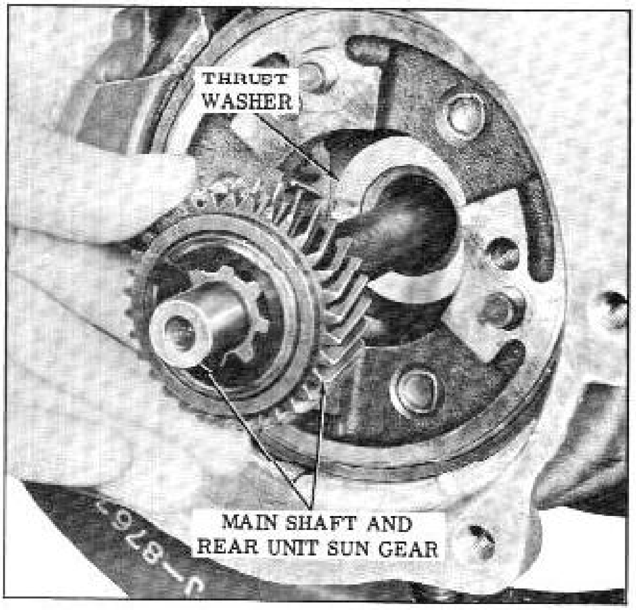

Fig. 3-103 Installing Rear Carrier

21. Install the output shaft on rear carrier using the marks for proper alignment.

22. Install the parking pawl spacer into counterbore in case. (Fig. 3-104)

23. Install the parking pawl and linkage against the spacer so that the tooth of the pawl faces the flange on the output shaft.

24. Install the parking pawl pivot shaft.

25. Engage the pawl with the output shaft.

26. Install the governor assembly with 3 attaching bolts. Torque 22-27 ft. lbs.

27. Install the speedometer drive gear 1/2" past snap ring groove using Tool J-8760 and 6133-A. (Fig. 3-105, 3-106)

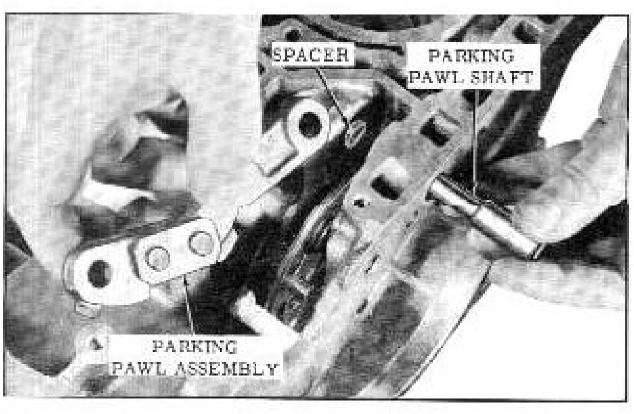

Fig. 3-104 Installing Parking Pawl

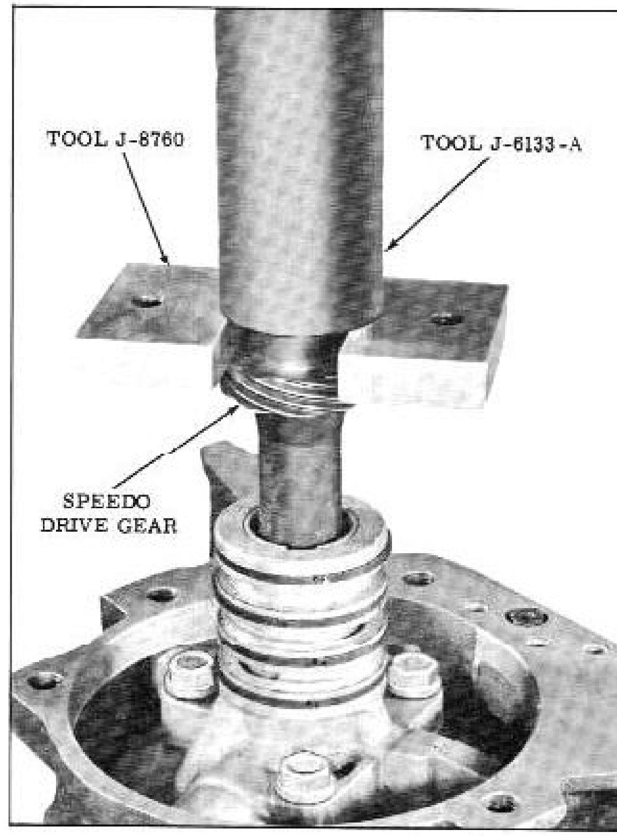

Fig. 3-105 Installing Speedometer Gear

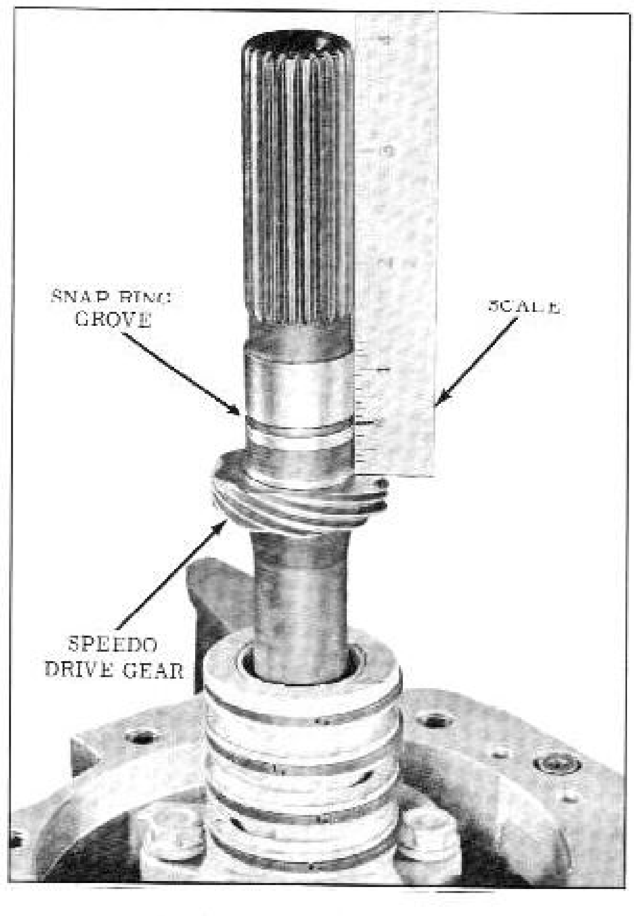

Fig. 3-106 Speedometer Gear Position

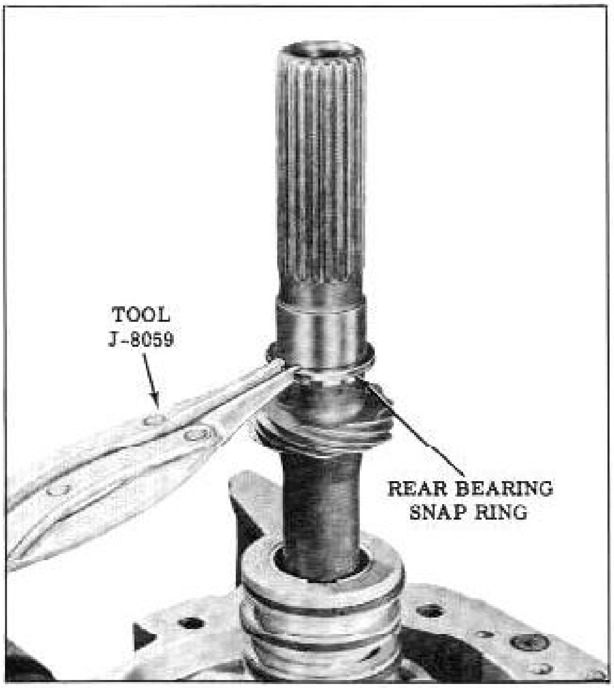

Fig. 3-107 Rear Bearing Snap Ring

28. Install the rear bearing to output shaft snap ring. (Fig. 3-107)
29. Install new gasket on the rear bearing retainer, retain with petrolatum.
30. Install rear bearing retainer over output shaft, guiding parking pawl shaft into the parking pawl assembly. (Fig. 3-108)

    NOTE: Use caution when guiding the retainer over the governor rings.

31. Install one long rear bearing retainer attaching bolt in the lower left hand corner of the retainer. Install breather pipe clip over upper right bolt.
32. Install 7 remaining rear bearing retainer attaching bolts. Torque all bolts 20-25 ft. lbs.

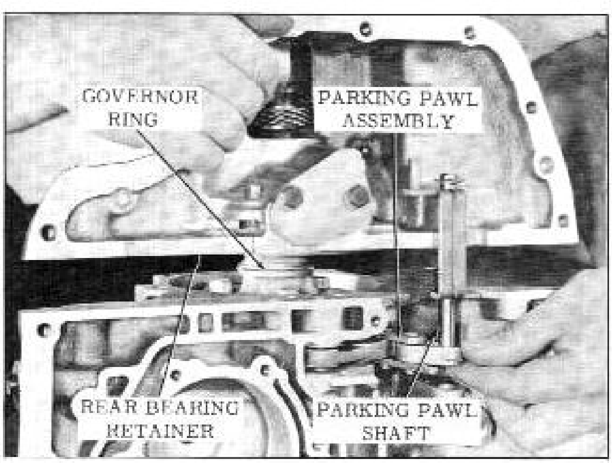

Fig. 3-108 Installing Rear Bearing Retainer

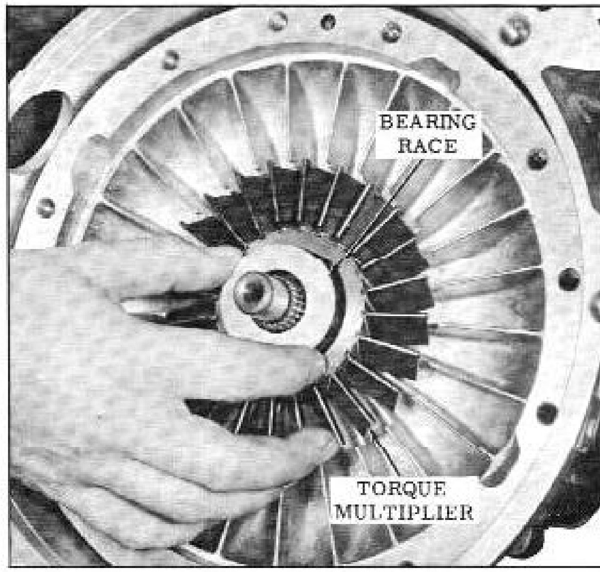

Fig. 3-109 Torque Multiplier Bearing Race

33. Rotate transmission front end up.
34. Install drive torus over front unit clutch. Be sure all clutch plates are engaged by observing that drive torus rests against the front carrier.
35. Install lock type oil ring on torque multiplier, if removed.
36. Install torque multiplier.
37. If removed install 2 lock type oil rings on driven torus.
38. Install the flat bearing race into torque multiplier. (Fig. 3-109)
39. Install cupped race and bearing into driven torus, bearing out. Retain with petrolatum. (Fig. 3-110)

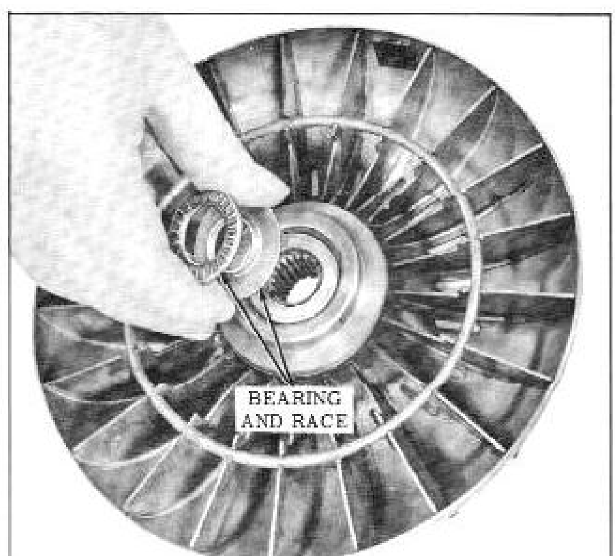

Fig. 3-110 Driven Torus Bearing

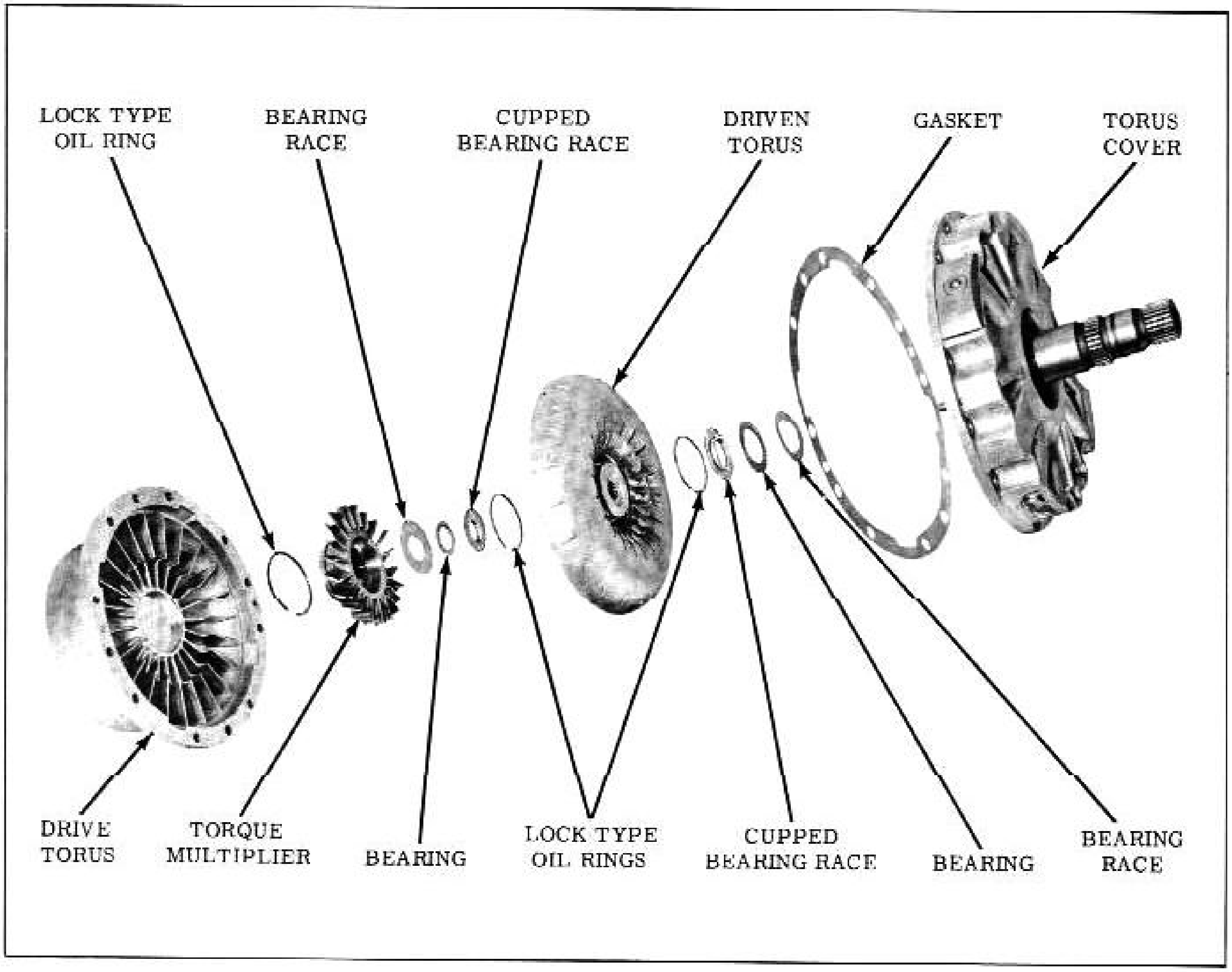

Fig. 3-111 Front Unit Assembly

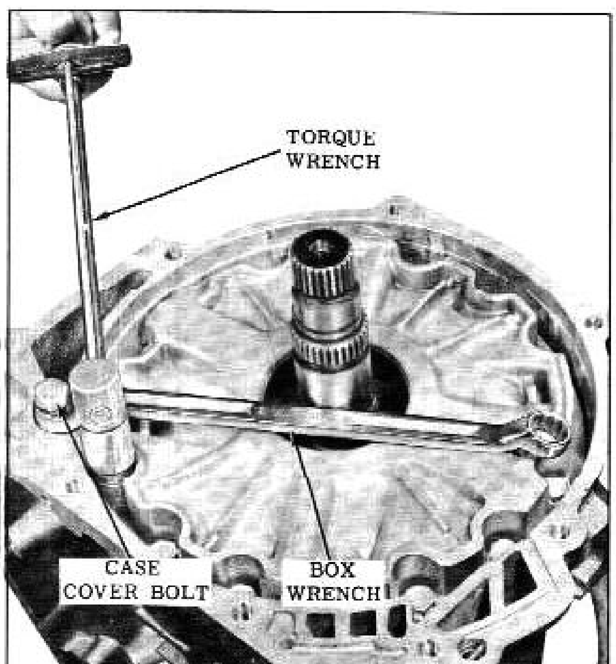

Fig. 3-112 Installing Torus Cover

40. Install driven torus on the mainshaft.

41. Install new driven torus to mainshaft retaining ring.

NOTE: It may be necessary to lift up on the mainshaft.

42. Install flat bearing race, bearing and cupped race (cup facing torus cover) into torus cover, retain with petrolatum.

43. Install NEW gasket on torus cover, aligning the dowel pin holes. Retain with petrolatum.

44. Install the torus cover on drive torus aligning the dowel pins with the dowel pin holes.

CAUTION: Dowel pins are slightly off set and must be aligned with holes to prevent damage to cover.

45. Install 12 torus cover attaching bolts and cross tighten the bolts 10-12 ft. lbs. (Fig. 3-112)

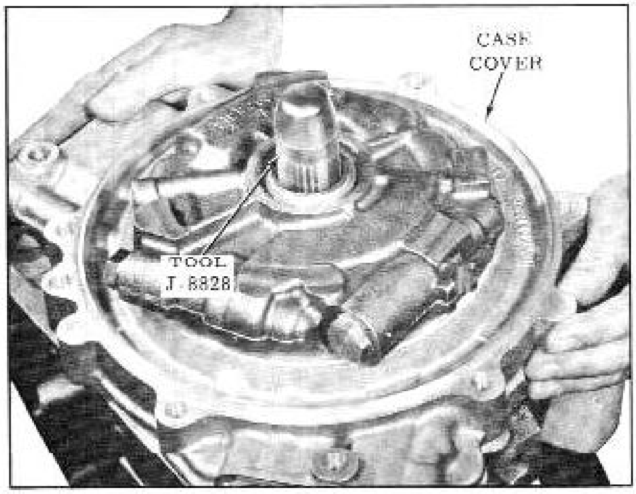

Fig. 3-113 Installing Case Cover

46. Install gasket on case cover and retain with petrolatum.

47. Install the case cover and pump assembly while aligning the attaching bolt holes. Install Tool J-8828 on shaft before installing case cover if seal was not removed. (Fig. 3-113)

48. Install 9 case cover to case attaching bolts. Torque 20-25 ft. lbs.

NOTE: Of the 9 bolts 1 is longer.

49. Install new seal by placing the front seal protector, J-8828 over input shaft, install seal and drive into pump with Tool J-8761. (Fig. 3-114)

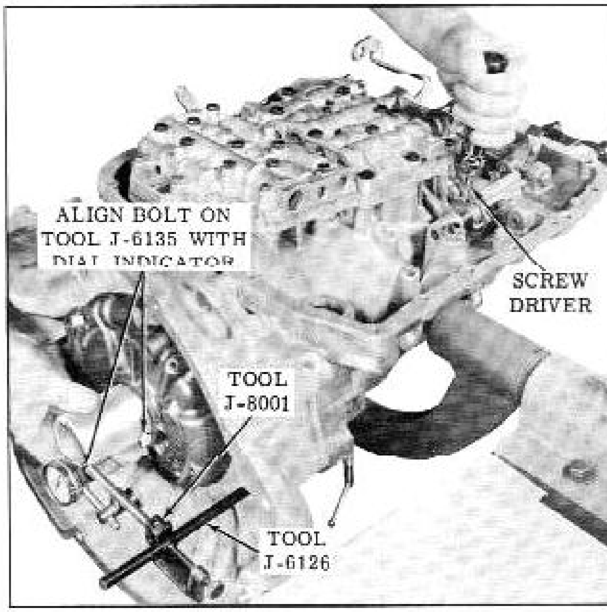

Fig. 3-115 Checking Front Unit End Play

50. Remove tools and rotate transmission to pan side up.

Front Unit End Play Check

a. Remove one case cover to case attaching bolt and install tools as shown. (Fig. 3-115)

b. Position a screw driver through case, behind the flange on the output shaft.

c. Gently pry forward on output shaft to position units forward. Be careful not to pry on governor weights.

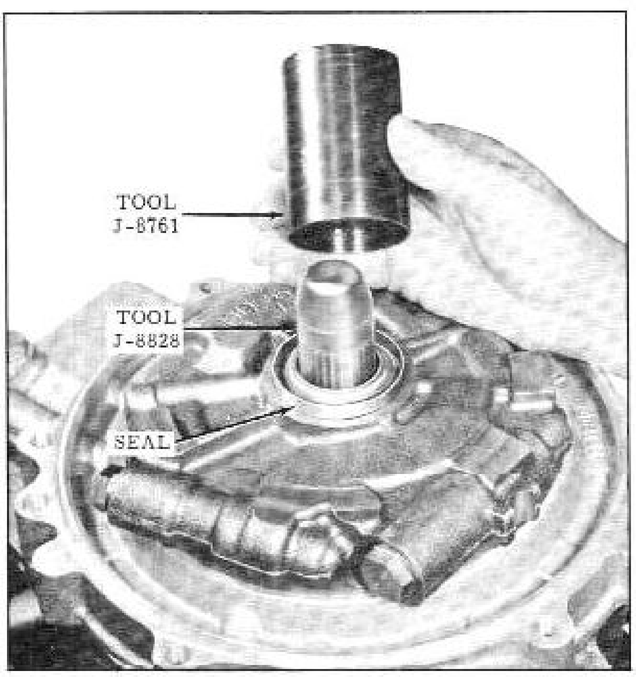

Fig. 3-114 Installing Pump Seal

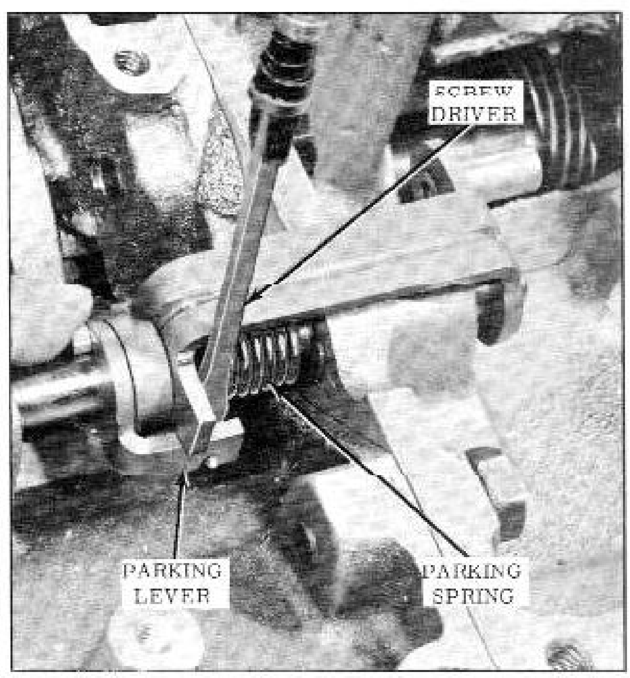

Fig. 3-116 Installing Parking Lever Spring

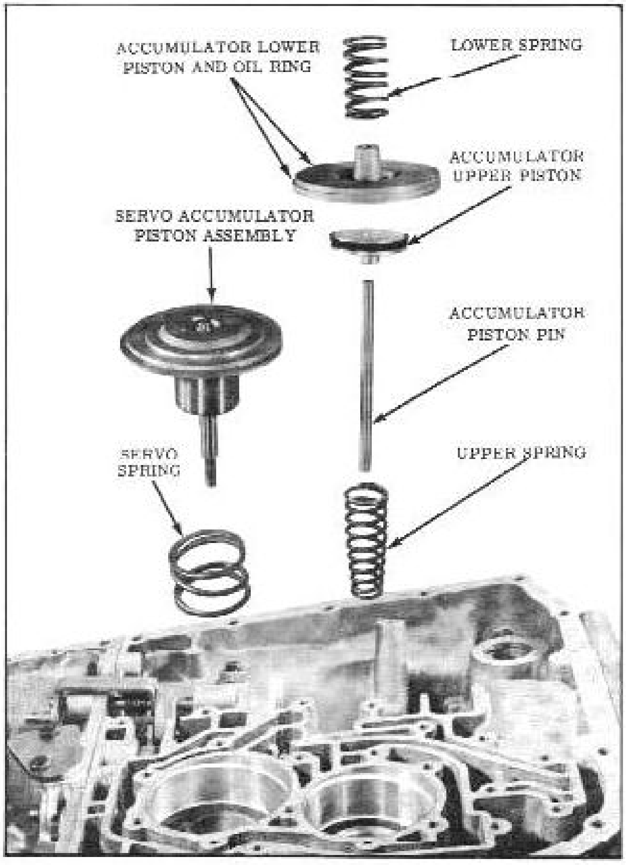

Fig. 3-117 Installing Accumulator

d. At the same time move input shaft in and out and record end play.

e. End play should be .004" to .022".

f. Remove tools.

NOTE: End play is corrected by changing the selective thrust washer behind the case cover as shown in Figs. 3-78 and 3-79.

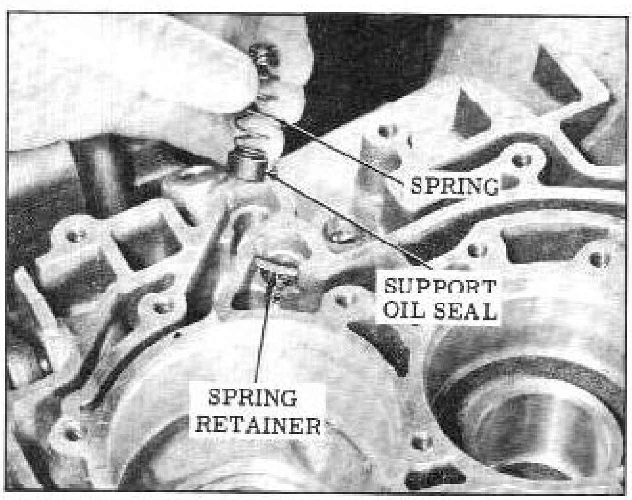

Fig. 3-118 Installing Case Support Seals

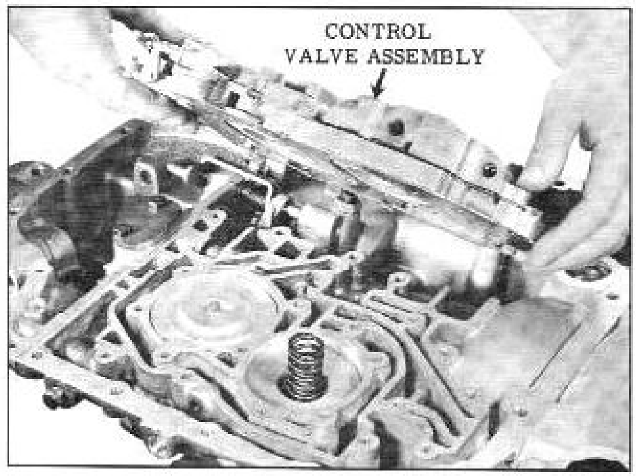

Fig. 3-119 Installing Valve Bodies

SELECTIVE THRUST WASHER CHART

PART NO.	THICKNESS	COLOR IDENT.
8620697	.027"-.029"	Bright Metal
8620698	.036"-.038"	Copper
8620699	.045"-.047"	Black
8620700	.054"-.056"	Bright and Flats on Edge

51. Hook curved end of spring into notch on parking lever. (Fig. 3-116)

52. Install the rear bearing retainer cover using 2 attaching bolts. Torque 20-25 ft. lbs.

53. Install the upper accumulator spring, pin, upper piston, lower piston, and spring into case. (Fig. 3-117)

54. Install the servo spring and piston assembly.

55. Install 2 case support to case seals on springs then install into case and push retainers into place. (Fig. 3-118)

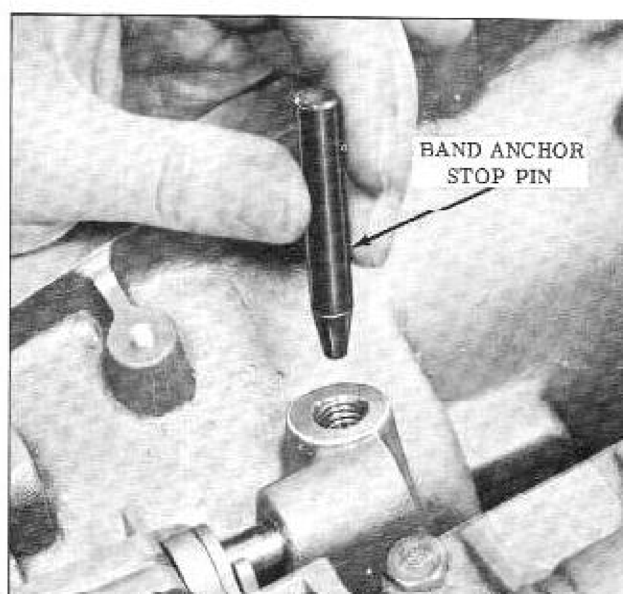

Fig. 3-120 Installing Band Anchor Pin

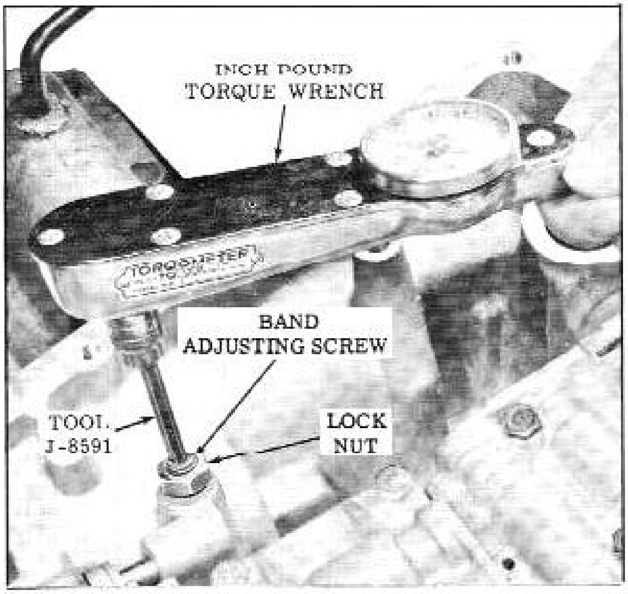

Fig. 3-121 Adjusting Band

56. Place the control valve assembly over the servo and accumulator pistons and install attaching bolts. Torque 6-8 ft. lbs. (Fig. 3-119)
57. Install the band anchor stop pin into hole in case. (Fig. 3-120)
58. Install the band adjusting screw and lock nut, leave the lock nut loose.
59. With J-8591 and inch pound torque wrench torque the band adjusting screw to 100 inch pounds, and then back the screw off 2-1/4 turns. (Fig. 3-121)
60. Tighten the band adjusting screw lock nut. Torque to 18-20 ft. lbs.
61. Install and "O" ring seal on manual lever shaft and install shaft as shown. (Fig. 3-122)

    NOTE: Depress detent plunger to allow manual and detent assembly to slide by.

62. Install "E" ring on manual shaft then install manual valve link in detent lever and manual

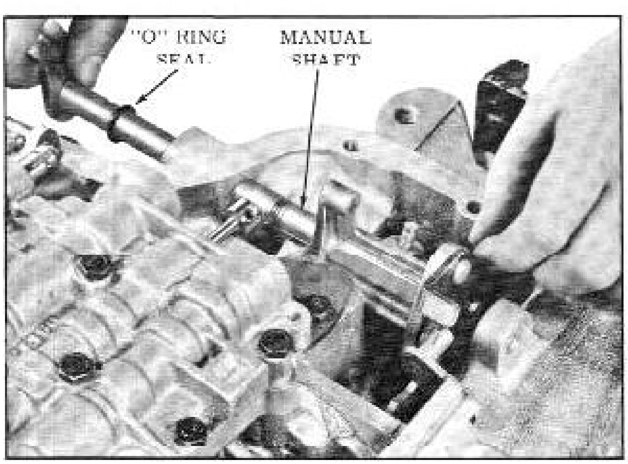

Fig. 3-122 Installing Manual Shaft

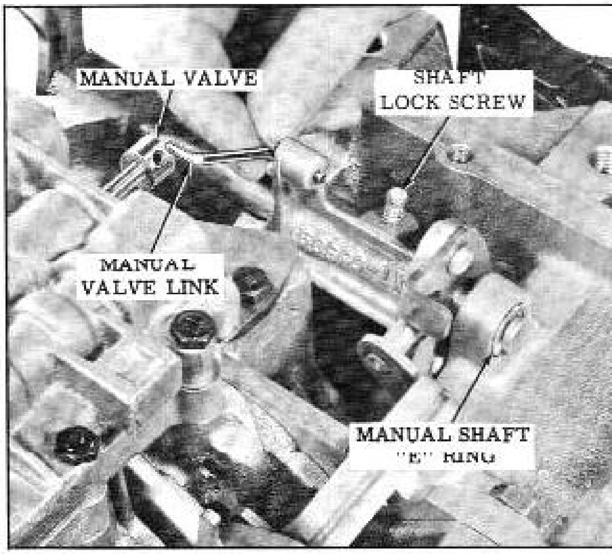

Fig. 3-123 Installing Manual Link

valve. Position detent and manual lever over detent plunger. (Fig. 3-123)

63. Tighten the manual shaft lock screw, indexing the lock screw with the groove in the manual shaft. Torque to 6-8 ft. lbs.
64. If removed, install inside T.V. link to front T.V. lever assembly and retain with "E" ring. (Fig. 3-124)
65. Install the spacer on outer T.V. lever.
66. Install an "O" ring on outer T.V. lever.
67. Install the outer T.V. lever through the case and into the front T.V. lever.
68. Align lock screw with hole in shaft and tighten lock screw. Torque to 6-8 ft. lbs.
69. Install the inside T.V. link over the rear T.V. lever shaft and retain with "E" ring.
70. Install the filler pipe "O" ring seal into bore inside of case, if removed.

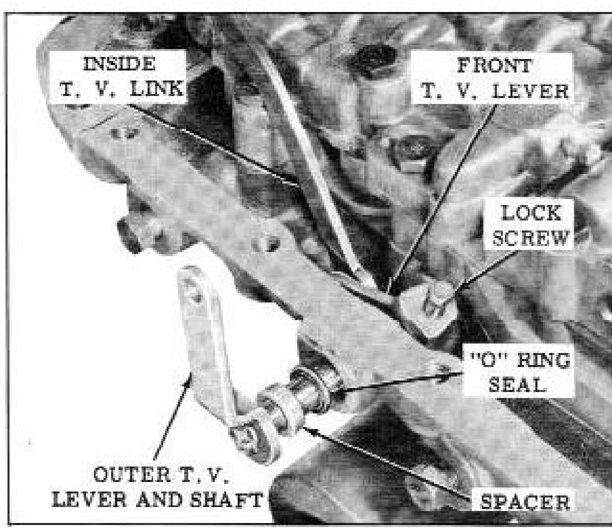

Fig. 3-124 Installing T.V. Link

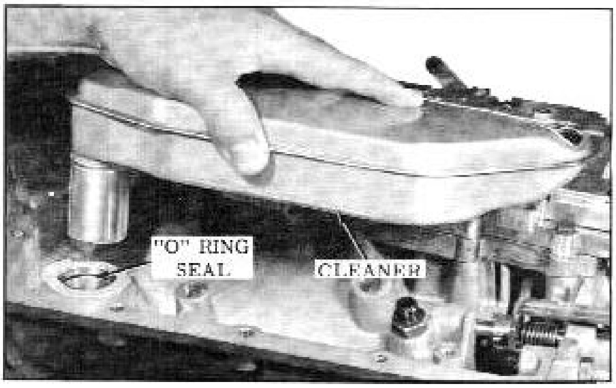

Fig. 3-125 Installing Cleaner

71. Install the cleaner "O" ring into bore in case. (Fig. 3-125)

72. Install the cleaner into case and clip into valve body.

73. Install a new oil pan gasket.

74. Install the bottom pan attaching bolts. Torque to 12-15 ft. lbs.

75. Engage parking pawl in park position.

76. Install the companion flange assembly, using Tool J-6505. (Fig. 3-126)

77. Install the companion flange attaching bolt. Torque to 30-40 ft. lbs.

SERVICING THE OIL COOLER

In the event of 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 located in the radiator lower tank. It 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.

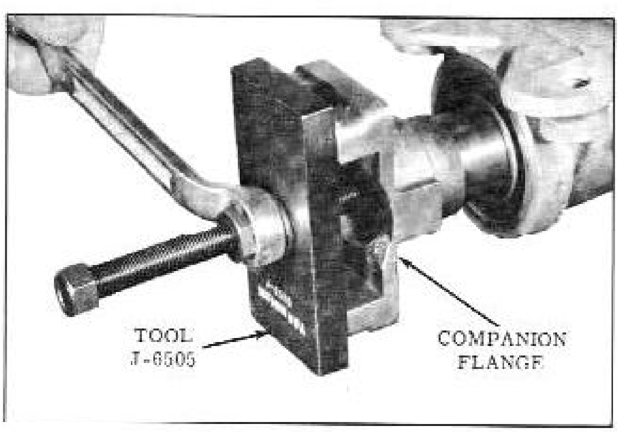

Fig. 3-126 Installing Companion Flange

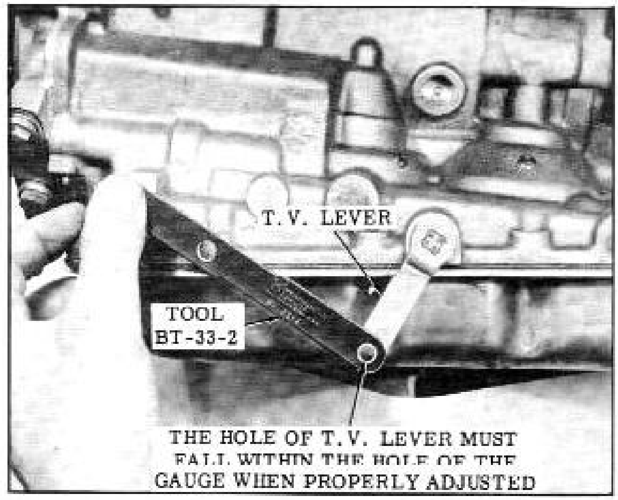

Fig. 3-127 Checking T.V. Lever

SERVICE ADJUSTMENTS

THROTTLE LINKAGE ADJUSTMENT (2GC) (HYDRA-MATIC)

NOTE: 4GC adjustment is on supplement page 3-83.

1. Raise car on hoist.

2. Disconnect lower T.V. rod from T.V. lever and position gauge BT-33-2 as shown in Fig. 3-127. The hole of the T.V. lever must be

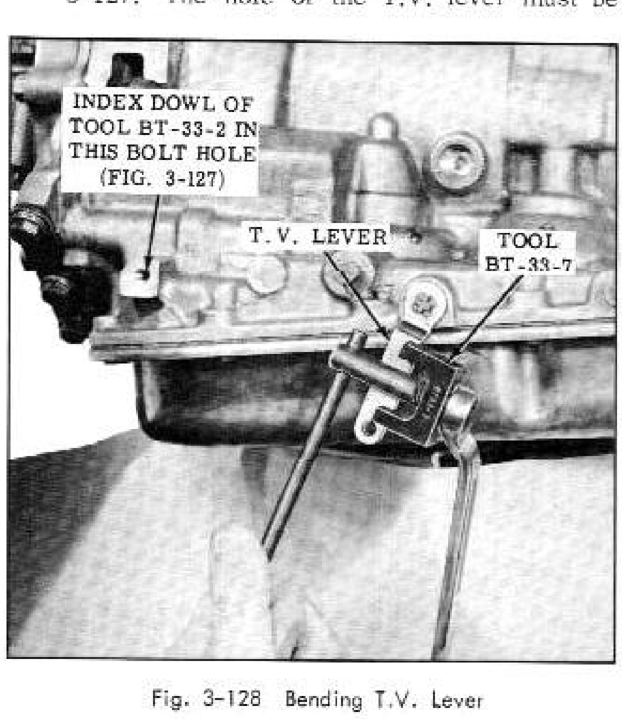

Fig. 3-128 Bending T.V. Lever

within the hole of the gauge as shown when holding T.V. lever in rearward position. If the hole of the T.V. lever does not fall within the gauge hole, bend the lever with bending tool BT-33-7. (Fig. 3-128)

3. Disconnect the lower T.V. rod from the T.V. bellcrank.

4. While holding lower T.V. rod downward and T.V. bellcrank down at the rear, the clevis pin must be a free pin. If necessary, adjust clevis, then connect lower T.V. rod to bellcrank.

5. Remove air cleaner and move throttle return check out of the way.

6. Block choke open.

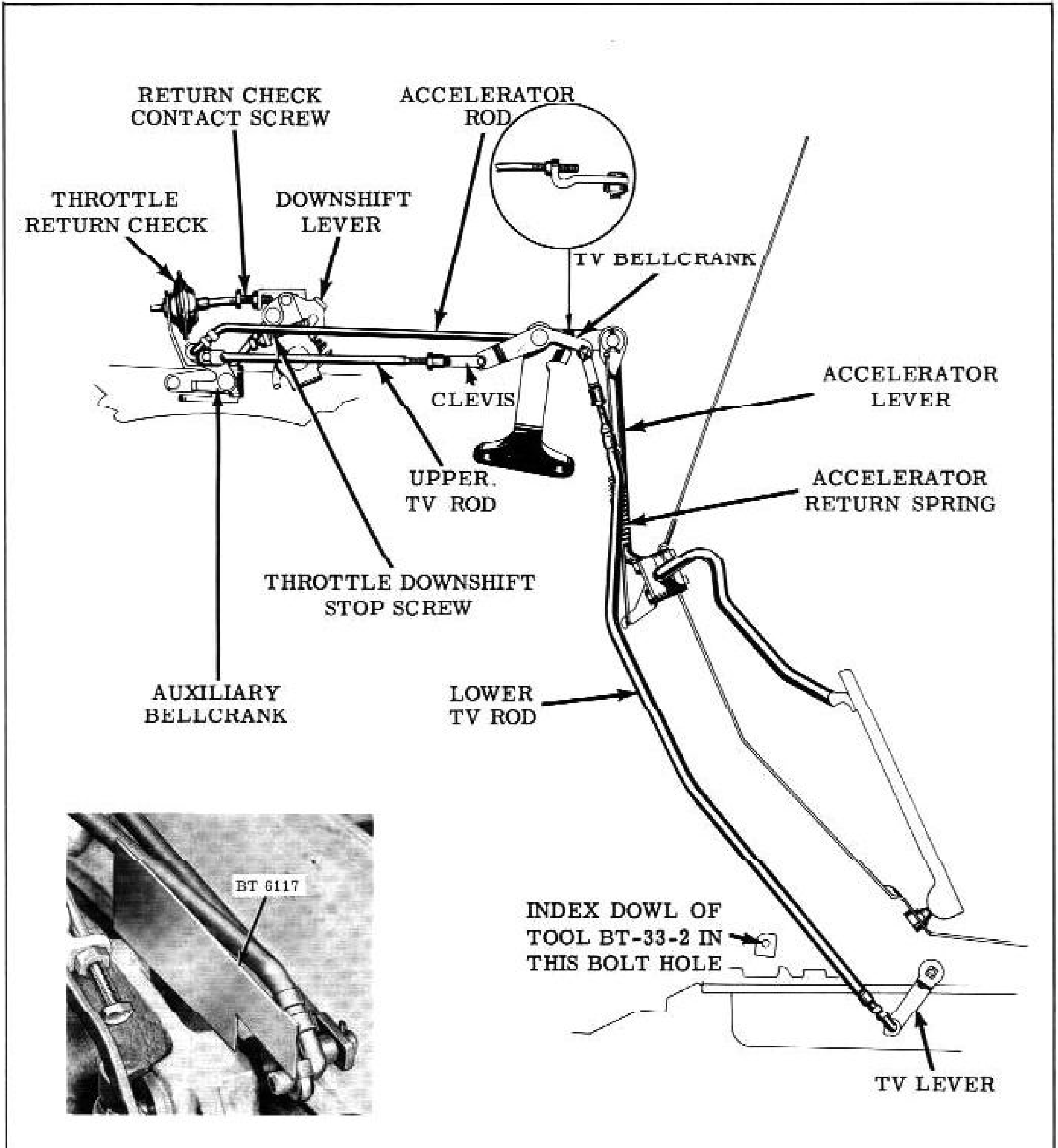

Fig. 3-129 Throttle Linkage

7. Back-off idle adjusting screw until it is not touching the idle cam when accelerator return spring is holding the throttle valves in the closed bore position.

8. If necessary, bend auxiliary bellcrank link to adjust the bellcrank. Use Tool BT-6117 as shown in the inset in Fig. 3-129. With the tool on the machine surface of the manifold, the top of the rod should just touch the tool as shown.

9. Adjust upper T.V. rod clevis to a free pin at T.V. bellcrank. The T.V. bellcrank must be held against its stop at the rear. Then adjust the clevis 1/2 turn long.

10. Loosen the throttle down shift stop screw lock nut and back-off stop screw approximately 6 turns. With the accelerator lever move the throttle to wide open and over travel the linkage to point of maximum transmission T.V. lever travel.

    CAUTION: Do not bend or stretch linkage.

11. Holding the accelerator lever in the wide open position, set the stop screw to just touch the down shift lever tang then screw the stop screw in an additional 1 1/2 turns and tighten lock nut.

12. Apply hand brake, start engine, and allow it to reach operating temperature. Adjust the idle speed with transmission in "Drive".

13. With the engine off, check and adjust the pedal height if necessary with Tool BT-33-2 as shown in Fig. 3-130.

14. Reposition the throttle return check and adjust the throttle return check stop screw to obtain .020" clearance at the return check plunger with the idle screw on the high step of the cam.

15. Lubricate linkage.

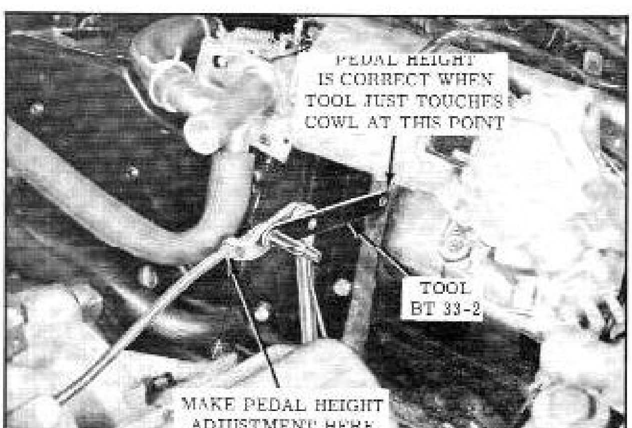

Fig. 3-130 Checking Pedal Height

	HMT	RPM	SMT	RPM
Without Air Conditioning	"DR"	500	N	550
With Air Conditioning(Off) "Carb-Airator Valve Closed"	"DR"	550	N	550

BAND ADJUSTMENT

The band must be adjusted every 26,000 miles.

Remove the oil pan and cleaner. Loosen the adjusting screw lock nut.

With an in. lb. torque wrench and Tool J-8591 tighten the adjusting screw to 100 in. lbs.

Loosen the screw 2-1/4 complete turns and hold while tightening lock nut. Torque the lock nut 18-20 ft. lbs. (Fig. 3-121)

Replace oil cleaner and pan.

T.V. LEVER ADJUSTMENT

Remove the lower T.V. rod from the T.V. lever. Place the pin of the T.V. lever gauge BT 33-2 in the threaded hole in the case, ahead of the T.V. lever. (Fig. 3-128) If the hole in the lever does not align WITHIN the hole in the gauge, bend the T.V. lever as necessary using Bending Tool BT-33-7 to the center of the hole WITHIN the gauge hole.

MANUAL LINKAGE ADJUSTMENT

Place selector lever in "N" position. Loosen front and rear lock nuts at manual lever on transmission. (Refer to Fig. 12-17, Page 12-7)

Hold the manual rod and shift lever upward so the selector lever is positioned against the neutral stop.

Tighten the rear lock nut until it just contacts the swivel, then tighten it two additional turns. Tighten the front lock nut.

ACCELERATOR PEDAL HEIGHT

The pedal height is adjusted by using Tool BT-33-2. Place the tool in position (with the hole nearest the pin) over the T.V. bell crank pin. Swing the gauge in an arc and adjust the length of the accelerator lever rod until the end of the gauge just contacts the closest surface of the cowl. (Fig. 3-130)

THROTTLE STOP SCREW ADJUSTMENT

The throttle stop screw is located in the channel body. The throttle lever is located in the valve body. It is necessary to check the throttle stop screw adjustment with gauge BT-33-6 whenever the channel body and throttle body have been separated or either has been replaced.

Disconnect the T.V. rod from the outer T.V. lever. Insert Tool BT-33-6 between the detent valve and the T.V. lever by pushing the valve into its bore and holding the lever rearward. (Fig. 3-131) Adjust the stop screw against the lever until the detent valve bottoms in its bore. Then back the stop screw out only enough to permit the gauge to be removed.

DIAGNOSIS

The information contained in this Diagnosis Guide has been prepared as a Supplementary Guide. It is an aid to and not a substitute for a good basic understanding of the Principles of Operation.

It is of utmost importance to observe and perform all preliminary steps outlined in this Diagnosis Guide.

Make certain that all "on the car repairs" possibilities have been exhausted before the transmission is removed from the car.

UNIT OPERATIONAL POWER FLOW

Range	Speed	Cplg.	Front Clutch	Band	Reverse Cone
Park	-	Full	Off	Off	Off
Neutral	-	Full	Off	Off	Off
Drive	First	Full	Off	On	Off
	Second	Empty	On	On	Off
	Third	Full	On	Off	Off
Super	First	Full	Off	On	Off
	Second	Empty	On	On	Off
	Third	Full	On	Off	Off
Lo	First	Full	Off	On	Off
Reverse	-	Full	Off	Off	On

Figs. 3-132, 133, 134, 135, show oil passages through the case cover and front pump.

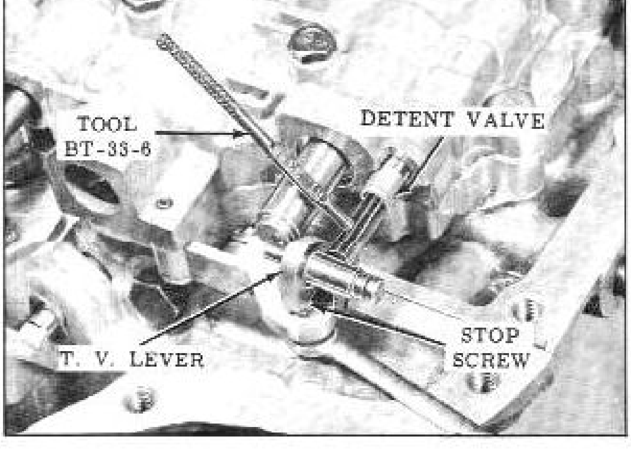

Fig. 3-131 Adjusting Throttle Stop Screw

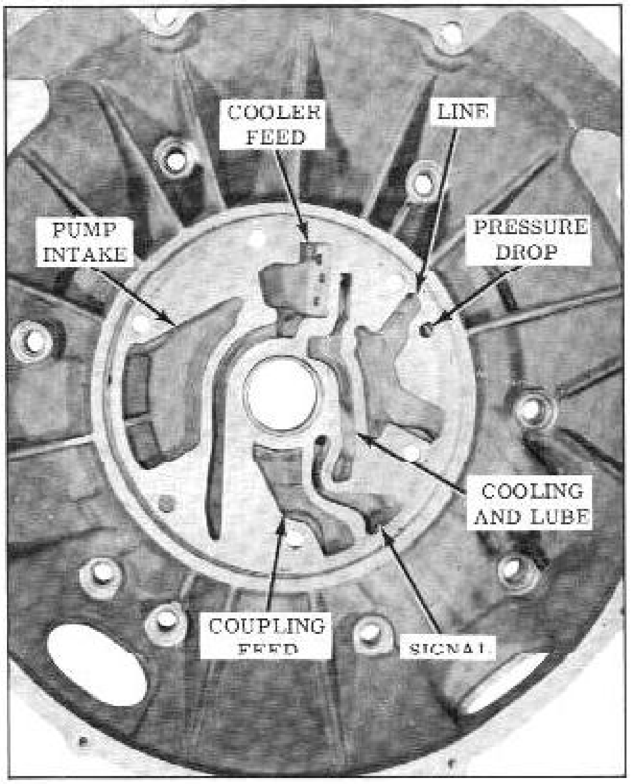

Fig. 3-132 Case Cover to Pump Oil Passages

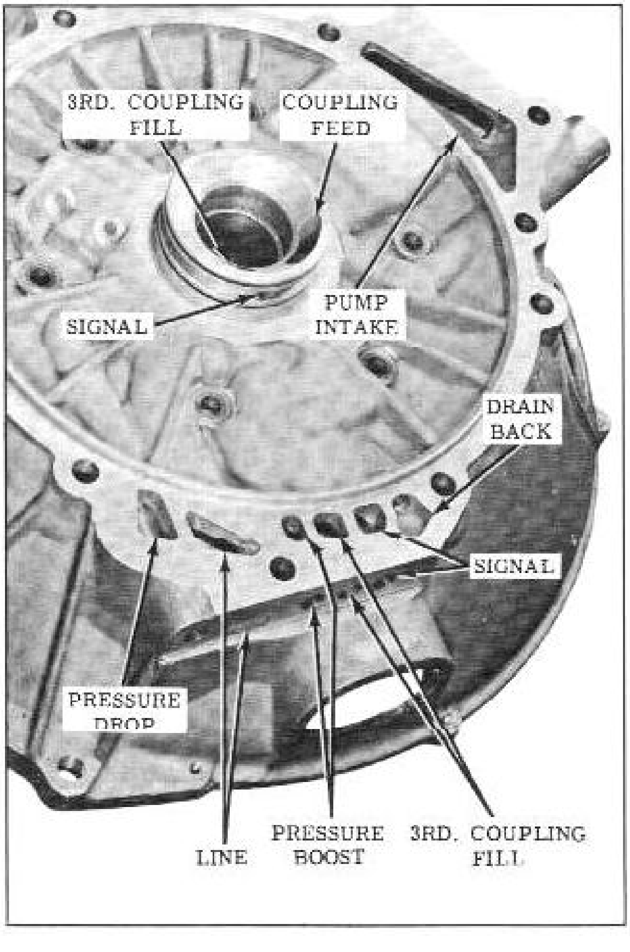

Fig. 3-133 Case Cover to Case Oil Passages

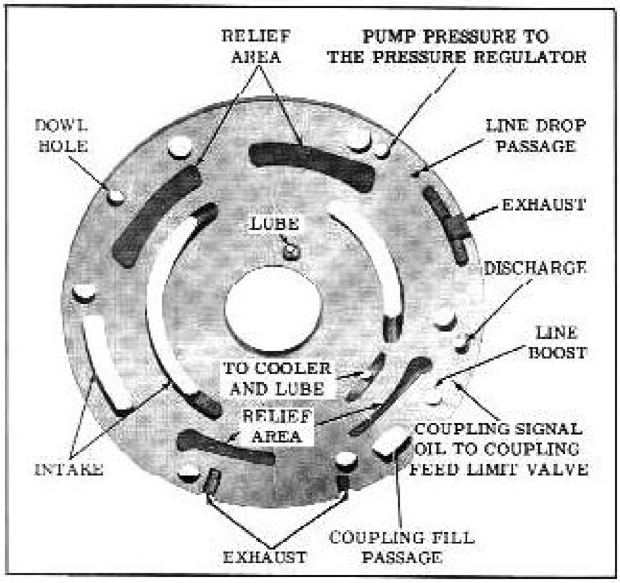

Fig. 3-134 Pump Plate Pump Body Oil Passages

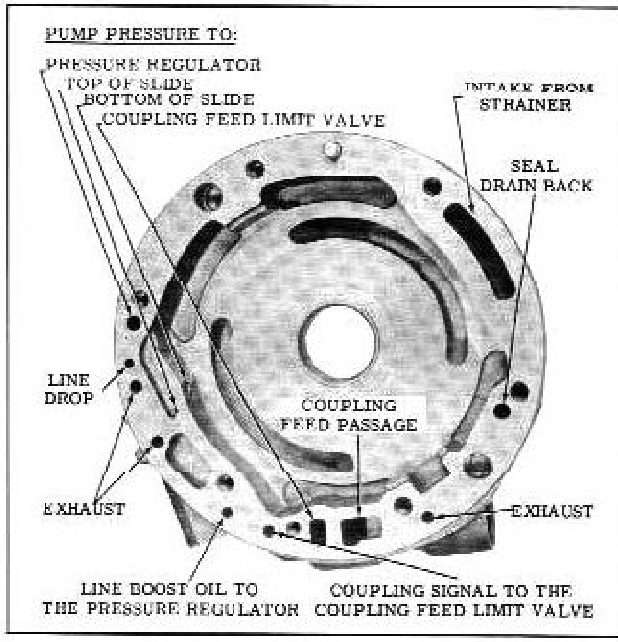

Fig. 3-135 Pump Body Oil Passages

MAIN LINE OIL PRESSURE TEST

The main line oil pressure test chart is to be used in conjunction with the diagnosis section to aid determining the malfunctioning unit(s). To check oil pressure, remove the pipe plug and connect a 300 lb. oil pressure gauge. In performing the oil pressure test it is extremely important that THE TRANSMISSION IS AT NORMAL OPERATING TEMPERATURE (APPROXIMATELY 175°).

SHOP TEST

ENGINE SPEED	SELECTOR LEVER POSITION	P.S.I.
500 r.p.m. (Parking Brake Applied)	P., N., DR., S., L., or R.	60 to 125 p.s.i. transmission temperature should not exceed 200°F. for this check. (With not more than 10 p.s.i. difference between ranges)

DO NOT STALL TEST as damage to the reverse unit may result.

ROAD TEST

SHIFT	SELECTOR LEVER POSITION	P.S.I.*
1st	DR., S., L., and REV.	118 to 175
2nd	S. 30 m.p.h.	98 to 111
3rd	DR. Zero Throttle 30 m.p.h.	68 to 78

*A drop in pressure of approximately 10 p.s.i. as each shift is made is normal, but the gauge reading should stabilize after each shift is made.

TESTING AND DIAGNOSIS

TESTING

This section outlines the procedure to be followed in testing and diagnosis prior to attempting to correct any assumed malfunctions of the Hydra-Matic transmission.

1. Check Oil Level

Always check the oil level before road testing. Erratic shifting or other malfunctions can in some cases be traced to improper oil level.

a. Park the car in a level position and set selector lever in the "P" position.

Let engine idle until operating temperature is reached.

b. Check oil level indicator. If oil level is low add Hydra-Matic fluid to "Full" mark.

CAUTION: Use only "G.M. Hydra-Matic Fluid" or "Automatic Transmission Fluid" (Type A) which have been approved and labeled "AQ-ATF-Number-A".

For a proper diagnosis, a thorough knowledge of the operation of the transmission is essential. A predetermined test route should be established to save time and permit comparison of different cars over the same route. Where possible, the route should be laid out to include some hilly section to test for open throttle downshifts, a level section for testing upshift points and a quiet section for testing for noise.

SHIFT SPEED CHART
UPSHIFTS IN M.P.H.

	Minimum Throttle	Maximum Throttle
Drive Range		
1-2	8 to 12	24 to 30
2-3	17 to 24	54 to 63
Super		
1-2	8 to 12	24 to 30
2-3	58 to 68	58 to 68
Lo Range		
1-2	Not Possible	
2-3	58 to 68	58 to 68

DOWNSHIFTS IN M.P.H.

	Part Throttle	Detent
Drive Range		
3-2	35 to 17	58 to 35
2-1	None	18 to 8

While road testing, the transmission oil pressure gauge should be connected and the pressures checked as follows:

Super-Range	Minimum	Maximum
2ND GEAR-Steady road load at approximately 25 m.p.h.	98	111
CAUTION: Do not hold brakes and accelerate engine with transmission in gear.		

LOW OIL PRESSURE

1. Oil Level - Low
2. Boost Plug - Wrong - Stuck
3. Pressure Regulator Valve or Spring
4. Strainer and "O" Ring
5. Manual Valve - Misaligned
6. Foaming or Cavitation
7. Internal Leak
8. Control Valve Assembly - Stuck Valve (Pressure Drop)
9. Front Pump - Slide - Low Output
10. Super Range only - Control Valve Assembly-Ball check valve.

HIGH OIL PRESSURE

1. Pressure Regulator Valve - Stuck
2. Boost Plug - Wrong - Stuck
3. Manual Valve - Misaligned with quadrent
4. Control Valve Assembly - Stuck Valve

5. Front Pump - Slide - High Output

Always be certain the engine is operating at peak performance. The engine and transmission are designed and built to operate as an integral power unit. Failure of the engine to deliver peak power can result in improper shift characteristics and apparent transmission malfunction.

EXTERNAL LINKAGE

The importance of proper linkage adjustment cannot be over emphasized. Improper linkage adjustment can cause rough erratic shifting, missing shifts, or the inability to select one or more of the ranges.

OIL LEAKS

Before attempting to correct an oil leak, the actual source of the leak must be determined. In many cases the source of the leak can be deceiving due to "wind flow" around the engine and transmission. If any doubt exists as to the source of the leak there are two ways to determine it.

1. Red Dye

   The addition of red dye to the transmission oil will indicate if the leak is from the transmission.

2. Black Light

   The use of a "Black Light"* to identify the oil from the leak is also suitable. Comparing the oil from the leak to that on the engine or transmission dip stick when viewed by black light will determine the source of the leak.

   *A "Black Light" testing unit may be obtained from several different service tool suppliers.

Oil leaks around the engine and transmission are generally carried toward the rear of the car by the air stream. For example, a transmission "oil filler tube to case leak" will sometimes appear as a leak at the rear of the transmission.

POSSIBLE POINTS OF OIL LEAKS

1. Transmission Oil Pan
   a. Improperly installed or damaged gasket.
   b. Attaching bolts not correctly torqued.
   c. Drain plug flange weld or stripped threads.
   d. Drain plug.
   e. Oil pan not flat.
   f. Rear bearing retainer and or case not positioned correctly at oil pan.
2. Rear Bearing Retainer
   a. Rear seal not installed properly or damaged.
   b. Gasket (rear bearing retainer to case) damaged or improperly installed.
   c. Rear bearing retainer to case attaching bolts not correctly torqued.
   d. Speedo gear housing not tight.
   e. Porus casting.
   f. Breather pipe.
3. Cooler Connections
   a. Adapter not correctly torqued.
   b. Adapter defective.
4. Case Cover Assembly Leaks
   a. Gasket-Case to case cover improperly installed.
   b. Bolts-Improperly torqued.
   c. Washer Seals-Damaged
   d. Plate Not Flat
   e. Plate Gasket-Defective
5. Front End Leaks
   a. Front pump "O" ring cut or improperly installed.
   b. Front seal.
   c. Case to case cover gasket.
   d. Case cracked or porus.
   e. Cut or improperly installed "O" ring-coupling feed limit valve, (front pump).
   f. Cut or improperly installed "O" ring-pressure regulator assembly.
   g. Manual Shaft Seal-Defective or improperly installed.
   h. Main Line Pressure Plug not tight-case.
   i. T.V. line pressure plug not tight-case.

DIAGNOSIS

CONDITION	CAUSE
NO DRIVE IN DRIVE RANGE	
1. Low Oil Level	Check
2. Low Oil Pressure	See Low Oil Pressure (Page 3-75)
3. Linkage Manual	Adjust
4. Control Valve Assembly	Sticking Valve
5. Band	Not Applying
6. Internal Leak	Check
7. Passage Restricted	Air Check
8. Coupling	Not Filling
MISSING ALL SHIFTS	
1. Governor	Sticking Valve
2. Control Valve Assembly	Sticking Valve
3. Clutch	Not Applying
DRIVE IN SECOND AND THIRD ONLY	
1. Control Valve Assembly	Sticking Valve
2. Clutch	Locked-Too Many Plates
DRIVE IN FIRST AND THIRD ONLY (MIGHT BE REPORTED AS 1-2 SLIP)	
1. Control Valve Assembly	Sticking Valve
2. Coupling	Not emptying
DRIVE IN FIRST AND SECOND ONLY	
1. Governor (G-2)	Sticking
2. Control Valve Assembly	Sticking Valve
DRIVE IN THIRD ONLY	
1. Control Valve Assembly	Sticking Valve
2. Band	Not Applying
3. Governor	Sticking Valves

DIAGNOSIS (Cont'd.)

CONDITION	CAUSE
DRIVE IN NEUTRAL (REVERSE OR FORWARD)	
1. Internal Linkage-Manual	Engaging
2. Front Clutch	Mispositioned
3. Reverse Cone Clutch	Not Applying
NO REVERSE	
1. Internal Manual Linkage	Mispositioned
2. Low Pressure	See Low Pressure (Page 3-75)
3. Reverse Cone Clutch	Not Engaging
4. Restricted Passage	Air Check Passages
5. Band	Not Releasing
ROUGH 1-2 SHIFT	
1. T.V. Linkage	Short or Long
2. Control Valve Assembly	Sticking Valves
3. Accumulator	Sticking Parts, etc.
4. Coupling	Not emptying fast enough
5. Front Clutch	Slipping
6. 1-2 Oil Passages	Restricted
ROUGH 2-3	
1. Band	Not Releasing quickly
2. Servo	Sticking parts
SLIPPING-ALL RANGES	
1. Low Oil Pressure	See Low Oil Pressure (Page 3-75)
SLIPPING 1-2 SHIFT (CAN BE REPORTED AS 1-3 ONLY)	
1. T.V. Linkage	Long
2. Low Oil Pressure	See Low Oil Pressure (Page 3-75)
3. Accumulator	Check for restrictions or sticking parts.
4. Control Valve Assembly	Sticking Valves
5. Band	Slipping
6. Front Clutch	Check number of plates
7. 1-2 Oil Passages	Restricted

DIAGNOSIS (Cont'd.)

CONDITION	CAUSE
SLIPPING - 2-3	
1. Control Valve Assembly	-Sticking valves
2. Coupling	Not filling fast enough
3. Front Clutch	Slipping
NO ENGINE BRAKING INTERMEDIATE OR LOW RANGE	
1. Control Valve Assembly	Sticking valves
2. Band	Slipping
3. Servo	Not applying
NO PART THROTTLE OR DETENT DOWNSHIFTS	
1. T.V. Linkage	Long
2. Control Valve Assembly	Sticking Valves
3. Accelerator Travel	Short
4. Governor	Valves Sticking
SELECTOR LEVER WILL NOT GO INTO REVERSE	
1. Internal Manual Linkage	Mispositioned
2. Reverse Blocker Valve	Stuck Open
3. Governor	G-2 Valve-Sticking
SELECTOR LEVER WILL NOT GO INTO PARK	
1. Parking Linkage	Broken, improperly assembled, distorted.
2. Manual Linkage	Not adjusted properly.
FORWARD DRIVE IN REVERSE	
1. Internal Manual Linkage	Improperly assembled, distorted.
HIGH UPSHIFTS	
1. T.V. Linkage	Short
2. Control Valve Assembly	Sticking Valve
3. Governor	Sticking Valve
4. T.V. Lever	Bent
5. T.V. Pressure	High
6. Line Pressure	High
7. Governor Oil Passage	Restricted

DIAGNOSIS (Cont'd.)

CONDITION	CAUSE
UPSHIFTS LOW	
1. T.V. Linkage	Long
2. Control Valve Assembly	Sticking Valve
3. Governor	Sticking Valve
4. T.V. Lever	Bent
5. T.V. Pressure	Low
6. Line Pressure	Low
7. Governor Passages	Restricted
HANGING IN 2ND - ENGINE STALL UPON STOP	
1. Governor	Sticking Valve
2. Control Valve Assembly	Sticking Valve
3. T.V.	Short
4. Clutch	Not Releasing

TORQUE SPECIFICATIONS

Location	Ft. Lbs.
Channel Plate to Valve Body	2.5 to 3.5
Secondary Valve Body to Channel Plate	2.5 to 3.5
Primary Valve Body to Channel Plate	2.5 to 3.5
Front T.V. Lever to Throttle Control Shaft	5 to 6
Inside Manual & Detent Lever to Manual Shaft	5 to 6
Valve Body to Case	6 to 8
Pump Cover to Pump Body	6 to 8
T.V. Pressure Take-Off (Plug)	6 to 7
Line Pressure Take-Off (Plug)	6 to 7
Case Cover to Pump	15 to 18
Oil Pan to Case	12 to 15
Front Internal Gear to Clutch Housing	22 to 27
(Governor) Output Shaft to Carrier	19 to 23
Torus Exhaust Valve Cover to Torus Cover	19 to 23
Torus Cover to Driving Torus	17 to 20
Band Adjusting Screw Lock Nut	18 to 20
Flange Assembly to Output Shaft	40 to 50
Rear Bearing Retainer to Case	20 to 25
Case Cover to Case	20 to 25
Oil Pan Drain Screw	35 to 45
Coupling Feed Limit Valve Plug	15 to 20
Pressure Regulator Plug	15 to 20
Cross Bar Support to Transmission	20 to 34
Cross Bar Brackets to Side Rails	20 to 34
Cross Bar to Side Brackets to Compress Rubber Mounts	20 to 30

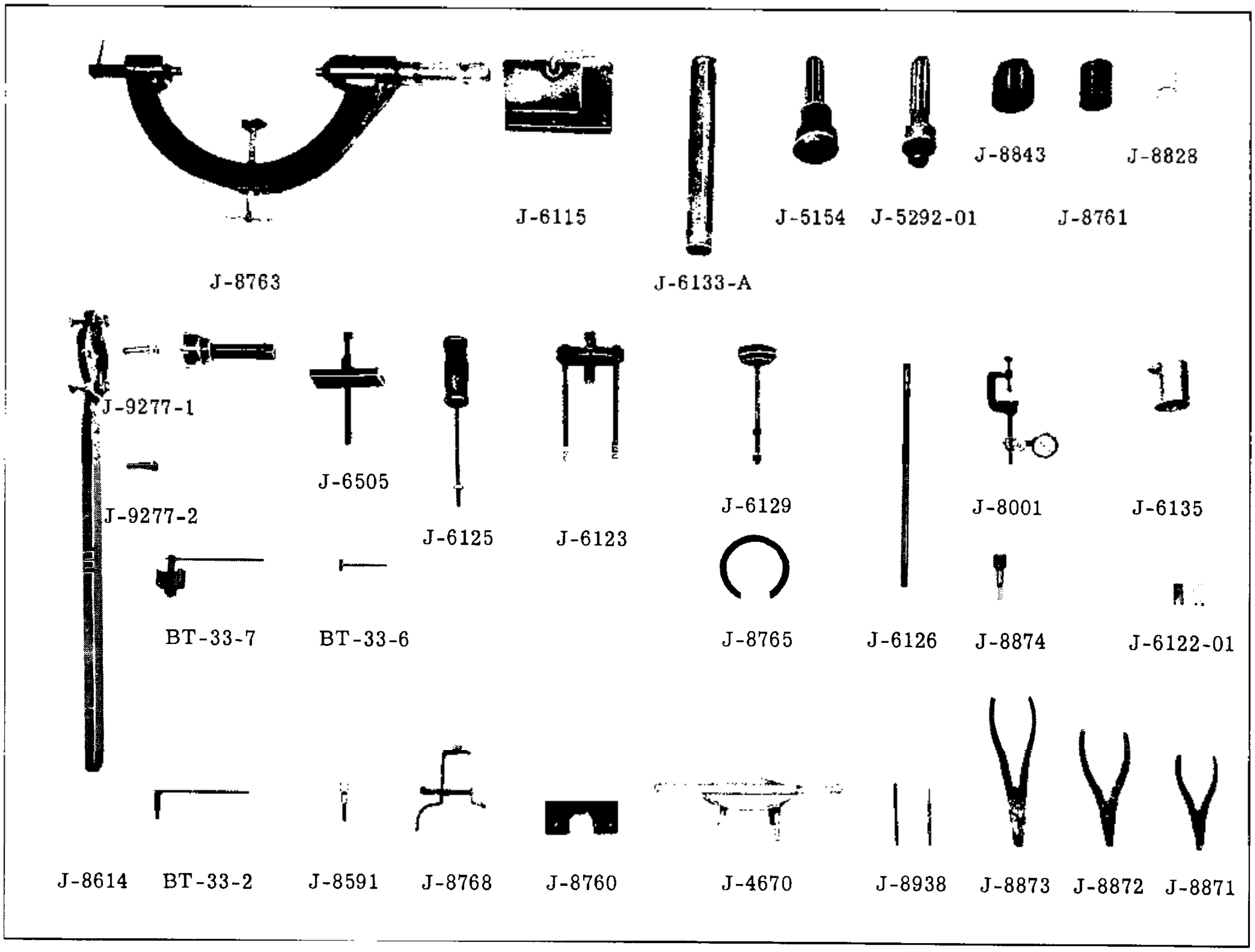

Fig. 3-136 Tools

*BT-33-2	T.V. Lever Gauge
*BT-33-6	Stop Screw Adjusting Gauge
*BT-33-7	T.V. Lever Bending Tool
J-4670	Clutch Spring Compressor
J-5154	Rear Bearing Retainer Seal Installer
J-5292-01	Differential Side Bearing Installer (Used to Install Rear Bushing Assembly)
J-6115	Transmission Holding Fixture Base
J-6122-01	Front Unit Coupling Valve Retainers
J-6123	Speedometer Gear Puller
J-6125	Slide Hammer (Used to Remove Reverse Cone)
J-6126	Dial Indicator Support
J-6129	Clutch Spring Compressor
J-6133-A	Speedometer Gear Installer
J-6135	Rear Unit Clutch Retainer (Used On Main Shaft To Check End Play)
J-6505	Rear Companion Flange Installer
J-8001	Dial Indicator Set
*J-8591	Band Adjuster
*J-8614	Companion Flange Holder and Remover
*J-8760	Speedometer Gear Remover Adapter Set
*J-8761	Front Pump Seal Installer
*J-8763	Transmission Holding Fixture
*J-8765	Reverse and Neutral Clutch Spring Compressor Adapter
*J-8768	Reverse Cone Remover
*J-8828	Oil Pump Seal Protector
*J-8843	Reverse Clutch Inner Seal Protector
*J-8871	Truarc 22-90° Plier External
*J-8872	Truarc 24-90° Plier External
*J-8873	Truarc 25-90° Plier Internal
*J-8874	Exhaust Valve Cover Remover
*J-8938	Internal Gear Holding Studs
*J-9277-1	Bolt For Removing Hydra-Matic Transmission Companion Flange
*J-9277-2	Bolt For Removing Syncro-Mesh Transmission Companion Flange

*New Tool for 1961

HYDRA-MATIC SUPPLEMENT

SERVICE ADJUSTMENTS

4GC THROTTLE LINKAGE ADJUSTMENT (HYDRA-MATIC)

1. Raise car on hoist.

2. Disconnect lower throttle valve rod from throttle valve lever and position gauge BT-33-2 as shown in Fig. 3-137. The hole of the throttle valve lever must be within the hole of the gauge as shown when holding throttle valve lever in rearward position. If the hole of the throttle valve lever does not fall within the gauge hole, bend the lever with bending Tool BT-33-7. (Fig. 3-138)

3. Lower car and disconnect upper throttle valve rod from throttle valve bellcrank. (Fig. 3-129)

4. Disconnect the lower throttle valve rod from the throtle valve bellcrank.

5. While holding lower throttle valve lever downward and throttle valve bellcrank down at the rear, the clevis pin must be a free pin. If necessary, adjust clevis then connect lower throttle valve lever to bellcrank.

6. Remove air cleaner and pivot throttle return check out of the way.

7. Block intermediate choke lever to release fast idle cam.

8. Back off idle adjusting screw until it is not touching the stop when accelerator return spring is holding the throttle valves in the closed bore position.

9. Bend auxiliary bellcrank link to obtain .020" - .040" between the auxiliary bellcrank and the gauge surface of the carburetor throttle body.

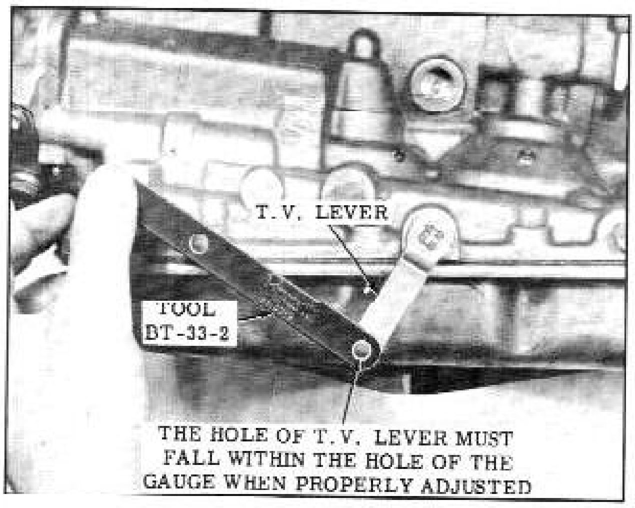

Fig. 3-137 Checking T.V. Lever

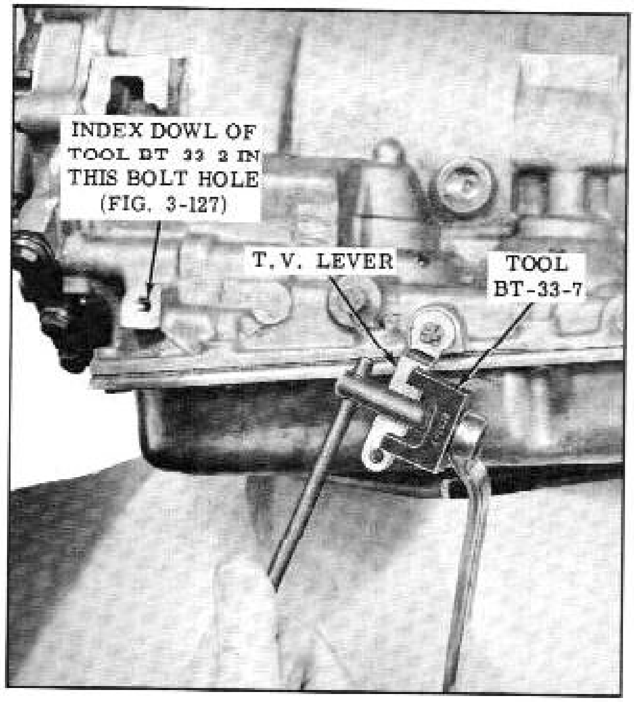

Fig. 3-138 Bending T.V. Lever

10. Adjust upper throttle valve rod "slightly short" and snap it onto the ball stud, then lengthen rod until a clearance of .002" to .005" is obtained at the throttle valve bellcrank stop. (Fig. 3-139)

11. Loosen the throttle down shift stop screw lock nut and back off stop screw approximately 6 turns. With the accelerator lever, move the

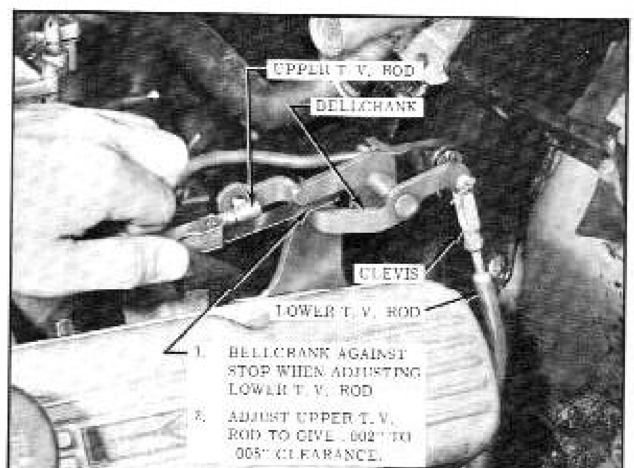

Fig. 3-139 Adjusting T.V. Rods

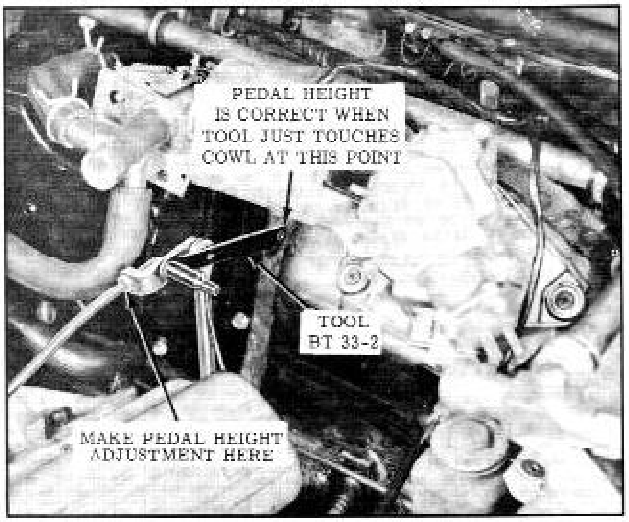

Fig. 3-140 Checking Pedal Height

throttle to wide open and over travel the linkage to the point of maximum transmission throttle valve lever travel.

CAUTION: DO NOT BEND OR STRETCH LINKAGE.

12. Holding the accelerator lever in the wide open position, set the stop screw to just touch the down shift lever tang then turn the stop screw in an additional 1-1/2 to 2 turns.

13. Remove block from intermediate choke lever. Start engine and allow engine to reach operating temperature. Adjust slow idle to 500 r.p.m. and fast idle to 1600 r.p.m.

14. Adjust pedal height with Tool BT-33-2 as shown in Fig. 3-140.

15. Reposition throttle return check and install attaching screw.

16. Adjust throttle return check plunger length to obtain .020" gap between plunger and carburetor lever.

17. Lubricate linkage.

STEERING

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POWER STEERING

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MAINTENANCE RECOMMENDATIONS

STEERING LINKAGE

The steering linkage should be lubricated with chassis lubricant every 2000 miles. At this time it should be visually inspected for wear.

MANUAL STEERING GEAR

Check steering gear lubricant level every 2000 miles and, if level is low, fill the gear with S.A.E. 80 Multi-Purpose Gear Lubricant. Frequent addition of lubricant indicates leakage. The source of any leakage should be located and eliminated. Regular or seasonal changes of lubricant are not necessary.

Periodically check and, if needed, adjust steering gear (manual or power) over center adjustment.

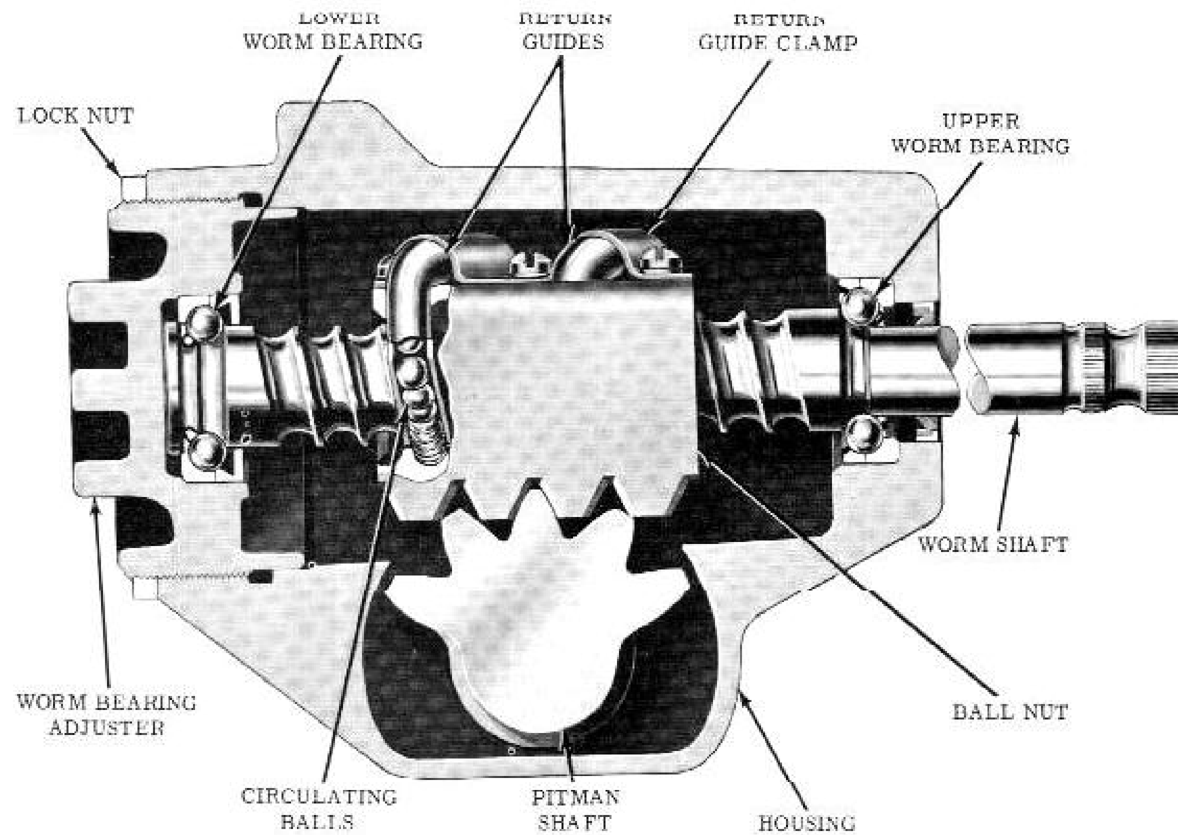

Fig. 4-1 Manual Steering Gear

DESCRIPTION

The steering system of the 1961 Oldsmobile F-85 is of the conventional relay type. The steering column assembly consists of a mast jacket, shift tube and steering shaft. The steering gear is the recirculating ball type mounted on the front cross bar. The worm shaft and the ball nut have mating spiral grooves in which two sets of twenty-five balls each circulate to provide a low friction drive between the worm shaft and ball nut. Each set of balls circulate through separate circuits. When the steering wheel is turned to the right, the ball nut is moved upward by the balls which roll between the worm shaft and ball nut. As the balls reach the outer guides, the guides direct them across the ball nut and back into the circuit again. As the ball nut moves upward during a right turn the pitman shaft rotates clockwise pulling the relay rod to the left through the pitman arm which turns the wheels to the right. Turning the steering wheel to the left moves the ball nut downward turning the wheels to the left. The steering linkage is of the relay type. The pitman arm is attached to a relay rod. The relay rod is attached to an idler which in turn is attached to a support bracket at the front suspension cross bar opposite of the steering pitman arm. The relay rod is attached to the plain arms through tie rods. (Fig 4-1 and 4-2)

STEERING WHEEL

Removal

1. To remove the standard wheel cap, loosen the attaching screw by inserting a phillips screw driver through the access hole in the side of the cap. With the screw loosened the cap then can be slid off the steering wheel. (Fig. 4-3)

   The deluxe wheel cap is held in place by spring steel clips. To remove the cap, gently pry the cap from the wheel. (Fig. 4-4)

2. Disconnect horn wire.

3. Remove hex nut and flat washer from steering column shaft.

4. Using Tool BT-61-9, pull steering wheel from steering shaft. (Fig. 4-5).

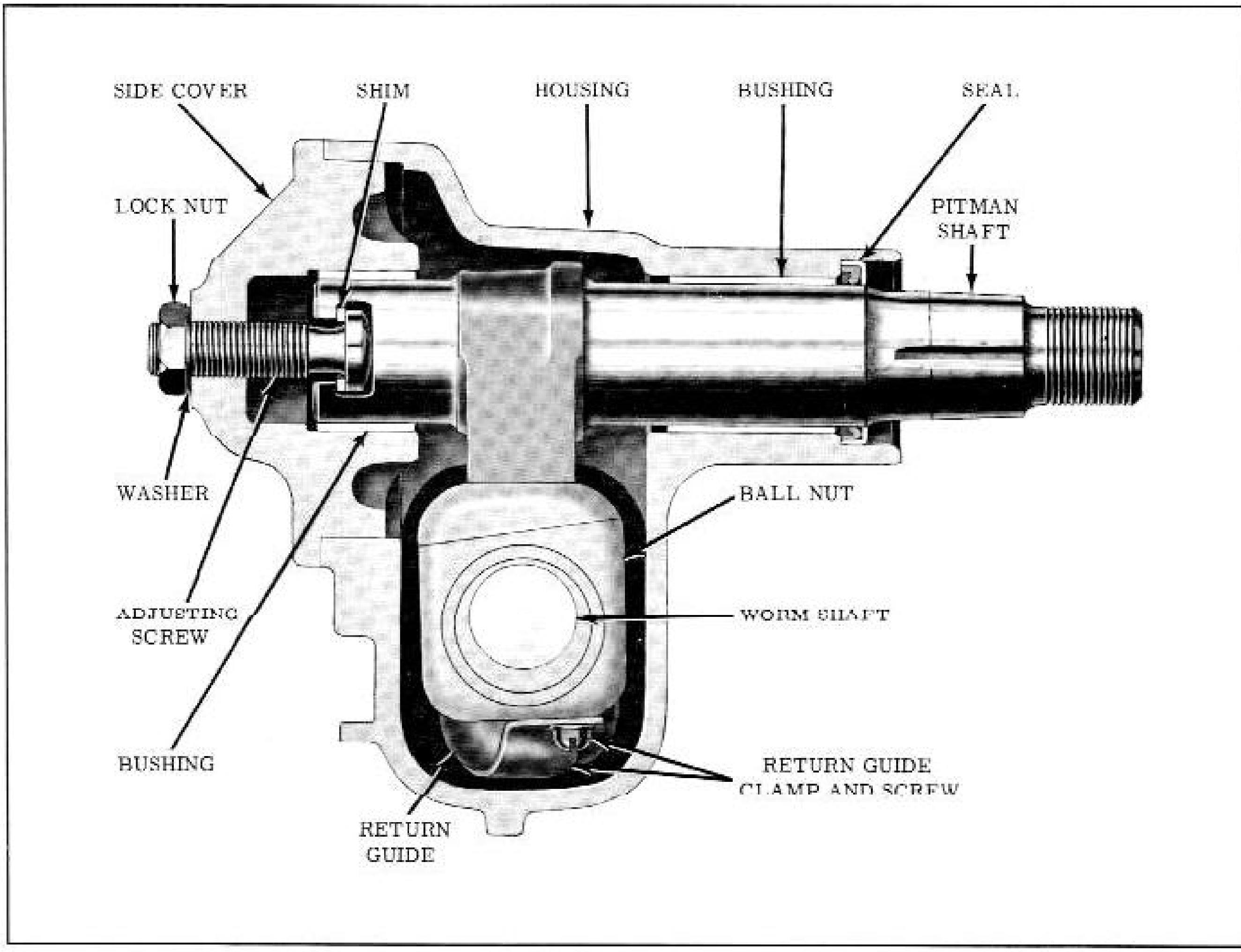

Fig. 4-2 Manual Steering Gear

Installation

1. Place steering wheel on splined steering shaft with alignment marks matched. (Fig. 4-6).
2. Install washer and nut on steering shaft. Torque nut 20-30 ft. lbs. and stake nut to steering shaft.
3. Reconnect horn wire.
4. Install horn shroud and retain with attaching screw.

STEERING SHAFT UPPER BEARING

Removal

1. Remove steering wheel.
2. Disconnect horn wire from chassis wiring harness.
3. Lift horn contact assembly from steering shaft.
4. Remove retainer which holds bearing assembly in recess of turn signal actuator assembly.
5. Remove upper bearing snap ring retainer, washer and spring.
6. Lift upper bearing from actuator assembly recess.

Installation

1. Position upper bearing in actuator assembly (flange up) with one notch of bearing race aligned with opening inside of bore of bearing recess as shown in Fig. 4-7. Notches in bearing flange must also be aligned on lug in actuator.
2. Install bearing retainer clip in the actuator assembly aligning retainer as shown in Fig. 4-8.
3. Install upper bearing spring, washer and snap ring retainer on steering shaft.
4. Install horn contact plate guiding the horn wire through the actuator housing and down through the mast jacket as shown in Fig. 4-9.

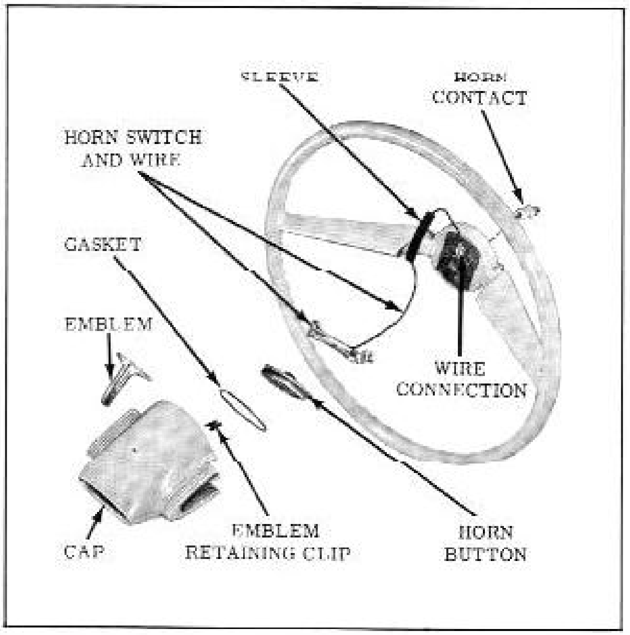

Fig. 4-3 Standard Steering Wheel

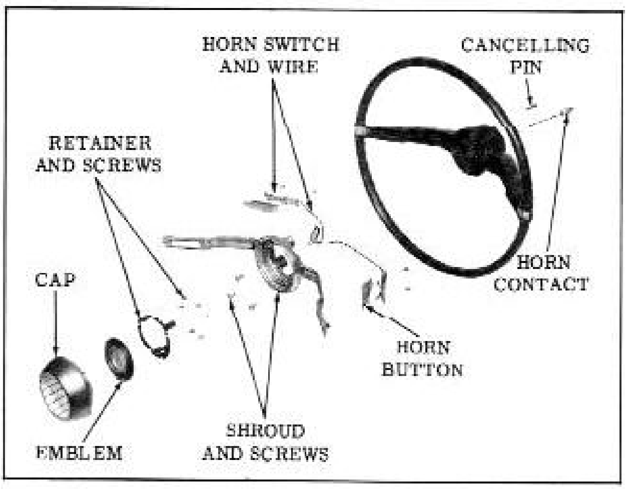

Fig. 4-4 Deluxe Steering Wheel

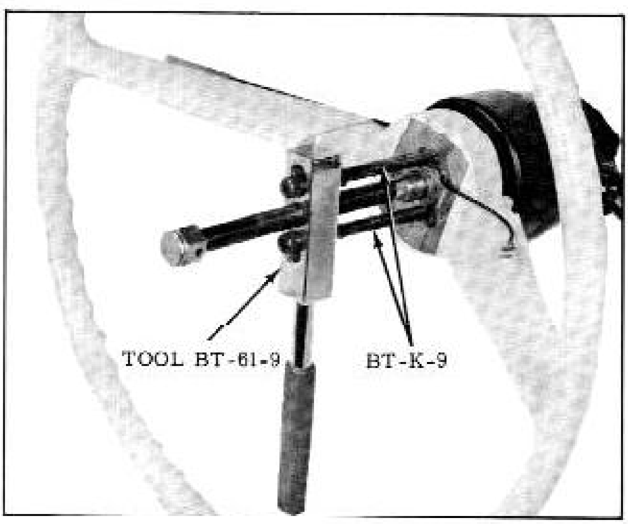

Fig. 4-5 Pulling Steering Wheel

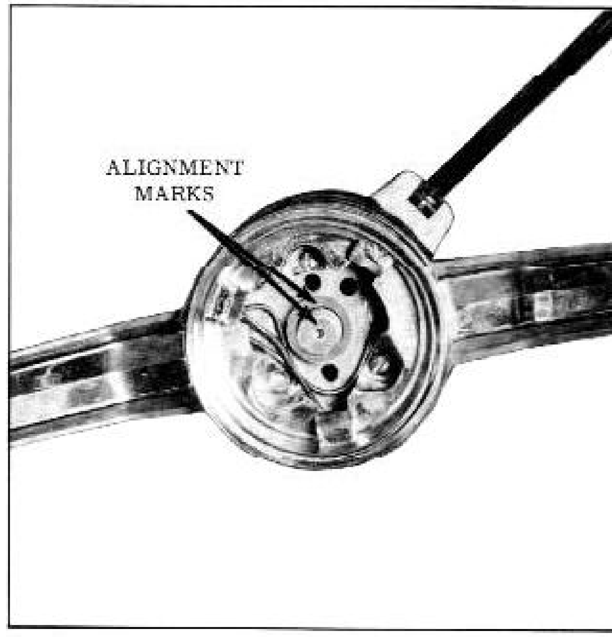

Fig. 4-6 Steering Wheel to Shaft Alignment

5. Reconnect horn wire to harness.

6. Install steering wheel following steps 1 through 4 under STEERING WHEEL INSTALLATION, Page 4-3.

TURN SIGNAL ACTUATOR ASSEMBLY

Removal

1. Remove steering wheel assembly, horn contact, turn signal actuator plate, and upper bearing.

2. Remove three phillips head screws from actuator retainer anchor plate.

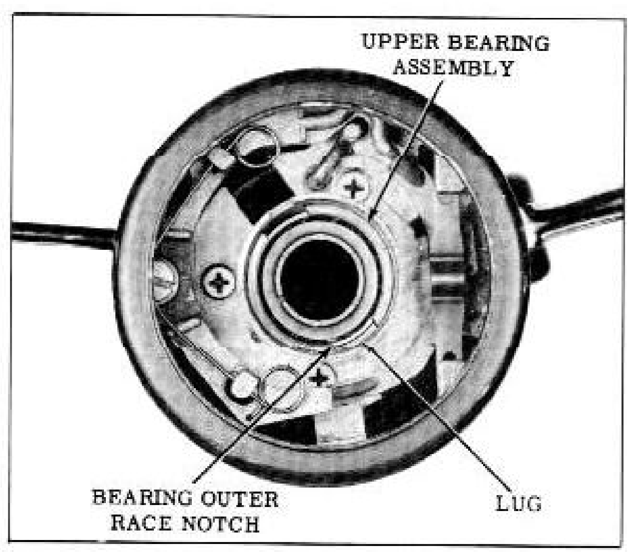

Fig. 4-7 Upper Bearing Position

3. Lift turn signal actuator assembly off of mast jacket.

STEERING SHAFT COUPLING

If the manual or power steering shaft coupling is to be removed, it will be necessary to raise the steering shaft in the mast jacket to provide clearance between the steering shaft and the steering gear worm shaft for removal of the coupling.

MANUAL STEERING COUPLING

Removal

1. Remove the steering shaft coupling clamp bolt and slide clamp off coupling housing onto steering gear worm shaft. Mark steering shaft in line with slot at coupling clamp surface.
2. Disconnect horn wire from harness.
3. Remove the horn shroud from center of steering wheel.
4. Remove steering wheel to steering shaft nut and washer.
5. Using Tool BT-61-9, pull the steering wheel from the steering shaft.
6. Pull the horn contact plate up out of recess in actuator assembly sufficient to give clearance for removal of upper bearing to actuator assembly retaining clip.
7. Using a small screw driver pry the upper bearing to actuator assembly retaining clip out of the actuator housing. (Fig. 4-8).
8. Pull steering shaft up out of steering column and block shaft up approximately two inches.

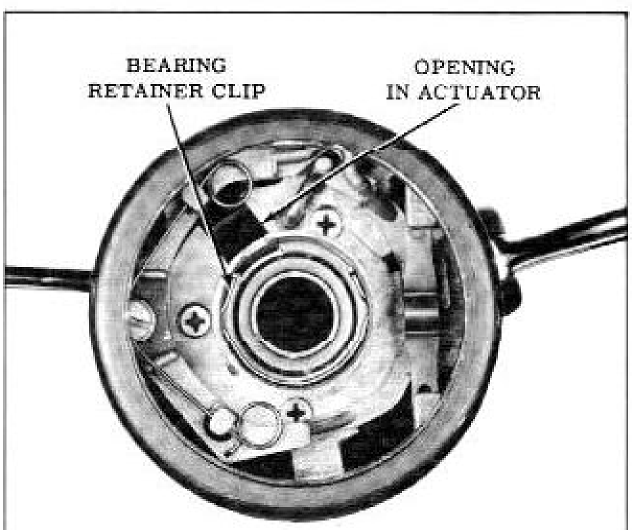

Fig. 4-8 Bearing Retainer Position

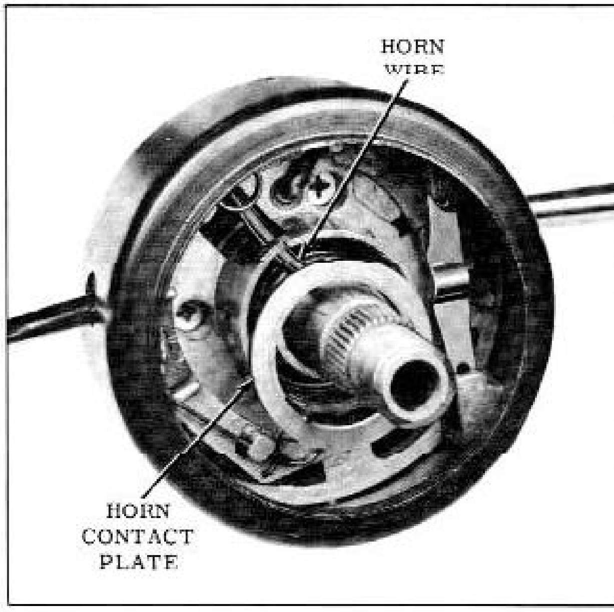

Fig. 4-9 Horn Contact Wire Installation

This will be sufficient clearance to remove the coupling from the steering shaft or the steering gear from the suspension cross bar.

9. Remove coupling seal retaining ring.
10. Position steering shaft so that steering shaft coupling pivot pin is in the horizontal plane. This will reduce the possibility of the coupling ball pivot bearings falling from the pivot pin.
11. Slide the coupling housing off shaft, holding one hand under coupling to catch internal parts if they should fall out of place.
12. Remove the anti-click spring and the two coupling ball pivot bearings from pivot pin.
13. Remove steel washer from shaft.
14. Clean and inspect parts for damage or abnormal wear.

Installation

1. Lubricate the coupling parts and pack the coupling housing with aluminum soap type chassis lubricant.
2. Position the steel washer on the steering shaft above the pivot bearings. (Fig. 4-11) Install the ball pivot bearings and the anti-click spring and retain with grease.
3. Install the ball pivot bearings on the pivot pin and align the two machined surfaces with the sides of the pivot groove. Install the coupling housing on the shaft with the slot of coupling clamp surface aligned with mark of steering shaft. Insert the rubber seal into the bore of the coupling housing and retain with the retaining ring.

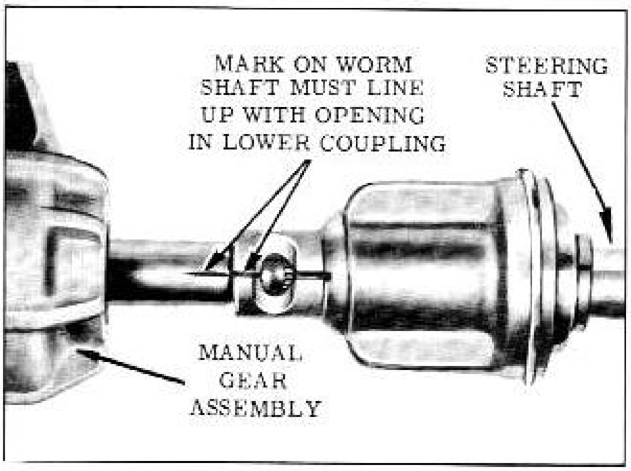

Fig. 4-10 Coupling to Steering Shaft Position

4. Lower the steering shaft (guide upper bearing into actuator assembly) and connect the coupling to the worm shaft matching up the alignment marks on the worm shaft with slot of clamp surface of coupling. (Fig. 4-10)
5. Place the coupling clamp into position on the coupling, but do not tighten the clamp.
6. Install the upper bearing retainer ring and place the horn contact plate in the actuator assembly.
7. Install the steering wheel on the steering shaft and install the washer and nut. Torque the nut to 25 ft. lbs. and stake nut to steering shaft.
8. Check operation of coupling by turning steering wheel. There should be no binding or misalignment of coupling.
9. Install the horn shroud and reconnect the horn wire to chassis wiring harness.
10. Tighten coupling clamp bolt and torque 35 to 40 ft. lbs.

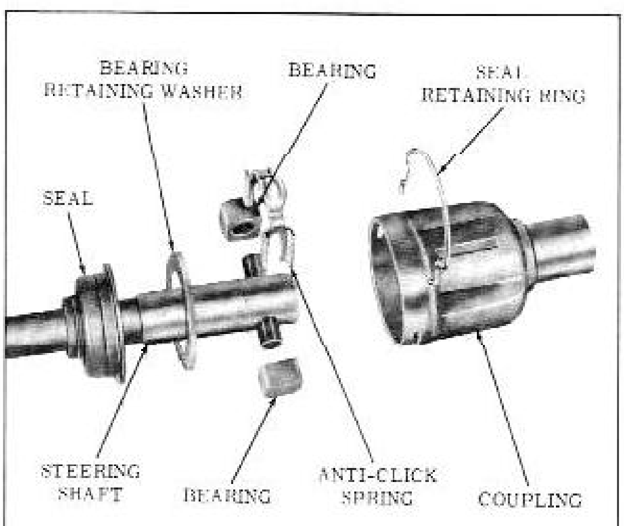

Fig. 4-11 Coupling Assembly

11. If steering gear mounting bolts were loosened, retighten and torque 45 to 60 ft. lbs.

POWER STEERING COUPLING

Removal

1. Remove the two flexible coupling to steering shaft attaching bolts.
2. Follow Steps 2 through 8 in the manual STEERING COUPLING REMOVAL, on Page 4-5.
3. Remove the flexible coupling to worm shaft clamp bolt.
4. Pull the flexible coupling off of the worm shaft.

Installation

1. Place the flexible coupling on the worm shaft and install the clamp bolt. Torque 20-35 ft. lbs. Coupling will go on worm shaft in only one position.
2. Position the steering shaft into the actuator, then follow Steps 6 thrugh 8 in the MANUAL STEERING COUPLING INSTALLATION, on Page 4-5.

STEERING COLUMN (SYNCRO-MESH)

Removal

1. Disconnect steering shaft from steering gear at coupling.

Fig. 4-12 Manual Gear Coupling

On manual steering equipped cars, loosen the steering shaft to gear worm shaft coupling clamp bolt as shown in Fig. 4-12.

On power steering equipped cars, remove the two flexible coupling bolts and nuts as shown in Fig. 4-13.

2. Disconnect shift levers.
3. Disconnect horn wire, turn signal switch, and neutral safety switch from chassis wiring harness.
4. Remove cover to floor pan attaching screws (Fig. 4-14)
5. Remove mast jacket to instrument panel "U" Bolt clamp, Fig. 4-15, and remove steering column assembly.

Installation

1. Place column assembly in position with tang on saddle, engaged in column. (Fig. 4-15)
2. Install "U" bolt and nuts but do not tighten.
3. On manual steering equipped cars, adjust column up or down to obtain 4-3/4" as shown in Fig. 4-16.
4. Coupling must align with alignment mark on shaft. (Fig. 4-17)
5. Align the power steering coupling by adjusting the steering column up or down.
6. Attach column to floor pan. Torque screws 3-5 ft. lbs.
7. Torque column to dash "U" bolt nuts 8-12 ft. lbs.

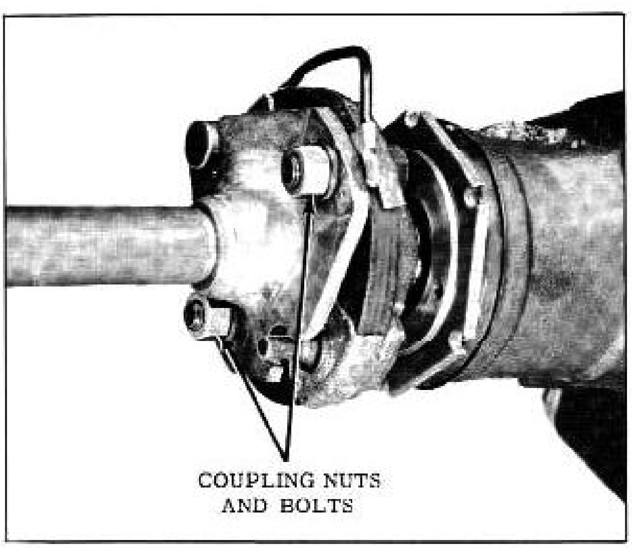

Fig. 4-13 Power Gear Coupling

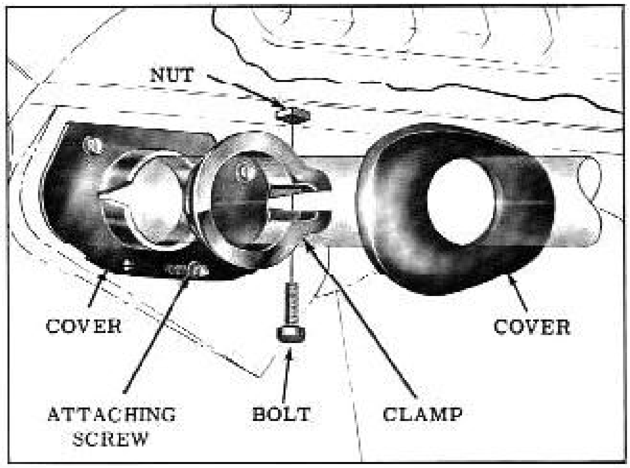

Fig. 4-14 Lower Column Attachment

Dissassembly

With column removed from car and steering wheel removed from column, proceed with following steps.

1. Remove turn signal switch from mast jacket.
2. Slide horn wire grommet retainer from mast jacket.
3. Lift horn contact plate from shaft and pull horn wire up through mast jacket.
4. Remove turn signal switch acutator pin, spring and rod.
5. Remove upper bearing thrust spring snap ring retainer, washer and spring.
6. Slide shaft out of lower end of steering column assembly.

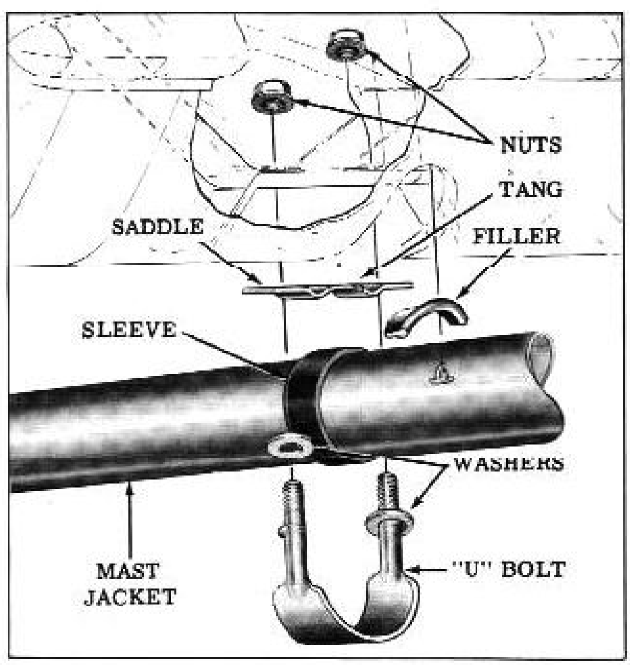

Fig. 4-15 Upper Column Attachment

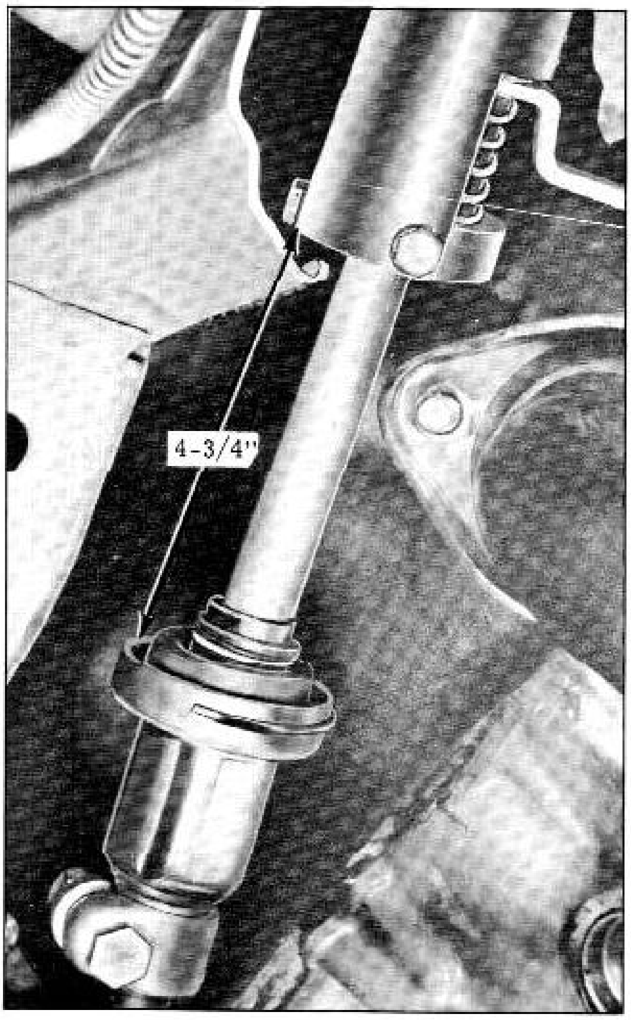

Fig. 4-16 Steering Column Position

7. Remove upper bearing retainer clip.
8. Lift upper bearing out of actuator assembly.
9. Remove the three turn signal actuator assembly retaining screws.
10. Lift turn signal actuator from mast jacket and remove thrust washer.

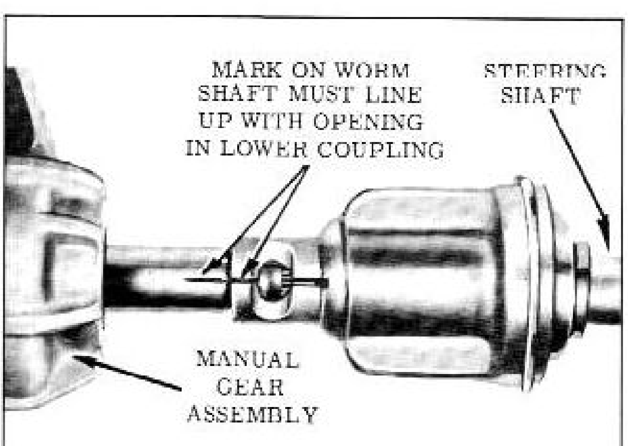

Fig. 4-17 Coupling to Steering Shaft Position

11. Remove turn signal actuator lock plate from mast jacket.
12. Drive out shift lever pivot pin with a suitable drift. Support shifter bowl to prevent breakage.
13. Remove shift lever and anti-rattle spring.
14. Slide shifter bowl from shift tube.
15. Remove nylon washer, wave washer and shift tube spacer from shift tube.
16. Remove (3) bolts from lower shift tube retainer. (Fig. 4-18)
17. Slide shift tube out of bottom of the mast jacket assembly.
18. Slide lower shift lever from shift tube.
19. Push the nylon bearing onto the shift tube far enough to clear the second lug and rotate the bearing so that the bearing holds the spring in compression. (Fig. 4-19)
20. Remove the two nylon washers and the upper shift lever by guiding them over the locating lugs on the shift tube.
21. Compressing the spring with the nylon bearing, rotate the bearing to align the slot in the bearing and the lug on the shift tube and allow the spring to expand. Remove the bearing, spring and spring stop washer.

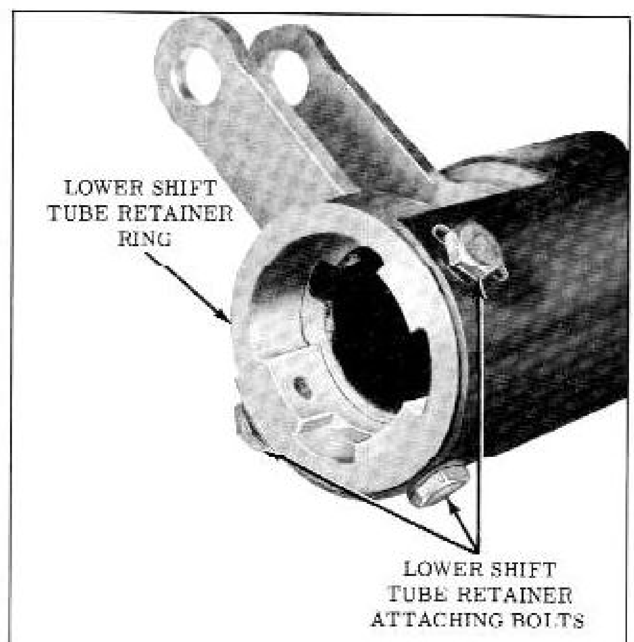

Fig. 4-18 Lower Shaft Tube Retainer

If manual steering coupling is to be disassembled, refer to MANUAL STEERING COUPLING, Page 4-7)

Assembly

1. Slide spring stop washer onto shift tube until washer seats against the shoulder on the shift tube.
2. Slide thrust spring onto shift tube.
3. Slide nylon bearing onto shift tube guiding it around the locator bosses. Push bearing onto the shaft far enough to compress the spring and rotate the bearing so that the second locator boss holds the bearing and spring in place. (Fig. 4-20)
4. Slide the upper shift lever onto the shift tube so the flange is nearest the lower end of the column assembly.
5. Slide one nylon washer onto the shift tube engaging the lug in the notch on the lever flange. (Fig. 4-21)
6. Slide the second nylon washer onto the shift tube with the locating lug toward the bottom of the column. (Fig. 4-21)
7. Slide the lower shift lever onto the shaft aligning the lever notch over the lower lug of the shift tube.

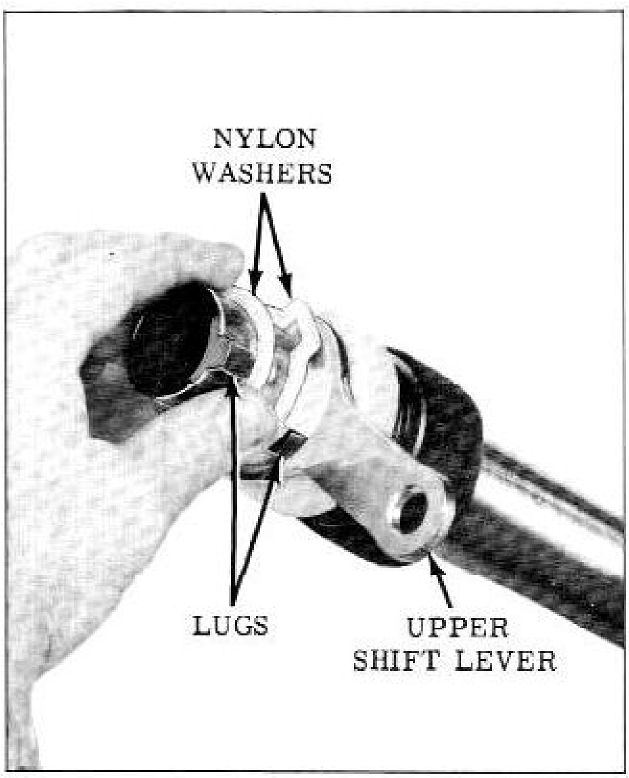

Fig. 4-19 Removing Upper Shaft Lever

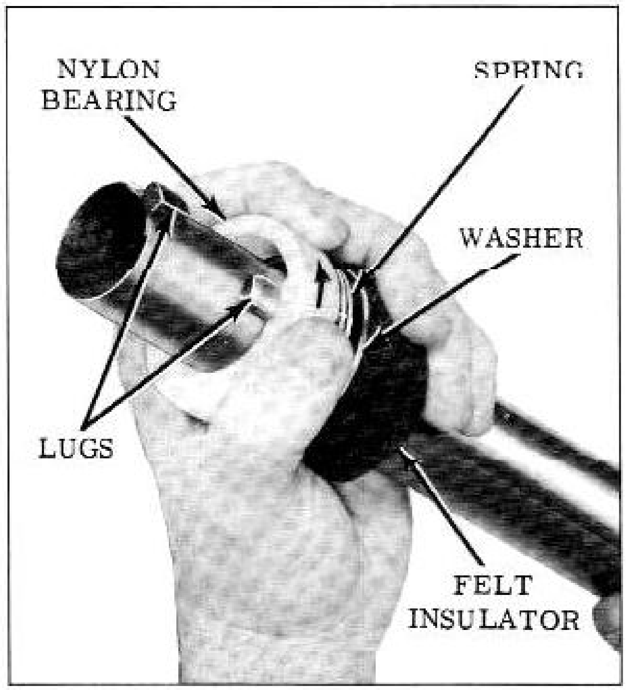

Fig. 4-20 Installing Nylon Bearing

8. Position the lug of the lower nylon washer into notch of the lower shift lever and butt it against the lower shift tube lug.
9. Compressing the bearing thrust spring, rotate the bearing so that the groove of the bearing is over the upper lug of the shift tube and allow spring to seat bearing against the upper shift lever.
10. Insert shift tube into mast jacket, from the bottom end. The 3 bearing notches must align with the lugs in the mast jacket.
11. Insert lower shift tube retaining ring into mast jacket and install (3) retaining bolts

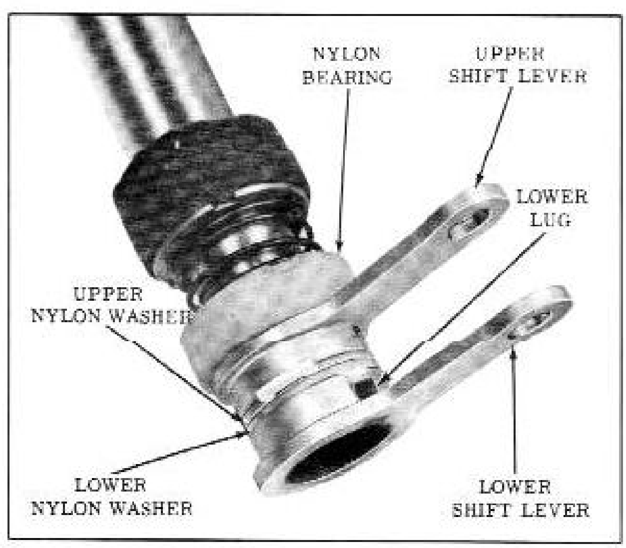

Fig. 4-21 Lever to Shift Tube Position

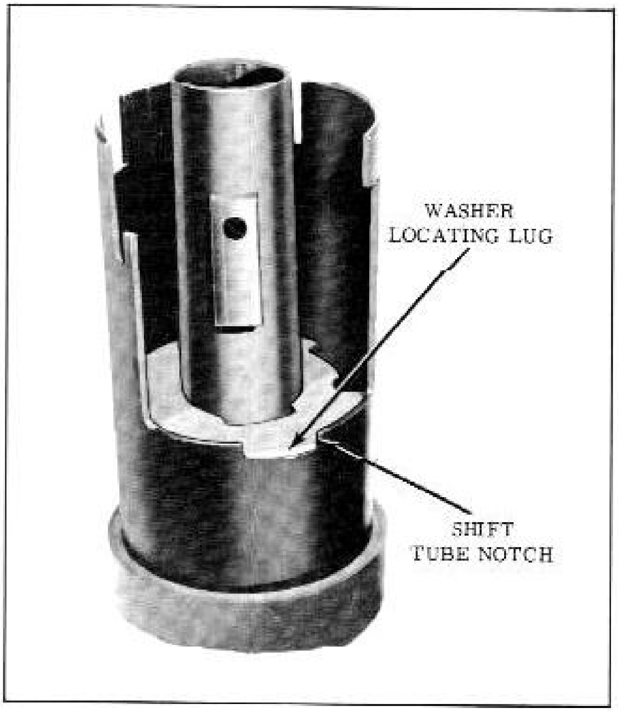

Fig. 4-22 Upper Shift Tube Washer

finger tight. Position as shown in Fig. 4-18.

12. Position the upper shift tube washer over the shift tube and inside the mast jacket with the locating lug and notch aligned. (Fig. 4-22)

13. Install the wave washer and nylon washer over upper end of the shift tube.

14. Slide shifter bowl onto shift tube and over mast jacket aligning groove of shifter bowl with lug on shift tube.

15. Position anti-rattle spring onto shift lever and install shift lever in the shift tube. Install

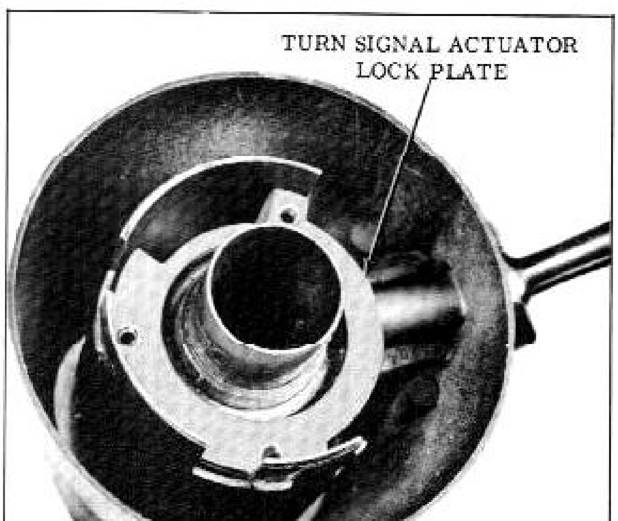

Fig. 4-23 Activator Lock Plate Position

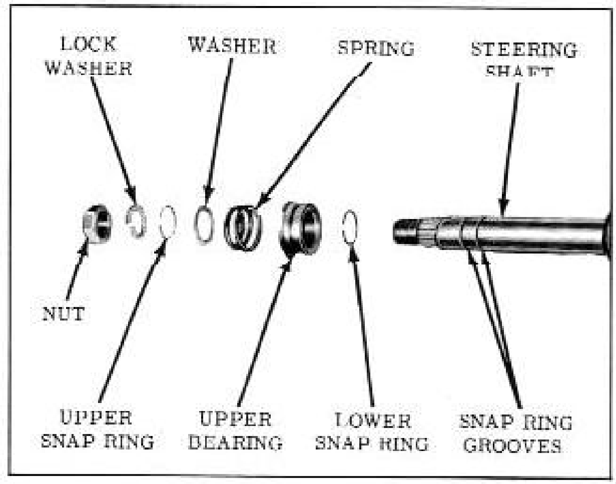

Fig. 4-24 Upper Shaft Assembly

shift lever pivot pin. Support shifter bowl while installing shift lever pivot pin to minimize possibility of damage.

16. Position turn signal actuator lock plate over shift tube and inside the mast jacket. (Fig. 4-23) Position thrust washer on steering shaft and against shift tube.

17. Position turn signal actuator on column and install three retaining screws.

18. Install new upper bearing lower retainer snap ring onto the steering shaft and position in snap ring groove. (Fig. 4-24)

19. Insert steering shaft into the shift tube through the bottom end.

NOTE: If manual steering coupling has been disassembled, position rubber grease seal on steering shaft before inserting shaft into shift tube.

20. Position bearing outer race notch over lug in inner diameter of the turn signal actuator frame. (Fig. 4-25)

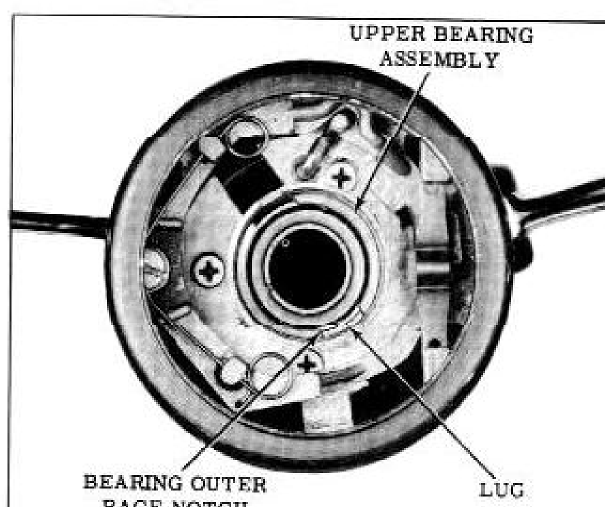

Fig. 4-25 Upper Bearing Position

21. Install upper bearing and shaft retainer clip with opening aligned with slot in actuator to provide clearance for horn contact wire. (Fig. 4-26)

22. Slide upper bearing, spring, (large diameter against bearing) washer and new upper retainer snap ring onto steering shaft. (Fig. 4-24)

23. Install horn wire and contact plate.

24. Position turn signal actuator rod in jacket assembly.

25. Install rod spring and switch pin on rod.

If manual steering coupling has been removed, refer to MANUAL STEERING COUPLING, Page 4-6.

26. Adjust clearance between lower shift lever and retaining ring to .005 inch by moving the retaining ring back and forth in slanted slot of mast jacket as shown in Fig. 4-18.

27. Tighten retainer ring attaching screws.

STEERING COLUMN (HYDRA-MATIC)

Removal and Installation

The removal and installation of the Hydra-Matic steering column assembly is the same as for the Syncro-Mesh equipped car except that there is only one shift lever to disconnect and the neutral safety switch must be disconnected from the chassis wiring harness. See STEERING COLUMN (SYNCRO-MESH), Removal on Page 4-6.

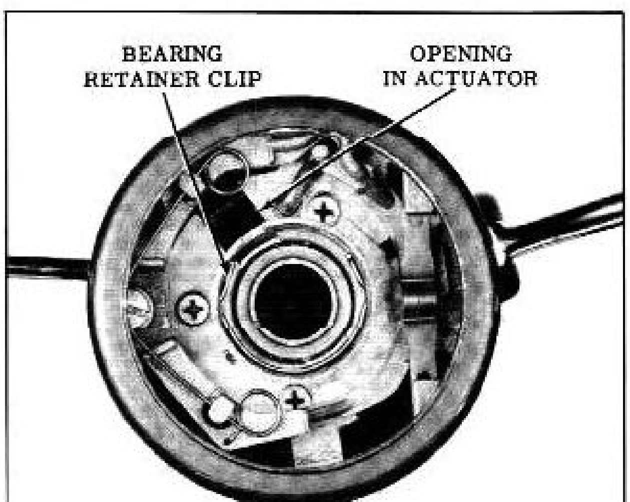

Fig. 4-26 Upper Bearing Retainer

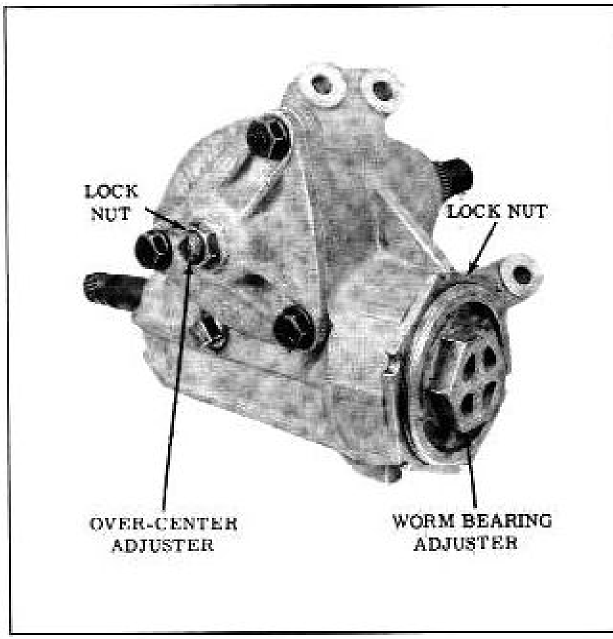

Fig. 4-27 Manual Steering Gear

Disassembly

1. To disassemble the steering column of a Hydra-Matic equipped car, follow Steps 1 through 17 of the Syncro-Mesh disassembly procedure. (Page 4-7)

2. Remove the shift tube spring and slide the shift tube out from the bottom of the mast jacket. It may be necessary to lightly tap shift tube from mast jacket.

Assembly

1. Slide the shift tube into the mast jacket at the bottom end of the mast jacket. The nylon bearing notches will fit mast jacket in only one position.

2. Position the shift tube spring over end of shift tube between the shift lever and retaining ring.

3. Install the shift tube retaining ring in bottom of mast jacket, compressing the spring. Position as shown in Fig. 4-18. Tighten shift tube retainer ring attaching bolts with bolts in uppermost position of slots.

4. Follow Steps 12 through 25 of the assembly procedure for a Syncro-Mesh equipped car (Page 4-9)

   NOTE: To reduce end play between the selector rod and the bushing in the shift lever, selective washers are available. Maximum end play should not exceed .020.

STEERING GEAR

ADJUSTMENT ON CAR

Before making adjustments in the steering gear check the front end alignment, shock absorbers, wheel balance and tire pressure to see that they are correct. There are two adjustments on the manual steering gear; worm bearing pre-load and over-center. (Fig. 4-27)

The worm bearing pre-load adjustment must be checked and, if necessary, corrected before the over-center adjustment is made. If the worm bearing pre-load is not correct, adjustment of the over-center may result in damage of the gear.

WORM BEARING PRE-LOAD ADJUSTMENT

1. Disconnect the pitman arm from the relay rod by:

   a. Remove the left hand relay rod end plug cotter pin and grease fitting.

   b. Thread the end plug out of the end of relay rod.

   c. Slide outer ball seat out of relay rod and drop relay rod away from pitman arm.

2. Using spring scale Tool J-544, measure the pull at the rim required to keep the wheel in motion at about one turn of the steering wheel from either extreme position.

3. The pull required should be from 1/4 to 3/4 lbs. If the pull does not fall in this range, it will be necessary to adjust the worm bearing pre-load as noted in the following steps.

4. Loosen the worm bearing adjuster lock nut with a brass drift. Turn the worm bearing adjuster nut in to tighten, or out to loosen to bring the pre-load into specifications. (Fig. 4-27)

5. After each adjustment, tighten the lock nut to maintain adjuster nut position since turning the worm shaft during pre-load measurement may cause the adjuster nut to loosen.

6. When adjustment is correct, re-tighten lock nut, recheck pre-load and proceed to make the over-center adjustment.

OVER-CENTER ADJUSTMENT

1. After the worm bearing adjustment has been checked and/or corrected, loosen the pitman shaft adjusting screw lock nut, tighten adjusting screw until a pull of 7/8 to 1-1/2 lbs. at the steering wheel rim is required to turn the wheel through the center range. The center is approximately 3 turns of the steering wheel from either extreme.

2. Tighten the lock nut and recheck over-center adjustment.

3. After completion of adjustments, reassemble the pitman arm to the relay rod. When installing the end plug, adjust the spring tension by threading the end plug down tight and backing it off 1/4 - 3/4 turn before installing the cotter pin. Install the cotter pin with head towards the front of the car. Lubricate relay rod with chassis lubricant.

Removal

To facilitate removal of the steering gear from the car it will be necessary to raise the steering shaft in the column assembly.

1. Raise the steering shaft as outlined in Steps 1 through 8 of MANUAL STEERING COUPLING REMOVAL on Page 4-5.

2. Remove the left hand end plug from the relay rod and pull the relay rod off of the pitman arm.

3. Remove the 4 gear to front suspension cross bar attaching bolts and remove the gear from the car.

Installation

Before installing the gear in the car, check the pitman shaft nut torque. Torque should be 100-125 ft. lbs.

1. Position gear on front suspension cross bar and install the 4 attaching bolts.

2. Reconnect pitman arm to the relay rod. Adjust relay rod spring tension by threading end plug in until tight and backing it off 1/4 -3/4 turn before installing the cotter pin. Install cotter pin.

3. Replace steering column in position as outlined in Steps 4 through 10 under MANUAL STEERING COUPLING INSTALLATION on Page 4-5.

4. Torque gear mounting bolts 45-60 ft. lbs.

Disassembly

As with any ball bearing unit, the steering gear parts must be kept free of dirt. Clean paper or rags should be spread on the bench before starting disassembly of the steering gear.

1. Remove pitman arm with puller J-5504. Loosen lock nut on end of pitman shaft and turn the over center adjuster a few turns counterclockwise (Fig. 4-27). This will remove the load from the worm bearings caused by the close meshing of the rack and sector teeth.

2. Loosen the lock nut on the worm bearing adjuster (Fig. 4-27) and turn the adjuster counterclockwise a few turns.

3. Place a pan under the assembly to catch the lubricant and remove the three bolts and washers attaching side cover to housing.

4. Pull the side cover with the pitman shaft from the housing (Fig. 4-28).

   NOTE: IF THE SECTOR DOES NOT CLEAR THE OPENING IN THE HOUSING EASILY, TURN THE WORM SHAFT BY HAND UNTIL THE SECTOR WILL PASS THROUGH THE OPENING IN THE HOUSING.

5. Remove the worm bearing adjuster, adjuster lock nut and lower ball bearing from housing.

6. Remove worm shaft and ball nut assembly from housing (Fig. 4-29). Remove upper ball bearing.

   CAUTION: USE CARE THAT THE BALL NUT DOES NOT RUN DOWN TO EITHER END OF THE WORM. DAMAGE WILL BE DONE TO THE ENDS OF THE BALL GUIDES IF THE NUT IS ALLOWED TO ROTATE UNTIL STOPPED AT THE END OF THE WORM.

7. Remove lock nut from lash adjuster and unscrew adjuster from side cover by turning adjuster clockwise. Slide adjuster and shim out of slot in end of sector shaft.

8. Remove the pitman shaft seal by tapping it toward the outside of the housing with a drift.

BALL NUT DISASSEMBLY

As a rule, disassembly of the ball nut will not be necessary if it is perfectly free with no indication of binding or tightness when rotated on the worm. However, if there is any indication of binding or tightness, the unit should be disassembled, cleaned and inspected as follows:

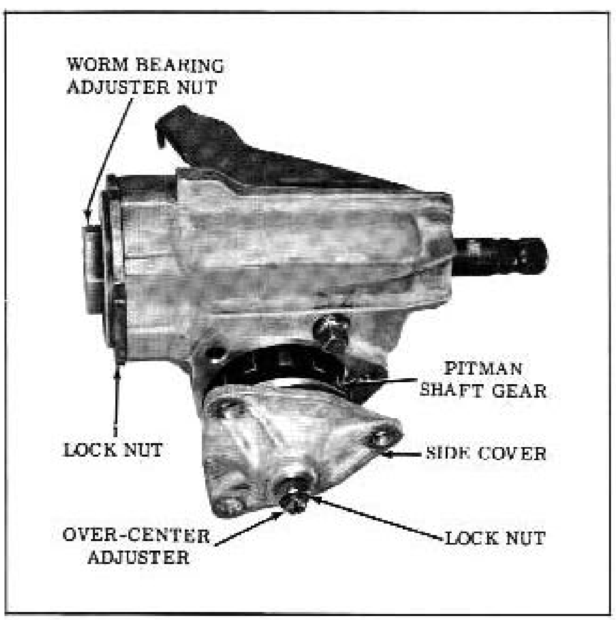

Fig. 4-28 Removing Pitman Shaft

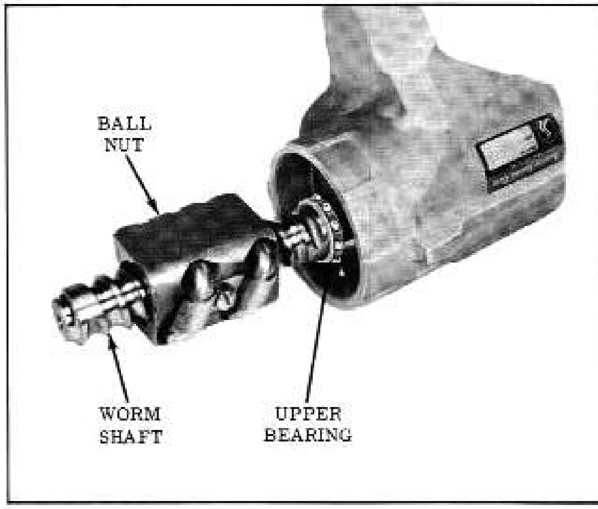

Fig. 4-29 Removing Worm Shaft

1. Remove screws and clamp retaining ball guides in nut. Lift guides out of nut.

2. Turn the nut upside down and rotate the worm shaft back and forth until all the balls have dropped out of the nut into a clean pan. With the balls removed the nut can be removed from the worm. Note the position of shaft in ball nut so it can be replaced the same way.

INSPECTION

With the steering gear completely disassembled (Fig. 4-30), wash all parts in cleaning solvent. Dry them thoroughly with clean rags. Inspect the ball bearings, bearing cups, worm and nut grooves and the surface of all balls for signs of indentation. Also check for any signs of chipping or breakdown of the surface.

Any parts that show signs of damage should be replaced. Balls should be replaced with genuine Oldsmobile parts made according to specifications for this steering gear.

Inspect worm shaft seal for defects.

Inspect the pitman shaft for wear and check the fit of the shaft in the housing bushings.

Inspect the fit of the pilot on the end of the pitman shaft in its bushing in the side cover. If this bushing is worn, a new side cover and bushing assembly should be installed.

Check ball guides for damage at ends where they deflect or pick the balls from the helical path. Any damaged guides should be replaced.

Check steering gear worm shaft assembly for bent or damaged shaft.

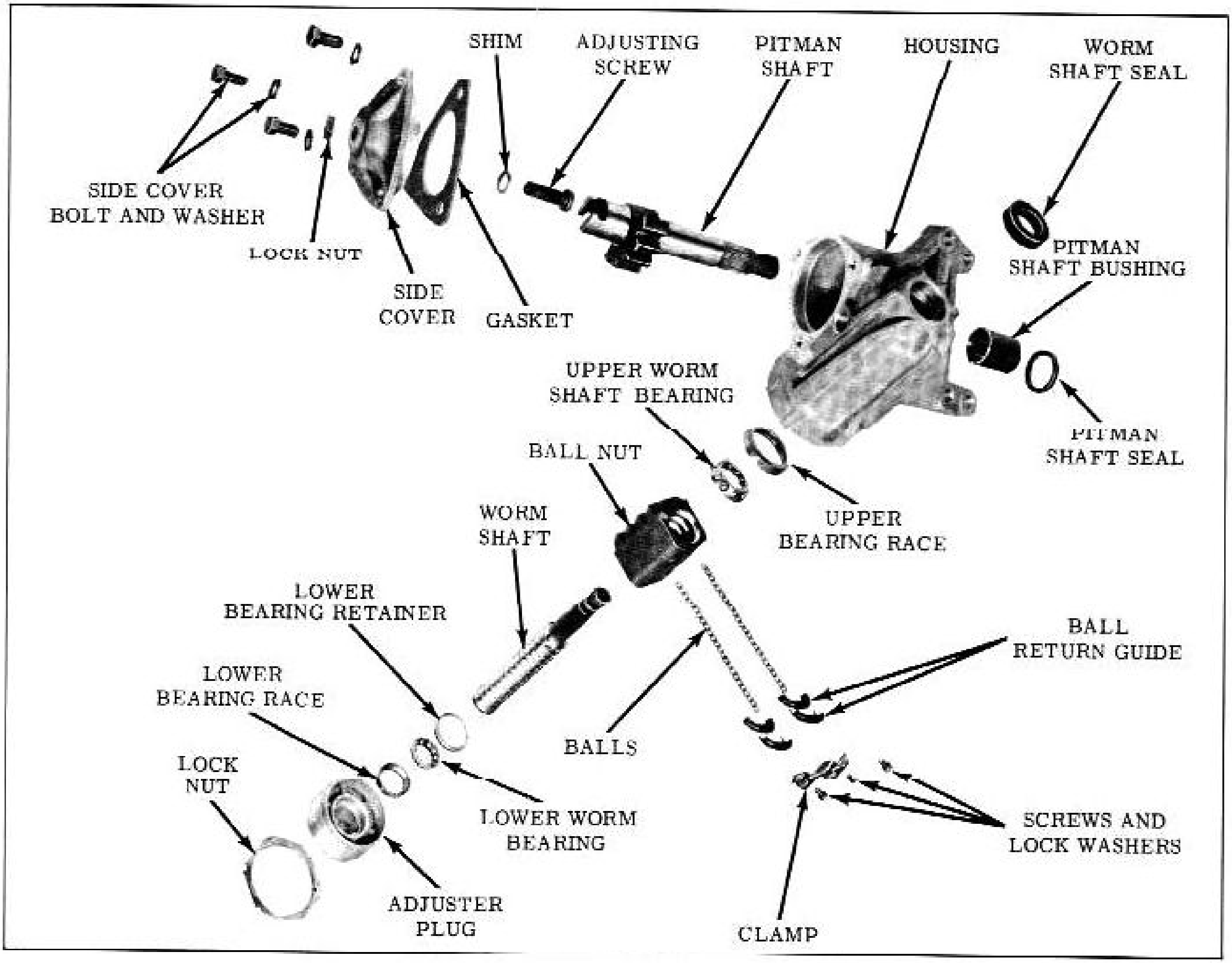

Fig. 4-30 Manual Steering Gear

PITMAN SHAFT BUSHING REPLACEMENT (Gear Disassembled)

1. After removing pitman shaft seal, support steering gear housing in an arbor press and press pitman shaft bushing from housing with Tool J-8810 inserted from lower end of housing as shown in Fig. 4-31.

2. Press new bushing into position using the same sector shaft bushing driver as used for removal.

NOTE: SERVICE BUSHINGS ARE BORED TO SIZE AND REQUIRE NO FURTHER FITTING.

WORM SHAFT SEAL REPLACEMENT

If the worm shaft seal indicates need of replacement, it should be removed with Tool J-8811. (Fig. 4-32)

Using Tool J-8811 in inverted position, install new seal. Seal must be installed FLUSH with housing (Fig. 4-33).

WORM SHAFT SEAL REPLACEMENT (Gear Assembled)

If necessary to replace the Upper Worm Shaft Seal with the gear assembled, it may be done by punching a small hole in the seal and installing a small metal screw approximately 2 turns. Then pry out as shown in Fig. 4-34.

Install the new seal with tool J-7132-7 as shown in Fig. 4-35.

SIDE COVER BUSHING REPLACEMENT

The entire side cover assembly, including bushing, is serviced as a unit and should be replaced when it is necessary to replace the bushing.

PITMAN SHAFT SEAL

The pitman shaft seal must be replaced each time a defective seal is indicated or the steering gear is disassembled.

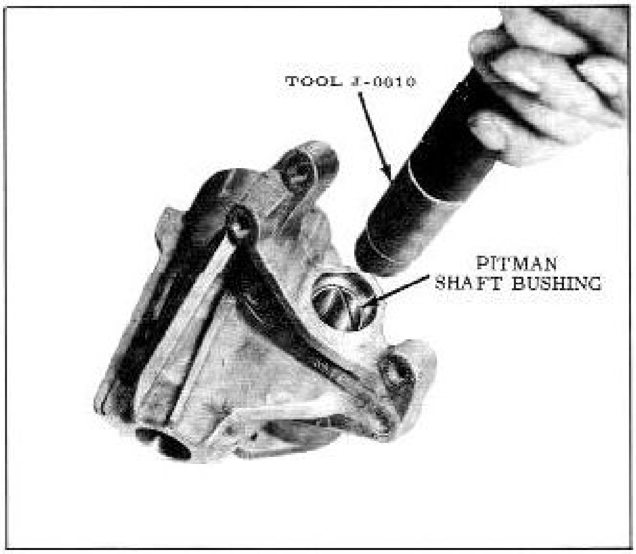

Fig. 4-31 Replacing Pitman Shaft Bushing

This seal is removed by driving it toward the outside of the housing with a drift.

To install a new seal use Tool J-8811 as shown in Fig. 4-36. The additional length of this tool guides in the pitman shaft bushing to insure correct seal installation. Install seal in housing until seal seats firmly on shoulder of housing bore.

WORM SHAFT BEARING RACE REPLACEMENT

The upper worm shaft bearing race may be serviced separately, the lower is serviced with the adjusting nut.

The upper race can be removed with a drift by tapping race into gear housing.

Press a new race into position with Tool J-8811 (Fig. 4-37).

To remove the lower bearing, pry out retainer as shown in Fig. 4-38.

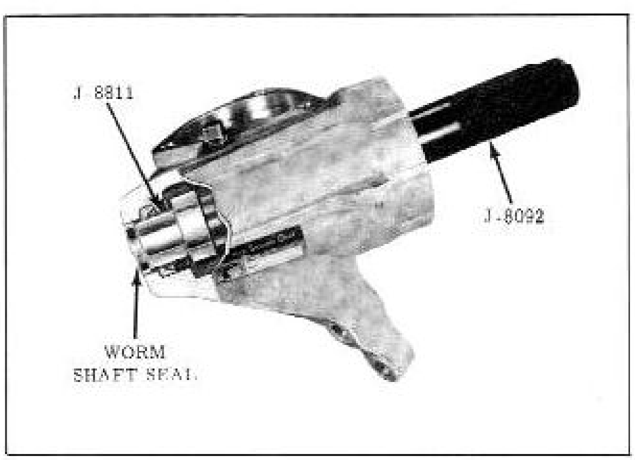

Fig. 4-32 Removing Worm Shaft Seal

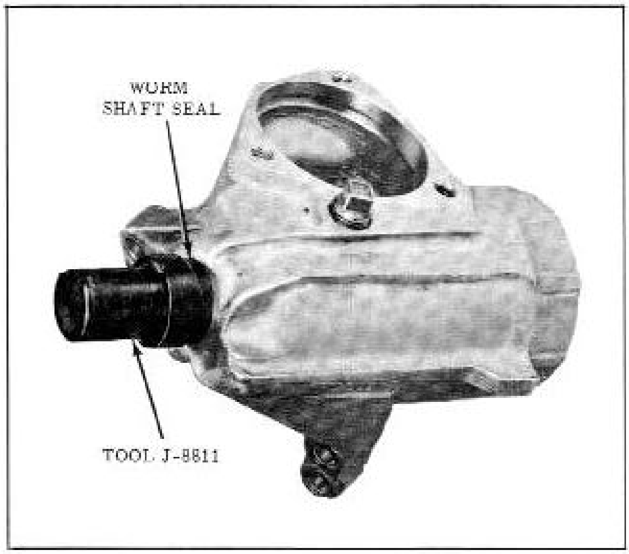

Fig. 4-33 Installing Worm Shaft Seal

BALL NUT ASSEMBLY

1. Place the worm shaft on the bench with the splined end to the right and with the ball nut over the worm with the ball guide holes up and the shallow end of the rack teeth away from you. Align the grooves in the worm and ball nut by sighting through the ball guide holes. Shaft should be centered about half way in ball nut.

2. Count twenty-five balls into a suitable container. This is the proper number of balls for one circuit. Insert balls into one of the guide holes while turning the worm gradually away from that hole. Continue until ball circuit is full from bottom of one guide hole to bottom

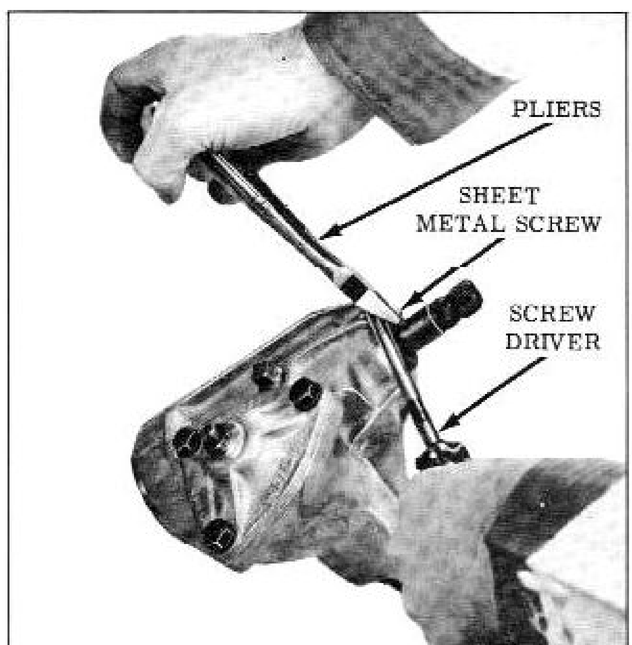

Fig. 4-34 Seal Replacement - Gear Assembled

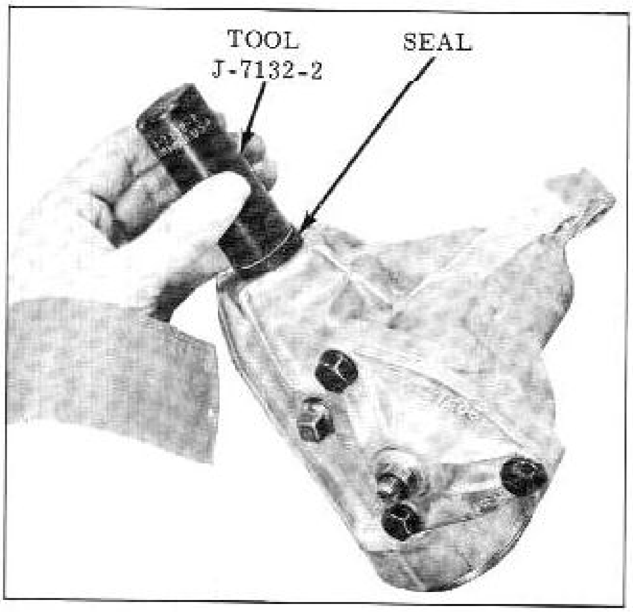

Fig. 4-35 Installing Seal - Gear Assembled

of the other or until stopped by reaching the end of the worm.

NOTE: IN CASES WHERE THE BALLS ARE STOPPED BY THE END OF THE WORM, HOLD DOWN THOSE BALLS ALREADY DROPPED INTO THE NUT WITH THE BLUNT END OF A CLEAN ROD OR DRIFT, (FIG. 4-39), AND TURN THE WORM IN THE REVERSE DIRECTION A FEW TURNS. THE FILLING OF THE CIRCUIT CAN THEN BE CONTINUED. IT MAY BE NECESSARY TO WORK THE WORM BACK AND FORTH, HOLDING THE BALLS DOWN FIRST IN ONE HOLE THEN THE OTHER, TO CLOSE UP THE SPACES BETWEEN THE BALLS AND FILL THE CIRCUIT COMPLETELY AND SOLIDLY.

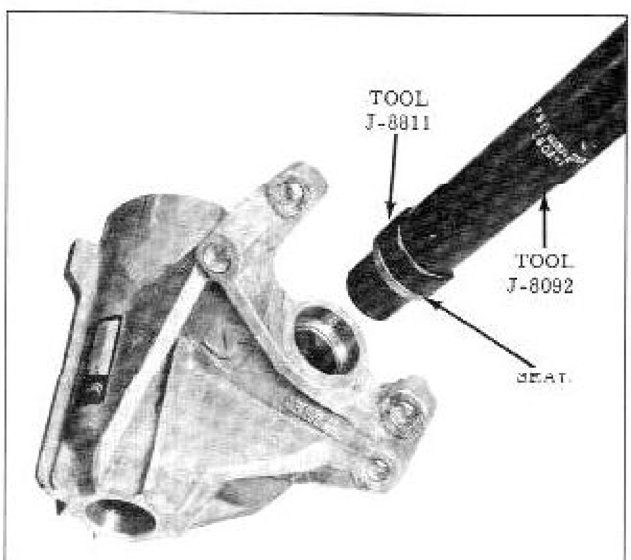

Fig. 4-36 Installing Pitman Shaft Seal

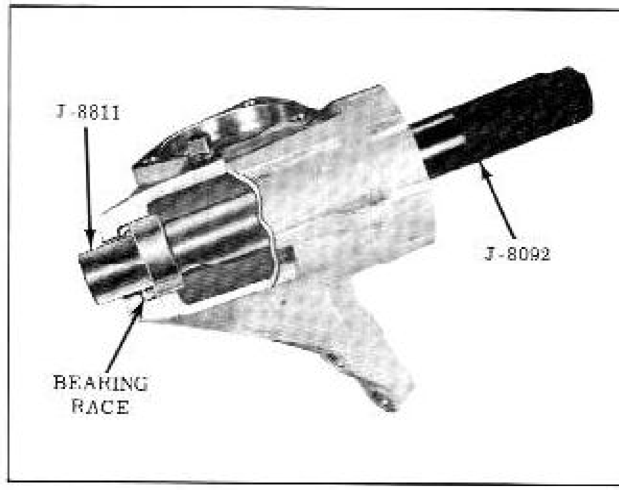

Fig. 4-37 Installing Upper Worm Bearing

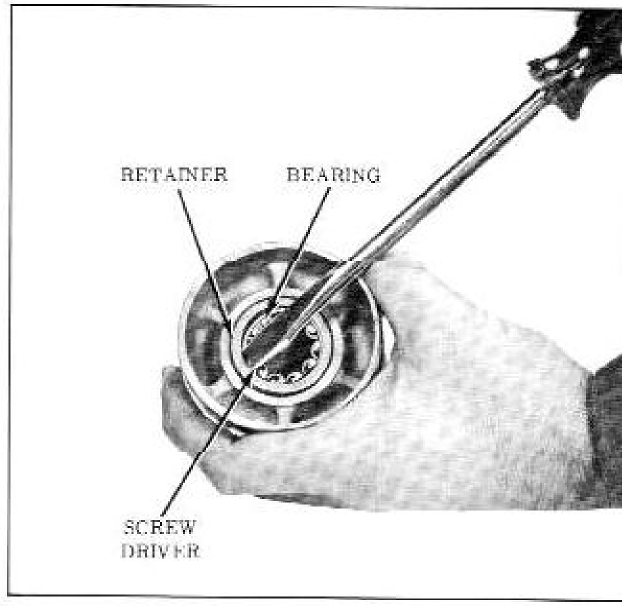

Fig. 4-38 Removing Lower Worm Bearing

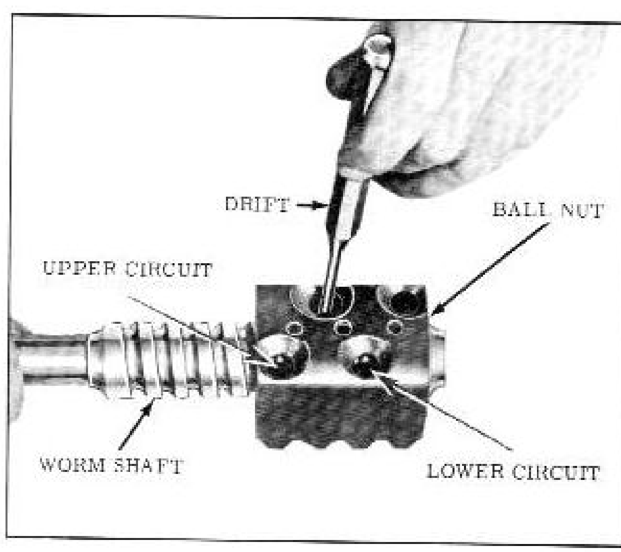

Fig. 4-39 Installing Balls in Ball Nut

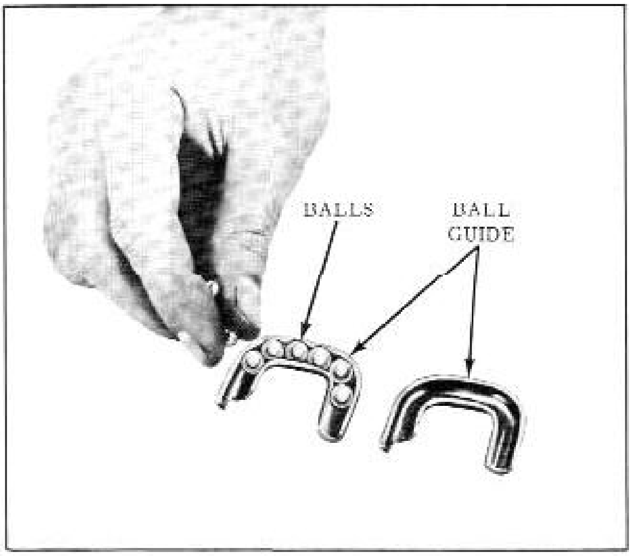

Fig. 4-40 Installing Balls in Guides

3. Lay one-half of the ball guide, groove up, on the bench and place the remaining balls from the count container in it (Fig. 4-40).
4. Close this half of guide with the other half. Hold the two halves together and plug each open end with petrolatum so balls will not drop out while installing guide (Fig. 4-41).
5. Push the guide into the guide holes of the ball nut (Fig. 4-42). This completes one circuit of balls. If the guide does not push all the way down easily, rotate worm shaft back and forth slightly until guide can be pushed into position.
6. Fill second ball circuit in the same manner.
7. Position the ball guide clamp over the ball guides on the ball nut and install the attaching screws with lock washers and tighten securely.

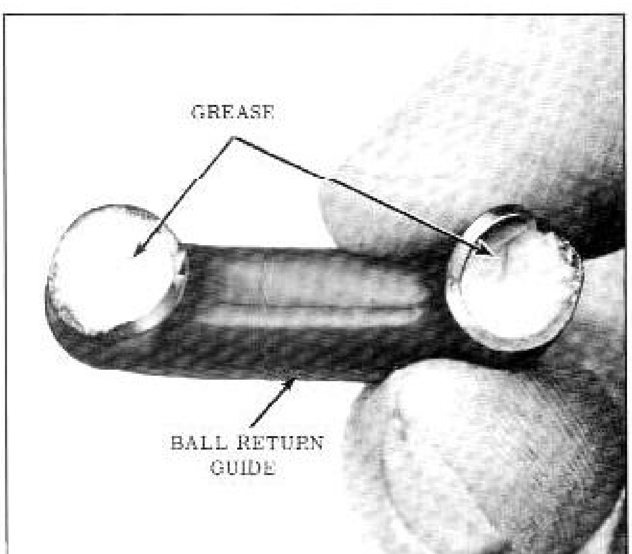

Fig. 4-41 Packing Ball Guides

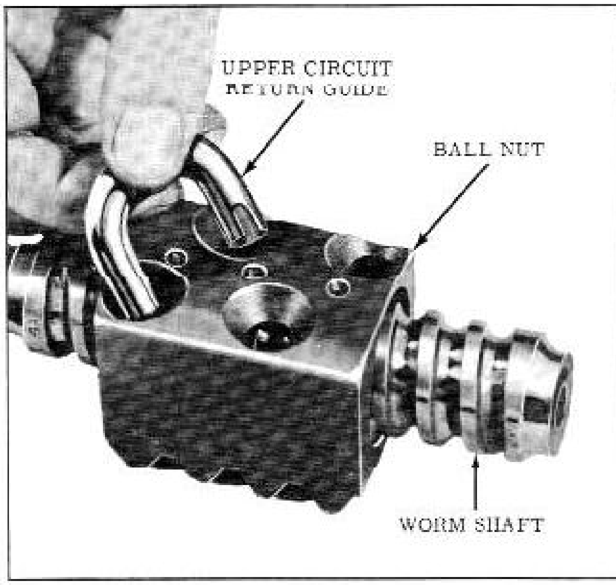

Fig. 4-42 Installing Ball Guides

Check the assembly by rotating the nut on the worm to see that it moves freely. Do not rotate the nut to the end of the worm threads as this may damage the ball guides. If there is any "stickiness" in the motion of the nut, some slight damage to the ends of the ball guides or to other gear components may have been overlooked.

Assembly

After a major overhaul where all of the original factory installed lubricant has been washed out of the steering gear assembly, side cover bolts and over-center adjuster should be coated with a suitable nondrying, oil resistant sealing compound such as Permatex No. 2. This is to prevent leakage of gear lubricant from the steering gear assembly. The compound should not be applied to female threads. DO NOT apply Permatex to the

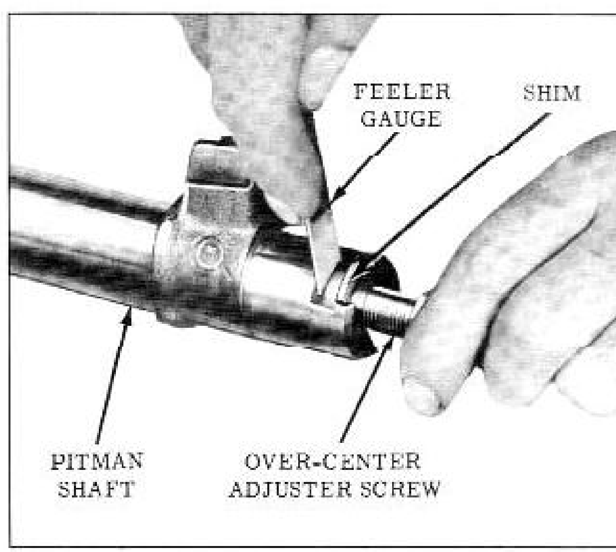

Fig. 4-43 Over-Center Screen Clearance

bearing pre-load adjuster nut. Also apply grease to the worm bearings, pitman shaft bushings, and ball nut teeth.

1. With worm shaft seal, bushings and bearing race installed and ball nut assembly installed on worm shaft, slip upper ball bearing over worm shaft and insert worm shaft and nut assembly into housing, feeding end of shaft through upper ball bearing cup and seal.

2. Place the lower ball bearing in the adjuster cup. IMPORTANT: Adjuster cup threads must be lubricated with grease before threading into housing. Install adjuster and lock nut in lower end of housing.

3. Assemble the over-center adjuster with shim in the slot in the end of the pitman shaft. Check the end clearance which should not be greater than .002" (Fig. 4-43). For the purpose of adjusting this end clearance, a steering gear over-center adjuster shim unit, Part Number 605142, is available. It contains four shims--.063", .065", .067" and .069" thick.

4. After over-center adjuster end clearance has been adjusted, start sector shaft pilot into bushing in side cover. Then, using a screwdriver through the hole in cover, turn lash adjuster in a counterclockwise direction to pull sector shaft pilot into its bushing as far as it will go.

5. Rotate worm shaft by hand until ball nut is about in the center of travel. This is to make sure that the rack and sector will engage properly with center tooth of the sector entering center tooth space of the nut.

6. Place a new gasket on side cover, then push side cover assembly including pitman shaft into place (Fig. 4-28). After making sure there is some lash between rack and sector teeth, assemble and tighten side cover bolts 25 to 35 ft. lbs. Fill gear with S.A.E. 80 Multi-Purpose gear lube to the level of the filler plug hole and replace filler plug.

7. Proceed with bench adjustment.

ADJUSTMENT ON BENCH

Bearing Pre-Load

1. Tighten the worm bearing pre-load adjuster until all worm shaft end play has been removed. Then tighten the lock nut.

2. Install the steering wheel on the worm shaft temporarily. Carefully turn the steering wheel all the way in one direction and then turn back about one turn.

NOTE: USE CARE WHEN PLACING STEERING WHEEL ON LOWER STEERING SHAFT. TAP IN PLACE LIGHTLY. DO NOT FORCE.

3. Using Tool J-544 at right angles to one spoke at wheel rim, measure the pull required to keep the wheel in motion at about one turn from either extreme position. This should be between 1/4 to 3/4 pounds. If necessary, adjust the worm bearing adjuster until proper pull is obtained.

4. Proceed with over-center adjustment.

Over-Center

1. Before making over-center adjustment check the bearing pre-load as outlined above.

2. After checking bearing pre-load, turn the steering wheel from one extreme to the other, counting the number of turns. Then turn the wheel back half the number of turns to center the gear. Move steering wheel about 90° off center.

3. Using Tool J-544, check the pull required at the rim of the steering wheel to move the steering wheel over the center point. The highest reading obtained while pulling the wheel through center should be between 7/8 and 1-1/2 lbs.

4. If necessary to adjust, loosen adjuster lock nut and turn adjuster screw clockwise to loosen or counterclockwise to tighten as required. Retighten lock nut while holding adjuster screw from turning.

5. Recheck over-center adjustment and repeat, if necessary, until proper setting is obtained.

6. When proper adjustment has been obtained, torque lock nut to approximately 10 to 15 ft. lbs. while holding adjuster screw from turning. If adjuster screw does turn, adjustment will not be correct. Recheck adjustment.

STEERING LINKAGE

Fig. 4-44 shows the pitman arm, relay rod, idler arm and bracket, the tie rods and tie rod ends in their respective positions. Condition and proper adjustment of these parts play an important role in the handling and steering ease of the vehicle and in the length of tire life. Poor adjustment of the tie rod ends will cause the toe-in to be off resulting in abnormally fast tire wear. Worn and loose steering linkage parts will cause poor handling and if allowed to become excessively loose, danger of steering failure is eminent. Therefore, periodic inspection of the steering linkage components is important. The component parts should be lubricated with chassis lubricant every 2,000 miles.

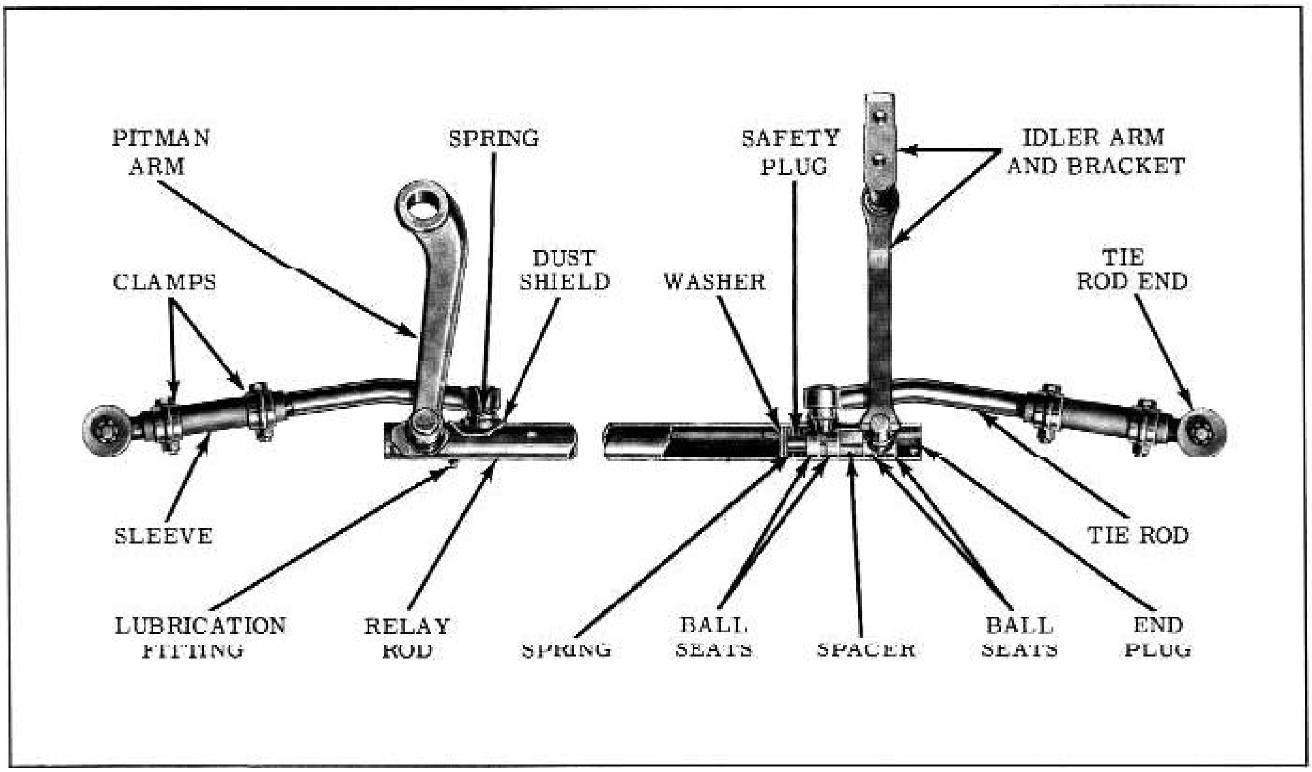

Fig. 4-44 Steering Linkage

PITMAN ARM

Removal

1. The pitman arm (connecting link from steering gear to relay rod) should be removed only after removing the steering gear from the car as outlined under STEERING GEAR REMOVAL on Page 4-12.

2. Place the steering gear in a vise and remove the pitman arm nut and lock washer.

3. Mark pitman shaft and pitman arm with a file.

4. Using Tool J-5504 or a similar puller disengage the pitman arm from the pitman shaft.

Installation

1. Position the pitman arm on the pitman shaft spline with alignment marks matched up.

2. Install the lock washer and nut. Torque the pitman arm nut to 150-180 ft. lbs.

3. Proceed to install gear as outlined under STEERING GEAR INSTALLATION on Page 4-12.

RELAY ROD

Removal

1. Remove the relay rod end plug cotter pins.

2. Remove the two end plugs and grease fittings.

3. Pull relay rod from steering gear pitman arm and the relay rod idler arm.

4. Remove the pitman arm and idler arm ball seats, the ball seat spacer and the tie rod outer ball seats. (Fig. 4-45)

5. Disconnect the relay rod from the tie rods and remove from car.

Installation

1. With the spring seat, safety plug, spring and

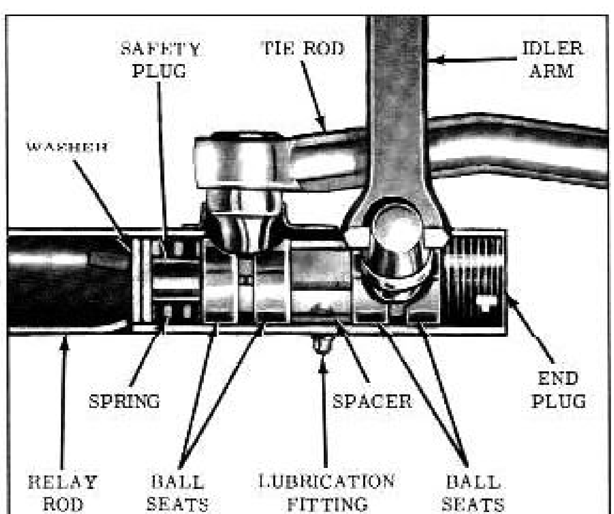

Fig. 4-45 Relay Rod End

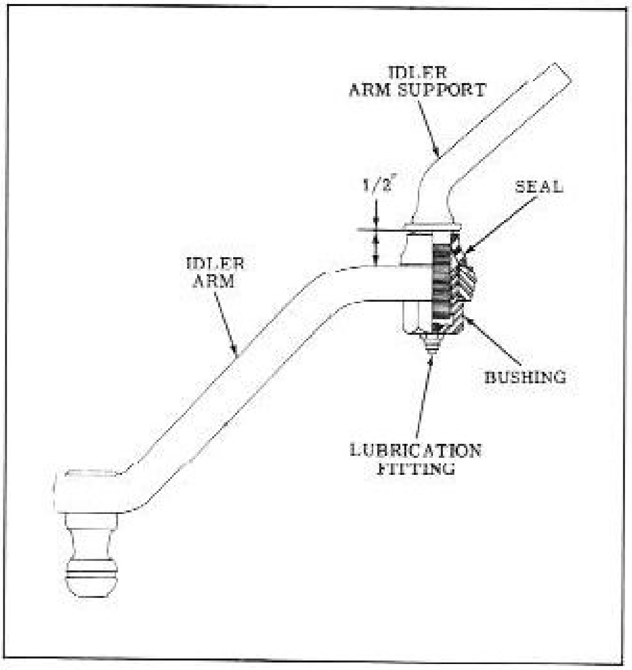

Fig. 4-46 Idler Arm to Support Position

inner ball seat in place, position the tie rod ball stud in the relay rod.

2. Install tie rod ball stud outer seat, the ball seat spacer and the idler arm or pitman arm inner ball seat.

3. Position the relay rod on the pitman arm and idler arm ball studs.

4. Install the outer ball seats.

5. Thread the relay rod end plugs into the relay rod until tight, back off 1/4 - 3/4 turn, and install cotter pin with head to front of car.

6. Lubricate relay rod with chassis grease.

IDLER ARM

Removal

1. To remove the idler arm and support, remove the two idler arm to suspension bar attaching bolts and disassemble the right hand end of the relay rod as outlined under RELAY ROD REMOVAL.

2. To remove the idler arm from the support, remove the bushing assembly from the idler arm and bracket.

Installation

1. If the idler arm has been removed from the support, proceed to install bushing in the idler arm and torque from 110-115 ft. lbs.

2. Thread idler arm support, with seal, into the bushing until the dimension from the upper face of the idler arm and the shoulder of the support is 1/2" as shown in Fig. 4-46. IDLER ARM MUST BE FREE TO ROTATE 90° IN EACH DIRECTION FROM STRAIGHT AHEAD POSITION.

3. Position idler arm and support on suspension bar, install attaching bolts and torque bolts 30-40 ft. lbs.

4. Reassemble the right hand end of relay rod to the idler arm.

5. Lubricate the idler arm bushing and the relay rod with chassis lubricant.

TIE ROD ENDS

Removal

1. Remove the tie rod end to plain arm attaching nut and disconnect the tie rod end from the plain arm.

2. Loosen the outer tie rod sleeve clamp.

3. Thread the tie rod end out of the tie rod sleeve.

Installation

1. Thread new tie rod end into the tie rod sleeve until approximately 1/4 to 3/8" of threads show at each end of tie rod clamp sleeve as shown in Fig. 4-47.

2. Position clamp on the sleeve with the bolt down and tighten clamp bolt. Torque nut 20-25 ft. lbs.

3. Place tie rod end stud in plain arm and install attaching nut. Torque nut 35-50 ft. lbs.

4. Lubricate tie rod with chassis lubricant.

Fig. 4-47 Installing New Tie Rod End

5. Check toe-in and steering wheel alignment and, if necessary, adjust.

PLAIN ARM

Removal

1. Disconnect tie rod end from plain arm.
2. Remove wheel, hub and drum, and two plain arm to steering knuckle attaching bolts.

Installation

1. Position plain arm on steering knuckle and install two attaching bolts. Torque the nuts 55-80 ft. lbs.
2. Attach the tie rod end to the plain arm and torque attaching nut 35-50 ft. lbs.
3. Replace the hub and drum and the wheel assembly. Adjust the front wheel bearing as outlined in Step 5 through 10 under FRONT WHEEL BEARING INSTALLATION on Page 7-12.

DIAGNOSIS OF MANUAL STEERING

EXTERNAL OIL LEAKS (WIPE GEAR THOROUGHLY AND MAKE SURE SOURCE OF LEAKAGE IS DETERMINED)

CAUSE	CORRECTION
1. Pitman shaft seals.	1. Replace seals.

GEAR NOISE (RATTLE 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.
2. Gear loose on cross bar.	2. Check gear to cross bar mounting bolts. Tighten bolts to specification.

EXCESSIVE WHEEL KICK-BACK OR LOOSE STEERING

CAUSE	CORRECTION
1. Lash in steering linkage.	1. Adjust parts affected.
2. Excessive lash between pitman shaft and rack-piston.	2. Make over-center adjustment.
3. Loose thrust bearing adjustment.	3. Remove gear and adjust to specification.

DIAGNOSIS OF MANUAL STEERING (Continued)

HARD STEERING WHEN PARKING

CAUSE	CORRECTION
1. Lack of lubrication in linkage or front suspension.	1. Add lubricant where needed.
2. Tires not properly inflated.	2. Inflate to recommended pressure.

HARD STEERING WHILE DRIVING OR POOR RETURN OF STEERING TO CENTER

CAUSE	CORRECTION
1. Tight steering shaft bearings.	1. Replace bearings.
2. Steering wheel rubbing against turn signal collar.	2. File edges of collar.
3. Steering adjustments tight.	3. Check adjustment by disconnecting pitman arm from gear. Readjust if necessary.
4. Tires not properly inflated.	4. Inflate to specifications.
5. Tight steering linkage.	5. Lubricate or otherwise free up.
6. Tightness of ball joints.	6. Lubricate.
7. Tight over-center adjustment.	7. Adjust in car to specifications.
8. Thrust bearing adjustment too tight.	8. Remove gear and adjust to specifications.
9. Steering shaft rubbing shift tube.	9. Align column.

CAR LEADS TO ONE SIDE OR THE OTHER

CAUSE	CORRECTION
1. Front end misaligned.	1. Adjust to specification.

POWER STEERING

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MAINTENANCE RECOMMENDATIONS

Check pump reservoir fluid level every 2,000 miles.

Inspect hoses and connections for leaks and deterioration at each 2,000 mile lubrication period.

Check steering gear adjustment when looseness is felt in the steering, or tire wear is noted.

DESCRIPTION

The Oldsmobile "F-85" Power Steering system is hydraulic, consisting of a belt driven pump, a rotary valve gear and relay type linkage.

The pump is mounted on a bracket attached to the left front of the engine, and the gear is mounted on the left side of the front cross bar.

The linkage is the same on both power and manual steering equipped cars.

OIL PUMP

Removal

1. Disconnect hoses and cap ends.
2. Remove pump pulley.
3. Remove 2 front pump to bracket nuts and remove belt.
4. Remove rear pump to bracket nut.
5. Remove rear bracket from engine and remove pump.

Installation

1. Place pump loosely in front bracket and place rear bracket in position.
2. Install pump to front bracket nuts. Torque 25-35 ft. lbs.
3. Install pulley, belt, and adjust belt with Tool 33-70.
4. Connect hoses.

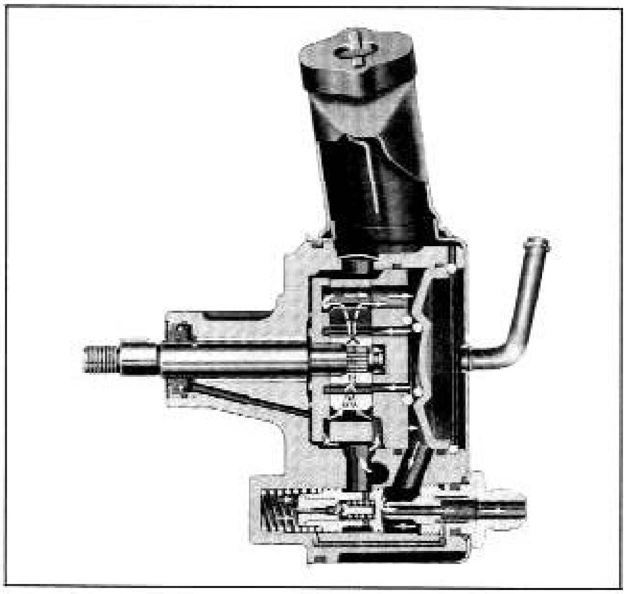


Fig. 4-48 Flow Control Valve - Straight Ahead

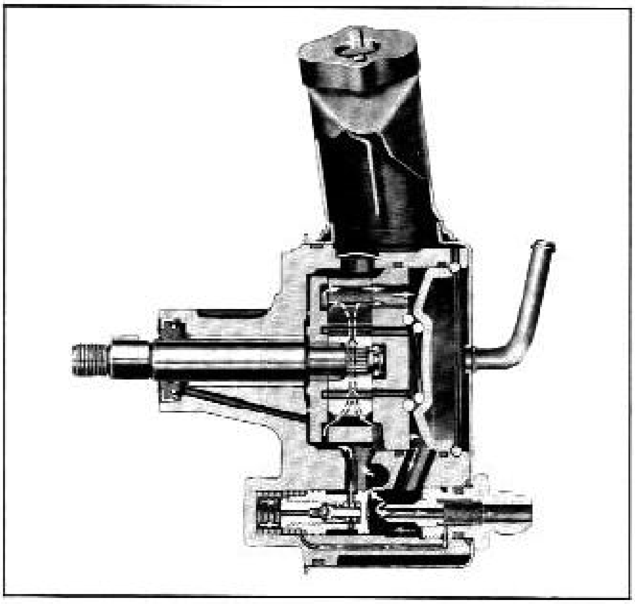


Fig. 4-49 Flow Control Valve - Turning

5. Check fluid level, and bleed system as outlined on Page 4-28.

Disassembly

CAUTION: In clamping pump in vise, be careful not to exert excessive force on front hub of pump as this may distort the bushing.

1. Remove union and seal.
2. Remove pump rear mounting studs. (Fig. 4-50)
3. Remove reservoir from housing by turning counterclockwise until reservoir can be lifted freely from housing.
4. Remove mounting stud "O" rings and union "O" rings.

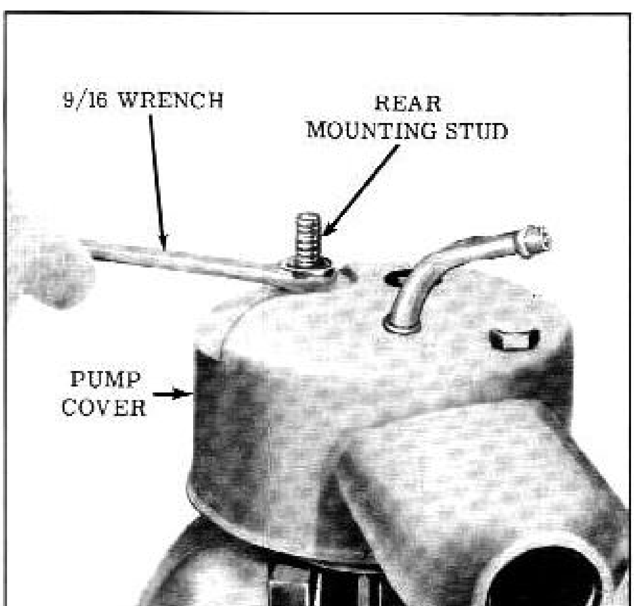


Fig. 4-50 Removing Reservoir

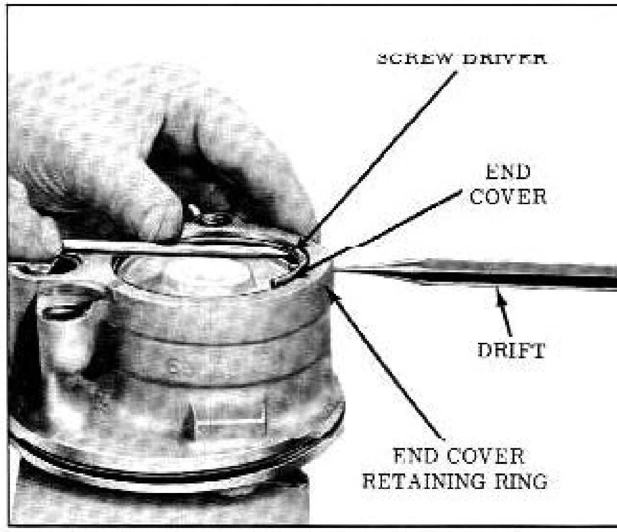


Fig. 4-51 Removing Cover Retainer

5. Rotate retainer ring so that one end is over hole in side of housing. Remove end cover retaining ring using 1/8 diameter hole in pump housing. When ring is in depressed position, remove as shown with screw driver. (Fig. 4-51)
6. Remove end cover. The end cover is spring loaded and will generally be above the housing level. If sticking should occur, a slight rocking action will free the cover.
7. Remove end cover "O" ring.
8. With pump housing turned over, tap housing on wood block until pressure plate falls free. (Fig. 4-52) Flow control valve will come out also.
9. Remove pressure plate, pump ring and vanes, being careful not to drop parts. (Fig. 4-53)

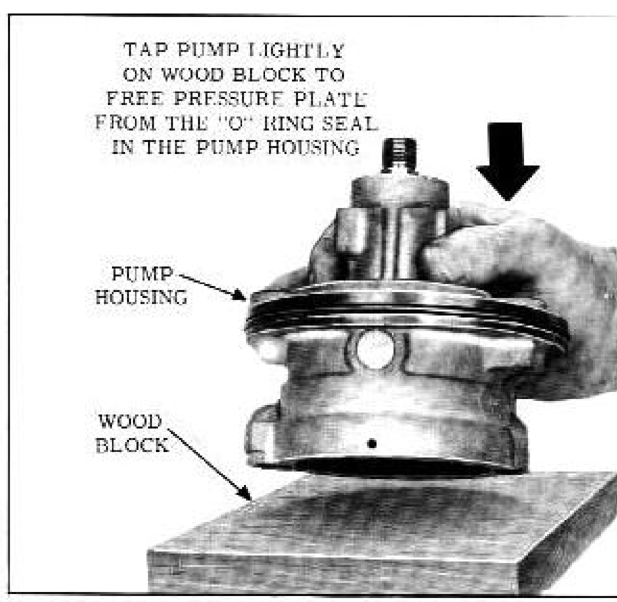


Fig. 4-52 Removing Pressure Plate

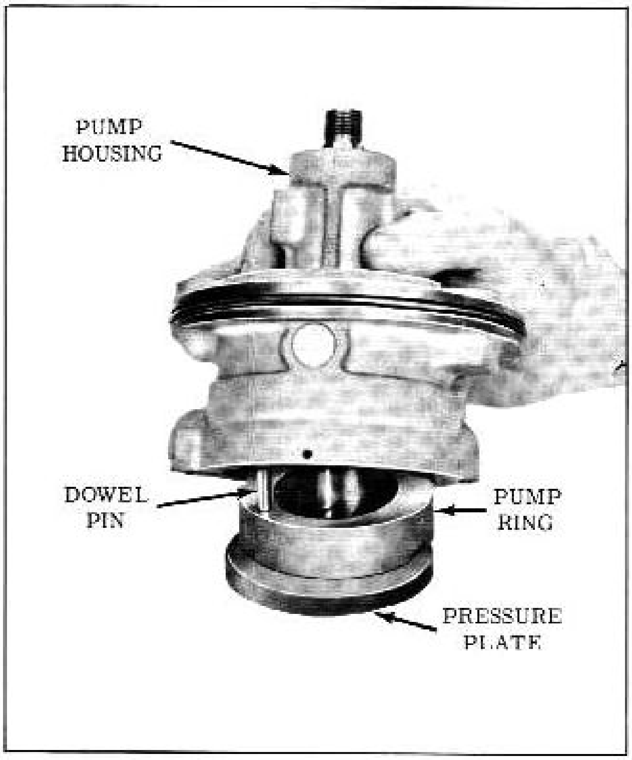


Fig. 4-53 Removing Pump Ring and Vanes

10. Remount housing in vise and, using a suitable tool, remove snap ring on end of drive shaft. (Fig. 4-54)
11. Remove rotor and thrust plate. (Fig. 4-55)
12. Remove shaft through front of housing. (Fig. 4-56)
13. From the rear of the housing, drive the seal out the front with a small punch.

Cleaning

"O" rings should be replaced and the pump seal should not be cleaned in solvent.

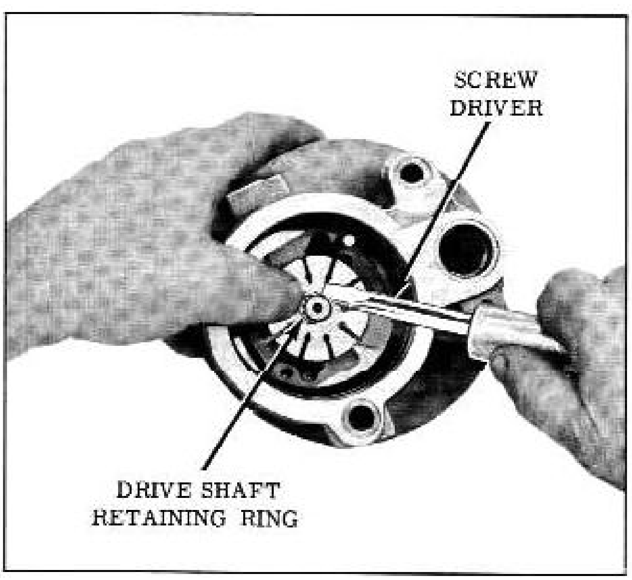


Fig. 4-54 Removing Snap Ring

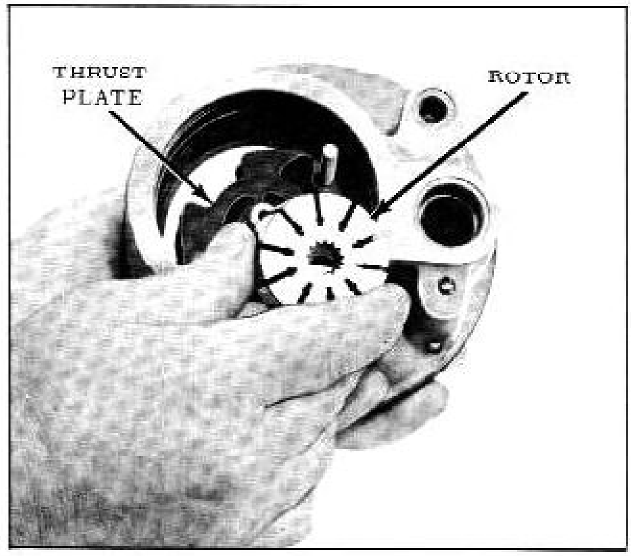


Fig. 4-55 Removing Rotor and Thrust Plate

Carefully clean all other parts in cleaning solvent. Lubricate new "O" ring seals and the drive shaft seal with petrolatum and install in proper location

Assembly

All parts must be clean during reassembly.

1. Insert shaft at hub end of housing, spline end entering mounting face side. (Fig. 4-58)
2. Insert dowels in holes in body. Install thrust plate on dowel pins with ported face to rear of pump housing. (Fig. 4-59)
3. Install rotor and be sure splines are free on pump shaft.

   NOTE: Assemble rotor with countersunk side toward shaft.

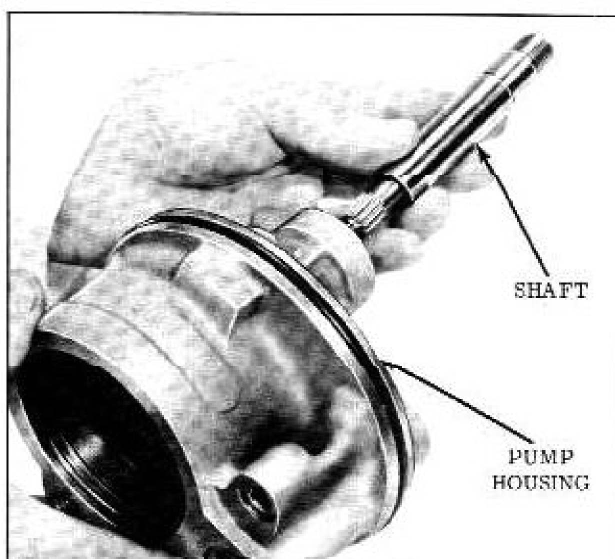


Fig. 4-56 Removing Shaft

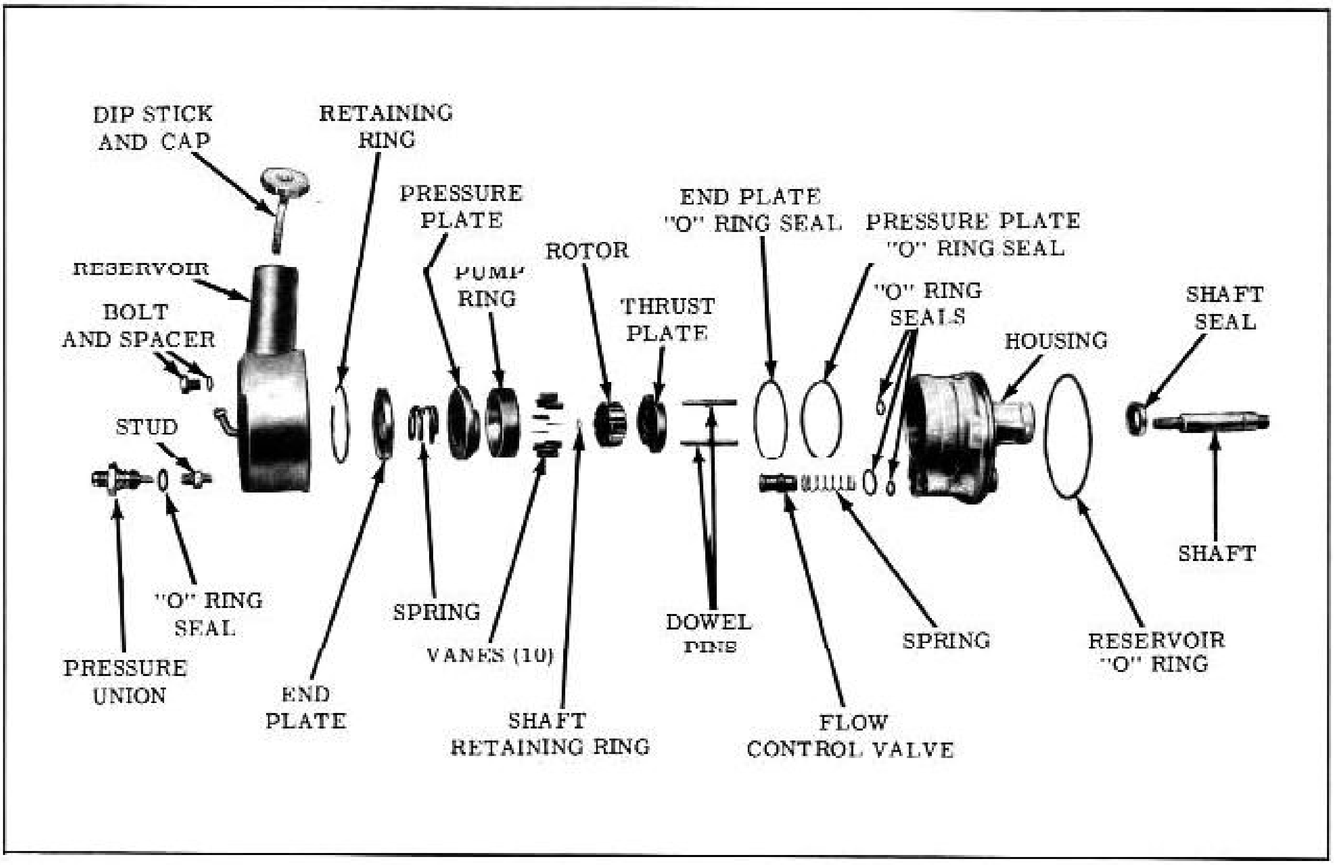


Fig. 4-57 Pump Assembly

4. Using a suitable tool, install shaft retaining ring. (Fig. 4-60)

5. Install pump ring on dowel pins with direction of rotation arrow to the rear of the pump housing. (Fig. 4-61) Rotation is clockwise.

6. Install vanes in rotor slots with radius edge towards outside as shown in Fig. 4-62.

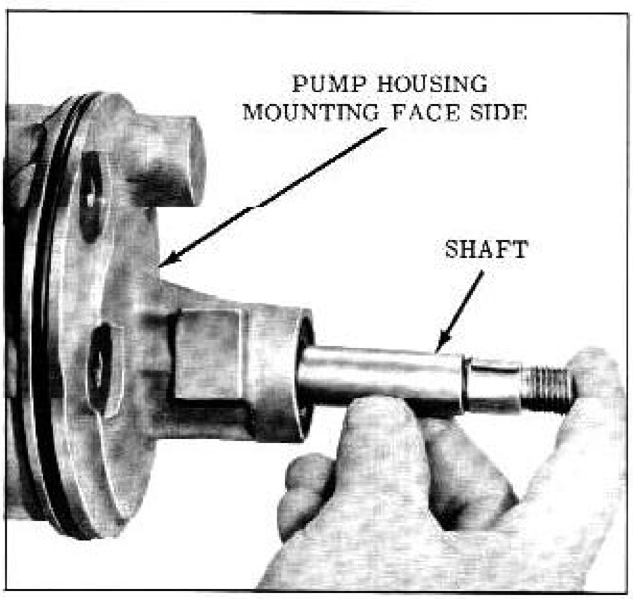


Fig. 4-58 Installing Shaft

7. Lubricate outside diameter and chamfer of pressure plate with petrolatum to insure against damaging "O" ring and install on dowel pins with ported face toward the pump ring. Using a 2-5/8 diameter tube to apply pressure to outer edge only, seat pressure plate by means of pressure on the sleeve with the use of an arbor press. Never press or hammer on the center of the pressure plate as this may cause permanent distortion with

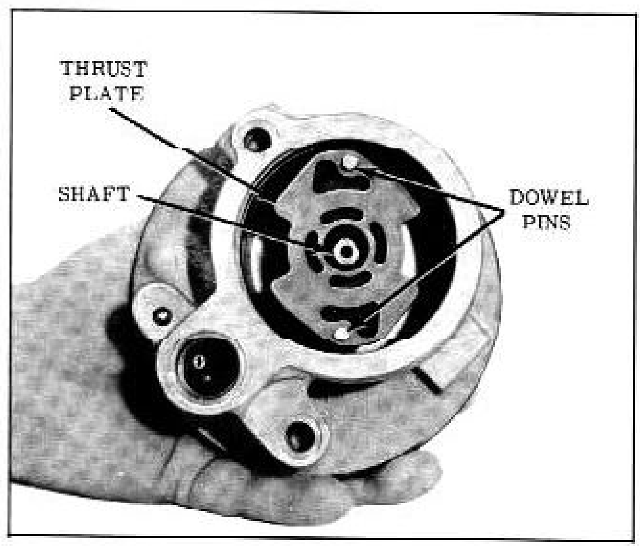


Fig. 4-59 Installing Dowel Pins

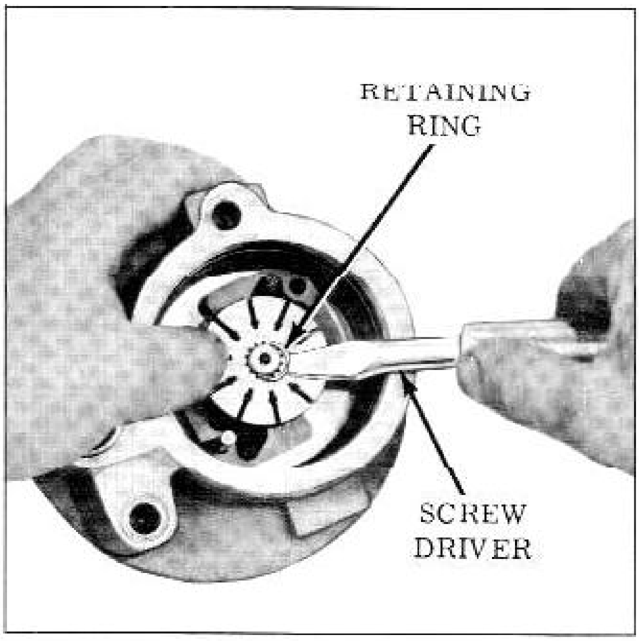


Fig. 4-60 Installing Rotor Snap Ring

resulting pump failure. (Pressure plate will travel about 1/16" to seat) (Fig. 4-63)

8. Install end plate "O" ring, in second groove.
9. Install pressure plate spring in recess of pressure plate. (Fig. 4-64)
10. Inspect outer edge of end cover and remove any nicks. Lubricate outside diameter and chamfer of end cover with petrolatum to insure against damaging "O" ring and install in housing using an arbor press.
11. Install end cover retaining ring while pump is in arbor press. Be sure it is completely seated in the groove of the housing.

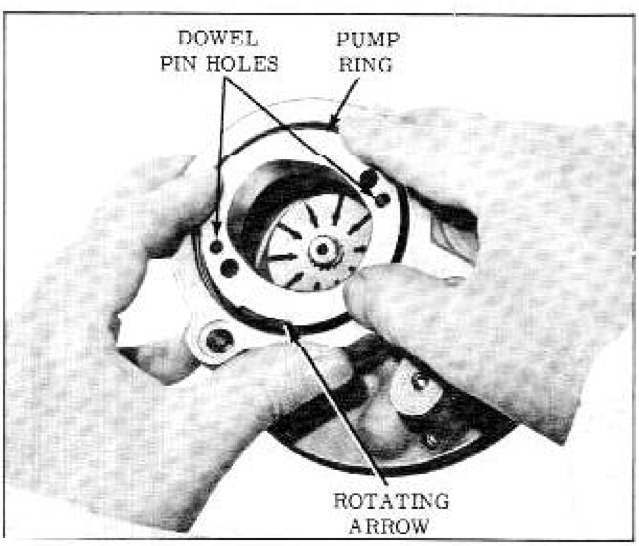


Fig. 4-61 Installing Pump Ring

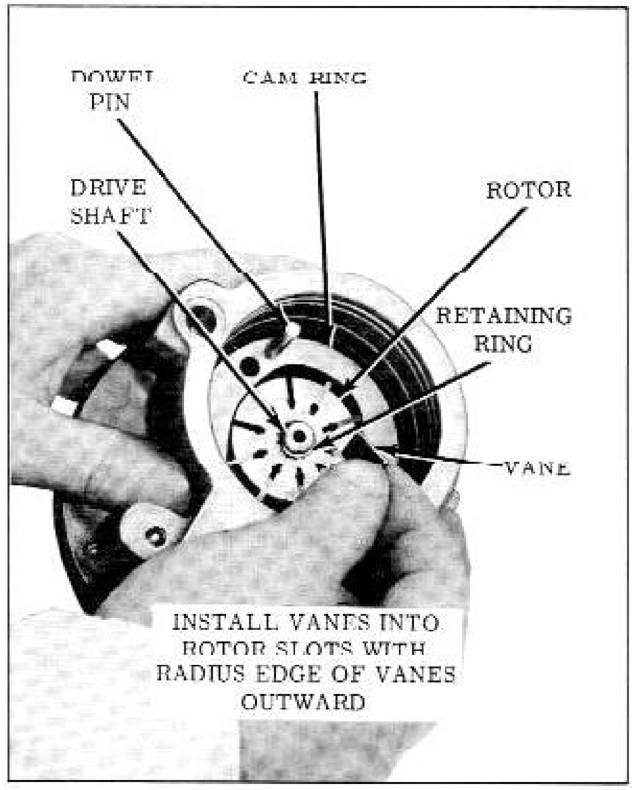


Fig. 4-62 Installing Vanes

12. Place two reservoir bolts and one flow control valve "O" ring in position.
13. Position reservoir cover on housing.

    NOTE: Reservoir must be seated before studs are installed.

14. Install reservoir studs, torque 25-30 ft. lbs., flow control spring and plunger with hex end in spring.
15. Carefully position new seal over shaft and install with tool J-8818 until front edge of seal is flush with front edge of seal bore.

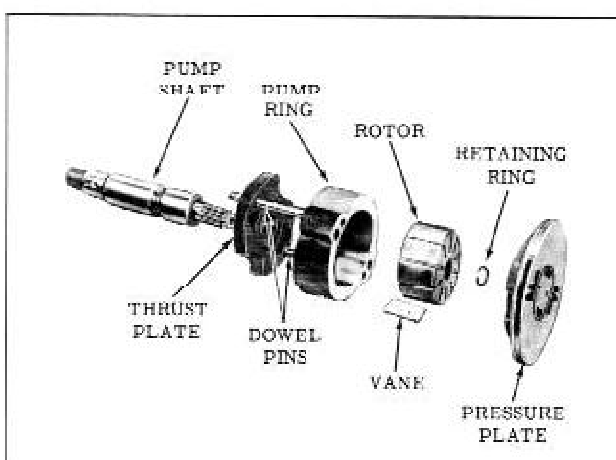


Fig. 4-63 Shaft and Rotor Assembly

Fig. 4-64 Installing Cover

15. Install union and drive shaft key. Torque to 20 ft. lbs.

    NOTE: End play in pump shaft is permissible if not over 1/32".

BELT ADJUSTMENT

1. Loosen power steering bracket to power steering pump attaching bolts.
2. Adjust belt with Tool 33-70 and tighten nuts.

BLEEDING HYDRAULIC SYSTEM

1. Fill oil reservoir to proper level and let oil remain undisturbed for at least two minutes.
2. Start engine and run at idle for approximately 10 seconds.
3. Add oil if necessary.

   IMPORTANT: OIL LEVEL MUST BE AT MAXIMUM AT ALL TIMES.

4. Raise front end of vehicle so that the wheels are off the ground.
5. Increase engine speed to approximately 1500 r.p.m.
6. Turn the wheels right and left, lightly contacting the stops.
7. Lower the car and turn wheels right and left, on the ground.
8. Check oil level and refill as required.
9. Continue this process as long as required to bleed all air out of the system (until oil in reservoir is clear and shows no foam).

HOSES

The power steering hoses may be replaced individually as necessary.

They should be inspected at each lubrication for deterioration and leaks.

When installing hoses, care must be taken not to cross threads on pump union or in gear. It will be necessary to check fluid level after installation and bleed system as outlined on Page 4-28.

HOSE CONNECTORS

Removal

If the hose connections were leaking at the connector seats in the housing, remove one or both connector seats as follows:

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 3 turns. (Fig. 4-65)
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.

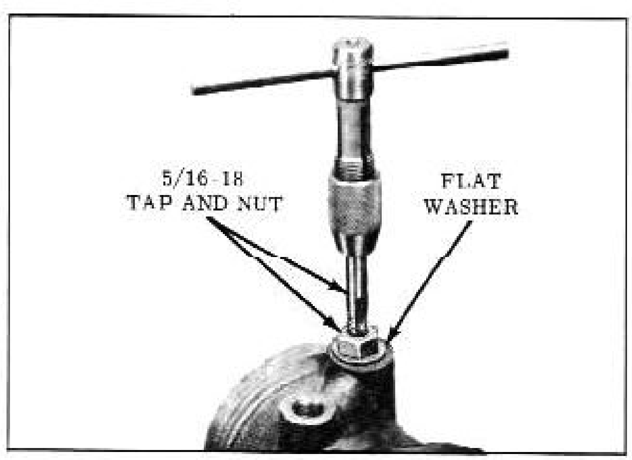


Fig. 4-65 Removing Hose Connector

Installation

To install a new connector seat, low pressure only, use Tool J-6217 to seat it in the housing. (Fig. 4-66) For high pressure seat start in housing with a brass drift, then seat with hose by threading hose nut into housing. Do not use Tool J-6217 on high pressure side as it will hit check valve before connector is seated.

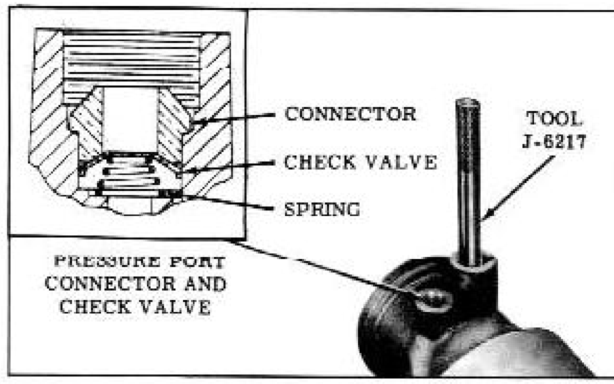


Fig. 4-66 Installing Hose Connector

GEAR

DESCRIPTION (Fig. 4-67)

The rotary valve type power steering gear used on 1961 Oldsmobile is compactly designed with the steering shaft, control valve, worm, rack-piston and power cylinder all in line. All oil passages are internal.

The outer race for the recirculating balls in the steering gear is an integral part of the rack-piston rather than being a separate ball nut.

When effort is not being applied at the steering wheel, the spool valve and valve body automatically center themselves resulting in a neutral condition with all passages open so only a low neutralizing oil pressure exists.

Only a small amount of movement of the steering wheel is required to actuate the control valve for power assist.

Power assist is obtained by a delay in the radial movement of the valve body in relation to

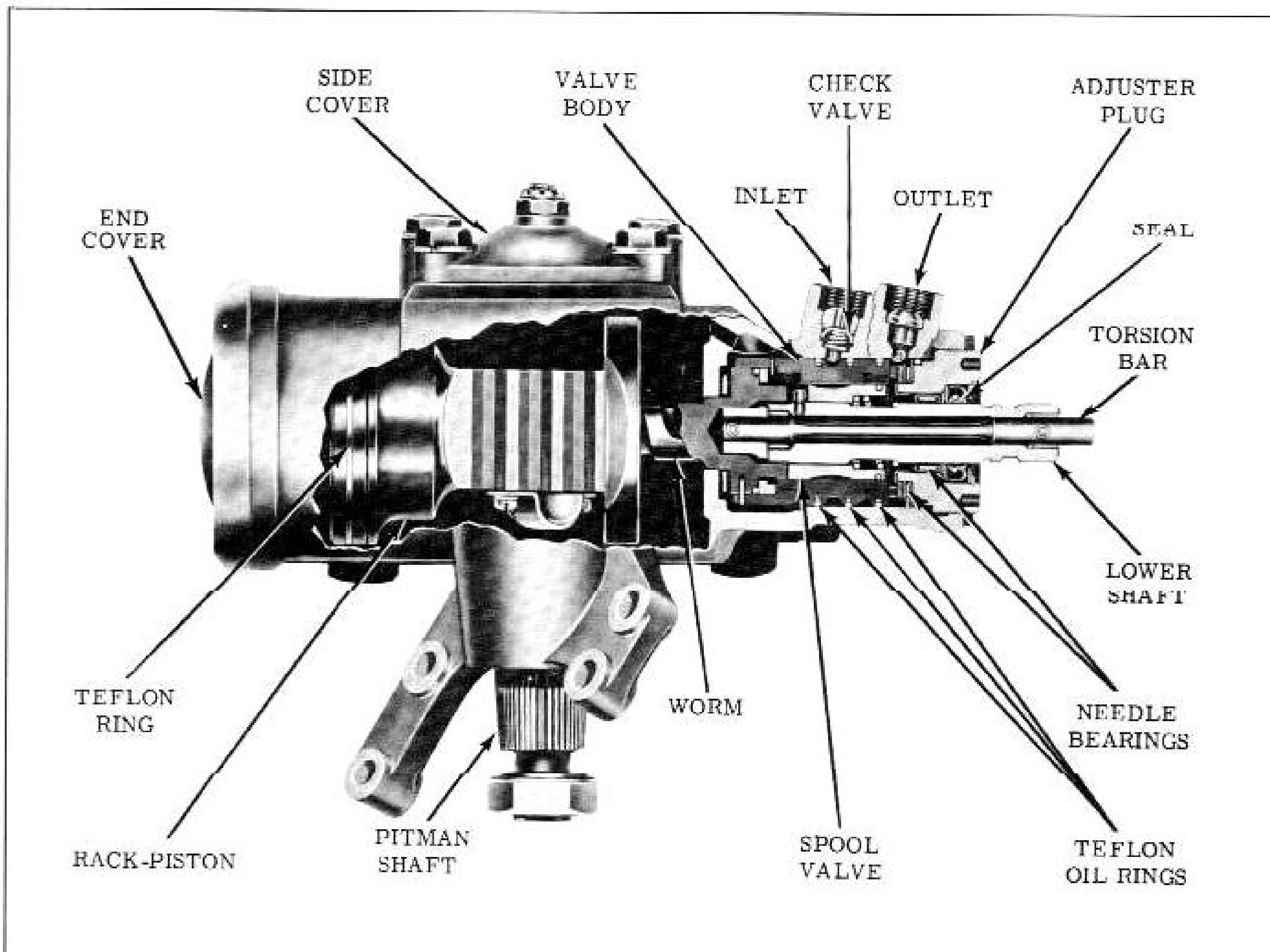


Fig. 4-67 Power Steering Gear

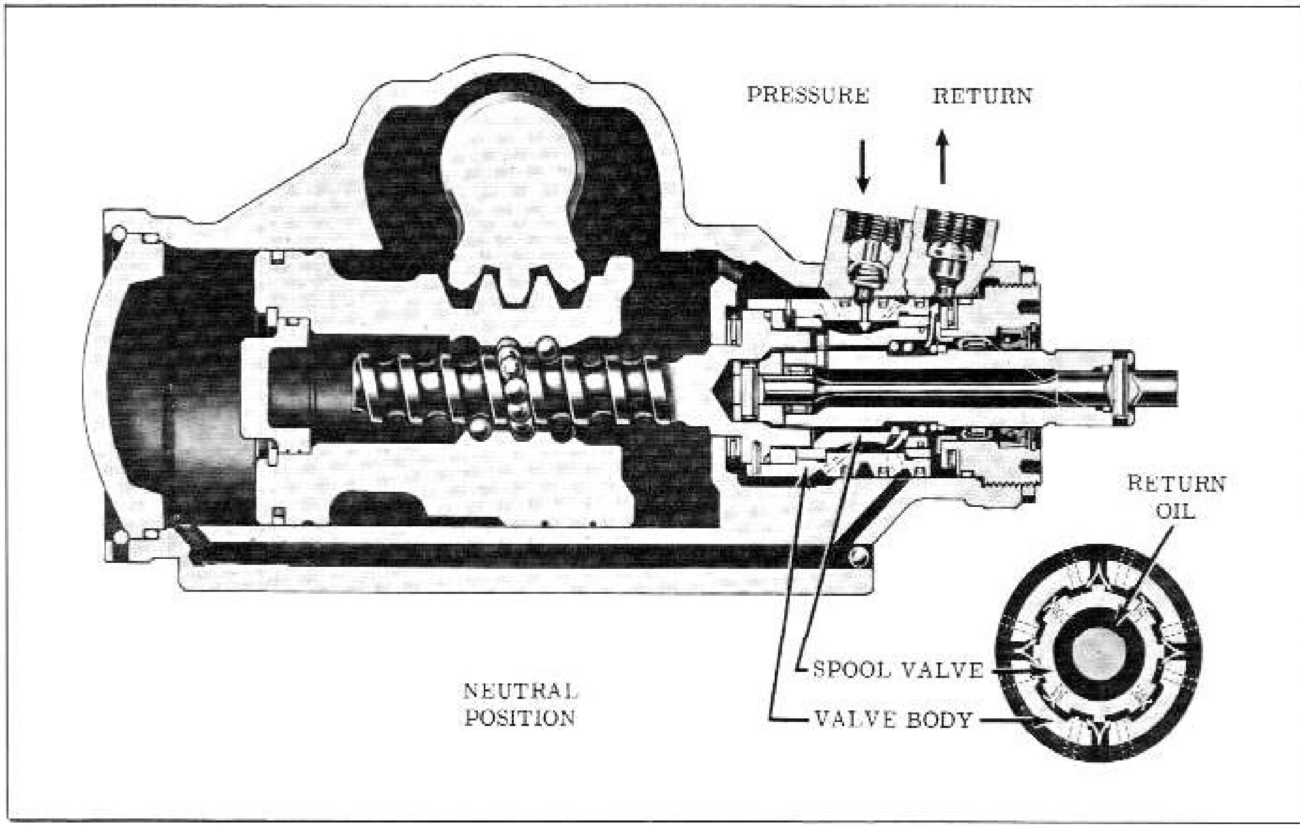


Fig. 4-68 Neutral (Straight Ahead Position)

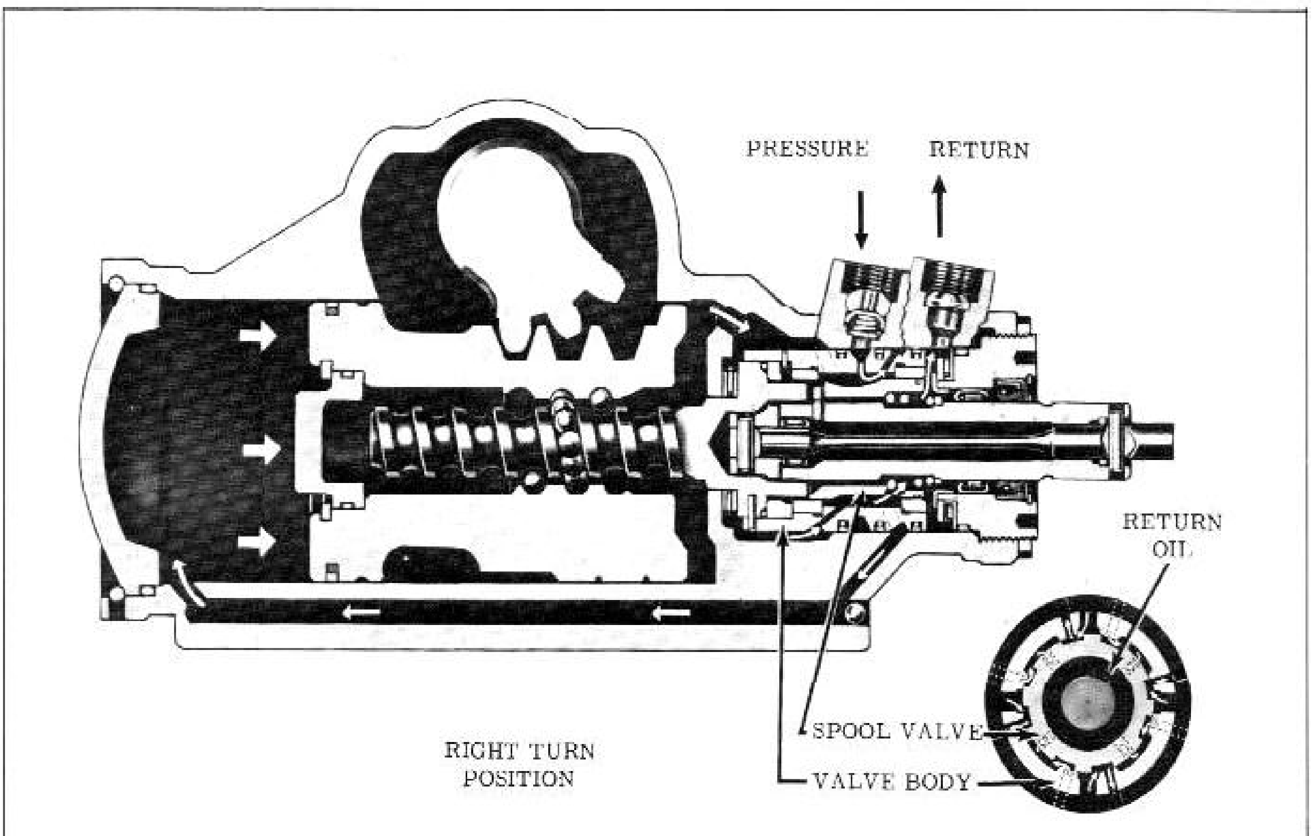


Fig. 4-69 Right Turn Position

the radial movement of the spool valve and is accomplished as follows:

Effort applied at the steering wheel is transferred through the steering shaft, flexible coupling to the lower shaft. The spool valve (pinned to the lower shaft) turns with the lower shaft. The upper end of the torsion bar (pinned to the lower shaft) also turns at the same rate as the lower shaft. The lower end of the torsion bar is pinned to the cap which in turn, is connected to the worm by 2 lugs. The worm resists turning due to the resistance of the front wheels, therefore, the valve body which is connected to the cap also remains stationary. With the worm and valve body held stationary and the lower shaft and spool valve turning a slight amount, the torsion bar will twist to allow the slots in the spool valve to align with the passages in the valve body to direct oil for power assist.

OPERATION

NEUTRAL (STRAIGHT AHEAD POSITION) (Fig. 4-68)

When turning effort is not being applied at the steering wheel, the slots in the spool valve are 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. 4-69)

When the steering wheel is turned 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 100 p.s.i. except when turning corners where it does not ordinarily exceed 400 p.s.i. Oil pressure when parking ranges from 800 to 900 p.s.i. 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 hydraulically dampens the shock transmitted to the steering gear when driving on washboard roads.

LEFT TURN (Fig. 4-70)

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.

Adjustments (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 preload.

1. Disconnect the pitman arm from the relay rod.

2. Loosen the pitman shaft adjusting screw lock nut 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.

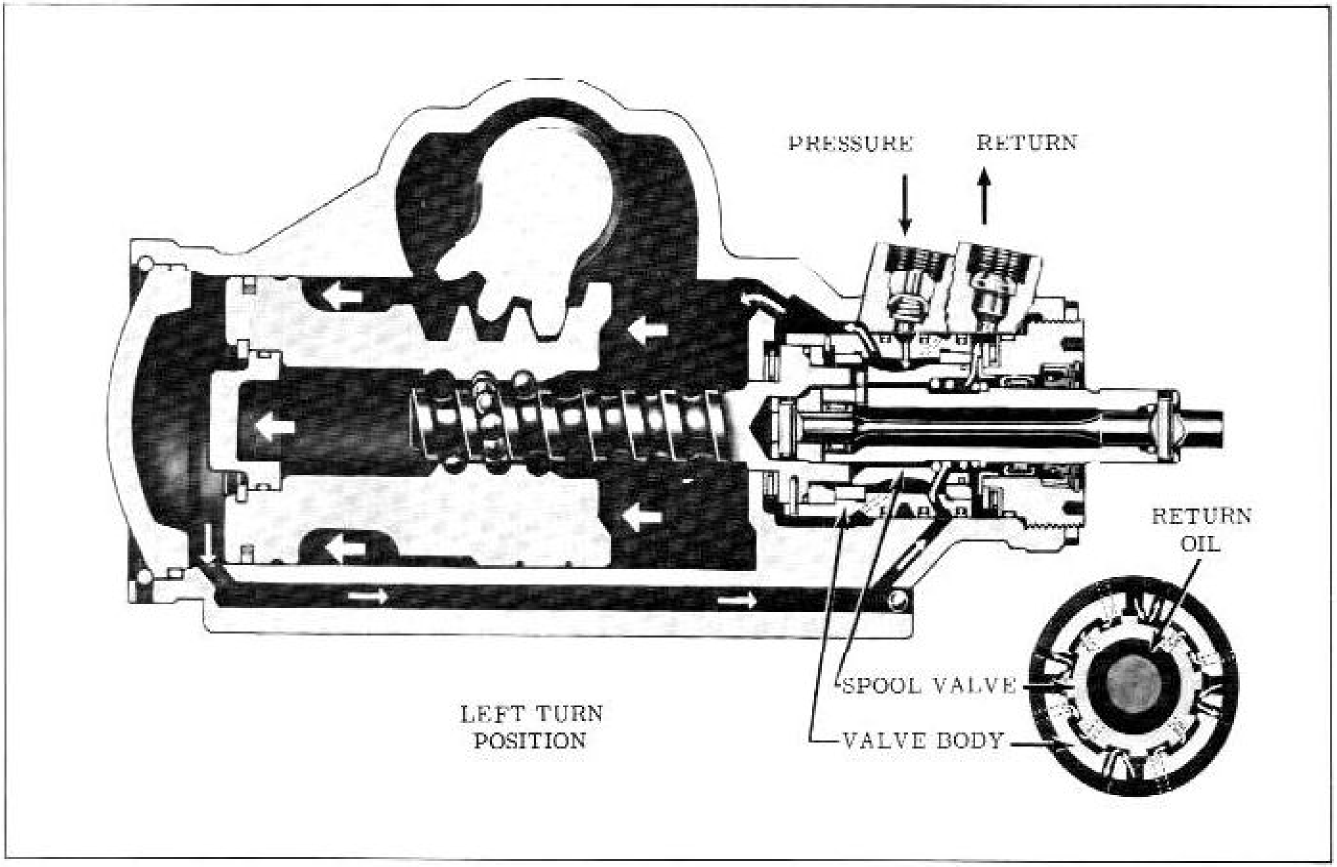


Fig. 4-70 Left Turn Position

4. Turn the steering wheel through its full travel, then locate the wheel at its center of travel.

5. Check the combined ball and thrust bearing preload with an inch-pound torque wrench on the steering shaft nut by rotating through the center of travel. (Approximately 1/4 turn in each direction.) Note the highest reading.

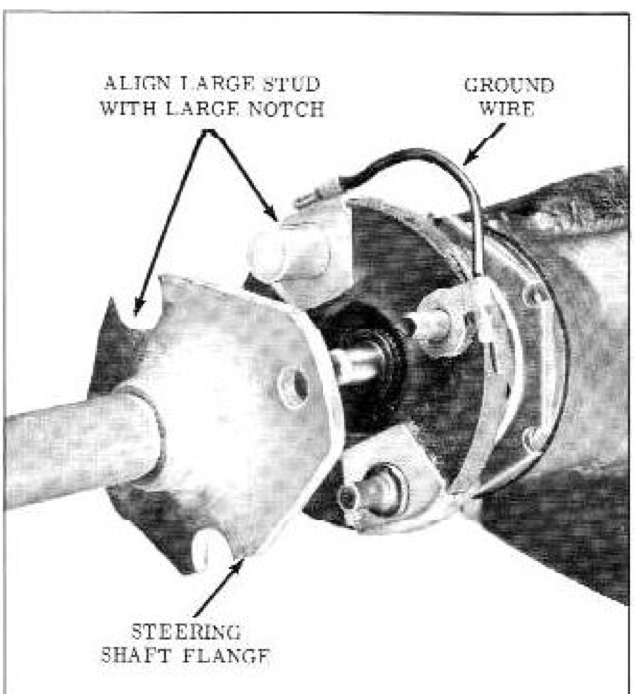


Fig. 4-71 Flexible Coupling

6. Tighten the pitman shaft adjusting screw until the torque wrench reads 3 to 6 in. lbs. higher and the total preload not over 14 in. lbs.

7. While holding the pitman shaft adjusting screw, tighten the lock nut and recheck the adjustment.

8. Install the horn button or ornament and connect the horn wire. Connect the relay rod to the pitman arm.

Removal

1. Remove the two coupling flange attaching nuts and lock washers. Remove ground wire from flange attaching bolt. (Fig. 4-71)

2. Disconnect the hoses from the pump and gear. Cap the pump, hose fittings and gear connectors.

3. Raise steering shaft up as outlined in steps 1-8 of "MANUAL STEERING COUPLING REMOVAL," Page 4-5.

4. Hoist car and disconnect the pitman arm from the relay rod.

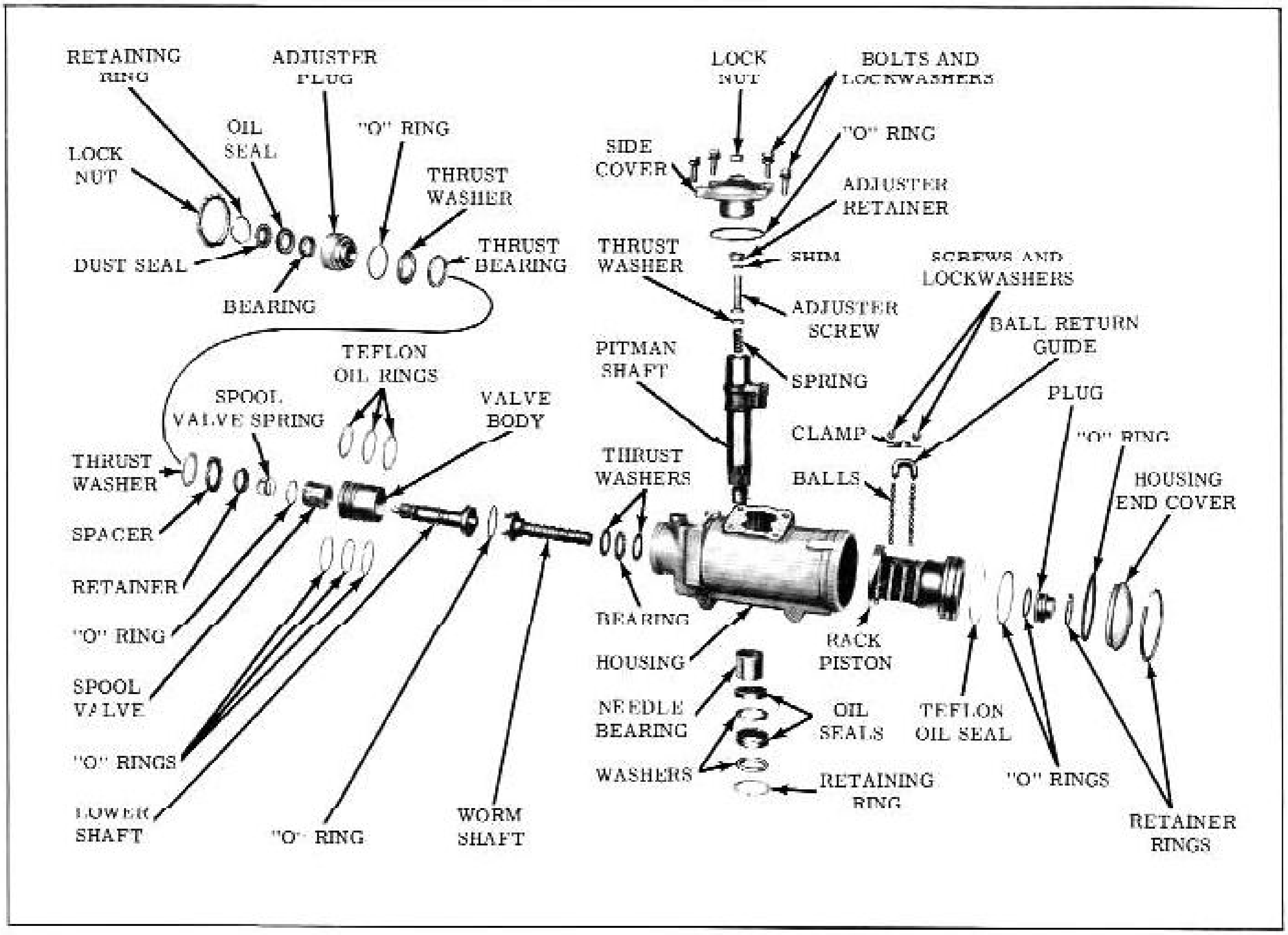


Fig. 4-72 Power Steering Gear

5. Remove the 4 bolts attaching the gear to the front suspension cross bar, then remove the coupling from the gear.

Installation

1. Check pitman arm to shaft nut, torque 150-180 ft. lbs.
2. Apply a sodium soap fine fiber grease to gear mounting to prevent squeaks.
3. Install gear and tighten nuts 45-60 ft. lbs.
4. Lower steering shaft, and attach to coupling on gear. Reassemble steering shaft to column at upper end.
5. Connect hoses, check fluid level and bleed system. (Page 4-28)

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 following procedure outlines the disassembly of the gear, then the disassembly of the individual components.

1. Rotate end cover retainer 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. 4-73)

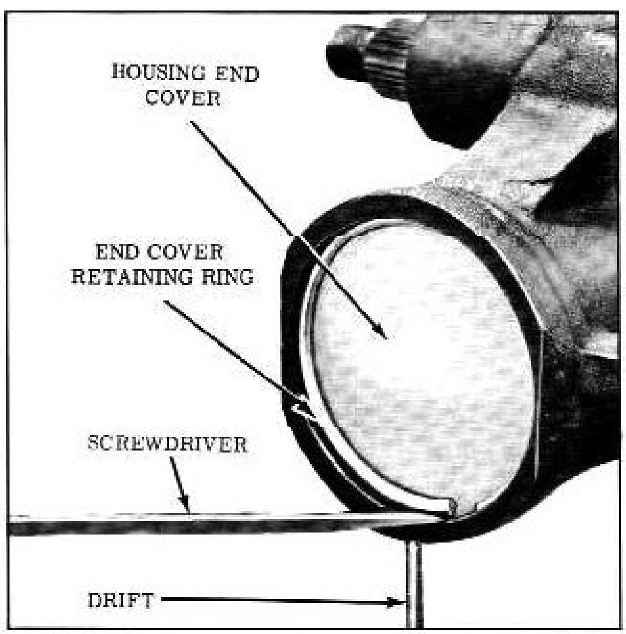


Fig. 4-73 Removing End Cover Retaining Ring

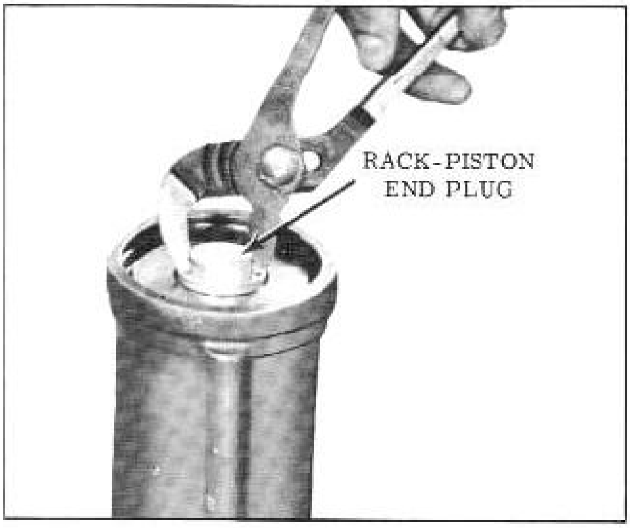


Fig. 4-74 Removing End Plug

2. Turn the 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 retaining ring using internal pliers, then pull the plug from rack-piston as shown in Fig. 4-74. Remove "O" ring from plug and discard.

4. Remove the pitman shaft and side cover as follows:

   a. Loosen the over-center adjusting screw lock nut and remove the 4 side cover attaching bolts and lock washers.

   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.

Fig. 4-75 Removing Rack Piston

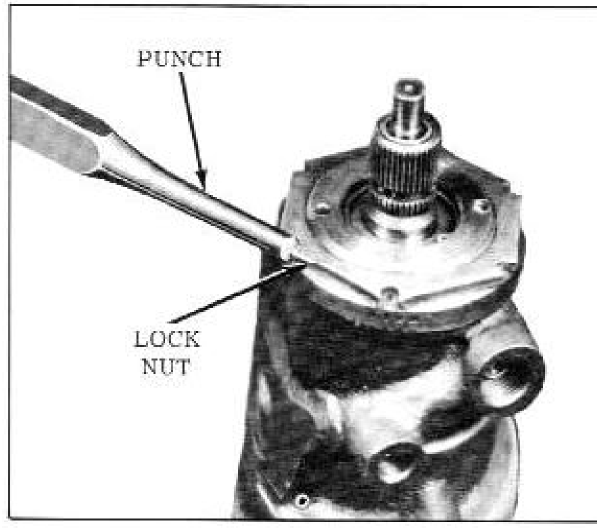


Fig. 4-76 Removing Lock Nut

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. 4-75) Turn coupling flange 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. Remove coupling flange attaching bolt and flange.

   b. Loosen the adjuster plug lock nut with punch. (Fig. 4-76)

   c. Remove adjuster plug assembly with Spanner Wrench J-7624. (Fig. 4-77) Remove and discard the plug "O" ring.

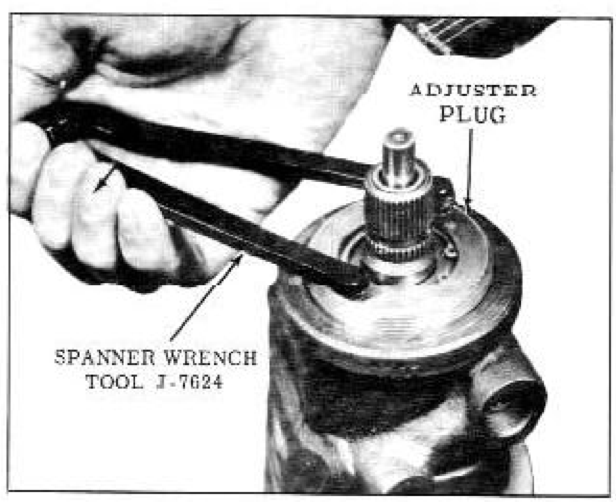


Fig. 4-77 Removing Adjuster Plug

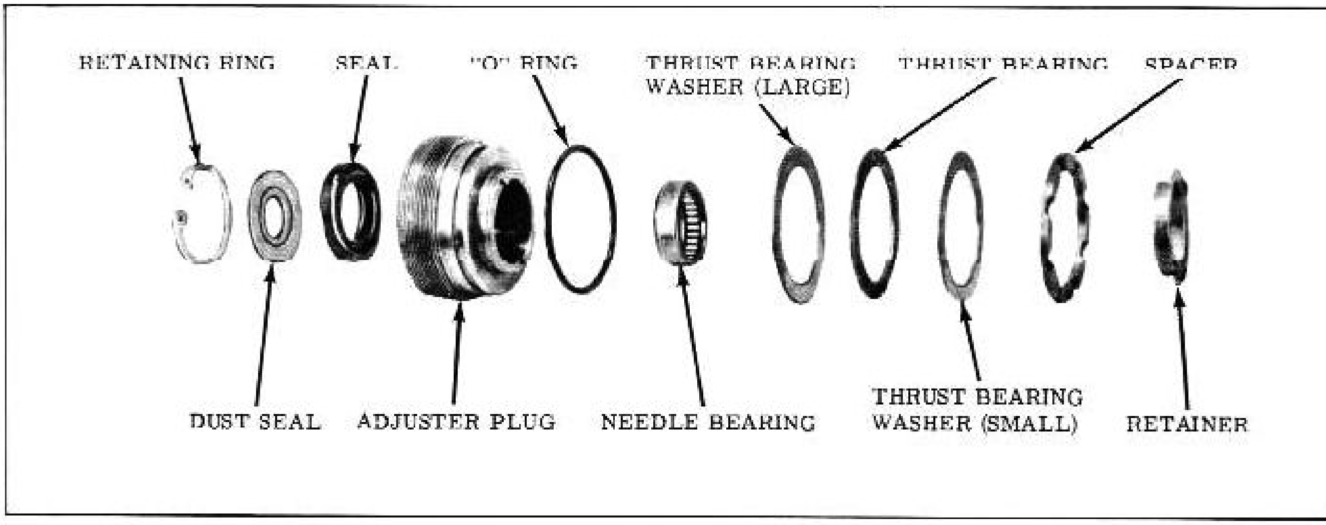


Fig. 4-78 Adjuster Plug Assembly

7. Grasp the lower shaft and pull the valve and shaft assembly from the housing bore. Seperate worm and shaft and remove the lower shaft cap "O" ring and discard.

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

Disassembly

1. 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. (Fig. 4-78)

2. Remove the thrust bearing retainer by prying at the two raised areas with an awl or small screw driver, remove the spacer, thrust bearing washer, thrust bearing and washer. (Fig. 4-79)

3. If the needle bearing is to be replaced, remove the retaining ring using internal pliers, then drive the dust seal, seal and bearing from the adjuster plug with Tool J-5254. (Fig. 4-80)

4. Wash all parts in clean solvent and dry parts with compressed air.

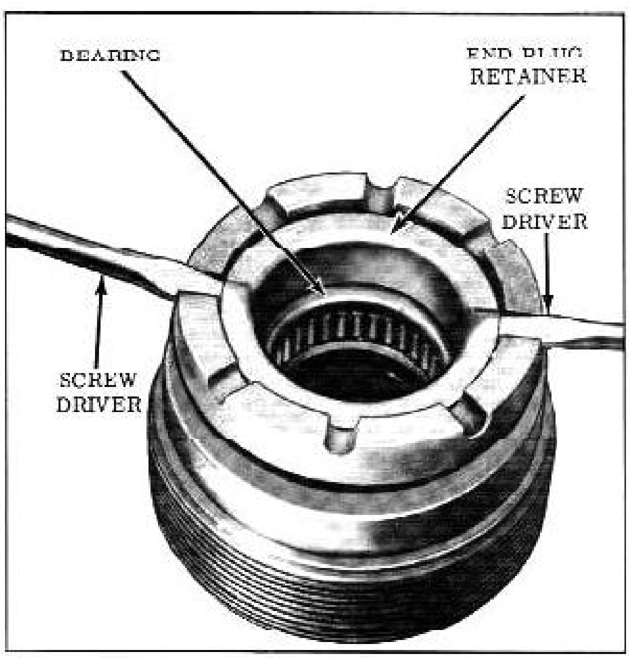


Fig. 4-79 Removing Retainer

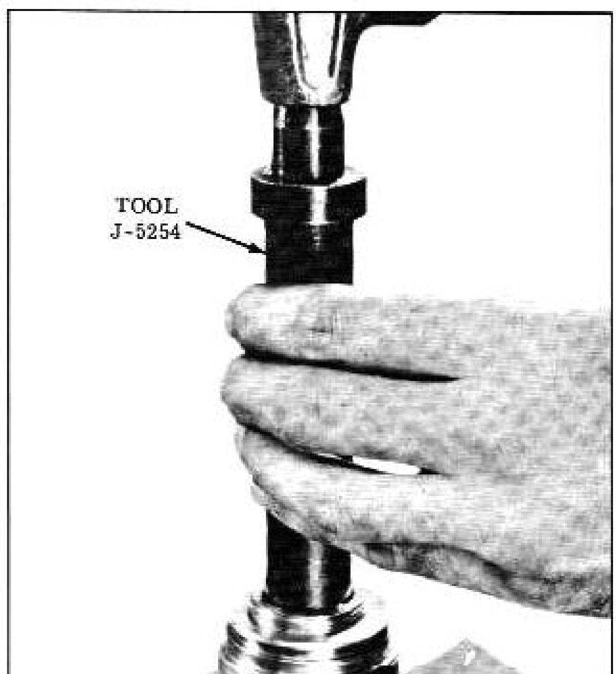


Fig. 4-80 Removing Bearing

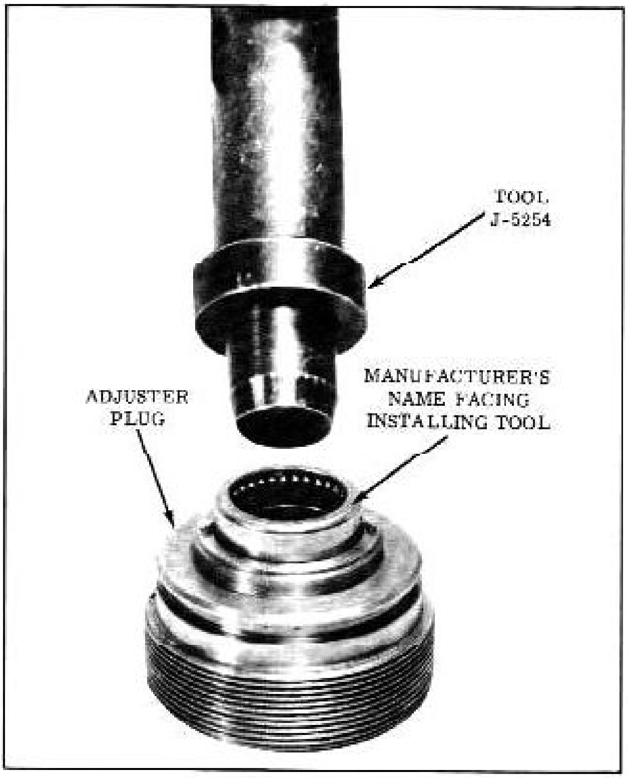


Fig. 4-81 Installing Bearing

5. Inspect thrust bearing spacer for wear or cracks. Replace if damaged.

6. Inspect thrust bearing rollers and washers for wear, pitting or scores. If any of these conditions exists, replace the bearing and washers.

Assembly

1. If the needle bearing was removed, place new needle bearing over Tool J-5254 with the bearing manufacturer's identification against the tool and drive or press bearing until it is flush with the surface of the seal bore. (Fig. 4-81)

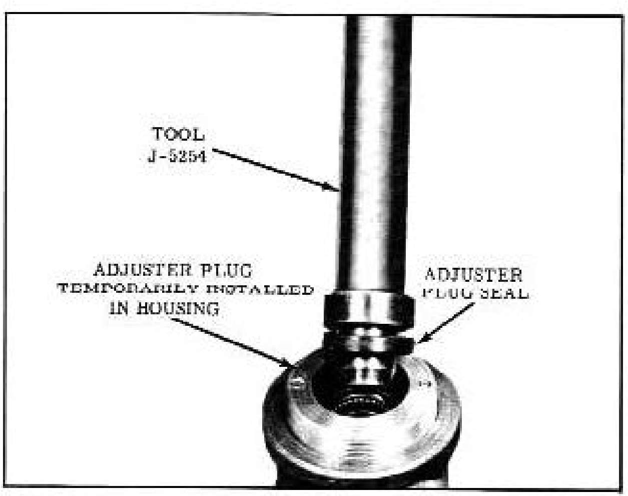


Fig. 4-82 Installing Seal

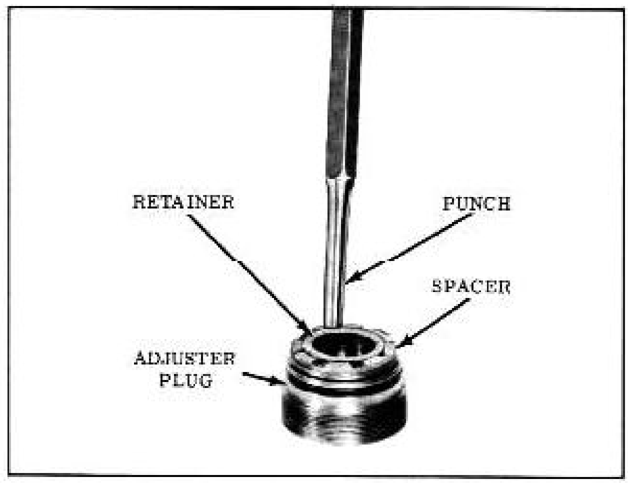


Fig. 4-83 Installing Retainer

2. 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 Hydra-Matic oil and drive or press seal into adjuster plug until seated. (Fig. 4-82) Tool J-5254 must be free of burrs that could scratch the seal.

3. Install retaining ring with internal pliers, then remove the adjuster plug from the housing.

4. Lubricate the thrust bearing assembly with Hydra-Matic oil. 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. 4-83)

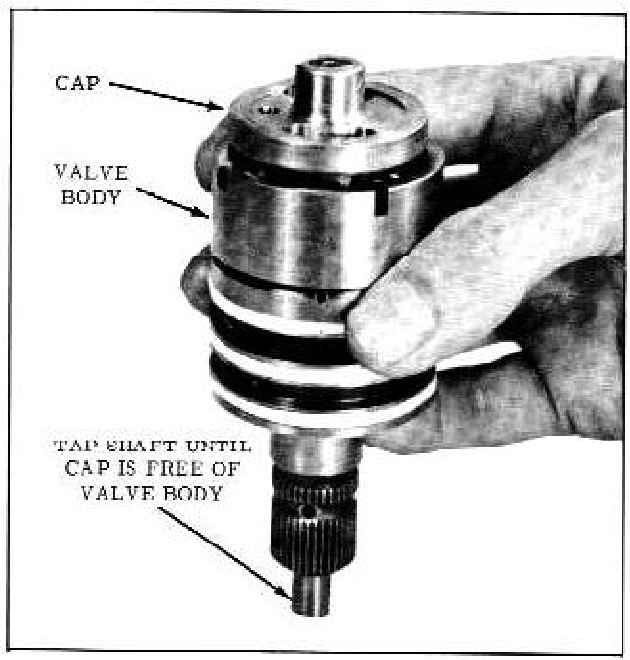


Fig. 4-84 Removing Lower Shaft

NOTE: The projections must not extend beyond the spacer when the retainer is seated. The spacer must be free to rotate.

Valve and Lower Shaft Assembly

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. Be careful not to distort spring.

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. 4-84) 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. 4-85) If the spool valve becomes cocked, carefully realign the spool valve then remove.

4. Remove the dampener "O" ring from the spool valve and discard.

5. If the teflon oil rings are to be replaced, cut the 3 teflon oil rings and "O" rings from the valve body and discard.

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 outside diameter of the spool valve and the inside diameter 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

1. If valve body "O" rings and teflon rings were removed, install "O" rings in the oil ring grooves and lubricate with Hydra-Matic oil.

2. Lubricate the 3 teflon oil rings with petrolatum and install in grooves over "O" rings.

   NOTE: The teflon 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 and is seated. (Fig. 4-86)

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.

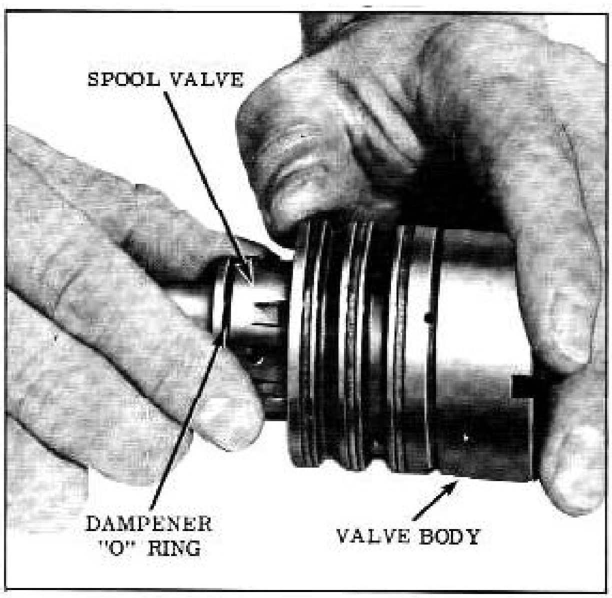


Fig. 4-85 Removing Spool Valve

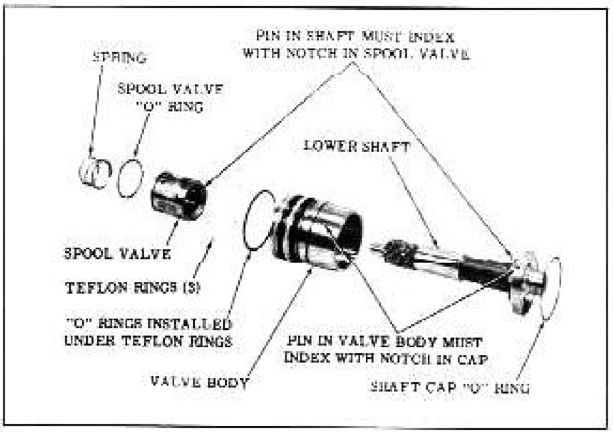


Fig. 4-86 Valve and Shaft Assembly

(Notch in spool towards the valve body). Rotate the spool valve while pushing valve into valve body to align notch in spool with the pin in the lower shaft. (Fig. 4-86)

c. Carefully press spool valve into body, engaging notch on pin. Extreme care must be taken, not to cut "O" ring. The spool valve is properly seated when it is flush with the top of valve body.

5. Place a piece of shim stock over the shaft to protect the seal surface.

6. 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. (Fig. 4-87)

Pitman Shaft and Side Cover Assembly

Disassembly

Remove the lock nut and side cover from the adjusting screw. Do not attempt to disassemble pitman shaft. Discard lock nut.

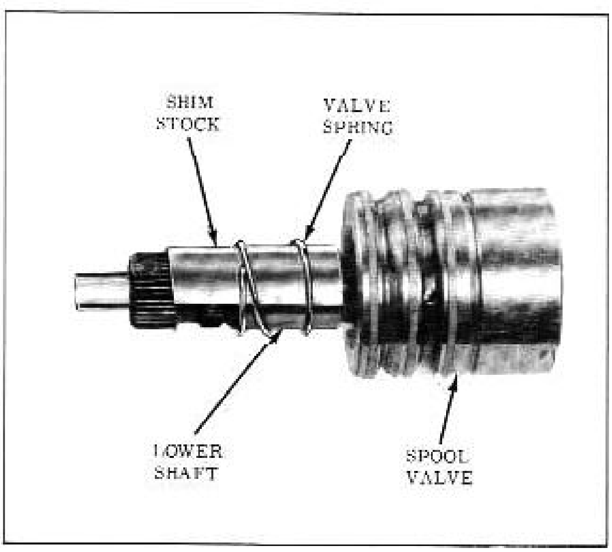


Fig. 4-87 Installing Valve Spring

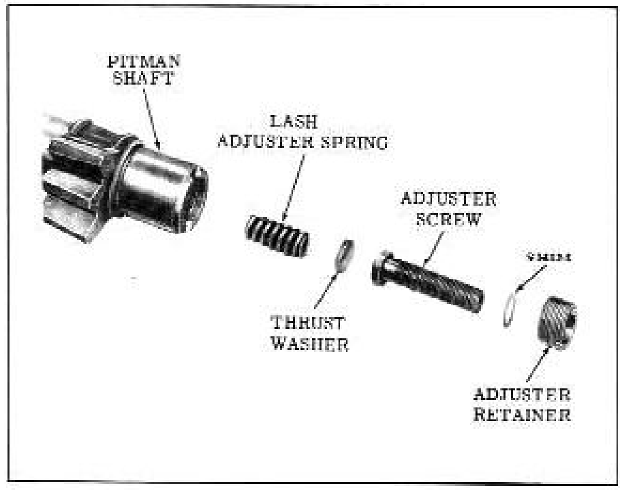


Fig. 4-88 Pitman Shaft

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.

In cases where gear chucking or "clunk" cannot be corrected by performing the over-center adjustment, the trouble may be due to excessive wear in the pitman shaft or a broken spring in the pitman shaft. (Fig. 4-88)

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

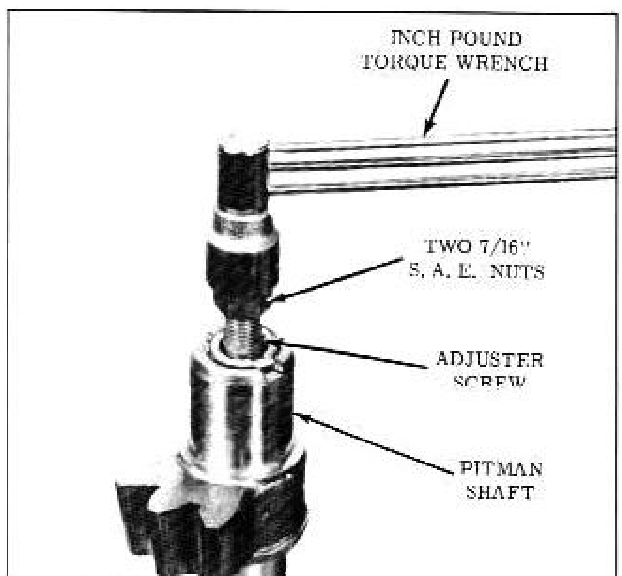


Fig. 4-89 Checking Pitman Shaft

7/16" S.A.E. 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. 4-89) Torque reading should be 1 to 15 inch pounds.

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.

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 a new adjusting screw lock nut, but do not tighten.

Rack-Piston

Disassembly

1. Check the ball preload 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 preload while rotating the torque wrench in a 120° arc. The reading should be 1/2 to 3 in. lbs. (Fig. 4-90)

   If a preload can be felt while rotating worm by hand, but it cannot be measured on a torque wrench, it will be acceptable.

   e. If the preload is not within limits, a new set of balls must be installed upon reassembly. Note the ball size stamped on the rack-piston and install the next size larger balls to increase the preload or the next size smaller balls to decrease the preload, black balls need not be replaced unless they are defective. A change of one ball size will change the preload approximately 1 in. lb.

   NOTE: If no number is apparent, the 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.

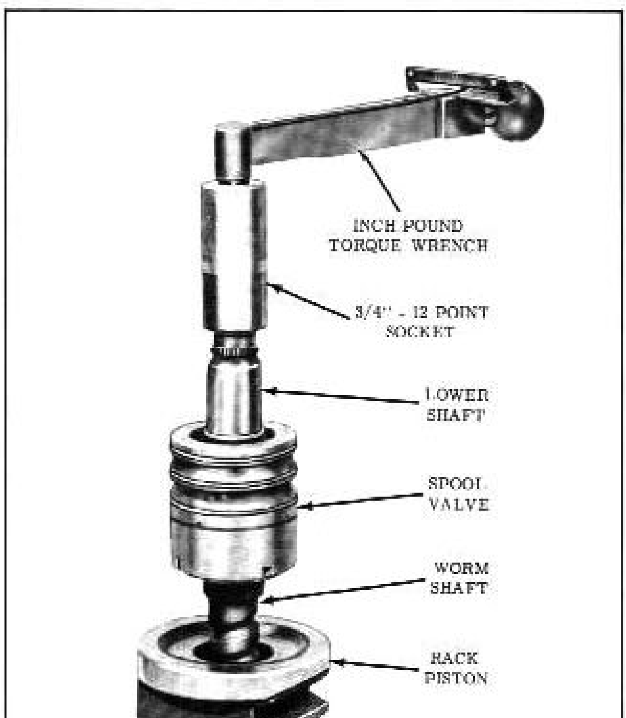


Fig. 4-90 Checking Preload

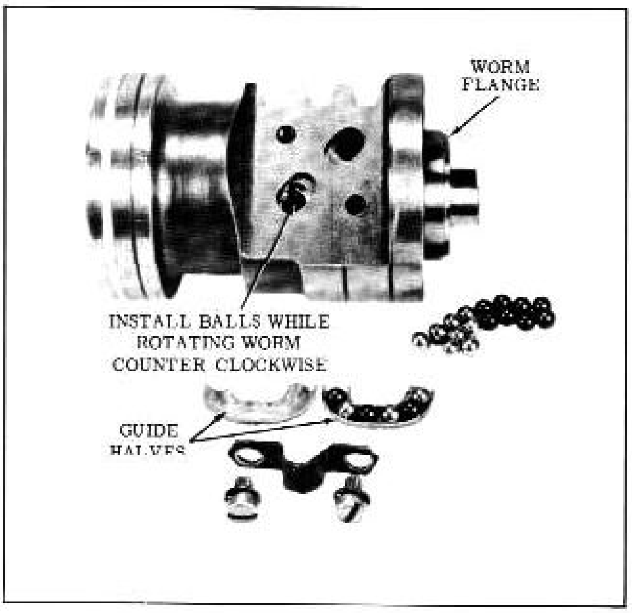


Fig. 4-91 Installing Balls In Rack Piston

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.

Assembly

1. If the teflon oil seal and "O" ring was removed, install a new "O" ring and seal lubricated with Hydra-Matic oil, 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.

3. Turn the worm until the worm groove is aligned with the lower ball return guide hole. (Fig. 4-91)

4. Lubricate the balls with Hydra-Matic 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 spring.

5. Alternately install 6 balls into the return guide and retain with petrolatum. Install balance of balls into piston alternating black and silver. It will be necessary to rotate worm while installing balls. Install the return guide assembly onto the rack-piston. Install the return guide clamp and tighten the 2 clamp screws 8 to 12 ft. lbs.

6. Check the ball preload if a new set of balls were installed. 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.

PITMAN SHAFT NEEDLE BEARING AND SEALS

Removal

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 pry out the inner seal. (Fig. 4-92)

2. If pitman shaft needle bearing replacement is necessary, remove with Tool J-6278.

Installation

1. If the pitman shaft needle bearing was removed, place Adaptor J-6278-2 over Tool J-6278; slide the new needle bearing on the

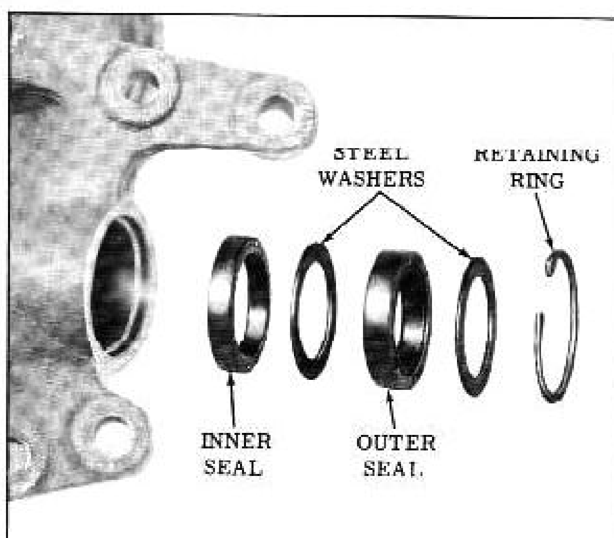


Fig. 4-92 Pitman Shaft Seals

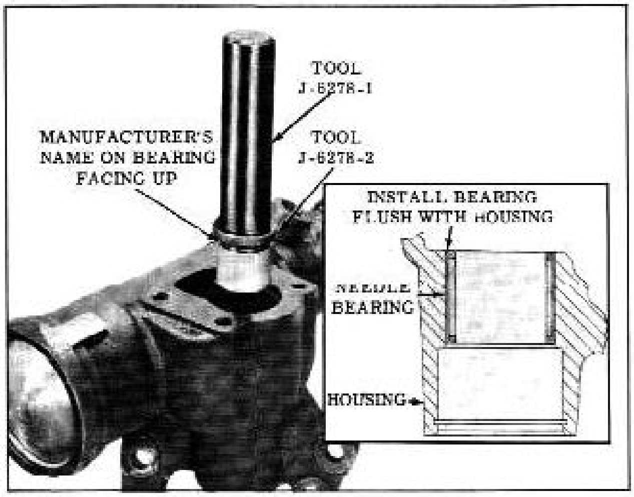


Fig. 4-93 Installing Pitman Shaft Bearing

tool with the bearing manufacturer's identification against the adaptor and drive the bearing into the housing until adaptor bottoms in housing. (Fig. 4-93)

2. Coat the lips of the oil seals with special lubricant (Part No. 567196).

3. Install the pitman shaft oil seals as follows:

   a. Place Adaptor J-6278-2 over Tool J-6278, then install the outer seal, inner steel washer, and inner seal with the lips of the seals facing away from the adaptor.

   b. Drive the seals into the housing until the top of Adaptor J-6278-2 is flush with the housing. (Fig. 4-94)

   c. Remove the tool and adaptor, 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 with Adaptor J-6278-2 and continue driving the seals until the retaining ring seats in its groove (Refer to Inset, Fig. 4-94), then remove the tool adaptor.

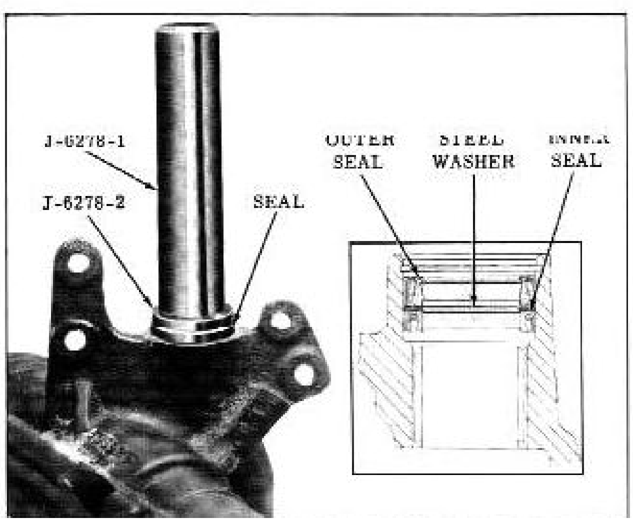


Fig. 4-94 Installing Pitman Shaft Seals

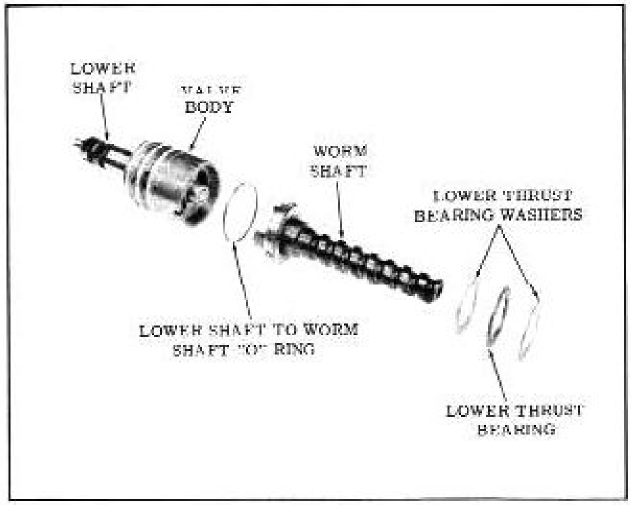


Fig. 4-95 Worm and Valve Body Assembly

Steering Gear Assembly

1. 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. (Fig. 4-95)

2. 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. 4-96) Apply pressure to

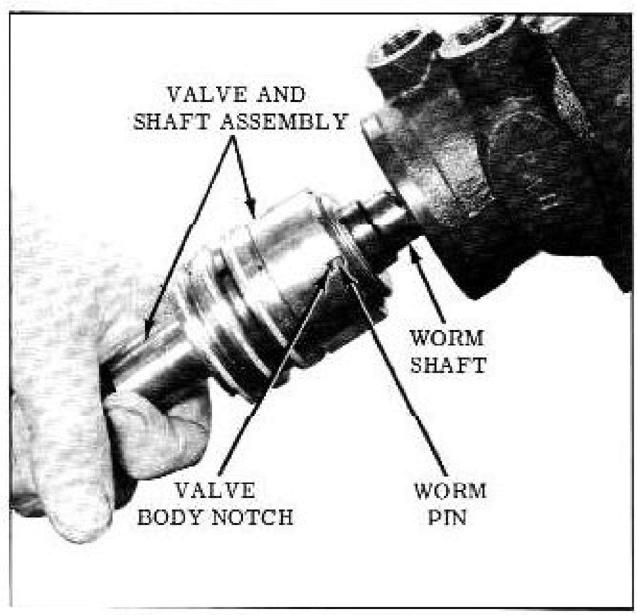


Fig. 4-96 Valve to Worm Position

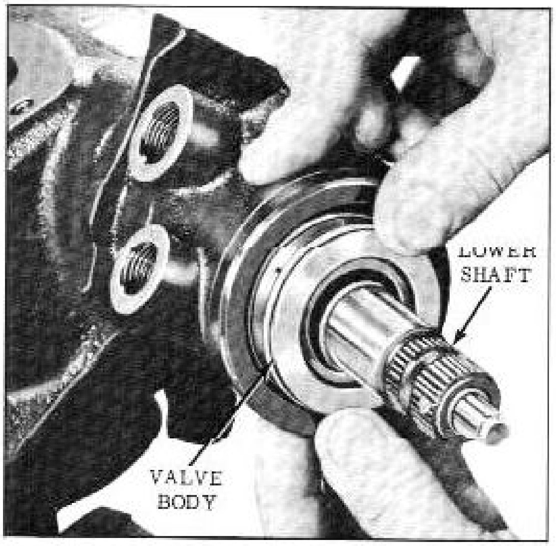


Fig. 4-97 Installing Valve Body

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. (Fig. 4-97)

3. Assemble worm to valve body.

4. With the valve bore of gear housing horizontal, insert the worm and valve assembly into the housing.

   NOTE: The valve body is properly seated when the oil return hole in the housing is entirely uncovered. (Fig. 4-98)

5. 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

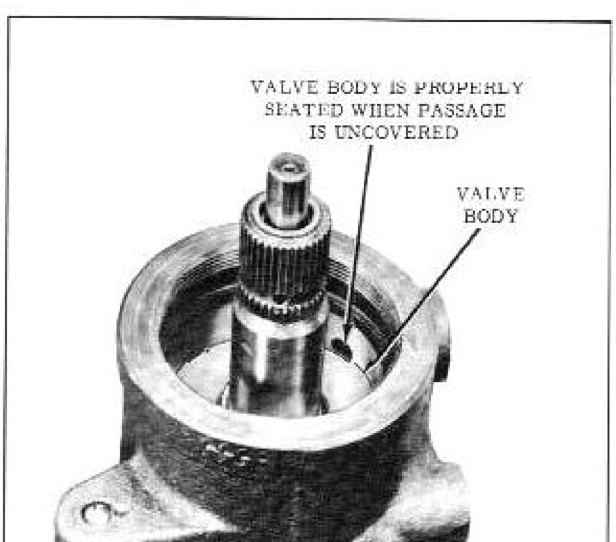


Fig. 4-98 Valve Body Position in Housing

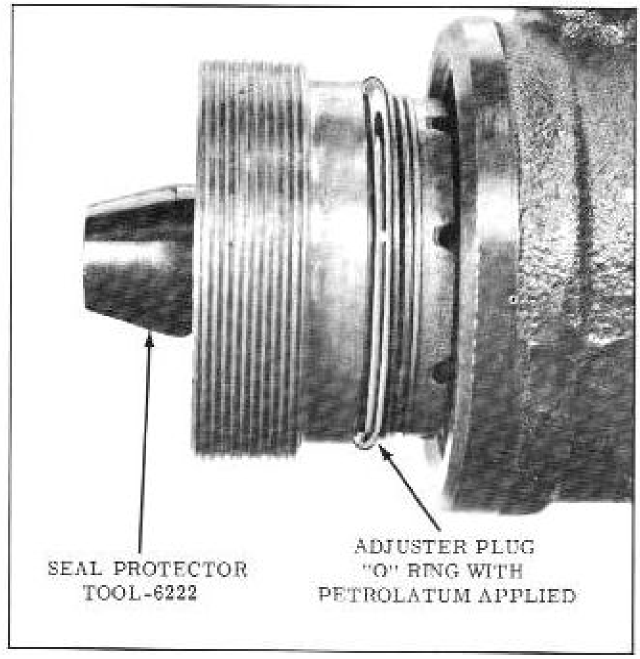


Fig. 4-99 Installing Adjuster Plug

body. (Fig. 4-99) Remove Seal Protector. Do not adjust the thrust bearing preload at this time.

6. Install the rack-piston as follows:

   a. Lubricate the rack-piston teflon seal with petrolatum.

   b. Position Seal Compressor J-8947 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 center of worm. (Fig. 4-100)

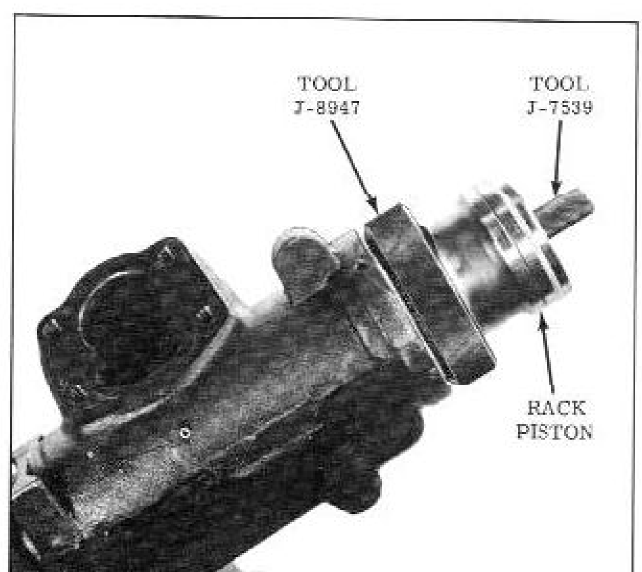


Fig. 4-100 Installing Rack Piston

d. Turn the lower shaft clockwise with a 3/4" twelve point socket or box end wrench to thread the rack-piston onto 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-8947.

7. Install a new "O" ring on the rack-piston plug and lubricate it with petrolatum, then tap the plug in the rack-piston with a soft hammer.

8. Install the rack-piston plug retaining ring in the bore of the rack-piston using internal pliers.

9. Install a new housing end cover "O" ring and lubricate it with petrolatum, then install the end cover and retaining ring.

10. 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 side cover bolts and lock washers and tighten 30-35 ft. lbs.

11. Adjust the thrust bearing preload as follows:

a. Turn the adjuster plug clockwise with Spanner Wrench J-7624 until it is tight, then loosen it 1/8 turn. (Approximately 1") Check preload, then tighten plug to obtain 1/2-2 more inch pounds and tighten lock nut. Total should not exceed 8 inch pounds.

b. Install the adjuster plug lock nut and tighten with Spanner Wrench J-972-A. While holding adjuster plug in position with Tool J-7624. (Fig. 4-101)

12. Adjust the over-center preload as follows:

a. Make sure the over-center adjusting screw is backed all the way out.

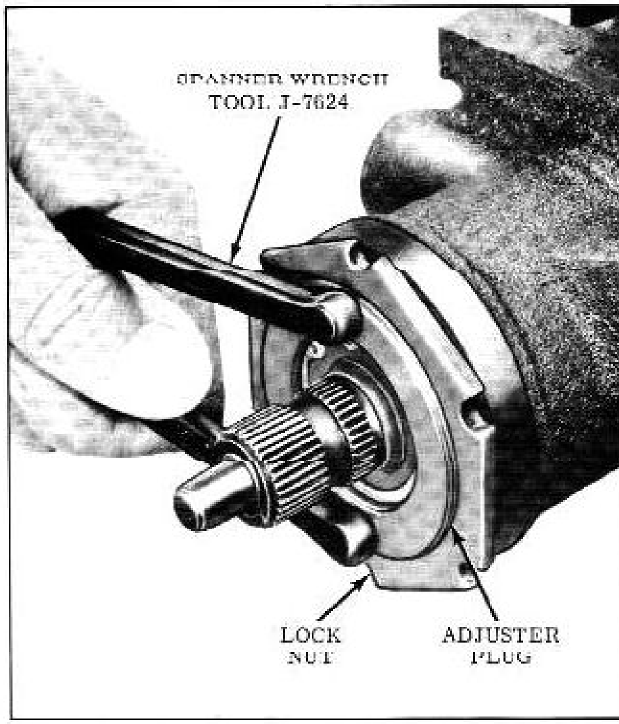


Fig. 4-101 Overcenter Adjustment

b. Install an inch-pound torque wrench with a 3/4" 12 point socket on the lower shaft splines.

c. Rotate the lower shaft from one stop to the other. Count the number of turns and locate the center of travel, then check the combined ball and thrust bearing preload by rotating the torque wrench through the center of travel. Note the highest reading.

d. Tighten the pitman shaft over-center adjusting screw until the torque wrench reads 3-6 in. lbs. higher than the reading. The total reading should not exceed 14 in. lbs.

e. While holding the adjusting screw, tighten the lock nut and recheck the adjustment.

13. Position the coupling flange onto the lower shaft, then install the flange attaching bolt and lock washer. Position the flange so that there is 3/4" between the adjuster lock nut and the coupling to steering flange bolt heads. Tighten the coupling flange attaching bolt 20-35 ft. lbs.

DIAGNOSIS OF POWER STEERING

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.	2. Loosen bolt and reposition for clearance.
3. Steering wheel rubbing against turn signal collar.	3. File edges of collar.
4. Steering adjustments tight.	4. Check adjustment by disconnecting pitman arm from gear. Readjust if necessary.
5. Tires not properly inflated.	5. Inflate to specifications.
6. Tight steering linkage.	6. Lubricate or otherwise free up.
7. Tightness of ball joints.	7. Lubricate.
8. Tight over-center adjustment.	8. Adjust in car to specifications.
9. Thrust bearing adjustment too tight.	9. Remove gear and adjust to specifications.
10. Ball preload too tight.	10. Remove gear and change ball size as required.
11. Sticky spool valve.	11. Remove and clean valve or replace valve assembly.
12. Steering shaft rubbing shift tube.	12. Align column.

CAR LEADS TO ONE SIDE OR THE OTHER

CAUSE	CORRECTION
1. Front end misaligned.	1. Adjust to specification.
2. Worn or damaged valve and shaft assembly. 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

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, rack-piston end plug seal, and/or replace valve.

DIAGNOSIS OF POWER STEERING (Continued)

EXTERNAL OIL LEAKS
(WIPE GEAR THOROUGHLY AND MAKE SURE SOURCE OF LEAKAGE IS DETERMINED)

CAUSE	CORRECTION
1. Loose hose connections.	1. Tighten.
2. Damaged Hose.	2. Replace.
3. Side cover "O" ring seal.	3. Replace seal.
4. Pitman shaft seals.	4. Replace seals.
5. Housing end cover "O" ring seal.	5. Replace seal.
6. Adjuster plug seals.	6. Replace seals.
7. Torsion bar seal.	7. Replace valve and shaft assembly.
8. Pump reservoir "O" ring.	8. Replace "O" ring or reservoir damaged.

GEAR NOISE (RATTLE 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.
2. Gear loose on crossbar.	2. Check gear to crossbar mounting bolts. Tighten bolts to specification.

GEAR NOISE ("HISSING" SOUND)

CAUSE	CORRECTION
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 affects 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.

DIAGNOSIS OF POWER STEERING (Continued)

EXCESSIVE WHEEL KICK-BACK OR LOOSE STEERING

CAUSE	CORRECTION
1. Lash in steering linkage.	1. Adjust parts affected.
2. Air in system.	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. Remove gear and adjust to specification.
5. Ball and worm preload incorrect.	5. Remove rack-piston and worm, and change balls to obtain specified preload.

STEERING WHEEL SURGES OR JERKS WHEN TURNING WITH ENGINE RUNNING, ESPECIALLY DURING PARKING

CAUSE	CORRECTION
1. Loose pump belt.	1. Adjust to specification.

HARD STEERING WHEN PARKING

CAUSE	CORRECTION
1. Loose pump belt.	1. Adjust to specification.
2. Low oil level in reservoir.	2. Fill to proper level. If excessively low, check all lines and joints for evidence of external leakage.
3. Lack of lubrication in linkage or front suspension.	3. Add lubricant where needed.
4. Tires not properly inflated.	4. Inflate to recommended pressure.
5. Insufficient oil pressure.	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. 4-102) 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.

DIAGNOSIS OF POWER STEERING (Continued)

HARD STEERING WHEN PARKING (Continued)

CAUSE	CORRECTION
	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. (meausred with a thermometer in the reservoir) oil pressure should not be less than 800 p.s.i. for satisfactory power steering operation. d. If the maximum oil pressure is less than 800 p.s.i., 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. (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.	6. Repair or replace as required.
7. Low oil pressure due to steering gear.	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, rack-piston end plug 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

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.

DIAGNOSIS OF POWER STEERING (Continued)

NO EFFORT REQUIRED TO TURN

CAUSE	CORRECTION
1. Broken torsion bar.	1. Replace valve and shaft assembly.

PUMP NOISE

CAUSE	CORRECTION
1. Loose belt.	1. Tighten belt.
2. Hoses touching other parts of car.	2. Adjust hose positions.
3. Low oil level.	3. Fill reservoir.
4. Air in the oil.	4. Locate source of air leak and correct.
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.
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)

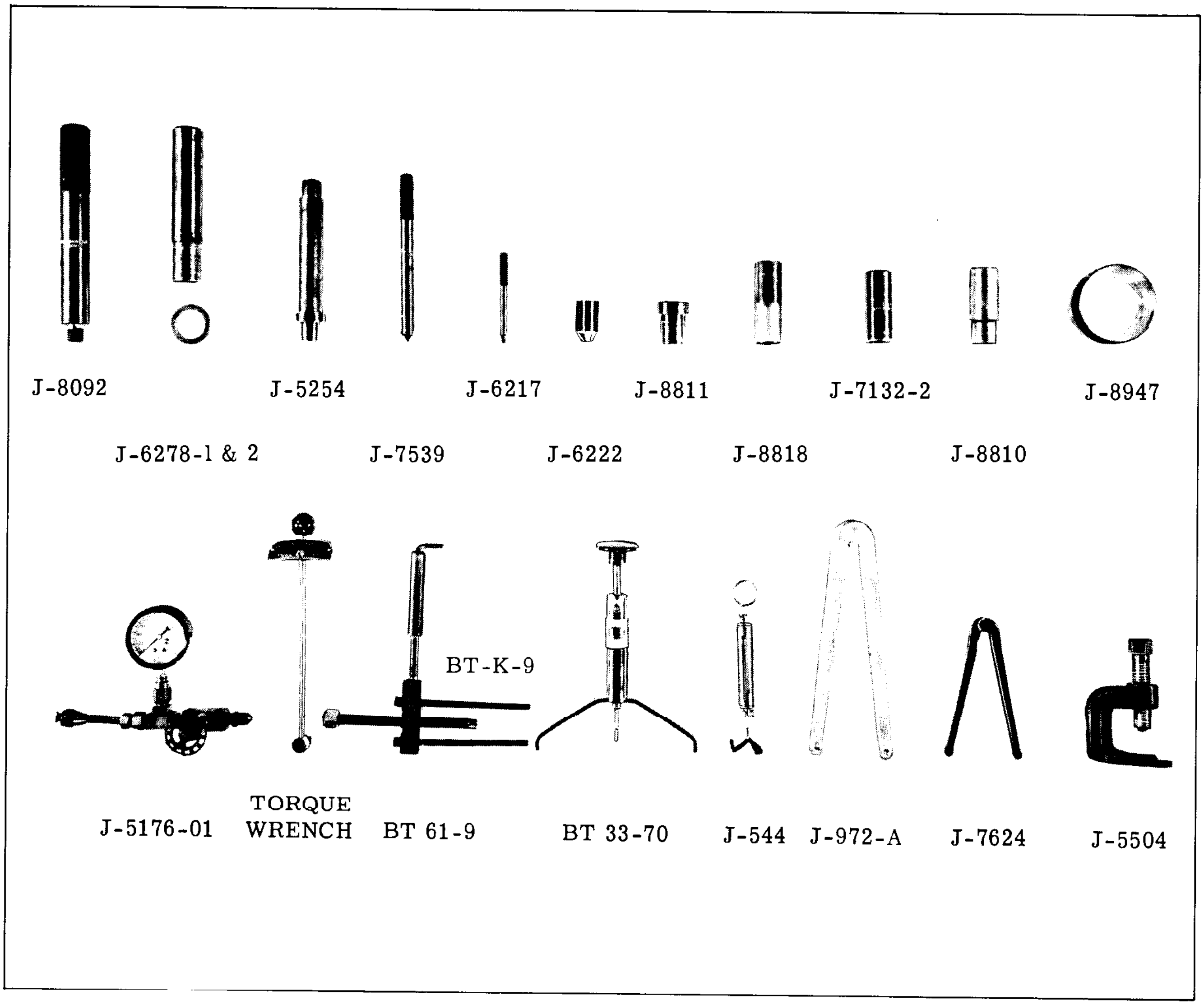
CAUSE	CORRECTION
1. Loose drive belt.	1. Tighten belt.
2. Low oil level.	2. Fill reservoir.
3. Air in the oil.	3. Locate source of air leak and correct.
4. Flow control valve stuck.	4. Remove burrs or dirt.
5. Vanes sticking in rotor slots.	5. Free up by removing burrs or dirt.
6. Faulty flow control valve assembly.	6. Clean and free up parts. Replace part(s) as necessary.

TORQUE SPECIFICATIONS

APPLICATION	FT.LBS.
STEERING LINKAGE	
Idler Arm Bushing	110 to 115
Idler Arm Support to Cross Bar	35 to 45
Relay Rod End Plug	Fully Tighten, Then Loosen 1/4-3/4 Turn
Tie Rod Clamp Bolts	20 to 25
Tie Rod to Plain Arm Nut	35 to 50
Steering Wheel Nut	20 to 30 and Stake
Plain Arm to Steering Knuckle	55 to 80
MANUAL STEERING GEAR	
Gear to Frame Bolts	45 to 60
Pitman Shaft Nut	150 to 180
Side Cover Bolts	25 to 35
Pitman Shaft Adjusting Screw Lock Nut	10 to 15
POWER STEERING PUMP	
Pulley Nut	40 to 45
Pump Bracket (Front) to Block	20 to 25
Pump Bracket (Front) to Front Cover	25 to 35
Pump Mounting Stud to Front Bracket	25 to 35
Pump Mounting Stud to Rear Bracket	25 to 35
Pump Bracket to Cylinder Head	25 to 35
Flow Control Valve Plug	4
Union	20
POWER STEERING GEAR	
Gear to Cross Bar	45 to 60
High Pressure Line Fitting (At Gear)	20 to 30
Oil Return Line Fitting (At Gear)	20 to 30
Pitman Shaft Adjusting Screw Lock Nut	25 to 35
Side Cover Bolts	30 to 35
Adjuster Plug Lock Nut	50 to 75
Coupling Flange Bolt	20 to 35
Return Guide Clamp Screws	8 to 12

SPECIFICATIONS

MANUAL STEERING	
RATIO	22 to 1
LUBRICANT	SAE 80 Multi-Purpose Gear Lubricant
ADJUSTMENTS	
Worm Bearing Preload	1/4 to 3/4 lbs.
Over-Center Adjustment	7/8 to 1-1/2 lbs.
Pitman Shaft Adjusting Screw End Clearance	.002" Max.
POWER STEERING	
RATIO	17.5 to 1
LUBRICATION	
Lubricant	G.M. Hydra-Matic Fluid
Capacity - Complete System	1 Qt.
Capacity - Pump Only	3/4 Qt. Approx.
ADJUSTMENTS	
Ball Preload	1/2 to 3 in. lbs.
Thrust Bearing Preload	1/2 to 2 in. lbs. in excess of initial load
Over-Center Adjustment	3 to 6 in. lbs. in excess of combined ball and thrust bearing preload



Inch Pound Torque Wrench	Torque Wrench
BT 61-9	Steering Wheel Puller
BT 33-70	Belt Tension Gauge
J-544	Tension Scale
J-972-A	Differential Bearing Adjusting Wrench
J-5176-01	Pressure Gauge
J-5254	Valve Cover Seal Installer
J-5504	Pitman Arm Puller
J-6217	Valve Connector Installer
J-6222	End Cover Seal Protector
J-6278-1 & 2	Pitman Shaft Bearing and Seal Remover and Installer
J-7132-2	Oil Seal Installer and Protector
J-7539	Rack Piston Ball Retainer
J-7624	Power Steering Gear Thrust Bearing Adjusting Wrench
J-8092	Driver Handle
J-8810	Pitman Shaft Bushing Remover and Installer
J-8811	Pitman Shaft Seal Installer
J-8818	Power Steering Pump Shaft Seal Installer
J-8947	Power Steering Gear Teflon Ring Compressor

Fig. 4-103 Tools

SUSPENSION

FRONT SUSPENSION

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REAR SUSPENSION

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MAINTENANCE RECOMMENDATIONS

Lubricate at all grease fittings every 2,000 miles. Repack front wheel bearings every 10,000 miles with wheel bearing lubricant.

DESCRIPTION

The front suspension system of the Oldsmobile F-85 is of the ball joint, independent type. It differs from the conventional Oldsmobile system in that it is attached to the body by three isolation mounts. The engine is supported by two mounts attached to the cross bar of the front suspension system. The complete system can be removed from the car as a single unit. Most parts can be serviced with the complete unit in its position attached to the body

ISOLATION MOUNTS

The three isolation mounts used to attach the front suspension system to the body frame are large rubber and steel bushings. These are positioned in their brackets on the cross bar. (Fig. 5-1)

FRONT MOUNT

Removal

1. Install engine support Tool J-8974.
2. Hoist car.

   NOTE: If frame contact hoist is used, and front suspension is raised off the floor, stands must be used to support suspension system.
3. Disconnect steering gear from shaft and remove the 3 isolation mount bolts.
4. Lower front cross bar enough to allow clearance to change the front mount.
5. It will be necessary to drive the mount from the bottom out the top. Care must be taken not to damage inside of mount bracket.

Installation

1. Place the new mount in position at top of bracket.

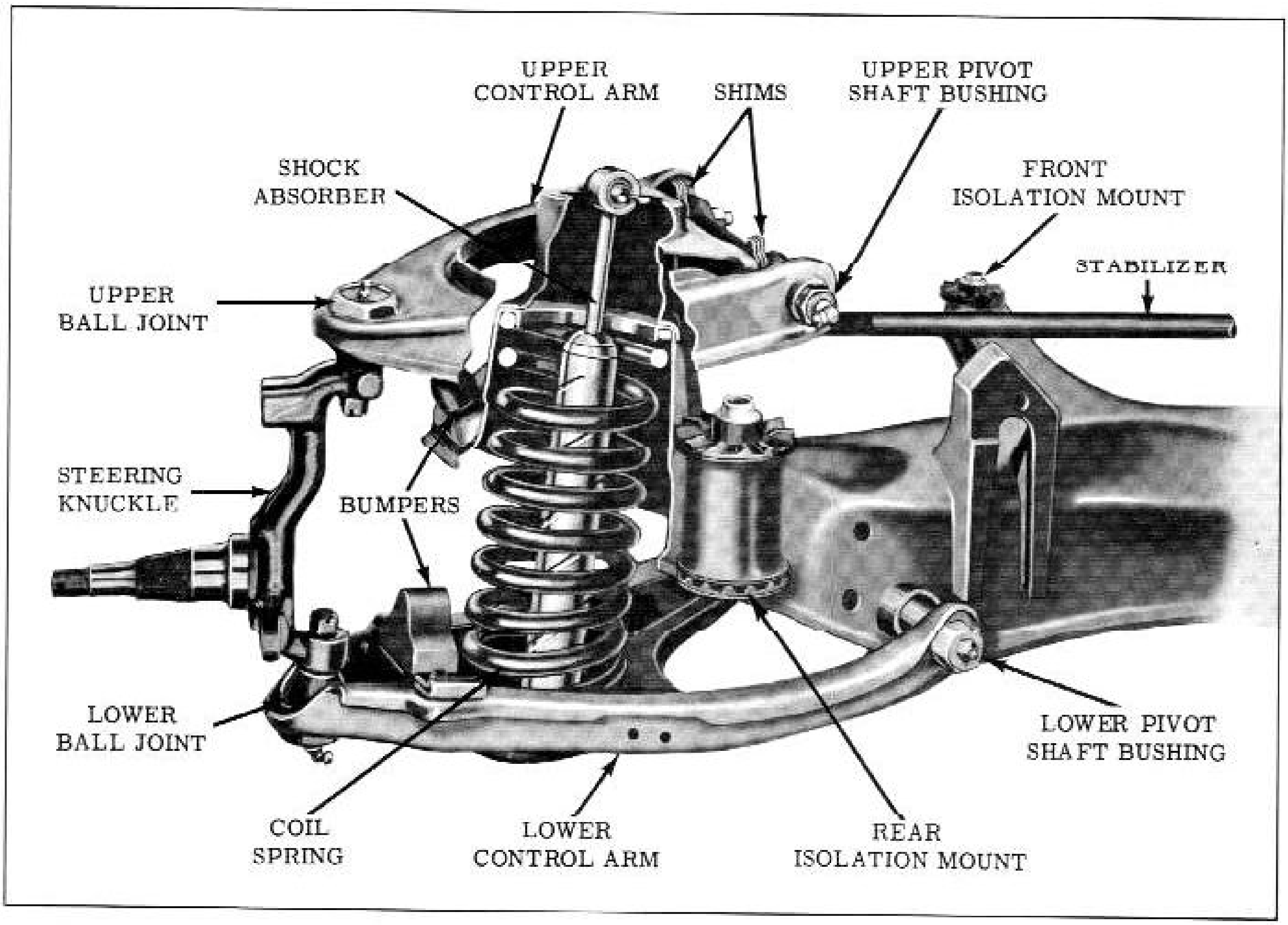


Fig. 5-1 Front Suspension

2. With a large washer on top of the mount, place a long bolt through the mount so the bolt head will be on the washer. Place on piece of steel bar across the bottom of the bracket with a hole in it the size of the bolt. Place the bolt through this hole and put a nut on the bolt. Tighten the nut to pull the mount into the bracket.

   NOTE: When placing the cross bar back in position, the protruding mount bushing must be properly positioned in the frame.

3. Install isolation mount bolts and connect steering gear. Torque bolts 65-90 ft. lbs.

4. Remove engine support tool.

REAR MOUNTS

Removal

1. Install engine support Tool J-8974.

2. Hoist car.

3. Disconnect steering shaft from steering gear.

4. Remove engine mount to cross bar bolts.

5. Disconnect stabilizer links and brake hoses.

   NOTE: Place stands under cross bar or body, depending on what type of hoist is being used. If using a frame contact type lift, lower the car until the front wheels are on the floor.

6. Remove the 3 isolation mount bolts being careful the suspension system does not tip.

7. Slowly lower cross bar or raise body enough to remove the mount by driving from the bottom.

Installation

Install the isolation mounts as outlined under "FRONT MOUNT -- INSTALLATION".

STABILIZER

The stabilizer shaft is attached to the body frame by two rubber insulator mounts, and is connected to the lower control arms by two links. The shaft must be replaced when damaged.

Removal

1. Disconnect 2 shaft to frame brackets.

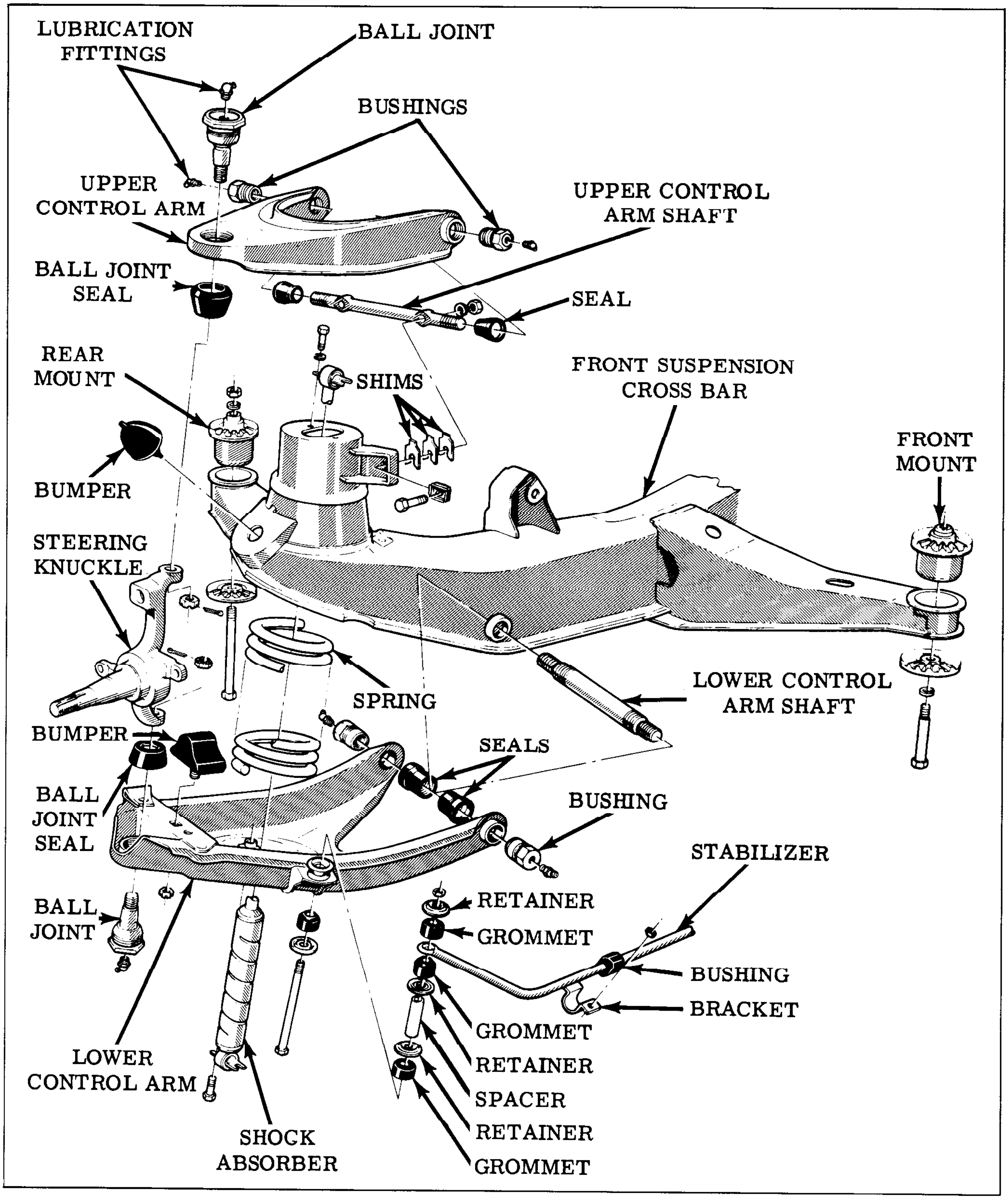


Fig. 5-2 Front Suspension - Exploded View

2. Disconnect stabilizer links from lower control arms.

Installation

When installing, connect links to shaft and lower control arms. Torque nuts 13-17 ft. lbs. Place brackets on shaft, and if necessary, a jack may be used to hold shaft in position against frame to attach brackets. Torque bracket bolts 25 to 45 ft. lbs. Do not lubricate bracket insulators as they are dependent upon a bonding of the rubber to the shaft for proper stabilizer action.

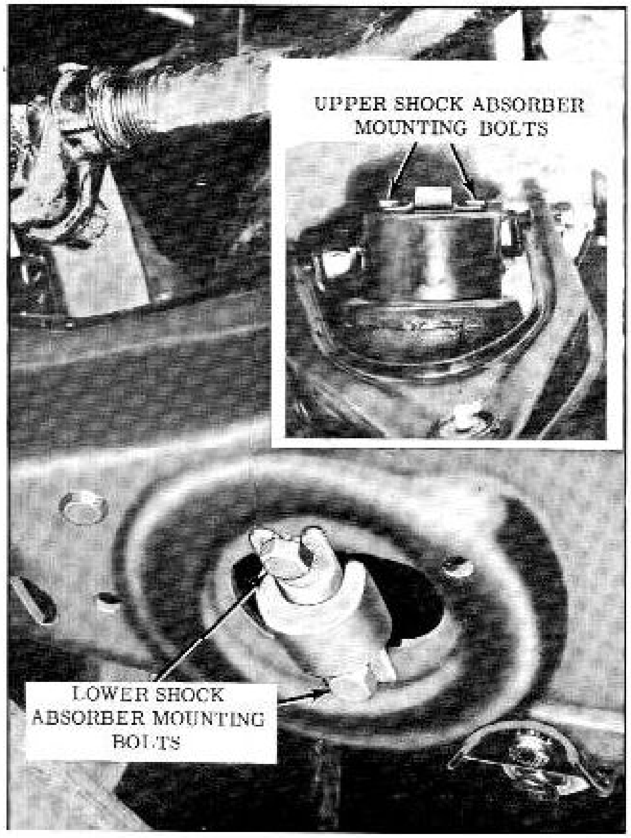


Fig. 5-3 Shock Absorber Attachment

STABILIZER BRACKET

Stabilizer brackets should be replaced if damaged, and rubber insulator if deteriorated.

They can be replaced by positioning a floor jack under stabilizer shaft to hold it in position against frame, replace one at a time.

Torque bracket bolts 25-45 ft. lbs.

STABILIZER LINKS

The stabilizer links should be replaced if damaged. If rubber grommets are deteriorated, they may be replaced separately. When replacing links remove bolt nut, pull bolt from linkage, and remove retainers, grommets and spacer. When replacing links, torque bolt nut 13-17 ft. lbs. and lubricate rubber grommets with a rubber lubricant.

SHOCK ABSORBER

Shock absorbers are sealed when manufactured. If found defective they must be replaced.

CHECKING

1. Inspect mountings.
2. If mountings are satisfactory, disconnect the lower mount and pump VERTICALLY several times. If smooth hydraulic resistance is present in both directions the shock absorber is satisfactory. (Fig. 5-3)

   DO NOT PUMP HORIZONTALLY IF SHOCK IS OFF CAR.
3. If a lag is felt when changing stroke, this will usually indicate a noisy shock on the car.
4. With the shock fully extended, pull hard. If spring tension is felt, this will usually indicate a noisy shock on the car.
5. Pump at different rates of speed. If a noise is heard from a deep to a high pitched squeak this will indicate a noisy shock on the car.

   NOTE: If a shock has been inoperative for a period of time, the seals may cause a squeal this will disappear after a few strokes and the seal becomes lubricated.
6. If a shock is believed to be weak it should be compared with the shock on the other side of the car. If both shocks test the same, it is unlikely they are defective.
7. Oil on the shock does not necessarily indicate a leak. It should be wiped dry and allowed to remain over night and again checked. A short drive will assist to determine if a leak is present.

Removal

1. Remove the 2 lower and 2 upper shock attaching bolts. (Fig. 5-3)
2. Raise car, (support on wheels) and remove shock from bottom through lower control arm.

Installation

Rubber bushings are an integral part of the shock mounting bracket. When installing, torque cap screws 15-25 ft. lbs.

STEERING KNUCKLE

Removal

1. Raise front of car and support with floor stands under cross bar.

   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, 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. Disconnect the control arm ball joints from the steering knuckle by:

   a. Removing cotter pins from ball joint studs.

   b. Loosen the upper and lower joint nuts, but do not remove, then tap knuckle with a brass drift at ball joint stud. (Fig. 5-4) This will loosen stud from steering knuckle.

   NOTE: After studs break loose from steering knuckle, position a floor jack under lower control arm and relieve spring tension. This will permit removal of ball joint nuts.

5. Remove steering knuckle from car.

Installation

1. Connect the upper and lower ball joints to the steering knuckle.

2. Torque stud nuts 35-60 ft. lbs. and install cotter pins. Tighten further, if necessary, to install cotter pin.

3. Install backing plate and plain arm to steering knuckle. Torque nuts 55-80 ft. lbs.

   NOTE: Use a thin film of Lubriplate on upper bolt head between the head and the anchor bolt lockplate to prevent a false bind and to obtain correct torque.

4. Install wheel and hub and drum assembly. Adjust wheel bearings. (Page 5-6)

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.

2. Remove wheel assembly.

3. Disconnect stabilizer link from lower control arm.

4. Remove shock absorber.

5. Position a floor jack to support lower control arm, between spring seat and ball joint.

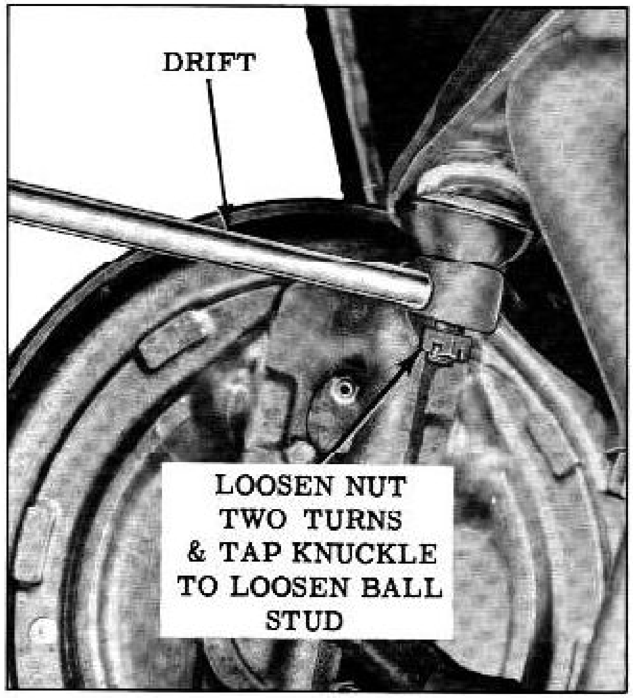


Fig. 5-4 Removing Ball Joint Stud

6. Disconnect the lower control arm ball joint from the steering knuckle. Fig. 5-4 illustrates upper, but same principle applies.

7. Slowly lower floor jack until spring is fully extended and remove spring.

Installation

IMPORTANT: The top of the spring may be identified by a flat coil.

1. While holding spring against pilot in front cross bar, tilt spring so it will pilot in lower control arm. Rotate spring so the end of the bottom coil will index with edge of hole in control arm spring seat. The coil should not cover any portion of the hole.

2. Position floor jack between spring seat and ball joint.

3. Raise control arm until the ball joint is tight in steering knuckle. Install ball joint nut and tighten to 35-60 ft. lbs. and install cotter pin. If necessary, nut may be tightened further to install cotter pin.

4. Install shock absorber. Torque bolts 15-25 ft. lbs.

5. Connect stabilizer link to lower control arm. Torque nut to 13-17 ft. lbs.

6. Install wheel and lower car.

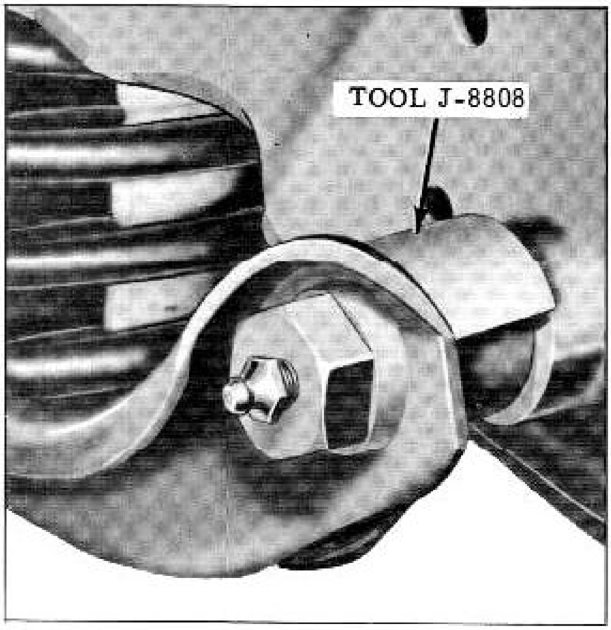


Fig. 5-5 Installing Lower Control Arm

WHEEL BEARING

(Refer to BRAKE SECTION)

WHEEL BEARING ADJUSTMENT

The proper functioning of the front suspension cannot be maintained unless the front wheel bearings are correctly adjusted. Bearing must be a slip fit on the spindle and the inside diameter of cones should be lubricated to insure that the cones will creep. Knuckle nut must be a free-running fit on threads.

The adjustment of front wheel bearings should be made as follows:

1. Tighten adjusting nut with a torque wrench to approximately 10-15 ft. lbs. while revolving wheels to insure that all parts are properly seated and threads are free.
2. Back nut off 1/6 to 1/4 turn maximum, then install pin.

LOWER CONTROL ARM

Removal

To replace the lower control arm, all the steps in Coil Spring replacement must be performed. After completing these, proceed as follows:

1. Remove pivot shaft bushings from control arm assembly. This will permit removal of control arm from shaft.

Installation

1. Install the rubber bumper on the control arm if not damaged. Torque 25-40 ft. lbs.

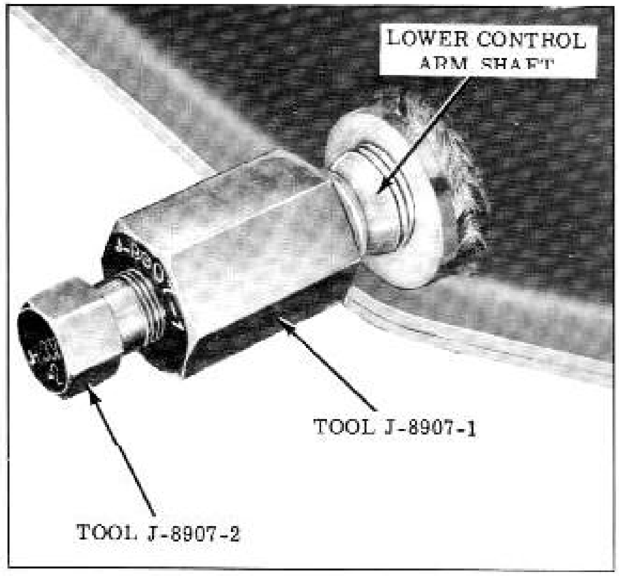


Fig. 5-6 Replacing Lower Shaft

2. Place spacer Tool J-8808 in position on shaft. (Fig. 5-5) Spacer must be raised off shaft enough to allow bushing to pass under it.
3. Apply chassis lubricant to pivot shaft threads and install rubber seals on shaft.
4. Position control arm on shaft, holding arm against spacer, start bushings on shaft and into arm.

   NOTE: Bushings may be threaded in more easily if a coating of lubriplate is applied to the outside diameter of the bushing.

5. Tighten bushings until the hex of bushings are solidly seated against the arm.
6. Remove spacer tool, and install opposite bushing as explained in steps 2 through 6.

LOWER CONTROL ARM SHAFT

Removal

The lower control arm shaft is threaded into bushings that are welded to the cross bar. The shafts may be replaced if necessary, however they are factory installed in a new cross bar.

1. Remove control arm as explained.
2. Place Tool J-8907 on rear end of shaft. Adjust lock bolt so tool will not thread tightly and bind on shaft. (Fig. 5-6)
3. Turn shaft clockwise to remove through front of cross member.

Installation

The shaft is stamped "F" which means front of car.

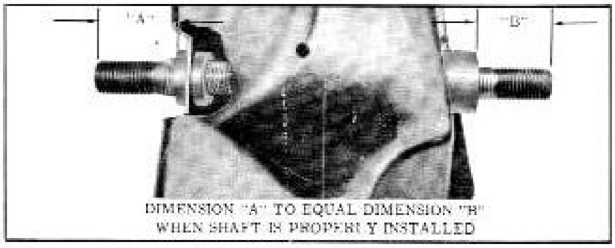


Fig. 5-7 Position of Lower Shaft

1. Position shaft through front bushing and into rear bushing with "F" toward the front. The shaft is a smaller diameter on the rear end.
2. Place Tool J-8907 on front of shaft and adjust lock bolt so tool will not thread tightly and bind on shaft.
3. Coat threads of shaft with lubriplate.
4. Thread shaft into cross bar until it extends equal distance out the front and rear of cross bar, approximately 1-11/16". (Fig. 5-7) It must be measured for accuracy.
5. Assemble balance of suspension as outlined under "LOWER CONTROL ARM" Page 5-6 and lubricate with chassis lubricant.

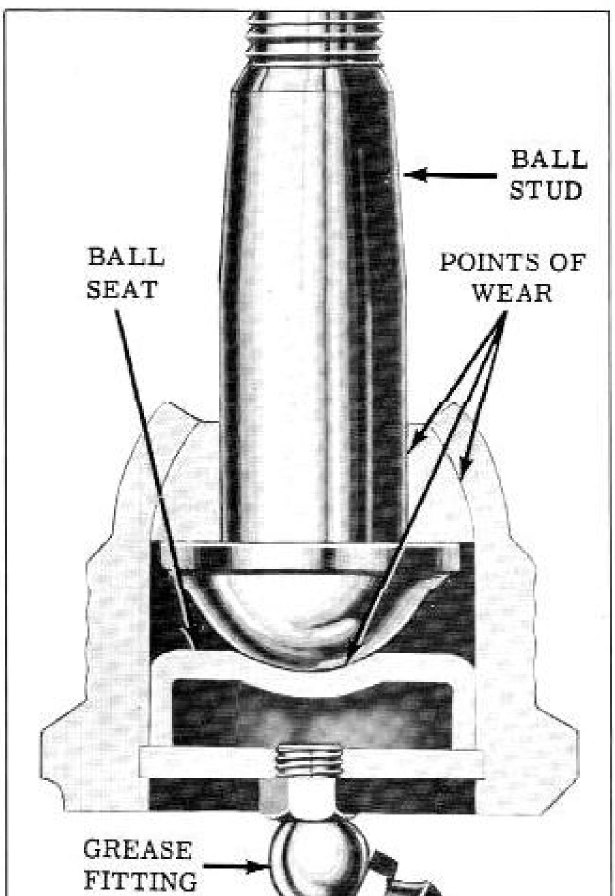


Fig. 5-8 Lower Ball Joint

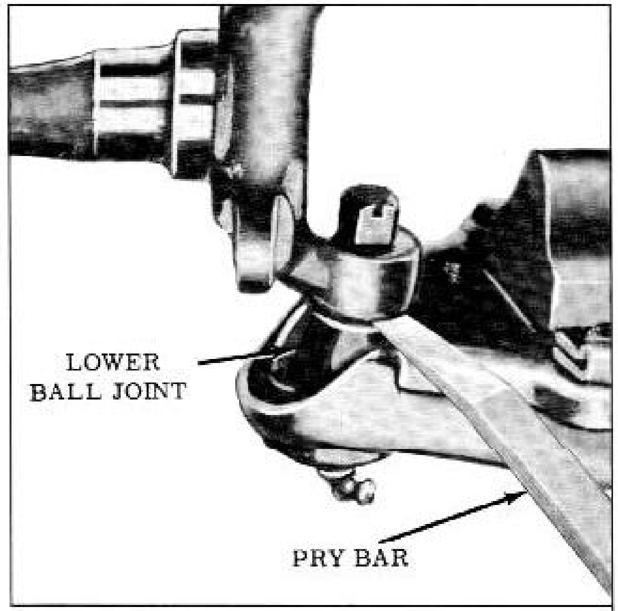


Fig. 5-9 Checking Lower Ball Joint

LOWER CONTROL ARM BALL JOINT

The lower control arm ball joint may be replaced if excessively worn in stud and socket. (Fig. 5-8)

IMPORTANT: If ball joint is loose in control arm, and a new ball joint assembly will not tighten satisfactorily, the lower control arm with ball joint must be replaced.

To check the lower ball joint for wear proceed as follows:

1. Place jack under control arm and raise car until wheel is off the floor.
2. Pry steering knuckle upward as shown in Fig. 5-9.
3. If more than 1/16" end play of the ball stud is detected, the joint should be replaced.

Removal

1. Raise car and support by cross bar with stands.
2. Place jack under control arm approximately 1/4" below coil spring.
3. Remove ball joint cotter pin and loosen nut. Coil spring tension will assist in breaking stud loose from steering knuckle.
4. With a brass drift tap steering knuckle at ball joint stud. (Fig. 5-4)
5. Remove nut and unscrew ball joint. (RH thread).

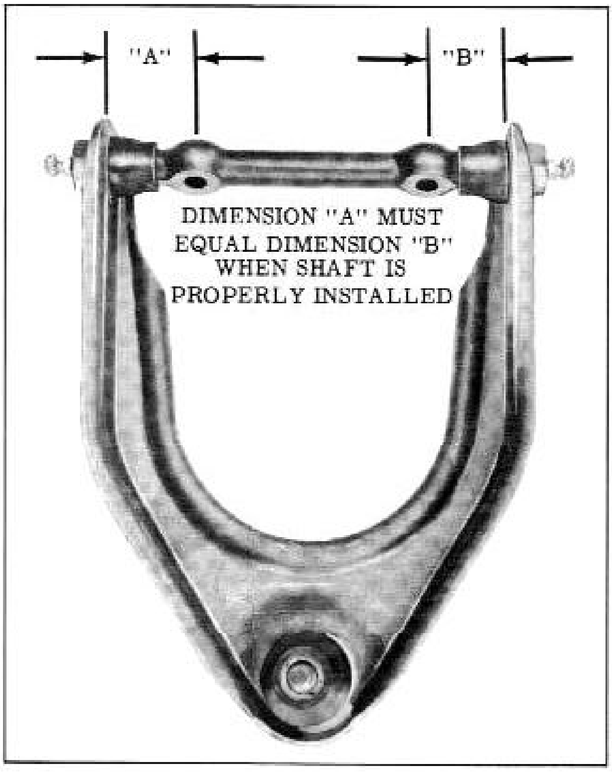


Fig. 5-10 Upper Control Arm Shaft

Installation

1. Lubricate with aluminum soap grease and tighten ball joint until hex starts to shave metal from arm.
2. Raise stud into knuckle and install nut. Torque nuts 35-60 ft. lbs.
3. Reconnect parts.

LOWER CONTROL ARM BUMPER

The lower control arm bumper is attached by a nut on the bumper stud. It is accessable from the underside of the control arm. If damaged or deteriorated, it should be replaced. Torque nuts 25-40 ft. lbs.

UPPER CONTROL ARM

The upper control arm is attached to the cross bar 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 support under lower control arm.
2. Remove wheel, upper ball joint cotter pin, and loosen nut.
3. Disconnect ball joint from knuckle by tapping knuckle with a drift at a stud. (Fig. 5-4)

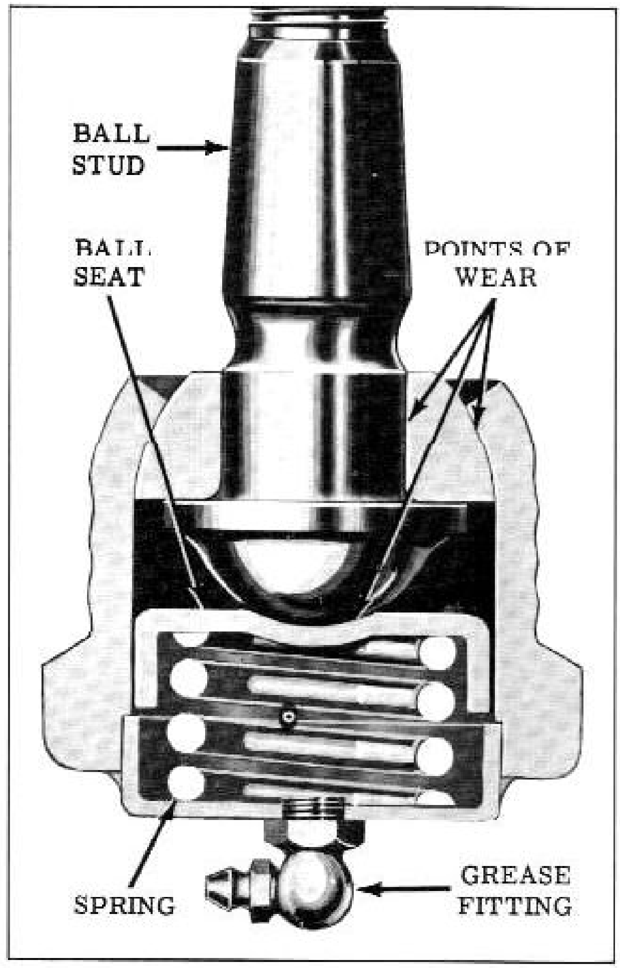


Fig. 5-11 Upper Ball Joint

4. Support hub assembly, remove inner shaft to cross bar bolts and remove arm assembly.

Installation

If arm and shaft are being replaced now as an assembly, center shaft in arm as shown in Fig. 5-10 before attaching to cross bar.

Place original shims in position, install bolts and torque 60-85 ft. lbs.

If the arm or shaft is being re-used, it will be necessary to assemble shaft to arm before attaching to cross bar.

1. Position arm on shaft.
2. Lubricate bushings with lubriplate and thread on shaft and into arm.
3. Center shaft in arm. (Fig. 5-10)
4. Attach arm assembly to cross bar using original shims. Torque bolts 60-85 ft. lbs.
5. After balance of suspension has been reassembled, lubricate and check front end for alignment.

UPPER CONTROL ARM SHAFT

The inner shaft may be replaced by referring to the preceding steps 1, 2, and 3, under "Installation, UPPER CONTROL ARM". It is suggested that the arm be removed from the car.

UPPER CONTROL ARM BALL JOINT

When necessary, the ball joint may be replaced without removing the control arm from the suspension system.

Check the ball joint by detaching from steering knuckle, and with an in. lb. torque wrench on ball stud nut, rotate stud. If reading is below 2 in. lbs., the joint should be replaced.

Removal

1. Support car by cross bar.
2. Remove wheel and tire.
3. Remove cotter pin and loosen ball joint nut.
4. With a brass drift, tap steering knuckle at ball joint stud, this will loosen stud. (Fig. 5-4)
5. Support brake assembly, raise arm and remove joint by turning counterclockwise.

Installation

1. Lubricate threads and thread joint into arm until hex of joint starts to cut metal in arm. Care must be taken not to cross thread joint in arm.
2. Attach all removed parts and lubricate with aluminum soap grease.

UPPER CONTROL ARM BUMPER

The upper control arm bumper is of the plug type and can be removed by prying out.

It may be installed by lubricating with a rubber lubricant, then press and twist into position.

CROSS BAR

In some cases it may be necessary to replace the cross bar. This may be done by performing the following operations, and where necessary refer to the individual component procedures previously mentioned in this section:

Removal

1. Install engine Support Tool J-8974 and disconnect engine mounts.
2. Disconnect steering shaft, brake lines, and stabilizer.
3. Remove the coil springs at this time. Lift car until weight is off front suspension and remove isolation mount bolts. This will detach suspension system from frame.

   CAUTION: Care must be taken to avoid damage to steering shaft.

The balance of the parts attached with the exception of the lower control arm shaft which will be installed in the new cross member, may now be easily removed. When assembling parts to new cross member, use same amount of alignment shims in upper inner control arm.

Installation

Refer to torque specifications at the back of this section for proper torque.

After attaching suspension system to the body, install coil springs, attach engine support pads and remove engine support tool. It will be necessary to check front end alignment and lubricate.

NOTE: Consult steering section for correct steering wheel and gear alignment. For Power Steering, Page 4-6, for Manual Steering, Page 4-7.

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.

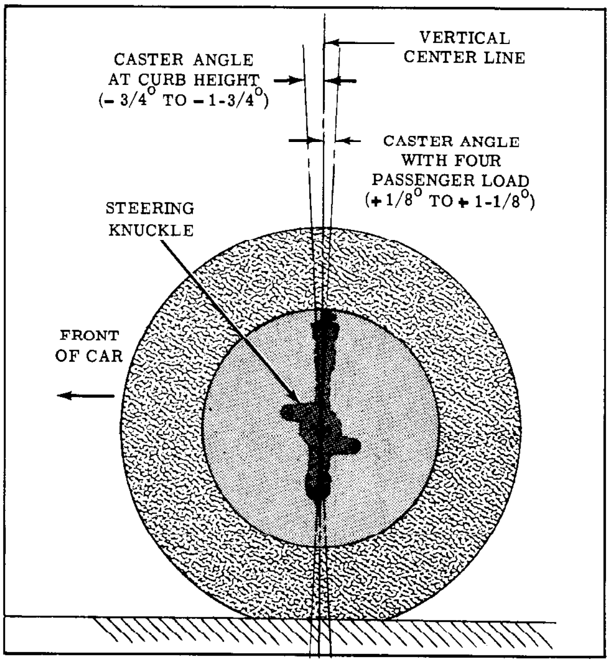


Fig. 5-12 Front Wheel Caster

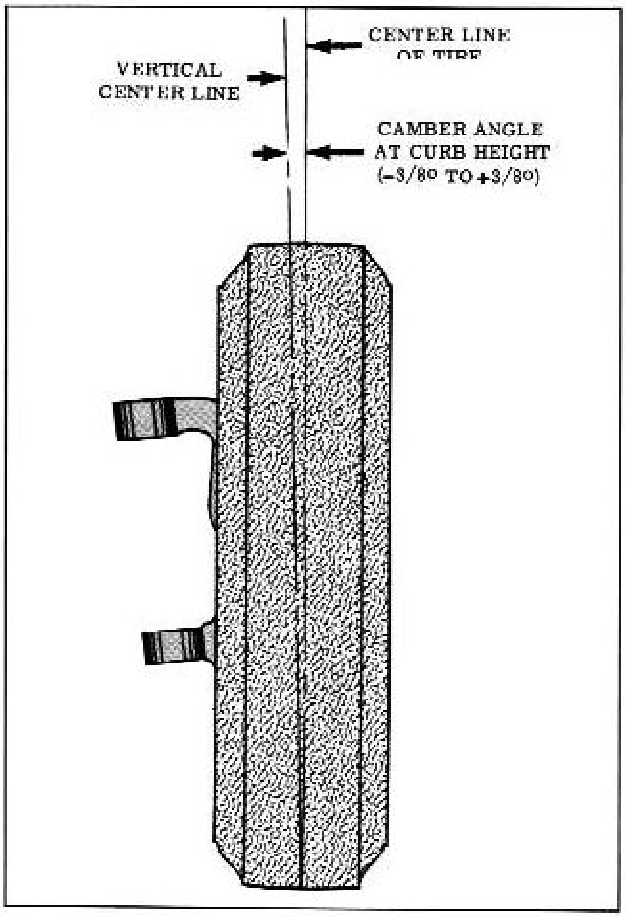


Fig. 5-13 Front Wheel Camber

The front wheel alignment factors are:

1. CASTER (Fig. 5-12)
2. CAMBER (Fig. 5-13)
3. TOE-IN (Fig. 5-14)
4. TOE-OUT (STEERING GEOMETRY) (Fig. 5-15)

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:

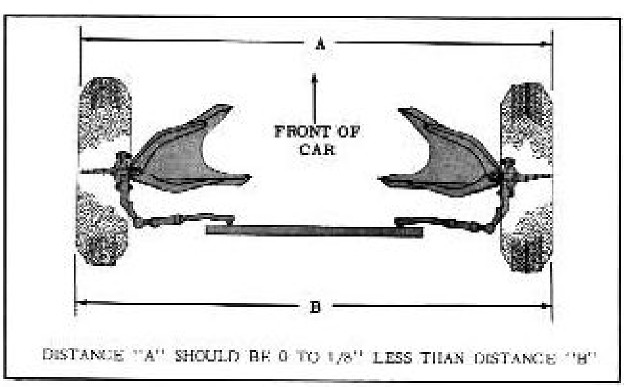


Fig. 5-14 Front Wheel Toe-In

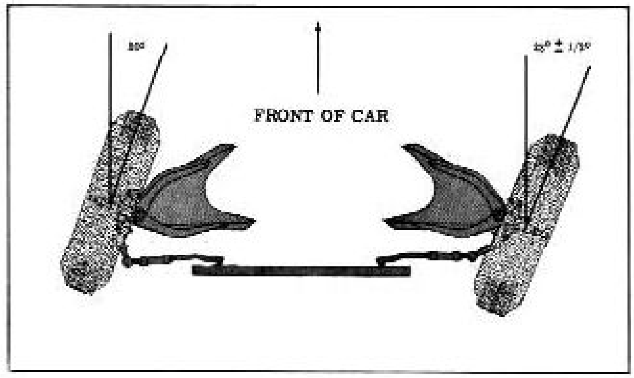
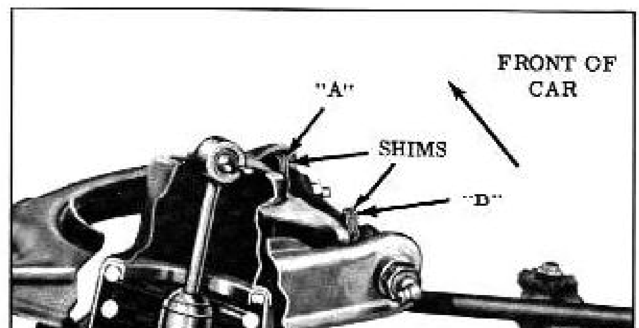


Fig. 5-15 Front End Toe-Out

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. Camber angle of



TO MAKE CASTER MORE NEGATIVE: ADD SHIMS AT "A".

TO MAKE CASTER MORE POSITIVE: REMOVE SHIMS AT "A".

* TO MAKE CAMBER MORE POSITIVE: REMOVE SHIMS AT BOTH "A" & "B".

* TO MAKE CAMBER MORE NEGATIVE: ADD SHIMS AT BOTH "A" & "B".

* NOTE: BY ADDING OR SUBTRACTING AN EQUAL AMOUNT OF SHIMS FROM "A" AND "B", CAMBER WILL CHANGE WITHOUT AFFECTING CASTER ADJUSTMENT.

Fig. 5-16 Front End Alignment Shims

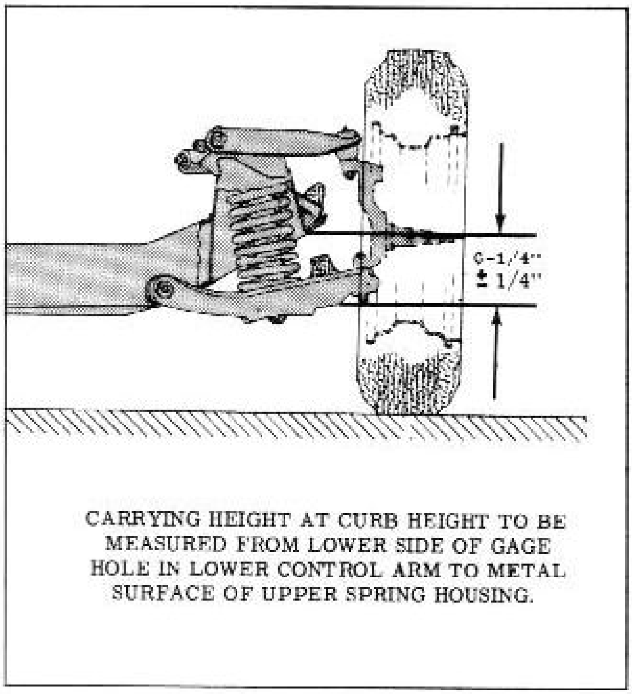


Fig. 5-17 Front Spring Carrying Height

the right and left wheel should be within 1/2° of each other for best handling characteristics.

CASTER AND CAMBER ADJUSTMENT

(CASTER) CURB - -3/4° to -1-3/4°
(CAMBER) CURB - -3/8° to +3/8°

Camber and Caster are adjusted by shims placed between the upper pivot shafts and the cross bar. (Fig. 5-16) 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 cross bar 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 60-85 ft. lbs. and recheck caster and camber.

Shim Thickness	One shim added to or substracted from BOTH BOLTS will change CAMBER	One shim added to or subtracted from FRONT BOLT ONLY will change CASTER
.030	1/4°	1/2°
.060	1/2°	1°
.120	7/8°	2°

FRONT SPRING CARRYING HEIGHT

Front spring carrying height is controlled by the front coil spring length and tension.

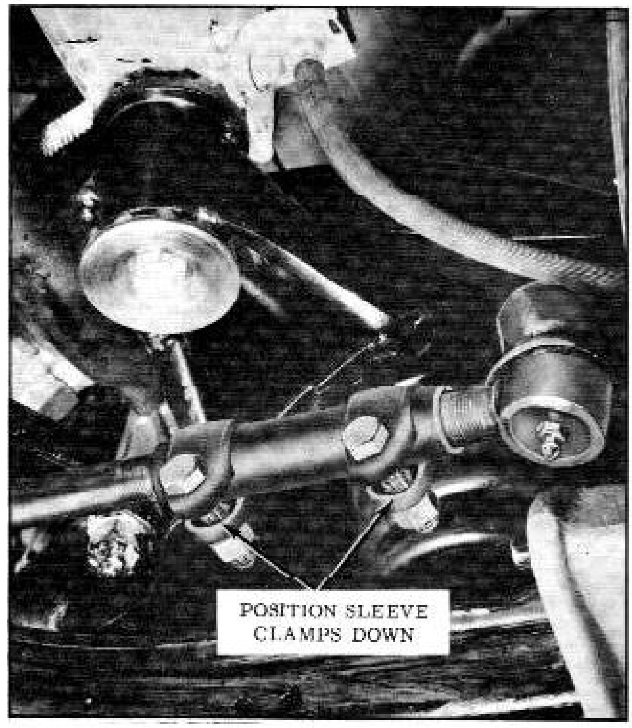


Fig. 5-18 Adjusting Clamp Position

Carrying height may be checked as indicated in Fig. 5-17.

TOE-IN ADJUSTMENT

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, 1/16''. (Fig. 5-14)
3. When adjustment has been completed according to the recommended specification, and tie rod and ball studs are riding squarely in their seats, position tie rods to relay rod ball studs to the bottom of the slot in the relay. Position inner clamps as shown in Fig. 5-18. Torque nut 20-25 ft. lbs.

TOE-OUT (STEERING GEOMETRY)

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 left wheel has been turned 20° from the straight ahead position. Right wheel setting should be 23° on all models. Then follow 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 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 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.

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 or adjusted too loosely.
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-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. 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-In 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-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 inoperative.

3. Loose or worn front wheel bearings.

CAR WANDERS

Cause:

1. Low or uneven tire pressure.

2. Steering gear or linkage worn or adjusted too loosely.

SPECIFICATIONS

FRONT SUSPENSION	
CASTER ANGLE (DEGREES)	$-3/4^{\circ}$ to $-1\text{-}3/4^{\circ}$
CAMBER (DEGREES)*	$-3/8^{\circ}$ to $+3/8^{\circ}$
TOE-IN	0 to 1/8
TOE-OUT ON TURNS	23°
BALL JOINT INCLINATION	$7^{\circ}30'$
TREAD	56"
CARRYING HEIGHT	6" to 6-1/2"

*MAXIMUM CAMBER VARIATION BETWEEN EITHER SIDE OF CAR SHOULD NOT EXCEED $1/2^{\circ}$

TORQUE SPECIFICATIONS

APPLICATION	Ft. Lbs.
FRONT SUSPENSION	
Stabilizer	
Stabilizer Link Nut	13 to 17
Stabilizer Shaft Bracket to Frame Bolt & Nut	25 to 45
Shock Absorber	
Shock Absorber to Cross Bar	15 to 25
Shock Absorber to Lower Control Arm	15 to 25
Control Arms	
Upper Control Arm Pivot Shaft to Crossbar Bolts & Nuts	60 to 85
Rubber Bumper to Lower Control Arm	25 to 40
Ball Joints	
Ball Joints to Steering Knuckle Nuts	35 to 60
Steering Knuckle	
Steering Knuckle to Backing Plate Bolts	55 to 80
Plain Arm to Steering Knuckle to Backing Plate Bolts	80 to 130
Wheel Bearing Adjustment Nut	(Refer to Wheel Bearing Adj.)
Wheel Nuts	55 to 70
Isolation Mounts to Body Frame	65 to 90
Tie Rod Adjuster	20 to 25

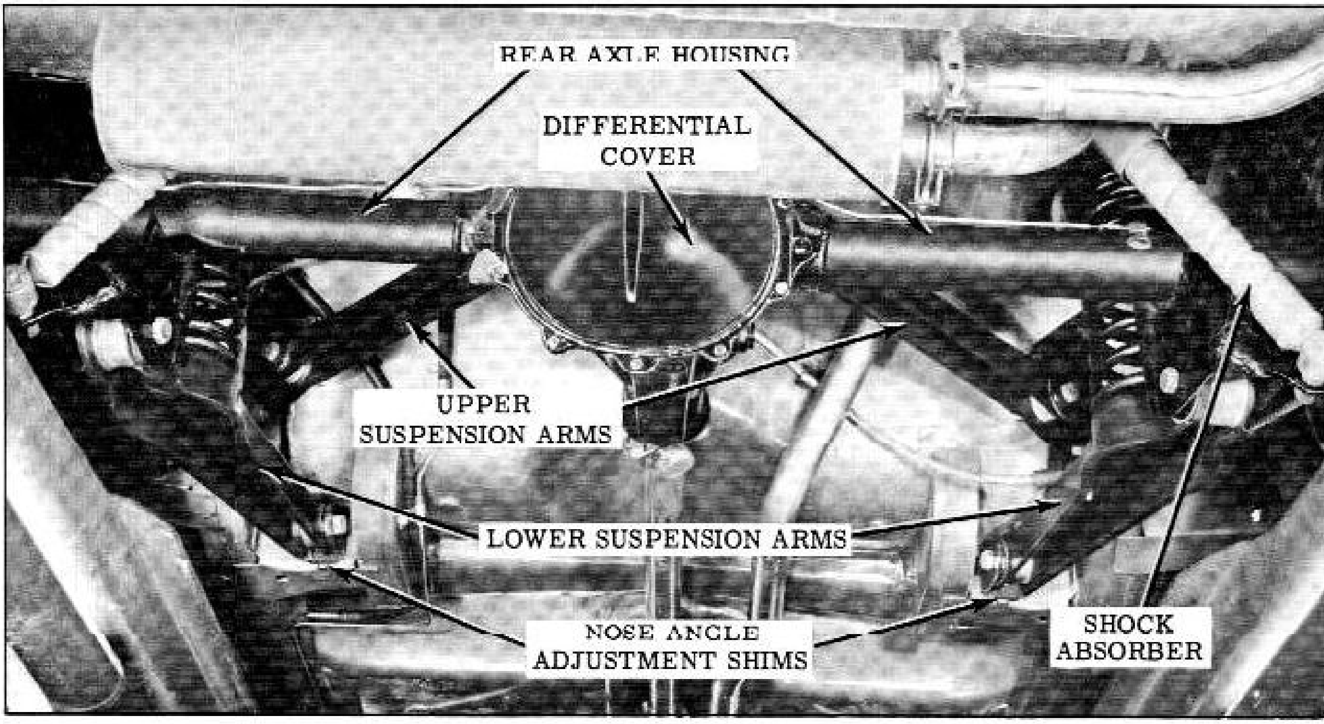


Fig. 5-19 Rear Suspension

REAR SUSPENSION

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DESCRIPTION

The rear suspension is of the link type with coil springs. It uses four suspension arms that attach the rear axle assembly to the body. The lower arm 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 body. The lower arm is used to obtain differential nose angle by shimming at the forward end. Two shocks are attached to the body and to brackets on the axle housing.

UPPER SUSPENSION ARMS

Removal

1. Remove nut from rear arm to differential housing bolt.
2. Remove bolt by rocking differential.

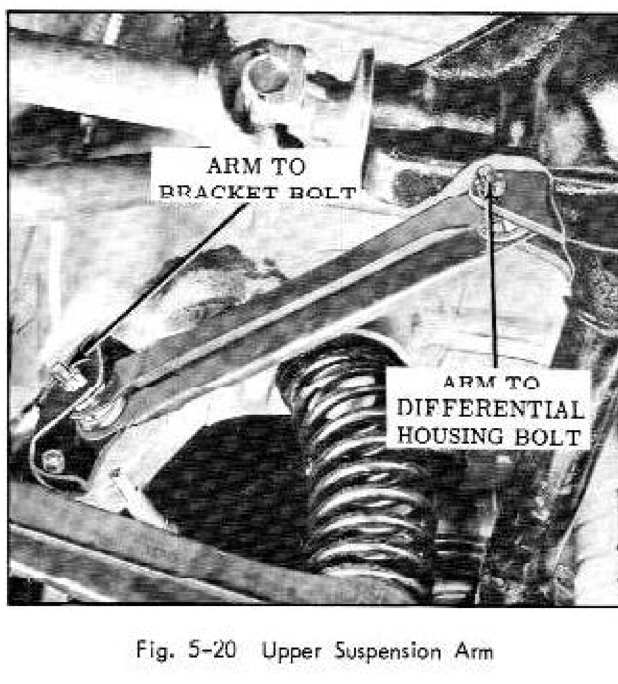

Fig. 5-20 Upper Suspension Arm

3. Front nut and bolt may now be removed.

4. Inspect bushings for damage.

Installation

When installing new arm, it is suggested it be attached at the body bracket first then the differential. The arm is reversible. Torque arm bolt nuts to 85-110 ft. lbs.

LOWER SUSPENSION ARMS

Removal

The lower suspension arms support the coil spring and are used for the adjustment of the differential angle. Care must be taken when servicing this arm because of the constant spring tension on the arm.

1. Disconnect lower shock stud from axle housing bracket.

2. Raise rear of car until coil spring can be easily removed.

3. Remove rear arm to axle housing bolt.

4. Remove two front arm bracket to body bolts.

NOTE: When removing the two front bracket bolts, the same amount of shims must be reinstalled.

Installation

Before installing arm, inspect coil spring insulator for damage. To replace arm reverse the above sequence of operations. Torque nuts to 85-110 ft. lbs. Install spring on lower arm with end coil correctly positioned.

BUSHINGS

Bushings are serviced by replacing complete arms only.

COIL SPRINGS

Removal

1. Disconnect shock from lower bracket.

2. Lift car at rear, by frame rail. This will allow suspension to drop far enough to remove the spring.

Installation

1. Place coil spring insulator in position.

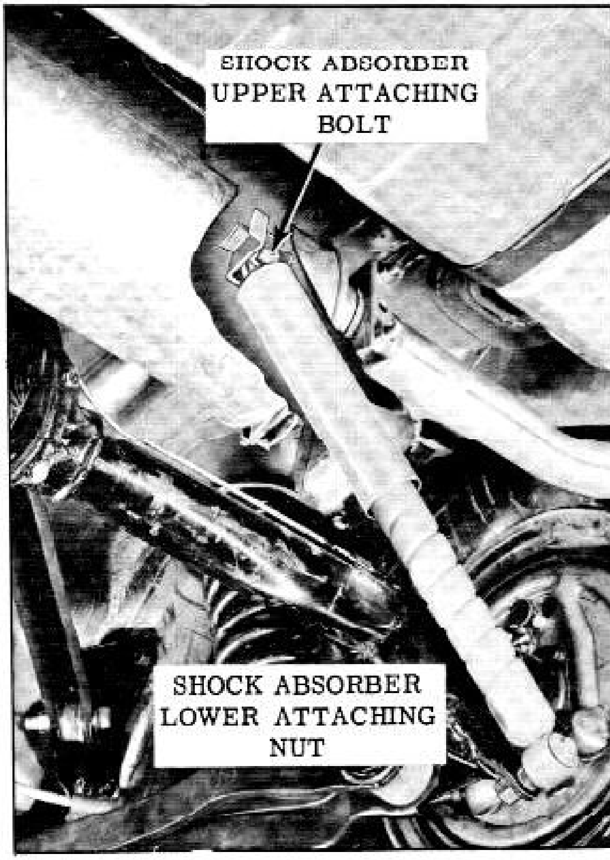

Fig. 5-21 Rear Shock Absorber

2. Lower car and attach shock to lower bracket. Torque shock nut 30-45 ft. lbs.

When installing springs, top insulator should be replaced, if damaged.

SHOCK ABSORBERS

The double action shock absorbers are mounted to a body bracket at the top and to a bracket welded on the axle housing. (Fig. 5-21)

To thoroughly check shock absorbers, refer to Front Suspension Shock Absorbers, Page 5-4.

Removal

If found necessary to replace, raise car, supporting rear axle, and remove upper and lower attaching nuts. The upper end has a bolt through the shock bushing. The lower end has a stud which is an integral part of the shock.

Installation

Loosely attach shock to both brackets before tightening nuts. Torque lower stud nut to 30-45 ft. lbs. and upper bolt nut 60-80 ft. lbs.

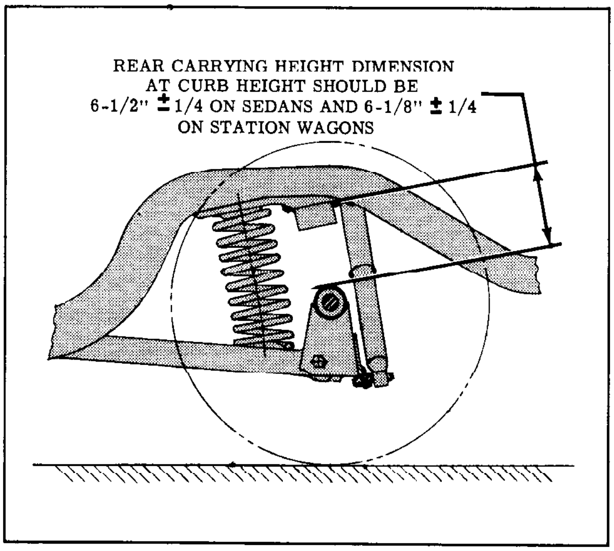

Fig. 5-22 Rear Spring Carrying Height

AXLE HOUSING

Removal

1. Disconnect shock from lower bracket.
2. Disconnect propeller shaft, brake line, and parking brake cable equalizer.
3. Disconnect upper suspension arm from differential.
4. Slowly raise car at rear and remove coil springs.
5. Disconnect lower suspension arms.

This will separate axle housing assembly from the body. 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, and check differential nose angle if a new housing has been installed.

BUMPER

The rear axle housing bumper is located above the axle housing and is attached by one cap screw. If found deteriorated or damaged it must be replaced.

REAR SPRING CARRYING HEIGHT

The rear spring carrying height is controlled by the length of the rear coil spring.

It may be checked as shown in Fig. 5-22.

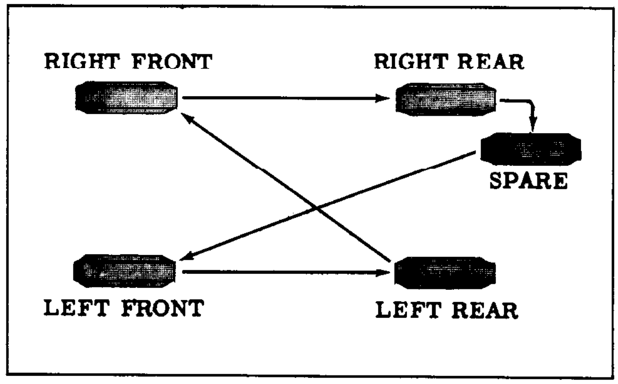

Fig. 5-23 Tire Rotation

WHEELS AND TIRES

MAINTENANCE RECOMMENDATIONS

Correct inflation pressure is of the most importance in tire care and service.

TIRE PRESSURE	FRONT	REAR
With Factory Installed Air Conditioning	24*	24*
Without Factory Installed Air Conditioning	22	22
*22 p.s.i. when o/s 700 x 13 tires are used		

Tire rotation every 4,000 miles will aid in longer life and prevent excessive uneven wear that may result in shimmy, vibrations, noise, bumpy or rough riding.

Tires used by Oldsmobile have an inner liner which, when punctured, forms a temporary seal until the object is removed.

The tire should be repaired after a puncture in accordance with the tire manufacturer's recommendations in this section.

TIRE AND WHEEL RUNOUT

Inflate tires to recommended pressure. Tire 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. 5-24)

Tire & Wheel Assembly -	Radial	.063"
	Lateral	.081"
Wheel	Radial	.045"
	Lateral	.045"

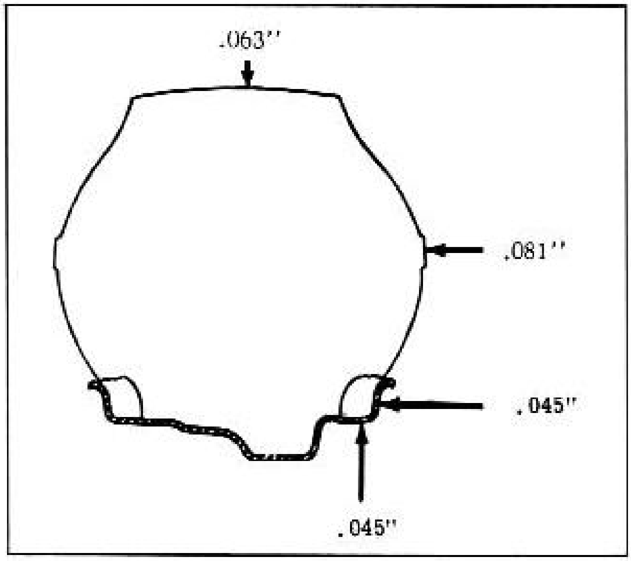

Fig. 5-24 Tire And Wheel Runout

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" 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.

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.

Tire mounting machines or irons may be used to mount tires, but extreme care must be taken not to damage sealing beads.

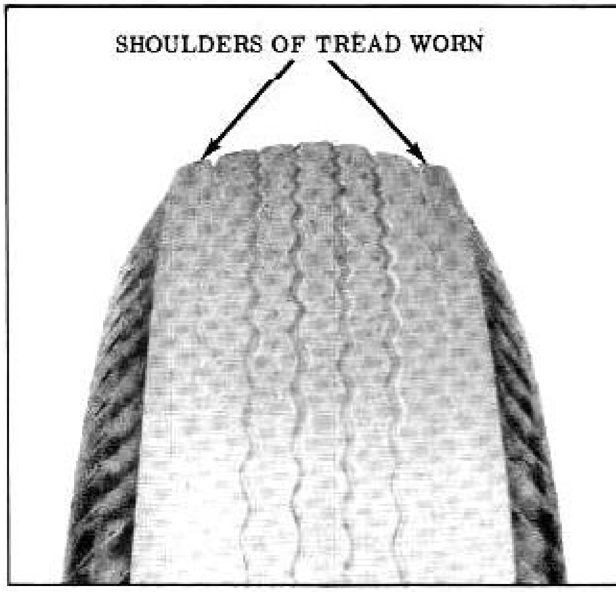

Fig. 5-25 Under-Inflation Wear

Tire lubricating soap should be used on beads, but an excessive amount may cause tire slippage on wheel.

Inflate tire to approximately 40 pounds 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 or 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.

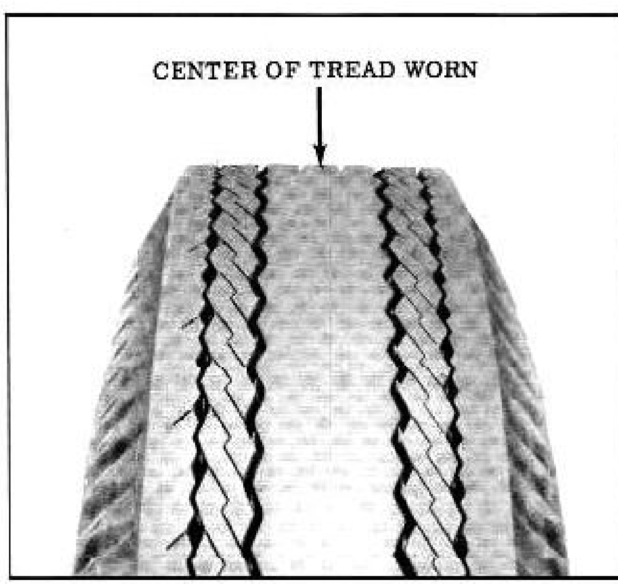

Fig. 5-26 Over Inflation

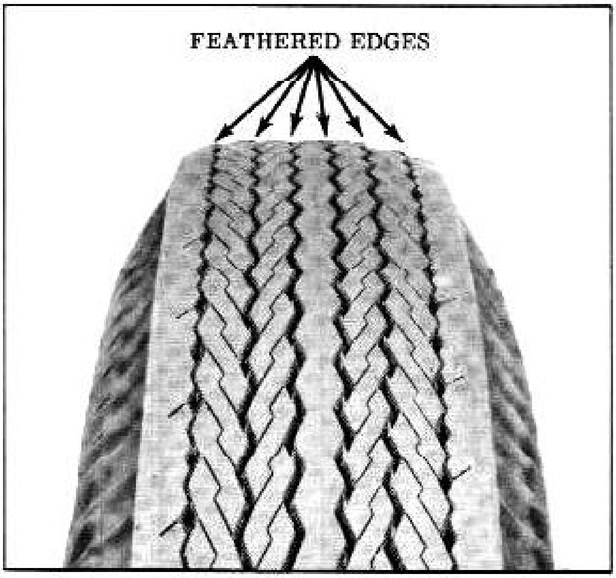

Fig. 5-27 Toe-in Wear

TIRE WEAR

Several illustrations are shown that reveal common tire wear patterns generally resulting from conditions noted.

AXLE HOUSING ALIGNMENT

Rear tire wear may indicate that the axle housing may be out of alignment. It can be checked as follows:

1. Back the car squarely onto an alignment machine.
2. Compensate for wheel run-out the same as for checking front wheel toe-in.
3. Check camber readings which should be: $1/4^{\circ}$ negative to $1/2^{\circ}$ positive.

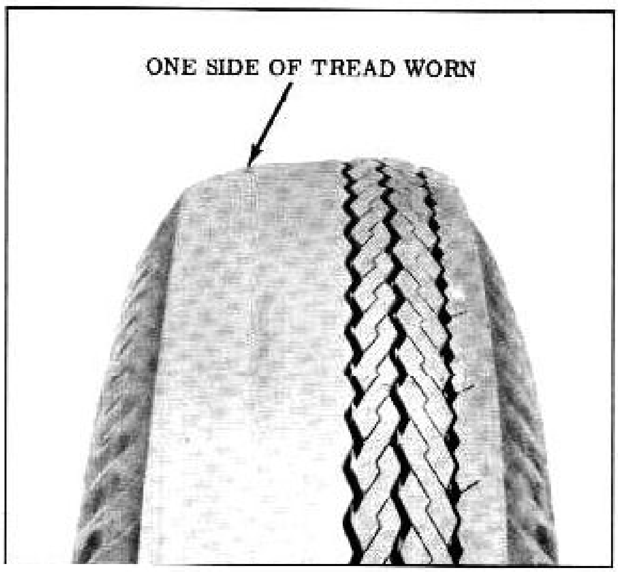

Fig. 5-28 Camber Wear

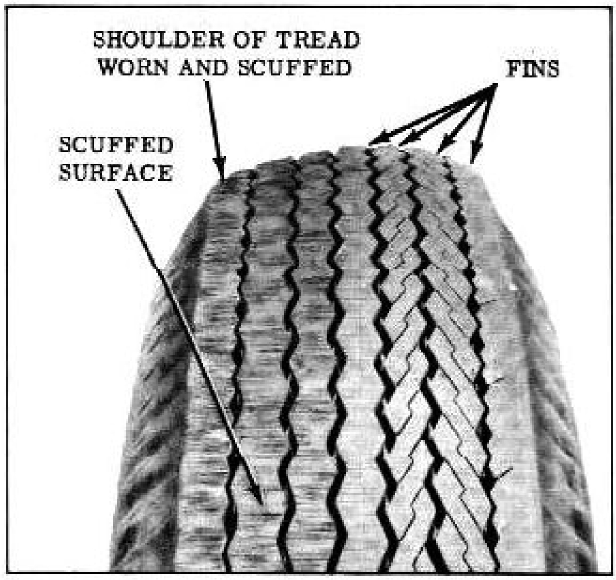

Fig. 5-29 Cornering Wear

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 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.

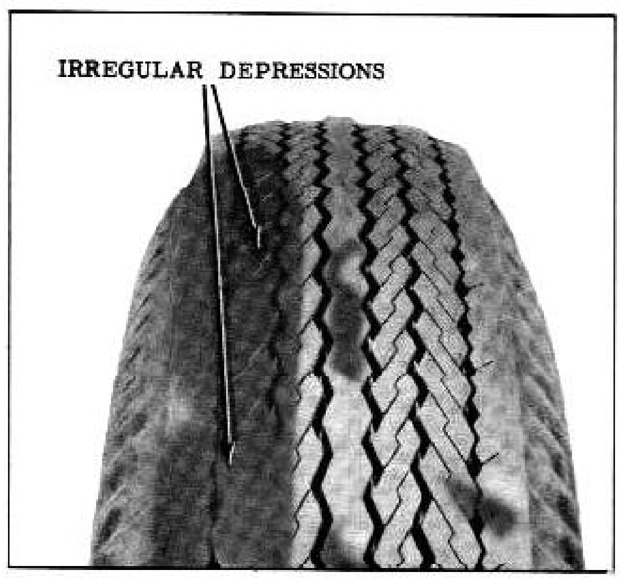

Fig. 5-30 Mechanical Condition Wear

DIFFERENTIAL NOSE ANGLE

The differential nose angle may be checked with Tool BT-30-2. Install tool at front arm of front cross bar as shown in Fig. 5-31.

The line to engine spacer is installed after rear bracket has been attached to the differential.

Place indicator against the pinion companion flange and cable must be in the notch marked F-85.

If necessary to adjust, if cable is below the notch, remove shim from front of lower suspension arm.

If cable is above notch, add shims.

NOTE: The same amount of shims must be added to both sides. 1/8" shim will raise or lower nose angle approximately 1/16 inch.

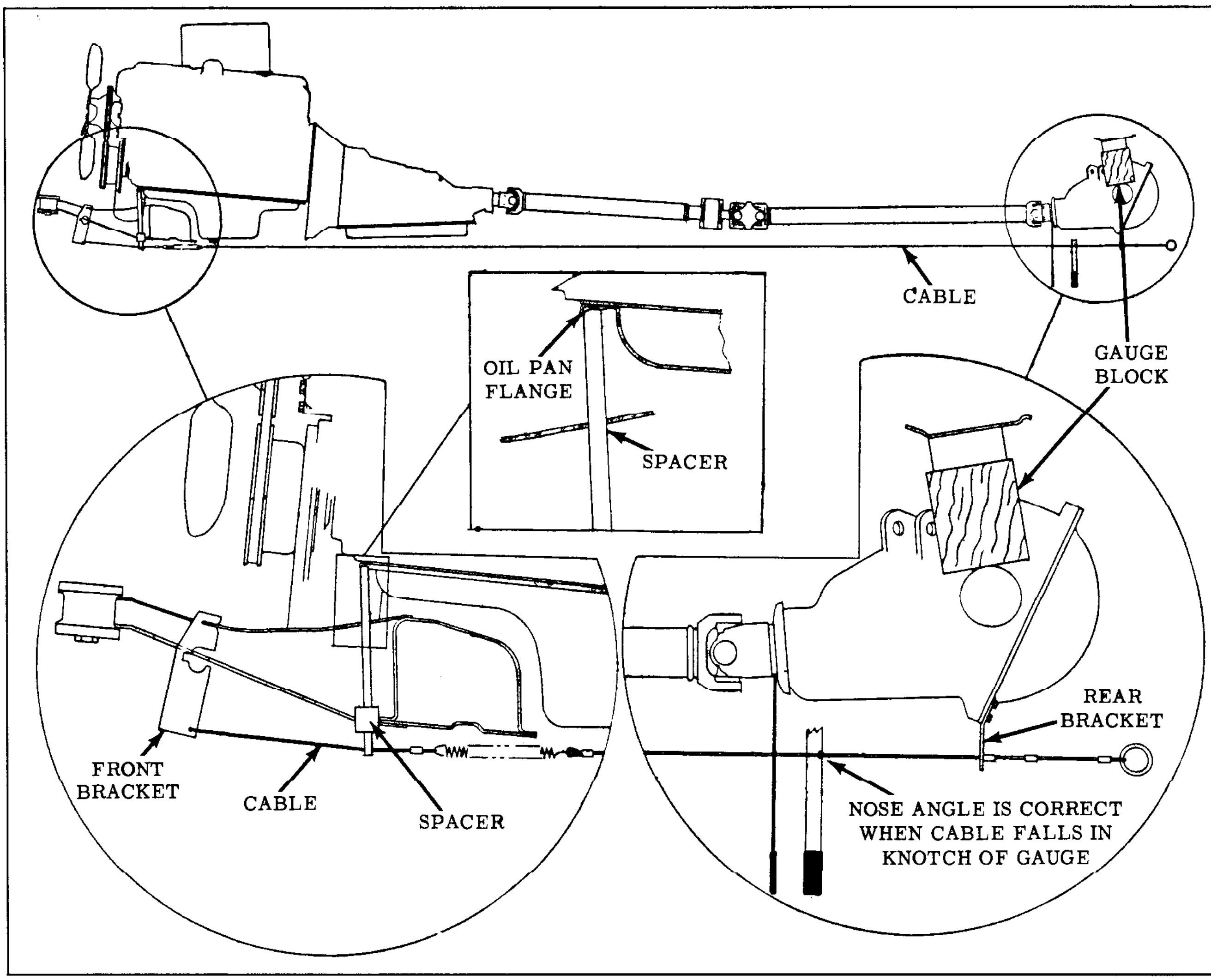

Fig. 5-31 Nose Angle Adjustment

WHEELS AND TIRES

WHEELS	
Rim Diameter	13"
Rim Width	4-1/2"
Radial Runout	Max. .045"
Lateral Runout	Max. .045"
TIRES & WHEEL ASSEMBLY	
Radial Runout	Max. .063"
Lateral Runout	Max. .081"

TIRE SIZES

All Series	Standard	Optional
Without Factory Installed Air Conditioning	6.50 x 13	7.00 x 13
With Air Conditioning	6.50 x 13	7.00 x 13

SPECIFICATIONS

REAR SUSPENSION	
Tread	56"
Allowable Out-of-True of Housing on the Vertical (at rear wheel)	$1/4^{\circ}$ neg. to $1/2^{\circ}$ pos.
Allowable Out-of-True of Housing on the Horizontal (at rear wheel)	3/64" to 5/32" toe-out
Carrying Height	
Sedans	(curb) 6-1/4" to 6-3/4"
Station Wagons	(curb) 5-7/8" to 6-3/8"

TORQUE SPECIFICATIONS

REAR SUSPENSION	FT. LBS.
Shock Absorber	
Upper Pivot Bolt & Nut	60 to 80
Lower Stud Nut	30 to 46
Rear Suspension Arm	
Upper Arm to Body Bracket	85 to 110
Upper Arm to Axle Housing	85 to 110
Lower Arm to Body Bracket	85 to 110
Lower Arm to Axle Housing	85 to 110
Backing Plate	
Backing Plate Attaching Bolts	45 to 60
Wheel Nuts	55 to 70

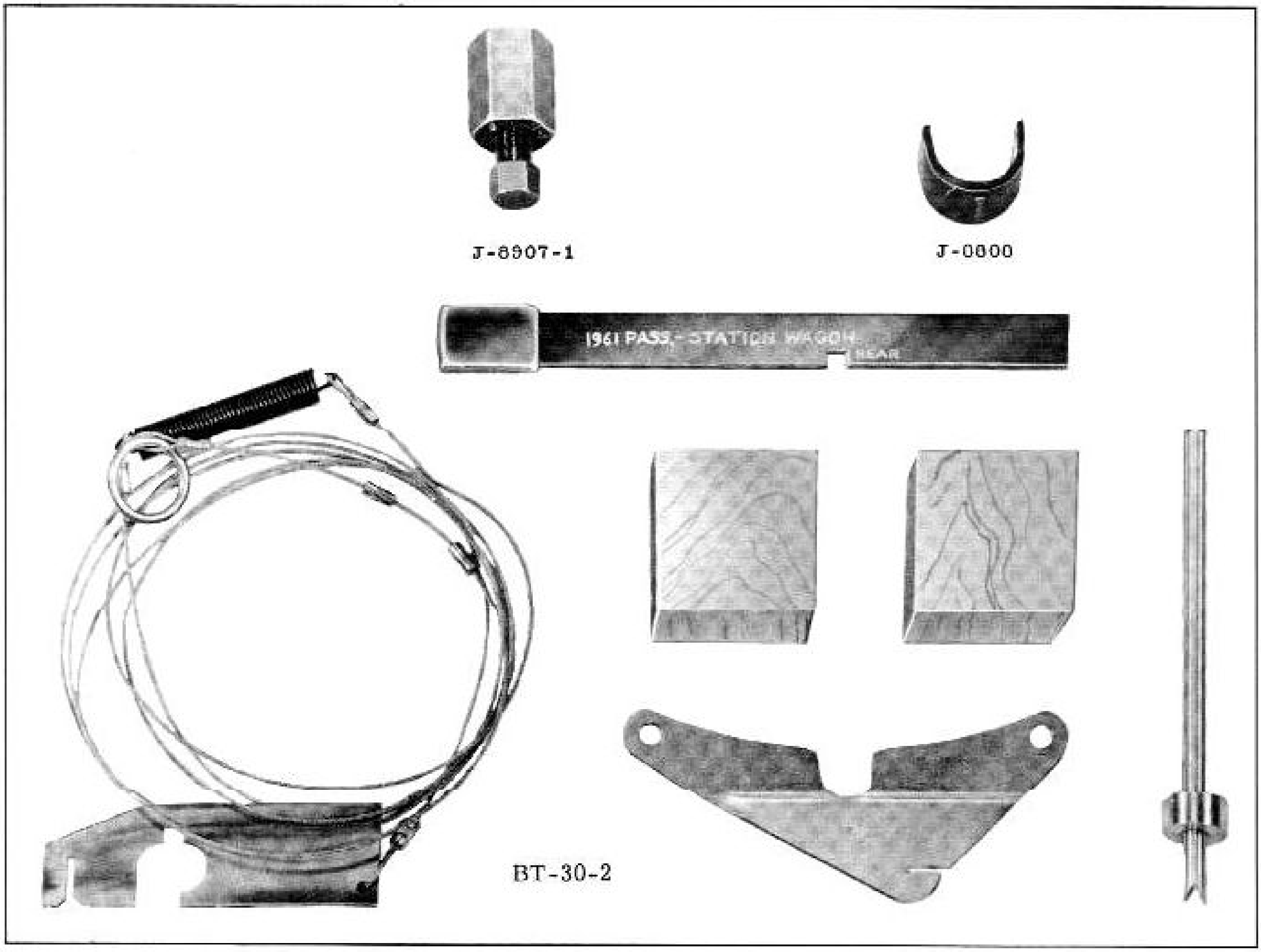

Fig. 5-32 Tools

BT-30-2 Differential Angle Gauge

J-8808 Lower Control Arm Spacer

J-8907-1 Lower Control Arm Shaft Remover and Replacer

DIFFERENTIAL, AXLES

AND

PROPELLER SHAFT

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PROPELLER SHAFT

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MAINTENANCE RECOMMENDATIONS

The lubricant should be checked at 2000 mile intervals by removing the side filler plug.

It should be up to filler plug level. If necessary to add lubricant, use SAE 90 multi-purpose gear lubricant. Also at this time the pinion and cover seal should be inspected for leaks.

DESCRIPTION

The differential is supported in the carrier housing by two bearings. The axle tubes are pressed into the differential carrier housing and welded. The case, ring gear and pinion assembly are of the conventional design. Exact adjustments of this unit are extremely important for satisfactory performance.

COMPANION FLANGE

Removal

1. Disconnect the propeller shaft from companion flange.
2. Attach Tool J-8614-1 (Fig. 6-2), (notches toward flange). Center on flange with Tool J-8614-2. Flange holding tool to flange bolts MUST BE TIGHT.
3. Remove pinion nut.
4. With Tool J-8614-2, remove flange. (Fig. 6-3)

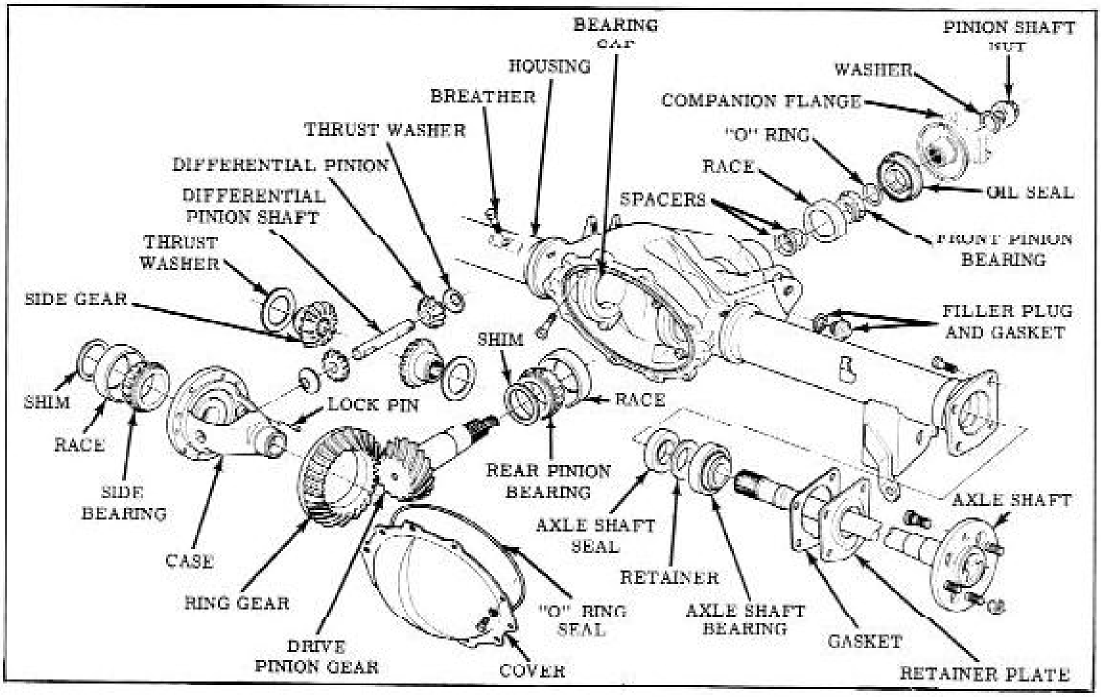

Figure 6-1 Rear Axle Assembly

Installation

1. Inspect seal surface of companion flange for nicks and wear. Lubricate seal surface with 567196 lubricant when installing.

2. With Tool J-8614-1 attached to flange, place flange on pinion enough to allow nut to start on threads. Thread nut on pinion without washer, then remove nut and install washer.

3. Tighten lock nut to 200 ft. lbs.

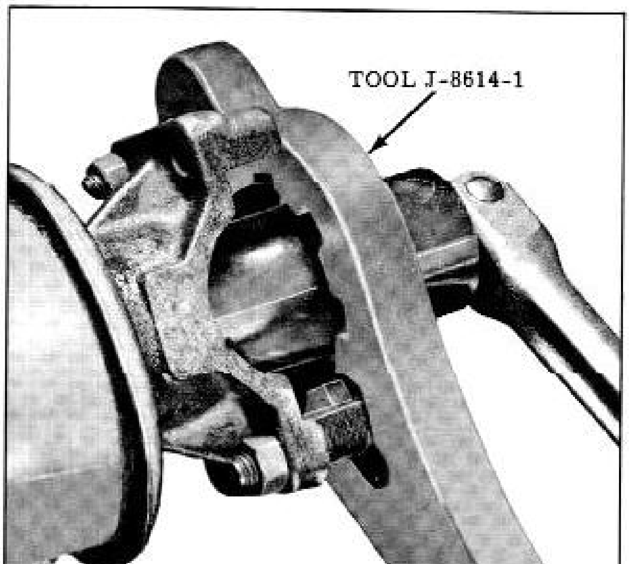

Figure 6-2 Removing Pinion Nut

PINION SEAL

Removal

1. Remove companion flange using Tool J-8614.
2. Remove seal with a chisel. (Fig. 6-4)

Installation

CAUTION: When installing pinion or any seals that are spring loaded, it is advisable to inspect the installation to be sure the spring has not come out of the seal from jarring on installation.

1. Coat outer edge of new seal with a sealing compound such as Permatex #2.
2. Drive seal into housing, using Tool J-8613. (Fig. 6-5)

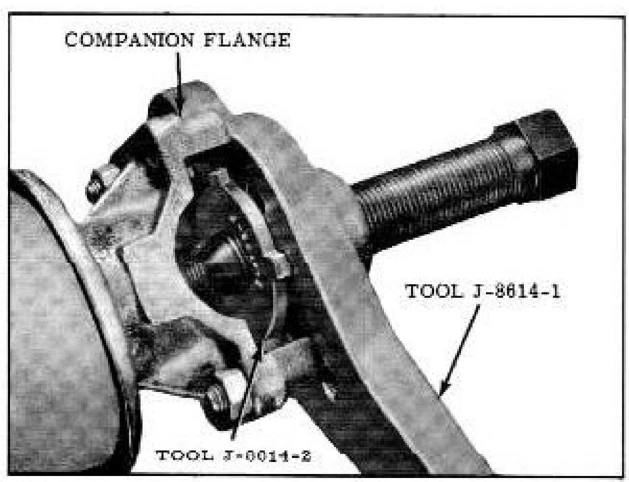

Figure 6-3 Removing Companion Flange

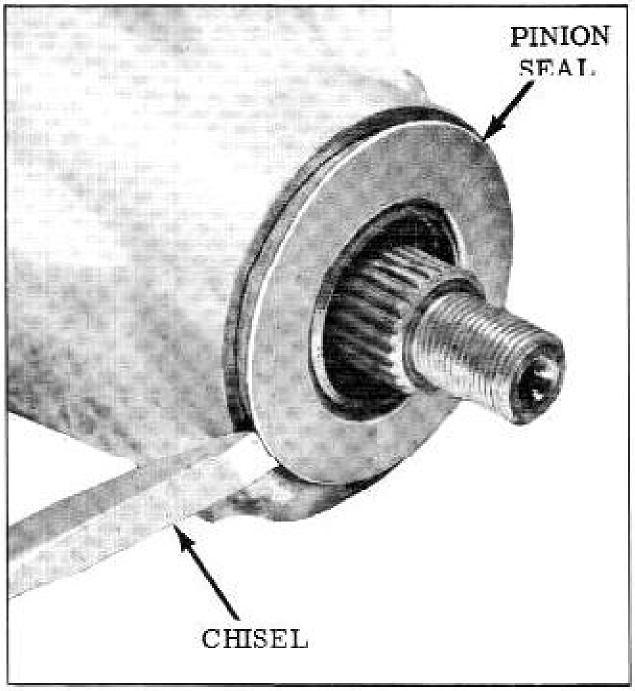

Figure 6-4 Removing Pinion Seal

DIFFERENTIAL CASE

Removal

To remove the differential case assembly from the axle housing, the following procedure may be followed whether the housing is still attached to the car or it is removed and on the bench.

1. Drain oil, and remove inspection cover.
2. Disconnect the propeller shaft.
3. Raise rear of car as high as possible and support by frame with stands.
4. Remove wheels, brake drums, and axles. (Refer to AXLE REMOVAL in this section, Page 6-8.)

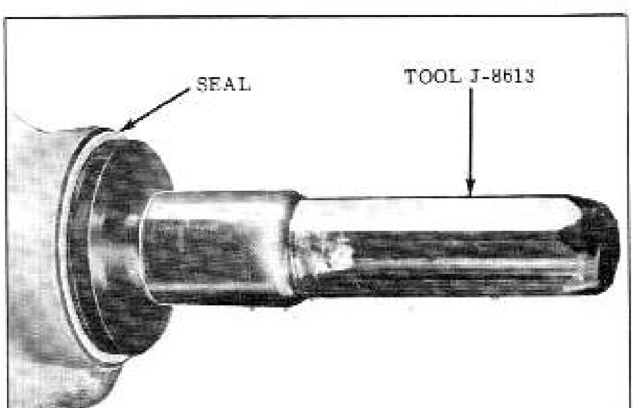

Figure 6-5 Installing Pinion Seal

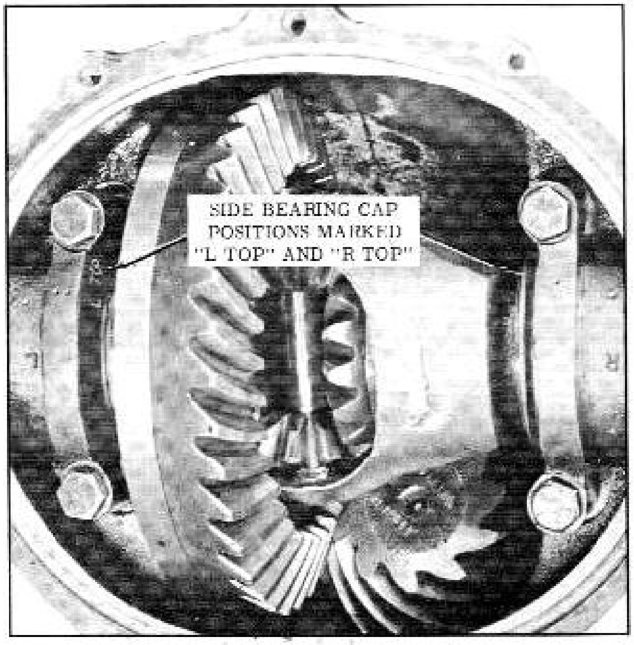

Figure 6-6 Case Assembly

5. Remove four side bearing cap bolts. (Fig. 6-6) Note: caps are marked "R Top" and "L Top".
6. Attach Tool J-8925 with Slide Hammer J-2619 to ring gear. (Fig. 6-7)
7. Pull case assembly from carrier keeping side bearings and shims in their respective positions.

Installation and Preload Adjustment

When setting side bearing preload, the pinion gear must be removed.

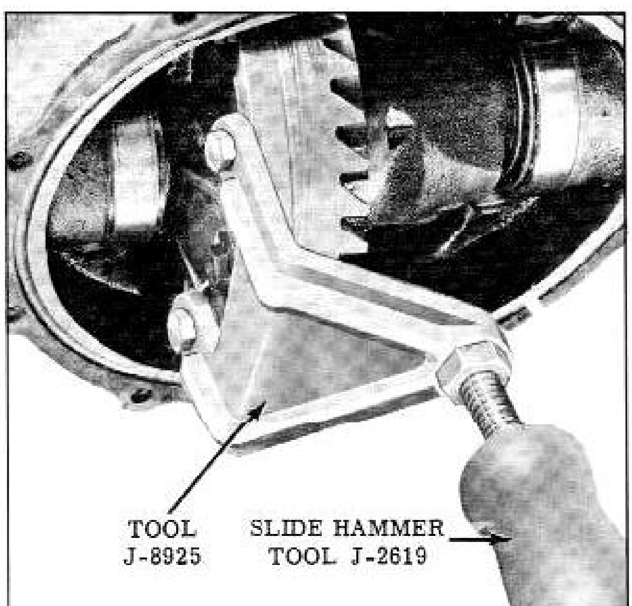

Figure 6-7 Removing Case Assembly

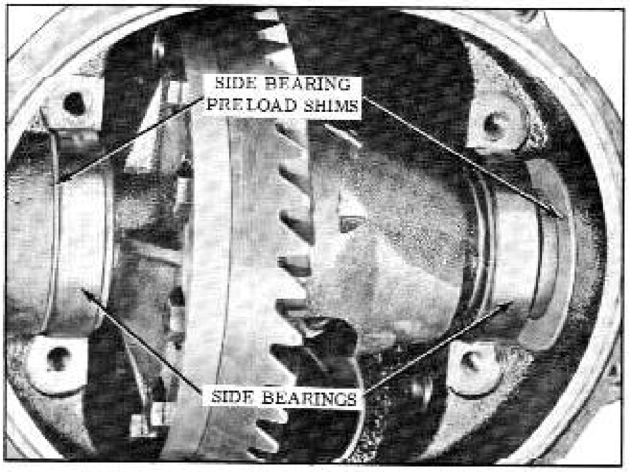

Figure 6-8 Side Bearing Shims

1. Side bearing surfaces in carrier must be free of burrs.

   NOTE: If new side bearings are used, use original shims as a starting guide to preload adjustment.

   If original side bearings are used, add a .002" thicker shim on each side than those removed.

   Equal amounts of shims must be added to each side.

2. Place case assembly in carrier with bearings and left shim in position. (Fig. 6-8)
3. Tap right shim into position with a plastic hammer.
4. Rotate case several turns to seat bearings.
5. With an in. lb. torque wrench on ring gear bolt, (Fig. 6-9), the reading should be 10-20 in. lbs. with original bearings or 20-30 in. lbs. with new bearings.

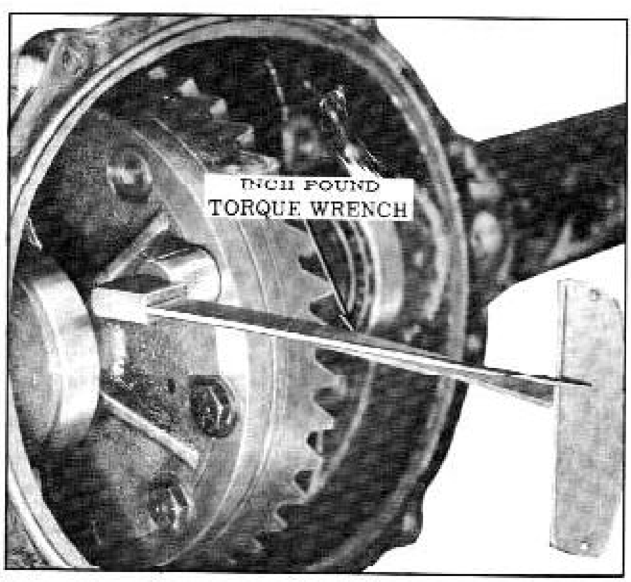

Figure 6-9 Preload Reading

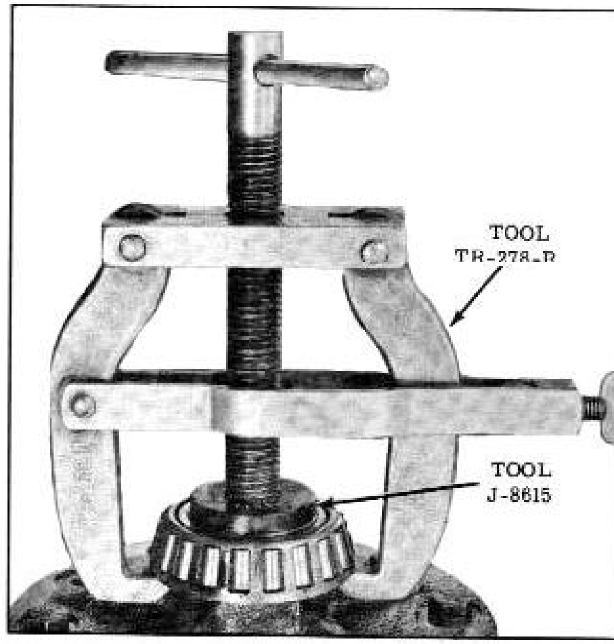

Figure 6-10 Removing Side Bearings

NOTE: Adding or subtracting .002" on each side will change in. lb. readings approximately 10 in. lbs. EQUAL AMOUNTS OF SHIMS MUST BE ADDED OR SUBTRACTED FROM EACH SIDE.

6. After the correct preload is set, the case may be removed, and set aside. Use extreme care so as not to mix bearings and shims.
7. Install pinion gear.
8. Install case assembly and torque side bearings cap bolts 70-80 ft. lbs.

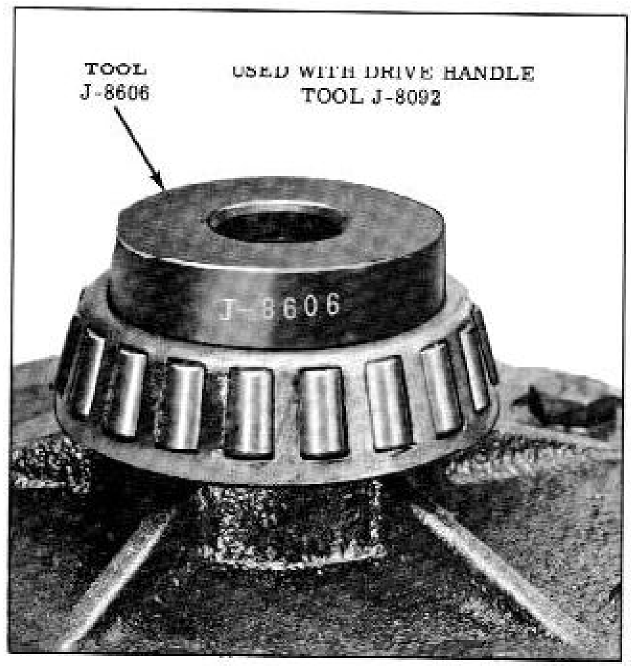

Figure 6-11 Installing Side Bearings

Disassembly

SIDE BEARINGS

Removal

1. Insert Adapter J-8615 and pull bearing using Puller TR-278. (Fig. 6-10)

Installation

Install bearings using Tool J-8606 and J-8092. (Fig. 6-11) Drive bearing on case until seated.

RING GEAR

1. Remove ring gear to case attaching bolts.
2. Drive pinion shaft spring pin from case. (Fig. 6-12)
3. Drive pinion shaft from case.
4. Remove pinions, side gears and thrust washers. Keep all parts identified so they may be re-installed in their original position.

Assembly

After cleaning, examine wearing surfaces of all parts for scoring or unusual wear patterns, and lubricate with gear lube before assembly.

1. Place side gear thrust washers over side gears and install. If parts are reused, place in original position.

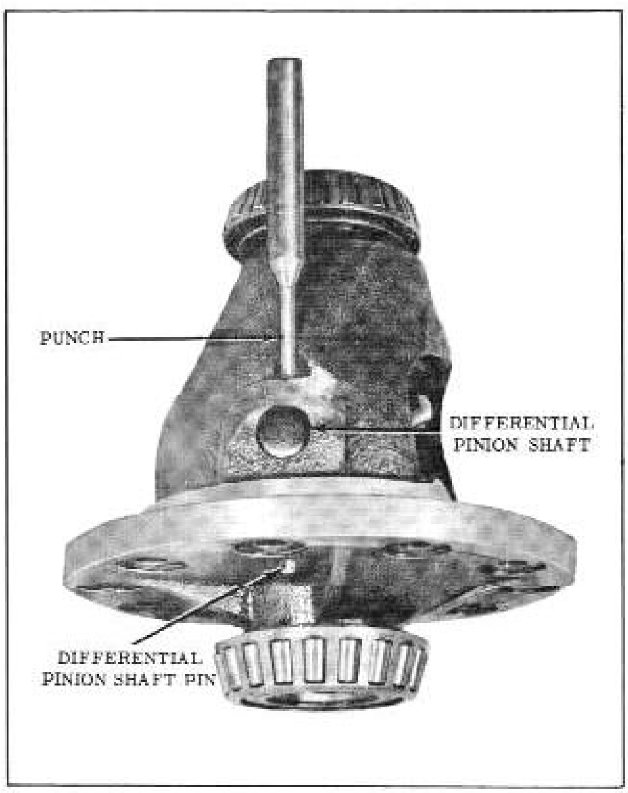

Figure 6-12 Removing Shaft Pin

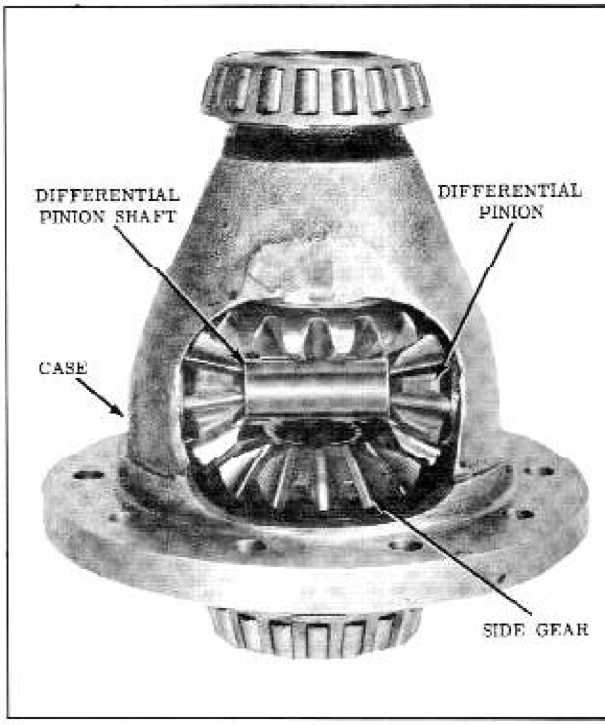

Figure 6-13 Case Assembly

2. Position one pinion (without washer) between side gears and rotate gears until pinion is directly opposite from loading opening in case. (Fig. 6-13) 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 installation of pinion thrust washers.
4. Install pinion shaft and align shaft hole with hole in case. Drive spring pin through hole in shaft until centered in shaft.

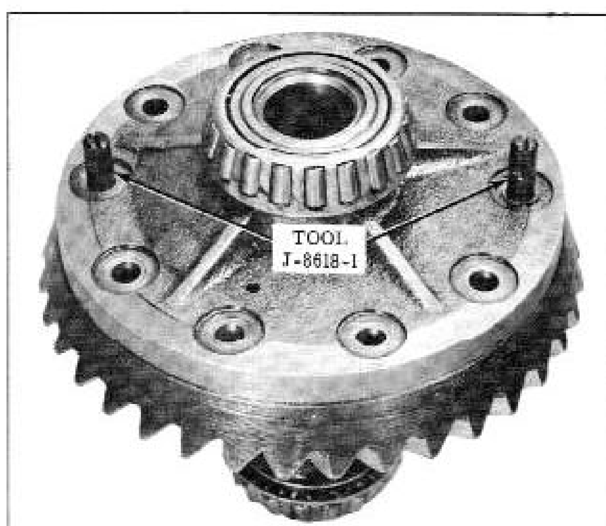

Figure 6-14 Installing Ring Gear

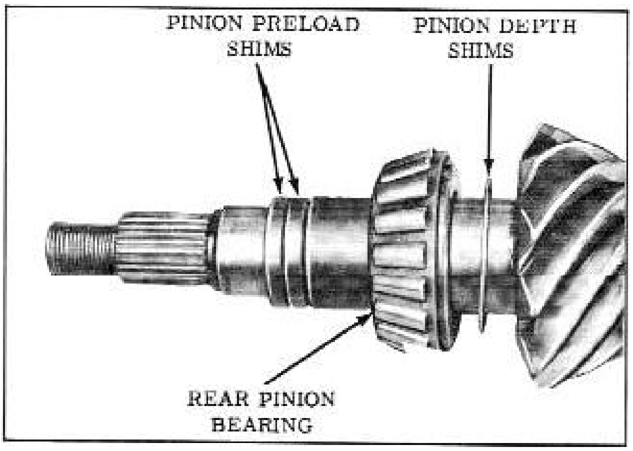

Figure 6-15 Pinion Gear Shims

5. After making sure that mating surfaces of case and ring gear are clean and free of burrs, thread two studs J-8618-1 into opposite sides of ring gear, then install ring gear on case. (Fig. 6-14) THESE STUDS MUST BE USED OR BOLTS MAY STRIP DUE TO IMPROPER ALIGNMENT. Install ring gear attaching bolts finger tight then tighten bolts alternately in progressive stages to 50 ft. lbs.

PINION GEAR

Removal

If gear is to be removed to inspect the bearings, check and record pinion preload as described in installation and preload procedure, step 5.

1. Remove companion flange as instructed on Page 6-1, and carefully remove gear from the rear.

Installation and Preload Adjustment

PRELOAD ADJUSTMENT MUST BE MADE FIRST BEFORE SETTING PINION DEPTH.

1. If new gear or new bearings are used, always install a new pinion seal. Use original preload shims to start with. (Fig. 6-15)
2. Lubricate seal with gear lube and install gear.

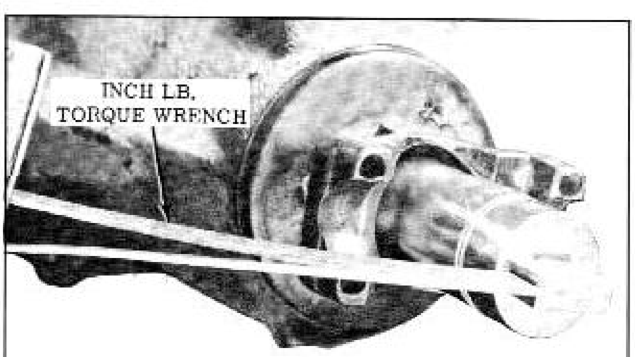

Figure 6-16 Pinion Gear Preload

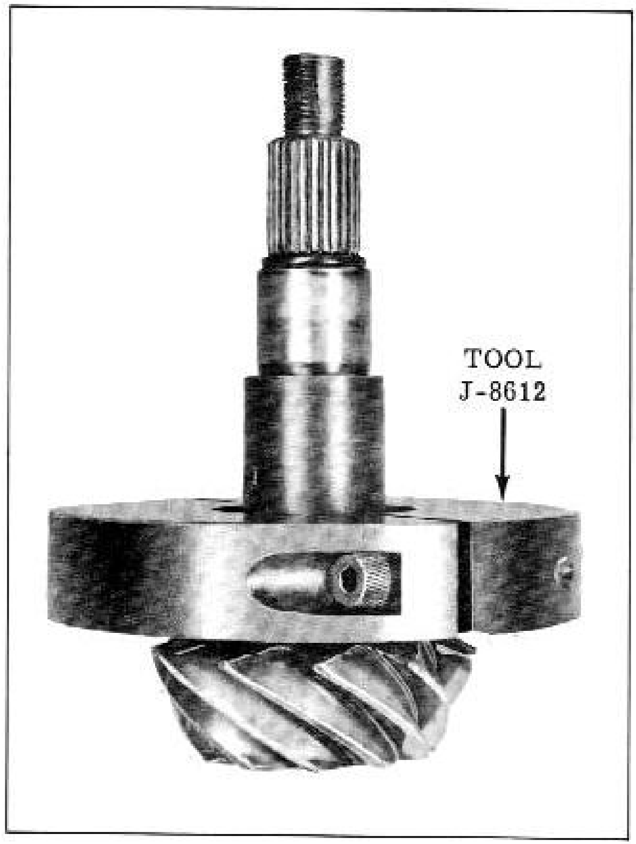

Figure 6-17 Removing Pinion Bearing

3. Install companion flange and torque nut to 200 ft. lbs. Use Tool J-8614 to hold flange while tightening nut. (Fig. 6-2)
4. Tap both ends of pinion gear lightly with a plastic hammer and rotate several times to seat bearings.
5. With an in. lb. torque wrench, and Tool J-8614 removed, rotate pinion gear. Reading should be 25-35 in. lbs. with new bearings and 15-25 in. lbs. with old bearings. (Fig. 6-16)
6. Increasing shim thickness will decrease preload. Decreasing thickness will increase preload.

REAR BEARING

The rear bearing must be removed when it becomes necessary to add or remove shims for pinion depth adjustment.

Using remover J-8612 press bearing off pinion gear. (Fig. 6-17)

Install bearing, using Tool J-8609. (Fig. 6-18)

To replace the rear bearing cup, drive from carrier with a brass drift in slots provided for this purpose.

Install bearing cup with Tool J-8608 and Handle J-8092.

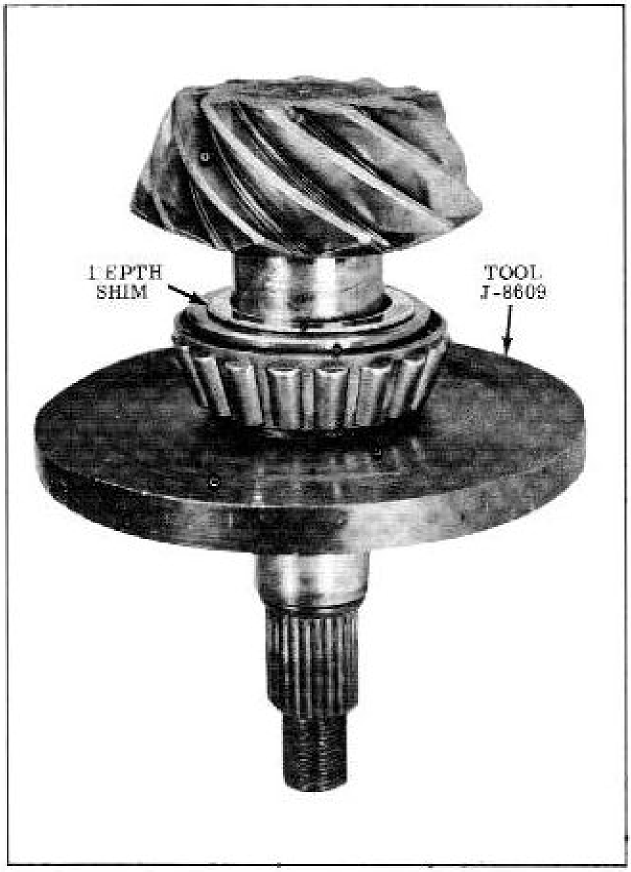

Figure 6-18 Installing Pinion Bearing

FRONT BEARING

Removal

1. Pry oil seal from housing and remove front pinion bearing.

2. If bearing is to be replaced, remove outer race with a brass drift.

Installation

1. Install outer race with Tool J-8611 and J-8092 handle.

2. Lubricate bearing with gear lube.

3. Coat outside diameter of seal with a sealer such as Permatex #2. Install seal with Tool J-8613. (Fig. 6-5)

DEPTH ADJUSTMENT

1. After the preload has been established, "zero" depth setting gauge J-8619 and J-5647-5. (Fig. 6-19) Yoke centering pin must be centered in gauge block recess. Holding yoke down firmly, rotate gauge so needle will be on zero.

2. Make sure differential bearing support bores are free of burrs and center of pinion is clean.

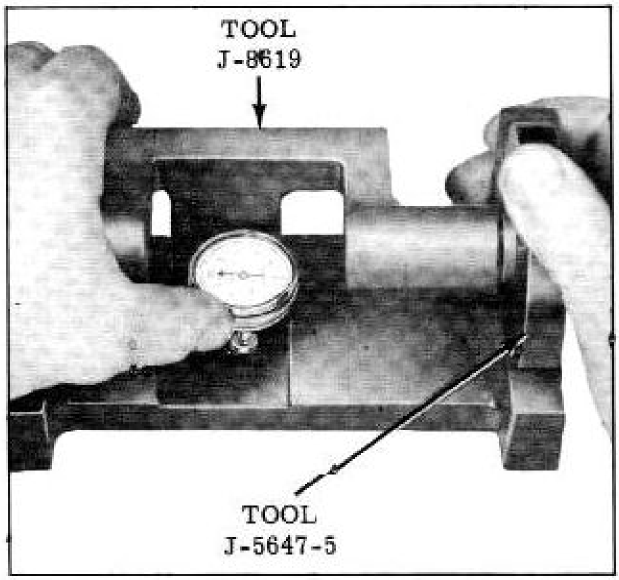

Figure 6-19 Setting Depth Gauge

3. Position pinion until gauging tooth is in position shown in Fig. 6-20.

4. Place gauge in carrier with indicator contacting gauging tooth. If necessary, rotate gear. (Fig. 6-21) Gauge guide pin must be in center of pinion.

   NOTE: It is necessary to hold down yoke tight against pinion gear. Figure is merely indicating position of gauge in carrier.

5. Press gauge firmly toward pinion and read dial indicator, noting whether the needle has moved clockwise or counterclockwise from the "O". (Fig. 6-22)

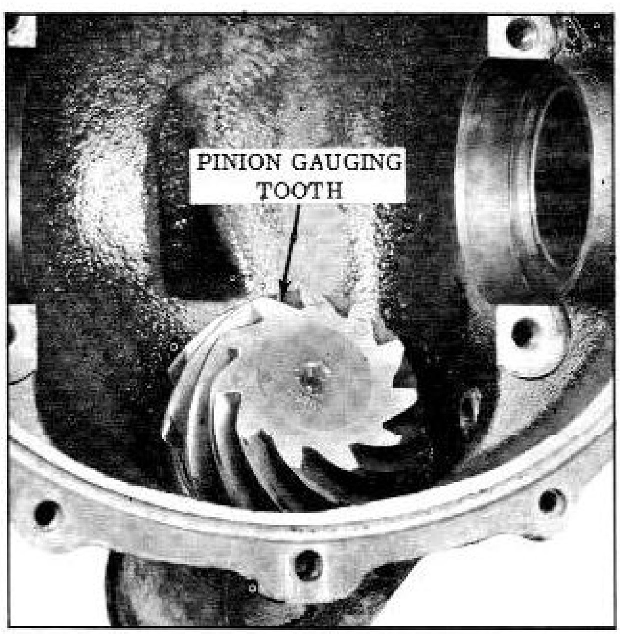

Figure 6-20 Pinion Gauging Tooth

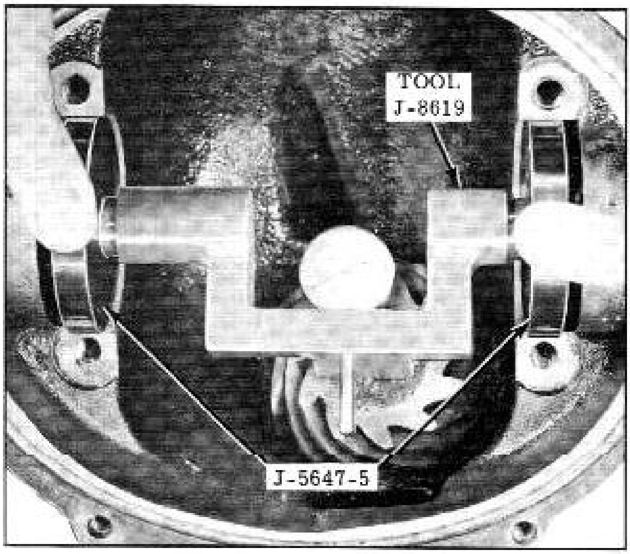

Figure 6-21 Gauging Pinion Depth

The pinion depth is adjusted by changing the shim between the rear pinion bearing and pinion gear. (Fig. 6-15)

With gauge reading and marks on pinion, refer to chart (Fig. 6-23) for amount the shim thickness must be changed.

Shims are available in graduations of .002". The specifications allow .0015" tolerance either side of the mark on the pinion, which gives a range of .003". When making a correction such as add .003", either .002" or .004" would bring the correction within the specifications. Use amount of shims that will make correction.

IMPORTANT: WHEN CHANGING DEPTH SHIMS, PRELOAD SHIMS MUST BE CHANGED THE SAME AMOUNT.

If the pinion is marked +8 and the gauge needle reads counterclockwise 5, the chart shows -3. This means remove .003" in shims. (.002" or .004")

If the pinion is marked -8 and the gauge needle reads clockwise 5, the chart shows +3. This means add .003" in shims. (.002" or .004")

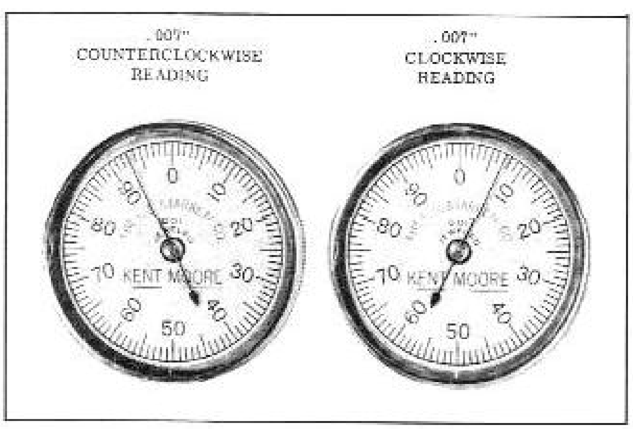

Figure 6-22 Reading Gauge

Minus (-) figures on the chart mean reduce shim thickness. Plus (+) figures mean, add to shim thickness.

BACKLASH

1. With pinion and case in carrier and all bolts torqued, install clamp and dial indicator as shown in Fig. 6-24.

2. Rotate ring gear in each direction bumping pinion teeth, noting reading on gauge. It should be within .007"-.009". Pinion gear must not move.

3. If correction is needed it is made by shifting the case. This is done by ADDING thicker side bearing shims to one side and REMOVING the SAME amount from the other side. To INCREASE backlash, move ring gear AWAY from pinion gear. To DECREASE, move ring gear TOWARD pinion gear. Moving the case assembly .002 will change backlash approximately .001.

AXLE SHAFT AND BEARING

Removal

1. Remove wheel and brake drum.

   NOTE: Wheel nuts on left side of car have left hand threads and the right side has right hand threads.

2. Remove 4 axle bearing retainer nuts.

3. Attach Puller J-2619 with Adapter J-8617 and pull axle from housing. Care must be taken not to loosen backing plate from housing as it may damage brake line. (Fig. 6-25)

   NOTE: Do not drag shaft over seal as this may damage seal.

4. Attach one axle bearing retainer nut to hold backing plate in position.

Installation

Before installing axle, examine the oil seal. The seals have feathered edges which form a tight seal around the shaft. If these feather edges are damaged in any way the oil seal must be replaced.

Examine the seal surface on the shaft. It must be smooth. If necessary, dress down with very fine emery cloth.

PINION MARK	GAUGE READING																														
	When needle reads Clockwise from O																When needle reads Counter-Clockwise from O														
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
+15	-30	-29	-28	-27	-26	-25	-24	-23	-22	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0
+14	-29	-28	-27	-26	-25	-24	-23	-22	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-8	-6	-5	-4	-3	-2	-1	0	+1
+13	-28	-27	-26	-25	-24	-23	-22	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2
+12	-27	-26	-25	-24	-23	-22	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3
+11	-26	-25	-24	-23	-22	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4
+10	-25	-24	-23	-22	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
+9	-24	-23	-22	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6
+8	-23	-22	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7
+7	-22	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8
+6	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9
+5	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10
+4	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11
+3	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12
+2	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13
+1	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14
0	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15
-1	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16
-2	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17
-3	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18
-4	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19
-5	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20
-6	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21
-7	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22
-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23
-9	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23	+24
-10	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23	+24	+25
-11	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23	+24	+25	+26
-12	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23	+24	+25	+26	+27
-13	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23	+24	+25	+26	+27	+28
-14	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23	+24	+25	+26	+27	+28	+29
-15	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12	+13	+14	+15	+16	+17	+18	+19	+20	+21	+22	+23	+24	+25	+26	+27	+28	+29	+30

Minus (–) signs – remove that amount of shim thickness (in thousandths of inches).
Plus (+) signs – add that amount of shim thickness (in thousandths of inches).

Correct gauge reading if pinion is properly set is as follows:

For (+) mark on pinion, gauge should read that amount counterclockwise.

For (–) mark on pinion gauge should read that amount clockwise.

Fig. 6-23 Pinion Depth Shim Corrections

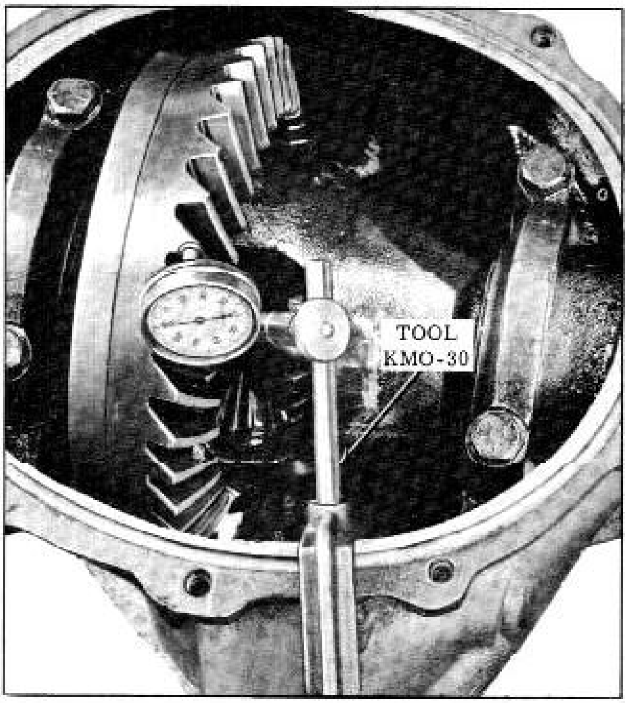

Figure 6-24 Adjusting Backlash

1. Remove nut holding backing plate to axle housing.
2. Clean bearing retainer gasket surface of backing plate and install new gasket. Clean gasket surface of bearing retainer.
3. Grease outside diameter of axle bearing, seal surface on axle shaft, and bore of axle housing with differential lubricant, and slide axle shaft and bearing assembly into place. EXTREME CARE MUST BE TAKEN NOT TO DAMAGE SEAL.
4. Place gasket and bearing retainer over studs, install nuts and torque 45-60 ft. lbs.

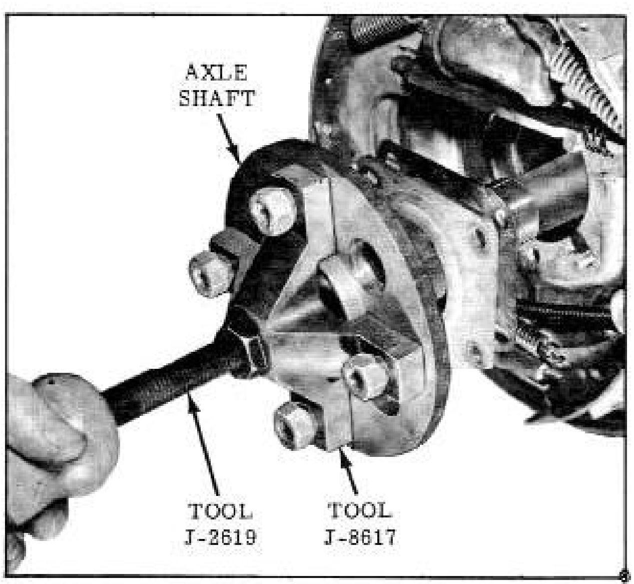

Figure 6-25 Removing Axle Shaft

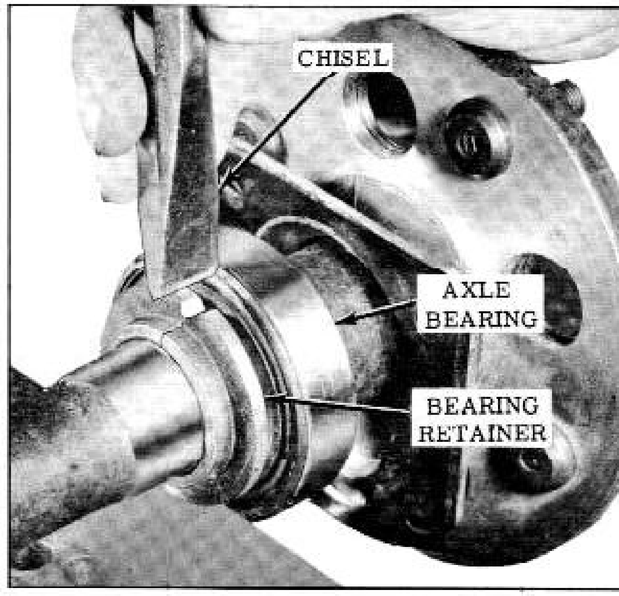

Figure 6-26 Removing Axle Bearing Retainer

BEARING

Removal

Bearings should be replaced if found to be rough or have greater than .020 end play. Remove bearing only when a new bearing is to be installed.

1. With axle shaft removed from housing, split retainer with a chisel as shown in Fig. 6-26.
2. With Tool J-8877 press bearing off shaft. (Fig. 6-27)

   NOTE: Use Tool J-8621 if using bench type hydraulic press.

   NOTE: For safety, an old brake drum can be placed over bearing, should bearing break while pressing off.

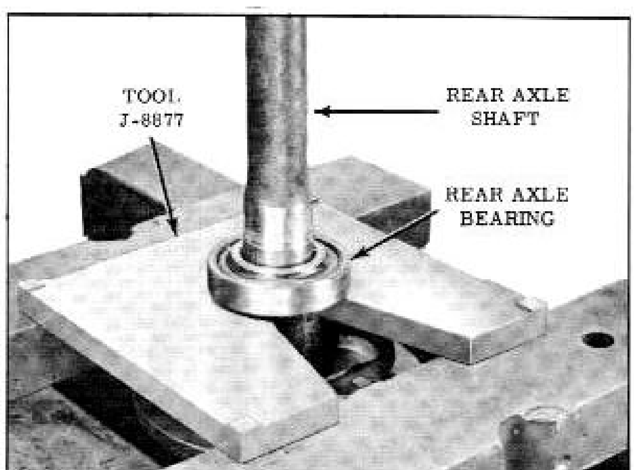

Figure 6-27 Removing Axle Bearing

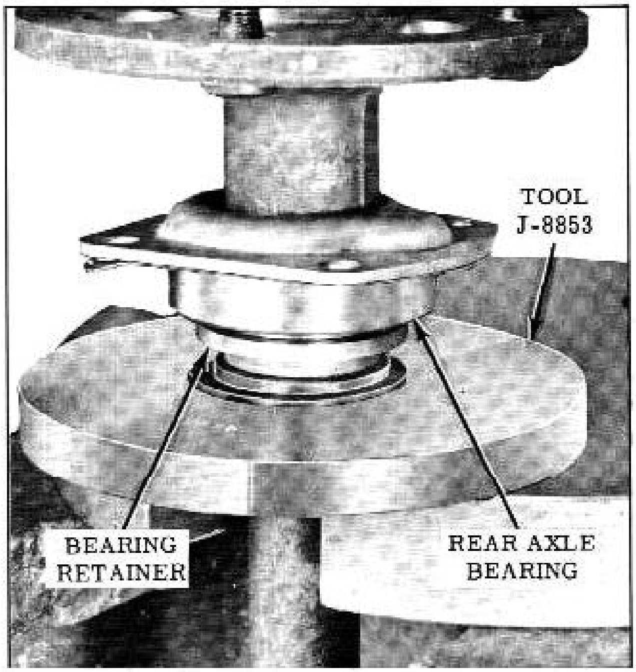

Figure 6-28 Installing Axle Bearing

Installation

With Tool J-8853 press bearing on shaft (Fig. 6-28), making sure bearing is being pressed on INNER RACE.

IMPORTANT: BEARING MUST BE INSTALLED BEFORE RETAINER.

Press retainer on shaft with Tool J-8853 (Fig. 6-28), until it is firmly against bearing.

FLANGE BOLTS

Axle flange bolts may be removed if damaged, by pressing them out of flange.

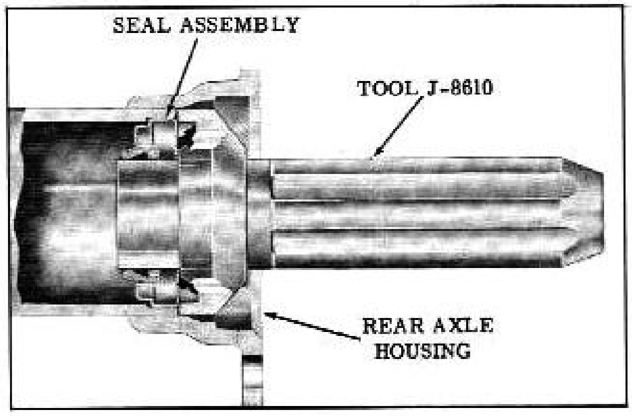

Figure 6-29 Installing Axle Shaft Oil Seal

They may be installed by pressing them in, then using Tool J-554-3 7/16" to peen the shoulder. The head of the bolt must be backed up when peening.

AXLE SHAFT OIL SEAL

Removal

Use any suitable tool to remove the seal. Slide Hammer J-2619 may be used by hooking the nut over the seal and bumping it outward.

Installation

1. Apply a sealer such as Permatex #2 to outside diameter of seal.

2. Position seal at axle housing and drive in with Tool J-8610 until tool is firmly seated. (Fig. 6-29) This will properly position seal.

PROPELLER SHAFT

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MAINTENANCE RECOMMENDATIONS

Lubricate slip yoke every 8,000 miles with Part No. 567196 lubricant. Fill through grease fitting until it appears at slip yoke nut.

Universal joints should be lubricated every 20,000 miles with fine fiber grease such as Marfax #2. The joint must be completely disassembled and cleaned. Lubricate the needles, and fill each journal reservoir.

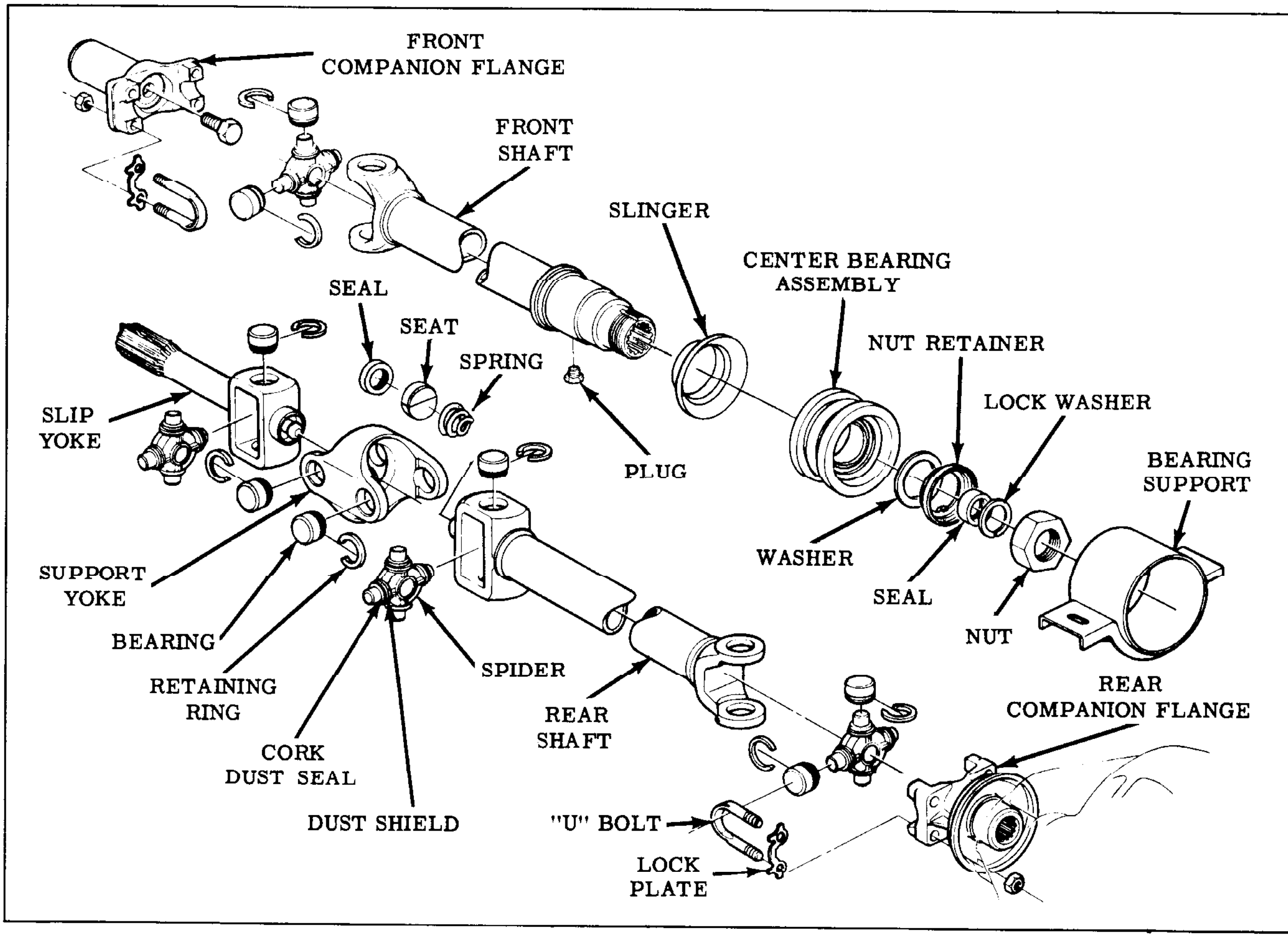

Fig. 6-30 Propeller Shaft Assembly

DESCRIPTION

The propeller shaft assembly consists of the front propeller shaft, rear propeller shaft and the center bearing support assembly. The front and rear propeller shafts are connected to each other by a slip yoke and a constant velocity type universal joint. The center bearing support assembly is attached to the body floor panel.

The front propeller shaft connects to the transmission through a universal joint and a companion flange. The rear end of the front propeller shaft is connected to the rear shaft by a splined slip yoke supported by the center bearing support assembly. The rear propeller shaft is attached to the differential by a universal joint and companion flange.

To remove either the front or rear propeller shaft or the center bearing, it is necessary to remove the complete propeller shaft assembly from the car. The propeller shaft assembly is a balanced unit and should be kept free of undercoating or other material which could destroy the balance. The front and rear shafts are not serviced separately.

PROPELLER SHAFT ASSEMBLY

Removal

1. Remove the "U" bolts from the companion flanges at the transmission and differential.

2. If "U" joint bearings that attach to a companion flange are not retained with a retainer strap, use a piece of wire or tape to hold bearings on their spider journals before removing from companion flange.

3. Remove 2 bearing support to body bolts and remove shaft. (Fig. 6-31)

   IMPORTANT: When handling the drive shaft assembly, extreme care must be taken not to let one shaft "flop" around loosely as this may damage center ball seat.

Installation

1. Position center bearing support on bearing insulator and attach to body. Torque bolts 10-18 ft. lbs.

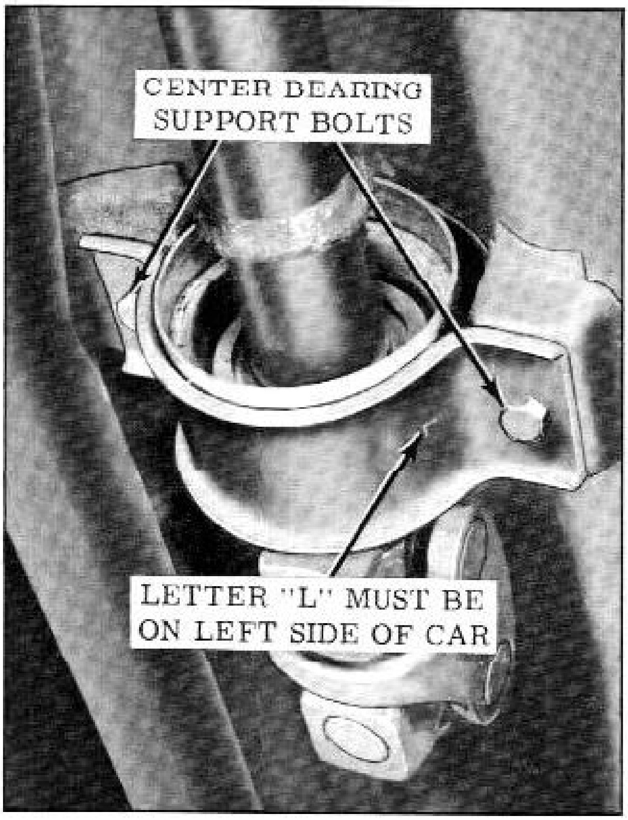

Fig. 6-31 Center Bearing Bracket

2. Attach front and rear joints to companion flanges. Torque "U" bolt nuts to 14-18 ft. lbs. Tighten each side uniformly before final torque is applied. After final torque, bend lock tangs over nuts.

IMPORTANT: Inspect center bearing rubber insulator to ascertain that edges of the insulator did not become folded under while installing it in support bracket. (Fig. 6-32)

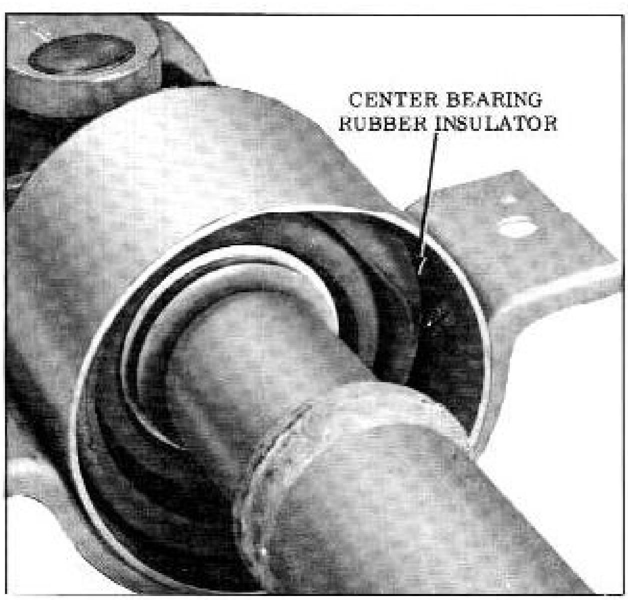

Fig. 6-32 Center Bearing Installation

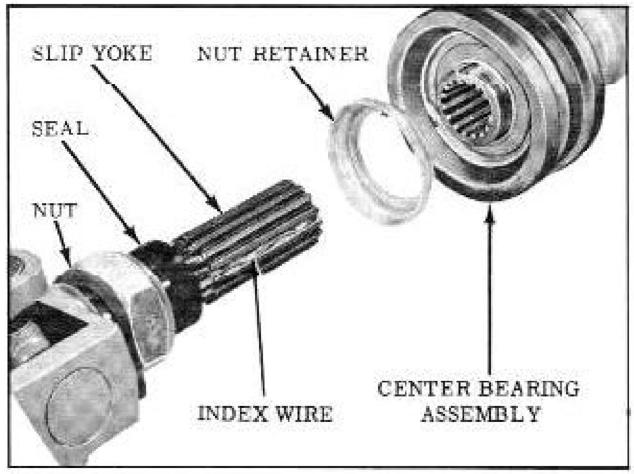

Fig. 6-33 Disassembly of Slip Yoke

CENTER BEARING AND MOUNT

Disassembly (Shaft Removed)

1. Slide bearing to body mounting bracket forward off bearing.
2. Pry crimped area of slip yoke nut retainer away from nut, then unscrew nut until it is free of threads.
3. Pull rear propeller shaft from front propeller shaft.

   NOTE: Watch for index wire in one spline of slip yoke. It is important that this wire be kept in same spline. (Fig. 6-33) Remove nut retainer and rear spacer.

4. If slip yoke seal is to be removed, it can be removed at this time.

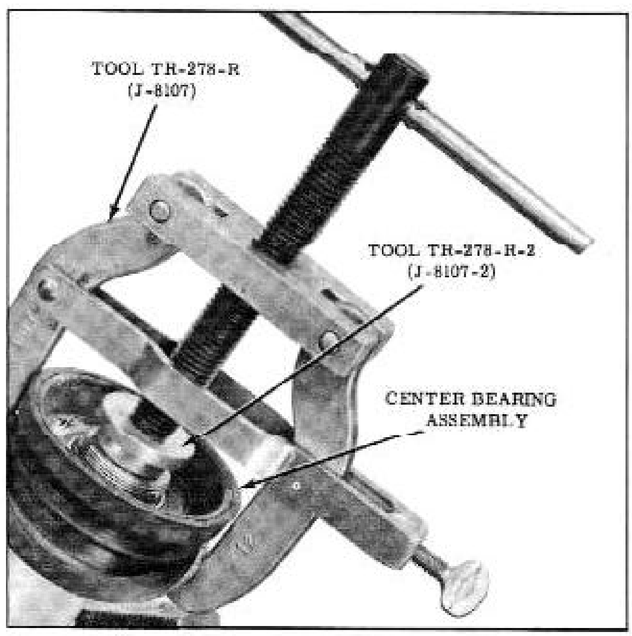

Fig. 6-34 Removing Center Bearing

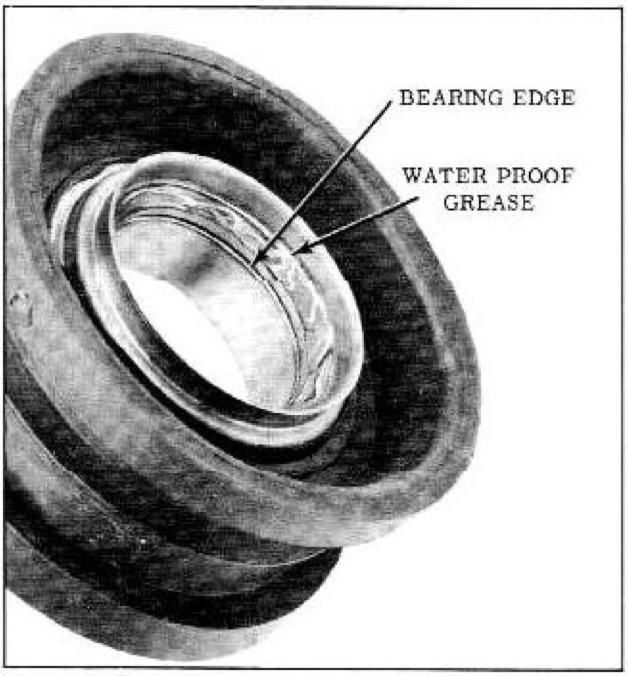

Fig. 6-35 Sealing Center Bearing

5. Remove the center bearing using Puller TR-278-R and Adapter TR-278-R-2. (Fig. 6-34)

NOTE: The center bearing, and insulator is serviced as an assembly.

The groove between the bearing and the front of the bearing retainer must be packed with waterproof grease. (Fig. 6-35)

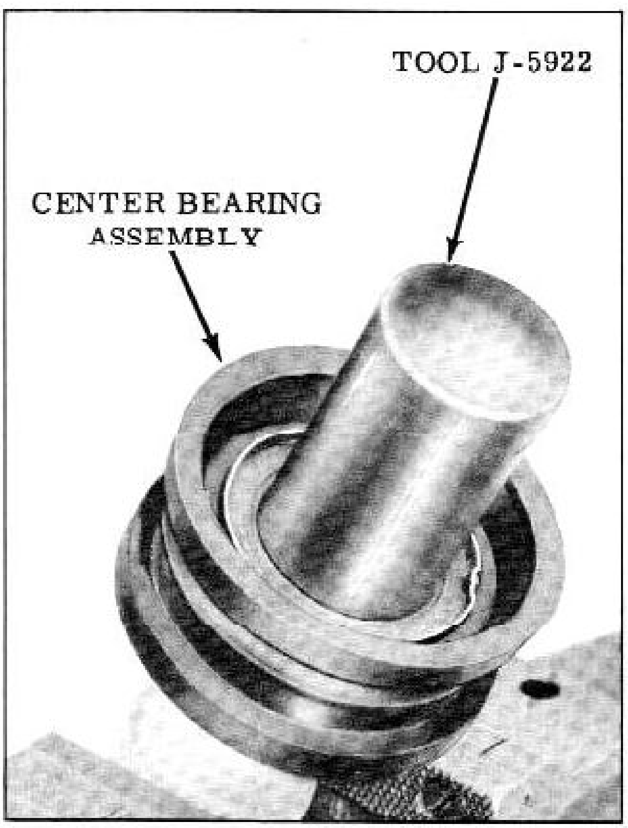

Fig. 6-36 Installing Center Bearing

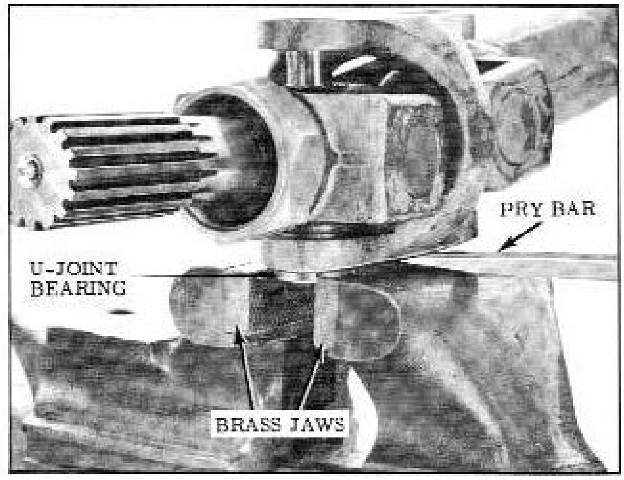

Fig. 6-37 Removal of "U" Joint Bearing

Assembly

1. If a new center bearing is to be installed, drive on shaft with Tool J-5922 until seated. (Fig. 6-36)
2. Place rear spacer, then nut retainer on the front propeller shaft with the tang of the retainer indexing the slot of the propeller shaft. The cupped side of the nut retainer must face rearward. (Fig. 6-33)
3. Apply Special Lubricant (Part No. 571035) to the splines in the front propeller shaft.
4. If slip yoke seal was removed install a new seal at this time.
5. Align slip yoke index spring wire with the wide serration in the front propeller shaft, then insert slip yoke into front propeller shaft.

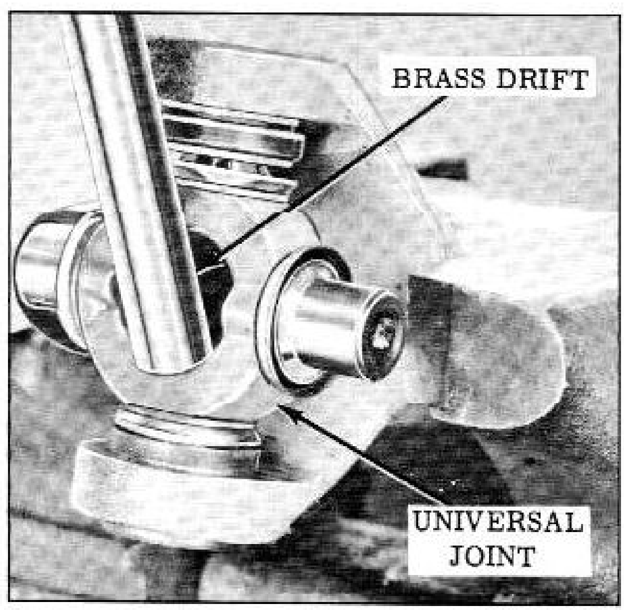

Fig. 6-38 Removing "U" Joint

6. Torque slip yoke lock nut 50-75 ft. lbs. Crimp nut retainer against the nut in two places.

UNIVERSAL JOINTS

Removal

1. With propeller shaft removed, remove all retaining rings that retain bearings in the yoke.

   NOTE: Mark all splined and shaft yokes (and joints if new joints are not to be installed) so that the units may be reassembled in their original position in order to maintain balance.

2. Position one end of propeller shaft on a vise so that the shaft yoke rests on the top of the vise jaws. The splined yoke or slip yoke must be free to move vertically between jaws of vise.
3. Apply force on yoke around bearing. This will drive splined or slip yoke down causing spider to force bearing partially out of the yoke.

   NOTE: When disassembling center support, the rear propeller shaft must be held above the horizontal to allow spider to move downward.

4. Clamp the partially exposed bearing in a brass jawed vise, then tap or pry yoke upward (Fig. 6-37), until bearing is removed. Remove bearing from vise.
5. To remove opposite bearing, rotate shaft one-half turn and repeat steps 2, 3, and 4.
6. Remove yoke or housing from spider.
7. Clamp shaft yoke in a vise.

   NOTE: Do not clamp the propeller shaft tube in a vise.

8. Drive on spider until bearing is partially forced out of yoke. (Fig. 6-38)
9. Clamp partially exposed bearing in a brass jawed vise and tap or pry upward on yoke until bearing is removed.
10. To remove opposite bearing, repeat steps 1, 2, 3, 8 and 9.
11. Remove spider from shaft yoke.

Cleaning and Inspection

1. Wash all parts thoroughly in cleaning solvent. Parts must be free of all grease and dry before re-lubrication.
2. If propeller shafts were separated, clean slip yoke splines thoroughly.
3. Inspect dust seals and shields for damage. Replace if necessary. Cork seals should be flexible. If brittle or hard replace seals.
4. Inspect roller bearing surfaces of spider journals, inner bearing surfaces of outer races and rollers for wear, scores, flat spots, or any other visible damage.

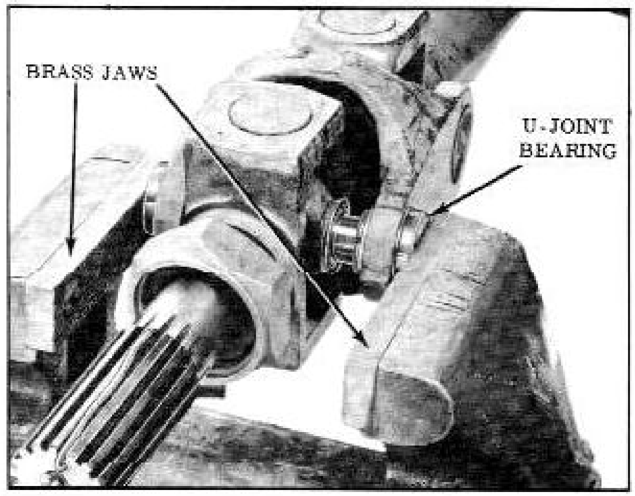

Fig. 6-39 Installing "U" Joint

Installation

1. Lubricate each needle bearing assembly and fill the reservoir in each spider journal with a sodium soap, fine fiber grease such as Marfax Heavy Duty #2.
2. Press cork dust seal into recess of bearings.
3. If new dust shields are to be installed, install at this time.
4. Position spider journal in a shaft yoke. Place joint in same position it was when removed if new joint is not used.
5. Press a bearing into one side of yoke, (Fig. 6-39), until retaining ring can be installed.
6. Install retaining ring with the gap toward the yoke.
7. Repeat steps 5 and 6 on opposite bearing. As the bearing is installed, align spider journal with the bearing.
8. To install a splined yoke or slip yoke onto a spider journal, position the yoke over the spider journal with scribe marks aligned, and repeat steps 5, 6, and 7.
9. Position bearings which attach to a companion flange, onto the spider journals and retain with wire or tape.

SLIP YOKE BALL SEAT

The slip yoke ball seat may be replaced by prying out the seal. The seat, spring and washer may then be removed.

When installing new seat, lubricate with wheel bearing grease and install seal flush. Lubricate seal with waterproof grease.

AXLE RATIOS AND SPEEDOMETER DRIVEN GEARS

TRANSMISSION	AXLE RATIO	GEAR RATIO	TIRE SIZE	SPEEDOMETER DRIVEN GEAR NO. OF TEETH	DRIVE GEAR
SYNCRO-MESH	3.08	40:13	7:00 x 13	19 Blue	8
	3.08	40:13	6:50 x 13	20 Red	8
	3.36	37:11	All	19 Blue	7
HYDRA-MATIC	3.23	42:13	6:50 x 13	24 Blue	9
	3.23	42:13	7:00 x 13	23 Red	9
	3.08	40:13	6:50 x 13	23 Red	9
	3.08	40:13	7:00 x 13	22 Brown	9
	3.36	37:11	6:50 x 13	25 Green	9
	3.36	37:11	7:00 x 13	24 Blue	9

TORQUE SPECIFICATIONS

APPLICATION	FT. LBS.
PROPELLER SHAFT	
Companion Flange "U" Bolts	14 to 18
Center Bearing Support to Body	10 to 18
Slip Yoke Nut	50 to 75
DIFFERENTIAL	
Side Bearing Cap Bolts	70 to 80
Ring Gear Bolts	50 to 60
Cover to Carrier Bolts	25 to 30
Pinion Gear Nut	200
AXLES	
Bearing Retainer to Housing	45 to 60
Wheel to Axle	55 to 70

SPECIFICATIONS

DIFFERENTIAL

LUBRICATION

Capacity . . . . 2 Pts. (Approx.)

Replenish . . . . S.A.E. 90 Multi-Purpose Gear Lubricant

ADJUSTMENTS

Backlash . . . . .007" to .009"

Drive Pinion Bearing Preload
- New Bearings . . . . 25 to 35 in. lbs.
- Old Bearings . . . . 15 to 25 in. lbs.

Side Bearing Preload
- New Bearings . . . . 20 to 30 in. lbs.
- Old Bearings . . . . 10 to 20 in. lbs.

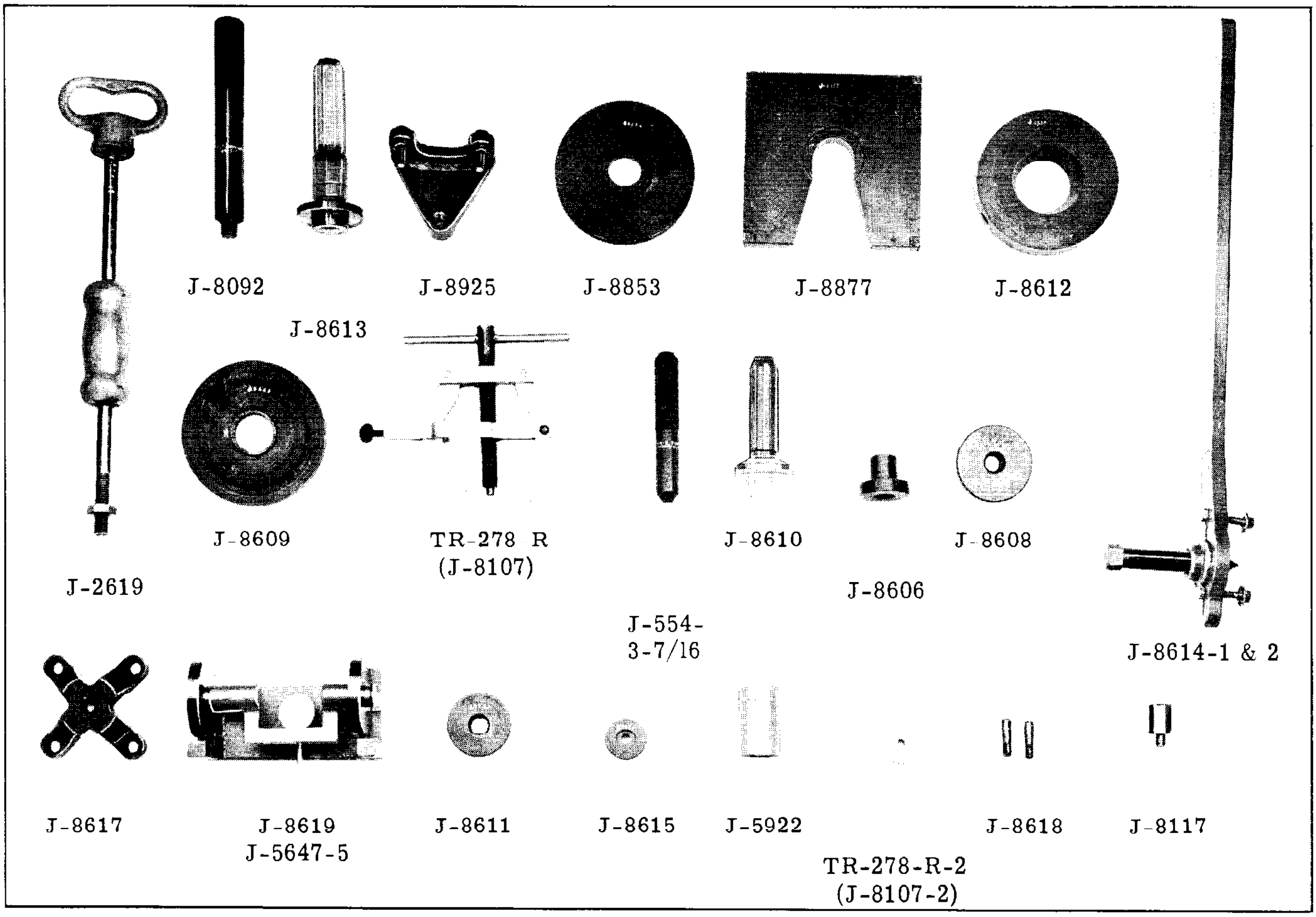

Fig. 6-40 Tools

TR-278-R-2 (J-8107 & 2)	Differential Side Bearing Puller
J-554-3-7/16	Hub Bolt Peening Tool
J-2619	Slide Hammer Assembly
J-5647-5	Pinion Setting Gauge Disc (2)
J-5922	Seal Installer (Used for Installing Propeller Shaft Center Bearing)
J-8092	Driver Handle
J-8117	Adapter
J-8606	Differential Side Bearing Installer
J-8608	Rear Pinion Bearing Cup Installer
J-8609	Rear Pinion Bearing Installer
J-8610	Axle Bearing Seal Installer
J-8611	Front Pinion Bearing Cup Installer
J-8612	Rear Pinion Bearing Remover
J-8613	Pinion Oil Seal Installer
J-8614-1-2	Companion Flange Holder and Remover
J-8615	Adapter Plug Side Bearing Remover
J-8617	Axle Shaft Remover
J-8618	Ring Gear to Case Alignment Stubs
J-8619	Pinion Setting Gauge
J-8853	Axle Bearing Installer Plate
J-8877	Axle Bearing Puller Plate
J-8925	Differential Case Assembly Puller

BRAKES

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MAINTENANCE RECOMMENDATIONS

Every 2,000 Miles:

Check level of brake fluid in reservoir; fluid level should be 1/2" below master cylinder filler cap. Replenish as necessary with G.M. Super 11 Brake Fluid.

Every 10,000 Miles:

FRONT WHEEL BEARINGS

Repack front wheel bearings with a fine fiber sodium soap grease.

PARKING BRAKE CABLES

Lubricate with Lithium soap grease.

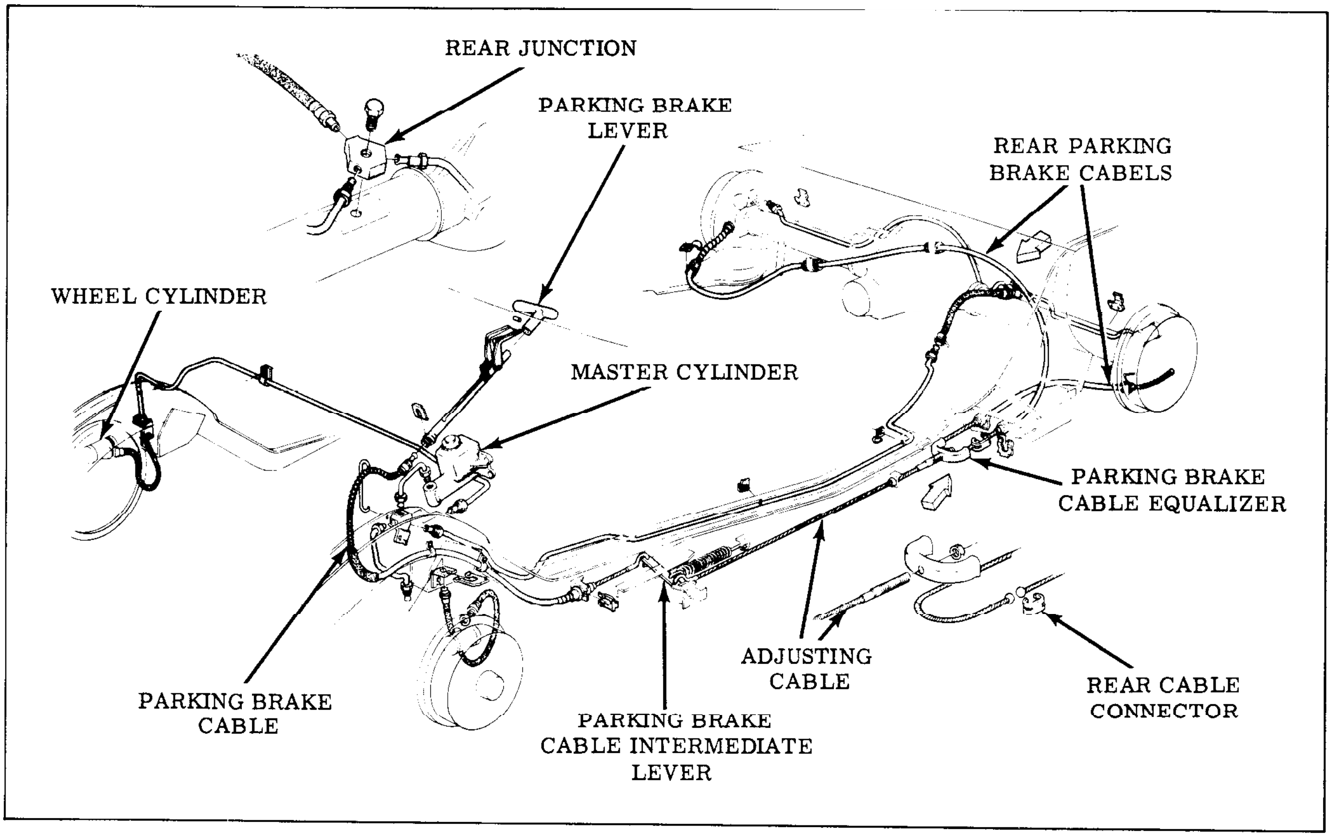

Figure 7-1 Brake System

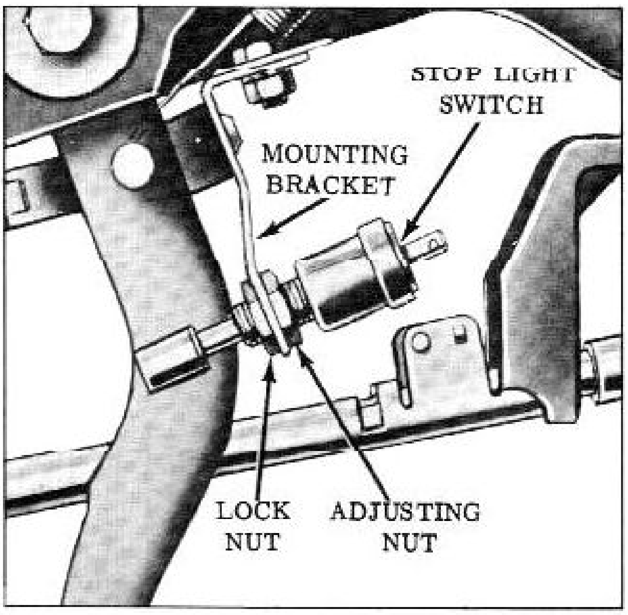

Figure 7-2 Stoplight Switch Adjustment

PERIODIC SERVICE

Whenever the vehicle is in the service area, the brake pedal free travel should be observed. If the pedal free travel, from the released to fully applied position exceeds 4 inches, the brake shoes should be adjusted. Also, brake hose, lines, master cylinder and wheel cylinders should be inspected for signs of leakage or damage.

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.

When the brake pedal is depressed, the piston in the master cylinder forces fluid under pressure to a wheel cylinder at each wheel which in turn pushes 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 self energizing action to the braking effort and thereby decreases the effort required by the driver to stop the car.

The parking brake applies the rear brakes through cables and linkage. The parking brake handle is mounted below the instrument panel to the right of the steering column. The parking brake is applied by pulling the lever out from the dash and is released by turning the handle clockwise and releasing to the forward position.

STOP LIGHT SWITCH

The stop light switch is attached to the brake pedal bracket below the dash as shown in Fig. 7-2. It is actuated by the forward movement of the brake pedal. The switch can be adjusted in and out of the mounting bracket by loosening the locking nuts and moving the switch in the bracket, then tighten the nuts.

ADJUSTMENTS

BRAKE SHOE

The brake shoes should be adjusted whenever the brake pedal travel from the released to the fully applied position exceeds four inches. There is no anchor pin adjustment since the anchor pin is a fixed stationary pin.

1. Fully release parking brake, check brake pedal free travel as outlined under BRAKE PEDAL ADJUSTMENTS, then hoist car.

2. Using a screw driver, remove adjusting screw hole cover from backing plate.

3. Using Tool J-4735, Fig. 7-3, expand brake shoes by moving outer end of tool upward. Expand shoes until there is a heavy uniform drag at the wheel.

   NOTE: Direction of turning of adjuster is the same on both sides of car since adjusting screws on right hand side of car have left hand threads.

4. Back adjuster off 15 notches.

5. Install adjusting screw hole cover.

6. Repeat steps 2, 3, 4, and 5 for remaining wheels.

7. Fill master cylinder to within 1/2" of bottom of filler cap opening.

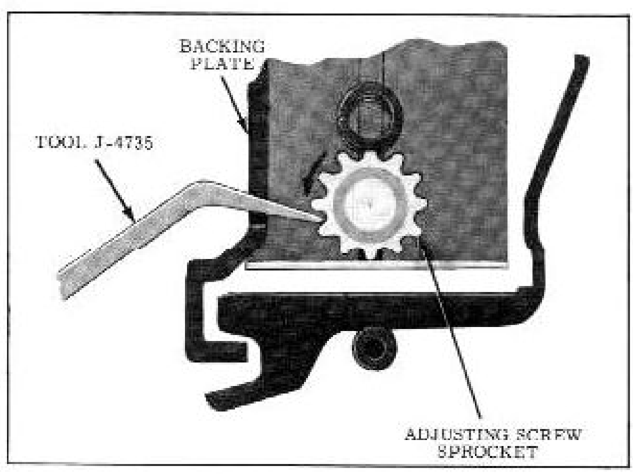

Figure 7-3 Brake Shoe Adjustment

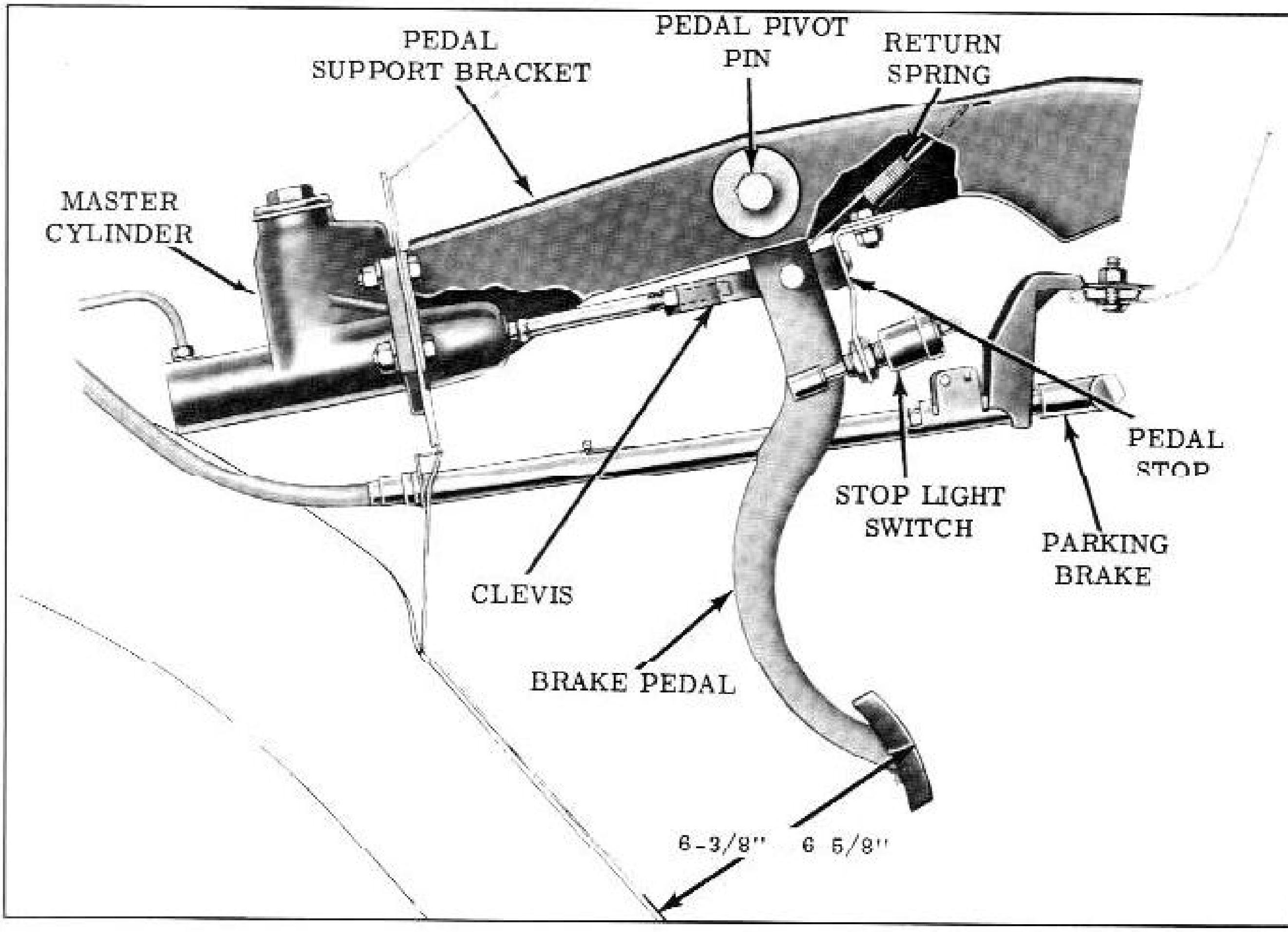

Figure 7-4 Brake Pedal and Support

BRAKE PEDAL

An incorrectly adjusted brake pedal can hold the master cylinder piston from fully returning to its released position, which may result in brake drag or lock-up. Brake drag at the time of shoe adjustment, may be caused by improper adjustment of shoes. Therefore, the free pedal adjustment should be inspected before brake shoe adjustment is made.

Since there is no clutch pedal return stop adjustment; it becomes necessary on Syncro-Mesh equipped cars, to adjust the brake pedal return stop so that the released brake pedal height matches the clutch pedal released height. Any change in the brake pedal return stop requires that adjustment of the free travel and stop light switch be made. Therefore brake pedal adjustment shall be broken down into two sections, Hydra-Matic and Syncro-Mesh.

Hydra Matic

1. Disconnect the brake pedal return spring from brake pedal.
2. Remove the cotter pin from the push rod clevis pin and remove clevis pin.
3. Turn back floor mat and check pedal height (from floor pan to top of pedal pad). If dimension is not 6-1/2" ± 1/8", loosen lock nut and adjust stop bracket on pedal support bracket. Tighten lock nut. (Fig. 7-4.)
4. To adjust master cylinder push rod, lightly push the master cylinder push rod until it contacts the hydraulic piston.
5. Turn the push rod in or out of clevis until clevis pin can be freely installed into the brake pedal, then shorten the push rod one turn to obtain proper free play.
6. Install new cotter key in clevis pin.
7. Attach pedal return spring to pedal.
8. Check operation of stop light switch and, if necessary, adjust.

Syncro-Mesh

1. Disconnect the pedal return spring from the pedal.
2. Remove cotter key from push rod clevis pin, and remove clevis pin.
3. Adjust pedal return stop by moving bracket on pedal support bracket. Adjust so that pedal in fully released position is in line with clutch pedal at its fully released position.

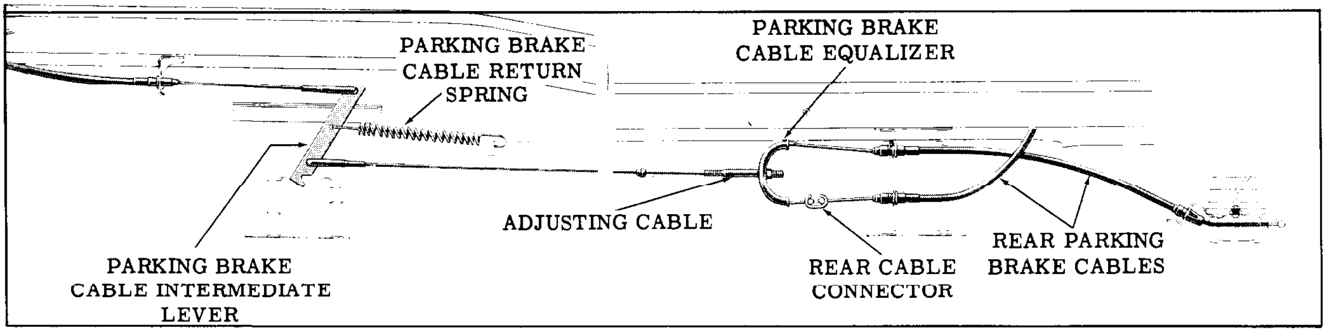

Figure 7-5 Parking Brake Layout

4. To adjust master cylinder push rod, lightly push the master cylinder push rod forward until it contacts the hydraulic piston.

5. Turn the push rod in or out of clevis until clevis pin can be freely installed into the brake pedal, then shorten the push rod one turn to obtain proper free play.

6. Install new cotter key in clevis pin.

7. Attach pedal return spring to pedal.

8. Check operation of stop light switch and, if necessary, adjust.

PARKING BRAKE

1. Release parking brake.

2. Adjust brake shoes if the service brake pedal travel from the released to the fully applied position exceeds four inches. See BRAKE SHOE ADJUSTMENT.

3. Adjust rear cables by first tightening the equalizer adjusting nut until a heavy drag is felt at rear brakes, then loosen the equalizer adjusting nut nine full turns. (Fig. 7-5)

BRAKE PEDAL

The brake pedal is suspended from a support bracket under the instrument panel. Nylon bushings between the pivot pin and the pedal eliminate periodic lubrication. The pedal is connected to the master cylinder push rod by a clevis.

Removal

1. Disconnect stop light switch wiring from terminals.

2. Disconnect the pedal return spring.

3. Remove master cylinder push rod clevis pin.

4. On Syncro-Mesh equipped cars, disconnect clutch return spring from clutch pedal. (CLUTCH PEDAL REMOVAL, Page 10-11)

5. Remove nut and lock washer from pedal pivot shaft pin.

6. Slide pedal pivot pin to the left, sufficient to allow the brake pedal assembly to fall from bracket. The clutch pedal on Syncro-Mesh equipped cars, need not be removed when removing brake pedal.

Installation

1. Lubricate nylon bushings with Lubriplate and insert bushings into pedal mounting bracket. (Fig. 7-6, 7-7.)

2. Position brake pedal in support, insert pedal pivot pin, and install lockwasher and nut. Torque pivot pin nut to 8-16 ft. lbs.

3. Install clevis pin. (Fig. 7-8)

4. Attach clutch pedal return spring (Syncro-Mesh) to clutch pedal and brake pedal return spring to brake pedal.

5. Connect stop light switch wiring to switch.

6. Check, and if necessary, adjust brake pedal stop, free play, and stop light switch.

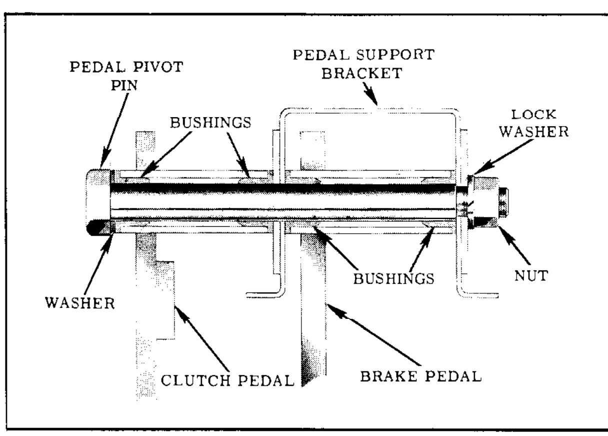

Figure 7-6 Syncro-Mesh Brake Pedal Attachment

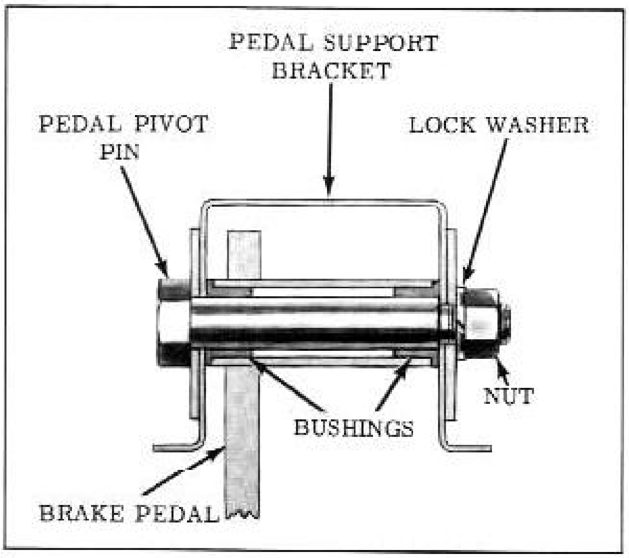

Figure 7-7 Hydra-Matic Brake Pedal Attachment

BRAKE PEDAL SUPPORT BRACKET

The brake pedal support bracket is attached to the dash panel and instrument panel by cap screws on each end.

Removal

1. If Syncro-Mesh, disconnect clutch pedal return spring and rod.
2. Disconnect master cylinder push rod.
3. Remove attaching bolts from each end.

Installation

1. Torque cap screw nuts 20-28 ft. lbs.
2. Connect removed parts.
3. Check clutch and brake pedal free travel and adjust if necessary.

PARKING BRAKE CABLES

FRONT

Removal

1. Disconnect intermediate lever return spring. (Fig. 7-5)
2. Remove retainer at body bracket and end of hand lever.
3. Remove cable.

Installation

1. Attach cable to hand lever, body bracket and intermediate lever, and attach return spring.
2. Adjust parking brake if necessary.

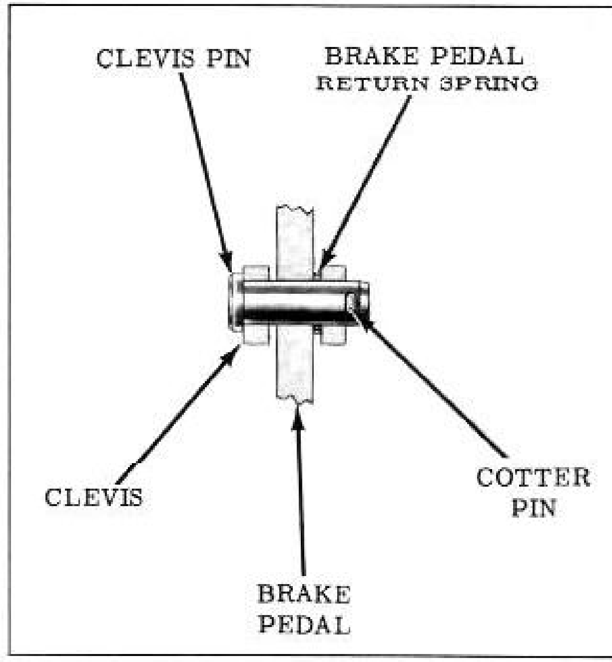

Figure 7-8 Brake Pedal Clevis Pin

REAR

Removal and Installation

1. Loosen nut at equalizer. (Fig. 7-5) Remove equalizer for left hand cable removal. Remove retainer clips from left and right hand cables at body bracket. Loosen right hand cable clamp from right lower suspension arm.
2. Remove wheel and drum.
3. Remove cable from parking brake lever on brake shoe.
4. Depress cable to backing plate retaining clip and remove cable.

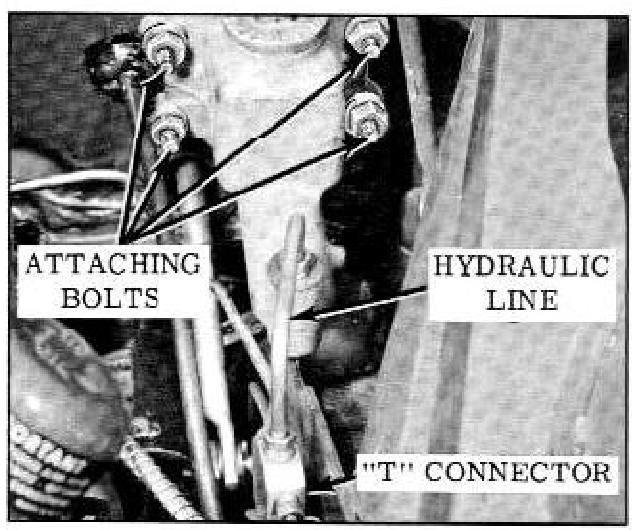

Figure 7-9 Master Cylinder Attachment

Installation

After installing cable, adjust parking brake as outlined under "PARKING BRAKE" on Page 7-4.

MASTER CYLINDER

Removal

1. Be sure area around master cylinder is clean, then disconnect the hydraulic line at the master cylinder. Plug or tape end of line to prevent entrance of dirt.

2. Remove master cylinder by removing the four attaching nuts. (Fig. 7-9) The brake master cylinder can be removed without disconnecting the push rod and clevis.

Installation

1. Lubricate push rod with a light film of brake fluid to facilitate positioning of rubber boot on push rod after master cylinder is installed.

2. Position master cylinder against cowl, push boot onto push rod and guide push rod into master cylinder piston cavity.

3. Install the attaching nuts. Torque nuts 20-28 ft. lbs.

4. From inside car, pull boot along push rod toward clevis until boot is fully extended. Check brake pedal as outlined under BRAKE PEDAL ADJUSTMENTS.

5. Install hydraulic line to master cylinder.

6. Fill master cylinder reservoir with G.M. Brake Fluid No. 11 and bleed all wheel cylinders as outlined under BLEEDING OF LINES.

Disassembly

1. Remove boot from master cylinder.

2. Remove the piston retaining ring from the bore of the master cylinder using internal pliers and remove piston.

3. Remove the primary cup, spring and residual check valve from bore of master cylinder.

4. Pry the rubber valve seat washer from cylinder bore.

Cleaning and Inspection

1. Wash all parts in Declene Flushing 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 seals 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 should be inspected and replaced if damaged.

3. Inspect the master cylinder bore for scores, rust, pits or etching. If any of these conditions exist, the complete master cylinder must be replaced 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 may leave the walls sufficiently rough and cause premature failure of the rubber cups. It also may enlarge the bore to the extent that the standard size piston will no longer fit properly. Oversize pistons and cups are not available.

Assembly

1. Lubricate master cylinder bore and all rubber parts with G.M. Brake Fluid No. 11.

2. Install check valve rubber washer against the shoulder inside the master cylinder bore. (Fig. 7-10)

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 (dished side toward spring).

5. Install piston into bore and while compressing spring, install retaining ring with internal pliers.

6. Install boot over lip of master cylinder casting.

WHEEL CYLINDERS

FRONT

Removal

1. Remove hub and drum assembly.

2. Disconnect brake shoe return springs.

3. Remove shoe hold down springs and pins.

4. Disconnect brake line from brake hose.

5. Remove the brake hose retainer clip at line connection.

6. Remove 2 wheel cylinder to backing plate cap screws and washers.

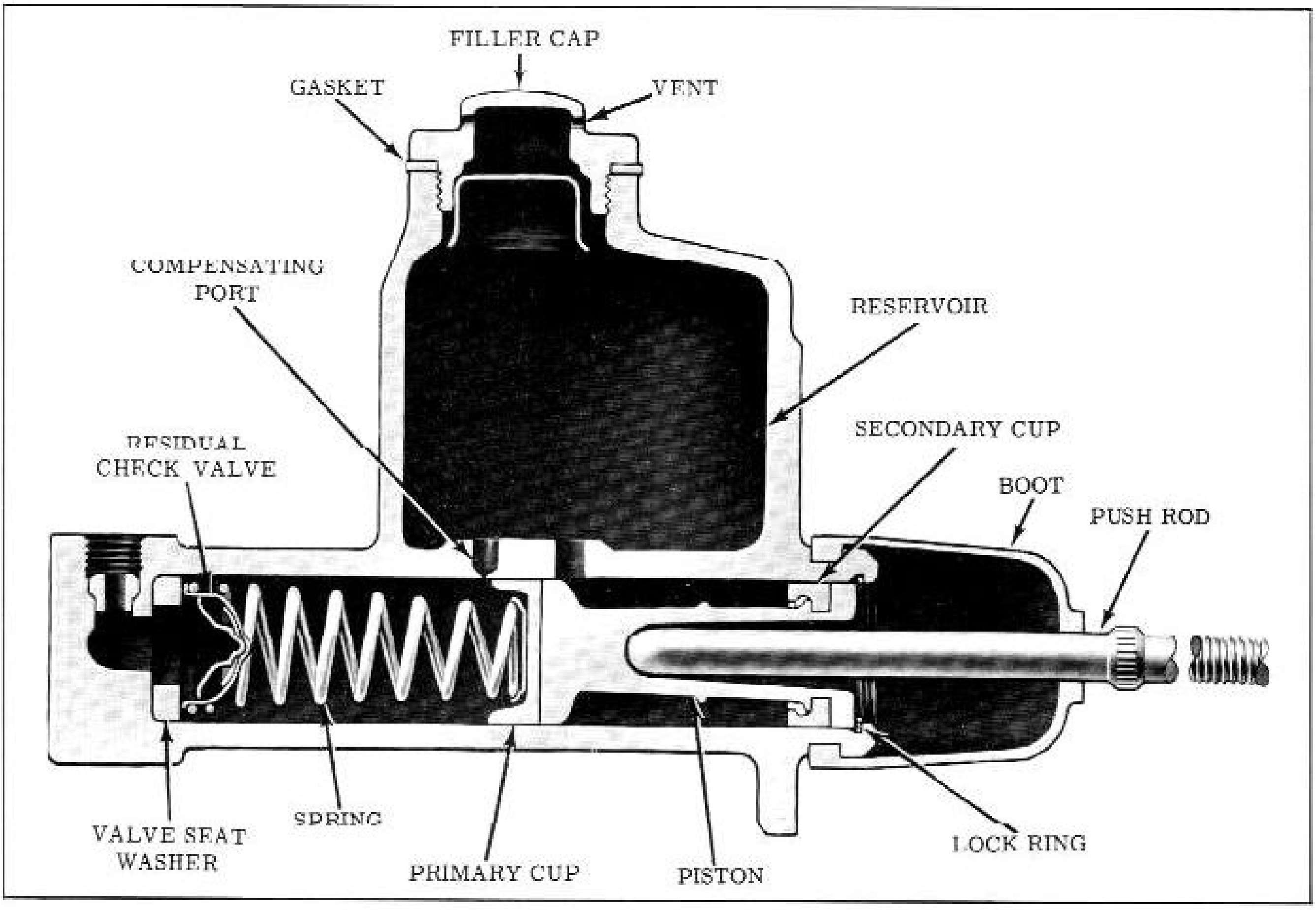

Figure 7-10 Master Cylinder

REAR

1. Remove wheel and drum.

2. Disconnect brake shoe return springs.

3. Remove shoe hold down springs and pins.

4. Disconnect brake line from wheel cylinder.

5. Remove 2 wheel cylinder mounting screws.

6. Spread shoes apart to remove wheel cylinder.

Installation

When installing wheel cylinders, tighten attaching bolts 10-12 ft. lbs. and bleed air from lines. This procedure is found under BLEEDING OF LINES. On front wheels, after installing wheel and drum assembly, adjust the front wheel bearing as follows:

1. Tighten spindle nut to 10-15 ft. lbs. while revolving wheel.

2. Back off 1/6 turn minimum to 1/4 turn maximum to install cotter pin.

Disassembly

1. Remove links and rubber boots.

2. Remove pistons, cups, expanders and spring from wheel cylinder bore.

Cleaning and Inspection

1. Wash all parts in Declene 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 inspected and replaced if damaged.

3. Inspect the wheel cylinder bore for scores, rust, pits or etching. If any such conditions exist, the complete wheel cylinder must 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 may leave the walls sufficiently rough and cause premature failure of the rubber cups.

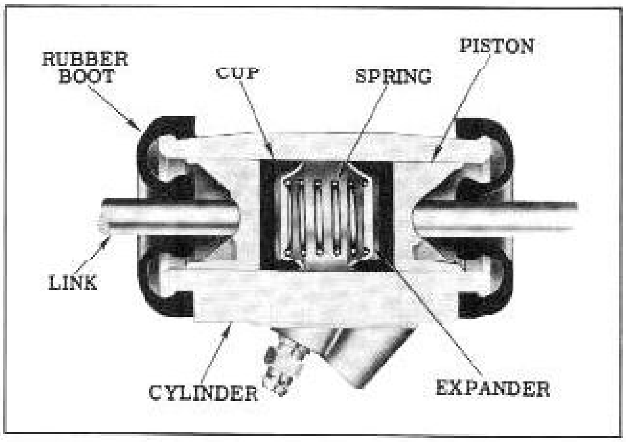

Figure 7-11 Wheel Cylinder

It also may enlarge the bore to the extent that the standard size pistons will no longer fit properly. Oversize pistons and cups are not available.

Assembly

Lubricate the bore of the wheel cylinder and all rubber parts with G.M. Brake Fluid No. 11 and assemble as shown in Fig. 7-11.

BLEEDING HYDRAULIC SYSTEM

Whenever a line is disconnected from any wheel cylinder, 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.

The system can be bled manually, or by using pressure bleeding equipment.

To bleed the system, the following procedure is recommended:

NOTE: It is suggested that the rear cylinders be bled first.

1. If brakes are to be bled manually, fill the brake reservoir with G.M. Brake Fluid 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 BRAKE BLEEDER MFG.'s SPECIFICATIONS, OR APPROXIMATELY 20 to 30 p.s.i.

3. Attach Bleeder Tube J-7779-2 to wheel cylinder bleeder valve. (Fig. 7-12)

   THE TUBE MUST BE SUBMERGED IN A CLEAN CONTAINER PARTIALLY FILLED WITH G.M. BRAKE FLUID NO. 11 DURING THE BLEEDING OPERATION.

4. Unscrew bleeder valve three quarters of a turn with a wrench such as J-7779-1 and watch flow of fluid from bleeder tube. When all air bubbles cease to appear, 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. Care must be taken to maintain fluid in the master cylinder at all times. 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 liquid, containing no air bubbles, emerges from bleeder tube. Close bleeder valve.

5. Remove bleeder tube.

6. Repeat the above steps on the remaining wheel cylinders if the entire system is to be bled.

7. Check fluid in 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, or foreign material has discolored or thickened the brake fluid, the entire

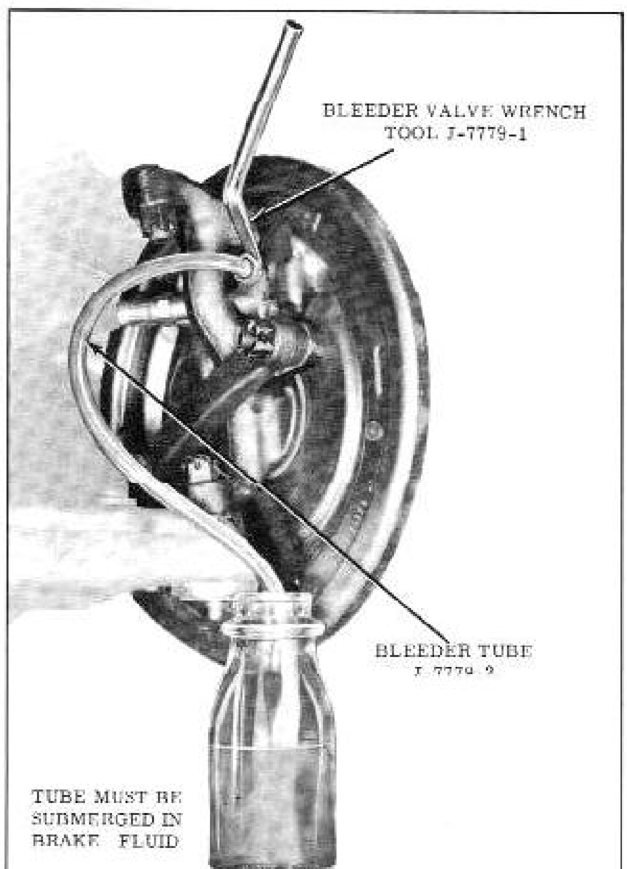

Figure 7-12 Bleeding Brakes

system should be thoroughly flushed with Declene Flushing Fluid. The Declene Flushing Fluid 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) except that the flushing fluid is forced through the system until the fluid emerges clear at the wheel cylinders.

When flushing is completed, bleed the hydraulic system with G.M. Brake Fluid No. 11 as outlined under BLEEDING OF LINES until all flushing fluid and air is expelled from the lines.

BRAKE DRUMS

Inspection

Whenever brake drums are removed, they should be inspected for scores, deep grooves, cracks and out of round.

Cracked drums must be replaced.

Drum wear or out of roundness can be measured with an inside micrometer or a dial indicator. Out of round measurements exceeding .010" (total indicator reading) require turning or replacement of drum.

TURNING DRUMS

If irregularities in the braking surface of the drum cannot be removed with fine cut emery cloth or out of round exceeds .010" (total indicator reading), the drum should be turned to .030" greater than the original inside diameter; that is, after being turned, the diameter should be 9.530". 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 methyl chloroform to remove the rust proof coating.

When it is necessary to replace a front brake drum, the hub and drum must be replaced as an assembly.

FRONT HUB BOLT REPLACEMENT

The following procedure should be followed whenever it is necessary to install a new hub bolt into the hub and drum assembly.

1. With the hub and drum assembly removed drill a 7/16" hole 1/4" deep into the head of the hub bolt.
2. Support hub and drum assembly and drive or press hub bolt out from the inside of the hub and drum assembly.

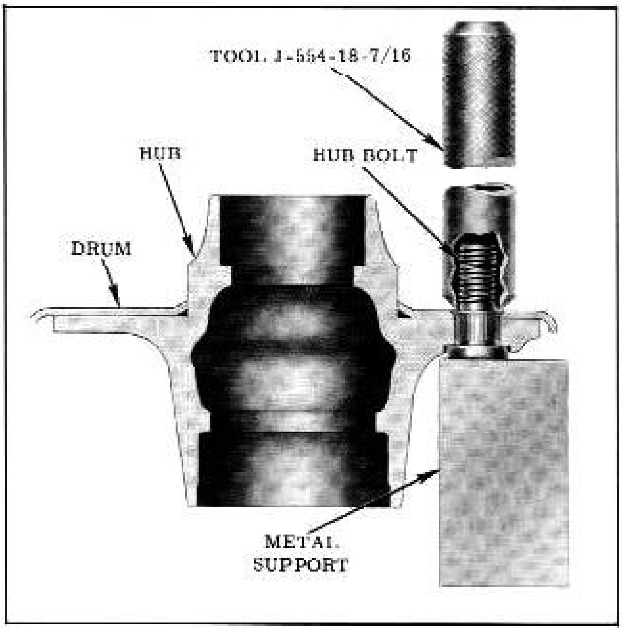

Figure 7-13 Peening Hub Bolt

3. Press a new hub bolt into the hub. Splines of hub bolt must press tightly into hub.
4. While supporting hub bolt, peen hub bolt into the countersunk area of drum with the use of Peening Tool J-554-3-7/16" until the drum is secure to the hub. (Fig. 7-13)

BRAKE SHOE ASSEMBLIES

If linings are worn nearly flush with rivets, new linings should be installed.

When brake lining replacement is necessary, it is recommended that all the linings be replaced. In some cases where there is extremely low mileage on the brake lining, it is permissible to replace the lining on one wheel when brake fluid or other foreign material has caused premature damage to the lining.

FRONT

Removal

1. Hoist car.
2. Remove wheel and drum.
3. Remove brake shoe return springs and hold-down pins. (Fig. 7-14)
4. Remove brake shoes, then remove secondary to primary shoe spring and adjusting screw.

Inspection

1. If linings are worn nearly flush with rivets, new linings should be installed.

IMPORTANT: When riveting lining to shoes, lining must be clamped tightly to shoes before installing rivets.

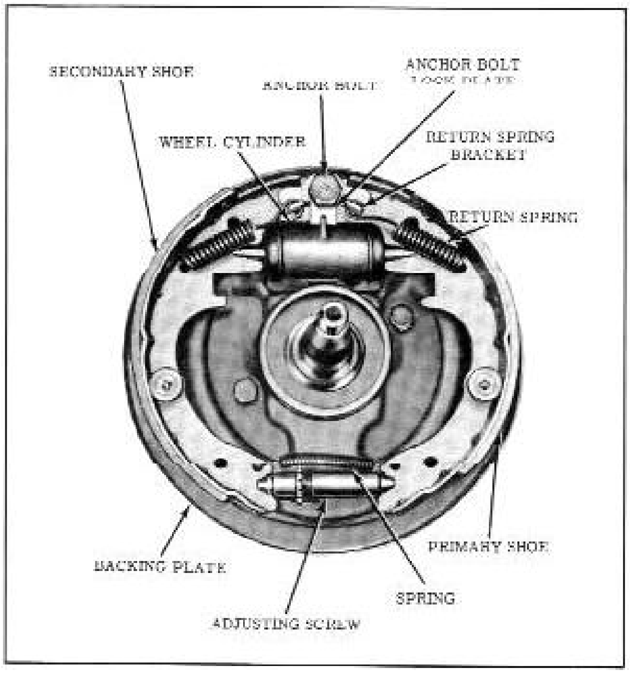

Figure 7-14 Front Brake Assembly

2. Loosen wheel cylinder boot and inspect wheel cylinders for brake fluid leakage. If leak exists, remove wheel cylinder for service or replacement. (See WHEEL CYLINDERS)

Installation

1. The adjusting screw threads, backing plate ledges, and all other contacting points should be lubricated with a compound mixture of 4 parts 567196, and 1 part powdered graphite.

2. Check backing plate to knuckle nuts. Torque should be 55-80 ft. lbs. Torque anchor bolt to knuckle 80-105 ft. lbs.

3. Assemble primary to secondary shoe spring to the shoes, and install the adjusting screws. (Fig. 7-14) The left side of car adjusting screws have left hand threads and can be identified by 4 grooves. All adjusting screws must be assembled with "SPROCKET" end of the screw toward the rear of the car.

4. Assemble shoe assembly to backing plate. Check wheel cylinder links, hold-down pins, and return springs for proper installation.

5. Install wheel and adjust wheel bearings and brake shoes.

REAR

Removal

1. Hoist car.

2. Loosen parking brake cable equalizer, then disconnect cables from equalizer.

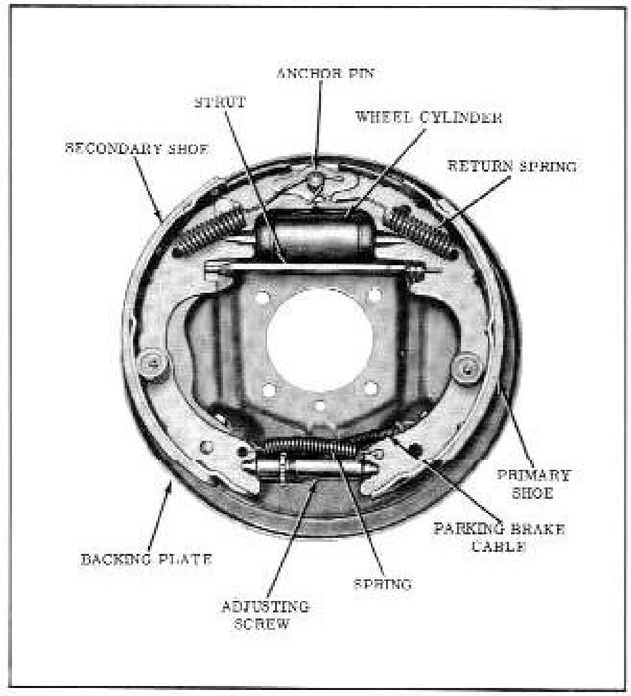

Figure 7-15 Rear Brake Assembly

3. Remove rear brake drums by removing wheel then removing 2 speed nuts from axle studs.

4. Remove brake shoe return springs, hold-down caps, springs and pins. (Fig. 7-15)

5. Spread shoes to clear wheel cylinder links. Remove parking brake operating lever strut and spring, then disconnect parking brake cable from operating lever.

6. Remove shoes, then remove secondary to primary shoe spring and adjusting screw.

7. Remove parking brake lever from secondary shoe if replacing shoes.

Inspection

1. If linings are worn nearly flush with rivets, new linings should be installed.

   IMPORTANT: When riveting lining to shoes, lining must be clamped tightly to shoes before installing rivets.

2. Loosen wheel cylinder boot and inspect wheel cylinders for brake fluid leakage. If leak exists, remove wheel cylinder for service or replacement. (See WHEEL CYLINDERS)

Installation

1. The adjusting screw threads, backing plate ledges, and all other contacting points should be lubricated with a mixture of 4 parts Part No. 567196 and 1 part of powdered graphite.

2. Pull parking brake cables rearward through conduits, lubricate freely with Lithum Soap

Grease, and return cable to normal position. Remove any excess lubricant.

3. Check rear backing plate to axle housing nuts. Torque should be 45-60 ft. lbs. Assemble the primary to secondary shoe spring to the shoes, and install the adjusting screws.

   IMPORTANT: The left front and rear adjusting screws have left hand threads and can be identified by 4 grooves. All adjusting screws must be installed with the "SPROCKET" end of the screw toward the rear of the car.

4. Assemble the parking brake cable to the parking brake lever.

5. Assemble shoe assembly to backing plate. Install the parking brake strut and spring. Strut must have 1/16" free end play.

6. Install the brake shoe hold-down pins, springs and caps.

7. Install the primary and secondary shoe to anchor pin springs. Primary spring must be installed first.

8. Install brake drums, making sure adjusting screws are backed off sufficiently.

9. Connect parking brake equalizer.

10. Adjust brake shoes as described under BRAKE SHOE ADJUSTMENT.

11. Adjust parking brake cables as outlined under PARKING BRAKE ADJUSTMENT.

12. Fill master cylinder. Fluid level should be within 1/2" below the master cylinder filler cap.

BRAKE LINE

When replacing a damaged brake line, the damaged section should be cut out 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.

BRAKE DIAGNOSIS

1. Hard pedal feel may be caused by:

   a. Bound up pedal mechanism.

   b. Glazed linings.

   c. Grease on brake drum.

2. "Grabby" or Severe brakes caused by:

   a. Grease or brake fluid on linings.

   b. Scored drums.

   c. Burned linings.

   d. Binding master cylinder piston.

3. Pedal goes to floor (or almost to floor), caused by:

   a. Brakes require adjustment.

   b. Air in hydraulic system.

   c. Hydraulic leak in lines or at wheel cylinders.

   d. Low fluid level in master cylinder reservoir.

   e. Leak at primary cup.

   f. Defective master cylinder.

4. Brakes lock up, caused by:

   a. Restricted compensator port in master cylinder.

   b. Incorrect master cylinder push rod adjustment.

   c. Incorrect pedal free travel.

   d. Emergency brake strut not free because of incorrect parking brake adjustment (rear brakes only).

FRONT WHEEL BEARINGS

Removal

1. Remove hub dust cap.

2. Remove cotter pin, knuckle nut, and washer.

3. Pull hub and drum assembly outward, then push back onto knuckle to clear outer bearing and remove outer bearing.

4. Pull hub and drum assembly off knuckle.

   NOTE: It may be necessary to back off the brake shoe adjustment before the hub and drum can be removed. Count the number of notches backed off and record.

5. Remove grease seal by placing the tip of a long screw driver under seal flange at hub and tapping other end of screw driver with a hammer to jar seal and retainer flange loose from hub bore.

6. Remove inner bearing.

7. Support drum and hub with J-7027 (flywheel housing support) when removing outer bearing race.

8. Use Tool J-8092 with Adapters J-7030-1 and J-7030-2, to drive outer bearing outer race out of the hub bore.

9. Use a brass drift to drive inner bearing outer race out of hub bore.

Installation

1. Support hub and drum with J-7027 (flywheel housing support) when installing inner bearing outer race. Install inner bearing outer race using Tool J-6198 (front pinion bearing cup installer) with Handle J-8092. Use flat side of J-6198 to drive race into hub bore and take up slack between tool and handle with 3/4" washers to remove driving force from handle threads.

2. Install outer bearing outer race using Tools J-6278 and J-6278-2.

3. Use a fine fiber sodium soap wheel bearing grease and pack the wheel bearing. Spread a thin film of grease on bearing races and install inner bearing assembly in the hub.

4. Install a new grease seal by tapping seal into hub.

5. Install wheel assembly on knuckle.

6. Install outer bearing, washer and knuckle nut on knuckle.

7. Tighten knuckle nut to 10-15 ft. lbs. while revolving wheel.

8. Back nut off 1/6 to 1/4 turn to install cotter pin.

9. Install dust cap.

10. If brake adjuster was backed off, readjust brake by turning adjuster the same number of notches used in removal procedure.

FRONT WHEEL BEARING GREASE SEAL

Removal

1. Remove wheel and hub assembly.

2. Pry grease seal assembly from hub.

Installation

1. With Tool J-5154, tap new grease seal into hub until flange is seated on hub rim.

2. Install wheel assembly on knuckle.

BRAKE SPECIFICATIONS

BRAKE ASSEMBLIES AND DRUMS	
1. BRAKING AREA	123.8 sq. in.
2. RATIO (Percentage of Braking Effect)	
Front Brakes	57%
Rear Brakes	43%
3. DRUMS	
Inside Diameter	9-1/2"
Out of Round for Service (Total Indicator Reading)	.010" (Max.)
4. LININGS	
Length - Primary Shoes	7.52"
Length - Secondary Shoes	9.79"
Width - Front Brake	2"
Width - Rear Brake	1-3/4"
Thickness	9/32"
Clearance between Drum	.015

BRAKE SPECIFICATIONS (Cont'd)

HYDRAULIC SYSTEM	
1. FLUID TYPE	G.M. No. 11
2. FLUID LEVEL	1/2'' Below Filler Cap
3. MASTER CYLINDER BORE	1''
Diameter of By-Pass Hole	.014''-.028''
4. WHEEL CYLINDER BORE	
Front	1''
Rear	7/8''

ADJUSTMENTS

BRAKE SHOE	Tighten adjusting screw until heavy drag is felt on brake drum, then back off 15 notches.
PEDAL HEIGHT .... (from floor pan to top of pedal pad)	6-3/8'' to 6-5/8''
FREE TRAVEL	3/16''
PEDAL TO FLOOR CLEARANCE .... (with brakes applied)	Not less than 2''
PARKING BRAKE .... (adjust with parking brakes released)	
Equalizer	Tighten equalizer adjusting nut until heavy drag is felt at rear wheels, then loosen nut 9 turns.

TORQUE SPECIFICATIONS

Application	Ft. Lbs.
General	
Brake Line Fittings	8 to 12
Steering Knuckle to Backing Plate Bolts & Nuts	80 to 100
Plain Arm to Steering Knuckle to Backing Plate Bolts & Nuts	55 to 80
Anchor Pin Bolt to Knuckle	85 to 110
Rear Brake Backing Plate to Axle Housing Nuts	45 to 60
Wheel Cylinder to Backing Plate Bolts	10 to 12
Wheel Nuts	55 to 70
Parking Brake	
Brake Lever Assembly to Instrument Panel Bolts	8 Max.
Brake Rod End to Intermediate Lever Bolts	10 to 18
Standard Brakes	
Pedal Mounting Bracket to Instrument Panel Bolts	20 to 28
Pedal Mounting Bracket and Master Cylinder Bolts to Dash	20 to 28
Pedal Pivot Pin Nut (Syncro-Mesh)	8 to 16
Master Cylinder Filler Cap	10 to 20

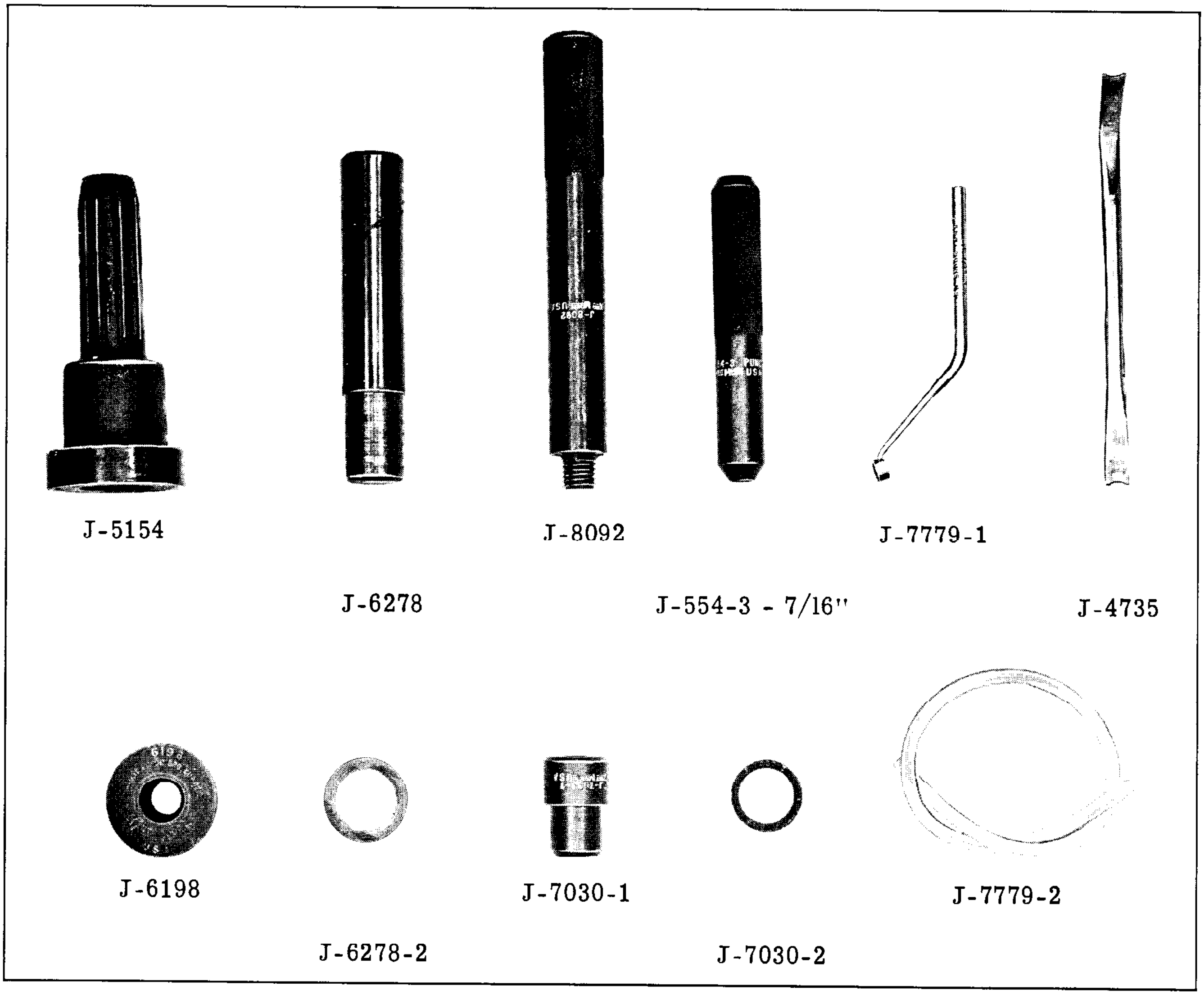

Fig. 7-16 Tools

J-554-3	7/16" Hub Bolt Peening Tool
J-4735	Brake Shoe Adjuster
J-5154	Seal Installer
J-6198	Bearing Installer
J-6278	Bearing Driver
J-6278-2	Adapter
J-7030-1	Adapter
J-7030-2	Spacer
J-7779-1	Bleeder Valve Wrench
J-7779-2	Bleeder Hose
J-8092	Driver Handle

ENGINE & CARBURETION

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MAINTENANCE RECOMMENDATIONS

To maintain maximum engine performance, it is recommended that the following service items be periodically performed at each of the mileage intervals indicated.

The initial oil change and subsequent changes should be made in accordance with the following chart.

Prevailing Daylight Temperature	Change Interval
Above 32°F.	*Every 3000 miles or every 3 months, whichever occurs first.
Below 32°F.	*Every 3000 miles or every 2 months, whichever occurs first.

* IMPORTANT: Certain adverse driving conditions such as dust, storms, continuous driving on dusty roads, extremely high humidity, or prolonged sub-zero temperatures necessitate more frequent oil changes. If the car has been driven in a dust or sand storm, the oil should be changed as soon as possible.

Crankcase Capacity

Oil change only, 4 qts.

Oil change and filter element change, 5 qts.

Oil Filter

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

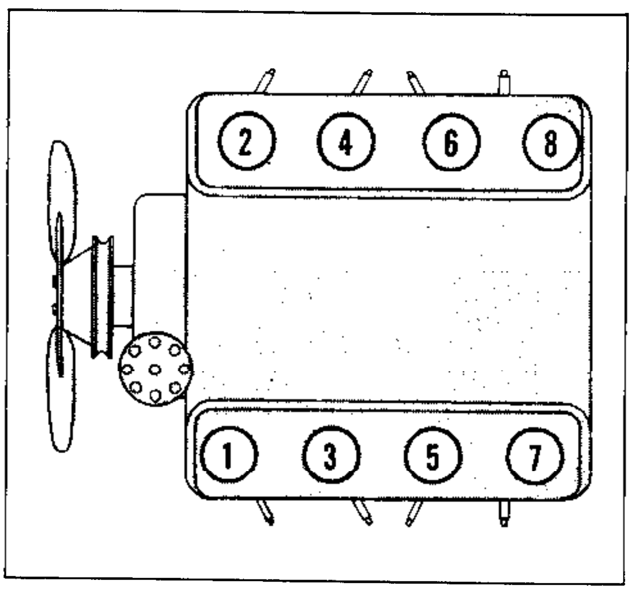

Fig. 8-1 Cylinder Numbers

Fuel Filter

Remove glass bowl as necessary and clean filter by washing in gasoline. Replace filter if necessary.

Crankcase Breather

The crankcase inlet breather cap should be washed in solvent and re-oiled with SAE 20 oil at every oil change.

Air Cleaner (Non-Disposable Type)

The polyurethane air cleaner element should be serviced every 6,000 miles. Operating conditions may require more frequent service.

The element is to be washed out in kerosene, then wrung dry. Saturate the element with new SAE 20 engine oil, then squeeze out excess oil.

Disposable Type

Replace every 16,000 miles.

Cooling System

When necessary, dirt and foreign material should be removed from the radiator cooling fins with compressed air. Each time the coolant is changed, 8 ounces of cooling system inhibitor, G.M. Part Number 989498 should be installed.

In areas that do not require anti-freeze in the winter months, the coolant should be changed annually and 8 ounces of cooling system inhibitor added.

Adding of rust inhibitor is not necessary when anti-freeze containing proper inhibitors are used.

The cooling system must be protected with anti-freeze in cold weather.

DESCRIPTION

The same V-8 engine is used in all series. Different flywheels and housings are used to accommodate either the Syncro-Mesh or Hydra-Matic transmission. The engine has a bore of 3.5" and a stroke of 2.8" providing a displacement of 215 cubic inches.

The cylinder block is cast aluminum with non-replaceable cast iron cylinder liners cast integral with the block. A one-piece intake manifold gasket is used which also serves as an engine top cover.

The left bank of cylinders (as viewed from the drivers 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. 8-1)

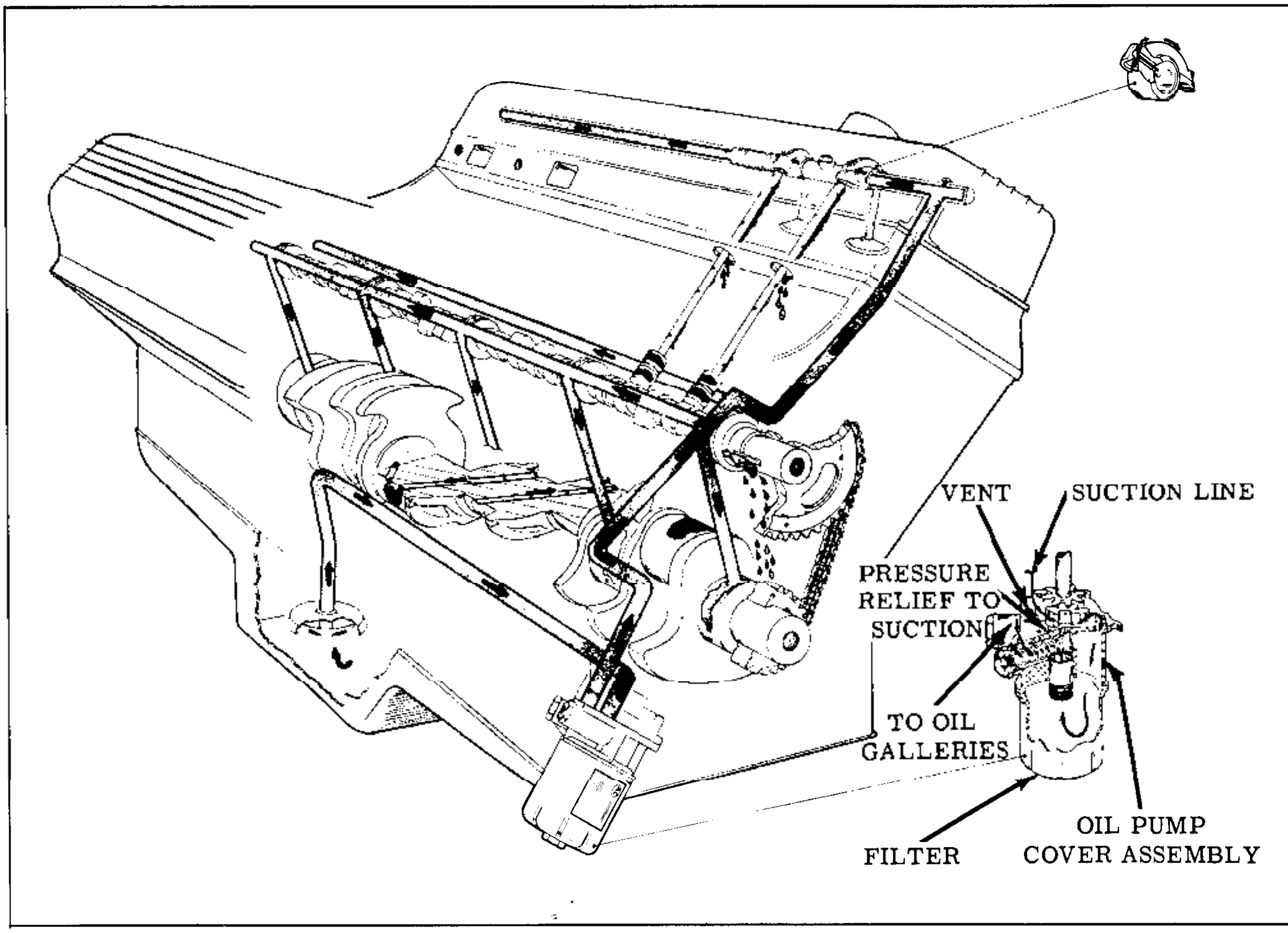

Fig. 8-2 Engine Oil Flow

The cylinder heads are made of cast aluminum with cast iron valve seat inserts and valve guides. Right and left cylinder heads are identical and interchangeable. The valve guides may be replaced.

The oil pump and distributor are located in the front engine cover. The distributor is driven by a driving gear that is bolted to the end of the cam shaft. The oil pump is driven by the distributor shaft. Oil flow in the engine is shown in Fig. 8-2.

REMOVAL (ENGINE ASSEMBLY)

When necessary to remove the engine assembly from the body the necessary items should be disconnected and the body raised off the engine and suspension assembly.

The following procedure is recommended.

Disconnect the following:

1. The front exhaust pipe from the rear exhaust pipe.
2. Speedometer cable, front of propeller shaft, and shift linkage from transmission.
3. Clutch and clutch equalizer on Syncro-Mesh equipped cars.
4. Battery cable from starter, ground cable and engine ground strap.
5. Accelerator linkage.
6. Oil pressure switch, ignition switch wire, temperature gauge and fuel line.
7. Drain radiator and disconnect radiator hoses and heater hoses. If air condition equipped, remove the pressure hoses from the compressor and fan shroud.
8. Stabilizer brackets from frame rail.
9. Front brake hoses.
10. Steering shaft from gear and raise up into steering column.
11. Remove the air cleaner and carburetor cover.
12. Place a block of wood between the front cross bar and the front of the engine oil pan. Remove the rear transmission mount cross support and support the rear of transmission with a stand.

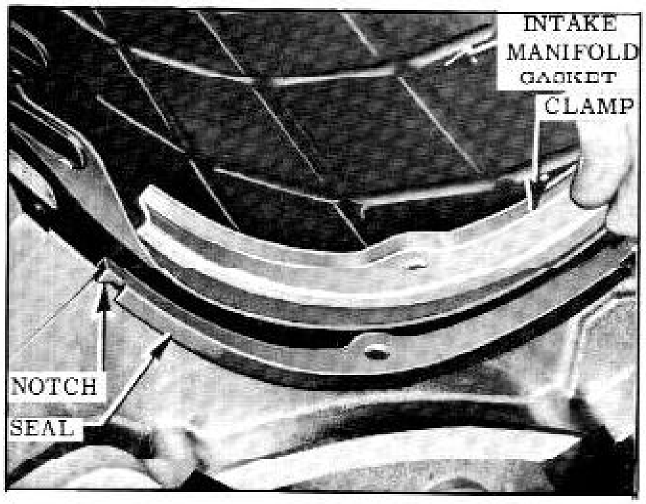

Fig. 8-3 Intake Gasket End Seals

13. With the front wheels on the floor, remove the 3 isolation mount bolts and carefully raise the body off the engine and suspension. Care must be taken not to let suspension tip.

Installation (Engine Assembly)

When installing the assembly into the body, the torque specifications and adjustments may be found for the specific unit in the corresponding section of this manual.

The brake system must be bled and the cooling and lubricating system properly serviced.

INTAKE MANIFOLD

Removal

1. Drain radiator, then disconnect upper radiator hose from water outlet. Also, disconnect heater hose at rear of manifold, (if car is so equipped).
2. Disconnect spark plug wires and remove the carburetor cover.
3. Disconnect throttle linkage from accelerator bell crank.
4. Disconnect choke heat tube and lower throttle rod.
5. Remove fuel and vacuum lines from carburetor.
6. Disconnect primary wiring from coil and secondary lead.
7. Disconnect temperature gauge wire.
8. Slide thermostat by-pass hose clamp back on hose at water pump.
9. Remove 12 intake manifold bolts. Then remove manifold with coil and carburetor attached.

   CAUTION: Aluminum can be dented or nicked if carelessly handled. Use particular care to protect gasket surfaces against damage.

10. Remove 2 intake manifold gasket clamp bolts, clamps, seals, and gasket.
11. 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 POB #3 and install new intake manifold gasket.
2. Install end seals and clamps. (Fig. 8-3) Lubricate bolts with engine oil and, torque bolts 10-15 ft. lbs.

   NOTE: When tightening clamp bolts, intake gasket must be positioned so manifold to head bolt holes will be open. (Fig. 8-4)

3. Position intake manifold on engine and connect thermostat by-pass hose to water pump.
4. Coat 12 intake manifold bolts with engine oil and install bolts. Torque alternately 25-30 ft. lbs. (Fig. 8-5)
5. Connect temperature gauge wire, primary wire and secondary lead to coil.
6. Install fuel and vacuum lines.
7. Connect upper radiator hose, spark plug wires, heater hose, carburetor linkage and install carburetor cover.
8. Fill cooling system.

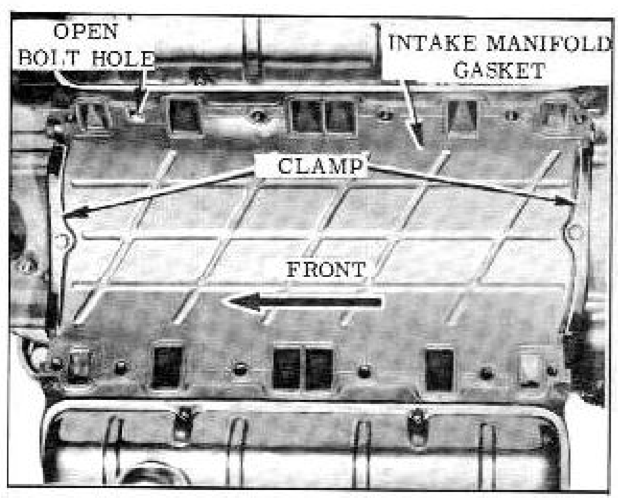

Fig. 8-4 Position of Intake Manifold Gasket

EXHAUST MANIFOLD

Removal

1. Disconnect the exhaust pipe.
2. For the right manifold, remove the rear generator mounting bolt, road draft tube, and disconnect the heat tube.
3. For the left manifold disconnect the dip stick tube, remove the power steering hoses, and raise the steering column.
4. Remove the manifold to head attaching nuts and washers and remove the manifold.
5. Clean manifold and cylinder head machined surfaces with a putty knife. Use extreme care not to gouge or scratch machined surfaces.

Installation

Apply a coat of Part No. 581823 graphite grease or equivalent on the head and manifold contact surfaces.

1. Install manifold to head and torque nuts 18-24 ft. lbs.
2. Reconnect disconnected parts.

POSITIVE CRANKCASE VENTILATION

DESCRIPTION

The positive crankcase ventilating system draws, by intake manifold vacuum, unburned fuel gases out of the crankcase and returns them to the combustion chamber to be burned.

It is very important that crankcase oil level be correctly maintained and not overfilled. Because of the nature of materials carried, it is recommended that the check valve be cleaned every 10,000 miles or more often if necessary. (Fig. 8-6)

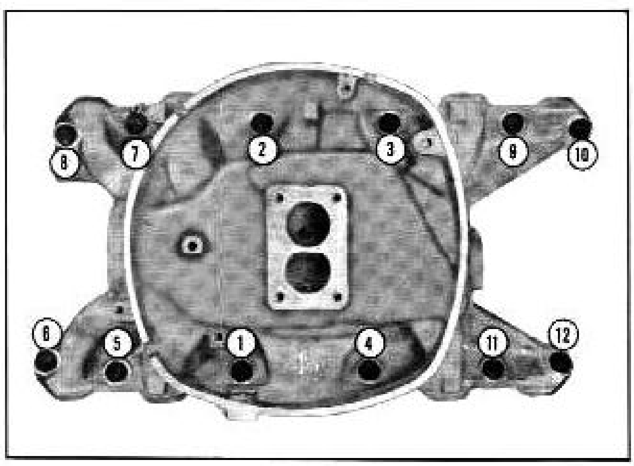

Fig. 8-5 Intake Manifold Bolt Torque Sequence

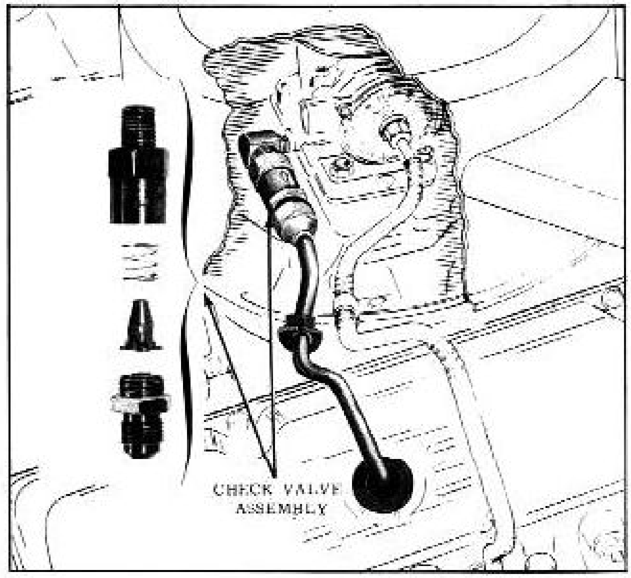

Fig. 8-6 Positive Crankcase Ventilation

TESTING

A rough idle or crankcase fumes escaping through the crankcase breather is an indication the system may need service.

SERVICE

1. Remove the hoses and blow out with compressed air.
2. Remove the valve and clean every 10,000 miles as follows:
   a. Clean with solvent and blow dry.
   b. Inspect spring and valve for distortion and etching.
   c. Clean small bleed hole in valve with a 1/16" drill. Twist drill by hand only.

   NOTE: When assembling valve, the spring end coil must be in the groove just under the head of the valve. If this is not properly installed, the valve may not close and will result in a rough idle.
3. Clean the crankcase and intake manifold connectors.
4. Service the air cleaner and crankcase breather and adjust idle.
5. After servicing and installing ventilator, repeat the test procedure.

ROCKER ARMS AND SHAFTS

Removal

1. Remove carburetor cover.

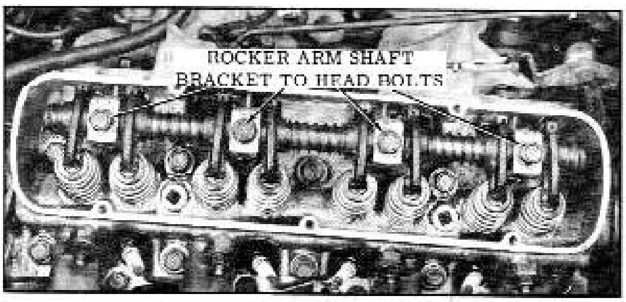

Fig. 8-7 Rocker Arm Assembly Attachment

2. Disconnect heat tube from carburetor and manifold on right side.

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

4. Remove 5 valve cover to cylinder head screws and rotate cover off of breather pipe and remove cover.

5. Remove 4 rocker arm shaft bracket to head bolts. (Fig. 8-7)

6. Remove heater blower assembly to remove right rocker arm assembly.

Disassembly

1. Remove cotter pins from ends of shaft.

NOTE: Disassemble one shaft assembly at a time and place on bench so parts may be reassembled in their original place.

2. Remove springs, arms and brackets from shaft.

If necessary to remove shaft end plug, punch hole in plug, then pry plug from end of shaft.

Assembly

1. If shaft end plug was removed, drive new plug in shaft to clear cotter pin hole.

2. Lubricate frictional surfaces of rocker arms and shaft with engine oil and assemble. (Fig. 8-8)

Installation

1. Position rocker arm shaft assembly on cylinder head and align brackets with mounting bolts. Shaft goes on a dowel on head. (Fig. 8-9)

2. Coat bolt threads with POB No. 4 Sealer or equivalent, and torque 45-55 ft. lbs. Check rocker arm to valve stem contact for proper alignment.

3. Install valve cover with a new gasket, connect spark plug wires, heat tube, heat tube retainer and carburetor cover.

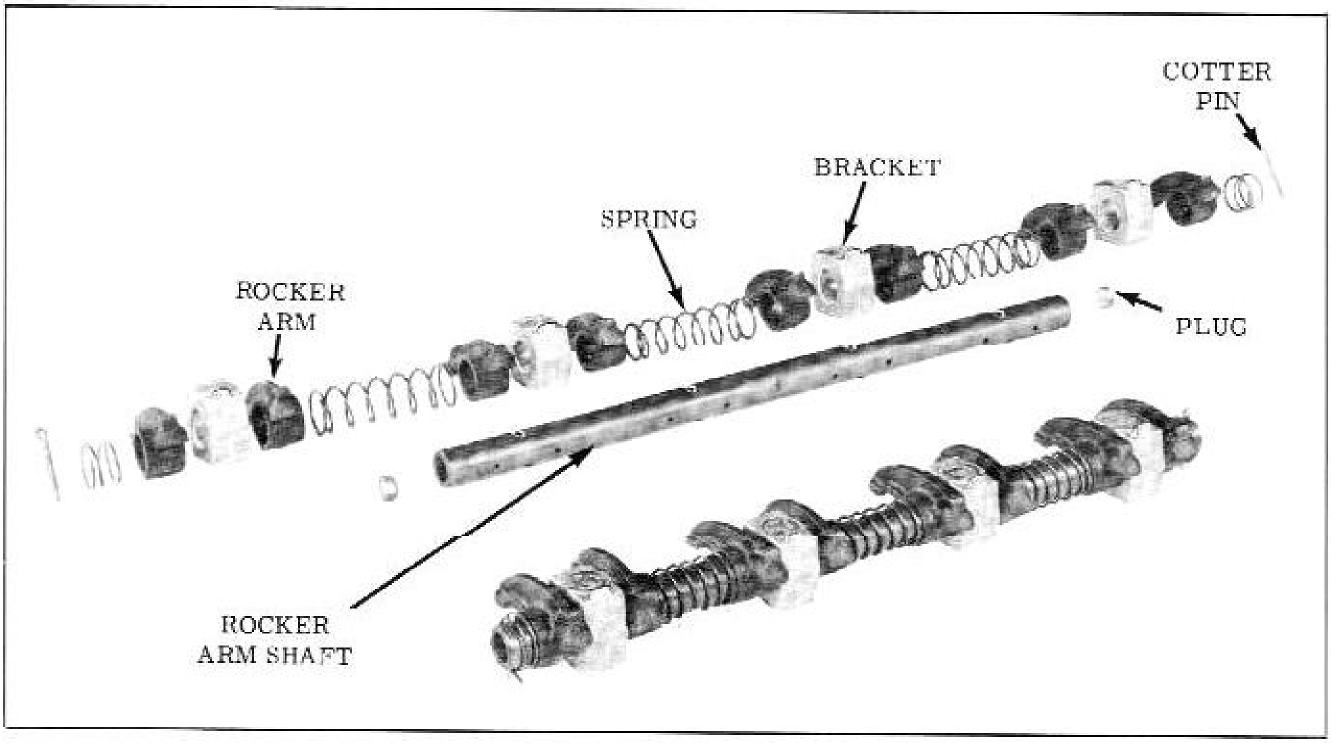

Fig. 8-8 Rocker Arm Shaft Assembly

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. (Fig. 8-10)

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 (Page 8-4)
2. Remove valve covers and rocker arm assemblies and push rods. (Page 8-5)
3. On varnished lifters, apply "D Carb" solution to lifter body. Allow 5 minutes for solution to remove varnish.
4. Remove lifters. Use of Tool BT-39 will aid in removal of varnished lifters. (Fig. 8-11)

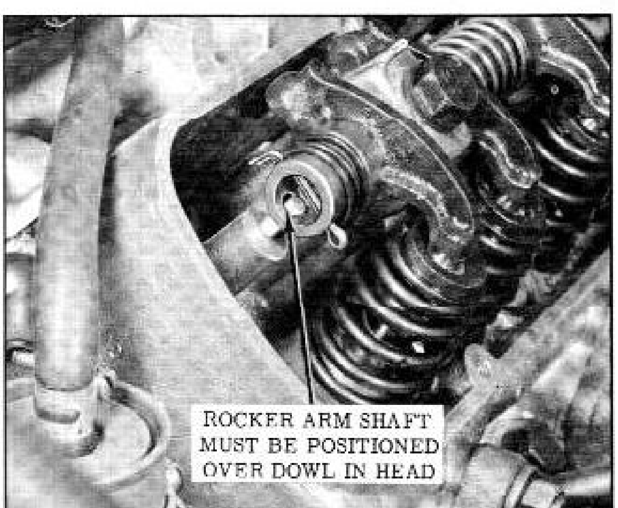

Fig. 8-9 Rocker Arm Shaft Position

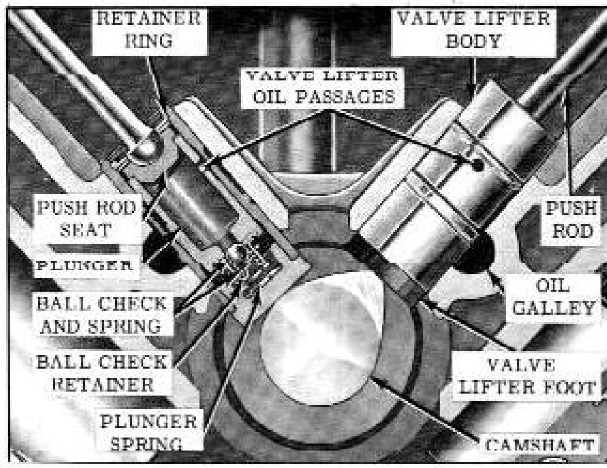

Fig. 8-10 Valve Lifter Operation

Disassembly

1. Remove retainer spring with Tool BT-31 or a small screw driver.
2. Remove push rod seat.
3. Remove plunger and plunger spring. If plunger is stuck tight, allow lifter to soak in "D-Carb" solvent for approximately five minutes, then remove.

   CAUTION: "D-Carb" 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.

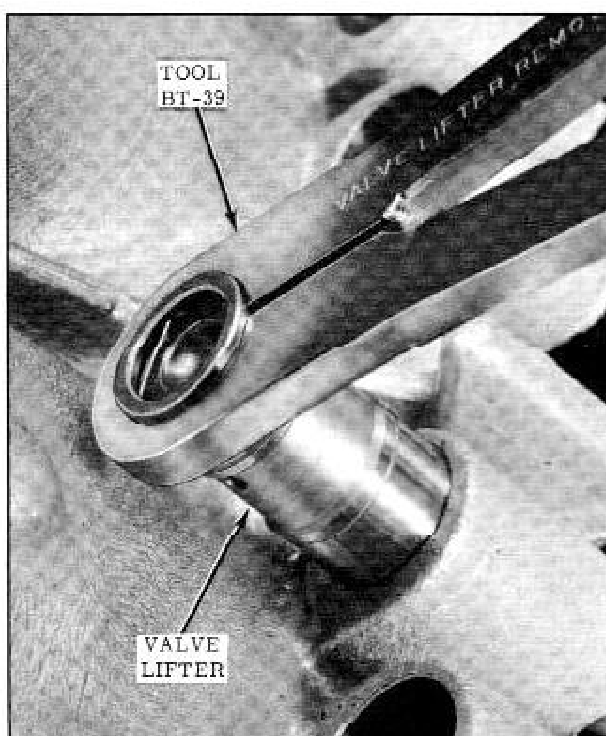

Fig. 8-11 Removing Valve Lifter

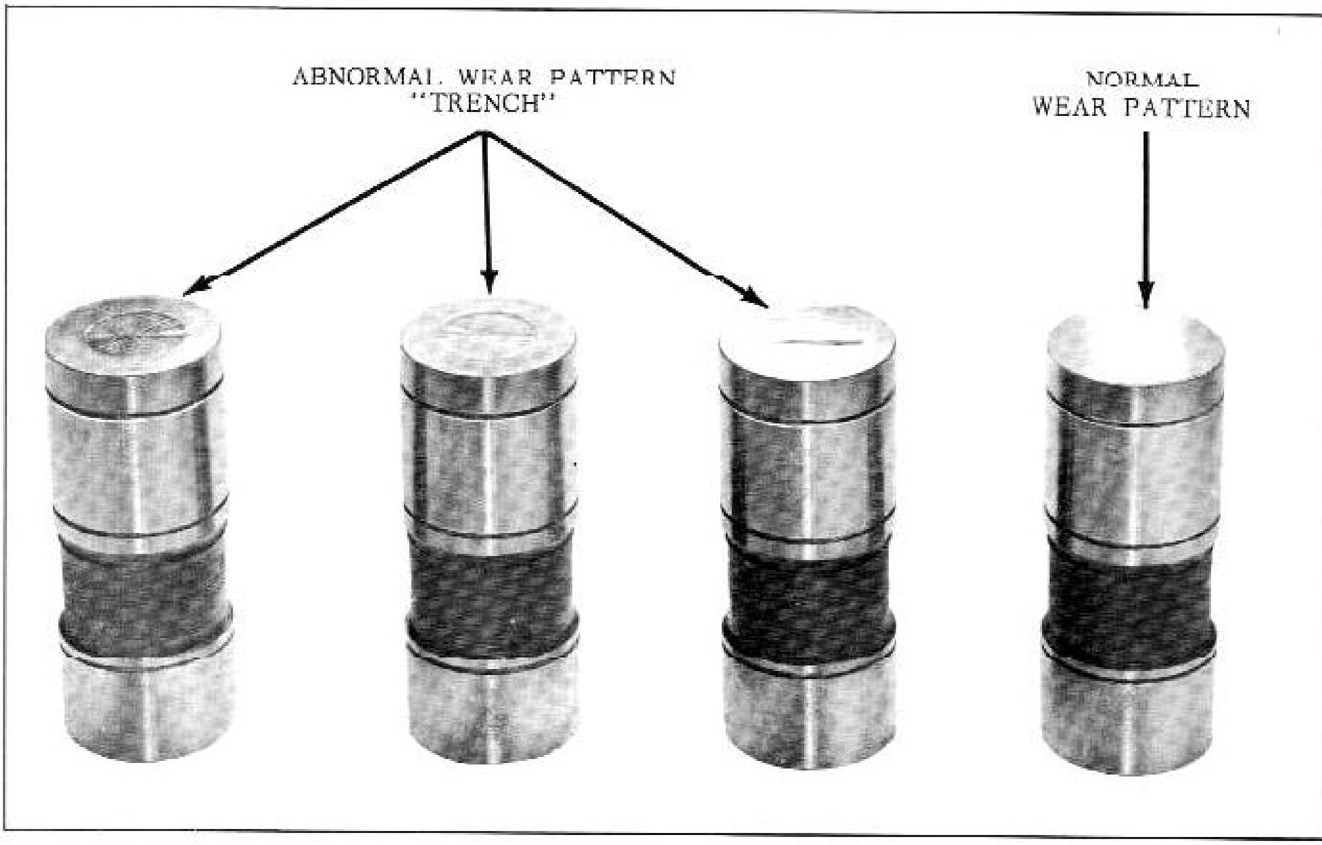

Fig. 8-12 Valve Lifter Wear Patterns

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. Balls, ball check retainers, springs, push rod seats, and snap rings are interchangeable and can be replaced individually. 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, (Fig. 8-12), unless the leak-down rate is not within specifications. (See VALVE LIFTER LEAK-DOWN - Page 8-8)

NOTE: Whenever lifters are removed, check the lifter foot for abnormal wear.

A slight concave condition is not an indication of lifter wear with this engine. A worn lifter foot can be readily seen as it will have a trench worn in it from the camshaft lobe. (Fig. 8-12)

NOTE: Install lifters and push rods into original position in cylinder block.

1. Install lifters and push rods.
2. Position rocker arm assembly on cylinder head and align brackets with mounting bolts.
3. Coat bolt threads with POB No. 4 Sealer or equivalent and install bolts. Torque 45-55 ft. lbs. Check rocker arm to valve stem contact.
4. Install valve cover, connect spark plug wires, heat tube and air cleaner.

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. 8-13) 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 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 2 seconds and time the indicator from the start to the stop line. (Fig. 8-14) Allowable tolerance for leak-down rate is 8 to 40 seconds (for used lifters) and 12 to 40 seconds (for new lifters).

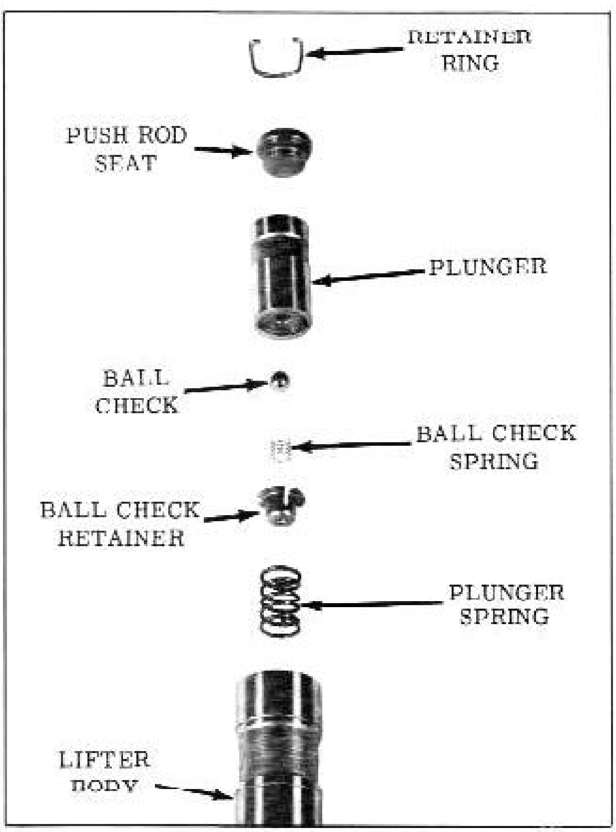

Fig. 8-13 Valve Lifter Exploded View

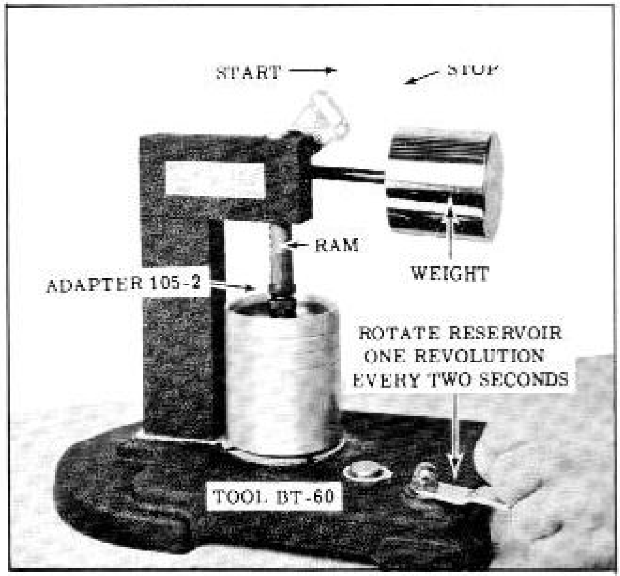

Fig. 8-14 Valve Lifter Bleed Down Test

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 ball.

3. Noisy At Slow Idle or With Hot Oil, Quiet With Cold 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 serviced. (Page 8-7)

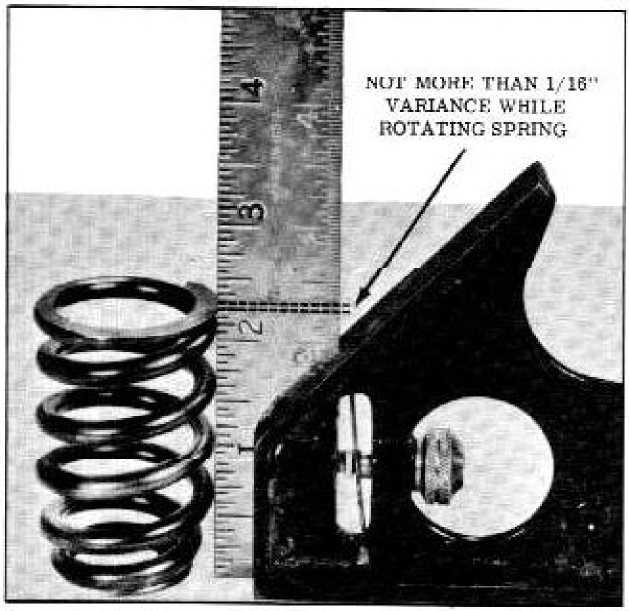

Fig. 8-15 Valve Spring Height

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 LUBRICATION 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 LUBRICATION SECTION.

5. Noisy at Idle Becoming Louder as Engine Speed is Increased to 1500 R.P.M.

   a. This noise is not connected with lifter malfunction. It becomes most noticeable in the car at 10-15 mph "Lo" range, or 30-35 mph "S" 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.

      (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.

Diagnosis:

Remove valve covers and while listening with a stethoscope, locate noisy valves by increasing engine speed slightly above idle, about 1000 r.p.m. 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 90°. 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. 8-15)

   b. Observe rocker arm pad for excessive wear or excessive off square. Replace as required. (Fig. 8-16)

   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 any of the following factors:

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

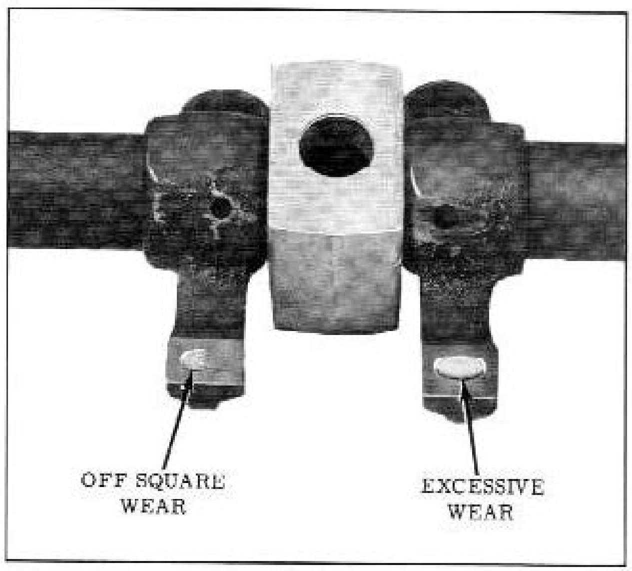

Fig. 8-16 Rocker Arm Wear

If a foreign particle in the lifter is restricting proper operation, this method sometimes proves successful in dislodging the particle. 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 the particle. 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 T.D.C. 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 shaft assembly 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. The rod and 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 O.K., trouble is in lifter. Lifter should be rebuilt, or replaced if necessary.

CYLINDER HEAD AND GASKET

Removal

1. Drain radiator and cylinder block.

2. Remove intake manifold. (Removal Procedure on Page 8-4)

3. Disconnect exhaust pipe.

4. Disconnect spark plug wires and remove valve cover.

5. Right cylinder head removal:

   a. Remove generator rear mounting bracket bolt.

   b. Remove ground straps at the front and rear of the cylinder head.

If equipped with heater the following procedure should be followed to remove right cylinder head.

   a. Remove all head bolts except rear rocker arm shaft bracket bolt. (Blower motor case prevents this.)

   b. Loosen rear rocker arm shaft bracket bolt and raise shaft assembly from head and remove push rods except No. 16.

   c. Lift No. 16 Push Rod to within 1" of blower case and tape to rocker shaft.

   d. Lift head, rocker shaft assembly and exhaust manifold off dowel pins and move forward to clear blower case.

Left cylinder head removal:

   a. Remove power steering belt if so equipped.

   b. Remove 2 power steering pump bracket to cylinder head bolts.

   CAUTION: Aluminum can be dented or nicked if carelessly handled. Use particular care to protect gasket surfaces against damage.

7. Remove rocker arm shaft assembly and remove push rods.

8. Remove cylinder head bolts and remove cylinder head with exhaust manifold attached.

Installation

All cylinder head bolt threads must be coated with POB No. 4 Sealer or equivalent. Torque head bolts 45-55 ft. lbs. and torque exhaust manifold to head bolts 18-24 ft. lbs. Follow sequence shown in Fig. 8-17.

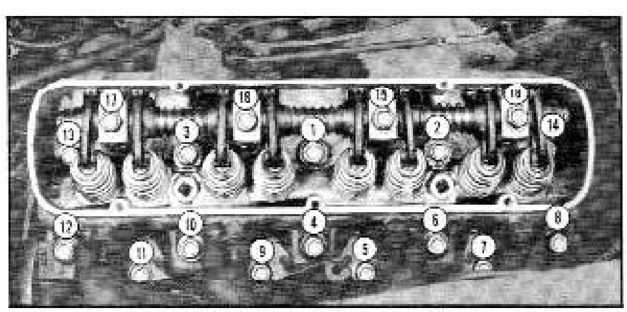

Fig. 8-17 Cylinder Head Torque Sequence

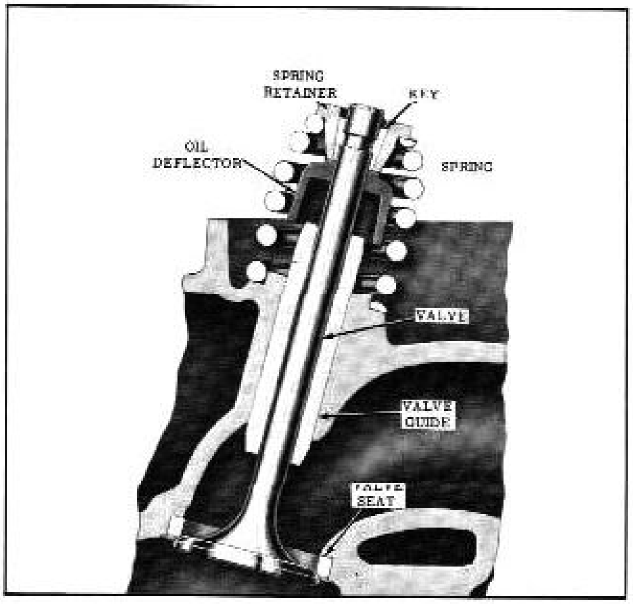

Fig. 8-18 Valve Assembly

Head gaskets should be coated on both sides with POB No. 4 Sealer or equivalent before installation.

VALVES AND SPRINGS (HEAD REMOVED)

NOTE: Valves used in engines equipped with a 4 Bbl. carburetor are identified by a letter "O" on the head of the valve.

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. 8-18)
4. Remove oil deflectors from valve stems.
5. Remove valves. Keep valves separated so they can be installed in their original locations.

Installation

1. Install valves in their respective guides.
2. Install new oil deflectors over valve stem. Force 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, large diameter against head.
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 18-24 ft. lbs.
7. Set spark plug gap to .040. Lubricate plug threads with 1 drop of engine oil and reinstall plugs. Torque 15-20 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 surface. A soft wire brush is suitable for the purpose. Whenever valves are replaced or new valves and guides are installed, the valve seats must be reconditioned. New guides, if required should be in place at the time seats are reconditioned. Service guides are finished to size.

IMPORTANT: To assure satisfactory service, it is necessary that valve seat width be maintained. (Intake and exhaust seat width should be 1/16", and angle, 45°.)

VALVE GUIDES

Valve guides are identified as follows:

Std. Guides	No Groove
.001" oversize	2 Grooves
.010" oversize	1 Groove
.011" oversize	3 Grooves

Standard guides should be replaced with .001" oversize guides and .010" guides should be replaced with .011" oversize.

Removal

1. Support cylinder head and drive out valve guide, using Tool BT-68-5A. (Fig. 8-19)

Installation

1. Lubricate guide and bore of head with engine oil.

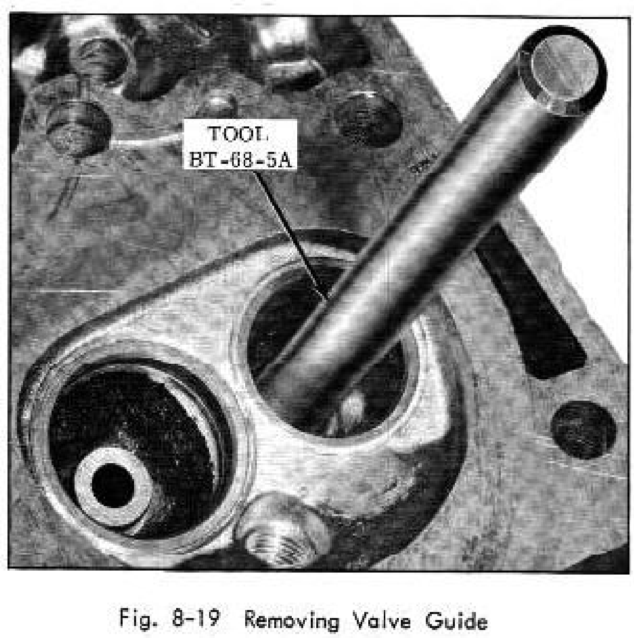

Fig. 8-19 Removing Valve Guide

2. Place valve guide into cylinder head with outside beveled end of guide up.

   The inside bore of the guides are grooved. The EXHAUST guide has grooves the full length of the bore. The INTAKE guide has grooves to within 1/2" of the bottom.

   NOTE: INTAKE GUIDES MUST BE INSTALLED WITH THE GROOVES UP.

3. Place guide Installer Tool BT-68-5B over new guide and drive until tool makes contact with cylinder head. This will automatically position guide. (Fig. 8-20)

REPLACING VALVE SPRING (HEAD ON ENGINE)

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

Removal

1. Remove rocker arm assembly. (Refer to Page 8-5)
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-72-2, (Fig. 8-21), compress the valve spring until valve keys are accessible, then remove keys, springs retainer cup, and spring.

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

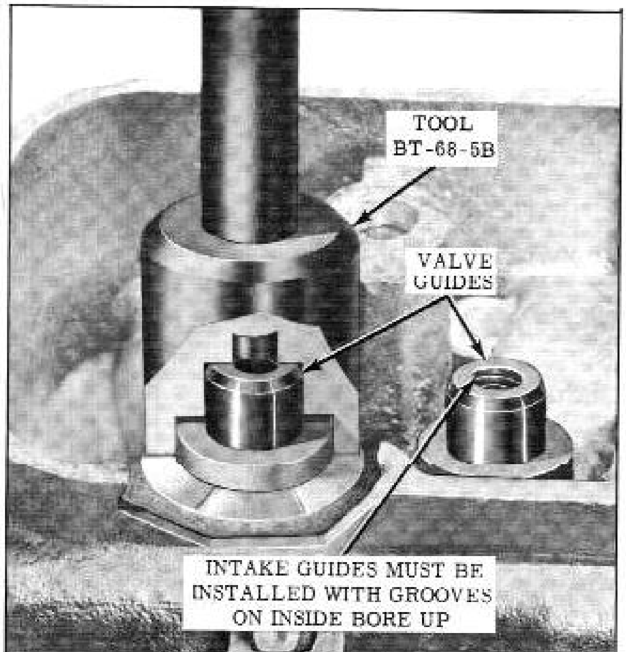

Fig. 8-20 Installing Valve Guides

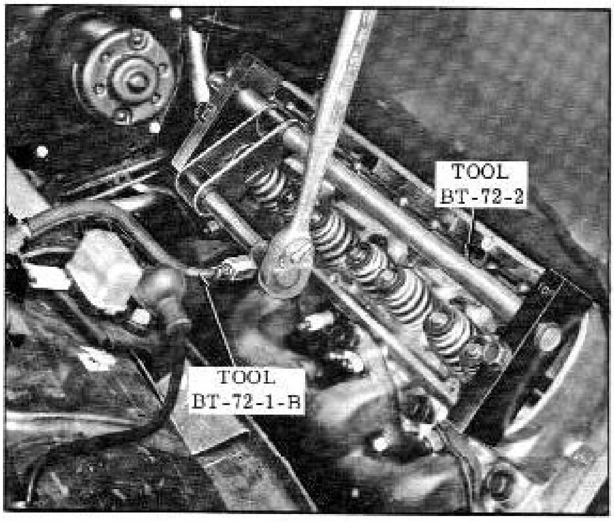

Fig. 8-21 Removing Valve Springs

Installation

1. Install valve spring and spring retainer. With Tool BT-72-2 compress the valve spring until valve keys can be installed.
2. Install spark plugs. Torque 15-20 ft. lbs.
3. Install rocker arm assembly. (Refer to Page 8-6)

OIL PAN

Removal

1. Remove the dipstick.
2. Hoist car and drain oil.
3. Disconnect idler arm from relay rod.
4. Remove the cover on the front of lower flywheel housing and remove pan bolts.

   NOTE: On some types of lifts, it may be necessary to drop the oil intake into the pan before removing pan. The crankshaft should be positioned so the counterweights do not interfere with the pan removal.

Installation

1. Lubricate pan bolts with engine oil and install pan. Torque bolts 6-15 ft. lbs.
2. Attach idler arm to relay rod and install flywheel cover.

CONNECTING ROD AND PISTON ASSEMBLY

Removal

1. Remove intake manifold, head or heads.
2. Remove oil pan.

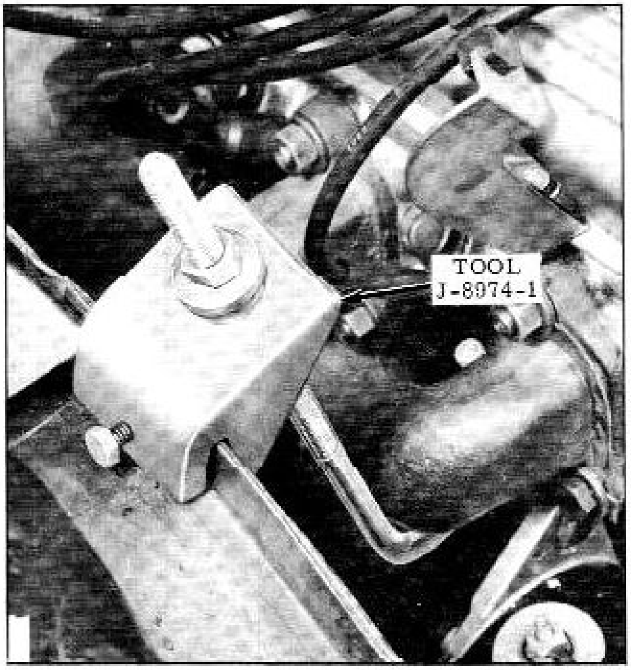

Fig. 8-22 Engine Support Tool

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.

3. Examine 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 Tool BT-8822 over threads of rod bolts. This is to prevent damage to bearing journal and rod bolt threads. (Fig. 8-23)

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

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

CONNECTING 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. (Page 8-13)

2. If all bearings are being removed, it will be advantageous to disconnect engine mounts and raise the engine one or two inches with Tool J-8974. (Fig. 8-22)

3. 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.

4. 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 or reground.

5. 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".

If plastigauge is to be used:

6. Clean oil from journal, bearing cap, connecting rod, and outer and inner surface of bearing inserts.

7. Place a piece of "Plastigauge" in the center of lower bearing shell.

8. Reinstall bearing cap and torque 30-35 ft. lbs.

9. 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

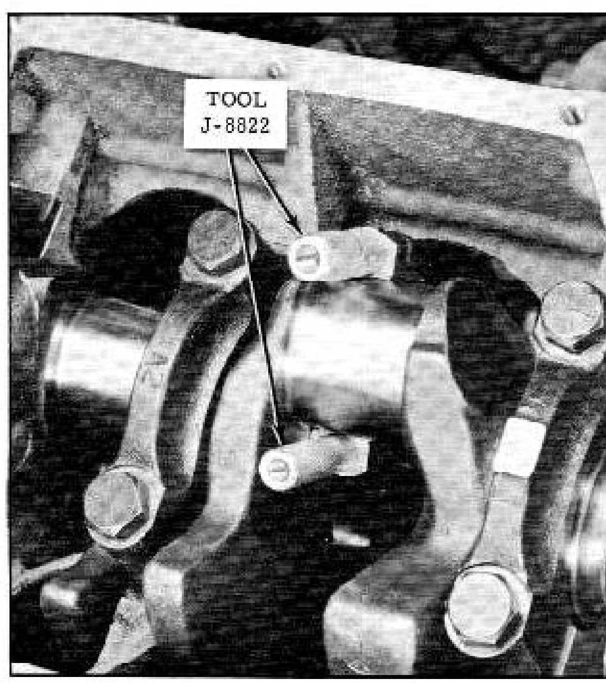

Fig. 8-23 Connecting Rod Bolt Guides

thousandths of an inch. (Fig. 8-24) If this clearance is greater than .0035", replace the bearing and recheck clearance with "Plastigauge".

NOTE: Lubricate bearing with S.A.E. 20 oil before installation. Repeat steps 2 thru 8 on remaining connecting rod bearings.

All rods must be connected to their journals when rotating the crankshaft.

ROD ASSEMBLY

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

PISTON

MEASURING PISTON

When replacing pistons, the original cylinder size is stamped with a code number near each cylinder on the oil pan rail.

If the cylinder size is 2-4-6 or 8, use that size piston. If the cylinder size is 1-3-5 or 7, use the next even number size larger. Example: If the rail is stamped 5, use the 6 size piston.

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. 8-25)

Fig. 8-24 Checking Oil Clearance

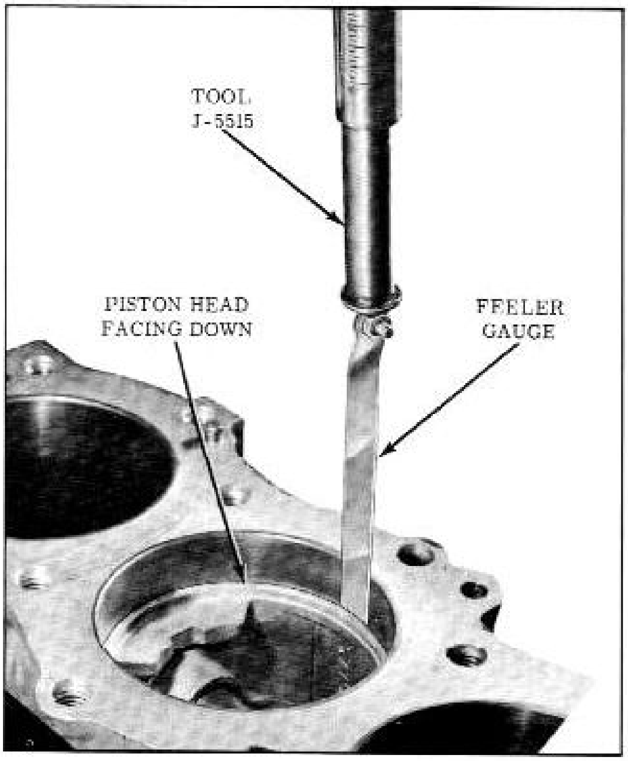

Fig. 8-25 Checking Piston Clearance

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.

CHECKING CYLINDER BORE

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. They should not be bored over .010".

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 and immerse the pistons in a solvent. Deposits in the ring grooves should be removed with a suitable ring groove cleaning tool.

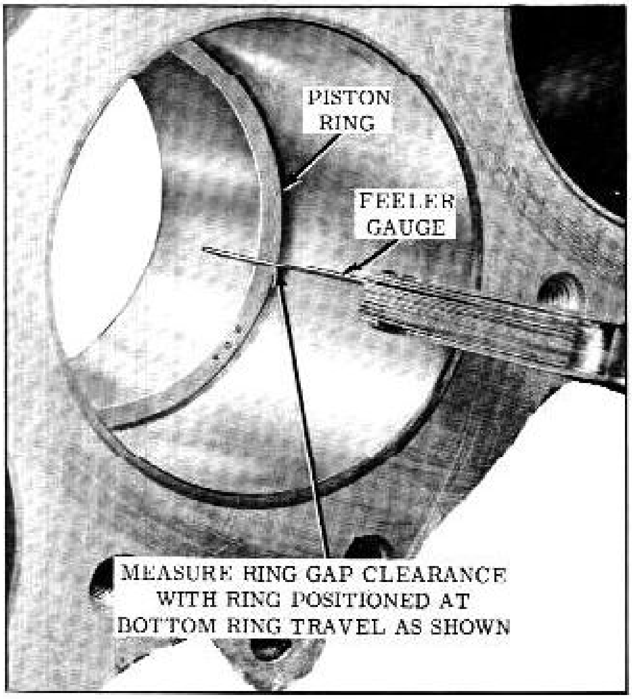

Fig. 8-26 Measuring Piston Ring Gap

RINGS

The pistons have three rings (two compression rings and one oil ring.)

The top compression ring is chrome plated, the second compression ring is of the step type and has a black finish. Both types of oil rings consist of 2 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 the ring or rail positioned squarely and at the bottom of the ring-travel area of the bore. (Fig. 8-26)

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.

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. 8-27) 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	.0005" to .0055"
Compression Ring	.003" to .005"

Ring Installation

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

ROD AND PISTON ASSEMBLY

Installation

1. Install connecting rod bolt guide Tool BT-8822 over rod bolt threads. (Fig. 8-23)

2. Apply S.A.E. No. 20 oil to rings and piston, then install piston ring compressing tool on piston. (Fig. 8-28)

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 new engine 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

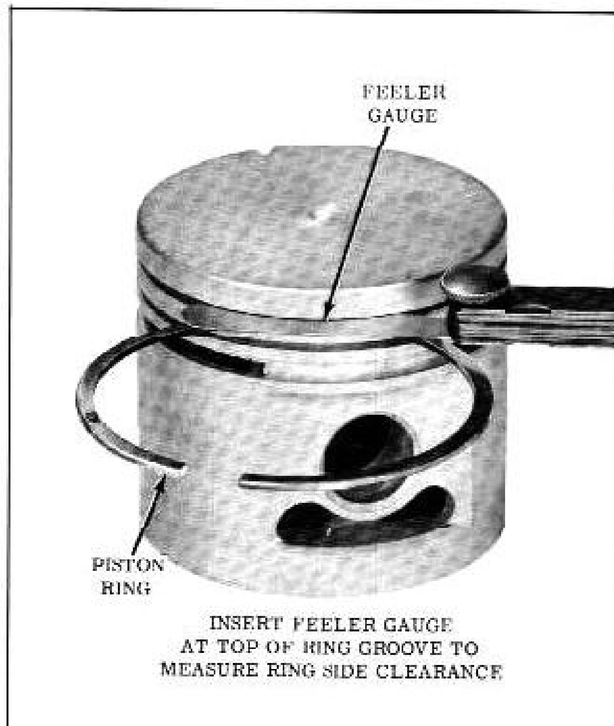

Fig. 8-27 Piston Ring Side Clearance

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 crank pin should be from .002" to .011".

5. Torque rod bolt nuts 30-35 ft.-lbs.

PISTON PIN

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. The pin will fall through the piston by its own weight. 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.

Removal

1. Place piston on piston pin remover Tool J-8754-1, with the letter "F" on piston facing up.

2. Place Remover Tool J-8855-3 in piston pin as shown in Fig. 8-29, and press pin out.

Installation

1. Place spring and guide stop Tool J-8751-2 in main body Tool J-8754-1. (Fig. 8-30)

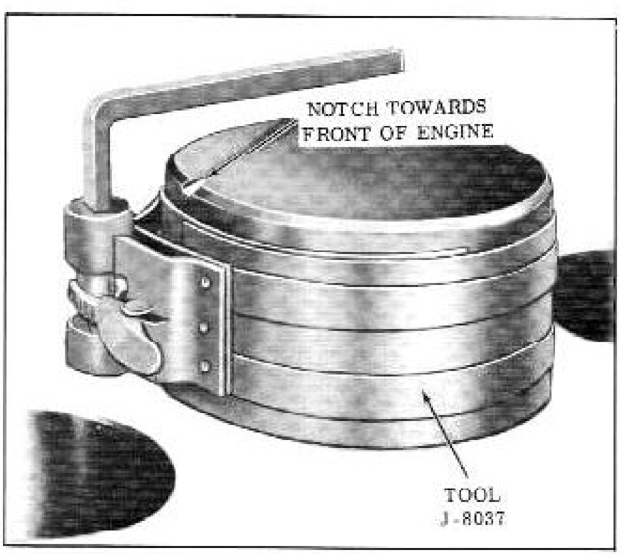

Fig. 8-28 Piston Ring Compressor

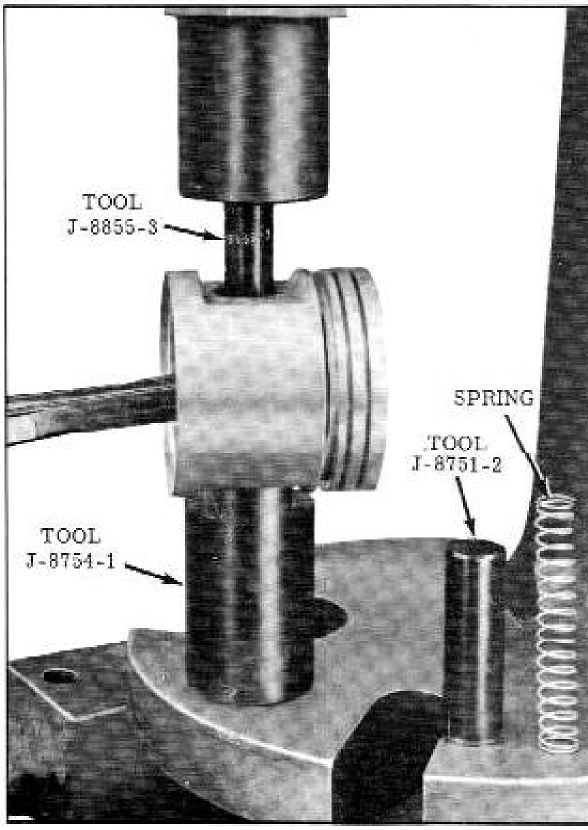

Fig. 8-29 Removing Piston Pin

2. Place piston on Tool J-8754-1 with letter "F" facing up. Refer to Fig. 8-31, for correct rod and piston assembly.

3. Coat piston pin with engine oil. Place pin in piston as shown in Fig. 8-32. Press in piston pin with Tool J-8855-3 until it makes contact with guide stop Tool J-8751-2 in main body Tool J-8754-1. This will automatically center the pin in the piston. Pin to connecting rod fit is .0007 to .0013 tight.

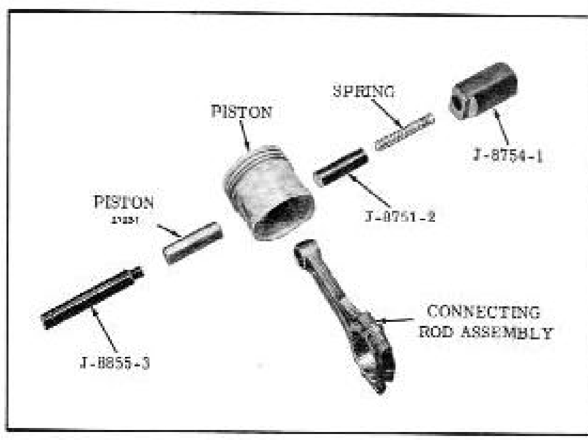

Fig. 8-30 Tool J-8754

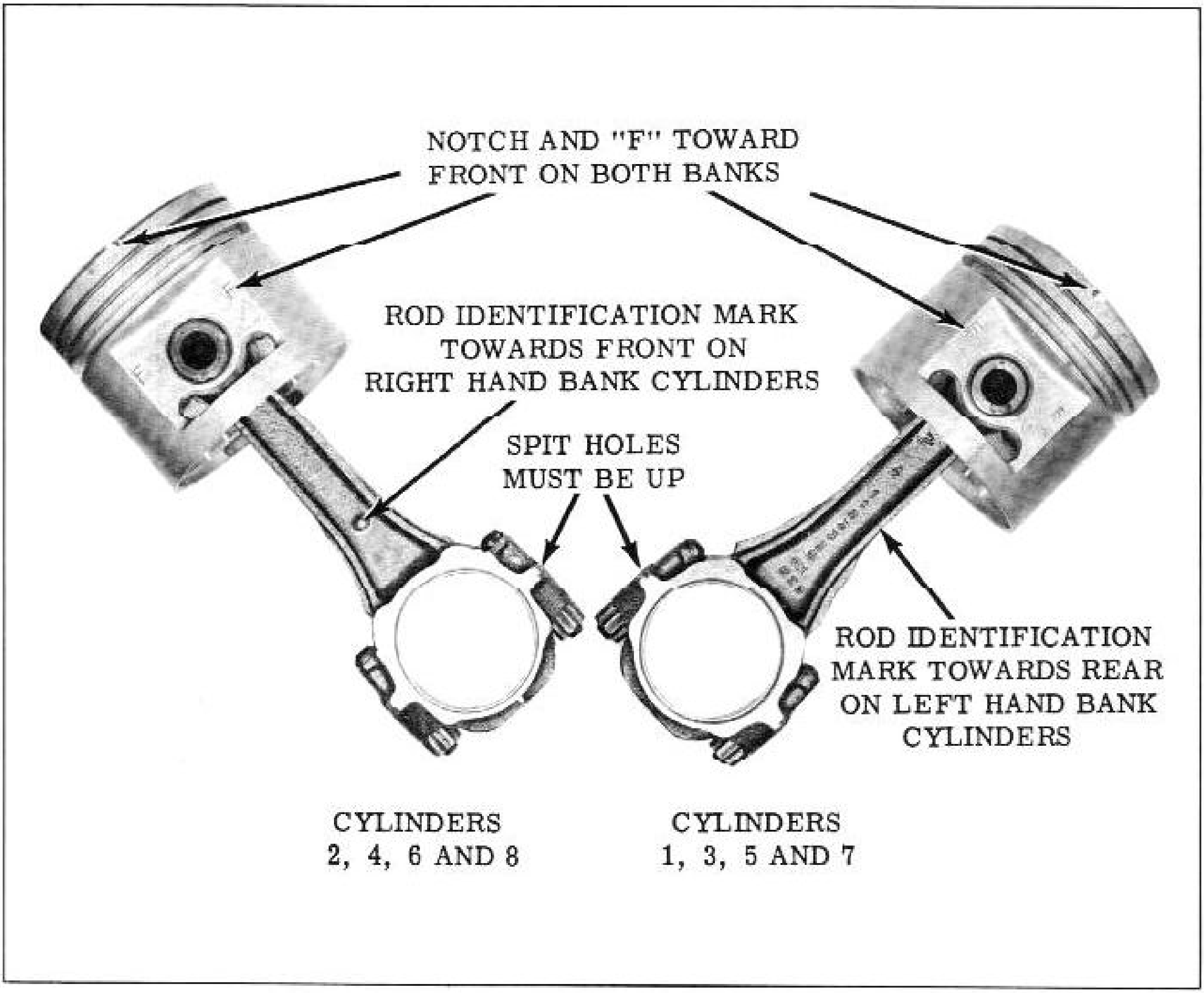

Fig. 8-31 Piston and Connecting Rod Assembly

CRANKSHAFT PULLEY

Removal

1. Remove belt(s). Remove fan. On air conditioning equipped cars remove fan shroud.

2. Hoist car.

3. Remove (6) pulley bolts, reinforcement plate and pulley. Air conditioning equipped cars do not have a reinforcement plate.

Installation

1. Install pulley, reinforcement plate and 6 bolts. Torque 15-20 ft. lbs.

2. Install fan pulley and fan.

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

CRANKSHAFT BALANCER

Removal

1. Remove belts. Remove fan and fan pulley, on air conditioning equipped cars remove fan shroud.

2. Remove crankshaft balancer bolt and washer.

3. Remove balancer.

NOTE: All crankshaft balancers, original and service replacements are balanced individually before being installed. After the balancer is attached to the crankshaft the engine and the balancer are balanced as an assembly. This is accomplished by inserting a balancing pin or pins, if necessary, into the holes provided along the outer circumference of the balancer. These pins are not staked.

When installing a service replacement balancer it is essential that the balancer be in balance with the engine. If there are no balancer pins in the original balancer the new balancer may be installed as is. If balance pin or pins are found on the original balancer, proceed as follows:

a. Lay new and old balancer with keyway in relative position. (Fig. 8-33)

b. Remove balancing pin(s) if any from old balancer and install in corresponding hole(s) in new balancer.

4. Install pulley and reinforcement plate on hub of balancer, then align small holes in plate and pulley with the bolt holes in balancer.

5. Install 6 pulley bolts and torque 15-20 ft. lbs.

Installation

1. Apply P.O.B. No. 3 Sealer to inside diameter of pulley and to crankshaft key to prevent possible oil leakage. Coat outside area of crankshaft pulley which enters seal with special seal lubricant.
2. Install pulley balancer assembly on crankshaft.
3. Install pulley balancer assembly washer and bolt. Torque 140-160 ft. lbs.
4. Install belt(s). Use Tool BT 33-70 and adjust.

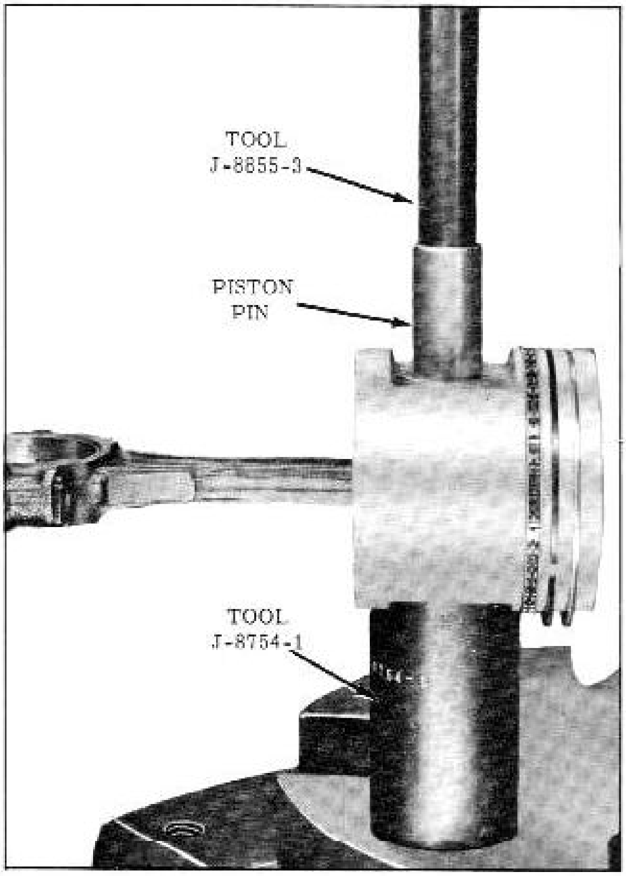

Fig. 8-32 Installing Piston Pin

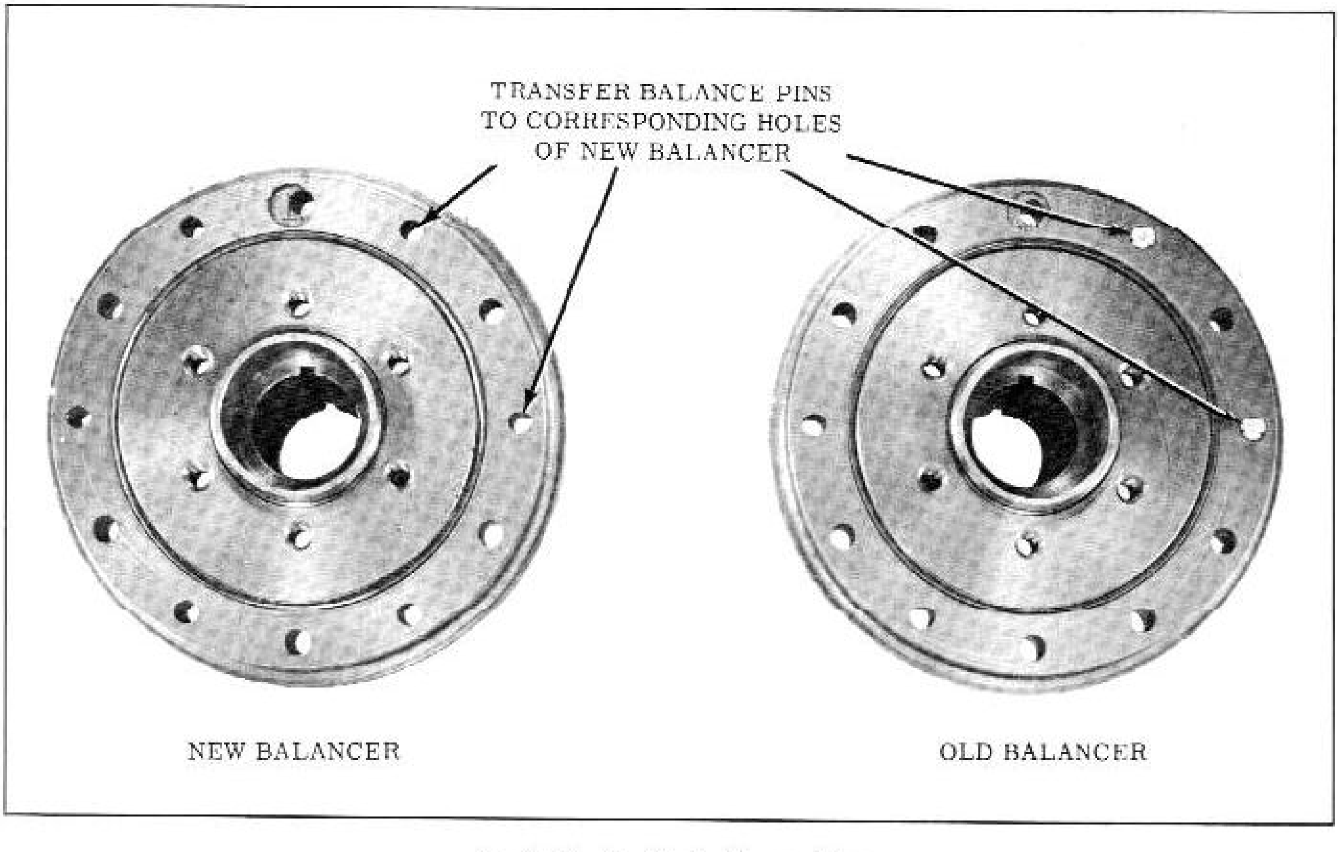

Fig. 8-33 Crankshaft Balancer Pins

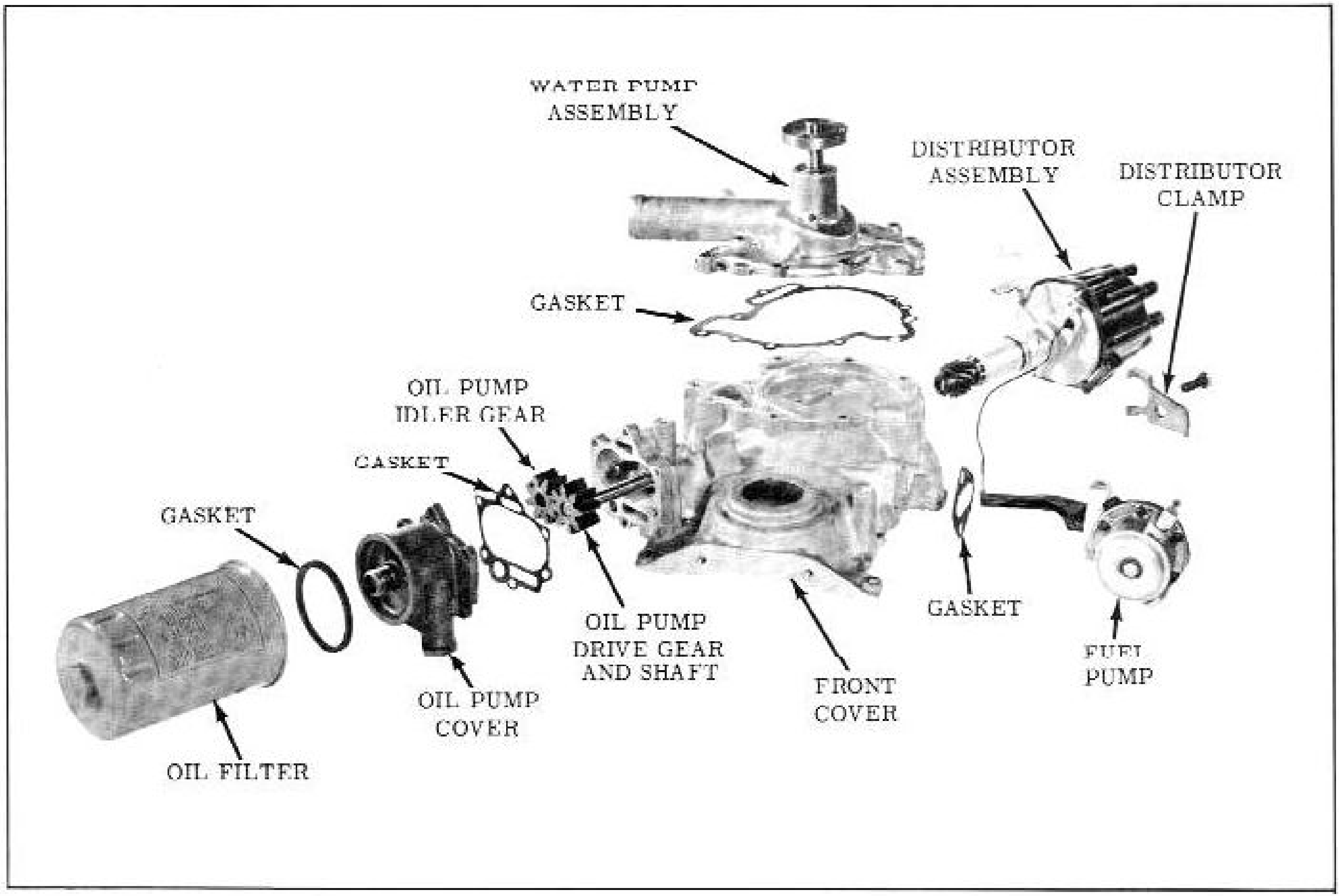

Fig. 8-34 Engine Front Cover

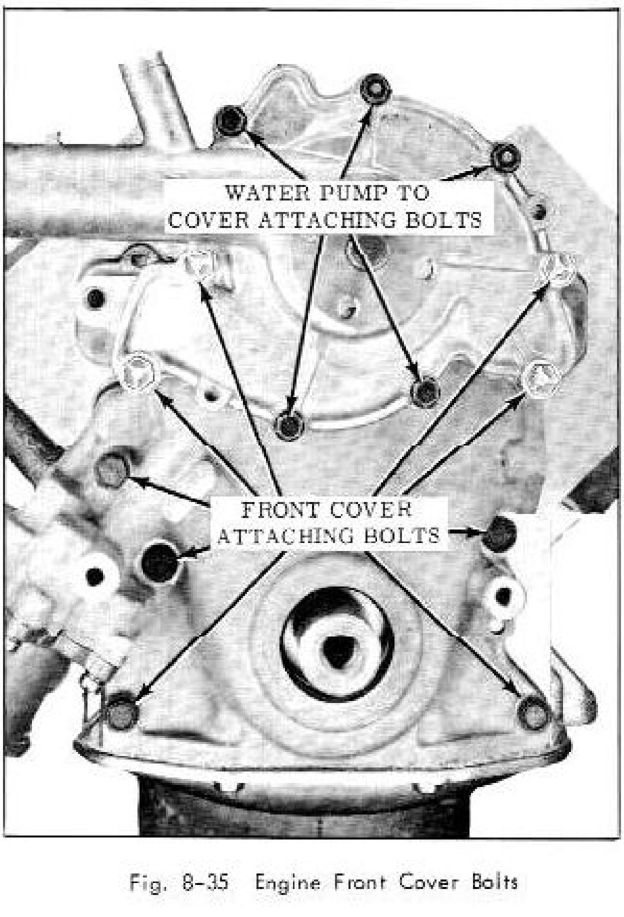

Fig. 8-35 Engine Front Cover Bolts

FRONT COVER

Removal

1. Drain cooling system.
2. Disconnect heater hose, by-pass hose, and both radiator hoses. Disconnect oil pressure switch wire.
3. Remove crankshaft pulley, fan and fan pulley, and all belts.
4. Remove distributor cap, vacuum hose, generator and mounting bracket.
5. Remove fuel pump hoses and fuel pump.
6. Remove oil pan.
7. Remove 9 cover to block attaching bolts and remove cover. (Fig. 8-35)

Installation

IMPORTANT: Whenever the front timing chain cover is removed it will be necessary to remove the oil pump cover and pack the space around the oil pump gears COMPLETELY FULL of Petrolatum. This step is very important as the oil pump may lose its prime when the cover is removed. If the pump is not packed it may not begin to pump oil as soon as the engine is started.

1. Install new cover gasket. Apply Permatex No. 2 to gasket and place on block.
2. Install front cover.
3. Apply engine oil to bolts and install. Torque bolts evenly 20-25 ft. lbs.
4. Apply special seal lubricant on pulley seal surface.
5. Install pulley, pulley bolt and pull pulley in place. Torque 140-160 ft. lbs.
6. Connect oil pressure switch.
7. Install generator, mounting bracket and adjusting link.
8. Install new fuel pump gasket using Permatex No. 2. Apply special seal lubricant on fuel pump arm.
9. Apply engine oil to 2 fuel pump attaching bolts and install. Torque 20-25 ft. lbs.
10. Connect fuel lines.
11. Install distributor. (See ELECTRICAL SECTION for engine timing.)
12. Connect distributor vacuum advance hose and primary lead.
13. Install distributor cap and wires.
14. Connect heater hose, by-pass hose and heater hoses.
15. Install fan pulley, fan and 4 attaching bolts.
16. Torque bolts 15-20 ft. lbs.
17. Install belts using Tool BT 33-70 for adjusting.
18. Install oil pan.
19. Fill radiator and crankcase.

OIL PUMP

Removal

1. Disconnect pressure switch wire.
2. Clean all dirt away from pump to front cover joint. Also, around oil filter joint.
3. Remove oil filter.
4. Remove 6 pump cover to front cover attaching screws.
5. Remove cover carefully as idler gear may fall out. Slide out idler and oil pump drive gears.

Disassembly

1. Remove oil filter by pass valve cap. (Cap with pressure switch.) (Fig. 8-36)
2. Remove oil filter by-pass spring and valve.
3. Remove oil pressure valve cap and spring.
4. Remove pressure regulator valve by tapping housing in palm of hand.

Cleaning and Inspection

1. Wash all parts in clean solvent and blow out passages with compressed air.
2. Inspect all parts for scoring. Small imperfections may be cleaned up with crocus cloth. DO NOT BREAK EDGES OF VALVE.
3. Check cover bore for cracks, nicks or warping.
4. Check pressure relief valve clearance in bore. Clearance should be .0015" to .0035". Too much clearance can affect oil pressure at idle. (The oil pressure warning light on the instrument panel is calibrated to light when oil pressure is less than 3 lbs.).
5. Check clearance of gears. End clearance of gears should be .0015" to .0075".

Assembly

1. Install filter by-pass valve into output passage bore (this is passage with inside dimeter ribs) seating squarely in bottom of passage.
2. Install spring (light weight), gasket and cap, replace gasket if damaged.

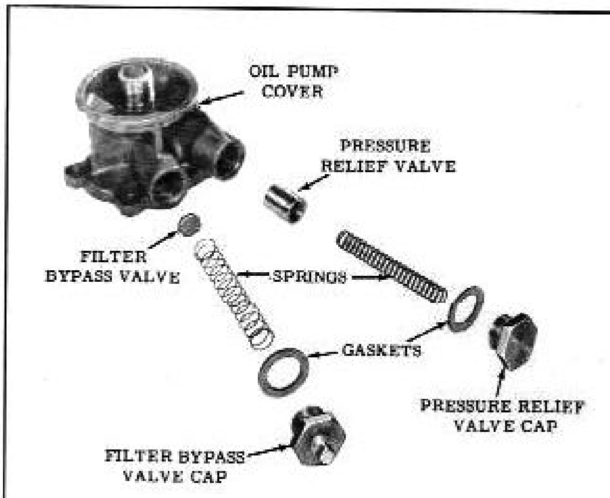

Fig. 8-36 Oil Pump Assembly

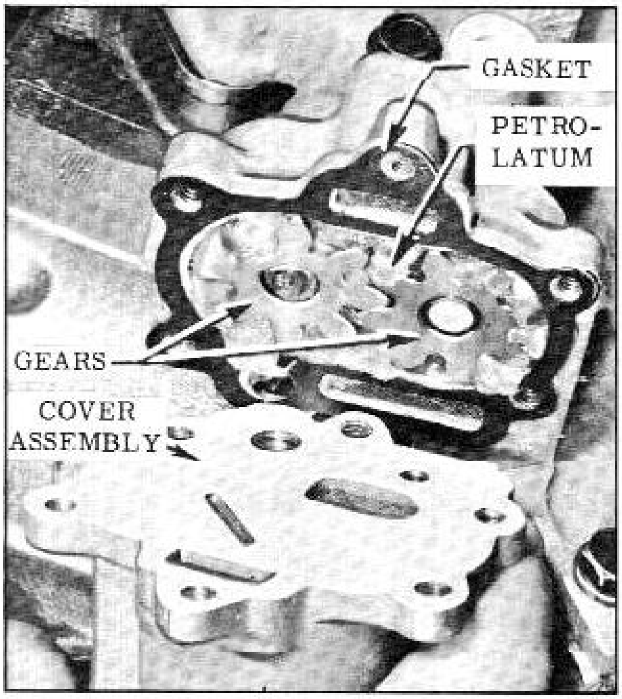

Fig. 8-37 Packing Oil Pump

3. Install pressure regulator valve (flat end first), pressure regulator spring, gasket and oil pressure regulator cap.

4. Torque caps 30-35 ft. lbs.

5. Install pump drive gear and idler gear.

6. Install new pump cover gasket.

7. Fill gear pocket with petrolatum and force into every cavity of the gear pocket. Also between teeth of gears. (Fig. 8-37)

NOTE: This step is very important. To assist in instant priming when engine is started, unless pump is packed with petrolatum it may not prime itself when engine is started.

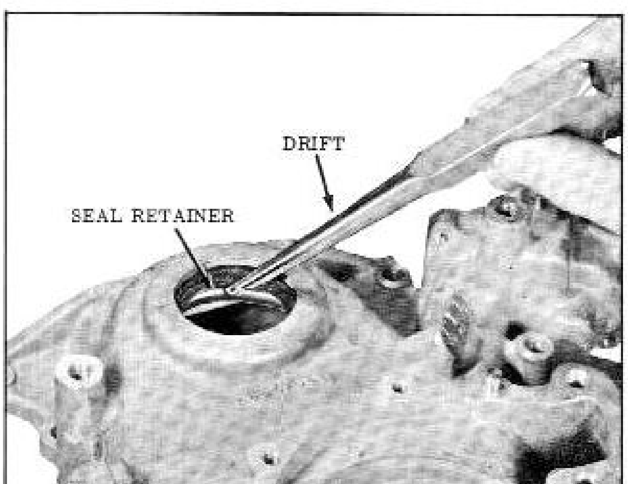

Fig. 8-38 Removing Front Oil Seal

OIL SEAL

Removal

1. Remove front cover. (Page 8-20)

2. Lay front cover flat on bench.

3. Remove seal retainer with drift. (Fig. 8-38)

Installation

1. Assemble seal in retainer.

2. Support front cover on block of wood. Apply P.O.B. No. 4 sealer to outside of seal retainer.

3. 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. 8-39)

4. 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. 8-40)

TIMING CHAIN AND GEARS

(With Front Cover Removed)

1. Remove distributor drive gear bolt, washer and gear from end of camshaft.

2. Remove fuel pump eccentric.

3. Remove crankshaft gear, chain, and cam gear together by prying off crankshaft gear.

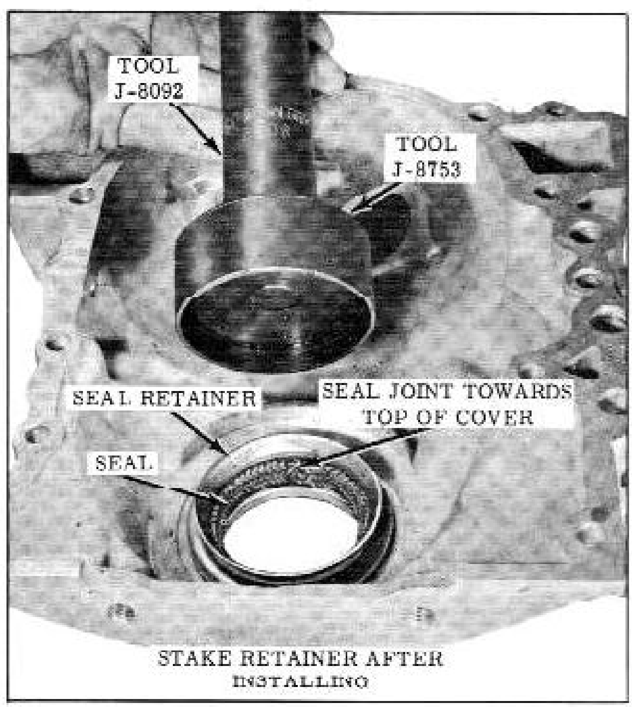

Fig. 8-39 Installing Front Seal

Installation

1. Install cam shaft gear, crankshaft gear, and timing chain together to align timing marks. (Fig. 8-41)
2. Install fuel pump eccentric with flat side rearward, distributor drive gear, washer and bolt. Torque bolt 40-45 ft. lbs. (Fig. 8-42)
3. Install oil slinger.

CAMSHAFT

Removal

1. Remove grille.
2. Remove radiator.
3. Remove front cover. (Page 8-20)
4. Remove timing chain and gears. (Page 8-22)
5. Remove intake manifold. (Page 8-4)
6. Remove rocker arm assembly, push rods, valve lifters. (Page 8-5)
7. Remove camshaft by carefully sliding it out the front of 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 engine oil mixed with G.M. Concentrate, Part No. 582099.

1. Install camshaft CAREFULLY.
2. Install valve lifters, push rods, and rocker arm assemblies. (Page 8-6)

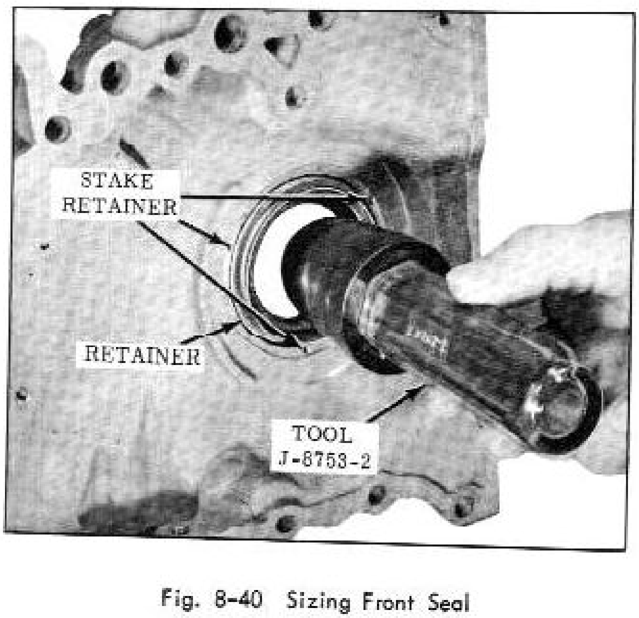

Fig. 8-40 Sizing Front Seal

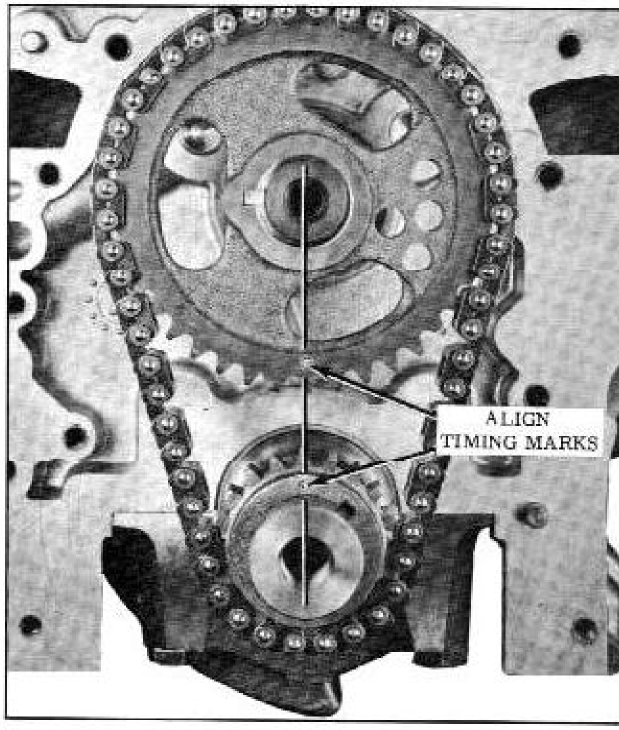

Fig. 8-41 Timing Gear Positions

3. Install intake manifold.
4. Install timing chain and gear, and front cover.
5. Install radiator and grille.

CAMSHAFT BEARINGS

The camshaft bearings must be replaced in complete sets. All bearings must be removed

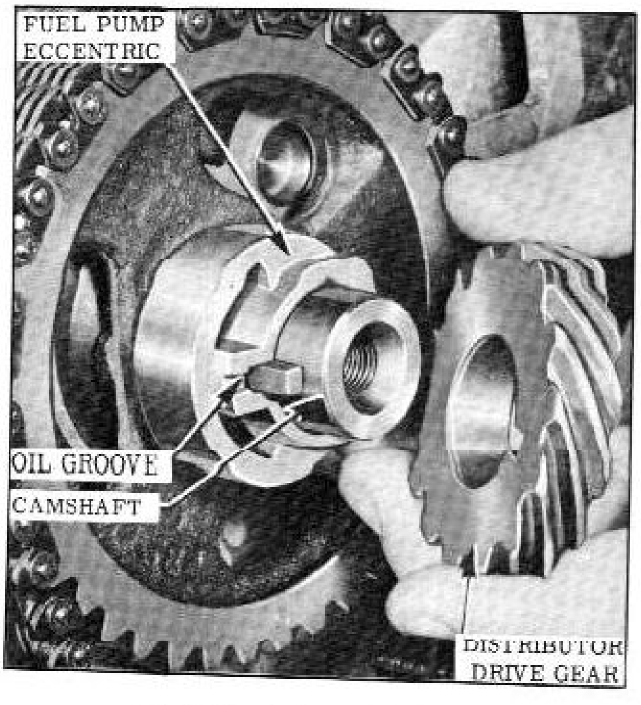

Fig. 8-42 Fuel Pump Eccentric

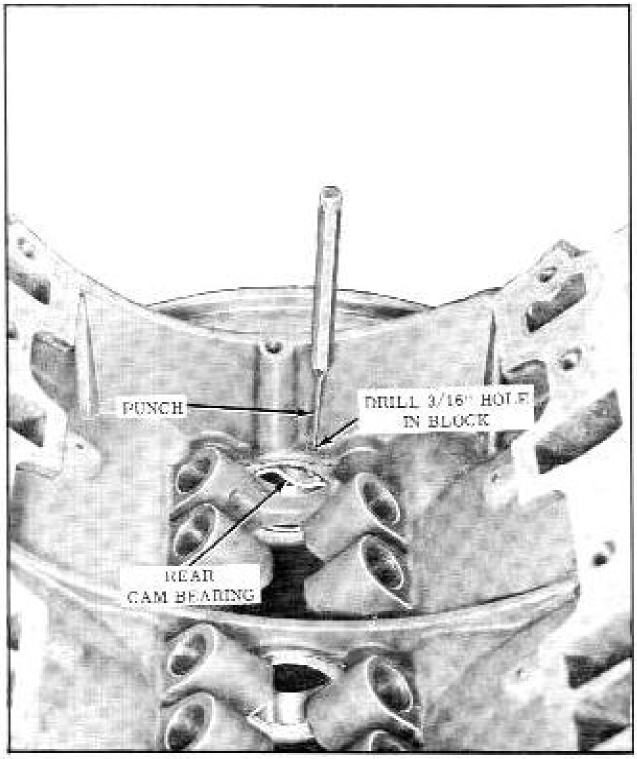

Fig. 8-43 Removing Rear Cam Bearing

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.

Removal

The intake manifold, valve cover, push rods, lifters, front cover, radiator, grille and camshaft must be removed.

The bearings may be removed by driving them rearward out of their bores with the exception of No. 5. This bearing must be removed by drilling a 3/16" hole in the block as shown in Fig. 8-43. Do not drill through the bearing. With a small drift, dent the bearing enough to allow it to be removed out of the front of the bore. Fig. 8-43 illustrates removal of rear bearing with engine in the car.

Installation

Install number 5 bearing first, then No. 4, 3, 2 and 1. Care must be taken that all oil passages are aligned.

The correct position of the bearings in the block is as follows. The front of No. 5 bearing is 18-7/32 inches from the front face of the block. No. 4 is 13-13/32 inches from the front, No. 3 is 9-11/64 inches from the front, No. 2 is 4-15/16 inches from the front, and No. 1 is 1/8 inch from the front.

CRANKSHAFT

Removal

It is recommended that the crankshaft be installed 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.

The crankshaft may then be removed by marking the position of the 5 main bearing caps and removing them.

Installation

1. Position upper half of main bearings in block and lubricate with engine oil.
2. Install a new rear main bearing seal and a new front seal.
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 567196 lubricant. Install caps with lower half of bearing lubricated with engine oil. Lubricate cap bolts with Part No. 980131 and install, but do not tighten.
4. With a block of wood (Fig. 8-44) bump shaft in each direction to align thrust flanges of center main bearing.
5. Torque main bearing cap bolts 50-60 ft. lbs.
6. Reassemble engine and install in chassis.

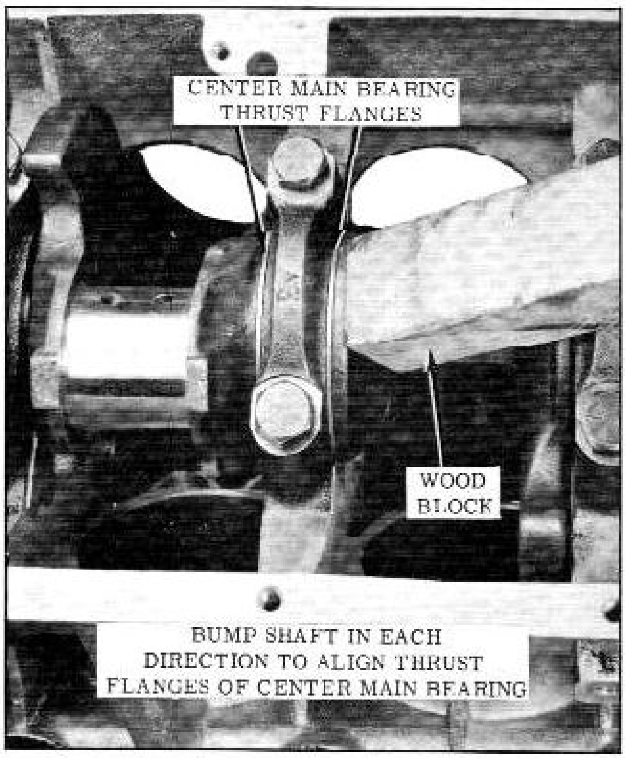

Fig. 8-44 Aligning Center Main Bearing Flanges

MAIN BEARINGS

Main bearing clearance must not exceed .0035" on all bearings. The .0035" clearance is permissable 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. 980131 lubricant on cap bolts and install. Torque 50-60 ft. lbs.
5. Remove bearing cap and determine bearing clearance 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. 8-24) If this clearance is greater than .0035", REPLACE BOTH BEARING SHELLS AS A SET. Recheck clearance after replacing shells. (Refer to MAIN BEARINGS - REPLACE)

Main Bearings—Replace

Main bearing clearances not within specifications (.0008" to .0024") must be corrected by the use of selective upper and lower shells. UNDER NO CIRCUMSTANCE 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. (Fig. 8-45)

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.

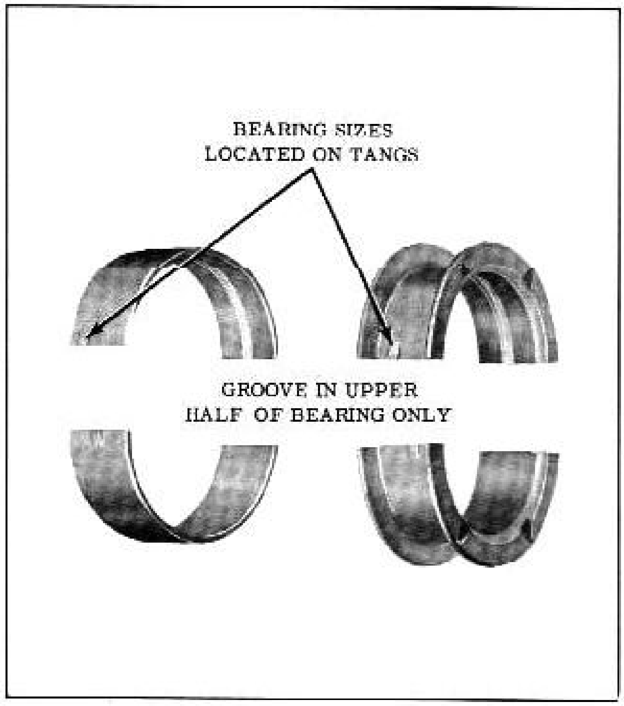

Fig. 8-45 Main Bearing Size Location

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 engine oil. Burrs may be removed with a fine oil stone. If the journals are scored or ridged, the crankshaft must be replaced or reground.

   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. No. 3 bearing, apply Special Lubricant (Part No. 567196) to the thrust flanges of bearing shells.
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. 8-46)
9. Install bearing caps, lubricate bolt threads with Part No. 980131 lubricant and install. Torque 50-60 ft. lbs.

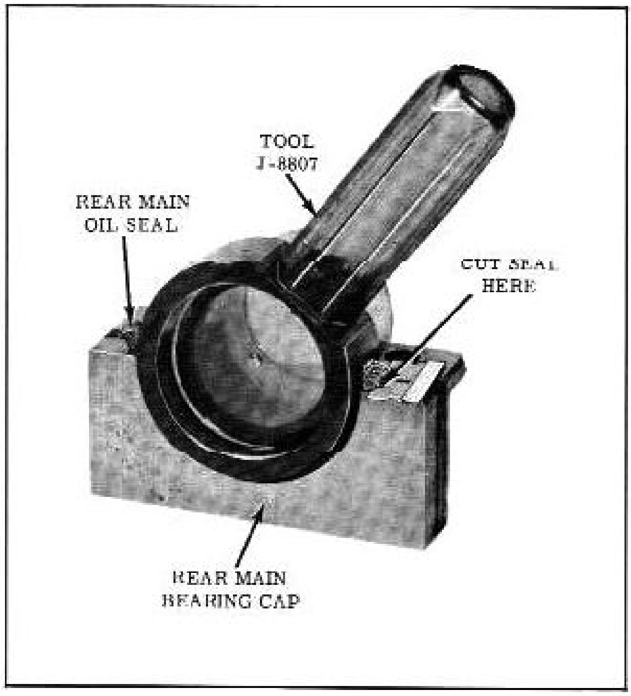

Fig. 8-46 Installing Rear Oil Seal

REAR MAIN OIL SEALS

Removal

1. Remove oil pan. (Page 8-13)
2. Remove the rear main bearing cap.
3. Remove bearing insert and old seals.
4. Clean bearing cap and seal grooves and inspect for cracks.
5. Install seal into bearing cap, packing by hand.
6. Using Seal Installer J-8807, hammer seal into groove. (Fig. 8-46)

   NOTE: To check if seal is fully seated in the bearing cap, slide Tool J-8807 away from seal. With Tool J-8807 fully seated in the bearing cap, slide tool against the seal. If under cut 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. (Fig. 8-46)

7. Hold Tool J-8807 as in Fig. 8-46. Cut seal 1/16" from bearing surface. Taper end of seal into a point. With screw driver, pack seal fibers towards center, away from edges. Rotate seal installer to cut seal between notch and handle.
8. Install two side bearing cap seals, leaving seal extended on each side of cap.
9. Coat back of insert with light film of oil and install in bearing cap.
10. Clean crankshaft bearing journal and seal contact.
11. Install bearing cap guide pins.
12. Install bearing cap into place by tapping with block of wood.
13. Remove guide pins.
14. Apply Part No. 980131 lubricant to cap bolts. Torque bolts 50-60 ft. lbs.
15. Do not trim ends of side seals.
16. Install pan with new gasket.
17. Install lower flywheel cover.

PILOT BEARING (SYNCRO-MESH)

On Syncro-Mesh equipped cars a Durex 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. 8-47). All old lubricant in the reservoir behind the bearing should be removed.

Install the new bearing using Tool J-4530-1, (Fig. 8-48). 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.

All flywheels, original and service replacement, are balanced individually. This is accomplished by inserting and staking a balancing pin or pins, if necessary, into the holes provided along the outer circumference of the flywheel. These staked balance pins are not to be removed.

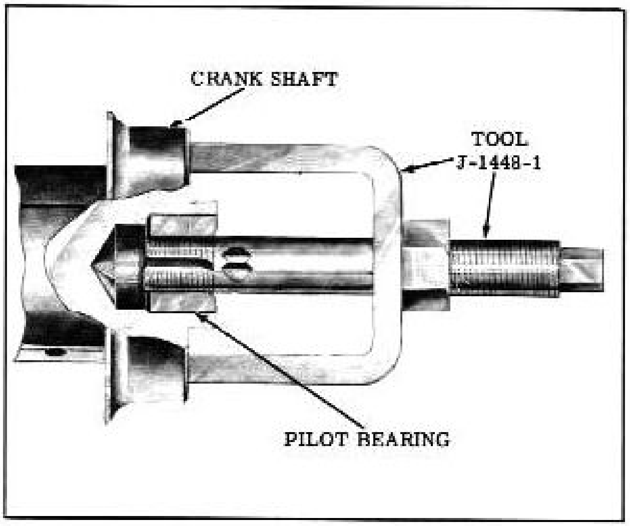

Fig. 8-47 Removing Pilot Bearing

After the flywheel is attached to the crankshaft, the engine and flywheel are again balanced as an assembly and, if necessary, additional balancing pins are installed in the flywheel. These pins are not staked.

When installing a service replacement flywheel it is essential that the flywheel be balanced with the engine. If there are no unstaked balance pins in the original flywheel, the new flywheel may be installed on the crankshaft as is. If unstaked balance pins are found on the original flywheel, proceed as follows:

1. Position the original flywheel over the new flywheel and align the flywheel to crankshaft attaching bolt holes.
2. Mark the position of the unstaked balancing pins on new flywheel.
3. Transfer the balancing pins from the original flywheel to the new flywheel in the holes marked. (Fig. 8-49)

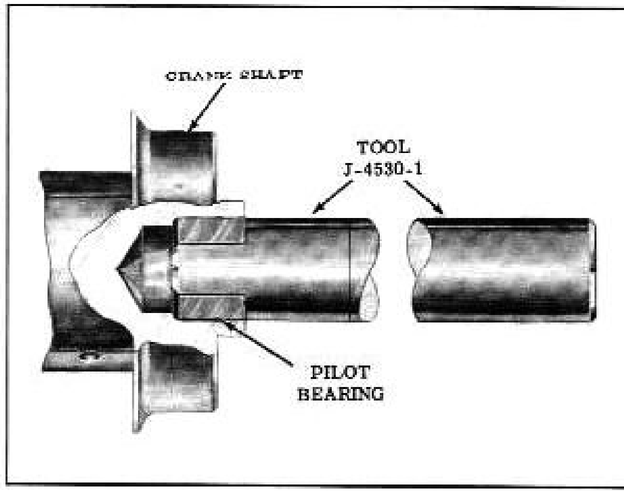

Fig. 8-48 Installing Pilot Bearing

NOTE: If an unstaked pin cannot be installed in the exact position as the original due to the presence of a staked pin, insert the pin into an adjoining hole on either side of the staked pin.

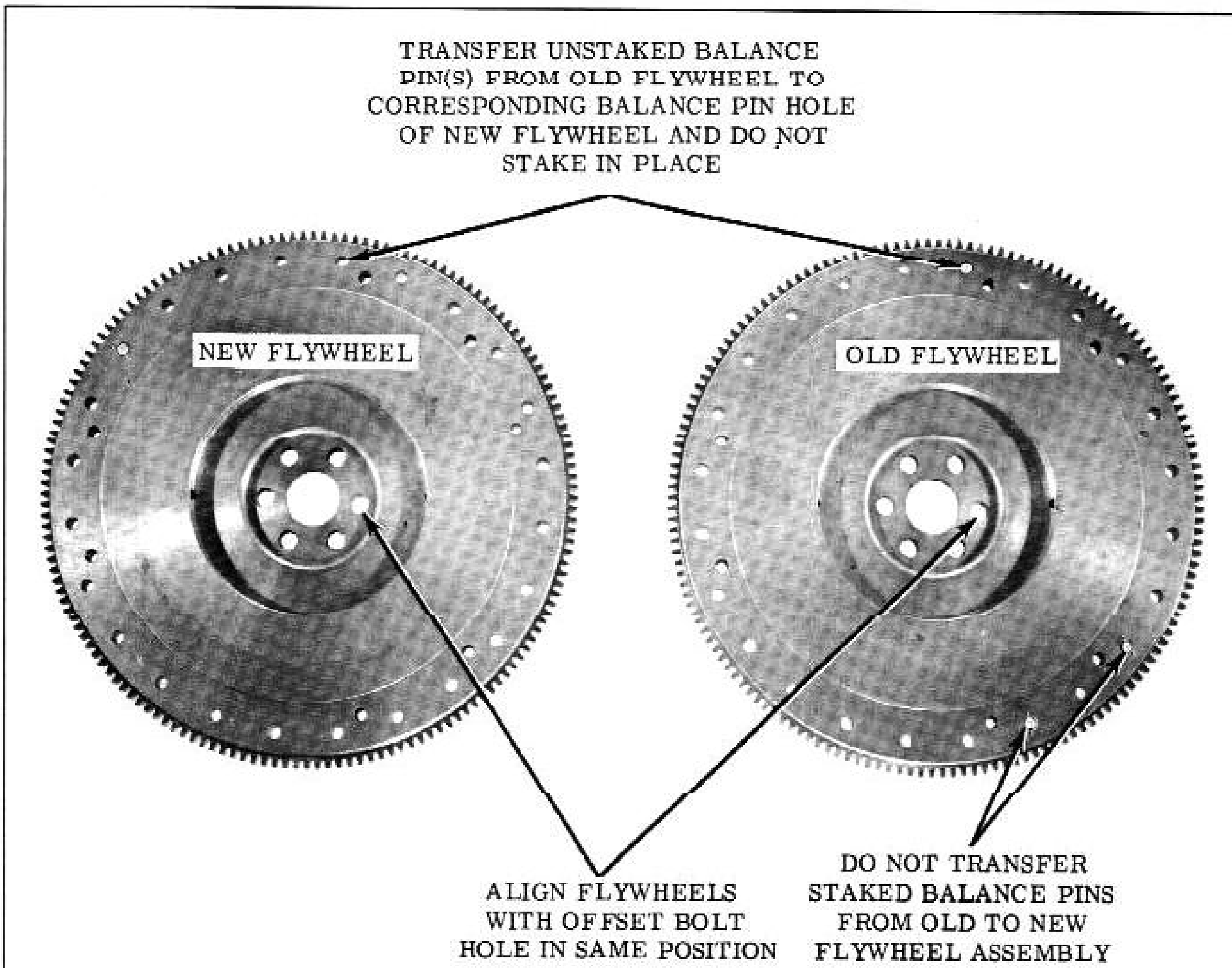

Fig. 8-49 Flywheel Balance Pins

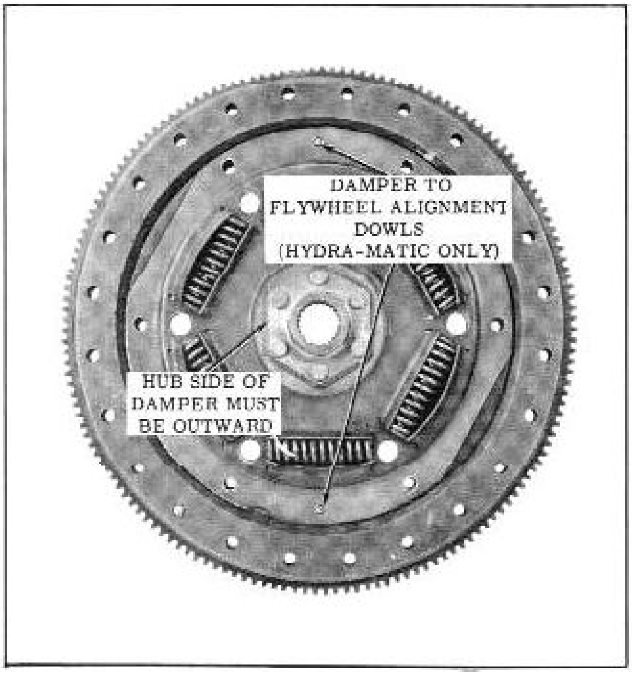

Fig. 8-50 Flywheel Damper

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.

FLYWHEEL DAMPER

A flywheel damper is used on Hydra-Matic equipped cars to drive the transmission. This damper is attached to the engine flywheel. (Fig. 8-50) It also assists in absorbing torsional vibrations.

When attaching the damper plate to the flywheel, the hub side must be out as shown in the figure.

ENGINE MOUNTS

FRONT

Removal

1. Support engine with Tool J-8974. (Fig. 8-22)
2. Remove mount to cross bar bolt and engine mount bolts.

Installation

To install new mount, USING ENGINE OIL LUBRICANT ON BOLTS, bolt securely to engine block first, torque bolts 50-55 ft. lbs., then bolt to cross bar and torque bolt 55-65 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 mount to transmission rear bearing retainer bolts 30-40 ft. lbs. and mount to support bar bolts 20-34 ft. lbs.

ENGINE OIL LEAKS

In cases where the engine oil leaks cannot be located visually, the use of DuPont Oil Red or "Blacklight" should be used.

To use Oil Red, drain one quart (minimum) of oil from the engine, then mix 1 tablespoon of the Oil Red and the oil that was drained. Pour this mixture into the crankcase. Start engine and inspect for trace of colored oil. Oil Red is harmless to the engine.

Blacklight should be used when it cannot be determined whether the oil leak originates from the engine or the transmission. To use the Blacklight method, remove engine and transmission dipsticks to compare with a sample of oil from the location of the leak. By viewing the oil on the dipsticks with a sample under Blacklight, it can be determined which unit is leaking.

The Blacklight method can also be used to pin point leaks after the suspected area has been wiped clean of oil and the engine runs long enough to show up a leak. The oil will glow when viewed with Blacklight.

HELI-COIL REPAIRS

Damaged Thread Repair Using Heli-Coils

Threaded holes which have been damaged or stripped may be repaired using "Heli-Coil" inserts as described in the following procedures.

1. Drill out the old threads, bolt or stud, (if any), using the proper size drill as indicated on the instruction sheet in the Heli-Coil Kit. (Fig. 8-51)

2. Cut new threads using the proper Heli-Coil tap for the size thread being repaired. Use only the special taps furnished in the kit. (Fig. 8-52)

3. Installing inserts:

   a. Using the proper size inserting tool on the "T" handle furnished, place an insert of the proper size over the top of the tool and engage the insert tang in the slot.

   b. Place the tool and insert squarely over the hole. Using the pressure plate from kit, press the insert firmly into the mouth of the hole.

   c. While maintaining pressure on the insert, turn it clockwise into the hole to engage the first 2 or 3 threads. DO NOT APPLY PRESSURE WITH THE INSERTING TOOL. Remove the pressure plate and continue the installation until the insert is 1/4 to 1/2 turns below the surface. (Fig. 8-53)

   CAUTION: If insert starts to cross thread, remove the tool and back the inserts out with fingers or pliers. Retap the hole to be sure the threads are clear, then install a new insert as previously described. Cross threaded inserts should not be reused.

4. Removing tang:

   a. In deep blind holes or through holes, where the tang will not cause damage, withdraw the inserting tool enough to disengage the tang and turn 1/4 turn. With the tool bearing against the tang, strike the tool sharply with a hammer to remove the tang.

   b. Where tang is to be retrieved, use needle nose pliers and flex the tang in and out until it breaks off. Do not attempt to twist the tang off as this may rotate the insert.

5. Removing inserts.

   a. Notch the top coil, about 1/4 turn from the end, using a small triangular file.

   b. Place one edge of a 3-edge scraper in the notch. Turn counterclockwise maintaining a steady downward pressure until the insert is completely removed.

   c. Discard the insert. Retap the hole. Install a new insert.

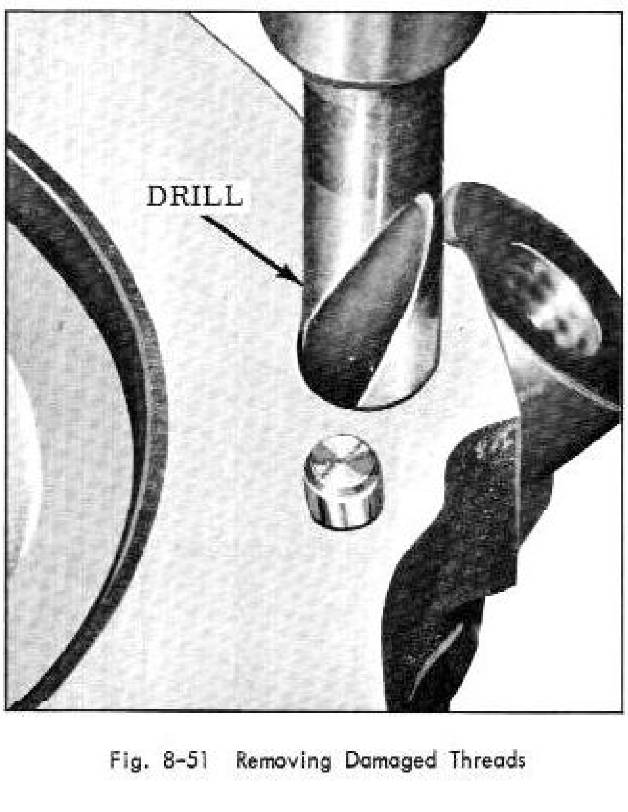

Fig. 8-51 Removing Damaged Threads

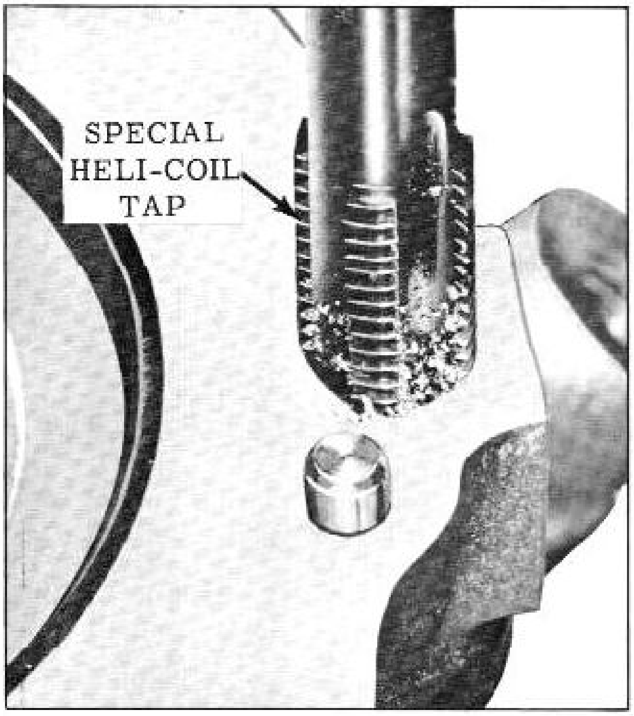

Fig. 8-52 Tapping New Threads

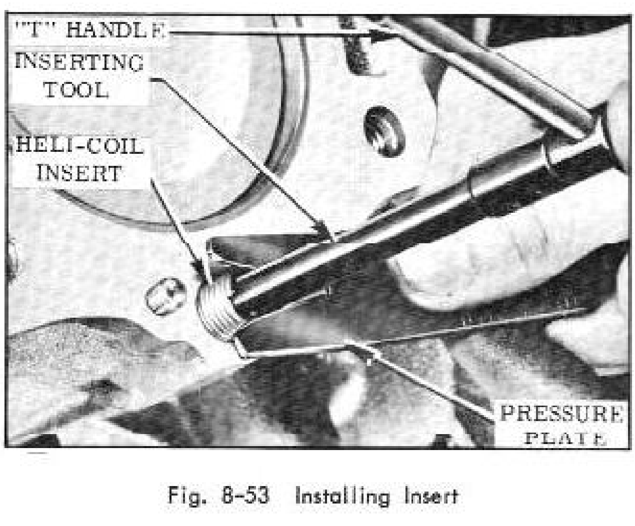

Fig. 8-53 Installing Insert

ENGINE SPECIFICATIONS

CYLINDER BLOCK

Engine Type	90° V-Type
Number of Cylinders	8
Bore and Stroke	
All Series	3.500" x 2.8"
Piston Displacement	
All Series	215 cu. in.
Compression Ratio	8.75 - 1
Firing Order	1-8-4-3-6-5-7-2
Main Bearing Bore (Inside Diameter)	3.188" - 3.189"

CRANKSHAFT

Diameter - Main Bearing Journal	
All	2.299" - 2.298"
Width - Main Bearing Journal, Including Fillets	
No. 1	1.052"
No. 3	1.062" - 1.064"
Nos. 2 and 4	1.055" - 1.065"
No. 5	1.085" - 1.095"
Diameter - Connecting Rod Bearing Journal	1.999" - 2.000"
Width - Connecting Rod Bearing, Including Fillets	1.698" - 1.702"
Length - Overall Crankshaft	23.510"
Diameter - Of Oil Holes in Crankshaft	.2188"
Clearance - Crankshaft End Thrust	.004" to .008"

MAIN BEARINGS

Oil Clearance - Crankshaft Vertical	
All	.0008" to .0024"
Width - Bearing Shaft	
Nos. 1, 2, 4 and 5	.797" - .807"
No. 3	1.056" - 1.058"

CONNECTING RODS

Length - Center to Center	5.658" - 5.662"
Diameter - Connecting Rod Bore	2.1247" - 2.1252"
Diameter - Pin Bore	.8742" - .8737"
Bearing Clearance - Crankshaft (Vertical)	.0002" - .0022"
Clearance - End to Crankshaft	.006" - .014"

PISTONS

Diameter - Nominal Outside	3.500"
Length Overall	3.060"
Length from Top of Piston to Pin Center	1.880"
Clearance (At Thrust Surface) Selective	.0005" - .0011"
Weight - Less Pins and Rings	14.779 oz.
Taper from Top of Skirt to Bottom	.0000" - .0005" Larger at Bottom
Ring Width (2 Compression)	.081"
(1 Oil)	.188"

PISTON PINS

Diameter	.8747" - .8750"
Length Overall	2.860" - 2.880"

ENGINE SPECIFICATIONS (Cont'd.)

Pin to Piston Clearance	.0003" - .0005" Loose
Pin to Rod Clearance	.0007" - .0013" Tight
PISTON RINGS	
Number of Compression Rings (Per Piston)	2
Width, Compression Ring Top and Bottom	.0780" - .0785"
Gap Clearance Compression Rings	.010" - .020"
Clearance in Groove, Compression Rings	.003" - .005"
Number of Oil Rings (Per Piston)	1
Gap Clearance, Oil Ring	.015" - .055"
Clearance - Oil Ring to Piston Groove	.0005" - .0055"
CAMSHAFT	
Bearing Journal Diameters	
No. 1	1.785" - 1.786"
No. 2	1.755" - 1.756"
No. 3	1.725" - 1.726"
No. 4	1.695" - 1.696"
No. 5	1.665" - 1.666"
Width (Including Chamfers)	.750"
Journal Clearance in Bushing	
No. 1	.0005" - .0025"
Nos. 2, 3, 4 and 5	.0005" - .0035"
End Thrust	.011" - .059"
VALVES - INTAKE	
Diameter - Head	1.517" - 1.527"
Diameter - Stem	.3427" - .3432"
Angle - Valve Seat	45°
Width - Valve Seat	.037" - .075"
Overall Length	(4 Bbl-4.943") (2 Bbl-4.863")
Clearance in Guide	.0010" - .0025"
Lash	Hydraulic
VALVES - EXHAUST	
Diameter - Head	1.348" - 1.358"
Diameter - Stem	.3422" - .3427"
Overall Length	(4 Bbl-4.941") (2 Bbl-4.861")
Angle - Valve Seat	45°
Width - Valve Seat	.037" - .075"
Clearance in Guide	.0015" - .0030"
Lash	Hydraulic
VALVE GUIDES	
Diameter - Inside Intake	.344" - .345"
(Outside Intake)	.657" - .658"
Diameter - Inside Exhaust	.344" - .345"
(Outside Exhaust)	.657" - .658"
Length-Overall	2.390"

ENGINE SPECIFICATIONS (Cont'd.)

VALVE SPRINGS

Length - Free	2.150"
Diameter - Wire	.180" - .184"
Diameter - Inside Top	.760"
Diameter - Outside Bottom	1.465" - 1.479"
Load @ 1-3/4"	70-80 Lbs.
Load @ 1.350"	160-175 Lbs.

VALVE LIFTERS

Diameter - Body	.8422" - .8427"
Length - Overall	1.997" - 2.007"
Clearance in Boss Selective	.0008" - .0023"

CAMSHAFT SPROCKET

Width	.521" - .529"
Pitch	.375"
Number of Teeth	40

CRANKSHAFT SPROCKETS

Width of Sprockets	.521" - .529"
Overall Width of Gear	1.774"
Pitch	.375"
Number of Teeth	20

TIMING CHAIN

Width	.875"
Number of Links	54
Pitch	.375"

FLYWHEEL

No. of Teeth on Starter Gear	156
No. of Teeth on Starter Pinion	9

LUBRICATION SYSTEM

Crankcase Capacity, Drain and Refill	4 Qts.
Drain and Refill with Filter Change	5 Qts.
Oil Pump	
Clearance - Pressure Relief Valve in Bore	.0025" - .005"
Clearance - End Gears	.0015" - .0075"

COOLING SYSTEM

Capacity	10.5 Qts.
For Heater, Add	1.5 Qts.
For Air Conditioning, Add	.5 Qt.
Pressure Cap	
With or Without Air Conditioning	15 Lbs.
Thermostat	170°

TORQUE SPECIFICATIONS

NOTE: Before threading bolts into aluminum, some must be coated with Part No. 980131 lubricant, some with engine oil and others with sealer. Consult the component part of the text for correct installation.

Application	Ft. Lbs.
CRANKSHAFT AND CONNECTING RODS	
Connecting Rod Bearing Cap Bolts	30 to 35
Crankshaft Bearing Cap Bolts (No. 1-2-3-4)	50 to 60
Crankshaft Bearing Cap Bolt (No. 5)	65 to 70
Crankshaft Balancer	140 to 160
Fan Driving Pulley to Balancer	15 to 20
Fan and Driven Pulley to Hub	15 to 20
ENGINE MOUNTS	
Front Mount to Block Bolts	50 to 55
Front Mount to Crossbar Nuts	55 to 65
Rear Mount to Transmission	30 to 40
Rear Mount to Cross Support	20 to 34
HEAD AND VALVE MECHANISM	
Valve Cover Bolts	3 to 5
Cylinder Head to Block Bolts	45 to 55
Rocker Shaft Bracket to Head	45 to 55
Spark Plugs (1 Drop of Engine Oil on Threads)	12 to 17
FLYWHEEL AND DAMPER	
Flywheel to Crankshaft Bolts	85 to 95
Clutch to Flywheel	14 to 17
Damper to Flywheel	17 to 22
CLUTCH HOUSING	
Clutch Lower Housing to Upper Housing Bolts	4 to 7
Clutch Housing to Block Bolts	30 to 35
Flywheel Cover to Housing Bolts	20 to 25
FRONT COVER AND WATER PUMP	
Cover to Block Bolts	20 to 25
Water Pump to Front Cover	6 to 8
Oil Pressure Switch to Filter Valve Cap	10 to 15
FUEL AND VACUUM PUMP	
Fuel Pump to Front Cover Bolts	20 to 35
Fuel Pump Eccentric to Camshaft	40 to 45
MANIFOLD	
Intake Manifold Gasket Clamp Bolts (2-5/16")	10 to 15
Intake Manifold to Head Bolts	25 to 30
Exhaust Manifold to Head Bolts and Nuts	18 to 24
Water Outlet to Intake Manifold	10 to 15
Carburetor to Intake Manifold	14 to 17

TORQUE SPECIFICATIONS (Cont'd.)

Application	Ft. Lbs.
OIL PAN, PUMP AND FILTER	
Oil Pan Bolts	6 to 15
Oil Pan Drain Plug	30 to 35
Pump Cover to Engine Front Cover	10 to 15
Pump Screen to Engine Block	10 to 15
Filter Assembly to Front Cover	30 to 35
Filter Assembly	10 to 15
Oil Pressure Valve Cap	30 to 35

COOLING, FUEL, AND EXHAUST SYSTEMS

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COOLING SYSTEM

MAINTENANCE RECOMMENDATIONS

A cooling system inhibitor is added to all new Oldsmobiles at the time of the initial fill. It is not necessary to add inhibitor to cars that have standard anti-freeze containing proper corrosion preventing inhibitors.

The Anti-Freeze should be drained in the spring and water and 8 ounces of inhibitor installed in the radiator.

In the fall, the system should be drained and anti-freeze added as required.

In areas where temperatures do not require anti-freeze during the winter months, the coolant should be drained in the spring and 8 ounces of Cooling System Inhibitor G.M. Part Number 989498 should be added.

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 in the water outlet on the intake manifold. Full length water jackets allow the engine coolant to completely surround all cylinders.

Operation

The water pump discharges water through the front engine cover into both banks of the block. The water 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 into the intake manifold water jacket. The water flows to the rear in the lower portion to the thermostat housing and thermostat by-pass. The flow of heated water through the intake manifold water jacket warms the manifold evenly to provide good vaporization of the incoming fuel charge.

A pellet type thermostat housed in the forward (outlet) end of the intake manifold 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 water through the engine to provide rapid warm up. When the thermostat opens, water is directed to the upper tank of the radiator and thence through the radiator core, lower tank to water pump inlet where the cycle is repeated.

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 in proper working order.

1. Completely drain the system by opening drain valves at radiator lower tank and on each side of engine block.

   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 water and 8 ounces of inhibitor, or a sufficient amount of anti-freeze.

FAN AND PULLEY

The fan blades and pulley can be removed without disturbing the water pump or radiator.

NOTE: If belt tension on pulley is not released, the fan can be removed without disturbing the

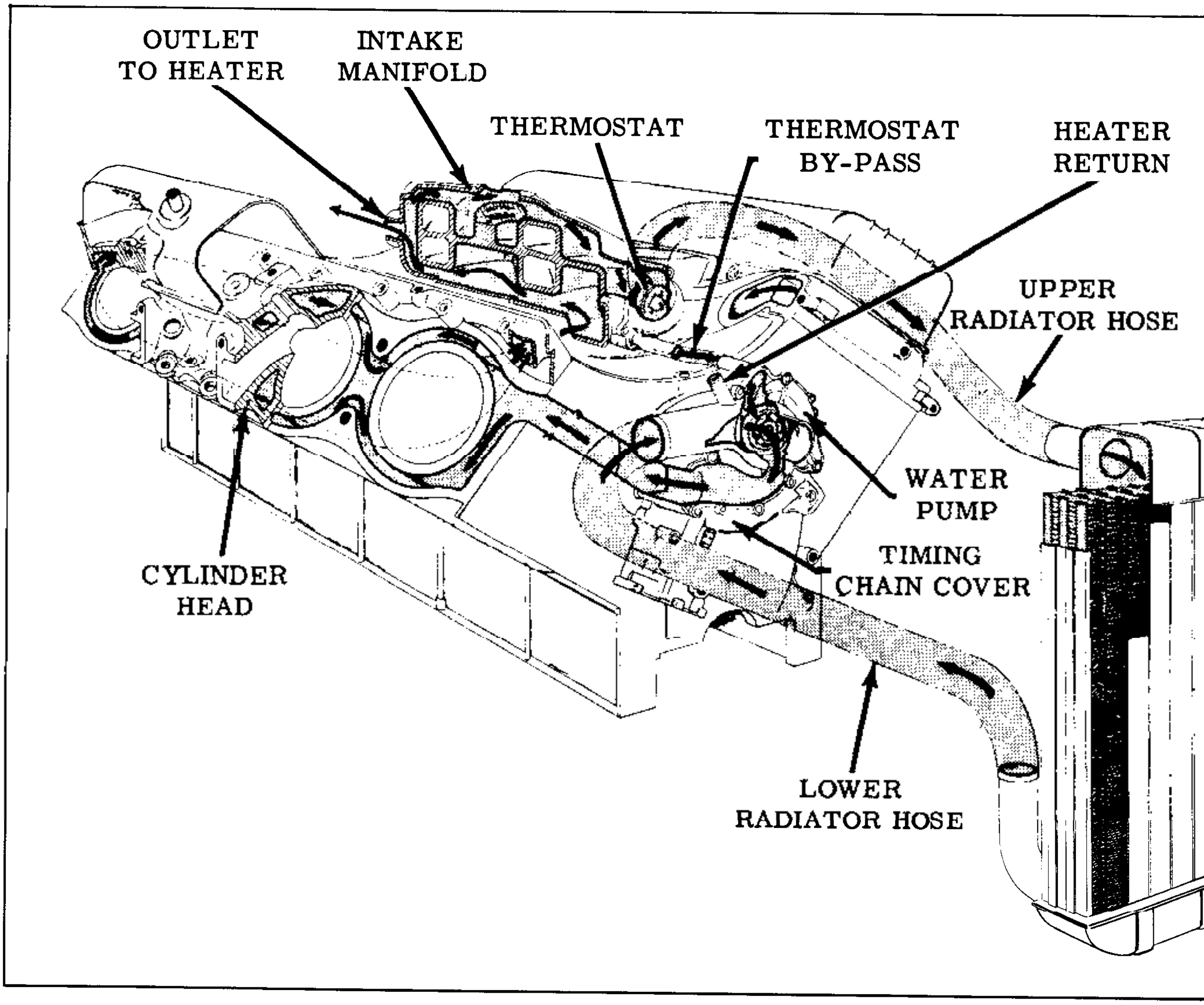

Fig. 8-54 Cooling System

pulley by removing 4 attaching bolts. When the first 2 bolts are removed, replace with aligning studs. The tension of the belt will keep the pulley in position.

Removal

1. Loosen generator and link adjusting bolt and remove belts from pulley.
2. Remove 4 fan and pulley attaching bolts.
3. Remove fan pulley.

Installation

1. Install fan and pulley.
2. Install 4 fan and pulley bolts.
3. Install belt(s) on pulley and adjust to proper tension.

NOTE: For power steering pump belt adjustment, see STEERING SECTION. For generator belt adjustment, see ELECTRICAL SECTION. For Compressor belt adjustment, see AIR CONDITIONING SECTION.

RADIATOR

Removal

1. Drain cooling system.
2. Remove upper radiator bracket.
3. Remove upper and lower radiator hose.

NOTE: If car is equipped with Hydra-Matic transmission:

4. Disconnect and cap cooler lines.

NOTE: If car is equipped with air conditioning:

5. Loosen fan shroud and move rearward.

6. Loosen lower radiator support bolts and move supports rearward to allow radiator to be removed.

Installation

1. Place radiator in lower supports.
2. In Hydra-Matic transmission cars, connect cooler liners.
3. On Air Conditioned Cars:
   a. Move lower supports forward and install bolts.
   b. Attach fan shroud to tie bar support.
4. Install upper and lower radiator hose.

   NOTE: The long end of the upper hose is to be installed on the radiator and the short end on the engine. The long end of the lower hose is to be installed on the water pump and the short end on the radiator.

5. Install upper radiator bracket.
6. Fill cooling system.

WATER PUMP

Removal

1. Drain cooling system.
2. Disconnect heater and lower radiator hose from pump.
3. Loosen pulley belts and remove fan and pulley from pump.
4. Remove 9 pump to front cover attaching bolts. (Fig. 8-35)

Installation

1. Apply a thin coat of gasket cement 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 1/4" bolts 6-8 ft. lbs. and 5/16" bolts 20-25 ft. lbs. Use engine oil on all bolts.
3. Install fan pulley. Torque fan to pump bolts 15-20 ft. lbs.
4. Install pulley belt(s) and adjust belt tension as outlined in STEERING, ELECTRICAL, OR AIR CONDITIONING SECTION.
5. Refill cooling system.

FUEL SYSTEM

DESCRIPTION

The fuel tank has a capacity of 16 gallons. The filler tube is located in the left quarter panel. Venting of the fuel tank is provided by a hose at the top of the tank.

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 approximately 1-11/16" so that the pipe bottoms on the shoulder inside the filler.

NOTE: Due to the engine operating temperatures, a fuel return from the fuel filter to the gas tank has been incorporated to prevent excessive fuel pressure build-up in the line between the fuel pump and the carburetor.

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.

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

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 downward, the fuel link pulls the fuel diaphragm upward. The enlargement of the fuel chamber draws fuel from the tank through the inlet valve and into the fuel chamber. (Fig. 8-55)

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 downward 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.

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.

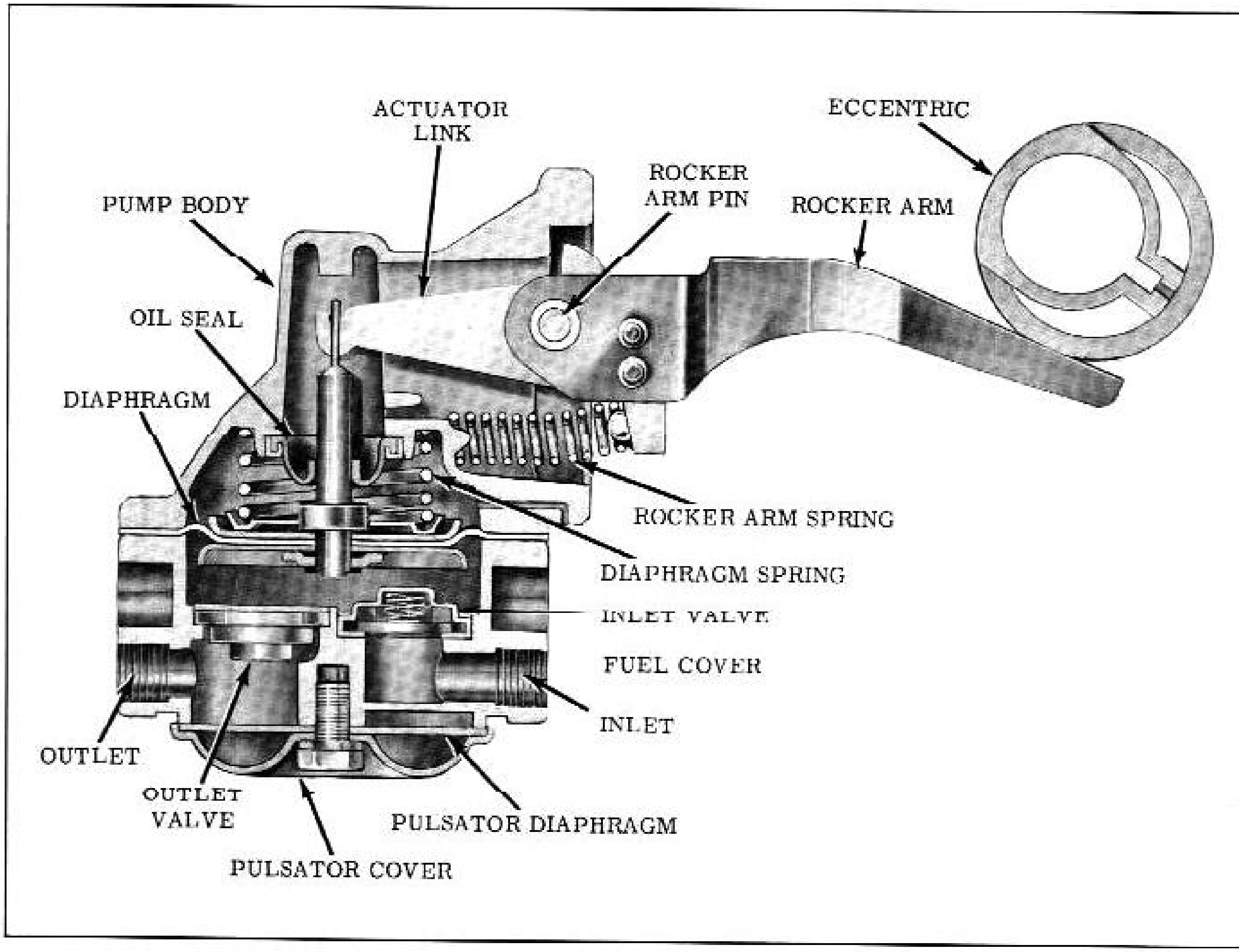

Fig. 8-55 Fuel Pump

2. With chuck of air hose inserted 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

1. Drain tank.

2. Disconnect gas hose from fuel line at left side of tank and the fuel return hose from return line at left side of gas tank.

3. Disconnect the gauge wire at connector in rear compartment, then feed wire thru floor. Remove the 2 tank straps and lower tank.

Installation

1. Position tank gauge wire to the rear of tank.

2. Install tank and position the 2 tank straps and tighten bolts.

3. Feed gas gauge wire thru floor and connect at the connector in the rear compartment.

4. Connect gas hoses at tank.

5. Fill tank.

Fuel Pump 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 filter 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 is clogged, filter 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.

Also, when testing the fuel system for volume flow the fuel filter should be checked. Volume flow can be first checked at the outlet side of the fuel filter and then at the inlet side.

As foreign material builds up on the filter, fuel flow restriction increases, resulting in a decrease of volume flow at the filter outlet. When the restriction becomes excessive, fuel flow to the carburetor can drop below engine requirements although the fuel pump is still capable of meeting volume specifications. THIS MAKES IT NECESSARY TO CHECK FUEL FLOW AT BOTH THE INLET AND OUTLET SIDE OF THE FUEL FILTER TO determine if the FUEL PUMP OR FILTER is out of specification.

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 1800 r.p.m. (using gasoline in carburetor bowl) and note reading on pressure gauge.

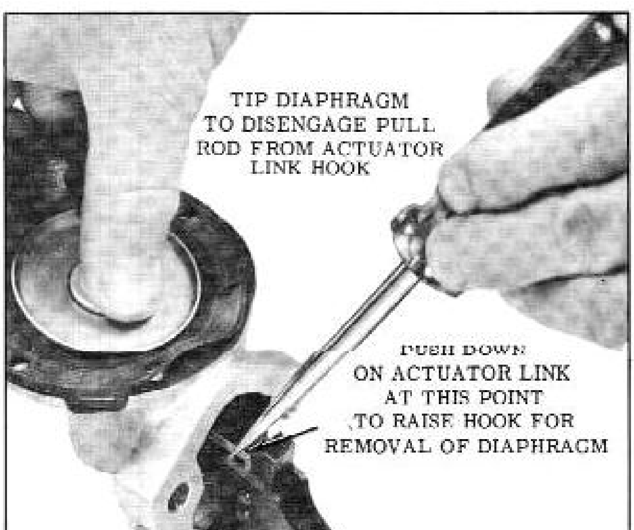

Fig. 8-56 Disengaging Diaphragm

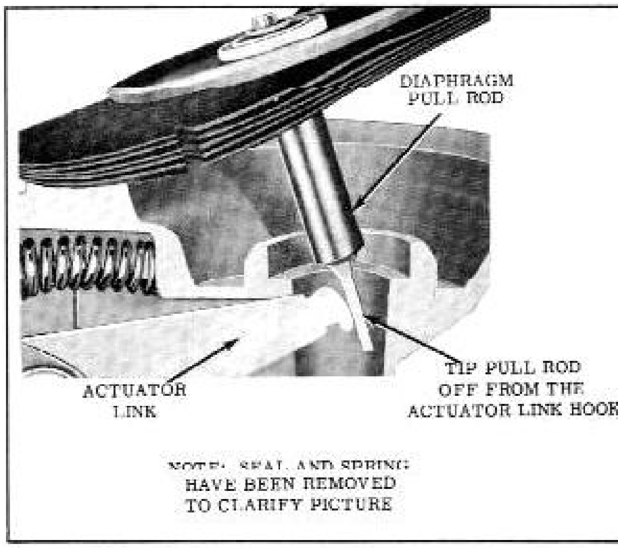

Fig. 8-57 Diaphragm Removal

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, the pump should be removed for repair or replacement.

Removal

1. Disconnect fuel lines at fuel pump.
2. Remove 2 fuel pump to front cover mounting bolts, and then remove fuel pump.

Service (Pump Off Car)

1. Clamp pump upside-down in vise by one ear of mounting flange. Clean dirt from outside of pump.
2. Remove fuel pulsator diaphragm plate attaching bolt, plate, and diaphragm from fuel cover.
3. To facilitate correct reassembly, mark edges of fuel cover and body flange with a file.
4. Loosen 6 cover screws about two turns.
5. Separate fuel cover from body by jarring cover lightly with a plastic hammer. Remove all but 2 attaching screws.
6. Holding the cover down against the diaphragm spring pressure, remove the 2 remaining cover screws and cover. Carefully separate the diaphragm from cover.
7. Remove rocker arm spring.
8. Push down on the end of the actuator link. (Fig. 8-56) This will hold the link up so that the diaphragm assembly may be tipped off of the link hook. (Fig. 8-57) To disconnect the diaphragm from the link, push down and away from the rocker arm side of pump.

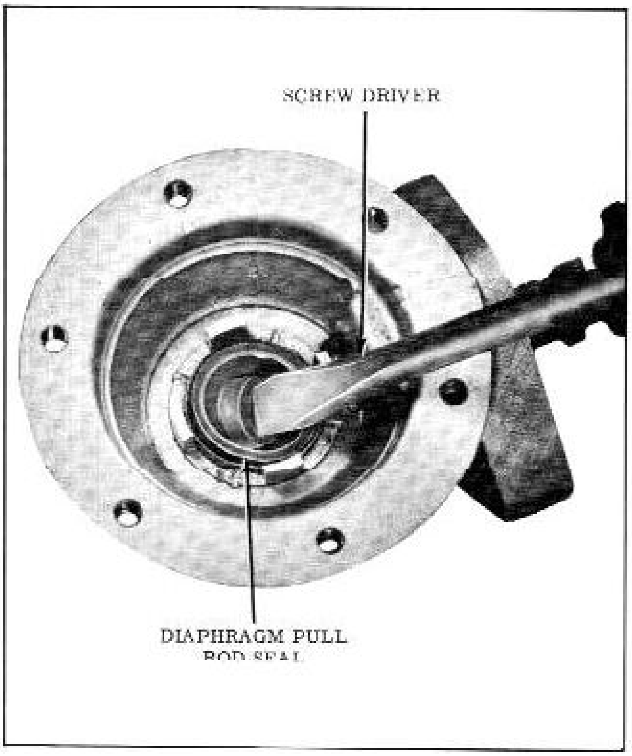

Fig. 8-58 Removing Seal

9. To remove valves, remove burrs produced by staking and pry inlet valve assembly from pump and push outlet valve assembly through cover from pulsator side of cover.

10. Remove staking burrs from diaphragm pull rod seal and remove seal by prying out with screw driver. (Fig. 8-58)

11. To remove rocker arm, drive out rocker arm pivot pin with a suitable drift, being sure the pump body is supported to prevent damage to casting. The rocker arm and link assembly will then slide from the pump body.

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, breakage, and distorted flanges. Examine all screw holes for stripped or crossed threads. Replacement of pump assembly is advisable if one or more of the following conditions are found:

   a. Body or cover castings warped or damaged.

   b. Rocker arm worn at cam pad.

   c. Rocker arm bushing worn.

   d. Links worn excessively.

NOTE: If flange facings are warped .010" or less, they can be trued up on a piece of plate glass with No. 400 grit sand-paper.

Assembly

1. Install a new pull rod seal using a socket or a tube which will rest on the outer shoulder of the retainer and stake securely.

2. Soak diaphragm in clean kerosene or fuel oil, and oil diaphragm pull rod.

3. Place spring over pull rod seal. Hold the fuel link up against the seal, as shown in Fig. 8-57, then install the diaphragm by inserting the pull rod through the spring and pull rod seal. With the flat of pull rod at a right angle to the fuel link, hook rod to link.

4. 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. (Fig. 8-59)

5. Using aligning pins, lift rocker arm until the diaphragm is flat across the body flange and install fuel cover on body, making sure that file marks on cover and body line up. While holding diaphragm flat, install cover screws and lock washers loosely until screws just engage lock washers. Remove aligning pins and install remaining screws with lock washers.

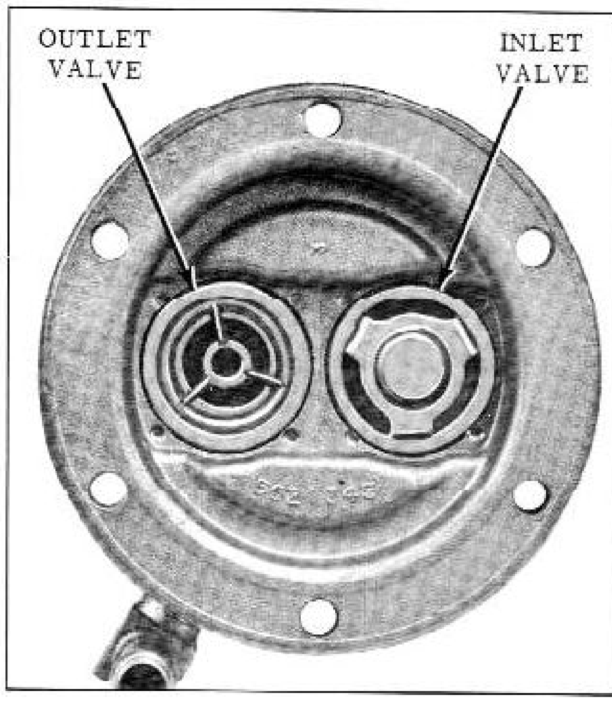

Fig. 8-59 Fuel Pump Valves

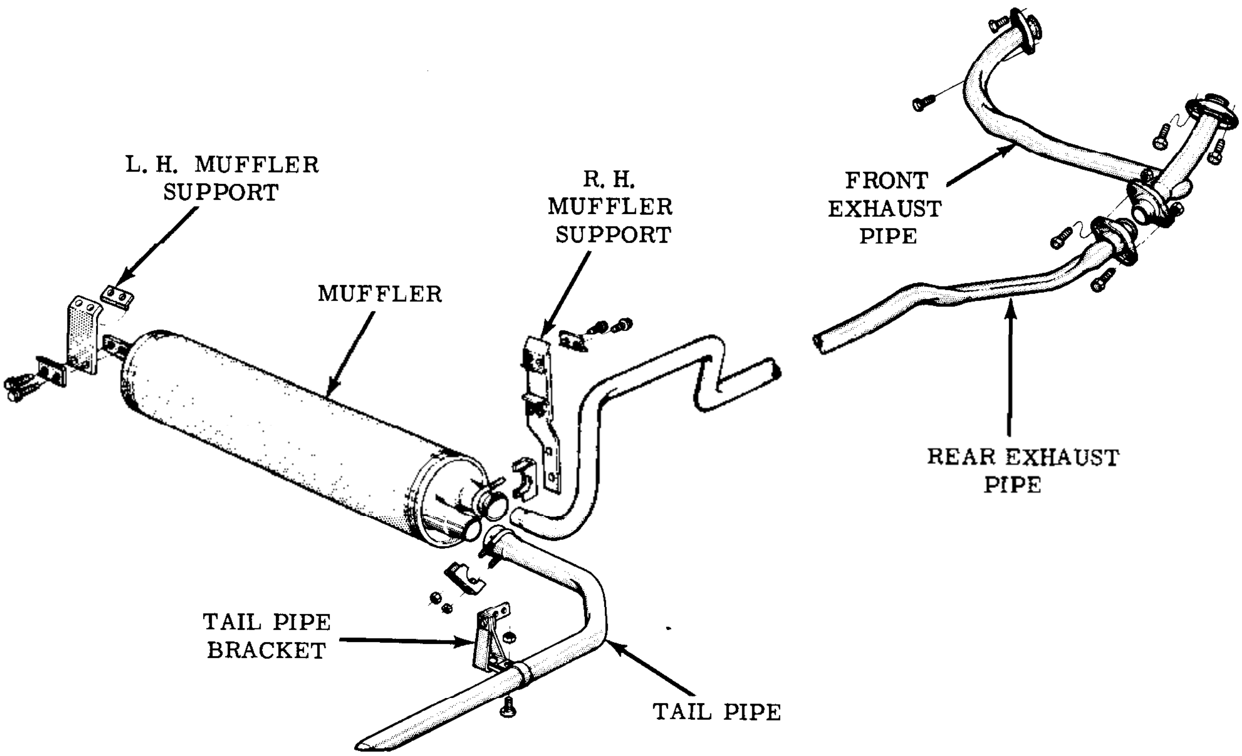

Fig. 8-60 Exhaust System

NOTE: Diaphragm must be flexed by several full strokes of rocker arm before tightening cover screws, or pump pressure will be incorrect and diaphragm may be damaged.

6. Tighten the cover screws alternately and securely.

7. Position pulsator diaphragm on fuel cover, then install pulsator cover and secure with attaching bolts.

FUEL STRAINER

The fuel bowl and strainer should be cleaned as required. The filter element may be cleaned by washing in clean gasoline. Do not use compressed air. The element may be replaced if necessary.

EXHAUST SYSTEM

DESCRIPTION

The single exhaust system (standard on all models) consists of a front exhaust pipe, rear exhaust pipe, muffler and tail pipe. The muffler is mounted in front of the gas tank, parallel to the rear bumper. The inlet and outlet is on the same end of muffler which is a reverse flow type, having an asbestos and steel outer shell.

For exhaust system repair refer to (Fig. 8-60) The front exhaust pipe is a one piece assembly which is attached to both exhaust manifolds. Before tightening any part of the exhaust system, align for adequate clearance between the body.

CARBURETION

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DESCRIPTION

The 2-barrel carburetor used on the F-85 Oldsmobile, aside from conventional carburetors, incorporates the following new features:

1. Main well insert tubes have been added in the main well, which completely surround the main well tube. The main well inserts have calibrated holes to break up any vapor bubbles which may form in the carburetor main well due to excessive heat during hot engine operation. This feature greatly improves hot idle characteristics and hot starting.

2. A cast aluminum throttle body is used in place of the conventional cast iron assembly. The new aluminum casting allows reduction in weight of the carburetor unit and also the overall height of the unit.

3. In place of the conventional off-idle mixture port drillings, a slotted type off-idle port is used.

4. A two hole pump lever is used which enables a much finer pump setting to be made over a wider range of climatic and temperature conditions.

5. The carburetor throttle lever is of new design to facilitate throttle linkage hook-up.

6. A fuel vapor cavity is incorporated in the venturi cluster just above the main well area. The cavity is located around the main nozzle and idle tube. It's purpose is to collect fuel vapors which may form in the top of the carburetor main well, condense these vapors and return them back into the main well. This feature prevents fuel vapors which may form from being forced out of the main well through the main well vents, into the venturi area causing poor engine idle and hard starting during hot engine operation.

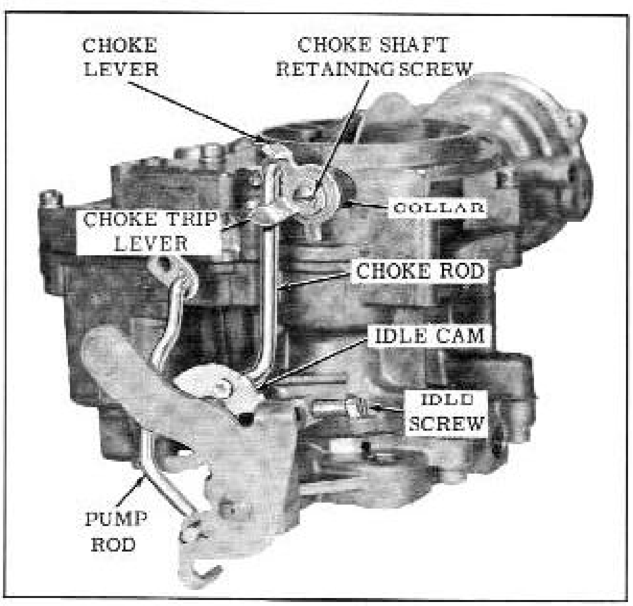

Fig. 8-61 2 Barrel Carburetor

SLOW IDLE ADJUSTMENT

1. The engine must be at normal operating temperature.

2. Remove the carburetor cover and air cleaner.

3. If Hydra-Matic, be certain that return check adjusting screw has ample clearance.

4. With the choke in "OFF" position adjust idle screw to r.p.m. indicated on chart.

5. After idle r.p.m. is stabilized, turn in or out each idle adjusting screw until the smoothest possible idle is obtained.

SYNCRO-MESH		
	TRANS.	R.P.M.
With Air Conditioning (Off)	N	550
Without Air Conditioning	N	550

HYDRA-MATIC		
	TRANS.	R.P.M.
With Air Conditioning (Off)	"DR"	550
Without Air Conditioning	"DR"	500

6. Adjust throttle return check screw to obtain .020" clearance.

THROTTLE RETURN CHECK ADJUSTMENT

The throttle return check adjustment can be made as follows:

1. Rotate idle cam so that the idle screw rests on top of the highest step of the cam.
2. Measure clearance between the plunger and the stop screw. Clearance should be .020".
3. If adjustment is necessary, adjust the stop screw.

NOTE: For throttle linkage adjustment, refer to the Hydra-Matic Section (3) or refer to Syncro-Mesh Throttle Linkage Adjustment in Carburetion Section (8).

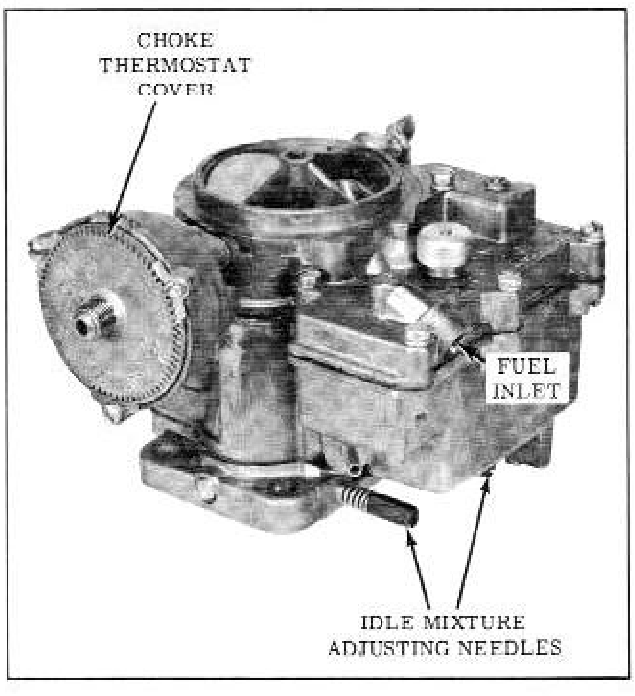

Fig. 8-62 2 Barrel Carburetor

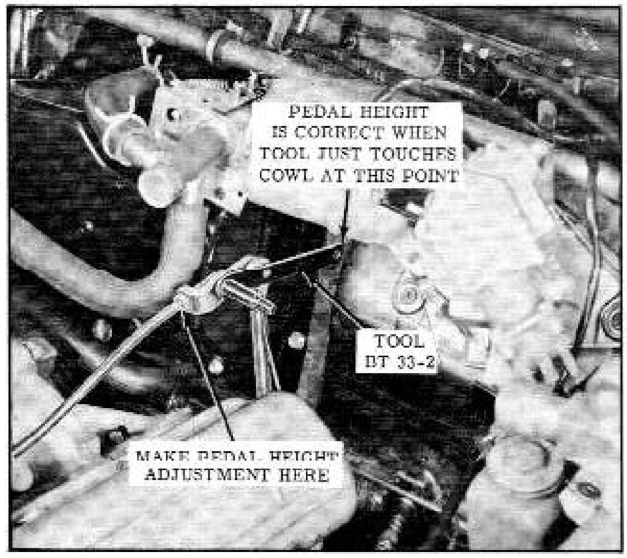

Fig. 8-63 Accelerator Pedal Height Adjustment

ACCELERATOR LINKAGE ADJUSTMENT

1. The choke must be fully off and the idle screw backed out to permit the throttle valve to be held at closed bore by the throttle return spring.
2. Adjust the auxiliary bellcrank as shown in inset of Fig. 3-129. Side clearance of the bellcrank should be not more than .010".
3. If adjustment is necessary, this is done by bending the auxiliary bellcrank to carburetor link.
4. Adjust accelerator pedal with Tool BT 33-2 as shown in Fig. 8-63.

CARBURETOR SYSTEMS

There are six basic systems used in the model 2GC and they are very similar to the ones used in the standard model 2GC, except for minor variations in restriction location and fuel flow. The six basic systems used are float, idle, part throttle, power, pump and choke. The following text describes the operation of each of these systems in detail.

Float System (Fig. 8-64)

The float system controls the level of the fuel in the carburetor bowl.

Fuel enters the carburetor through the fuel inlet fitting and channel, passes on through the needle and seat strainer, then through the needle and seat, and into the carburetor float bowl. The fuel continues until the rising liquid level raises the float, to a position where the float needle valve is closed. As fuel is used from the carburetor bowl the float pontoon drops downward, allowing

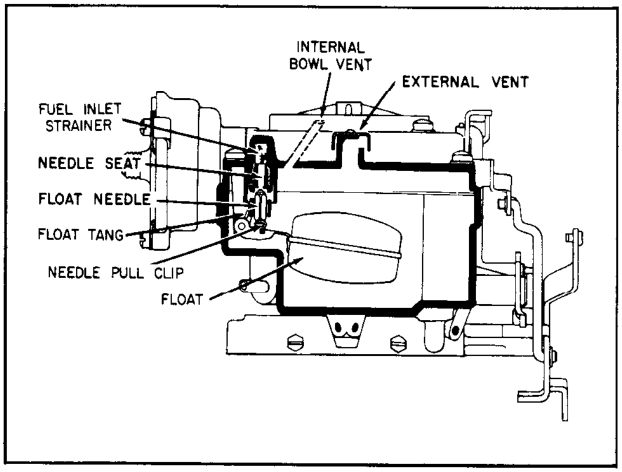

Fig. 8-64 Float System

the float needle to come off its seat which, in turn, lets more fuel into the fuel bowl until the correct level is reached. The fuel level can be regulated by setting the float to close the valve when the proper fuel level is reached in the carburetor bowl.

The float tang, located at the rear of the float arm, prevents the float from traveling too far downward. A float needle pull clip, connecting the float arm to the needle valve, keeps the needle from sticking closed in the seat.

The float bowl is externally and internally vented to balance the air pressure inside the air horn bore with air pressure acting upon the fuel in the carburetor bowl.

A fixed external capped vent, located on top of the air horn, vents the bowl itself to atmosphere. Fuel vapors which may form in the float bowl will thus be vented to the outside so that metering will not be disrupted.

Idle System (Fig. 8-65)

The idle system consists of idle tubes, idle passages, idle air bleeds, idle channel restrictions, off idle discharge port, idle needle discharge holes and idle adjustment needles.

In the curb idle speed position, the throttle valve is slightly open, allowing a small amount of air to pass between the wall of the carburetor bore and the edges of the throttle valve.

The idle needle hole is in the high vacuum (low pressure) area below the throttle valves, while the fuel bowl is vented to atmospheric pressure.

The higher atmospheric pressure forces the fuel from the float bowl through the main metering jets into the main well. The fuel is metered by the calibrated orifice at the lower tip of the idle tube and travels up the idle tube. When the fuel reaches the top of the idle tube, it is mixed with air through three idle air bleed holes, one is located directly over the idle tube in the idle channel, one at the side through the cross channel, and one below the channel restriction. The air/fuel mixture then moves down the idle passage, through a channel restriction, located in the cluster just above the fuel bowl. It then moves down the vertical passage through a second idle channel restriction, located in the throttle body just above the off-idle port. More air is added to the mixture through the off-idle port slot just above the throttle valve. The mixture then moves down to the idle needle hole and on into the bore of the carburetor to mix with the incoming air, past the slightly open throttle valve. For smooth operation, the air from the carburetor bore and the air/fuel mixture from the idle needle hole must combine to form the correct final mixture for curb engine idle speed.

The position of the idle mixture adjusting needle regulates the amount of air/fuel mixture admitted into the carburetor bore. Turning inward on the idle mixture screw makes a leaner idle mixture, while turning the screw outward, or counterclockwise, enrichens the idle mixture. Except for this variable at the idle mixture needle, and curb idle adjusting screw, the idle system is specifically calibrated for low engine speed.

As the throttle valves are opened, a pressure differential occurs. Opening of the throttle valve progressively exposes the off-idle port slot to manifold vacuum and the air flow, with the result that it delivers additional air/fuel mixture for off-idle engine requirements.

Part Throttle System (Fig. 8-66)

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 than the idle system, for supplying additional fuel to meet engine requirements.

Further opening of the throttle valve increases the speed of the air stream passing through the venturi, thus lowering the pressure, (raising the

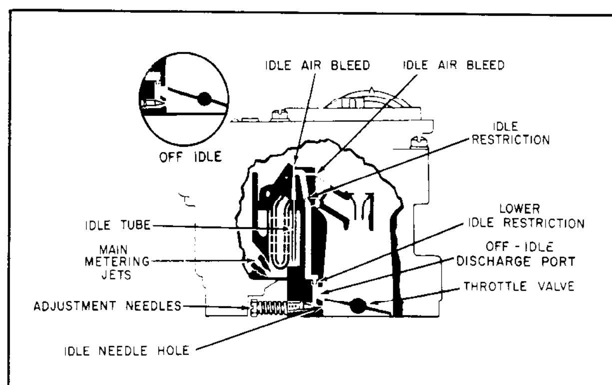

Fig. 8-65 Idle System

vacuum) in the small venturi area of the carburetor bore. At the same time, the edge of the throttle valve is moved away from the wall of the carburetor bore, gradually reducing the vacuum until the discharge of the fuel mixture at the idle needle hole and off-idle port gradually diminishes.

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 to the venturi, as follows:

The fuel passes through the main metering jets into the main well, where it passes through the holes in the main well tube insert and raises in the main well tube. Air entering through the main well air bleeds, in the top of the venturi cluster, is mixed with the fuel in the main well tube through the holes located in each side of the tube. The mixture continues up the main well tube, through the nozzle, where more air is added at the tip of the nozzle through the mixture passage. The air/fuel mixture then passes down through the mixture passage to the small venturi, where it mixes with the intake air for complete and final mixture for part throttle operation. The calibrated main well air bleeds control the level of the fuel in the main well and also maintains the proper air/fuel mixture to the engine throughout the part throttle range.

Jets and air bleeds calibrate the main metering system for efficient part throttle operation.

It should be noted that main well inserts are used in conjunction with the main well tubes in this model carburetor. The purpose of the main well inserts is to help break up any vapor bubbles which may form in the main well so that efficient carburetor metering can be maintained during hot engine operation. The addition of the main well inserts help to maintain a more stable engine idle and also more efficient operation of the main metering system.

Power System (Fig. 8-67)

The power system provides additional fuel as required for heavy load and high speed engine requirements.

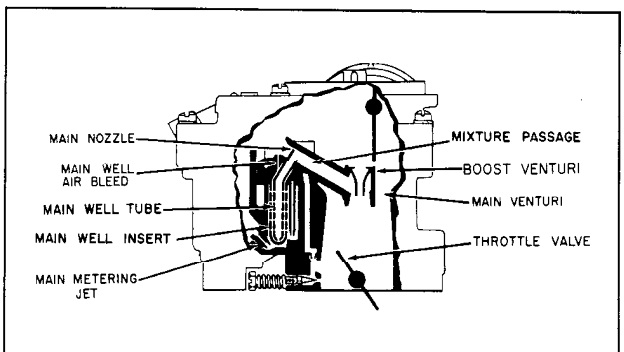

Fig. 8-66 Part Throttle System

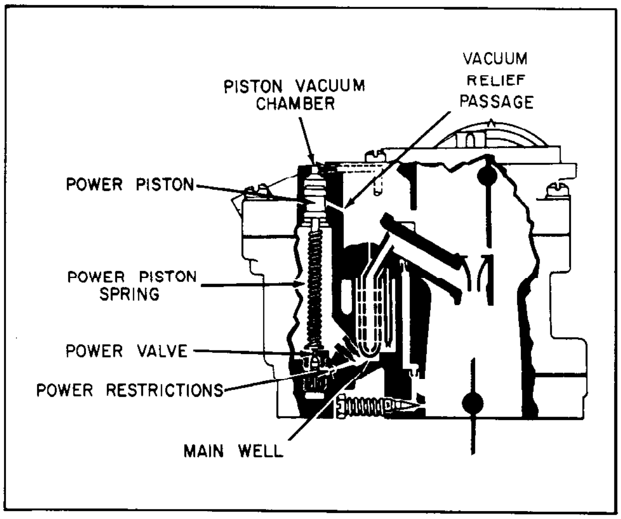

Fig. 8-67 Power System

A spring loaded power piston controlled by engine manifold vacuum regulates the power valve to supply additional fuel required by the engine in respect to speed and load.

The power piston vacuum chamber is open to manifold vacuum beneath the throttle valves. This allows the vacuum in the channel to rise and fall with engine manifold vacuum.

During idle and part throttle operation, the vacuum in the chamber is normally high enough to hold the power piston in the fully raised position against the tension of the power valve spring. As the manifold vacuum drops with engine load, the calibrated spring forces the piston down against the power valve. The power valve is opened and allows additional fuel to flow through calibrated power restriction in the power system fuel passage and then on into the main wells.

The power valve allows the gradual increase in fuel flow as the power valve is fully opened to permit an efficient calibrated fuel flow from the power system.

As the engine load decreases, manifold vacuum increases. The increasing vacuum pull on the power piston gradually overcomes the spring tension of the power piston spring and the power piston returns to its original raised position; then the power valve is fully closed.

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. The purpose of this hole is to prevent the transfer of vacuum acting on the power piston to 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 thusly, will not affect carburetor calibration.

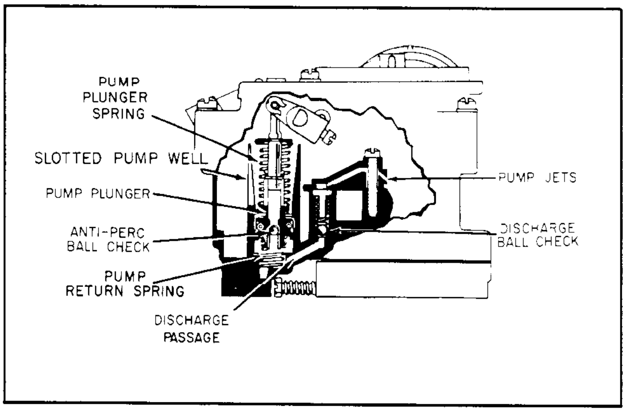

Fig. 8-68 Pump System

Pump System (Fig. 8-68)

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 on rapid acceleration.

Fuel for acceleration is supplied by a double spring loaded pump plunger. The top and bottom springs combine to move the plunger so that a smooth, sustained charge of fuel is delivered for acceleration.

When the pump plunger moves upward, fuel enters the slotted pump well, flows by the ball check in the pump plunger head and also between the pump leather and the wall of the pump well.

Downward motion of the plunger seats the check ball in the pump plunger head. Fuel is forced through the pump discharge passage where it unseats the discharge ball check and then passes on through the passage at the pump discharge holes in the cluster, where it sprays into the venturi.

The ball check in the pump plunger head also serves as a vapor vent from the pump well. Without this vent, vapor pressure in the pump well might force fuel from the pump system into the engine manifold, causing hard starting and pump sludging under conditions of extreme heat. The pump discharge ball check in the accelerator pump passage prevents pull-over or discharge of fuel from the pump nozzles when the accelerator pump is not in operation.

Choke System (Fig. 8-69)

For cold engine operation, a richer mixture at the carburetor is required so that a combustible mixture enters the manifold system to be drawn into the engine cylinders after considerable condensation of the fuel vapor on the cold engine parts. The function of the choke system is to subject all fuel outlets in the bore of the carburetor to high vacuum while restricting the intake of the air. The choke system is composed of a thermostatic coil, vacuum piston, off-set choke valve, fast idle cam and choke linkage. Its operation is controlled by the combination of intake manifold vacuum, the off-set choke valve, atmospheric temperature, and exhaust manifold heat.

The thermostatic coil is calibrated to hold the choke valve closed when the engine is cold. As the engine is started, air velocity against the off-set choke valve causes the valve to open slightly against the torque of the thermostatic coil. In addition, intake manifold vacuum applied to the choke piston through the vacuum channel also tends to pull the choke valve open. Vacuum pull on the choke piston is off-set by tension on the thermostatic coil. As the engine warms up, heated air is drawn into the choke housing through the choke heat tube by vacuum, through a passage hole in the choke housing. As the engine temperature increases, it causes the thermostatic coil to relax its tension, which together with vacuum pull on the choke piston causes the choke valve to open to wide open position.

A mechanical choke unloader is incorporated to open the choke valve slightly when the engine is cold. The choke unloader provides a means for opening the choke valve to allow additional air to enter and mix with any over-rich mixtures encountered during cold starting.

To prevent stalling during the warm up period, it is necessary to run the engine at a slightly higher idle r.p.m. than for a warm engine. This is accomplished by the idle screw which rests on the steps of the fast idle cam. The fast idle cam is, in turn, linked to the choke valve shaft by the choke rod, choke trip lever and choke lever and collar assembly. This holds the throttle valves open sufficiently during the warm-up period to give the increased idle r.p.m., until the choke valve moves to the full open position.

Removal

1. Remove carburetor cover and air cleaner.

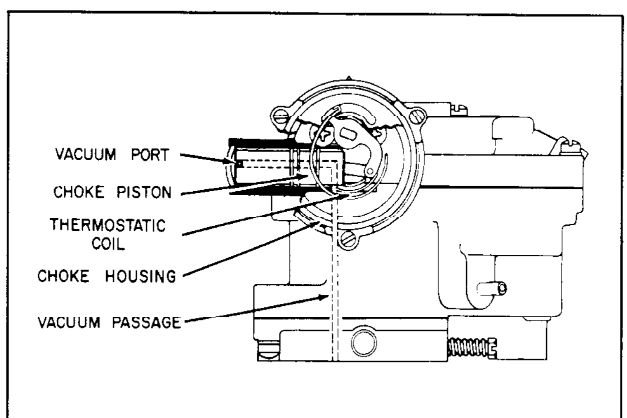

Fig. 8-69 Choke System

2. Disconnect heat tube, vacuum line and fuel inlet line.

3. Disconnect accelerator linkage, remove 4 carburetor to intake manifold nuts and remove carburetor.

Installation

1. Place carburetor on intake manifold and install nuts. Torque 14-17 ft. lbs.

2. Connect linkage, fuel line, vacuum line and heat tube.

3. Perform adjustments as outlined on Page 8-42, "ON CAR ADJUSTMENTS."

4. Install air cleaner and carburetor cover.

DISASSEMBLY

Air Horn

1. Mount carburetor on proper holding fixture.
2. Remove fuel inlet fitting.
3. Remove 3 thermostat cover retaining screws and then remove the thermostat cover coil assembly, gasket and inside baffle plate. (Fig. 8-70)
4. Remove pump rod by removing the upper horseshoe retaining clip at the upper pump lever and retaining clip at the throttle lever end.
5. Remove retaining screw at the end of choke shaft and remove choke trip lever, choke lever and collar assembly. (Fig. 8-61)

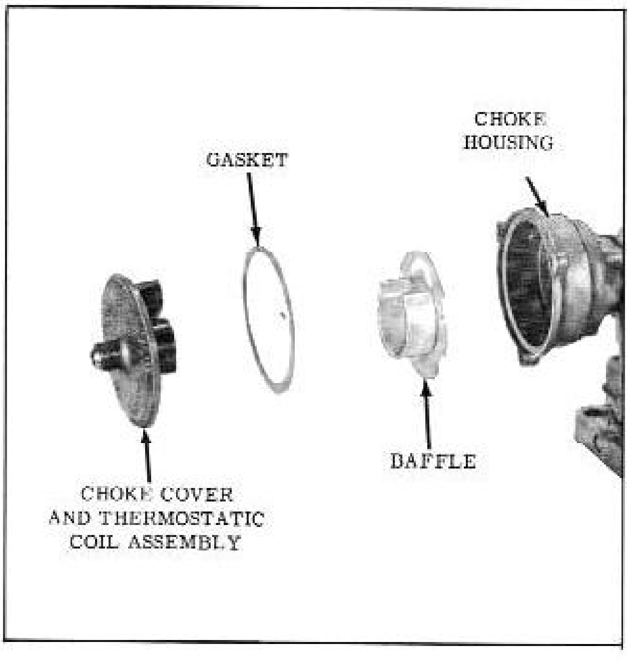

Fig. 8-70 Choke Thermostat Assembly

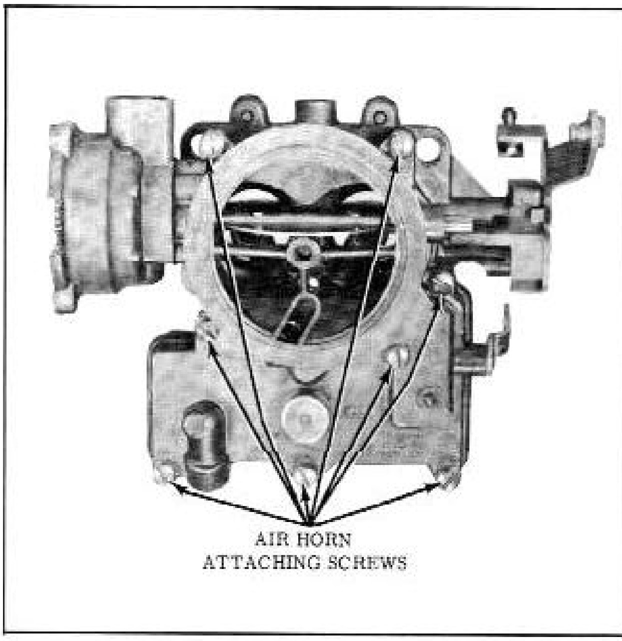

Fig. 8-71 Air Horn Attachment

6. Remove fast idle cam attaching screw; then remove choke lever and collar assembly, choke rod and fast idle cam as an assembly.
7. Remove 8 air horn attaching screws and carefully remove air horn from float bowl by lifting upward. (Fig. 8-71)

8. Invert the air horn and place on a flat surface, then remove the float hinge pin, float and needle assembly. Float needle may be removed from float. (Fig. 8-72)

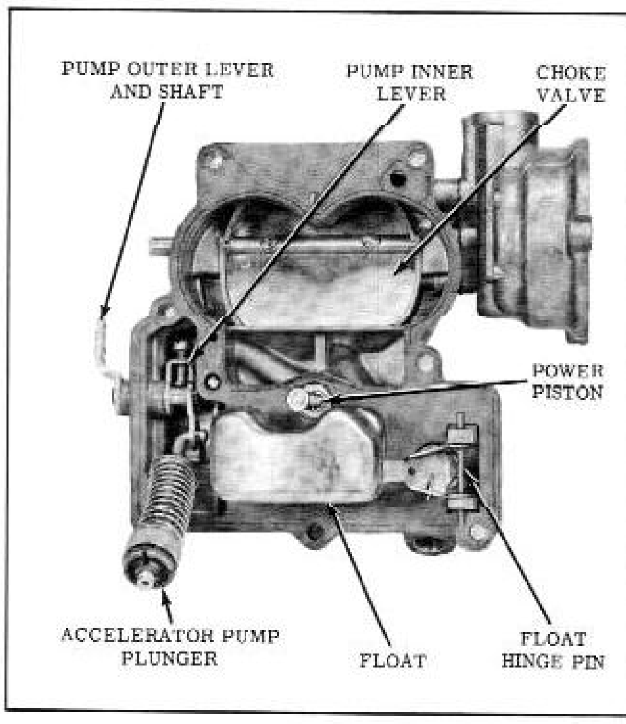

Fig. 8-72 Air Horn Assembly

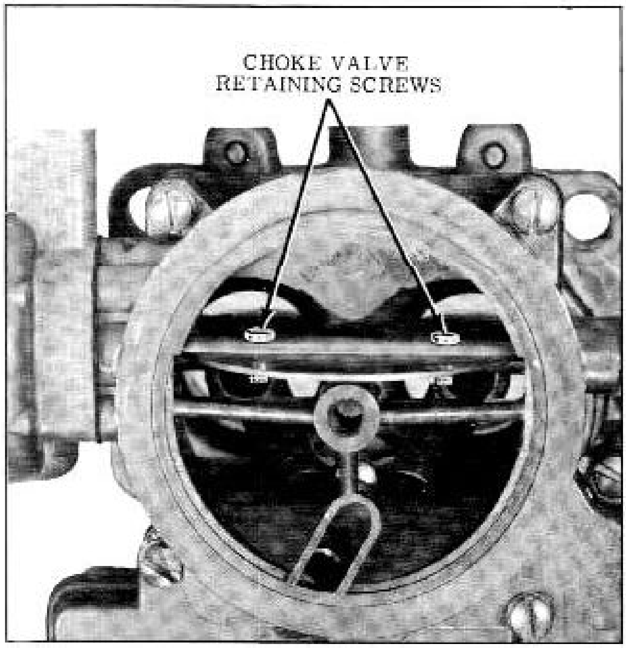

Fig. 8-73 Choke Valve and Shaft

9. Remove the float needle seat, fiber gasket and needle seat screen. (Use Tool BT-52)

10. Remove the air horn gasket.

11. Remove power piston by depressing shaft, allowing spring to snap, thus forcing piston from casting.

    NOTE: If heavy staking is encountered, remove from around power piston retaining washer.

12. Remove the retainer from the pump plunger shaft and remove pump plunger.

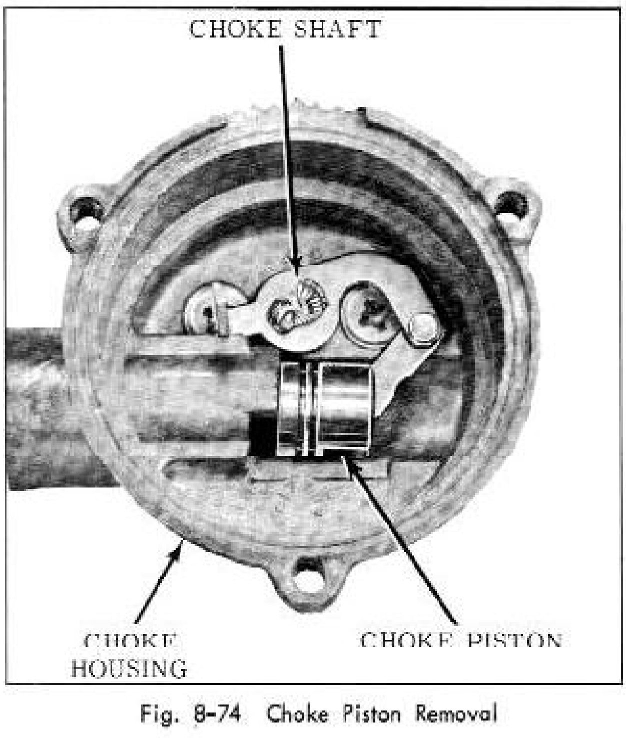

Fig. 8-74 Choke Piston Removal

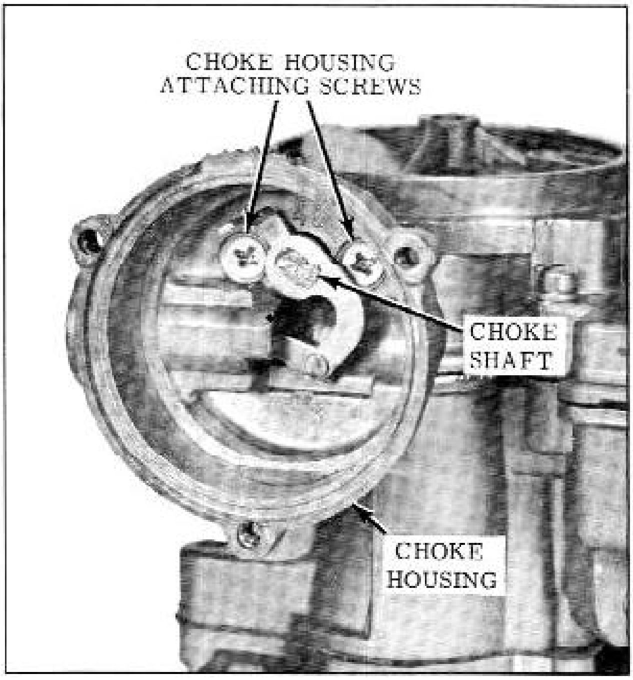

Fig. 8-75 Choke Housing Attaching Screws

13. The pump lever and shaft may be removed by loosening set screw on inner arm and removing outer lever and shaft assembly.

14. Remove 2 choke valve retaining screws (file off staked ends). Remove choke valve. (Fig. 8-73)

15. Rotate choke shaft and piston assembly counterclockwise to free choke piston from the choke housing, then remove choke piston and shaft from air horn. (Fig. 8-74) Choke piston

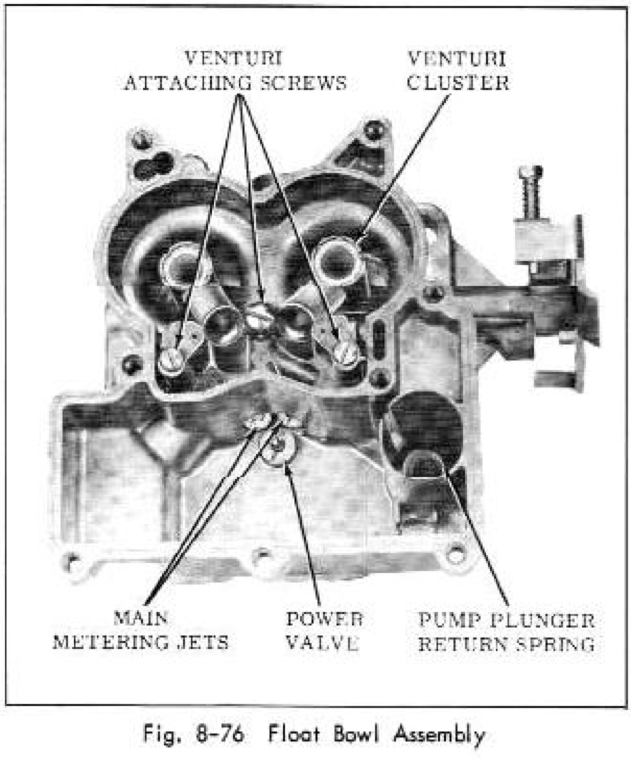

Fig. 8-76 Float Bowl Assembly

may be removed from the choke piston link by tapping lightly into the palm of hand.

16. Remove 2 choke housing attaching screws. Choke housing and gasket may now be removed from air horn assembly. (Fig. 8-75)

Float Bowl

1. Remove pump plunger return spring from the pump well. (Fig. 8-76)

2. Remove the 2 main metering jets and power valve and gasket.

3. Remove 3 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.

4. Using a pair of needle nosed pliers, remove the pump discharge spring guide, then remove the spring and steel ball. (Fig. 8-77)

5. Remove 2 main well inserts from the main well.

THROTTLE BODY

1. Invert float bowl and remove 3 throttle body attaching screws, then remove the throttle body and gasket. (Fig. 8-78)

2. Remove idle mixture adjusting needles and springs.

3. Remove idle screw from throttle body if replacement is necessary.

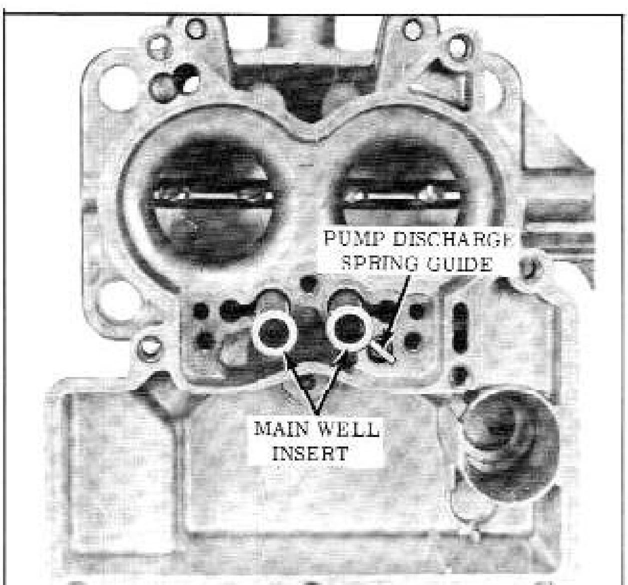

Fig. 8-77 Pump Discharge Spring Guide

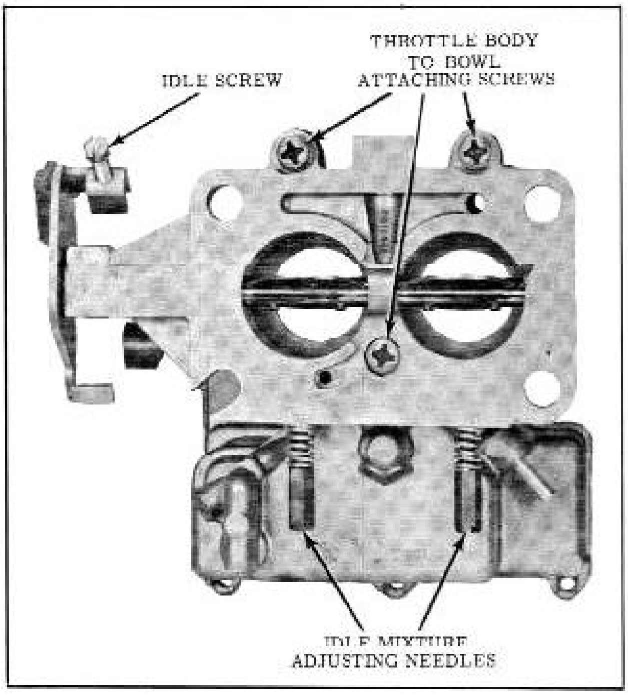

Fig. 8-78 Throttle Body

No other disassembly of the throttle body is necessary. The throttle valves should not be removed, as the idle ports are located in direct relation to the location of the throttle valves. Removal of the throttle valves will upset this location. The throttle body is serviced as a complete unit with throttle valves intact.

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 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 screens of dirt or lint. If filter screens are distorted or plugged, they should be replaced.

Inspection of Parts

1. Check floats for dents or excessive wear at hinge pin holes.

2. Shake floats to check for leaks.

3. Examine float needle and seat. If grooved or scored, replace with a new matched float needle seat and gasket assembly.

4. Inspect the idle mixture adjusting needles for burrs or ridges, or being bent out of alignment. Replace if necessary.

5. Inspect the upper and lower surface of the float bowl to see if the small sealing beads are not damaged. Damaged beading may result in air or fuel leaks at this 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 period.

8. Inspect the pump plunger leather for cracks and pliability. If the pump leather is damaged, replace the pump plunger as an assembly.

9. Inspect the throttle body to make sure the idle passages and vacuum channels are open.

CARBURETOR ASSEMBLY

Throttle Body

1. If removed, install the idle speed screw. (Fig. 8-78)

2. Install the idle mixture needles and springs into the throttle body. Tighten the screws until finger tight, then back out 1-1/2 turns as a preliminary idle adjustment.

3. Place a new gasket on the bottom of the float bowl with holes aligned, then position the throttle body assembly on the gasket and install the 3 attaching screws. Tighten screws evenly and securely.

Float Bowl

1. Install steel pump discharge ball, spring and guide into the pump discharge passage, in the venturi cluster mounting surface. (Fig. 8-77)

2. Install the 2 main well tube inserts into the main wells. Make sure the lip on the main well inserts are seated properly in the casting. (Fig. 8-77)

3. Install the venturi cluster, gasket and attaching screws. Screw with gasket must be inserted in center hole.

4. Install the main metering jets and power valve with gasket.

5. Install pump return spring into the pump well. Push the pump return spring downward with finger to make sure the spring is seated in the bottom of the pump well.

Air Horn

1. Place new choke housing gasket in position on air horn and install choke housing, retaining with 2 Phillips head attaching screws. Tighten screws evenly and securely.

2. Assemble choke piston to choke shaft and link assembly, retain with piston pin. Piston should be installed on the choke piston link so that the pin faces towards the air horn.

3. Install choke shaft into air horn, rotating choke piston until it enters choke piston bore in the choke housing.

4. Install choke valve in the choke shaft with letters "RP" facing upward. Install 2 choke valve retaining screws but do not tighten securely until choke valve is centered.

   NOTE: Center choke valve on choke shaft by installing choke lever and collar assembly and trip lever. Maintain approximately .020" clearance between the counterweight lever and air horn casting. Tighten choke valve screws and stake lightly in place. The choke shaft is aluminum and care must be taken when staking choke valve screws.

5. Install the outer pump lever and inner pump arm to air horn and tighten set screw securely. (Fig. 8-72)

6. Attach pump plunger assembly to inner pump arm with pump shaft pointing inward, and install horseshoe retainer. (Fig. 8-72)

7. Install screen on the float needle seat and assemble float needle seat, screen and gasket to the air horn. Tighten securely using Tool BT-52.

8. Install power piston into vacuum cavity; piston should travel freely in cavity. Lightly stake retainer in place.

9. Install air horn gasket on the air horn.

10. Attach float needle to float, carefully position float and insert hinge pin.

Float Level Adjustment (Fig. 8-79)

1. With the air horn inverted and gasket in place, position the float level gauge BT 61-01 on the gasket as shown. The sharp edge of the seam of the float should be even with the top edge of the gauge.

2. Bend the float arm, as shown in Fig. 8-79.

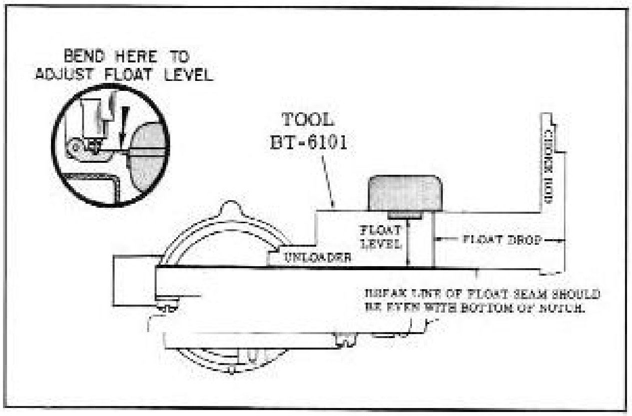

Fig. 8-79 Float Level Adjustment

Float Drop Adjustment (Fig. 8-80)

1. With the air horn held upright and gasket in place, measure the distance from the gasket to the bottom of the float. Use float gauge as shown, to check this setting.
2. If necessary to adjust, bend the float tang which contacts the needle and seat. Bend the tang toward the needle and seat to decrease float drop and away from the seat to increase the drop.

Completion of Carburetor Assembly (Fig. 8-69)

1. Install the air horn on the float bowl while guiding accelerator pump in place. Install and tighten the air horn screws evenly and securely.
2. Insert the choke rod into the upper choke lever and install the idle cam on the lower end of the lever; then attach idle cam to float bowl, retaining with the idle cam screw. (Fig. 8-81)
3. Install accelerator pump rod retaining in position with 2 horseshoe clips.

   NOTE: Place upper end of pump rod in outer hole on upper pump lever for normal setting. Inner hole should be used only when a leaner pump is desired, for abnormal operating conditions.

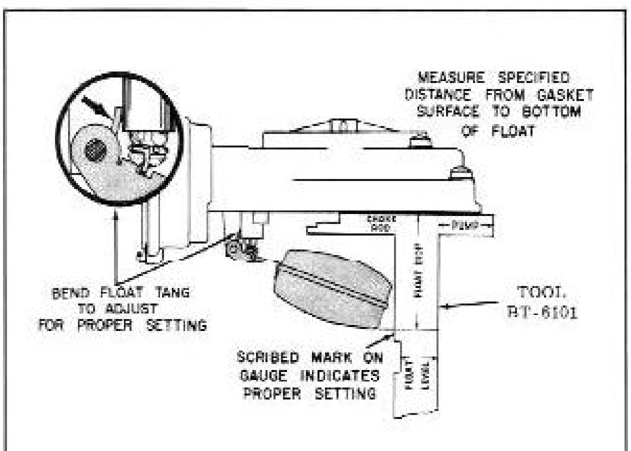

Fig. 8-80 Float Drop Adjustment

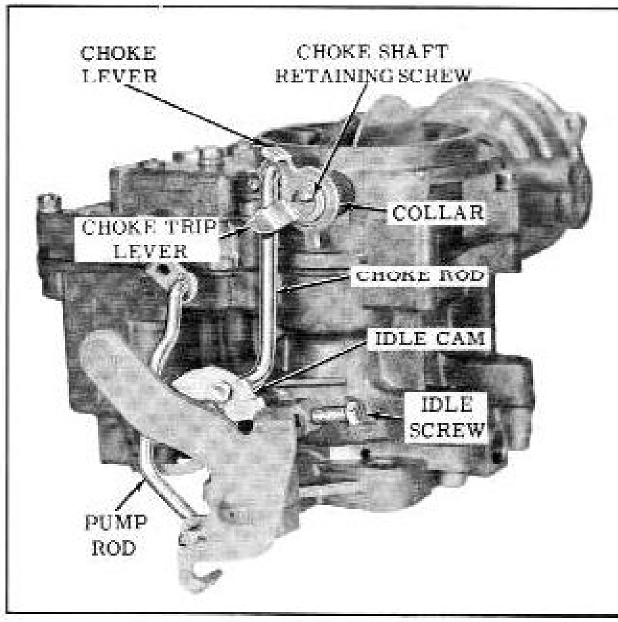

Fig. 8-81 Choke Rod Assembly

4. Place baffle plate into choke housing and then install thermostatic coil and cover assembly and gasket.
5. Rotate thermostatic cover counterclockwise until the choke valve begins to close and continue in rotation until the proper index marking is aligned as specified. (Fig. 8-82)
6. Attach 3 choke cover retainers and screws to choke housing and tighten securely. Choke setting: Index on Hydra-Matic equipped cars and 1 notch lean on Syncro-Mesh.

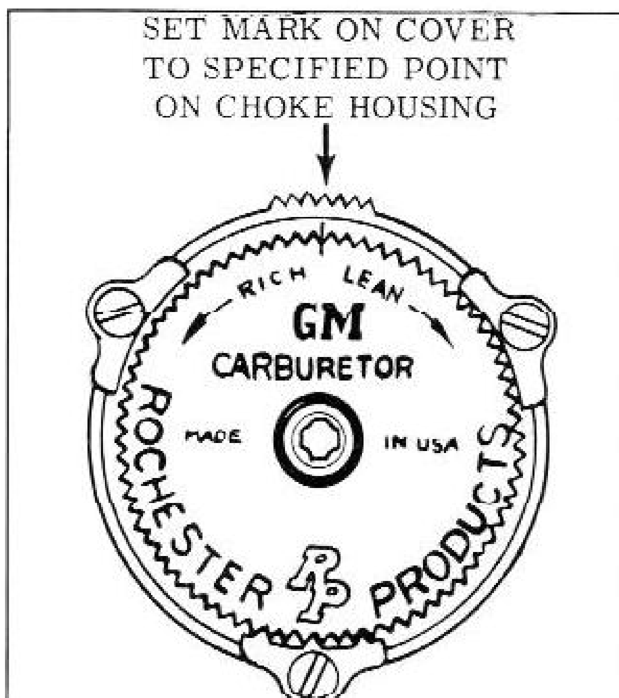

Fig. 8-82 Choke Cover Index

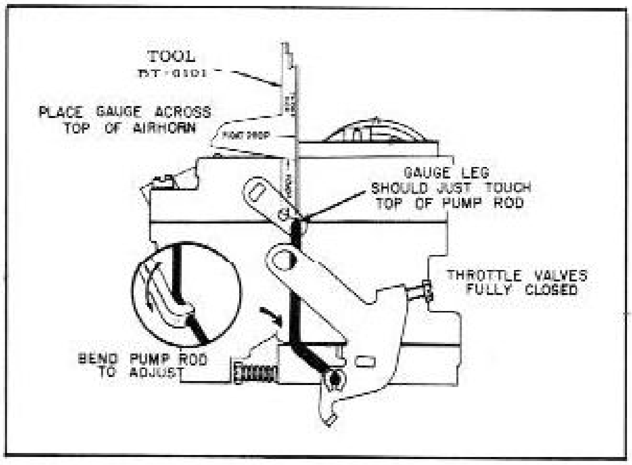

Fig. 8-83 Pump Rod Adjustment (Syncro-Mesh)

Adjustments (On or Off the Car)

Pump Rod Adjustment (Fig. 8-83)

NOTE: Place pump rod in outer hole. Back out idle screw until the throttle valves are completely closed in the throttle bore. Place gauge across top of air horn casting, as shown, with leg of gauge pointing downward towards the top of the pump rod. Bend the pump rod, as shown, until the top of the pump rod just touches the edge of the gauge leg.

Choke Rod Adjustment (Figs. 8-84, 8-85)

1. Turn the idle screw in until it just contacts the second step of the fast idle cam. With the screw resting on the second step and against the high step, bend the choke lever tang as necessary to admit the small end of gauge between the upper edge of the choke valve and the air horn wall.

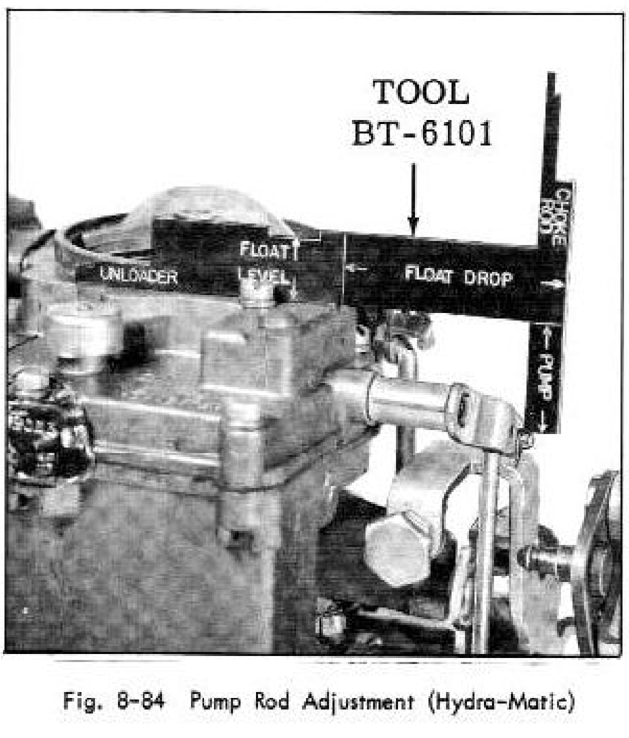

Fig. 8-84 Pump Rod Adjustment (Hydra-Matic)

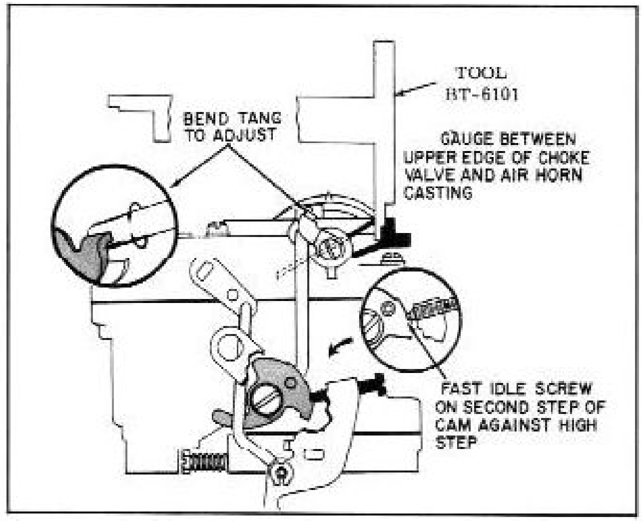

Fig. 8-85 Choke Rod Adjustment

Unloader Adjustment (Fig. 8-86)

1. Hold the throttle valves in the wide open position.

2. The large end of the gauge should go just between the upper edge of the choke valve and the inner air horn wall.

3. To adjust, bend the tang on the throttle lever as shown.

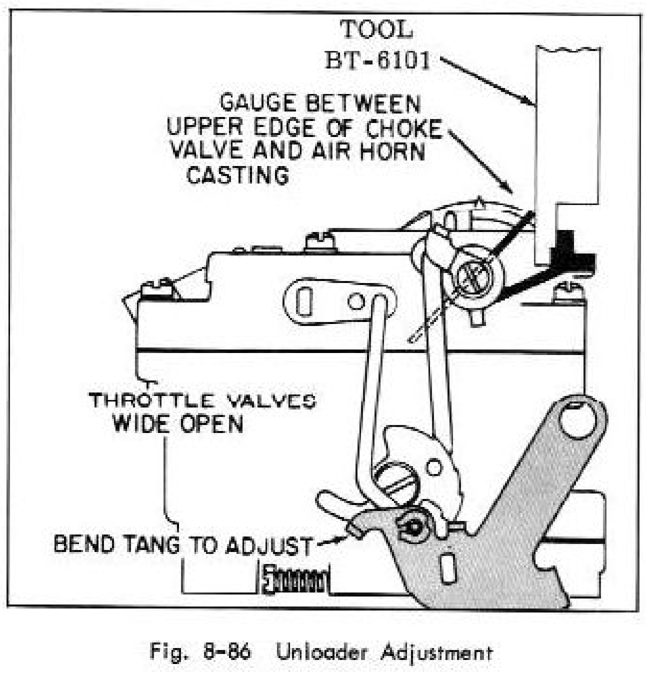

Fig. 8-86 Unloader Adjustment

CARB-AIRATOR

The "Carb airator" is an external breather attached to the carburetor on air conditioned cars equipped with 2-Barrel carburetors. Its purpose is to assist in reducing rich fuel and air mixture brought about during hot idling conditions.

Adjustments

Adjust normal idle with the engine cool (approximately 70° outside temperature). When the engine is started, be sure the Carb-airator valve closes (Fig. 8-87).

If in extreme hot temperatures, (95° outside temperature), the idle is rough and erratic, or stalling occurs, tighten the temperature screw one turn and road test. CAUTION: Do not upset normal idle and do not overtighten the temperature screw. If the engine idles too fast under extreme hot conditions (95° outside temperature), tighten the air screw.

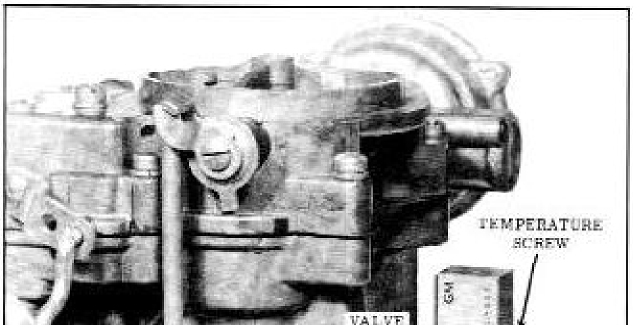

Fig. 8-87 Carb-Airator Adjustment

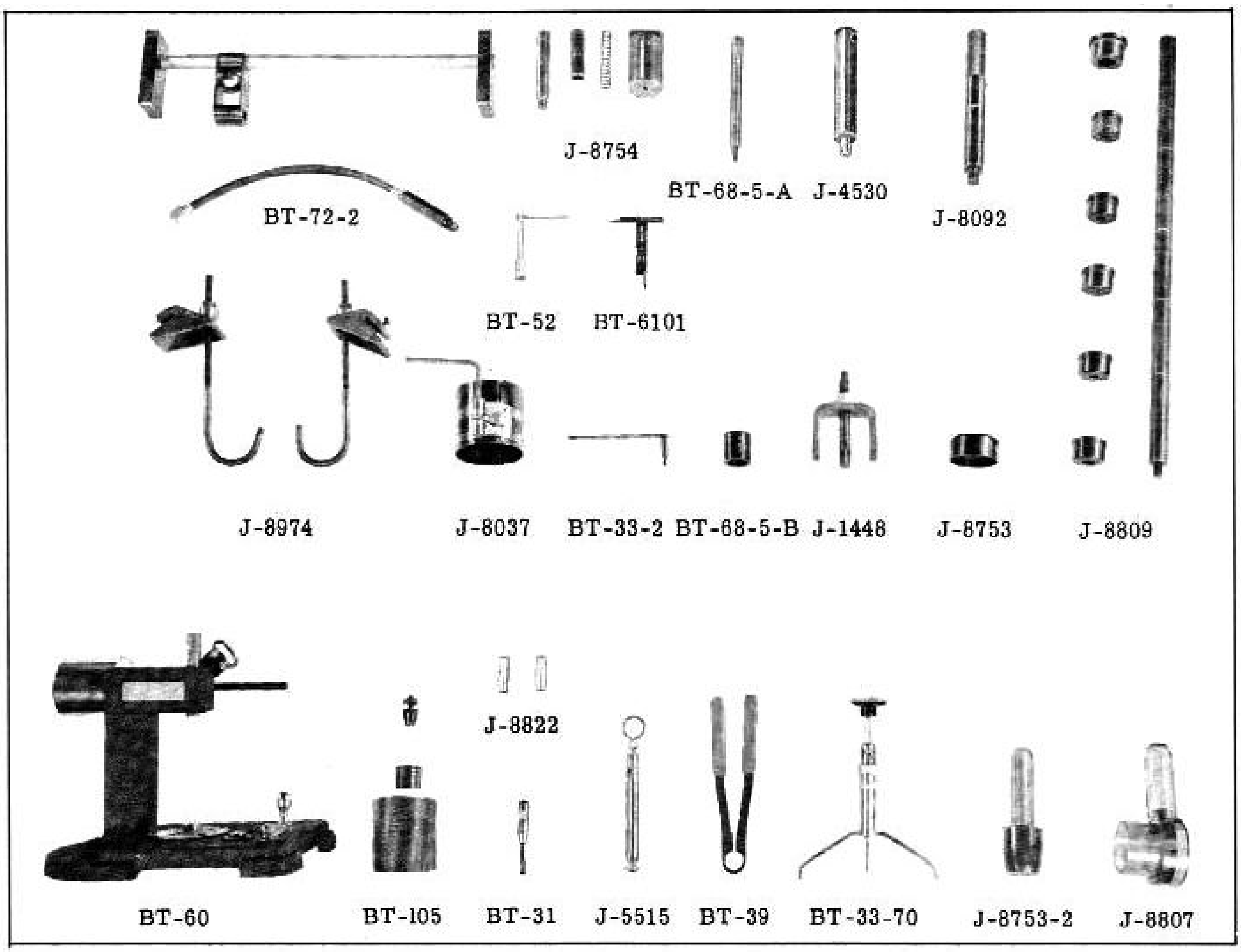

Fig. 8-88 Tools

BT-31	Valve Lifter Remover	J-1448	Crankshaft Pilot Bushing Remover
BT-33-2	Accelerator Pedal Height Gauge	J-4530	Crankshaft Pilot Bushing Installer
BT-33-70	Belt Tension Gauge	J-5515	Spring Scale (Used For Fitting Piston)
BT-39	Valve Lifter Remover	J-8037	Piston Ring Compressor
BT-52	Float Needle Seat Remover	J-8092	Drive Handle
BT-60	Hydraulic Valve Lifter Tester	J-8753	Front Cover Seal Installer
BT-6101	Carburetor Gauge Set	J-8753-2	Front Seal Sizer
BT-68-5-A	Valve Guide Remover	J-8754	Piston Pin Remover And Replacer Set
BT-68-5-B	Valve Guide Installer		
BT-72-1-B	Valve Holding Tool	J-8807	Crankshaft Rear Seal Installer
BT-72-2	Valve Spring Compressor	J-8809	Cam Bearing Remover and Installer
BT-105	Adapter Kit (Used With Hydraulic Valve Lifter Tester)	J-8822	Connecting Rod Bolt Guide Set
		J-8974	Engine Support Hooks

CARBURETION SUPPLEMENT

ROCHESTER 4GC

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ROCHESTER CARBURETOR MODEL 4GC

THEORY OF OPERATION

FLOAT SYSTEM (Fig. 8-89)

The Rochester 4GC carburetor employs two sets of twin floats to maintain correct fuel level in both float bowls under all conditions of operation.

Fuel enters the carburetor on the primary side. Some of this fuel passes through a channel in the air horn and enters the inlet passage on the secondary side at (9). As the fuel level on the primary side drops, the floats (5) drop, moving the inlet needle (12) off its seat (14). The fuel pump forces fuel through the filter screen (2) into the inlet passage (3), thru the small filter screen (4), and then into the float bowl. As the fuel level in the bowl rises, the floats rise and close off the inlet needle.

A coil spring located on the power piston stem, acts as an assist in closing the inlet needle on its seat by exerting pressure on a tang located at the center of the float arms.

The only time the vacuum assist spring applies pressure to the tang on the float lever is during carburetor idle and part throttle operation. This is when the power piston is in the full up position. During heavy acceleration and power system operation, the power piston drops and releases all pressure applied to the floats to hold them closed. This allows maximum float drop and full fuel flow to eliminate the possibility of dry jets and engine cut-out.

As fuel is drawn from the bowl on the secondary side, the float action is similar to that on the primary side. As the floats (7) drop, the fuel pump forces fuel through the fuel inlet (1) and the filter screen (2). Fuel then passes through the fuel channel in the air horn, the small filter screen (9), and secondary needle seat (10) and into the fuel bowl. When the fuel level rises, the floats (7) rise and when the proper fuel level is reached in the carburetor bowl, the inlet needle closes, shutting off all fuel flow. A float balance spring (11) installed between the float hanger posts applies pressure on the float tang at the rear of the float arm to assist in closing the needle seat.

Both float systems are provided with float needle pull-clips (8 and 13), which pull the inlet needles from their seats by a drop in fuel level in the float bowls. This is to prevent the possibility of gum deposits causing a sticking condition.

Both sides of the carburetor are individually and internally vented by the channels shown at (6). These vents transmit the air pressure from beneath the air cleaner to the fuel in the float bowl. The amount of fuel metered by the carburetor is dependent upon the pressure in the float bowl. By locating the vents below the air cleaner, or internally, the carburetor automatically compensates for air cleaner restriction, since the same pressure causing air to flow will also be causing fuel to flow.

A cored passage in the float bowl, slightly above the normal fuel level, links the primary and secondary float bowls together. In this way, any abnormal rise in level on one side will be absorbed

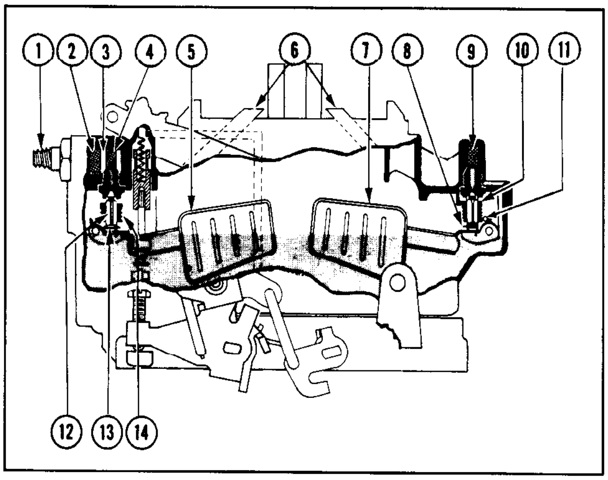

Fig. 8-89 Float System

by the other and will not seriously disrupt the operation of the engine.

IDLE SYSTEM (Fig. 8-90)

At small throttle openings (1) vacuum created by the main venturi is not sufficient to cause fuel to flow. Therefore, an additional system has been provided to furnish the proper mixture ratios required throughout the low speed range.

An adjustable idle system (2) in the primary side and a fixed idle system (14) 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 (2) 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 (14) 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 (3) into the main well, passing through the calibrated idle tube restriction (4) and idle tubes. Air joins this fuel at the calibrated air bleed at (5). The air/fuel mixture then passes through a calibrated restriction (9). More air is added at the secondary idle air bleeds (10) and passes down through the lower idle air bleeds (11) and secondary idle discharge holes (12). The resultant mixture is then discharged into the throttle bore from the idle needle holes (2).

As the throttle valves (1) are opened from the curb idle position, air entering the secondary idle discharge holes (12) gradually diminishes. When these holes become exposed to manifold vacuum they then become fuel discharge holes to meet the increased demand of the engine.

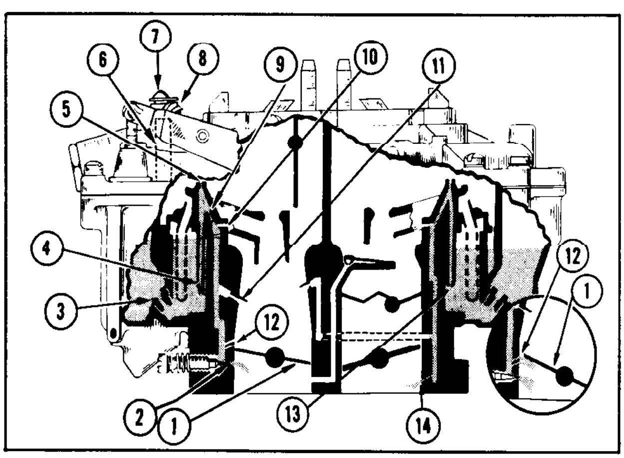

Fig. 8-90 Idle System

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 (11), 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 (2) 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 difficult hot weather starting or rough idling due to fuel vapor formation in the carburetor bowl, the model 4GC carburetor incorporates an external vent (6) which opens when the throttle valves are in the idle position. The external idle vent (6) is located in the center of the carburetor air horn on the primary side of the carburetor. It consists of an actuating tang (8) integral with the pump lever which operates a rubber valve (7) mounted over the vent hole. The rubber vent is attached to a spring steel arm.

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.

Carburetors, on cars equipped with factory installed air conditioning, incorporate an idle compensator to prevent stalling under prolonged "hot idle" conditions. (Fig. 8-91) The idle compensator consists of a bi-metal strip, a valve and a mounting bracket. It is mounted between the venturi on the secondary side. The valve seats on a hole drilled into the center throttle body attaching bolt hole leading to the underside of the primary throttle valves.

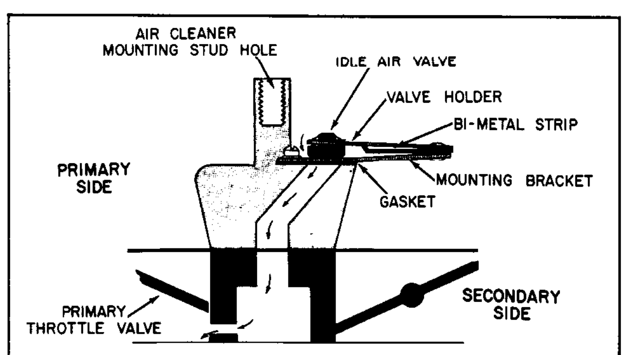

Fig. 8-91 Idle Compensator

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. 8-92)

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 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 (9) and secondary venturi (8), is transmitted to the tip of the main well tubes or main discharge nozzles (6). This vacuum draws fuel from the float bowl through the calibrated main metering jets (2) and into the main well tubes (3). After passing through the main well tubes (3) air joins the mixture at the main well bleeds (4). The mixture then passes from the tip of the nozzle (6) through the mixture passage (7), to the secondary venturi (8), 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 (4) 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.

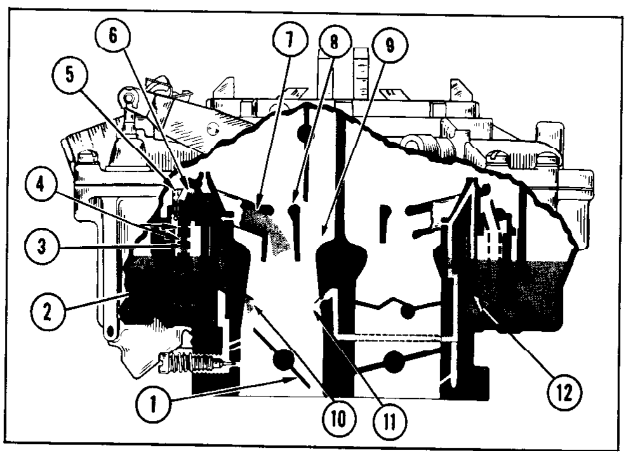

Fig. 8-92 Part Throttle System

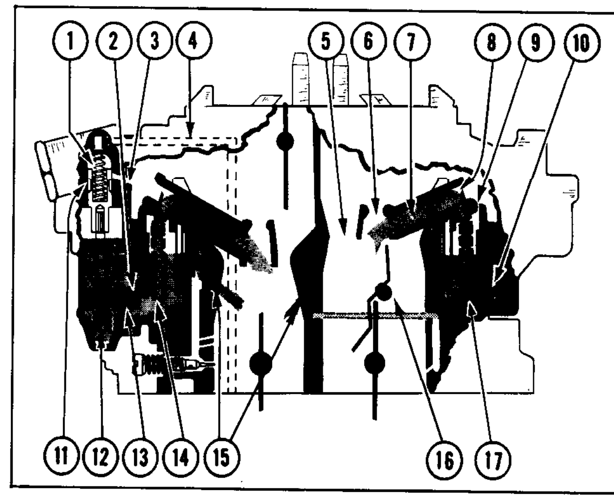

Fig. 8-93 Power System

As throttle opening increases, the lower idle air bleeds become part throttle feed nozzles in the main bore below the primary venturi (9). Discharge nozzles (11) are located in the venturi wall on the primary side, and are fed by the idle tubes (12) 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 m.p.h. 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. 8-93)

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 (11) in the air horn and a power valve (12) in the float bowl.

The power system is located on the primary side of the carburetor. The power piston vacuum channel (4) 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 (11) in its extreme up position. However, as the throttle valves are progressively opened, the vacum drops.

When the vacuum drops below approximately 9" hg., the calibrated spring (1) 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 (12). This permits additional fuel to flow from the float bowl through the calibrated power restriction (13) and into the main wells. The additional fuel supplements fuel already flowing through the main metering jets (2) and main well tubes, (14) (on the primary side) making the mixture being delivered to the manifold considerably richer than normal part throttle mixtures.

This power mixture continues to be supplied as long as the manifold vacuum remains below approximately 9" hg. When the manifold vacuum again increases sufficiently, the force of the power piston spring (1) is overcome and the piston is drawn up, returning the carburetor to the economical 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 (3). 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 (5) and secondary (6) venturi, drawing fuel from the float bowl through the calibrated main metering jets (10) into the main wells. This fuel then passes through the main well tubes (17) 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 (9) and is then drawn to the tips of the main well tubes (8). It then passes through the mixture passage (7) to the secondary venturi (6) and is discharged into the intake manifold.

The lower idle air bleeds (15) also supply fuel through out the power range in a manner similar to that described under the part throttle system operation.

The auxiliary valves (16) 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, wide-open-throttle operation.

PUMP SYSTEM (Fig. 8-94)

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. Since the throttle valves on the secondary side of the carburetor remain fully closed throughout part throttle operation, it is necessary to have only one accelerator pump located on the primary side of the carburetor.

A double spring pump plunger is used on the carburetor. The rates of compression of the top spring (7) and the bottom spring (4) are calibrated to insure a smooth sustained charge of fuel for acceleration. On the pump intake or up-stroke of the plunger, fuel from the float bowl passes through the pump filter screen (2), unseating the aluminum inlet ball (3), 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 down stroke of the pump plunger, the force of fuel in the pump well seats the inlet ball (3). The fuel is then forced through the discharge channel (1), unseating the pump outlet ball (11), and then discharges through the pump jets (9) into the air stream. At the end of the discharge, the outlet ball is returned to its seat by the spring (10), which prevents air being drawn back into the fuel channel during the intake stroke.

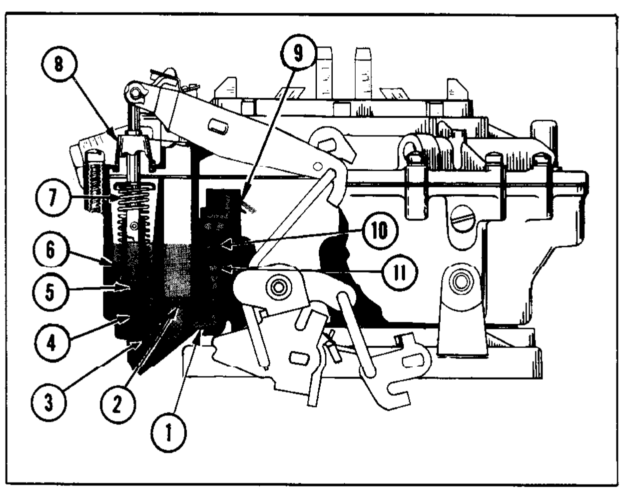

Fig. 8-94 Pump System

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 (5). Any build-up of fuel vapors in the pump well will rise, by-pass the ball and vent into the float bowl. This insures a solid charge of fuel beneath the plunger head for rapid acceleration. Without this feature, any vapor pressure build-up would evacuate the charge of fuel in the pump system, causing poor initial acceleration as well as difficult hot weather starting.

The carburetor also makes use of a pump plunger shaft dust boot (8) 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. 8-95)

The choke system permits the fast idle speed to be regulated independently of the choke valve. The system is fully automatic to insure proper starting and driving when the engine is cold, with the added advantage of a shorter choking period while maintaining fast idle speeds adequate for fast warm-up. It also allows easier re-starting on a partially warm engine.

Choking of the carburetor is necessary only on the primary side because the secondary throttle valves are locked in the closed position whenever the choke valve is even partially closed. This is accomplished by a secondary throttle shaft lockout lever, located on the choke housing side of the throttle body, and a slot on the fast idle cam. Whenever the choke valve is closed the lockout lever prevents opening of the secondary throttle valves. When the choke valve is wide open, the fast idle cam drops down so that the lockout lever clears the cam, permitting the secondary throttle valves to open.

The choke system is composed of a thermostatic coil (4), vacuum piston (2), offset choke valve (6), and fast idle cam (1). Operation is controlled by a combination of intake manifold vacuum, the offset choke valve, atmospheric temperature and exhaust manifold heat.

When the engine is cold, the thermostatic coil s calibrated to hold the choke valve closed. As .he engine is started, air velocity against the offset choke valve causes the choke valve to open against the torque of the thermostatic coil (4). Intake manifold vacuum is applied to the vacuum piston (2) through the vacuum channel (3) which also tends to open the choke valve. The choke valve is not balanced between the torque of the thermostatic coil against vacuum pull upon the choke piston and air velocity against the offset choke valve, causing a regulated air flow into the carburetor providing a richer mixture during the warm-up period.

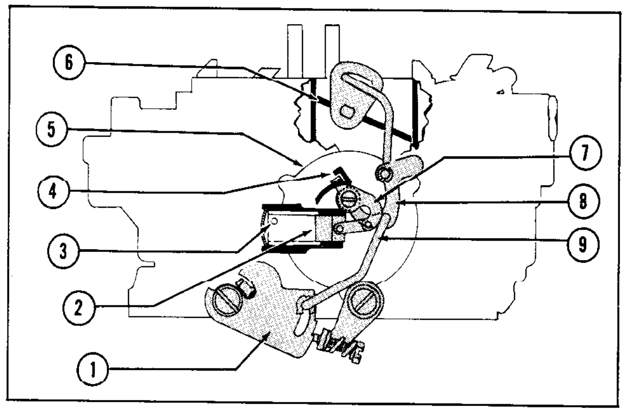

Fig. 8-95 Choke System

During warm-up, the vacuum piston modifies choke action to compensate for varying engine loads or acceleration. Any acceleration or increased load, decreases the vacuum applied on the choke piston. This allows the thermostatic coil to momentarily decrease choke valve opening providing the engine with a richer mixture for acceleration.

As the engine warms up, hot air from the exhaust manifold is drawn into the thermostatic coil housing (5). The hot air raises the temperature and causes the coil to slowly relax its tension allowing the choke valve to move gradually to the full open position.

To prevent stalling during the warm-up period it is necessary to run the engine at a slightly higher idle speed. This is accomplished by the fast idle screw which rests on the steps of the fast idle cam located next to the choke housing opposite the main throttle levers.

The fast idle cam is linked to the choke lever (7) by the fast idle cam rod (9) and the intermediate lever (8). This makes the movement of the fast idle cam directly related to the movement of the coil, allowing the choke valve to open sooner while maintaining increased idle r.p.m. until the choke coil is completely released.

While the automatic choke is in operation, the driver may wish to advance the throttle to the wide open position. Since this would decrease pull upon the vacuum piston (2), thereby closing the choke valve, it is necessary to provide increased carburetor air flow by opening the choke valve mechanically. To accomplish this, a tang on the fast idle cam is made to contact the throttle lever at wide open throttle position so as to sufficiently open the choke valve. This is also called a choke unloader and also serves to dechoke a flooded carburetor during starting operation whenever the engine is cranked with the accelerator held fully depressed.

REMOVAL AND INSTALLATION

1. Remove air cleaner.
2. Remove cotter key, which retains bellcrank, and retainer from bellcrank rod and remove bellcrank and rod as an assembly.
3. Disconnect fuel line from front of carburetor.
4. Disconnect choke pipe from choke cover.
5. Disconnect vacuum lines.
6. Remove four throttle body to intake manifold nuts and remove carburetor.
7. If equipped with positive crankcase ventilation inspect and clean the vacuum plate as necessary.

To install reverse removal procedure and make adjustments outlined under Adjustments (On Car). Torque carburetor to intake manifold nuts 11 to 14 ft. lbs.

CARBURETOR DISASSEMBLY

DISASSEMBLY OF AIR HORN (Fig. 8-96)

1. Mount the carburetor on Holding Fixture J-5923-B, or 30-14.
2. Remove the fuel inlet fitting and gasket, then remove the filter screen from the air horn.
3. Remove idle vent valve screw, shield and valve.
4. Remove the retainer from the upper end of the pump rod and disengage rod.

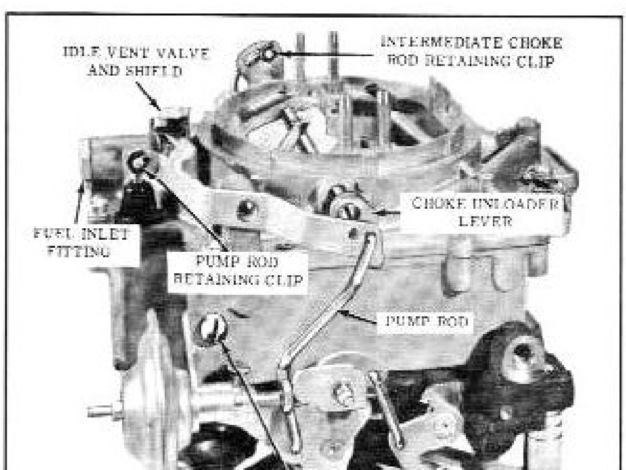

Fig. 8-96 4GC Carburetor

5. Remove the retainer from pump plunger shaft and unhook the shaft from pump arm.
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.
10. Remove the hinge pin from the primary float assembly, then slide the float and needle away from the power piston stem. (Fig. 8-97)
11. Remove primary float needle seat and gasket, using Tool BT-52. Remove the small filter screen from the needle seat bore.

    NOTE: The float needle and seat are matched and must be installed as an assembly.
12. Remove the hinge pin, 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 burrs around power piston bore due to staking and remove the power piston assembly by depressing the stem and allowing it to snap back into position. Remove the spring under the piston.

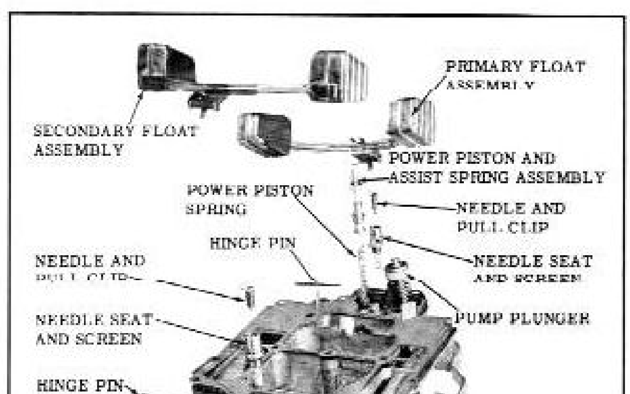

Fig. 8-97 Air Horn Assembly

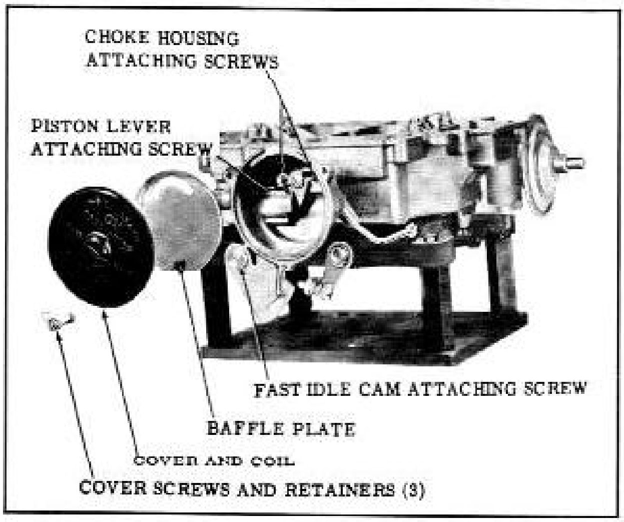

Fig. 8-98 Choke Assembly and Fast Idle Cam

15. Remove the pump plunger assembly by sliding the shaft through the rubber seal. Remove the rubber seal from the top side of the air horn casting.

DISASSEMBLY OF FLOAT BOWL

1. Remove the fast idle cam attaching screw. (Fig. 8-98)
2. Remove the three choke cover attaching screws and retainers, then remove the choke cover, gasket and baffle from the choke housing.
3. Remove the choke piston lever attaching screw, then remove the lever link and piston assembly from the choke housing.
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 return check by removing the attaching screw, and the rubber tee from the vacuum fitting on the throttle body.
7. Remove the three attaching screws and lock washers from the venturi cluster on the primary side, then remove the cluster and gasket. (Fig. 8-99)
8. Remove the three attaching screws and lockwashers from the venturi cluster on the secondary side, then remove the cluster and gasket.
9. If equipped with idle compensator, remove attaching screws then remove the idle compensator and gasket.

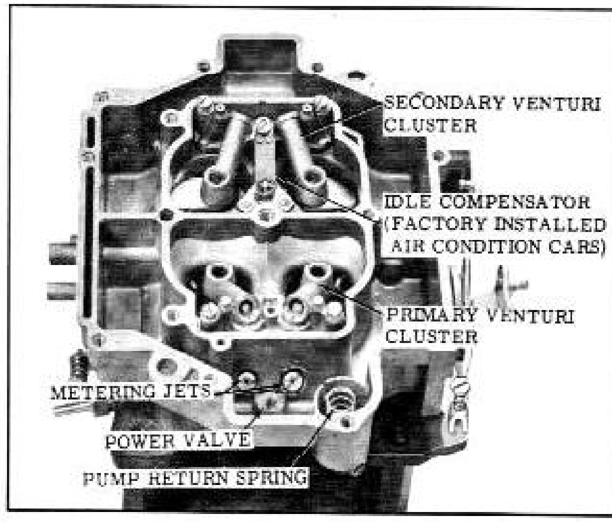

Fig. 8-99 Float Bowl Assembly

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 secondary 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. 8-100)
15. If it is necessary to clean or replace the small screen next to the pump plunger bore, remove the retainer ring and screen.

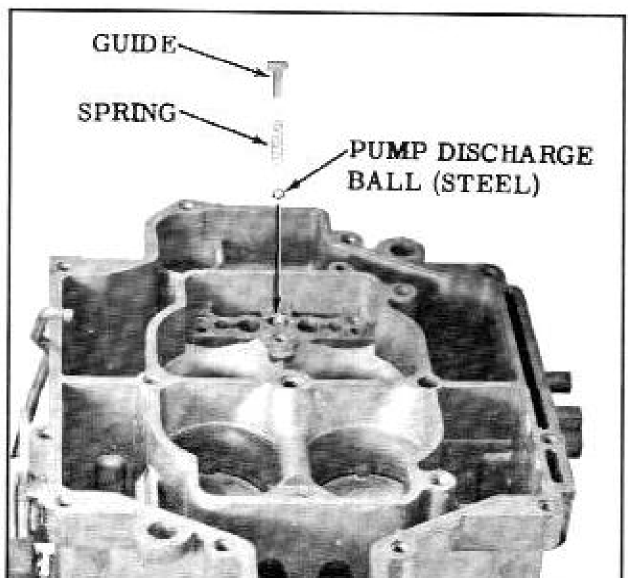

Fig. 8-100 Pump Discharge Spring Guide

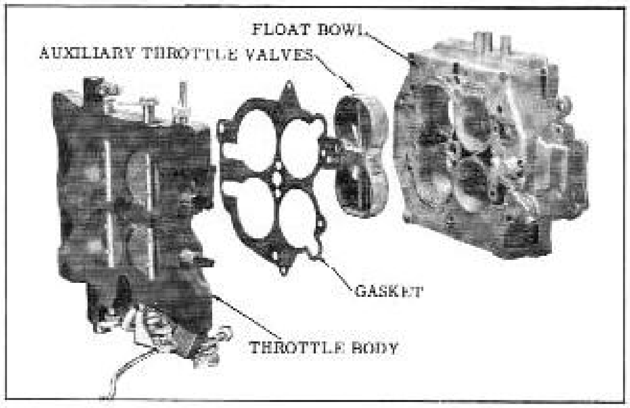

Fig. 8-101 Throttle Body and Auxilliary Throttle Valves

16. Invert the carburetor body and remove the four throttle flange attaching screws. Remove the throttle flange and gasket. (Fig. 8-101)

17. Remove the secondary auxiliary throttle valve assembly from the carburetor body.

DISASSEMBLY OF THE THROTTLE BODY

NOTE: No attempt should be made to remove the throttle valve or shaft from the throttle flange 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.

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 floats for dents or excessive wear at hinge pin holes.

2. Shake 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.

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 leather for cracks or creases. If the pump plunger leather is damaged, replace the pump plunger as a complete assembly.

9. Inspect the throttle flange assembly. Make sure the idle passages and vacuum channels are clean.

10. Inspect filter screens. If screens 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.

CARBURETOR ASSEMBLY

ASSEMBY OF THE 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.

ASSEMBLY OF THE FLOAT BOWL

1. With the carburetor body in the inverted position, install the auxiliary throttle valve assembly so that the calibrated spring operating pin is down. (Fig. 8-101)

2. Position the throttle body gasket on the float bowl so that all holes are properly aligned.

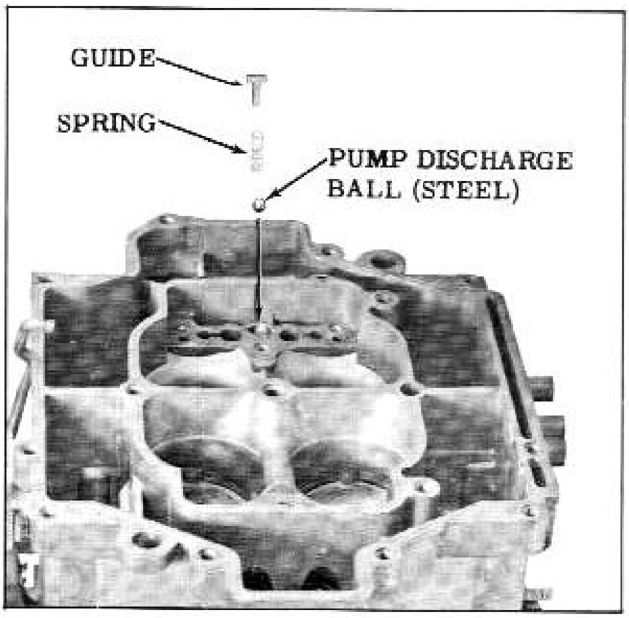

Fig. 8-102 Pump Discharge Spring Guide

3. Place the throttle body on the float bowl and install the four attaching screws. Tighten the center screw 9 to 10 ft. lbs. and the outer screws 3 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. 8-102)

6. Install the power valve and gasket, and the two primary main metering jets. (Fig. 8-103)

7. Install the two secondary main metering jets.

8. If equipped with idle compensator, install compensator and gasket and retain with 2 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.

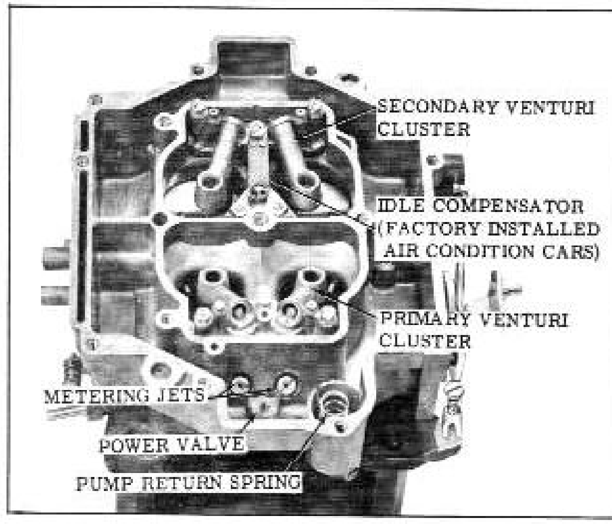

Fig. 8-103 Float Bowl Assembly

13. Install the choke housing gasket, intermediate choke lever and shaft with linkage, in the choke housing. (Fig. 8-104)

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.

ASSEMBLY OF THE AIR HORN (Fig. 8-105)

1. Install the power piston spring in the bore, then install the power piston in the air horn

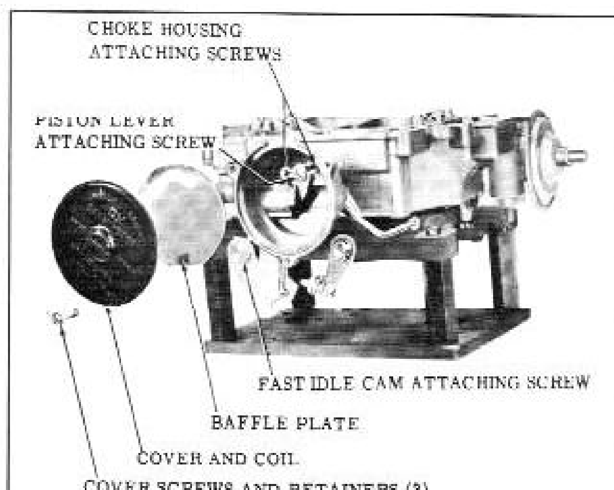

Fig. 8-104 Choke Assembly and Fast Idle Cam

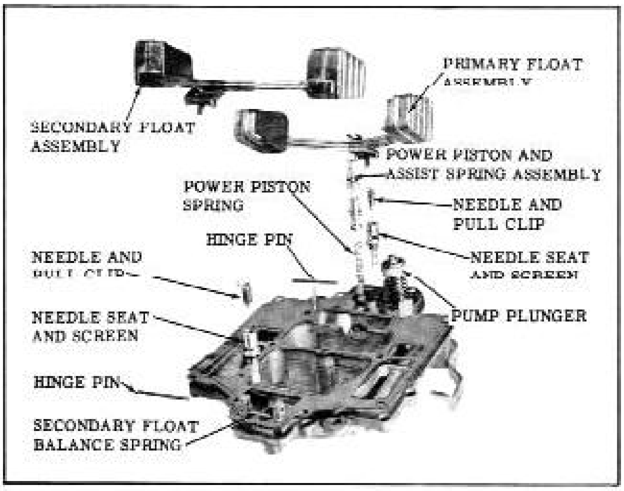

Fig. 8-105 Air Horn Assembly

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 screens attached using Tool BT-52.

6. Install secondary float assembly on the air horn, retaining in place with hinge pin. Make sure tang on rear of the float arms is over the balance spring.

7. Install primary float assembly with the center of the float arms on the power piston shaft under the vacuum assist spring retainer.

8. Make float adjustments as outlined under float adjustments.

FLOAT ADJUSTMENTS

FLOAT LEVEL AND ALIGNMENT PRIMARY SIDE

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.

1. With gasket in place and the air horn inverted, position gauge BT-6123 under the primary float as shown in Fig. 8-106.

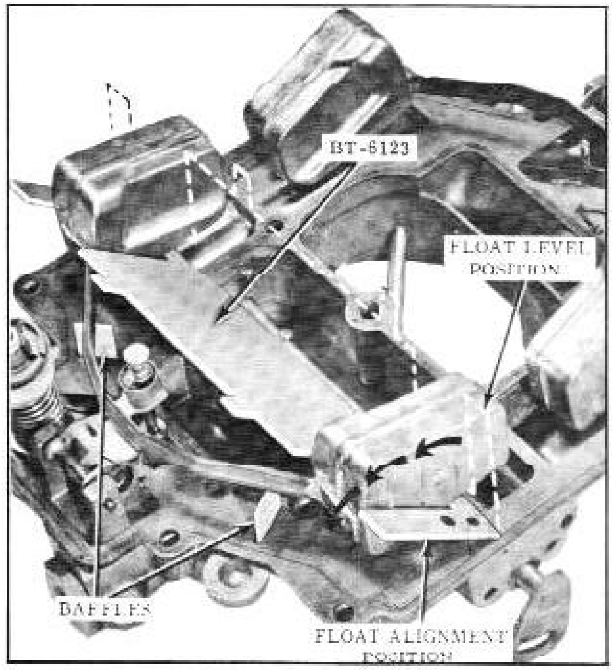

Fig. 8-106 Checking Primary Float Level and Alignment

2. With the gauge held vertical, the lower surfaces of each float pontoon should just touch the gauge. The lower surface of each pontoon should be parallel with the air horn.

3. If necessary to adjust, bend the float arm as indicated in Fig. 8-107.

4. To check float alignment rotate gauge as indicated in Fig. 8-106. Float pontoon should be centered in the gauge cutout.

5. If adjustment is necessary, bend the float arms horizontally as required. After bending float arms, recheck the float level.

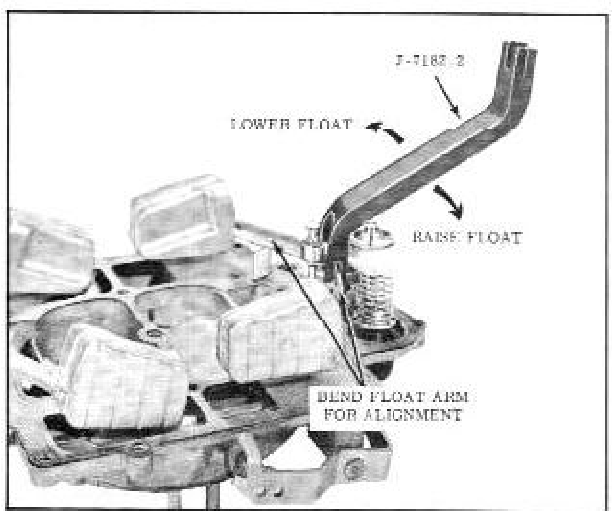

Fig. 8-107 Adjusting Float Level (Primary Shown)

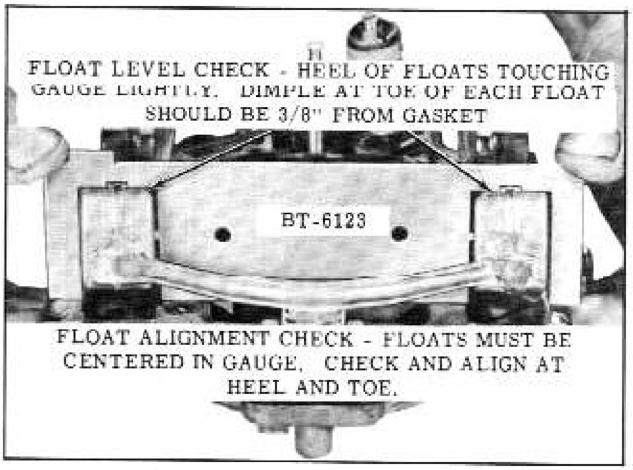

Fig. 8-108 Checking Secondary Float Level and Alignment

FLOAT LEVEL AND ALIGNMENT SECONDARY SIDE

1. With the gasket in place and the air horn inverted, position gauge as shown in Fig. 8-108.
2. The highest point of the float pontoons at the heel should just touch the gauge.
3. If necessary to adjust, bend the float arms at the center with Tool BT-6123.
4. Measure distance from the dimple on the side of each pontoon to the air horn gasket. Distance should be 3/8".
5. If an adjustment is necessary, bend each float arm as required, then recheck float level.
6. To check for float alignment, position gauge BT-6123 over the floats. With the gauge centered on the air horn, the float pontoons should be centered in the gauge.
7. If an alignment is necessary, bend the float arm to center the pontoon in the gauge. Recheck the float level.

VACUUM ASSIST SPRING ADJUSTMENT

1. Position the air horn as shown in Fig. 8-109, with the power piston retained in the up position.
2. Bounce the floats lightly and measure the distance from the gasket to the dimple on the side of the primary float.
3. If an adjustment is necessary, bend the tang under the vacuum assist spring and retainer as indicated in Fig. 8-110.

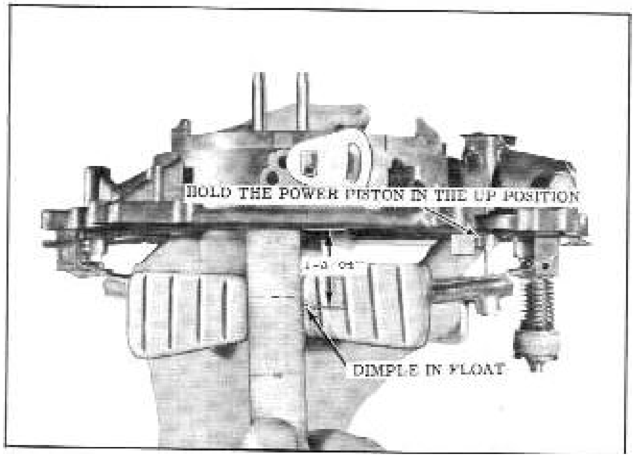

Fig. 8-109 Checking Vacuum Assist Spring Adjustment

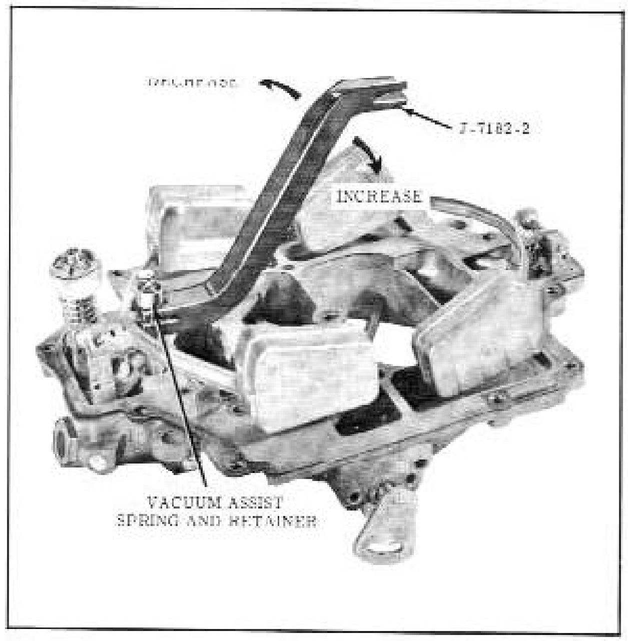

Fig. 8-110 Adjusting Vacuum Assist Spring

FLOAT DROP ADJUSTMENT PRIMARY AND SECONDARY

1. Position the air horn as shown in Fig. 8-111. Do not hold the power piston for this adjustment.
2. Bounce the floats lightly and measure the distance from the air horn gasket to the center

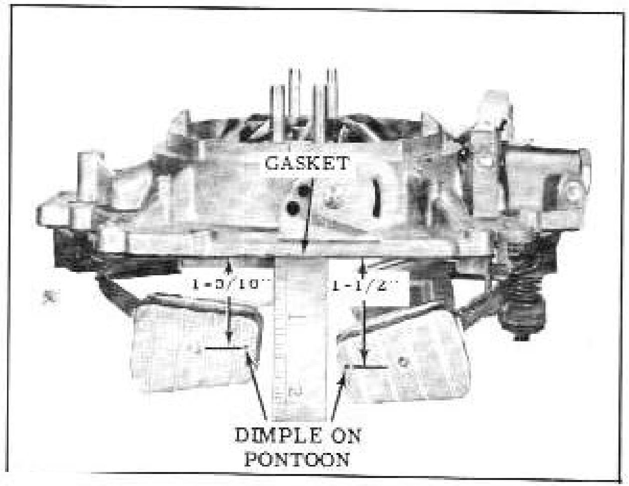

Fig. 8-111 Checking Primary and Secondary Float Drop

of the dimple on the secondary and primary float pontoons. Distance on the secondary should be 1 3/8". Distance on the primary should be 1-1/2".

3. If an adjustment is necessary, bend the tang at the rear of the float arms toward the needle and seat to decrease the setting, away from the needle and seat to increase the setting.

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 screen, gasket and fitting in the air horn.

8. Install the choke unloader lever on the choke shaft.

9. Install the intermediate choke rod into the choke lever.

10. Adjust intermediate choke rod and choke coil as outlined under ADJUSTMENTS (ON OR OFF THE CAR).

11. Install the rubber tee on the vacuum fitting in the throttle body.

12. Adjust fast idle cam rod, secondary lockout, secondary throttle lockout, pump rod, and unloader as outlined under ADJUSTMENT (ON OR OFF CAR).

ADJUSTMENTS
(On or Off the Car)

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.

1. With the choke cover and baffle removed position the fast idle screw on the high step of the fast idle cam. Raise the intermediate choke lever to its full up position then push lightly on the end of choke piston to remove all lash in the linkage, check to see if the choke piston is flush to 1/32" out of the choke piston bore. (Fig. 8-112)

2. Bend the intermediate choke rod if necessary to correctly position choke piston.

3. Position baffle in choke housing, then install cover gasket, cover and coil assembly, and three screws and retainers.

4. Rotate cover counterclockwise until coil picks up tang on piston linkage. Continue rotating cover until scribe line on cover is on index. (Fig. 8-113)

5. Tighten the three cover attaching screws.

FAST IDLE CAM ROD ADJUSTMENT

In addition to the intermediate choke rod and choke coil adjustment, it is necessary to adjust

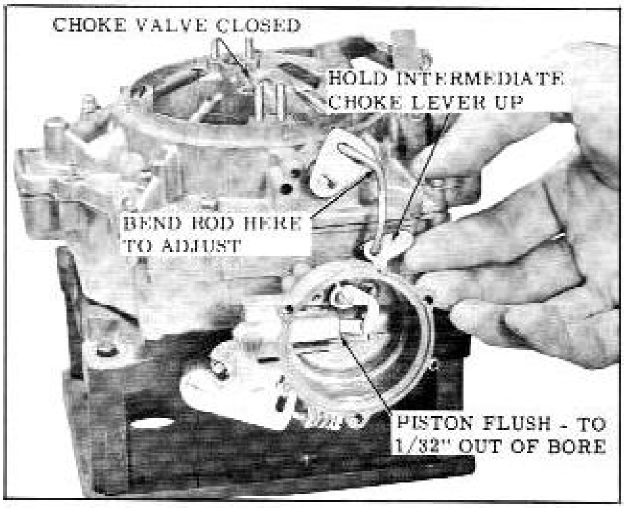

Fig. 8-112 Intermediate Choke Rod Adjustment

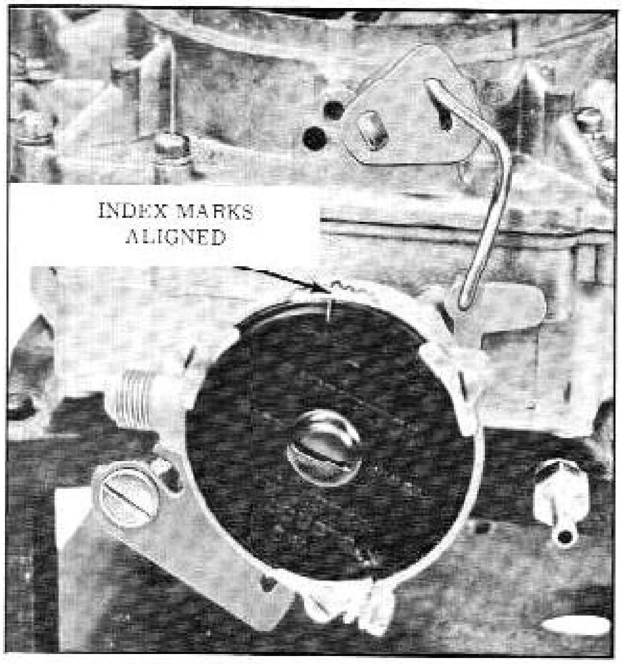

Fig. 8-113 Choke Coil Setting

the fast idle cam rod to the cam. This insures proper positioning of the fast idle cam when the choke coil is in operation.

1. Turn in the fast idle screw until it just contacts the middle step of the fast idle cam.

2. With the shoulder of the highest step of the fast idle cam held against the fast idle screw, hold the intermediate choke lever in the extreme up position. The intermediate choke rod and the fast idle cam rod must be at the upper limit of travel in the slot to remove all travel. Check the clearance between the top edge of the choke valve and the dividing wall of the air horn. Check clearance with small end of gauge BT-68. Clearance should be .053". (Fig. 8-114)

3. If necessary to adjust, bend the fast idle cam rod (lower rod).

SECONDARY THROTTLE LOCK-OUT ADJUSTMENT

The secondary throttle lock-out 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.

1. Measure the clearance between the lock-out tang and the top edge of the slot in the fast idle cam. The clearance should be .015" ± .005". (Fig. 8-115)

2. If adjustment is necessary, bend the tang sideways using Tool BT-18 until the proper clearance is obtained.

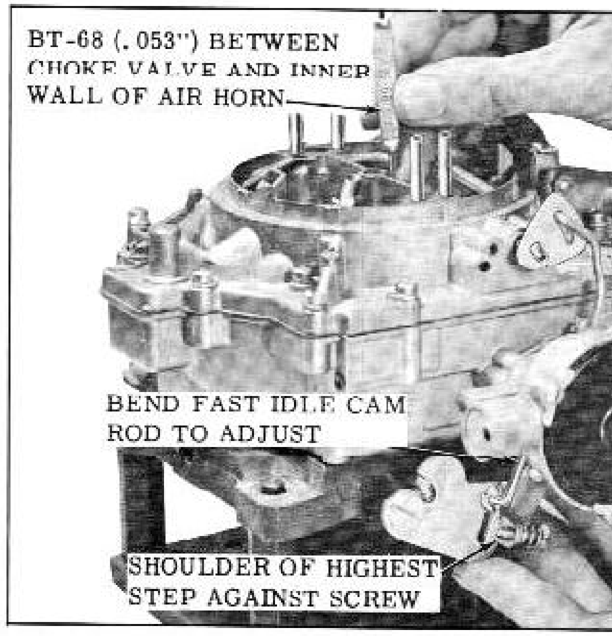

Fig. 8-114 Fast Idle Cam Rod Adjustment

SECONDARY THROTTLE CONTOUR CLEARANCE ADJUSTMENT

The secondary throttle contour clearance adjustment, which is performed after the lock-out adjustment, actually times the unlocking of the secondary throttle valve in relation to engine temperature.

1. Hold the choke valve in the wide open position so that the secondary lock-out tang is positioned over the fast idle cam, then measure the clearance between the tang and the fast

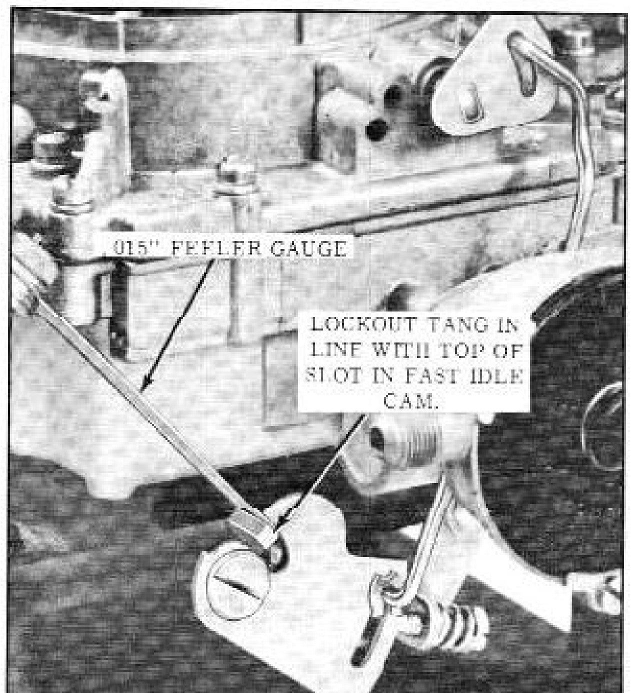

Fig. 8-115 Secondary Throttle Lock-Out Adjustment

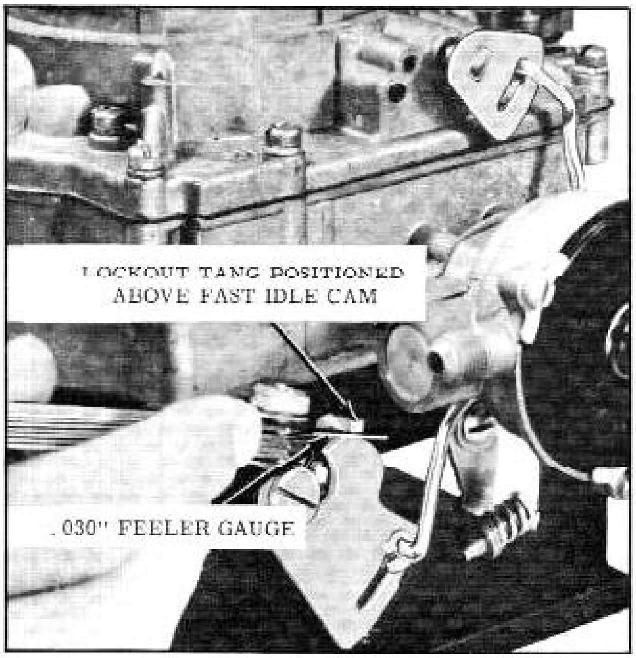

Fig. 8-116 Secondary Throttle Contour Clearance Adjustment

idle cam. The clearance should be .030" ± .010". (Fig. 8-116)

2. If adjustment is necessary, allow the choke to close so that the tang is again in the slot of the fast idle cam, then use Tool BT-91 to bend the tang straight up or down as required for proper clearance.

PUMP ROD ADJUSTMENT

1. 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. It should be 1-1/64". (Fig. 8-117)

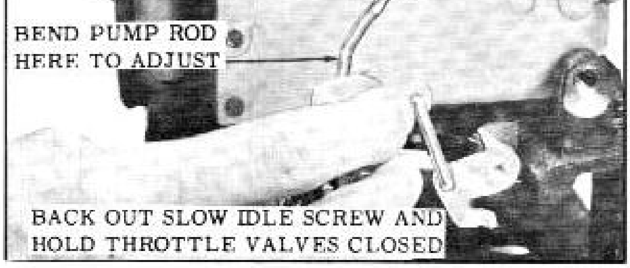

Fig. 8-117 Pump Rod Adjustment

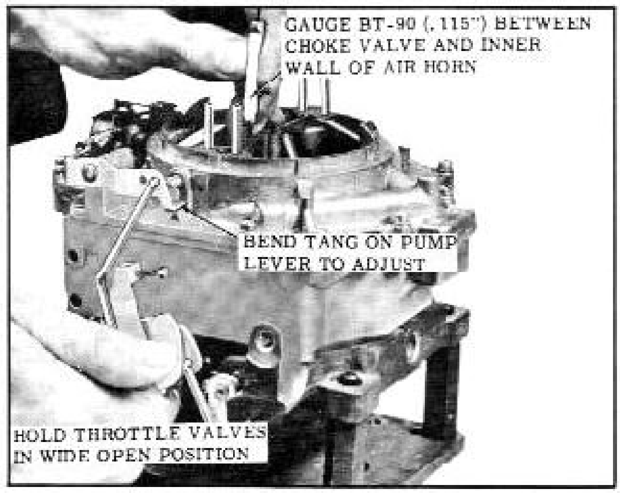

Fig. 8-118 Unloader Adjustment

2. If adjustment is necessary, bend the pump rod using Tool BT-18.

3. Operate the pump rod several times to be sure the movement is free.

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.

1. Be sure the pump rod adjustment is correct.

2. While holding the throttle lever in the wide open position (with carburetor off car), or with accelerator pedal completely depressed (with carburetor on car), check the clearance between the top edge of the choke valve and the dividing wall. The correct clearance is .115" and can be checked with gauge BT-90. (Fig. 8-118)

3. If necessary, bend the small tang on the pump lever with Tool BT-91 to obtain the correct dimension.

   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.

SECONDARY ACTUATING LEVER ADJUSTMENT

1. Loosen screw and position throttle return check out of way.

2. Back out the fast idle adjusting screw until the throttle valves are fully closed. Be sure the fast idle screw is not resting against the fast idle cam.

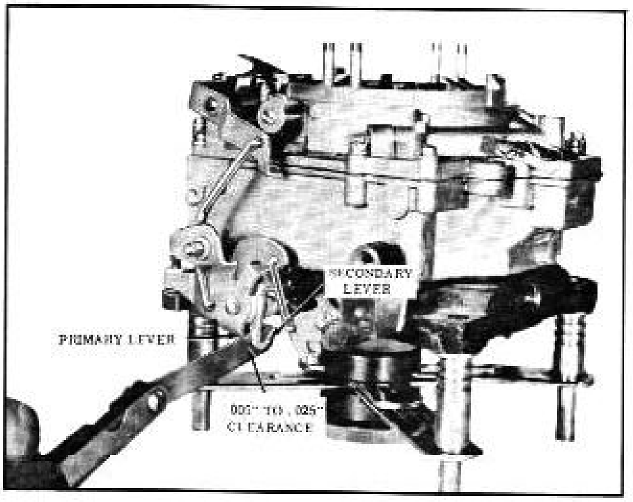

Fig. 8-119 Secondary Actuating Lever Adjustment

3. Remove slack from linkage and insert a feeler gauge between the actuating lever and the primary lever. (Fig. 8-119)

4. Clearance should be between .005" and .025".

5. To adjust, open the throttle valves and bend the actuating tang with Bending Tool BT-18.

6. Reposition throttle return check.

ADJUSTMENT (ON CAR)

There are six adjustments that must be made with the carburetor mounted on the engine. They are: Carburetor Lever to Auxiliary Bellcrank Link Clearance Adjustment, Slow Idle Adjustment, Fast Idle Adjustment, Throttle Return Check Adjustment and Atmospheric Idle Vent Adjustment and Accelerator Pedal Height Adjustment.

ADJUST CARBURETOR LEVEL TO AUXILIARY BELLCRANK LINK

a. Measure clearance as shown in Fig. 8-120 (Hydra Matic) or Fig. 8-121 (Syncro-Mesh) with feeler gauge. To obtain proper clearance of .020"-.040" remove carburetor lever to auxiliary bellcrank link and bend. Reinstall link and recheck clearance. Link can be installed up or down.

SLOW IDLE ADJUSTMENT

(Air Cleaner Removed)

Engine must be at operating temperature. Throttle return check must be positioned out of way when making the slow idle speed adjustment on hydramatic equipped cars.

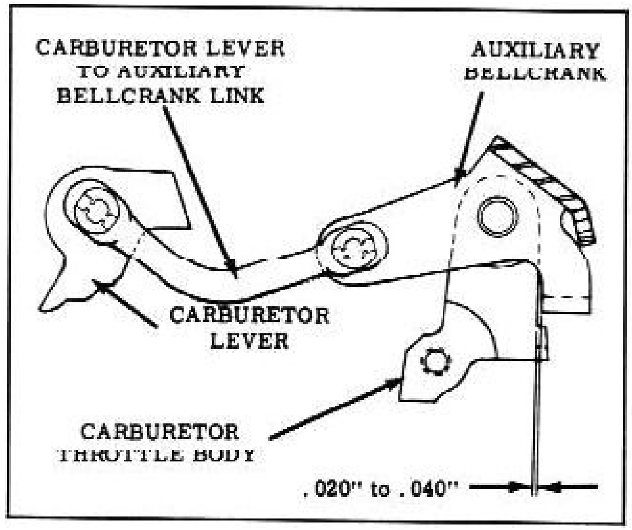

Fig. 8-120 Checking 4GC Carburetor Link (HMT)

SLOW IDLE SPEED

TRANSMISSION	GEAR	R.P.M.
Hydra-Matic	Drive	500
Syncro-Mesh	Neutral	550

Factory Installed Air Conditioning - Air Conditioning turned "OFF", Idle Compensator held closed.

Dealer Installed Air Conditioning (Without Idle Compensator) - Air Conditioning turned "ON".

After the idle r.p.m. is stabilized, turn in or out each idle mixture adjusting needle screw until the smoothest possible idle is obtained. This normally is accompanied by a higher manifold vacuum reading and/or an increase of idle r.p.m. Then, turn out (rich) each needle 1/4 turn, at

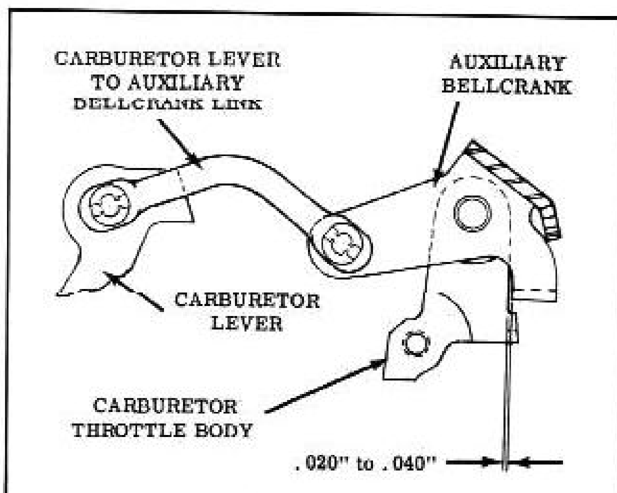

Fig. 8-121 Checking 4GC Carburetor Link (SMT)

which time both the idle vacuum and r.p.m. will drop off slightly. This adjustment will prove to be correct for all normal requirements.

NOTE: Idle speed and mixture should be re-checked with air cleaner installed.

When setting the idle speed and mixture on cars with an idle compensator (factory installed air conditioning only) make sure the idle compensator stays closed by holding it down. If the idle speed increases when the air cleaner is installed, do not reduce the idle speed setting since the idle compensator is open. If the speed decreases, re-adjust idle to correct r.p.m.

FAST IDLE ADJUSTMENT

When the engine is cold and the choke valve is partially closed, it is necessary that the engine r.p.m. at idle be higher than normal to prevent stalling. This adjustment, if correct, will assure proper engine r.p.m. during the warm-up period.

1. Open throttle valves and rotate the fast idle cam so that the fast idle screw is resting on the high step of the cam.

2. With the engine running at operating temperature, transmission selector lever in neutral and the parking brake applied, adjust the fast idle screw to obtain an engine speed of 1600 r.p.m.

   NOTE: Any time the fast idle is changed it will be necessary to adjust the throttle return check. (Hydra-Matic equipped cars only)

THROTTLE RETURN CHECK ADJUSTMENT (HYDRA-MATIC EQUIPPED CARS ONLY)

The throttle return check is designed to open the throttle valves to increase engine speed when engine vacuum drops if the engine loads up and starts to stall. It also acts to retard throttle closing when the driver suddenly takes his foot off the accelerator pedal.

The vacuum to the throttle return check has an air bleed above the throttle valves to give faster response to the return check on decelleration.

1. Be sure the fast idle adjustment has been made, then shut off the engine.

2. Rotate the fast idle cam so that the fast idle screw rests on top of the highest step of the fast idle cam.

3. Measure the clearance between the contact screw and the contact on the throttle lever. The clearance should be .020''.

4. If adjustment is necessary, adjust the throttle return check contact screw using two wrenches.

   NOTE: Any time the fast idle is changed, it will be necessary to readjust the throttle return check.

ATMOSPHERIC IDLE VENT ADJUSTMENT

The atmospheric idle vent is designed to vent any vapor formed in the float bowl during slow idle operation. It is opened by a tang on the pump lever whenever the throttle valves are in the slow idle position.

1. Rotate fast idle cam until the fast idle screw is resting on the highest step of the fast idle cam. (1600 r.p.m.) The idle vent valve should just be closed.

2. If necessary to adjust, bend the idle vent tang on the pump lever, using Tool BT-69.

3. Run the engine on slow idle. The idle vent must be open.

ACCELERATOR PEDAL HEIGHT ADJUSTMENT

The pedal height is adjusted by using Tool BT-33-2. Place the tool in position (with the hole nearest the pin) over the T.V. bell crank pin. Swing the gauge in an arc and adjust the length of the accelerator lever rod until the end of the gauge just contacts the closest surface of the cowl.

ENGINE PERFORMANCE AND DIAGNOSIS

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IGNITION TIMING	9-2	TORQUE SPECIFICATIONS	9-4

To maintain the most satisfactory performance of the engine, it is recommended that every 10,000 miles, the following maintenance be performed; clean, check and gap spark plugs. Check and adjust if necessary, ignition points, timing, idle speed and fuel mixture. After work is performed, the car should be road tested.

Spark Plug Gap . . . . .040''
Ignition Timing 2 Bbl. . 5° BTDC at 850 r.p.m.
4 Bbl. $7\text{-}1/2^{\circ}$ BTDC at 850 r.p.m.
Dwell Angle . . . . 30°
Idle Speed . . . . H.M.T. 500, S.M.T. 550

For diagnosis of abnormal engine operating conditions consult the condition and cause chart.

SPARK PLUGS

1. Remove foreign material from around spark plugs and remove plugs.
2. Clean exterior of plugs and inspect for cracks or excessively burned electrodes.
3. Clean serviceable plugs with an abrasive type cleaner, file center electrode flat and gap to .040'' with a round wire feeler gauge. (Fig. 9-1)

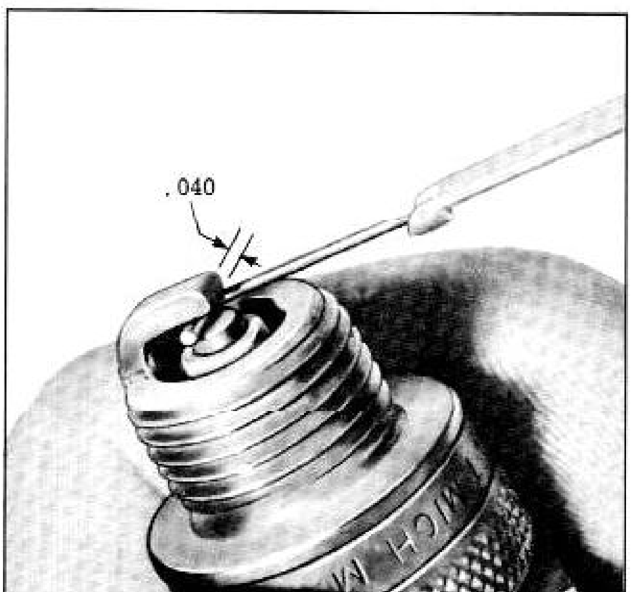

Fig. 9-1 Adjusting Spark Plug Gap

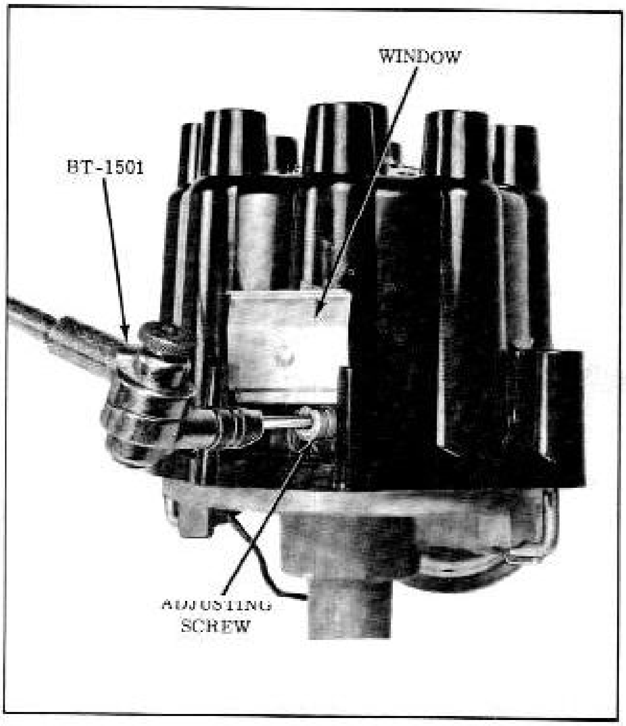

Fig. 9-2 Adjusting Dwell

4. Place a coating of 980131 lubricant on plug threads and install with a new gasket by turning in approximately 3 turns by hand, then torque 12-17 ft. lbs.

IGNITION POINTS

1. Inspect contact points for excessive burning and replace if necessary. Clean, etc.
2. Remove scale from contact points with a fine cut contact point file. Do not attempt to remove all roughness. File contacts flat.
3. Apply a thin film of Delco-Remy cam and ball bearing lubricant or equivalent to the breaker cam and the contact set rubbing block.

DWELL ANGLE

1. With the engine idling at 550 r.p.m. for S.M.T. and at 500 R.P.M.H.M.T., use Tool BT-1501 and adjust the dwell to 30°.

IGNITION TIMING

1. The timing marks are located on the engine front cover, 0°, 5° and 10°. (Fig. 9-3)
2. Disconnect the vacuum line from the distributor and cover the end.

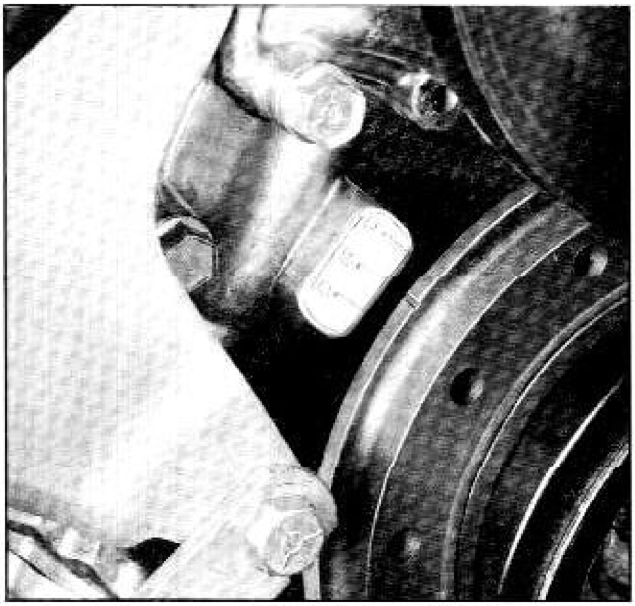

Fig. 9-3 Ignition Timing

3. Increase engine speed to 850 r.p.m. and adjust timing to 5° by loosening the distributor clamp and rotating the distributor. Then tighten clamp bolts.

   NOTE: If a tuned engine detonates with this setting, the cause is low octane fuel or carbon build-up in the combustion chamber. If these factors are not corrected, the timing should be set at $2\text{-}1/2^\circ$ (midway between 0° and 5° marks) before top dead center at 850 r.p.m. In areas that have an extra high octane, the timing may be advanced beyond 5° providing spark knock is not encountered.

4. Remove cover from vacuum line and reconnect to distributor.
5. Adjust idle speed.

	SYNCRO-MESH		HYDRA-MATIC	
	Gear Position	RPM	Gear Position	RPM
With * Air Conditioning	N	550	"DR"	550
Without Air Conditioning	N	550	"DR"	500

*With A/C off and "Carb-Airator" Valve closed

ENGINE CONDITIONS	POSSIBLE CAUSES
Hard Starting	Fuel System, Timing, Distributor, Battery, Starter, Ignition Coil, Wiring
Rough Idle	Carburetion - Spark Plugs, Engine Valves Leaking Intake Manifold
Stalls On Idle	Idle Speed, Fuel Mixture, Choke, Intake Manifold Leak
Poor Acceleration	Timing, Fuel System, Compression
Cuts Out On Acceleration	Carburetion, Ignition System
Miss On Acceleration	Spark Plugs, Points, Carburetor, Wiring Condensor
Steady Low Top Speed	Fuel Lines, Fuel Filter, Fuel Pump, Gas Tank Vent, Timing, Distributor, Air Filter, Low Compression, Exhaust System Clogged, Lifter
Surges On Steady Throttle	Fuel Line, Fuel Filter, Gas Tank Vent, Fuel Pump, Carburetion
High Speed Miss	Spark Plugs, Ignition Points, Fuel System, Valve Mechanism, Ignition Coil, Wiring
Valve Noise	Incorrect Oil Level In Crankcase, Lifters Dirty, Worn Rocker Arms, Worn Lifters, Oil To Rocker Arms Restricted

SPECIFICATIONS

CHOKE SETTING (Hydra-Matic)	Index
(Syncro-Mesh)	1 Notch Lean
DISTRIBUTOR (1110975)	
Cam Angle Range	28° to 32° (Adjust to 30°)
Contact Point Opening	.016"
Contact Arm Spring Tension	19 to 23 oz.
Condenser Capacity	.18 to .23 Mfd.
Vacuum Advance Per Inch of Vacuum	
5" to 7"	Start
15" to 17"	(Max.) 12°
Mechanical Advance Per Distributor r.p.m.	
400 r.p.m.	0° to 2°
1000 r.p.m.	5° to 7°
2100 r.p.m.	11° to 13°
Firing Order	1-8-4-3-6-5-7-2
IGNITION TIMING -- 850 R.P.M. - VACUUM DISCONNECTED	
Normal Setting	4 Bbl-7-1/2°, 2 Bbl-5° BTDC
SPARK PLUGS	
Make	AC
Type	4 Bbl-45FF, 2 Bbl-46FF
Body	13/16" Hex
Spark Gap	.040"
Thread	14MM
BATTERY SPECIFIC GRAVITY	
Half Charge	1.215 @ 80°
Full Charge	1.260-1.280 @ 80°
IGNITION RESISTOR (IN HARNESS)	1.75-1.85 Ohms.
COIL	
Primary Resistance	1.28 to 1.42 Ohms.
Secondary Resistance	7200 to 9500 Ohms.
GENERATOR	
Charging Rate Cold - at 14.0 Volts, 2670 r.p.m.	35 Amps.
Charging Rate Hot	(Controlled by Current Regulator)
Field Current Draw at 12 Volts, 80°F	1.69 to 1.79 Amps.
Brush Spring Tension	28 Oz.
GENERATOR REGULATOR (MODEL 1119253)	
Cut Out Relay	
Air Gap	.020"
Point Opening	.020"
Closing Voltage	11.8 to 13 Volts (Adjust to 12.8 Volts)
Voltage Regulator	
Air Gap	.075"
Voltage Setting	Refer to Electrical Section
Current Regulator	
Air Gap	.075"
Current Setting	32 to 37 Amps. (Adjust to 35 Amps.)

NOTE: Operating temperature shall be assumed to exist after not less than 25 minutes of continuous operation with a charge rate of 1 to 10 amperes.

TORQUE SPECIFICATIONS

APPLICATION	TORQUE
Battery Hold-Down Nuts	1.5 to 2.5 ft. lbs.
Connector Strap to Starting Motor Bolt	6 to 8 ft. lbs.
Distributor Clamp to Front Cover Bolt	11 to 14 ft. lbs.
Distributor Air Baffle Nut	6 to 8 ft. lbs.
Generator to Generator Bracket Nut	14 to 17 ft. lbs.
Generator Bracket Brace and Battery Ground Strap to Head Nut	25 to 30 ft. lbs.
Generator to R.H. Exhaust Manifold Bolts	14 to 17 ft. lbs.
Generator to Generator Brace Bolt	14 to 17 ft. lbs.
Generator Bracket and Brace to Timing Chain Cover Bolt	30 to 35 ft. lbs.
Generator Terminal Nuts	2 to 4 ft. lbs.
Ignition Coil to Intake Manifold Bolts	20 to 25 ft. lbs.
Spark Plugs	12 to 17 ft. lbs.
Starter Motor to Cylinder Block Bolts	30 to 35 ft. lbs.
Ignition Coil Terminal Nuts	15 to 20 oz. in.
Intake Manifold to Head Bolts	25 to 30 ft. lbs.
Exhaust Manifold to Head Bolts and Nuts	18 to 24 ft. lbs.

SYNCRO-MESH

AND

CLUTCH

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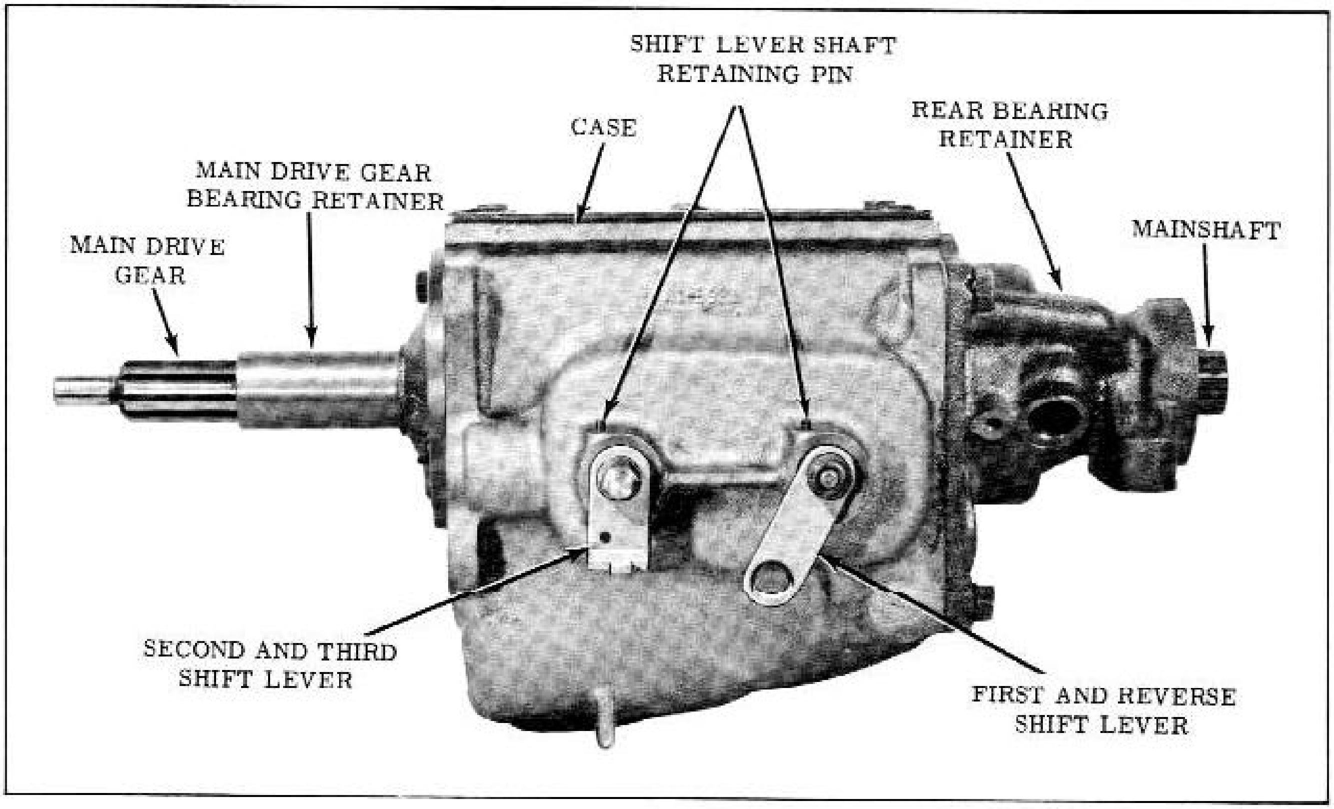

Fig. 10-1 Synchro-Mesh Transmission

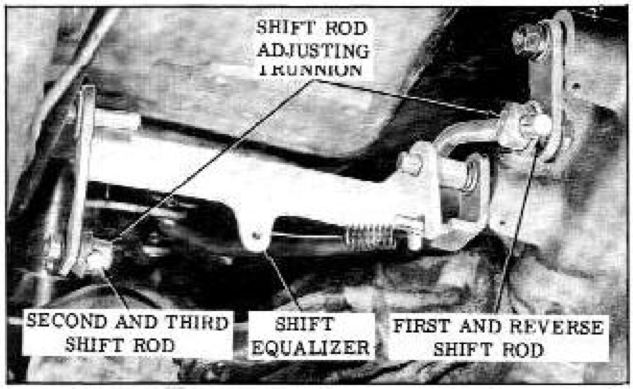

Fig. 10-2 Adjusting Shift Linkage

MAINTENANCE RECOMMENDATIONS

Clean dirt from around filler plug, and check the lubricant level every 2000 miles. If level is low, inspect the transmission for leaks and correct any leaks found. Fill the transmission to the level of the filler plug opening with Syncro-Mesh Transmission Lubricant Part No. 582840. Seasonal change of the Syncro-Mesh transmission is not recommended. The capacity of the transmission is 2-1/2 pints. It is important that the shift linkage be properly adjusted.

DESCRIPTION

A three-speed Syncro-Mesh transmission (Fig. 1) is used as standard equipment. This transmission incorporates all helical gears which are machined from drop forged steel gear blanks. The shafts are machined from high grade steel and heat treated.

The main drive gear is supported by a heavy duty ball bearing at the front end of the transmission case. The main drive gear shaft is piloted at its front end in an oil impregnated bushing in the engine crankshaft. The front end of the mainshaft is piloted in a set of roller bearings set into the hollow end of the main drive gear and the rear end is carried by a ball bearing mounted in the rear of the case.

The countershaft cluster gear is carried on roller bearings at both ends while thrust is taken by thrust washers located between each end of the counter gear and the case. Retaining washers and a tubular spacer maintain the positioning of the counter gear bearing rollers.

The reverse idler gear is carried on ball indented bronze bushings and a reverse idler gear shaft.

Gearshifting is manual through a concentric steering column gearshift mechanism to the transmission shift lever shafts located on the side of the transmission. Shifting is accomplished by two yokes which directly engage the gears to be shifted.

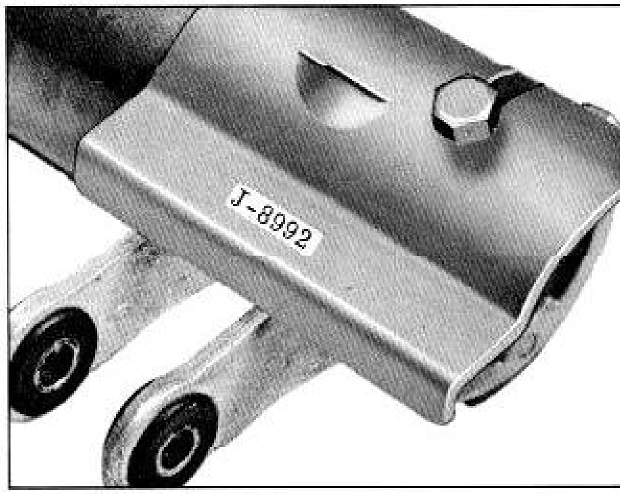

Fig. 10-3 Alignment of Shift Levers

The Syncro-Mesh transmission gear ratios are as follows:

First Gear	2.571:1
Second Gear	1.550:1
Third Gear	1:1
Reverse Gear	3.489:1

ADJUSTMENTS

SHIFT LINKAGE (FIG. 10-2)

1. Loosen trunnion nuts at bottom of steering column to equalizer and shift lever rods.
2. Place hand selector lever, and shift levers on transmission in neutral position.
3. Position shift levers in steering column in alignment with each other as well as horizontal, using tool J-8992. (Fig. 10-3)
4. Tighten trunnion nuts.

REAR OIL SEAL

Removal

1. Disconnect propeller shaft.
2. Remove companion flange.
3. Using an awl, puncture seal and pry out of housing. (Fig. 10-4)
4. Wash counterbore with cleaning solvent and inspect for damage.

Installation

1. Coat new seal, outside diameter with Permatex #2 or equivalent and using Tool J-5154, drive seal into counterbore until seated.
2. Install companion flange, torque bolt 30-45 ft. lbs.
3. Connect propeller shaft. Torque "U" bolt nuts 14-18 ft. lbs.

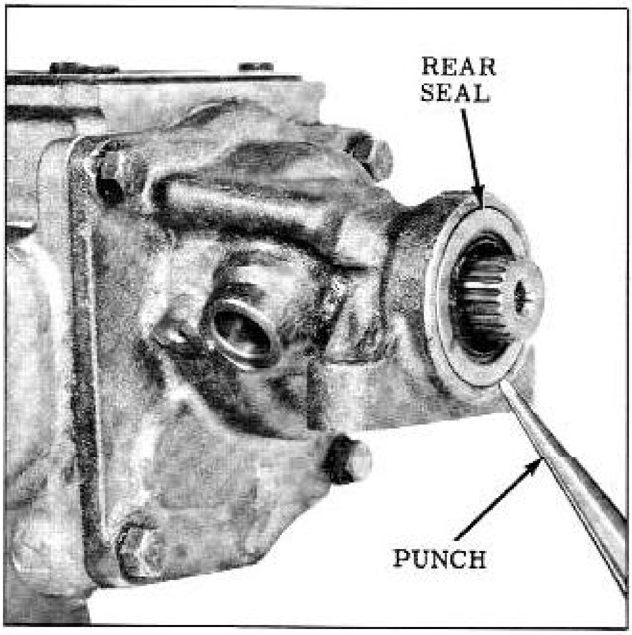

Fig. 10-4 Removing Rear Seal

SHIFT LEVER SHAFT SEAL

Removal

1. Disconnect transmission shift linkage from shift lever.
2. Remove shift lever attaching nut, washer, and lever from shift lever shaft.
3. Puncture metal edge of seal with a prick punch and pry the seal out of the case. (Fig. 10-5)
4. Clean seal bore in case and shift lever shaft.

Installation

1. Coat new seal outside diameter with Permatex #2 or equivalent. Coat seal lip with Synthetic Seal Lubricant. With a 11/16" socket, drive seal into case until flush.

SPEEDOMETER DRIVEN GEAR

1. Disconnect speedometer cable from gear. Loosen lock plate to case bolt and remove lock plate from slot in gear.
2. Pull gear from rear bearing retainer.

When installing, use a new "O" ring.

Removal (Transmission Assembly)

1. Disconnect shift rods from levers.
2. Disconnect the speedometer cable from speedometer driven gear.
3. Disconnect propeller shaft from transmission rear companion flange.

NOTE: Do not let front section of propeller shaft fall loose. Move to side and tie to exhaust pipe to avoid damage to center joint ball and seat.

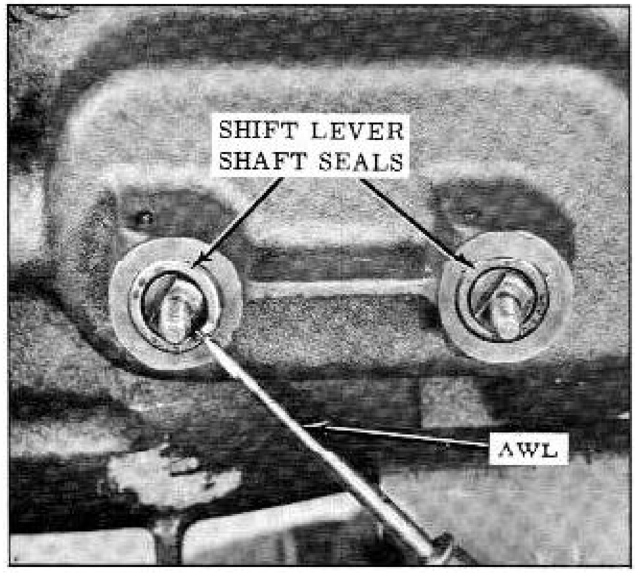

Fig. 10-5 Removing Shift Lever Shaft Seal

4. Support rear of engine with a high floor stand.
5. Remove rear transmission mount and support bar. (Fig. 10-6)
6. Remove the 4 transmission to clutch housing bolts.
7. Slide the transmission straight back until the main drive gear is free of splines in the clutch disc.

Installation (Transmission Assembly)

1. Inspect clutch pilot bushing and lubricate with wheel bearing grease.
2. Install 2 guide pins in clutch housing to guide the transmission. One in the upper left bolt hole, 3" long and one in the lower right, 4" long.

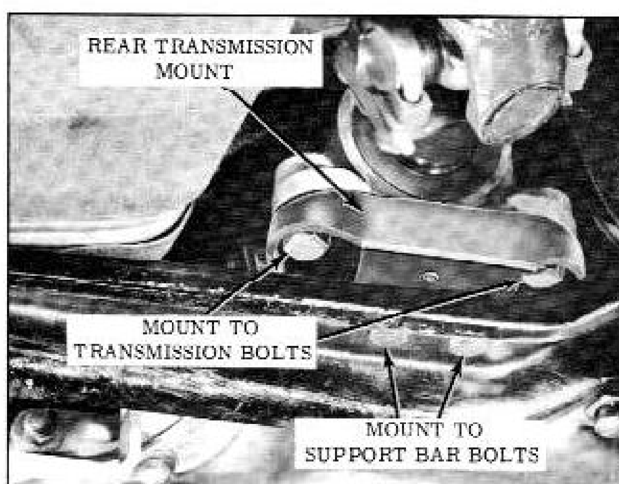

Fig. 10-6 Rear Transmission Mount

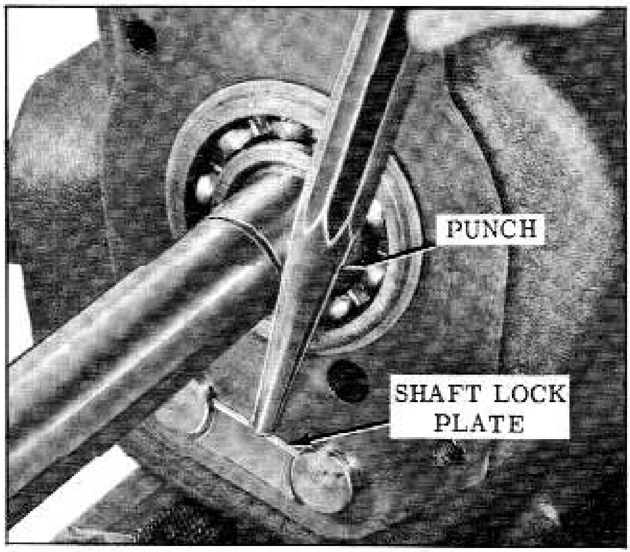

Fig. 10-7 Removing Rear Lock Plate

3. Carefully install transmission assembly main drive gear through clutch disc and install 4 transmission to clutch housing bolts. Tighten alternately and torque 30-35 ft. lbs.
4. Install rear mount and support bar. Torque rear mount of transmission 30-40 ft. lbs. Rear mount to cross bar 20-35 ft. lbs. and cross bar to body frame 20-35 ft. lbs.
5. Connect propeller shaft to companion flange. Torque "U" bolt nuts 14-18 ft. lbs.
6. Check and adjust linkage as necessary as outlined under "ADJUSTMENTS".
7. Connect speedometer cable to driven gear and tighten securely.
8. Check fluid level and add if necessary.

Disassembly

1. Remove 6 transmission case top cover bolts and remove top cover and gasket. Visually inspect condition of transmission parts. (Fig. 10-18)

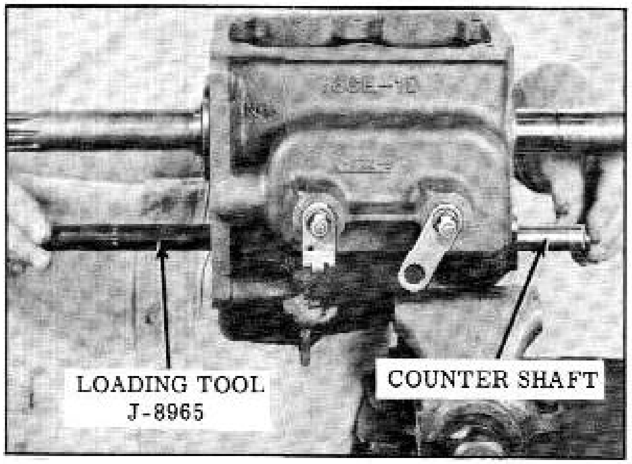

Fig. 10-8 Removing Countershaft

2. Remove speedometer driven gear from rear bearing retainer.
3. Remove companion flange. If flange does not come off easily, it may be necessary to use Tool J-8614-1-2.
4. Remove 4 rear bearing retainer to transmission case attaching bolts and remove bearing retainer.
5. Remove the 3 front bearing retainer to case attaching bolts and remove retainer.
6. Remove the countershaft and reverse idler gear shaft lock plate by tapping it out of shaft grooves with a punch. (Fig. 10-7)
7. With Tool J-8965 drive countershaft out the REAR of the transmission case. Countershaft must be driven out from front to rear as the rear of shaft is a larger diameter. The J-8965 Tool must always be held tightly against the countershaft while removing to prevent any thrust washers from falling out of position. Carefully drive tool into case only until counter gear will drop to bottom of case with tool in position. (Fig. 10-8)
8. Pull the main drive gear, and bearing out the front of the case. If necessary a brass drift may be used to tap gear out. Remove carefully and assist at rear with screw driver to prevent rollers from falling out the rear of the gear. (Fig. 10-9)
9. Pull the main shaft rearward sufficient to move bearing out of case.

NOTE: Do not pull too far as synchronizer retainers may fall out.

This will allow the shaft assembly to be tipped away from 2nd and 3rd shifting yokes. Remove this yoke. (Fig. 10-10)

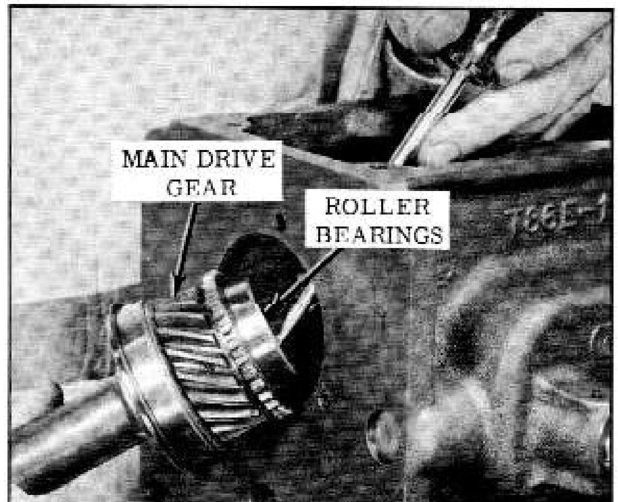

Fig. 10-9 Removing Main Drive Gear

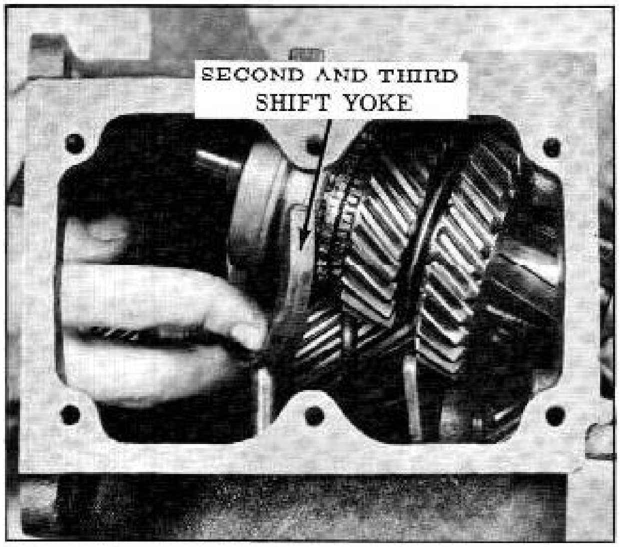

Fig. 10-10 Removing Mainshaft

10. Remove the synchronizer assembly to main shaft retainer ring.

11. Remove synchronizer assembly and 2nd speed gear. Remove together so synchronizer does not come apart.

12. Remove first and reverse shifter yoke.

13. Remove main shaft from case.

14. Remove the first and reverse gear from inside of case.

15. Using a long brass drift, drive the reverse idler gear shaft out the rear of the case and remove idler gear from case. (Fig. 10-11)

16. Lift countershaft cluster gear and shaft assembly and tool out of case. Carefully note position of thrust washers.

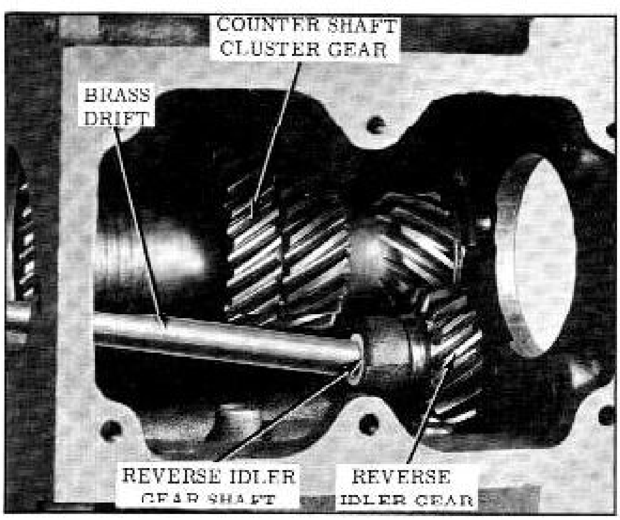

Fig. 10-11 Removing Idler Gear

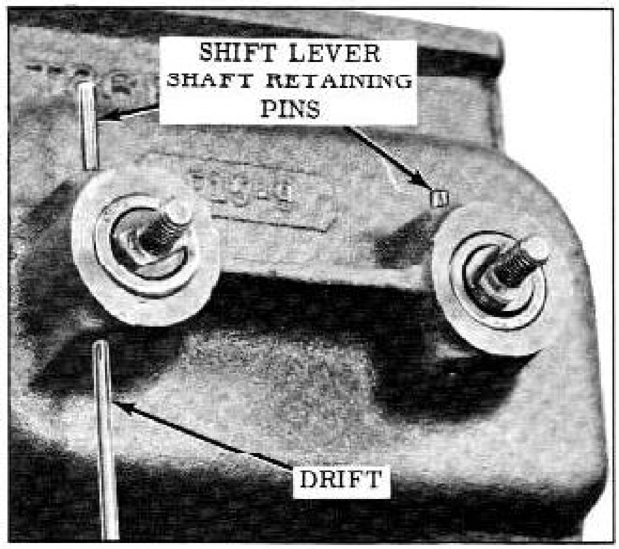

Fig. 10-12 Removing Shift Lever Shaft Pins

17. Remove the two shift lever shaft retaining pins. These pins are tapered and will come out from the top only. With a drift, drive the retaining pins out of the case. (Fig. 10-12)

18. Pull the shift lever shafts and yokes toward the outside of case. The interlock balls will be released into case.

19. Remove the outer shift levers, and remove the shift levers and shafts from case.

20. Remove shift lever interlock sleeve, spring and pin.

21. Remove the countershaft cluster gear bearing rollers (22 on each end), bearing retainer washers (2 on each end), and spacer from the gear.

22. Remove the brass synchronizer rings from each end of synchronizer assembly (one of

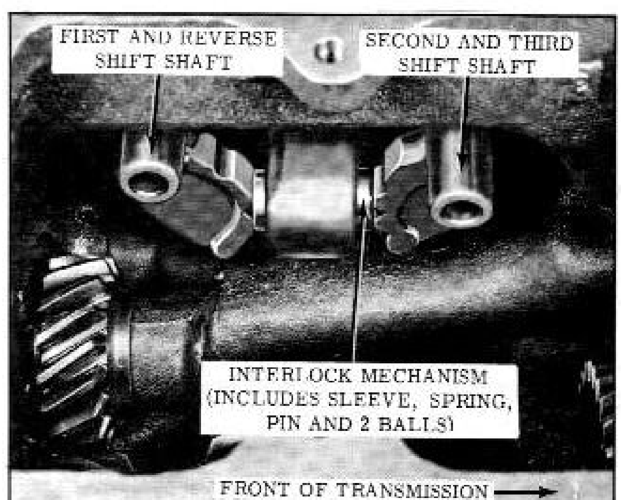

Fig. 10-13 Shift Lever Mechanism

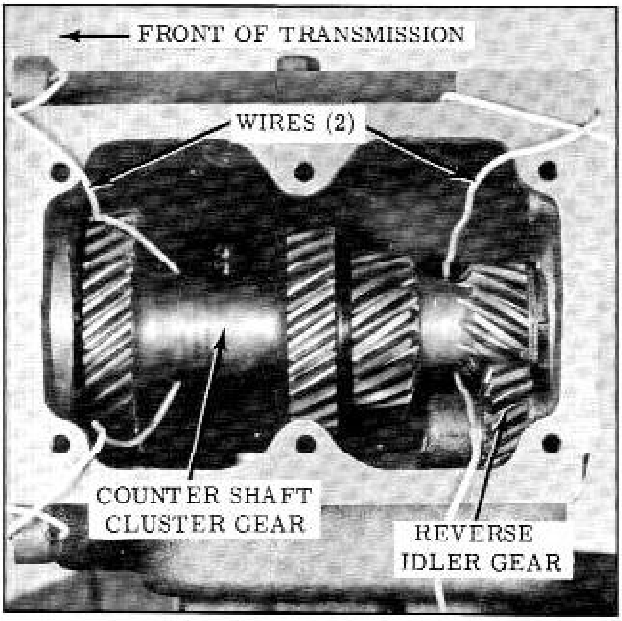

Fig. 10-14 Positioning Cluster Gear

the rings may have remained on the main drive gear cone).

23. Remove the snap ring retainers from each end of synchronizer gear noting their position. Slide the synchronizer sleeve off from the synchronizer gear and remove the 3 synchronizer retaining plates.

24. Wash all parts in clean solvent and inspect parts for possible damage or abnormal wear. New thrust washers should be installed if worn or scored.

Assembly

1. Install interlock spring and pin in bore of the interlock sleeve and install sleeve in case.

2. Install the first and reverse shift lever and shaft into case. (Fig. 10-13) (Notches far apart)

3. Install the second and third shift lever and shaft into case. (Fig. 10-13) (Notches close together)

4. Install the two interlock balls in the interlock sleeve and retain with the shift levers. With one lever in neutral detent, and the other in a gear detent, hold the interlock sleeve against one lever and the clearance between the sleeve and other shaft must be .001"-.007". Selective fit sleeves are available.

   Install shift lever retaining pins.

5. Center the countershaft bearing spacer in the bore of the countershaft cluster gear.

6. Place one bearing retainer washer against each end of tubular spacer.

7. Insert the countershaft assembly tool in bore of countershaft cluster gear and bearing spacer.

8. Load 22 bearing rollers in each end of countershaft using synthetic seal lubricant on bearings. Install the 2 outer bearing roller retaining washers.

9. Grease with petrolatum, and position the smaller bronze faced steel thrust washer on the small end of the countershaft cluster gear with the tangs in the slots of the gear.

10. Place the small steel thrust washer on the bronze faced washer with sufficient grease to hold in position, tang up.

11. Coat the larger bronze faced thrust washer with grease and place in position on the large end of countershaft cluster gear with bronze face towards the gear. Tang must be up to align with recess in case.

12. Position two pieces of wire (14 gauge electrical) in the bottom of the case as shown in Fig. 10-14. These wires will be used later to lift the cluster gear into position for installation of countershaft.

13. Hold tool in gear flush with washers on each end, and lower assembly, large end to front, carefully position cluster gear in bottom of transmission case. Tangs of thrust washers must be in their proper positions in the case.

14. Position reverse idler gear in case with relieved end of gear teeth towards front of transmission. (Fig. 10-15)

15. Install reverse idler gear shaft into case. Using the lock plate as a guide, position the slot towards countershaft hole in case. Drive the shaft in until inner edge of slot is nearly flush with case.

16. Install the first and reverse gear shift yoke in first and reverse gear shift lever.

17. Place 3 synchronizer retaining plates on synchronizer gear and install in sleeve. (Fig. 10-16) Install wire retaining rings. (Fig. 10-17)

18. Place mainshaft and bearing assembly into case. Place first and reverse gear (yoke groove toward front), on shaft and engage gear with yoke. Place second speed gear on shaft, then synchronizer assembly with rear synchronizer ring. (Yoke groove to rear) (Fig. 10-9)

19. Install the synchronizer assembly snap ring retainer on the mainshaft.

20. Install second and third speed yoke.

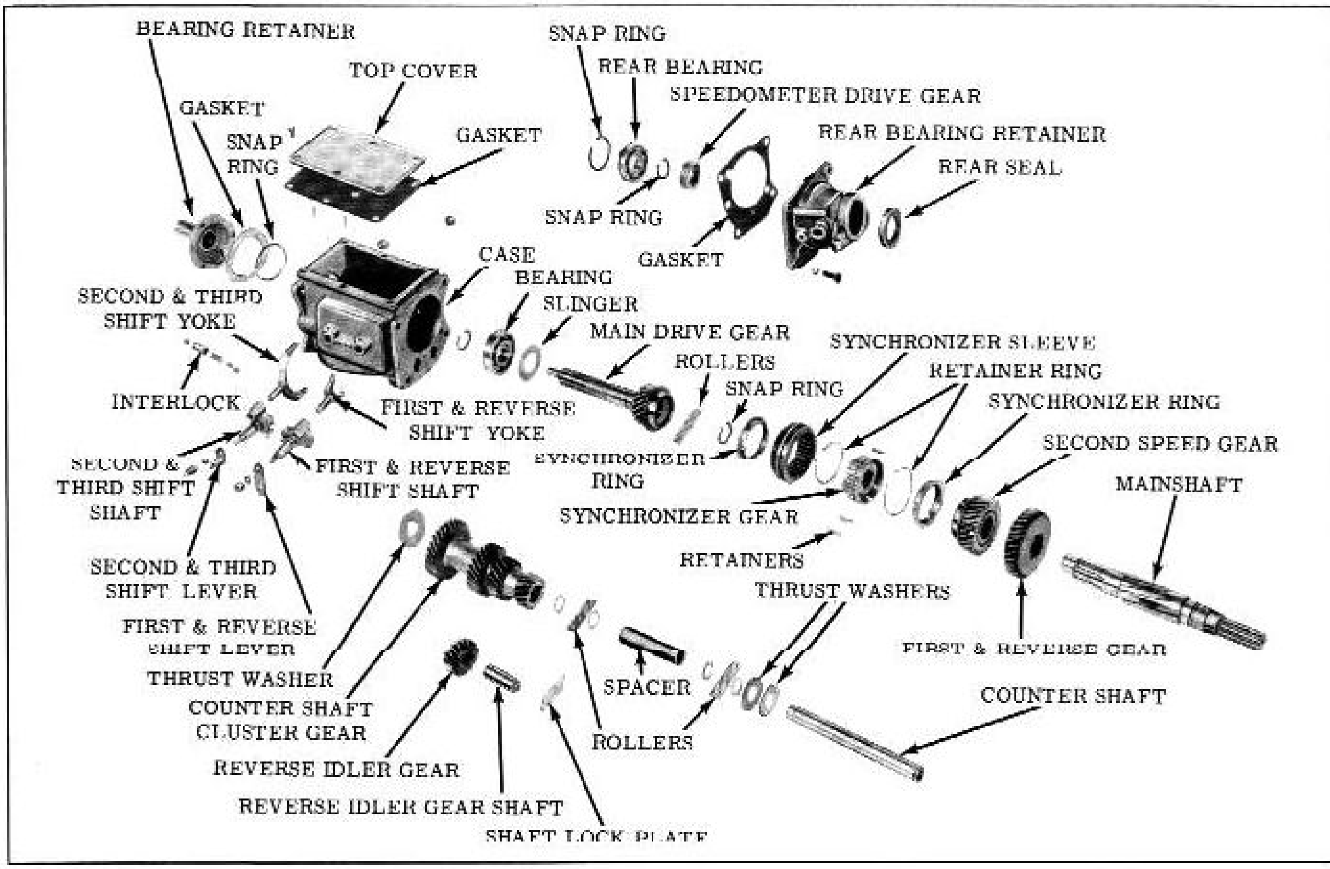

Fig. 10-15 Synchro-Mesh Transmission - Exploded View

21. Position mainshaft and bearing in case being certain both yokes are engaged. (Fig. 10-18)

22. Place front brass synchronizer ring in synchronizer, aligning notches with the 3 retainer plates.

23. With 14 bearings installed in main drive gear with sufficient grease to hold them in position, install main drive gear into front of case. Care must be taken to be sure brass synchronizer ring is properly engaged in synchronizer, and main drive gear bearing snap ring is tight against case.

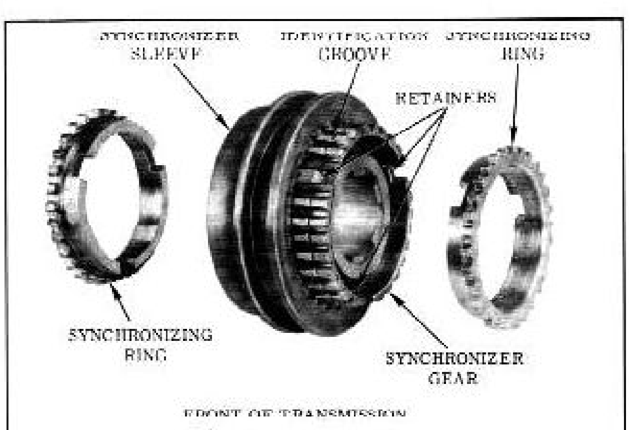

Fig. 10-16 Synchronizer Assembly

24. Install main drive gear bearing retainer and gasket. Seal bolts with Permatex #2 to prevent leakage. Torque bolts 17 to 20 ft. lbs.

25. Using previously positioned wires, carefully raise countershaft cluster gear assembly so that the countershaft may be installed. Install countershaft through rear of case, (lock plate notch to rear), rotating shaft so that the lock plate groove is towards the reverse idler

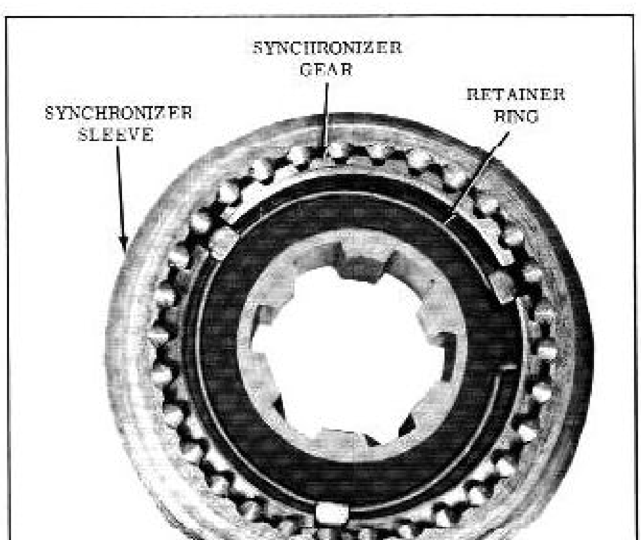

Fig. 10-17 Synchronizer Retaining Ring

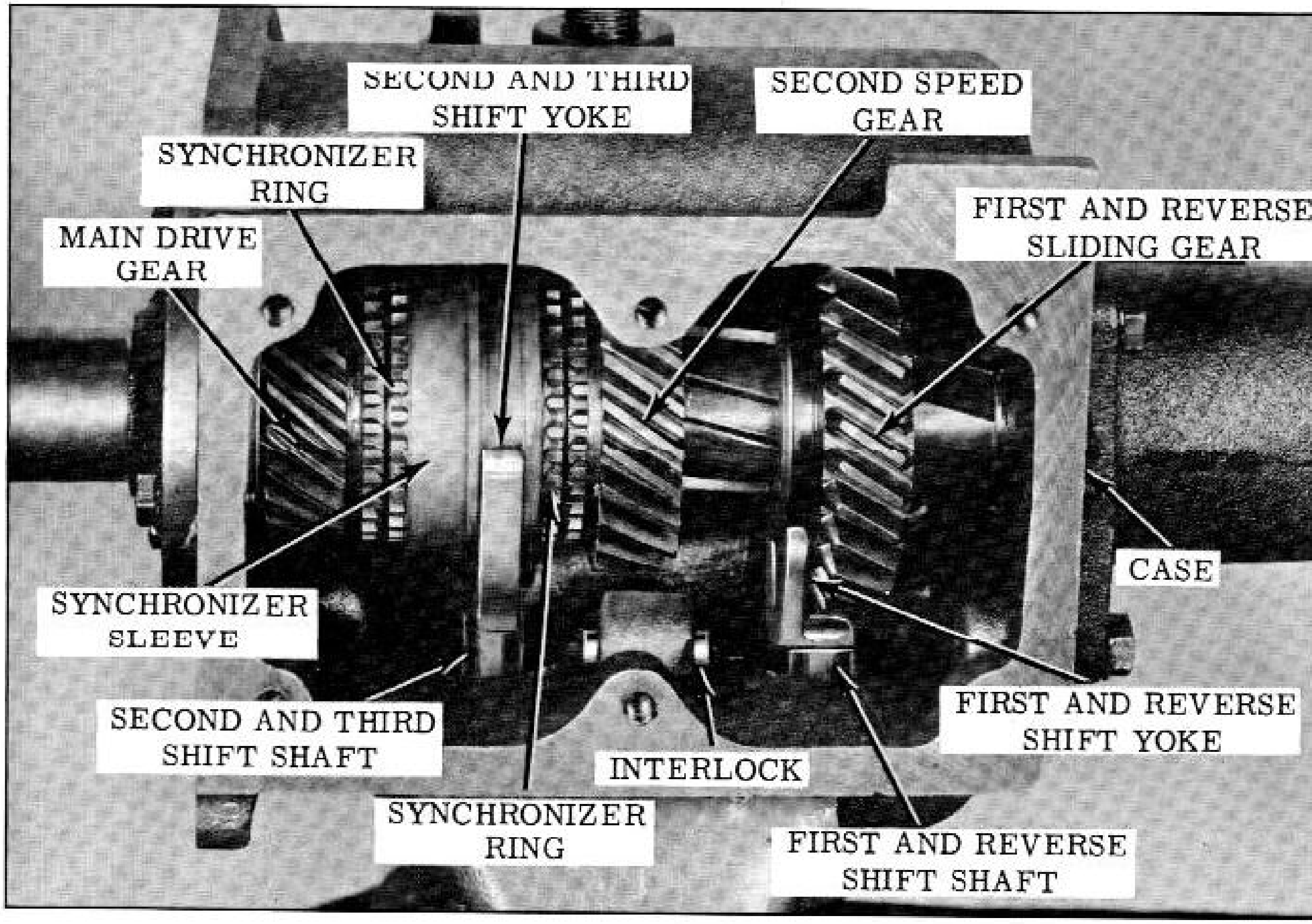

Fig. 10-18 Gear Positions

gear shaft (Fig. 10-8) Use an awl to assist in aligning shaft.

NOTE: Countergear shaft and tool must be held tightly together while installing countershaft so washers don't fall out of position.

26. Tap countershaft into case until the lock plate groove is just short of being flush with the case. Position the lock plate into shaft grooves and tap into place. Tap shafts into case until lock plate is against case.

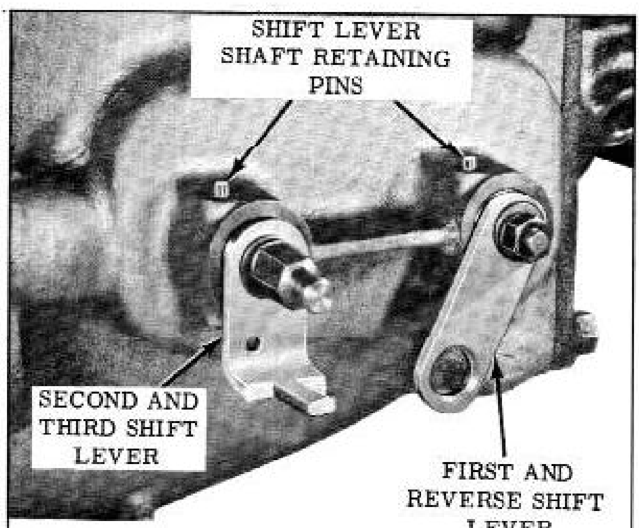

Fig. 10-19 Shift Lever Positions

27. Remove the two pieces of wire.

28. Install the rear bearing retainer and gasket. Torque attaching bolts to 28-33 ft. lbs.

29. Install shift lever shaft seals, outer shift levers, washers, and attaching nuts. (Fig. 10-19)

30. Check shift levers and synchronizer for operation.

NEUTRAL: Both levers in center detent position, hold main shaft and turn main drive gear shaft. Main shaft should not turn.

FIRST: With shift lever, move first and reverse gear forward, turn main drive approximately 2-1/2 times and main shaft should turn around once.

2ND: With shift lever, move synchronizer assembly rearward, other shift lever should be in center detent. Turn main drive approximately 1-1/2 turns and main shaft should turn once.

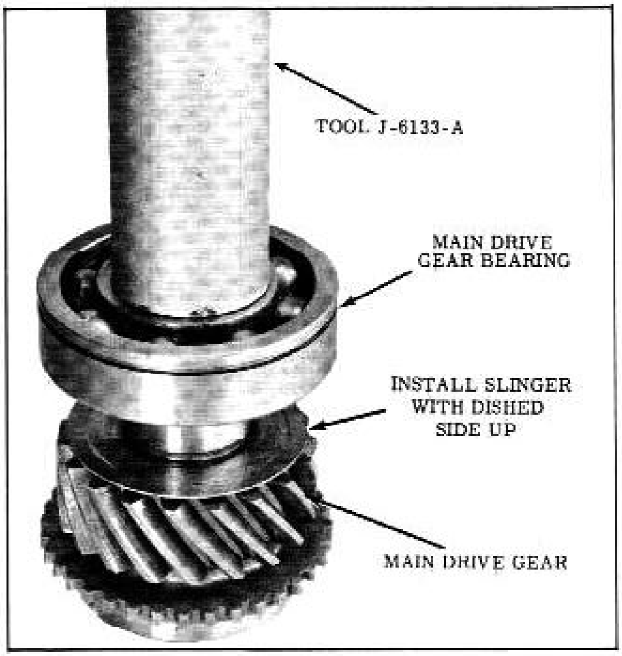

Fig. 10-20 Installing M.D. Gear Bearing

3RD: Move synchronizer assembly forward and turn main drive one turn and main shaft should turn once.

REVERSE: With synchronizer lever in center detent, first and reverse rearward, main drive, gear should turn approximately 3-1/2 times and main shaft once.

31. Install speedometer gear, companion flange, top cover and gasket, and torque attaching bolts 10-12 ft. lbs.

NOTE: When installing companion flange bolt use POB 3 sealer around lock washer and head of bolt.

MAIN DRIVE GEAR BEARING

Removal

1. Remove the main drive gear by performing steps 1 thru 8 in the disassembly procedure.
2. Remove the bearing snap ring from shaft.
3. Jar bearing off shaft. In some cases it may be necessary to tap bearing off shaft with a brass drift.

Installation

1. Place bearing on shaft with oil slinger washer. (Fig. 10-20) If washer is damaged it must be replaced.
2. With Tool J-6133 drive bearing on shaft until seated.
3. Install snap ring. Selective rings are available to obtain a tight fit in groove.

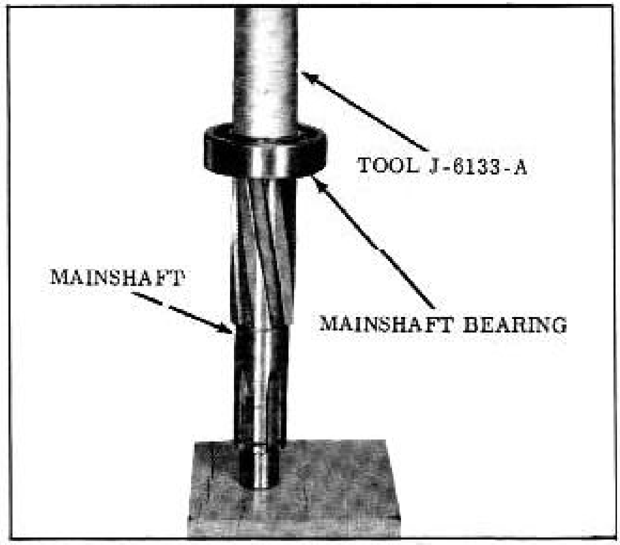

Fig. 10-21 Installing Mainshaft Bearing

MAIN SHAFT BEARING

Removal

1. Remove main shaft assembly by performing steps 1 thru 14 in the disassembly procedure.
2. Remove main shaft bearing snap ring.
3. With first and reverse gear on shaft, bounce shaft on wooden block and gear will assist in driving bearing off shaft.

Installation

1. Install bearing with Tool J-6133. (Fig. 10-21)
2. Install snap ring.
3. Assemble transmission as outlined in steps 18 thru 31 in the transmission assembly procedure (exclude step 29).

SYNCHRONIZER ASSEMBLY

Removal

The synchronizer assembly may be replaced by following steps 1 thru 11 in the transmission disassembly procedure.

The synchronizer rings must be inspected for worn teeth and if worn or damaged, should be replaced. Also, inside of rings must have very fine machine grooves visible. If worn smooth, they must be replaced.

Refer to Fig. 10-16, and step 24 for disassembly.

Installation

Assemble synchronizer as described in step 17 of the transmission assembly procedure, also refer to Fig. 10-17.

SHIFT YOKES

Second and Third

This yoke may be replaced by using steps 1 thru 9 in the disassembly procedure, and steps 20 thru 31 in the assembly procedure.

Low and Reverse

This yoke may be replaced by using steps 1 thru 12 in the disassembly procedure, and steps 16 thru 31 in the assembly procedure.

TORQUE SPECIFICATIONS

Application	Ft. Lbs.
Propeller Shaft to Companion Flange "U" Bolts	14 to 18
Companion Flange to Output Shaft	25 to 35
Rear Mount to Rear Bearing Retainer	30 to 40
Rear Mount to Cross Bar	20 to 35
Cross Bar to Body Frame	20 to 35
Transmission to Clutch Housing	30 to 35
Speedometer Cable to Transmission	3 to 4
Lock Plate to Rear Bearing Retainer	10 to 15
Rear Bearing Retainer to Transmission Case	28 to 33
Top Cover to Transmission Case	10 to 12
Main Drive Gear Bearing Retainer to Case	17 to 20

CLUTCH

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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 S.A.E. 20 Motor Oil. The clutch pedal free travel should be checked whenever the car is in the service area. Free travel should be 7/8" to 1".

DESCRIPTION

The single plate, dry disc clutch, is mounted with a free sliding fit on the splines of the Syncro-Mesh Transmission main drive gear. Engagement of the clutch is accomplished by a spring loaded pressure plate.

The clutch pedal is suspended from a support under the instrument panel. When the clutch pedal is depressed, the clutch release yoke moves the release bearing forward on the transmission bearing retainer sleeve until the bearing moves the inner end of the release levers. The release levers pivot at yokes (attached to the cover plate) and overcome the pressure spring force to move the pressure plate rearward to disengage the driven plate.

When the clutch pedal is released, the pressure springs compress the driven plate between the pressure plate and the flywheel to engage the clutch. The engagement of the clutch is cushioned by springs mounted between the facing discs of

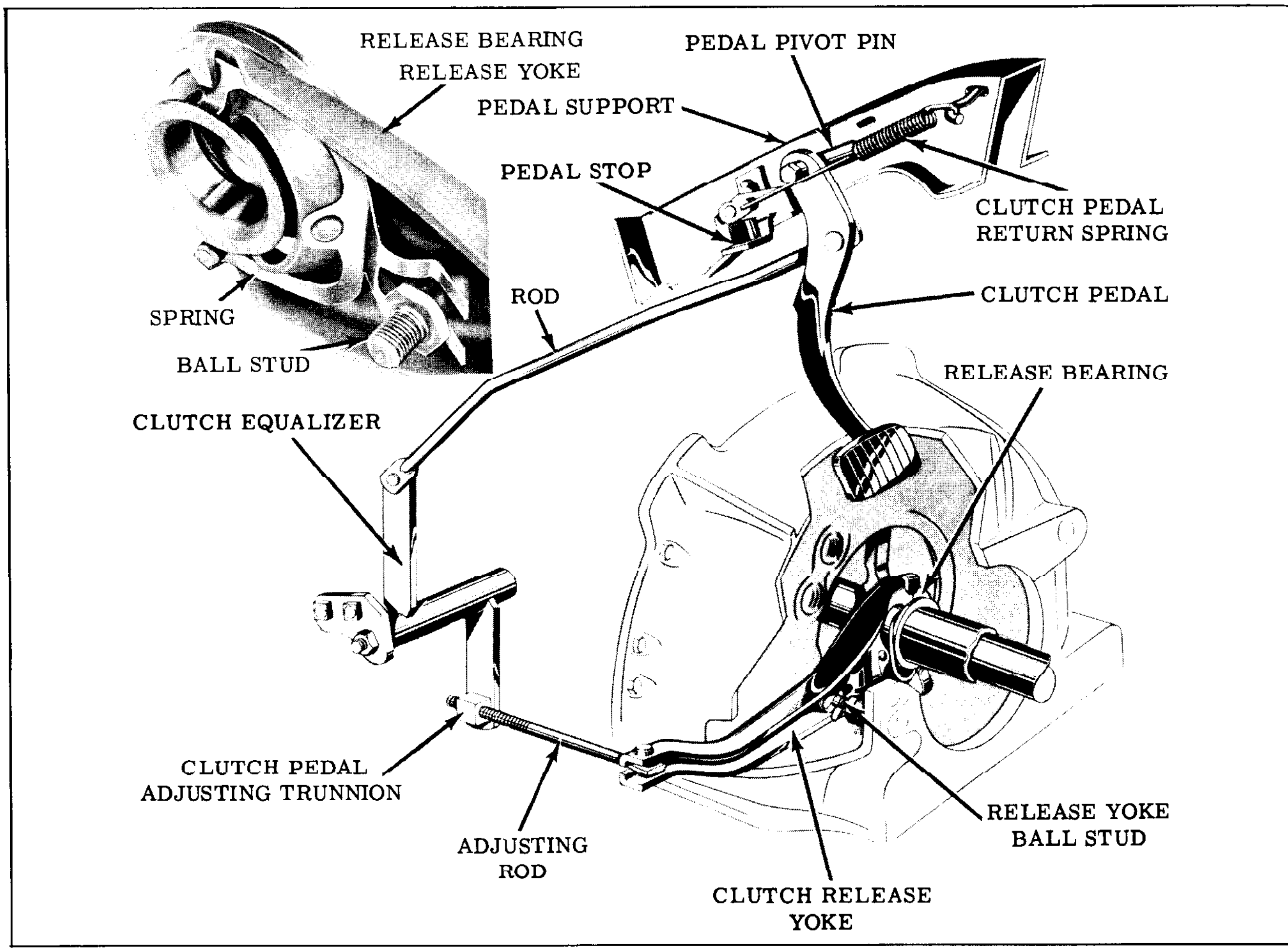

Fig. 10-22 Clutch Mechanism

the clutch plate. As the speed of the engine increases, the weighted outer ends of the release levers, through centrifugal force, add to the spring force exerted on the driven plate, thereby increasing clutch pressure and increasing the clutch torque capacity.

Torsional vibrations from the engine are prevented from being transmitted to the transmission by coil springs mounted in the hub of the driven plate. Balance is obtained by means of narrow sheet metal strips crimped around the webs of the driven disc.

ADJUSTMENTS

PEDAL FREE TRAVEL

1. Disconnect the lower clutch control rod from the equalizer by removing the wire clip.
2. Adjust the lower clutch control rod in and out of the trunnion nut to obtain 7/8" to 1" free travel at the clutch pedal. (Fig. 10-22)
3. Check the free travel at the clutch pedal pad with the lower clutch control rod connected to the release yoke.

CLUTCH PEDAL

Removal

1. Disconnect the clutch rod from the clutch pedal and disconnect brake pedal return spring.
2. Remove the clutch pedal stop from pedal support.
3. Slowly allow pedal to travel rearward and remove pedal return spring.
4. Remove clutch and brake pedal pivot pin nut.
5. Slide pivot pin out of clutch pedal while sliding a 5/16" rod through the bracket and brake pedal, to support brake pedal.
6. Lower clutch pedal from support.

Installation

1. Position clutch pedal in support and insert pivot pin through clutch and brake pedal assemblies.

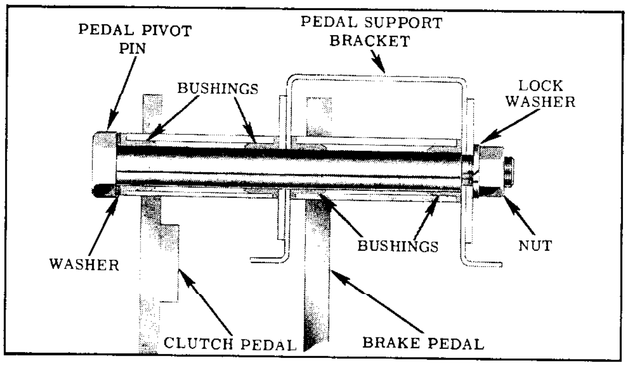

Fig. 10-23 Clutch Pedal Support

2. Install pivot pin nut and torque to 8-16 ft. lbs.

3. Attach pedal return spring, move pedal forward and install stop bracket and pedal to equalizer rod.

CLUTCH

Removal

1. Remove transmission. (Page 10-3)

2. Remove lower flywheel housing and release bearing.

3. Mark flywheel and clutch cover for reassembly, and alternately loosen the 6 clutch cover attaching bolts, two turns at a time to prevent distortion.

Installation

1. Lubricate pilot bearing with wheel bearing grease.

2. Place new disc in cover assembly, and attach to flywheel. Do not tighten bolts.

3. Place an old main drive gear in disc and into pilot bearing to align disc. Tighten cover bolts alternately and torque 14-17 ft. lbs.

4. Lubricate internal groove of release bearing with 567196 lubricant and install bearing.

5. Lubricate release yoke ball stud also with 567196 lubricant.

6. Remove old main drive gear, and install transmission. (Page 10-3)

7. Adjust linkage.

RELEASE BEARING

Removal

1. Disconnect propeller shaft from front companion flange.

2. Disconnect transmission shift control linkage from transmission side levers.

3. Disconnect rear transmission mount from bearing retainer and remove rear mount support bar.

4. Remove transmission and lower clutch housing dust cover.

5. Disconnect release bearing from release yoke and remove bearing through clutch housing bore.

Installation

1. Lubricate groove in bearing with 567196 lubricant and attach to release yoke with the thrust surface adjacent to the clutch pressure plate fingers.

2. Install transmission, positioning front bearing retainer sleeve inside of release bearing.

   Torque transmission attaching bolts 30-35 ft. lbs.

3. Install cross bar and attach rear mount to the bearing retainer. Torque mount bolts 30-40 ft. lbs.

4. Connect propeller shaft to front companion flange. Torque "U" bolts 14-18 ft. lbs.

5. Connect shift control linkages to transmission side levers.

6. Install lower clutch dust cover and torque bolts 20-25 ft. lbs.

7. Check clutch pedal free travel.

RELEASE YOKE

Removal

1. Follow procedure under "RELEASE BEARING REMOVAL" and proceed to remove bearing.

2. Disconnect clutch control rod from release yoke.

3. Disconnect release yoke from ball pivot stud.

4. Remove ball stud to provide clearance to remove yoke.

5. Remove yoke through lower flywheel dust cover opening.

Installation

1. Insert release yoke in position through the lower flywheel dust cover opening.

2. Install ball pivot stud and torque 35-40 ft. lbs. Lubricate threads with 980131 and ball with 567196 lubricant.

3. Attach release yoke to ball pivot stud by sliding yoke over stud until spring clip retainer snaps into place.

4. Connect clutch control rod to release yoke.

5. Proceed to install release bearing following steps under "RELEASE BEARING INSTALLATION."

EQUALIZER SHAFT

The equalizer shaft is attached to the frame rail and a ball stud mounted on the engine block. (Fig. 10-24)

When replacing assembly, it should be lubricated with 567196 lubricant.

The mounting stud threads should be lubricated with 980131 lubricant before being installed in block.

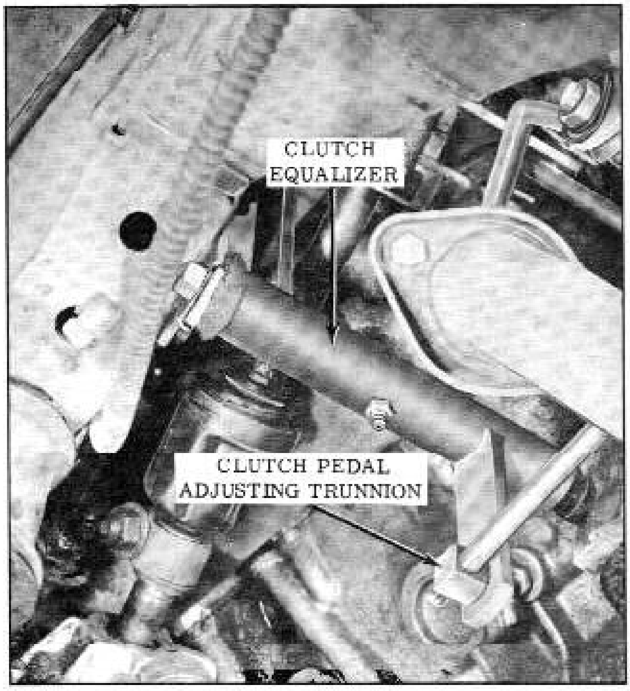

Fig. 10-24 Clutch Equalizer

CLUTCH SPECIFICATIONS

CLEARANCE	
Hub and Splines on Clutch Shaft	.00175" - .005"
DISC FACINGS	
Diameter - Inside	6"
Diameter - Outside	9-1/2"
Number Used	2
Thickness	.125"
DRIVEN DISC ASSEMBLY	
Number Used	1
Overall Thickness (Clutch Engaged)	0.300"
Hub Dimensions	1-1/8" - 10 Spline
PEDAL FREE TRAVEL	7/8" - 1"
PEDAL HEIGHT	Approx. 6-1/2"
PRESSURE SPRINGS	
Number Used	6
RELEASE BEARING	
Type	Sealed Ball
CLUTCH PILOT BEARING	
Type	Oil Impregnated Bushing

TORQUE SPECIFICATIONS

NOTE: Use Special Lubricant #980131 when installing bolts to aluminum block or housing.

Application	Ft. Lbs.
Equalizer Stud to Block	30 to 35
Equalizer Bracket to Frame	14 to 17
Clutch to Flywheel Bolts	14 to 17
Clutch Release Ball Stud	35 to 40
Clutch Housing to Block Bolts	30 to 35
Rear Engine Mount to Transmission	30 to 40
Cross Bar to Body Frame	20 to 34
Rear Engine Mount to Cross Bar	20 to 34
Transmission to Housing	30 to 35
Speedometer Cable to Transmission	3 to 4
Propeller Shaft "U" Bolts to Companion Flange	14 to 18

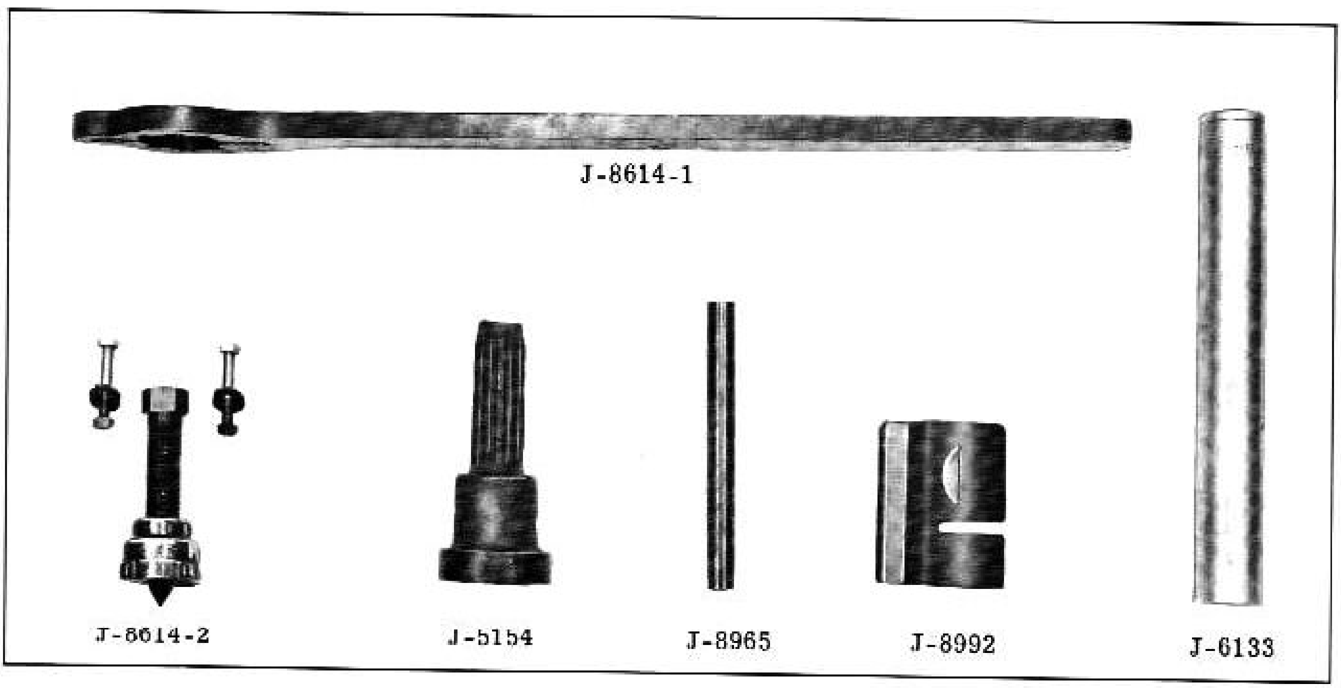

Fig. 10-25 Tools

J-5154 Rear Seal Installer
J-6133 Bearing Installer
J-8614-1 Companion Flange Tool
J-8614-2 Companion Flange Tool
J-8965 Countershaft Needle Bearing Loader
J-8992 Shift Linkage Locating Fixture

CHASSIS SHEET METAL

AND

BUMPERS

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HOOD ASSEMBLY

Removal

The hood is attached to the car by the hood hinges located at the rear of the hood.

Before attempting to remove hood, it is suggested that adjoining painted areas be covered to prevent damage.

With the hood supported, scribe the hinge position on the hood reinforcement and remove the two hinge to hood bolts from each hinge. (Fig. 11-1)

Installation

When installing hood, position the hinges to the scribed lines. If further adjustment is necessary, follow the hood and hinge alignment procedure.

HOOD HINGE SPRING

Removal

To remove the spring from the hood hinge, raise hood approximately 12" and place Tool J-8923-1 over the spring. (Fig. 11-1) Raise hood and the spring will unhook.

Installation

When installing a new spring, stretch the spring, then Tool J-8923-1 can be placed over the spring. Position spring (with tool in place) on hinge. Lower hood slightly to expand spring, then remove Tool.

HOOD HINGE

Removal (With Spring Removed)

1. Mark the hinge outline on the body and hood to facilitate alignment on installation.

2. While supporting hood, remove the two hinge

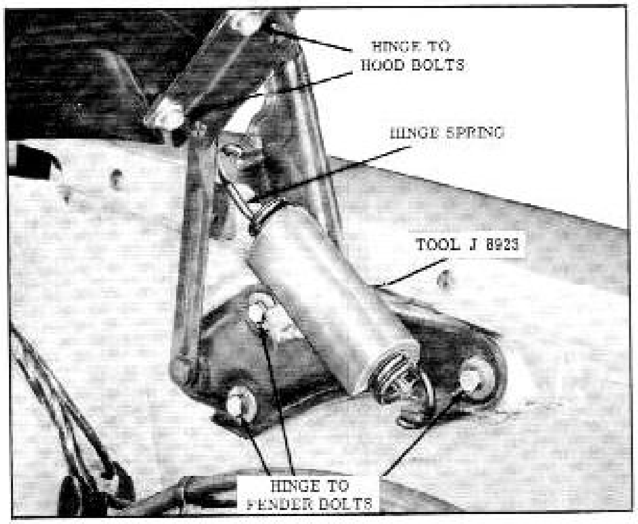

Fig. 11-1 Hood Hinge and Spring

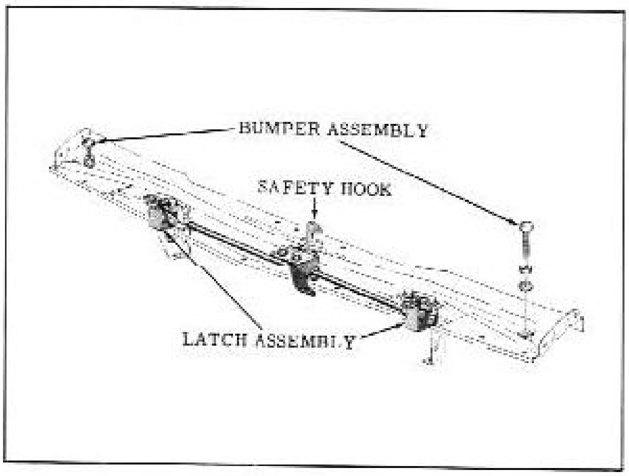

Fig. 11-2 Hood Latch Assembly

bracket to hood bolts and remove hood. Then remove the three hinge bracket to fender bolts.

3. Remove hinge assembly.

Installation

Torque hinge to body bolts 15-20 ft. lbs. Align hood after hinge is installed.

HOOD LATCH ASSEMBLY

The hood latch assembly is attached by six bolts to the fender tie bar and it is serviced as an assembly. It is adjustable as an assembly. (Fig. 11-2) It should be lubricated periodically with lubriplate for proper operation.

HOOD EMBLEM

The hood emblem is attached to the hood panel by two self-threading nuts which are accessible from the underside of the hood.

Fig. 11-3 Hood and Fender Clearances

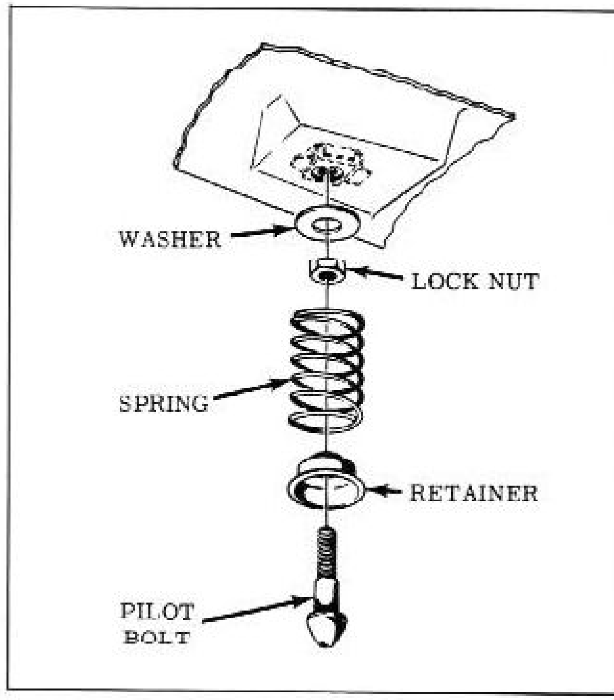

Fig. 11-4 Hood Pilot Bolt

HOOD AND HINGE ALIGNMENT

The hood hinge adjustment provides fore and aft and vertical alignment of the rear edge of the hood in relation to the cowl vent grille and fenders.

To properly align hood, all hinge attaching bolts should be in place and tight enough only to hold hood in position, and yet allow movement by tapping.

1. Place hood in closed position and check clearances. (Fig. 11-3)

2. With hood in closed position, shift hood to obtain correct clearances.

3. Adjust hood front bumpers to align front of hood vertically with fenders. Lateral adjustment of the front of hood is obtained by adjusting the pilot bolts. (Fig. 11-4)

4. Raise or lower rear of hood to align with cowl vent grille and rear of fenders.

5. Carefully raise hood and tighten all hinge bolts.

6. Adjust pilot bolts vertically to latch properly.

Pilot Bolt Adjustment

A properly adjusted pilot bolt fully engages in the hood latch and holds the hood tight against the rubber bumpers. It may also assist in obtaining correct hood to fender clearances at the front. The rubber bumpers adjust vertically to align hood with fenders. By loosening the lock nut, a vertical and lateral adjustment may be made.

The pilot bolts position the hood as it is lowered. Vertical adjustment can be made by loosening the pilot bolt lock nuts and adjusting the threaded pilot bolts up or down for proper engagement with the latch assemblies. Lateral adjustment can be made by loosening the lock nuts on the pilot bolts and moving the pilots right or left until front hood to fender clearances are 1/8" maximum. (Fig. 11-3)

FENDER ASSEMBLY

Removal

Before removing a fender painted areas and moldings adjacent to the fender should be covered for protection against scratches.

1. Remove 7 headlamp door attaching screws and remove headlamp door. (Fig. 11-5)

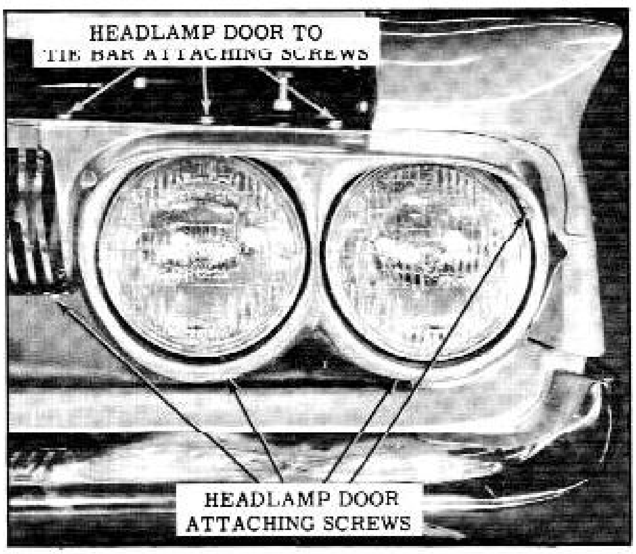

Fig. 11-5 Headlamp Door

2. Disconnect headlamp wiring connectors from headlamp terminal and remove headlamp ground screw. (Fig. 11-6)

3. Remove 4 headlamp assembly attaching screws and remove headlamp assembly. (Fig. 11-7)

4. Remove the 3 fender to stone shield side attaching screws. (Fig. 11-8)

5. Remove the 7 stone shield to side baffle attaching screws. (Fig. 11-8)

6. Remove the "OLDSMOBILE" grille name plate bracket to side baffle attaching screw. (Fig. 11-9)

7. Remove the 2 fender extension to fender attaching screws. The lower fender extension screw is accessible from underneath the fender and it is behind the rubber side baffle to fender seal. (Fig. 11-10)

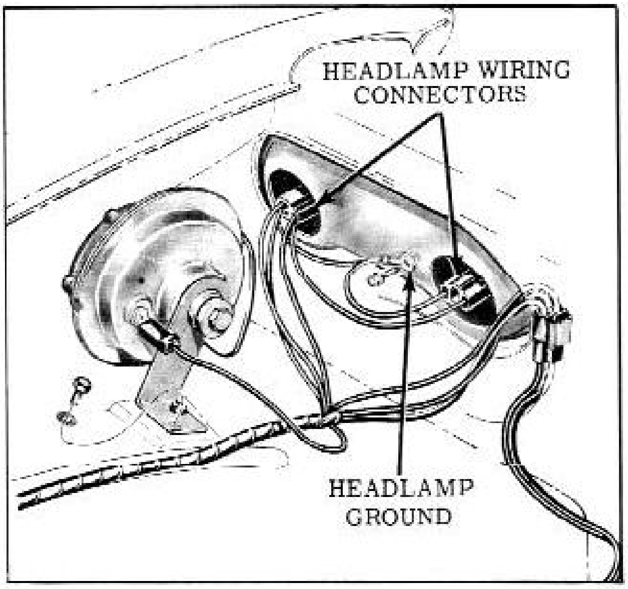

Fig. 11-6 Headlamp Wiring

8. Using a suitable tool, pry the stone shield away from the side baffle to gain clearance to remove the fender extension. Tip the upper edge of the fender extension forward and pull fender extension lower flange from between the stone shield and side baffle.

9. Remove the 2 fender tie bar attaching screws. (Fig. 11-11)

10. Remove the fender to inner rocker panel attaching bolt at the lower rear corner of front fender, and the upper fender to cowl attaching bolt as shown in Fig. 11-12.

11. If car is radio equipped, remove the antenna mast from antenna base when removing right-hand fender.

12. Remove the 7 fender upper flange attaching screws. (Fig. 11-13)

13. Pull the fender forward just sufficient to clear lower windshield corner cowl area.

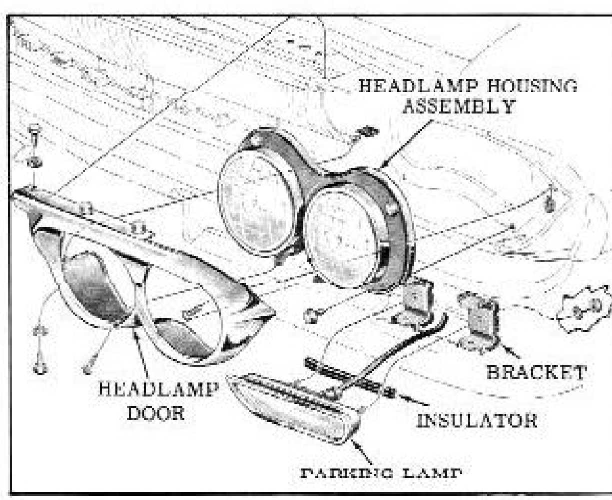

Fig. 11-7 Headlamp Assembly

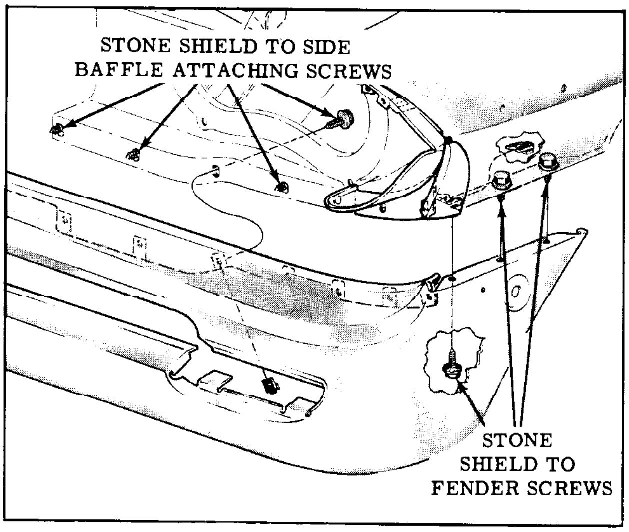

Fig. 11-8 Fender to Stoneshield

14. With the rear lower corner pulled away from inner rocker panel, lift the rear of fender sufficient to (on right hand) clear the antenna base and move fender forward and up off from front end sheet metal.

Installation

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. Reverse the removal procedure for installation.

OUTER FENDER EXTENSION

Removal

The outer fender extension is attached to the fender by two screws. The upper screw is accessible from behind the side panel to fender seal.

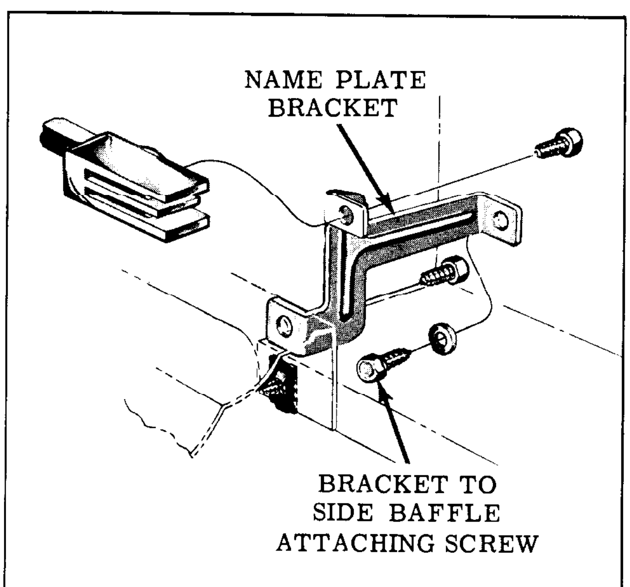

Fig. 11-9 Grille Nameplate

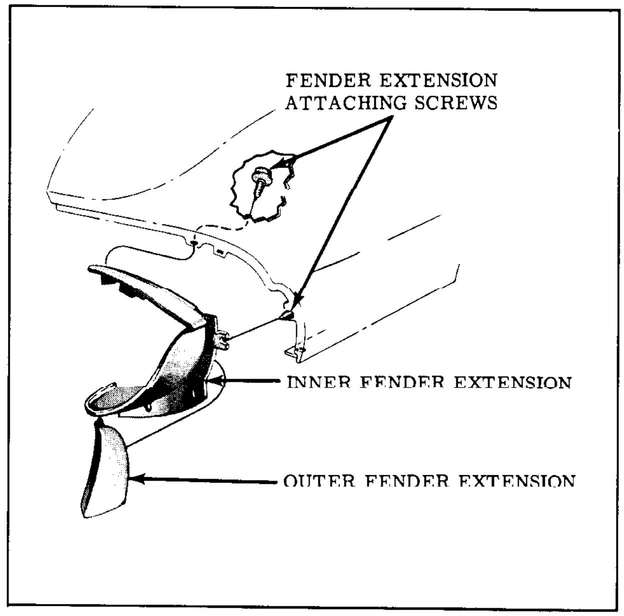

Fig. 11-10 Fender Extension

The lower screw is the stone shield to fender side attaching screw nearest the front of the car as shown in Fig. 11-10.

Installation

When installing tighten screws evenly to obtain correct fit to fender.

INNER FENDER EXTENSION

Removal

The lower stone shield must be loosened from the side baffle and fender before the inner fender extension can be removed from between the stone shield and side baffle.

1. Remove the headlamp door and headlamp assembly. (Fig. 11-7)

2. Remove the 3 fender to stone shield side attaching screws. (Fig. 11-8)

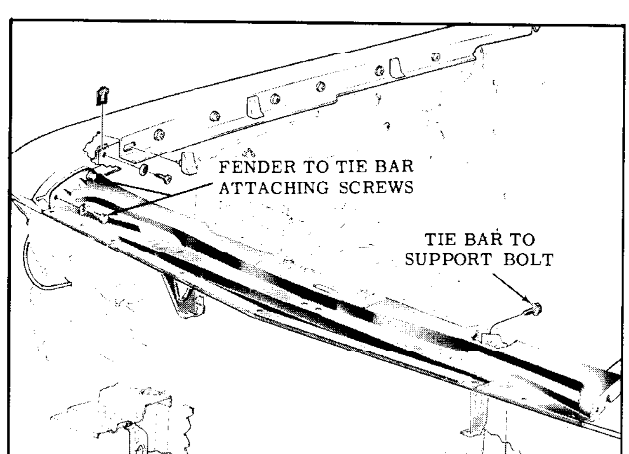

Fig. 11-11 Fender Tie Bar

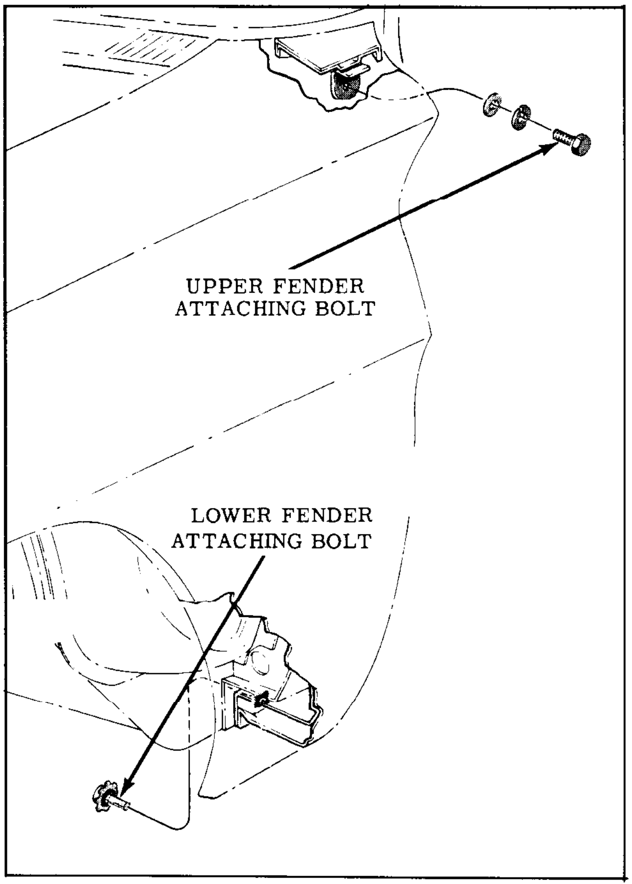

Fig. 11-12 Front Fender Rear Attachment

3. Remove the 7 stone shield to side baffle attaching screws. (Fig. 11-8)
4. Remove the "OLDSMOBILE" grille name plate to side baffle attaching screw. (Fig. 11-9)
5. Remove outer fender extension.
6. Pry the stone shield away from the side baffle lower edge to gain clearance for removal of inner extension. Tip upper edge of extension forward, pull extension lower flange from between the stone shield and side baffle.

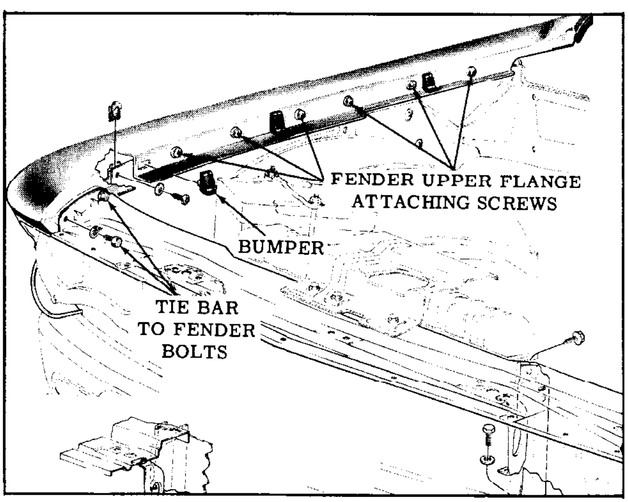

Fig. 11-13 Fender Upper Attachment

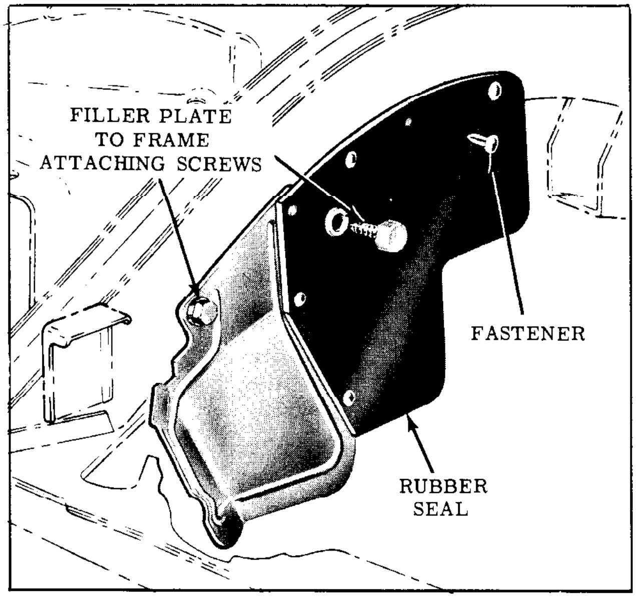

Fig. 11-14 Engine to Frame Filler Plate

Installation

Install all screws and tighten evenly. Check fits and clearances as screws are being tightened.

FILLER PLATE

The filler plates are welded to the body frame at the rear and lower edges. The fender attaches by screws to the top and lower front of the filler plate. Replacement filler plates will be bolted to the body frame and cowl. When replacing the fender filler plate it will be necessary to remove the fender, the side baffle, and the side baffle bracket. All wiring and parts should be disconnected or removed from the filler plate prior to removal of filler plate. Remove the filler plate by breaking the spot welds at the frame rail. Place the new fender filler plate in position and reinstall the side baffle and bracket attaching the

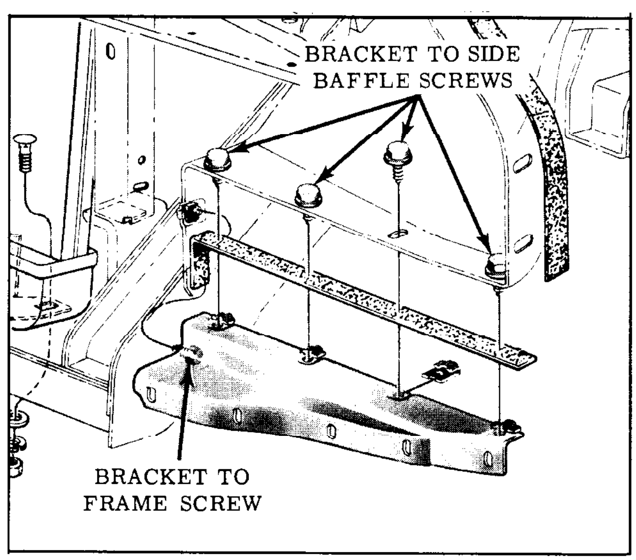

Fig. 11-15 Side Baffle and Bracket

filler plate to the side baffle. This will insure proper alignment of filler plate. Next, drill mounting holes in frame side rail and cowl and install filler plate attaching screws. Reassemble wiring and fender. Adjust clearances to those shown in Fig. 11-3.

ENGINE TO FRAME FILLER PLATES

The front engine to frame filler plate is attached to the frame side rail by two screws. A rubber seal is clipped to the plate and frame as shown in Fig. 11-14.

SIDE BAFFLE AND BRACKET

The side baffle is a plate between the tie bar support, fender filler plate, and the front fender. The side baffle is attached by sheet metal screws to the stone shield, side baffle support bracket, tie bar, and fender filler plate. The fender must be removed. The side baffle bracket is attached to the fender filler plate by 5 sheet metal screws as shown in Fig. 11-15.

Parking Lamp Baffle

The parking lamp baffle is attached to the lower side baffle bracket and stone shield with 4 screws as shown in Fig. 11-16.

UPPER RADIATOR BRACKET FAN SHIELD

The fan shield incorporates the upper radiator support. When the shield is removed the rubber insulator should be inspected for damage. If damaged, rubber insulator insert should be replaced.

The upper radiator bracket is attached to the tie bar by 3 sheet metal screws as shown in Fig. 11-17.

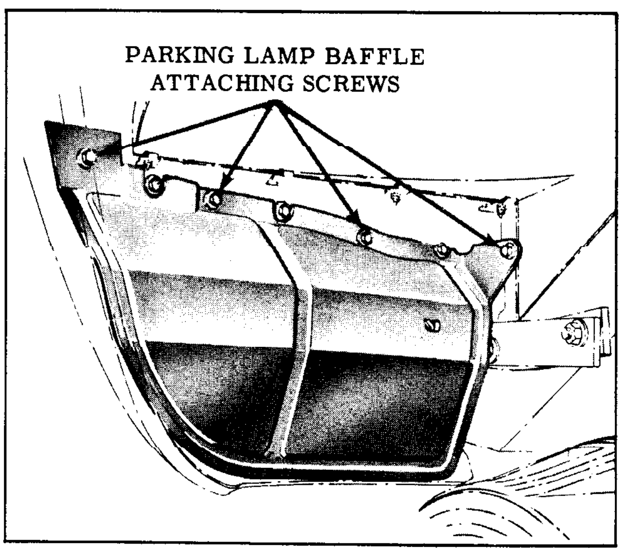

Fig. 11-16 Parking Lamp Baffle

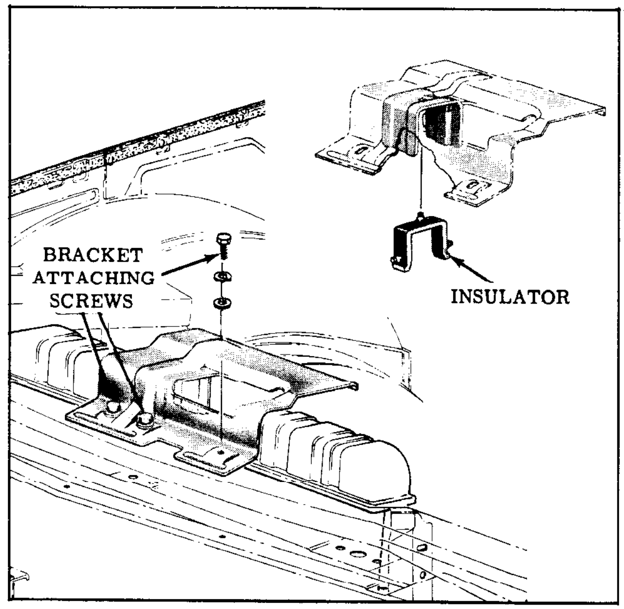

Fig. 11-17 Upper Radiator Bracket

LOWER RADIATOR BRACKETS

The lower radiator brackets act as saddles for the radiator. Each bracket has a rubber insulator between the bracket and the radiator. The bracket is attached to the front frame cross member by 3 bolts as shown in Fig. 11-18.

FRONT BUMPER STONE SHIELD

1. Remove 2 outer bumper to stone shield bolts, 4 bracket to body frame bolts and remove bumper. (Fig. 11-19)
2. Remove 20 (10 on each side) stone shield to side baffle and fender screws as shown in Fig. 11-8.

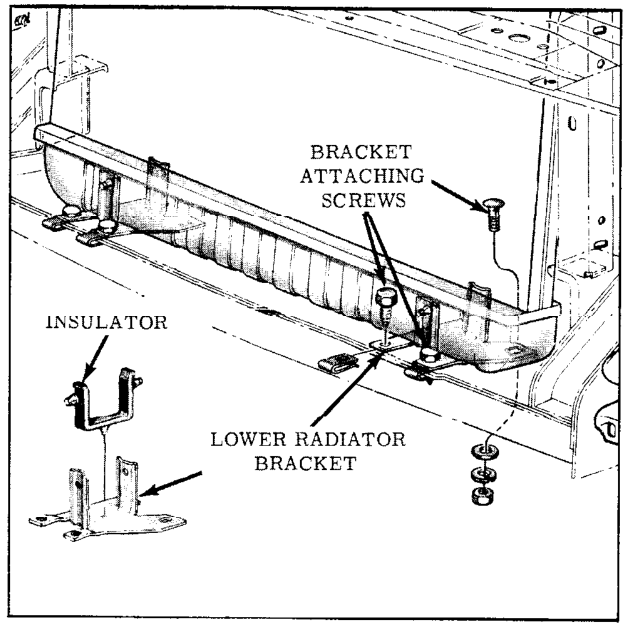

Fig. 11-18 Lower Radiator Brackets

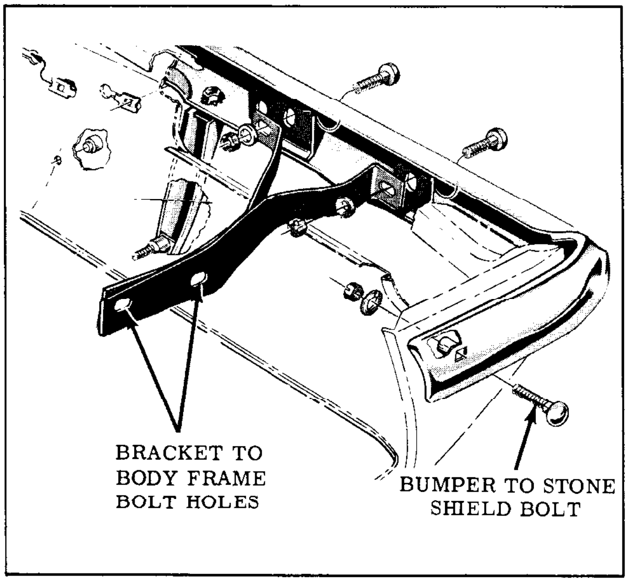

Fig. 11-19 Front Bumper Stone Shield

3. Disconnect parking lamp wiring.
4. Remove two name plate outer bracket to side baffle attaching screws. (Fig. 11-9)

   This will permit the stone shield to be removed with parking lamps and name plate intact. If new stone shield is being installed these items, if damaged, may be easily transferred at this time.

   After installation of stone shield, check parking lights for operation, alignment of name plate, and alignment of front bumper. Torque bumper bracket nuts 20-28 ft. lbs. Torque outer bumper bolts to 20-28 ft. lbs.

MOLDING (3100 SERIES ONLY)

Fender Side Molding

The fender side molding is retained by molding

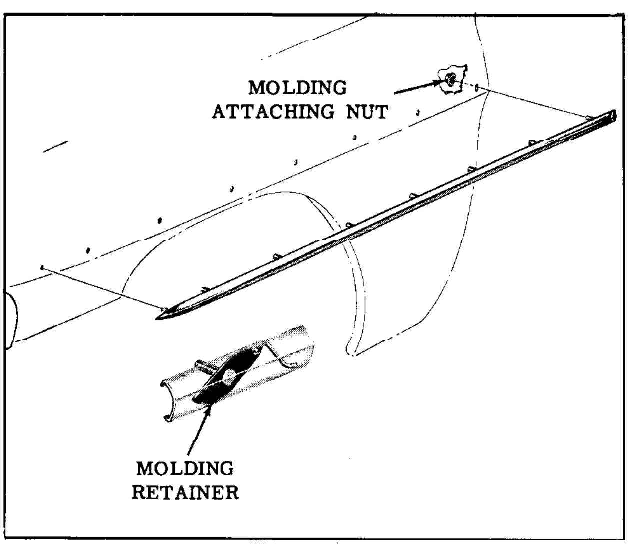

Fig. 11-20 Fender Side Molding

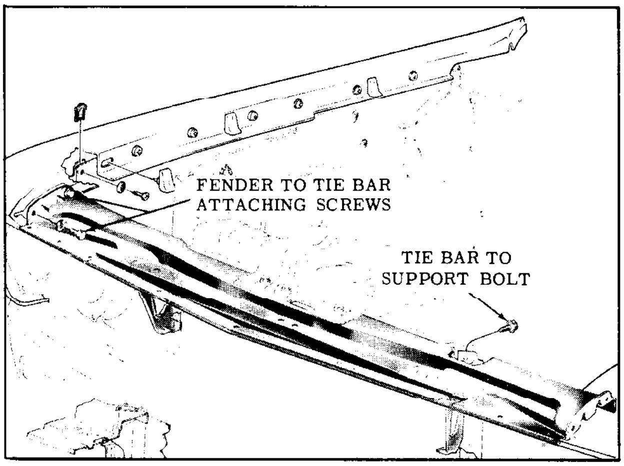

Fig. 11-21 Fender Tie Bar and Support

clips. To remove the molding, it is necessary to loosen the fender from the cowl and filler plate, disconnect it at the lower bracket and move it outward to reach the one rear molding clip nut. The front stud nut is accessible from beneath the fender as shown in Fig. 11-20.

FENDER ALIGNMENT

The holes in the body and fender 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.) 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 TIE BAR AND SUPPORT

The fender tie bar is held in position by two bolts to each fender, one bolt to each support, located on each side of the radiator, and two bolts to each hood latch support. (Fig. 11-21) To remove the tie bar, the fan shield must be removed, plus the above mentioned bolts.

GRILLE

The grille can be removed by raising the hood and removing six upper and lower screws. (Fig. 11-22)

GRILLE NAME PLATE

The grille name plate is attached by 4 sheet metal screws to 4 grille support brackets. (Fig. 11-22)

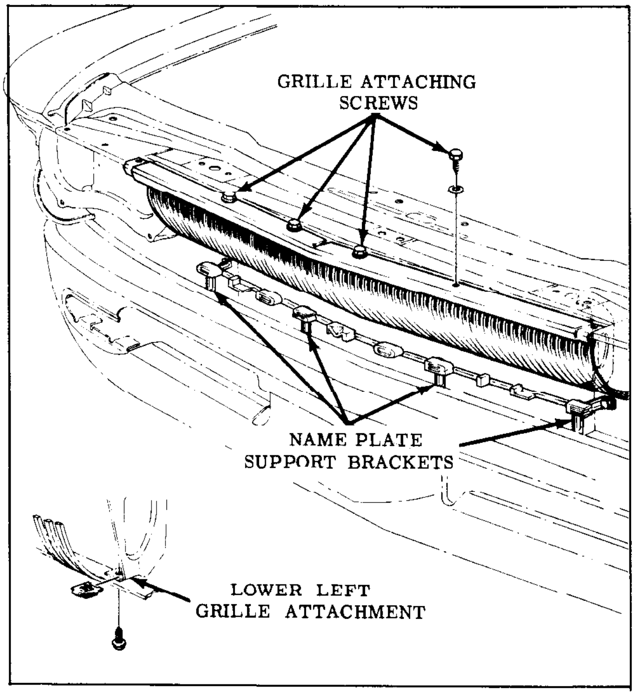

Fig. 11-22 Grille

HEADLAMP DOORS AND HOUSING

The headlamp housings are retained by four sheet metal screws to the side baffle. To remove, proceed as follows:

1. Disconnect headlamp wiring.
2. Remove headlamp doors attached by seven screws. (Fig. 11-23)
3. Remove the four headlamp housing attaching screws and remove housing.

After installation check headlamp aim and adjust if necessary.

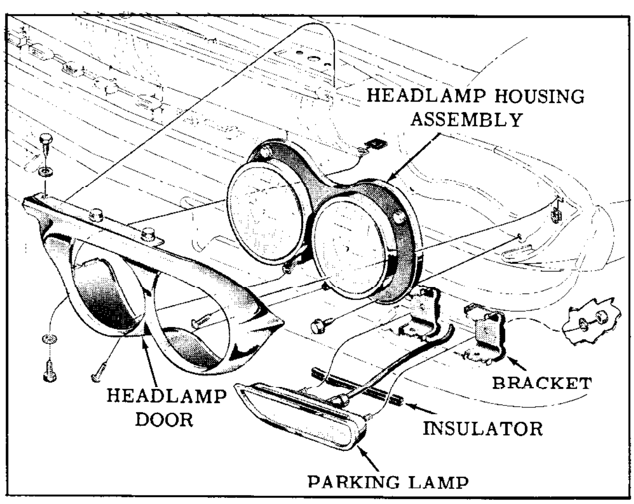

Fig. 11-23 Headlamp doors and Housing

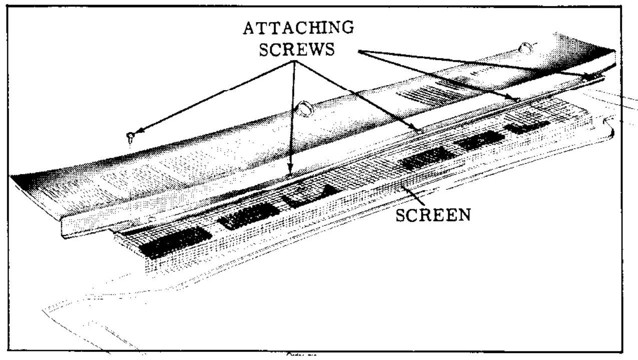

Fig. 11-24 Cowl Vent Grille

SEALED BEAM LAMPS

To replace a sealed beam lamp:

1. Remove headlamp door. (Fig. 11-5)
2. Disengage lamp retainer spring.
3. Disconnect electrical plug from back of lamp.
4. Remove two lamp retainer screws and remove lamp.

When installing lamp only, it should not be necessary to aim headlamps.

COWL VENT GRILLE

Removal

1. Remove windshield wiper arms.
2. Raise hood and remove five cowl vent grille to cowl screws. (Fig. 11-24)
3. 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 moldings attaching clips and install grille to cowl screws.

REAR END BODY PANEL LETTERS

On all series, each letter is fastened to the rear end body panel with two self-threading nuts. When installing the letters, place a daub of auto body caulking compound around letter studs after installation.

TAIL LAMP ASSEMBLY

Removal and Installation

The tail lamp assembly is assembled to the rear quarter panel with nuts accessible from inside the trunk compartment on 19 styles, and by removing rear quarter trim on 35 styles. Bulbs may be replaced by removing lens from outside.

BUMPERS

FRONT

Removal

Remove two lower guard nuts, four bumper bracket to frame bolts, and two outer end chrome headed bumper bolts as shown in Fig. 11-25.

Installation

On assembly it is necessary to maintain alignment which is adjustable through the use of elongated holes at both bumper bracket and support brackets. Bumper should be level with car and centered.

GUARDS

Guards can be removed after bumper bar is removed, by removing one bolt at lower edge of bumper primary bar as shown in Fig. 11-25.

BRACKETS

Each bumper bar bracket is attached to the primary bar by two bolts as shown in Fig. 11-25.

PARKING LAMPS

The parking lamp assemblies may be removed by disconnecting the wiring and removing the four stud nuts and two clamps, and removing the clamp from the rear of the stone shield. (Fig. 11-23)

REAR BUMPER (19 Styles) (Disconnect License Lamp Wire)

The primary bar is attached by four mounting bolts accessible through the trunk compartment and two lower guard bolts attached through the lower rear stone shield accessible from front of stone shield as shown in Fig. 11-26.

When assembling, alignment can be made through slotted bolt holes in mounting brackets shown in Fig. 11-26. Torque primary bar nuts to 20-28 ft. lbs. and lower guard bolts to 15-20 ft. lbs. Torque bracket to frame bolts to 20-28 ft. lbs.

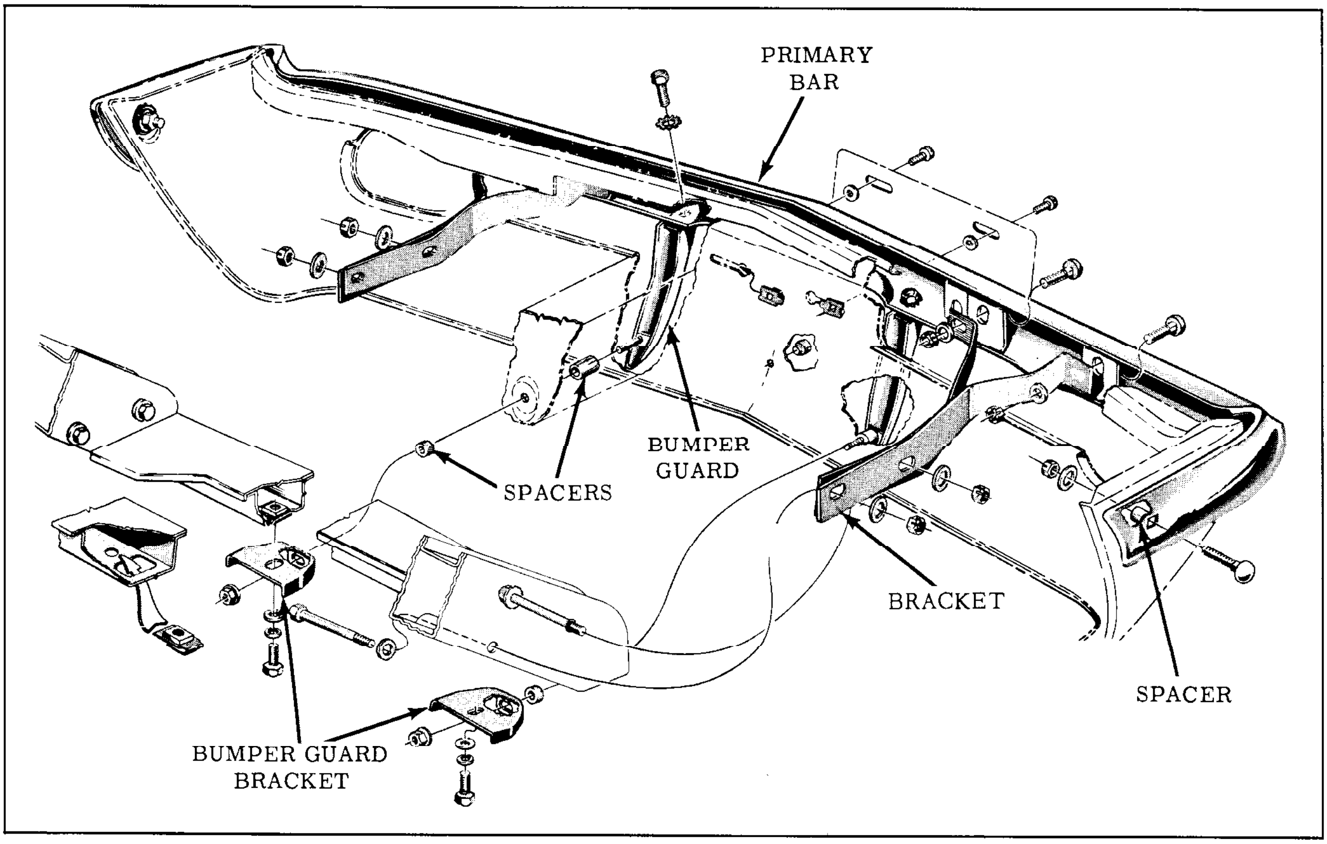

Fig. 11-25 Front Bumper

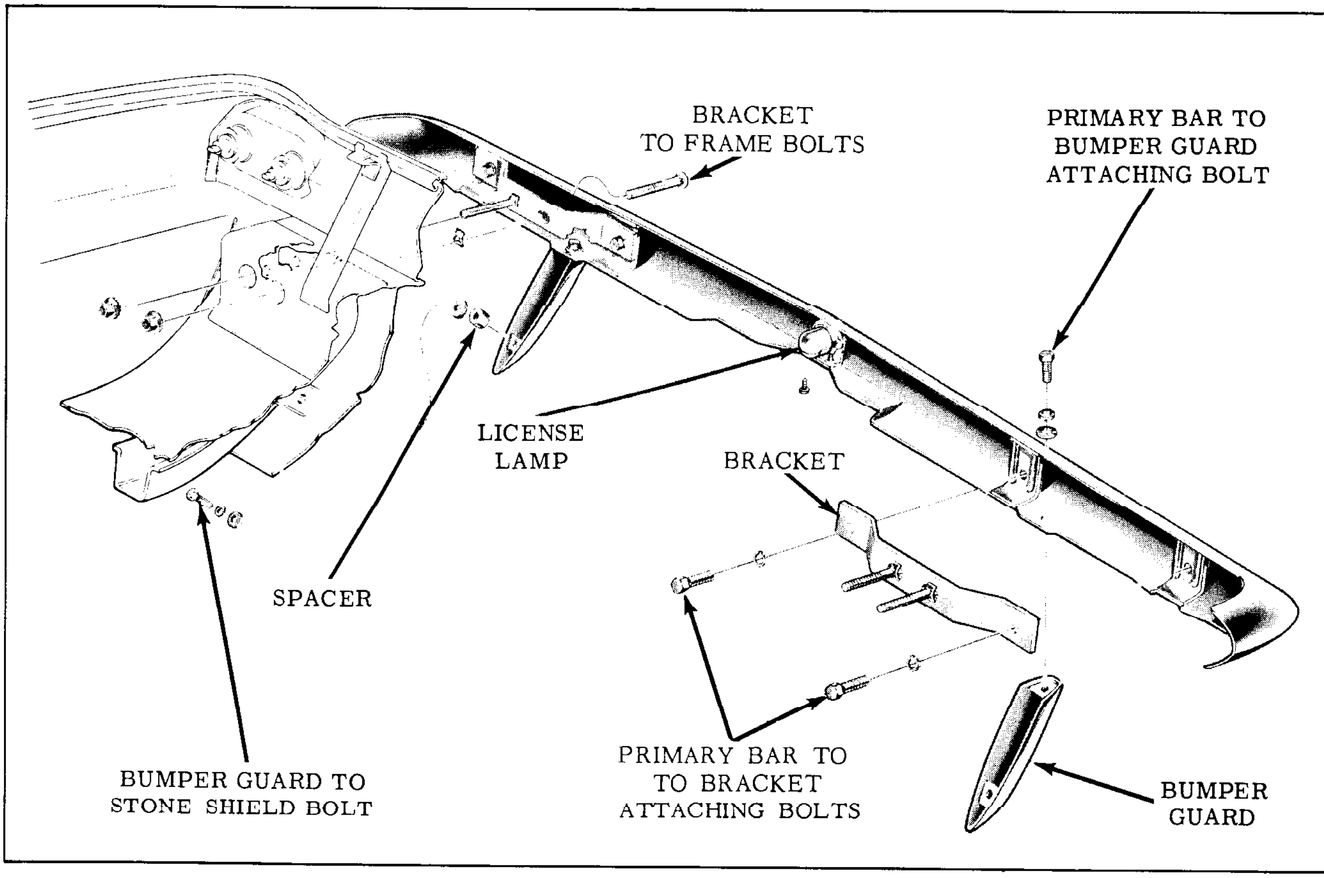

Fig. 11-26 Rear Bumper

"35" STYLES

The primary bar is attached to the brackets by four mounting bolts. The brackets are attached to the body and the bolts are accessible through the spare tire compartment. The bumper guard is attached to the lower edge of the primary bar and to the rear stone shield. After proper alignment is obtained, torque the bracket bolts to 20-28 ft. lbs. Torque the bumper guard bolts to 15-20 ft. lbs.

GUARDS

The bumper guard is attached to the primary bar with one bolt and to the lower stone shield with one bolt. Bumper guard to stone shield dimension is maintained with a tubular spacer held in position by the lower guard bolt as shown in Fig. 11-26.

ALIGNMENT

Bumper alignment is obtained by elongated holes in the brackets. It necessitates merely loosening attaching bolts and nuts, positioning bumper to desired position and tightening. Make sure that bumpers are horizontal and clearance between bumper and fenders is even on both sides. Torque nuts 20-28 ft. lbs.

REAR LICENSE LAMP

The rear license lamp is attached to the rear bumper by two Phillips head screws accessible

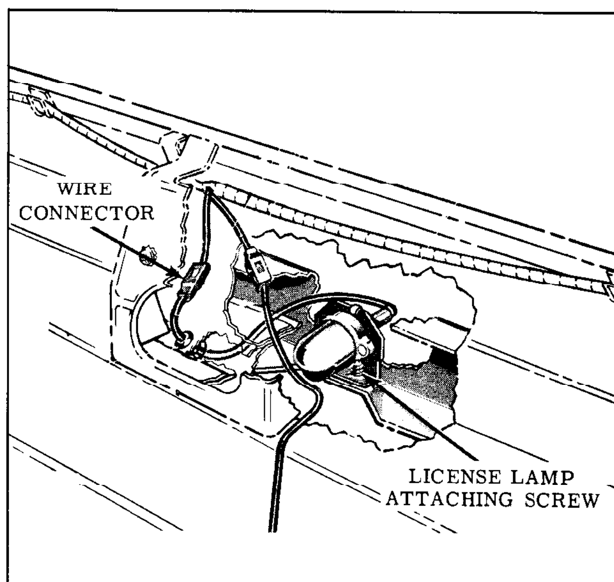

Fig. 11-27 Rear License Lamp

from lower side of the bumper primary bar. (Fig. 11-27)

To replace, disconnect wire and remove the two attaching screws.

For bulb replacement, remove lamp from bumper and remove lens.

TORQUE SPECIFICATIONS

APPLICATION	FT. LBS.
FRONT BUMPER	
Guard to Primary Bar	15 to 20
Front Bumper Wing to Stone Shield Panel	20 to 28
Brackets to Frame	20 to 28
Brackets to Primary Bar	20 to 28
Bumper Bracket to Cross Bar	15 to 20
Guard to Frame Bracket	8 Max.
REAR BUMPER	
Guard to Primary Bar	15 to 20
Brackets to Primary Bar	20 to 28
Brackets to Body Bracket	20 to 28
Rear Guard to Body Bracket	15 to 20

INSTRUMENT PANEL AND RADIO

CONTENTS OF SECTION 12

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INSTRUMENT PANEL COVER	12-7

DESCRIPTION

To describe the components in this section it becomes necessary to make reference to the instrument panel such as "front of instrument panel" or "rear of instrument panel."

Front and rear, usually refer to the front and rear of the car in general. IN THIS SECTION however, we refer to the FRONT of the instrument panel as that side as viewed from the drivers seat and the REAR as that side toward the front of the car.

The Instrument Panel Section covers all items operated from the Driver's Seat.

For servicing of individual components of instrument cluster, refer to the electrical section.

INSTRUMENT CLUSTER

The instrument cluster is of the printed circuit type which eliminates external wiring at each component of the cluster. All of the electrical instruments and lights are connected to the wiring harness by a plug located at the rear of the cluster. (Fig. 12-1)

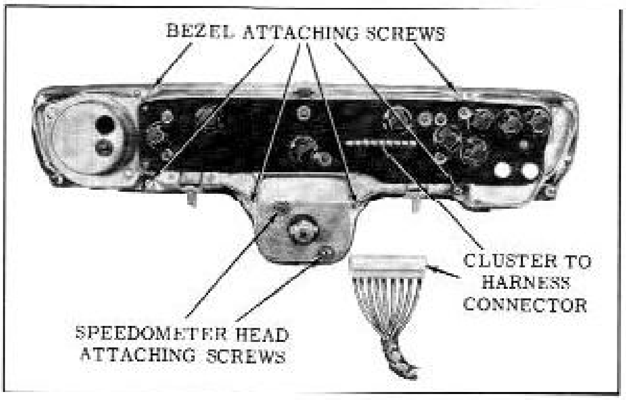

Fig. 12-1 Instrument Cluster Connector

All the instruments in the cluster are electrically operated, except the speedometer, which is 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 is at normal operating temperature.

The generator light will show red while idling, until engine reaches 600 r.p.m.

The light sockets used in the instrument cluster can be removed by turning the socket 1/8 of a turn counterclockwise.

Removal

1. Disconnect positive battery cable from battery.

2. Remove cluster cover attaching screws. (Fig. 12-2) Disconnect the wiring harness, clock, and speedometer cable at the cluster.

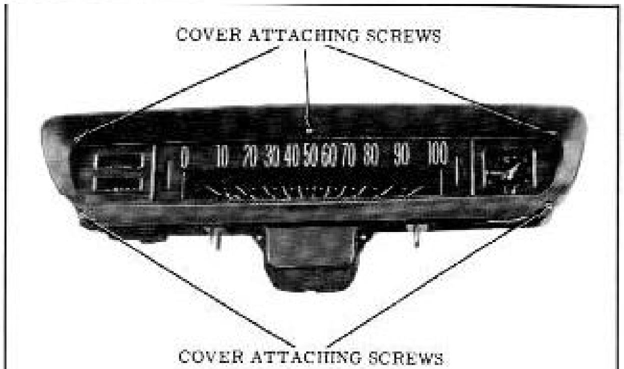

Fig. 12-2 Cover Removal

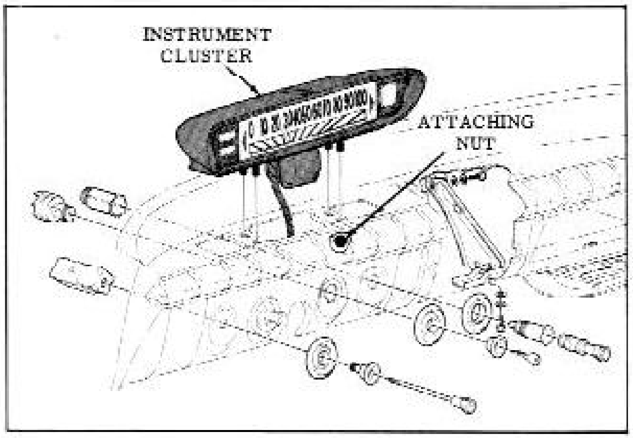

Fig. 12-3 Instrument Cluster Removal

3. Remove the four cluster to instrument panel attaching nuts and lock washers, from under instrument panel, then remove cluster from top of instrument panel. (Fig. 12-3)

Installation

When installing cluster, it is important that care be exercised so damage will not result to the printed circuit.

SPEEDOMETER HEAD

Removal

1. With instrument cluster removed from car, remove the 6 instrument cluster bezel to case attaching screws and remove bezel and face from cluster as shown in Fig. 12-1.

2. Remove the 2 speedometer head attaching screws from the case assembly and remove speedometer head from front of case. (Fig. 12-1)

PRINTED CIRCUIT

Removal

To prevent possible damage to the printed circuit, no attempt should be made to remove or install it without first removing the cluster assembly.

1. Remove all cluster lamp sockets, and five circuit attaching screws. (Fig. 12-4)

2. Remove 2 hex nuts from fuel gauge mounting studs.

3. Lift printed circuit from cluster.

Installation

When installing printed circuit, care should be taken not to over tighten attaching screws or nuts. This can result in cracking circuit causing a malfunction.

FUEL GAUGE

The fuel gauge assembly can be removed without removing the instrument cluster as follows: (Fig. 12-5)

1. Disconnect the positive battery cable from battery.

2. Remove cluster cover.

3. Disconnect the fuel gauge wiring connector and the light socket from the printed circuit.

4. Remove the two attaching nuts and withdraw fuel gauge from front of instrument cluster.

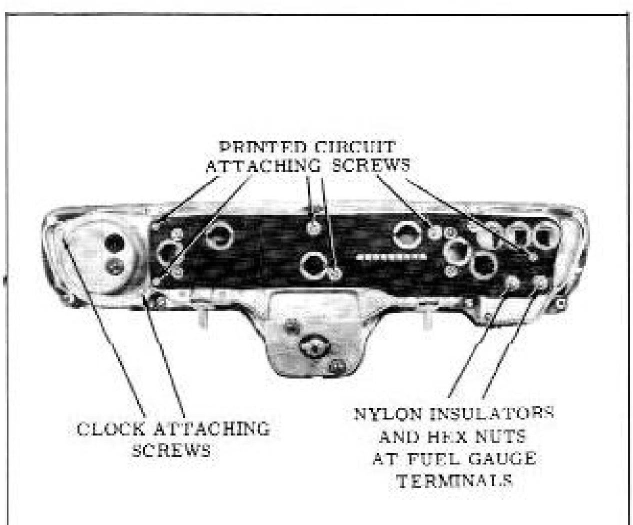

Fig. 12-4 Printed Circuit Attachment

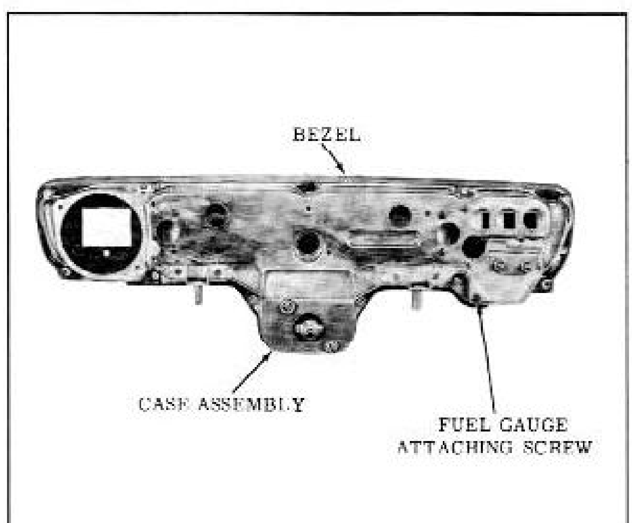

Fig. 12-5 Fuel Gauge Attachment

5. To install the gauge, it is extremely important that care be exercised at all times when handling this unit.

NOTE: For servicing and testing of the fuel gauge, refer to the ELECTRICAL SECTION, Page 13-52.

CLOCK

The clock is electrically wound. The rewind mechanism winds the clock when the clocks electrical circuit is energized, (approximately every two minutes). The clock incorporates a self-regulating feature. When the hand setting knob is pulled out to set the hands, an automatic regulating device is placed in operation. Setting the hands ahead or back will cause the device to regulate the clock to run either faster or slower, determined by the degree of time setting change.

The clock housing is retained to the instrument cluster by two screws. Wiring is attached to the rear of the clock and the light socket snaps into the clock housing. After the clock is disconnected, it can be withdrawn from the rear of the instrument cluster. (Fig. 12-6) The knob must be removed by threading it off the shaft, and the cluster cover removed.

VENTILATING CONTROLS

The ventilating controls are independently mounted below each side of the dash. (Fig. 12-7) They are cables operating the doors in the air valve body. For service refer to Ventilating and Heating section.

HEATING CONTROLS

The heating controls are attached to the dash panel by 3 studs. (Fig. 12-7) Operation of these controls is described in the Heating Section of this manual.

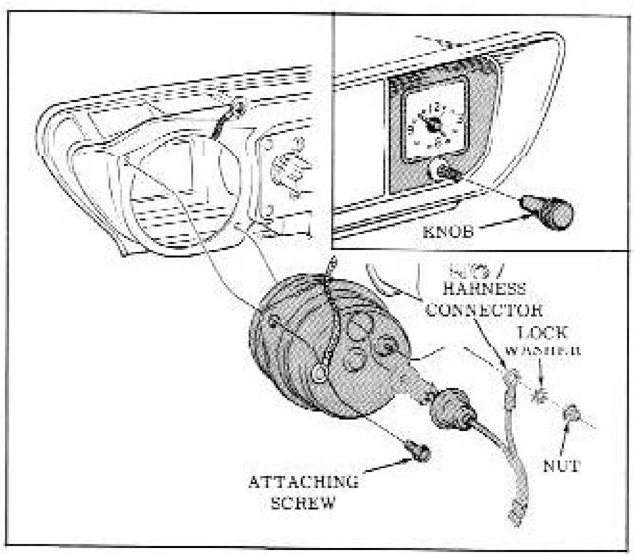

Fig. 12-6 Clock Installation

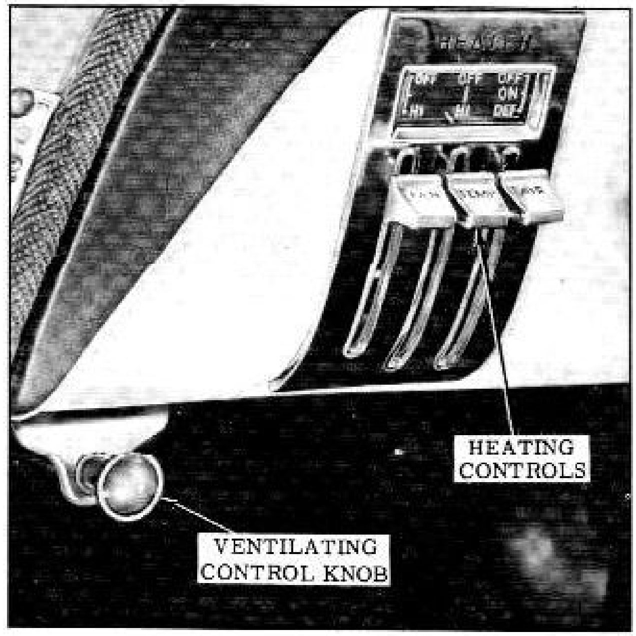

Fig. 12-7 Heating and Ventilating Controls

HEADLIGHT SWITCH

All connections in the headlight switch are connected as a group by a female connector.

The brightness of the instrument panel lights is controlled through a variable resistor unit by turning the light switch knob right or left.

By rotating the knob fully counterclockwise will cause the dome light to light.

Removal

1. Disconnect positive battery cable from battery.
2. Disconnect wiring from light switch.
3. Remove knob and rod by first pulling knob out to "Headlight" position, then depress

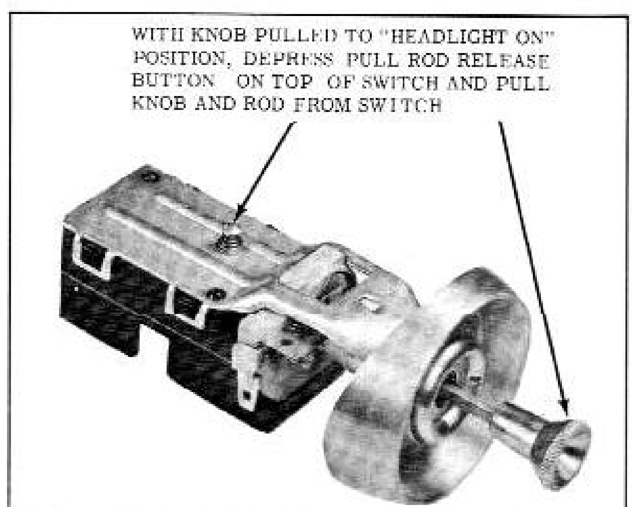

Fig. 12-8 Headlight Switch

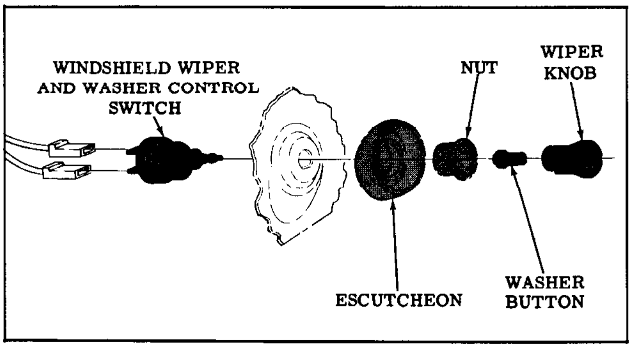

Fig. 12-9 Wiper Control

button on top of switch assembly and pull rod out. (Fig. 12-8)

4. Remove escutcheon with Tool J-6592-01.
5. Remove headlight switch from rear of instrument panel.

After installation, check operation.

WIPER CONTROL

Removal

1. Disconnect positive battery cable.
2. Remove wiper control knob by removing set screw. With Tool J-6592-01 remove nut, escutcheon and control. (Fig. 12-9)
3. Disconnect wiring harness from wiper control.
4. Connect battery cable.

After installation check operation.

IGNITION STARTER SWITCH

1. Remove escutcheon from instrument panel, with Tool J-6592-01, then remove switch assembly from rear of instrument panel.

   NOTE: A tool to remove escutcheon can easily be made from 16 gauge metal 4" long, 13/16" wide and 1/16" thick.

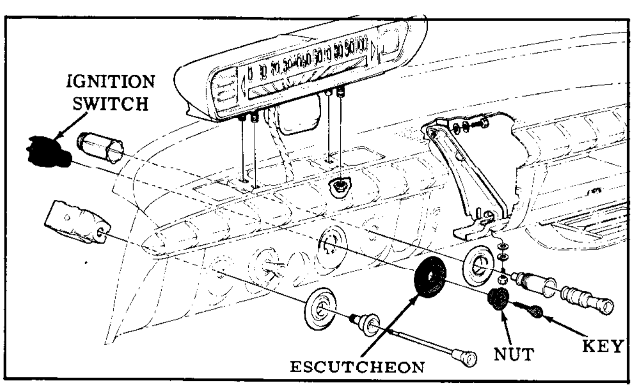

Fig. 12-10 Ignition Starter Switch

2. Disconnect wiring connector from back of ignition switch.

   NOTE: The ignition switch wiring connector is locked to the back of the ignition switch by means of a special terminal tang which fits in a hole in the terminal for the accessory wire. The connector plastic insulation has a slot in it to gain access to the tang. To remove the connector, insert a small punch or awl through the slot to depress the terminal tang and disengage it from the terminal, then pull the connector from the ignition switch. The tang automatically engages the terminal when the connector is reinstalled. (Fig. 12-10)

To remove lock cylinder:

1. Insert key and turn to the left.
2. Push a wire in hole in face of lock cylinder.
3. Turn cylinder to left as far as it will go and withdraw cylinder.

CIGAR LIGHTER

Removal

1. Disconnect positive battery cable from battery.
2. Disconnect fuse holder on back of lighter. (Fig. 12-11)
3. Unscrew the retainer from the lighter body assembly behind the instrument panel.

ASH TRAYS

Ash tray housings are attached with three screws on the back of the instrument panel and the two lower ones can be loosened to align housing. (Fig. 12-12)

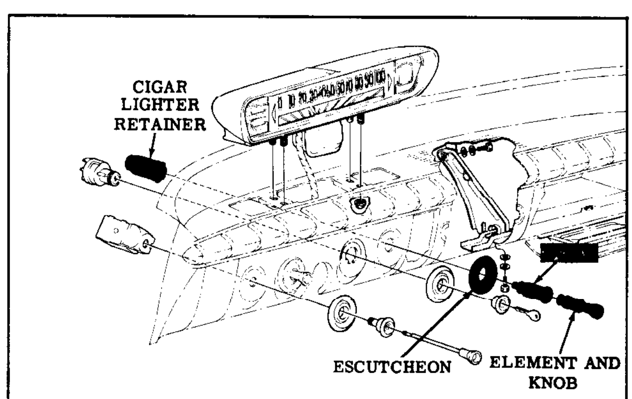

Fig. 12-11 Cigar Lighter

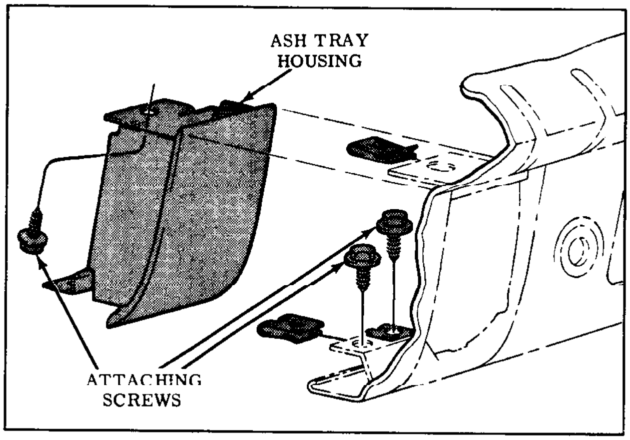

Fig. 12-12 Ash Trays

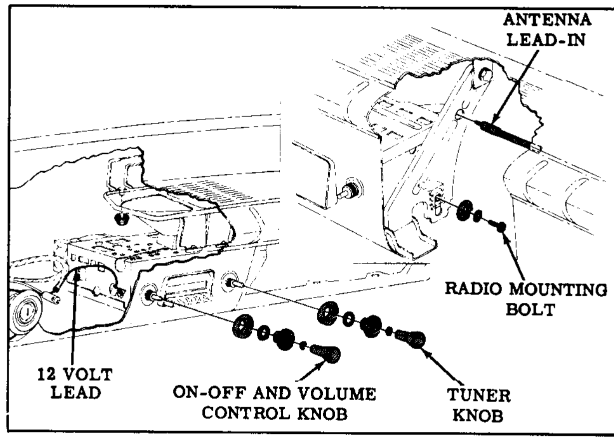

Fig. 12-13 Radio Installation

RADIO

Removal

The radio consists of the receiver unit and the speaker unit. The serial number plate on the radio is located on the R.H. side of the receiver chassis visible through opening in left end of glove box.

Receivers have 5 push buttons for touch tuning, (which mechanically tunes the radio to pre-selected stations), and a control knob for manual selection of stations.

Push Button Adjustment

1. Allow the receiver to warm up for a few minutes.
2. Select a push button 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.
5. Proceed in the same manner to set the remaining push buttons.
6. After all the buttons have been adjusted, re-check 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.

Removal

1. Disconnect radio lead from wiring harness, (Fig. 12-13) Disconnect antenna lead-in and speaker wire.
2. Remove radio control knobs, escutcheons and nuts from front of instrument panel.
3. While supporting receiver to prevent it from falling, disconnect receiver rear bracket from receiver and remove the receiver.

Installation

When installing the receiver, attach rear bracket first and be certain escutcheons properly fit contour of dash and cover holes.

RADIO SPEAKER

Removal

To remove the speaker, disconnect the speaker

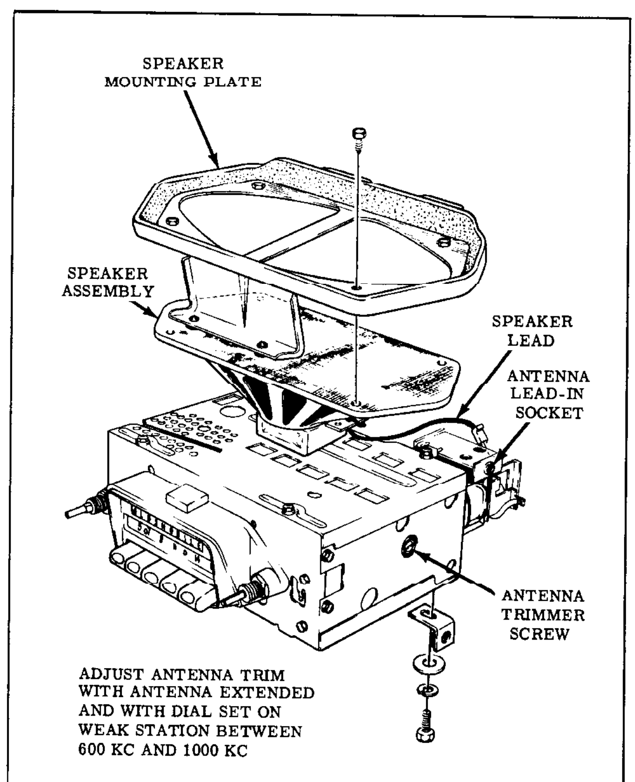

Fig. 12-14 Speaker Installation

lead wire and remove radio receiver. Remove the 2 speaker to instrument panel nuts. Speaker will pivot downward for removal. (Fig. 12-14)

Installation

Position the two prongs on the speaker bracket into the slots provided under the instrument panel and rotate upward over studs and install nuts.

RADIO DIAL LIGHT

The dial light may be replaced after removing the receiver from the dash, and then removing the top cover. The bulb number is 1893. (Fig. 12-15)

ANTENNA

Trimmer Adjustment

1. With the antenna fully extended, turn the radio on.
2. Turn the volume control full on and tune the receiver to a weak station between 600 and 1000 K.C. on the dial.
3. With a small screw driver, adjust the antenna trimmer located on the R.H. side of the receiver (accessible through cutout in L.H. end of glove box) for maximum volume.

Checking Antenna

To check antenna for partial short, remove lead-in from side of receiver and check resistance from lead-in connector to a good ground using an ohmmeter. Resistance should be 3 megohms or more.

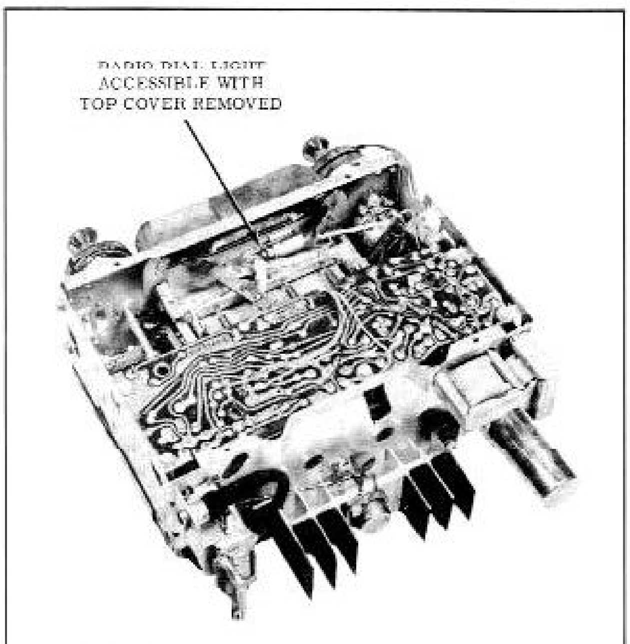

Fig. 12-15 Radio Dial Light

Removal

To remove the antenna mast, loosen the antenna cap nut and lift the mast out of socket. To remove antenna socket and lead-in, proceed as follows:

1. Remove right cowl trim panel and insulation.
2. Remove lead-in plug from right side of radio receiver.
3. Remove antenna mast; then remove attaching nut, upper spacer, and gasket. (Fig. 12-16)
4. Remove bolt holding antenna lead-in brace in right cowl at air inlet.
5. Remove lead-in assembly through cowl opening, being careful not to lose lower spacer, and pull lead-in cable out between end of plenum chamber and reinforcement.

GLOVE BOX

The glove box can be easily removed by removing the 3 lower, 2 side, and 2 upper attaching screws and rotating the rear downward.

GLOVE BOX DOOR

The door may be adjusted vertically or sideways by loosening the 3 screws holding the hinge to the door.

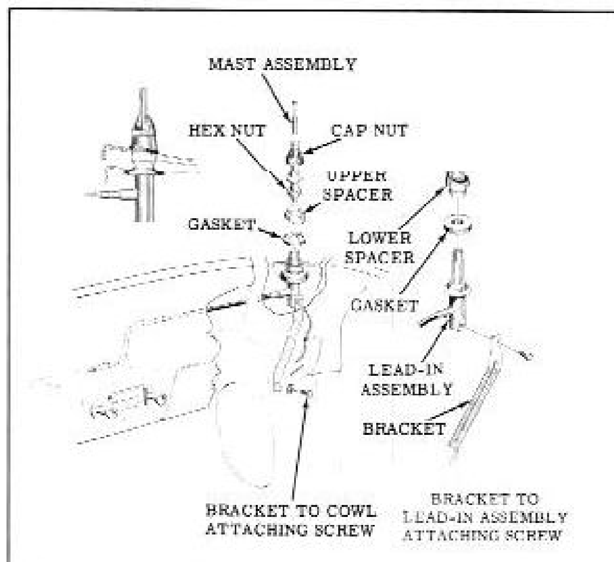

Fig. 12-16 Antenna Installation

Fore and aft adjustment of the bottom edge may be made by loosening the 3 screws holding the hinge to the instrument panel.

Fore and aft adjustment of the top edge of the door or adjustment of the glove box door latch plate may be made by loosening the two screws holding the latch plate to the upper flange of the glove box door opening.

HYDRA-MATIC INDICATOR NEEDLE

Removal and Installation

The hydra-matic indicator needle is a part of the steering column shift lever collar.

Adjustment

With Manual Linkage Adjusted, page 3-72, loosen lock nut at transmission shift lever, and adjust shift rod until indicator is in correct position on quadrant and tighten lock nut. (Fig. 12-17)

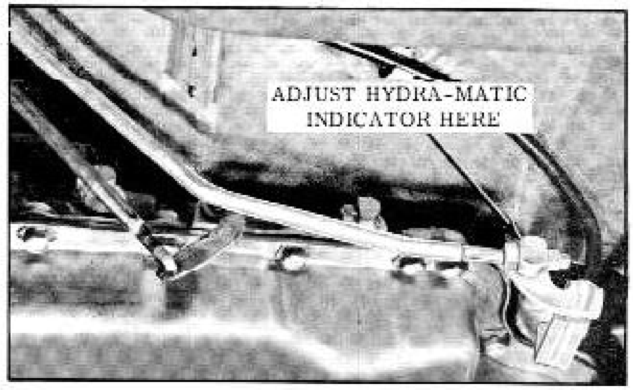

Fig. 12-17 Hydra-Matic Indicator Adjustment

INSTRUMENT PANEL COVER

The instrument panel cover is attached by seven studs, spacers and nuts accessible from rear of instrument panel. By removing these nuts, pad may be easily lifted from panel.

ELECTRICAL

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MAINTENANCE RECOMMENDATIONS

GENERATOR

Every 2,000 miles add 8-10 drops of S.A.E. 20W engine oil to the hinge cap oilers.

DISTRIBUTOR

The distributor shaft requires no external lubrication. The upper bushing is lubricated by a special lubricant which never needs addition or replacement. The lower bushing is lubricated by splash from distributor drive gear.

Every 6,000 miles.

1. Apply one drop of oil to the breaker lever pivot.
2. Apply a little Delco-Remy cam and ball bearing lubricant or equivalent to the breaker cam.

Periodically clean and tighten connections.

SPARK PLUGS

Every 10,000 miles.

1. Remove, clean, inspect, and regap.
2. Replace defective plugs.

BATTERY

Every 2,000 miles.

1. Adjust electrolyte level.
2. Oil positive terminal felt washer with S.A.E. 20W oil.

Periodic

1. Inspect external condition of battery.
2. Clean top of battery.
3. Check hold down clamp for proper tightness.

REGULATOR

Normally, periodic servicing is not required, however it may be necessary to occasionally clean contact points and adjust.

STARTING MOTOR AND SOLENOID

No periodic lubricant required.

IGNITION COIL

Inspect periodically for dirt, oil leakage, cracks, and loose terminals.

WIRING SYSTEM

The wiring system incorporates a wiring harness designed such that several conductors are wound into a single loom or cable with branches along the harness to connect the various electrical components. The wiring circuit is broken down into two sections, they are; the chassis wiring harness, and the body wiring harness. The chassis wiring harness connects those components located in the instrument panel and directly ahead of the instrument panel. The body wiring harness, with few exceptions, connects all electrical components in the body shell from the instrument panel on back to the rear of the car.

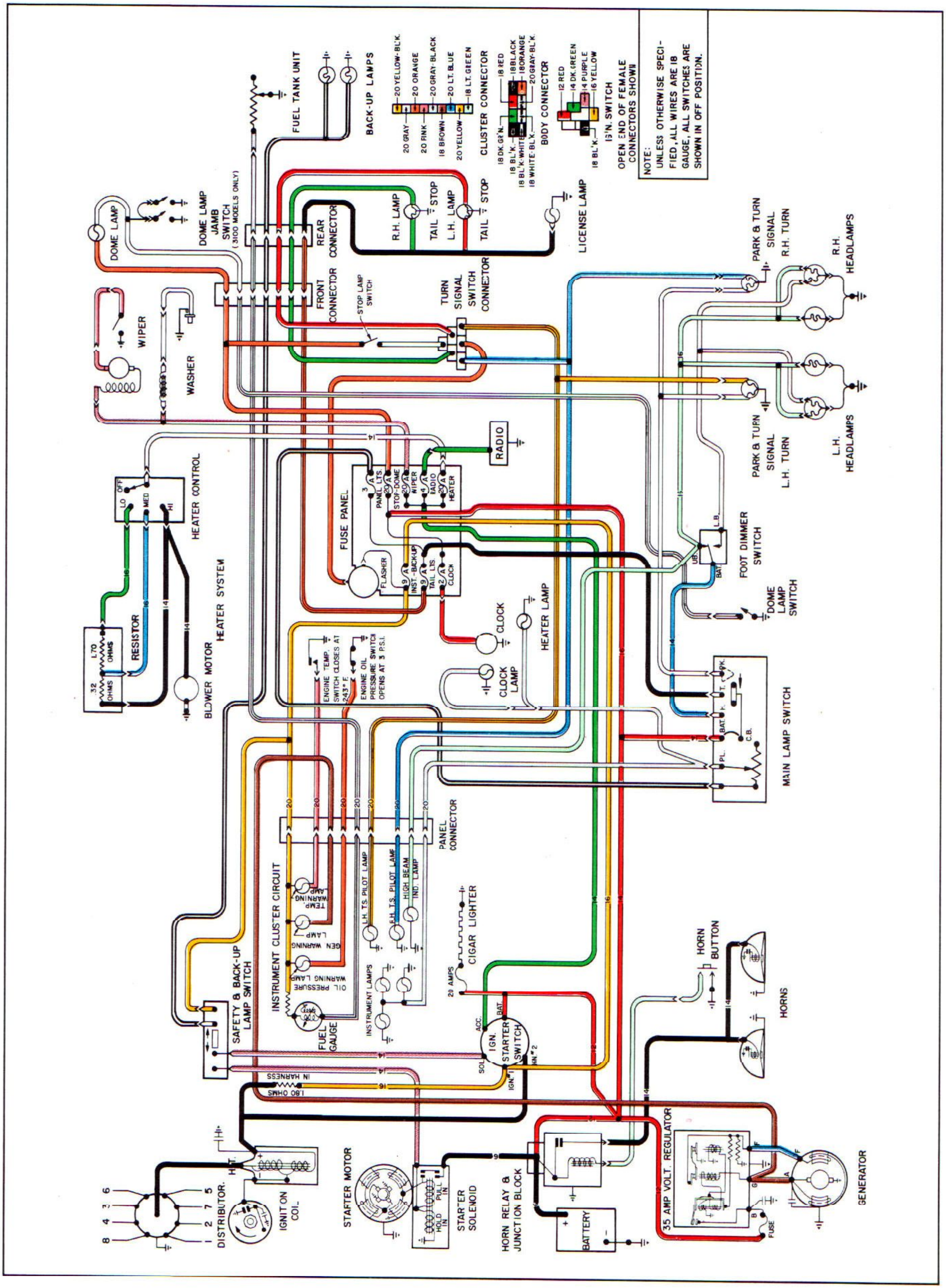

Fig. 13-1 Wiring Diagram

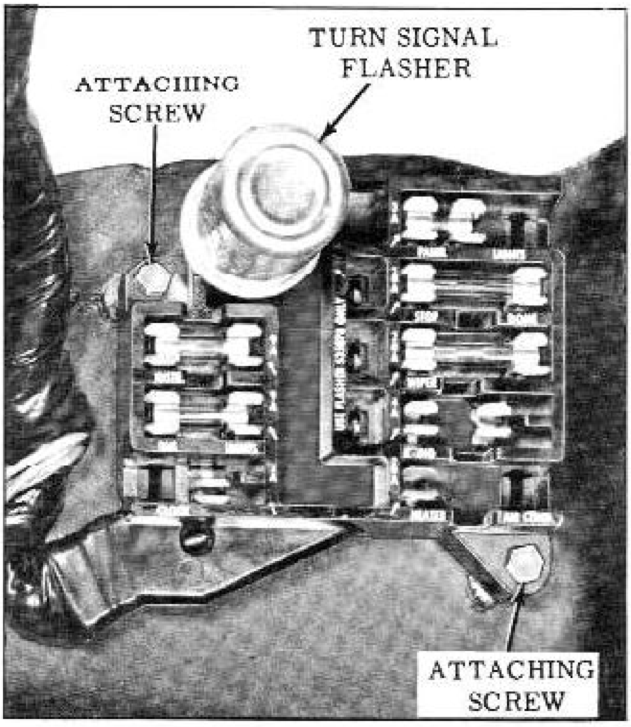

Fig. 13-2 Fuse Panel

A combination junction block and fuse panel is mounted with two hex head sheet metal screws, on the cowl under the instrument panel and just to the left of the steering column. The fuse panel is color coded to correspond to the wiring color code. The turn signal flasher unit socket is at the upper left hand corner of the fuse panel. All instrument panel units are connected to the chassis wiring harness by a multiple contact connector that is designed to prevent improper assembly. The body wiring harness is connected to the chassis wiring harness by a keyed multiple contact connector. This chassis-body wiring harness connector is located under the left side of the instrument panel. A wiring diagram of the complete electrical system is illustrated in Fig. 13-1.

FUSE PANEL

Removal

1. Disconnect the battery positive cable.
2. Disconnect the clock feed wire at the fuse panel.
3. Remove the two sheet metal mounting screws. (Fig. 13-2)

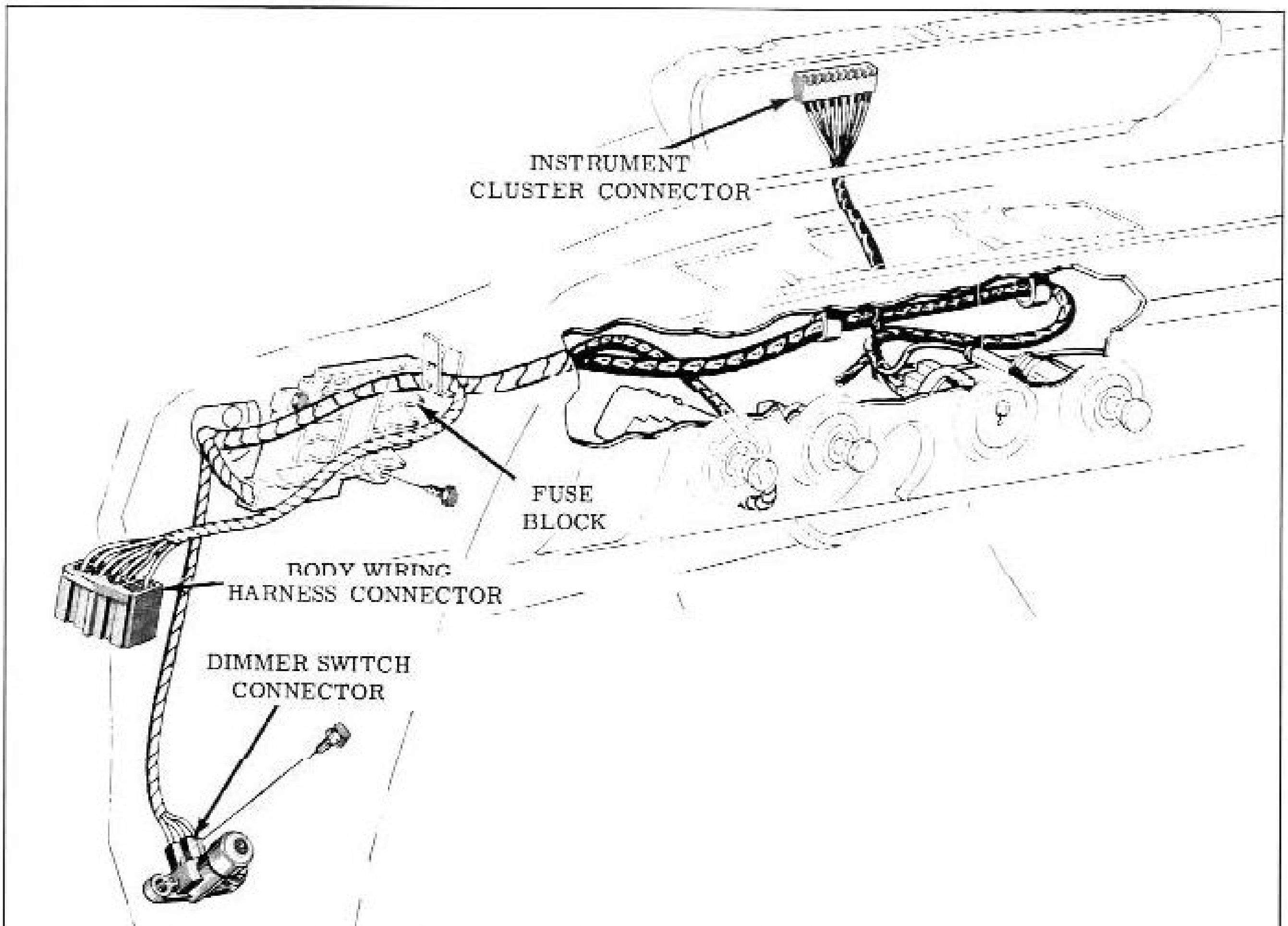

Fig. 13-3 Instrument Panel Wiring

4. Remove fuses from panel.

5. Disconnect the wiring from the back of the panel by removing the fuse holder clips. To remove the fuse clip, insert a cotter pin over the center of the fuse clip and push in to disengage locking ears on both sides of the clip. When the locking ears are disengaged, the fuse clip can be pushed on out the back of the fuse panel.

Installation

1. Insert fuse clips into back of panel until locking ears snap, locking the clip in place.

2. Mount the panel on the cowl using two sheet metal screws. (Fig. 13-2)

3. Replace fuses.

4. Connect clock feed wire if car is so equipped.

5. Connect battery positive lead.

CHASSIS WIRING HARNESS

Removal

Whenever a failure in the main wiring harness makes it necessary to replace the harness, it is suggested that all harness leads to cut off within about an inch of the connectors. This will leave the correct color coded wire at the connector and will make correct identification of connections possible.

IMPORTANT: WHENEVER IT IS NECESSARY TO DISCONNECT THE BODY WIRING HARNESS FROM THE CHASSIS WIRING HARNESS OR WHENEVER ANY ELECTRICAL TESTS OR REPAIRS ARE MADE IN THE HARNESS, THE WIRE TO THE FUEL GAUGE TANK UNIT MUST BE DISCONNECTED TO PREVENT DAMAGE TO THE TANK UNIT RESISTANCE COIL.

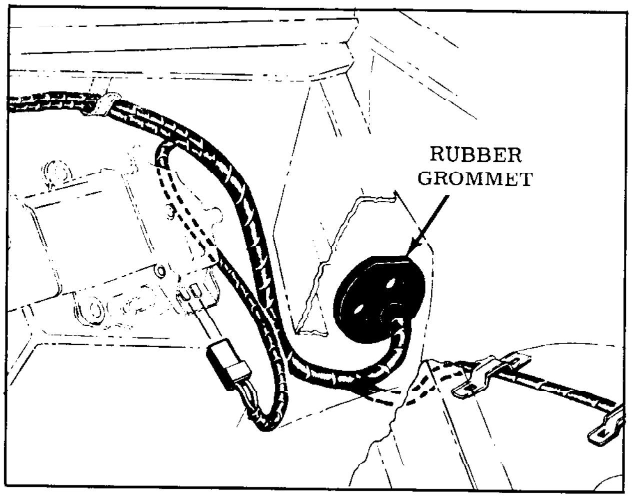

Fig. 13-4 Wiring Harness Routing

1. Disconnect the battery positive cable.

2. Cut all harness to component leads near the connector.

3. Remove fuse panel.

4. Remove damaged harness.

Installation

1. Mount fuse panel on cowl. (Fig. 13-2)

2. Route harness branches to components under instrument panel. (Fig. 13-3)

3. Route under-hood branches through rubber grommet in cowl panel. (Fig. 13-4)

4. Connect each connector of new harness as the trimmed off connector of old harness is removed by following color of old wire.

5. Reconnect battery cable to terminal (positive) of battery.

CHARGING CIRCUIT

DESCRIPTION

The charging circuit consists of a battery, generator, voltage regulator and a generator warning light. A schematic wiring diagram of the charging circuit is illustrated in Figure 13-5.

The "F-85" is equipped with a Delco battery. (Fig. 13-6) The battery is a six cell, fifty-four plate, twelve volt, forty ampere - hour storage battery. The prime function of the battery is to supply electrical energy for starting the car and to supply electrical energy to all of the cars electrical components whenever the generator is not supplying electrical energy. The generator maintains the battery in a charged condition by forcing electrical energy through the battery in a reverse direction to renew the battery to a fully charged chemical state.

The generator is a belt driven twelve volt, thirty-five ampere D.C. unit which is mounted at the R.H. lower front section of the engine. The generator supplies electrical power, at speeds above idle to operate all of the electrical components and to charge the battery. The output of the generator is limited by the voltage regulator.

The voltage regulator is a Delco-Remy twelve volt, thirty-five ampere unit consisting of a cutout

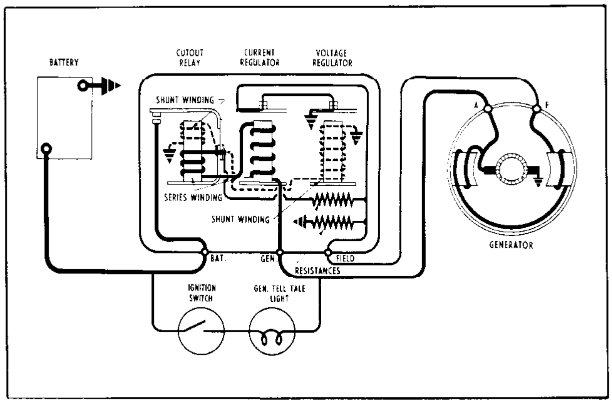

Fig. 13-5 Charging Circuit

relay, a voltage regulator, and a current regulator, (Fig. 13-7) A special fuse assembly is attached to the "BAT" terminal of the regulator, (Fig. 13-7) This fuse protects the generator armature from over heating if the cutout relay points should become stuck in the closed position. It also protects wiring.

The cutout relay closes and opens the charging circuit between the generator and the battery. When the generator output voltage reaches the value for which the cutout relay is adjusted, the contact points close allowing the current to flow from the generator toward the battery. When the generator voltage falls below the battery voltage, the points open to prevent the battery from discharging through the generator when the engine is idling or stopped.

The voltage regulator limits the voltage of the electrical system to a safe maximum. The con-

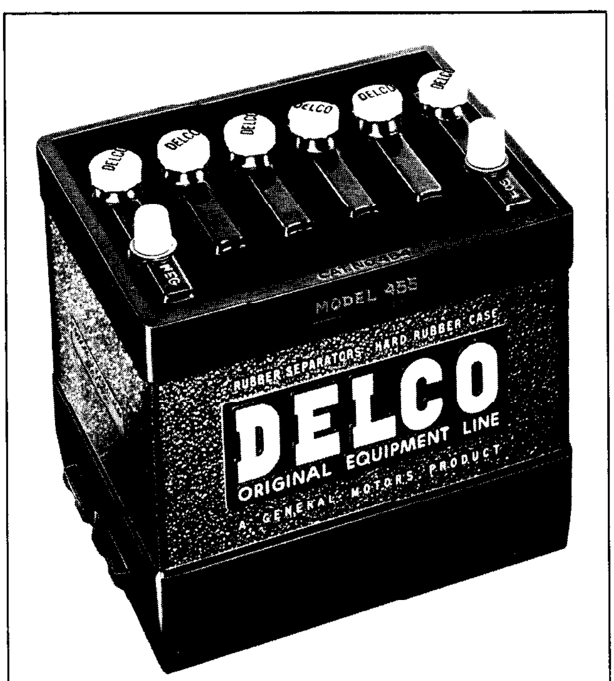

Fig. 13-6 Battery

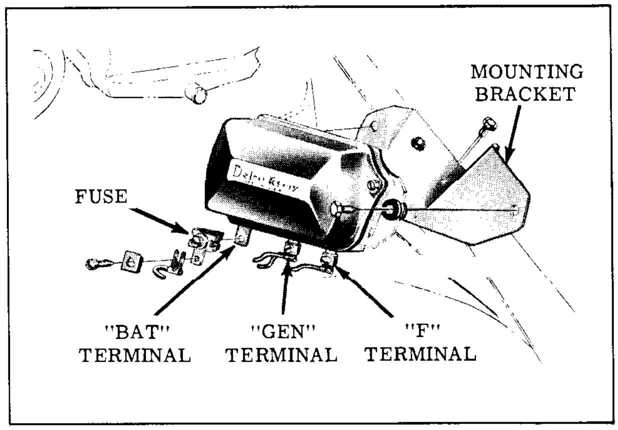

Fig. 13-7 Voltage Regulator

tacts of the voltage regulator oscillate at a high speed, opening and closing the points. This action intermittently introduces resistance into the generator field circuit, thereby reducing voltage.

The current regulator prevents overheating of the generator armature by limiting the generator output. When the generator output reaches the value for which the current regulator is set, the points open, inserting a resistance into the generator field circuit. This causes the generator output and the field voltage to decrease, allowing the contact points to close. This cycle occurs many times each second, thereby limiting generator output to a safe maximum.

The generator warning light will come on when the generator output voltage falls below the battery voltage. When the generator output voltage becomes greater than the battery voltage, the red light should go out. This does not, however, indicate whether the battery is being charged or the regulator is functioning properly. This should be checked with an amp-volt-resistance unit if trouble is experienced with the charging circuit. The generator light will stay lit until the engine reaches about 600 r.p.m. This is equivalent to 8-10 m.p.h. and it does not indicate a malfunction of the charging circuit.

MAINTENANCE

BATTERY

Electrolyte level in the battery should be checked at least every 2,000 miles or once a month (more often in hot weather). When the electrolyte level is found to be low, water should be added to each cell until the liquid level rises to the bottom of the vent well or split ring. DO NOT OVERFILL! Distilled water, clean rain water, or water passed through a "demineralizer" should be used for this purpose in order to eliminate the possibility of harmful impurities being added to the electrolyte. Many common impurities will greatly shorten battery life. DO NOT ADD ANY SUBSTANCE TO THE ELECTROLYTE EXCEPT WATER.

The external condition of the battery and the battery cables should be checked periodically. The top of the battery should be kept clean and the battery hold-down bolts should be kept properly tightened. Particular care should be taken to see that the tops of twelve-volt batteries are kept clean of acid film and dirt because of the high voltage between the battery terminals. For best results when cleaning batteries, wash first with a diluted ammonia or soda solution to neutralize any acid present and then flush off with clean water. Care must be taken to keep vent plugs tight so that the neutralizing solution does not enter the cell. The hold-down bolts should be kept tight enough to prevent the battery from shaking around in its holder, but they should not be tightened to the point where the battery case will be placed under a severe strain.

To insure good contact, the battery cables should be tight and bottomed on the battery posts. The new spring type battery cable clamps require that the ends of the clamps must be spread with a suitable pliers to remove or install, (Fig. 13-8). IT IS IMPORTANT THAT THE CLAMPS BE FULLY BOTTOMED DURING INSTALLATION. If the battery posts or cable terminals are corroded, the cables should be disconnected and the terminals and clamps cleaned separately with a soda solution and a wire brush. IT IS RECOMMENDED THAT NO LUBRICATION BE APPLIED TO THE BATTERY TERMINALS OR CABLE CLAMPS SINCE IT MAY CONTRIBUTE TO SLIPPAGE OF THE NEW TYPE CABLE CLAMPS FROM THE TERMINALS.

The positive terminal felt washer should be lubricated every 2,000 miles with engine oil.

GENERATOR

1. Add 8-10 drops of S.A.E. 20 engine oil to the

Fig. 13-8 Battery Cable Clamps

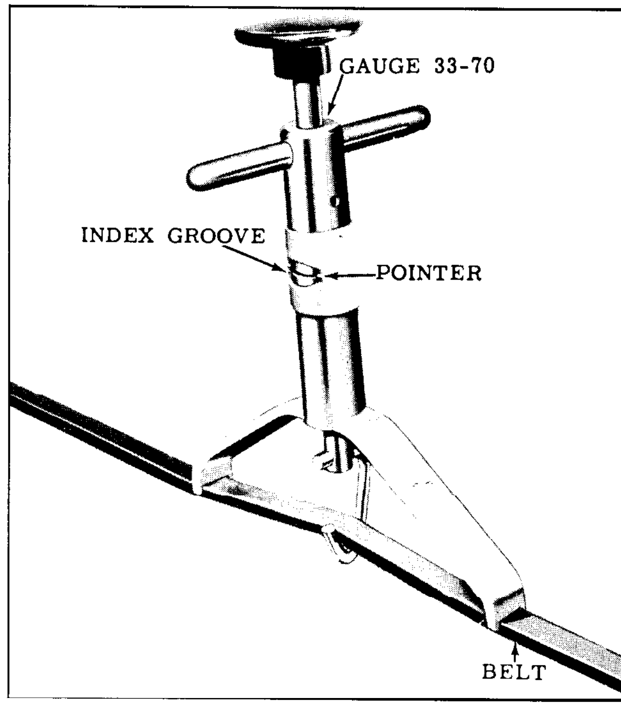

Fig. 13-9 Belt Tension Gauge

hinged cap oilers at each chassis lubrication. (2,000 Miles)

2. Inspect the commutator and brushes for wear and cleanliness. (Observe through commutator end frame.) If commutator is dirty, clean with number 00 sand paper, brush seating stone, or seating paste while engine is running. DO NOT USE EMERY CLOTH.

3. If brushes are worn to less than half their original length, replace them as outlined under disassembly of generator.

4. Check generator belt tightness and adjust if necessary.

   a. Place Belt Tension Tool 33-70 on generator belt.

   b. Loosen generator adjusting link bolt.

   c. Tighten generator belt until the line on the gauge is even with the pointers as shown in Fig. 13-9. The generator belt can be tightened when the generator is pivoted away from the engine by prying between the generator and the lugs of the generator mounting bracket from underneath the car. (Fig. 13-19)

   d. Tighten generator adjusting link bolt to 14-17 ft. lbs. of torque.

REGULATOR

1. Visually inspect connections for corrosion.
2. Inspect "BAT" terminal fuse for continuity.
3. Tighten all connections.

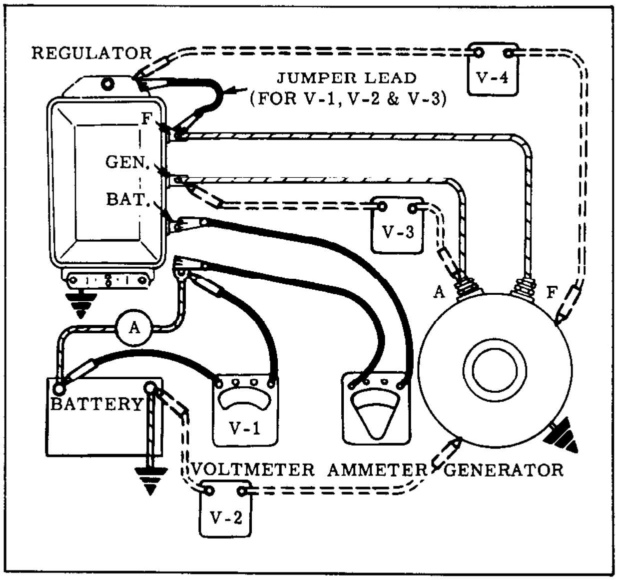

Fig. 13-10 Testing Charging Circuit Voltage Drop

CHARGING CIRCUIT CHECKS AND ADJUSTMENTS

To check for excessive voltage drops caused by loose connections, burned or broken wires or other high resistances proceed as follows:

1. Ground the "F" terminal of the regulator.
2. Connect an ammeter in series between the positive battery cable and the "BAT" terminal of the regulator as shown in Fig. 13-10, (Testing Charging Circuit Voltage Drop).
3. Turn off all accessories and operate the generator at a speed sufficient to produce a charging rate of twenty amperes.
4. Measure the voltage drops at V-1, V-2, and V-3 as shown in Fig. 13-10. V-1 plus V-2 should not exceed 0.5 volt. V-3 should not exceed 0.3 volts. Excessive readings indicate abnormally high resistances in the areas checked. These high resistances may be caused by loose or corroded connections.
5. Remove the ground jumper from the "F" terminal of the generator and turn on all lights and accessories. Measure the voltage drop V-4 as shown in Fig. 13-10. If this reading is more than 0.1 volt, excessive resistance is indicated in this portion of the circuit and can be due to a poor ground at the regulator or at the engine ground strap.
6. If excessive resistance is indicated in any part of the circuit, clean and tighten all connections and check the wires and replace as necessary.

BATTERY

If a battery failure is encountered, the cause may lie outside the battery itself. DO NOT BE SATISFIED MERELY TO RECHARGE OR REPLACE IT. FIND THE CAUSE OR FAILURE AND PREVENT RECURRENCE OF THE TROUBLE.

Inspect the outside of the battery for damage or signs of serious abuse. Inspect for cracked or broken case, broken or missing cell covers, leakage or distortion of the case or cell covers, and excessive tightness or looseness of the battery hold-down clamp.

The basic instruments required for battery testing are the hydrometer, thermometer, and the voltmeter.

For best results, read battery specific gravity with a calibrated hydrometer and correct for temperature.

Measurement of the specific gravity is an indication of the state of charge of an individual cell. Since an increase in electrolyte temperature causes the electrolyte to expand which in turn reduces the density and specific gravity, it is necessary to correct a given reading to compensate for a temperature differential from the standard temperature of 80°F. Therefore, it is necessary to measure the electrolyte temperature after allowing sufficient time for temperature stabilization before making the hydrometer test. To evaluate the effect of temperature on the specific gravity reading, for every 10° of electrolyte temperature, above 80°F, four gravity points (.004) must be added to the gravity reading. And for every 10° below 80°F, (.004) gravity points must be subtracted from the gravity reading. These adjustments compensate for the gain or loss in gravity caused by the contraction or expansion of the liquid as the temperature decreases or increases.

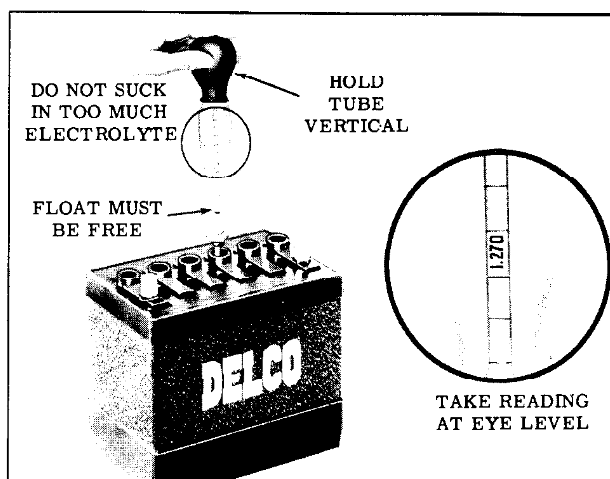

Fig. 13-11 Testing Specific Gravity

In taking a specific gravity reading it is important that the float be freely suspended in the liquid, not touching the walls, top or bottom of the tube. Observe the graduations on the stem of the float with the liquid level in the hydrometer at eye level to minimize reading error. (Fig. 13-11)

A specific gravity reading of 1.270 to 1.215 at 80°F, is considered satisfactory for continued use or testing. Batteries having specific gravity readings below 1.215 at 80°F. are considered unsatisfactory for continued use or testing until recharged and returned to a fully charged condition.

If after the hydrometer test the battery still checks out to be in good condition, it should be given a load test. The load test will indicate the batteries cranking ability as well as forms of deterioration and internal damage not otherwise detectable.

Before making the load test the following condition should prevail:

1. Battery specific gravity should be between 1.215 and 1.270 at 80°F.

Inspection

Check outside of battery for damage or signs of serious abuse such as broken case or broken covers. Check inside of battery by removing the vent caps and inspecting for signs of abuse such as electrolyte level too low to see, or bad or unusual odors. If battery shows signs of serious damage or abuse, it should be replaced. If not, make Light Load Test.

Light Load Test

Check electrical condition of battery cells as follows:

1. First, place load on battery by holding starter switch "ON" for 3 seconds. It makes no difference whether starter turns engine or not. However, if engine starts, turn off ignition immediately.
2. Then, turn on headlights (low beam). After 1 minute, with the lights still "ON" read individual cell voltages of battery with voltmeter (.01 volt division). Compare readings with the following:

Uniform Readings

If any cell reads 1.95 volts or more and the difference between the highest and lowest cell is less than .05 volts, battery is good. However, if any cell reads less than 1.95 volts, battery should be fully recharged for good performance. See CHARGING AFTER LIGHT LOAD TEST.

Non-Uniform Readings

If any cell reads 1.95 volts or more and there is a difference of .05 volts or more between the highest and lowest cell, the battery should be replaced.

Low Readings

If all cells read less than 1.95 volts, battery is too low to test properly.

FAILURE OF THE METER TO REGISTER ON ALL CELLS DOES NOT 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 second boost charge should be replaced.

NOTE: If any battery found to be good by the Light Load Test does not perform satisfactorily in subsequent service, it should again be tested as outlined under SLOW CHARGING.

Boost Charging For the Light Load Test

Boost 12-volt passenger car batteries at 50 amperes for 20 minutes (50 x 20 - 1,000 ampere minutes.) Boost all other batteries at 60 amperes for 30 minutes (60 x 30 - 1,800 ampere minutes.) If charger will not give these rates, charge for an equal number of ampere minutes at best rate available. For purposes of this test do not boost battery more than the amount indicated.

Charging After the Light Load Test

For best performance, a good battery should be fully charged before being returned to service.

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 batteries ampere-hour capacity. Ex: 7% of 40 A.H. = 2.8 amperes. This is called the "Normal" charge rate. The battery is fully charged when specific gravity readings taken at hourly intervals show no increase during three consecutive readings. Although the slow-charge method is recommended for charging all batteries, discharged 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 quick 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-charge for 48 hours or more before a rise in gravity reading occurs. If the specific gravity readings 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.

Adjust electrolyte to the proper level by adding water, then charge the battery at 2.8 amperes until fully charged. Full charge of the battery is indicated when all cell gravities do not increase when checked at three consecutive one hour intervals and all cells are freely gassing. In the charging process, highly inflammable hydrogen gas is produced. Therefore, the following precaution should be observed at all times:

CAUTION: A FLAME OR SPARK CREATED IN THE VICINITY OF A CHARGING BATTERY MAY RESULT IN AN EXPLOSION.

ALSO, THE BATTERY ELECTROLYTE IS AN ACID SOLUTION AND CAUTION SHOULD BE EXERCISED WHENEVER WORKING ON OR NEAR A BATTERY SINCE CONTACT WITH THE SOLUTION WILL BURN THE SKIN AND CAUSE DETERIORATION OF CLOTHING.

When the specific gravity has become stable the battery is fully charged. Measure specific gravity of each cell. HYDROMETER READINGS TAKEN ON PARTIALLY CHARGED BATTERIES ARE UNRELIABLE.

Measure specific gravity of electrolyte in each cell and compare readings with the following:

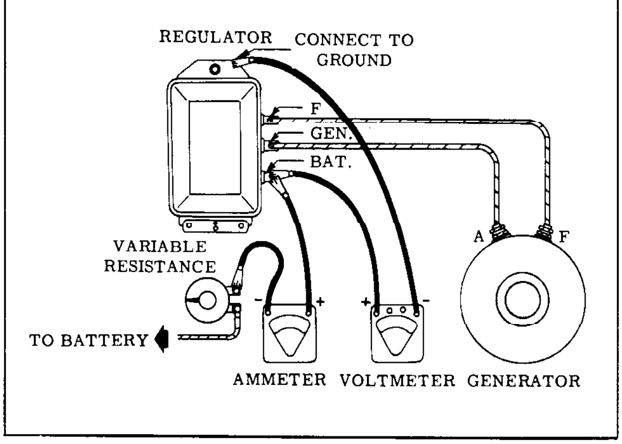

Fig. 13-12 Variable Resistance Voltage Regulator Setting

The battery is ready for use if cell readings fall inside a range from 1.215 to 1.270.

The battery should be replaced if the specific gravity of any one cell falls outside the above range, (1.215-1.270).

REGULATOR

Before attempting regulator adjustments, the regulator must be at normal operating temperature. Allow a cold engine to run approximately 15 minutes before making any voltage adjustments. On cars which have been driven into the service area, and are at normal operating temperature, the voltage adjustments can be made immediately. After the voltage adjustments have been made, turn on all lights and accessories and run engine at fast idle for an additional 25 minutes. The additional 25 minute interval is required in order that the current regulator is allowed to stabilize before making any current regulator adjustments. If the current regulator is not allowed to stabilize, the current regulator setting may be as high as 6 amperes off the specified settings.

NOTE: To prevent the engine from overheating, it may be necessary, in some areas, to place fans in front of the radiator to assist in engine cooling.

Before making voltage adjustments and/or current adjustments on the regulator, position a good quality (graduations directly on glass) mercury type glass thermometer within 1/4" of the regulator cover. This measures the ambient (surrounding) temperatures of the regulator. After the ambient temperature is known, the correct regulator settings can be made in relation to the temperature.

The electrical checks should be made in the following order:

Voltage Regulator Setting

Cutout Relay Closing Voltage

Current Regulator Setting

Voltage Regulator Setting (Variable Resistance Method)

1. Connect a variable resistance (not less than 25 watts) and an ammeter into the charging circuit at "BAT" terminal of regulator as in Fig. 13-12.

2. Connect a voltmeter from regulator "BAT" terminal to ground.

3. Position a thermometer on the regulator so that the bulb is within a 1/4" of the regulator cover.

4. Start engine and adjust variable resistance to obtain a current flow of not more than 10 amperes. Operate the engine at 1600 to 1900 r.p.m. for 15 minutes. Regulator cover must be in place.

5. Cycle the generator by stopping the engine and restarting it.

6. Run engine at 1600 to 1900 r.p.m. and record the voltage reading. Voltage reading should be within the Normal Specification Range as indicated by the regulator ambient temperature. (Fig. 13-13)

7. If voltage does not fall within the Normal Specification Range adjust the voltage until it is midway between the high and low of the Normal Specification Range as indicated by the regulator ambient temperature. (Fig. 13-13)

8. To adjust the voltage setting, remove the thermometer and regulator cover and turn the adjusting screw. (Fig. 13-14) Increase spring tension to raise the setting; decrease spring tension to lower the setting. Before taking the reading after each adjustment, replace the regulator cover as quickly as possible and cycle the generator. (The engine should be stopped while removing and replacing the regulator cover to reduce the possibilitiy of causing a short.)

CAUTION: Final adjustment should always be made by increasing spring tension to assure contact between the screw head and spring support. Sometimes the spring support does not follow the screw head as spring tension is decreased, and it will be necessary to bend the spring support up to insure contact between the spring support and screw head before final adjustment is completed.

AMBIENT TEMPERATURE	VOLTAGE	CURRENT
65°F.	14.4 - 15.4	35.0 - 40.0
85°F.	14.2 - 15.2	34.0 - 38.5
105°F.	14.0 - 14.9	32.5 - 37.0
125°F.	13.8 - 14.7	31.0 - 35.5
145°F.	13.5 - 14.3	29.5 - 33.5
165°F.	13.1 - 13.9	-----

VOLTAGE AND CURRENT CORRECTION FACTORS (35 AMP REG.)

Fig. 13-13 Ambient Temperature Factors

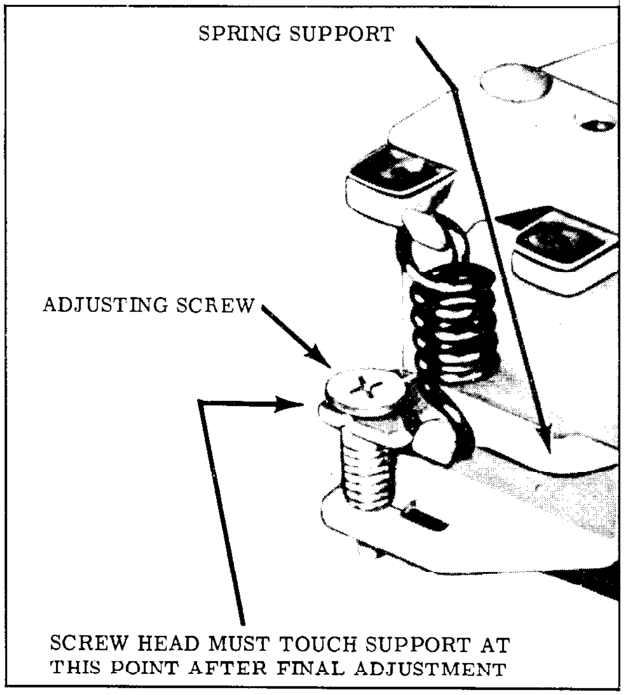

Fig. 13-14 Adjusting Voltage

Cutout Relay Closing Voltage Setting

1. Connect a voltmeter between the regulator "GEN" terminal and ground. (Fig. 13-15)

2. Connect Variable Resistance J-7099 in series with the field circuit. Turn on the resistance.

3. Operate the engine at 1600 r.p.m., then decrease the resistance and note the voltage at which the relay closes. Closing voltage should be 11.8 to 13.5 volts.

   Make sure relay opens when the resistance is again increased.

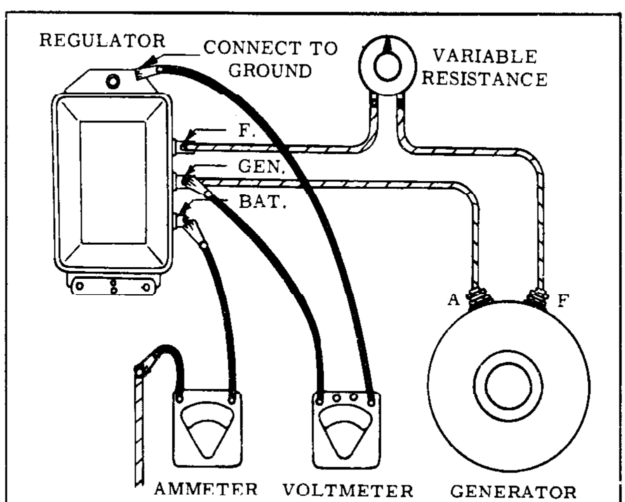

Fig. 13-15 Cutout Relay Closing Voltage

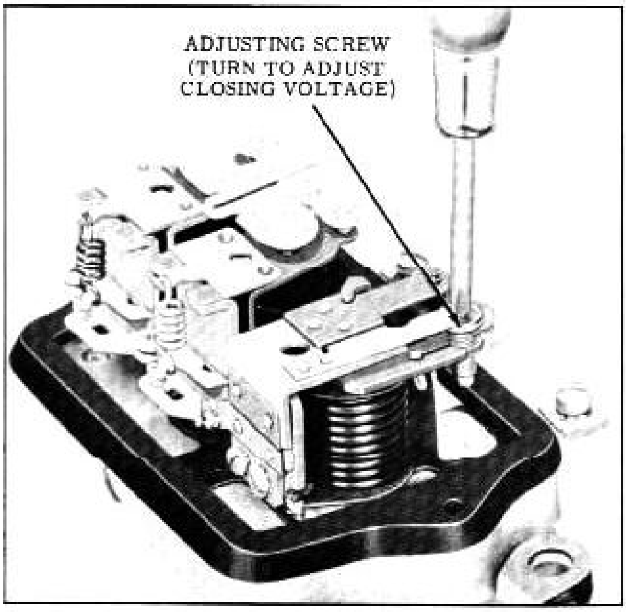

Fig. 13-16 Adjusting Cutout Relay

4. Adjust the closing voltage to 12.8 volts by turning the adjusting screw clockwise to increase the setting or counterclockwise to decrease the setting. (Fig. 13-16)

Current Regulator Setting

1. Connect an ammeter into the circuit as shown in Fig. 13-17.
2. Turn on all lights and accessories or connect a load across the battery to reduce the system voltage to 12.5 to 13 volts.
3. Position a thermometer on the regulator so that the bulb is 1/4" away from the regulator cover.
4. Operate the generator at an engine speed of 1600 r.p.m. for at least 25 minutes to establish operating temperature and stabilize the regulator.

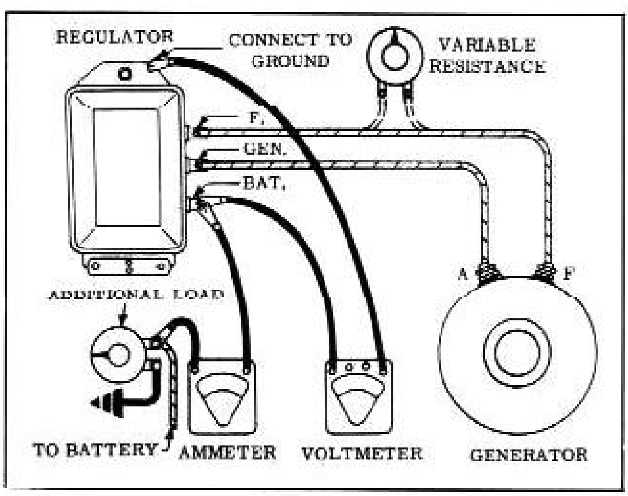

Fig. 13-17 Checking Current Regulator

5. Cycle the generator by either of the following methods.

METHOD A - Stop the engine; restart, and bring engine back to 1600 r.p.m. and record the current setting. Current setting should be midway between the high and low as indicated by the regulator ambient temperature correction chart. (Fig. 13-13)

METHOD B - Connect Variable Resistor J-7099 into the field circuit as in Fig. 13-15. Move the voltmeter lead from "BAT" to "GEN" terminal of regulator. With the generator operating at 1600 to 1900 r.p.m., slowly increase (turn in) the resistance of the variable resistor until generator voltage is reduced below 4 volts. Move voltmeter lead back to "BAT" terminal of regulator. Decrease (turn out) all of the resistance of the variable resistor. Note current setting. Setting should be midway between the high and low as indicated by the regulator ambient temperature correction chart. (Fig. 13-13)

6. Adjust current regulator in the same manner as that used for adjusting voltage regulator settings.

Check for Oxidized Regulator Points

Abnormal fluctuation of the voltmeter or ammeter pointer while testing the voltage or current regulator indicates an oxidized condition of regulator contact points. This condition may cause a high resistance in the generator field circuit and reduced generator output. Test for oxidized contact points as follows:

1. Turn on the headlights.
2. Operate the generator at speed which will produce a charge rate of 5 amperes.

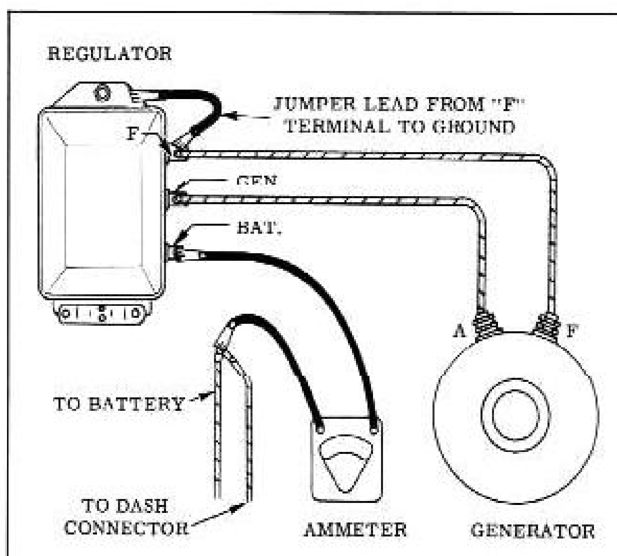

Fig. 13-18 Checking for Oxidized Points

3. Ground the "F" terminal of the regulator as shown in Fig. 13-18.

4. If generator output increases more than 2 amperes, oxidized regulator contact points are indicated and the regulator should be removed from the car and the contact points should be cleaned.

SERVICING UNITS

BATTERY

Removal

1. Disconnect the battery cables from the battery terminals using a suitable tool to spread cable spring clamp. (Fig. 13-8)

2. Remove battery hold-down clamp.

3. Lift battery from battery tray and note position of positive and negative terminals with respect to the tray.

Installation

1. Position battery in tray with negative terminal closest to the engine.

2. Install battery hold-down clamp and tighten sufficient to hold battery firmly. Do not tighten battery clamp too tight since too much pressure may crack the battery case. Torque 1 1/2 - 2-1/2 ft. lbs.

3. Apply a few drops of oil to positive terminal felt washer.

4. Connect the spring clamps of the battery cables to their respective terminals.

GENERATOR

Removal

1. Disconnect battery positive cable.

2. Disconnect generator armature and field leads from terminals on generator frame.

3. Remove generator belt adjusting link bolt.

4. Loosen (2) generator to mounting bracket bolts.

5. Remove generator drive belt.

6. Remove generator mounting bolts and lift generator from engine bracket.

Installation

1. Position the generator on the engine mounting bracket and install the generator to mounting bracket attaching bolts, but do not tighten.

2. Install generator drive belt.

3. Start generator adjusting link lock bolt and run down finger tight.

4. Install Belt Tension Tool 33-70 on belt.

5. Pivot the generator away from the engine by prying between the generator body and the lugs of the generator bracket to place tension on the belt. (Fig. 13-19)

6. Tighten the generator adjusting link bolt and the two generator attaching bolts. Torque 14-17 ft. lbs.

7. Remove belt tensioner tool from belt.

8. Connect the twelve gauge brown armature lead to the generator armature terminal marked "A".

   CAUTION: On radio equipped cars connect the radio by-pass condenser to the generator armature (A) terminal and not to the generator field terminal.

9. Connect the eighteen gauge blue field lead to the generator field terminal marked "F".

10. Connect the battery cable.

11. Polarize the generator by momentarily connecting a jumper wire between the "BAT" and "GEN" terminals on the regulator as shown in Fig. 13-20.

12. Start engine. If brushes squeak, seat them by placing brush seating paste on the commutator. The soft abrasive material of the paste will be carried under the brushes and will wear the brush faces to the commutator contour in a few seconds.

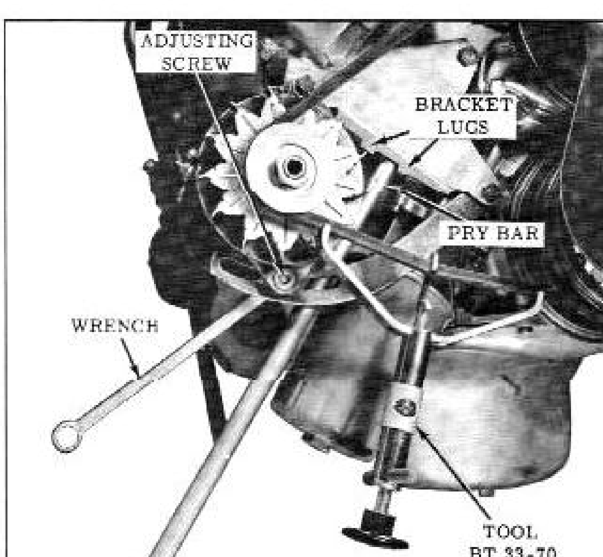

Fig. 13-19 Adjusting Generator Belt

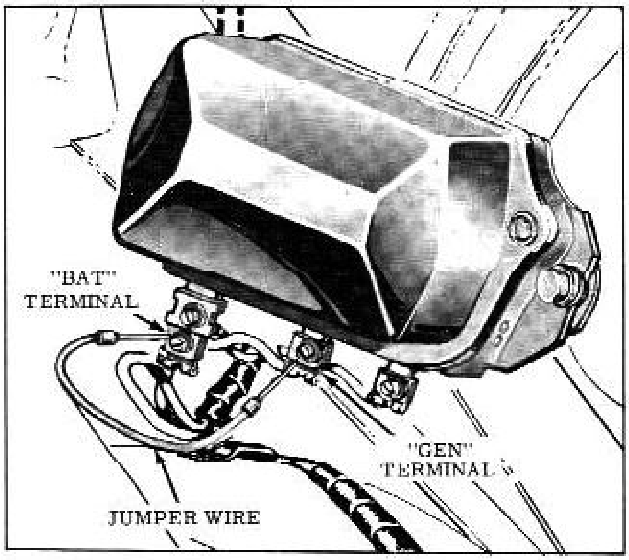

Fig. 13-20 Polarizing Generator

Disassembly

1. Mount generator in a vise, being careful not to damage generator frame.

2. Remove the 2 through bolts, then pull commutator end frame from rear of field frame. Remove brushes.

3. If necessary to remove commutator end frame bearing, use hooked shaped piece of welding rod to pull bearing from frame. Remove "O" ring from bore of frame and discard.

4. Remove armature and drive end frame assembly from front of field frame.

5. Mount armature assembly in a vise, then remove pulley nut and lockwasher. Remove pulley and fan from armature shaft.

6. Remove key from keyway. Slide long spacer from armature shaft.

7. Slide drive end frame and short spacer from shaft.

8. If necessary to remove the drive end bearing from the frame, remove the 3 bearing retainer plate attaching screws, then remove plate, gasket, bearing, felt washer retainer and felt washer.

9. If necessary to remove field coils, proceed as follows:

   a. Remove field and armature terminal nuts, then push terminal studs through frame.

   b. Remove 2 large screws and remove pole shoes and field coils from generator frame.

Cleaning and Inspection

1. Check brush holders for bends or deformities which might prevent proper functioning. Check brush spring tension (28 ounces) as shown in Fig. 13-21.

2. Wash all metal parts except armature and fields in cleaning solvent. Degreasing solvents will damage the insulation of fields and armature.

3. Inspect ball bearing for roughness.

4. Inspect armature commutator for roughness. Rough commutator should be turned down and undercut. Check solder connections where armature wires connect to commutator bars.

5. Place armature on growler and check for shorts by rotating armature with hack saw blade over core. (Fig. 13-22) If saw blade vibrates, armature is shorted. If cleaning commutator bars does not correct the vibration, replace the armature.

6. Place one lead of 110 volt test lamp on the armature core and the other lead on each commutator bar. (Fig. 13-23) If lamp lights, armature is grounded and must be replaced.

7. Place one lead of the 110 volt test lamp on the field terminal and the other lead on the

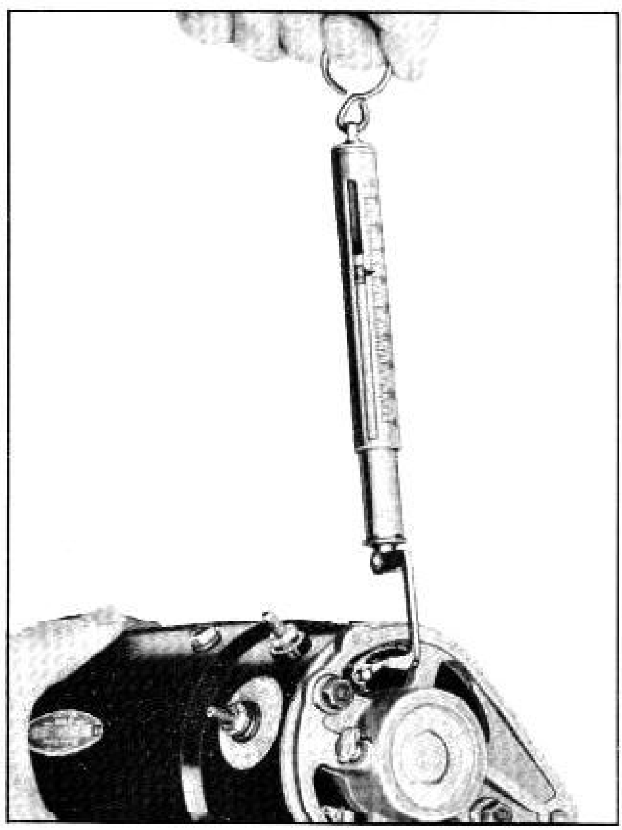

Fig. 13-21 Checking Brush Spring Tension

Fig. 13-22 Testing Armature for Shorts

armature terminal. (Fig. 13-24) If lamp does not light, check for loose connections. If no loose connections are found, field coils are open. Replace coils.

8. Ground one lead of test lamp on frame and place other lead on field terminal. (Be sure free end of field wire is not touching frame and field terminal insulation is not broken.) (Fig. 13-25) If lamp lights, field coils are grounded. If ground in coils cannot be located and repaired, replace coils.

9. Place one lead of test lamp on generator positive (output) lead and the other lead on generator frame. Make sure loose end of terminal lead is not touching frame. (Fig. 13-26) If lamp lights, positive terminal insulation through frame is defective and must be replaced.

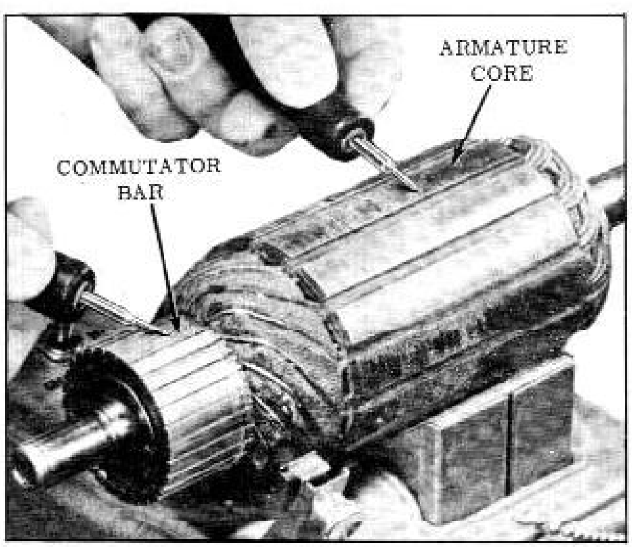

Fig. 13-23 Testing Armature for Ground

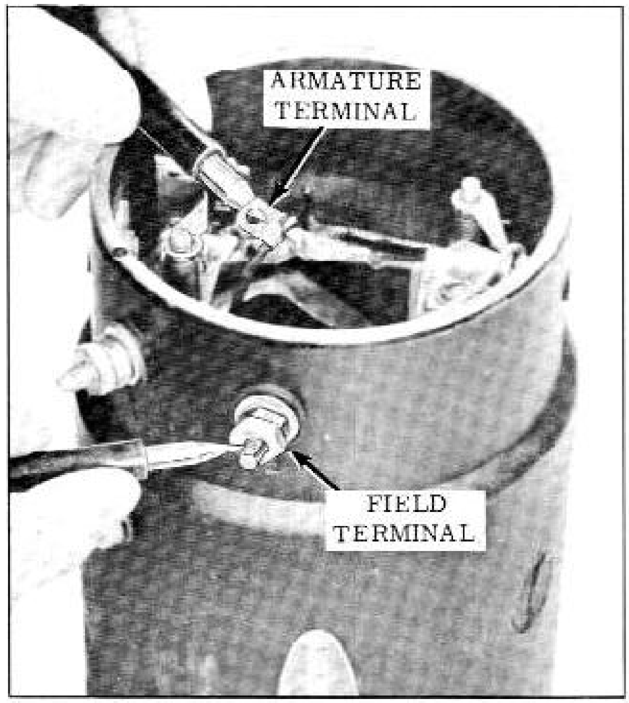

Fig. 13-24 Testing Fields for an Open

10. Place one lead of test lamp on the positive (insulated) brush holder and the other lead on frame. (Fig. 13-27) If lamp lights, brush holder is grounded due to defective insulation at the frame.

11. Check armature for open circuit by making a bar-to-bar check on the commutator.

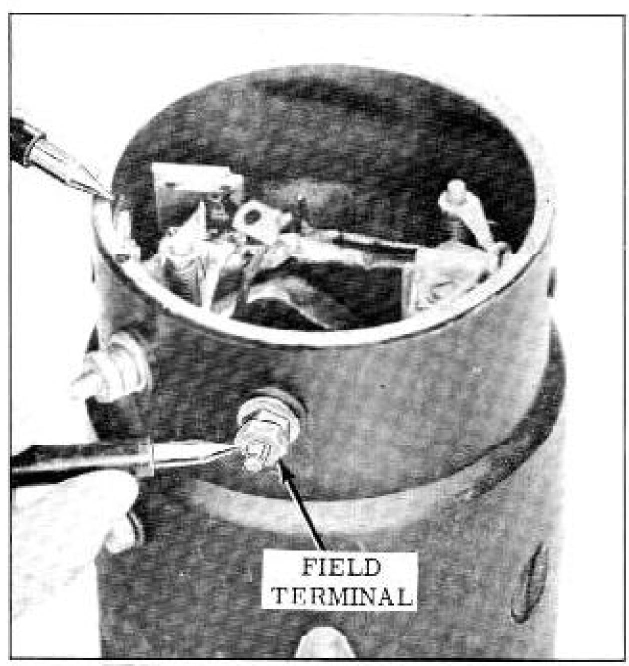

Fig. 13-25 Testing Fields for a Ground

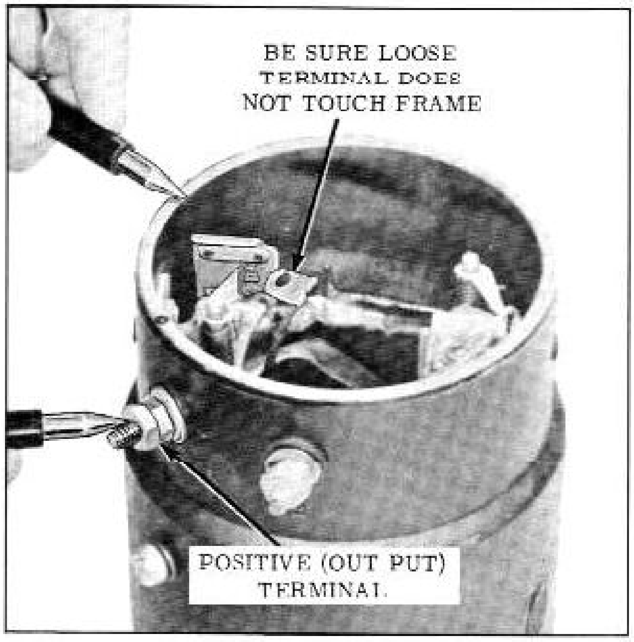

Fig. 13-26 Testing Positive Terminal

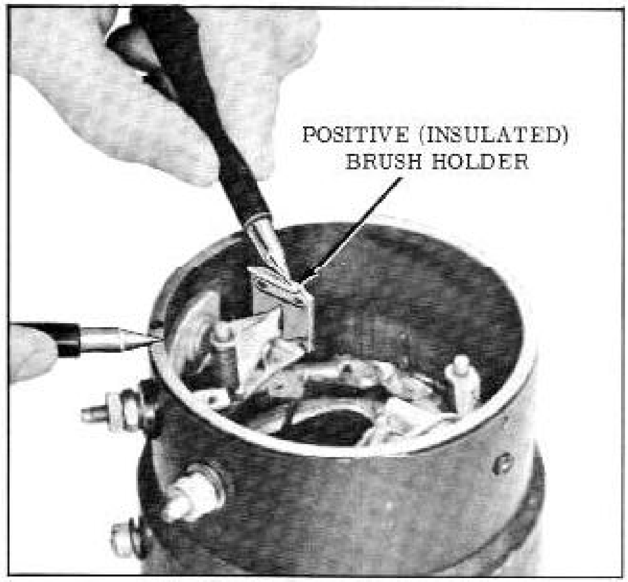

Fig. 13-27 Testing Positive Brush Holder

Repairs

Loose electrical connections - When an open soldered connection is found during inspection, it may be resoldered provided rosin flux is used for soldering.

CAUTION: Acid flux must never be used on electrical connections.

Turning commutator - When inspection shows commutator roughness, it should be cleaned as follows:

1. Turn down commutator in a lathe until it is thoroughly cleaned.
2. Undercut insulation between commutator bars 1/32". This undercut must be the full width of insulation and flat at the bottom; a triangular groove will not be satisfactory. After undercutting, the slots should be cleaned out carefully to remove any dirt and copper dust.
3. Sand the commutator lightly with No. 00 sandpaper to remove any slight burrs left from undercutting.
4. Recheck armature on growler for short circuits.

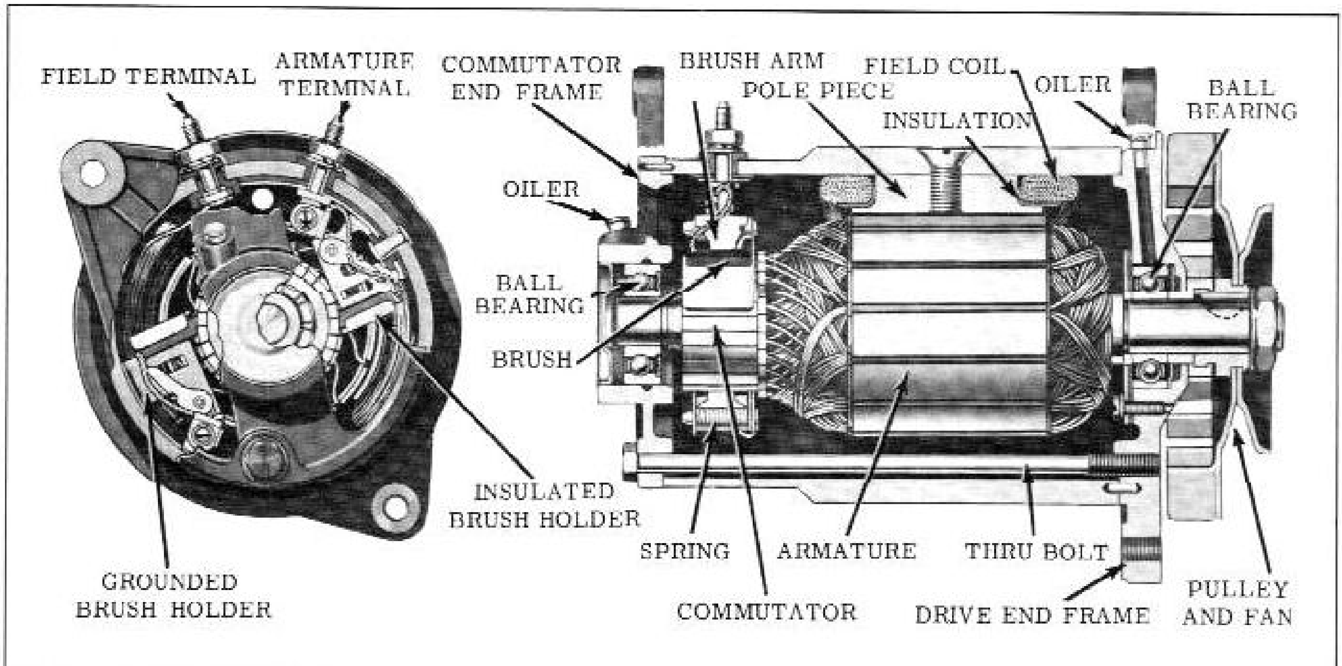

Fig. 13-28 Generator Cross Section

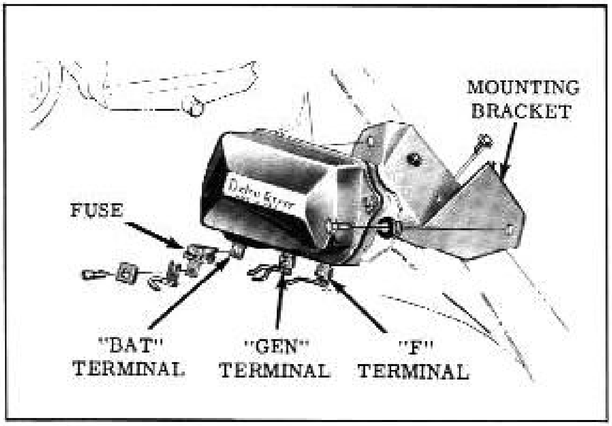

Fig. 13-29 Voltage Regulator

Assembly (Fig. 13-28)

1. If field coils were removed:
   a. Install pole piece in field coils and install this assembly in field frame, being sure field terminal lead is near the hole in frame for lead terminal stud.
   b. Install 2 screws which hold pole pieces and field coils to frame.
   c. Install field terminal stud through insulator in generator frame.
   d. Install armature lead and terminal stud through insulator in generator frame.
2. Install short spacer on armature shaft.
3. If drive end bearing was removed from the frame, install as follows:
   a. Install felt washer and felt washer retainer into bore of frame.

      NOTE: Install retainer with dished side away from felt washer.

   b. Pack bearing with Delco-Remy Cam and

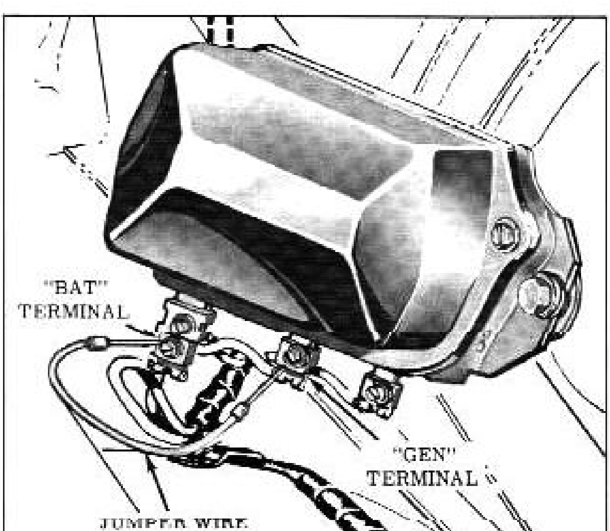

Fig. 13-30 Polarizing Generator

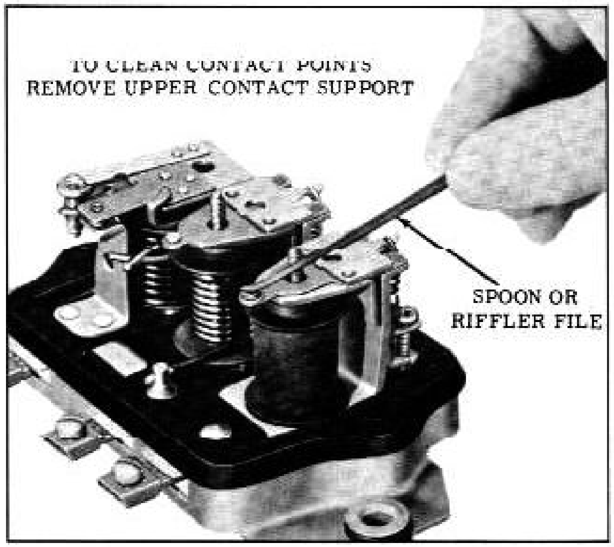

Fig. 13-31 Cleaning Regulator Contacts

Ball Bearing Lubricant or equivalent, then install bearing in drive end frame. Install bearing retainer plate and gasket on drive end frame and tighten the 3 screws.

4. Slide the drive end frame assembly on armature shaft and install a long spacer.
5. Install key into keyway of shaft, then place armature shaft into vise.
6. Slide fan and pulley over shaft, then install pulley lock washer and nut. Torque nut to 70 ft. lbs. Remove armature and drive-end-frame assembly from vise.
7. If the commutator end frame bearing was removed, install as follows:

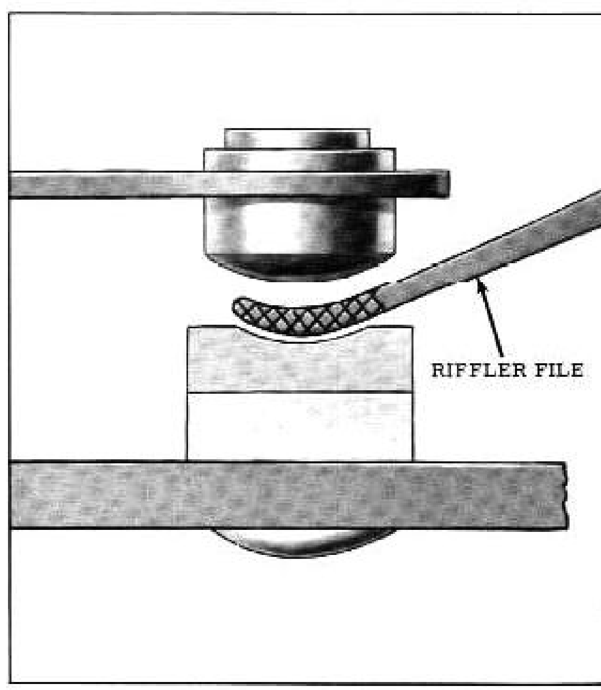

Fig. 13-32 Contact Cavity

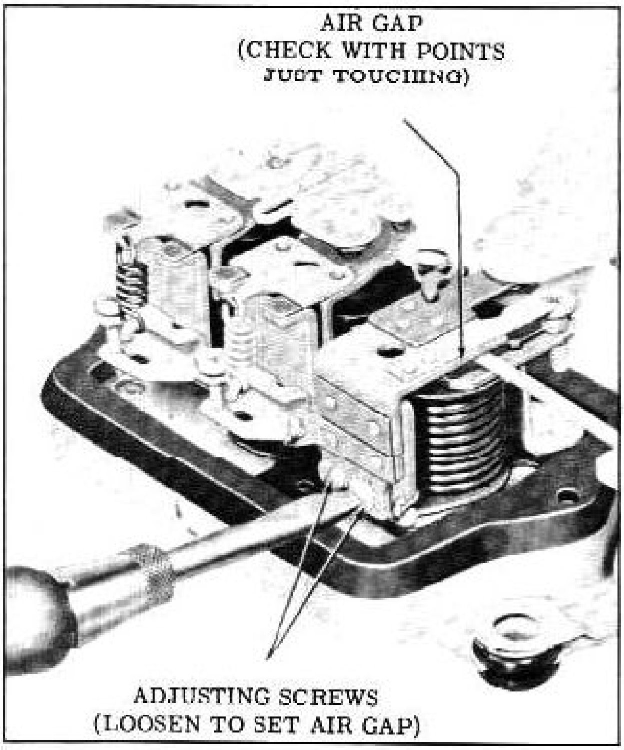

Fig. 13-33 Cutout Air Gap

a. Coat new "O" ring with S.A.E. 20 oil and install in bore of commutator end frame.

b. Pack bearing with Delco-Remy Cam and Ball Bearing Lubricant or equivalent. Install bearing in frame (with sealed side of bearing facing outward.)

8. Install brushes in brush holders.

9. Install armature and drive-end-frame assembly in generator frame.

10. Align field frame dowel pin with hole in drive-end-frame.

11. Inspect brushes to see that they are seated correctly; then install commutator end frame on field frame, aligning dowel pin with hole. Install and tighten 2 through-bolts.

REGULATOR

Removal

1. Disconnect the battery ground cable from the battery negative terminal.

2. Disconnect the wires from the "BAT", "GEN" and "F" terminals of the regulator. (Fig. 13-29)

3. Remove the 3 hex head sheet metal mounting screws and lift the regulator from the mounting plate.

Installation

1. Position the regulator on the mounting plate and install regulator attaching screws.

   CAUTION: Do not tighten the mounting screws excessively as this will destroy the cushioning effect of rubber grommets in the mounting.

2. Inspect the "BAT" terminal fuse for continuity.

3. Connect the blue 18 gauge field wire to the terminal marked "F".

4. Connect the brown 12 gauge field wire to the terminal marked "GEN".

5. Connect the red 12 gauge wire to the terminal marked "BAT".

   NOTE: On radio equipped cars mount the by-pass condenser to the grounded end of the regulator using a regulator attaching screw to hold condenser in position and connect the positive lead of the condenser to the "BAT" terminal of the regulator.

6. Connect the battery ground cable to the negative battery terminal.

7. Polarize the generator by momentarily connecting a jumper wire between the "BAT" and "GEN" terminals on the regulator as shown in Fig. 13-30.

Cleaning Points

Remove the regulator cover and inspect the contact points for pits and oxidation. To clean the

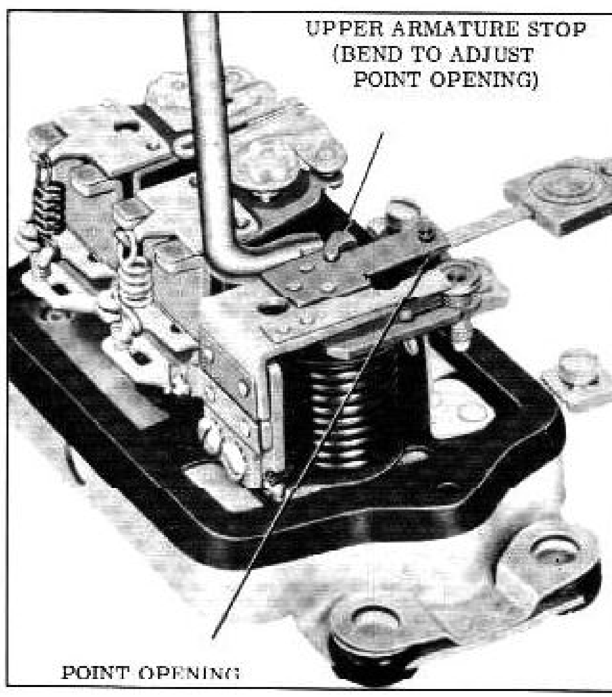

Fig. 13-34 Adjusting Point Opening

contact points, remove the upper contact bracket. The large flat contact point, located on the voltage regulator armature and the upper contact support on the current regulator, always develops a slight cavity and should be cleaned of oxides by using a riffler file as shown in Figs. 13-31 and 13-32.

CAUTION: Do not file contact points excessively. Never use sandpaper or emery cloth.

If necessary, the upper contact points of the regulator may be replaced.

Cutout Relay Gap and Point Opening Adjustment

1. Place fingers on armature directly above core and move armature down until points just close. Measure air gap between armature and center of core (.020"). Check to see that points close simultaneously. To adjust air gap, loosen 2 screws at back of relay and raise or lower armature as required. (Fig. 13-33)

2. Check point opening and adjust to .020" by bending upper armature stop. (Fig. 13-34)

Voltage Regulator Air Gap Adjustment

Push armature down to core and release it until contact points just touch and then measure air gap between armature and center of core. Air gap should be .075". Adjust gap by loosening contact mounting screws and raising or lowering contact brackets as required. (Fig. 13-35) Check to see that points are lined up and tighten screws after adjustment.

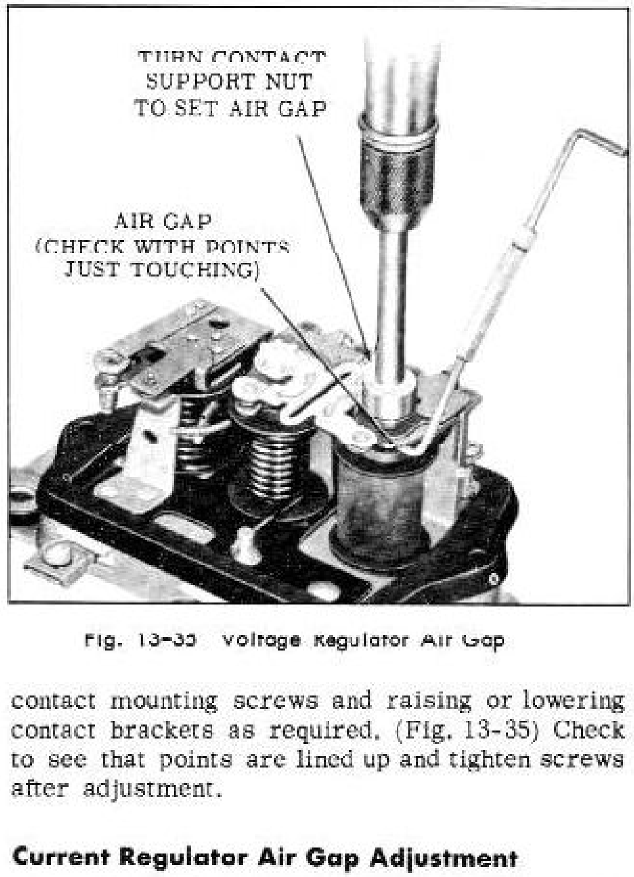

Fig. 13-33 Voltage Regulator Air Gap

Current Regulator Air Gap Adjustment

Check and adjust current regulator air gap in exactly the same manner as the voltage regulator. Air gap should be .075".

STARTING CIRCUIT

DESCRIPTION

The starting circuit consists of the battery, the ignition switch, the starting motor, the starting motor solenoid, and the ignition resistor by-pass to the primary of the ignition coil. The circuit is shown in Fig. 13-36.

When the ignition switch is rotated to the starting position, current from the battery is directed through the neutral safety switch to the starting motor solenoid. Both the solenoid pull-in coil and the hold-in coil are energized to move the solenoid plunger into the coils. The solenoid plunger closes the starter solenoid switch and by means of a mechanical lever moves the starter drive clutch and pinion into mesh with the engine flywheel. The starter solenoid switch when closed energizes the starter motor field coils and armature and the starter begins cranking the engine. The solenoid pull-in coil is by-passed when the solenoid switch is closed so that only the hold-in coil remains energized holding the solenoid plunger in. When the engine starts, the overrunning clutch disengages the starter drive pinion, so that the drive pinion free wheels until the starter circuit is broken. The starter solenoid is de-energized when the ignition switch is allowed to return to ignition number one position.

The Delco-Remy starting motor is a 12-volt unit, having four poles and a series field. The starting motor field coils are connected in series from the field terminal to the insulated brushes as shown in Fig. 13-37.

The armature rotates in bushings at both ends. An overrunning clutch drive is used to engage the cranking motor pinion with flywheel. The overrunning action of the clutch protects the cranking motor armature from excessive speed when the engine starts.

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. An assist spring between the armature winding and the collar of the clutch drive aids the solenoid

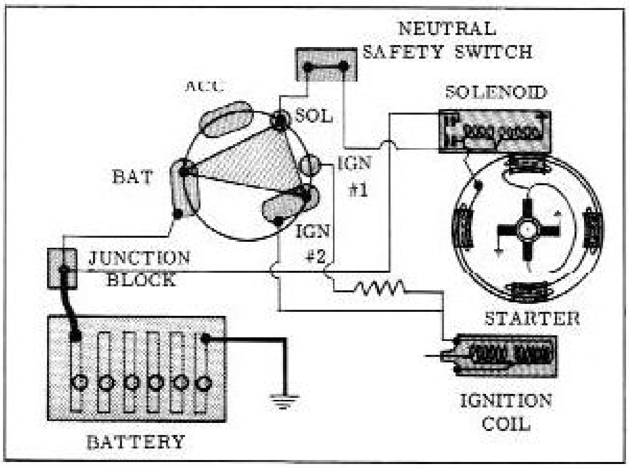

Fig. 13-36 Starting Circuit

in overcoming the return spring force in the initial movement of the clutch. A pinion stop, consisting of a snap ring retainer and thrust collar assembled on the armature shaft, takes all the end thrust.

Removal (Starter Assembly)

1. Disconnect the positive battery cable.

2. Disconnect the positive battery cable from the junction block, remove the starter positive cable from the junction block, and disconnect the purple solenoid switch wire from the chassis wiring harness.

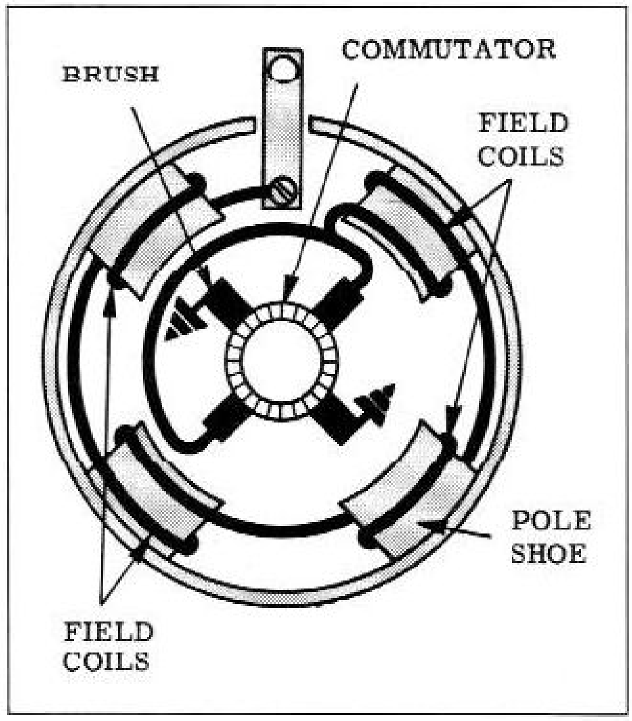

Fig. 13-37 Starter Field Coils

3. Hoist car.

4. Disconnect the starting motor from the engine cylinder block and remove starting motor while sliding battery cable loom through cable support tube.

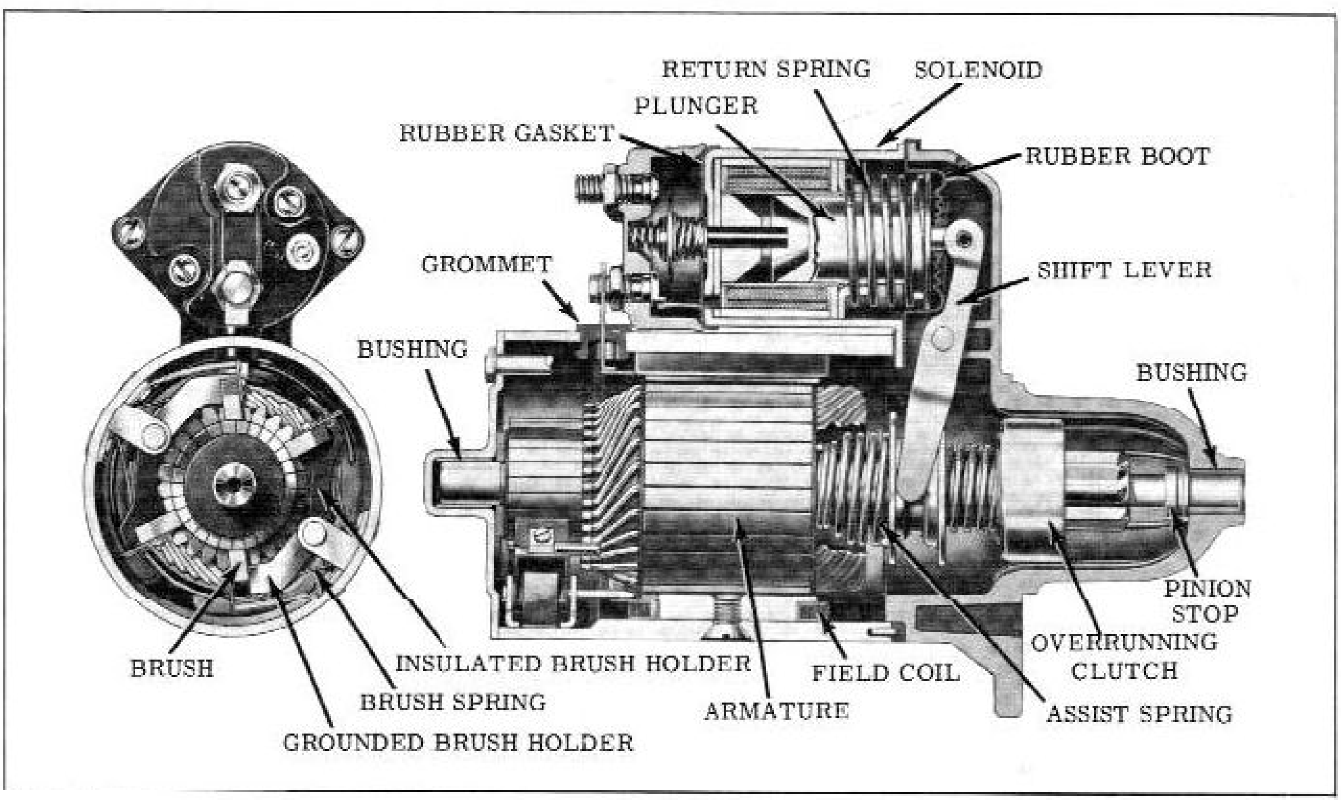

Fig. 13-38 Starting Motor Cross Section

Installation

1. Position starting motor on the cylinder block and install attaching bolts. Torque bolts 30-35 ft. lbs.

2. Slide starting motor cable loom through support tube.

3. Reconnect cables to junction block and solenoid wire to harness.

4. Connect positive battery cable.

Disassembly

1. Disconnect the field coil connector from the motor solenoid terminal. (Fig. 13-38)

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. 13-39)

   b. Slide a standard half-inch pipe coupling or 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. 13-40) With armature shaft supported on wood block, tap end of driving tool until retainer clears snap ring.

   c. Rémove 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, clutch assembly, and assist spring from armature shaft.

5. If necessary to replace brush holding parts, proceed as follows:

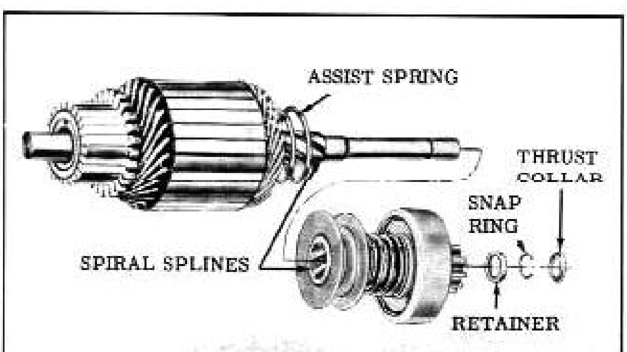

Fig. 13-39 Armature and Clutch

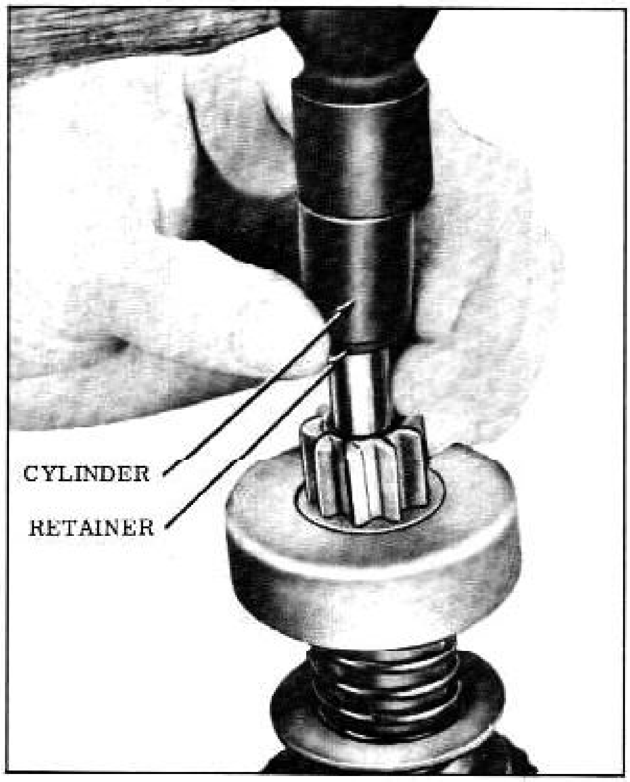

Fig. 13-40 Installing Retainer

   a. Remove screws attaching leads and brushes to the holders.

   b. Press down on the flat spring so that center of spring clears the retaining slot. Slide off the brush spring and 2 brush holders as an assembly.

   c. Reassemble and install new brushes if necessary.

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.

   b. To remove shift lever and/or plunger, remove shift lever pivot bolt.

   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 A SOLVENT WOULD DISSOLVE THE GREASE PACKED IN THE CLUTCH MECHANISM AND WOULD DAMAGE ARMATURE AND FIELD COIL INSULATION.

2. Test overrunning clutch action. The pinion should turn freely in the overrunning direction. Check pinion teeth to see that they have

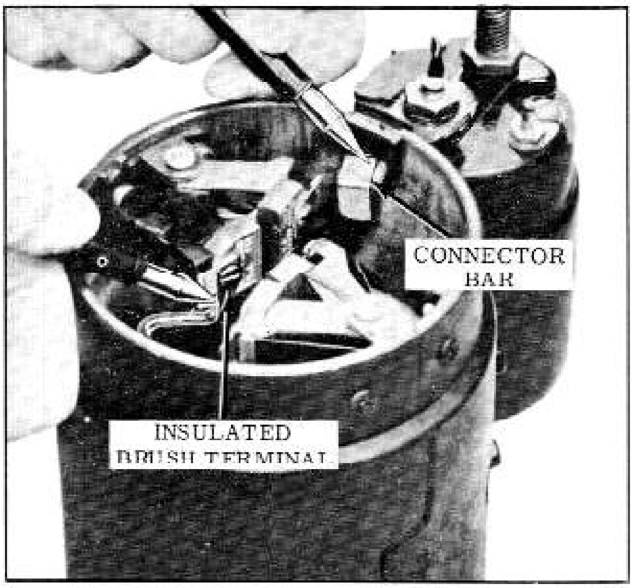

Fig. 13-41 Testing Fields for an Open

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.

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.

   b. Using a 110-volt test lamp place one lead on the armature shaft and the other on the commutator. If the lamp lights, the armature is grounded and must be replaced.

   c. Using a 110-volt test lamp, place one lead on the connector bar and the other lead on one of the insulated brush terminals. (Fig. 13-41). If the lamp does not light the series coils are open and will require repair or replacement.

   d. Using a 110-volt test lamp, place one lead on the connector bar and the other on the field frame. (Fig. 13-42) If the lamp lights, the field coils or the connector bar insulator is grounded and will require repair or replacement.

   e. Check the current draw of the solenoid winding. (See SOLENOID CURRENT DRAW, Page 13-23).

Assembly

1. If the solenoid assembly or shift lever was removed, proceed as follows:

   a. Assemble shift lever and plunger.

   b. Position shift lever and plunger assembly in drive gear housing and install lever pivot bolt.

   c. Install solenoid assembly to drive gear housing.

2. If the overrunning clutch was removed from the armature shaft, assemble as follows:

   a. Lubricate drive end of armature shaft with S.A.E. No. 10 oil, then install assist spring against armature.

   b. Slide clutch assembly onto armature shaft with pinion away from armature. (Fig. 13-39)

   c. Slide retainer onto shaft with cupped surface facing away from clutch assembly.

   d. Install snap ring into groove on armature shaft.

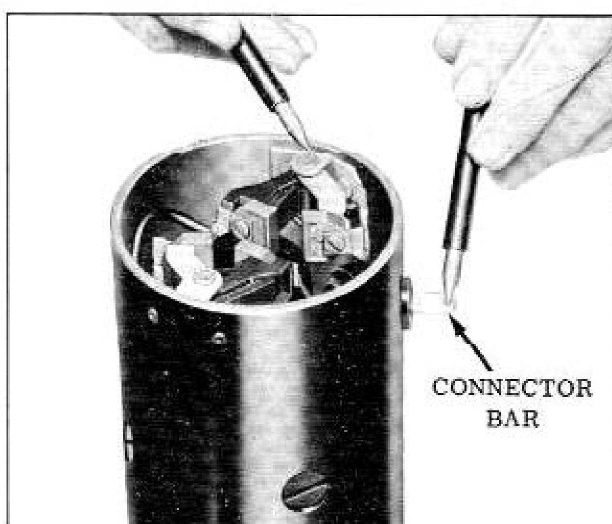

Fig. 13-42 Testing for a Ground

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. 13-43)

3. Lubricate drive gear housing bushing with 4 or 5 drops of light engine oil.

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 Permatex No. 2 on solenoid flange.

6. Position field frame against drive gear housing using care to prevent damage to brushes.

7. Lubricate commutator end frame bushing with 4 or 5 drops of light engine oil.

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 starting 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

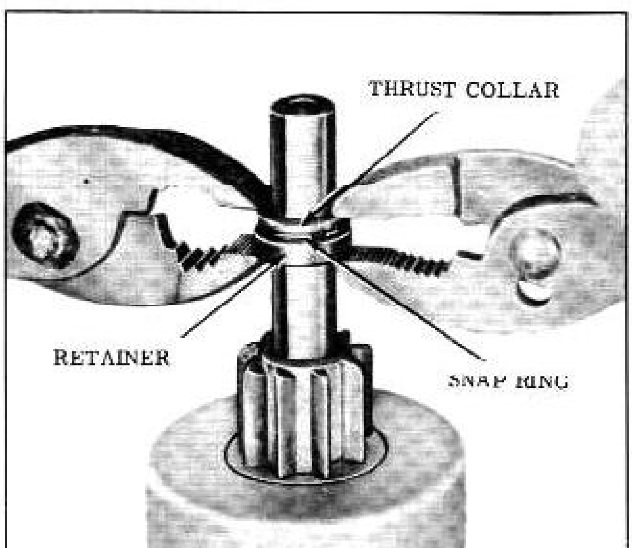

Fig. 13-43 Installing Thrust Collar and Retainer

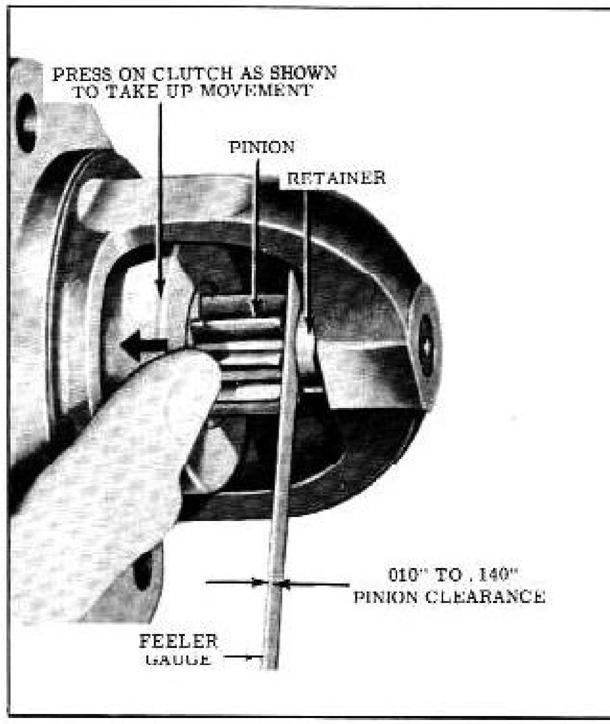

Fig. 13-44 Pinion Clearance

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 3 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. 13-44) The clearance should be .010" to .140".

Means for adjusting pinion clearance is not provided on the starting motor. If the clearance does not fall within limits, check for improper installation and replace all worn parts.

SOLENOID CURRENT DRAW (Fig. 13-45)

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 heating 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

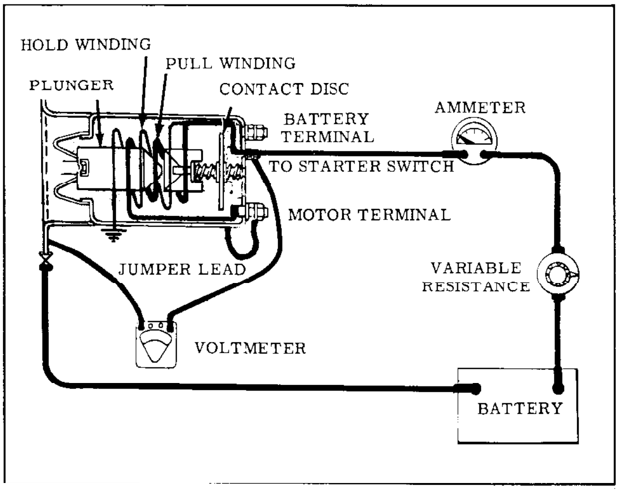

Fig. 13-45 Testing Solenoid Current Draw

to ground. Adjust the voltage to 10-volts and note the ammeter reading. It should be 10.5 to 12.5 amperes.

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.

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.

IGNITION AND STARTING SWITCH

The starter switch is included in the ignition switch. 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.

NEUTRAL SAFETY SWITCH

A neutral safety switch mounted on the mast jacket, is employed as a safety factor on Hydra-Matic models. The switch prevents unintentional 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 hand brake firmly.
2. Put shift lever into "D" range and turn ignition switch to "Start".
3. While holding ignition switch on "Start" slowly move shift lever toward "N" position until engine cranks and starts.
4. Without moving the shift 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

To adjust the neutral safety switch, loosen the switch attaching screws on the mast jacket. With the selector lever in the neutral position, position the switch so that a .090" pin can be inserted through the hole in the switch arm and into the hole in the face of the switch. Tighten the switch attaching screws and remove the pin. Recheck adjustment.

CHECKING STARTING CIRCUIT

Whenever the starting 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 starting motor on the car.

1. Test battery and charge if necessary.

   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. 13-46)
3. Measure the voltage drop (V2) during cranking between the "BATTERY" terminal of the solenoid and the "MOTOR" terminal of the solenoid.

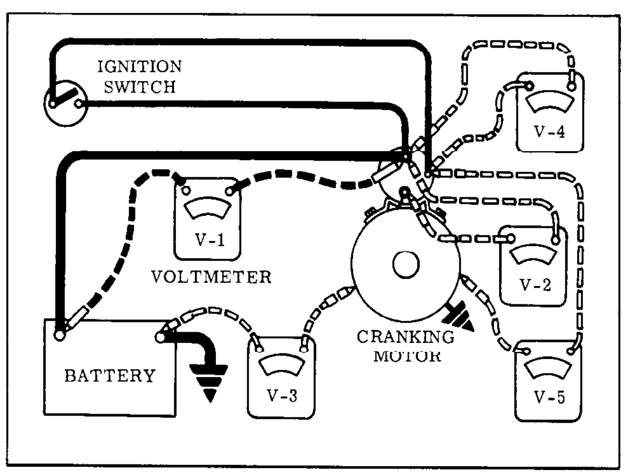

Fig. 13-46 Checking Starting Circuit

4. Measure the voltage drop (V3), during cranking between the negative battery post and the starter motor frame.

If the voltage drop for 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 as outlined under SOLENOID CHECK.

IGNITION SYSTEM

DESCRIPTION

The ignition circuit is made up of the battery, junction block, ignition switch, ignition resistor, ignition coil, ignition distributor, and the spark plugs. The ignition circuit is shown in Fig. 13-47.

The ignition and starting switch is key-operated to close the ignition primary circuit and to energize the solenoid for engine cranking. Accessories may be used when the engine is not running if the ignition switch key is turned counterclockwise, to the accessory position.

The ignition coil is a pulse transformer that steps up the low voltage from the battery or generator to a voltage high enough to jump a spark gap at a spark plug. The coil is oil filled for effective electrical insulation and cooling, (Fig. 13-48). The ignition resistor is a stainless steel wire that is built into the chassis wiring harness. The resistor, connected in series with the primary circuit between the ignition switch and the 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

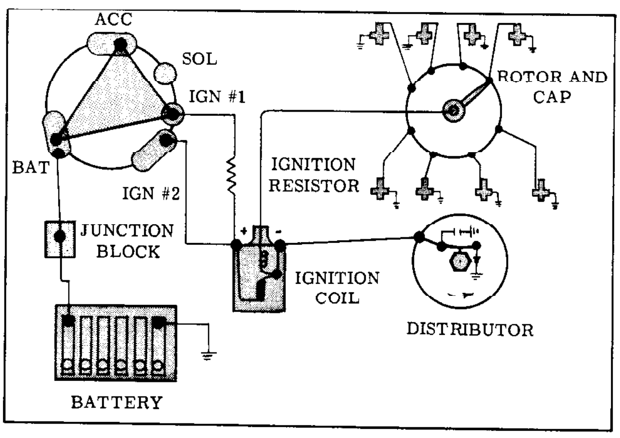

Fig. 13-47 Ignition System

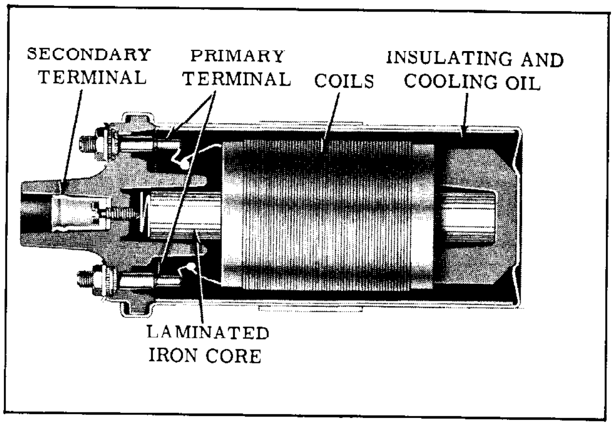

Fig. 13-48 Ignition Coil

cranking, thereby connecting the ignition coil primary directly to the battery through the ignition switch.

This makes full battery voltage available in the coil and keeps the ignition voltage as high as possible during engine cranking.

The distributor cap has a window for adjusting point opening (dwell angle) while the cap is mounted and the engine is running. (Fig. 13-49) 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 is sufficient to actuate the vacuum control diaphragm, thus advancing the spark and increasing 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.

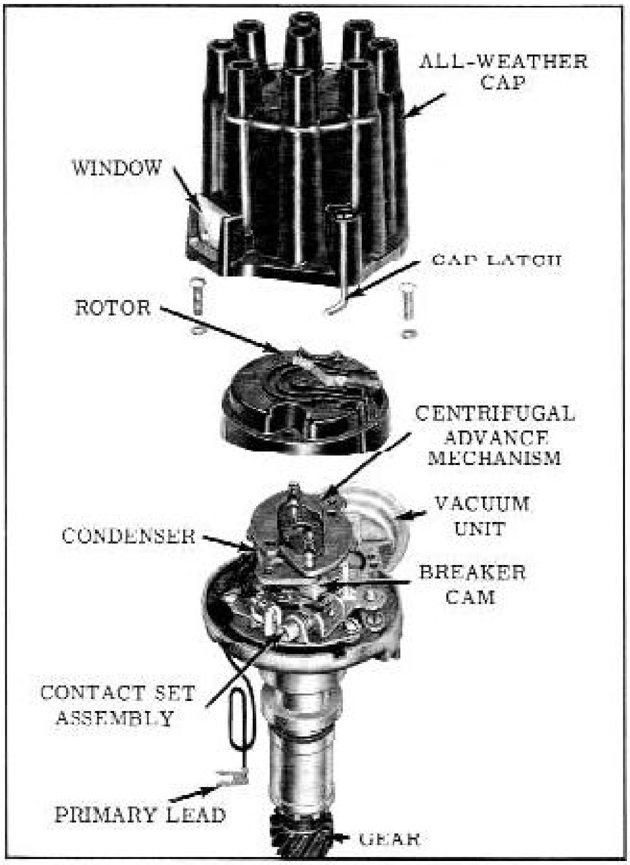

Fig. 13-49 Ignition Distributor

The centrifugal advance mechanism consists of a cam actuated by two centrifugal weights controlled by spring. 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.

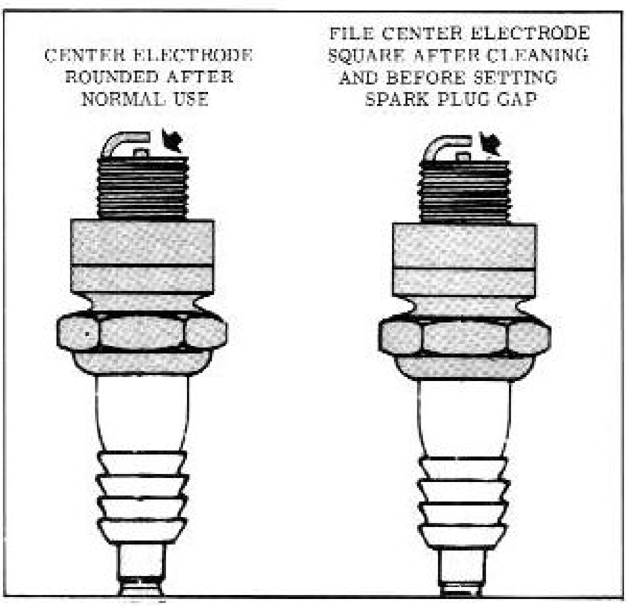

Fig. 13-50 Spark Plug Electrodes

Type 46 FF spark plugs are used on the "F-85" engine. The spark plugs have 14 MM threads and a 13/16" hex body. The proper spark gap setting is 0.040". Satisfactory results can be assured only when genuine AC plugs of the type recommended are used.

MAINTENANCE

DISTRIBUTOR

When replacing contact point assembly, apply a small amount of Delco-Remy Cam and Ball Bearing lubricant or equivalent to the breaker cam. No other lubricant is required.

In addition to lubrication, the distributor requires periodic inspection of the cap, rotor, wiring, breaker points, and timing.

IGNITION COIL

The ignition coil should be cleaned of all oil and dust periodically to insure the prevention of spark leakage. All connections should be cleaned and tightened to insure good contact and minimize resistance.

SPARK PLUGS

Whenever spark plugs are removed from the car and cleaned, the following precautionary steps should be followed to insure against voltage leakage:

1. The center electrode should be filed flat before setting the gap. (Fig. 13-50)

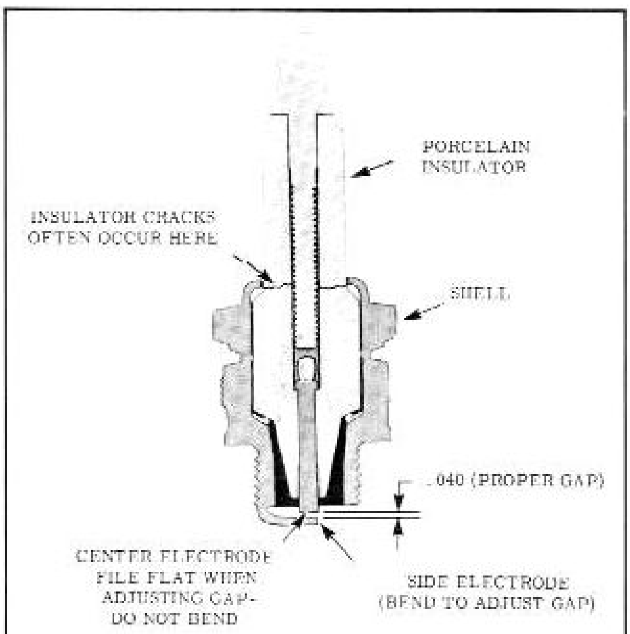

Fig. 13-51 Spark Plug Construction

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 porcelain.

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. (Fig. 13-51) Use a spark plug tester to test plugs.

If the spark plug porcelain is cracked a new spark plug must be installed.

The spark plug gap should not be measured with flat feeler gauge stock but should be measured with a wire gauge as shown in Fig. 13-52.

CHECKS AND ADJUSTMENTS

DISTRIBUTOR

Adjustment of Distributor Dwell Angle (On Car)

1. Connect a dwell meter to the primary distributor lead terminal on the coil and a suitable ground.

2. Raise window on side of distributor cap.

3. With the engine running at idle speed, insert Dwell Adjusting Tool BT-1501 into the head of the adjusting screw as shown in Fig. 13-53, and adjust dwell angle to 30°.

NOTE: If the dwell angle reading is erratic, check the primary circuit, points, and condenser.

The dwell angle variation should not exceed 3° at engine speeds between idle and 1,750 r.p.m. Excessive variation indicates distributor wear.

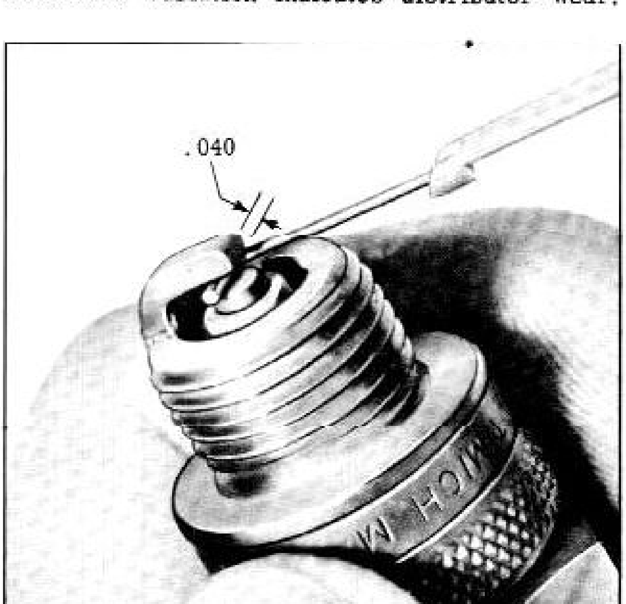

Fig. 13-52 Adjusting Spark Plug Gap

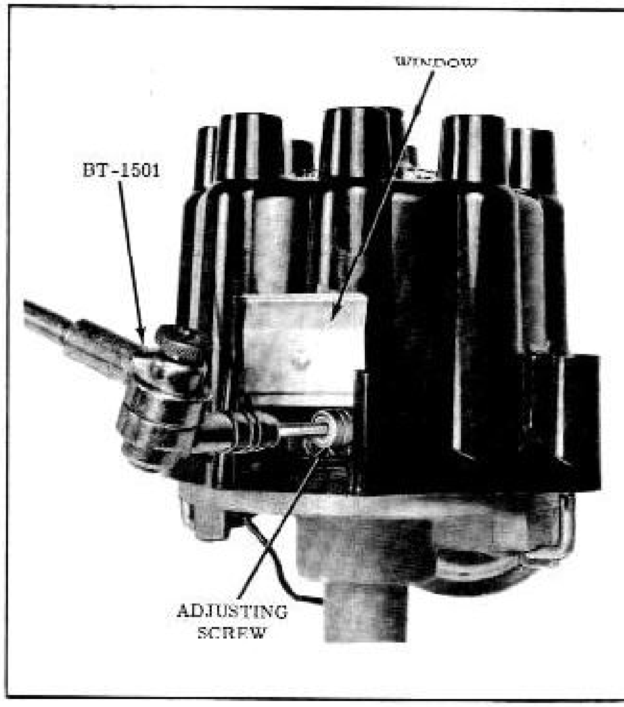

Fig. 13-53 Adjusting Dwell

Adjusting Distributor Dwell Angle (Off Car)

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°.

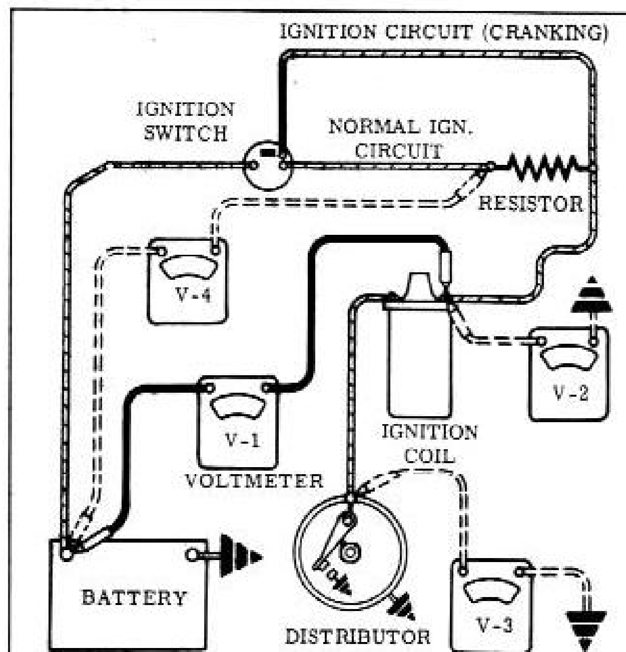

Fig. 13-54 Ignition System Tests

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. 13-54, and IGNITION SYSTEM CHECK CHART). All checks are to be made with the lights and accessories off and in the sequence shown.

IGNITION SYSTEM CHECK CHART

Operation	Specification	Possible Trouble
Check all connections in Primary and Secondary circuit:		
Remove secondary lead from distributor cap. Hold 1/4" from engine while cranking and observe if spark occurs:		Distributor cap. Rotor. Spark plug wiring.
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.
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.
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.
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.
Check Voltage V4 ignition switch "On", points closed:	0.7 Volt Max.	Loose connection from resistor through ignition switch circuit to battery.
If these checks fail to find cause of trouble - remove distributor, coil and resistor from engine and check to specifications. Also check wiring harness.		

SERVICING OF UNITS

SPARK PLUGS

Removal

1. Disconnect the spark plug secondary wires from the spark plugs.

2. Remove dirt from around the base of the spark plugs by blowing out with compressed air.

3. Using a 13/16" spark plug socket, remove the spark plug from the cylinder head.

Inspection

Spark plugs should be removed from the car, cleaned, and regapped periodically. This will insure top performance and maximum life of the spark plug.

Worn or dirty plugs may function satisfactorily at idle and low speeds, whereas at high speeds they may fail noticeably. Faulty plugs may show up with a noticeable drop in fuel economy, power, and performance, and they may also cause high speed miss and hard starting. Spark plugs fail because of fouling, excessive gap or broken insulators.

Dirty or leaded plugs may be evident by black carbon deposits, or red, brown, yellow or blistered oxide deposits on the plugs. The black deposits are usually the result of low speed driving and short runs where sufficient engine operating temperature is seldom reached. Worn pistons, rings, faulty ignition, over-rich carburetion and spark plugs which are too "cold" will also result in carbon deposits. Red, brown, etc., oxide deposits, a consequence of the use of leaded fuel, usually result in spark plug failure under severe operating conditions. The oxides have no adverse effect on plug operation as long as they remain in a powdery state. But, under high speed or hard pull, the powder oxide deposits melt and form a heavy glaze coating on the insulator which, when hot, acts as a good electrical conductor, allowing current to follow the deposits and short out the plug.

Excessive gap wear on plugs of low mileage usually indicates the engine is operating at high speeds or loads that are consistently greater than normal or that a plug which is too "hot" is being used. In addition, electrode wear may be the result of plug overheating, caused by combustion gases leaking past the threads and gasket, due to insufficient compression of the spark plug gasket, dirt under the gasket seat, or the use of old gaskets. Too "lean" carburetion will also result in excessive electrode wear.

Broken insulators are usually the result of improper installation or carelessness when regapping the plug. Broken upper insulators usually result from a poor fitting wrench or an outside blow. The cracked insulator may not make itself evident immediately, but will as soon as oil or moisture penetrates the fracture. The fracture is usually just below the crimped part of the shell and may not be visible.

Broken lower insulators usually result from carelessness when regapping and generally are visible. In fairly rare instances, this type of a break may result from the plug operating too "hot" such as encountered in sustained periods of high speed operation or under extremely heavy loads. When regapping a spark plug, to avoid lower insulator breakage, always make the gap adjustment by bending the ground (side) electrode.

Never bend the center wire. Spark plugs with broken insulators should always be replaced.

Cleaning and Adjusting

1. Clean the spark plugs using an abrasive type cleaner.

2. File the center electrode square as shown in Fig. 13-50.

3. Set the spark plug electrode gap at 0.040" using a wire gauge as shown in Fig. 13-52.

4. Clean the upper porcelain removing all dirt, grease, or paint.

5. Since cracked insulators are not always visible, the spark plug should be given a performance check in a spark plug tester. Any cracked porcelain insulators will show up in the form of a spark shorting across the insulator through the crack.

6. Replace faulty plugs.

Installation

1. Always use new spark plug gaskets when installing spark plugs.

2. Place a coating of 980131 lubricant on the spark plug threads before installing.

3. Using a 13/16" spark plug socket, install the spark plug, and torque to 12-17 ft. lbs.

4. Connect the secondary lead to the spark plug.

DIAGNOSIS

PLUG CONDITIONS	FACTORS CAUSING THIS CONDITION	CORRECTIVE ACTION
Plug "Flash Over" (Firing from upper terminal to base of plug):	Dirty insulator tops—oil, dirt and moisture on insulator will shunt current to base of plug. The above condition can be caused by failure of spark plug boot.	Keep plugs wiped clean with cloth moistened with cleaning solvent. Check spark plug boot and replace if necessary.
Oil or Carbon Fouling:	Wet, black deposits on firing end of plug indicate oil pumping condition. This is usually caused by worn piston rings, pistons, cylinders or sticky valves. Soft, fluffy, dry black carbon deposits usually indicate a rich mixture operation, excessive idling, improper operation of automatic choke or faulty adjustment of carburetor. Hard baked-on, black carbon deposits result from use of too cold a plug.	Correct engine condition. In most cases plugs in this condition will be serviceable after proper cleaning and regapping. If troubles are not eliminated, use "hotter" type plug. Use "hotter" type plug.
Lead Fouling (Light & powdery or shiny glazed coating on firing end):	By-products of combustion and fuel additives, deposited as a powder which may later melt and glaze on insulator tip.	Remove deposits by blast cleaning. If this is not possible, plugs should be replaced.
Normal Electrode Wear:	Due to intense heat, pressure and corrosive gases together with spark discharge, the electrode wears and gap widens.	Plugs should be regapped every 10,000 miles.
Rapid Electrode Wear:	Condition may be caused by (1) burned valves, (2) gas leakage past threads and seat gaskets, due to insufficient installation torque or damaged gasket, (3) too lean a mixture or (4) plug too "hot" for operating speeds and loads.	Correct engine condition. Install plugs to specified torque. Use a new spark plug seat gasket each time a new or cleaned spark plug is installed. Use "colder" type plug if condition continues to exist.
Broken Upper Insulator (Firing around shell crimp under load conditions):	Careless removal or installation of spark plug.	Replace with a new spark plug.
Broken Lower Insulator (Firing Tip):	The cause is usually carelessness in regapping by either bending of center wire to adjust the gap or permitting the gapping tool to exert pressure against the tip of the center electrode or insulator when bending the side electrode to adjust the gap. Fracture or breakage of lower insulator may also occasionally occur if the engine has been operated under conditions causing severe and prolonged detonation or pre-ignition.	Replace with a new spark plug. Use "colder" type plug for the particular type of operation.
Damaged Shell:	Very seldom occurs but cause is almost always due to mishandling by applying excessive torque during installation. This failure is usually in the form of a crack in the Vee of the thread next to the seat gasket or at the groove below the hex.	Replace with a new spark plug.

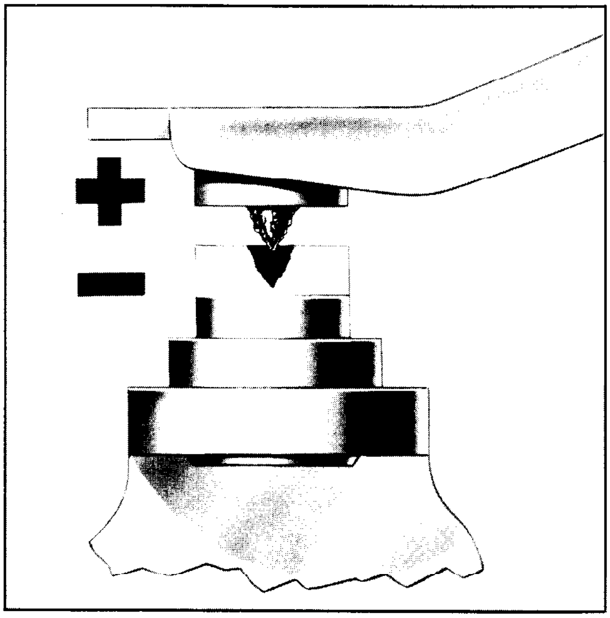

Fig. 13-55 Effects of High Capacitance

CONTACT POINTS

Removal

1. Remove distributor cap.
2. Remove the rotor.
3. Disconnect the distributor primary lead and condenser lead from the contact set terminal by loosening the attaching screw.
4. Loosen the 2 attaching screws which hold the base of the contact set to the breaker plate. Lift up and rotate the contact set counterclockwise sufficient to clear the 2 mounting screws and lift the contact assembly from the breaker plate.

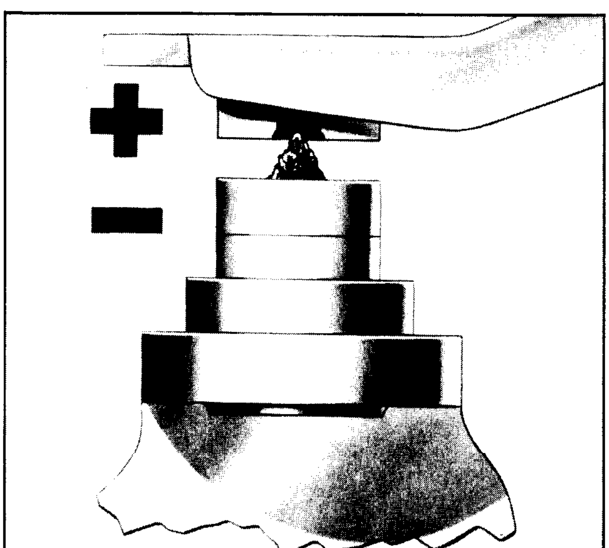

Fig. 13-56 Effects of Low Capacitance

Inspection, Cleaning, and Alignment

Examine the contact points for presence of dirt, abnormal wear, burning, or pitting. Dirty points should be dressed with a few strokes of a clean fine-cut contact point file. NEVER USE EMERY CLOTH TO CLEAN CONTACT POINTS. Contact point surfaces may not appear bright and shiny after prolonged use, but this does not necessarily indicate that they are not functioning satisfactorily. Do not attempt to remove all of the roughness to make the points smooth. Simply remove excess scale and dirt.

Contact point burning may result from high voltage, presence of oil and dirt, improper adjustment or alignment and/or a defective condenser. An improperly adjusted voltage regulator could be the cause of point burning from excess voltage.

Contact point pitting results from improper ignition circuit capacitance. If the material transfer is from negative to positive, as shown in Fig. 13-55, the capacitance is too high. If the material transfer is from positive to negative as shown in Fig. 13-56, the capacitance is too low. Capacitance can be increased by replacing condenser with a higher value capacitance, by shortening the condenser lead, by separating the distributor to coil low tension and high tension leads, and/or by moving these leads closer to ground. To reduce circuit capacitance, move distributor to coil leads closer together, or move these leads away from ground, or lengthen the condenser lead.

The point opening on new points can be set using a feeler gauge; however, a feeler gauge should

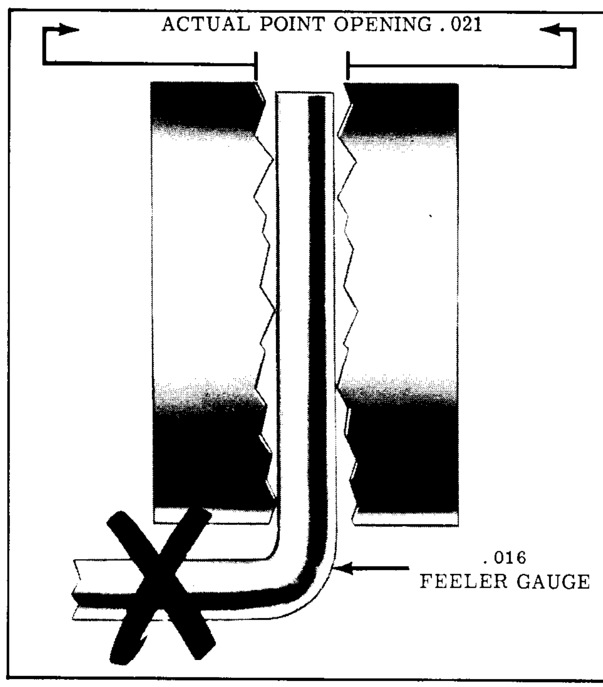

Fig. 13-57 Inaccurate Point Setting

not be used on rough or uncleaned points since the gauge would touch only the high points resulting in an inaccurate gauging as is shown in Fig. 13-57.

Only misaligned new points should be corrected. If serious misalignment of used points is encountered, the points should be replaced rather than attempting to align the contacts. Align new points by bending the fixed contact support. See Fig. 13-58. DO NOT ATTEMPT TO BEND THE BREAKER LEVER. BENDING OF THE BREAKER LEVER WILL RESULT IN IMPROPER SPRING TENSION AND WILL AFFECT THE PROPER OPERATION OF THE CONTACT SET.

Installation

1. When installing the contact set, be sure the dowel pin hole in the contact set base is centered over the dowel pin on the distributor breaker plate. Apply a thin film of Delco-Remy Cam and Ball Bearing lubricant, or equivalent, to breaker cam.

2. Insert the right end of the contact set under its mounting screw and pivot the contact set clockwise until contact set will drop onto alignment dowel. (Fig. 13-59)

Adjustment

1. Turn engine over until the breaker arm rubbing block is on a high point of the breaker cam to open points.

2. Measure point gap with a .016" feeler gauge.

3. Adjust the gap by turning adjusting screw using a 1/8" Allen wrench. To decrease the point gap rotate adjusting screw clockwise. To increase gap rotate adjusting screw counterclockwise.

   The gap can also be measured by using a dwell meter. If this method is preferred proceed to:

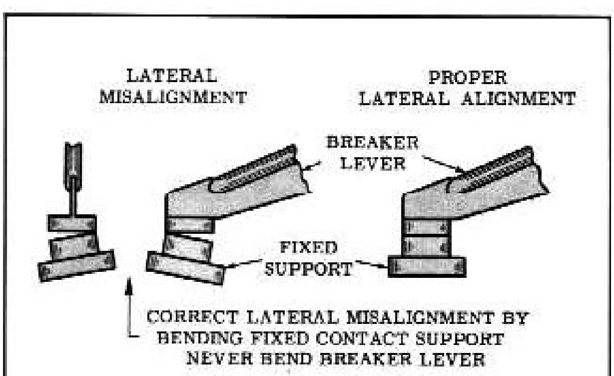

Fig. 13-58 Aligning Points

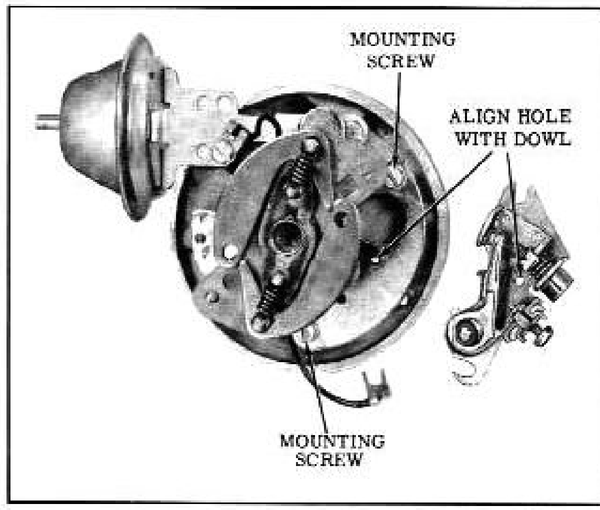

Fig. 13-59 Contact Point Position

a. Install distributor rotor and distributor cap.

b. Connect dwell meter positive (red) lead to the distributor primary terminal at the ignition coil. Connect dwell meter negative (black) lead to ground.

c. Check the dwell angle with engine at idle.

d. Adjust dwell to 30° using Tool BT-1501 as shown in Fig. 13-53.

CONDENSER

Removal

1. Remove distributor cap.

2. Loosen condenser lead screw at contact set terminal and remove condenser lead.

3. Remove condenser mounting screw.

4. Lift condenser from breaker plate.

Installation

1. Place condenser and mounting band in position on the breaker plate alignment pin and install mounting screw. (Fig. 13-60)

2. Insert condenser lead into contact, set terminal and tighten terminal screw.

Testing

The following four factors affect condenser operation. They should be checked with a suitable tester following the test equipment manufacturer's instructions.

1. Breakdown of insulation or direct short.

2. High leak-down rate preventing condenser from holding charge.

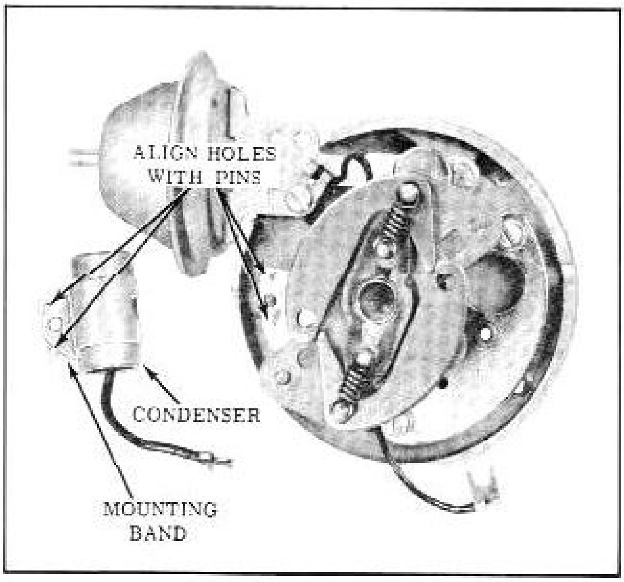

Fig. 13-60 Condenser Installation

3. High series resistance caused by broken strands in condenser lead.

4. Capacitance should be (0.18-0.23 Microfarad).

ROTOR

Removal

1. Remove distributor cap by pressing down on and turning latch as shown in Fig. 13-61.

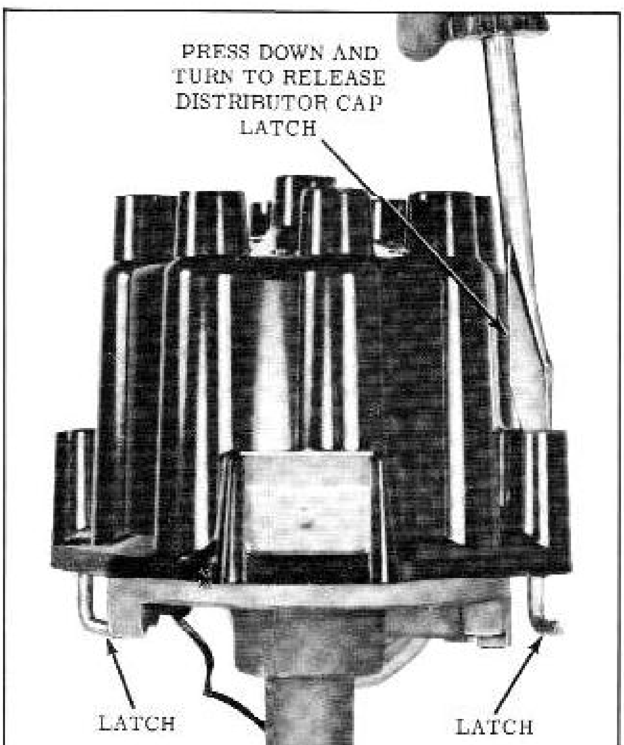

Fig. 13-61 Distributor Cap Removal

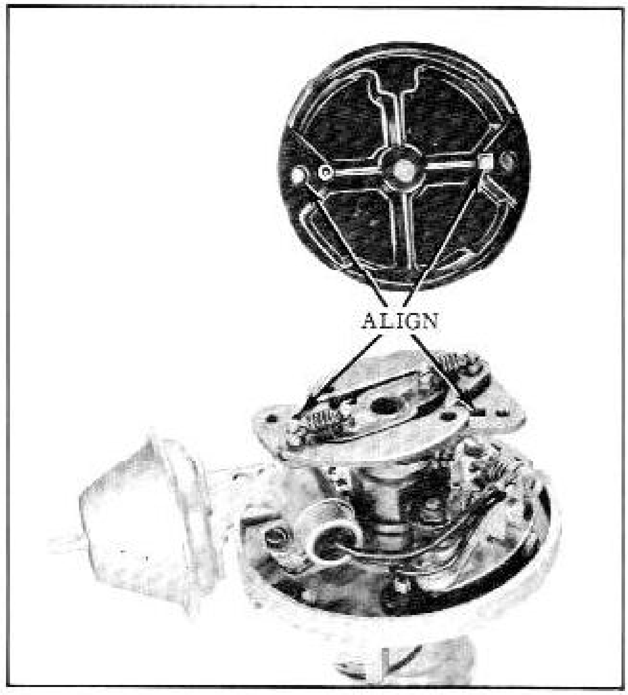

Fig. 13-62 Rotor Installation

2. Remove 2 rotor mounting screws and lift rotor from distributor mechanical advance mechanism.

Installation

1. Install rotor, aligning round and square lugs shown in Fig. 13-62.

2. Install mounting screws.

VACUUM ADVANCE UNIT

Removal

1. Disconnect the vacuum hose from unit.

2. Remove distributor cap.

3. Remove rotor.

4. Rotate breaker plate to provide access to unit mounting screws and remove mounting screws.

5. Pull the vacuum advance unit out from the distributor so that the breaker plate is rotated approximately 30° counterclockwise. Holding the breaker plate in this position, disengage the vacuum advance unit rod from the breaker plate and remove vacuum advance unit. (Fig. 13-63)

Installation

1. Engage vacuum advance unit rod with breaker plate.

2. Install mounting screws attaching the ground wire to the outer mounting screw as shown in Fig. 13-64.
3. Install rotor and distributor cap.
4. Connect vacuum hose to vacuum advance unit.

IGNITION COIL

Removal

1. Remove coil secondary wire from coil tower. Do not jerk the wire out, but remove by pulling with a steady pressure to prevent damage to wire connector.
2. Disconnect the coil primary wires by removing the 2 hex nuts at the coil terminals.
3. Remove the hex mounting bolt and lift coil from engine.

Installation

1. Before mounting coil place a small amount of thread lubricant on threads of coil mounting bolt.
2. Position coil on intake manifold, install mounting bolt, and torque to not more than 20-25 ft. lbs.
3. Connect the ignition primary lead and radio condenser lead if so equipped to the coil positive terminal and tighten hex nut to 15-20 in. oz. of torque.
4. Connect the coil to distributor primary lead to the negative terminal and tighten the hex nut to 15-20 in. oz. torque.
5. Insert the coil secondary lead into the coil tower and slide boot over tower.

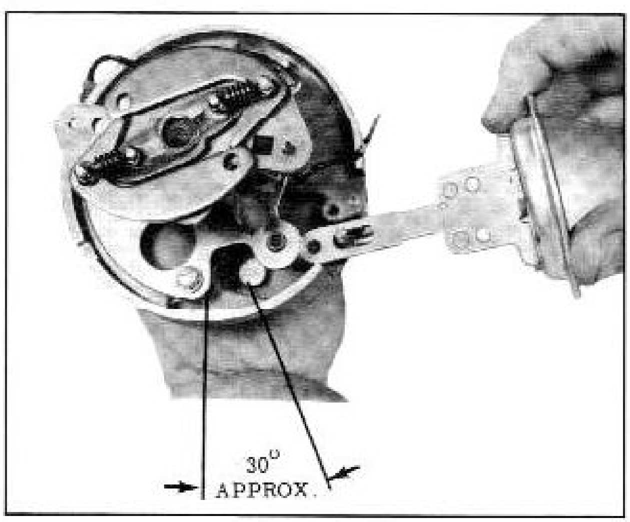

Fig. 13-63 Vacuum Advance Removal

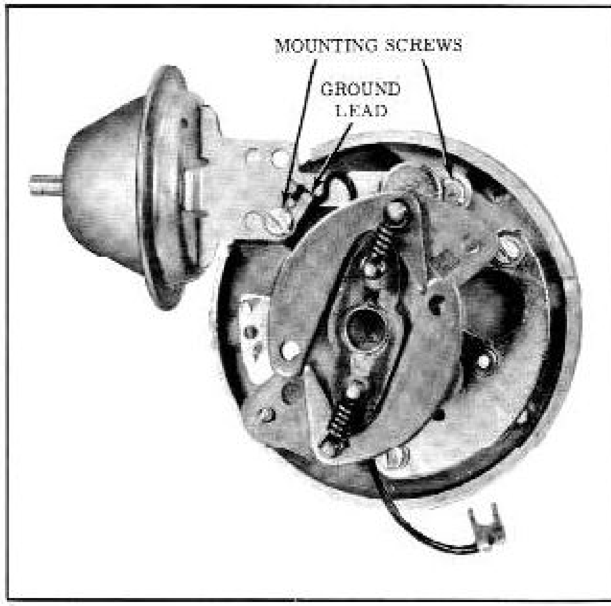

Fig. 13-64 Vacuum Advance Installation

Testing

The voltage output can be checked with any suitable test equipment following the manufacturer's test instructions.

The primary coil resistance should be from 1.28 ohms to 1.42 ohms at 80°F. The secondary coil resistance should be from 7200 ohms to 9500 ohms at 80°F.

IGNITION SWITCH

Removal

1. Disconnect harness connector from ignition switch.
2. Remove ignition switch nut.
3. Remove switch escutcheon.
4. Slide switch through instrument panel opening from the back side of the instrument panel. (See Fig. 13-65)

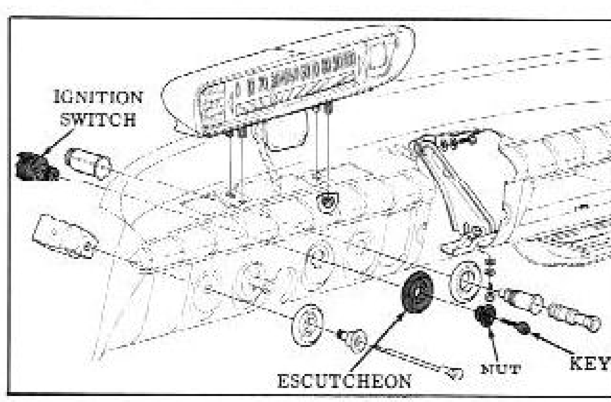

Fig. 13-65 Ignition Switch

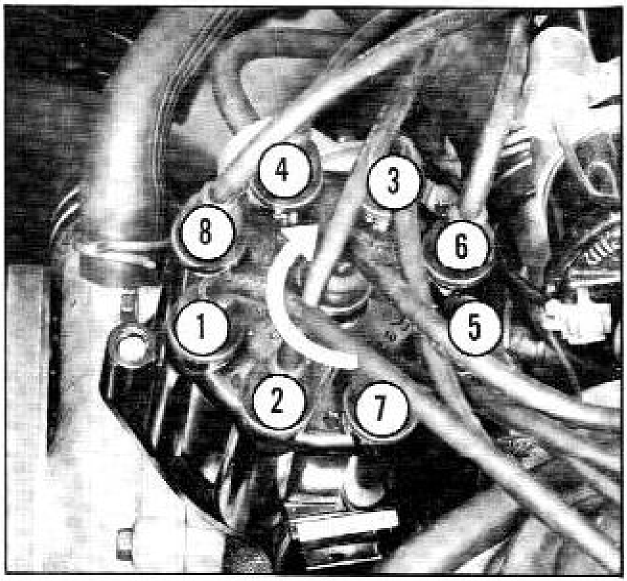

Fig. 13-66 Plug Wire Locations In Cap

Installation

1. From back side of instrument panel, slide switch into mounting hole and align lug with slot.
2. Position escutcheon over switch.
3. Install ignition switch nut.
4. Connect harness connector to ignition switch.

DISTRIBUTOR

Removal

1. Disconnect the distributor primary wire from the coil.
2. Remove the distributor cap as shown in Fig. 13-61.

   NOTE: If necessary to remove the secondary wires from the cap, mark the position for the number one cylinder on the distributor cap tower and reassemble as shown in Fig. 13-66. This will make it possible to correctly replace the secondary leads.

3. Remove the vacuum hose line from the distributor vacuum advance unit.
4. Remove the hex head bolt and hold-down clamp.
5. Mark the position of the rotor, then pull the distributor up until the rotor just stops turning clockwise and note the position of the rotor at this point.
6. Remove distributor from front cover.

Installation (Engine Not Disturbed)

1. Rotate rotor to the same position as that at removal.
2. Install distributor into engine block and align distributor drive gear with oil pump drive shaft and camshaft gear. This can be done by rotating distributor drive shaft to first pick up oil pump drive shaft and secondly engage cam gear and distributor drive gear so that rotor is positioned as it was before removal after the gear is engaged.
3. Position hold-down clamp and install clamp bolt finger tight using a drop of engine oil on bolt threads.
4. Cover distributor vacuum advance hose with tape.
5. Connect the positive (red) lead of the dwell meter to the distributor primary lead terminal at the ignition coil and the negative (black) lead of the dwell meter to ground.
6. Start the engine and with the engine running at idle speed insert dwell adjusting Tool J-6296 or BT-1501 through the distributor window into the Allen head of the adjusting screw as shown in Fig. 13-67. Adjust the dwell angle to 30°.
7. Connect timing light spark plug high tension lead to the number one cylinder spark plug line by inserting a probe lead between the spark plug rubber boot insulator and the high tension lead.

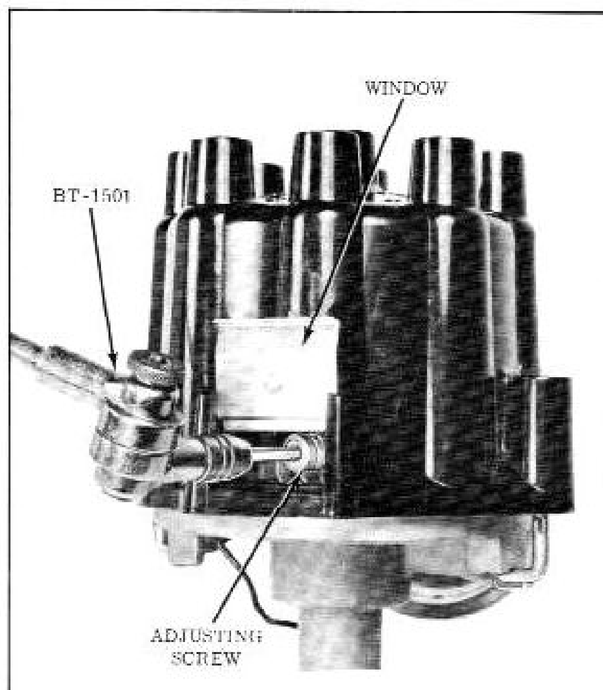

Fig. 13-67 Adjusting Dwell

8. Connect the positive (red) timing light lead to the battery positive terminal and the negative (black) timing light lead to the battery negative terminal.

9. Adjust the engine speed to 850 r.p.m.

10. Set the timing to 5° before top-dead-center by rotating the distributor and tighten the distributor hold-down clamp bolt. 7-1/2° is the setting for 4 Bbl. carburetor equipped engines.

11. **Torque** the distributor hold-down clamp bolt to 25-30 ft. lbs.

12. Remove the tape from the distributor vacuum line and connect vacuum line to vacuum advance unit.

Installation (Engine Disturbed)

If the engine is turned over after the distributor is removed or if the engine has been disassembled for some reason, it will be necessary to perform the following steps:

1. Position the number one cylinder piston in firing position by either of the two following methods:

   a. Remove the number one cylinder spark plug. Using an auxiliary starter switch and a compression gauge, crank the engine until compression is indicated on gauge. Continue to crank engine intermittently to align timing mark on crank shaft balancer with the zero line on the front cover. This will place the piston at top-dead-center for initial timing.

   b. Remove the left bank rocker cover. Crank engine until the number one cylinder intake valve closes and the zero timing mark on front cover is aligned with the notch on the crankshaft balancer rim. The piston will be at top-dead-center when the intake valve rocker-arm is at its upper extreme on the valve stem end.

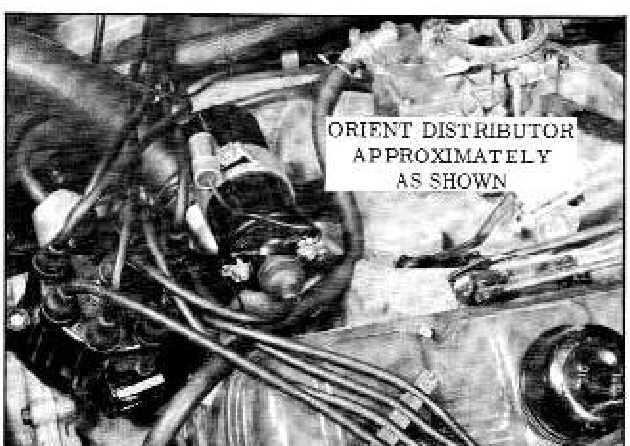

Fig. 13-68 Distributor Installation

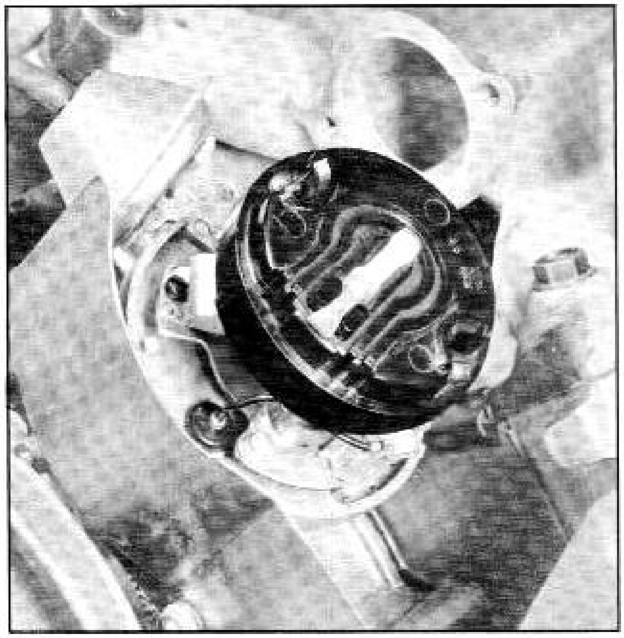

Fig. 13-69 Distributor Installation

2. Install the distributor with the vacuum advance positioned to the right of the engine as shown in Fig. 13-68.

3. Rotate rotor to engage oil pump drive shaft.

4. Position the rotor so that it points toward the distributor cap number one cylinder tower. This will be positioned just slightly to the left of center and towards the front of the engine. (Fig. 13-69)

5. Rotate the rotor about 1/8 turn clockwise and push down to engage camshaft gear.

6. Install hold-down clamp and bolt finger tight using engine oil on bolt threads.

7. Cover distributor vacuum advance vacuum hose with tape.

8. Connect the positive (red) lead of the dwell meter to the distributor primary lead terminal at the ignition coil and the negative (black) lead of the dwell meter to ground.

9. Start the engine and with the engine running at idle speed insert dwell adjusting Tool J-6296 or BT-1501 through the distributor window into the Allen head of the adjusting screw as shown in Fig. 13-67. Adjust the dwell angle to 30°.

10. Connect timing light spark plug high tension lead to the number one cylinder spark plug line by inserting a probe lead between the spark plug rubber boot insulator and the high tension lead.

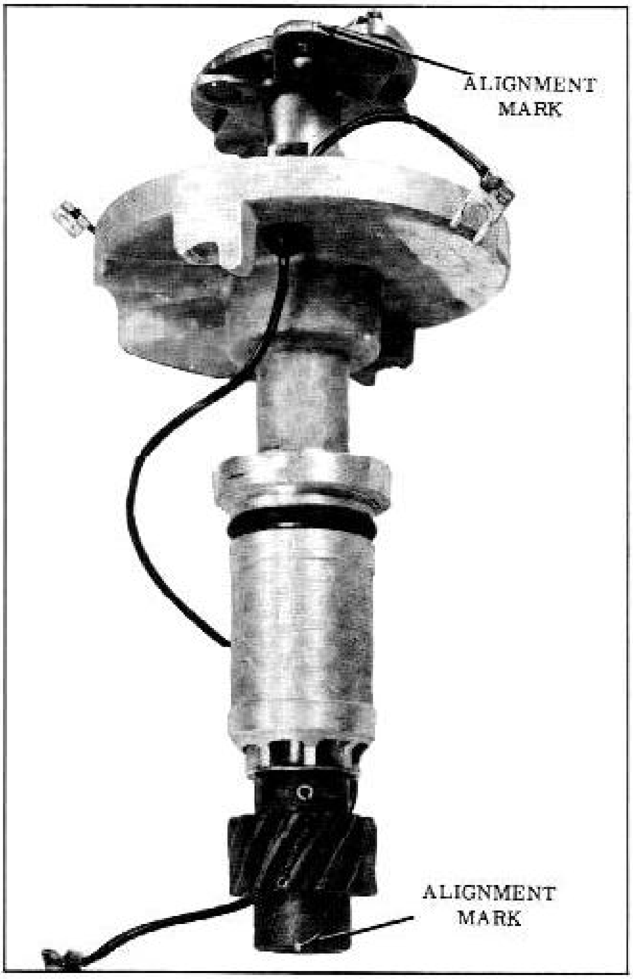

Fig. 13-70 Distributor Shaft and Gear

11. Connect the positive (red) timing light lead to the battery positive terminal and the negative (black) timing light lead to the battery negative terminal.

12. Adjust the engine speed to 850 r.p.m.

13. Set the timing to 5° before top-dead-center by rotating the distributor and tighten the distributor hold-down clamp bolt. $7\text{-}1/2^{\circ}$ is the setting for 4 Bbl. carburetor equipped engines.

14. Torque the distributor hold-down clamp bolt to 25-30 ft. lbs.

15. Remove the tape from the distributor vacuum line and connect vacuum line to vacuum advance unit.

Disassembly

1. With distributor cap and rotor removed, mark the distributor gear and the distributor shaft at the centrifugal advance mechanism so that they may be reassembled in the same position. (Fig. 13-70)

2. Using a suitable drift, drive out the gear retaining roll pin.

3. Slide drive gear from distributor shaft and remove the shaft thrust washer.

4. Loosen the ground lead terminal screw and disconnect the ground lead terminal from the vacuum advance unit. (Fig. 13-71)

5. Disconnect the primary lead from the contact set.

6. Remove the shaft retaining ring from the upper bushing and lift the breaker plate and felt wick from the bushing. (Fig. 13-72)

7. Remove the two vacuum advance unit retaining screws and the vacuum advance unit.

Assembly

1. Install the vacuum advance unit and be sure the locating lug is seated in the hole in the housing. Just start the ground lead terminal screw.

2. Place the felt wick on the upper bushing, then place the breaker plate over the upper bushing and vacuum advance link. (Fig. 13-72)

3. Install the retaining ring on the upper bushing.

4. Insert the ground lead under the retaining screw and tighten.

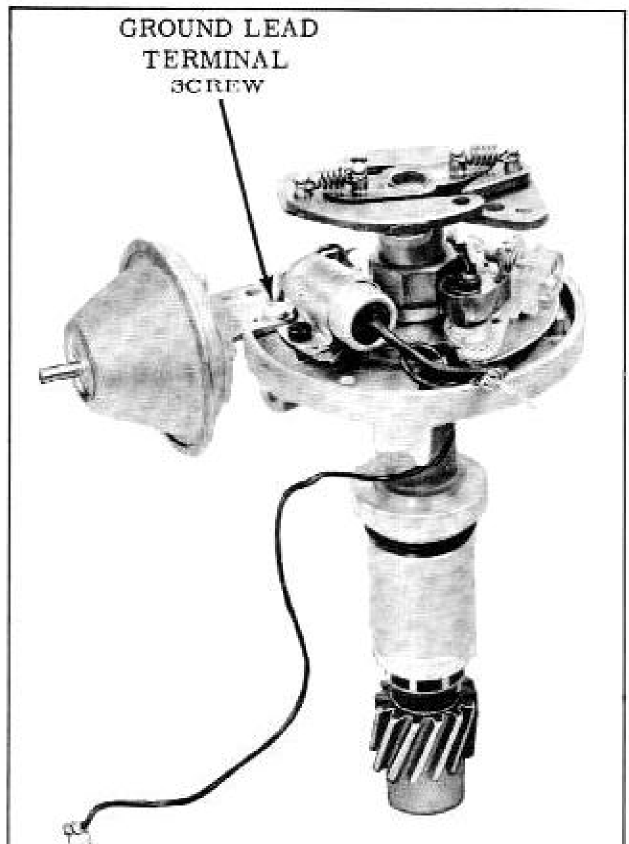

Fig. 13-71 Distributor Ground Lead

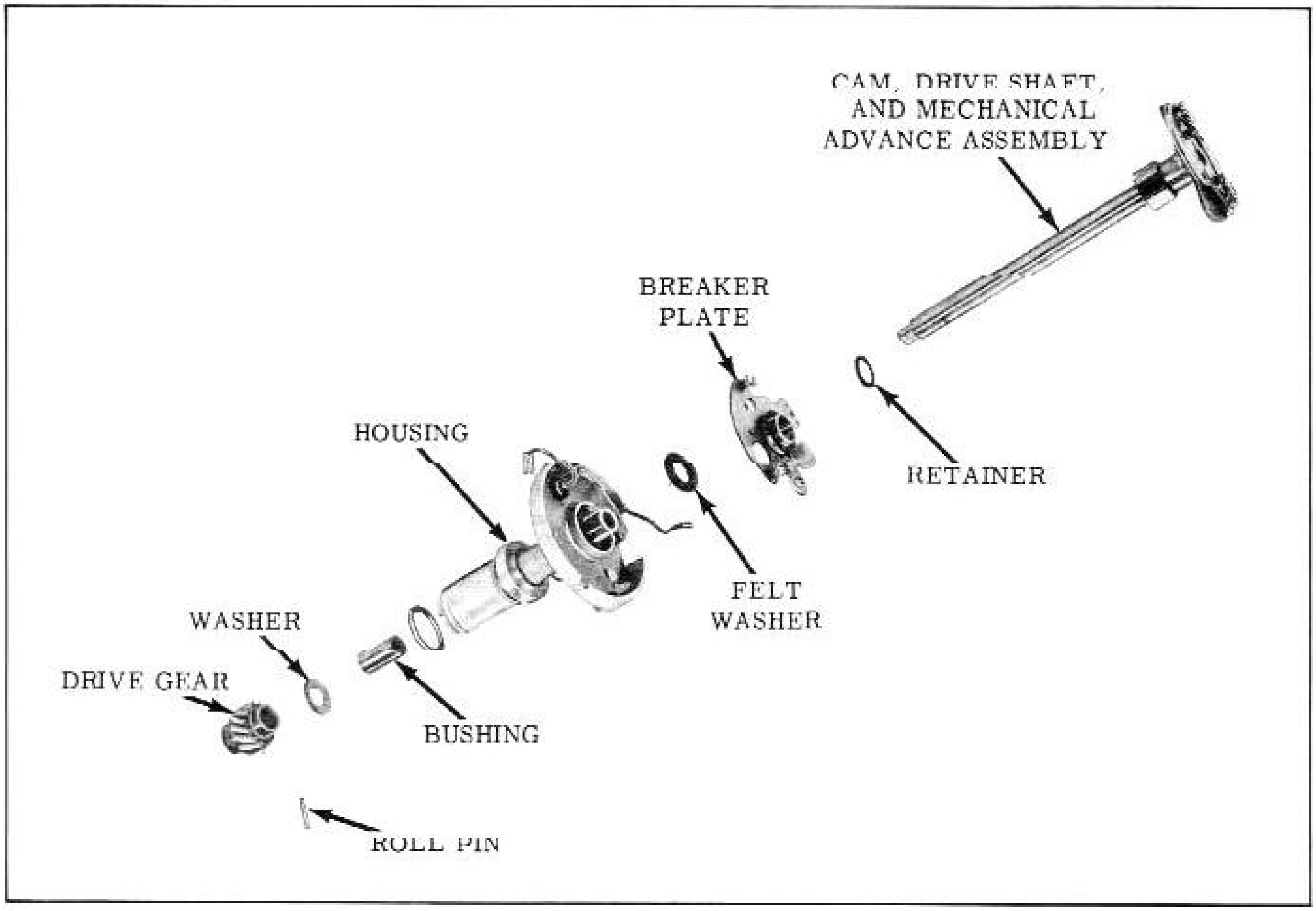

Fig. 13-72 Distributor Assembly

5. Connect the primary wire to the contact set terminal. (Fig. 13-73)
6. Slide the distributor shaft through the housing bushings.
7. Slide a new thrust washer onto the shaft.
8. Slide the drive gear onto the shaft aligning pin hole and the alignment marks.
9. Install the gear retaining roll pin.
10. Apply a small amount of Delco-Remy Cam and Ball Bearing lubricant or equivalent to the breaker cam.
11. Check and adjust dwell, vacuum advance and mechanical advance.

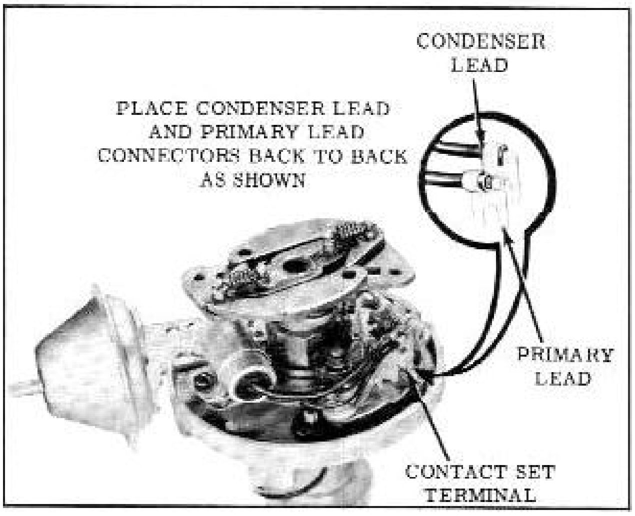

Fig. 13-73 Condenser and Primary Lead

LIGHTING SYSTEM

DESCRIPTION

HEADLAMP SWITCH

The headlamp switch controls the headlamps, parking lamps, tail lamps, and instrument panel lamps. Turning the knob counterclockwise against the stop turns on the dome lamp. 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 normal lighting load is not sufficient to cause the circuit breaker (located on the headlamp switch) to open. If a short circuit or overload occurs, the circuit breaker will cause the lamps to flicker on and off rapidly. This flickering will continue until the cause of the malfunction is corrected. The circuit breaker is not adjustable.

HEADLAMPS

The dual headlamp system consists of four headlamps paired horizontally. Each pair of lamps consists of a sealed beam unit (inner unit with number one embossed on the lens) with 1 filament which provides an upper beam only, and a sealed beam unit (outer unit, with number two embossed on the lens) with 2 filaments which provides both an upper and lower beam. The sub-body is also identified.

Since the number two headlamp lens is designed to provide maximum illumination on lower beam and the upper beam filament is not at the focal point of the number two lamp, the major portion of the upper beam illumination is supplied by the number one unit. Thus, the upper beam is supplied by all 4 headlamps.

When the lower beam is desired, the number one lamps are turned off, the upper filament of the number two lamps are turned off and the lower filaments of the number two lamps are turned on.

DIMMER SWITCH

The foot dimmer switch is used to select high or low beam of the headlamps as desired.

TAIL LAMP

The tail lamp bulb is a double element bulb which acts as a stop lamp, tail lamp and turn signal lamp.

The lamp bulb on all series may be replaced by removing the tail lamp lens.

LICENSE LAMP

The rear license plate is illuminated by a lamp that is mounted in the bumper above the license plate.

STOP LAMP SWITCH

The stop lamp switch is a mechanically operated electrical switch. It is mounted through a bracket to the instrument panel brace. When the brake pedal is applied the switch plunger is allowed to move outward. This outward movement of the switch plunger energizes the brake lamp circuit lighting the rear stop lamps.

TURN SIGNAL CIRCUIT

The turn signal circuit consists of the switch, flasher, 2 pilot lamps in the instrument cluster, the stop lamp filaments in the rear lamps, the turn signal filaments in the parking lamps.

The turn signal switch is mounted on the steering column jacket just above the Hydra-Matic neutral safety switch and actuated by a rod extending down the mast jacket from the turn signal actuator assembly.

FLASHER

The flasher is mounted on the fuse panel, and is a single circuit magnetic type unit. Should it need replacement, Part No. 535078 only must be used.

The front turn signal lamp, rear turn signal lamp and pilot lamp are all connected in parallel and light simultaneously when the flasher makes contact.

If either the front or the rear turn signal lamp burns out, the pilot lamp on that side of the instrument panel will flash approximately twice the normal rate. The normal frequency of the turn signal is 80 to 100 flashes per minute.

BACK-UP LAMP SWITCH

On cars equipped with Hydra-Matic, the back-up lamp switch is incorporated with the neutral safety switch. The neutral safety switch, mounted on the steering column mast jacket, is employed as a safety factor on Hydra-Matic models. The switch prevents unintentional starting of the engine with the transmission in gear. When the switch is properly adjusted the engine can only be started with the selector lever in "NEUTRAL" or "PARK" position.

The back-up lamp switch on Syncro-Mesh equipped cars is mounted on the steering column mast jacket adjacent to the lower hole.

This switch is actuated by a lever attached to the shift tube. Placing the shift lever in reverse actuates this switch, turning the back-up lamps on.

DOME LAMP

The dome lamp is located in the center of the interior roof area. Turning the headlamp switch knob counterclockwise against the stop causes the dome lamp to operate. (3100 models are also equipped with 2 Door lamp switches. Opening either of the front doors causes the dome lamp to operate.)

INSTRUMENT LIGHTING

The instrument cluster is equipped with 3 lamps to light the speedometer dial and fuel gauge. The clock, located in the cluster, is illuminated with 1 lamp bulb. The cluster also houses a high beam indicator, 2 turn signal indicators, a temperature warning lamp, a generator warning lamp and an oil pressure warning lamp. All lamp bulbs, except the clock lamp, are in sockets in the printed circuit.

The engine temperature indicator lamp is controlled by a thermal switch in the right front of the intake manifold. (Fig. 13-74) If the engine cooling system is not functioning properly, the thermal switch will close the circuit to the red light when the temperature reaches 238°F ± 2°F, (cars without air conditioning). The thermal switch does not require servicing. If it is defective, it should be replaced.

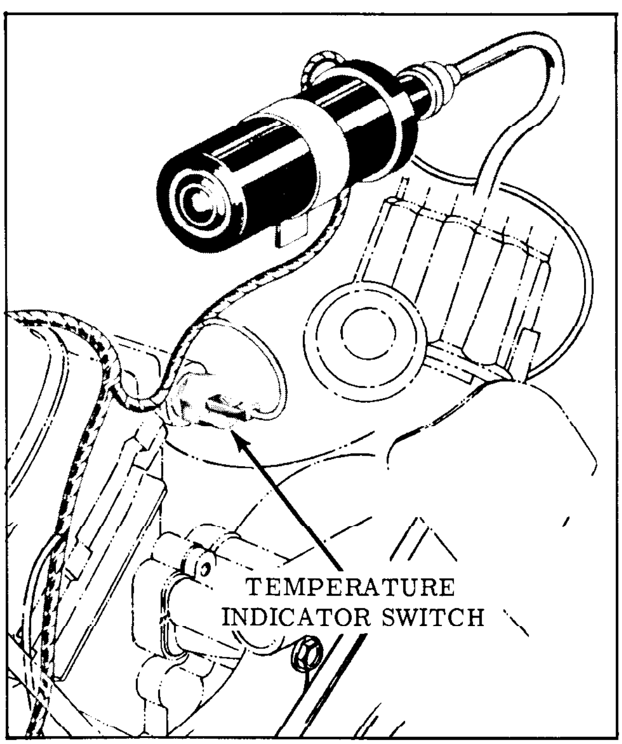

Fig. 13-74 Temperature Indicator Switch

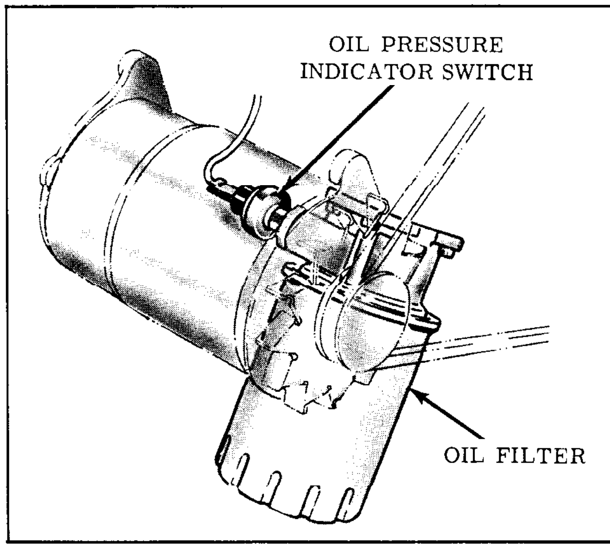

Fig. 13-75 Oil Pressure Switch

The engine oil pressure indicator lamp is controlled by a pressure operated switch located in the oil filter pad. (Fig. 13-75) With the engine running, the light operates only when the oil pressure is not satisfactory. This lamp should come on when the ignition is turned on and the engine is not running.

The generator warning lamp should come on when the ignition switch is turned on and the engine is not running. With the engine running the generator warning lamp will go out at about 600 engine r.p.m. or about 8-10 m.p.h. if the generator is functioning properly. If the lamp remains on below this speed a malfunctioning generator is not necessarily indicated.

The heater control and radio dial are also illuminated.

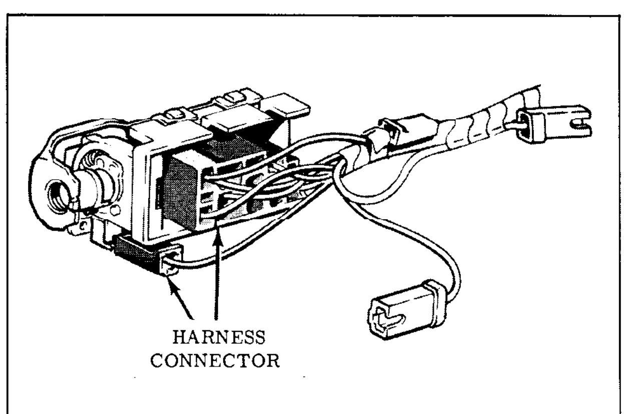

Fig. 13-76 Headlamp Switch Wiring

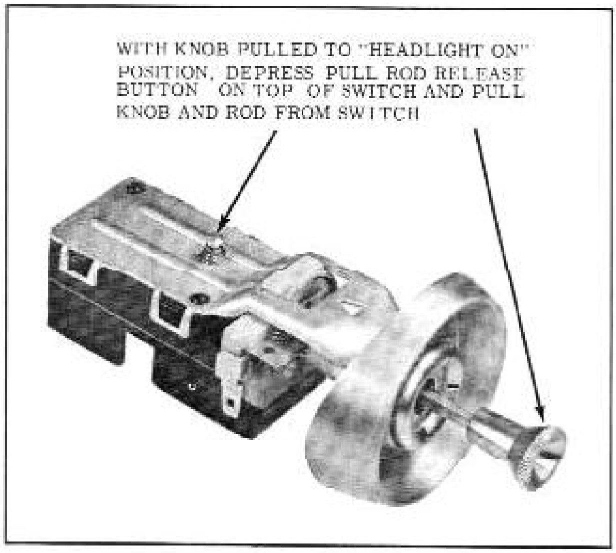

Fig. 13-77 Headlamp Switch Removal

SERVICING UNITS

HEADLAMP SWITCH

Removal

1. Disconnect wiring from lamp switch. (Fig. 13-76)
2. Remove knob and rod by first pulling knob out to the headlamp "ON" position, then depress pull rod release button on the side of the switch assembly and pull the rod out. (Fig. 13-77)
3. Remove sleeve nut with a screw driver.
4. Remove escutcheon.
5. Remove headlamp switch from rear of instrument panel.

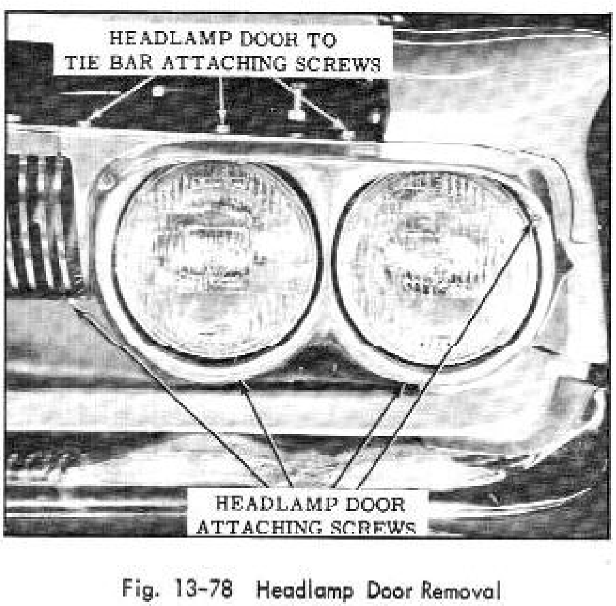

Fig. 13-78 Headlamp Door Removal

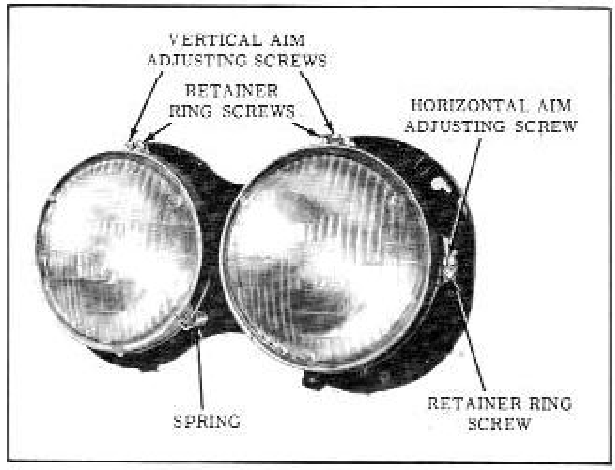

Fig. 13-79 Headlamp Retaining Ring Removal

Installation

1. Install headlamp switch through mounting hole of instrument panel.
2. Install escutcheon.
3. Install sleeve nut.
4. Insert pull rod into switch and push in until the release button snaps into the lock position to retain pull rod.
5. Connect the harness connector to the switch assembly.

HEADLAMP (SEALED BEAM)

Removal

1. Remove headlamp door. (Fig. 13-78)
2. Using long nosed pliers disconnect the retaining ring spring.
3. Remove 2 retaining ring attaching screws, but DO NOT DISTURB THE ADJUSTING SCREWS. (Fig. 13-79)
4. Remove retaining ring and pull headlamp sealed beam out to gain access to wiring connector.
5. Disconnect wiring connector from sealed beam unit and remove unit.

Installation

1. Attach connector to new sealed beam unit.
2. Position unit in mounting ring so that the alignment lugs are seated in slots provided in mounting ring and the sealed beam unit is right side up.
3. Install retaining ring and 2 retaining ring attaching screws.
4. Attach retainer spring to retaining ring using long nose pliers.
5. Replace headlamp door.

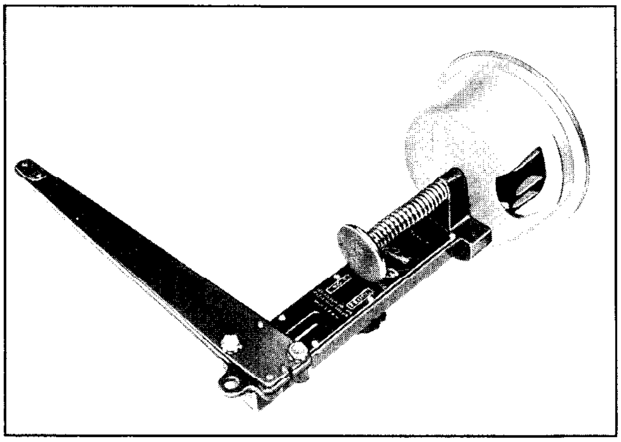

Fig. 13-80 T-3 Headlamp Aimer

Adjustment (T-3 Safety Aimer)

The T-3 Safety Aimer, Type B, (Fig. 13-80) consists of a circular base the size of the 5-3/4" dual seal beam units. The aimer attaches to the sealed beam unit by means of a plunger operated suction cup. (An adapter converts the aimer for use with 7" T-3 Sealed Beam units when desired.) Attached to the front of the base and extending perpendicular to the base is an "L" shaped arm. When mounted on the sealed beam unit this arm points toward the center of the car and is parallel to the ground. Mounted in the arm between the base and cross arm is a bubble level which may be adjusted to compensate for variations in floor levelness. With the Safety-Aimer, the headlamps may be correctly aimed in the daylight without even turning them on. The T-3 Aimer meets SAE specifications for mechanical headlamp aimers.

While aiming headlamps, the car should be at curb weight, that is, with spare tire, fuel tank and crank case filled to capacity, and no passengers or luggage. The tires should be uniformly inflated to the recommended pressure.

Before adjusting aim of headlamp, bounce car up and down and roll the vehicle back and forth several times to allow suspension to settle. The floor should be reasonably level with enough room to walk around the car. If the area is level the T-3 Aimer can be used as it comes from the factory. Before the Aimer is packaged, the bubbles are set for use on level aiming space. The Aimer itself provides a means of checking any given area for levelness.

The following Oldsmobile headlamp aiming procedures are based on a recommended "2" deflection from horizontal for the vertical aim. Where State laws require aiming other than that recommended below, follow the regulations of those States whenever adjusting headlamps.

Checking the Calibration of the T-3 Aimer

The factory calibration of the T-3 Aimers may be quickly checked by using an easily constructed checking fixture (Fig. 13-81). Construct such a fixture as follows:

1. Fasten a 10" square of 3/4" plywood to the wall.
2. Install 3 1/2" No. 6 pan head wood screws on the wooden board as shown in Fig. 13-81 so that the screw heads are approximately 1/4" from the board and spaced as shown.
3. Set the numeral "2" in the DOWN view window of the aimer.
4. Hold the seating plane of the aimer in contact with the 3 screws and with the horizontal arm parallel with the floor (Fig. 13-82) The

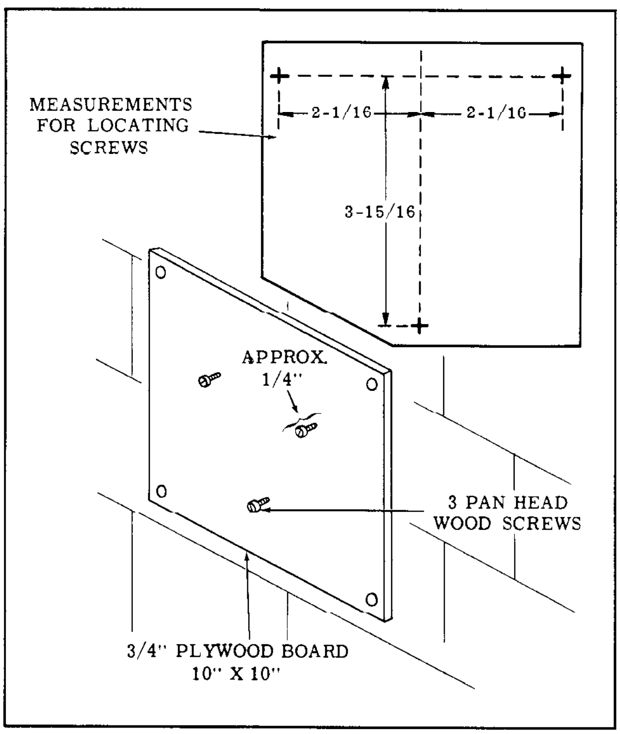

Fig. 13-81 T-3 Calibration Fixture

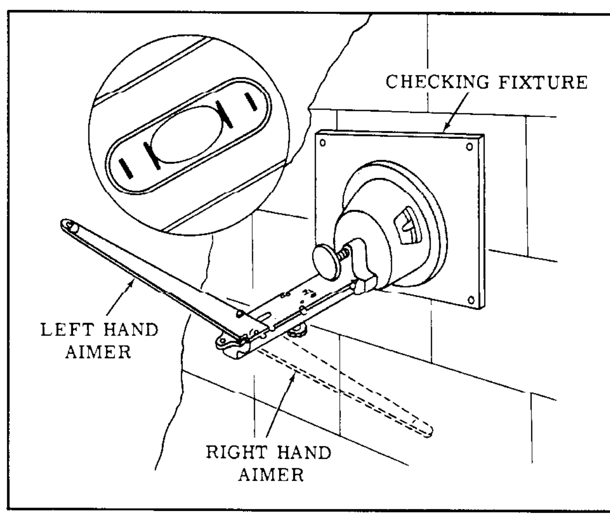

Fig. 13-82 Vertical Check of Aimers

screw heads must be long enough to provide clearance between the flange of the aimer and the board.

5. Adjust the 3 wood screws until the bubble in the T-3 Aimer is centered. Leave the wood screws in this position.

After the checking fixture has been constructed and adjusted as outlined above, the T-3 Aimers may be quickly and easily checked should they ever be dropped or damaged.

Vertical Check of Aimer

1. With the numeral "2" in the DOWN window of the aimer, hold the aimer seating plane against the 3 screws on the plywood board with the horizontal arm parallel to the floor (Fig. 13-82) If the bubble is centered, the aimer is in calibration.

2. If the bubble is not centered, adjust screw (Fig. 13-83) on the bottom of the aimer until the bubble is centered. The aimer is now calibrated vertically for a level floor.

Horizontal Check of Aimer

Rotate the aimer so that the horizontal arm points toward the floor (Fig. 13-84) Tie a small weight on the end of a 3 foot string, then connect the opposite end of the string to the slot in the aimer arms. The string should fall as shown

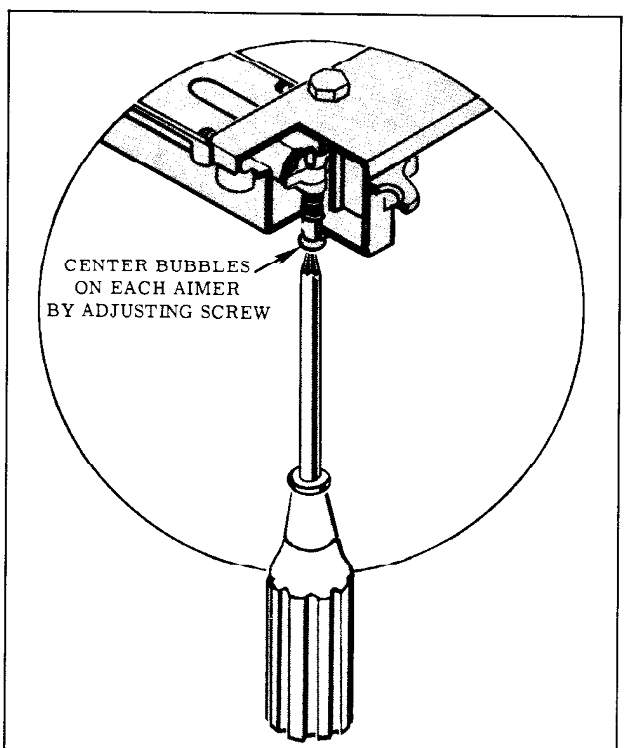

Fig. 13-83 Aimer Vertical Adjusting Screw

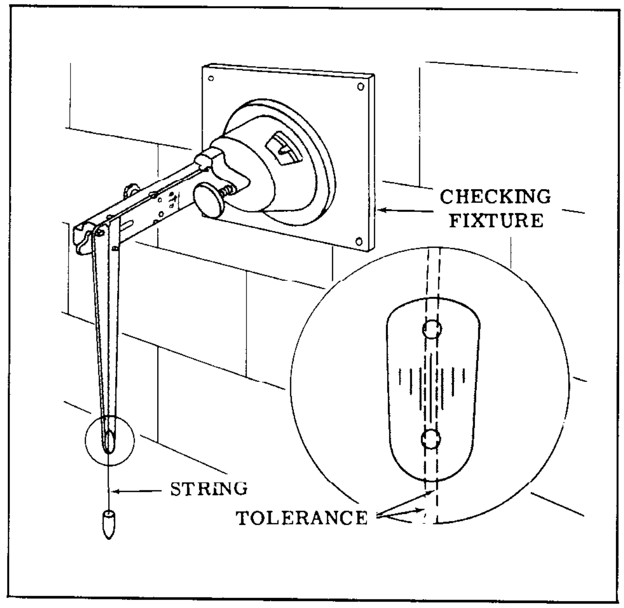

Fig. 13-84 Horizontal Check of Aimer

in Fig. 13-84. If it falls outside the tolerances shown, the aimer should be replaced.

How to Select a Level Aiming Area

1. Select area you believe to be level.

2. Remove headlamp doors and install aimers on each headlamp, making sure aiming lugs of headlamp (Fig. 13-85) engage smooth inner ring of the aimer. To install aimer, press firmly on the knob extending out from the center of the aimer base. (Fig. 13-86) This forces the suction cup into place on the sealed beam unit. It may be necessary to clean headlamp lens to provide an air tight seal for the suction cup.

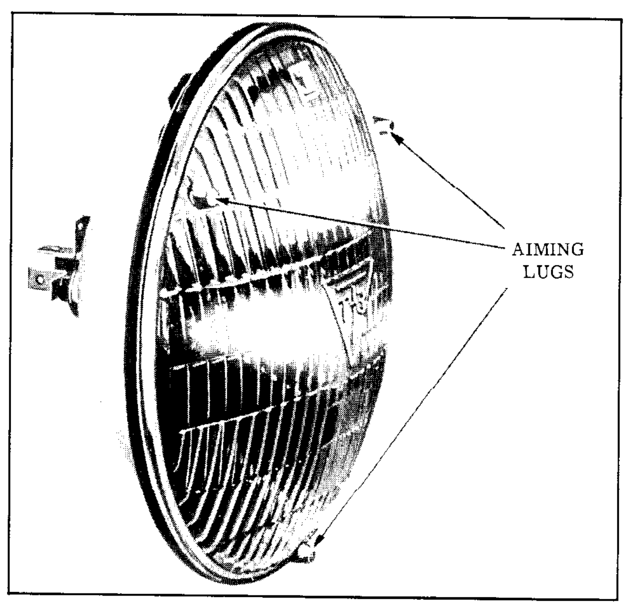

Fig. 13-85 Headlamp Aiming Lugs

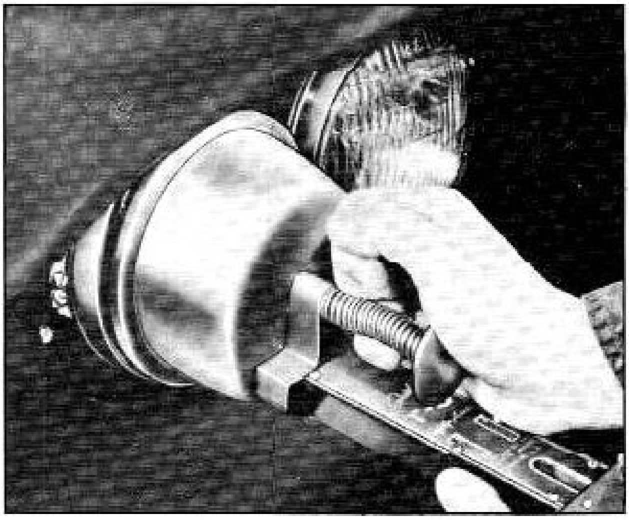

Fig. 13-86 Installing Aimer

3. Loosen the slider knob beneath the aimer arm and set the number "2" in the DOWN view window. (Fig. 13-87) Back vertical lamp adjuster out on each lamp until bubble is outside of black lines of vial by turning clockwise.

4. After both bubbles are centered, turn the car around end for end, making sure the tires rest in the spots made on the floor before the car was moved. (Fig. 13-88)

5. If the bubbles are still within the 2 outside black marks on the vials, the floor is level enough to use the aimers as they come from the factory. (Fig. 13-89)

NOTE: A quick level check can be made by using the T-3 Safety Aimer as a level. Use with a true 8 to 10 foot 2 by 4 as an extension. Make sure pads on base of aimer are used. Place the board where you expect the wheels to be and take readings as outlined above.

6. If either bubble moves outside the black lines

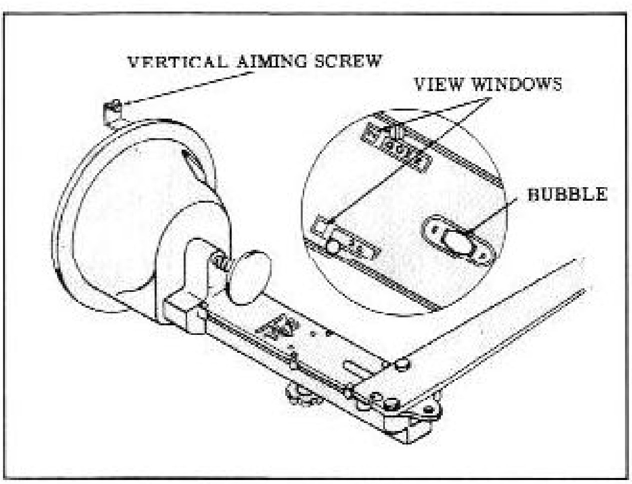

Fig. 13-87 Vertical Alignment

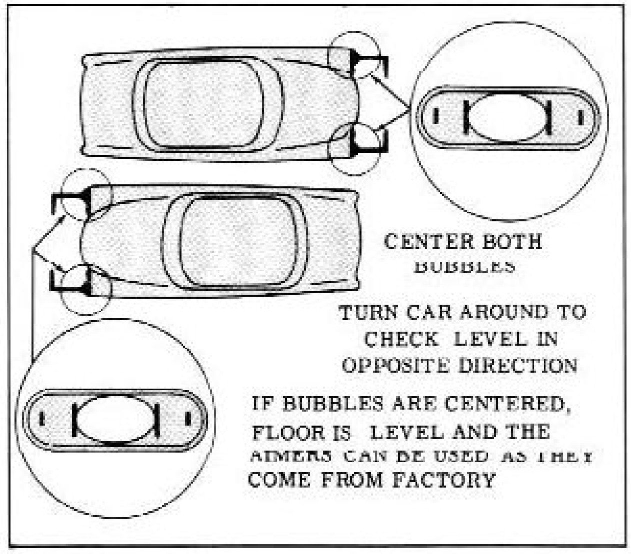

Fig. 13-88 Selecting an Aiming Area

of the vial there is too much slant to the floor. Try driving the car in at different angles onto the aiming area. If bubbles cannot be centered follow procedure under "How To Compensate for Unlevel Floor."

NOTE: When level portion of floor is obtained, mark tire spots on floor so spots can be used next time without calibrating aimer. These will be a different set of marks than the ones used for the regular Oldsmobile Passenger Car. New marks will be required for the "F-85" due to the shorter wheelbase and tread.

How to Compensate for Unlevel Floors

If your floor is not level within the limits specified, the T-3 Aimer can be calibrated to compensate for the error in the floor. Follow this procedure with both aimers.

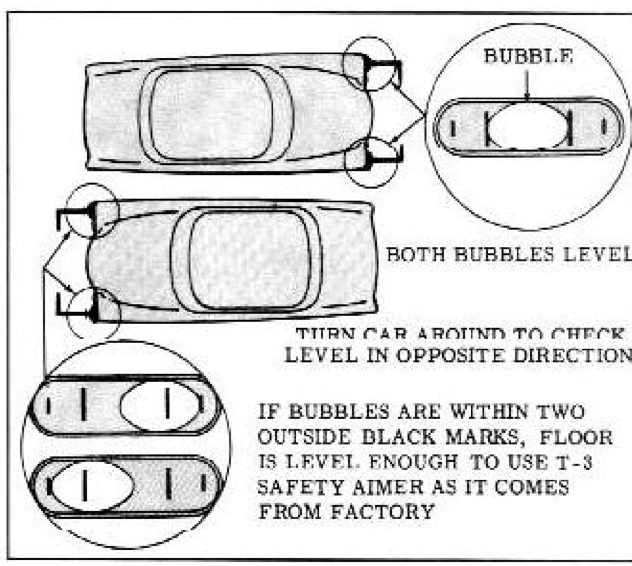

Fig. 13-89 Limits for Aiming Area

1. Drive the car onto the area for which you wish to compensate the aimers, and install the aimers in place on either the number one or the number two pair of headlamps.

2. Loosen knob beneath the aimer arm and move the slider until the bubble is centered.

3. Record the numeral in the view window. (This numeral is to be used only for recalibration.)

4. Move the slider to a position halfway between this recorded numeral and the numeral "2" in the DOWN window. (This numeral is used only in recalibration and not for headlamp aiming.)

5. Recalibrate aimers by turning screw shown in Fig. 13-83, until the bubble is centered.

6. The T-3 Aimers are now calibrated for the selected area. All future aiming must be done in the same area and with the car pointed in the same direction. Mark the tire spots on the floor so that cars ("F-85" size only) can be located in the same position.

NOTE: Due to the difference in wheelbase and tread, the "F-85" will have a different set of marks than the regular Oldsmobile.

Headlamp Adjustment—T-3 Headlamp

1. Drive vehicle onto selected aiming area. Tires should be at recommended pressures and the vehicles should be unloaded -- no extreme load in trunk compartment and no passengers.

2. Remove headlamp doors.

3. Mount the T-3 Aimers on the number one pair of headlamps so that the points of the headlamps engage the smooth inner ring of the aimers.

4. Secure the aimers to the headlamp units by pressing knob extending out from center of aimer base firmly. Rotate the crossarms to approximately horizontal position and pointing toward center of the car.

5. With both aimers in place on the same pair of headlamp units, knot both ends of the elastic string and fasten, using slots provided, from the left to the right aimer across the top of the horizontal crossarms. (Fig. 13-90)

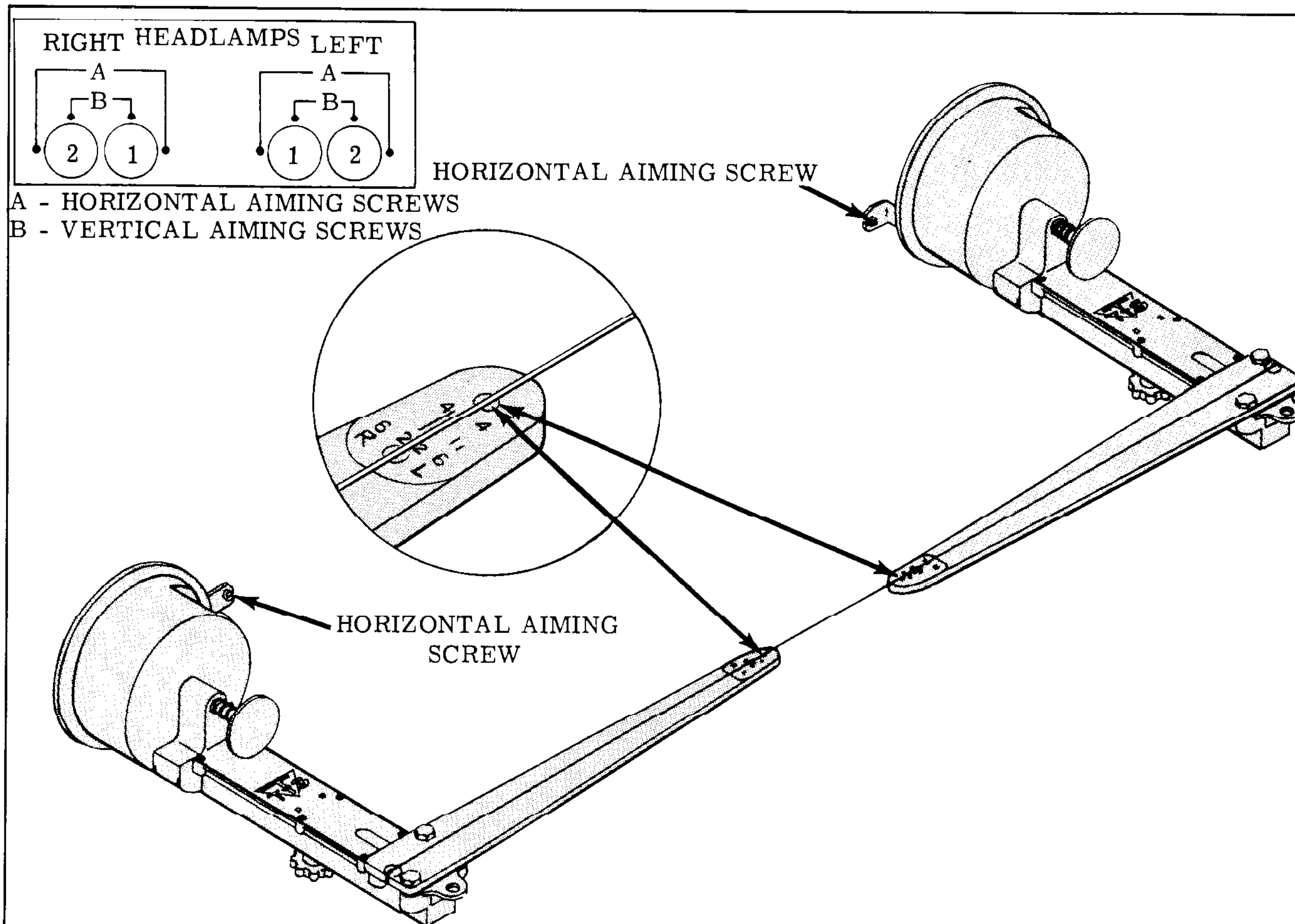

Fig. 13-90 Horizontal Headlamp Aiming

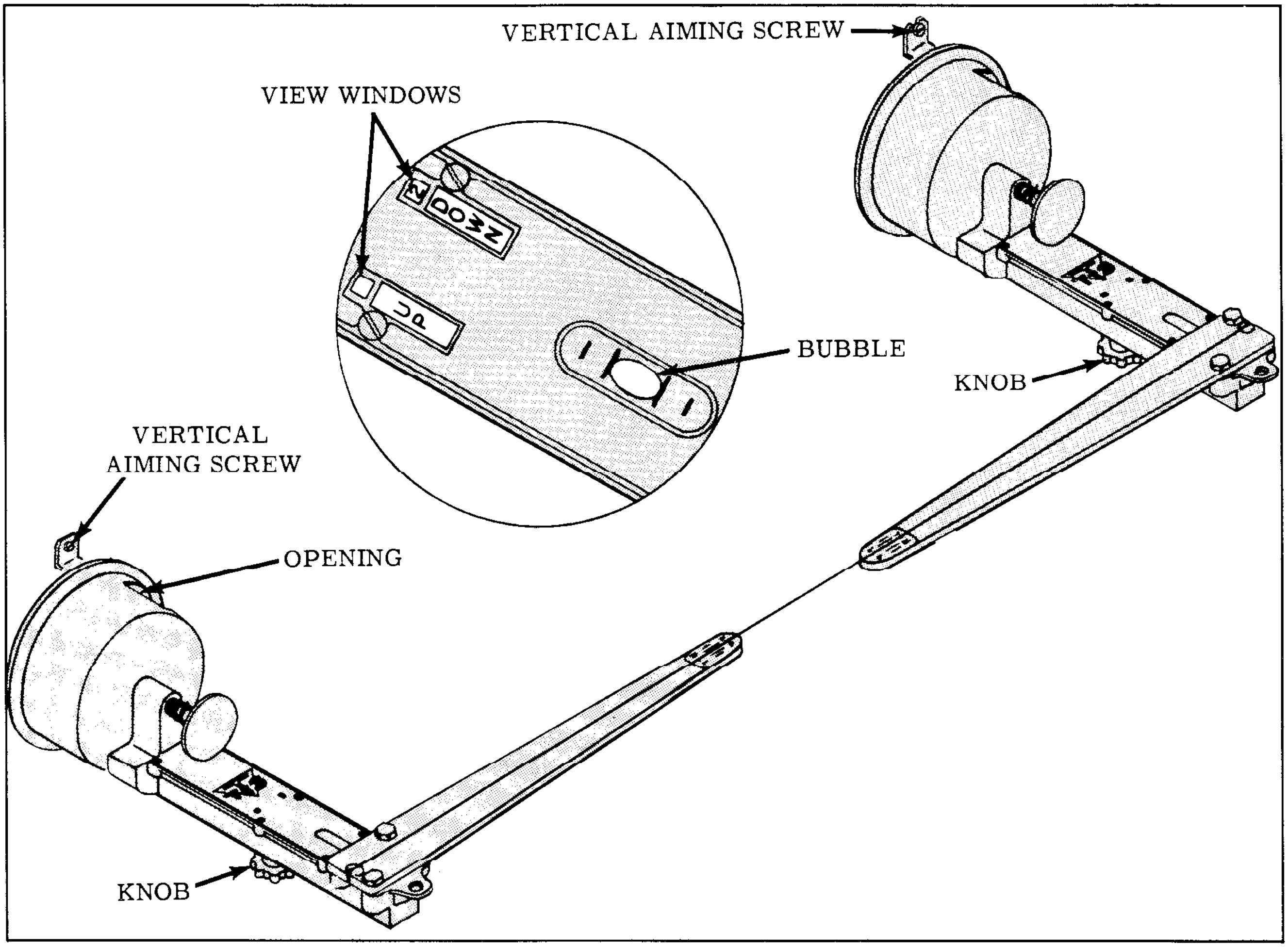

Fig. 13-91 Vertical Headlamp Aiming

6. Bounce car up and down and roll the vehicle back and forth several times to allow suspension to settle.

7. Rotate both aimers downward slightly so that the points of the crossarms just clear the string.

8. Horizontal adjustment.

   a. Turn horizontal aiming screw, Fig. 13-90, on left-hand lamp until the string is positioned over the crossarm center-line. Turn the screw clockwise in making the final adjustment to take up play in the headlamp mechanism.

   b. Repeat the same operation on the right-hand lamp to complete the horizontal adjustment of this pair of lamps.

9. Vertical Adjustment.

   a. Numeral "2" should appear in the DOWN window of each aimer. If not, loosen knob beneath aimer arm and slide back and forth until the numeral does appear.

   b. Turn headlamp vertical aim screw (Fig. 13-91) on the left-hand unit counterclockwise until the bubble is at the end of the level toward the T-3 unit. Then turn screw clockwise until the bubble is centered.

   c. Repeat this operation on the right-hand headlamp unit, if necessary.

10. Recheck the string at the ends of each crossarm for correct setting and the bubble on each aimer for centered position.

11. Remove the aimers by pulling on the suction cup tabs through the openings in the aimers (Fig. 13-85) and mount the aimers on the number two pair of headlamp units. Repeat steps 4 through 10.

12. When both pairs of headlamps have been properly aimed, remove the safety aimers and replace the headlamp doors.

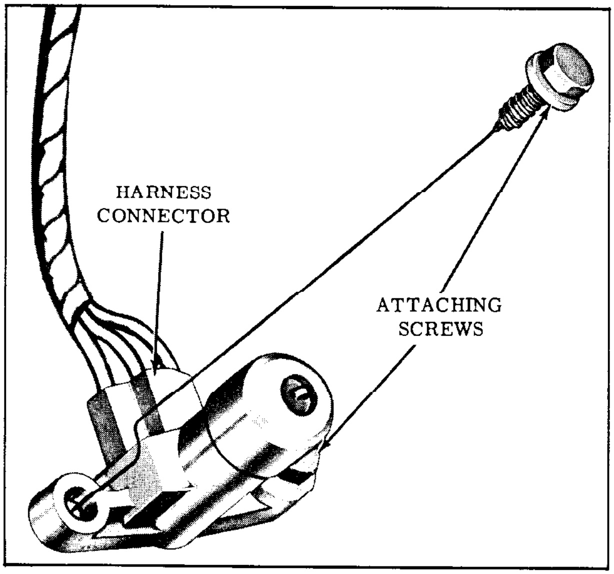

Fig. 13-92 Dimmer Switch

DIMMER SWITCH

Removal

1. Remove retaining screws and roll front floor mat carpet down at left front corner.
2. Disconnect wire connector from dimmer switch. (Fig. 13-92)
3. Remove switch by removing 2 hex head sheet metal screws.

Installation

1. Position switch on toe pan and install 2 hex head screws.
2. Connect wire plug connector to dimmer switch.
3. Replace floor carpet in correct position.

STOP LAMP SWITCH

Removal

1. Disconnect harness connector from switch terminals.
2. Loosen and remove lower lock nut and slip switch out of mounting bracket hole.

Installation

1. Position switch on mounting bracket and install and tighten lock nut.
2. Connect harness connector to switch terminals.
3. Adjust switch.

Adjustment

The stop lamp switch must be checked whenever brake pedal height has been changed. Adjustment is made by moving the switch in its mounting bracket. (Fig. 13-93)

The brake stop lamp switch is adjusted by means of 2 lock nuts. The switch can be positioned back and forth in its mounting bracket and it can be locked in place on the bracket through a range of positions allowing for adjustment. To adjust, merely loosen lock nuts and thread them on or

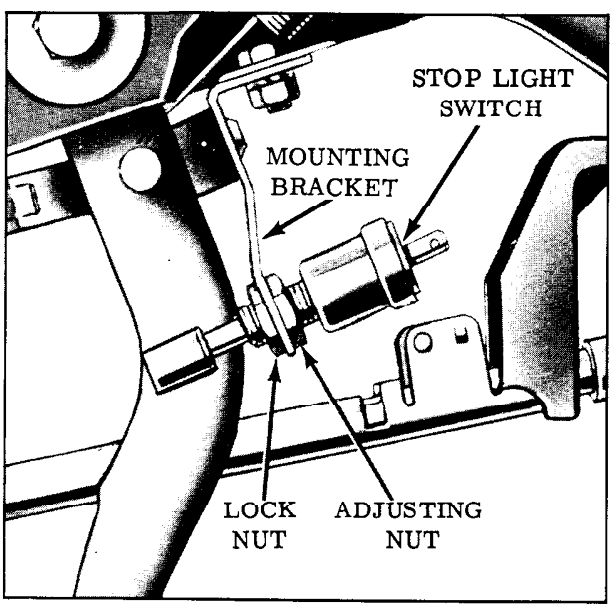

Fig. 13-93 Stoplamp Switch

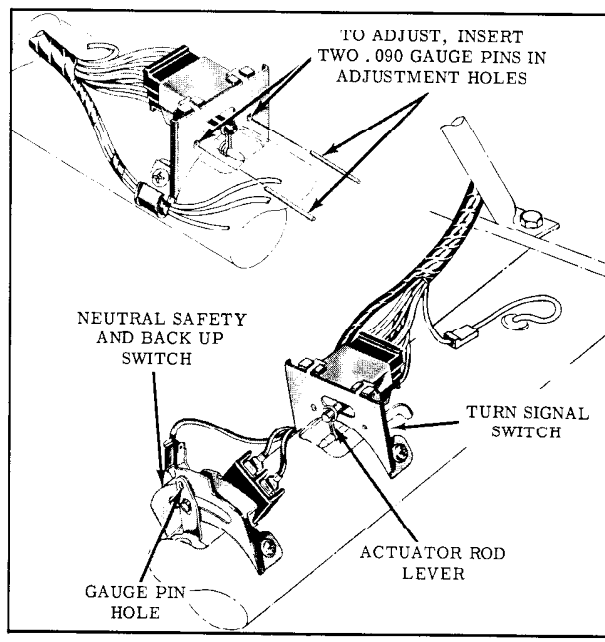

Fig. 13-94 Turn Signal Switch

off the switch to move switch either closer to or farther away from the brake pedal switch actuating lever. (Fig. 13-93)

TURN SIGNAL SWITCH

Removal

1. Disconnect the harness plug connector from the switch. (Fig. 13-94)
2. Remove the 2 mounting screws.
3. Slide switch actuator pin from actuator rod lever and remove switch from mast jacket.

Installation

1. Position switch on mast jacket with the actuator pin inserted into the actuator rod lever as shown in Fig. 13-94.
2. Install the 2 Phillips Head mounting screws, but do not tighten.
3. With the turn signal lever in the neutral position shift the switch back and forth on the mast jacket until 2 .090" pins can be inserted into the holes in the face of switch. (Fig. 13-94)
4. Tighten mounting screws and remove alignment pins.
5. Connect harness plug connector to the switch.

Adjustment

1. Loosen switch mounting screws.
2. Place the turn signal lever in the neutral position.
3. Shift switch back and forth on mast jacket until 2 .090" pins can be inserted into the holes in the face of the switch. (Fig. 13-94)
4. Tighten mounting screws and remove alignment pins.

BACK-UP LAMP SWITCH

Hydra-Matic (Neutral Safety)

Removal

1. With ignition switch in the "OFF" position disconnect the neutral safety switch and back-up lamp switch wires, noting wire positions.
2. Remove 2 attaching screws and remove switch from mast jacket.

Installation

1. Position the selector lever in the "N" position.
2. Position the switch on the mast jacket so that a .090" pin can be inserted through the hole in the switch arm and into the hole in the face of the switch. (Fig. 13-94)
3. Tighten mounting screws and reconnect wires to switch.
4. Apply the parking brake firmly.
5. Place the selector lever in the "D" position and turn the ignition switch full clockwise to the "START" position.
6. While holding the ignition switch in the "START" position, slowly move the selector lever toward the "N" position until engine cranks and starts.
7. Without moving the selector lever after the engine starts, depress the accelerator pedal slightly to determine whether or not the transmission is in gear. If neutral safety switch is properly adjusted the transmission will not be in gear.
8. Check operation of back-up lights. With neutral safety switch properly adjusted the back-up lights should come on when the selector lever is in the "R" position.

Syncro-Mesh

Removal

1. Disconnect harness connectors from switch.
2. Remove 2 attaching screws and lift switch from mast jacket.

Installation

1. Position switch on mast jacket and install attaching screws.
2. Position adjustable operating lever so that it operates switch in reverse only. (Fig. 13-95)

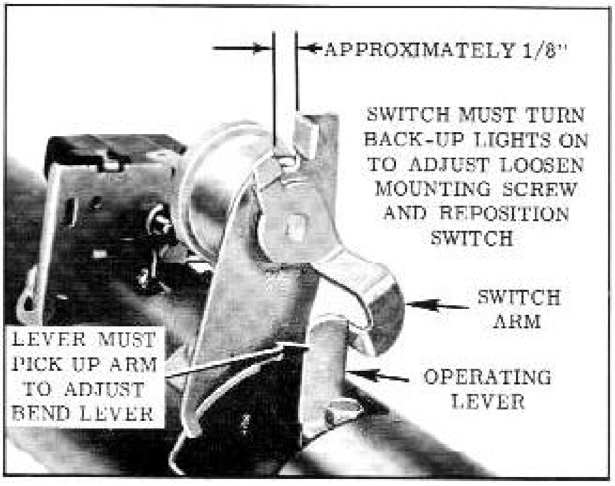

Fig. 13-95 Back Up Lamp Switch (Rev. Pos)

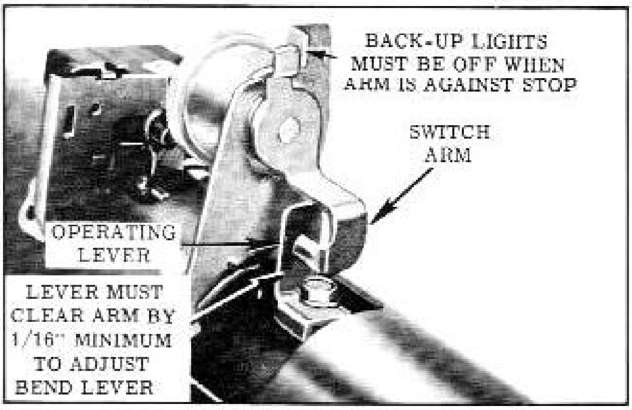

Fig. 13-96 Back Up Lamp Switch (2nd)

Adjustment

1. Install switch on steering column using screw in single mounting hole, but do not tighten screw.

2. Place transmission shift lever in reverse. Move switch clockwise until there is approximately 1/8" gap between switch lever and stop. (Fig. 13-95) Tighten mounting screw.

3. Move shift lever to second gear. Operating lever should clear switch lever by a minimum of 1/16". (Fig. 13-96)

4. Move shift lever to neutral. Switch arm should be against stop and back-up lamps should be off. (Fig. 13-97)

5. Connect harness connectors to switch.

6. Check operation by turning on ignition and placing selector lever in reverse. Check second gear position to be sure lamps do not come on in second gear.

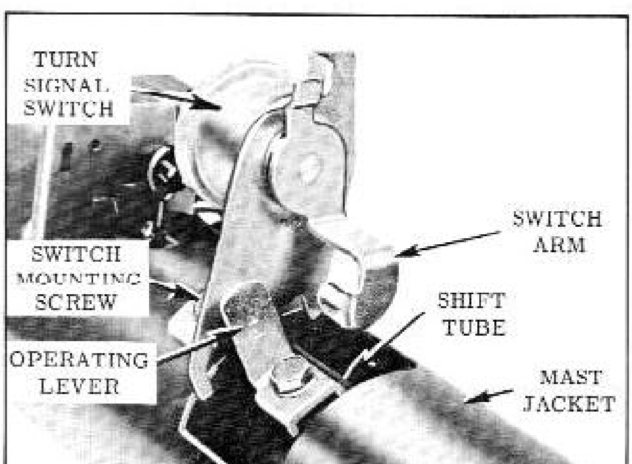

Fig. 13-97 Back Up Lamp Switch (Neutral)

STOP, TURN SIGNAL, TAIL AND PARKING LAMP BULB

Removal

1. Remove lamp lens by removing attaching screws.
2. Push in on bulb and rotate counterclockwise to release bayonet lugs of bulb base from the socket.

Installation

1. Position bulb so that the lugs on the base of the bulb line up with their respective grooves in lamp socket.

2. Push the bulb into the socket compressing the contact spring and rotate clockwise to engage lugs in the socket.

3. Energize bulb circuit to insure proper bulb operation.

4. Replace the lamp lens and attaching screws.

REAR LICENSE LAMP

Removal

1. Remove 2 lamp attaching screws from bottom side of rear bumper. (Fig. 13-98)

2. Pull lamp assembly from behind bumper.

3. Remove the 2 lens retainer attaching screws and remove the lens and retainer from the mounting bracket.

4. Remove the lamp bulb from the socket.

Installation

1. Place new bulb in lamp socket.

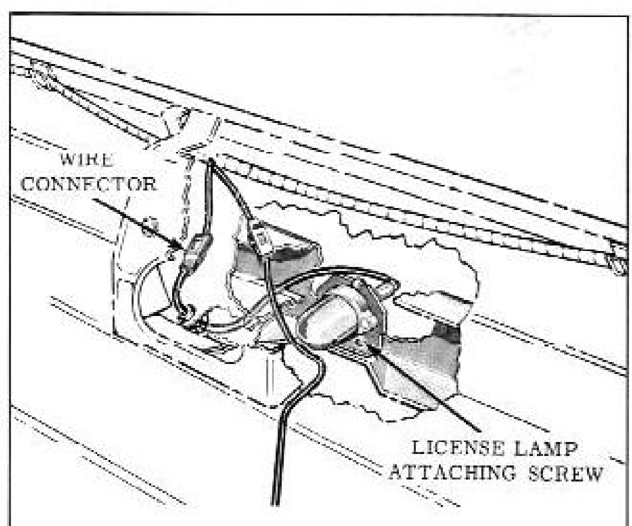

Fig. 13-98 Rear License Lamp

2. Check bulb operation. Turn on parking lamps and ground the socket to the bumper. Turn off lamps.
3. Replace the lens, lens retainer, and retainer attaching screws.
4. Position the lamp bracket on the bumper and install attaching screws.

INSTRUMENT PANEL LAMPS

Removal

1. Remove the 4 instrument cluster cover attaching screws. (Fig. 13-99)
2. The instrument panel lamps, except the clock and heater control lamp, are mounted on a printed circuit panel. Fig. 13-100 identifies the position of the indicator lamps and the cluster lighting lamps. These lamps may be removed by turning the socket counterclockwise (looking at the back of the instrument cluster), to disengage the locking lugs. The electric clock lamp socket and the heater control lamp socket are the push in type lamp sockets and they can be removed by simply pulling straight out from the back of the instrument panel.

DOME LAMP

Removal

1. Remove lamp lens by pinching sides together

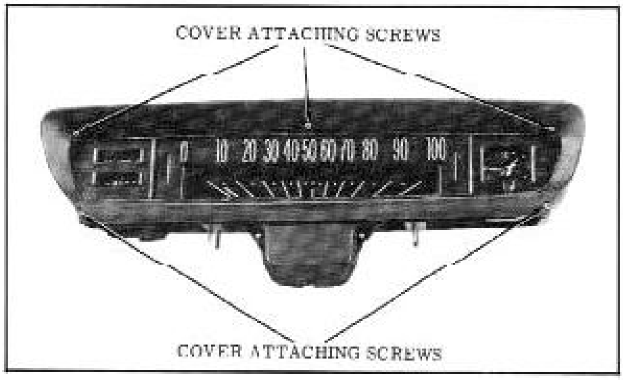

Fig. 13-99 Instrument Cluster Cover

to release tangs from base.

2. Pry tube type lamp from terminal clips.

Installation

1. Install lamp bulb in contact holder.
2. Snap the lense into position on lamp base.

FUEL GAUGE

The gasoline fuel gauge circuit consists of an electrical indicator in the cluster and a float-controlled rheostat in the tank. The circuit can be checked for accuracy with Tester BT-11-13.

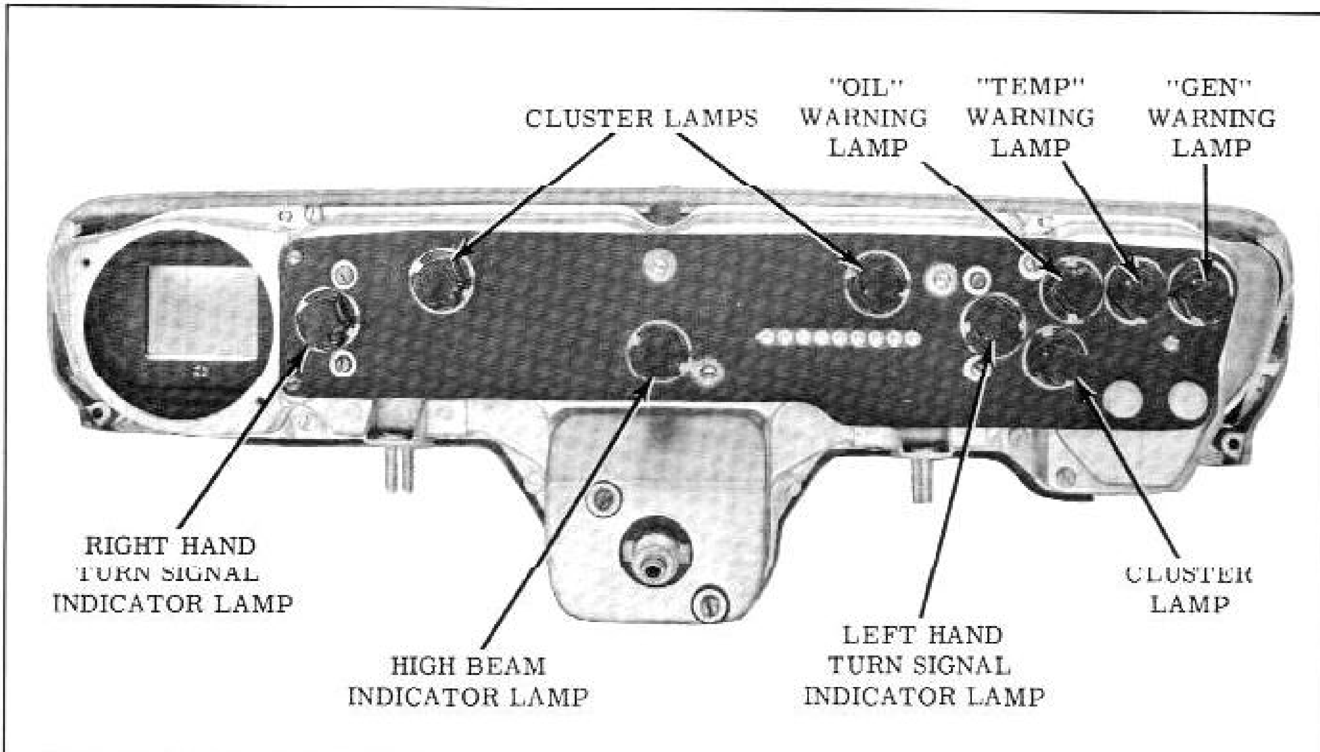

Fig. 13-100 Instrument Panel Lamps

TESTING FUEL GAUGE CIRCUIT

IMPORTANT: Engine must be running at least 1500 r.p.m. when testing the gasoline 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-11-13 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, restart it, and again set engine speed at 1500 r.p.m. before taking each fuel gauge reading.

FUEL GAUGE CHECK AT TRUNK COMPARTMENT

1. Set Tester BT-11-13 on "F" position.
2. Connect one lead of tester to the gray wire in the trunk compartment from the dash unit gauge and the other lead to ground.
3. Start the engine and set at 1500 r.p.m., then check the reading on the dash gauge. It should read within 1/16" of the "F" position.
4. Set the tester on "1/2" position, then "E" position. In both cases dash gauge should read within 1/16" of indicated position.

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 reads incorrectly, the trouble is in the dash unit, in the wire from the printed circuit to the trunk compartment connector, or in the instrument cluster printed circuit. If the gauge registers full, regardless of the position of the tester, there is an open circuit in the wire from the dash 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 and the tank unit. Clean all dirt from around the tank unit terminal.
2. Connect the tank unit wire to the trunk compartment connector and ground the tank unit to the car.

   CAUTION: Never connect the tank unit directly to a 12 volt source since damage to the unit will result.

3. Turn the ignition switch on, and move the float arm up and down. If the unit is operative, the gauge will give readings corresponding to the movement of the arm.

   NOTE: Readings taken in this manner will not be accurate unless engine is running at 1500 r.p.m. and test is started with float in "full" position and then moved down. Also check for freedom of movement of the float arm.

4. If the tank unit is replaced, always check the new unit in the same manner before installing it in the tank.

FUEL GAUGE CHECK AT CLUSTER

To determine whether the dash gauge or wiring to the trunk compartment connector is at fault, proceed as follows:

NOTE: With the instrument cluster printed circuit, it is not possible to disconnect the tank unit wire at the dash gauge. To check the dash gauge alone:

1. Unscrew the plastic caps on both terminals of the dash gauge.
2. Connect one lead of tester to the L.H. terminal of the gauge (as viewed from the rear of the instrument cluster) and the other lead to ground.
3. Set Tester BT-11-13 on "F" position.
4. Disconnect the wiring plug from the printed circuit and connect a jumper wire between a known "hot" source and the R.H. terminal of the gas gauge (as viewed from rear of instrument cluster).
5. Start the engine and set at 1500 r.p.m., then check the reading on the gauge. It should read within 1/16" of the "F" position.
6. Set the tester at "1/2" position, then "E" position. In both cases gauge should read within 1/16" of the indicated position.

If the gauge registers correctly, the trouble is in the printed circuit or the wire from the printed circuit to the trunk compartment connector. If the gauge does not register correctly, during this test, it is defective, and should be replaced.

If both dash and tank units 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.

HORNS

DESCRIPTION

The horns are mounted one on each inner front fender baffle. (Fig. 13-101)

The horn relay is part of the main wiring harness junction block as shown in Fig. 13-102.

When the horn button on the steering wheel is pressed a circuit is closed which energizes the horn relay which in turn closes, supplying electricity to the horns.

SERVICING UNITS

HORNS

Removal

1. Disconnect horn lead wire from horn terminal. (Fig. 13-101)
2. Remove 2 hex head sheet metal screws.

Installation

1. Position horn on inner fender baffle and install attaching screws.
2. Connect horn lead wire to horn terminal.

HORN RELAY

Removal

1. Disconnect battery ground cable from negative terminal.
2. Remove hex nut from junction post and disconnect battery positive cable and starter lead cable from post. (Fig. 13-102)
3. Disconnect horn relay wire connector from horn relay.
4. Remove 2 hex head sheet metal screws and lift relay and junction block assembly from fender inner baffle.

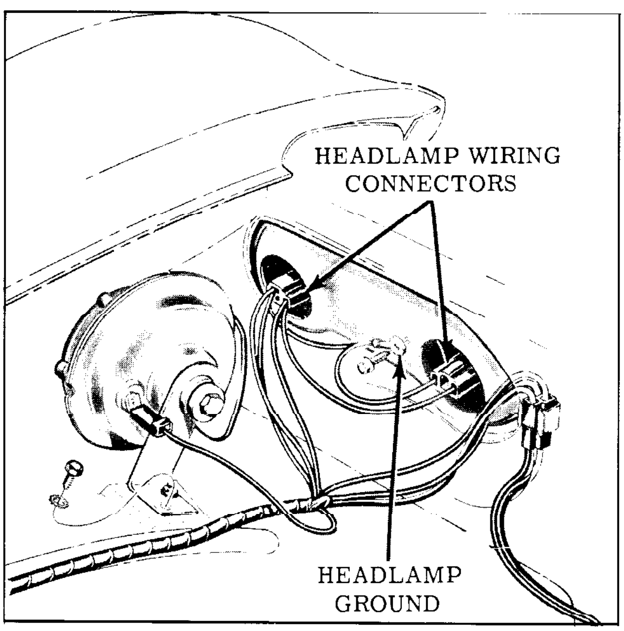

Fig. 13-101 Horns

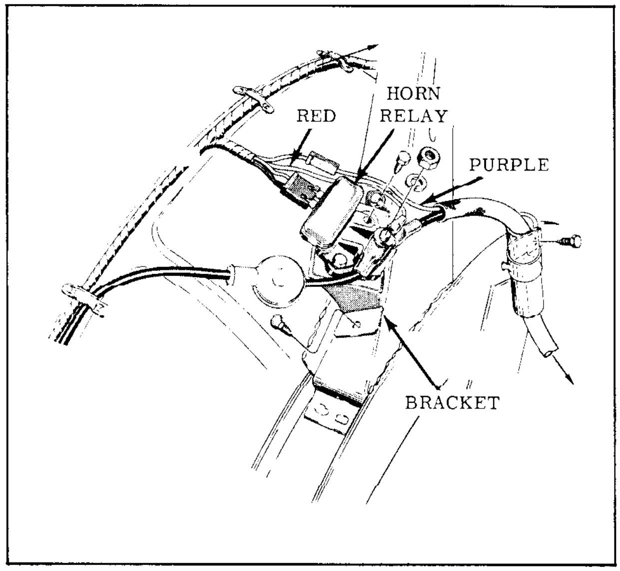

Fig. 13-102 Horn Relay

Installation

1. Place relay and junction block assembly in position on the inner fender baffle and install attaching screws.
2. Connect horn relay wire connector to horn relay terminals.
3. Replace battery positive cable and starter lead cable on junction block post and install terminal nut.
4. Replace battery ground cable on battery negative terminal.

Checks and Adjustments

When horn trouble is encountered, the difficulty may be in the horn relay, wiring, or the horn itself. Quick checks to determine cause of trouble may be made as follows:

1. Ground the "S" terminal of the horn relay.
   a. If the horn operates satisfactory the trouble is in the horn contact, the wiring, or the ground strap. The ground strap provides a circuit from the steering gear and front suspension to the chassis sheet metal.
   b. Connect a jumper wire between the "H" terminal of the horn relay and the battery. If horn now operates satisfactorily, the trouble is in the horn relay. (See HORN RELAY CHECKS AND ADJUSTMENTS.)

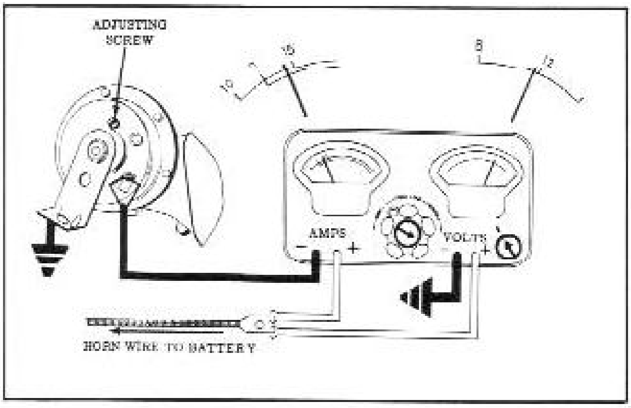

Fig. 13-103 Horn Current Adjustment

c. If the above checks indicate that the horn wiring and relay are not defective, connect a voltmeter to the "H" terminal and ground. As the horn control circuit is closed, note the reading on the voltmeter. The horn should blow at any voltage above 7.0 volts, however, it may be weak or have poor tone at any voltage below 11.25 volts. If the voltmeter shows no reading the wiring between the horn relay and horn is open or the horn is not grounded. If reading is less than 7.0 volts the fault is high resistance in the wiring or a faulty horn.

After previous checks have been made and it is established that the horn is at fault, the trouble may be that the contacts are held open by a foreign particle. To dislodge the particle, energize the horn and tap the horn lightly. If this is the trouble the horn will start to blow and resume normal operation.

Horn Current Adjustment

Connect an ammeter and a voltmeter as shown in Fig. 13-103. With horn operating, the current draw should be 7.0 to 11.0 amperes at 12.0 volts. To change the current adjustment turn the adjusting screw on the horn clockwise to increase and counterclockwise to decrease the setting. (Fig. 13-104)

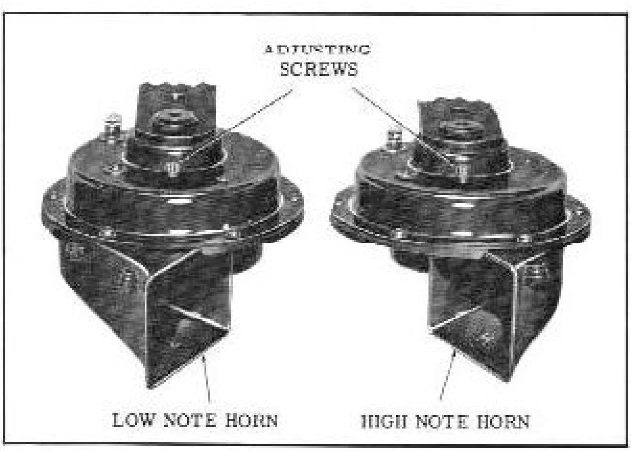

Fig. 13-104 Horn Adjusting Screws

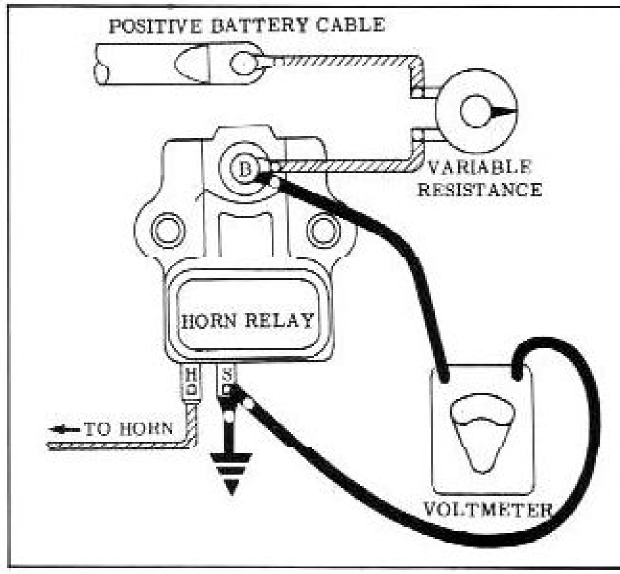

Fig. 13-105 Checking Horn Relay

If horn fails to operate properly after the above adjustments have been made, the horn should be replaced.

HORN RELAY CHECKS AND ADJUSTMENTS

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. 13-105)
3. Connect a voltmeter across the "S" terminal and "B" terminal of the horn relay. Ground the "S" terminal.
4. Slowly decrease the resistance until horn relay points close. Closing voltage should be

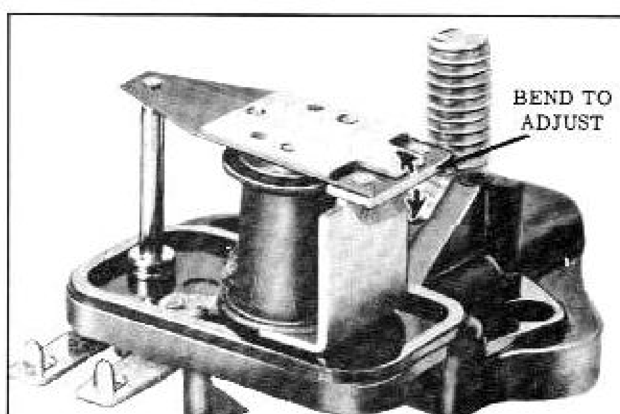

Fig. 13-106 Adjusting Relay

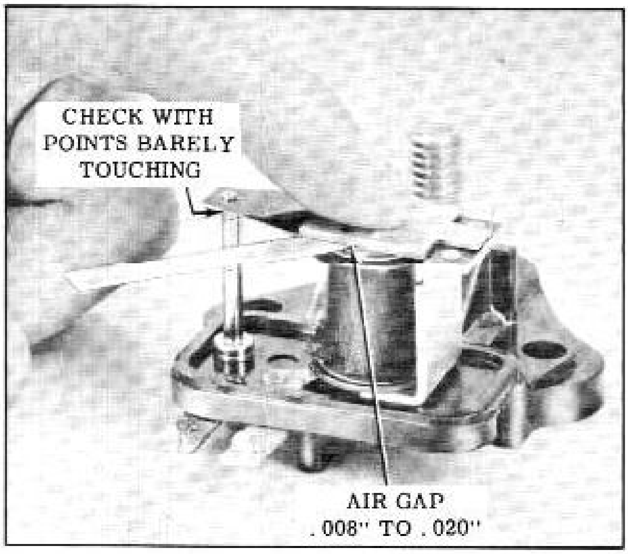

Fig. 13-107 Air Gap Adjustment

1.5 to 2.5 volts. If voltage is outside this range, adjust to 6.5 volts by bending armature spring post down to increase the voltage or up to decrease the voltage. (Fig. 13-106)

Air Gap

NOTE: The closing voltage adjustment must be correct before making the following check.

With the positive battery cable disconnected, check the air gap with the points barely touching. (Fig. 13-107) Air gap should be .008" to .020". No adjustment is provided.

Point Opening

NOTE: The closing voltage adjustment must be correct before making the following check.

With the positive battery cable disconnected, check the point opening. (Fig. 13-108) Point opening should be .020" (minimum). No adjustment is provided.

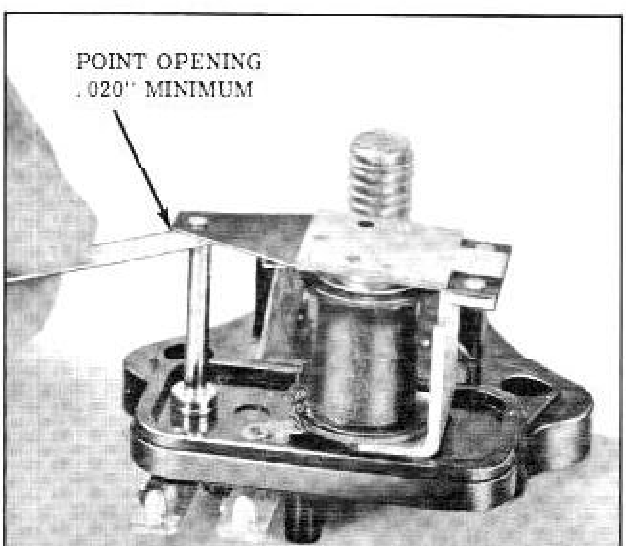

Fig. 13-108 Point Adjustment

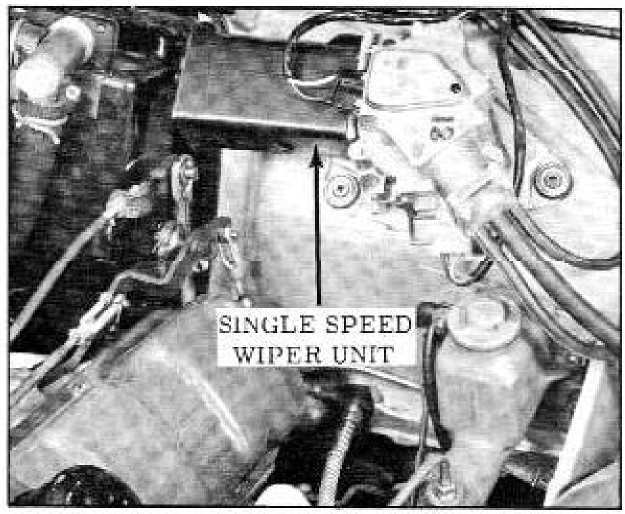

Fig. 13-109 Single Speed Windshield Wiper

WINDSHIELD WIPER AND WASHER SYSTEM

DESCRIPTION

The 1961 Oldsmobile "F-85" is equipped with a single speed wiper unit, however, a two speed wiper is optional. The wiper motor is mounted under the hood on the cowl panel. (Fig. 13-109-Fig. 13-110) The motor drives the 2 windshield wiper transmissions through connecting links. The wiper system is designed so that both wiper blades move together in the same direction. This allows overlapping of the wiper patterns at the center providing a large glass area coverage. The wiper transmission and drive links are under the instrument panel, inside the car.

An automatic reset type circuit breaker, located internally on the motor brush plate, protects the motor field coils from over heating.

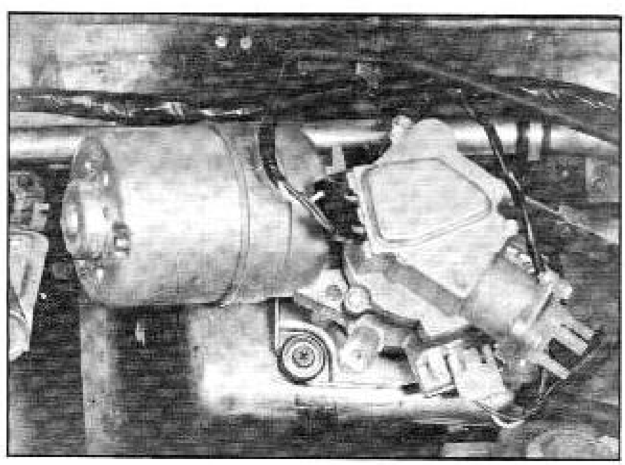

Fig. 13-110 Two Speed Windshield Wiper

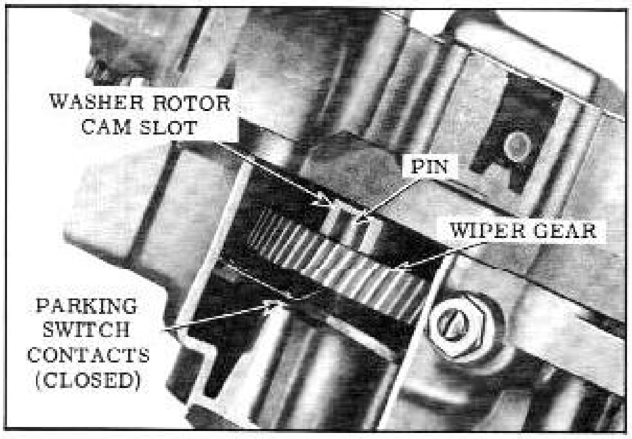

Fig. 13-111 Parking Switch

The two speed wiper motor is a non-depressed park unit. It consists of a round compound wound motor attached to a gear box similar to the single speed unit.

Except for the fact that this type wiper has two speeds, the basic principle of operation is very similar to that of the single speed rectangular unit. Two switches, a dash switch and a parking switch, control the starting and stopping of the wiper. The parking switch located in the gear box and controlled through a ring on the gear functions the same as the parking switch in the single speed wipers. The parking switch acts as a holding switch to maintain motor circuits until the wiper blades reach their park position.

A washer pump (optional equipment) mounts on the gear housing section of the wiper and it is driven by the wiper motor.

The wiper control switch is mounted on the instrument panel. The control consists of a knob for operating the wipers and a button for operating the windshield washer pump when the car is so equipped.

When the windshield washer button is depressed,

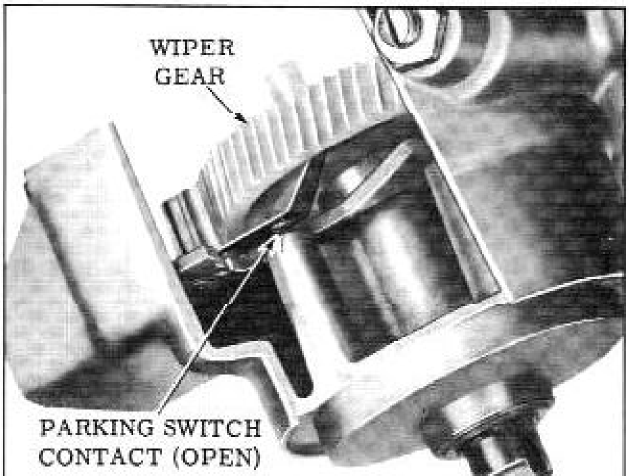

Fig. 13-112 Parking Switch Open

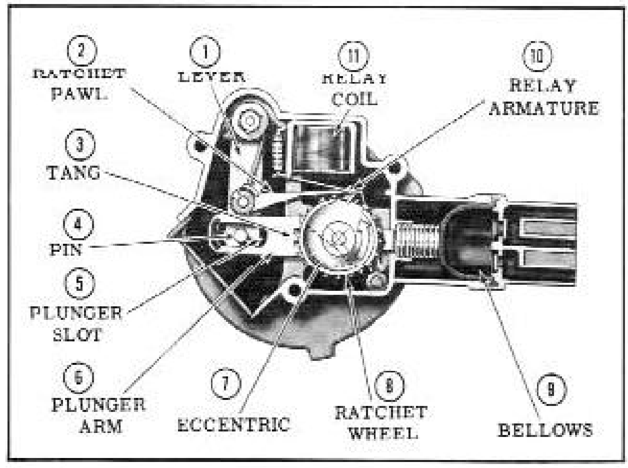

Fig. 13-113 Washer Operation

the wipers are also started and manual operation of the wiper switch is required to shut off the wipers.

When the wiper is first turned "OFF" the wiper motor circuit to ground is opened at the dash switch control. However, the wiper motor continues in the cycle it is in and stops at the extreme end of the downward stroke. This is accomplished through the parking switch contacts as shown in Fig. 13-111. When the control is turned off the parking switch contacts continue to maintain a ground, energizing the motor circuits until the extreme downward position is reached. When the downward position is reached the motor circuit to ground is broken by the parking switch contacts. (Fig. 13-112)

Whenever the windshield wiper is in operation the washer cam rotates with the wiper drive gear. Rotation of the washer cam (Fig. 13-113) actuates a spring loaded lever (1), pin (4) and the ratchet pawl (2).

The lever arm pin extends into a slot (5) in the plunger arm (6). The spring loaded plunger, which is attached to the bellows (9), is held in the retracted position by an eccentric (7) on the ratchet

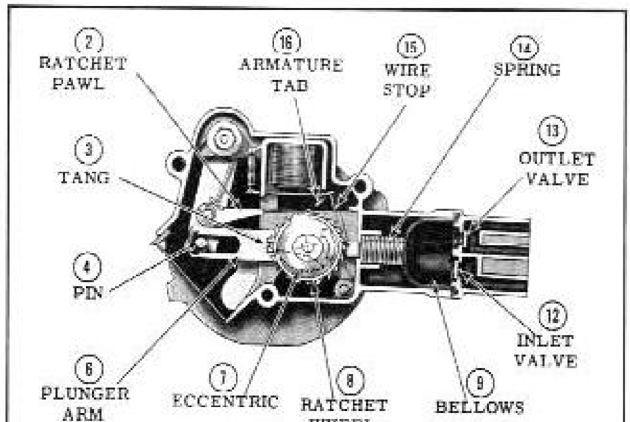

Fig. 13-114 Washer Operation

wheel. With the plunger in the retracted position, the lever arm pin can move back and forth in the plunger arm slot without actuating the plunger. The ratchet pawl is prevented from rotating the ratchet wheel by the relay armature (10).

When the washer button on the instrument panel is depressed, the relay coil (11) is energized, which in turn raises the relay armature and ratchet pawl. The relay armature is held in the raised position by the wire stop (15). (Fig. 13-114)

The ratchet pawl (2), which previously was moving back and forth through the armature opening, now drops out of the opening and engages the ratchet wheel (8).

As the ratchet wheel rotates, the eccentric (7) 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 and collapses the bellows (9) forcing the water out through the outlet valves (13) to the nozzles. As the washer cam rotates, each of the 4 lobes actuate the lever arm which in turn pulls back the plunger arm, compressing the spring (14). As the plunger arm is pulled back, water is drawn in through the inlet valve (12).

For each revolution of the wiper gear and washer cam there are 4 intake and 4 exhaust strokes. On each intake stroke the ratchet wheel is turned 1 tooth by the ratchet pawl. As the ratchet wheel is turned, the eccentric contacts the wire stop and forces it away from the relay armature. This allows the armature to drop so that the armature tab (16) rests on the shoulder of the ratchet wheel. Further rotation of the ratchet wheel allows the eccentric to contact the plunger arm tang (3), resulting in shorter intake and exhaust strokes. When the ratchet wheel has been turned 360° the relay armature tab drops into the ratchet wheel slot allowing the ratchet pawl to enter the armature opening preventing further ratchet wheel rotation. At the same time the ratchet wheel eccentric has moved the plunger arm into the retracted position, allowing the washer pump to return to idle, completing the washer cycle.

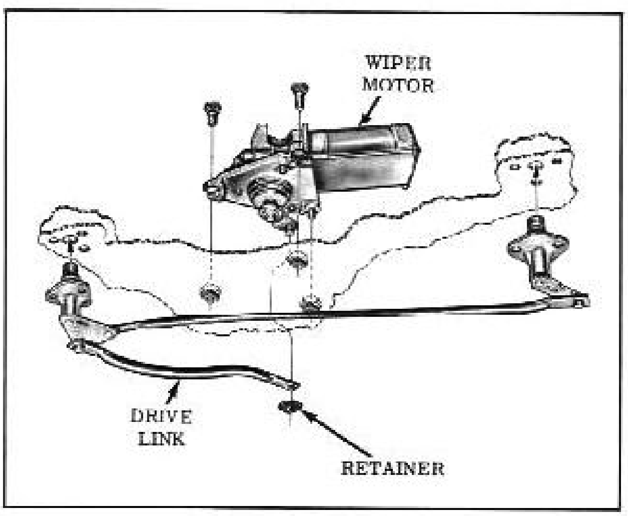

Fig. 13-115 Wiper Motor and Linkage

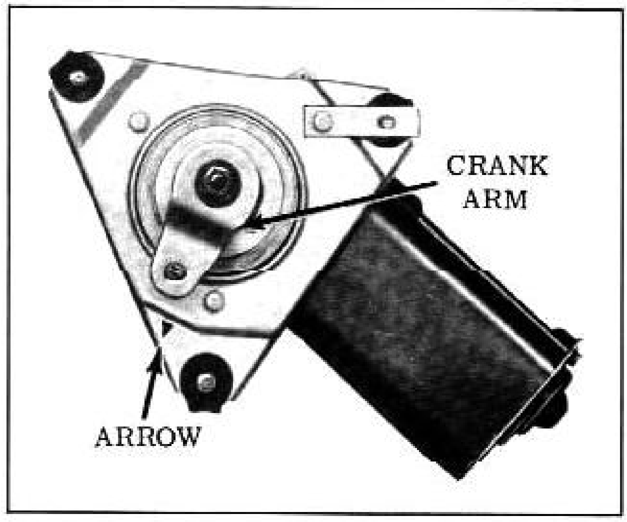

Fig. 13-116 Motor Installation

SERVICING UNITS

SINGLE SPEED WIPER MOTOR

Removal

1. Disconnect drive link from crank arm under instrument panel by removing retaining clip (Fig. 13-115)
2. Disconnect harness connector from motor terminals.
3. If car is equipped with windshield washers, note the location of washer hoses, then remove hoses from washer pump.
4. Remove 3 attaching screws.
5. Lift wiper motor assembly from cowl, guiding crank arm out of hole in cowl panel.

Installation

1. With wiper motor crank arm in the park position, as shown in Fig. 13-116, place the motor assembly on the cowl panel and install the 3 attaching screws. Be sure the attaching screws are fully tightened so that the sleeves surrounding the screws bottom to prevent "floating of the motor".
2. If car is equipped with windshield washers attach the washer hoses to the washer pump.
3. Attach the harness connector to the motor terminals.

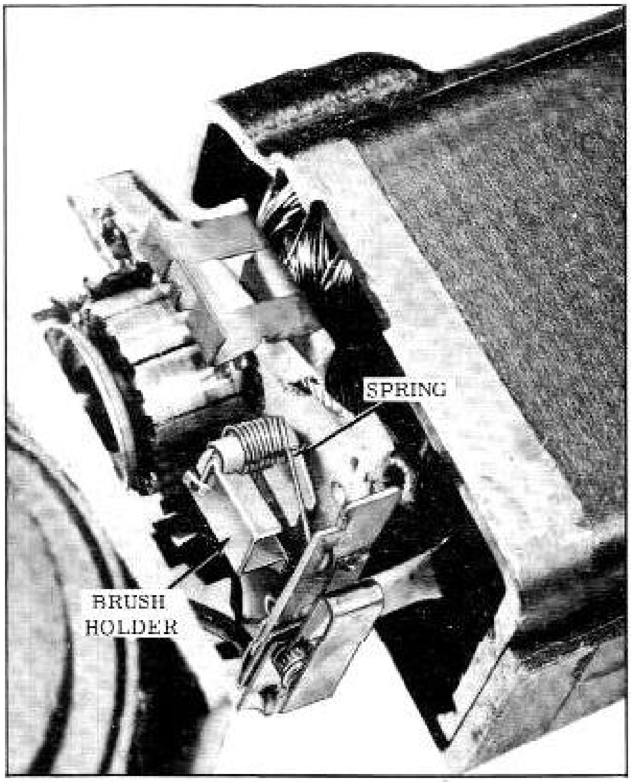

Fig. 13-117 Installing Armature

4. Connect the drive link to the crank arm and install the retaining clip.

Armature Removal Only

If only the motor armature is to be removed, it will not be necessary to completely disassemble the motor and gear box assembly. However, if brushes, fields, brush plate, or terminal board are to be removed, complete disassembly of the motor and gear box assembly will be necessary.

1. Remove 2 motor through tie bolts.
2. Remove end plate assembly.
3. Thread armature worm shaft counterclockwise from gear box.

Armature Installation Only

1. Pull the field and frame assembly away from gear box housing to gain access to the brush plate.
2. Pull brush plate from field and frame assembly by prying retainers from the frame.
3. Unload the brush springs, using a small wire hook, by pulling the brush end of spring up out of the slot of brush holder and hooking the end of spring on the edge of the spring holder. (Fig. 13-117)
4. Load brushes into the brush holders.
5. Insert armature into field and frame assembly and guide worn end of shaft through brush plate and bushing in gear box housing.
6. Thread armature worm shaft clockwise into gear box to engage worm with gear.
7. With brushes and brush plate positioned on armature commutator replace the end of the brush spring in the brush holder slot to load brushes.
8. Using a screwdriver to seat retainers, reposition the brush plate in the frame and position frame on gear box housing.
9. Be sure worm shaft is threaded in until it seats against the end of the armature end play adjusting screw.
10. Install end plate assembly, being sure the thrust ball is lubricated and in place in the end of armature shaft.
11. Install 2 through frame tie bolts.
12. Adjust end play adjusting screw by tightening finger tight and backing off 1/4 turn.

Disassembly

Gear Box

1. Mark end of shaft and crank arm to facilitate correct reassembly. (Fig. 13-118)
2. Remove crank arm retaining nut.
3. Remove crank arm by tapping and rocking to loosen from gear shaft.
4. Remove seal, retaining ring, and end play washers.
5. Remove gear box cover or washer pump by removing 3 attaching screws.
6. Pull gear and shaft from housing. (Fig. 13-119)
7. Remove fiber plate shield.
8. Remove terminal board by removing 2 attaching screws.
9. If necessary to replace terminal board, note position of wires and unsolder from terminals.

Wiper Motor

1. Disassemble gear box as outlined under "Gear Box Disassembly".
2. Remove 2 motor frame tie bolts.
3. Remove end plate assembly.

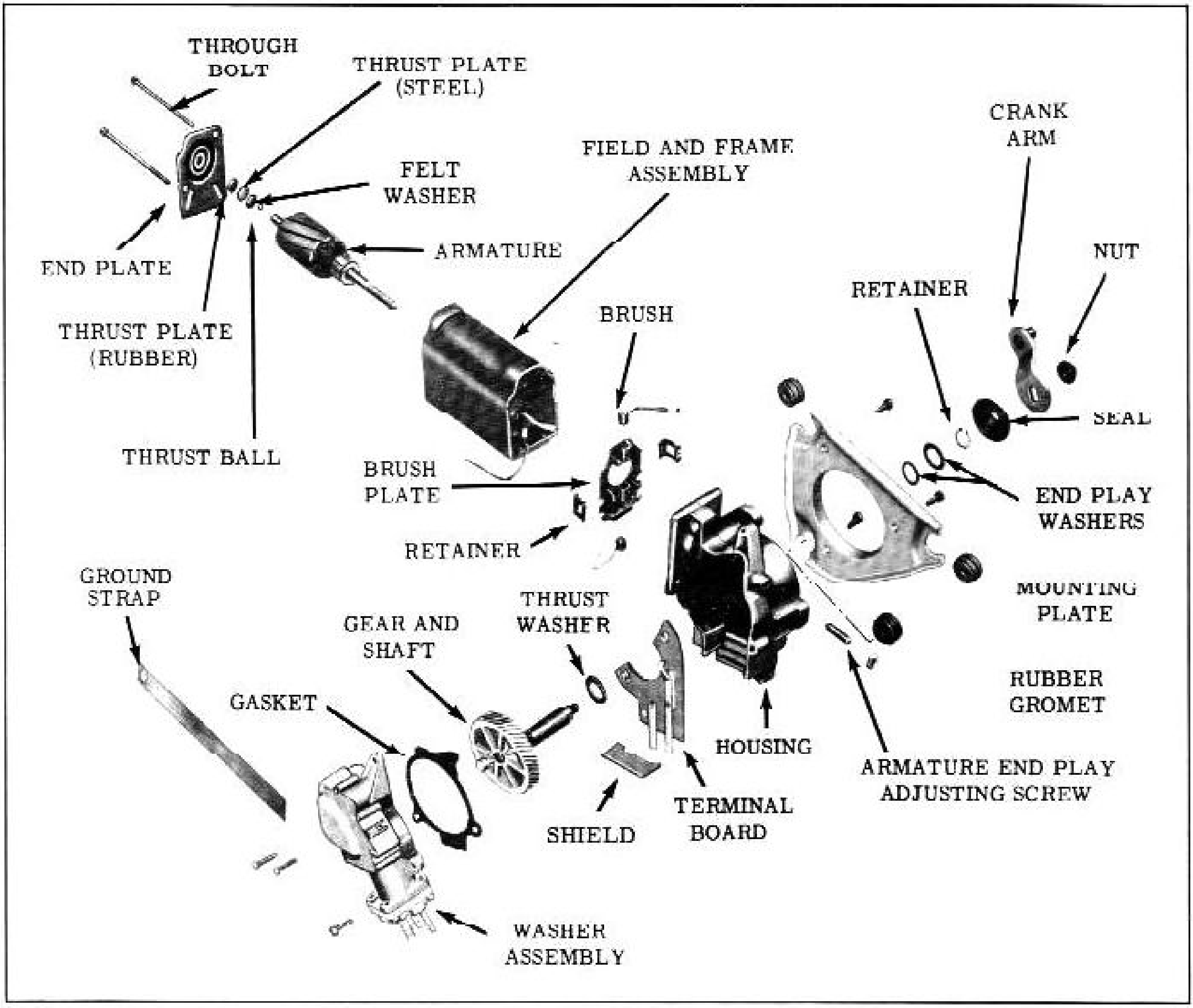

Fig. 13-118 Wiper Motor Assembly

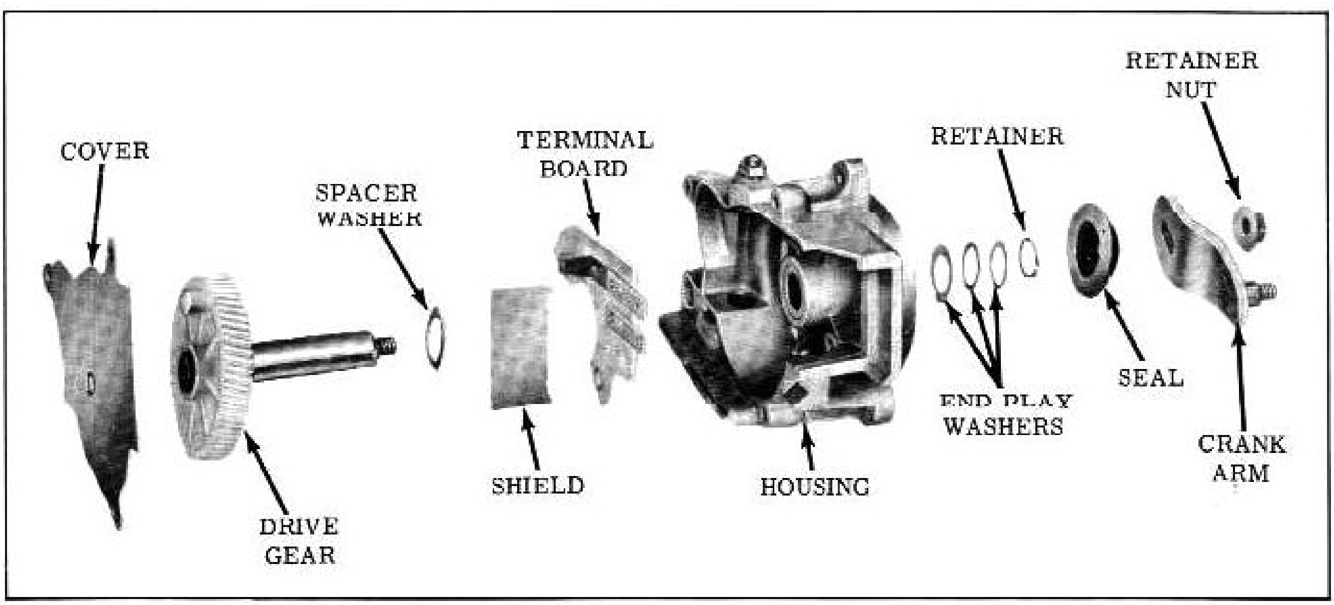

Fig. 13-119 Gear Box Assembly

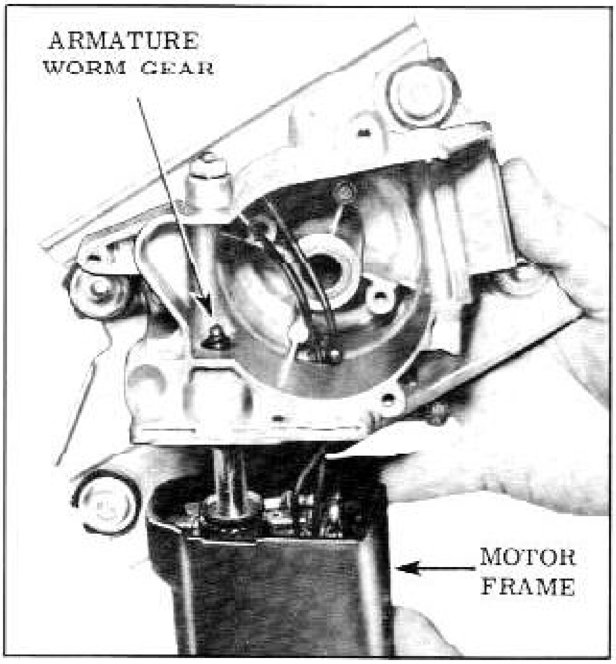

Fig. 13-120 Removing Motor Frame

4. Tap frame lightly to loosen from gear box and pull frame and armature assembly away from gear box. (Fig. 13-120)

5. Pry brush plate retainers loose from frame and pull brush plate out from frame. If brushes are to be replaced unsolder brush leads and remove old brushes. Solder in new brush leads at their respective positions. (Fig. 13-121)

Assembly

Wiper Motor

1. Unload brush spring pressure by lifting spring off end of brush and placing off to one side of brush holder. (Fig. 13-117)

2. Insert brushes into brush holders and install brush plate in field frame.

3. Insert armature into field and frame assembly and guide armature worm shaft through the brush plate.

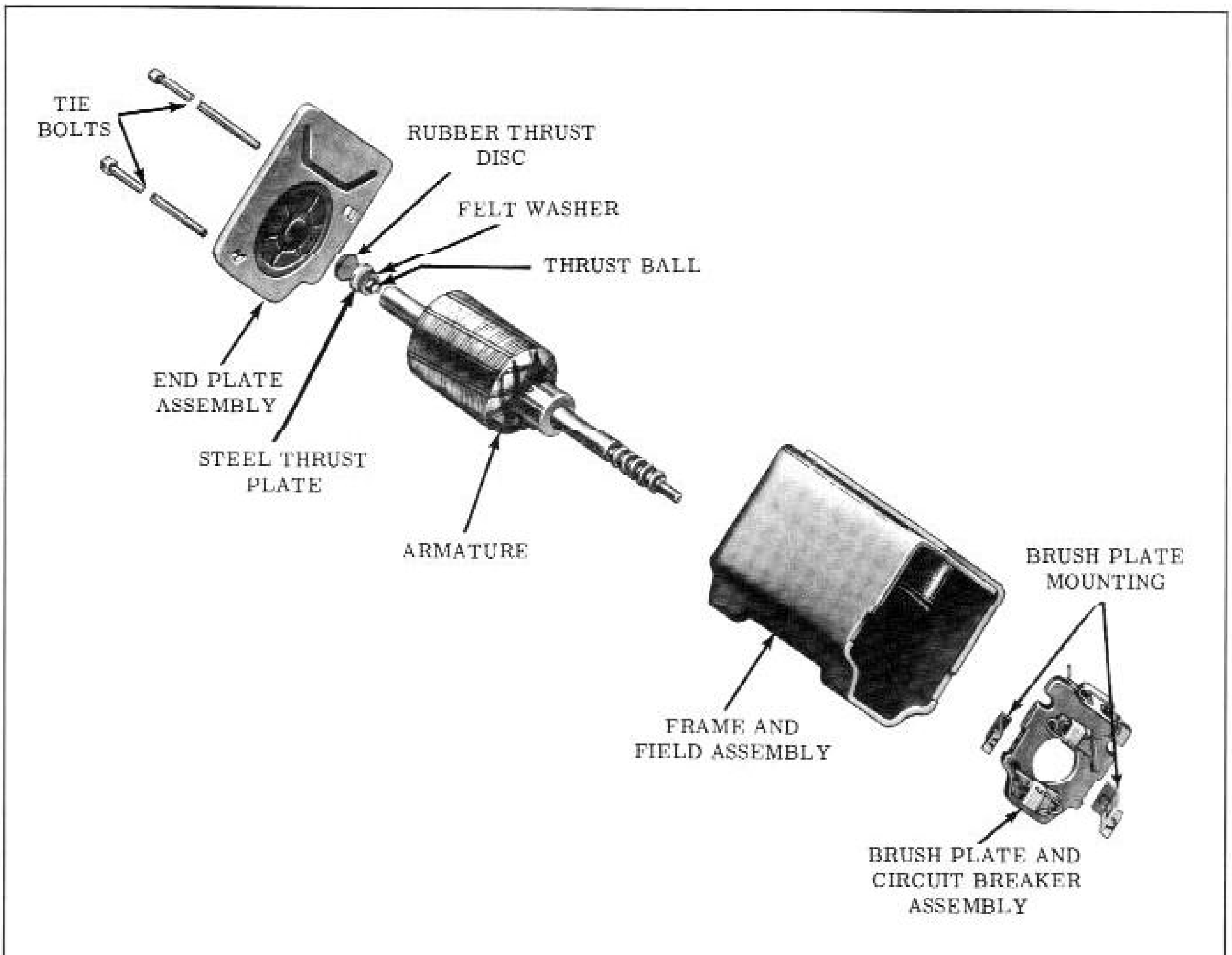

Fig. 13-121 Motor Assembly

4. Position the brushes and brush plate over the armature commutator and replace end of spring in brush holder slot.

5. Lubricate the steel thrust ball and wormshaft with Delco-Remy Cam and Ball Bearing Lubricant.

6. Install armature wormshaft into gear box and position the field and frame assembly onto the gear box housing.

7. Install thrust ball in socket of armature shaft.

8. Install rubber thrust disc, steel thrust plate and felt washer into bore end of plate assembly.

9. Position end plate assembly over armature shaft, on frame and field assembly and retain with the 2 through tie bolts.

Gear Box

1. Position the terminal board in the gear box and retain with 2 attaching screws.

2. Place thrust washer on gear shaft and install gear and shaft assembly in the gear box housing.

3. Place the end play washers on the shaft and install retainer ring.

4. Check end play of gear shaft by inserting feeler gauge between housing and end play washers while moving shaft in and out. End play should not exceed .005". If necessary to adjust end play, remove retainer and add end play washers as required and reinstall the retainer. (Fig. 13-122)

5. Install gasket and gear box cover or washer pump.

NOTE: When installing washer pump, align cam slot with drive pin. (Fig. 13-123)

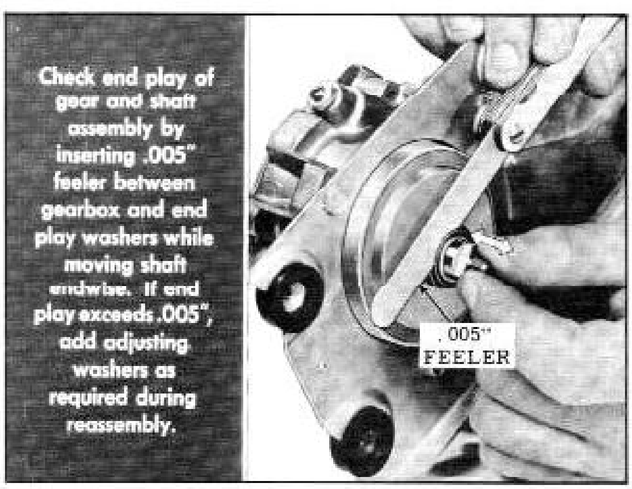

Fig. 13-122 Gear Shaft End Play

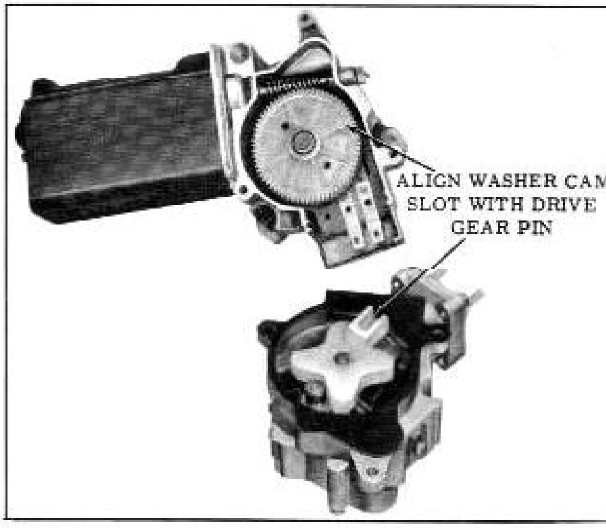

Fig. 13-123 Alignment of Cam Slot

6. Connect wiper as shown in Fig. 13-124 and cycle wiper.

7. Allow wiper to park by disconnecting the jumper wire. (Fig. 13-124) This step is necessary to insure that the wiper is in the park position when the crank arm is reassembled.

8. Install seal, crank arm and crank arm retainer nut.

9. Adjust the armature end play by loosening the end play adjusting screw lock nut and tightening the adjusting screw finger tight. Back adjusting screw off 1/4 turn and tighten lock nut while holding adjusting screw fast.

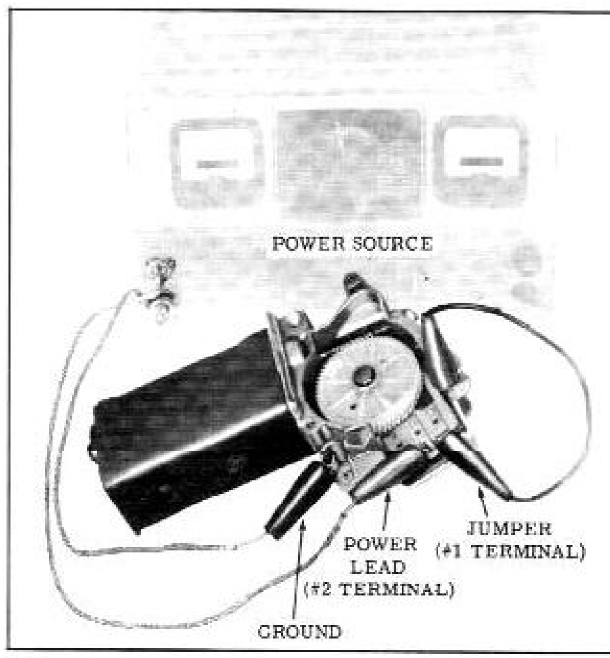

Fig. 13-124 Cycling Wiper Motor

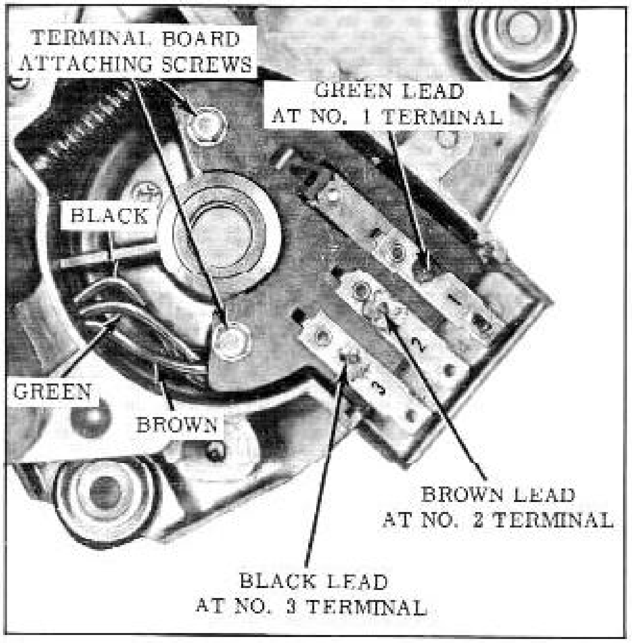

Fig. 13-125 Removing Terminal Board

TWO SPEED (WIPER MOTOR)

Removal and Installation

Two speed wiper motor removal and installation is the same as Single Speed Wiper Motor Removal and Installation procedure. (Page 13-57).

Disassembly

Gear Box

Follow steps 1-9 Single Speed Wiper Gear Box Disassembly on Page 13-58.

Wiper Motor

1. Disassemble gear box as outlined under "GEAR BOX DISASSEMBLY".
2. Remove 2 motor frame through bolts and loosen the armature end play adjusting screw and lock nut.
3. Tap the brush end of the motor case with a mallet to free it from the gear housing.
4. Remove the armature from the motor field frame.

   NOTE: The steel thrust ball is retained in the commutator end of the armature shaft by grease. The ball can be removed by dissolving the grease with solvent.

Assembly

Wiper Motor

1. Lubricate the steel thrust ball, the bearing and worm surface of the armature shaft with Delco-Remy Cam and Ball Bearing lubricant.
2. Install brush springs and brushes in holder. Retain brushes in holders and install the armature in the motor case.
3. While holding the armature in the motor case, start the armature shaft through the bearing in the gear housing.
4. Rotate motor case until the through bolt holes in the case are aligned with those in the gear housing, then install the 2 through bolts and tighten.
5. Tighten end play adjusting screw finger tight, then loosen 1/4 turn.
6. Tighten the adjusting screw lock nut being careful not to change the adjustment.

Gear Box

Follow steps 1-9 of Single Speed Gear Box Assembly on Page 13-60.

Field Coil Removal (Armature Removed)

1. Scribe an alignment mark on the field coil and housing to facilitate assembly. This mark can then be transferred from the old field coil to the new field coil for proper assembly.
2. Remove wiper gear cover or washer.
3. Slide terminal shield from housing.
4. Remove 2 terminal board attaching screws and lift terminal board from gear housing. Unsolder the black wire from connection at terminal board. (Fig. 13-125)
5. Unsolder black wire from brush holder and unsolder wire from circuit breaker in motor case.
6. Remove field coil from housing using Tool J-7844 as shown in Fig. 13-126.

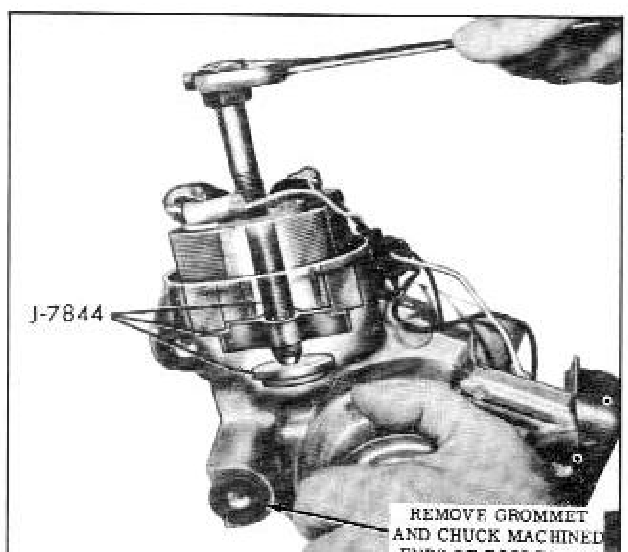

Fig. 13-126 Removing Field Coils

Field Coil Installation

1. Position a new field coil in the housing in proper alignment.
2. Temporarily install through bolts to act as guide while installing field coil.
3. Lightly tap the field coil evenly into gear housing using a brass drift. Use caution not to damage field wiring.

   NOTE: If field coil requires excessive force to install, remove and file outer diameter of field laminations at point of interference.
4. Solder black wire to proper terminal of the terminal board. (Fig. 13-125) Solder the black lead on opposite end of same field coil to the circuit breaker contacts on the brush plate.
5. Solder other field coil black lead to brush.

WIPER TRANSMISSION

Removal

1. Remove wiper arms from wiper transmission.
2. Tape fender edge adjacent to cowl air inlet grill.
3. Raise hood, remove 6 cowl vent to cowl attaching screws, and remove cowl vent grill and screen.
4. Remove glove box and defroster hoses.
5. Disconnect wiper motor to left hand transmission drive link by removing Tru-Arc snap ring retainer and clip. (Fig. 13-115)
6. Remove 3 transmission attaching bolts from both transmissions and allow transmission assemblies to drop from cowl. (Fig. 13-127)

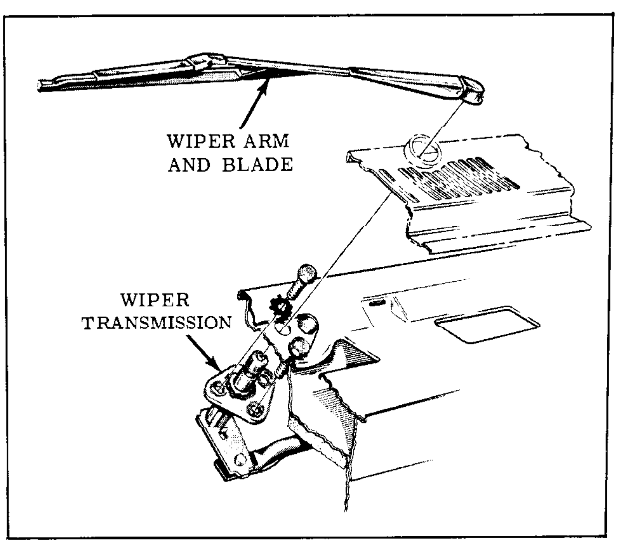

Fig. 13-127 Transmission Attaching Screws

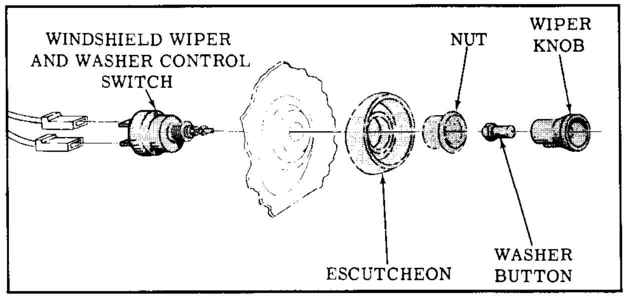

Fig. 13-128 Wiper Switch

7. Remove Tru-Arc snap ring retainer from the long drive link and the transmission being removed and remove transmission from car.

Installation

1. Connect drive link to transmission under the instrument panel and retain with Tru-Arc snap ring retainer.
2. Apply medium bodied sealer around the transmission shaft housing and attaching bolt holes. (Fig. 13-127)
3. Position transmission on cowl and install.
4. Connect wiper motor to left hand transmission drive link. Retain link at the transmission with a Tru-Arc snap ring and at the motor with the spring clip.
5. Install defroster hoses and glove box.
6. Install vent screen and vent grill on cowl and retain with attaching screws.
7. Install wiper arms and remove protective tape from fenders.

WIPER AND WASHER SWITCH

Removal

1. Remove wiper control knob by loosening set screw and sliding knob off of wiper control switch shaft. (Fig. 13-128)
2. Using Tool J-6592-01 remove the retaining nut and escutcheon.
3. Remove switch assembly from back of instrument panel.
4. Disconnect harness connector from switch.

Installation

1. Connect wiring to switch and insert switch through mounting hole in instrument panel from the back side.

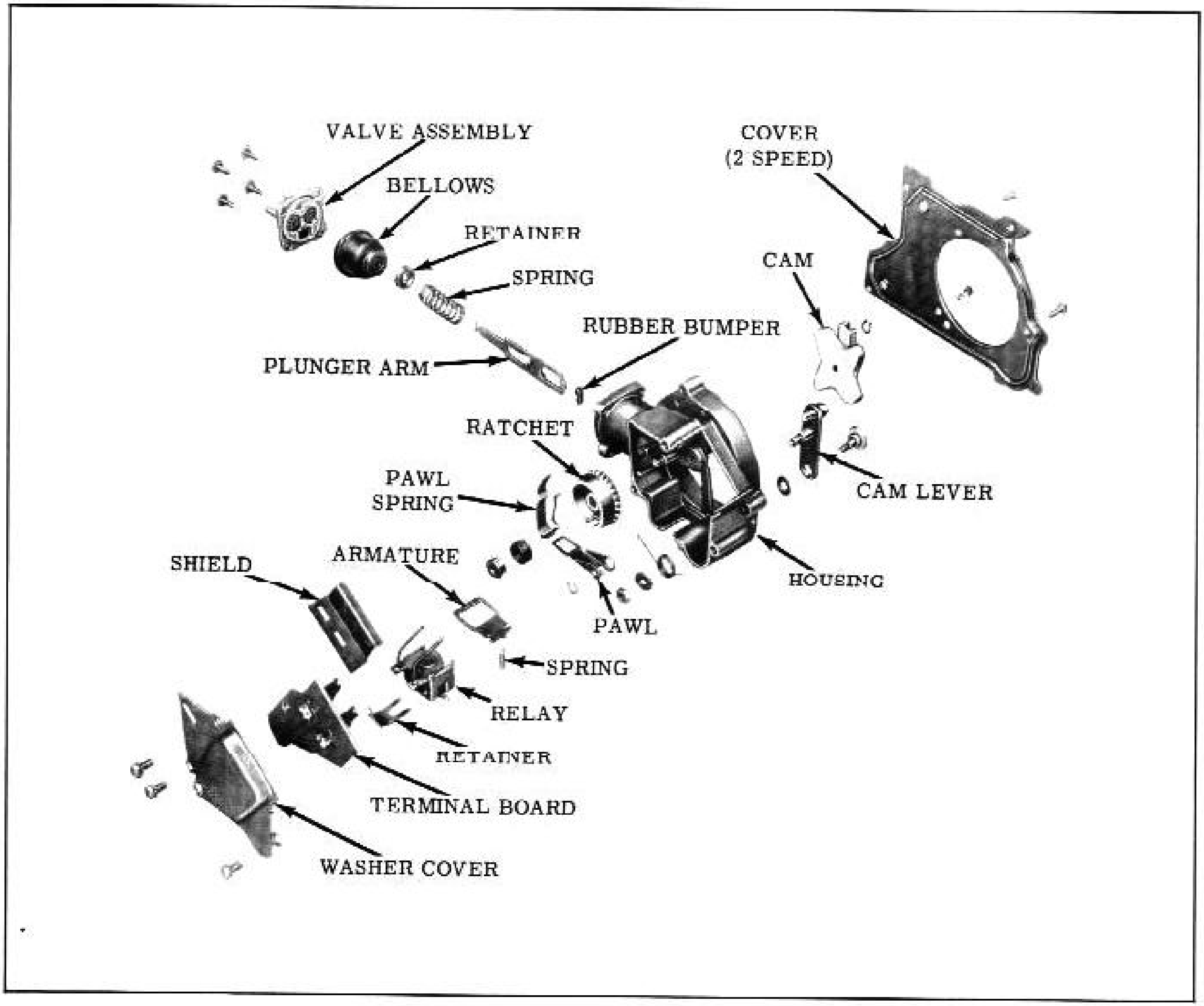

Fig. 13-129 Washer Pump Assembly

2. Install escutcheon and retaining nut.
3. Install knob and tighten set screw.

WASHER PUMP

Removal

1. Disconnect the washer hoses and note their respective positions.
2. Remove 3 pump attaching screws and remove pump assembly and mounting gasket.

Installation

1. Retain mounting gasket to pump body with a little sealer.
2. Aligning the cam slot with drive pin, install the washer assembly on the wiper gear housing and install the 3 attaching screws.
3. Install washer hoses on washer pump.

Disassembly

Valve Assembly

1. Remove the valve assembly by removing 4 retaining screws and prying gently between plastic valve body and pump housing. (Fig. 13-130)

Bellows

1. Remove valve assembly.
2. If the pump is in the idle position push the relay armature toward the relay coil until the wire stop spring engages the relay armature.
3. Manually rotate washer cam until the bellows extend partially out of the pump housing.
4. Place a small wooden block between the plunger arm and the housing.

5. While pressing against the bottom of the bellows, rotate the bellows 1/4 turn to release bellows from plunger arm.

6. Remove the spring and spring retainer.

Relay

1. Remove washer pump cover.

2. Remove the relay retaining clip.

3. Move ratchet out of relay armature slot then remove relay, terminal board, and insulator.

Assembly

Relay

1. While holding the relay armature against the relay coil, position the coil mounting stud in the housing slot.

2. Install relay retaining clip.

3. Assemble insulator over terminal and position terminal board in housing.

4. Install washer pump cover and retain with 3 screws.

Bellows

1. Block plunger away from housing.

2. Install spring and retainer.

3. With bellows aligned with plunger push bellows onto plunger and rotate 1/4 turn to retain bellows on plunger.

Valve Assembly

1. Position valve assembly on bellows so that the single valve is towards the cam side of pump and install retaining screws.

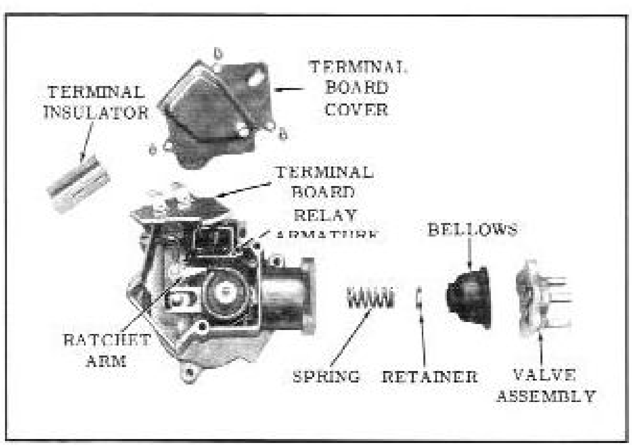

Fig. 13-130 Washer Valve Assembly

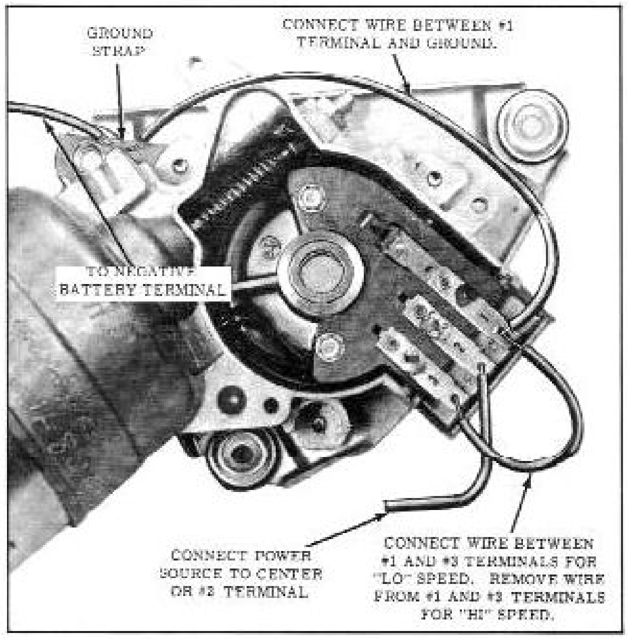

Fig. 13-131 Checking Wiper Circuit Wiring

DIAGNOSIS (One Speed Wiper Motor and Washer)

WIPERS WILL NOT OPERATE

1. Fuse blown.

2. Open circuit in purple or pink wire.

3. Wiper control switch defective.

   a. To test purple and pink wires and wiper control switch, disconnect harness from motor and connect test lamp across terminals in connector.

   b. Turn ignition switch to "accessory" position and turn wiper control switch on. If test lamp lights, the wires and switches are good, it indicates a defective motor or a bind in the linkage.

4. Disconnect linkage from motor and attach jumper wires to motor terminals to determine whether motor or linkage is inoperative.

5. Motor defective.

   a. Open or short in circuit breaker, field windings, brushes, or armature.

   b. Shaft bushings seized.

WIPERS CONTINUE TO OPERATE WITH WIPER CONTROL SWITCH "OFF"

1. Defective switch (internally grounded).

2. Pink wire shorted to ground.

3. Defective park switch in gear box housing (grounded).

4. Grounded circuit in motor between brush with yellow insulator and ground terminal.

WIPERS STOP WHEN WIPER CONTROL SWITCH IS TURNED OFF—DO NOT RETURN TO PARK POSITION

1. Park switch defective.

WASHER INOPERATIVE (CHECK ON CAR)

1. Blown fuse: If a new fuse blows, it indicates a short in the purple wire from wiper terminal board to washer connector or the feed wire from the washer connector to the washer relay.

2. Check for 12 volts at the purple wire that connects to the washer pump. No voltage indicates an open in the purple wire from the wiper terminal board to the washer relay connection. (Wipers operate normally.)

3. To determine if washer pump or the washer control switch is at fault, operate the washer pump with the washer switch wire (white) and feed wire (purple) disconnected at the pump. Connect 12 volts to either of the washer pump terminals. Turn the wiper motor on and connect a jumper wire from the other terminal to ground. If the washer pump operates, the washer control switch or wire is open.

Loose connectors at the wiper or washer as well as loose soldered connections within the unit can cause intermittent operation. This is indicated by failure of the wiper to continue to operate when the wiper control switch is on. The wipers also may not start when the wiper control switch is first turned on. A loose connection to the washer, or an internal break in the relay coil, would be indicated by the failure of the washer to operate every time the button is depressed.

DIAGNOSIS (Two Speed Non-Depressed Park Wiper)

WIPER INOPERATIVE (ON CAR)

1. Check for blown fuse. If a new fuse blows, check for mechanical "lock-up" or short in circuit. If equipped with washer, check purple wire from wiper terminal board to washer connection for a short.

2. Connect a jumper wire from the wiper motor to ground. If the wiper motor will operate with ignition switch in "accessory" position and wiper control switch in low or high speed position, a defective wiper ground strap or connection is indicated.

3. With the ignition in the "accessory" or "on" position, check for 12 volts at the center terminal of wiper terminal board. If there is no voltage at this point, but there is voltage at the fuse clips, the purple wire from the fuse block to the wiper connector is open.

4. To determine if dash switch or vehicle wiring is the source of trouble disconnect wires at the wiper terminal board and operate the wiper motor independently of the wiper control switch as follows:

   a. Connect a 12 volt supply to the center or number two terminal of the terminal board. (Fig. 13-131)

      Connect a jumper between the 2 outer terminals. (No. 1 and No. 3)

      Connect another jumper between the number one terminal and ground. The wiper should operate at "LO" speed.

   b. To check the "HI" speed operation, remove the jumper wire from between the number one and number three terminals of the terminal board. The wiper should then operate at "HI" speed.

   c. If the wiper operates when making either test a or b, it indicates that the wires from the motor to the wiper control switch, the wiper control switch, or the connectors are at fault.

5. If the wipers fail to operate after making tests a, b, or c, disconnect the transmission link arm from the motor. If the wiper motor will operate with the transmission disconnected, the trouble is in the transmission(s). If wiper still fails to operate, remove it from car and check it according to procedure outlined under WIPER INOPERATIVE (OFF CAR).

WIPER INOPERATIVE (OFF CAR)

1. Remove gear box cover or washer pump assembly. Visually inspect for loose connections or burned wires at terminal connector board and relay control switch.

2. Connect 12 volts to center terminal on terminal board and ground the motor housing, also connect the wiper ground strap to motor housing. Connect an ammeter in the supply line and connect jumpers as shown in Fig. 13-132.

   If a current reading of approximately 2 amperes is obtained, check for an open armature, hung brushes, poor solder connections, or a broken green lead.

If a current reading of approximately 13 amperes is obtained, check for a broken gear or some similar condition that would stall the wiper.

If a current reading of zero amperes is obtained, check for dirty or defective circuit breaker contacts, or poor solder connections at circuit breaker terminals.

WIPER WILL NOT SHUT OFF

1. Check wiper for both "LO" and "HI" speeds.
   a. If wiper has only "LO" speed, follow procedure under WIPER HAS ONE SPEED, "SLOW".
   b. If wiper has only "HI" speed, follow procedure under WIPER HAS ONE SPEED, "FAST".
   c. If wiper has both speeds proceed with next step.
2. By-pass car wiring and dash switch and operate wiper as shown in Fig. 13-131.
3. Disconnect jumper wire number two. Wiper should shut off when blades reach park position.

   If wiper still fails to shut off the parking switch contacts probably are not opening. Repair or replace parking switch contacts.

   If wiper shuts off correctly check for a grounded condition in car wiring leads that connect to the number one wiper terminal.

WIPER HAS ONE SPEED "FAST"

1. By-pass car wiring and dash switch and connect wiper as shown in Fig. 13-131. This should operate wiper in "LO" speed (approximately 35-45 wipes per minute.)

   If wiper operates correctly, check to see that lead from terminal number three to dash switch is not open. If lead is not open, switch is at fault.

   If wiper still has one speed "FAST", remove wiper from car and follow procedures outlined under TROUBLE SHOOTING-WIPER DETACHED.

WIPER HAS ONE SPEED "SLOW"

1. By-pass car wiring and dash switch and connect wiper as shown in Fig. 13-131. This should operate wiper in "LO" speed. Next, disconnect jumper wire number one. This should operate wiper in "HI".

   If wiper operated correctly and has both speeds, look for a grounded condition in the wire between wiper terminal number three and dash switch.

   If wiper still has one speed "slow", remove wiper from car and check for a ground in the wiper motor black wire that connects to number three terminal.

WIPER WILL NOT PARK BLADES CORRECTLY

When dash switch is turned to "OFF" position blade movement stops immediately regardless of blade position on windshield.

1. Remove wiper from car and check to see that parking switch contacts are not bent, dirty or broken.

WIPER SPEED NORMAL IN "LO" BUT TOO FAST IN "HI"

1. Remove wiper from car and check for an open terminal board resistor.

INTERMITTENT OPERATION

Wiper cycles on and off automatically.

1. Remove wiper from car and follow Intermittent Operation checking procedures outlined under TROUBLE SHOOTING-WIPER DETACHED.

TROUBLE SHOOTING—WIPER DETACHED FROM CAR

Check wiper operation as follows:

"LO" Speed	- Using an ammeter in the feed wire circuit from battery connect wiper as shown in Fig. 13-131.
"HI" Speed	- Disconnect jumper lead number one from number three terminal.
To Park Wiper	- Leave jumper lead number one connected and disconnect jumper lead number two from ground.

WIPER INOPERATIVE

The following ammeter readings will provide a hint as to where trouble might be located.

Approximately 2 amperes indicates an open armature, hung brushes, poor solder connections, or broken green lead.

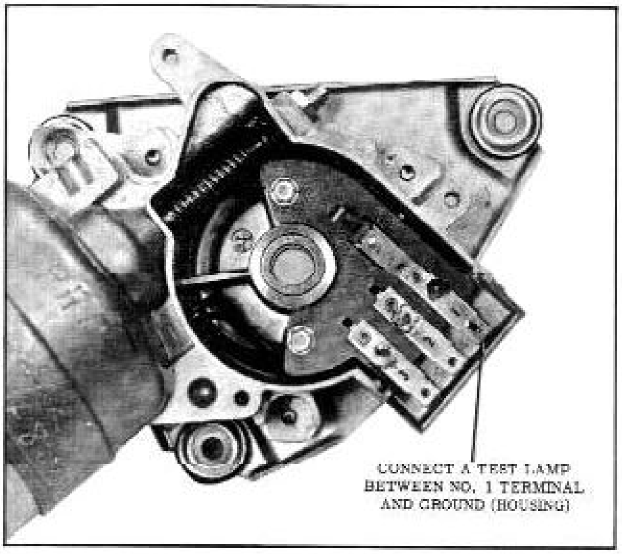

Fig. 13-132 Checking Wiper for Ground

Zero Amperes indicates dirty or defective circuit breaker contacts, or solder connections at circuit breaker terminals.

Approximately 13 amperes indicates a broken gear or some similar condition that would stall the wiper.

WIPER WILL NOT SHUT OFF

1. Check that wiper has "LO" speed. If wiper has only one speed (fast), look for an open shunt field circuit.
2. Check that parking switch contacts are opening as follows:
   a. Remove wiper gear from housing and check that parking switch contacts are not stuck or bent together.
   b. To double check operation of park switch, slide gear and shaft out of housing far enough to disengage gear teeth from worm shaft. Turn gear so that gap in ring can be positioned over the raised part of the parking switch and slide gear back in housing. Connect a test light as shown in Fig. 13-132. Test lamp should not light.
3. If the checks in step 1 fail to locate the trouble, look for a grounded condition in the green lead.

WIPER HAS ONE SPEED "FAST"

1. Check for an open shunt field circuit.

WIPER HAS ONE SPEED "SLOW"

1. Look for a grounded condition in the shunt field circuit.

WIPER CRANK ARM STOPS ROTATING IMMEDIATELY WHEN JUMPER NUMBER TWO IS DISCONNECTED FROM GROUND. (Stops in any position.)

1. Check that parking switch contacts are not dirty, bent or broken.

WIPER SPEED NORMAL IN "LO" BUT TOO FAST IN "HI"

1. Check for an open resistor on wiper terminal board.

INTERMITTENT OPERATION (WIPER CYCLES ON AND OFF AUTOMATICALLY)

1. Operate wiper in "LO" speed and observe current draw. If current draw exceeds 3.5 amperes when operating with no load on bench, check the following items:
   a. Armature end play too tight.
   b. Armature shorted or grounded.
   c. Field assembly shorted.
   d. Gear Assembly end play tight.

If current draw is normal, a defective circuit breaker is indicated and it should be replaced.

DISTRIBUTOR TEST SPECIFICATIONS

Distr. No.	Rotor Viewed From Top	Spring Tension	Vacuum Advance		Mechanical Advance			
1110975	Clockwise	19-23 oz.	5"-7"	15.25"-17"	Dist. r.p.m.	500	1000	2100
	R.H. Drive		Start	(Max) 12°	Degrees	$0-2^{\circ}$	$5^{\circ}-7^{\circ}$	$11^{\circ}-13^{\circ}$

ELECTRICAL SPECIFICATIONS

STARTING MOTOR (1108303)
- Make . . . . Delco-Remy
- Brush Spring Tension . . . . 35. oz. min.
- Number of Brushes Used 4
- Number of Fields 4
- Number of Teeth on Starter Pinion 9

SOLENOID SWITCH (1114266)
- Current Consumption. Both Windings @ 10 volts @ 80°F . . . . 42-49 amps.
- Current Consumption. Hold-In Windings @ 10 volts @ 80°F . . . . 10.5-12.5 amps.

GENERATOR (1100393)
- Charging Rate Cold @ 14 volts @ 2670 r.p.m. . . . . 35 amps.
- Charging Rate Hot is controlled by voltage regulator.
- Field Current Draw @ 12 volts @ 80°F . . . . 1.69-1.79 amps.
- Brush Spring Tension . . . . 28 oz.

GENERATOR REGULATOR
CUT OUT RELAY
- Air Gap . . . . .020"
- Point Opening . . . . .020"
- Closing Voltage . . . . 11.8-13.0 volts (Adjust to 12.8 volts.)

VOLTAGE REGULATOR
- Air Gap . . . . 0.075"
- Voltage Setting . . . . Refer to Ambient temp. Chart Fig. 13-13

CURRENT REGULATOR
- Air Gap . . . . 0.075"
- Current Setting . . . . Refer to Ambient temp. Chart Fig. 13-13

BATTERY
- Make . . . . Delco-Remy
- Model Number 455
- Catalogue Number 454
- Number of Cells 6
- Number of Plates . . . . 9/cell or 54
- Voltage Rating . . . . 12 volts
- Capacity @ 20 hr. Rate . . . . 40 amp. hour
- Specific Gravity @ Full Charge . . . . 1.270 ± .010 @ 80°F
- Ground . . . . Negative

ELECTRICAL SPECIFICATIONS (Cont'd.)

COIL	
Primary Resistance @ 80°F	1.28-1.42 ohms
Secondary Resistance @ 80°F	7200-9500 ohms
IGNITION RESISTOR (IN HARNESS)	
Resistance @ 80°F	1.75-1.85 ohms
DISTRIBUTOR	
Cam Angle Range	28°-32° (Adjust to 30°)
Contact Point Opening	.016"
Contact Arm Spring Tension	19-23 oz.
Condenser Capacity	0.18-0.23 mfd.
SPARK PLUGS	
Make	AC
Type	(4 Bbl-45FF) (2Bbl-46FF)
Thread	14MM (Metric)
Body	13/16" Hex
Electrode Gap	.040"
HORNS	
Current Draw @ 12 volts	7-11 amperes
HORN RELAY	
Point Opening	.020" Min.
Closing Voltage	1.5-9.5 volts (Adjust to 6.5 volts)
Air Gap-Points Closed	.008"-.020"
TURN SIGNAL FLASHER	
Flasher per Minute (Non-Adjustable)	80-100

LIGHT BULB NUMBERS

Headlamps (Inner, #1, upper beam only)	4001
Headlamps (Outer, #2, lower and upper beam)	4002
Stop and Tail Lights	1034
Parking and Turn Signal (Front)	1034
Dome Light (Tubular)	211
Electric Clock Lamp	57
Heater Control Lamp	57
Generator Warning Lamp	57
High Beam Indicator Lamp	57
Instrument Cluster Lamps	57
Oil Pressure Warning Lamp	57
Temperature Indicator Lamp	57
Turn Signal Indicator Lamps	57
License Lamp	67
Back-Up Lamps	1073
Radio Dial Lamp	1893

FUSE SPECIFICATIONS AND LOCATIONS

APPLICATION	FUSE TYPE AND AMPERES	FUSE LOCATION
Electric Clock	AGA 2	
Dome Lights	SFE 20	
Stop Lights		
Temperature Indicator Light		
Fuel Gauge		
Oil Pressure Warning Light		
Generator Warning Light	SFE 9	
Back-Up Light		Located in Fuse Block
Turn Signal		
Tail Lights		
Radio - Deluxe	AGW 4	
Heater and/or Air Conditioning	SFE 20	
Electric Windshield Wipers & Washer		
Instrument Cluster Light		
Clock Light	AGA 3	
Heater Ventilator & Air Conditioning Lights		
Generator Armature and Wire	575532	On "Bat" Terminal Of Regulator
Headlights	Circuit Breaker	On Headlight Switch
Cigar Lighter (Instrument Panel)	SFE 20	On Back of Lighter
Flasher		Part Number 535078

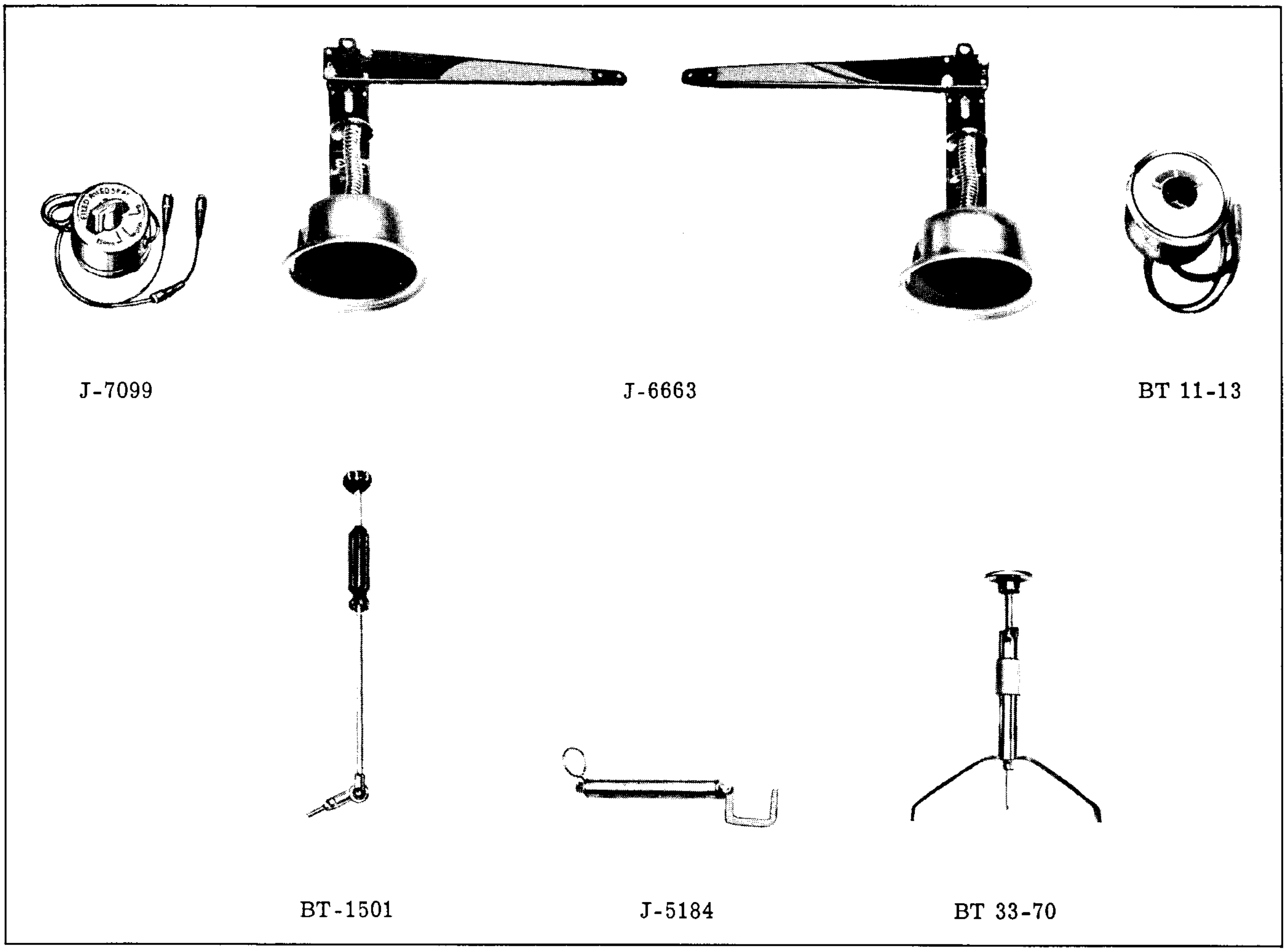

Fig. 13-133 Tools

33-70	Belt Tension Gauge	BT-1501	Distributor Dwell Angle Adjusting Tool
J-6663	Headlamp Aimers	J-5184	Spring Tension Scale
BT-11-13	Gas Gauge Tester	J-7099	25 Ohms Variable Resistance

VENTILATING, HEATING AND AIR CONDITIONING

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VENTILATING AND HEATING

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AIR CONDITIONING

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MAINTENANCE RECOMMENDATIONS

Periodically inspect heater hose connections for leakage. Inspect hoses for cracks or deterioration which may lead to leakage of coolant.

DESCRIPTION

VENTILATING

The body ventilating system incorporates the use of an air intake grille located at the top of the cowl. The air entering through the intake grille is directed through a duct to the right and left sides of the cowl, through an outlet assembly into the passenger compartment. The flow of air through the passenger compartment is controlled by manually operated doors in the outlet assemblies.

MANUAL CONTROL

For body ventilation, a cowl air outlet is provided on each side of the passenger compartment.

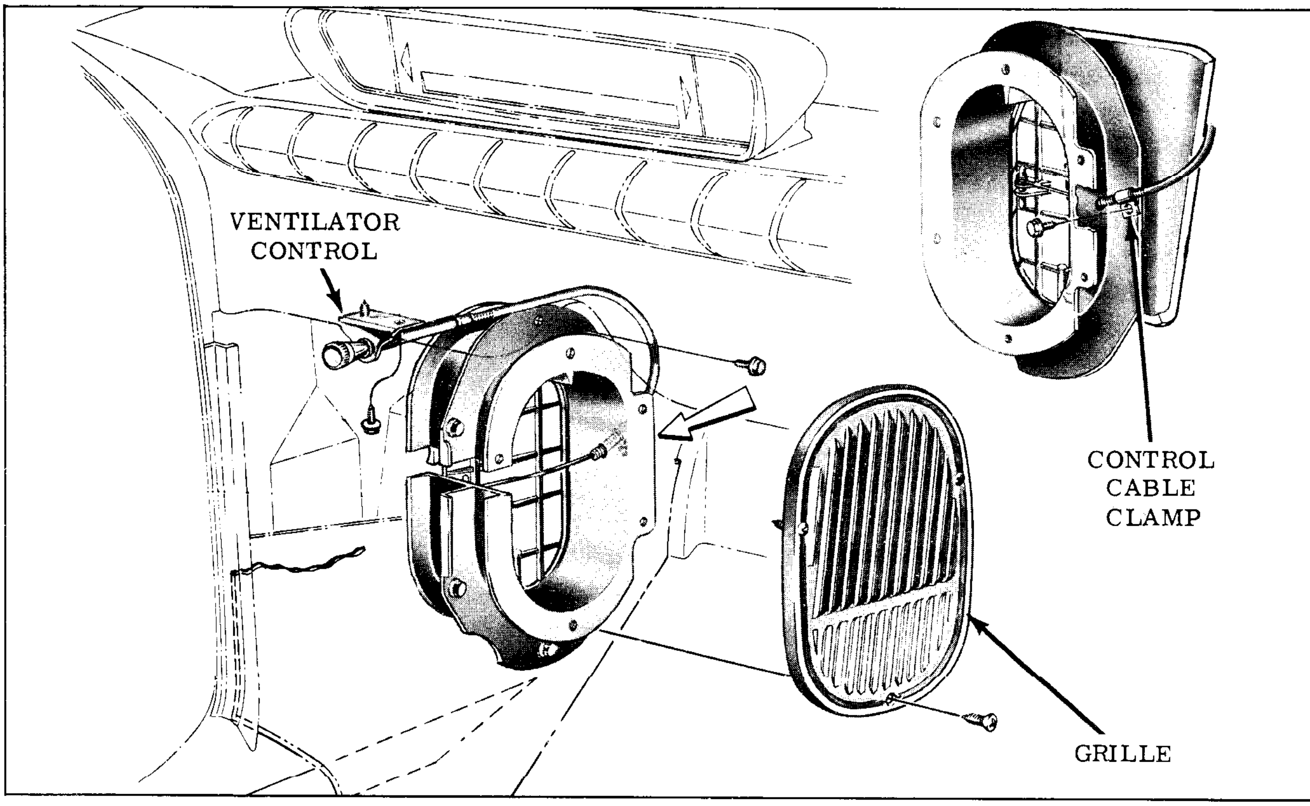

Fig. 14-1 Cowl Ventilator

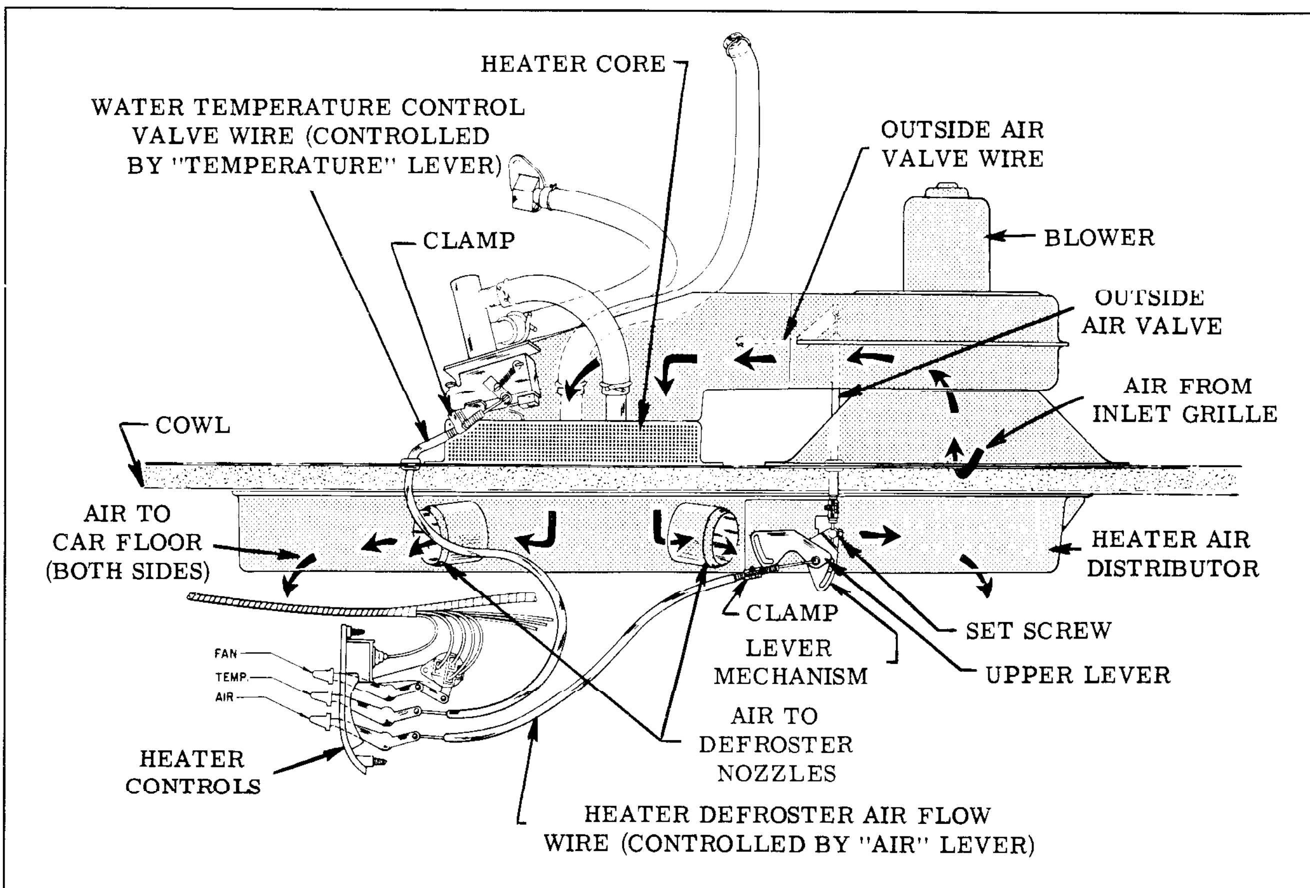

Fig. 14-2 Heater Air Distribution

Each outlet has its own control cable. The handle is mounted on each side of the dash for its corresponding outlet. The cable and handle is serviced as an assembly. (Fig. 14-1)

For air to come through these outlets, the car must be moving forward. The amount of air coming into the body can be controlled by the control handle. With the handle in the extreme outward position outlet door will be fully opened.

MANUAL CONTROL ADJUSTMENT

The cowl outlet door can be adjusted to operate properly, as follows:

1. Remove outlet grille, kick pad and insulation.
2. Be sure knob is pressed fully forward.
3. If door is not closed loosen cable clamp, move cable into outlet until door closes and tighten clamp.
4. Check operation of cable.

COWL OUTLET

Removal (Fig. 14-1)

1. Remove air outlet grille, trim pad and insulation.

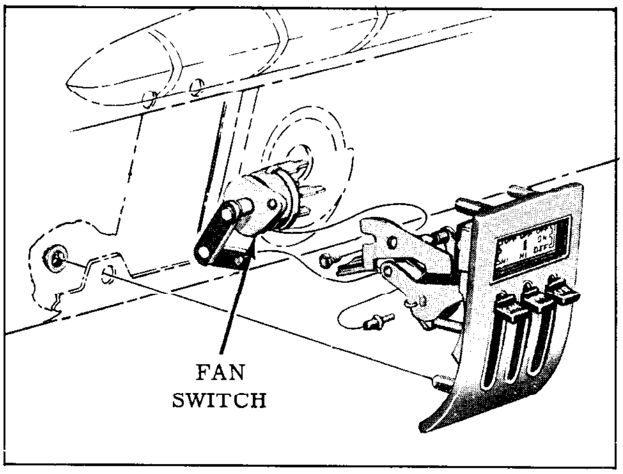

Fig. 14-3 Heater Control

2. Disconnect cable from outlet door by pulling cable wire loop up off of vent door lever pin.
3. Loosen cable clamp forward of outlet and remove cable from outlet.
4. Remove 6 outlet to cowl attaching screws and remove body.

On installation, apply a 3/16" bead of caulking compound between the valve body and cowl. Check

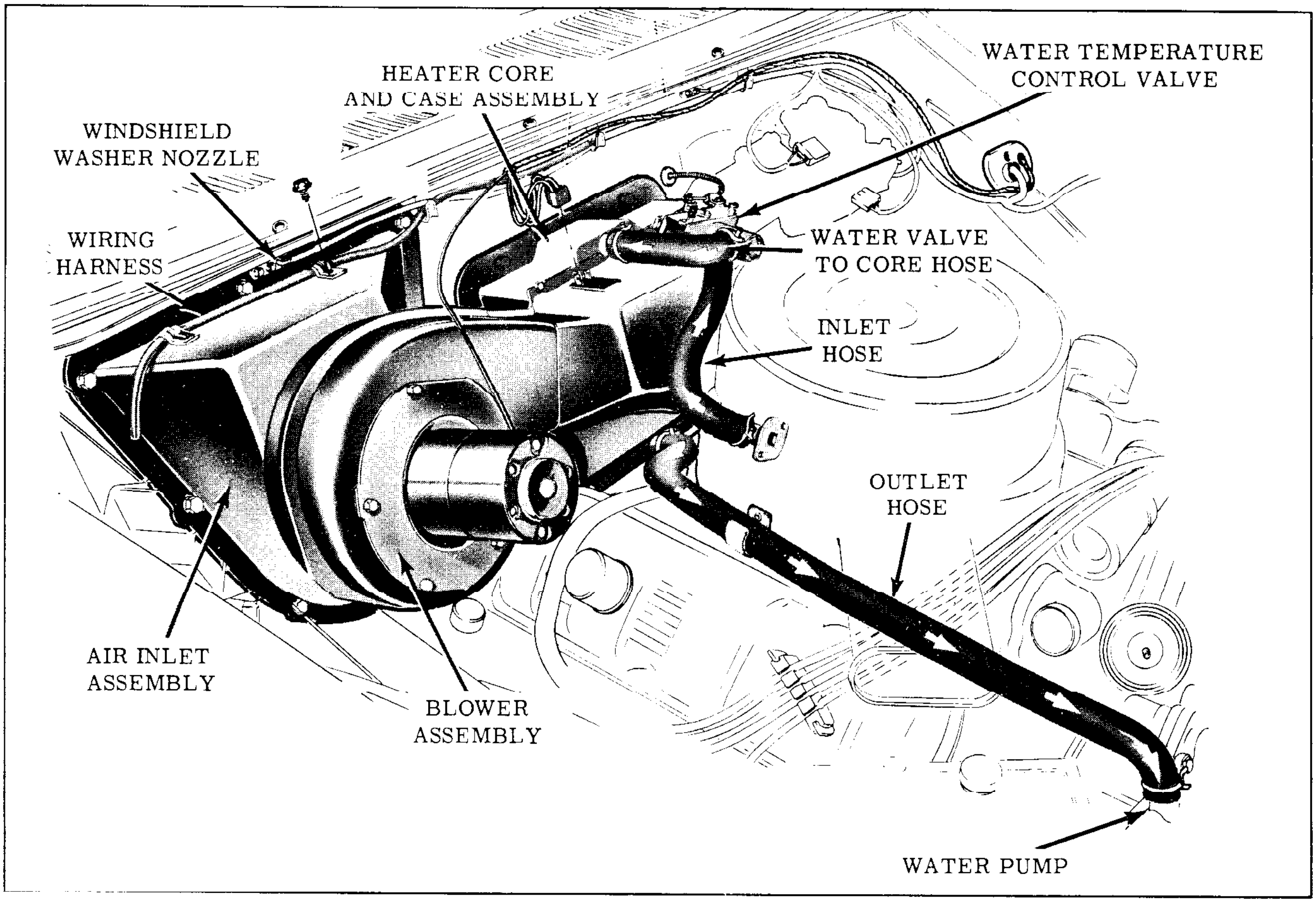

Fig. 14-4 Heater Assembly

cowl outlet control cables for proper adjustment. Vent door should be closed when control knob is pushed in.

DESCRIPTION

HEATING

Air for the heater enters the cowl vent grille and is blown through ducts by the blower motor, through the heater core and into the passenger compartment. (Fig. 14-2)

For heating, the heater blower switch lever must be pushed downward from the "Off" position toward the "On" position. The temperature control lever marked "Temp" must be pushed downward depending on the amount of heat required, as this lever regulates the water control valve.

The air flow lever must be placed in the desired position, "Off", "On", or "Defrost". This lever directs the flow of air into the passenger compartment when it opens the door in the air inlet assembly. When the lever is moved to the defrost position 2 valves, one at each end of the heater distributor, close off the heater outlet louvers allowing the heater blower to force air out through the defroster nozzles.

The blower switch is a 3 speed switch. The first mark under the "OFF" position is low, the second is medium and the third, marked "HI", is the maximum.

CONTROL ADJUSTMENTS

The control cables can be adjusted by repositioning the cable housing in the retaining clamps. When cables are properly adjusted, the control levers will not touch either end of the control lever slot.

HEATER CONTROLS

Removal

Disconnect 2 control cables and wiring. Remove the 3 control attaching nuts from in back of instrument panel and remove control from the front. (Fig. 14-3)

When installing cables, check for ease of operation. Positions of wiring, hoses, and cables are shown in Figs. 14-4 and 14-5.

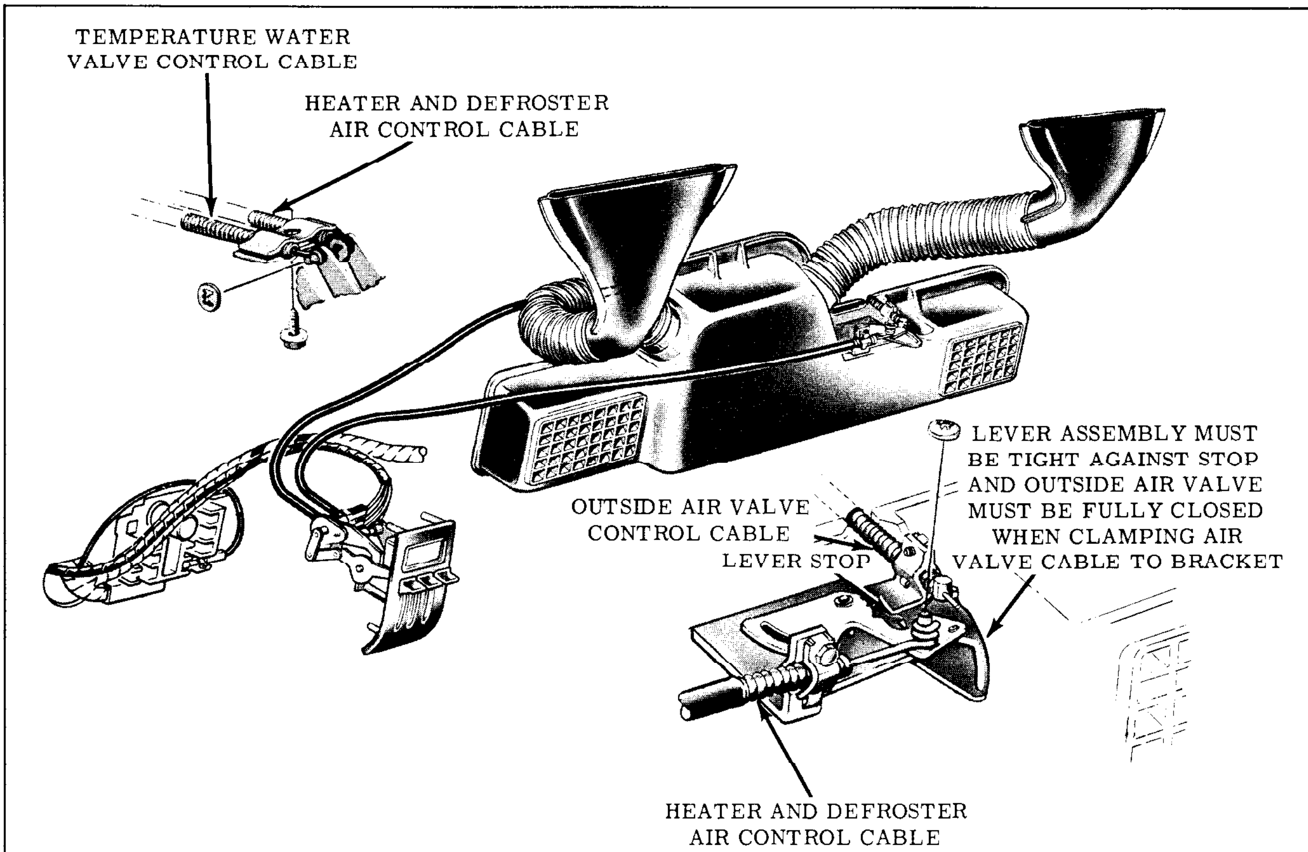

Fig. 14-5 Heater Control Cables

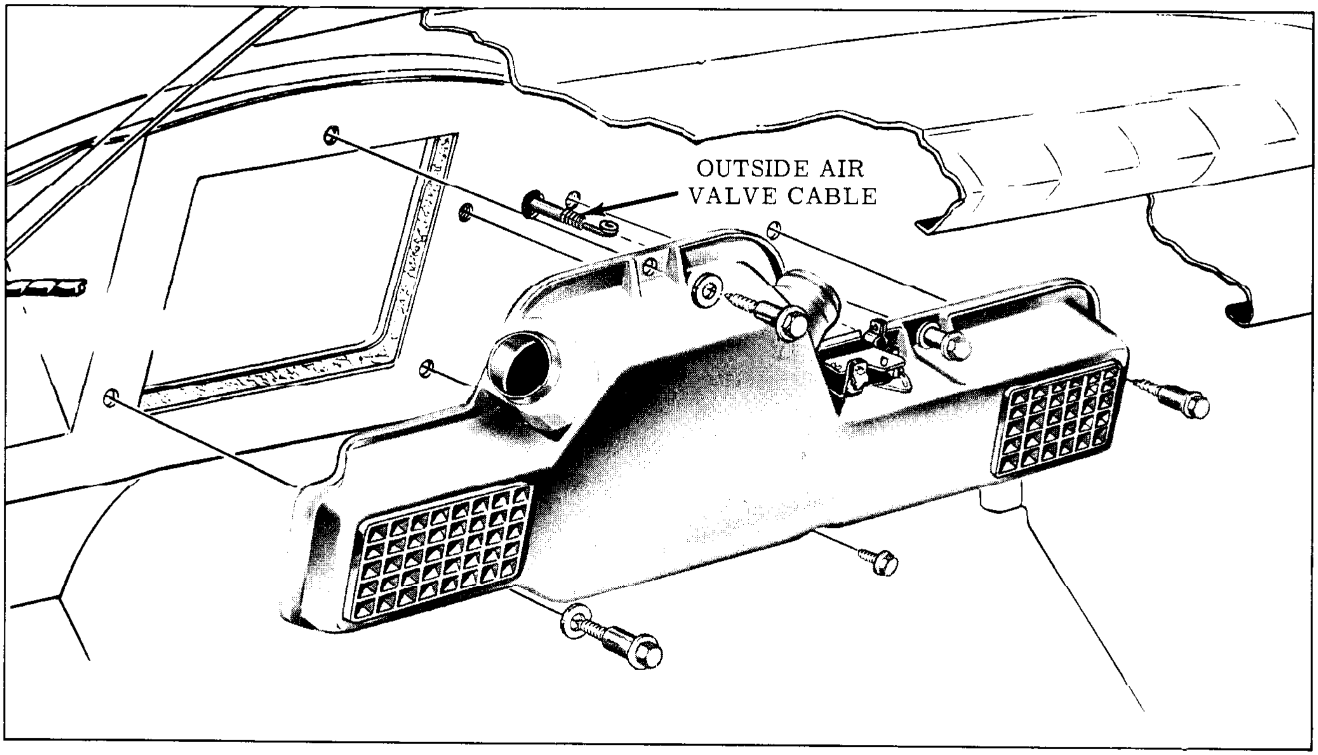

Fig. 14-6 Heater Distributor Assembly

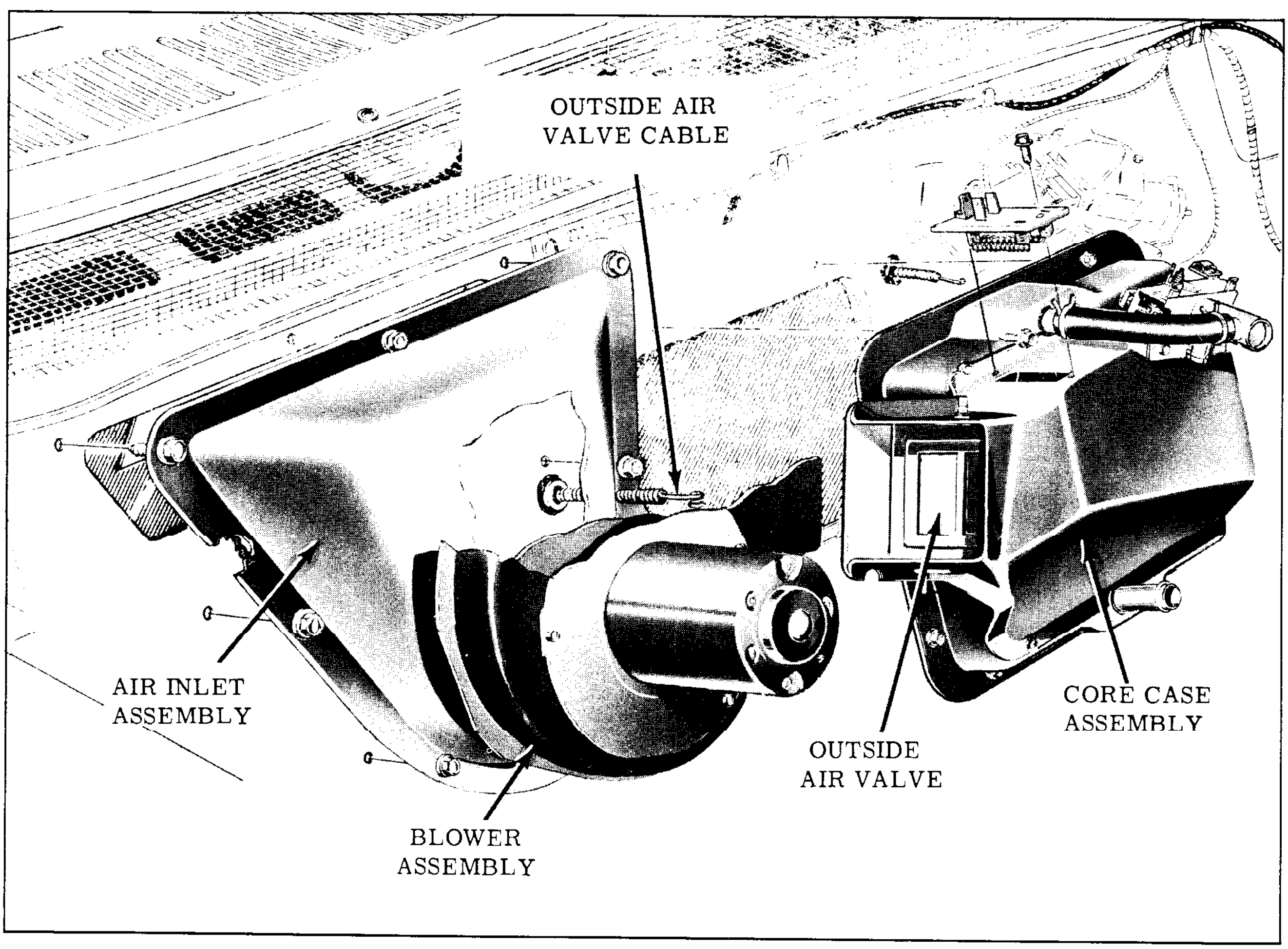

Fig. 14-7 Blower, Duct, & Core Assembly

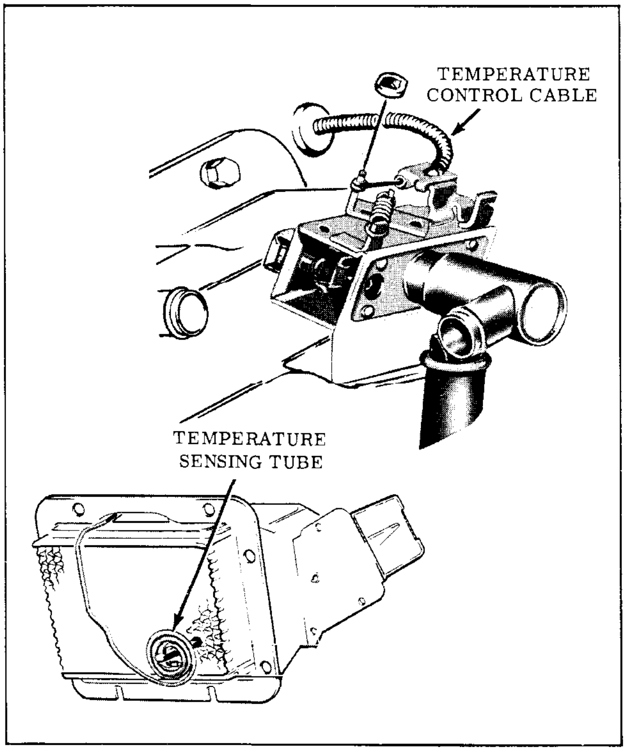

Fig. 14-8 Water Control Valve

HEATER CASE

1. Disconnect heater control cables, and defroster hoses.

2. Remove the heater case to cowl attaching screws. (Fig. 14-6)

   NOTE: When installing heater case, heater outlets should be clear of all hoses, wiring, bowden cables, etc., so that air flow direction will not be adversely affected. The hoses, etc., should be clipped in place out of the way of the heater opening.

AIR INLET ASSEMBLY AND CORE

Removal and Installation

1. Drain radiator.

2. Disconnect water hoses from heater core.

3. Disconnect cable from thermostat and wiring from resistor.

4. Remove the 8 heater inlet to cowl attaching nuts and washers, disconnect air inlet door cable, and remove heater inlet and core. (Fig. 14-7)

5. The core is attached to the heater inlet by 2 screws.

When installing, care must be taken not to bind core pipes when assembling core.

BLOWER SWITCH

The blower switch is attached to the back side of the heater control assembly by a sheet metal screw. The switch actuator lever is pinned to the control lever as shown in Fig. 14-3.

BLOWER ASSEMBLY

The heater blower and motor can be removed by removing the 5 attaching screws. (Fig. 14-7) The blower is held onto the motor shaft by a nut threaded on the end of the shaft.

HEATER WATER VALVE AND RESISTOR

Removal and Installation

The heater water valve is attached to the heater case by 2 metal screws as shown in Fig. 14-8. To remove, drain radiator, disconnect 2 hoses, and control cable, and remove screws. The air inlet and heater core assembly must be removed. Then remove heater core from air inlet assembly and disconnect temperature sensing tube from the heater core.

The heater resistor, (Fig. 14-9), is mounted on the top of the air inlet assembly with the 2 sheet metal screws. To remove, disconnect wires and remove 2 screws and lift resistor upward.

After installing check operation of heater system.

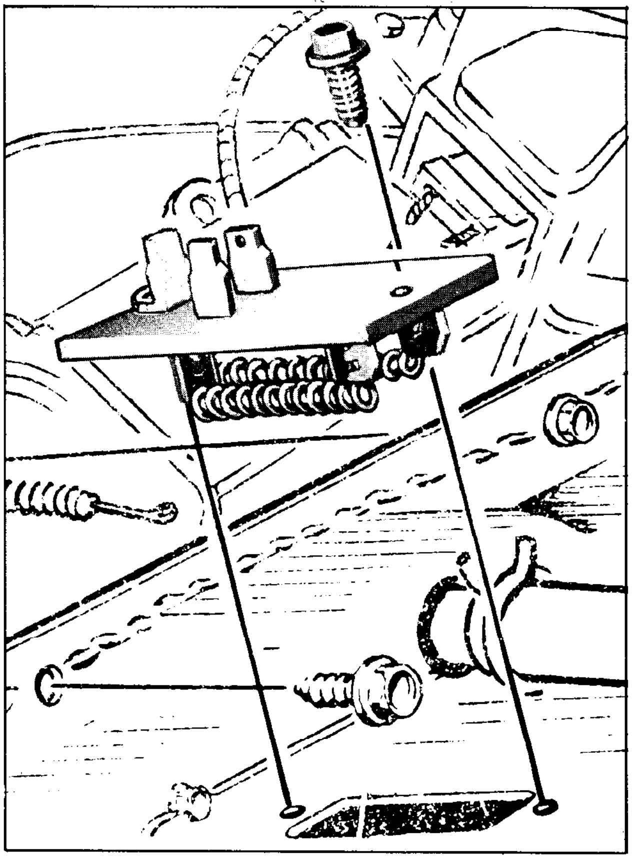

Fig. 14-9 Heater Resistor

AIR CONDITIONING

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MAINTENANCE RECOMMENDATIONS

The air conditioning system should be operated for 5 minutes during each month that the system is not in regular use. A thorough service inspection should be performed at the beginning of the cooling season or as otherwise indicated below:

1. Check refrigerant and oil at least twice a year and replenish as necessary.
2. Periodically check and adjust compressor belt tension.
3. Periodically remove road accumulation from condenser (bugs, etc.)

DESCRIPTION

The Oldsmobile F-85 Air Conditioning System can be operated any time the engine is run-

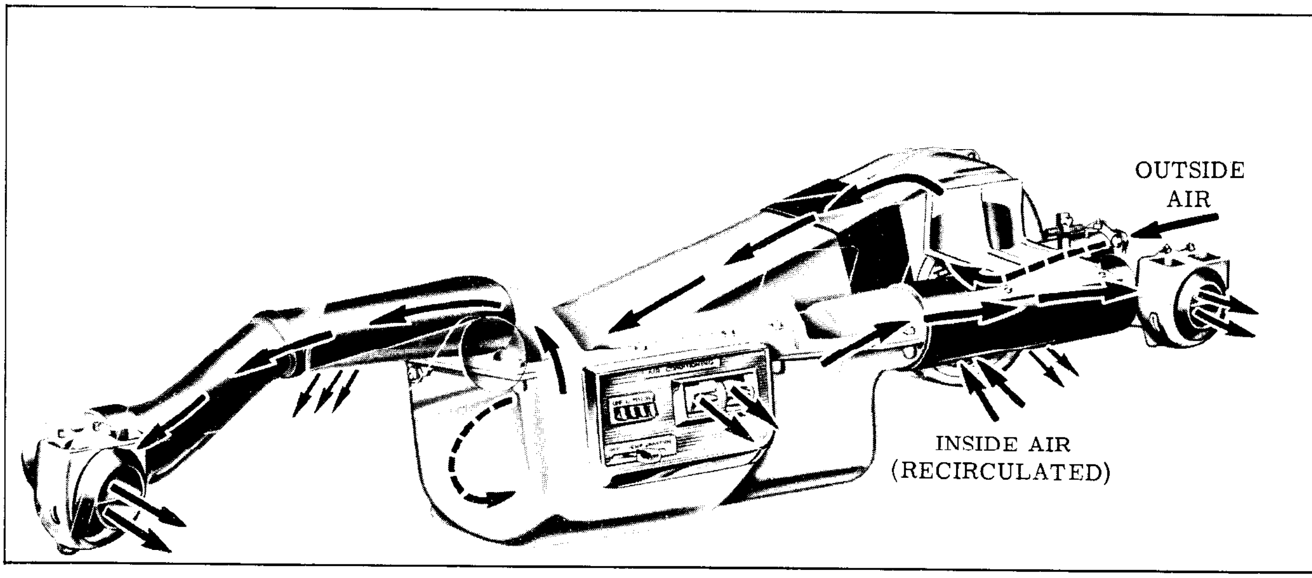


Fig. 14-10 Air Conditioning Air Distribution

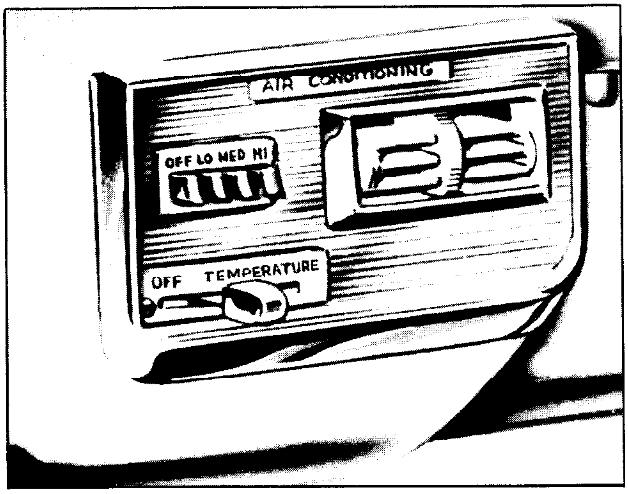


Fig. 14-11 Air Conditioning Controls

ning, to provide refrigerated and dehumidified air to cool the car interior. The system uses both outside air and recirculated inside air. Outside air enters the car at the cowl inlet grille below the windshield. The outside air passes through the cowl plenum chamber and enters the passenger compartment air inlet duct at the right hand side cowl panel. The air then passes through the inlet duct into the passenger compartment in front of the air conditioning blower intake screen. The outside air enters the blower, passes into the evaporator case and through the evaporator. (Fig. 14-10)

The recirculating inside air joins the outside air at the blower inlet screen, passes into the evaporator case and through the evaporator. From the evaporator the air is then directed to the passenger compartment outlets.

The temperature of the air leaving the air conditioning outlets is regulated by a single control lever. The outside air inlet valve is opened completely when the temperature lever is moved approximately 1/4 to the right. In addition, outside air will be admitted to the passenger compartment, even though the blower is off and the air conditioning is apparently not functioning, if the temperature control lever is not placed in its warmest setting. Therefore, in winter driving it will be necessary to have the temperature control in the extreme left hand position in order to prevent a cold air draft since the outside air inlet valve is closed only in the extreme left hand position.

The amount of air moved through the evaporator is controlled by the blower speed. Four buttons ("OFF", "LOW", "MED" and "HIGH") on the evaporator case, control the blower speed. (Fig. 14-11)

Refrigerated air enters the passenger compartment through 3 air outlets. (Fig. 14-12) Two revolvable nozzles, one at each lower side of the instrument panel, can be moved as desired to direct cooling air in any direction away from the instrument panel.

An air outlet on the evaporator case at the center of the instrument panel can be adjusted from an opened to closed position. For maximum cooling this door should be wide open.

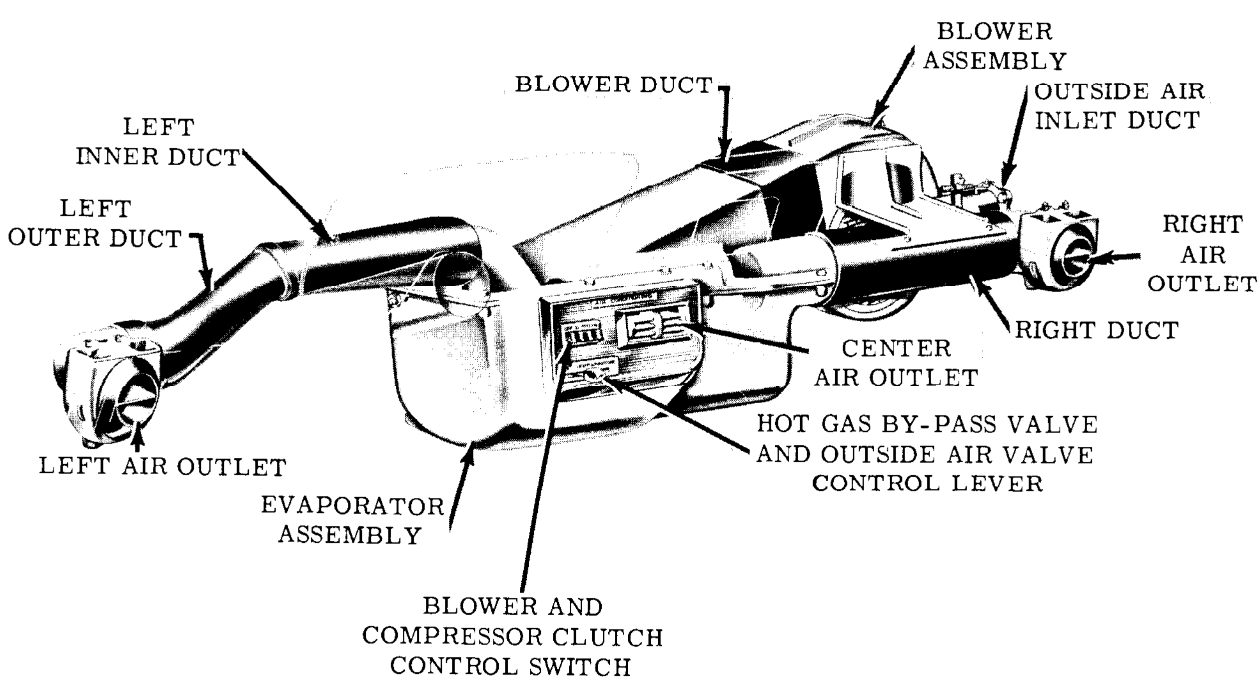


Fig. 14-12 Evaporator Case & Distributor Assembly

The blower buttons also control the operation of the air conditioning compressor. With the "OFF" button depressed the compressor clutch is disengaged. With any blower speed button depressed, the compressor clutch is engaged providing cooling.

Fast Cool Down

To rapidly cool a car which has been standing for a period of time in the sun, open center outlet. Depress "HI-SPEED" button and slide temperature lever to the extreme right position. Open car windows just long enough to expel hot air and then close windows. After car has cooled, adjust temperature control lever position and blower speed to suit individual comfort. Air flow can be directed by adjusting the side and center outlets. THE RECOMMENDED POSITION OF THESE OUTLETS, FOR BEST OVERALL FRONT AND REAR SEAT COOLING, IS WHEN THE OUTLETS ARE ADJUSTED TO DIRECT THE AIR FLOW ALONG THE INSIDE ROOF LINE.

Serial Numbers

The serial number plate is attached to the top side of the compressor. The plate includes the Serial Number and Model Number.

IMPORTANT: ALWAYS INCLUDE BOTH SERIAL NUMBER AND MODEL NUMBER ON ALL REPORTS.

OPERATION OF THE SYSTEM

Controls

The air conditioning control assembly is mounted in the front of the evaporator case at the lower center of the instrument panel. Four blower speed control buttons, ("OFF", "LOW", "MED" and "HIGH") are located at the upper left of the control assembly. Whenever the blower circuit is energized the compressor clutch is energized also. The temperature control lever is located at the lower left of the control assembly and it controls the amount of cooling.

Compressor

The refrigeration system uses an axial type compressor. (Fig. 14-13) It is a reciprocating compressor having 5 cylinders, 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 intake (low) side. Oil is picked up by the refrigerant in the compressor and is pumped through the refrigeration system. An oil test fitting is on the lower side of the compressor. The solenoid-operated clutch pulley permits the

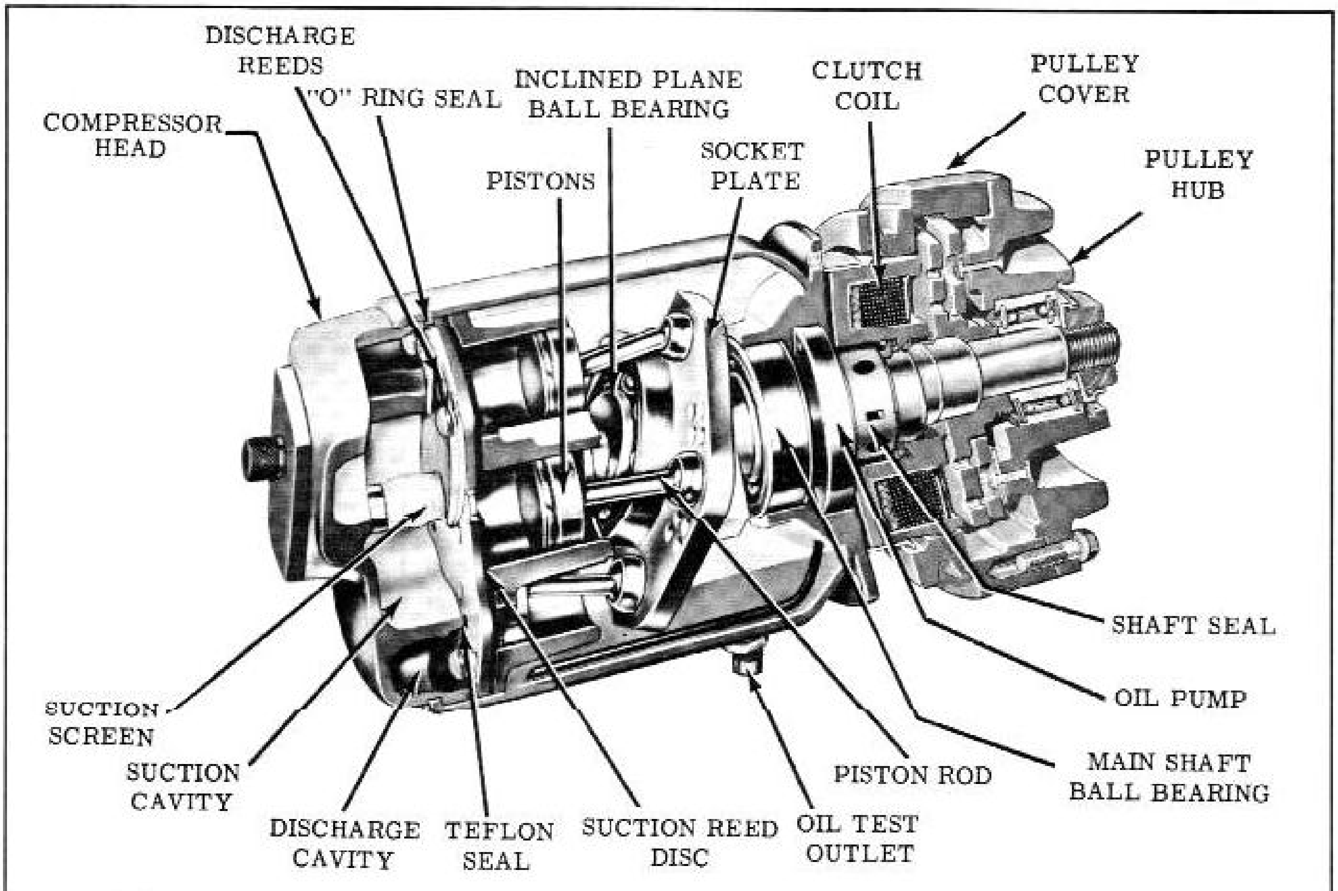


Fig. 14-13 Air Conditioning Compressor

compressor to run only when refrigeration is desired. The only items to be serviced are the clutch pulley assembly, solenoid, compressor shaft seal and oil pump.

Compressor Pressure Relief Valve

The compressor pressure relief valve is located on the high pressure service valve at the muffler. The relief valve is placed in the system as a safety factor. Under certain conditions, the refrigerant on the high side may exceed a safe operating pressure; therefore, to prevent damage, the valve is designed to open automatically at approximately 430 p.s.i. Any condition that causes this valve to open should be corrected, and the refrigerant oil and refrigerant should be replenished as necessary.

Compressor High and Low Pressure Valves (Hand Shut-Off) (Fig. 14-14)

The compressor shut-off valves are necessary to permit pressure checks and servicing of the refrigerant system.

The compressor high pressure valve is located at the muffler. It is an integral part of the muffler and the 2 units are serviced as an assembly.

The compressor low pressure valve is located in the low pressure compressor return line between the evaporator and the compressor.

The compressor high and low pressure valves are two-way valves. When the valve stems are turned completely counterclockwise, the passage to the compressor is connected to the refrigerant line, but sealed from the gauge fitting. This is the normal operating position.

When the valve stems are turned completely clockwise, the passages to the refrigerant lines are sealed, and the passages to the gauge fittings are opened. In this position the evaporator and condenser are shut off from the compressor and the compressor can be removed or serviced.

CAUTION: NEVER OPERATE THE COMPRESSOR WITH THE HIGH PRESSURE VALVE CLOSED. (FULLY CLOCKWISE).

When the valve stems are opened slightly from the counterclockwise position, both the passages to the gauge fittings and to the compressor are open. This permits pressure gauge readings while operating the system.

Compressor Muffler

A muffler has been placed in the high pressure side of the system to reduce compressor noises and high pressure line vibrations. The muffler tank absorbs the surges from the compressor in

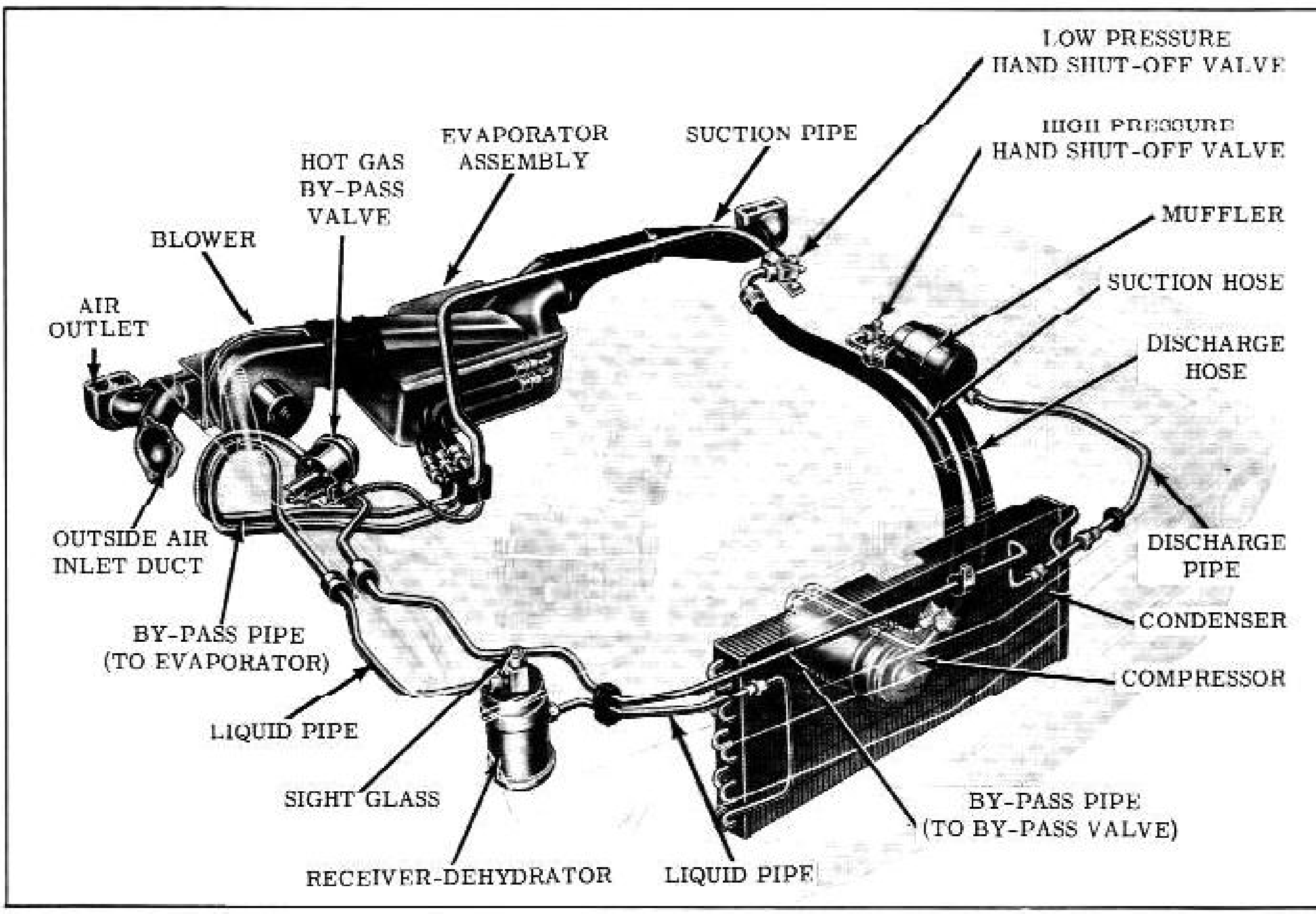


Fig. 14-14 Air Conditioning System

a manner similar to the action of a hydraulic accumulator. No repairs are to be made on the muffler. If it is defective, it should be replaced. Always install the muffler with the outlet side down.

Condenser

The condenser is similar to the ordinary car radiator. It 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 liquid refrigerant.

Sight Glass

The refrigerant sight glass (at top of dehydrator-filter-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.

The sight glass can be serviced without removing the dehydrator-filter-receiver assembly. After removal of the retaining screw the sight glass can be lifted out with caulking compound and the "O" ring can be removed with a wire hook.

CAUTION: When performing this operation the system should not be left open longer than absolutely necessary as the dehydrator will soak up moisture like a sponge. Refer to "SERVICING OF THE REFRIGERATION SYSTEM".

DEHYDRATOR-FILTER-RECEIVER ASSEMBLY

The functions of this unit are to absorb moisture and foreign material 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 low pressure side of the system that permitted air and moisture to be drawn into the system. (Fig. 14-15)

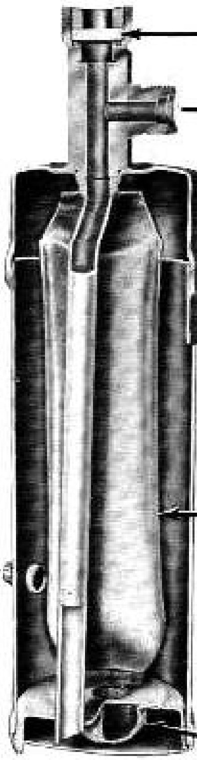


Fig. 14-15 "Receiver" Dehydrator Assembly

EXPANSION VALVE

The expansion valve, mounted inside the evaporator case, controls the flow of refrigerant into the evaporator. It is adjusted so that the temperature of the refrigerant at the evaporator outlet must be 6°F. higher than the temperature of the refrigerant at the inlet before more refrigerant is allowed to enter the evaporator. A capillary tube filled with carbon dioxide provides the temperature regulation of the expansion valve. The capillary tube is fastened to the low pressure refrigerant line coming out of the evaporator inside the evaporator case so that it communicates the temperature of the refrigerant at this point to the expansion valve. If the temperature differential between the inlet and outlet decreases below 6°F., the expansion valve will automatically reduce the amount of refrigerant entering the evaporator. If the temperature differential increases above 6°F., the expansion valve will automatically allow more refrigerant to enter the evaporator, thus increasing the cooling. The only service operations to be performed on the expansion valve are the cleaning and/or replacement of the inlet filter screen. (Fig. 14-16)

NOTE: It is very important that the expansion valve capillary tube bulb be tightly clamped to the low pressure refrigerant line coming out of the evaporator for proper operation. Both the low pressure line and capillary tube should be cleaned at the points of contact.

EVAPORATOR

The evaporator (cooling coils) is located in a housing which is attached under the instrument panel above the transmission hump.

Air from the blower housing is directed through the evaporator case to the distribution hoses and air outlets inside the car. Heat is absorbed from the air by the liquid refrigerant entering the evaporator, causing the refrigerant to vaporize.

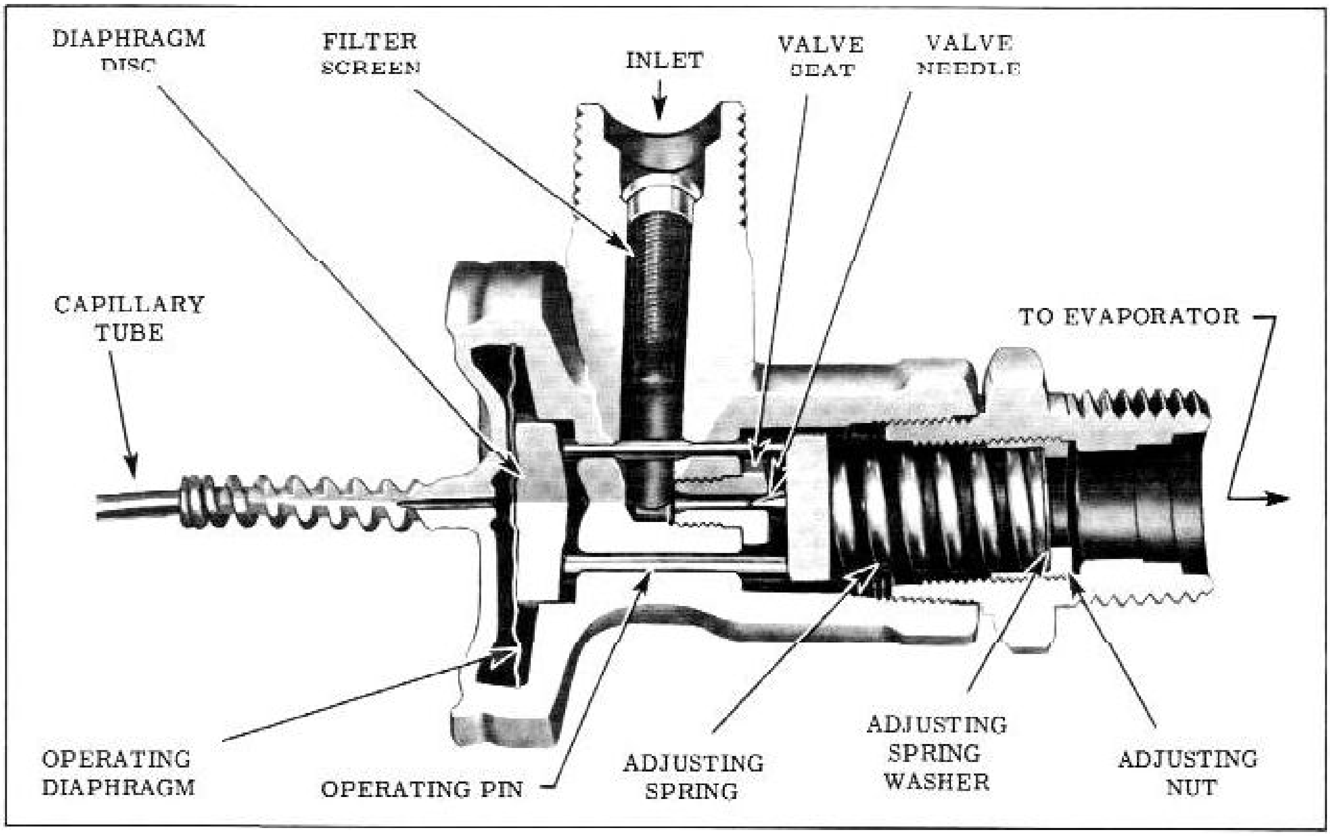


Fig. 14-16 Expansion Valve

Refrigerant "Hot Gas" By-Pass Valve

The refrigerant by-pass valve performs two functions in the refrigeration circuit. First, it acts as a temperature control and secondly it limits the evaporator minimum pressure to prevent "freezing-up" of the evaporator coils. The valve serves as a temperature control, being linked directly to the air conditioning temperature lever by a cable. The by-pass valve is wide open when the temperature lever on the air conditioning control is in the extreme left position. In this position it maintains high evaporator pressure. The farther to the right the temperature lever is positioned, the lower the evaporator pressure will become and thus the car will become cooler. The by-pass control cable adjustment is of extreme importance to insure proper operation in all temperature lever positions.

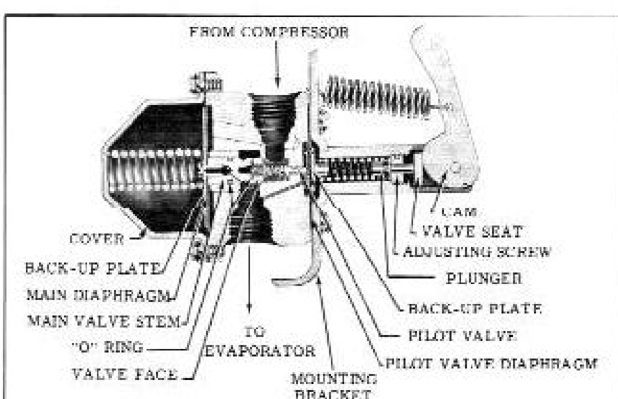


Fig. 14-17 "Hot Gas" By-Pass Valve

When the temperature lever is moved fully to the right, the by-pass valve is set to maintain low evaporator pressure (24 p.s.i.) which results in maximum cooling ability of the evaporator and consequently maximum cooling of the discharge air. The evaporator minimum pressure is limited by automatically injecting "Hot Refrigerant Gas" into the low pressure line from the evaporator core. This action takes place when the evaporator pressure tends to drop below 24 p.s.i. (Fig. 14-17)

REFRIGERATION CIRCUIT

Heat laden, low pressure vapor 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 refrigerant. The liquid refrigerant passes from the condenser into the dehydrator-filter-receiver which acts as a reservoir. The liquid in the receiver is still under high pressure. (Fig. 14-18)

Liquid refrigerant from the receiver passes through the sight glass to the expansion valve.

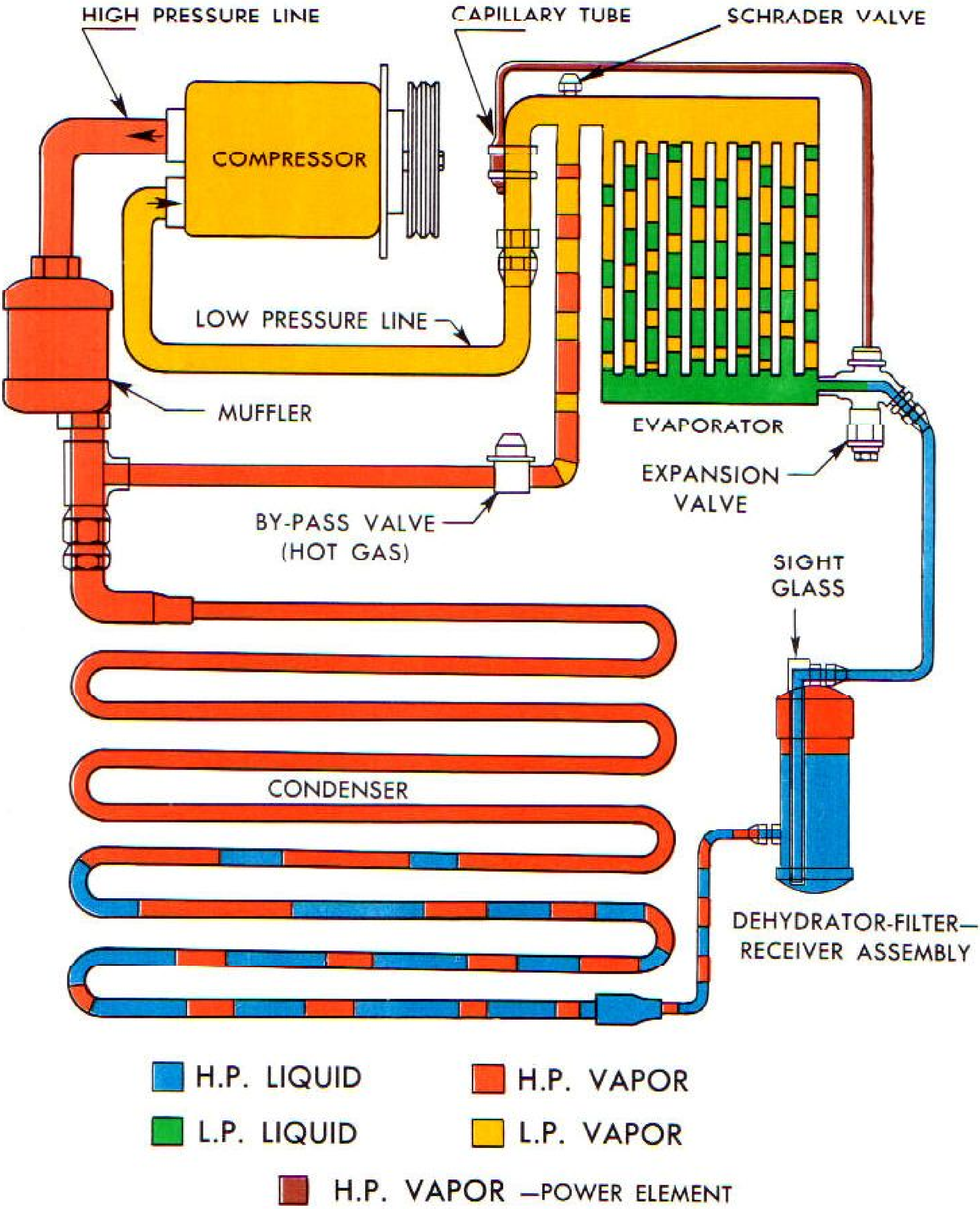


Fig. 14-18 Refrigeration Circuit

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 low pressure line to the compressor. When the evaporator pressure drops below 24 p.s.i. the refrigerant by-pass valve partially opens to permit "Hot Gas" from the compressor to enter the suction line from the evaporator core to prevent freezing of the core. It is this same action that regulates the amount of cooling when the temperature lever on the instrument panel is moved to the left. By-pass valve action maintains higher evaporator pressures and warmer discharge air.

On a cold day, the system will by-pass almost constantly. As the ambient (atmospheric) temperature becomes higher, the by-pass system will work less and less.

PRECAUTIONS IN HANDLING REFRIGERANT 12

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 is 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 refrigerant 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 pressure in the system.

Do Not Fill the Drum Completely

When filling a small drum from a 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 air 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 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, here is what to do:

1. DO NOT rub the eye. 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 has been frost-bitten 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 the pure refrigerant 12. As long as the system contains only pure refrigerant 12 (plus a certain 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 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 Tubing Sealed

Whenever it becomes necessary to disconnect a refrigerant line, it should be immediately capped. Air that enters any part of the system will carry moisture with it and the exposed surfaces will collect the moisture quickly. Capping the lines will also prevent dirt and foreign matter from entering.

Keep Tools Clean

Tools should be kept clean and dry. This includes the gauge set and replacement parts. Keep gauge lines plugged.

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.

Do Not Keep System Open Longer Than Five Minutes

Precaution In Handling Lines

All 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.

Refrigerant line 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. Rubber "O" rings are used at all connections. A great amount of pressure is not required to tighten fittings. 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 2 WRENCHES WHEN TIGHTENING OR LOOSENING REFRIGERANT LINE FITTINGS. All fittings use "O" rings for sealing.

When disconnecting any fitting in the refrigeration system, proceed very cautiously regardless of gauge readings. Open very slowly, keeping face and hands away so that no injury can occur if there happens to be liquid refrigerant in the line. If pressure is noticed when fitting is loosened, allow it to bleed off very slowly.

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

The gauge set is used when purging, 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 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. (Fig. 14-19)

The hand 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 (TORCH)

The leak detector (torch) is used to locate a leak in any part of the refrigerant system. To operate, the detector is ignited and the sampling tube is held close to all possible points of leakage (fittings, connections, etc.) If the flame changes color, particularly green, brilliant blue, or purple, refrigerant is being drawn into the sample tube, indicating a leak.

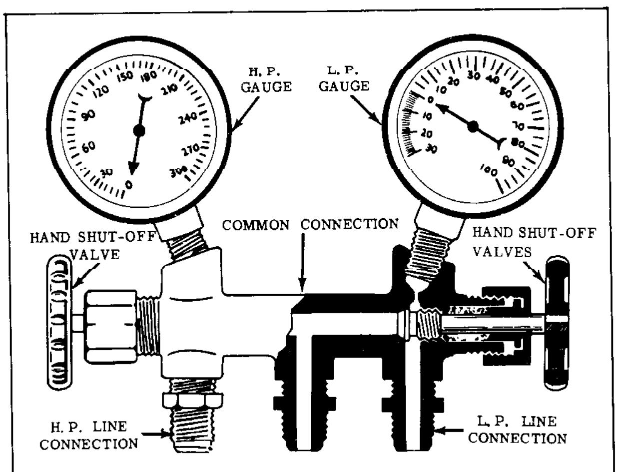


Fig. 14-19 Gauge Set

CAUTION: DO NOT BREATH THE FUMES THAT ARE PRODUCED BY THE LEAK DETECTOR AS THEY ARE POISONOUS.

NOTE: The valve should never be closed tightly when the needle is hot because the needle will "freeze" when the burner cools and the valve seal will be damaged.

For confined areas, such as sections of the evaporator and condenser, the alcohol torch or a Bernz-O-Matic torch is the only method which can be used.

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

The vacuum pump is recommended as a service tool. If a leaking system has been operated in a discharged condition, the receiver-dehydrator-filter assembly should be replaced and a vacuum pump should be used to thoroughly evacuate the system.

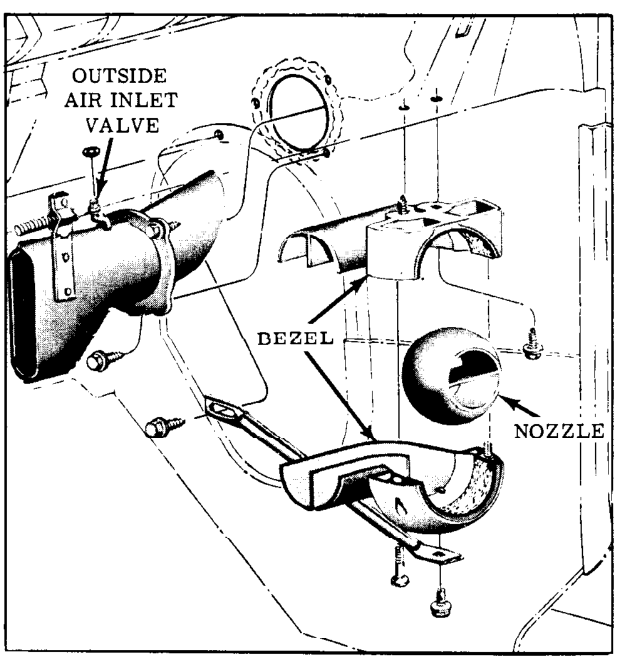


Fig. 14-20 Air Outlet Nozzle

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 BT-33-70 is used to check the compressor belt tension.

If belt requires adjustment:

1. Loosen the compressor bolts and nuts.
2. Pivot the compressor until the pointers on Tool BT-33-70 are even with line on tool plunger.
3. Tighten the compressor bracket bolts adjusting link.

AIR OUTLETS

Removal of Nozzle Assembly (Fig. 14-20)

1. Slide duct off nozzle retainer assembly.
2. On right hand side remove bracket to nozzle retainer attaching screw.
3. On left hand side remove ventilation control bracket. Remove 2 screws at bottom of lower retainer.
4. Remove 2 upper retainer to instrument panel attaching screws, then remove outlet assembly.

"HOT GAS" BY-PASS VALVE CABLE ADJUSTMENT

1. Check to insure cable is not kinked and operates freely, then disconnect return spring.
2. Place the lever in the extreme right position.
3. Disconnect the cable from the lever and loosen the cable clamp on the by-pass valve bracket.
4. Loosen the lock screw on the lever assembly.
5. With the lever against stop, position the cam so that it just touches the nylon plunger. Tighten the lock screw in this position.
6. With the by-pass lever held against its stop, install the control wire coil over the lever pin and tighten the cable clamp. Install return spring.
7. Move the control to the left and back to the extreme right position. There should now be

1/16" spring-back of the lever. Again check to make sure that the cam is just touching the nylon plunger.

BLOWER ASSEMBLY

Removal

1. Disconnect motor lead at motor terminal.
2. Remove the blower motor clamp bolt and nut. (Fig. 14-21)
3. Loosen motor clamp bracket screw and ground wire and pivot clamp bracket down to provide clearance for blower removal.
4. Remove 2 blower front support and glove box hinge screws.
5. Slide blower duct onto evaporator case and pivot blower down and out from under instrument panel.

Installation

1. Position blower assembly under instrument panel.
2. Install 2 front blower support and glove box hinge screws.
3. Reposition motor clamp bracket and ground wire and tighten mounting screw.
4. Install motor clamp bolt and nut.
5. Attach blower motor lead to motor terminal.
6. Slide duct onto blower.

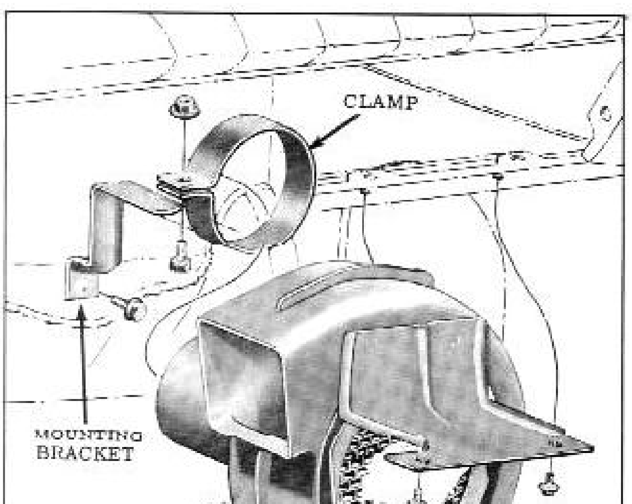
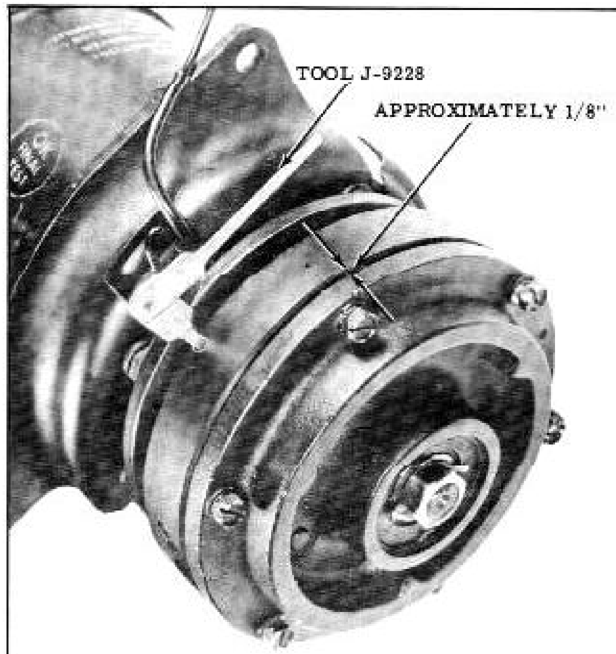


Fig. 14-21 Blower Assembly



LOOSEN SIX PULLEY HUB TO PULLEY COVER SCREWS AND MOVE PULLEY COVER APPROXIMATELY 1/8" REARWARD TO ALIGN ACCESS HOLE WITH AIR GAP

Fig. 14-22 Checking Clutch Air Gap

CLUTCH AND PULLEY ASSEMBLY

Clutch Air Gap Checking

1. Loosen drive belt.
2. Energize the clutch coil by disconnecting coil wire at connector on compressor, then connect a jumper wire from a known 12 volt source to the coil wire.
3. Loosen the 6 pulley hub bolts and slide the pulley cover rearward approximately 1/8" to position gauge hole in pulley cover over air gap between the rotor plate and the coil seal housing.
4. Insert the flat feeler gauges (Tool J-9228) through the hole in pulley cover. The air gap is correct when the .022" gauge will enter air gap and when the .037" gauge will not enter air gap. If the air gap is not within these specifications, it will be necessary to remove the rotor plate and add or subtract shims as necessary. (Fig. 14-23) Seven shims are available (.010", .012", .015", .018", .020", .022" and .025"). With proper selection of these shims, .002" variation in air gap can be obtained. (Fig. 14-22)

Clutch Pulley Hub and Armature Plate Assembly Removal (Fig. 14-23)

NOTE: If clutch and pulley removal is due to suspected malfunction of the clutch, the air gap

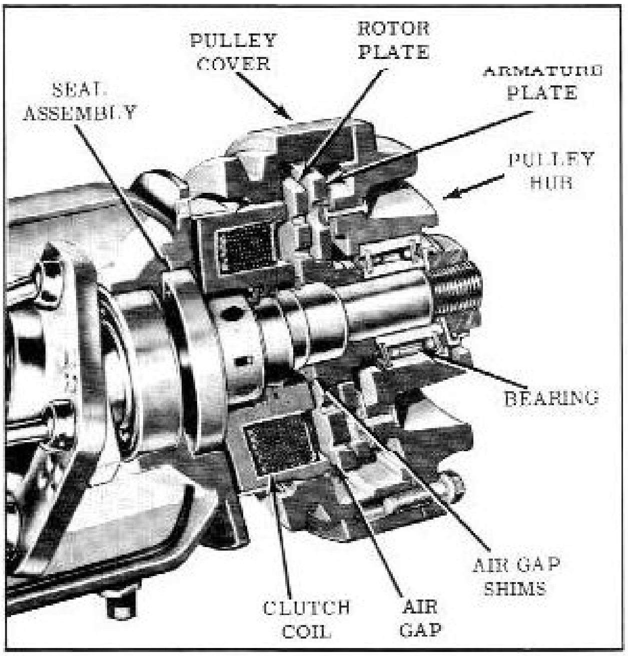


Fig. 14-23 Compressor Clutch

between the clutch plate and the coil housing should be checked before the assembly is removed. Refer to "CLUTCH AIR GAP CHECKING".

1. Energize compressor clutch coil long enough to permit removal of the compressor shaft nut after straightening lock tangs.

   NOTE: Energize clutch coil by disconnecting coil wire at connector on compressor, then connect a jumper wire from known 12 volt source to coil wire. Remove nut and lock from the compressor shaft.

2. Remove 6 pulley hub to clutch cover bolts, using Tool J-8433 to remove hub assembly. (Fig. 14-25)

   NOTE: Scoring of the armature plate and rotor plate is normal and these parts must not be replaced for this condition. (Fig. 14-24)

Clutch Rotor Plate and Pulley Cover Removal

1. Remove clutch pulley hub assembly. (Fig. 14-25)

2. Thread Tool J 6322 onto hub of rotor plate. While holding the tool with a wrench, tighten the tool bolt to remove clutch rotor plate. (Fig. 14-26)

   Remove Tool J-6322 from the rotor plate hub.

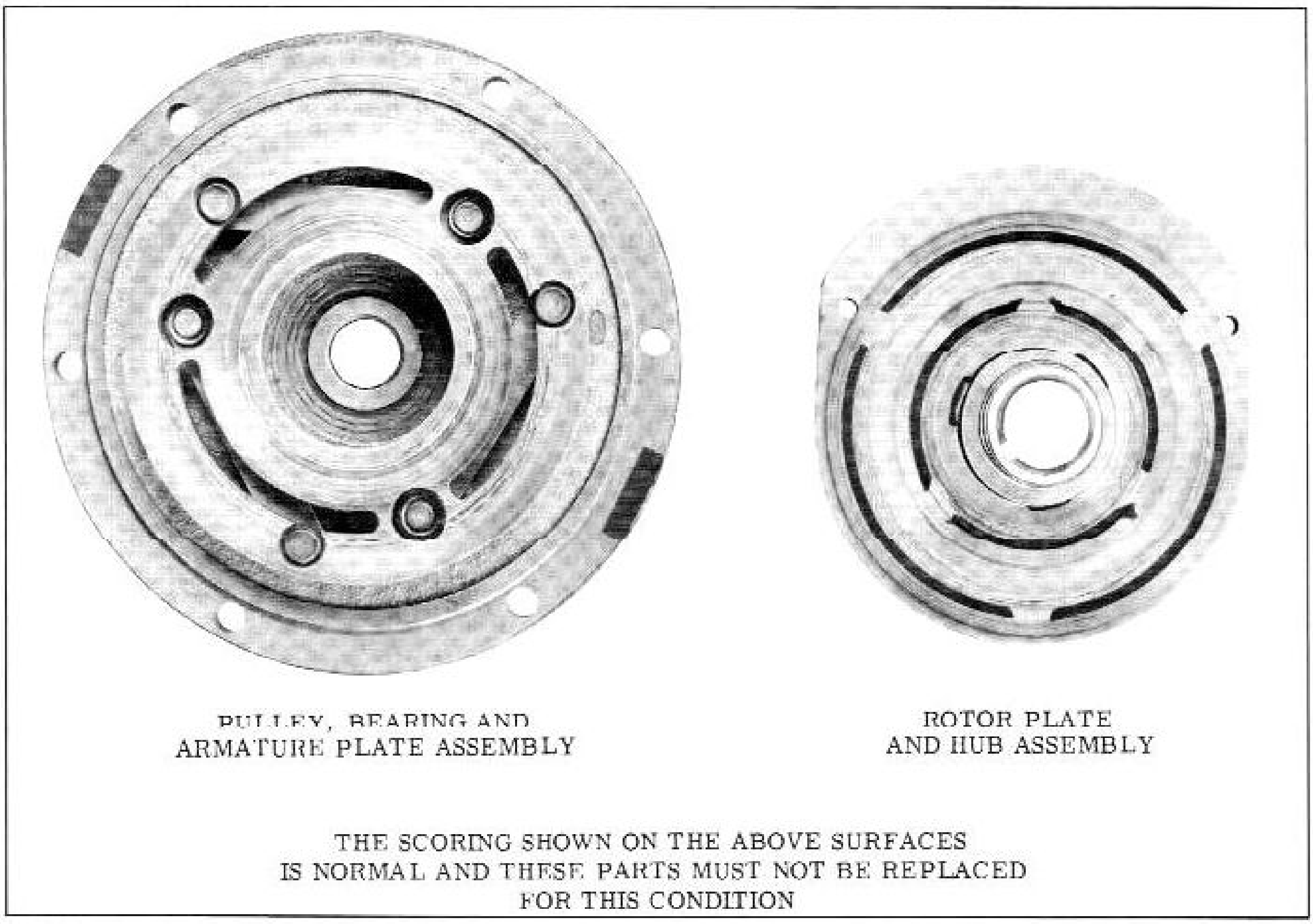


Fig. 14-24 Armature & Rotor Plate Normal Wear

3. Remove pulley cover.

4. If selective shims or spacer are to be removed, remove the Woodruff key.

Clutch Rotor Plate Installation

1. With spacer, shims, pulley cover and Woodruff key installed, position clutch rotor plate and hub over Woodruff key on compressor shaft. (Threaded end of hub facing away from compressor.)

2. If Tool J-6323 is to be used, place Spacer J-6323-5 on the compressor shaft with the chamfered side facing the clutch rotor plate.

3. Thread the bolt of Tool J-6323 or J-8446 (without spacer) onto the compressor shaft and, while holding the bolt, turn the nut counterclockwise until the rotor plate and hub seats against the spacer and shims. (Fig. 14-27) Remove the tool(s).

4. Install 6 clutch pulley cover to hub attaching bolts. Do not tighten bolts; but leave bolts loose enough to position the pulley cover approximately 1/8" to the rear. With the pulley in this position, insert feeler gauge (Tool J-9228) through access hole and into air gap. The air gap is correct when the .022" gauge will enter the air gap and when the .037" gauge will not enter the air gap. If air gap is not within these specifications, add or subtract shims as necessary to correct.

5. Tighten 6 clutch pulley cover to hub bolts.

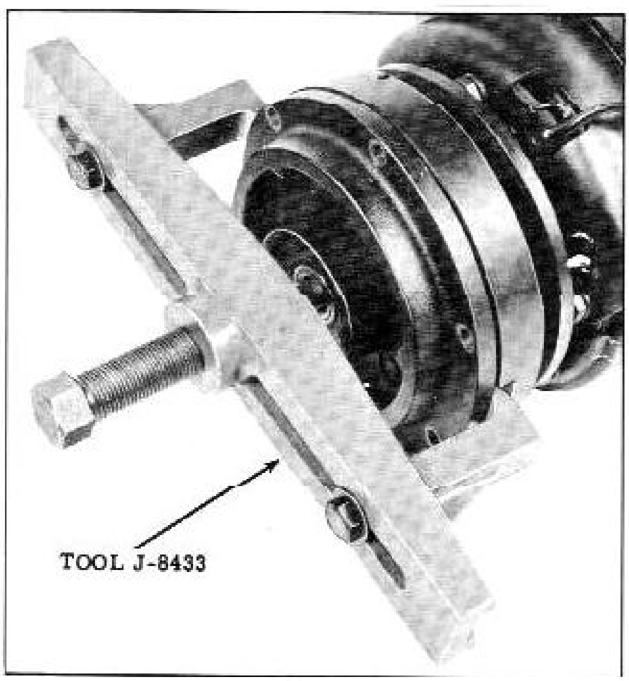


Fig. 14-25 Removing Clutch Pulley Hub

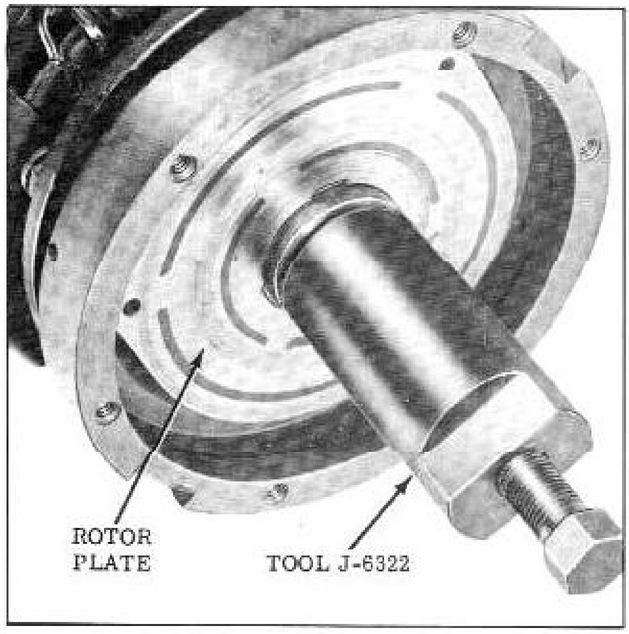


Fig. 14-26 Removing Clutch Rotor Plate

Clutch Pulley Hub and Armature Plate Assembly Installation

1. With pulley cover in place start pulley hub on compressor shaft. Place Spacer J-6323-5 over the tool bolt with the chamfered side away from the tool if using Tool J-6323. Thread bolt of Tool J-6323 or J-8446 (without spacer) onto compressor shaft. While holding the tool bolt, turn the tool nut counterclockwise to press the pulley hub onto the compressor shaft. (Fig. 14-28) Remove tool(s).

2. Install lock with tang facing in and nut on compressor shaft. (Do not torque at this time.)

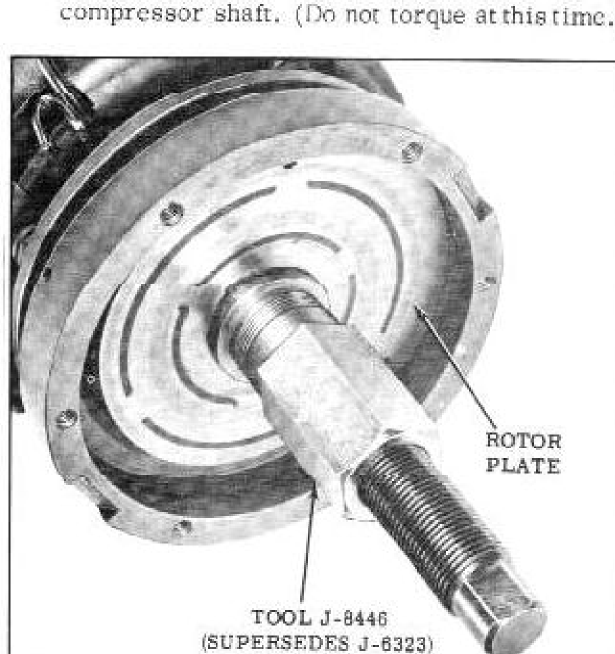


Fig. 14-27 Installing Clutch Rotor Plate

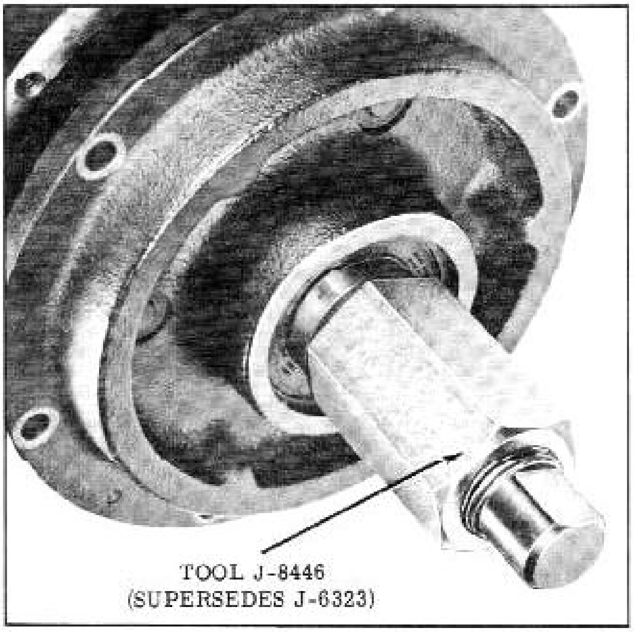


Fig. 14-28 Installing Pulley Hub

3. With the clutch coil energized, torque the compressor shaft nut 5 to 7 ft. lbs.

4. Install clutch pulley cover and 6 attaching bolts.

5. Install and adjust compressor belt using Tool BT-33-70.

PULLEY BEARING

Removal

1. Remove pulley and hub assembly.

2. Remove bearing retainer ring from groove in pulley cavity using No. 3 Truarc Pliers.

3. Remove bearing from pulley hub.

   NOTE: If pulley hub shows evidence of wear due to outer race of bearing rotating in hub, replace pulley hub.

Installation

1. Install new bearing into pulley hub by pressing on outer race of bearing.

2. Install retainer ring (chamfer out), then install pulley and hub assembly on compressor shaft.

CLUTCH ACTUATING COIL

Removal

1. Remove 6 pulley hub to clutch cover bolts.

2. Remove the pulley hub assembly.

3. Remove clutch rotor plate from compressor shaft and remove clutch pulley cover.

4. Remove the coil retainer pins, retainer and insulator.

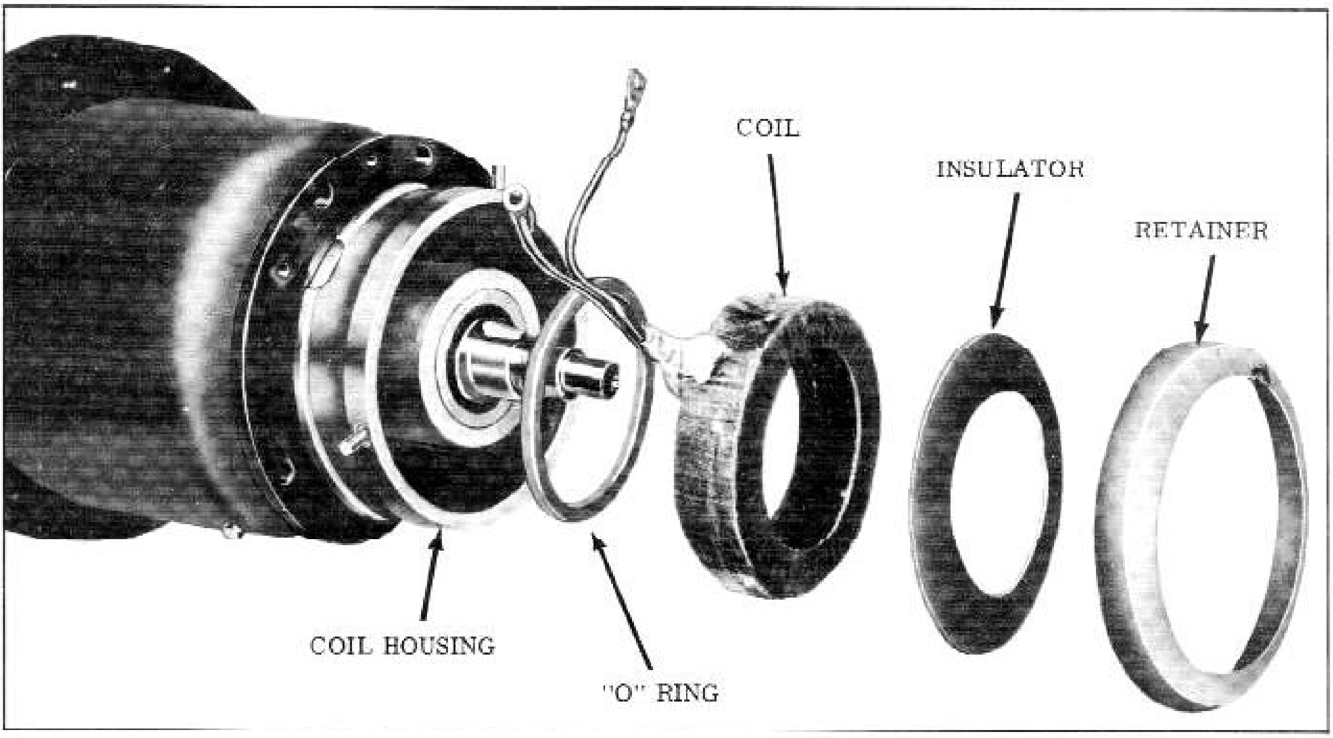


Fig. 14-29 Clutch Actuating Coil

5. Disconnect the lead-in wire and remove the ground wire screw and synthetic resin around wire in the opening. (Fig. 14-29)
6. Remove the coil and insulator from coil housing taking care not to damage the coil.
7. Inspect insulators and replace if damaged.

Installation

1. Route coil leads through opening in coil housing and install coil and synthetic resin around wire in the opening.
2. Connect ground wire.
3. Install paper insulator with the dished side toward the coil.
4. Install coil retainer over coil insulator with dished side toward coil and press firmly in place while installing the 3 retainer pins.
5. Position clutch pulley cover on shaft.
6. Install clutch rotor plate and hub on shaft over Woodruff key.
7. Install the pulley hub assembly. Install pulley lock washer and nut. Energize clutch coil by connecting lead to 12 volt source. Tighten pulley nut 5 to 7 ft. lbs. of torque. Disconnect the coil wire from the 12 volt source and reconnect coil wire to harness connector.
8. Install 6 pulley hub to pulley cover attaching bolts but do not tighten.
9. With the pulley cover positioned approximately 1/8" rearward, check the air gap between the clutch rotor plate and the coil seal housing using Tool J-9228 as outlined under "CLUTCH AIR GAP CHECKING".
10. Tighten the 6 pulley hub to pulley cover bolts.

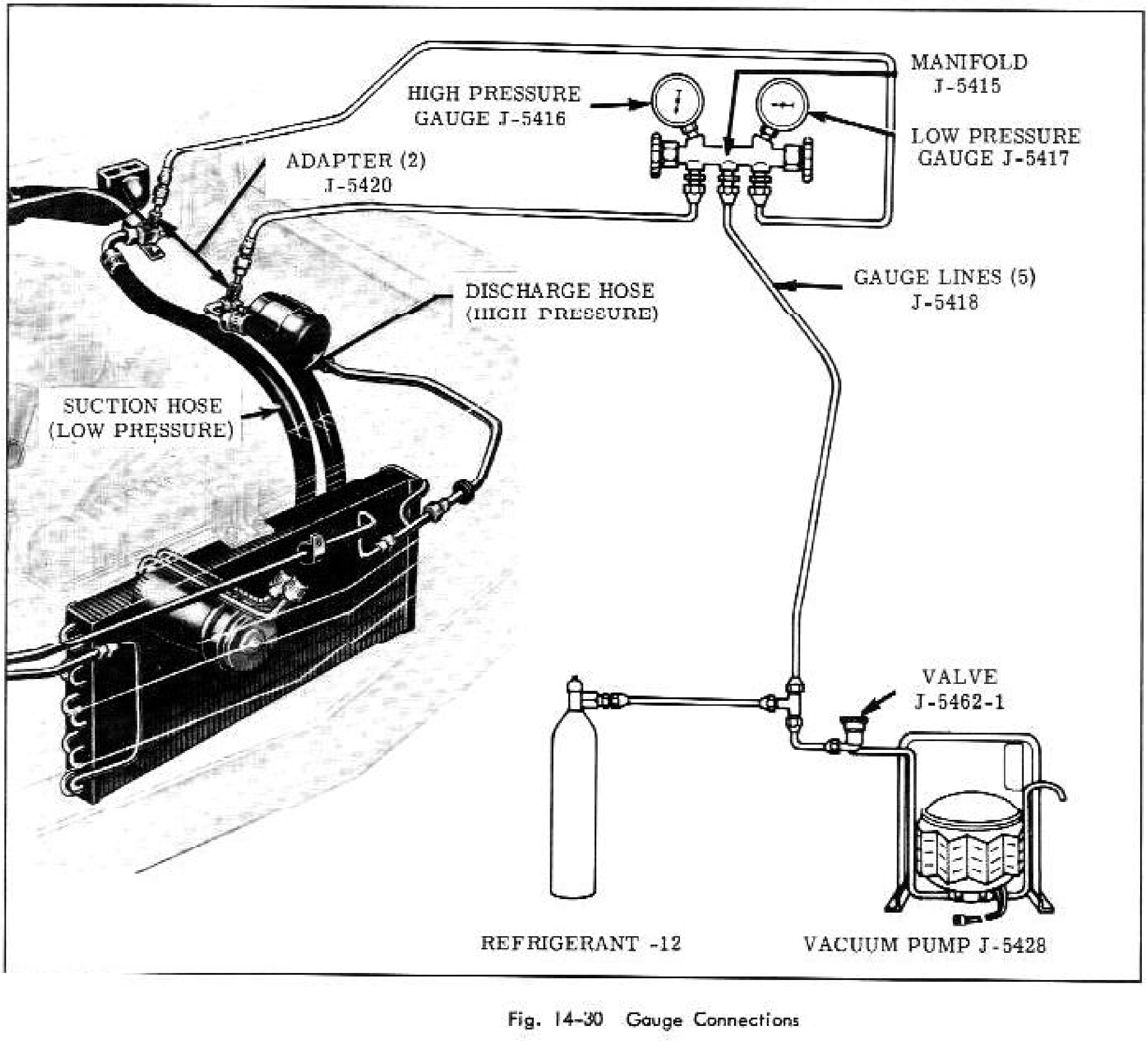


Fig. 14-30 Gauge Connections

SERVICING OF THE REFRIGERATION SYSTEM

In removing and replacing any part in the refrigeration system except the compressor, the following operations must be performed.

1. Purge 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 2 pounds and 8 ounces of refrigerant 12.

PURGING THE SYSTEM

1. With the engine stopped, remove protective caps from compressor high and low pressure hand shut-off valves. (Fig. 14-30)
2. Make sure both valves are turned fully counterclockwise; this is to assure that gauge outlets are closed.
3. Remove caps from both gauge outlets.
4. Crack open (turn clockwise) high and low pressure hand shut-off valves and allow refrigerant to escape from the system.

   CAUTION: Do not open valves beyond cracking point or compressor oil may be discharged with the refrigerant.

The complete system has now been purged of refrigerant and any part in the refrigeration system can be replaced.

EVACUATING THE SYSTEM WITHOUT USING VACUUM PUMP (VACUUM PUMP RECOMMENDED)

1. Have gauge set and refrigerant drum connected as shown in Fig. 14-31.

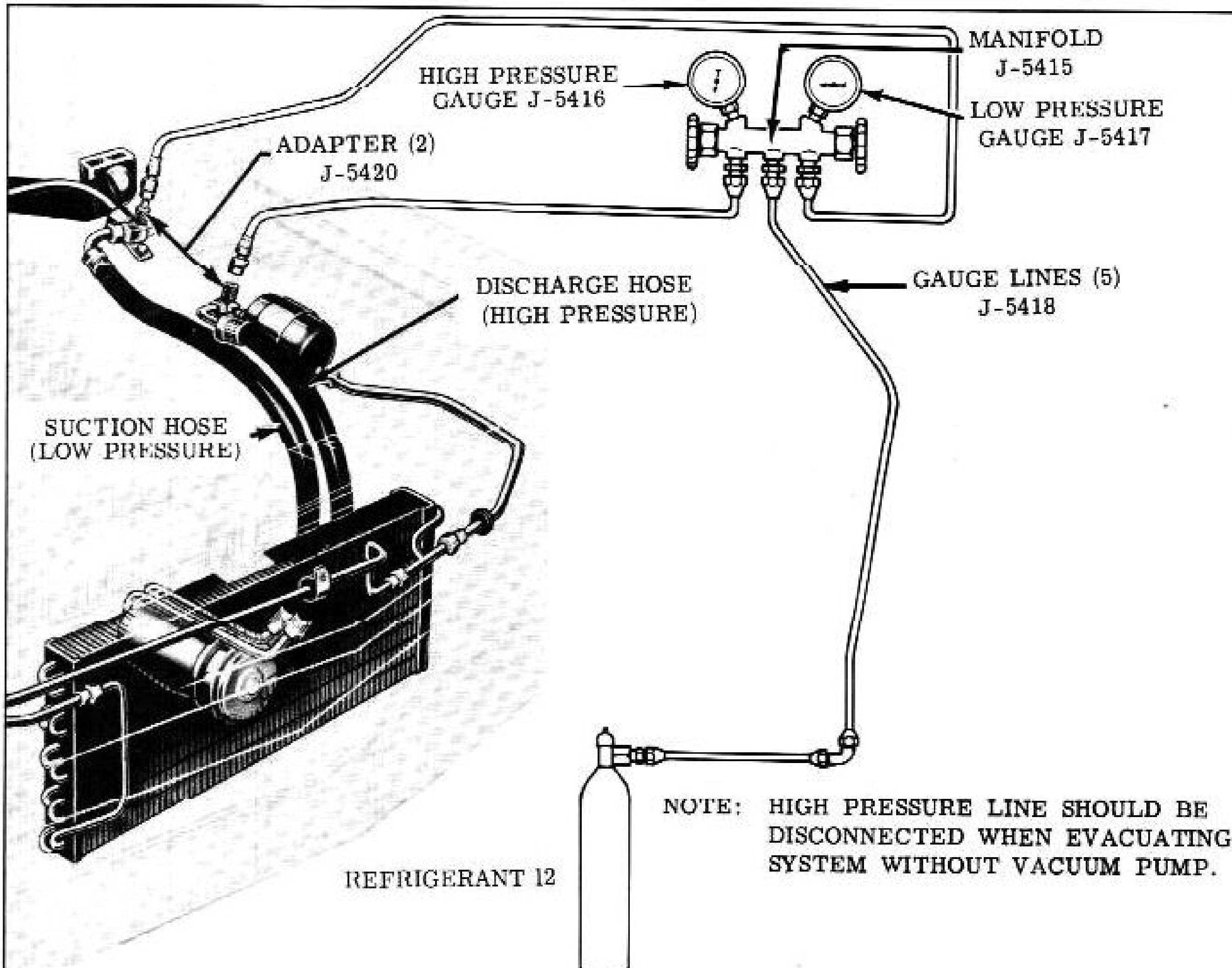


Fig. 14-31 Evacuating System without Vacuum Pump

2. Turn high pressure hand shut-off valve fully clockwise. Turn low pressure hand shut-off valve fully counterclockwise, then two turns clockwise. Replace end caps and tighten.

   CAUTION: Leave high pressure gauge outlet cap off.

3. Close high pressure gauge valve and open low pressure gauge valve.

4. Set refrigeration temperature control lever fully to the right and depress high button, start engine and allow to run at slow idle to obtain a vacuum of 28" for 5 minutes.

   NOTE: Position a container to receive any oil discharged from the high pressure gauge outlet so that an equivalent amount of new oil can be added.

5. While engine is running, install cap on compressor high pressure gauge outlet.

6. Stop engine and observe if 28" vacuum will hold for 3 minutes.

7. Open valve on refrigerant drum and allow system to charge up to drum pressure; then close valve on refrigerant drum.

8. Again purge the system through the high pressure gauge outlet, by removing gauge outlet cap. After system is purged, start the engine. Allow to run at slow idle to obtain a vacuum of 28" for 5 minutes.

9. While engine is running, install cap on high pressure gauge outlet, then stop the engine.

   NOTE: This second evacuation is to eliminate any air or moisture that might have remained in the system.

10. Place refrigerant drum on scales and weigh accurately. This is to determine amount of refrigerant used to bring the system up to drum pressure and to complete the full charge of refrigerant. Set drum in a pail of water at not more than 125°F. if desired. (If pail of water is used, weigh it with refrigerant drum.)

11. Open valve on refrigerant drum to charge system to drum pressure.

12. Turn high pressure hand shut-off valve fully counterclockwise and remove gauge outlet cap.

13. Crack open high pressure hand shut-off valve to purge outlet, crack open high pressure gauge to valve to purge hose, and connect hose high pressure valve while purging.

14. Turn high pressure hand shut-off valve clockwise two turns, then close high pressure gauge valve.

The system is now ready for charging.

CHARGING THE SYSTEM WITH REFRIGERANT

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 valve on the refrigerant drum is closed; then proceed as follows:

1. Open valve on refrigerant drum to allow refrigerant to enter the system. Start the engine and operate at fast idle with the temperature control fully to the right and the button depressed. Close low pressure valve in gauge set at frequent intervals to be certain pressure in the low side is always maintained above 5 p.s.i.

2. When 2 lbs. 8 ozs. of refrigerant has entered the system, close the refrigerant drum valve and the low pressure gauge valve.

3. Turn both hand shut-off valves fully counterclockwise, remove the gauge set, and replace caps on hand shut-off valves and gauge fittings.

BY-PASS VALVE

NOTE: When leak testing, be sure the cover attaching screws and the mounting bracket attaching screws are tight. Also, a small leak at the By-Pass Valve adjusting screw is normal after the lever has been moved, and will not require a new parts kit installation.

Disassembly

1. Remove valve assembly from car for bench disassembly of unit.

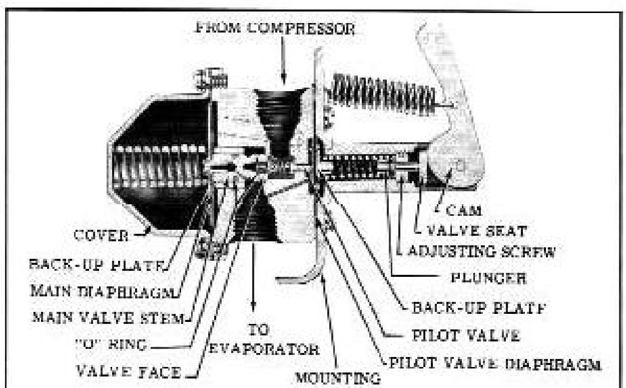


Fig. 14-32 "Hot Gas" By-Pass Valve

2. With unit on bench, remove counter balance springs, retainer, pin, lever, and molded spacer from mounting bracket. (Fig. 14-32)

3. Using Tool J-6389, remove the adjusting screw from mounting bracket.

4. Remove plunger, shim washers, and adjusting spring from mounting bracket.

5. Mark both mounting bracket and valve body with a scribed line or center punch to assure same reassembly of units.

6. Remove the 4 attaching screws and lock washers, mounting bracket, back-up plate, and pilot diaphragms.

7. Remove 6 cover attaching screws. (Use caution, cover is under spring tension.)

8. Remove cover, main valve spring, main valve and diaphragm assembly, pilot valve spring and pilot valve.

9. Thoroughly clean valve body with cleaning solvent and blow out all passages with dry air.

Assembly

1. Apply compressor oil to valve end of main valve and diaphragm assembly. Be sure "O" ring seal on main valve is lubricated.

2. Place new pilot valve spring in hollow end of Tool J-6389 and then place the new nylon pilot valve into end of spring. Hold valve body with flange facing down and insert pilot valve and spring into valve body bore. Be sure nylon tip is extending out of hole in valve body. Install main valve and diaphragm assembly into bore. Be sure screw head on main valve enters pilot valve spring. This can be determined by viewing through line connection opening in valve body.

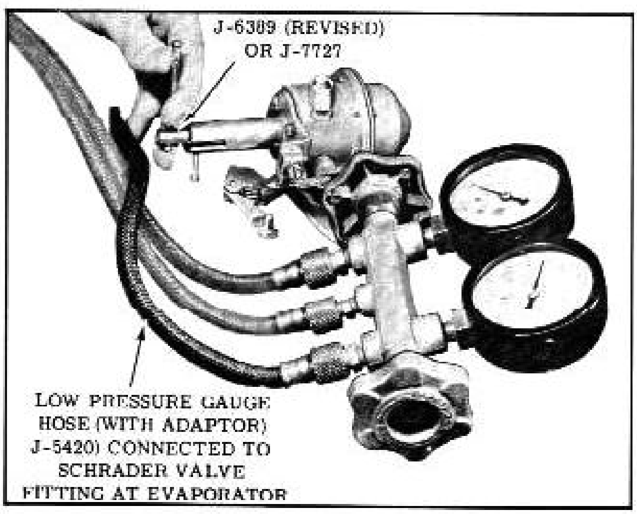


Fig. 14-33 "Hot Gas" By-Pass Valve Adjustment

3. Place main valve spring on top of main valve diaphragm and the cover over the main valve spring.

4. Align holes in main diaphragm, valve body and cover and install 6 attaching screws and lock washers, tighten evenly.

5. Place diaphragm cup, with flange toward main valve body, over end of nylon pilot valve stem that protrudes from valve body.

6. Place new pilot diaphragm over diaphragm cup and align the 4 holes in diaphragm with screw holes in valve body.

7. Place back-up plate next to pilot diaphragm, then place mounting bracket into position by matching up alignment marks and attach with the 4 screws and lock washers.

8. Place shim washers over the large diameter of the plunger and place adjusting spring next to the shim washers. Insert this assembly into the threaded cavity of the mounting bracket.

9. Install adjusting screw into threaded cavity in mounting bracket.

NOTE: Before installing lever and counter balance spring, the valve requires adjustment with the by-pass valve mounted on the car.

10. Install valve, then evacuate and charge the refrigeration system.

11. Adjust by-pass valve as outlined under "BY-PASS VALVE ADJUSTMENT".

NOTE: If the adjusting screw travels out of range before the proper adjustment it will be necessary to remove or add shim washers as necessary.

12. Adjust the cable as outlined under "BY-PASS VALVE CABLE ADJUSTMENT".

BY-PASS VALVE ADJUSTMENT

The "Hot Gas" by-pass valve is adjusted to regulate evaporator pressure so that it will not fall below 23.5 to 24.5 p.s.i. If it controls below 23.5 p.s.i., 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 and will be especially noticeable in extremely hot weather. This is because for each pound in pressure higher than 24.5 p.s.i., the discharge air temperature will be raised one degree. The controlling pressure of the valve can be checked and adjusted as follows:

1. Remove the Schrader valve fitting cap at low pressure line near evaporator.

2. Install Adapter J-5420 on the low pressure gauge hose, and connect the adapter to the Schrader valve fitting on the evaporator.

3. Purge the gauge and hose by opening low pressure gauge valve for a few seconds.

4. Start engine and allow to run at 2000 r.p.m. Move temperature control lever to the extreme right position, turn blower speed on "LOW".

5. Place paper in front of condenser to obtain a head pressure of 200 p.s.i.

6. Observe pressure gauge and adjust valve only if pressure is not 23.5 to 24.5 p.s.i. (Fig. 14-33)

   NOTE: If necessary to adjust the valve pressure setting, the control cable and the lever and cam will have to be disconnected from the by-pass valve in order to insert Tool J-6389 (revised) or Tool J-7727 into the valve. (Fig. 14-32) After the valve pressure has been adjusted to 24 p.s.i., the control cable adjustment will have to be made. (Refer to "BY-PASS CONTROL CABLE ADJUSTMENT".)

7. Turn adjusting screw clockwise to increase pressure; counterclockwise to decrease pressure.

8. Turn engine off, remove gauge hose from Schrader valve fitting.

9. Install Schrader valve fitting cap.

EVAPORATOR CASE ASSEMBLY

NOTE: The expansion valve cannot be reached without removing the evaporator assembly from the case.

Removal

1. Purge refrigeration system as outlined under "PURGING THE SYSTEM".

2. Disconnect hot gas by-pass valve cable at valve. Disconnect wiring from fuse panel, blower, and compressor clutch.

3. Disconnect left hand outlet duct from case. Remove right hand and left hand rear bracket to case screws. Remove 2 front case bracket to instrument panel screws. Lower case assembly and pull out from under instrument panel to gain access to lines.

4. Disconnect high pressure line and low pressure lines at back of evaporator case. (Fig. 14-35) Tape fittings to prevent entrance of dirt and moisture. Pull by-pass valve control cable through toe pan grommet.

5. Remove control panel attaching screws. Remove 8 screws from evaporator case then remove upper section of case.

6. Remove evaporator housing bolts, nuts and washers, then remove evaporator from housing.

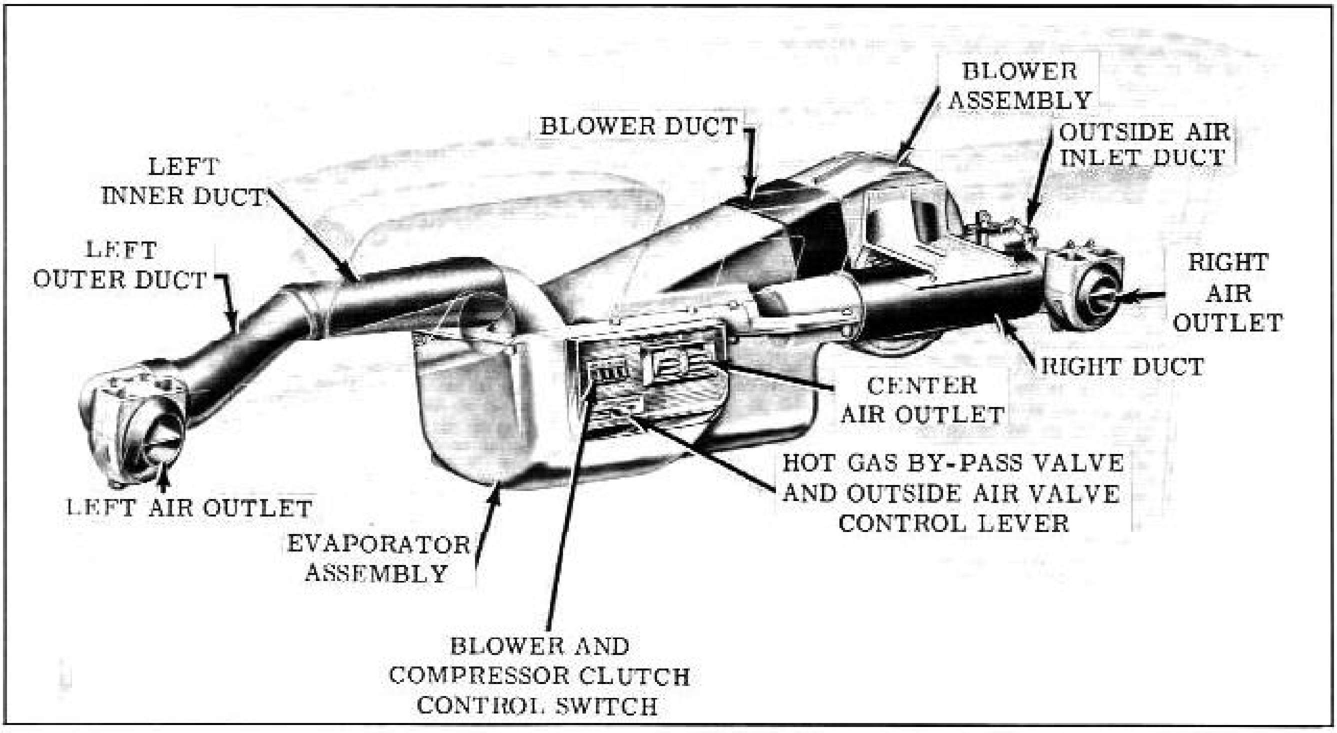


Fig. 14-34 Evaporator Case & Distributor Assembly

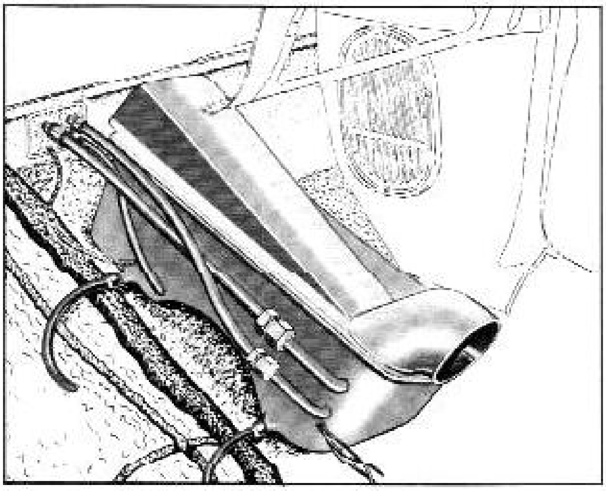


Fig. 14-35 Evaporator Case Ass'y.

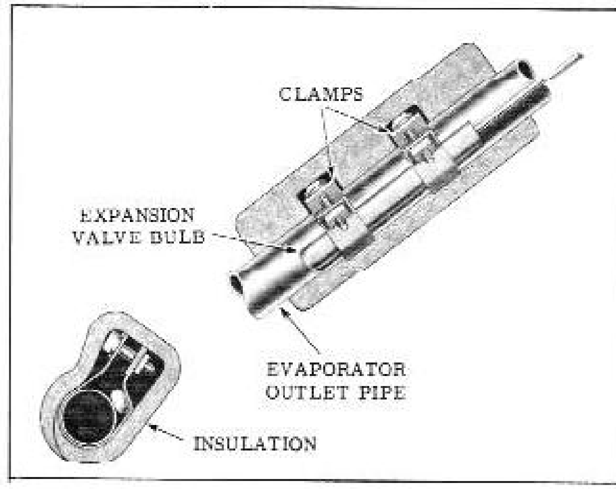


Fig. 14-36 Expansion Valve Bulb

7. If necessary to service expansion valve, remove expansion valve from evaporator by loosening the line fitting and removing the capillary bulb clamps. (Fig. 14-36)

Installation

1. With rubber gasket cemented to evaporator, position the evaporator assembly in case and install attaching screws.

2. Place upper section of case in position, then install 8 attaching screws.

3. Remove caps and tape from lines, oil the fittings with Frigidaire 1000 oil, then connect the lines to the evaporator pipes.

4. Position case assembly under instrument panel connecting right hand duct. Install 2 front bracket to instrument panel screws. Install right hand and left hand rear bracket to case screws. Reconnect left hand duct to case. Reroute by-pass valve cable to valve and reconnect. Reseal grommet at evaporator case where the rubber hose exits from case on R.H. side.

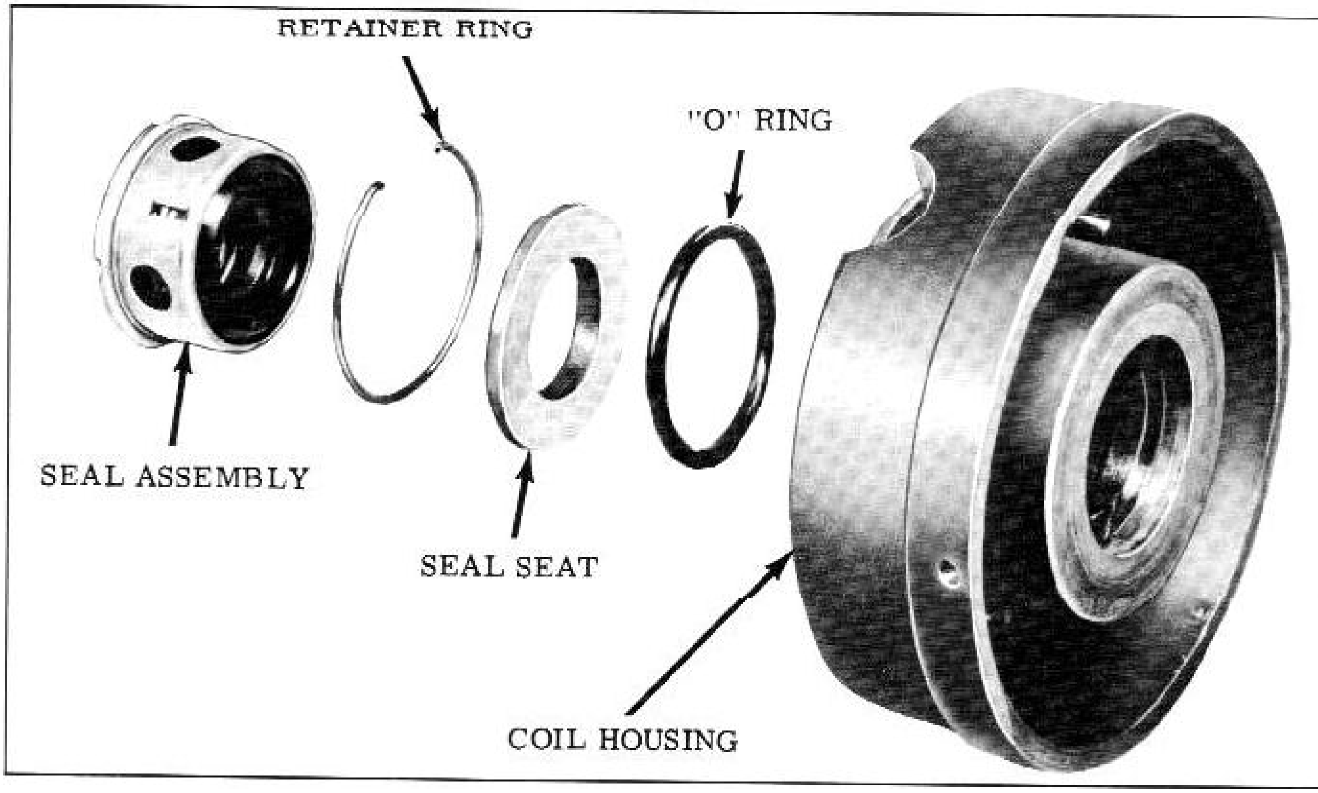


Fig. 14-37 Compressor Seal Assembly

5. Evacuate the system as outlined under "EVACUATING THE SYSTEM".

6. Charge the system as outlined under "CHARGING THE SYSTEM".

7. Leak test all line fittings that were disconnected. Refer to "LEAK DETECTOR".

COMPRESSOR SEAL AND OIL PUMP

Removal

1. Remove caps from high and low pressure hand shut-off valves.

2. Turn both hand shut-off valves fully clockwise to close the system and open pressure gauge outlets.

3. Crack open high pressure gauge outlet cap and allow refrigerant to purge until "hiss" is no longer heard.

4. Remove clutch coil. Refer to "CLUTCH PULLEY HUB AND ARMATURE PLATE ASSEMBLY REMOVAL", and "CLUTCH ROTOR PLATE REMOVAL", and "CLUTCH ACTUATING COIL REMOVAL". Remove Woodruff key and shims.

5. Remove the 6 screws and pull the coil housing from the compressor.

   NOTE: To aid in removal of screws, a No. 3 Phillips head socket should be used. Tapping socket head lightly before applying torque to screws will also aid in their removal.

6. Remove seal assembly from compressor shaft. (Fig. 14-37)

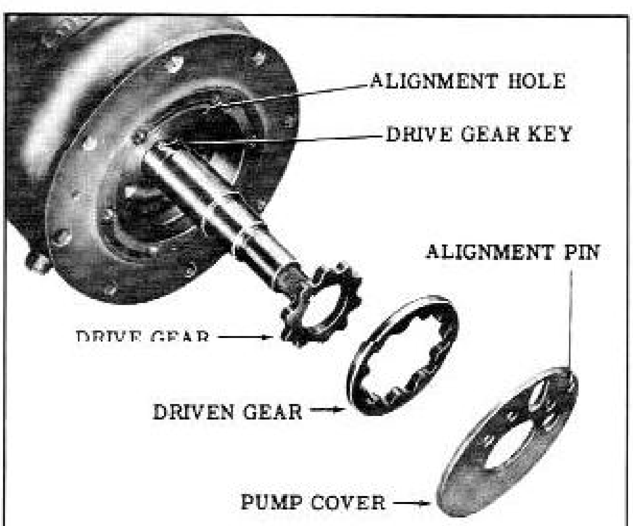


Fig. 14-38 Oil Pump Assembly

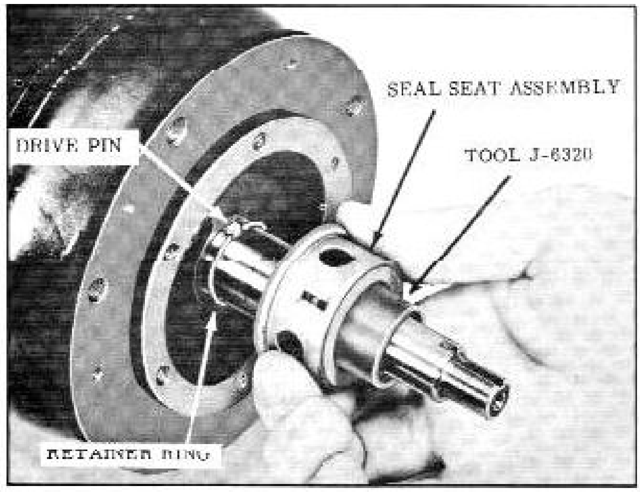


Fig. 14-39 Installing Seal

7. From the compressor side of the coil housing remove the snap ring, seal seat, and "O" ring.

8. Remove oil pump plate and gears for inspection. (Fig. 14-38)

Cleaning and Inspection of Parts

Thoroughly clean and seal cavity and shaft with wiping tissues furnished in the seal package. DO NOT touch or mar the contacting face of the new seal or seal seat with hands or tools since this may damage the seal. All seals and "O" rings must be replaced with new parts. Inspect oil pump gears for scoring and excessive wear. Replace gears if damaged.

Installation

1. Lubricate pump gears with Frigidaire 1000 Viscosity oil and install as shown in Fig. 14-39.

2. Flush the coil housing seal cavity with Frigidaire Oil No. 1000.

3. Install wave washer in recess of compressor flange.

4. Install Tool J-6320 on the compressor shaft with the tapered end toward the front of the shaft. Align the seal drive pin and rotate the retaining ring to contact the pin to hold it in place.

5. Coat the entire seal assembly with Frigidaire Oil and install the seal assembly, making sure the drive pin engages the keyway in the seal. Remove Tool J-6320.

6. Install the "O" ring into the seal cavity of the coil housing.

7. Coat the seal seat with Frigidaire Oil and place into seal cavity with small diameter out so that it will face the compressor.

   CAUTION: Do not touch sealing surface.

8. Install seal seat retaining ring into seal cavity, being extremely careful not to mar sealing surface.

9. Install the coil housing with the wire opening positioned between the tapped holes for ground wire and hold-down clamp.

10. Start the 6 coil housing screws and tighten evenly to 15 ft. lbs. of torque.

11. Install coil rotor plate, and pulley. (Refer to "CLUTCH ACTUATING COIL INSTALLATION", "ROTOR PLATE INSTALLATION", and "PULLEY INSTALLATION".)

12. Connect gauge set as shown in Fig. 14-40. Be sure the hand shut-off valve caps are replaced after the gauge set is connected.

13. Remove cap from the high pressure gauge outlet, close high pressure gauge valve, and open low pressure gauge valve.

14. Start engine and allow to run at slow idle. Move temperature control lever fully to the right. Position a container to receive any oil discharge from the high pressure gauge outlet so that an equivalent amount of new oil can be added.

15. Allow engine to run until 28" of vacuum has been maintained for 5 minutes.

16. While engine is running, install cap on the high pressure gauge outlet and stop the engine. Observe if 28" vacuum will hold for 3 minutes.

   NOTE: If vacuum does not hold, charge system with drum pressure and check for leaks.

17. Open valve on refrigerant drum and allow compressor to come up to drum pressure, then close valve.

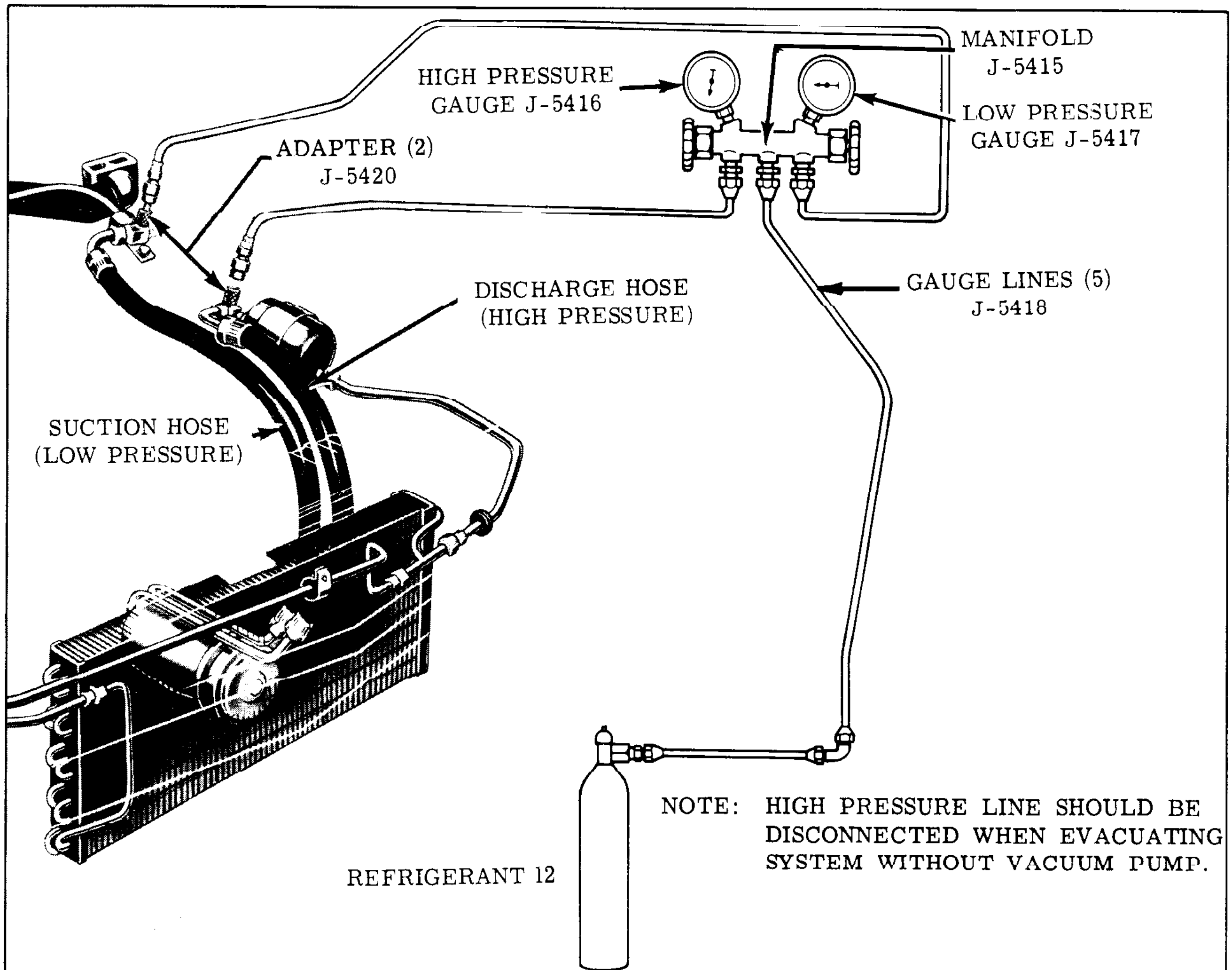


Fig. 14-40 Evacuating System without Vacuum Pump

18. Purge the compressor again through the high pressure gauge outlet, then remove the cap from the gauge outlet and start the engine. Allow to run at idle until 28" of vacuum has been maintained for 5 minutes, then install cap on the high pressure gauge outlet and stop the engine.

19. Open valve on refrigerant drum to charge compressor, then momentarily crack open the high pressure gauge outlet cap to purge the air remaining in the high pressure side of the compressor.

20. Remove the high pressure hand shut-off valve cap, then turn valve fully counterclockwise, and remove the cap from the high pressure gauge outlet.

21. Crack open the high pressure hand shut-off valve to allow refrigerant to purge slowly from gauge outlet; then crack open high pressure gauge hose and connect hose to gauge outlet and tighten.

22. Close valves on refrigerant drum and high pressure gauge.

23. Turn the high pressure hand shut-off valve two turns clockwise. Turn the low pressure hand shut-off valve fully counterclockwise, then two turns clockwise.

24. Check the system as outlined under "ADDING REFRIGERANT - PARTIAL CHARGE". If it is necessary to add refrigerant, omit steps 1 through 7 of the procedure for adding refrigerant, since the gauge set on the refrigerant drum is already connected.

MALFUNCTIONING COMPRESSOR

A new compressor does not have the clutch actuating coil parts, the pulley clutch parts, or the line fittings assembly. A service shipping plate is bolted over 2 "O" rings to seal the line port openings. The 2 "O" rings under the shipping plate should be transferred to the old assembly and 2 new "O" rings used when installing the compressor in the car. A new compressor is charged with 13 ounces of Frigidaire 1000 Viscosity oil, and a mixture of Refrigerant 12 and nitrogen under approximately 5 p.s.i. pressure. Envelopes attached to the compressor contain enough shims to insure a sufficient number of shims for the compressor clutch adjustments.

Removal

1. Remove protective caps from the high and low pressure hand shut-off valves.

2. Turn both hand shut-off valves two turns clockwise to open the gauge outlets.

3. Crack open the high pressure gauge outlet cap and allow refrigerant to purge from system until "hiss" is no longer heard; then turn both hand shut-off valves fully clockwise.

NOTE: When an air conditioning failure is due to a malfunctioning compressor it will be necessary to purge the system to remove foreign materials from the system. However, it will not be necessary to purge the entire system when a compressor clutch failure is encountered.

4. Disconnect clutch coil wire at harness connector, then connect a jumper wire from a known 12 volt source to the coil wire. Loosen the pulley nut, then disconnect jumper wire.

5. Remove the pulley nut and lock.

6. Remove the belts from the compressor pulley.

7. Remove the bolt holding the line manifold assembly to the compressor, then remove the assembly from the compressor.

8. Remove the rear compressor-to-support bolts. Remove the front compressor belt adjuster bolt and the front pivot bolt. Remove compressor from car. (Fig. 14-41)

9. Remove the pulley clutch and coil. (Refer to "PULLEY AND ROTOR PLATE REMOVAL AND CLUTCH ACTUATING COIL REMOVAL.")

Installation

1. Remove the protective covering from the shaft of the new compressor.

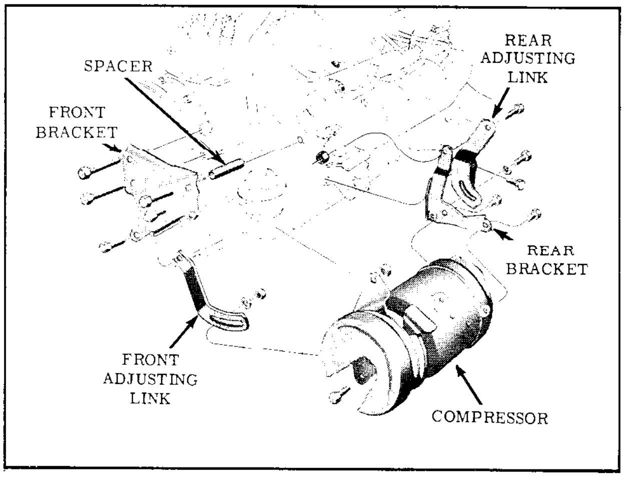


Fig. 14-41 Compressor Mounting Brackets

2. Install coil, clutch, and pulley. (Refer to "COIL INSTALLATION, and CLUTCH AND PULLEY INSTALLATION".)

3. Position the new compressor on the support plates, then install and tighten the compressor-to-support plate bolts to 15 ft. lbs. torque.

4. Connect a jumper wire from a known 12 volt source to the clutch coil wire.

5. Check clearance between clutch plate and coil housing as outlined under "CLUTCH AIR GAP CHECKING".

6. Remove jumper wire and install coil wire in harness connector.

7. Remove the shipping plate from the rear of the compressor, then remove the 2 "O" rings from the valve port openings, and install 2 new "O" rings.

8. Install the line manifold assembly on the compressor, then install the mounting bolt and tighten to 15 ft. lbs. torque.

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

10. Install a charging line to the high pressure gauge outlet and to a drum of Refrigerant 12.

11. Disconnect the liquid line from the dehydrator-filter-receiver assembly on the inlet side, and cap the dehydrator-filter-receiver immediately.

12. Turn the high pressure hand shut-off valve fully counterclockwise, then turn it back two turns clockwise.

13. 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.

14. Close the drum valve and connect the dehydrator-filter-receiver assembly.

15. Remove the expansion valve screen and clean or replace as necessary.

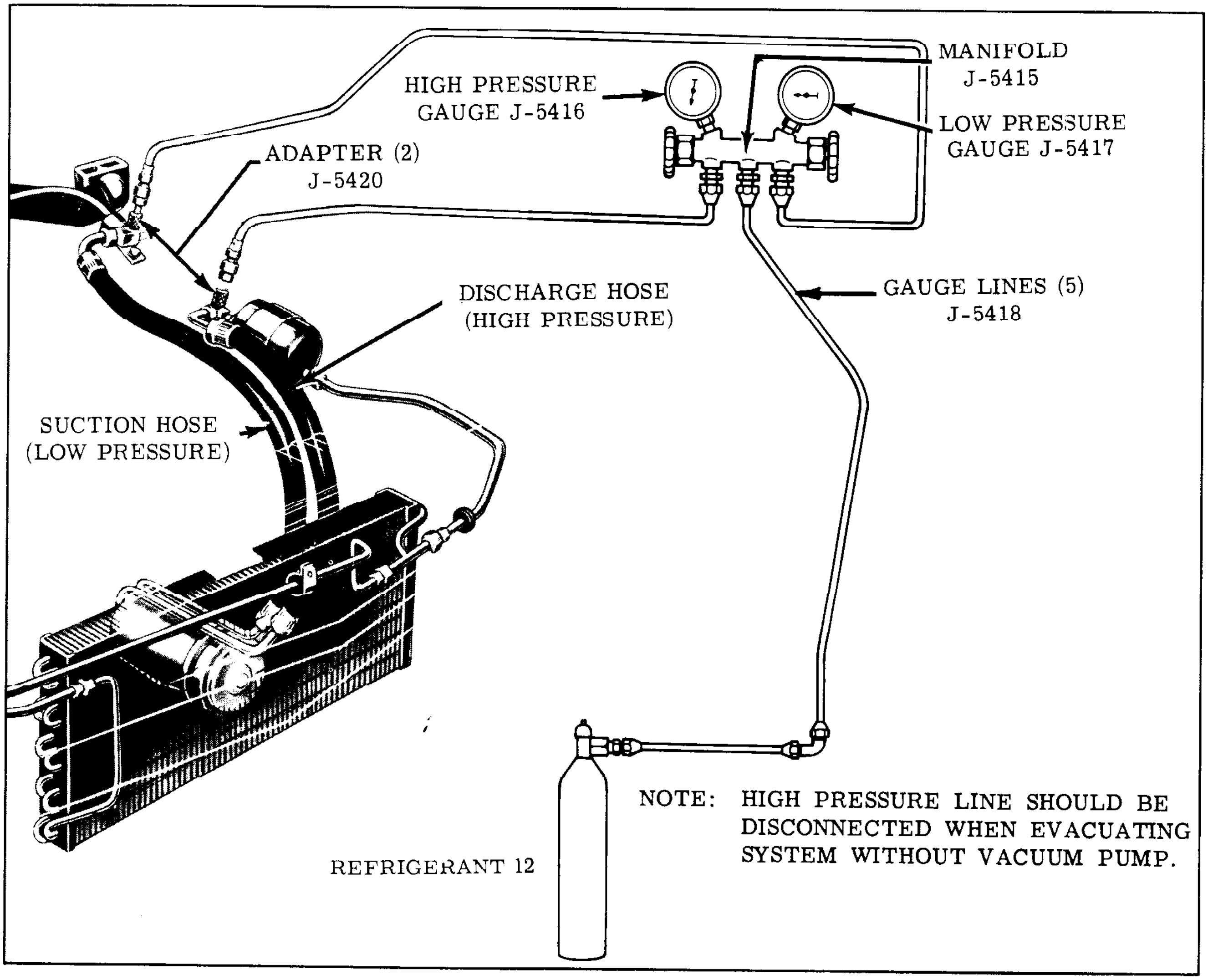


Fig. 14-42 Adding Refrigerant (Partial Charge)

16. Remove the charging line from the high pressure gauge outlet, install the gauge set, and evacuate the entire system as outlined under "EVACUATING THE SYSTEM".

17. Recharge the system as outlined under "CHARGING THE SYSTEM WITH REFRIGERANT - COMPLETE CHARGE".

ADDING REFRIGERANT—PARTIAL CHARGE

The proper charge of refrigerant to insure a clear sight glass under operating conditions at various ambient temperatures is 2 lbs. 8 ozs. Since less than 2 lbs. 8 ozs. 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 5 minutes before checking sight glass.

Ambient Temp. (Outside of Car)	Blower Switch Position	Temp. Control Setting	Engine RPM
70°- 80°	High	Fully to Right	1600
80°- 90°	Medium	Fully to Right	1600
90° or Above	Low	Fully to Right	1600

If the system is low on refrigerant, proceed as follows:

1. Turn off the ignition.
2. Remove both hand shut-off valve protective caps and make sure both valves are turned fully counterclockwise.
3. Remove both gauge outlet fitting caps and install the gauge hoses on the fittings. (Fig. 14-42)
4. Make sure both gauge valves are closed, then turn both hand shut-off valves two turns clockwise.
5. 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 fitting on the refrigerant container, connect the center hose to the refrigerant container.
6. Close the refrigerant container valve and both gauge valves.
7. Start the engine and set at 1600 r.p.m. Make sure the temperature control lever is fully to the right, and blower switch is set.
8. 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.
9. 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 lbs. of refrigerant after sight glass clears.
10. Shut off engine, turn both hand shut-off valves fully counterclockwise, remove gauge set, and install all protective caps.

CHECKING OIL LEVEL

If a refrigerant leak is found which indicates some loss of oil by the presence of oil around the leak, or if it is necessary to determine whether or not the compressor has a sufficient amount of oil, the following procedure should be used;

1. Start engine and operate at 1600 r.p.m. with temperature control lever fully to the right, for five minutes, then stop the engine.
2. Slowly open the oil test valve on the compressor and allow the first surge of oil and refrigerant to escape against a clean cloth. The refrigerant will evaporate, while the oil will saturate the cloth.

   NOTE: The first surge of oil may be only the amount of oil standing in the fitting. The valve should be held in the open position just long enough to be certain the oil level is at least to the top of the fitting.

3. If oil continues to escape with the refrigerant vapor, the oil level in the compressor is satisfactory.
4. If oil does not continue to escape from the test valve, the oil is below the minimum level.

ADDING OIL (Fig. 14-43)

1. Remove protective caps from high and low pressure hand shut-off valves and make sure valves are turned fully counterclockwise.
2. Remove plug from high pressure gauge outlet and connect high pressure gauge hose to system high pressure fitting.
3. Install plug in center hose on gauge set.
4. Turn high pressure hand shut-off valve two turns clockwise and replace protective cap.
5. Crack open the high pressure valve on the gauge manifold.

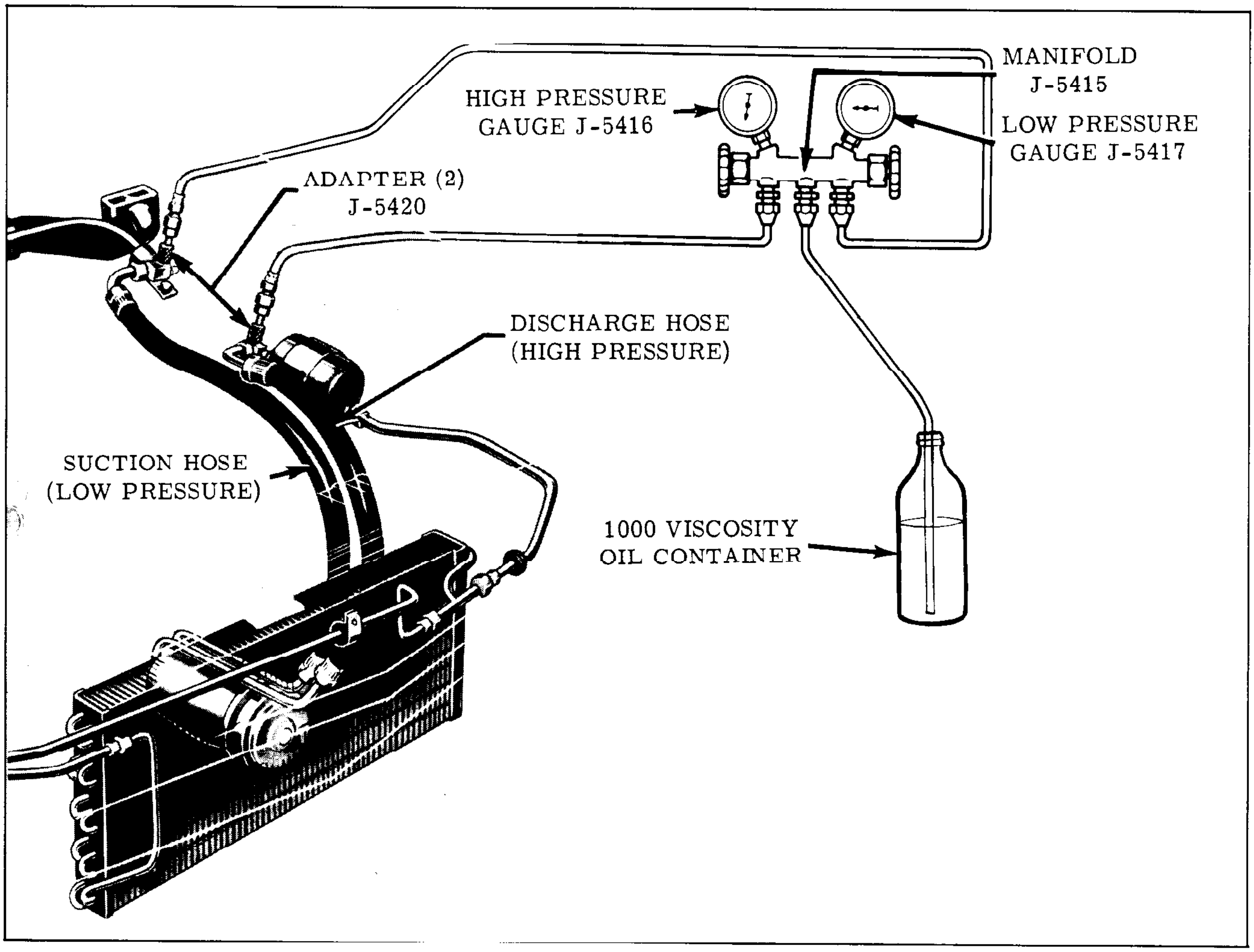


Fig. 14-43 Adding Oil

6. Crack open the low pressure valve on the gauge manifold to purge air from gauge set. While vapor is still escaping from the low pressure gauge line, connect to low pressure fitting on the system hand shut-off valve.

7. Close the high and low pressure valves on the gauge set.

8. Turn the low pressure hand shut-off valve fully clockwise.

9. Remove center hose on gauge set and install oil charging line.

   NOTE: Make certain oil line is clean. (Use a 1/4" x 10" copper tube with fitting to connect to center connection on gauge set.)

10. Crack open the high pressure valve on the gauge set to purge air from the oil charging line.

11. While vapor is still escaping from the oil charging line, uncap the oil bottle (Frigidaire 1000 Viscosity) and insert the oil line to the bottom of the oil bottle and allow vapor to slowly bubble through the oil.

12. Close high pressure valve on gauge set. Allow time for escaped vapor to dissipate. Leak test all connections that were made during repair.

13. Position the gauge set and oil charging line, while still inserted to the bottom of the oil bottle so that it will not be disturbed during the following procedure.

14. Move temperature control lever to extreme right position, depress "LOW" button, and start engine and allow to run at slow idle until approximately 10" vacuum is obtained.

15. Stop the engine and observe the low pressure gauge to see if the vacuum will hold. There should not be any fast change of gauge reading.

16. Open the low pressure valve on the gauge set and allow 2 ounces of oil to be drawn from the bottle.

17. Close the low pressure valve on the gauge set. Remove the oil charging line from the bottle and replace cap on bottle. Remove the oil charging line from the gauge set and install a cap on the center connection.

18. Open the high pressure valve on the gauge set.

19. Open the low pressure valve on the gauge set slowly to allow the high side pressure to force the oil remaining in the gauge set and low pressure gauge line into the compressor.

20. Close high and low pressure valves on the gauge set and then turn system low pressure valve fully counterclockwise and replace protective cap.

21. Start engine and operate at 1600 r.p.m. with temperature control lever fully to the right and "LOW" button depressed for 5 minutes, then stop engine.

22. Again open oil test valve and allow first surge of oil to escape against a clean cloth. If oil continues to escape the oil level is satisfactory. If oil does not come out after first surge, add another 2 ounces at a time, following previous procedure, until test indicates a sufficient amount has been added.

23. Remove end cap from high pressure hand shut-off valve and turn valve fully counterclockwise and replace end cap.

24. Remove gauge lines and replace caps on gauge lines and on system valves.

CHECKING AND ADDING OIL AFTER MAJOR LOSS

The compressor was originally charged with 13 ounces of Frigidaire 1000 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. To determine if the compressor has sufficient oil, and oil test valve has been placed on the underside of the compressor body. 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 coil electrical lead (black wire).

2. Remove protective caps from hand shut-off valves and turn valves fully clockwise. Remove pipe adapter plate from compressor by removing center bolt.

3. Remove compressor mounting bolts.

4. Transfer compressor to bench and loosen the oil drain screw.

5. 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 "INSTALLING A NEW COMPRESSOR".

6. 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, 13 ounces of NEW Frigidaire 1000 Viscosity Oil into the compressor.

7. Tighten the oil drain screw.

8. Install compressor and generator on the engine and connect electrical lead to coil.

9. Using new "O" rings, install compressor pipe adapter plate then torque bolt to 15 ft. lbs.

10. Install belt and adjust tension using Tool BT 33-70.

11. 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 and windows open, the temperature control lever fully to the right, blower speed switch on "HI", and auxiliary fan in front of the radiator, and the car hood raised.

1. Remove Schrader valve fitting cap at evaporator.

2. Install Adapter J-5420 on the low pressure gauge hose, and connect the adapter to the Schrader valve fitting on evaporator, then momentarily open low pressure gauge valve to purge gauge hose.

3. Remove the high pressure outlet cap and install high pressure gauge hose.

4. Make sure high pressure gauge valve is closed, then turn system high pressure hand shut-off valve two turns clockwise. Momentarily open high pressure gauge to purge the gauge and hose.

5. In Neutral, adjust engine speed to maintain 1600 r.p.m. until stabilization is achieved.

6. After temperature and humidity have been determined, compare test results with the Performance Chart.

7. To obtain low pressure reading at evaporator, proceed as follows:

   a. Connect tachometer and set engine speed at 1600 r.p.m. Record evaporator pressure, discharge air nozzle temperature and discharge pressure.

b. Disconnect low pressure gauge at evaporator.

c. Remove the evaporator low pressure gauge outlet cap and install the low pressure gauge hose.

d. Check tachometer to make sure engine r.p.m. has not changed. Then compare readings with Performance Chart.

8. When test is completed, turn high and low pressure hand shut-off valves fully counterclockwise. Disconnect gauge hoses, and install protective caps.

9. Install Schrader valve fitting cap.

DIAGNOSIS OF PERFORMANCE TEST RESULTS

CONDITION AND CAUSE	CORRECTION
ENGINE RPM TOO HIGH	
A. Defective or improperly adjusted "hot gas" by-pass valve.	A. Adjust or replace as necessary.
B. Restriction in low pressure line.	B. Remove, inspect, and clean or replace.
C. Loose compressor drive belts.	C. Adjust as outlined.
D. Defective or improperly adjusted pulley clutch.	D. Adjust or replace as necessary.
E. Defective expansion valve.	E. Replace as necessary.
F. Expansion valve capillary tube not tight to evaporator.	F. Check clamp for tightness.
G. Clutch slipping.	G. Refer to CLUTCH SLIPPAGE.
HIGH PRESSURE SIDE OF SYSTEM TOO HIGH (With High Engine Speed)	
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 purge system on high pressure side with engine not running; then, operate system and re-check pressure. Repeat as necessary. Check sight glass with system under load.
D. Restriction in condenser, dehydrator-filter-receiver assembly, or any high pressure 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.
ENGINE RPM TOO LOW	
A. Insufficient Refrigerant	A. Add Refrigerant as outlined.
B. Restricted air passage.	B. Check air flow.

DIAGNOSIS OF PERFORMANCE TEST RESULTS (Cont'd)

CONDITION AND CAUSE	CORRECTION
NOZZLE DISCHARGE AIR TOO WARM (With Other Readings OK)	
A. Air hoses not properly connected.	A. Inspect air hoses and manifolds.
B. Defective or mispositoned evaporator drain hoses.	B. Replace or align as necessary.
C. Poor Seal - Evaporator.	C. Correct sealing.
CLUTCH SLIPPAGE	
A. Incorrect clutch air gap.	A. Place correct number of shims at the REAR of the clutch plate assembly. (See "CLUTCH ADJUSTMENT.")
B. Head pressure too high.	B. Purge system until bubbles appear in sight glass and then add one pound of Freon.
C. Pulley wobbles	C. Check and replace, if necessary, the pulley bearing. If pulley has been worn by bearing, replace pulley.
VELOCITY OF AIR AT DISCHARGE NOZZLES TOO LOW	
A. Restricted air hoses.	A. Inspect and replace if necessary.
B. Defective blower motor.	B. Check and replace if necessary.
C. Defective switches.	C. Check and replace if necessary.
D. Poor wiring connection (Low voltage at blower.)	D. Correct wiring.
FROSTING OF EVAPORATOR LOW PRESSURE OUTLET LINE	
A. Defective expansion valve.	A. Replace valve.
B. Defective or improperly adjusted "hot gas" by-pass valve.	B. Adjust or repair valve as necessary.
SWEATING OF AIR DISCHARGE NOZZLES	
A. Heater valve not completely closed or leaking.	A. Check air valve for proper closing.
B. Air leak at dash or toe pan.	B. Properly seal all holes in dash and toe pan.
WATER BLOWING OUT AIR DISCHARGE NOZZLE	
A. Plugged or kinked evaporator drain hose.	A. Clean or align as necessary.
INOPERATIVE CONTROLS	
A. Kinked or incorrectly routed bowden cables.	A. Replace or reroute.

PERFORMANCE CHART

*Car Interior		Evaporator Pressure	Engine Speed	Discharge Air R.H. Nozzle	**Pressure
Humidity	Temp.	(At Schrader Valve) ± 2 lbs.	RPM	Temp. ± 1°F	High (Discharge) ± 5 lbs.
20	100 110	32 37	1600	45 53	283 340
30	90 100 110	27 35 41	1600	42 49 58	240 295 354
40	80 90 100 110	26 28 37 46	1600	39 45 53 63	204 252 307 366
50	70 80 90 100 110	25 27 30 40 50	1600	36 40 47 58 67	168 212 266 320 380
60	70 80 90 100	25 26 32 43	1600	36 41 49 59	172 222 278 335
70	70 80 90 100	25 28 35 47	1600	37 42 51 63	175 229 288 345
80	70 80 90 100	25 27 37 49	1600	38 44 53 66	180 236 298 360
90	70 80 90	25 29 40	1600	38 46 57	184 242 305

*Atmospheric Temperature and Relative Humidity to be taken at Car Interior.
**The Low Pressure (Suction) reading should be 1 to 2 lbs. lower than Evaporator Pressure.

PRESSURE-TEMPERATURE RELATIONSHIP OF REFRIGERANT

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
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	14.5	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)

Cooling System Capacity

- With Air Conditioning . . . . 11 qts.
- Without Air Conditioning . . . . 10-1/2 qts.
- For Heater (Add) . . . . 1-1/2 qts.

Fuse (at Fuse block) . . . . 20 Amps.

Amount of Refrigerant in System: . . . . 2 Lbs. 8 Oz.

Total Amount of Oil in Freon System . . . . 13 Fluid Oz.

Type of Oil . . . . Frigidaire 1000 Viscosity

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS	Ft. Lbs.
Compressor Front Bracket to Cylinder Block Bolt	20 to 25
Compressor Front Bracket and Brace to Timing Chain Cover Bolt	25 to 35
Compressor Front Adapter to Front Bracket Nut	25 to 35
Compressor Front Adapter to Brace Nut	25 to 35
Compressor to Front Adapter Bolt	20 to 25
Compressor Rear Adapter and Brace to Block Nut	25 to 35
Compressor Rear Adapter and Brace to Compressor Bolt	20 to 25
Compressor Front Bracket and Spacer to Cylinder Head Bolt	25 to 35
High and Low Pressure Hose Assembly to Compressor	15
Pulley to Compressor Shaft	5 to 7
Coil and Seal Housing to Compressor	15
"Hot-Gas" By-Pass Valve Fitting	25 to 30

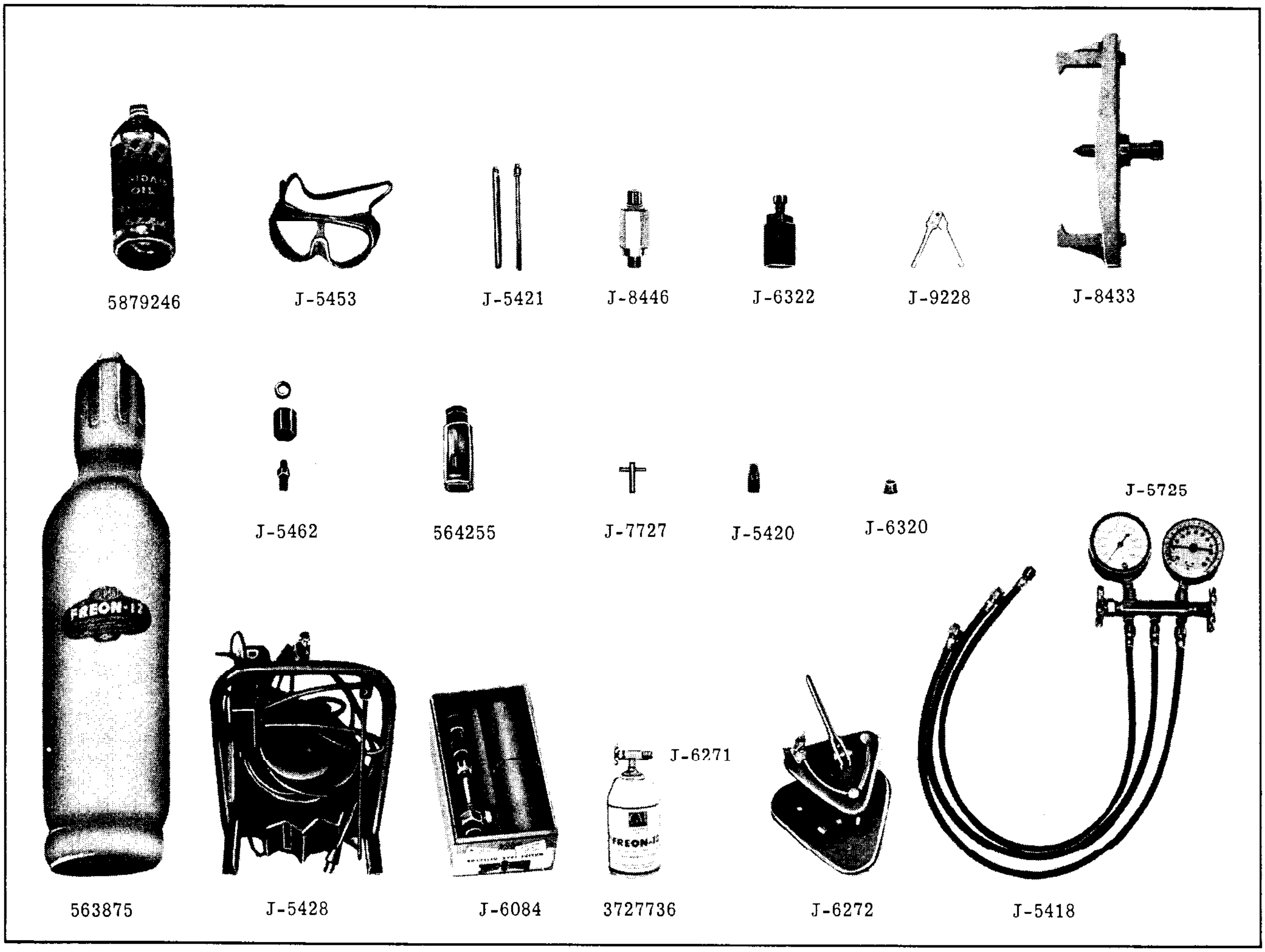
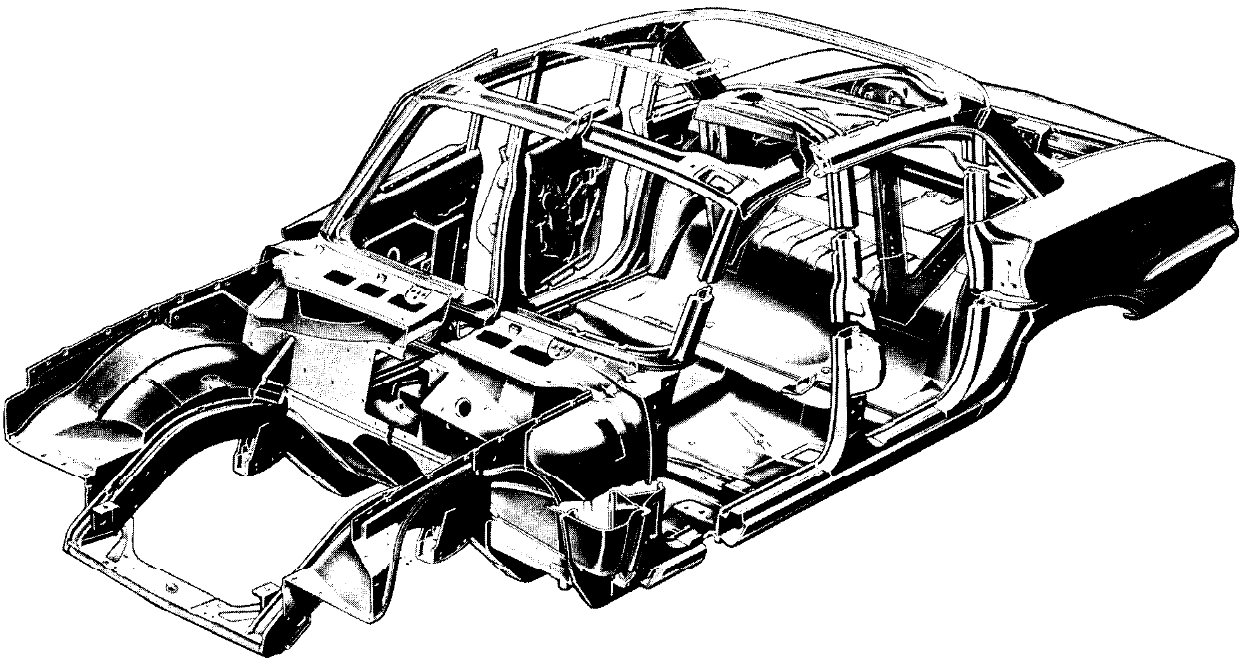
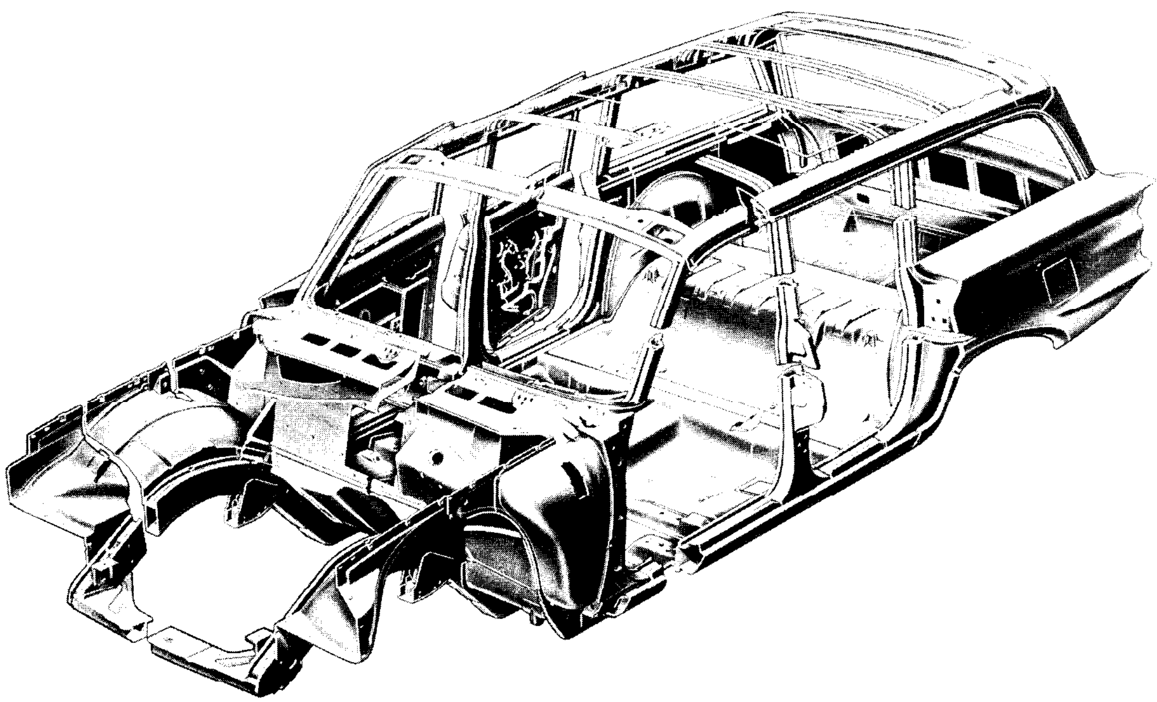


Fig. 14-44 Tools

J-5418	Gauge Charging Line
J-5420	Gauge Adapter
J-5421	Pocket Thermometer
J-5428	Vacuum Pump
J-5453	Goggles
J-5462	Freon 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-6320	Compressor Seal Protector
J-6322	Compressor Clutch Plate Puller
J-7727	"Hot Gas" By-Pass Valve Adjusting Tool
J-8433	Pulley Puller
J-8446	Compressor Clutch Plate and Pulley Installer
563875	25 Lbs. Freon 12
564255	4 Oz. Leak Detector
3727736	15 Oz. Freon 12
5879246	Frigidaire "1000" Viscosity Oil



Body Shell Construction–Sedan



Body Shell Construction–Station Wagon

BODY

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BODY CONSTRUCTION

The over-all rigidity of the integral body construction is drawn from each of the individual metal components which, when welded together, comprise the body shell assembly. The floor pans and rail assemblies forming the underbody area incorporate attachment provisions for the power train and the suspension systems. The underbody, therefore, contributes the greatest amount of strength to the body assembly. This type of integral construction eliminates the conventional independent chassis frame and has become known as the "unitized" type of body construction.

ALIGNMENT CHECKING PROCEDURE

The underbody assembly is comprised of side rails, cross rails, floor pan cross bars, inner and outer rocker panels and other floor panel components. The underbody is of all-welded construction. Misalignment in the underbody can affect fit of doors and rear compartment lid. Most important, however, underbody misalignment can influence the suspension system, thereby causing many of the problems that arise from a suspension misalignment. Underbody misalignment in the area of the drive shaft center support bearing may also adversely affect drive shaft alignment. Underbody alignment, therefore, should be exact to within plus or minus 1/16" of the specified dimensions.

In the event of extensive collision damage, major underbody repairs may be required to reestablish proper alignment. Extensive collision damage may include twist, side-sway, complicated sags or a combination of these conditions in the underbody area. In some cases, it may be determined that the most practical method of repairing the damage is to employ a frame straightening machine and a qualified operator. A frame machine offers a variety of controlled pushing and pulling operations as well as accurate frame centering and leveling gauges which are especially helpful in checking the conditions described above.

To assist in checking alignment of the underbody components, repairing minor underbody damage or locating replacement parts, the following underbody dimension and alignment checking information is presented.

Body Tram Gauge

An accurate method of determining the alignment of the underbody utilizes a measuring tram gauge. The tram gauge required to perform all recommended measuring checks properly must be capable of extending from a length of approximately 12 inches to a length of 90 inches.

Dimensions shown in the upper portion of the Underbody Dimension Chart are calculated on a horizontal plane parallel to the plane of the underbody. Precision measurements can be made only if the tram gauge is also always parallel to the plane of the underbody. This can be controlled by setting the vertical pointers on the tram gauge according to the dimensions shown in the lower portion of the Underbody Dimension Chart.

At least one of the vertical pointers on the tram gauge must have a minimum reach of 17 inches.

A proper tramming tool is essential for analyzing and determining the extent of collision misalignment present in underbody construction.

ALIGNMENT REFERENCE POINTS

Fig. 15-1 shows the specific reference points used in making underbody measurements. Dimensions to gauge holes and other unthreaded holes are measured to dead center of the holes and flush to the adjacent surface metal.

Following is a description of the specific body reference points for the horizontal and vertical dimensions:

1. Center of hole in front cross rail for front cross member front center attaching bolt (front suspension removed).

2. Rear edge of front cross rail at point of contact with inboard facing of motor compartment side rail. See View "A" in Fig. 15-1.

   Center of 3/4" diameter gauge hole in lower horizontal surface of front suspension rear support bracket (just rearward of front cross member rear attaching point on each side of car).

4. Center of 5/16" diameter gauge hole in bottom surface of each motor compartment side rail (located in area of transmission rear cross member attaching bolt holes).

5. Center of left attaching bolt hole for drive shaft center bearing support (drive shaft, bearing and support removed).

6. Center of 5/16" diameter gauge hole in bottom surface of side rail (located directly opposite the center of the drive shaft center bearing support).

7. Center of right attaching bolt hole for drive shaft center bearing support (drive shaft, bearing and support removed).

8. Center of 5/16" diameter gauge hole in bottom surface of rear compartment side rail (located outboard of the forward attaching area of the rear axle lower control arm).

9. Lower rear edge of rear suspension mounting support, directly below center of rear axle lower control arm front support bracket attaching bolt hole. See View "B" in Fig. 15-1.

10. Center of rear axle upper control arm upper rear attaching bolt hole on outboard side of rear compartment side rail. See View "C" in Fig. 15-1.

11. Center of hole in rear spring upper mounting plate (on rear compartment side rail).

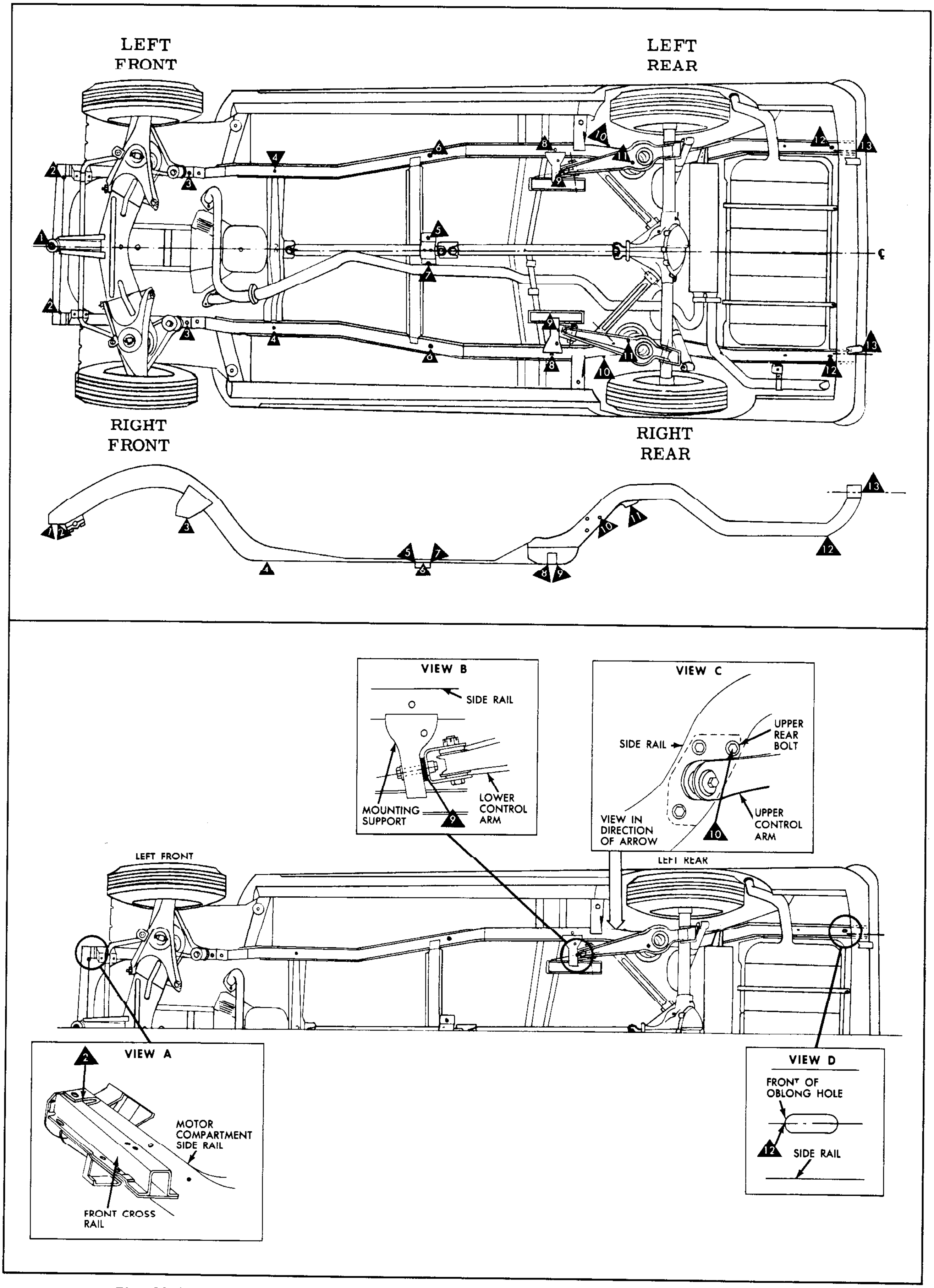


Fig. 15-1 Location of Underbody Alignment Reference Points (Consists of 15-1-A & 15-1-8)

12. Center front edge of oblong hole in bottom surface of rear compartment side rail (located slightly forward of rear end lower panel). See View "D" in Fig. 15-1.

    NOTE: Reference point "12" in left side rail (gas tank filler neck side) is 1-5/16 inches further from body centerline than reference point "12" in right side rail (tail pipe side).

13. Center of inboard attaching bolt hole for rear bumper support.

    NOTE: In some cases, reference point 6 may have been omitted. This is a 5/16" hole exactly midway between points 5 and 7 on frame rail. (Fig. 15-1)

ALIGNMENT DIMENSION CHART

HORIZONTAL:

Fig. Ref.	Dimension	Ref. Point	to Ref. Point	
A	28-29/32	2	2	
B	14-15/32	1	2	(either side)
C	48	2	4	(same side)
D	56-5/8	2	4	(opp. side)
E	40-5/8	2	3	(opp. side)
F	27-23/32	2	3	(same side)
G	31-5/32	3	3	
H	20-9/32	3	4	(same side)
I	37-3/16	3	4	(opp. side)
J	31-5/32	4	4	
K	81-29/32	3	9	(same side)
L	69-1/2	4	8	(opp. side)
M	47-15/16	4	6	(opp. side)
N	59-7/8	4	8	(same side)
O	37-27/32	6	6	
P	47-3/32	6	8	(opp. side)
Q	87-23/32	3	9	(opp. side)
R	87-19/32	3	8	(opp. side)
S	40-1/8	8	8	
T	31-21/32	9	9	
U	17-23/32	8	11	(same side)
V	37-1/32	11	11	
W	69-23/32	8	12	(left side)
X	68-15/16	8	12	(right side)
Y	55-7/8	3	12	(same side)
Z	42	12	12	

NOTE: Horizontal dimensions to reference points "5" and "7" will be covered independently in drive shaft alignment section.

VERTICAL:

Fig. Ref.	Dimension	Datum Line to Ref. Point
a	12-1/2	1
b	12-7/16	2
c	14-3/8	3
d	6-1/16	4
e	7-3/32	5
f	6-1/16	6
g	9-9/16	7
h	6	8
i	6-1/32	9
j	14-11/16	10
k	16-13/32	11
l	10	12
m	18-21/32	13

PRINCIPLES OF TRAMMING

As indicated in the underbody dimension chart, all diagonal dimensions (except "W" and "X") are of equal distance to the same matching reference points on the opposite side of the body. These are commonly referred to as crosscheck dimensions.

EXAMPLE: Dimension "L" is 69-1/2 inches measuring from reference point "4" on right side to reference point "8" on left side; the crosscheck dimension between reference point "4" on left side to reference point "8" on right side (indicated by dotted line in Fig. 15-2 is also 69-1/2 inches.

To measure the distance accurately between the two reference points on the underbody, two specifications are required:

1. The horizontal dimension between the two reference points to be trammed.

2. The vertical dimension from the datum line to the reference points to be trammed. As an example, diagonal measurement "R" (calculated on a horizontal plane) between reference point "3" and reference point "8" is 88-19/32 inches.

The specifications from the datum line to the reference points indicate a vertical height difference of 8-3/8 inches between forward reference point "3" and rearward reference point "8". The front vertical pointer used at reference point "8" should be adjusted so as to extend 8-3/8 inches further from the tram bar than the rear pointer used at reference point "8".

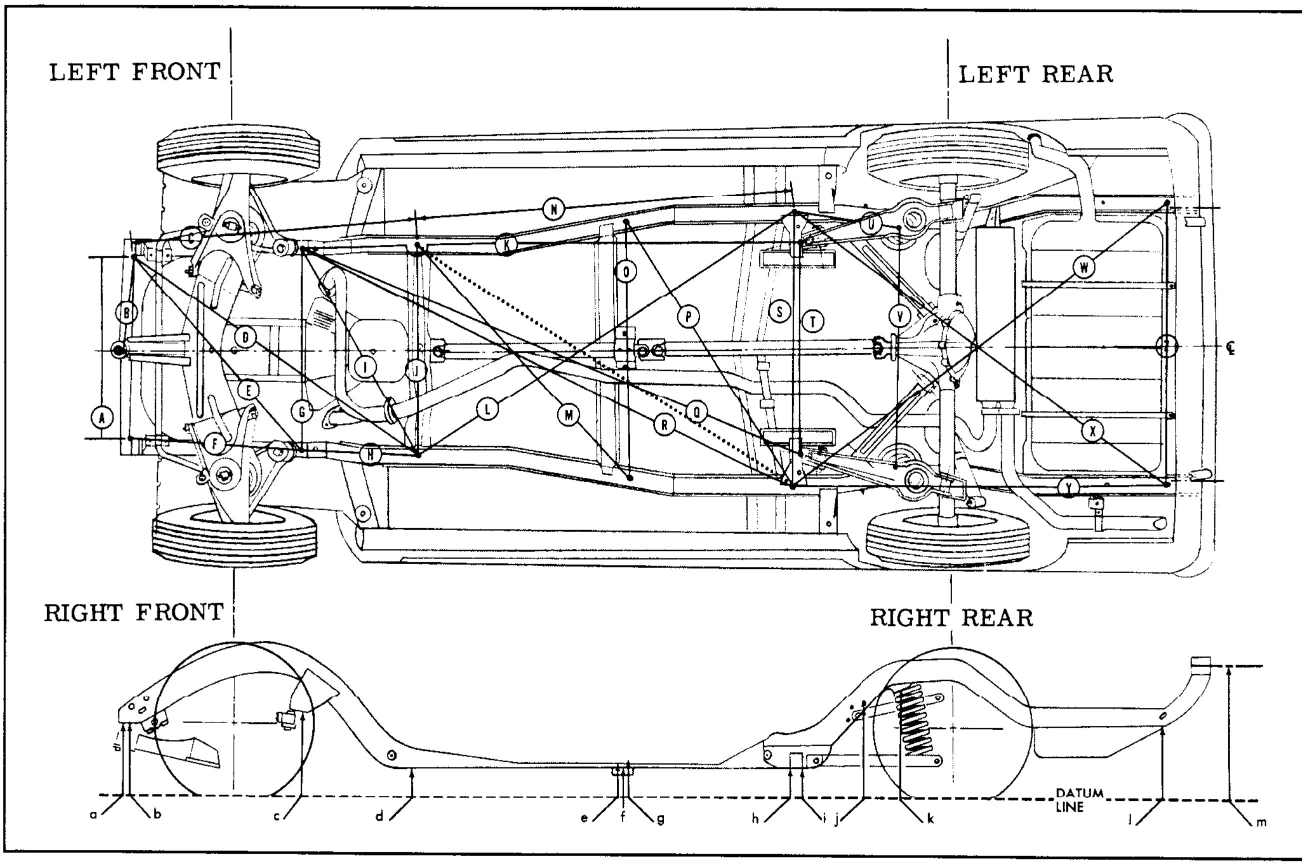


Fig. 15-2 Underbody Alignment Reference Dimensions

With the proper settings the tram bar will be on a plane parallel to that of the body plane. The exception to this would be when one of the reference points is included in the misaligned area; then, the parallel plane between the body and the tram bar may not prevail. After completion of the repairs, the tram gauge should be set at the specified dimensions to check the accuracy of the repair operation.

Car Preparation

Preparing the car for the underbody alignment check involves the following:

1. Place the car on level surface.
2. The weight of the car should be supported at the wheel locations.
3. Visual damage inspection should be made to eliminate needless measuring. Obviously damaged or misaligned areas can often be located by sight.

Tramming Sequence

The tramming sequence will vary depending upon the nature and location of the misaligned area. Basically there are eleven key reference points that should be utilized when making underbody alignment checks. These reference points are:

1. Center of front crossmember front attaching bolt hole. (Point 1, Fig. 15-1)
2. Center of gauge holes in front crossmember rear attaching bolt support brackets. (Point 3, Fig. 15-1)
3. Center of gauge holes in motor compartment side rail at transmission. (Point 4, Fig. 15-1)
4. Center of gauge holes in side rails at drive shaft center bearing support. (Point 6, Fig. 15-1)
5. Center of gauge holes in rear compartment side rail at lower control arm. (Point 8, Fig. 15-1)
6. Below center of lower control arm front support bracket attaching holes. (Point 9, Fig. 15-1)

Prior to performance of any tramming operation, the accuracy of reference points to be used must be determined. A measurement that originates from a reference point which is included in a damaged area will produce untrue results and confuse the evaluation of the underbody condition.

Unlike the conventional type of frame design, the unitized type of body construction seldom develops the two conditions of "twist" and "diamond" in the floor pan area as a result of front or rear end collisions. Therefore, underbody alignment checking can usually originate from the 5/16" diameter gauge holes in the side rails (reference points "4", "6" and "8").

If inspection indicates that these locations have been disturbed and are not suitable for measuring, one of the undamaged suspension locations should be used as a beginning reference point. If a rare situation should exist where all of the key locations are not suitable as reference points, repair operations should begin with the body floor pan area. All other underbody components should be aligned progressively from this area.

NOTE: If preliminary tram checks (covering horizontal dimension "O" and vertical dimensions "e", "f" and "g") reveal any alignment discrepancy, consult drive shaft alignment section before attempting repairs.

CENTERING GAUGES

Another tool that is extremely useful in repairing underbody collision damage is a body centering gauge set. The centering gauges automatically indicate the body centerline and the body level. Collision damage may result in twist, side-sway or sags to the underbody which may not be readily apparent to the naked eye. Sighting along the center vertical pointers and along the horizontal bars of the centering gauges will make these conditions very apparent and will help to isolate the particular areas which are affected. A minimum of three centering gauges must be used simultaneously. Fig. 15-3 shows five pair of attaching points (A, B, C, D and F) which are located symmetrically on both sides of the body and are considered suitable for mounting most types of hang-on centering gauges.

Magnetically attached type of centering gauges may also be used at these points as well as at other points along the bottom surface of the side rails from the front of the car to the rear axle area.

From the rear axle area to the rear of the car, the left side rail (gas tank filler neck side) is positioned 1-5/16 inches further from the body centerline than the right side rail. Compensation for this variance must be made when using any type of centering gauge in this area.

Following is a description of the specific attaching locations shown in Fig. 15-3.

1. Lowest point of oblong hole located in front compartment side rail (located slightly above and ahead of the front stabilizer support brackets).
2. Front tie down hole in front compartment side rail.

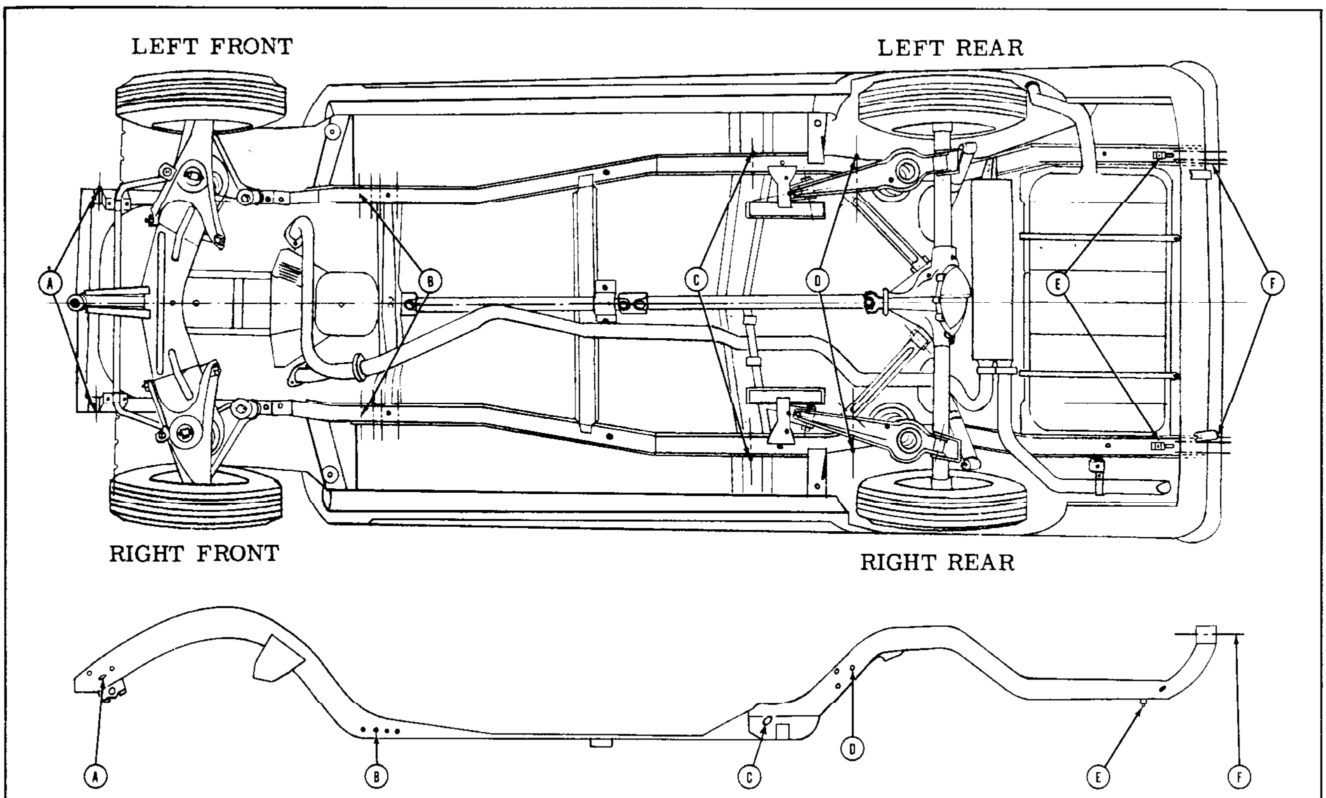


Fig. 15-3 Centering Gauge Attaching Points

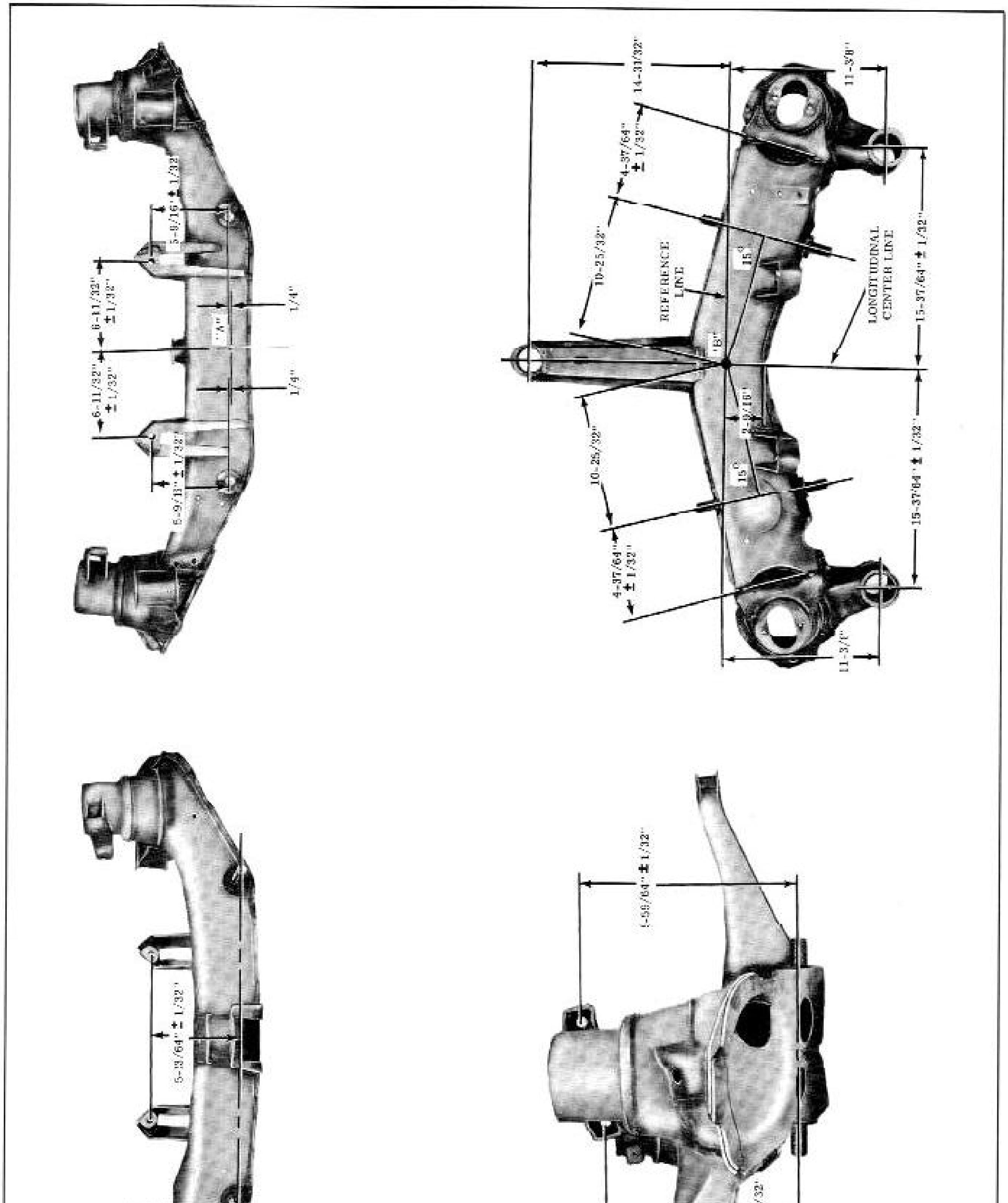


Fig. 15-4 Front Suspension Cross Bar Alignment Dimensions

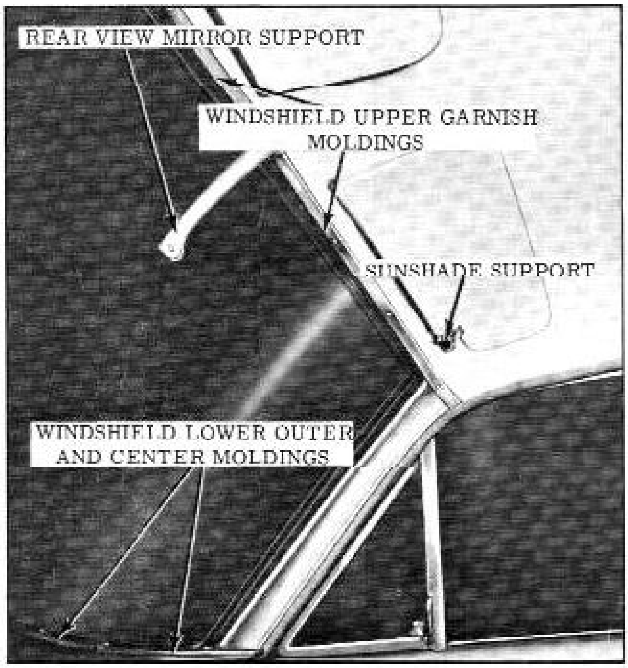


Fig. 15-5 Garnish Molding Attachment

3. Rear tie down hole in rear compartment side rail.

4. Upper rear attaching hole for rear axle upper control arm forward support (bolt removed).

5. Optional: If magnets are used, they should be attached to lower surface of rear compartment side rail. Rear edge of both magnets should be at front edge of oblong hole in each side rail (just forward of rear end lower panel). Left magnet (gas tank filler neck side) and right magnet (tail pipe side) should be positioned to compensate for variance between centers of side rails and body centerline (1-5/16 inches differential).

6. Rear bumper inboard attaching bolt holes. Bumper assembly must be removed for this hook-up.

FRONT SUSPENSION CROSS BAR ALIGNMENT

Alignment dimensions shown in Fig. 15-4 are provided for checking the front suspension cross bar alignment Minor straightening of a misaligned cross bar is permissable. Gauge pin hole "A" is the first reference point established on the cross bar and it is located on the longitudinal center line of the cross bar. The lower control arm cross shafts are located from this gauge pin hole and the reference point "B". Point "B" is located on the longitudinal center line and in the center of the cross bar (2-9/16" from rear face of cross bar). Other points on the cross bar are located from the gauge pin hole "A", the longitudinal center line, point "B" and a reference line through point "B" as shown in Fig. 15-4.

WINDSHIELD ASSEMBLY

GARNISH MOLDINGS

The windshield garnish moldings consist of upper right and left moldings, lower center molding and right and left lower outer moldings. The lower outer moldings must be removed prior to removing the lower center molding. All moldings are secured by screws. (Fig. 15-5)

Removal and Installation

1. Place protective coverings over front seat and instrument panel.

2. Remove rear view mirror support, then upper garnish molding.

3. Remove lower end moldings and lower center molding.

4. To install, reverse removal procedure.

GLASS

Removal

1. Place protective covering over hood, front fenders instrument panel and front seat assembly.

2. Remove rear view mirror support and garnish moldings.

3. Remove windshield wiper arms.

4. On inside of body loosen lip of rubber channel from pinchweld flange along top and sides of windshield as follows:

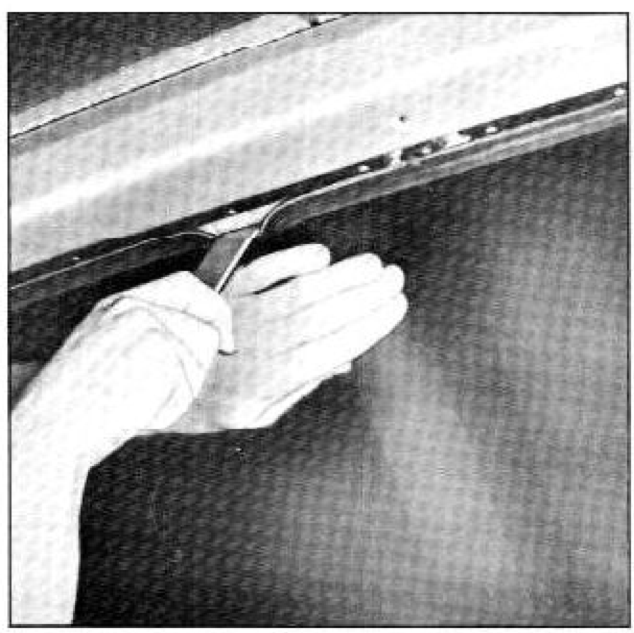


Fig. 15-6 Windshield Glass Remover

With palm of hand, apply pressure to glass near edge. (Fig. 15-6) At same time, use a blunt putty knife or other suitable tool and carefully assist rubber channel over pinchweld flange.

5. After windshield rubber channel is free from pinchweld flange, with aid of helper, carefully lift windshield assembly from body opening and place it on a protected bench.

6. Remove windshield reveal moldings from rubber channel on styles incorporating reveal moldings.

7. Remove rubber channel from glass.

Checking Body Windshield Opening

It is important that the body windshield opening be checked thoroughly before installation of a replacement windshield glass. The procedure below outlines the method which may be used to check the windshield opening.

1. Remove windshield from body.

2. Check windshield rubber channel for any irregularities.

3. Clean off old sealer around windshield opening and check entire body opening flange for any irregularities.

4. Install five (5) windshield checking blocks J-8942 to pinchweld flange. (Fig. 15-7) Position one block over lower pinchweld flange on each side of body approximately twelve inches inboard from the lower outer corner of the opening. Position final block on lower pinchweld flange in center of windshield opening. Position one block over upper pinchweld flange midway between center block and each outboard block on lower retaining flange.

5. With aid of helper, carefully position replacement glass on blocks in windshield opening.

CAUTION: Care should be exercised to make certain glass does not strike body metal during installation. Edge chips can lead to future breaks.

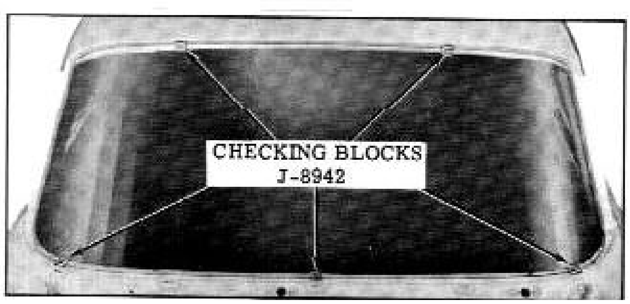


Fig. 15-7 Body Windshield Opening

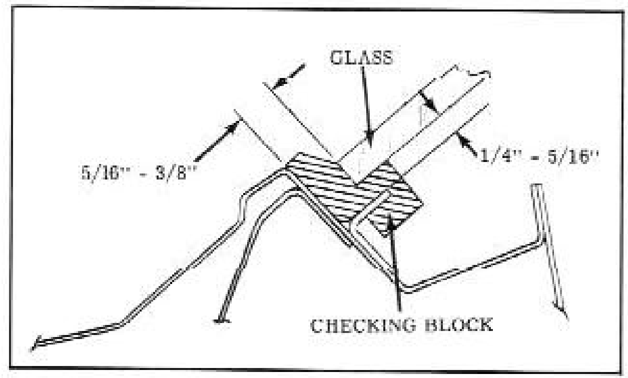


Fig. 15-8 Windshield Opening Check

6. With windshield glass supported and centered in the body opening by checking blocks, check relationship of glass. Fig. 15-8 shows a typical section taken through the glass channel and body opening. Check glass to body relationship as follows:

   a. The inside surface of the glass should be uniform distance from pinchweld flange. The dimension should be from 1/4" to 5/16".

   b. The outer edge of glass should be a uniform distance from body metal, measured in the plane of the glass. This dimension should be from 5/16" to 3/8".

7. Mark any sections of body to be re-formed, remove glass and re-form opening as required.

8. Recheck windshield opening as outlined above. Then mark the center line on the glass and body so that glass can be accurately centered in opening when installed.

Installation

1. Clean out old sealer in glass cavity of windshield rubber channel and around base of rubber channel.

2. Install rubber channel to glass.

3. Install reveal moldings in rubber channel on styles incorporating reveal molding.

4. Insert a strong cord in pinchweld cavity of rubber channel completely around windshield. Tie ends of cord and tape to inside surface of glass at bottom center of glass. (Fig. 15-9)

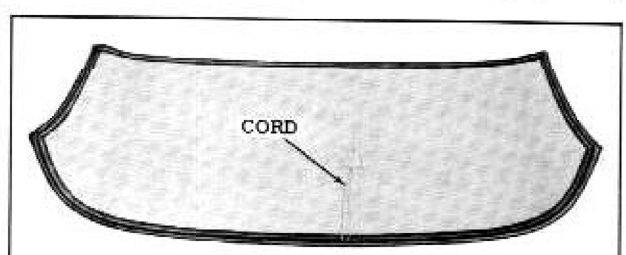


Fig. 15-9 Windshield Installation

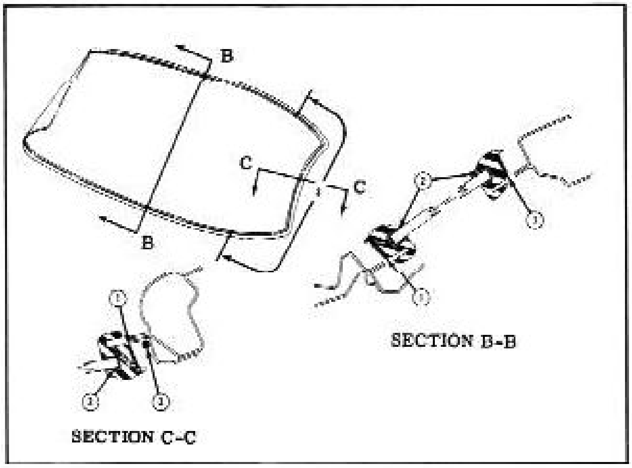


Fig. 15-10 Windshield Sealing

5. Apply a ribbon of medium-bodied sealer completely around base of rubber channel as indicated by "1". (Fig. 15-10)

6. Apply a bead of medium-bodied sealer, approximately 1/4" in diameter to corner of windshield opening rabbet around each side of windshield for distance indicated by "3". (Fig. 15-10)

7. With aid of helper, carefully position and center windshield assembly in windshield opening.

   CAUTION: Do not position glass by tapping or hammering at any time.

When the glass and channel are properly positioned in opening, slowly pull ends of cord, starting at lower center of windshield, to seat lip of rubber channel over pinchweld flange. Cord should be pulled first across bottom of windshield, then up each side and finally across top of windshield.

9. Using a pressure type applicator, seal inner and outer lips of rubber channel to glass as indicated by "2" in Fig. 15-10 with an approved weatherstrip adhesive. Seals are to extend completely around rubber channel.

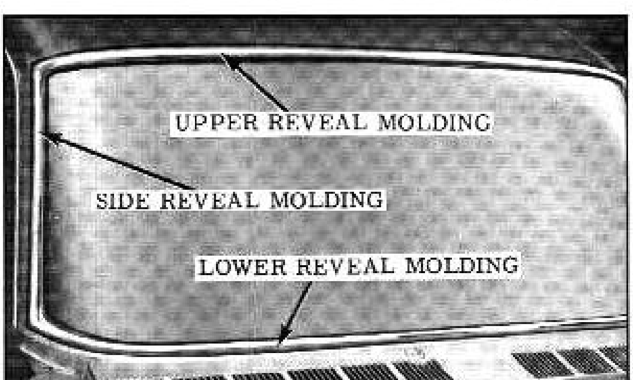


Fig. 15-11 Windshield Reveal Moldings

10. Clean off excess sealer from windshield glass with mineral spirits.

11. Reinstall all previously removed parts and remove protective coverings.

REVEAL MOLDINGS

The windshield reveal moldings are secured in a cavity of the windshield rubber channel. The moldings consist of an upper and lower reveal molding and a right and left side reveal molding. The ends of the side reveal moldings overlap the upper and lower reveal moldings. (Fig. 15-11)

Removal

1. Mark center line on glass and body, remove windshield assembly and place it on a protected bench.

2. Locate and mark center of upper and lower reveal moldings.

3. Carefully remove side reveal moldings from cavity of rubber channel; then, remove upper and lower reveal moldings.

Installation

1. Install and center upper and lower reveal moldings in cavity of rubber channel; then, install side reveal moldings.

   NOTE: To facilitate installation of the moldings, apply a mild soap solution to the cavity of the rubber channel prior to installing the moldings.

2. Install windshield assembly in body.

PILLAR DRIP MOLDING

Removal and Installation

1. Remove screws securing drip molding. (Fig. 15-12), and remove molding.

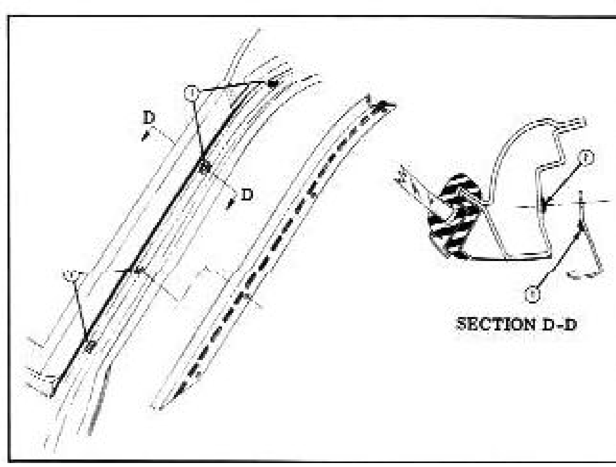


Fig. 15-12 Windshield Pillar Drip Molding Sealing

2. To install, apply medium-bodied sealer to screw attaching holes and to drip molding as indicated in Fig. 15-12.

INSTRUMENT PANEL ASSEMBLY

COMPARTMENT DOOR

Removal and Installation

1. Mark location of compartment door hinge on door inner panel.
2. Remove hinge stop attaching screws from door inner panel. (Fig. 15-13)
3. Remove door hinge attaching screws from door inner panel and remove door. (Fig. 15-13)
4. To install, position door within locating lines and install attaching screws. Install hinge stop and adjust as necessary.

Adjustments

1. To reposition compartment door up or down in its opening, loosen hinge and hinge stop attaching screws at door inner panel and shift door in desired direction.

   NOTE: A slight up or down adjustment may also be obtained at hinge-to-instrument panel attachment.

2. To position the door right or left, loosen hinge-to-instrument panel attaching screws located on desired position. Adjust stop assembly accordingly on door inner panel.
3. The door lock striker may be adjusted by loosening attaching screws and moving striker forward or rearward. (Fig. 15-13)

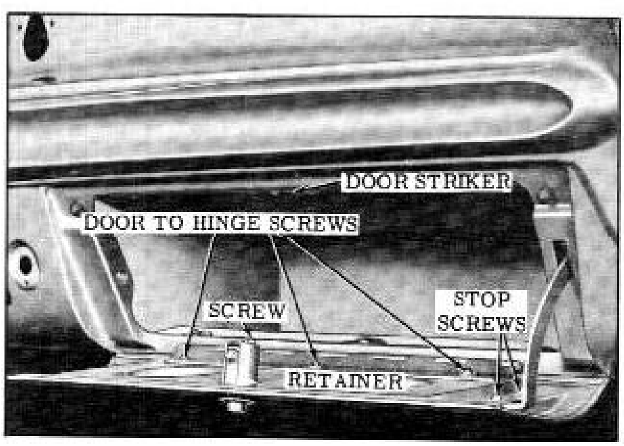


Fig. 15-13 Instrument Panel Compartment Door Assembly

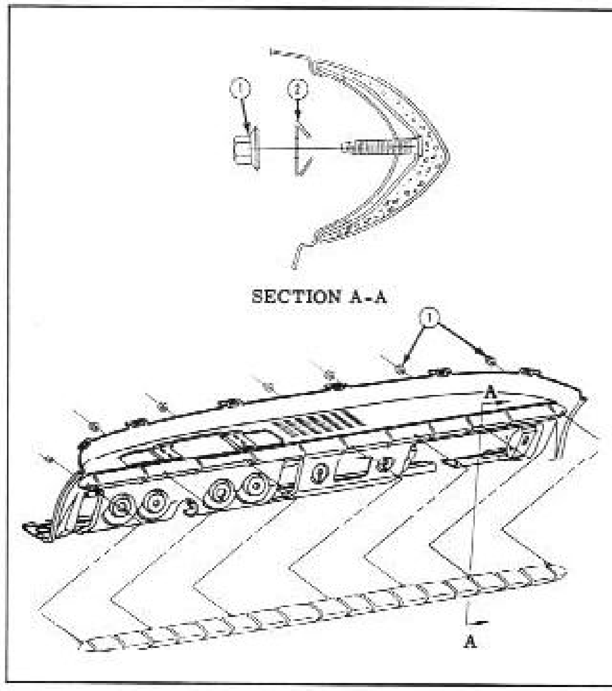


Fig. 15-14 Instrument Panel Cover

COMPARTMENT DOOR HINGE STOP

Removal and Installation

1. Remove hinge stop attaching screws, (Fig. 15-13), and remove body.
2. When installing, check for proper alignment of hinge stop to door inner panel.

INSTRUMENT PANEL COVER

The instrument panel cover assembly is a soft molded "Nose" design, applied to the formed surface of the instrument panel and is attached by studs and nuts as indicated by Fig. 15-14.

Removal and Installation

1. From underside of instrument panel remove attaching nuts and spacer shims and remove assembly.
2. When installing, make certain spacer shims are installed over studs as indicated by "2" in Fig. 15-14.

VENTILATOR GRILLE

The body ventilating system incorporates the use of an air intake grille located on top of the shroud panel. The air entering the shroud top ventilator grille flows through a duct which guides the air into the body through a shroud side duct panel air outlet assembly. The door in the outlet assembly regulates the flow of air and is adjusted by the use of a cable and knob control. Water entering the air inlet grille flows down the shroud side duct panel and is discharged through an opening in the shroud side panel.

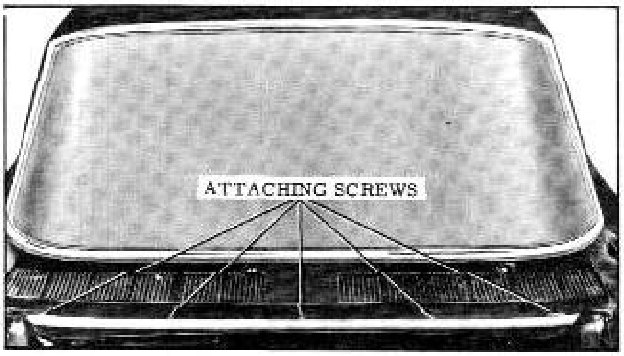


Fig. 15-15 Air Intake Grille

Removal and Installation

1. Place protective coverings over hood and fenders.

2. Remove windshield wiper arms.

3. Raise hood, remove screws securing grille to shroud. (Fig. 15-15)

4. Carefully raise front edge of grille and slide grille forward to disengage tabs along rear edge of grille from slots in shroud.

5. To install, apply medium-bodied sealer around screw attaching holes and grille retaining slots. (Fig. 15-15)

6. Insert retaining tabs along rear edge of grille in slots in shroud panel.

   NOTE: Exercise care so that grille does not contact hood.

COWL TRIM PANEL

Removal and Installation

1. Remove screws shown in Fig. 15-16 securing upper and lower end of air inlet grille.
2. Slide foundation forward to disengage rear edge of foundation from retainer and remove foundation.

AIR OUTLET

Removal and Installation

1. Remove cowl trim panel.
2. Remove screws securing outlet to cowl panel, disengage cable from pin on door and remove outlet.
3. To install, apply a bead of caulking compound between the cowl and outlet.

AIR OUTLET DOOR

Removal and Installation

1. Remove cowl trim panel.

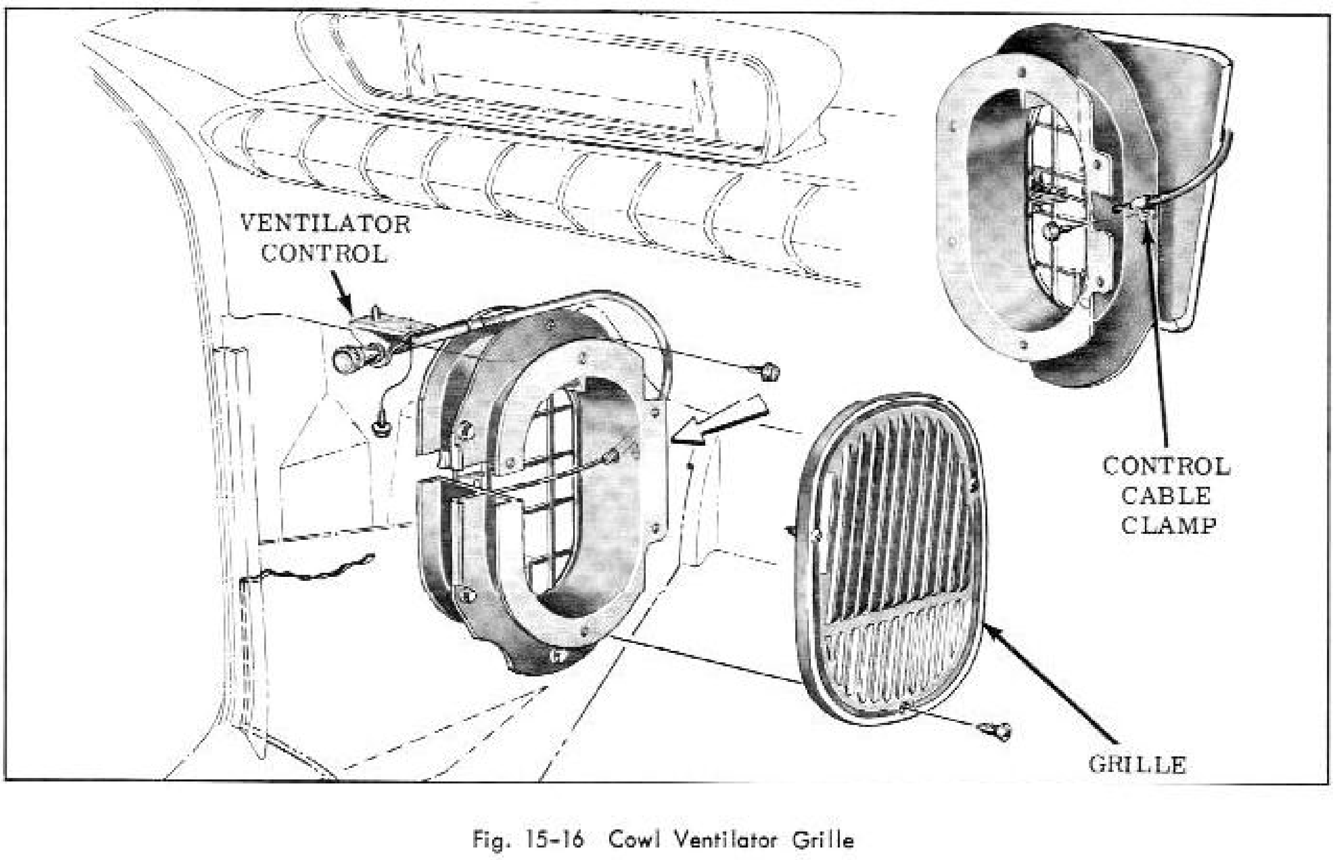


Fig. 15-16 Cowl Ventilator Grille

2. Remove end of control cable from pin.
3. Pry hinge pin downward and remove door.
4. To install, reverse removal procedure.

DOORS (FRONT AND REAR)

INSIDE HANDLES

Removal

1. Depress door trim assembly at handle sufficiently to install Tool J-7797 between handle and bearing plate.
2. Push handle retaining spring out of engagement and remove handle and bearing plate from door. (Fig. 15-17)

Installation

1. Install retaining spring on handle and bearing plate over regulator spindle.
2. Position handle on spindle at same angle as handle on opposite door, and push handle until spring is engaged.

   NOTE: Handles are installed in a horizontal position with open end forward when glass is in full up position.

TRIM ASSEMBLIES

Both the front and rear door trim assemblies are secured to the door panel (inner) by a trim pad retainer and screws at the bottom of the door, and by retaining nails at the sides and top of the door. The nails are pressed or tapped into plastic retainers which fit into slots in the door inner panel.

Removal and Installation

1. Remove door inside handles and arm rest assembly.
2. At each lower corner of trim assembly remove screw securing assembly to door inner panel.

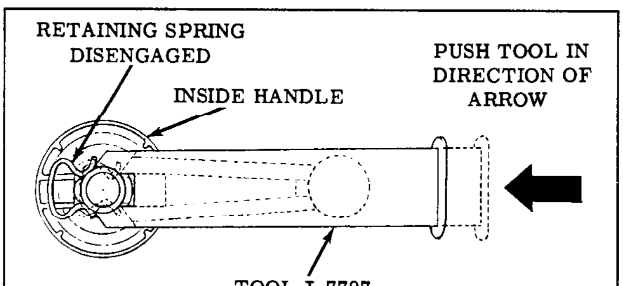


Fig. 15-17 Removing Inside Handle Retaining Spring

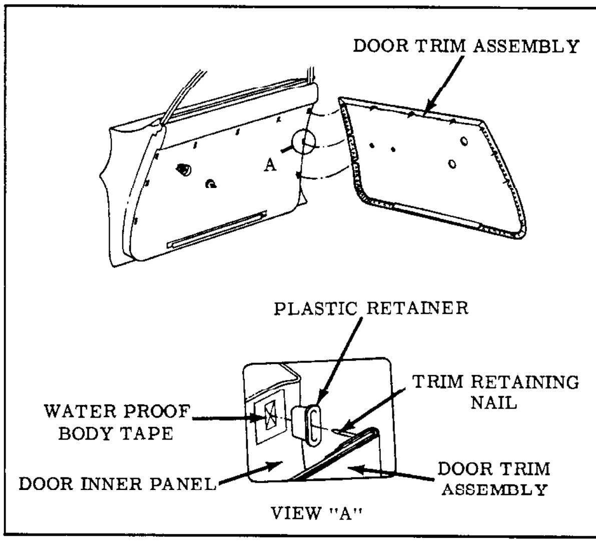


Fig. 15-18 Door Trim Installation

3. With a clean rubber mallet, tap along sides and top of trim assembly to free trim nails from door inner panel.
4. Starting at top of trim assembly, carefully insert Tool J-6335 or a suitable flat-bladed tool between door trim assembly and door inner panel at retaining nail locations and disengage nails from retainers. (Fig. 15-18)

   NOTE: Exercise care so as not to disturb inner panel water deflector.

5. Lift trim assembly upwards to disengage lower edge of assembly from door inner panel and remove trim assembly.
6. When installing, broken nails should be replaced with repair tabs which are available as a service part.

   NOTE: Retaining nails must not pierce back of plastic retainers as water leaks may develop. For this reason it is important that PROPER LENGTH repair tab nails (1/2") are used when replacing broken trim retaining nails.

7. If plastic retainers are loose and will not remain engaged in door inner panel, install a 1/2" x 3/4" piece of cloth-backed waterproof body tape over retaining hole in door inner panel. Make two (2) slits in tape to form an "X" pattern. Check retainer for snug fit. If retainer is still loose, repeat above operation by installing a second piece of tape over existing repair. This procedure may also be used to repair water leaks which may develop around perimeter of retainer.

WATER DEFLECTORS

A waterproof paper deflector is used to seal the door inner panel and prevent entry of water into the body. The polyethylene (shiny or black) side of the deflector is placed against the inner panel. The deflector fits into a retaining slot at the bottom of the door inner panel and deflects the water to the bottom of the door and out the bottom drain holes. The deflector is further secured by a new string loaded sealing material along both front and rear edges and by the application of waterproof sealing tape at front and rear lower corners. Whenever work is performed on front or rear doors where the paper water deflector has been disturbed, the deflector must be properly sealed and taped to the inner panel to prevent serious waterleaks. It is important that all service personnel performing door hardware adjustments of sealing operations are aware of the importance of using the specified material and recommended removal and installation or replacement procedures. For service sealing, body caulking compound is recommended if additional sealing material is required.

When access to the inner panel is required to perform service operations, the deflector may be completely or partially detached from the inner panel. If the existing water deflector is damaged so that it will not properly seal the door, replacement of the deflector is required.

The following procedure covers complete removal and installation of the water deflector. If only partial removal of the deflector is required, perform only those steps which are necessary to expose the required area of the door inner panel.

Removal

1. Remove door trim assembly.
2. Remove strips of waterproof body tape securing lower corners of water deflector. (Fig. 15-19)
3. Carefully break cement bond securing upper corners of water deflector to door inner panel. Then while holding string located within sealer against water deflector, carefully disengage edges of deflector from door. Exercise care so as not to tear water deflector.

   NOTE: If necessary, a flat-bladed tool such as a putty knife can be used to help break cement bond.

4. Disengage lower edge of water deflector from retaining slot in door inner panel and remove water deflector.

Installation

1. Inspect water deflector and, where necessary, repair any tears or holes with waterproof body tape applied to both sides of deflector. In addition, if bond between polyethylene and deflector paper has been torn, cut or damaged, apply waterproof body tape to both sides of deflector over damaged area to prevent water from wicking on uncoated side of deflector.
2. If a new water deflector is to be installed, use old water deflector as a template, trim new deflector to proper size and cut holes for door inside hardware. If old sealer does not effect a satisfactory seal, apply a bead of body caulking compound (approximately 3/16'' diameter) to inner panel at unsealed areas. (Fig. 15-19)
3. Seal all arm rest screw attaching holes with body caulking compound.
4. Position water deflector to door inner panel with polyethylene coated side of deflector against inner panel. Insert lower edge of deflector in retaining slot. Then firmly roll or press sealed areas to obtain a good bond between deflector and door inner panel.
5. Seal lower corners of deflector with 2'' or 2-1/2'' water proof body sealing tape. (Fig. 15-19)

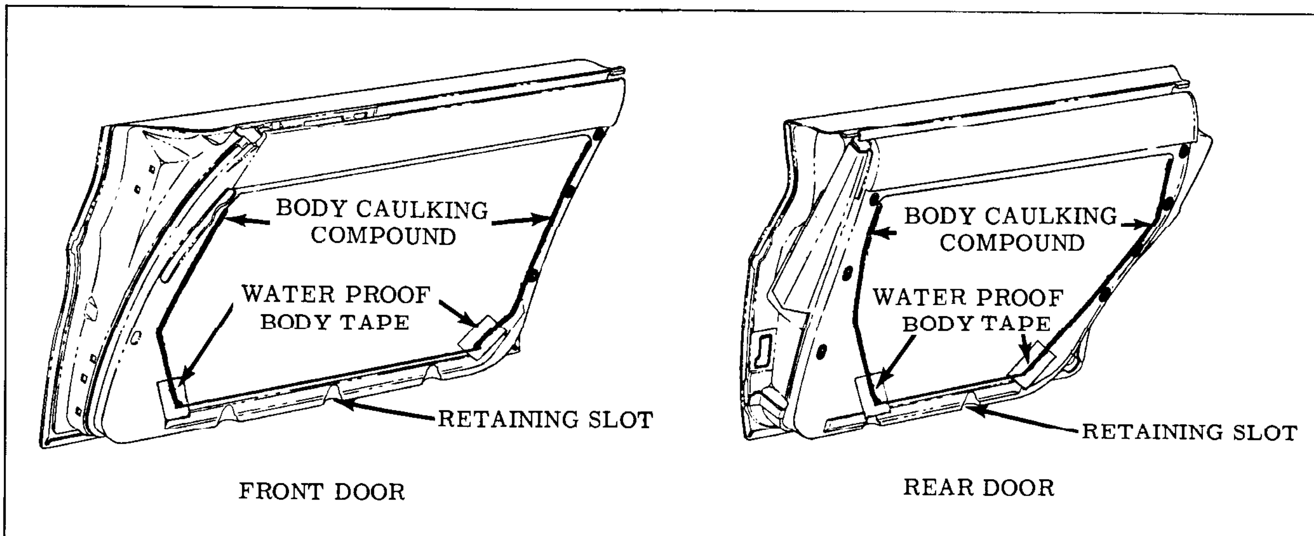


Fig. 15-19 Door Inner Panel Water Deflector Installation

6. Clean off all excess cement or caulking compound and install previously removed door trim and inside hardware.

DOOR LOCK STRIKERS

Removal and Installation

1. With pencil, mark position of striker on body pillar.

2. Remove 3 door lock striker attaching screws and remove striker and adjusting plates from pillar.

3. To install, seal all striker plate attaching screw clearance holes with body caulking compound.

4. Apply 1/8" bead of body caulking compound around entire back surface of striker plate. No skips must exist in caulking compound; then place striker and adjusting plates within marks on pillar and install striker plate attaching screws.

   IMPORTANT: Whenever a door has been removed and installed, or realigned, the door SHOULD NOT be closed completely until visual check is made to determine if lock extension will engage in striker notch. Where required, door lock striker emergency spacers should be installed so that door can be closed and an accurate check made to determine emergency spacer requirements.

5. Clean off all excess caulking compound.

Adjustments

1. To adjust striker up or down or in or out, loosen striker plate attaching screws and shift striker and adjusting plates as required, then tighten screws.

Dimensional Specifications for Use of Door Lock Striker Emergency Spacers

1. Door(s) should be properly aligned before checking door spacer requirements.

2. To determine if door lock striker emergency spacers are required, apply modeling clay or body caulking compound in door lock striker notch where lock extension engages, and then close door to form measurable impression in clay or caulking compounds as shown in Fig. 15-20.

When dimension "A" from rear face of striker teeth to rear edge of depression in clay is less than 11/32", install emergency spacers and proper length striker attaching screws as indicated.

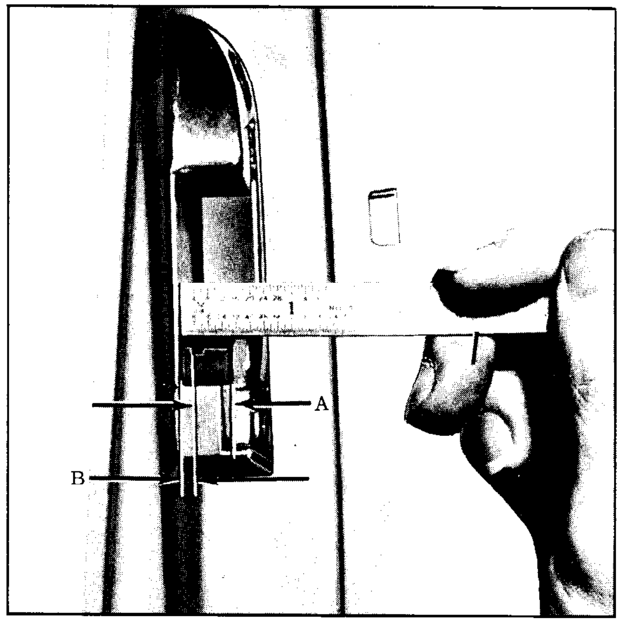


Fig. 15-20 Door Lock Striker Engagement Check

Dimension "A"	No. of Required Spacers
11/32" to 9/32"	1
9/32" to 7/32"	1
7/32" to 5/32"	1- (1/16" Spacer) 1- (1/8" Spacer)
5/32" to 3/32"	2- (1/8" Spacer)

Spacer Thickness	Striker Attaching Screws*
1/16"	Original
1/8"	Emergency (1/8" Longer)
3/16"	Emergency (1/8" Longer)
1/4"	Emergency (1/4" Longer)

NOTE: Dimension "B" in the illustration should never be less than 1/8".

*Zinc or cadium plated flat-head cross-recess screw with countersunk washer.

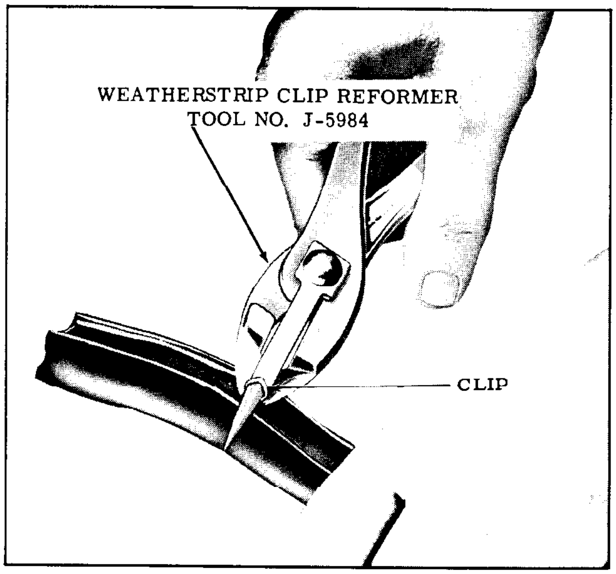


Fig. 15-21 Reforming Weatherstrip Clips with Tool J-5984

DOOR WEATHERSTRIPS

The one-piece door weatherstrip is cemented into the door window frame assembly which forms a retainer type channel for retention of the weatherstrip assembly. The remainder of the door weatherstrip is retained by clips inserted into attaching hole sealing plugs. Service procedures for front and rear door weatherstrips are similar and both weatherstrips are covered as follows:

Removal

1. With a flat-bladed tool, carefully break cement bond along door window frame assembly and at belt line.

2. Insert tip of Tool J-5757 at clip location and carefully snap clips from retaining plugs and remove weatherstrip from door.

Installation

1. Clean off old cement from window frame and door inner panel to insure a clean cementing surface.

2. Check weatherstrip clips for proper contour and reform if necessary using Tool J-5984. (Fig. 15-21)

3. Check all attaching hole sealing plugs. If sealing plugs are loose and will not remain engaged in door inner panel, install a 1/2" x 1" piece of clothbacked waterproof body tape over sealing plug retaining hole as shown in Section "G-G" of Fig. 15-22. Make two 5/16" slits in tape to form an "X". Install plug and check for a snug fit. If plug is still loose, repeat above operation by installing a second piece of tape over existing repair. This procedure may also be used to repair waterleaks which may develop at sealing plug locations.

4. Prior to installation of weatherstrip on either door, apply a continuous bead of an approved weatherstrip cement extending from approximately 1 inch below window frame at hinge pillar section (see View "B" or "D") along entire outboard portion of door window frame assembly (see Section "F-F") to approximately 1 inch below lock pillar section of window frame assembly as shown in Section "C".

   NOTE: When applying weatherstrip cement, follow manufacturer's directions.

5. Starting at uppermost clip hole on either door pillar, install clips to door by placing notched end of Tool J-5757 in loop of clip and pushing clip into attaching hole sealing plug. Repeat operation along both sides and bottom of door.

   NOTE: Do not distort clips or unsatisfactory weatherstrip retention will result.

6. Using a putty knife or other suitable flat-bladed tool, install door weatherstrip into door window frame assembly.

7. Clean off all excessive weatherstrip adhesive.

GLASS RUN CHANNEL INNER STRIP ASSEMBLY

Removal and Installation

1. Lower door window. Apply masking tape over door inner panel adjacent to strip assembly to protect paint finish.

2. With a screwdriver or other suitable flat-bladed tool carefully pry up inner edge of strip assembly at clip locations and remove assembly from door.

3. To install, align clips with holes in door inner panel and press strip assembly into place. Remove tape from door inner panel.

DOOR WINDOW GLASS RUN CHANNEL OUTER STRIP ASSEMBLY

Removal and Installation

1. Lower door window. Apply masking tape to door outer panel adjacent to strip assembly to protect paint finish.

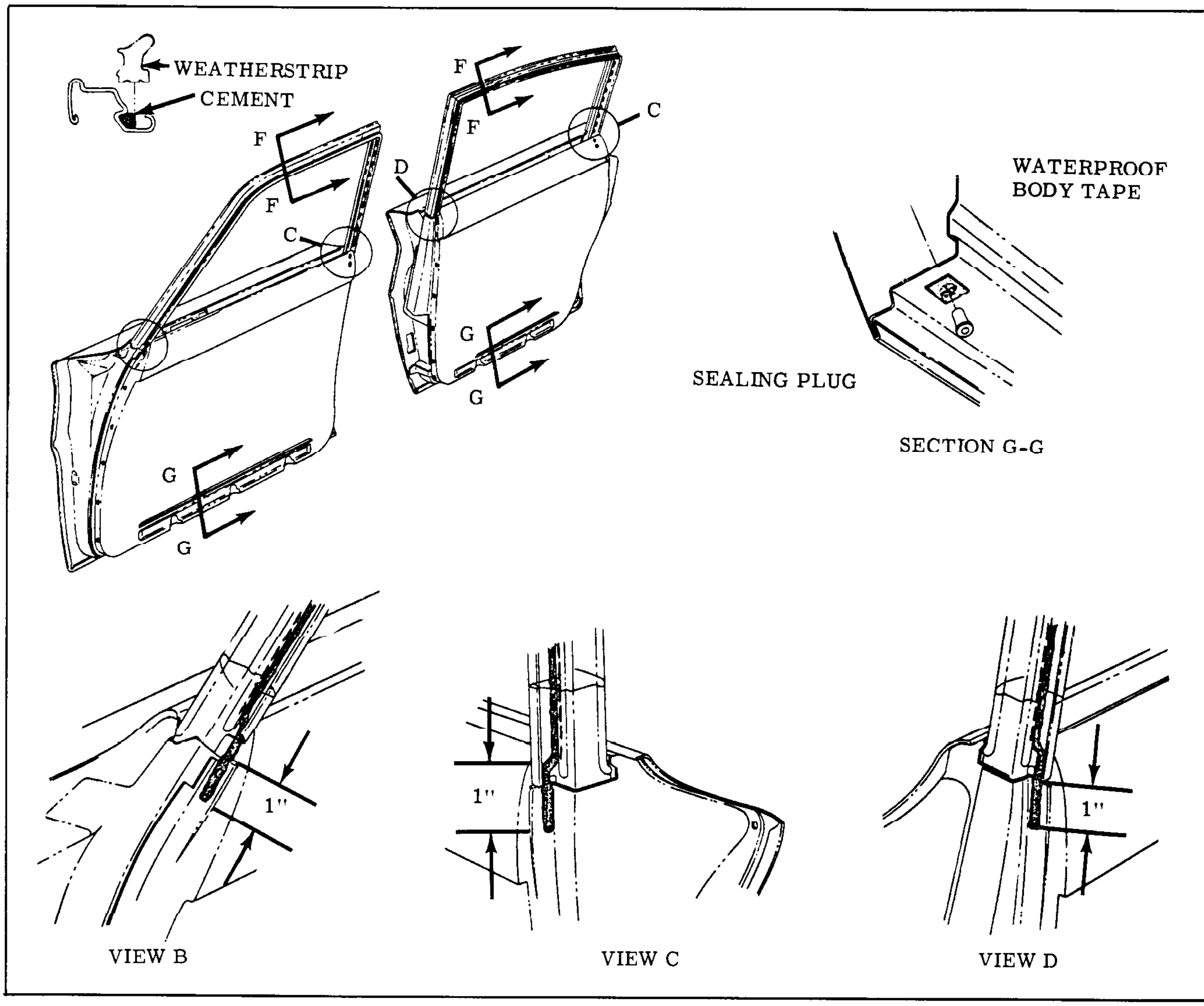


Fig. 15-22 Door Weatherstrips

2. With a screwdriver or other suitable flat-bladed tool, carefully pry up outer edge of strip assembly at clip locations and remove strip from door. (Fig. 15-23)

3. To install, align clips with holes in outer panel return flange and press strip assembly into place. Remove tape from door outer panel.

OUTSIDE HANDLE

Disassembly and Assembly

1. Remove door outside handle (separately described in "FRONT DOORS" and in "REAR DOORS" sections).

2. Depress retainer slightly and turn retainer one-quarter turn. Remove retainer, spring, push button and shaft and sealing ring from handle. (Fig. 15-24)

3. To assemble, reverse disassembly procedure.

WINDOW GLASS RUN CHANNELS

Removal and Installation

1. Remove door window.

2. Starting at either end of glass run channel, press sides of channel together and remove from window frame assembly.

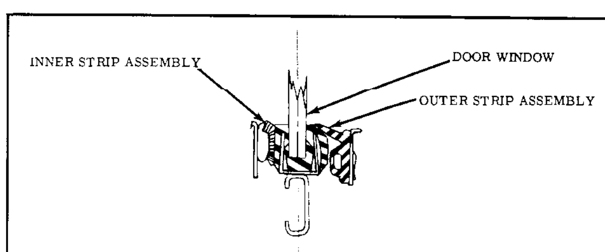


Fig. 15-23 Glass Run Channel Inner and Outer Strip Assemblies

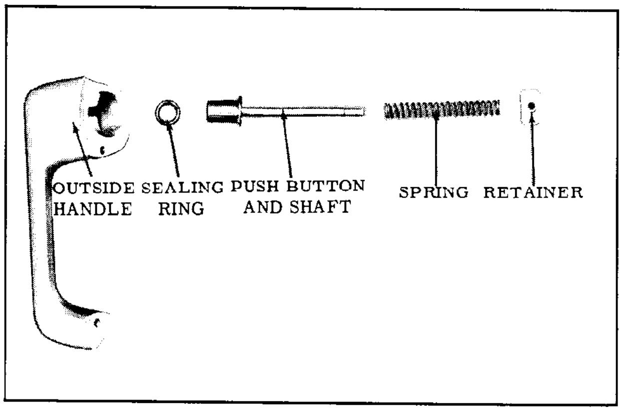


Fig. 15-24 Front Door Outside Handle Disassembled

3. To install, start at either upper corner of window frame assembly and reverse removal procedure.

PINCHWELD FINISHING STRIPS

Pinchweld finishing strips are installed over the pinchweld flange around each door opening. The front door finishing strips consist of a center pillar and side roof rail front finishing strip while the rear door finishing strips consist of a center pillar rear, side roof rail rear, and rear body lock pillar finishing strip. Prongs in the metal insert of each finishing strip secure the strip to the pinchweld flange.

Removal and Installation

1. To remove front door pinchweld finishing strips, remove door sill plate, center pillar-to-side roof rail finishing plate and retaining clip at butt joint. Then starting at end of each strip carefully pull strips away from pinchweld flange and remove from body.

2. To remove rear door pinchweld finishing strips, remove door sill plate, center pillar-to-side roof rail finishing plate, back window upper outer garnish molding and retaining clips at butt joints. Then starting at end of each strip carefully pull strips away from pinchweld flange and remove from body.

3. To install, start at top of center pillar and press strips over pinchweld.

   NOTE: Use caution so as not to bend or deform strips as it will make installation difficult and result in poor appearance.

LOCKSPRING CLIP(S)

A spring clip is used on the door lock levers to secure the remote control connecting link and inside locking rod connecting link to the door levers. A slot in the spring clip provides for disengagement of the clip, thereby facilitating detachment of the connecting link from the lock lever.

To disengage the spring clip, use a screwdriver or other suitable tool to slide the clip out of engagement. Fig. 15-25 shows the door lock spring clip engaged and disengaged.

FRONT DOORS

FRONT FENDER FILLER PANEL (3100 Series Only) (Fig. 15-26)

FRONT DOOR ASSEMBLY AND HINGES

The front door assembly may be removed with or without the hinges attached.

To remove the front door assembly with hinges attached, proceed as follows:

Removal

1. Place suitable protective covering over front fender at door opening to protect finish.

2. Remove front fender opening filler panel.

3. Open door and mark hinge locations on front body hinge pillar.

4. If necessary loosen lower rear fender attaching bolt at underside of body to gain additional access to lower hinge attaching bolts.

5. With aid of a helper to properly support door, remove bolts securing upper and lower hinges to body and remove door assembly with attached hinges from body. (Fig. 15-27)

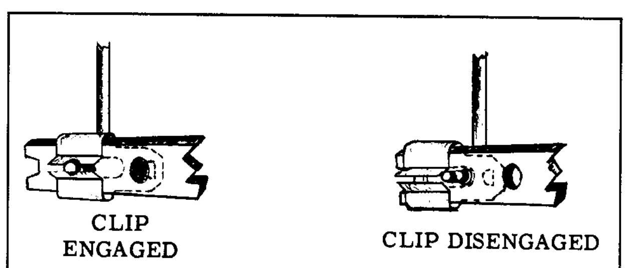


Fig. 15-25 Door Lock Spring Clip

Installation

1. As an anti-squeak precaution and to prevent entry of water into body at hinge attaching bolt locations, coat attaching surfaces of hinges with heavy-bodied sealer prior to installing door. (Fig. 15-28)

2. With aid of a helper, re-install door to body opening. Align hinges within scribe mark and tighten bolts.

3. Check door for proper operation and alignment, and where required adjust door as described under "Front Door Adjustments".

4. Install front fender opening filler panel and remove protective covering from front fender.

NOTE: For lubrication of hinges, see BODY LUBRICATION, Section 2.

To remove the front door assembly from the hinges, proceed as outlined previously only remove the door to hinge bolts and it will not be necessary to remove the lower fender attaching bolt. (Fig. 15-29)

When installing, as an anti-squeak precaution, coat attaching surfaces of hinges with heavy bodied sealer prior to installing door. (Fig. 15-28)

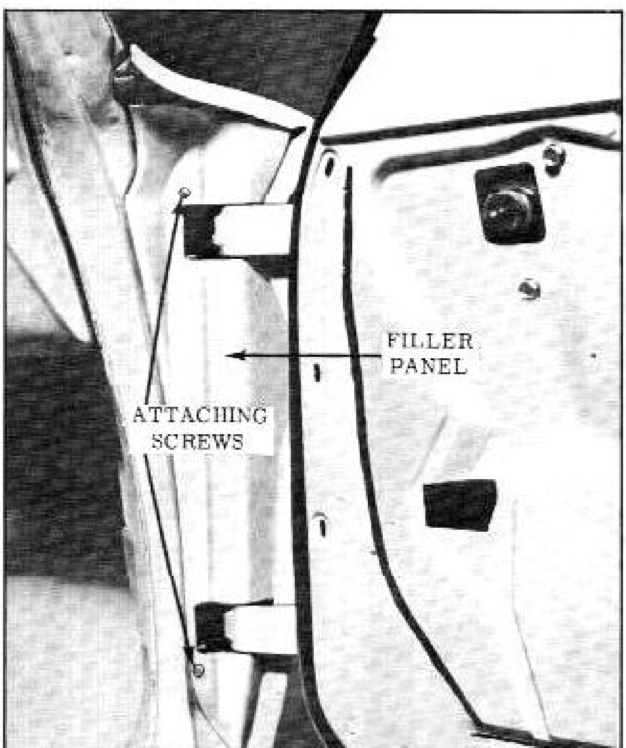


Fig. 15-26 Front Fender Filler Panel

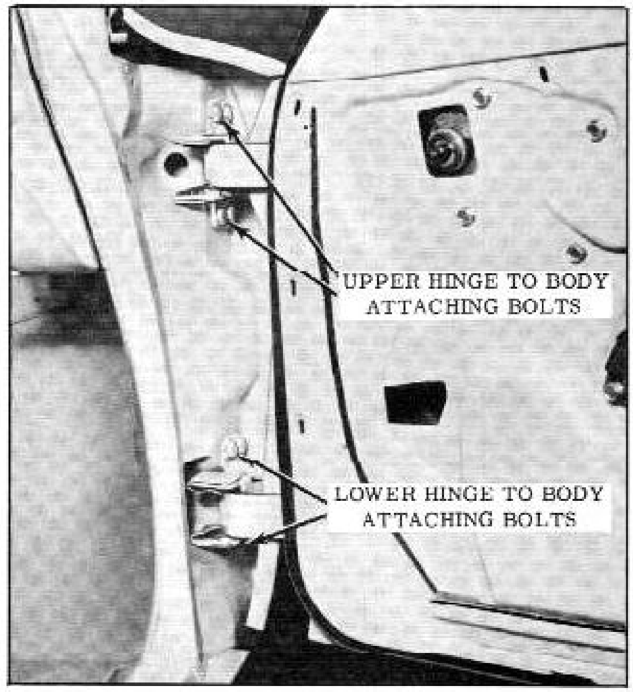


Fig. 15-27 Front Door Hinge Attachment to Cowl

ADJUSTMENT

Door adjustments are provided through the use of floating anchor plates at the door and body pillars. When checking the door for misalignment, remove the door lock striker from the body pillar to allow door to hang free on its hinges.

To adjust the door up or down and/or fore or aft at the front body hinge pillar, proceed as follows:

1. Remove front fender filler panel.
2. Mark location of hinges on front body hinge pillar.

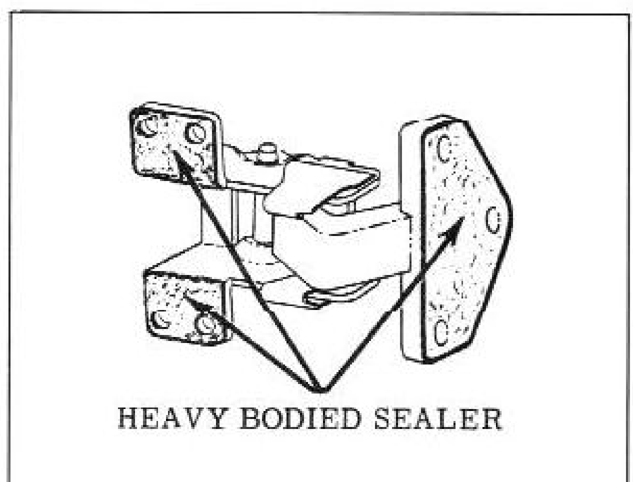


Fig. 15-28 Front Door Hinge Assembly

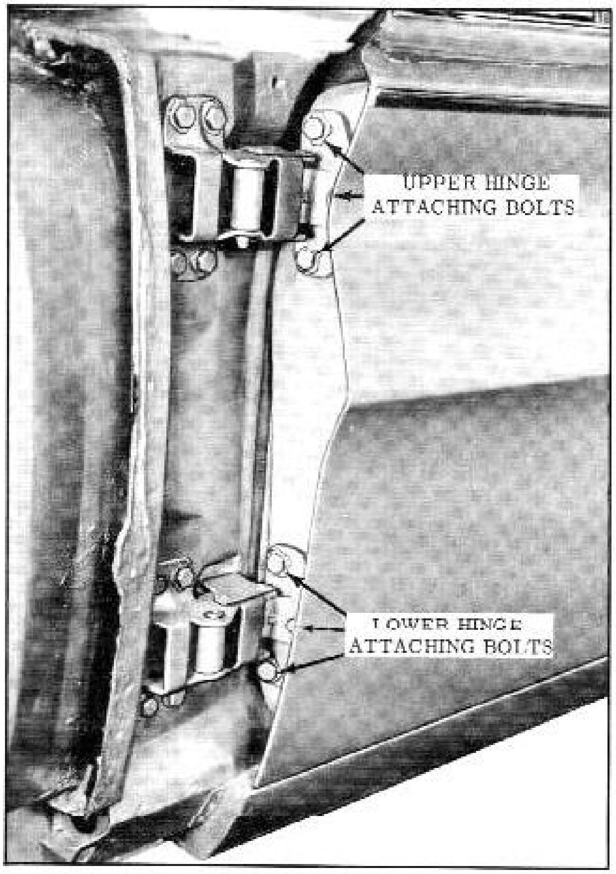


Fig. 15-29 Front Door Hinge Attachment to Door

3. Loosen hinge attaching bolts and shift door to desired position; then tighten hinge attaching bolts. (Fig. 15-27)

   NOTE: Loosen front fender lower rear attaching bolt if necessary to gain additional access to lower hinge attaching bolts.

4. Reinstall door lock striker and check lock extension-to-striker engagement as described under DOOR LOCK STRIKER - Adjustments.

To adjust door in or out and/or up or down at the door hinge pillar, proceed as follows:

1. Mark hinge locations on door.
2. Loosen hinge attaching bolts. (Fig. 15-29) Shift door to desired position, then tighten hinge attaching bolts.
3. Check door for proper alignment and, where necessary, repeat steps 1 and 2 above until desired adjustment is obtained.

DOOR LOCK REMOTE CONTROL ASSEMBLY AND CONNECTING LINK

Removal and Installation

1. Raise door window. Remove door trim assembly and detach inner panel water deflector.
2. With aid of a screwdriver or other suitable tool, disengage end of connecting link from lock assembly. See DOOR LOCK SPRING CLIP.
3. Remove screws securing remote control assembly to door inner panel. Pull remote control away from door inner panel; then rotate remote control assembly one quarter turn to disengage connecting link from remote control assembly. Remove remote control assembly and connecting link from door. (Fig. 15-30)
4. To install, reverse removal procedure. Check operation of door lock before installing inner panel water deflector.

VENTILATOR ASSEMBLY

Removal and Installation

1. Raise door window. Remove door trim assembly and detach inner panel water deflector.
2. Remove door lock remote control assembly and connecting link.
3. Remove door window bumper support assembly and ventilator division channel lower adjusting stud and nut.
4. Carefully lower door window to extreme down position. Remove three door window frame to ventilator attaching screws and one inner panel to ventilator attaching screw. (Fig. 15-30)

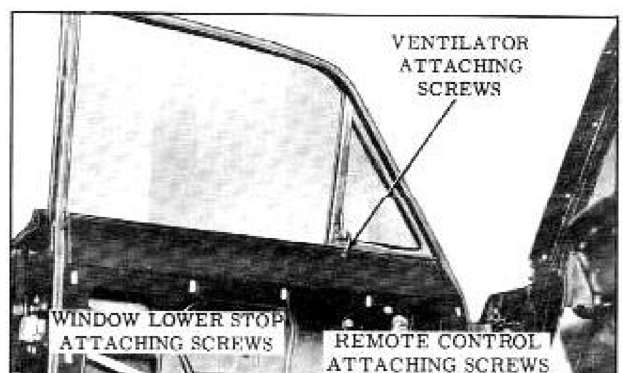


Fig. 15-30 Front Door Ventilator and Remote Control Attachment

5. Disengage upper front corner of glass run channel from window frame assembly.

6. Carefully tilt ventilator assembly rearward until clear of window frame assembly; then lift ventilator inboard and upward and remove from door.

   CAUTION: After ventilator has been removed, door glass should be held or otherwise suitably supported to prevent damage to door glass.

7. To install, reverse removal procedure. Check operation of ventilator and door window assembly and, where required, adjust ventilator assembly as described under FRONT DOOR VENTILATOR ADJUSTMENTS.

Adjustments

1. To adjust ventilator division channel in or out or fore or aft, remove door trim assembly and detach inner panel water deflector sufficiently to loosen division channel lower adjusting stud nut. (Fig. 15-30) Adjust stud in or out as required or position channel fore or aft as required; then tighten stud nut. Seal water deflector and install door trim and inside hardware.

2. The effort required to open or close the ventilator may be increased or decreased by bending up washer tab and tightening or loosening the adjusting nut. (Fig. 15-31)

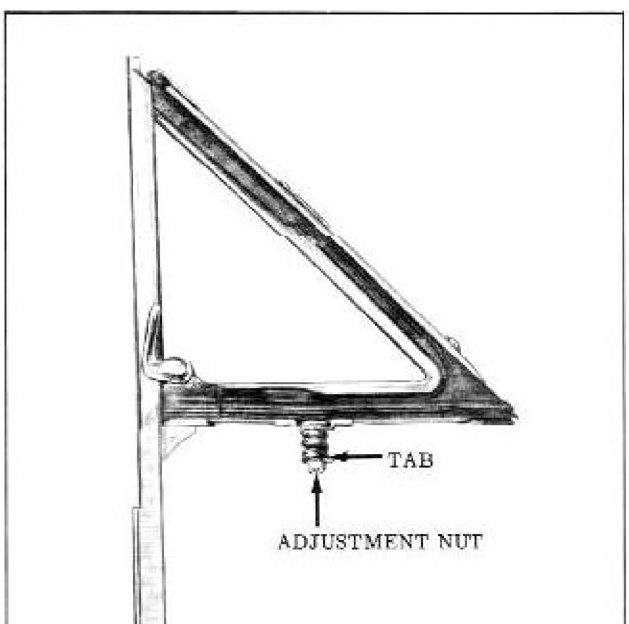


Fig. 15-31 Ventilator Friction Adjustment

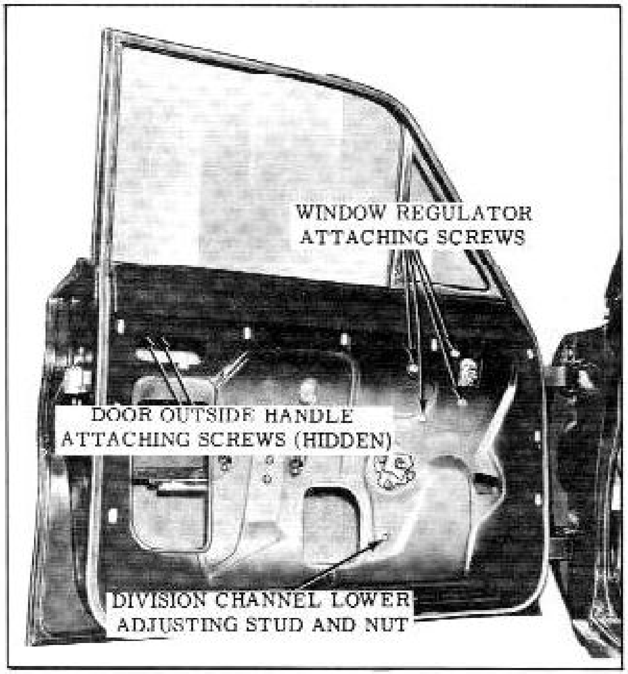


Fig. 15-32 Window Regulator and Outside Handle Attachment

Tightening the adjusting nut will increase effort required to open and close ventilator, loosening adjusting nut will decrease opening and closing effort. When desired adjustment has been obtained, bend down washer tab to lock nut in position.

NOTE: This adjustment should be performed as a bench operation.

WINDOW REGULATOR ASSEMBLY

Removal and Installation

1. Remove door trim assembly and detach inner panel water deflector.

2. Raise door window. Place a protective piece of paper over window frame assembly and door weatherstrip to protect paint and weatherstrip from damage; then secure window in full up position by installing a twelve to fifteen inch piece of body tape (2" or 2-1/2" in width) over window frame and firmly pressing tape to both sides of glass. This is necessary to positively hold glass in the up position during removal of the window regulator.

3. Remove remote control assembly and ventilator division channel lower adjusting stud and nut.

4. Remove window regulator attaching screws then work window regulator rearward to disengage arm from window lower sash channel cam and remove regulator from door. (Fig. 15-32)

5. To install, reverse removal procedure. Cycle window several times to insure proper operation before installing water deflector.

FRONT DOOR WINDOW

The front door glass is a solid tempered safety plate glass. The glass fits into a lower sash channel assembly which incorporates a welded-on lower sash channel cam. With this type design, the door glass, lower sash channel and sash channel cam are removed from the door as a unit.

CAUTION: Care should be exercised to make certain glass does not strike body metal during installation procedure as edge chips can cause tempered plate glass to shatter. DO NOT attempt to grind glass.

Removal and Installation

1. Remove door trim assembly and detach inner panel water deflector.
2. Remove front door ventilator assembly as previously described under FRONT DOOR VENTILATOR - Removal and Installation.

   CAUTION: After ventilator has been removed, door glass should be held or otherwise suitably supported to prevent damage to door glass.

3. Carefully lift window assembly upward and forward to disengage regulator arm from door window lower sash channel cam and remove window assembly from between inner and outer panels.

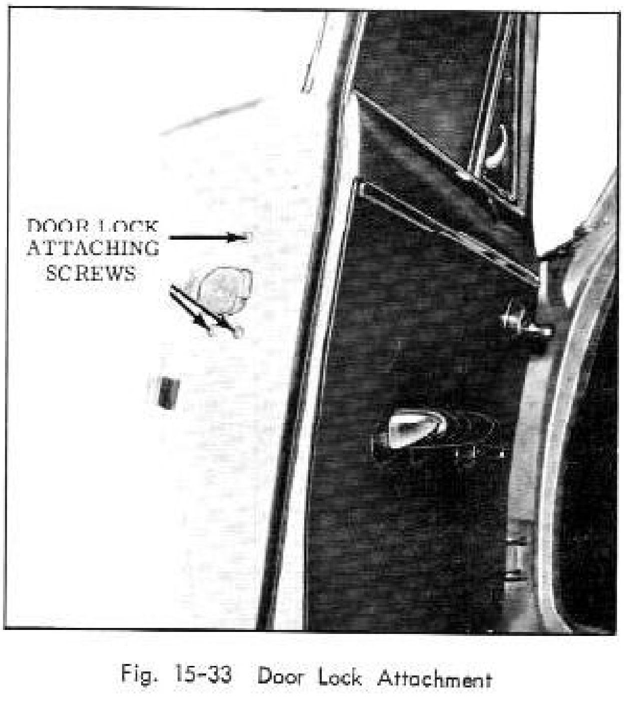


Fig. 15-33 Door Lock Attachment

4. To install, reverse removal procedure. After installation of window assembly, lubricate lower sash channel cam along entire length of cam with lubriplate or its equivalent.

Adjustments

1. To adjust the lower portion of the ventilator division channel in or out or fore or aft, lower door window and loosen ventilator division channel adjusting stud nut. (Fig. 15-30) Turn adjusting stud in or out or position lower end of channel fore or aft as required; then tighten stud nut.
2. A slight up or down adjustment of the door window can be obtained by adjusting the door window bumper support assembly.

OUTSIDE HANDLE ASSEMBLY

Removal and Installation

1. Raise door window. Remove door trim assembly and detach upper rear corner of inner panel water deflector sufficiently to gain access to door outside handle attaching screws. (Fig. 15-32)
2. Remove screws then remove door lock handle and gaskets from outside of body.
3. To install, reverse removal procedure.

DOOR LOCK ASSEMBLY

All locks are the rotary bolt-type lock with safety interlock feature. With the safety interlock feature it is very important that the lock extension engages properly in the door lock striker notch and that, where necessary, striker emergency spacers of the proper thickness are used to obtain proper engagement.

Removal and Installation

1. Raise door window. Remove door trim assembly and detach inner panel water deflector
2. Remove lock cylinder assembly.
3. With a screwdriver or other suitable pointed tool disengage remote control connecting link from door lock assembly (See DOOR LOCK SPRING CLIP).
4. Remove door lock attaching screws and remove lock assembly through inner panel access hole. (Fig. 15-33)
5. To install, reverse removal procedure. Check all operations of lock assembly before installing inner panel water deflector.

LOCK CYLINDER ASSEMBLY

Removal and Installation

1. Raise door window. Remove door trim assembly and detach inner panel water deflector.
2. With a suitable tool, through inner panel access hole pry out lock cylinder retaining clip sufficiently to allow removal of cylinder, then remove cylinder and gasket. (Figs. 15-34 & 35)
3. To install, reverse removal procedure. Using key, check operation of lock cylinder assembly.

Disassembly and Assembly

1. Remove cylinder assembly from door as previously described.
2. With a suitable tool, through inner panel access hole, slide lock cylinder retaining clip forward sufficiently to allow removal of cylinder, then remove cylinder and gasket. (Fig. 15-35)
3. To assemble, reverse disassembly procedure.

   NOTE: The lock cylinder housing scalp used in production is usually damaged when removed and must be replaced by a new scalp available as a service part. The service lock cylinder housing scalp is secured by tabs.

REAR DOOR ASSEMBLY AND HINGES

The rear door assembly is attached to the body center pillar with butt-type hinges. The upper hinge on all styles is secured with screws to an anchor plate at the door hinge pillar and bolts to

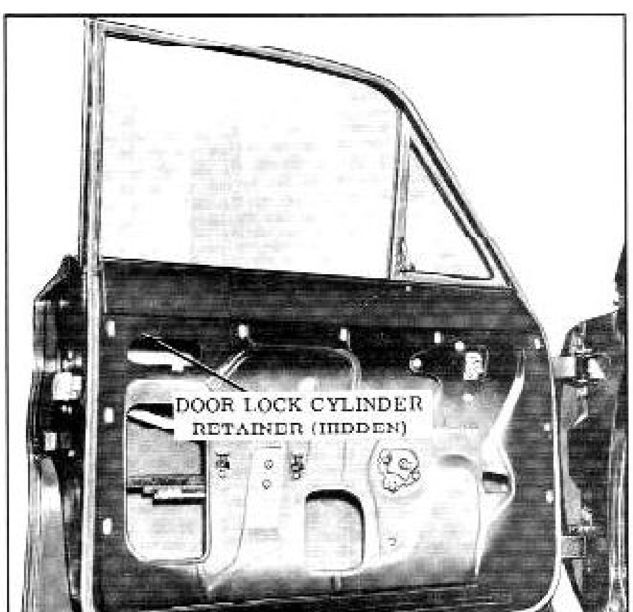


Fig. 15-34 Door Lock Cylinder Attachment

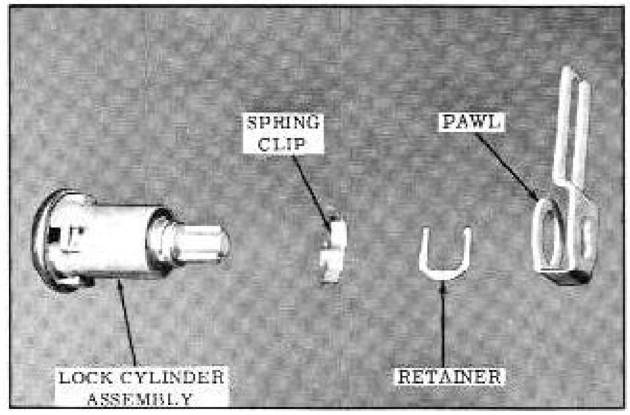


Fig. 15-35 Rear Cylinder Assembly

an upper hinge support at the center pillar. The lower hinge on all styles incorporates an integral type door check and hold open and is secured with screws to an anchor plate at both the door hinge pillar and center pillar. The rear door assembly may be removed with or without the hinges attached.

Removal

1. Clean off excess sealer from around each hinge strap and mark hinge location on door hinge pillar or center pillar, depending on method of removal being used.
2. With door properly supported, remove upper and lower hinge attaching screws at door hinge pillar or screws and bolts at center pillar, depending on method of removal being used. (Fig. 15-36)

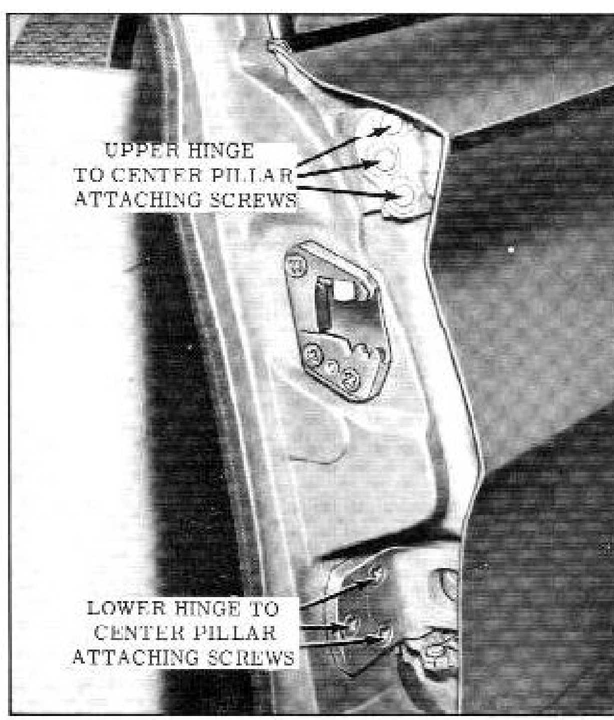


Fig. 15-36 Rear Door to Center Pillar Attachment

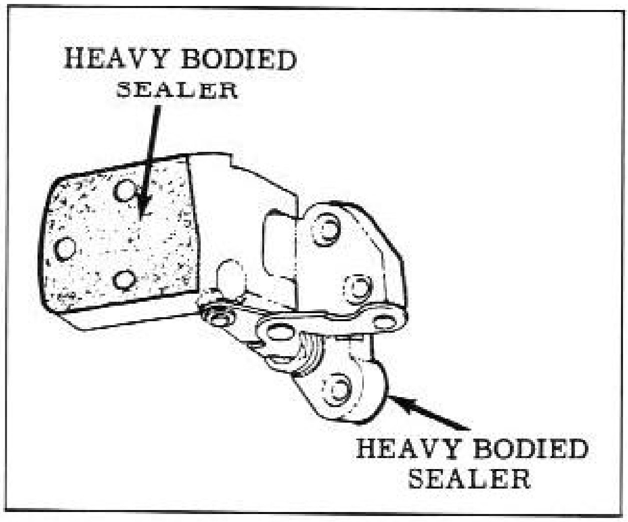


Fig. 15-37 Rear Door Hinge Assembly

3. With aid of a helper, remove door from body opening.

Installation

1. With scraper and mineral spirits, carefully clean off old sealing compound at hinge areas.

2. Apply a coat of heavy bodied sealer to attaching surfaces of hinge straps or corresponding surfaces of door or body. (Fig. 15-37)

3. With helper, lift door into position, attach hinge loosely, then align straps within marks on pillar and tighten screws or screws and bolts. Check door for alignment.

ADJUSTMENTS

The in and out adjustments on the rear door are provided at the door hinge pillar while the up and down or fore and aft adjustments are provided at center pillar. When checking the door for alignment, remove the door lock striker from body pillar to allow door to hang free on its hinges.

1. For in and out adjustment, loosen hinge to door pillar attaching screws. Adjust door as required and tighten screws.

2. To adjust door up or down or fore or aft, loosen hinge to center pillar attaching bolts and screws. Adjust door up or down or fore or aft as required and tighten attaching bolts and screws.

   NOTE: When performing fore or aft adjustments, adjust 1 hinge at a time so that the up and down adjustment of door is maintained. After completing any fore or aft adjustments, the rear door upper hinge may have to be adjusted in or out due to the design of the center pillar hinge support.

   CAUTION: Use only the recommended procedures for adjusting rear doors. The upper hinge is constructed of die cast aluminum which will break under strain of bending in an attempt to short-cut adjustments.

Reinstall door lock striker and check lock extension to-striker engagement as described under DOOR LOCK STRIKER - Adjustments.

GLASS RUN CHANNEL REAR RETAINER ASSEMBLY

Removal and Installation

1. Raise rear door window. Remove door trim assembly and detach inner panel water deflector.

2. Remove rear door window glass run channel rear retainer assembly lower attaching bolt from lock pillar facing of door. (Fig. 15-38)

3. Inside of door, disengage end of window glass run channel from retainer. Then lower retainer to disengage upper end from rear door window frame and remove retainer from door.

4. To install, reverse removal procedure. Check operation of window assembly and, if required, adjust rear retainer as outlined under REAR DOOR WINDOW ADJUSTMENTS.

DOOR LOCK ASSEMBLY

Locks are the rotary bolt-type with the safety interlock feature. With the interlock feature it is very important that the lock extension engages properly in the door lock striker notch and that, where necessary, striker emergency spacers of the proper thickness be used to obtain proper engagement.

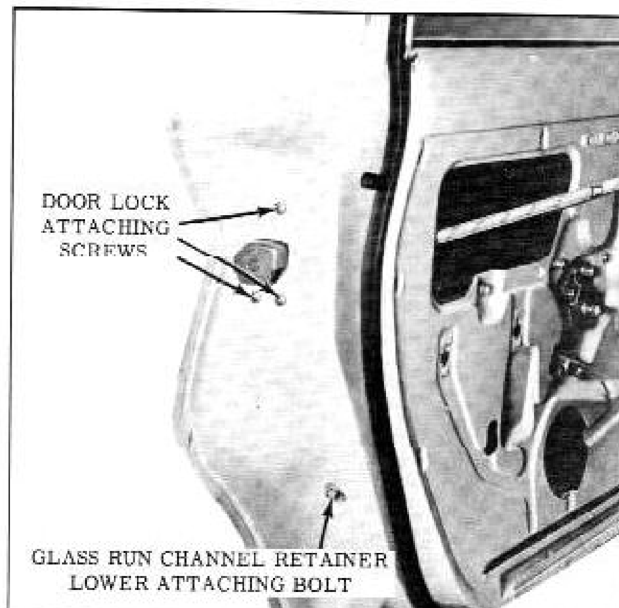


Fig. 15-38 Rear Door Lock and Glass Run Channel Retainer Attachment

Removal and Installation

1. Raise rear door window. Remove door trim assembly and detach inner panel water deflector sufficiently to gain access to door lock.

2. Remove rear door window glass run channel retainer assembly.

3. With a screwdriver or other suitable tool, disengage spring clips and detach inside lock connecting rod and remote control connecting rod from door lock, See DOOR LOCK SPRING CLIPS.

4. Remove screws securing lock to door lock levers and reverse removal procedure. Check all operations of lock assembly before installing inner panel water deflector.

REMOTE CONTROL ASSEMBLY AND CONNECTING ROD

Removal and Installation

1. Remove door trim assembly and detach inner panel water deflector sufficiently to gain access to remote control attaching screws. (Fig. 15-39)

2. Remove screws securing remote control assembly to door inner panel and detach remote control from remote control-to-lock connecting rod.

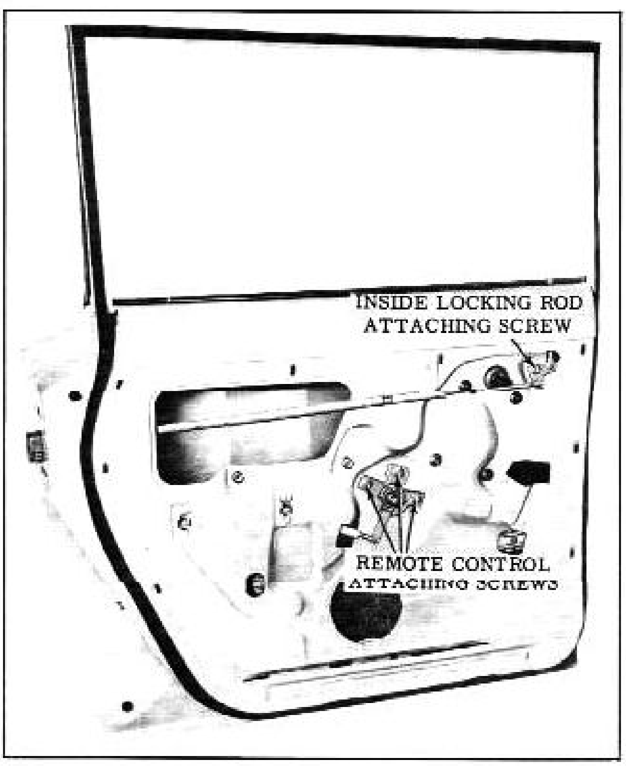


Fig. 15-39 Rear Door Remote Control and Inside Locking Rod Attachment

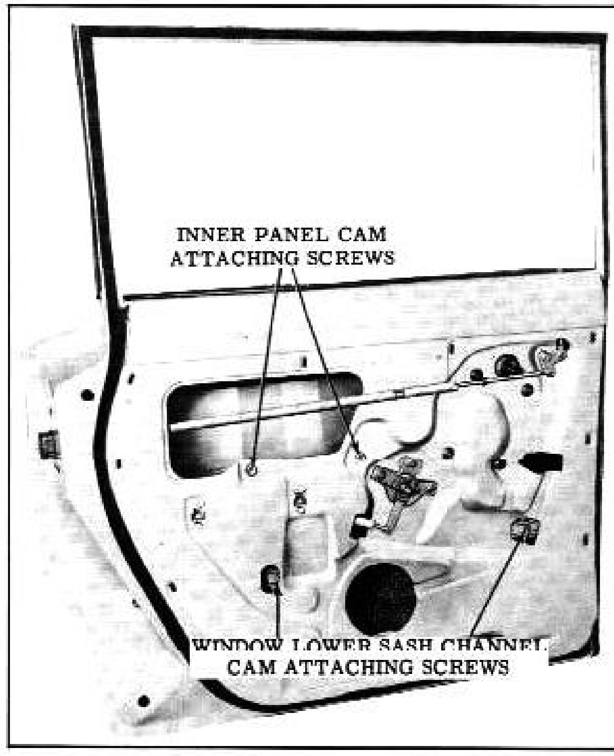


Fig. 15-40 Inner Panel Cam and Window Lower Sash Channel Cam Attachment

3. Through access hole, disengage rod from lock, See DOOR LOCK SPRING CLIPS.

4. To install remote control and connecting rod, reverse removal procedure. Position remote control rearward sufficiently to take up slack in linkage so that all clearances are taken out of linkage in a rearward position. Check lock for proper operation before installing inner panel water deflector.

INSIDE LOCKING TO LOCK ROD ASSEMBLY

Removal and Installation

1. Raise door window. Remove door trim assembly and detach inner panel water deflector.

2. Remove locking rod knob from rod.

3. Remove inside locking rod assembly attaching screw and washer and detach connecting rod from clip on inner panel. (Fig. 15-39)

4. Through access hole, disengage spring clip securing inside lock connecting rod from door lock and disengage rod from lock, then remove inside locking rod assembly from door.

5. To install, reverse removal procedure. Check operation of inside locking rod assembly before installing door inner panel water deflector.

INNER PANEL CAM ASSEMBLY

Removal and Installation

1. Raise door window. Remove door trim assembly and detach inner panel water deflector sufficiently to expose inner panel cam attaching screws. (Fig. 15-40)

2. Remove cam attaching screws; then disengage cam from window regulator arm roller and remove from door.

3. To install, reverse removal procedure. Prior to installation of inner panel cam, lubricate entire length of cam with #630 AAW Lubriplate or equivalent.

WINDOW LOWER SASH CHANNEL CAM

Removal and Installation

1. Remove door trim assembly and detach inner panel water deflector.

2. Lower door window sufficiently to gain access to sash channel cam attaching screws through access holes in door inner panel and remove screws. (Fig. 15-40)

3. While supporting window by hand, carefully disengage cam from window lower sash channel and rollers on window regulator arms and remove from door. Then carefully lower window.

4. To install, reverse removal procedure. Prior to installation, lubricate entire length of window lower sash channel cam with #630 AAW Lubriplate or equivalent. Check operation of window prior to installing inner panel water deflector.

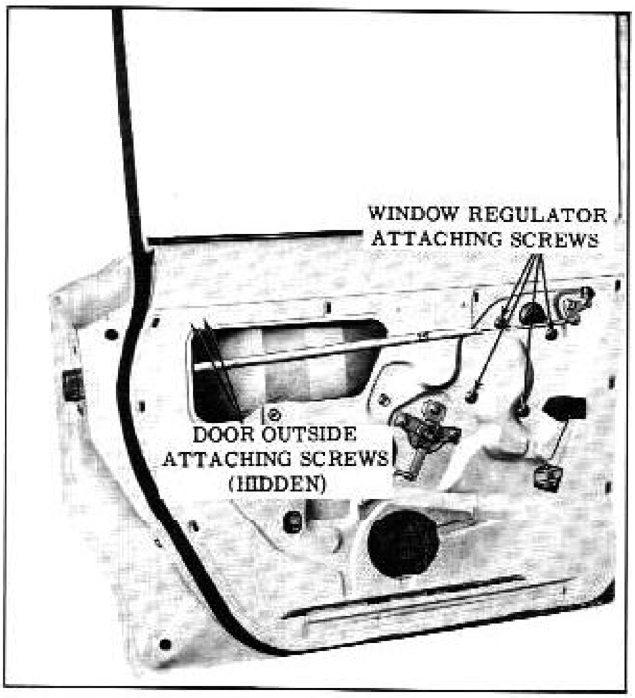


Fig. 15-41 Window Regulator and Outside Handle Attachment

WINDOW REGULATOR ASSEMBLY

Removal and Installation

1. Remove door trim pad and detach inner panel water deflector.

2. Remove door window lower sash channel cam.

3. Carefully raise door window. Place a protective piece of paper over window frame assembly and door weatherstrip to protect paint and weatherstrip from damage and secure window in the full-up position by installing a twelve to fifteen inch piece of body tape (2" or 2-1/2" in width) over window frame and firmly pressing tape to both sides of glass. This is necessary to positively hold glass in the up position during removal of the window regulator.

4. Remove window regulator attaching screws. (Fig. 15-41) Carefully move regulator assembly rearward to disengage regulator arm roller from inner panel cam; then remove regulator from door.

5. To install, reverse removal procedure. Lubricate cams with #630 AAW Lubriplate or equivalent and check window operation prior to installing water deflector.

WINDOW ASSEMBLY

The rear door glass is a solid tempered safety plate glass. The glass fits into a lower sash channel assembly which incorporates a screwed-on lower sash channel cam.

CAUTION: Care should be exercised to make certain glass does not strike body metal during installation procedure as edge chips can cause tempered plate glass to shatter. DO NOT attempt to grind glass.

Removal and Installation

1. Raise door window. Remove door trim assembly and detach inner panel water deflector.

2. Remove rear door window glass run rear retainer assembly.

3. Carefully lower door window and through access holes in door inner panel remove screws securing window lower sash channel cam to window lower sash channel. (Fig. 15-40)

   NOTE: Exercise care when lowering window since rear guide is not present.

4. While supporting window by hand, carefully disengage lower sash channel cam from window lower sash channel and window regulator arm rollers and remove cam from door. Disengage spring clips and detach inside lock connecting rod and remote control connecting rod from door lock.

5. Completely lower door window assembly. Then tilt front edge of glass upward and carefully lift window upward and outboard to clear window frame and remove from door.

   NOTE: On station wagon styles, tilt rear edge of glass upward, then lift window upward and outward to remove from door.

6. To install, reverse removal procedure. Prior to installation of water deflector, lubricate lower sash channel cam and inner panel cam with #630 AAW Lubriplate or equivalent. Check operation of window and, where required, adjust window assembly as described under ADJUSTMENTS, below.

Adjustments

1. To adjust rear door window in or out, lower door window. Loosen rear glass run channel retainer assembly attaching screw and adjust guide assembly as required; then tighten screw. (Fig. 15-40)

2. To correct a condition where the glass is cocked in the glass run channels, loosen door window inner panel cam front and/or rear attaching screw(s), adjust cam as required, and tighten screws. (Fig. 15-40)

OUTSIDE HANDLE

Removal and Installation

1. Raise door window. Remove door trim assembly and detach inner panel water deflector sufficiently to gain access to outside handle attaching screws.

2. Remove screws securing outside handle and remove handle and gaskets. (Fig. 15-41)

3. To install, reverse removal procedure. Check operation of outside handle prior to installing inner panel water deflector.

REAR QUARTER WINDOW ("19" Styles)

Removal and Installation

1. Remove rear seat cushion and back, rear quarter window garnish moldings and belt finishing molding.

2. Remove retainers securing glass and rubber channel; then from outside of body carefully push glass and rubber channel assembly from body opening. Remove rubber channel from glass.

3. To install rear quarter window, first clean off all old sealer from rubber channel and body opening. Apply a bead of medium-bodied sealer on wall of window opening rabbet completely around window opening to effect a seal between body and rubber channel. (See 1 in Fig. 15-42)

4. Position glass and rubber channel assembly into window opening and install retainers loosely. Using a pressure type applicator, apply weatherstrip adhesive (black) between rubber channel and outside surface of glass. (See 2 in Fig. 15-42)

5. Tighten rubber channel and glass assembly retainers. Clean off all excess sealer and weatherstrip adhesive; then install garnish moldings and belt finishing molding.

REAR QUARTER WINDOW ("35" Styles)

Removal and Installation

1. Remove rear quarter window lower garnish moldings and back body opening upper finishing panel. On 3135 styles remove upper garnish molding.

2. Remove retainers securing glass and rubber channel; on 3035 styles upper retainers are located under lip of rubber channel. From outside of body carefully push glass and rubber channel assembly from body opening. Remove rubber channel from glass.

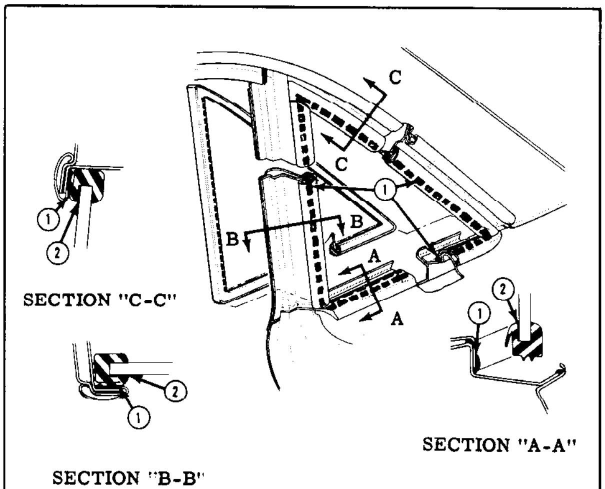


Fig. 15-42 Rear Quarter Window Sealing

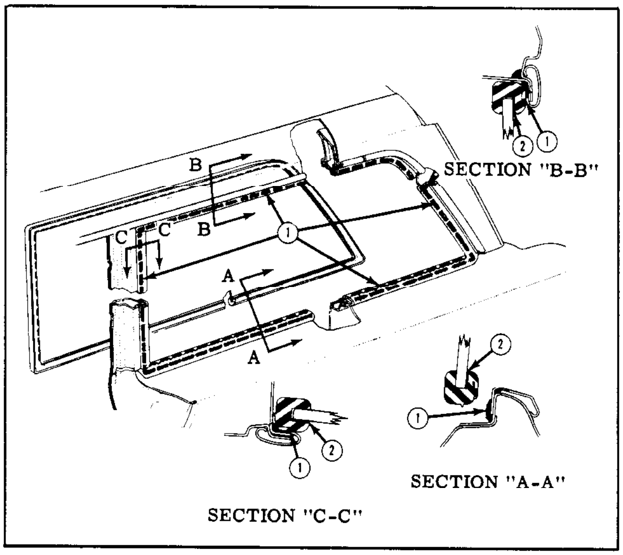


Fig. 15-43 Rear Quarter Window Sealing (Station Wagon)

3. To install rear quarter window, first clean off all old sealer from rubber channel and body opening. Apply a bead of medium-bodied sealer on the wall of window opening rabbet completely around window opening to effect a seal between body and rubber channel. (See 1 in Fig. 15-43)

4. Position glass and rubber channel assembly into window opening and install retainers loosely. Using a pressure type applicator apply weatherstrip adhesive (black) between rubber channel and outside surface of glass. (See 2 in Fig. 15-43)

5. Tighten rubber channel and glass assembly retainers. Clean off all excess sealer and weatherstrip adhesive; then install garnish moldings and back body opening upper finishing panel.

REAR QUARTER FRONT AND REAR TRIM PANELS ("35" Styles)

Removal and Installation

Front Trim Panel

1. Remove rear quarter window front garnish molding and rear trim panel front attaching screw.

2. Remove front trim panel attaching screws and remove panel.

Rear Trim Panel

1. Loosen rear quarter window front garnish molding rear attaching screw; then remove rear garnish molding.

2. Remove rear trim panel attaching screws and remove panel.

3. To install rear quarter front and rear trim panels, reverse removal procedure.

REAR WHEELHOUSE TRIM ("35" Styles)

Removal and Installation

1. Remove rear quarter front and rear trim assemblies.

2. Remove screw securing rear floor filler panel to rear floor compartment panel and fold filler panel forward.

3. Remove rear floor compartment panel, spare tire cover panel and floor compartment side panel, as described and illustrated under, FOLDING SEAT BACK and REAR COMPARTMENT FLOOR PANELS, in the Seat Section.

4. Carefully detach wheelhouse trim from cemented areas of quarter panel, wheelhouse and floor pan; then remove trim.

5. To install rear wheelhouse trim, apply trim cement to contacting surfaces of trim and body panels; then install trim to wheelhouse making sure trim is properly positioned and free of wrinkles.

To complete installation, reverse removal procedure (steps 1 through 3).

FUEL TANK FILLER NECK DOOR AND HINGE

Removal and Installation

1. To remove gas tank filler neck door, open door and remove 2 bolts securing door to hinge.

2. To remove gas tank filler neck door hinge, open door and remove 2 bolts securing hinge to hinge support inside opening.

3. To install, reverse removal procedure.

FILLER NECK DOOR AND HINGE ADJUSTMENTS

To adjust door forward, rearward, or up or down, loosen door to hinge attaching bolts, shift door to desired position then tighten bolts.

To adjust front of door in or out, loosen door to hinge attaching bolts, shift door to desired position then tighten bolts.

The rear edge of the door may be adjusted inward by trimming off the rubber bumpers to obtain the desired inward adjustment.

BACK WINDOW REVEAL MOLDINGS (3000 Series)

The back window reveal moldings are equipped with an "L" shaped retaining flange which is secured in an "L" shaped cavity in the back window rubber channel. To remove the reveal moldings it is necessary to first remove the back window and rubber channel assembly.

BACK WINDOW REVEAL MOLDINGS (3100 SERIES)

The back window reveal moldings are secured by pronged retainer clips which require the use of reveal molding removal Tool J-7898-01 to disengage moldings from the clips. (Fig. 15-44)

To disengage moldings from clips, insert one end of tool between back window rubber channel and reveal molding, engage point of tool between retaining clip and molding, then swing tool slightly, (Fig. 15-44), to disengage prongs of clip from molding and lift molding free of clip. Repeat this operation at each of the molding retaining clips.

Positioning of back window reveal molding retaining clips is shown in Fig. 15-45.

To install back window reveal moldings, position molding so that flange of molding is between clips and body metal, then push molding at retaining clip locations until molding is properly secured by retaining clips.

BACK WINDOW ASSEMBLY ("19" STYLES)

Removal

1. Place protective coverings over rear seat cushion and back assemblies, over parcel shelf trim and over painted surfaces around back window.
2. Remove back window garnish moldings.
3. Remove back window reveal moldings.
4. From inside of body using a hooked or other suitable tool carefully break seal between lip of rubber channel and pinchweld flange completely around perimeter of glass.
5. Carefully push back window and rubber channel assembly outward until lip of rubber channel is disengaged from pinchweld and retaining flange.

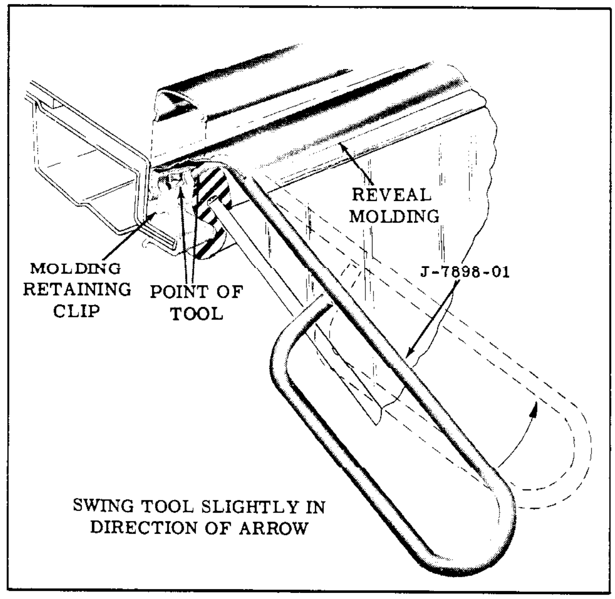


Fig. 15-44 Back Window Reveal Molding Removal Tool

6. With aid of a helper, lift complete assembly from body opening and place on a protected surface. On styles with reveal moldings secured in the rubber channel remove moldings from rubber channel.

Installation

IMPORTANT: Care should be exercised to make certain glass does not strike body metal during installation as edge chips can cause tempered plate glass to shatter. DO NOT attempt to grind glass.

1. Clean original sealer from back window body opening and rubber channel and install rubber channel to glass.

   IMPORTANT: Before installing back window glass, check the back window body opening and pinchweld flange for any irregularities and correct, where necessary. Mark center of back window and body opening.

2. Check installation of reveal molding clips at pinchweld and retaining flange and remove any damaged clips.
3. Prior to installing any reveal molding clips apply a continuous ribbon of medium-bodied sealer (approximately 1/4" thick) along the pinchweld and retaining flange, as indicated at "1" in Section "A-A", Fig. 15-45, completely around opening.

   Replace any damaged or missing reveal molding clips.

4. Apply a second continuous ribbon of medium-bodied sealer (approximately 1/4 inch thick) along the outer wall of the back window opening, as indicated at "2" in Section "A-A", Fig. 15-45, completely around opening.

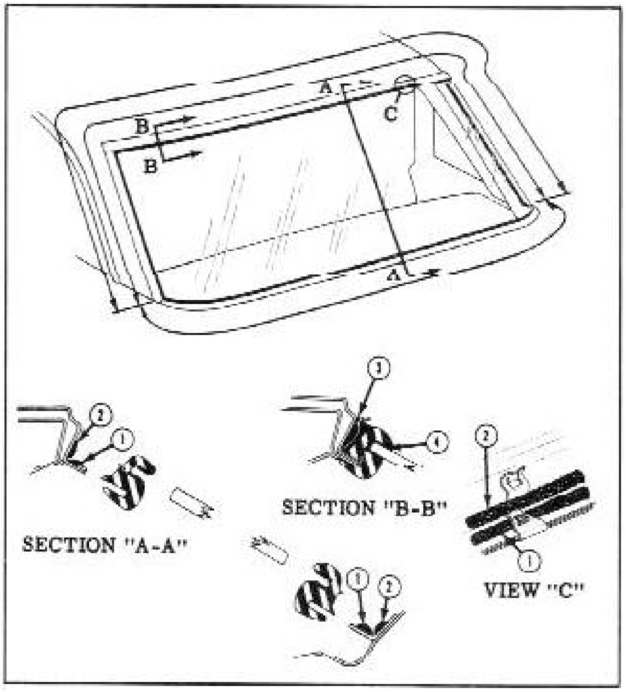


Fig. 15-45 Back Window Sealing

5. Install rubber channel to glass and insert a strong cord into pinchweld cavity of rubber channel; tie ends together at bottom center and tape ends to inside surface of glass. On styles where the reveal moldings are secured by the rubber channel install moldings to rubber channel and, where necessary, tie moldings to glass and channel assembly. Make sure moldings are positioned properly as moldings are difficult to reposition after installation of back window assembly.

6. With aid of a helper, position back window and rubber channel assembly into body opening. While helper is applying hand pressure to outside surface of glass, carefully pull ends of cord across bottom, up sides and across top of window opening to seat lip of rubber channel over pinchweld and retaining flange completely around back window.

7. Apply sufficient medium-bodied sealer to fill the void between rubber channel and body opening up sides and across top of window, as indicated at "3" in Section "B-B", Fig. 15-45.

8. Using a pressure type applicator apply an approved weatherstrip adhesive between outer lip of rubber channel and glass, as indicated at "4" in Section "B-B", Fig. 15-45, completely around rubber channel.

9. Install back window reveal moldings.

10. Clean off excess sealer and cement; install previously removed parts and remove protective coverings.

REAR COMPARTMENT LID

Removal and Installation

1. Open lid and place protective covering along edges of rear compartment opening to prevent damage to painted surfaces.

2. Scribe location of hinge straps on lid inner panel.

3. With aid of a helper to hold lid, remove lid attaching bolts "A" and "B", Fig. 15-46, at both hinge straps and remove rear compartment lid.

4. To install rear compartment lid, first, as an anti-squeak precaution, apply a coat of heavy-bodied sealer on the surface of the compartment lid hinge which contacts the rear compartment lid; then, reverse removal procedure.

ADJUSTMENTS

1. To adjust compartment lid forward or rearward or from side to side in body opening, loosen hinge strap attaching bolts "A" and "B", Fig. 15-46, on both sides of lid, adjust lid as required, then tighten bolts.

2. To adjust front of compartment lid up or down, install shims between lid inner panel and hinge strap as follows:

   a. To raise front edge of lid, place shim(s) between lid inner panel and forward portion of one or both hinge straps at "A", Fig. 15-46.

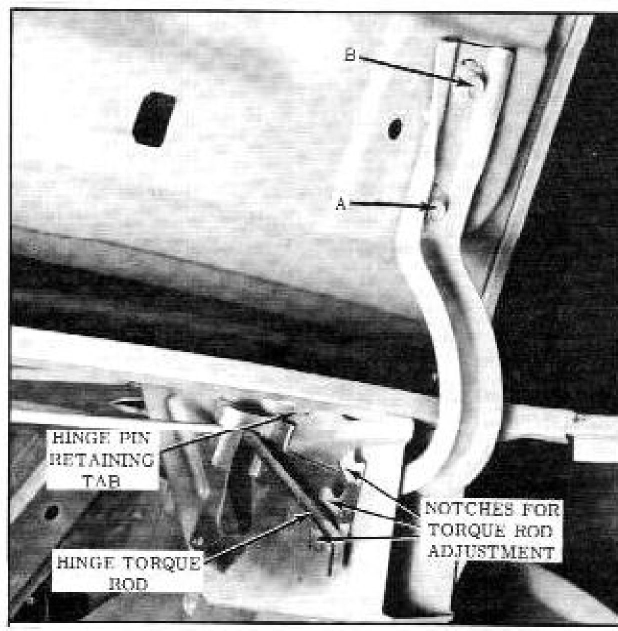


Fig. 15-46 Back Door Hinge and Torque Rod

b. To lower front edge of lid, place shim(s) between lid inner panel and rear portion of one or both hinge straps at "B", (Fig. 15-46)

3. To check lid lock bolt engagement with lock striker, See REAR COMPARTMENT LID LOCK STRIKER ENGAGEMENT CHECK.

TORQUE ROD ADJUSTMENTS

The amount of effort required to open and close the rear compartment lid is determined by the position of the torque rods in the notches on the inboard face of the hinge boxes. (Fig. 15-46) If the torque rod is located in the lowest notch the effort required to open the lid is the greatest and the amount of effort required to close the lid is the least. If the torque rod is located in the top notch, the amount of effort required to open the lid is the least and the amount of effort to close the lid is the greatest.

The torque rods can be disengaged and engaged in the notches by using a suitable length of pipe over the end of the torque rod.

NOTE: It is not necessary to adjust the left and right torque rods at the same time or to the same final position (notch).

LID HINGE

Removal

1. Open lid and place protective covering along edges of rear compartment opening to prevent damage to painted surfaces. Provide support for lid on side where hinge is to be removed.

2. Remove rear compartment side trim foundation at hinge area.

3. Scribe location of hinge strap on lid inner panel and remove bolts "A" and "B", (Fig. 15-46), securing hinge strap to lid.

4. With a suitable length of pipe, disengage torque rod from notched retainer on inboard face of opposite hinge boss.

5. Bend up hinge pin retaining tab on inboard face of hinge box and remove hinge pin, then remove hinge from box.

Installation

1. Position hinge in box and install hinge pin. Bend over retaining tab to secure hinge pin.

2. Install "U" shaped end of torque rod to hinge box making certain outer end of rod is engaged in hole in outboard face of hinge box.

3. Engage torque rod in notch of hinge strap lever; then, engage other end of rod to correct retaining notch on inboard face of opposite hinge box.

4. As an anti-squeak precaution, apply a coat of heavy-bodied sealer to surface of hinge strap which contacts the rear compartment lid.

5. Position hinge strap within scribe marks on lid inner panel and install attaching bolts.

6. Check alignment of rear compartment lid and make any necessary adjustments.

7. Replace all previously removed trim.

LOCK CYLINDER

Removal and Installation

1. Carefully bend lock cylinder retainer tab, (Fig. 15-47) forward to allow disengagement of retainer.

2. Using a suitable hooked tool, pull lock cylinder retainer, (Fig. 15-47) until retainer disengages from lock cylinder.

3. Remove lock cylinder and gasket from rear end panel.

4. To install rear compartment lid lock cylinder, replace gasket, if necessary, and reverse removal procedure.

LID LOCK

Removal and Installation

1. Remove rear compartment lid lock cylinder.

2. Remove 3 rear compartment lock attaching screws. (Fig. 15-47) and remove lock.

3. To install rear compartment lid lock, reverse removal procedure.

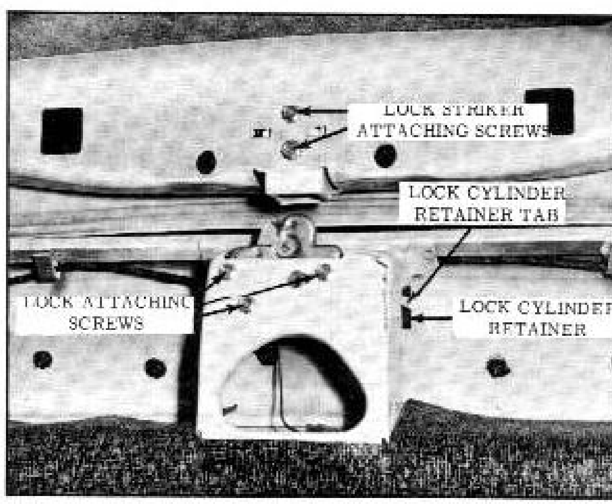


Fig. 15-47 Rear Compartment Lid Lock & Striker

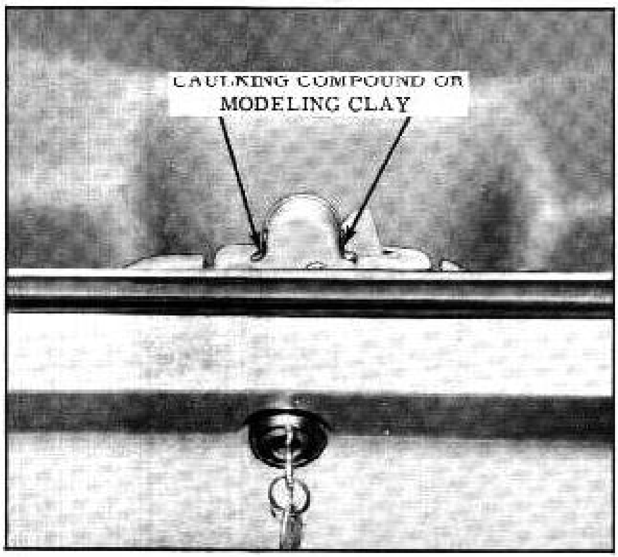


Fig. 15-48 Rear Compartment Lock Striker Engagement Check

LID STRIKER

Removal and Installation

1. Mark location of striker on compartment lid panel, then, remove striker attaching bolts and remove striker and retaining plate. (Fig. 15-47)
2. To install striker, position striker and retaining plate within scribe marks and install attaching bolts and washers.

LID STRIKER ENGAGEMENT CHECK

IMPORTANT: Make sure rear compartment lid is properly positioned in body opening before performing striker engagement check.

To check for proper engagement of rear compartment lid striker with lock bolt, use the following procedure:

1. Place a small amount of modeling clay or body caulking compound on frame of lock at both sides of the lock bolt. (Fig. 15-48) Close lid with moderate force.
2. Open lid and check amount of engagement of striker with lock frame, as indicated by the compression of the clay. The striker impressions in the clay should be even on both sides of the lock frame, as indicated in Fig. 15-48. Where required, loosen striker attaching screws; adjust striker sideways or up or down to obtain proper engagement, then tighten screws.

WEATHERSTRIP

Removal

1. Separate "butt" ends of weatherstrip at rear of compartment opening.
2. Using a flat-bladed tool, carefully disengage weatherstrip from its cemented foundation in gutter around entire perimeter of rear compartment and remove weatherstrip.

Installation

1. Clean out gutter around entire rear compartment opening to provide a clean cementing surface.
2. Apply (brush) a continuous coat of weatherstrip cement (neoprene type) along the lower and outer surfaces of the rear compartment gutter, as indicated at "1" in Fig. 15-49, around full length of gutter.
3. Using a flat-bladed tool such as a putty knife or headlining inserting tool, insert weatherstrip into gutter starting with one end of weatherstrip at rear center of gutter and working completely around gutter.
4. If installing new weatherstrip, trim end of weatherstrip to form a butt joint at rear center of opening. Brush weatherstrip adhesive (black) on both ends of weatherstrip and secure ends together to form a butt joint.
5. Using a pressure type applicater, apply weatherstrip cement (neoprene type) between weatherstrip and outer surface of gutter as indicated at "2" in Fig. 15-49, completely around gutter to assure a watertight seal.
6. Roll or press weatherstrip to aid in obtaining a good cement bond and proper retention of the weatherstrip. Allow sufficient time for cement to set before closing rear compartment lid.

BACK DOOR ("35" Styles)

Removal and Installation

1. Open back door and mark location of hinge strap on back door inner panel to facilitate installation in same location.

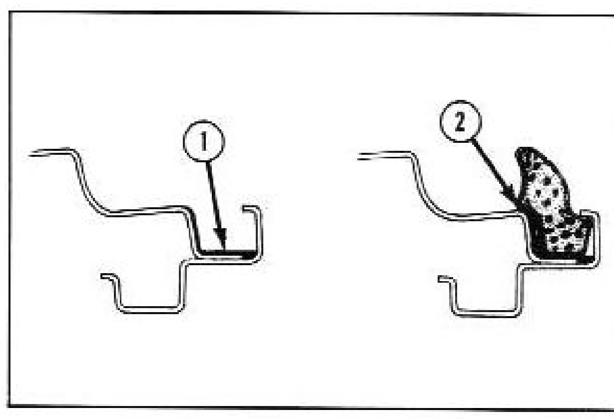


Fig. 15-49 Cross Section View of Rear Compartment Gutter & Weatherstrip

2. With the aid of a helper to hold back door, remove hinge-to-back door attaching bolts. (Fig. 15-51)

3. To install back door assembly, first, as an anti-squeak precaution, apply a coat of heavy-bodied sealer to attaching surfaces of both hinges, (Fig. 15-50) then, reverse removal procedure. Align back door with previously made hinge marks.

4. Where required, adjust back door as described under, BACK DOOR ADJUSTMENTS.

ADJUSTMENTS

1. To adjust the back door assembly up or down or sideways in the back body opening, remove back door lock striker and loosen both right and left hinge-to-back door attaching bolts. Shift door to desired position on hinges; then, tighten hinge attaching bolts and install back door lock striker.

2. To adjust the upper portion of the back door in or out proceed as follows:

   a. Remove back door opening upper finishing panels.

   b. Mark position of torque rod retainers, (Fig. 15-51), at both right and left hinges to facilitate repositioning of retainers in same fore and aft position.

   c. Using a suitable length of pipe over end of torque rod, release tension of torque rod from retainer. While tension of torque rod is released from retainer, loosen retainer attaching bolts, (Fig. 15-51), then, release retainer. Loosen the two remaining hinge attaching bolts. Perform this operation at both right and left hinges.

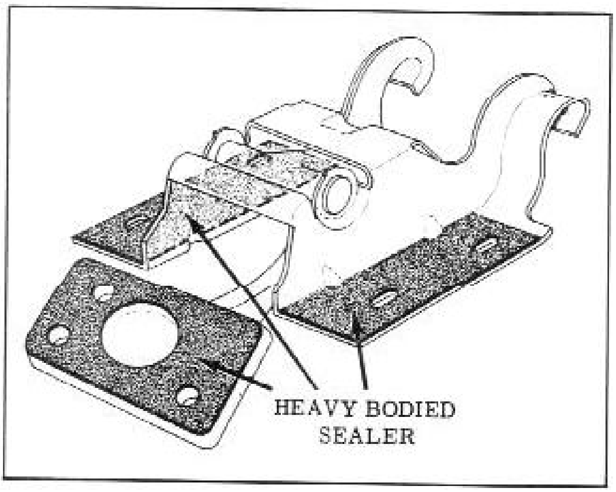


Fig. 15-50 Back Door Hinge - Anti-Squeak

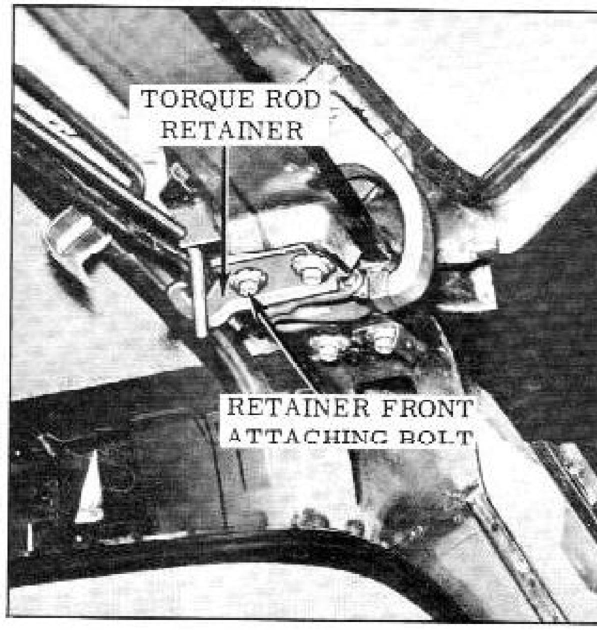


Fig. 15-51 Back Door Hinge & Torque Rod Retainer

   d. Shift the hinges and back door assembly to desired position; then, tighten hinge attaching bolts making sure torque rod retainers are aligned with previously made marks. Install back door opening upper finishing panels.

3. To adjust the lower portion of the door in or out, See BACK DOOR LOCK STRIKER ADJUSTMENTS.

TORQUE ROD AND BACK DOOR HINGE ASSEMBLY

Removal

1. Raise back door and remove both right and left back body opening upper finishing panels.

2. Prop the back door in the open position on the side from which hinge is being removed.

   NOTE: If removing both hinges, remove the back door assembly from the hinges.

3. Mark position of torque rod retainer to facilitate installation in same fore and aft position.

4. Using a suitable length of pipe over end of torque rod, release tension of torque rod from retainer. While tension of torque rod is released from retainer, remove retainer front attaching bolt and loosen (no more than 2 turns) retainer rear attaching bolt; then, swing front end of retainer towards outside of body and release torque rod. (Fig. 15-52)

5. If removing left torque rod, remove clip securing torque rod to body upper panel. Loosen

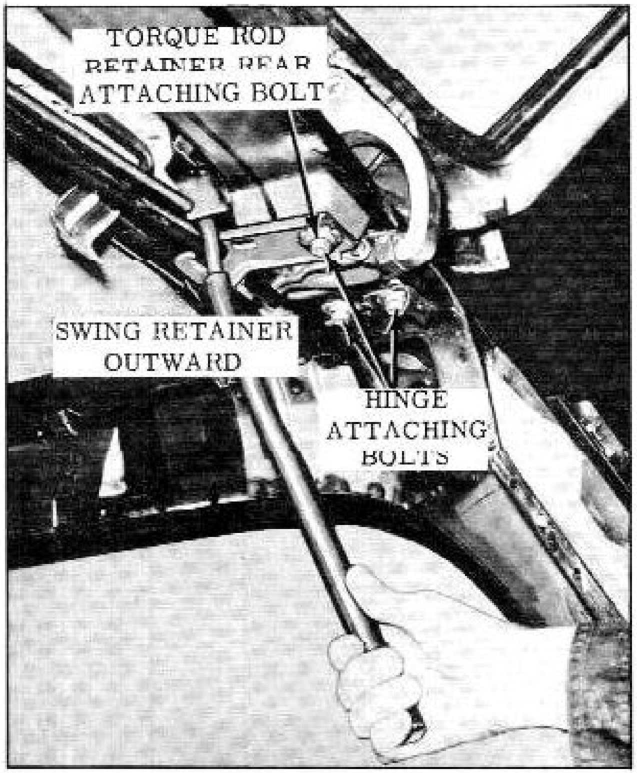


Fig. 15-52 Back Door Hinge & Torque Rod Removal

anti-rattle clip attached to both torque rods; then, disengage torque rod from hinge and remove torque rod.

6. Remove hinge to back door attaching bolts; then, remove hinge to body attaching bolts and remove torque rod retainer and hinge from body.

Installation

1. Lubricate both right and left hinge pivot pins with an approved dripless oil. (Fig. 15-53)

2. As an anti-squeak precaution, apply a coat of heavy-bodied sealer to surfaces of hinge which contact body and back door. (Fig. 15-50)

3. To install back door hinge assembly, reverse steps 1 through 7 of the "Removal" procedure.

   NOTE: When installing hinge torque rod make certain torque rod is properly engaged with hinge, as shown in Fig. 15-53, and align torque rod retainer with previously made marks.

4. After installation of torque rods, lubricate torque rod frictional surfaces on both right and left hinges and frictional surfaces of both torque rod clips with Lubriplate #630 AAW or equivalent. (Fig. 15-53)

5. Where required, adjust back door as described under, BACK DOOR ADJUSTMENTS.

TORQUE ROD TENSION ADJUSTMENT

The amount of effort required to open and close the back door is determined by the forward and rearward position of the right and left torque rod retainers. If both torque rod retainers are adjusted to the full forward position the amount of effort to raise the lid is the greatest and the amount of effort to close the lid is the least. If both torque rod retainers are adjusted to the full rearward position the amount of effort to raise the lid is the least and the amount of effort to close the lid the greatest.

NOTE: It is not necessary to adjust both right and left torque rod retainers at the same time or to the same final position.

Adjust torque rod retainers as follows:

1. Raise back door and remove both right and left back body opening upper finishing panels.

2. Securely prop back door in the open position.

3. Mark location of retainer to facilitate adjustment from original position.

4. Using a suitable length of pipe over end of torque rod remove tension of torque rod from retainer. While tension of torque rod is removed from retainer, loosen retainer attaching bolts, (Fig. 15-53), adjust retainer forward or rearward, as required; then, tighten retainer attaching bolts.

5. Lubricate both right and left hinge pivot pins with an approved dripless oil. (Fig. 15-53) Lubricate torque rod frictional surfaces on both hinges and frictional surfaces of both torque rod clips with Lubriplate #630 AAW or equivalent. (Fig. 15-53)

6. Install back body opening upper finishing panels.

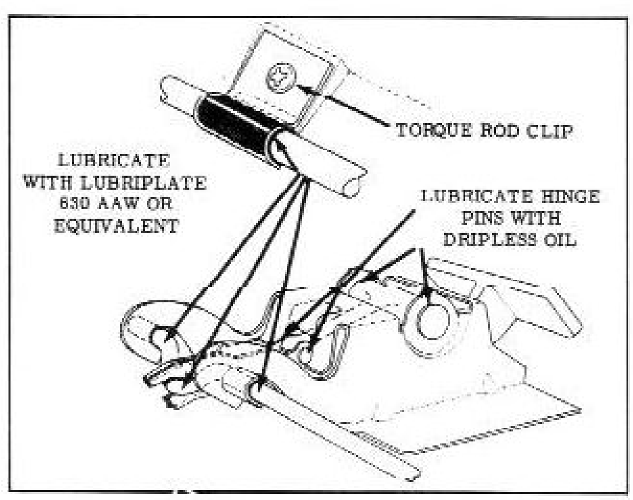


Fig. 15-53 Back Door Hinge & Torque Rod Lubrication

TRIM ASSEMBLY

Removal and Installation

1. Apply masking tape to back door inner panel adjacent to trim at retaining nail locations.
2. Using a clean rubber mallet, tap around edge of trim assembly to free trim nails in nail slots.
3. Insert a flat-bladed tool between inner panel and trim assembly at each retaining nail location; carefully disengage retaining nails from retaining slots in inner panel and remove trim from door.
4. To install, reverse removal procedure. Broken retaining nails should be replaced with repair tabs which are available as service parts.

LOCK ASSEMBLY

Removal and Installation

1. Remove door trim assembly as described under BACK DOOR TRIM ASSEMBLY.
2. Remove three back door lock attaching screws from face of lock pillar, (Fig. 15-54), and remove lock through hole in door inner panel.

   To install, reverse removal procedure. Check operation of lock before installing inside trim.

LOCK STRIKER ADJUSTMENTS

1. To adjust the back door lock striker forward or rearward to obtain in or out adjustment of the lower portion of the door, or to adjust the striker sideways to obtain proper alignment with the back door lock rotary bolt, loosen striker attaching screws, shift striker to desired position and tighten screws.

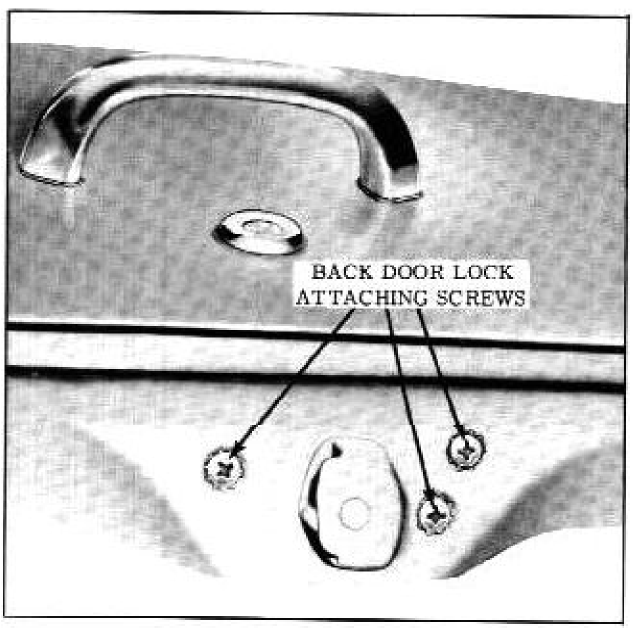


Fig. 15-54 Back Door Lock

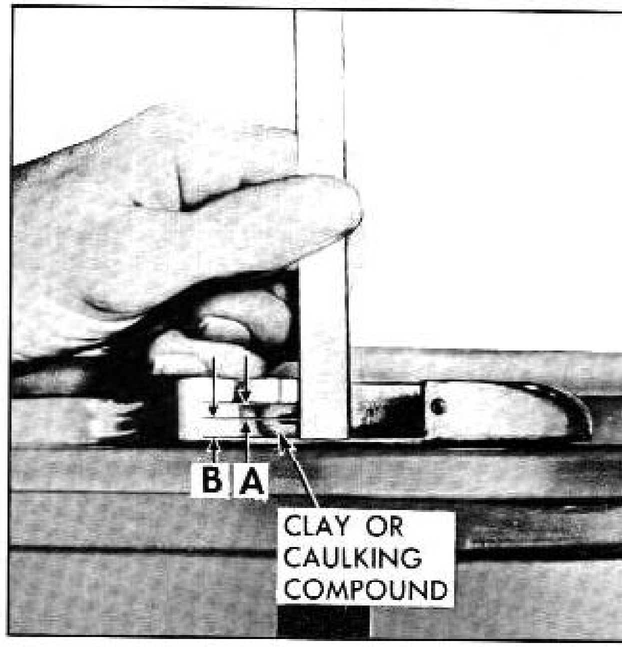


Fig. 15-55 Lock Stricker Engagement Check

2. Lock striker emergency spacer requirements:
   a. The back door assembly should be properly aligned in the body opening before checking spacer requirements.
   b. To determine if lock striker emergency spacers are required, apply modeling clay or body caulking compound in the lock striker notch where the lock extension engages; then, close the back door to form a measureable impression in the clay or caulking compound. (Fig. 15-55)

      When dimension "A" from inside face of striker teeth is less than 3/16", install one or more 1/16" emergency spacers (See Parts Book) to bring dimension "A" to the specified 3/16". If two or three spacers are required, install 1/8" longer striker attaching screws. If three or four spacers are required, install 1/4" longer striker attaching screws.

      NOTE: Dimension "B" from center of lock extension to inside face of striker should never be less than 1/8".

OUTSIDE HANDLE

Removal and Installation

1. Remove back door trim assembly as described under BACK TRIM ASSEMBLY.

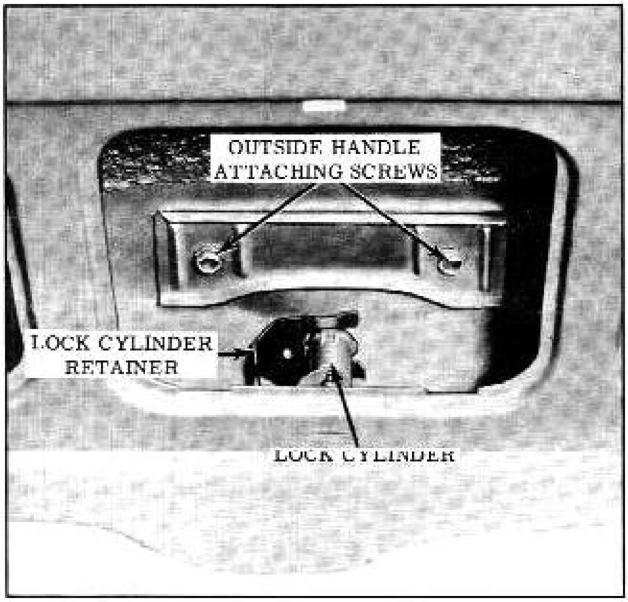


Fig. 15-56 Back Door Outside Handle & Lock Cylinder

2. Remove 2 screws securing outside handle (Fig. 15-56), and remove handle and gaskets.

3. To install back door outside handle, first cement handle gaskets to handle with weatherstrip adhesive (black) and apply a coat of adhesive to surface of gaskets which contacts door outer panel, (Fig. 15-56); then, reverse removal procedure.

LOCK CYLINDER ASSEMBLY

Removal and Installation

1. Remove back door trim assembly as described under BACK DOOR TRIM ASSEMBLY.

2. Using a hooked tool or other suitable tool through access holes in door inner panel pry out lock cylinder retaining clip, (Fig. 15-56), sufficiently to allow removal of lock cylinder and gasket from outer panel.

3. To install lock cylinder assembly, reverse removal procedure. Apply weatherstrip adhesive (black) on both contacting surfaces of lock cylinder gasket. Check operation of lock cylinder and lock before installing inside trim.

WEATHERSTRIP

Removal

1. With a flat-bladed tool, carefully break cement bond securing butt ends of weatherstrip at bottom center of door and cement bond securing weatherstrip to door for a distance of approximately 2 inches on both sides of butt joint.

2. Starting at bottom center of door, insert tip of weatherstrip clip inserting Tool J-5757 or other suitable tool at the first clip and carefully snap clip from retaining hole. Then, using a flat-bladed tool, carefully break cement bond securing weatherstrip in corner of rabbet to the next clip. Perform the alternate operations of snapping clip out of retaining hole, and breaking cement bond to the next clip completely around door; then, remove weatherstrip.

Installation

1. Clean off old cement from back door to provide a clean cementing surface.

2. Check weatherstrip clips for proper contour and reform clips, where required, using clip reforming Tool J-5984. (Fig. 15-57)

3. For a distance of 2 inches on both sides of the butt joint location (bottom center of door), apply weatherstrip adhesive (neoprene type) to the door panel surface contacted by weatherstrip (See "1" in view "A", Fig. 15-58)

4. Apply a bead of weatherstrip adhesive (black) in the corner of the rabbet, as shown at "2" in Sections "B-B" and "C-C" in Fig. 15-58, completely around door.

5. For a distance of 2 inches on both ends of weatherstrip, apply a coat of weatherstrip adhesive (neoprene type) to the weatherstrip surface which contacts the door panel as indicated at "3" in view "A" Fig. 15-58.

6. Starting with end of weatherstrip at bottom center of door, install weatherstrip clips into

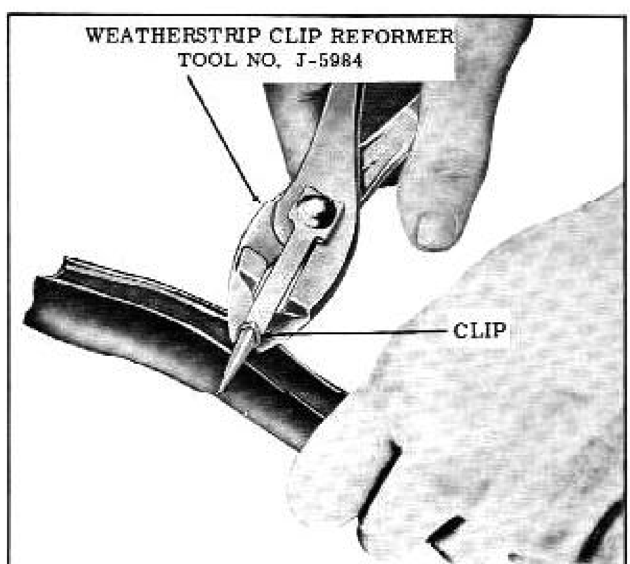


Fig. 15-57 Reforming Weatherstrip Clips with Tool J-5984

retaining holes completely around door using weatherstrip clip inserting Tool J-5757. Press or roll weatherstrip completely around door to assure a good cement bond.

7. Apply weatherstrip adhesive (neoprene type) to butt ends of weatherstrip and cement ends together to form an even butt joint. (See view "A" Fig. 15-58)

WINDOW

Removal

1. From inside body, carefully break seal between inside lip of rubber channel and pinchweld flange completely around rubber channel.

2. With aid of a helper to support glass on outside of body, carefully push lower edge of glass and rubber channel assembly outward until lip of rubber channel is disengaged from pinchweld flange; then, disengage remainder of rubber channel from pinchweld flange and remove rubber channel and glass from back door window opening.

3. Remove rubber channel and, where present, reveal moldings from glass.

Installation

IMPORTANT: Care should be exercised to make certain glass does not strike body metal during installation as edge chips can cause tempered plate glass to shatter. DO NOT attempt to grind glass.

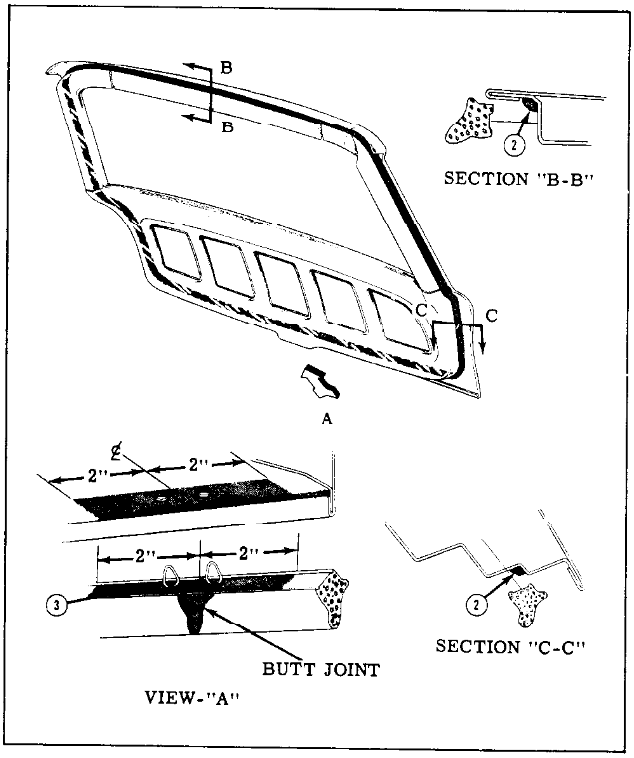


Fig. 15-58 Back Door Weatherstrip Installation

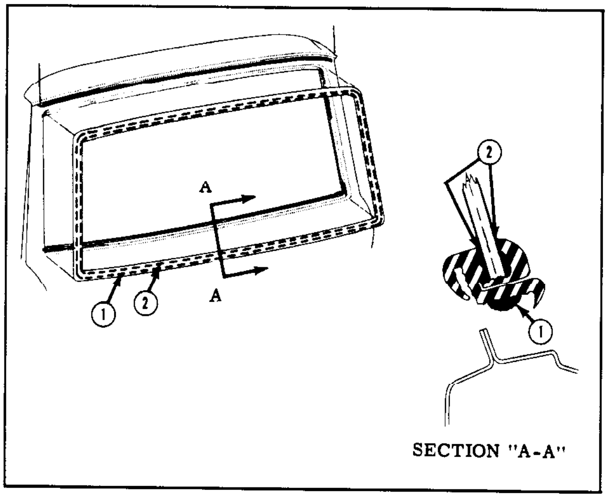


Fig. 15-59 Back Door Window Sealing

1. Clean off original sealer from rubber channel and back door window opening.

2. Check back door window opening pinchweld flange for any irregularities and correct, where required.

3. Install rubber channel to glass. Install reveal moldings in rubber channel. The side reveal moldings overlap the lower reveal molding.

4. Apply a continuous ribbon of medium-bodied sealer (approximately 1/4" thick) to base of rubber channel, as indicated at "1" in Section "A-A", Fig. 15-59, completely around rubber channel.

5. Insert a strong cord into pinchweld cavity of rubber channel so that ends of cord are at bottom center of glass. Tape ends of cord to inside surface of glass.

6. With aid of a helper, position glass and rubber channel assembly into door window opening. While a helper is applying hand pressure to outside surface of glass, use a hooked tool to seat lip of rubber channel over pinchweld flange at sides of window opening; then, pull cords in rubber channel to seat lip over flange across bottom and across top of window opening.

7. Using a pressure type applicator, apply weatherstrip adhesive (black) between rubber channel and glass on inside and outside of glass, as indicated at "2" in Fig. 15-59, completely around glass and rubber channel. Application of adhesive should be continuous with no skips.

8. Clean off all excess sealer and adhesive.

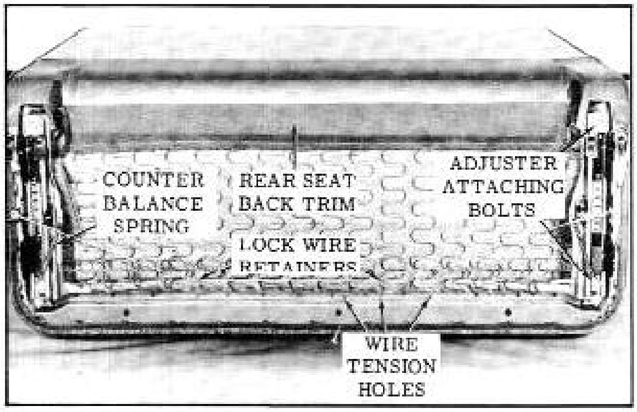


Fig. 15-60 Front Seat Adjuster Removal

SEATS

FRONT SEAT ASSEMBLY

Manually operated front seat adjusters provide fore and aft movement of the seat. When the lever at the left seat adjuster is raised the seat adjusters unlock, permitting horizontal travel of the seat. When the seat is in the desired position, the lever is released and the seat is locked.

The front seat adjusters may be reworked to reposition the front seat assembly 1 inch rearward.

FRONT SEAT ASSEMBLY WITH SEAT ADJUSTERS ATTACHED

Removal and Installation

1. Turn back floor carpeting where necessary, to expose seat adjuster-to-seat support attaching bolts.
2. Scribe location of rear end of adjuster on front seat rear support and remove adjuster rear attaching bolts.
3. With aid of a helper, tilt seat assembly forward; then, slide seat assembly rearward to disengage front legs of adjusters from retainers. Remove seat assembly from body.
4. To install, reverse removal procedure.

   NOTE: Make certain front legs of adjusters are completely engaged under retainers and adjusters are aligned within scribe marks before installing attaching bolts.

FRONT SEAT ADJUSTERS

Removal and Installation

1. Remove front seat assembly with adjusters attached from body and place it upside down on a clean, protected bench.
2. Remove seat adjuster counterbalance spring attached to seat adjuster front support and seat bottom frame as shown in Fig. 15-60.
3. Operate adjusters so that both front and rear attaching bolts are accessible.
4. Squeeze hooked end of seat adjuster locking wire together and slide retaining spring back over hump in locking wire and remove locking wire from adjuster.
5. Remove adjuster-to-seat bottom frame front and rear attaching bolts shown in Fig. 15-60 and remove seat adjuster from seat assembly.
6. After installation, check seat assembly for proper operation prior to installing seat assembly.

   NOTE: The right and left seat adjuster sliding mechanisms should be in same relative position when attaching adjuster to seat bottom frame.

7. If right adjuster does not lock or unlock satisfactorily when control handle on left adjuster is operated, disengage locking wire retainer on right side of seat from hole in seat bottom frame and engage retainer in one of adjacent holes to obtain proper tension in wire. (Fig. 15-60)

FRONT SEAT BACK ASSEMBLY

Removal and Installation

1. Remove front seat assembly from body and place it upside down on a clean, protected bench.
2. Remove hog rings securing central portion of lower rear edge of seat back trim from front seat cushion spring assembly. (Fig. 15-60)
3. Raise trim and remove cardboard breakover foundation to expose seat cushion spring attachment to seat back frame along rear of seat and hog rings securing ends of seat back trim to seat bottom frame. (Fig. 15-61)

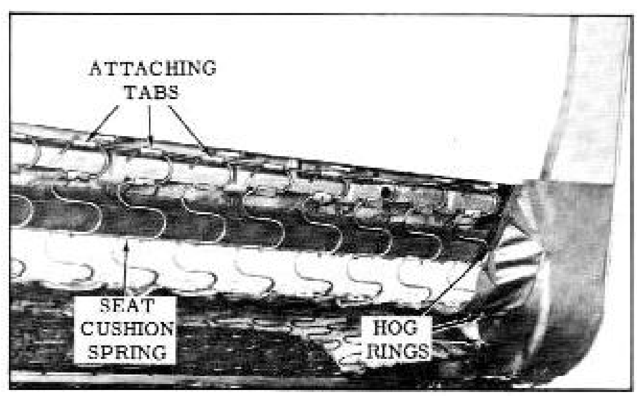


Fig. 15-61 Front Seat Cushion Spring Attachment

4. Bend open tabs securing seat cushion spring assembly to seat back frame and carefully disengage springs from tabs. (Fig. 15-61)

5. At each end of seat remove hog rings securing lower edge of seat back trim from seat bottom frame. Then raise seat back trim to expose bolts securing seat back reinforcement to seat bottom frame. (Fig. 15-62)

6. Place seat assembly in upright position. Then with a helper, holding seat back assembly, remove seat back reinforcement-to-seat bottom frame attaching bolts on each side of seat and remove seat back assembly.

7. To install, reverse removal procedure.

NOTE: Make certain rear edge of seat cushion spring assembly is properly engaged to seat back frame and cardboard breakover foundation is properly positioned prior to hog-ringing central portion of trim in place.

FRONT SEAT SIDE PROTECTOR COVER

Removal and Installation

1. Turn back floor covering along outboard side of front seat adjuster sufficiently to expose protector cover.

2. Remove screws shown in Fig. 15-63, securing cover to floor pan and remove cover.

3. To install, reverse removal procedure.

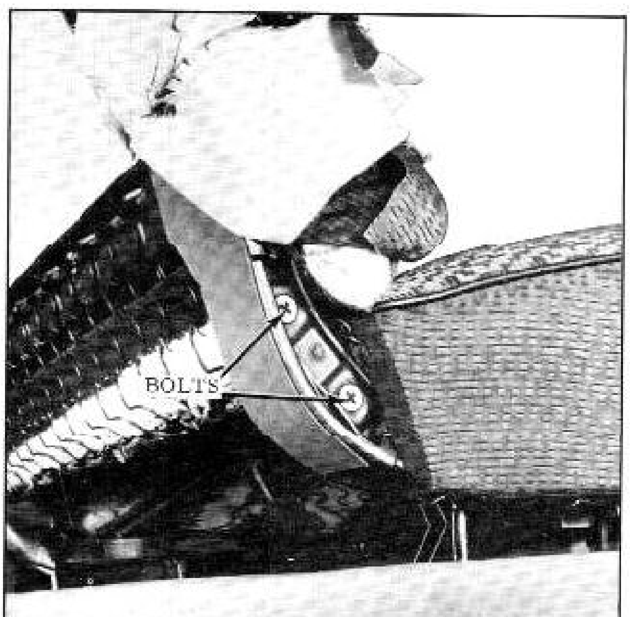


Fig. 15-62 Front Seat Back Attachment

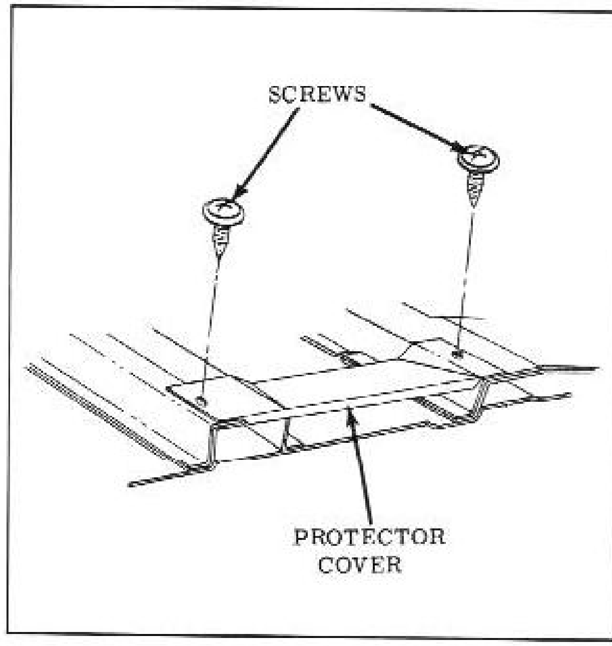


Fig. 15-63 Front Seat Side Protector Cover

REPOSITIONING FRONT SEAT ASSEMBLY

To reposition front seat assembly 1 inch rearward, proceed as follows:

1. Remove front seat assembly from body and place it upside down on a clean protected bench.

2. Remove seat adjuster retainers from front seat floor pan support.

3. Turn seat adjuster retainer 180° and install retainer.

4. Enlarge pilot holes in seat adjuster located 1 inch forward of attaching holes at rear of each seat adjuster to 3/8" diameter. (Fig. 15-64)

5. Install front seat assembly. Check seat for proper operation.

The following view (Fig. 15-65) is typical of the Station Wagon folding rear seat back and rear compartment floor panels. This illustration identifies the component parts of the rear compartment area, their relationship and various attaching points.

FOLDING REAR SEAT CUSHION ("35" Styles)

Removal and Installation

1. Lift up front edge of folding rear seat cushion assembly to disengage retainers in seat bot-

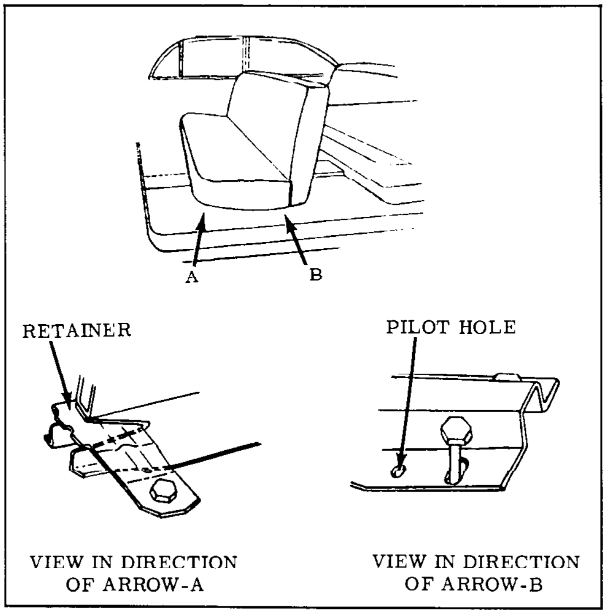


Fig. 15-64 Front Seat Repositioning

tom frame from slots in rear seat support and remove cushion assembly.

2. To install, reverse removal procedure. Make certain that protrusions are fully engaged in rear seat support.

FOLDING REAR SEAT BACK ASSEMBLY ("35" Styles)

Removal and Installation

1. Fold rear seat back assembly to down position.
2. Remove rear floor filler panel to folding seat back panel attaching screws as shown in Fig. 15-66.
3. At each side of seat, remove screws securing mounting support link assembly to folding seat back assembly. (Fig. 15-67)
4. With aid of helper, carefully remove folding seat back assembly from body and place it on clean, protected bench.
5. To install, reverse removal procedure.

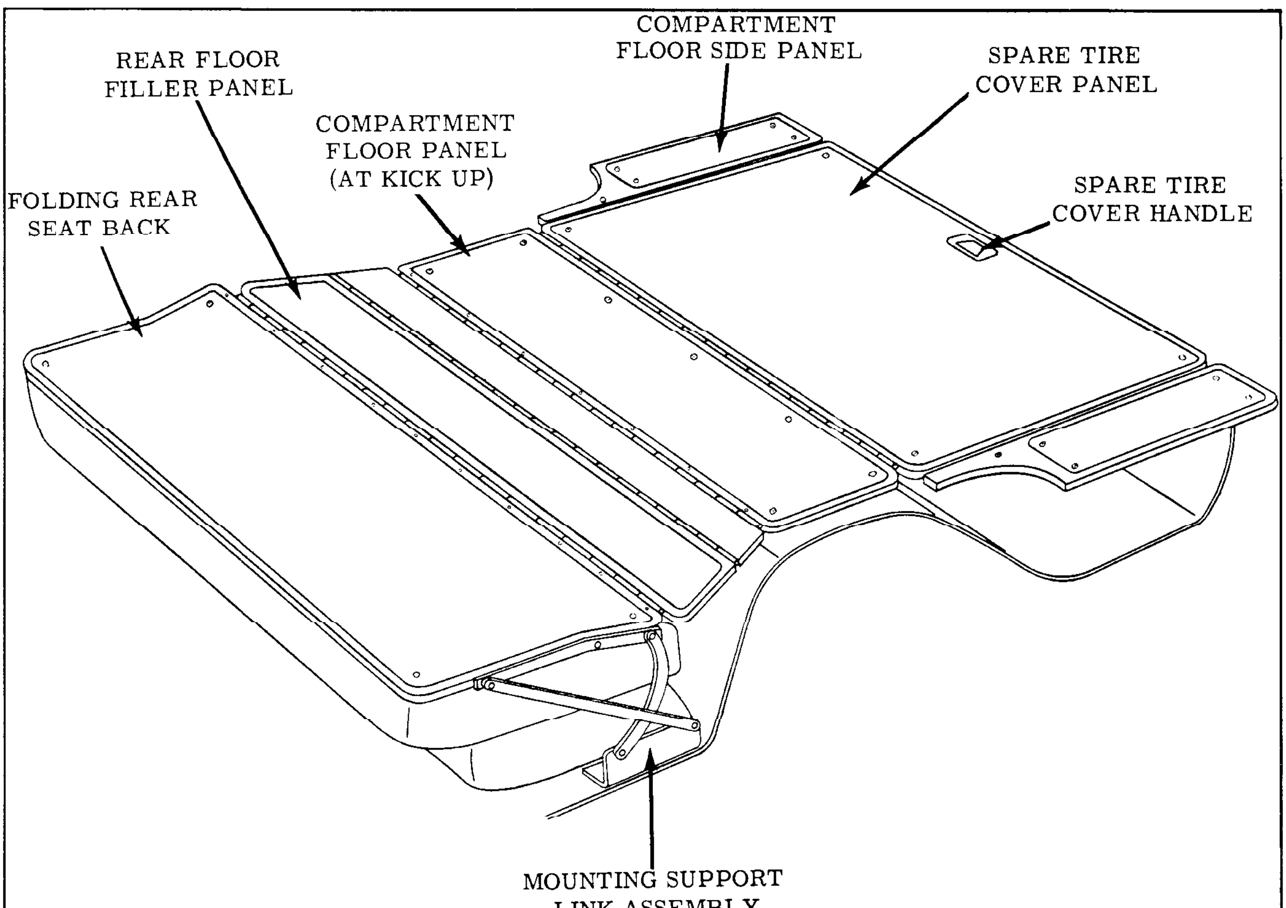


Fig. 15-65 Folding Rear Seat Back and Rear Compartment Floor Panels

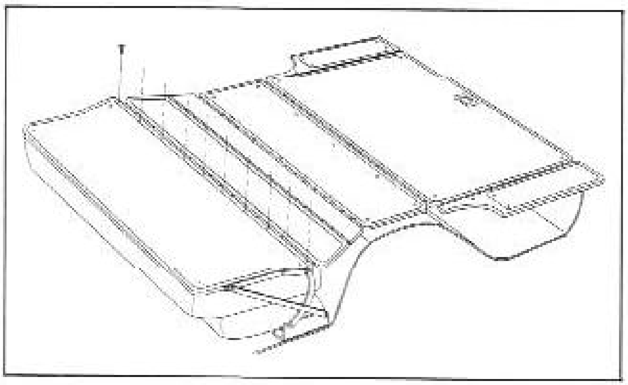


Fig. 15-66 Folding Rear Seat Back Assembly

FOLDING REAR SEAT BACK MOUNTING SUPPORT LINK ASSEMBLY ("35" Styles)

Removal and Installation

1. Release rear seat cushion and slide cushion forward.

2. Turn back rear floor carpet sufficiently to expose mounting support link to floor pan anchor plate attaching screws and remove screws.

3. Fold rear seat back assembly to down position.

4. Remove mounting support to folding seat back attaching screws as shown in Fig. 15-67, and remove mounting support link assembly from body.

5. To install, reverse removal procedure. Check operation of folding rear seat back and filler panel assembly. Where required, loosen mounting support to anchor plate attaching screws. Adjust mounting support fore or aft as required for proper folding seat back operation.

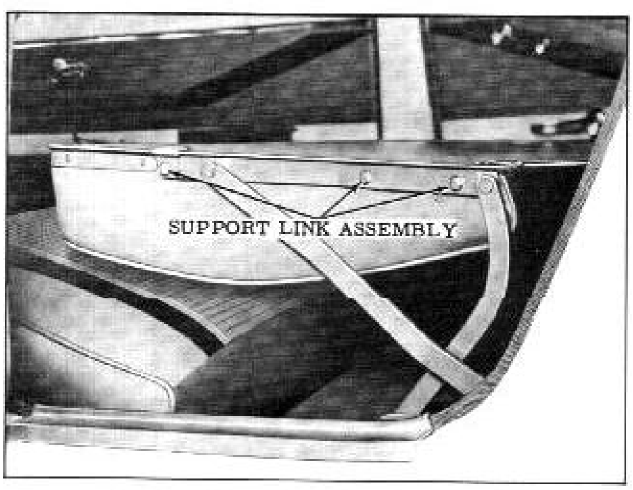


Fig. 15-67 Folding Seat Back Mounting Support Link Assembly

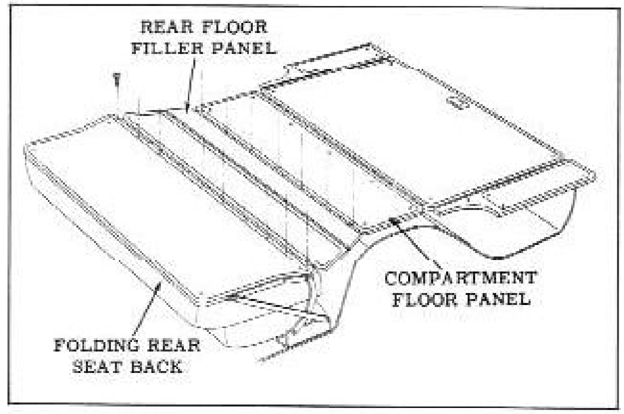


Fig. 15-68 Folding Rear Floor Filler Panel Assembly

FOLDING REAR FLOOR FILLER PANEL ASSEMBLY ("35" Styles)

Removal and Installation

1. Fold rear seat back assembly to down position.

2. Remove filler panel to folding seat back attaching screws and filler panel to rear seat pan attaching screws as shown in Fig. 15-68, and remove filler panel from body.

4. To install, reverse removal procedure.

Adjustments

To adjust folding rear floor filler panel assembly, proceed as follows:

1. At each side of seat, loosen mounting support to floor pan anchor plate attaching screws.

2. Adjust mounting supports fore or aft as required and tighten screws.

3. Check operation of folding seat back and filler panel assembly. When the seat back is in the "down" or folded position, the back and rear floor filler panel should form a level floor surface. Where necessary readjust mounting supports as required for proper seat back and filler panel operation.

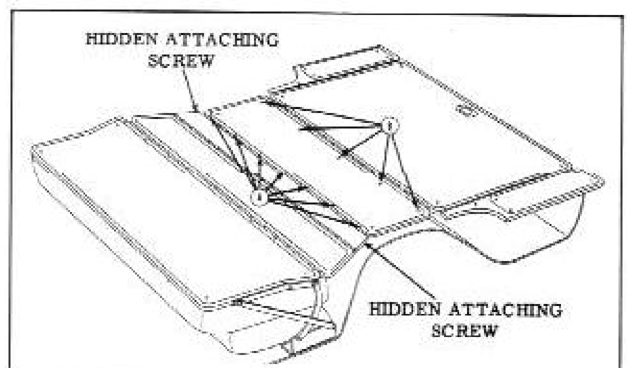


Fig. 15-69 Compartment Floor Panel Assembly

COMPARTMENT FLOOR PANEL ASSEMBLY (AT KICK-UP) ("35" Styles)

Removal and Installation

1. Lower folding rear seat back assembly.
2. Remove rear floor filler panel to rear seat pan attaching screws as shown at "A" in Fig. 15-69.
3. Fold rear floor filler panel forward sufficiently to gain access to compartment floor panel to rear seat pan attaching screws and remove screws from panel.

   NOTE: Attaching screws are located at each end of panel. (See HIDDEN ATTACHING SCREWS, Fig. 15-69)
4. Remove floor panel to spare tire cover hinge support panel attaching screws, shown at "B", Fig. 15-69, and remove compartment floor panel assembly from body.
5. To install, reverse removal procedure.

SPARE TIRE COVER PANEL ASSEMBLY ("35" Styles)

Removal and Installation

1. Remove compartment floor panel assembly as previously described.
2. Remove screws securing spare tire cover panel hinge to hinge support.
3. Using spare tire cover handle, lift panel upward and remove spare tire cover panel assembly from body.
4. To install, reverse removal procedure.

COMPARTMENT FLOOR SIDE PANEL ASSEMBLY (RIGHT OR LEFT SIDE) ("35" Styles)

Removal and Installation

1. Remove compartment floor panel assembly as previously described.
2. Remove screws securing compartment floor side panel to side panel support as shown at "A", Fig. 15-70, and remove panel assembly from body.
3. To install, reverse removal procedure.

FOLDING REAR SEAT BACK BUMPER, RETAINER AND SUPPORT (RIGHT OR LEFT SIDE)

Removal and Installation

1. With folding rear seat back in down position, remove screw shown in View "A", Fig. 15-71.

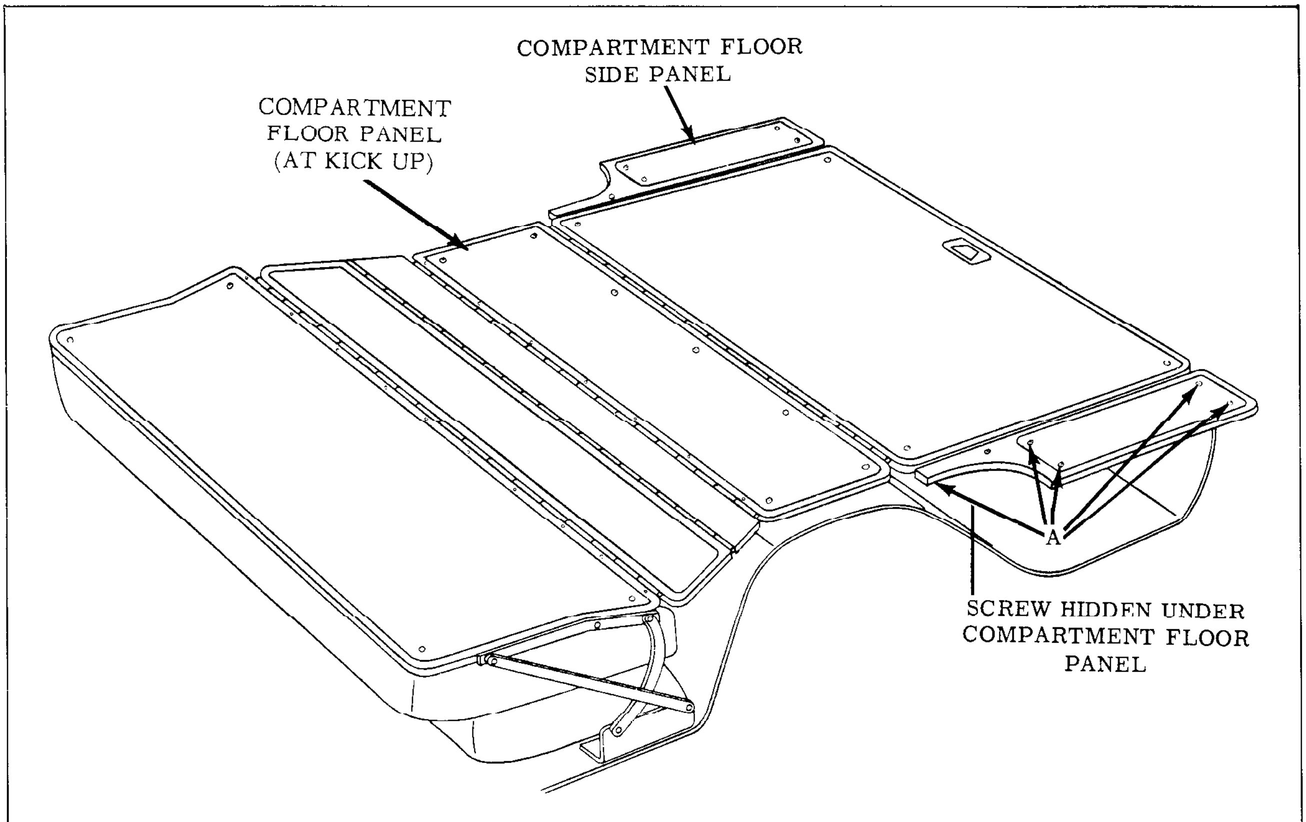


Fig. 15-70 Compartment Floor Side Panel Assembly

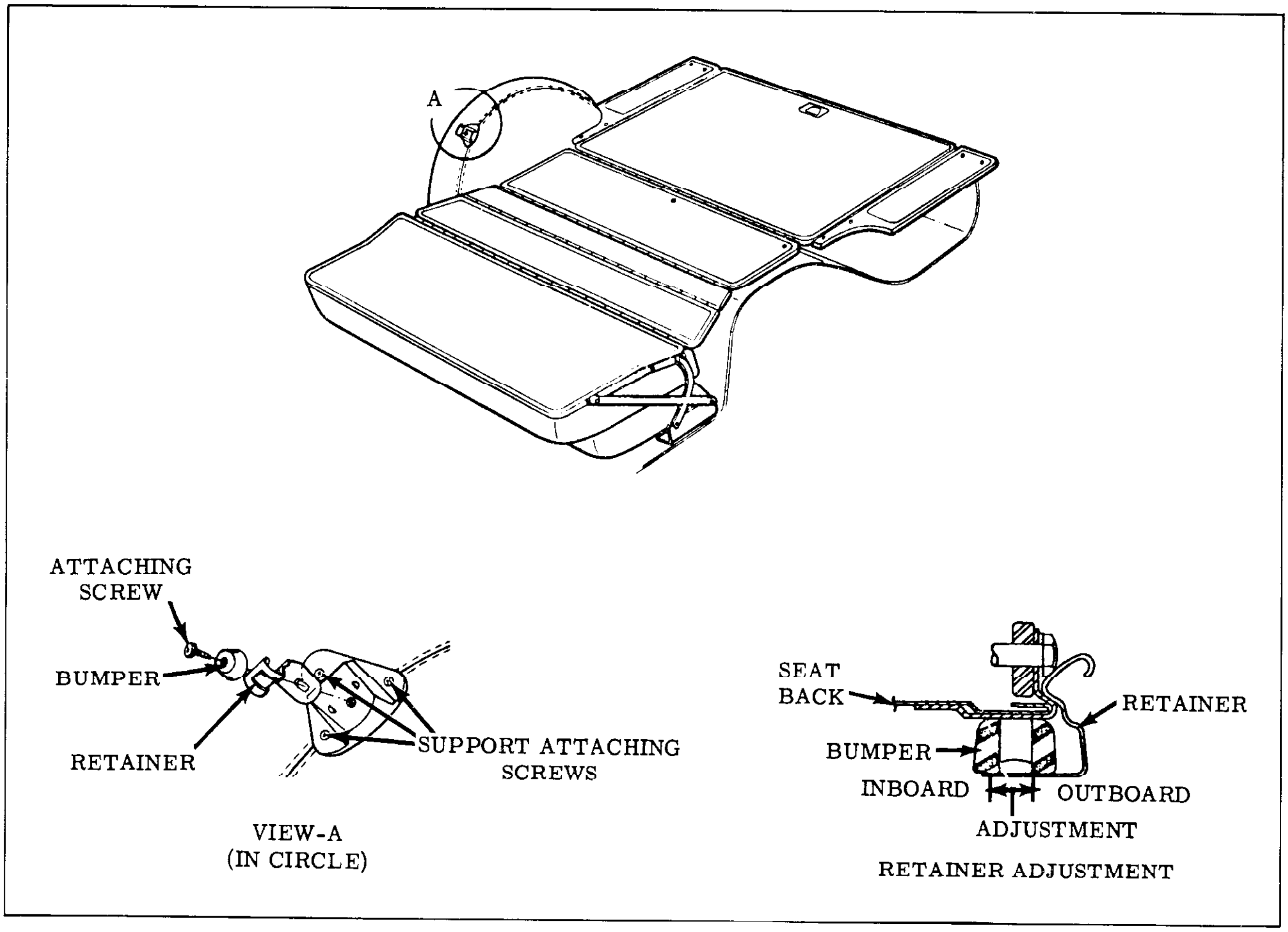


Fig. 15-71 Folding Rear Seat Back Bumper, Retainer & Support

and remove bumper and retainer from wheelhouse support.

2. Remove 3 screws shown in View "A", Fig. 15-71 and remove support from wheelhouse assembly.

3. To install, reverse removal procedure.

NOTE: The folding rear seat back retainer is adjustable inboard or outboard. To adjust retainer, raise folding rear seat back to up position and check retainer tension. Lower folding seat back and loosen retainer attaching screw. Adjust retainer inboard or outboard as required then tighten attaching screw. Recheck folding seat back assembly. Where required, readjust retainer until desired seat back retention has been obtained.

SPARE TIRE COVER HANDLE ASSEMBLY

Removal and Installation

1. Remove 4 screws securing handle to spare tire cover panel and remove handle assembly from panel.
2. To install, reverse removal procedure.

HEADLINING ASSEMBLY (All Styles)

The headlining assembly is formed to contour by concealed listing wires. Both ends of each listing wire are installed into holes in listing wire clips which are secured to the side roof inner rail assembly. The headlining assembly is secured at the windshield and back window by cement and tacks or staples. Along the side roof rail, the headlining is cemented around the flange of the side roof inner rail assembly.

CAUTION: CLEAN HANDS AND TOOLS ARE ESSENTIAL WHEN WORKING WITH HEADLINING MATERIAL.

Removal

1. Place protective coverings over seat cushions and backs.

2. Prior to removing headlining, remove following hardware and trim assemblies:

   a. Sunshade support assembly(s)

   b. Rear view mirror support

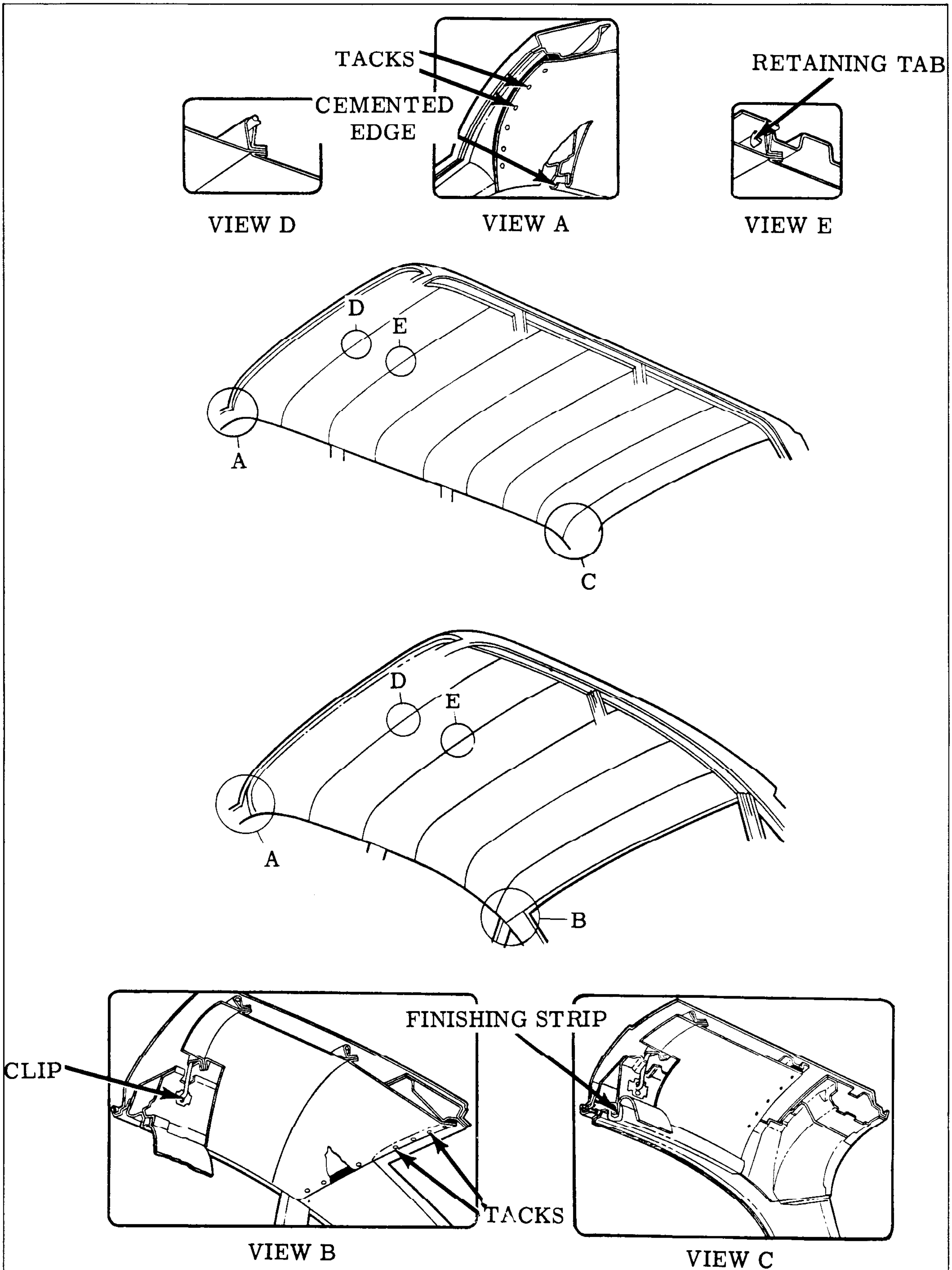


Fig. 15-72 Headlining Installation

c. Windshield upper garnish moldings

d. Center pillar-to-roof rail finishing plates

e. Coat hooks (where present)

f. Back window upper garnish moldings, eight, left and center

g. Dome lamp assembly

h. Front and rear door opening pinchweld finishing strip along top of each door opening sufficiently to expose edge of headlining

i. Body lock pillar to roof rail finishing plates (station wagon only)

j. Back body opening upper finishing panels (station wagon only)

k. Rear quarter upper pinchweld finishing strips (station wagon only)

3. Carefully detach cemented edge of headlining along each side roof inner rail including rear quarter windows on station wagon styles. (See View "A", Fig. 15-72)

4. Carefully remove tacks or staples securing headlining at windshield opening as shown in View "A" and along back window or back body opening as shown in Views "B" and "C", Fig. 15-72, then carefully detach cemented edges of headlining from openings.

5. Working from front to rear of body, disengage headlining #1 listing wire from clip on side roof inner rail. Gather or roll headlining with listing wires on outside to keep headlining clean.

6. At roof bow, bend down metal tabs, shown in View "E", Fig. 15-72, and remove listing support wire from roof bow.

7. Disengage remaining listing wires from clips on side roof inner rail and remove headlining from body and place on clean protected surface.

IMPORTANT: Note which holes the ends of the listing wires are installed in side roof rail clips to insure proper installation. (View "B".)

8. If replacing the headlining, remove listing wires from pockets of headlining.

Installation

1. If previously removed, install listing wires into pockets of new headlining assembly.

2. Apply approved trim cement to headlining attaching surfaces at windshield and back window openings. Also apply cement to headlining attaching surfaces along side roof inner rails.

3. Lift entire headlining assembly into body, then install rear listing wire. Center and align headlining in relation to back window opening and side roof rails. Working forward, install ends of listing wires into listing wire holes in side roof rails.

NOTE: The headlining listing wires are normally installed in center hole of clip as shown in View "B".

4. Install headlining listing support wire over metal tabs on roof bow. Bend up metal tabs so that support wire is securely fastened to roof bow. (View "E", Fig. 15-72)

5. Install #1 listing wire into hole of clip on side roof inner rail.

NOTE: Headlining listing wires may be adjusted up or down in different clip holes as required to compensate for a headlining which may be too tight against the roof panel or too loose making it difficult to remove draws or wrinkles.

6. Stretch and stay tack headlining along entire windshield and back window openings.

7. Apply trim cement to side edges of headlining assembly.

8. Working toward front of body, install headlining to side roof inner rail, cutting headlining to shape at center pillar and upper rear body lock pillar. Remove all draws or wrinkles as required from headlining assembly.

9. Trim excess material from edges of headlining assembly.

10. Using a headlining inserting tool, install trimmed edges of headlining to outer surface of side roof inner rail to give headlining a finished appearance.

11. Inspect headlining along back window opening. Remove draws or wrinkles as required by stretching material and retacking. After all fullness has been removed, permanently tack headlining assembly across back window opening.

12. Trim away excess material across back window opening.

13. Inspect headlining along windshield opening. Remove draws or wrinkles as required by stretching material and retacking. After all fullness has been removed, permanently tack headlining assembly across windshield opening.

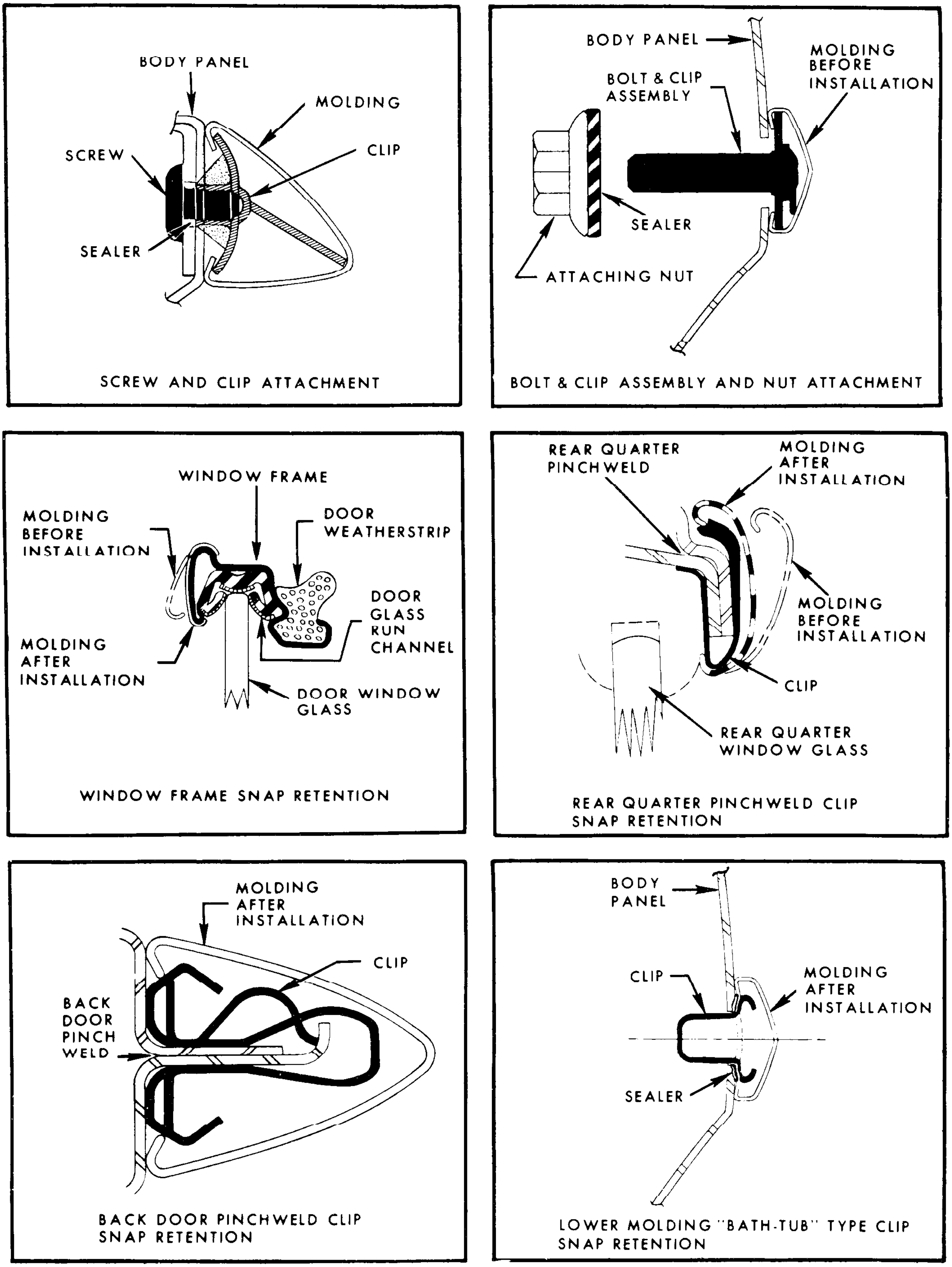
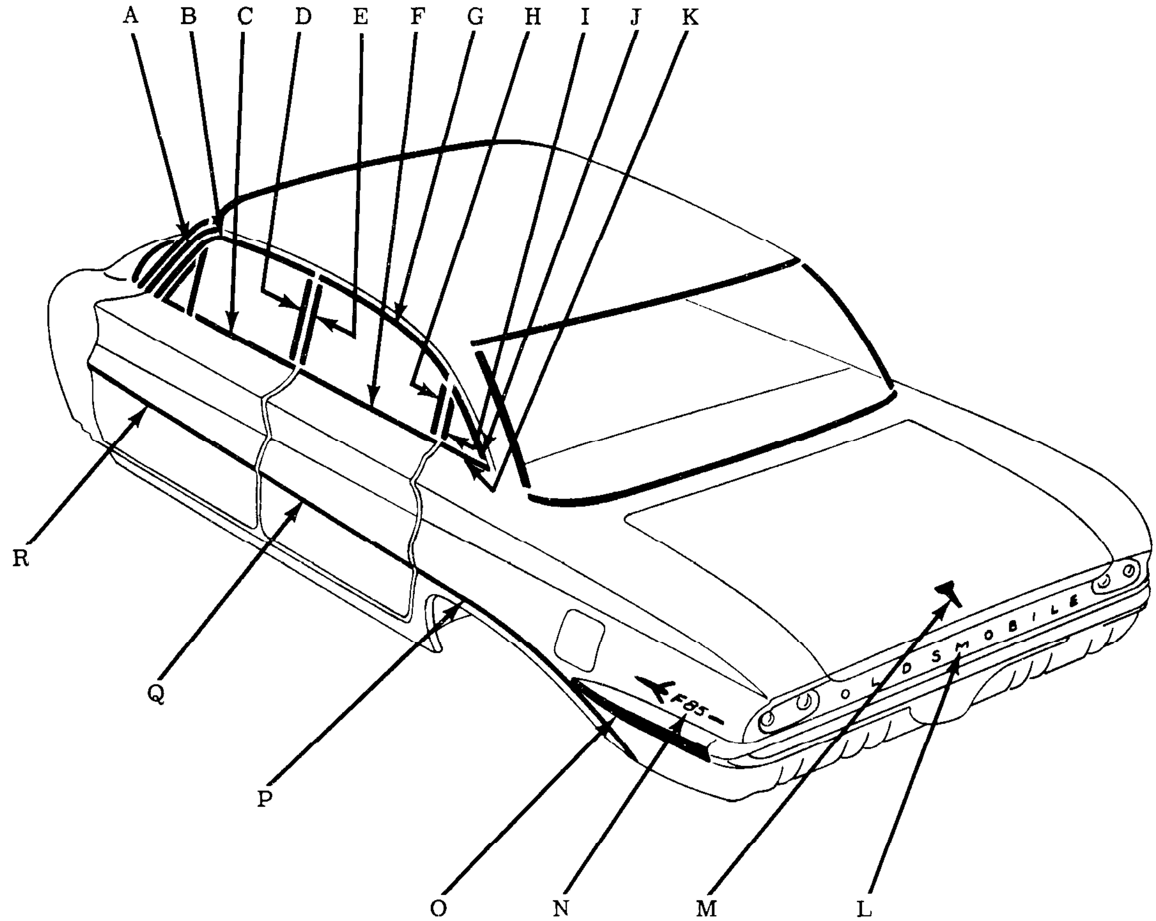
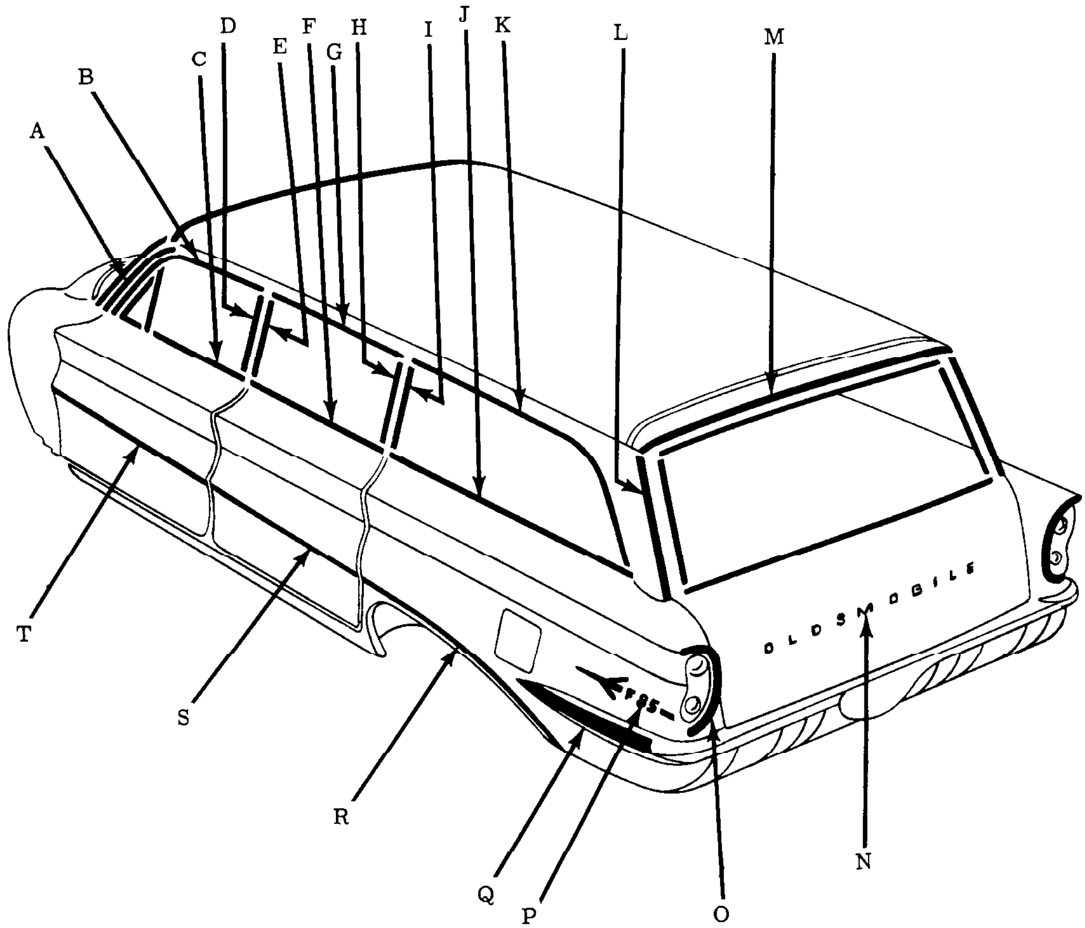


Fig. 15-73 Typical Methods of Molding Attachment



A. WINDSHIELD PILLAR DRIP MOLDING
B. FRONT DOOR WINDOW FRAME UPPER SCALP MOLDING
C. FRONT DOOR WINDOW REVEAL MOLDING
D. FRONT DOOR WINDOW FRAME VERTICAL SCALP MOLDING
E. REAR DOOR WINDOW FRAME FRONT VERTICAL SCALP MOLDING
F. REAR DOOR WINDOW REVEAL MOLDING
G. REAR DOOR WINDOW FRAME UPPER SCALP MOLDING
H. REAR DOOR WINDOW FRAME REAR VERTICAL SCALP MOLDING
I. REAR QUARTER WINDOW FRONT REVEAL MOLDING
J. REAR QUARTER WINDOW UPPER REVEAL MOLDING
K. REAR QUARTER WINDOW LOWER REVEAL MOLDING
L. REAR END PANEL NAME PLATE
M. REAR COMPARTMENT LID OUTER PANEL EMBLEM
N. REAR FENDER NAME PLATE
O. REAR FENDER BLISTER MOLDING
P. REAR FENDER LOWER MOLDING
Q. REAR DOOR OUTER PANEL LOWER MOLDING
R. FRONT DOOR OUTER PANEL LOWER MOLDING

Fig. 15-74 Exterior Moldings Style 3119



A. WINDSHIELD PILLAR DRIP MOLDING
B. FRONT DOOR WINDOW FRAME UPPER SCALP MOLDING
C. FRONT DOOR WINDOW REVEAL MOLDING
D. FRONT DOOR WINDOW FRAME VERTICAL SCALP MOLDING
E. REAR DOOR WINDOW FRAME FRONT VERTICAL SCALP MOLDING
F. REAR DOOR WINDOW REVEAL MOLDING
G. REAR DOOR WINDOW FRAME UPPER SCALP MOLDING
H. REAR DOOR WINDOW FRAME REAR VERTICAL SCALP MOLDING
I. REAR QUARTER WINDOW FRONT REVEAL MOLDING
J. REAR QUARTER WINDOW LOWER REVEAL MOLDING
K. REAR QUARTER WINDOW UPPER REVEAL MOLDING
L. BACK BODY OPENING SIDE UPPER PINCHWELD FINISHING MOLDING
M. BACK DOOR OUTER PANEL PINCHWELD FINISHING MOLDING
N. BACK DOOR OUTER PANEL NAME PLATE
O. REAR OF REAR FENDER MOLDING
P. REAR FENDER NAME PLATE
Q. REAR FENDER BLISTER MOLDING
R. REAR FENDER LOWER MOLDING
S. REAR DOOR OUTER PANEL LOWER MOLDING
T. FRONT DOOR OUTER PANEL LOWER MOLDING

Fig. 15-75 Exterior Moldings Style 3135

14. Trim away excess material across windshield opening.

15. Install door opening and/or rear quarter upper pinchweld finishing strips and all other previously removed inside hardware.

EXTERIOR MOLDINGS

Removal and Installation

The exterior moldings are secured to the body by any one or a combination of the following: attaching screws, attaching nuts, snap retention on body parts, "bath-tub" type snap-on clips of steel or plastic construction, friction type snap-in clips, bolt and clip assemblies, joint plates and molding integral attaching studs. Fig. 15-73, depicts cross-section drawings which illustrate some of the typical methods used in attaching moldings to the body.

When removing and installing body exterior moldings, certain precautions should be exercised. Adjacent paint finishes should be protected to avoid refinishing. Proper tools and methods should be employed to guard against molding damage, particularly if the part is to be reused. Whenever a sealing operation is disturbed, appropriate sealing materials and methods should be used to provide the required watertight seal. Every screw, nut or clip that secures a molding to a body outer panel, including the attaching hole, requires a specialized type of sealing operation. An approved grade of medium-bodied sealer and body caulking compound are the sealers used most generally in the effective sealing of these moldings. The exterior moldings are identified in Figs. 15-74 and 15-75.

If it is necessary to replace a "bath-tub" type clip as shown in Fig. 15-76, it may be removed with a sharp flat-bladed tool. Hammer the chisel until the base of the clip is cut approximately half-way through; then disengage the clip from the hold in the outer panel. In some cases it may be necessary to cut the clip at the opposite side. To install a new steel clip, insert it in the hole in the

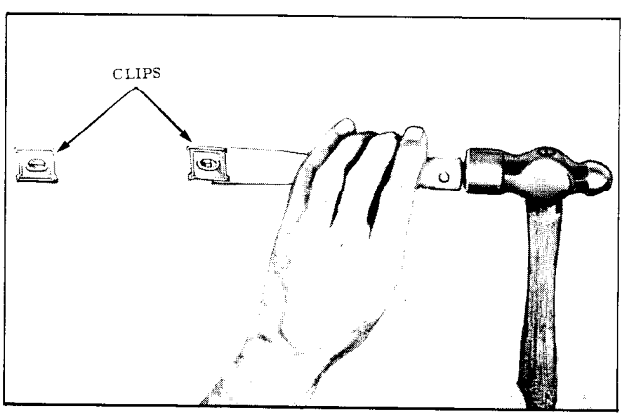


Fig. 15-76 Removing A "Bath Tub" Type Clip

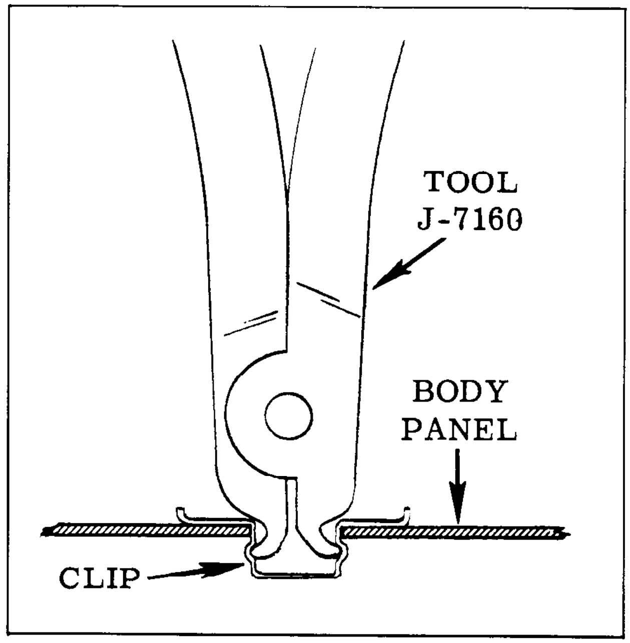


Fig. 15-77 Installing a "Bath Tub" Type Clip

outer panel and secure it to the panel using Tool J-7160 as shown in Fig. 15-77.

WINDSHIELD PILLAR DRIP MOLDING

The molding (painted body color) extends from the front of the roof drip molding to the belt line, is secured to the pillar with screws, and requires sealing.

To remove the molding: open the door, remove the attaching screws, disengage the molding from the pillar and unhook it from the roof drip molding.

To install the molding: clean the mating surfaces of the parts and apply a continuous ribbon of medium-bodied sealer along the center of the entire length of the molding attaching surface. Position the molding to the pillar and hook the upper edge over the front edge of the roof drip molding. Align and seal the screw holes and install the attaching screws.

FRONT DOOR WINDOW FRAME UPPER SCALP MOLDING (3100 Series)

The molding is secured to the window frame by snap retention. The front of the molding is overlapped by the reveal molding.

To remove the molding: remove the door ventilator frame attaching screws, lower the door window and move the ventilator rearward slightly for access purposes. Then with a suitable flat-bladed hook tool, unsnap the upper scalp molding from the window frame by working outwardly from the window opening. Start removal at the rear of the molding. Before unsnapping the front of the molding, slide it upward to clear the reveal molding. Use care not to damage any door parts during this operation.

To install the molding: apply body caulking compound (1/8" x 1/4" x 1/4") at six inch intervals on the inner side of the molding. Engage the front end of the molding on the window frame and slide it behind the reveal molding. Position the molding to the rear corner of the window frame above the vertical molding and to the outside edge of the window frame and snap it into place. Install the door ventilator attaching screws.

FRONT DOOR WINDOW FRAME VERTICAL SCALP MOLDING (3100 Series)

The vertical scalp molding is overlapped by the upper scalp molding and by the window reveal molding. The vertical scalp molding is secured to the door window frame by snap retention.

To remove the molding: loosen the upper scalp molding from the door rear edge to the ventilator division channel. With a flat-bladed hook tool, unsnap the vertical molding from the window frame by working outwardly from the window opening. Start the removal at the top. Before unsnapping the lower end, slide the molding upward to clear the reveal molding. Use care not to damage any door parts during the operation.

To install the molding: apply body caulking compound (1/8" x 1/4" x 1/4") at six inch intervals on the inner side of the molding. Position the molding to the outside edge of the window frame and slide it behind the reveal molding. Snap the upper portion of the molding into place. Complete the installation of the upper scalp molding.

FRONT DOOR WINDOW REVEAL MOLDING (3100 Series)

The reveal molding is secured to the door by an attaching screw at each end and by integral snap-in type clips.

To remove the molding: remove the door ventilator. Lower the door window below the reveal molding attaching screws. Remove attaching screws at the front and rear of the molding. With a flat-bladed tool, carefully pry the molding, with integral clips, from the door by rotating it outwardly from the window opening.

To install the molding: align the molding clips to the attaching holes in the door, position the molding, and secure each clip with a moderate pressure. Install the molding front and rear attaching screws and the previously removed parts.

FRONT DOOR OUTER PANEL LOWER MOLDING (3100 SERIES)

The molding is secured to the door outer panel by a screw at the hinge pillar and lock pillar hemming flanges and by (bath-tub type) snap-on clips which are previously installed on the door.

To remove the molding: remove the front and rear attaching screws. With a flat-bladed tool, carefully unsnap the molding from the door at each clip location.

To install the molding: replace damaged clips as required. Place the molding upper return flange over the clips, and snap the opposite flange over the clips. Seal and install the molding end attaching screws.

REAR DOOR WINDOW FRAME UPPER SCALP MOLDING (3100 Series)

The upper scalp molding is secured to the window frame by snap retention.

To remove the molding: use a suitable flat-bladed hook tool to unsnap the upper scalp molding from the window frame by working outwardly from the window opening. Use care not to damage any door parts.

To install the moldings: apply body caulking compound (1/8" x 1/4" x 1/4") at six inch intervals on the inner side of the molding. Position the molding to each corner of the window frame above the vertical moldings and to the outside edge of the window frame. Snap the molding inwardly over the window frame to secure it.

REAR DOOR WINDOW FRAME FRONT VERTICAL SCALP MOLDING AND REAR DOOR WINDOW FRAME REAR VERTICAL SCALP MOLDING (3100 Series)

The vertical scalp moldings are overlapped by the upper scalp molding and by the reveal molding. They are secured to the door window frame by snap retention.

To remove either molding: first remove the upper scalp molding. Then, with a suitable flat-bladed hook tool, unsnap the vertical scalp molding from the window frame by starting at the top and by working outwardly from the window opening. Before unsnapping the lower end, slide the molding up to clear the reveal molding. Use care not to damage any door parts.

To install the molding: apply body caulking compound (1/8" x 1/4" x 1/4") at six inch intervals on the inner side of the molding. Position the molding to the outside edge of the window frame, snap the lower end of the molding on the window frame, and slide it behind the reveal molding. Snap the upper portion of the molding into place. Install the upper scalp molding.

REAR DOOR WINDOW REVEAL MOLDING (3100 Series)

The reveal molding is secured to the door by an attaching screw at the front and by integral snap-in type clips.

To remove the molding: remove the front attaching screw. With a flat-bladed tool, carefully pry the molding with integral clips from the door by rotating it outwardly from the window opening.

To install the molding: align the molding clips to the attaching holes in the door and secure each clip with a moderate hand pressure. Install the front attaching screw.

REAR DOOR OUTER PANEL LOWER MOLDING (3100 Series)

The molding is secured to the door outer panel by a screw at each end and by (bath-tub type) snap-on clips which are previously installed on the door.

To remove the molding: remove front and rear attaching screws. With a flat-bladed tool carefully unsnap the molding from the door at each clip location.

To install the molding: replace damaged clips as required. Place the molding upper return flange over the clips and snap the opposite flange over the clips. Seal and install the molding end attaching screws.

REAR QUARTER WINDOW FRONT REVEAL MOLDING

The molding, of bright finish on the 3100 series and of painted finish on the 3000 series, is secured by snap retention to special, previously installed clips on the quarter window pinchweld. The molding is overlapped by the upper reveal molding.

To remove the molding: on 19 styles remove the upper reveal molding. On 35 styles loosen the front half of the upper reveal molding. Using a suitable flat-bladed hook tool, unsnap the outer edge of the molding from the retaining clips located at the top and bottom of the molding.

To install the molding: replace molding retain ing clips as required. Position the molding to the lower reveal molding, engage the inner edge of the molding over the retaining clips, and snap the molding into place. On 19 and 35 styles, install the upper reveal molding. Seal and complete the installation of the rear quarter window.

REAR QUARTER WINDOW UPPER REVEAL MOLDING

The molding, of bright finish on the 3119 style and of painted finish on the 3019 style, is secured by snap retention to special, pre-installed clips on the quarter window pinchweld.

To remove the molding: remove the rear quarter window. Protect the front reveal molding from damage as required. With a flat-bladed hook tool, unsnap the outer edge of the molding from each retaining clip.

To install the molding: replace retaining clips as required. Align the molding with the front reveal molding and engage the inner edge of the molding with the retaining clips. Protect the front reveal molding from damage as required. With a pair of pliers, properly insulated, snap the molding into position at each clip location. Seal and complete the installation of the rear quarter window.

REAR QUARTER WINDOW LOWER REVEAL MOLDING

The molding is secured to the body by attaching screws. The front and upper reveal moldings fit flush to the surface of the lower reveal molding.

To remove the molding: remove the rear quarter window, the upper reveal molding and the front reveal molding. Remove the molding attaching screws and lift the molding at the front end upward and outward to remove it.

To install the molding: position the molding to the body by placing rear end under pinchweld flange first and rotating front end until flange fits over quarter panel. Seal and install the attaching screws. Install the front, then the upper reveal molding. Seal and complete the installation of the rear quarter window.

REAR FENDER NAME PLATE

The name plate is sealed and is secured to the rear fender with attaching nuts.

To remove the name plate: on 35 styles remove the rear quarter rear trim assembly. On all styles, remove the attaching nuts.

To install the name plate: apply body caulking compound to the name plate studs and to the attaching nuts, position the name plate and install the attaching nuts. On 35 styles, install the rear quarter rear trim assembly.

REAR FENDER BLISTER MOLDING (3100 Series)

The molding is sealed and is secured to the rear fender by bolt and clip assemblies and attaching nuts.

To remove the molding: on 35 styles remove the rear quarter rear trim assembly. On all styles, remove the attaching nuts.

To install the molding: apply body caulking compound to the clip bolts and to the attaching nuts, position the molding to the fender and install the attaching nuts. On 35 styles install the rear quarter rear trim assembly.

REAR FENDER LOWER MOLDING (3100 Series)

The molding is sealed and is secured to the rear fender by snap retention over previously installed "bath-tub" type retaining clips and by an attaching screw at the rear.

To remove the molding: remove the attaching screw. With a flat-bladed tool, carefully unsnap the molding from each retaining clip.

To install the molding: replace and seal damaged clips as required. Position the molding to the lock pillar, place the molding return flange over the clips, and snap the opposite flange over the clips. Install the molding end attaching screw.

REAR OF REAR FENDER MOLDING ("35" Styles)

The molding is sealed and is secured to the rear fender with attaching nuts.

To remove the molding: remove the rear quarter rear trim assembly and remove the molding attaching nuts.

To install the molding: apply body caulking compound to the molding studs and to the attaching nuts, position the molding to the fender and install the attaching nuts. Install the trim assembly.

REAR COMPARTMENT LID OUTER PANEL EMBLEM ("19" Styles)

The emblem is sealed and is secured to the lid outer panel with attaching nuts.

To remove the emblem: remove the attaching nuts through the access holes provided in the lid inner panel.

To install the emblem: apply body caulking compound to the integral studs on the emblem and to the attaching nuts. Position the emblem and install the attaching nuts to effect a watertight seal.

REAR END PANEL NAME PLATE ("19" Styles)

The name plate is comprised of individual letters. Each letter is sealed and is secured to the rear end panel by an attaching nut.

To remove the name plate: remove the attaching nuts.

To install the name plate: position each name plate letter to the rear end panel, apply body caulking compound to each letter attaching stud and nut and install the attaching nuts to effect a watertight seal.

BACK BODY OPENING SIDE UPPER PINCHWELD FINISHING MOLDING ("35" Styles)

The molding is secured by snap retention over special pinchweld clips.

To remove the molding: use a suitable flat-bladed tool and loosen the molding at each clip location.

To install the molding: replace and seal any damaged clips as necessary. Before clip replacement, apply medium-bodied sealer to the pinchweld surfaces contacted by the clips. Hook one edge of the molding over the clips and snap the opposite side over the clips to secure it.

BACK DOOR OUTER PANEL PINCHWELD FINISHING MOLDING ("35" Styles)

The molding is secured by a screw at each outer end and by snap retention over special pinchweld clips.

To remove the molding: remove the end attaching screws and, with a suitable flat-bladed tool, unsnap the molding at each clip location.

To install the molding: replace and seal damaged clips as necessary. Before clip replacement, apply medium-bodied sealer to the pinchweld surfaces contacted by the clip. Hook one edge of the molding over the clips and snap the opposite side over the clips to secure it. Install and seal the end attaching screws.

BACK DOOR OUTER PANEL NAME PLATE ("35" Styles)

The name plate is comprised of individual letters each of which is secured to the outer panel by means of two integral studs and two special, pre-installed "snap-in" type retaining clips.

To install the name plate: if necessary, secure replacement clips. Insert the clips into the back door attaching slots. Fill each clip with body caulking compound.

Also, apply compound around the clip edges to provide a watertight seal. Align the name plate letter studs with the clips and apply an even, gradual pressure on each letter to secure it flush to the panel.

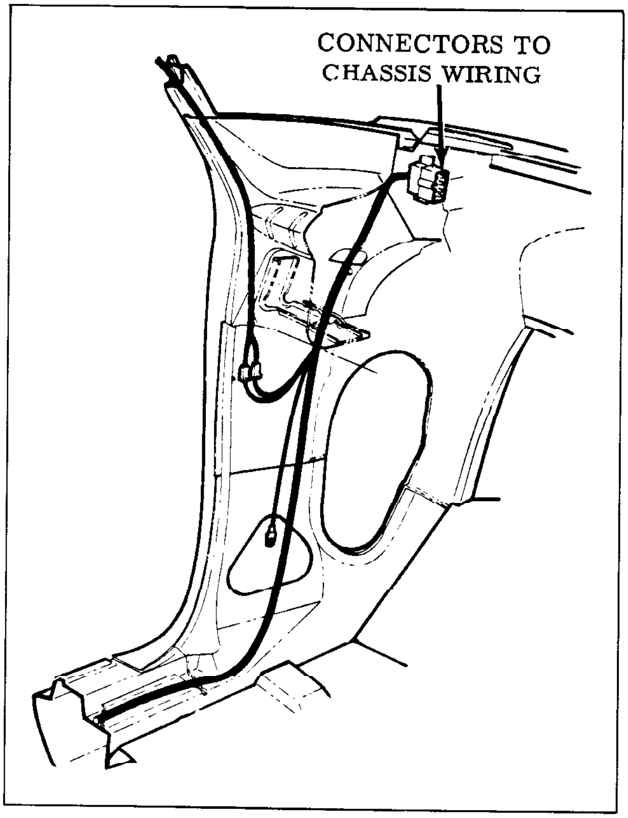


Fig. 15-78 "3000" Series Front End Wiring

ELECTRICAL

BODY WIRING

The current for all of the electrical circuits is provided by a twelve volt battery. The installation of the body wiring includes the dome lamp, stop and back-up lights, and tail lights. (Fig. 15-78, 15-79, 15-80, and 15-81) The body wiring consists of a front and rear harness which is joined by a multiple connector located at the left side of the rear compartment. The front end of the front harness is designed with a multiple connector which joins the chassis wiring at the left shroud.

The circuit diagrams for typical body wiring circuits are illustrated in Fig. 15-82. Failures in a circuit are usually caused by short circuits or open circuits. Open circuits are usually caused by breaks in the wiring, faulty connections or

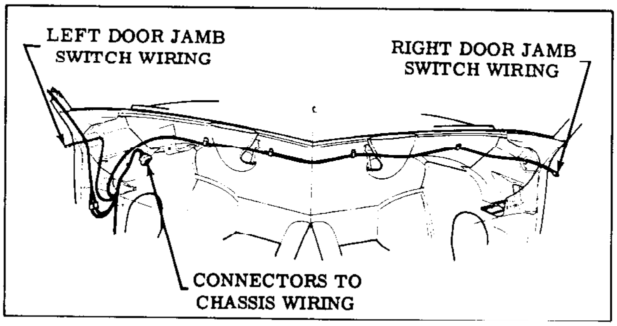


Fig. 15-79 "3100" Series Front End Wiring

mechanical failure in a component such as a switch. 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 sharp metal edge, etc.

If a failure is encountered in one of the body circuits, the circuit diagram should be thoroughly reviewed to become familiar with the circuit before performing the cause and location of the failure.

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.

   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 is 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 switches are not actuated, the failure is probably due to defective switches, or to the wire leading to the switches being grounded.

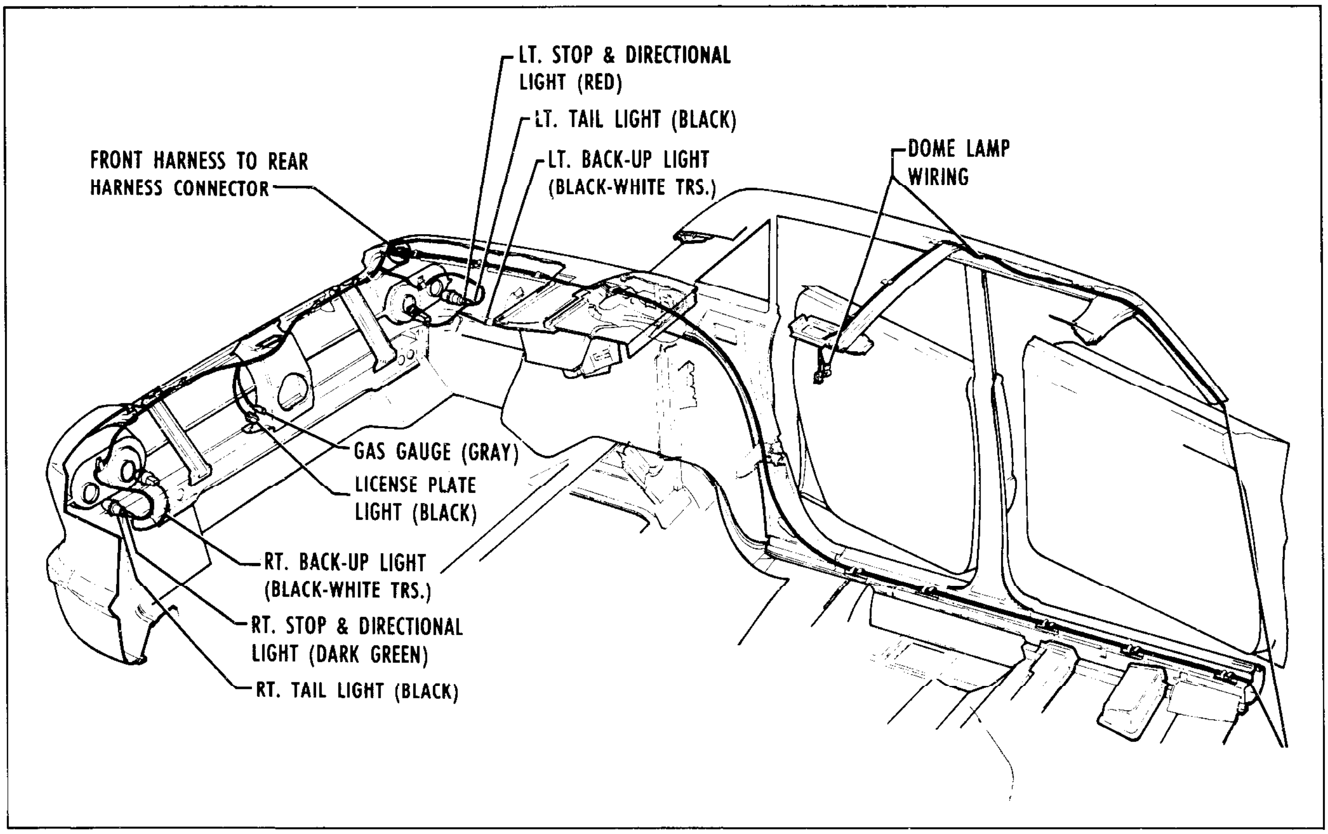


Fig. 15-80 Sedan Body Wiring Installation

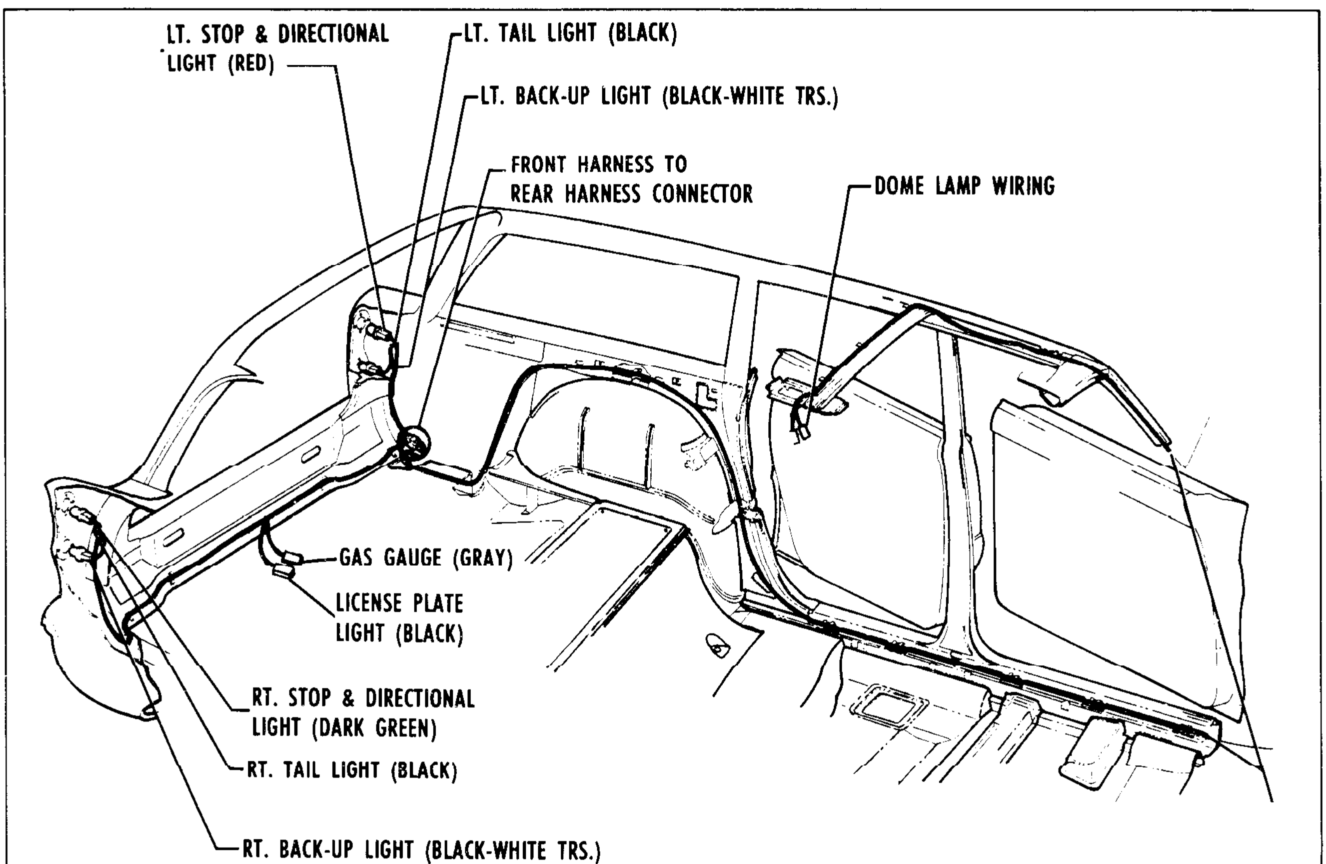


Fig. 15-81 Station Wagon Body Wiring Installation

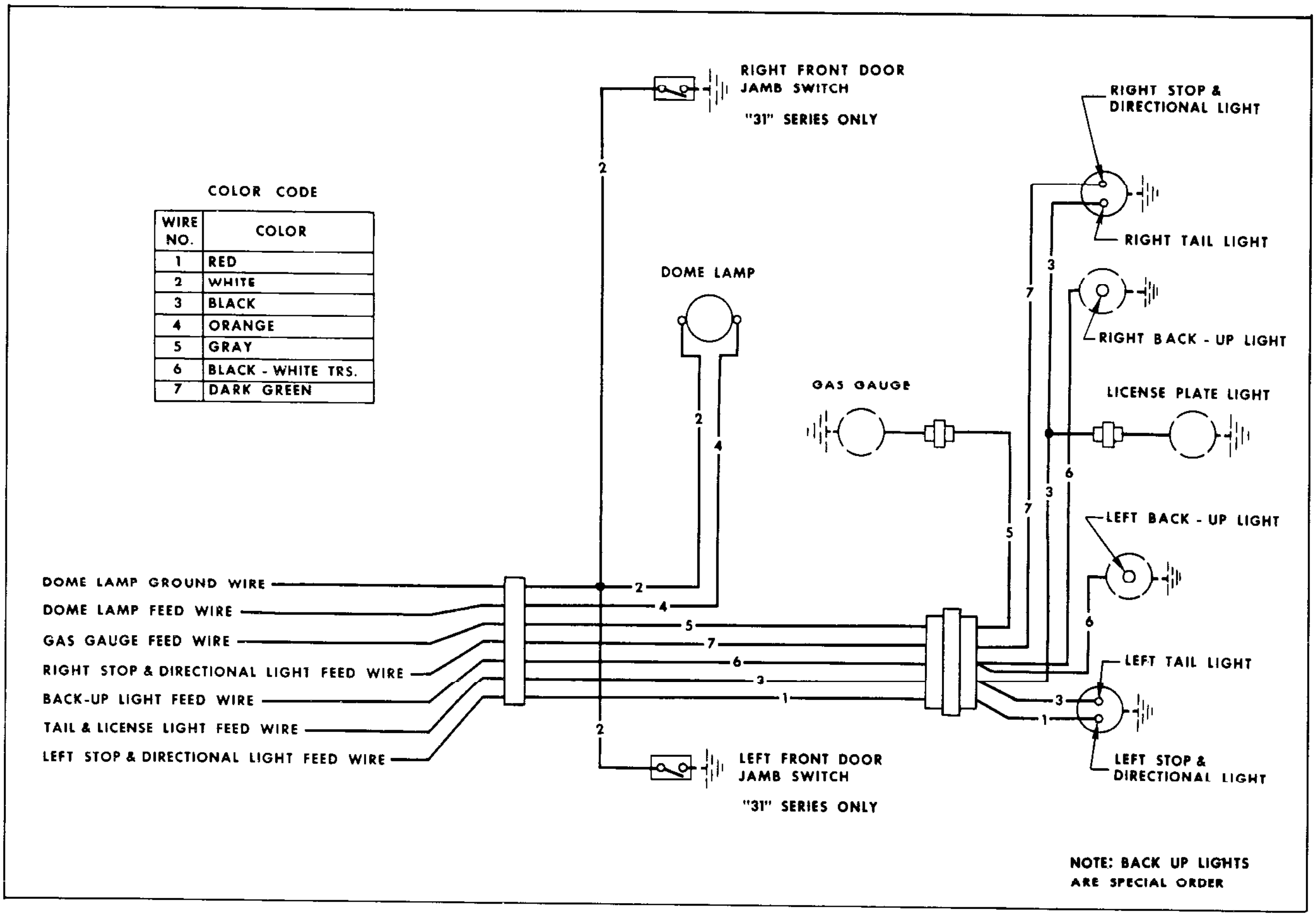


Fig. 15-82 Body Wiring Circuit Diagram

1961 PAINT SERVICE NUMBERS
EXTERIOR COLORS

Comb. Code	Color	R. M. Stock No.	DuPont Stock No.
A	Ebony Black	A-946	88-L
B	Twilight Mist	A-1398	4153-L
C	Provincial White	A-1199	4024-L
D	Platinum Mist	A-1203	4023-L
F	Azure Mist	A-1396	4143-L
H	Glacier Blue	A-1399	4150-L
J	Tropic Mist	A-1394	4143-L
K	Alpine Green	A-1391	4148-L
L	Garnet Mist	A-1221 R	4034-LH
N	Cordovan Mist	A-1218	4035-L
P	Turquoise Mist	A-1395	4141-L
Q	Aqua	A-1392	4149-L
R	Sandalwood	A-1133	2694-L
S	Autumn Mist	A-1401 R	4154-L
T	Fawn Mist	A-1397	4146-L

INSTRUMENT PANEL AND INTERIOR LACQUER COLORS

Color	Dupont		Rinshed-Mason
	Stock No.	Formula No.	Stock No.
White		92632	59 O 91
Light Green		94545	61 O 33
Light Blue		94544	61 O 27
Light Fawn		93638	60 O 82
Light Gray		93361	61 O 11
Medium Green		94297 H	61 O 31
Medium Blue		94235	61 O 23
Medium Fawn		94171	61 O 82
Medium Red	4066 H		60 C 61 R

GLOSS AND FLAT*

Color	Dupont Stock No.	Rinshed-Mason Stock No.	
Dark Gray	95040	61 O 12	*To Derive Flat Paint From Gloss Paint Add R-M Universal Flattening Concentrate Code No. 850 or Dupont No. 4528 Flattening Concentrate to Gloss Paint.
Dark Green	94298	61 O 32	
Dark Blue	94294	61 O 25	
Dark Fawn	95039	61 O 83	
Dark Red	94498	61 O 52	

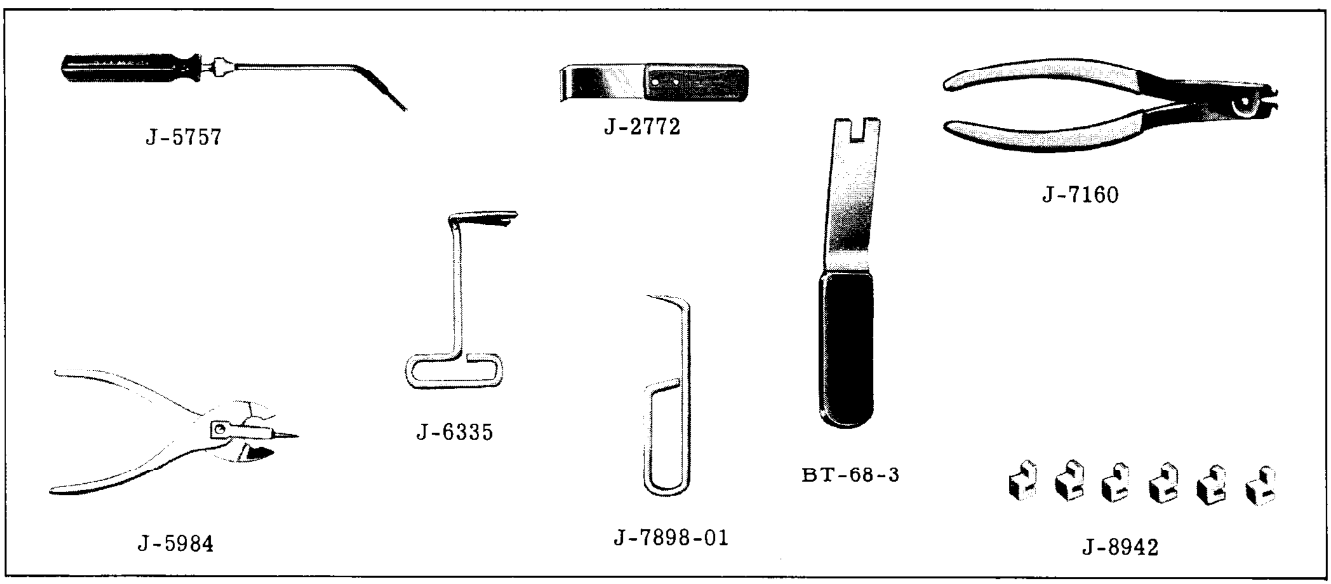


Fig. 15-83 Tools

BT68-3	Door Handle Clip Remover	J-6335	Trim Pad Remover
J-2772	Headlining Installing Tool	J-7160	Side Molding Clip Pliers
J-5757	Weatherstrip Inserting Tool	J-7898-01	Reveal Molding Clip Remover
J-5984	Weatherstrip Clip Reforming Tool	J-8942	Windshield Alignment Blocks

BODY SUPPLEMENT

CONTENTS OF SECTION

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STATIONARY SIDE WINDOWS	15-57	WINDOW REGULATOR ELECTRIC MOTOR	15-58
DROPPING WINDOW	15-57	BACK WINDOW REVEAL MOLDINGS	15-58

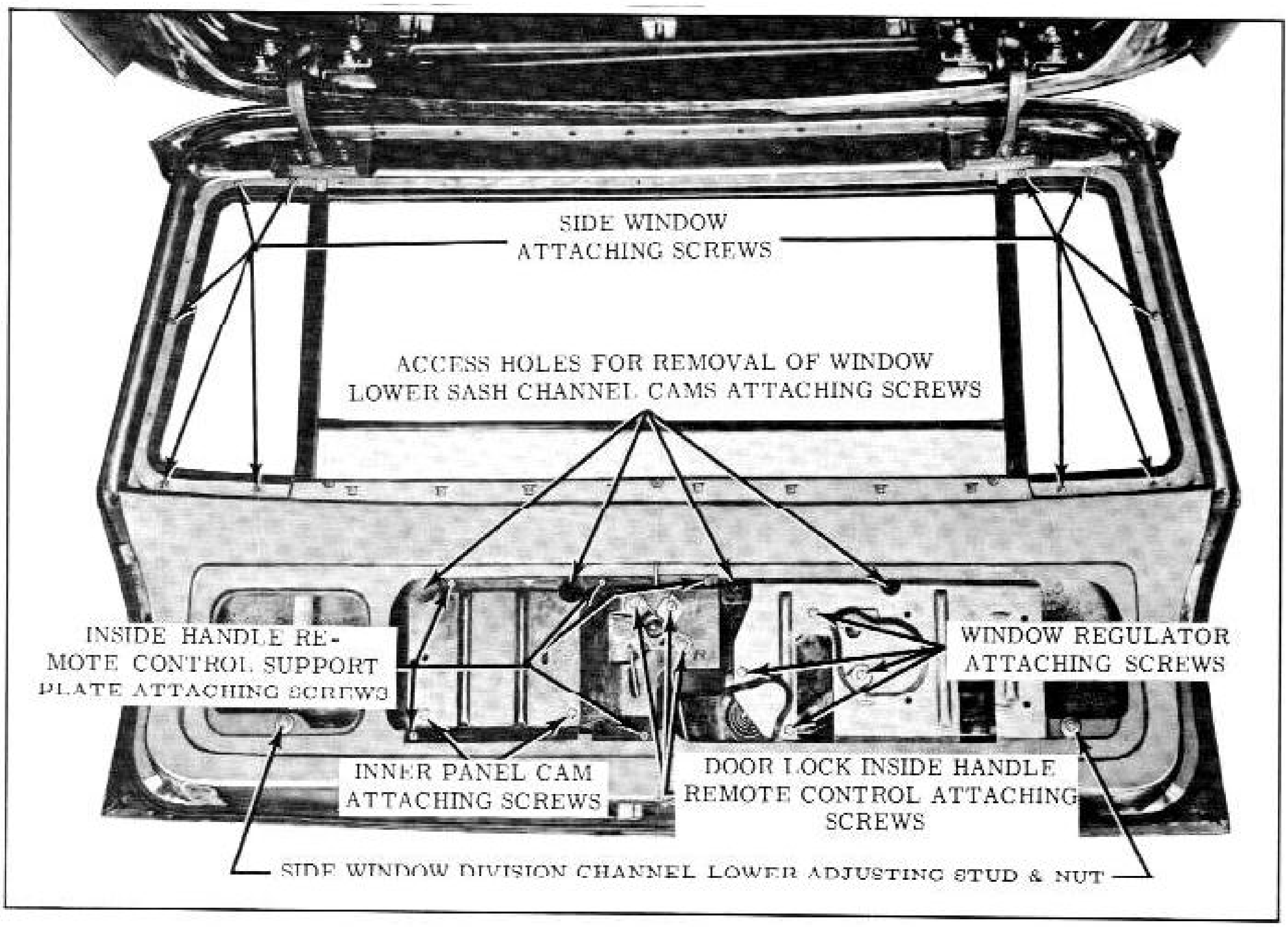

Fig. 15-84 Back Door Window Mechanism

BACK DOOR STATIONARY SIDE WINDOWS

Removal and Installation

1. Open back door and raise dropping window; remove garnish moldings and inner panel cover.

   NOTE: If removing left stationary side window on styles with electrically operated dropping window it will first be necessary to remove the right stationary side window and the dropping window to facilitate removal of the left side window.

2. Remove side window division channel lower attaching stud nut. (Fig. 15-84)
3. Remove side window frame attaching screws; then remove division channel lower adjusting stud.
4. Carefully rotate side window inward to disengage division channel from dropping window; then, remove side window from door.

   NOTE: Use caution not to chip solid plate dropping glass during removal.

5. To install, reverse removal procedure. Adjust side window division channel lower adjusting stud for proper operation of dropping window.

DROPPING WINDOW
(Manual or Electric)

1. Remove right stationary window.

2. Lower dropping window until lower sash channel cam attaching screws are aligned with access holes in inner panel. (Fig. 15-84); Then, remove both right and left cam attaching screws.

3. Remove dropping window from between panels from inside of door.

4. When installing, lubricate window lower sash channel cams with 630AAW lubriplate or equivalent; then, reverse removal procedure.

REGULATOR

Removal and Installation

1. On back doors with electrically operated window remove right side stationary window, dropping window and left side stationary window. Disconnect wire harness connector from regulator.

   IMPORTANT: Do not operate regulator motor after window assembly is disengaged from regulator arms. Operation of motor with load removed may damage unit.

2. On back doors with manually operated window, remove lower garnish molding and inner cover panel. Lower dropping window until lower sash channel cam attaching screws are aligned with access holes in inner panel (Fig. 15-84); then, remove both right and left cam attaching screws and remove cams from regulator lift arms.

3. Remove back door lock inside handle remote control attaching screws; disconnect remote control from connecting rod and remove remote control.

4. Remove screws securing inside handle remote control support plate; then, move support plate towards right side of door to disengage inner panel cam from regulator arm roller and remove support plate.

5. Remove regulator attaching screws and remove regulator.

   NOTE: To remove window regulator electric motor assembly see "WINDOW REGULATOR ELECTRIC MOTOR".

6. To install, first lubricate regulator window lower sash channel cams and inner panel cam with Lubriplate 630AAW or equivalent; then, reverse removal procedure.

WINDOW REGULATOR ELECTRIC MOTOR

Removal and Installation

1. Remove window regulator as described under "DROPPING WINDOW REGULATOR (Manual or Electric) - Removal and Installation".

   IMPORTANT: BE SURE TO PERFORM STEPS 2 AND 3 BEFORE ATTEMPTING TO REMOVE MOTOR FROM REGULATOR. The regulator lift arm, which is under tension from the counterbalance spring, can cause serious injury if the motor is removed without locking the sector in position with a nut and bolt.

2. Place regulator and motor assembly in a vise. Drill a 1/4" hole through back plate and sector. (Fig. 17-85)

   NOTE: Do not drill into motor housing, part of which is indicated by dotted line. DO NOT locate hole less than 1/2" away from edge of back plate or sector.

3. Insert a 3/16" bolt through hole in back plate and sector and install nut to bolt. Do not tighten nut.

4. Remove motor attaching bolts and remove motor assembly from regulator.

   NOTE: Clean off steel chips from regulator sector and motor pinion gear.

5. To install regulator motor assembly, reverse removal procedure. If difficulty is encountered when trying to line up motor attaching holes, the regulator lift arm may be moved up or down manually so that motor pinion gear will mesh with teeth on regulator sector and regulator attaching holes will line up.

   Lubricate regulator sector teeth and all frictional points with 640AAW Lubriplate or equivalent.

   NOTE: Be sure to remove temporary nut bolt from regulator before installing regulator in door.

BACK WINDOW REVEAL MOLDINGS

The back window reveal moldings consisting of an upper, a right and left side and a lower molding are secured to the back door by screws through the window opening flanges.

UPPER REVEAL MOLDING

Remove back window garnish moldings and right and left stationary side window attaching screws. Rotate window sufficiently to gain access to reveal molding attaching screws. Remove dropping window upper run channel; then, remove upper reveal molding attaching screws and molding.

LOWER REVEAL MOLDING

Remove back window garnish moldings. Remove both right and left stationary side window attaching screws. Remove dropping window upper run channel. Raise window sufficiently to gain access to molding screws from under window frame. Remove lower reveal attaching screws and remove molding.

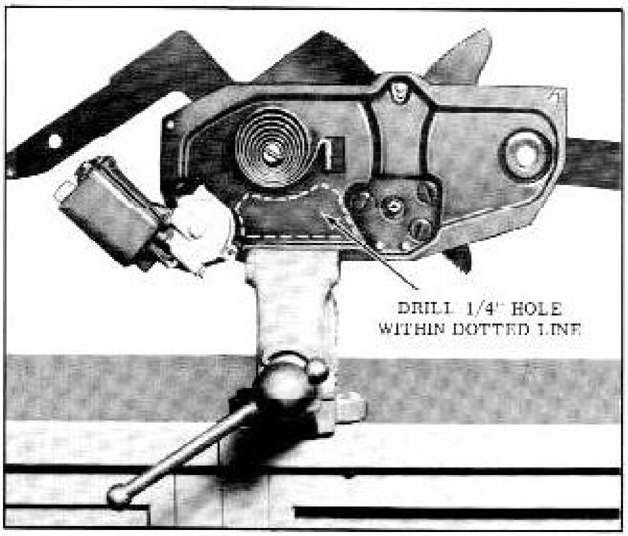

Fig. 15-85 Regulator Motor Removal

SIDE REVEAL MOLDING (RIGHT OR LEFT)

Remove back window garnish molding and stationary side window attaching screws on side which reveal molding is being removed. Push out window sufficiently to gain access to molding screws. Remove screws and molding.