1964 OLDSMOBILE

Service manual

CONTENTS

no. 3

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SERVICE MANUAL

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FOREWORD

This manual is compiled to provide service procedures, adjustments and specifications for the 1964 Oldsmobiles. An understanding of the material contained herein and in monthly issues of the Oldsmobile Service Guild and Dealer Technical Information Bulletins, issued when necessary, will assist service personnel in properly maintaining the quality to which Oldsmobile cars are built.

QUICK REFERENCE INDEX. To use, move either the hand or selection tool directly over the section you desire to reference. Simply click once with the mouse button and the manual will automatically jump to that section.

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MANUAL NUMBER 3

SERVICE DEPARTMENT

OLDSMOBILE DIVISION

GENERAL MOTORS CORPORATION

LANSING, MICHIGAN

Litho in U.S.A.
GMP B-1875

STEERING

(ALL SERIES)

CONTENTS OF SECTION 8

PERIODIC MAINTENANCE

Power Steering gear lubrication is accomplished by the oil supplied through the gear by the power steering pump. Regular or seasonal changes are unnecessary. Refer to PERIODIC MAINTENANCE, Section 2, for steering linkage lubrication requirements.

STEERING LINKAGE (Fig. 8-1 & 8-2)

GENERAL INFORMATION

The only steering linkage adjustment is at the tie rod sleeves for the setting of steering wheel spoke alignment and front wheel toe-in.

SUSPENSION AND STEERING LINKAGE CHECK

1. Raise car on one side at frame torque box located directly behind the front wheel so that tire is approximately one inch off the floor.
2. Position dial indicator as shown in Fig. 8-3.
3. Grasp front wheel as shown in Fig. 8-3. With wheels in straight ahead position, move wheel back and forth without moving steering wheel. Gauge reading should not exceed .180".
4. If gauge reading is not within specifications, a check should be made of all suspension and linkage parts.

STEERING GEAR LASH CHECK

1. With the front wheels on the floor and in the straight ahead position, move steering wheel in both directions without moving the front wheels.

NOTE: If car is equipped with power steering, the engine must be running.

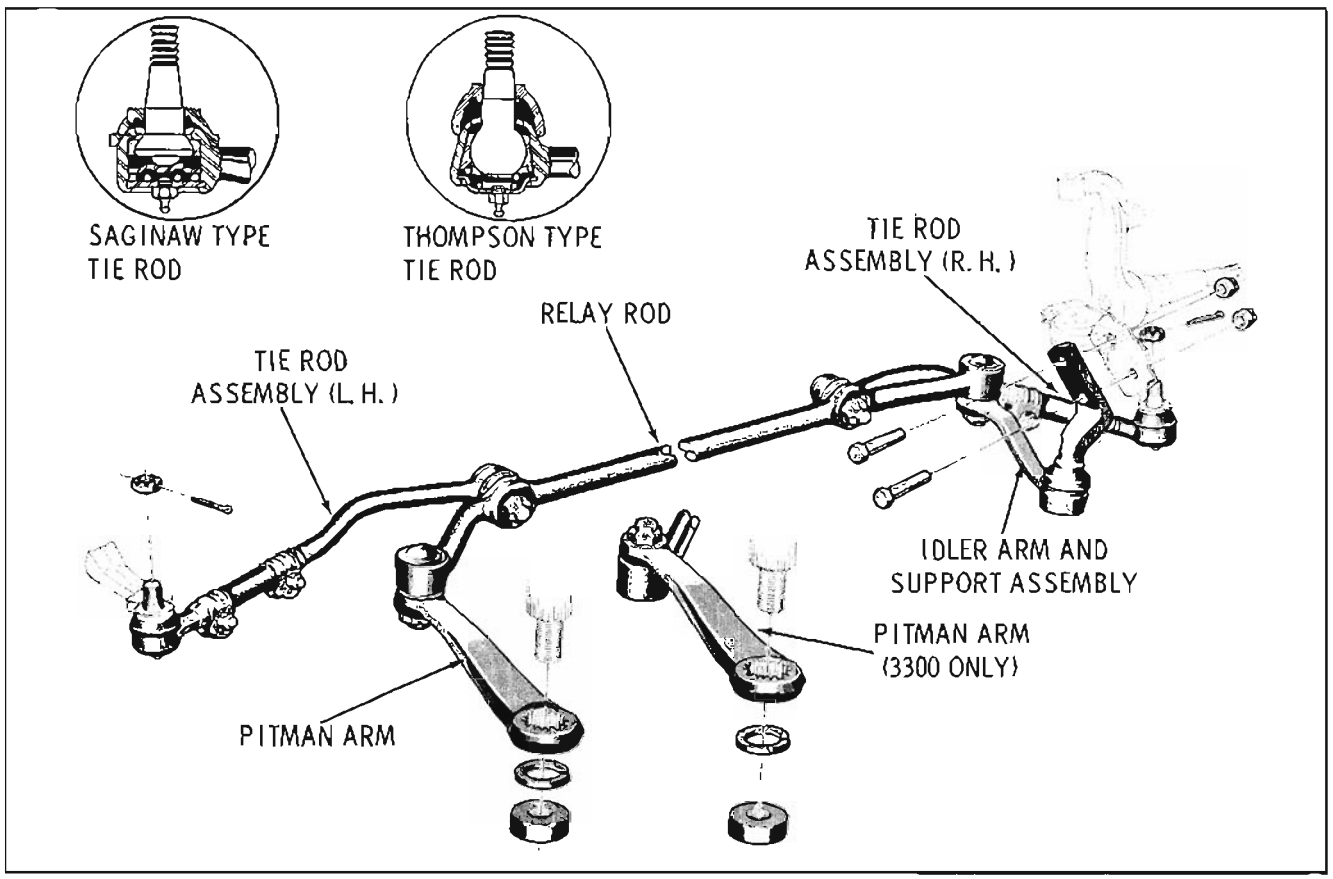


Fig. 8-1 Steering Linkage (33 - 34 - 35 - 36 - 38 & 39 Series)

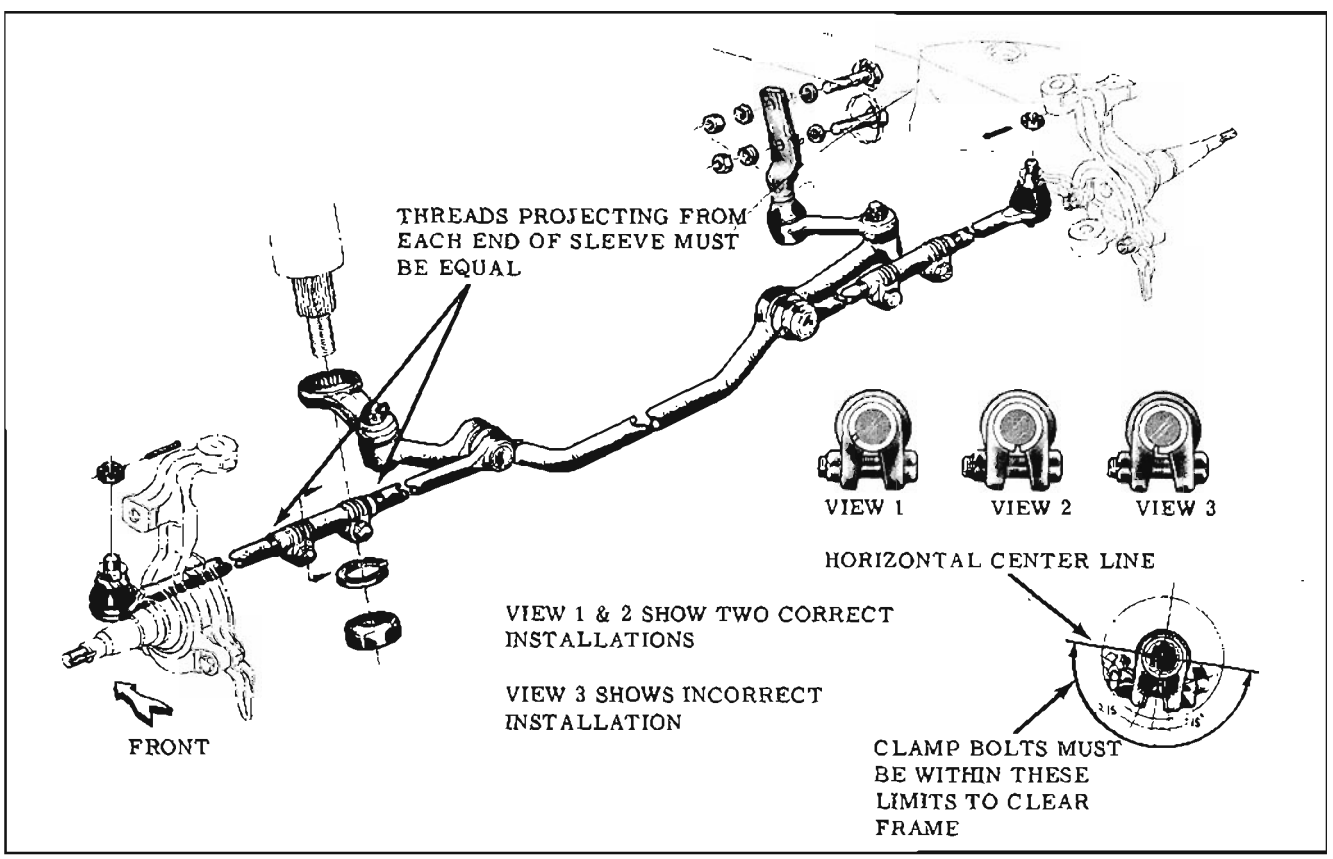


Fig. 8-2 Steering Linkage (30 - 31 & 32 Series)

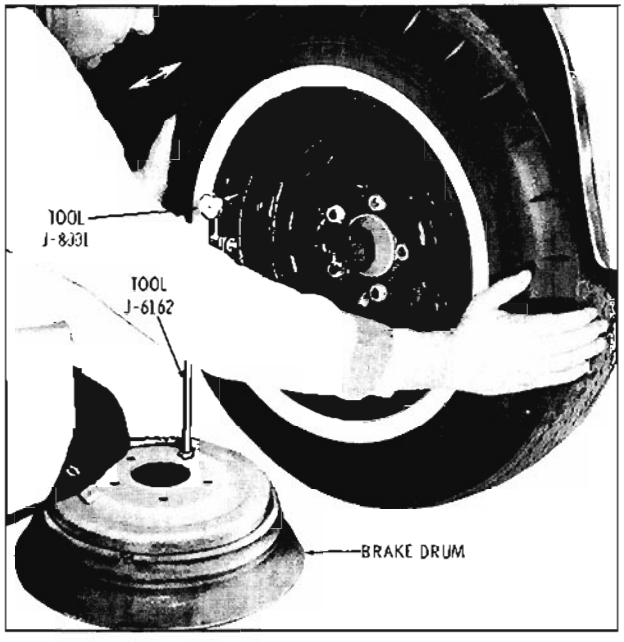


Fig. 8-3 Suspension and Linkage Check

2. If steering gear lash exceeds two inches maximum and/or the gear binds when turning steering wheel from lock to lock, the gear must be adjusted or the cause of the bind corrected.

REPLACEMENT OF STEERING LINKAGE PARTS

PITMAN ARM

To disconnect the pitman arm from the pitman shaft use Tool J-5504-B or a similar puller. Upon assembly, install the pitman arm with the front wheels in the straight ahead position and with the steering wheel at the center of its travel. Torque pitman shaft nut 120 to 150 ft. lbs.

LINKAGE JOINTS

IMPORTANT: When disconnecting a linkage joint, no attempt should be made to disengage the joint by driving a wedge between the joint and the attached part.

Tie rod joints should be disconnected from the relay rod, after removing the attaching nut, by using Tool J-5504-B. (Fig. 8-4) To disconnect the outer end of a tie rod, remove the tie rod to plain arm attaching nut, then tap the END of the PLAIN ARM with a hammer to free the tie rod from the plain arm. Tool BT 6320 can be used to remove the tie rod ends, however the seal must be cut before the tool can be used. Use new seals on assembly. (Fig. 8-5) Upon re-assembly, the linkage joint nuts should be tightened 50 to 60 ft. lbs. To remove the pitman arm or idler arm from the relay rod, the steering

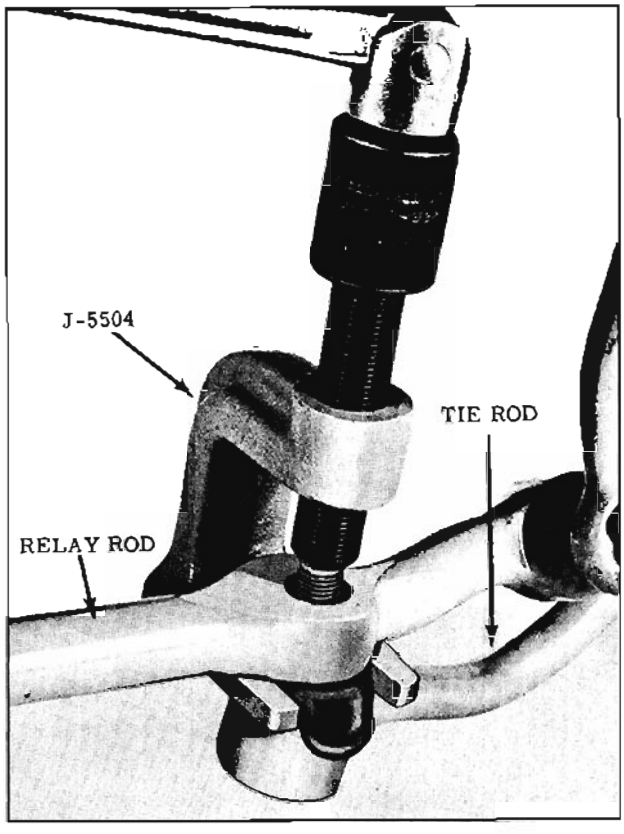


Fig. 8-4 Disconnecting Linkage Joint

linkage should be removed from the car. After removing the nut, the relay rod can be clamped in a vise or supported so that the joint can be driven out of the relay rod.

IDLER ARM AND SUPPORT ASSEMBLY

The idler arm and support is serviced as an assembly and no adjustments are required. When

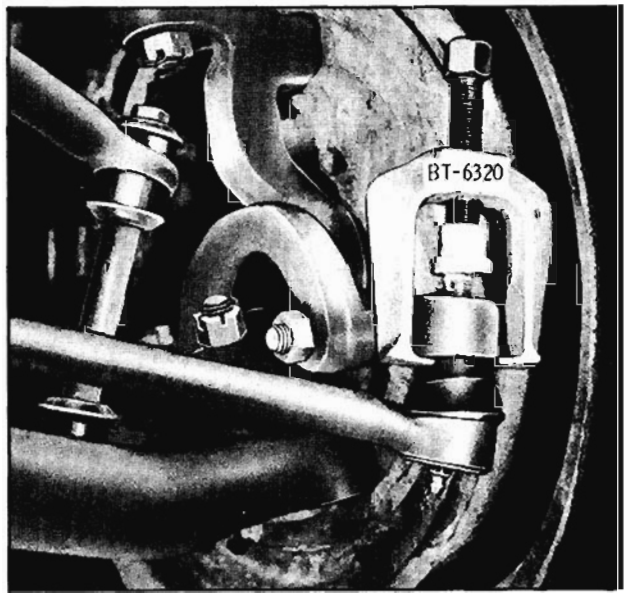


Fig. 8-5 Disconnecting Linkage Joint

installing the support to the frame bracket, torque the bolts 25 to 35 ft. lbs.

TIE RODS

Whenever the tie rod end is assembled to the tie rod and prior to assembling the tie rod end to the plain arm, make certain that an equal number of tie rod and tie rod end threads are exposed at each end of the tie rod sleeve.

LINKAGE ADJUSTMENT

Toe-in and steering wheel spoke alignment is obtained by turning the adjusting sleeves on the tie rods which in turn lengthen or shorten the tie rod assemblies. Refer to WHEEL ALIGNMENT. After adjusting toe-in, make certain that the sleeve clamps are positioned as shown in Fig. 8-2 or 8-6.

MANUAL STEERING (Fig. 8-7)

ADJUSTMENTS (ON CAR)

Before any adjustments are made to the steering gear in an attempt to correct such conditions as shimmy, hard or loose steering, or road shock, a careful check should be made to determine that front end alignment, shock absorbers, wheel balance, and tire pressure are correct.

There are two adjustments on the manual steering gear:

a. WORM BEARING PRE-LOAD ADJUSTMENT

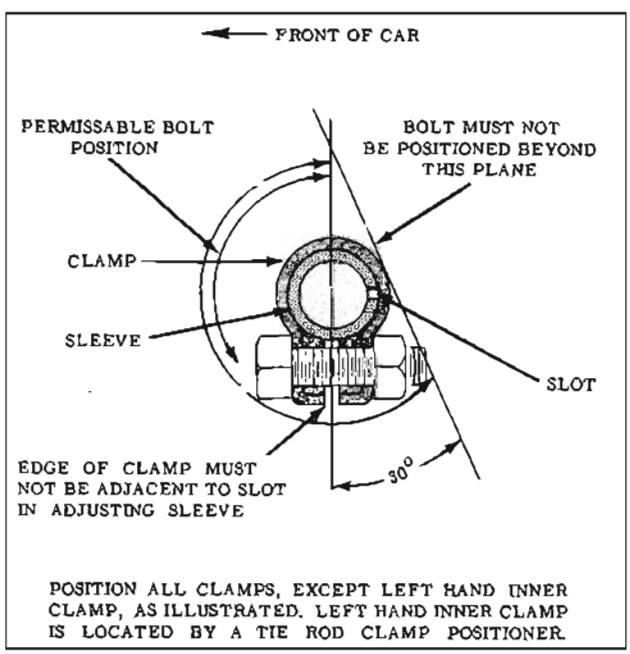


Fig. 8-6 Tie Rod Clamp Positioning (33 - 34 - 35 - 36 - 38 & 39 Series)

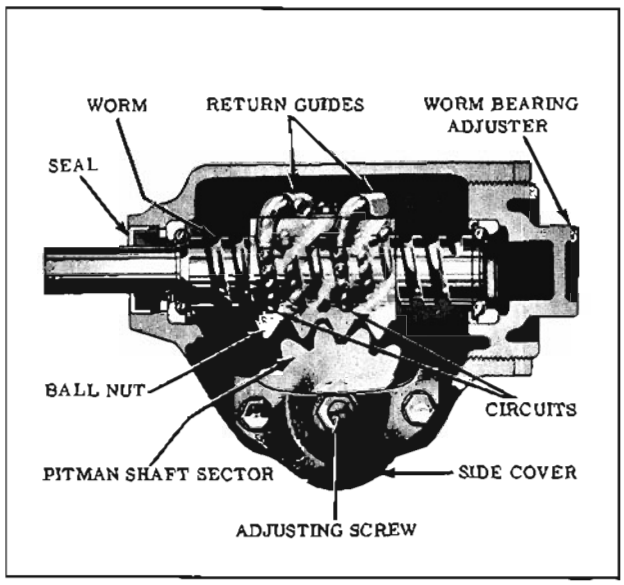


Fig. 8-7 Manual Steering Gear

b. OVER-CENTER ADJUSTMENT

IMPORTANT: The worm bearing preload adjustment must be checked and corrected if necessary before the over-center adjustment is made. Failure to follow the proper sequence may result in damage to the steering gear.

WORM BEARING PRE-LOAD ADJUSTMENT

1. Disconnect the pitman arm from pitman shaft using Tool J-5504-B or a similar puller.
2. Loosen pitman shaft adjusting screw locknut and loosen adjusting screw a few turns. (Fig. 8-7)

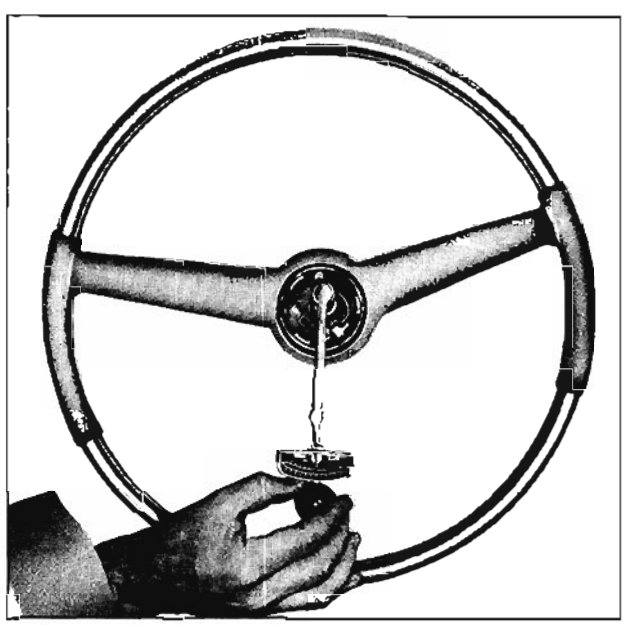


Fig. 8-8 Checking Worm Bearing Pre-load

3. Using an inch pound torque wrench measure the torque which is required to keep the wheel in motion at about 30° off straight ahead position. (Fig. 8-8)

4. The torque required should be between 4 and 7 inch pounds. If it is not, it will be necessary to loosen the worm bearing adjuster locknut with a brass drift (Fig. 8-9) and turn the worm bearing adjuster the required amount to bring the torque within limits.

5. When adjustment is correct, retighten locknut 70 to 100 ft. lbs. and recheck preload.

OVER-CENTER ADJUSTMENT

6. After making the worm bearing adjustment, the pitman shaft adjusting screw should be tightened until a pull of 4 to 10 inch pounds in excess of worm bearing pre-load is required to turn the wheel through the center range. (Approximately 2-7/8 turns from either end of travel on car or 3-1/8 turns for bench adjustment) (Fig. 8-10) Tighten the locknut 18 to 27 ft. lbs. and recheck the over-center adjustment.

7. After adjustments have been made, assemble pitman arm to pitman shaft with front wheels and steering wheel in the straight ahead position so that splines will align properly. Torque pitman shaft nut (100 to 120 ft. lbs.)

GEAR ASSEMBLY REMOVE AND INSTALL

1. Remove the two flex coupling flange attaching nuts and lockwashers.

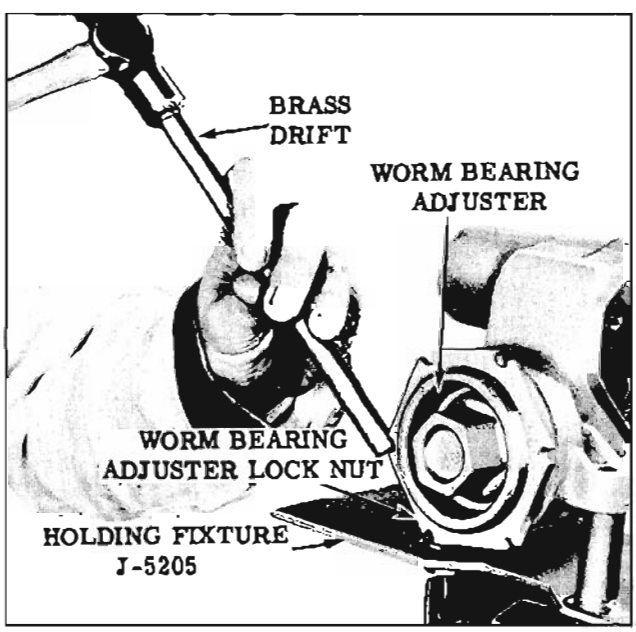


Fig. 8-9 Loosening Lock Nut

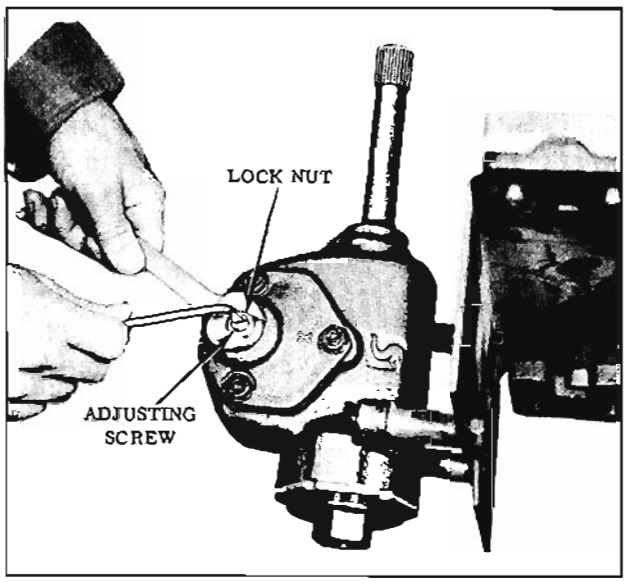


Fig. 8-10 Over-Center Adjustment

2. Hoist front of car and support car with floor stands under outer ends of lower control arms.

3. Remove pitman shaft nut and pull pitman arm from shaft using Tool J-5504-B or a similar puller.

4. Remove gear to frame bolts, position steering linkage and speedometer cable, if so equipped, out of the way and withdraw gear assembly from under car.

If necessary to remove the upper worm shaft seal with the gear assembled, punch a small hole in the seal and install a small metal screw approximately two turns. Then pry out the seal with a pair of side cutters. Drive new seal flush with housing with Tool J-21421.

To install gear, apply wheel bearing grease to the gear mounting pads to prevent gear to frame squeak, then reverse removal procedure. Torque steering gear to frame bolts 60 to 80 ft. lbs. Torque pitman shaft nut 100 to 120 ft. lbs.

DISASSEMBLY OF GEAR

1. Mount gear on Holding Fixture J-5205.

2. Loosen the pitman shaft adjusting screw locknut.

3. Rotate worm shaft 3-1/8 turns from end of travel, then remove side cover and pitman shaft from steering gear housing.

4. Loosen worm bearing adjuster locknut with a brass drift, then remove locknut and adjuster assembly from gear housing.

5. Remove worm shaft assembly (with ball nut) out through bottom of housing. Remove upper worm bearing from steering shaft.

SERVICING INDIVIDUAL UNITS

PITMAN SHAFT AND SIDE COVER

Disassembly

1. Remove pitman shaft adjusting screw locknut.
2. Thread, adjusting screw through pitman shaft cover, then remove cover and gasket.
3. Wash all parts in clean solvent and dry with compressed air. Inspect parts.

If the bushing in the side cover is defective the side cover must be replaced as the bushing is not serviced separately.

Assembly

1. Check the end clearance of the adjusting screw in the slot of the pitman shaft. (Fig. 8-12) The screw should rotate freely but not have more than .002" clearance. If clearance exceeds .002", select the proper shim to bring the clearance to specification. (Shim thicknesses are .063", .065", .067", and .069")
2. Assemble the pitman shaft and adjusting screw (with proper shim) to side cover. Thread the adjusting screw through the side cover until the side cover bottoms on the pitman shaft.

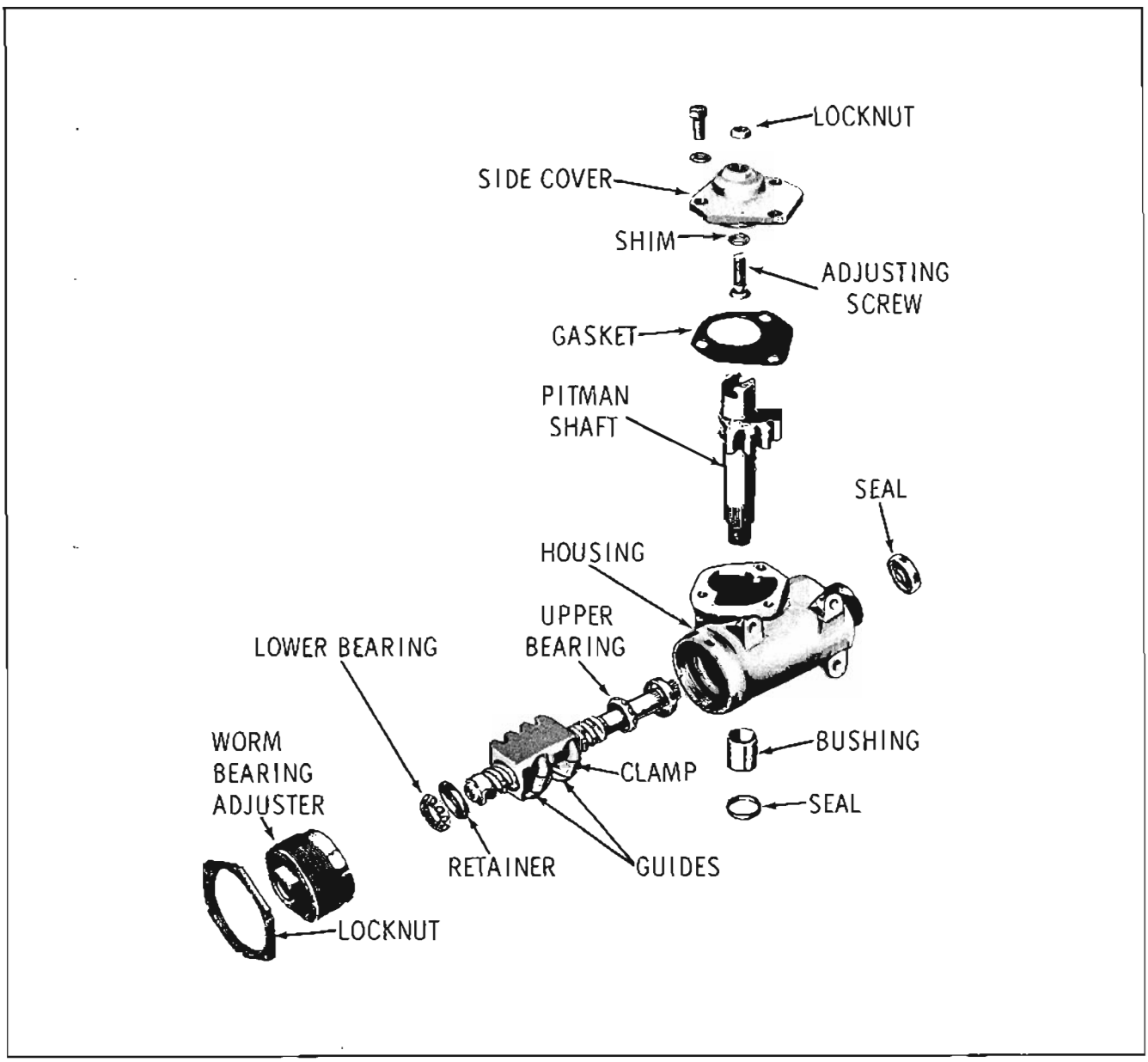


Fig. 8-11 Manual Steering Gear

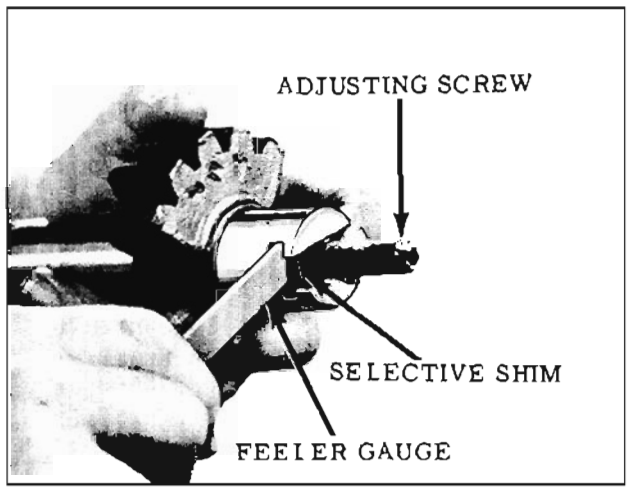


Fig. 8-12 Checking End Clearance

3. Install locknut but do not tighten.

HOUSING

Disassembly

1. If pitman shaft seal ONLY is to be replaced, use a small chisel to collapse the seal so it can be lifted from the housing. (Fig. 8-13)

2. If pitman shaft bushing is to be replaced, use Tool J-8810 with Driver Handle J-8092 to drive bushing and seal from housing. (Fig. 8-14)

3. The upper worm bearing race can be removed with a brass drift and installed with Tool J-8811.

4. Wash housing in clean solvent and dry with compressed air.

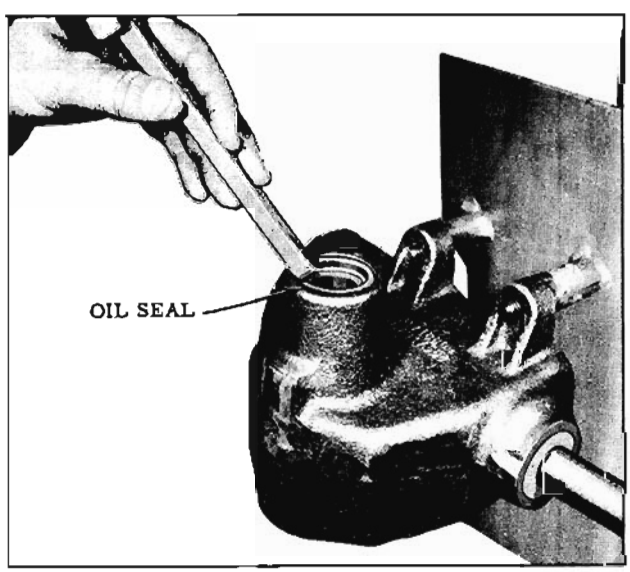


Fig. 8-13 Removing Pitman Shaft Seal

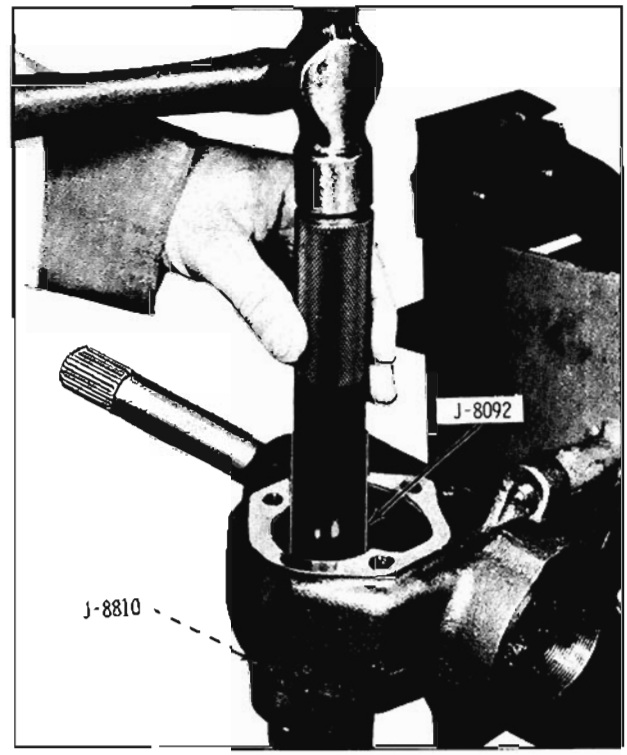


Fig. 8-14 Removing Bushing

Assembly

1. If pitman shaft bushing was removed, place a new bushing over end of Tool J-8810, then drive bushing into housing as shown in Fig. 8-15.

2. Place a new seal into housing with lip of seal facing inward. Drive seal in the housing until it bottoms against shoulder of counterbore, using Tool J-8811. (Fig. 8-16) Coat lip of seal with seal lubricant, Part No. 567196.

WORM BEARING ADJUSTER

1. Pry lower worm bearing retainer from adjuster, then remove lower worm bearing.

2. Wash all parts in clean solvent and dry with compressed air. Inspect parts for wear.

Assemble

Pack lower worm bearing with SAE 80 Multi-Purpose Gear Lubricant, then place bearing on race and install retainer.

BALL NUT

Remove

1. Remove ball return guide clamp and guides from ball nut.

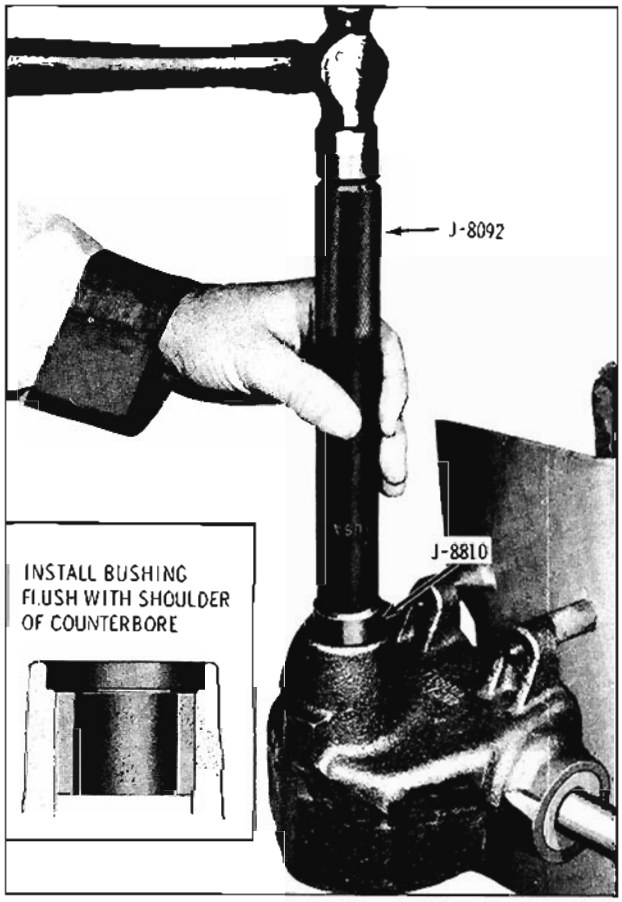


Fig. 8-15 Installing Pitman Shaft Bearing

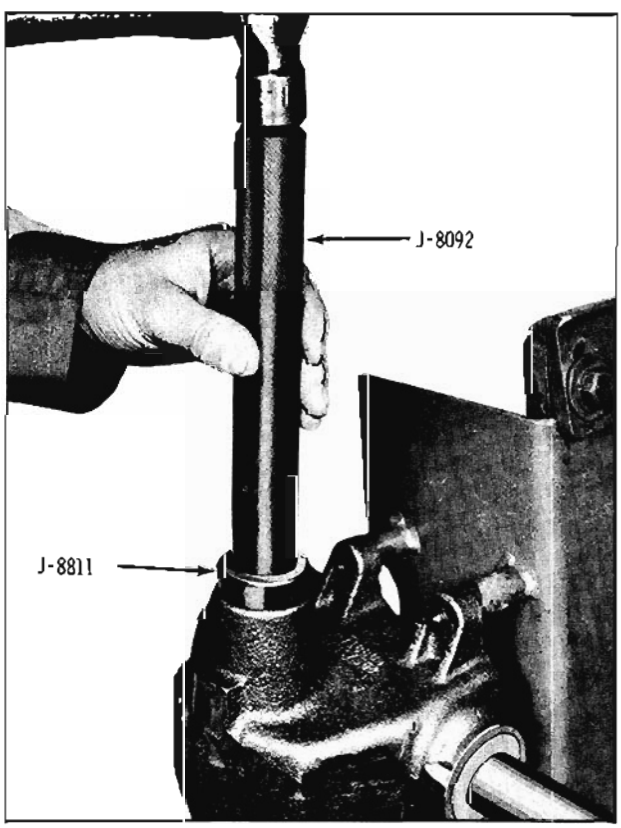


Fig. 8-16 Installing Pitman Shaft Seal

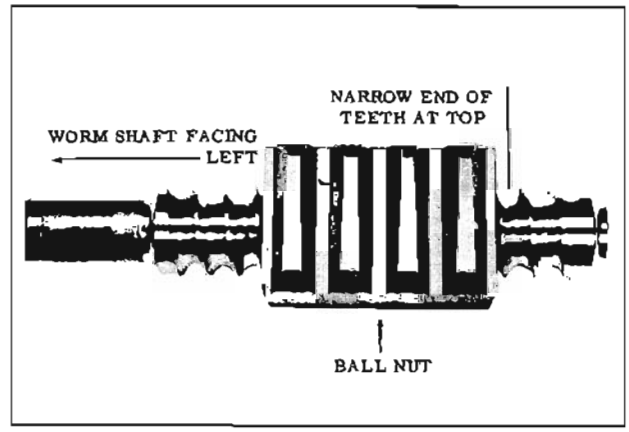


Fig. 8-17 Positioning Ball Nut

2. Rotate worm until all balls have dropped out of the nut, then remove nut from worm.

3. Wash all parts in clean solvent and dry with compressed air. Inspect parts for wear.

Install

1. Coat ball nut and worm with steering gear lubricant.

2. Slide ball nut over worm. (Fig. 8-17)

3. Position the ball return guides on the ball nut.

4. Install 25 balls into each circuit through the hole in the return guides. (Fig. 8-18)

5. Install the guide clamp.

ASSEMBLY OF STEERING GEAR

1. Pack the upper worm bearing with SAE 80 Multi-Purpose Gear Lubricant, then slide

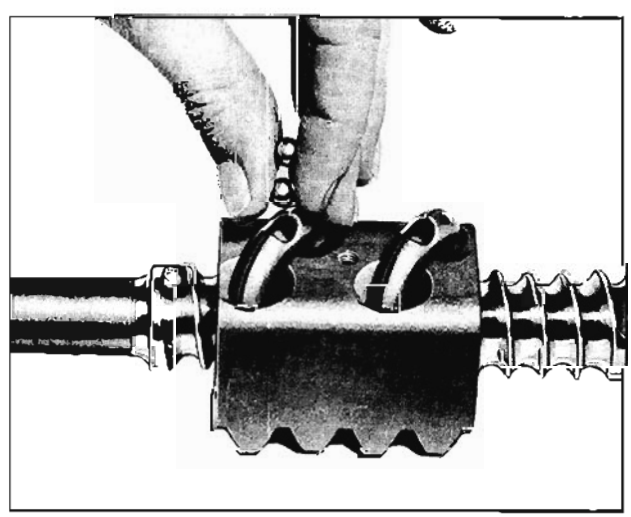


Fig. 8-18 Ball Installation

upper worm bearing over worm shaft and position bearing against worm. Install grommet. Slide worm shaft, bearing and ball nut assembly into gear housing.

2. Install worm bearing adjuster into gear housing. Adjuster should be installed just tight enough to hold worm bearing in place. Final adjustment will be made later.

3. Install pitman shaft and side cover assembly and gasket, with sector and ball nut teeth centered as shown in Fig. 8-19. Torque side cover bolts 20 to 22 ft. lbs.

4. Fill steering gear with SAE 80 Multi-Purpose Gear Lubricant.

5. Steering gear should be bench adjusted before it is installed in the car as follows:

   a. Attach Torque Wrench J-5853 to worm shaft and turn shaft to extreme right or left position.

   b. Turn worm bearing adjuster to obtain a reading of 4 to 7 inch pounds with worm shaft turning slowly. Worm bearing preload adjustment must be made within 1/2 turn of worm shaft from extreme position.

   c. Tighten worm bearing adjuster locknut and recheck reading.

   d. Turn worm shaft from one extreme to the other while counting turns, then turn back 1/2 the total number of turns. This places the steering gear on the "over-center" or "high point" position.

   e. Loosen pitman shaft lash adjuster locknut and turn lash adjuster until a reading of 4 to 10 inch pounds higher than worm bearing preload is obtained while rotating worm through the "over-center" range. Tighten locknut and recheck reading. Total "over-center" pull should not exceed 14 inch pounds.

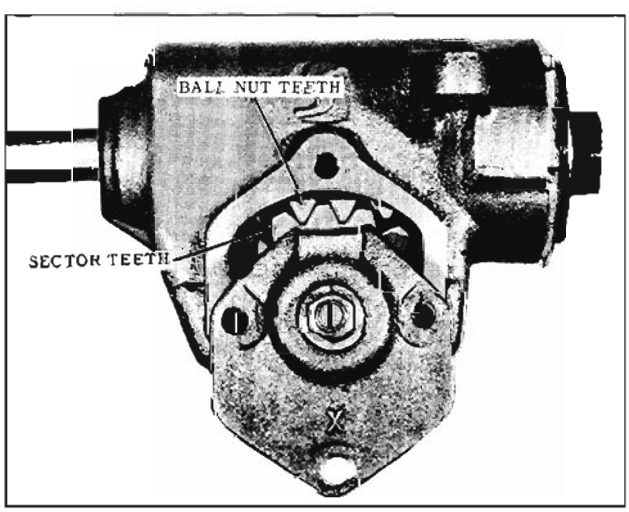


Fig. 8-19 Sector and Ball Nut Centered

POWER STEERING PUMP

OPERATION (Fig. 8-20)

Oil is supplied from the reservoir to the pumping chambers (composed of the cam ring, rotor, thrust plate and pressure plate) through passage A. Oil discharged from the pumping chamber is discharged to cavity B. From the cavity B, oil passes through orifice C into the outlet passage and on through the flexible lines to the steering gear. Part of the oil in cavity B passes through openings D in the pressure plate to act on the inner edge of the ten vanes and assist centrifugal force in keeping the vanes out against the cam ring. The thrust plate has four blind cavities directly opposite these four openings in the pressure plate to prevent side thrust on the vanes.

When pump output exceeds the calibration of orifice C, a back pressure builds up behind the flow control valve at E which overcomes spring force and opens the valve to allow oil to return to the intake side of the pump and to the reservoir. (Inset, Fig. 8-20) Flow control is desirable to reduce power consumption which would otherwise result if the pump were allowed to circulate oil through the steering gear with no regulation when driving at high speed.

When steering conditions demand high pressure for power assist, the pump builds up sufficient pressure on the steering gear rack-piston to turn the pitman shaft. This pressure is also being exerted on the front end of the flow control valve through passage F. When extremely high pressure is built up in the steering gear (such as when holding the steering linkage against its stop) the pressure relief ball G is forced from its seat. Oil flowing past the ball, plus the normal internal leakage at the outer edge of the flow control valve, reduces the pressure on the forward side of the flow control valve. The flow control valve then opens, allowing oil to return to the intake side of the pump and to the reservoir.

When making a partial turn at low speed, the pressure requirements are normally well below maximum pressure, so the pressure relief ball will be closed. Also the pump output is less than system requirements so the flow control valve is closed.

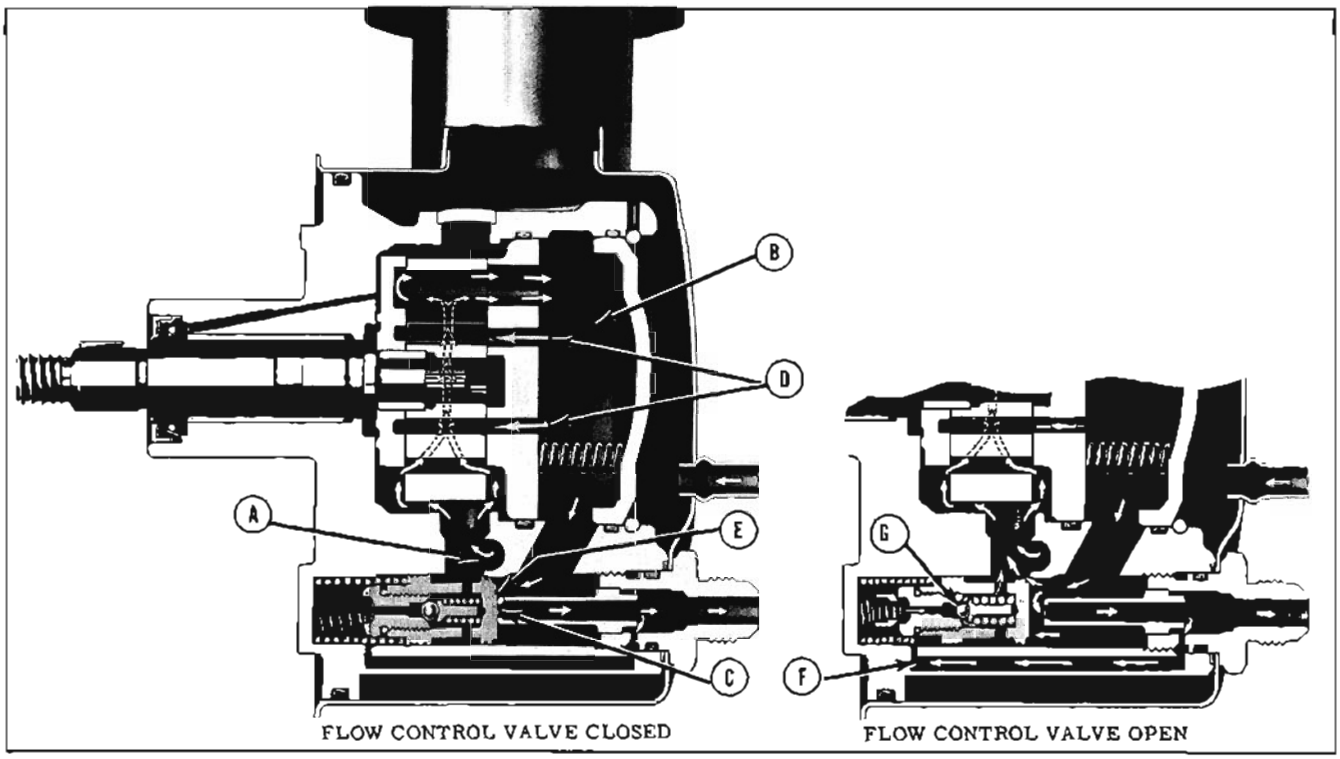


Fig. 8-20 Oil Flow at Low Speed

MINOR SERVICE OPERATIONS

PUMP BELT ADJUSTMENT

Checking

Position Gauge 33-70M on pump belt as shown in Fig. 8-21. If the pointer of tool does not index with correct mark, corresponding with the type of belt to be adjusted, the belt should be adjusted as follows:

Adjustment

With Gauge 33-70M positioned on pump belt, loosen the pump attaching bolts and adjust the belt tension by moving the pump away from engine.

SERVICING OF THE FLOW CONTROL VALVE (WITHOUT REMOVING PUMP ASSEMBLY FROM CAR)

1. Disconnect high pressure hose from pump union and drain oil.
2. Remove union and withdraw flow control valve and spring with a magnet.
3. For disassembly and assembly of flow control valve refer to step 13 under PUMP DISASSEMBLY and step 1 under PUMP ASSEMBLY.
4. To install reverse the above procedure and install a new "O" ring seal on the union.

PUMP SHAFT OIL SEAL REPLACEMENT (WITHOUT DISASSEMBLING PUMP)

The pump shaft oil seal can be replaced without disassembling the pump from the car as follows:

1. With the pump pulley removed, bend a piece of .005" shim stock (approximately 2-1/2" long) into a cylindrical shape, then push the shim stock past seal until it bottoms in pump body. (Fig. 8-22)

   NOTE: The use of seal protector Tool J-7132-1 will aid in pushing shim stock into pump body. The use of shim stock around the drive shaft will prevent damage to the machined surfaces of the shaft when removing seal.

2. Cut metal body of seal with a small chisel as shown in Fig. 8-22.
3. Tear metal body approximately 1" with diagonals. Force an awl between the pump body and the OD of seal to collapse the seal, then pry seal from pump body. (Fig. 8-23) Remove shim stock.
4. Apply special seal lubricant (Part No. 567196) to the sealing lip of a new seal, then install seal over seal protector Tool J-7132-1 with metal side of seal against tool.
5. Slide Tool J-7132-1 (with seal) over drive shaft, then using Tool J-7132-2, drive seal into pump body. (Fig. 8-24)

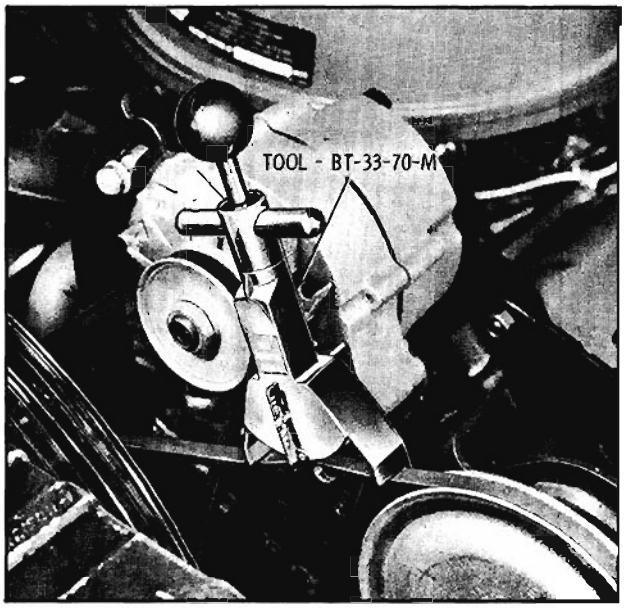


Fig. 8-21 Adjusting Power Steering Belts

6. Remove tools.

POWER STEERING PUMP

Removal and Installation

The power steering pump is attached as shown in Figs. 8-25, 8-26 or 8-27. When removing the pulley nut do not loosen the belt tension as the belt tension will prevent the pulley from turning.

When disconnecting the hoses from the pump, secure the end of the hoses above the fluid level. Cap the pump fittings.

To install, reverse the removal procedure. Tighten the rear bracket attaching nuts 20 to 40 ft. lbs., rear bracket to intake manifold bolt and pump to front bracket bolts 20 to 28 ft. lbs. and the pulley attaching nut 35 to 45 ft. lbs. Fill reservoir with Fluid, Part No. 1099021, then bleed pump by turning pulley counterclockwise until air bubbles cease to appear. Refill reservoir to proper fluid level, if necessary. Adjust pump belt as outlined under PUMP BELT ADJUSTMENT.

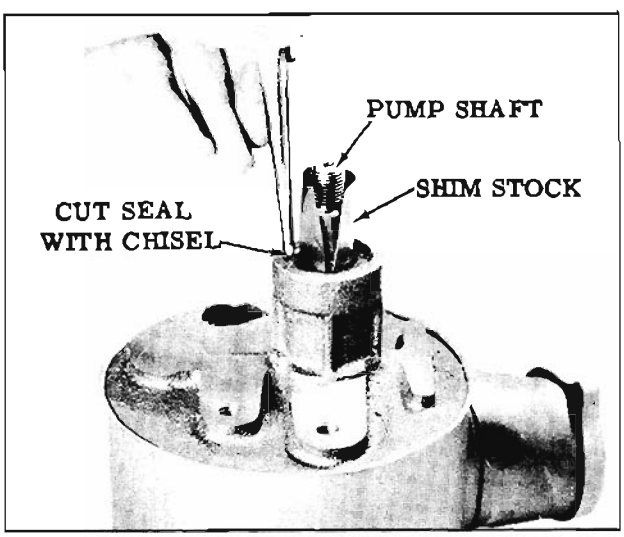


Fig. 8-22 Cutting Pump Seal

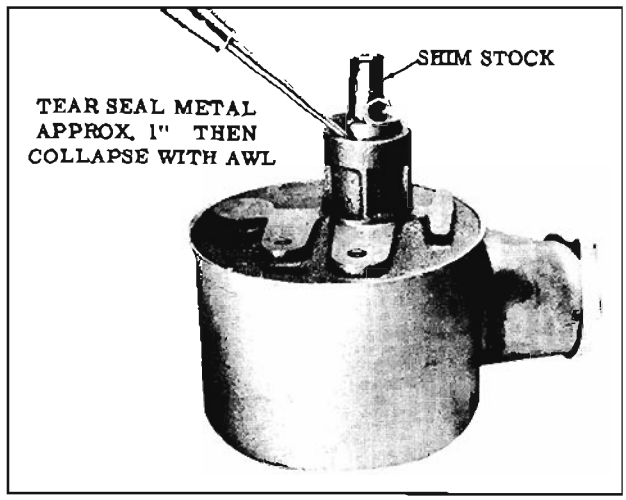


Fig. 8-23 Removing Pump Seal

DISASSEMBLY (Fig. 8-29)

1. Clean the exterior of the pump and drain the reservoir. Lightly clamp the pump body in a vise so that the rear of the reservoir is facing up.

2. Remove the rear mounting stud and then remove the "O" ring seal. Discard the seal.

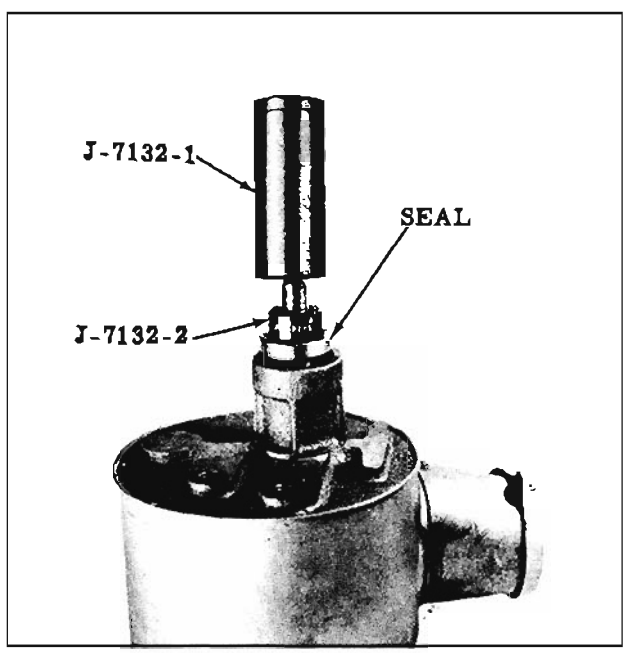


Fig. 8-24 Installing Pump Seal

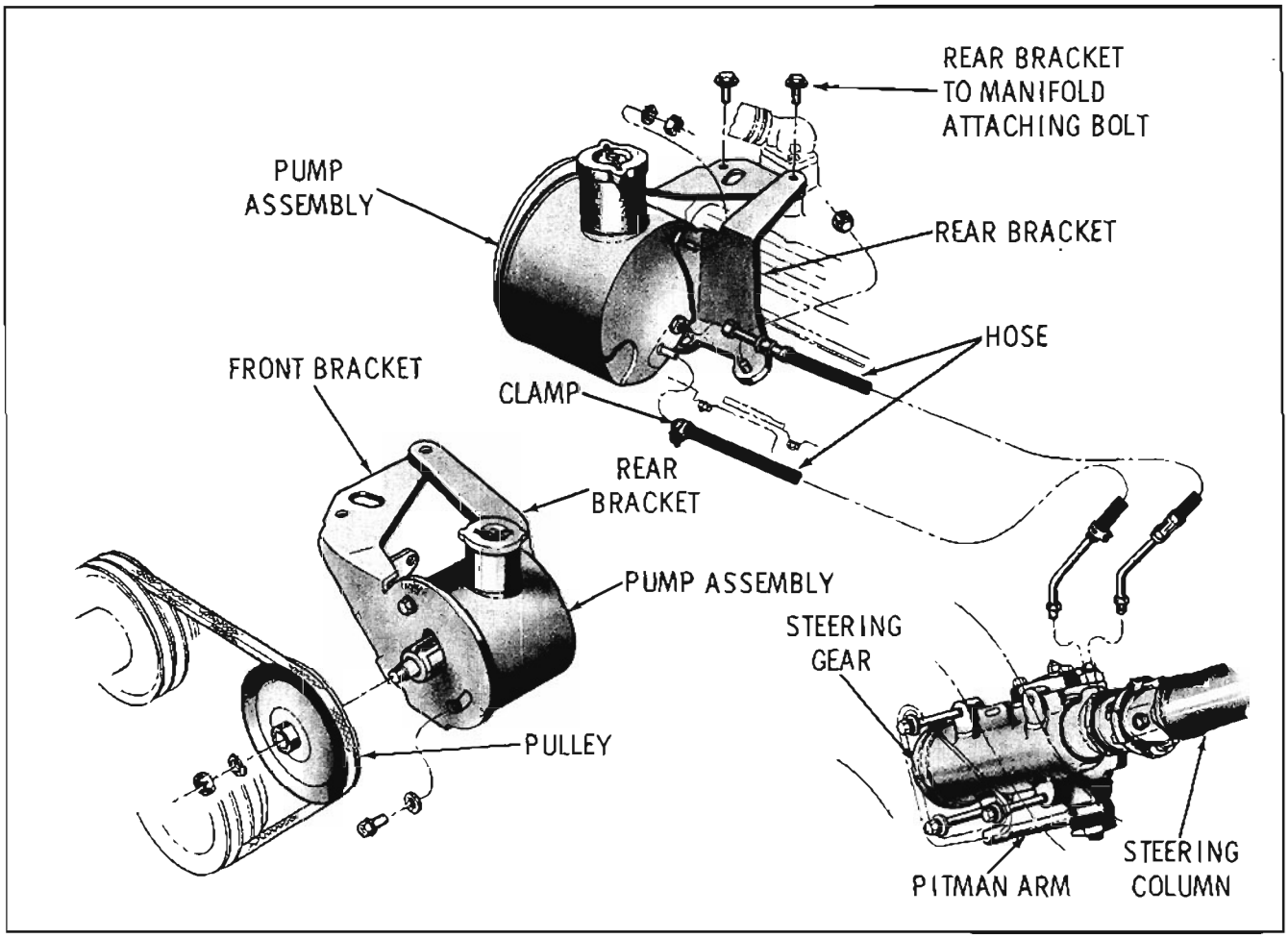


Fig. 8-25 Pump Mounting (34 - 35 - 36 - 38 & 39 Series)

3. Remove the union. Remove "O" ring seal from union and discard.

4. Remove the reservoir by rocking it while pulling upward. Remove pump body from vise.

5. Remove the "O" ring, flow control valve assembly and spring from the bore in the pump body.

6. Rotate the end cover retainer ring so that one end of the ring is over the hole in the side of body, then force end of ring from its groove and remove ring. (Fig. 8-28)

7. Remove end cover from pump body. If cover is cocked in pump body, tap plate with a soft hammer to free up.

8. Remove the two pressure plate springs from the dowel pins.

9. Remove the drive shaft key, then place the pump on a bench with the drive shaft up. Tap end of shaft with a soft hammer until it is free.

10. Lift the pump body off the shaft, then remove the drive shaft, thrust plate, dowel pins, cam ring, rotor, vanes and pressure plate.

11. Remove two inside and one outside "O" ring from the pump body.

12. Pry the drive shaft oil seal from the pump body with a screwdriver.

13. If necessary to disassemble the flow control valve, proceed as follows:

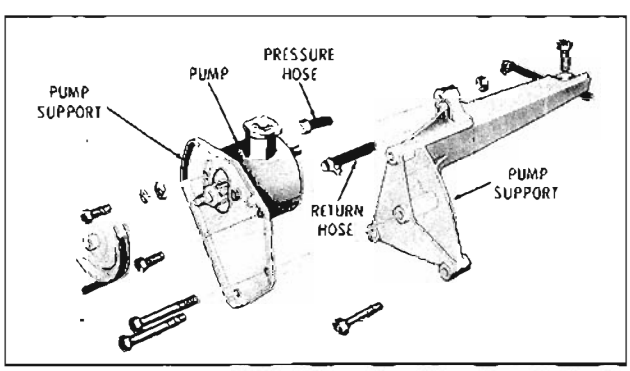


Fig. 8-26 Pump Mounting (33 Series)

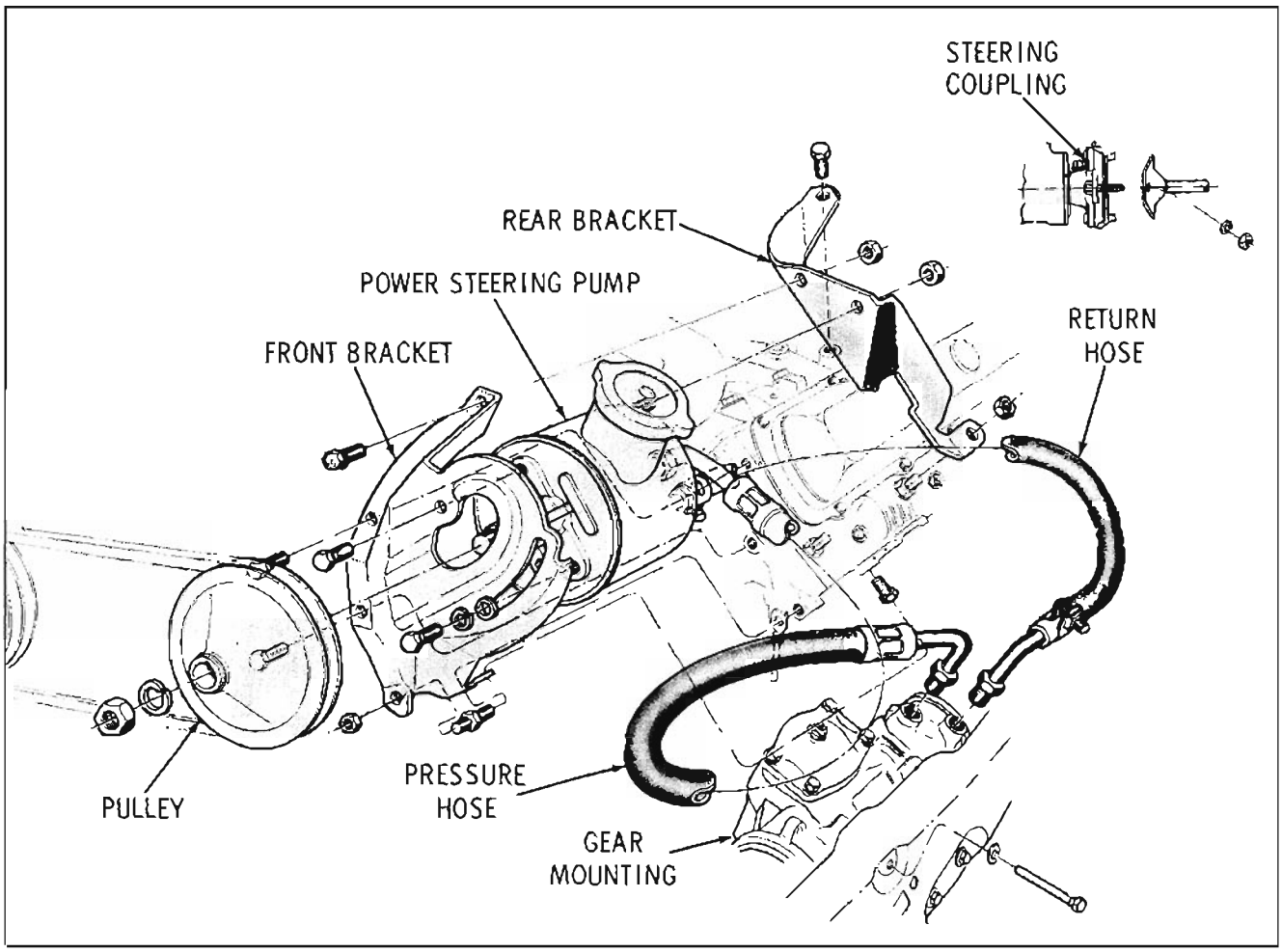


Fig. 8-27 Pump Mounting (30 - 31 & 32 Series)

a. Clamp the valve in a brass jawed vise.

b. Remove the hex head plug and shims. (Fig. 8-30) Note the number of shim(s) on the plug so the same number of shim(s) can be reinstalled during assembly.

c. Remove the pressure relief ball, guide and spring from the flow control valve.

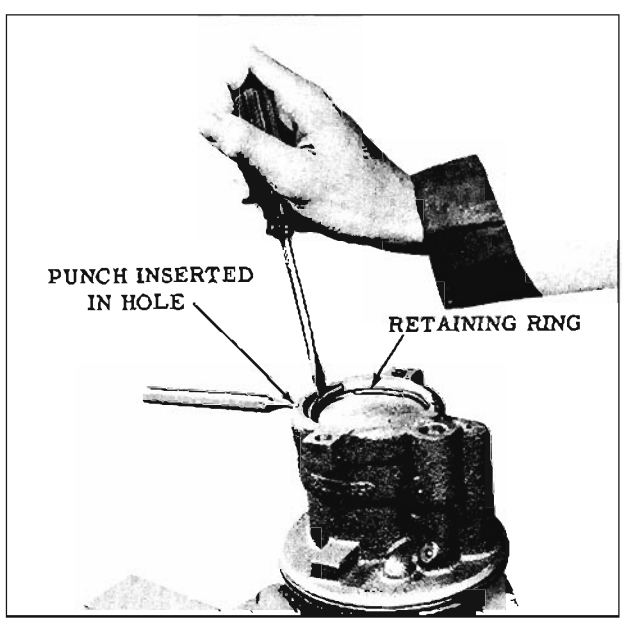


Fig. 8-28 Removing End Cover Retaining Ring

CLEANING AND INSPECTION

1. Wash all parts in clean solvent, blow out all passages with compressed air and air dry.

2. Inspect the drive shaft for wear and see that the seal area of the shaft is smooth and free of nicks.

3. Check the fit of the vanes in the rotor slots. They must slide freely but snugly in the slots. Tightness may be relieved by thorough cleaning or by removal of irregularities with a fine stone. Replace the rotor and/or vanes if excessive looseness exists between the rotor and vanes.

4. Inspect the flat surfaces on the thrust plate and pressure plates for scoring or irregular wear. Light scores can be smoothed by light lapping, after which all lapping compound must be thoroughly removed.

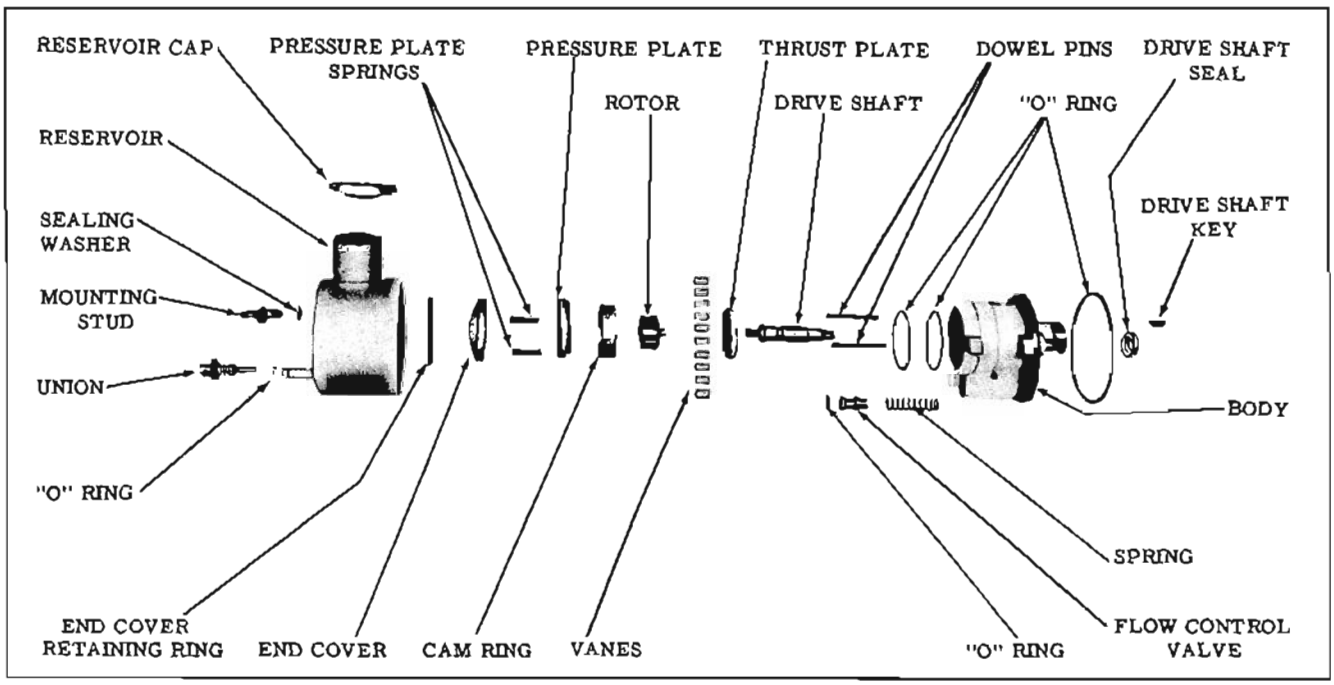


Fig. 8-29 Power Steering Pump

5. Inspect all ground surfaces of the cam ring for roughness or irregular wear. Light scores on the flat surfaces may be smoothed by lapping. Normal wear or scuff marks on the inner surface do not affect pump operation or cause excessive noise; however, if the wear consists of chatter marks or gouges, both the cam ring and vanes should be replaced.

6. Inspect the ground surfaces of the flow control valve and remove any slight irregularities with a fine stone. Install the flow control valve spring on the valve, insert the spring end of the valve in the pump body and check the fit of the valve by pushing it down into its operating position.

7. Check the end cover for nicks on the surface which contacts the "O" ring. Remove small nicks with a fine stone. Replace the cover if it is badly nicked or distorted.

8. Inspect the pump body bushing. If the bushing is scored or badly worn, replace the pump body and bushing as an assembly.

9. Inspect the reservoir for cracks, broken welds or distortion. If any of these conditions are present, replace the reservoir.

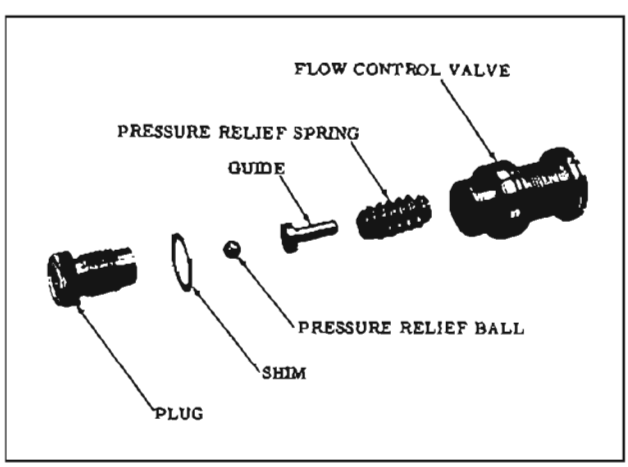


Fig. 8-30 Flow Control Valve

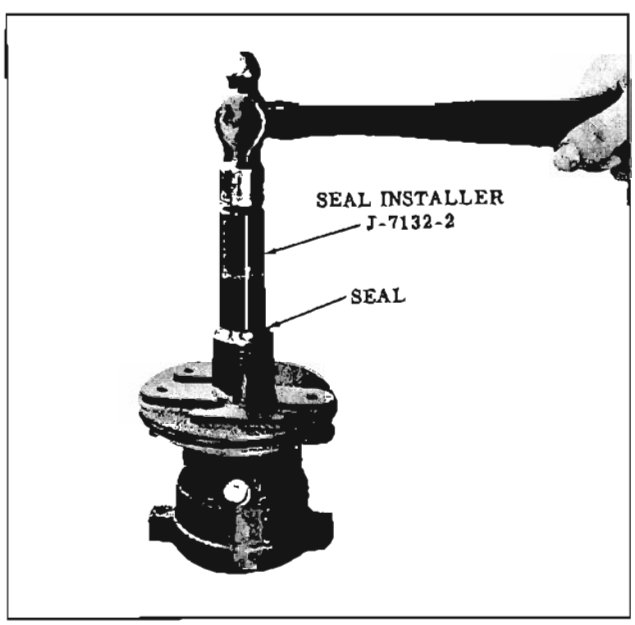


Fig. 8-31 Installing Pump Seal

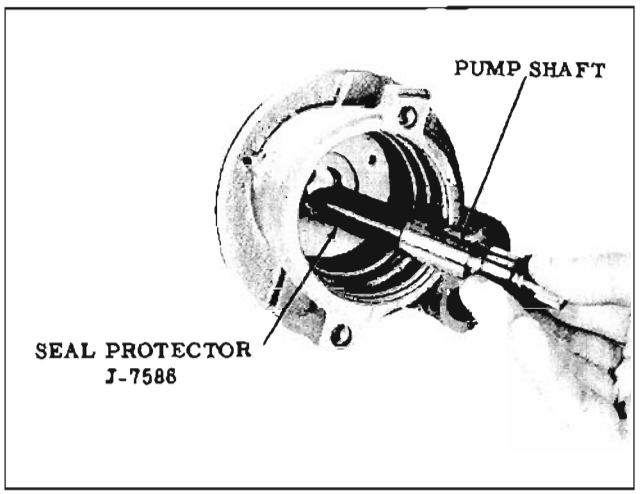


Fig. 8-32 Installing Pump Shaft

ASSEMBLY

1. If the flow control valve was disassembled, assemble as shown in Fig. 8-30. Use the same number of shims removed, as altering shim thickness will change relief pressure. Tighten the plug to approximately 4 ft. lbs.

2. Apply Special Seal Lubricant (Part No. 567196) to the sealing lips of a new drive shaft seal and drive the seal into the pump body using Tool J-7132-2. (Fig. 8-31) Remove tool.

3. Place Seal Protector J-7586 over the threaded end of the shaft, then install the shaft in the pump body. (Fig. 8-32) Remove protector.

4. Lightly clamp body in a vise, cavity up.

5. Coat a new pressure plate to pump body "O" ring with petrolatum and install in the lower groove in the pump body.

   NOTE: This "O" ring is slightly smaller in diameter than the end cover "O" ring.

6. Coat the end cover to pump body "O" ring with petrolatum and install in the upper "O" ring groove.

7. Install the two dowel pins in the holes at the bottom of the pump body cavity.

8. Install the thrust plate over the dowel pins with the oil ports up.

   NOTE: One of the dowel pin holes is slightly elongated in both the thrust plate and cam ring. These holes should be at the same dowel pin to minimize the possibility of pump noise. (Fig. 8-33)

9. Install the cam ring with the small holes over the dowel pins SO THAT THE ARROW ON THE OUTER SURFACE IS NEAR THE TOP OF THE CAM RING. (Fig. 8-33)

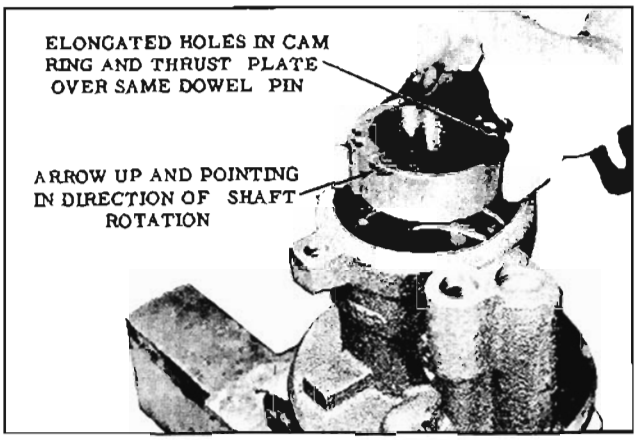


Fig. 8-33 Installing Cam Ring

10. Install the rotor with the alignment sleeve down.

11. Install the vanes in the rotor slots with the radius edge of vanes outward.

12. Apply petrolatum to the outer circumference of the pressure plate, then, with the oil ports down toward the rotor, install the pressure plate over the dowel pins through the two smallest notches in the pressure plate until the pressure plate seats against the cam ring.

13. Install the two springs over the dowel pins.

14. Install the end cover and retaining ring as follows:

    a. Apply petrolatum to the outer circumference of the end cover and position the cover into the pump body.

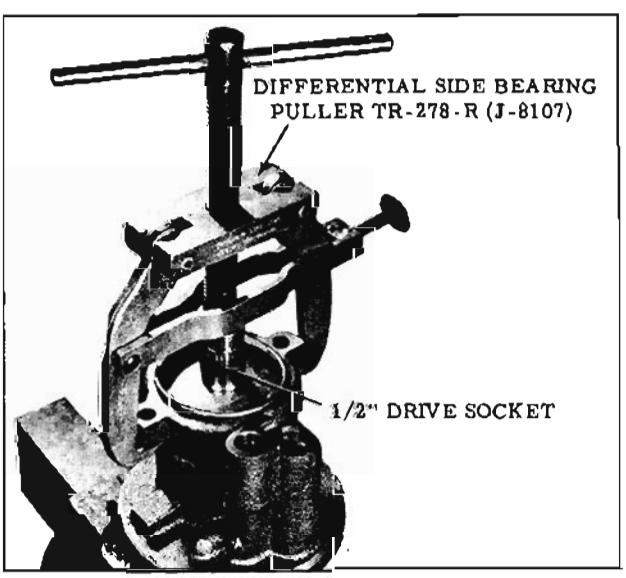


Fig. 8-34 Installing End Cover

b. Install Differential Side Bearing Puller (J-8107), along with a 1/2" drive socket to press the end cover down beyond the retaining ring groove. (Fig. 8-34)

c. Install the retaining ring in the pump body and remove the puller and socket.

15. Install flow control valve spring, flow control valve (hex head plug end down), and "O" ring seal into pump body bore.

16. Apply petrolatum to the reservoir to pump body "O" ring, then install the "O" ring on the pump body.

17. Place the reservoir over the pump body, align the holes, and push the reservoir down over the "O" ring.

18. Install the "O" ring seal on the short end of the mounting stud, then install the stud and tighten 25 to 35 ft. lbs.

19. Install the "O" ring on the union, (groove next to hex head) then install union and tighten 15 to 20 ft. lbs.

20. Install the drive shaft key while supporting the shaft on the opposite side.

POWER STEERING GEAR (Fig. 8-35)

OPERATION

NEUTRAL (STRAIGHT AHEAD POSITION) (Fig. 8-36)

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

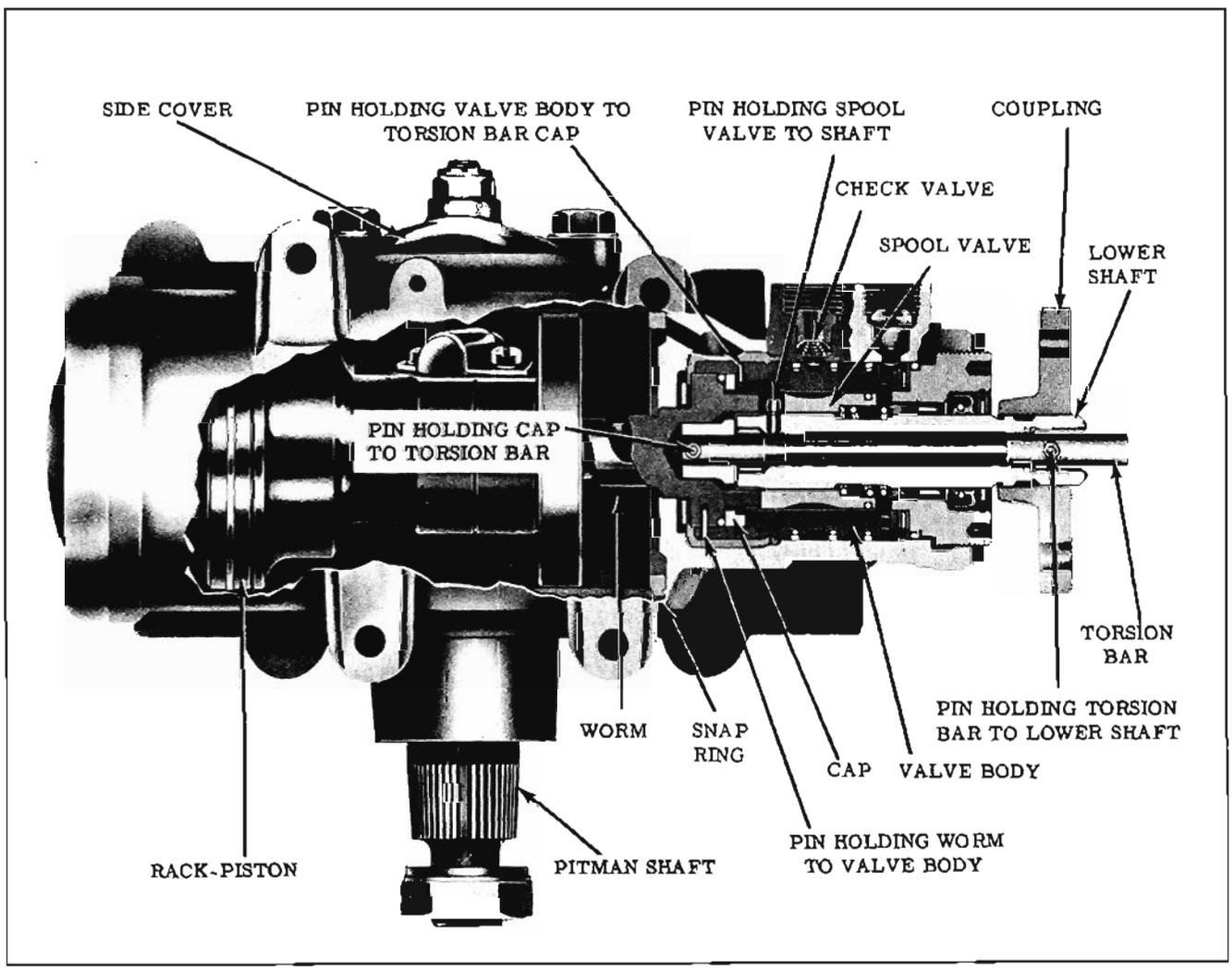


Fig. 8-35 Power Steering Gear

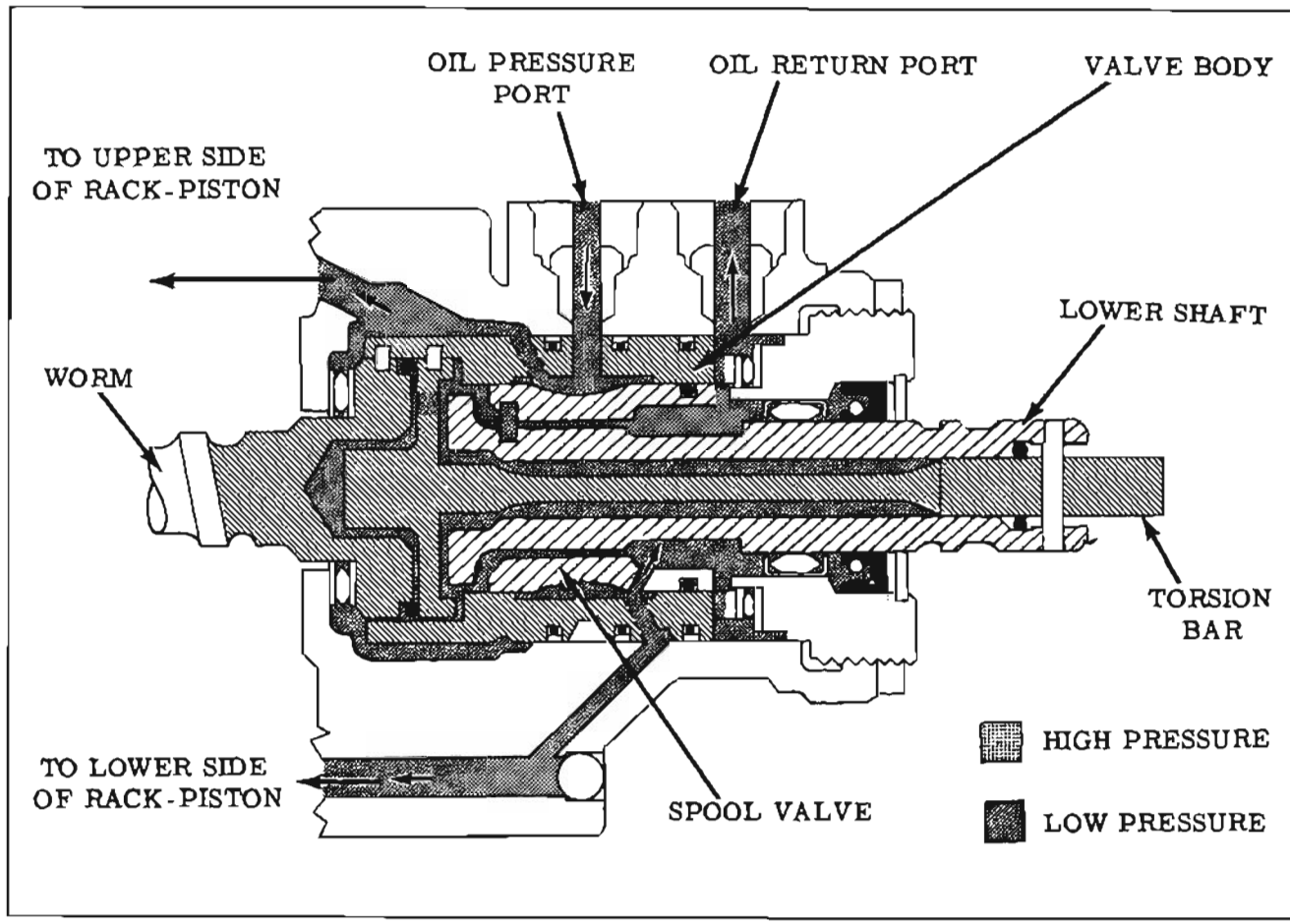


Fig. 8-36 Neutral Position

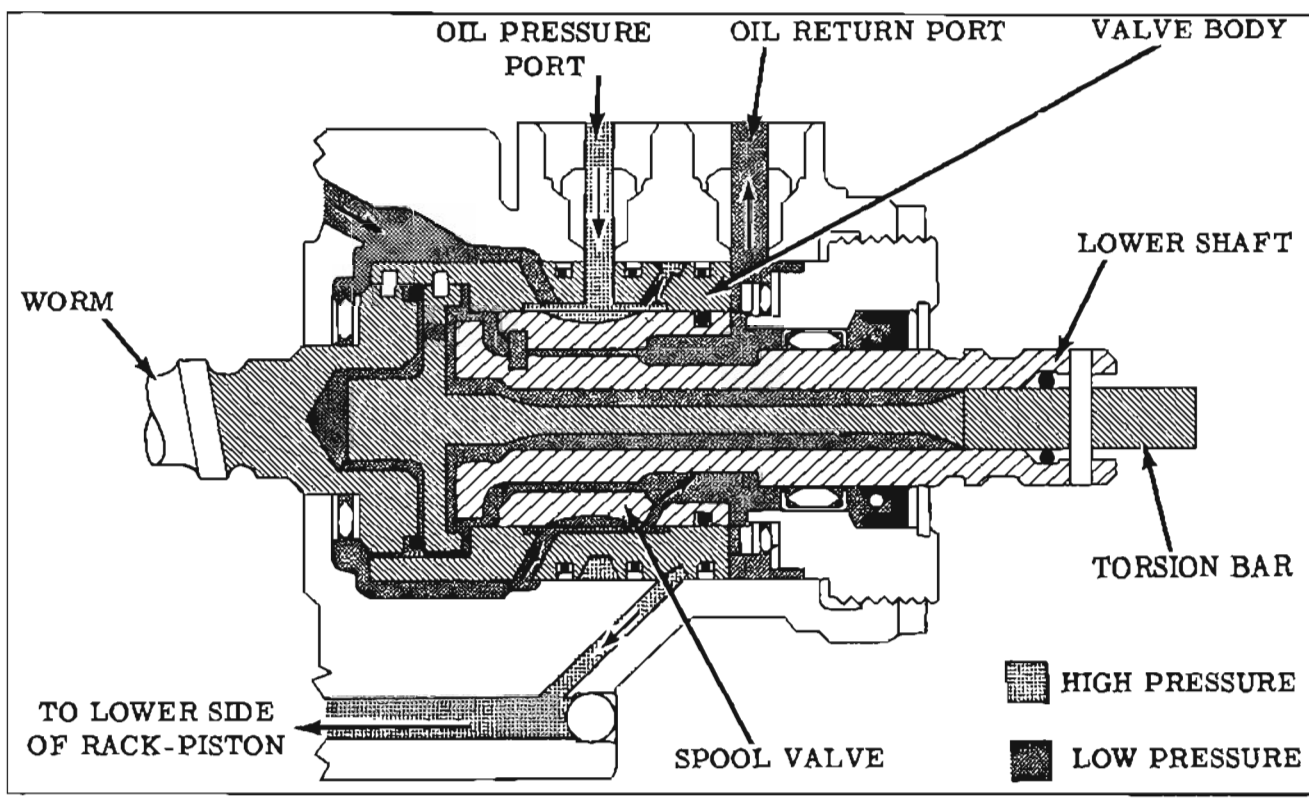


Fig. 8-37 Right Turn Position

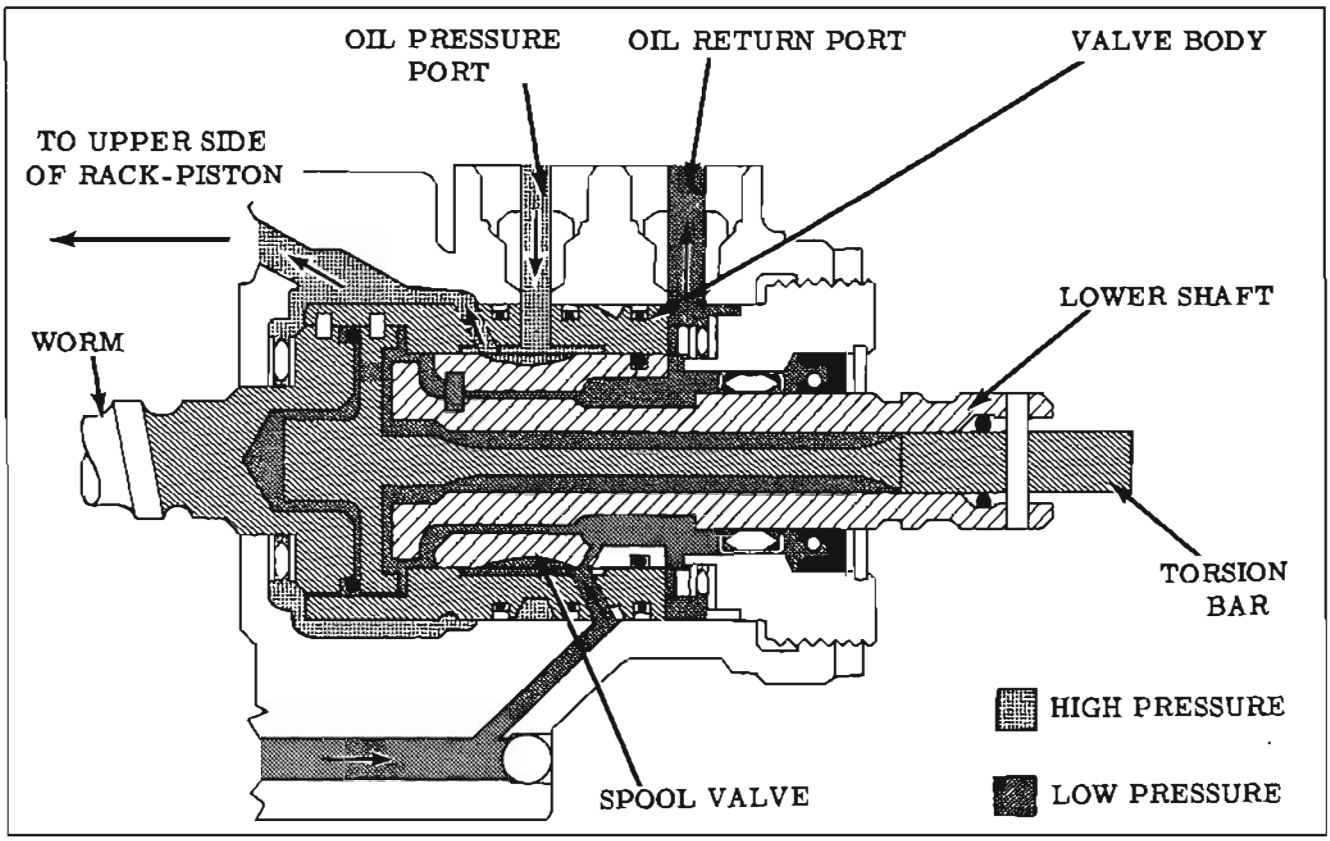


Fig. 8-38 Left Turn Position

driver. In addition, this oil lubricates all the internal components of the gear.

RIGHT TURN (Fig. 8-37)

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 200 psi except when turning corners where it does not ordinarily exceed 600 psi. Oil pressure, when parking, ranges from 1,200 to 1,300 psi depending upon road conditions and weight of the car. The steering effort during normal driving, ranges from 1 to 2 lbs. and during parking from 2 to 3-1/2 lbs. again depending upon road conditions.

A check valve located under the high pressure connector seat (Fig. 8-34) hydraulically dampens the shock transmitted to the steering gear when driving on washboard roads.

LEFT TURN (Fig. 8-38)

When the steering wheel is turned to the left, the relationship between the spool valve slots and valve body slots is again changed through twisting of the torsion bar. Pressure immediately builds up against the upper end of the rack-piston, forcing it downward to apply turning effort to the

pitman shaft. The oil in the chamber at the lower end of the rack-piston is forced out through the valve body and spool valve to the pump reservoir.

ADJUSTMENT (ON CAR)

OVER-CENTER ADJUSTMENT

The over-center adjustment is the only power steering gear adjustment which can be made on the car; however, in order to make this adjustment, it is also necessary to check the combined ball and thrust bearing pre-load.

1. Remove the pitman shaft nut, then disconnect the pitman arm from the pitman shaft using Puller J-5504-B or a similar puller.
2. Loosen the pitman shaft adjusting screw locknut and thread the adjusting screw out to the limit of its travel through the pitman shaft side cover.
3. Disconnect the horn wire at the relay, then remove the horn button or ornament from the steering wheel.
4. Count the number of turns of the steering wheel through its full travel to locate the steering wheel at its center of travel.
5. Check the combined ball and thrust bearing pre-load with an inch-pound torque wrench on the steering shaft nut by rotating through the center of travel. (Fig. 8-39) Note the highest reading.
6. Tighten the pitman shaft adjusting screw until the torque wrench reads 4 to 8 in. lbs. higher than the previous reading on the steering shaft. The total over-center pre-load should not exceed 16 in. lbs.
7. While holding the pitman shaft adjusting screw, tighten the locknut and recheck the adjustment.
8. Install the horn button or ornament and connect the horn wire. Connect the pitman arm to the pitman shaft. Torque pitman shaft nut 120 to 150 ft. lbs.

REMOVAL AND INSTALLATION

1. Remove the coupling flange hub bolt. (Fig. 8-40)
2. Disconnect the hoses from the pump and cap the pump and hose fittings.
3. Hoist the car.
4. Remove the pitman shaft nut, then disconnect the pitman arm from the pitman shaft using Puller J-5504-B or a similar puller.
5. Remove the three bolts attaching the gear to the frame side rail, permit the lower shaft to slide free of the coupling flange then remove the gear with the hoses attached.

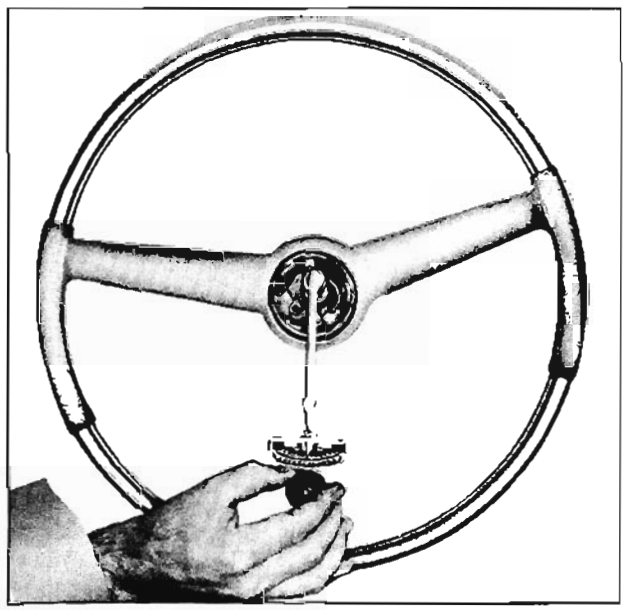


Fig. 8-39 Checking Worm Bearing Pre-load

Before installing the steering gear, apply a sodium soap fine fiber grease to the gear mounting pads to prevent squeaks between the gear housing and the frame. Make sure the alignment pin on the gear housing enters the hole provided in the frame side rail. Make certain there is a minimum of .040" clearance between coupling hub and steering gear upper seal. Install the coupling flange hub bolt and torque 20 to 25 ft. lbs. Before tightening the steering gear to frame bolts, shift the steering gear as necessary to place it in the same plane as the steering shaft so that the

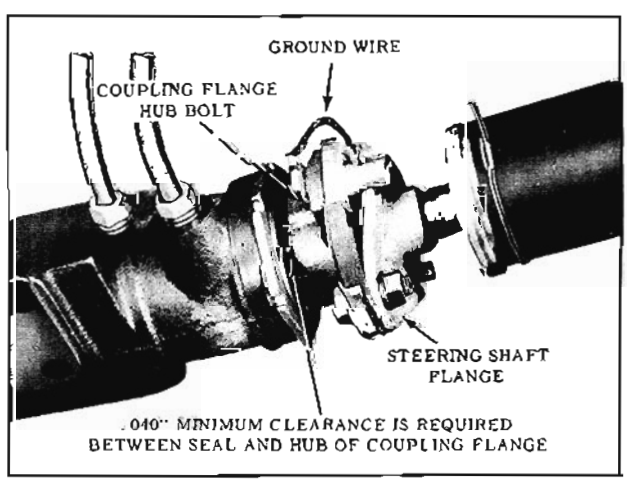


Fig. 8-40 Flex-Coupling

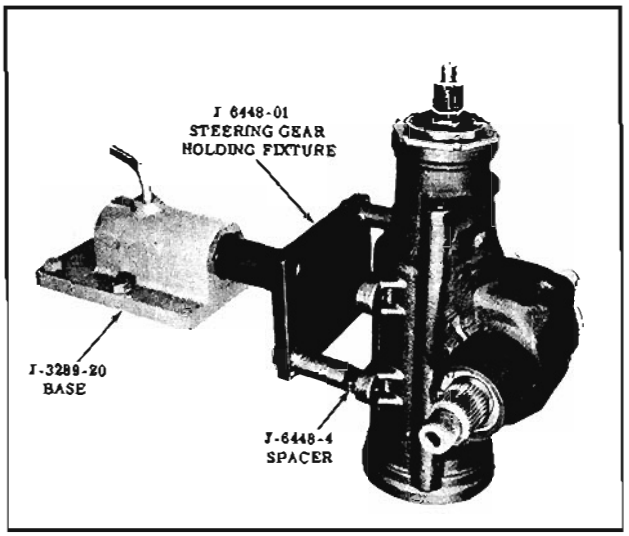


Fig. 8-41 Holding Fixture J-6448-01

flexible coupling is not distorted. Tighten the steering gear to frame bolts 60 to 80 ft. lbs. and the pitman shaft nut 120 to 150 ft. lbs.

After the hoses are connected to the pump, add Hydra-Matic oil as necessary to bring the fluid level to the full mark. Run engine at idle for 30 seconds, then run at fast idle for one minute before turning steering wheel. With the engine running, turn the steering wheel through its full travel two or three times to bleed air from the system. Recheck the oil level and add oil if necessary.

DISASSEMBLY

NOTE: In many cases, complete disassembly of the gear will not be necessary since most of the component parts can be removed without complete disassembly of the gear. The procedure for such operations are not specifically outlined; however, the following basic procedure and specifications will apply.

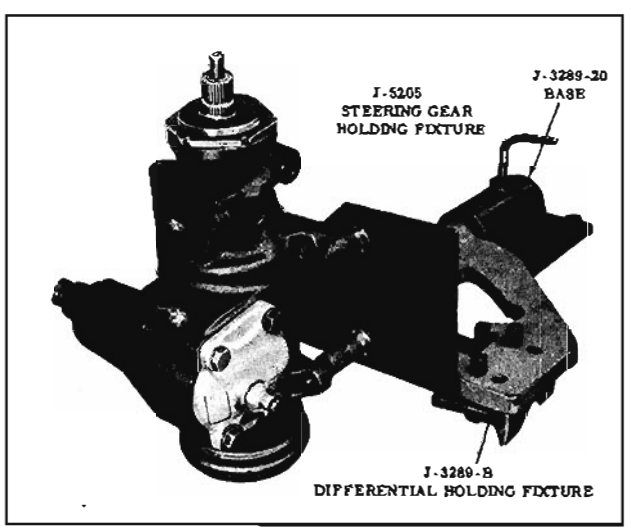


Fig. 8-42 Holding Fixture J-5205

To facilitate servicing of the gear, the gear should be mounted in Holding Fixture J-6448-01 (Fig. 8-41) or Holding Fixture J-5205. Holding Fixture J-5205 is designed to be used with Modified Differential Holding Fixture J-3289-B. (Fig. 8-42)

1. Rotate end cover retaining ring so that one end of the ring is over hole in side of housing then force end of ring from its groove and remove ring. (Fig. 8-44)

2. Turn coupling flange counterclockwise until rack-piston just forces end cover out of housing otherwise the worm may thread out of the rack-piston and the balls will fall out of their circuit. Remove cover and discard "O" ring.

3. Remove the rack-piston plug from rack-piston as shown in Fig. 8-45.

4. Remove the pitman shaft and side cover as follows:

   a. Loosen the over-center adjusting screw locknut and remove the four side cover attaching cap screws and three lockwashers.

   b. Rotate side cover until the rack-piston and pitman shaft teeth are visible, then turn the coupling flange until the pitman shaft teeth are centered in the housing opening. Tap pitman shaft with a soft hammer and remove the pitman shaft and side cover from the housing. Remove the side cover "O" ring and discard.

5. Remove the rack-piston as follows:

   a. Insert Ball Retainer Tool J-7539 into the rack-piston bore with pilot of tool seated in the end of the worm. (Fig. 8-46) Turn lower shaft counterclockwise while holding tool tightly against worm. The rack-piston will be forced onto the tool.

   b. Remove the rack-piston with Ball Retainer Tool J-7539 from gear housing.

6. Remove the adjuster plug as follows:

   a. Loosen the adjuster plug locknut with punch. (Fig. 8-47)

   b. Remove adjuster plug assembly with Spanner Wrench J-7624. (Fig. 8-48) Remove and discard the plug "O" ring.

7. Grasp the lower shaft and pull the valve and shaft assembly from the housing bore. Separate worm and shaft and remove the lower shaft cap "O" ring and discard.

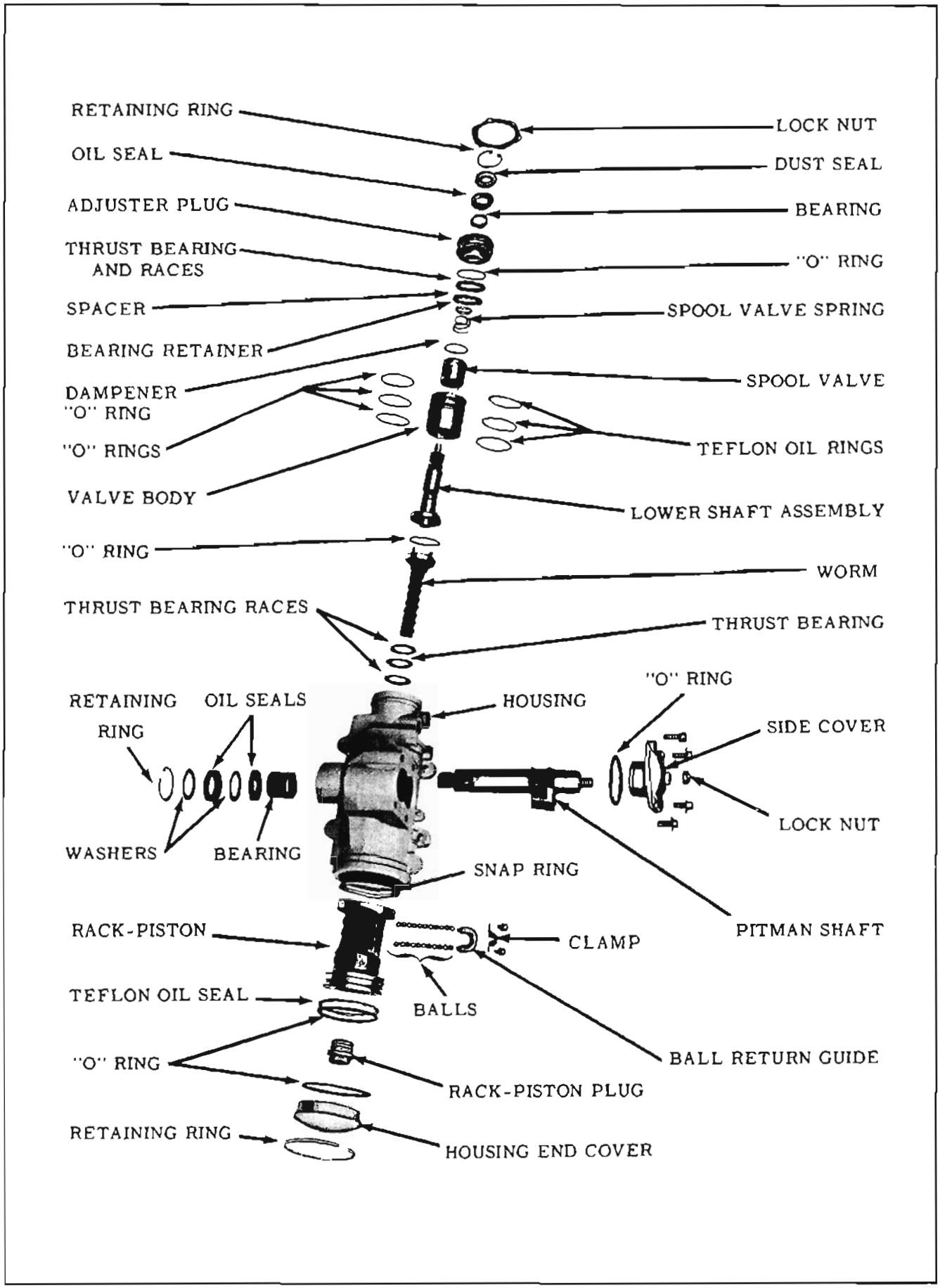


Fig. 8-43 Power Steering Gear

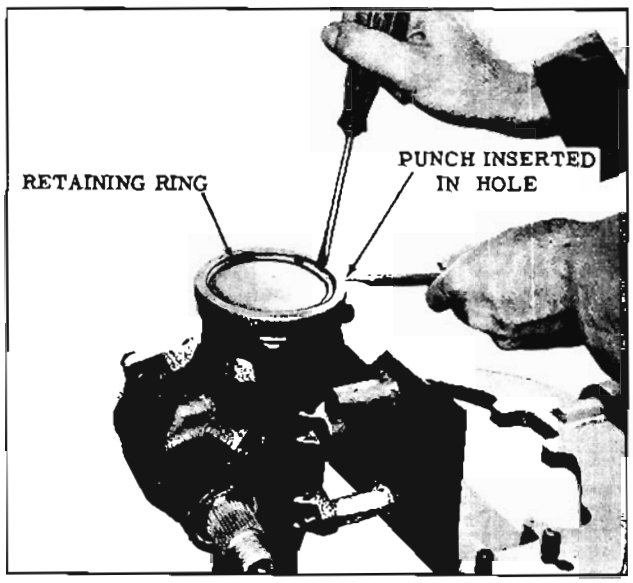


Fig. 8-44 Removing End Cover Ring

8. If the worm or lower thrust bearing and race(s) remained in the gear housing, remove at this time.

SERVICING INDIVIDUAL UNITS

ADJUSTER PLUG ASSEMBLY (Fig. 8-49)

Disassembly

1. Remove the thrust bearing retainer by prying at the two raised areas with an awl or small screwdriver, remove the thrust bearing spacer, thrust bearing and washers.

2. If the seal ONLY is to be replaced and not the bearing, remove the retaining ring with internal pliers, then remove the dust seal. Pry the seal from the bore of the adjuster plug. Discard seal.

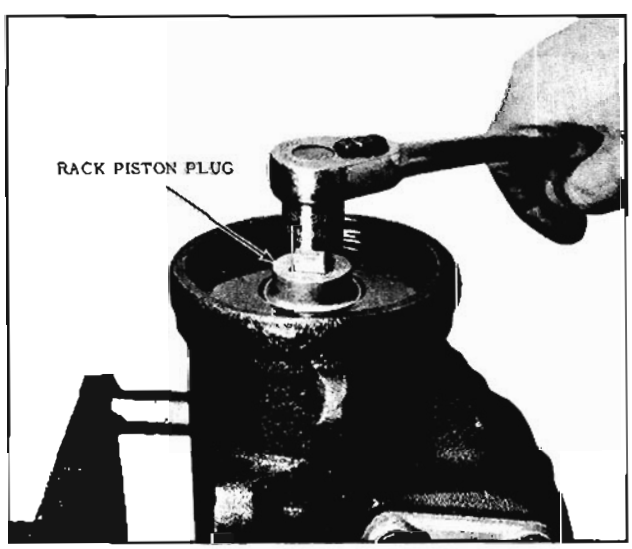


Fig. 8-45 Removing Rack-Piston Plug

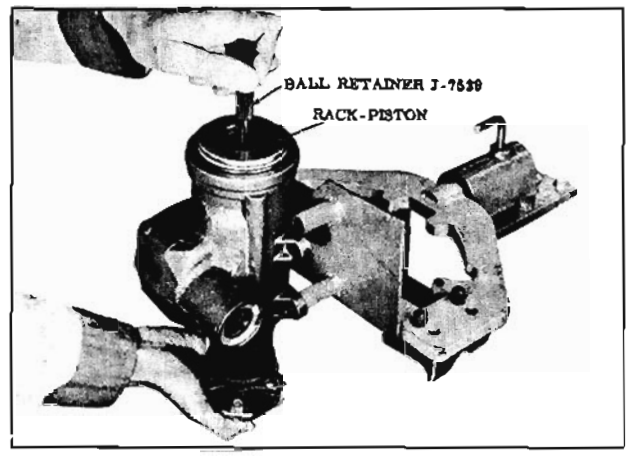


Fig. 8-46 Removing Rack-Piston

3. If the needle bearing is to be replaced, remove the retaining ring using internal pliers, then drive the dust seal, seal and bearings from the adjuster plug with Tool J-5254. (Fig. 8-50) Discard seal and bearing.

CLEANING AND INSPECTION

1. Wash all parts in clean solvent and dry parts with compressed air.

2. Inspect thrust bearing spacer for wear or cracks. Replace if damaged.

3. Inspect thrust bearing rollers and washers for wear, pitting or scores. If any of these conditions exists, replace the bearing and washers.

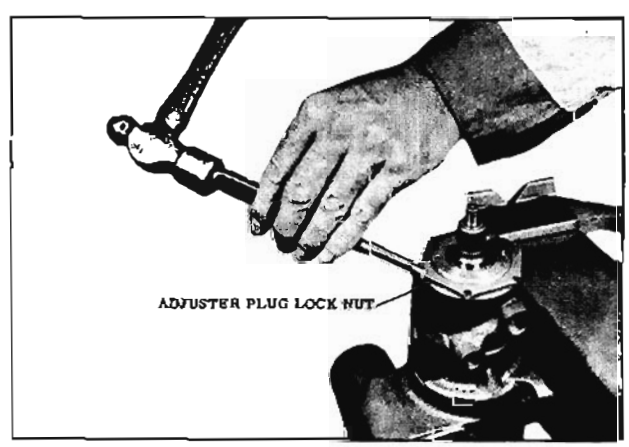


Fig. 8-47 Loosening Lock-Nut

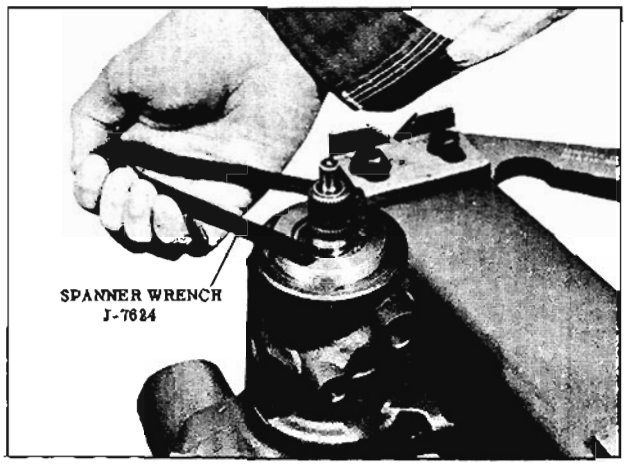


Fig. 8-48 Removing Adjuster Plug

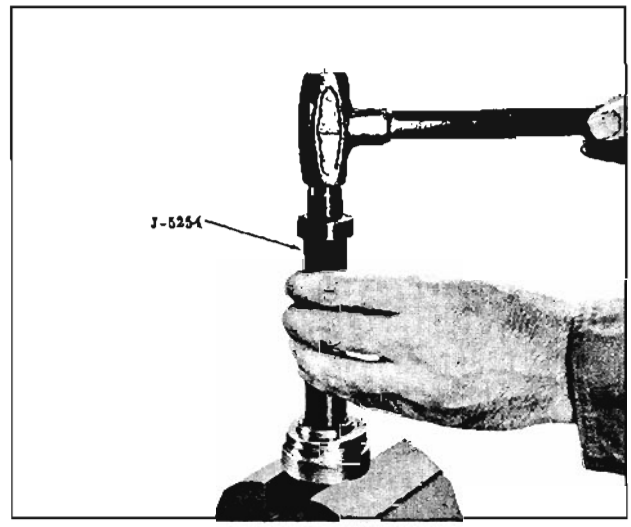


Fig. 8-50 Seal and Bearing Removal

Assembly

1. If the needle bearing was removed, place new needle bearing over Tool J-5254 with the manufacturer's identification against the tool and drive or press bearing until it is flush with the surface of the seal bore. (Fig. 8-51)
2. If seal was removed, temporarily install the adjuster plug in the gear housing and place dust seal and a new oil seal on Tool J-5254 (lip of seal away from tool). Lubricate seal with Hydra-Matic oil and drive or press seal into adjuster plug just far enough to provide clearance for the retaining ring. (Fig. 8-52) 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. 8-53)

   NOTE: The projections must not extend beyond the spacer when the retainer is seated. The spacer must be free to rotate.

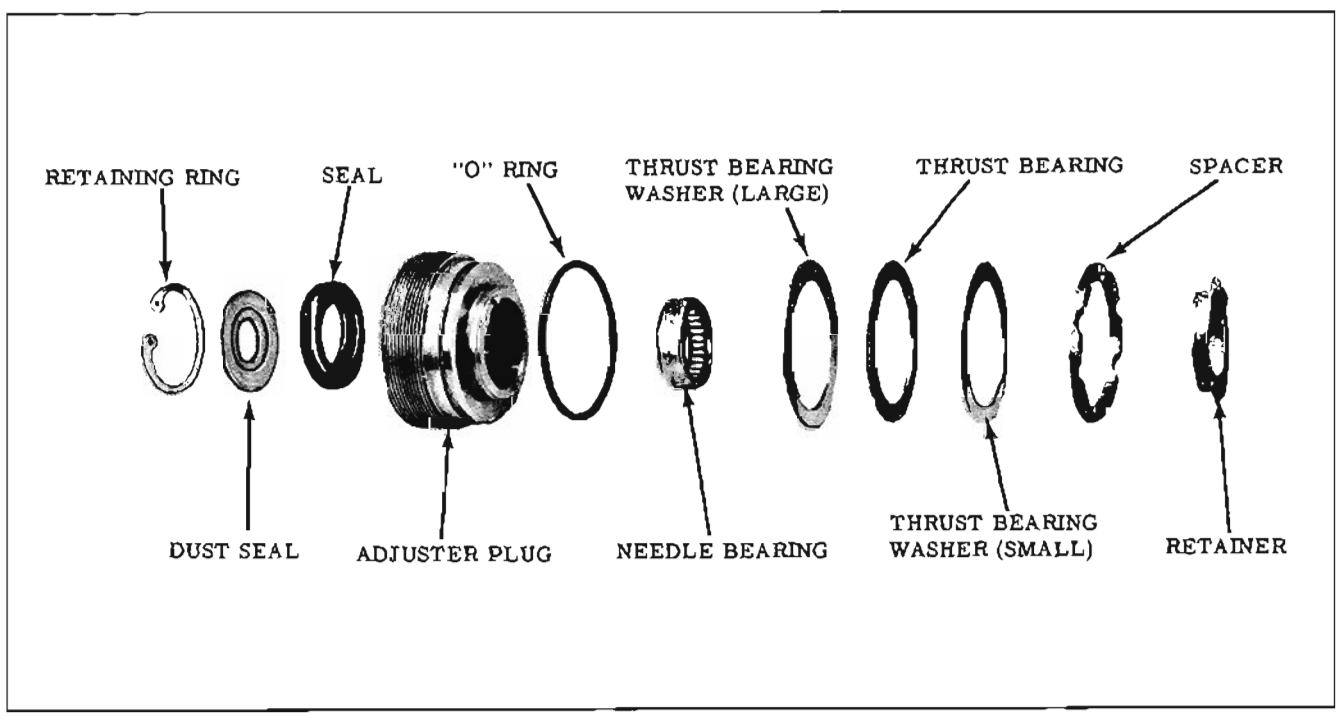


Fig. 8-49 Adjuster Plug Assembly

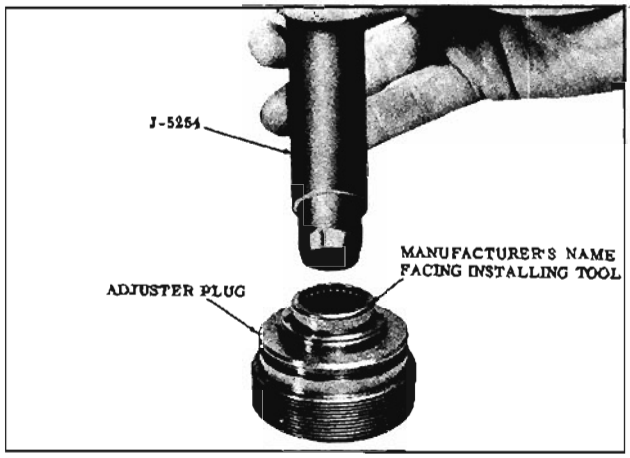


Fig. 8-51 Installing Bearing

VALVE AND LOWER SHAFT ASSEMBLY (Fig. 8-54)

Disassembly

1. Remove the spool valve spring by carefully prying top coil out of groove in the lower shaft, then slide the spring from the shaft.

2. To remove the lower shaft assembly from the valve body, proceed as follows:

   a. While holding the assembly (lower shaft down), lightly tap the lower shaft against the bench until the shaft cap is free from the valve body. (Fig. 8-55) The spool valve should be held in the valve body while tapping the shaft.

   b. Carefully remove the lower shaft assembly so as not to cock the spool valve in the valve body.

3. Push the spool valve out of the flush end of the valve body until the dampener "O" ring is exposed, then carefully pull the spool from the valve body while rotating the valve. (Fig. 8-56) If the spool valve becomes cocked, reverse the withdrawal procedure, then again attempt to remove the valve.

   IMPORTANT: Do not attempt to force the spool valve in or out of the valve body. If the spool is cocked in the valve body, straighten the spool by tapping with a plastic or rawhide mallet, then push the spool back into the body and repeat the removal procedure.

4. Remove the dampener "O" ring from the spool valve and discard.

5. If the teflon oil rings are to be replaced, cut the three teflon oil rings and "O" rings from the valve body and discard.

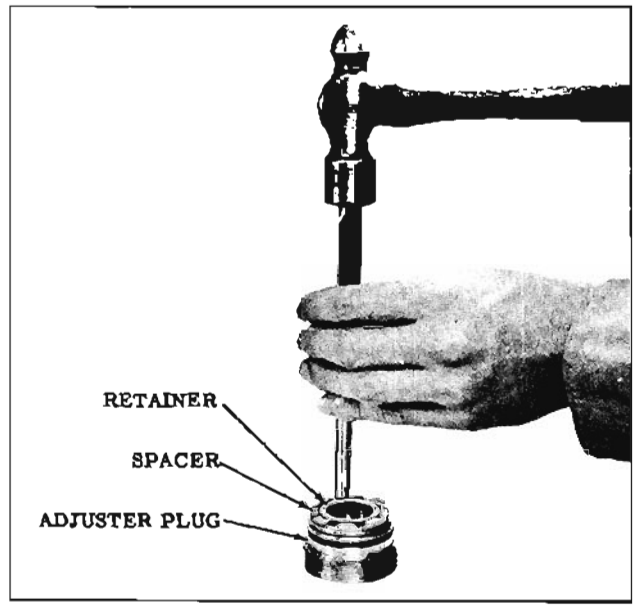


Fig. 8-53 Installing Bearing Retainer

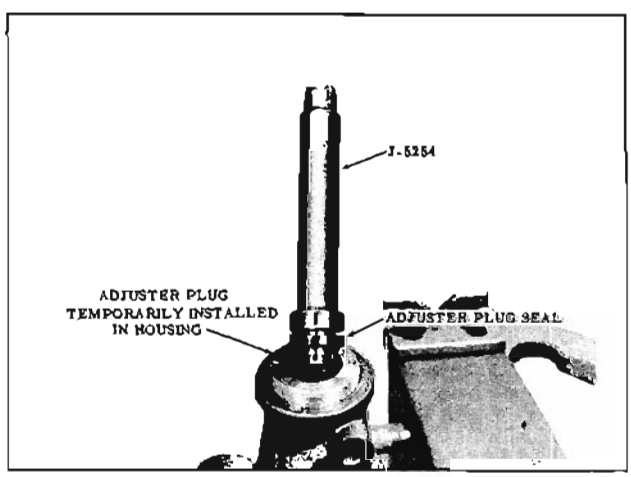


Fig. 8-52 Installing Seal

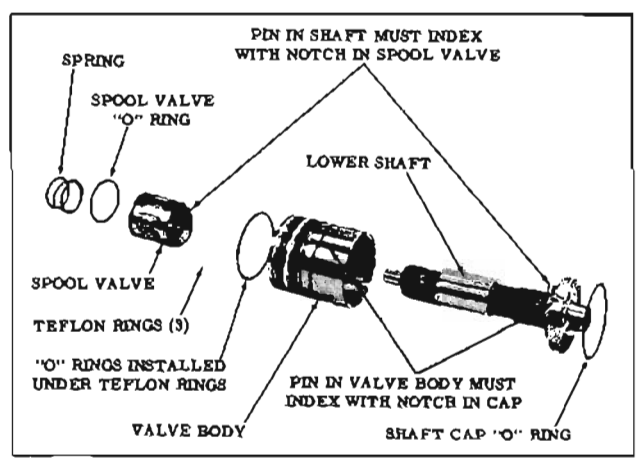


Fig. 8-54 Valve and Lower Shaft Assembly

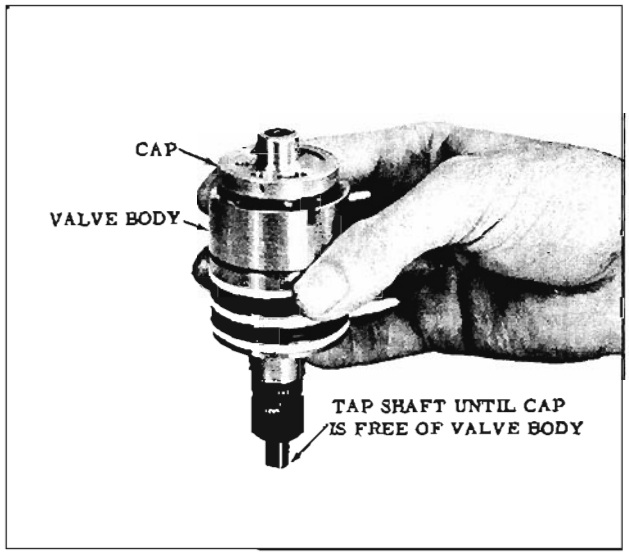


Fig. 8-55 Freeing Shaft Cap

Cleaning and Inspection

1. Wash all parts in clean solvent and blow out all oil holes with compressed air.

2. If the drive pin in the lower shaft or valve body is cracked, excessively worn or broken, replace the complete valve and shaft assembly.

3. If there is evidence of leakage between the torsion bar and the lower shaft, or scores, nicks, or burrs on the ground surface of the lower shaft that cannot be cleaned up with crocus cloth, the entire valve and shaft assembly must be replaced.

4. Check the OD of the spool valve and the ID

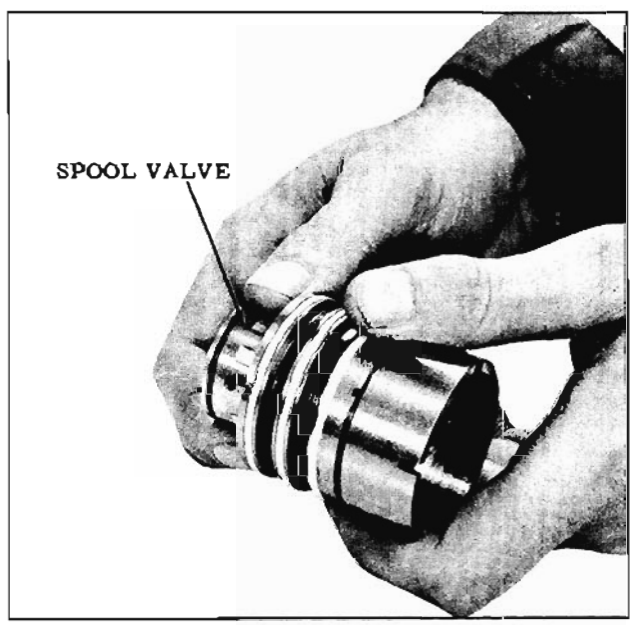


Fig. 8-56 Removing Spool Valve

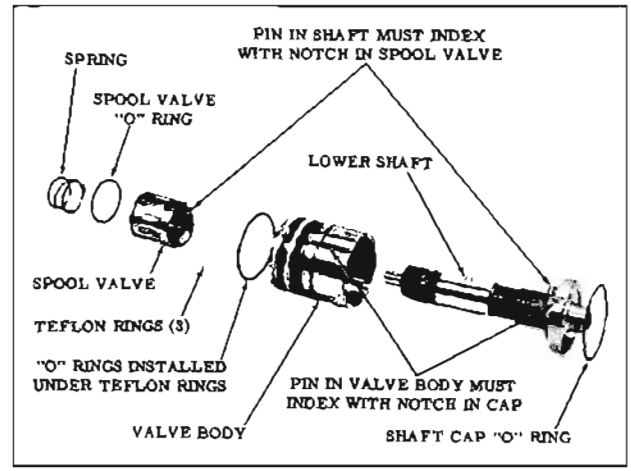


Fig. 8-57 Valve and Lower Shaft Assembly

of the valve body for nicks, burrs, or bad wear spots. If the irregularities cannot be cleaned up by the use of crocus cloth, the complete valve and shaft assembly will have to be replaced.

5. If the small notch in the skirt of the valve body is excessively worn, the complete valve and shaft assembly will have to be replaced.

6. Lubricate the spool valve with Hydra-Matic fluid and check the fit of the spool valve in the valve body (with the spool valve dampener "O" ring removed). If the valve does not rotate freely without binding, the complete valve and shaft assembly will have to be replaced.

7. Check the overall length of the spool valve spring. The spring should be approximately 3/4". If it is less than 11/16", replace the spring.

ASSEMBLY (Fig. 8-57)

1. Install the three valve body "O" rings in the oil ring grooves and lubricate with Hydra-Matic oil.

2. Lubricate the three teflon oil rings with petrolatum and install in grooves over "O" rings.

   NOTE: The oil rings may appear to be distorted, but the heat of the oil during operation of the gear will straighten them out.

3. Assemble the lower shaft assembly in the valve body so the notch in the lower shaft cap engages with the pin in the valve body. (Fig. 8-57) If necessary, tap the shaft cap with a plastic hammer until cap is seated in the valve body.

4. Install the spool valve as follows:

   a. Lubricate the spool valve dampener "O" ring with petrolatum and install over spool valve.

   b. Lubricate the spool valve with Hydra-Matic oil and slide the valve over the lower shaft (notch in spool towards the valve body). Rotate the spool valve while pushing the valve into the valve body until the notch in the spool engages the pin in the lower shaft.

   c. Carefully crowd the dampener "O" ring into its groove until the spool valve can be pushed all the way in the valve body. The spool valve is properly seated when it is flush with the top of valve body.

      NOTE: Exercise extreme caution during this operation so the "O" ring will not be cut.

5. Slide the valve spring over the lower shaft and down into the spool valve until the top coil of the spring is in the shaft groove.

PITMAN SHAFT AND SIDE COVER (Fig. 8-58)

Disassembly

Remove the locknut and side cover from the adjusting screw. Do not attempt to disassemble pitman shaft. Discard locknut.

NOTE: The power steering gear is equipped with a self-adjusting type of pitman shaft which automatically keeps the over-center adjustment within specifications for a limited mileage (up to approximately 10,000 miles), regardless of the wear of the rack-piston and related parts. This is accomplished by the use of a wear washer and a heavy spring in the pitman shaft assembly. The wear washer is calibrated to wear at the same rate as the other components of the gear. Replacement pitman shafts do not have this feature and adjusting screw torque is zero.

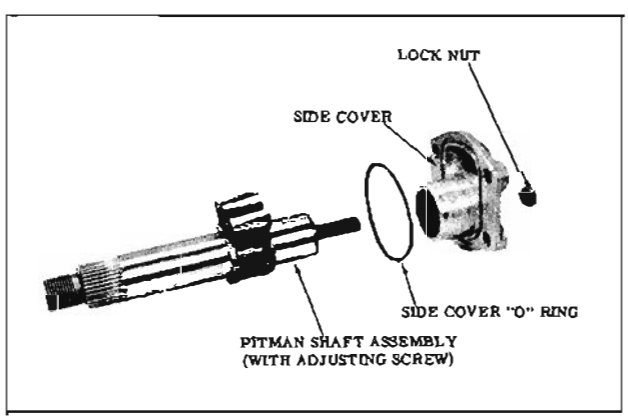


Fig. 8-58 Pitman Shaft and Side Cover

In cases where gear chucking or "clunk" cannot be corrected by performing the over-center adjustment (See POWER STEERING GEAR ADJUSTMENT-ON CAR), the trouble may be due to excessive wear in the pitman shaft or a broken spring in the pitman shaft.

To check the pitman shaft for excessive wear or a broken spring:

1. With the side cover removed from the pitman shaft, clamp the shaft in a vise and thread two 7/16" SAE nuts on the adjusting screw. Tighten nuts so they are locked on the shaft.

2. Using a 5/8" socket and an inch-pound torque wrench, measure the torque required to turn the adjusting screw. (Fig. 8-59) Torque reading should be 1 to 15 in. lbs.

3. If the reading is not within this range, the complete pitman shaft assembly must be replaced. DO NOT ATTEMPT TO CORRECT READING BY DISASSEMBLING THE PITMAN SHAFT.

4. Remove the torque wrench and the two 7/16" nuts from the adjusting screw.

Cleaning and Inspection

1. Wash all parts in clean solvent and dry parts with compressed air.

2. Check pitman shaft bearing surface in the side cover for scoring. If badly worn or scored, replace the side cover.

3. Check the sealing and bearing surfaces of the pitman shaft for roughness, nicks, etc. If minor irregularities in surface cannot be cleaned by use of crocus cloth, replace the pitman shaft.

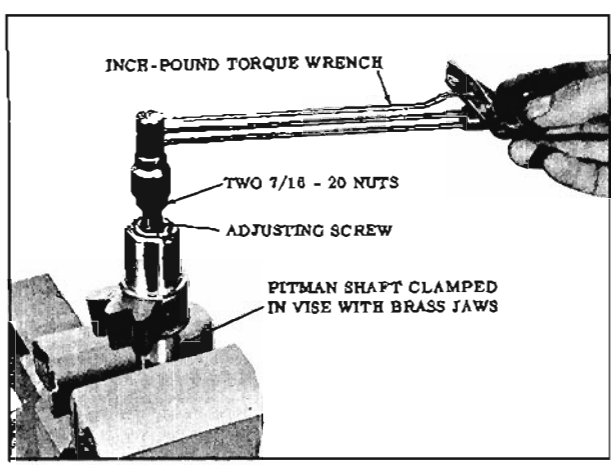


Fig. 8-59 Checking Adjusting Screw Torque

4. Replace pitman shaft assembly if teeth are damaged or if the bearing surfaces are pitted or scored.

Assembly

Thread the side cover onto the pitman shaft adjusting screw until it bottoms. Install, but do not tighten, a new adjusting screw locknut.

RACK-PISTON

Disassembly

1. Check the ball pre-load as follows:

   a. Lightly clamp the rack-piston assembly in a brass jawed vise with Tool J-7539 still in place.

   b. Thread worm into rack-piston while holding Tool J-7539 tightly against worm so the balls will not fall out of the rack-piston. When the worm is in place, remove Tool J-7539.

   c. Clamp rack-piston (flanged end of worm up) in vise, then install the valve and lower shaft assembly so that the small notch in the valve body engages the drive pin in the worm. Locate the over-center position of the worm by slowly turning the worm and noting the area where the turning effort is highest. DO NOT THREAD THE WORM OUT TOO FAR SINCE THIS MAY CAUSE SOME OF THE BALLS TO DROP OUT OF THE RACK-PISTON.

   d. Using a torque wrench and a 3/4" 12 point socket, check the pre-load while rotating the torque wrench in a 120° arc. The reading should be 1/16 to 5 in. lbs. (Fig. 8-60)

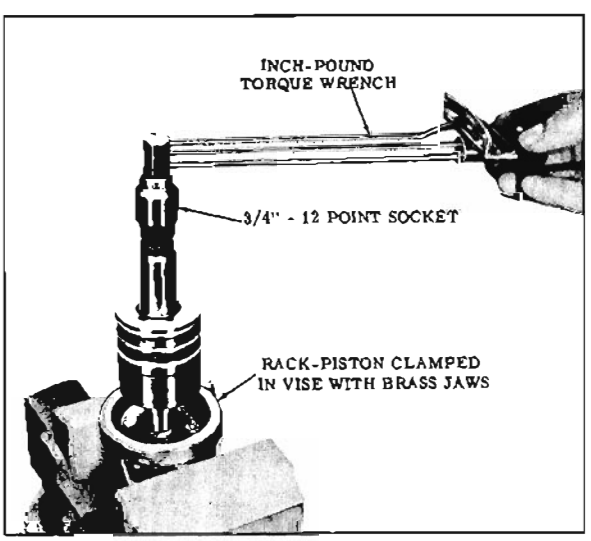


Fig. 8-60 Checking Pre-load

   e. If the pre-load is not within limits, a new set of balls must be installed upon reassembly. Install the next size larger balls to increase the pre-load or the next size smaller balls to decrease the pre-load, black balls need not be replaced unless they are defective. A change of one ball size will change the pre-load approximately 1 in. lb.

      NOTE: Standard ball size is number 7.

   f. Remove the torque wrench and valve and shaft assembly.

2. Thread the worm out of the rack-piston, remove ball return guide clamp, guide valves and balls.

3. If necessary to replace the teflon oil seal and "O" ring, remove at this time.

Cleaning and Inspection

1. Wash all parts in clean solvent and dry with compressed air.

2. Inspect the worm and rack-piston grooves and all the balls for scoring. If either the worm or rack-piston needs replacing, both must be replaced as a matched assembly.

3. Inspect ball return guide halves, making sure that the ends where the balls enter and leave the guides are not damaged.

4. Inspect lower thrust bearing and washers for scores or excessive wear. If any of these conditions are found, replace the thrust bearing and washers.

5. Inspect rack-piston teeth for scores or excessive wear. Inspect the external ground surfaces for wear, scoring or burrs.

6. Inspect the rack-piston stop ring (inside of housing) and replace if damaged.

Assembly

1. If the teflon oil seal and "O" ring were removed, install a new "O" ring and seal, lubricated with 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.

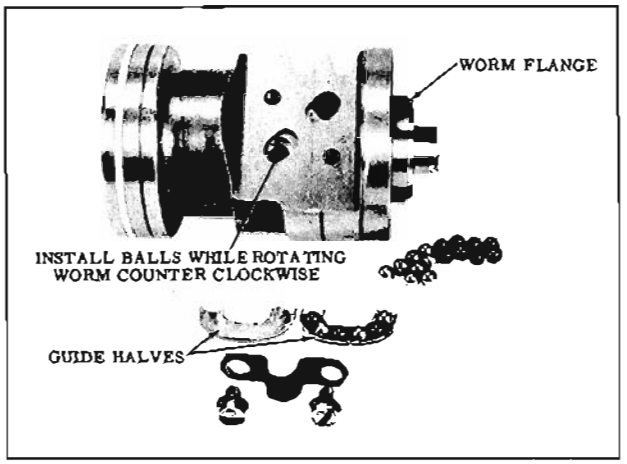


Fig. 8-61 Installing Balls in Rack-Piston

3. Turn the worm until the worm groove is aligned with the lower ball return guide hole. (Fig. 8-61)

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 guide.

5. Alternately install six balls into the return guide and retain with petrolatum. Install the return guide assembly onto the rack-piston. Install the return guide clamp and tighten the two clamp screws 8 to 12 ft. lbs.

6. Check the ball pre-load if it was necessary to install a new set of balls to correct the pre-load. Refer to RACK-PISTON - DISASSEMBLY (Step 1).

7. Insert Bearing Retainer Tool J-7539 into the rack-piston, then while holding tool tightly against end of worm, thread worm out of the rack-piston.

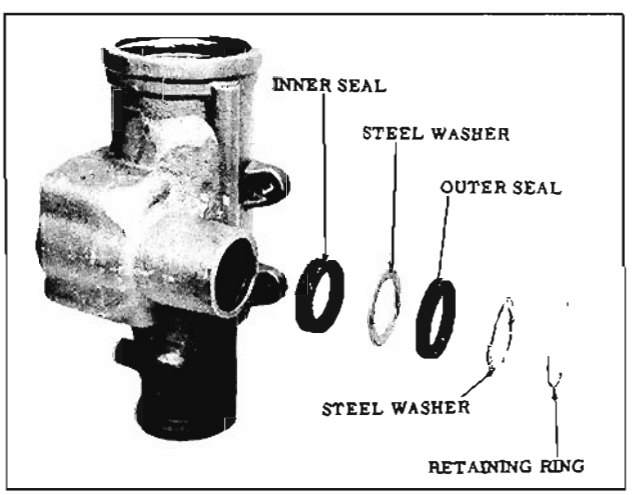


Fig. 8-62 Pitman Shaft Seals

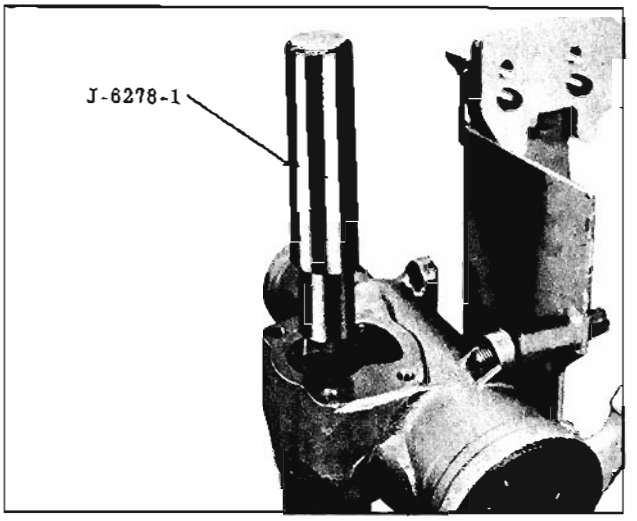


Fig. 8-63 Needle Bearing and Seal Removal

PITMAN SHAFT NEEDLE BEARING AND SEALS (Fig. 8-62)

Remove

1. If pitman shaft seals ONLY are to be replaced, remove the seal retaining ring and outer steel washer, then pry out the outer seal. Remove the inner steel washer, then drive out the inner seal.

2. If pitman shaft needle bearing replacement is necessary, remove the seal retaining ring, outer steel washer, then drive needle bearing, seals and inner washer out with Tool J-6278-1. (Fig. 8-63)

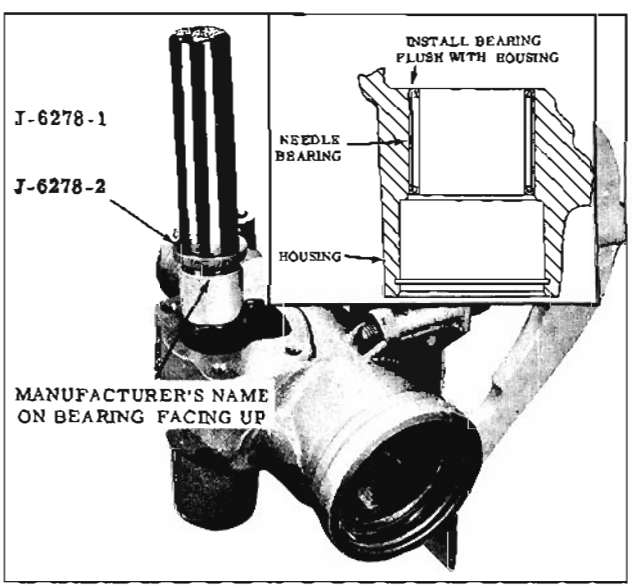


Fig. 8-64 Installing Needle Bearing

Install

1. If the pitman shaft needle bearing was removed, place Adapter J-6278-2 over Tool J-6278-1; slide the new needle bearing on the tool with the manufacturer's identification against the adapter and drive the bearing into the housing until adapter bottoms in housing. (Fig. 8-64)

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 Adapter J-6278-2 over Tool J-6278-1; then install the outer seal, inner steel washer, and inner seal with the lips on the seals facing away from the adapter.

   b. Drive the seals into the housing until the top of Adapter J-6278-2 is flush with the housing. (Fig. 8-65)

   c. Remove the tool and adapter, then install the outer steel washer and seal retaining ring. The retaining ring will not seat in the groove at this time.

   d. Reinsert Tool J-6278-1 with Adapter J-6278-2 and continue driving the seals until the retaining ring seats in its groove (inset, Fig. 8-65), then remove the tool and adapter.

HOSE CONNECTORS

Remove

If the hose connections were leaking at the connector seats in the housing, remove one or both connector seats as follows:

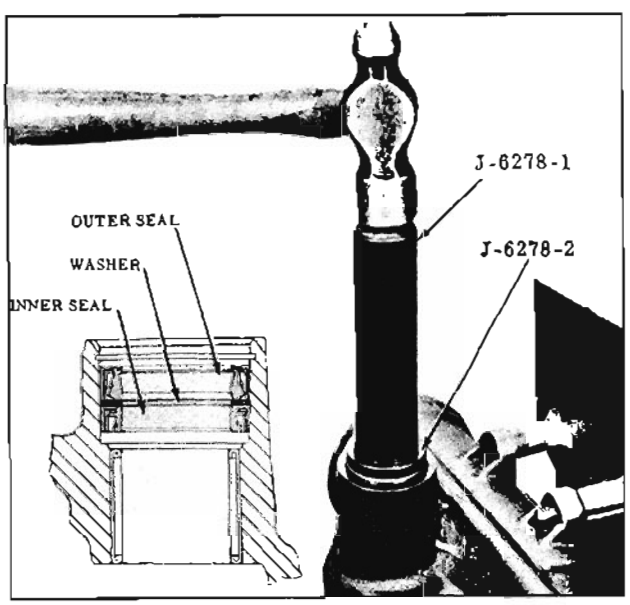


Fig. 8-65 Installing Oil Seals

1. Thread a nut and place a washer on a 5/16"-18 tap.

2. If the connector seat is being removed from an assembled gear, coat the end of the tap with petrolatum to prevent chips from entering the passage while tapping the seat.

3. With the steering gear in a vertical position, thread the tap into the connector seat not more than three turns. (Fig. 8-66)

4. Tighten the nut to remove the seat.

   NOTE: A check valve and spring is located below the high pressure connector seat and can be replaced when seat is removed.

Install

To install a new connector seat, use Tool J-6217 to seat it in the housing. (Fig. 8-67)

STEERING GEAR ASSEMBLY

1. Install the worm as follows:

   a. Lubricate the worm, lower thrust bearing and the two thrust washers with Hydra-Matic oil, then install one thrust washer, the bearing, and the other thrust washer over the end of the worm.

   b. With the valve bore end of gear housing down, insert the worm and thrust bearing assembly into the housing. While holding the worm in place, turn the gear housing so the valve bore end of the housing is up.

2. Install the valve and lower shaft assembly as follows:

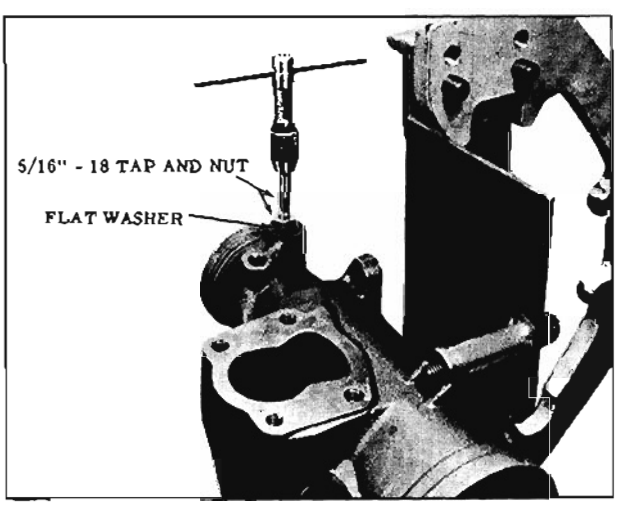


Fig. 8-66 Removing Connector Seal

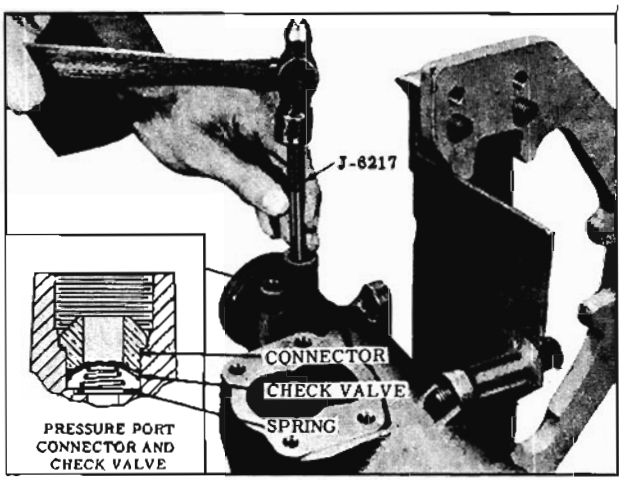


Fig. 8-67 Installing Connector Seat

a. Lubricate the valve body teflon rings and a new lower shaft cap "O" ring with petrolatum. Install the lower shaft cap "O" ring in the valve body so it is seated against the lower shaft cap. Align the NARROW NOTCH in the valve body with the pin in the worm, then install the valve and shaft assembly in the gear housing. (Fig. 8-68) Apply pressure to the VALVE BODY when installing. If pressure is applied to the lower shaft during installation, the shaft may be forced out of the valve body.

IMPORTANT: The valve body is properly seated when the oil return hole in the housing is entirely uncovered. (Fig. 8-69)

3. Lubricate a new adjuster plug "O" ring with petrolatum and install in groove on adjuster plug. Place Seal Protector J-6222 over lower shaft, then install the adjuster plug assembly in the housing until it seats against the valve body. (Fig. 8-70) Remove Seal Protector. Do not adjust the thrust bearing pre-load at this time.

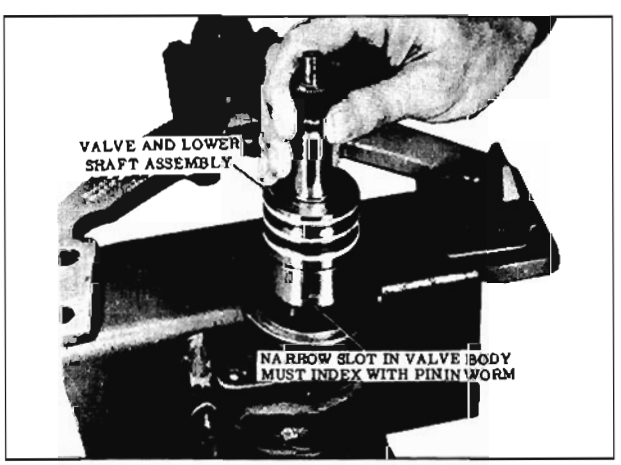


Fig. 8-68 Installing Valve and Lower Shaft Assembly

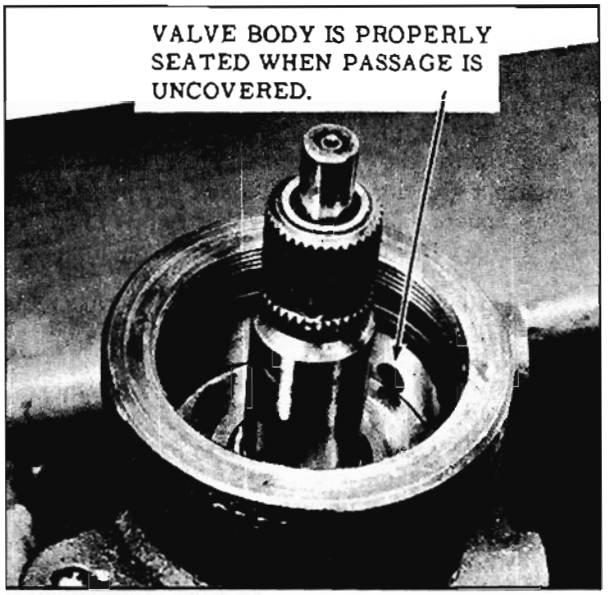


Fig. 8-69 Valve Body Properly Seated

4. Install the rack-piston as follows:

a. Lubricate the rack-piston teflon seal with petrolatum.

b. With the rack-piston bore of the housing facing up, position Seal Compressor J-7576 against the shoulder in the housing.

c. With Ball Retainer J-7539 in place in the rack-piston, push the rack-piston into the housing until Tool J-7539 contacts the worm. (Fig. 8-71)

d. Turn the lower shaft clockwise with a 3/4" 12-point socket or a replacement coupling flange to thread the rack-piston onto

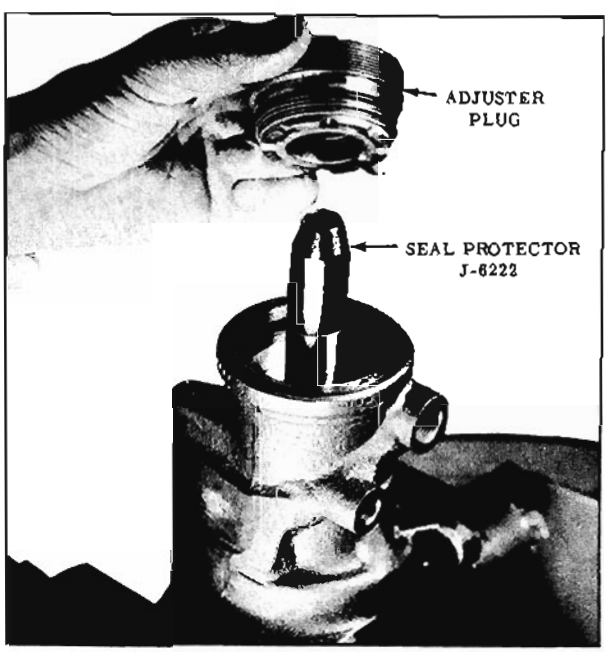


Fig. 8-70 Installing Adjuster Plug

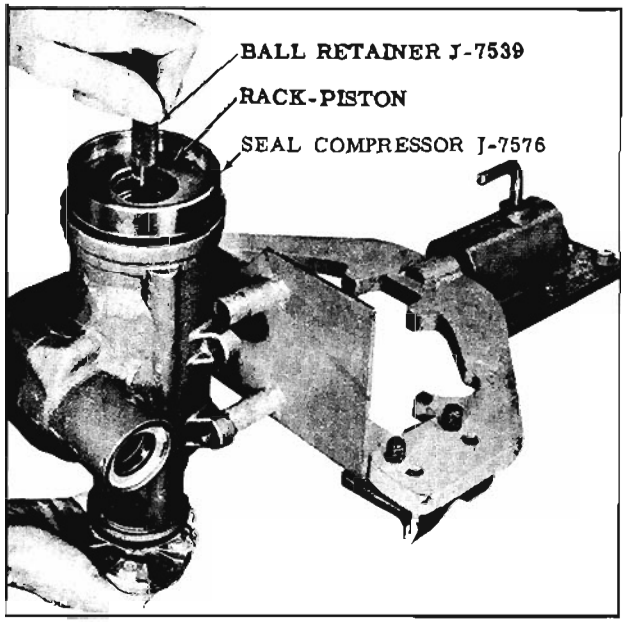


Fig. 8-71 Installing Rack-Piston

the worm while holding Tool J-7539 against the end of the worm.

e. When the rack-piston is completely threaded on the worm, remove Ball Retainer J-7539 and Seal Compressor J-7576.

5. Install the rack-piston plug in the rack-piston and torque 30 to 65 ft. lbs.

6. Install a new housing end cover "O" ring and lubricate it with petrolatum, then install the end cover and retaining ring.

7. Install the pitman shaft and side cover as follows:

   a. Install a new "O" ring in the pitman shaft side cover and retain with petrolatum.

   b. Turn the lower shaft until the rack-piston teeth are centered in the pitman shaft opening, then install the pitman shaft and side cover so that the center tooth of the pitman shaft engages the center groove of the rack-piston.

   c. Install the four side cover bolts and three lockwashers and tighten 25 to 30 ft. lbs. Refer to Fig. 8-72 for washer location.

8. Adjust the thrust bearing pre-load as follows:

   a. Turn the adjuster plug clockwise with Spanner Wrench J-7624 until it is tight, then loosen it 1/8 turn.

   b. Install an inch-pound torque wrench with a 3/4" 12-point socket on the lower shaft splines. (Fig. 8-72)

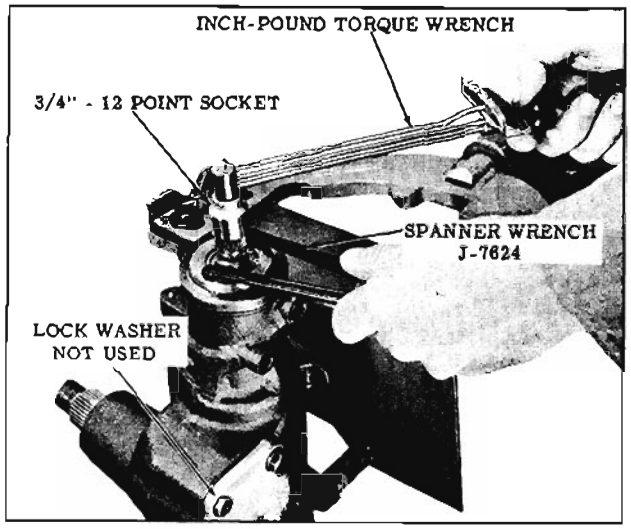


Fig. 8-72 Adjusting Thrust Bearing Pre-Load

   c. Rotate the torque wrench in a 45° arc and note the highest reading.

   d. Tighten the adjuster plug with Spanner Wrench J-7624 until the torque wrench reads 1 to 3 in. lbs. higher than the initial load reading.

   e. Install the adjuster plug locknut and tighten with Spanner Wrench J-972-A.

   f. Recheck the adjustment to be sure it is still only 1 to 3 in. lbs. higher than the initial load reading. If the adjustment changed when tightening the locknut, re-adjust the adjuster plug.

9. Adjust the over-center pre-load as follows:

   a. Make sure the over-center adjusting screw is backed all the way out.

   b. Install an inch-pound torque wrench with a

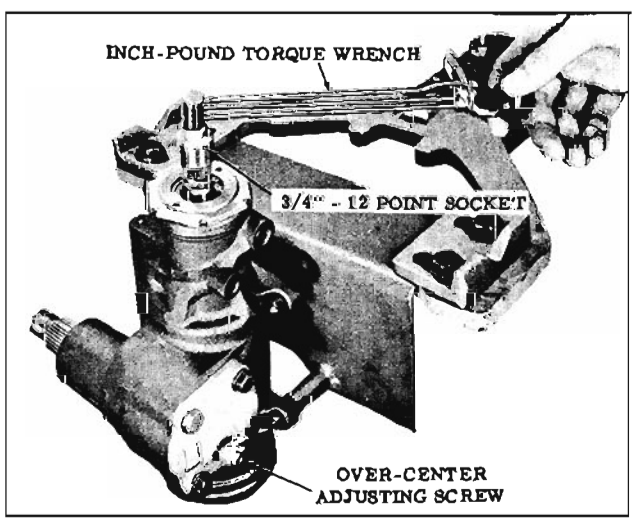


Fig. 8-73 Checking Over-Center Pre-Load

3/4" 12-point socket on the lower shaft splines.

c. Rotate the lower shaft from one stop to the other to count the number of turns and locate the center of travel, then check the combined ball and thrust bearing pre-load by rotating the torque wrench through the center of travel. (Fig. 8-73) Note the highest reading.

d. Tighten the pitman shaft adjusting screw until the torque wrench reads 4 to 8 in. lbs. higher than the previous reading. The total reading should not exceed 16 in. lbs.

e. While holding the adjusting screw, tighten the locknut and recheck the adjustment.

10. Position the coupling flange onto the lower shaft, then install the flange attaching bolt and lockwasher. Position the flange so that there is 3/4" between the adjuster locknut and the coupling to steering flange bolt heads. Tighten the coupling flange attaching bolt 15 to 20 ft. lbs.

STEERING WHEEL AND HORN CONTACT

STEERING WHEEL

Remove (Fig. 8-74 & 8-75)

1. Disconnect the horn wire from the wiring harness.
2. Standard wheel - Pull lens and bezel assembly from wheel.
3. Deluxe wheel - Carefully pry the cap and emblem assembly from the shroud. On 30, 31 and 32 Series, rotate cap clockwise to disengage locking tab.
4. Remove the steering wheel attaching nut and washer, then using a puller such as BT-61-9, remove the steering wheel from the steering shaft. (Fig. 8-76) Remove puller from steering wheel.

Install

1. With the marks on the steering wheel and steering shaft aligned, install the wheel, flatwasher and nut.

   NOTE: When mark on steering wheel hub and steering shaft are lined up, wheel spokes should be horizontal as car is driven straight ahead.

   If spokes are not horizontal, it will be necessary to adjust the tie rod ends until steering wheel assumes its proper position. When a new steering gear is installed, it may be necessary to adjust steering wheel spoke alignment even though spoke alignment had been correct for the old gear.

2. Torque the nut 30 to 40 ft. lbs. and stake to steering shaft. On standard steering wheels, install lens and bezel assembly. Water may be used on bezel retainer ring to aid installation. DO NOT USE LUBRICANT ON RETAINER RING. On deluxe steering wheels, install cap and emblem assembly. On 30, 31

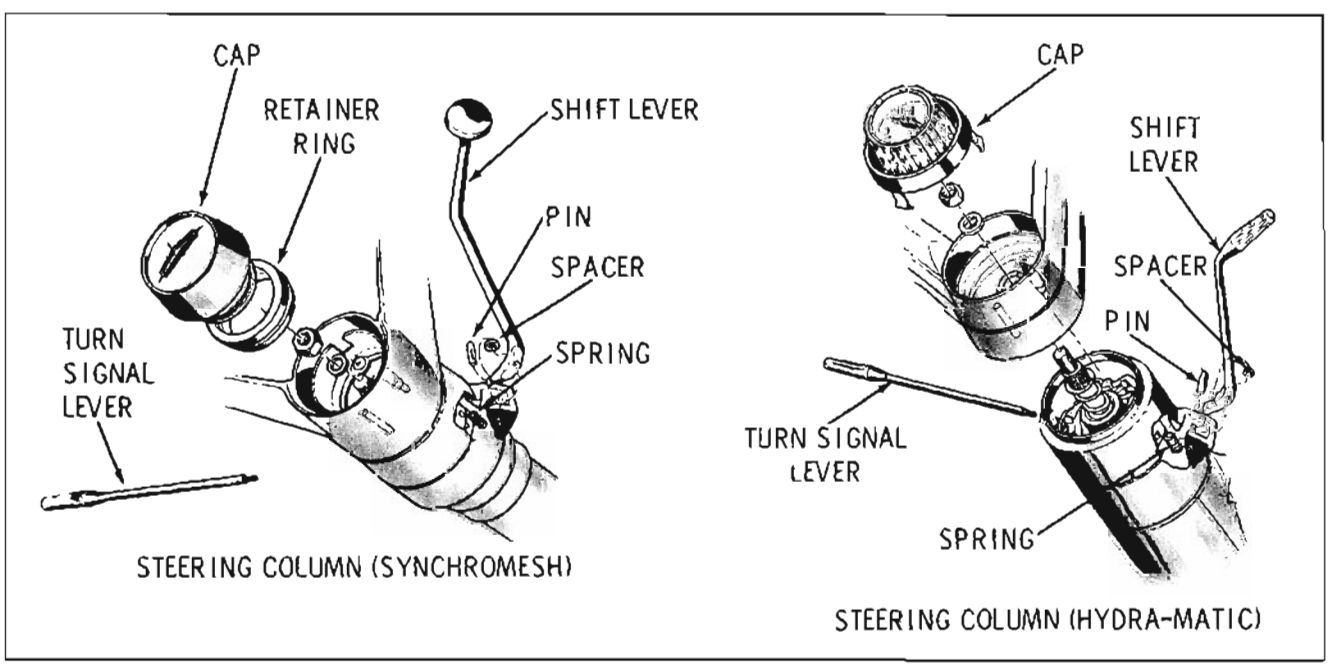


Fig. 8-74 Steering Wheel Attachment (33 - 34 - 35 - 36 - 38 & 39 Series)

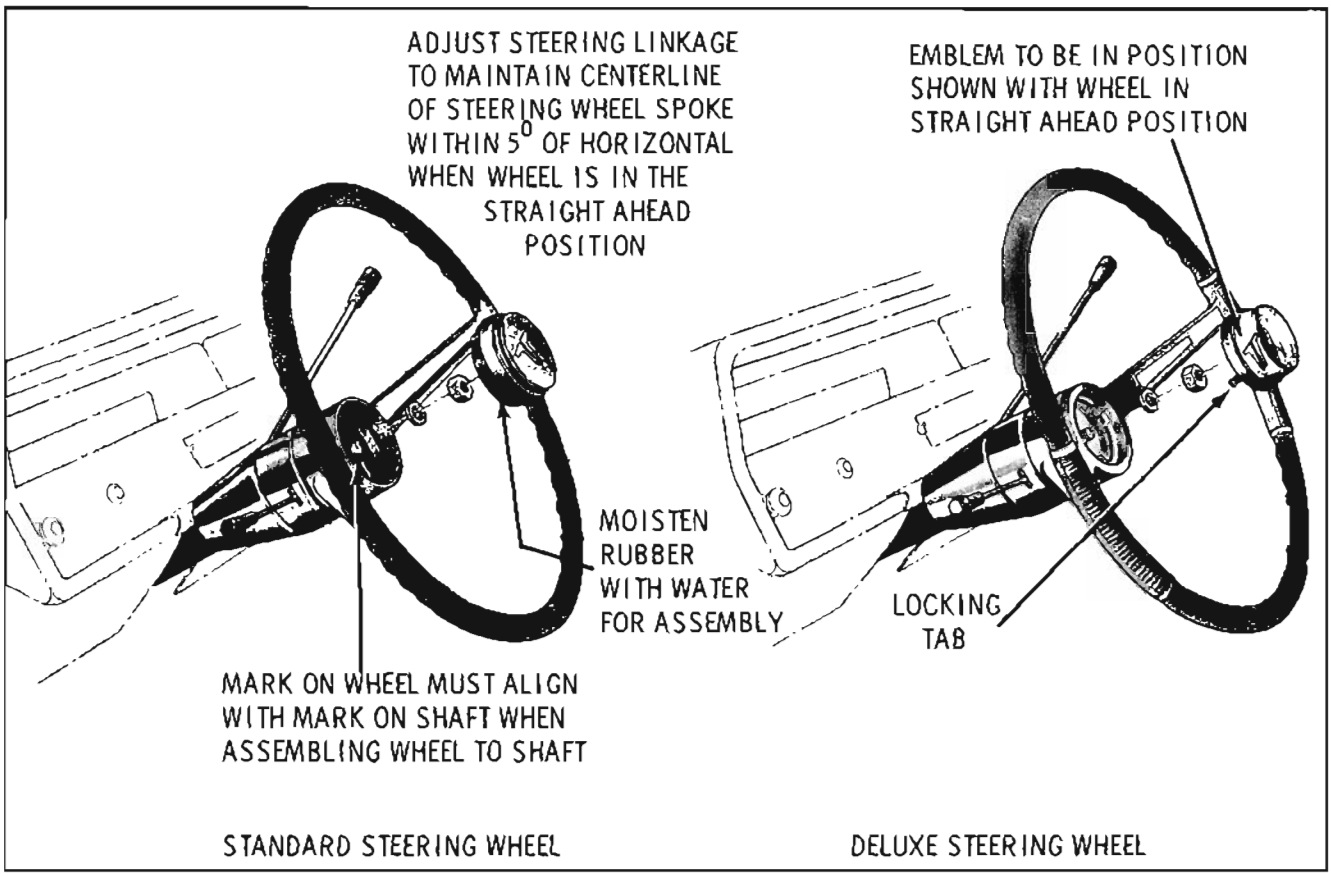


Fig. 8-75 Steering Wheel Attachment (30 - 31 & 32 Series)

and 32 Series, position cap into slots and turn counterclockwise to lock.

3. Connect horn wire to wiring harness.

HORN CONTACT OR SWITCH

The horn contact or switch is installed as shown in Figs. 8-77, 8-78, 8-79 and 8-80.

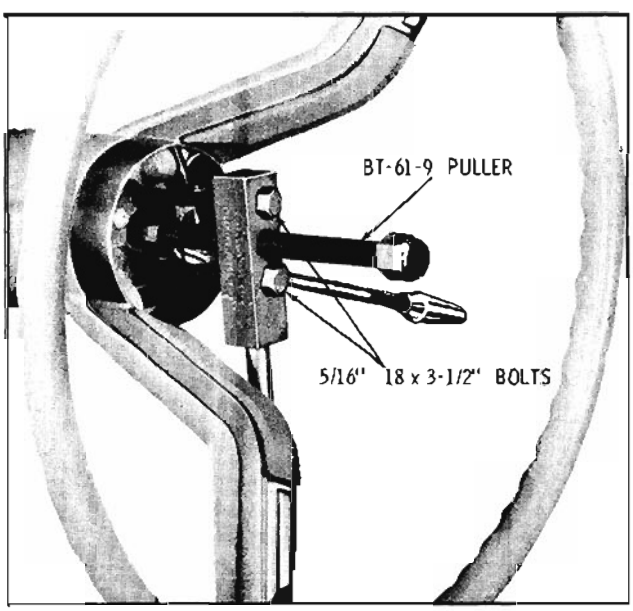


Fig. 8-76 Removing Steering Wheel

UPPER BEARING, HORN CONTACT RING OR WIRE REPLACEMENT (Without Tilt-Away Steering Wheel) (33-34-35-36-38 & 39 Series)

1. Disconnect horn contact wire from chassis wiring harness.
2. Remove steering wheel.
3. Pry bearing from retainer, then pry horn contact from bearing just enough to expose horn wire tang. (Fig. 8-81)
4. Depress tang and remove horn contact and wire from bearing.
5. Prior to assembly, bend horn wire terminal tang if necessary so that it will lock in horn contact. (Fig. 8-82)
6. After assembly of contact and bearing, install assembly into retainer using hand pressure.
7. Install steering wheel and connect horn wire.

TURN SIGNAL ACTUATOR ASSEMBLY REMOVE AND INSTALL (Fig. 8-83)

1. Remove the steering wheel assembly and the turn signal lever.

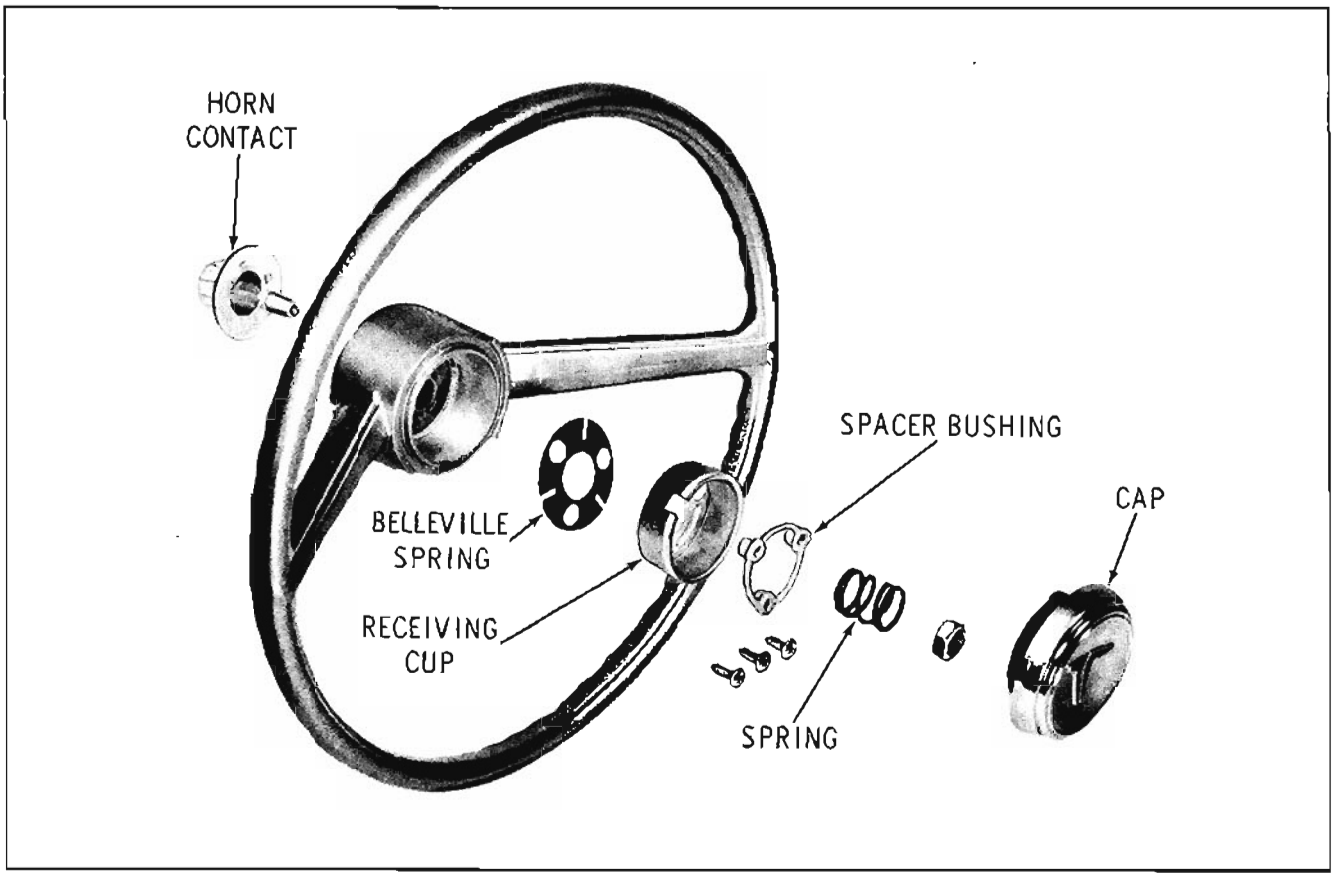


Fig. 8-77 Standard Steering Wheel (30 - 31 & 32 Series)

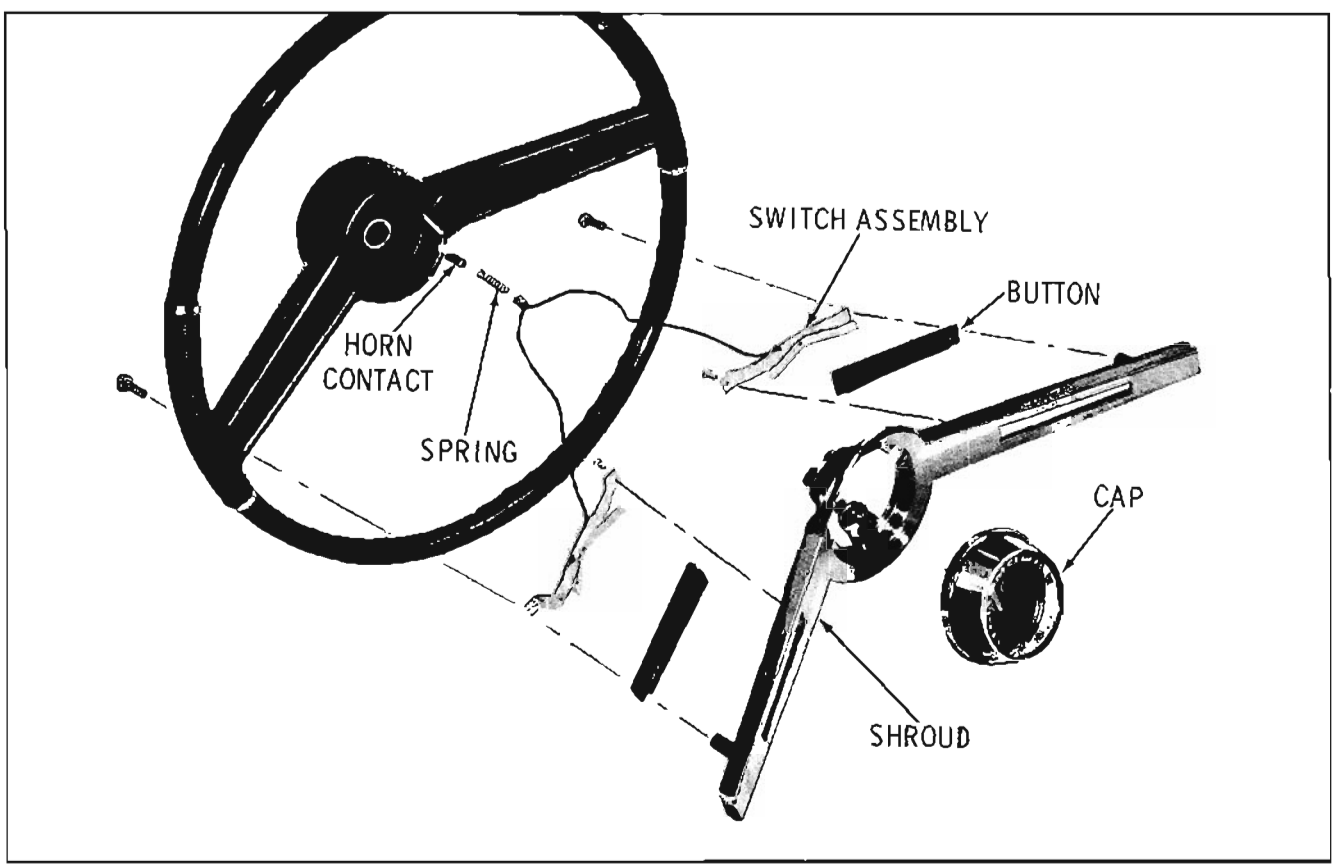


Fig. 8-78 Deluxe Steering Wheel (30 - 31 & 32 Series)

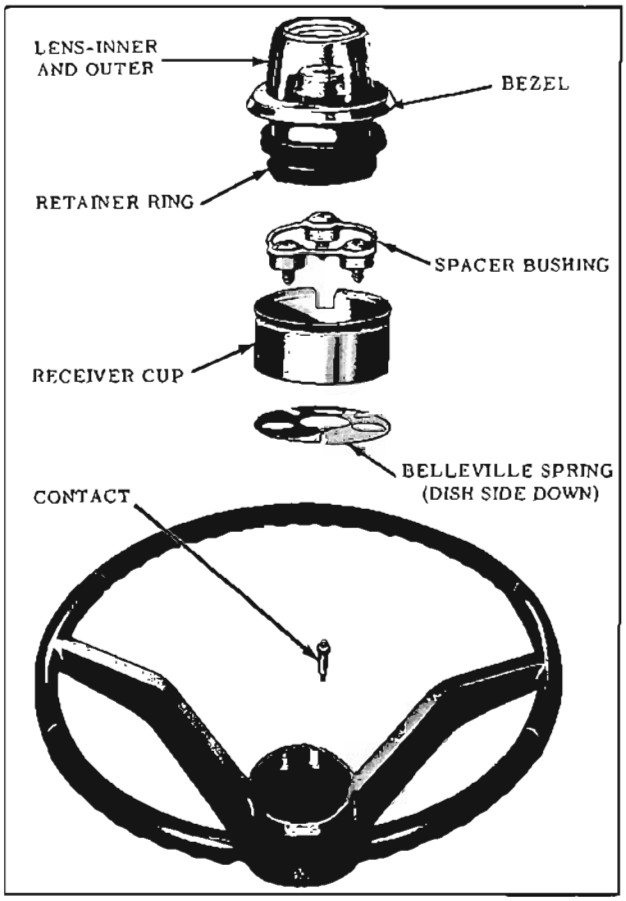


Fig. 8-79 Standard Steering Wheel (33 - 34 - 35 - 36 - 38 & 39 Series)

2. Insert a screwdriver, with a round shank, through the turn signal lever hole in the housing and pull or pry the housing from the bearing retainer.

3. Remove the cancel spring and pivot pin with wave washer from the lever plate.

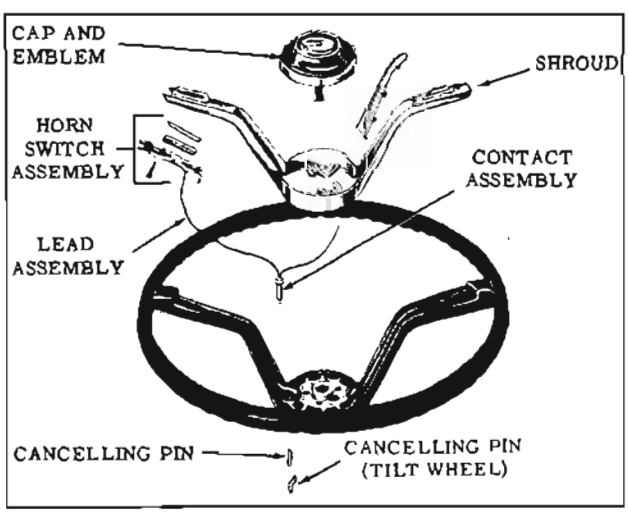


Fig. 8-80 Deluxe Steering Wheel (33 - 34 - 35 - 36 - 38 & 39 Series)

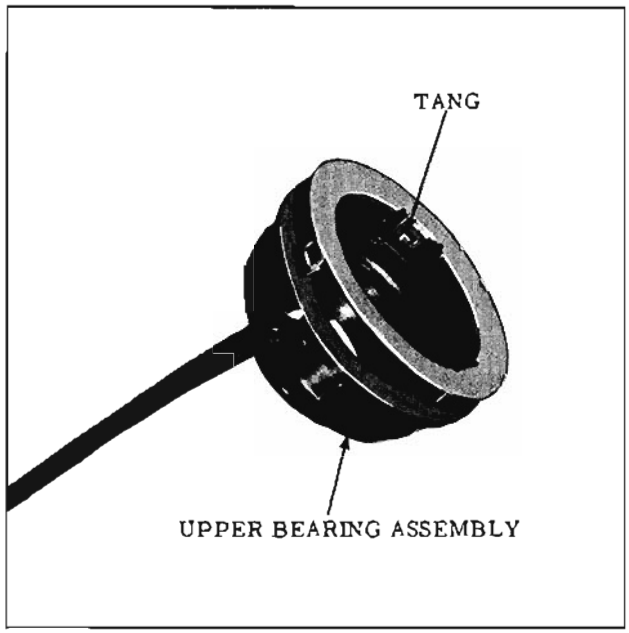


Fig. 8-81 Horn Contact Removal

4. Depress the detent spring to disengage it from the upper bearing retainer, then separate the lever plate, detent spring, detent roller and detent balls from the upper bearing retainer. (Fig. 8-83)

5. To install, reverse the removal procedure and lubricate all frictional areas with a thin coat of Lithium Soap Grease. Press the housing over the upper bearing retainer so that it just snaps over the rim of the bearing retainer flange.

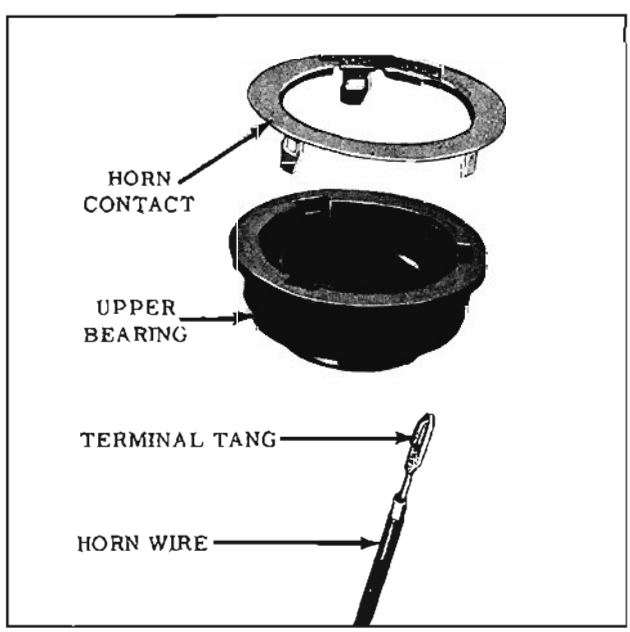


Fig. 8-82 Horn Contact and Bearing

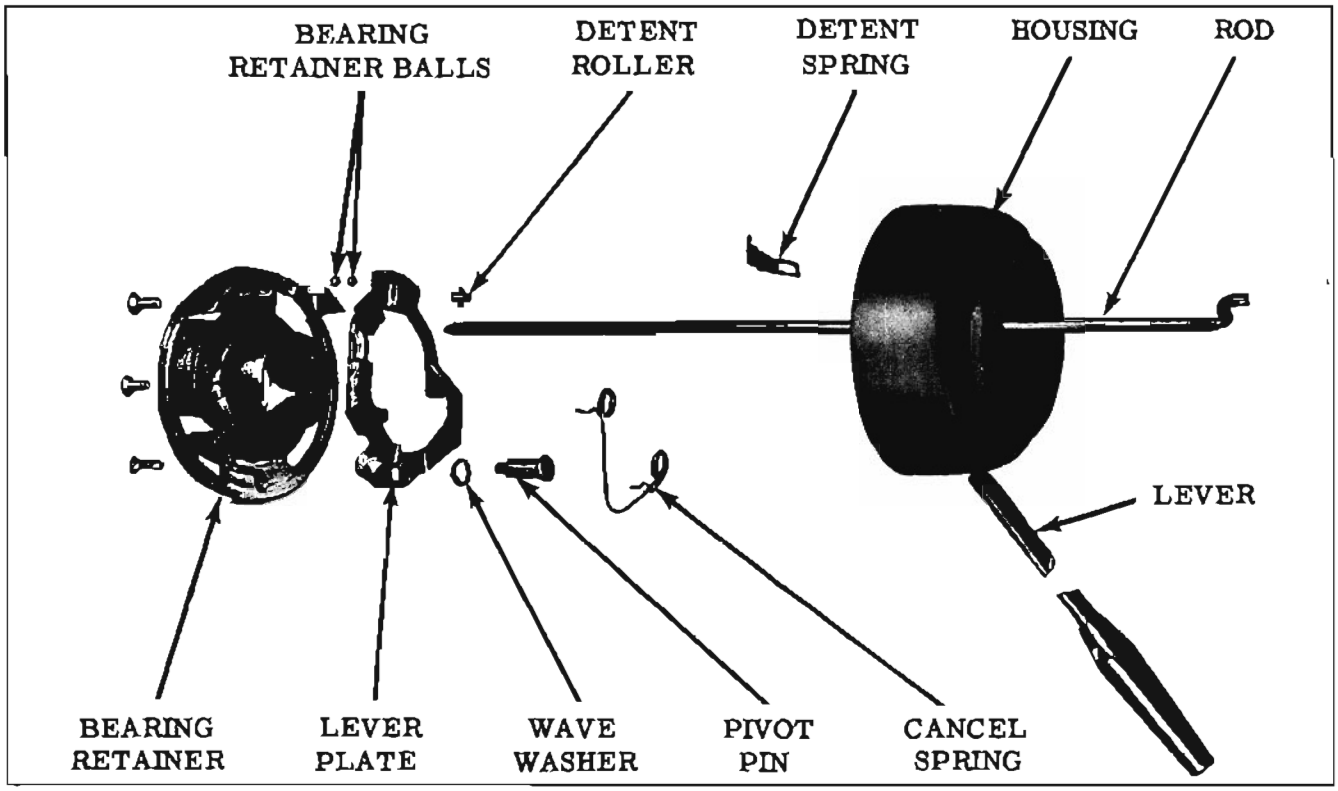


Fig. 8-83 Turn Signal Actuator Assembly (33 - 34 - 35 - 36 - 38 & 39 Series)

TURN SIGNAL CONTROL
(Fig. 8-84) (30-31 & 32 Series)

1. Remove steering wheel.
2. Remove the turn signal concelling cam.
3. Remove the turn signal lever.
4. Remove the three turn signal control attaching screws.

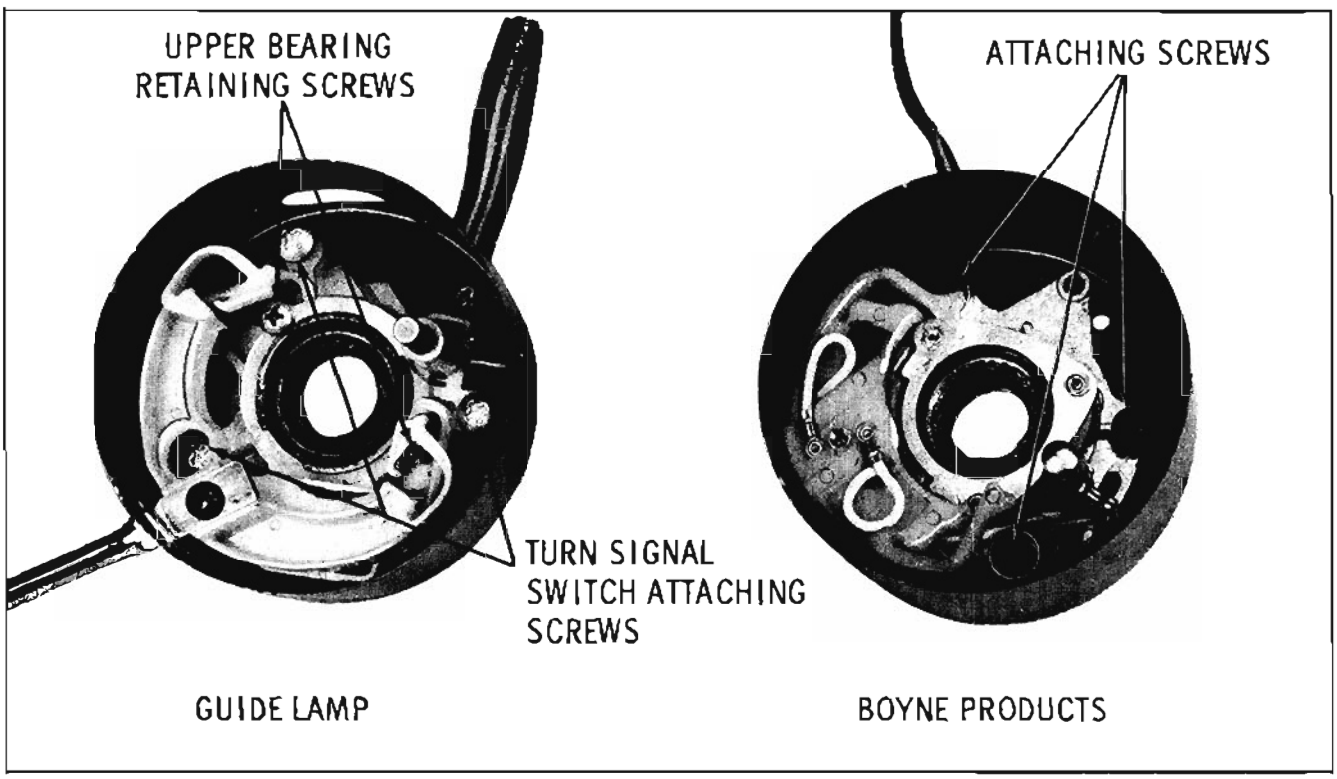


Fig. 8-84 Turn Signal Switch (30 - 31 & 32 Series)

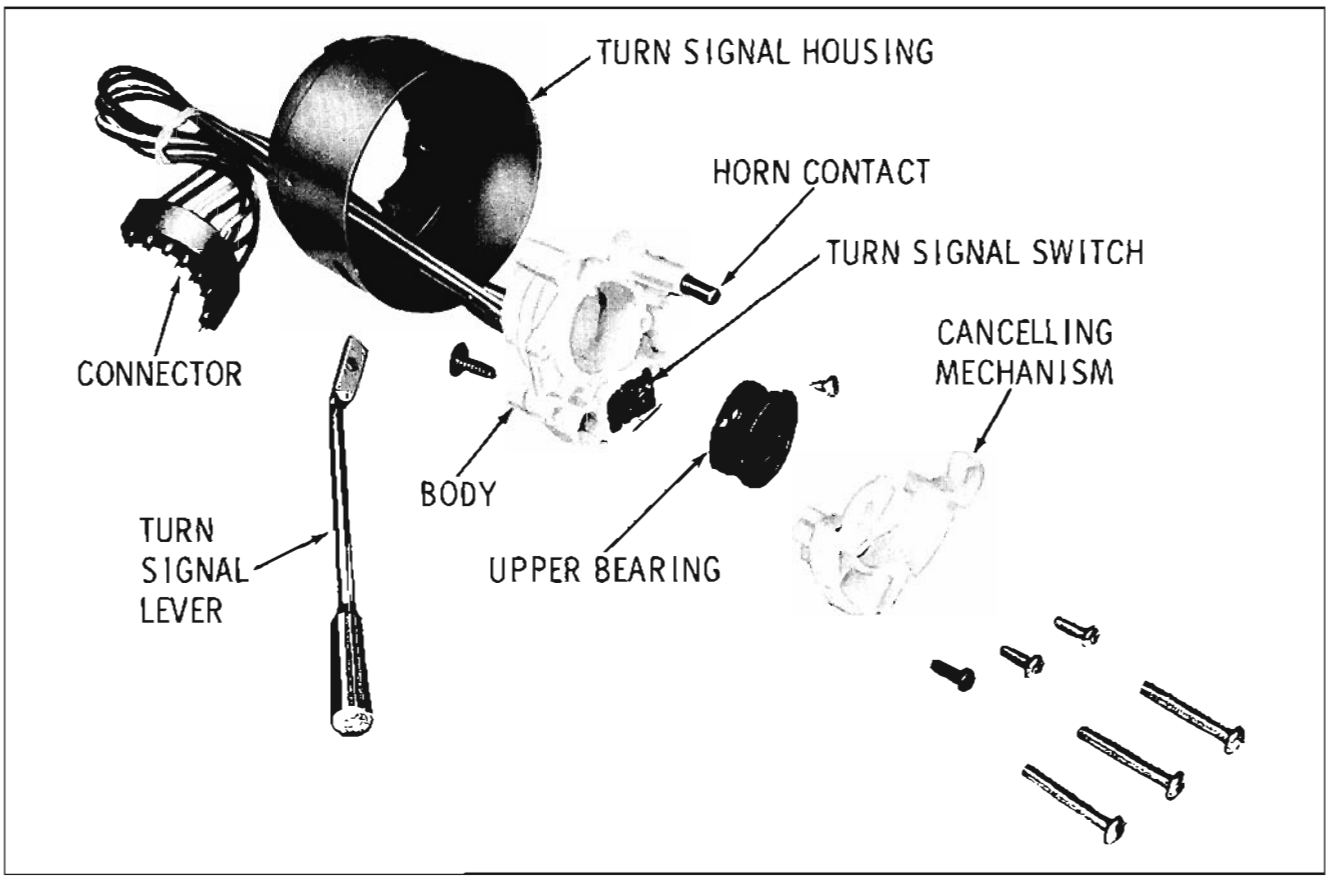


Fig. 8-85 Turn Signal Switch Disassembled (30 - 31 & 32 Series)

5. Disconnect steering column wiring harness plug from main wiring harness.

6. Lift turn signal control out of housing and disconnect wiring plug and horn contact wire from turn signal control.

   NOTE: On cars equipped with Synchromesh transmission, the wiring harness is part of the turn signal control.

7. On cars equipped with automatic transmission, the bearing, actuator, and turn signal contacts can be disassembled. (Fig. 8-85)

To install, reverse removal procedure. Before tightening the three control to housing attaching screws, rotate housing until it locks to the steering column.

STEERING COLUMN (ALL SERIES)

REMOVE AND INSTALL (Figs. 8-86 & 8-87)

1. Disconnect battery and remove steering wheel. For other than Tilt-Away Wheel, remove spring and other retainer.

2. Disconnect rod from lower shift lever.

3. On cars equipped with Synchromesh, disconnect rod from cross shift lever.

4. From under instrument panel, disconnect the wiring from the steering column.

5. On column shift, disconnect the indicator needle from the shifter tube.

6. Disconnect grommet and cover from floor pan.

7. Disconnect positive battery cable sleeve from lower clamp if so attached.

8. Remove upper steering column clamp.

9. For other than Tilt-Away column, slide mast jacket off steering shaft.

10. For Tilt-Away column, disconnect flexible coupling from steering shaft and remove column assembly.

    To install steering column assembly, reverse removal procedure.

    NOTE: Before tightening the steering column upper clamp, slide the column up or down on the steering shaft until the shaft extends 2-3/16" above the turn signal housing on 33, 34, 35, 36, 38 and 39 series and 1-3/4" on 30, 31 and 32 series.

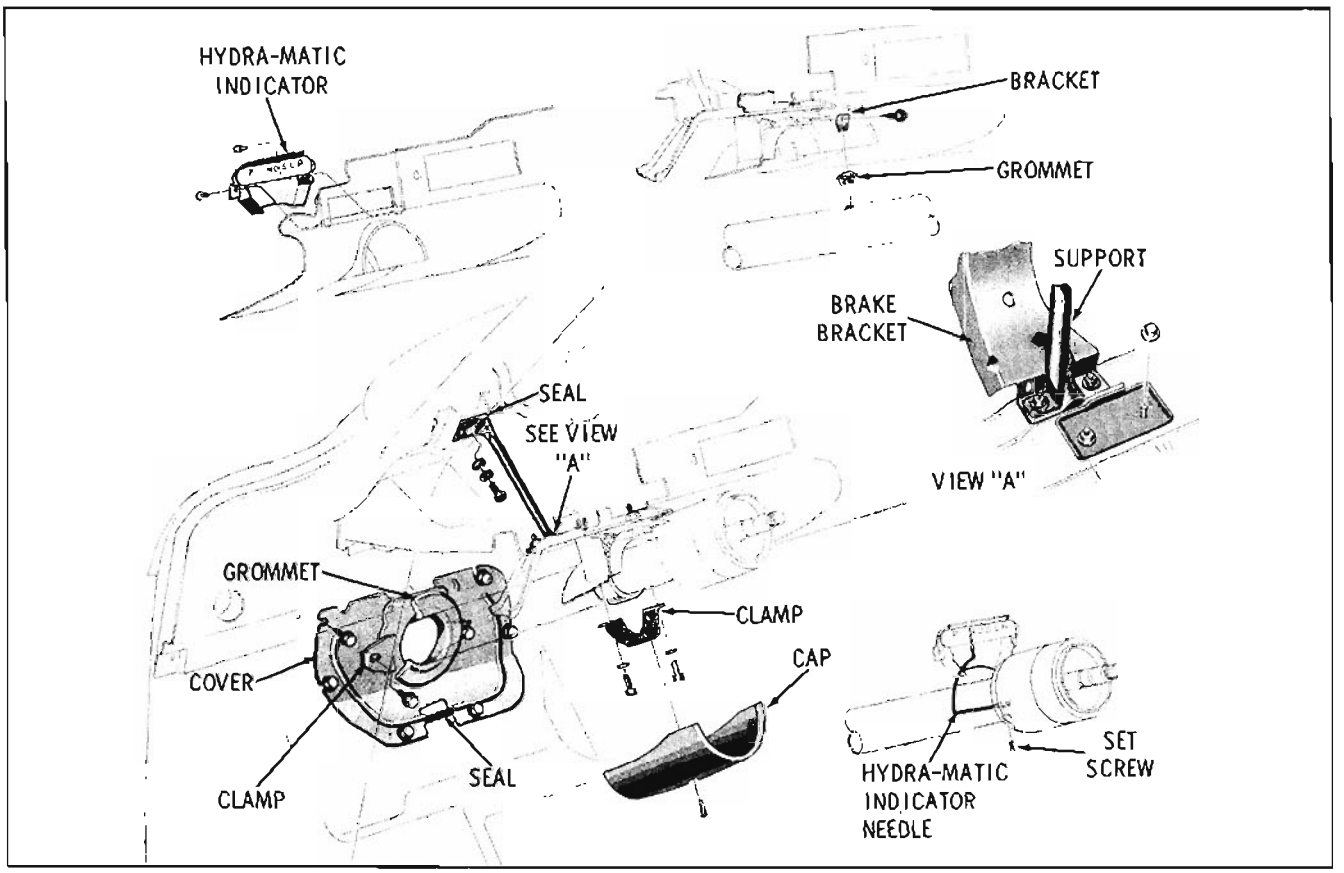


Fig. 8-86 Steering Column Installation (33 - 34 - 35 - 36 - 38 & 39 Series)

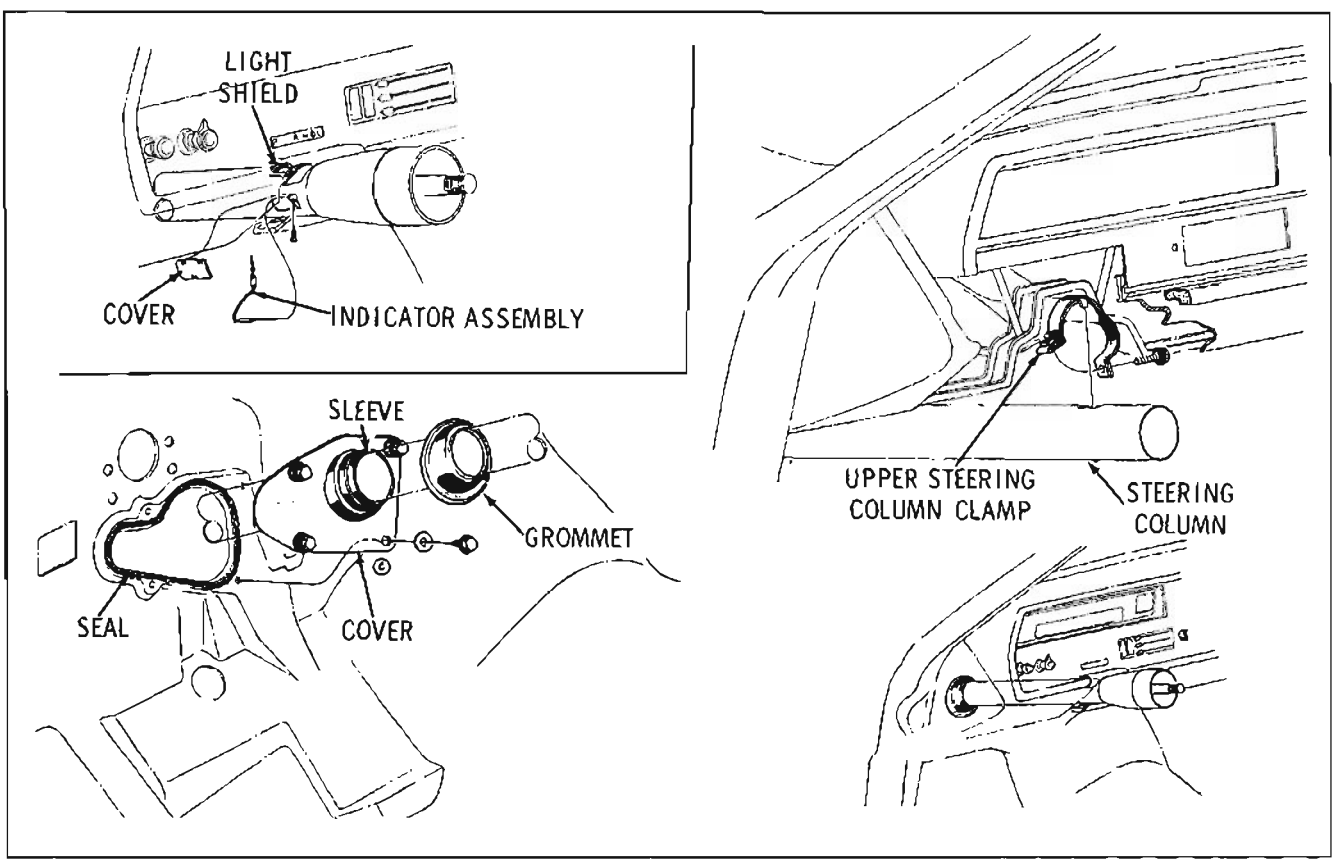


Fig. 8-87 Steering Column Installation (30 - 31 & 32 Series)

DISASSEMBLE AND ASSEMBLE
(Figs. 8-88 and 8-89)
(Without Tilt-Away Steering Wheel)
(33-34-35-36-38 & 39 Series)

NOTE: If console equipped, disregard reference to shift tube.

1. Remove turn signal switch from side of mast jacket. Remove the switch pin and spring from the turn signal rod.

2. Remove the combination neutral safety and back-up light switch or the Synchromesh back-up light switch from the mast jacket. Remove the switch lever from the shift tube.

3. Remove the turn signal lever and pull upper bearing retainer housing.

4. Pry out the upper bearing from the bearing retainer, then remove the upper bearing and horn wire.

5. Automatic Transmission: Remove the shift tube retainer ring and washer from inside the upper bearing retainer.

6. Remove the three upper bearing retainer screws, then remove the upper bearing retainer and turn signal actuator assembly.

   NOTE: If necessary, the shift stop plate (Hydra-Matic models) can be removed from the upper bearing retainer at this time.

7. Automatic Transmission: Remove wave washer from shift tube.

8. Support shifter bowl, and drive shift lever pin from bowl. Remove shift lever and spring from bowl.

9. Pull shifter bowl from shift tube.

10. On Synchromesh models, loosen lower clamp, and remove lower bearing.

11. Automatic Transmission without console: Remove lower bearing retainer and bearing.

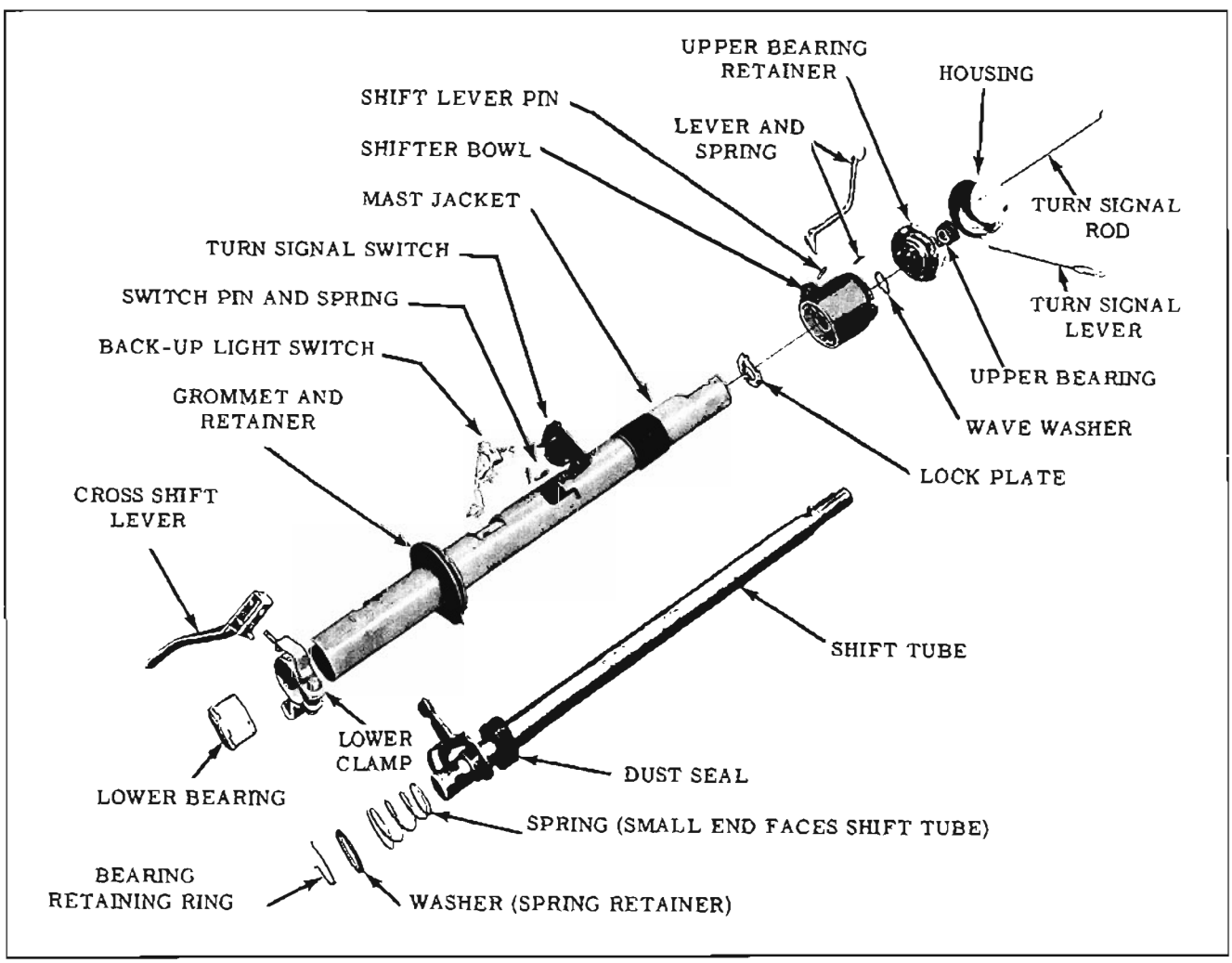


Fig. 8-88 Steering Column - Synchromesh (33 - 34 - & 35 Series)

12. On Synchromesh model, remove spring retainer and spring.

13. Remove shift tube from lower end of mast jacket.

14. For Synchromesh models, remove lock plate from top of mast jacket.

NOTE: The lower bearing should not be disassembled.

To reassemble steering column, reverse the removal procedure. Apply a thin film of Lithium Soap Grease to all frictional surfaces. Locate lower bearing adapter so that steering shaft extends 2-3/16" above the turn signal housing, then install the retaining ring.

DISASSEMBLY AND ASSEMBLY
(Figs. 8-90 & 8-91)
(Without Tilt-Away Steering Wheel)

NOTE: If equipped with floor shift, disregard reference to shift tube or levers.

1. Remove the neutral safety and back-up lamp switch.
2. Remove the turn signal cancelling cam.
3. Remove the turn signal lever.
4. Remove the three turn signal control attaching screws.
5. Lift the control assembly partially out of the housing and disconnect the wires from the control. Remove the control from the housing.
6. Remove the turn signal control housing.
7. Remove the roll pin and remove the shift lever and spring.
8. Remove the steering column cover, then remove the shift indicator.
9. Remove the shift bowl from the mast jacket.
10. Remove the thrust washer and wiring harness from the shift bowl.

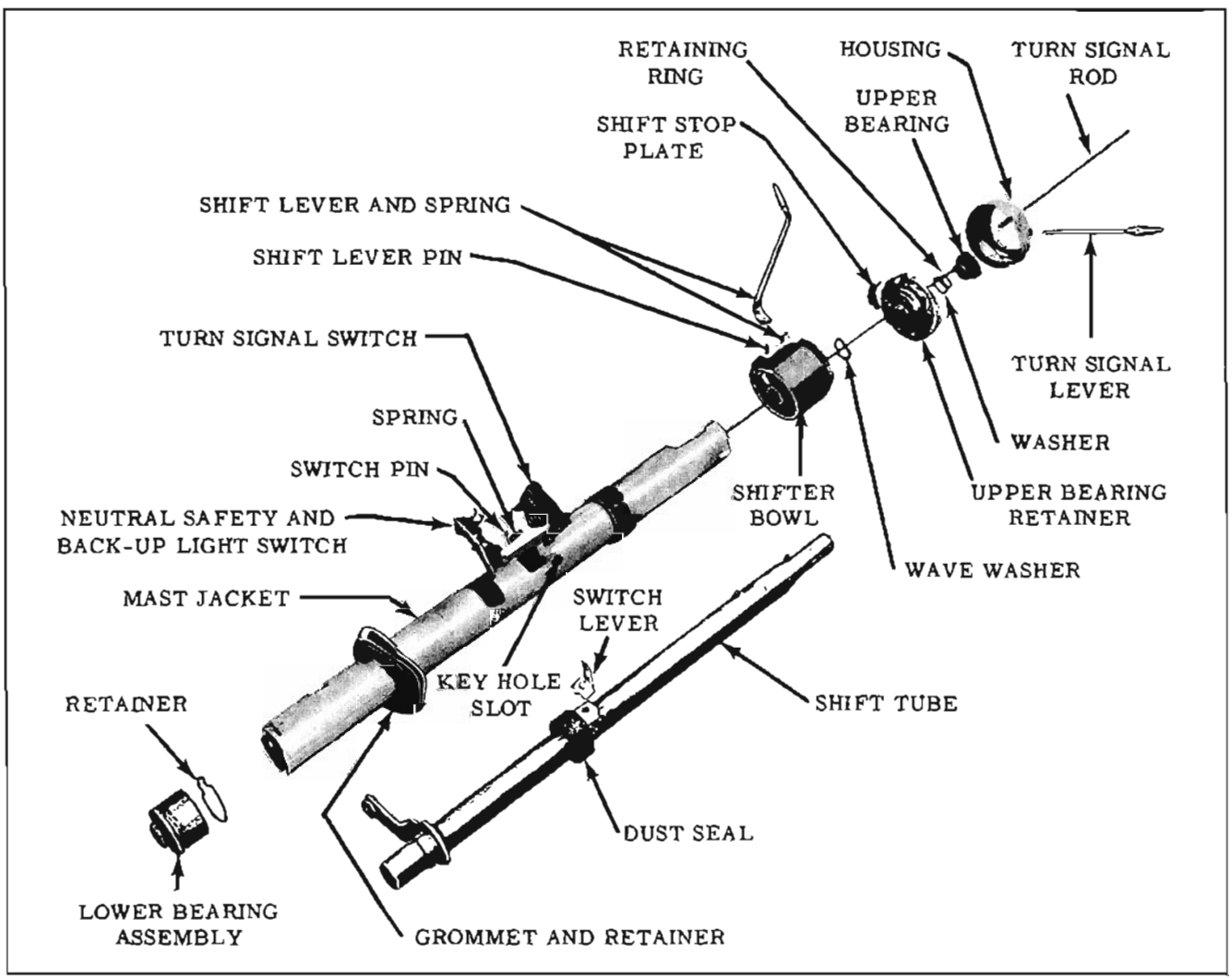


Fig. 8-89 Steering Column (Automatic Transmission) Without Console (33-34-35-36-38 & 39 Series)

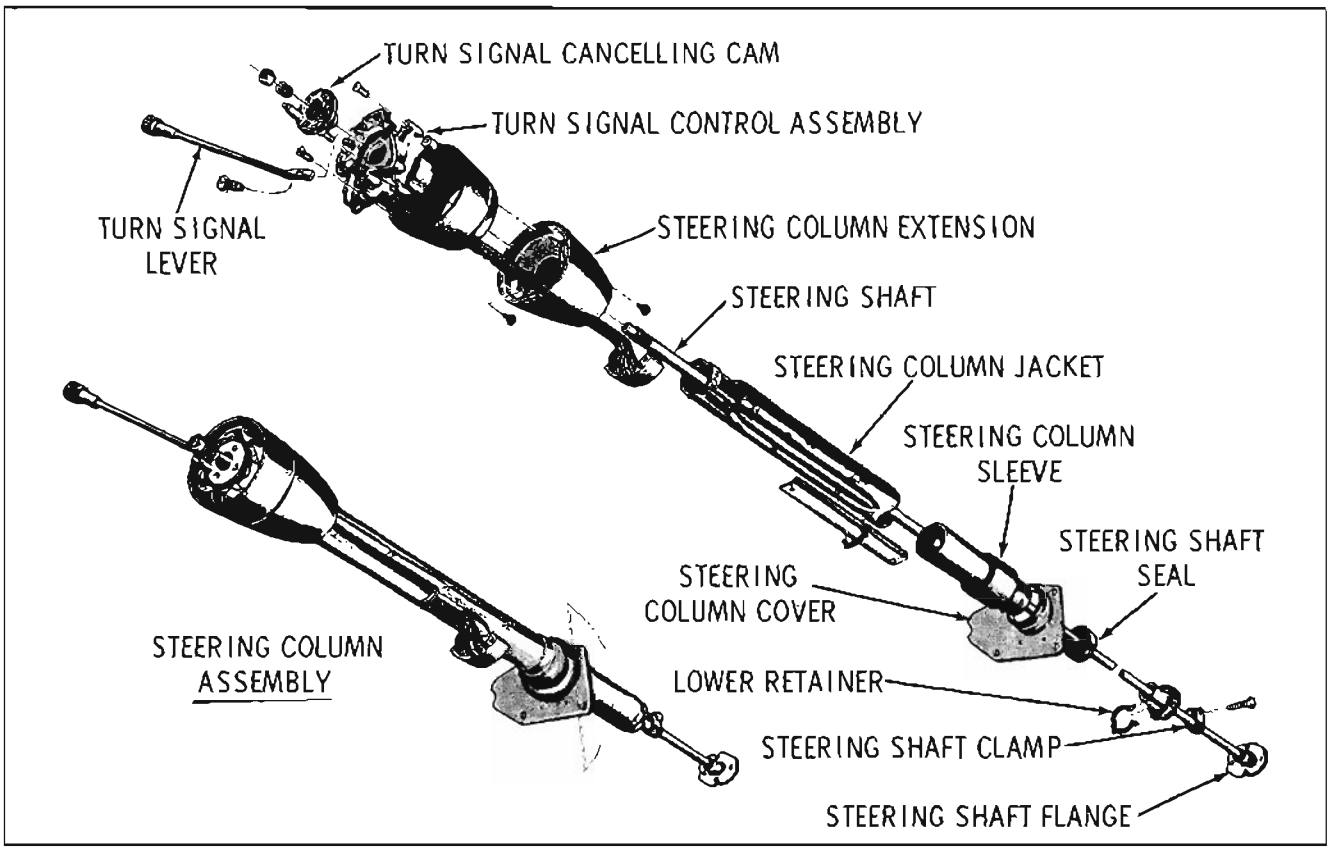


Fig. 8-90 Steering Column Console Shift (30 - 31 & 32 Series)

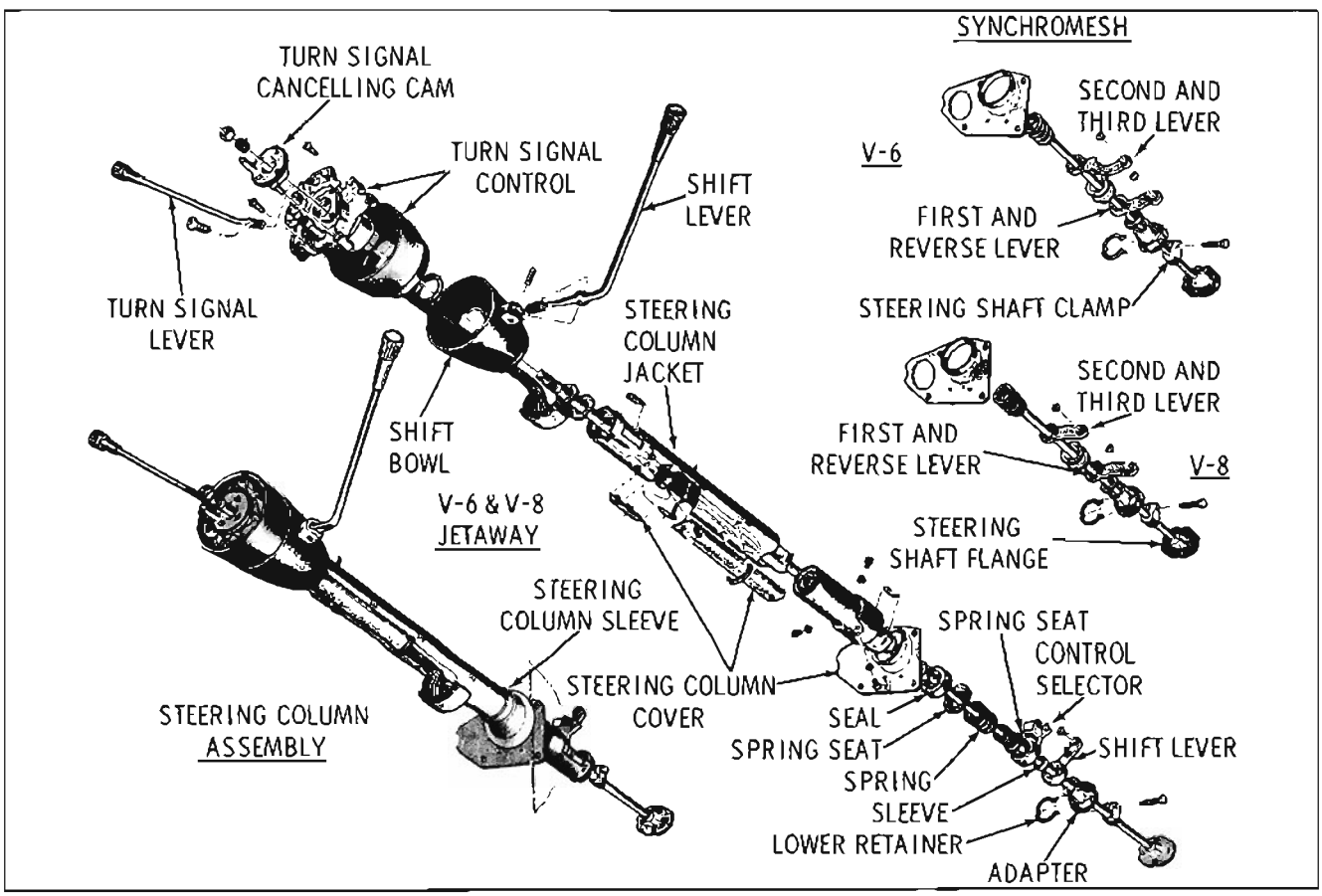


Fig. 8-91 Steering Column - Column Shift (30 - 31 & 32 Series)

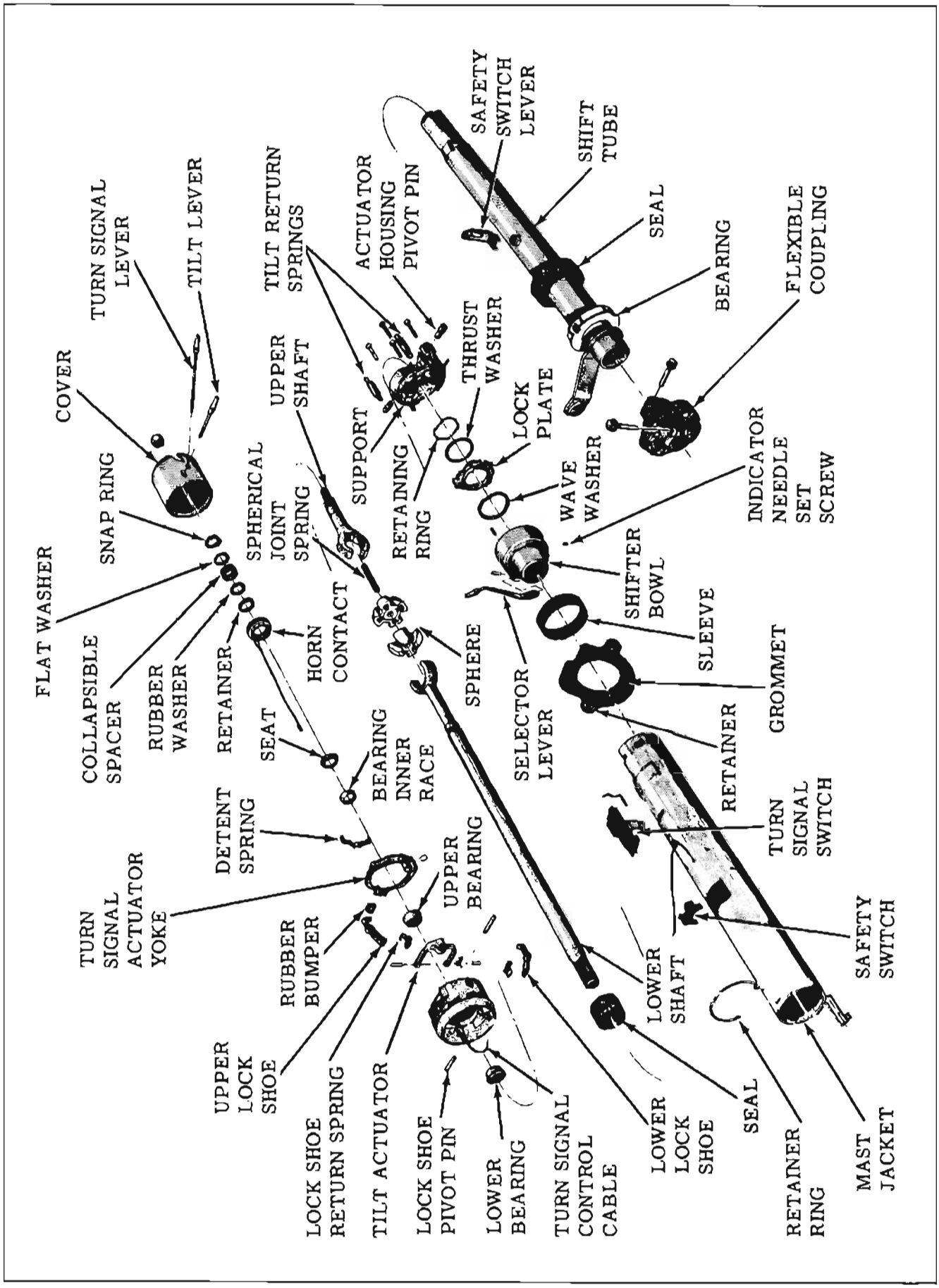


Fig. 8-92 Tilt-Away Steering Column (Typical of all Series)

11. Column Shift - Remove the "D" shaped flat and wave washer from the shift tube.

12. Remove the lower bearing retainer and lower bearing assembly.

13. Column Shift - Remove the three shift tube retaining bolts and remove the shift tube. Remove felt washer from shift tube.

14. Column Shift Synchromesh - Remove the shift levers.

15. Remove the steering column toe pan cover and sleeve.

To assemble, reverse the removal procedure. Apply a thin coat of Lithium Soap Grease to all frictional parts.

Locate clamp on steering shaft so that the steering shaft extends 1-3/4" above the turn signal housing, then tighten clamp.

TILT-AWAY STEERING WHEEL COLUMN DISASSEMBLY

The following disassembly procedure is applicable for all Tilt-Wheel steering columns. If the steering column is from a car that has a console, disregard reference to the shift tube and the safety switch.

TURN SIGNAL AND NEUTRAL SAFETY SWITCH REMOVAL

1. Remove the turn signal switch from the mast jacket by removing the two attaching screws and disconnecting the Bowden cable by loosening the cable clamp and removing the gripper washer from the switch pin.

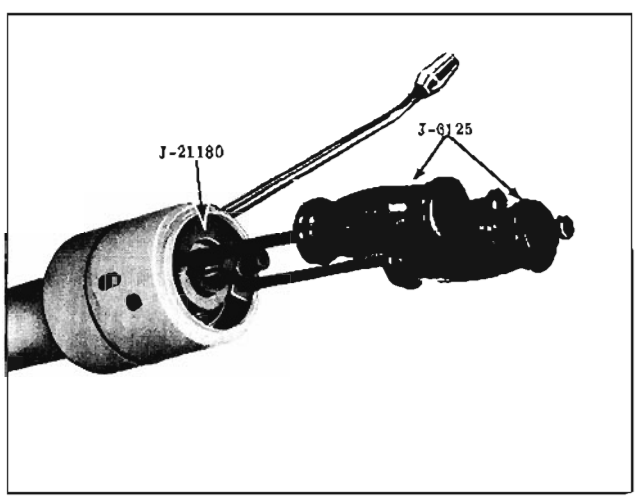


Fig. 8-93 Removing Turn Signal Cover

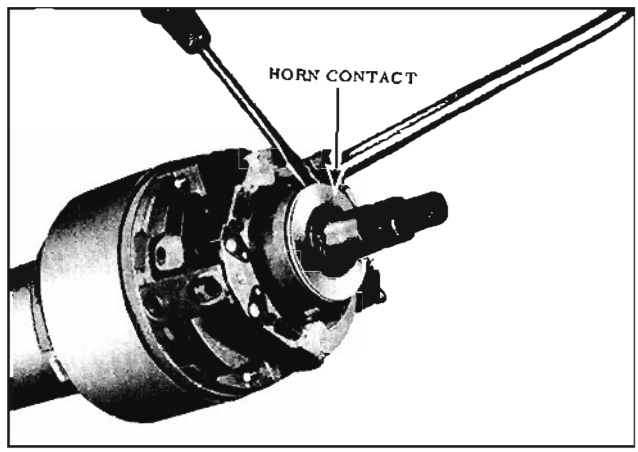


Fig. 8-94 Removing Horn Contact

2. Remove the neutral safety and back-up lamp switch assembly from the mast jacket, then remove the switch lever from the shift tube.

ACTUATOR HOUSING REMOVAL

1. With the column in the centered position, remove the turn signal lever and the tilt lever.

2. Remove the turn signal cover. (Fig. 8-93)

3. Pry out the horn contact assembly from the turn signal actuator housing and remove the contact and wire assembly. (Fig. 8-94)

4. Remove the upper shaft snap ring. (Fig. 8-95)

5. Remove the washer, collapsible spacer, rubber washer, retainer, bearing seat, inner race and steering shaft upper bearing. (Fig. 8-96)

NOTE: The collapsible spacer MUST NOT be re-used.

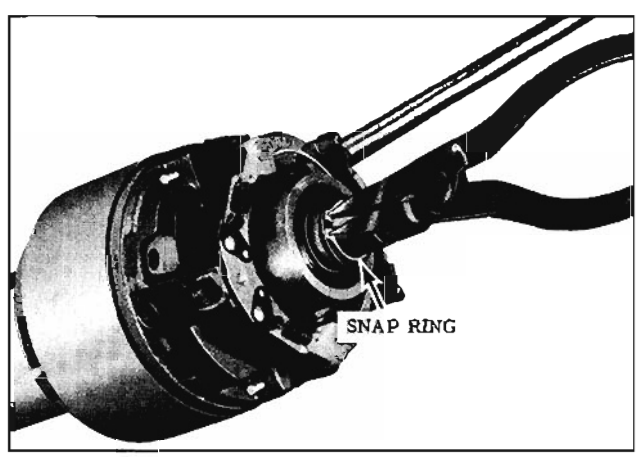


Fig. 8-95 Removing Upper Shaft Retaining Ring

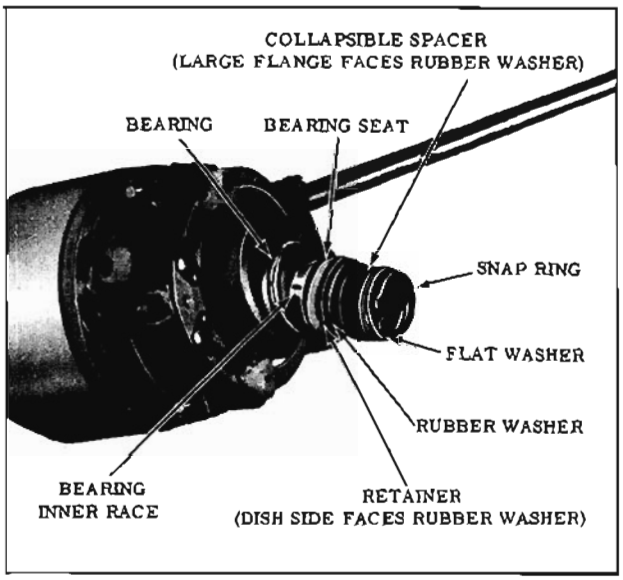


Fig. 8-96 Removing Upper Shaft Parts

6. Remove the turn signal switch detent spring, then pull the actuator yoke from the actuator housing.

7. Install the tilt lever and lift up so the column will go to the full up position, then unhook the upper ends of the two tilt return springs by inserting a small bladed screwdriver through the upper coil and lifting up. (Fig. 8-97) It may be necessary to use another screwdriver to unhook the spring as shown. Installer Tool J-21181 may be required to remove the right hand return spring.

8. Remove the two pivot pins with Tool J-21179. (Fig. 8-98)

   CAUTION: If the screw starts to turn, hold it with a wrench. Do not allow the screw to bottom in the pivot pin or the tool to become cocked on the housing.

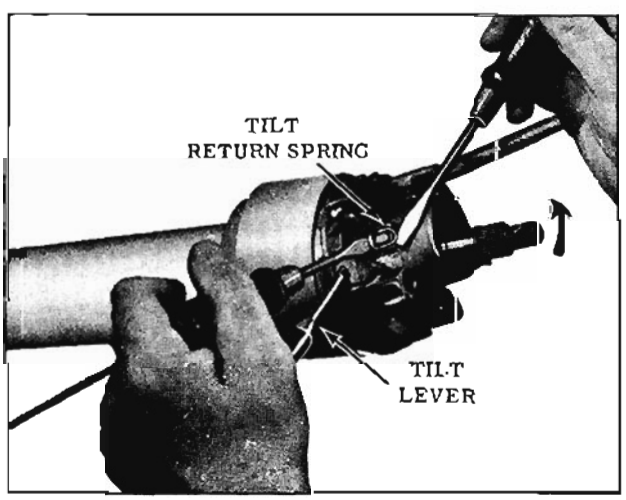


Fig. 8-97 Removing Tilt Return Springs

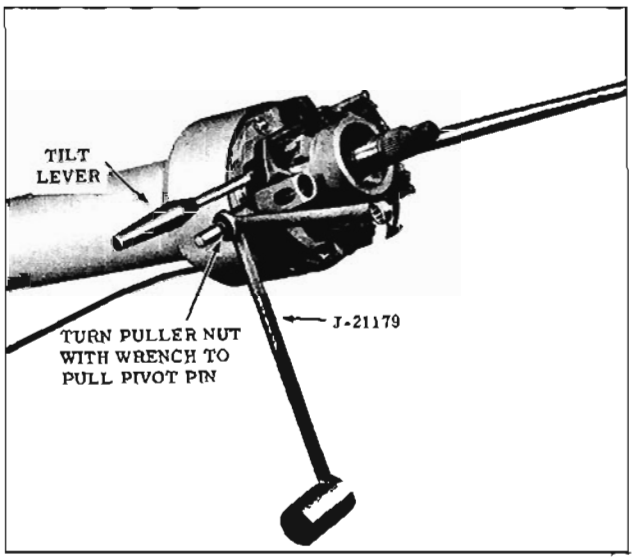


Fig. 8-98 Removing Actuator Housing Pivot Pins

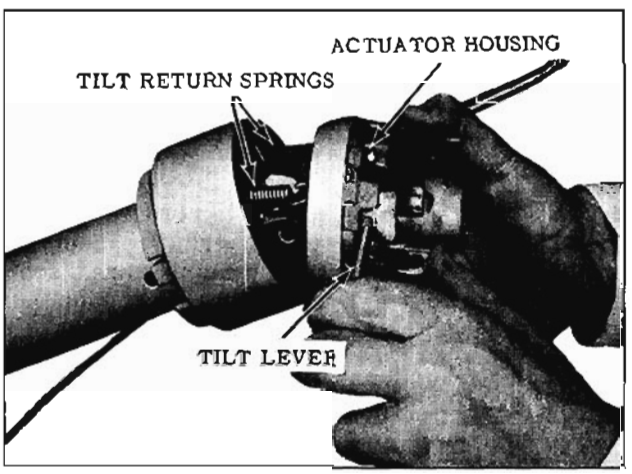


Fig. 8-99 Removing Actuator Housing

9. Slightly lift the tilt lever to disengage the lock shoes from the pins and remove the actuator housing, then remove the tilt return springs and the upper shaft lower bearings. (Fig. 8-99)

ACTUATOR HOUSING DISASSEMBLY

1. Back up the lock shoe pivot pin boss in the actuator housing, with a suitable tool, inboard of the pivot pins. (Fig. 8-100)

2. Drive the upper and lower lock shoe pivot pins from the actuator housing with an 1/8" straight punch.

3. Remove the lock shoes and springs by pushing the upper end of the lock shoe through the openings in the actuator housing. (Fig. 8-101)

4. Remove the turn signal switch control cable from the turn signal bellcrank by removing

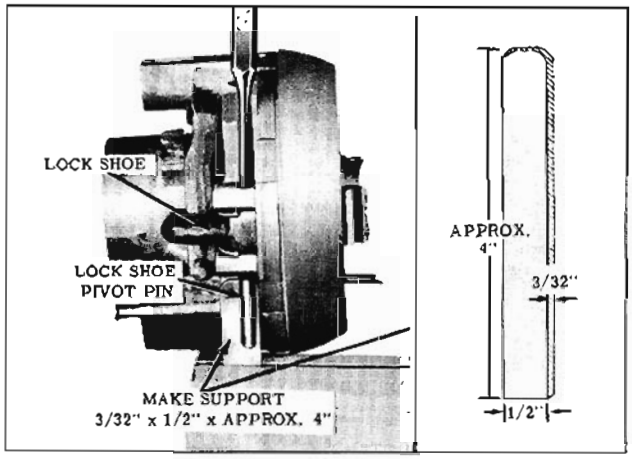


Fig. 8-100 Removing Lock Shoe Pivot Pins

the retaining screw at the top of the housing and disconnecting from the bellcrank. Remove the cable through the top of the actuator housing.

STEERING SHAFT DISASSEMBLY

1. Pull the steering shaft assembly upward and out of the mast jacket. On 30, 31, and 32 series, loosen clamp at lower end of steering slots.

2. Clamp the steering shaft in brass jawed vise.

3. Move the upper shaft fully from center line of lower shaft.

4. Using a narrow bladed screwdriver through the coils of the spring, compress spring enough to remove the upper end from the upper seat. (Fig. 8-102)

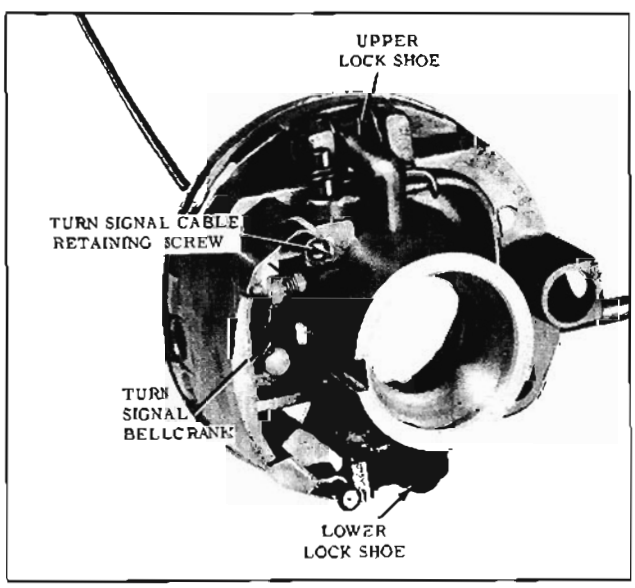


Fig. 8-101 Actuator Housing (Top View)

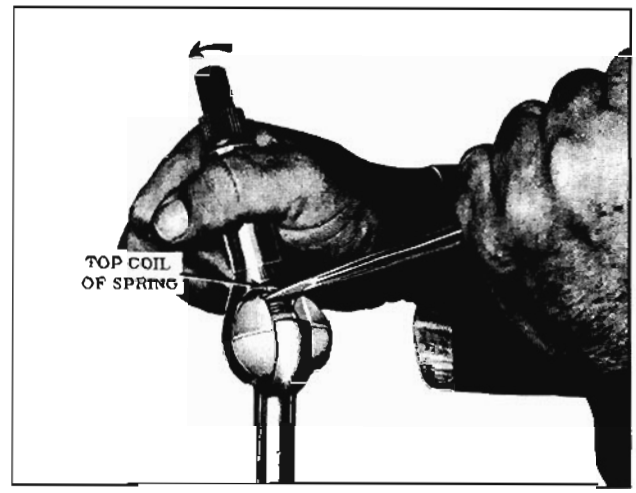


Fig. 8-102 Removing Spherical Joint Spring

5. Move the upper shaft to the opposite side and allow the spring to snap out of the opening between the shaft and the sphere.

6. Remove the spring.

7. Turn the upper shaft 90° from the center line of the lower shaft and remove the upper shaft and sphere from the lower shaft. (Fig. 8-103)

8. Remove the sphere from the upper shaft by rotating so flats on sphere align with socket.

SHIFT TUBE AND SHIFTER BOWL REMOVAL

1. Remove the four support screws, then lift the support from the mast jacket. (Fig. 8-104)

   NOTE: Support may have to be tapped slightly to loosen.

2. Remove the shift tube retainer ring and washer from the top of the shift tube. (Fig. 8-105)

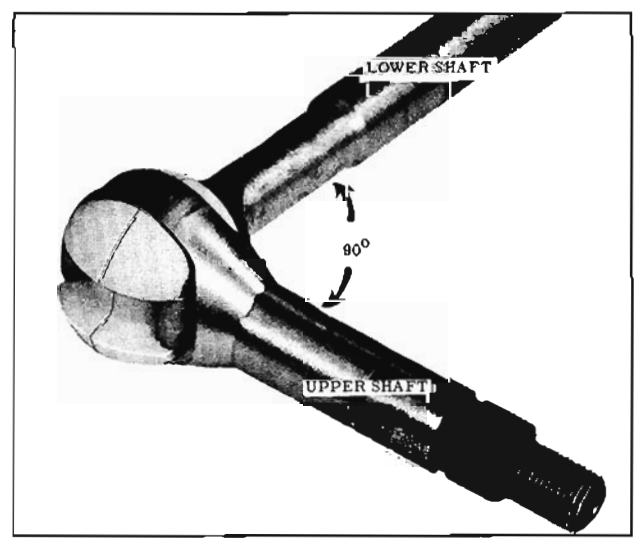


Fig. 8-103 Removing Sphere and Upper Shaft

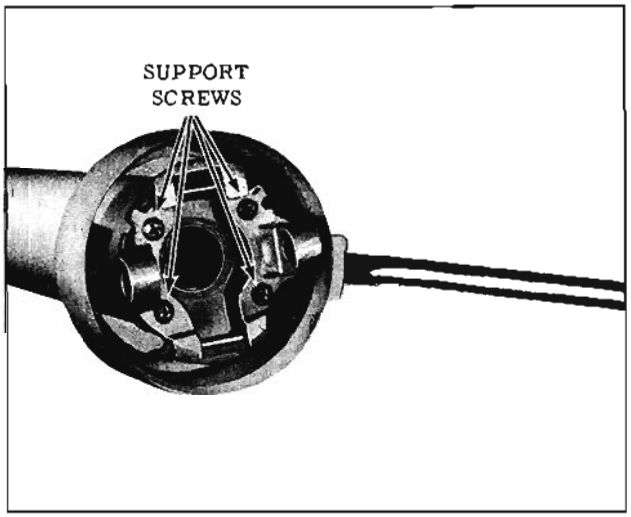


Fig. 8-104 Support Screw Location

3. Remove the shift tube bearing retainer from the lower end of the mast jacket. On the 30, 31 and 32 series, remove the adapter assembly.

4. Remove the shift tube from the lower end of the mast jacket using Tool J-21180 and two Slide Hammers J-6125. (Fig. 8-106) On 30, 31 and 32 series, the shift tube can be removed by tapping the shift lever with a plastic hammer.

5. Remove the lock plate, wave washer and shifter bowl from upper end of the mast jacket. It may be necessary to slide the bowl toward the shift lever to remove the lock plate.

6. Drive the shift lever pivot pin from the bowl.

7. Remove the anti-rattle grommet from the shift lever.

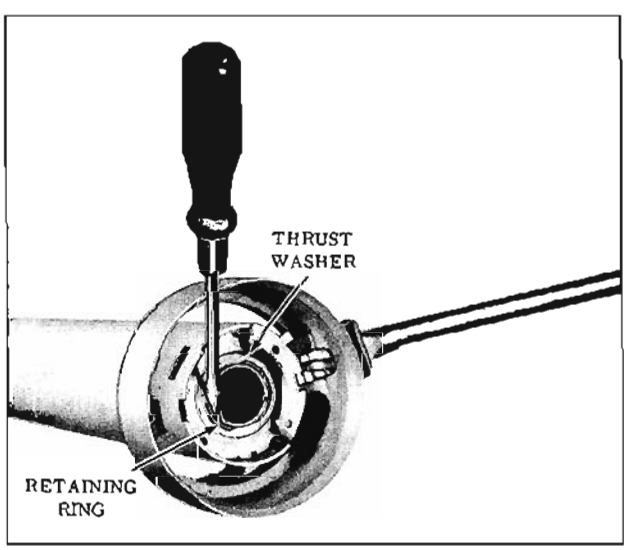


Fig. 8-105 Removing Shift Tube Upper Retaining Ring

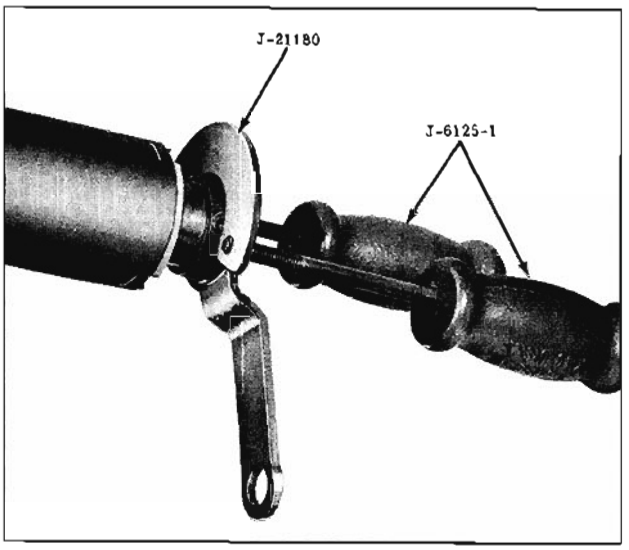


Fig. 8-106 Removing Shift Tube

ASSEMBLY OF TILT-AWAY STEERING COLUMN

When assembling the steering column, APPLY A THIN COAT OF BALL JOINT LUBRICANT, PART NO. 585617, TO ALL FRICTION PARTS.

SHIFT TUBE AND SHIFTER BOWL ASSEMBLY

1. Install the anti-rattle grommet on the shift lever, if removed.

2. Place shift lever spring and lever in bowl, then install the pin.

3. Place the shifter bowl on the mast jacket with the shift lever on the right side of the column.

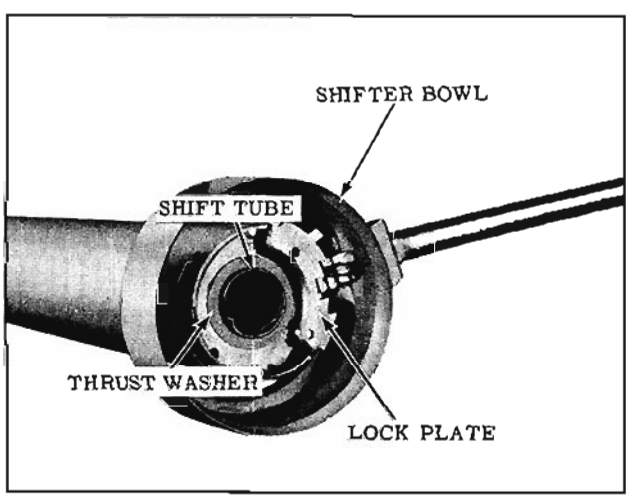


Fig. 8-107 Lock Plate Location

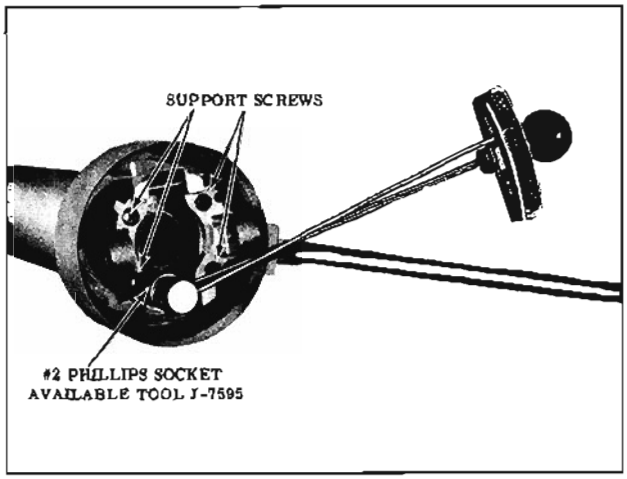


Fig. 8-108 Installing Support Screws

4. Insert the shift tube and felt dust seal assembly into the lower end of the mast jacket. Guide the shift tube into the shifter bowl aligning the key in the bowl with the keyway in the tube. Hold the shifter bowl and tap the lower end of the shift tube until the upper end of the tube is flush with the inner portion of the shifter bowl.

5. Position the lower mast jacket bushing flange against the lower end of the mast jacket, align the slots in the bushing with the holes in the mast jacket and install the retaining ring.

6. Place the wave washer on the lower side of the lock plate, retain with ball joint lubricant, then slide the lock plate into position through the opening in the mast jacket. (Fig. 8-107)

7. Align the lock plate and wave washer with the end of the shift tube, then tap the lower end of the tube to fully seat it in the jacket.

8. Install the thrust washer and retaining ring on the upper end of the shift tube.

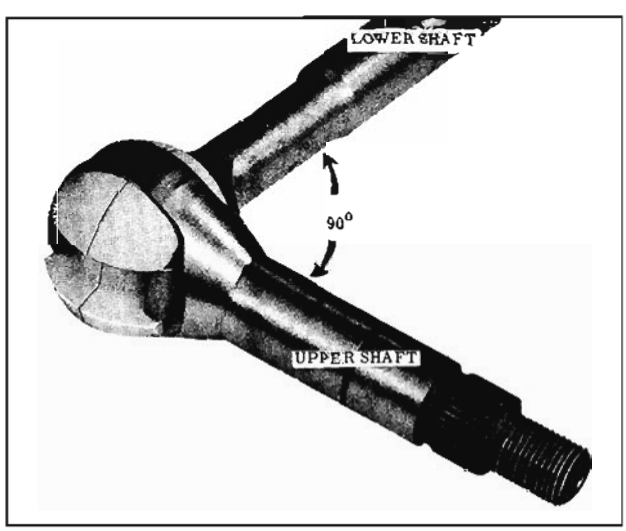


Fig. 8-109 Installing Sphere and Upper Shaft

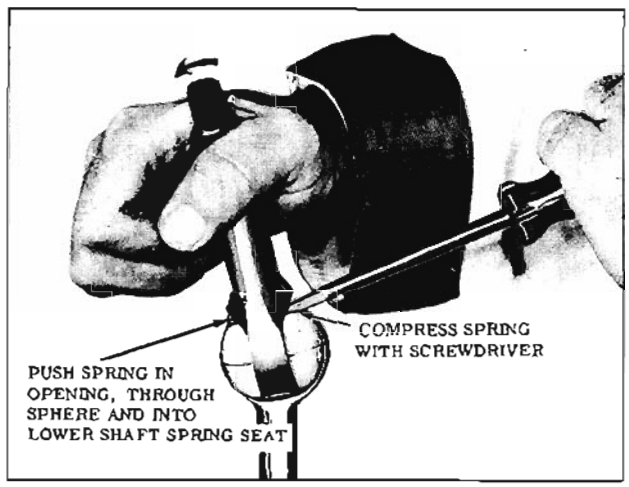


Fig. 8-110 Installing Spherical Joint Spring

9. Install the support on the upper end of the mast jacket with the long leg aligned with the notch in the low side of the lock plate, then install the four attaching support screws. (Fig. 8-108) Torque the two larger (left) screws first, 20 to 25 ft. lbs., then torque the right two screws 20 to 25 ft. lbs. using a No. 2 Phillips Socket, J-7595.

STEERING SHAFT ASSEMBLY

1. Lubricate the grooves of the centering sphere with ball joint lubricant, Part No. 585617, then place the sphere in the upper shaft socket.

2. Turn the sphere so the lower shaft can be installed over the flat area of the sphere (Fig. 8-109) approximately 90° from center line of lower shaft, then, install lower shaft socket over the sphere and straighten the shaft.

3. Install the pre-load spring through the centering sphere and into the spring seat in the lower shaft. Compress the spring into the opening between the sphere and the upper shaft, then move upper shaft to hold spring. With a screwdriver, inserted through the coils from the opposite side of the shaft, compress the spring so the upper end will snap into the spring seat in the upper shaft. (Fig. 8-110)

4. Install the steering shaft assembly into the mast jacket from the upper end.

5. Install the steering shaft felt seal on lower end of steering shaft. On 30, 31 and 32 series, install the adapter assembly.

ACTUATOR HOUSING ASSEMBLY

1. Install the lock shoe return springs on the upper and lower lock shoes as follows:

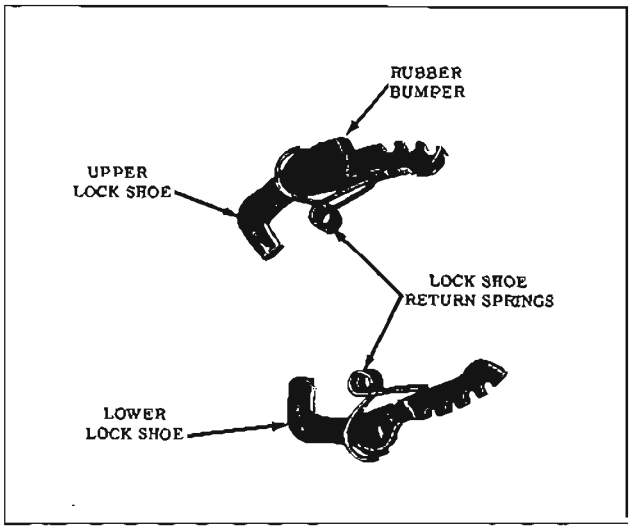


Fig. 8-111 Lock Shoes and Spring

NOTE: The upper lock shoe has three notches and a rubber bumper, whereas, the lower shoe has four notches. (Fig. 8-111)

a. Place the actuator housing on the bench with the lower side up and the turn signal and tilt lever openings on the right side. (Fig. 8-112)

b. Install the upper shoe in the upper opening of the housing by pushing on the rubber bumper and the end of the shoe.

c. Turn the housing around and insert the lower shoe as in Step "B".

d. Install the pivot pins in the actuator and through the lock shoes making certain that the pins are centered.

2. From the top of the actuator housing, install the turn signal switch control cable on the plastic bellcrank with the cable loops facing toward the center of the actuator, then install the cable bracket screw.

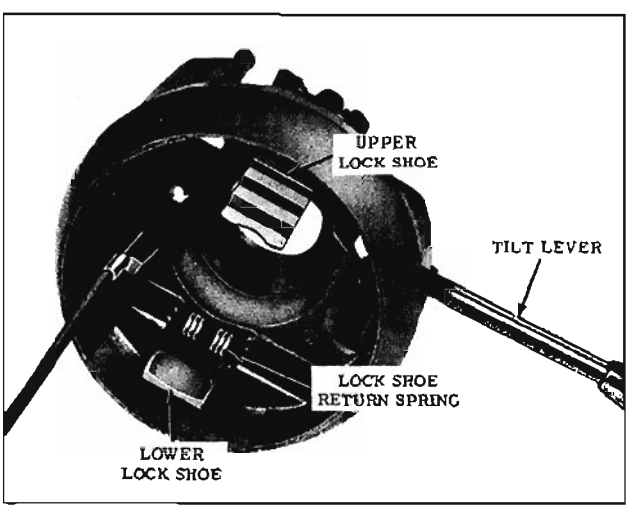


Fig. 8-112 Actuator Housing (Bottom View)

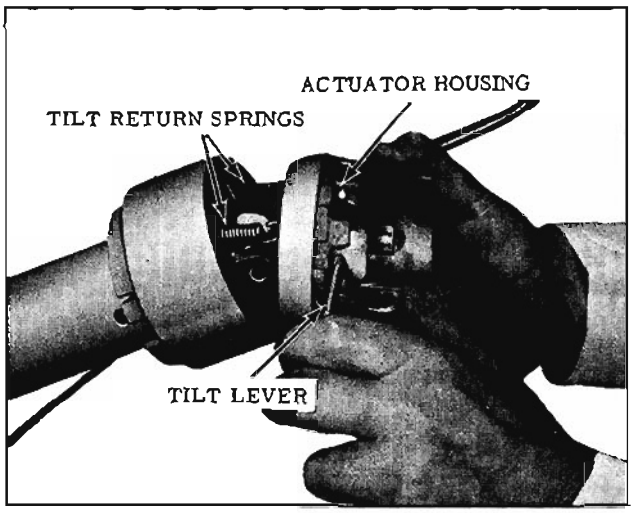


Fig. 8-113 Installing Actuator Housing

3. Install the horn contact wire through the keyway in the actuator housing. Do not install the contact at this time.

4. Install upper shaft lower bearing with rollers down.

5. Install the lower ends of the two return springs on the support spring anchors.

NOTE: The loops on the upper ends of the springs must have the opening toward the top of the column. (Fig. 8-113)

6. Install the tilt lever in the actuator.

ACTUATOR HOUSING INSTALLATION

1. Raise the tilt lever up slightly to prevent the lock shoes from engaging the pins, then

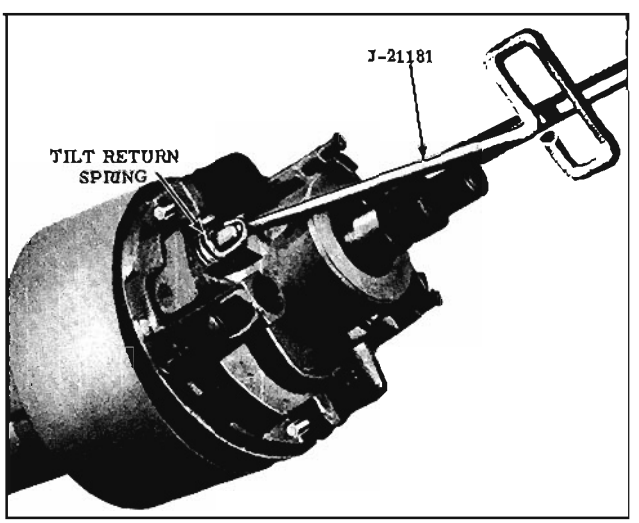


Fig. 8-114 Installing Tilt Return Springs

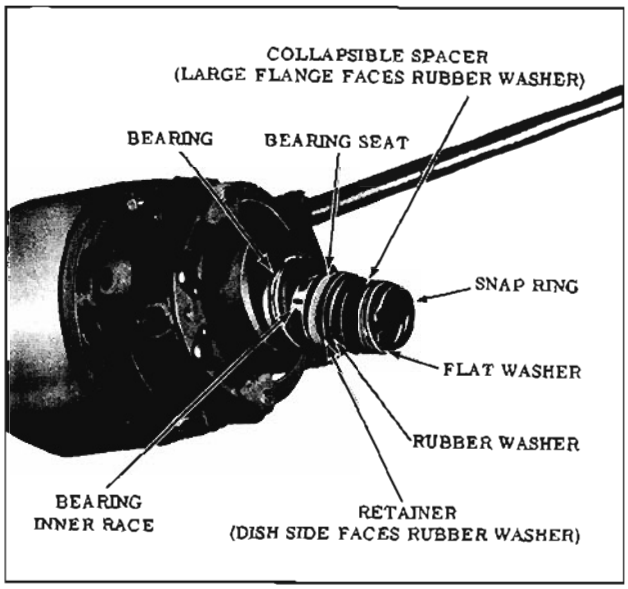


Fig. 8-115 Installing Upper Shaft Parts

install the actuator assembly over the steering shaft while guiding the turn signal cable and horn wire through the shift bowl. (Fig. 8-113)

2. Align the actuator assembly pivot pin holes with the holes in the support assembly, then install the pivot pins using a brass drift to fully seat the pins. Steering shaft may have to be slightly raised to have lock shoes clear socket.

3. Raise the tilt lever and lift the upper steering column to the full up position.

4. Install the upper ends of the two tilt return springs with Tool J-21181. (Fig 8-114)

5. Install the turn signal actuator yoke assembly making sure that the ball socket engages the bellcrank ball, then install the detent spring.

6. Install the upper bearing (roller facing up), bearing inner race, bearing seat (flanged portion up, retainer (dish facing up), rubber washer, a new collapsible spacer and washer. (Fig. 8-115)

   NOTE: When installing these parts on the shaft, make sure that they do not hang up on the snap ring groove.

7. Install the snap ring over the steering shaft and against the collapsible spacer, then place Tool J-21179 over the steering shaft with the window in line with the snap ring opening. (Fig. 8-116)

8. Install the steering wheel nut and turn down until the upper edge of the window (cut out) in Tool J-21179 is in line with the upper edge

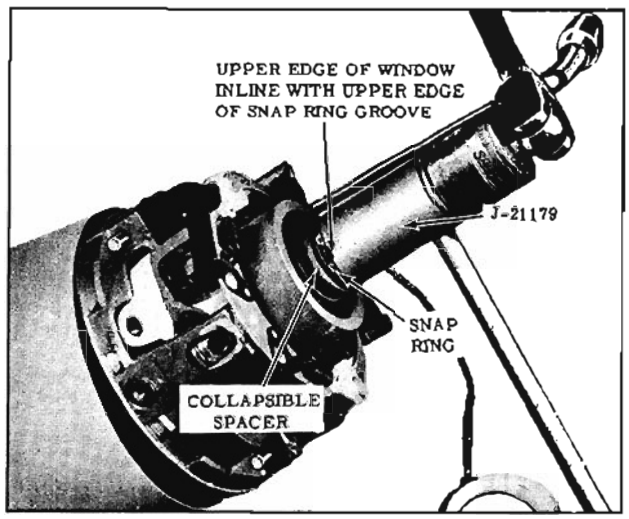


Fig. 8-116 Installing Upper Shaft Snap Ring

of the snap ring groove. This will compress the spacer and pre-load the upper shaft bearings.

9. Remove the steering wheel nut and Tool J-21179 making sure the snap ring seats in the groove.

CHECKING THE STEERING SHAFT TORQUE

1. Install the steering wheel nut on the upper shaft.

2. Check the torque of the steering shaft by installing a 3/4" 12-point socket and using an in. lb. torque wrench. (Fig. 8-117) The shaft should rotate with the column in the full up position and the full down position with a

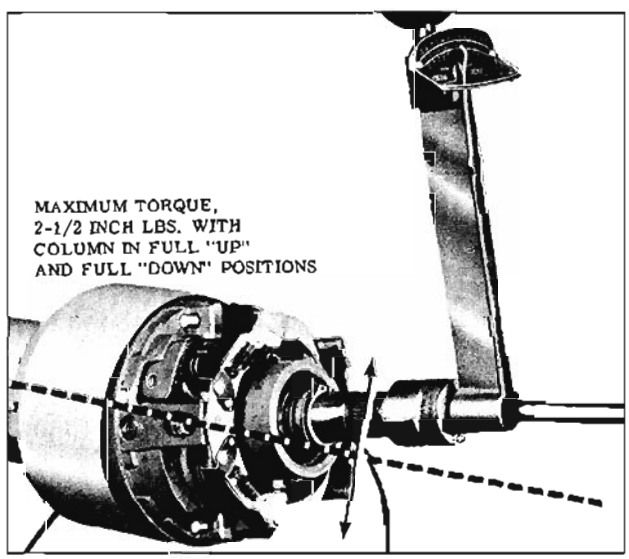


Fig. 8-117 Checking Steering Shaft Torque

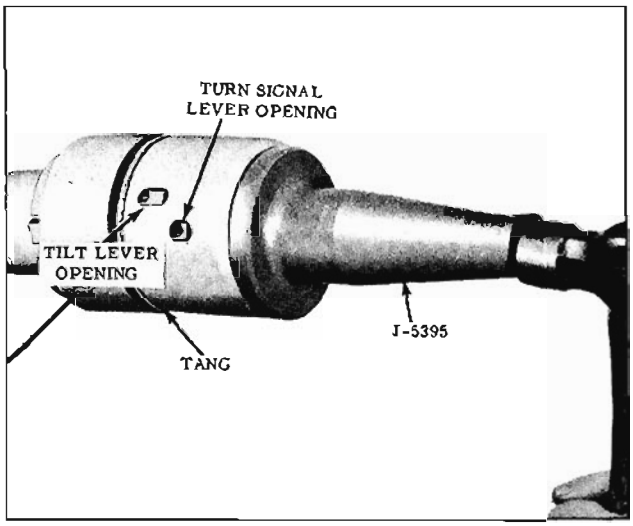


Fig. 8-118 Installing Turn Signal Cover

maximum reading of 2-1/2 in. lbs. If the torque reading is greater than 2-1/2 in. lbs., it will be necessary to install a new collapsible spacer.

3. Remove the steering wheel nut.

HORN CONTACT AND TURN SIGNAL COVER

1. Install the horn contact in the actuator housing.

2. Move the column to the centered position, then remove the tilt lever.

3. Install the turn signal cover with Tool J-5395, pinion seal installer, aligning the openings for the tilt and turn signal levers, and with the small tang on the lower edge of the cover in line with the groove in the actuator housing. (Fig. 8-118)

4. Install the tilt and turn signal levers.

TURN SIGNAL SWITCH INSTALLATION AND ADJUSTMENT

1. Check to see that the turn signal lever is in the neutral position.

2. Place the loop of the control cable through the cable clamp and over the switch pin.

3. Center the switch pin, install a .060" pin in the switch carrier, then tighten the control cable clamp Remove pin.

4. Install the gripper washer on the switch pin.

5. Move the steering wheel to the full down position.

6. Position the switch on the column and secure with the two screws leaving a minimum amount of slack in the control cable.

NEUTRAL SAFETY SWITCH AND BACK-UP LIGHT SWITCH

Install and adjust as outlined in the ELECTRICAL section.

DIAGNOSIS GUIDE FOR TILT-AWAY STEERING WHEEL

TURN SIGNAL NOT CANCELLING FROM EITHER TURN POSITION	
CAUSE	**CORRECTION**
Turn signal cancelling pin incorrect distance from centerline of steering shaft: 1 (Fig. 8-119)	Bend pin outward to 1-1/32" from centerline of steering shaft.
Turn signal cancelling pin not pressed in to correct dimension: 1 (Fig. 8-119)	Press pin to 1" from hub of wheel to end of pin.

DIAGNOSIS GUIDE (Cont'd.)

TURN SIGNAL MALFUNCTIONS	
CAUSE	**CORRECTION**
Clamps at either end of Bowden cable are loose or pulled off. 2 (Fig. 8-119)	Install new Bowden cable.
Bowden cable wire loops are uncoiled. 2 (Fig. 8-119)	Install new Bowden cable.
Override spring on actuator yoke is bent, allowing plastic trigger to pass over top and possibly bind on the spring. 3 (Fig. 8-119)	Install new yoke assembly.
Trigger spring is broken or unattached. 4 (Fig. 8-119)	Install new trigger spring or attach trigger spring.
Channel stamping on underside of yoke is not engaging ball end of bellcrank. 5 (Fig. 8-119)	Engage ball by lifting yoke and repositioning.
Detent spring deformed to a point where switch will not remain indexed. 6 (Fig. 8-119)	Install new detent spring.
Turn signal binds, preventing cancellation. Caused by wire ring on yoke pilot being installed with open ends out of position. 7 (Fig. 8-119)	Reinstall with open ends in hole for the signal switch lever.
Dimples in actuator yoke improperly formed (not large enough) allowing the override spring to pivot out of position. 8 (Fig. 8-119)	Replace yoke.
Mounting legs are bent on column signal switch. 9 (Fig. 8-119)	Install new signal switch.
Failure of switch to index in RT position only. Bowden cable mounted incorrectly in the actuator casting. 10 (Fig. 8-119)	Remove cable from upper plastic lever and install with coils inward toward base of post.

TURN SIGNAL NOT OPERATING IN SOME OF THE TILT POSITIONS	
CAUSE	**CORRECTION**
Turn signal switch is mounted incorrectly on jacket. 11 in (Fig. 8-119)	Readjust signal switch to correct location.

DIAGNOSIS GUIDE (Cont'd.)

TURN SIGNAL NOT OPERATING IN SOME OF THE TILT POSITIONS (Cont'd.)	
CAUSE	**CORRECTION**
Centerline distance from flag clamp to Bowden wire loop is incorrect (first type cable). 12 in (Fig. 8-119)	Install new Bowden cable.

HORN SHORTING	
CAUSE	**CORRECTION**
Terminal strap contacting actuator casting because it is not centered in slot of actuator. Horn wire terminal not seated in its pocket in the actuator casting allowing the turn signal cancelling pin to contact, short or damage the terminal. 13 in (Fig. 8-119)	Install new horn cable and insulator assembly, making certain that the terminal is centered and seated in the casting pocket.
Horn cable brittle from too high paint baking temperature, causing insulation fractures. 14 in (Fig. 8-119)	Install new horn cable.
Excessive solder on horn cable assembly. 15 in (Fig. 8-119)	Install new horn cable assembly or file off excessive solder.
Turn signal cancelling pin incorrect distance from centerline of steering shaft. 1 in (Fig. 8-119)	Bend pin outward to 1-1/32" from centerline of steering shaft.

TURN SIGNAL ACTUATOR SCRAPING ON BOWL	
CAUSE	**CORRECTION**
End of jacket not square with centerline, shroud portion of bowl is not concentric with hub or lockplate tab holes in jacket are improper width. 16 in (Fig. 8-119)	Replace parts with jacket, lockplate and bowl.

STEERING WHEEL LOOSE	
CAUSE	**CORRECTION**
Flange on bearing seat is rolled over and washer retainer is cupped. 17 in (Fig. 8-119)	Install new seat, retainer and collapsible spacer.

DIAGNOSIS GUIDE (Cont'd.)

STEERING WHEEL LOOSE (Cont'd.)	
CAUSE	**CORRECTION**
Excessive clearance between pivot pin and holes in support. 18 in (Fig. 8-119)	Replace support and pivot pins.
Collapsible spacer retainer (snap ring) is unseated. 19 in (Fig. 8-119)	Replace collapsible spacer and retainer.
STEERING WHEEL LOOSE EVERY OTHER TILT POSITION	
CAUSE	**CORRECTION**
If looseness prevails in 15° and 5° above center and 5° and 15° below, the lower shoe is faulty. At 10° above, 10° below and on center, the upper shoe is faulty. 20 in (Fig. 8-119)	Install new shoe pivot pin and shoe indicated.
STEERING WHEEL NOT LOCKING IN EVERY OTHER TILT POSITION	
CAUSE	**CORRECTION**
Fault lies with shoes as above. The shoe may have seized on its pivot pin or weld flash is between the shoe and the support. 21 in (Fig. 8-119)	Install new shoe pivot pin and shoe, remove grease from support and shoe (weld flash is embedded in grease) and re-grease.
STEERING WHEEL FAILS TO RETURN FREELY TO TOP TILT POSITION	
CAUSE	**CORRECTION**
Pivot pins are bound up. 22 in (Fig. 8-119)	Remove pivot pins and check holes for burrs. Install new pivot pins.
Wheel tilt springs are defective. 23 in (Fig. 8-119)	Install new springs.
NOISE WHEN STEERING WHEEL RETURNS TO TOP TILT POSITION	
CAUSE	**CORRECTION**
Tilt wheel stop bumper on upper shoe has failed. 24 in (Fig. 8-119)	Install new upper shoe assembly.

DIAGNOSIS GUIDE (Cont'd.)

POOR RETURNABILITY OF STEERING WHEEL	
CAUSE	**CORRECTION**
Deformed felt seal between steering shaft and jacket in floor shift cars. Deformed felt seal between steering shaft and shift tube and/or between shift tube and jacket in columns with gearshift. 25 in (Fig. 8-119)	Disassemble and install new seal.
Too much bearing pre-load. 26 in (Fig. 8-119)	Replace and adjust load.
GEARSHIFT LEVER FAILS TO INDEX TRANSMISSION	
CAUSE	**CORRECTION**
The weld of the lower gearshift lever to the shift tube has failed. 27 in (Fig. 8-119)	Install new shift tube assembly.
Key for shift tube sheared off shift bowl. 28 in (Fig. 8-119)	Replace shift bowl.
HIGH EFFORT IN GEARSHIFT MECHANISM	
CAUSE	**CORRECTION**
Undersize ID on lockplate. 29 in (Fig. 8-119)	Install new lockplate.
NOISE IN GEARSHIFT MECHANISM	
CAUSE	**CORRECTION**
Oversize lockplate ID. 29 in (Fig. 8-119)	Install new lockplate.
Key for shift tube sheared off shift bowl. 28 in (Fig. 8-119)	Install new shift bowl.
Wave washer damaged or omitted. 30 in (Fig. 8-119)	Install new wave washer.
Bowl driven too far on shift tube. 31 in (Fig. 8-119)	Install new shift tube.

DIAGNOSIS GUIDE (Cont'd.)

NOISE IN STEERING SHAFT

CAUSE	CORRECTION
Column improperly aligned when installed in car (steering shaft must be mounted in the center of shift tube). 32 in (Fig. 8-119)	Relocate toe pan cover on floor board, aligning steering shaft properly.
Torque flange bolt 25 to 35 ft. lbs.	Flexible coupling flange not tightened on steering shaft. 33 in (Fig. 8-119)

DUST ENTERING THROUGH COLUMN

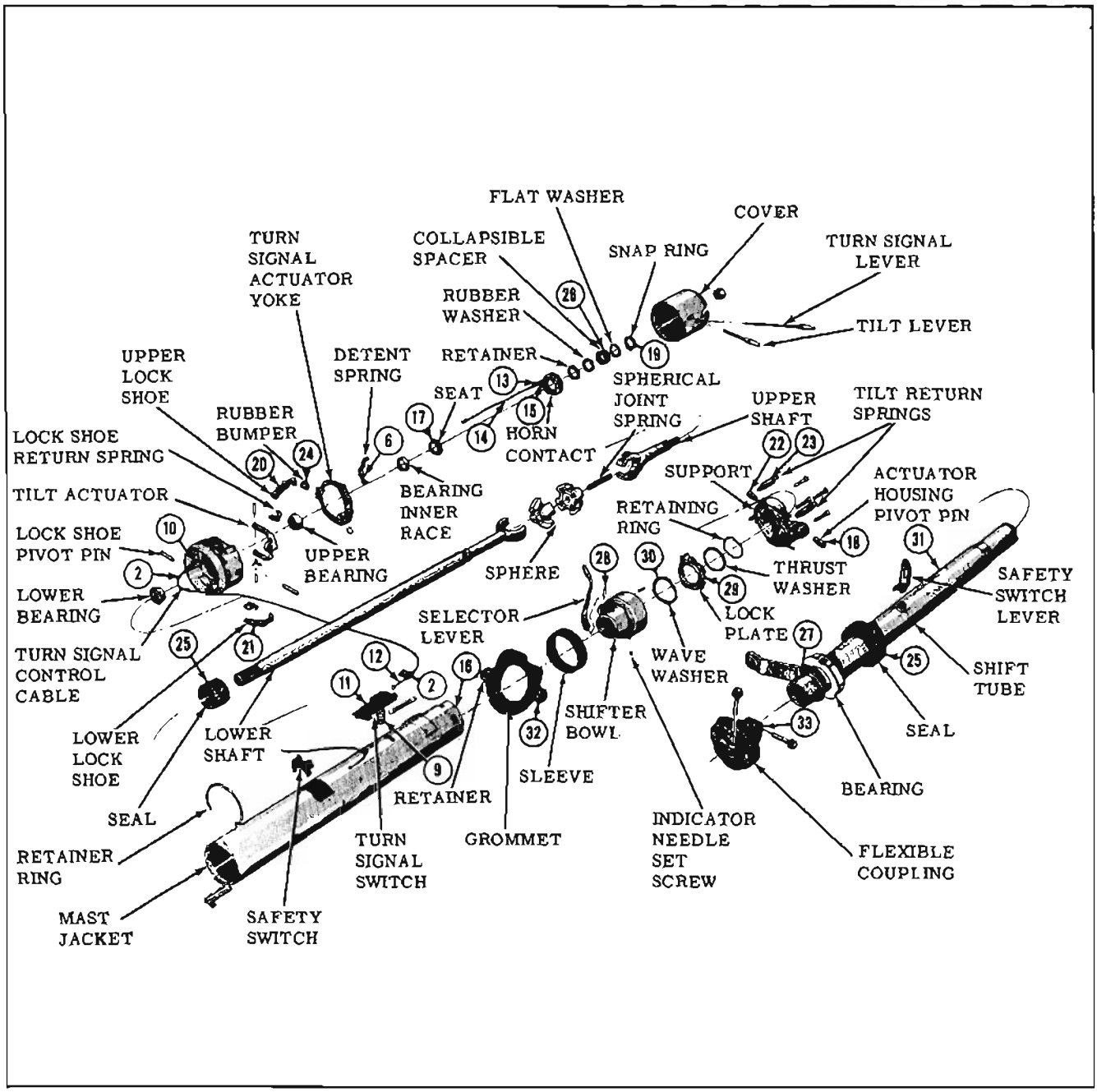
CAUSE	CORRECTION
Felt seals between steering shaft and jacket and/or shift tube are deformed or out of position. 25 in (Fig. 8-119)	Install new seals.

DIAGNOSIS OF MANUAL AND POWER STEERING

NOTE: Items identified by (M.S.) apply to manual steering only and items identified by (P.S.) apply to power steering only. All items not identified by (M.S.) or (P.S.) apply to both units.

HARD STEERING WHILE DRIVING OR POOR RETURN OF STEERING TO CENTER

CAUSE	CORRECTION
1. Tight steering shaft bearings.	1. Replace bearings.
2. Lower coupling flange rubbing against adjuster plug. (P.S.)	2. Loosen bolt and reposition for clearance.
3. Steering wheel rubbing against turn signa. collar.	3. Adjust mast jacket endwise.
4. Tires not properly inflated	4. Inflate to specifications.
5. Steering linkage tie-rod joints misaligned.	5. Loosen tie-rod sleeve and center ball joint.
6. Steering gear misaligned.	6. Align at frame.
7. Tight over-center adjustment.	7. Adjust in car to specifications.
8. Thrust bearing adjustment too tight.	8. Adjust to specifications.
9. Ball preload too tight. (P.S.)	9. Remove gear and change ball size as required.
10. Sticky spool valve. (P.S.)	10. Remove and clean valve or replace valve assembly.
11. Sticking pump flow control valve. (P.S.)	11. Remove valve and clean.



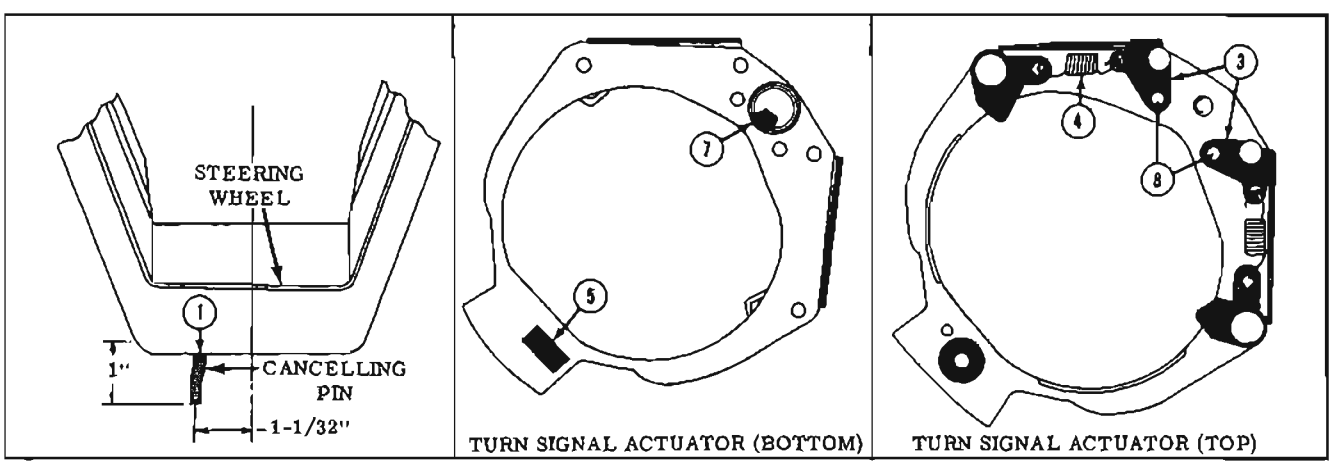


Fig. 8-119 Tilt-Wheel Diagnosis

DIAGNOSIS OF MANUAL AND POWER STEERING (Cont'd.)

CAR LEADS TO ONE SIDE OR THE OTHER

CAUSE	CORRECTION
1. Front end misaligned.	1. Adjust to specifications.
2. Worn or damaged valve shaft assembly. (P.S.) NOTE: If this is the cause, steering effort will be very light in direction of lead and heavy in opposite direction.	2. Replace valve and shaft assembly.

MOMENTARY INCREASE IN EFFORT WHEN TURNING WHEEL FAST TO THE RIGHT OR LEFT (P.S.)

CAUSE	CORRECTION
1. Low oil level in pump.	1. Check oil level in pump reservoir.
2. Pump belt slipping.	2. Tighten or replace belt.
3. Excessive internal leakage.	3. Replace rack-piston teflon seal and "O" ring and/or replace spool valve.

EXTERNAL OIL LEAKS (WIPE GEAR THOROUGHLY AND MAKE SURE SOURCE OF LEAKAGE IS DETERMINED)

CAUSE	CORRECTION
1. Loose hose connections. (P.S.)	1. Tighten.
2. Damaged hose. (P.S.)	2. Replace.
3. Side cover "O" ring seal. (P.S.)	3. Replace seal.
4. Pitman shaft seals.	4. Replace seals.
5. Housing end cover "O" ring seal. (P.S.)	5. Replace seal.
6. Adjuster plug seals. (P.S.)	6. Replace seals.
7. Torsion bar seal. (P.S.)	7. Replace valve and shaft assembly.

GEAR NOISE (RATTLE, CREAK OR CHUCKING)

CAUSE	CORRECTION
1. Loose over-center adjustment. NOTE: A slight rattle may occur on turns because of the increased lash off the "high point". This is normal and the lash must not be reduced below the specified limits to eliminate this slight rattle.	1. Adjust to specification.

DIAGNOSIS OF MANUAL AND POWER STEERING (Cont'd.)

GEAR NOISE (RATTLE, CREAK OR CHUCKING) (Cont'd.)

CAUSE	CORRECTION
2. Gear loose on frame.	2. Check gear to frame mounting bolts. Tighten bolts to specification.
3. Lack of lubricant at gear contact points.	3. Lubricate gear box to frame contact points.

GEAR NOISE ("HISSING" SOUND) (P.S.)

There is some noise in all power steering systems. One of the most common is a "hissing" sound most evident at standstill parking. There is no relationship between the noise and performance of the gear. "Hiss" may be expected when steering wheel is at end of travel or when slowly turning at standstill.	Do not replace valve and shaft assembly unless "hiss" is extremely objectionable. Slight "hissing" is satisfactory and in no way effects steering. A replacement valve and shaft assembly may also exhibit slight noise and is not always a cure for the objection. Check clearance around safety drive bolts in flexible coupling. Be sure steering shaft and gear are aligned so the flexible coupling rotates in a flat plane and is not distorted as shaft rotates. Any metal to metal contact through the flexible coupling will transmit the valve "hiss" into the car.

EXCESSIVE WHEEL KICK-BACK OR LOOSE STEERING

CAUSE	CORRECTION
1. Lash in steering linkage.	1. Replace parts affected.
2. Air in system. (P.S.)	2. Add oil to pump reservoir.
3. Excessive lash between pitman shaft and rack-piston.	3. Make over-center adjustment.
4. Loose thrust bearing adjustment.	4. Adjust to specification.
5. Ball and worn pre-load incorrect. (P.S.)	5. Remove rack-piston and worm, and change balls to obtain specified pre-load.

STEERING WHEEL SURGES OR JERKS WHEN TURNING ENGINE RUNNING, ESPECIALLY DURING PARKING (P.S.)

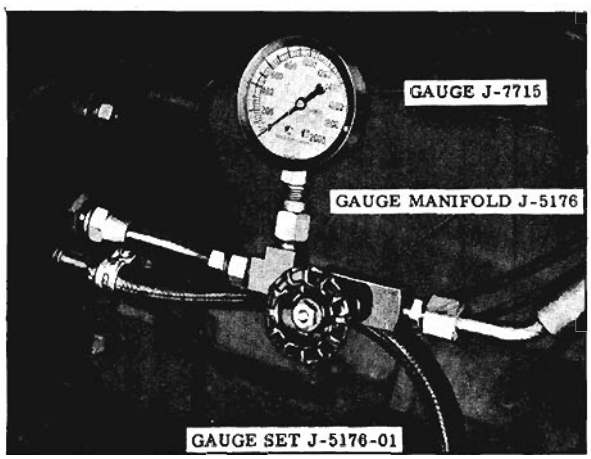
CAUSE	CORRECTION
Loose pump belt.	Adjust to specification.

HARD STEERING WHEN PARKING

CAUSE	CORRECTION
1. Loose pump belt. (P.S.)	1. Adjust to specification.

DIAGNOSIS OF MANUAL AND POWER STEERING (Cont'd.)

HARD STEERING WHEN PARKING (Cont'd.)

CAUSE	CORRECTION
2. Low oil in reservoir. (P.S.)	2. Fill to proper level. If excessively low, check all lines and joints for evidence of external leakage.
3. Lack of lubricant in ball joints or steering linkage.	3. Add lubricant.
4. Tires not properly inflated.	4. Inflate to recommended pressure.
5. Insufficient oil pressure. (P.S.)	5. If all of the above checks do not reveal the cause of hard steering, make the following tests of oil pressure.
 Fig. 8-120 Oil Pressure Gauge	a. Disconnect the pressure line at pump, then install Gauge Set J-5176-01. (Fig. 8-120) b. With engine at slow idle and gauge valve open, note the oil pressure on the gauge while turning steering wheel from one extreme position to the other. Especially note the maximum pressure which can be built up with the wheel held in either right or left extreme position. CAUTION: Do not hold wheel in extreme position for an extended period of time because it will drastically increase the oil temperature and will cause undue wear on the pump. c. With oil temperature between 150° F. and 170° F. (measured with a thermometer in the reservoir) oil pressure should not be less than 1,000 psi for satisfactory power steering operation. (Fig. 8-120) d. If the maximum oil pressure is less than 1,100 psi, it indicates trouble in the pump, hoses, steering gear, or a combination of these parts. To eliminate the hoses and gear, close the gauge valve and quickly test pressure of the pump only with the engine at slow idle, then open the valve to avoid increasing oil temperature. e. Comparing the maximum pressure obtained in these two tests will indicate source of trouble as follows: (1) First test (step b) pressure low, and second test (step d) pressure normal - indicates faulty hoses or steering gear.

DIAGNOSIS OF MANUAL AND POWER STEERING (Cont'd.)

HARD STEERING WHEN PARKING (Cont'd.)

CAUSE	CORRECTION
	(2) First test (step b) and second test (step d) pressure equally low - indicates faulty oil pump.
6. Low oil pressure due to restriction in hose. (P.S.)	6. Clean or replace as required.
7. Low oil pressure due to steering gear. (P.S.)	7. Remove steering gear for disassembly.
a. Pressure loss in cylinder due to worn rack-piston seal, damaged "O" ring or scored housing bore.	a. Inspect rack-piston seal and "O" ring and housing bore.
b. Leakage at valve rings, valve body to worm seal.	b. Replace rings and seals.
c. Loose fit of spool in valve body or leaky valve body.	c. Replace valve and shaft assembly.

VALVE "SQUAWK" WHEN TURNING OR WHEN RECOVERING FROM A TURN (P.S.)

CAUSE	CORRECTION
1. Cut or worn dampener "O" ring on spool valve.	1. Replace dampener ring.
2. Loose or worn valve.	2. Replace valve and shaft assembly.

NO EFFORT REQUIRED TO TURN (P.S.)

CAUSE	CORRECTION
Broken torsion bar.	Replace valve and shaft assembly.

PUMP NOISE

CAUSE	CORRECTION
1. Loose belt.	1. Tighten belt.
2. Hose(s) touching other parts of car.	2. Adjust hose position.
3. Low oil level.	3. Fill reservoir.
4. Air in the oil.	4. Check oil level.
5. Excessive back pressure caused by hoses or steering gear.	5. Locate restriction and correct.
6. Scored pressure plate.	6. Lap away light scoring. Replace heavily scored part.
7. Vanes not installed properly.	7. Install properly.

DIAGNOSIS OF MANUAL AND POWER STEERING (Cont'd.)

PUMP NOISE (Cont'd.)

CAUSE	CORRECTION
8. Vanes sticking in rotor slots.	8. Free up by removing burrs or dirt.
9. Extreme wear of pump ring.	9. Replace part.
10. Face of thrust plate scored.	10. Lap away light scoring. Replace heavily scored part.
11. Scored rotor.	11. Lap away light scoring. Replace heavily scored part.

INOPERATIVE, POOR, OR NO ASSIST: (PUMP ASSEMBLY)

CAUSE	CORRECTION
1. Loose drive belt.	1. Tighten belt.
2. Low oil level.	2. Fill reservoir.
3. Air in the oil.	3. Add oil to pump reservoir.
4. Flow control valve stuck.	4. Remove burrs or dirt.
5. Vanes sticking in rotor slots.	5. Free up by removing burrs or dirt.
6. Faulty flow control valve assembly.	6. Clean and free up parts. Replace part(s) as necessary.

GENERAL SPECIFICATIONS

MANUAL STEERING
- RATIO 24:1
- LUBRICANT . . . . . SAE 80 Multi-Purpose Gear Lubricant
- ADJUSTMENTS
  1. Worm Bearing Pre-load . . . . . 4 to 7 in. lbs.
  2. Over-Center Adjustment . . . . . 4 to 10 in. lbs. in excess of worm bearing pre-load (14 in. lbs. Max.)
  3. Pitman Shaft Adjusting Screw End Clearance. . . . . .002" Max.

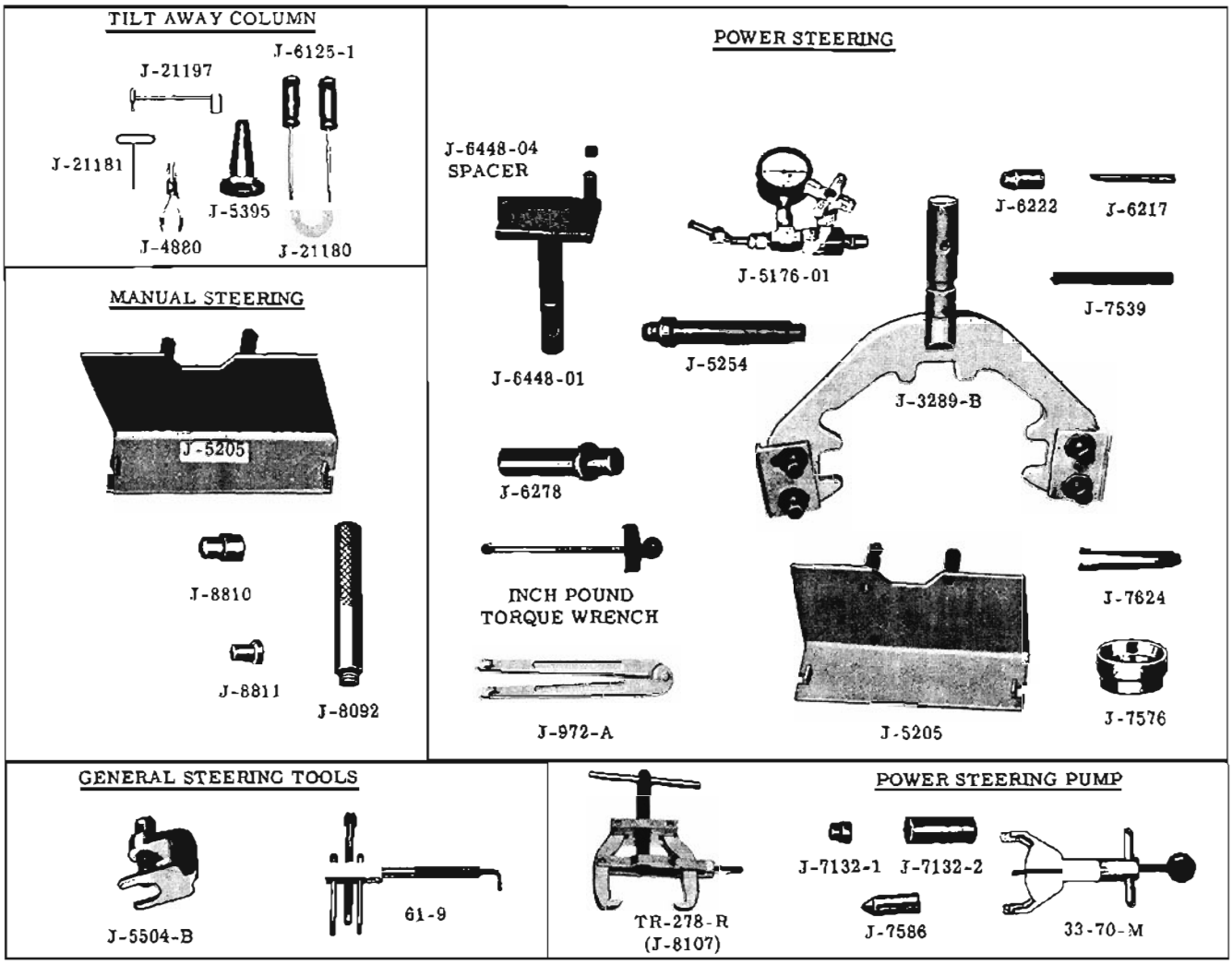
POWER STEERING
- RATIO 17.5:1
- LUBRICATION
  4. Lubricant . . . . . Power Steering Fluid Part No. 1099021
  5. Capacity - Complete System. . . . . 1-3/4 Qts.
  6. Capacity - Pump Only . . . . . 1 Qt.
- ADJUSTMENTS
  7. Ball Pre-load . . . . . 1/2 to 5 in. lbs.
  8. Thrust Bearing Pre-load . . . . . 1 to 3 in. lbs. in excess of initial load
  9. Over-Center Adjustment. . . . . 4 to 8 in. lbs. in excess of combined ball and thrust bearing pre-load

TORQUE SPECIFICATIONS

NOTE: Specified torque is for installation of parts only. Checking of torque during inspection may be 15% below the specifications.

APPLICATION	FT. LBS.
STEERING LINKAGE	
Idler Arm Support to Frame Bolt	25 to 35
Tie Rod Clamp Bolts	20 to 25
Tie Rod to Plain Arm and Relay Rod Nuts	50 to 60
Steering Wheel Nut	30 to 40
Idler and Pitman Arm to Relay Rod	*45 to 50
Tie Rod to Relay Rod	*45 to 50
MANUAL STEERING GEAR	
Gear to Frame Bolts	60 to 80
Pitman Shaft Nut	120 to 150
Side Cover Bolts	25 to 35
Pitman Shaft Adjusting Screw Locknut	18 to 27
Bearing Pre-load Adjuster Locknut	70 to 100
Coupling Flange Bolts	15 to 20
POWER STEERING PUMP	
Pulley Nut	35 to 45
Pump Mounting Stud	25 to 35
Union	25 to 35
Flow Control Valve Plug	4
POWER STEERING PUMP BRACKETS	
33, 34, 35, 38 & 39 Series	
Pump to Brace	20 to 28
Pump to Bracket	20 to 28
Pump to Support	20 to 28
Pump to Bracket	20 to 28
Pump Bracket to Intake Manifold	20 to 28
Pump Bracket to Cylinder Head	20 to 28
Pump Bracket and Support to Cylinder Head 3/8"	20 to 28
Pump Bracket and Brace to Cylinder Head 7/16"	25 to 40
30, 31 & 32 Series	
Pump Front Bracket to Block	30 to 40
Pump Front Bracket to Cylinder Head	30 to 40
Front Bracket to Pump	30 to 40
Rear Bracket to Pump	30 to 40
Rear Bracket to Intake Manifold	30 to 40
Front and Rear Bracket to Cylinder Head	30 to 40
Power Steering Bracket to Head Bolt	40 to 60
POWER STEERING GEAR	
Gear to Frame Bolts	60 to 80
High Pressure Line Fitting (At Gear)	20 to 30
Oil Return Line Fitting (At Gear)	20 to 30
Pitman Shaft Adjusting Screw Locknut	20 to 30
Side Cover Bolts	25 to 35
Adjuster Plug Locknut	50 to 110
Coupling Flange Bolt(s)	15 to 25
Return Guide Clamp Screws	8 to 12
Rack-Piston Plug	35 to 65

*Do not back off to insert cotter pin - turn to next hole.



61-9	Steering Wheel Puller	J-6278-2	Adapter (Used with J-6278 for Installing Pitman Shaft Seals and Bearing)
TR-278-R	(J-8107) Differential Side Bearing Puller (Used for Pump End Cover Installation)	J-6448-01	Power Steering Gear Holding Fixture
J-544-A	Spring Scale	J-6448-04	Spacer (Used with J-6448-01)
J-3289-B	Differential Holding Fixture (Used for Mounting Gear Holding Fixture J-5405)	J-7132-1	Seal Protector
		J-7132-2	Seal Installer
33-70 M	Belt Tensioning Gauge	J-7539	Ball Retainer
J-4880	No. 2 Snap Ring Pliers	J-7576	Rack-Piston Teflon Ring Compressor
J-5176-01	Pressure Testing Manifold (Used with Gauge J-7715)	J-7586	Pump Oil Seal Protector
		J-7624	Spanner Wrench (Used for Removing and Installing Adjuster Plug. Also used for Adjusting Thrust Bearing Preload)
J-5190-A	1955 Power Steering Gear End Casting Bearing Puller (Used for Side Cover Needle Bearing Puller)	J-7715	Pressure Testing Gauge (Used with Gauge Manifold J-5176)
J-5254	End Cover Seal and Needle Bearing Installer (Used for Removing and Installing Adjuster Plug Oil Seal and Needle Bearing)	J-8092	Drive Handle
		J-8810	Pitman Shaft Bushing Installer
J-5205	Steering Gear Holding Fixture	J-8811	Upper Bearing Race Installer and Pitman Shaft Oil Seal Installer
J-5395	Turn Signal Cover Installer (Pinion Seal Installer)		
J-5504-B	Pitman Arm Puller	J-972-A	Differential Adjusting Nut Wrench (Used for Tightening Adjuster Plug Locknut)
J-6125-1	Slide Hammer		
J-6217	Hose Connector Installer	J-21180	Turn Signal Cover and Shift Tube Remover
J-6222	End Cover Seal Protector (Used for Installing Adjuster Plug)	J-21181	Spring Installer
		J-21197	Pivot Pin Remover and Snap Ring Installer
J-6278	Pitman Shaft Bearing Remover and Installer		

Fig. 8-121 Steering Tools

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SUSPENSION

33-34-35-36-38 & 39 SERIES

CONTENTS OF SECTION 9

FRONT SUSPENSION

PERIODIC MAINTENANCE

For ball joint seal inspection and lubrication interval, refer to PERIODIC MAINTENANCE, Section 2.

A periodic front wheel bearing repack is not required. However, when major brake service is being performed, it is recommended that the front wheel bearings be cleaned and repacked with a sodium soap, fine fiber grease.

WHEEL BEARINGS (Fig. 9-3)

The proper functioning of the front suspension cannot be maintained unless the front wheel TAPER ROLLER BEARINGS are correctly adjusted. Cones must be a slip fit on the spindle and the inside diameter of cones should be lubricated to insure that the cones will creep. Spindle nut must be a free-running fit on threads.

Adjustment

1. While rotating hub and drum assembly, at lease three times the speed of nut rotation, tighten nut 25 to 30 ft. lbs.
2. Back off nut 1/2 turn.
3. Retighten nut finger tight and install retainer ring or cotter key if possible.

   NOTE: If unable to install retainer, back off nut (not to exceed 1/12 turn) until slot in nut and keyway align, then install retainer or cotter key.

HUB AND DRUM ASSEMBLY

Remove (Wheel Removed)

1. Remove grease cap from hub.

   CAUTION: Use care when removing the left front cap which contains the front wheel speedometer drive coupling. Tool BT-6318-1 will easily remove the cap without distortion.

2. Remove cotter pin or retainer, nut and washer from spindle.
3. Carefully pull hub and drum assembly from spindle.

   NOTE: It may be necessary to back off the brake shoe adjustment before the hub and drum can be removed.

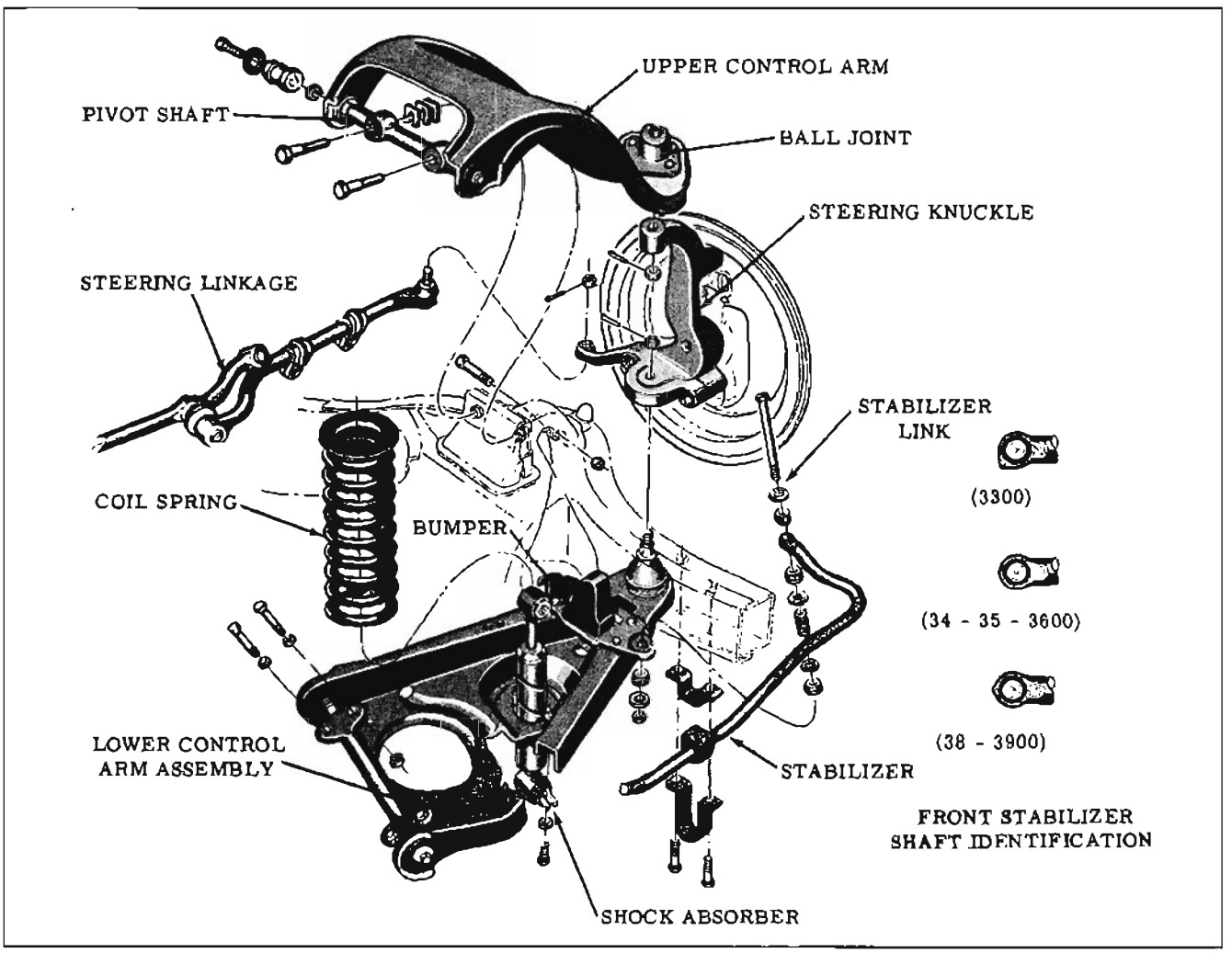


Fig. 9-1 Front Suspension Layout

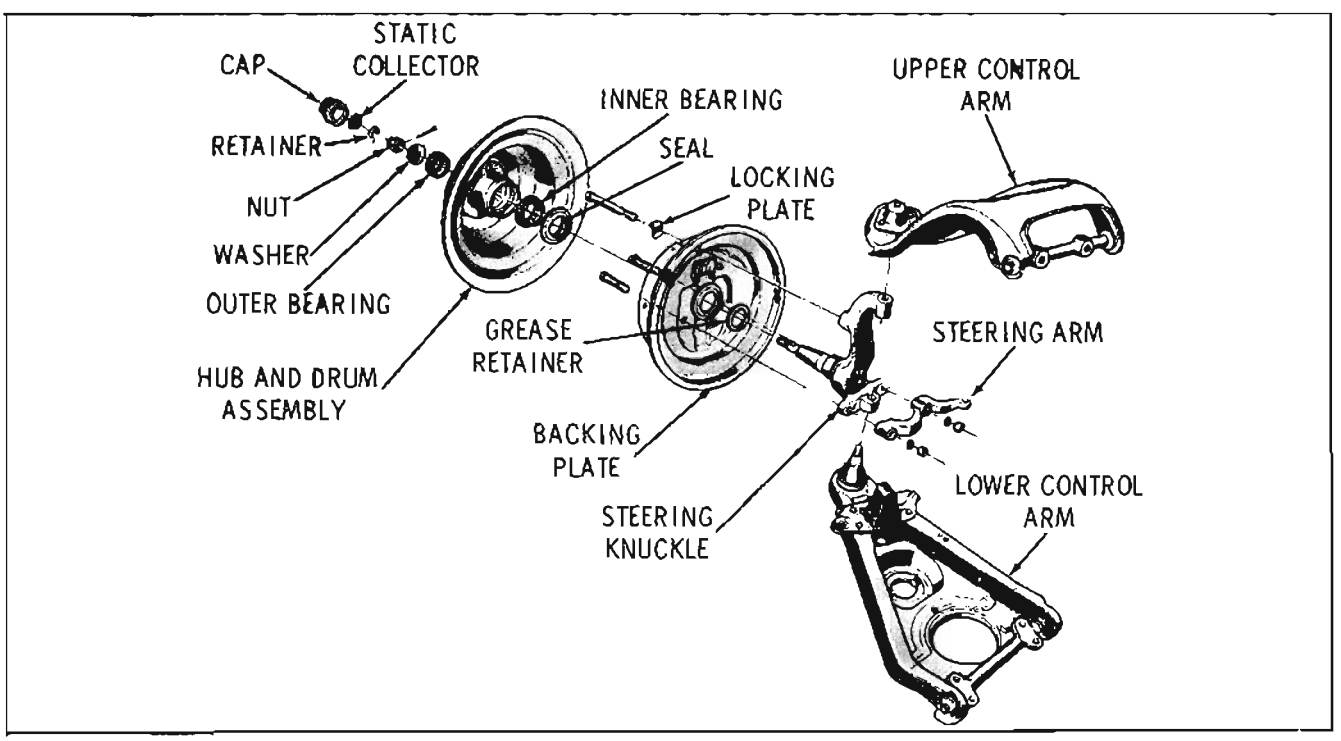


Fig. 9-2 Front Suspension Layout

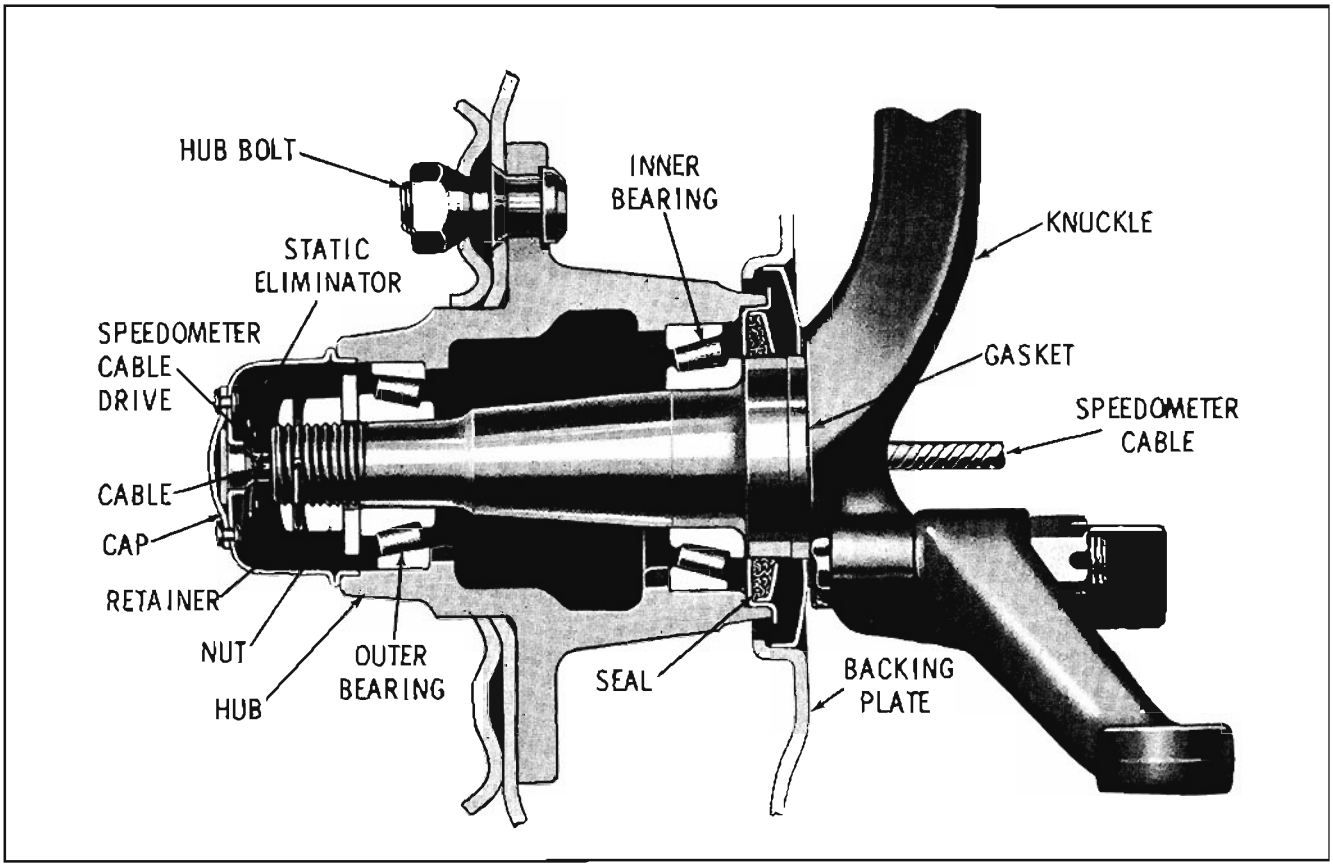


Fig. 9-3 Knuckle and Hub Assembly (Left Shown)

Bearing and Seal Removal

1. Remove washer retaining the ball and separator assembly in the hub.
2. Remove the outer bearing inner race and the roller and separator assembly from hub.
3. Pry seal from hub, then remove inner bearing inner race and roller and separator assembly from hub.
4. If necessary to remove outer races, insert a brass drift into hub, indexing end of drift with notches in hub behind bearing outer race, and tap with a hammer.

Cleaning and Inspection

NOTE: For inspection of front drums, refer to BRAKE DRUMS, Section 11.

1. Wash all parts in clean solvent with the exception of the roller and separator assemblies and races and air dry. Roller and separator assemblies should be washed in gasoline.
2. Check bearings for cracked separators and worn or pitted rollers.
3. Check bearing races for cracks, scores or a brinelled condition.

Bearing and Seal Installation

1. If the outer races were removed, drive or press the races into the hub as shown in Fig. 9-4 and 9-5.
2. Lubricate the bores of the inner races and

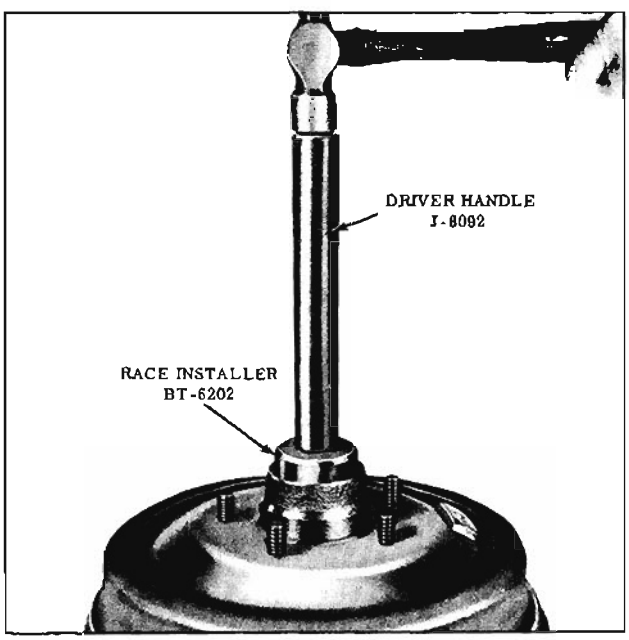


Fig. 9-4 Installing Outer Bearing Race

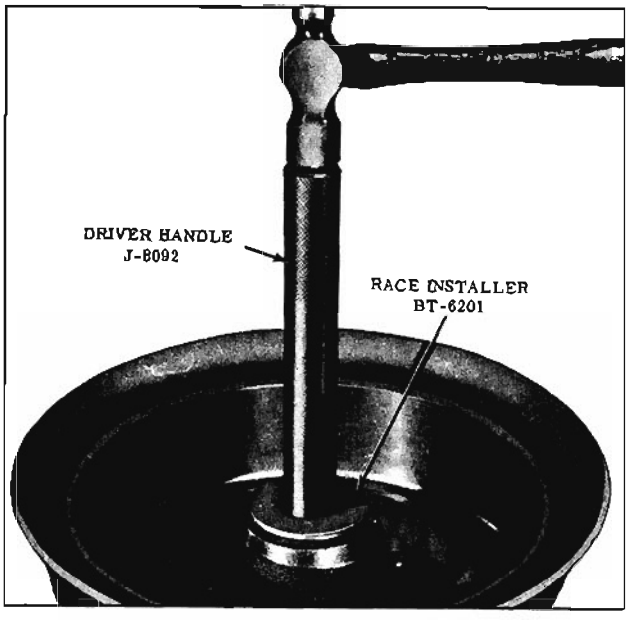


Fig. 9-5 Installing Inner Bearing Outer Race

fully pack the roller and separator assemblies with a sodium soap, fine fiber grease.

3. Install inner bearing roller and separator assembly into outer race, then install inner bearing inner race.

4. Carefully tap seal into hub.

5. Clean any traces of grease from brake lining and drum with fine sandpaper. If necessary to adjust brake linings, refer to Brake Linings Adjust, Section 11.

6. Position hub and drum assembly over spindle.

7. Install outer bearing roller and separator into hub.

8. Install outer bearing inner race over spindle, then install the washer and spindle nut. Draw spindle nut up snug and adjust bearing as outlined under WHEEL BEARING ADJUSTMENT.

9. Install dust cap. Tool BT-6318-2 can be used to install the dust cap without distortion.

Hub Bolt Replacement

1. With the hub and drum assembly removed, drill a 5/8" hole 1/4" deep into the head of the hub bolt.

2. Support hub and drum assembly and drive or press hub bolt out through the front of the hub and drum assembly.

3. Press a new hub bolt into the hub.

4. While supporting hub bolt, peen hub bolt into the countersunk area of drum with the use of Peening Tool J-554-18 until the drum is secure to the hub. (Fig. 9-6).

FRONT SHOCK ABSORBERS

A slight amount of fluid may bleed by the rod seal in cold weather and deposit a light film on the upper area of the shock absorber. This condition will not impair operation and should be considered normal. A shock absorber should never be checked horizontally or with the rod extension down.

For a complaint of a noisy or defective shock absorber, first check the mounting torque. If mounting is satisfactory, disconnect the lower mountings and pump the shock absorbers by hand in a vertical position. Compare both shock absorbers. If both shocks respond the same, it is unlikely that a defective shock absorber exists.

Thumping Noise

A thumping noise usually occurs when a shock absorber is changing its direction of stroke.

1. The shock absorber should be pumped with a rapid change of stroke. If lag is felt when changing stroke, this unit will be noisy.

2. Completely extend the shock absorber and pull hard. If spring tension is felt, this shock absorber will be noisy and should be replaced.

Squeaky or Reed Type Noise

Hand pump the shock absorber at different rates of speed. If noise is heard that changes from a deep grunt to a high-pitched squeak, the shock absorber needs replacement.

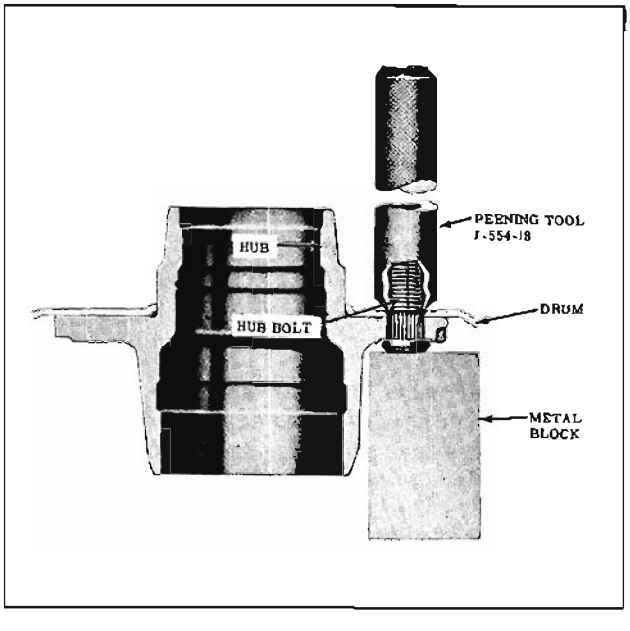


Fig. 9-6 Peening Hub Bolt

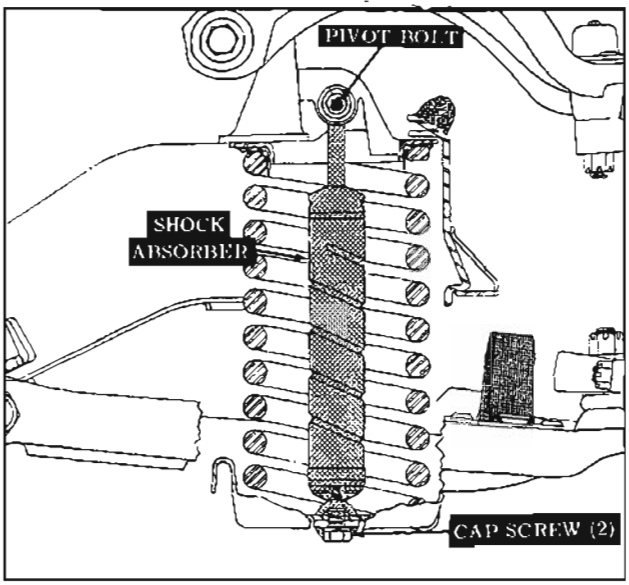


Fig. 9-7 Shock Absorber Mounting

NOTE: A squealing noise could be atributed to seals. This is particularly true if the shock has been inoperative for a period of time. This noise will disappear after a few strokes of the shock absorber and is not a cause for rejection.

Remove and Install (Fig. 9-7)

1. Remove upper pivot bolt from the shock absorber.

2. Remove the two cap screws and lockwashers attaching shock absorber to lower control arm and remove shock absorber.

To install shock absorber, reverse sequence of operations. Torque the pivot bolt nut 45 to 60 ft. lbs. and the cap screws 15 to 24 ft. lbs.

STABILIZER

Remove and Install (Fig. 9-8)

1. Disconnect each side of stabilizer linkage by removing nut from link bolt; pull bolt from linkage, and remove retainers, grommets, and spacer.

2. Remove bracket to frame bolts and remove stabilizer bar, rubber bushings, and brackets.

3. To install, reverse sequence of operations. The rubber bushings should be positioned squarely in the brackets with the opening in the bushings facing the front of car. Torque stabilizer link nut 12 to 17 ft. lbs. and bracket bolts 25 to 45 ft. lbs.

IMPORTANT: Never lubricate stabilizer bar rubber bushings as they are dependent upon a bonding of the rubber to the bar for proper stabilizer action.

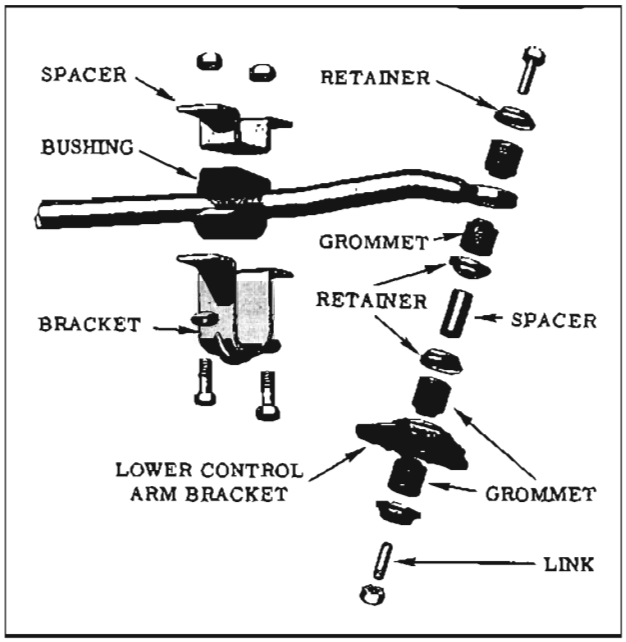


Fig. 9-8 Stabilizer Bar and Linkage

BALL JOINTS

BALL JOINT LUBRICATION (Only In the Event of Noisy Joints)

1. Place car on hoist that provides free access under ball joints.

2. Visually examine seals for breaks, cuts, or grease leakage. (If defects are found, follow procedure for replacing seal.)

3. Thoroughly clean top of upper ball joint and bottom of lower ball joint to remove all foreign matter away from lubrication hole.

4. Remove plug from lubrication hole.

   CAUTION: Prevent dirt or foreign material from getting into the lubrication hole.

5. Use a hand operated, ball type nozzle grease gun filled with Ball Joint Grease Part No. 585617. DO NOT SUBSTITUTE. Operate grease gun until grease begins to flow from tip.

   NOTE: Before using a new gun, first count the number of turns or pumps required to obtain .01 of a lb. of grease (approximately one teaspoonful).

6. Hold tip of grease gun firmly into lubrication hole and install correct amount of grease by counting the number of turns or pumps (Fig. 9-9)

   IMPORTANT: DO NOT OVERFILL BALL JOINT WITH GREASE. Excess grease will cause improper action of the seal and could

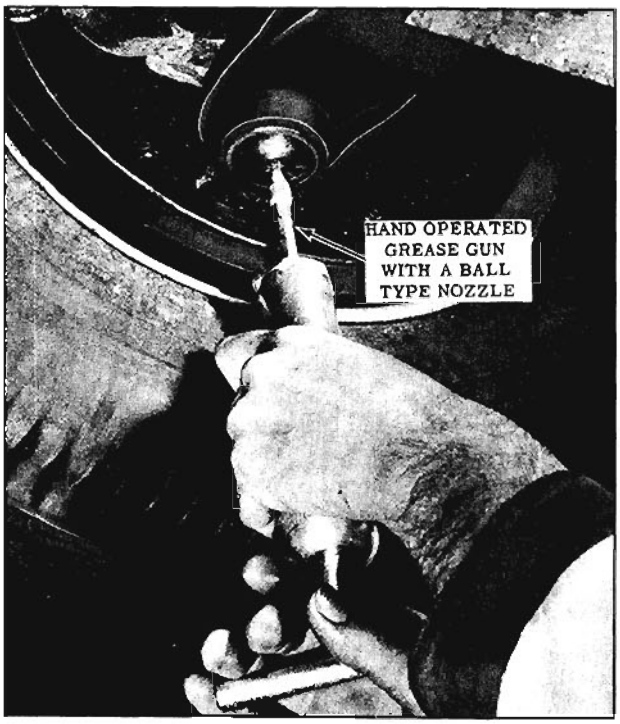


Fig. 9-9 Adding Lubricant to Ball Joint

result in early failure. .01 of a lb. of grease will adequately relubricate joint without overfilling it.

NOTE: DO NOT INSTALL GREASE FITTING OR ATTEMPT TO FILL WITH PRESSURE GUN. Either method will result in overfill or mixing of greases which may harm the part.

7. Wipe away excess grease and install plug.

BALL JOINT CHECKS

NOTE: Before checking ball joints, the wheel bearings must first be properly adjusted. To check the steering linkage and steering gear lash, refer to STEERING, Section 8.

Vertical Check

1. Raise car and position floor stands under the left and right lower control arm as near as possible to each lower ball joint. Car must be stable and should not rock on the floor stands.

2. Position dial indicator as shown in Fig. 9-10.

3. Place a pry bar between the lower control arm and the plain arm. (Fig. 9-11)

NOTE: On 30, 31 and 32 Series, place a 6" 2x4 vertically on the lower control arm and pry on upper end of 2x4 and upper end of steering knuckle.

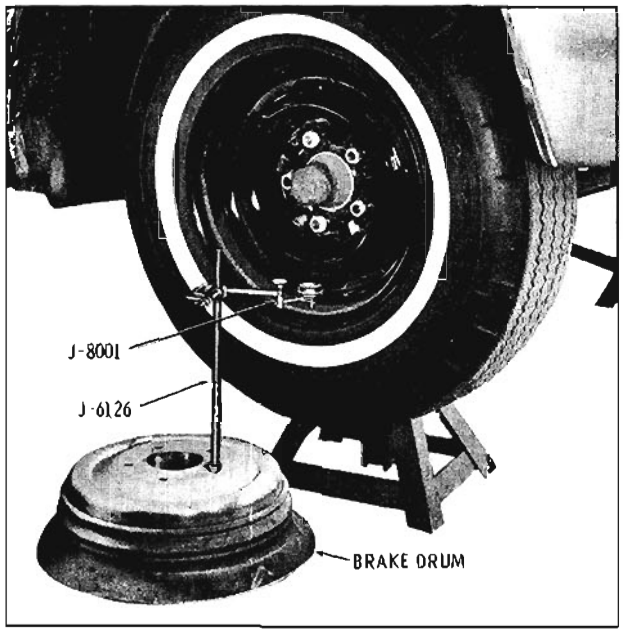


Fig. 9-10 Ball Joint Vertical Check

4. Move pry bar gently up and down and observe vertical deflection on dial indicator. Reading must not exceed .125".

5. Repeat Steps 2, 3 and 4 on opposite ball joint.

Horizontal Check

1. Place car on floor stands as outlined in Step 1 of the VERTICAL CHECK.

2. Position dial indicator as shown in Fig. 9-12.

3. Grasp front wheel as shown in Fig. 9-12 and push in on bottom of tire while pulling out at

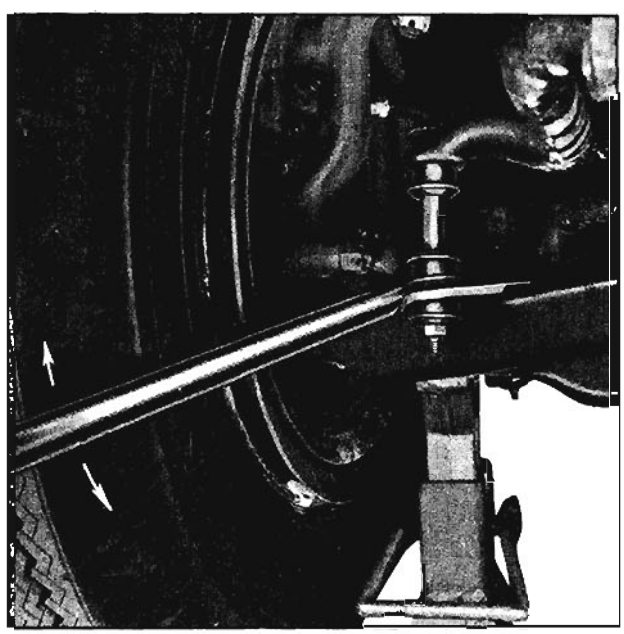


Fig. 9-11 Pry Bar Installation

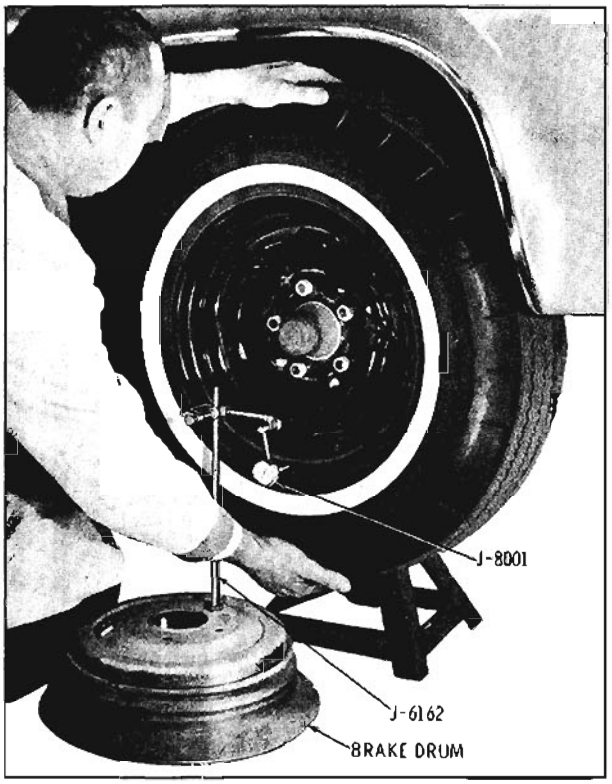


Fig. 9-12 Ball Joint Horizontal Check

the top. Read gauge, then reverse the push-pull procedure. Horizontal deflection on gauge should not exceed .125" at the wheel rim. This procedure checks both the upper and lower ball joints.

4. Repeat Steps 2 and 3 on the opposite ball joint.

UPPER CONTROL ARM ASSEMBLY REMOVAL

1. Raise front of car and support lower control arm with floor stands.

   NOTE: Since the weight of the car is used to relieve spring tension on the upper control arm, the floor stands must be positioned between the spring seats and ball joints of the lower control arms for maximum leverage.

2. Remove wheel and front wheel speedometer cable from knuckle if so equipped, then loosen the upper ball joint from the steering knuckle as follows:
   a. Remove the cotter pin from the upper ball joint stud and clean threads of stud.

   b. Loosen the upper ball joint nut and install Tool J-8806 as shown in Fig. 9-13.

   c. Apply pressure on stud by expanding the tool until the stud breaks loose.

   d. Remove Tool J-8806 and upper ball joint nut, then pull stud free from knuckle.

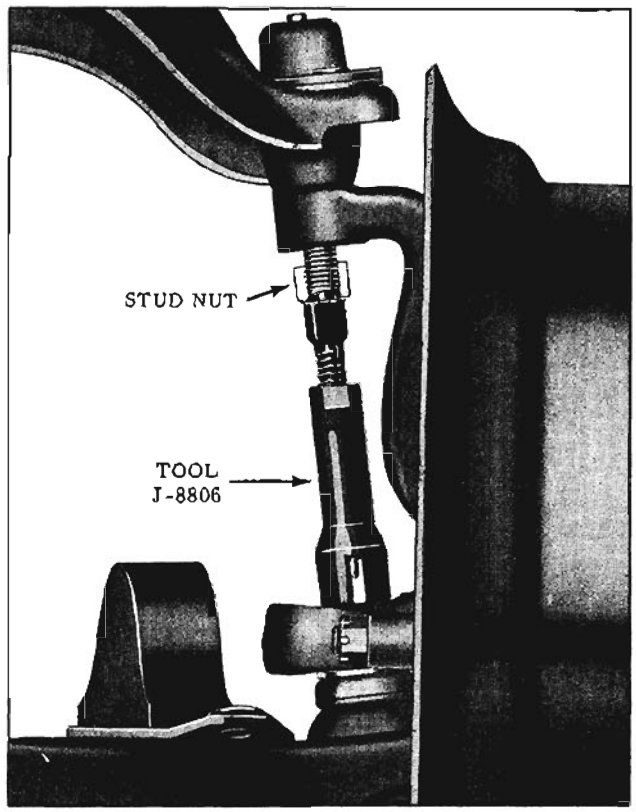


Fig. 9-13 Loosening Upper Ball Joint

4. Disconnect ground strap from control arm. Support the hub and drum to prevent weight of the assembly from damaging the brake hose.

5. Using a 7/8" deep flex socket with a long extension, remove the pivot shaft to frame attaching nuts from under the fender. (Fig. 9-14) Remove wheel alignment shims, control

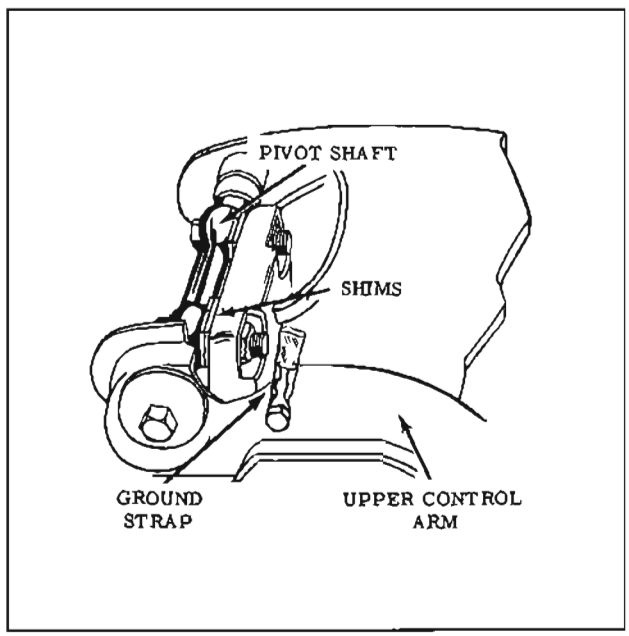


Fig. 9-14 Upper Control Arm Mounting

arm and pivot shaft assembly from car.

NOTE: Keep shims grouped so that they may be reinstalled in their original position.

Install

1. Position pivot shaft on the frame, then install pivot shaft attaching bolts and nuts with the original alignment shims installed between the pivot shaft and frame on their respective bolts. Torque nuts 100 to 150 ft. lbs.

2. Remove the temporary support from the hub and drum, then connect ball joint to steering knuckle. Torque nut 40 ft. lbs. (minimum) and install cotter pin. Tighten nut further, if necessary, to install cotter pin. Attach ground strap to control arm. (Fig. 9-13)

3. Install speedometer cable and wheel, then check wheel alignment and adjust if necessary.

UPPER CONTROL ARM PIVOT SHAFT BUSHING REPLACEMENT

1. Remove upper control arm assembly from the car.

2. Remove bolts and washers from ends of pivot shaft.

3. Position control arm assembly and tools in a press as shown in Fig. 9-15 and press bushing out of control arm.

4. Repeat Step 3 on other bushing.

5. To install bushings, place pivot shaft in control arm and press new bushing into control arm and over end of pivot shaft. (Fig. 9-16)

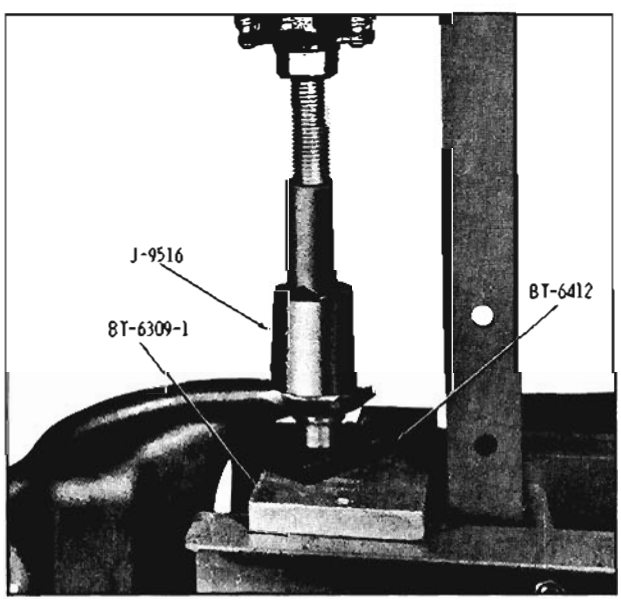


Fig. 9-15 Upper Control Arm Bushing Removal

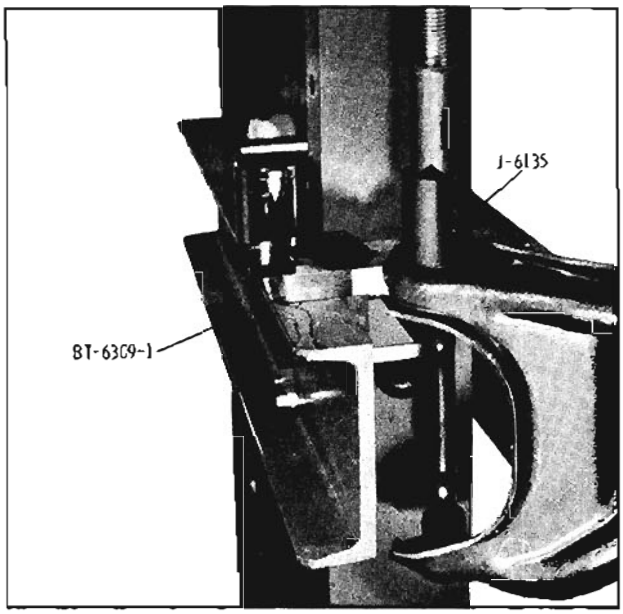


Fig. 9-16 Installing Bushing

6. Repeat Step 5 on other bushing.

7. Assemble bolts and washers to ends of pivot shaft. Torque bolts 50 to 60 ft. lbs.

8. Install the upper control arm assembly on the car.

UPPER CONTROL ARM BALL JOINT OR SEAL REPLACEMENT (Fig. 9-17)

1. Disconnect the ball joint from the steering knuckle.

2. Using a 1/8" drill, drill a hole 1/4" deep in the center of the rivets.

3. Using a 1/2" drill, drill the rivet heads just deep enough to remove the rivet head.

4. Drive out the rivet heads.

5. If only the ball joint seal is to be replaced, proceed as follows:

   a. Remove the ball joint seal assembly and determine whether it is a Saginaw Steering Gear or Thompson Products ball joint.

   b. Clean ball joint pivot and stud and thoroughly wipe out all old grease.

   c. Lubricate ball joint until clean grease, Part No. 585617, fills the ball joint socket. Lubricant should be flush with ball joint socket.

   d. Install a new ball joint seal assembly from the same vendor as the one removed.

6. Install the ball joint and seal assembly into

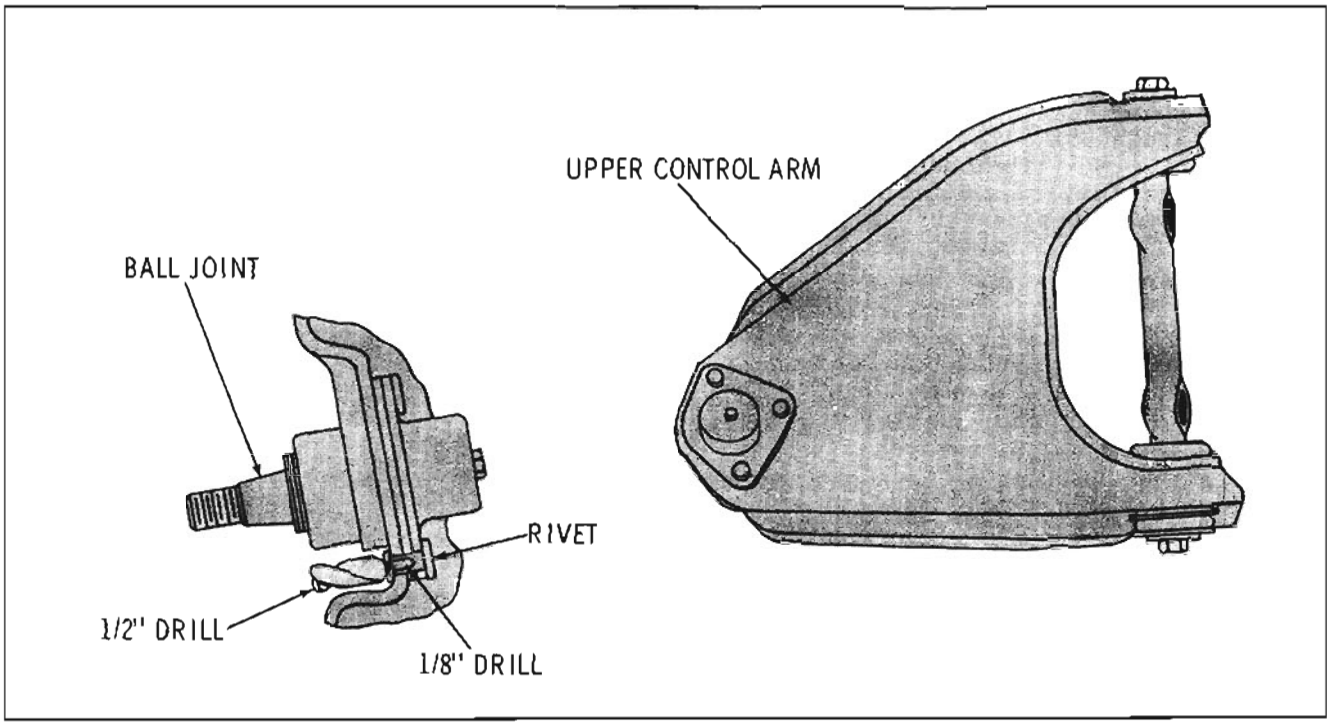


Fig. 9-17 Removing Upper Ball Joint or Seal

the control arm. Fasten with the bolts and nuts supplied with the parts package. Install bolts from top side of control arm. Tighten nuts to 8 ft. lbs. torque.

LOWER CONTROL ARM ASSEMBLY AND/ OR COIL SPRING

Remove

1. Raise front of car and support frame with floor stands.
2. Remove wheel assembly and disconnect speedometer cable from steering knuckle if so equipped.
3. Disconnect stabilizer link and speedometer cable clamp from lower control arm.
4. Loosen control arm shaft bushing bolts.
5. Remove shock absorber.
6. Position a floor jack under lower control arm between the spring seat and ball joint. Raise floor jack until it supports lower control arm.
7. Disconnect the lower control arm ball joint from the steering knuckle as follows:
   a. Remove the cotter pin from the lower ball joint stud and clean threads above nut.
   b. Loosen the lower ball joint nut, then install Ball Joint Removing Tool J-8806. (Fig. 9-18)
   c. Apply pressure on stud by expanding the tool until the stud breaks loose from the steering knuckle.
   d. Remove Tool J-8806 and ball joint nut.
8. Slowly lower floor jack until spring is fully extended and remove spring.

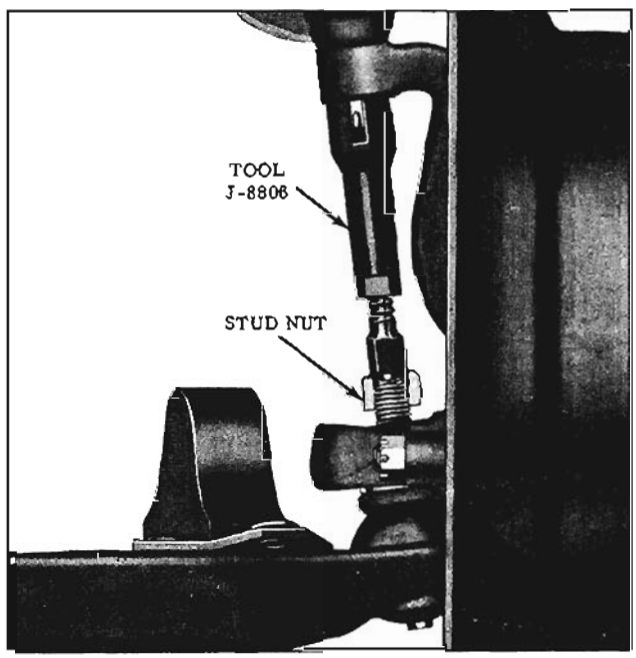


Fig. 9-18 Loosening Lower Ball Joint

IMPORTANT: The left and right coil springs should not be interchanged. The coil spring part number is stamped on the outer side of the end coil.

9. If necessary to remove lower control arm, remove pivot shaft to cross member attaching bolts.

Install

1. If the lower control arm was removed, connect control arm pivot shaft to frame cross member. Torque pivot shaft nuts 50 to 65 ft. lbs. using a torque wrench adapter. (Fig. 9-19)

2. Tape spring insulator to the top of spring at least six places.

   IMPORTANT: The top of the spring may be identified by a flat coil which will allow the insulator to seat squarely on the top coil.

3. While holding spring and insulator against pilot in frame crossmember, tilt spring so it will pilot in lower control arm. (Fig. 9-20) 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.

4. Position floor jack between spring seat and ball joint. Chain the upper control arm to the base of the jack.

5. Raise control arm until the ball joint is tight in steering knuckle. Install ball joint nut and tighten to 70 ft. lbs. (minimum) and install cotter pin. Tighten nut further, if necessary, to install cotter pin.

   NOTE: A screwdriver slot is provided in the lower ball joint stud as a means of preventing the stud from turning when tightening the ball joint nut.

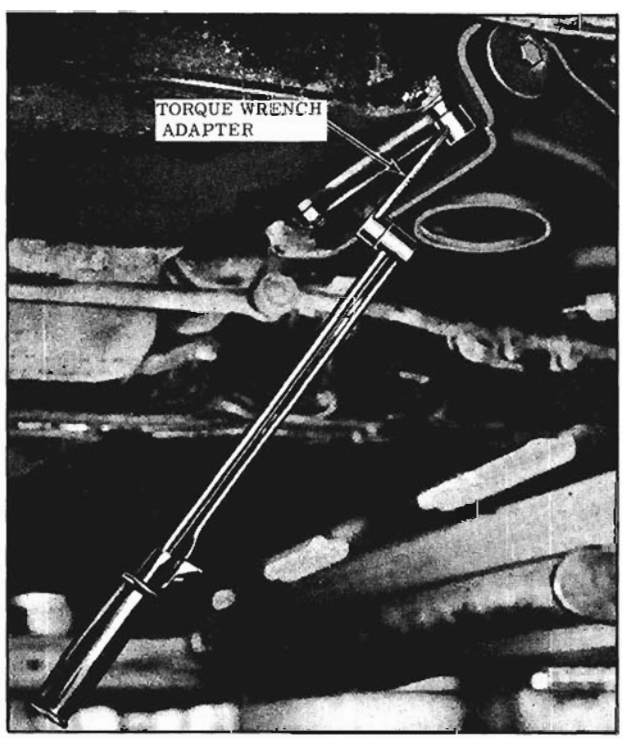


Fig. 9-19 Checking Pivot Shaft Torque

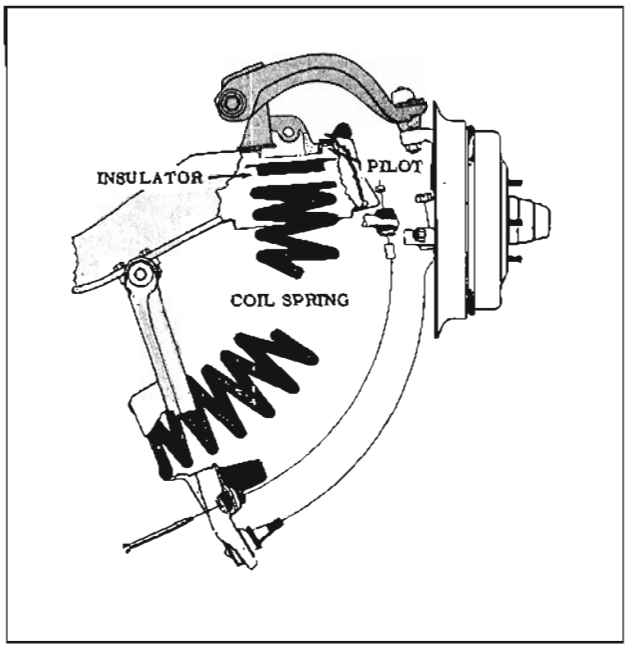


Fig. 9-20 Coil Spring Installation

6. Install shock absorber and speedometer cable.

7. Connect stabilizer link and speedometer cable clamp to lower control arm.

8. Install wheel and lower car.

9. Torque control arm shaft bushing bolts 60 to 80 ft. lbs. with weight of car on wheels.

LOWER CONTROL ARM PIVOT SHAFT BUSHING REPLACEMENT

1. Remove lower control arm assembly from car.

2. Remove bolts and washers from ends of pivot shaft.

3. Place control arm assembly and tools in a press as shown in Figure 9-21 and press bushing out of control arm as far as possible.

4. Repeat Step 3 on other bushing.

5. Place spacer Tool BT-6309-2 on pivot shaft between ears of pivot shaft and end of bushing.

6. Place control arm assembly in press as shown in Figure 9-22 and finish pressing bushing from control arm.

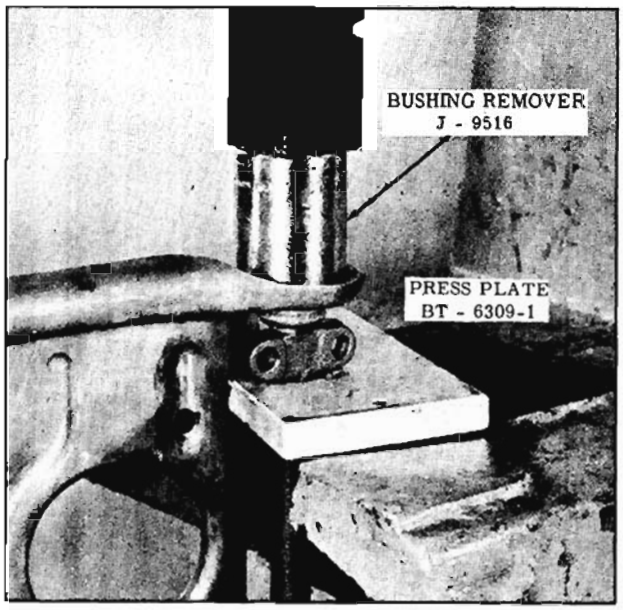


Fig. 9-21 Partial Pivot Shaft Bushing Removal

7. Repeat Steps 5 and 6 for other bushing.

8. To install bushings, place pivot shaft in control arm and press new bushing into control arm and over end of pivot shaft. (Fig. 9-23)

9. Repeat press operation of Step 8 for other bushing.

10. Assemble bolts and washers to ends of pivot shaft but do not torque until car weight is on wheels.

11. Install lower control arm assembly on car.

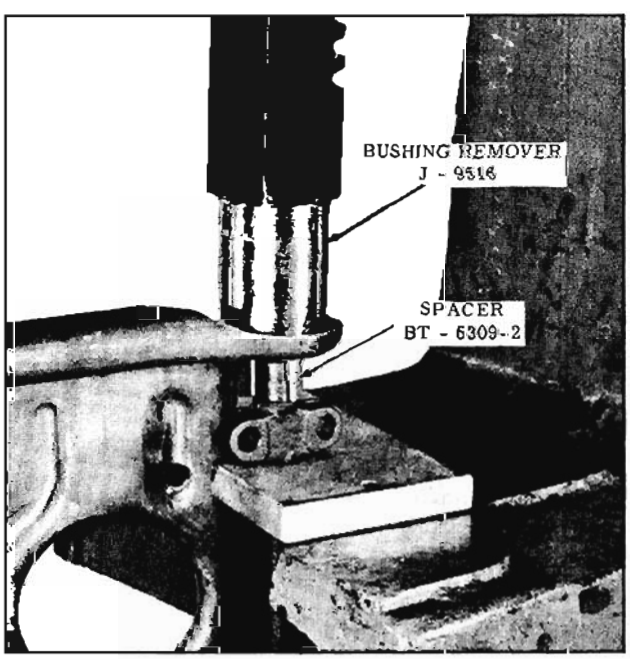


Fig. 9-22 Pivot Shaft Bushing Removal

LOWER CONTROL ARM BALL JOINT SEAL REPLACEMENT

1. Support lower control arm and disconnect ball joint from steering knuckle.

2. Clean exterior of ball joint.

3. For Inland joints, drive seal retaining ring from ball joint and discard seal assembly.

   For Saginaw joints, pry garter spring from bottom of seal, then remove and discard seal and garter spring.

CAUTION: Exercise care while performing the following operations to prevent entry of dirt into the ball joints.

4. Clean joint pivot and stud thoroughly and wipe out as much old grease as possible.

5. Remove plug from ball joint cover.

6. Using a hand operated ball type nozzle grease gun filled with Ball Joint Grease, Part No. 585617, lubricate ball joint until clean grease completely fills the ball joint reservoir. (Figs. 9-24 and 9-25)

7. Install plug in ball joint cover, then clean grease from ball joint stud and sealing area of joint with a clean dry cloth. (Figs. 9-24 and 9-25)

8. Apply a thin film of Ball Joint Grease to outside area of new seal to aid installation of Tool J-8761 (Inland) or Garter Spring Installer J-6119 (Saginaw).

9. The saw-tooth area of the seat that fits around the ball stud should be coated with Ball Joint Grease. (Fig. 9-25)

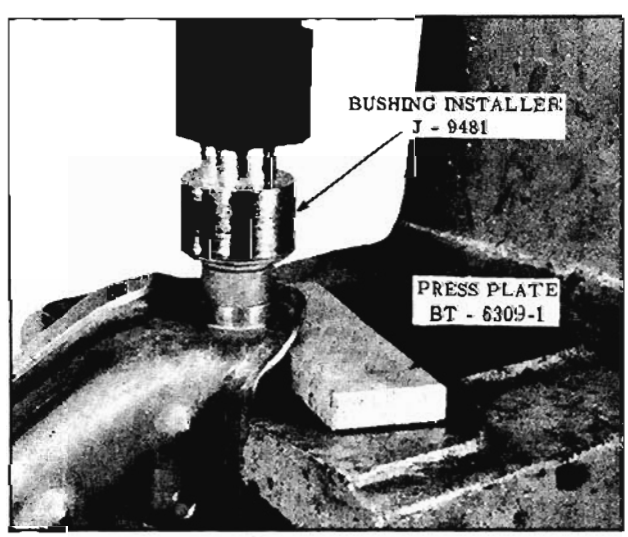


Fig. 9-23 Installing Pivot Shaft Bushing

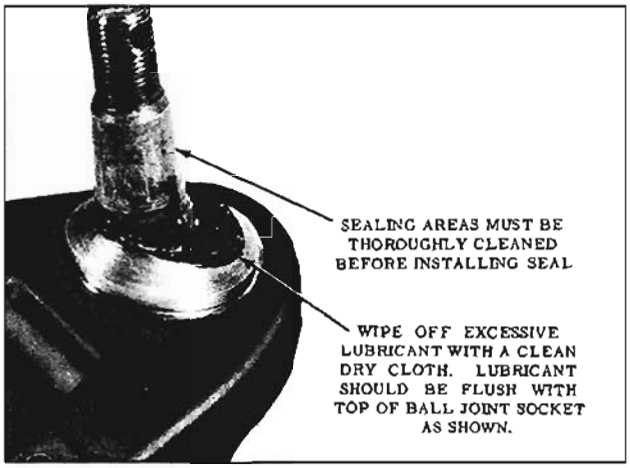


Fig. 9-24 Ball Joint Prior to Installing Seal

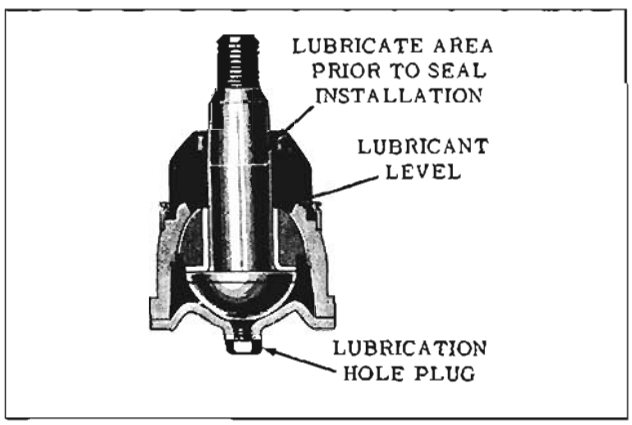


Fig. 9-25 Ball Joint Assembly

10. For Saginaw type, stretch garter spring around Tool J-6119. Do not stretch garter spring any more than necessary when installing on tool. Place seal on ball joint and install garter spring as shown in Fig. 9-26.

    For Inland type, place seal inside of Seal Installing Tool J-8761, then drive seal onto ball joint as shown in Fig. 9-27. Make sure that seal is driven on squarely without cocking.

11. Reassemble ball joint stud to steering knuckle.

LOWER CONTROL ARM BALL JOINT REPLACEMENT

1. Raise front of car, support outboard end of lower control arm with floor stand and remove wheel assembly.

2. Disconnect lower ball joint from steering knuckle using Tool J-8806.

3. Block steering knuckle, backing plate and hub and drum assembly away from the lower control arm to obtain accessibility.

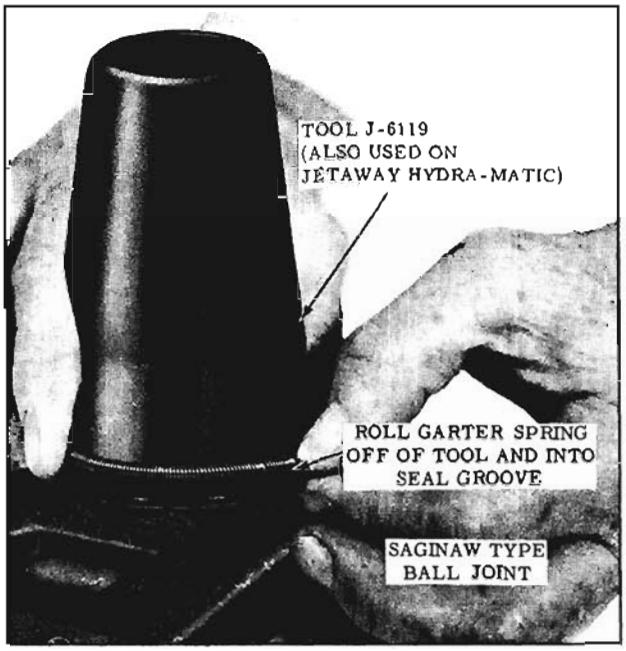


Fig. 9-26 Installing Saginaw Type Seal

4. Remove ball joint seal and press ball joint from control arm as shown in Fig. 9-28.

5. Install new ball joint assembly as shown in Fig. 9-29.

6. Reassemble suspension and torque ball joint stud nut to 70 ft. lbs. minimum and install cotter pin.

STEERING KNUCKLE

Remove

1. Raise front of car and support lower control arms with floor stands.

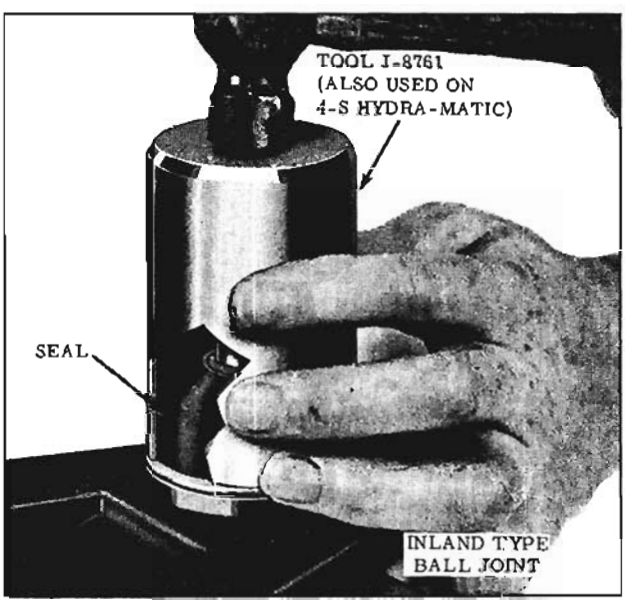


Fig. 9-27 Installing Inland Type Seal

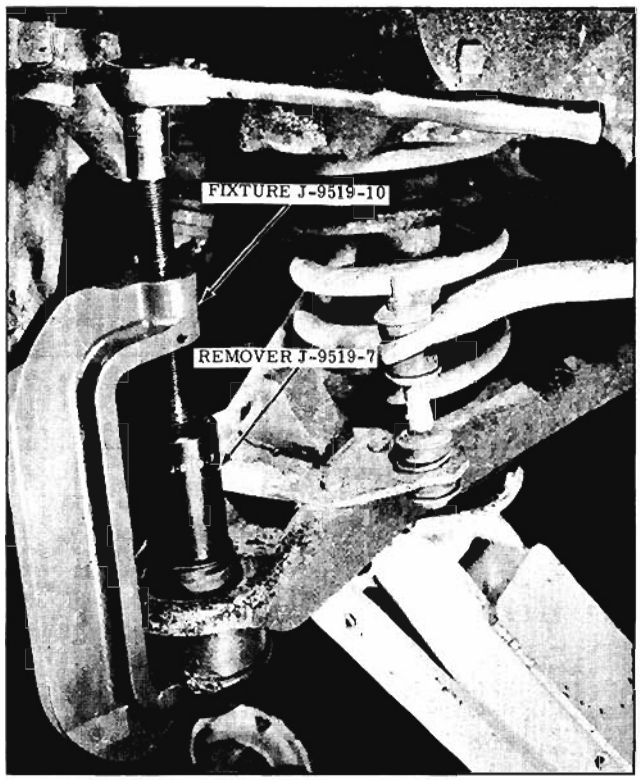


Fig. 9-28 Removing Lower Ball Joint

NOTE: Since the weight of the car is used to relieve the spring tension from the knuckle, the floor stands must be positioned between the spring seats and ball joints of the lower control arms for maximum leverage.

2. Remove front wheel, hub and drum assembly.

3. Disconnect speedometer cable from steering knuckle, if so equipped.

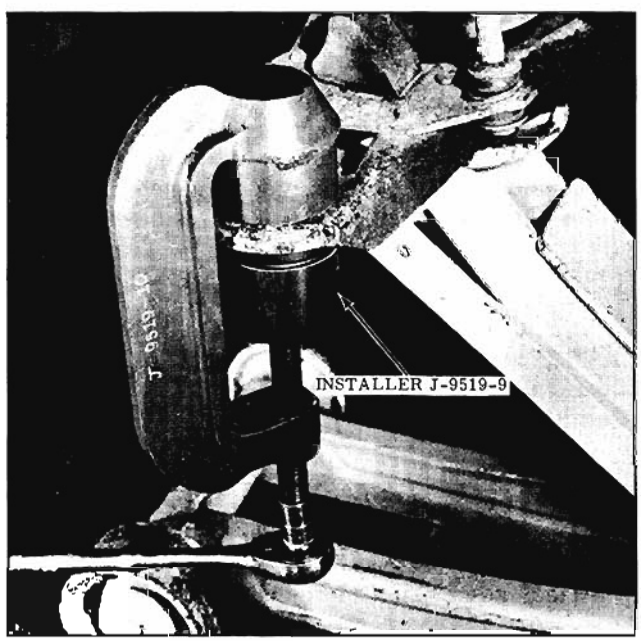


Fig. 9-29 Installing Lower Ball Joint

4. Remove backing plate without disconnecting brake hose. Leave plain arm connected to tie rod end.

NOTE: Support the backing plate assembly out of way to avoid any strain on brake hose.

5. Disconnect the control arm ball joints from the steering knuckle as outlined under CONTROL ARM REMOVAL. (Figs. 9-13 and 9-18)

6. Remove steering knuckle from car.

Install

1. Connect the upper and lower ball joints to the steering knuckle.

2. Torque upper stud nut to 40 ft. lbs., lower stud nut to 40 ft. lbs. and install cotter pins. Tighten further, if necessary, to install cotter pin.

NOTE: A screwdriver slot is provided in the lower ball joint stud as a means of preventing the stud from turning when tightening ball joint nut.

3. Install a new backing plate to steering knuckle gasket on the steering knuckle.

4. Install backing plate and plain arm to steering knuckle. Torque backing plate anchor bolt 80 to 105 ft. lbs. on 33 series and 120 to 145 ft lbs. on 34, 35, 36, 38 and 39 series.

5. Connect speedometer cable to steering knuckle, if so equipped.

Torque plain arm to steering knuckle to backing plate nuts 100 to 140 ft. lbs.

6. Install wheel and hub and drum assembly. Adjust wheel bearings.

7. Lower car.

8. Check camber, caster and toe-in and adjust, if necessary.

WHEEL ALIGNMENT

The front wheel alignment factors are:

1. CASTER (Fig. 9-30)

2. CAMBER (Fig. 9-31)

3. TOE-IN (Fig. 9-32)

4. TOE-OUT (STEERING GEOMETRY) (Fig. 9-33)

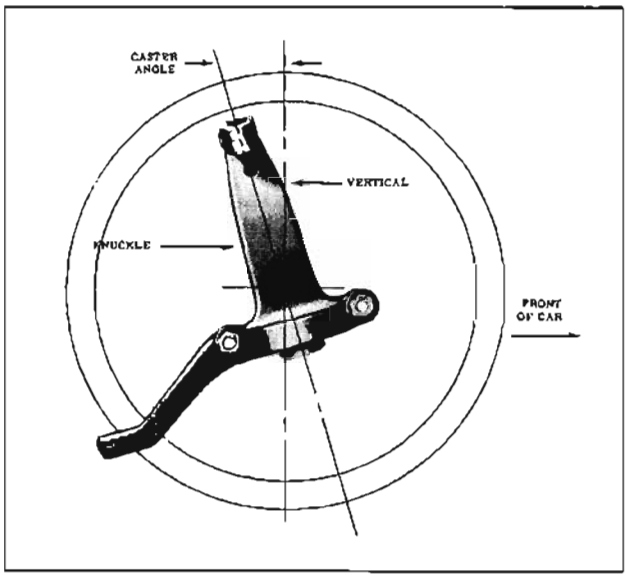


Fig. 9-30 Front Wheel Caster

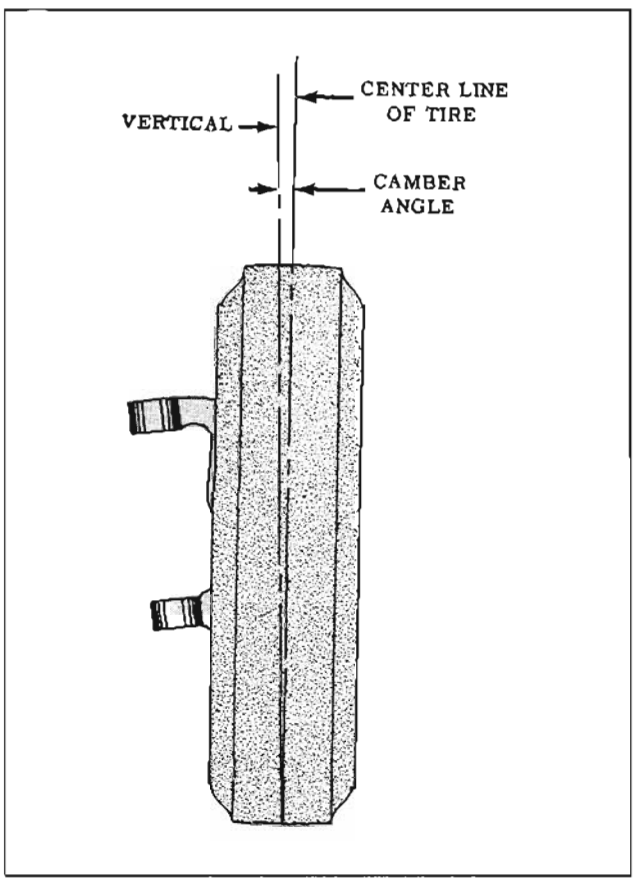


Fig. 9-31 Front Wheel Camber

Before any attempt is made to check or correct Caster, Camber, Toe-In or Toe-Out, the following preliminary checks and necessary corrections should be made on those parts which influence the steering of the car:

1. Inflate tires to recommended pressure.
2. Check front wheel bearings and steering gear for proper adjustments.

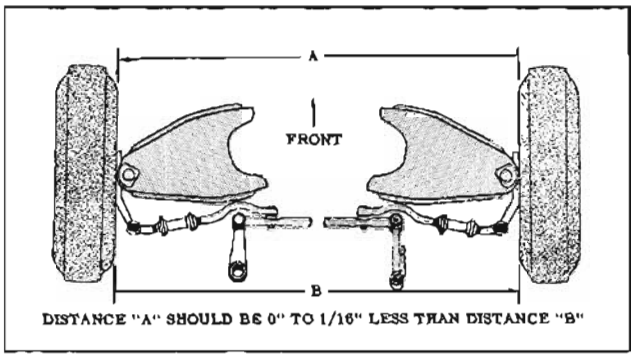


Fig. 9-32 Front Wheel Toe-In

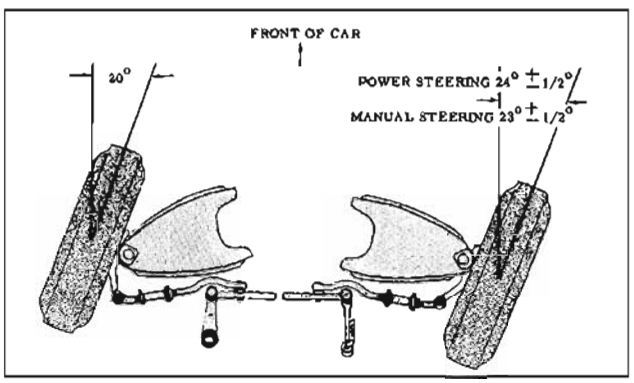


Fig. 9-33 Front Wheel Toe-Out

3. Check front wheel and tire assemblies for radial and lateral runout.
4. Grasp front bumper in center and raise and lower front end several times to allow car to come to its normal level. Check for erratic shock absorber action.

The method of checking alignment will vary depending on the type of equipment being used. The instructions furnished by the manufacturer of the equipment should be followed.

NOTE: Check front wheel alignment without passengers or load in or on car and with car doors closed, as the addition of load or shifting of weight will result in incorrect alignment. Camber angle of the right and left wheel should be within 1/2° of each other for best handling characteristics.

CASTER AND CAMBER ADJUSTMENT (Caster 0° to 1°—) (Camber ¼°—to ½° +)

Camber and Caster are adjusted by shims placed between the upper pivot shafts and the frame. (Fig. 9-34) 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, do not remove weight from the front wheels. Loosen

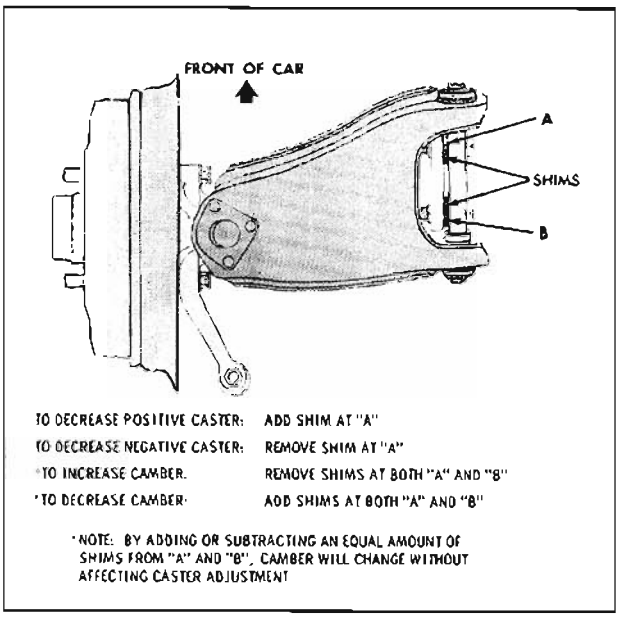


Fig. 9-34 Caster and Camber Adjustments

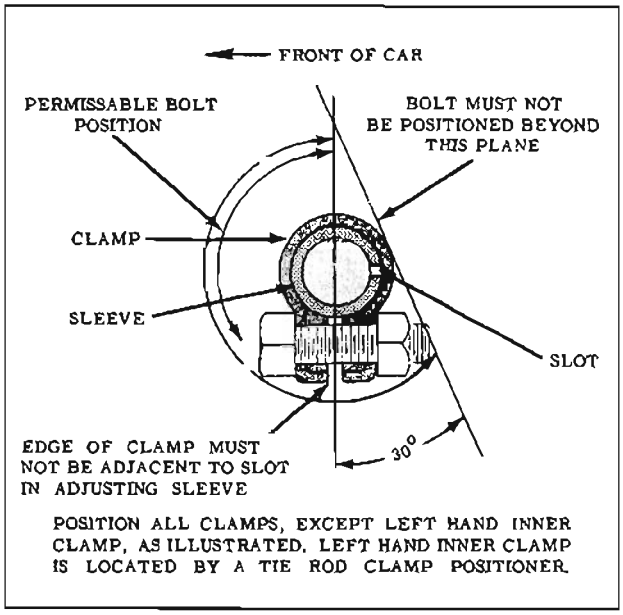


Fig. 9-35 Tie Rod Clamp Positioning

the pivot shaft to frame bolts using a 7/8" deep flex socket and a long extension.

NOTE: Loosen the top and rear fasteners on the fender filler plate aprons to gain access to the pivot shaft bolts.

Refer to the shim chart to determine the amount of shims necessary to correct the adjustment. After the correct number of shims have been installed, torque the pivot shaft mounting nuts 100 to 150 ft. lbs. and recheck caster and camber.

Shim Thickness	One shim added to or subtracted from BOTH BOLTS will change camber	One shim added to or subtracted from FRONT BOLT ONLY will change caster
.020"	1/8°	5/16°
.050"	5/16°	1/2°
.120"	5/8°	1-3/8°

TOE-IN ADJUSTMENT (0" to 1/16") (Fig. 9-32)

1. Loosen the clamp bolts at each end of the steering tie rod adjustable sleeves.
2. With steering wheel set in straight ahead position, turn tie rod adjusting sleeves to obtain the proper toe-in adjustment.
3. When adjustment has been completed according to the recommended specification, and tie rod and ball studs are riding squarely in their seats, position inner clamps as shown in Fig. 9-35.

TOE-OUT (STEERING GEOMETRY) (Fig. 9-33)

To check, turn wheels to right until left wheel has been turned 20° from straight ahead position. Right wheel setting should be 23° + 1/2° without power steering and 24° + 1/2° with power steering on all models. Then follow same procedure with wheels turned to left.

Errors found are usually due to bend 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.

FRONT SUSPENSION DIAGNOSIS

WHEEL BEARING NOISE

Wheel bearing noise may be confused with rear axle noise; however, front wheel bearing noise does not change when comparing "pull" and "coast". A bad bearing will cause a knock or click approximately every two revolutions of the wheel. To determine which wheel bearing is noisy, hoist the car and spin each wheel while listening at the hub cap.

HARD STEERING

Cause:

1. Low or uneven tire pressure.
2. Steering gear adjusted too tight.

3. Insufficient or incorrect steering gear lubricant used.
4. Improper caster.
5. Upper or lower control arms bent.
6. Frame bent or broken.
7. Steering knuckle bent.

EXCESSIVE PLAY OR LOOSENESS IN STEERING SYSTEM

Cause:

1. Steering gear adjusted too loosely or worn linkage.
2. Control arm ball joints worn.
3. Front wheel bearings worn or incorrectly adjusted.
4. Loose front stabilizer link or worn bushings.

ERRATIC STEERING ON APPLICATION OF BRAKE

Cause:

1. Low or uneven tire pressure.
2. Incorrect or uneven caster.
3. Steering knuckle bent.
4. Loose steering linkage or suspension.
5. Dirt or grease on brake lining.

FRONT WHEEL SHIMMY

Cause:

1. Uneven tire pressure.
2. Steering linkage worn.
3. Front wheel bearings worn or incorrectly adjusted.
4. Shock absorbers worn or inoperative.
5. Control arm ball joints worn.
6. Toe-in incorrect.
7. Incorrect or uneven caster.
8. Steering knuckle bent.
9. Wheels, tires, or brake drums out-of-balance.
10. Excessive runout of wheels or tires.

CAR PULLS TO ONE SIDE

Cause:

1. Low or uneven tire pressure.
2. Rear wheels not tracking equally with front wheels.
3. Shock absorbers worn or inoperative.
4. Toe-in incorrect.
5. Incorrect or uneven caster or camber.
6. Frame or frame member bent or broken.

WORN TIRE TREAD EDGES

Cause:

1. Improper front end alignment.
2. High speed driving on curves.
3. Steering knuckle bent.
4. Steering plain arm bent.
5. Low tire pressure.

SCUFFED TIRES

Cause:

1. Tires improperly inflated.
2. Wheels or tires out-of-true.
3. Control arm ball joints worn.
4. Toe-In incorrect.
5. Uneven caster.
6. Incorrect toe-out on turns.
7. Steering gear incorrectly adjusted.
8. Eccentric or bulged tires.

FRONT OR REAR WHEEL TRAMP

Cause:

1. Wheels, tires, or brake drums out-of-balance.

2. Shock absorbers worn or inoperative.

3. Loose or worn front wheel bearings.

CAR WANDERS

Cause:

1. Low or uneven tire pressure.

2. Steering gear adjusted to loosely or worn linkage.

REAR SUSPENSION

REAR SHOCK ABSORBER

A slight amount of fluid may bleed by the rod seal in cold weather and deposit a light film on the upper area of the shock absorber. This condition will not impair operation and should be considered normal. A shock absorber should never be checked horizontally or with the rod extension down.

For a complaint of a defective or noisy shock absorber, first check the mounting torque. If mounting is satisfactory, disconnect the lower mountings and pump the shock absorber by hand in a vertical position. Compare both shock absorbers. If both shocks respond the same, it is unlikely that a defective shock absorber exists.

THUMPING NOISE

A thumping noise usually occurs when a shock absorber is changing its direction of stroke.

1. The shock absorber should be pumped with a rapid change of stroke. If lag is felt when changing stroke, this unit will be noisy.

2. Completely extend the shock absorber and pull hard. If spring tension is felt, this shock absorber will be noisy and should be replaced.

SQUEAKY OR REED TYPE NOISE

Hand pump the shock absorber at different rates of speed. If noise is heard that changes from a deep grunt to a high-pitched squeak, the shock absorber needs replacement.

NOTE: A squealing noise could be attributed to seals. This is particularly true if the shock has been inoperative for a period of time. This noise will disappear after a few strokes of the shock absorber and is not a cause for rejection.

REMOVE AND INSTALL (Fig. 9-36)

1. Remove shock absorber lower mounting nut at axle housing lower suspension arm bracket.

2. Remove shock absorber upper pivot bolt from frame and remove shock absorber.

To install, loose-assemble shock absorber at both ends, then torque lower stud nut 30 to 46 ft. lbs. and the upper bolt and nut 45 to 55 ft. lbs.

REAR SUSPENSION ARMS (Fig. 9-36)

The rear axle housing is attached to the frame with four suspension arms. When removing and installing suspension arms, the frame and axle housing should be supported. When removing the lower control arms, also support the differential at the companion flange so that the axle housing will not move out of location.

The control arms must be installed with the open side of the channel facing downward.

CAUTION: Whenever a suspension arm is installed, torque the attaching bolts 55 to 75 ft. lbs. WITH THE CAR RESTING AT NORMAL CARRYING HEIGHT.

REAR SPRINGS

Remove (Fig. 9-36)

1. Hoist rear of car and disconnect shock absorbers from rear axle housing.

2. Loosen suspension arm bolts at frame and axle.

3. Support frame to relieve weight from springs.

4. Remove the upper and lower spring mounting bolts and clamps.

5. Remove the coil spring and insulators by dislodging spring from lower seat. (The coil spring will be under slight compression.)

Install

1. Place upper insulator in coil spring and rotate

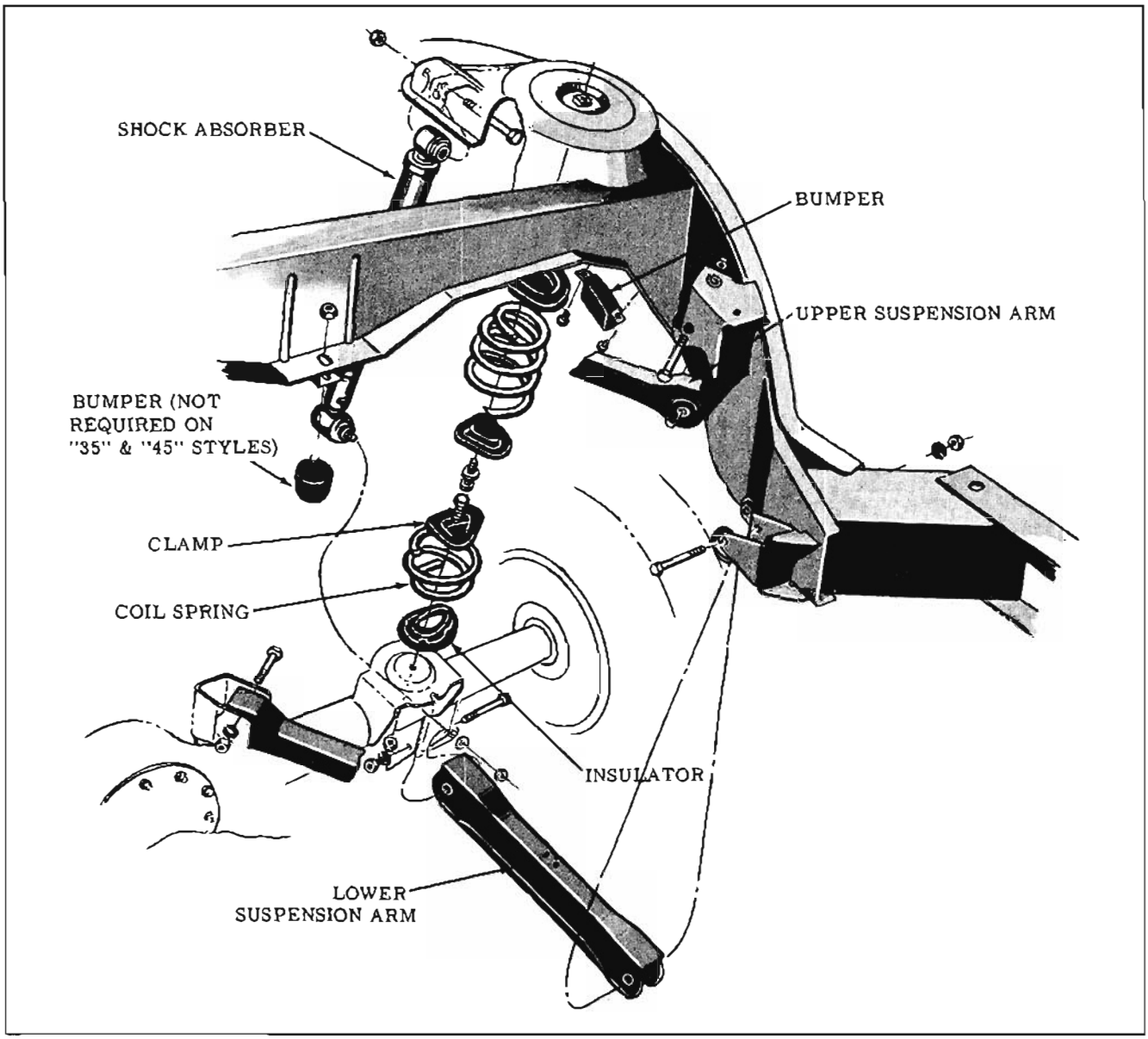


Fig. 9-36 Rear Suspension

insulators lightly so that insulator fits snugly in end of spring coil. (Fig. 9-37)

2. Position coil spring with insulator against upper seat and install clamp but do not tighten upper attaching bolt.

IMPORTANT: Locate the clamp so that it nests in the insulator, (tang in notch) then torque the mounting bolt 35 to 45 ft. lbs.

3. Position lower end of coil spring on axle housing pad and raise axle housing to compress spring to normal carrying height.

4. Install Spring Holding Tool BT-6102 at front of spring. (Fig. 9-38)

5. Lower axle housing and position other spring insulator as in Step 1; then raise axle and install lower clamp.

6. Position lower clamp so that it nests in the insulator, then tighten the lower mounting bolt 35 to 45 ft. lbs.

7. Raise axle if necessary for the removal of Tool BT-6102.

8. Connect shock absorbers and torque suspension arm bolts 70 to 90 ft. lbs. with the weight of the car resting on the rear springs.

AXLE SHAFT BEARING AND OIL SEAL (Fig. 9-39)

Axle Shaft—Remove

1. Remove wheel.

NOTE: All wheel nuts have right hand threads.

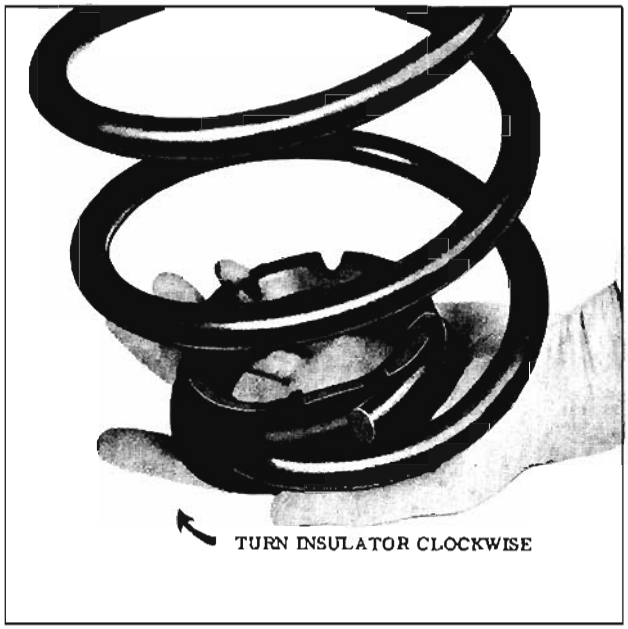


Fig. 9-37 Spring Insulator Installation

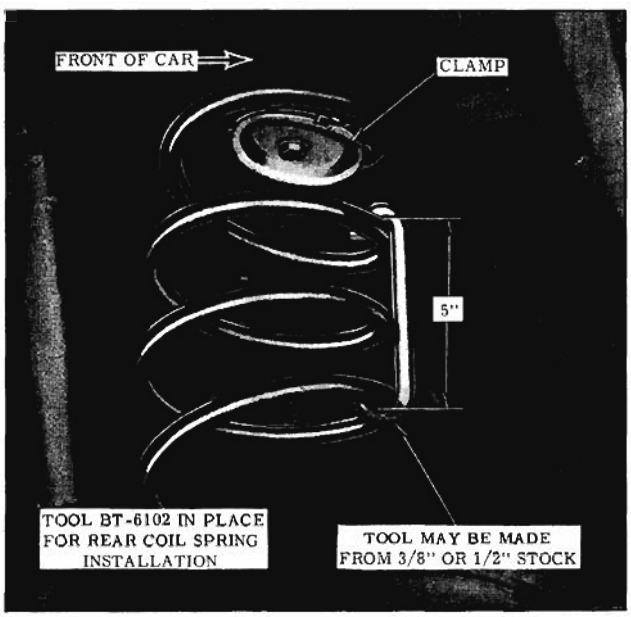


Fig. 9-38 Coil Spring Installation

2. Remove the two spring nuts from wheel studs which hold the brake drum in place and remove the drum.

3. Remove nuts from the four bolts attaching brake backing plate to axle housing.

4. Pull axle shaft bearing retainer plate away from backing plate, taking care not to dislodge backing plate as brake line may be damaged.

5. Pull axle shaft and bearing assembly from housing. Use Tool J-942-1 and Slide Hammer J-2619 if bearing is a tight press fit in the axle housing. (Fig. 9-40)

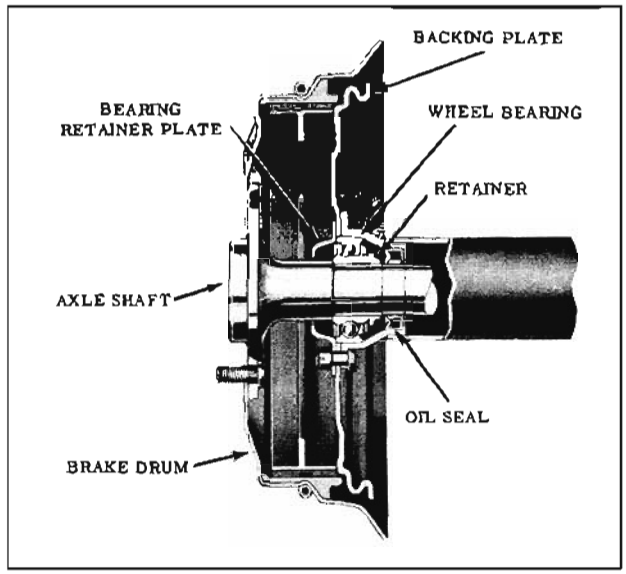


Fig. 9-39 Axle Shaft and Related Parts

NOTE: Extreme care must be exercised to prevent the axle shafts from dragging on oil seal. Bearings should then be covered by a clean cloth to prevent dirt getting into bearings.

6. Replace one backing plate attaching nut to hold plate in position.

Bearing Removal

The sealed rear wheel bearings are built with .012" to .015" end-play between balls and races and should not be rejected unless end-play is greater than .020" or definite roughness between ball and race can be felt when bearing is rotated

Fig. 9-40 Removing Axle Shaft

by hand. The bearing should be checked for end-play and roughness before it is removed from the axle shaft because if bearing has been removed from the axle shaft, it cannot be used again.

NOTE: Tipping of either race can cause a large error in end-play reading.

1. With axle shaft removed, remove bearing retainer collar after splitting with cold chisel as shown in Fig. 9-41. Do not damage axle shaft.

2. Engaging outer race of bearing with Tool J-947-2, used in conjunction with J-947-1, press off bearing in arbor press, (Fig. 9-42). Remove bearing only when a new bearing is to be installed. (Tool J-947-2 is used during removal to prevent breakage of the bearing outer race which could result in personal injury).

Axle Shaft Flange Bolt—Remove and Install

The axle shaft flange bolts can be removed by pressing bolts from axle flange. To install, press new bolts into flange using care not to damage threads. Support bolt head and peen bolt with Peening Tool J-554-18.

Bearing—Install

Using Tool J-947-3 in conjunction with plate

Fig. 9-41 Removing Bearing Retainer

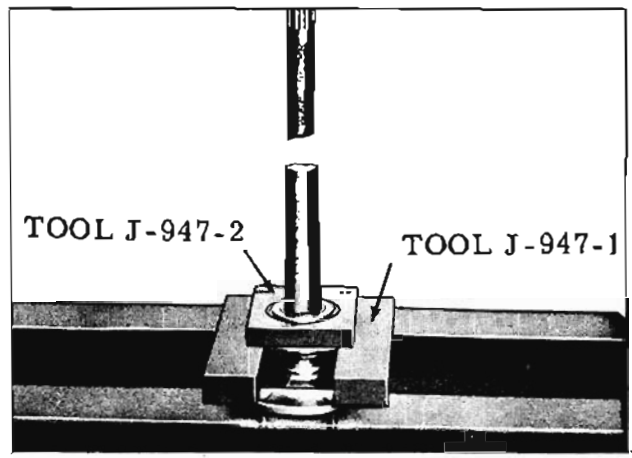


Fig. 9-42 Removing Axle Shaft Bearing

J-947-1, press bearing over axle shaft being sure that pressure is applied to inner race of bearing. After bearing has been pressed firmly against axle shaft shoulder, press new bearing retainer collar over axle shaft until it is firmly seated against bearing. (Fig. 9-43) Do not damage shaft oil seal surface.

Axle Shaft—Install

Before installing axle shafts examine oil seals The oil seals have feather edges which form a tight seal around the axle shafts. If these feather edges are damaged in any way, the oil seals must be replaced.

Examine the surface of the shaft on which the seal wipes to make sure that it is smooth and free from tool marks. If necessary, dress down shaft with crocus cloth.

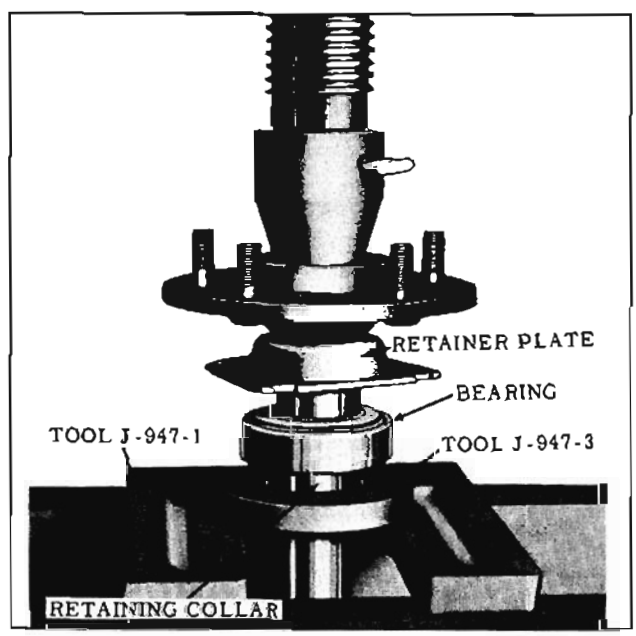


Fig. 9-43 Installing Axle Shaft Bearing Retainer

If roughness or excessive play is detected in wheel bearings, they should be replaced.

Axle shafts are serviced with wheel studs pressed into the flange of the shaft.

1. Remove temporary nut holding backing plate to axle housing.
2. Clean inner surface of backing plate and place new gasket over backing plate mounting studs. Clean gasket side of retainer plate.
3. Slide axle shaft and bearing assembly into place. EXTREME CARE MUST BE EXERCISED WHEN SLIDING THE AXLE SHAFT THROUGH THE OIL SEAL TO AVOID DAMAGING THE SEAL.
4. Place retainer plate over backing plate mounting studs and install self-locking nuts. Torque 23 to 28 ft. lbs.
5. Replace brake drum and wheel assembly.

OIL SEAL (AXLE SHAFT REMOVED)

Remove

1. Insert splined end of axle shaft into seal.
2. With splined end of axle shaft contacting upper ID of seal, press down on axle shaft until seal is removed from axle housing.

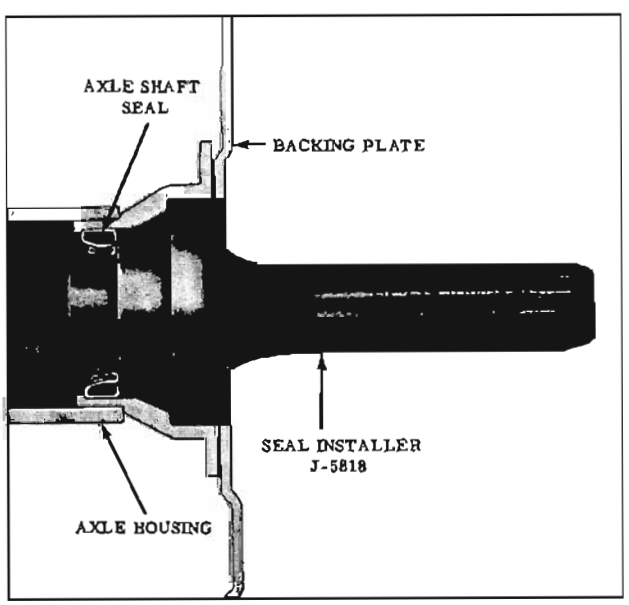


Fig. 9-44 Installing Rear Axle Oil Seal

Install

1. Apply sealer Part No. 557622 to OD of seal.
2. Position seal into axle housing. Drive seal into housing with Tool J-5818 until seal is fully seated. (Fig. 9-44)

AXLE HOUSING

ALIGNMENT

If rear tire wear indicates that the axle housing may be bent, the alignment can be checked as follows:

1. Back the car squarely onto an alignment machine.
2. Compensate for wheel run-out the same as for checking front wheel toe-in.
3. Check camber readings which should be 1/4° negative to 1/2° positive.
4. Check the amount of toe-out, which should be 1/16" to 3/16".

   NOTE: Due to the fact that the car is backed onto an alignment machine, the actual toe-out will be read on the scale as toe-in. However, if the toe-out is checked with a tram gauge, disregard the aforementioned.

5. If a tram gauge is used for checking toe-out, it will still be necessary to perform Steps 1 and 2 in order to check camber.

The necessary straightening operations may be performed using frame straightening equipment without removing the axle housing from the car. This procedure will allow checks during the straightening operation to determine when the housing is within the prescribed limits.

WHEELS AND TIRES

DISMOUNTING TIRES

1. With wheel assembly removed, remove valve cap and core to deflate tires.
2. Use commercial type bead breaker to loosen tire sealing beads from rim.

   CAUTION: DO NOT use tire irons for breaking beads from rim as this may damage beads.

3. After beads have been loosened, remove the outside bead from the rim with two tire irons.
4. Turn the tire over and again use tire irons,

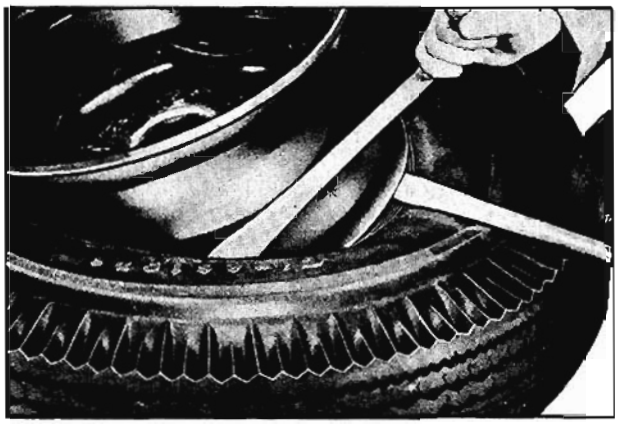


Fig. 9-45 Removing Tire

one between the rim and bead to pry the rim out, the other to pry outward between the tire bead and rim as shown in Fig. 9-45.

VALVE REMOVAL AND REPLACEMENT (Tire Removed)

To remove a rubber snap-in valve from rim, force a small screwdriver blade between valve and edge of hole. Then, while prying on valve to start groove out of edge of hole, push the valve back through the rim.

IMPORTANT: To insure against air leaking around the valve, always use a new valve once a valve is removed from the rim.

The one piece snap-in type rubber valve is installed as follows:

1. Clean all particles of foreign matter from around the area and the edges of the valve hole in the rim with steel wool.

2. Lubricate the outside of the valve with water or a very light film of tire lubricating soap.

   IMPORTANT: DO NOT USE GREASE OR DRY SOAP AS IT WILL DETERIORATE THE RUBBER.

3. Insert the snap-in type rubber valve through the hole in rim as far as it will go, then pull the valve through the hole with a tire valve fishing tool until the valve snaps into position. (Fig. 4-46)

   NOTE: Do not attempt to drive the valve into position with a hammer or pull the valve with pliers as damage to the valve may result.

MOUNTING TIRES

Tire mounting machines or tire irons can be

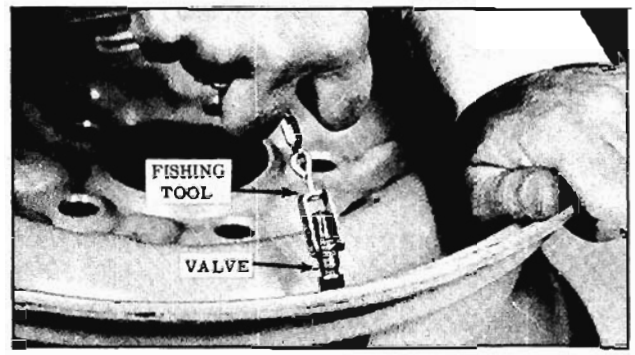


Fig. 9-46 Installing Valve

used, however, extreme care must be exercised to prevent injury to the sealing bead and circumferential bead when forcing tire over rim.

1. If a new tire is to be mounted, remove the cardboard spacer.

2. Apply a light film of tire lubricating soap to sealing beads of tire.

   NOTE: DO NOT use excessive lubricant as this may lead to rim slippage and subsequent breakage of air seal.

3. Carefully mount inner bead in usual manner. If tire irons are used, take small "bites" around rim being careful not to injure the tire bead. (Fig. 9-47)

   CAUTION: DO NOT use a hammer, as damage to bead will result.

4. Install outer bead in the same manner.

   Fig. 9-48 illustrates a tire mounting band slipped around the outside of the tire to compress center of tire tread to force bead out against the rim seat. A sash cord winched around a jack handle will serve the same purpose.

5. While holding the tire in upright position,

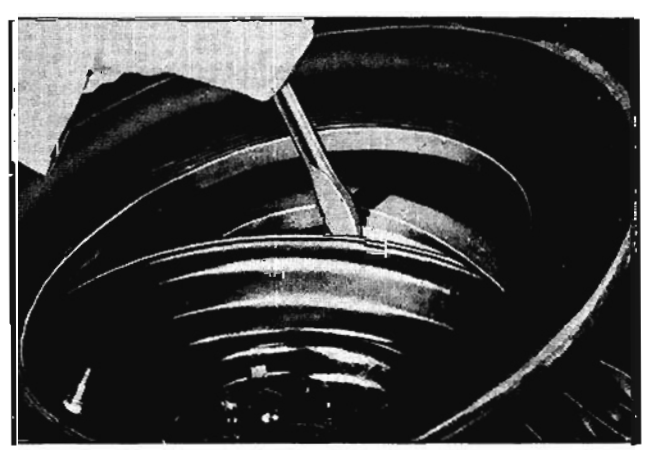


Fig. 9-47 Mounting Tire

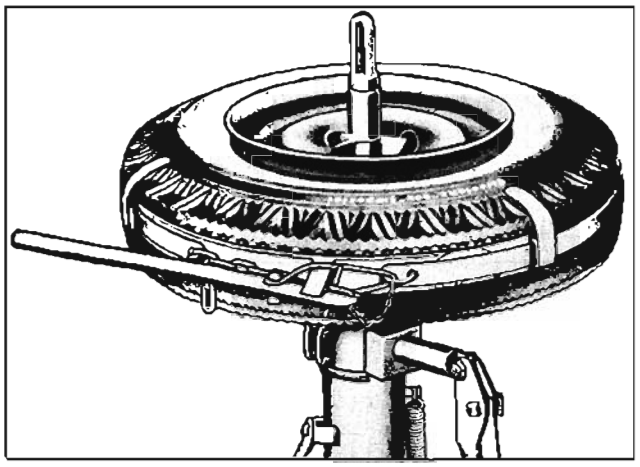


Fig. 9-48 Tire Mounting Band

press against the outside of the wheel. This will start the outside bead onto the bead seat.

6. Next, lean the tire so the weight of the wheel will help seat the inside bead.

7. Give a few quick "shots" of air to seat the tire beads on the bead seats.

   CAUTION: KEEP HANDS AWAY FROM TIRE BEAD RIM DURING THIS OPERATION.

8. Inflate tire to 40 pounds.

9. Check to be sure that the bead positioning rib (outer ring of tire) is visible evenly just above the rim flange all the way around tire, both sides.

10. Deflate to recommended air pressure.

TIRE INFLATION

Maintenance of the correct inflation pressure is one of the most important elements in tire care.

For recommended tire pressure (tires cold) refer to chart in GENERAL INFORMATION section.

Too great a tire pressure is detrimental, but not so much as under inflation. Higher inflation pressure than recommended will cause:

1. A harder riding car.

2. A tire more susceptible to various types of bruises.

3. Tire chatter, resulting in uneven wear.

4. Excessive wear at the center of the tire tread.

Even when a tire is properly inflated, it is flat where it contacts the road so that the car at all times is in effect being pushed up hill. This condition is exaggerated on an under-inflated tire.

Inflation pressures lower than recommended will result in:

1. Higher gasoline consumption.

2. Rapid and uneven wear on the edges of the tire tread.

3. A tire more susceptible to rim bruises and various types of rupture.

4. Increased cord fatigue or broken tire cords.

5. Hard steering.

6. High tire temperatures.

7. Car roll on sharp curves.

8. Tire squeal on curves.

TIRE NOISE

Complaints of axle noise are more frequently caused by tires than by differential gears, bearings, etc.

Tire noise is frequently diagnosed as axle noise. Tire noise is relative directly to the speed of the car and the road surface. Tests made for drive, float, and coast noise as used for differential testing will have little or no effect on noise level if tires are the cause.

VARIOUS TYPES OF TIRE WEAR

Under Inflation Wear

Under inflation results in abnormal wear of the tread shoulder, caused by the tires rolling on the shoulders with a wiping action. (Fig. 9-49)

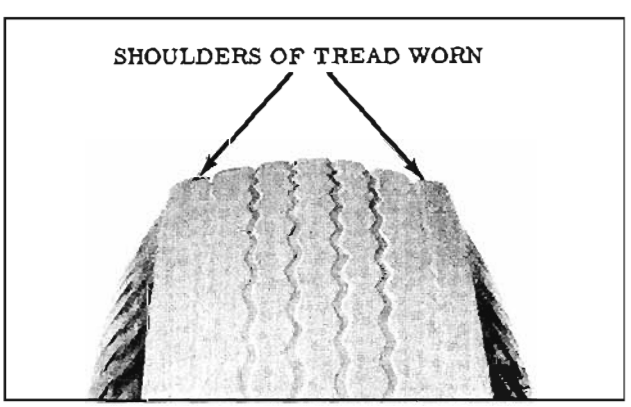


Fig. 9-49 Under Inflation Wear

In addition, under-inflated tires are subjected to continual flexing, causing high internal temperatures and cracking of the sidewall.

Over InflationWear

Over inflation causes the center section of the tread to receive excessive driving and braking, therefore, the center section is worn more than the shoulders. (Fig. 9-50) An over-inflated tire is subject to breaks in the fabric from severe impacts and is more easily cut or punctured.

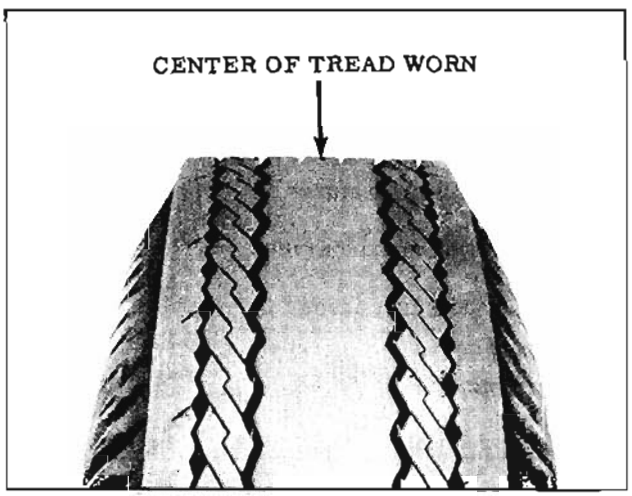


Fig. 9-50 Over Inflation Wear

Toe-in or Toe-out Wear

Excessive toe-in or toe-out has the effect of dragging the tires sideways down the road, which results in feathering the raised portions of the tread.

Improper toe-in is indicated by feather edges on the inner side of the tread. (Fig. 9-51) Toe-out is indicated by the feather edges on the outer side of the tread.

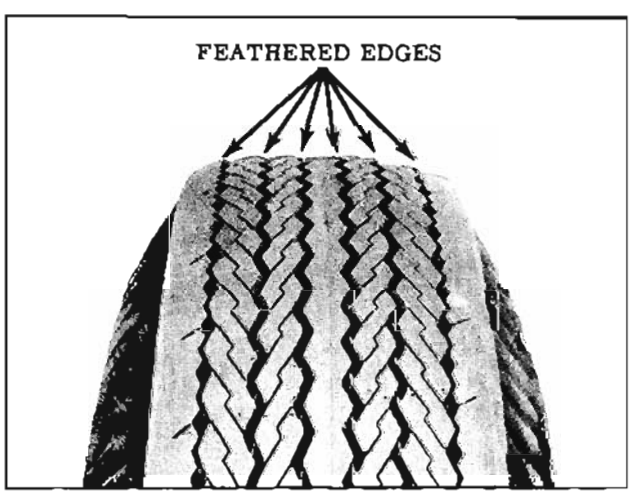


Fig. 9-51 Toe-In Wear

Camber Wear

Excessive positive camber will cause wear on the outer side of the tread. (Fig. 9-52) Excessive negative camber will cause wear on the inner side of the tread. Camber wear may also be evident if the car is driven continually on highly crowned roads.

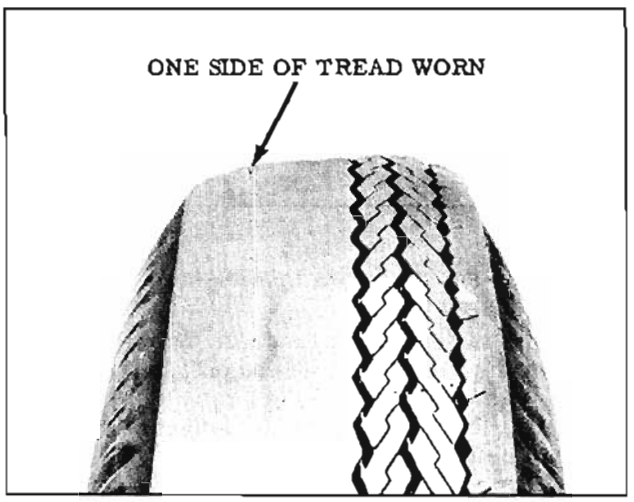


Fig. 9-52 Camber Wear

Wear Due to Driver Habits

Owner driving habits may cause cornering wear, rear tire inside wear, and front tire heel and toe wear even though all wheel alignment factors are within specifications and tires are properly inflated.

Cornering wear, caused by high speeds on turns, is identified by the rounded shoulders of the tire and small rough abrasions and fins raised by cornering friction against the road. (Fig. 9-53)

Rear tire inside wear is caused by rapid acceleration which causes the axle to bend slightly in a horizontal plane to toe-in the rear tires. This results in excessive wear on the inner shoulders of the rear tires and is similar in appearance as camber wear. (Fig. 9-52)

Wear Due to Mechanical Conditions

Loose parts of the front suspension system such as worn ball joints, mountings of the upper and lower control arms, inoperative shock absorbers and unbalanced wheels and tires, will cause flat spots, cups, gouges and wavy wear. (Fig. 9-54)

TIRE ROTATION

In order to obtain maximum tire tread life and keep the spare tire from deteriorating due to lack

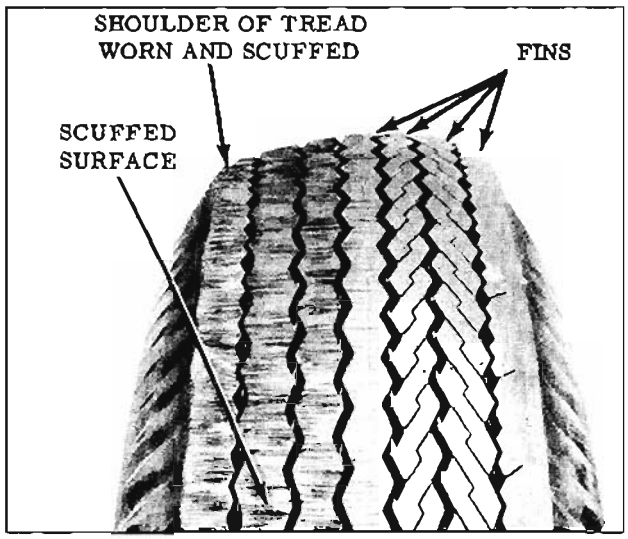


Fig. 9-53 Cornering Wear

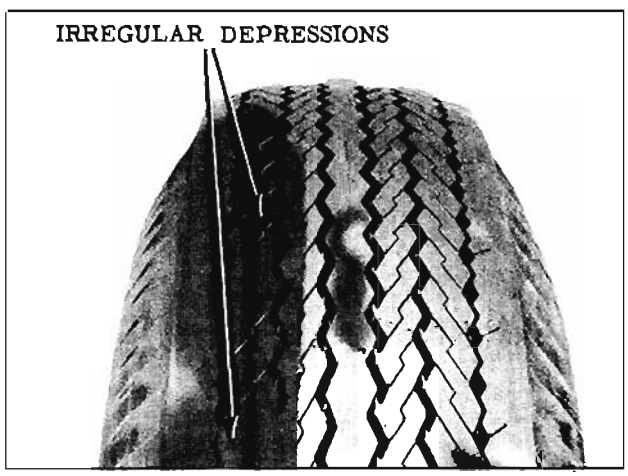


Fig. 9-54 Wear Due To Mechanical Conditions

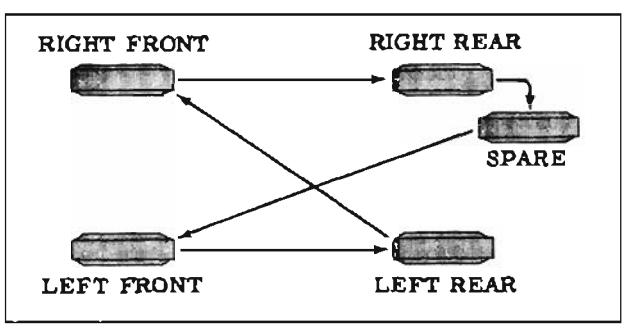


Fig. 9-55 Tire Rotation

of use, tires should be rotated at 6,000 mile intervals as shown in (Fig. 9-55).

TIRE AND WHEEL RUNOUT

Wheel and tire assemblies may be checked for runout with a dial indicator at points shown in Fig. 9-56. Runout should not exceed the following limits:

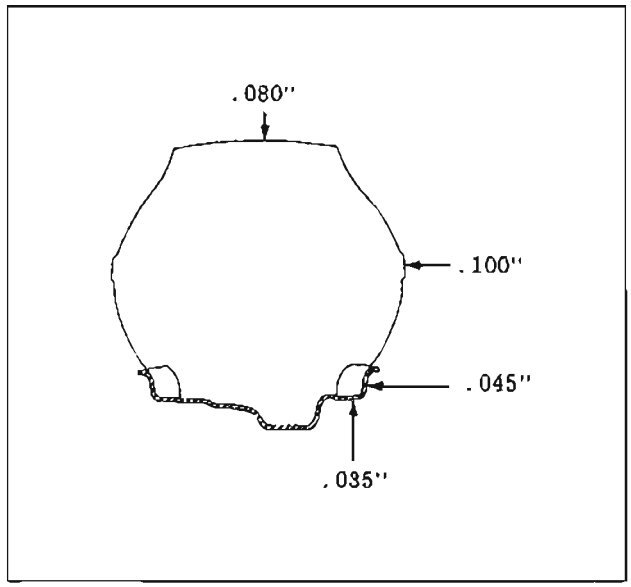


Fig. 9-56 Wheel and Tire Runout Specifications

Tire Runout:	Radial	.080"
	Lateral	.100"
Wheel Runout:	Radial	.035"
	Lateral	.045"

NOTE: Tire runout should be checked as soon as possible after car has been driven to avoid false readings due to the tendency of tires to take a temporary "set" after standing for a few hours.

WHEEL AND TIRE BALANCE

Wheel, tire, and brake drum balance must be maintained within certain limits; otherwise, wheel tramp and high speed shimmy will result.

Front wheel tramp and front wheel shimmy are two entirely different conditions. Front wheel tramp, which usually occurs at high speed, is a wheel hop caused from an unbalanced condition of wheels, loose linkage in the front end, or improperly operating shock absorbers.

Shimmy may occur at the lower speeds and is a wobbly condition of the front wheels caused from an unbalanced condition, loose front end linkage, loose steering gear parts, or faulty steering gear adjustment. Tramp and shimmy will be felt in the whole car, however, shimmy can also be felt at the steering wheel. Shimmy is a front wheel condition entirely, whereas it is possible to have tramp in front or rear wheels.

Due to the irregularities in tread wear caused by sudden brake application, misalignment, low inflation pressure, or tire repair, etc., a wheel and tire assembly may lose its original balance. Consequently, if front end instability develops, the tire and wheel assembly whould be checked for static and dynamic balance.

SPECIFICATIONS

FRONT SUSPENSION

1. CASTER ANGLE (DEGREES)	0° to 1°-
2. CAMBER (DEGREES)*	1/4° - to 1/2°+
3. TOE-IN	0" to 1/16"
4. TOE-OUT ON TURNS	
MANUAL STEERING	20°=23° ± 1/2°
POWER STEERING	20°=24° ± 1/2°
5. BALL JOINT INCLINATION	11°
6. TREAD	
33 SERIES	61.0"
ALL OTHERS	62.2"

*Maximum Camber variation between either side of the car should not exceed 1/2°.

REAR SUSPENSION

1. REAR AXLE

a. Tread	61"
b. Road Clearance at Differential	7.05"
c. Allowable Out-of-True of Housing on the Vertical (At Rear Wheel)	1/4° neg. to 1/2° pos. camber
d. Allowable Out-of-True of Housing on the Horizontal (At Rear Wheel)	1/16" to 3/16" Toe-Out
2. CARRYING HEIGHT	(Refer to Fig. 9-57)

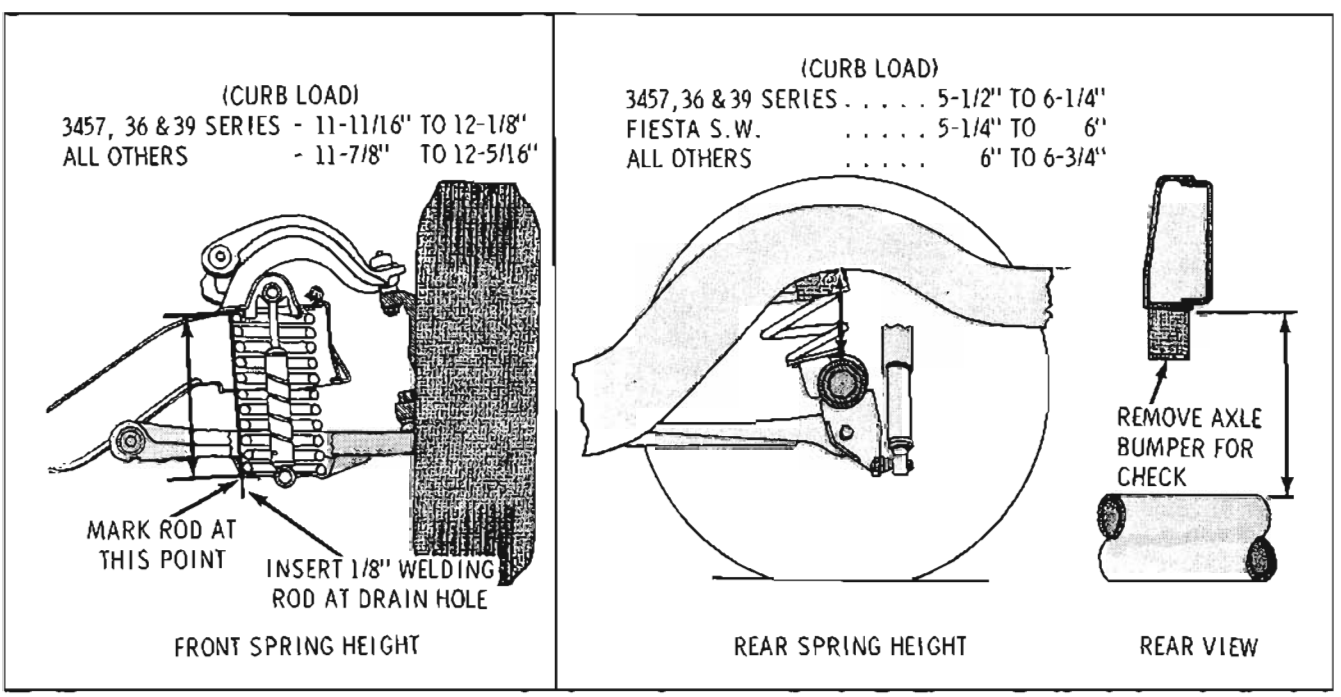


Fig. 9-57 Spring Carrying Heights

SPECIFICATIONS (Cont'd.)

WHEELS AND TIRES

1. WHEEL BASE	
a. 33, 34, 35 & 36 Series	122.9"
b. 38 & 39 Series	125.9"
2. WHEELS	
a. Rim Diameter	14"
b. Rim Width	6"
c. Radial Runout*	.035" Max.
d. Lateral Runout*	.045" Max.
3. TIRES	
a. Radial Runout*	.080" Max.
b. Lateral Runout*	.100" Max.

*Total Indicator Reading

TIRE SIZES

Series	Standard	Optional
33 Without Factory Installed Air Conditioning	7.50 x 14	8.00 x 14
33 With Factory Installed Air Conditioning	8.00 x 14	----
34, 35 & 3657 Without Factory Installed Air Conditioning	8.00 x 14	8.50 x 14
34, 35 & 3657 With Factory Installed Air Conditioning	8.50 x 14	----
3667, 38 & 39 Without Factory Installed Air Conditioning	8.50 x 14	9.00 x 14
3667, 38 & 39 With Factory Installed Air Conditioning	9.00 x 14	----

TORQUE TIGHTNESS CHART

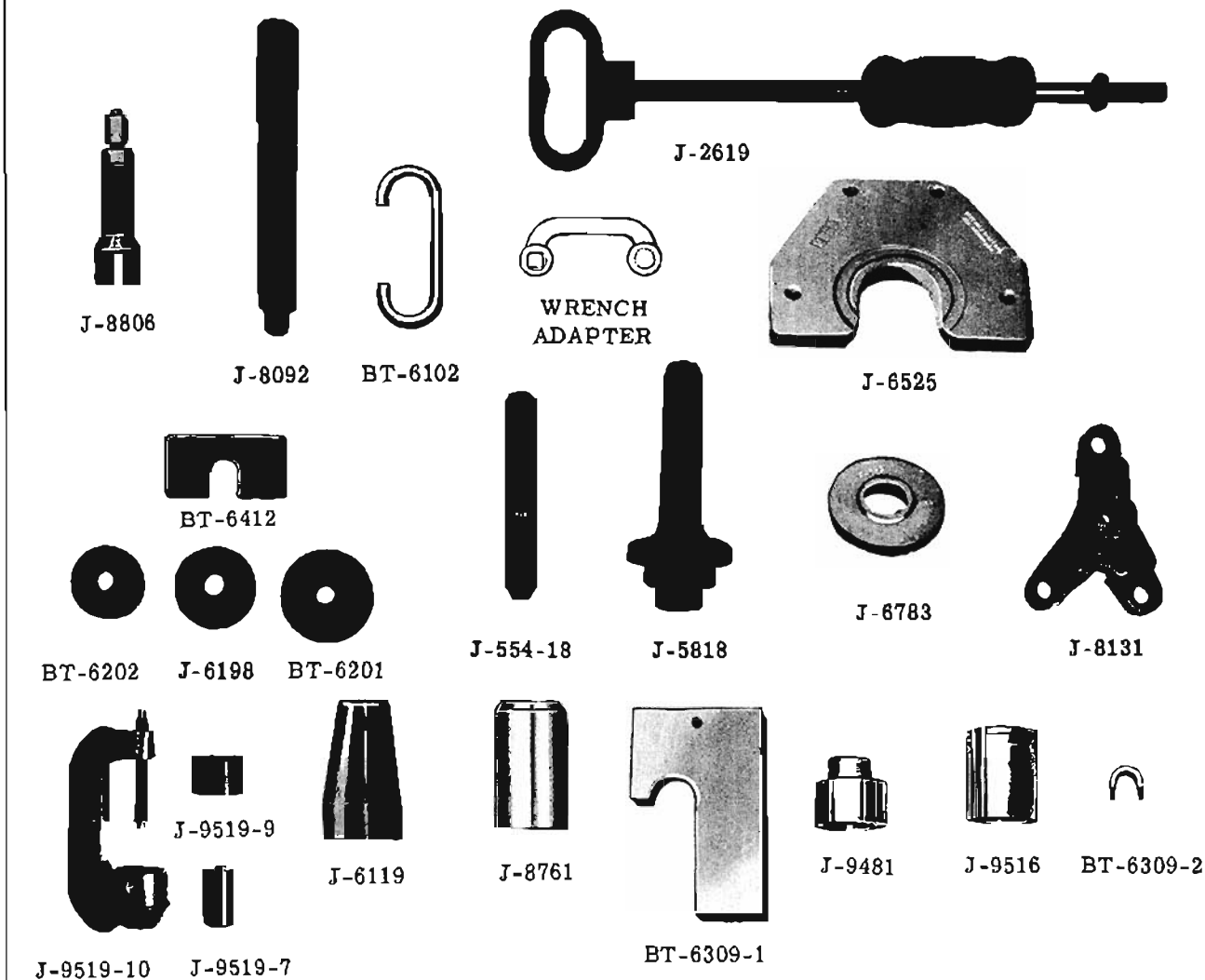
NOTE: Specified torque is for installation of parts only. Checking of torque during inspection may be 15% below the specifications.

Application	Ft. Lbs.
FRONT SUSPENSION	
Stabilizer	
Stabilizer Link Nut	12 to 17
Stabilizer Bar Bracket to Frame Bolt & Nut	25 to 45
Shock Absorber	
Shock Absorber Upper Pivot Bolt & Nut	45 to 60
Shock Absorber to Control Arm Bolts	15 to 24
Control Arms	
Upper Control Arm Pivot Shaft to Frame Bolts & Nuts	100 to 150

TORQUE TIGHTNESS CHART

(Cont'd.)

Lower Control Arm Pivot Shaft to Frame Bolts & Nuts	50 to 65
Upper Arm Bushing Bolt	50 to 60
Lower Arm Bushing Bolt	60 to 80
Ball Joints	
Service Ball Joints to Upper Control Arm	8
Ball Joints to Steering Knuckle Nuts (Lower)	70 Min.
(Upper)	40 Min.
Steering Knuckle	
Backing Plate to Steering Knuckle (Anchor Bolt) (33 Series Only)	80 to 105
Backing Plate to Steering Knuckle (Anchor Bolt)	120 to 145
Plain Arm to Steering Knuckle to Backing Plate Bolts (1/2")	100 to 140
Wheel Bearing Adjustment Nut	(Refer to Wheel Bearing Adj.)
REAR SUSPENSION	
Shock Absorber	
Upper Pivot Bolt & Nut	45 to 55
Lower Stud Nut	30 to 46
Suspension Arms	
Pivot Bolts & Nuts	55 to 75
Rear Spring	
Upper & Lower Bolt	35 to 45
Backing Plate	
Backing Plate Attaching Bolts	23 to 28
MISCELLANEOUS	
Wheel Nuts	70 to 85



BT-6102	Rear Spring Installer
BT-6201	Front Wheel Bearing Inner Race Installer
BT-6202	Front Wheel Bearing Outer Race Installer
BT-6309-1	Pivot Shaft Bushing Press Plate
BT-6309-2	Pivot Shaft Bushing Remover Spacer
BT-6412	Back-Up Plate
J-554-18	Hub Bolt Peening Tool
J-2619	Slide Hammer Assembly (Used to Remove Axle Shafts)
J-5818	Axle Shaft Oil Seal Installer
J-6119	Flywheel Housing Oil Seal Installer (Used to Install Saginaw Ball Joint Garter Spring)
J-6198	Front Pinion Bearing Cup Installer (Used to Install Outer Bearing Inner Race Retainer)

J-6525 (J-947-1 and J-947-2) Axle Shaft Bearing Remover

J-6783 (J-947-3) Axle Shaft Bearing Retainer Installer

J-8092	Driver Handle (Used with J-6198, J-7578 and J-7585)

J-8131 (J-942-1) Axle Shaft Remover

J-8761	Front Pump Seal Installer (Used to Install Inland Ball Joint Seal)
J-8806	Ball Joint Remover
J-9481	Pivot Shaft Bushing Installer
J-9516	Pivot Shaft Bushing Remover
J-9519-10	Ball Joint Fixture
J-9519-7	Ball Joint Remover
J-9519-9	Ball Joint Installer

Pivot Shaft Torque Wrench Adapter (Available on the open market)

Fig. 9-58 Suspension Tools

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SUSPENSION

30-31-32 SERIES

CONTENTS OF SECTION 9

FRONT SUSPENSION

REAR SUSPENSION

FRONT SUSPENSION

MAINTENANCE RECOMMENDATIONS

For lubrication information, refer to PERIODIC MAINTENANCE, Section 2.

During an oil change, the ball joint seals should be observed for cracks or cuts. If a seal is damaged, it can be replaced by referring to FRONT SUSPENSION BALL JOINT.

Periodic lubrication of the front wheel bearings if not required; however, when brake maintenance requires removal of the front drums, the bearings should be cleaned and repacked with a sodium soap, fine fiber grease.

WHEEL BEARINGS (Fig. 9-103) (Includes 33 Series)

The proper functioning of the front suspension cannot be maintained unless the front wheel TAPER ROLLER BEARINGS are correctly adjusted. Cones must be a slip fit on the spindle and the inside diameter of cones should be lubricated to insure that the cones will creep. Spindle nut must be a free-running fit on threads.

Adjustment

The adjustment of front wheel bearings should be made WHILE REVOLVING THE WHEEL AT LEAST THREE TIMES THE SPEED OF NUT ROTATION when taking the torque readings as follows:

1. Tighten adjusting nut with a torque wrench 25 to 30 ft. lbs. to insure that all parts are properly seated and threads are free.
2. Back off nut 1/2 turn. Retighten nut finger tight.
3. If unable to install cotter pin at finger tight position, back off to first notch and install cotter pin.

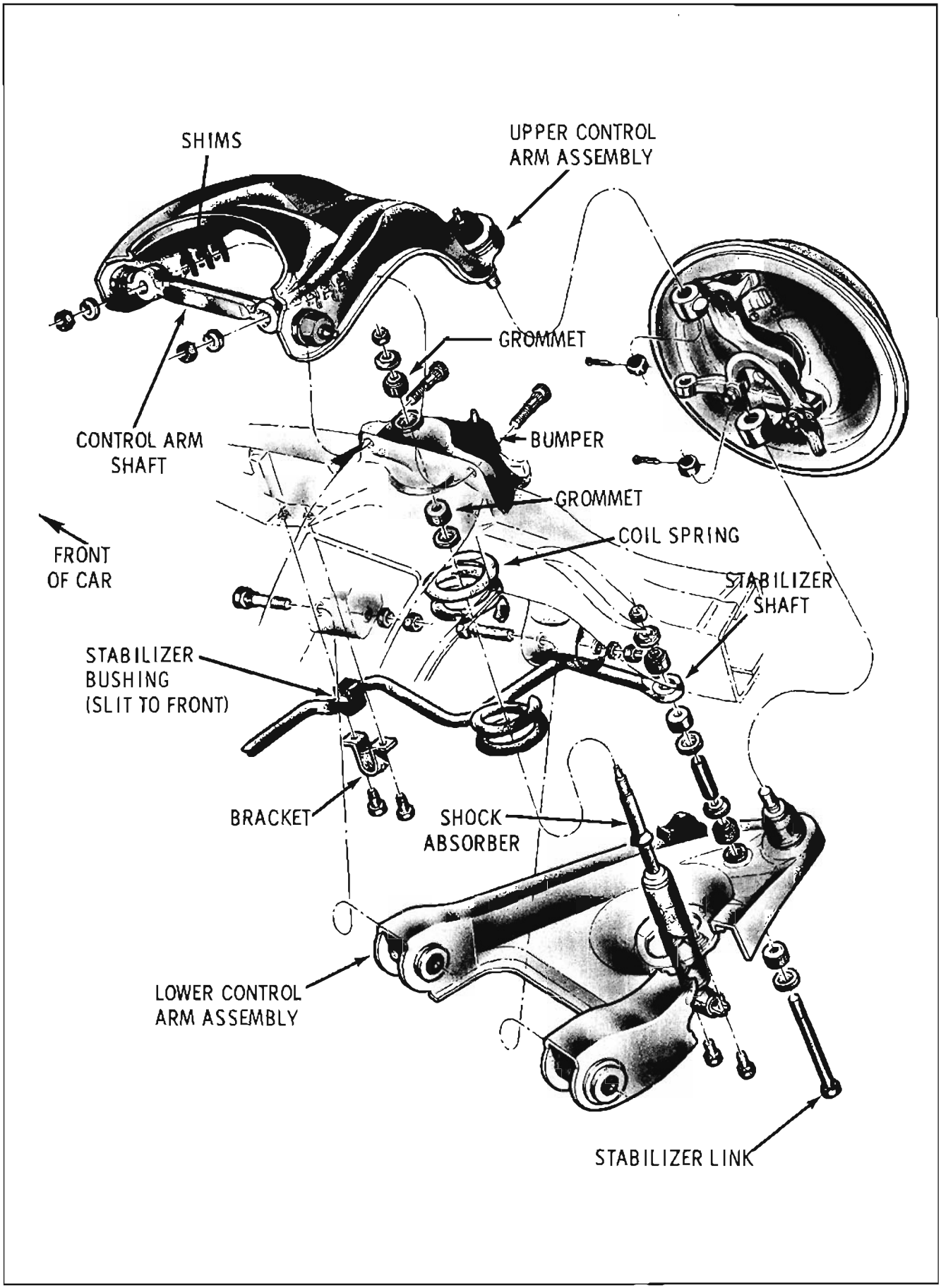


Fig. 9-101 Front Suspension—Exploded View

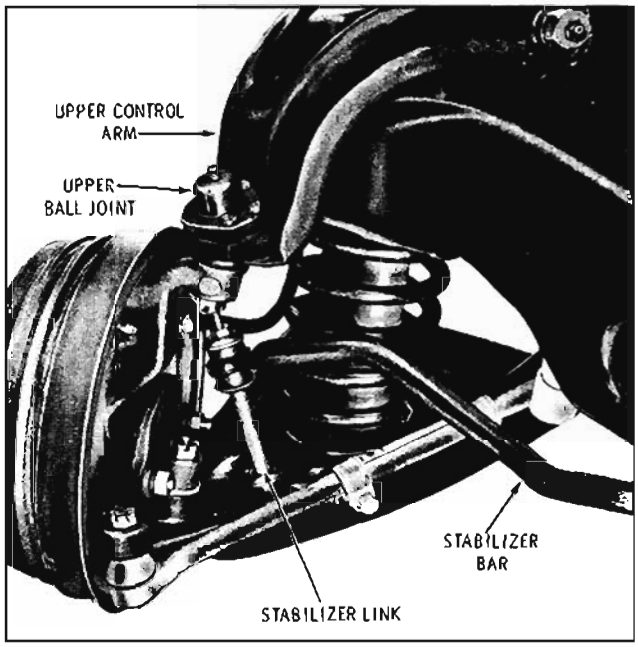


Fig. 9-102 Front Suspension Assembly

HUB AND DRUM ASSEMBLY (Figs. 9-103 & 9-104) (Includes 33 Series)

REMOVAL (WHEEL REMOVED)

1. Remove grease cap from hub.
2. Remove cotter pin, nut and washer from spindle.
3. Carefully pull hub and drum assembly from spindle.

NOTE: It may be necessary to back off the brake shoe adjustment before the hub and drum can be removed.

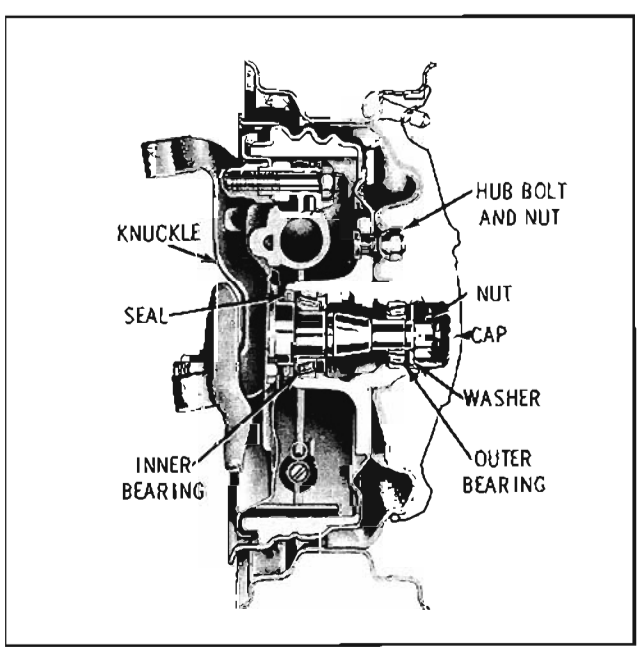


Fig. 9-103 Front Hub and Drum Assembly

BEARING AND SEAL REMOVAL

1. Remove washer retaining the roller and separator assembly in the hub.
2. Remove the outer bearing inner race and the roller and separator assembly from hub.
3. Pry seal from hub, then remove inner bearing inner race and roller and separator assembly from hub.
4. If necessary to remove outer races, insert a brass drift into hub, indexing end of drift with notches in hub behind bearing outer race and tap with a hammer. Tap alternately on each side of bearing race. (Fig. 9-105)

CLEANING AND INSPECTION

NOTE: For inspection of front drums, refer to BRAKE DRUMS, Section 11.

1. Wash all parts in clean solvent with the exception of the roller and separator assemblies and races and air dry. Roller and separator assemblies and races should be washed in gasoline.
2. Check bearings for cracked separators and worn or pitted rollers.
3. Check bearing races for cracks, scores or a brinelled condition.

BEARING AND SEAL INSTALLATION

1. If the outer races were removed, drive or press the races into the hub as shown in Figs. 9-106 and 9-107.
2. Lubricate the bores of the inner races and fully pack the roller and separator assemblies with a sodium soap, fine fiber grease.
3. Install inner bearing roller and separator assembly into outer race, then install inner bearing inner race.
4. Carefully tap seal into hub.
5. Clean any traces of grease from brake lining and drum with fine sandpaper. If necessary to adjust brake linings, refer to BRAKE LINING - Adjust, Section 11.
6. Position hub and drum assembly over spindle.
7. Install outer bearing roller and separator into hub.
8. Install outer bearing inner race over spindle, then install the washer and spindle nut. Draw spindle nut up snug and adjust bearing as outlined under WHEEL BEARING ADJUSTMENT.

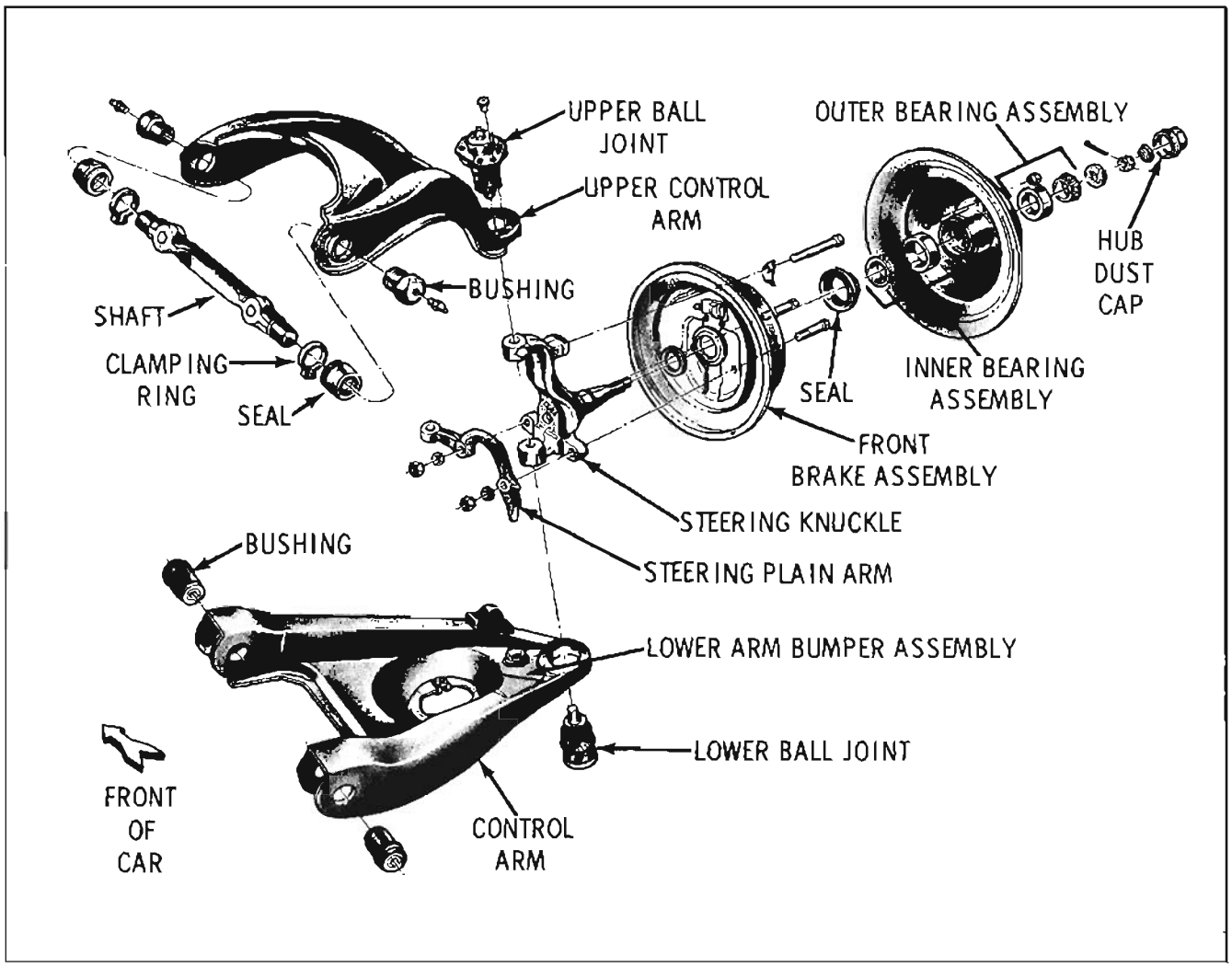


Fig. 9-104 Front Suspension—Exploded View

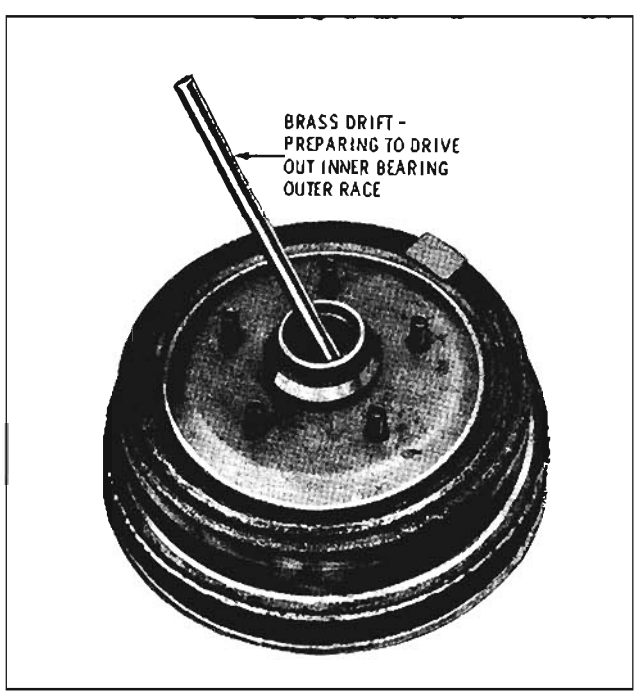


Fig. 9-105 Removing Wheel Bearing Races

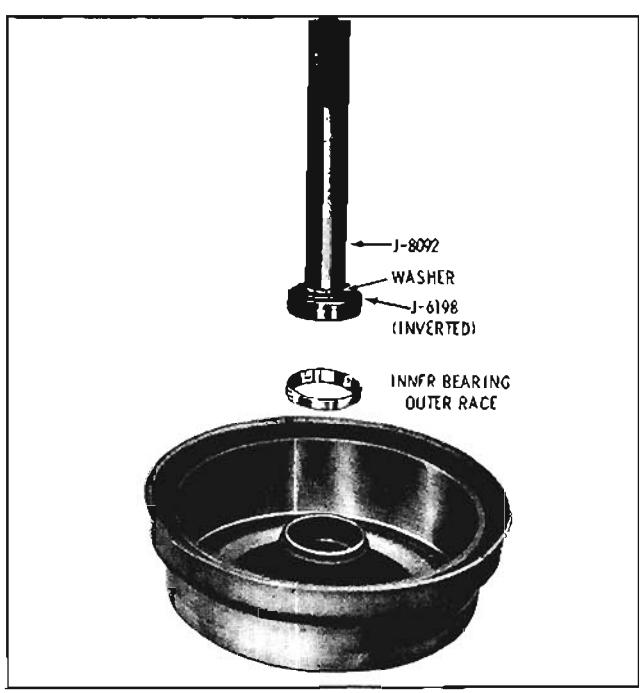


Fig. 9-106 Installing Inner Bearing Race

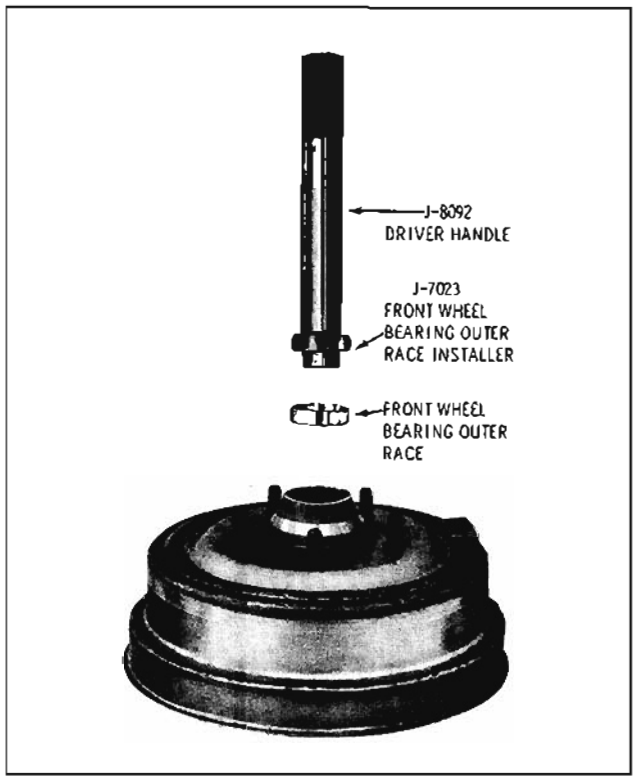


Fig. 9-107 Installing Outer Bearing Race

HUB BOLT REPLACEMENT

1. With the hub and drum assembly removed, drill a 5/8" hole 1/4" deep into the head of the hub bolt.

2. Support hub and drum assembly and drive or press hub bolt out through the front of the hub and drum assembly.

3. Press a new hub bolt into the hub.

4. While supporting hub bolt, peen hub bolt into countersunk area of drum with the use of Peening Tool J-554-18 until the drum is secure to the hub. (Fig. 9-108)

SHOCK ABSORBERS

A slight amount of fluid may bleed by the rod seal in cold weather and deposit a light film on the upper area of the shock absorber. This condition will not impair operation and should be considered normal. A SHOCK ABSORBER SHOULD NEVER BE CHECKED HORIZONTALLY OR WITH THE ROD EXTENSION DOWN.

For a complaint of a noisy or defective shock absorber, first check the mounting torque. If mounting is satisfactory, disconnect the lower mountings and pump the shock absorbers by hand in a vertical position. Compare both shock absorbers. If both shocks respond the same, it is unlikely that a defective shock absorber exists.

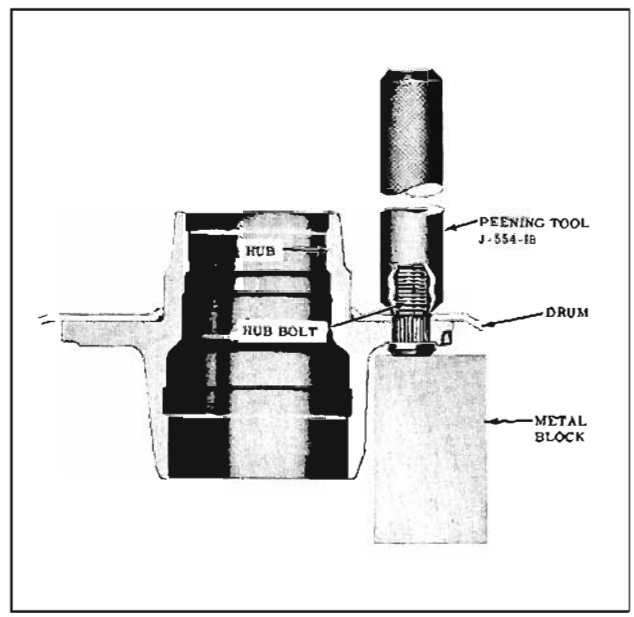


Fig. 9-108 Peening Hub Bolt

THUMPING NOISE

A thumping noise usually occurs when a shock absorber is changing its direction of stroke.

1. The shock absorber should be pumped with a rapid change of stroke. If lag is felt when changing stroke, this unit will be noisy.

2. Completely extend the shock absorber and pull hard. If spring tension if felt, this shock absorber will be noisy and should be replaced.

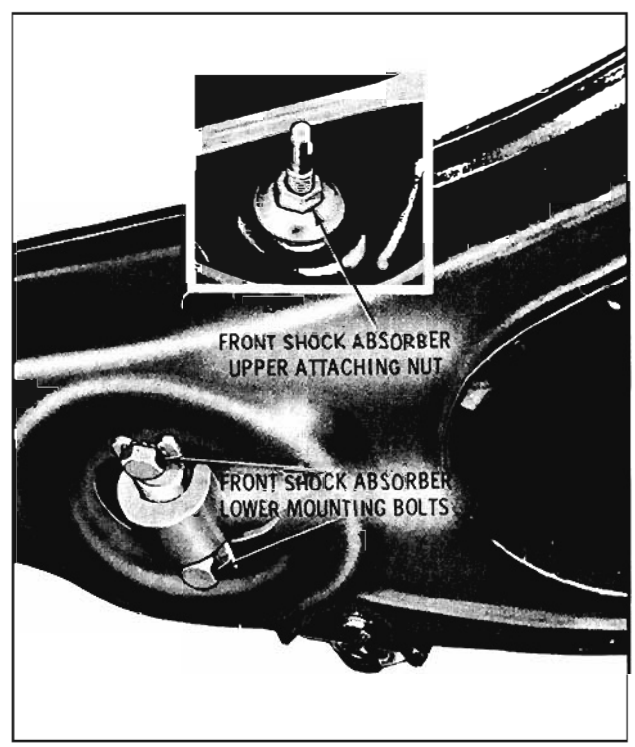


Fig. 9-109 Front Shock Absorber Attachment

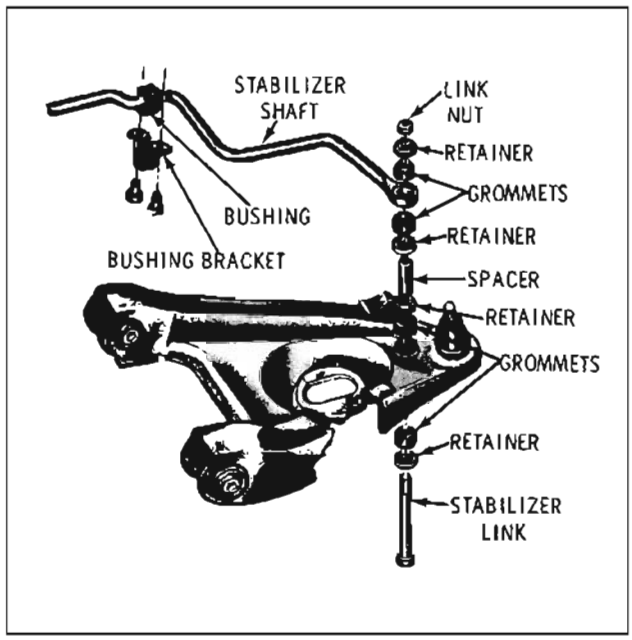


Fig. 9-110 Stabilizer Bar Attachment

SQUEAKY OR REED TYPE NOISE

Hand pump the shock absorber at different rates of speed. If noise is heard that changes from a deep grunt to a high-pitched squeak, the shock absorber needs replacement.

NOTE: A squealing noise could be attributed to seals. This is particularly true if the shock has been inoperative for a period of time. This noise will disappear after a few strokes of the shock absorber and is not a cause for rejection.

FRONT SHOCK ABSORBERS

REMOVE AND INSTALL (Fig. 9-109)

1. Remove upper attaching nut, retainer and grommet from the shock absorber.

2. Remove the two bolts and lockwashers attaching shock absorber to lower control arm and remove shock absorber.

   To install shock absorber, position grommet and retainer over shock and slide shock up through spring and frame. Install and torque the upper attaching nut 10 to 20 ft. lbs. or until nut is to end of threads on stud, and the lower cap screws 15 to 24 ft. lbs.

   NOTE: The part number of each shock absorber is stamped on the outer casing.

STABILIZER BAR

REMOVE AND INSTALL (Fig. 9-110)

1. Disconnect each side of stabilizer linkage by removing nut from link bolt, pull bolt from linkage and remove retainers, grommets and spacer.

2. Remove bracket to frame bolts and remove stabilizer bar, rubber bushings and brackets.

3. To replace, reverse sequence of operations. The rubber bushings should be positioned squarely in the brackets with the opening in the bushings facing the front of car. Torque stabilizer link nut 5 to 15 ft. lbs. and bracket bolts 10 to 15 ft. lbs. If 5/16" production bracket bolt strips, it can be replaced with a 3/8" service bolt.

   IMPORTANT: Never lubricate stabilizer bar rubber bushings, as they are dependent upon a bonding of the rubber to the bar for proper stabilizer action.

STEERING KNUCKLE (Figs. 9-103 & 9-104)

Removal

1. Raise front of car and support with floor stands under frame.

   NOTE: Spring tension is needed to assist in breaking ball joint studs loose from steering knuckle. Do not place stands under lower control arm.

2. Remove front wheel and hub and drum assembly.

3. Remove backing plate without disconnecting brake hose. Leave plain arm connected to tie rod end.

   NOTE: Support the backing plate assembly out of the way to avoid any strain on brake hose.

4. Place floor jack under lower control arm.

5. Disconnect the control arm ball joints from the steering knuckle by:

   a. Removing cotter pins from ball joint studs.

   b. Remove the upper and lower joint nuts to clean the threads. REPLACE THE NUT, LEAVING IT APPROXIMATELY TWO TURNS LOOSE. Lower floor jack slightly, then tap knuckle with a brass drift at ball joint stud. This will loosen stud from steering knuckle. Tool J-8806 can be used as shown in Fig. 9-111 to break ball joints loose from knuckle.

   NOTE: After stud breaks loose from steering knuckle, raise floor jack and

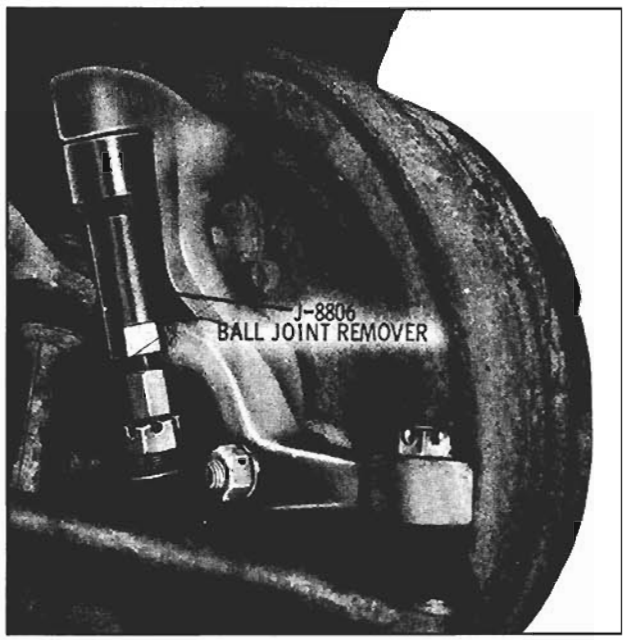


Fig. 9-111 Disconnecting Ball Joint

Fig. 9-112 Front Spring Positioning

relieve spring tension. This will permit removal of ball joint nut.

6. Lift upper control arm and remove steering knuckle from car.

Installation

1. Connect the upper and lower ball joints to the steering knuckle.

2. Torque stud nuts 40 ft. lbs. (min.) and install cotter pins. Tighten further, if necessary, to install cotter pin.

3. Install backing plate and plain arm to steering knuckle. Torque nuts 60 to 82 ft. lbs. Torque anchor bolt 80 to 105 ft. lbs.

4. Install wheel and hub and drum assembly. Adjust wheel bearings.

5. Check camber, caster and toe-in and adjust if necessary.

COIL SPRING

Removal

1. Raise front of car and support by frame with floor stands.

2. Remove wheel and tire assembly.

3. Disconnect stabilizer link from lower control arm.

4. Remove shock absorber.

5. Position a floor jack between spring seat and joint with handle straight out from car to support lower control arm.

6. To disconnect the lower control arm ball joint from the steering knuckle:

   a. Remove cotter pin from ball joint stud.

   b. Remove the nut to clean the threads. REPLACE THE NUT, LEAVING IT APPROXIMATELY TWO TURNS LOOSE. Lower floor jack slightly, then tap knuckle with a brass drift at ball joint stud. This will loosen stud from steering knuckle. Tool J-8806 can be used as shown in Fig. 9-111 to break ball joint loose from knuckle.

   NOTE: After studs break loose from steering knuckle, raise floor jack and relieve spring tension. This will permit removal of ball joint nut. If interference is encountered between the ball joint and the backing plate, it will be necessary to loosen the backing plate slightly to obtain the necessary clearance.

7. Block upper control arm and backing plate assembly up out of the way.

8. Slowly lower floor jack until spring is fully extended and remove spring.

Installation

1. While holding spring against pilot in frame, tilt spring so it will pilot in lower control arm. Rotate spring so the end of the top coil will index against step in upper

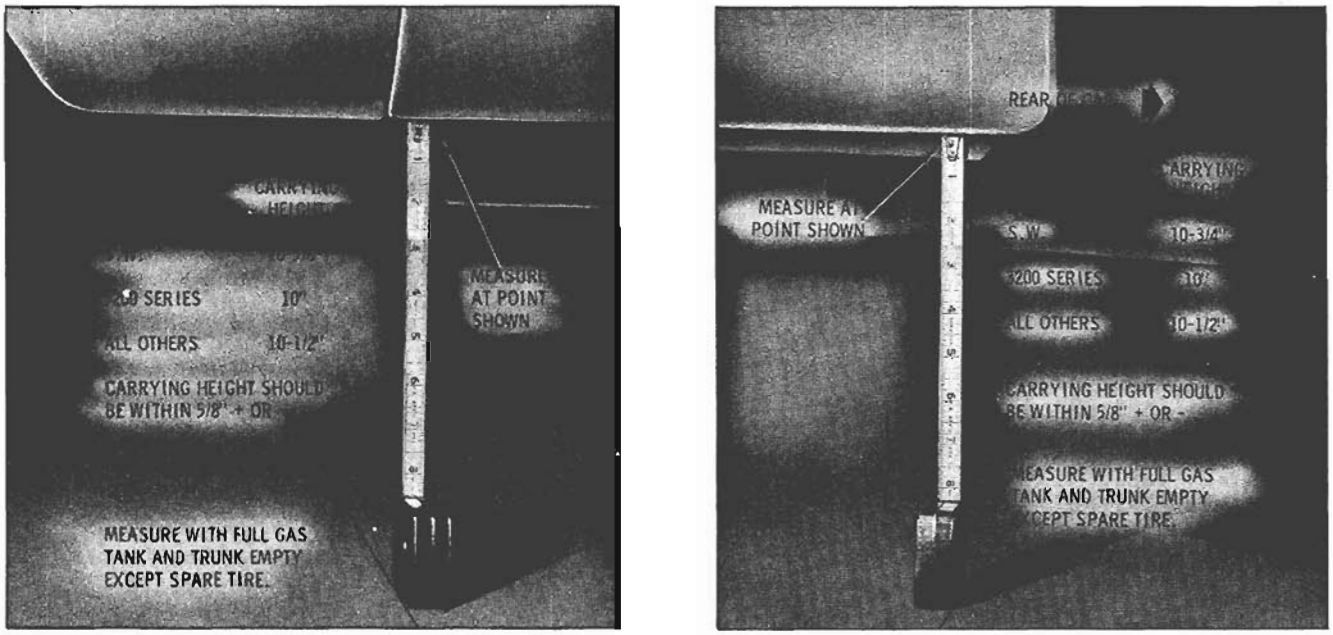


Fig. 9-113 Checking Spring Carrying Height

spring seat. Check spring indexing as shown in Fig. 9-112.

2. Position floor jack with handle straight out from car, between spring seat and ball joint.

3. Lower upper control arm and backing plate assembly into position.

4. Raise lower control arm until the ball joint is tight in steering knuckle. Install ball joint nut, torque 40 ft. lbs. (min.) and install cotter pin. If necessary, nut may be tightened further to install cotter pin. USE EXTREME CAUTION TO PREVENT SPRING FROM DISLODGING WHILE RAISING JACK.

   NOTE: Tighten backing plate attaching bolts if necessary.

5. Install shock absorber. Torque bolts 15 to 24 ft. lbs.

6. Connect stabilizer link to lower control arm. Torque nut 5 to 15 ft. lbs.

7. Install wheel and tire assembly and lower the car.

SPRING CARRYING HEIGHT

Spring carrying height is controlled by the spring length and spring rate and may be checked as indicated in Fig. 9-113.

LOWER CONTROL ARM (Figs. 9-101 & 9-102)

Removal

1. To remove the lower control arm, all the steps in COIL SPRING - Removal, must be performed. After completing these, proceed as follows.

2. Remove control arm-to-frame attaching bolts and nuts and remove control arm.

Installation

1. Position control arm and install control arm to frame attaching bolts.

2. Replace coil spring as outlined under COIL SPRING - Installation.

LOWER CONTROL ARM BUSHINGS

Refer to LOWER CONTROL ARM - Removal and Installation. Remove control arm before attempting to replace bushings.

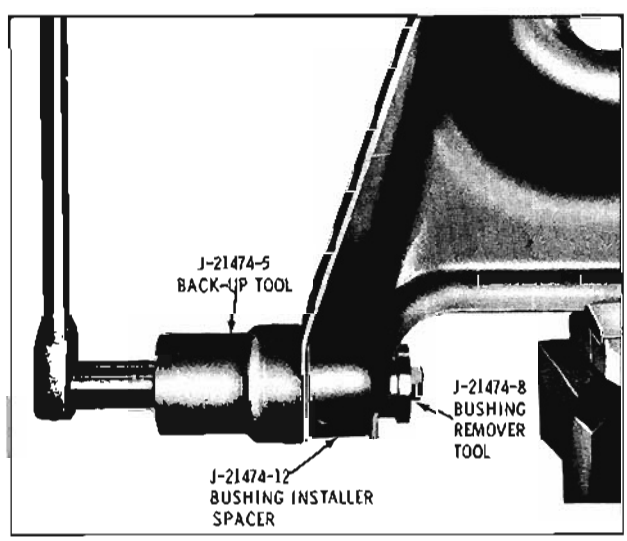


Fig. 9-114A Removing Front Bushing

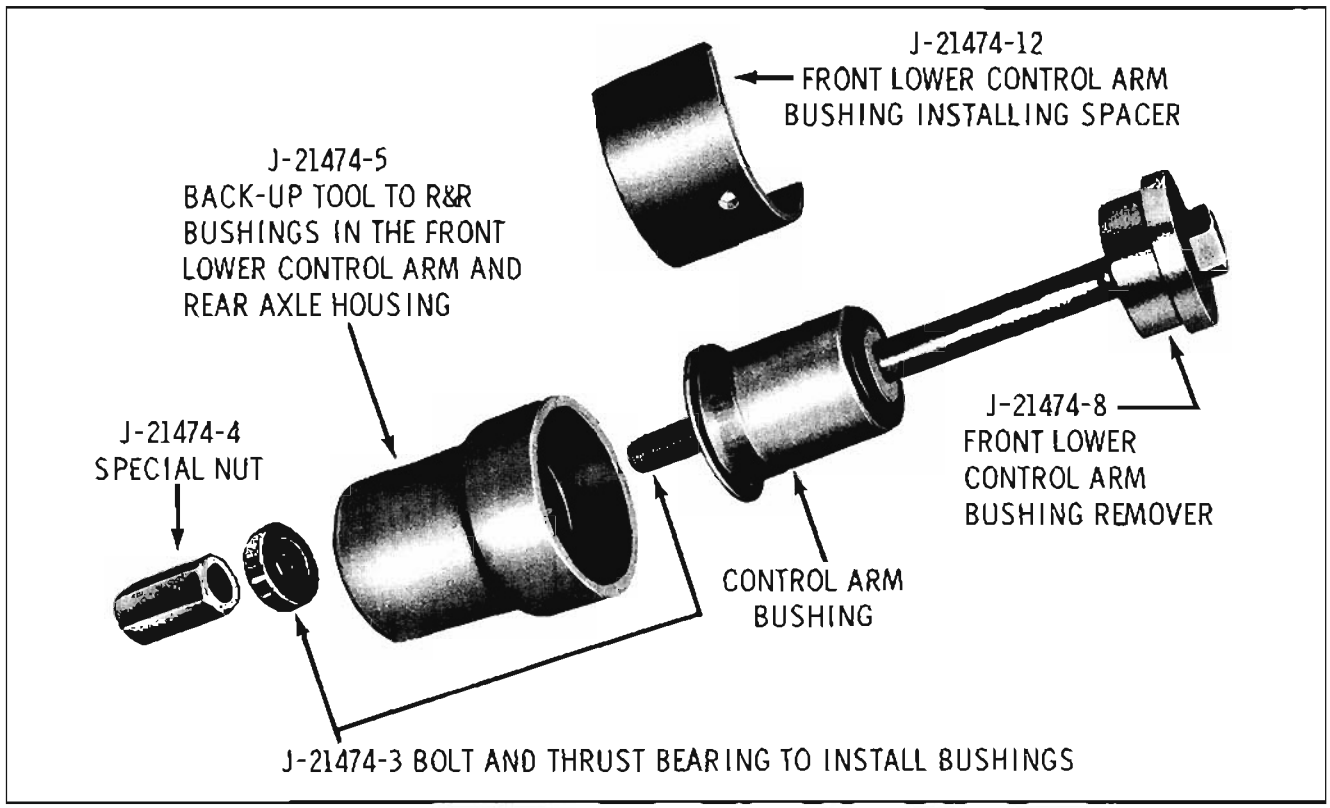


Fig. 9-114B Removing Front Bushing

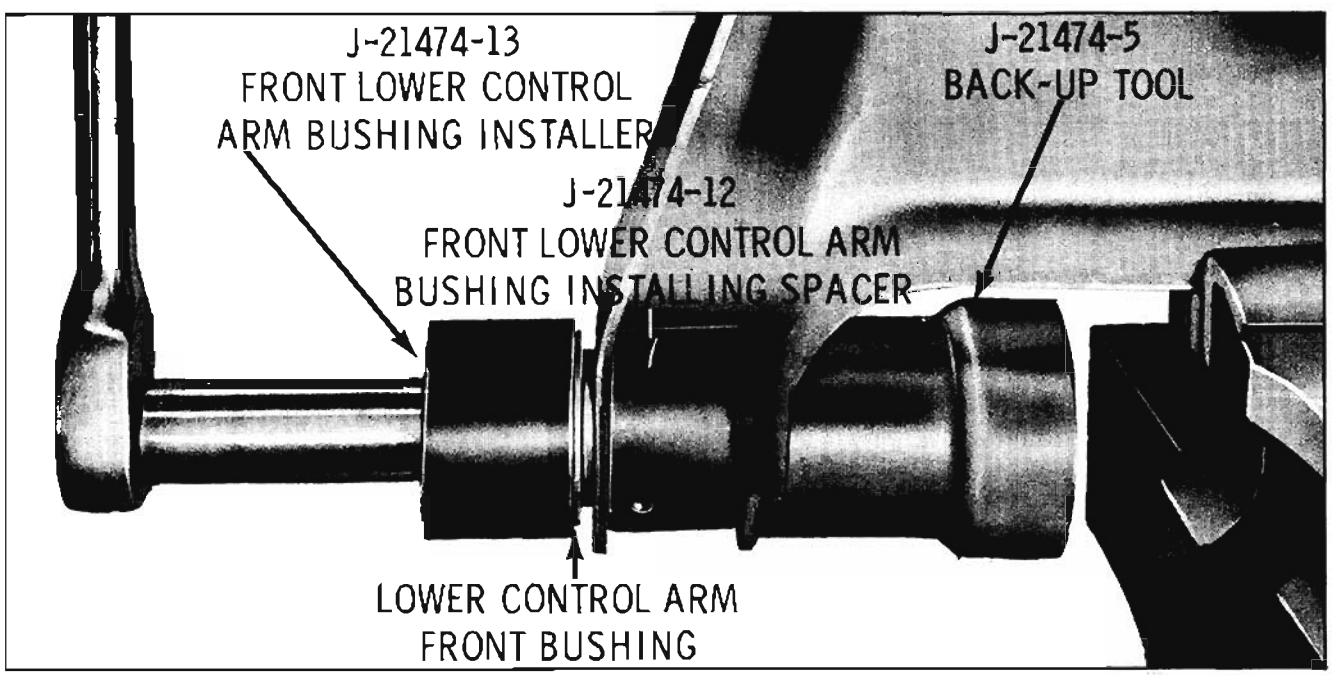


Fig. 9-115A Installing Front Bushing

FRONT BUSHING

Remove bushing as shown in Figs. 9-114A and 9-114B.

Install bushing as shown in Figs. 9-115A and 9-115B. Bushing should bottom against control arm.

REAR BUSHING

Remove bushing as shown in Fig. 9-116.

Install bushing as shown in Fig. 9-117. Bushing should bottom against control arm.

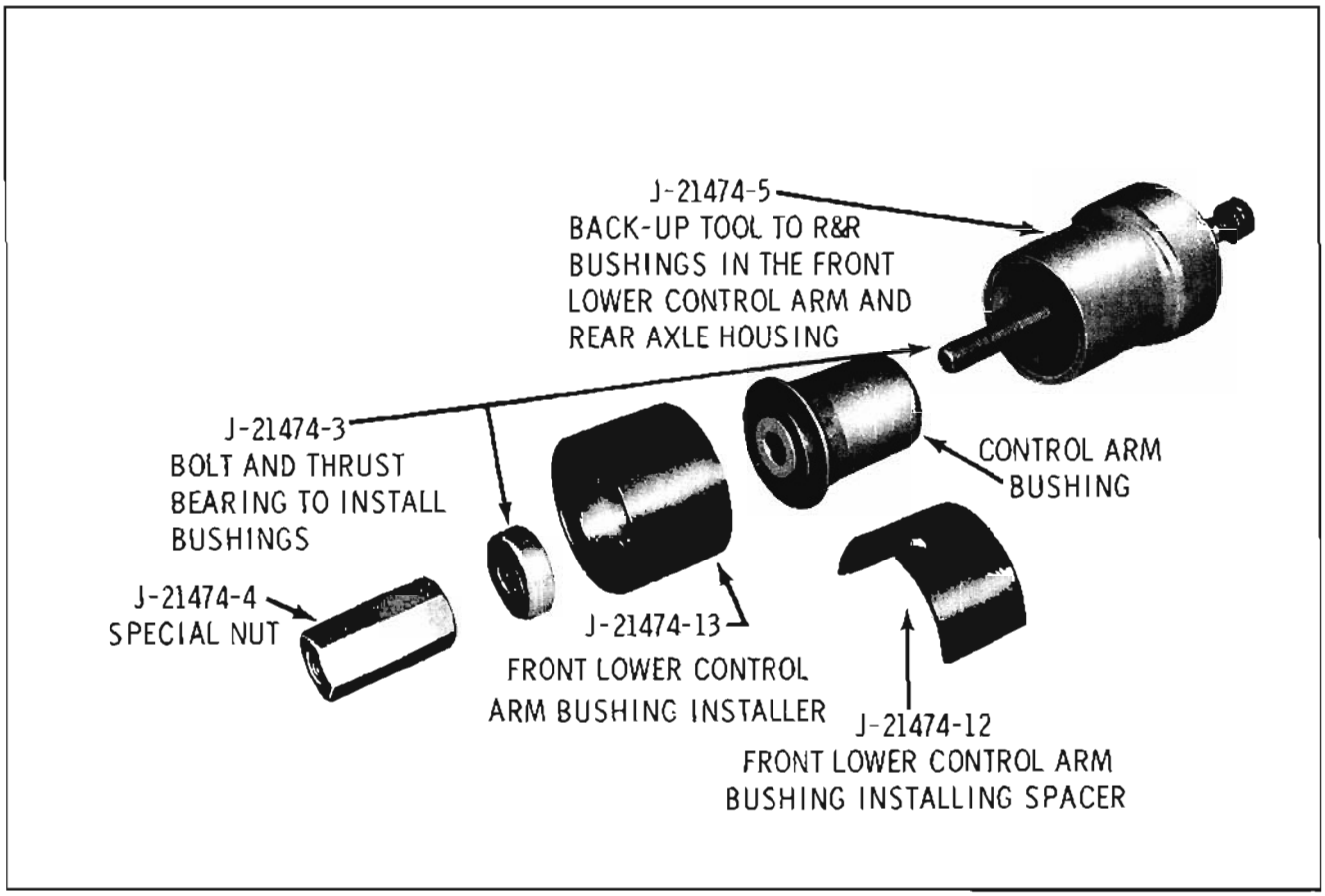


Fig. 9-1158 Installing Front Bushing

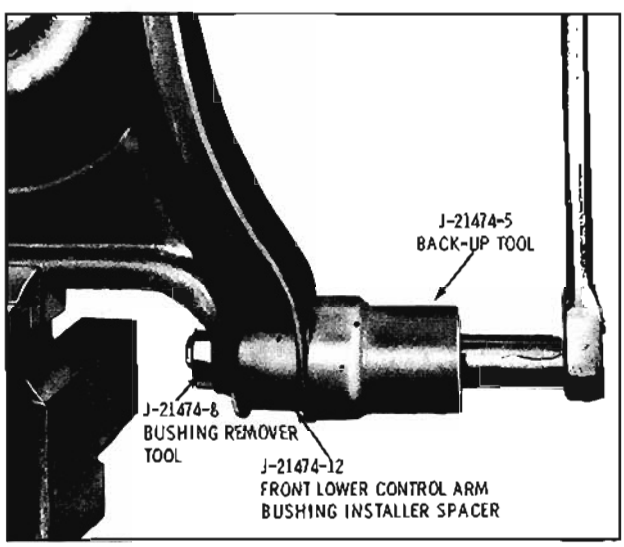


Fig. 9-116 Removing Rear Bushing

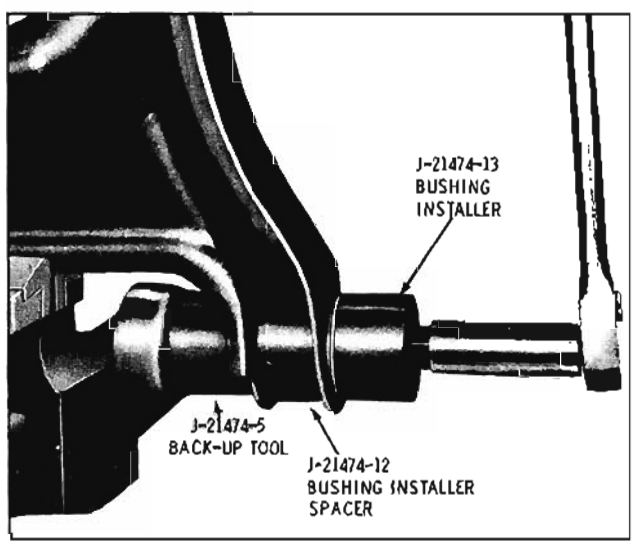


Fig. 9-117 Installing Rear Bushing

BALL JOINTS (Figs. 9-118 & 9-119)

The upper and lower ball joints can be replaced if checking indicates they are worn. The ball joint and front suspension checking procedure is covered in the 33-34-35-36-38 and 39 series SUSPENSION, Section 9.

REMOVAL—LOWER

1. Raise car, support with floor stands under frame.
2. Remove tire and wheel assembly.
3. Place floor jack under control arm spring seat.

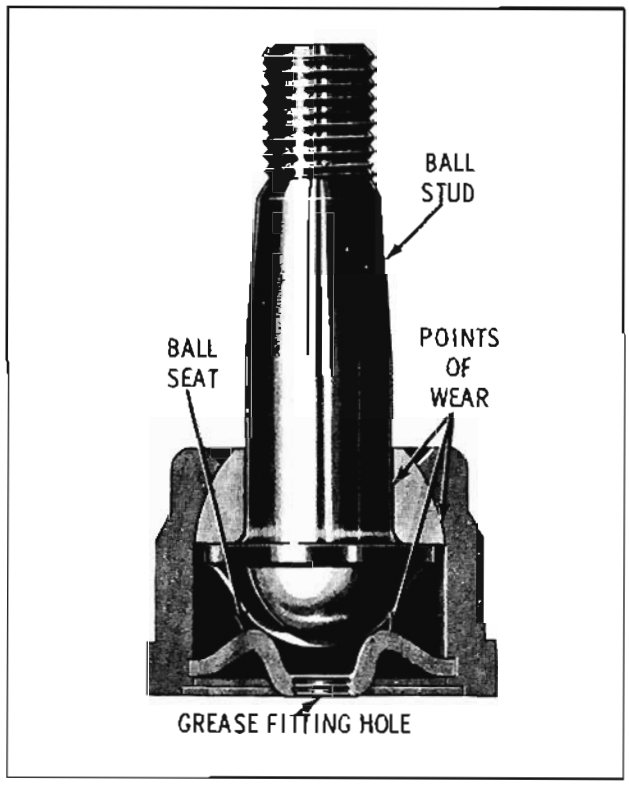


Fig. 9-118A Saginaw Lower Ball Joint

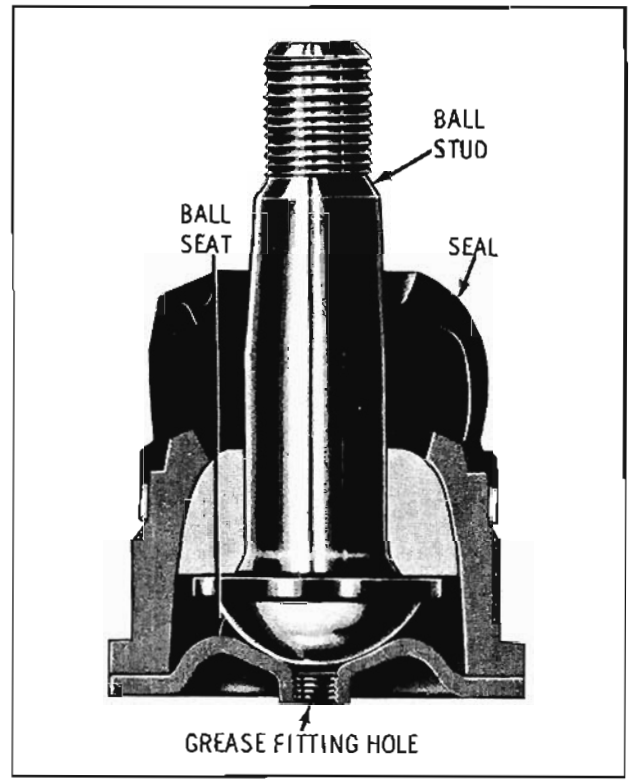


Fig. 9-118B Inland Lower Ball Joint

4. To disconnect the lower control arm ball joint from the steering knuckle:

   a. Remove the cotter pin from ball joint stud.

   b. Remove the nut to clean the threads. REPLACE THE NUT, LEAVING IT APPROXIMATELY TWO TURNS LOOSE. Lower floor jack slightly, then tap knuckle with a brass drift at ball joint stud. This will loosen stud from steering knuckle. Tool J-8806 can be used as shown in Fig. 9-111 to break the ball joint loose from knuckle.

      NOTE: After studs break loose from steering knuckle, raise floor jack and relieve spring tension. This will permit removal of ball joint nut.

5. After stud breaks loose, raise control arm to relieve spring tension, then remove stud nut.

   NOTE: If interference is encountered between the ball joint and the backing plate, it will be necessary to loosen the backing plate slightly to obtain the necessary clearance.

6. Block brake drum out of the way by placing a wooden block between frame and upper control arm.

Remove ball joint seal by prying off retainer with a screwdriver or driving off with a chisel as shown in Fig. 9-122.

7. Remove grease fitting, then install tools as shown in Fig. 9-120 and press out ball joint.

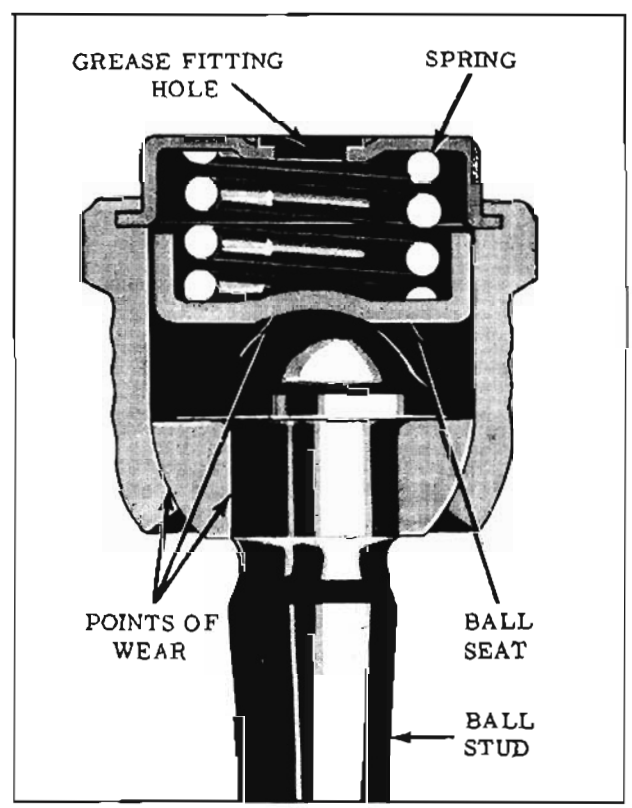


Fig. 9-119A Saginaw Upper Ball Joint

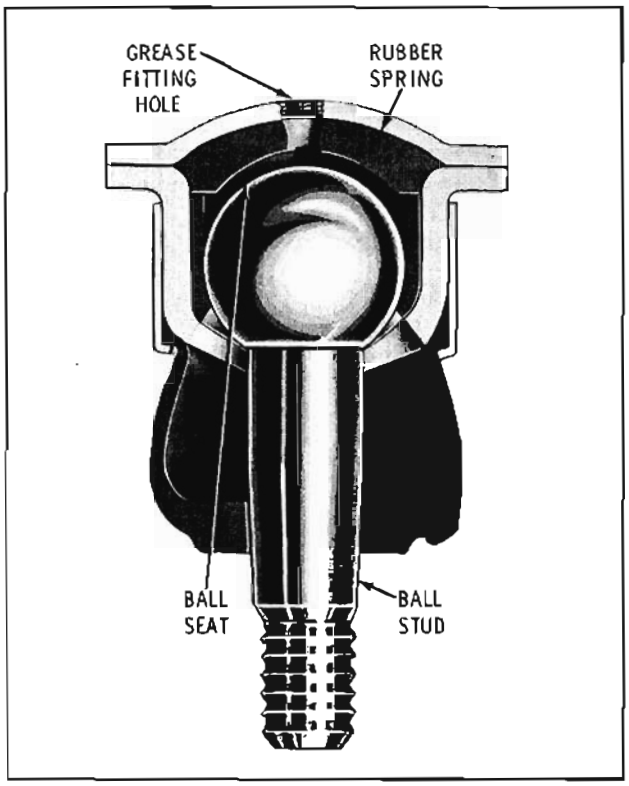


Fig. 9-119B Inland Upper Ball Joint

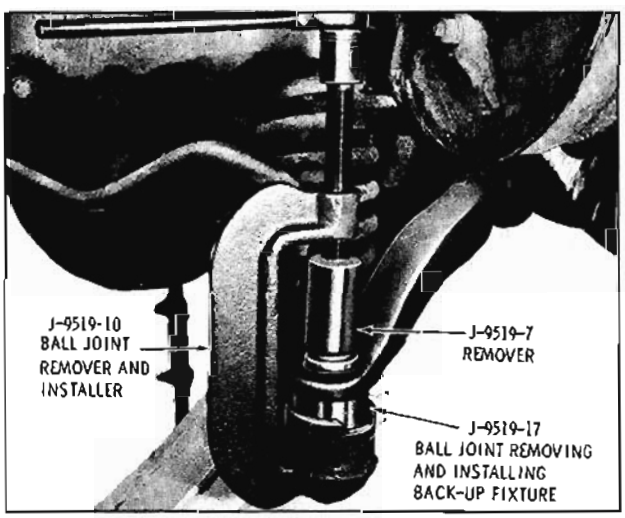


Fig. 9-120 Removing Lower Ball Joint

INSTALLATION—LOWER

1. Position ball joint into lower control arm and press in until it bottoms on the control arm using tools as illustrated in Fig. 9-121.

2. Install new ball joint seal and retainer as shown in Fig. 9-123A and Fig. 9-123B.

3. Install ball joint stud into steering knuckle. Torque nut 40 ft. lbs. (min.) and install cotter pin.
   NOTE: Tighten backing plate attaching bolts if necessary.

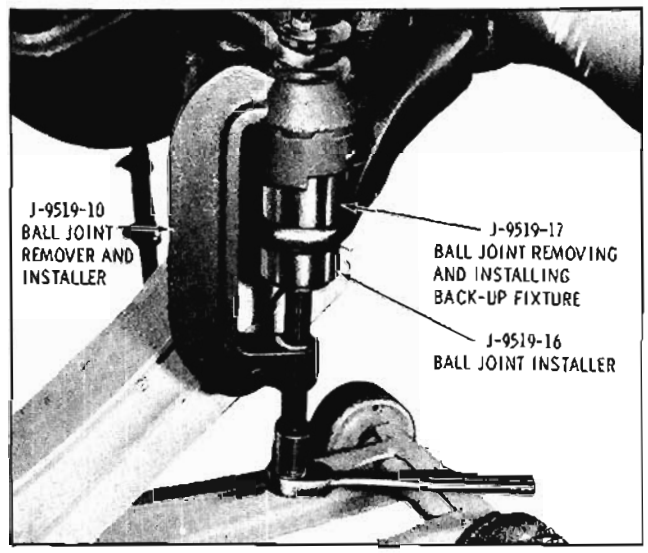


Fig. 9-121 Installing Lower Ball Joint

4. Install and lubricate ball joint fitting until grease appears at the seal.

5. Install tire and wheel assembly.

REMOVAL—UPPER (Figs. 9-124 & 9-125)

1. Refer to UPPER CONTROL ARM - Removal, and remove upper control arm.

2. Clamp control arm in a vise and drill four rivets 1/4" deep using an 1/8" diameter drill. (Fig. 9-124A)

3. Drill off rivet heads using a 1/2" diameter drill. (Fig. 9-124B)

4. Punch out rivets using a small punch and remove ball joint. (Fig. 9-125)

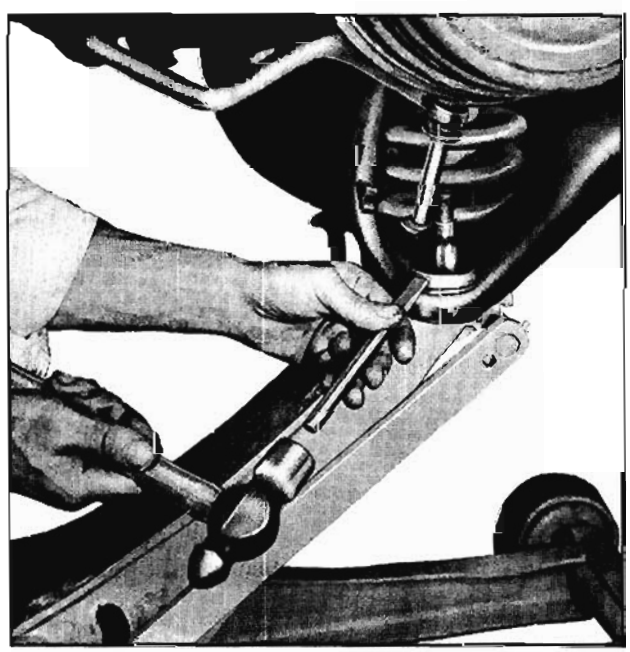


Fig. 9-122A Removing Lower Ball Joint Seal

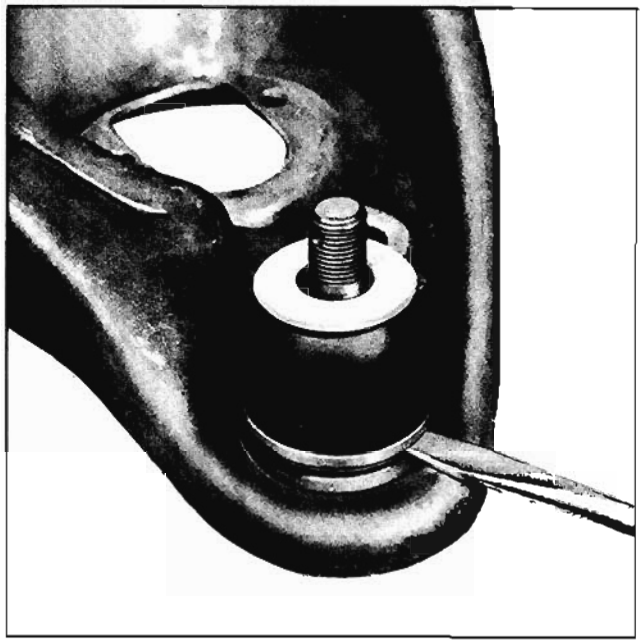


Fig. 9-122B Removing Lower Ball Joint Seal

INSTALLATION—UPPER (Fig. 9-126)

1. Position ball joint in control arm and install the four attaching bolts. Torque nuts to 8 ft. lbs.

2. Refer to UPPER CONTROL ARM - Installation, and install upper control arm.

BALL JOINT SEALS (UPPER AND LOWER)

The ball joint seals can be installed with the control arm either on or off the car and both upper and lower are replaceable. All service ball joint seals use a keystone clamp retainer.

Fig. 9-123A Installing Ball Joint Seal

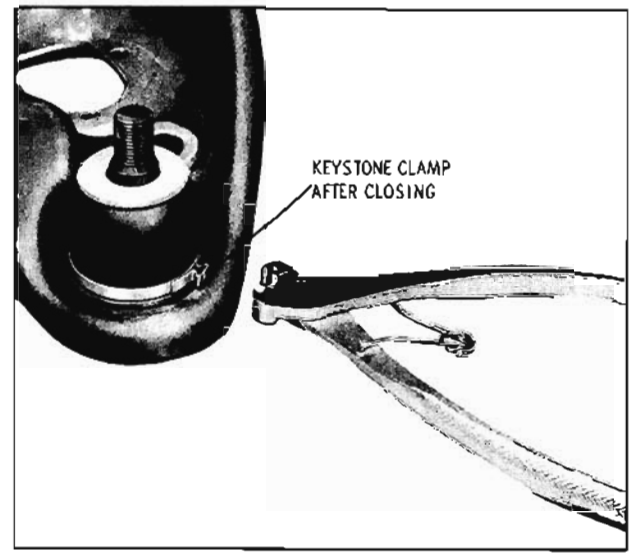


Fig. 9-123B Installing Ball Joint Seal

Removal

1. Raise car, support with floor stands under frame.

2. Remove tire and wheel assembly.

3. Place floor jack under control arm.

4. Remove cotter pin and remove the nut to clean the threads. (REINSTALL THE NUT, LEAVING IT APPROXIMATELY TWO TURNS LOOSE.)

5. Remove ball joint stud from steering knuckle as shown in Fig. 9-111 and described under BALL JOINTS - Removal.

6. Remove the seal by prying off retainer with

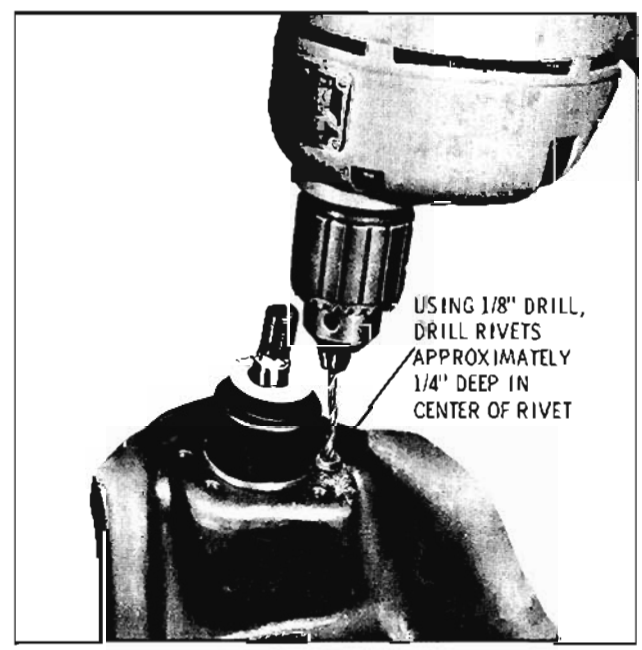


Fig. 9-124A Drilling Upper Ball Joint Attaching Rivets

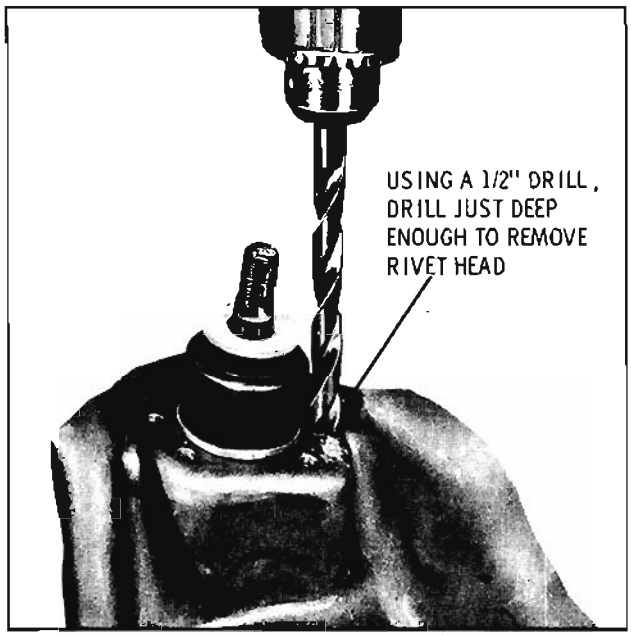


Fig. 9-124B Drilling Upper Ball Joint Attaching Rivets

a screwdriver or driving it off with a chisel. (Fig. 9-122)

7. Wipe grease from ball joint and stud.

Installation

1. Position new seal and retainer squarely over the ball joint stud and install as shown in Fig. 9-123.

2. Install the ball joint stud through the steering knuckle. Install ball joint nut and cotter pin, torque nut 40 ft. lbs. (min.).

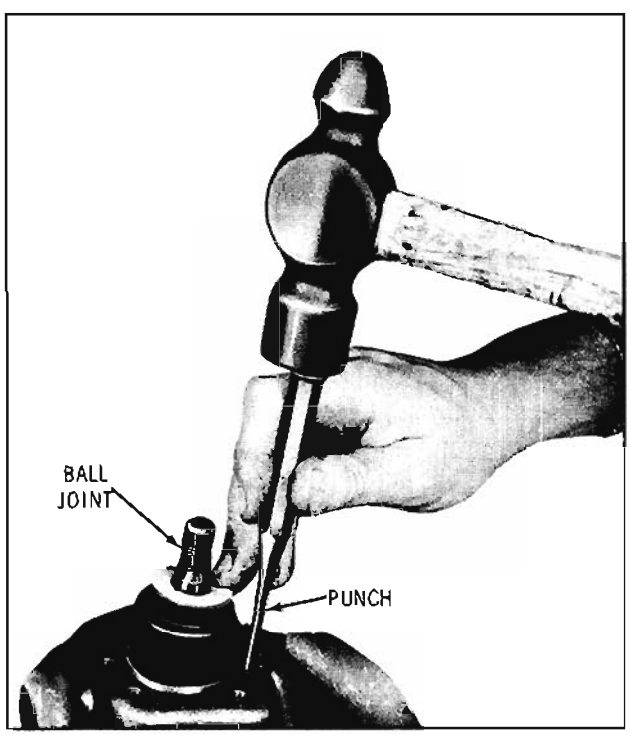


Fig. 9-125 Removing Upper Ball Joint

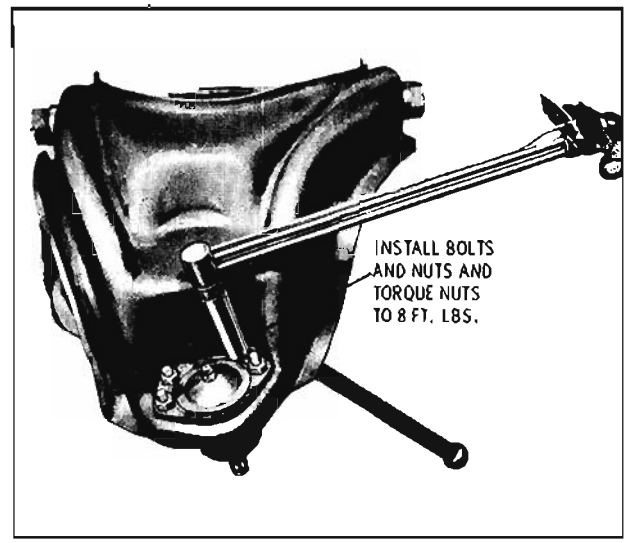


Fig. 9-126 Installing Upper Ball Joint

3. Lubricate the ball joint fitting until grease appears at the seal.

4. Install tire and wheel assembly.

UPPER CONTROL ARM

The upper control arm is attached to the frame by a cross shaft and bushings on the inner end and a ball joint on the outer end which is attached to the steering knuckle.

Removal

1. Raise car and place floor stands under frame.

2. Remove tire and wheel assembly.

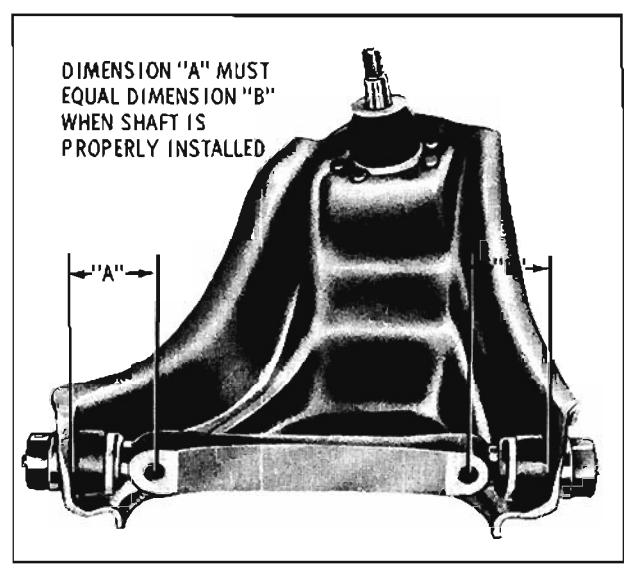


Fig. 9-127 Centering Inner Control Arm Shaft

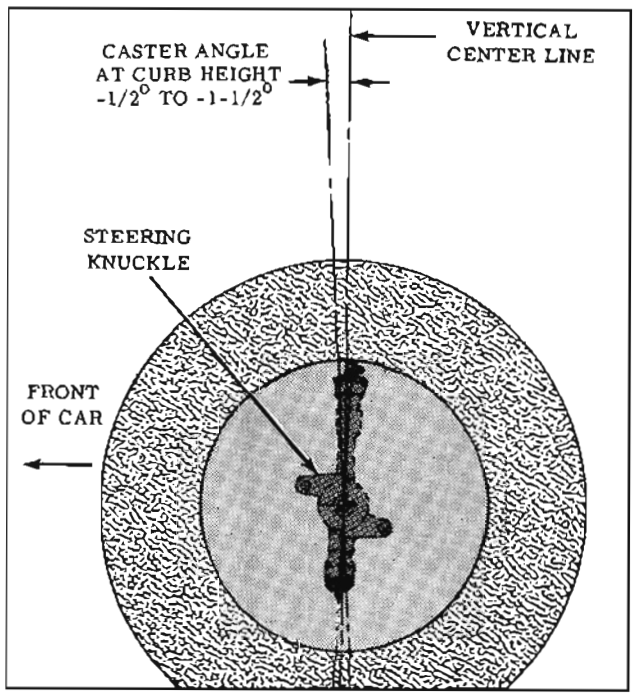


Fig. 9-128 Front Wheel Caster

3. Place floor jack under lower control arm spring seat.

4. Remove ball joint stud from steering knuckle as shown in Fig. 9-111 and described under BALL JOINTS - Removal.

5. Support hub assembly, remove inner shaft to frame bolts and remove upper control arm assembly. These bolts are splined into the frame, making it necessary to tap them lightly to loosen them before removing them.

   NOTE: Alignment shims are to be installed in the same position from which they were removed.

If arm and shaft are being replaced new as an assembly, center shaft in arm as shown in Fig. 9-127 before attaching to frame.

If the arm or shaft is being reused, it will be necessary to assemble the shaft to arm before attaching to frame. Refer to UPPER CONTROL ARM SHAFT instructions. Perform steps 2 through 6, then refer to UPPER CONTROL ARM - installation instructions.

Installation

1. Position arm on shaft.

2. Lubricate bushings with lubricant and thread on shaft and into arm.

3. Center shaft in arm. (Fig. 9-127)

4. Attach arm assembly to frame using original shims. Torque bolts 60 to 82 ft. lbs.

5. Install ball joint stud into the steering knuckle. Torque nut 40 ft. lbs. (min.) and install cotter pin.

6. Lubricate bushing fittings. Lubricate ball joint fitting until grease appears at the ball joint seal.

7. Install hub and drum assembly and tire and wheel assembly.

UPPER CONTROL ARM SHAFT

The inner shaft bushings, or inner shaft and seals may be replaced. (The seals are not serviced separately.) To do so, it will be necessary to remove the upper control arm.

1. Refer to UPPER CONTROL ARM - Removal. Remove upper control arm.

2. Clamp control arm cross shaft in vise.

3. Unthread the two bushings and remove the arm.

4. Install the new cross shaft (with seal installed) in the arm.

5. Install the two bushings. Center the shaft in the arm as shown in Fig. 9-127.

6. Install control arm. Refer to UPPER CONTROL ARM - Installation.

7. Lubricate shaft bushing fittings.

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.

The front wheel alignment factors are:

1. CASTER (Fig. 9-128)

2. CAMBER (Fig. 9-129)

3. TOE-IN (Fig. 9-130)

4. TOE-OUT (STEERING GEOMETRY) (Fig. 9-131)

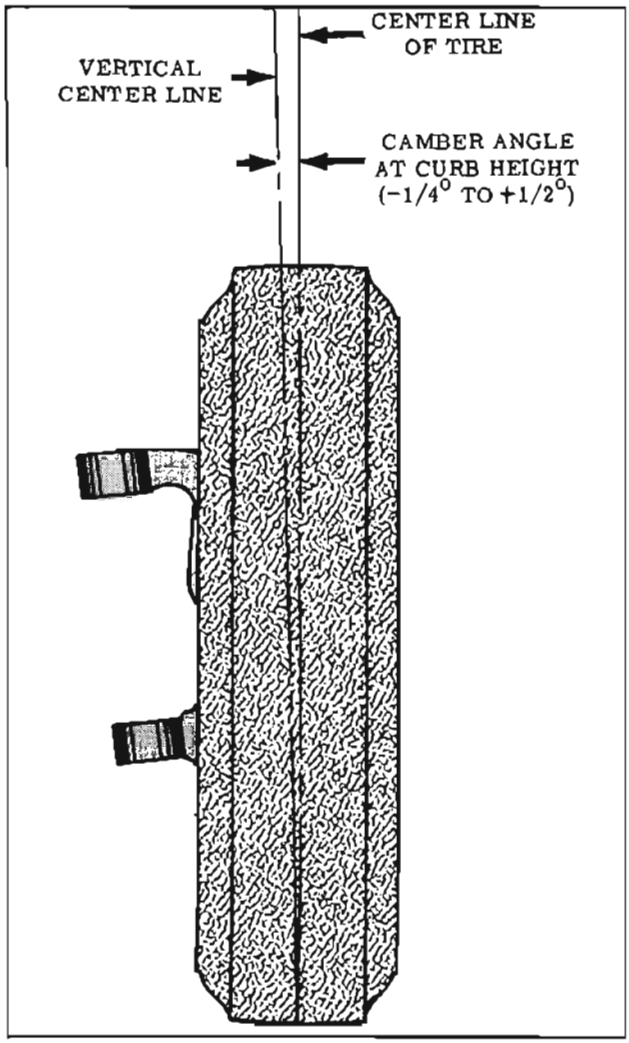


Fig. 9-129 Front Wheel Camber

Before any attempt is made to check or correct caster, camber, toe-in or toe-out, the following preliminary checks and necessary corrections should be made on those parts which influence the steering of the car:.

1. Inflate tires to recommended pressure.

2. Check front wheel bearings and steering gear for proper adjustments.

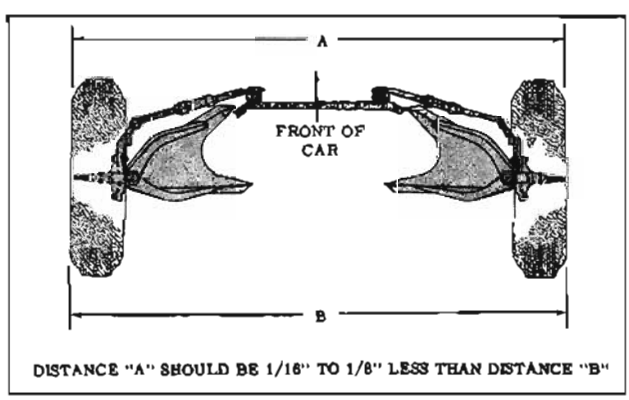


Fig. 9-130 Front Wheel Toe-In

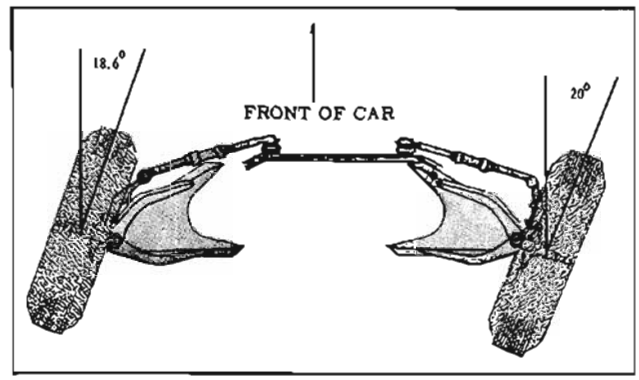


Fig. 9-131 Front Wheel Toe-Out

3. Check front wheel and tire assembly for radial and lateral runout.

4. Grasp front bumper in center and raise and lower front end several times to allow the car to come to its normal level. Check for erratic shock absorber action.

The method of checking alignment will vary depending on the type of equipment being used. The instructions furnished by the manufacturer of the equipment should be followed.

NOTE: Check front wheel alignment without passengers or load in or on car. Camber angle of the right and left wheel should be within 1/2° of each other for best handling characteristics.

CASTER AND CAMBER ADJUSTMENT

CASTER - 1/2° to -1-1/2°
CAMBER - 1/4° to +1/2°

Camber and caster are adjusted by shims placed between the upper pivot shafts and the frame. (Fig. 9-132) Both caster and camber adjustments can be made at the same time after the wheel alignment checks have been completed.

In order to remove or install shims, loosen the pivot shaft to frame bolts.

Refer to the Shim Chart to determine the approximate thickness necessary to correct the adjustment. After the correct number of shims have been installed, torque the pivot shaft mounting nuts 60 to 82 ft. lbs. and recheck caster and camber.

Shim Thickness	One shim added to or subtracted from BOTH BOLTS will change CAMBER	One shim added to or subtracted from FRONT BOLT ONLY will change CASTER
.020"	1/8°	3/16°
.030"	3/16°	1/4°
.060"	3/8°	1/2°
.120"	3/4°	1°

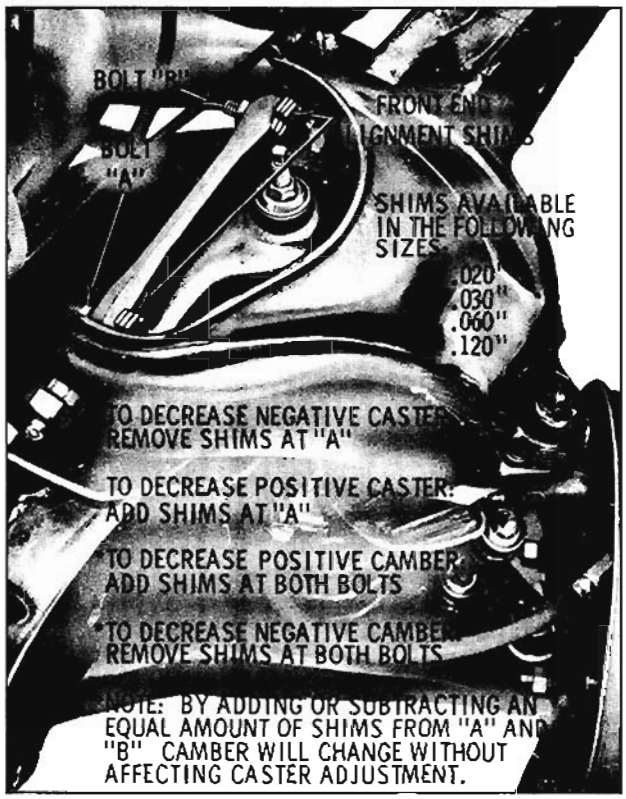


Fig. 9-132 Front Wheel Alignment Shims

TOE-IN ADJUSTMENT (Fig. 9-130)

Toe spec. 1/16" to 1/8" In

1. Loosen the clamp bolts at each end of the steering tie rod adjustable sleeves.
2. With steering wheel set in straight ahead position, turn tie rod adjusting sleeves to obtain the proper toe-in adjustment at curb load. (Fig. 9-130)
3. When adjustment has been completed according to the recommended specification, position inner clamps so that entire bolt is below centerline of tie rod. Torque nut 12 to 20 ft. lbs.

TOE-OUT (STEERING GEOMETRY) (Fig. 9-131)

Toe out is the mechanics of keeping the front wheels in proper relative alignment as the wheels are turned right or left. When turning, the wheels go into a toe-out position (further apart at the front of the tire than they are at the back). This condition increases with the increase of the turn.

To check, turn wheels to right until right wheel has been turned 20° from the straight ahead position. Left wheel setting should be 18.6° on all models. Follow the same procedure with wheels turned to left. Errors found are usually due to bent plain arms or incorrect caster, camber or toe-in. If error is due to bent plain arm, replacement with new arm should be made. When replacements of this kind are made, it is important that other front end parts are checked and front wheels aligned.

DIAGNOSIS

WHEEL BEARING NOISE

Wheel bearing noise may be confused with rear axle noise; however, front wheel bearing noise does not change when comparing "pull" and "coast". A bad bearing will cause a "knock" or "click" approximately every two revolutions of wheel since the bearing rollers do not travel at the same speed as the wheel. To determine which wheel bearing is noisy, hoist the car and spin each wheel while listening at the hub cap.

HARD STEERING

Cause:

1. Low or uneven tire pressure.
2. Steering gear or linkage adjusted too tight.
3. Insufficient or incorrect lubricant used.
4. Improper caster.
5. Upper or lower control arms bent.
6 Frame bent or broken.
7. Steering knuckle bent.

EXCESSIVE PLAY OR LOOSENESS IN STEERING SYSTEM

Cause:

1. Steering gear or linkage worn.
2. Control arm ball joints worn.
3. Front wheel bearings worn or incorrectly adjusted.
4. Loose front stabilizer.

ERRATIC STEERING ON APPLICATION OF BRAKE

Cause:

1. Low or uneven tire pressure.
2. Brakes incorrectly or unevenly adjusted.
3. Incorrect or uneven caster.

4. Steering knuckle bent.
5. Loose steering linkage or suspension.
6. Dirt or grease on brake lining.

FRONT WHEEL SHIMMY

Cause:

1. Uneven tire pressure.
2. Steering linkage worn or incorrectly adjusted. Loose adjusters on tie rods.
3. Front wheel bearings worn or incorrectly adjusted.
4. Shock absorbers inoperative or leaking.
5. Control arm ball joints worn.
6. Toe incorrect.
7. Incorrect or uneven caster.
8. Steering knuckle bent.
9. Wheels, tires or brake drums out-of-balance.
10. Excessive runout on wheels or tires.

CAR PULLS TO ONE SIDE

Cause:

1. Uneven tire pressure.
2. Rear wheels not tracking with front wheels.
3. Brakes incorrectly or unevenly adjusted.
4. Shock absorbers worn or inoperative.
5. Toe incorrect.
6. Incorrect or uneven caster or camber.

WORN TIRE TREAD EDGES

Cause:

1. Improper front end alignment.
2. High speed driving on curves.
3. Steering knuckle bent.
4. Steering plain arm bent.
5. Low tire pressure.

SCUFFED TIRES

Cause:

1. Tires improperly inflated.
2. Wheels or tires out-of-true.
3. Control arm ball joints worn.
4. Toe incorrect.
5. Uneven caster.
6. Incorrect toe-out on turns.
7. Steering gear incorrectly adjusted.
8. Eccentric or bulged tires.

FRONT OR REAR WHEEL TRAMP

Cause:

1. Wheels, tires or brake drums out-of-balance.
2. Shock absorbers inoperative.
3. Loose or worn front wheel bearings.

CAR WANDERS

Cause:

1. Low or uneven tire pressure.
2. Steering gear or linkage worn.

REAR SUSPENSION

DESCRIPTION (Figs. 9-133 & 9-134)

The rear suspension is of the link-type with coil springs. It uses four suspension arms that attach the rear axle assembly to the frame. A bracket on the axle supports the coil spring, the top of which is positioned under the frame rail. The upper arms are attached to the top of the differential and extend forward to the frame. Two shocks are attached to the frame and to brackets on the axle housing.

UPPER SUSPENSION ARMS

Removal

1. Remove nut from rear arm to differential housing bolt. (Fig. 9-134)
2. Remove rear bolt by rocking differential.

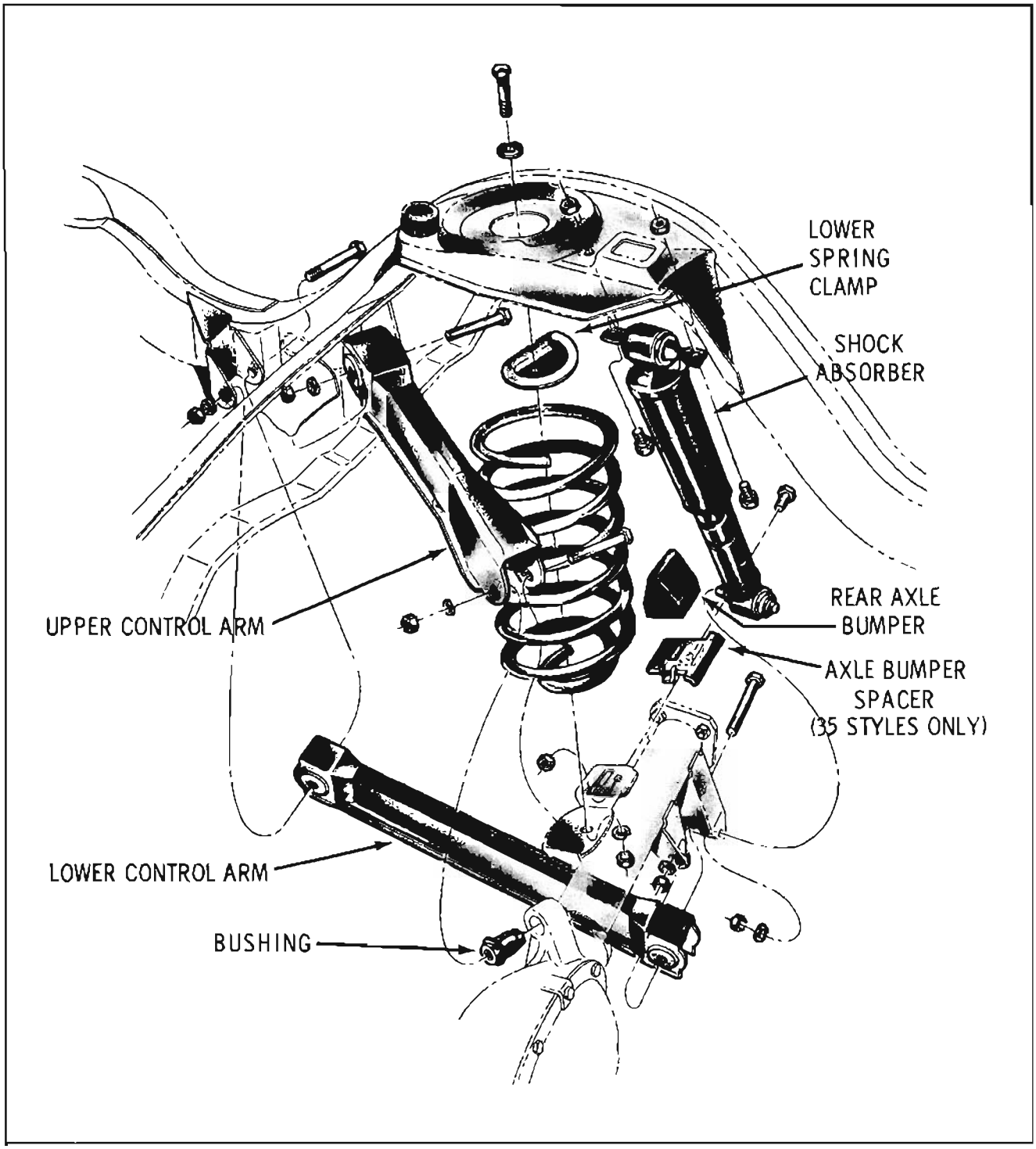


Fig. 9-133 Rear Suspension—Exploded View

3. Front nut and bolt may now be removed.

4. Inspect bushings for damage.

Installation

To install, reverse above procedure. Torque both nuts 60 to 90 ft. lbs.

LOWER SUSPENSION ARMS (Fig. 9-135)

Removal

1. Raise car and support under axle housing.

2. Remove rear arm to axle housing bracket bolt.

3. Remove front arm to bracket bolt.

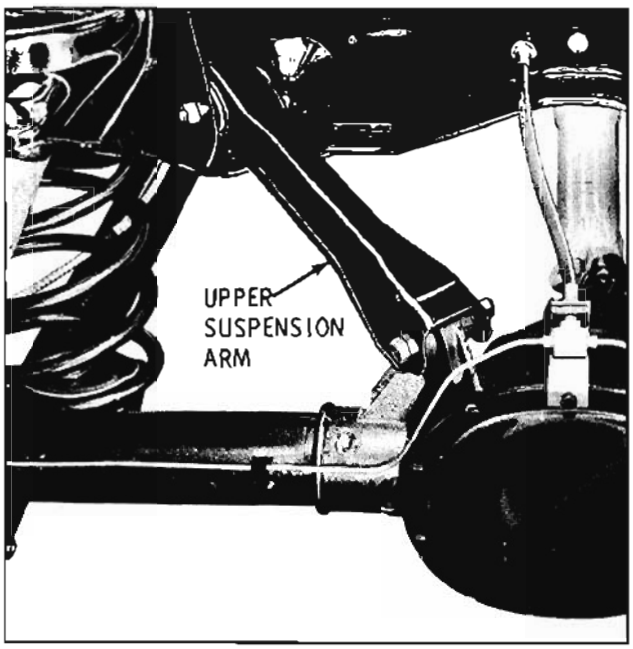


Fig. 9-134 Rear Suspension Assembly

Installation

To replace arm, reverse the above sequence of operations. Torque arm attaching bolts and nuts to 60 to 90 ft. lbs.

BUSHINGS (Figs. 9-136 & 9-137)

The bushings for the upper suspension arms through the differential carrier are replaceable. The remaining bushings can only be serviced by replacing the complete arm.

The rear bushing in the upper suspension arm can be replaced as follows:

1. Raise car and support under frame so axle housing hangs down.
2. Disconnect upper arm at differential and hold it up and out of the way.
3. Position tools as shown in Fig. 9-136 and pull bushing out.

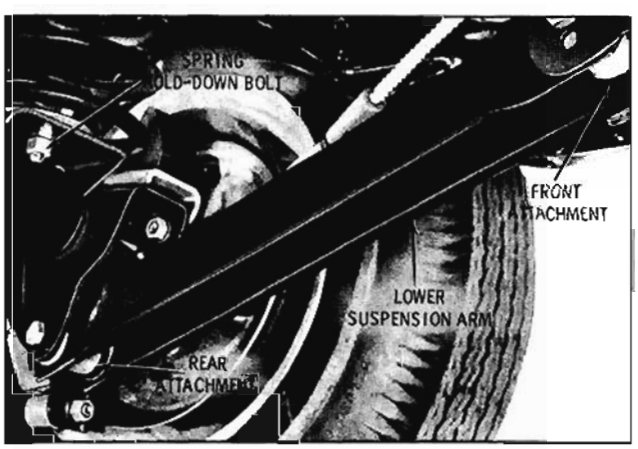


Fig. 9-135 Lower Suspension Arm

Fig. 9-136 Upper Arm Rear Bushing - Removal

4. To install, the bushing, reverse the tool as shown in Fig. 9-137 and pull bushing into position. Connect the upper suspension arm. Install bolt and torque nut 60 to 90 ft. lbs.

COIL SPRINGS

Removal

1. Disconnect shock from lower bracket. (Fig. 9-138)
2. Lift car at rear by frame rail. This will allow suspension to drop far enough to remove the spring.

   CAUTION: DO NOT STRETCH BRAKE HOSE.

3. Remove spring hold-down clamp and remove spring.

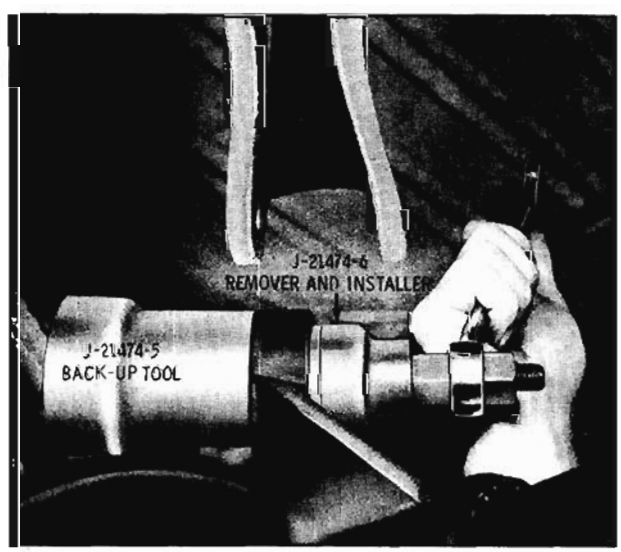


Fig. 9-137 Upper Arm Rear Bushing - Installation

Fig. 9-138 Coil Spring

Installation

1. Place coil spring in position so that spring tail is positioned against step in upper spring seat. (Fig. 9-138)

2. Install spring hold-down clamp. Torque nut 20 to 30 ft. lbs.

3. Lower car sufficiently to attach shock to lower bracket. Torque shock nut 30 to 45 ft. lbs.

SHOCK ABSORBERS

The double action shock absorbers are mounted by two bolts through the frame at the top and to a bracket welded on the axle housing. (Fig. 9-139)

To thoroughly check shock absorbers, refer to FRONT SUSPENSION SHOCK ABSORBERS.

NOTE: If noisy rear shock absorbers are encountered, the attaching bolts should be retorqued. If this does not correct the noise, further checking will be necessary. If found necessary to replace, raise car and support rear axle. The lower end has a stud which is an integral part of the shock. Remove the nut and tap shock free from bracket. To disconnect the shock at the top, remove the two bolts, nuts and lockwashers.

Installation

Loosely attach shock at both ends before tightening nuts. Torque lower stud nut to 30 to 45 ft. lbs. and upper bolts 10 to 20 ft. lbs.

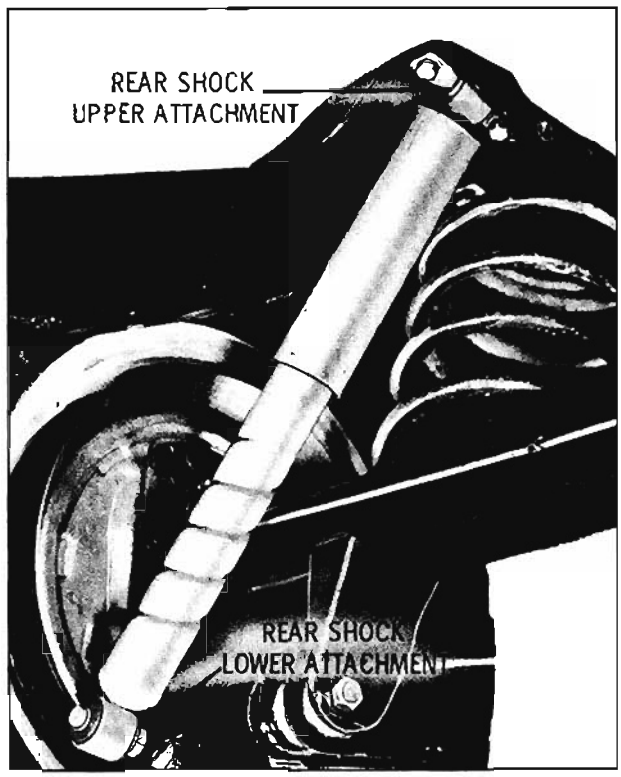


Fig. 9-139 Rear Shock Absorber

AXLE HOUSING

ALIGNMENT

Rear tire wear may indicate that the axle housing is out of alignment. It can be checked as follows:

1. Back the car squarely onto an alignment machine.

2. Compensate for wheel runout the same as for checking front wheel toe-in.

3. Check camber readings which should be: 1/4° negative to 1/2° positive.

4. Check the amount of toe-out, which should be: 3/64" to 5/32".

   NOTE: Due to the fact that the car is backed onto an alignment machine, the actual toe-out will be read on the scale as toe-in. However, if the toe-out is checked with a tram guage, disregard the aforementioned.

5. If a tram gauge is used for checking toe-in, it will still be necessary to perform Steps 1 and 2 in order to check camber.

The necessary straightening operations may be performed using frame straightening equipment without removing the axle housing from the car. This procedure will allow checks during the straightening operation to determine when the

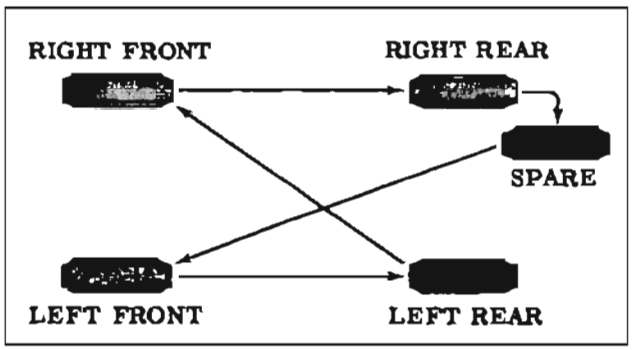


Fig. 9-140 Tire Rotation

housing is within the prescribed limits.

REMOVAL (FOR 33 SERIES—REFER TO 34-35-36-38-39 SERIES)

1. Disconnect shock from lower bracket.
2. Disconnect propeller shaft, brake line and parking cable equalizer. Compress parking brake cable housing clamp and pull housing through lower suspension arm mounting bracket.
3. Slowly raise car at rear end and remove coil springs.
4. Disconnect the upper suspension arm from the differential and the lower suspension arms from the brackets on the axle housing.

This will separate housing assembly from the frame. If replacing the housing with another, the components may be changed following the procedures outlined for these units in their respective sections.

INSTALLATION

After installing the assembly, it will be necessary to bleed the rear wheel brake cylinders, check brake and parking brake adjustment.

BUMPER

The rear axle housing bumper is located on the top of the axle housing and is attached by snapping into a bracket on the axle housing. If found deteriorated or damaged, it must be replaced.

WHEELS AND TIRES

MAINTENANCE RECOMMENDATIONS

Correct inflation pressure is of the most importance in tire care and service. All tires, regardless of body style or equipment, are to be inflated to 24 psi front and rear. Stations wagons carrying heavy loads should have rear tires inflated to 28 psi.

Tire rotation every 6,000 miles will aid in longer life and prevent excessive uneven wear that may result in shimmy, vibrations, noise, bumpy or rough riding. (Fig. 9-140)

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 recommendation.

The tire chart indicates the tire sizes available and the corresponding models.

TIRE AND WHEEL RUNOUT

Inflate tires to recommended pressure. Tires should be checked as soon as possible after car has been driven to avoid false readings due to the tendency of tires to take a temporary "set" after standing for a period of time.

Wheels and tires can be checked for runout at points indicated and should not exceed the following limits. (Fig. 9-141)

Tire & Wheel Assembly	-Radial	.063"
	Lateral	.081"
Wheel	-Radial	.035" or .022" in any 45° arc
	Lateral	.045" or .029" in any 45° arc

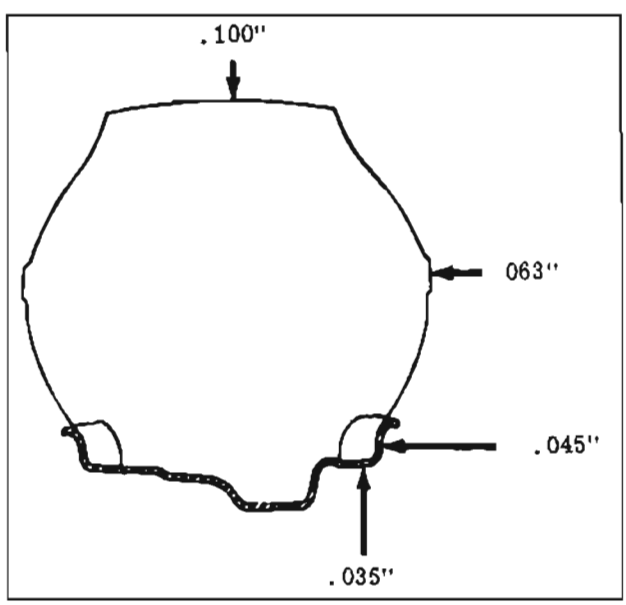


Fig. 9-141 Tire and Wheel Runout

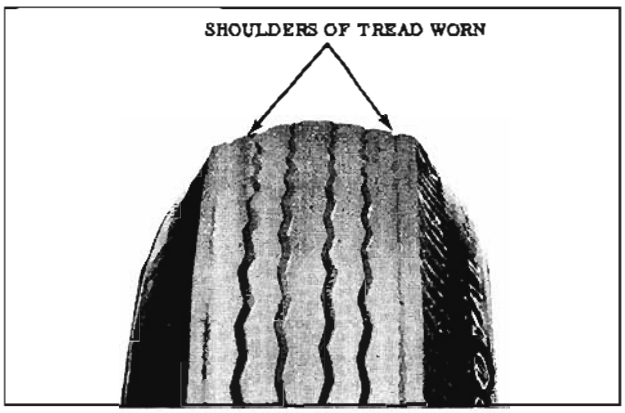


Fig. 9-142 Under Inflation Wear

WHEEL AND TIRE BALANCE

Wheel, tire and brake drum balance must be maintained within certain limits, otherwise, wheel "tramp" and high speed "shimmy" will result.

NOTE: When installing wheel weights on cars with wheel discs, use a weight of such size that it will not interfere with disc.

Front wheel "tramp" and front wheel "shimmy" are two entirely different conditions. Front wheel "tramp", which usually occurs at high speed, is a wheel "hop" from an unbalanced condition of wheels, loose linkage in the front end or improperly operating shock absorbers.

"Shimmy" may occur at the lower speeds and is a wobbly condition of the front wheels caused from an unbalanced condition, loose front end linkage, loose steering gear parts or faulty steering gear adjustment. "Tramp" and "shimmy" will be felt in the whole car; however, "shimmy" can also be felt at the steering wheel. "Shimmy" is a front wheel condition entirely, whereas, it is possible to have "tramp" in front and rear wheels.

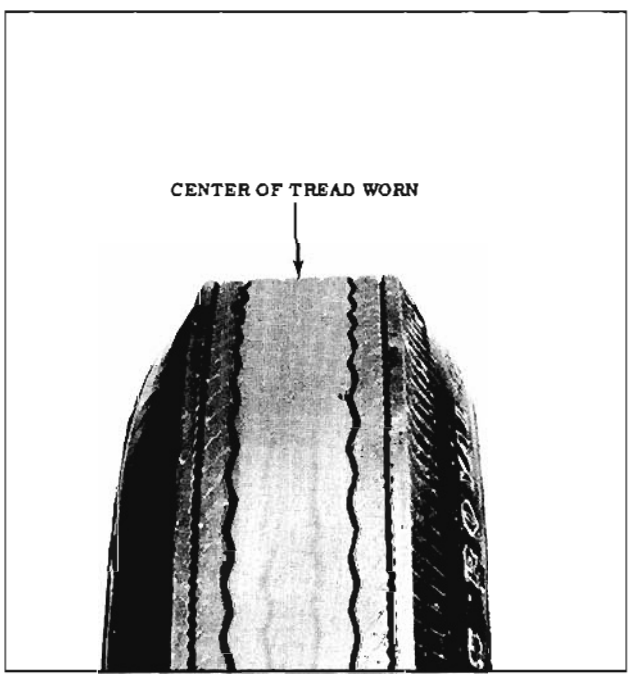


Fig. 9-143 Over Inflation Wear

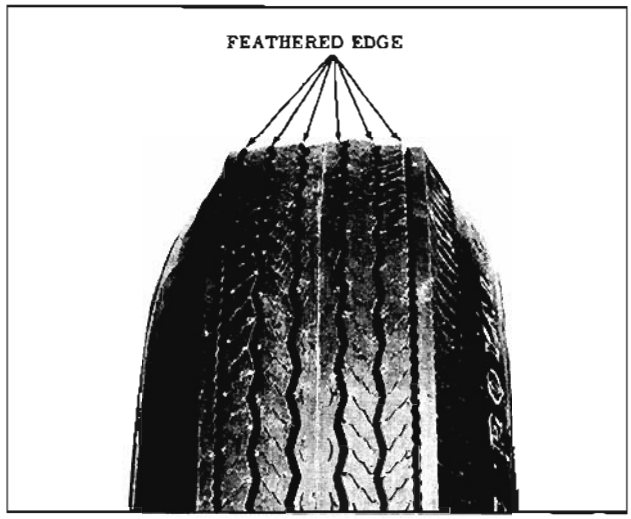


Fig. 9-144 Toe-In Wear

Due to irregularities in tread wear caused by sudden application, misalignment, incorrect inflation pressure or tire repair, etc., a wheel and tire may lose its original balance. Consequently, if front end instability develops, the tire and wheel assembly should be checked for static and dynamic balance.

DISMOUNTING AND MOUNTING

Several types of bead breakers are available to loosen tire from rim.

Fig. 9-145 Camber Wear

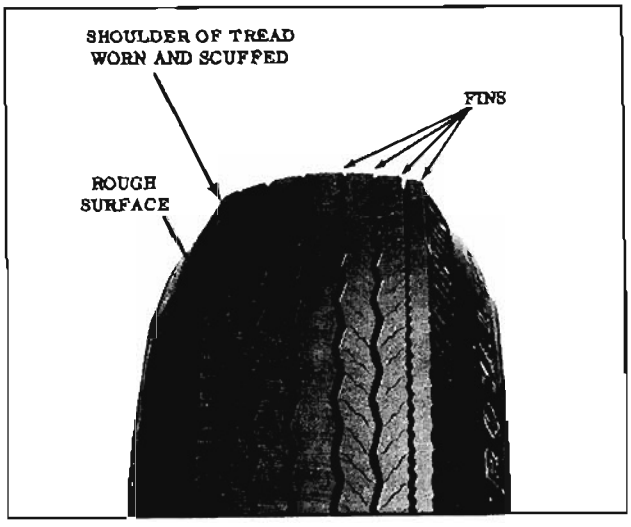


Fig. 9-146 Comering Wear

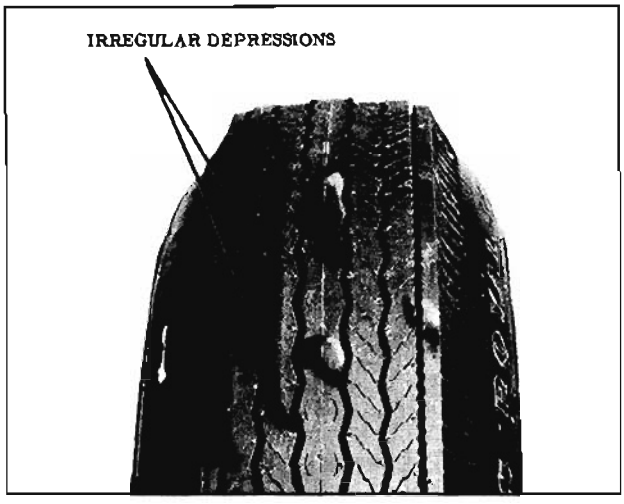


Fig. 9-147 Mechanical Condition Wear

DO NOT USE TIRE IRONS AS THIS MAY DAMAGE SEALING BEADS.

Tire mounting machines may be used to mount tires, but extreme care must be taken not to damage sealing beads.

Tire lubricating soap should be used on beads, but an excessive amount may cause tire slippage on wheel.

Inflate tire to approximately 40 psi to seat sealing beads. Be sure bead position is even all around, then deflate to recommended pressure.

TIRE REPAIRING

There are several methods of repairing tubeless tires. Oldsmobile recommends the "hot patch of self-vulcanizing method".

These methods are not recommended for punctures over 3/16" diameter. For repairs larger than this, consult the tire manufacturer's recommendations.

TIRE WEAR

Several illustrations are shown that reveal common tire wear patterns generally resulting from conditons noted. (Figs. 9-142 thru 9-147)

TIRE CHART

Styles	69		27		35		37	67
All Except A/C	V-6	V-8	V-6	V-8	V-6	V-8	V-8	V-8
6:50 x 14	Std.	N.A.	Std.	N.A.	N.A.	N.A.	N.A.	N.A.
7:00 x 14	O.S.	Std.	O.S.	Std.	Std.	Std.	Std.	Std.
7:50 x 14	N.A.	O.S.	N.A.	O.S.	O.S.	O.S.	O.S.	O.S.
With A/C								
6:50 x 14	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
7:00 x 14	Std.	Std.	Std.	Std.	Std.	Std.	N.A.	N.A.
7:50 x 14	N.A.	O.S.	N.A.	O.S.	O.S.	O.S.	Std.	Std.

N.A. - Not Available
Std. - Standard
O.S. - Oversize

TORQUE SPECIFICATIONS

Application	Ft. Lbs.
Front and Rear Wheel Nuts	55 to 75
Front Hub Bolts	55 to 75
Rear Hub Bolts	55 to 75
Front Shock Absorber Lower Mounting	15 to 24
Front Stabilizer Link	5 to 15
Stabilizer Bracket to Frame	10 to 15
Rear Shock Absorber Upper Mounting	15 to 24
Lower Control Arms to Frame - Front Suspension	60 to 90
Spring Clamp to Lower Arm - Rear Suspension	20 to 30
Shock Absorber Lower Mounting - Rear Suspension	30 to 45
Anchor Bolt - Backing Plate to Knuckle	80 to 105
Ball Joint Stud Nuts	40 Min.
Front Shock Absorber Upper Mounting	10 to 20
Upper Arm Shaft to Front Frame Bracket	60 to 80
Bumper Spacer to Axle Housing Bracket	35 to 55
Backing Plate to Knuckle	60 to 82
Backing Plate to Axle Housing	40 to 55

J-21474-3	Special Bolt And Thrust Bearing Assembly	J-21474-13	Front And Rear Lower Control Arm Bushing Installer
J-21474-4	Special Nut	J-9519-10	Ball Joint Installing Tool
J-21474-5	Receiver Tool	J-9519-16	Ball Joint Fixture
J-21474-6	Axle Housing Bushing Installer	J-9519-17	Ball Joint Remover Back-Up Tool
J-21474-8	Front And Rear Lower Control Arm Bushing Remover	H.C.P. 10	Keystone Clamp Pliers (Cornwell Tool)
J-21474-12	Front Lower Control Arm Bushing Installer Spacer	J-9519-7	Ball Joint Remover

Fig. 9-148 Tools

PROPELLER SHAFT AND DIFFERENTIAL

34-35-36-38 & 39 SERIES

CONTENTS OF SECTION 10

PROPELLER SHAFT

PERIODIC MAINTENANCE

The propeller shaft slip yoke does not require a scheduled lubrication interval. However, if at high mileage a tendency for stickiness should develop at the slip yoke it should be lubricated with Seal Lubricant, Part No. 567196, until lubricant appears at the vent hole. Universal joints, under both hot and cold weather conditions, do not require a scheduled lubrication interval.

DESCRIPTION (Fig. 10-1)

The rear yoke shaft is bonded in rubber to the inside of the propeller shaft tube and cannot be removed for service.

Both Saginaw and Spicer propeller shaft assemblies are used, refer to Fig. 10-2 for identification.

The propeller shaft assembly is a balanced unit and should be kept free of under coating or other material which could upset the balance.

Remove and Install

1. Straighten lock tangs away from the four U-bolt nuts and remove the U-bolts from the differential companion flange.

2. If the companion flange U-joint bearings are not retained with a metal retaining strap, use a piece of wire or tape to hold bearings on their spider journals.

3. Lower the rear of the shaft and slide rearward.

To install, apply one ounce of Seal Lubricant, Part No. 567196, to the splines of the slip yoke (Hydra-Matic only). Using new companion flange U-bolt locks, torque U-bolt nuts 14 to 18 ft. lbs. then bend the lock tangs against the nuts.

UNIVERSAL JOINT BEARINGS—REMOVE

Saginaw Type (Fig. 10-2)

Production Saginaw propeller shafts use an internally molded nylon ring to retain the universal joint bearings to the yoke. When servicing this type of bearing, the molded nylon retaining ring is sheared when disassembling the bearing. When assembling new bearings, metal retaining rings must be installed.

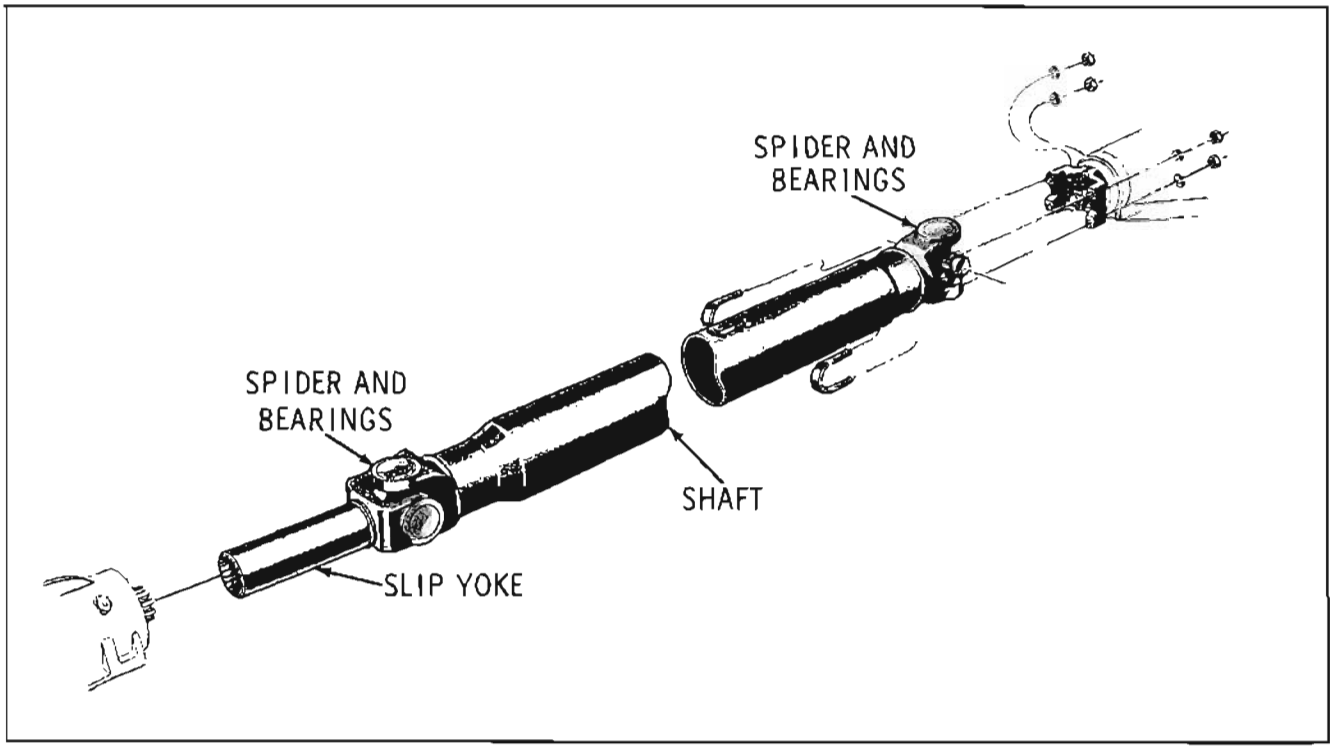


Fig. 10-1 Propeller Shaft Assembly

1. With propeller shaft removed from the car, remove all bearing retaining rings if so equipped.

NOTE: Mark both yoke and shaft so that the units may be reassembled in their original position in order to maintain the original balance.

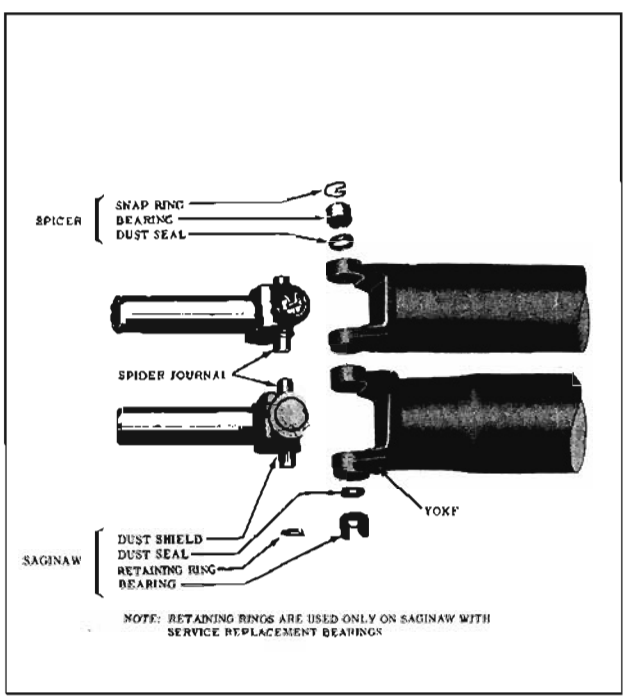


Fig. 10-2 Propeller Shaft Identification

2. Position the slip yoke end of propeller shaft on a vise so that the shaft yoke rests on top

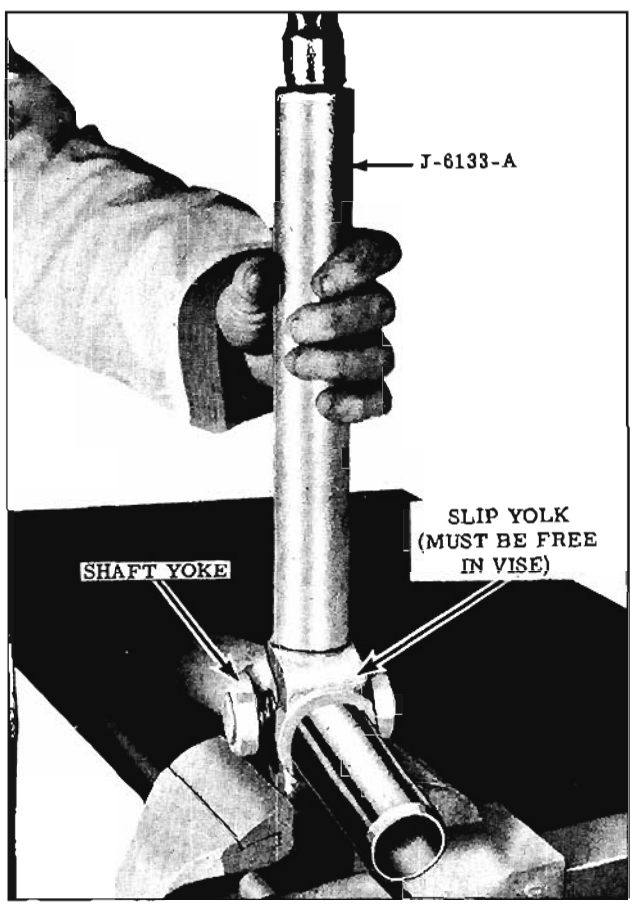


Fig. 10-3 Partial Bearing Removal (Saginaw)

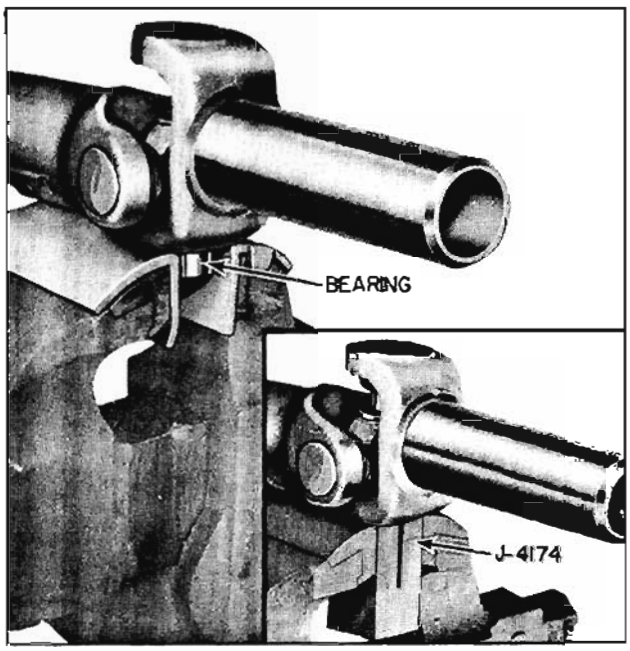


Fig. 10-4 Bearing Removal (Saginaw)

of the vise jaws. The slip yoke must be free to move vertically between jaws of vise.

3. Apply force on yoke around bearing. (Fig. 10-3) This will drive the slip yoke down causing spider to force bearing partially out of the yoke.

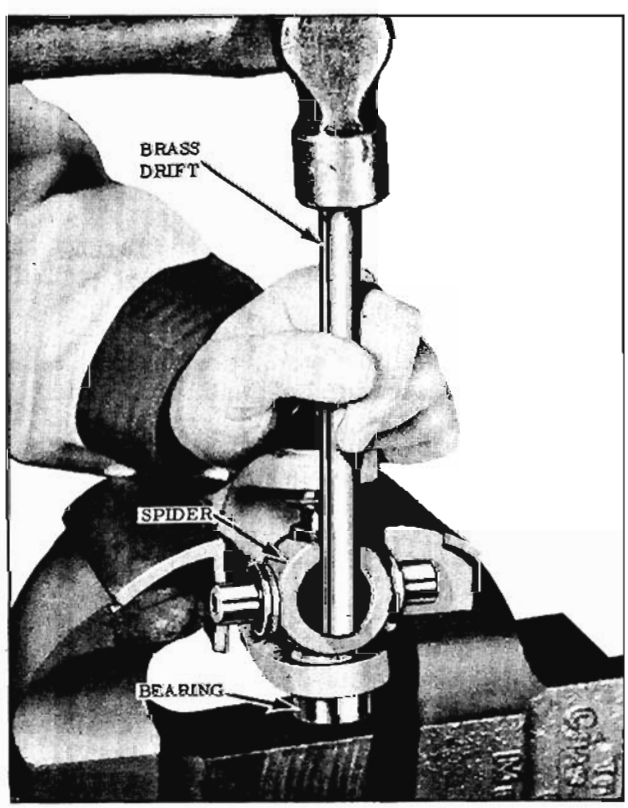


Fig. 10-5 Partial Bearing Removal (Saginaw)

4. Clamp the partially exposed bearing in a brass jawed vise, then tap yoke until bearing is removed. (Fig. 10-4) Remove bearing from vise.

NOTE: The use of Tool J-4174 will facilitate removal of bearings. (Inset, Fig. 10-4)

5. To remove opposite bearing, repeat Steps 2, 3 and 4.

6. Remove slip yoke from spider.

7. Clamp shaft yoke in 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. 10-5)

9. Clamp partially exposed bearing in a brass jawed vise and tap on yoke until bearing is removed.

10. To remove opposite bearing, repeat Steps 7, 8 and 9.

11. Remove spider from shaft yoke.

12. Remove rear spider and bearings.

Spicer Type (Fig. 10-2)

1. With propeller shaft removed, remove all retaining rings that retain bearings in the yoke.

NOTE: Mark slip yoke and shaft yoke, so that the units may be reassembled in their original position to maintain original balance.

2. Press the bearings from the yoke as shown in Fig. 10-6. Continue pressing until bearing

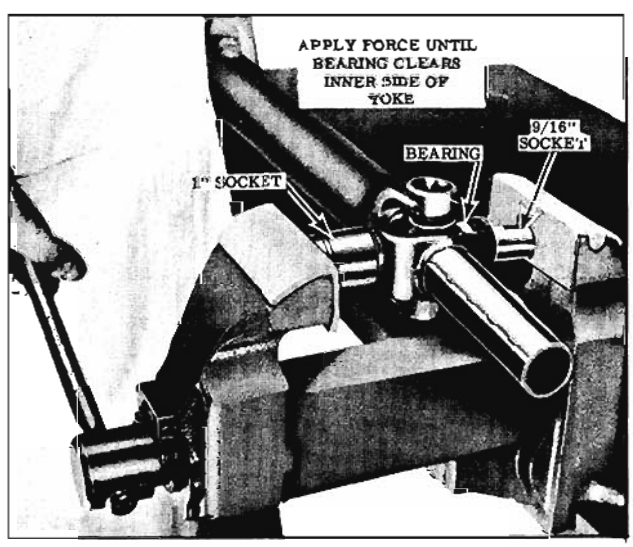


Fig. 10-6 Pressing Bearing From Yoke (Spicer)

which is pushed by the 9/16" socket clears inner side of yoke.

3. Remove propeller shaft and sockets from vise.

4. If exposed bearing on the outer side of yoke is still tight, clamp bearing in a brass jawed vise and tap yoke until bearing is free.

5. Remove slip yoke from spider. Remove bearing from spider journal.

6. To remove bearings from shaft yoke, repeat Step 2.

7. Clamp exposed bearing in a brass jawed vise and tap yoke until bearing is free.

8. Remove spider from shaft yoke.

9. Remove spider and bearings from rear yoke.

CLEANING AND INSPECTION

1. Wash all parts thoroughly in cleaning solvent.

   NOTE: Bearings and spiders should be washed in clean gasoline, not light oil. If bearings are washed in light oil, the grease will not adhere to the bearings and the bearings will run dry.

2. Inspect dust seals and shields for damage. Replace if necessary. Seals should be flexible. If brittle or hard, replace seals.

3. 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.

UNIVERSAL JOINT BEARINGS—INSTALL

Saginaw and Spicer

1. Lubricate each needle bearing assembly and fill the reservoir in each spider journal with a sodium soap, fine fiber grease.

2. Install neoprene dust seals on the bearings.

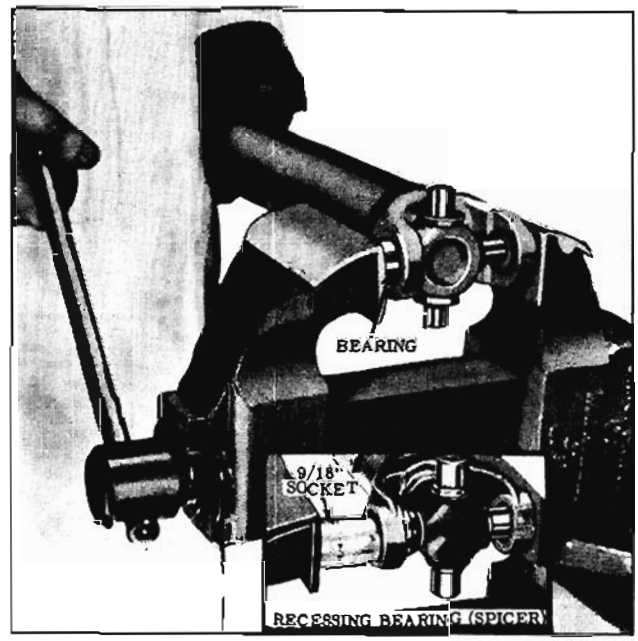


Fig. 10-7 Installing Bearings

3. If new dust shields are to be installed on Saginaw spiders, install at this time.

4. Position a spider journal in a shaft yoke.

5. Press a bearing into one side of yoke until retaining ring can be installed. (Fig. 10-7)

   NOTE: On Spicer units the bearing must be recessed into the yoke so that the retaining ring can be installed. The bearing can be recessed with a 9/16" socket and vise. (Inset, Fig. 10-7)

6. Install retaining rings. Retaining rings on Saginaw units must be installed 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 the slip yoke, 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.

DIFFERENTIAL

PERIODIC MAINTENANCE

Periodic or seasonal lubricant changes are not recommended. The lubricant level should be checked at each oil change interval. If lubricant addition is required, add:

Conventional Differential: Special Lubricant, Part No. 531536, or S.A.E. 90 Hypoid Gear Lubricant meeting the requirements of military specifications MIL-L-2105B.

Anti-Spin Differential: Only Special Lubricant, Part No. 531536.

IMPORTANT: Use of other than the above mentioned type of lubricant in the Anti-Spin Differential may cause chatter. If the wrong type of lubricant is used in the Anti-Spin, it will require draining the differential and installing the recommended lubricant, Part No. 531536. It may be necessary to drive Anti-Spin equipped cars for distances of 50 miles or more to allow the new lubricant to work through the plates before the chatter will disappear.

MINOR SERVICE OPERATIONS

PINION OIL SEAL REPLACEMENT

1. Disconnect propeller shaft from differential companion flange and support shaft up in body tunnel by wiring propeller shaft to the exhaust pipe. If U-joint bearings are not retained by a retainer strap, use a piece of wire to hold bearings on their spider journals.

2. Mark the position of the companion flange, pinion shaft and nut so that they can be reinstalled in the same position.

3. Remove companion flange nut, using Tool J-6544 to hold flange. (Fig. 10-8) Remove washer.

4. Remove companion flange using Puller J-6295-01 (Fig. 10-9)

5. Remove oil seal by driving it out of carrier with a blunt chisel.

6. Examine surface of companion flange for tool marks, nicks, or damaged surface. If damaged, replace flange as per instructions under COMPANION FLANGE REPLACEMENT.

7. Examine carrier bore and remove any burrs that might cause leaks around the OD of the seal.

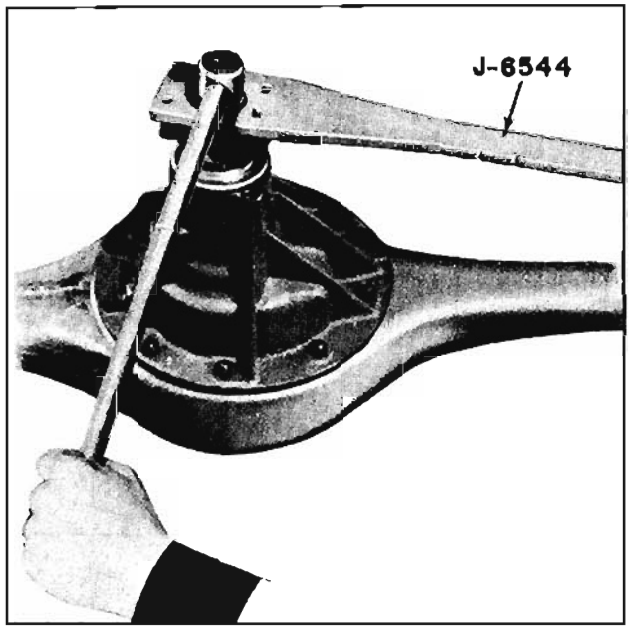


Fig. 10-8 Removing Companion Flange Nut

8. Coat outside diameter of new seal sparingly with sealer, Part No. 557622 and install seal using Driver J-5395-01 to properly locate seal in carrier. (Fig. 10-10)

9. Apply Special Seal Lubricant, Part No. 567196, to the OD of the companion flange and sealing lip of new seal.

10. Install companion flange and tighten nut to the same position as marked in Step 2, while holding companion flange with Tool J-6544. Tighten nut 1/16" beyond alignment marks.

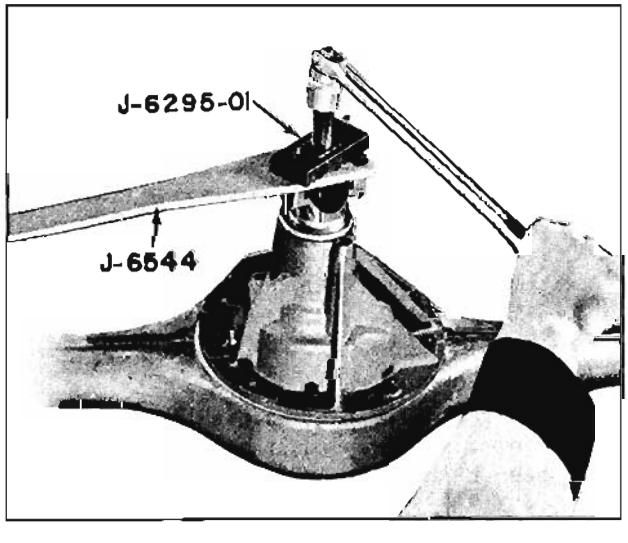


Fig. 10-9 Removing Companion Flange

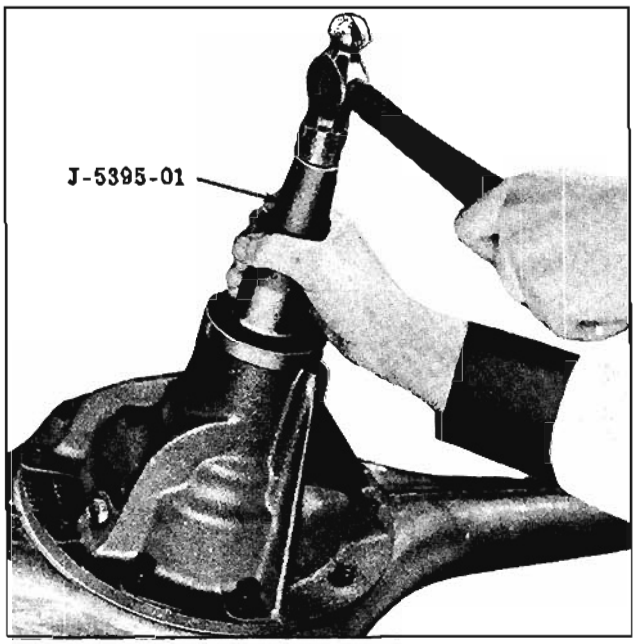


Fig. 10-10 Installing Pinion Oil Seal

COMPANION FLANGE REPLACEMENT

1. Remove both rear wheels and brake drums.
2. Remove both axle shafts BEING CAREFUL NOT TO DRAG THE AXLE SHAFTS ACROSS THE SEALS.
3. Disconnect rear universal joint and support propeller shaft by tying propeller shaft to exhaust pipe. If U-joint bearings are not retained by a retainer strap, use a piece of wire to hold bearings on their spider journals.
4. Remove companion flange nut using Holding Tool J-6544 to hold flange. (Fig. 10-8)
5. Remove washer and then remove companion flange using Puller J-6295-01. (Fig. 10-9)
6. Apply Special Seal Lubricant, Part No. 567196, to the OD of the new companion flange, then install companion flange, washer and companion flange nut finger tight.
7. While holding companion flange with Tool J-6544, tighten the nut a little at a time and turn drive pinion several revolutions after each tightening to seat the rollers. Check the pre-load of bearings each time with an inch pound torque wrench or with Spring Scale J-544-A until pre-load is 10 to 15 inch pounds. (See CARRIER DISASSEMBLY, Step 1)

   NOTE: The bearing pre-load should never exceed 25 inch pounds if the differential has been in use.
8. Connect rear universal joint to differential companion flange.

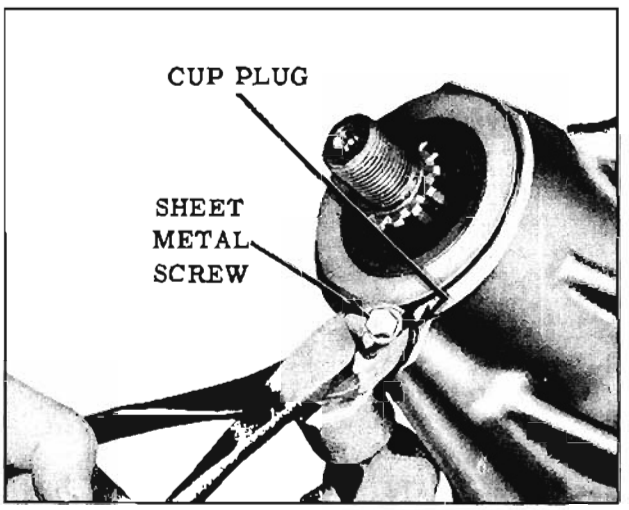


Fig. 10-11 Removing Cup Plug

9. Install axle shafts carefully to avoid dragging shafts across seals. Torque 23 to 28 ft. lbs.
10. Install drums and wheels.

OIL GALLEY PLUG REPLACEMENT

1. Remove companion flange. (See PINION OIL SEAL REPLACEMENT, Steps 1 thru 5)
2. Center punch and drill hole in plug to receive sheet metal screw.
3. Remove plug as shown in Fig. 10-11.
4. Clean metal particles from oil galley.
5. Coat OD of a new plug with sealer, Part No. 557622, then drive plug into oil drain galley until it is FLUSH with carrier. (Fig. 10-12)
6. Install companion flange (see COMPANION FLANGE REPLACEMENT, Steps 6 thru 10).

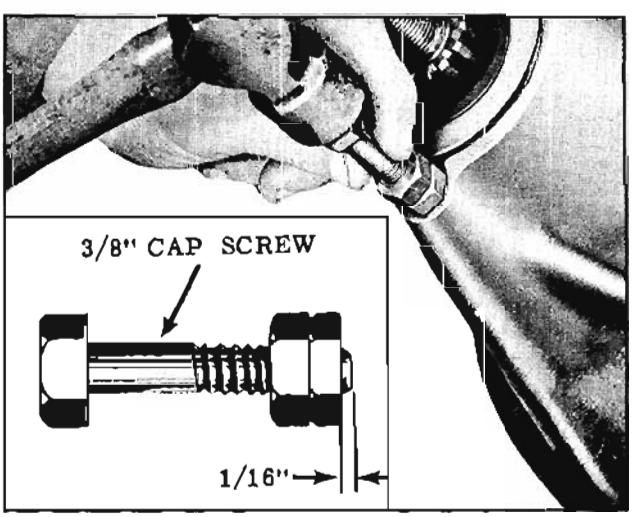


Fig. 10-12 Installing Cup Plug

DIFFERENTIAL—REMOVE

1. Remove the axle shafts.

2. Clean the differential carrier and the axle housing around carrier to prevent dirt from entering the housing or falling on the gears.

3. Remove the companion flange U-bolts. If U-joint bearings are not retained by a retainer strap, use a piece of wire or a rubber band to hold U-joint bearings on the spider. Support the propeller shaft by tying it to the exhaust pipe.

4. Drain the oil by removing nuts from carrier mounting studs and moving carrier away from axle housing.

   CAUTION: Do not clean the differential until it has been disassembled. This will avoid washing dirt into the bearings.

DIFFERENTIAL—INSTALL

IMPORTANT: Differential gears that have failed or bearings that are damaged by chipping are certain to leave particles of metal in the housing. These particles must be thoroughly cleaned from the housing before installing the carrier to prevent repeat failure.

Bearings that are not chipped, but are loose (lapped-in) are an indication of dust, grit, or dirt in the oil that caused the bearings to wear. This too must be thoroughly cleaned from the housing before installing the differential to prevent excessive bearing wear.

To insure that the housing is clean, thoroughly wash the interior of the housing with clean solvent. Loosen any particles that may be lodged by tapping the housing its entire length, then wipe the inside of housing dry to remove all particles.

1. Clean the gasket surface on housing and install a new gasket.

2. Align the differential with the housing and carefully install the differential over the mounting studs. Install nuts on studs and tighten evenly. Torque 50 to 60 ft. lbs.

3. Install axle shafts. Torque 23 to 28 ft. lbs.

4. Install brake drums and wheels. Connect propeller shaft to differential companion flange.

5. With car level, fill the rear axle housing to filler plug level with Special Lubricant, Part No. 531536.

   CAUTION: If new gears and/or bearings are installed, the owner should be advised

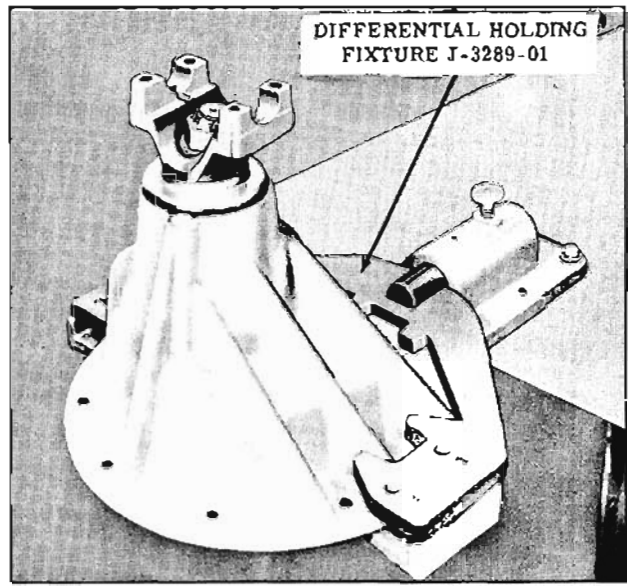


Fig. 10-13 Holding Fixture

NOT TO DRIVE CAR OVER 50 MILES PER HOUR OR USE FULL THROTTLE FOR THE FIRST 50 MILES. This will permit proper "break-in" of the gears and bearings.

DIFFERENTIAL—DISASSEMBLY

Careful inspection of the differential while disassembling the unit will assist in determining the cause of axle noise, as in many instances improper bearing pre-load and/or ring gear to pinion backlash are the basic causes of the noise.

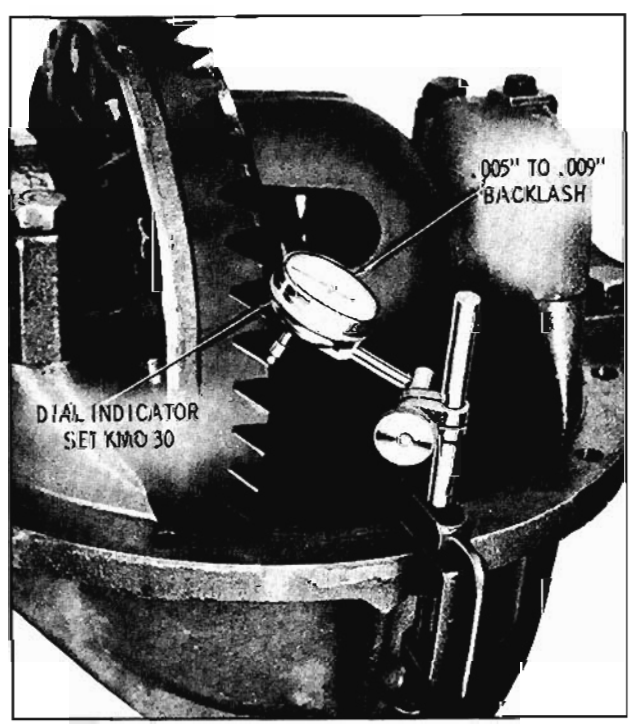


Fig. 10-14 Measuring Backlash

1. Mount differential in Holding Fixture J-3289-01. (Fig. 10-13)

2. If original pinion gear and ring gear are to be reinstalled, install dial indicator set KMO-30 as shown in Fig. 10-14. Measure backlash at two points (180° apart). The lowest reading should be within .005" to .009".

3. Mark the right side bearing adjusting nut, bearing cap, and carrier with two punch marks as shown in Fig. 10-15, also mark the left side in the same manner using one punch mark. These marks will serve for location and adjusting purposes when rebuilding differential with the original gear set.

4. Remove bearing cap lock screws and locks.

5. To determine if the side bearing pre-load is correct:

   a. Loosen each bearing cap attaching bolt (1/4 to 1/2 turn) just enough to turn adjusting nut. (Tap lightly on bearing cap to assure freeness of nut in threads.)

   b. Back off the right hand adjusting nut (one opposite ring gear) with Tool J-972-A and watch the outer race of the bearing.

   NOTE: If the side bearing pre-load is correct, the outside bearing race should start to turn the instant the adjusting nut is loosened. It should continue to turn until the adjusting nut is loosened two to three notches. Count and record the notches between the punch marks on the nut and those on the carrier where bearing race stopped turning.

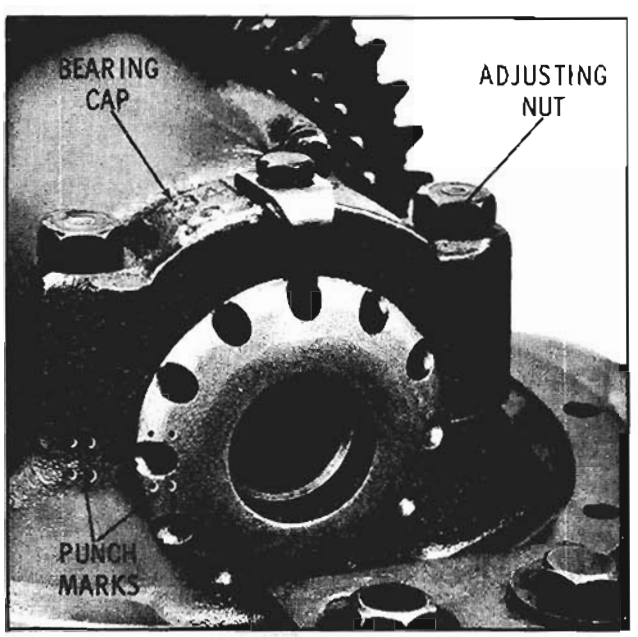


Fig. 10-15 Adjusting Nut Markings

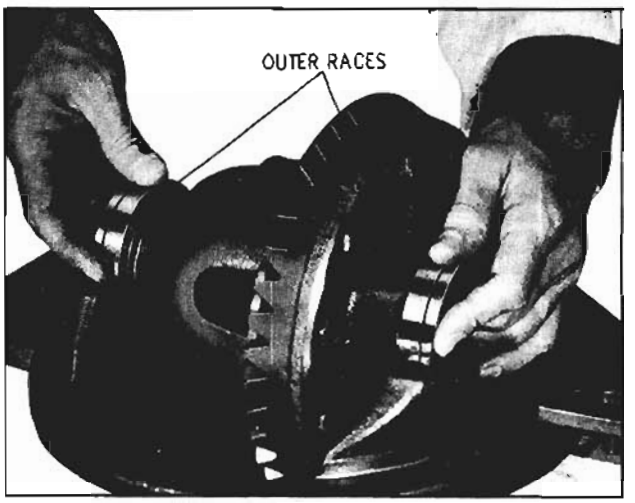


Fig. 10-16 Removing Differential Case

6. Remove the bearing cap bolts, bearing cap, and adjusting nuts.

7. Lift the differential case from the carrier while holding the side bearing outer races against rollers. (Fig. 10-16) Remove bearing outer races.

   IMPORTANT: DO NOT DROP OR MIX THE DIFFERENTIAL SIDE BEARING OUTER RACES AS THEY MUST BE ASSEMBLED TO THE SAME BEARING FROM WHICH THEY WERE REMOVED.

CASE (Fig. 10-18)

Conventional Differential Only

1. If side bearings are to be removed, use Differential Side Bearing Remover TR-278-R and Adapter TR-278-R-4 and turn differential

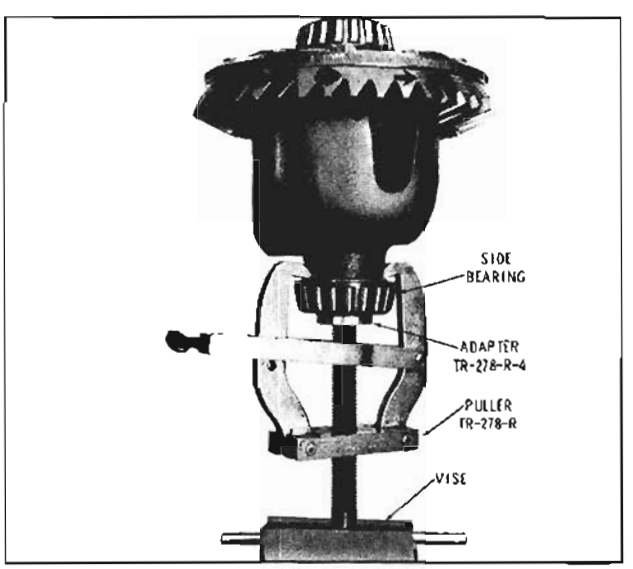


Fig. 10-17 Removing Side Bearings

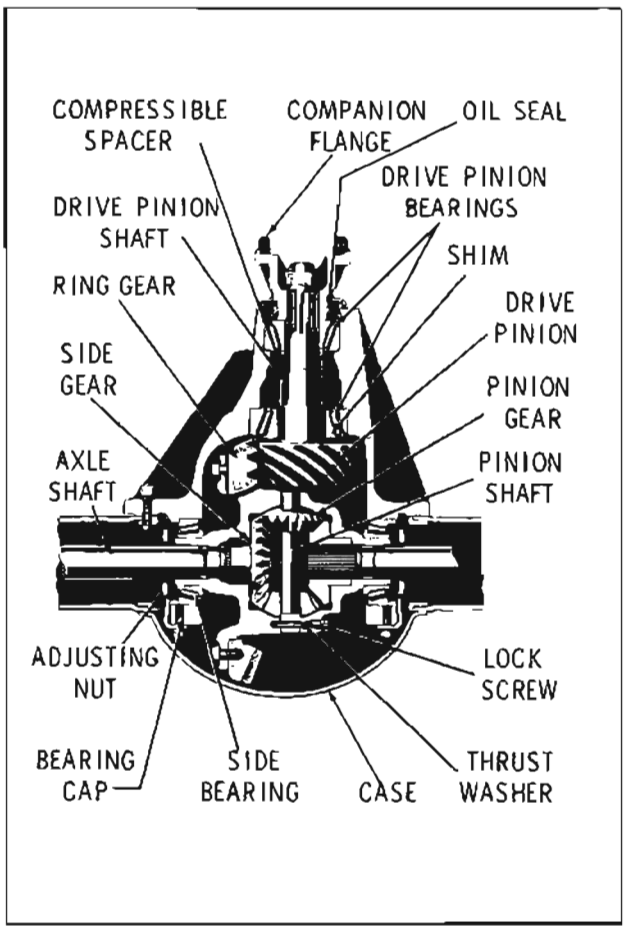


Fig. 10-18 Differential Assembly (Standard)

case in direction of arrows (counterclockwise) as shown in Fig. 10-17. Be sure ends of puller are placed in recess in differential case.

2. If the ring gear or differential case is to be replaced, remove ring gear from case.

3. Remove lock screw and pinion gear shaft, then remove the pinion gears, side gears and thrust washers from case.

CARRIER

1. Check pinion bearing pre-load with an inch-pound torque wrench as shown in Fig. 10-19. Pre-load should be within 10 to 15 in. lbs. for old bearings, 24 to 32 in. lbs. for new bearings.

   If an inch pound torque wrench is not available, Spring Scale J-544-A may be used by hooking to Companion Flange Holding Tool J-6544 at a point 10 inches from pinion shaft center, as shown in Fig. 10-20. The reading in pounds, multiplied by 10 will give inch-pounds. Thus 3 lbs. on the scale will indicate 30 in. lbs. The reading BETWEEN POUND GRADUATIONS must be read in TENTHS rather than ounces. Example: 2 lbs., 8 oz., is read 2.5 lbs., which equals 25 in. lbs.

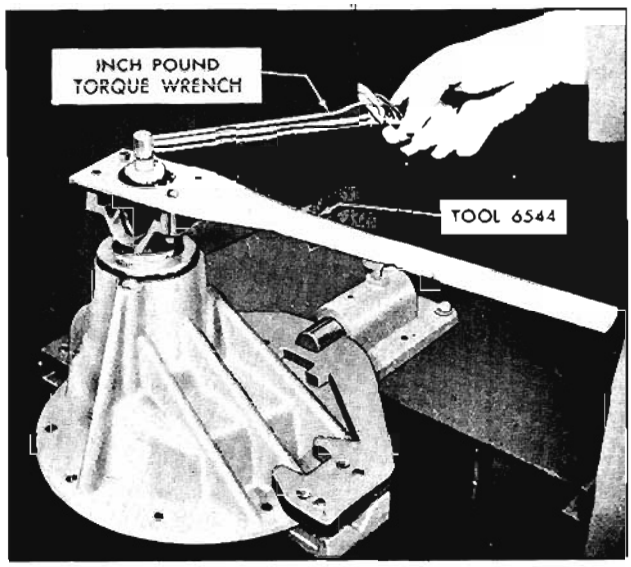


Fig. 10-19 Measuring Bearing Pre-Load

2. Turn the assembly to a horizontal position as shown in Fig. 10-21, then, using Tool J-6544 to hold companion flange, remove the companion flange nut using a 1-1/4" socket.

3. Remove washer.

   CAUTION: To avoid possibility of dropping the drive pinion assembly, leave the carrier in a horizontal position until the pinion assembly is removed.

4. Using Companion Flange Puller J-6295-01 and Holding Tool J-6544, remove companion flange. (Fig. 10-22)

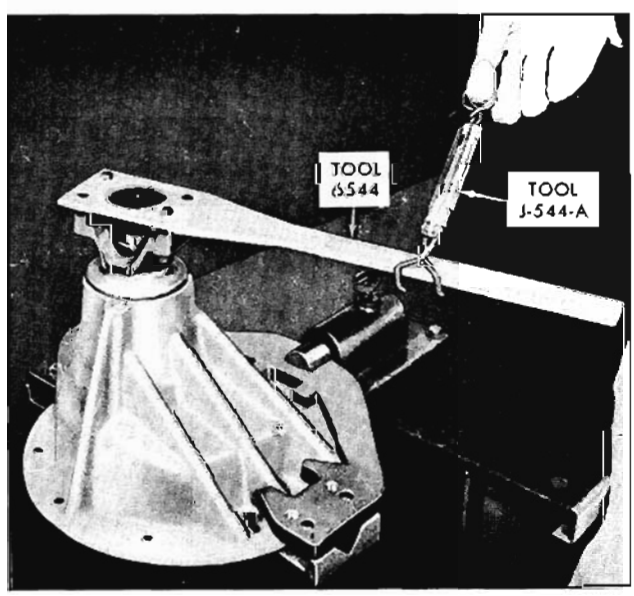


Fig. 10-20 Measuring Bearing Pre-Load

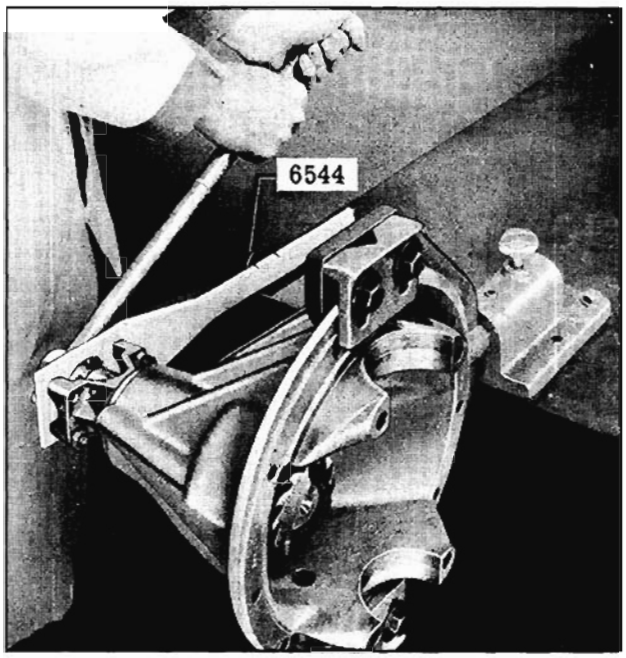


Fig. 10-21 Removing Companion Flange Nut

5. Remove the drive pinion, rear bearing, and spacer by one of the following methods:

   a. Remove the drive pinion by hand if it has a sliding fit in front bearing.

   b. If the drive pinion has a light press fit in the front bearing, lightly tap the pinion free with a composition hammer.

   c. If drive pinion has a tight press fit in front bearing, remove with an arbor press.

   NOTE: In some cases, a shim washer .037" to .045" thick will be found between the compressible spacer and inner race of the front drive pinion bearing. This shim is used in production to salvage the compressible spacer should the recommended pre-load be exceeded.

   It can be used in assembly in the same manner, and its use will be covered later. No more than one shim is to be used.

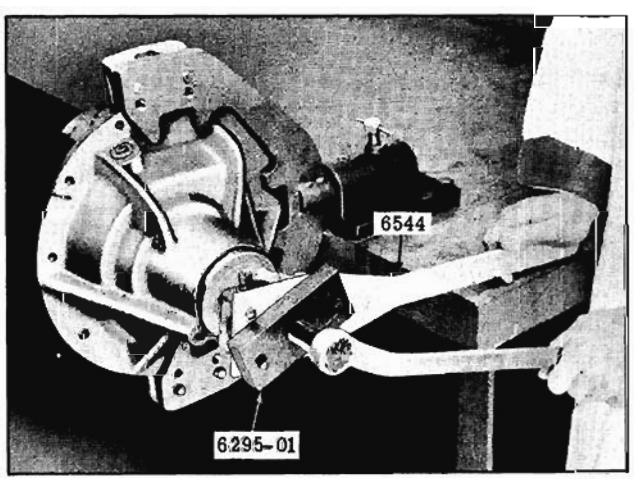


Fig. 10-22 Removing Companion Flange

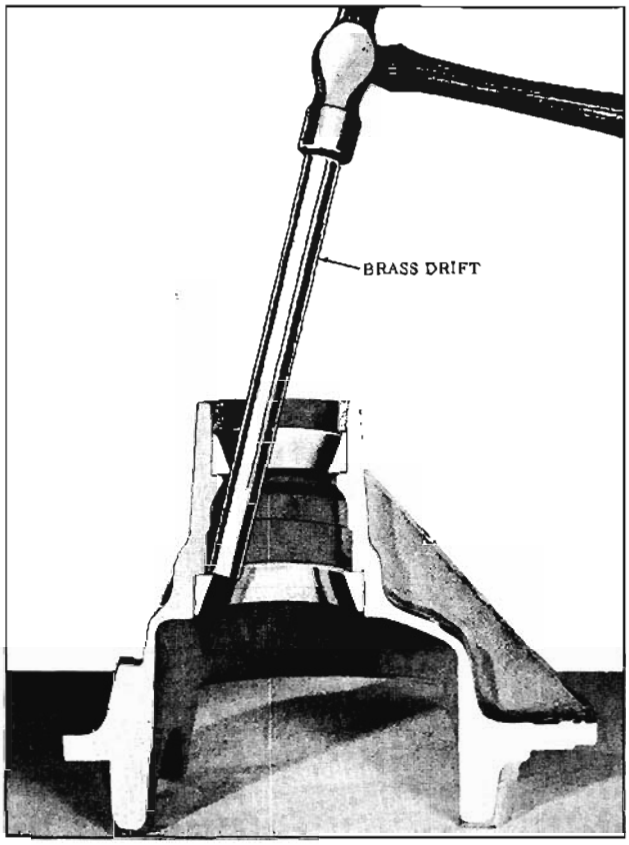


Fig. 10-23 Removing Rear Bearing Outer Race

6. Remove the oil seal by driving it out of the carrier with a blunt chisel.

7. Remove the front inner race and roller assembly.

8. Drive rear bearing outer race from carrier. (Fig. 10-23)

9. Drive the front bearing outer race from carrier. (Fig. 10-24)

10. If the rear pinion bearing or shims are to be replaced, use an arbor press as shown in Fig. 10-25 to press the rear bearing inner race and roller assembly off the pinion shaft.

    NOTE: The shims between the pinion bearing and the pinion gear are the selective shims used to locate the drive pinion gear with the ring gear.

CLEANING AND INSPECTION

1. Clean all differential bearings thoroughly in clean solvent (do not use a brush). Examine bearings visually and by feel. All bearings

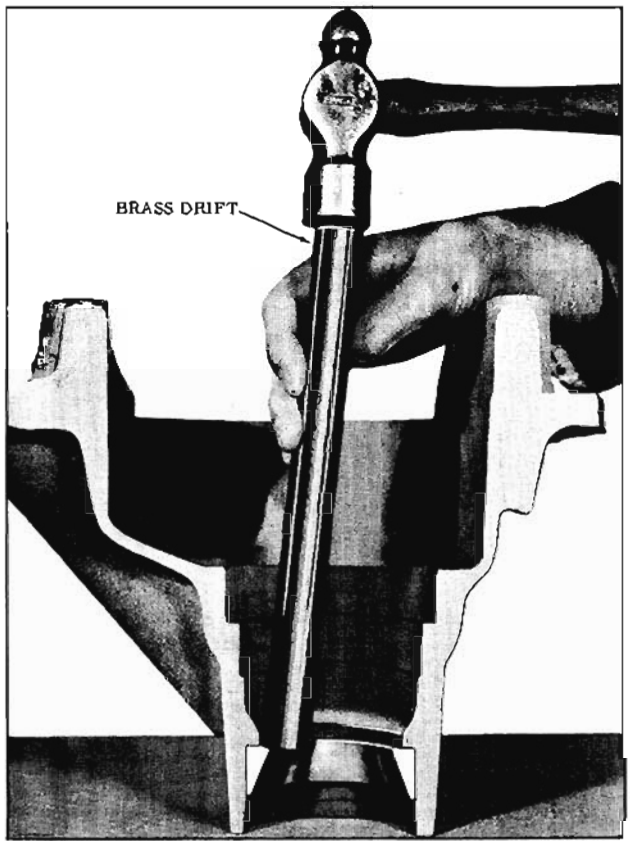


Fig. 10-24 Removing Front Bearing Outer Race

should feel smooth when oiled and rotated while applying as much hand pressure as possible.

NOTE: Minute scratches and pits that appear on rollers and races at low mileage are due to the initial pre-load, and bearings having these marks should not be rejected.

2. Examine sealing surface of companion flange for nicks, burrs, or rough tool marks which would cause damage to seal and result in an oil leak. Replace if damaged.

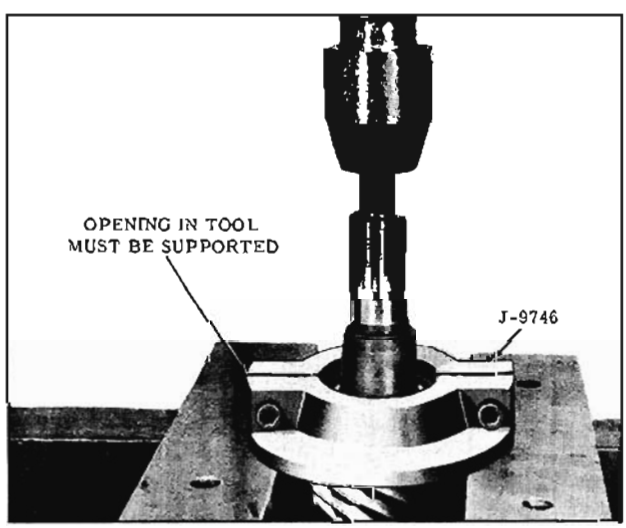


Fig. 10-25 Removing Rear Bearing

3. Examine carrier bore and remove any burrs that might cause leaks around the OD of the seal.

4. Examine the differential ring gear and drive pinion teeth for nicks, burrs and scoring. Any of these conditions will require replacement of the gear set.

5. Inspect the differential pinion gear shaft for unusual wear; also, the pinion and side gears and thrust washers.

6. Check the press fit of the side bearing inner race on the differential case hub by prying against the shoulder at the puller recess in the case. Side bearings must be a tight press fit on the hub.

7. Remove oil galley plug at front of carrier, clean passage, and install new plug as outlined under OIL GALLEY PLUG REPLACEMENT.

8. Diagnosis of a differential failure such as: chipped bearings, loose (lapped-in) bearings, chipped gears, etc., is a warning that some foreign material is present; therefore, the axle housing must be cleaned.

DIFFERENTIAL—ASSEMBLY

CASE
Conventional Differential Only

1. If the ring gear was removed, position the gear on the case flange and install the attaching bolts. Tighten the attaching bolts evenly and alternately across the diameter in progressive stages. Torque 55 to 65 ft. lbs.

2. If side bearings were removed, install as shown in Fig. 10-26.

3. Lubricate the side gears, pinion gears and thrust washers.

4. Place the side gear thrust washers over gear hubs and install side gears in case.

5. While holding the upper side gear up into its bore, position one pinion gear (without a washer) between side gears and rotate gears until pinion gear is directly opposite from loading opening in case.

6. Place the other pinion gear in position between side gears so that the pinion gear shaft holes are in line.

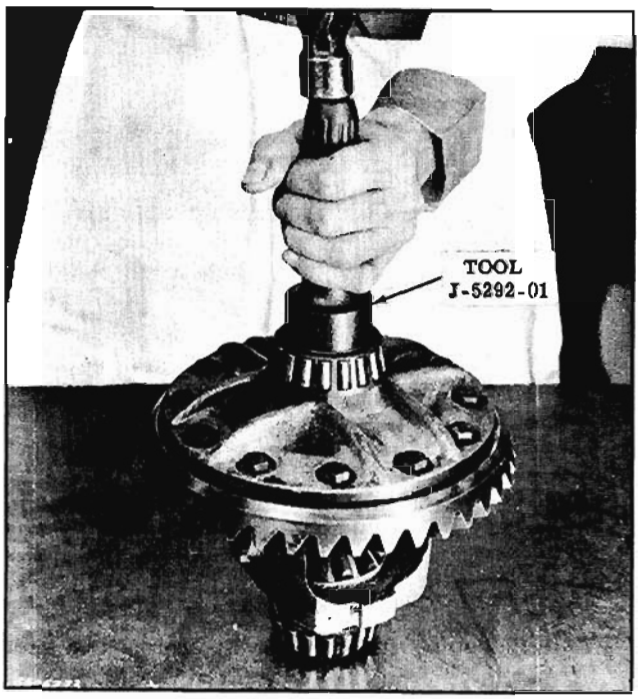


Fig. 10-26 Installing Side Bearings

7. Rotate the pinion gears in position to assure pinion gear shaft holes in gears are lined up with shaft holes in case. If not, pinion will require repositioning in side gear teeth.

8. With gears properly meshed, rotate assembly just enough to permit working the pinion thrust washers into position between gears and case.

9. Install the pinion gear shaft and lock it in place with lock screw and lockwasher. Torque lock screw 15 to 25 ft. lbs.

CARRIER

Marking on Differential Carrier and Pinion

Before installing the drive pinion, the correct number of shims to locate the drive pinion properly must be determined from markings on the differential carrier and end of pinion gear. Drive pinions ground to zero specifications are not marked as they are considered "0".

The differential carrier is marked on the face of the flange. (Fig. 10-27) "D" means "deep" and "S" means "shallow" depth of carrier bore to the shoulder for the rear pinion bearing. The digit following the letter designates the number of thousandths "deep" of "shallow".

If shims are required to correct an error in pinion machining, a number will be ETCHED on the end of the drive pinion indicating in thousandth of an inch the correction required to position

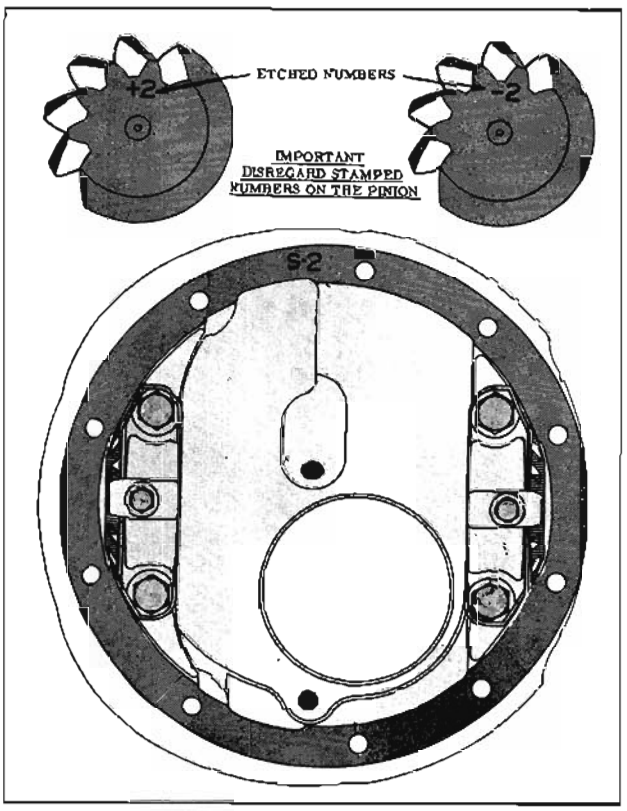


Fig. 10-27 Pinion and Carrier Markings

pinion in carrier. Examples: +2 requires .002" added shim thickness and -2 requires .002" less shim thickness. (Fig. 10-27) Disregard numbers which are STAMPED on end of pinion. They are for manufacturing control and DO NOT REFER TO SHIMS.

CAUTION: Always use the shim chart to correctly position the pinion when rebuilding a differential using new gears, pinion bearings or carrier.

How To Use The Shim Chart

Read the markings STAMPED on the carrier and ETCHED on drive pinion (Fig. 10-27) and then refer to the "SHIM CHART".

In the column "Carrier Marking" read to the right to the "Pinion Marking" vertical column. The intersection of these columns show the correct total shim thickness for this particular carrier and pinion.

Notice on the chart, the shim requirement for a carrier marked "0" together with an unmarked pinion is .016". This means that any "Plus" or "Minus" markings or "Shallow" or "Deep" markings, represent the variation in shim thickness from the starting point of .016".

Example: Carrier which is marked "D-1" with a pinion not marked requires total shim thickness

of .017". Use shim thickness chart to identify (by notches) thickness of shims. If necessary, measure shims with a micrometer.

NOTE: Due to the tolerances of the bearings used in production, the shim thickness as found in differentials with original bearings may vary slightly from the service shim chart. However, always use the shim cahrt when installing new bearings, as service bearings are within the standard height range.

SHIM CHART

Service Shim Selection Chart		
Part No.	Thickness	Identification Notches
524014	.004	None
524015	.005	1 Notch
524016	.006	2 Notches
524017	.007	None
524020	.010	None
531711	.013	1 Notch
531712	.014	2 Notches
531713	.015	None
531714	.016	1 Notch
531715	.017	2 Notches

Carrier Marking	Pinion Marking		
Mark	-2	0	+2
S-5	.009	.011	.013
S-4	.010	.012	.014
S-3	.011	.013	.015
S-2	.012	.014	.016
S-1	.013	.015	.017
0	.014	.016	.018
D-1	.015	.017	.019
D-2	.016	.018	.020
D-3	.017	.019	.021
D-4	.018	.020	.022
D-5	.019	.021	.023

If new bearings are not installed when a new pinion or carrier is installed, any variation from the chart must be taken into consideration when determining the new shim requirements.

Example: If a differential with original bearings had an unmarked pinion and a carrier marked "O", the shim requirements according to the shim chart would be .016". If only .013" shim thickness was found in the differential, then obviously the bearing accounted for the .003" variation. This variation will have to be taken into consideration when installing a new pinion or carrier.

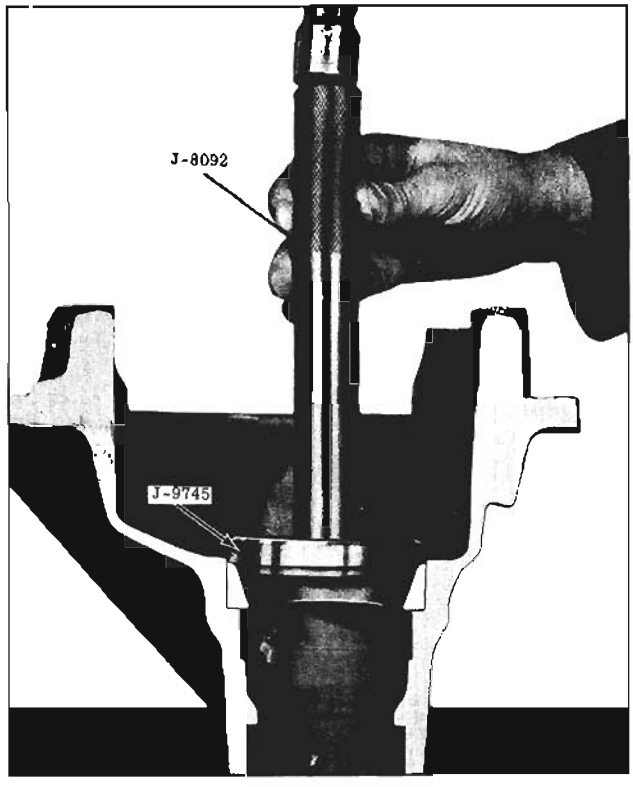


Fig. 10-28 Installing Rear Bearing Outer Race

When To Use a New Compressible Spacer

A washer with the old compressible spacer or a new compressible spacer should be used under the following conditions:

a. When a new drive pinion gear and/or pinion bearings or carrier is installed.

b. When the required pre-load has been exceeded during the adjustment.

NOTE: If a washer was found between the spacer and outer pinion bearing assembly, the washer should be discarded and a new compressible spacer used.

1. Press outer race of rear pinion bearing firmly in place against shoulder in the carrier. (Fig. 10-28)

2. Press outer race of front pinion bearing firmly against shoulder in carrier. (Fig. 10-29)

3. Install correct number of pinion adjusting shims against shoulder of drive pinion shaft.

4. Lubricate the rear bearing roller assembly, then press the rear bearing inner race and roller assembly firmly in place against the shims on pinion shaft. (Fig. 10-30)

5. Place the compressible spacer over the drive pinion shaft (with the large diameter against

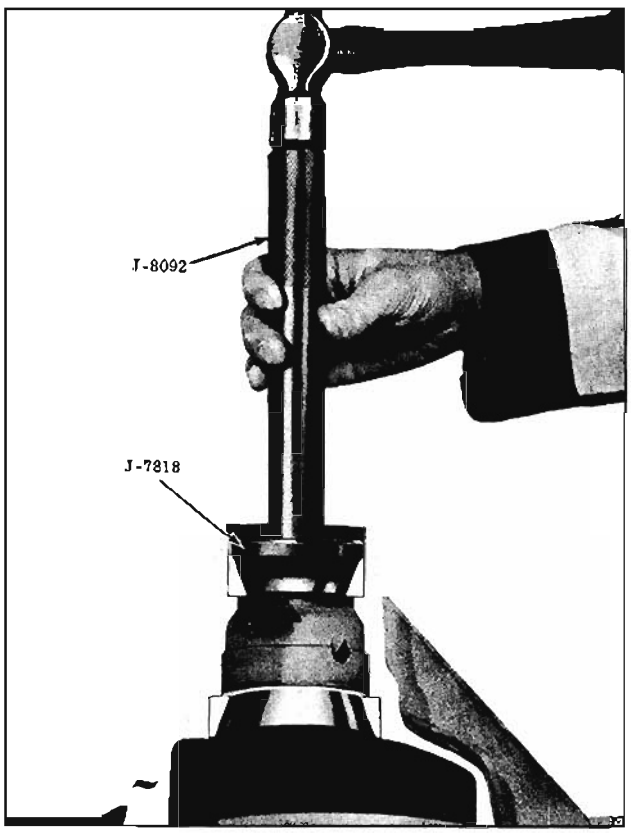


Fig. 10-29 Installing Front Bearing Outer Race

drive pinion shaft shoulder). Install washer if original spacer is reused.

6. Place the drive pinion assembly into position in the carrier. Lubricate the front bearing roller assembly and slide over the pinion shaft. Install front bearing inner race.

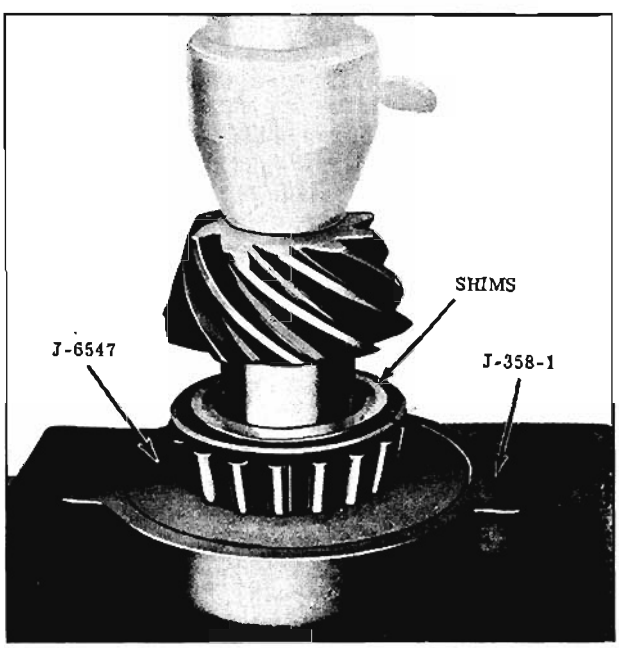


Fig. 10-30 Installing Bearing on Pinion Shaft

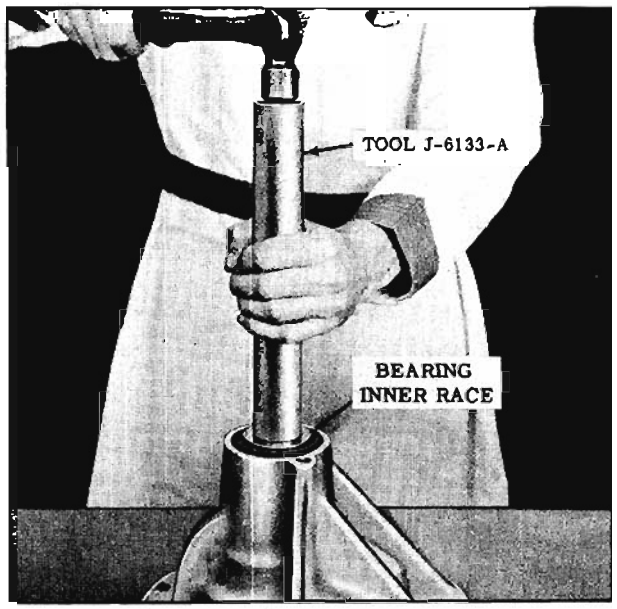


Fig. 10-31 Installing Front Pinion Bearing Inner Race

NOTE: If the drive pinion shaft is a press fit in the front bearing, install the roller and race using Tool J-6133-A to press or drive the assembly onto the pinion shaft while supporting pinion gear. (Fig. 10-31)

7. Coat the outer diameter of a new pinion oil seal sparingly with sealer, Part No. 557622.

8. Just start the seal into carrier by tapping lightly and then finish driving the seal in place

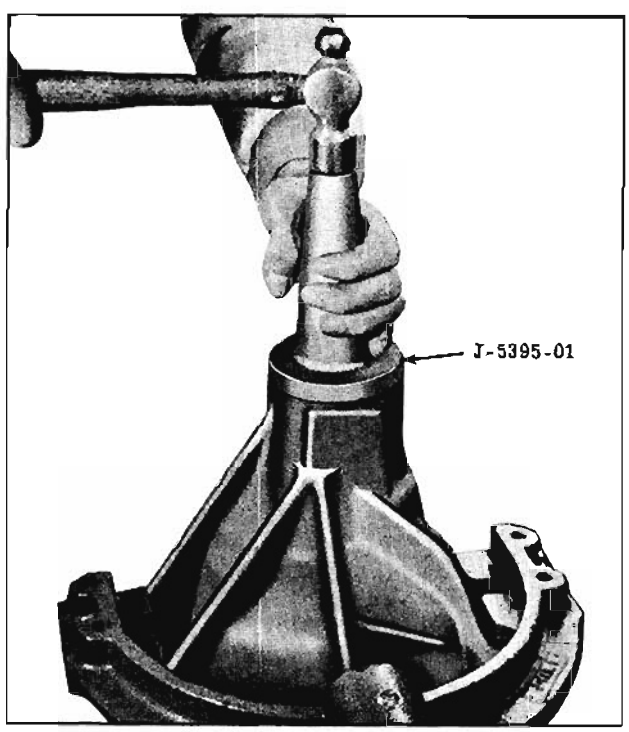


Fig. 10-32 Installing Pinion Oil Seal

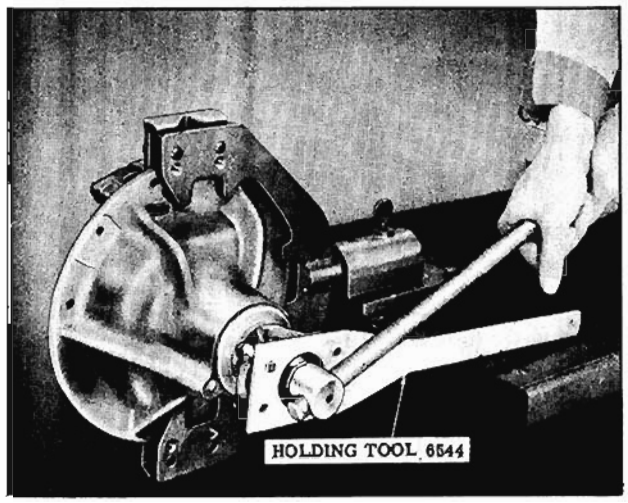


Fig. 10-33 Tightening Companion Flange Nut

with Pinion Seal Installer J-5395-01. (Fig. 10-32)

9. Apply a coating of Special Lubricant (Part No. 567196) to the OD of the companion flange and the sealing lip of the new seal.

10. While supporting the drive pinion shaft, tap the companion flange onto the drive pinion shaft.

11. Oil the flat washer and threads of drive pinion shaft and then install the washer and nut but do not tighten.

12. Adjust pinion bearing pre-load.

Adjusting Pinion Bearing Pre-Load

CAUTION: Extreme care must be used in tightening companion flange nut to pre-load pinion bearings correctly. Incorrect pre-load may result in bearing failure. Never back off nut to secure proper pre-load if specified pre-load has been exceeded. If specified maximum pre-load is exceeded, it will be necessary to use a washer, or use a new compressible spacer.

Position carrier assembly as shown in Fig. 10-33 and tighten companion flange nut using Flange Holding Tool J-6544 and a heavy duty socket until all end play in drive pinion assembly is removed. Continue to tighten nut carefully, not more than 1/6 turn at a time, then turn drive pinion shaft several revolutions to seat rollers and check bearing pre-load with an inch-pound torque wrench (Fig. 10-34) or Spring Scale J-544-A. (Fig. 10-35)

NOTE: If Spring Scale J-544-A is used to check pre-load, it should be hooked to Companion Flange Holding Tool J-6544 at a point 10 inches from drive shaft center. (Fig. 10-35) Readings in pounds times 10 will give inch-pounds. Readings between pound graduations must be read in tenths rather than in ounces; for example: 2 lbs. 8 oz., is read 2.5 lbs. times 10 = 25 inch-pounds.

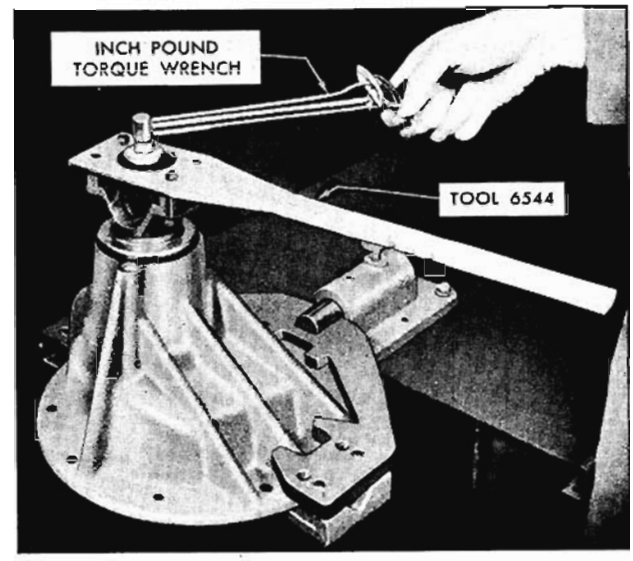


Fig. 10-34 Measuring Bearing Pre-Load

Repeat tightening and checking until pre-load is 24 to 32 inch-pounds for new bearings, or 10 to 15 inch-pounds for old bearings.

DIFFERENTIAL CASE—INSTALL

1. Lubricate the side bearings, side gears and pinion gears.

2. Hold the differential side bearing outer races in position over the side bearings and carefully lower the differential case and ring gear assembly into carrier pedestal, engaging the ring gear with the drive pinion gear teeth.

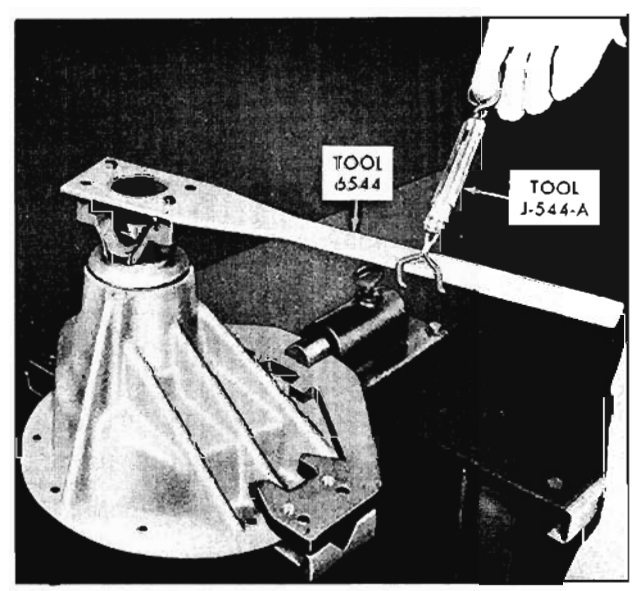


Fig. 10-35 Measuring Bearing Pre-Load

3. Move the assembly toward the pinion until the lash between the ring gear and pinion is taken up.

4. Place the adjusting nuts (right and left) in position squarely against the bearing outer races and into the threads of carrier pedestal.

   NOTE: Rotate the adjusting nuts back and forth a few times by hand to be sure they are free and correctly positioned in threads. Leave the nuts snug against the bearings.

5. Install the bearing caps as marked.

   CAUTION: Make sure the adjusting nuts are properly seated, threads not crossed, and pedestal caps not interchanged.

6. Install the cap screws (no washers are used) and draw them down only sufficiently to lightly hold the caps in place. This can be done by drawing them down snugly and then loosening them approximately 1/4 to 1/2 turn.

7. Adjust backlash and side bearing pre-load.

Adjusting Backlash and Side Bearing Pre-Load

NOTE: Whenever new parts, such as gear sets, bearings, etc., are installed, the markings on the carrier and adjusting nuts (indicating the original position of gears and side bearing pre-load) should be disregarded. Whenever original parts are installed, the markings can be used to reset the adjustments providing the original settings were correct.

With bearing caps tightened just snug, proceed as follows:

1. Using Tool J-972-A, back off the right hand adjusting nut (one opposite ring gear) approximately three turns (just enough so lash between ring gear and pinion can be removed).

2. Tighten the left hand adjusting nut to move ring gear into mesh with pinion until all lash is removed, then back off adjusting nut three notches.

   NOTE: This is only a starting point and may need to be readjusted depending on the backlash present after making the following adjustments.

3. Tighten the right hand adjusting nut while watching the outer race of bearing. When the bearing race starts to turn along with the adjusting nut, indicating pre-load on bearing, tighten two additional notches. Tighten adjusting nut to align closest notch in nut with cap screw hole in bearing cap. Do not loosen nut to align notch with hole in bearing cap.

Fig. 10-36 Adjusting Backlash

4. Tighten bearing cap bolts 65 to 85 ft. lbs.

5. Clamp dial indicator to differential carrier and check backlash between ring gear and drive pinion, using Dial Indicator Set KMO-30. (Fig. 10-36) If the same ring gear and pinion were installed, the backlash should be adjusted according to markings on the bearing caps and adjusting nuts providing the differential was not disassembled to correct a noise complaint.

   NOTE: If backlash is not within .005" to .009", it will be necessary to adjust backlash .007" to .008". To do this, and at the same time retain the two notches pre-load on the side bearing, proceed as follows:

6. Loosen bearing cap bolts slightly, then move both adjusting nuts in the same direction one notch at a time until correct backlash is obtained. For example, if left nut is backed off one notch, right nut must be tightened one notch.

   NOTE: To increase backlash, move ring gear away from drive pinion gear. To decrease backlash move ring gear toward drive pinion gear.

   Be sure bearing cap bolts are tightened 65 to 85 ft. lbs. each time backlash is checked.

7. After side bearing pre-load is correct, install bearing cap locks and lock bolts.

ANTI-SPIN DIFFERENTIAL CASE

A first and second type Anti-Spin differential is used in production. For service procedures regarding the first type, refer to the 1963 Service Manual. Service procedures for the second type follow.

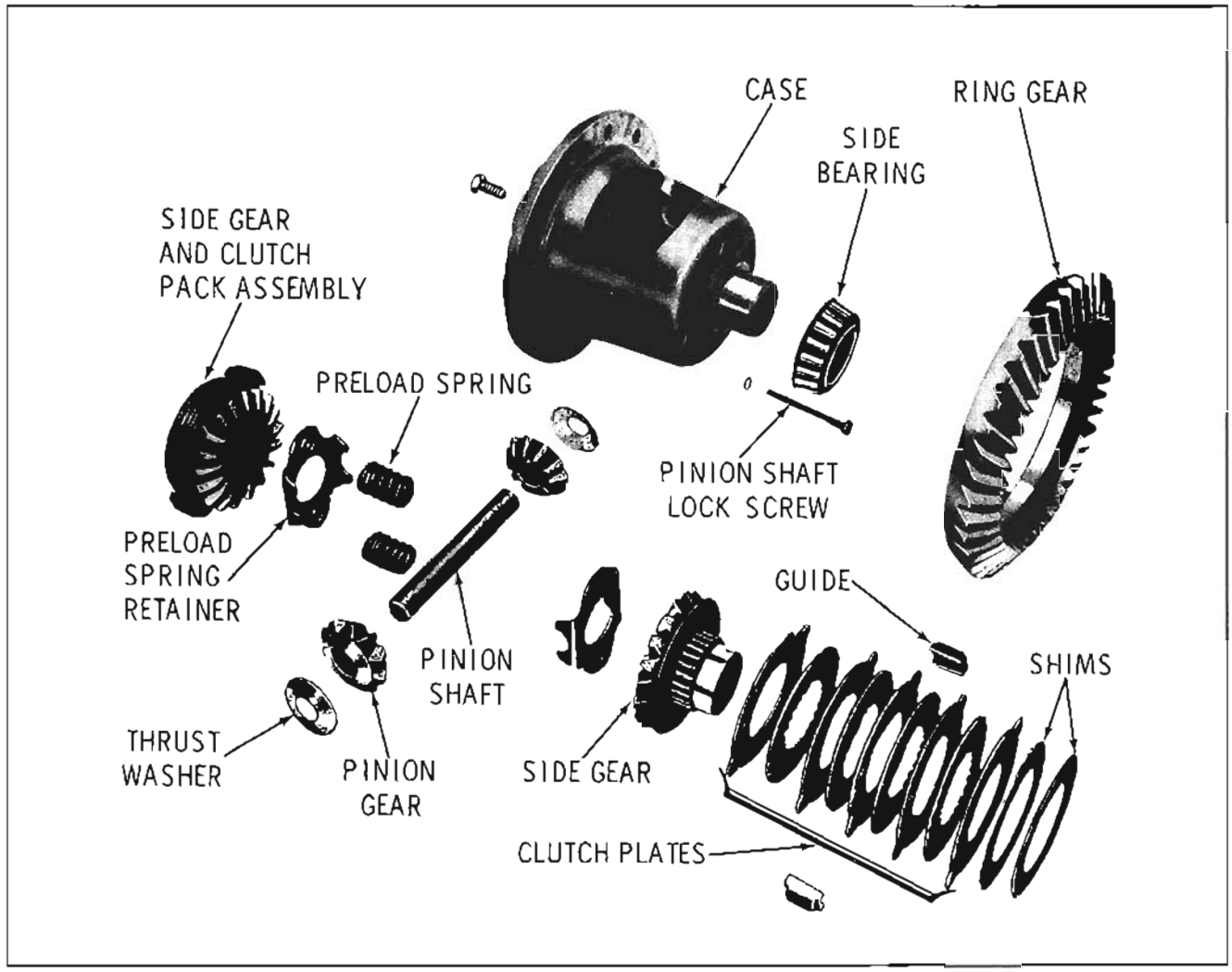


Fig. 10-37 Anti-Spin Differential

NOTE: Service procedures and specifications for the Anti-Spin differential are the same as the conventional differential except for the Anti-Spin case assembly unless otherwise specified.

GENERAL DESCRIPTION

The conventional differential divides the driving force equally to both rear wheels. The driving force is limited by the wheel which has the least amount of traction; therefore, if one wheel is on snow or mud, the wheel will spin and the driving force is lost.

The Anti-Spin differential (optional on all series) through the use of clutch plates directs the driving force to the wheel with the best traction thus improving the ability of the car to pull out of mud or snow.

Anti-Spin differentials can be identified by the Anti-Spin lubrication tag attached by a carrier to axle housing nut and also by the letter "L" on the axle ratio pad. (Fig. 10-45)

CAUTION: ON CARS EQUIPPED WITH ANTI-SPIN DIFFERENTIALS, DO NOT RUN ENGINE WITH ONE REAR WHEEL OFF THE GROUND AND TRANSMISSION IN GEAR.

OPERATION

The Anti-Spin differential transmits torque from the drive pinion gear to the ring gear and to the case in the same manner as the conventional differential. In addition, the Anti-Spin differential incorporates the use of clutch plates which tend to lock the axle shafts to the case, or in effect, to each other.

When driving force is applied at the differential case, the pinion shaft, pinion gears and side gears (splined to the axle shafts) begin to rotate as an assembly in the same direction as the case. Although traction at the rear wheels may not be equal, their resistance to turning allows the pinion gears to bear against the side gears (splined to the axle shaft and the clutch plates) to apply the clutches, and to lock the axle shafts to the case. This allows both rear wheels to turn at an equal

speed and the driving force is not lost by the wheel with poor traction.

When turning a corner, the action is essentially that of a conventional differential.

ANTI-SPIN CONVERSION INFORMATION

The case assembly (less ring gear and side bearings) is available for converting a conventional differential to Anti-Spin. The ring gear and side bearings of the conventional differential, if in good condition, can be used with the Anti-Spin case assembly.

CASE DISASSEMBLY (Fig. 10-37)

1. If side bearings are to be removed, use Differential Side Bearing Remover TR-278-R and Adapter TR-278-R-4 and turn differential case in direction of arrows (counterclockwise) as shown in Fig. 10-38. Be sure ends of puller are placed in recess in differential case.

2. If the ring gear or differential case is to be replaced, remove ring gear from case.

3. Remove pinion shaft lock screw and lockwasher, then remove pinion shaft from case.

4. Remove the pre-load spring retainer and springs from the case. (Fig. 10-39)

5. Rotate side gears until the pinions are in the open area of the case. Remove the pinions and thrust washers.

6. Remove a side gear, clutch pack and shims from the case, noting its location in the case to aid in reassembly. Remove the side gear clutch pack and shims from the opposite side.

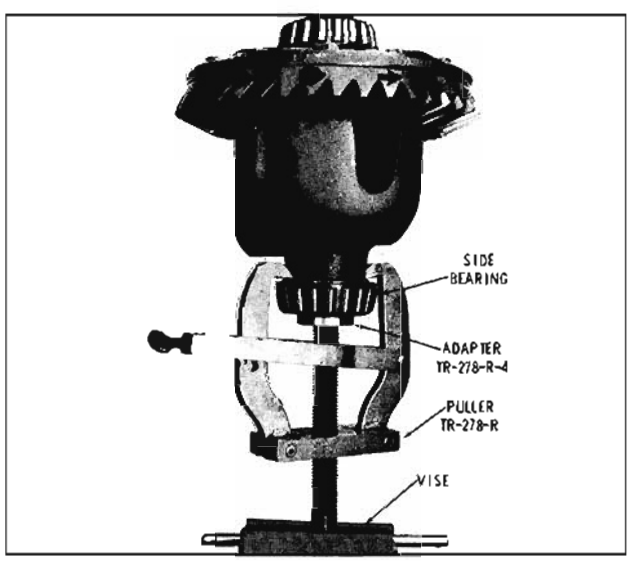


Fig. 10-38 Removing Side Bearing

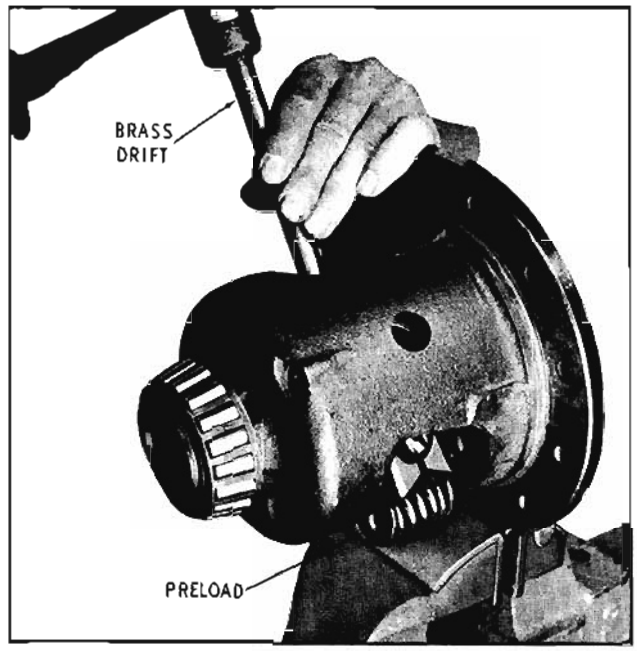


Fig. 10-39 Removing Pre-Load

NOTE: If a side gear or clutch pack cannot be readily removed from the case, drive it out with a brass drift. (Fig. 10-40)

5. Remove the clutch plate guides and separate the shims and clutch plates from the side gears.

NOTE: Keep the clutch plates in their original location in the clutch pack.

CLEANING AND INSPECTION OF CASE

1. Clean side bearings thoroughly in clean solvent (do not use a brush). Examine bearings visually and by feel. Bearings should feel smooth when oiled and rotated while applying as much hand pressure as possible.

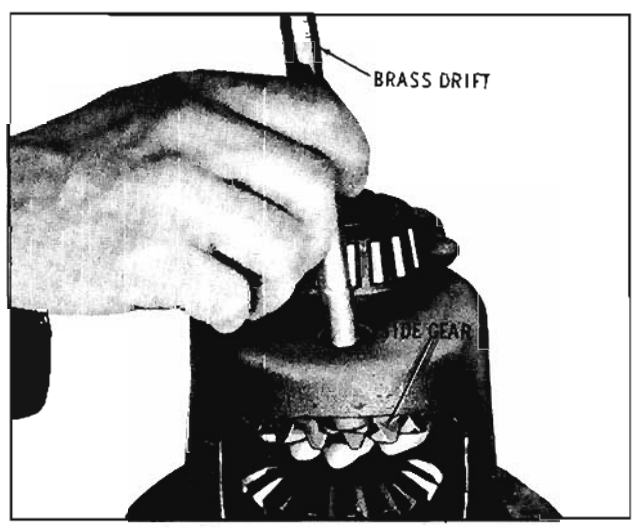


Fig. 10-40 Removing Side Gear

NOTE: Minute scratches and pits that appear on rollers and races at low mileage are due to the initial pre-load, and bearings having these marks should not be rejected.

2. Examine the ring gear and drive pinion teeth for nicks, burrs, or scoring. Any of these conditions will require replacement of the gear set.

3. Inspect pinion shaft, pinion and side gears. Replace if parts are excessively scored, pitted or worn.

4. Check the press fit of the side bearing inner race on the differential case. Side bearings must be a tight press fit on the hub.

5. Inspect clutch plates for scored, worn, cracked or a distorted condition. If any of these conditions exist, new clutch plates must be installed.

DIFFERENTIAL CASE—ASSEMBLY

1. If the ring gear was removed, position the gear on the case flange and install the attaching bolts. Tighten the attaching bolts evenly and alternately across the diameter in progressive stages. Torque 55 to 65 ft. lbs.

2. If side bearings were removed, lubricate the bearings and install on case hubs as shown in Fig. 10-41.

3. Apply Special Lubricant, Part No. 531536, to the clutch plates.

4. Assemble the clutch packs as follows:

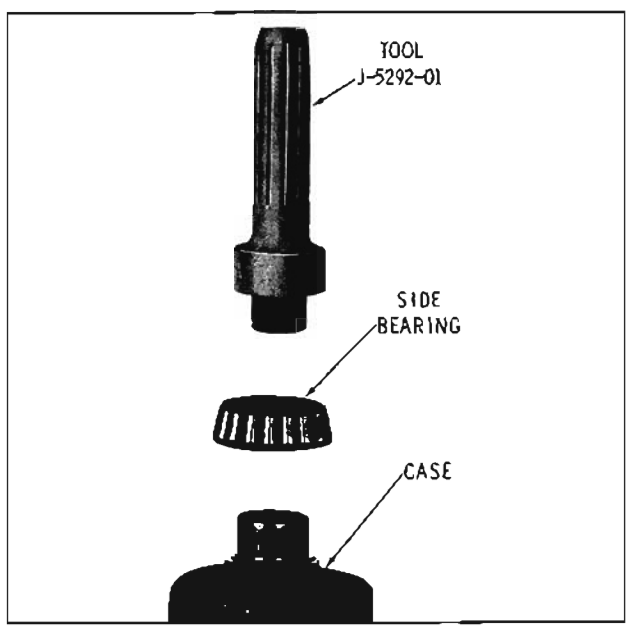


Fig. 10-41 Installing Side Bearing

a. Alternately position nine clutch plates on the side gear, starting and ending with a clutch plate with the external lugs.

b. Install the two clutch guides over the clutch plate lugs.

c. Install the same shims which were removed or an equal amount on the clutch plate.

d. Repeat Steps a, b, and c on the other clutch pack.

5. Check the pinion to side gear clearance as follows:

a. Install one side gear with clutch pack and shims in the case.

b. Position the two pinion gears and thrust washers on the side gear and install the pinion shaft.

c. Compress the clutch stack by inserting a screwdriver or wedge between the side gear and the pinion shaft.

d. Install dial indicator KMO-30 with the contact button against the pinion gear. (Fig. 10-42)

e. Rotate pinion gear. Clearance should be .001" to .006".

f. If clearance is more than .006", add shims between clutch pack and case. If clearance is less than .001", remove shims. A .002" shim will change clearance approximately .001". Recheck clearance after adding or subtracting shims.

g. Remove side gear and repeat procedure with opposite clutch pack, on opposite side of case.

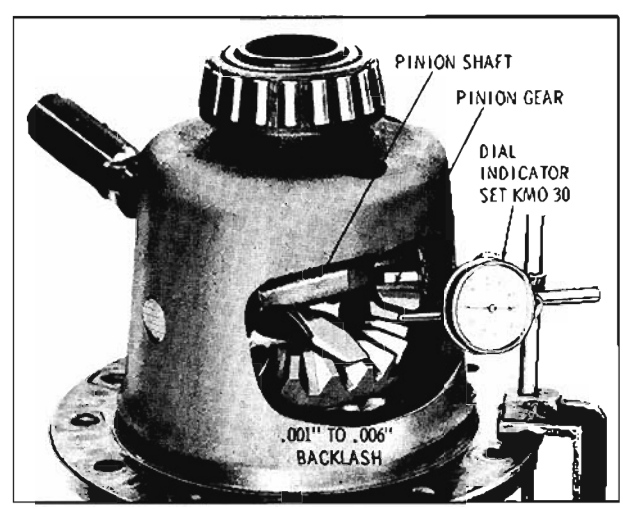


Fig. 10-42 Checking Side Gear to Pinion Backlash

6. Remove pinion shaft, pinions and thrust washers.

7. Install the remaining side gear and clutch pack with correct shims in the case.

8. Place the pinion gears on the side gears and rotate into correct position.

9. Compress the pre-load springs as shown in Fig. 10-43 and drive the pre-load retainer and springs between the side gears.

10. Insert the thrust washers behind the pinion gears.

11. Install the pinion shaft and retain with the lock bolt. Tighten lock bolt 15 to 25 ft. lbs.

12. Check the side gear splined hole to be certain it is in line with the hole in the pre-load spring retainer. The spring retainer can be moved slightly to correct misalignment.

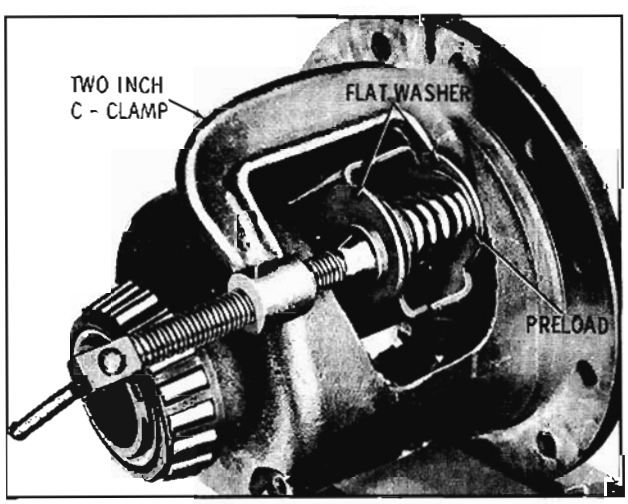


Fig. 10-43 Compressing Pre-Load Springs

DIAGNOSIS

ANTI-SPIN OPERATION

If an Anti-Spin differential is suspected of not providing positive traction to the non-slipping wheel, the condition can be checked as follows:

1. Place the transmission in neutral.

2. Raise one wheel off the floor and place a block in the front and rear of the opposite wheel.

3. Remove hub cap or wheel disc and apply a torque wrench as shown in Fig. 10-44.

4. Disregard breakaway torque and observe only the torque required to continuously turn the wheel smoothly.

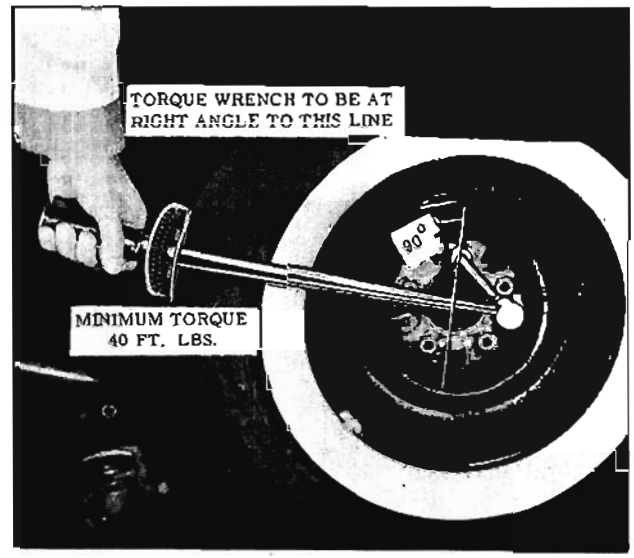


Fig. 10-44 Checking Anti-Spin

If the torque reading is less than 40 ft. lbs., the unit should be disassembled and the case assembly repaired as necessary.

DIFFERENTIAL NOISE

When a differential assembly is suspected of being noisy, a thorough road test should be made to make sure that the noise is not being caused by tires, road surface, wheel bearings, engine, transmission, muffler, body or propeller shaft.

TIRE NOISE

Different types of road surfaces will affect tire noise but will not affect rear axle noise. For road testing, select a level tarvia or asphalt road, as this type road surface practically eliminates tire noise. For test purposes only, inflating all tires to approximately 50 lbs. pressure will materially alter noise caused by tires, but will not affect noise caused by the rear axle. Rear axle noise usually ceases when coasting with transmission in neutral at speeds under 30 mph, however, tire noise continues with lower tone as car speed is reduced. Rear axle noise always changes when comparing "pull" and "coast", but tire noise remains about the same.

WHEEL BEARING NOISE

Wheel bearing noise may be confused with differential noise; however, a rough rear wheel bearing produces a vibration or growl which continues with car coasting with transmission in neutral. A bad bearing may cause a knock or click approximately every two revolutions of the wheel since the bearing rollers do not travel at the same speed as the rear axle shaft. To determine which front wheel bearing is noisy, hoist the car and

spin each wheel while listening at the hub cap. To determine which rear wheel bearing is noisy, hoist car and start engine. With transmission in gear, use a piece of rubber hose or stethoscope BT-37 at the axle housing to locate the noise.

ENGINE AND TRANSMISSION NOISE

Note speed at which noise occurs, and with car standing and transmission in neutral, accelerate the engine to approximate speed where noise was noticed. If a similar noise is produced with the car standing, it cannot be due to the differential.

DIFFERENTIAL SIDE AND PINION GEAR NOISE

Differential side gears and pinions seldom cause noise because their movement is negligible on straight ahead driving.

RING GEAR AND PINION GEAR NOISE

These generally show up as drive noise, coast noise, or float noise. Drive noise is most pronounced on constant acceleration through the speed range. Coast noise is most pronounced when the car is allowed to coast through the speed range while in gear. Float noise is the most pronounced while holding the car speed constant at various speeds. Drive, coast, and float noises will be very rough and irregular if the differential side bearings or drive pinion bearings are rough, worn, or loose.

DRIVE PINION BEARING AND SIDE BEARING NOISE

Rough or brinnelled bearings produce a continuous whine starting at a relatively low speed. The noise is most noticeable with a light pull between 18 to 25 miles per hour.

DIFFERENTIAL CLUTCH CHATTER
Anti-Spin Only

Improper lubricant can cause the clutch plates to grab and release intermittently resulting in chatter when the car is turning a corner slowly. Special Lubricant, Part No. 531536, MUST be used for initial fill of the differential, small amounts of S.A.E. 90 Multi-Purpose Gear Lubricant meeting the requirements of military specifications MIL-L-2105B can be added to bring the lubricant up to filler plug level.

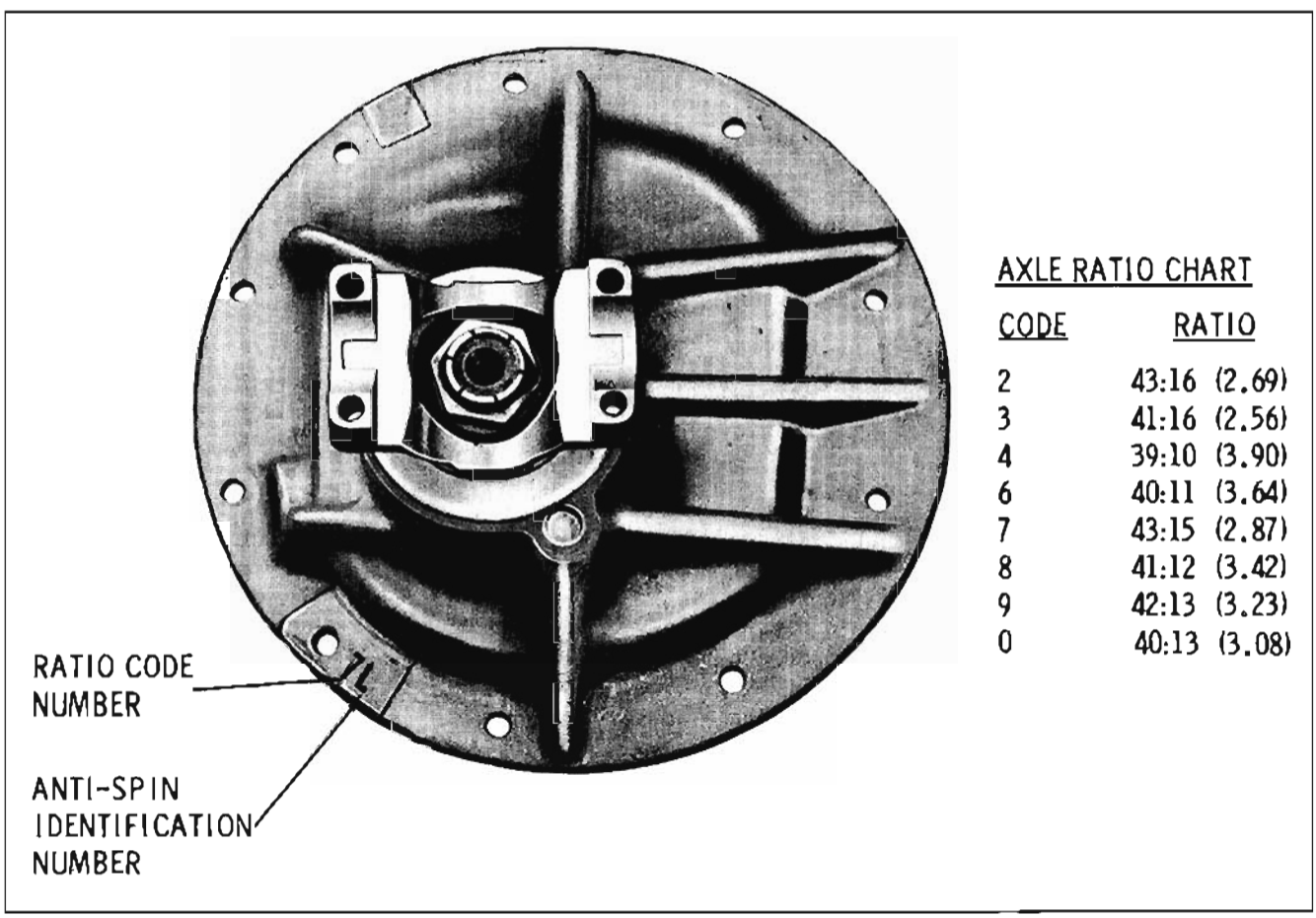


Fig. 10-45 Axle Ratio Code

AXLE RATIOS

Usage	Type	Ratio	Code	Remarks
34 Series Synchromesh				
All Except 3457	Standard	42:13 (3.23)	9	Including Air Conditioning
3457	Standard	41:12 (3.42)	8	Including Air Conditioning
All Styles	Performance	40:11 (3.64)	6	Including Air Conditioning
34 Series Hydra-Matic				
3435,39,45,47,67 & 69	Standard	40:13 (3.08)	0	Including Air Conditioning
3457	Standard	41:12 (3.42)	8	Including Air Conditioning
3435,39,45,47,67 & 69	HC Opt. Engine	42:13 (3.23)	9	Air Conditioning
All Styles	Performance	39:10 (3.90)	4	Including Air Conditioning
3435,39,45,47,67 & 69	Performance	42:13 (3.23)	9	Including Air Conditioning
3435,39,45,47,67 & 69	Performance	41:12 (3.42)	8	Including Air Conditioning
All Styles	Performance	40:11 (3.64)	6	Including Air Conditioning
3435,39,45,47,67 & 69	2-BBL. Engine Plains	41:16 (2.56)	3	Including Air Conditioning
3435,39,45,47,67 & 69	4-BBL. Engine Plains	43:16 (2.69)	2	Including Air Conditioning
3439,47,67 & 69	LC Opt. Engine	43:16 (2.69)	2	Except Air Conditioning
3435 & 45	LC Opt. Engine	43:15 (2.87)	7	Including Air Conditioning
3439,47,67 & 69	LC Opt. Engine	43:15 (2.87)	7	Air Conditioning
35 Series Synchromesh				
All Styles	Standard	42:13 (3.23)	9	Including Air Conditioning
All Styles	Performance	40:11 (3.64)	6	Including Air Conditioning
35 Series Hydra-Matic				
All Styles	Standard	40:13 (3.08)	0	Including Air Conditioning
All Styles	Standard	42:13 (3.23)	9	Air Conditioning
All Styles	Performance	39:10 (3.90)	4	Including Air Conditioning
All Styles	Performance	42:13 (3.23)	9	Including Air Conditioning
All Styles	Performance	41:12 (3.42)	8	Including Air Conditioning
All Styles	Performance	40:11 (3.64)	6	Including Air Conditioning
All Styles	Plains	43:16 (2.69)	2	Including Air Conditioning
All Styles	Starfire Engine	41:12 (3.42)	8	Including Air Conditioning
36 Series Hydra-Matic				
All Styles	Standard	41:12 (3.42)	8	Including Air Conditioning
All Styles	Performance	39:10 (3.90)	4	Including Air Conditioning
All Styles	Performance	40:11 (3.64)	6	Including Air Conditioning
38 Series Hydra-Matic				
All Styles	Standard	40:13 (3.08)	0	Including Air Conditioning
All Styles	Standard	42:13 (3.23)	9	Air Conditioning
All Styles	Performance	39:10 (3.90)	4	Including Air Conditioning
All Styles	Performance	42:13 (3.23)	9	Including Air Conditioning
All Styles	Performance	41:12 (3.42)	8	Including Air Conditioning
All Styles	Performance	40:11 (3.64)	6	Including Air Conditioning
All Styles	Plains	43:16 (2.69)	2	Including Air Conditioning
All Styles	Starfire Engine	41:12 (3.42)	8	Including Air Conditioning
39 Series Hydra-Matic				
All Styles	Standard	41:12 (3.42)	8	Including Air Conditioning
All Styles	Performance	39:10 (3.90)	4	Including Air Conditioning
All Styles	Performance	40:11 (3.64)	6	Including Air Conditioning

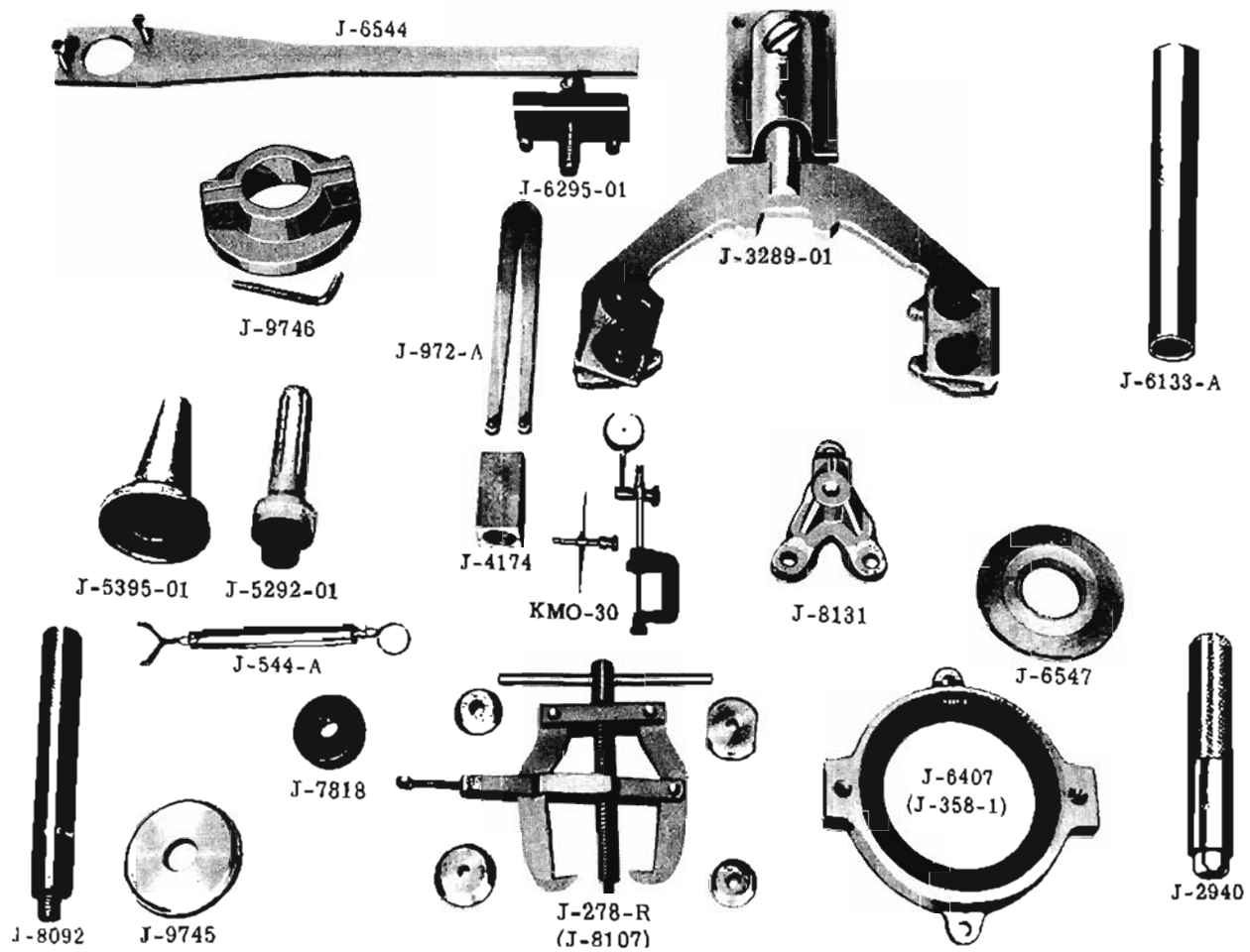
SPECIFICATIONS

PROPELLER SHAFT	
1. Length (From Center Line of Front U-Joint to Center Line of Rear U-Joint)	
a. 34, 35 and 36 Series (Except Fiestas)	58.00"
b. 34 Series (Fiesta)	56.83"
c. 38 and 39 Series	61.00"
DIFFERENTIAL	
LUBRICATION	
1. Capacity	5 Pts. (Approx.)
2. Drain and Refill	Special Lubricant Part No. 531536
3. Replenish	Special Lubricant Part No. 531536 or S.A.E. 90 Multi-Purpose Gear Lubricant meeting requirements of Military specification MIL-L-2105B.
ADJUSTMENTS	
4. Backlash, Ring Gear to Drive Pinion (.005" to .009")	Adjust to .007" to .008"
5. Backlash, Side Gear to Pinion (Anti-Spin)	.001" to .006"
6. Drive Pinion Bearing Pre-Load	
a. New Bearings	24 to 32 in. lbs.
b. Old Bearings	10 to 15 in. lbs.
7. Side Bearing Pre-Load	2 to 3 notches

TORQUE SPECIFICATIONS

NOTE: Specified torque is for installation of parts only. Checking torque during inspection may be 15% below specified minimum.

APPLICATION	FT. LBS.
PROPELLER SHAFT	
Companion Flange "U" Bolts	14 to 18
DIFFERENTIAL	
Carrier to Axle Housing Nuts	50 to 60
Bearing Cap Bolts	65 to 85
Ring Gear Cap Screws	55 to 65
Pinion Shaft Lock Bolt	15 to 25



KMO-30	Dial Indicator Set
J-8107	Differential Side Bearing Puller
J-544-A	Spring Scale
J-942-1 (J-8131)	Axle Shaft Puller Adapter
J-972-A	Differential Adjusting Nut Wrench
J-2935	Rear Pinion Bearing Outer Race Press Plate
J-2940	Driver Handle
J-3289-01	Differential Holding Fixture
J-4174	"U" Joint Bearing Remover
J-5292-01	Differential Side Bearing Installer
J-5395-01	Pinion Seal Installer
J-6133-A	H.M. Rear Oil Pump Bearing & Speedometer Gear Installer (Used for Front Pinion Inner Race Installer)
J-6295-01	Companion Flange Puller
J-6407 (J-358-1)	Press Plate Holder
J-6525 (J-947-2)	Axle Shaft Bearing Remover and Installer
J-6544	Companion Flange Holding Tool
J-7818	Front Pinion Bearing Outer Race Installer
J-8092	Driver Handle
J-9745	Rear Pinion Bearing Outer Race Installer
J-9746	Rear Pinion Bearing Remover

Fig. 10-46 Propeller Shaft and Differential Tools

DIFFERENTIAL AND PROPELLER SHAFT

30, 31, 32, & 33 SERIES

CONTENTS OF SECTION 10

CONVENTIONAL DIFFERENTIAL

30-31-32-33 SERIES

MAINTENANCE RECOMMENDATIONS

Periodic or seasonal lubricant changes are not recommended. However, if for any reason it does become necessary to make a complete lubricant change, it will be permissible to use either Special Lubricant Part No. 531536 or SAE 90 Multi-Purpose Gear Lubricant meeting the requirements of Military Specifications MIL-L-2105B. The lubricant level should be checked at each oil change interval. If lubricant addition is required, add Special Lubricant Part No. 531536 or SAE 90 Multi-Purpose Gear Lubricant meeting the requirements of Military Specifications MIL-L-2105B.

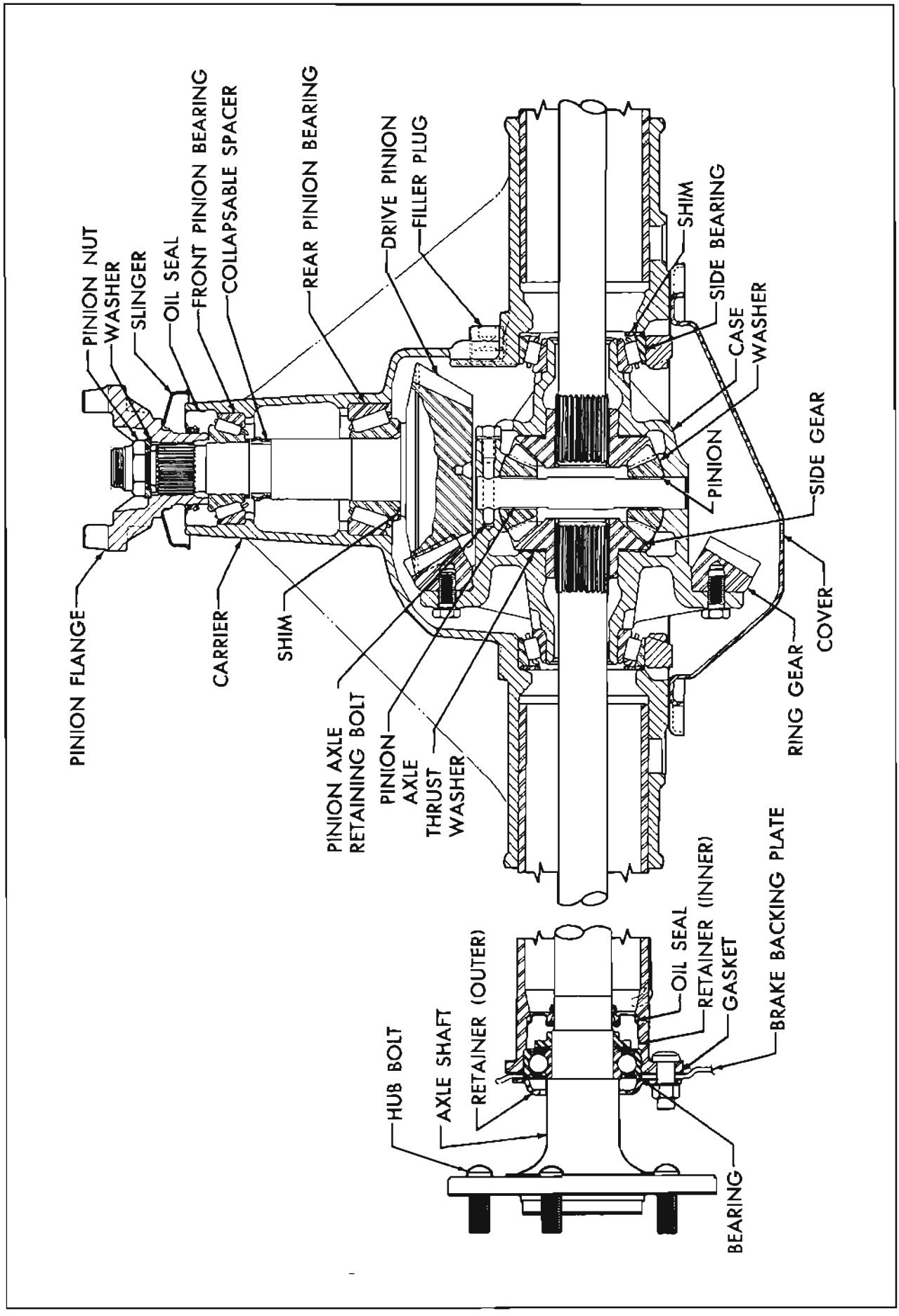


Fig. 10-101 Conventional Differential Assembly

DESCRIPTION

The rear axle assembly is of the semi-floating type in which the car weight is carried on the axle shafts through ball bearings enclosed in the outer axle housing tubes. The rear axle is designed for use with an open drive line and coil springs. Drive from the axle housing is transmitted to the frame through two lower and two upper control arms. Large rubber bushings at either end of these control arms are designed to absorb vibration and noise. The final drive has a hypoid-type ring gear and pinion with the centerline of the pinion below the centerline of the ring gear. See Fig. 10-101.

The drive pinion is mounted in two tapered roller-bearings which are preloaded by means of a compressible spacer at assembly. The pinion is positioned by shims located between a shoulder on the drive pinion and the rear bearing. The front bearing is held in place by the companion flange.

The differential is supported in the carrier by two tapered roller side bearings. These are preloaded by inserting shims between the bearings and the carrier. The differential assembly is positioned for proper gear and pinion backlash by varying these shims. The ring gear is bolted to the case. The case houses two side gears in mesh with two pinions mounted on a pinion axle which is anchored in the case by a bolt. The pinions and side gears are backed by thrust washers.

The axle shaft inner splines engage the differential side gears with a floating fit. The outer ends are supported in the axle housing by thrust-type ball bearings which are factory packed for the life of the bearing and sealed on both sides. The axle shaft oil seals are located inboard of the bearings. The bearings are secured against shoulders on the shafts by press fit retainer rings. Retainer plates hold the bearings against shoulders in the housing. Wheel side thrust is taken at the wheel bearing so an axle shaft may be removed simply by removing the bolts holding the retainer to the brake backing plate and axle housing flange.

The differential carrier is a malleable iron casting with tubular axle housings pressed into the sides and welded to form a complete assembly. A removable steel cover is bolted on the rear of the carrier to permit service of the differential without removing the rear axle from the car. A seal in the front of the carrier bears against the companion flange.

Lower brackets welded to the tubular axle housings and upper brackets integral with main carrier casting is the means of attaching the rear axle to the frame.

NOTE: The upper brackets for the 33 series are welded to the tubular axle housings.

An oil feed passage to the pinion bearings and an oil return hole are provided in the carrier casting to allow lubricant to circulate.

The differential filler plug is located on the right side of the carrier casting.

The rear brake drum is mounted directly against the axle flange on hub bolts pressed through the back of the axle flange.

REAR AXLE TROUBLE DIAGNOSIS

ELIMINATION OF EXTERNAL NOISES

When a differential is suspected of being noisy, it is advisable to make a thorough test to determine whether the noise originates in the tires, road surface, front wheel bearings, engine, transmission or rear axle assembly. Noise which originates in other places cannot be corrected by adjustment or replacement of parts in the differential assembly.

1. Road Noise. Some road surfaces, such as brick or rough surfaced concrete, cause noise which may be mistaken for tire or differential noise. Driving on a different type of road, such as smooth asphalt or dirt, will quickly show whether the road surface is the cause of the noise. Road noise usually is the same on drive or coast.

2. Tire Noise. Tire noise may easily be mistaken for differential noise, even though the noisy tires may be located on the front wheels. Tires worn unevenly or having surfaces of non-skid divisions worn in saw-tooth fashion are usually noisy and may produce vibrations which seem to originate elsewhere in the vehicle. This is particularly true with low tire pressure. Some designs of non-skid treads may be more noisy than others, even when tires are new.

3. Test for Tire Noise. Tire noise changes with different road surfaces, but differential noise does not. Temporarily inflating all tires to approximately 50 pounds pressure, for test purposes only, will materially alter noise caused by tires but will not affect noise caused by rear axle. Differential noise usually ceases when coasting at speeds under 30 mph; however, tire noise continues but with lower tone as car speed is reduced. Differential noise usually changes when comparing "pull" and "coast" but tire noise remains about the same.

4. Front Wheel Bearing Noise. Loose or rough wheel bearings will cause noise which may be confused with differential noises; however, front wheel bearing noise does not change when comparing "pull" and "coast". Light application of brake while holding car speed steady will often cause wheel bearing noise to diminish, as this takes some weight off the bearing. Front wheel bearings may be easily checked for noise by jacking up the wheels and spinning them, also by shaking wheels to determine if bearings are loose.

5. Engine and Transmission Noises. Sometimes a noise which seems to originate in the differential is actually caused by the engine or transmission. To determine which unit is actually causing the noise, observe approximate car speeds and conditions under which the noise is most pronounced; then stop the car in a quite place to avoid interfering noises. With transmission in NEUTRAL, run engine speeds corresponding to car speed at which the noise was most pronounced. If a similar noise is pronounced with car standing, it is caused by the engine or transmission and not the differential.

DIFFERENTIAL NOISES

If a careful test of the car shows that the noise is not caused by external items as described above, it is then reasonable to assume that the noise is caused by the differential assembly. The differential should be tested on a smooth level road to avoid road noise. It is not advisable to test differential for noise by running engine with rear wheels jacked up.

Noises in differential assembly may be caused by a faulty propeller shaft, faulty rear wheel bearings, faulty differential or pinion shaft bearings or misalignment between two U-joints. Noises may also be caused by mismatched, improperly adjusted or scored ring and pinion gear set.

1. Rear Wheel Bearing Noise. A rough rear wheel bearing produces a vibration or growl which continues with car coasting and transmission in NEUTRAL. A brinelled rear wheel bearing causes a knock or click approximately every two revolutions of rear wheel, since the bearing rollers do not travel at the same speed as the rear axle and wheel. With rear wheels jacked up, spin rear wheels by hand while listening at hubs for evidence of rough or brinelled wheel bearing.

2. Differential side gears and pinions seldom cause noise, since their movement is relatively slight on straight ahead driving.

3. Pinion Bearing Noise. Rough or brinelled pinion bearings produce a continuous low pitch whirring or scraping noise starting at relatively low speed.

4. Ring and Pinion Gear Noise. Noise produced by the ring and pinion gear set is classified as drive noise, coast noise or float noise.

   a. Drive noise is noise produced during vehicle acceleration.

   b. Coast noise is noise produced while allowing car to coast with throttle closed.

   c. Float noise is noise occuring while just maintaining constant car speed at light throttle on a level road.

   d. Drive, coast and float noises will be very rough and irregular if the differential or pinion shaft bearings are rough, worn or loose.

BODY BOOM NOISE OR VIBRATION

Objection "body boom" noise or vibration at 55-65 mph can be caused by an unbalanced propeller shaft. Excessive looseness at the spline can contribute to this unbalance.

Other items that may also contribute to the noise problem are as follows:

1. Undercoating or mud on the shaft causing unbalance.

2. Shaft damage such as bending, dents or nicks.

3. Tire-type roughness. Switch tires from a known good car to determine tire fault.

CHECK FOR PROPELLER SHAFT VIBRATION

Objectionable vibrations at high speed (65 mph or higher) may be caused by a propeller shaft that is out-of-balance. Out-of-balance may be due to a bent shaft.

To determine whether propeller shaft is causing vibration, drive car through speed range and note speed at which vibration is most pronounced. Shift transmission into lower gear range and drive car at same engine speed as when vibration was most pronounced in direct drive. Note effect on vibration.

To determine engine speed, divide vehicle speed by the following transmission gear ratios as listed below:

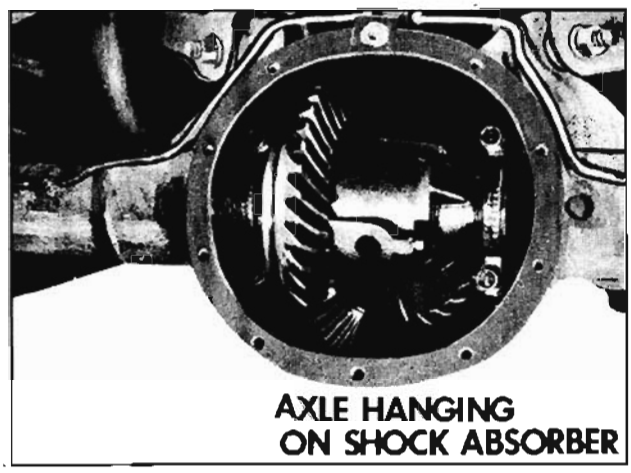


Fig. 10-102 Cover Removed

1.48 (three-speed synchromesh in second gear)

1.48 (four-speed synchromesh in third gear)

1.76 (Jetaway transmission in low range)

EXAMPLE: If vibration is most pronounced in direct drive at 65 mph, the same engine speed would be produced:

In second gear (three-speed synchromesh) at 65/1.48 = 44 mph.

In third gear (four-speed synchromesh) at 65/1.48 = 44 mph.

In low range (Jetaway) at 65/1.76 = 37 mph.

If the vibration is still present at the same engine speed, whether in direct drive or in the lower gear, since the propeller shaft speed varies this cannot be the fault. If the vibration decreases or is eliminated in the lower gear, then the propeller shaft is out-of-balance.

OIL LEAKS

It is difficult to determine the source of some oil leaks. When there is evidence of an oil leak at these locations, the probable cause is as follows:

1. Oil coming from the drain hole under the axle housing at the brake backing plate is caused by a leaking axle shaft seal or a leaking wheel bearing inner gasket.

2. Oil coming from between the rear companion flange shield and the carrier is caused by a leaking pinion seal.

REAR AXLE HOUSING

Removal and Installation

It is not necessary to remove the rear axle housing for any normal repairs. However, if the housing is damaged, it may be removed and installed following procedure given in Section 9, SUSPENSION.

DISASSEMBLY OF DIFFERENTIAL ASSEMBLY

Most differential service repairs can be made with the assembly in the car by raising the rear end of the car with the rear axle housing hanging on the shock absorbers. See Fig. 10-102 Lubricant may be drained by backing out all cover bolts and breaking cover loose at the bottom.

REMOVE AXLE SHAFT ASSEMBLIES

Design allows for axle shaft end play up to .042" loose. This end play can be checked with the wheel and brake drum removed by measuring the difference between the end of the housing and the axle shaft flange while moving the axle shaft in and out by hand.

End play over .042" is excessive. Compensating for all of the end play by inserting a shim inboard of the bearing in the housing is not recommended, since it ignores the end play of the bearing itself and may result in improper seating of the gasket or backing plate against the housing. If the end play is excessive, the axle shaft and bearing assembly should be removed and the cause of the excessive end play determined and corrected.

1. Remove wheels.

2. Remove brake drums.

3. Remove nuts holding retainer plates to brake backing plates. Pull retainers clear of bolts and reinstall two lower nuts finger tight to hold brake backing plate in position.

4. Pull out axle shaft assemblies using Puller J-21579 with a slide hammer. (Fig. 10-103)

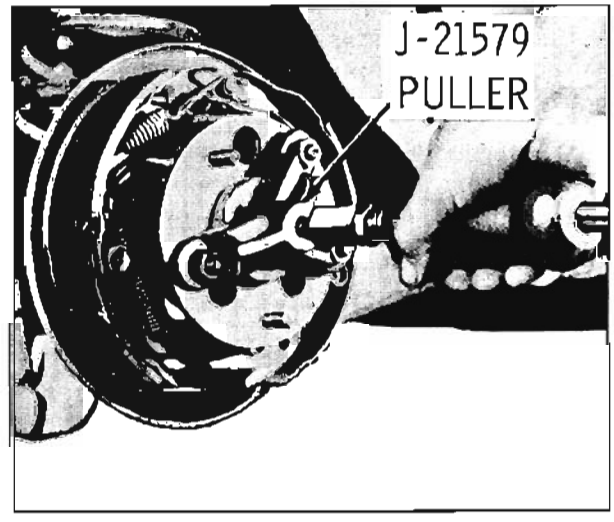


Fig. 10-103 Removing Axle Shaft

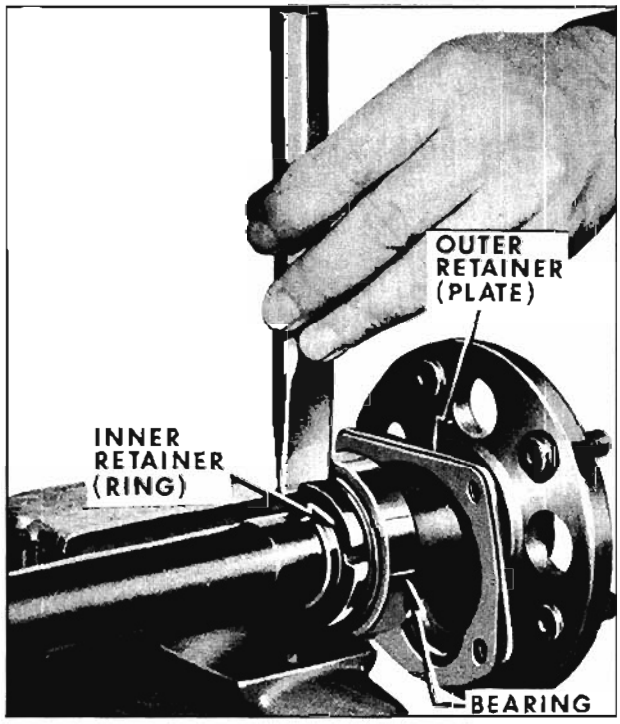


Fig. 10-104 Removing Bearing Retainer

CAUTION: While pulling axle shaft out through oil seal, support shaft carefully in center of seal to avoid cutting seal lip.

INSTALL AXLE SHAFT ASSEMBLIES

1. Apply a coat of wheel bearing grease in bearing recesses of housing. Install new outer retainer gaskets. Apply a thin coating of P.O.B. #2 or equivalent to outer diameter of seal if replaced. To help prevent damage to the lip of the wheel bearing seal when installing axle shaft and to insure lubricant on the seal lip during the first few miles of operation, the axle shaft should be lightly lubricated with axle lubricant from the sealing surface to approximately six inches inboard of the shaft. Insert axle shaft assemblies carefully until shaft splines engage in differential to avoid damage to seals.
2. Drive axle shaft assemblies into position.
3. Place gasket and retainer over studs and install nuts. Torque nuts 30 to 40 ft. lbs.
4. Install brake drums over wheel bolts.
5. Install wheels and tighten wheel nuts.

REMOVE AND INSTALL AXLE SHAFT BEARING

1. Nick bearing retainer in three or four places with a chisel, deep enough to spread ring. Retainer will then slip off. (Fig. 10-104)

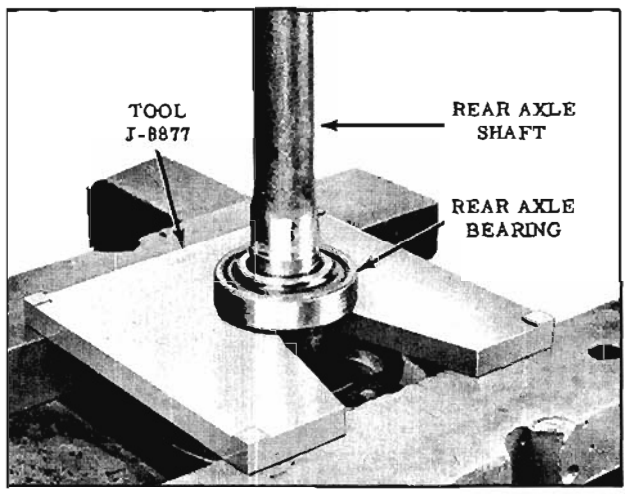


Fig. 10-105 Removing Axle Bearing

2. Press axle shaft bearing off using Puller Plate J-8877.

   NOTE: Use Tool J-8621 if using bench type hydraulic press. (Fig. 10-105)

3. Retainer plate which retains bearing in housing must be on axle shaft before bearing is is installed; retainer gasket can be installed after bearing. Press new axle shaft bearing against shoulder on axle shaft using Installer J-8853. (Fig. 10-106)
4. Press new retainer ring against bearing using Installer J-8853.

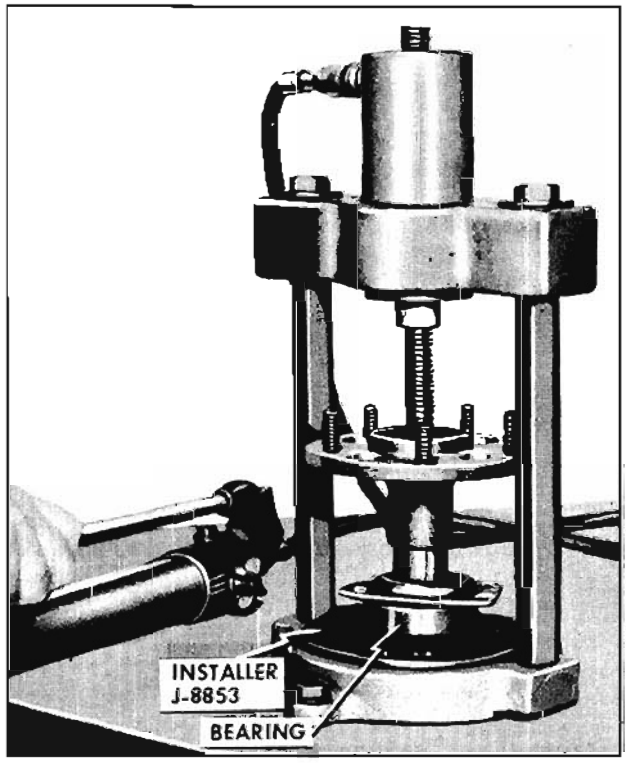


Fig. 10-106 Installing Axle Shaft Bearing

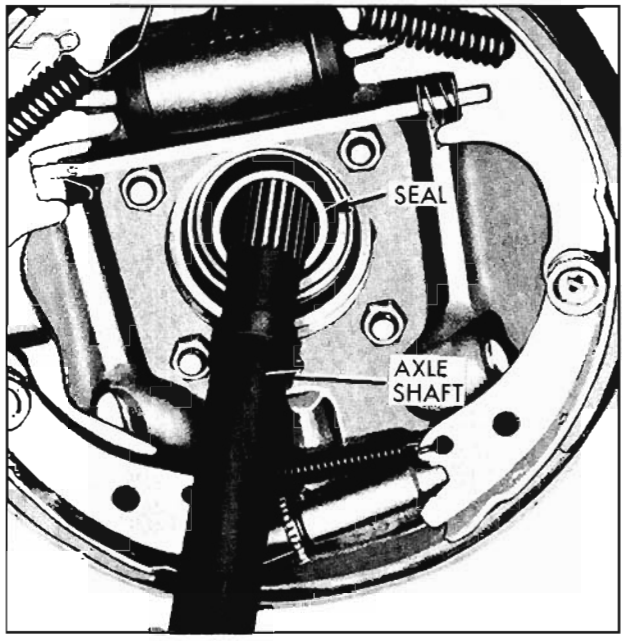


Fig. 10-107 Removing Axle Shaft Seal

REMOVE AND INSTALL REAR WHEEL BOLT

1. To remove and install a rear wheel bolt, axle shaft assembly must be out of car. Remove rear wheel bolt by pressing from axle flange.

2. Install new rear wheel bolt by pressing through axle flange. Check new bolt for looseness; if bolt is loose, axle shaft must be replaced.

REMOVE AND INSTALL AXLE SHAFT SEAL

1. Insert axle shaft so that splined end is just through seal.

2. Using axle shaft as a lever, push down on shaft until seal is pried from housing. (Fig. 10-107)

   NOTE: If desired, a slide hammer with a large nut can be used. Hook nut back of seal and tap out seal.

3. Apply sealer to OD of new seal.

4. Position seal over Installer J-21129 and drive seal straight into axle housing until fully seated. (Fig. 10-108)

COMPANION FLANGE REPLACEMENT

1. Remove both rear wheels and brake drums.

2. Remove both axle shafts, BEING CAREFUL NOT TO DRAG THE AXLE SHAFTS ACROSS THE SEALS.

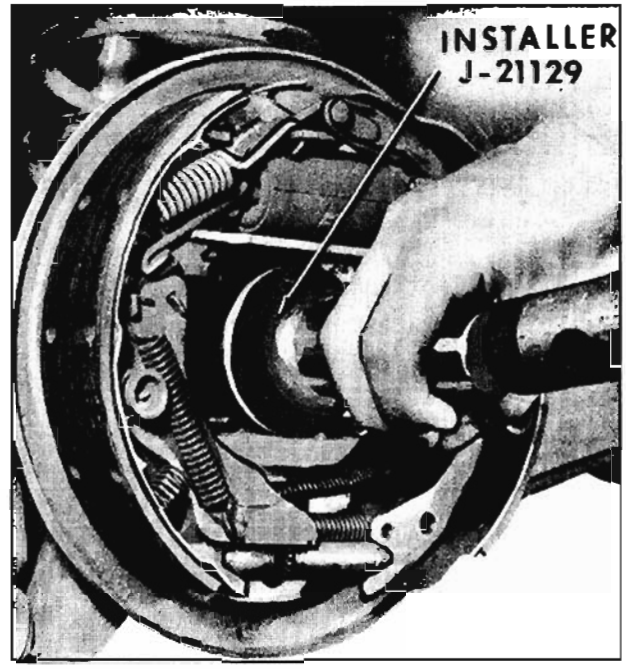


Fig. 10-108 Installing Axle Shaft Seal

3. Disconnect rear universal joint and support propeller shaft by tying propeller shaft to exhaust pipe. If U-joint bearings are not retained by a retainer strap, use a piece of wire to hold bearings on their spider journals.

4. Remove companion flange nut using Holding Tool J-8614-01 to hold flange. (Fig. 10-109)

5. Remove washer and then remove companion flange using Puller J-8614-02. (Fig. 10-110)

6. Apply Special Seal Lubricant Part No. 567196 to the OD of the new companion flange, then install companion flange, washer and companion flange nut finger tight.

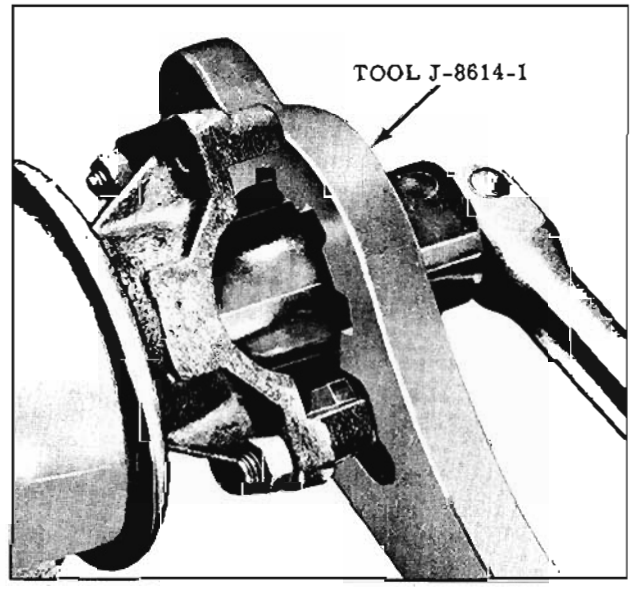


Fig. 10-109 Removing Pinion Nut

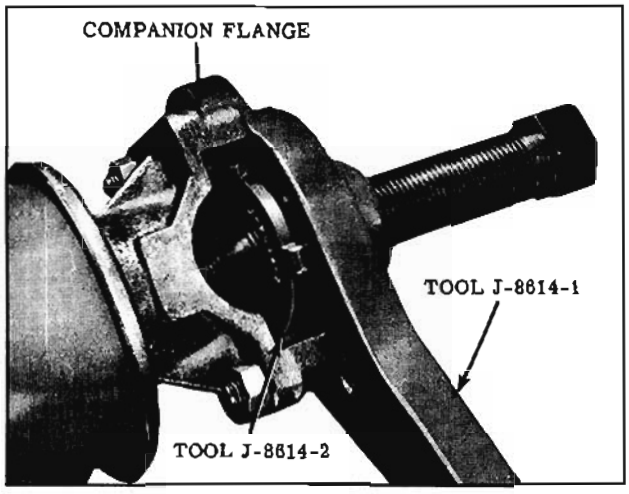


Fig. 10-110 Removing Companion Flange

7. While holding companion flange with Tool J-8614-01, tighten the nut a little at a time and turn drive pinion several revolutions after each tightening to seat the rollers. Check the preload of bearings each time with an inch pound torque wrench or with Spring Scale J-544-A until preload is 10 to 15 in. lbs.

   NOTE: The bearing preload should never exceed 25 in. lbs. if the differential has been in use.

8. Connect rear universal joint to differential companion flange.

9. Install axle shafts carefully to avoid dragging shafts across seals. Torque 40 to 55 ft. lbs.

10. Install drums and wheels.

Pinion Oil Seal Replacement

1. Disconnect propeller shaft from differential companion flange and support shaft up in body tunnel by wiring propeller shaft to the exhaust pipe. If U-joint bearings are not retained by a retainer strap, use a piece of wire to hold bearings on their spider journals.

2. Mark the position of the companion flange, pinion shaft and nut so that they can be reinstalled in the same position.

3. Remove companion flange nut using Tool J-8614-01 to hold flange. Remove washer. (Fig. 10-109)

4. Remove companion flange using Puller J-8614-02. (Fig. 10-110)

5. Remove oil seal by driving it out of carrier with a blunt chisel.

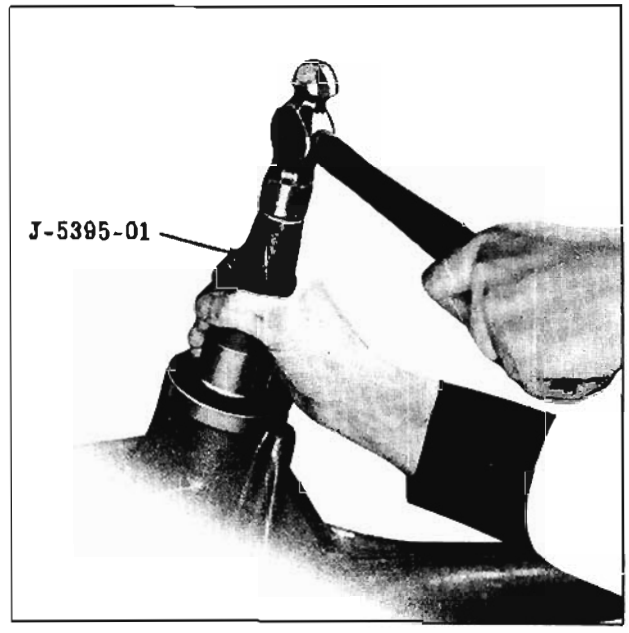


Fig. 10-111 Pinion Oil Seal

6. Examine surface of companion flange for tool marks, nicks or damaged surface. If damaged, replace flange.

7. Examine carrier bore and remove any burrs that might cause leaks around the OD of the seal.

8. Install seal using Driver J-5395-01 to properly locate seal in carrier. (Fig. 10-111)

9. Apply Special Seal Lubricant Part No. 567196 to the OD of the companion flange and sealing lip of new seal.

10. Install companion flange and tighten nut to the same position as marked in Step 2, while holding companion flange with Tool J-8614-01. Tighten nut 1/16" beyond alignment marks.

REMOVE DIFFERENTIAL CASE ASSEMBLY

1. Before removing differential from housing, it is advisable to check the existing ring gear to pinion backlash. This will indicate gear or bearing wear or an error in backlash or preload setting which will help in determining cause of axle noise. Backlash should be recorded so that if same gears are reused, they may be reinstalled at original lash to avoid changing gear tooth contact.

2. Remove differential bearing cap bolts. Bearing caps are marked "R TOP" and "L TOP" in production to make sure they will be reassembled correctly.

3. Remove two ring gear retaining bolts from differential case and install Ring Gear and

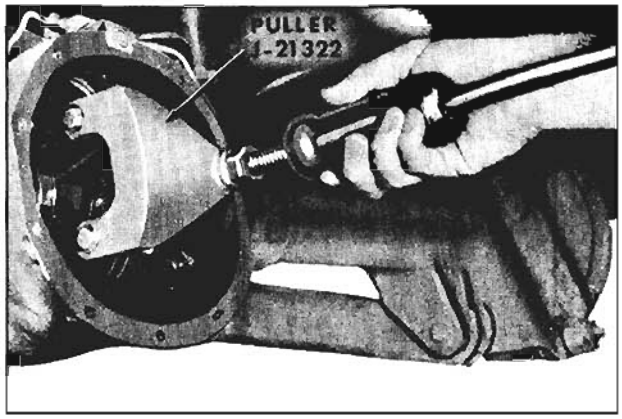


Fig. 10-112 Removing Ring Gear and Case Assembly

Case Remover J-21322 with slide hammer as shown in Fig. 10-112. Remove case assembly and place right and left bearing outer races and shims in sets with marked bearing caps so that they can be reinstalled in their original positions.

DISASSEMBLY OF DIFFERENTIAL ASSEMBLY

1. If differential side bearings are to be replaced, insert Remover Adapter J-2241-8 or J-8615 in center hole and pull bearing using J-2241 or TR-278-R. See Fig. 10-113.

2. Remove bolt that retains differential pinion axle. See Fig. 10-114, Remove differential pinions, side gears and thrust washers from case.

3. If ring gear is to be replaced and it is tight on case after removing bolts, tap it off using a soft hammer. Do not pry between ring gear and case.

REMOVE PINION ASSEMBLY

1. Check pinion bearing preload. If there is no preload reading, check for looseness of pinion assembly by shaking. Looseness indicates need for bearing replacement. If assembly is run long with very loose bearings, ring and pinion will also require replacement.

2. Install Holder J-8614-01 on companion flange by using two 5/16" x 2" bolts with flat washers. Remove pinion nut and washer. (Fig. 10-109)

3. Pull companion flange from pinion using Puller J-8614-02 in Holder J-8614-01. To install puller, back out puller screw, insert puller through holder and rotate 1/8 turn. (Fig. 10-110)

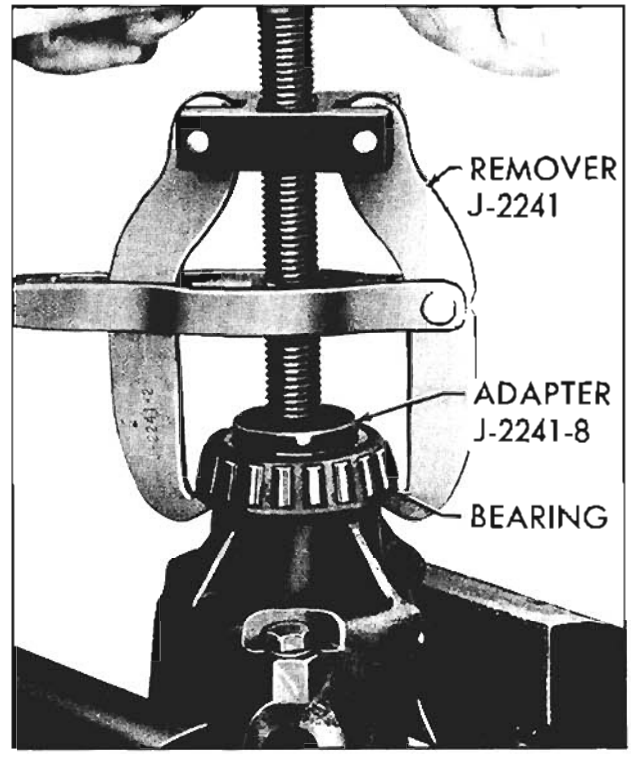


Fig. 10-113 Removing Differential Side Bearing

4. Remove pinion assembly. If necessary, tap pinion out with soft hammer while being careful to guide pinion with hand to avoid damage to bearing outer races.

DISASSEMBLE PINION ASSEMBLY

The rear pinion bearing must be removed when it becomes necessary to change the pinion depth adjustment.

Fig. 10-114 Pinion Shaft Retaining Bolt

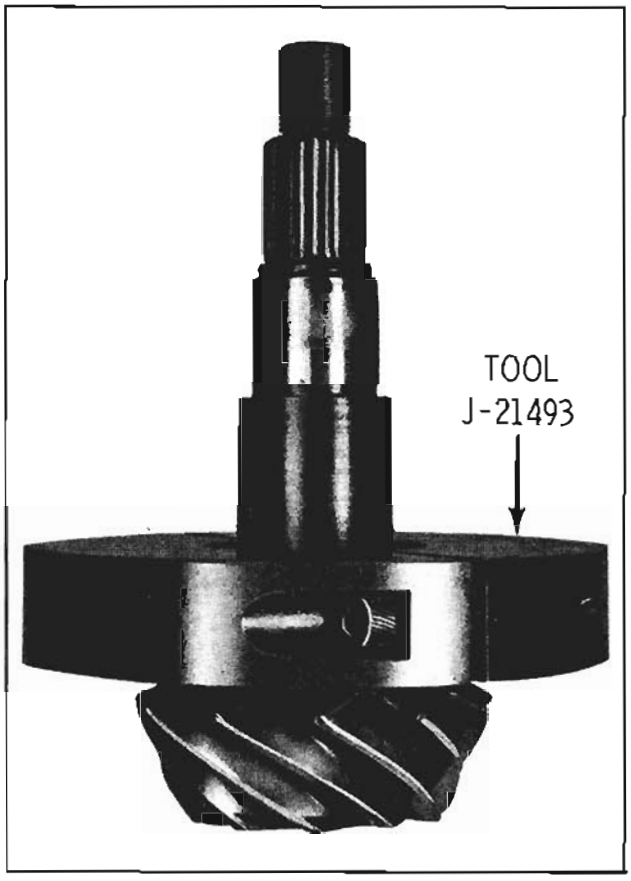


Fig. 10-115 Removing Pinion Bearing

1. With drive pinion removed from carrier, press bearing off from pinion gear using Remover J-21493. (Fig. 10-115)

2. Pry pinion oil seal from carrier and remove front pinion bearing. If this bearing is to be replaced, drive outer race from carrier using a drift.

3. If rear pinion bearing is to be replaced, drive outer race from carrier using a drift in slots provided for this purpose.

ASSEMBLY OF DIFFERENTIAL ASSEMBLY

Install Pinion Bearing Outer Races In Carrier

1. If rear pinion bearing is to be replaced, install new outer race using Installer J-6197 with Driver Handle J-8092. (Fig. 10-116)

2. If front pinion bearing is to be replaced, install new outer race using Installer J-7817 with Driver Handle J-8092. (Fig. 10-117)

SET PINION DEPTH

All production pinions are marked to indicate variations in thousandths of an inch over or under

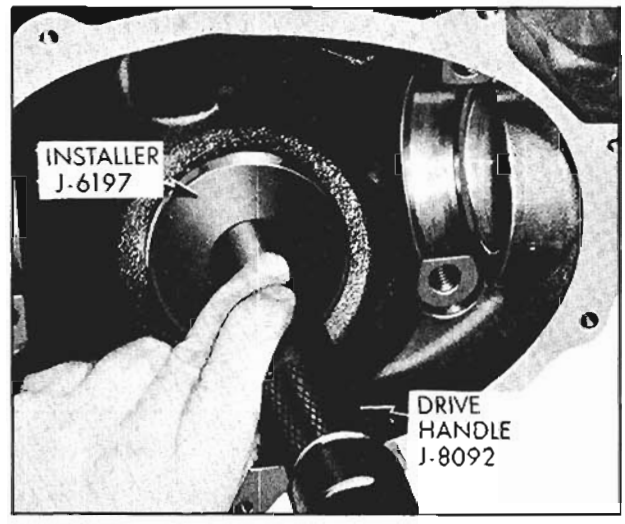


Fig. 10-116 Installing Rear Pinion Bearing Outer Race

"nominal" setting. When a pinion is marked "+" (plus), it means that the pinion, when installed in the carrier, must be at a given distance from the centerline of the pedestals, plus the amount indicated on the pinion in order for it to be positioned at the "nominal" setting. When a pinion is marked "-" (minus), it means that it must be located at a given distance from the centerline of the pedestals, minus the amount indicated on the pinion in order for it to be located at the "nominal" setting. All pinions produced for service are "nominal" or "zero" pinions and are unmarked.

Pinion depth is set with Pinion Setting Gauge J-8619 which consists of the following: one master gauge, one indicator gauge with dial indicator, two J-8619-10 Discs, one J-8619-11 Gauge Plate, J-8619-12 Pilot and Nut with J-8619-13 Stud. (Fig. 10-118)

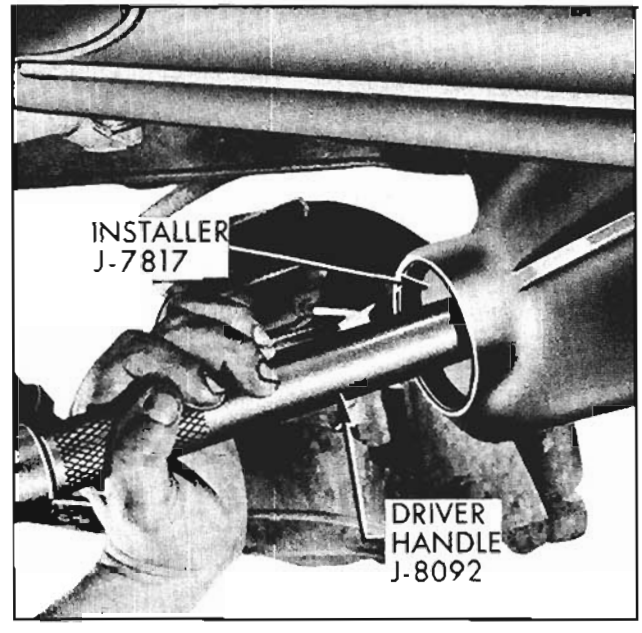


Fig. 10-117 Installing Front Pinion Bearing Outer Race

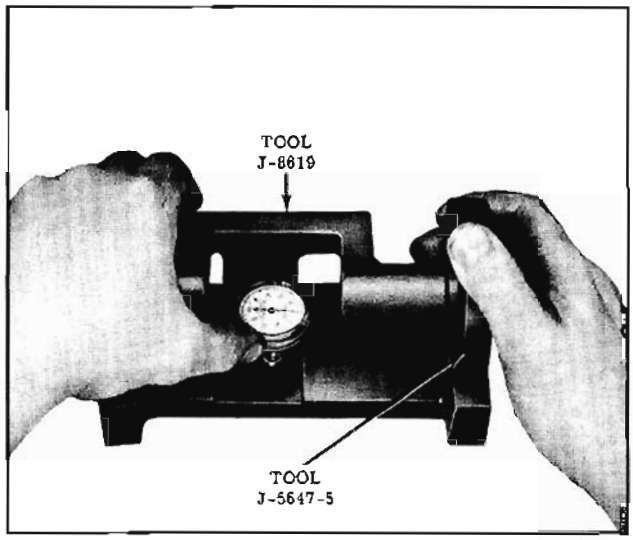


Fig. 10-118 Pinion Setting Gauge

Although production pinions are marked, neither production nor service pinions have a gauging tooth. The pinion setting gauge provides in effect a "nominal" or "zero" pinion as a gauging reference.

1. Make certain all of the gauge parts are clean, particularly the discs and center of the indicator gauge. Also check the centering hole and disc pads on the master gauge.

2. Install the J-8619-10 discs on the indicator gauge. Install the small contact button on the stem of the dial indicator and mount the dial indicator on the indicator gauge. (Fig. 10-119)

3. Place the indicator gauge on the master gauge as shown in Fig. 10-119 so that the spring loaded center is engaged in the centering hole and the inner, large diameter

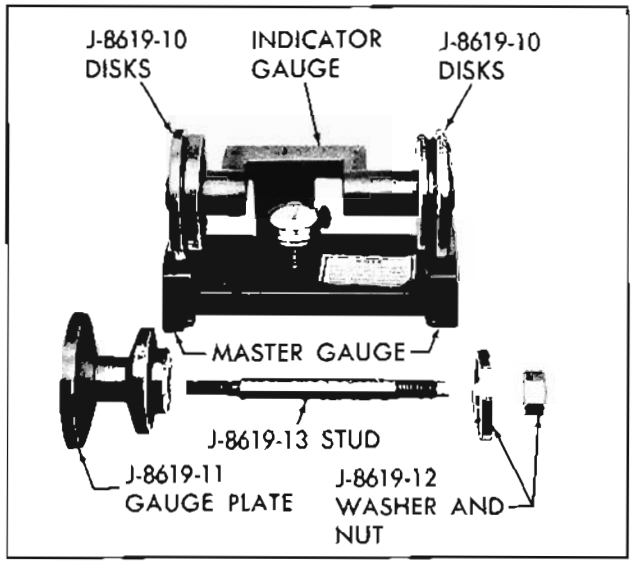


Fig. 10-119 Adjusting Gauge

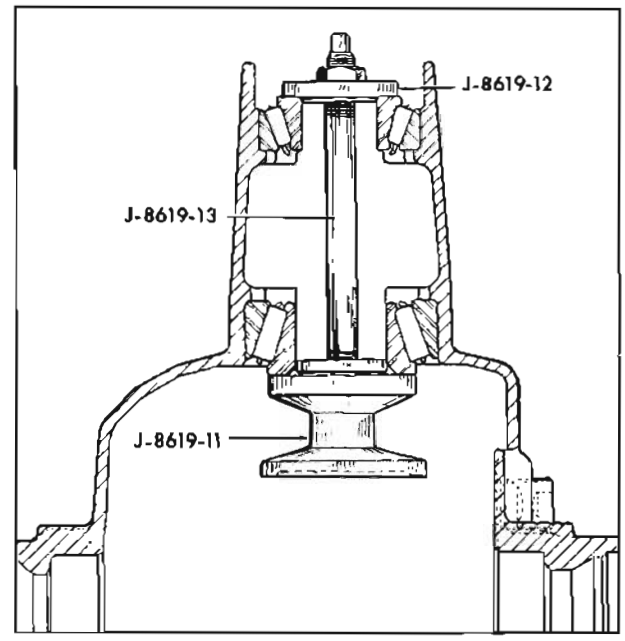


Fig. 10-120 Securing Gauge Plate in Carrier

portion of each disc contacts the master gauge pads.

4. Center the indicator contact button on the indicator pad and lock the indicator by tightening the thumb screw.

5. Hold yoke down firmly with both discs contacting the horizontal and vertical pads on master gauge and set master gauge at zero.

6. Lubricate front and rear pinion bearings; then position them in their respective races in the carrier. While holding bearings in place, install Gauge Plate J-8619-11 in carrier on rear pinion bearing inner race and place washer on surface of front pinion bearing. Insert Stud J-8619-13 through pilot, front and rear bearings and thread it into gauge plate. (Fig. 10-120)

7. Install a nut on Stud J-8619-13. Hold stud stationary with wrench positioned over flats on ends of stud and tighten nut until a reading of 15 to 25 in. lbs. is obtained when rotating gauge plate assembly with an inch pound torque wrench.

8. Make certain differential bearing support bores are free of burrs. Install indicator gauge in carrier so that small diameter outer portion of discs rest in differential bearing pedestal support bores. Spring loaded center of gauge must be located in centering hole of gauge plate and contact button of dial indicator must be positioned to bear against outer edge of gauge plate top surface. (Fig. 10-121)

9. Press gauge yoke down firmly toward gauging plate. Record the number of thousandths

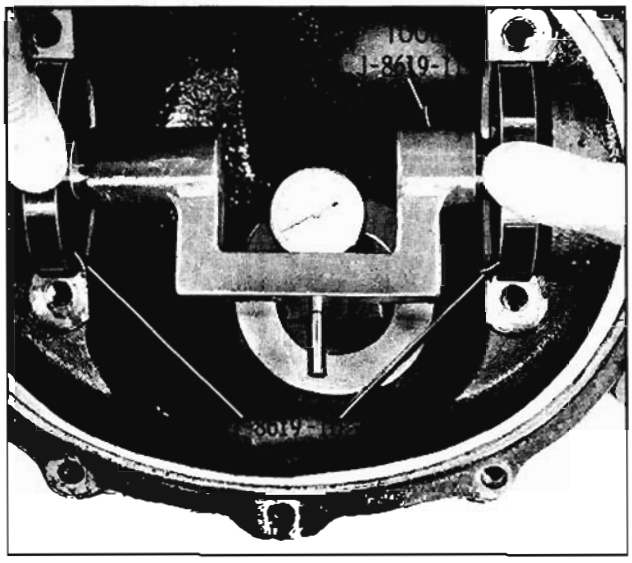


Fig. 10-121 Measuring Pinion Depth

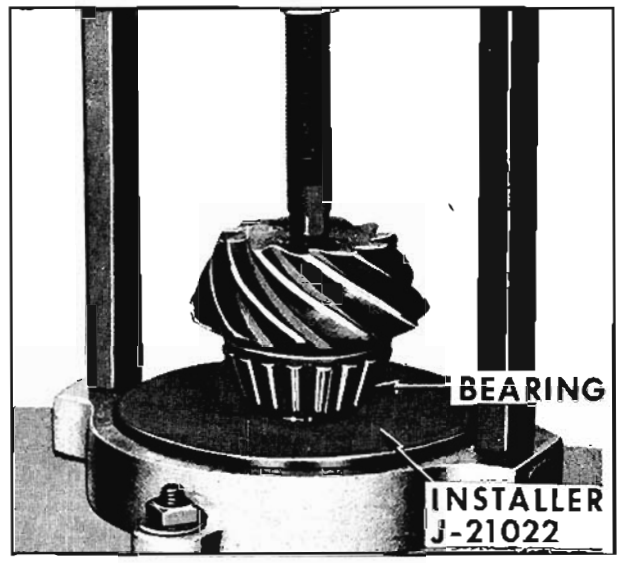


Fig. 10-122 Installing Rear Pinion Bearing

the dial moves from zero. Remove indicator gauge and recheck "zero setting" on master gauge to make sure this setting was not disturbed by handling.

10. If zero setting is still correct, remove gauging set-up and both bearings from the carrier.

11. Examine the ring gear for nicks, burrs or scoring. Any of these conditions will require replacement of the gear set.

12. Select the correct pinion shim to be used during pinion reassembly on the following basis:

    a. If the production pinion is being reused and the pinion is marked "+" (plus), the correct shim will have a thickness equal to the indicator gauge reading found in Step 9, plus the amount specified on the pinion.

    b. If the production pinion is being reused and the pinion is marked "-" (minus), the correct shim will have a thickness equal to the indicator gauge reading found in Step 9, less the amount specified on the pinion.

    c. If a service pinion is being used (no marking), the correct shim will have a thickness equal to the indicator gauge reading found in Step 9.

13. Position correct shim on pinion shaft and install rear pinion bearing. Use Installer J-21022 as shown in Fig. 10-122.

14. Loosen Stud J-8619-13 and remove Gauge Plate J-8619-11, Washer J-8619-12 and both bearings from case.

15. Examine ring gear and pinion for nicks, burrs or scoring. Any of these conditions will require replacement of gear set. If gears are in good condition, slide pinion shim onto pinion shaft and install rear pinion bearing on pinion using Installer J-8609 in a press or as shown in Fig. 10-122.

ASSEMBLE DIFFERENTIAL CASE ASSEMBLY

Before assembling the differential, examine the wearing surfaces of all parts for scoring or unusual wear. Also make certain that all parts are absolutely clean. Lubricate parts with rear axle lubricant just before assembly.

1. Place side gear thrust washers over side gear hubs and install side gears in case. If same parts are reused, replace in original sides.

2. Position one pinion (without washer) between side gears and rotate gears until pinion is directly opposite from loading opening in case. Place other pinion between side gears so that pinion axle holes are in line, then rotate gears to make sure holes in pinions will line up with holes in case.

3. If holes line up, rotate pinions back toward loading opening just enough to permit sliding in pinion thrust washers.

4. Install pinion axle. Install pinion axle retaining bolt. Torque 20 to 28 ft. lbs.

5. After making certain that mating surfaces of case and rear gear are clean and free of burrs, thread two 3/8" x 2" studs into opposite sides of ring gear, then install ring gear on case. (Fig. 10-123) Install

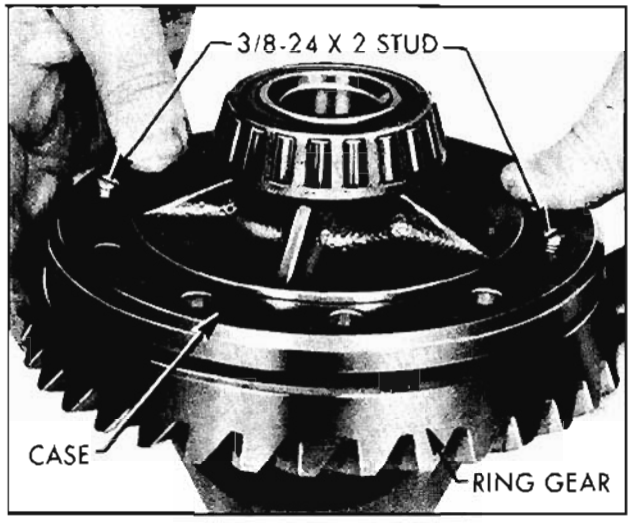


Fig. 10-123 Installing Ring Gear

ring gear attaching bolts just snug. Torque bolts alternately in progressive stages to 50 to 60 ft. lbs.

6. If differential side bearings were removed, install new bearings using Installer J-21132 with Driver Handle J-8092. (Fig. 10-124)

INSTALL DIFFERENTIAL CASE AND ADJUST SIDE BEARING PRE-LOAD

NOTE: This adjustment is to be made before installing pinion.

If the side bearing shims consists of two cast iron shims (one each side), it will be necessary to discard these cast iron shims and replace them with .120" service cast iron shims; then obtain sufficient steel shims to perform the side bearing pre-load as outlined below.

Differential side bearing pre-load is adjusted by changing the thickness of both the right and left shims by an equal amount. By changing the thickness of both shims equally, the original backlash will be maintained. Steel differential adjusting shims are available in thickness ranging from .040" to .082" by two thousandths.

1. Before installation of case assembly, make sure that side bearing surfaces in carrier are clean and free of burrs. Side bearings must be oiled with gear lube and if same bearings are being reused, they must have original outer races in place.

2. Place differential case and bearing assembly in position in carrier. If new side bearings were installed, use original adjusting shims. If same bearings are to be reused, select new right and left adjusting shims each .002" thicker than original shim. Slip left shim in position at left bearing, then drive right

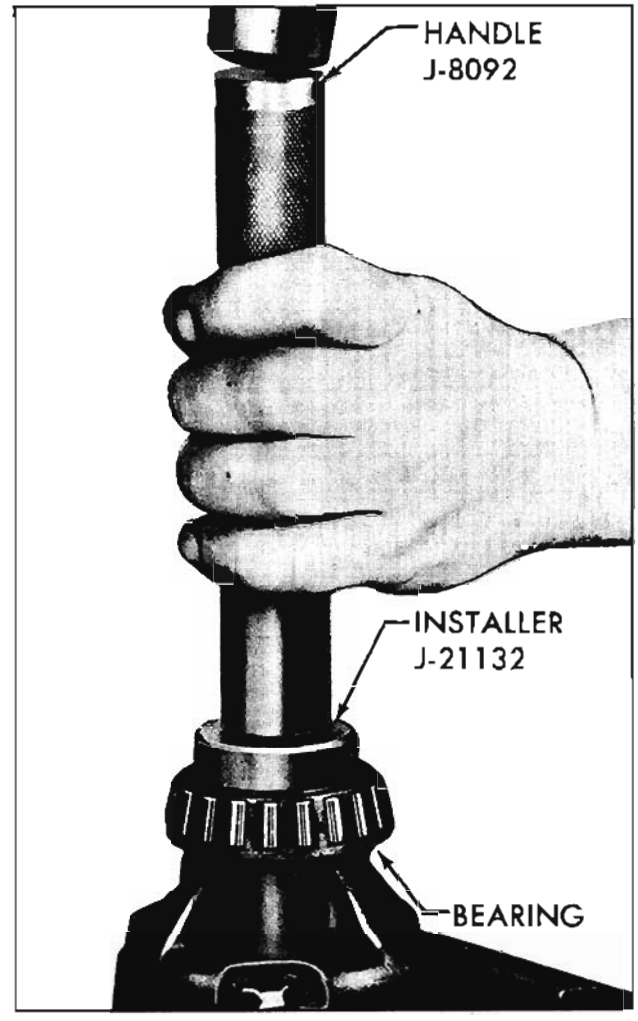


Fig. 10-124 Installing Side Bearing

shim carefully into position using a soft hammer. (Fig. 10-125)

3. As a safety precaution, install bearing caps and bolts. Do not tighten bolts.

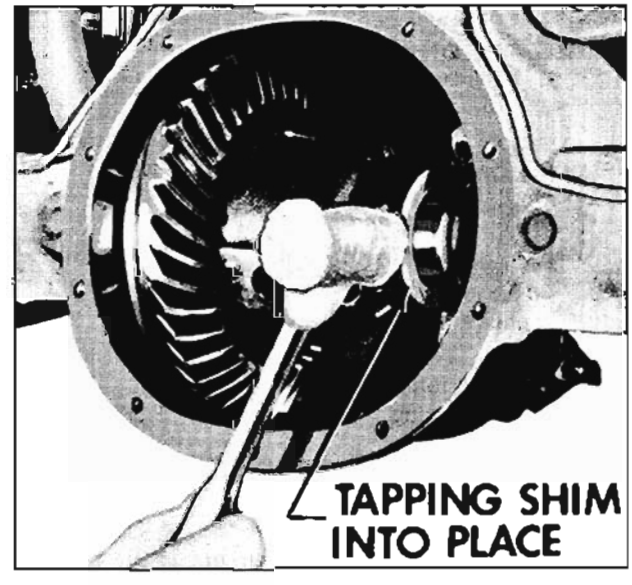


Fig. 10-125 Installing Shims

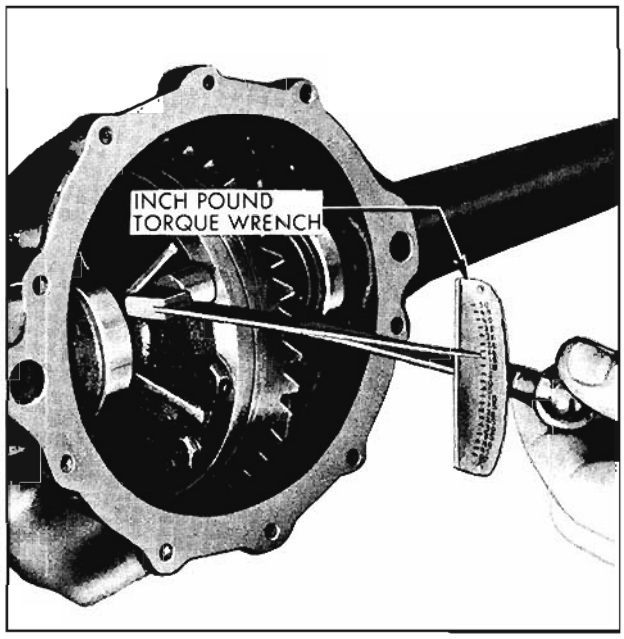


Fig. 10-126 Checking Side Bearing Pre-load

4. Rotate differential case several complete turns to seat bearings. Check bearing pre-load using an inch pound torque wrench connected at ring gear attaching bolt. With wrench projecting approximately straight out, bearing pre-load should read 30 to 40 in. lbs. with new bearings, or 20 to 30 in. lbs. with reused bearings. (Fig. 10-126) If pre-load is not according to these specifications, increase shim thickness on each side, .002" for each additional 10 in. lbs. pre-load desired, or decrease shim thickness .002" on each side for each 10 in. lbs. pre-load to be subtracted.

5. When pre-load is correctly adjusted, remove four bolts and caps and remove case assembly. Note shim location and thickness.

INSTALL PINION ASSEMBLY AND ADJUST PINION PRE-LOAD

1. Position pinion assembly in carrier and install collapsible spacer as shown in Fig. 10-127.

2. Place front pinion bearing in position on pinion. Hold pinion fully forward and push bearing over pinion until seated.

3. Install pinion oil seal in carrier. Install seal by using Installer J-5395-01. (Fig. 10-128)

4. Coat lips of pinion oil seal, seal surface of pinion flange with Part No. 567196 Lubricant. Install companion flange on pinion by tapping with a soft hammer until a few pinion threads project through flange.

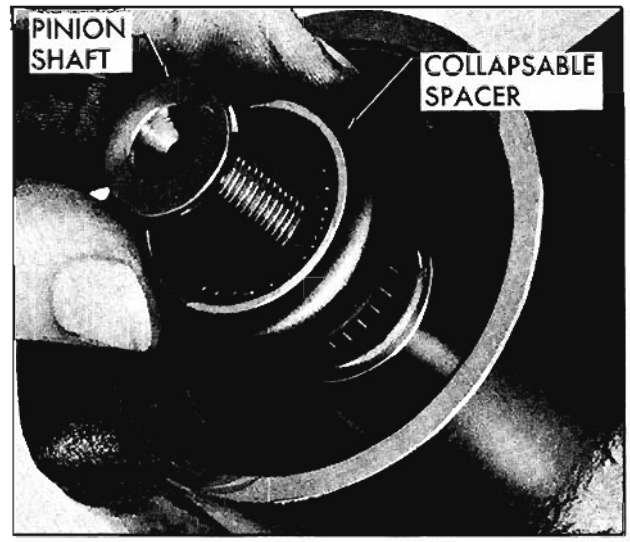


Fig. 10-127 Installing Collapsible Spacer

5. Install pinion washer and nut. Hold companion flange with Holder J-8614-10. While intermittently rotating pinion to seat bearings, tighten pinion nut until end play begins to be taken up. (Fig. 10-129)

   CAUTION: When no further end play is detectable and when Holder J-8614 will no longer pivot freely as pinion is rotated, pre-load specifications are being approached. Further tightening should be done after pre-load has been checked.

6. Check preload by using an inch pound torque as shown in Fig. 10-130.

   CAUTION: After preload has been checked, final tightening should be done very cautiously. For example, if when checking, pre-load was found to be 5 in. lbs., additional

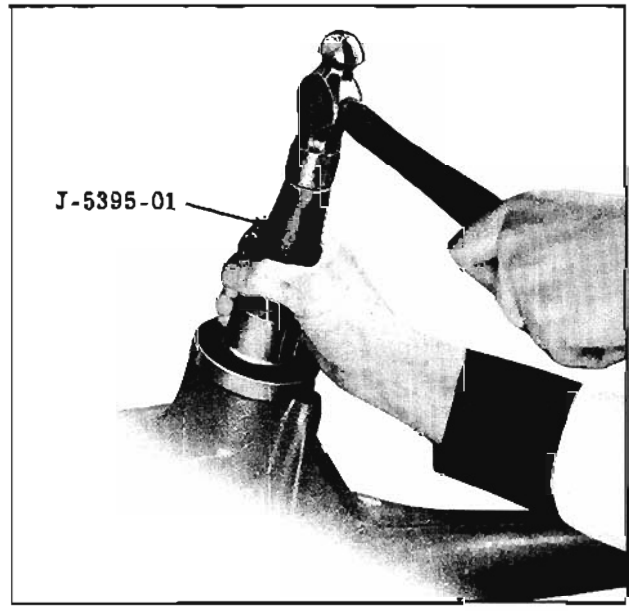


Fig. 10-128 Pinion Oil Seal

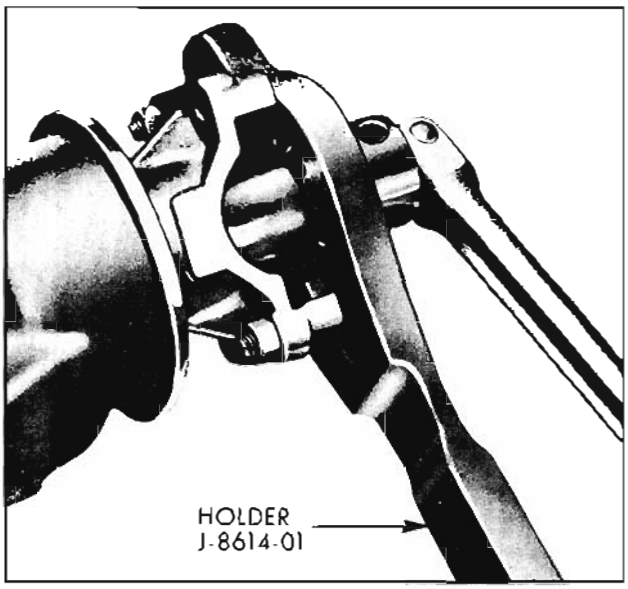


Fig. 10-129 Installing Pinion Nut

tightening of the pinion nut as little as 1/8 turn can add five additional inch pounds drag. Therefore, the pinion nut should be further tightened only a little at a time and pre-load should be checked after each slight amount of tightening. Exceeding pre-load specifications will compress the collapsible spacer too far and require its replacement.

7. While observing the preceding caution, carefully set pre-load drag at 20 to 30 in. lbs. on new bearings or 12 to 20 in lbs. on used bearings.

8. Rotate pinion several times to assure that bearings have been seated. Check pre-load again. If drag has been reduced by rotating pinion, reset pre-load to specifications.

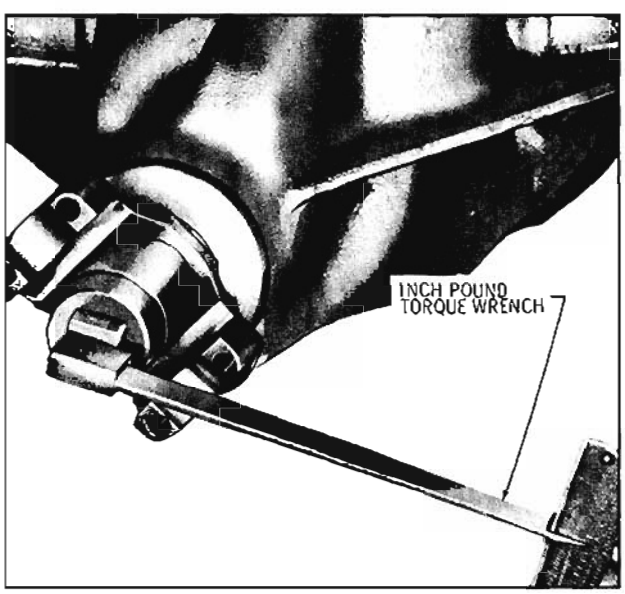


Fig. 10-130 Checking Pre-load

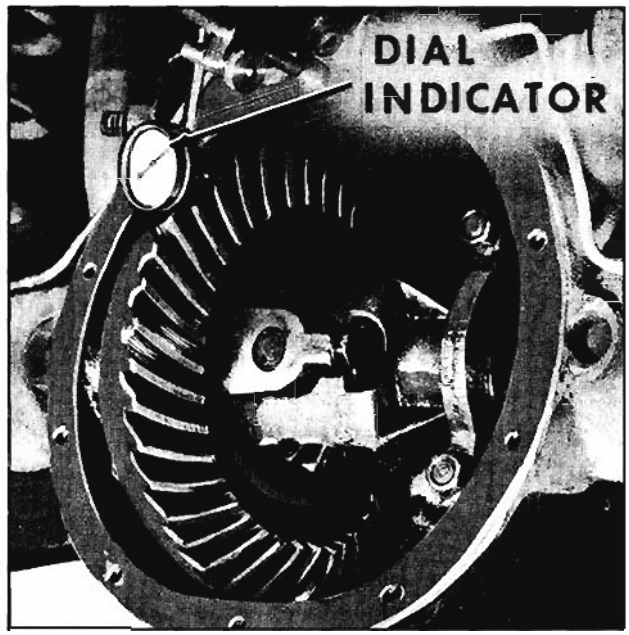


Fig. 10-131 Checking Ring Gear to Pinion Backlash

ADJUST DIFFERENTIAL BACKLASH

1. Reinstall differential case placing shims as covered previously under INSTALL DIFFERENTIAL CASE AND ADJUST SIDE BEARING PRE-LOAD.

2. Rotate differential case several times to seat bearings, then mount dial indicator as shown in Fig. 10-131. Use a small buttom on indicator stem so that contact can be made near heel end of tooth. Set dial indicator so that stem is as nearly as possible in line with gear rotation and perpendicular to tooth angle for accurate backlash reading.

3. With pinion locked to carrier, check gear lash at three or four points around ring gear. Lash must not vary over .001" around ring gear.

   If variation is over .001" check for burrs, uneven bolting conditions or distorted case flange and make corrections as necessary.

4. Gear lash at the point of minimum lash should be between .007" and .008", or between .008" and .009" for all new gears. If adjustment is necessary, adjust to .008". If original gear set having a wear pattern is being reinstalled, original gear lash should be maintained within ± .001".

5. If gear backlash is not within specifications, correct by increasing thickness of one differential shim and decreasing thickness of other shim the same amount. In this way, correct differential bearing pre-load will be maintained.

Shift .002" in shim thickness for each .001" change in backlash desired. If backlash is .001" too much, decrease thickness of right shim .002" and increase thickness of left shim .002". If backlash is .002" too little, increase thickness of right shim .004" and decrease thickness of left shim .004".

6. When gear backlash is correctly adjusted, torque bearing cap bolts to 40 to 65 ft. lbs.

7. Install new gasket in housing using heavy grease to retain it in place. Install cover. Torque cover bolts to 25 to 35 ft. lbs.

ANTI-SPIN DIFFERENTIAL (30-31-32-33 SERIES)

DESCRIPTION (Figs. 10-132 and 10-133)

The Anti-Spin differential is optional equipment on all 30-31-32-33 series. It is designed to perform all the desirable functions of a conventional differential and at the same time overcome its limitations. With a conventional differential, when one wheel is on a slippery surface, its pulling power is limited by the wheel with the lowest traction. Unlike the conventional differential, with the Anti-Spin differential, the locking action is controlled by the wheel having the best traction.

The Anti-Spin differential is not a fully locking type and will release before excessive driving force can be directed to one rear wheel. The safety value of this feature eliminates the possibility of dangerous steering reaction. When the rear wheels are under extremely unbalanced tractive conditions, such as having one wheel on ice and the other on dry pavement, wheel spin can occur, if over acceleration is attempted. However, even when wheel spin does occur, the major driving force is directed to the non-spinning wheel.

Another advantage of the anti-spin differential is that on uneven surfaces such as railroad tracks, chuck holes, etc., wheel action is not adversely affected. During power application on a conventional differential, when one wheel hits a bump and bounces clear of the road, it spins momentarily. When this rapidly spinning wheel again contacts the road, the sudden shock may cause the car to swerve. This action is also hard on tires and the entire drive train. With a Anti-Spin differential, the free wheel rotates at the same speed as the wheel on the road, thereby, minimizing adverse effects.

OPERATION

The design of the Anti-Spin differential is basic and simple. The unit is completely interchangeable with a conventional differential. However, this unit has in addition coarse, spiral-threaded cone brakes installed behind the side gears. These brakes are statically spring pre-loaded to provide an internal resistance to the differential action within the case itself. This pre-load assures an adequate amount of pull when extremely low tractive conditions such as wet ice, mud or snow are encountered at one rear wheel. It also provides smooth transfer of torque when traveling over alternating tractive conditions at both rear wheels.

During application of torque to the axle, the initial spring-loading of the cone brakes is supplemented by the inherent gear separating forces between the side and spider gears which progressively increases the resistance in the differential. This unit is therefore an automatic throttle-sensitive device that provides greater resistance under greater torque loads. It should be remembered, however, that this is not a positive lock differential, and it will release before excessive driving force can be applied to one wheel.

CAUTION: When working on a car with Anti-Spin differential, never raise one rear wheel and

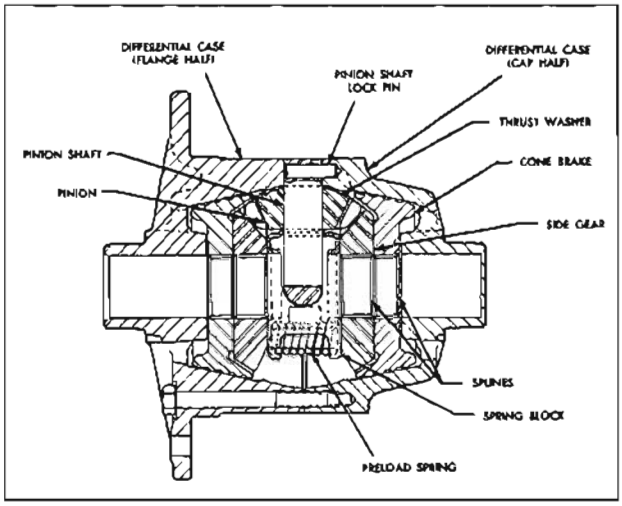


Fig. 10-132 Anti-Spin Differential

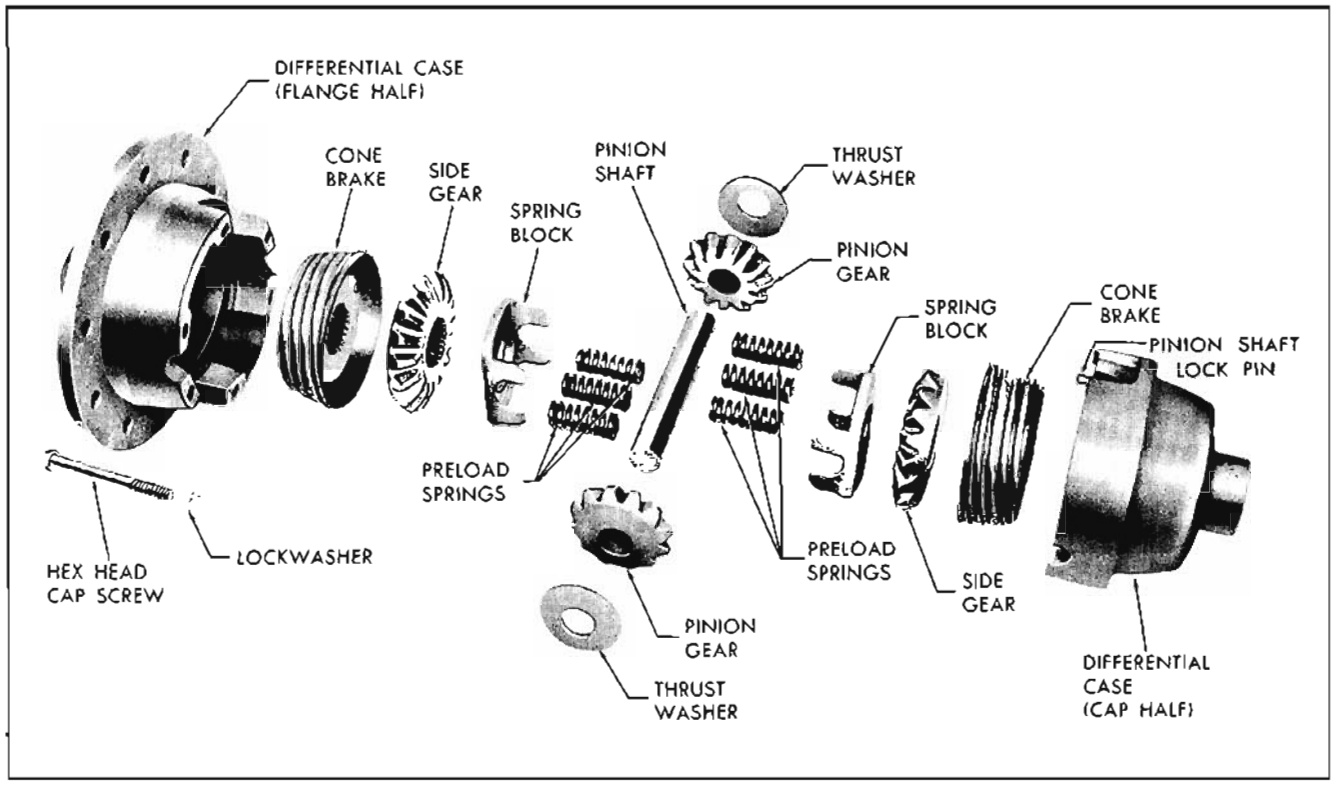


Fig. 10-133 Anti-Spin Differential—Exploded View

run the engine with the transmission in gear. The driving force to the wheel on the floor could cause the car to move.

LUBRICATION OF ANTI-SPIN DIFFERENTIAL

The lubricant level should be checked every 6000 miles. Maintain level between the bottom of the filler plug opening and 1/4" below the opening by adding anti-spin lubricant or equivalent available through the Parts Department under Part No. 531536.

IMPORTANT: Use of other than the above mentioned type of lubricant in the Anti-Spin differential may cause chatter. If the wrong type of lubricant is used on the Anti-Spin, it will require draining the differential and installing the recommended lubricant Part No. 531536.

Anti-Spin differentials can be easily identified either by a stainless steel plate under a cover bolt or by an X in a circle stamped on the bottom edge of the carrier housing flange. However, if the wrong lubricant is accidentally added, it will be necessary to completely remove all lubricant, flush with light engine oil, and then fill with the special lubricant. Capacity of the rear axle housing is 2-3/4 pints.

ANTI-SPIN DIFFERENTIAL SERVICE PROCEDURES

All differential service procedures are the same in the Anti-Spin differential as in a conventional differential, except for servicing the internal parts of the differential assembly. All rear axle parts outside of the differential, such as the ring gear, differential side bearings and axle shafts, are the same in either rear axle assembly.

DISASSEMBLY OF DIFFERENTIAL

1. If ring gear or differential case is to be replaced, remove ring gear from case. Otherwise ring gear need not be removed.

2. If a differential bearing is to be replaced, pull bearing outer race from case using Remover J-2241-A, as described in the CONVENTIONAL DIFFERENTIAL Section.

3. Clamp case assembly in a brass jawed vise by ring gear or by case flange.

4. Mark flange half of case and cover half with a center punch or paint to provide alignment for reassembly. (Fig. 10-134)

5. Loosen six bolts holding cover half of case to cap half. Remove assembly from vise, place on bench with bolt heads up and remove bolts.

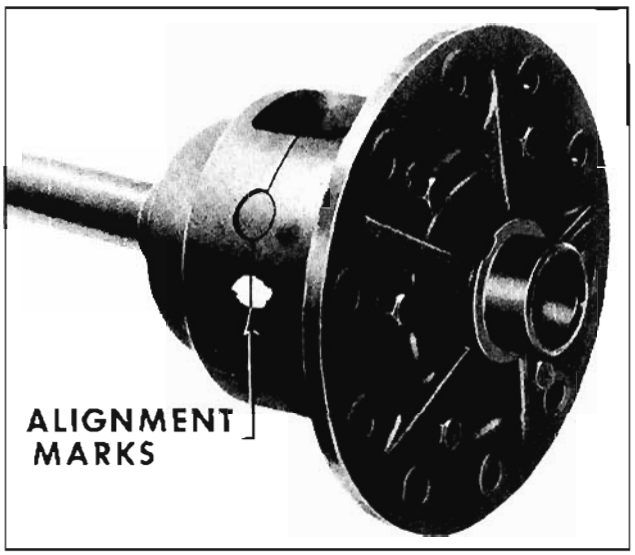


Fig. 10-134 Alignment Marks

6. Lift cap half of case from flange half. Remove cap half, cone brake, preload springs, spring block and side gear shims, if provided, from assembly so that they can be reinstalled in their original positions.

7. Remove corresponding parts from flange half of case and keep with flange half.

CLEANING AND INSPECTION OF PARTS

1. Make certain all parts are absolutely clean and dry.

2. Inspect pinion shaft, pinion and side gears, brake cone surfaces and corresponding cone seats in the case. The cone seats in the case should be smooth and free of any excessive scoring. Slight grooves or scratches indicating passage of foreign material are permissible and normal. The land surface on the heavy spirals of the male cones will duplicate the case surface condition. Replace any parts which are excessively scored, pitted or worn. Both halves of case must be replaced if one half is damaged or worn.

ASSEMBLY OF DIFFERENTIAL

CAUTION: When assembling the unit, use axle shafts as mounting tools to assure proper gear and cone spline alignment. Do not ignore this procedure as it will be impossible to install shafts at final assembly and attempting to force the shafts into position may result in damage to the spring thrust blocks.

1. Clamp one axle shaft in a vise allowing three inches to extend above vise jaws; then place the cap side of differential case over extended axle shaft with interior of case facing up. (Fig. 10-135)

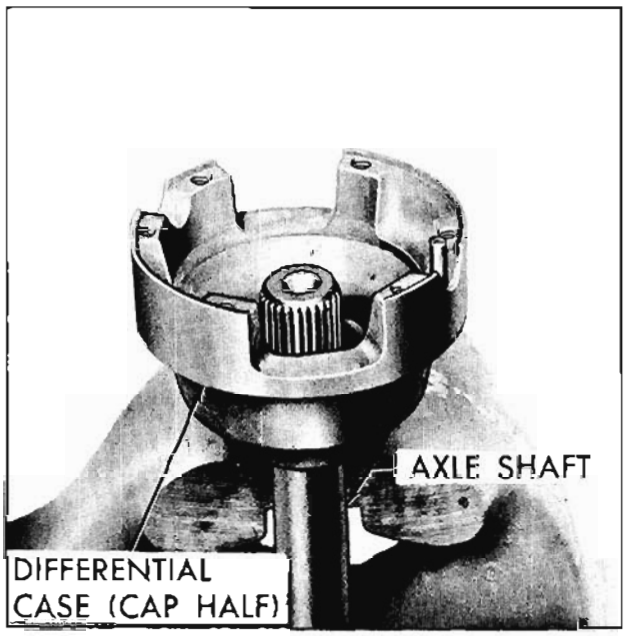


Fig. 10-135 Assembling Cap Half of Case

2. Install proper cone over axle shaft splines, seating it into position in cap half of case.

NOTE: Be certain that each cone is installed in proper case half since tapers and surfaces become matched and their positions should not be changed.

3. If unit was originally assembled with shim located between side gears and cones for backlash adjustment, reinstall side gear with shim so that gear may seat on shim. If unit was originally assembled without shims, reassemble the same way.

NOTE: When installing a service case it is also necessary that the cones are installed in their respective positions.

4. Place one thrust block in position over gear face in alignment with pinion gear shaft grooves. Install thrust block, pinion shaft, pinion gears and thrust washers into cap half of differential case in such a manner that pinion shaft retaining dowel can be inserted through pinion gear shaft into differential case. This prevents the pinion shaft from sliding out and causing damage to the carrier assembly. (Fig. 10-136)

5. Insert springs into spring thrust block that is already installed into case, and then place second thrust block over springs. (Fig. 10-137)

NOTE: The legs on the thrust blocks are offset. During reassembly, be sure to position the legs as shown in Fig. 10-138.

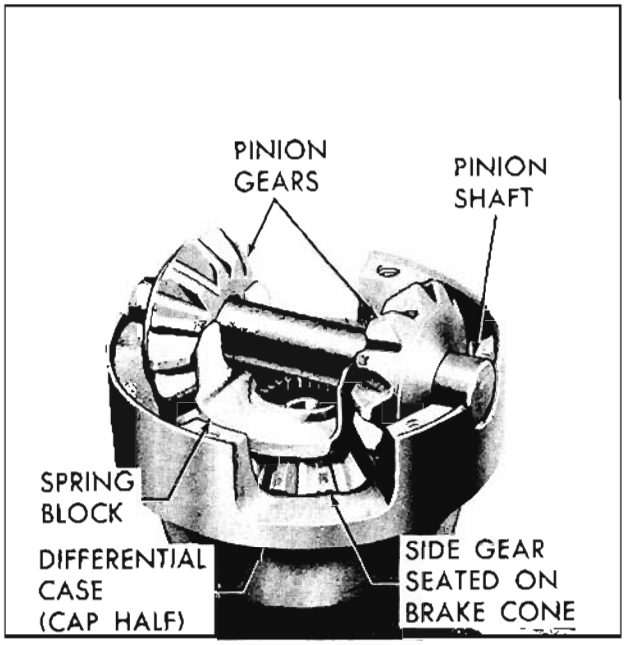


Fig. 10-136 Installing Thrust Block

6. Install second side gear face down on spring thrust block so that side gear will mesh with pinion gears.

7. Place shim, if provided, and remaining cone over side gear.

8. Install flange side of differential assembly over cone in proper position to match alignment marks; insert two bolts finger tight 180° apart. (Fig. 10-139)

9. Install other axle shaft through flange half of differential case rotating axle to enter cone splines and then side gear splines.

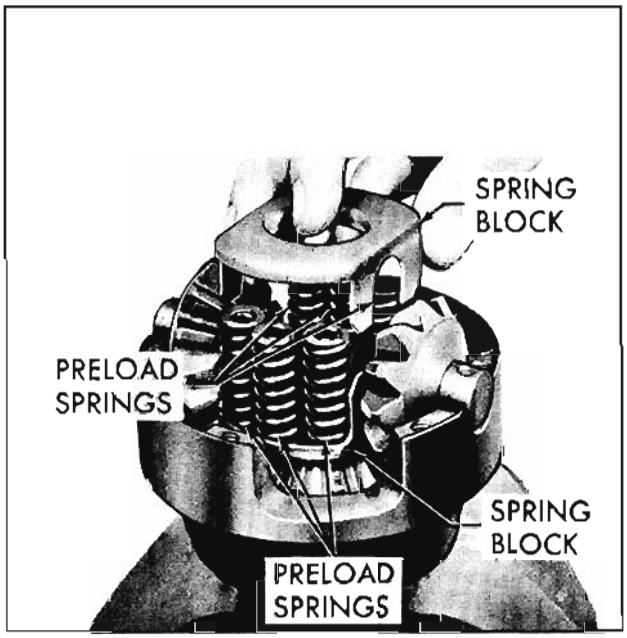


Fig. 10-137 Installing Preload Springs

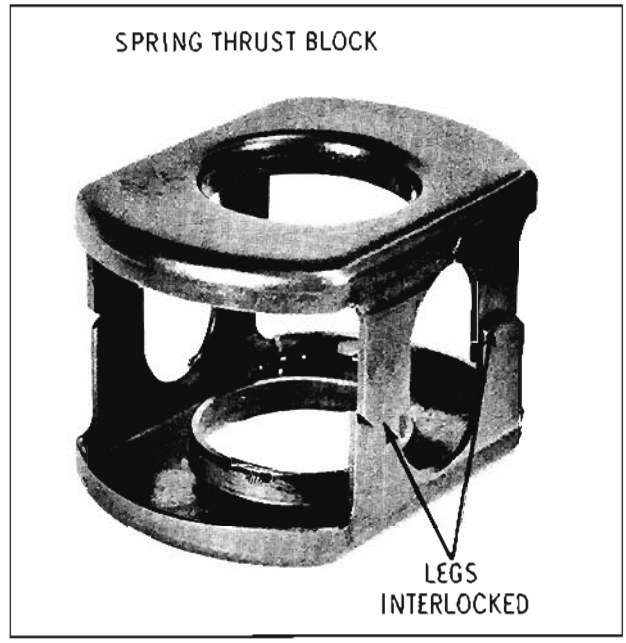


Fig. 10-138 Thrust Blocks

Leaving the axle shaft in this position, insert remaining bolts and tighten to 15 to 18 ft. lb. (Fig. 10-140)

10. Remove axle shafts. A slight tapping on the shafts with a soft hammer may be necessary to align the splines during assembly. The shafts can then be readily reinstalled without spline interference during final assembly.

11. Install unit into axle carrier following instructions given in CONVENTIONAL DIFFERENTIAL Section.

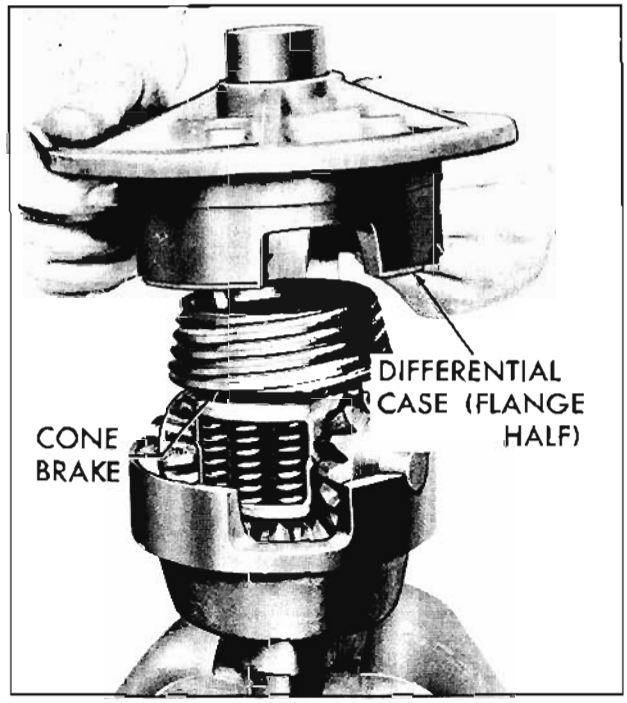


Fig. 10-139 Assembling Case

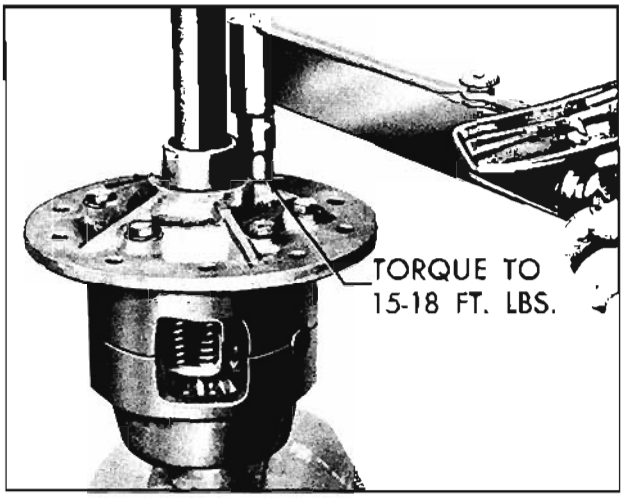


Fig. 10-140 Installing Case Bolts

CAUTION: After unit is installed in carrier, do not attempt to rotate one axle shaft until both are in position. Rotation of one shaft without the other installed will result in misalignment of cone and side gear splines and may prevent entry of second shaft.

DIAGNOSIS

ANTI-SPIN OPERATION

If an Anti-Spin differential is suspected of not providing positive traction to the non-slipping wheel, the condition can be checked as follows:

1. Place the transmission in NEUTRAL.
2. Raise one wheel off the floor and place a block in the front and rear of the opposite wheel.
3. Remove hub cap or wheel disc and apply a torque wrench to wheel nut.
4. Disregard breakaway torque and observe only the torque required to continuously turn the wheel smoothly.

If the torque reading is less than 40 ft. lbs., the unit should be disassembled and the case assembly should be repaired as necessary.

PROPELLER SHAFT

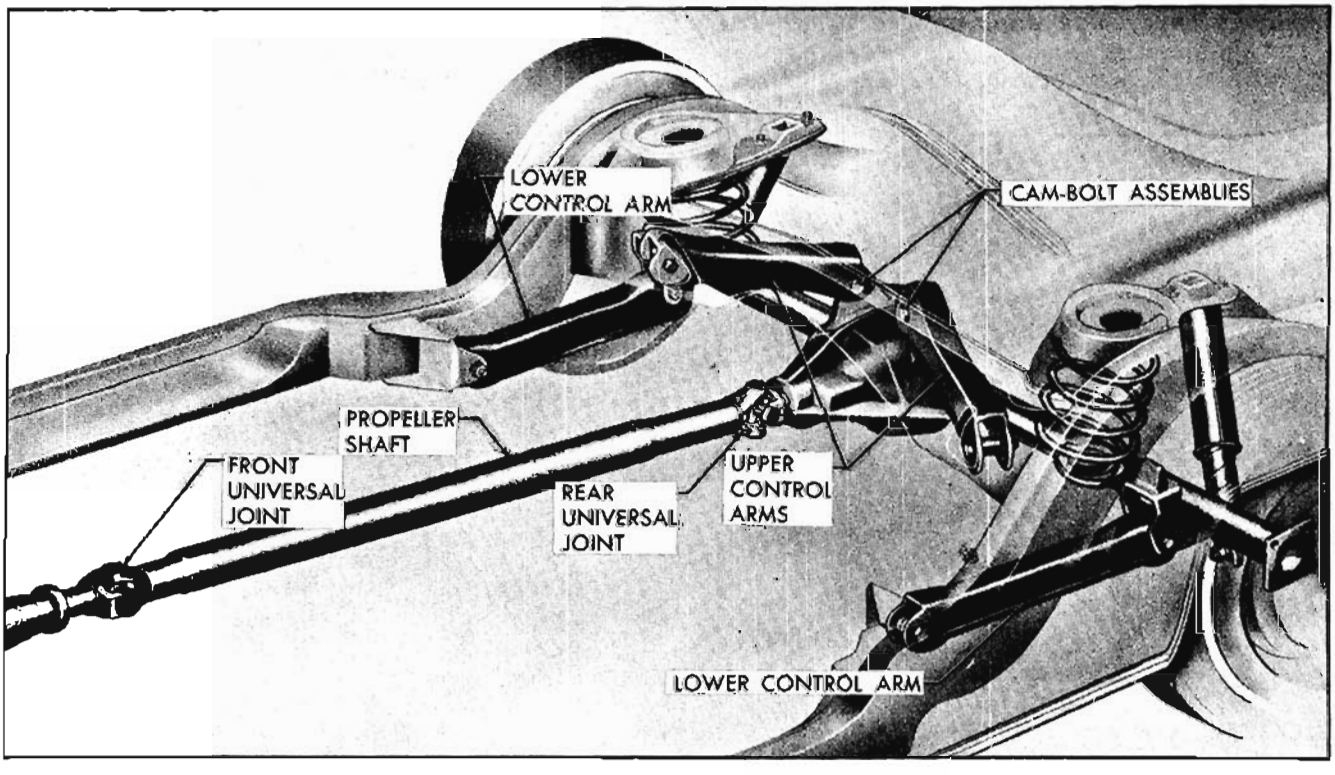


Fig. 10-141 Propeller Shaft Assembly

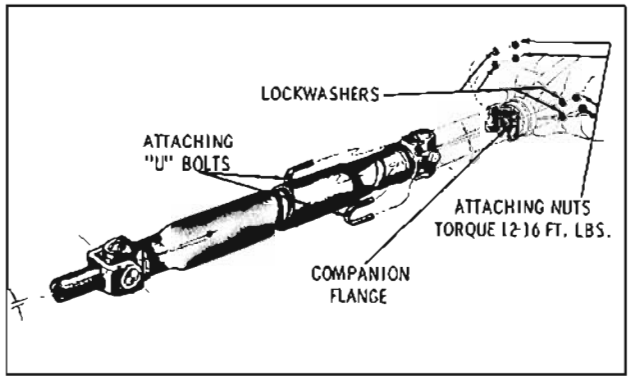


Fig. 10-142 Propeller Shaft Installation

PERIODIC MAINTENANCE

The propeller shaft slip yoke does not require a scheduled lubrication interval. Universal joints, under both hot and cold weather conditions, do not require a scheduled lubrication interval.

On 33 series with high mileage, a stickiness might develop at the slip yoke. If so, it should be lubricated with Seal Lubricant, Part No. 567196 until lubricant appears at the vent hole.

DESCRIPTION (Fig. 10-141)

The rear yoke shaft on Jetaway equipped 30, 31 & 32 series cars and all 33 series cars, is bonded in rubber to the inside of the propeller shaft tube and cannot be removed for service. The shaft for a synchromesh is one piece.

The propeller shaft assembly is a balanced unit and should be kept free of undercoating or other material which could upset the balance.

REMOVE AND INSTALL (Fig. 10-142)

1. Remove the four nuts and lockwashers from the "U" bolts at the differential companion flange.

2. If the companion flange "U" joint bearings are not retained with a metal retaining strap, use a piece of wire or tape to hold bearings on their spider journals.

3. Lower the rear of the shaft and slide rearward.

   To install, apply one ounce of Seal Lubricant, Part No. 567196, to the splines of the slip yoke (Jetaway and 33 series) and reverse removal procedure. Torque "U" bolt nuts 12 to 16 ft. lbs.

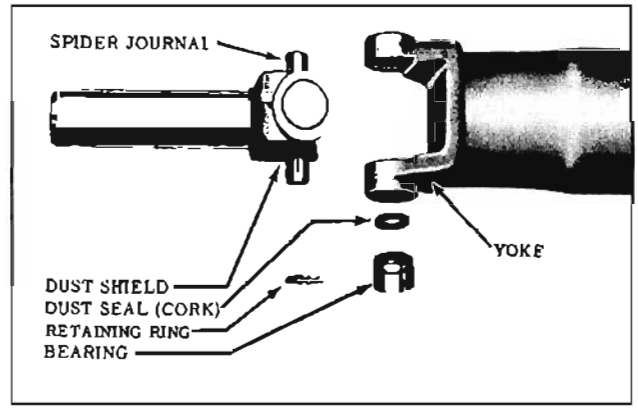


Fig. 10-143 Universal Joint Bearings

UNIVERSAL JOINT BEARINGS REMOVAL (Fig. 10-143)

1. With propeller shaft removed from the car, remove all bearing retaining rings.

   NOTE: Mark both yoke and shaft so that the units may be reassembled in their original position in order to maintain the original balance.

2. Position the slip yoke end of propeller shaft on a vise so that the shaft yoke rests on top of the vise jaws. The slip yoke must be free

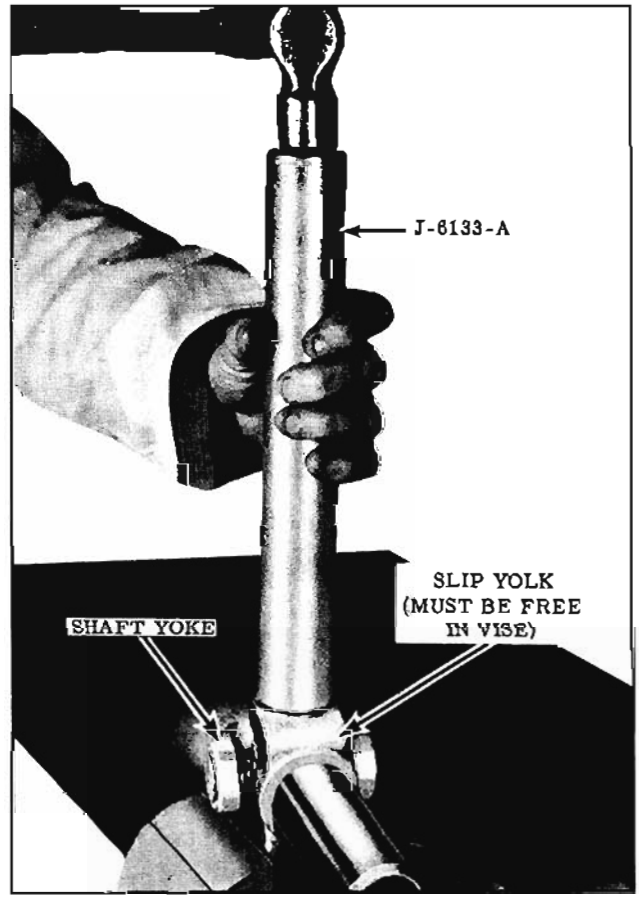


Fig. 10-144 Partial Bearing Removal

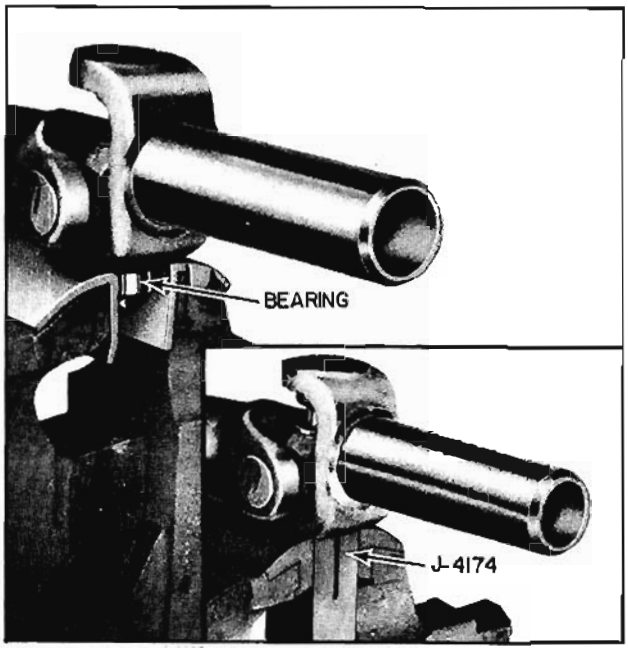


Fig. 10-145 Bearing Removal

to move vertically between jaws of vise.

3. Apply force on yoke around bearing. (Fig. 10-144) This will drive the slip yoke down causing spider to force bearing partially out of the yoke.

4. Clamp the partially exposed bearing in a brass jawed vise, then tap yoke until bearing is removed. (Fig. 10-145) Remove bearing from vise.

NOTE: The use of Tool J-4174 will facilitate removal of bearings. (Inset, Fig. 10-145)

5. Remove slip yoke from spider.

6. Clamp shaft yoke in vise.

NOTE: Do not clamp the propeller shaft tube in a vise.

7. Drive on spider until bearing is partially forced out of yoke. (Fig. 10-106)

8. Clamp partially exposed bearing in a brass jawed vise and tap on yoke until bearing is removed.

9. To remove opposite bearing, repeat Steps 7, 8 and 9.

10. Remove spider from shaft yoke.

11. Remove spider and bearings.

CLEANING AND INSPECTION

1. Wash all parts thoroughly in cleaning solvent.

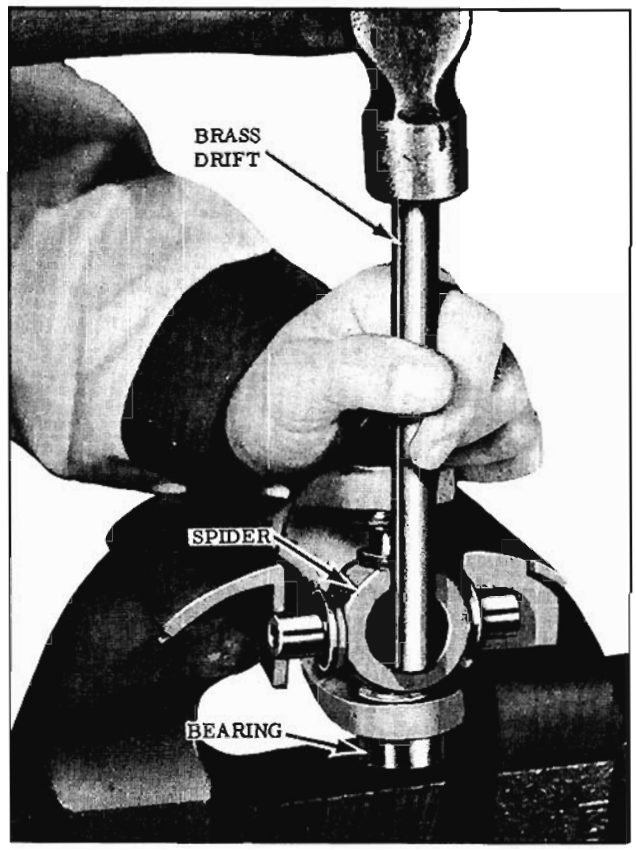


Fig. 10-146 Partial Bearing Removal

NOTE: Bearings and spiders should be washed in clean gasoline, not light oil. If bearings are washed in light oil, the grease will not adhere to the bearings and the bearings will run dry.

2. Inspect dust seals and shields for damage. Replace if necessary. Seals should be flexible. If brittle or hard, replace seals.

3. 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.

INSTALLATION

1. Lubricate each needle bearing assembly and fill the reservoir in each spider journal with a lithium soap, fine fiber grease.

2. Press dust seal into recess.

3. If new dust shields are to be installed, install at this time.

4. Position a spider journal in a shaft yoke.

5. Press a bearing into one side of yoke until retaining ring can be installed. (Fig. 10-147)

6. Install retaining ring. Retaining rings must be installed with the gap toward the yoke.

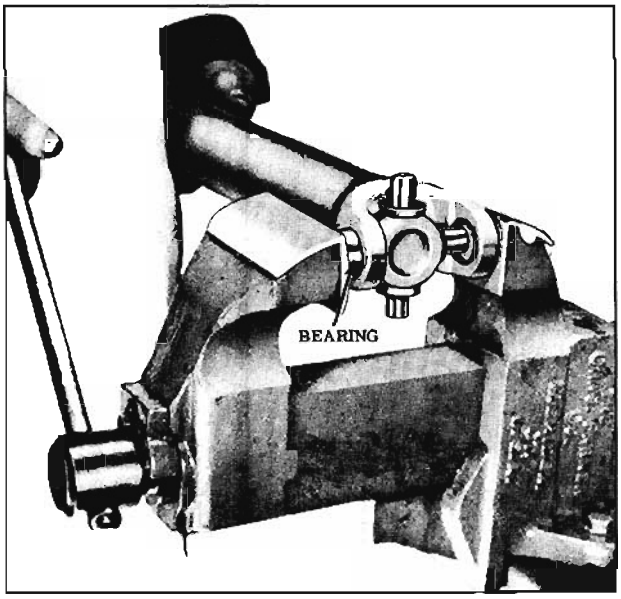


Fig. 10-147 Installing Bearings

7. Repeat Steps 5 and 6 on opposite bearing. As the bearing is installed, align spider journal with the bearing.

8. To install the slip yoke, 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.

TORQUE SPECIFICATIONS

NOTE: Specified torque is for installation of parts only. Checking of torque during inspection may be 15% below the specified minimum.

APPLICATION	FT. LBS.
DIFFERENTIAL	
Case Cover to Case Bolts (Anti-Spin)	15 to 18
Companion Flange to Differential Pinion	200
Differential Filler Plug	20 to 30
Propeller Shaft to Differential Companion Flange	12 to 16
Rear Axle Housing Cover to Carrier	25 to 35
Ring Gear Bolts	50 to 60
Side Bearing Cap Bolts	45 to 65
Pinion Axle Retaining Bolt	20 to 28
AXLES	
Rear Axle Bearing Retainer to Housing	30 to 40
Rear Wheel Hub Bolts	55 to 75
PROPELLER SHAFT	
Propeller Shaft to Rear Companion Flange	12 to 16

SPECIFICATIONS

DIFFERENTIAL	
LUBRICATION	
Capacity	2 3/4 pts. Approx.
Replenish (Conventional)	S.A.E. 90 Multi-Purpose Gear Lubricant Meeting Military Specification MIL-L-2105B
Replenish (Anti-Spin)	Special Lubricant Part No. 531536
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	30 to 40 in. lbs.
Old Bearings	20 to 30 in. lbs.

AXLE AND SPEEDOMETER RATIOS

Series	Transmission	Body Style	Axle Ratio Identification					No. of Speedometer Gear Teeth	
			Engine	Axle Ratio	Gear Ratio	Code	Tire Size	Drive	Driven
30-31	SM & FS	27 & 69	V-6	3.23	42/13	B	6.50 x 14	8	20
30-31	SM & FS	All	V-6	3.23	42/13	B	7.00 x 14	8	20
30-31	SM & FS	35	V-6	3.23	42/13	B	7.50 x 14	8	19
30-31	SM & FS	All	V-8	3.08	37/12	A	7.00 x 14	8	19
30-31	SM & FS	All	V-8	3.08	37/12	A	7.50 x 14	8	18
30-31	SM & FS	All	V-6	3.36	37/11	E	7.00 x 14	8	21
30-31	SM & FS	35	V-6	3.36	37/11	E	7.50 x 14	8	20
30-31-32	SM & FS	All	V-8	3.36	37/11	E	7.00 x 14	8	21
30-31-32-33	SM & FS	All	V-8	3.36	37/11	E	7.50 x 14	8	20
30-31	SM & FS	All	V-6	3.90*	39/10	F	7.00 x 14	8	21
30-31	SM & FS	35	V-6	3.90*	39/10	F	7.50 x 14	8	20
30-31-32	SM & FS	All	V-8	3.90*	39/10	F	7.00 x 14	8	21
30-31-32	SM & FS	All	V-8	3.90*	39/10	F	7.50 x 14	8	20
30-31-32	SM & FS	All	V-8	3.23	42/13	B	7.00 x 14	8	20
30-31-32-33	SM & FS	All	V-8	3.23	42/13	B	7.50 x 14	8	19
30-31	JT	27 & 69	V-6	3.23	42/13	B	6.50 x 14	17	43
30-31	JT	All	V-6	3.23	42/13	B	7.00 x 14	17	42
30-31	JT	35	V-6	3.23	42/13	B	7.50 x 14	17	41
30-31-32	JT	All	V-8	2.78**	39/14	C	7.00 x 14	17	36
30-31-32	JT	All	V-8	2.78**	39/14	C	7.50 x 14	17	36
30-31	JT	All	V-6	3.36	37/11	E	7.00 x 14	17	43
30-31	JT	35	V-6	3.36	37/11	E	7.50 x 14	17	43
30-31-32	JT	All	V-8	3.36	37/11	E	7.00 x 14	17	43
30-31-32-33	JT	All	V-8	3.36	37/11	E	7.50 x 14	17	43
30-31	JT	All	V-6	3.90*	39/10	F	7.00 x 14	17	43
30-31	JT	35	V-6	3.90*	39/10	F	7.50 x 14	17	43
30-31-32	JT	All	V-8	3.90*	39/10	F	7.00 x 14	17	43
30-31-32-33	JT	All	V-8	3.90*	39/10	F	7.50 x 14	17	43
30-31	JT	All	V-8	2.78**	39/14	C	7.00 x 14	17	36
30-31-32	JT	All	V-8	3.08	40/13	A	7.00 x 14	17	40
30-31-32-33	JT	All	V-8	3.08	40/13	A	7.50 x 14	17	39
33	SM & FS	All	V-8	3.23	42/13	B	8.00 x 14	8	19
33	SM & FS	All	V-8	3.36	37/11	E	8.00 x 14	8	20
33	SM & FS	All	V-8	3.90*	39/10	F	7.50 x 14	8	21
33	SM & FS	All	V-8	3.90*	39/10	F	8.00 x 14	8	20
33	SM & FS	69	V-8	3.55	39/11	D	7.50 x 14	8	21
33	SM & FS	69	V-8	3.55	39/11	D	8.00 x 14	8	21
33	JT	All	V-8	3.08	40/13	A	8.00 x 14	17	38
33	JT	All	V-8	3.36	37/11	E	8.00 x 14	17	42
33	JT	All	V-8	3.90*	39/10	F	8.00 x 14	17	42
33	JT	69	V-8	3.55	39/11	D	7.50 x 14	17	39
33	JT	69	V-8	3.55	39/11	D	8.00 x 14	17	39
33	JT	All	V-8	3.23	42/13	B	8.00 x 14	17	38

*All cars equipped with a 3.90 differential use a speedometer cable adapter with a speed reduction ratio of .8653 to 1 to provide accurate speedometer indication.

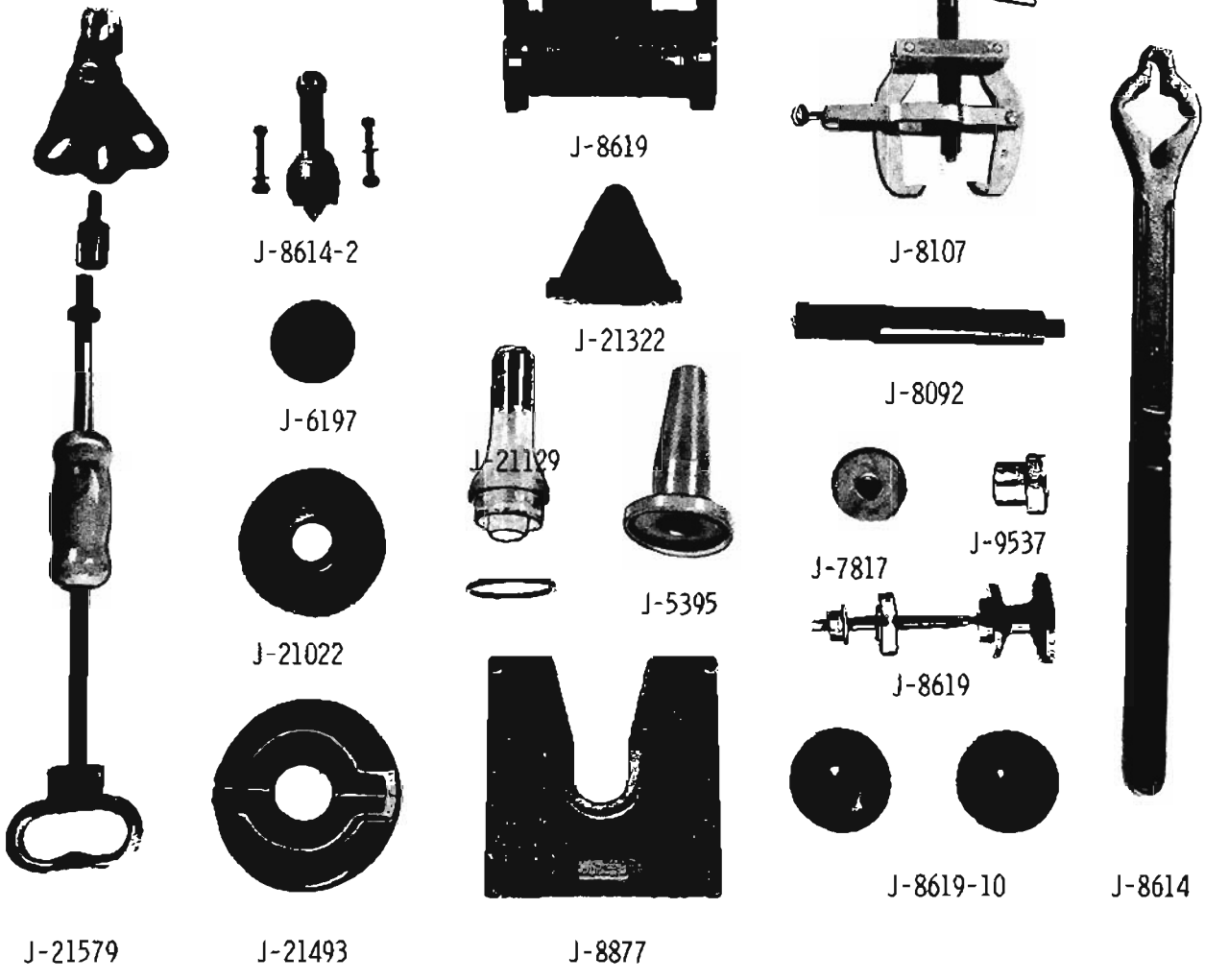
**All cars equipped with a 2.78 differential use a speedometer cable adapter with a speed multiplication ratio of 1.125 to 1 to provide accurate speedometer indication.

15" TIRE OPTION

Series	Transmission	Body Style	Axle Ratio Identification					No. of Speedometer Gear Teeth	
			Engine	Axle Ratio	Gear Ratio	Code	Tire Size	Drive	Driven
30	SM & FS	35	V-6	3.23	42/13	B	6.70 x 15	8	19
30-31	SM & FS	All	V-8	3.08	37/12	A	6.70 x 15	8	18
30	SM & FS	35	V-6	3.36	37/11	E	6.70 x 15	8	20
30-31-32	SM & FS	All	V-8	3.36	37/11	E	6.70 x 15	8	20
30	SM & FS	35	V-6	3.90*	39/10	F	6.70 x 15	8	20
30-31-32	SM & FS	All	V-8	3.90*	39/10	F	6.70 x 15	8	20
30-31-32	SM & FS	All	V-8	3.23	42/13	B	6.70 x 15	8	19
30	JT	35	V-6	3.23	42/13	B	6.70 x 15	17	40
30-31	JT	All	V-8	2.78**	39/14	C	6.70 x 15	17	39
30	JT	35	V-6	3.36	37/11	E	6.70 x 15	17	42
30-31-32	JT	All	V-8	3.36	37/11	E	6.70 x 15	17	42
30	JT	35	V-6	3.90*	39/10	F	6.70 x 15	17	42
30-31-32	JT	All	V-8	3.90*	39/10	F	6.70 x 15	17	42
30-31-32	JT	All	V-8	2.78**	39/14	C	6.70 x 15	17	39
30-31-32	JT	All	V-8	3.08	37/12	A	6.70 x 15	17	38
31	SM & FS	All	V-6	3.36	37/11	E	6.70 x 15	8	20
31	SM & FS	All	V-6	3.90*	39/10	F	6.70 x 15	8	20
31	SM & FS	All	V-6	3.23	39/10	F	6.70 x 15	8	19
31	JT	All	V-6	3.23	42/13	B	6.70 x 15	17	40
31	JT	All	V-6	3.36	37/11	E	6.70 x 15	17	42
31	JT	All	V-6	3.90*	39/10	F	6.70 x 15	17	42
33	SM & FS	All	V-8	3.23	42/13	B	7.10 x 15	8	19
33	SM & FS	All	V-8	3.36	37/11	E	7.10 x 15	8	20
33	SM & FS	All	V-8	3.90*	39/10	F	7.10 x 15	8	20
33	SM & FS	69	V-8	3.55	39/11	D	7.10 x 15	8	21
33	JT	All	V-8	3.08	40/13	A	7.10 x 15	17	38
33	JT	All	V-8	3.36	37/11	E	7.10 x 15	17	42
33	JT	All	V-8	3.90*	39/10	F	7.10 x 15	17	42
33	JT	69	V-8	3.55	39/11	D	7.10 x 15	17	39
33	JT	All	V-8	3.23	42/13	B	7.10 x 15	17	40

DRIVEN GEAR COLOR CODE

Synchromesh Gear	Color
18 Teeth	Brown
19 Teeth	Natural
20 Teeth	Blue
21 Teeth	Red
Jetaway Gear	
36 Teeth	White
39 Teeth	Brown
40 Teeth	Black
41 Teeth	Yellow
42 Teeth	Green
43 Teeth	Purple



J-5395 Pinion Seal Installer
J-6197 Front Pinion Bearing Cup Installer
J-7817 Pinion Bearing Installer
J-8092 Driver Handle
J-8107 Differential Side Bearing Pulley
J-8614 1 & 2 Companion Flange Holder and Re-Mover
J-8619 Pinion Setting Gauge
J-8877 Axle Bearing Pulley Plate
J-9537 Side Bearing Installer
J-21022 Rear Pinion Bearing Installer
J-21129 Axle Shaft Oil Seal Installer
J-21322 Ring Gear and Case Remover
J-21493 Rear Pinion Bearing Remover
J-21579 Axle Shaft Remover

Fig. 10-148 Tools

BRAKES

(ALL SERIES)

CONTENTS OF SECTION 11

PERIODIC MAINTENANCE

Each time the car is in the service department, the brake pedal height should be observed. If the brake pedal travel from the released to the fully applied position (engine running, power brakes) exceeds 1-7/8" on power brakes or 4" on standard brakes, the car should be driven alternately forward and backward, and the brakes applied moderately each time to operate the self-adjuster until the proper pedal height is obtained. If brake pedal travel cannot be reduced in this manner, the drums should be removed and the self-adjusting mechanism inspected for the cause of inoperation.

The adjusting screws should be cleaned and lubricated with brake lubricant, Part No. 987786.

The fluid in the master cylinder reservoir should be checked at every engine oil change interval. Fluid level should be no more than 1/4" below the reservoir opening. Replinish as necessary with Brake Fluid, Super No. 11.

Brake hoses and pipes should be inspected for chafing, deterioration or other damage.

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

DESCRIPTION

The braking system consists of hydraulically operated brakes that apply the brake shoes simultaneously at all four wheels, and a mechanically operated parking brake that applies the brake shoes at the rear wheels only.

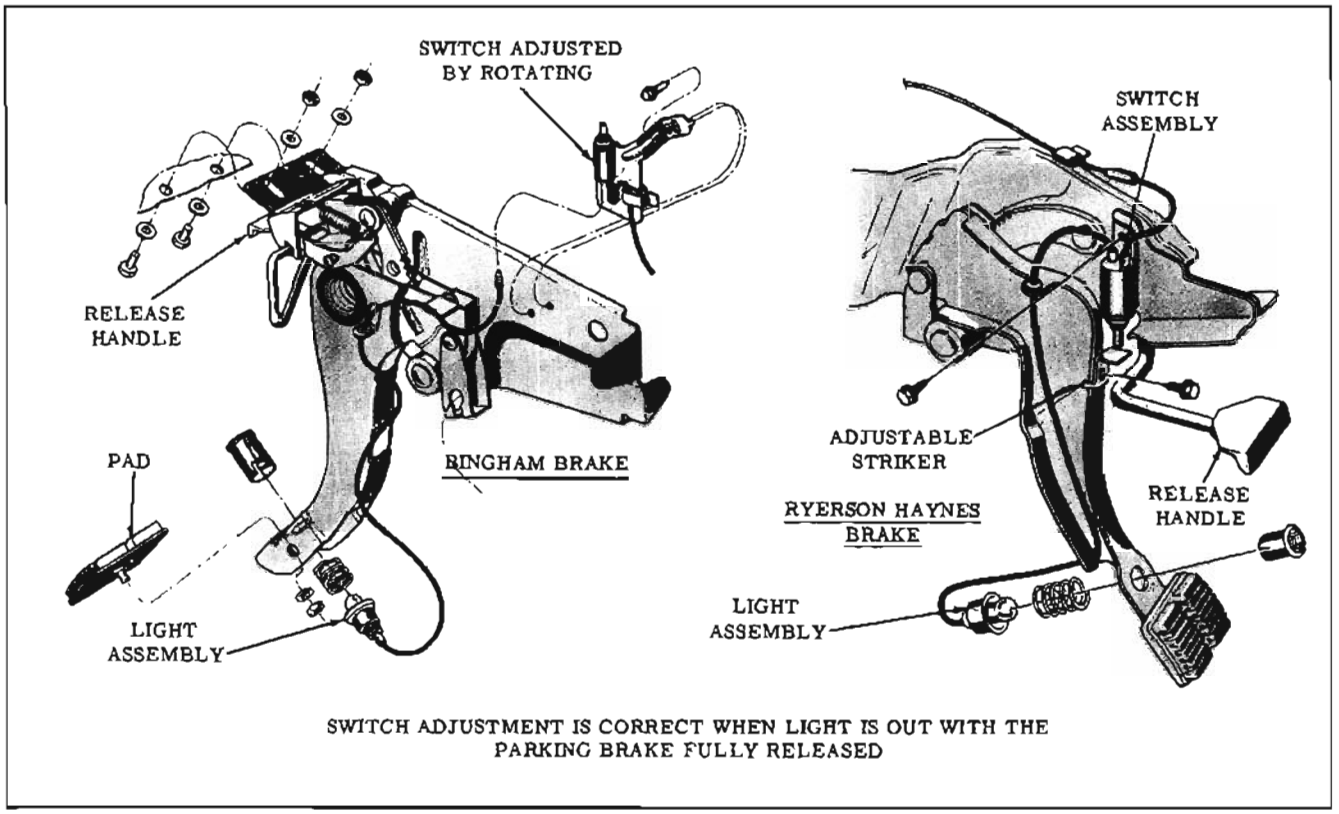


Fig. 11-1 Parking Brake (33, 34, 35, 36, 38 & 39 Series)

HYDRAULIC BRAKE

When the hydraulic brake pedal is depressed, the piston in the master cylinder forces fluid under pressure to a wheel cylinder at each wheel, which in turn, push the brake shoes against the brake drum. As the shoes contact the drum, the friction between the shoes and the rotating drum moves the primary shoe downward against the adjusting screw which acts as a link to transmit the force of the primary shoe to the lower end of the secondary shoe. With the upper end of the secondary shoe being held by the stationary anchor pin, the secondary shoe is wedged against the drum. This wedging action, due to frictional force, imparts the self-energizing action to the braking effort and thereby decreases the effort required by the driver to stop the car.

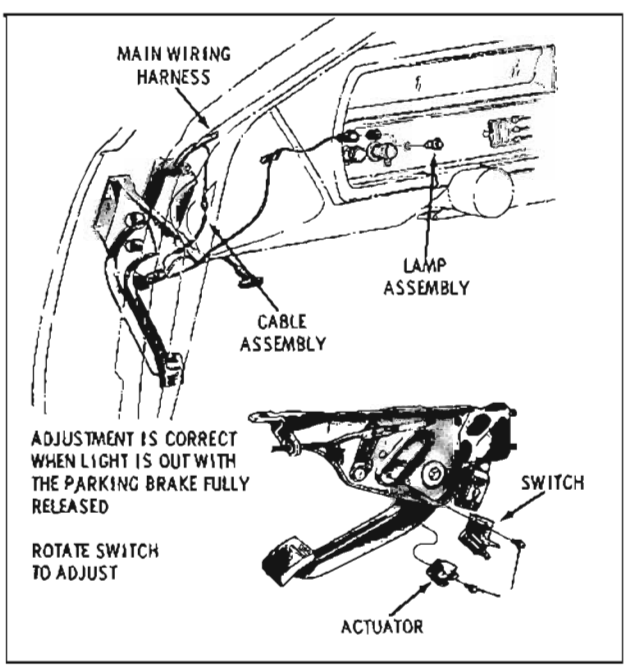


Fig. 11-2 Parking Brake (30, 31 & 32 Series)

PARKING BRAKE (Figs. 11-1 & 11-2)

The parking brake applies the rear brakes through cable and linkage by means of a foot operated parking brake pedal mounted below the instrument panel. The parking brake is released by a release handle.

SELF-ADJUSTING BRAKE

General Description

All cars are equipped with self-adjusting brakes. The self-adjusting brake mechanism consists of an actuating link, adjuster lever, adjuster lever return spring, override spring and override pivot.

Operation (Fig. 11-3)

The self-adjusting brake mechanism operates only when the brakes are applied while the car is

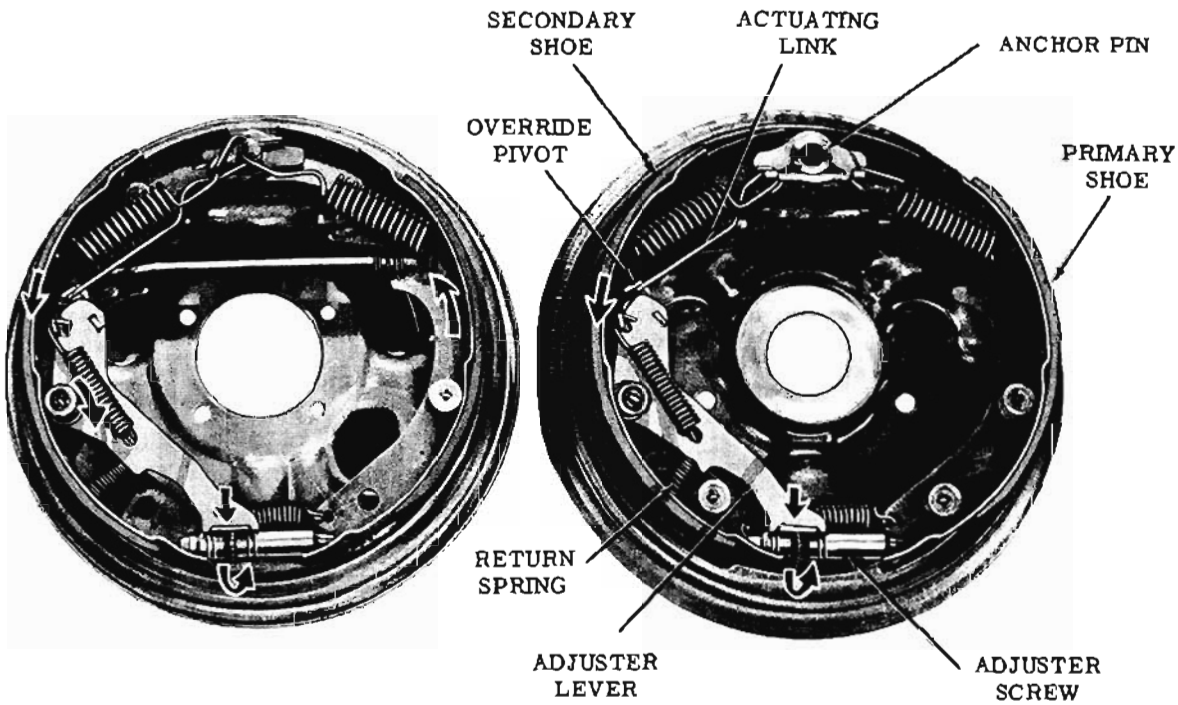


Fig. 11-3 Self-Adjusting Brake

moving rearward and only when the secondary shoe moves a pre-determined distance toward the brake drum.

As the car moves rearward and the brakes are applied, friction between the primary shoe and the drum forces the primary shoe against the anchor pin. Hydraulic pressure in the wheel cylinder forces the upper end of the secondary shoe away from the anchor pin. As the secondary shoe moves away from the anchor pin, the upper end of the adjuster lever is prevented from moving by the actuating link. This causes the adjuster lever to pivot on the secondary shoe forcing the adjuster lever against the adjusting screw sprocket. If the brake linings are worn enough to allow the secondary shoe to move the pre-determined distance, the adjuster lever will turn the adjusting screw sprocket one or two teeth, depending on lining wear. If the secondary shoe does not move the pre-determined distance, movement of the adjuster lever will not be great enough to rotate the adjusting screw sprocket.

When the brakes are released, the adjusting lever return spring will move the adjuster lever into the adjusting position on the sprocket.

An override feature is built into the self-adjusting brake which allows the secondary shoe to be applied in reverse in the event the adjusting screw becomes "frozen" preventing the self-adjuster from operating.

When the car is moving forward and the brakes are applied, the upper end of the secondary shoe is forced against the anchor pin due to the self-energizing action of the brakes, and the self-adjuster does not operate.

ADJUSTMENTS

PARKING BRAKE LAMP SWITCH

The parking brake lamp switch is bolted to the pedal mounting bracket and is actuated by a striker on the pedal.

To adjust switch, refer to Figs. 11-1 & 11-2.

STOP LAMP SWITCH

The stop lamp switch is attached to the brake pedal bracket and is actuated by the brake pedal arm.

Adjustment (33, 34, 35, 36, 38 & 39 Series)

To obtain proper operation of the stop lamps, adjust the switch as follows:

1. With brake pedal in the fully released position, loosen switch locknuts and adjust switch until stop lamps just go off; then adjust switch until plunger is depressed an additional 7/64" (approximately three turns of the switch). Tighten locknuts.

2. Check stop lamp switch operation by applying and releasing the brake, making certain that stop lamps go off when brake pedal is in fully released position.

Adjustment (30, 31 & 32 Series)

1. With the brake pedal height correctly adjusted, insert switch into tubular clip until switch body seats on tube clip.

2. Pull brake pedal rearward until it contacts the internal stop. This moves the switch in the tubular clip providing proper adjustment.

3. Check stop lamp switch operation by applying and releasing the brake, making certain that the stop lamps go off when the brake pedal is in the fully released position.

BRAKE SHOE

A brake shoe adjustment is required only when new linings are installed or whenever the length of the brake shoe adjusting screw has been manually changed.

1. With the brake drums removed, position the drum end (inside diameter measuring caliper) of the Brake Drum and Shoe Gauge, Tool J-21177, to the inside diameter of the drum and tighten clamp screw. (Fig. 11-4)

2. Position the brake shoe end (outside diameter measuring caliper) of Tool J-21177 over the brake shoes as shown in Fig. 11-5. Rotate gauge slightly around shoes to insure that gauge contacts the linings at the largest diameter. Adjust brake shoes until gauge is a snug fit on linings at the point of largest lining diameter.

   NOTE: If it is necessary to back off the brake shoe adjustment, it will be necessary to hold the adjuster lever away from the sprocket.

3. Remove the gauge.

STANDARD BRAKE PEDAL ADJUSTMENT (33, 34 & 35 Series)

An incorrectly adjusted brake pedal can hold the master cylinder piston from fully returning to its released position, which will result in brake drag or lock-up.

1. Remove the pedal return spring and the master cylinder push rod clevis pin.

2. Turn back floor mat and check pedal height (from floor pan to top of pedal pad). If dimension is not 7-15/16" ± 1/8", loosen locknut and adjust stop screw. (Fig. 11-6) Tighten locknut and recheck adjustment.

Fig. 11-4 Checking Brake Drum

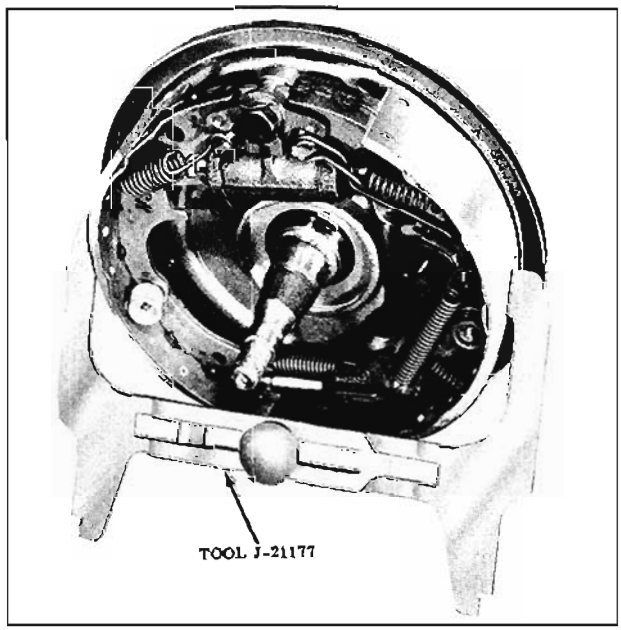


Fig. 11-5 Checking Lining

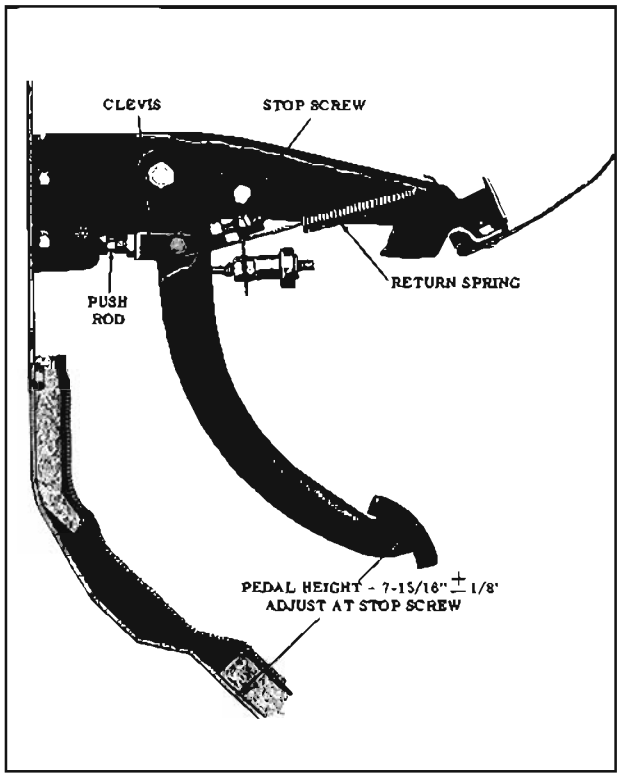


Fig. 11-6 Brake Pedal Adjustment

3. To adjust the master cylinder push-rod, lightly push the master cylinder push-rod until it contacts the hydraulic piston.

4. Loosen locknut and adjust push-rod until clevis pin can be freely installed into the brake pedal, then shorten push-rod one turn for proper free play.

5. Tighten locknut and connect push-rod to brake pedal.

NOTE: Whenever the brake pedal height has been changed, the stop lamp switch adjustment should be checked and adjusted if necessary.

30, 31 & 32 Series

1. Turn back floor mat and check pedal height (from floor pan to the top of the pedal pad at the center). Dimension should be 7-1/2" ± 1/8". (Fig. 11-7)

2. If dimension is incorrect, remove the master cylinder push-rod clevis pin. Loosen clevis locknut and adjust clevis until correct pedal height is obtained.

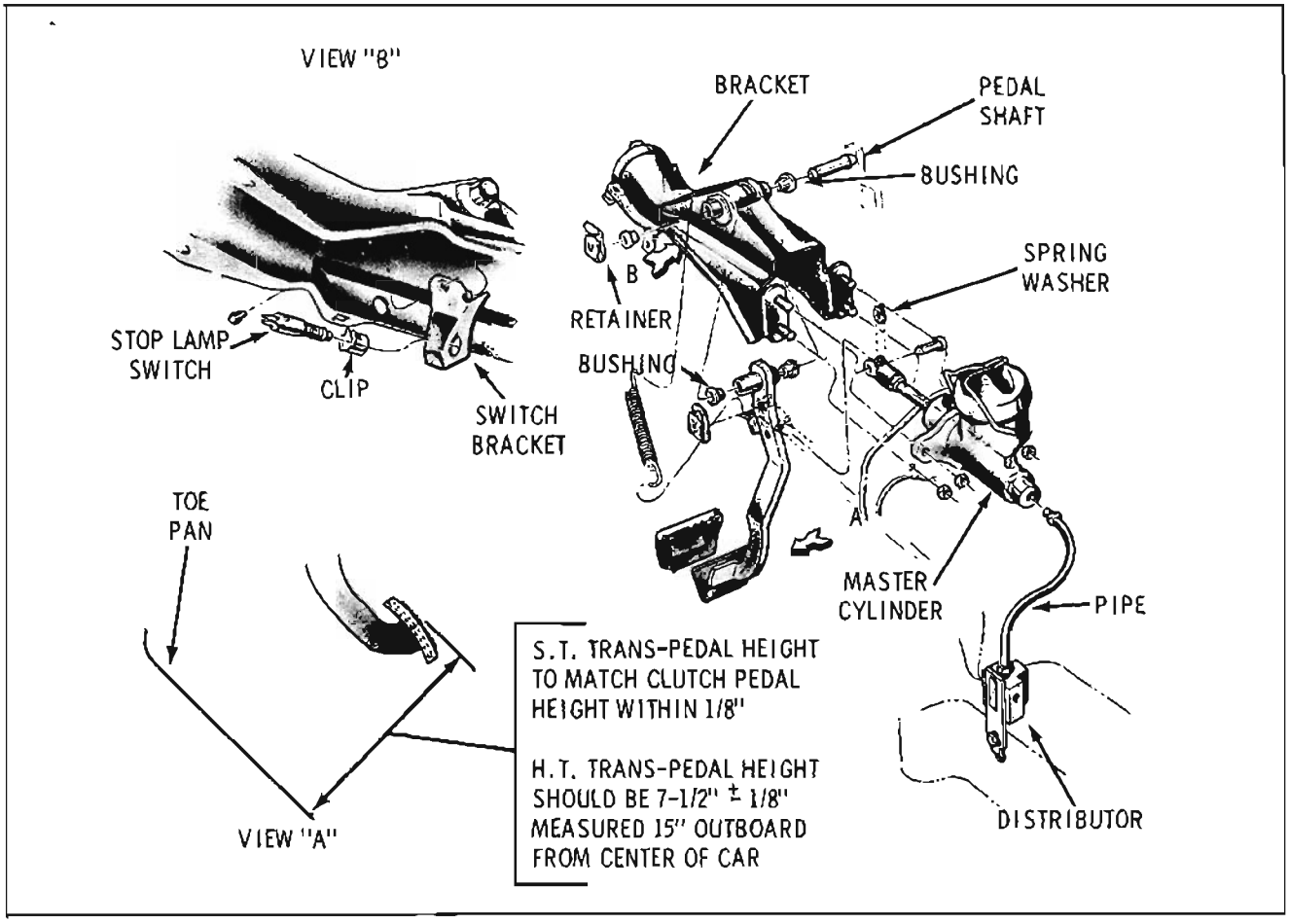
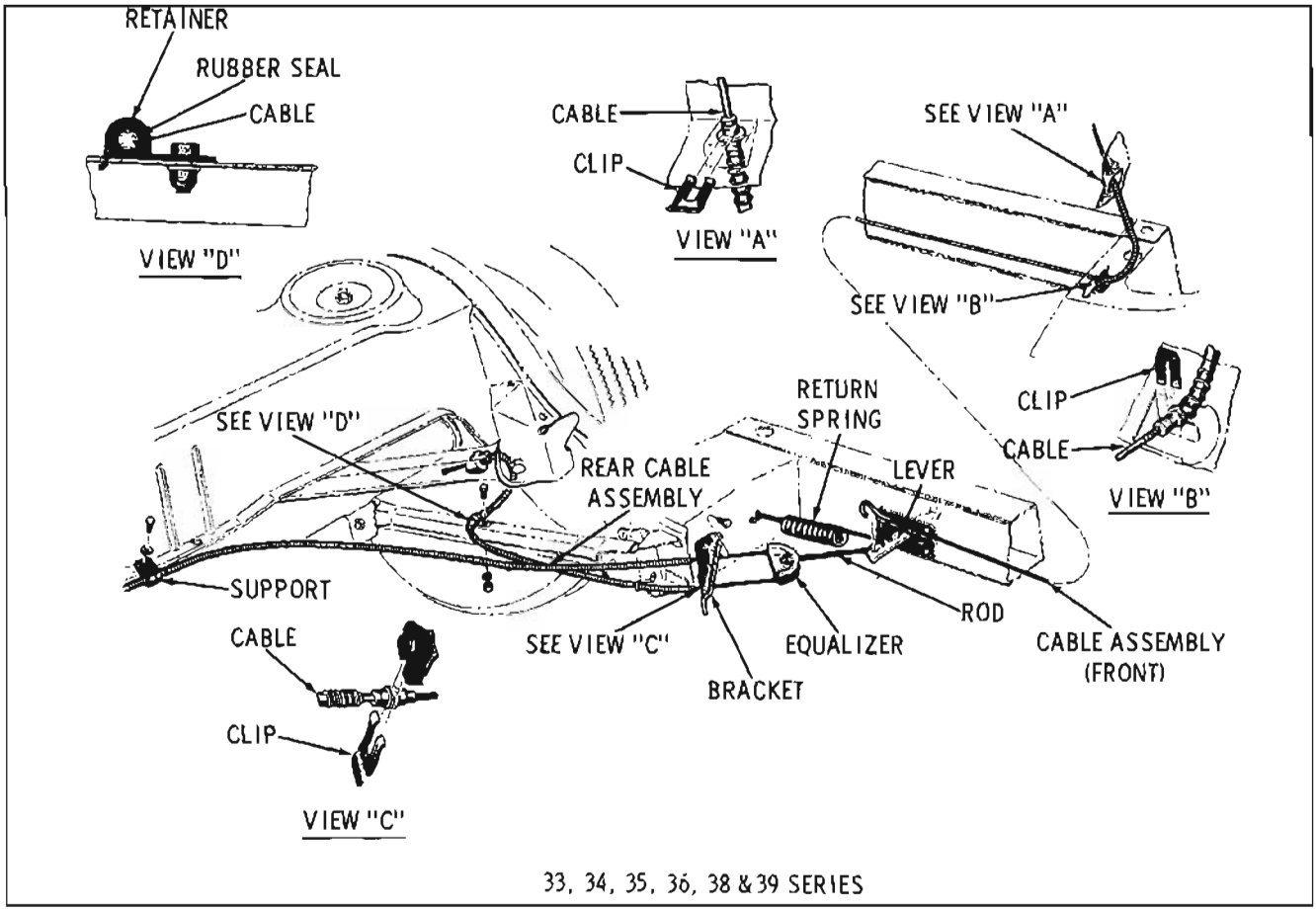
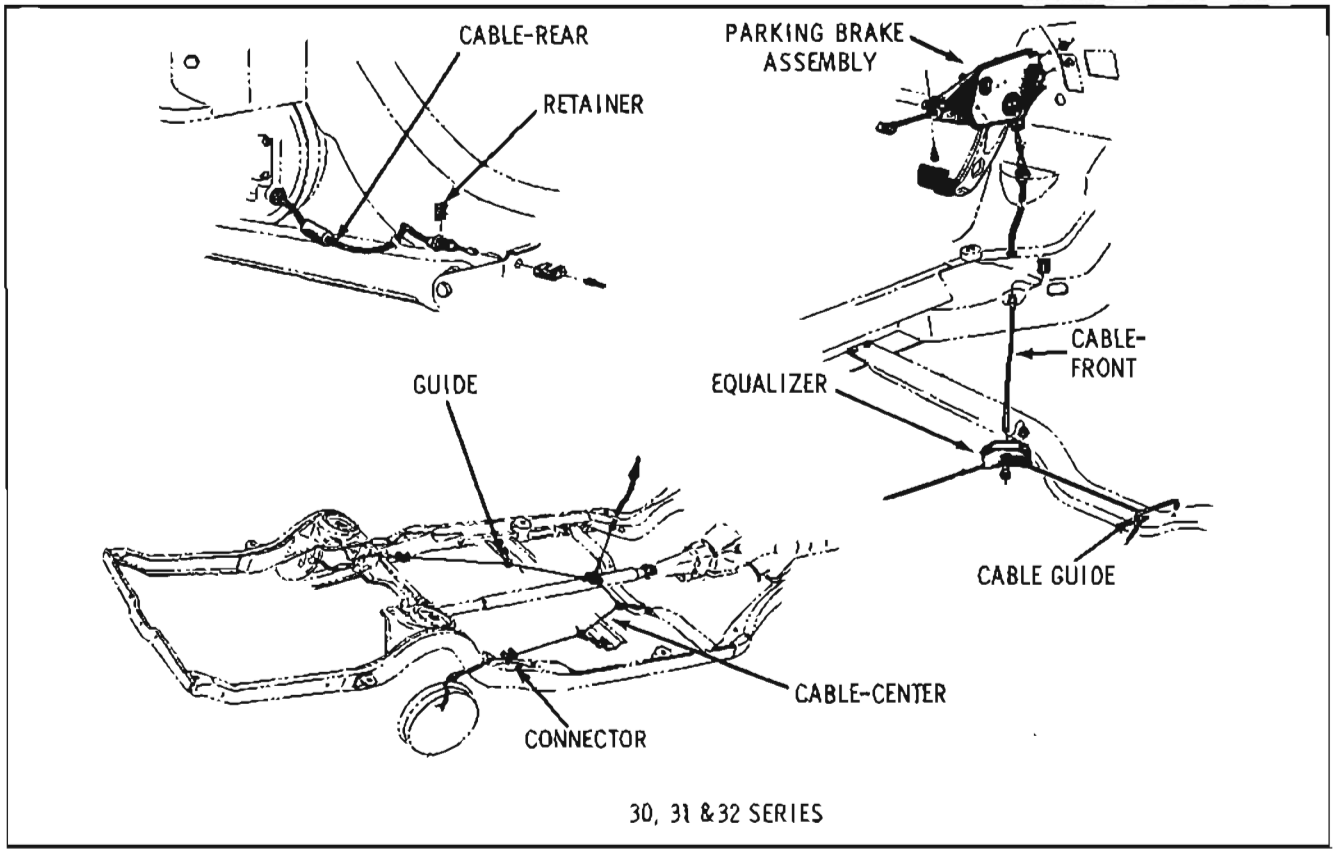


Fig. 11-7 Brake Pedal Adjustment (30, 31 & 32 Series)



33, 34, 35, 36, 38 & 39 SERIES



30, 31 & 32 SERIES

Fig. 11-8 Parking Brake Layout

3. If car is equipped with Synchromesh transmission, adjust brake pedal height to match the clutch pedal height, within 1/8".

4. Tighten locknut on clevis and connect the push-rod to the brake pedal.

NOTE: Whenever the brake pedal height has been changed, the stop lamp switch adjustment should be checked and adjusted if necessary.

PARKING BRAKE ADJUSTMENT (ALL SERIES)

1. Release parking brake.

2. Be sure hydraulic pedal travel is within specifications before adjusting parking brake.

3. Adjust cables by first tightening equalizer adjusting nut until a heavy resistance is felt when rotating rear wheels forward, then loosen equalizer adjusting nut seven full turns. (Fig. 11-8)

MINOR SERVICE OPERATIONS

BRAKE PEDAL AND BRACKET (STANDARD BRAKES)

The brake pedal is suspended from a mounting bracket under the instrument panel. Nylon bushings between the pivot bolt and the pedal eliminates periodic lubrication. The pedal is connected to the master cylinder push rod by a clevis. The brake pedal or bracket can be removed as shown in Figs. 11-7 and 11-9.

To install, lubricate inside of bushings, clevis pin and stop lamp switch bolt head with lubricant, Part No. 567196. Torque pivot pin nut, on 33, 34 and 35 series, 10 to 18 ft. lbs. Adjust brake pedal as outlined under STANDARD BRAKE PEDAL ADJUSTMENT.

HYDRAULIC SYSTEM

BLEEDING OF LINES

Whenever a line is disconnected from any wheel, it is necessary that the wheel cylinder be bled. If the hydraulic line is disconnected from the master cylinder or the brake pedal has a spongy feeling, each wheel cylinder must be bled to expel air from the system.

NOTE: Power brakes can be bled in the same manner as a standard brake system. If pressure bleeding equipment is not available, DO NOT use the vacuum assist. With the engine shut off, the vacuum reserve should be depleted by applying the brakes several times before starting the bleeding procedure.

The system can be bled manually or by using pressure bleeding equipment.

To bleed the system, the following procedure is recommended:

The correct sequence for bleeding is left front, right front, left rear, right rear. On 30, 31 and 32 series with power brakes, bleed the master cylinder bleeder first.

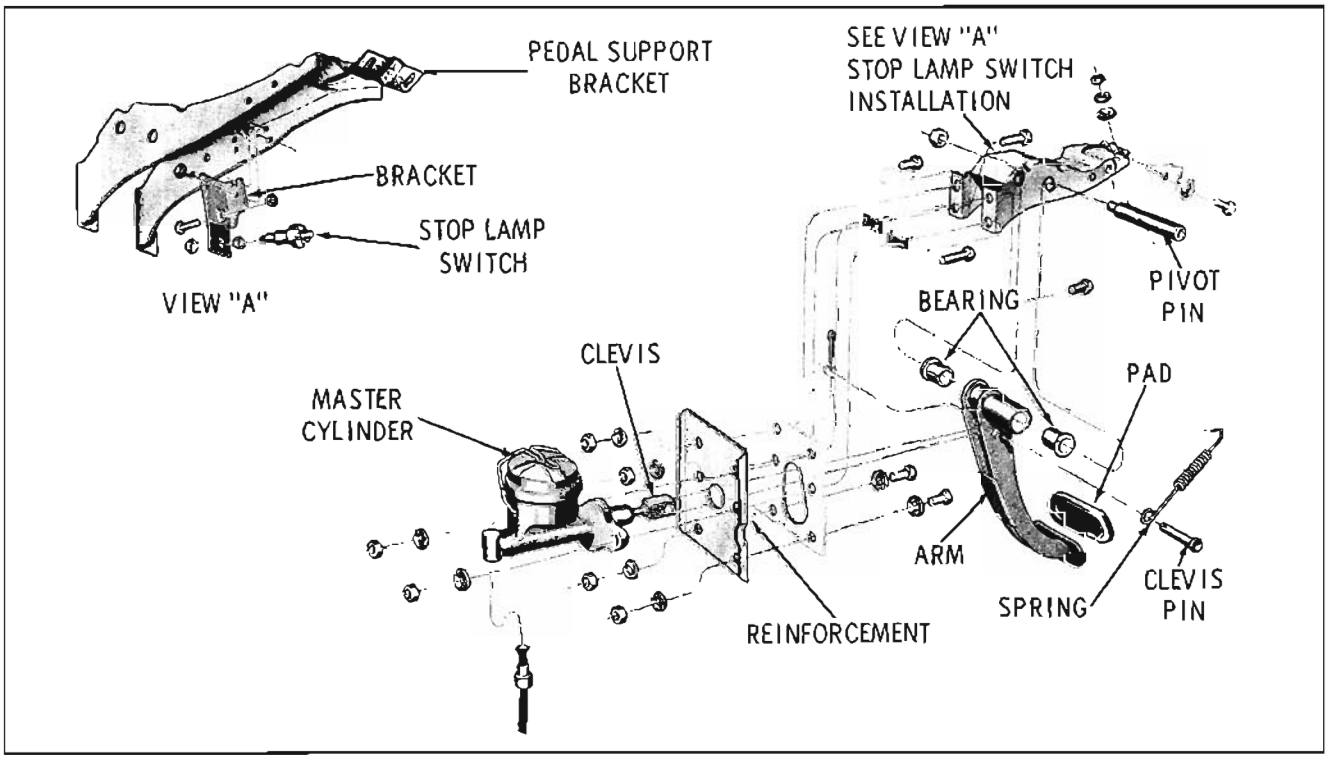


Fig. 11-9 Standard Brake Layout (33, 34, 35, 36, 38 & 39 Series)

1. If brakes are to be bled manually, fill the brake reservoir with Brake Fluid, Super No. 11 and KEEP AT LEAST ONE-HALF FULL OF FLUID DURING THE BLEEDING OPERATION.

2. If brakes are to be bled with pressure equipment, connect the tank to the brake reservoir and raise the pressure in the brake system to 20 to 30 psi.

3. Attach Bleeder Tube J-7779-2 to bleeder valve. (Fig. 11-10) THE TUBE MUST HANG SUBMERGED IN A CLEAN CONTAINER PARTIALLY FILLED WITH BRAKE FLUID, SUPER NO. 11 DURING THE BLEEDING OPERATION.

4. Unscrew bleeder valve three-quarters of a turn with a wrench such as J-21472 and watch flow of fluid from bleeder tube. When all air bubbles cease to appear and fluid is clear, close bleeder valve.

   NOTE: If brakes are bled without the aid of pressure equipment, the brake pedal must be operated during this operation to force the fluid from the bleeder hose. To do this, open the bleeder valve, fully depress the brake pedal, then slowly release pedal until it is in the fully released position. Continue operating pedal until fluid, containing no air bubbles, emerges from bleeder tube. Close bleeder valve.

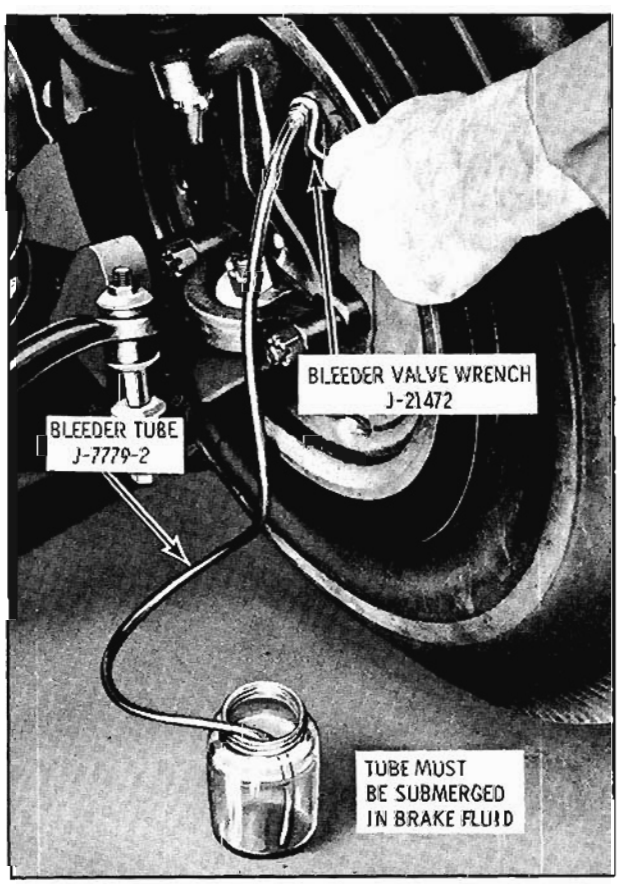


Fig. 11-10 Bleeding Brakes

5. Remove bleeder tube.

6. Repeat steps on the remaining wheel cylinders if the entire system is to be bled.

7. If the brakes were bled manually, check fluid in the reservoir and replenish if necessary, after the bleeding operation has been completed.

FLUSHING HYDRAULIC SYSTEM

Whenever mineral oil has been introduced into the hydraulic system, the entire system must be thoroughly flushed with brake Flushing Fluid and all rubber parts must be replaced. The brake 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).

When flushing is completed, bleed the hydraulic system with Brake Fluid Super No. 11 until all flushing fluid and air is expelled from the lines.

MASTER CYLINDER

STANDARD AND POWER

The standard and power brake master cylinders are a sealed type, consisting of a flexible diaphragm located between the fluid reservoir and the vented filler cover. This allows the brake fluid in the system to be sealed from outside air and dust while maintaining normal atmospheric pressure on the fluid in the fluid reservoir.

A Bendix master cylinder is used on the Bendix power brake and can be identified by the screw type master cylinder cover. A Moraine master cylinder is used with all standard and Moraine or Kelsey-Hayes power brakes and can be identified with the bail-type master cylinder cover.

Remove (Fig. 11-16)

The standard brake master cylinder, on 33, 34 and 35 series, can be removed without disconnecting the push-rod and clevis. The hydraulic master cylinder, on all series equipped with power brakes, can be removed and serviced without removing the vacuum cylinder from the car.

1. Be sure the area around master cylinder is clean, then disconnect the hydraulic lines at the master cylinder. Plug or tape end of line to prevent entrance of dirt, or loss of brake fluid.

2. On 30, 31 and 32 series, remove the push-rod to brake pedal clevis pin.

3. Remove master cylinder by removing the attaching nuts.

4. Drain master cylinder.

Install

1. To install the standard brake master cylinder on 33, 34 and 35 series:

   a. Lubricate push rod with a light film of lubricant, Part No. 567196 to facilitate positioning of rubber boot on push-rod after master cylinder has been installed.

   b. Position master cylinder against cowl, push boot onto push-rod and guide push-rod into master cylinder piston cavity.

   c. Install the attaching nuts and lockwashers. Torque nuts 20 to 27 ft. lbs.

   d. From inside car, pull boot along push-rod toward clevis until boot is fully extended. Check brake pedal as outlined under BRAKE PEDAL ADJUSTMENTS (Standard Brake).

2. To install the standard brake master cylinder on 30, 31 and 32 series:

   a. Position the master cylinder against cowl and install the attaching nuts. Torque nuts 20 to 28 ft. lbs.

   b. Install the push-rod to brake pedal clevis pin.

3. To install the power brake master cylinder:

   a. Position a new filter on the flange of the master cylinder. (Moraine Power Brake Only)

   b. Position master cylinder so that push-rod enters cavity in master cylinder piston.

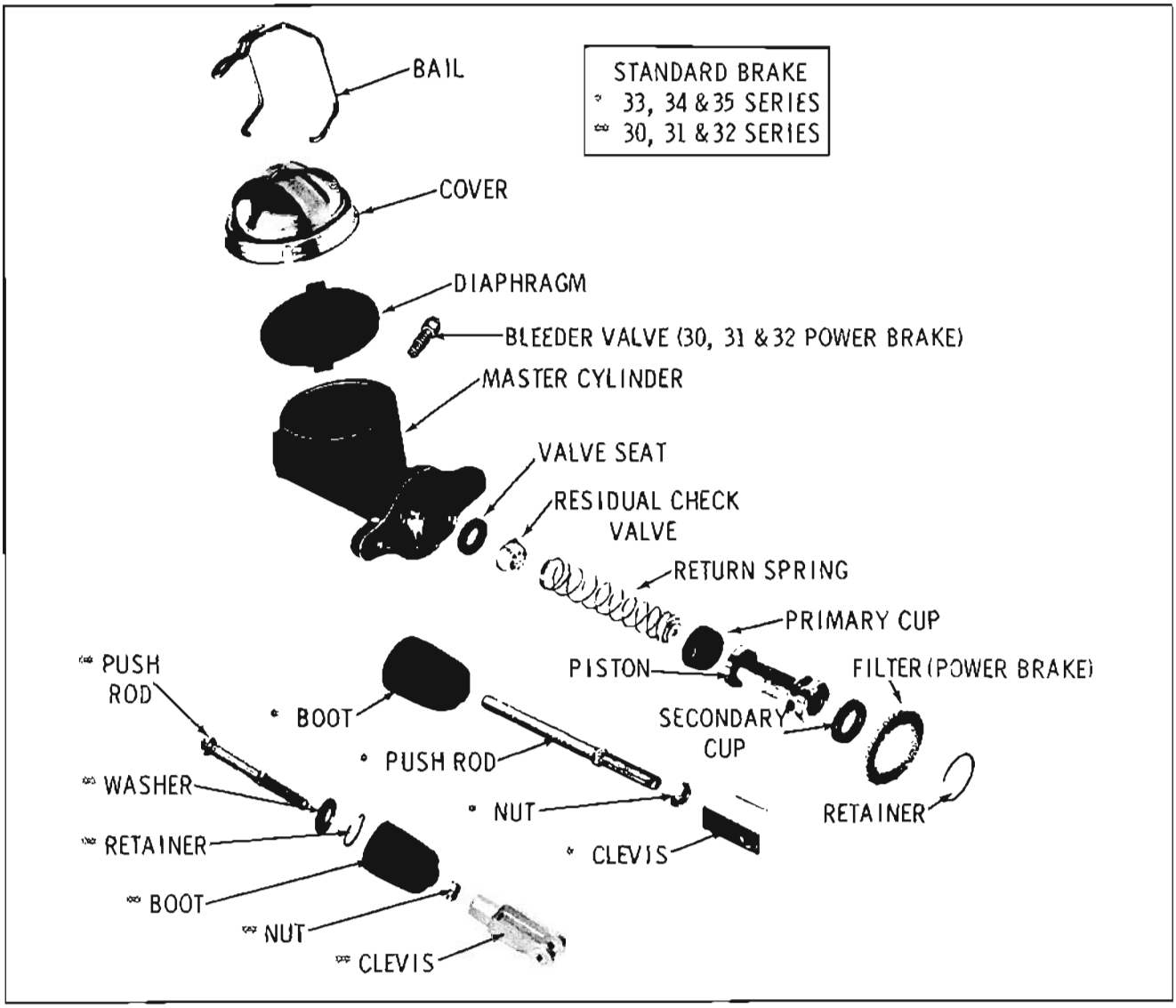


Fig. 11-11 Master Cylinder (Moraine)

NOTE: If a new push-rod was installed, adjust push-rod as outlined under PUSH-ROD ADJUSTMENT.

c. Install master cylinder attaching nuts and lockwashers. Torque 20 to 27 ft. lbs.

4. Install hydraulic line to master cylinder.

5. Fill master cylinder reservoir with Brake Fluid, Super No. 11 and bleed all wheel cylinders as outlined under BLEEDING OF LINES.

Disassembly (Figs. 11-11 & 11-12)

1. Standard brake - remove boot from master cylinder.

2. Remove the retaining ring from the bore of the master cylinder. On 30, 31 and 32 series, remove the push-rod.

3. Remove the piston primary cup, spring and residual check valve from bore of master cylinder.

4. On Moraine power and standard master cylinder, remove the rubber valve seat washer from cylinder bore with a wire hook.

5. Power brake - remove filter from flange of master cylinder.

6. On 30, 31 and 32 series power brake master cylinder, remove the bleeder valve.

CLEANING AND INSPECTION

1. Wash all parts in brake 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 secondary seal for a swelling or distorted condition. Replace if damaged. If such a condition exists, the entire system should be flushed (See FLUSHING HYDRAULIC SYSTEM) and all rubber parts in the wheel cylinders replaced.

3. Inspect the master cylinder bore for scores, rust, pits or etches. If any of these conditions exist, the complete master cylinder must be serviced as an assembly.

CAUTION: Do not attempt to hone the master cylinder bore as a means of salvaging the cylinder assembly. Reconditioning of the bore leaves the walls sufficiently rough to cause premature failure of the rubber cups. It also

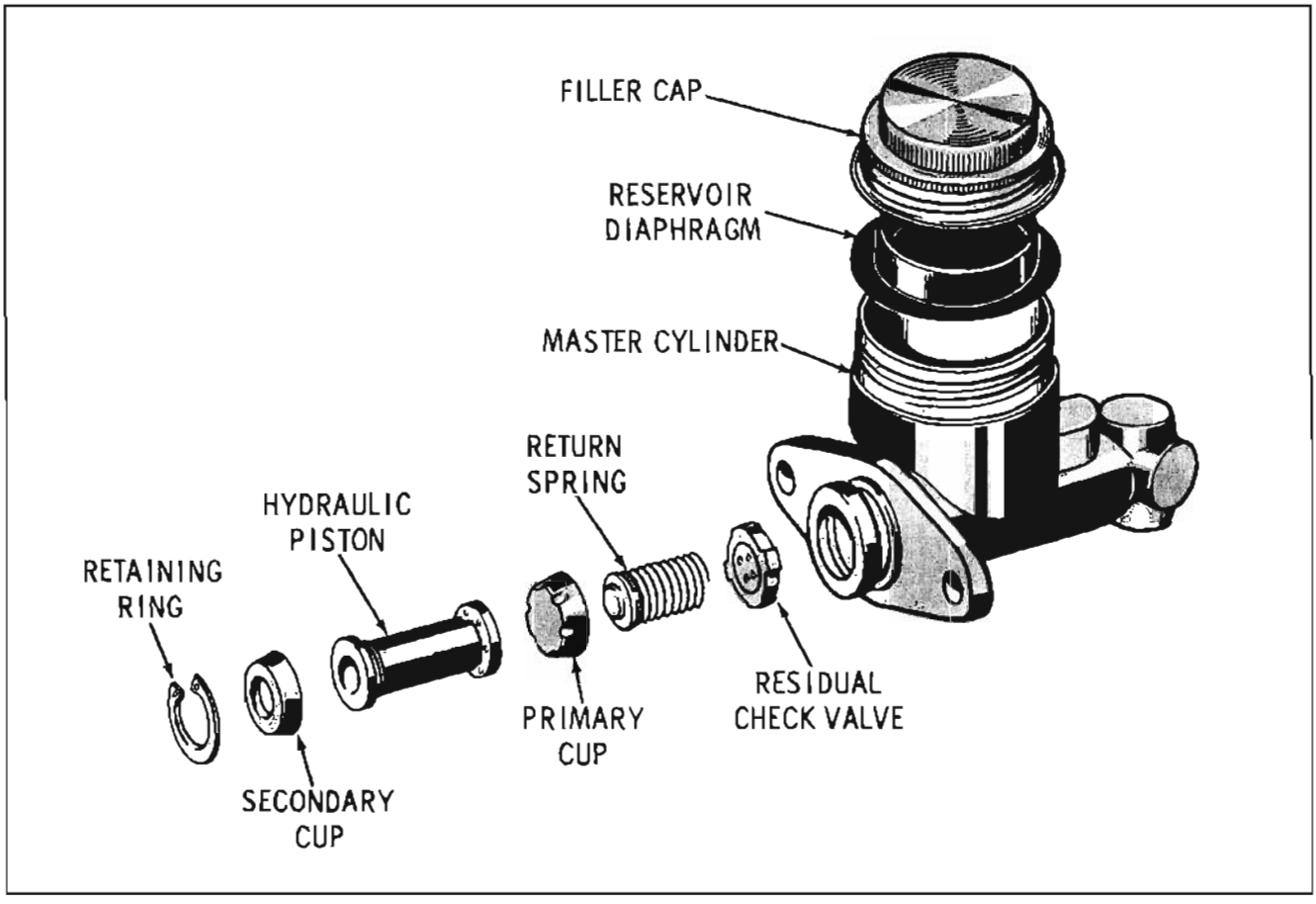


Fig. 11-12 Master Cylinder (Bendix)

enlarges the bore to the extent that the standard size piston and seals will not fit properly.

Assembly (Figs. 11-11 & 11-12)

1. Lubricate master cylinder bore and all rubber parts with Brake Fluid Super No. 11.
2. Install check valve rubber washer against the shoulder inside the master cylinder bore.
3. Install large end of spring over residual check valve, then install the assembly into the bore (check valve end first).
4. Install primary cup over end of spring (dish side toward spring).
5. On all except 30, 31 and 32 series (manual brake) install piston into bore and while compressing spring, install retaining ring.
6. On 30, 31 and 32 manual brake series install piston and push-rod and while compressing spring, install retaining ring.
7. Standard brake - install boot over lip of master cylinder casting.
8. On 30, 31 and 32 series power brake master cylinder, install bleeder valve.

WHEEL CYLINDERS

REMOVE AND INSTALL

1. Remove brake drums and shoes as outlined under DRUM AND BRAKE ASSEMBLIES, REMOVE.
2. Front wheel cylinder:
   a. Remove brake line from brake hose.
   b. Remove the brake hose retainer clip at the frame bracket.
   c. Remove brake hose from wheel cylinder.
3. Rear wheel cylinder - remove the brake line from the wheel cylinder.
4. Remove the wheel cylinder to backing plate attaching bolts and remove wheel cylinder.

To install, reverse the removal procedure, torque wheel cylinder to backing plate bolts 8 to 16 ft. lbs. and bleed the lines. (See BLEEDING OF LINES).

DISASSEMBLY (Fig. 11-13)
(30, 31, 32 & 33 Series)

The internal wheel cylinder boots, used on the 30, 31, 32 and 33 series, should be disassembled only when they are visibly damaged or leaking fluid.

Wheel cylinders having torn, cut, or heat cracked boots should be completely overhauled.

Inspection for leakage may be accomplished at the boot center hose after removal of the link pin. Fluid coatings on the piston within the cylinder and on the end of the link pin are normal, as the cylinder contains a porous Durex piston which is impregnated with a corrosion inhibiting fluid. Fluid spilling from the boot center hole, after the link pin is removed, indicates cup leakage and the necessity of completely overhauling the cylinder.

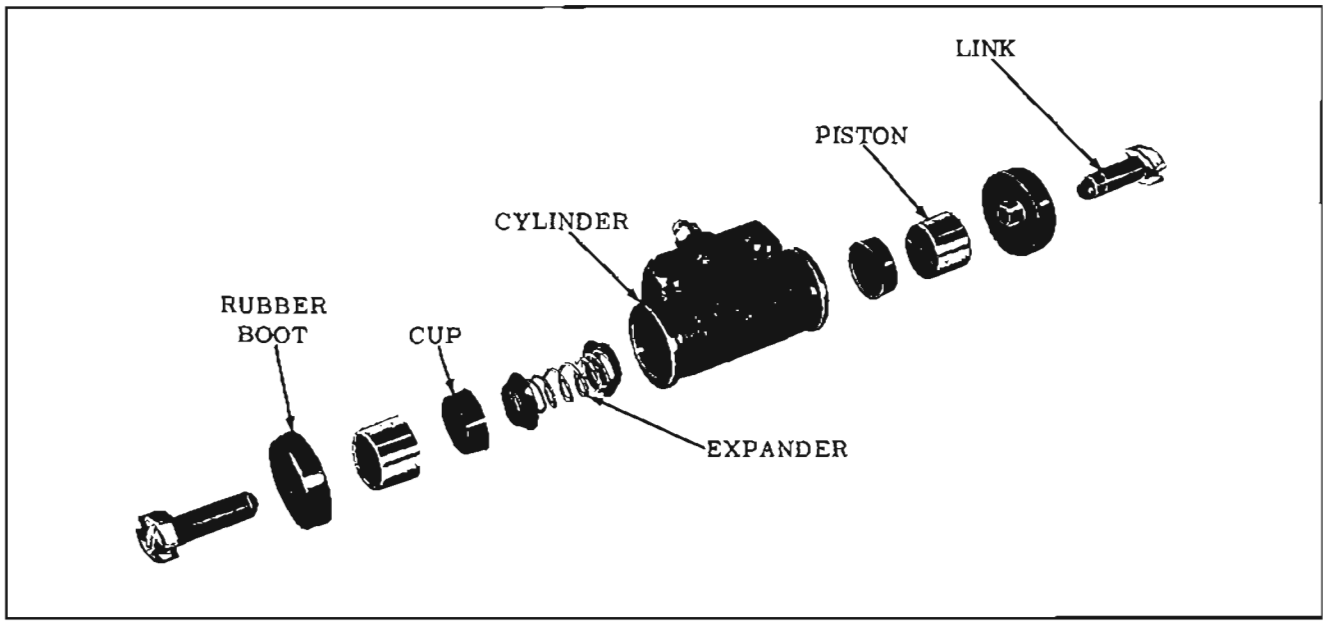


Fig. 11-13 Wheel Cylinder (30, 31, 32 & 33 Series)

1. Pull boots from cylinder ends with pliers and discard boots.

2. Remove and discard pistons and cups.

CLEANING AND INSPECTION

1. Inspect cylinder bore. Check for staining or corrosion. It is best to discard a corroded cylinder.

   NOTE: Staining is not to be confused with corrosion. Corrosion can be identified as pits or excessive bore roughness.

2. Polish any discolored or stained area with crocus cloth by revolving the cylinder on the cloth supported by a finger. Do not slide the cloth in a lengthwise manner under pressure. Do not use any other form of abrasive or abrasive cloth.

3. Rinse the cylinder in Declene or brake fluid.

4. Shake excess cleaning fluid from the cylinder. Do not use a rag to dry the cylinder as lint from the rag cannot be kept from the cylinder bore surfaces.

ASSEMBLY

1. Lubricate the cylinder bore and counterbore with brake fluid and insert spring-expander assembly.

2. Install new cups. (Be sure cups are lint and dirt free.) Do not lubricate cups prior to assembly.

3. Install new Durex pistons as they are received in the parts package. Do not lubricate pistons with brake fluid.

4. Press new boots into cylinder counterbores by hand. Do not lubricate boots prior to assembly.

DISASSEMBLY (34, 35, 36, 38 & 39 Series)

1. Remove links and rubber boots.

2. Remove pistons, cups, expanders and spring from wheel cylinder bore.

CLEANING AND INSPECTION

1. Wash all metal parts in brake flushing fluid and blow out all passages with compressed air.

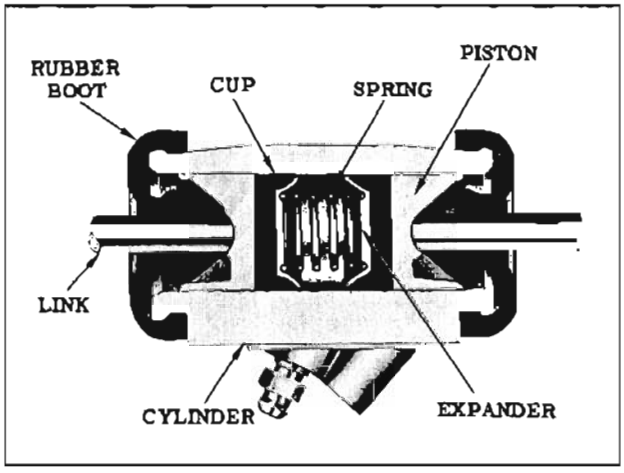


Fig. 11-14 Wheel Cylinder (34, 35, 36, 38 & 39 Series)

2. Inspect cups for a swelling or distorted condition, replace if damaged. If a swelling condition exists, the entire hydraulic system should be flushed (see FLUSHING HYDRAULIC SYSTEM) and all the rubber parts in the hydraulic system should be replaced.

3. Inspect the wheel cylinder bore for scores, rust, pits or etches. If any such conditions exist, the complete wheel cylinder will have to be replaced as an assembly.

   CAUTION: Do not attempt to recondition a wheel cylinder bore as a means of salvaging the cylinder. Reconditions of the bore leaves the walls sufficiently rough to cause premature failure of the rubber cups. It also enlarges the bore to the extent that the standard size pistons and seals will not fit properly.

ASSEMBLY

Lubricate the bore of the wheel cylinder and all rubber parts with Brake Fluid Super No. 11 and assemble as shown in Fig. 11-14.

DRUMS AND BRAKE ASSEMBLIES

INSPECTION

Whenever brake drums are removed, they should be inspected for scores, deep grooves, cracks and out of round.

Cracked drums must be replaced. However, cracks running circumferentially at the back corner of drum where the cast iron blends into the steel portion of the drum are of no consequence and drums should not be replaced.

NOTE: Grooves extending around the entire

braking surface of the brake drum are permissible providing the edges of the grooves that contact the shoes are smooth.

Drum out-of-round can be measured with a dial indicator and extension rod. Out-of-round measurements exceeding .005" front drum and .006" rear drum, (total indicator reading) require turning or replacement of drum.

TURNING DRUMS

If irregularities in the braking surface of the drum cannot be removed with emery cloth or out of round exceeds .005" front drum and .006" rear drum (total indicator reading), the drum should be turned to .060" greater than the original inside diameter; that is, after being turned, the diameter should be 11.060" for all except 30, 31 and 32 series, or 9.560 on 30, 31, 32 and 33 series. Oversize brake linings must be used with turned drums.

REPLACING DRUMS

Whenever new drums are to be installed, the braking surface of the drum must be thoroughly cleaned with lacquer thinner to remove the rustproof coating.

BRAKE LINES

When replacing a damaged brake line, the damaged section should be cut off and repaired with steel brake tubing, listed under Group 8.964 in the Chassis Parts Book. Flare connections must be a double lap. Follow Flaring Tool Manufacturer's instructions for proper flaring of the double lap flare

Refer to Figs. 11-15 and 11-16 for brake line routing and attachment.

BRAKE LINING

If linings are worn nearly flush with the rivets, new linings should be installed.

When brake lining replacement is necessary, it is recommended that both front or both rear linings be replaced at the same time.

FRONT BRAKE SHOES AND BACKING PLATE

Remove (Figs. 11-17 & 11-18)

1. Hoist car.

2. Remove the hub and drum assembly and the

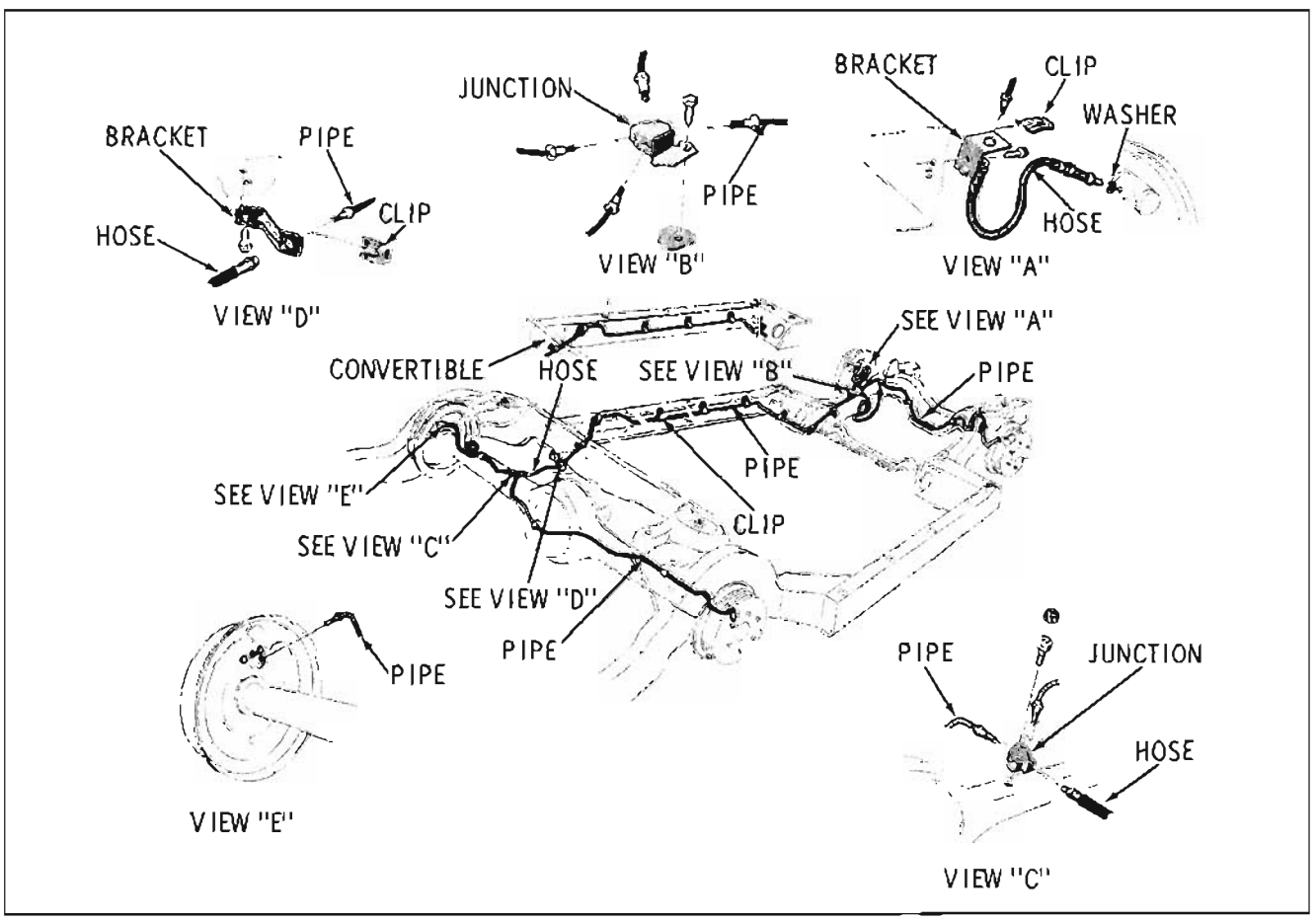


Fig. 11-15 Brake Lines (33, 34, 35, 36, 38 & 39 Series)

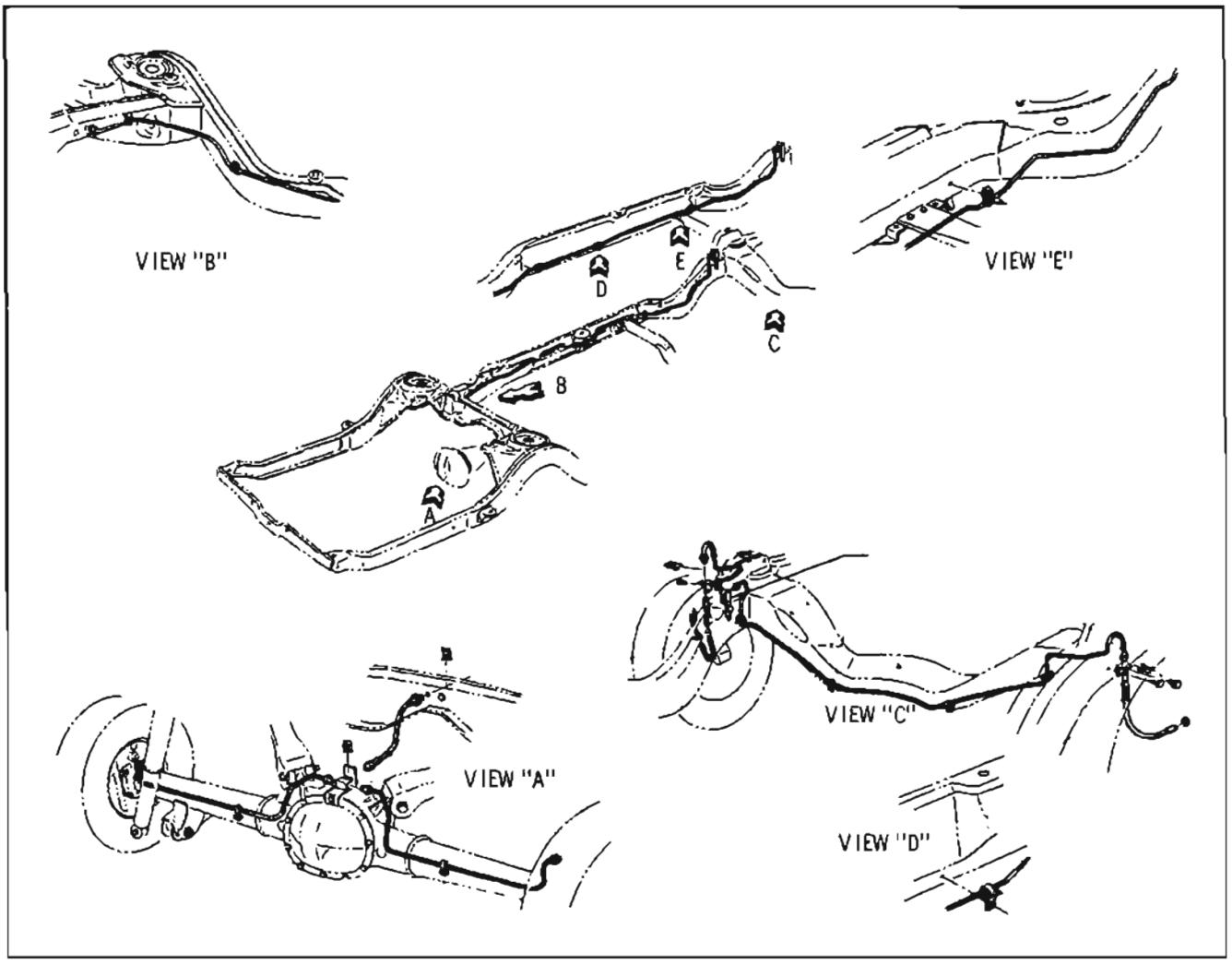


Fig. 11-16 Brake Lines (30, 31 & 32 Series)

inner bearing inner race from the steering knuckle.

NOTE: It may be necessary to back off the brake shoe adjustment before the brake drum can be removed. To back off the brake shoe adjustment, refer to Figs. 11-19 and 11-20.

3. Remove the primary and secondary shoe return springs and the actuating link.

4. Remove brake shoe hold-down springs, pins and washers and the adjuster lever and return spring.

5. Spread shoes to clear wheel cylinder links, then remove the primary and secondary shoes as an assembly.

6. Remove the primary to secondary shoe spring and the adjusting screw.

7. If the front backing plate is to be removed, proceed as follows:

   a. Loosen lock tab from anchor pin, then remove the anchor pin bolt.

   b. Remove the brake hose from the brake line.

   c. Remove the wheel cylinder and brake hose from the backing plate.

   d. Remove the plain arm to steering knuckle to backing plate bolts and nuts, then remove the backing plate.

REAR BRAKE SHOES AND BACKING PLATE

Remove

1. Hoist car, remove wheel and brake drum.

   NOTE: It may be necessary to back off the brake shoe adjustment before the brake drum can be removed. To back off brake shoe adjustment, refer to Figs. 11-19 & 11-20.

2. Disconnect the parking brake cable from the operating lever.

3. Remove the brake shoe return springs, actuating link and guide.

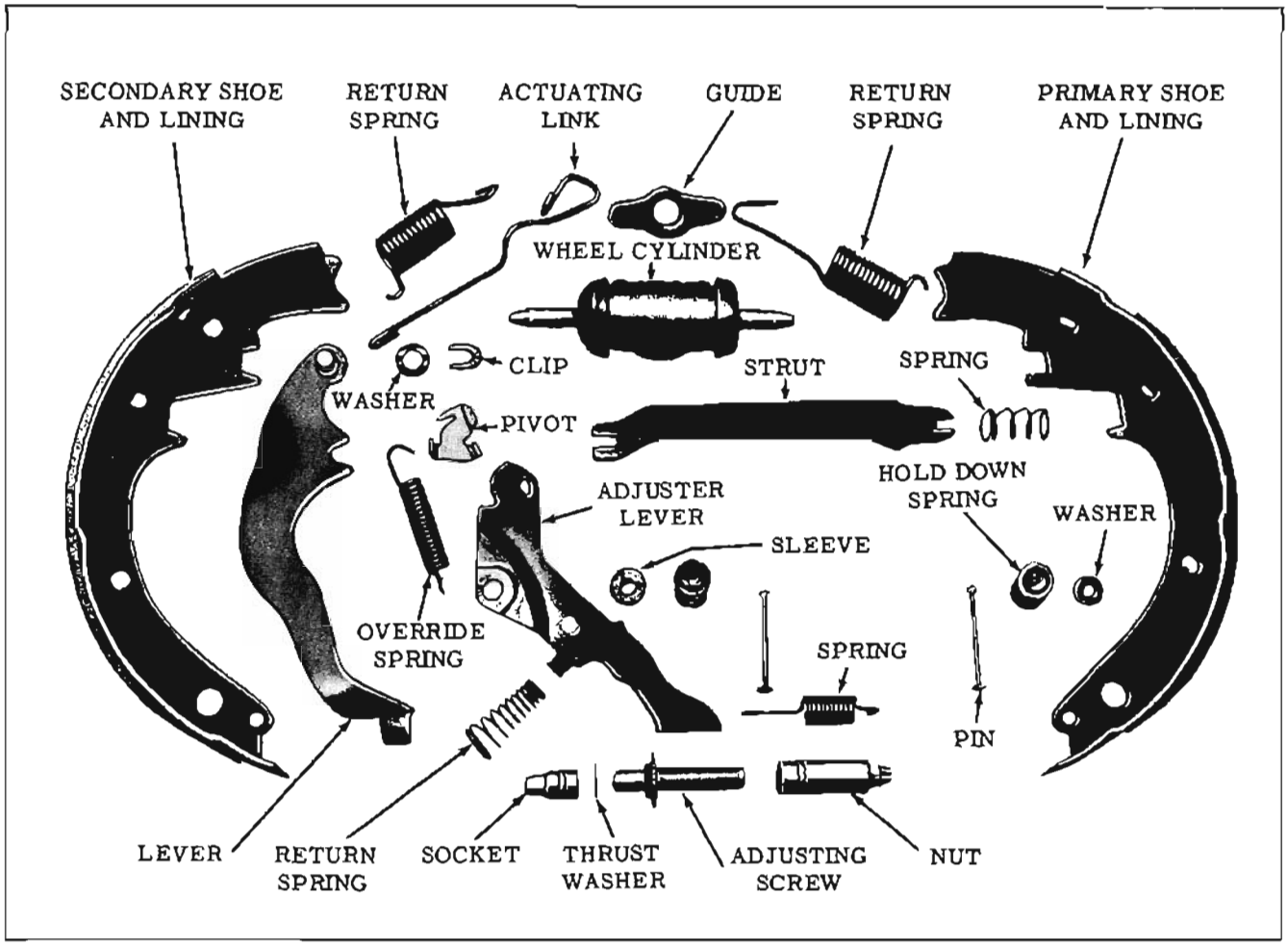


Fig. 11-17 Brake Assembly (34, 35, 36, 38 & 39 Series)

4. Remove the brake shoe hold-down springs, the adjuster lever and return spring and the parking brake lever strut and spring.

5. Spread shoes to clear wheel cylinder links, then remove the brake shoes as an assembly.

6. If necessary to remove the rear backing plate, proceed as follows:
   a. Remove the axle shaft. (Refer to AXLE SHAFT-REMOVE Section 9)
   b. Remove brake line from wheel cylinder, remove wheel cylinder from backing plate.
   c. Disconnect the parking brake cable from the backing plate.
   d. Remove the backing plate.

CLEANING AND INSPECTION

1. Inspect linings for wear. If linings are worn nearly flush with rivets, new linings should be installed.

2. Check wheel cylinder for leakage by loosening the boot on 34, 35, 36, 38 and 39 series or by removing the link on 30, 31, 32 and 33 series. If leak exists, remove wheel cylinder for service or replacement.

3. Clean inner surfaces of brake backing plates and all shoe contacting points.

4. Clean exposed portions of parking brake cables.

5. Disassemble the adjusting screw assembly. Clean and inspect as follows:
   a. Check thrust washer and mating surfaces for burrs or excessive wear.
   b. Inspect teeth on sprocket for wear.
   c. Remove all foreign material from adjusting screw and nut. Nut must rotate freely on threads.

6. Check the foot of the adjuster lever for wear. Replace if necessary.

7. Check the override pivot for wear or deformed parts.

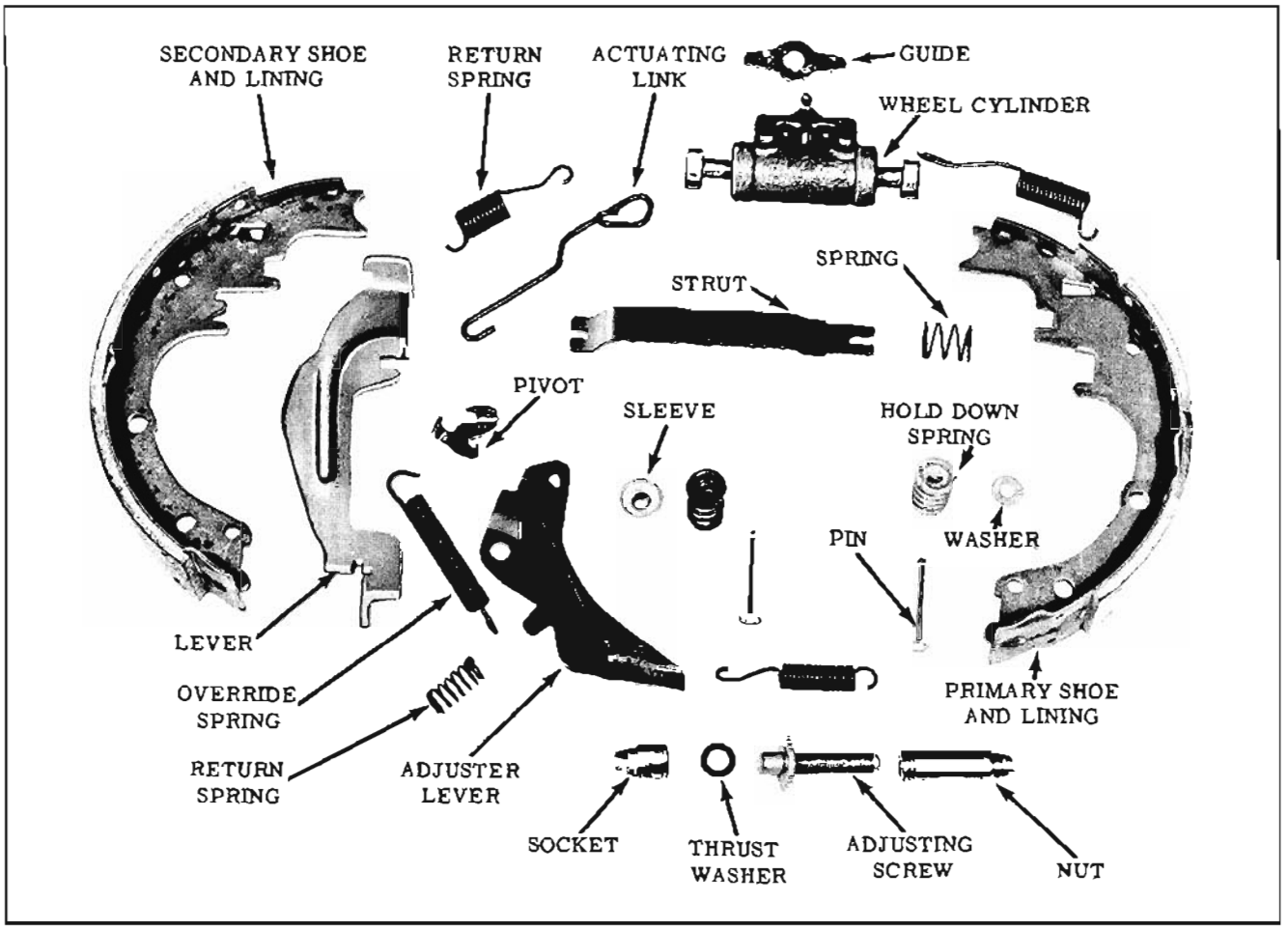


Fig. 11-18 Brake Assembly (30, 31, 32 & 33 Series)

8. Check brake drum for buildup of rust and dirt at outer circumference. Remove buildup so that drums can be installed over preadjusted linings. Check drum for cracks and an out-of-round condition.

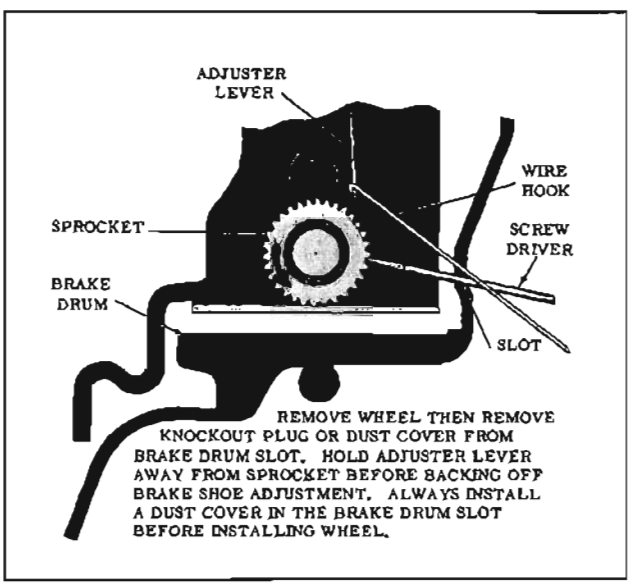


Fig. 11-19 Backing Off Brake Shoe Adjustment (34, 35, 36, 38 & 39 Series)

FRONT BRAKE AND BACKING PLATE

Install

1. If the front backing plate was removed, install as follows:

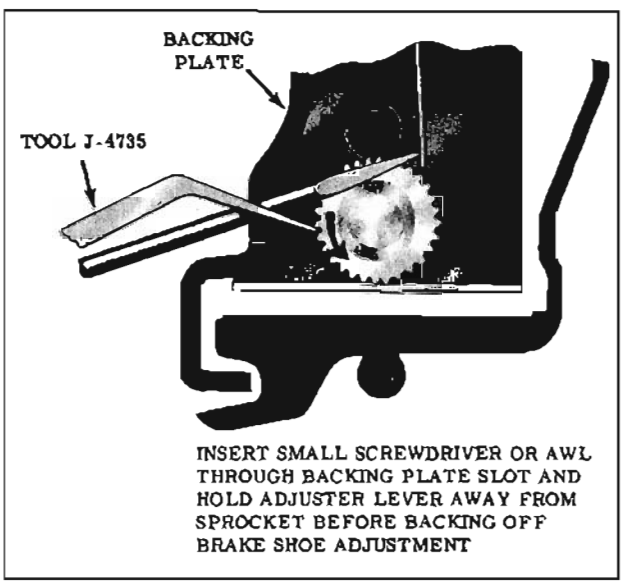


Fig. 11-20 Backing Off Brake Shoe Adjustment (30, 31, 32 & 33 Series)

a. Position the backing plate on the steering knuckle. Install the two plain arm to steering knuckle to backing plate bolts and nuts. Torque nuts 100 to 140 ft. lbs. on 34, 35, 36, 38 and 39 series and 60 to 82 ft. lbs. on 30, 31, 32 and 33 series.

b. Install the wheel cylinder. Torque attaching nuts 8 to 16 ft. lbs. Connect brake hose to brake line. Tighten brake line fittings 8 to 12 ft. lbs.

c. Install the brake hose retainer.

d. Position a new lock tab over the anchor pin bolt and install bolt.

e. Align the slot in the lock tab with the boss on the wheel cylinder. Torque anchor pin bolt 120 to 145 ft. lbs. on 34, 35, 36, 38 and 39 series, 80 to 105 ft. lbs. on 30, 31, 32 and 33 series. Bend lock tab down until it contacts the anchor pin bolt head.

2. Lubricate the adjusting screw threads, thrust washer mating surfaces and backing plate ledges with brake lubricant, Part No. 987786.

3. Assemble the adjusting screw.

4. Attach the primary to secondary shoe spring to the shoes, and install the adjusting screw. The primary to secondary shoe spring must not contact the adjusting screw sprocket.

IMPORTANT: THE RIGHT FRONT ADJUSTING SCREW HAS LEFT HAND THREADS AND CAN BE IDENTIFIED BY TWO FLAT GROOVES IN THE ADJUSTING SCREW NUT. THE LEFT FRONT ADJUSTING SCREW HAS RIGHT HAND THREADS AND CAN BE IDENTIFIED BY TWO "V" GROOVES IN THE ADJUSTING SCREW NUT.

5. Position shoe assembly on the backing plate. Be sure wheel cylinder links are properly positioned in the shoe notches.

6. Position the upper end of the actuating link on the brake shoe guide.

7. Engage the actuating link with the override pivot then position the adjuster lever and return spring on the secondary shoe. Fasten with the hold-down spring assembly.

NOTE: The front brake on 34, 35, 36, 38 and 39 series use four hold-down springs identified with the numeral "1" stamped on the outer face. The 30, 31, 32 and 33 series use two hold-down springs identified with the numeral "4" stamped on the outer face.

8. Install the remaining hold-down springs.

9. Install the primary and secondary brake shoe return springs.

10. Adjust brake shoes as outlined under ADJUSTMENTS - BRAKE SHOE.

11. Install the front hub and drum assembly. Adjust wheel bearings as outlined under WHEEL BEARING ADJUSTMENT, Section 9.

12. If wheel cylinder was removed, bleed brakes.

13. Check fluid level in master cylinder. Fluid level should be no more than 1/4" below the reservoir opening.

14. Check brake pedal travel to be sure it is within specifications, then road test car for proper operation of the brake system.

REAR BRAKE AND BACKING PLATE

Install

1. If the backing plate was removed, install as follows:

a. Install wheel cylinder on backing plate. Torque attaching bolts 8 to 12 ft. lbs.

b. Position backing plate on axel housing and install the axel shaft. Torque the backing plate to axel housing 40 to 55 ft. lbs.

c. Install the parking brake cable on the backing plate.

2. Lubricate the adjusting screw threads, thrust washer mating surfaces and backing plate ledges with brake lubricant, Part No. 987786.

3. Pull parking brake cables forward and rearward through conduits, lubricate freely with Lithium Soap Grease and return cable to normal position. Remove any excess lubricant.

4. Install the parking brake lever to the secondary shoe.

5. Assemble the adjusting screw.

6. Attach the primary to secondary shoe spring to the shoes, and install the adjusting screw. The primary to secondary shoe spring must not contact the adjusting screw sprocket.

IMPORTANT: THE RIGHT HAND REAR ADJUSTING SCREW HAS LEFT HAND THREADS AND CAN BE IDENTIFIED BY TWO FLAT GROOVES IN THE ADJUSTING NUT. THE LEFT REAR ADJUSTING SCREW HAS RIGHT HAND THREADS AND CAN BE IDENTIFIED BY TWO "V" GROOVES IN THE ADJUSTING SCREW NUT.

7. Position shoe assemblies on the backing plate. Be sure wheel cylinder links are properly positioned in the shoe notches. Install the parking brake strut and spring.

8. Position the upper end of actuating link over the anchor pin.

9. Engage the actuating link with the override pivot, then position the adjuster lever and return spring on the secondary shoe. Fasten with the hold-down spring assembly.

   NOTE: The rear brake uses two hold-down springs, with the retaining pins being identified with the numeral "8" stamped on the outer face.

10. Install the remaining hold-down spring.

11. Install the parking brake cable on the parking brake lever.

12. Install the primary and secondary brake shoe return springs.

13. Adjust brake shoes as outlined under ADJUSTMENTS - BRAKE SHOE.

14. Install the rear brake drums and wheels.

15. Adjust the parking brake.

16. If the wheel cylinder was removed, bleed brakes.

17. Check fluid level in master cylinder. Fluid level should be no more than 1/4" below the reservoir opening.

18. Check brake pedal travel to be sure it is within specifications, then road test car for proper operation of the brake system.

POWER BRAKES

DESCRIPTION

Four different power brake units are used. The 30, 31 and 32 series use a Moraine or a Kelsey-Hayes brake. The 33, 34, 35, 36, 38 and 39 series use a Moraine or a Bendix brake.

The Moraine vacuum units are identical, with the exception of the mounting and the operating rod assembly, and service procedures for both units will be covered under one write-up.

Internally, all units differ in construction but all units are designed to seal off atmospheric pressure when the pedal is in the released position. The hydraulic master cylinder on the power brake units are similar in construction and service to the standard brake master cylinder. For

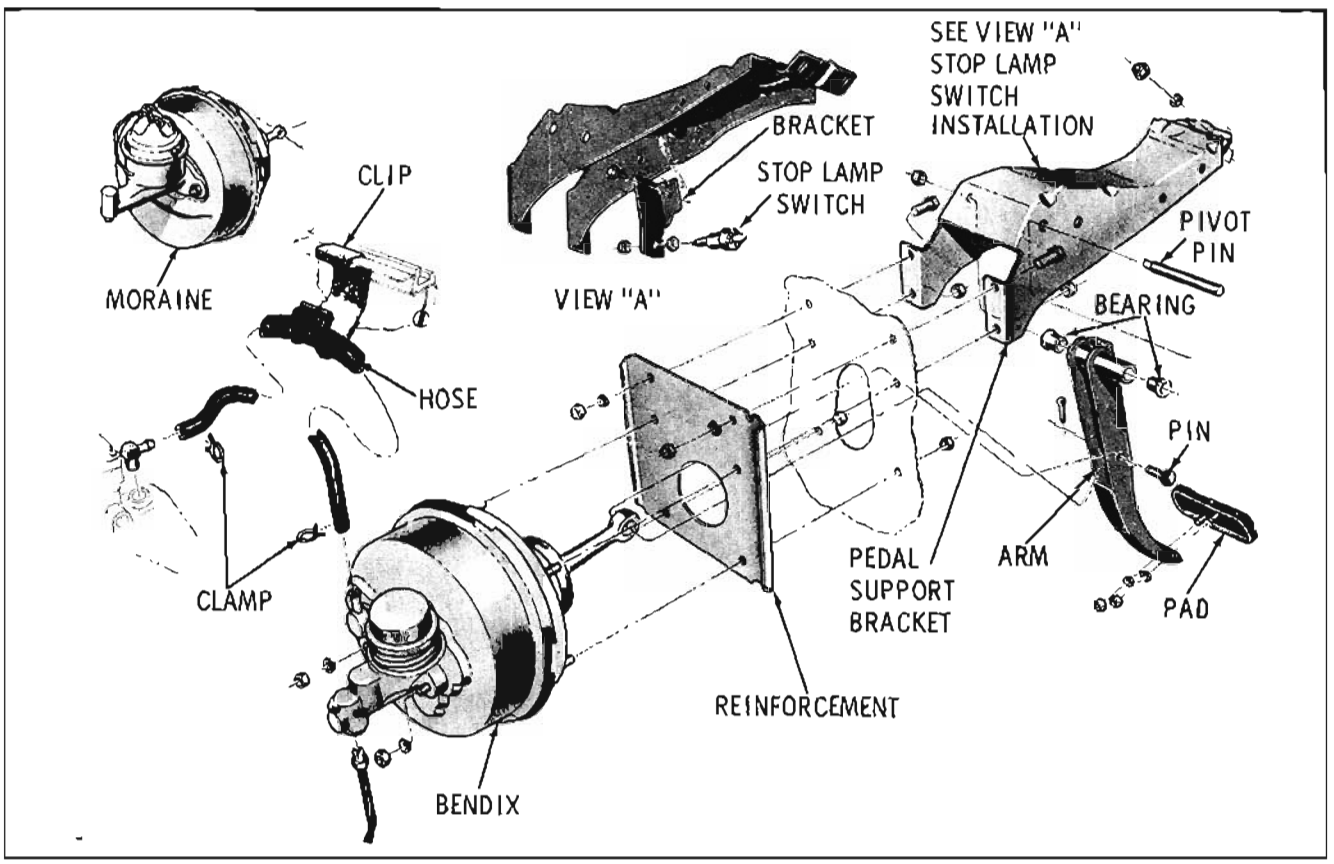


Fig. 11-21 Power Brake Installation (33, 34, 35, 36, 38 & 39 Series)

removal and service of the power brake master cylinder, refer to MASTER CYLINDER.

A vacuum check valve traps vacuum inside the power brake unit, at the highest manifold vacuum available, making possible brake application after the engine has been shut off for several hours or more. If the engine should stall, several applications of the brakes can still be made with vacuum assist. After the vacuum supply is exhausted, brake applications can still be made; however, more effort is required due to the lack of vacuum assist.

MINOR SERVICE OPERATIONS

BRAKE PEDAL OR BRACKET

Remove and Install

The power brake pedal and mounting bracket is attached as shown in Fig. 11-21 or Fig. 11-22.

To install, lubricate nylon bushings and clevis pin with lubricant, Part No. 567196. Torque pivot pin nut on 33, 34, 35, 36, 38 and 39 series 10 to 18 ft. lbs. On 30, 31 and 32 series, check and adjust brake pedal height if necessary. Check and adjust stop lamp switch if necessary.

POWER BRAKE UNIT

Remove and Install (Figs. 11-21 or 11-23)

1. Disconnect hydraulic line. Plug or tape line to prevent dirt from entering the hydraulic system.
2. Disconnect the vacuum line from the vacuum check valve.
3. Disconnect the operating rod from the power brake pedal.
4. Remove the four vacuum cylinder unit to cowl attaching nuts.
5. To install, reverse removal procedure. Torque the vacuum cylinder to cowl bolts 20 to 27 ft. lbs. Fill master cylinder with Brake Fluid Super No. 11 and bleed entire system. (See BLEEDING OF LINES) On 30, 31 and 32 series, check and adjust brake pedal height. If necessary.

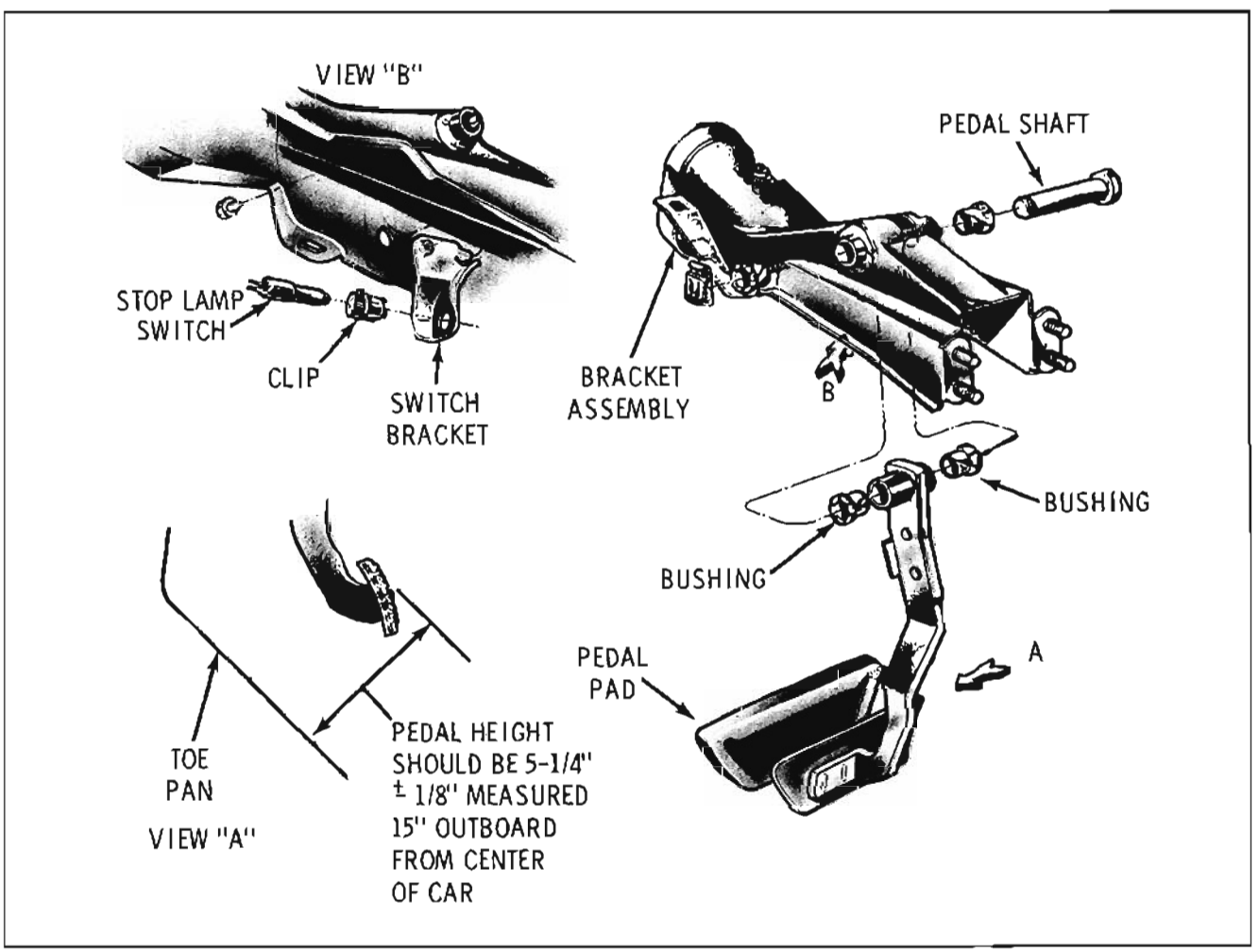


Fig. 11-22 Power Brake Mounting (30, 31 & 32 Series)

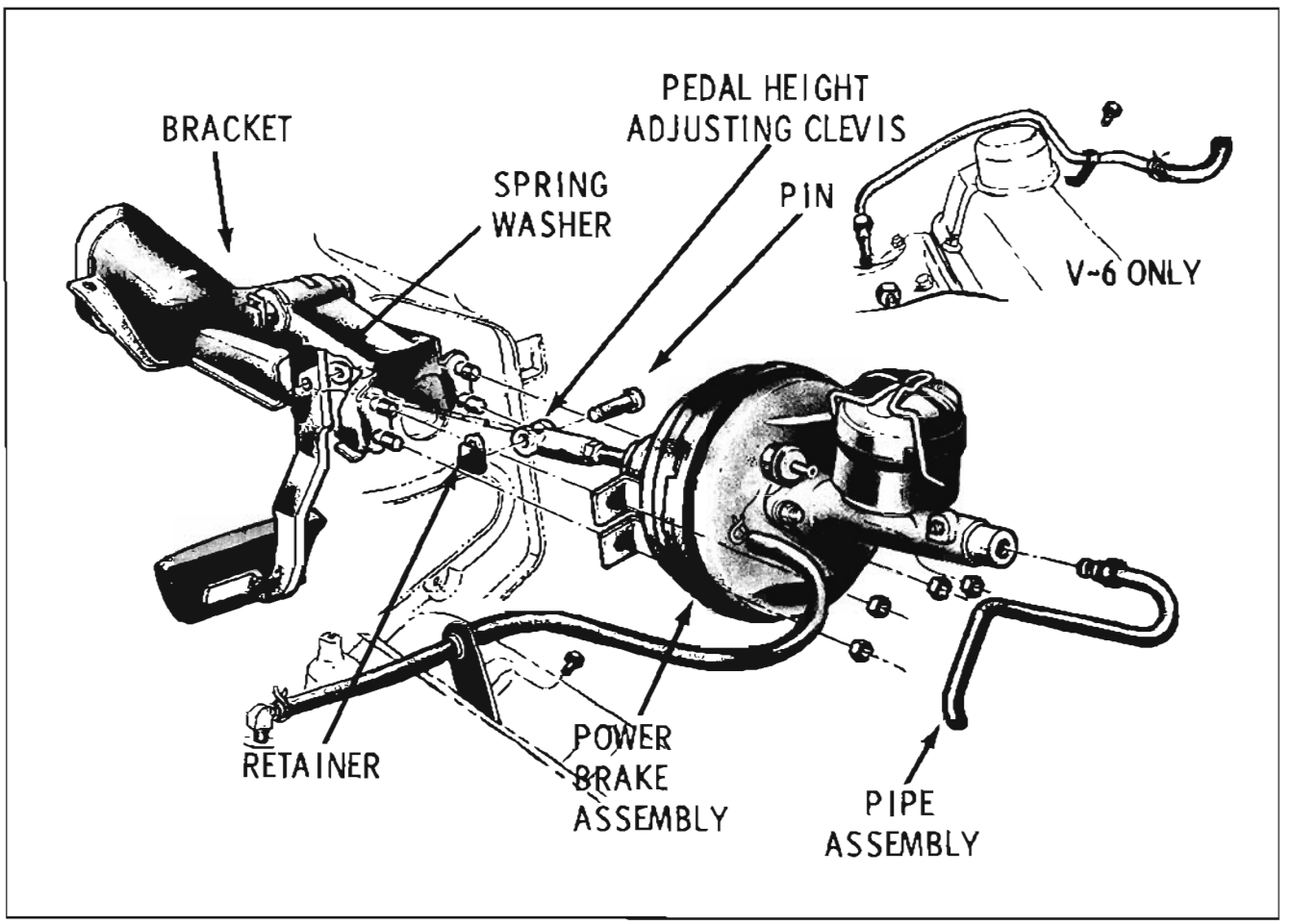


Fig. 11-23 Power Brake Installation (30, 31 & 32 Series)

MORAINE POWER BRAKE

PRINCIPLES OF OPERATION

Released Position (Fig. 11-24)

In the released position, both sides of the vacuum piston are open to vacuum. This allows the vacuum piston to be held in the released position by the vacuum piston return spring. This is accomplished as follows.

In the released position, the air valve is seated on the floating valve. Air, under atmospheric pressure, is shut off at the air valve. The floating valve is held away from the valve seat in the power piston. Vacuum, which is present at all times at the forward side of the vacuum piston, evacuates any existing air at the rear of the vacuum piston. This air is drawn through two small passages in the vacuum piston over the valve seat to the forward side of the vacuum piston.

The master cylinder piston push-rod, being attached to the vacuum piston assembly, is also held in the released position by the vacuum piston return spring. In the released position, the compensating port is open and fluid can flow in either direction between the master cylinder and the fluid reservoir. A slight pressure is maintained in the lines by the residual check valve.

As the pedal is depressed, the operating rod carries the air valve away from the floating valve. Further movement allows the floating valve to contact a seat in the vacuum piston, shutting off the vacuum to the rear of the vacuum piston. Air, under atmospheric pressure, can now enter through the air filter, travels past the air valve seat and through two passageways to the rear of the vacuum piston. With vacuum on the forward side and atmospheric pressure at the rear, a force is developed which moves the vacuum piston and the master cylinder piston push-rod in the apply direction.

The initial movement of the master cylinder piston in the apply direction closes the compensating port, sealing off the fluid reservoir from the master cylinder. Further movement of the master cylinder piston in the apply direction increases pressure in the master cylinder, forcing fluid past the residual check valve, through the lines and into the wheel cylinders to apply the brakes.

As the pressure in the master cylinder increases, the force on the end of the master

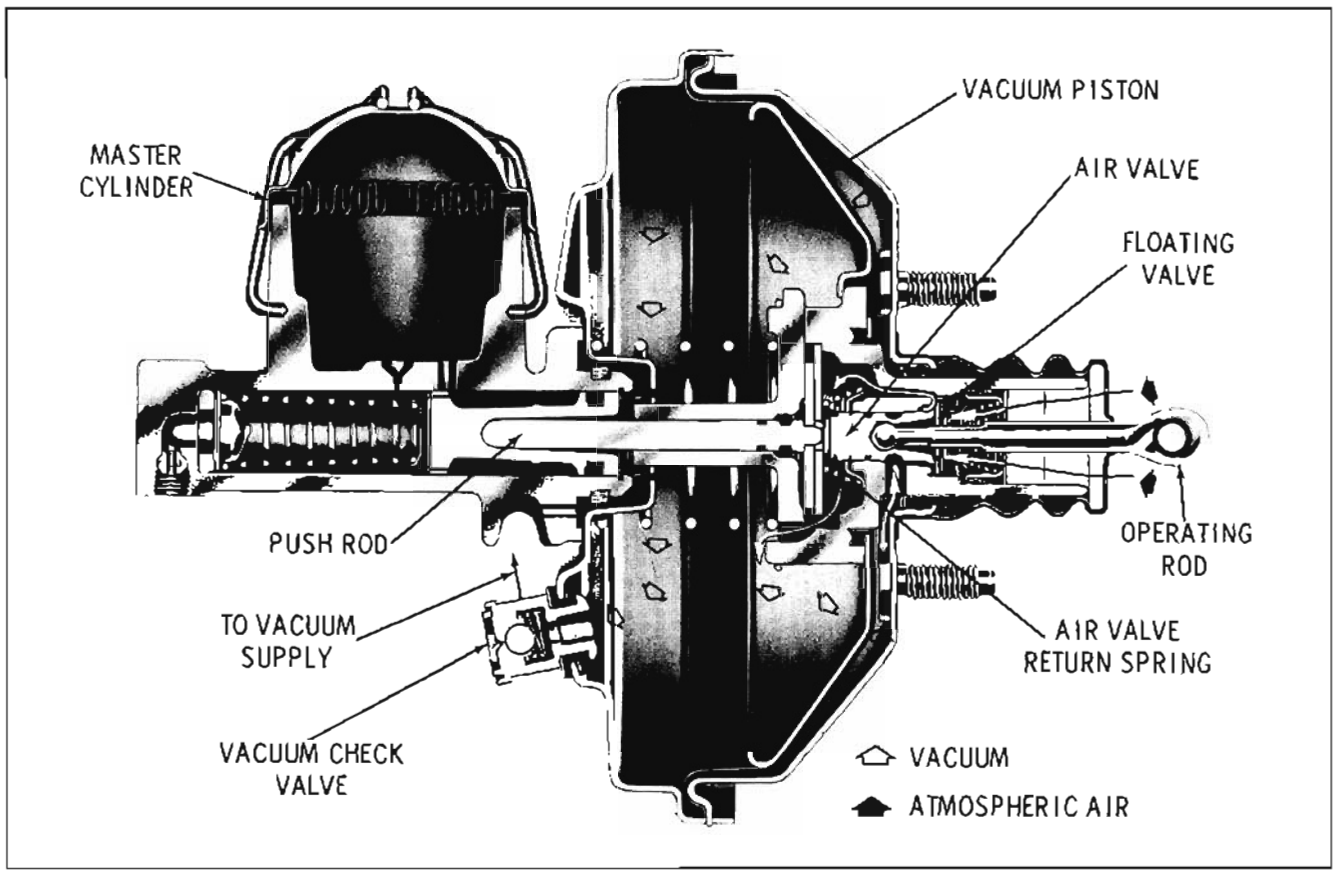


Fig. 11-24 Released Position

cylinder piston causes the piston push-rod reaction plate to move away from its stop and press against the reaction levers. The levers in turn, pivot and press against the end of the air valve and operating rod assembly. This allows approximately 30% of the load to be transferred back through the reaction system to the brake pedal. This gives the driver brake feel.

Holding (Fig. 11-26)

When the desired brake pedal pressure is obtained, the vacuum piston continues to move forward until the floating valve, which is still seated on the power piston, again seats on the air valve. The vacuum piston will remain stationary until pressure is applied or released at the brake pedal.

Releasing (Fig. 11-24)

As the pressure on the brake pedal is released, the air valve spring forces the air valve back until the snap ring contacts the vacuum piston. Further movement of the air valve unseats the floating valve from the vacuum piston. As the air valve seats on the floating valve, it shuts off the supply of air under atmospheric pressure. As the floating valve unseats from the vacuum piston, it opens the area to the rear of the vacuum piston to vacuum.

With vacuum on both sides of the vacuum piston, the vacuum piston return spring returns the vacuum piston together with the master cylinder piston push-rod into the released position. Brake fluid, under pressure, in the lines now flows back through the residual check valve and into the master cylinder reservoir.

DISASSEMBLY OF MORAINE POWER BRAKE (Figs. 11-27 or 11-28)

NOTE: Use extreme care to keep mineral oil or grease from coming in contact with hydraulic parts.

1. Deplete vacuum supply, then clean the outside of the power brake unit. Remove filler cap then empty brake fluid from master cylinder reservoir.

2. Clamp master cylinder in a vise with the operating rod up. Scribe an alignment mark on the top center of the front and rear housing.

3. Rotate the rear housing counterclockwise to separate the two housings. If the rear housing cannot be readily loosened, tap the rear housing lightly with a plastic hammer. (Fig. 11-29 or 11-30)

NOTE: When separating housings, maintain

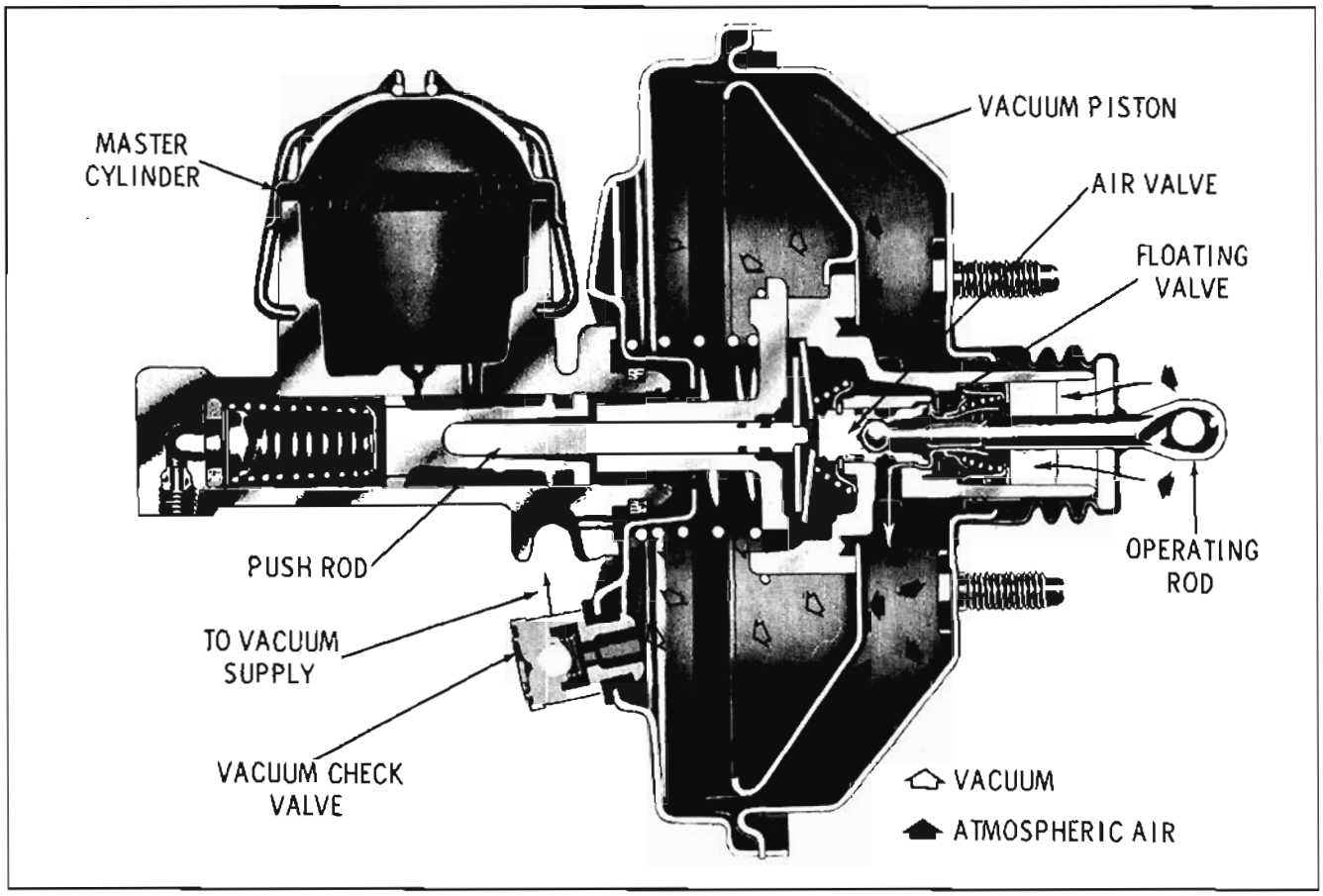


Fig. 11-25 Holding Position

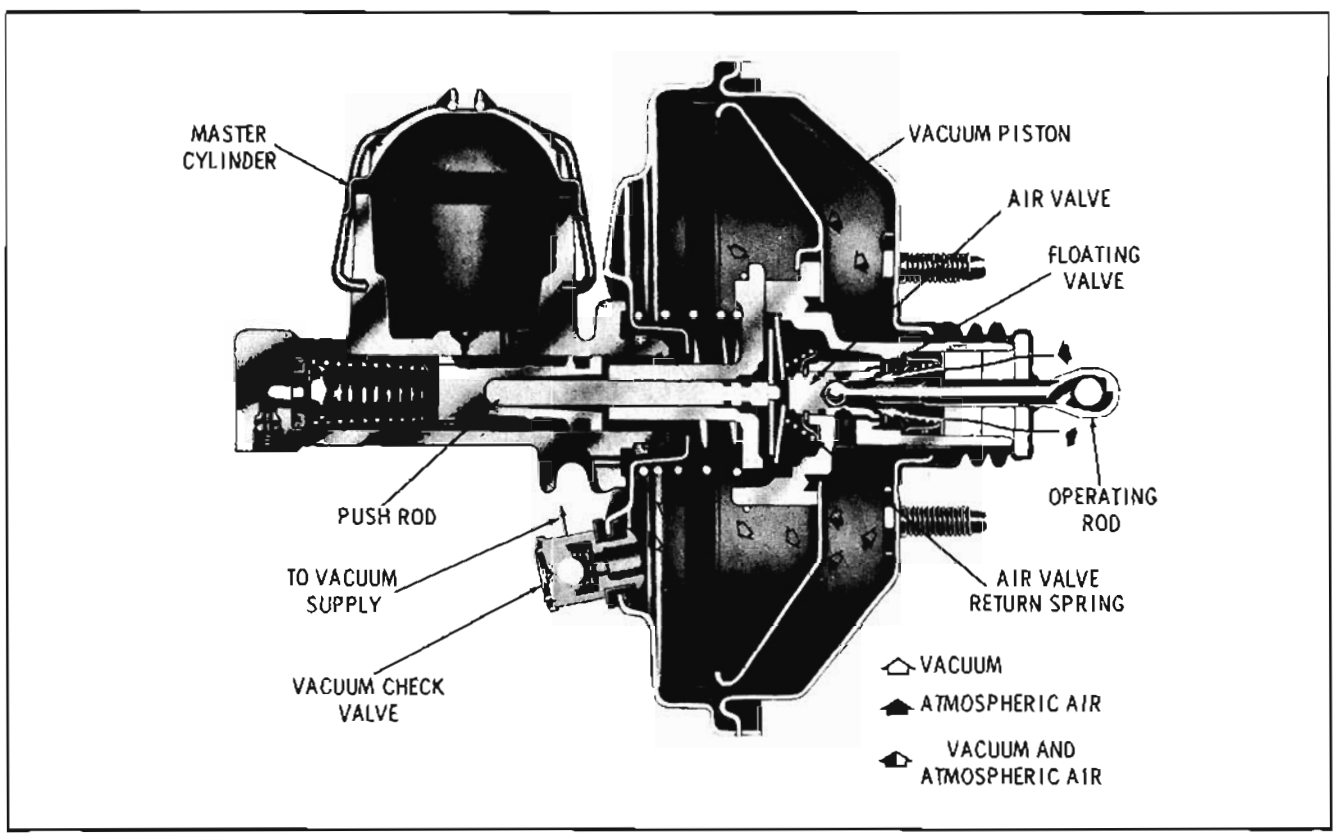


Fig. 11-26 Released Position

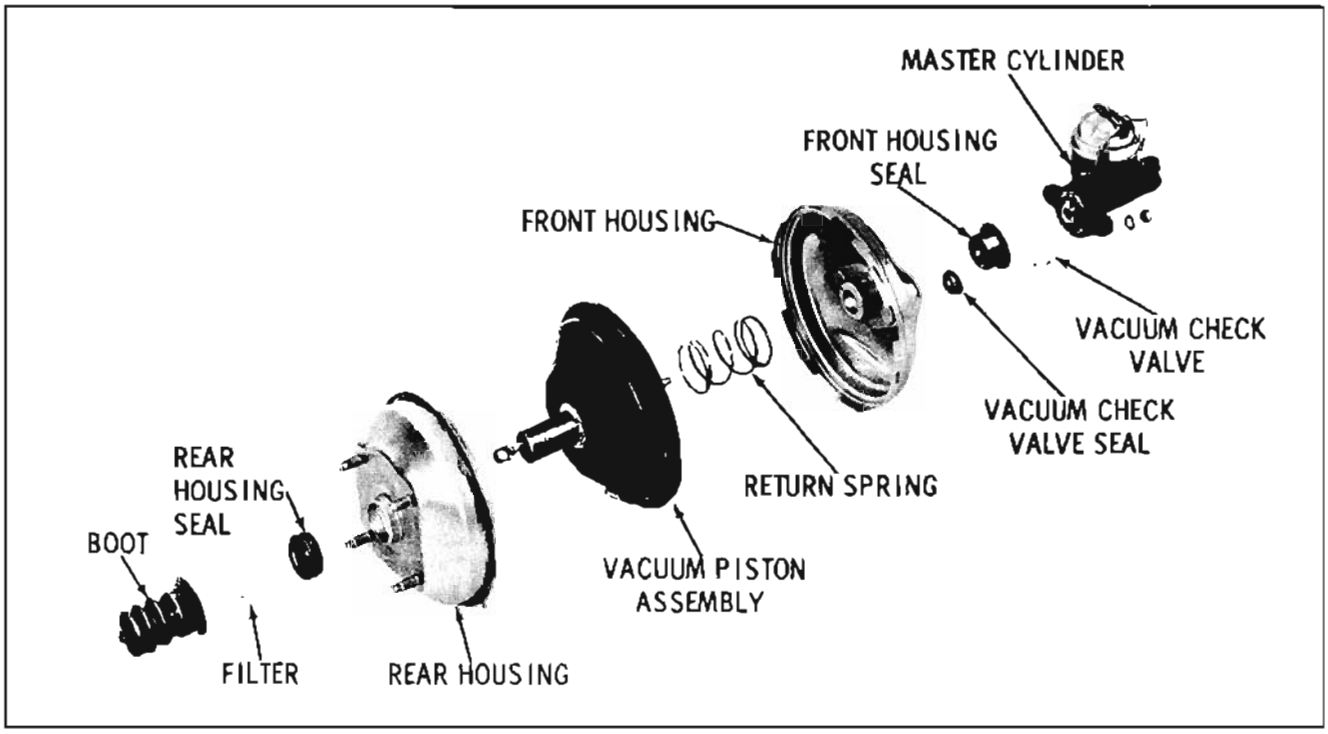


Fig. 11-27 Moraine Power Brake Assembly (33, 34, 35, 36, 38 & 39 Series)

pressure on the rear housing as it is under spring tension.

4. Remove the rear housing and vacuum piston assembly from the front housing.

5. All series except 30, 31 and 32, remove the rubber boot from the rear housing. Remove the filter from inside the boot.

6. On 30, 31 and 32 series, remove the plastic boot from between the mounting brackets. Remove the retaining ring, clevis and locknut, then remove the filter from the operating rod.

7. Remove the vacuum piston assembly from the rear housing.

8. Remove the seal from the rear housing.

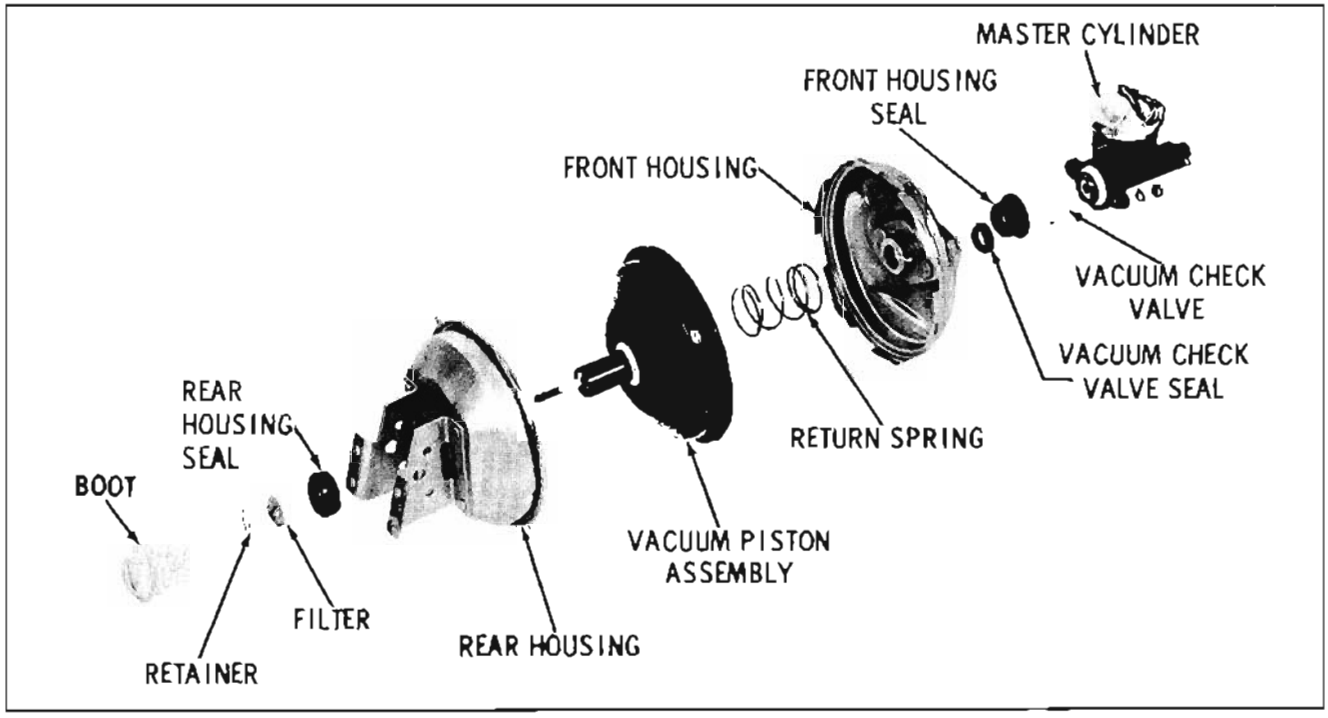


Fig. 11-28 Moraine Power Brake Assembly (30, 31 & 32 Series)

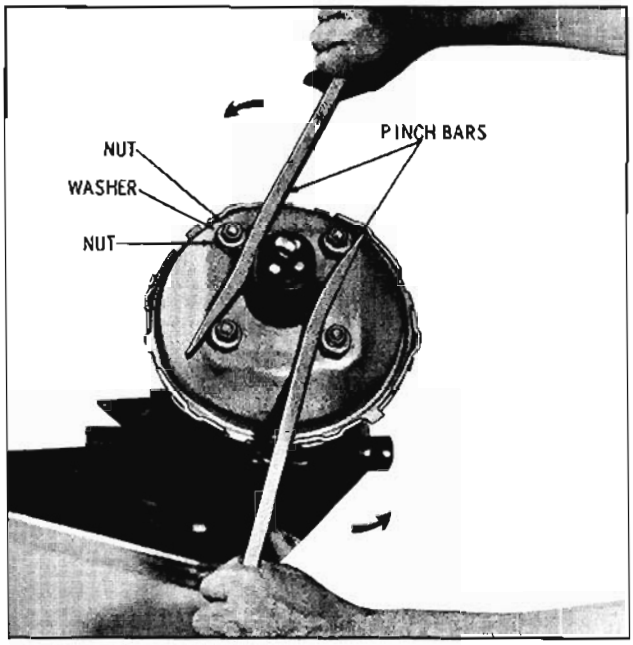


Fig. 11-29 Separating Housings (33, 34, 35, 36, 38 & 39 Series)

9. Remove the master cylinder to front housing attaching nuts and remove the master cylinder from the front housing.

10. Remove the front housing seal and the vacuum check valve and seal from the front housing.

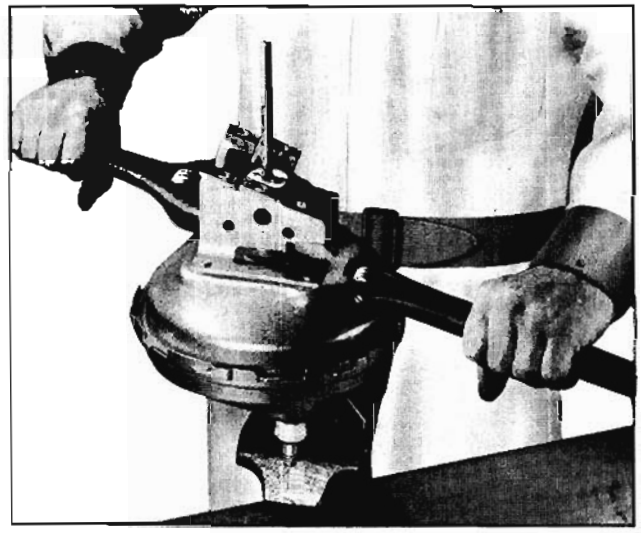


Fig. 11-30 Separating Housings (30, 31 & 32 Series)

DISASSEMBLY OF VACUUM PISTON (Fig. 11-31)

1. Remove the lock ring from the vacuum piston by prying one of the ends out from under the large divided locking lug.

2. Remove the reaction retainer and push-rod, reaction plate, reaction levers and air valve spring. Also, remove the small reaction bumper and the air valve spring seat from the air valve.

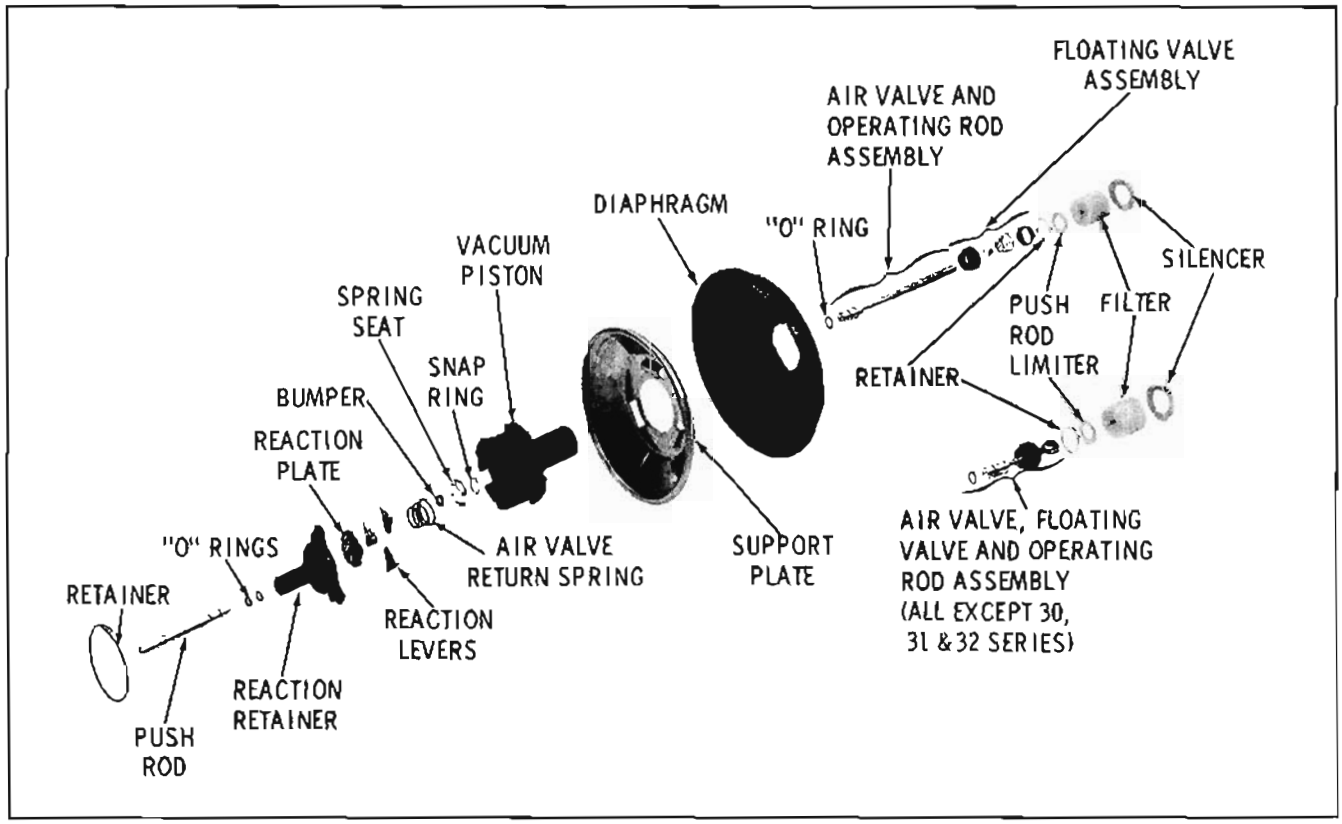


Fig. 11-31 Vacuum Piston Assembly

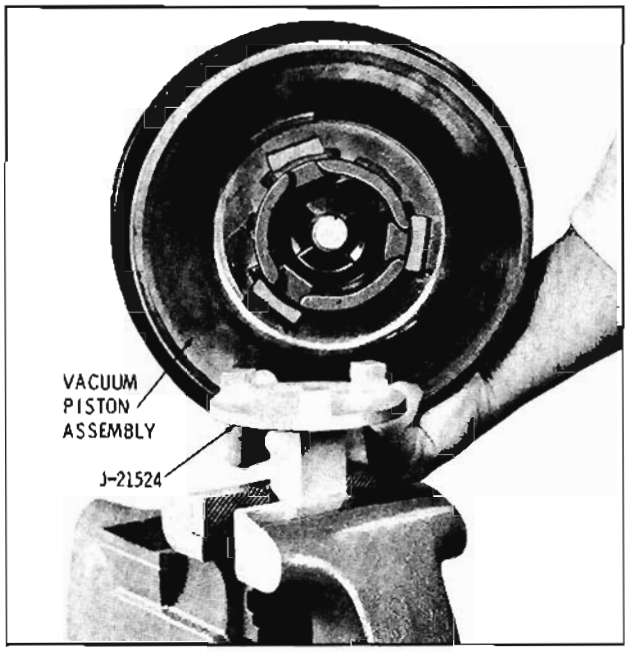


Fig. 11-32 Positioning Vacuum Piston on Tool J-21524

3. Install Tool J-21524 in a vise. Position the vacuum piston assembly on Tool J-21524 so that the three lugs on the tool fit into the three notches in the vacuum piston. (Fig. 11-32)

4. Fold the diaphragm away from the support plate so that the hands can grip the steel support plate and rotate support plate counterclockwise until the support plate separates from the vacuum piston. (Fig. 11-33)

5. Remove the diaphragm from the support plate.

6. Remove the silencer from the neck of the vacuum piston tube.

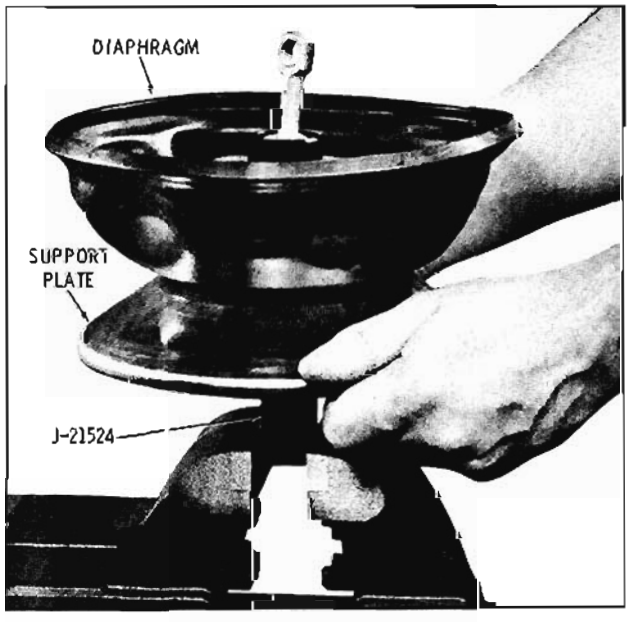


Fig. 11-33 Removing Support Plate

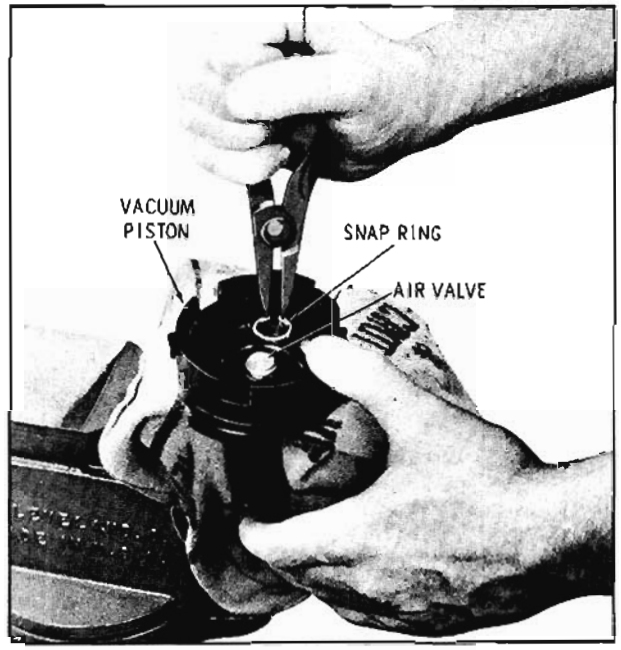


Fig. 11-34 Removing Snap Ring

7. Position the vacuum piston in a vise padded with shop towels. Do not clamp vise on tube. Using Truarc pliers J-4880, remove the snap ring on the air valve. (Fig. 11-34)

8. Place the vacuum piston, tube down, in a press. Using a rod not exceeding 1/2" in diameter, press the air valve assembly from the vacuum piston. (Fig. 11-35)

NOTE: On all series except 30, 31 and 32, it is necessary to service the complete air valve, floating valve and operating rod assembly. On 30, 31 and 32 series, the air valve and operating rod do not have to be replaced if they are not defective. However, a new floating valve must be installed on the assembly.

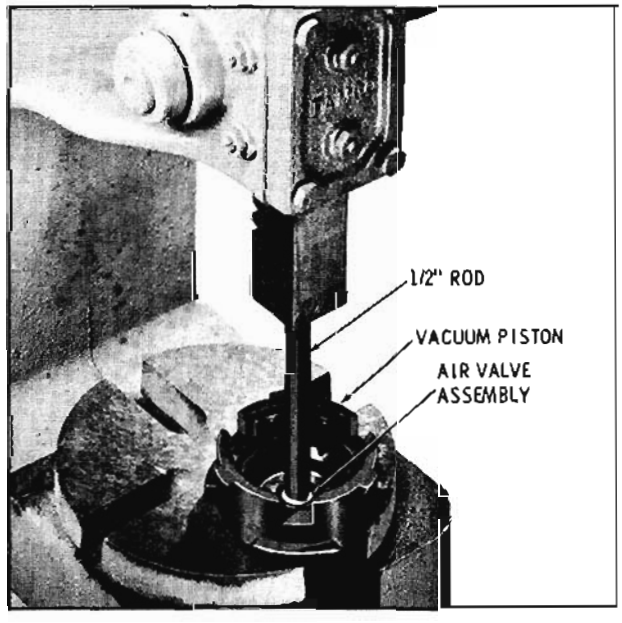


Fig. 11-35 Removing Air Valve

9. Remove the limiter washer and air filter from the operating rod.

10. Remove the master cylinder push-rod from the reaction retainer. Remove the two "O" rings from the push rod.

CLEANING AND INSPECTION

1. Thoroughly wash all parts in alcohol, blow out all passages and air dry. Place parts on clean paper.

2. Inspect front and rear housings for scoring, pitting, dents or nicks. Small imperfections may be smoothed out with fine crocus cloth. Check housings for loose studs. Replace housings if they cannot be repaired.

3. Inspect vacuum piston diaphragm for deterioration or abrasions. Replace if damaged.

4. 30, 31, and 32 Series—Inspect air valve and operating rod assembly for scratches, nicks distortion or corrosion. Check seat for smoothness. Operating rod should move freely in air valve but should not pull out. Replace assembly if worn or damaged.

5. Check vacuum piston support plate and reaction retainer for cracks, distortion damaged reaction lever seats or rough and uneven floating valve seat. Be sure all openings and passages are clean.

6. Check reaction levers for distortion. Replace if damaged.

7. Replace air filters and silencer if dirty or torn.

ASSEMBLY OF MORAINE POWER BRAKES

For assembly of master cylinder refer to MASTER CYLINDER - ASSEMBLY.

Vacuum Piston

NOTE: During assembly, when a lubricant is specified, use either the lubricant furnished with the repair kit or Seal Lubricant Part No. 567196.

1. Install two new "O" rings, coated with lubricant on the push-rod.

2. Insert the push-rod so that the round end of the piston protrudes from the end of the tube of the reaction retainer.

3. Wipe a film of lubricant on the large OD of the floating valve and on the "O" ring on the air valve. On 30, 31 and 32 series, install a new "O" ring on the air valve.

4. Position a new air valve and operating rod assembly, air valve first, into the tube of the vacuum piston. On 30, 31 and 32 series, install the new floating control valve, so that the flat face of the valve seats against the air valve.

5. Position the floating valve retainer over the push-rod so that the flat side seats on the floating control valve.

6. Using Tool J-21601, press the floating valve until it seats in the vacuum piston. Line on tool will be flush with top of vacuum piston when floating valve is fully seated. (Fig. 11-36)

7. Position the operating rod limiter washer over the operating rod and down onto the floating valve.

8. Position the large ID air silencer over the neck of the vacuum piston. Install the small ID filter inside the neck of the vacuum piston over the operating rod.

9. Install Tool J-21524 in a vise. Position vacuum piston on the tool so that the three lugs fit into the notches in the vacuum piston.

10. Install the vacuum piston diaphragm on the diaphragm support plate, on the side opposite the locking tangs. The inner lip of the diaphragm must fit over the edge of the center hole of the support plate.

11. Coat the entire inner lip of the diaphragm with lubricant.

12. Position the support plate and diaphragm over the tube of the vacuum piston. The flange of

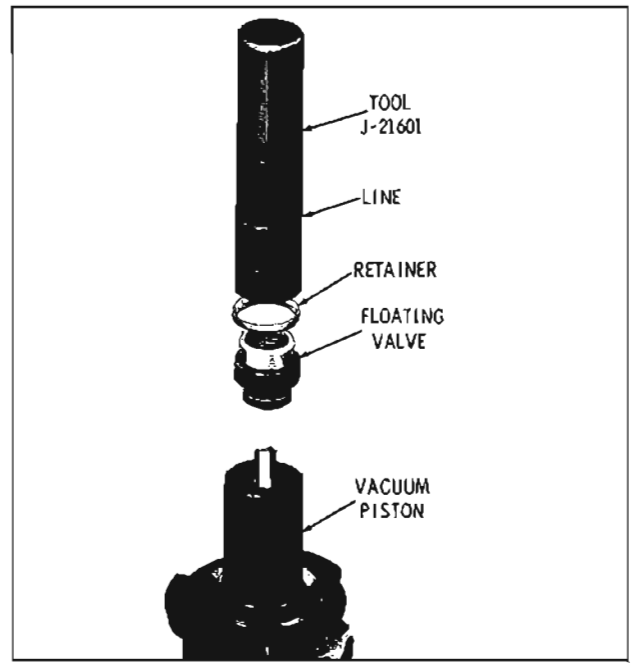


Fig. 11-36 Installing Floating Valve

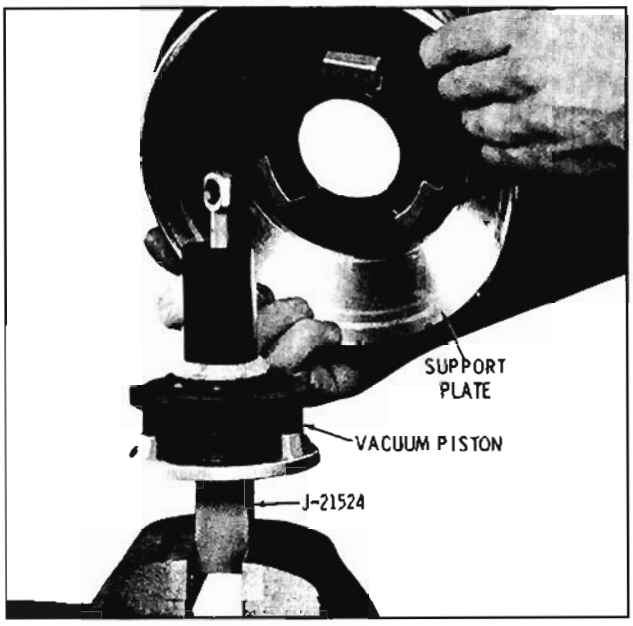


Fig. 11-37 Positioning Support Plate on Vacuum Piston

the diaphragm fits into the groove on the power piston. (Fig. 11-37)

13. Press down and rotate the support plate clockwise until the lugs on the power piston rest against the stops on the support plate.

14. Position the vacuum piston assembly in a padded vise, tube down. Do not clamp tube. Using Truarc pliers J-4880, install the snap ring into the groove in the air valve. (Fig. 11-34)

15. Install the air valve spring seat, dished side down, so it seats on the snap ring. Install the reaction bumper into the groove in the end of the air valve.

16. Install the air valve return spring so that the large end seats on the spring seat.

17. Install the three reaction levers in the slots in the vacuum piston.

18. Position the reaction plate, numbered side up, on top of the reaction levers. Press down on the reaction plate until the reaction levers pop up.

19. Position the reaction retainer and push-rod as shown in Fig. 11-38. While retaining pressure on the reaction retainer, install the lock ring as shown in Fig. 11-39.

ASSEMBLY OF POWER BRAKE UNIT

1. Coat the rear housing seal with lubricant and install in the rear housing with the large flange of the seal on the same side as the mounting studs.

2. Apply lubricant to the tube of the vacuum piston and insert the tube of the vacuum piston through the seal of the rear housing.

3. Coat the vacuum check valve seal with lubricant and install with the beveled side of the seal toward the inside of the front housing.

4. Install the vacuum check valve in the front housing.

5. Install the front housing seal and the master cylinder on the front housing. Torque master cylinder attaching nuts 15 to 20 ft. lbs.

6. Clamp the master cylinder in a vise. Position the vacuum piston return spring over the hub of the front housing.

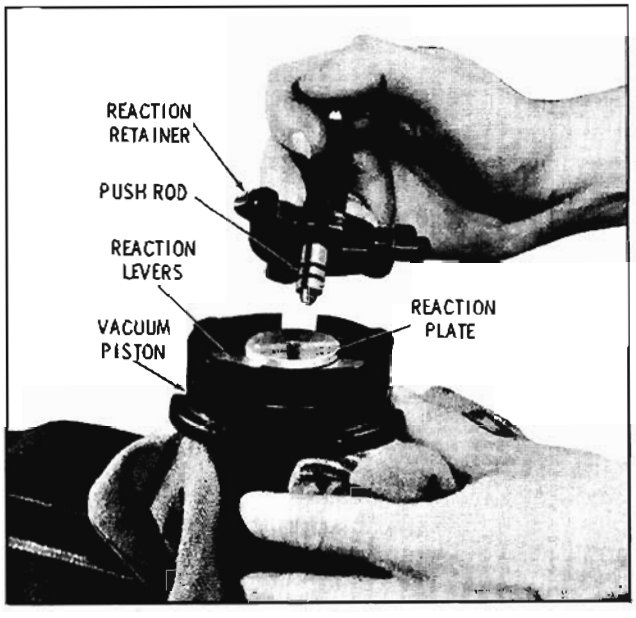


Fig. 11-38 Installing Reaction Retainer

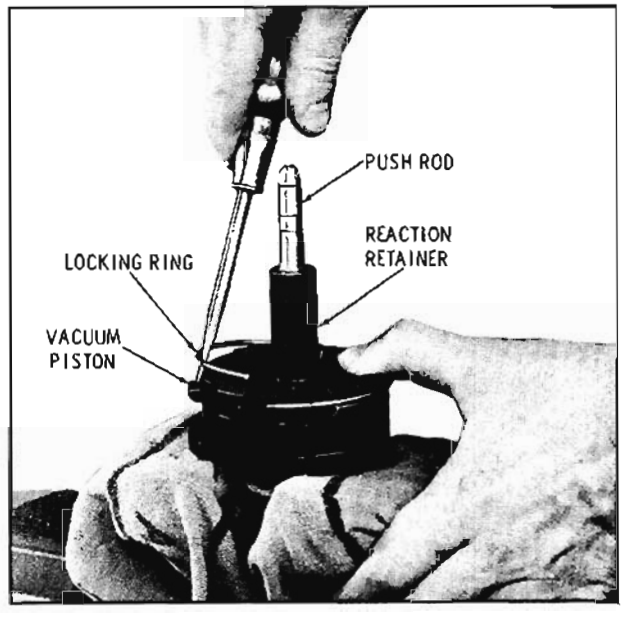


Fig. 11-39 Installing Locking Ring

7. Position the rear housing over the front housing so that the scribe marks will be aligned when housings are assembled.

8. Depress and rotate rear housing clockwise until the front and rear housings are locked.

9. All series except 30, 31 and 32—Install the felt filler into the last fold of the rubber boot and install the boot over the operating rod.

10. 30, 31 and 32 Series—Install the felt filter over the operating rod and install the retaining key. Install the plastic boot over the operating rod so that the projections locate in the holes of the bracket. Install the locknut and clevis.

11. Check the push-rod adjustment as outlined under PUSH-ROD ADJUSTMENT.

PUSH ROD ADJUSTMENT (Fig. 11-40)

The push-rod adjustment is important because the compensating port in the master cylinder must be open when the vacuum piston is in the released position.

The push-rod adjustment can be checked as follows:

1. With the vacuum unit assembled and the master cylinder and front housing seal removed, position Gauge J-7723-01 over the push-rod with the legs of the gauge resting on the front housing of the vacuum cylinder.

2. The adjustment is correct if the guage just contacts the tip of the push-rod or if the tip of the push-rod is no more than .010" below the gauge.

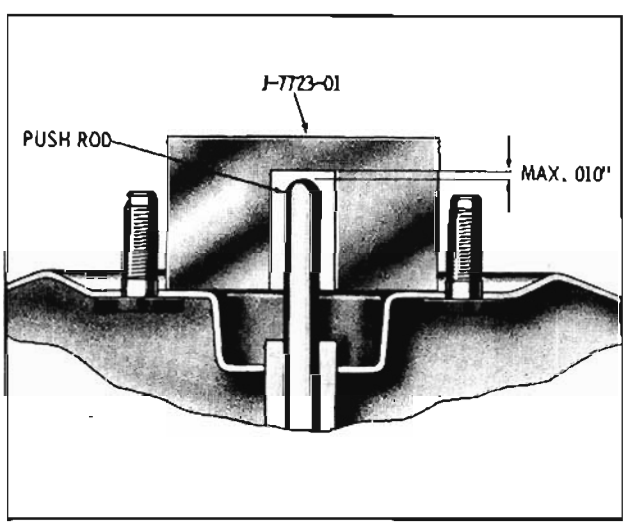


Fig. 11-40 Checking Push Rod Adjustment

3. If the push-rod is not within specifications, and the push-rod does not have an adjusting screw, a new service adjustable push-rod must be installed and adjusted to specification. If the push-rod, being checked, has an adjusting screw, adjust the push-rod to specification.

BENDIX POWER BRAKE

PRINCIPLES OF OPERATION

Released Position (Fig. 11-41)

With no pressure applied to the brake pedal, the air valve and operating rod are held in the released position by the air valve return spring. This closes the atmospheric port and opens the vacuum port to the rear of the vacuum piston. With vacuum on both sides of the vacuum piston, the vacuum piston return spring holds the vacuum piston in the released position.

Applying Position (Fig. 11-42)

As the brakes are applied, the operating rod and air valve move forward in the vacuum piston to close the vacuum port. Further movement in the applied direction allows the air valve to unseat the floating valve and open the atmospheric port. With vacuum at the forward side and atmospheric pressure at the rear of the vacuum piston, a force is developed which moves the vacuum piston, push-rod and the hydraulic piston in the apply direction.

As fluid pressure increases in the master cylinder, a reaction force is transmitted through the push-rod to the reaction disc to apply a pressure on the air valve. This reaction force moves the air valve slightly rearward in relation to the vacuum piston to close off the atmospheric port. The reaction force is in proportion to the fluid pressure in the hydraulic system and balances the force exerted on the operating rod, providing the drive with brake "feel".

In the fully applied position, maximum atmospheric pressure is allowed to enter at the rear of the vacuum piston. Any additional increase in hydraulic pressure beyond this point must be supplied by physical effort of the driver.

Holding Position (Fig. 11-43)

During brake application, the reaction against the air valve works against pedal pressure to close the atmospheric port. With the vacuum and atmospheric ports closed, the brake is in the hold position. The brake remains in this position until pressure is either increased or decreased on the brake pedal.

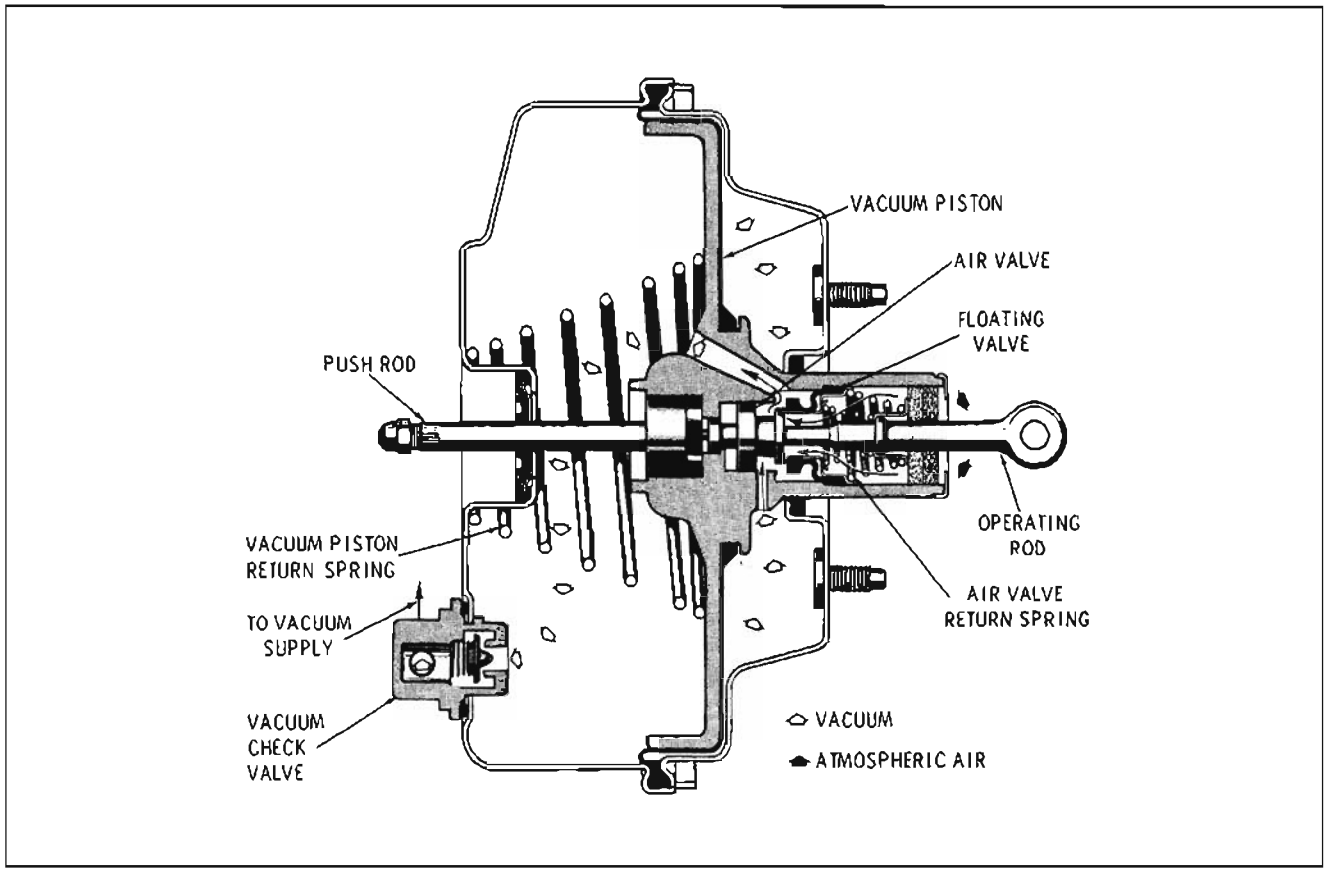


Fig. 11-41 Released Position

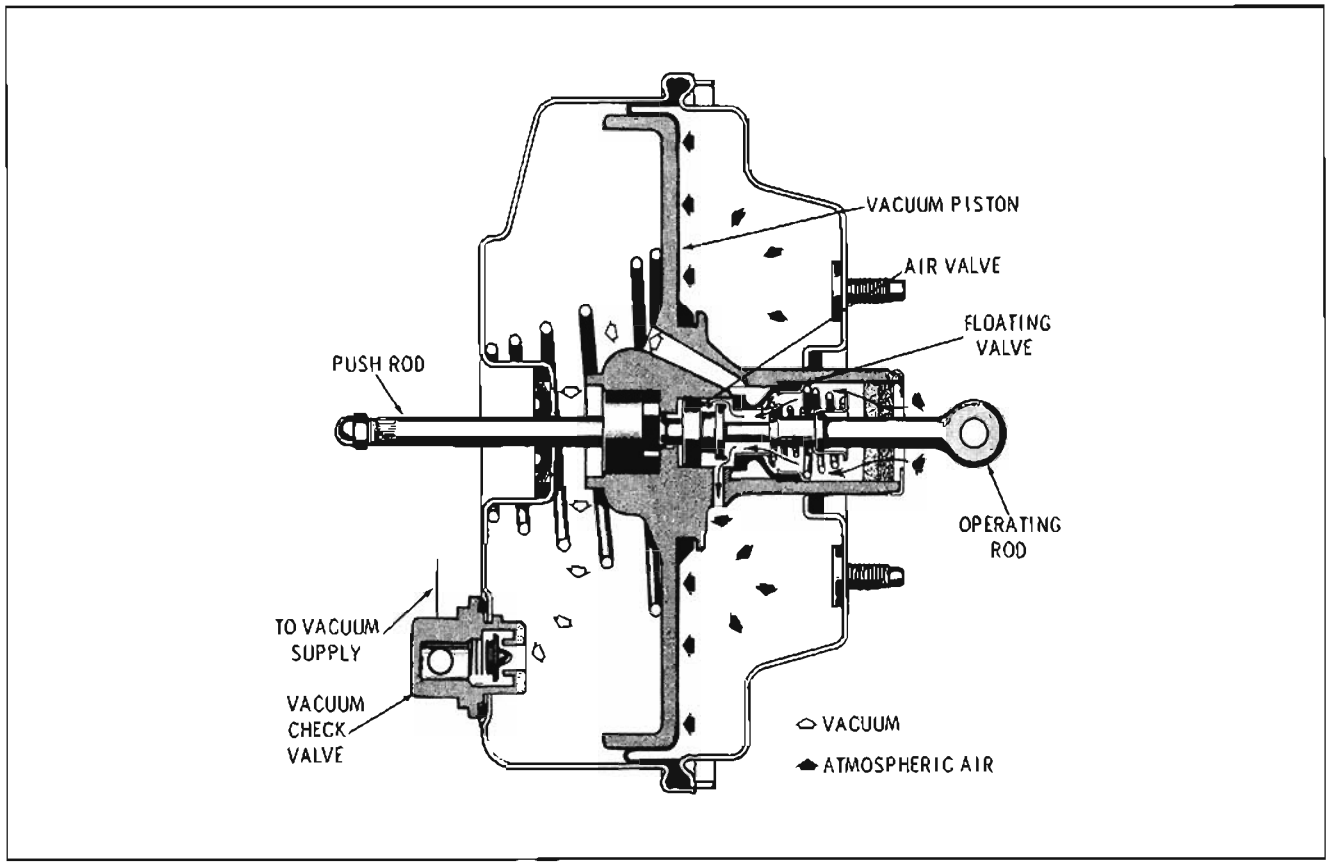


Fig. 11-42 Applied Position

DISASSEMBLY OF BENDIX POWER BRAKE (Fig. 11-44)

NOTE: Use extreme care to keep mineral oil or grease from coming in contact with hydraulic parts.

1. Deplete vacuum supply, then clean the outside of the power brake unit. Remove the filler cap, then empty brake fluid from master cylinder reservoir.
2. Clamp the master cylinder in a vise with the operating rod up. Remove the nylon bellows retainer and bellows from the rear housing.
3. Scribe a line across the front and rear housings and the master cylinder to facilitate reassembly.
4. Brush locking tangs of front and rear housings liberally with seal lubricant. Rotate rear housing so that cut-outs in rear housing line up with tangs of the front housing. Tap rear housing lightly with a plastic hammer to assist in removal. (Fig. 11-45)

NOTE: Loosen rear housing carefully as it is spring-loaded.

5. After transferring the rear housing, piston return spring and push-rod to the bench, remove the return spring and push-rod from the rear housing.
6. Remove the master cylinder to front housing attaching nuts and separate the master cylinder from the front housing.
7. Remove the front housing seal.
8. Remove the vacuum check valve from the front housing if valve is defective.
9. Pry off the filter retainer and remove the felt and foam rubber filters. Use care not to chip the plastic housing when removing the filter retainer.
10. Remove the vacuum piston from the rear housing.
11. Remove the vacuum diaphragm from the vacuum piston.

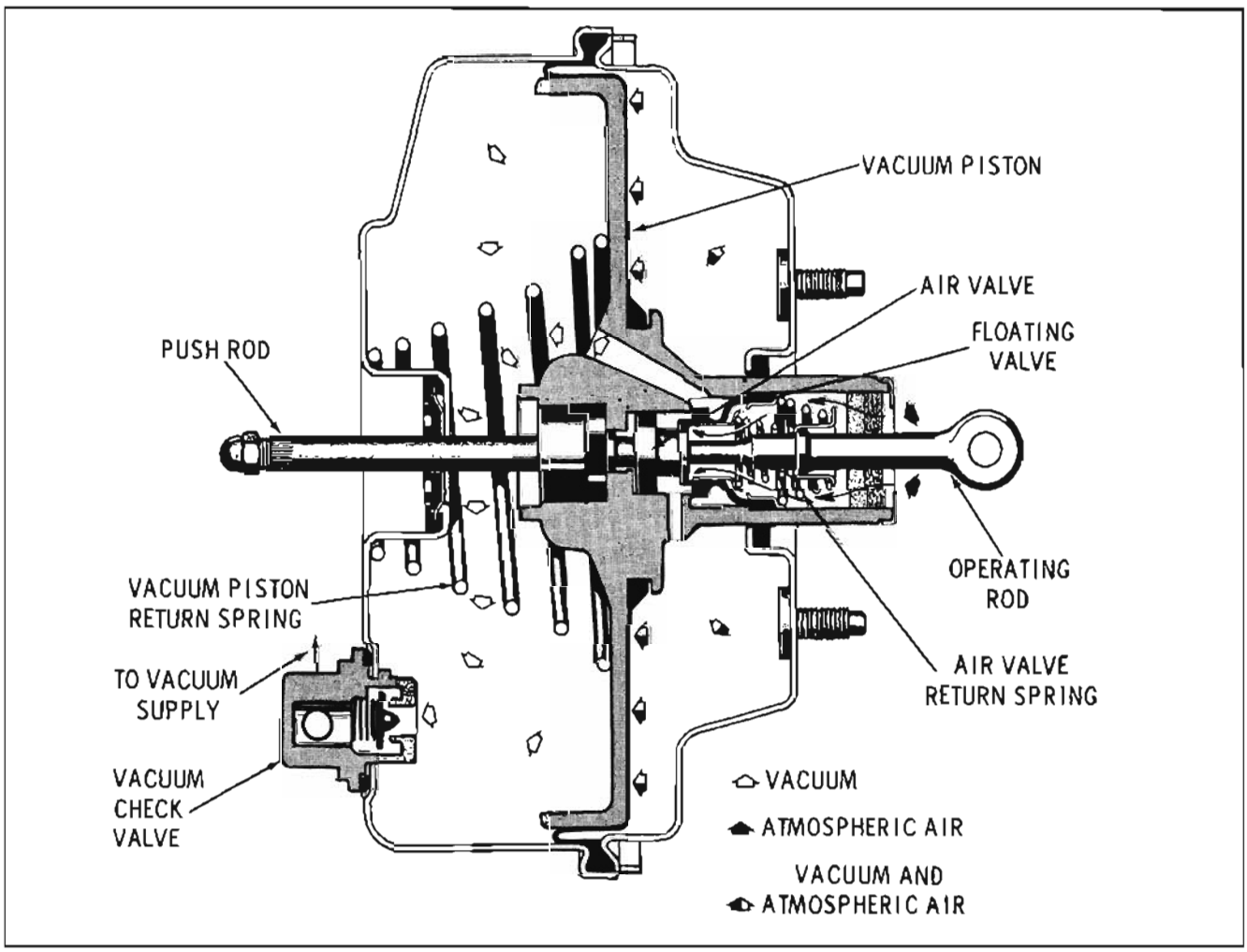


Fig. 11-43 Holding Position

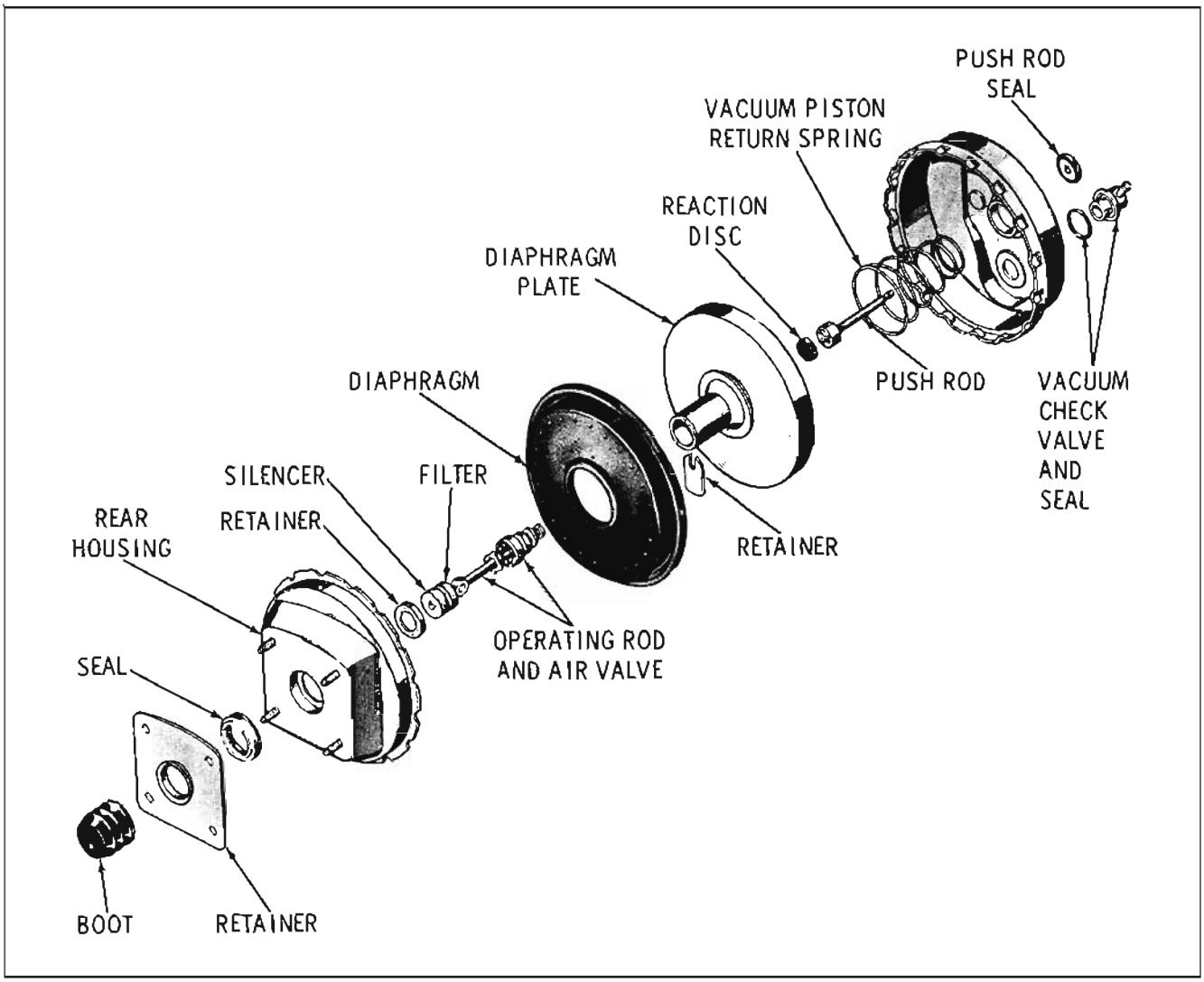


Fig. 11-44 Bendix Power Brake Assembly

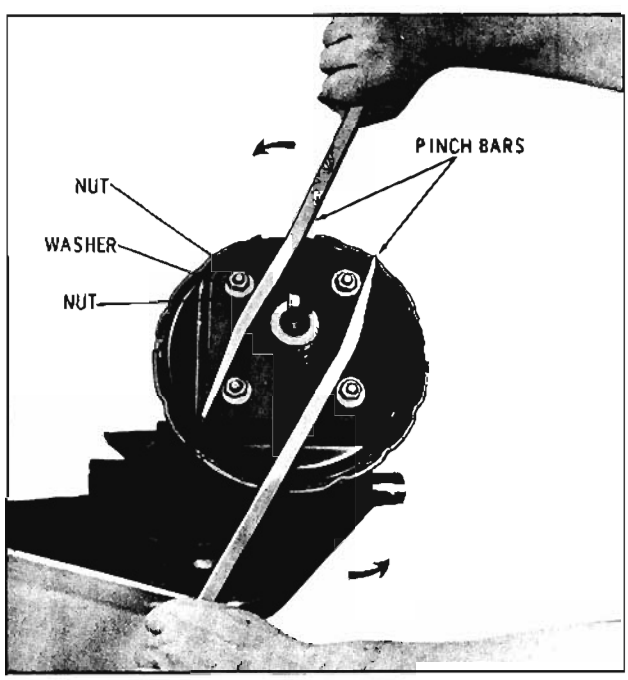


Fig. 11-45 Separating Housings

12. While holding the vacuum piston and operating rod parallel to the bench and with the air valve retainer facing down, depress the operating rod slightly to release the air valve retainer.

13. Remove the air valve assembly from the vacuum piston. Remove the reaction disc from the vacuum piston with a blunt tool. Do not disassemble the air valve assembly.

14. Remove the rear housing seal. (Fig. 11-46)

CLEANING AND INSPECTION

1. Thoroughly wash all metal parts in cleaner. Use ONLY alcohol or brake flushing fluid on the plastic or rubber parts. Blow out all passages and air dry. Place parts on clean paper.

2. Inspect front and rear housings for scoring, pitting, dents, nicks or loose mounting studs. Small imperfections may be smoothed out

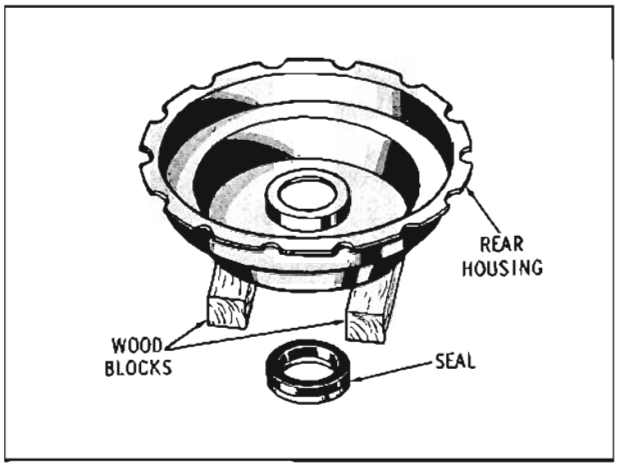


Fig. 11-46 Removal of Bearing Seal from Rear Housing

with fine crocus cloth. Replace housing if damaged.

3. Inspect air valve for scratches, nicks, or breakage. Check seat for smoothness and flatness. Valve should have a free sliding fit when inserted in the vacuum piston bore. Check floating valve for distortion of metal parts and deterioration or abrasions of rubber parts. Replace complete air valve, floating valve and operating rod assembly if any parts are damaged.

4. Check vacuum piston for cracks or rough or uneven floating valve seat. Be sure all openings and passages are clean.

5. Replace air filter element if dirty.

NOTE: When overhauling a unit, use all the parts furnished with the parts kit. Discard all old rubber parts.

ASSEMBLY OF BENDIX POWER BRAKE (Figs. 11-47 & 11-48)

For assembly of master cylinder, refer to MASTER CYLINDER - ASSEMBLY.

NOTE: On assembly, if a lubricant is specified, use Seal Lubricant Part No. 567196.

1. Coat a new rear housing seal with lubricant and install with Tool J-8761. (Fig. 11-49)

2. Coat the floating valve with lubricant and install in the vacuum piston. Depress the operating rod and insert the air valve retainer.

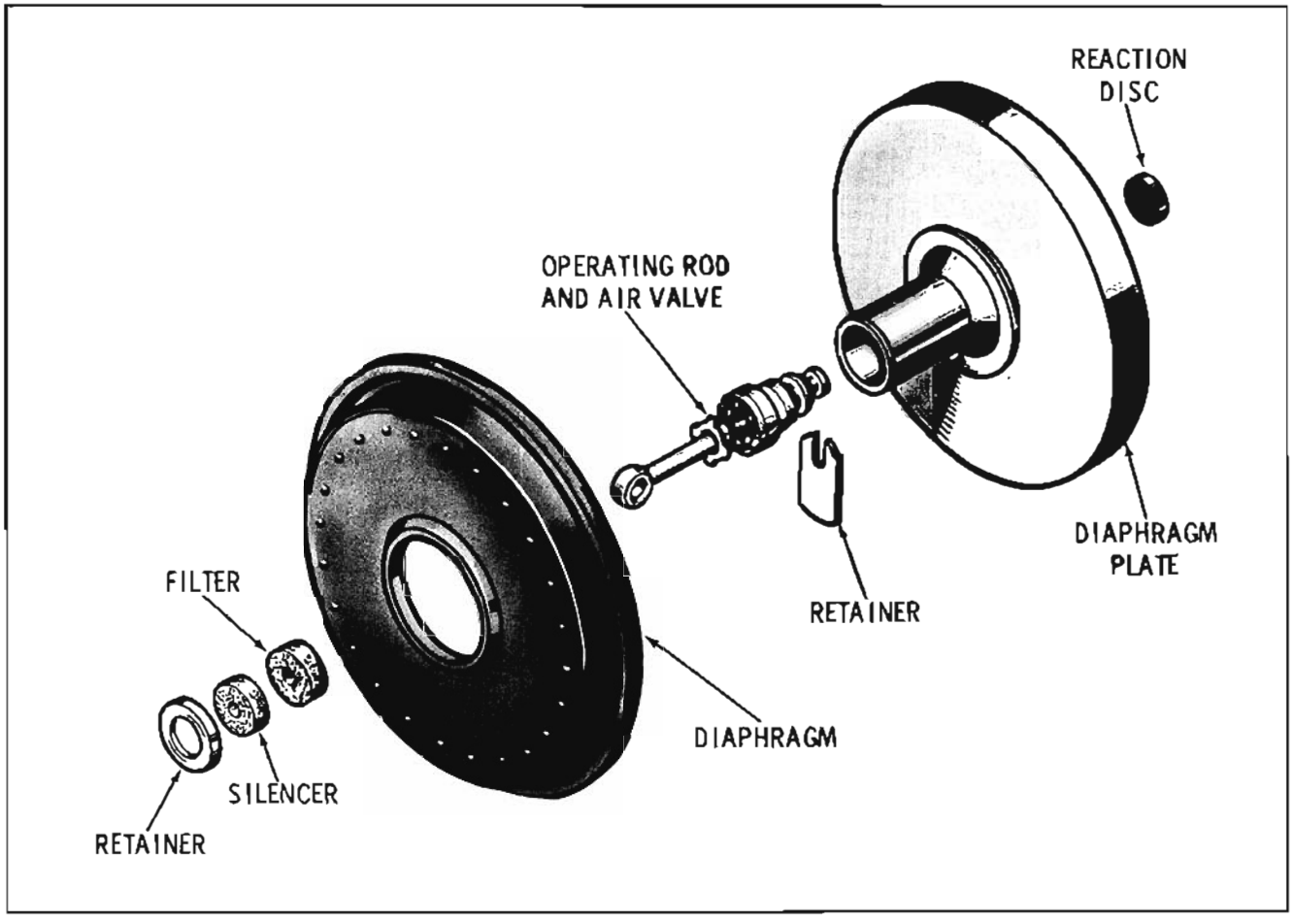


Fig. 11-47 Disassembly of Air Valve and Diaphragm

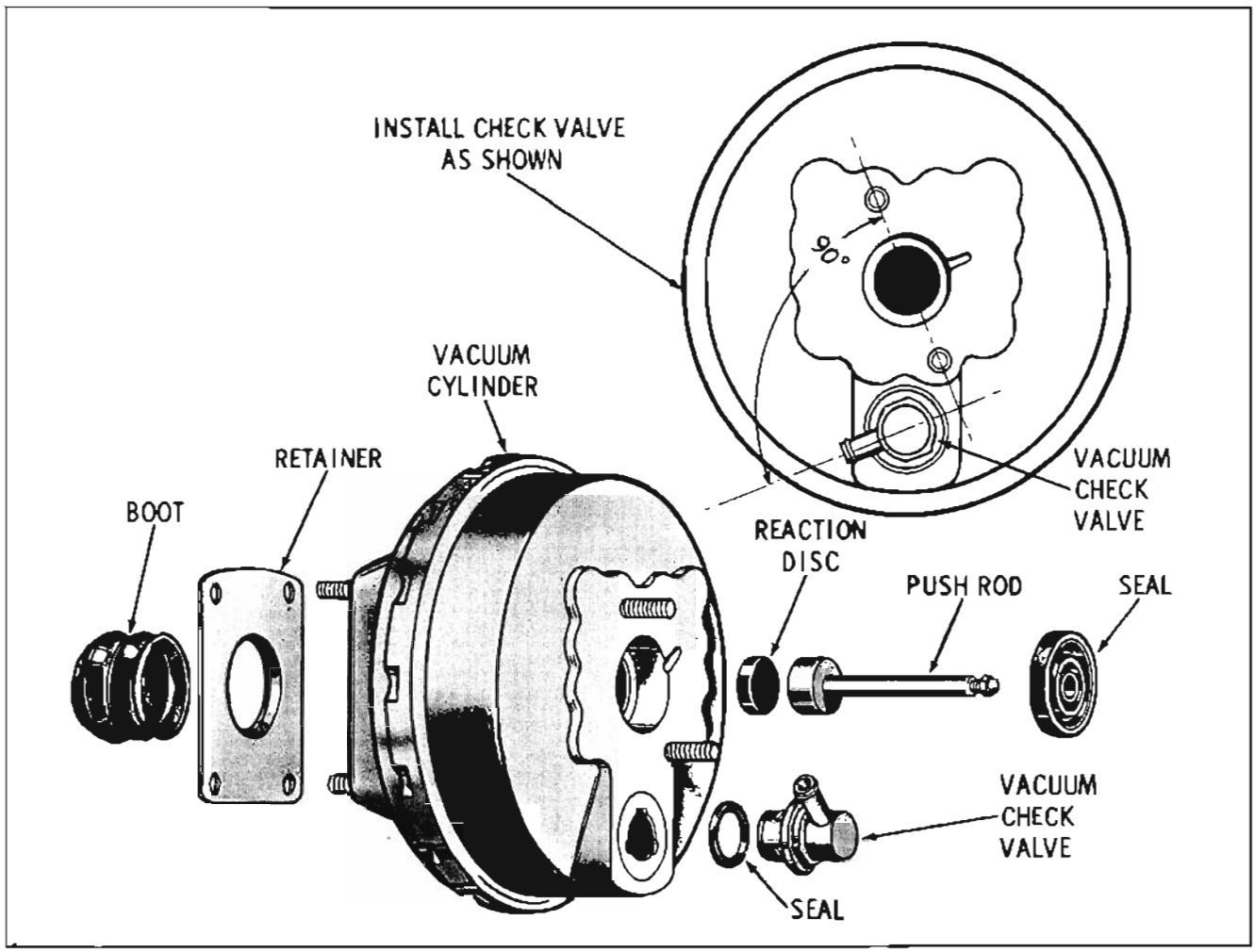


Fig. 11-48 Front and Rear Housing Assembly

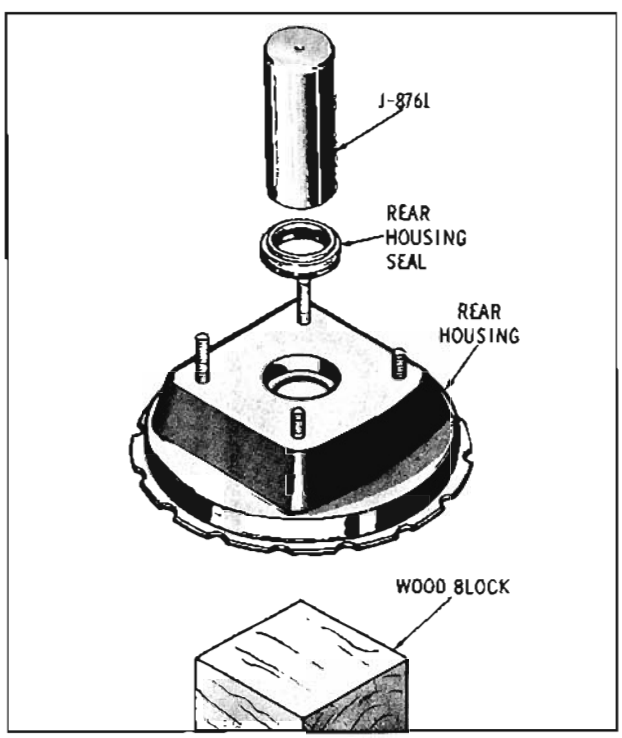


Fig. 11-49 Installing Rear Housing Seal

3. Install the vacuum diaphragm on vacuum piston. Inner lip of diaphragm must fit inside flange on vacuum piston.

4. Install the reaction disc into the vacuum piston with tip of the disc toward the air valve.

5. Install the foam rubber filter, then the felt filter over the operating rod. Install the filter retainer.

6. Coat a new front housing seal with lubricant and install into the front housing. The metal side of the seal faces toward the inside of the front housing. Install a new vacuum check valve if the old one was removed.

7. Install the master cylinder on the front housing. Torque nuts 15 to 20 ft. lbs.

8. Position the master cylinder in a vise with the front housing up. Install the vacuum piston return spring in the front housing with small ID of the spring over the hub in the front housing.

9. Insert the vacuum piston into the rear

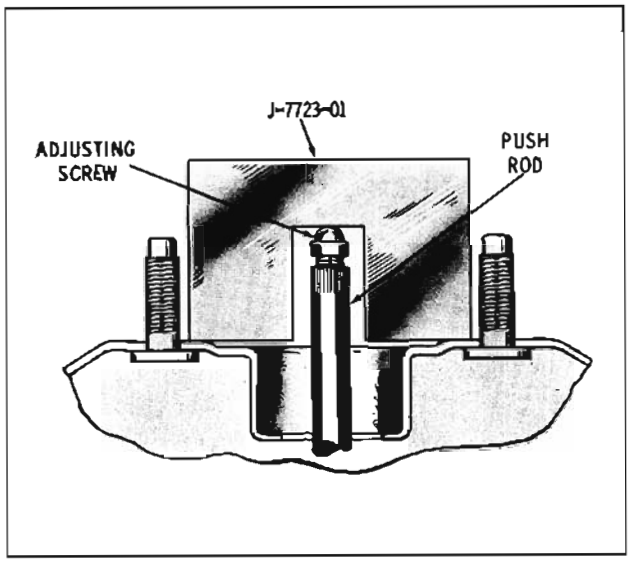


Fig. 11-50 Checking Push-Rod Adjustment

housing. Coat the large OD of the push rod with lubricant and install piston into vacuum piston.

10. Position the rear housing over the front housing. Compress the return spring. While maintaining pressure on the rear housing, rotate the rear housing clockwise to lock the housings together.

11. Check push-rod adjustment as outlined under PUSH-ROD - ADJUSTMENT.

PUSH-ROD ADJUSTMENT (Fig. 11-50)

The push-rod incorporates a self locking adjusting screw to provide a means of maintaining correct relationship between the vacuum piston and the master cylinder piston. The relationship between the pistons is important because the compensating port must be open when the vacuum piston is in the released position.

Under normal service conditions, the push-rod does not require any attention, provided the adjustment has not been changed and the push-rod remains in the original vacuum unit.

When a new push-rod is used or the push-rod is transferred to another unit, the push-rod adjustment must be checked as follows:

a. With the vacuum unit assembled, position Gauge J-7723-01 over the push-rod with the legs of the gauge resting on the front housing. The push-rod adjusting screw should just touch the gauge.

b. If necessary to adjust, rotate the adjusting screw until the adjusting screw just touches the gauge.

KELSEY-HAYES POWER BRAKE

PRINCIPLES OF OPERATION

Released Position (Fig. 11-51)

With no pressure applied to the brake pedal, the air valve and operating rod are held in the released position by the air valve return spring. This closes the atmospheric port and opens the vacuum port to the rear of the vacuum piston. With the vacuum on both sides of the vacuum piston, the vacuum piston return spring holds the vacuum piston in the released position.

Applying Position (Fig. 11-52)

As the brakes are applied, the operating rod and air valve move forward in the vacuum piston to close the vacuum port. Further movement in the applied direction allows the air valve to unseat the floating valve and open the atmospheric port. With vacuum at the forward side and atmospheric pressure at the rear of the vacuum piston, a force is developed which moves the vacuum piston, push-rod and the hydraulic piston in the apply direction.

As fluid pressure increases in the master cylinder, a reaction force is transmitted through the push-rod to the reaction insert to apply a pressure on the air valve. This reaction force moves the air valve slightly forward in relation to the vacuum piston to close off the atmospheric port. The reaction force is in proportion to the fluid pressure in the hydraulic system and balances the force exerted on the operating rod, providing the driver with brake "feel".

In the fully applied position, maximum atmospheric pressure is allowed to enter at the rear of the vacuum piston. Any additional increase in hydraulic pressure beyond this point must be supplied by physical effort of the driver.

Holding Position (Fig. 11-53)

During brake application, the reaction valve against the air valve works against pedal pressure to close the atmospheric port. With the vacuum and atmospheric ports closed, the brake is in the hold position. The brake remains in this position until pressure is either increased or decreased on the brake pedal.

DISASSEMBLY (Figs. 11-54 and 11-55)

NOTE: Use extreme care to keep mineral oil or grease from coming in contact with hydraulic parts.

1. Deplete vacuum supply, then clean the outside of the power brake unit. Remove filler cap,

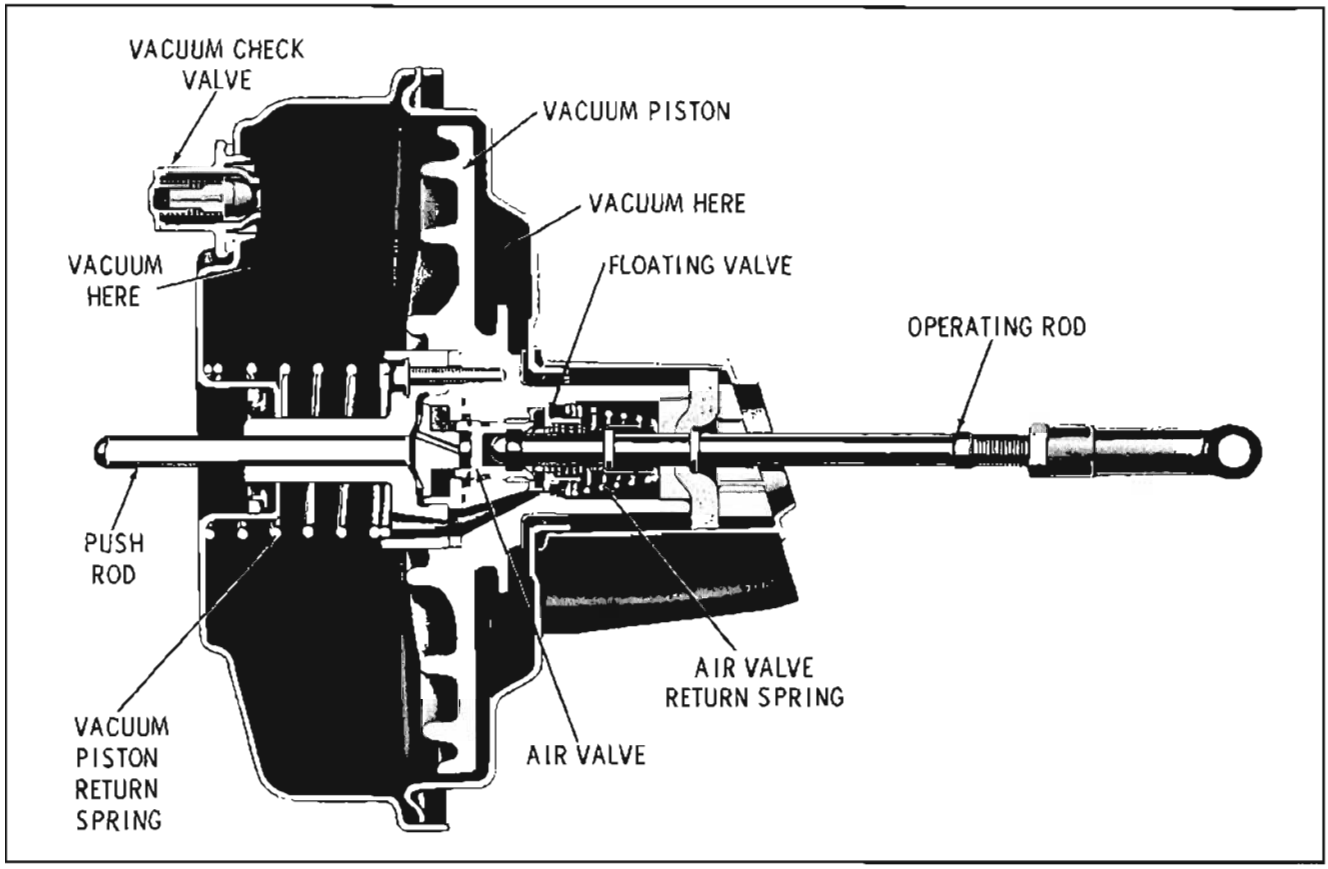


Fig. 11-51 Released Position

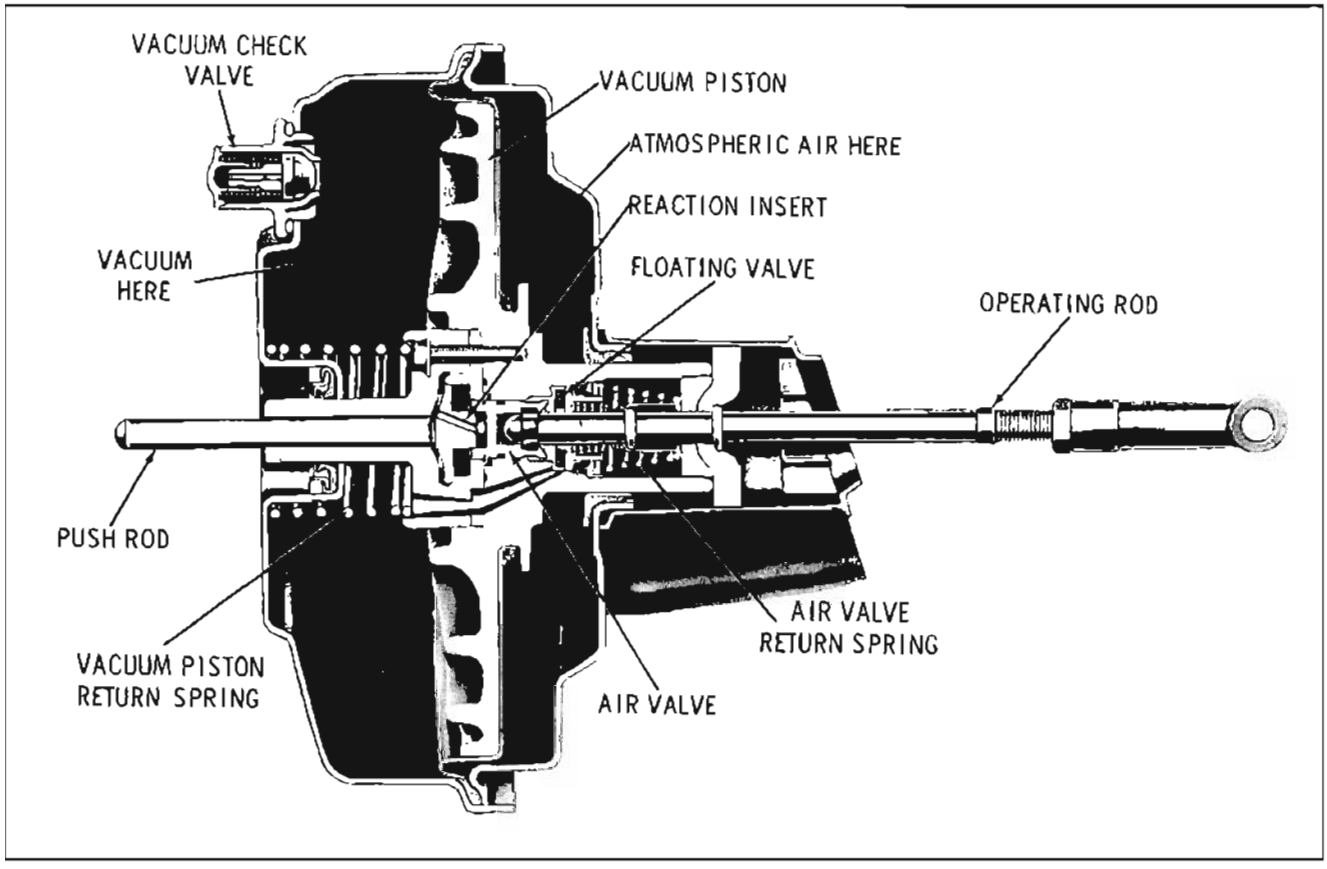


Fig. 11-52 Applying Position

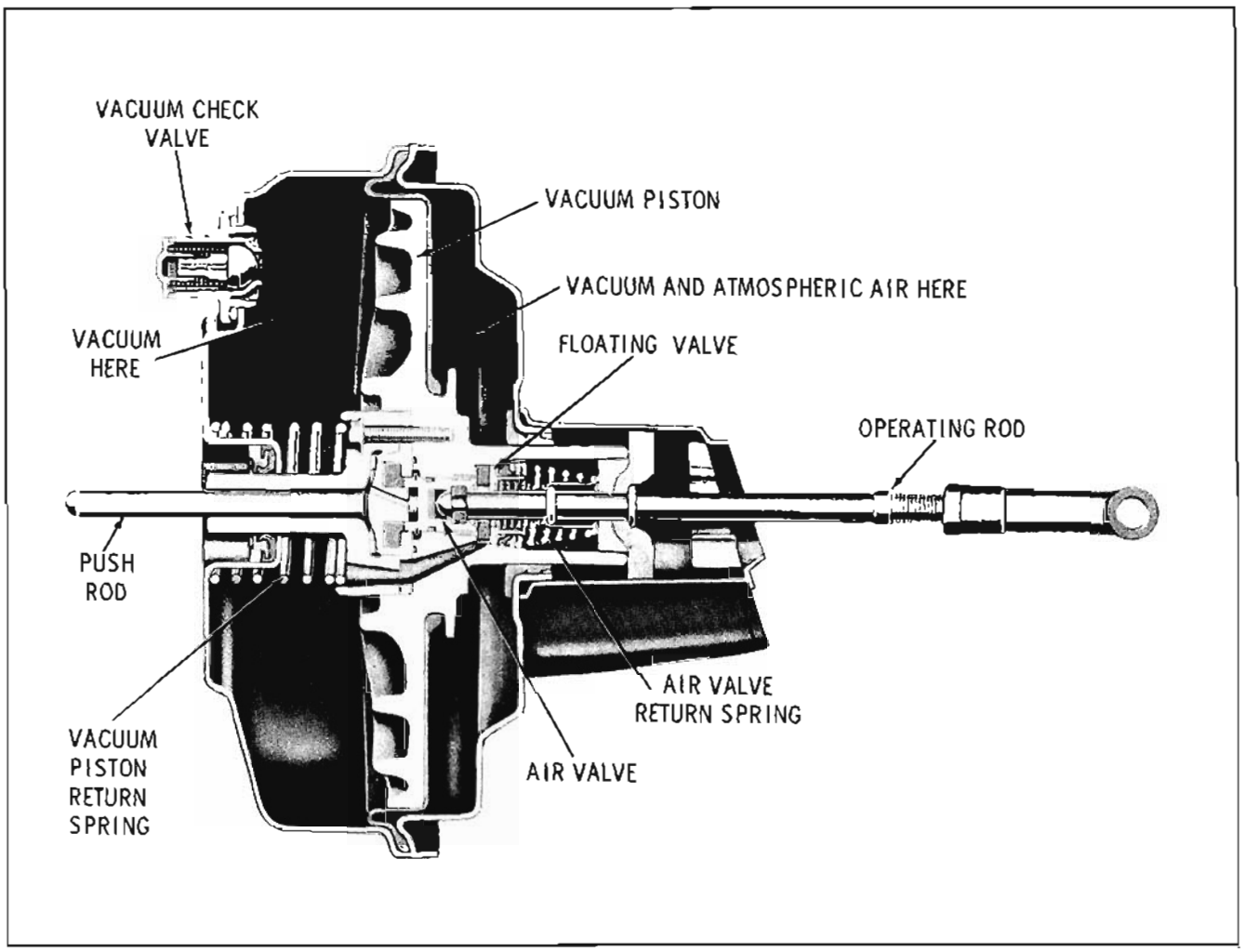


Fig. 11-53 Holding Position

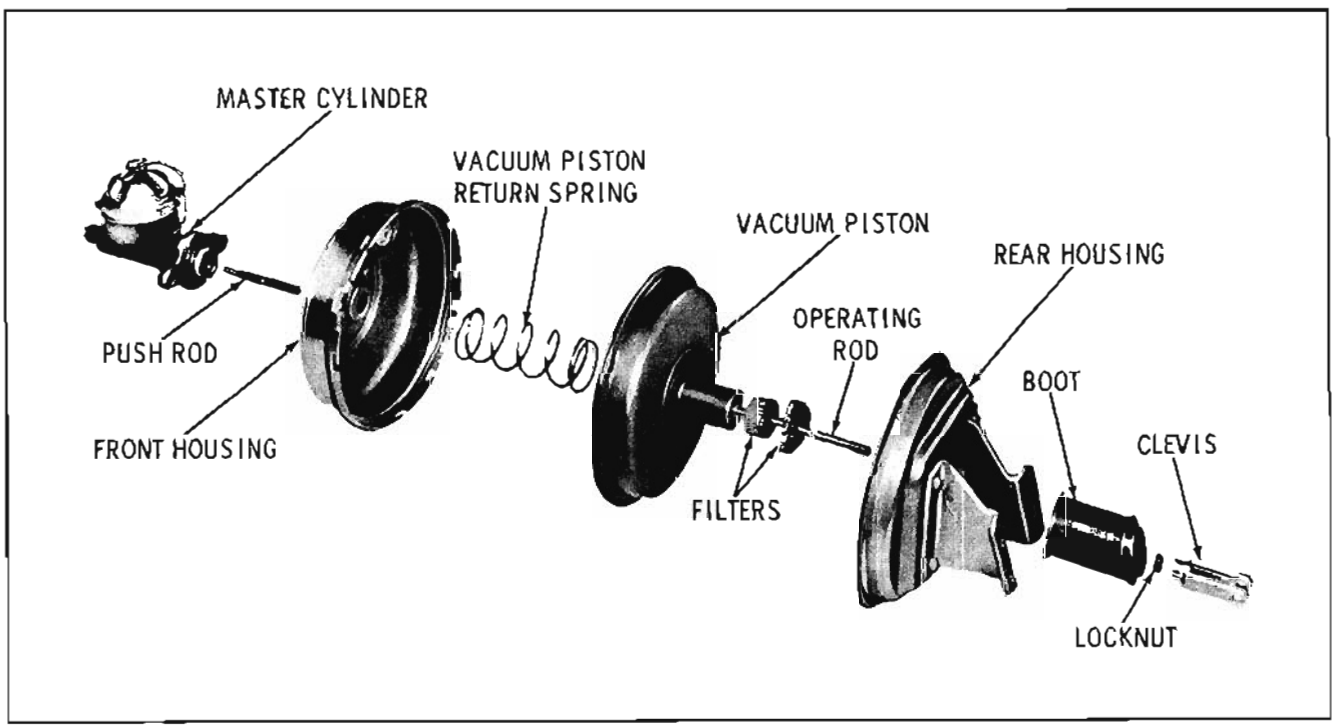


Fig. 11-54 Kelsey-Hayes Power Brake

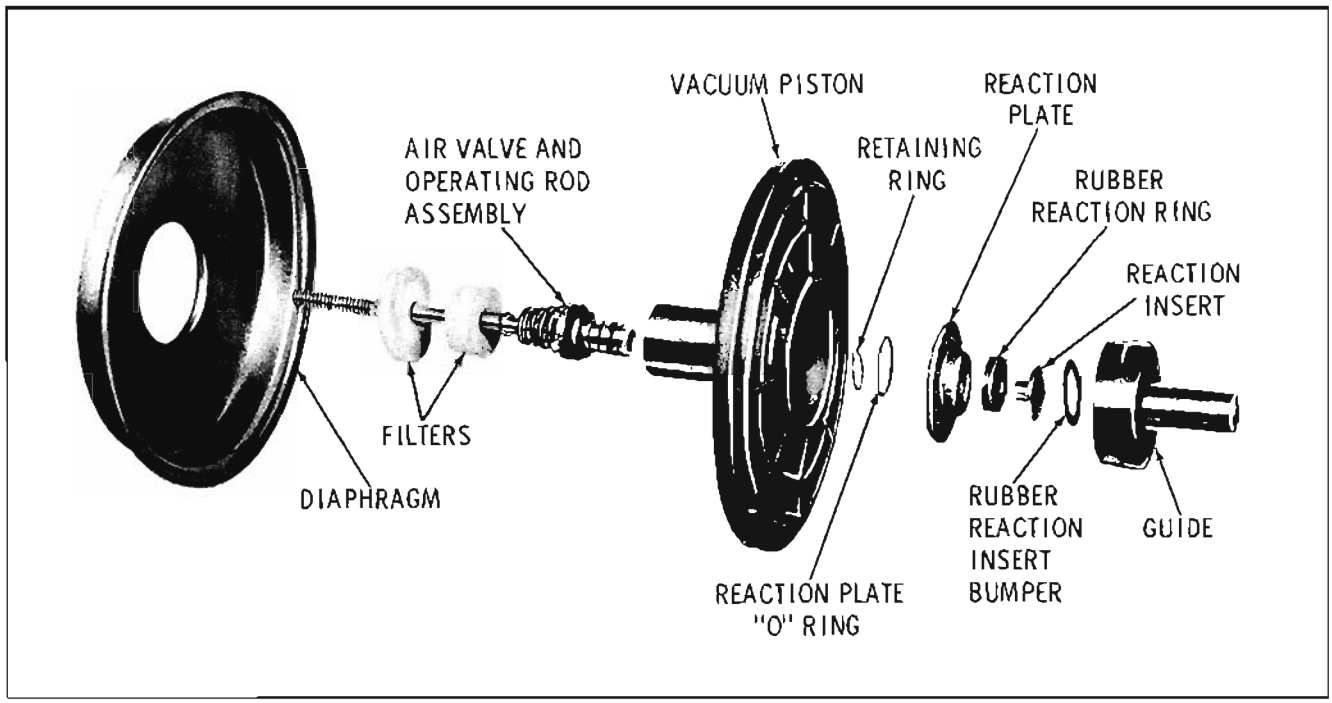


Fig. 11-55 Vacuum Piston Assembly

then empty brake fluid from the master cylinder reservoir.

2. Clamp the master cylinder in a vise with the operating rod up.

3. Loosen the locknut on the operating rod, then remove the clevis, locknut, plastic boot and the air filters.

4. Scribe a line across the front and rear housings and the master cylinder to facilitate reassembly.

5. Remove the front to rear housing retainer, noting its location.

6. Brush locking tangs of front and rear housings liberally with seal lubricant. Rotate rear housing to separate the housings. Tap rear housing lightly with a plastic hammer to assist in removal. (Fig. 11-56)

NOTE: Loosen rear housing carefully as it is spring loaded.

7. Transfer the rear housing to the bench.

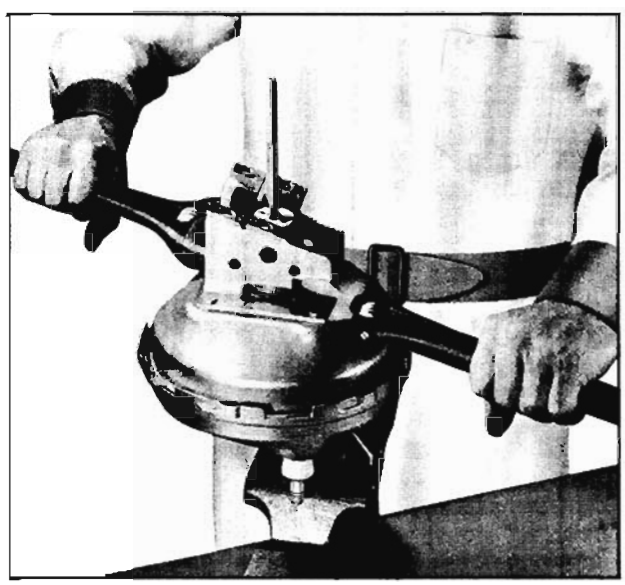


Fig. 11-56 Removing Rear Housing

Fig. 11-57 Removing Seal and Filter

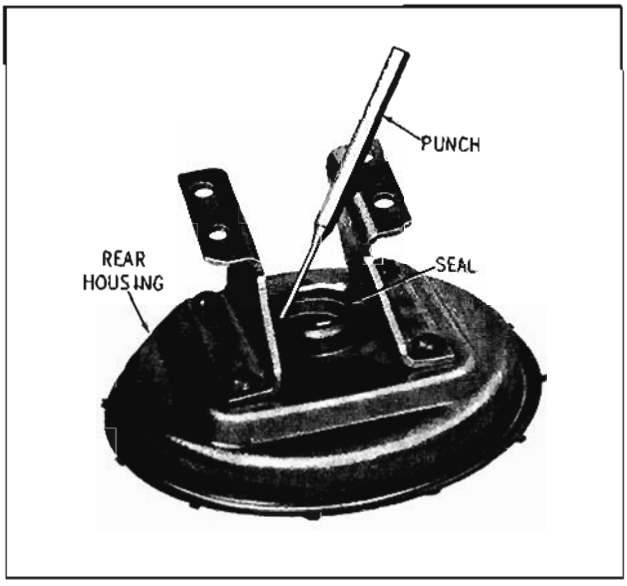


Fig. 11-58 Removing Rear Housing Seal

8. Remove the vacuum piston return spring and the push-rod from the front housing.

9. Remove the master cylinder from the front housing.

10. Remove the vacuum check valve and "O" ring from the front housing.

11. Remove the air filter and front housing seal. (Fig. 11-57)

12. Remove the vacuum piston from the rear housing.

13. Remove the seal from the rear housing (Fig. 11-58)

14. Remove the diaphragm from the vacuum piston.

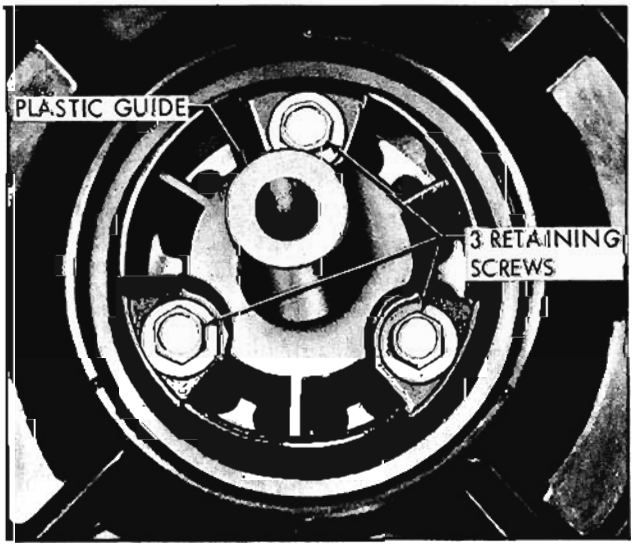


Fig. 11-59 Location of Guide Screws

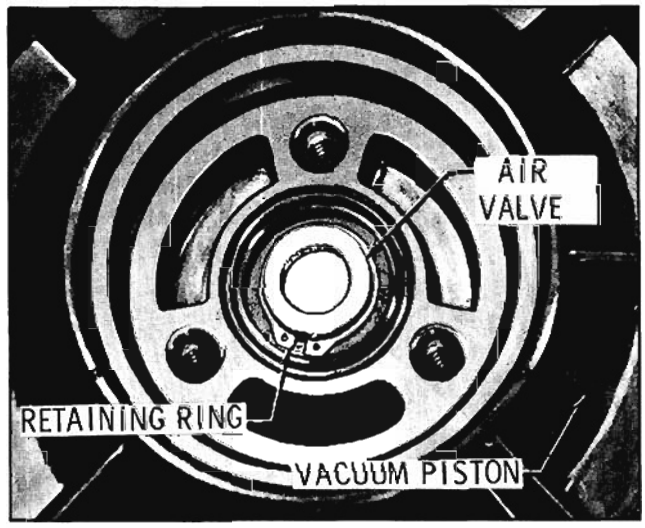


Fig. 11-60 Retaining Ring Location

15. Loosen the three guide attaching screws and remove the guide. Remove the rubber reaction bumper from the guide. (Fig. 11-59)

16. Depress operating rod and remove the reaction plate. Remove the reaction insert and the rubber reaction ring from the reaction plate.

17. Remove the reaction plate "O" ring from the vacuum piston.

18. Depress operating rod and remove the retaining ring from the air valve. (Fig. 11-60)

19. Remove the air valve, floating valve and operating rod assembly from the vacuum piston.

CLEANING AND INSPECTION

1. Thoroughly wash all metal parts in cleaner. Use ONLY alcohol or brake flushing fluid on plastic or rubber parts. Blow out all passages and air dry. Place parts on clean paper.

2. Inspect front and rear housings for scoring, pitting, dents, nicks or loose mounting studs. Small imperfections may be smoothed out with fine crocus cloth. Replace housing if damaged.

3. Inspect air valve for scratches, nicks or breakage. Check seat for smoothness and flatness. Valve should have a free sliding fit when inserted in the vacuum piston bore. Check floating valve for distortion of metal parts and deterioration or abrasions of rubber parts. Replace complete air valve, floating valve and operating rod assembly, if any parts are damaged.

4. Check vacuum piston for cracks or rough or uneven floating valve seat. Be sure all openings and passages are clean.

5. Replace air filter elements if dirty.

NOTE: When overhauling a unit, use all the parts furnished with the parts kit. Discard all old rubber parts.

ASSEMBLY
(Figs. 11-54 & 11-55)

For assembly of master cylinder, refer to MASTER CYLINDER - ASSEMBLY.

NOTE: On assembly, if a lubricant is specified, use Seal Lubricant, Part No. 567196.

1. Coat a new rear housing seal with lubricant and install as shown in Fig. 11-61.

2. Coat the floating valve and the "O" ring on the air valve with lubricant and install the operating rod assembly into the vacuum piston. Install the retaining ring. (Fig. 11-60)

3. Install the reaction plate "O" ring on the vacuum piston.

4. Position the reaction plate on the vacuum piston, aligning three of the holes with the threaded holes in the vacuum piston. (Fig. 11-62)

5. Install the rubber reaction ring and the reaction insert into the reaction plate.

NOTE: Coat the outer diameter of the reaction insert with lubricant. Do not lubricate the rubber reaction ring.

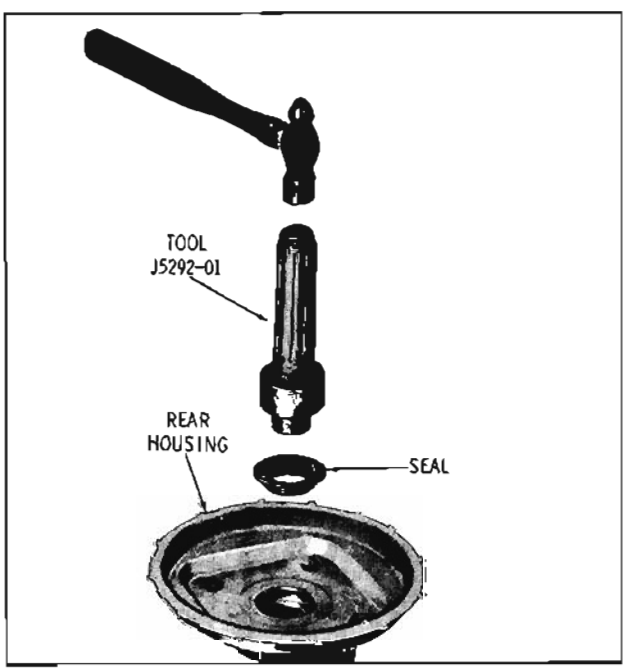


Fig. 11-61 Installing Rear Housing Seal

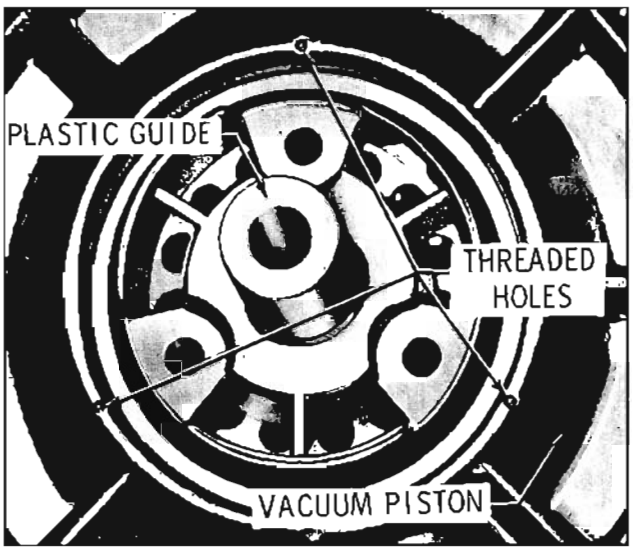


Fig. 11-62 Aligning Vacuum Piston and Guide

6. Coat the reaction insert bumper with libricant and install into the guide.

7. Position the guide on the vacuum piston. Retain the three screws. Torque screws 80 to 100 in. lbs.

8. Install the diaphragm on the vacuum piston making sure the diaphragm is seated in the groove of the vacuum piston.

9. Apply lubricant to the ID of the rear housing seal, then insert the vacuum piston into the rear housing.

10. Apply lubricant to a new front housing seal and install seal in the front housing, metal ridge of seal up. (Fig. 11-63)

11. Install a new air filter over the seal.

12. If the vacuum check valve was removed, install a new check valve and "O" ring into the front housing.

13. Position master cylinder on the front housing. Torque attaching nuts 15 to 20 ft. lbs.

14. Clamp master cylinder in a vise with the front housing up.

15. Insert the push-rod into the master cylinder piston with the adjusting screw toward the master cylinder.

16. Position the vacuum piston return spring over the hub of the front housing.

17. Apply lubricant to both sides of the outer edge of the diaphragm.

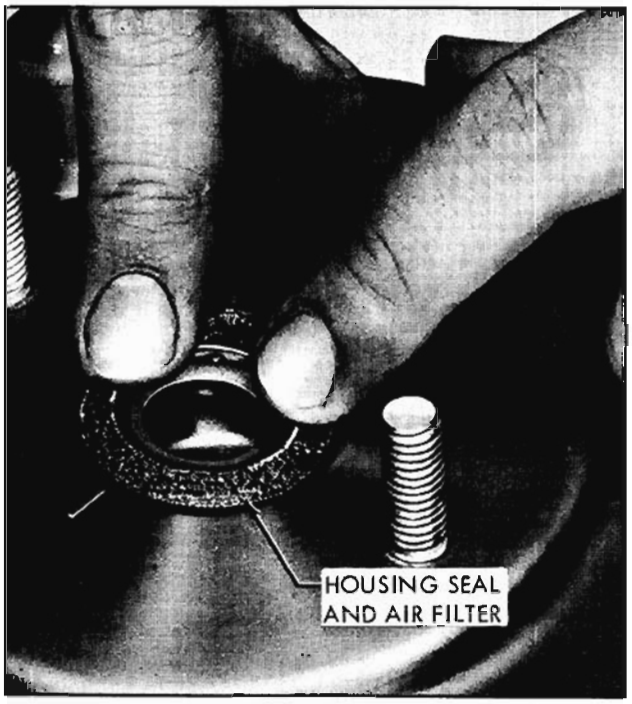


Fig. 11-63 Installing Housing Seal and Air Filter

18. Position the rear housing over the front housing, noting the alignment marks. Depress rear housing and rotate until the housings are locked. Install the front to rear housing retainer.

19. Install the air filters over the operating rod, small diameter filter first.

20. Install the plastic boot over the operating rod. Compress the sides of the boot so that the projections on the boot enter the holes in the mounting bracket.

21. Install the locknut and the clevis on the operating rod.

22. Adjust push-rod as outlined under PUSH-ROD ADJUSTMENT.

PUSH-ROD ADJUSTMENT (Fig. 11-64)

Under normal service conditions, the push-rod does not require any attention provided the push-rod remains in the original vacuum unit.

When a new push-rod is used or the push-rod is transferred to another unit, the push-rod must be checked as follows:

1. With the vacuum unit assembled, position Gauge J-7723-01 over the push-rod with the legs of the gauge resting on the front housing. The push-rod should just touch the gauge.

2. If the push-rod is high, grind the end of the push-rod until it just touches the gauge.

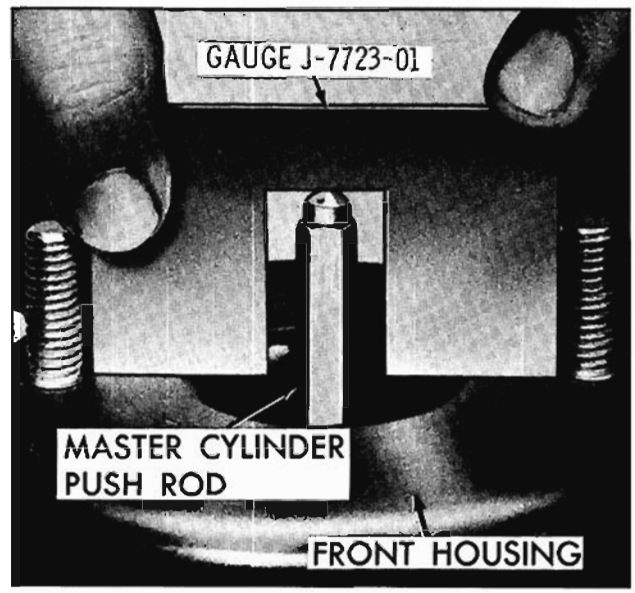


Fig. 11-64 Measuring Push-Rod Height

3. If the push-rod is low, a new service push-rod must be installed and ground down until adjustment is correct.

POWER BRAKE TESTING

Road test the brakes by making a brake application at about 20 mph to determine if the vehicle stops evenly and quickly. If the pedal has a spongy feel, when applying the brakes, air is present in the hydraulic system. Bleed the system at each wheel cylinder.

With the engine stopped and the transmission in neutral, apply the brake several times to exhaust all vacuum in the system. While depressing the brake pedal, start the engine. If the vacuum system is operating, the pedal will tend to move away under foot pressure, and less pressure will be required to hold the pedal in the applied position. If no action is felt, the vacuum system is not functioning.

Stop the engine and again exhaust all vacuum in the system. Without starting the engine, depress the brake pedal and hold foot pressure on the pedal. If the pedal gradually falls away under foot pressure, the hydraulic system is leaking.

To check the vacuum check valve, start the engine and accelerate to 20 mph and turn off the ignition. Immediately close the throttle to build up the vacuum supply. Wait at least 90 seconds and apply the brakes. If not vacuum assisted, the vacuum check valve or vacuum cylinder is leaking.

BRAKE DIAGNOSIS

The following diagnosis applies to both power brakes and standard brakes unless otherwise specified.

1. Hard Pedal Feel May Be Caused By:

   A. Power brake vacuum failure due to:

      (1) Faulty vacuum check valve or seal.

      (2) Collapsed vacuum hose to manifold.

      (3) Plugged or loose vacuum hose or fitting.

      (4) Leaks in front or rear housing.

   B. Bound up pedal mechanism.

   C. Grease on brake drum or linings.

   D. Power brake unit trouble due to:

      (1) Jammed air valve.

      (2) Vacuum leak past the vacuum diaphragm.

      (3) Leak in vacuum cylinder.

      (4) Restricted air filter.

      (5) Malfunctioning air valve.

      (6) Leaking past floating or air valve.

2. "Grabby" or Severe Brakes Caused By:

   A. Grease or brake fluid on linings.

   B. Scored drums.

   C. Burned linings.

   D. Power brake unit trouble due to:

      (1) Sticking air valve.

      (2) Binding master cylinder piston.

3. Pedal Goes to Floor (or almost to floor) Caused By:

   A. Self-adjuster not operating.

   B. Air in hydraulic system.

   C. Hydraulic leak in line or at wheel cylinders.

   D. Low fluid level in master cylinder reservoir.

   E. Leak at primary cup.

   F. Sand hole or crack in master cylinder.

   G. Worn brake linings.

4. Brake Lock-Up Caused By:

   A. Restricted compensator port.

   B. Incorrect push-rod adjustment (Power).

   C Incorrect pedal free travel (Standard).

   D. Faulty hydraulic check valve.

   E. Sticking air valve.

5. Excessive Lining Wear Rear Brakes

   Parking brake improperly adjusted.

GENERAL SPECIFICATIONS

BRAKE ASSEMBLIES AND DRUMS

LINING AREA

1. 30, 31, 32 and 33 Series	155.0 sq. in.
2. 34, 35, 36, 38 and 39 Series	191.7 sq. in.

RATIO (Percentage of Brake Effect)

1. 30, 31, 32 and 33 Series	
A. Front Brakes	52%
B. Rear Brakes	48%
2. 34, 35, 36, 38 and 39 Series	
A. Front Brakes	56%
B. Rear Brakes	44%

DRUMS

1. 30, 31, 32 and 33 Series	
A. Inside Diameter	9.50"
B. Out-of-Round (Total Indicator Reading)	
(1) Front	.005" Max.
(2) Rear	.006" Max.
2. 34, 35, 36, 38 and 39 Series	
A. Inside Diameter	11.0"
B. Out-of-Round (Total Indicator Reading)	
(1) Front	.005" Max.
(2) Rear	.006" Max.

LININGS

1. 30, 31, 32 and 33 Series	
A. Length - Primary Lining	7-1/2"
B. Length - Secondary Lining	9-7/8"
C. Width - Front Linings	2-1/2"
D. Width - Rear Linings	2"
E. Thickness	
(1) Primary Lining	3/16"
(2) Secondary Lining	1/4"
2. 34, 35, 36, 38 and 39 Series	
A. Length - Primary Lining	9-3/8"
B. Length - Secondary Lining	12"
C. Width - Front Linings	2-1/2"
D. Width - Rear Linings	2"
E. Thickness	
(1) Primary Lining	1/4"
(2) Secondary Lining	5/16"

GENERAL SPECIFICATIONS
(Cont'd)

HYDRAULIC SYSTEM

FLUID TYPE	Super No. 11
FLUID LEVEL (Power or Standard)	1/4" Below Master Cylinder Opening

MASTER CYLINDER BORE

All Except 3300 Power	1.0"
3300 Power	7/8"

WHEEL CYLINDER BORE

1. 30, 31, 32 and 33 Series	
A. Front	1-1/16"
B. Rear	15/16"
2. 34, 35, 36, 38 and 39 Series	
A. Front	1-1/8"
B. Rear	1.0"

ADJUSTMENTS

BRAKE SHOE (Standard and Power)	Self-Adjusting

PEDAL HEIGHT (Floor Pan to Center of Pedal Pad)

1. 30, 31 and 32 Series	
A. Standard	7-1/2" ± 1/8"
B. Power	5-1/4" ± 1/8"
2. 33, 34, 35, 36, 38 and 39 Series (Standard)	7-15/16" ± 1/8"

MAXIMUM ALLOWABLE BRAKE PEDAL TRAVEL (BEFORE ADJUSTMENT)

1. Standard	4.0"
2. Power	1-7/8"

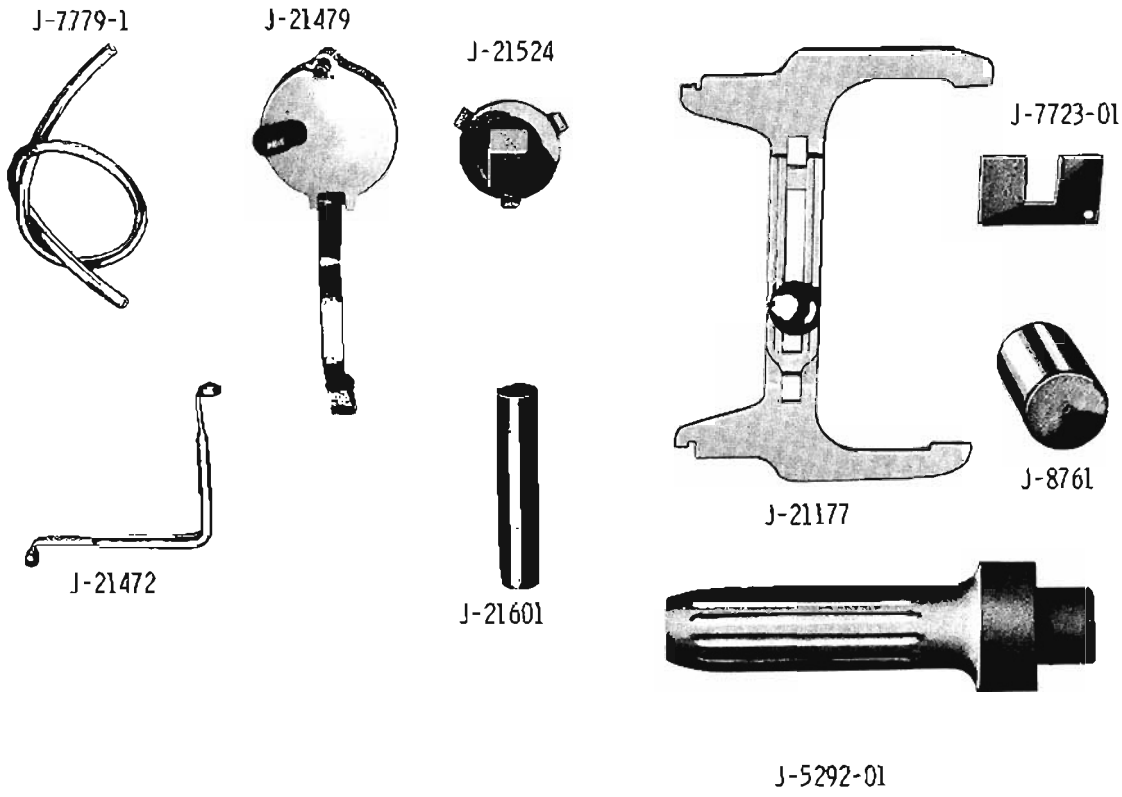
PARKING BRAKE (Adjust with parking brake released)

1. Equalizer	Tighten equalizer adjusting nut until heavy drag is felt at rear wheels, then loosen nut seven turns.

TORQUE SPECIFICATIONS

NOTE: Specified torque is for installation of parts only. Checking of torque during inspection may be 15% below the specified.

Application	Ft. Lbs.
Front Brake Hose To Wheel Cylinder	28 to 35
Rear Brake Hose To Junction Block	20 to 28
Anchor Pin To Steering Knuckle Bolt	
34, 35, 36, 38 and 39 Series	120 to 145
30, 31, 32 and 33 Series	80 to 105
Plain Arm To Steering To Backing Plate Bolts and Nuts	
34, 35, 36, 38 and 39 Series	100 to 140
30, 31, 32 and 33 Series	60 to 82
Backing Plate to Axle Housing Nuts	50 to 55
Wheel Cylinder To Backing Plate Cap Screws	8 to 16
Wheel Nuts	
34, 35, 36, 38 and 39 Series	70 to 85
30, 31, 32 and 33 Series	55 to 75
Parking Brake Lever To Dash	
34, 35, 36, 38 and 39 Series	5 to 7
30, 31, 32 and 33 Series	18 to 22
Parking Brake Lever To Instrument Panel Cap Screws	5 to 7
Pedal Mounting Bracket To Instrument Panel Cap Screws	5 to 7
Pedal Mounting Bracket and Master Cylinder Bolts To Cowl	20 to 27
Pedal Pivot Bolt Nut	10 to 18
Master Cylinder Reservoir Cap (Bendix)	Finger Tight
Master Cylinder To Front Housing	20 to 27
Rear Housing To Cowl	20 to 27
Master Cylinder To Cowl	20 to 27



J-7779-1	Bleeder Hose	J-21177	Brake Drum and Shoe Gauge
J-21479	Pressure Bleeder Cap	J-8761	Hydra-Matic Front Pump Seal Installer (Used to Install Rear Seal in Kelsey-Hayes Power Brake)
J-21524	Vacuum Piston and Support Plate Remover and Installer	J-5292-01	Differential Side Bearing Installer (Used to Install the Rear Seal in the Kelsey-Hayes Power Brake)
J-7723-01	Push Rod Gauge		
J-21472	Bleeder Valve Wrench		
J-21601	Floating Valve Retainer Installer (Moraine)		

Fig. 11-65 Tools