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CHASSIS
OVERHAUL MANUAL

CHEVROLET · CHEVELLE
CAMARO · CHEVY II
CORVETTE

CHEVROLET

ST 131-67

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.

1967 CHEVROLET, CHEVELLE, CAMARO, CHEVY II AND CORVETTE CHASSIS OVERHAUL MANUAL

FOREWORD

This manual includes procedures involved in disassembly and assembly of major components, except the body, for Chevrolet, Chevelle, Camaro, Chevy II and Corvette vehicles. Information on maintenance and adjustments, minor service operations, removal and installation for these components is contained in the 1967 Chassis Service Manual, which also contains service information for 1967 Corvette body items. Service information for 1967 Chevrolet, Chevelle, Chevy II Camaro body items is contained in the 1967 Body Service Manual.

The Section Index on this page enables the user to quickly locate any desired section. At the beginning of each section containing more than one major subject is a Table of Contents, which gives the page number on which each major subject begins. An Index is placed at the beginning of each major subject within the section.

Summaries of Special Tools, when required, are found at the end of major sections, while Specifications covering vehicle components are presented at the rear of the manual.

This manual should be kept in a handy place for ready reference. If properly used, it will enable the technician to better serve the owners of Chevrolet built vehicles.

All information, illustrations and specifications contained in this literature are based on the latest product information available at the time of publication approval. The right is reserved to make changes at any time without notice.

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CHEVROLET MOTOR DIVISION
General Motors Corporation
DETROIT, MICHIGAN

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SECTION 1

AIR CONDITIONING COMPRESSOR

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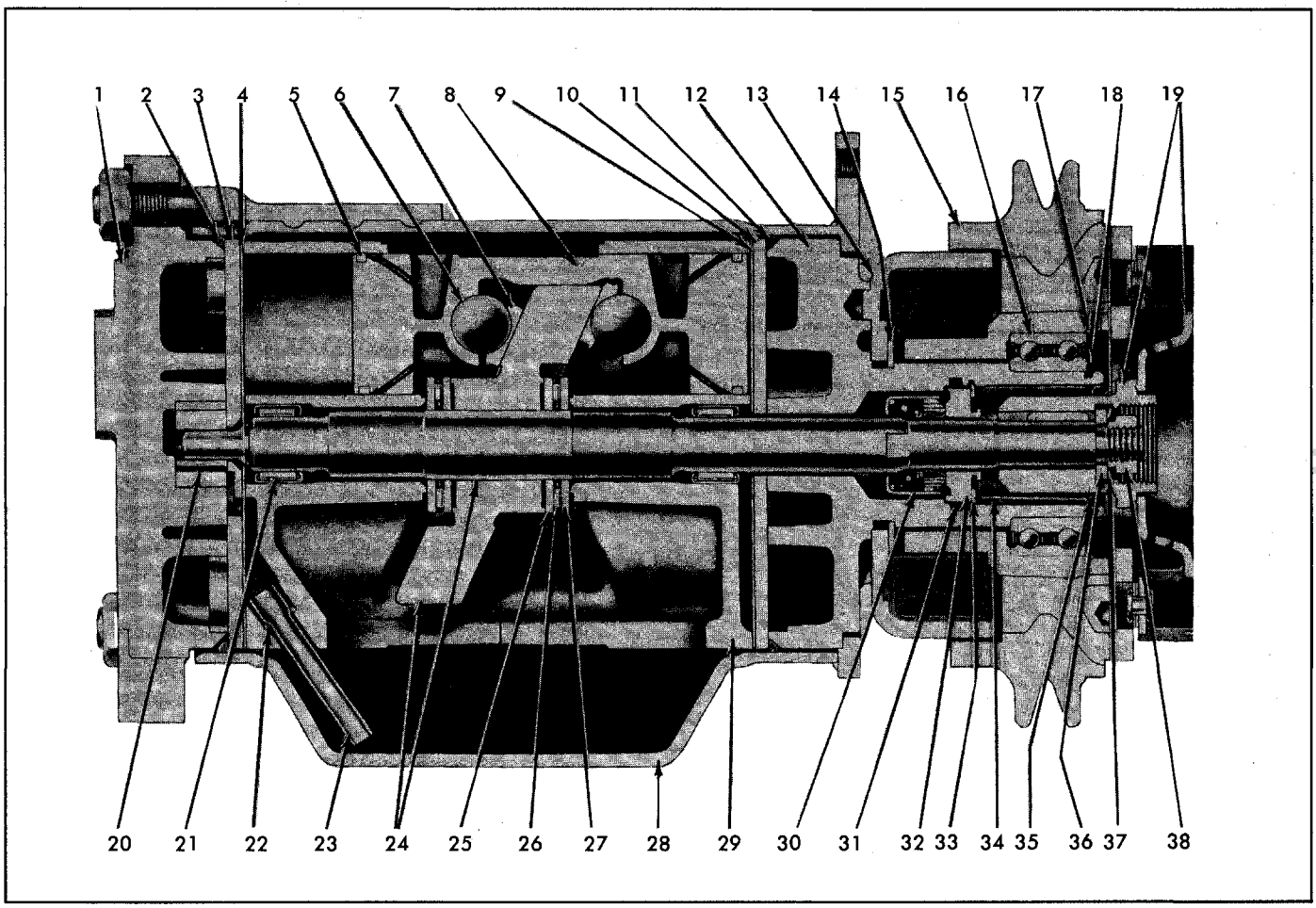


Fig. 1—Six Cylinder Compressor—Cross Section View

1. Rear Head
2. Rear Head to Shell "O" Ring
3. Rear Discharge Valve Plate
4. Rear Suction Reed Plate
5. Piston Ring
6. Piston Drive Ball
7. Ball Seat
8. Piston
9. Front Suction Reed Plate
10. Front Discharge Valve Plate
11. Front Head to Shell "O" Ring
12. Front Head
13. Coil and Housing Assembly
14. Coil Housing Retainer Ring
15. Pulley and Bearing Assembly
16. Pulley Bearing
17. Pulley Bearing Retainer Ring
18. Pulley and Bearing Retainer Ring
19. Clutch Hub and Drive Plate Assembly
20. Oil Pump Gears
21. Mainshaft Bearing (Rear)
22. Oil Inlet Tube "O" Ring
23. Oil Inlet Tube
24. Wobble Plate and Mainshaft Assembly
25. Thrust Race
26. Thrust Bearing
27. Thrust Race
28. Compressor Shell
29. Cylinder Assembly
30. Shaft Seal
31. Shaft Seal Seat "O" Ring
32. Shaft Seal Seat
33. Shaft Seal Seat Retainer Ring
34. Felt Sleeve
35. Felt Sleeve Retainer
36. Spacer
37. Clutch Hub Retainer Ring
38. Shaft Nut

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For all practical purposes all Chevrolet vehicles make use of the same air conditioning compressor. Actual differences between compressors are found in their mounting brackets, connector assemblies and compressor capacities, none of which affect the following Overhaul Procedures.

MINOR REPAIR PROCEDURES

The following operations to the Hub and Drive Plate, Pulley and Bearing, and Coil Housing are covered as "Minor" because they may be performed without first purging the system or removing the compressor from the vehicle. The Shaft seal assembly may also be serviced without removing the compressor from the vehicle but this operation is covered later in this section as a "Major Repair Procedure" because the system must first be purged of refrigerant.

Illustrations used in describing these operations show the compressor removed from the vehicle to more clearly illustrate the various operations.

Hub and Drive Plate

Removal

1. If disassembly is being performed on a bench, mount Support Bracket J-9396 in a vise and attach the compressor to the bracket.
2. Using Drive Plate Holding Tool J-9403 and Socket J-9399, remove the locknut from the shaft (fig. 2). Discard locknut.
3. Tool J-9401 may now be used to remove the hub and drive plate assembly (fig. 3).

   NOTE: Carefully snug tool into place with wrench to insure engagement with threads.

4. Use Snap Ring Pliers J-5403 to remove the retainer ring (Item 35, fig. 1). Then remove the hub spacer.

Inspection

If the frictional surface shows signs of damage due to excessive heat, the hub and drive plate and the pulley should be replaced. Check further for the underlying cause of the damage, i.e. low coil voltage or binding of the compressor internal mechanism.

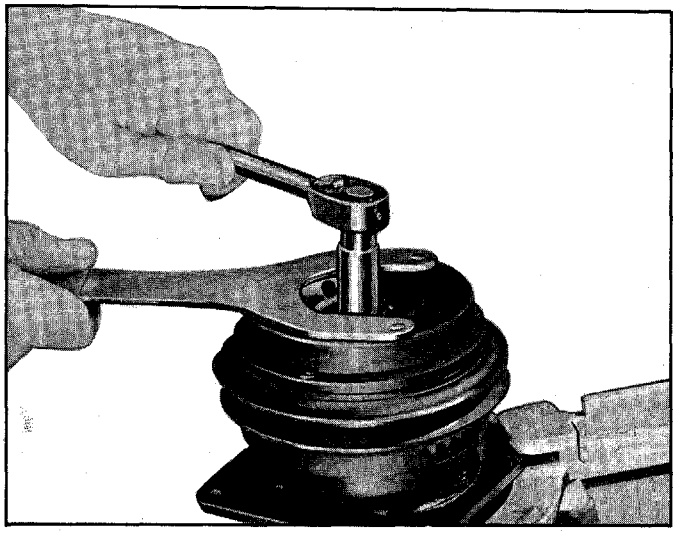


Fig. 2—Removing Shaft Locknut

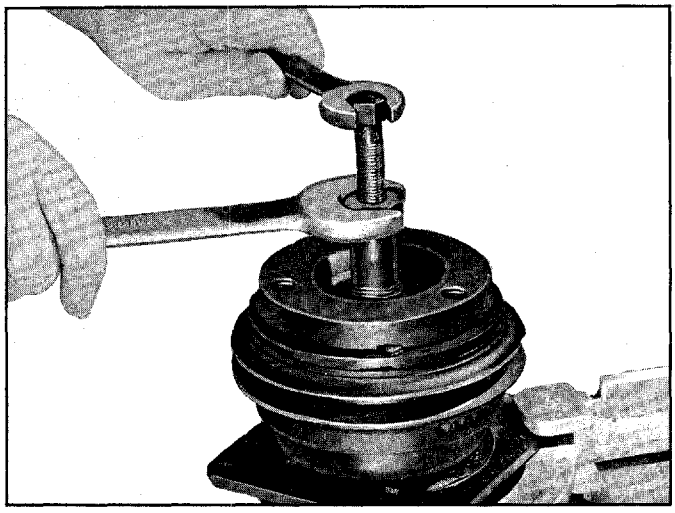


Fig. 3—Removing Hub and Drive Plate Assembly

Installation

NOTE: When hub and drive plate assembly is ready for installation, clean its frictional face with a suitable cleaner.

1. Insert the square hub and drive plate key into the keyway in the drive shaft allowing it to project approximately 3/16" out of the end of the keyway (fig. 4).
2. Line up the key in the shaft with the keyway in the hub.
3. Using Tool J-9480 and Washer J-9480-2 (fig. 5), install the hub and drive plate assembly. Pull the assembly onto the shaft until there is approximately 3/32" space between the frictional surfaces of the drive plate and pulley. (A ZERO thrust race is approximately 3/32" in. thickness and may be used to roughly gauge this operation.)

   NOTE: Use Tool J-9403 to hold hub and drive plate if necessary.

4. Install the hub spacer washer and, using Snap Ring Pliers J-5403, install the retainer ring (Item 35, fig. 1), convex side of ring facing washer.
5. Use J-9399 and J-9403 to install a new locknut. Tighten the nut to 14-26 ft. lbs. torque. Air gap between the frictional faces should now be .022" to .057".

   NOTE: The shoulder or circular projection on the locknut must face towards retainer ring.

6. The pulley should now rotate freely.

   CAUTION: Never pound or drive the hub and drive plate into position. Always use the proper tools when removing or replacing clutch parts. Failure to do so may result in serious internal compressor damage.

7. Operate the refrigeration system and rapidly cycle the clutch (by turning the air conditioning off and on

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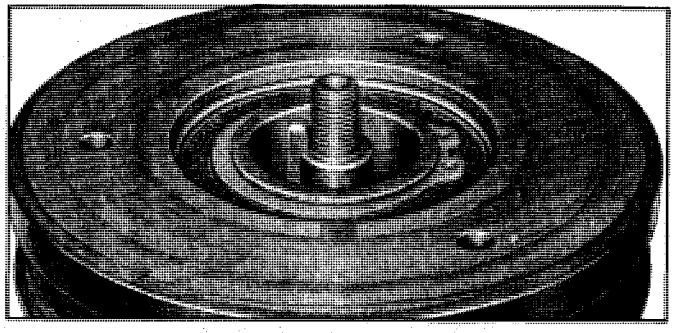


Fig. 4—Drive Plate Key Installed in Keyway

at least 20 times at approximately one second intervals) to seat the mating parts of the clutch.

Pulley and Bearing Assembly

Removal

1. Remove the hub and drive plate assembly.
2. Using Snap Ring Pliers J-6435, remove the pulley and bearing retainer ring (fig. 6).
3. Remove shaft key.
4. Place Puller Pilot J-9395 over the compressor shaft and pull off the pulley assembly using J-8433 pulley puller (fig. 7).

Inspection

Check the appearance of the pulley and bearing assembly. If the frictional surface of the pulley shows signs of excessive grooving due to slippage both the pulley and the clutch hub and drive plate assembly should be replaced. The frictional surfaces of the bearing to be used should be cleaned with a suitable solvent before reinstallation.

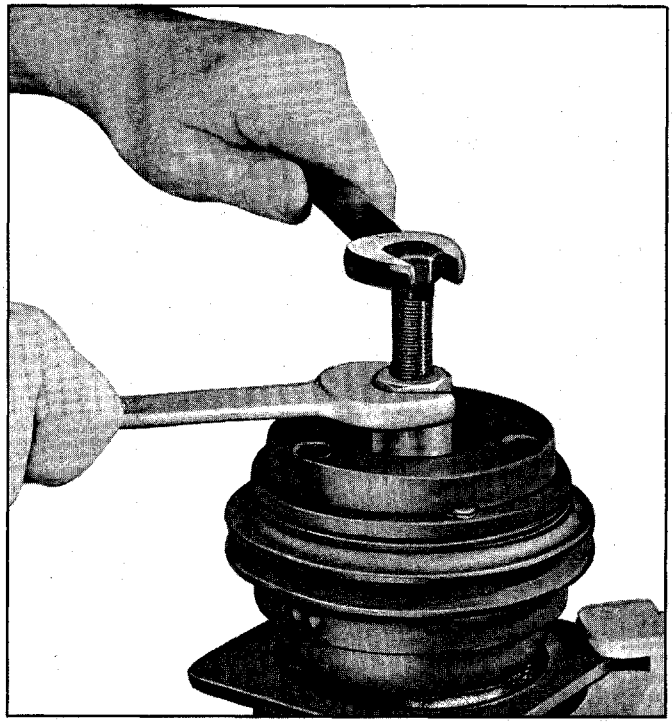


Fig. 5—Installing Hub and Drive Plate Assembly

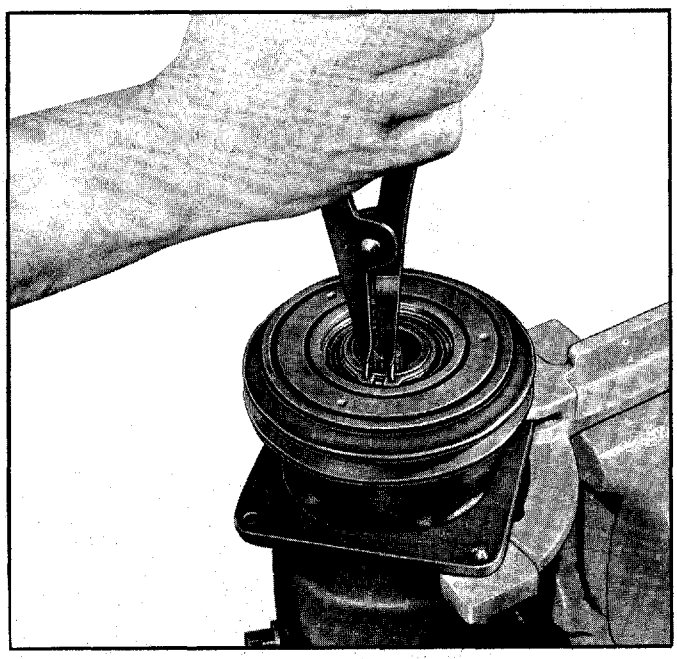


Fig. 6—Removing Pulley and Bearing Assembly Retainer Ring

Bearing Replacement

1. With the pulley and bearing assembly removed from the compressor, use a sharp pointed instrument to remove the wire retainer ring.

   CAUTION: If the bearing is to be reused be careful not to slip and damage the seal.

2. From the rear of the pulley, press or drive bearing out of pulley using Tool J-9398 and Handle J-8092.
3. From the front of the pulley and using Tool J-9481 with Handle J-8092, press or drive the new bearing into the pulley.

Installation

1. Using Tool J-9481, press or drive the pulley and bearing assembly onto the compressor neck. The pulley should now rotate freely.
2. Install retainer ring using Snap Ring Pliers J-6435.

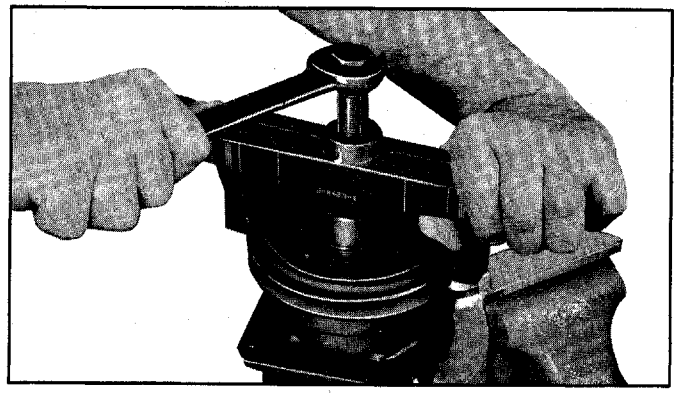


Fig. 7—Removing Pulley

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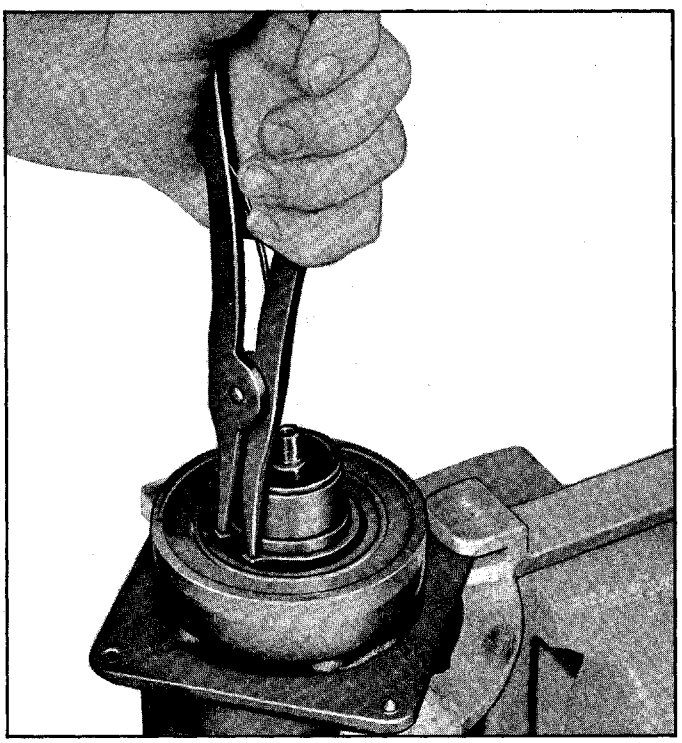


Fig. 8—Removing Coil Housing Retainer Ring

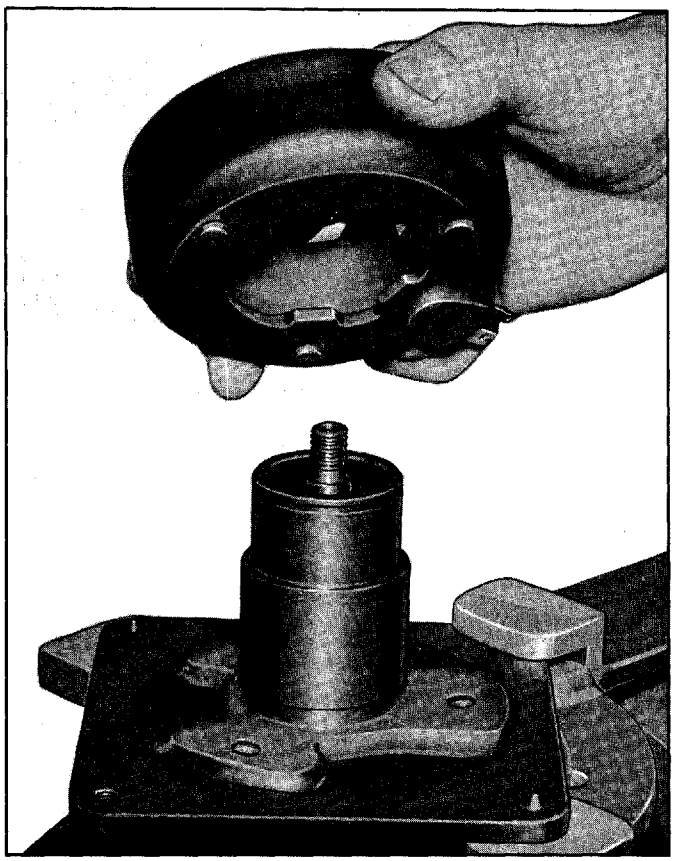


Fig. 9—Installing Coil Housing

3. Replace the hub and drive plate assembly. Use proper tools. DO NOT drive or pound on the hub assembly.
4. Install the wire bearing retainer ring.

Coil Housing Assembly

Removal

1. Remove the hub and drive plate assembly, the pulley and bearing assembly, and electrical connector.
2. Scribe the location of the coil housing to the compressor body. This operation is to insure that the electrical terminals will be reassembled in the same position.
3. Using Snap Ring Pliers J-6435, remove the coil housing retainer ring (fig. 8).
4. Remove the coil housing assembly.

Inspection

Check coil for loose connectors or cracked insulation. Amperage should not be more than 3.2 amps at 12 volts D.C. at room temperature.

Installation

1. Rotate the coil housing to the correct position as indicated by the scribe marks and the location of the electrical terminals and fit into place (fig. 9).
2. Use Snap Ring Pliers J-6435 to install retainer ring.

   NOTE: Install flat surface of the retainer ring facing the coil housing.

3. Replace the pulley and bearing assembly and the hub and drive plate assembly. DO NOT drive or pound on the hub assembly.
4. If the compressor is installed in the vehicle, connect the electrical connections.

MAJOR REPAIR PROCEDURES

The following service procedures are considered major since the refrigeration system must be completely purged of refrigerant before proceeding and/or because major internal operating and sealing components of the compressor are being disassembled and serviced. A clean workbench, preferably covered with a sheet of clean paper, orderliness in the work area and a place for all parts being removed and replaced is of great importance as is the use of the proper service tools. Any attempt to use make-shift or inadequate equipment may result in damage and/or improper compressor operation.

These procedures are based on the use of the proper service tools and the condition that an adequate stock of service parts is available. This service parts stock should include the following:

1. Major interior mechanism assembly - ready for installation in shell as is.
2. Service cylinder assembly - front and rear halves with main bearings in place and halves dowel pinned together.
3. Standard size piston drive balls.
4. Ball seats - total of 10 sizes, including the ZERO seat.
5. Thrust races - total of 14 sizes, including the ZERO race.
6. Pistons.

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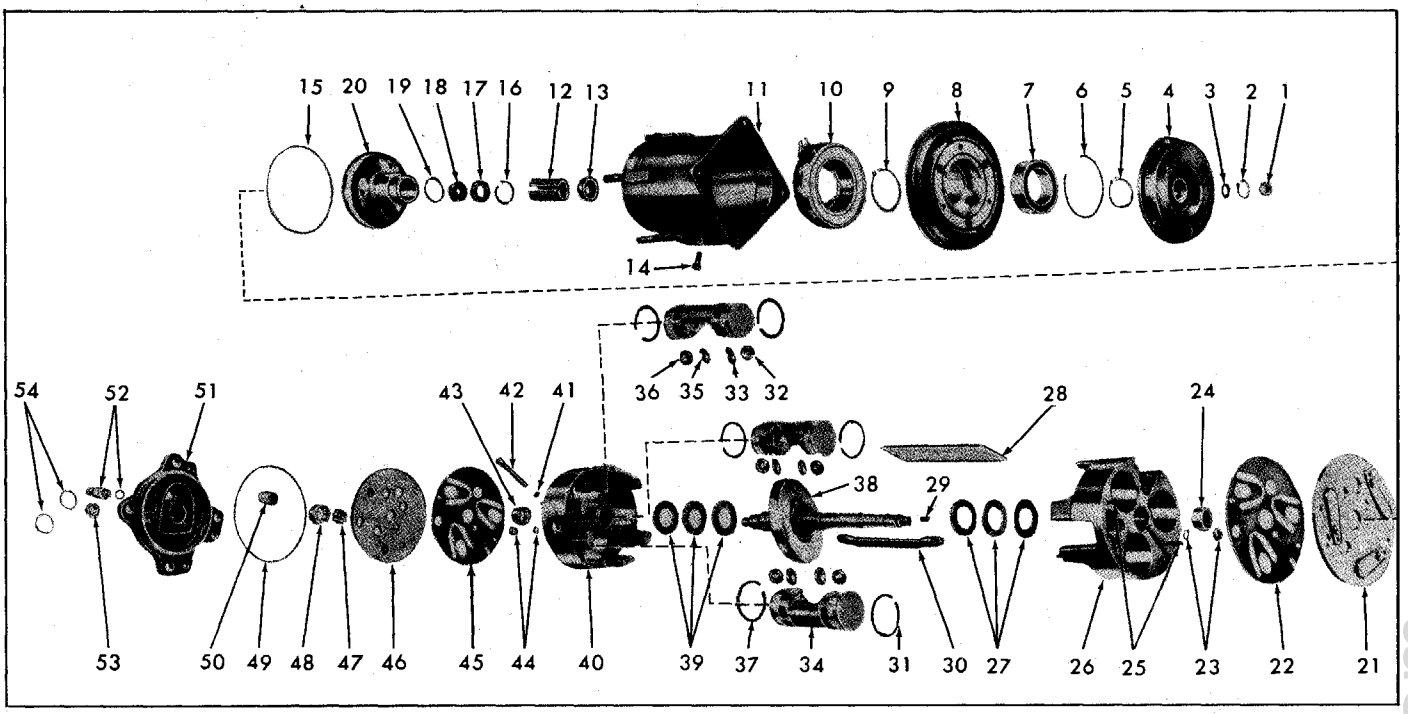


Fig. 10—Six Cylinder Compressor—Exploded View

1. Shaft Nut
2. Clutch Hub Retainer Ring
3. Spacer
4. Clutch Hub and Drive Plate Assembly
5. Pulley and Bearing Retainer Ring
6. Pulley Bearing Retainer Ring
7. Pulley Bearing
8. Pulley
9. Coil Housing Retainer Ring
10. Coil Housing
11. Compressor Shell
12. Felt Sleeve
13. Felt Sleeve Retainer
14. Oil Drain Plug
15. Front Head-to-Shell "O" Ring
16. Shaft Seal Seat Retainer Ring
17. Shaft Seal Seat
18. Shaft Seal
19. Shaft Seal Seat "O" Ring
20. Compressor Front Head
21. Front Discharge Valve Plate
22. Front Suction Reed Valve
23. Discharge Crossover Tube Front "O" Ring and Spacer
24. Mainshaft Front Bearing
25. Head Locating Pins
26. Front Cylinder Half
27. Front Thrust Race and Bearing Pack
28. Suction Crossover Cover
29. Drive Key
30. Discharge Crossover Tube
31. Piston Ring
32. Piston Front Drive Ball
33. Piston Front Ball Seat
34. Piston
35. Piston Rear Ball Seat
36. Piston Rear Drive Ball
37. Piston Ring
38. Drive Shaft and Wobble Plate Assembly
39. Rear Thrust Race and Bearing Pack
40. Rear Cylinder Half
41. Oil Inlet Tube "O" Ring
42. Oil Inlet Tube
43. Mainshaft Rear Bearing
44. Discharge Crossover Tube Rear "O" Ring and Spacer
45. Rear Suction Reed Plate
46. Rear Discharge Valve Plate
47. Oil Pump Drive Gear
48. Oil Pump Driven Gear
49. Rear Head-to-Shell "O" Ring
50. Strainer Screen
51. Compressor Rear Head
52. High Pressure Relief Valve and "O" Ring
53. Rear Head-to-Shell Retaining Nuts
54. Compressor-to-Connector "O" Rings

7. Main shaft bearings.
8. Thrust bearings.
9. Compressor shaft and wobble plate.
10. Suction reed valves.
11. Discharge valve plate - front and rear.
12. Seal kit - service - contains all seals and "O" rings. To be used each time a compressor is rebuilt.
13. Shaft seal kit.
14. Nuts - head to shell, and shaft.
15. Retainer rings - all necessary sizes.
16. Cylinder locator (dowel) pins.
17. Valve and head locator (dowel) pins.
18. Service discharge crossover tube kit.

All parts required for servicing are protected by a preservation process and packaged in a manner which will eliminate the necessity of cleaning, washing or flushing of the parts. The parts can be used in the mechanism assembly just as they are removed from the service package.

Piston ball seats and shaft thrust races will be identified on the parts themselves to denote their size and dimension.

Shaft Seal Assembly

When replacing the shaft seal assembly, even if the compressor remains on the vehicle during the operation, it will be necessary to purge the system of refrigerant as outlined previously in this section.

Removal

1. After first purging the system of refrigerant, remove the clutch hub and drive plate, and the shaft key.
2. Before removing the seal seat and retaining ring, thoroughly clean the area of the neck of the compressor surrounding the shaft to remove all dirt or foreign material. Pry out the felt retaining ring and remove the felt sleeve. Remove the seal seat retaining ring using Snap Ring Pliers J-5403.
3. Using Tool J-9393 (1 and 2), grasp the flange on the seal seat and lift out the seal seat (fig. 12).
4. Remove the seal seat "O" ring from the housing bore using Tool J-9553 (fig. 12).
5. Engage the tabs on the seal assembly with the locking

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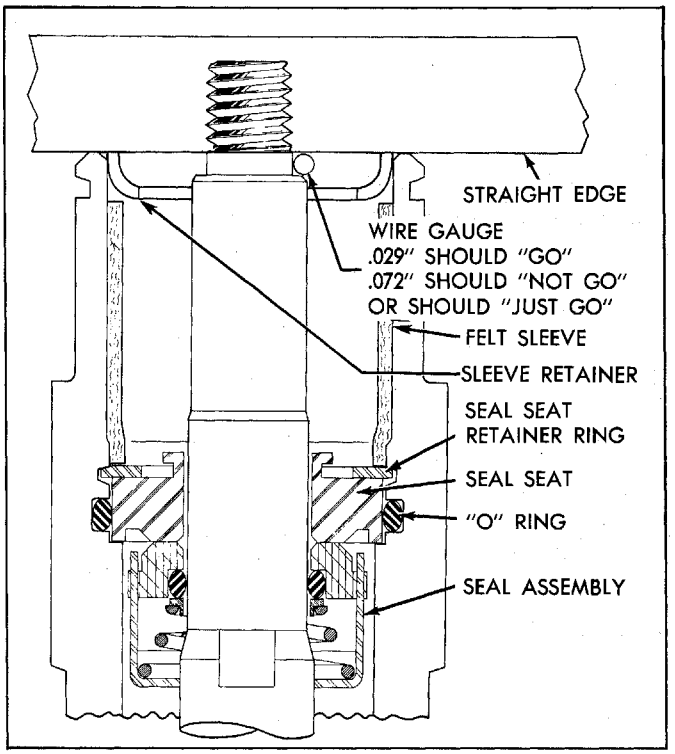


Fig. 11—Checking for Wobble Plate Position on Shaft

tangs on Tool J-9392 by pressing down and twisting the tool, then lift the seal out.

Inspection

Check the face of the seal for nicks, gouges or serrations. If damage of any kind is evident, replace the seal. Be extremely careful that the face of the seal which is to be installed is not scratched or damaged in any way.

Apparent seal leaks are sometimes the result of mispositioning of the wobble plate on the compressor shaft caused by improper procedures during pulley removal or pounding or dropping on the compressor shaft. Check as shown in Figure 11. If measurement is greater than shown, replace the shaft and wobble plate assembly.

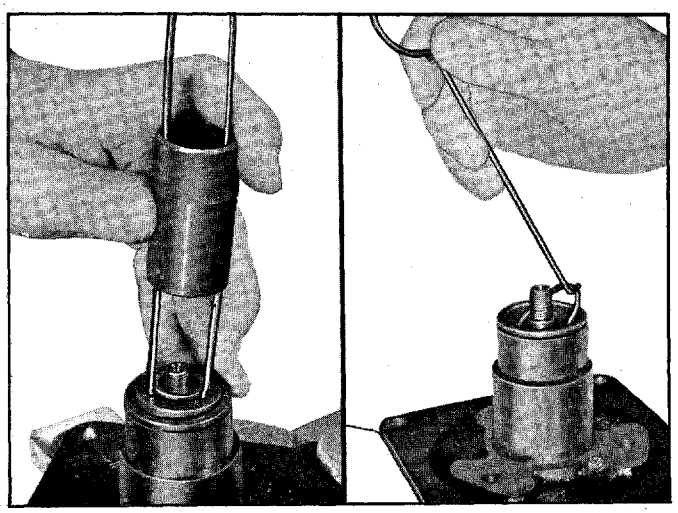


Fig. 12—Removing Seal Seat and "O" Ring

Installation

1. Engage seal onto the locking tangs of Tool J-9392 (fig. 13) and, with J-21303 installed over the end of the shaft, carefully insert the seal and tool over the end of the shaft. Turn seal to engage the flat on the shaft, then remove the tool.
2. Coat a new "O" ring and the interior of the seal cavity, shaft and seal with clean refrigeration oil, and, using Tool J-21508, install the "O" ring in its groove just above the seal.

   To install the "O" ring place "O" ring on tool as shown in Figure 13, insert the tool fully into the front head bore, press down the slider, twist entire tool to seat "O" ring and then remove tool.
3. Using Tool J-9393 grasp the seal seat and set in place on top of the seal.
4. Using Snap Ring Pliers J-5403, replace the retaining ring. Tap with the palm of the hand on the barrel of J-9393 to press the retainer ring into place.

   NOTE: Install the retaining ring with the flat surface facing the seal seat.
5. Leak test the compressor as described under "Leak Testing the Compressor" in this section.
6. Roll the felt into a cylinder and slip it into the neck of the compressor with the overlapping ends toward the compressor top. With a small screwdriver or similar tool, spread the felt so that the ends butt. Using tool J-9395, tap the felt retaining ring (flange first) into the compressor neck until flush with the end.
7. Reinstall the clutch hub and drive plate.
8. Replace the compressor on the vehicle if it was previously removed, and evacuate and charge the system.

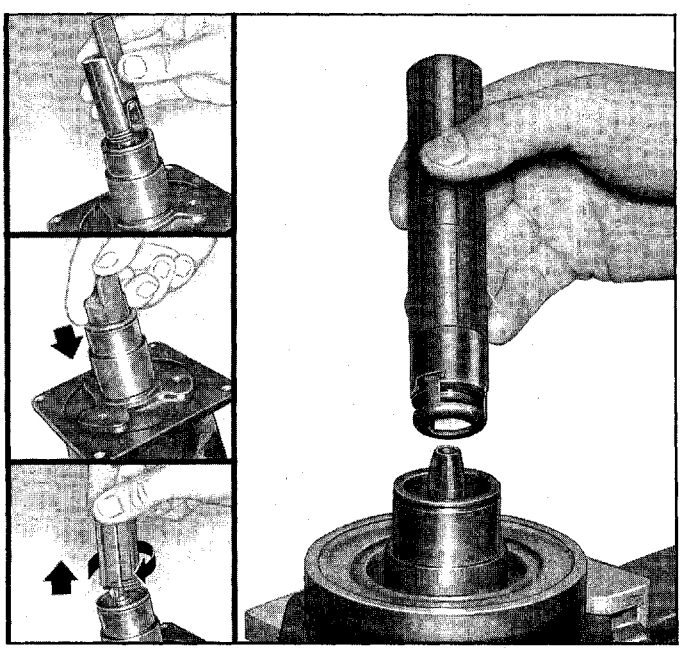


Fig. 13—Replacing Seal and "O" Ring

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Pressure Relief Valve

When a faulty pressure relief valve, located in the rear head casting, is encountered, the valve assembly should be removed after purging the system and a new valve and gasket installed. The entire system should then be evacuated and recharged.

Compressor Rear Head and Internal Mechanism

Service operations to the rear head or internal mechanism of the compressor should be performed with the compressor removed from the vehicle to insure that the necessary degree of cleanliness may be maintained. Clean hands and a clean bench, preferably covered with clean paper, are of extreme importance.

Rear Head, Oil Pump and Valve Assemblies

Removal

1. Remove the compressor from the vehicle, drain compressor oil into a clean container, clean the exterior of the compressor case and rear head casting with a suitable solvent and mount the compressor, rear head up, in holding Fixture J-9396 which should then be mounted securely in a vise.
2. Remove the four nuts from the shell studs.
3. Remove the rear head. Examine the teflon surface on the casting webs. If this surface is damaged by nicks or scratches, the head should be replaced.
4. Examine the suction screen in the rear head for any damage or contamination. Clean or replace the screen as necessary.
5. Remove and examine the oil pump gears. If either of the gears shows any wear or damage, replace both gears.

   NOTE: Keep the ends of the two oil pump gears matched and replace the same end toward the discharge plate upon reassembly.

6. Remove the rear head-to-shell "O" ring and discard.
7. With two screw drivers, carefully pry up on the rear discharge valve plate assembly (fig. 14). Check for broken reeds or damaged seats and replace entire assembly if such is found.

   CAUTION: Excessive force during this operation may loosen valve reed retainer rivets.

8. Carefully lift off the rear suction reed valve. Valve must be replaced if any damage is evident.

Installation

1. Carefully replace the suction reed valve and the rear discharge plate over the dowel pins and ports in the cylinder assembly. Proper positioning of the reed plate may be determined by lining up the proper opening in the plate with the discharge crossover tube opening.
2. Position the rear head casting to align with the dowel pins. The two lower mounting pads will be in alignment with the oil sump in the shell. Rotate the cylinder assembly back and forth by hand, if necessary, to permit this alignment. Remove the rear head from this trial assembly.
3. Install the inner oil pump gear over the "D" flat on the shaft and place the outer oil pump gear over the inner gear. Position the outer gear as follows:
   a. Observe the position of the oil sump in the shell.

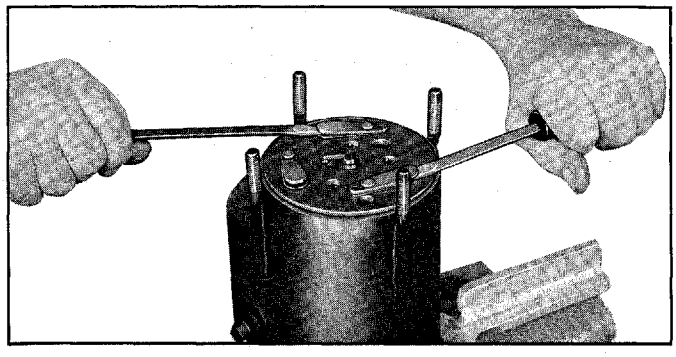


Fig. 14—Removing Rear Discharge Valve Plate

   b. Locate the approximate centerline of this pump.
   c. Facing the centerline of the sump and viewing from the sump side (bottom) of the compressor, move the OUTER gear toward the right (side having the oil drain fitting) until it is at approximately 90° (3 o'clock position) from the centerline of the oil sump (fig. 15).
4. Coat the head-to-shell "O" ring with clean refrigeration oil and generously lubricate the area around the outer edge of the valve plate where the "O" ring will be placed. Oil also the oil pump gears, valve reeds and the area where the teflon gasket will contact the valve plate.
5. Install the head-to-shell "O" ring.
6. Be sure that the suction screen is properly positioned in the rear head, then assemble the rear head to the compressor shell being careful not to damage the teflon gasket.

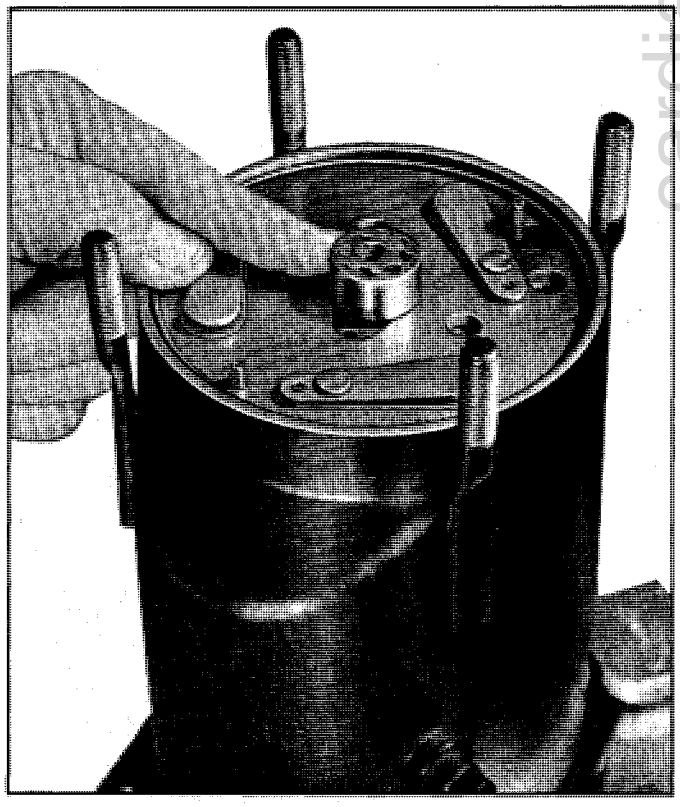


Fig. 15—Proper Oil Pump Gear Positioning

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CAUTION: Be sure head does not bind against oil pump gears when being installed.

7. Install new nuts to the threaded shell studs and tighten to 19-25 ft. lbs. torque.
8. Leak test the compressor as outlined under "Leak Testing the Compressor" in this section.
9. Install compressor in the vehicle.

Major Internal Mechanism

The clutch hub and drive plate assembly, drive key, pulley and coil housing should be removed before proceeding with the following compressor disassembly.

Removal from Shell

1. Remove the rear head, discharge plate and suction reed valve from the compressor as outlined under "Rear Head and Reed Valve Assemblies" above.
2. Remove the oil inlet tube and "O" ring with J-5139 as shown in Figure 16.
3. Carefully lay the compressor shell on its side and slide out interior mechanism and front head assembly. Do not hammer or use undue force to remove the mechanism; however, gentle taps on the head casting may aid in removing the assembly.
4. Remove front head casting, front discharge valve plate and suction reed valve from the mechanism. Examine parts for damage and replace if necessary. Check particularly for damage to the teflon surfaces on the front head casting webs.
5. Examine the mechanism for any obvious damage.
6. Remove the suction crossover cover (fig. 17).
7. If desired, the mechanism may be assembled in checking Cage J-9397 and operated on a motor test stand, or by some other suitable means, to observe sound level and general operation. Tighten cage nuts evenly to 14-16 ft. lbs. torque.

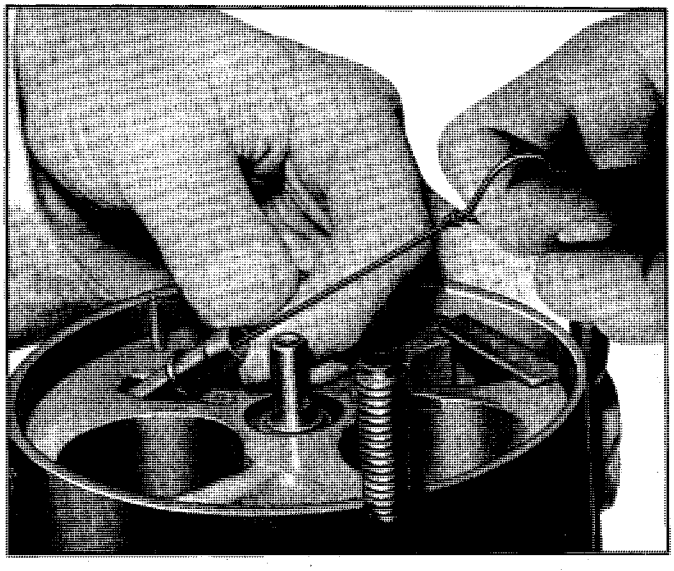


Fig. 16—Removing Oil Inlet Tube and "O" Ring

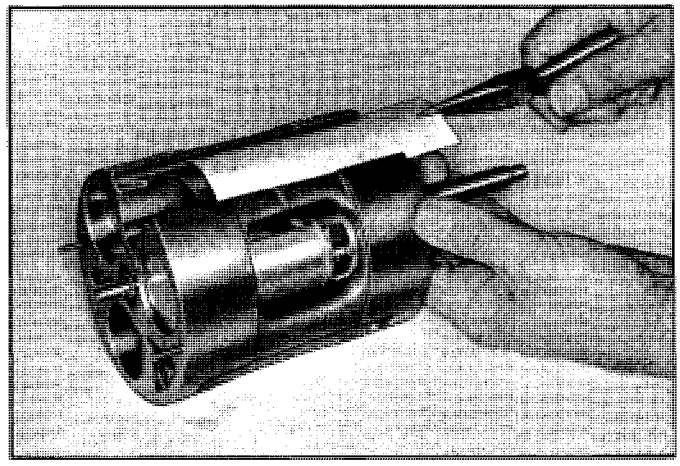


Fig. 17—Removing Suction Crossover Cover

8. Remove mechanism from the cage.

Disassembly

If the mechanism has sustained major damage, due possibly to loss of refrigerant and/or oil, it may be necessary to replace it with a complete service interior mechanism assembly rather than to replace individual parts. If further disassembly is considered worthwhile, proceed as follows:

1. Before disassembling the cylinder and mechanism, number the pistons and cylinder locations so that all parts may be replaced in their original location. Pistons and cylinder bores may be identified by numbering them 1, 2 and 3 with a pencil.
2. Use an old discharge tube to drive discharge tube out of cylinder (fig. 18). (Drive from REAR of cylinder.)
3. Drive the cylinder halves apart and free from the dowel pins and discharge crossover tube using a fiber block and mallet (fig. 19). Discard the discharge crossover tube.

   NOTE: Before driving cylinder apart, position wobble plate toward front of compressor in area of the crossover tube.

4. Carefully remove the rear half of the cylinder from the pistons and set the front cylinder half, with the piston, shaft and wobble plate, in J-9397.
5. Push up on the shaft and, one assembly at a time, remove pistons, rings, seats and balls placing all parts in Tray J-9402 in the compartment associated with the proper end of the piston. Discard all piston ball seats.

   NOTE: The front of the piston may be identified by a notch in the casting web. See Figure 20. The piston compartments in Tray J-9402 have a boss at this notch location to indicate the front.

6. Remove and inspect all piston rings. Replace all broken or damaged rings. Damaged pistons must also be replaced.
7. Examine piston balls. Replace if they show burning or excessive wear.

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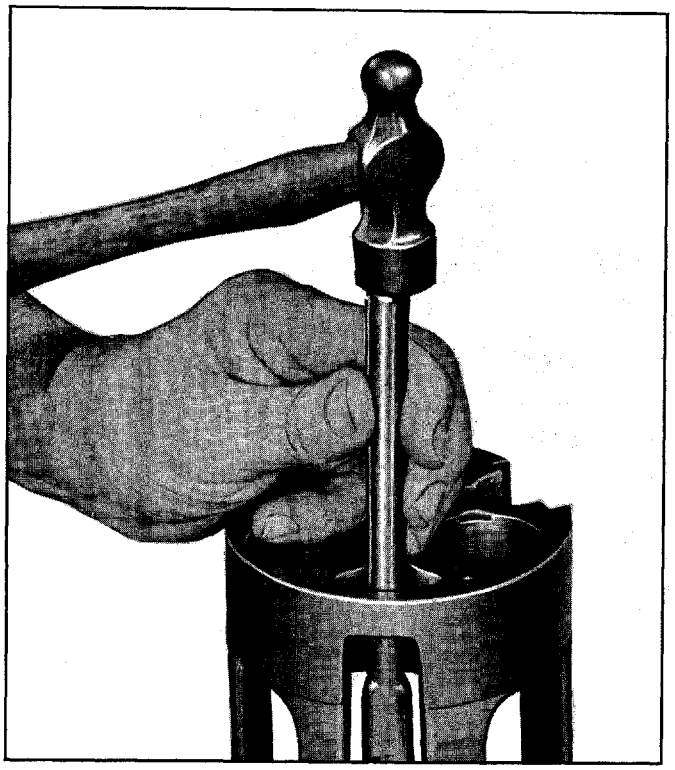


Fig. 18—Unseating Discharge Crossover Tube

8. Remove the rear combination of thrust races and bearing from the shaft and discard all three pieces.
9. Remove the shaft and wobble plate assembly from the front half of the cylinder.
10. Remove the front combination of thrust washers and bearing and discard all three pieces.
11. Examine all surfaces of the wobble plate and, if satisfactory, reuse. If it shows signs of wear, replace the shaft and wobble plate as an assembly. Use care not to move wobble plate on the shaft. This is factory set.
12. Examine the front and rear cylinder halves and replace if cylinder bores are deeply scored or damaged.
13. Wash all parts to be reused in a suitable cleaner. Blow dry all parts.
14. If cylinder main bearings are to be replaced they may be removed and reinstalled at this time using Tool J-9432. Drive against the lettered end of the bearings and from the outside of the cylinder. Bearing must be not more than 1/8" below surface.

Gauging Procedure

The gauging operations which follow have been worked out on a simple basis to establish and provide necessary running clearances. Two gauging procedures are necessary.

The first gauging operation is made to choose the proper size ball seats to provide, at each piston, a .0005" to .0010" total preload between the seats and the wobble plate at the tightest place through the 360° rotation of the wobble plate. The bronze ball seats are provided in .0005" variations including a basic ZERO seat.

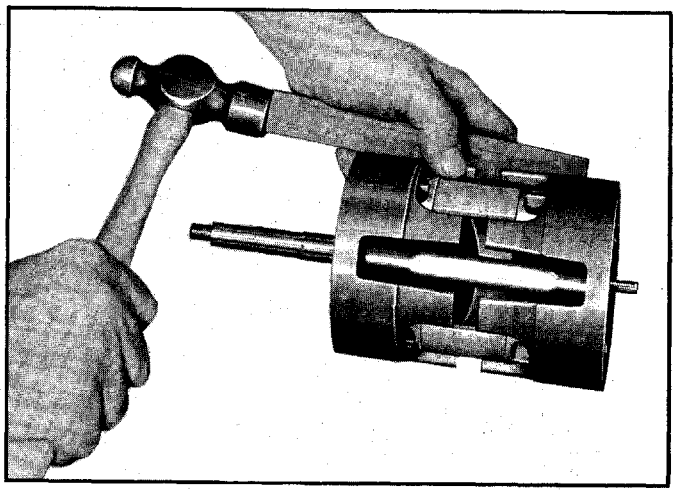


Fig. 19—Separating Cylinder Halves

The second gauging operation, performed at the rear shaft thrust bearing and race pack, is designed to obtain .0005" to .0015" preload between the hub surfaces of the wobble plate and the front and rear hubs of the cylinder. A total of 14 steel thrust races, including a basic ZERO race, are provided in increments of .0005" thickness to provide the required fit. Proper selection of thrust races and ball seats is of extreme importance.

1. Secure from service parts stock:
   Four-ZERO thrust races
   Three-ZERO ball seats
   Two-New thrust bearings
2. Assemble a ZERO thrust race, a new needle thrust bearing and another ZERO thrust race, in that order, to the front end of the shaft. (A dab of petroleum jelly will hold the bearing-race pack together and in place of the shaft.) Lubricate front and rear faces of the wobble plate with refrigeration oil.
3. With the front half of the cylinder assembly resting on Tool J-9397, insert the shaft, threaded end through the front main bearing until the thrust race assembly rests on the front cylinder hub.
4. Assemble a ZERO thrust race, a new needle bearing and a second ZERO thrust race in that order, to the rear of the shaft.
5. Apply a light smear of clean petroleum jelly to the ball pockets of each of the three pistons.

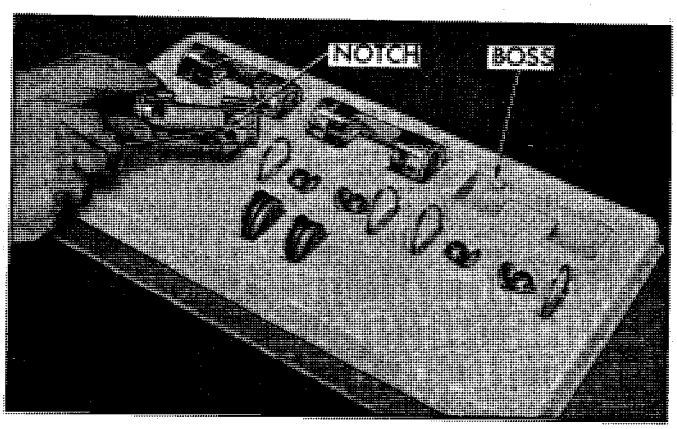


Fig. 20—Notch Identifying Front End of Piston

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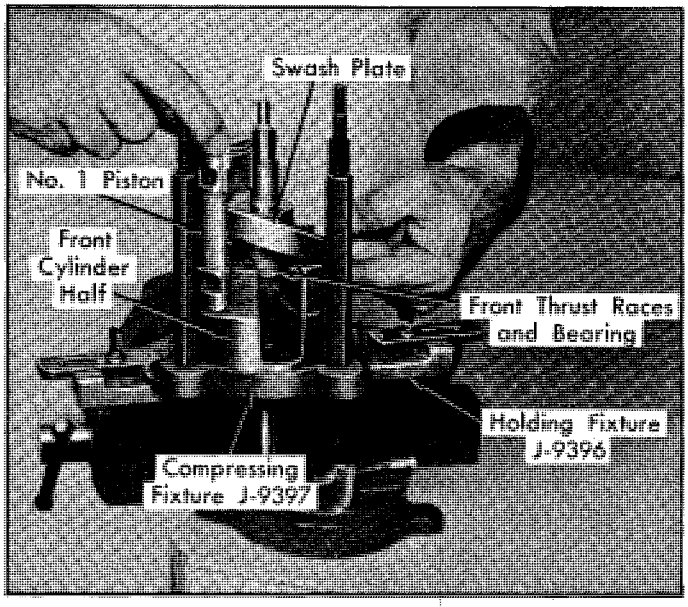


Fig. 21—Installing Piston, Front Ball and Seat and Rear Ball

6. Place the balls in the piston pockets. The petroleum jelly will hold the balls in place.
7. Apply a light smear of petroleum jelly to the cavity of three new ZERO ball seats and place one seat over each front piston ball. There should now be a ball and seat in the front ball pocket of each piston and a ball only in the rear ball pocket.

   NOTE: Do not assemble any of the piston rings at this time.

8. Rotate the shaft and wobble plate until the high point of the wobble plate is directly over the cylinder bore previously designated as No. 1. Lift up slightly on the shaft and wobble plate assembly, insert the front (notched) end of the No. 1 piston into the cylinder bore, and at the same time, place the front ball and seat and the rear ball only over the wobble plate (fig. 21). Hold front thrust bearing pack tight against wobble plate hub while lifting shaft.
9. Repeat this operation with pistons No. 2 and No. 3.
10. Align the rear head casting with bores, suction passage, discharge crossover holes, and dowel pins. Tap into place, using a plastic block and mallet (fig. 22).
11. Place the cylinder assembly in the checking cage with the front of the compressor shaft pointing up, positioning the discharge tube opening between the cage bolts. This will provide access for the feeler gauge. Assemble the cage and tighten all nuts evenly to 14-16 ft. lbs. torque.
12. Use a leaf type feeler gauge and a suitable spring scale to check clearance between the REAR ball and the wobble plate (fig. 23) of the No. 1 piston. Use a suitable combination of feeler gauge leafs until 4 to 8 oz. of force is required to pull gauge from between the ball and the plate.

    NOTE: Use undamaged feeler gauges generously lubricated with refrigeration oil. Support the spring scale so that only the actual force required to pull the feeler gauge free is measured.

    Rotate the shaft approximately 120° and again check with a feeler gauge between the parts. Rotate the shaft another 120° and make a third check. From this total of three feeler gauge checks, use the MINIMUM reading to select a numbered seat to correspond to the feeler gauge reading (i.e. - if minimum reading was .019, use a No. 19 seat. If reading was .0195, use a No. 19-1/2 seat). Place this seat in the parts tray in the compartment corresponding to the rear ball position of the No. 1 piston.
13. Repeat the operation described in Step 12 for pistons No. 2 and No. 3.
14. The next gauging operation is to determine the space between the REAR thrust bearing and the upper (outer) rear thrust race. Use a suitable combination

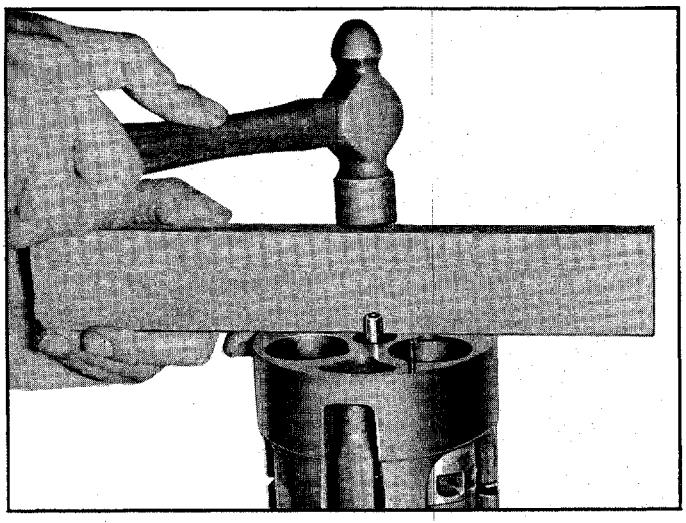


Fig. 22—Assembling Cylinder Halves

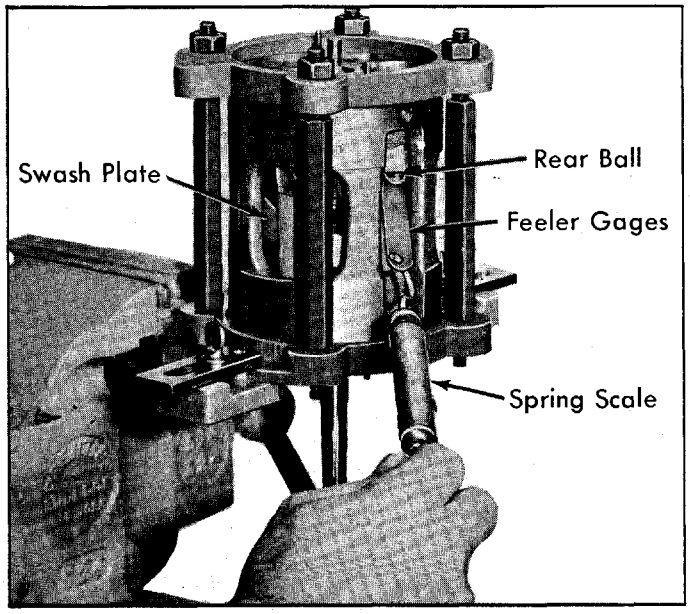


Fig. 23—Checking Clearance Between Rear Ball and Wobble Plate

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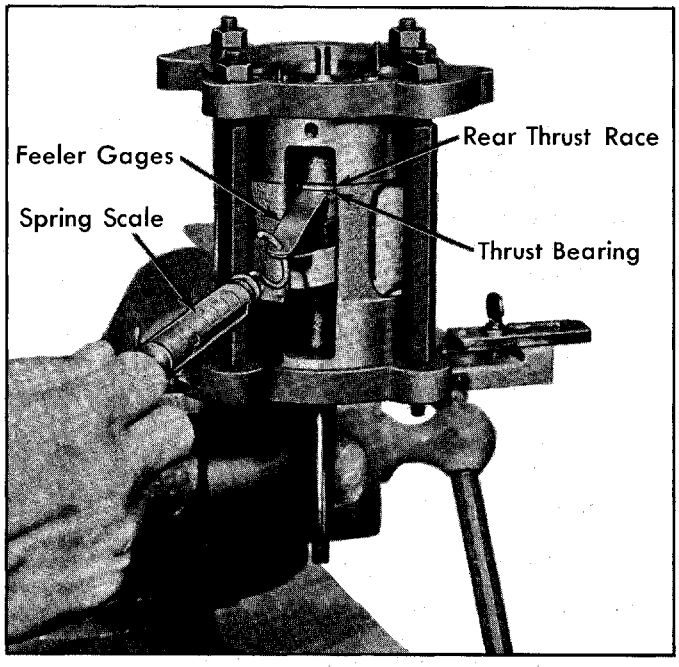


Fig. 24—Checking Clearance Between Rear Thrust Bearing and Outer Thrust Race

of feeler gauge leafs so that 4 to 8 oz. of force is required to pull gauge free (fig. 24). Select a numbered thrust race to correspond to this feeler gauge reading and place this race in parts tray in the rear thrust race compartment.

15. Loosen the nuts and ring from the checking cage.
16. Drive the cylinder halves apart, using a fiber block and mallet.
17. Carefully remove the rear half of the cylinder and set the front half (including the pistons and shaft and wobble plate assembly) on J-9397.
18. Carefully remove one piston at a time from the wobble plate and the front half of the cylinder. Transfer each piston, ball and seat to its proper place in the parts tray along with the numbered rear seat chosen in Steps 12 and 13 above.

    CAUTION: When the balls and seat are removed from the piston, be sure that they are placed in the proper parts tray pocket so as not to lose the relationship of the balls and seats to the proper end of the piston.

19. Remove the rear outer (upper) ZERO thrust race from the compressor shaft and replace it with the numbered thrust race (determined in Step 14 above) from the parts tray.

    NOTE: This ZERO thrust race may be put aside for reuse in future gauging and/or rebuild operations.

20. The gauging operations are now complete.

Assembly

After properly performing the gauging procedure and choosing the correct ball seats and thrust races as outlined under "Gauging Procedures," the cylinder assembly may be reassembled. Be sure to install all new seals and "O" rings. All are included in the compressor seal service kit.

Assembly procedure is as follows:

1. Support the front half of the cylinder assembly on Fixture J-9397 and install the shaft and wobble plate, threaded end down, with its front bearing race pack (ZERO race, bearing and ZERO race) and its rear bearing race pack (ZERO race, bearing, numbered race) if this was not already done at the end of the "Gauging Procedure."
2. Assemble a piston ring, scraper groove toward the center of the piston, to each end of the three pistons.
3. Apply a light smear of petroleum jelly to the numbered ball seats chosen in the gauging procedure and install all balls and seats (if removed in Step 18 of the gauging procedure) in their proper place in the piston.
4. Rotate the wobble plate so that the high point is above cylinder bore No. 1. Carefully assemble piston No. 1, complete with ball and ZERO seat on the front and ball and numbered seat on the rear, over the wobble plate. Hold front thrust pack tight against wobble plate hub while lifting hub. Compress and enter the piston ring into the front cylinder half.
5. Repeat this operation for pistons No. 2 and No. 3.
6. Assemble one end of a service discharge crossover tube into the hole in the front cylinder half.
7. Rotate the shaft to position the pistons in a stair-step arrangement, then carefully place the rear cylinder half over the shaft and start the pistons into the cylinder bores.
8. Compress the piston ring on each piston to permit its entrance into the cylinder.

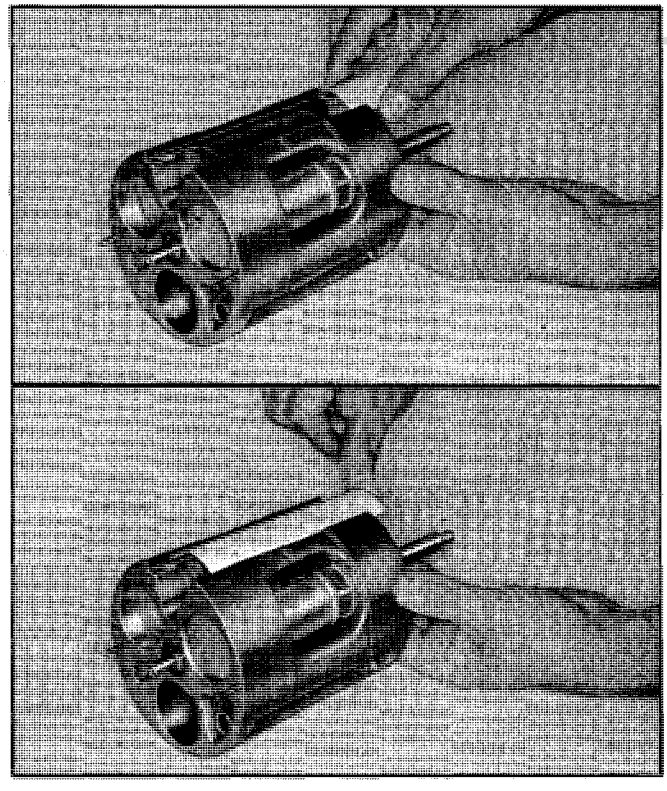


Fig. 25—Installing Suction Crossover Cover

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9. When all three pistons and rings are in their respective cylinders, align the end of the discharge crossover tube with the hole in the rear half of the cylinder.

   NOTE: Be sure the flattened portion of this tube faces the inside of the compressor to allow for wobble plate clearance.

10. When all parts are in proper alignment, tap with a fiber block and mallet to seat the rear half of the cylinder over the locating dowel pins. If necessary, clamp the cylinder in J-9397 to complete drawing the cylinder halves together.
11. Generously lubricate all moving parts with clean refrigeration oil and check for free rotation of the parts.

    NOTE: It may be desirable to clamp the cylinder assembly in compressing Fixture J-9397 and check on the motor test stand for proper operation before proceeding further. If any improper operation is observed, the mechanism should be regauged to insure proper operation. Complete the assembly procedure when correct operation is obtained.

12. Replace the suction crossover cover as shown in Figure 25. Compress the cover as shown to start it into the slot and then press it in until flush on both ends.

Installation Into Shell

1. Support the cylinder on Fixture J-9521 with the threaded end of the shaft up.
2. Assemble the two dowel pins in the front cylinder if they are not already in place.

   NOTE: A rod drilled 1/4" deep to the O.D. of the dowel pins will aid in installing.

3. Install the discharge crossover tube front "O" ring and spacer (fig. 26).
4. Aligning the dowel pin holes, discharge crossover and oil return slot, assemble the suction reed valve to the front end of the cylinder.
5. Assemble the front discharge valve plate, aligning the holes with the dowel pins and proper opening in the head.

   NOTE: The front discharge plate has a larger diameter hole in the center than the rear discharge plate.

6. Check the teflon surface on the compressor front head casting webs and replace the entire casting if there is any evidence of damage. Discard the "O" ring.
7. Coat the valve plate with clean refrigeration oil. Rotate the front head casting until it is properly positioned over the discharge reed retainers and dowel pins, then set it in place (being careful not to damage the teflon surfaces) and seat it over dowels with light mallet taps.

   NOTE: Dowel pin and hole location can be marked with pencil to aid in locating proper position.

8. Apply clean refrigeration oil to a new "O" ring and "O" ring groove at the lower edge of the front head casting and carefully assemble the "O" ring in the groove.

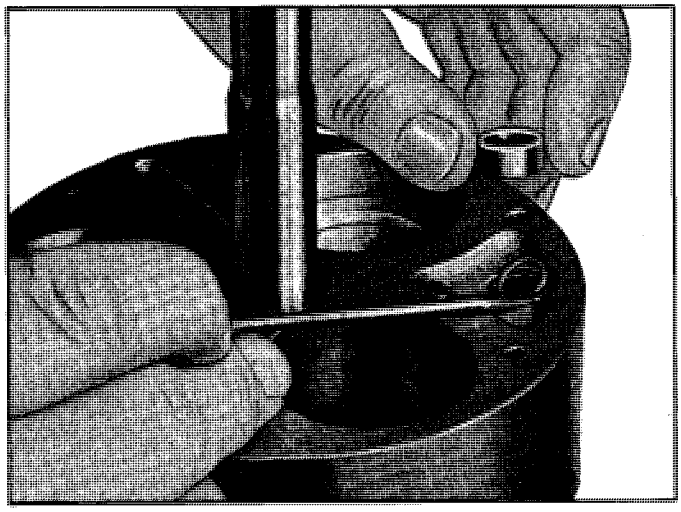


Fig. 26—Installing Discharge Crossover Tube Front "O" Ring and Spacer

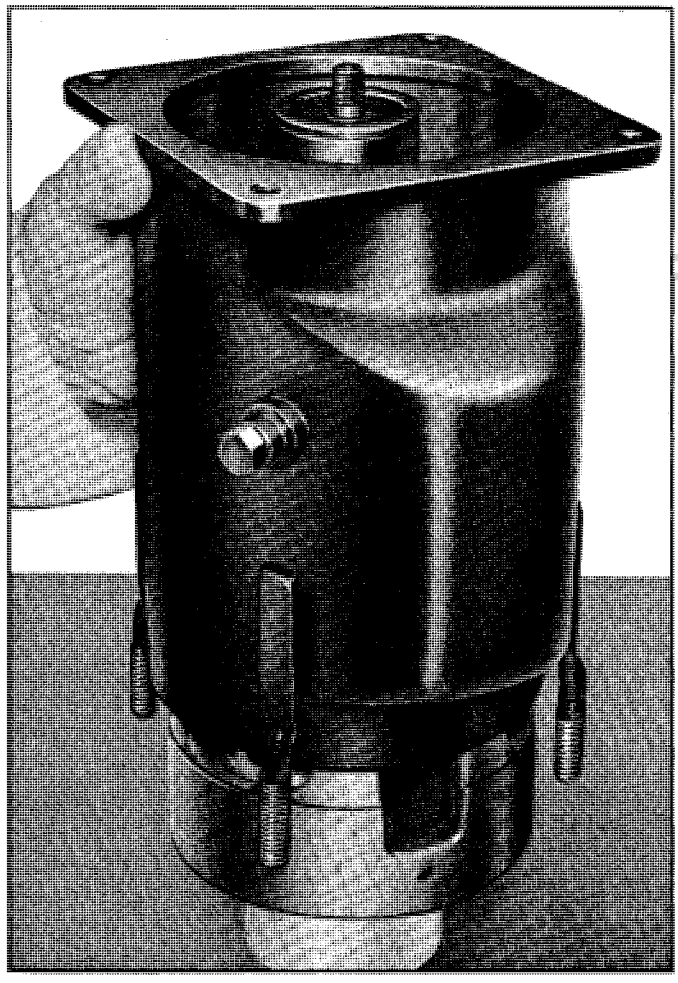


Fig. 27—Installing Shell Over Internal Mechanism

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9. Coat the inside machined surfaces of the compressor shell with refrigeration oil.
10. Locate the oil intake tube hole in the rear discharge plate. Line up the oil sump with this hole location and slide the shell down over the mechanism while supporting the mechanism on J-9521 (fig. 27).
11. Place Compressor Support Bracket J-9396 in a vise and, carefully inverting the compressor shell with the mechanism inside, mount the front compressor flange on the support bracket.
12. Place a new "O" ring in the oil intake tube hole applying clean refrigeration oil to the oil intake tube hole and the "O" ring. Rotating the compressor mechanism to line up with the hole in the compressor oil sump baffle, install the pickup tube. Be sure that the "O" ring and intake tube are properly seated.
13. Assemble the dowel pins into the rear cylinder.
14. Install the discharge crossover tube rear "O" ring and spacer.
15. Replace the rear suction reed valve, rear discharge valve plate, oil pump gears, rear head and head nuts as outlined previously under "Rear Head and Reed Assemblies - Installation."

Leak Testing the Compressor

Whenever service operations are performed on the compressor shaft seal assembly or on the interior mechanism, use the following procedure to leak test the reassembled compressor.

1. Install "O" rings and Cover Plate J-9527 over the suction and discharge ports of the compressor head.
2. Hook up a Refrigerant-12 container and charging line (using Adapter J-5420) to cover plate fitting over the suction port, charge the compressor up to can pressure, and leak test compressor with a leak detector.

   Turn off the refrigerant container valve. Transfer gauge line and adapter to cover plate fitting over the discharge port and repeat the procedure outlined in Step 2.
3. Correct any leaks present.

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SPECIAL TOOLS

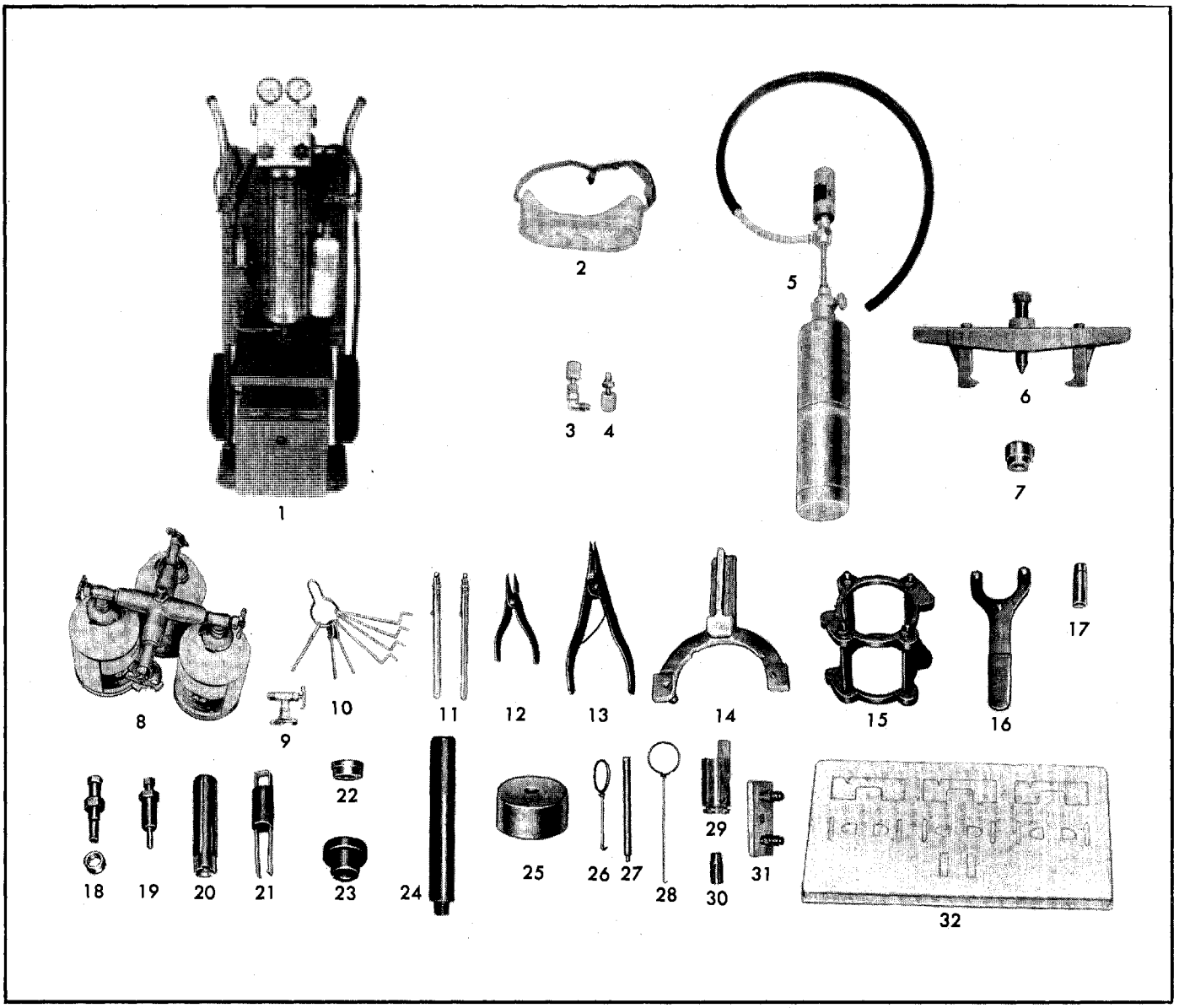


Fig. 28—Air Conditioning Special Tools

1. J-8393 Charging System
2. J-5453 Goggles
3. J-9459 90° Gauge Line Adapter
4. J-5420 Gauge Line Adapter
5. J-6084 Leak Detector
6. J-8433 Puller
7. J-9395 Puller Pilot
8. J-6272 Multi-Opener (4 Can)
9. J-6271 Fitzall Valve (Single Can)
10. J-7151 Non-Magnetic Clutch Shims
11. J-5421 Pocket Thermometers (2)
12. J-5403 #21 Snap Ring Pliers
13. J-6435 #26 Snap Ring Pliers
14. J-9396 Compressor Holding Fixture
15. J-9397 Compressing Fixture
16. J-9403 Clutch Hub Holding Tool
17. J-9399 9/16" Thin Wall Socket
18. J-9480 Hub and Drive Plate Assembly Installer
19. J-9401 Hub and Drive Plate Assembly Remover
20. J-9392 Seal Remover
21. J-9393 Seal Seat Remover
22. J-9398 Pulley Bearing Remover
23. J-9481 Pulley and Bearing Installer
24. J-8092 Handle
25. J-9521 Internal Assembly Support Block
26. J-5139 Oil Pickup Tube Remover
27. J-9432 Needle Bearing Installer
28. J-9553 Seal Seat "O" Ring Remover
29. J-21508 Seal Seat "O" Ring Installer
30. J-21303 Shaft Seal Protector
31. J-9527 Pressure Test Connector
32. J-9402 Parts Tray

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SECTION 4
REAR AXLE DIFFERENTIAL CARRIER

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CONVENTIONAL DIFFERENTIAL CASE AND DRIVE PINION (CHEVROLET, CAMARO, CHEVELLE, AND CHEVY II)

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Differential Case and Drive Pinion

Removal

1. Raise vehicle and remove axle shafts.

   NOTE: On Camaro models it will be necessary to remove the engine muffler to obtain sufficient clearance for differential case removal.

2. Roll out the differential pinions and thrust washers, then remove side gears and thrust washers. Mark pinions and side gears so that they can be reassembled in original position.
3. Mark one bearing cap and housing for reassembly in same position. Remove bearing cap bolts and bearing caps tap surface of bearing caps to loosen them.

   CAUTION: Do not attempt to pry caps off as this may damage machined face of caps.

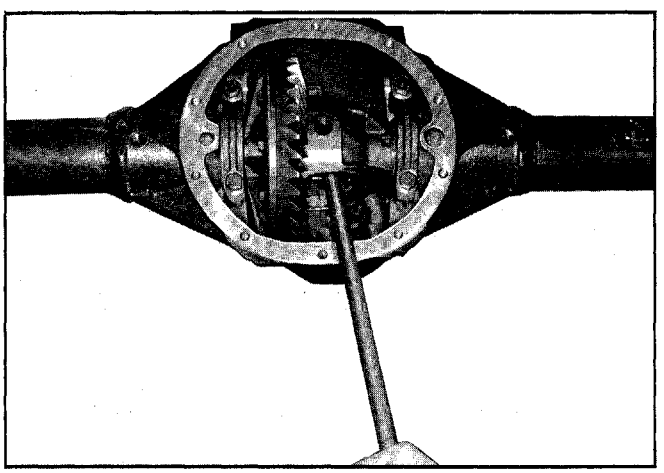


Fig. 1—Differential Case Removal

4. Using a pry bar as shown in Figure 1, pry differential case out of carrier. Exercise caution in prying on carrier so that gasket sealing surface is not damaged. If the bearings are preloaded, the case will suddenly fall free when it is pried past a certain point; therefore, make sure case is properly supported to prevent damage. The bearing caps may be loosely installed, as shown in Figure 1, to prevent case from falling.
5. Place left and right bearing cups with bearing caps so that they may be reinstalled in original positions. Place shims with appropriate cups.
6. Install Tool J-8614-1 on pinion flange and remove pinion flange nut and washer (fig. 2). (Position J-8614-1 on flange so that the four notches are toward flange.) Discard nut and use a new one upon reassembly.
7. Thread pilot end of Tool J-8614-3 into small O.D. end of J-8614-2. Then with J-8614-1 installed as in Step 6, insert J-8614-2 into J-8614-1 and turn it 45

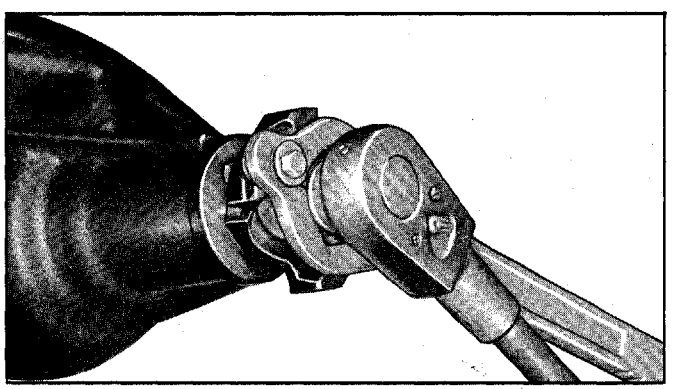


Fig. 2—Drive Pinion Nut Removal

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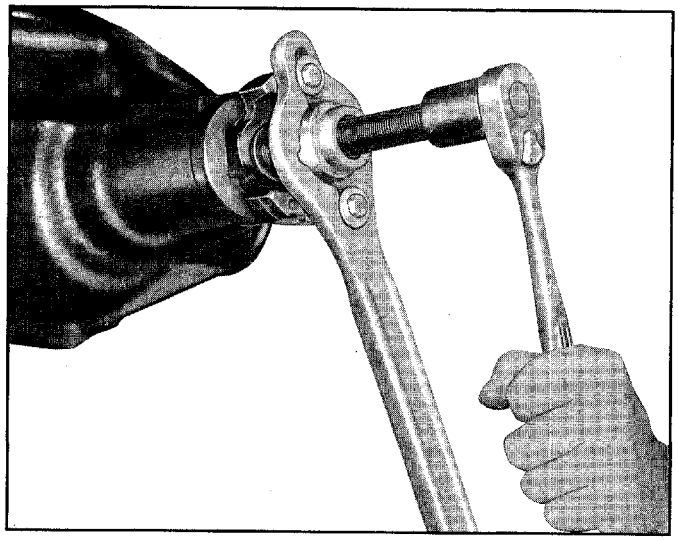


Fig. 3—Drive Pinion Flange Removal

degrees to locked position. Remove flange by turning J-8614-3 while holding J-8614-1 (fig. 3).

8. Pry old seal out of bore, using a screw driver or a hammer and chisel.
9. If deflector requires replacement, remove by tapping from flange, clean up stake points; install new deflector, and stake deflector at three new equally spaced positions.

   NOTE: Staking operation must be performed in such a manner that the seal operating surface is not damaged.

10. Remove drive pinion by tapping on front end with a soft faced hammer. Then remove pinion front bearing cone from carrier bore. Discard pinion bearing spacer and use a new one upon reassembly.

Inspection

1. Clean all gears and bearings in an approved cleaning solvent and inspect all bearing cups, races and rollers for scoring, chipping or evidence of excessive wear. On pinion bearing rollers, inspect large end of rollers for wear. This is where wear is most evident on tapered roller bearings.

   NOTE: The pinion bearings are of the tapered type, and the natural wear pattern is a frosted condition with occasional slight scratches on races or rollers. This does not indicate a defective bearing.

2. Inspect pinion splines and flange splines for evidence of excessive wear.
3. Inspect ring gear and pinion teeth for possible scoring, cracking or chipping.
4. Inspect differential case for cracks or scores on side gears, thrust washers, and pinion thrust faces.
5. Check fit of differential side gears in case.
6. Check fit of side gear and axle shaft splines.
7. Inspect differential pinion shaft for scoring or evidence of excessive wear.

Repairs

Pinion and/or Bearing Replacement

1. Remove pinion front and rear bearing cups from their positions in the carrier, using a brass drift of suitable length. Tap alternately on opposite side of cups during removal to prevent cups from cocking in the carrier.
2. Position new bearing cup in carrier, thick edge of cup toward shoulder in carrier, then using Cup Installer J-7137 for heavy-duty axle and J-7817 for light-duty axle to install front cup and J-0270-14 for light-duty axle and J-8608 for heavy-duty axle to install rear cup, press cup into carrier until it seats against shoulder (fig. 4). Check installation to make certain that cup is not cocked and that it is fully seated against shoulder.
3. Remove pinion rear bearing cone and roller assembly, using split plate holder (Tool J-0358-1) in conjunction with bearing remover (split plate) J-7028 for light-duty axle and J-9771 for heavy-duty axle as shown in Figure 5. Record thickness of shim removed from between bearing cone and pinion head.
4. If the original ring gear and pinion and the pinion rear bearing assembly will all be reinstalled, the original shim or one of the same thickness may be used. If the ring gear and pinion or the pinion rear bearing assembly are replaced, the correct shim thickness may be determined as follows.
   a. Lubricate pinion bearing cone and roller assemblies and position them in proper cups.
   b. Position appropriate Pinion Depth Setting Gauge Plate in pinion rear bearing (fig. 6).

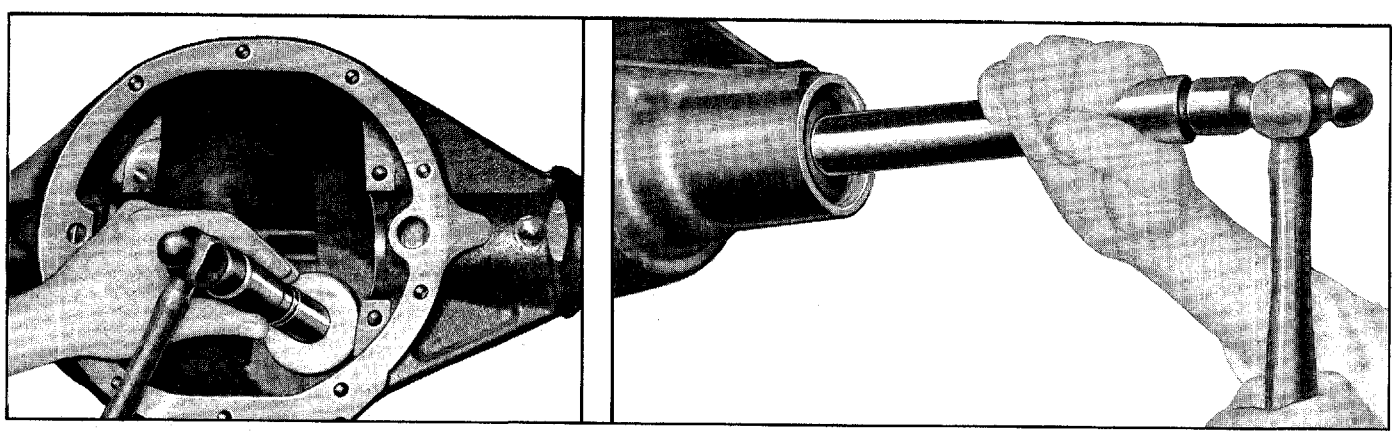


Fig. 4—Drive Pinion Front and Rear Bearing Cup Installation

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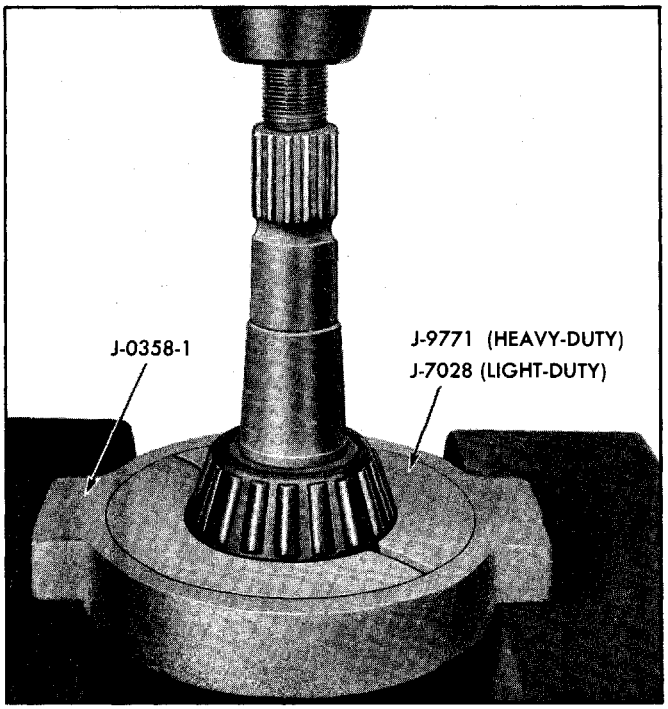


Fig. 5—Drive Pinion Cone and Roller Assembly Removal

Gauge Plate Usage

J-6266-35--Chevrolet, Camaro, Chevy II, and Chevelle with light-duty axle.

J-6266-36--Chevrolet, Camaro, Chevelle and Chevy II with heavy-duty axle.

c. Insert clamp screw through gauge plate and both of the pinion bearings.

d. Position J-6266-25 on threaded end of clamp screw and index it in front bearing, install hex nut and rotate bearings several times to make sure that they are seated.

e. Tighten hex nut until 20 to 30 in. lbs. of torque is required to rotate bearings (fig. 7).

f. After torque has been established, position gauge plate in carrier so that the large overhanging end is in the up position (fig. 8).

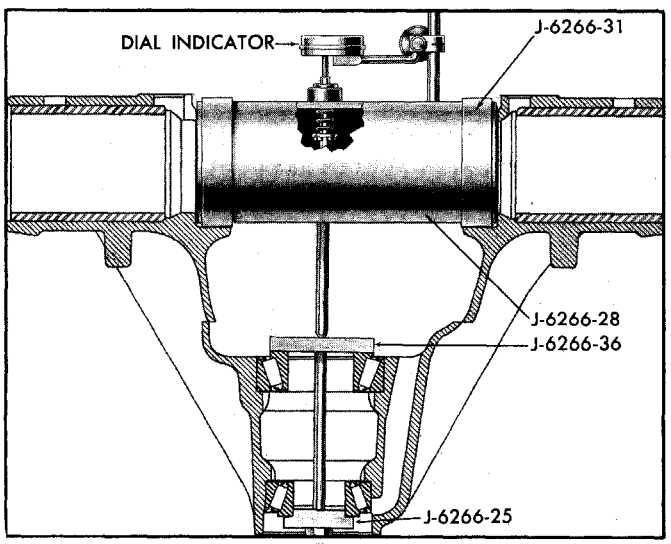


Fig. 6—Installed View of Pinion Depth Gauge

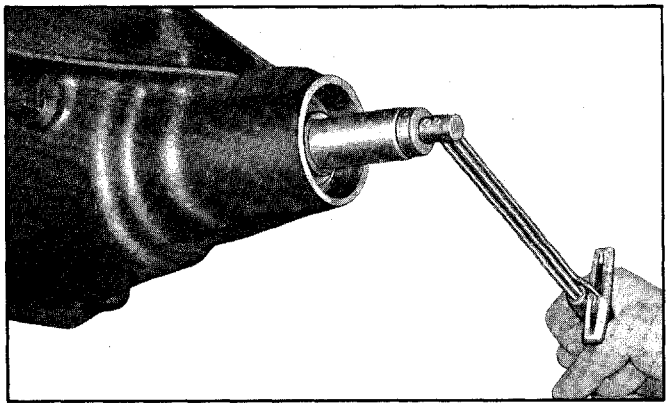


Fig. 7—Measuring Drive Pinion Bearing Simulated Preload

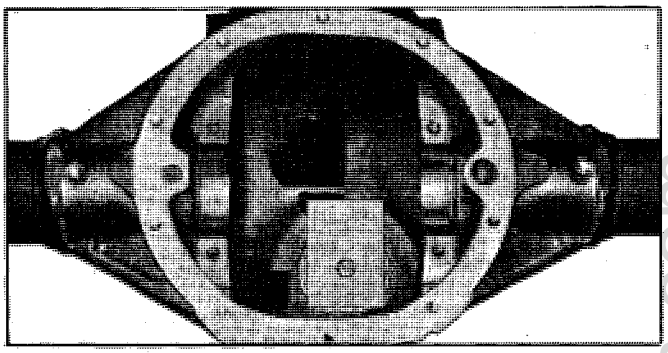


Fig. 8—Drive Pinion Depth Setting Gauge Plate Installed

g. Position dial indicator (Tool J-8001-3) on gauge post of Tool J-6266-28 so that indicator button rests on top of tool plunger.

h. Position Tool J-6266-28 in carrier as shown in Figure 9. Swing tool body so that plunger does not touch gauge plate, and set indicator dial at zero.

NOTE: Barrel Adapters Tool J-6266-31 must be used when gauging Chevrolet, Camaro, Chevelle, and Chevy II with heavy-duty axle. Make sure adapters are seated in differential bearing bores of carrier before measuring depth.

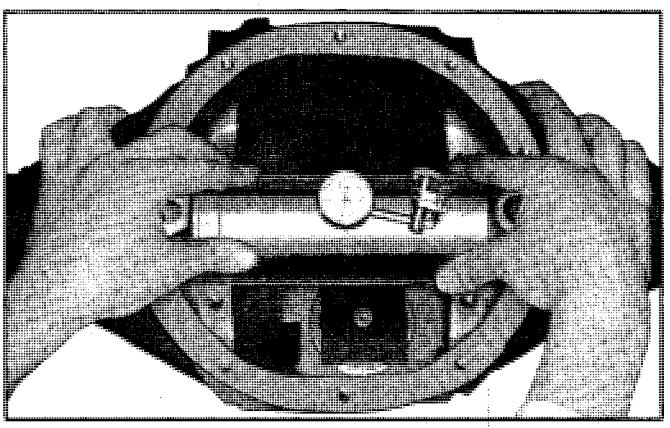


Fig. 9—Measuring Drive Pinion Shim Requirement

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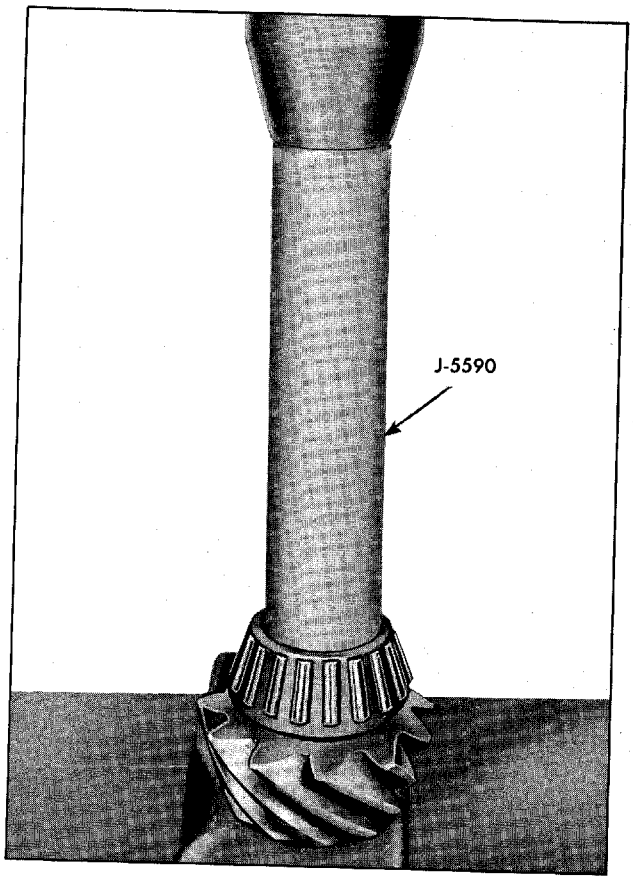


Fig. 10—Drive Pinion Cone and Roller Assembly Installation

i. Slowly swing inner end of tool plunger across gauge plate until highest indicator reading is obtained. Record this measurement and recheck to see that it is correct.

j. All pinion gears are stamped with a code number on the threaded end of the pinion. The numerical difference between the code number and the gauge reading obtained in Step i determines the required thickness of the pinion locating shim.

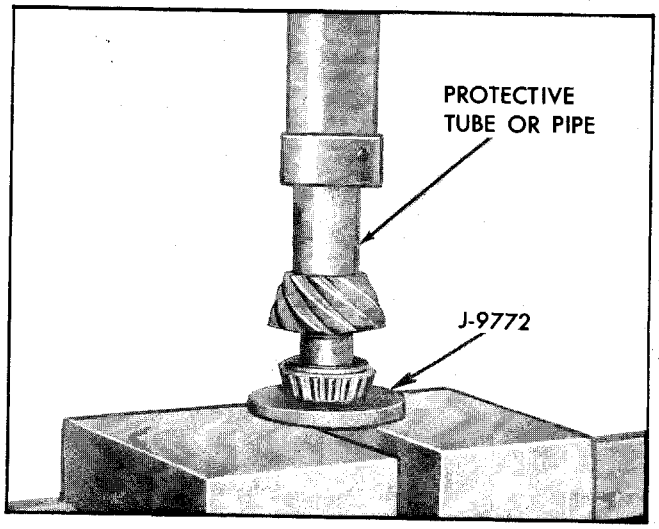


Fig. 11—Drive Pinion Cone and Roller Assembly Installation

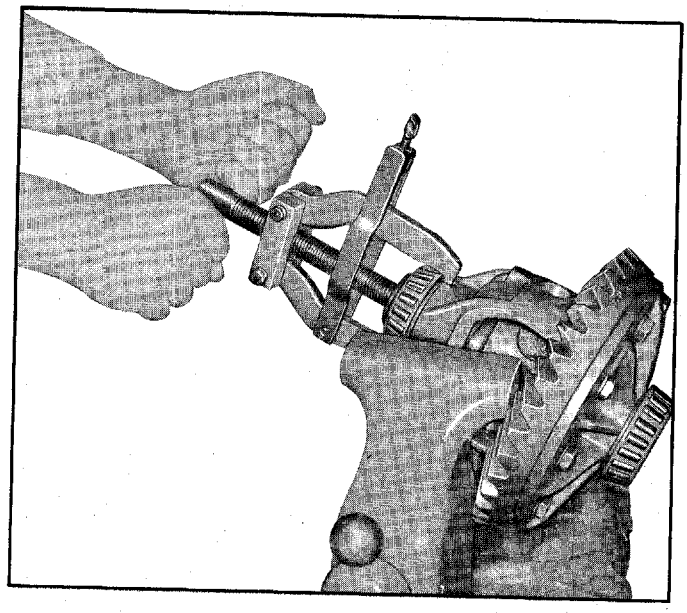


Fig. 12—Differential Bearing Removal

EXAMPLE:	
Pinion Code Number	#2
Dial Indicator Reading	45
Difference	16
Proper Shim Thickness	29
	.029"

NOTE: Shims are available in .001" increments from .021" to .037". Each shim has the thickness etched on flat surface for easy identification.

5. Remove Tool J-6266 and pinion bearing cone and roller assemblies from carrier.
6. Position shim selected in above procedure on pinion shaft and against pinion head.
7. Install new cone and roller assembly, using Tool J-5590 for light-duty axle (fig. 10) or Tool J-9772 for heavy-duty axle (fig. 11). Press cone against shim and rear face of pinion.

Differential Bearing Replacement

1. Install Tool J-7112 and Adapter Plug J-8107-4, making sure puller legs are fitted securely in notches in case and against bearing cone. Then tighten puller yoke against puller legs.
2. Tighten puller screw to remove bearing (fig. 12).
3. Place new bearing on hub with thick side of inner race toward case and drive into place, using Tool J-9537 for light-duty axle and Tool J-8359 for heavy-duty axle.
4. Before installing bearing on opposite hub, support differential case on Adapter Plug J-8107-4. This allows differential case to rest on adapter instead of bearing cage (fig. 13). Install remaining bearing as instructed in Step 3.

Ring Gear or Differential Case Replacement

1. Remove ring gear screws and lock washers and, using a soft faced hammer, tap ring gear off the case.

   NOTE: Do not attempt to pry ring gear from case, to do so may damage machined surfaces.

2. Install guide pins, made from 3/8"-24 x 1-1/2" long

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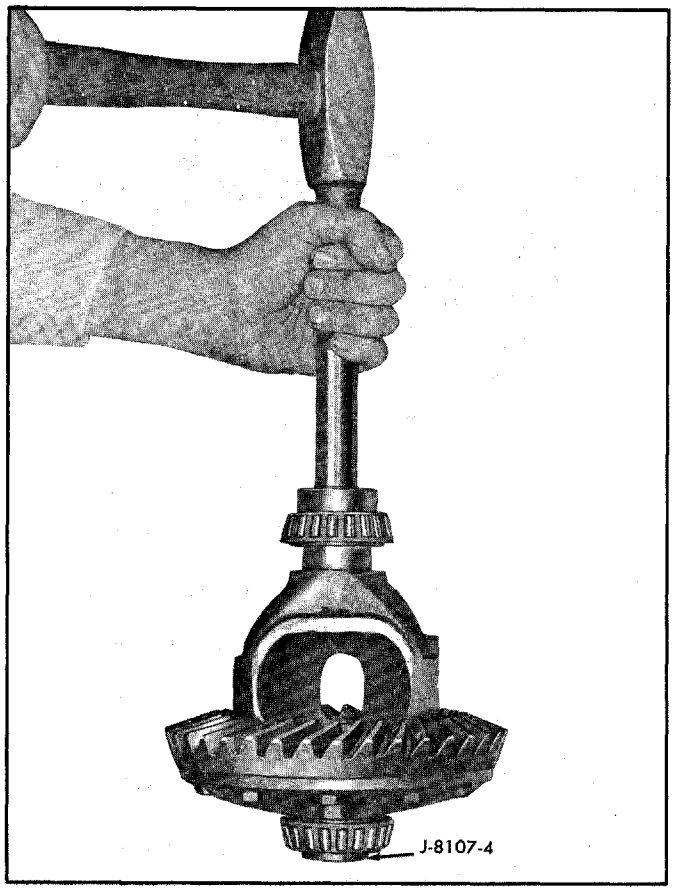


Fig. 13—Differential Bearing Installation

cap screws with heads cut off and ends slotted, to ring gear (fig. 14).

3. Position ring gear over pilot diameter of the case. Install every other ring gear bolt and lock washer, then draw them up evenly and snugly so that gear face is flush with face of case.
4. Remove guide pins and install remaining bolts - torque all bolts to specifications.
5. Install thrust washers and side gears in case, if same parts are used, replace in original sides. Position pinions and thrust washers through loading hole in case 180 degrees apart so that they engage side gears. Rotate gears until pinion shaft holes are aligned. Install pinion shaft and lock screw.

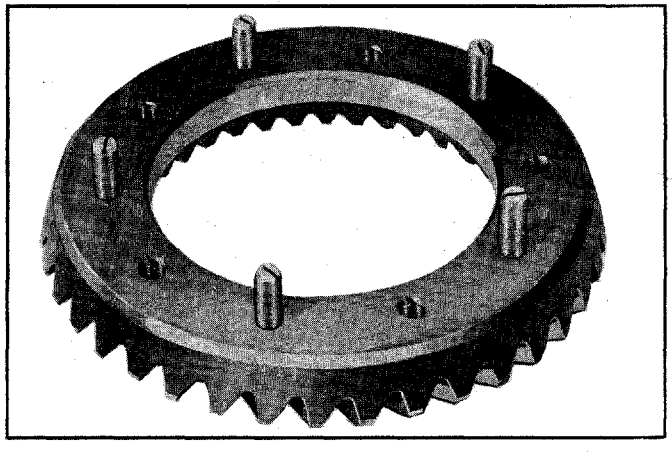


Fig. 14—Ring Gear Guide Pins Installed

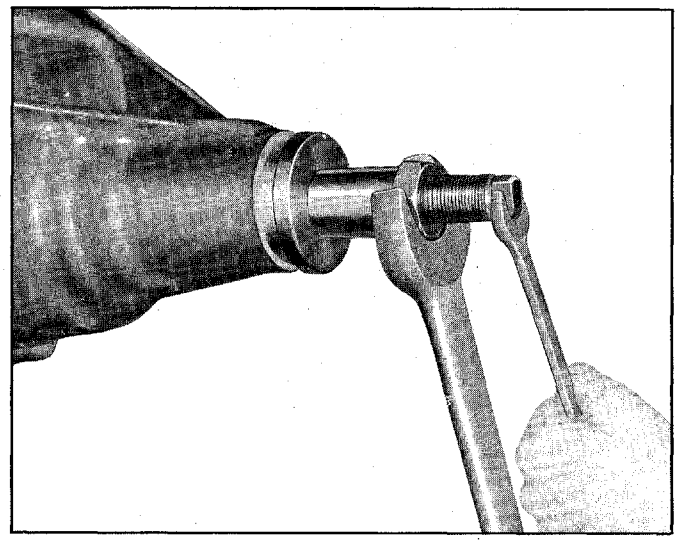


Fig. 15—Drive Pinion Flange Oil Seal Installation (Light-Duty)

Installation

Drive Pinion and Bearing

1. Position pinion and rear bearing cone and roller assembly in carrier, install a new pinion bearing spacer on pinion shaft and install pinion front bearing cone and roller assembly.
2. Pack the cavity between the seal lips of the pinion flange oil seal with a lithium-base extreme pressure lubricant, position seal in bore, then using Tools J-21468 and J-9458 for light-duty axle and Tool J-21057 for heavy-duty axle, press seal into bore until it seats against shoulder (fig. 15 and 16).

   CAUTION: Pinion oil seal flange must not bottom against carrier. Press seal into carrier bore until it seats against internal shoulder - do not apply unnecessary pressure after seal is seated. To do so will destroy rubber seat and distort seal.
3. Position and align pinion flange on pinion shaft, using Tools J-9458 and J-8614-1. Tool J-9458-1 is threaded onto pinion shaft and nut tightened against

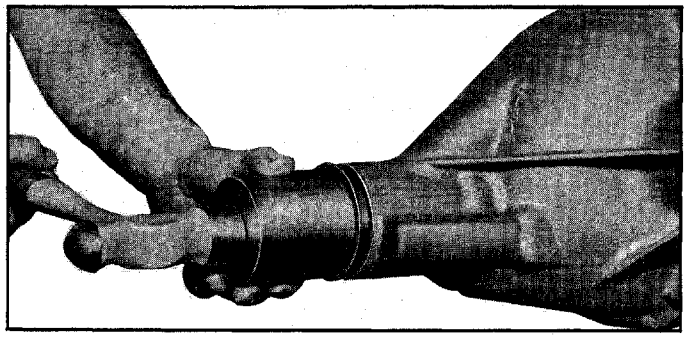


Fig. 16—Drive Pinion Flange Oil Seal Installation (Heavy-Duty)

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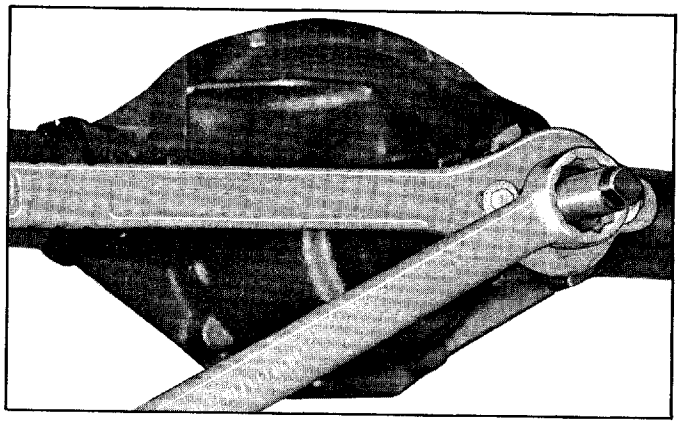


Fig. 17—Drive Pinion Flange Installation

J-9458-2 to pull flange on shaft (fig. 17). Remove J-9458 after flange is seated.

4. Pack the cavity between end of pinion splines and pinion flange with a nonhardening sealer (such as Permatex Type A) prior to installing washer and nut on pinion.
5. Install washer and a new self-locking nut on pinion shaft. Tighten nut to remove end play - continue alternately tightening, in small increments, and checking preload with Torque Wrench J-5853 and Adapter J-5810 until torque required to rotate pinion is 20-30 in. lbs. for new bearings and seal, or 5-15 in. lbs. when used parts are reinstalled (fig. 18).

Differential Bearing Preload

1. Check condition of bearing, bearing cups, cup seat in carrier and carrier caps to make sure that they are free from nicks, burrs and foreign material.
2. Lubricate bearings with axle lubricant, position cups on proper bearing then install differential assembly in carrier and support the assembly to prevent it from falling.
3. Position one service spacer between each bearing race and carrier housing--chamfered side of spacer against bearing. Loosely install left bearing cap to prevent differential case from falling. Service spacers are available in one thickness only for each axle: .170" ± .001" for light-duty and .160" ± .001" for heavy-duty.

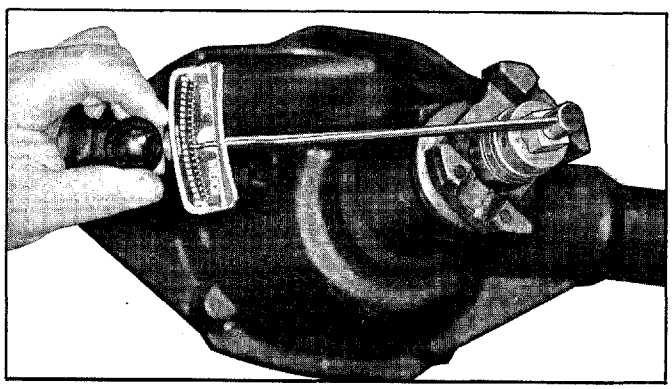


Fig. 18—Measuring Drive Pinion Bearing Preload

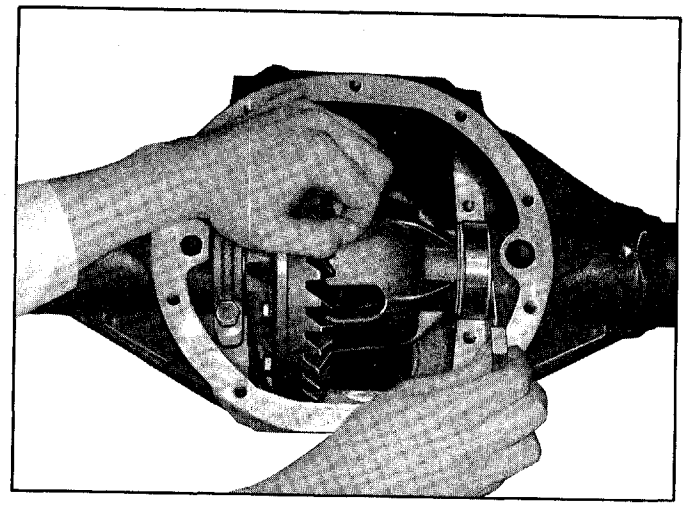


Fig. 19—Measuring Differential Shim Requirement

NOTE: Production preloading of the differential bearings is accomplished by the use of automated equipment that permits the use of cast iron preload shims. These shims can not be used when rebuilding the carrier as they may break when tapped into place. Therefore, as an aid in determining the approximate shim requirement, measure thickness of each cast iron shim.

4. Subtract total of two service spacers plus .025" gauging space from total thickness of the cast iron shims removed during carrier disassembly. Select two service shims equal to the difference and position both shims between the right bearing cup and service spacer. See shim chart for shim availability and identification.
5. Make sure that left bearing cup and spacer are against seat in carrier; then determine distance between right cup and spacer, using feeler gauge as shown in Figure 19. Observe the following procedure to determine proper shim thickness.
   a. Insert a feeler gauge with a thickness known to be less than the distance between shim and bearing cup. Withdraw feeler gauge and reinsert several times to get "feel" produced by drag of gauge against shim and bearing. Rotate differential case while gauging.
   b. Progressively insert (in increments of .002") larger feeler gauges until there is a noticeable increase in the drag produced on the feeler gauge. The gauge thickness used just before additional drag is encountered is the proper thickness.

   NOTE: When determining proper shim thickness, do not apply pressure on bearings so as to preload them. Required shim thickness is determined by line-to-line measurement--preload on bearing will, in effect, produce an incorrect shim thickness, thereby causing excessive preload.
6. Remove the previously installed shims and the bearing cap from the carrier. Service spacers installed in Step 4 are to remain in the carrier.

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7. Select two shims of equal thickness which in total are equal to value of shims selected in Step 4 and thickness of feeler gauge determined in Step 5b.

   EXAMPLE:
   Shim thickness used in Step 4 (0.070" x 2) . . 0.140"
   Thickness of feeler gauge determined in Step 5b . . . . . 0.027"
   TOTAL SHIM THICKNESS REQUIRED . . . . . 0.167"
   SHIM THICKNESS FOR EACH SIDE . . . . . 0.084"

8. Install one shim between each side bearing race and service spacer.

   NOTE: If insertion of left shim causes excessive pinion-to-ring gear contact, select thinner left shim and add difference to right shim. Keep total shim thickness at a value equal to that obtained in Step 7.

9. Check ring gear and pinion adjustment and ring gear and pinion contact pattern as outlined in this section.
10. Remove shims installed in Step 8, after satisfactory tooth pattern and lash adjustments have been completed, making note of shim thickness taken from each side.
11. Select two shims each .004" thicker than those removed and install one shim on each side. Make sure that both shims are .004" thicker than the shims used when adjusting lash and tooth pattern, also that the .004" thicker shims are inserted in proper side of carrier. If shims are not inserted in proper side of carrier lash and tooth pattern will be affected.

    NOTE: Install left shim first then wedge right shim between bearing cup and spacer (position shim so that chamfered side is outward or next to spacer). If shim does not have sufficient chamfer or lead around O.D. to allow easy installation without scraping spacer, file or grind chamfer before installing.

12. If difficulty is encountered in installing shim, partially remove case and slide case and shim into position. Tap shim into position, using a soft-faced hammer, while rotating differential case with free hand (fig. 20).

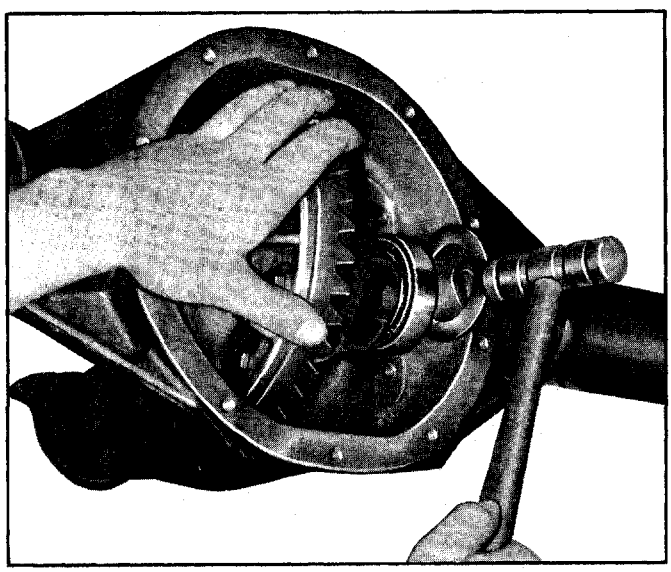


Fig. 20—Installing Differential Shim

DIFFERENTIAL BEARING SHIM IDENTIFICATION

Thickness*	Identification Notches			
	I.D.		O.D.	
	Light-Duty	Heavy-Duty	Light-Duty	Heavy-Duty
.064	0	0	0	2
.066	0	0	1	3
.068	0	0	2	4
.070	0	1	3	0
.072	1	1	0	1
.074	1	1	1	2
.076	1	1	2	3
.078	1	1	3	4
.080	2	2	0	0
.082	2	2	1	1
.084	2	2	2	2
.086	2	2	3	3
.088	3	2	0	4
.090	3	3	1	0
.092	3	3	2	1
.094	3	3	3	2
.096		3		3
.098		3		4
.100		4		0

*Additional shims are available for the light-duty axle; these shims, with a thickness of .052" through .062", are identified by a number stamped on the shim. This number indicates the shim thickness.

Ring Gear and Pinion Adjustment

1. Mount a dial indicator on the carrier and check the backlash (fig. 21) between the ring gear and pinion. The backlash should be within the range of 0.003"-0.010" with a reading of 0.005"-0.008" preferred. Check gear lash at four different equally spaced positions around the gear. Variation in readings should not exceed 0.001".

   NOTE: Position the dial indicator so that indicator button is perpendicular to tooth angle and in line with gear rotation.

   If variation in backlash readings exceed 0.001", measure ring gear and case runout as shown in Figure 22. Gear runout should not exceed 0.002"; should runout exceed this limit check ring gear and case for deformation and/or foreign matter between case and gear.
2. If gear lash is not within limits, correct by decreasing shim thickness on one side and increasing thickness of other shim the same amount. Total shim thickness must be maintained at all times to maintain proper line-to-line contact.

   For each 0.001" change in backlash required, change shim thickness 0.002". If lash is too high, add thicker shim to left side and decrease right side by same amount; if lash is too low, add thicker shim to right side and decrease left side by same amount.

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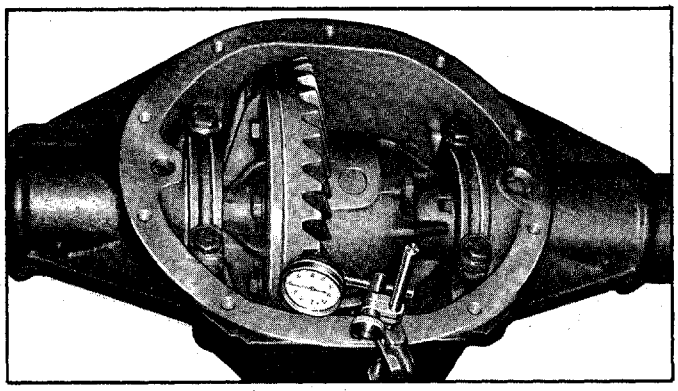


Fig. 21—Checking Ring Gear Backlash

Ring Gear and Pinion Contact Pattern

1. Thoroughly clean the ring and pinion gear teeth.
2. Paint ring gear teeth lightly and evenly with a mixture of powdered red lead and oil of a suitable consistency to produce a contact pattern.
3. Remove the differential pinion shaft, and install axle shaft and drum - install wheel bolts to retain drum on axle shaft. Expand brake shoes until a torque of 60 ft. lbs. is obtained at pinion nut.
4. Rotate pinion through several revolutions in the forward and reverse direction until a definite contact pattern is developed on the ring gear.
5. Inspect the contact pattern produced by the above procedure. Figure 23 shows the terminology used in analyzing contact patterns.

   The large end of the tooth is called the "heel" and the small end of the "toe". Also, the top of the tooth, which is the part above the pitch line, is called the "face", while the part below the pitch line is called the "flank". The space between the adjacent meshing teeth is referred to as "backlash".

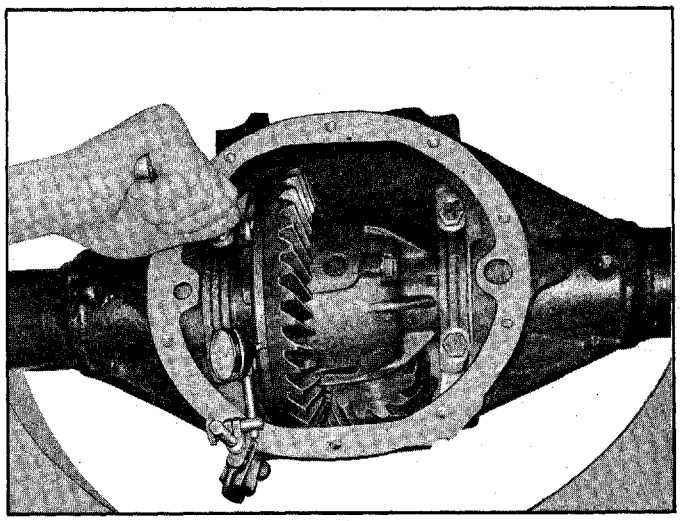


Fig. 22—Checking Ring Gear Runout

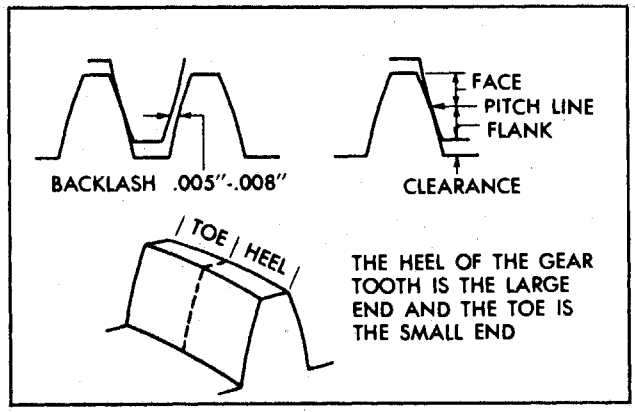


Fig. 23—Gear Tooth Nomenclature

Figure 24 shows correct and incorrect contact patterns.

Contact pattern "A" provides the ideal bearing for quietness and long life. If the pattern shows a toe contact "B", it indicates not enough backlash. To correct, move the ring gear away from the pinion by increasing right shim thickness while decreasing left shim thickness an equal amount.

If the pattern shows a heel contact "C", it indicates too much backlash. To correct, move the ring gear toward the pinion by increasing left shim thickness while decreasing right shim thickness an equal amount.

NOTE: Make adjustment increasing and decreasing shim thickness by 0.002" at a time, check contact with red lead mixture and continue adjustment until tooth contact appears as in "A". Backlash must remain within limits.

If the pattern shows a high face contact "D", it indicates that the pinion is too far out, that is, too far toward the front of the car.

To correct a pattern such as "D", it will be necessary to install a thicker pinion shim as described under "Pinion and/or Bearing Replacement". A .001" thicker shim is recommended as a starting point. Continued changes may be necessary to obtain the correct setting.

If the pattern shows a flank contact "E", it indicates that the pinion is in too far. To correct replace the pinion shim with a .001" thinner shim and recheck contact pattern.

In making pinion adjustments, be sure backlash is correct before testing contact pattern. Moving the pinion in reduces backlash and moving it out increases backlash.

After satisfactory contact pattern is produced as in "A", clean ring and pinion gear teeth and pour a liberal quantity of rear axle lubricant on gears and bearings - turn gears to work lubricant into all surfaces.

6. Install axle shafts, drums and wheel assemblies; fill rear axle with proper lubricant to a level even with bottom of filler hole and road test vehicle.

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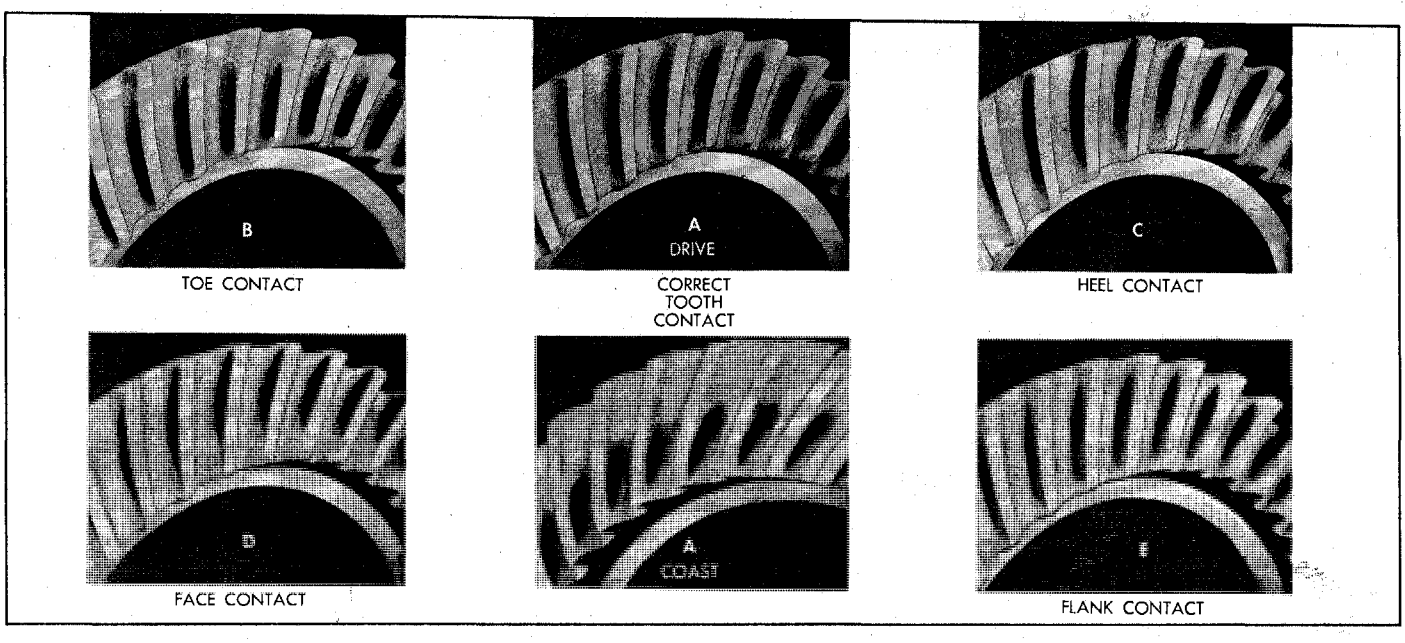


Fig. 24—Gear Tooth Contact Patterns

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CONVENTIONAL DIFFERENTIAL CASE AND DRIVE PINION (CORVETTE)

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Differential Case and Drive Pinion

Removal

1. Clamp carrier in Holding Fixture J-3289.
2. Remove snap rings securing side gear yokes and pull yokes out of carrier (fig. 25).
3. Mark differential bearing caps for reassembly in same relative location and remove caps.
4. Pull differential assembly out of carrier, taking care not to damage machined mounting surface on carrier (fig. 26). Remove differential bearing shims and mark for future reference.
5. Turn holding fixture over and remove companion flange nut using J-8614-1 Holder (fig. 27).
6. Pull companion flange using J-8614-1 Holder with Puller J-8614-2 (fig. 28).
7. With companion flange removed, pinion gear and rear bearing assembly can be removed from carrier.
8. Pry companion flange seal out of carrier using screw driver and discard seal. Remove pinion front bearing inner race and roller assembly.
9. Pry differential side gear yoke seals out of carrier and discard seals. Using a piece of 1-3/4" O.D. pipe of suitable length, tap yoke bearings out of bore.

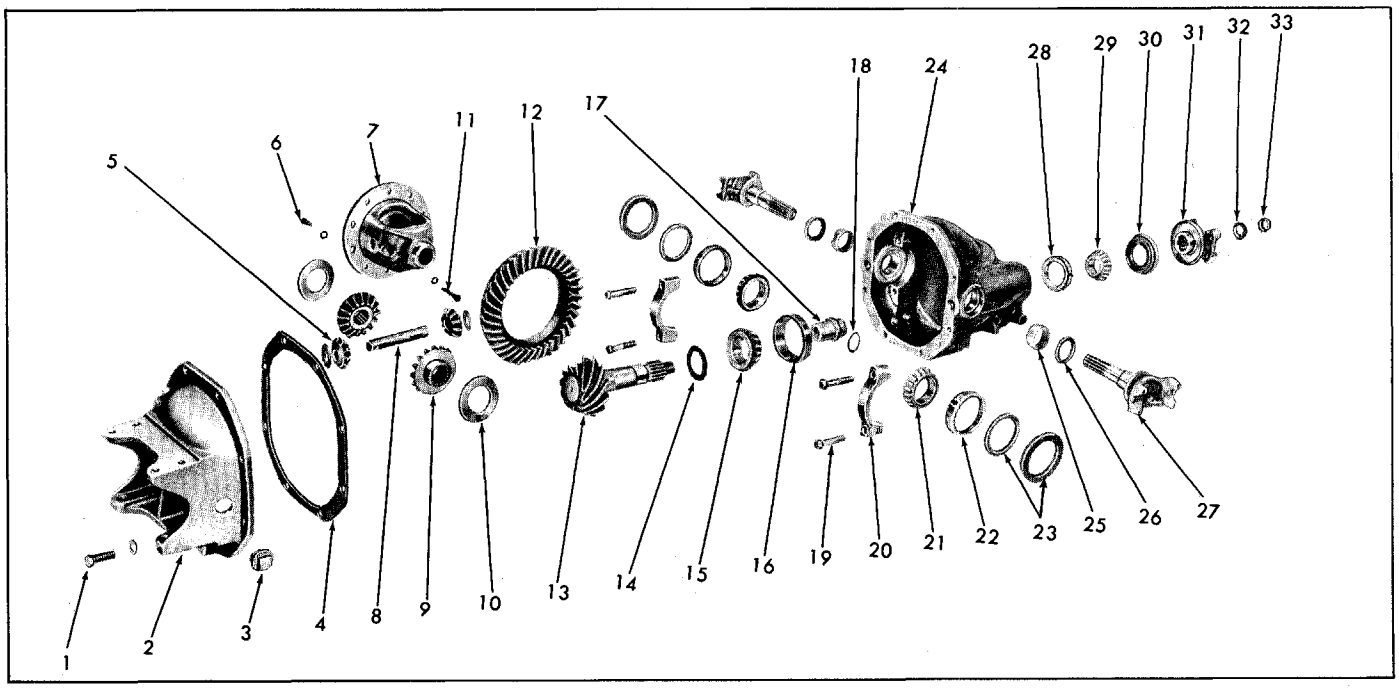


Fig. 25—Carrier Assembly—Exploded View

1. Cover Bolt
2. Carrier Cover
3. Filler Plug
4. Cover Gasket
5. Differential Pinion
6. Ring Gear Bolt
7. Differential Case
8. Pinion Shaft
9. Differential Side Gear
10. Side Gear Thrust Washer
11. Differential Pinion Pin Retainer
12. Hypoid Ring Gear
13. Hypoid Drive Pinion
14. Pinion Bearing Shim
15. Pinion Rear Bearing
16. Pinion Rear Bearing Cup
17. Pinion Bearing Spacer
18. Side Gear Yoke Snap Ring
19. Side Bearing Cap Bolt
20. Side Bearing Cap
21. Differential Side Bearing
22. Side Bearing Cup
23. Side Bearing Shim and Spacer
24. Differential Carrier
25. Side Gear Yoke Bearing
26. Side Gear Yoke Bearing Seal
27. Side Gear Yoke
28. Pinion Front Bearing Cup
29. Pinion Front Bearing
30. Pinion Oil Seal
31. Companion Flange
32. Companion Flange Washer
33. Pinion Nut

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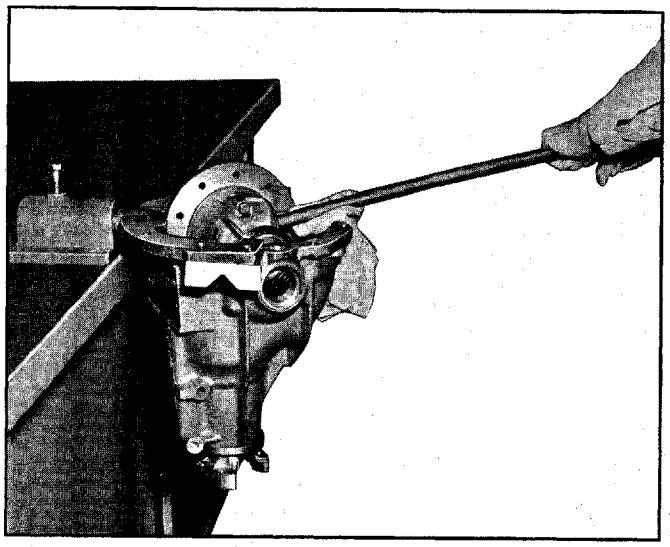


Fig. 26—Removing Differential

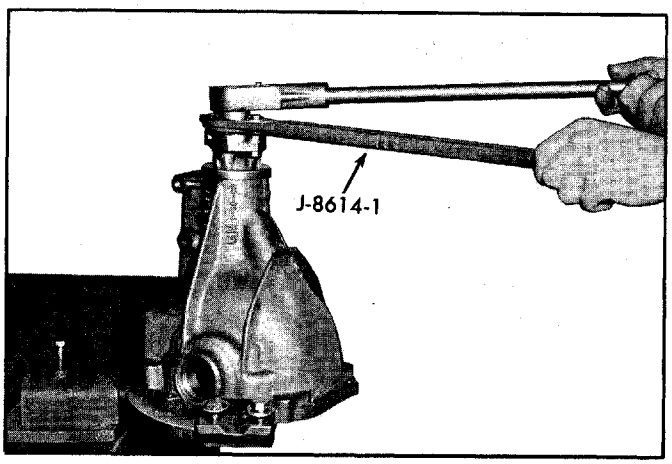


Fig. 27—Removing Companion Flange Nut

10. Disassemble differential assembly by removing pinion pin lock screw and pulling out pinion pin, differential pinions, pinion thrust washers, side gears and thrust washers. Do not remove ring gear unless replacement of gear set or case is necessary.

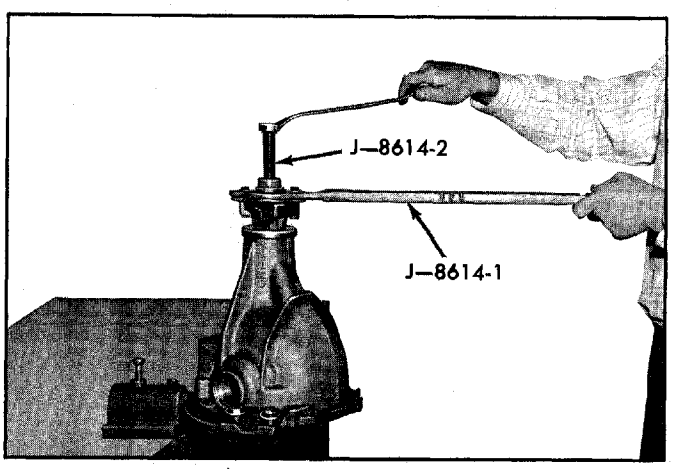


Fig. 28—Removing Companion Flange

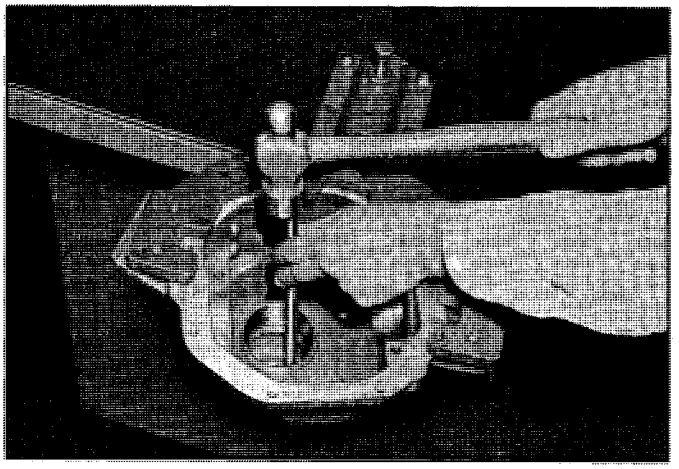


Fig. 29—Removing Pinion Bearing Cup

Inspection

1. Clean all gears and bearings in an approved cleaning solvent and blow dry.

   NOTE: Do not spin bearings during drying process. The extremely fast spinning and lack of lubrication may quickly result in the failure of an otherwise reusable bearing.

2. Inspect gears for scoring, pitting or cracks.
3. Inspect bearings for spalling, pitting or scoring. Discard all parts that show excessive wear or failure.
4. Inspect side gear driveshaft yokes closely for spline wear or yoke cracking. If equipment is available, use magnetic penetrant method to check for minute fractures in yokes or gears.

Repairs

Pinion and/or Bearing Replacement

1. If necessary to replace pinion bearings, tap old cups out of carrier using brass drift or long punch (fig. 29).
2. Select front and rear pinion bearings and drive cups into carrier using Drive Handle J-8092 and Cup Installers J-8608 for the rear cup and J-7137 for front cup (fig. 30). Seat cups securely and squarely against shoulders in carrier.
3. Remove pinion rear bearing inner race and roller assembly using Press Plates J-9771 in Holder J-0358-1 (fig. 31). Remove and discard shim between bearing and gear head.

Determining Pinion Shim

If hypoid gear set, pinion rear bearings or carrier assembly are to be replaced, thickness of pinion bearing shim will have to be determined as follows:

1. Lightly lubricate pinion bearings, place in carrier and rotate several times to seat properly.
2. Position Gauge Plate J-6266-33 on rear bearing making sure it is properly seated and piloted. Loose pilot allows plate to be easily centered in bearing.
3. Insert clamp screw through gauge plate, both

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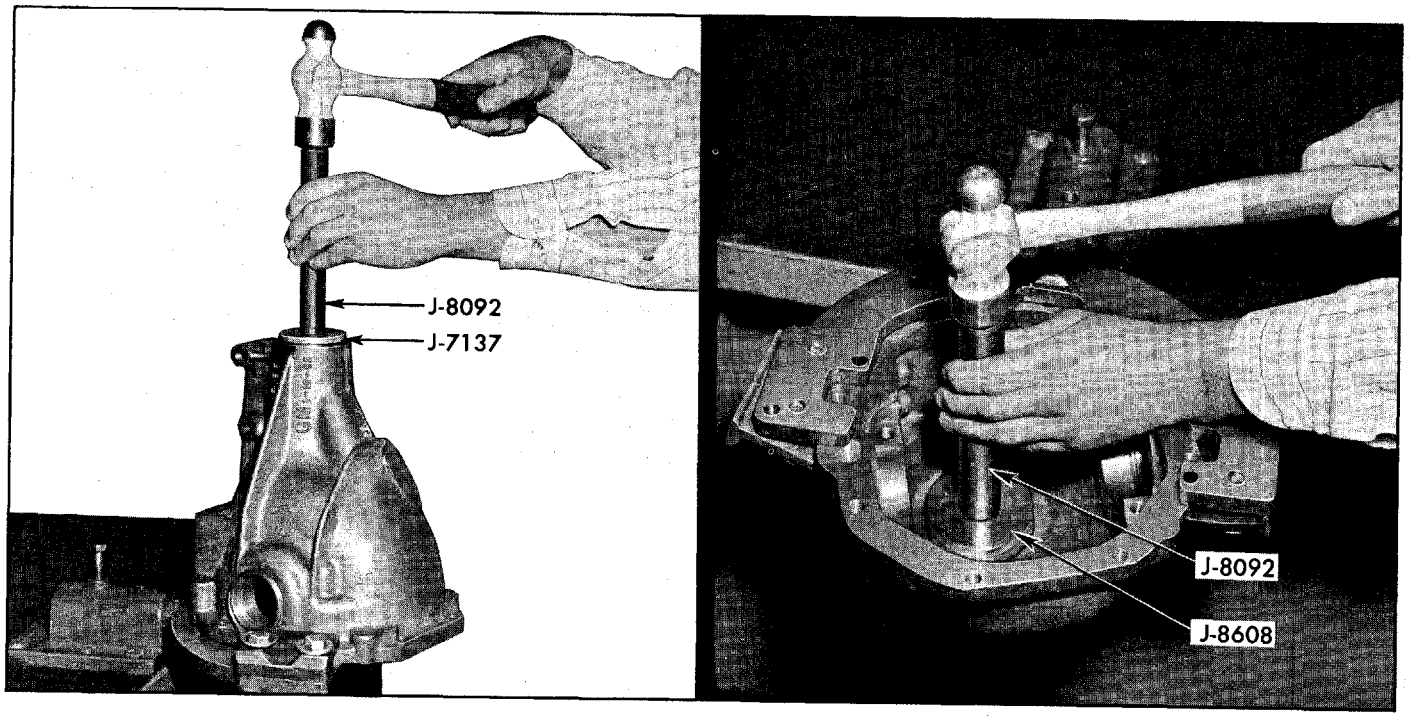


Fig. 30—Installing Pinion Bearing Cups

bearings and Clamp Plate J-8107-4 on front bearing (fig. 32). Tighten clamp bolt enough to seat properly and check gauge plate alignment.

4. Tighten clamp screw until it takes a torque of 20 in. lb. to rotate bearings (fig. 33).
5. Carefully slide Adapter Rings J-6266-32 over Gauge Barrel J-6266-28 and place barrel assembly in differential bearing bores (fig. 34). Plunger on barrel must rest on lowest step of Gauge Plate J-6266-33.
6. Mount Dial Indicator J-8001 on gauge post and place pointer on top of plunger (fig. 35). Swing gauge barrel aside so plunger does not touch gauge plate and set indicator at zero.
7. Swing gauge plunger back across plate and record highest indicator reading.
8. All pinion gears are stamped with a code number on the threaded end of the pinion. The numerical difference between the code number and the gauge reading obtained in Step 7 determines the required thickness of the pinion locating shim.

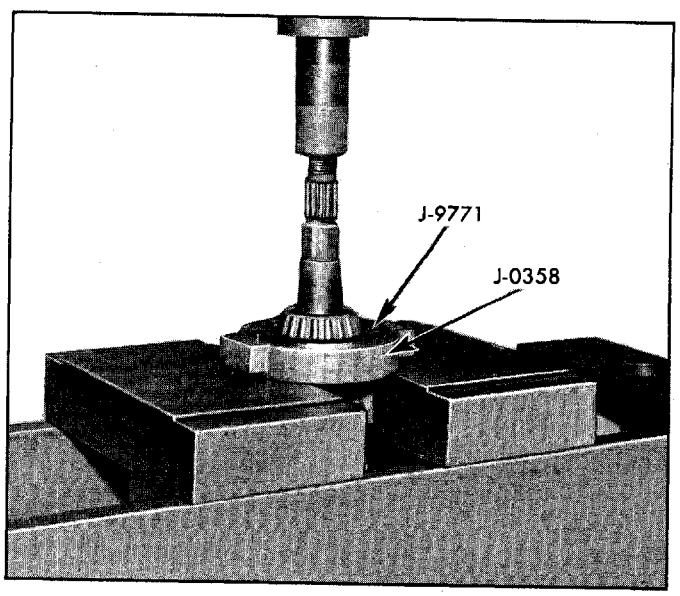


Fig. 31—Removing Pinion Rear Bearing

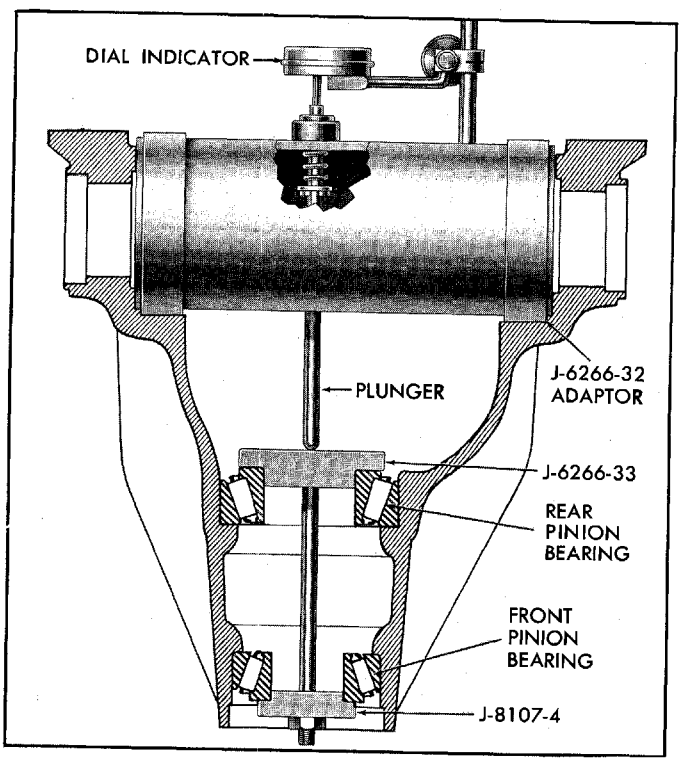


Fig. 32—Gauge and Clamp Plates Installed

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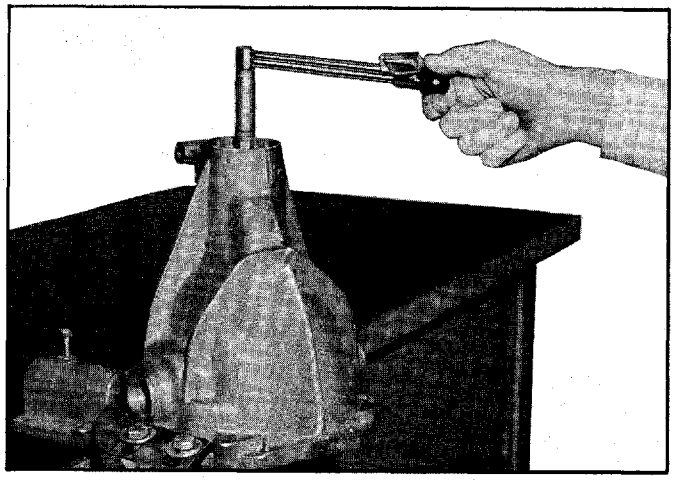


Fig. 33—Checking Bearing Pre-Load

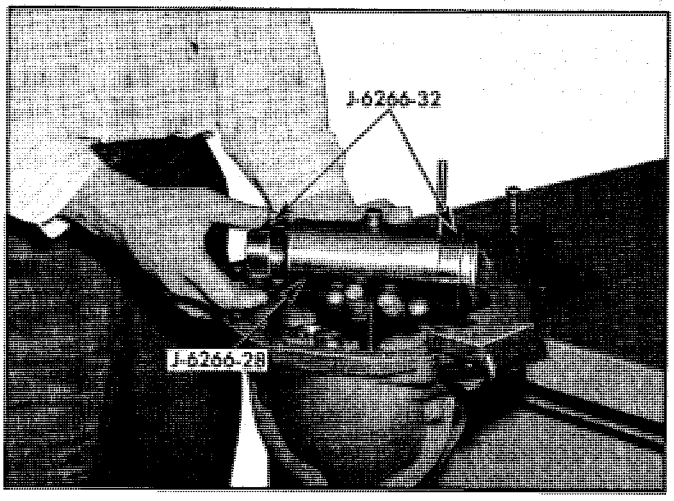


Fig. 34—Installing Gauge Barrel

Example:	#1	#2	#3
Pinion Code Number	40	45	50
Dial Indicator Reading	19	16	14
Difference	21	29	36
Proper Shim Thickness	.021"	.029"	.036"

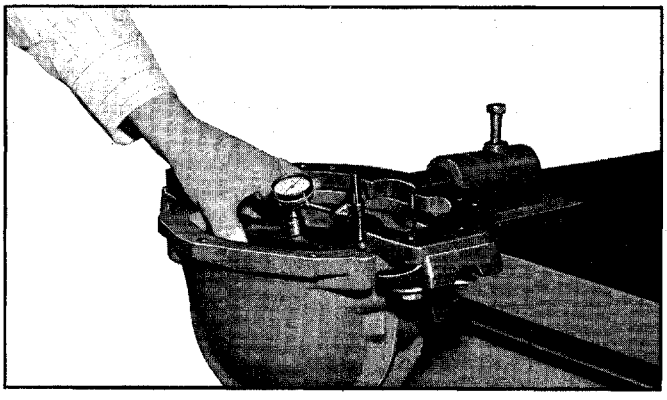


Fig. 35—Gauging Pinion Depth

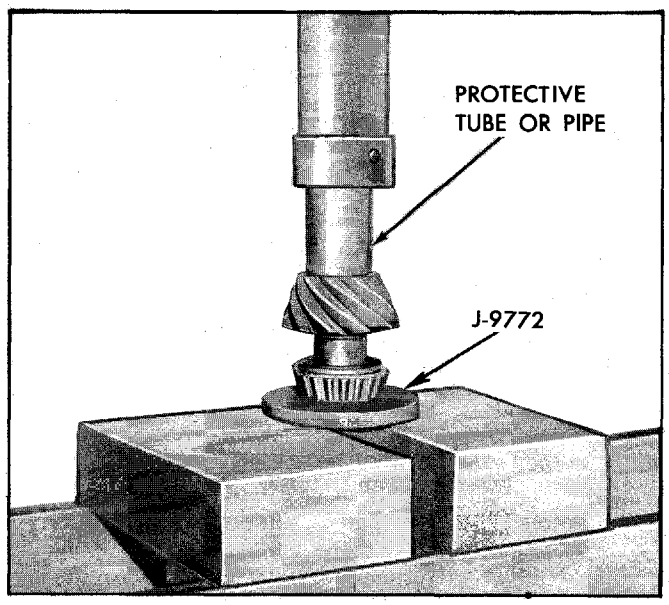


Fig. 36—Installing Pinion Rear Bearing

NOTE: Shims are available in .001" increments from .021" to .037". Each shim has the thickness etched on flat surface for easy identification.

9. Remove gauge, gauge plates and clamp screw. Remove pinion rear bearing inner race and roller assembly from carrier.
10. Position pinion shim selected in Step 8 on pinion head and press pinion bearing on pinion using J-9772 Press Plate (fig. 36).

Differential Bearing Replacement

1. Place Puller J-8107 over differential bearing using Adapter Plug J-8107-4 in side gear bore. Tighten puller screw to remove bearing (fig. 37).
2. Install new bearing on hub using Installer J-8359 (fig. 38).
3. Before installing bearing on opposite hub, support differential case on Adapter Plug J-8107-4. This allows differential case to rest on plug instead of bearing cage (fig. 38). Install remaining bearing.

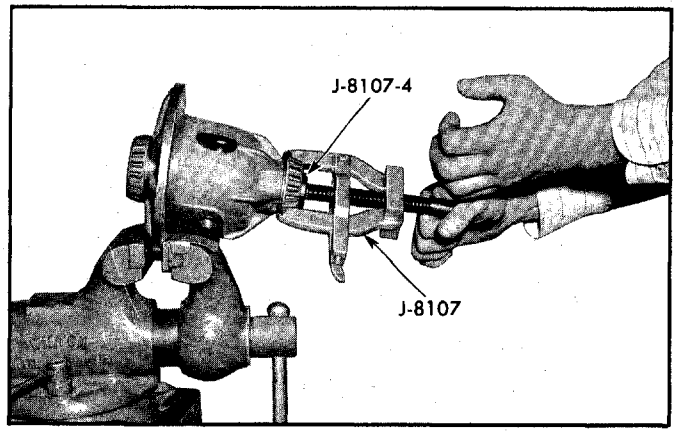


Fig. 37—Removing Differential Bearing

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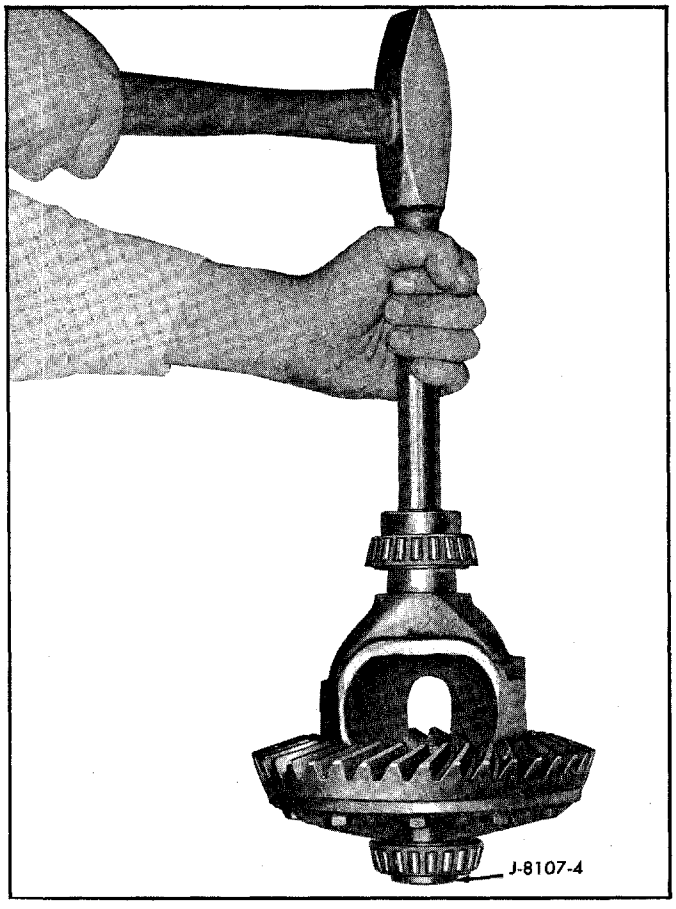


Fig. 38—Differential Bearing Installation

Ring Gear or Differential Case Replacement

1. Remove ring gear bolts and tap ring gear off differential case.
2. Install guide pins fabricated from 3/8-24 x 1-1/2" bolts with heads removed and ends slotted (fig. 39).
3. Clean ring gear mounting surface and mounting flange on case. Place ring gear on pilot case diameter.
4. Install every other ring gear bolt and draw ring gear up evenly until gear is seated against flange.

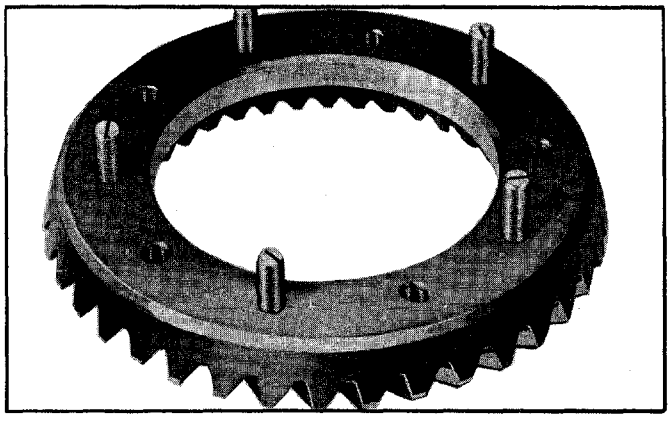


Fig. 39—Ring Gear Guide Pins Installed

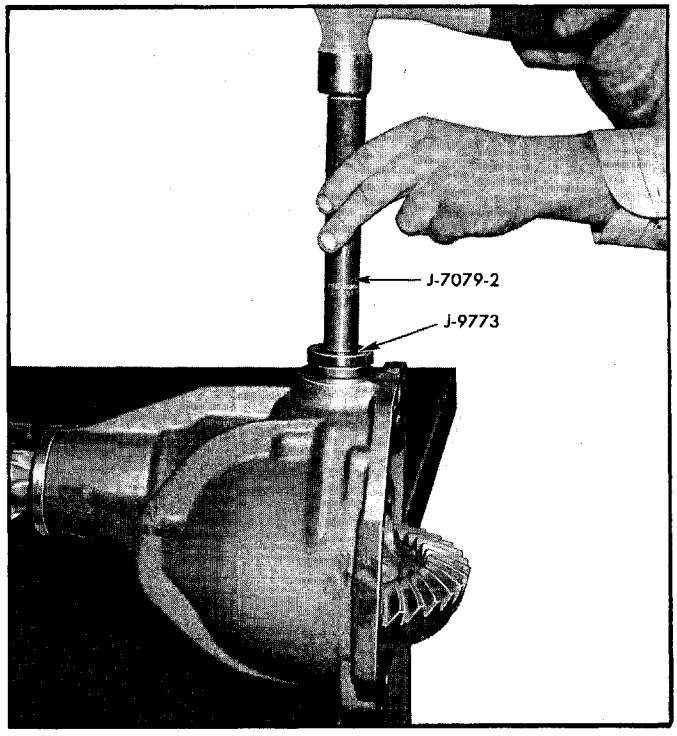


Fig. 40—Installing Side Gear Yoke Bearings

5. Remove guide vins and install remaining ring gear bolts. Torque bolts to specifications.
6. Install thrust washers and side gears in case, if same parts are used, replace in original sides. Position pinions and thrust washers through loading hole in case 180 degrees apart so that they engage side gears. Rotate gears until pinion shaft holes are aligned. Install pinion shaft and lock screw.

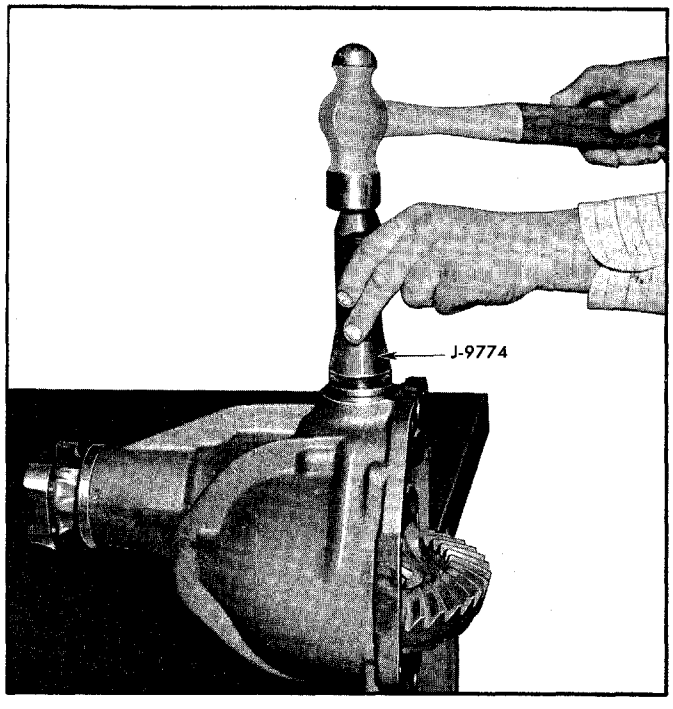


Fig. 41—Installing Side Gear Yoke Seal

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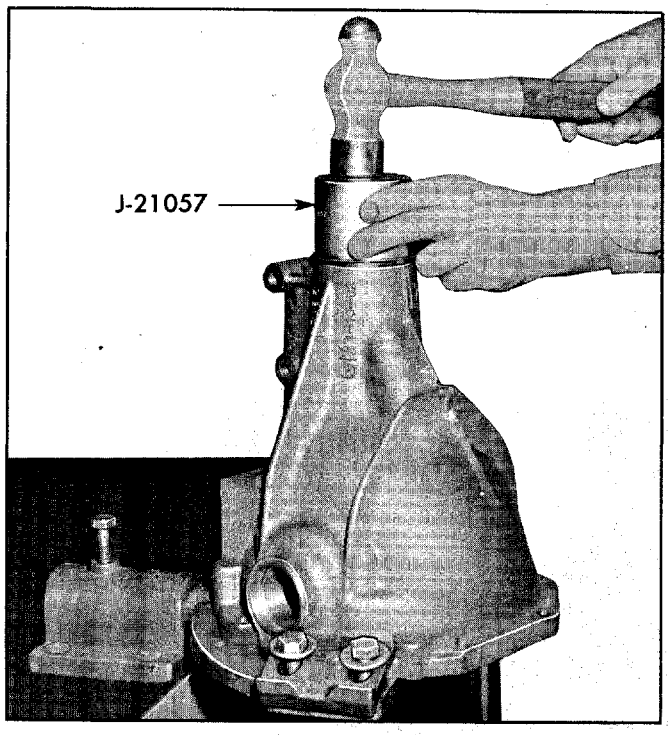


Fig. 42—Installing Pinion Seal

Side Gear Yoke Bearing and/or Seal Replacement

1. Place new yoke bearings on Installer J-9773 and install bearing into carrier bore using Handle J-7079-2 (fig. 40). Drive bearing until it is fully seated.
2. Place new seal on Installer J-9774 and install into seal bore outboard of bearing (fig. 41).

Installation

Drive Pinion and Bearing

1. Lubricate pinion bearings and place pinion gear in carrier.
2. Place a new pinon bearing spacer over pinion so it seats on inner race of rear bearing.
3. Slide pinion front bearing cone and roller assembly over pinion shaft so it seats against spacer.
4. Place new pinion seal squarely into seal bore and install using J-21057 (fig. 42).

NOTE: Be sure seal does not cock during installation. When seal is fully installed, there

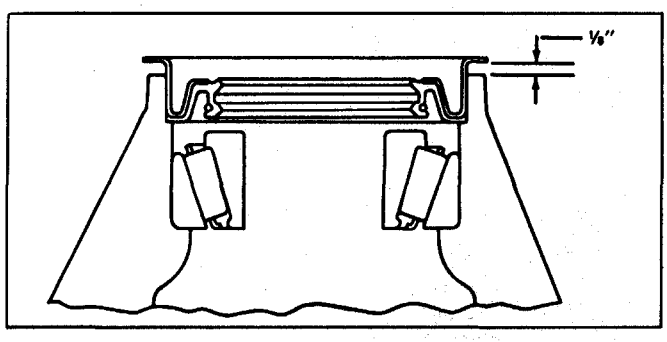


Fig. 43—Pinion Seal Installed

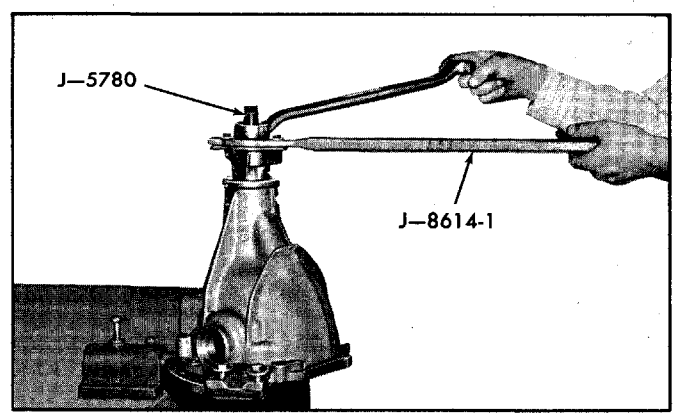


Fig. 44—Installing Companion Flange

should be a gap of approximately 1/8" between seal flange and carrier (fig. 43).

5. Install companion flange using Holder J-8614-1 and Installer J-5780 (fig. 44).
6. Install companion flange washer and nut, holding flange with Holder J-8614-1. Tighten nut until bearing is pre-loaded and a torque of 15-25 in. lbs. is required to rotate pinion (5-15 in. lbs. for used bearings). Inch-pound torque Wrench J-5853 and Adapter J-5810, or Spring Scale J-0544 and Handle J-8614-1 may be used to check pre-load (figs. 45 and 46). If spring scale is used, it should read 1 lb. 14 oz. to 3 lbs. 2 oz. (10 oz. to 1 lb. 14 oz. for used bearings) when used at notches on holding tool.

NOTE: There should be no contact between companion flange deflector and oil seal flange.

Differential Bearing Preload

1. Check condition of bearing, bearing cups, cup seat in carrier and carrier caps to make sure that they are free from nicks, burrs and foreign material.
2. Lubricate bearings with axle lubricant, position cups on proper bearing then install differential assembly in carrier (fig. 47).
3. Position one service spacer (available in .160" ± .001" thickness only) between each bearing race and

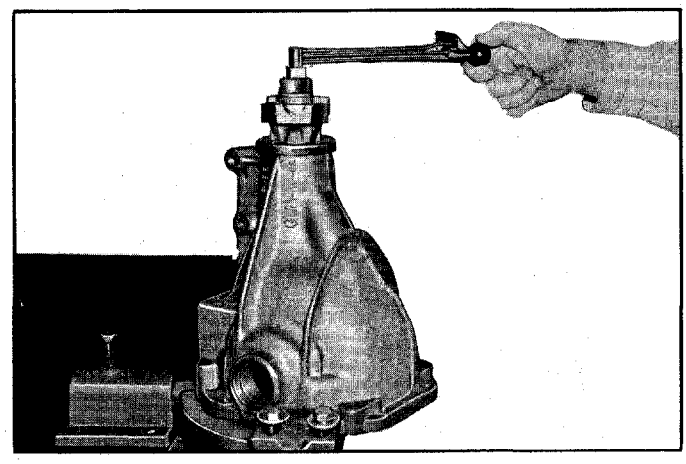


Fig. 45—Checking Pre-Load (Torque Wrench)

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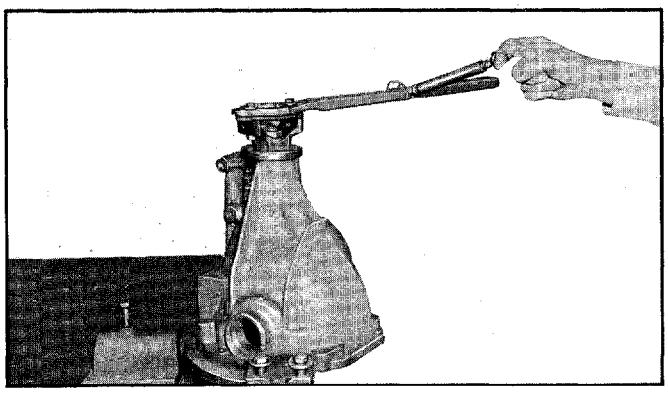


Fig. 46—Checking Pre-Load (Scale)

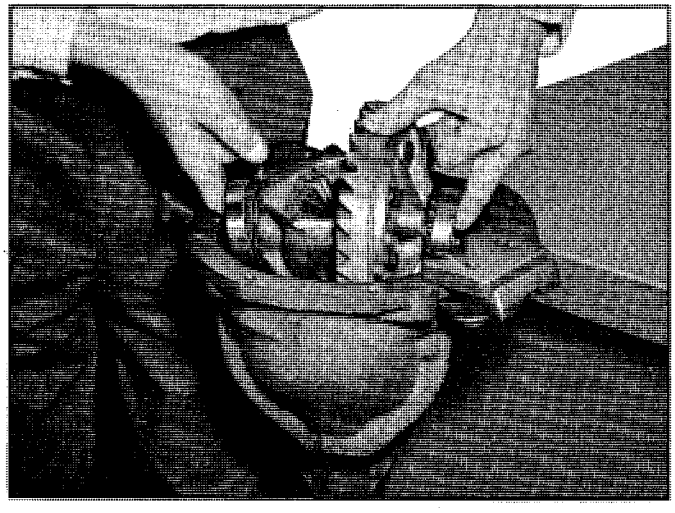


Fig. 47—Installing Differential Assembly

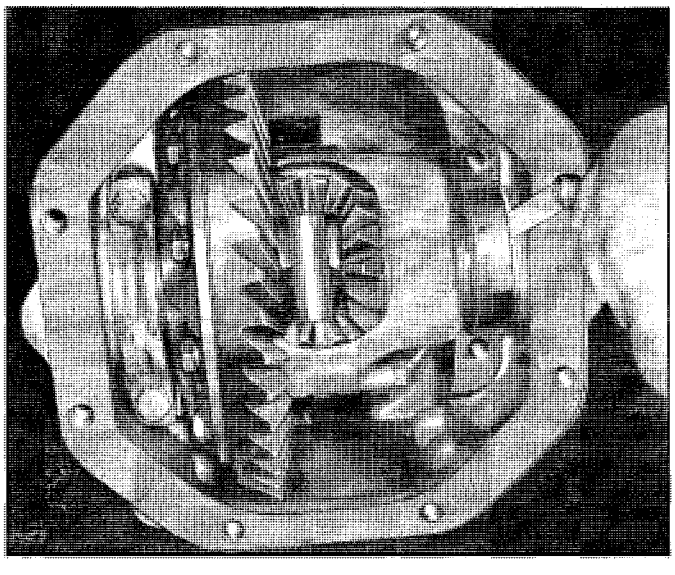


Fig. 48—Measuring Differential Shim Requirements

carrier housing--chamfered side of spacer against bearing.

NOTE: Production preloading of the differential bearings is accomplished by the use of automated equipment that permits the use of cast iron preload shims. These shims can not be used when rebuilding the carrier as they may break when tapped into place. Therefore, as an aid in determining the approximate shim requirement, measure thickness of each cast iron shim.

4. Subtract .345" (total of two .160" service spacers plus .025" gauging space) from total thickness of the cast iron shims removed during carrier disassembly. Select two service shims equal to the difference and position both shims between the right bearing cup and service spacer. See shim chart for shim availability and identification.
5. Make sure that left bearing cup and spacer are against seat in carrier; then determine distance between right cup and spacer, using feeler gauge as shown in Figure 48. Observe the following procedure to determine proper shim thickness.
   a. Insert a feeler gauge with a thickness known to be less than the distance between shim and bearing cup. Withdraw shim and reinsert several times to get "feel" produced by drag of gauge against shim and bearing. Rotate differential case while gauging.
   b. Progressively insert (in increments of .002") larger feeler gauges until there is a noticeable increase in the drag produced on the feeler gauge. The gauge thickness used just before additional drag is encountered is the proper thickness.

NOTE: When determining proper shim thickness, do not apply pressure on bearings so as to preload them. Required shim thickness is determined by line-to-line measurement--preload on bearing will, in effect, produce an incorrect shim thickness, thereby causing excessive preload.

6. Remove the previously installed shims from the carrier. Service spacers installed in Step 4 are to remain in the carrier.
7. Select two shims of equal thickness which in total are equal to value of shims selected in Step 4 and thickness of feeler gauge determined in Step 5b.

EXAMPLE:

Shim thickness used in Step 4 (0.070" x 2)	0.140"
Thickness of feeler gauge determined in Step 5b	0.027"
TOTAL SHIM THICKNESS REQUIRED	0.167"
SHIM THICKNESS FOR EACH SIDE	0.084"

8. Install one shim between each side bearing race and service spacer.

NOTE: If insertion of left shim causes excessive pinion-to-ring gear contact, select thinner left shim and add difference to right shim. Keep total shim thickness at a value equal to that obtained in Step 7.

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9. Check ring gear and pinion adjustment and ring gear and pinion contact pattern as outlined in this section.
10. Remove shims installed in Step 8, after satisfactory tooth pattern and lash adjustments have been completed, making note of shim thickness taken from each side.
11. Select two shims each .004" thicker than those removed and install one shim on each side. Make sure that both shims are .004" thicker than the shims used when adjusting lash and tooth pattern, also that the .004" thicker shims are inserted in proper side of carrier. If shims are not inserted in proper side of carrier lash and tooth pattern will be affected.

    NOTE: Install left shim first then wedge right shim between bearing cup and spacer (position shim so that chamfered side is outward or next to spacer). If shim does not have sufficient chamfer or lead around O.D. to allow easy installation without scraping spacer, file or grind chamfer before installing.

12. If difficulty is encountered in installing shim, partially remove case and slide case and shim into position. Tap shim into position, using a soft-faced hammer, while rotating differential case with free hand (fig. 49).

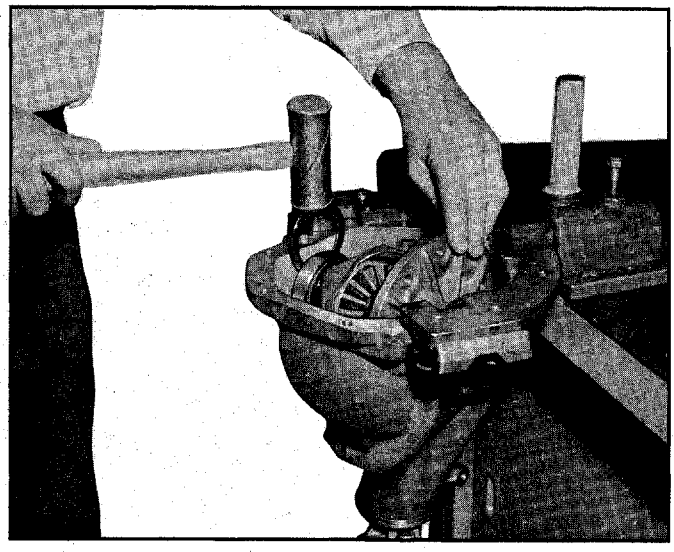


Fig. 49—Installing Differential Shims

Shim Identification		
Shim	Notches	
	I.D.	O.D.
.064	None	2
.066	None	3
.068	None	4
.070	1	None
.072	1	1
.074	1	2
.076	1	3
.078	1	4
.080	2	None
.082	2	1
.084	2	2
.086	2	3
.088	2	4
.090	3	None
.092	3	1
.094	3	2
.096	3	3
.098	3	4
.100	4	None

Backlash Adjustment

1. Install bearing caps in their original position and tighten, but do not torque.
2. Mount dial indicator on carrier with pointer set on ring gear tooth and check backlash (fig. 50).
3. If backlash is within .003"-.010" limit (.005"-.008" preferred), no further adjustments are needed.
4. If backlash is not within limits, adjust as follows:
   a. Ring gear should be moved toward or away from pinion an amount sufficient to bring backlash within limits. To accomplish this, install thinner shim behind right or left bearing while increasing shim thickness an equal amount on opposite side. Example:
   If backlash is .013" and .007" is desired, install .006" thinner shim behind right bearing and .006" thicker shim behind left bearing.
   Maintain the original total shim stack-up (sum of both shims) throughout backlash adjustment. In this manner, line-to-line-contact is not changed during adjustment.
   b. Continue changing shims as necessary to obtain correct backlash, always increasing shim thickness on one side an amount equal to shim thickness decrease on the opposite side.

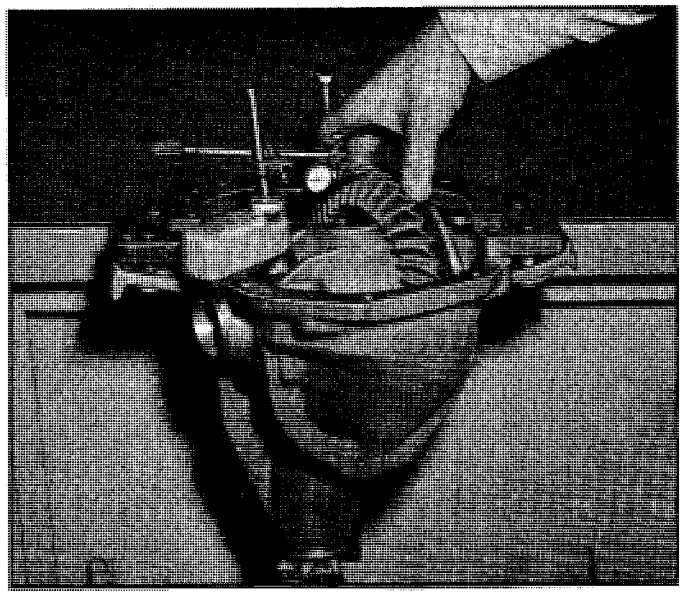


Fig. 50—Checking Backlash

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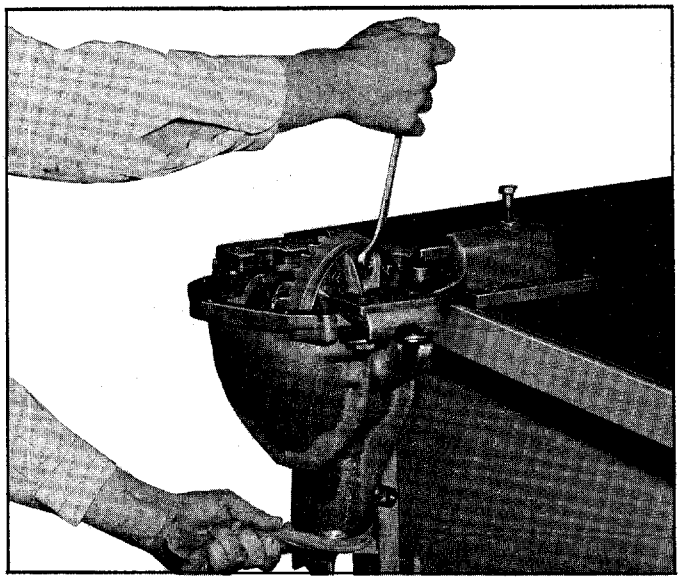


Fig. 51—Developing Tooth Pattern

5. Torque differential bearing cap bolt to specifications.
6. Thoroughly clean the ring and pinion gear teeth.
7. Paint ring gear teeth lightly and evenly with a mixture of powdered red lead and oil of a suitable consistency to produce a contact pattern.
8. Grasp companion flange firmly with a cloth to form a friction brake. Rock the ring gear back and forth, shifting bolt heads to develop a contact pattern on ring gear teeth (fig. 51).

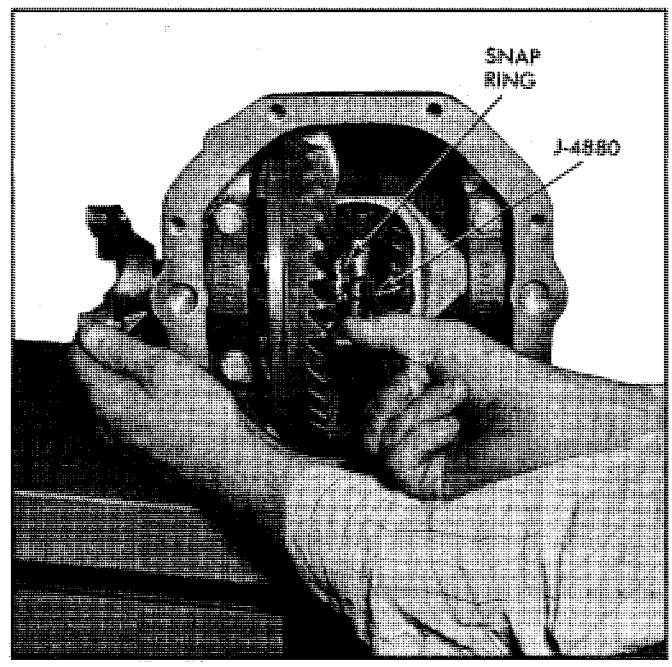


Fig. 52—Installing Side Gear Yoke

9. Inspect contact pattern and refer to "Ring Gear and Pinion Contact Pattern" outlined previously to determine if further adjustments are required.
10. Insert side gear yokes into side gears and install snap rings (fig. 52).

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POSITRACTION DIFFERENTIAL CASE AND DRIVE PINION (DANA)

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Differential Case and Drive Pinion

The optionally available Dana Positraction differential unit (fig. 53) is installed in the conventional carrier to replace the standard differential unit.

Overhaul procedures for the Positraction equipped axle are the same as on a conventional axle except for the operations listed below.

Disassembly

1. Remove ring gear and install spring Tool J-21752, making sure spring jaws are securely indexed between spring coils.
2. Compress J-21752 until spring is compressed sufficiently to slide out of retainer seats then remove spring and spring cups (fig. 54). Repeat on remaining springs.
3. Remove differential pinions by rotating side gear with axle shaft until they move around to large opening in case. Pry clutch pack away from pinion until pinion drops out. Remove pinion thrust washers.
4. Remove clutch packs and side gears (fig. 55).

NOTE: The clutch pack is assembled to a predetermined height of .552"+.002", therefore, make sure that clutch pack components are removed and maintained as a unit. Do not mix plates, discs or shims from one pack with those of another pack.

5. Pry clutch pack cage out of differential case (fig. 56).

Inspection

1. Clean and inspect side gear thrust surfaces, pinion gear thrust surfaces, thrust washers and spring cup for excessive wear and replace where necessary.
2. Inspect clutch pack for excessive wear or overheating and replace as a unit if necessary.
3. If plates and discs are suitable for reinstallation, measure the clutch pack thickness (including shim). Total thickness should be .552+.002", replace shims as required to maintain this height. Shims are available in thicknesses of .016", .020", .024", .026" and .028".

Reassembly—Refer to Figure 53

1. Place clutch pack cages into case with side tabs up and flat sides parallel with flat sides in case.
2. Place aluminum spring seat plate over side gear (fig. 57).
3. Alternately place clutch plate and clutch disc on side gear until assembly of pack is complete (fig. 58). Make sure clutch discs index with teeth in side gear, then position shim over last clutch disc.
4. Install clutch pack and side gear assemblies in case. Tilt case on its side to prevent side gear from falling out.
5. Place pinion gear between differential side gears through large opening in case. Rotate side gears and

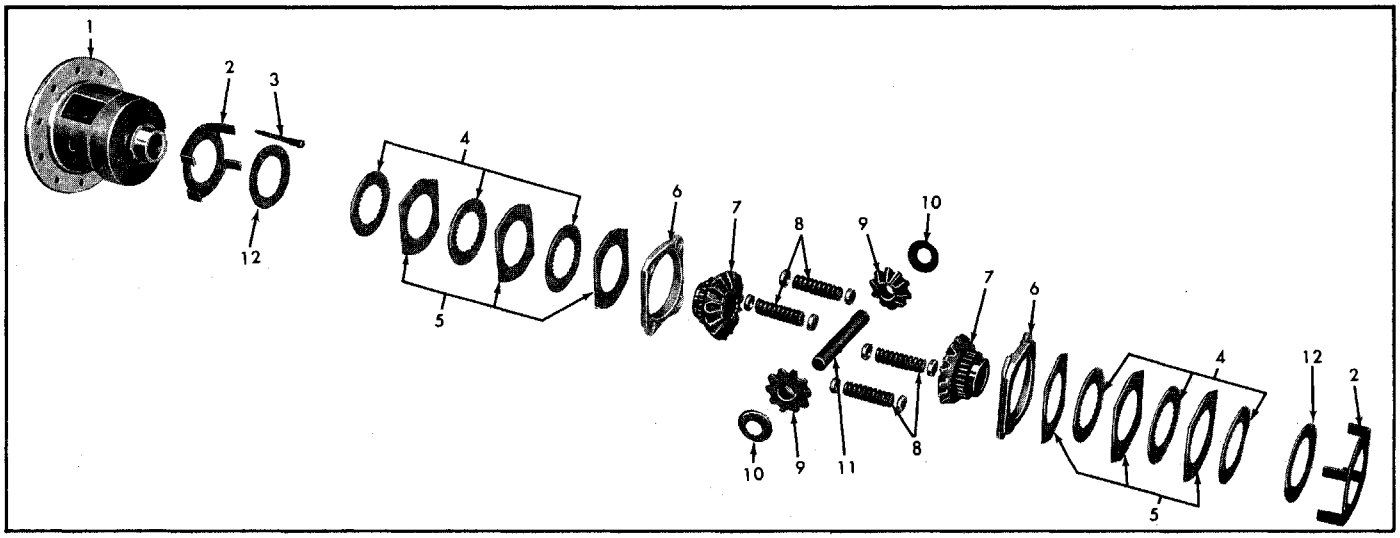


Fig. 53—Positraction Exploded View (DANA)

1. Differential Case
2. Cage
3. Lock Pin
4. Clutch Disc
5. Clutch Plate
6. Spring Seat
7. Side Gear
8. Spring and Spring Cups
9. Pinion
10. Thrust Washer
11. Pinion Shaft
12. Shim

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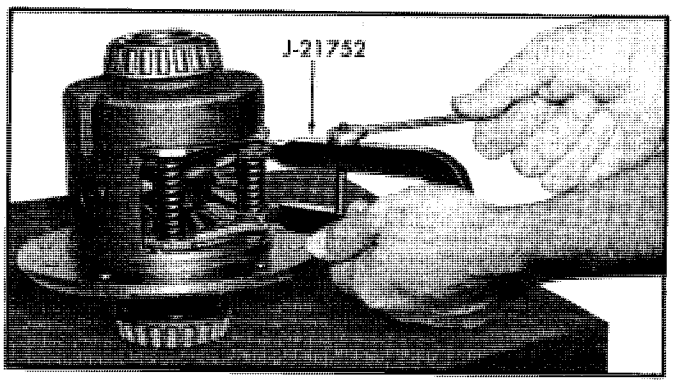


Fig. 54—Spring Removal

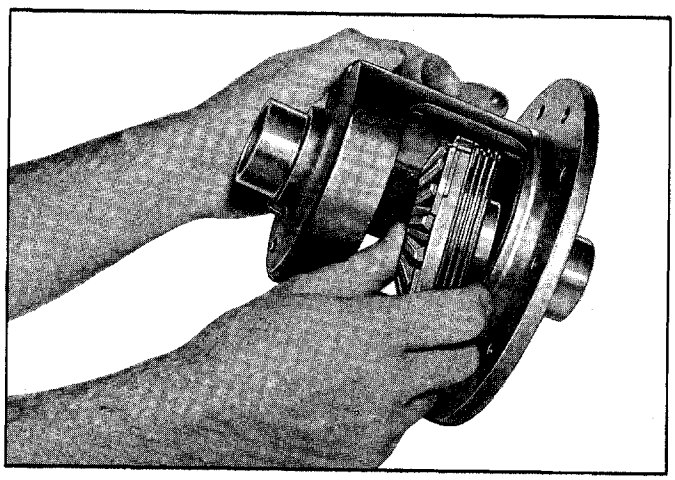


Fig. 55—Clutch Pack and Side Gear Removal

install second pinion directly opposite first. Install pinion thrust washers.

6. Place spring cup in spring seat bore and install clutch spring in jaws of J-21752, compress spring to approximately 1.90", install spring cup on top of spring and carefully insert into spring seats. Release spring and remove tool. Repeat for remaining springs.
7. Install ring gear on case as outlined under Ring Gear or Differential Case Replacement in this section.

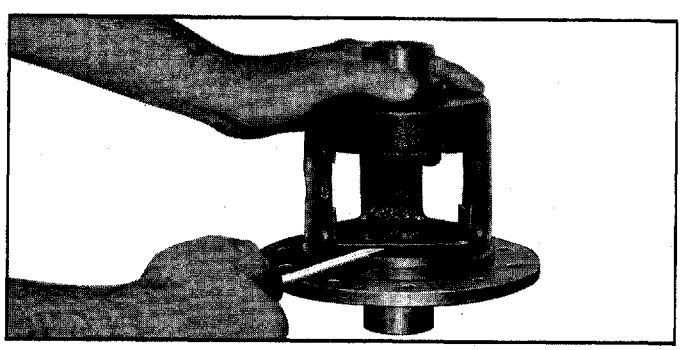


Fig. 56—Clutch Pack Cage Removal

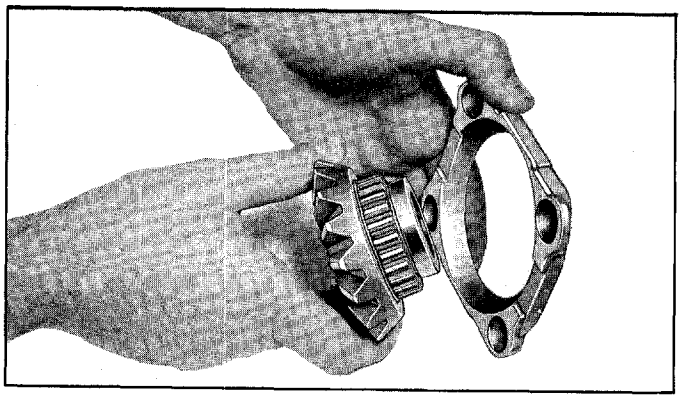


Fig. 57—Installing Spring Seat to Side Gear

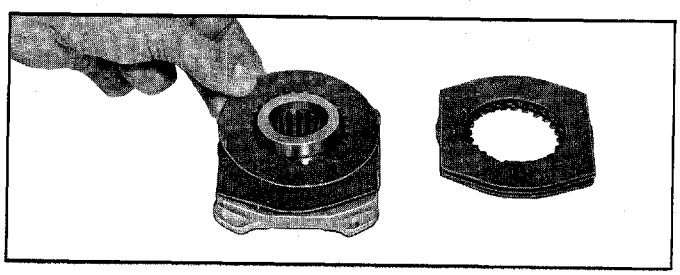


Fig. 58—Installing Clutch Pack

8. Place differential in carrier and adjust bearings and backlash as outlined in this section.
9. Check operation of unit as follows:
   a. Raise rear of vehicle until rear wheels are off the ground, and remove one wheel and tire assembly.
   b. Attach Adapter J-5748 to axle shaft flange and install a 1/2-13 bolt into adapter (fig. 59).
   c. With wheel and tire assembly still on vehicle held firmly to prevent turning, measure torque required to rotate opposite axle shaft with a 0-150 lb. torque wrench attached to J-5748. Torque required to rotate axle shaft should be no less than 40 ft. lbs.

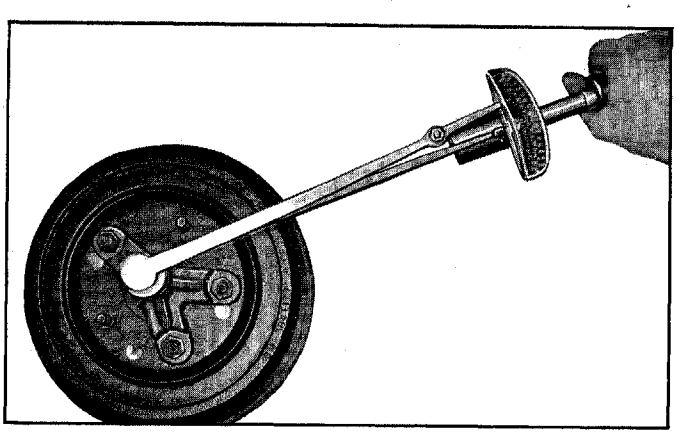


Fig. 59—Measuring Positraction Rotating Torque

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POSITRACTION DIFFERENTIAL CASE AND DRIVE PINION (EATON)

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Differential Case and Drive Pinion

The optionally available Eaton Positraction differential unit (fig. 60) is installed in the conventional carrier to replace the standard differential unit.

Overhaul procedures for the Positraction equipped axle are the same as on a conventional axle except for the operations listed below.

Disassembly

1. Remove ring gear and side bearings following the procedures established for the conventional differential unit.

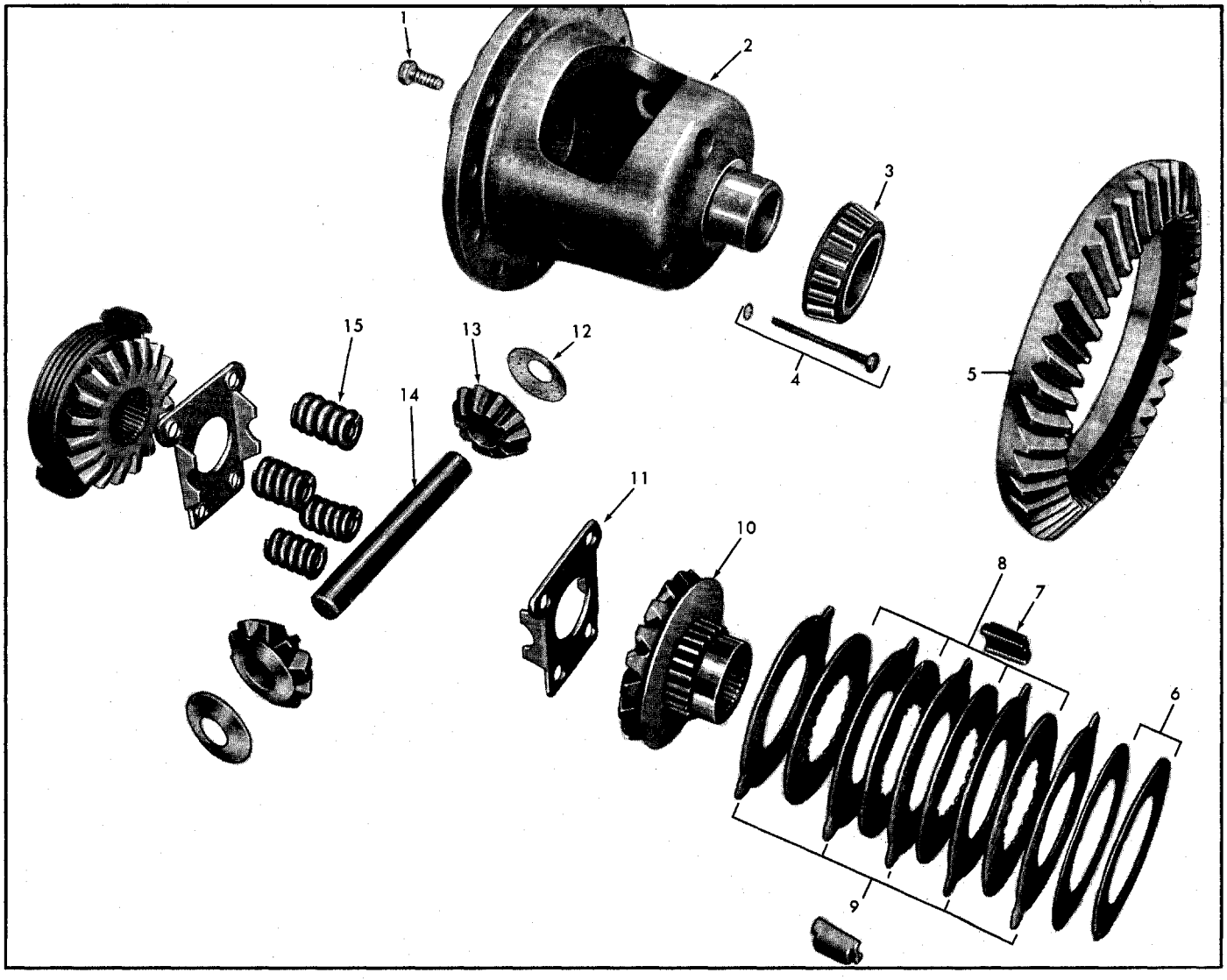


Fig. 60—Positraction Exploded View (EATON)

1. Ring Gear-to-Case Bolt
2. Differential Case
3. Side Bearing
4. Pinion Lock Screw and Washer
5. Ring Gear
6. Shims
7. Clutch Pack Guide
8. Clutch Disc
9. Clutch Plates
10. Side Gear
11. Spring Retainer
12. Pinion Thrust Washer
13. Pinion Gear
14. Pinion Shaft
15. Preload Spring

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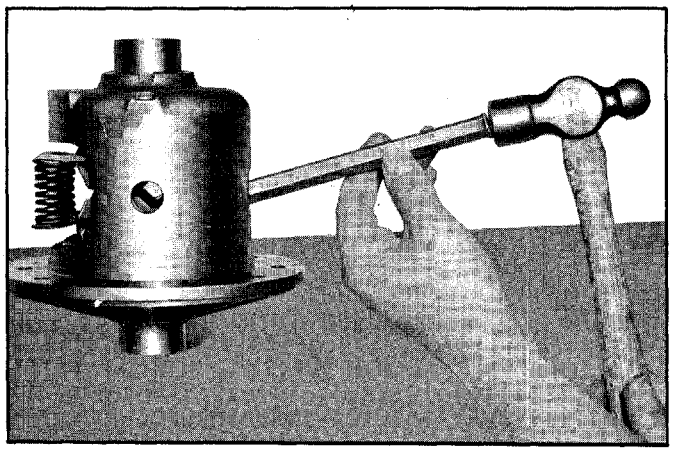


Fig. 61—Removing Preload Spring Pack

2. Remove the differential pinion shaft lock screw and tap pinion shaft from the case.
3. On all vehicles except Corvette, remove the preload spring retainer and springs by tapping on the spring retainer through the observation hole in the case (fig. 61).
4. On Corvette vehicles, it will be necessary to raise the spring retainers slightly to clear the shoulder on the side gears. Install Tool J-22311 to clutch pack so that slotted ends are equally engaged at front and rear of spring retainer (fig. 62).
5. Install provided bolt through tool halves and clutch pack - compress clutch pack sufficiently to allow removal. Secure pack with 1/4" bolts (fig. 63) then withdraw clutch pack from case.
6. Drive the spring retainer from the case sufficiently to allow insertion of a 1/4 inch bolt in each of the two front springs. Secure each bolt with a nut (fig. 63).
7. After installing the retaining bolts in Step 6, continue

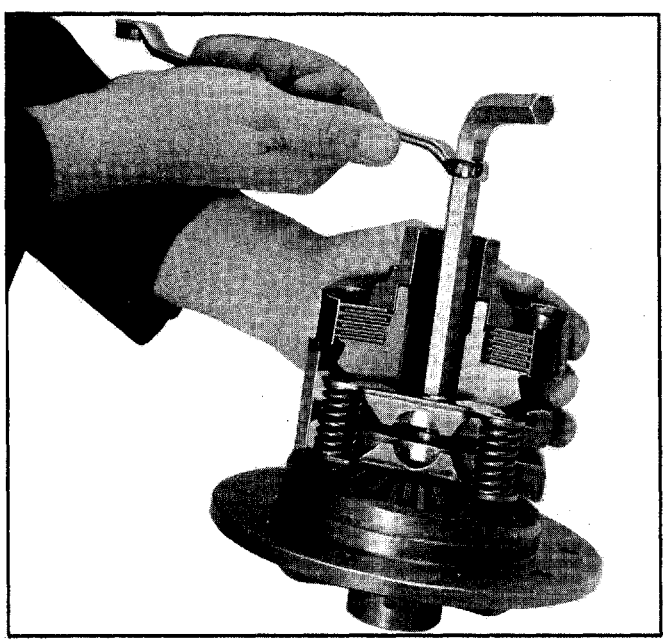


Fig. 62—Removing Preload Spring Pack (Corvette)

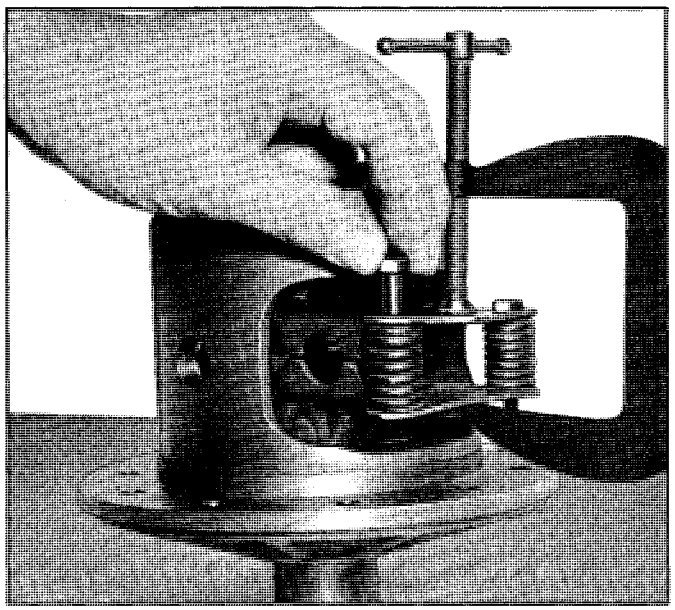


Fig. 63—Installing Bolts to Retain Springs

to drive spring retainer from the case until enough of the retainer is exposed to permit installation of bar stock and "C" clamp (fig. 64). Center the bar stock over the axle shaft hole in the spring retainer, then compress "C" clamp sufficiently to permit withdrawal of spring pack.

8. Position spring pack in vise and remove 1/4 inch bolts. Alternately relieve "C" clamp pressure and vise pressure until spring compression is relieved (fig. 65).
9. Remove the pinion thrust washers from behind the pinion gears.
10. Remove pinion gears from the case - pinion gears can be removed by rotating them in one direction only. Using Figure 66 as a reference, rotate differential case clockwise to remove the first gear,

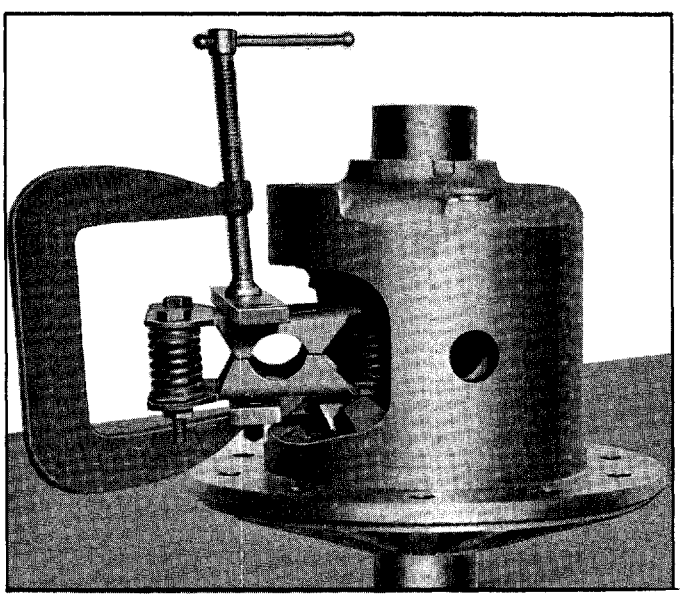


Fig. 64—"C" Clamp and Bar Stock Installed for Spring Removal

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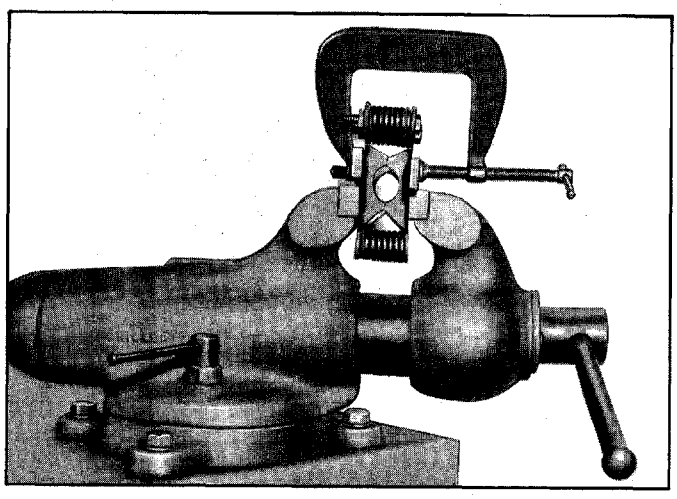


Fig. 65—Removing Preload Springs from Pack

then rotate case counter-clockwise to remove the second gear. To remove second gear, it may be necessary to assist pinion gear upon its seat by prying on gear through observation hole in case (fig. 66).

11. Remove side gear, clutch pack, shims and guides from case. Tap the assembly from the case, using a brass drift as shown in Figure 67. Repeat removal on opposite gear.
12. Separate clutch pack assembly from side gear. Retain clutch pack assembly with original side gear.

Inspection

1. Check clutch plates and discs for excessive wear and signs of overheating.

   NOTE: Clutch plates or discs are not serviced separately, if replacement is required, clutch pack must be replaced as an assembly.

2. Inspect preload springs for distortion and other defects.

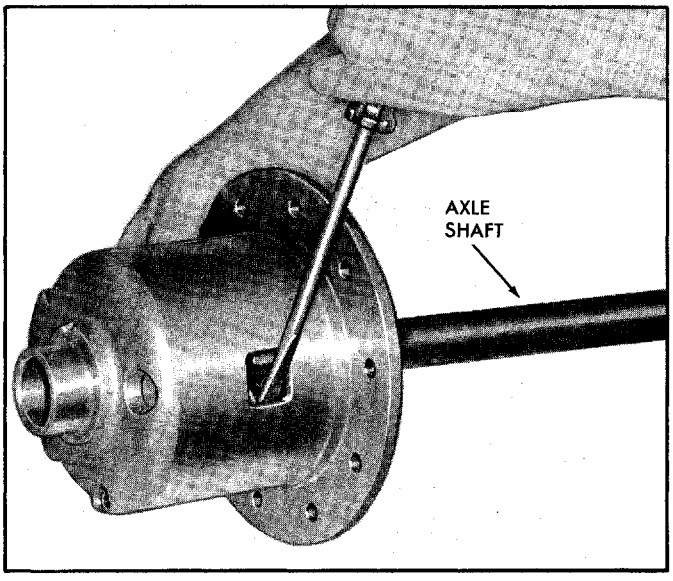


Fig. 66—Removing Differential Pinion Gears

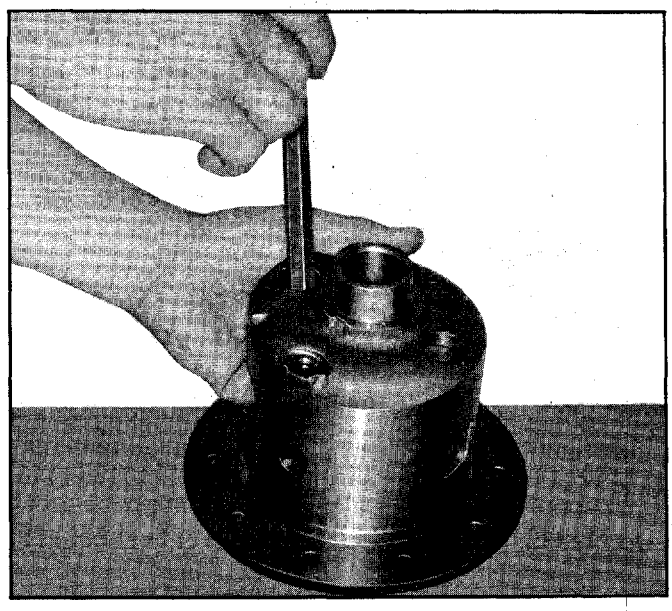


Fig. 67—Removing Clutch Pack

3. Compress springs and determine if they are capable of properly preloading the clutch pack, replace springs that are weak or questionable.
4. Examine spring retainer for alignment between the retainer halves and for excessive wear at spring seats.

Reassembly

1. Lubricate clutch plates and discs with special positraction lubricant.
2. Alternately position clutch plate and clutch disc on side gear, beginning and ending with clutch plate, until assembly of clutch pack is complete (fig. 68).
3. Install clutch pack guides on the clutch plate lugs. Make sure that the clutch disc lugs engage with side gear teeth.
4. Select shims of equal thickness as those removed from the case, or if old shims are suitable, reinstall them over the side gear hub.
5. Lubricate and assemble opposite side gear as above.
6. Install one side gear, clutch pack assembly and shim(s) in the differential case.

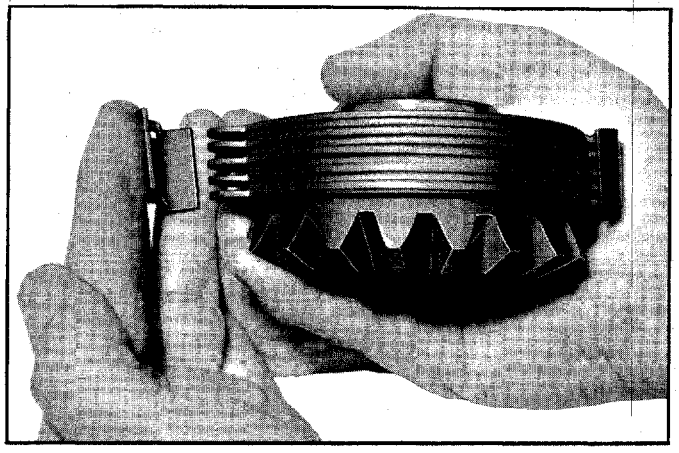


Fig. 68—Assembling Clutch Pack

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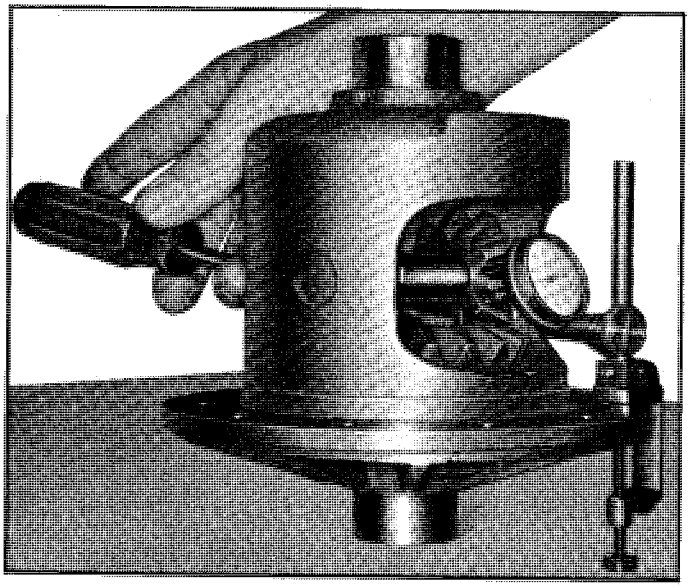


Fig. 69—Measuring Pinion Gear Tooth Clearance

7. Position pinion gears and thrust washers on side gears, install pinion shaft through case and gears.
8. Install dial indicator on case so that contact button rests against pinion gear (fig. 69).
9. Compress clutch pack, using a screw driver as shown in Figure 69. Move the pinion gear to obtain tooth clearance.
10. Tooth clearance should be .001" to .006", if required change shims to obtain proper tooth clearance.
11. Remove side gear assembly and repeat tooth clearance procedure for gear on opposite side of case.
12. Remove pinion shaft, gears and thrust washers.
13. Install remaining side gear, clutch pack assembly and shims in case.
14. Install pinion gears and thrust washers. Installation of pinion gears can be performed by reversing the pinion gear removal procedure.

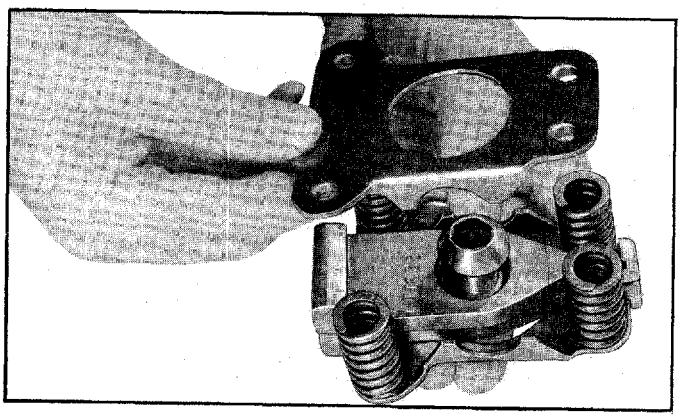


Fig. 71—Installing Spring Pack Compression Tool (Corvette)

15. Assemble springs in spring retainer and clamp assembly in vise. Install "C" clamp and bar stock on spring retainer then install a 1/4 inch bolt and nut in each front spring (fig. 70).
16. Position spring pack between side gears and remove bar stock and "C" clamp.
17. On Corvette vehicles, install Tool J-22311 to compress clutch pack, secure pack with 1/4" bolts (fig. 70). Partially install pack then remove bolts and complete pack installation - remove tool.
18. Drive spring pack into side gears sufficiently to retain front springs, then remove 1/4 inch bolts from springs. Drive spring pack into position (fig. 72).
19. Install the pinion shaft and lock screw. Torque lock screw to specifications.
20. Check alignment of spring retainer with side gears. Slight movement of the spring pack can be made if necessary.
21. Install side bearings and ring gear to case using procedure outlined for the conventional differential.

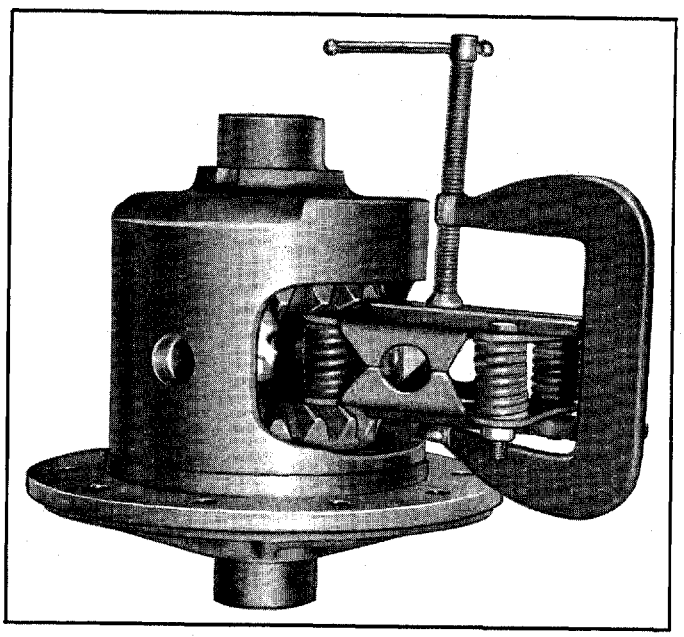


Fig. 70—Spring Pack Compressed for Installation

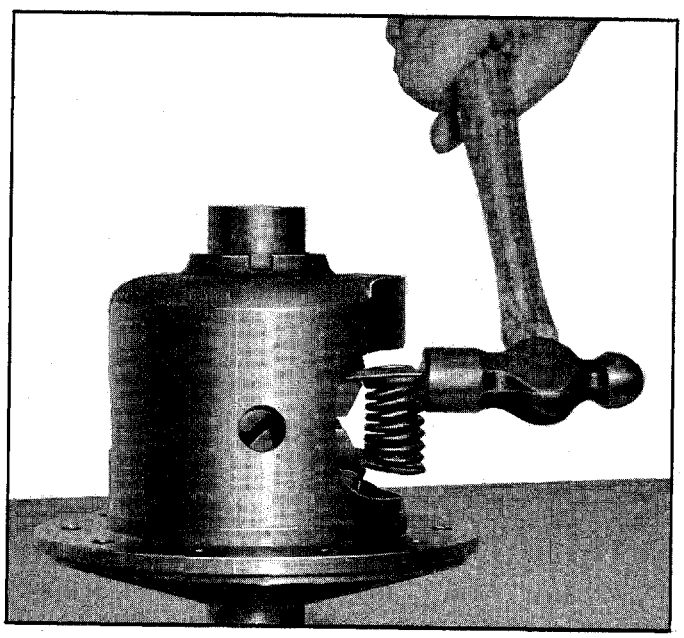


Fig. 72—Installing Spring Pack

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22. Place differential in carrier and adjust bearings and backlash as outlined in this section.
23. Check operation of unit as follows:
    a. Raise rear of vehicle until rear wheels are off the ground, and remove one wheel and tire assembly.
    b. Attach Adapter J-5748 to axle shaft flange and install a 1/2-13 bolt into adapter (fig. 59).
    c. With wheel and tire assembly still on vehicle held firmly to prevent turning, measure torque required to rotate opposite axle shaft with a 0-150 lb. torque wrench attached to J-5748. Torque required to rotate axle shaft should be no less than 40 ft. lbs.

SPECIAL TOOLS

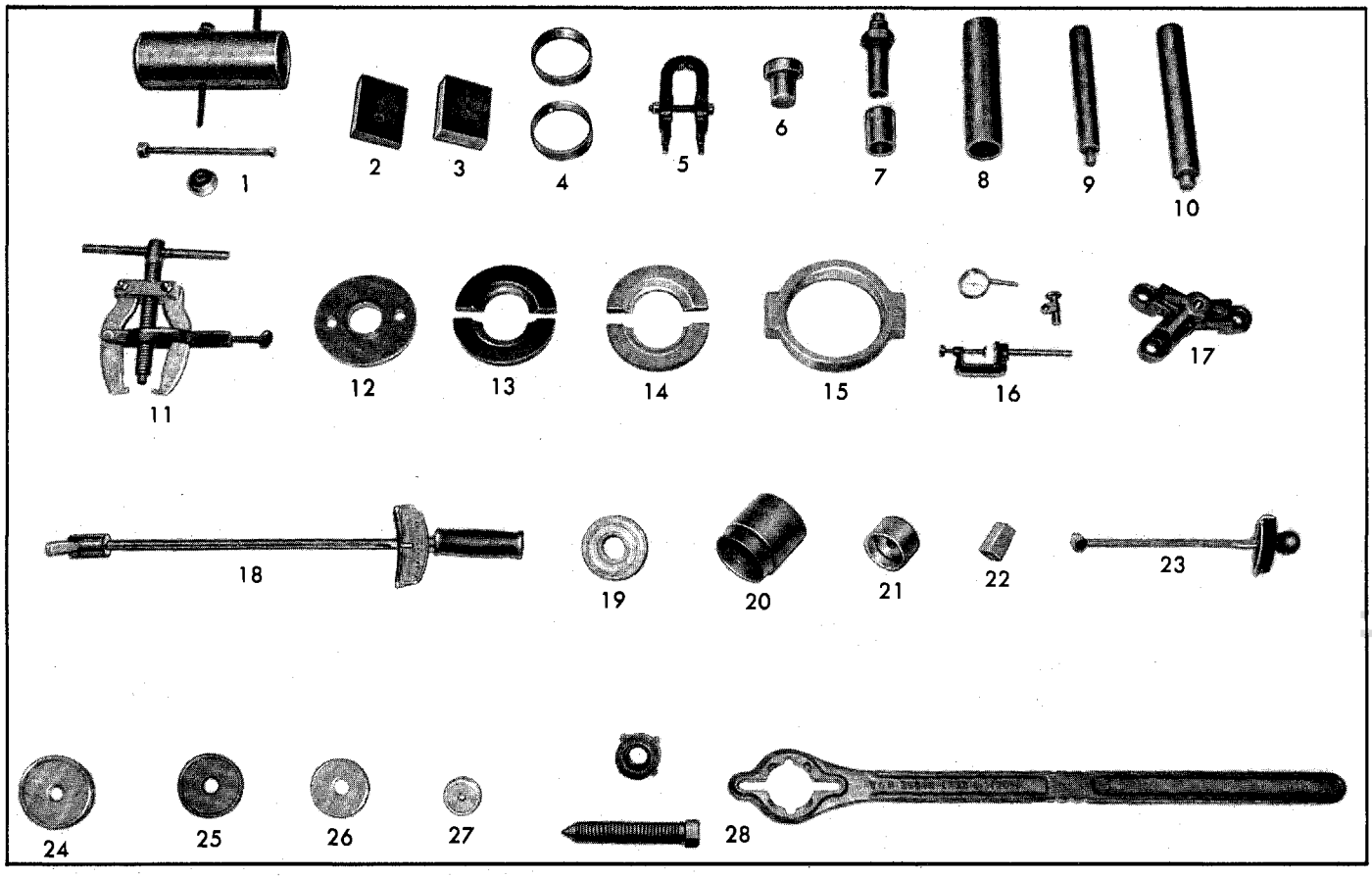


Fig. 73—Special Tools (Chevrolet, Camaro, Chevelle and Chevy II)

1. J-6266 Pinion Setting Gauge - Consists of J-6266-28 Barrel Adapter, and J-6266-25 Plug
2. J-6266-35 Pinion Setting Gauge Plate-Light Duty Axle
3. J-6266-36 Pinion Setting Gauge Plate-Heavy Duty Axle
4. J-6266-31 Pinion Setting Gauge Sleeves-Heavy Duty Axle
5. J-21752 Positraction Spring Compressor (DANA)
6. J-9537 Differential Bearing Installer-Light Duty Axle-(Used with J-7079-2).
7. J-9458 Companion Flange Installer
8. J-5590 Pinion Rear Bearing Cone and Roller Assembly Installer-Light Duty Axle
9. J-7079-2 Driven Handle (Insert Type)
10. J-8092 Driver Handle (Threaded Type)
11. J-7112 Differential Bearing Remover-(Used with J-8107-4 Adapter)
12. J-9772 Drive Pinion Rear Bearing Installer-Heavy Duty Axle
13. J-7028 Pinion Rear Bearing Cone and Roller Assembly Remover-Light Duty Axle-(Used with J-0358-1)
14. J-9771 Pinion Rear Bearing Cone and Roller Assembly Remover-Heavy Duty Axle-(Used with J-0358-1)
15. J-0358-1 Press Plate Holder
16. J-8001 Dial Indicator Set
17. J-5748 Positraction Torque Measuring Adapter
18. J-1313 0-150 ft. Lbs. Torque Wrench
19. J-21468 Drive Pinion Oil Seal Installer-Light Duty Axle (Used with J-9458)
20. J-21057 Drive Pinion Oil Seal Installer-Heavy Duty Axle
21. J-8359 Differential Bearing Installer-Heavy Duty Axle (Used with J-8092)
22. J-5810 Torque Wrench Adapter (3/4" male to 3/8" female)
23. J-5853 0-50 In. Lbs. Torque Wrench
24. J-0270-14 Pinion Rear Bearing Cup Installer-Light Duty Axle (Used with J-8092)
25. J-7137 Pinion Front Bearing Cup Installer-Heavy Duty Axle (Used with J-8092)
26. J-7817 Pinion Front Bearing Cup Installer-Light Duty Axle (Used with J-8092)
27. J-8107-4 Differential Bearing Remover/Installer Adapter (Used with J-9537 and J-7112)
28. J-8614 Companion Flange Holder and Remover

Not Illustrated J-8608 Pinion Rear Bearing Cup Installer-Heavy Duty Axle (Used with J-8092)

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SPECIAL TOOLS

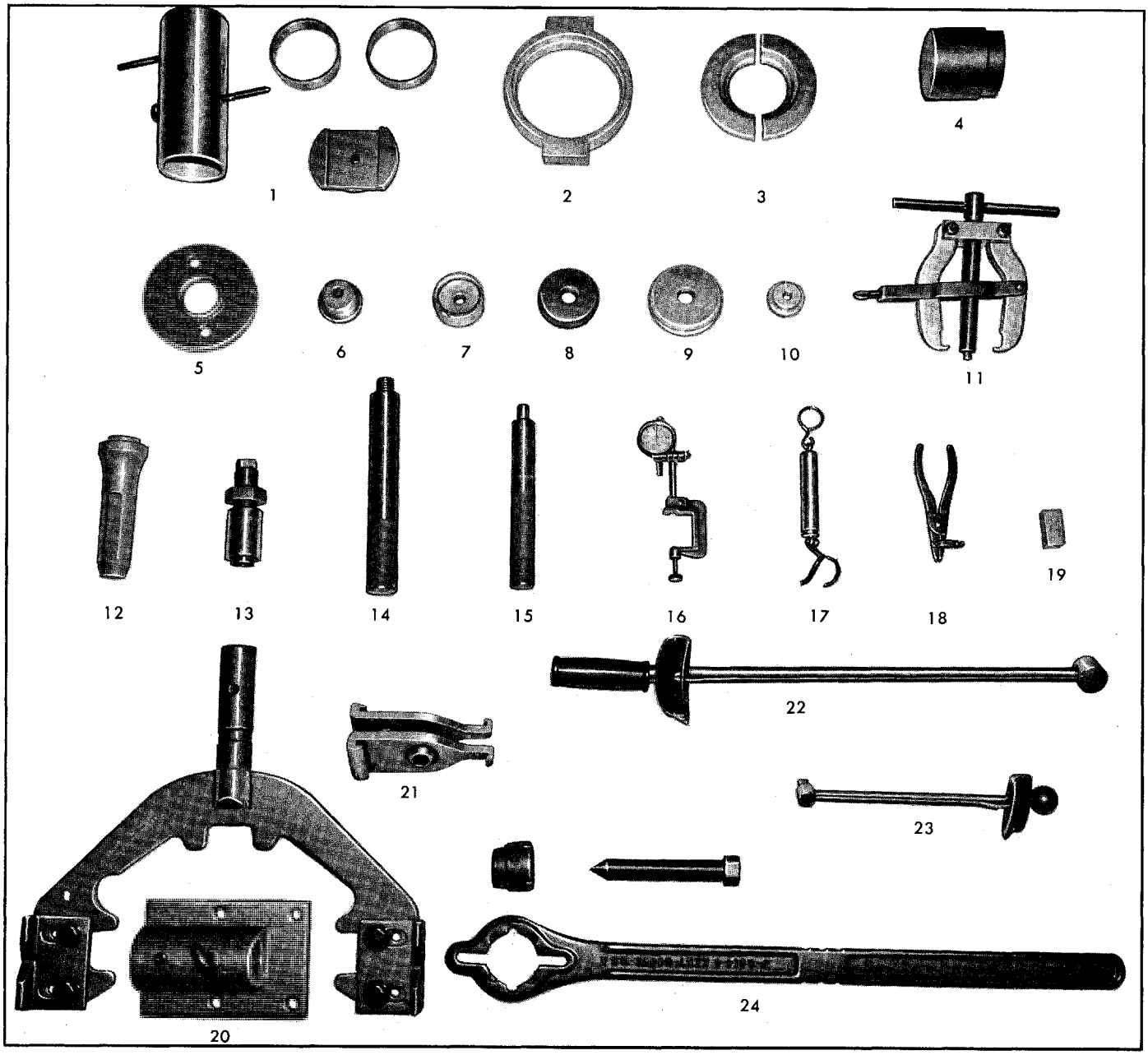


Fig. 74—Special Tools (Corvette)

1. J-6266 Pinion Setting Gauge - Consists of J-6266-28 Barrel Gauge, J-6266-31 Gauge Sleeves and J-6266-33 Gauge Plate
2. J-0358-1 Press Plate Holder
3. J-9771 Drive Pinion Bearing Cone and Roller Assembly Remover (Used with J-0358-1)
4. J-21058 Drive Pinion Oil Seal Installer
5. J-9772 Drive Pinion Rear Bearing Cone and Roller Assembly Installer
6. J-9773 Differential Yoke Bearing Install (Used with J-7079-2)
7. J-8359 Differential Bearing Installer (Used with J-8092)
8. J-7137 Drive Pinion Front Bearing Cup Installer (Used with J-8092)
9. J-8608 Drive Pinion Rear Bearing Cup Installer (Used with J-8092)
10. J-8107-4 Adapter Plug (Used with J-6266 and J-7112)
11. J-7112 Differential Bearing Remover (Used with J-8107-4)
12. J-9774 Differential Yoke Bearing Seal Installer
13. J-5780 Companion Flange Installer
14. J-8092 Driver Handle (Threaded Type)
15. J-7079-2 Driver Handle (Insert Type)
16. J-8001 Dial Indicator Set
17. J-0544 Spring Scale
18. J-4880 Snap Ring Pliers
19. J-5810 Torque Wrench Adapter (3/4" male to 3/8" female)
20. J-3289 Differential Carrier Holding Fixture
21. J-22311 Positraction Clutch Pack Remover and Installer
22. J-1313 0-150 ft. lbs. Torque Wrench
23. J-5853 0-15 in. lbs. Torque Wrench
24. J-8614 Companion Flange Holder and Remover

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SECTION 5

POWER BRAKE CYLINDERS

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BENDIX POWER BRAKE CYLINDER

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Inspection	5-2
Assembly	5-2

NOTE:

The following service procedures apply to the Chevrolet passenger car; Chevelle and Camaro are the same as Chevrolet passenger car except for an added mounting bracket.

Disassembly

1. Scribe across outer edges of both shells and main cylinder and, if used, across mounting bracket flanges to provide a guide mark for reassembly.
2. Remove main cylinder attaching nuts and lockwashers and set main cylinder aside.
3. Remove hydraulic push rod and air filter from front shell and, if used, remove vacuum seal and plate from push rod.
4. Remove rubber boot from valve rod and felt and foam air filter-silencers from inside boot and plastic hub of power piston.
5. Pull elbow or straight nipple vacuum check valve and grommet straight out of front shell.
6. To separate front and rear shells:
   a. Clamp base of Tool J-9576-1 in bench vise.
   b. Insert 3-4 studs of rear shell, as required, in matching holes in base.
   c. Place flat bar wrench over studs of front shell and align top clamp bar with base.
   d. Attach hook bolts of top clamp bar to holes at opposite ends of base.
   e. Tighten "T-hande" center bolt sufficiently to compress shells and free twelve lanced locks around shell edges.
   f. Turn flat bar wrench clockwise until cut-outs on front shell are aligned with locks on rear shell.
   g. Unscrew center bolt. (Shells should begin to separate as load on center bolt is released.) If shells do not separate, check-out and lock alignment, and then tap shell flange lightly with soft hammer to break bond between diaphragm and shells.

   NOTE: Press down firmly on top clamp bar while removing hook bolts from base to prevent interval spring force from causing shells to fly apart.

   h. Remove hood bolts, top clamp bar, flat bar wrench, front shell, and return spring.
   i. Lift power piston and diaphragm assembly from rear shell and remove rear shell from fixture base.
7. Remove diaphragm from power piston.
8. Press in on valve rod to permit removal of valve plunger retainer and then remove valve rod and plunger assembly.
9. Press reaction disc out of power piston hub from opposite end.

   NOTE: Perform Step 10 only if seal is defective and a new seal is available. Do not reuse seal once it has been removed from the unit.

10. To replace rear vacuum seal and bearing, place shell on work bench with studs up, and drive seal out of shell with a punch or a thin blade screwdriver. Discard seal.

Cleaning

Use an approved nontoxic cleaning solvent to clean all metal parts. Use alcohol or an approved commercial cleaning solvent for cleaning rubber and plastic parts. Immerse parts in cleaning solvent and use a hair brush to remove foreign matter. Blow out all passages, orifices and valve holes. Air dry and place cleaned parts

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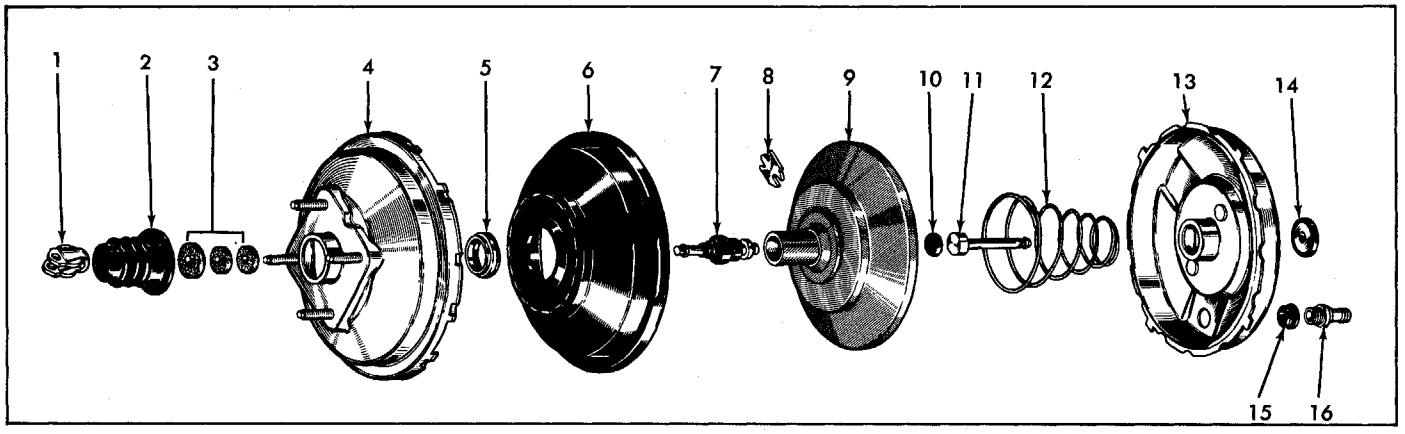


Fig. 1 - Bendix Power Cylinder Components (Typical)

1. Clevis
2. Rubber Boot
3. Foam and Felt Air Filter-Silencers
4. Rear Shell
5. Bearing Seal
6. Rolling Diaphragm
7. Air Valve Push Rod Assembly
8. Air Valve Lock
9. Diaphragm Plate
10. Reaction Disc
11. Hydraulic Push Rod
12. Power Piston Return Spring
13. Front Shell
14. Push Rod Seal
15. Grommet
16. Check Valve

on clean paper or lint-free cloth. If slight rust is found on inside surface of power cylinder housing, polish clean with crocus cloth or fine emery cloth, then follow with a thorough cleaning.

The use of gasoline, kerosene, antifreeze alcohol or any other cleaner with even a trace of mineral oil will damage rubber parts. Be particularly careful during reassembly that no grease or mineral oil comes in contact with these rubber parts.

Inspection

Carefully inspect each part for damage and wear inspect rubber parts for cuts, nicks and distortion. These rubber parts are the key to control of air flow and should account for the majority of trouble traceable to leakage. If there is any question whatever as to serviceability of any part, replace it.

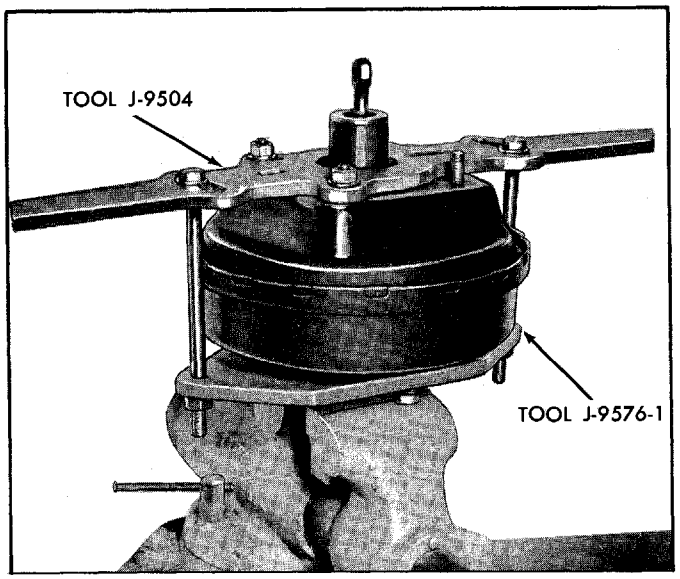


Fig. 2 - Separating Shells with Tools J-9504 and J9576-1

Assembly

The following procedure refers to the power section of the power brake unit only--for assembly procedure of the main cylinder, refer to applicable portion of "Standard Brakes".

During assembly, make sure all parts are free of foreign material before applying lubricant. If there is any doubt of cleanliness, rewash and air dry. When applying lubricant as specified in assembly procedure, use an approved lubricant of known quality and composition that will not be harmful to rubber and plastic materials.

1. If piston bearing seal was removed from rear shell, press new seal into shell cavity using Tool J-22677 (fig. 4), plastic side inward until flat rubber surface is approximately 7/16" below flat, inside shell surface.
2. Assemble the power piston assembly (See Figure 3).
   a. Apply lubricant to outside diameter of diaphragm plate and extension, to bearing surfaces of valve and plunger, and to outer edge of valve poppet.

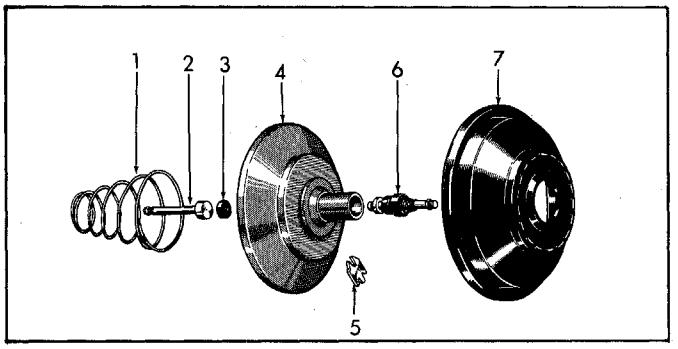


Fig. 3 - Power Piston

1. Power Piston Return Spring
2. Hydraulic Push Rod
3. Reaction Disc
4. Diaphragm Plate
5. Air Valve Lock
6. Air Valve Push Rod Assembly
7. Rolling Diaphragm

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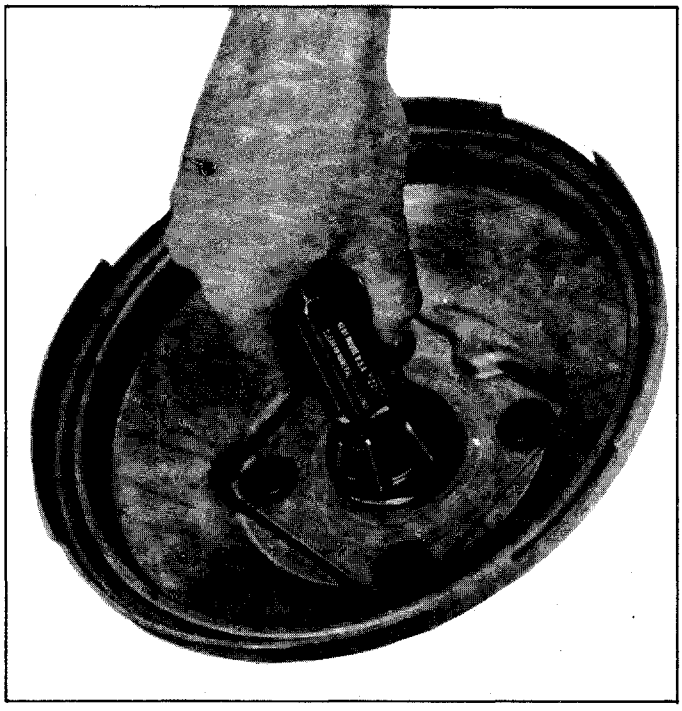


Fig. 4 - Installing Piston Bearing Seal

Depress valve plunger and poppet into position and align slot in power piston with groove in valve plunger.

b. Insert valve plunger retainer in slot and assemble diaphragm center bead in groove in power piston.
c. Place rear shell on assembly fixture base in vise. Liberally lubricate outer flange of rear shell with silicone lubricant.
d. Lubricate bearing seal in the rear shell and guide the valve rod and plastic hub of the power piston and diaphragm assembly through the rear bearing seal.
e. Assemble diaphragm return spring on power piston with the front shell on the small coil of the spring.
f. With shells aligned to scribe marks, clamp shells together in press, and compress spring until cut-outs and locks on outer flanges of shells mate.
g. Twist front shell counterclockwise in relation to rear shell until shells are fully locked.
h. Remove hook bolts, clamp bar, and power section from base.

3. Sparingly lubricate the hydraulic push rod shaft, while carefully avoiding adjusting nut end. Also lubricate piston end of push rod and all surfaces of rubber reaction disc.
4. Assemble flat side of disc against piston end of push rod, and push rod into center bore of power piston.
5. Press and twist push rod in order to seal push rod and disc in power piston.

NOTE: If reaction disc is not fully seated, it will result in an erroneous push rod height adjustment.

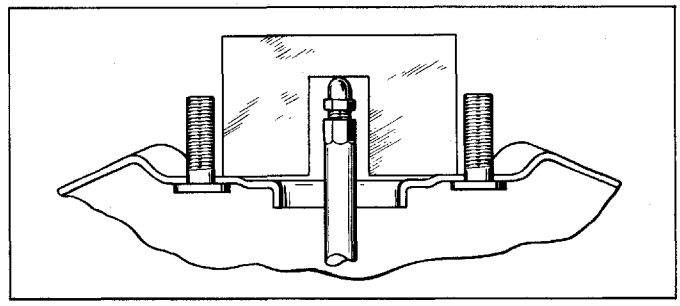


Fig. 5 - Adjustment of Push Rod

6. Assemble push rod seal, plate side first over end of push rod, and press seal into bottom of shell cavity.
7. If vacuum check valve and grommet were removed, dip new parts in alcohol and install in front shell. Examine grommet for cuts or damage - replace if necessary. (Beveled flange of grommet should be inside shell and shoulder of check valve should seat against outer flange of grommet.)
8. Assemble foam and felt air filter silencers over valve rod, and press into end of plastic hub.
9. Install new rubber boot on valve rod and seat boot against rear shell.
10. Place Tool J-7723-01 over the push rod so that it fits between studs on front shell (fig. 5). Guage should be parallel to studs and resting on surface of front shell. Cutout portion of gauge should just match height of push rod. Any variation may be compensated for by turning adjusting screw.

NOTE: If push rod height adjustment gauge is not available, the required dimensions for fabrication are given in Figure 6.

11. After push rod adjustment is correct, assemble main cylinder to front shell and securely tighten retaining nuts.

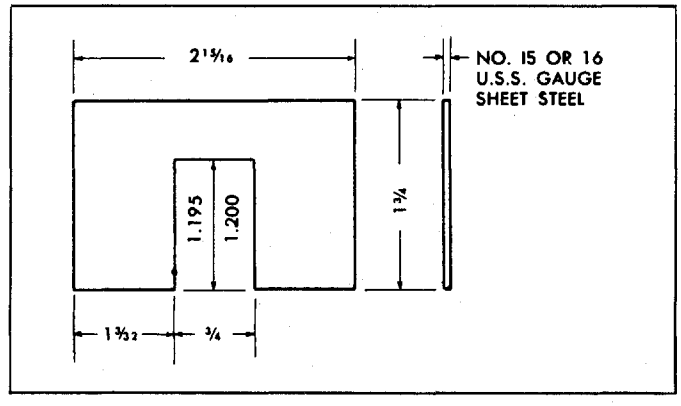


Fig. 6 - Push Rod Gauge

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MORAINE POWER BRAKE CYLINDER

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NOTE:

The following service procedures applies to the Chevrolet passenger car; Chevelle, Camaro, and Corvette are the same as Chevrolet passenger car except for an added mounting bracket; Chevy II is the same as Chevrolet except for an unadjustable air valve push rod and two air valve springs instead of one. A complete new valve assembly should always be used on Chevy II Power brake cylinders whenever removed from the power piston.

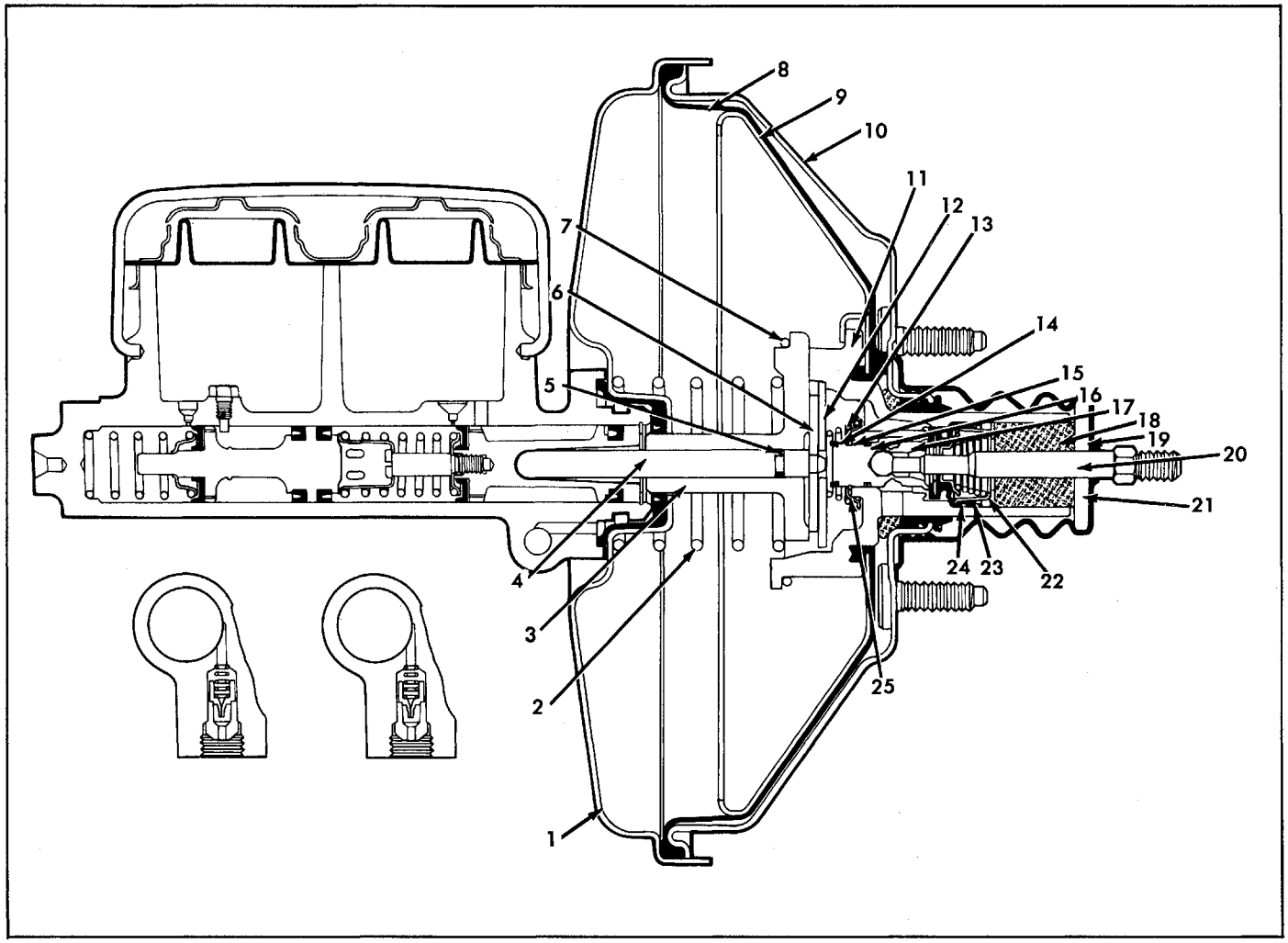


Fig. 7 - Moraine Vacuum Power Cylinder (Typical)

1. Front Shell
2. Power Piston Return Spring
3. Reaction Retainer
4. Master Cylinder Piston Rod
5. "O" Ring
6. Reaction Plate
7. Lock Ring
8. Diaphragm
9. Support Plate
10. Rear Shell
11. Power Piston
12. Reaction Levers
13. Air Valve Spring (Two for Chevy II only)
14. Reaction Bumper
15. Snap Ring
16. "O" Ring
17. Air Valve
18. Air Filters
19. Boot
20. Push Rod
21. Silencer
22. Limiter Washer
23. Floating Control Valve Assembly
24. Floating Control Volve Retainer
25. Air Valve Spring Retainer

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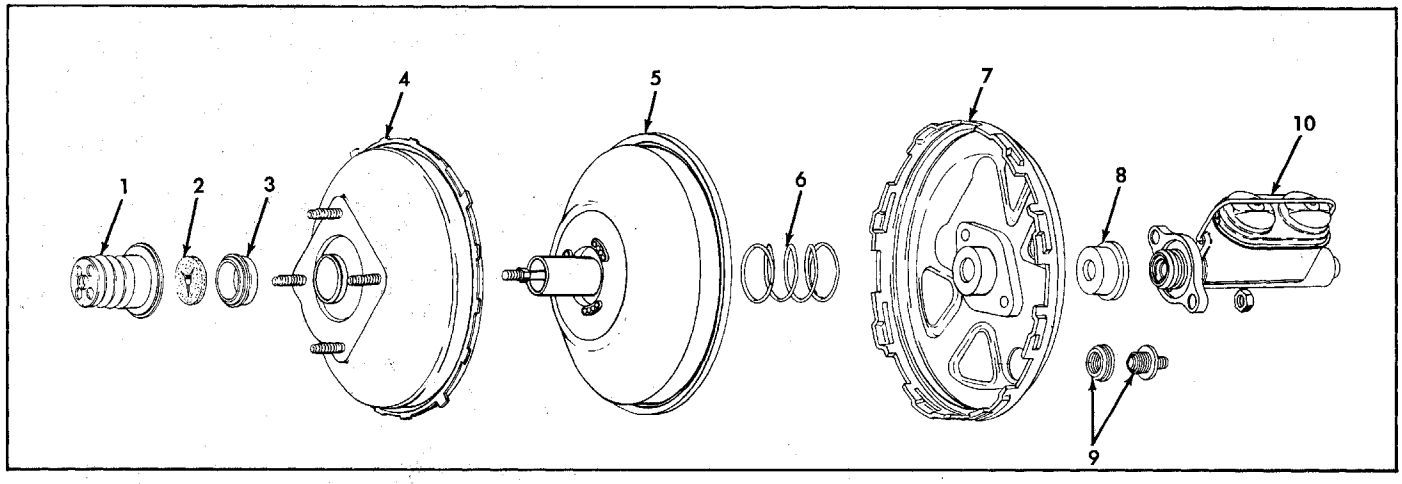


Fig. 8 - Moraine Power Unit

1. Boot
2. Silencer
3. Seal
4. Rear Housing
5. Power Piston Assembly
6. Power Piston Return Spring
7. Front Housing
8. Front Housing Seal
9. Vacuum Check Valve
10. Main Cylinder Assembly

DISASSEMBLY

The following procedure applies to the power section of the power brake unit only (fig. 7) - for service of the main cylinder refer to applicable portion of "Standard Brakes" in the "Service" manual.

1. Place the unit in a vise and firmly clasp the vise on the main cylinder reservoir.

   NOTE: Scribe alignment marks on top center of front and rear shell to facilitate reassembly.

2. With metal bar in position, press down on bar and rotate rear shell counter-clockwise until rear shell is separated from front shell.

   CAUTION: Care must be exercised not to damage or loosen studs in shell. Also, take care that no pressure is brought to bear on plastic power piston extension.

3. Lift the power piston assembly and rear housing from the unit.
4. Remove power piston and boot from the rear housing.
5. Remove the silencer from inside the boot (fig. 8).
6. Remove the power piston return spring from the front housing.
7. Reposition the main cylinder assembly in the vise

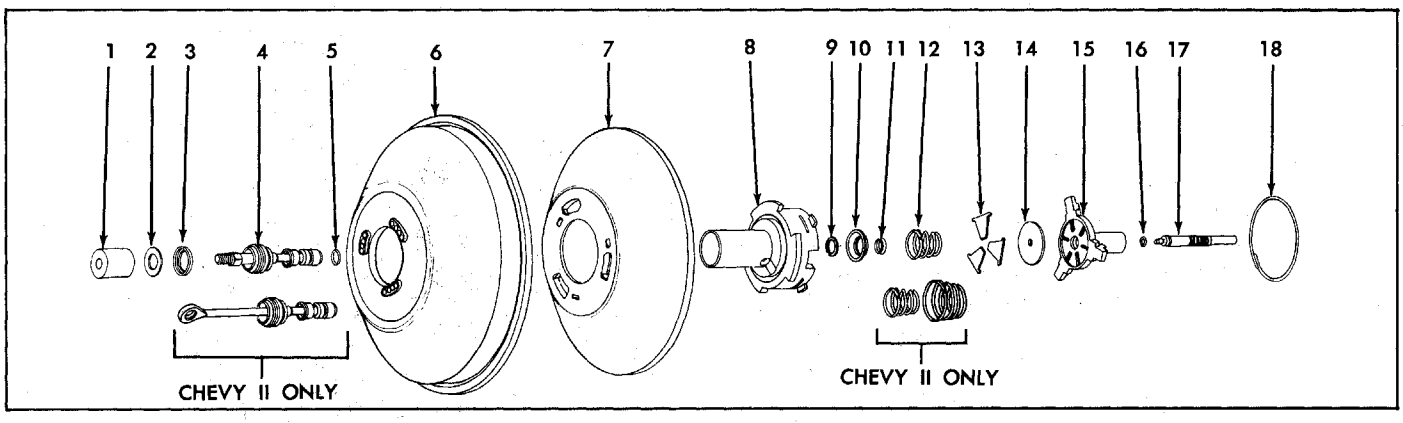


Fig. 9 - Power Piston and Components

1. Air Filter
2. Limiter Washer
3. Floating Control Valve Cup
4. Floating Control Valve Assembly
5. "O" Ring
6. Diaphragm
7. Support Plate
8. Power Piston
9. Snap Ring
10. Air Valve Spring Retainer
11. Reaction Bumper
12. Air Valve Spring
13. Reaction Levers
14. Reaction Plate
15. Reaction Retainer
16. "O" Ring
17. Main Cylinder Piston Rod
18. Lock Ring

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and remove the main cylinder from the power brake unit and place main cylinder aside.

8. Remove the front housing seal from the center of the front housing.
9. Remove the check valve and grommet from the front housing.
10. Remove the power piston bearing from the rear housing.

CAUTION: Extreme care must be taken in handling the diaphragm of the power piston assembly (fig. 9). The diaphragm should be guarded against grease, oil, foreign matter and must be protected from nicks, scratches and gouges.

11. Remove the lock ring from the power piston by prying one of the ends out from under the large divided locking lug, and then pull it from under the remaining two small lugs.
12. Remove the reaction retainer, piston rod, reaction plate, three reaction levers, air valve spring, (Chevy II has two air valve springs) small reaction bumper, and air valve spring retainer.
13. Place square shank of Tool J-21524 in a vise and position the assembly down on the tool so that the three lugs on the tool fit into the three notches in the power piston.
14. Pull the diaphragm edges away from the support plate and grip the steel support plate by hand, press down and rotate counter-clockwise to separate the plate from the power piston (fig. 10).
15. Remove the diaphragm from the support plate and lay both parts aside.
16. Remove the silencer from the neck of the power piston tube.
17. Position the power piston in a vise padded with shop-towels, with the tube down (fig. 11).

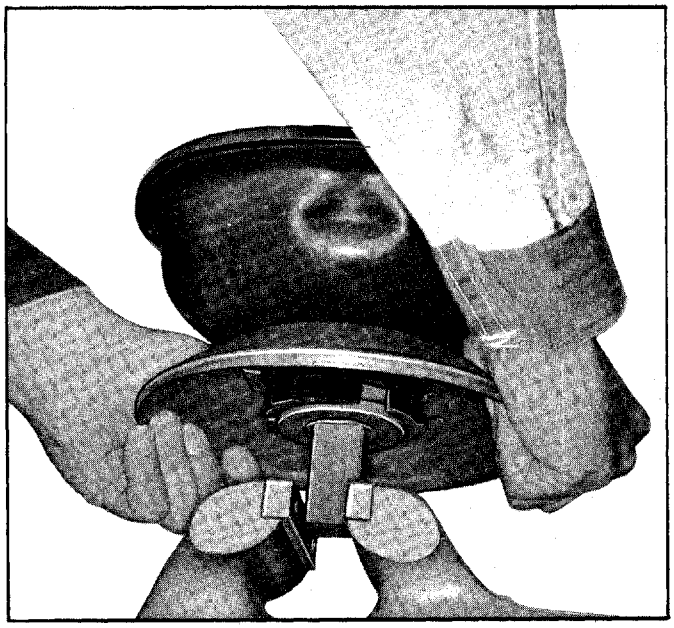


Fig. 10 - Separating Power Piston from Support Plate



Fig. 11 - Removing Air Valve Snap Ring

18. Using Pliers J-4880 remove the snap ring from the air valve.
19. Place the power piston with tube down in an arbor press. Using a rod not exceeding 1/2" in diameter press the air valve assembly from the power piston (fig. 12).
20. Push the main cylinder piston rod from the reaction retainer and remove the "O" ring from the rod.

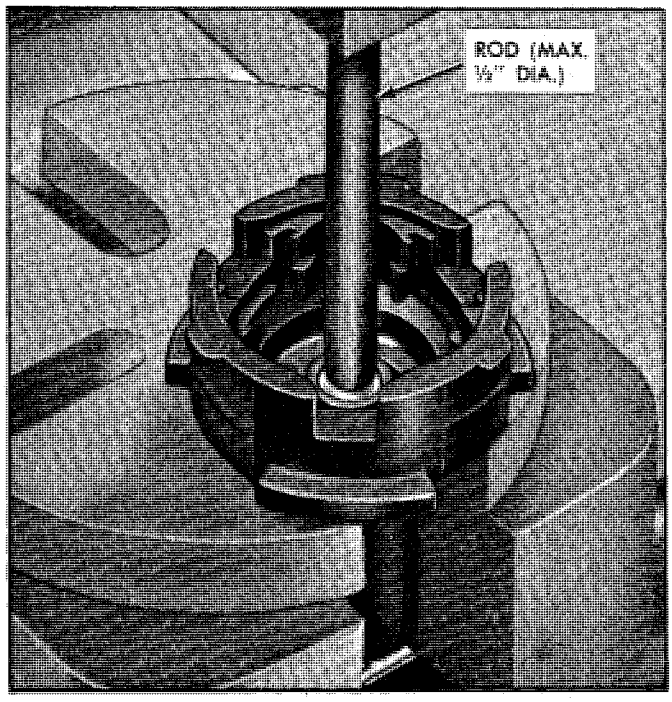


Fig. 12 - Removing Air Valve Assembly from Power Piston

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NOTE: On Chevrolet, Chevelle and Corvette a new floating control valve should always be used whenever it is removed from the power piston. On Chevy II a new valve assembly should always be used whenever it is removed from the power piston.

Cleaning

Use Declene or clean brake fluid to clean all metal, plastic and rubber parts of the power cylinder. Immerse parts in cleaning fluid and use a hair brush to remove foreign matter. Blow out all passages, orifices and valve holes. Air dry and place cleaned parts on clean paper or lint-free cloth. If slight rust is found on inside surface of power cylinder housing, polish clean with crocus cloth or fine emery cloth, then follow with a thorough cleaning.

Dirt is the major cause of trouble and wear in service. Be certain to keep parts completely clean until reassembly.

If there is any suspicion of contamination or evidence of corrosion, completely flush hydraulic brake system as described in this section. Failure to clean hydraulic system can result in early repetition of trouble.

Use of gasoline, kerosene, anti-freeze alcohol or any other cleaner with even a trace of mineral oil will damage rubber parts. Be particularly careful during reassembly that no grease or mineral oil comes in contact with these rubber parts.

Inspection

Wipe cleaning fluid from all parts and carefully inspect each part for damage and wear. Inspect rubber parts for cuts, nicks and distortion. These rubber parts are the key to control of air flow and should account for the majority of troubles traceable to leakage. If there is any question whatever as to serviceability of any part, replace it.

ASSEMBLY (Figs. 7, 8 and 9)

Be sure that all parts are clean. If there is any doubt of cleanliness, rewash and air dry. Lubricate rubber parts with an approved rubber lubricant. Lubricate all plastic and metal friction points with an approved lubricant.

1. Replace the vacuum check valve, using a new grommet, if old one is cracked or damaged.
2. Place new front housing seal in the center of the front housing so that the flat surface of the cup lies against the bottom of depression in the housing.
3. Assemble the master cylinder onto the front housing with the scribe mark on the top of the housing lining up with the center of the master cylinder cover. Install self locking nuts and tighten finger tight only.
4. Install a new "O" ring in the groove on the main cylinder piston rod. Apply a thin film of lubricant to "O" ring.

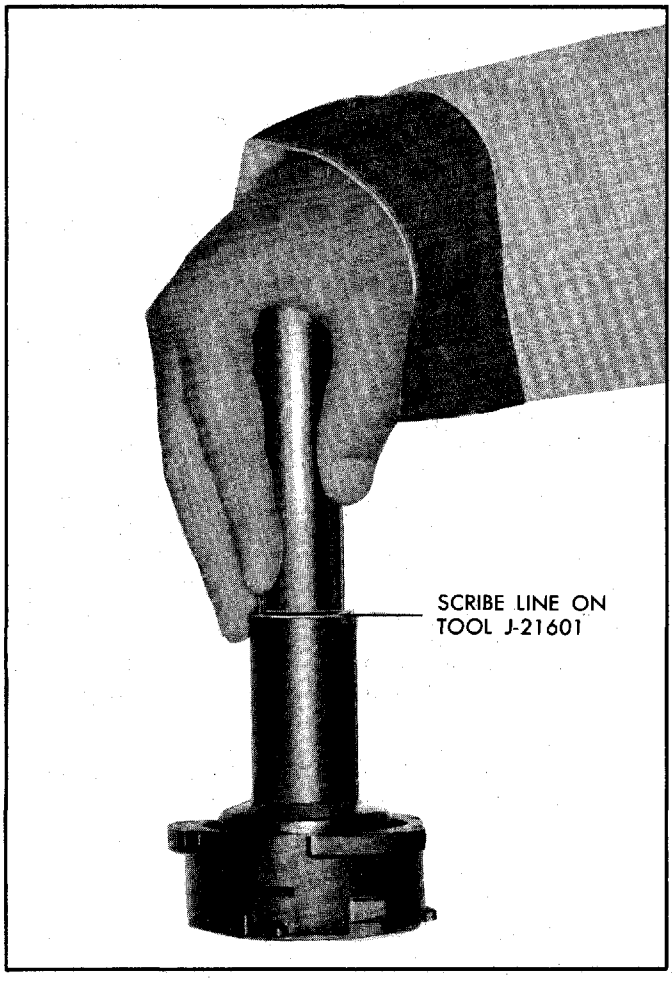


Fig. 13 - Installing Air Valve and Retainer

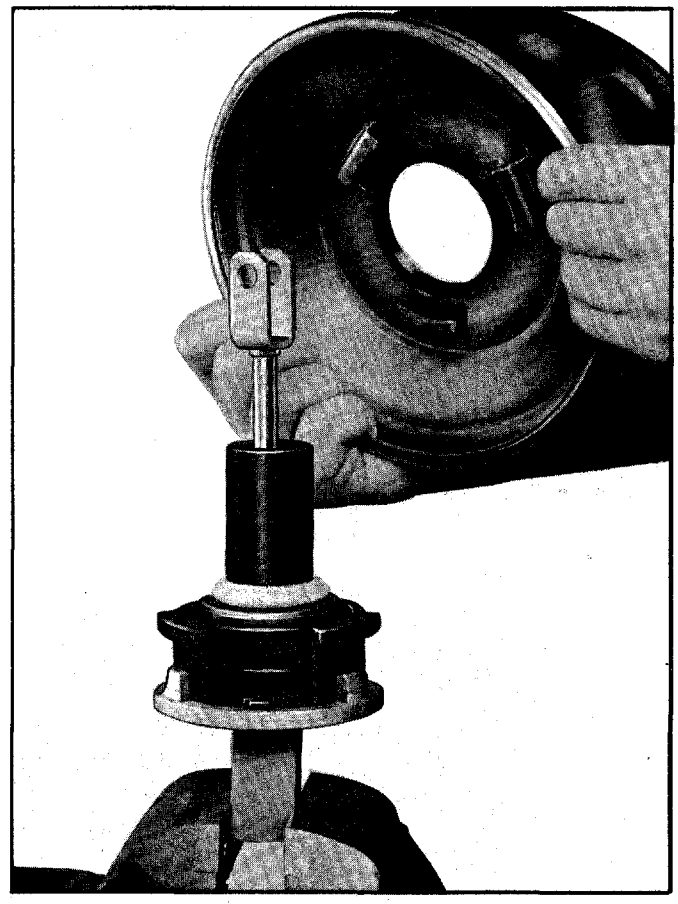


Fig. 14 - Installing Power Piston to Support Plate

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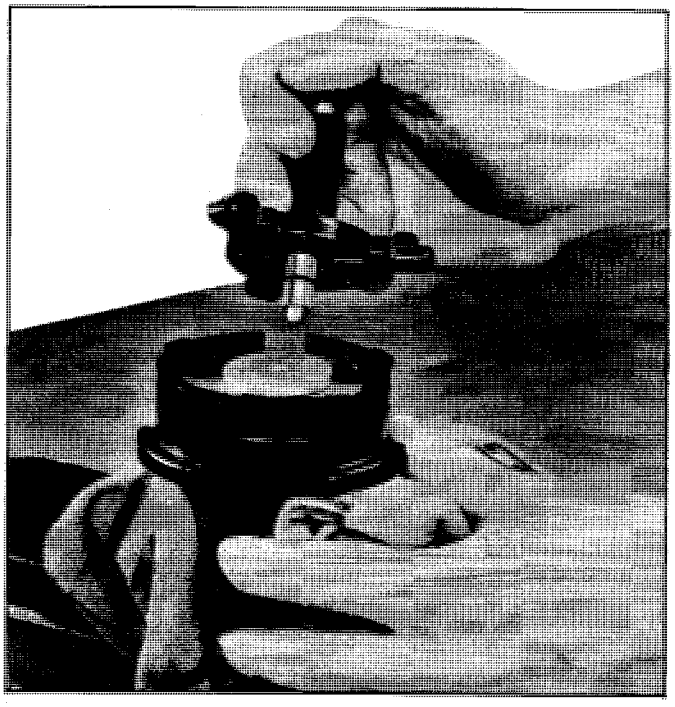


Fig. 15 - Installing Reaction Retainer on to Power Piston

5. Insert main cylinder piston rod through the reaction retainer with round end of rod at tube end of retainer.
6. Place the square shank of Tool J-21524 in a vise and position power piston on tool with the three lugs fitting into the notches of the power piston.
7. Install a new "O" ring on the air valve in the second groove from the push rod end.

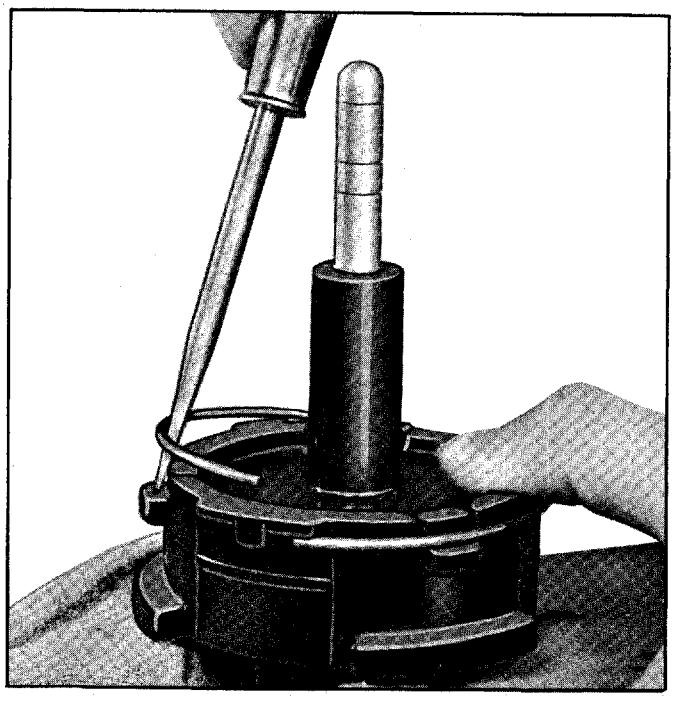


Fig. 16 - Installing Retainer Lock Ring

8. Coat the new floating control valve rubber and the air valve "O" ring with a thin film of lubricant.
9. Press the air valve assembly (air valve first) to its seat in the power piston tube.
10. Install a new floating control valve retainer over the push rod, (flat side toward the floating control valve).
    Chevy II: A new valve should always be used whenever it is removed from the power piston.
11. Start the floating control valve and retainer into the power piston tube.
12. Seat retainer in the power piston tube by pressing it in place with Tool J-21601. (Scribe line on tool should line up with top edge to power piston tube, Figure 13.)
13. Install the push rod limiter washer over the push rod and then the air filter element.
14. Install the power piston diaphragm on the support plate (opposite side of locking tang).

    NOTE: Make sure the support plate is in the groove in the center flange of the diaphragm.

15. Holding the support plate on the bare metal, with locking tangs down, place the support plate assembly over the tube of the power piston.

    NOTE: The flange of the diaphragm will fit into the groove on the power piston.

16. Press down and rotate the support plate assembly clockwise, until the lugs on the power piston come against the stops on the support plate.
17. Place this assembly tube down in a padded vise, (Do Not Clamp).
18. Install snap ring in groove of air valve with Pliers J-4880 (fig. 11).
19. Install the air valve spring retainer to seat on the snap ring.
20. Install the reaction bumper into the groove in the end of the air valve.
21. Position the air valve return spring, (large end down) on the spring retainer. (Chevy II has two air valve springs-position larger spring over the smaller.)
22. Install the 3 reaction levers into the slots of the power piston with the small end resting on the air valve return spring.
23. Install main cylinder piston rod through the reaction retainer with round end out tube side.
24. Center reaction plate on the reaction levers (numbered side up), and place reaction retainer down on power piston. (Make sure small end of push rod engages in center hole of reaction plate), (fig. 15).
25. Push reaction retainer down and line up the lugs with the notches in the power piston.
26. Secure with lock ring making sure ends of lock ring are set in place on the large divided lug of the power piston, (one end on each side of lug), (fig. 16).
27. Install a new power piston bearing in the center of the rear housing (large flange of bearing on stud side of housing). Lubricate the inside of the bearing.

    NOTE: Make sure flange on rear housing is engaged in groove of power piston bearing.

28. Install air silencer over the holes on the power piston tube and lubricate tube.
29. Install power piston tube through rear housing, (from side opposite of studs).

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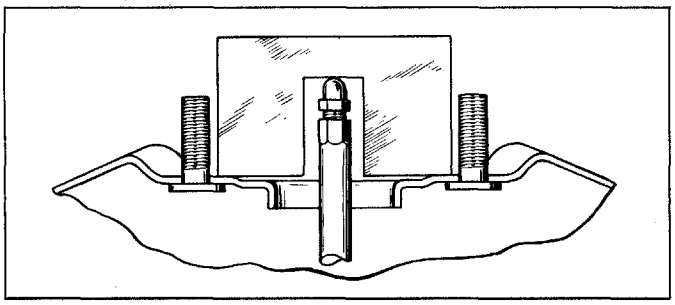


Fig. 17 - Adjustment of Push Rod

30. Clamp front housing in a vise with main cylinder down and place power piston return spring over the inset in the front housing.
31. Lubricate the I.D. of the support plate seal and the reaction retainer tube. Talcum powder the beaded edge of the diaphragm.
32. Place the rear housing assembly over the front housing assembly (with main cylinder push rod down), and align the scribed marks of the two housings so they will match when in locked position.
33. Position adjustable wrenches on rear shell brackets; press down and check to be sure that bead on edge of rolling diaphragm is positioned correctly between the shells. If this is satisfactory, apply additional downward pressure and rotate rear shell clockwise into locked position.

    NOTE: If unit is not easily locked, hold shells together and apply vacuum to check valve in front shell. Do not put pressure on power piston extension.

34. Install felt silencer over push rod to seat against end of power piston tube, secure with snap ring retainer, and place plastic boot with large holes in center of brackets. Install locknut and clevis on push rod.
35. Remove unit from vise and remove master cylinder from power cylinder assembly.
36. Place power unit in a vise so that master cylinder push rod is up.
37. Place Tool J-7723-01 over the push rod so that it fits between the studs on front housing. Gauge should be parallel to studs resting on surface of housing. The cutout portion of the gauge should never be lower than the end of the piston rod, and the gap should never be more than .010 inch (fig. 17).
38. Any variation beyond these two limits would require replacement of the piston rod with the service adjustable piston rod, and adjusting the screw in the end of the rod to match the height of the gauge.
39. Position main cylinder to power cylinder. Install lock washers and nuts and torque to 20-30 foot pounds.

Assembly

1. Put new secondary seals in the two grooves in the flat end of the floating piston assembly. The seal which is nearest the flat end will have its lips facing toward the flat end. The seal in the second groove should have its lips facing toward the end of the floating piston which contains the small compensating holes.
2. The primary seal, and primary seal protector are now assembled over the end of the floating piston opposite the secondary seals, so that the flat side of the seal seats against seal protector and the seal protector seats against the flange of the piston which contains the small compensating holes.
3. The new secondary seal is now assembled into the groove on the push rod end of the primary piston. The lips of this seal should face toward the small compensating holes in the opposite end of the primary piston.
4. The primary seal protector and primary seal are now pressed on the end of the primary piston opposite the secondary seal. It is positioned the same as the primary seal and primary seal protector on the floating piston. (See Step 2.)
5. Assemble the spring retainer in one end of the primary piston spring. Place the end of the spring down over the end of the primary piston so that the retainer locates on the extension on the end of the piston.
6. Place the piston extension screw down through the floating piston stop and primary spring retainer and screw it into the primary piston until it bottoms out.
7. Coat the bore of the master cylinder and the primary and secondary seals on the floating piston with clean brake fluid.
8. Insert the floating piston spring retainer into the floating piston spring. Place the retainer and spring down over the end of the piston so that the retainer locates inside the lips of the primary cup.
9. Holding the master cylinder with the open end of the bore down, push the floating piston into the bore so that the spring will seat in against the closed end of the bore. Use a small wooden rod to push the floating piston to seat.
10. Place the master cylinder in a vise with the open end of the bore up. Coat the primary and secondary seals on the primary piston with clean brake fluid. Push the primary piston, floating piston stop first, into the bore of the master cylinder. Hold the piston down and snap the lock ring into position in the small groove in the I.D. of the bore.
11. Continue to press the primary piston down into the bore. This holds the floating piston down so that the stop screw hole is clear. The stop screw is now potioned in its hole in the bottom of the front fluid reservoir. Tighten to a torque of 35 in. lbs.
12. Fill reservoir with supreme #11 brake fluid or its equivalent to within 1/16" to 1/8" from top of reservoir.
13. Install the reservoir covers.

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SPECIAL TOOLS

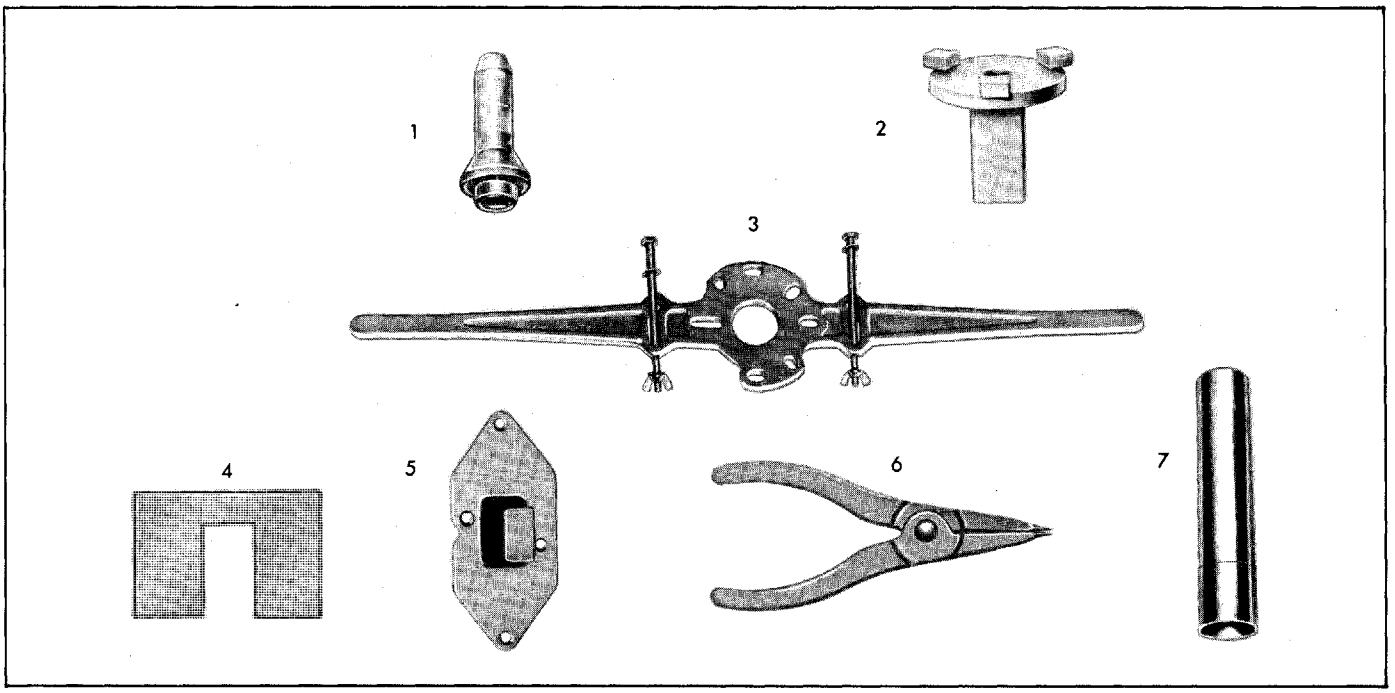


Fig. 18 - Power Brake Special Tools

1. J-22677 Vacuum Power Cylinder Seal Installer
2. J-21524 Power Piston Remover and Installer
3. J-9504 Vacuum Power Cylinder Spanner Wrench
4. J-7723-01 Push Rod Height Gauge
5. J-9576-1 Vacuum Power Cylinder Holder and Compressor
6. J-4880 Truarc Pliers (External Type)
7. J-21601 Power Brake Retainer Installer

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SECTION 6
ENGINE
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INTRODUCTION

This section (covering all liquid cooled engines used in passenger cars) has been condensed using only typical illustrations and procedures except where specific illustrations and procedures will help clarify the operation. The similarity of engines, engine parts and engine sub-assemblies and the resulting similarity of procedures required to service these units should aid the technician in servicing the many engines.

Many operations outlined in this section, when done as single operations and not part of a general overhaul, should be performed with the engine in the vehicle.

GENERAL DESCRIPTION

IN LINE ENGINES

Cylinders are numbered front to rear. Firing order is 1-3-4-2 for the L4 engine and 1-5-3-6-2-4 for the L6 engines. Crankshaft rotation as viewed from the rear is counter-clockwise.

The L4 crankshaft has five main bearings, the L6 crankshafts have seven. The L4 camshaft has three bearings, the L6 camshafts have four.

Full pressure lubrication, through a full flow oil filter is furnished by a gear-type oil pump. The distributor, driven by a helical gear on the camshaft, drives the oil pump. The main oil gallery feeds oil, through drilled passages to the camshaft and crankshaft to lubricate the bearings. The main oil gallery also feeds the valve lifters which, through hollow push rods, feed the individually mounted rocker arms (fig. 1).

V8 ENGINES

Cylinders are numbered front to rear, 1-3-5-7 on the left bank and 2-4-6-8 on the right bank. Firing order is, 1-8-4-3-6-5-7-2. Crankshaft rotation as viewed from the rear is counter-clockwise.

The crankshaft has five main bearings and the camshaft has five bearings.

Full pressure lubrication through a full flow oil filter, is furnished by a gear-type oil pump.

The distributor, driven by a helical gear on the camshaft, drives the oil pump. The main oil gallery feeds oil, through drilled passages, to the camshaft and crankshaft to lubricate the bearings. The valve lifter oil gallery feeds the valve lifters which, through hollow push rods, feed the individually mounted rocker arms (figs. 2 and 3).

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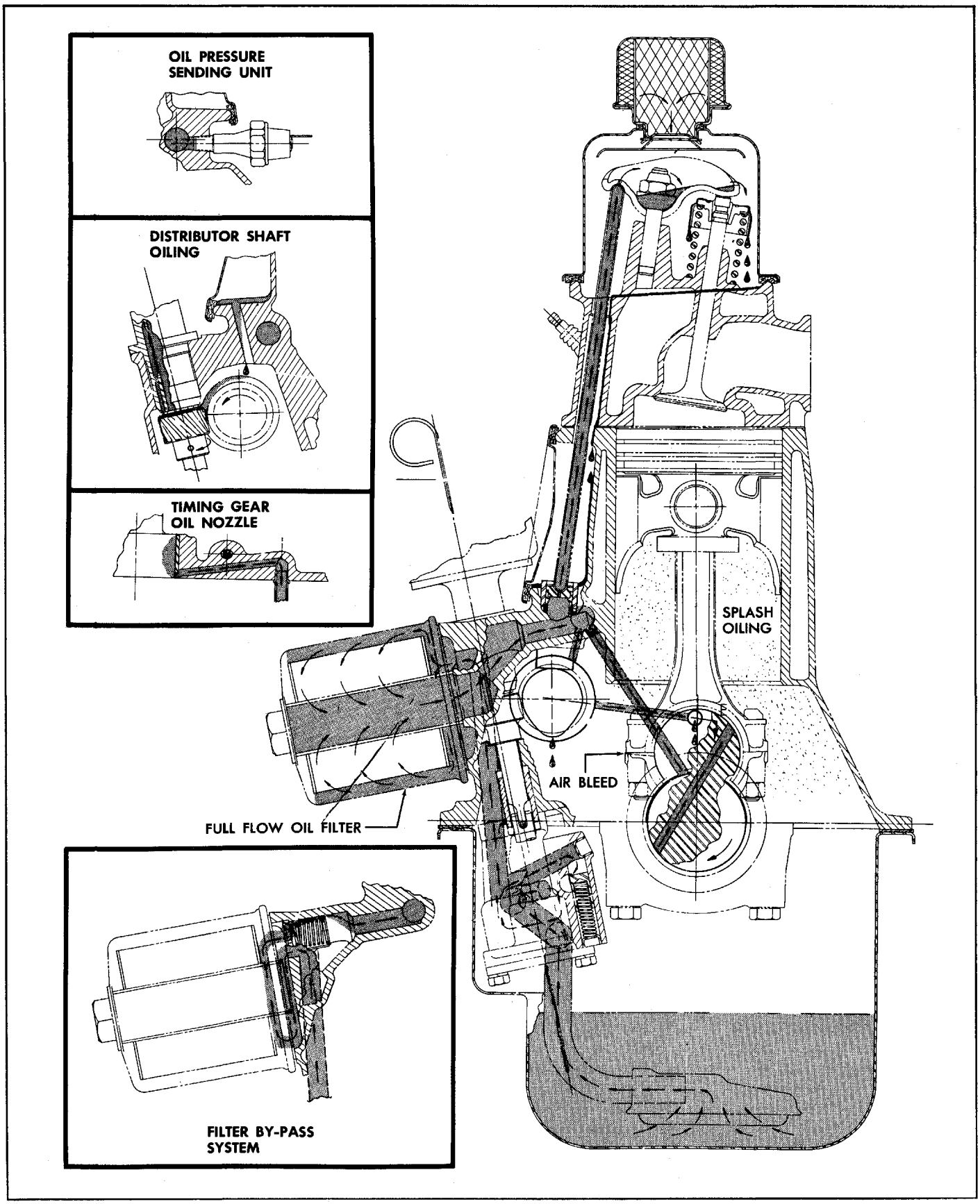


Fig. 1—In Line Engine Lubrication

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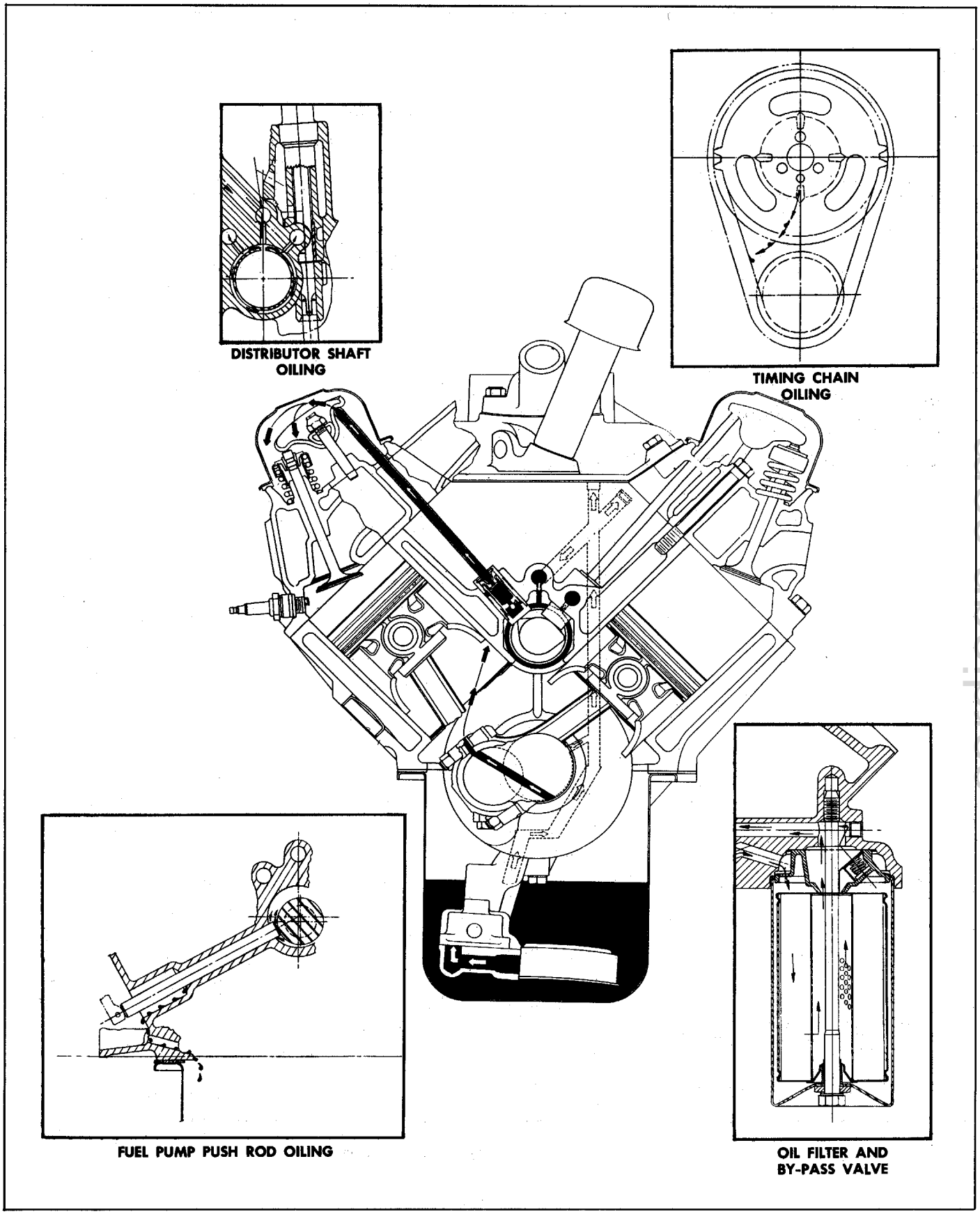
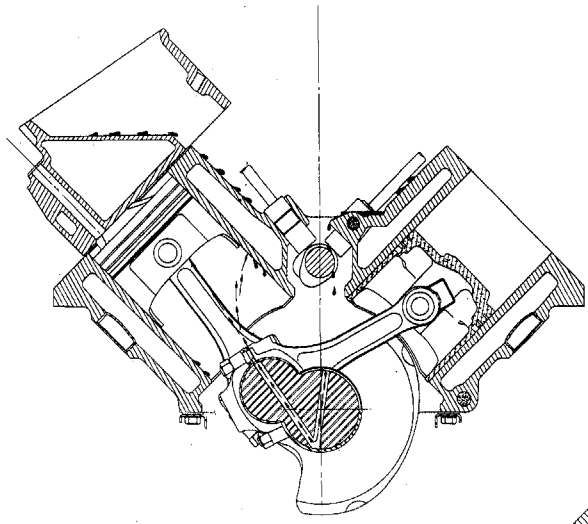


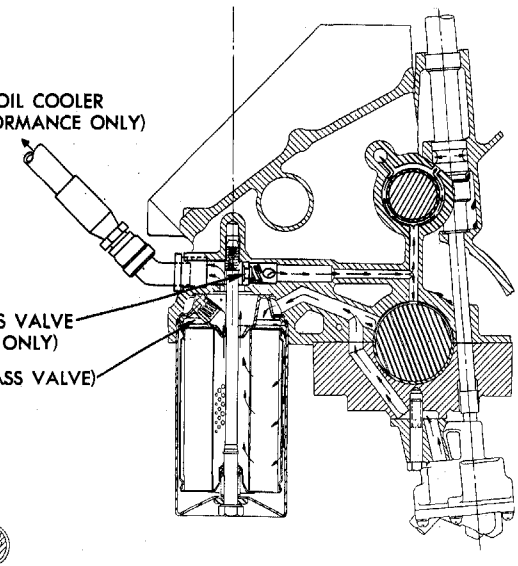
Fig. 2—V8 Engine Lubrication (283, 327 and 350)

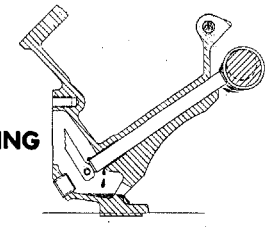
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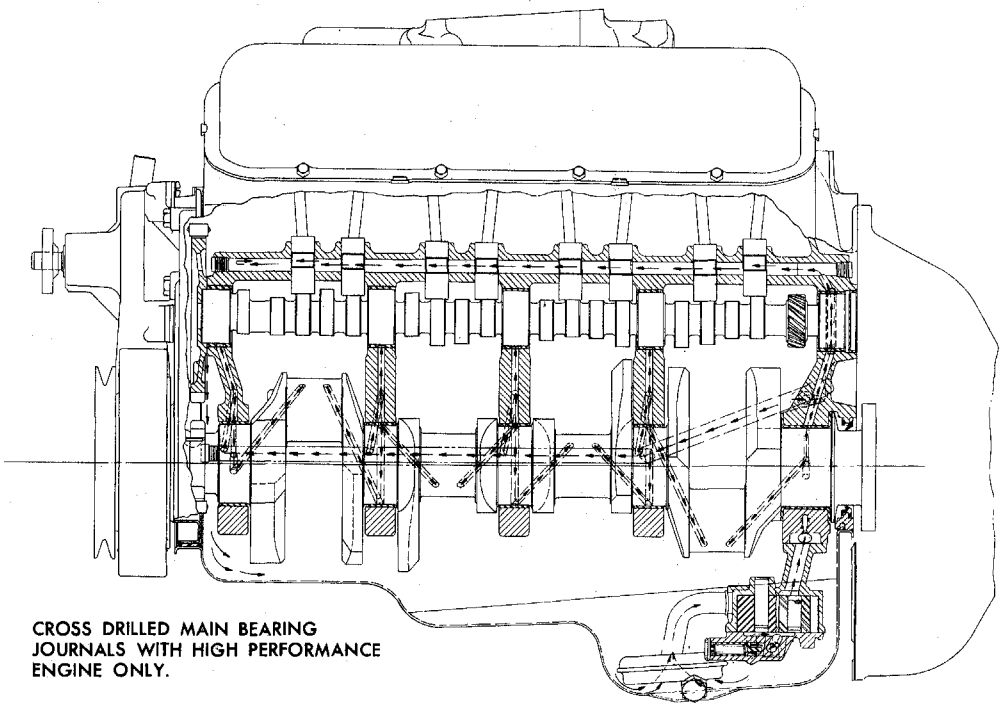
TO PROVIDE CYLINDER WALL OILING.
RELIEF OCCURS AT THIS POSITION
THRU CONNECTING ROD CAP ONCE IN 360°

CYLINDER WALL AND CAMSHAFT LOBE OILING



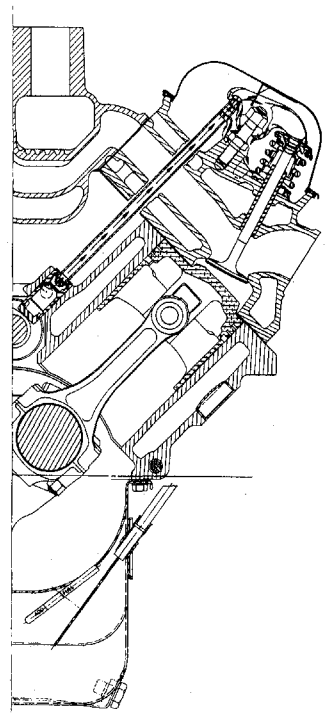


FUEL PUMP PUSH ROD OILING



CROSS DRILLED MAIN BEARING
JOURNALS WITH HIGH PERFORMANCE
ENGINE ONLY.

CRANKCASE AND CRANKSHAFT OILING



VALVE MECHANISM OILING

Fig. 3—V8 Engine Lubrication (396 and 427)

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REPAIR PROCEDURES

ENGINE ASSEMBLIES

Disassembly

NOTE: For partial disassembly of the engine refer to the "Passenger Chassis Service Manual" under the part or sub-assembly to be serviced. For complete disassembly of the engine (into sub-assemblies) follow the outline below.

1. With the engine mounted on an engine stand (transmission and/or clutch housing removed from the engine), remove the following sub-assemblies (if applicable). Refer to the "Passenger Chassis Service Manual".
   - Air Conditioning Compressor (with brackets).
   - Power Steering Pump (with brackets).
   - Air injection Reactor System (with brackets).
   - Delcotron (with brackets).
   - Accessory Drive Pulley(s) (and belts).
   - Water Pump.
   - Fuel Pump (and fuel pump push rod on V8 engines).
   - Distributor Cap (with spark plug wires).
   - Carburetor (and fuel lines).
   - Oil Filter.
   - Starter.
   - Clutch Pressure Plate and Disc.
   - Ground Strap.
   - Oil Dipstick and Oil Dipstick Tube.
2. Remove intake and exhaust manifolds.
3. On In Line engines, remove push rod covers.
4. Loosen valve rocker arm nuts until rocker arms can be pivoted, then remove push rods and valve lifters. Place push rods and valve lifters in a rack so they may be installed in the same location during engine assembly.
5. Remove the cylinder head(s).
6. Using Tool J-6978, remove the torsional damper.
7. Remove the oil pan.
8. Remove crankcase front cover.
9. On hi-performance Corvette engines, remove the oil baffle.
10. Remove oil pump and screen assembly. On V8 engines, remove the extension shaft.
11. Check connecting rods and caps for cylinder number identification and if necessary, mark them. Check cylinder bores for ridge and if necessary, remove ridge.
12. Remove connecting rod caps and using connecting rod guide set, Tool J-5239 (3/8") or J-6305 (11/32"), push connecting rod and piston assemblies out of block.

    NOTE: It will be necessary to turn the crankshaft to disconnect and remove some of the connecting rod and piston assemblies.

13. Remove the camshaft as follows:

    CAUTION: Use care in removing camshaft to avoid damaging bearings.

    WITH TIMING CHAIN (V8)

    - Remove camshaft sprocket bolts then remove camshaft sprocket and timing chain.

    NOTE: Sprocket is a light press fit on camshaft. To dislodge, tap lightly on lower edge of camshaft sprocket with a plastic hammer.

    - Install two 5/16-18 bolts in camshaft sprocket bolt holes and carefully remove camshaft.

    WITH TIMING GEAR (In Line)

    - Remove camshaft thrust plate screws (through holes in camshaft gear), then remove camshaft and gear as an assembly.
14. Remove the flywheel.
15. Remove main bearing caps and lift crankshaft out of cylinder block.
16. Remove rear main bearing oil seal from cylinder block and rear main bearing cap.
17. Discard all gaskets and seals removed during engine disassembly.

    NOTE: For further disassembly, cleaning and inspection refer to the part or sub-assembly to be serviced.

Assembly

NOTE: For inspection, repair, assembly or replacement of any engine part or sub-assembly refer to this section under the part or sub-assembly being serviced. Use new gaskets and seals on engine assembly.

1. Install the crankshaft as follows:
   a. Install rear main bearing oil seal in cylinder block and rear main bearing cap grooves. Install with lip of seal toward front of engine.
   b. Lubricate lip of seal with engine oil. Keep oil off parting line surface, this surface is treated with glue.
   c. Install main bearings in cylinder block and main bearing caps then lubricate bearing surface with engine oil.
   d. Install crankshaft, being careful not to damage bearing surfaces.
   e. Install main bearing caps with arrows pointing toward front of engine.
   f. Torque all except rear main bearing cap bolts to specifications. Torque rear main bearing cap bolts to 10-12 ft. lbs. then tap end of crankshaft, first rearward then forward with a lead hammer. This will line up rear main bearing and crankshaft thrust surfaces. Retorque all main bearing cap bolts to specifications.
   g. Measure crankshaft end play with a feeler gauge. (Force crankshaft forward and measure clearance between the front of the rear main bearing and the crankshaft thrust surface. Refer to Figure 42.
2. Install flywheel and torque to specifications. A wood block placed between the crankshaft and cylinder block will prevent crankshaft from rotating.

   NOTE: Align dowel hole in flywheel with dowel hole in crankshaft. On vehicles equipped with automatic transmissions, install flywheel with the convertor attaching pads towards transmission.

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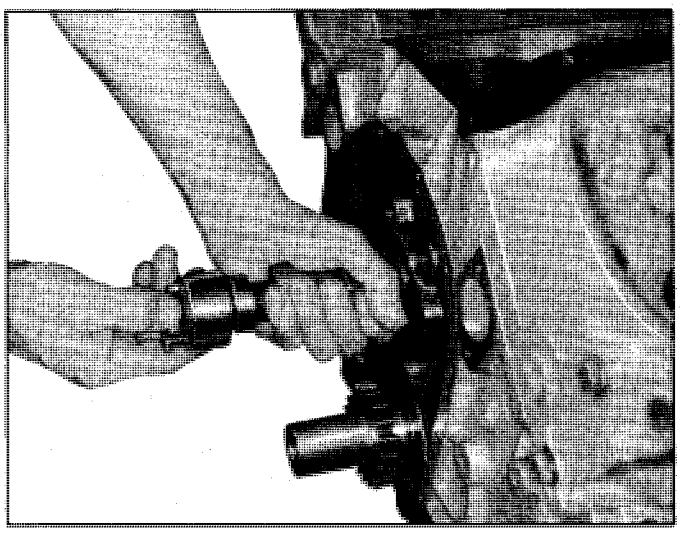


Fig. 4—Installing Camshaft (V8)

3. Install the camshaft as follows:

NOTE: Whenever a new camshaft is installed, lubricate camshaft lobes with "Molykote" or its equivalent.

WITH TIMING CHAIN: (V8)

a. Install two 5/16-18 bolts in camshaft bolt holes, then lubricate camshaft journals with engine oil and install camshaft, being careful not to damage bearings (fig. 4). Remove the two 5/16-18 bolts.
b. Install timing chain on camshaft sprocket then align marks on camshaft and crankshaft sprockets and connect chain to crankshaft sprocket. Align dowel on camshaft with dowel hole in camshaft sprocket and install sprocket on camshaft (fig. 5).

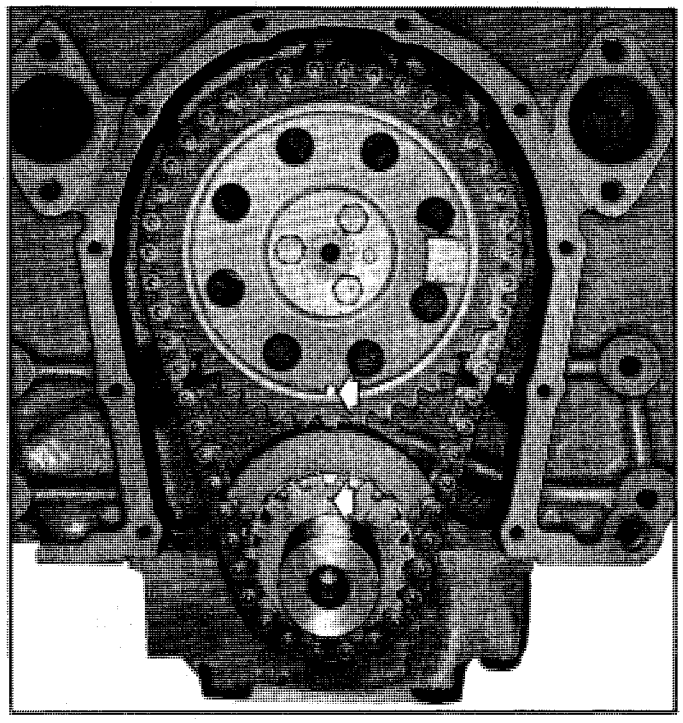


Fig. 5—Timing Sprocket Marks

CAUTION: Do not hammer camshaft sprocket onto camshaft. This may loosen rear camshaft welsh plug.

c. Draw camshaft sprocket onto camshaft, using the mounting bolts. Torque bolts to specifications.
d. Lubricate timing chain with engine oil.

WITH TIMING GEAR (In Line)

a. Lubricate camshaft journals with engine oil, then rotating crankshaft and camshaft so marks on gears will line up, install camshaft and gear assembly being careful not to damage bearings (fig. 6).

4. Install connecting rod and piston assemblies as follows:

a. Install connecting rod bearings in connecting rods and connecting rod caps then lubricate bearings, pistons, piston rings and cylinder walls lightly with engine oil.
b. Install connecting rod guide set Tool J-5239 (3/8") or Tool J-6305 (11/32") on connecting rod bolt and using Tool J-8307 to compress the rings, install number one connecting rod and piston assembly in its respective bore. Use a hammer handle and light blows. Hold the ring compressor firmly against the cylinder block until all piston rings have entered the bore.

CAUTION: Be sure ring gaps are properly positioned on piston and piston is properly positioned in cylinder block. Refer to Figures 56 and 58.

c. Remove connecting rod guide set then install connecting rod cap and torque nuts to specifications. Repeat step b and c for the remaining connecting rod and piston assemblies.
d. Measure connecting rod side clearance (see specifications). Measure between connecting rod cap and side of crankpin on In Line engines and between connecting rod caps on V8 engines. Refer to Figures 46 and 47.

5. Install oil pump and screen assembly (and extension

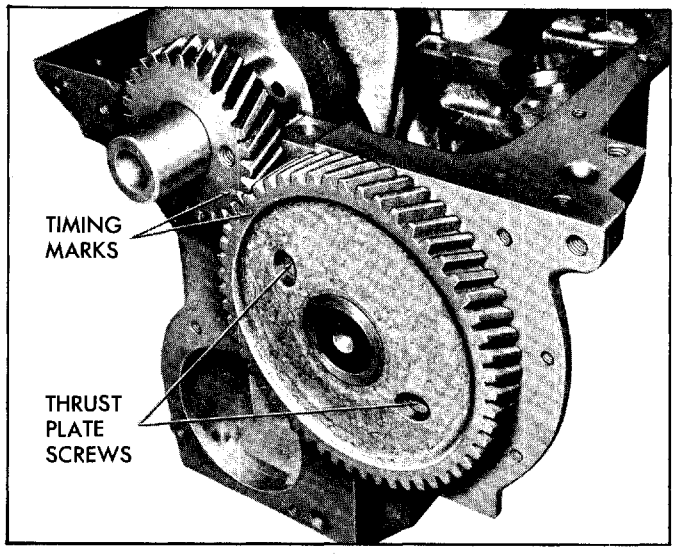


Fig. 6—Timing Gear Marks

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shaft on V8 engines). On Hi-Performance Corvette engines, install the oil baffle.

b. Check camshaft and crankshaft gear run out with a dial indicator (fig. 7). The camshaft gear run out should not exceed .004", and the crankshaft gear run out should not exceed .003".

c. Check the backlash between the timing gear teeth with a dial indicator (fig. 8). The backlash should not be less than .004" nor more than .006".

d. Lubricate timing gears with engine oil.

6. Install the crankcase front cover as follows:

IN LINE ENGINES

a. Lubricate seal lip with engine oil then install crankcase front cover aligning Tool J-0966 or J-21742 in seal (fig. 9).

b. Coat gasket with sealer and place in position on cover, then install crankcase front cover on cylinder block and torque bolts to specifications. Remove tool.

V8 ENGINES (283, 327 and 350 cu. in.)

a. Coat crankcase front cover gasket with sealer and place in position over dowel pins on cylinder block.

b. Lubricate seal lip with engine oil then place crankcase front cover in position over dowel pins and torque bolts to specifications.

V8 ENGINES (396 and 427 cu. in.)

a. Lubricate seal lip with engine oil then install crankcase front cover aligning tool J-21202 in seal (fig. 10).

b. Coat gasket with sealer and place in position on cover, then install crankcase front cover on cylinder block and torque bolts to specifications. Remove tool.

7. Install the oil pan as follows:

a. Install side gaskets on cylinder block using sealer as a retainer.

b. Install rear oil pan seal, in groove in rear main bearing cap, with ends butting side gaskets.

c. Install oil pan front seal, in crankcase front cover, with ends butting side gaskets.

d. Install oil pan and torque bolts to specifications.

8. Install torsional damper as follows:

CAUTION: The inertia weight section of the torsional damper is assembled to the hub with a rubber type material. The installation procedure (with proper tool) must be followed or movement of the inertia weight section on the hub will destroy the tuning of the torsional damper.

DRIVE ON TYPE (Without retaining bolt)

a. Coat front cover seal area (on damper) with engine oil.

b. Attach damper Installer Tool J-22197 to damper. Tighten fingers of tool to prevent weight from moving (fig. 11).

c. Position damper on crankshaft and drive into position using J-5590 until it bottoms against

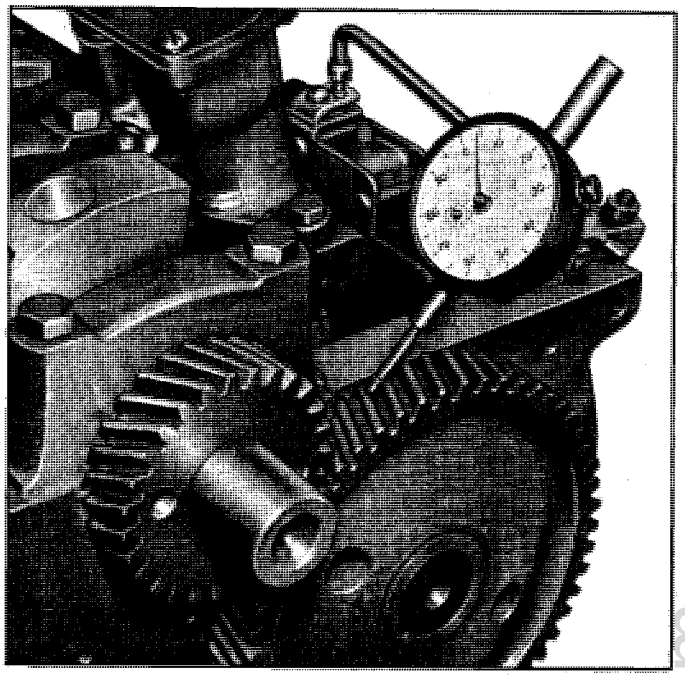


Fig. 8—Checking Timing Gear Backlash

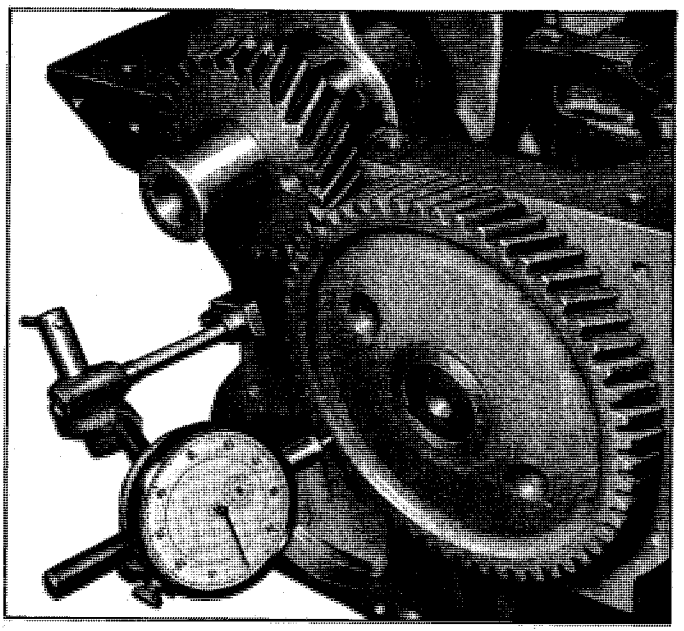


Fig. 7—Checking Timing Gear Runout

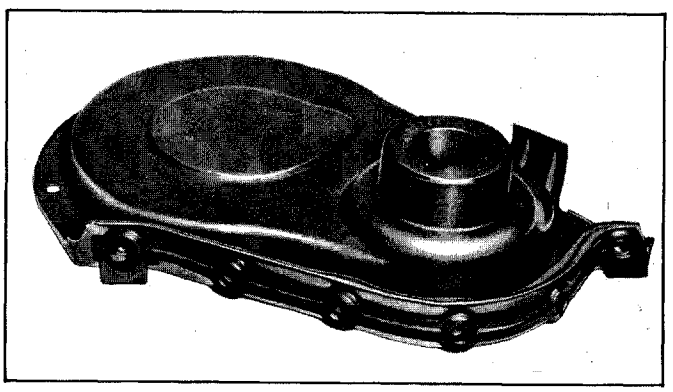


Fig. 9—Centering Tool in Cover (In Line)

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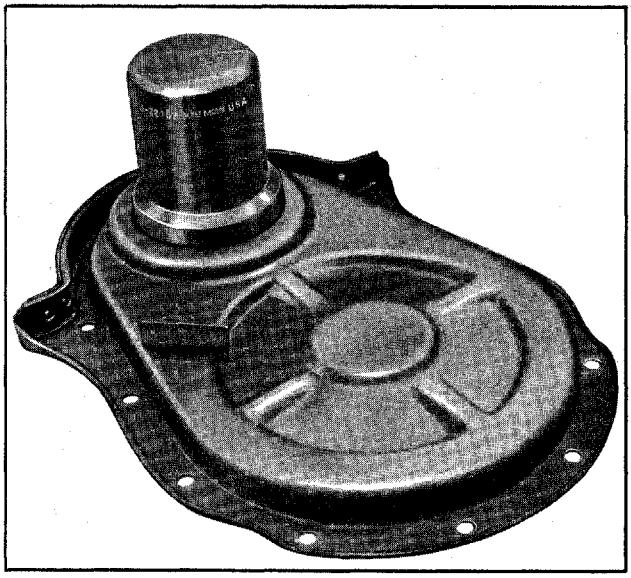


Fig. 10—Centering Tool in Cover (V8-396 and 427)

crankshaft gear or sprocket (fig. 11). Remove installer tool.

NOTE: To install crankshaft pulley hub (L4 engine) use Tool J-5590.

PULL ON TYPE (With retaining bolt)

a. Coat front cover seal contact area (on damper) with engine oil.
b. Place damper in position over key on crankshaft.
c. Using Tool J-21058 pull damper onto crankshaft (fig. 12).

CAUTION: Install bolt in crankshaft with sufficient thread engagement (min. 1/2").

d. Remove tool from crankshaft.
e. Install damper retaining bolt and torque to specifications.

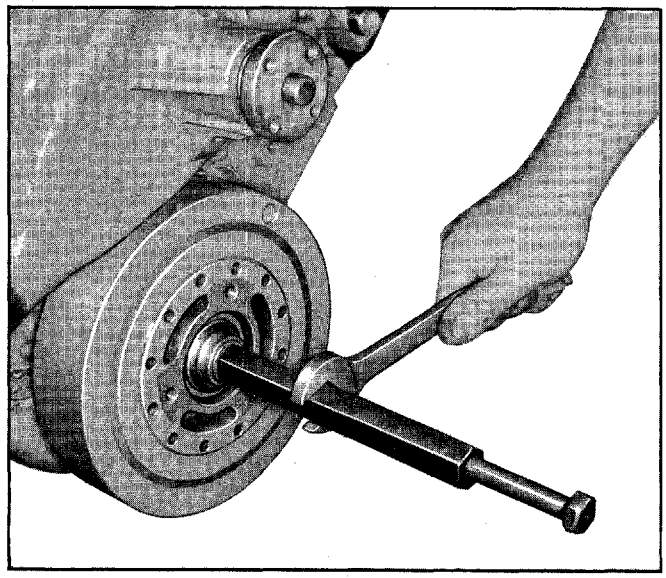


Fig. 12—Installing Torsional Damper (Pull on Type)

NOTE: On 327 cu. in. (325 HP, 350 HP) engines with a 7/16"-20 retaining bolt use a 7/16"-20 x 4" bolt and a 7/16"-20 nut in place of the bolt and nut furnished with Tool J-21058.

9. Install cylinder head(s) as follows:

CAUTION: The gasket surfaces on both the head and the block must be clean of any foreign matter and free of nicks or heavy scratches. Cylinder bolt threads in the block and threads on the cylinder head bolts must be cleaned. (Dirt will effect bolt torque.)

a. On engines using a STEEL gasket, coat both sides of gasket with sealer, spread the sealer thin and even. Too much sealer may hold the beads of the gasket away from the head or block. One method of applying the sealer that will assure the proper coat is with the use of a paint roller.

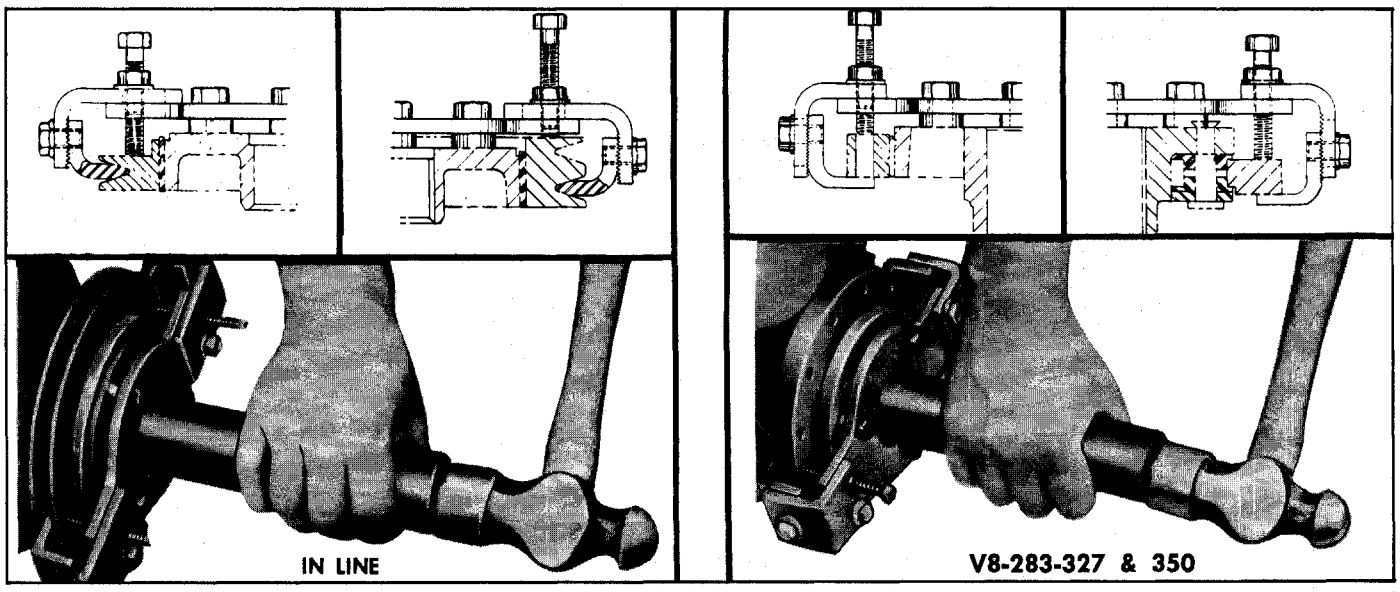


Fig. 11—Installing Torsional Damper (Drive on Type)

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CAUTION: Use no sealer on engines using a composition STEEL ASBESTOS gasket.

b. Place the gasket in position over the dowel pins, with the bead up.
c. Carefully guide cylinder head into place over dowel pins and gasket.
d. Coat threads of cylinder head bolts with sealing compound and install finger tight.

NOTE: 427 cu. in. engines with aluminum cylinder heads have hardened steel washers on the cylinder head bolt. These bolts require a special torque.

e. Tighten cylinder head bolts a little at a time in the sequence shown until the specified torque is reached (See Engine Torques).

NOTE: All In Line engines using composition STEEL ASBESTOS gaskets must have the cylinder head retorqued after engine warm-up.

10. Install valve lifters and push rods. Install in the same location from which removed during engine disassembly.

NOTE: Whenever new valve lifters and/or rocker arms and balls are being installed coat foot of valve lifters and surfaces of rocker arms and balls with "Molykote" or its equivalent.

11. Install valve rocker arms, rocker arm balls and nuts and tighten rocker arm nuts until all push rod end play is taken up.
12. On In Line engines, install push rod covers.
13. Install intake and exhaust manifolds. Torque to specifications in the sequence outlined under "Engine Torques".
14. Install the following sub-assemblies (if applicable) as outlined in the "Passenger Chassis Service Manual."

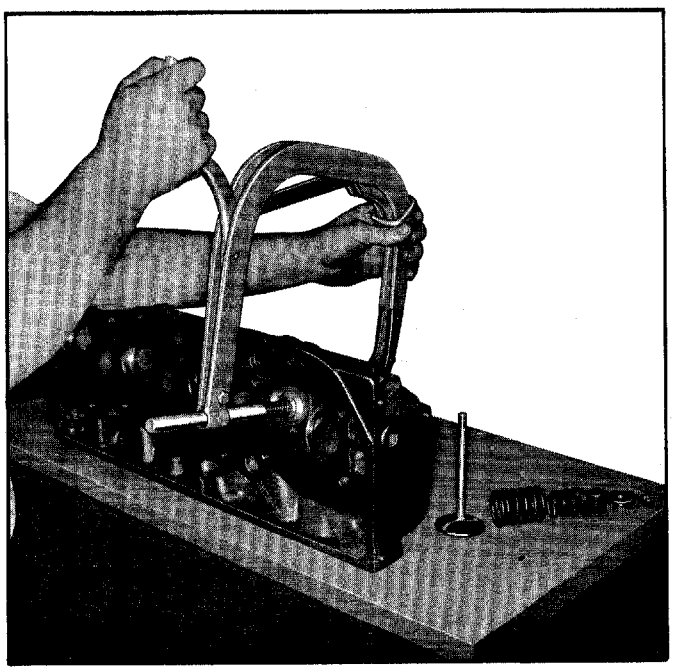


Fig. 13—Compressing Valve Spring

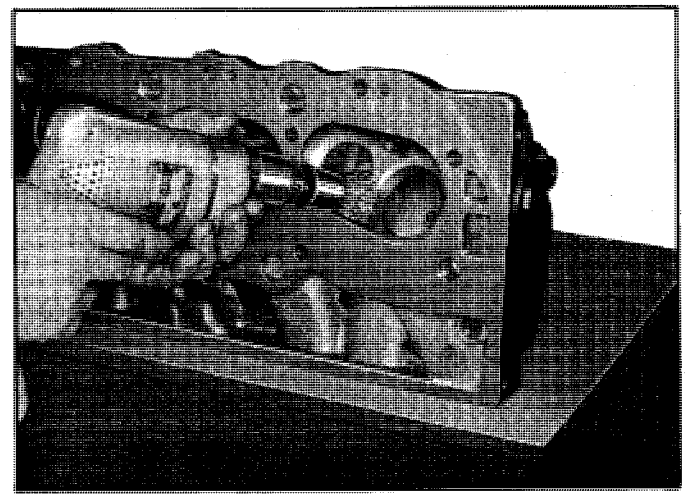


Fig. 14—Cleaning Combustion Chamber

- Oil Dipstick Tube and Oil Dipstick
- Ground Strap
- Clutch Pressure Plate and Disc
- Starter
- Oil Filter (new)
- Carburetor and Fuel Lines
- Distributor Cap (with spark plug wires)
- Fuel Pump (and fuel pump push rod on V8 engines)
- Water Pump
- Accessory Drive Pulley(s) (and belts)
- Delcotron (with brackets)
- Air Injection Reactor System (with brackets)
- Power Steering Pump (with brackets)
- Air Conditioning Compressor (with brackets)

15. Adjust all belts as necessary.
16. Adjust valves as outlined in the "Passenger Chassis Service Manual" under Valve Mechanism, Installation and Adjustment.
17. Attach engine lift at appropriate cylinder head bolt location.

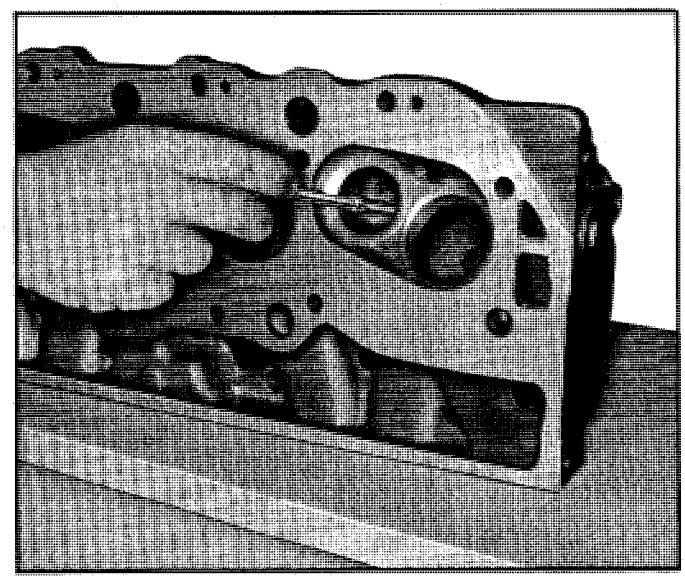


Fig. 15—Cleaning Valve Guide

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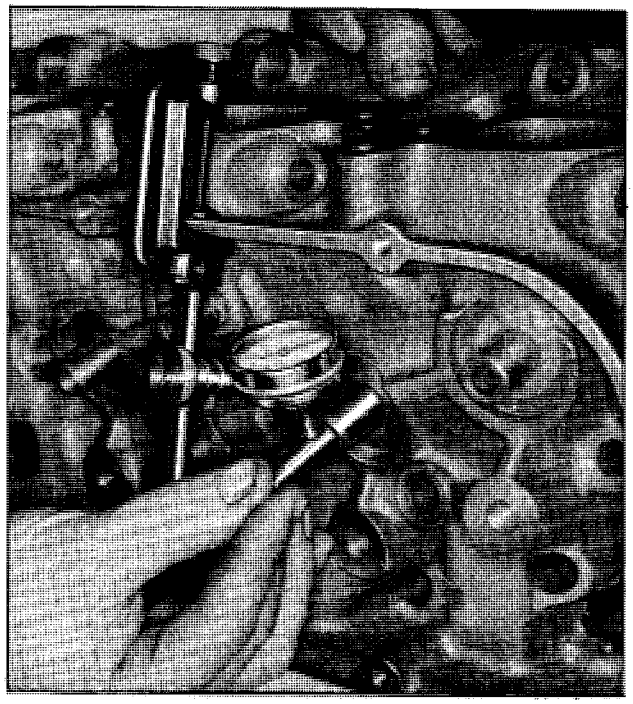


Fig. 16—Measuring Valve Stem Clearance

CYLINDER HEAD ASSEMBLIES

Disassembly

1. With cylinder head removed, remove valve rocker arm nuts, ball and rocker arms (if not previously done).
2. Using Tool J-8062, compress the valve springs (fig. 13) and remove valve keys. Release the compressor tool and remove spring caps, spring shields (if so equipped) springs and spring damper, then remove oil seals and valve spring shims.
3. Remove valves from cylinder head and place them in a rack in their proper sequence so they can be assembled in their original positions.

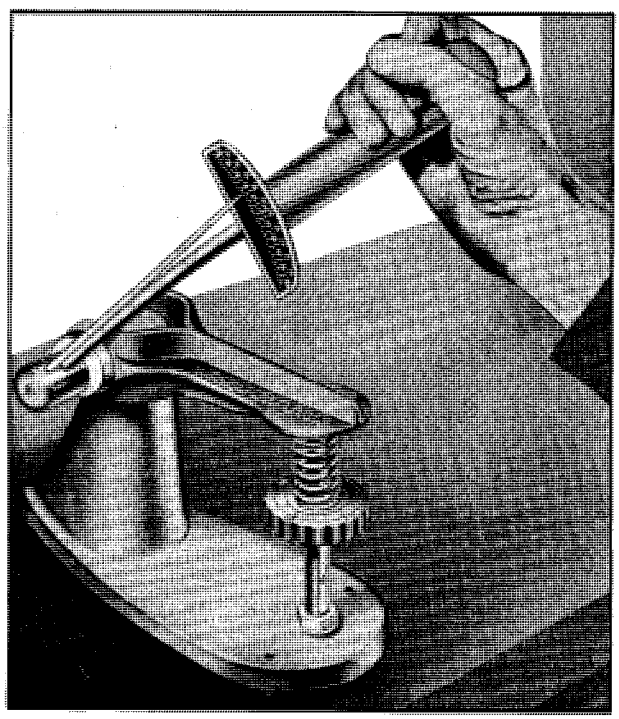


Fig. 17—Checking Valve Spring Tension

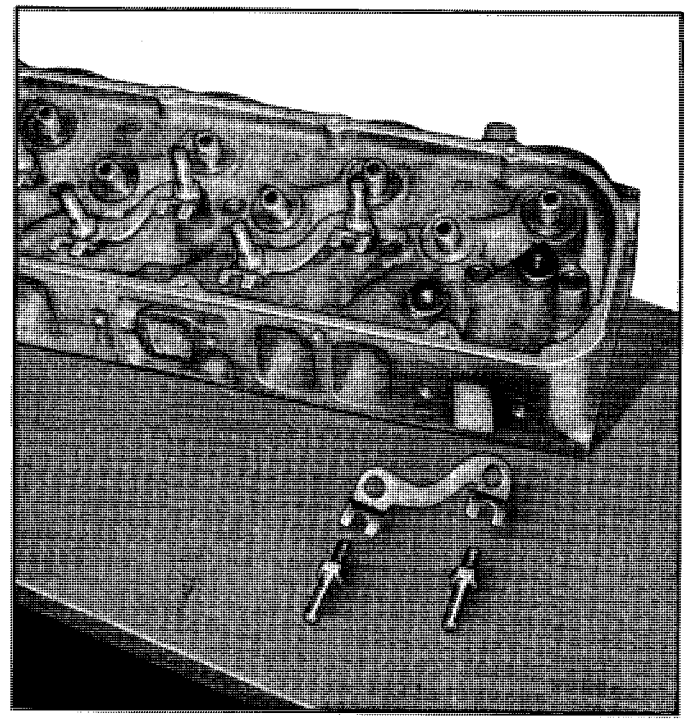


Fig. 18—Rocker Arm Stud and Push Rod Guide (396 and 427 V8)

Cleaning

1. Clean all carbon from combustion chambers and valve ports using Tool J-8089 (fig. 14).
2. Thoroughly clean the valve guides using Tool J-8101 (fig. 15).
3. Clean all carbon and sludge from push rods, rocker arms and push rod guides.
4. Clean valve stems and heads on a buffing wheel.
5. Clean carbon deposits from head gasket mating surface.

Inspection

1. Inspect the cylinder head for cracks in the exhaust ports, combustion chambers, or external cracks to the water chamber.
2. Inspect the valves for burned heads, cracked faces or damaged stems.

   NOTE: Excessive valve stem to bore clearance will cause excessive oil consumption and may cause valve breakage. Insufficient clearance will result in noisy and sticky functioning of the valve and disturb engine smoothness.

3. Measure valve stem clearance (fig. 16) as follows: Clamp a dial indicator on one side of the cylinder head rocker arm cover gasket rail, locating the indicator so that movement of the valve stem from side to side (crosswise to the head) will cause a direct movement of the indicator stem. The indicator stem must contact the side of the valve stem just above the valve guide. With the valve head dropped about 1/16" off the valve seat; move the stem of the valve

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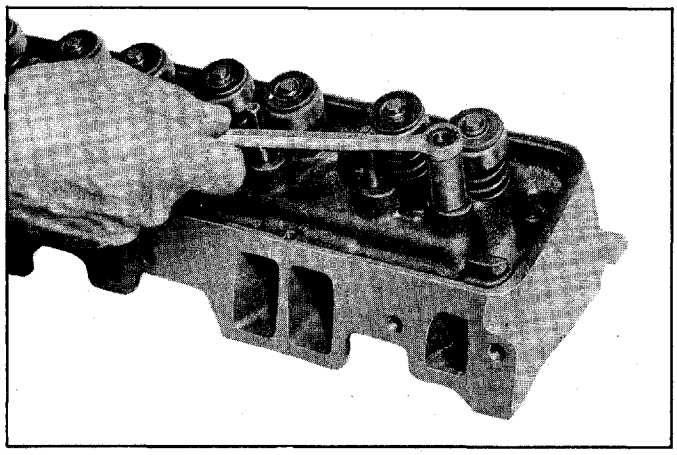


Fig. 19—Removing Rocker Arm Stud (In Line and 283, 327, 350 V8)

from side to side, using light pressure to obtain a clearance reading. If clearance exceeds specifications it will be necessary to ream valve guides for oversize valves as outlined.

4. Check valve spring tension with Tool J-8056 spring tester (fig. 17).

   NOTE: Springs should be compressed to the specified height and checked against the specifications chart. Springs should be replaced if not within 10 lbs. of the specified load (without dampers).

5. Inspect rocker arm studs for wear or damage. Inspect push rod guides on 396 and 427 cu. in. V8 engines for wear or damage.

Repairs

Rocker Arm Studs and Push Rod Guides (396 and 427 V8)

The push rod guides are retained to the cylinder head by the rocker arm studs (fig. 18). Replace where necessary and torque rocker arm studs to specifications.

NOTE: Coat threads on cylinder head end of rocker arm studs with sealer before assembling to cylinder head. On aluminum cylinder head, use anti-seize compound.

Rocker Arm Studs (In Line and 283, 327, 350 V8)

Rocker arm studs that have damaged threads or are loose in cylinder heads should be replaced with new studs available in .003" and .013" oversize. Studs may be installed after reaming the holes as follows:

1. Remove old stud by placing Tool J-5802-1 over the stud, installing nut and flat washer and removing stud by turning nut (fig. 19).
2. Ream hole for oversize stud using Tool J-5715 for .003" oversize or Tool J-6036 for .013" oversize (fig. 20).

   CAUTION: Do not attempt to install an oversize stud without reaming stud hole.

3. Coat press-fit area of stud with hypoid axle lubricant. Install new stud, using Tool J-6880 as a guide. Gauge should bottom on head (fig. 21).

Valve Guide Bores

Valves with oversize stems are available (see specifications). To ream the valve guide bores for oversize valves use Tool Set J-5830 (In Line and 283, 327, 350 cu. in. V8) or J-7910 (396 and 427 cu. in. V8) (fig.22.)

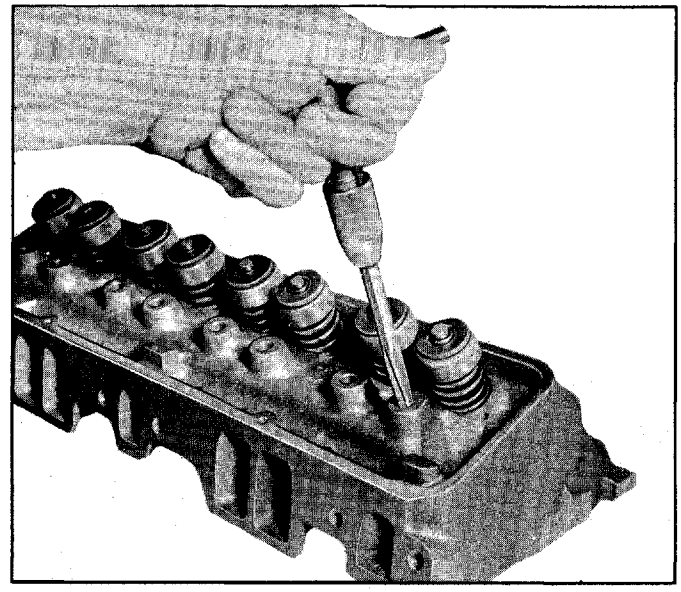


Fig. 20—Reaming Rocker Arm Stud Bore (In Line and 283, 327, 350 V8)

Valve Seats

Reconditioning the valve seats is very important, because the seating of the valves must be perfect for the engine to deliver the power and performance built into it.

Another important factor is the cooling of the valve heads. Good contact between each valve and its seat in the head is imperative to insure that the heat in the valve head will be properly carried away.

Several different types of equipment are available for reseating valve seats. The recommendations of the manufacturer of the equipment being used should be carefully followed to attain proper results.

Regardless of what type of equipment is used, however, it is essential that valve guide bores be free from

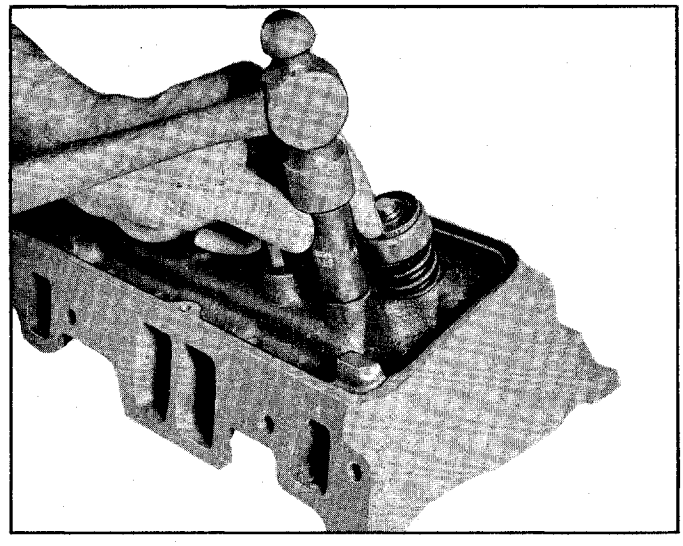


Fig. 21—Installing Rocker Arm Stud (In Line and 283, 327, 350 V8)

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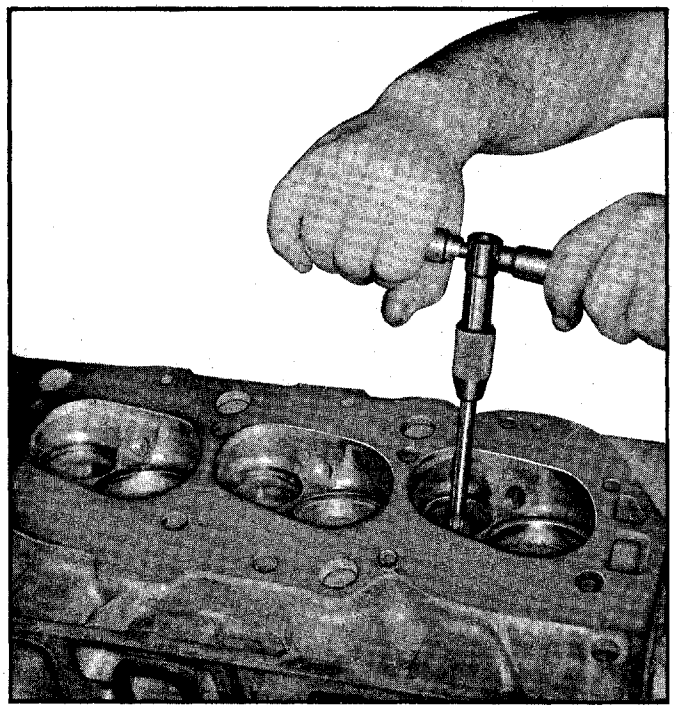


Fig. 22—Reaming Valve Guide

carbon or dirt to insure proper centering of pilot in the guide.

1. Install expanding pilot in the valve guide bore.
2. Place roughing stone or forming stone over pilot and just clean up the valve seat. Use a stone cut to specifications.
3. Remove roughing stone or forming stone from pilot, place finishing stone, cut to specifications, over pilot and cut just enough metal from the seat to provide a smooth finish. Refer to specifications and Figure 24.
4. Narrow down the valve seats to the specified width.

   NOTE: This operation is done by grinding the port side with a 30° stone to lower seat and a 60° stone to raise seat.

5. Remove expanding pilot and clean cylinder head carefully to remove all chips and grindings from above operations.
6. Measure valve concentricity (fig. 23).

   NOTE: Valve seats should be concentric to within .002" total indicator reading.

Valves

Valves that are pitted can be refaced to the proper angle, insuring correct relation between the head and stem, on a valve refacing mechanism. Valve stems which show excessive wear, or valves that are warped excessively should be replaced. When a valve head which is warped excessively is refaced, a knife edge will be ground on part or all of the valve head due to the amount of metal that must be removed to completely reface. Knife edges lead to breakage, burning or pre-ignition due to heat localizing on this knife edge. If the edge of the valve head is less than 1/32" thick after grinding, replace the valve.

Several different types of equipment are available for refacing valves. The recommendations of the manufacturer of the equipment being used should be carefully followed to attain proper results.

1. If necessary, dress the valve refacing machine grinding wheel to make sure it is smooth and true. Set chuck at angle specified for valve. Refer to specifications and Figure 24.
2. Clamp the valve stem in the chuck of the machine.
3. Start the grinder and move the valve head in line with the grinder wheel.
4. Turn the feed screw until the valve head just contacts wheel. Move valve back and forth across the wheel and regulate the feed screw to provide light valve contract
5. Continue grinding until the valve face is true and smooth all around the valve. If this makes the valve head thin (1/32" min.) the valve must be replaced as the valve will overheat and burn.
6. Remove valve from chuck and place stem in "V" block. Feed valve squarely against grinding wheel to grind any pit from rocker arm end of stem.

   NOTE: Only the extreme end of the valve stem is hardened to resist wear. Do not grind end of stem excessively.

7. After cleaning valve face and cylinder head valve seat of grinding particles, make pencil marks about 1/4" apart across the valve face, place the valve in cylinder head and give the valve 1/2 turn in each direction while exerting firm pressure on head of valve.
8. Remove valve and check face carefully. If all pencil marks have not been removed at the point of contact with the valve seat, it will be necessary to repeat the refacing operation and again recheck for proper seating.
9. Grind and check the remaining valves in the same manner.

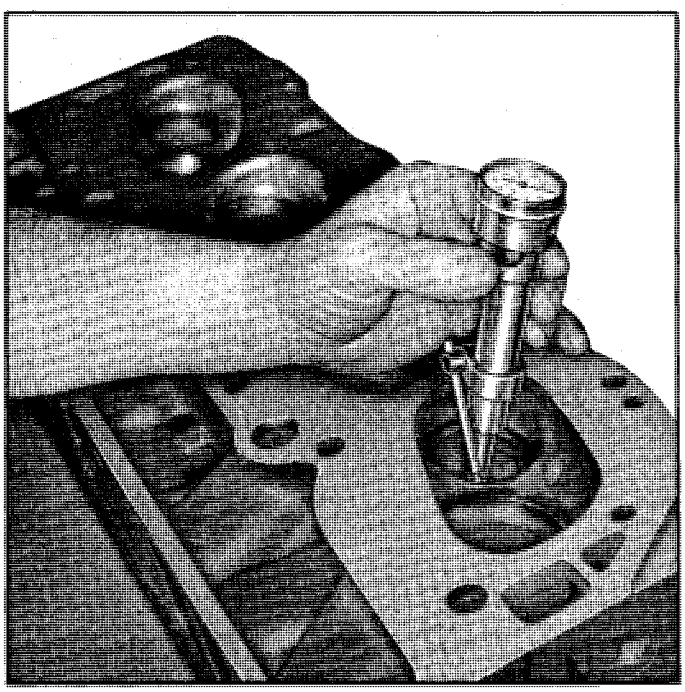


Fig. 23—Measuring Valve Seat Concentricity

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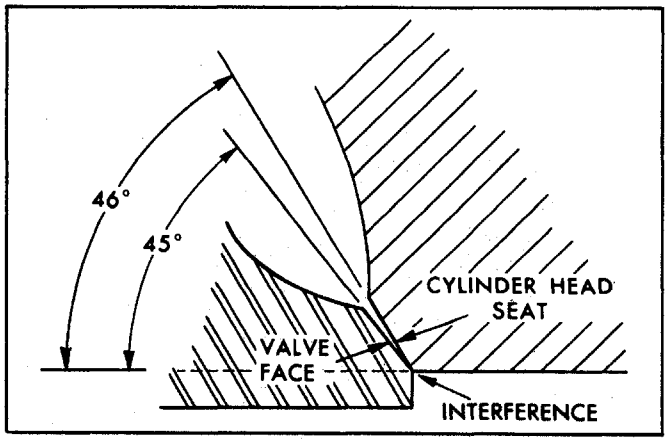


Fig. 24—Relation of Valve and Seat Angles

Assembly

1. Insert a valve in the proper port.
2. Assemble the valve spring and related parts as follows:

IN LINE AND 283, 327, 350 cu. in. V8.

a. Set the valve spring shim, valve spring (with damper, (if used) valve shield and valve cap in place (fig. 25). The close coiled end of the spring is installed against the cylinder head.
b. Compress the spring with Tool J-8062.
c. Install oil seal in the lower groove of the stem, making sure the seal is flat and not twisted.
d. Install the valve locks and release the compressor tool, making sure the locks seat properly in the upper groove of the valve stem.

396 AND 427 cu. in. V8

a. Install valve spring shim on valve spring seat then install a new valve stem oil seal over valve and valve guide.
b. Set the valve spring (with damper), and valve cap in place (fig. 26).
c. Compress the spring with Tool J-8062.
d. Install the valve locks and release the compressor tool, making sure the locks seat properly in the groove of the valve stem.

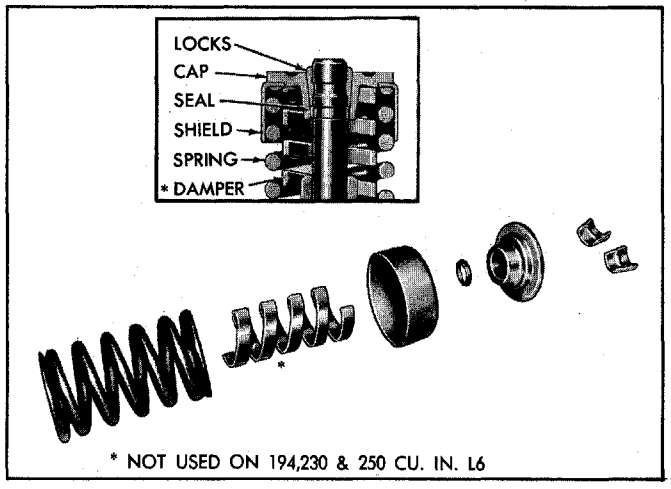


Fig. 25—Valve Spring Installation (In Line and 283, 327, 350 V8)

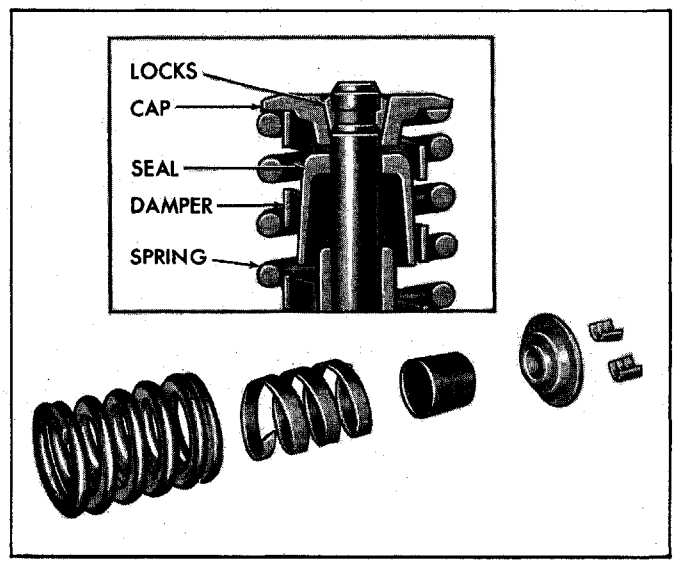


Fig. 26—Valve Spring Installation (396 and 427 V8)

NOTE: Grease may be used to hold the locks in place, while releasing the compressor tool.

3. Install the remaining valves.
4. On In Line and 283, 327, 350 cu. in. V8 engines check each valve stem oil seal by placing a vacuum cup or similar device over the end of the valve stem and against the cap. Operate the vacuum cup and make sure no air leaks past the seal. A vacuum cup can be made from a small syringe and a high voltage shield (fig. 27).
5. Check the installed height of the valve springs, using a narrow thin scale. A cutaway scale will help (fig. 28). Measure from the top of the shim or the spring seat to the top of the valve spring or valve spring shield (fig. 29). If this is found to exceed the specified height, install a valve spring seat shim approximately 1/16" thick. At no time should the spring be shimmed to give an installed height under the minimum specified.

VALVE LIFTERS (HYDRAULIC)

Two types of hydraulic lifters are used. Both types of lifters operate on the same principle and are serviced basically in the same manner. The complete lifter assemblies are interchangeable but parts from one lifter are not interchangeable with another. Both lifters are easily identified by the outside configuration of the lifter body. For purposes of identification we refer to them as lifter "A" and lifter "B" (fig. 30).

Disassembly

1. Hold the plunger down with a push rod, and using the

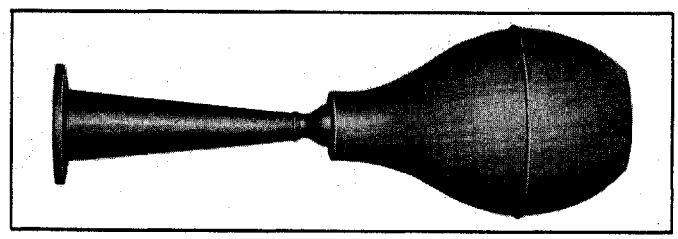


Fig. 27—Vacuum Cup

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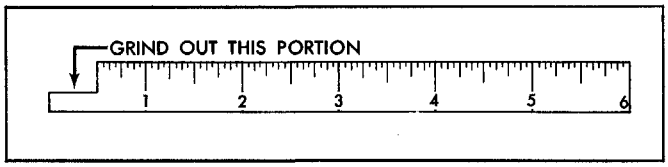


Fig. 28—Cutaway Scale

blade of a small screw driver, remove the push rod seat retainer.

2. Remove the push rod seat and metering valve (lifter "A") or the push rod seat and inertia valve assembly (lifter "B") (fig. 30).
3. Remove the plunger, ball check valve assembly and the plunger spring.
4. Remove the ball check valve and spring by prying the ball retainer loose from the plunger with the blade of a small screw driver (fig. 31).

Cleaning and Inspection

Thoroughly clean all parts in cleaning solvent, and inspect them carefully. If any parts are damaged or worn the entire lifter assembly should be replaced. If the lifter body wall is scuffed or worn, inspect the cylinder block lifter bore, if the bottom of the lifter is scuffed or worn inspect the camshaft lobe, if the push rod seat is scuffed or worn inspect the push rod.

NOTE: Inertia valve and retainer (lifter "B") (fig. 30) should not be removed from the push rod seat. To check the valve, shake the push rod seat and inertia valve assembly and the valve should move.

Assembly

1. Place the check ball on small hole in bottom of the plunger.
2. Insert check ball spring on seat in ball retainer and place retainer over ball so spring rests on the ball. Carefully press the retainer into position in plunger with the blade of a small screw driver (fig. 32).
3. Place the plunger spring over the ball retainer and slide the lifter body over the spring and plunger, being careful to line up the oil feed holes in the lifter body and plunger.
4. Fill the assembly with SAE 10 oil, then insert the end of a 1/8" drift pin into the plunger and press down solid. At this point oil holes in the lifter body and plunger assembly will be aligned (fig. 33).

CAUTION: Do not attempt to force or pump the plunger.

5. Insert a 1/16" drift pin through both oil holes to hold the plunger down against the lifter spring tension (fig. 33).

NOTE: On lifter "B" (fig. 30) the drift pin must not extend inside the plunger.

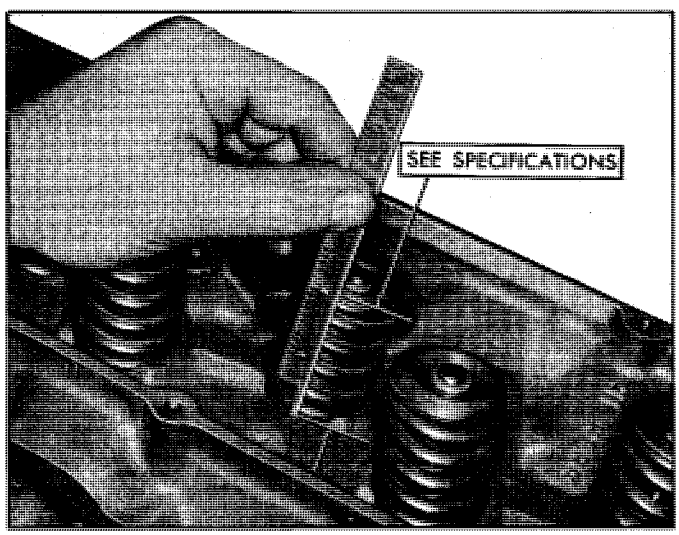


Fig. 29—Measuring Valve Spring Installed Height

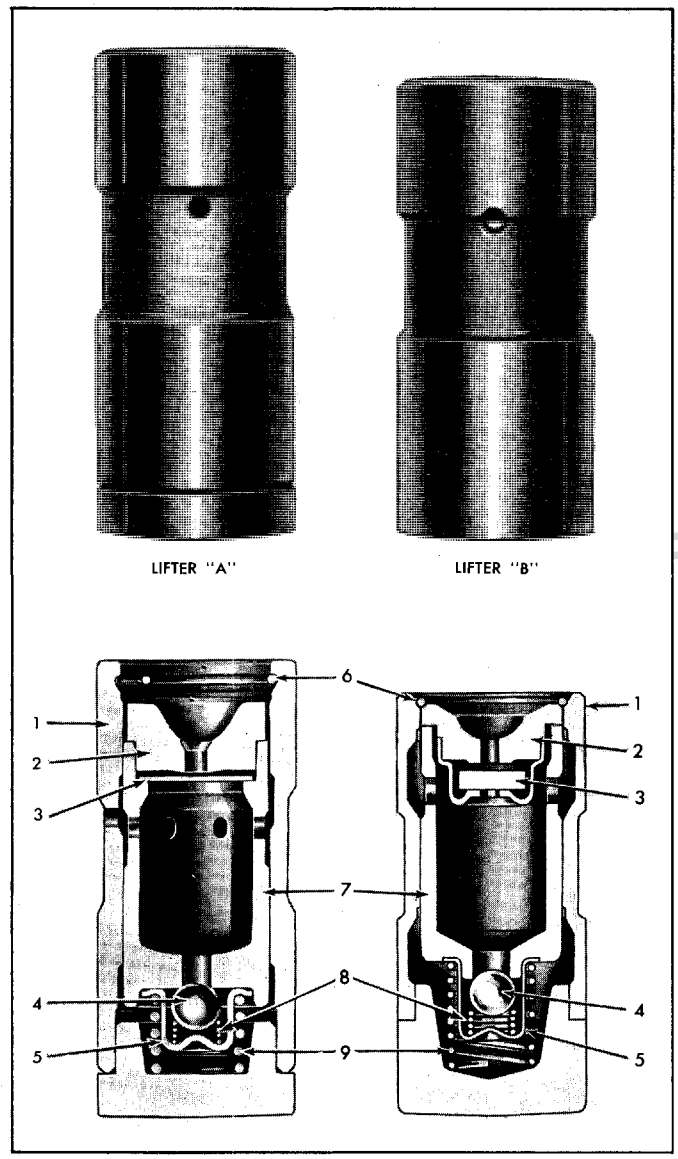


Fig. 30—Hydraulic Valve Lifters

1. Lifter Body
2. Push Rod Seat
3. Metering Valve (Lifter A) Inertia Valve (Lifter B)
4. Check Ball
5. Check Ball Retainer
6. Push Rod Seat Retainer
7. Plunger
8. Check Ball Spring
9. Plunger Spring

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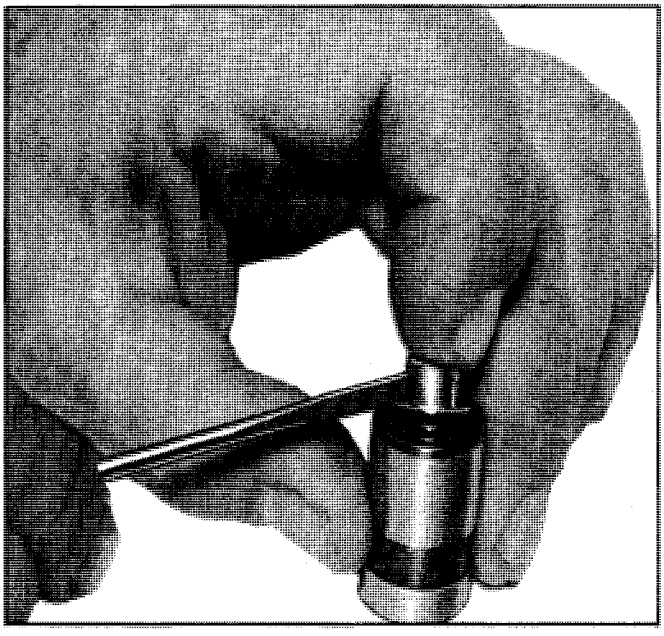


Fig. 31—Removing Ball Check Valve

6. Remove the 1/8" drift pin, refill assembly with SAE 10 oil.
7. Install the metering valve and push rod seat (lifter "A") or the push rod seat and inertia valve assembly (lifter "B") (fig. 30).

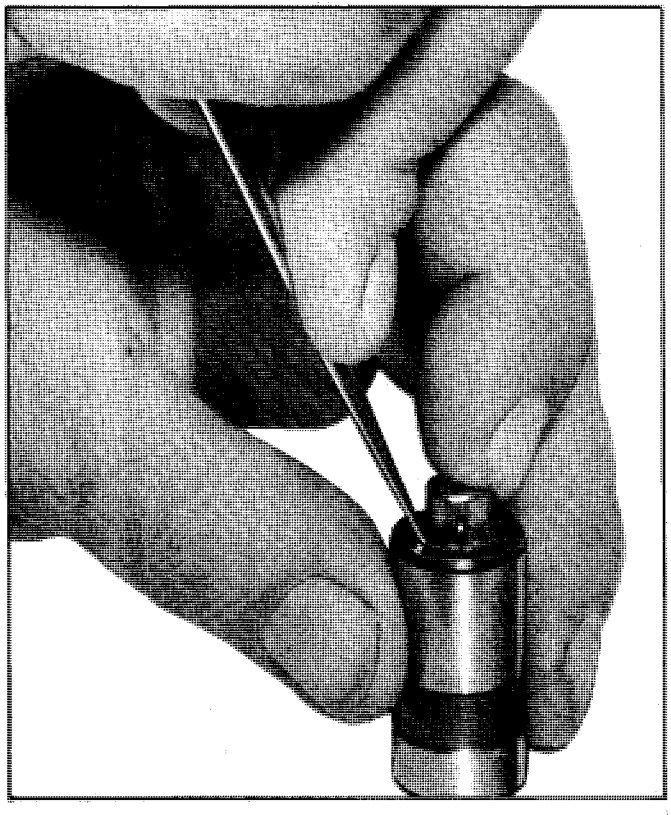


Fig. 32—Installing Ball Check Valve

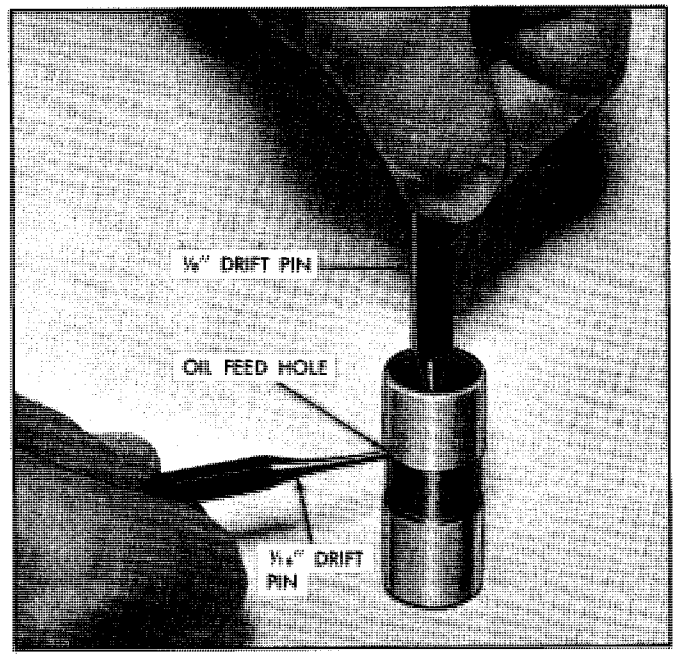


Fig. 33—Assembling Hydraulic Lifters

8. Install the push rod seat retainer, press down on the push rod seat and remove the 1/16" drift pin from the oil holes. The lifter is now completely assembled, filled with oil and ready for installation.

NOTE: Before installing any new lifters, coat the bottom of the lifter with Molykote or its equivalent.

VALVE LIFTERS (MECHANICAL)

Cleaning and Inspection

The mechanical valve lifter (fig. 34) should never be disassembled. Wash lifter assembly in cleaning solvent and dry with compressed air. Blow out oil holes in lifter body and push rod seat with compressed air. Inspect push rod seat retainer. Inspect lifter for scuffed or worn lifter body or push rod seat. If the lifter body wall is scuffed or worn inspect the cylinder block lifter bore. If the bottom of the lifter is scuffed or worn inspect the camshaft lobe, if the push rod seat is scuffed or worn inspect the push rod. All damaged or worn lifters should be replaced.

NOTE: Before installing a new lifter, coat the bottom of the lifter with Molykote or its equivalent.

OIL PUMP

The oil pump consists of two gears and a pressure regulator valve enclosed in a two-piece housing. The oil pump is driven by the distributor shaft which is driven by a helical gear on the camshaft.

A baffle is incorporated on the pickup screen to eliminate pressure loss due to sudden or surging stops.

Disassembly

Refer to Figures 35, 36 and 37

1. Remove the pump cover attaching screws, the pump

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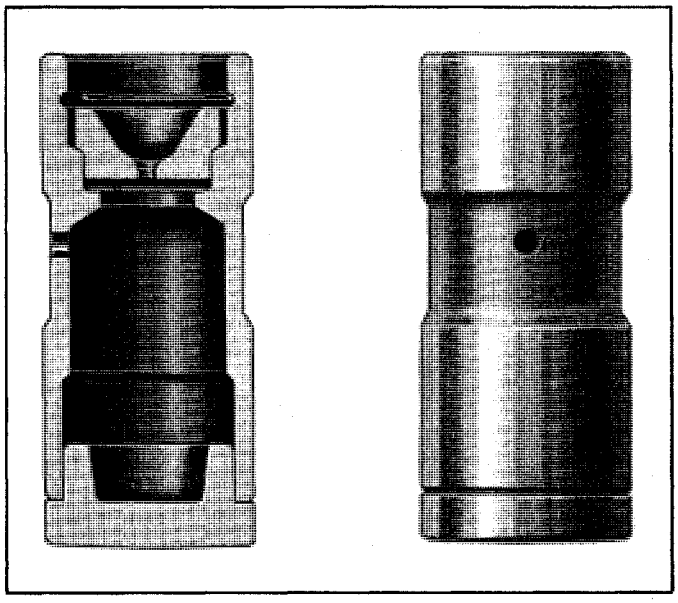


Fig. 34—Mechanical Valve Lifters

cover and on In Line engines the pump cover gasket.

NOTE: Mark gear teeth so they may be reassembled with the same teeth indexing.

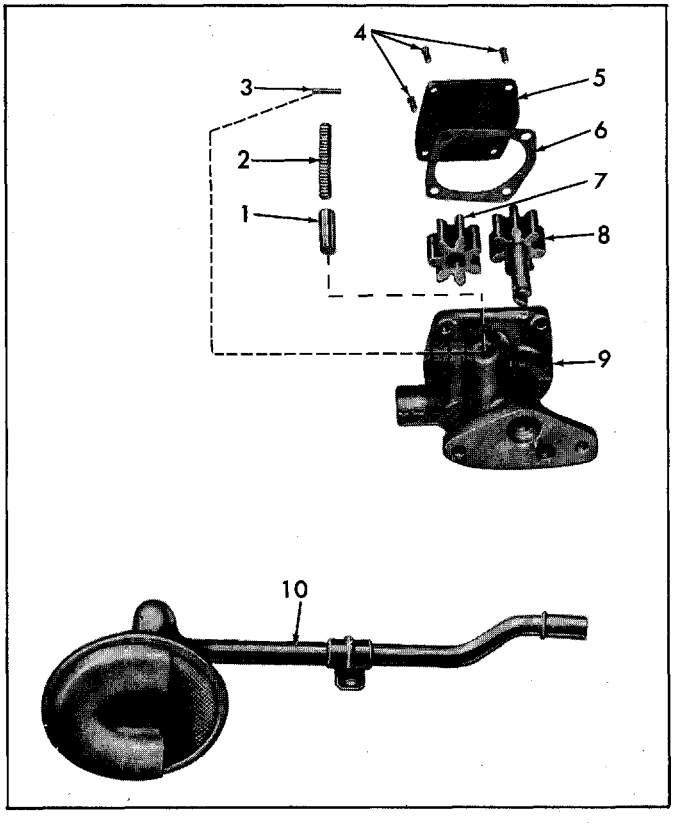


Fig. 35—Oil Pump (In Line)

1. Pressure Regulator Valve
2. Pressure Regulator Spring
3. Retaining Pin
4. Screws
5. Pump Cover
6. Cover Gasket
7. Idler Gear
8. Drive Gear and Shaft
9. Pump Body
10. Pickup Screen and Pipe

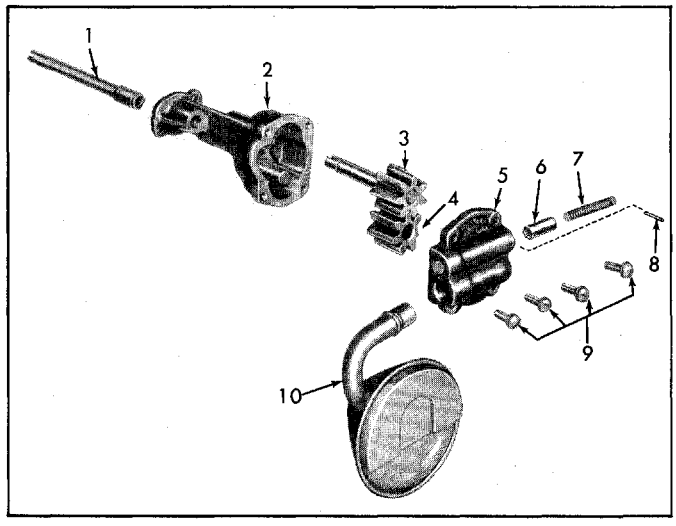


Fig. 36—Oil Pump (283, 327 and 350 V8)

1. Shaft Extension
2. Pump Body
3. Drive Gear and Shaft
4. Idler Gear
5. Pump Cover
6. Pressure Regulator Valve
7. Pressure Regulator Spring
8. Retaining Pin
9. Screws
10. Pickup Screen and Pipe

2. Remove the idler gear and the drive gear and shaft from the pump body.
3. Remove the pressure regulator valve retaining pin, pressure regulator valve and related parts.
4. If the pickup screen and pipe assembly need replacing, mount the pump in a soft-jawed vise and extract pipe from pump.

CAUTION: Do not disturb the pickup screen on the pipe. This is serviced as an assembly.

Cleaning and Inspection

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

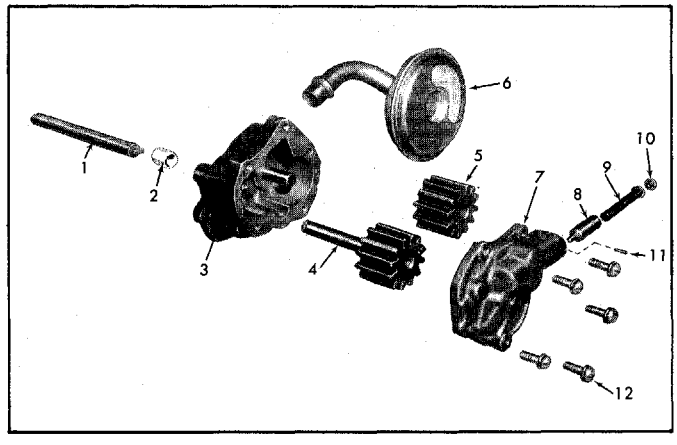


Fig. 37—Oil Pump (396 and 427 V8)

1. Shaft Extension
2. Shaft Coupling
3. Pump Body
4. Drive Gear and Shaft
5. Idler Gear
6. Pickup Screen and Pipe
7. Pump Cover
8. Pressure Regulator Valve
9. Pressure Regulator Spring
10. Washer
11. Retaining Pin
12. Screws

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2. Inspect the pump body and cover for cracks or excessive wear.
3. Inspect pump gears for damage or excessive wear.
4. Check the drive gear shaft for looseness in the pump body.
5. Inspect inside of pump cover for wear that would permit oil to leak past the ends of the gears.
6. Inspect the pickup screen and pipe assembly for damage to screen, pipe or relief grommet.
7. Check the pressure regulator valve for fit.

NOTE: The pump gears and body are not serviced separately. If the pump gears or body are damaged or worn, replacement of the entire oil pump assembly is necessary.

Assembly

Refer to Figures 35, 36 and 37

1. If the pickup screen and pipe assembly was removed, mount the pump in a soft-jawed vise, apply sealer to end of pipe, and using Tool J-8369 for In Line and 283, 327, 350 V8 (fig. 38) or J-22144 or 396 and 427 V8 (fig. 39) tap the pipe in place with a plastic hammer.

CAUTION: Be careful of twisting, shearing or collapsing pipe while installing in pump. Pickup screen must be parallel to bottom of oil pan when oil pump is installed.

2. Install the pressure regulator valve and related parts.
3. Install the drive gear and shaft in the pump body.
4. Install the idler gear in the pump body with the smooth side of gear towards pump cover opening.
5. Install the pump cover (with new gasket on In Line engines) and torque attaching screws to specifications.

MAIN BEARINGS

Main bearings are of the precision insert type and do not utilize shims for adjustment. If clearances are found to be excessive a new bearing, both upper and lower halves, will be required. Bearings are available in standard size and .001", .002", .009", .010", .020" and .030" undersize.

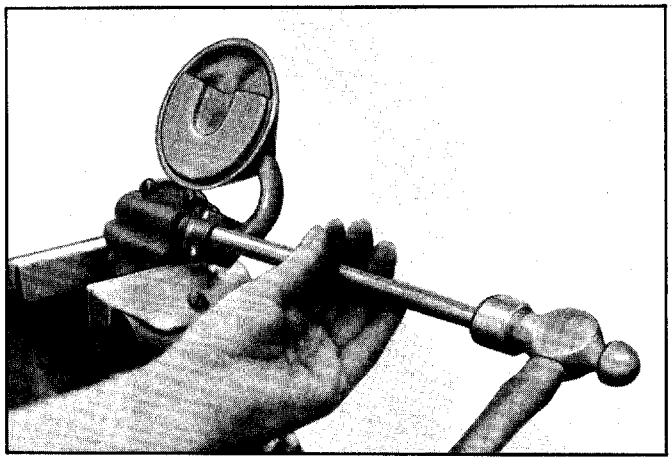


Fig. 38—Installing Screen (In Line and 283, 327, 350 V8)

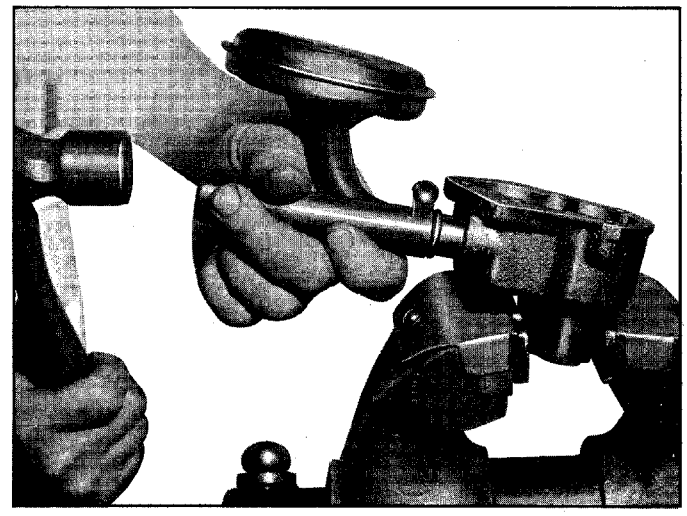


Fig. 39—Installing Screen (396 and 427 V8)

Selective fitting of both rod and main bearing inserts is necessary in production in order to obtain close tolerances. For this reason you may find one half of a standard insert with one half of a .001 undersize insert which will decrease the clearance .0005 from using a full standard bearing.

When a production crankshaft cannot be precision fitted by this method, it is then ground .009" undersize on main journals only. A .009 undersize bearing and .010 undersize bearing may be used for precision fitting in the same manner as previously described. Any engine fitted with a .009 undersize crankshaft will be identified by the following markings.

- ".009" will be stamped on the crankshaft counterweight forward of the center main journal.
- A Figure "9" will be stamped on the block at the left front oil pan rail.

NOTE: If, for any reason, main bearing caps are replaced, shimming may be necessary. Laminated shims for each cap are available for service. Shim requirement will be determined by bearing clearance.

Inspection

In general, the lower half of the bearing shows a greater wear and the most distress from fatigue. If upon inspection the lower half is suitable for use, it can be assumed that the upper half is also satisfactory. If the lower half shows evidence of wear or damage, both upper and lower halves should be replaced. Never replace one half without replacing the other half.

Checking Clearance

To obtain the most accurate results with Plastigage, (or its equivalent) a wax-like plastic material which will compress evenly between the bearing and journal surfaces without damaging either surface, certain precautions should be observed. If the engine is out of the vehicle and upside down, the crankshaft will rest on the upper bearings and the total clearance can be measured between the lower bearing and journal. If the engine is to remain in the vehicle, the crankshaft should be supported both front and rear (damper and flywheel) to remove the clearance from the upper bearing. The total

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clearance can then be measured between the lower bearing and journal.

NOTE: To assure the proper seating of the crankshaft all bearing cap bolts should be at their specified torque. In addition, preparatory to checking fit of bearings, the surface of the crankshaft journal and bearing should be wiped clean of oil.

1. With the oil pan and oil pump removed, and starting with the rear main bearing, remove bearing cap and wipe oil from journal and bearing cap.
2. Place a piece of gauging plastic the full width of the bearing (parallel to the crankshaft) on the journal (fig. 40).

CAUTION: Do not rotate the crankshaft while the gauging plastic is between the bearing and journal.

3. Install the bearing cap and evenly torque the retaining bolts to specifications.
4. Remove bearing cap. The flattened gauging plastic will be found adhering to either the bearing shell or journal.
5. On the edge of gauging plastic envelope there is a graduated scale which is correlated in thousandths of an inch. Without removing the gauging plastic measure its compressed width (at the widest point) with the graduations on the gauging plastic envelope (fig. 41).

NOTE: Normally, main bearing journals wear evenly and are not out-of-round. However, if a bearing is being fitted to an out-of-round journal (.001" max.), be sure to fit to the maximum diameter of the journal. If the bearing is fitted to the minimum diameter and the journal is out-of-round .001", interference between the bearing and journal will result in rapid bearing failure. If the flattened gauging plastic tapers toward the middle or ends, there is a difference in clearance indicating taper, low spot or other irregularity of the bearing or journal. Be sure to measure the journal with a micrometer if the flattened gauging plastic indicates more than .001" difference.

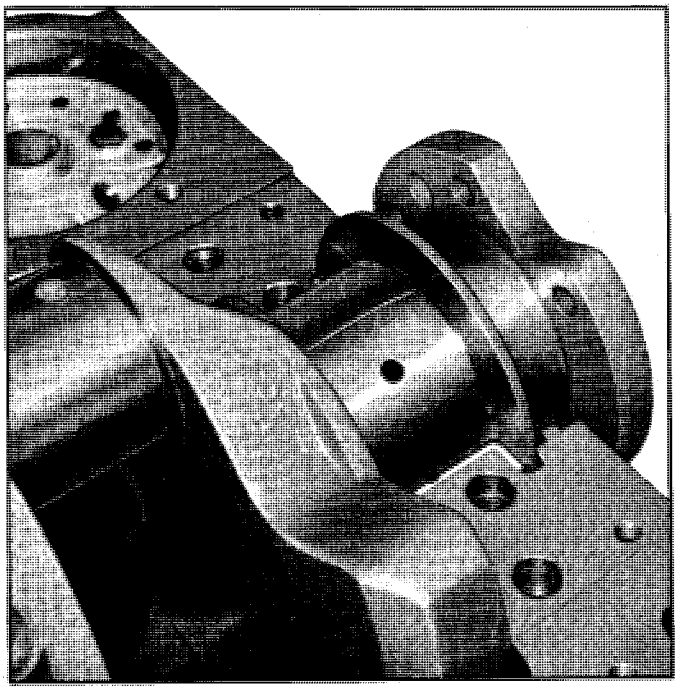


Fig. 40—Gauging Plastic on Journal

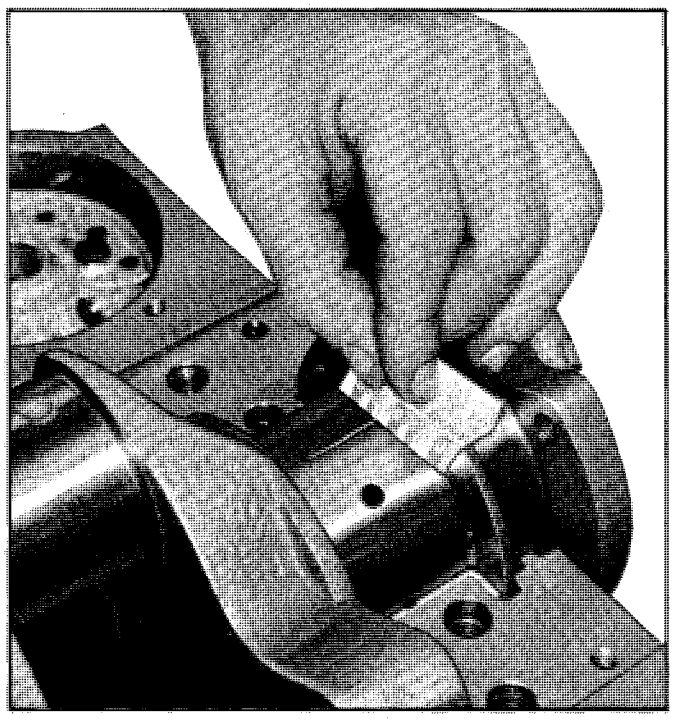


Fig. 41—Measuring Gauging Plastic

6. If the bearing clearance is within specifications, the bearing insert is satisfactory. If the clearance is not within specifications, replace the insert. Always replace both upper and lower insert as a unit.

NOTE: If a new bearing cap is being installed and clearance is less than .001", inspect for burrs or nicks; if none are found then install shims as required.

7. A Std., .001" or .002" undersize bearing may produce the proper clearance. If not, it will be necessary to regrind the crankshaft journal for use with the next undersize bearing.
8. Proceed to the next bearing. After all bearings have been checked rotate the crankshaft to see that there is no excessive drag.
9. Measure crankshaft end play (see specifications) by forcing the crankshaft to the extreme front position. Measure at the front end of the rear main bearing with a feeler gauge (fig. 42).
10. Install a new rear main bearing oil seal in the cylinder block and main bearing cap.

Replacement

NOTE: Main bearings may be replaced with or without removing the crankshaft.

With Crankshaft Removal

1. Remove and inspect the crankshaft.

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2. Remove the main bearings from the cylinder block and main bearing caps.
3. Coat bearing surfaces of new, correct size, main bearings with oil and install in the cylinder block and main bearing caps.
4. Install the crankshaft.

Without Crankshaft Removal

1. With oil pan, oil pump and spark plugs removed, remove cap on main bearing requiring replacement and remove bearing from cap.
2. On the In Line engine crankshaft, the rear main journal has no oil hole. Replace the rear main bearing upper half as follows:
   a. Use a small drift punch and hammer to start the upper bearing half rotating out of block.
   b. Use a pair of pliers (with taped jaws) to hold the bearing thrust surface to the oil slinger and rotate the crankshaft to remove bearing (fig. 43).
   c. Oil new selected size upper bearing and insert plain (unnotched) end between crankshaft and indented or notched side of block.
   d. Use pliers as in removing to rotate bearing into place. The last 1/4" movement may be done by holding just the slinger with the pliers or tap in place with a drift punch.
3. All other crankshaft journals (In Line and V8) have oil holes. Replace the main bearing upper half as follows:
   a. Install a main bearing removing and installing tool in oil hole in crankshaft journal.

   NOTE: If such a tool is not available, a cotter pin may be bent as required to do the job.

   b. Rotate the crankshaft clockwise as viewed from the front of engine. This will roll upper bearing out of block.

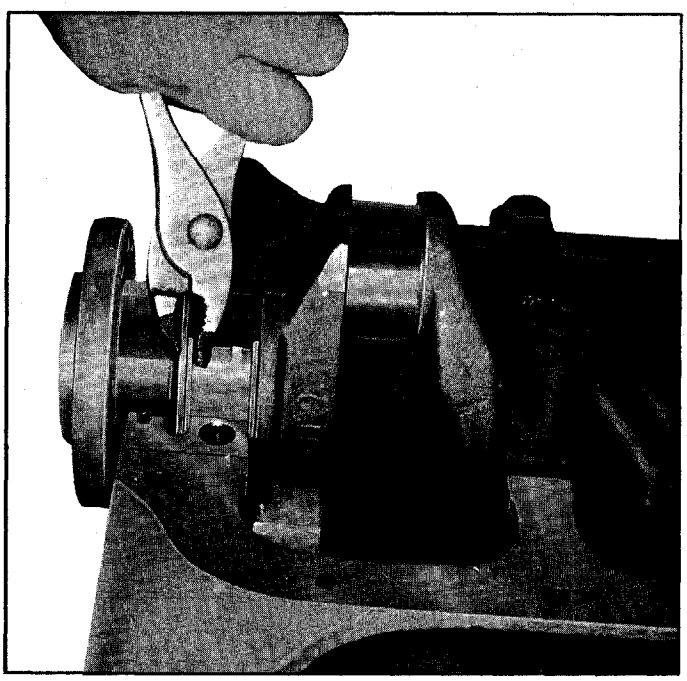


Fig. 43—Replacing Upper Rear Main Bearing (In Line)

   c. Oil new selected size upper bearing and insert plain (unnotched) end between crankshaft and indented or notched side of block. Rotate the bearing into place and remove tool from oil hole in crankshaft journal.
4. Oil new lower bearing and install in bearing cap.
5. Install main bearing cap with arrows pointing toward front of engine.
6. Torque main bearing cap bolts to specifications.

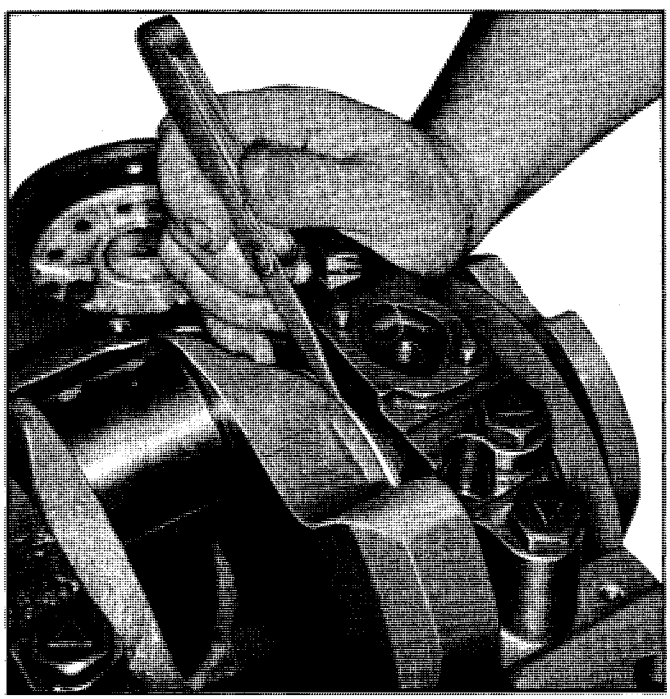


Fig. 42—Measuring Crankshaft End Play

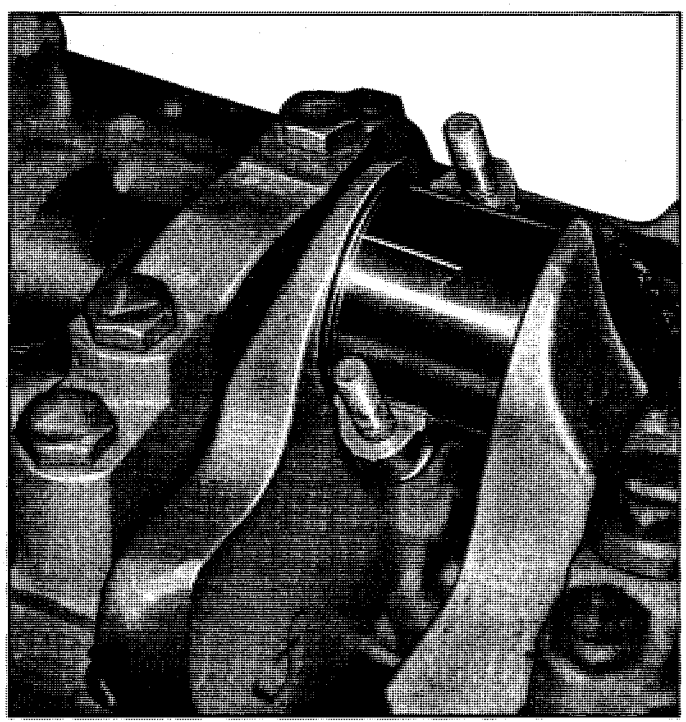


Fig. 44—Gauging Plastic on Crankpin

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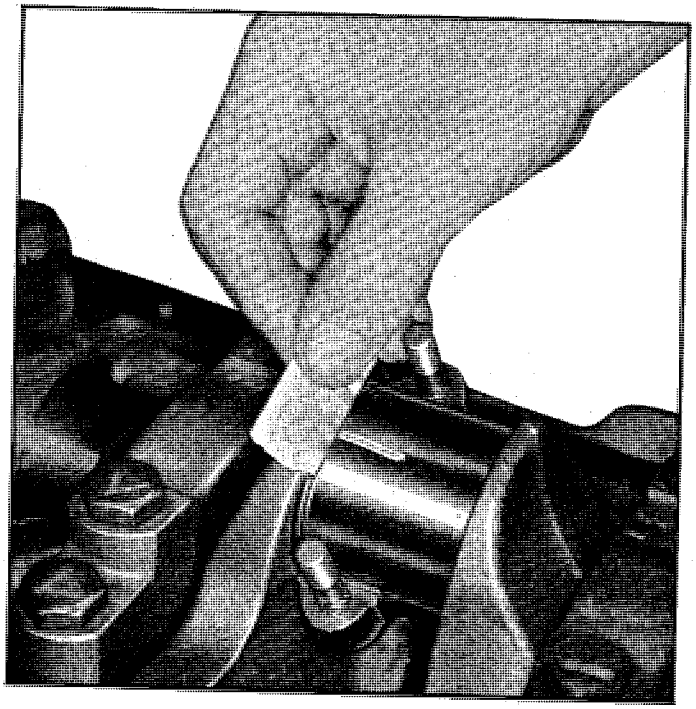


Fig. 45—Measuring Gauging Plastic

CONNECTING ROD BEARINGS

Connecting rod bearings are of the precision insert type and do not utilize shims for adjustment. DO NOT FILE RODS OR ROD CAPS. If clearances are found to be excessive a new bearing will be required. Bearings are available in standard size and .001" and .002" undersize for use with new and used standard size crankshafts, and in .010" and .020" undersize for use with reconditioned crankshafts.

Inspection and Replacement

1. With oil pan and oil pump removed, remove the connecting rod cap and bearing.
2. Inspect the bearing for evidence of wear or damage. (Bearings showing the above should not be reinstalled).
3. Wipe the bearings and crankpin clean of oil.
4. Measure the crankpin for out-of-round or taper with a micrometer. If not within specifications replace or recondition the crankshaft. If within specifications and a new bearing is to be installed, measure the maximum diameter of the crankpin to determine new bearing size required.
5. If within specifications measure new or used bearing clearances with Plastigage or its equivalent.

   NOTE: If a bearing is being fitted to an out-of-round crankpin, be sure to fit to the maximum diameter of the crankpin. If the bearing is fitted to the minimum diameter and the crankpin is out-of-round .001", interference between the bearing and crankpin will result in rapid bearing failure.

   a. Place a piece of gauging plastic the full width of the crankpin (parallel to the crankshaft) (fig. 44).
   b. Install the bearing in the connecting rod and cap.
   c. Install the bearing cap and evenly torque nuts to specifications.

   CAUTION: Do not turn the crankshaft with the gauging plastic installed.

   d. Remove the bearing cap and using the scale on the gauging plastic envelope, measure the gauging plastic width at the widest point (fig. 45).
6. If the clearance exceeds specifications select a new, correct size, bearing and remeasure the clearance.
7. Coat the bearing surface with oil, install the rod cap and torque nuts to specifications.
8. When all connecting rod bearings have been installed tap each rod lightly (parallel to the crankpin) to make sure they have clearance.
9. Measure all connecting rod side clearances (see specifications), between the connecting rod cap and side of crankpin on In Line engines (fig. 46) or between connecting rod caps on V8 engines (fig. 47).

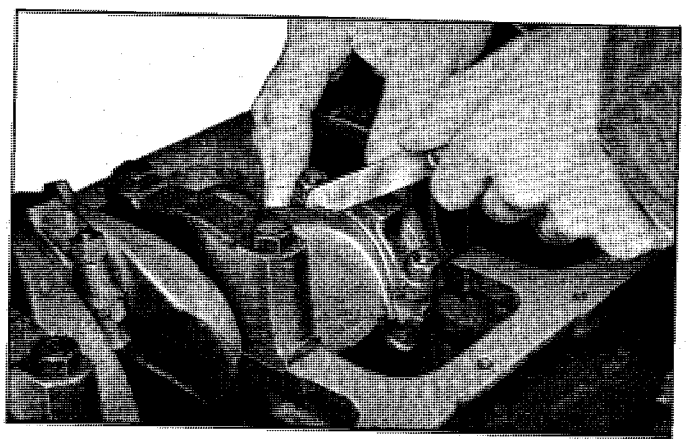


Fig. 46—Measuring Connecting Rod Side Clearance (In Line)

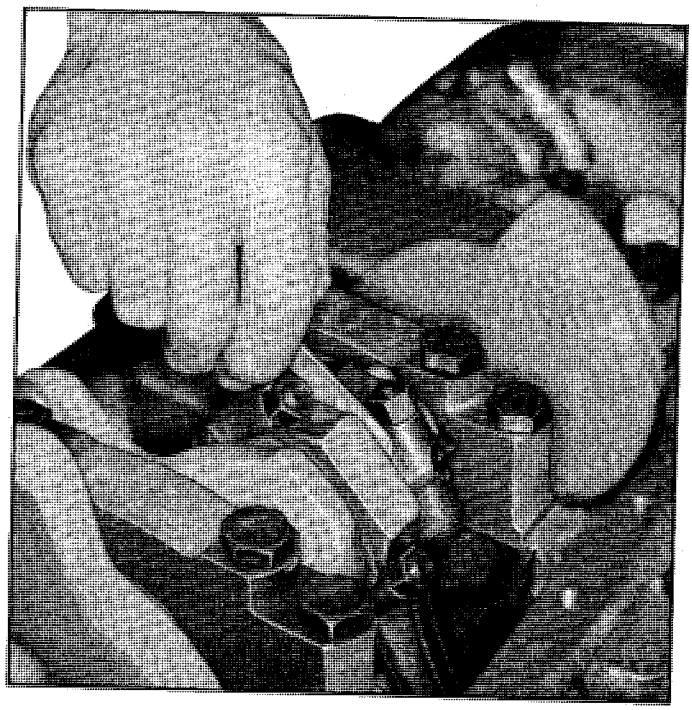


Fig. 47—Measuring Connecting Rod Side Clearance (V8)

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CONNECTING ROD AND PISTON ASSEMBLIES

Removal

1. With oil pan, oil pump and cylinder head removed, use a ridge reamer to remove any ridge and/or deposits from the upper end of the cylinder bore.

   NOTE: Before ridge and/or deposits are removed, turn crankshaft until piston is at the bottom of stroke and place a cloth on top of piston to collect the cuttings. After ridge and/or deposits are removed, turn crankshaft until piston is at top of stroke and remove cloth and cuttings.

2. Inspect connecting rods and connecting rod caps for cylinder identification. If necessary mark them.
3. Remove connecting rod cap and install Tool J-5239 (3/8") or J-6305 (11/32") on studs. Push connecting rod and piston assembly out of top of cylinder block (fig. 48).

   NOTE: It will be necessary to turn the crankshaft slightly to disconnect some of the connecting rod and piston assemblies and push them out of the cylinder.

Disassembly

1. Remove connecting rod bearings from connecting rods and caps.

   NOTE: If connecting rod bearings are being reused, place them in a rack so they may be reinstalled in their original rod and cap.

2. Remove piston rings by expanding them and sliding them off the pistons. Tools J-8020 (3-9/16"), J-8021 (3-7/8"), J-8032 (4"), J-22147 (4-3/32") and J-22250 (4-1/4") are available for this purpose.
3. Using Tool J-9510 for In Line and 283, 327, 350 cu. in. V8 (fig. 49) or Tool J-6994 for 396 and 427 cu. in. V8 (fig. 50), place connecting rod and piston assembly in an arbor press with piston on Support then using Remover, press piston pin out of connecting rod and piston.
4. Remove assembly from arbor press and remove tools, piston pin, connecting rod and piston.

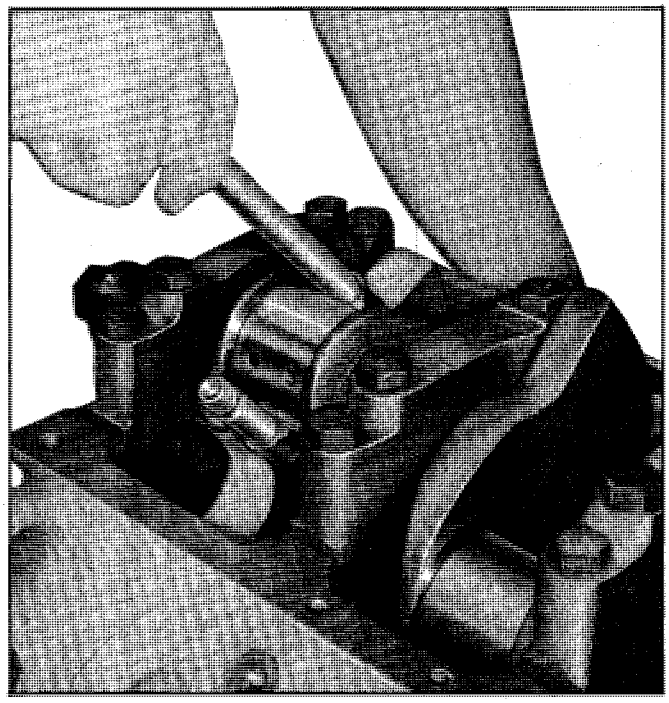


Fig. 48—Removing Connecting Rod and Piston Assemblies

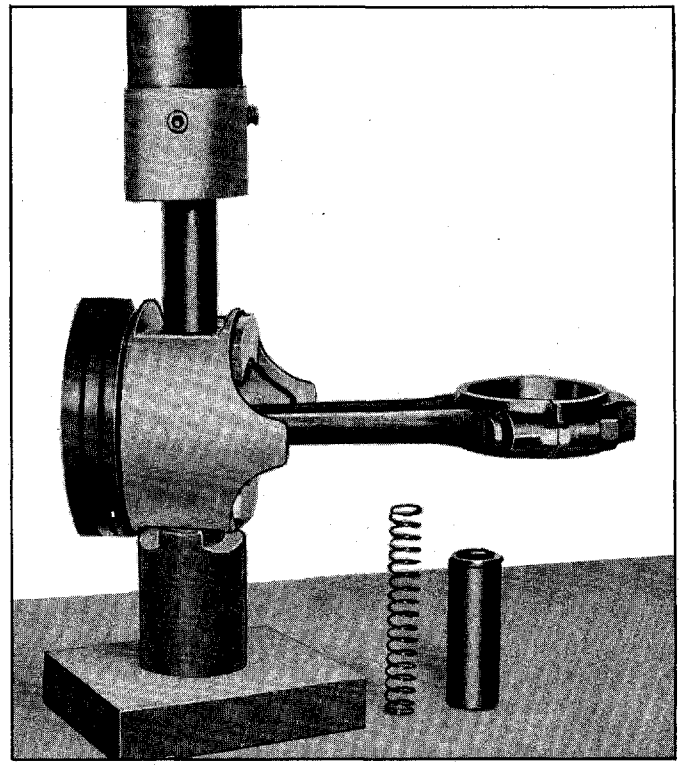


Fig. 49—Removing Piston Pin (In Line and 283, 327, 350 V8)

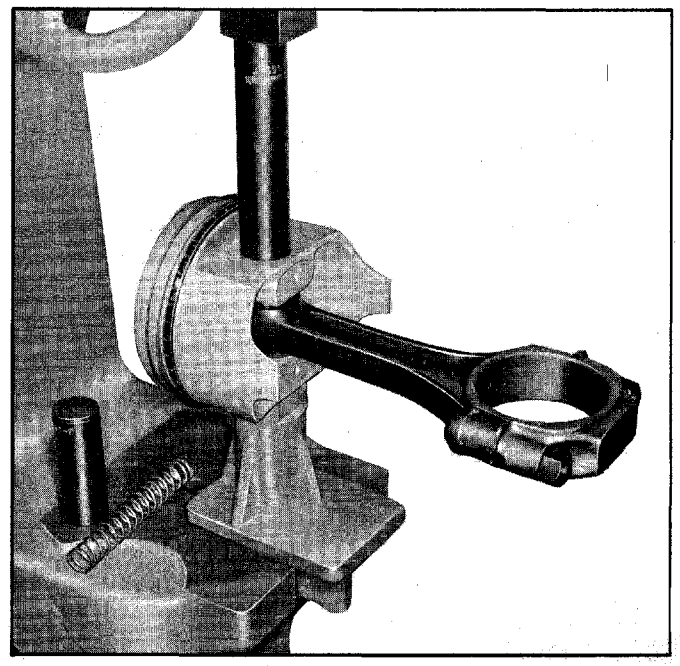


Fig. 50—Removing Piston Pin (396 and 427 V8)

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Cleaning and Inspection

Connecting Rods

Wash connecting rods in cleaning solvent and dry with compressed air.

Check for twisted or bent rods and inspect for nicks or cracks. Replace connecting rods that are damaged.

Pistons

Clean varnish from piston skirts and pins with a cleaning solvent. DO NOT WIRE BRUSH ANY PART OF THE PISTON. Clean the ring grooves with a groove cleaner and make sure oil ring holes and slots are clean.

Inspect the piston for cracked ring lands, skirts or pin bosses, wavy worn ring lands, scuffed or damaged skirts, eroded areas at top of the piston. Replace pistons that are damaged or show signs of excessive wear.

Inspect the grooves for nicks or burrs that might cause the rings to hang up.

Measure piston skirt (across center line of piston pin) and check clearance as outlined under "Piston Selection".

Piston Pins

The piston pin clearance is designed to maintain adequate clearance under all engine operating conditions. Because of this, the piston and piston pin are a matched set and not serviced separately.

Inspect piston pin bores and piston pins for wear. Piston pin bores and piston pins must be free of varnish or scuffing when being measured. The piston pin should be measured with a micrometer and the piston pin bore should be measured with a dial bore gauge or an inside micrometer. If clearance is in excess of the .001" wear limit, the piston and piston pin assembly should be replaced.

Assembly

1. Lubricate piston pin holes in piston and connecting rod to facilitate installation of pin.
2. Using Tool J-9510 for In Line and 283, 327, 350 cu. in. V8 (fig. 51) or Tool J-6994 for 396 and 427 cu. in. V8 (fig. 52) place Support with spring and Pilot in place on an arbor press.
3. Position piston on connecting rod with appropriate side of piston (fig. 53) and oiling hole in connecting

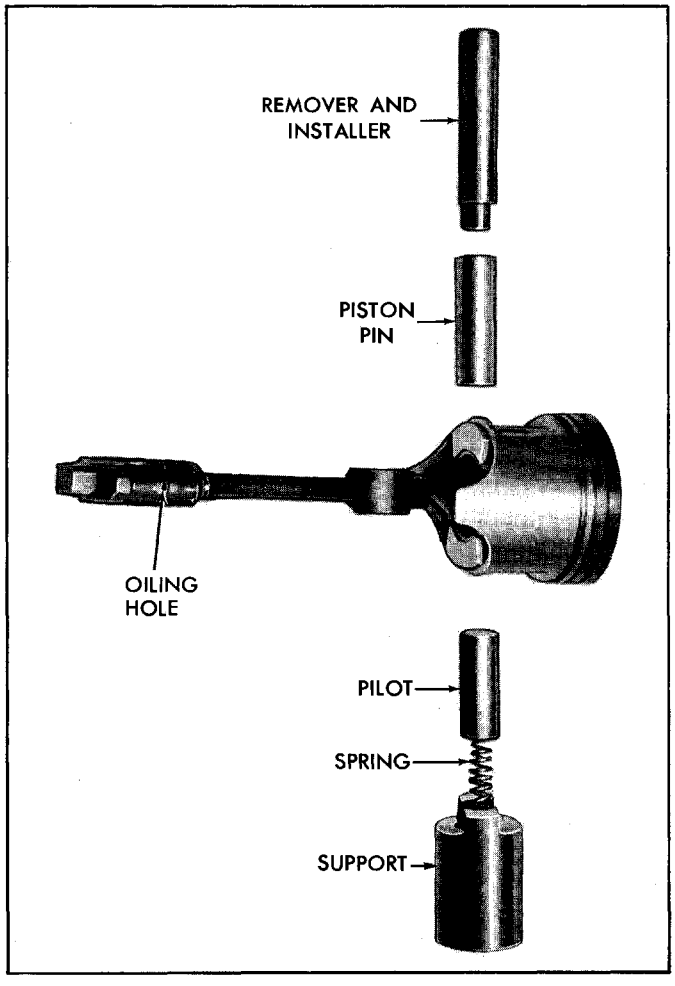


Fig. 51—Piston Pin and Tool Layout (In Line and 283, 327, 350 V8)

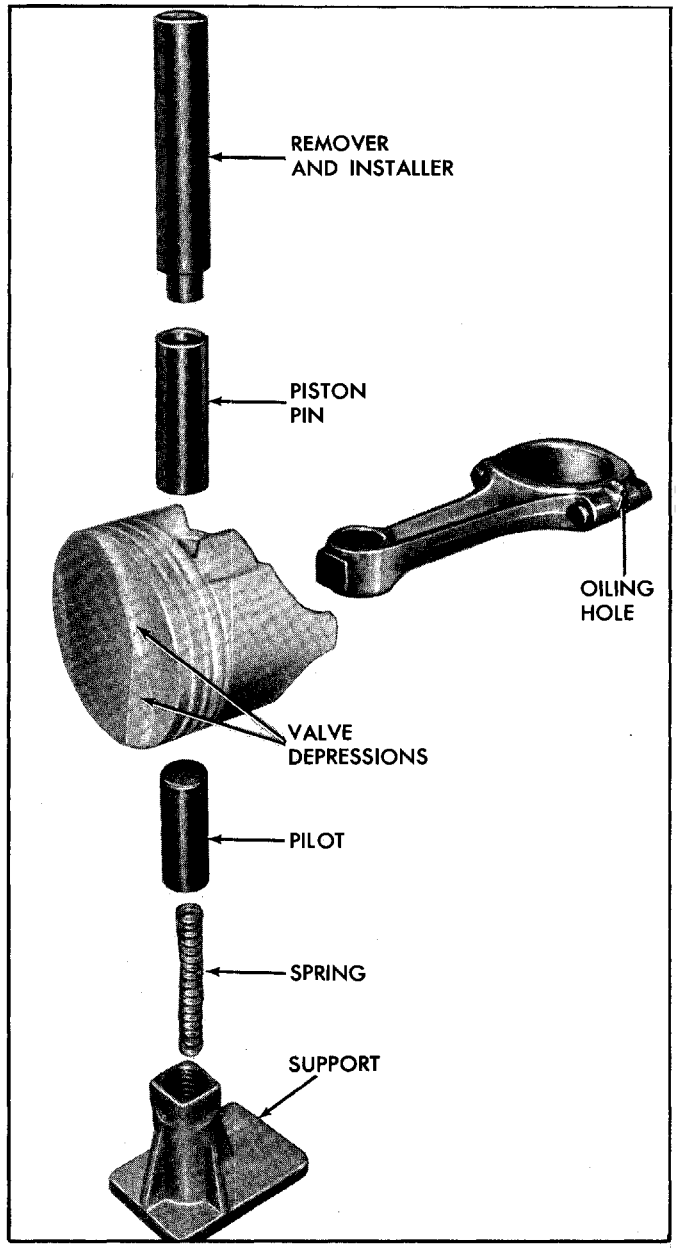


Fig. 52—Piston Pin and Tool Layout (396 and 427 V8)

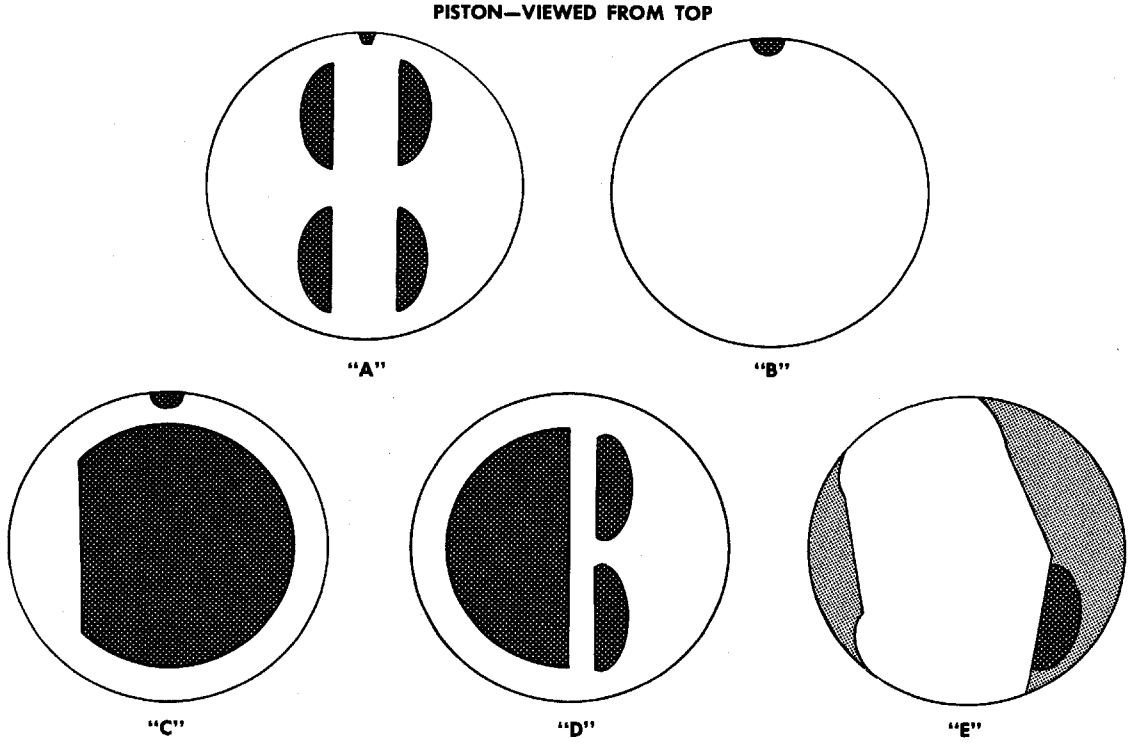
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rod aligned (figs. 51 or 52).

4. Place piston on support, indexing pilot through piston and rod.
5. Place Installer on piston pin, start piston pin into piston and press on installer until pilot bottoms in support.
6. Remove installer from connecting rod and piston assembly and check piston for freedom of movement on piston pin.

Piston Rings

All compression rings are marked on the upper side of the ring. When installing compression rings, make sure the marked side is toward the top of the piston.



ENGINE	PISTON	CYLINDER	SIDE OF PISTON ALIGNED WITH OILING HOLE
153 CU. IN.	"A"	ALL	RIGHT
194 CU. IN.	"B"	ALL	RIGHT
230 CU. IN.	"A"	ALL	RIGHT
250 CU. IN.	"C"	ALL	RIGHT
283 CU. IN.	"A"	1-3-5-7	RIGHT
		2-4-6-8	LEFT
327 CU. IN. (EXCEPT 325 & 350 HP)	"A"	1-3-5-7	RIGHT
		2-4-6-8	LEFT
327 CU. IN. (325 & 350 HP)	"D"	ALL	RIGHT
350 CU. IN.	"A"	1-3-5-7	RIGHT
		2-4-6-8	LEFT
396 CU. IN.	"E"	ALL	RIGHT
427 CU. IN.	"E"	ALL	RIGHT

Fig. 53—Connecting Rod and Piston Relationship

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The top ring is chrome faced, or treated with molybdenum for maximum life.

The oil control rings are of the three piece type, consisting of two segments (rails) and a spacer.

1. Select rings comparable in size to the piston being used.
2. Slip the compression ring in the cylinder bore; then press the ring down into the cylinder bore about 1/4 inch (above ring travel). Be sure ring is square with cylinder wall.
3. Measure the space or gap between the ends of the ring with a feeler gauge (fig. 54).
4. If the gap between the ends of the ring is below specifications, remove the ring and try another for fit.
5. Fit each compression ring to the cylinder in which it is going to be used.
6. If the pistons have not been cleaned and inspected as previously outlined, do so.
7. Slip the outer surface of the top and second compression ring into the respective piston ring groove and roll the ring entirely around the groove (fig. 55) to make sure that the ring is free. If binding occurs at any point the cause should be determined, and if caused by ring groove, removed by dressing with a fine cut file. If the binding is caused by a distorted ring, check a new ring.
8. Install piston rings as follows (fig. 56).

   NOTE: Tools J-8020 (3 9/16"), J-8021 (3 7/8"), J-8032 (4"), J-22147 (4 3/32") and J-22250 (4 1/4") are available for this purpose.

   a. Install oil ring spacer in groove and insert anti-rotation tang in oil hole.
   b. Hold spacer ends butted and install lower steel oil ring rail with gap properly located.
   c. Install upper steel oil ring rail with gap properly located.
   d. Flex the oil ring assembly to make sure ring is free. If binding occurs at any point the cause should be determined, and if caused by ring groove removed by dressing groove with a fine cut file. If binding is caused by a distorted ring, check a new ring.
   e. Install second compression ring expander then ring with gaps properly located.
   f. Install top compression ring with gap properly located.
9. Proper clearance of the piston ring in its piston ring groove is very important to provide proper ring action and reduce wear. Therefore, when fitting new rings, the clearances between the surfaces of the ring and groove should be measured (fig. 57). (See Specifications).

Installation

NOTE: Cylinder bores must be clean before piston installation. This may be accomplished with a hot water and detergent wash or with a light honing as necessary. After cleaning, the bores should be swabbed several times with light engine oil and a clean cloth and then wiped with a clean dry cloth.

1. Lubricate connecting rod bearings and install in rods and rod caps.

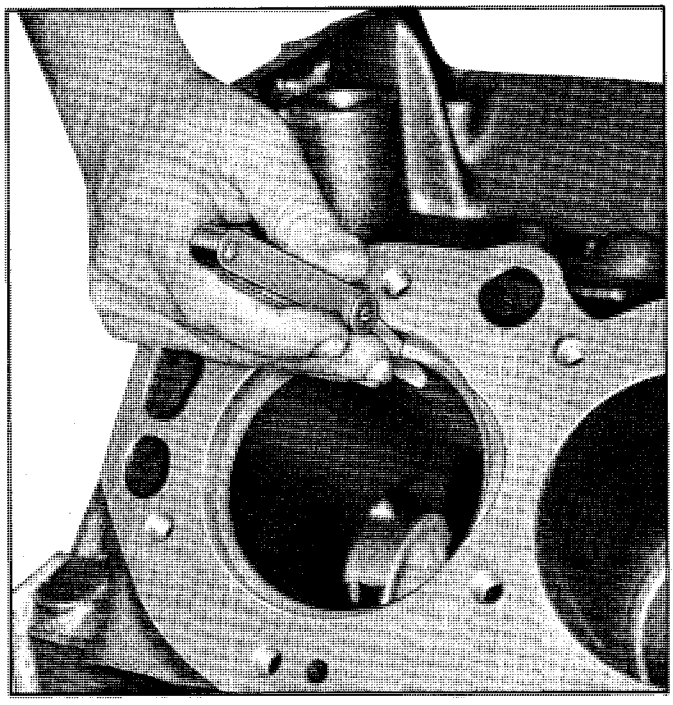


Fig. 54—Measuring Ring Gap

2. Lightly coat pistons, rings and cylinder walls with light engine oil.
3. With bearing caps removed, install Tool J-5239 (3/8") or J-6305 (11/32") on connecting rod bolts.

   CAUTION: Be sure ring gaps are properly positioned as previously outlined.

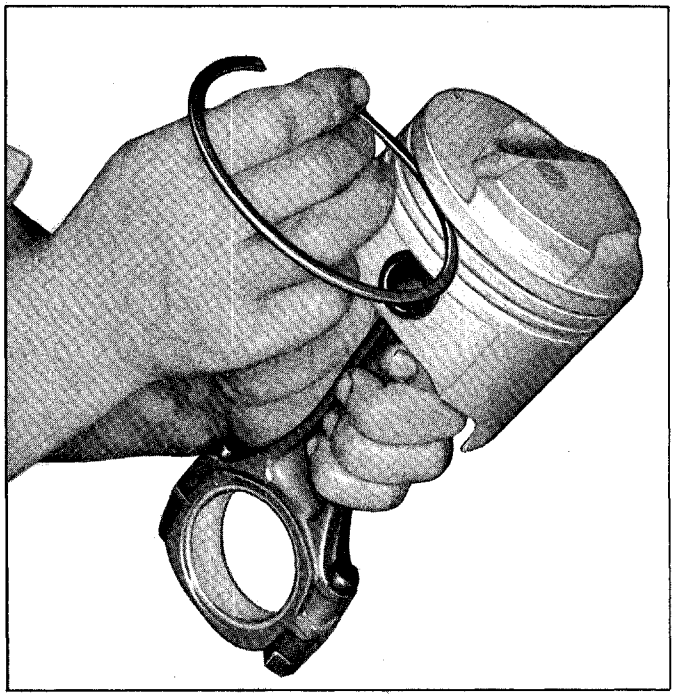


Fig. 55—Checking Ring in Groove

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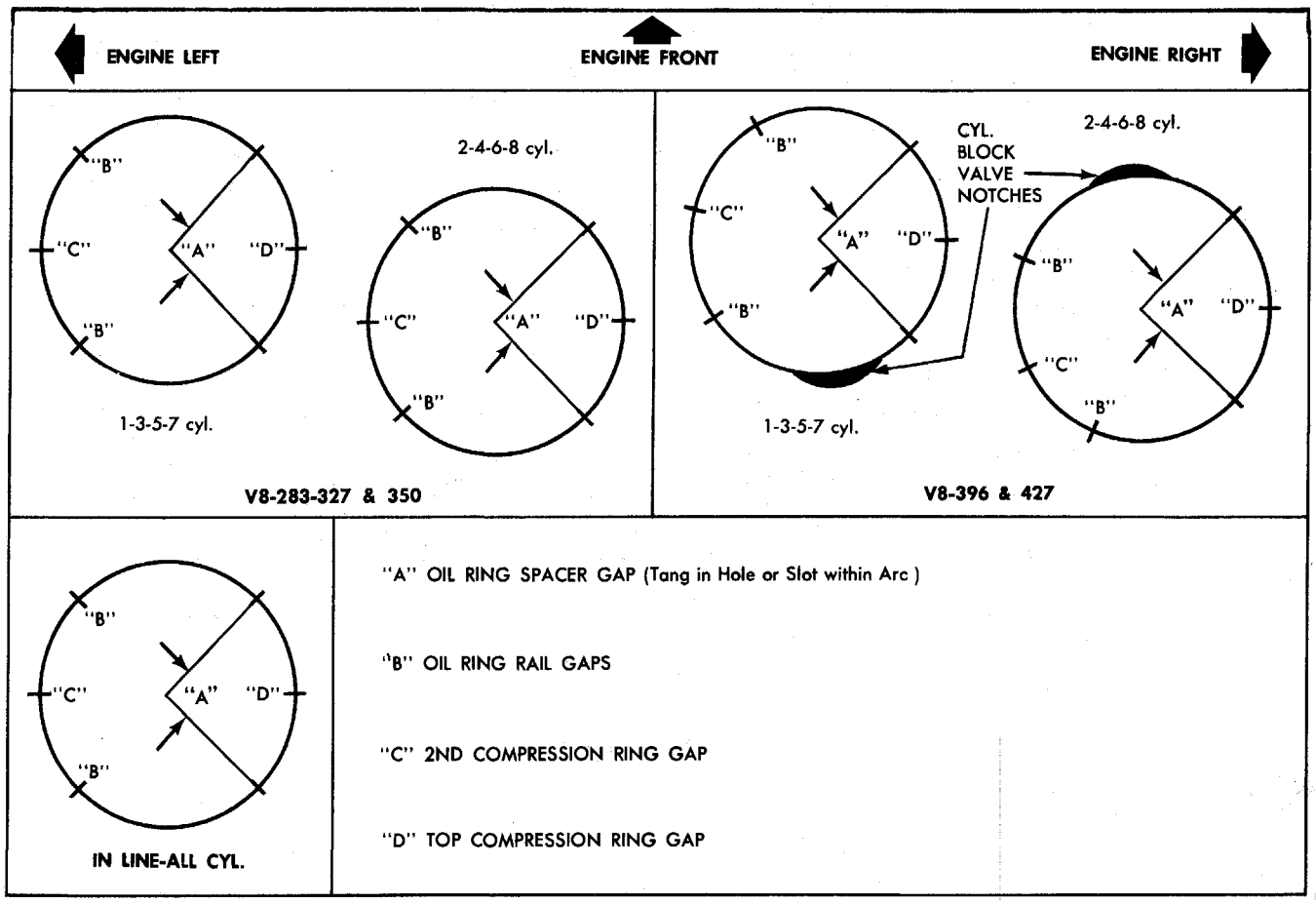


Fig. 56—Ring Gap Location

4. Install each connecting rod and piston assembly in its respective bore. Install with cylinder wall oiling hole in connecting rod towards camshaft (fig. 58). Use Tool J-8307 to compress the rings (fig. 59). Guide the connecting rod into place on the crankshaft journal with Tool J-5239 (3/8") or J-6305 (11/32"). Use a hammer handle and light blows to install the piston into the bore. Hold the ring compressor firmly against the cylinder block until all piston rings have entered the cylinder bore.
5. Remove Tool J-5239 or J-6305.
6. Install the bearing caps and torque nuts to specifications.

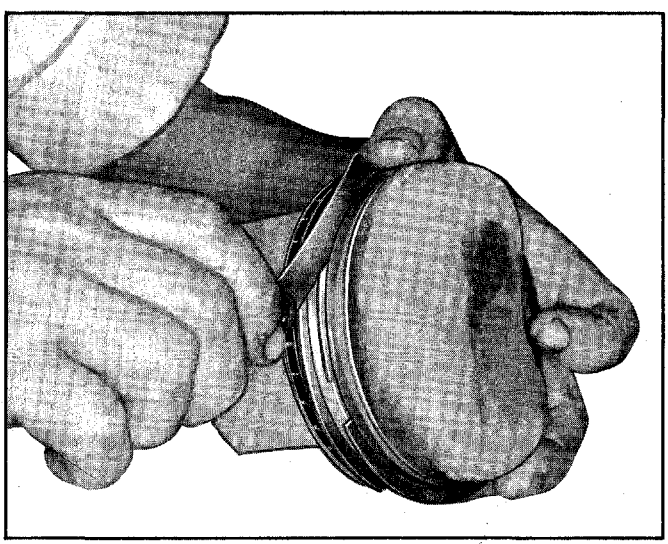


Fig. 57—Measuring Ring Groove Clearance

NOTE: If bearing replacement is required refer to "Connecting Rod Bearings".

NOTE: Be sure to install new pistons in the same cylinders for which they were fitted, and used pistons in the same cylinder from which they were removed. Each connecting rod and bearing cap should be marked, beginning at the front of the engine. On V8 engines 1, 3, 5 and 7 in the left bank and 2, 4, 6 and 8 in the right bank. The numbers on the connecting rod and bearing cap must be on the same side when installed in the cylinder bore. If a connecting rod is ever transposed from one block or cylinder to another, new bearings should be fitted and the connecting rod should be numbered to correspond with the new cylinder number.

CRANKSHAFT

The crankshaft can be removed while the engine is disassembled for overhaul, as previously outlined or without complete disassembly as outlined below.

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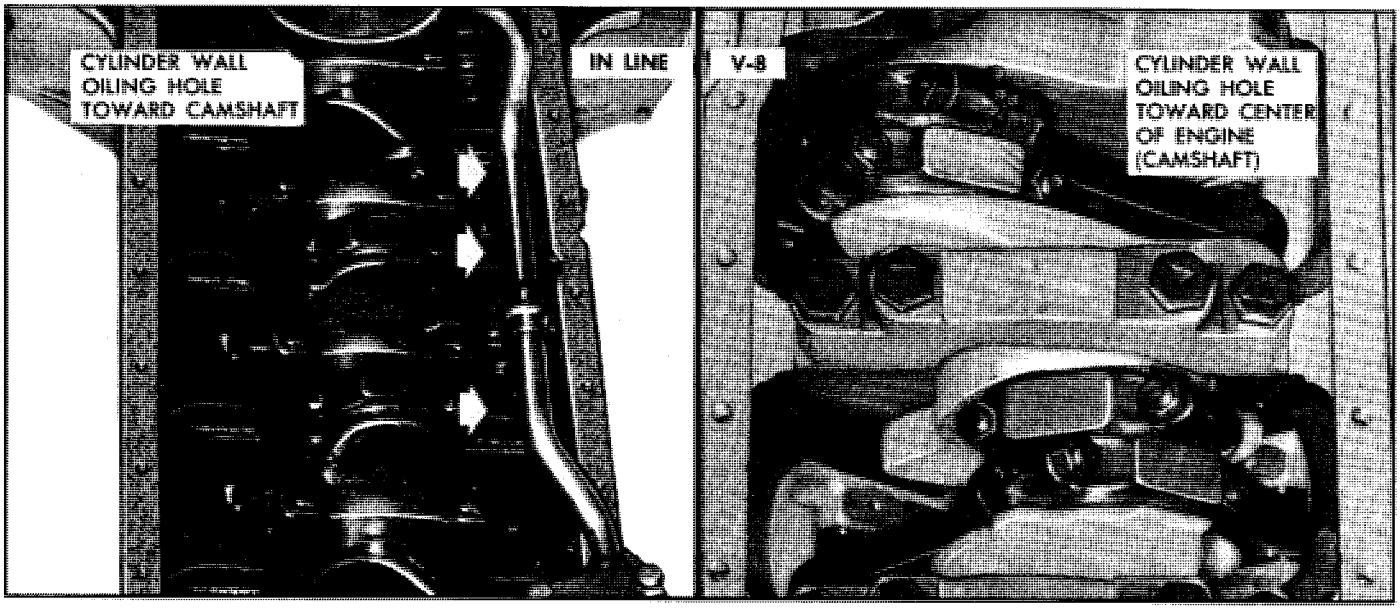


Fig. 58—Connecting Rod—Installed Position

Removal

1. With the engine removed from the vehicle and the transmission and/or clutch housing removed from the engine, mount engine in overhaul stand and clamp securely.
2. Remove the oil dip stick and oil dip stick tube, (if applicable).
3. Remove the starting motor, clutch assembly (if equipped) and flywheel.
4. Remove the spark plugs.
5. Remove crankshaft pulley and torsional damper.
6. Remove oil pan and oil pump.
7. Remove crankcase front cover, and if so equipped timing chain and camshaft sprocket.
8. Check the connecting rod caps for cylinder number identification. If necessary mark them.
9. Remove the connecting rod caps and push the pistons to top of bores.
10. Remove main bearing caps and lift crankshaft out of cylinder block.
11. Remove rear main bearing oil seal and main bearings from cylinder block and main bearing caps.

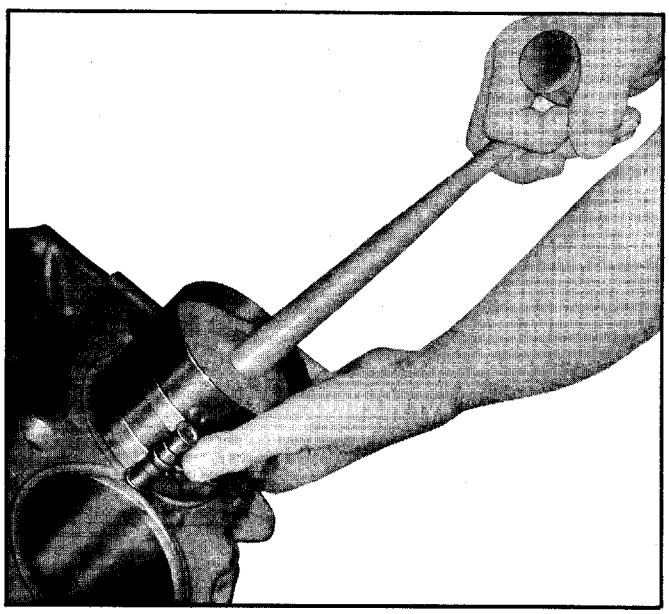


Fig. 59—Installing Connecting Rod and Piston Assemblies

Cleaning and Inspection

1. Wash crankshaft in solvent and dry with compressed air.
2. Measure dimensions of main bearing journals and crankpins with a micrometer for out-of-round, taper or undersize (see specifications).
3. Check crankshaft for run-out by supporting at the front and rear main bearings journals in "V" blocks and check at the front and rear intermediate journals with a dial indicator (see specifications).
4. Replace or recondition the crankshaft if out of specifications.

Sprocket or Gear Replacement (Refer to Fig. 60)

- On In Line engines, remove crankshaft gear using Tool J-8105, install using Tool J-5590.
- On 283, 327, and 350 cu. in. V8 engines, remove crankshaft sprocket using Tool J-5825, install using Tool J-5590.
- On 396 and 427 cu. in. V8 engines, exc. 427 H.D., remove crankshaft sprocket using Tool J-1619, install using Tool J-21058.

Installation

For installation of crankshaft, refer to the applicable steps under "Engine Assembly" previously outlined.

CAMSHAFT

Inspection

The camshaft bearing journals should be measured with a micrometer for an out-of-round condition. If the journals exceed .001" out-of-round, the camshaft should be replaced.

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The camshaft should also be checked for alignment. The best method is by use of "V" blocks and a dial indicator (fig. 61). The dial indicator will indicate the exact amount the camshaft is out of true. If it is out more than .002" dial indicator reading, the camshaft should be replaced.

On In Line engines inspect the camshaft gear and thrust plate for wear or damage. Measure the camshaft end play. This should be .001" to .005" (fig. 62).

Oil Nozzle Replacement (In Line)

1. Remove nozzle with pliers (fig. 63).
2. Drive new nozzle in place (oil hole in vertical position) using a suitable light plastic or rubber hammer.

Camshaft Gear Replacement (In Line)

1. If the inspection indicated that the shaft, gear or thrust plate should be replaced, the gear must be removed from the shaft. This operation requires the use of camshaft gear remover Tool J-971.
2. Place the camshaft through the gear remover, place end of remover on table of a press and press shaft out of gear (fig. 64).

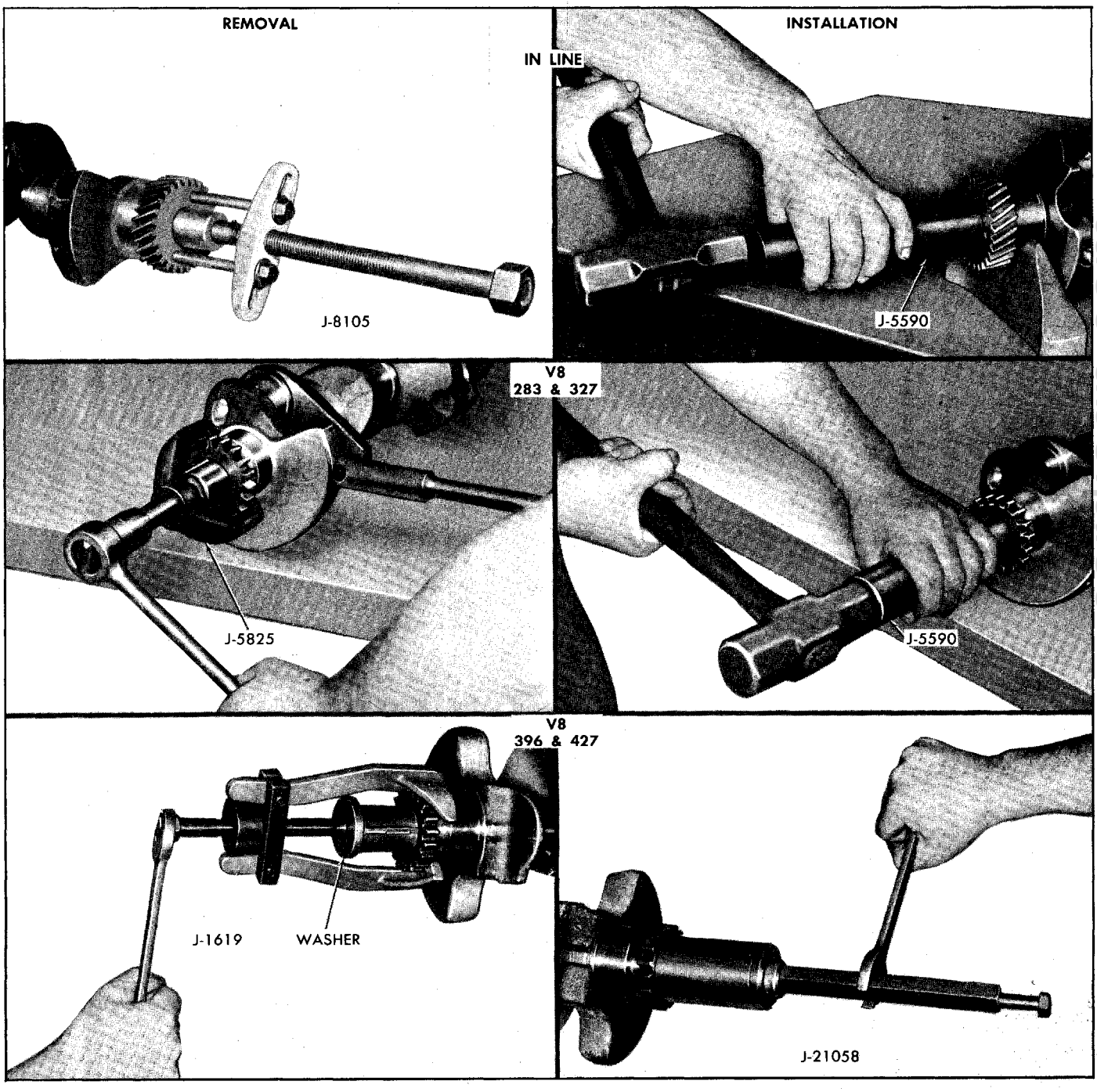


Fig. 60—Sprocket or Gear Replacement

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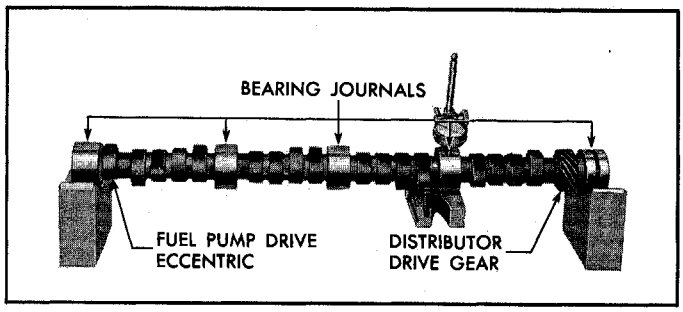


Fig. 61—Checking Camshaft Alignment

CAUTION: Thrust plate must be so positioned that woodruff key in shaft does not damage it when the shaft is pressed out of gear. Also, support the hub of the gear or the gear will be seriously damaged.

3. To assemble camshaft gear, thrust plate and gear spacer ring to camshaft, firmly support shaft at back of front journal in an arbor press.
4. Place gear spacer ring and thrust plate over end of shaft, and install woodruff key in shaft keyway. Install camshaft gear and press it onto the shaft until it bottoms against the gear spacer ring. The end clearance of the thrust plate should be .001" to .005" (fig. 62).

CAMSHAFT BEARINGS

Inspection

With the camshaft removed, inspect the bearings for evidence of wear or damage. (Bearings showing the above should be replaced).

Removal

Camshaft bearings can be replaced while engine is disassembled for overhaul, or without complete disassembly of the engine. To replace bearings without complete disassembly remove the camshaft and crankshaft, leaving cylinder heads attached and pistons in place. Before removing crankshaft, tape threads of connecting rod bolts to prevent damage to crankshaft. Fasten connecting rods against sides of engine so they will not be in way while replacing camshaft bearings.

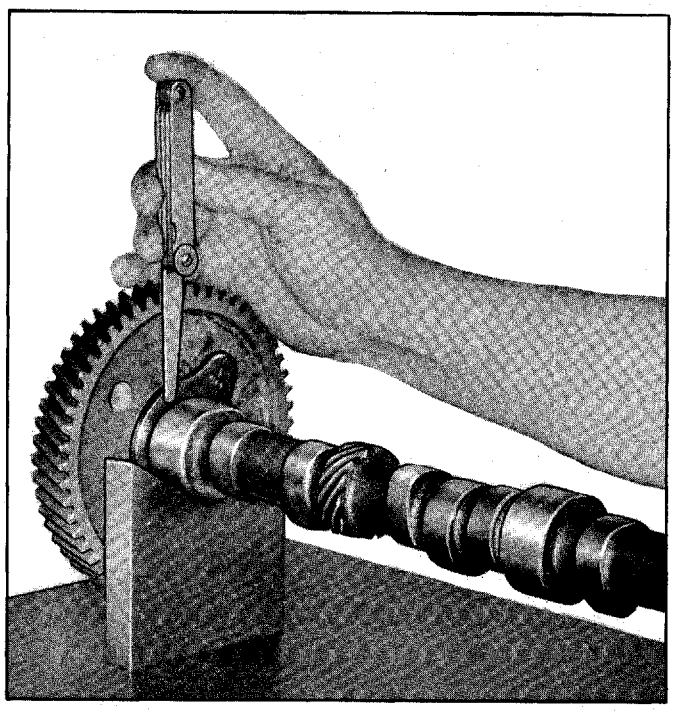


Fig. 62—Measuring Camshaft End Play

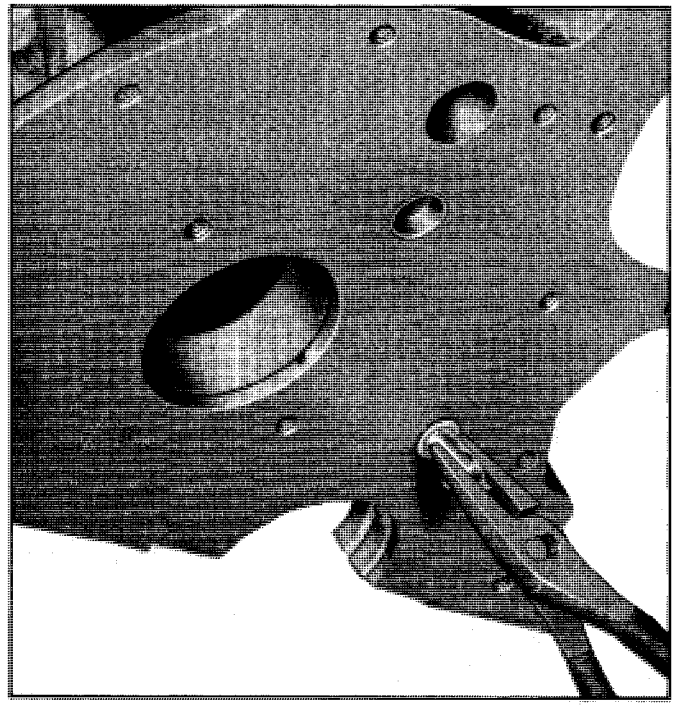


Fig. 63—Oil Nozzle Replacement (In Line)

1. With camshaft and crankshaft removed, drive camshaft rear plug from cylinder block.

   NOTE: This procedure is based on removal of the bearings nearest center of the engine first. With this method a minimum amount of turns are necessary to remove all bearings.

2. Using Tool Set J-6098, with nut then thrust washer installed to end of threads, index pilot in front camshaft bearing and install puller screw through pilot.
3. Install remover and installer tool with shoulder toward bearing, making sure a sufficient amount of threads are engaged.
4. Using two wrenches, hold puller screw while turning nut. When bearing has been pulled from bore, remove remover and installer tool and bearing from puller screw (fig. 65).
5. Remove remaining bearings (except front and rear) in the same manner. It will be necessary to index pilot in rear camshaft bearing to remove the rear intermediate bearing.
6. Assemble remover and installer tool on driver handle and remove front and rear camshaft bearings by driving towards center of cylinder block (fig. 66).

Installation

The front and rear camshaft bearings should be installed first. These bearings will act as guides for the pilot and center the remaining bearings being pulled into place.

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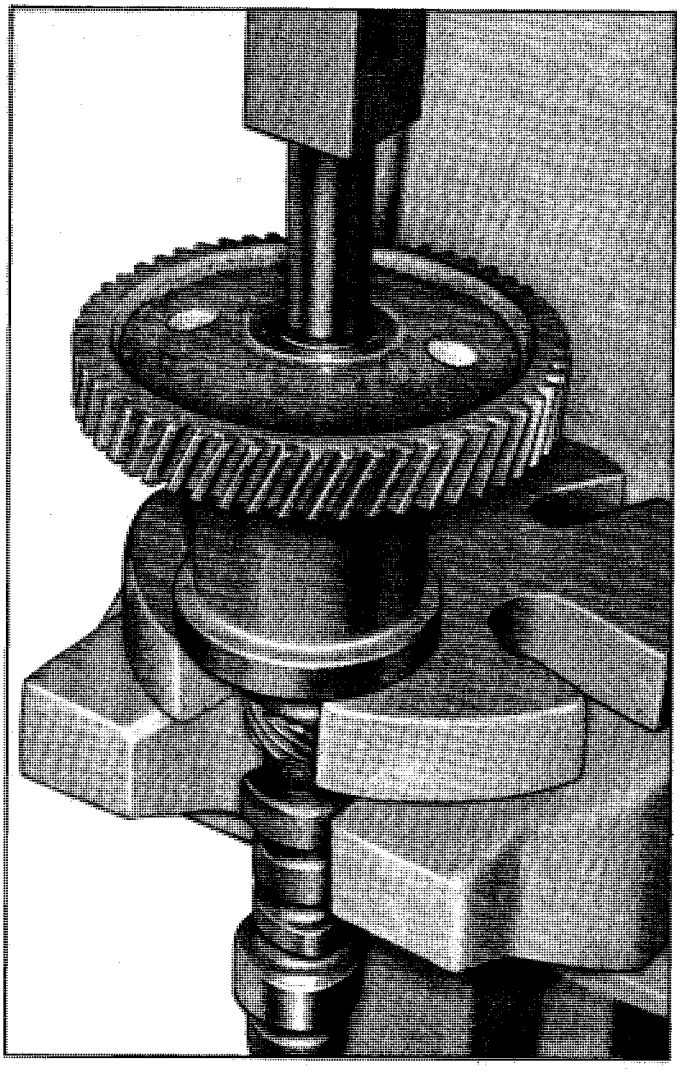


Fig. 64—Removing Camshaft Gear (In Line)

1. Assemble remover and installer tool on driver handle and install front and rear camshaft bearings by driving towards center of cylinder block (fig. 66).

   CAUTION: Oil holes in bearings must line up with oil holes in cylinder block.

2. Using Tool Set J-6098, with nut then thrust washer installed to end of threads, index pilot in front camshaft bearing and install puller screw through pilot.
3. Index camshaft bearing in bore, then install remover and installer tool on puller screw with shoulder toward bearing.
4. Using two wrenches, hold puller screw while turning nut. After bearing has been pulled into bore, remove the remover and installer tool from puller screw and check alignment of oil hole in camshaft bearing (fig. 65).
5. Install remaining bearings in the same manner. It will be necessary to Index pilot in the rear camshaft bearing to install the rear intermediate bearing.
6. Install a new camshaft rear plug.

   NOTE: Plug should be installed flush to 1/32" deep and be parallel with rear surface of cylinder block.

CYLINDER BLOCK

Cleaning and Inspection

1. Wash cylinder block thoroughly in cleaning solvent and clean all gasket surfaces.
2. Remove oil gallery plugs and clean all oil passages.

   NOTE: These plugs may be removed with a sharp punch or they may be drilled and pried out.

3. Clean and inspect water passages in the cylinder block.
4. Inspect the cylinder block for cracks in the cylinder walls, water jacket valve lifter bores and main bearing webs.
5. Measure the cylinder walls for taper, out-of-round or excessive ridge at top of ring travel. This should be done with a dial indicator. Set the gauge so that the thrust pin must be forced in about 1/4" to enter gauge in cylinder bore. Center gauge in cylinder and turn dial to "0". Carefully work gauge up and down cylinder to determine taper and turn it to different points around cylinder wall to determine the out-of-round condition. If cylinders were found to exceed specifications honing or boring will be necessary (fig. 67).

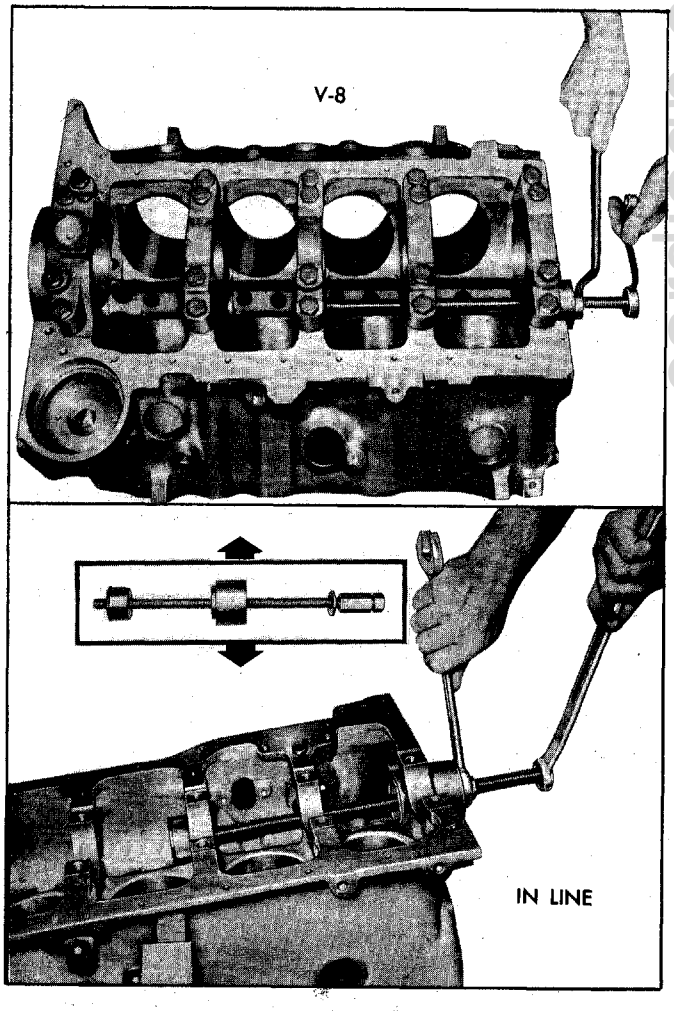


Fig. 65—Replacing Center Camshaft Bearing

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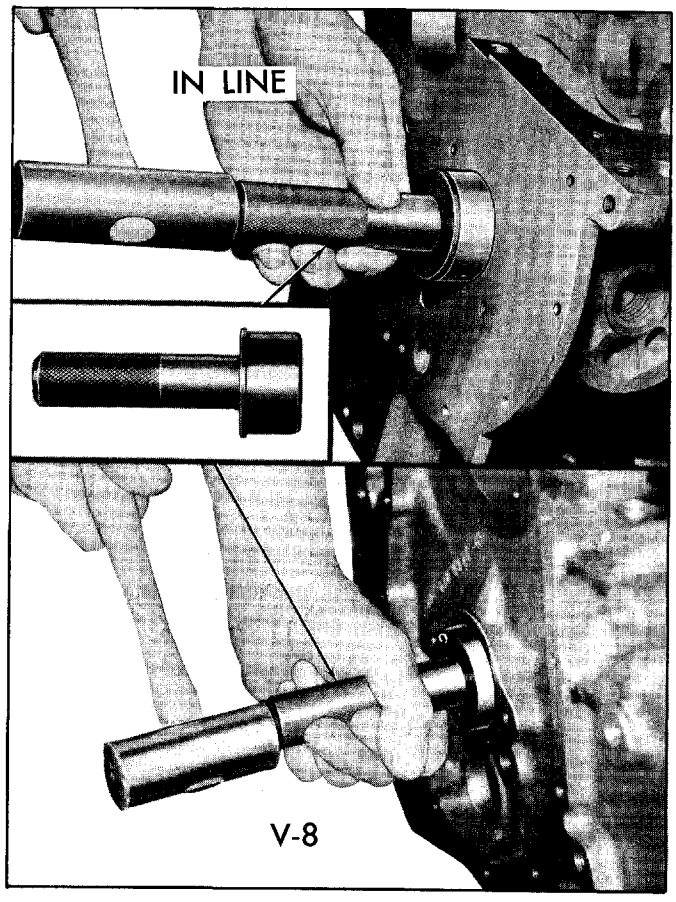


Fig. 66—Replacing Front Camshaft Bearing

Oil Filter Bypass Valve Inspection and Replacement

In Line Engines

With the oil filter removed, check the spring and fibre valve for operation. Inspect for a cracked or broken valve. If replacement is necessary, remove valve by prying it out with a screw driver. Install and seat a new valve by taping it in place, using a 9/16 thin-wall deep socket (fig. 68).

V8 Engines

With the oil filter removed, check the spring and fibre

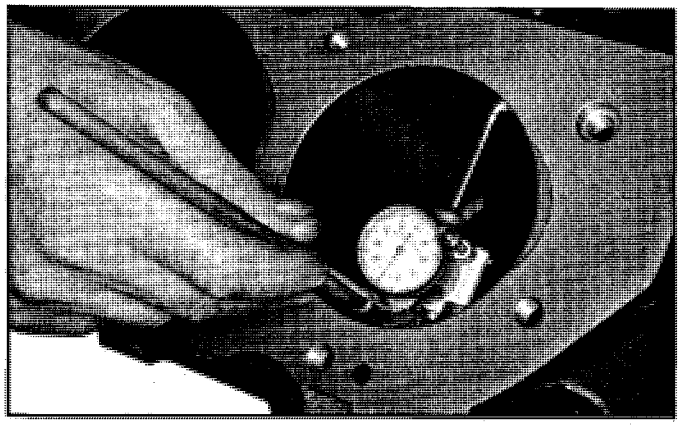


Fig. 67—Measuring Cylinder Bore

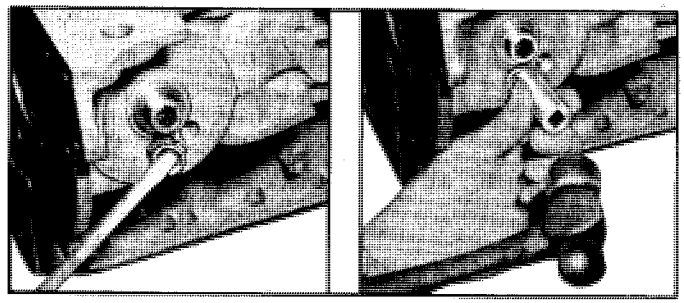


Fig. 68—Oil Filter Bypass Valve (In Line)

valve for operation. Inspect for a cracked or broken valve. If replacement is necessary, remove valve adapter and seal, clean valve chamber in cylinder block and install a new valve and reinstall adapter with a new seal and gasket. Torque bolts to specifications (fig. 69).

Distributor Lower Bearing and Thrust Washer Replacement (In Line)

The distributor lower bearing is a bronze bushing pressed into the lower side of the engine block. Its upper inside diameter pilots the distributor shaft and the outside diameter extending below the block pilots the oil pump.

Some engines have a thrust washer at the upper end of the bushing bore. The thrust washer, where used, may be replaced at the same time the bushing is replaced.

The lower bushing will ordinarily require only a clearance or wear check during engine overhaul. When distributor shaft-to-bushing clearance exceeds .0035",

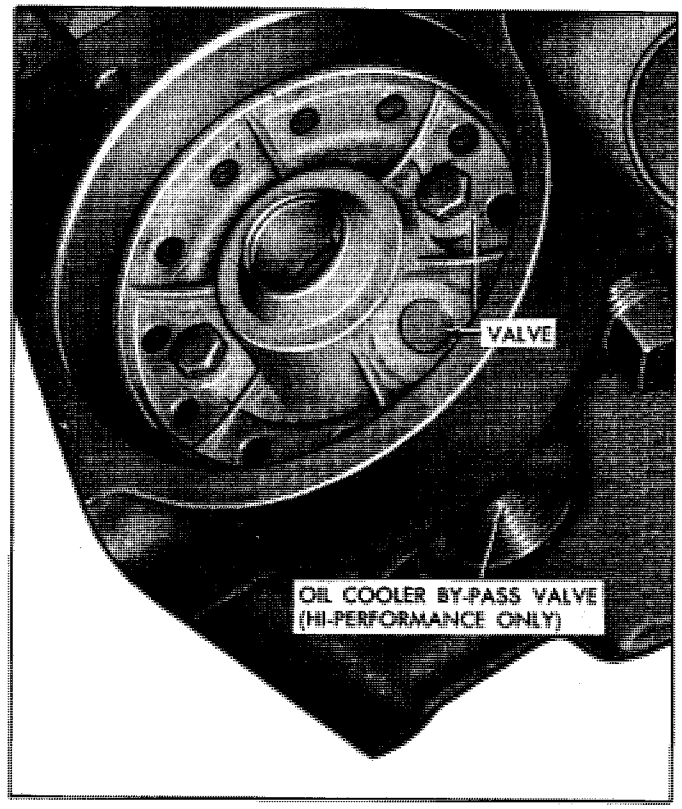


Fig. 69—Oil Filter Bypass Valve (V8)

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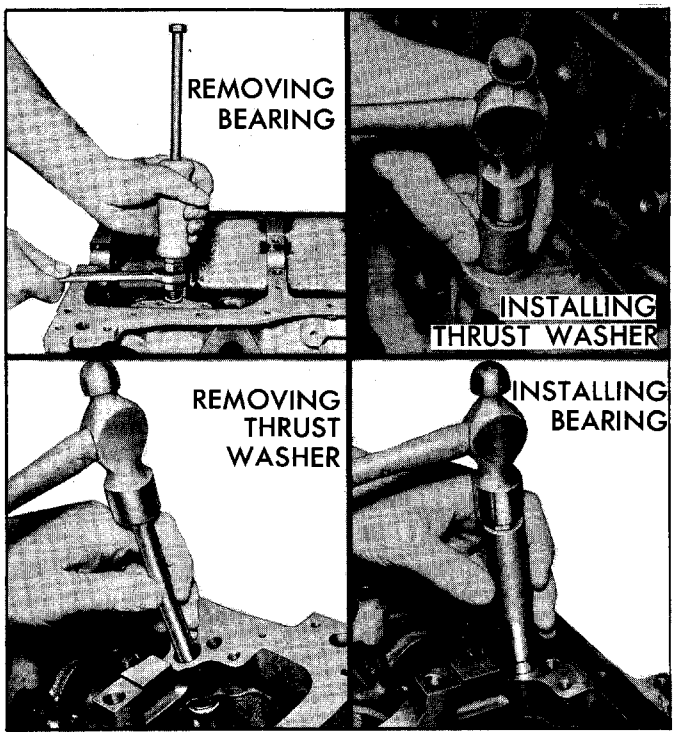


Fig. 70—Replacing Distributor Bearing and Thrust Washer

the bushing should be replaced as follows with oil pump and distributor removed (fig. 70).

1. Install Tool J-9534 into bushing and using a slide hammer, remove the bushing.
2. Using a drift up through bushing bore, drive thrust washer (if installed) out of bore and remove from block.
3. Clean bushing bore in block and check for burrs or damage.
4. If thrust washer was removed, start new washer in position in bore and drive into place using Tool J-9535.
5. Using Tool J-9535 with driver-bolt in driver handle, install driver into new bushing from large inside diameter.
6. Position bushing and driver to block and drive the bushing in position, which is determined by tool bottoming against the block.
7. Remove tool from bushing. It is possible that the bushing with minimum I.D. will collapse enough, during installation, to slightly seize the installer arbor. If this happens, remove installer tool using slide hammer in driver bolt hole of driver handle.

NOTE: This will not damage the bushing and tool is designed for this purpose, should it occur.

Repairs

Cylinder Conditioning

The performance of the following operation is contingent upon engine condition at time of repair.

If the cylinder block inspection indicated that the block was suitable for continued use except for out-of-round or tapered cylinders, they can be conditioned by honing or boring.

If the cylinders were found to have less than .005" taper or wear they can be conditioned with a hone and fitted with the high limit standard size pistons. A cylinder bore of less than .005" wear or taper may not entirely clean up when fitted to a high limit piston. If it is desired to entirely clean up the bore in these cases, it will be necessary to rebore for an oversize piston. If more than .005" taper or wear, they should be bored and honed to the smallest oversize that will permit complete resurfacing of all cylinders.

When pistons are being fitted and honing is not necessary, cylinder bores may be cleaned with a hot water and detergent wash. After cleaning, the cylinder bores should be swabbed several times with light engine oil and a clean cloth and then wiped with a clean dry cloth.

Cylinder Boring

1. Before using any type boring bar, the top of the cylinder block should be filed off to remove any dirt or burrs. This is very important. Otherwise, the boring bar may be tilted which would result in the rebored cylinder wall not being at right angles to the crankshaft.
2. The piston to be fitted should be measured with a micrometer, measuring at the center of the piston skirt and at right angles to the piston pin. The cylinder should be bored to the same diameter as the piston and honed to give the specified clearance.

   NOTE: Hone cylinders as outlined under "Cylinder Honing and Piston Fitting".

3. The instructions furnished by the manufacturer of the equipment being used should be carefully followed.

Cylinder Honing

1. When cylinders are to be honed follow the hone manufacturer's recommendations for the use of the hone and cleaning and lubrication during honing.
2. Occasionally during the honing operation, the cylinder bore should be thoroughly cleaned and the piston selected for the individual cylinder checked for correct fit.
3. When finish honing a cylinder bore to fit a piston, the hone should be moved up and down at a sufficient speed to obtain very fine uniform surface finish marks in a cross-hatch pattern of approximately 45° to 65° included angle. The finish marks should be clean but not sharp, free from imbedded particles and torn or folded metal (fig. 71).
4. Permanently mark the piston for the cylinder to which it has been fitted and proceed to hone cylinders and fit the remaining pistons.

CAUTION: Handle the pistons with care and

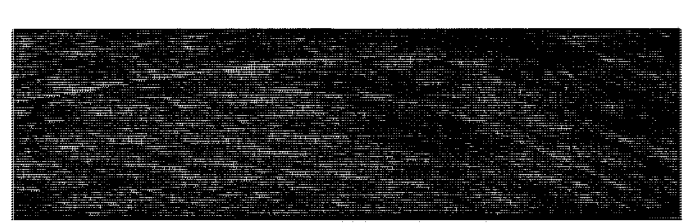


Fig. 71—Cylinder Finish Marks

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do not attempt to force them through the cylinder until the cylinder has been honed to correct size as this type piston can be distorted through careless handling.

5. Thoroughly clean the cylinder bores with hot water and detergent. Scrub well with a stiff bristle brush and rinse thoroughly with hot water. It is extremely essential that a good cleaning operation be performed. If any of the abrasive material is allowed to remain in the cylinder bores, it will rapidly wear the new rings and cylinder bores in addition to the bearings lubricated by the contaminated oil. The bores should be swabbed several times with light engine oil and a clean cloth and then wiped with a clean dry cloth. Cylinders should not be cleaned with kerosene or gasoline. Clean the remainder of the cylinder block to remove the excess material spread during the honing operation.

Piston Selection

1. Check USED piston to cylinder bore clearance as follows:
   a. Measure the "Cylinder Bore Diameter" with a telescope gauge (2 1/2" from top of cylinder bore).
   b. Measure the "Piston Diameter" (at skirt across center line of piston pin).
   c. Subtract piston diameter from cylinder bore diameter to determine "Piston to Bore Clearance".
   d. Locate piston to bore clearance on Piston Selection Chart (fig. 72) and determine if piston to bore clearance is in the acceptable range.
2. If used piston is not acceptable, check Piston Size Chart (fig. 73) and determine if a new piston can be selected to fit cylinder bore within the acceptable range.
3. If cylinder bore must be reconditioned, measure new piston diameter (across center line of piston pin) then hone cylinder bore to correct clearance (Preferable range).
4. Mark the piston to identify the cylinder for which it was fitted.

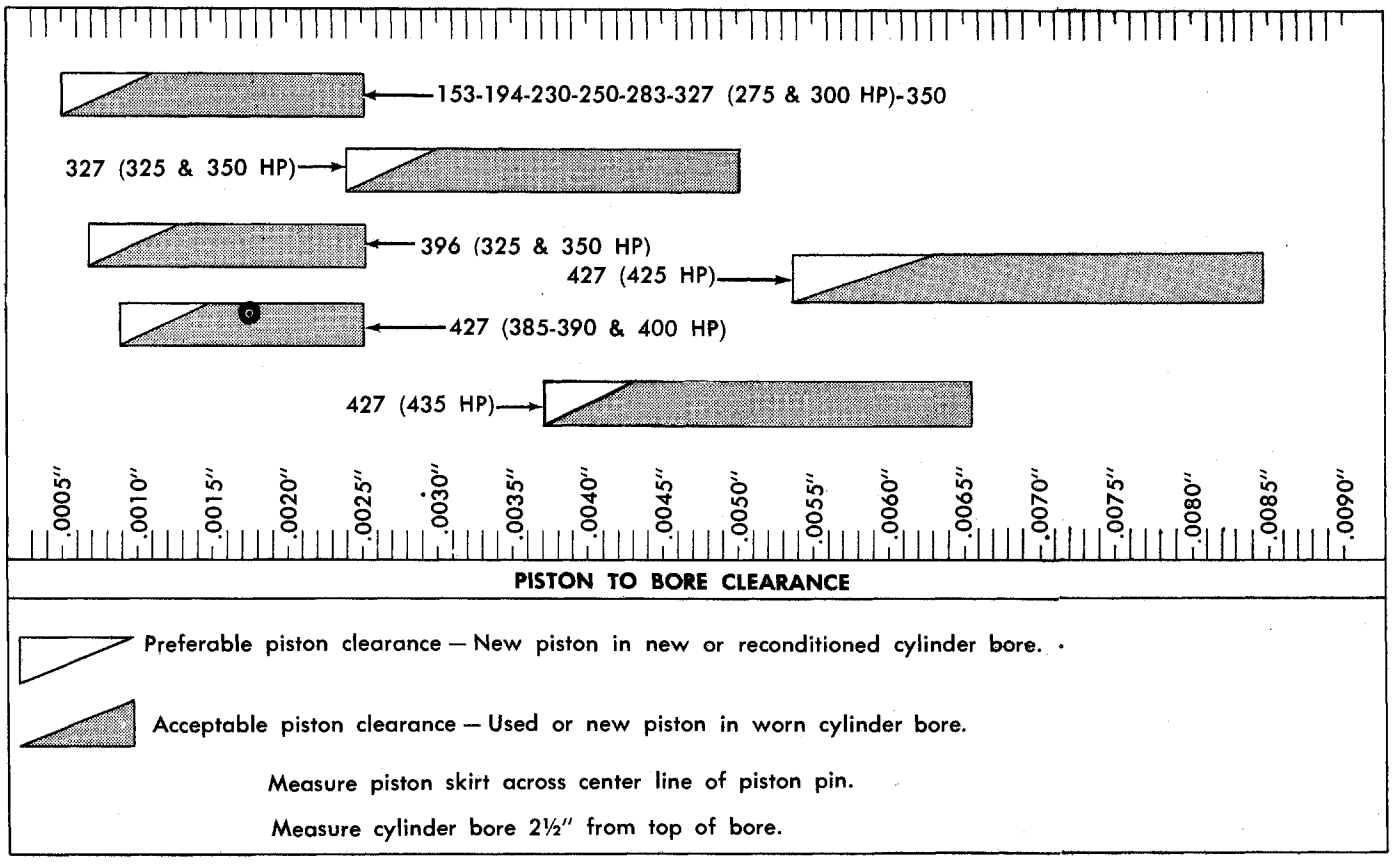


Fig. 72—Piston Selection Chart

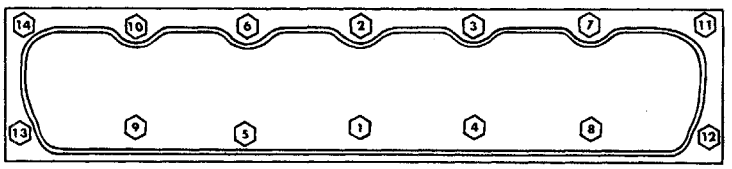
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ENGINE (DISPLACEMENT)	PISTONS AVAILABLE					
	STD.	OVERSIZE				
		.001"	.020"	.030"	.040"*	.060"
153, 230, 250 & 283	3.8750" 3.8760"	3.8760" 3.8770"	3.8937" 3.8957"	3.9037" 3.9057"	3.9137" 3.9157"	
194	3.5625" 3.5635"	3.5635" 3.5645"	3.5812" 3.5832"	3.5912" 3.5932"	3.6012" 3.6032"	
327 (210, 275, & 300 HP) 350	4.0000" 4.0010"	4.0010" 4.0020"	4.0187" 4.0207"	4.0287" 4.0307"		
327 (325 & 350 HP)	3.9965" 3.9975"	3.9975" 3.9985"		4.0264" 4.0284"		
396 (325 & 355 HP)	4.0920" 4.0930"	4.0930" 4.0940"	4.1130" 4.1150"	4.1230" 4.1250"		
427 (385 & 400 HP)	4.2488" 4.2498"	4.2498" 4.2508"	4.2678" 4.2698"	4.2778" 4.2798"		
427 (425 & 435 HP)	4.2455" 4.2465"	4.2465" 4.2475"		4.2760" 4.2780"		4.3060" 4.3080"
*Not Available on the 250 cu. in. Engine						

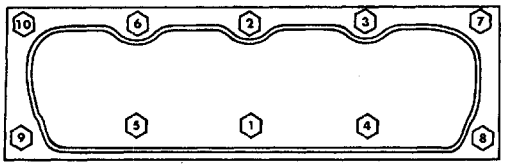
Fig. 73—Piston Size Chart

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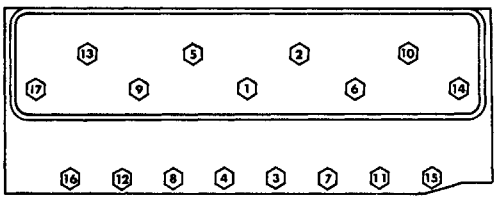
CYLINDER HEAD TORQUE SEQUENCE



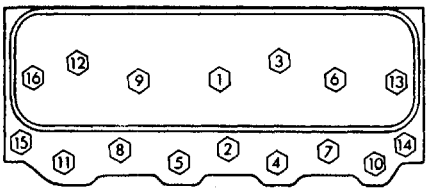
L6



L4



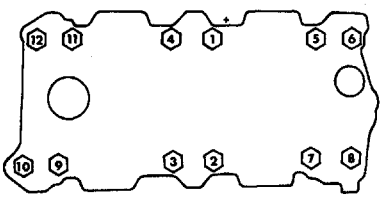
V8-283-327 & 350



V8-396 & 427

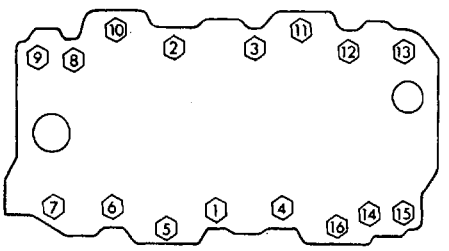
INTAKE MANIFOLD TORQUE SEQUENCE

FRONT



V8-283 & 327

FRONT



V8-396 & 427

Fig. 74—Torque Specifications

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SPECIAL TOOLS

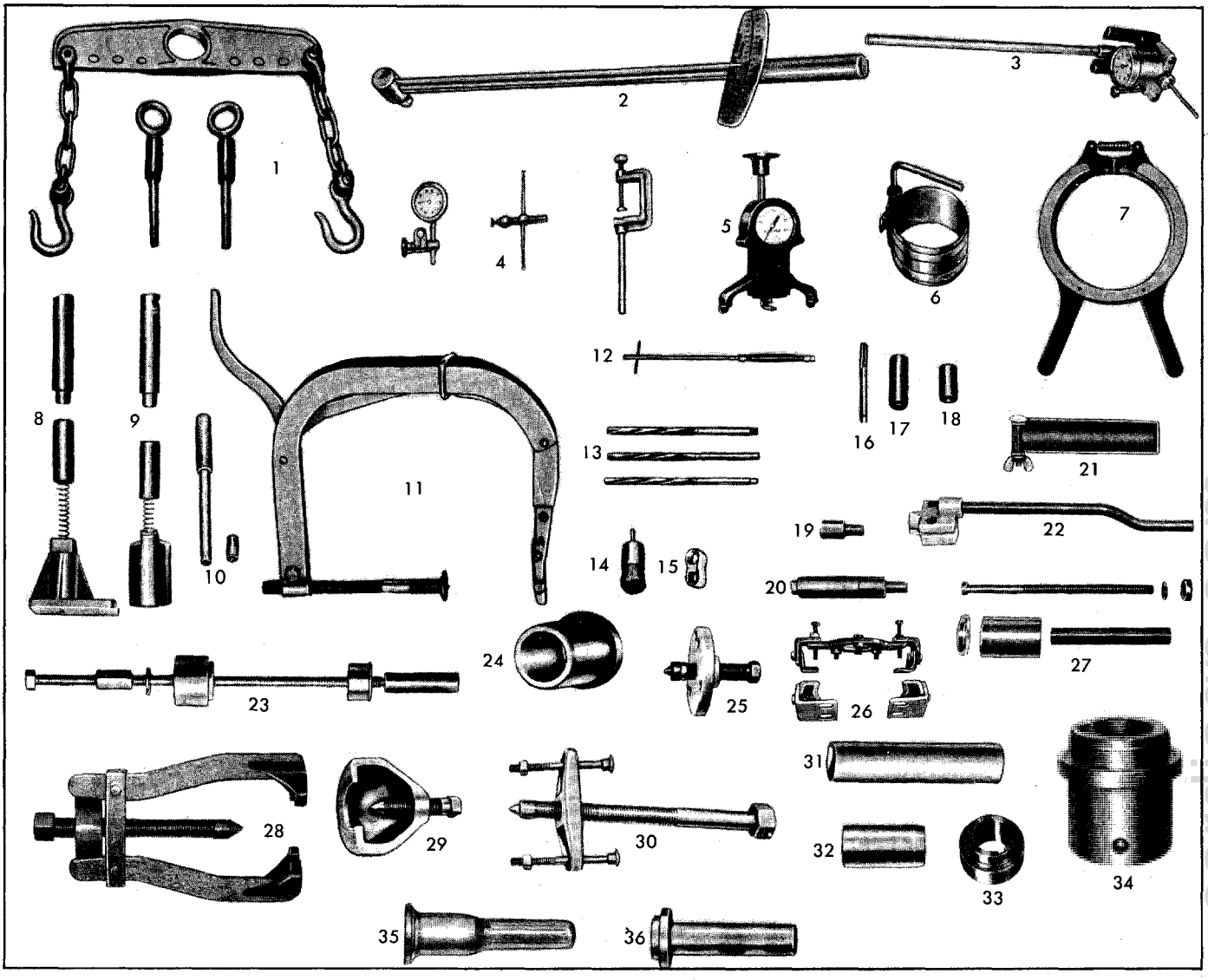


Fig. 75—Engine Special Tools

1. J-4536 Engine Lift Kit
2. J-1264 (0-200 ft. lb.) Torque Wrench
   J-8058 (0-50 ft. lb.)
   J-5853 (0-100 in. lb.)
3. J-8087 Indicator Set (Cylinder Bore)
4. J-8001 Indicator Set (Universal)
5. J-7316 Belt Tension Gauge
6. J-8037 Piston Ring Compressor
7. J-8020 (3 9/16") Piston Ring Expander
   J-8021 (3 7/8")
   J-8032 (4")
   J-22249 (3 15/16")
   J-22147 (4 3/32")
   J-22250 (4 1/4")
8. J-6994 Piston Pin Assembly Tool
9. J-9510 Piston Pin Assembly Tool
10. J-5239 (3/8") Connecting Rod Guide Set
    J-6305 (11/32")
11. J-8062 Valve Spring Compressor
12. J-8101 Valve Guide Cleaner
13. J-5830 (11/32") Valve Guide Reamer Set
    J-7049 (3/8")
14. J-8089 Carbon Removing Brush
15. J-5860 Cylinder Head Bolt Wrench
16. J-5715 (.003") Rocker Arm Stud Reamer
    J-6036 (.013")
17. J-6880 Rocker Arm Stud Installer
18. J-5802 Rocker Arm Stud Remover
19. J-9534 Distributor Lower Bushing Remover
20. J-9535 Distributor Lower Bushing Installer
21. J-22144 Oil Pick-up Screen Installer
22. J-8369 Oil Pick-up Screen Installer
23. J-6098 Cam Bearing Tool
24. J-0971 Camshaft Gear Support
25. J-6978 Torsional Damper Puller
26. J-22197 Torsional Damper Installer
27. J-21058 Torsional Damper and Sprocket Installer
28. J-1619 Crankshaft Sprocket Puller
29. J-5825 Crankshaft Sprocket Puller
30. J-8105 Crankshaft Gear Puller
31. J-5590 Crankshaft Sprocket or Gear Installer
32. J-0966 Crankshaft Cover Centering Gauge
33. J-21742 Crankcase Cover Centering Gauge
34. J-22102 Crankcase Cover Tool
35. J-8340 Crankcase Cover Seal Installer
36. J-5595 Crankcase Cover Seal Installer

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SECTION 6K

WATER PUMP

INDEX

	Page		Page
General Description	6K-1	Inspection	6K-1
Repair Procedures	6K-1	Assembly	6K-2
Disassembly	6K-1	Special Tools	6K-5

GENERAL DESCRIPTION

All water pumps (figs 1 and 2), used in conjunction with Chevrolet passenger cars, are the centrifugal vane impeller type. Because of their similarity only typical illustrations and procedures are used in this section unless specific illustrations or procedures are necessary to clarify the operation.

REPAIR PROCEDURES

Disassembly

1. Remove bolts and fan and pulley.
2. On V 8 models, remove back plate screws, plate and gasket.
3. Support fan hub in an arbor press and press pump shaft out of hub. A 1/2" dia. x 2" rod will allow the shaft to be pushed through the hub (fig. 3).
4. Support pump in an arbor press as shown (fig. 4). Press shaft and impeller assembly out of pump, applying pressure on the outer race of the shaft bearing only.

   CAUTION: Shaft and bearing assembly must not be pushed out of housing by applying force on shaft, or bearings will be damaged. Use a 7/8" deep socket or piece of tubing 1-1/8" O.D. on 283 and 327 cu. in. engines. Use a 1-1/16" deep socket or a piece of tubing 1-7/16" O.D. on 396 and 427 cu. in. engines. Shaft and bearing assembly should be pressed out of rear of pump only.

5. Support impeller on seal surface, using Tool J-5855 in an arbor press, and using a 1/2" x 1" pin, press shaft out of impeller (fig. 5). Discard seal.

Inspection

1. Wash all parts except pump shaft bearing in cleaning solvent. Figures 6 and 7 show the water pumps disassembled.

   NOTE: Pump shaft bearing is a permanently sealed and lubricated bearing and should not be washed in cleaning solvent.

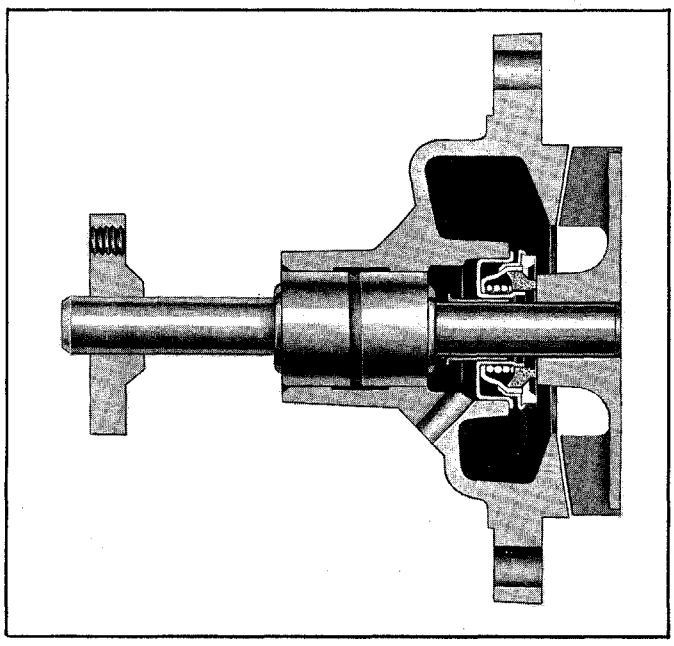


Fig. 1—Water Pump - Typical In Line

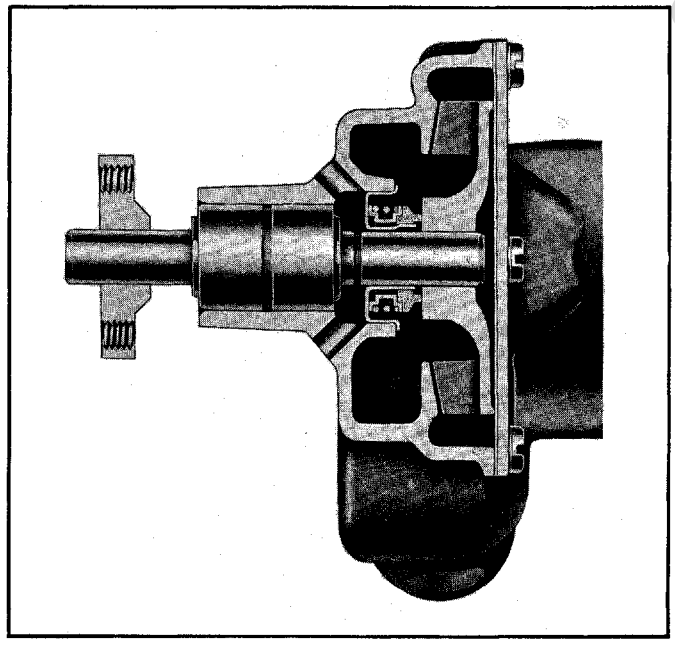


Fig. 2—Water Pump - Typical V-8

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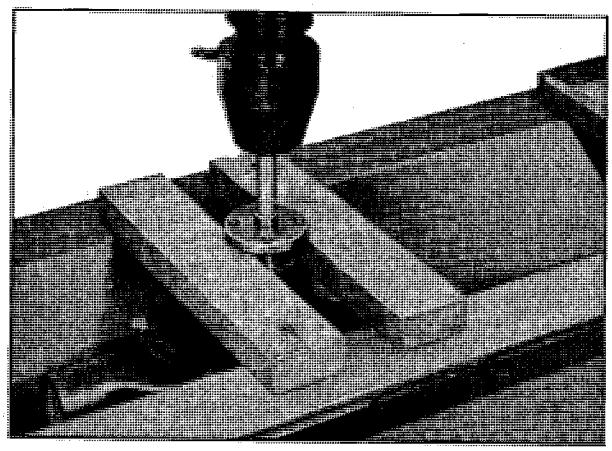


Fig. 3—Removing Fan Hub

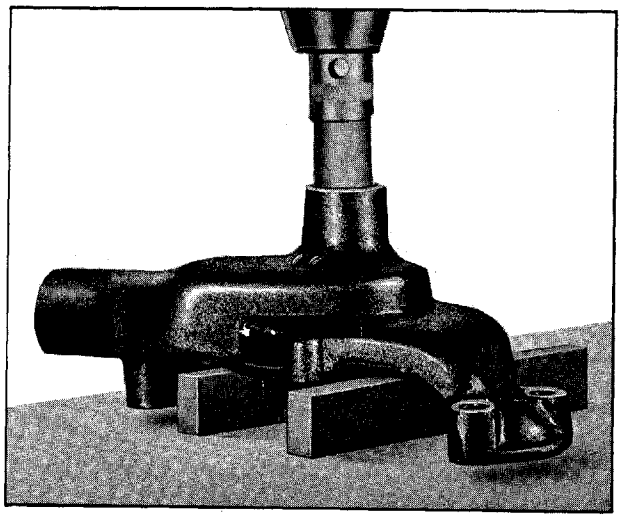


Fig. 4—Removing Shaft and Bearing Assembly

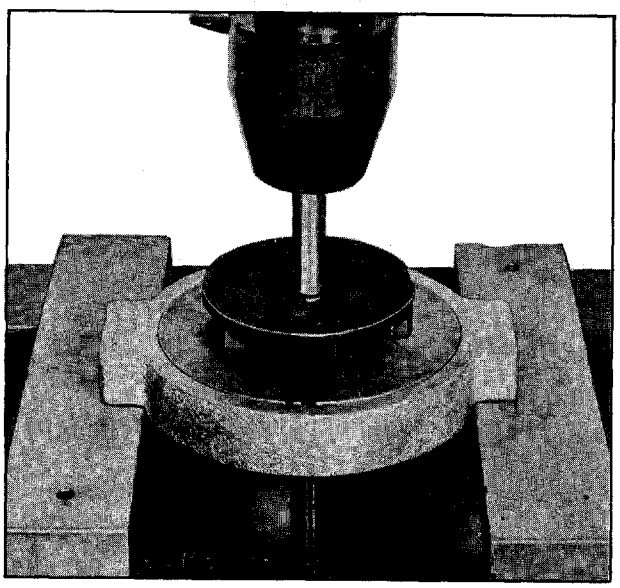


Fig. 5—Removing Seal

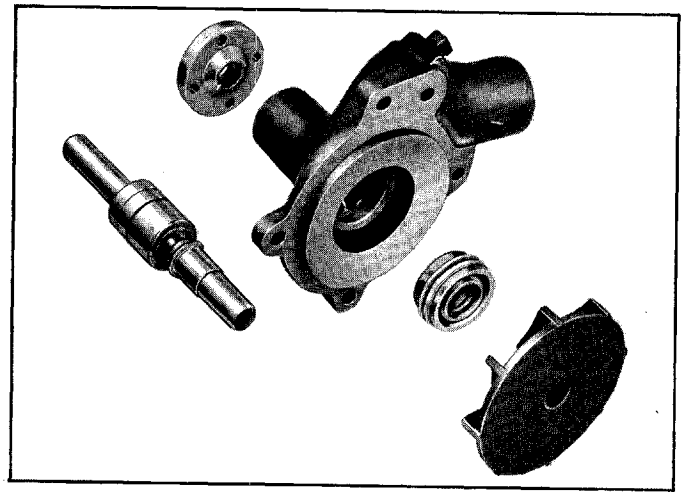


Fig. 6—In Line Pump Disassembled

2. Inspect shaft and bearing assembly for roughness or excessive end play. Remove any rust or scale from shaft with fine emery cloth. The bearing should be wrapped in cloth while this operation is performed to prevent emery dust from entering bearing.
3. Inspect sealing face on impeller for pit marks or scoring. If sealing face is scored or pitted the impeller and seal should be replaced.

Assembly

1. Install pump shaft and bearing assembly into pump body bearing bore, applying pressure to outer race until it is flush with front of pump body (fig. 8).

   CAUTION: Apply pressure to outer race only.

2. Lightly coat O.D. of new seal with a sealing compound and press into place with Tool J-5590, applying pressure to the seal outer flange. The seal should bottom with the outer flange against the pump body (fig. 9).
3. Press on fan hub. Check fan hub location using J-22162 fan hub locating gauge (figs. 10 and 11). See chart in this section for specific engine fan hub locating dimension.

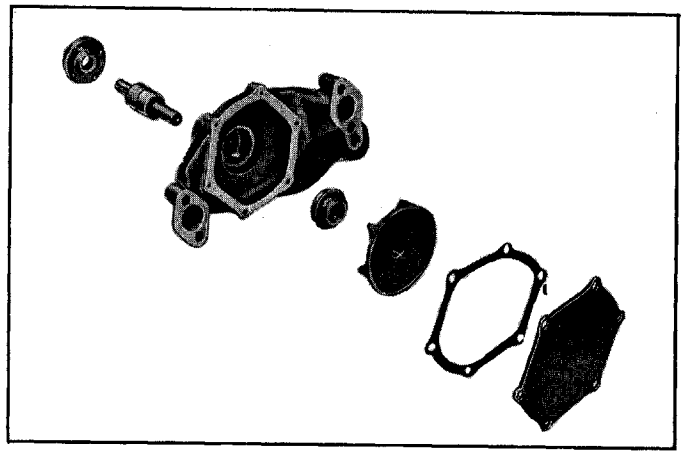


Fig. 7—V-8 Pump Disassembled

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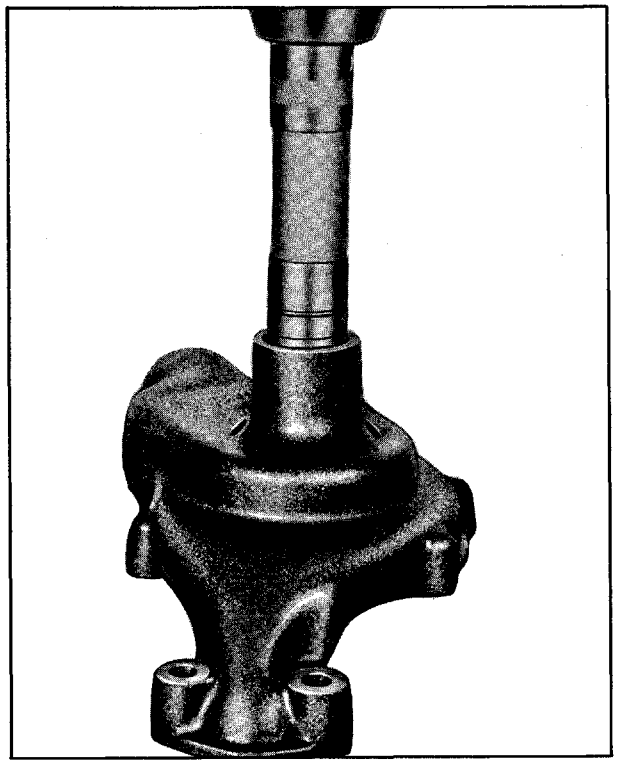


Fig. 8—Installing Shaft and Bearing Assembly

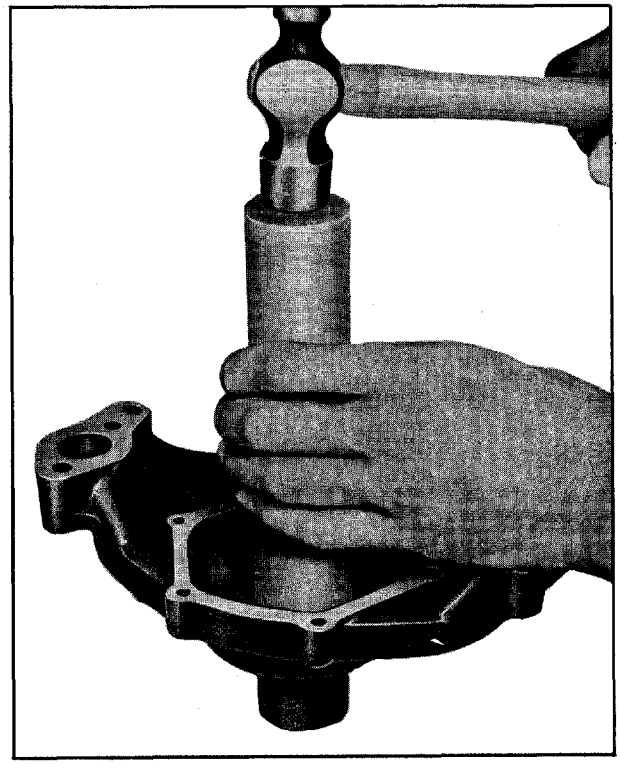


Fig. 9—Installing Seal

4. Support pump on front (hub end) of shaft and press on impeller. Press to obtain .010" to .035" clearance between impeller vanes and pump body. On V8 models; it will be necessary to put a bend about 1/2" from end of feeler gauge to enable clearance checking (figs. 12 and 13). Impeller must be flush to .018" below pump body back plate gasket surface on V8 models.
5. On V8 models, install pump back plate and gasket with a light coat of gasket sealer and install screws, then tighten all six diagonally.

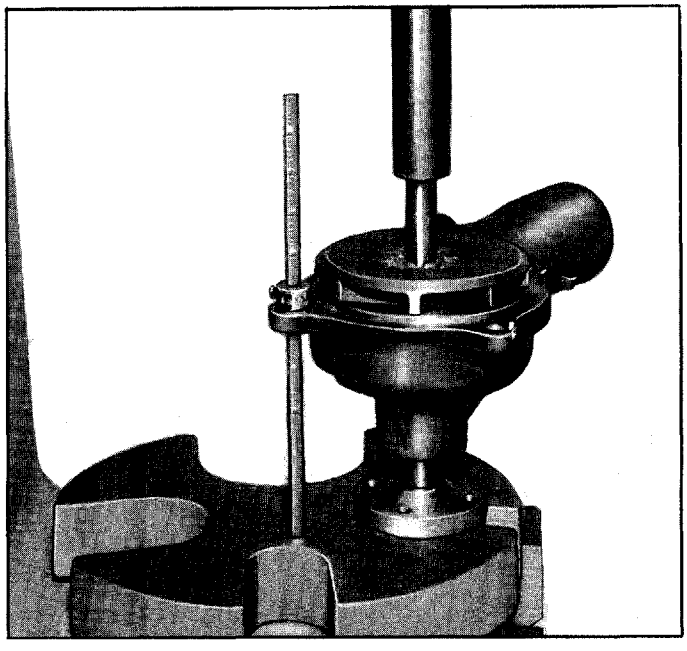


Fig. 10—Installing Fan Hub - In Line

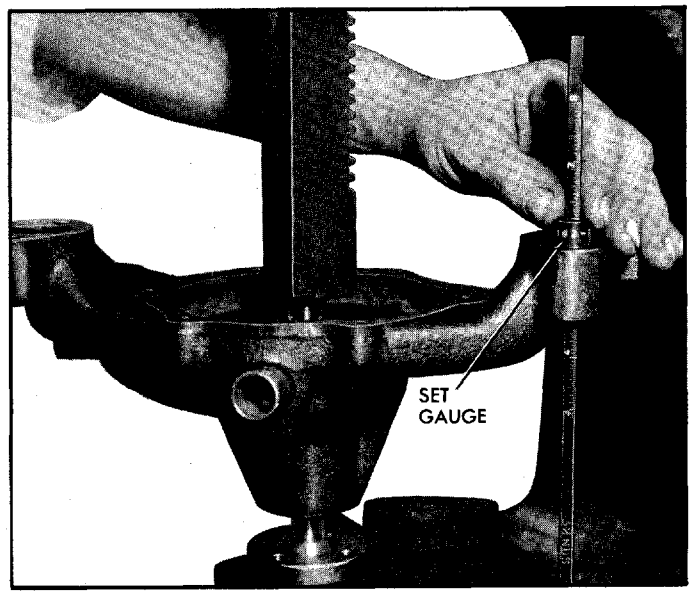


Fig. 11—Installing Fan Hub - V-8

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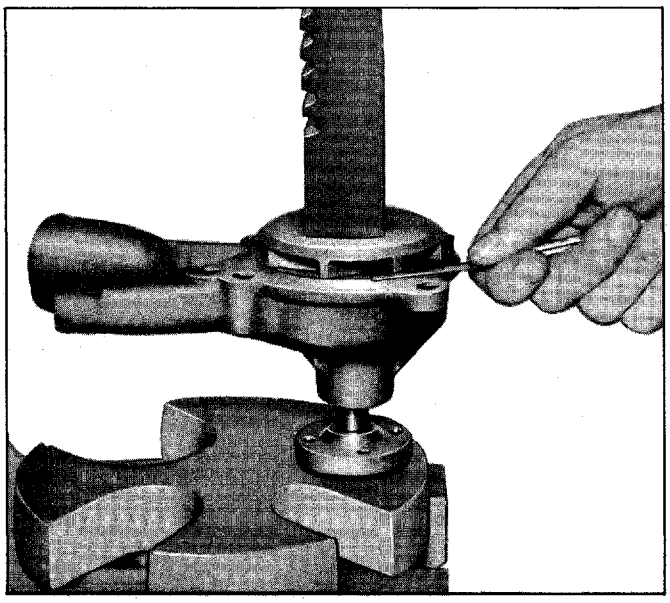


Fig. 12—Installing Impeller - In Line

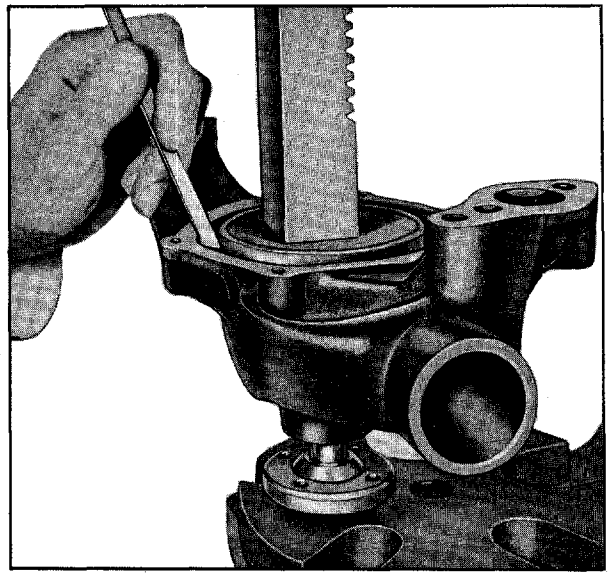


Fig. 13—Installing Impeller - V-8

FAN HUB LOCATING DIMENSION					
Engine	Chevrolet	Chevelle	Chevy II	Camaro	Corvette
153	—	—	3- 7/8"	—	—
194	—	—	3- 7/8"	—	—
230	—	4- 3/8"*	3- 7/8"	3- 7/8"	—
250	3- 7/8"	4- 3/8"*	—	3- 7/8"	—
283, 327	5-9/16"	5-9/16"	5-9/16"	5-9/16"	5-9/16"
350	—	—	—	5-9/16"	—
396, 427	5- 3/4"	5- 3/4"	—	—	5- 3/4"

*3-1/8" With Air Conditioning

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SPECIAL TOOLS

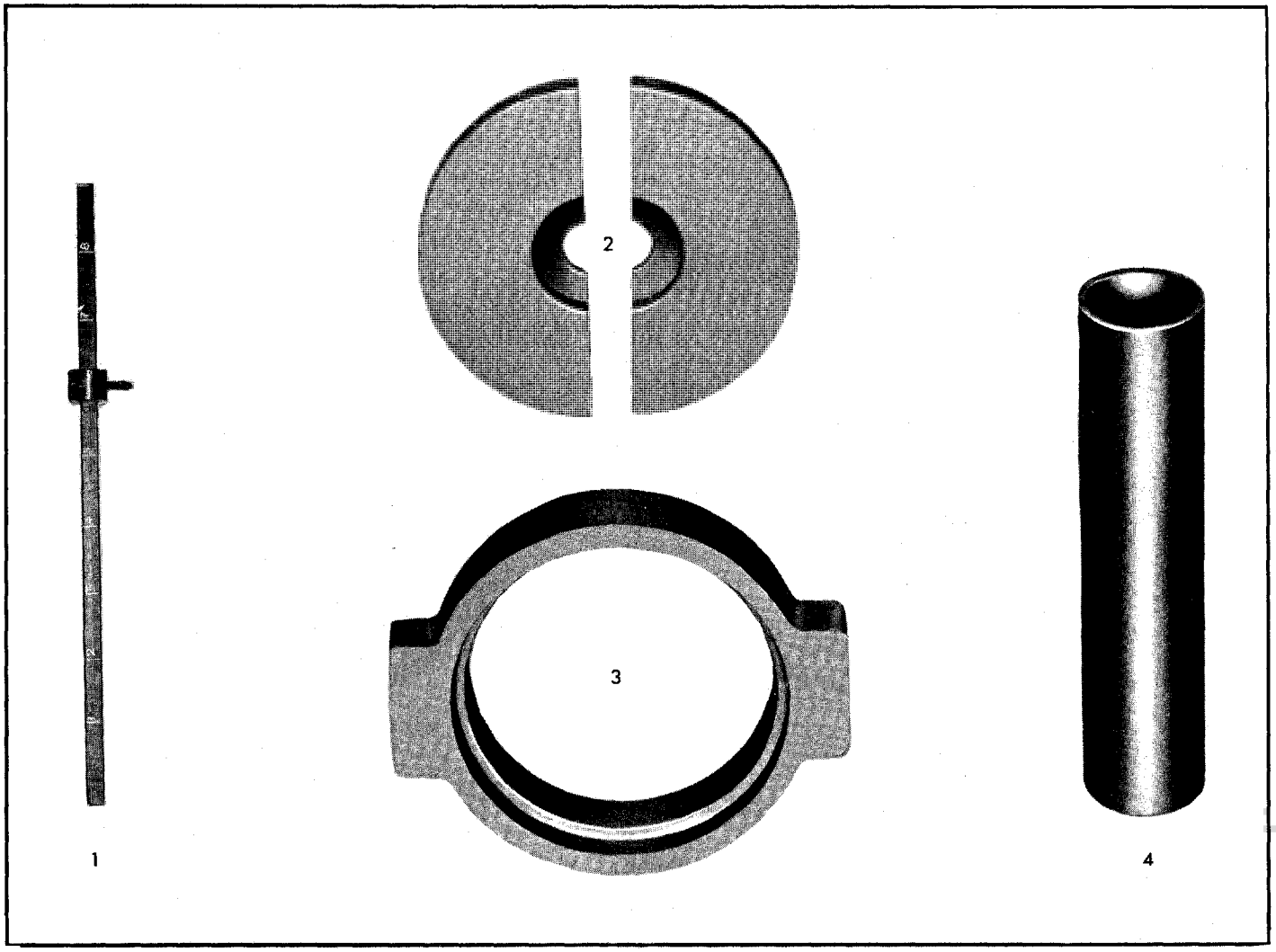


Fig. 14—Water Pump Special Tools

1. J-22162 Fan Hub Locating Gauge
2. J-5855 Impeller Remover
3. J-358-1 Holder
4. J-5590 Seal Installer

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SECTION 6M

CARBURETORS

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Rochester 4MV	6M-14	Special Tools	6M-46

INTRODUCTION

Various carburetors, designed to meet the particular requirements of engines, transmission and vehicles, are used on passenger vehicles and although carburetors may look alike they are not always interchangeable. Refer to carburetor part number and/or specifications.

This section, divided into sub-sections by carburetor model, covers the repair procedures for the various carburetors. Although illustrations showing bench operations are used, most single operations, when not part of a general overhaul, should be performed (if practical) with the carburetor on the engine. Typical illustrations and procedures are used except where specific illustrations or procedures are necessary to clarify the operation.

ROCHESTER BV

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Cleaning and Inspection	6M-3	Adjust Choke Unloader	6M-6
Assembly and Adjustments	6M-4	Adjust Choke Vacuum Break	6M-6
Assemble Bowl and Throttle Body	6M-4	Adjust Idle Vent	6M-6
Assemble Air Horn	6M-5		

GENERAL DESCRIPTION

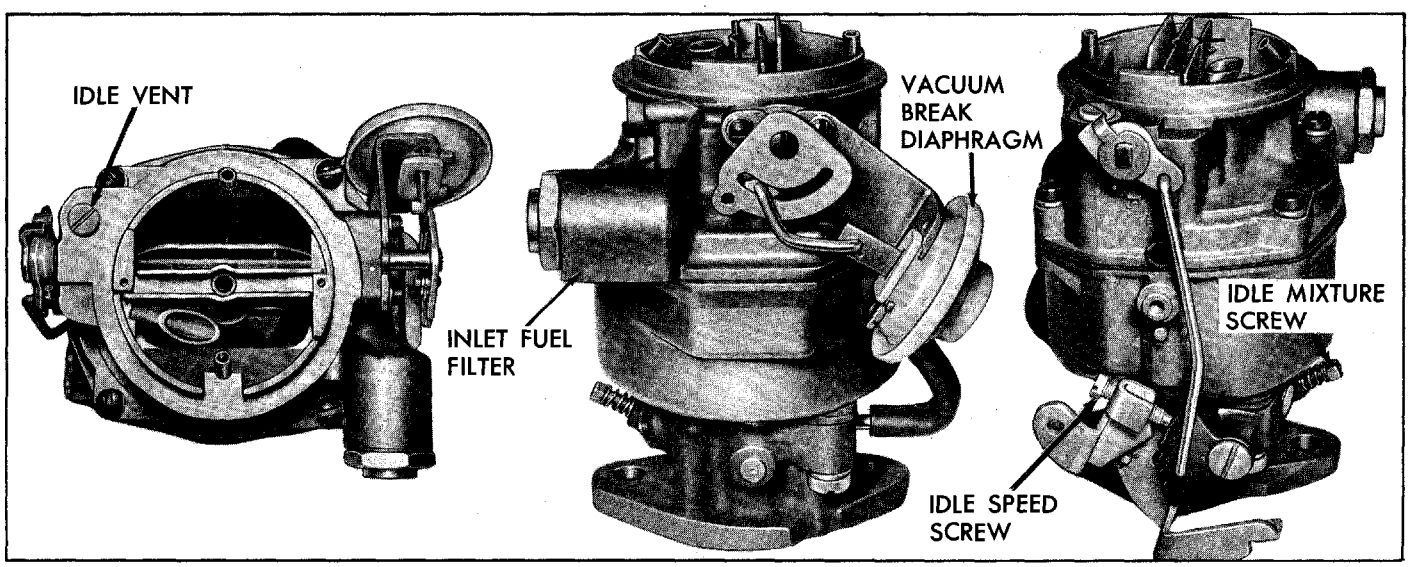


Fig. 1R—Rochester BV Carburetor

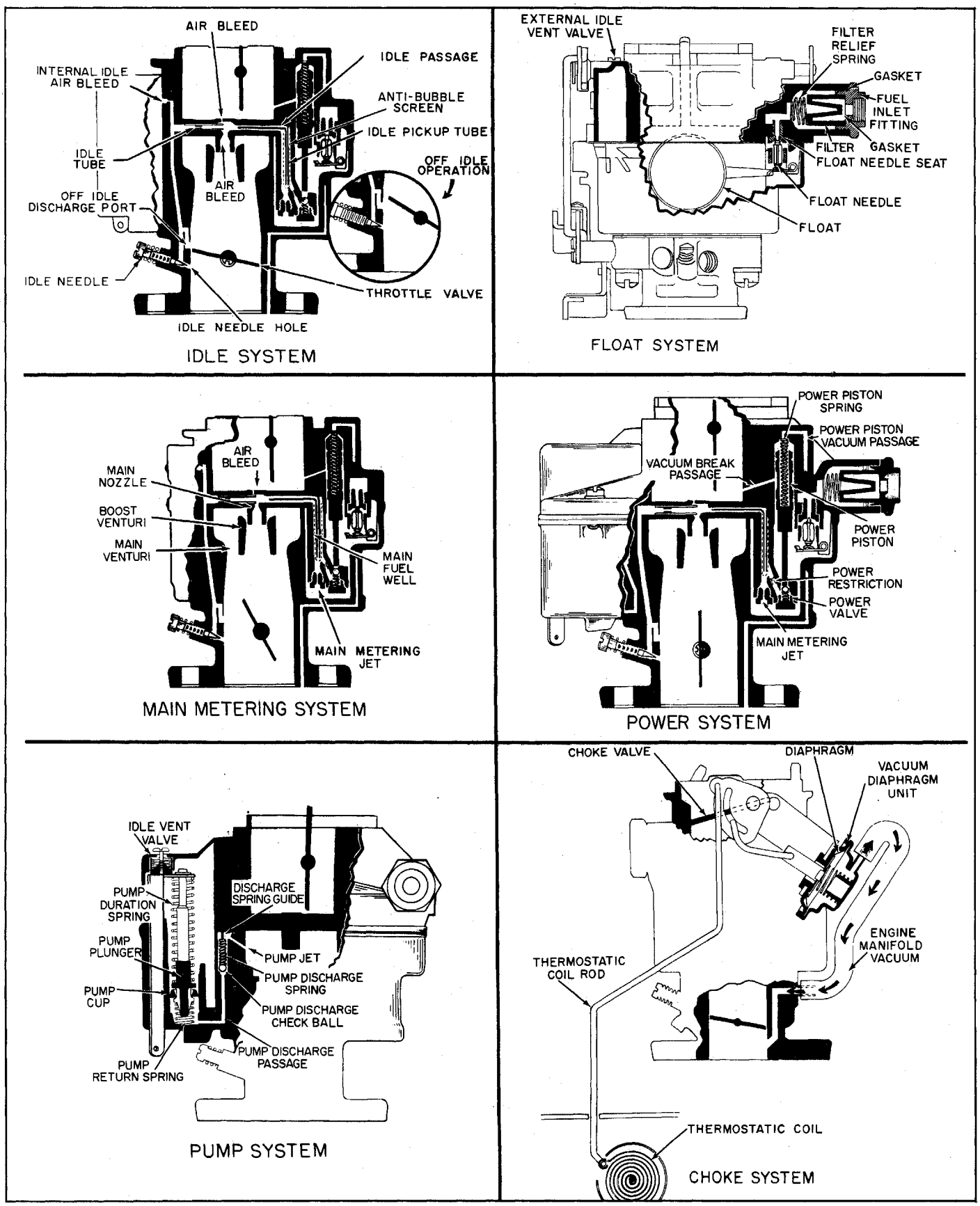


Fig. 2R—Rochester BV Systems

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The Rochester BV Carburetor (fig. 1R) used in conjunction with a temperature sensing choke coil (mounted in a sheet metal assembly which is attached to the exhaust manifold) is used with same L6 engines.

This is a single barrel carburetor with a concentric float bowl which completely surrounds the main bore of the venturi. The float bowl design, in conjunction with the centrally located main nozzle, prevents fuel spill-over regardless of engine angle.

The main well assembly, containing the main metering jet and power valve, is attached to the air horn and suspended in the float bowl. With this design, engine heat cannot be transmitted directly to the main well area and percolation spill-over during hot engine operation is held at a minimum (fig. 2R).

REPAIR PROCEDURES

Disassembly

1. Disconnect choke diaphragm vacuum hose at diaphragm.
2. Remove fast idle cam, then disconnect fast idle rod at choke lever.
3. Remove fuel line fitting, gasket, bronze fuel filter and spring from air horn.
4. Remove four bowl cover screws.
5. Lift cover straight up to prevent damage to floats.
6. Place bowl cover up-ended on flat surface and remove float hinge pin, floats and float needle (fig. 3R).
7. Using screw driver of proper width, remove float needle seat and gasket.
8. Remove main metering jet and power valve assembly from main well support.

   NOTE: Use care when removing power valve not to lose small spring and ball.

9. Remove main well support attaching screw and remove support. Lift straight up to prevent damage to main well support tube.
10. Lift power piston and spring from air horn.
11. Lift gasket from air horn.
12. Remove choke shaft lever screw (diaphragm side), remove two diaphragm bracket screws and remove diaphragm.
13. Holding accelerator pump plunger all the way down, remove hairpin retainer from pump link and remove pump link from throttle lever and pump plunger. Pump plunger may now be lifted from bowl. Place plunger in gasoline or kerosene to prevent rubber from drying out.
14. Lift pump spring from pump well.
15. With small needlenose pliers, remove pump discharge guide (fig. 4R). Pump discharge spring and ball check will fall from bowl when turned upside down.
16. With bowl upside down, remove 2 throttle body attaching screws and remove throttle body assembly.
17. Remove idle adjusting needle and spring from throttle body.

Cleaning and Inspection

1. Wash all metal parts thoroughly in carburetor solvent and dry with compressed air.

   CAUTION: Vacuum diaphragm and pump plunger should not be immersed in cleaning solvent. Clean the plunger in clean gasoline - clean the diaphragm unit by wiping with a rag only.

2. Check all parts and passages for carbon deposits.
3. Blow out all drilled passages with compressed air and check to make sure they are clean.

   CAUTION: Do not pass drills or wires through calibrated jets or passages as this may enlarge orifice and seriously affect carburetor calibration.

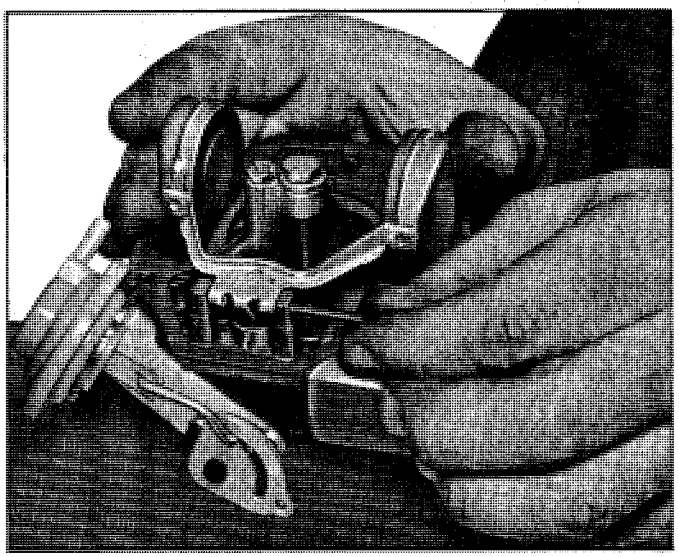


Fig. 3R—Removing Float

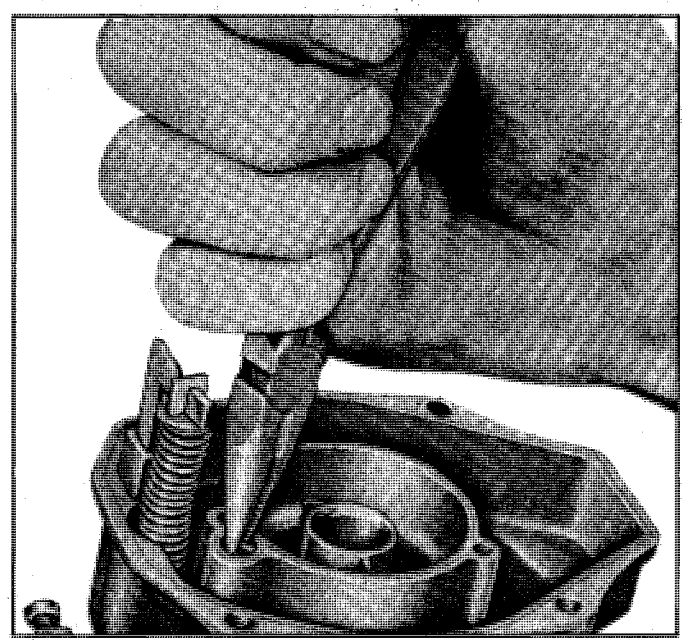


Fig. 4R—Removing Pump Discharge Guide

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4. Inspect pump plunger. If the rubber is damaged, the plunger assembly should be replaced. Shake the plunger to determine if by-pass ball check is free.

To check pump system: Pour 1/2 inch of gasoline into carburetor bowl. Take pump plunger from can of gasoline or kerosene and slide into pump cylinder. Place the discharge check ball into body. Raise plunger and press lightly on shaft to expel air from the pump passage. Using a small clean brass rod, hold the discharge ball down firmly on its seat. Again raise plunger and press downward. No fuel should be emitted from either the intake or discharge passage. If any fuel does emit from either passage, the presence of dirt or a damaged check ball are indicated. Clean the passage again and repeat the test. If leakage is still present, replace the check valve.

5. Check floats for dents and wear on lip and hinge pin. Also check air horn for wear in hinge pin holes.
6. Check float needle. If wear is noted on float needle, install new float needle assembly consisting of matched and tested needle and seat and new fibre gasket.
7. Check power piston for burrs or other damage. Piston must move freely in cover bore.
8. Check throttle arm for looseness on the shaft and for excessive wear at throttle rod connection.
9. Check throttle shaft for excessive looseness in throttle body.

NOTE: Any damage or excessive wear in throttle arm or shaft necessitates replacement of the throttle body assembly. This is due to the close tolerance of throttle valve fit required and the fact that the idle discharge and spark advance holes are drilled in relation to a proper fitting valve.

10. Check the choke valve for freedom of operation in air horn.
11. Check bronze fuel filter for cleaniness or damage. Blow on cone end, element should allow air to pass freely. Clean element by washing in solvent and blowing out. Blowing opposite direction of fuel flow.
12. Check fast idle cam for corrosion. If present, remove with a wire brush.

Assembly and Adjustments

Assemble Bowl and Throttle Body

1. Install idle needle and spring finger-tight in throttle body. As a temporary idle adjustment, back needle out 1-1/2 turns.
2. Using a new throttle body gasket, attach bowl to throttle body. Tighten screws evenly and securely.
3. Place pump return spring into pump well and center it by depressing with finger.
4. Install pump plunger and connect pump link to throttle lever and pump rod. Install hairpin retainers at both upper and lower ends.
5. Drop large steel ball into pump discharge cavity of bowl and place bronze color spring on top of ball (fig. 6R).

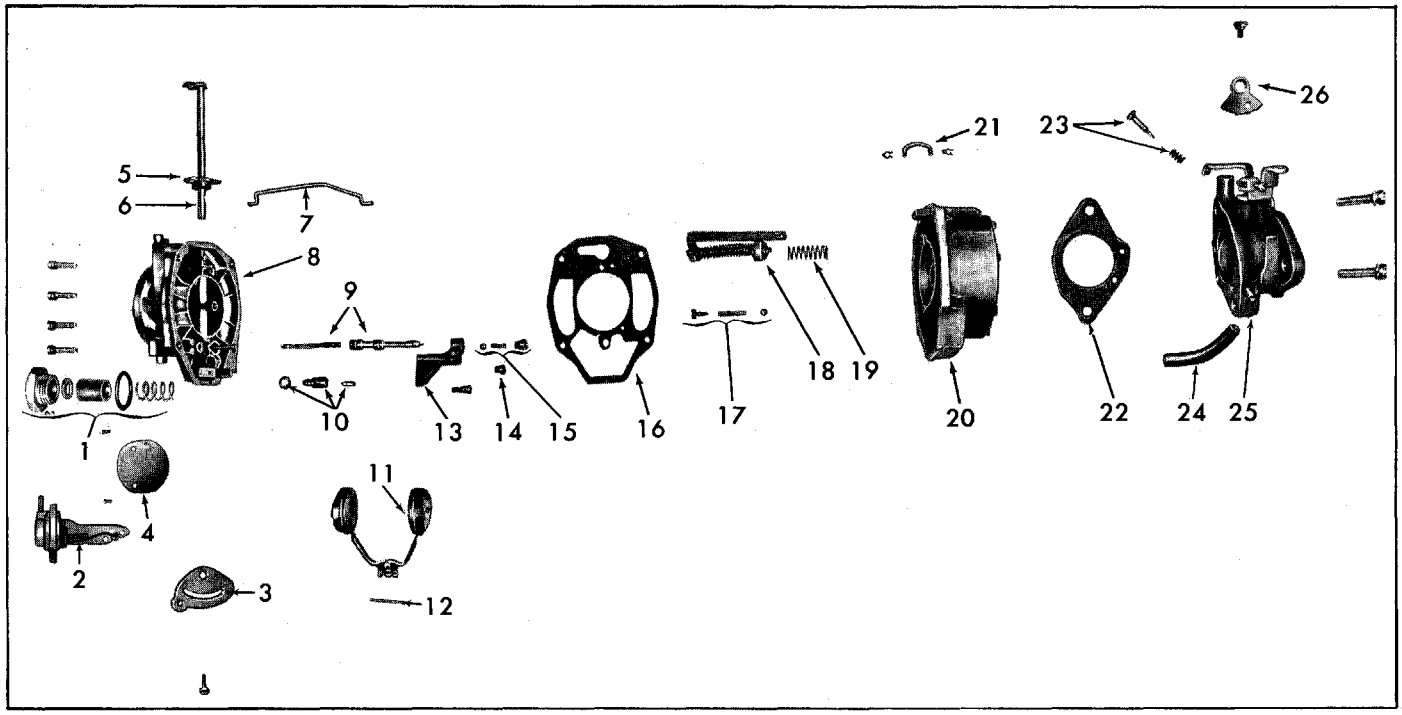


Fig. 5R—Rochester BV—Exploded View

1. Fuel Inlet Filter Assembly
2. Vacuum Diaphragm Assembly
3. Choke Lever
4. Choke Valve
5. Choke Lever
6. Choke Shaft
7. Choke Rod
8. Air Horn
9. Power Piston and Spring
10. Needle and Seat Assembly
11. Float
12. Float Pin
13. Main Well Support
14. Main Metering Jet
15. Power Valve Assembly
16. Air Horn Gasket
17. Pump Discharge Check Assembly
18. Accelerator Pump
19. Pump Return Spring
20. Bowl
21. Pump Link
22. Throttle Body Gasket
23. Idle Mixture Needle and Spring
24. Vacuum Diaphragm Hose
25. Throttle Body Assembly
26. Fast Idle Cam

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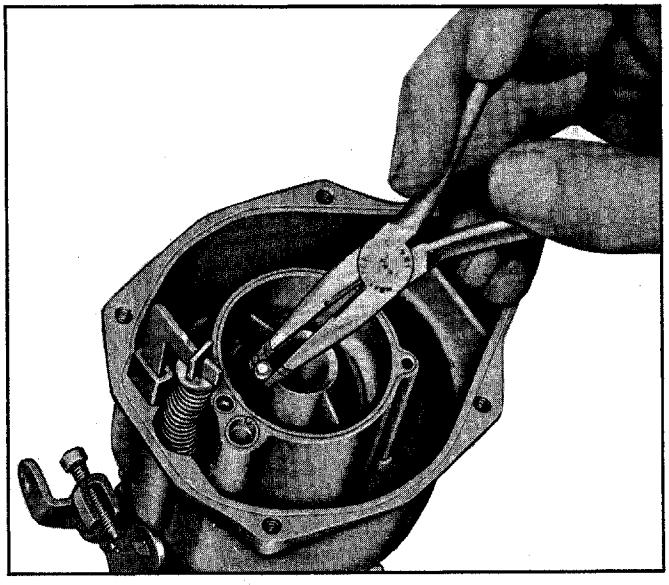


Fig. 6R—Installing Pump Discharge Ball

6. Index end of pump discharge guide into bronze color spring and press down until guide is flush with bowl surface.

Assemble Air Horn

1. Place new gasket on air horn.
2. Place power piston spring and power piston in air horn cavity and attach main well support to air horn.
3. Install main metering jet and tighten securely.
4. Hold power piston stem down and install power ball, spring and plug and tighten securely.
5. Install spring and bronze fuel filter with opening away from spring and attach fuel line fitting with gasket.
6. Install vacuum diaphragm, two bracket screws and choke valve lever.
7. Install float needle seat using new gasket and install float needle.
8. Attach float with hinge pin.

Adjust Float

1. With the air horn inverted and the gasket in place, check height of each float as shown. Bend tang which contacts needle until each pontoon is set to specified dimension. Align floats to avoid interference in bowl (fig. 7R).

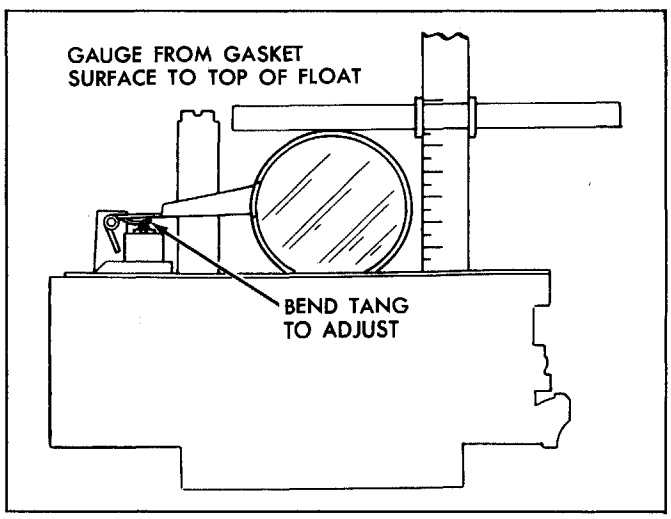


Fig. 7R—Float Level Adjustment

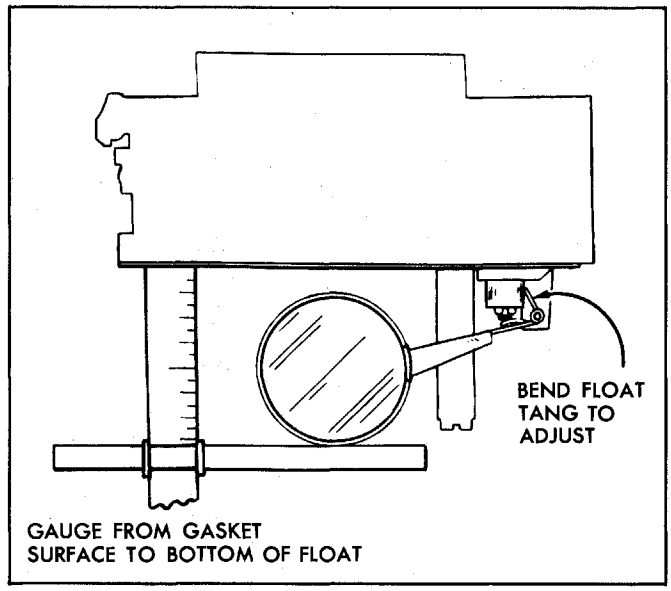


Fig. 8R—Float Drop Adjustment

2. With the air horn assembly held upright and floats suspended freely, carefully bend the float tang at the rear of the float arm so that the bottom of the float pontoon is set as specified (fig. 8R).

Assemble Air Horn to Bowl

1. Carefully place air horn assembly on bowl, making certain the main channel male centering protrusion

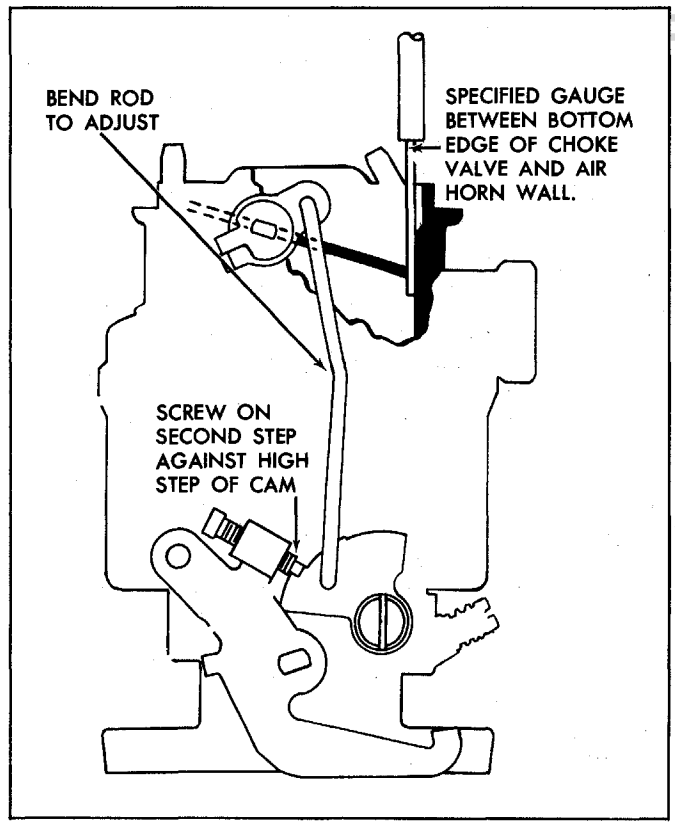


Fig. 9R—Choke Rod (Fast Idle) Adjustment

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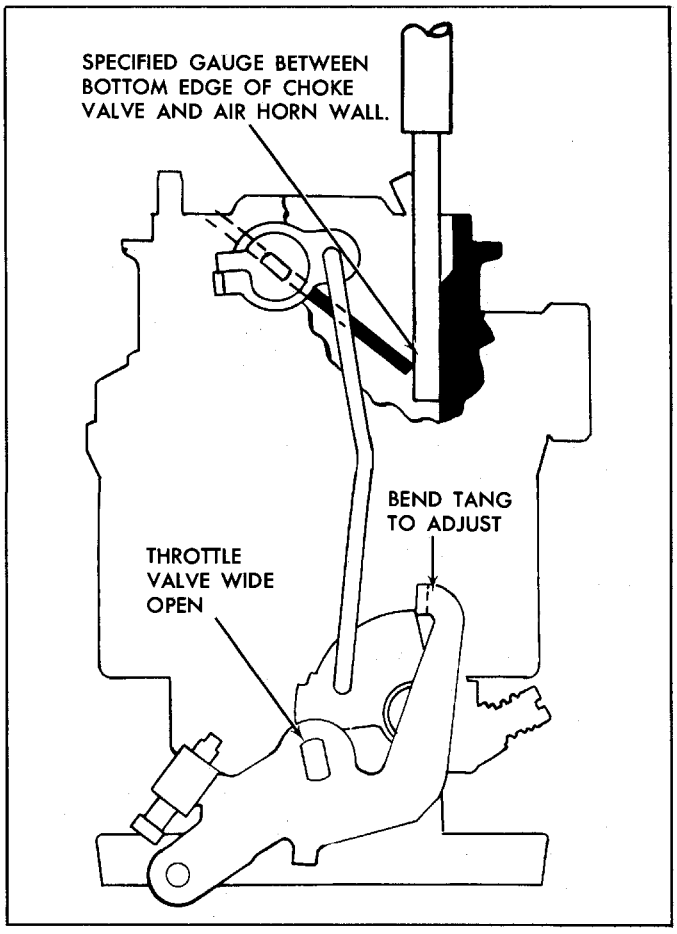


Fig. 10R—Choke Unloader Adjustment

in the air horn is properly aligned with the female channel in the bowl.

2. Make certain air horn sits flat on bowl, then install attaching screws and tighten securely.
3. Connect choke vacuum diaphragm hose securely.
4. Connect choke rod at choke lever, then connect and install fast idle cam.

Adjust Choke Rod (Fast Idle)

With the idle screw on the second step and against the high step of the fast idle cam, bend the choke rod to obtain specified dimension between the lower edge of the choke valve and the air horn wall (fig. 9R).

Adjust Choke Unloader

With the throttle valve wide open and the choke valve held toward the closed position with a rubber band, bend the unloader tang on the throttle lever to obtain specified clearance between the lower edge of the choke valve and the air horn wall (fig. 10R).

Adjust Choke Vacuum Break

Push the vacuum break diaphragm plunger in until seated. Hold the choke valve toward the closed position with a rubber band. Bend vacuum break link so that specified gauge will fit between lower edge of choke valve and inside of air horn wall (fig. 11R).

Adjust Idle Vent

1. Adjust idle speed screw until it just touches low step of fast idle cam.
2. Turn idle speed screw two additional turns in (for initial idle setting).

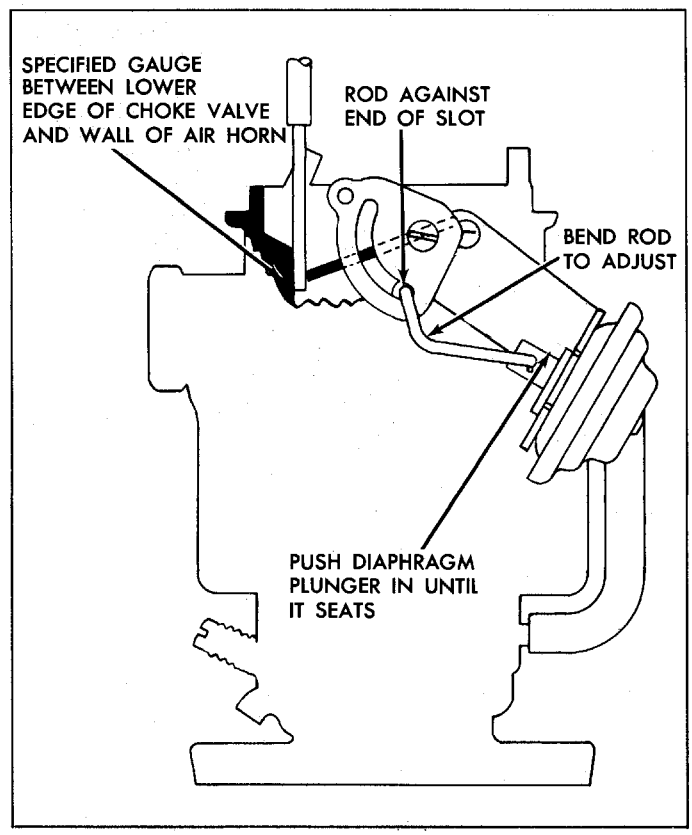


Fig. 11R—Choke Vacuum Break Adjustment

3. With idle screw on low step of cam, the idle vent valve should be open as specified. Adjust by turning valve on top of air horn as needed (fig. 12R).

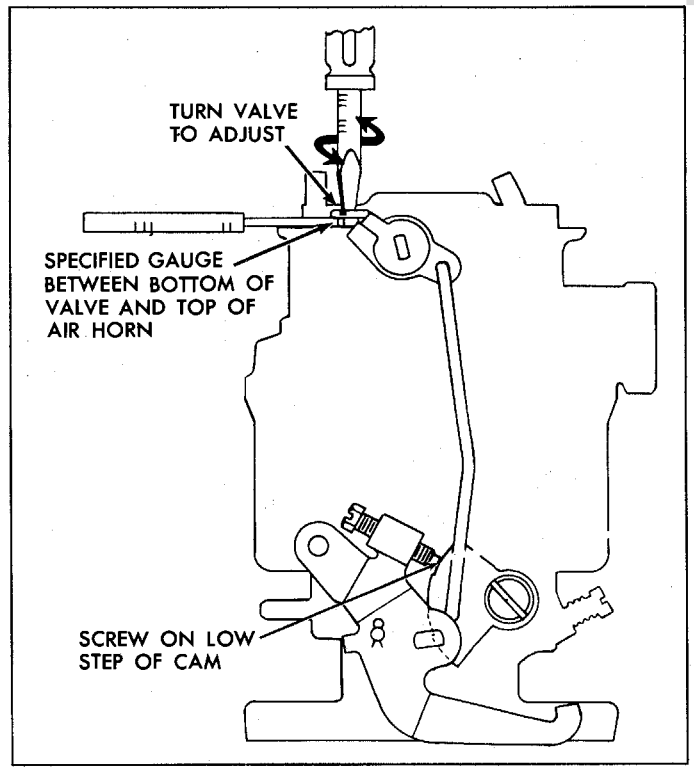


Fig. 12R—Idle Vent Adjustment

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ROCHESTER 2GV

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GENERAL DESCRIPTION

The Rochester 2GV Carburetor (fig. 13R), used in conjunction with a temperature sensing choke coil (mounted on the intake manifold over the exhaust crossover passage), is used with the V8-283 and 327 cu. in. engines.

This is a two barrel carburetor with two venturi and a separate fuel feed for each. All fuel metering is centrally located so each system will give instantaneous response for maximum efficiency and performance.

The removable venturi cluster contains the main nozzles, idle tubes, mixture passages, air bleeds and pump jets. The main nozzles and idle tubes are suspended in fuel in the main wells of the float bowl which helps insulate them from engine heat and minimize percolation spill-over during hot engine operation (fig. 14R).

On vehicles equipped with air conditioning, the carburetor contains a hot idle compensator (fig. 15R). The hot idle compensator consisting of a bi-metal strip, a valve and a mounting bracket located in a cavity at the rear of the carburetor bowl, is a thermostatic controlled air bleed which supplies additional air to the idle mixture during prolonged hot idle periods.

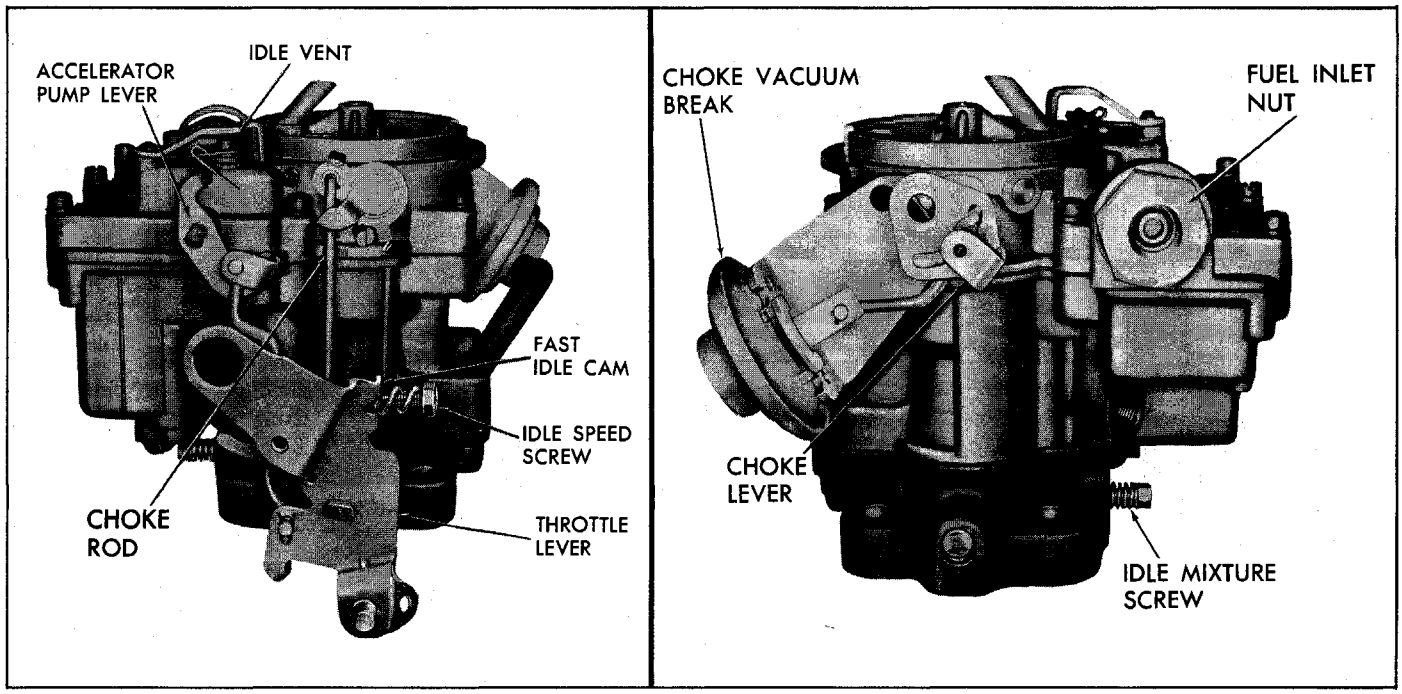


Fig. 13R—Rochester 2GV Carburetor

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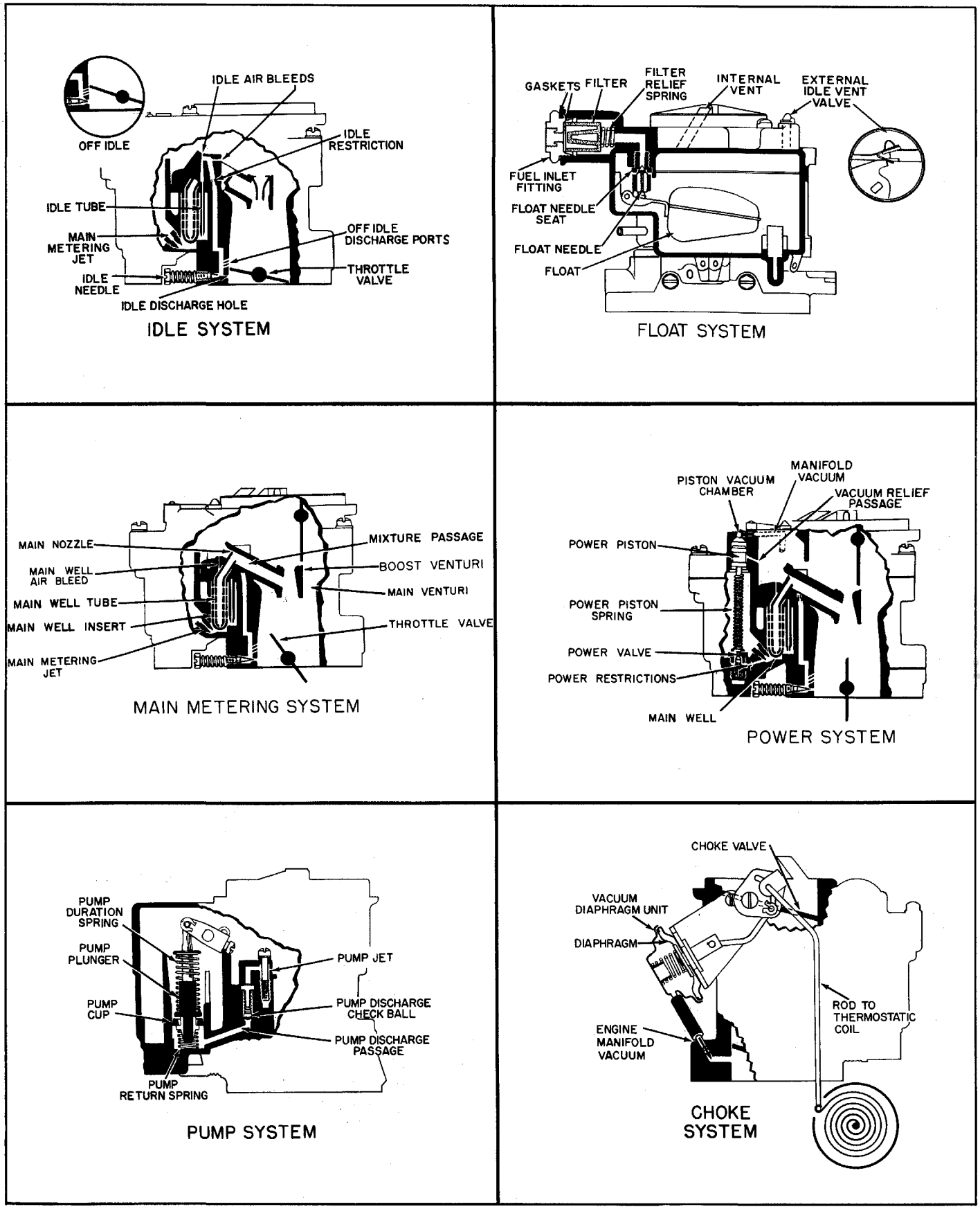


Fig. 14R—Rochester 2GV Systems

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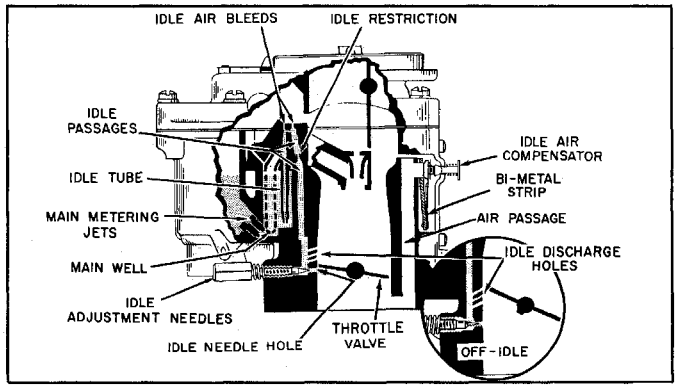


Fig. 15R—Hot Idle Compensator

REPAIR PROCEDURES

Disassembly

Disassemble Air Horn

1. Remove pump rod retaining clip (throttle lever end) then remove rod.
2. Remove fast idle cam, rotate rod to align tang with groove at choke kick lever end, then remove cam and rod.
3. Disconnect choke vacuum diaphragm hose at diaphragm.
4. Remove fuel filter inlet nut, filter, spring and two gaskets.

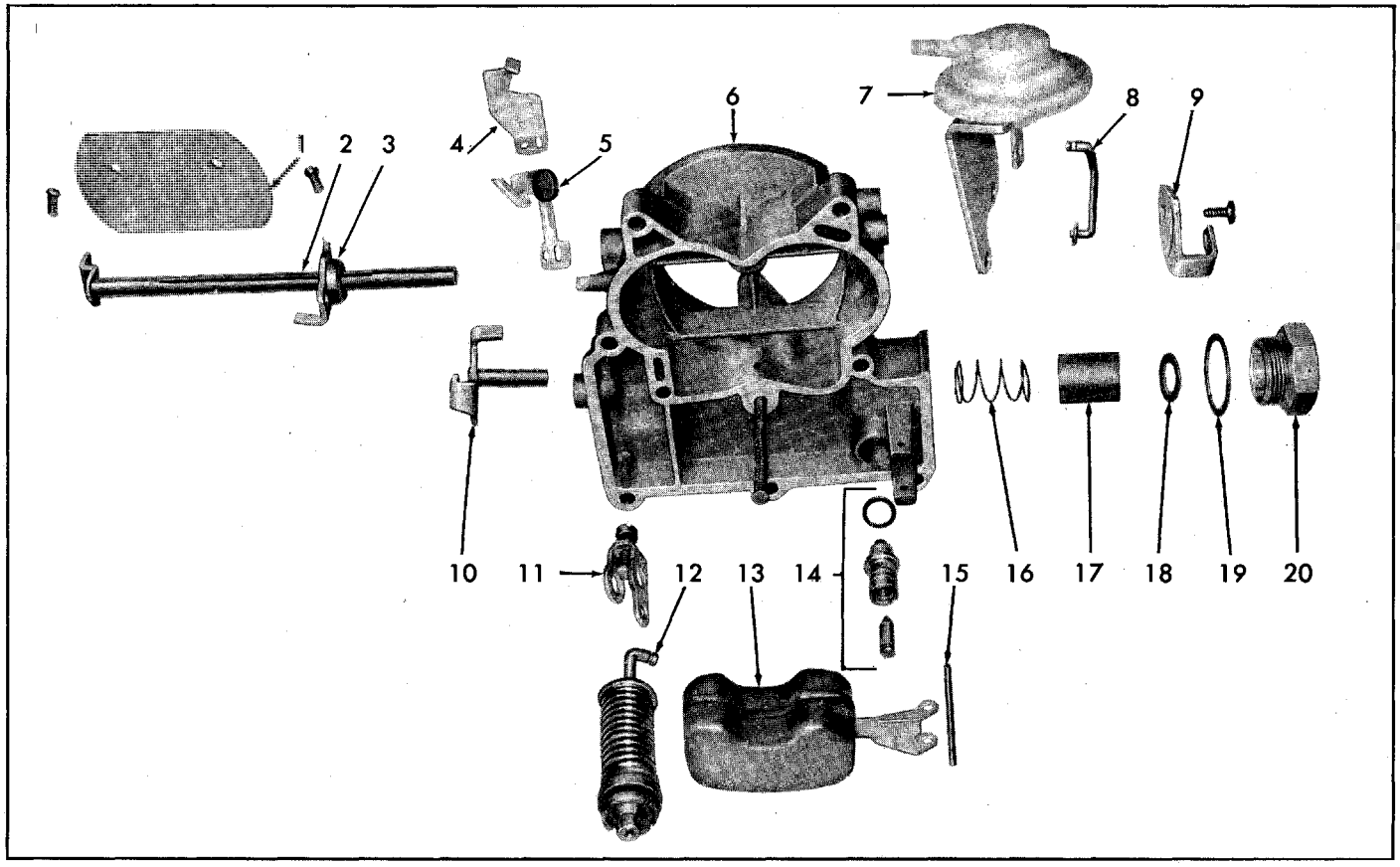


Fig. 16R—Air Horn—Exploded View

1. Choke Valve
2. Choke Shaft
3. Choke Kick Lever
4. Vent Shield
5. Vent Valve
6. Air Horn
7. Vacuum Diaphragm
8. Diaphragm Link
9. Choke Lever
10. Pump Outer Lever
11. Pump Inner Lever
12. Accelerator Pump
13. Float
14. Needle and Seat Assembly
15. Float Hinge Pin
16. Filter Spring
17. Inlet Fuel Filter
18. Gasket—Filter
19. Gasket—Inlet Nut
20. Inlet Nut
21. Fuel Inlet Baffle

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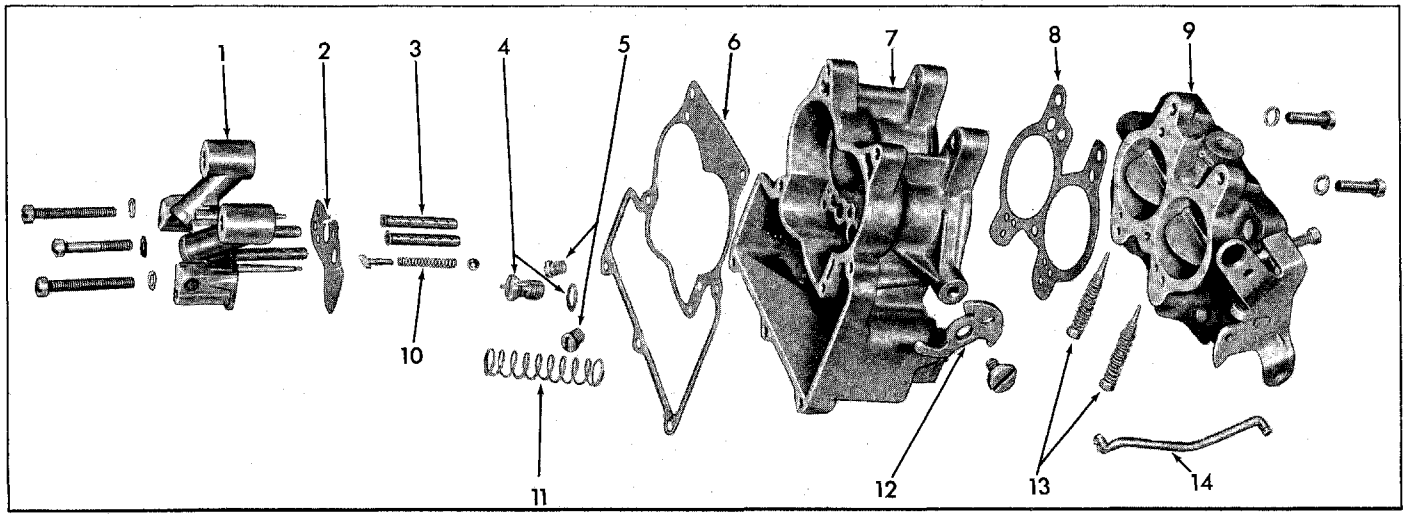


Fig. 17R—Bowl and Throttle Body—Exploded View

1. Cluster Assembly
2. Gasket
3. Splash Shield—Main Well
4. Power Valve Assembly
5. Main Jets
6. Air Horn Gasket
7. Bowl Assembly
8. Throttle Body to Bowl Gasket
9. Throttle Body Assembly
10. Pump Discharge Check Assembly
11. Accelerator Pump Spring
12. Fast Idle Cam
13. Idle Mixture Screws
14. Choke Rod

5. Remove idle vent and bracket.
6. Remove screws and lift air horn from bowl.
7. Place the air horn top-down on bench and remove float hinge pin, float and float needle.
8. Remove float needle seat and gasket with wide blade screw driver.
9. Removing power piston by depressing shaft and allowing spring to snap, thus forcing piston from casting.
10. Remove retainer on pump plunger shaft, remove plunger assembly from pump arm. Place plunger in gasoline or kerosene to prevent rubber from drying out. The pump lever and shaft may be removed by loosening set screw on inner arm and removing outer lever and shaft.

    NOTE: The pump plunger may be further disassembled by compressing the spring and removing the retainer.

11. Remove the air horn gasket.
12. Remove choke lever screw, disengage lever from choke shaft and let it hang from diaphragm rod, then remove diaphragm mounting screws and remove the assembly.
13. If choke shaft or valve need replacement, remove two choke valve screws, then remove choke valve, and slide shaft from cover.

Disassemble Bowl and Throttle Body

1. Remove pump plunger return spring from pump well, and baffle plate from panel.
2. Remove main metering jets and power valve.
3. Remove three screws on top of cluster, then remove cluster and gasket and main well inserts.
4. Using a pair of needlenose pliers, remove the pump discharge spring retainer. Then the spring and check ball may be removed by upending carburetor.
5. Upend carburetor and remove three large bowl to throttle body attaching screws. Throttle body and gasket may now be removed.
6. Remove idle adjusting needles and springs from throttle body.

Cleaning and Inspection

1. Thoroughly clean carburetor castings and metal parts in cleaning solvent.

   CAUTION: Vacuum diaphragm and pump plunger should not be immersed in cleaning solvent. Clean the plunger in clean gasoline - clean the diaphragm unit by wiping with a rag only.

2. Blow all passages in castings dry with compressed air.

   CAUTION: Do not pass drills or wires through calibrated jets or passages as this may enlarge orifice and seriously affect carburetor calibration.

3. Inspect all parts for wear. If wear is noted, defective parts must be replaced. Note especially the following:
   a. Inspect float needle and seat for wear. If wear is noted the assembly must be replaced.
   b. Inspect float lip for wear and float for dents. Inspect floats for leaks by shaking.
   c. Inspect throttle and choke shaft bores in throttle body and air horn castings for wear or out of round.
   d. Inspect idle adjusting needles for burrs or ridges. Such a condition requires replacement.
   e. Inspect fast idle cam. If wear is noted on steps of fast idle cam, it should be replaced as it may upset engine idle speed during the choking period.
   f. Inspect pump plunger rubber. Replace plunger if rubber is damaged.
   g. Inspect gaskets to see if they appear hard or brittle or if the edges are torn or distorted. If any such condition is noted they must be replaced.
   h. Inspect filter for dirt or lint. Clean and if it is distorted or remains plugged, replace.

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i. Inspect cluster assembly. If for any reason parts have become loose or damaged in the cluster casting, it must be replaced.

Assembly and Adjustments

Assemble Bowl and Throttle Body

1. Screw idle adjusting needles and springs into throttle body until finger tight. Back out screw 1-1/2 turns as a temporary idle adjustment.

   CAUTION: Do not force needle against seat or damage will result.

2. Upend bowl, place new throttle body gasket in position and attach throttle body to bowl. Tighten screws evenly and securely.
3. Drop pump discharge check ball into discharge hole. Ball is 3/16" diameter steel. Install spring and retainer.
4. Install main well inserts, gasket and cluster assembly, tighten screws evenly and securely. Make certain center screw is fitted with gasket.
5. Install main metering jets, power valve gasket and power valve. Figure 18R shows the bowl and throttle body at this stage of assembly.
6. Install pump return spring, pressing with finger to center it in pump well. Install baffle plate.

Assemble Air Horn

1. Install choke shaft and choke valve if they were removed.
2. Install vacuum diaphragm with bracket screws, then install choke lever on end of choke shaft and retain with screw.
3. Install vent valve and shield.
4. Install fuel inlet filter spring, filter, gaskets and inlet nut.
5. Install pump lever assembly.

   NOTE: Lubricate pump shaft bearing surface with lubriplate before installation.

6. Install float needle seat and gasket, using wide blade screw driver.
7. Install power piston in vacuum cavity; piston should travel freely in cavity. Lightly stake retainer in place.
8. Attach accelerator pump shaft with retainer, with shaft end pointing inward.
9. Install air horn gasket.
10. Attach needle to float, carefully position float and insert float hinge pin. Figure 19R shows the air horn assembled.

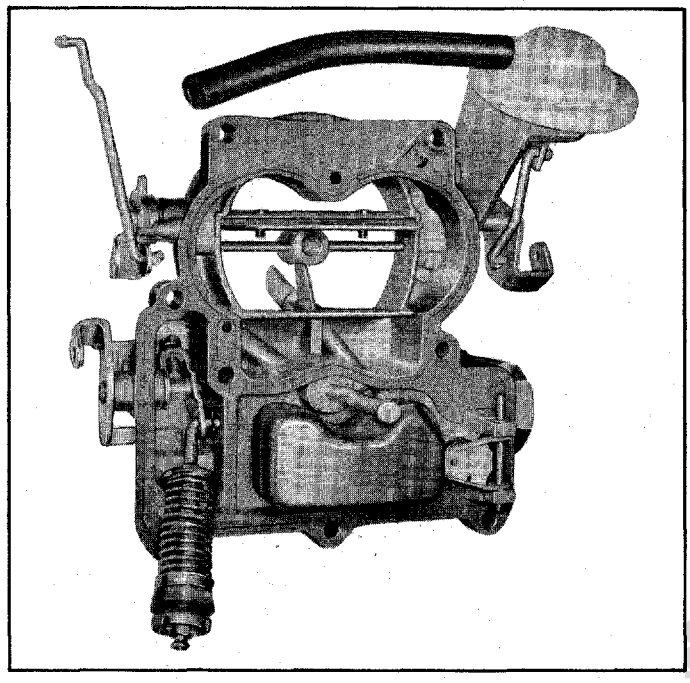


Fig. 19R—Air Horn Assembly—Parts Location

Adjust Float

1. With air horn inverted and air horn gasket installed measure the distance from the air horn gasket to the lower edge (sharp edge) of the float seam at the outer end of the float pontoon. To adjust, bend the float arm at rear, as shown in inset (fig. 20R).

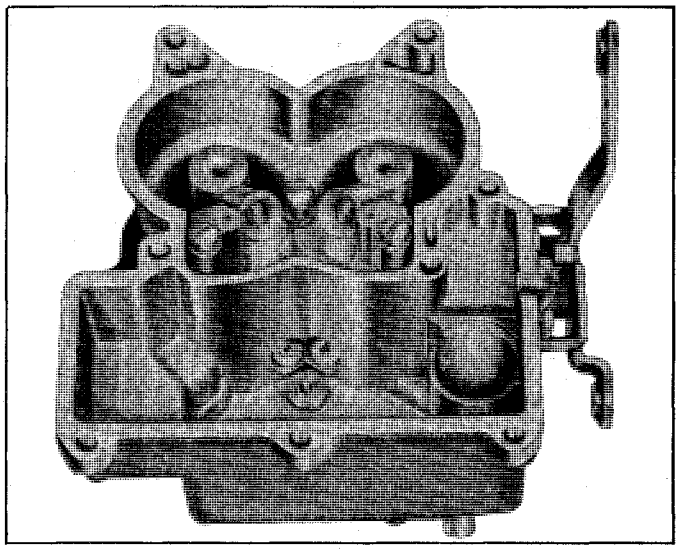


Fig. 18R—Bowl Assembly—Parts Location

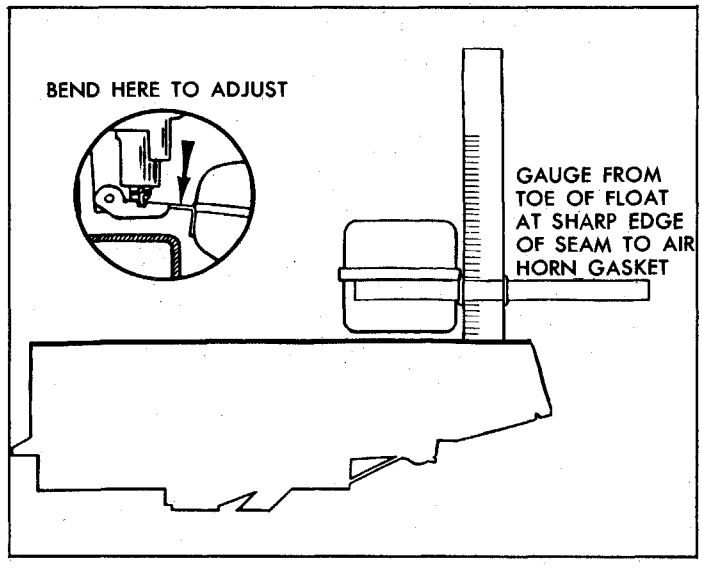


Fig. 20R—Float Level Adjustment

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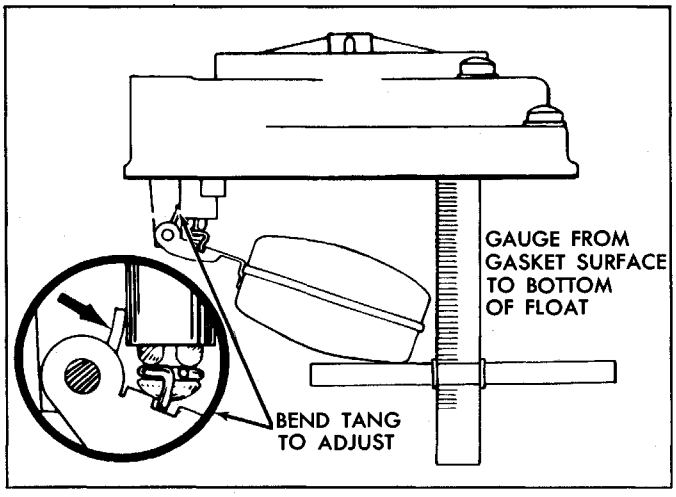


Fig. 21R—Float Drop Adjustment

2. With the air horn assembly held upright and floats suspended freely, measure dimension from air horn gasket to bottom of float pontoon at toe, adjust to specified dimension by bending tang which contacts seat at rear of float arm (fig. 21R).

Assemble Air Horn to Bowl

1. Place air horn on bowl, making certain that accelerator pump plunger is positioned and will move freely. Raise air horn and lower straight down to insure proper installation.
2. Install and tighten 8 air horn screws evenly and securely.
3. Install pump rod and retainer.
4. Install fast idle rod in choke kick lever, then fast idle cam at the other end, rotate the rod and install cam on bowl.

   NOTE: The rod offset end goes toward fast idle cam.

5. Connect vacuum hose at flange.

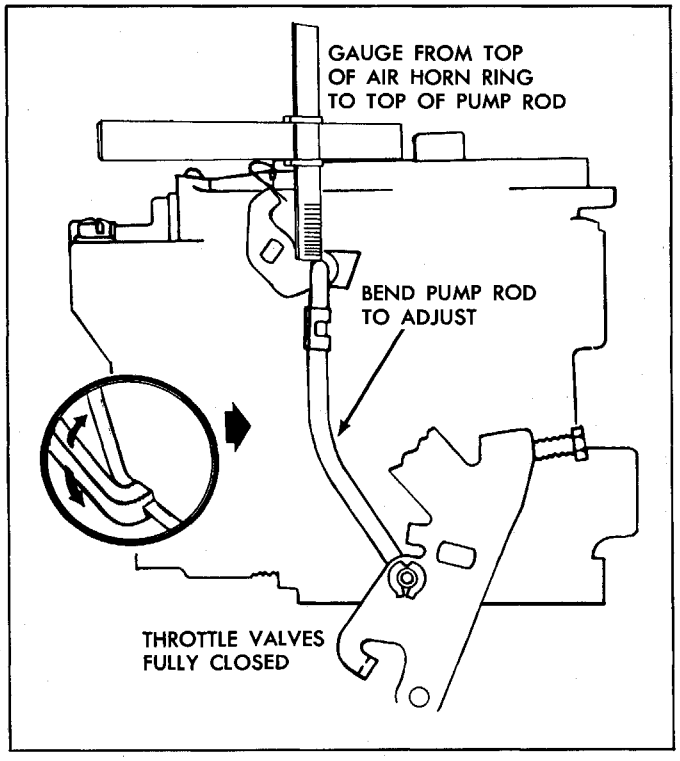


Fig. 22R—Accelerator Pump Rod Adjustment

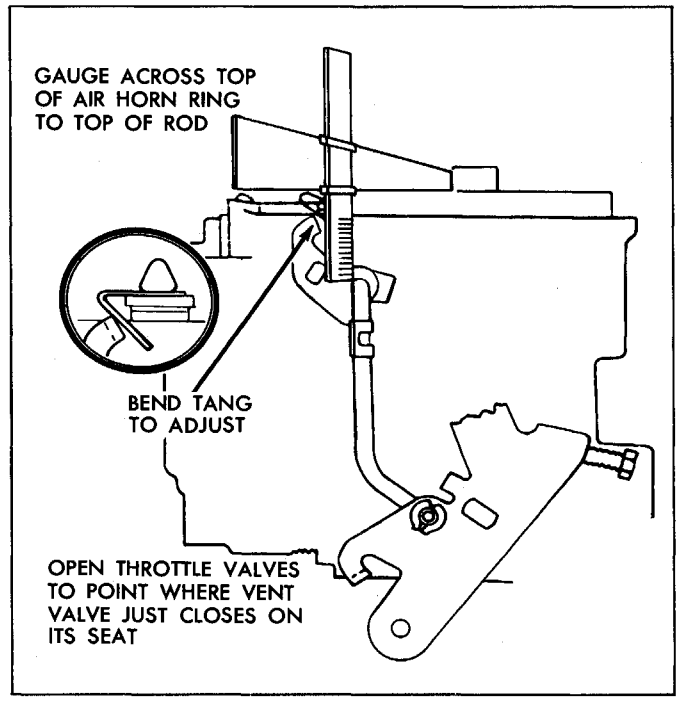


Fig. 23R—Idle Vent Adjustment

Adjust Accelerator Pump Rod

Back out idle stop screw and completely close throttle valves in bore. Place gauge on top of air horn ring. Bend the pump rod at lower angle to obtain specified dimension, to top of pump rod (fig. 22R).

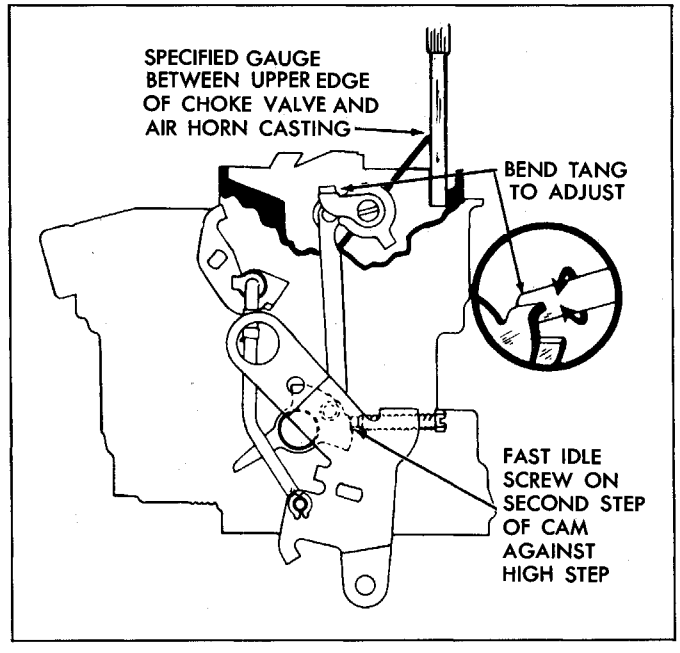


Fig. 24R—Choke Rod (Fast Idle) Adjustment

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Adjust Idle Vent

NOTE: Always make pump rod adjustment before checking and adjusting idle vent valve.

Open throttle until vent valve just closes. Place gauge on top of air horn ring. Dimension to top of pump rod should be as specified. Adjust by bending tang on pump lever (fig. 23R).

Adjust Choke Rod (Fast Idle)

Turn stop screw in until it just contacts bottom step of fast idle cam. Then turn screw in one full turn. Place idle screw on second step of fast idle cam against shoulder of high step. With screw in this position, hold choke valve toward closed position with a rubber band and check clearance between upper edge of choke valve and air horn wall. Adjust to specified dimension by bending tang on choke lever and collar assembly (fig. 24R).

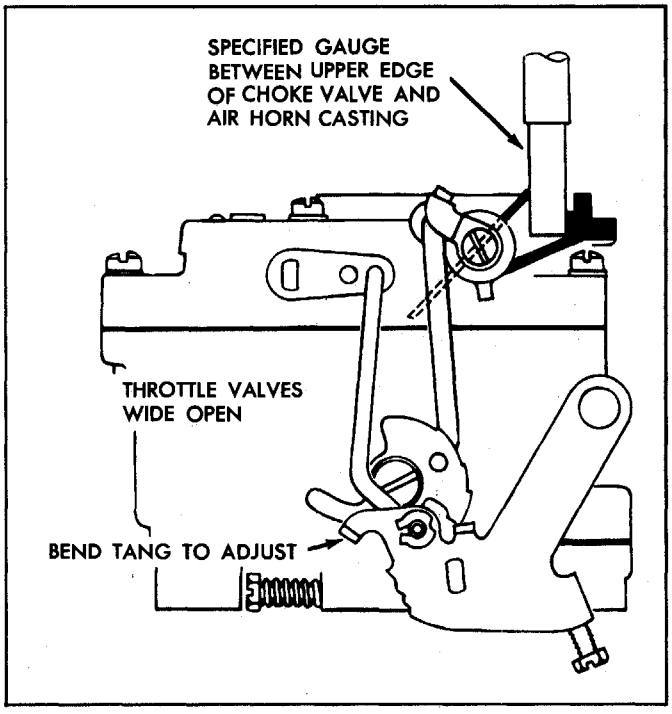


Fig. 25R—Choke Unloader Adjustment

Adjust Choke Unloader

With the throttle valves held wide open and the choke valve held toward the closed position with a rubber band, bend the unloader tang on the throttle lever to obtain specified clearance between the upper edge of the choke valve and air horn wall (fig. 25R).

Adjust Choke Vacuum Break

Push the vacuum break diaphragm plunger in until seated. Hold the choke valve toward closed position with a rubber band. Bend vacuum break line so that the specified gauge will fit between the upper edge of the choke valve and inside wall of the air horn (fig. 26R).

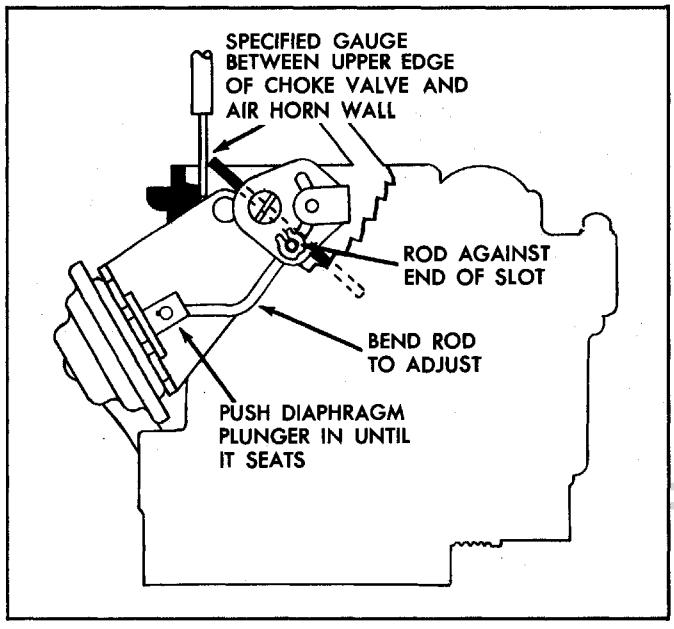


Fig. 26R—Choke Vacuum Break Adjustment

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ROCHESTER 4MV

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GENERAL DESCRIPTION

The Rochester 4MV Carburetor (fig. 27R), used in conjunction with a temperature sensing choke coil (mounted on the intake manifold over the exhaust crossover passage), is used with 327 cu. in. (275 HP) engines, with 350 cu. in. (295 HP) engines, with 396 cu. in. (325 HP) engines, and with 427 cu. in. (385 HP Chevrolet) engines.

This is a four barrel, two stage carburetor with versatility and principles of operation that make it adaptable for small to large engines without design changes.

The fuel bowl is centrally located to avoid problems of fuel slosh, causing engine turn cut-out, and delayed fuel flow to the carburetor bores. The float needle valve is pressure balanced to permit use of a small single float pontoon.

The primary side has small bores and a triple venturi for fine fuel control in the idle and economy ranges. The secondary side has large bores and an air valve for high air capacity (fig. 28R).

A hot idle compensator, consisting of a bi-metal strip, a valve and a mounting bracket located at the rear of the carburetor adjacent to the secondary bores supplies additional air to the idle mixture during prolonged hot idle periods.

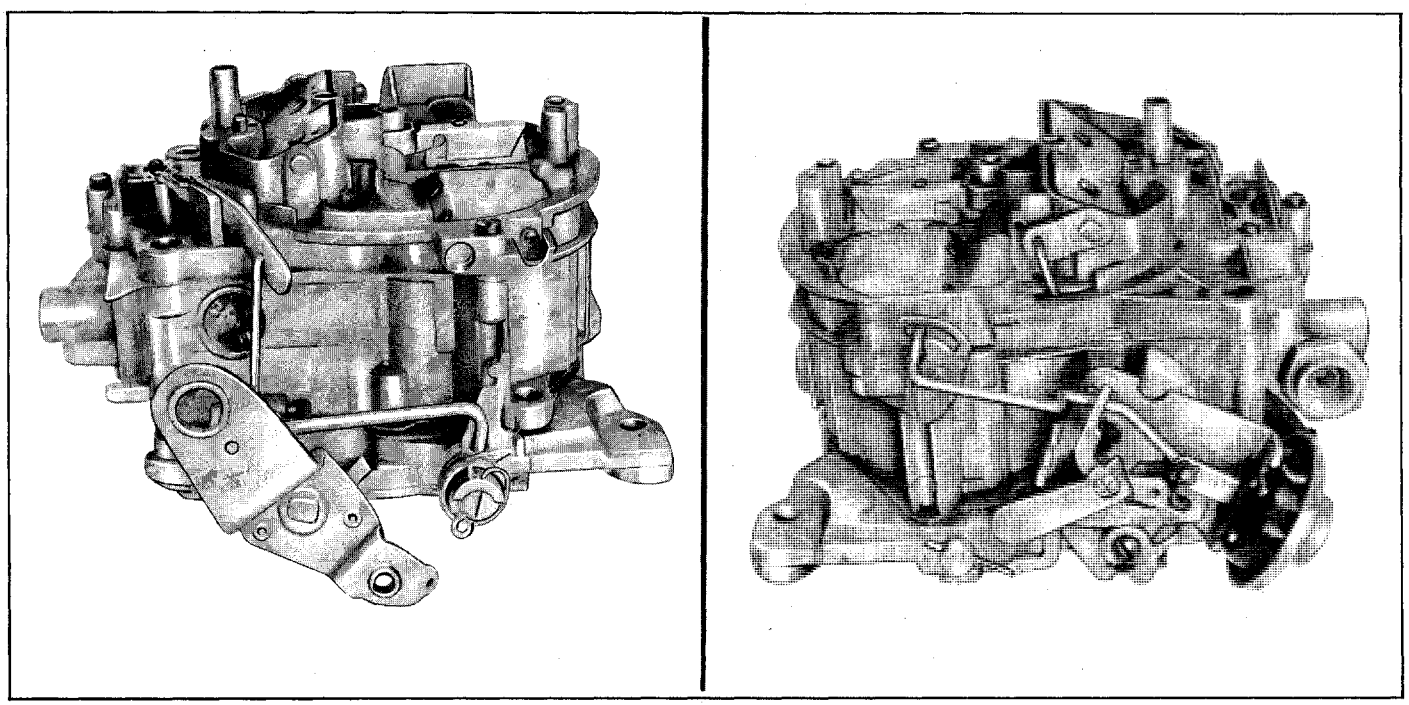


Fig. 27R—Rochester 4MV Carburetor

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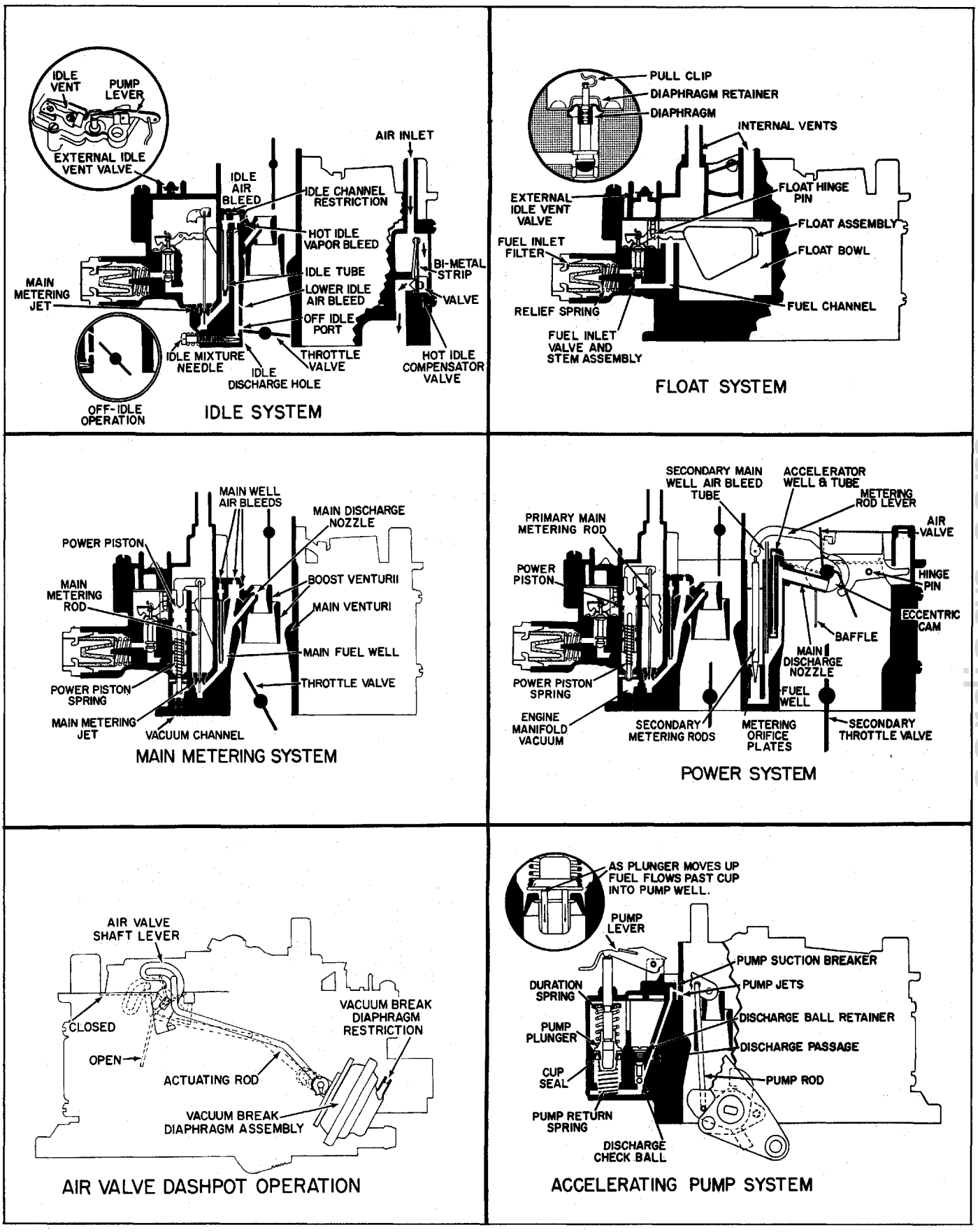


Fig. 28R—Rochester 4MV Fuel Systems

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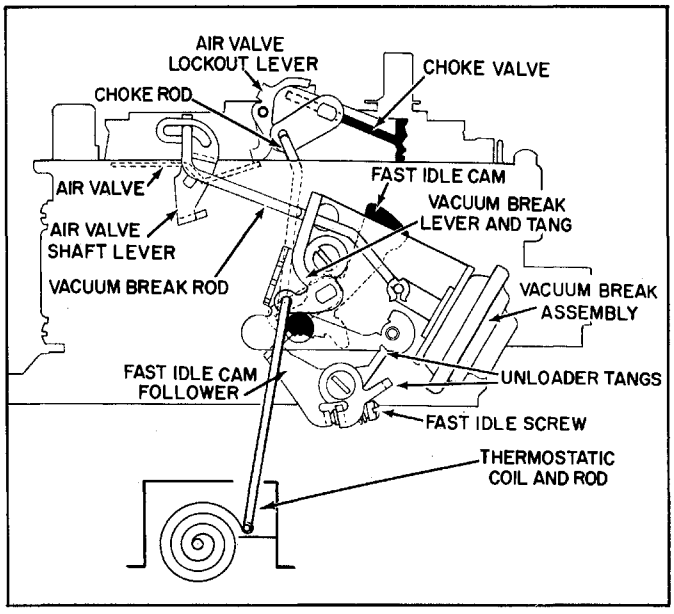


Fig. 29R—Choke System 327-350 cu. in. Engine

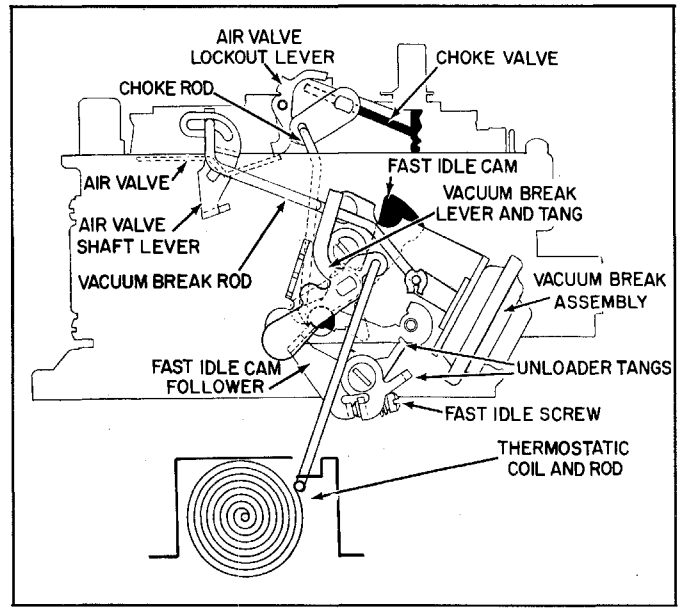


Fig. 30R—Choke System 396-427 cu. in. Engine

REPAIR PROCEDURES

Disassembly

NOTE: Place carburetor on proper holding fixture.

Air Horn Removal

1. Remove idle vent valve attaching screw then remove idle vent valve assembly.
2. Remove clips from upper end of choke rod, disconnect choke rod from upper choke shaft lever and remove choke rod from bowl.
3. Remove spring clip from upper end of pump rod then disconnect pump from pump lever.
4. Remove seven air horn to bowl attaching screws, two attaching screws are located next to the primary venturi. (Two long screws, three short screws, two counter-sunk screws).
5. Remove air horn by lifting straight up. Air horn gasket should remain on bowl for removal later.

CAUTION: Care must be taken not to bend two small main well air bleed tubes protruding from air horn. These are permanently pressed into casting. DO NOT REMOVE.

Air Horn Disassembly

1. Remove secondary metering rods by holding air valve wide open, then tilt and slide rods from holes in hanger.

NOTE: Further disassembly of the air horn is not required for cleaning purposes. If part replacement is required, proceed as follows:

2. Remove choke valve attaching screws then remove choke valve and shaft.
3. Remove pump lever roll pin then pump lever.

CAUTION: Air valves and air valve shaft are calibrated and should not be removed.

Float Bowl Disassembly

1. Remove pump plunger from pump well.
2. Remove air horn gasket from dowels on secondary side of bowl, then remove gasket from around power piston and primary metering rods.
3. Remove pump return spring from pump well.

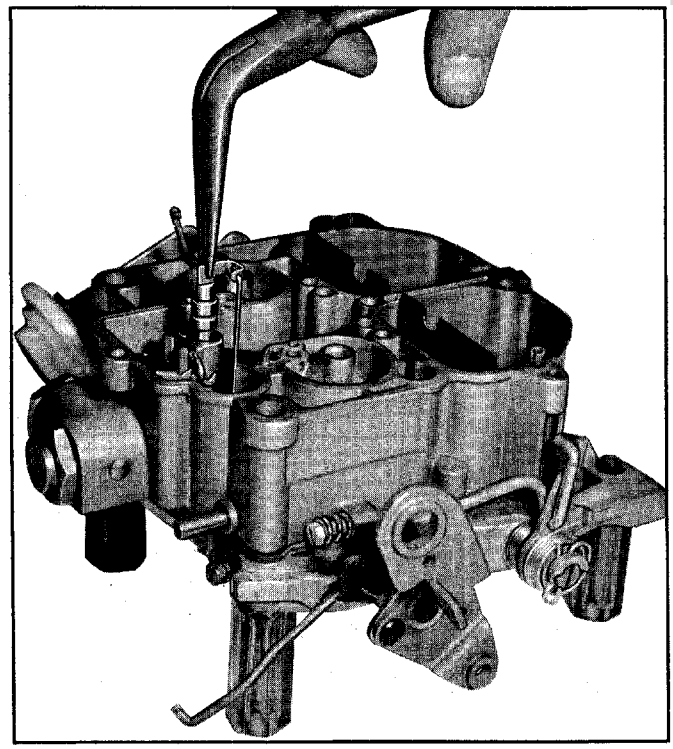


Fig. 31R—Removing Power Piston

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4. Remove plastic filler over float valve.
5. Remove power piston and primary metering rods, using needle nosed pliers to pull straight up on metering rod hanger directly over power piston (fig. 31R). Remove power piston spring from well.

   NOTE: The power piston assembly is held in place for ease in assembly of the air horn, by a brass expansion ring around the power piston.

6. Remove metering rods from power piston by disconnecting tension spring from top of each rod then rotating rod to remove from hanger.
7. Remove float assembly by pulling up slightly on retaining pin until pin can be removed by sliding toward pump well. After pin is removed, slide float assembly toward front of bowl to disengage needle pull clip being careful not to distort pull clip.
8. Remove pull clip from needle.
9. Remove two screws from float needle retainer then remove retainer and needle assembly.

   CAUTION: Needle seat is factory staked and tested. Do not attempt to remove or restake. If damaged, replace float bowl assembly.

10. Remove primary metering jets. No attempt should be made to remove secondary metering discs.
11. Remove pump discharge check ball retainer and check ball.
12. Remove baffle from secondary side of bowl.
13. Remove vacuum hose from vacuum break assembly and from tube connection on bowl.
14. Remove retaining screw from choke assembly and remove assembly from float bowl then remove secondary lock out link from bowl.

    NOTE: If further disassembly of choke is necessary, remove clip from vacuum break link, at vacuum break lever, then remove rod from vacuum break lever. Spread the retaining ears on bracket next to vacuum break assembly, then remove vacuum break assembly from lever.

15. Remove fast idle cam from choke assembly.

    CAUTION: Do not place vacuum break assembly in carburetor cleaner.

16. Remove lower choke rod and actuating lever from inside of float bowl well.
17. Remove two screws from hot idle compensator cover then remove hot idle compensator and "O" ring from float bowl.
18. Remove fuel inlet filter nut, gasket, filter and spring.
19. Remove throttle body by removing throttle body to bowl attaching screws.
20. Remove throttle body to bowl insulator gaskets.

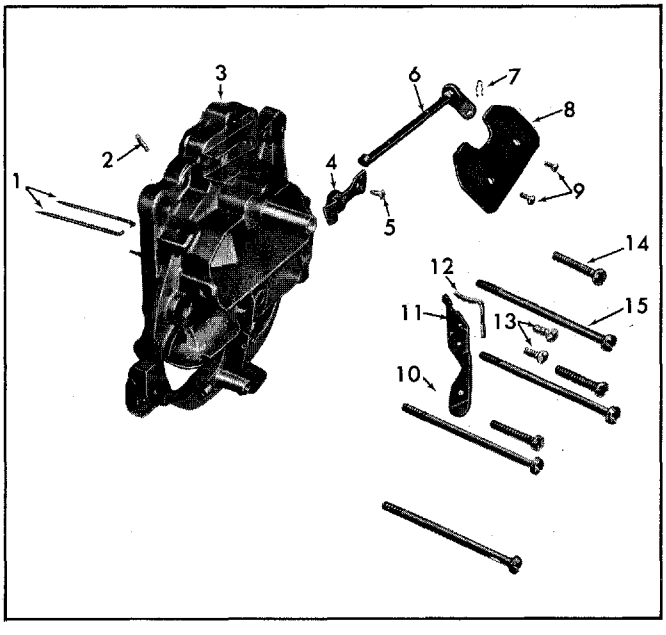


Fig. 32R—Air Horn—Exploded View

1. Metering Rod - Secondary
2. Roll Pin - Pump Lever
3. Air Horn Assembly
4. Idle Vent Valve
5. Screw - Idle Vent Valve
6. Choke Shaft and Lever Assembly
7. Clip - Choke Rod
8. Choke Valve
9. Screw - Choke Valve
10. Clip - Pump Rod
11. Lever - Pump Actuating
12. Lever - Idle Vent Valve
13. Screw - Air Horn
14. (Counter Sunk) Screw - Air Horn (Short)
15. Screw - Air Horn (Long)

Throttle Body Disassembly

1. Remove pump rod from throttle lever by rotating rod out of primary throttle lever.
2. Remove idle mixture screws and springs.

   CAUTION: Extreme care must be taken to avoid damaging secondary throttle valves.

   NOTE: No further disassembly of the throttle body is required.

Cleaning and Inspection

NOTE: The carburetor should be cleaned in a cold immersion type cleaner.

1. Thoroughly clean carburetor castings and metal parts in an approved carburetor cleaner.

   CAUTION: Any rubber parts, plastic parts, diaphragms, pump plungers, should not be immersed in carburetor cleaner. However, the delrin cam on the air valve shaft will withstand normal cleaning in carburetor cleaner.

2. Blow out all passages in castings with compressed air. Do not pass drills through jets or passages.
3. Inspect idle mixture needles for damage.
4. Examine float needle and diaphragm for wear. Replace if necessary with new float needle assembly.
5. Inspect upper and lower surfaces of carburetor castings for damage.
6. Inspect holes in levers for excessive wear or out of round conditions. If worn, levers should be replaced.
7. Examine fast idle cam for wear or damage.
8. Check air valve for binding conditions. If air valve is damaged, air horn assembly must be replaced.
9. Check all throttle levers and valves for binds or other damage.

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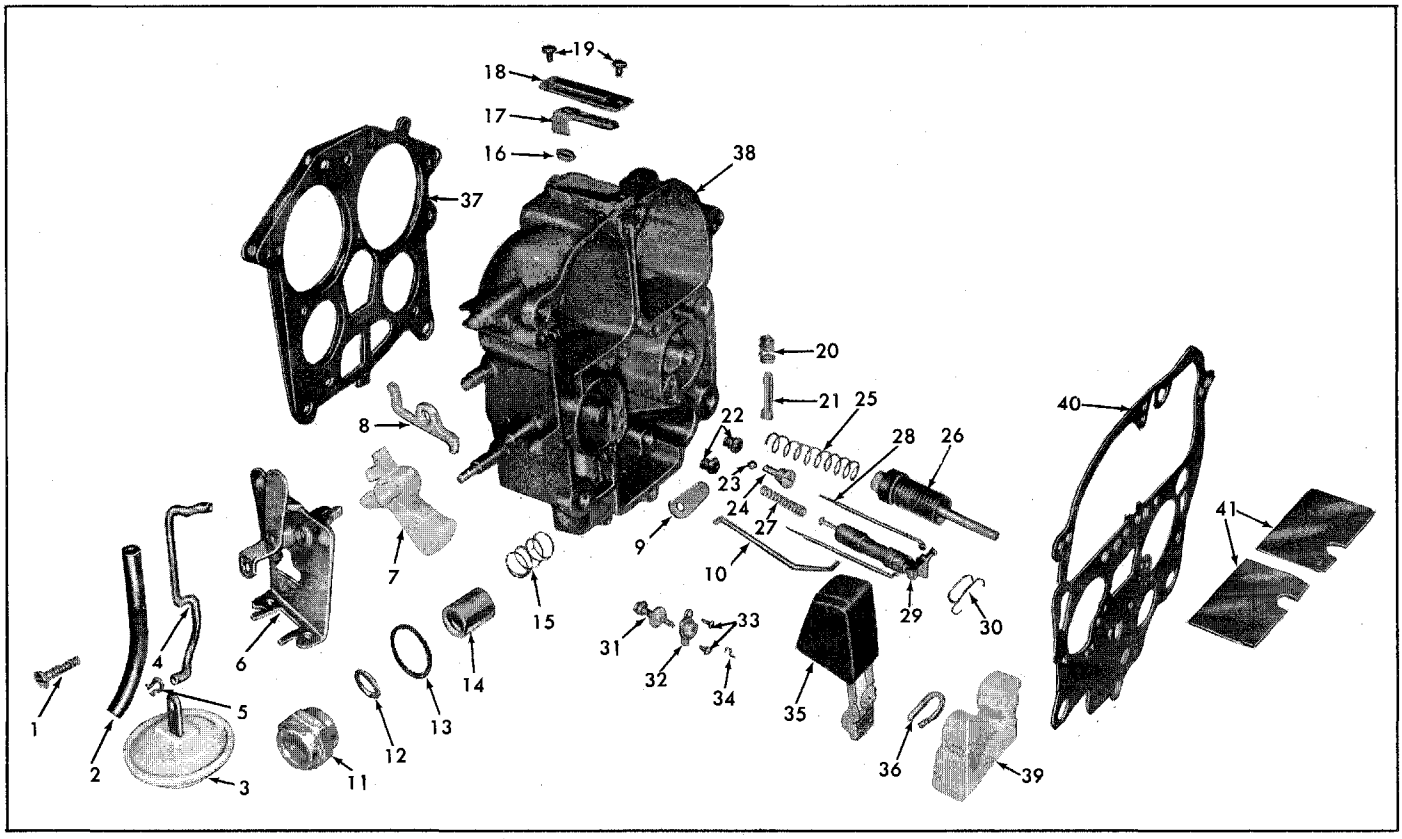


Fig. 33R—Float Bowl—Exploded View

1. Screw - Choke Control
2. Hose - Vacuum Break
3. Vacuum Break
4. Link - Vacuum Break
5. Clip - Vacuum Break Rod
6. Bracket Assembly - Choke Control
7. Cam-Fast Idle
8. Lever - Secondary Lock Out
9. Lever - Choke Intermediate
10. Rod - Choke
11. Nut - Fuel Inlet
12. Gasket - Fuel Filter
13. Gasket - Fuel Inlet Nut
14. Filter - Fuel Inlet
15. Spring - Fuel Filter
16. Gasket - Idle Compensator
17. Idle Compensator Assembly
18. Cover - Idle Compensator
19. Screw - Idle Compensator Cover
20. Spring - Idle Speed Screw
21. Screw - Idle Speed
22. Jet - Primary
23. Ball - Pump Discharge
24. Retainer - Pump Discharge Ball
25. Spring - Pump Return
26. Pump Assembly
27. Spring - Power Piston
28. Metering Rod - Primary
29. Power Piston Assembly - Primary
30. Spring - Metering Rod Primary
31. Float Needle and Diaphragm Assembly
32. Retainer - Float Needle Assembly
33. Screw - Float Needle Retainer
34. Pull Clip - Float Needle
35. Float Assembly
36. Hinge Pin - Float Assembly
37. Gasket - Throttle Body
38. Float Bowl Assembly
39. Insert - Float Bowl
40. Gasket - Air Horn
41. Baffle - Float Bowl

Assembly and Adjustments

Throttle Body Assembly

1. Install idle mixture needles and springs until seated. Back out needles two turns as a preliminary idle adjustment.
2. Install pump rod in hole of throttle lever by rotating rod.

Float Bowl Assembly

1. Install new throttle body to bowl insulator gasket being certain the gasket is properly installed over two locating dowels on bowl.
2. Install throttle body making certain throttle body is properly located over dowels on float bowl then install throttle body to bowl screws and tighten evenly and securely.

   Place carburetor on proper holding fixture.
3. Install fuel inlet filter spring, filter, new gasket and inlet nut and tighten nut securely.
4. Install hot idle compensator "O" ring seal in recess in bowl then install hot idle compensator.

NOTE: If vacuum break diaphragm was removed from bracket, slide vacuum break diaphragm between retaining ears to hold securely. Install vacuum break rod (U-bend end) in diaphragm link with end towards bracket then install grooved end of rod in hole of actuating lever and retain to vacuum break lever with spring clip.

5. Install fast idle cam on vacuum break assembly. Be sure fast idle cam actuating pin on intermediate choke shaft is located in cut out area of fast idle cam.
6. Connect choke rod to choke rod actuating lever (plain end) then holding choke rod, with grooved end pointing inward, position choke rod actuating lever in well of float bowl and install choke assembly engaging shaft with hole in actuating lever (fig. 35R). Install retaining screw and tighten securely. Remove choke rod from lever for installation later.
7. Install vacuum hose to tube connection on bowl and vacuum break assembly.

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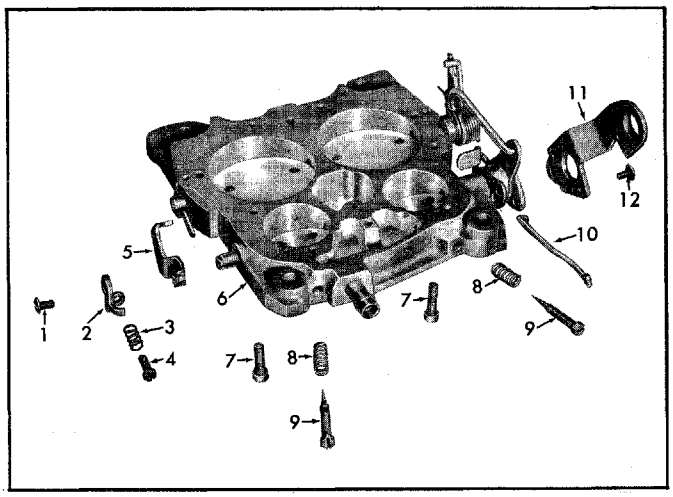


Fig. 34R—Throttle Body—Exploded View

1. Screw - Cam and Fast Idle Levers
2. Fast Idle Lever
3. Spring - Fast Idle Screw
4. Screw - Fast Idle Adjusting
5. Cam Lever
6. Throttle Body Assembly
7. Screw - Throttle Body
8. Spring - Idle Needle
9. Idle Needle
10. Rod - Accelerator Pump
11. Throttle Lever
12. Screw - Throttle Lever

8. Install air deflector in secondary side of bowl with notches towards top.
9. Install pump discharge check ball and retainer in passage next to pump well.
10. Install primary main metering jets.
11. Insert float needle and diaphragm assembly. Be certain diaphragm is properly positioned before installing retainer. Install needle retainer and two screws and tighten securely.

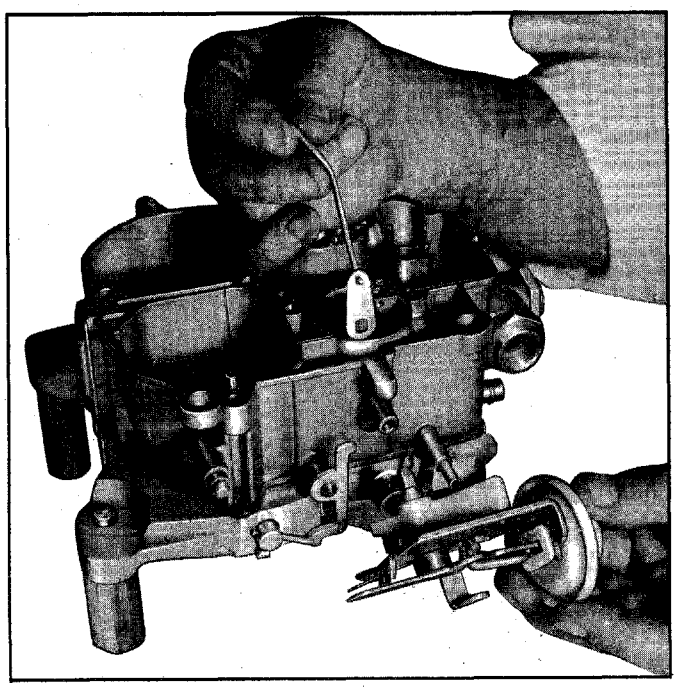


Fig. 35R—Installing Choke Assembly

12. Using needle nosed pliers to hold needle pull clip, install pull clip on needle. Pull clip is properly positioned with open end towards front of bowl.
13. Install float by sliding float lever under pull clip from front to back. With float lever in pull clip, hold float assembly at toe and install retaining pin from pump well side. Be careful not to distort pull clip.

14. Float Level Adjustment (Fig. 36R)

a. With adjustable T-scale, measure from top of float bowl gasket surface (gasket removed) to top of float at toe (located gauging point 3/16" back from toe).

NOTE: Make sure retaining pin is held firmly in place and tang of float is seated on float needle.

b. Bend float up or down for proper adjustment.

15. Install power piston spring in power piston well. If primary main metering rods were removed from hanger reinstall making sure that tension spring is connected to top of each metering rod. Install power piston assembly in well with metering rods properly positioned in metering jets. Press down firmly on power piston to insure engagement of retaining clip.
16. Install plastic filler over float needle, pressing downward until seated properly.
17. Install pump return spring in pump well.
18. Install air horn gasket around primary metering rods and piston. Position gasket over two dowels on secondary side of bowl. Press power piston down firmly to assure correct alignment engagement of pin.
19. Install pump plunger in pump well.

Air Horn Assembly

1. Install the following, if removed.
   - Install pump lever and retain with roll pin.
   - Install choke shaft, choke valve, and two attaching screws.
2. Install secondary metering rods. With air valve held wide open, rods should be positioned with upper ends through hanger holes and towards each other (fig. 37R).

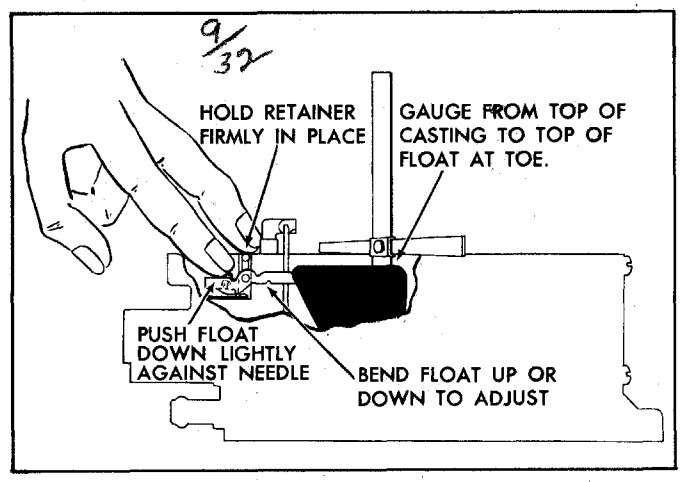


Fig. 36R—Float Level Adjustment

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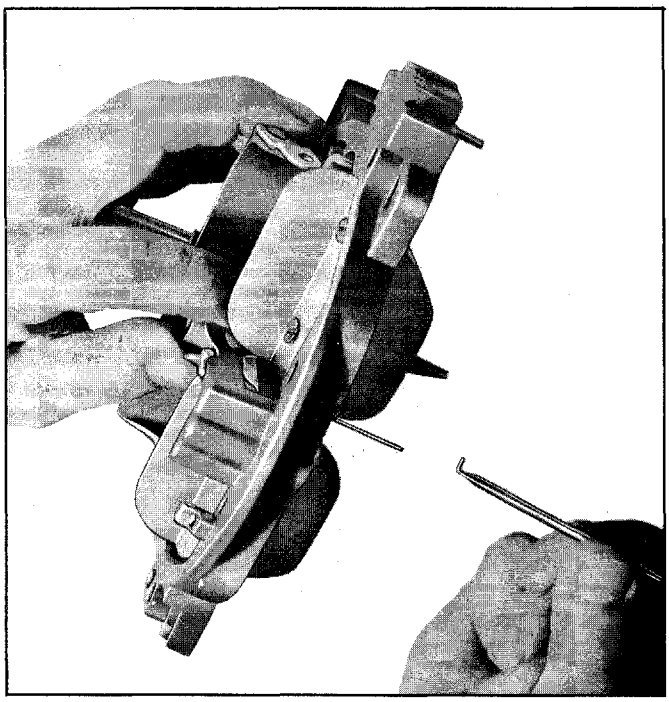


Fig. 37R—Installing Secondary Metering Rods

Air Horn to Bowl Installation

1. Place air horn assembly on bowl carefully, positioning secondary metering rods, vent tubes, and accelerating well tubes through air horn gasket. Do not force air horn assembly on to float bowl as distortion of secondary metering discs will result. A slight sideward movement will center metering rods in metering discs.
2. Install two long air horn screws, three short screws, snd two counter-sunk screws in primary venturi area. All screws must be tightened evenly and securely.
3. Install idle vent actuating rod in pump lever.
4. Connect pump rod in pump lever and retain with spring clip.
5. Connect choke rod in lower choke lever and retain in upper lever with spring clip.

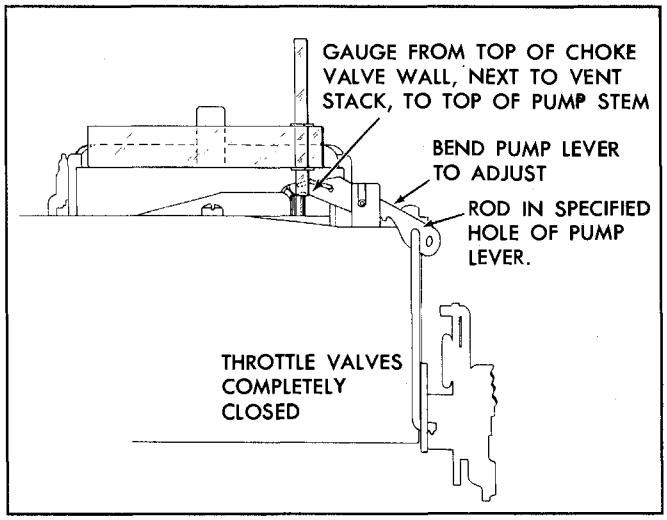


Fig. 38R—Pump Rod Adjustment

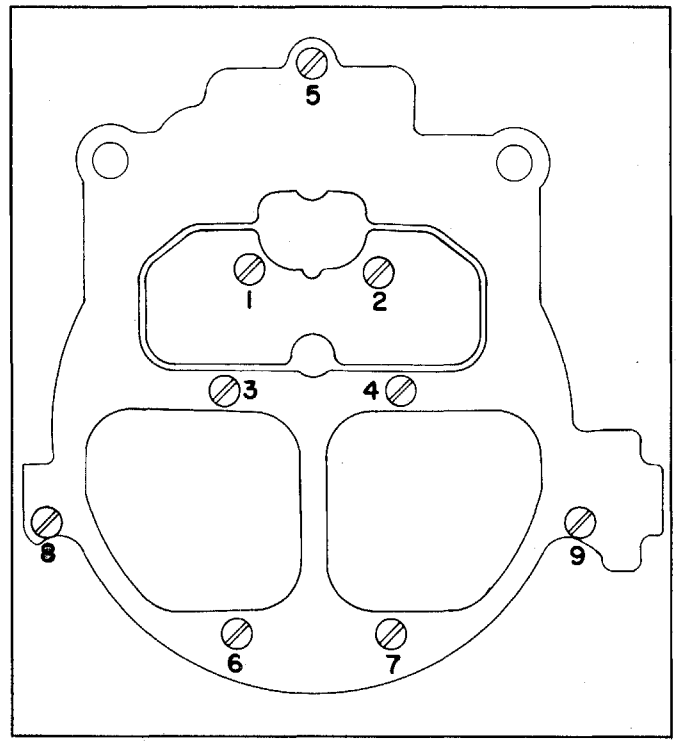


Fig. 39R—Air Horn Tightening Sequence

6. Install idle vent valve, engaging actuating rod and tighten attaching screw.

Pump Rod Adjustment

With throttle valves completely closed and pump rod in specified hole of pump lever, measure from top of choke valve wall, next to vent stack, to top of pump stem with adjustable T-scale. Dimension should be as specified. Bend pump lever to adjust (fig. 38R).

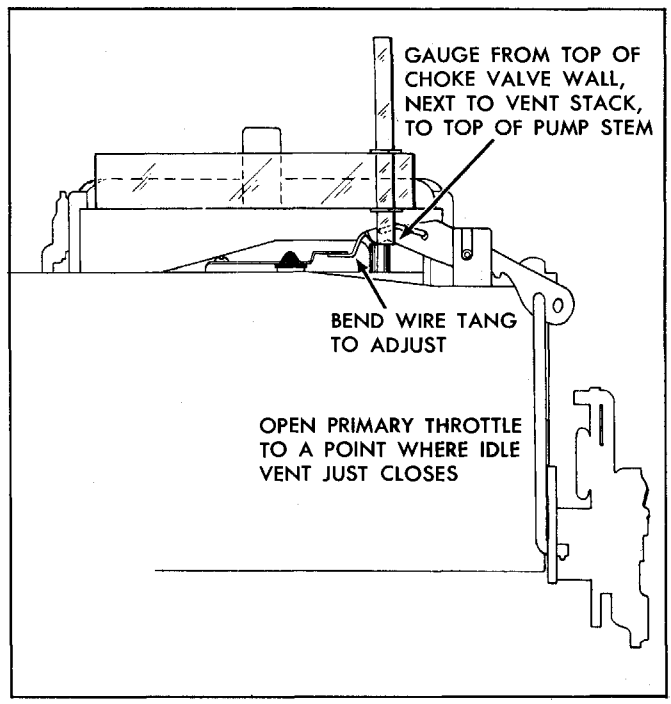


Fig. 40R—Idle Vent Adjustment

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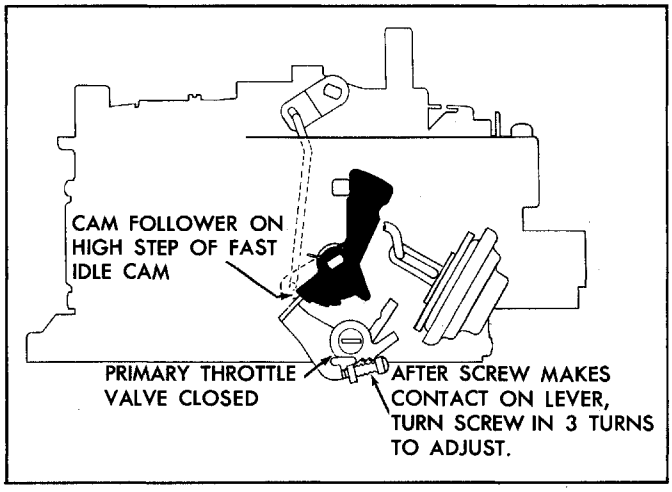


Fig. 42R—Fast Idle Adjustment

Idle Vent Adjustment

After pump rod adjustment has been made, open primary throttle to a point where the idle vent just closes.

With adjustable T-scale, measure the distance from the top of choke valve wall, next to vent stack, to top of the pump plunger stem. Bend wire tang on pump lever to adjust (fig. 40R).

Fast Idle Adjustment

With primary throttle valves completely closed and the cam follower over the high step of the fast idle cam, turn fast idle screw in 3 turns after screw makes contact on lever (fig. 42R).

Choke Rod Adjustment

With the fast idle adjustment made, and cam follower on second step of fast idle cam and against the high step, rotate the choke valve toward the closed position by pushing down on the vacuum break tang. Dimension between the lower edge of choke valve, at choke lever end, should be as specified. Bend choke rod to adjust (fig. 43R).

Vacuum Break Adjustment

Hold the choke valve toward the closed position using a rubber band on the vacuum break lever. Hold vacuum

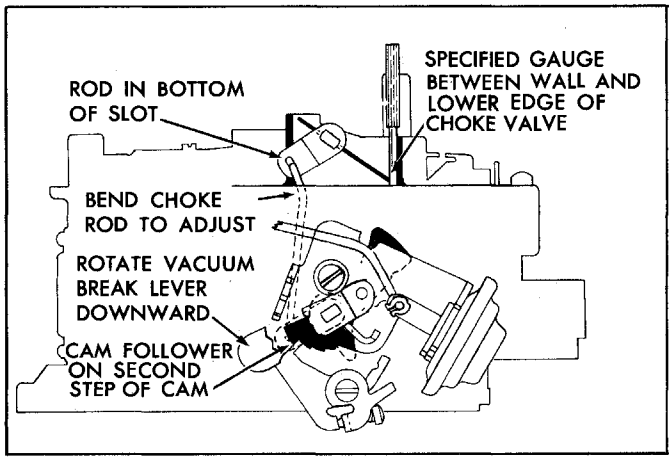


Fig. 43R—Choke Rod Adjustment

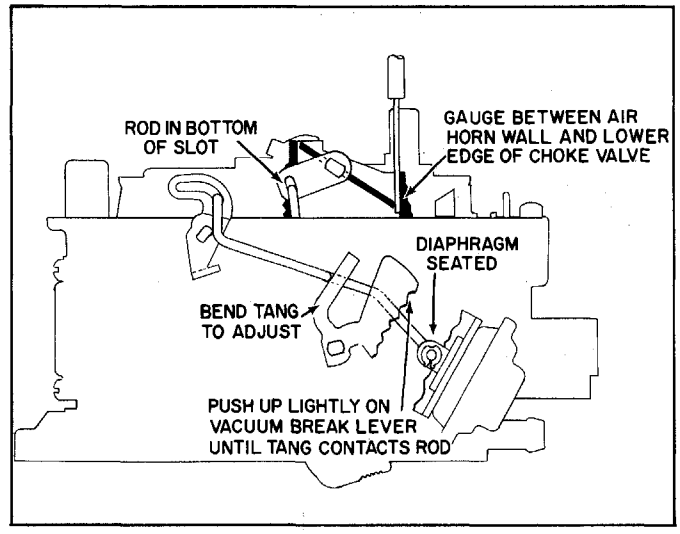


Fig. 44R—Vacuum Break Adjustment

break diaphragm stem against its seat so vacuum link is at the end of slot. The dimension between the lower edge of choke valve and air horn, at choke lever end, should be as specified. Bend tang to adjust (fig. 44R).

Air Valve Dashpot Adjustment

With the vacuum break diaphragm seated, there must be clearance as specified between the dashpot rod and end of slot in air valve lever. Bend rod, at air valve end, to adjust (Fig. 45R).

Unloader Adjustment

With the choke valve held in the closed position, by a rubber band on the vacuum break lever, open the primary throttle to the wide open position. With the valves in this position, the dimension between the lower edge of choke valve and air horn wall should be as specified. Bend the tang on the fast idle lever to adjust (fig.46R).

NOTE: Carburetors for vehicles with automatic transmissions use an air valve lockout, those for vehicles with synchronized transmissions use a secondary throttle lockout.

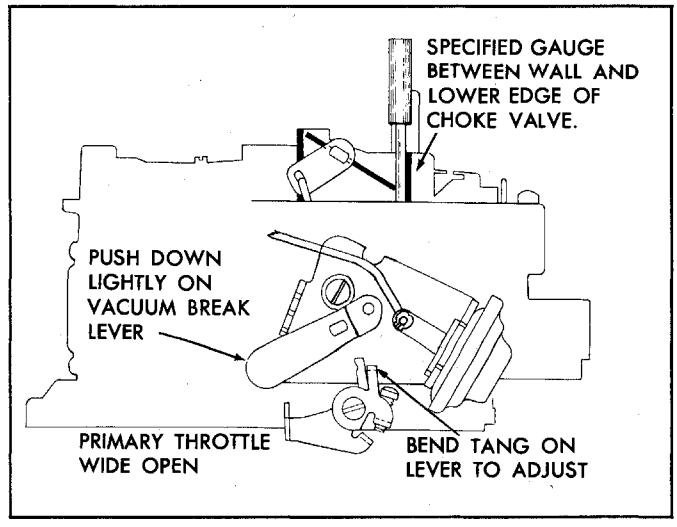


Fig. 45R—Air Valve Dashpot Adjustment

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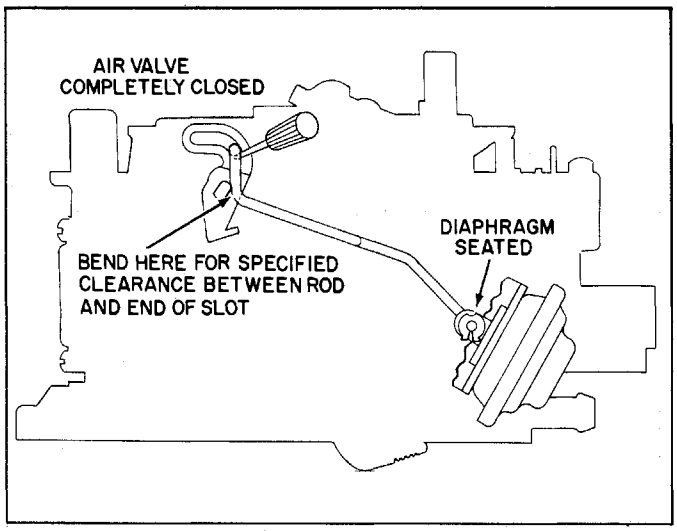


Fig. 46R—Unloader Adjustment

Air Valve Lockout Adjustment (Fig. 47)

A. Opening Clearance

With the choke valve wide open, apply sufficient force to rotate the vacuum break lever or thermostat tang to the wide open choke stop. Move the air valve in the direction of open valve. Bend the upper end of the air valve lockout lever, if necessary, to give an opening, as specified, between the lockout tang and the front edge of the air valve.

B. Lockout

Open choke valve to its wide open position by applying force to the up side or the choke valve. Making sure choke rod is in bottom of slot in the choke lever, the air valve lockout tang must hold the air valve closed.

Secondary Opening Adjustment

Holding choke valve and primary throttle valve in wide open position, with secondary throttle valve closed the lockout pin should have a minimum of 75% contact on lockout lever. To adjust, bend lockout lever (48R).

Secondary Lockout Clearance

With choke valve and both throttle valves fully closed

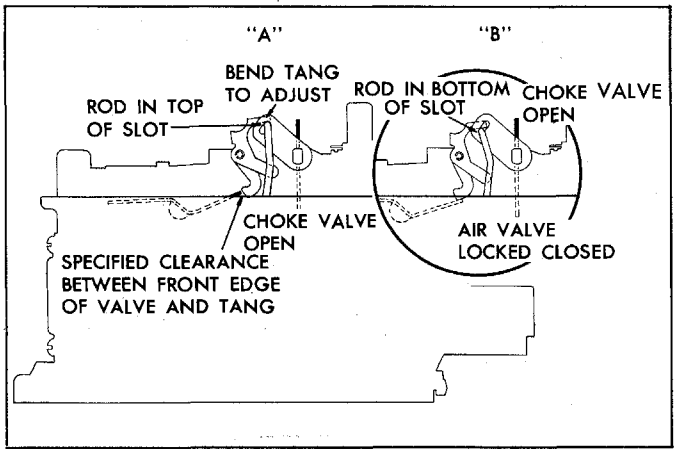


Fig. 47R—Air Valve Lockout Adjustment

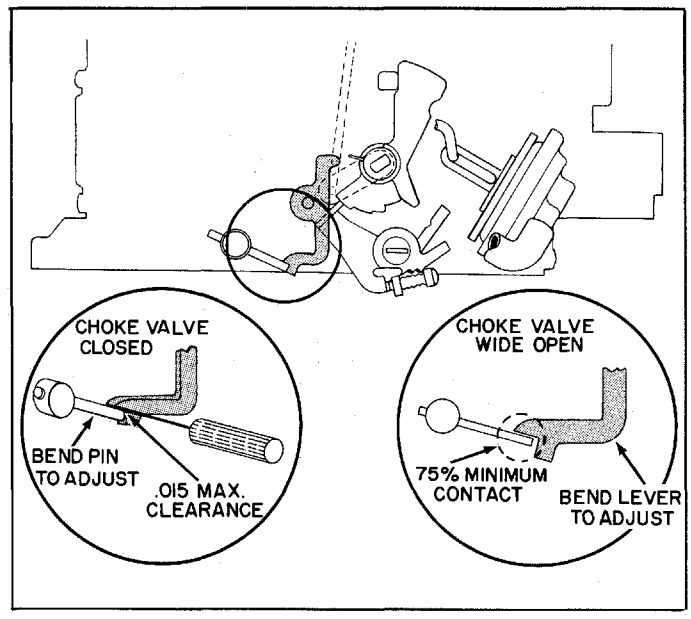


Fig. 48R—Secondary Lockout Clearance and Opening Adjustment

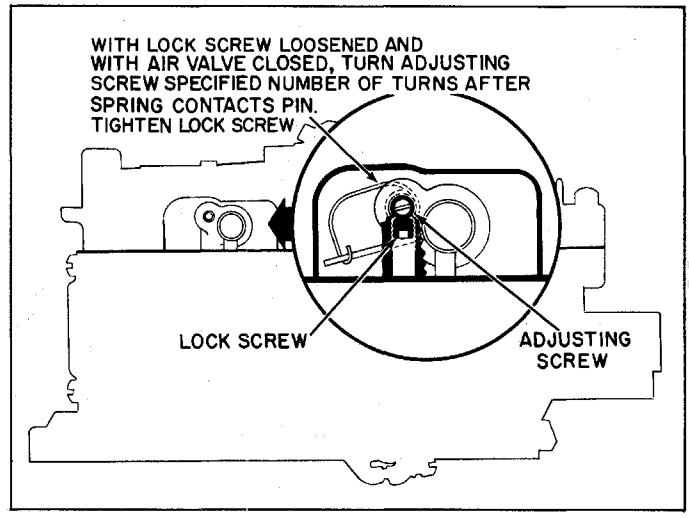


Fig. 49R—Air Valve Spring Adjustment

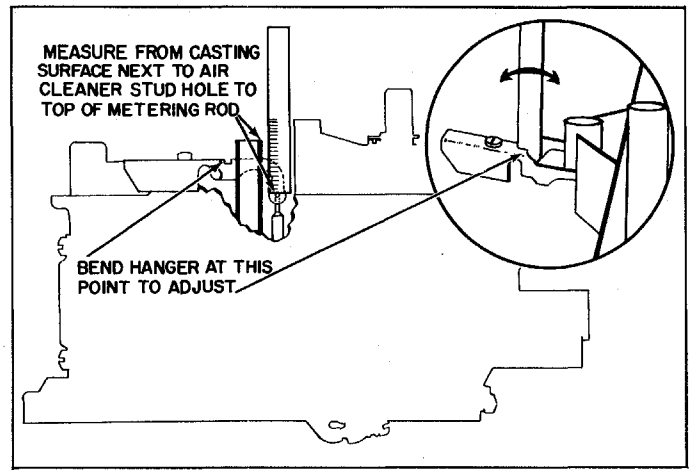


Fig. 50R—Secondary Metering Rod Adjustment

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lockout lever should not contact lockout pin. Clearance must not exceed .015". Bend lockout pin to adjust (fig. 48R).

Air Valve Spring Adjustment

Loosen lockscrew (allen screw) and turn spring adjusting screw counterclockwise to remove all spring tension. With air valve closed, turn adjusting screw clockwise the specified number of turns after the torsion spring contacts pin on shaft. Hold adjusting screw in this position and tighten lockscrew (fig. 49R).

With air valve closed, measure from top of casting surface behind air cleaner stud hole to top of metering (fig. 50R). To adjust bend secondary metering rod hanger with Tool J-22514 until rod height is to correct specification.

CARTER YF

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GENERAL DESCRIPTION

The Carter YF Carburetor with manual choke is used with the L4 engine. The Carter YF Carburetor with an automatic choke, used in conjection with a temperature sensing choke coil (mounted in a cast depression on the exhaust manifold) is used with the L6 engine when the "Air Injection Reactor System" is used (fig. 1C).

Both Carter YF Carburetors have the conventional float, low speed circuit, high speed circuit and accelerator pump circuit. The high speed circuit is controlled by a metering rod. The accelerator pump circuit and metering rod are mechanical and vacuum controlled.

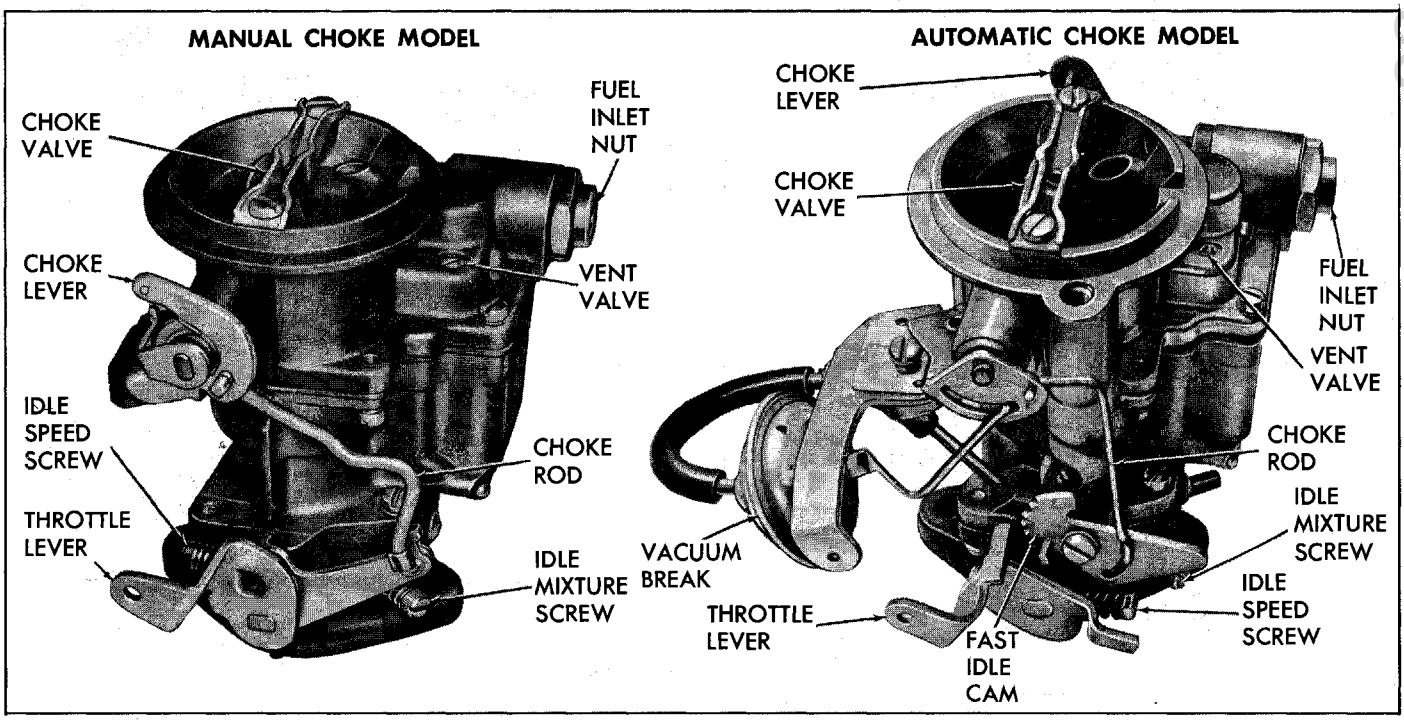


Fig. 1C—Carter YF Carburetor

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REPAIR PROCEDURES

Disassembly

1. On carburetors so equipped, disconnect vacuum break hose at bowl and remove vacuum break assembly. Disconnect vacuum break link at choke lever by rotating vacuum break.
2. Remove choke rod, inlet filter nut, filter and spring.
3. Remove 6 air horn screws (3 from body to air horn then 3 from air horn to body) and lift air straight up from body (to prevent float damage).
4. Place air horn up-ended on a flat surface and remove float hinge pin, float, and float needle.
5. Remove float needle seat using a wide screw driver.
6. Check the fuel bowl for evidence of dirt, grit, or metal particles in the fuel or in bottom of bowl, then hold finger over pump discharge passage (to retain discharge needle) and operate the pump manually a few times to check operation of diaphragm; check ball and needle, and passage restriction.
7. Empty the gas and remove pump discharge needle by up-ending carburetor bowl.
8. Loosen throttle shaft pump arm lock screw and remove arm and pump connector link.
9. Remove diaphragm housing screws and lift out entire pump, metering rod, and idle vent assembly (fig. 2C).
10. Remove metering rod from metering rod arm, then compress upper pump spring(s); remove retainer, spring(s), metering rod arm, and pump lifter link assembly. If necessary, remove idle vent screw assembly from lifter link (fig. 3C).
11. Compress lower spring; remove the spring retainer and lower pump spring (fig. 3C).
12. Remove pump housing screws from housing and diaphragm, then remove diaphragm shaft retaining ring and slide diaphragm assembly out of housing (fig. 3C).
13. Remove low speed (idle) jet. (Do not remove any pressed-in parts.)
14. Remove idle mixture screw and 2 remaining body-flange attaching screws and remove body and gasket from throttle flange.

Ordinarily, the carburetor flange and air horn are disassembled as far as is necessary during an overhaul procedure. The valve and shaft should not

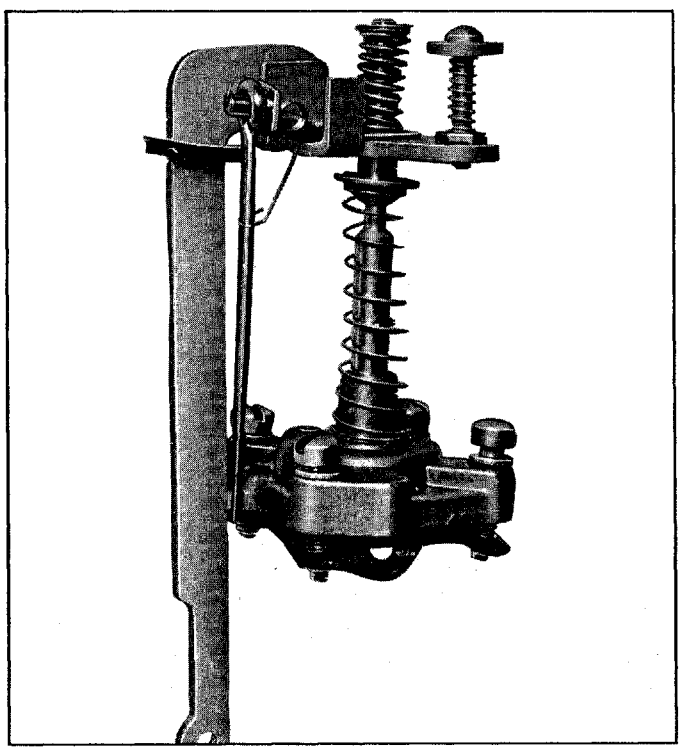


Fig. 2C—Pump and Metering Rod Assembly

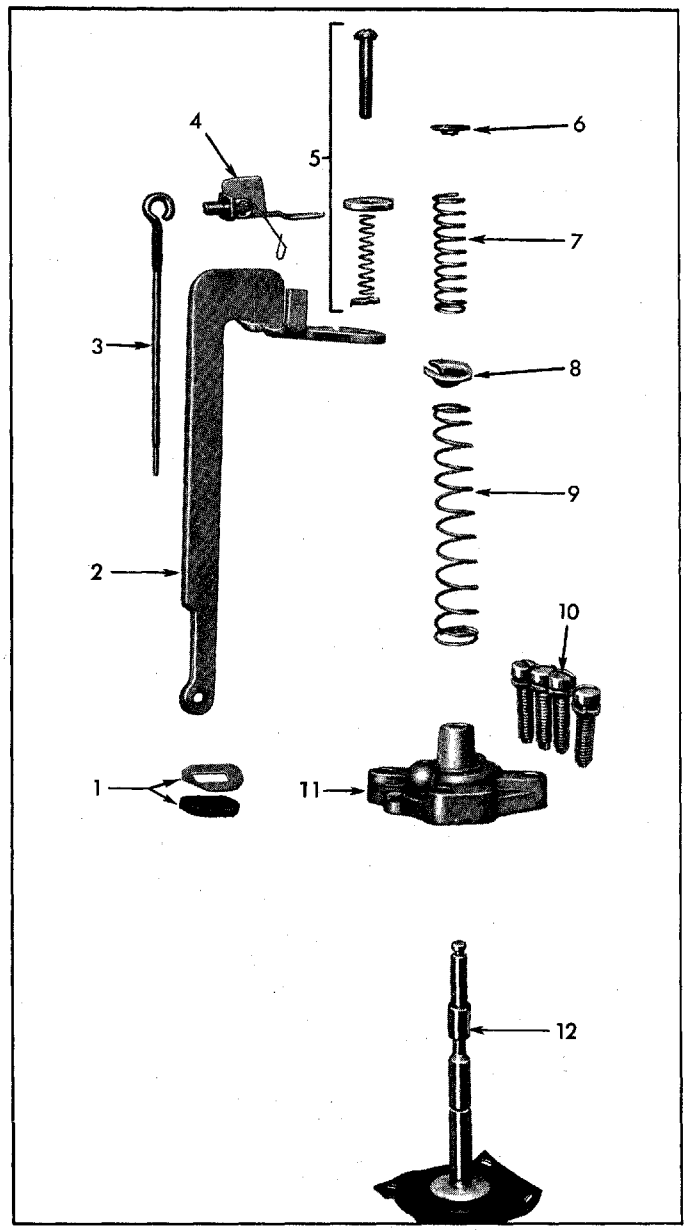


Fig. 3C—Pump and Metering Rod—Exploded View

1. Seal
2. Lifter Link
3. Metering Rod
4. Metering Rod Arm
5. Idle Vent Assembly
6. Retainer
7. Upper Spring
8. Retainer
9. Lower Spring
10. Screws
11. Pump Housing
12. Diaphragm Assembly

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be removed unless shaft is binding, valve is damaged or shaft spring (with manual choke) needs replacing. If either condition exists, disassemble as follows:

15. File staked ends of choke valve screws flush with shaft to prevent damage to shaft threads, then remove screws and choke valve and slide choke shaft from housing.
16. To remove choke cam lever on carburetors with manual choke pry off retainer ring, then slide lever and spring from mounting boss.
17. File staked ends of throttle valve screws flush with throttle shaft; remove screws and throttle plate, then slide shaft out of flange and remove fast idle arm (with manual choke).

Cleaning and Inspection

1. Wash all metal parts in cleaning solvent and dry with compressed air.
2. Check all passages for clogging and blow clean with compressed air.

   CAUTION: Do not use wire or other pointed instruments to clean drilled passages or calibrated openings.

3. Inspect pump diaphragm for tears or holes and diaphragm housing for free intake check ball and clean passages.
4. Check floats for leaks, dents, wear at lip and hinge pin.
5. Check float needle and seat for wear and replace if necessary.
6. Check fuel filter for chips, cracks or clogging.
7. Check throttle flange for surface squareness and for slop in shaft bores.

   NOTE: Damage or excessive wear in throttle shaft bores necessitates replacement of the throttle flange to maintain position of drilled passages to throttle plate.

8. Check choke valve and shaft for binding in air horn when assembled.

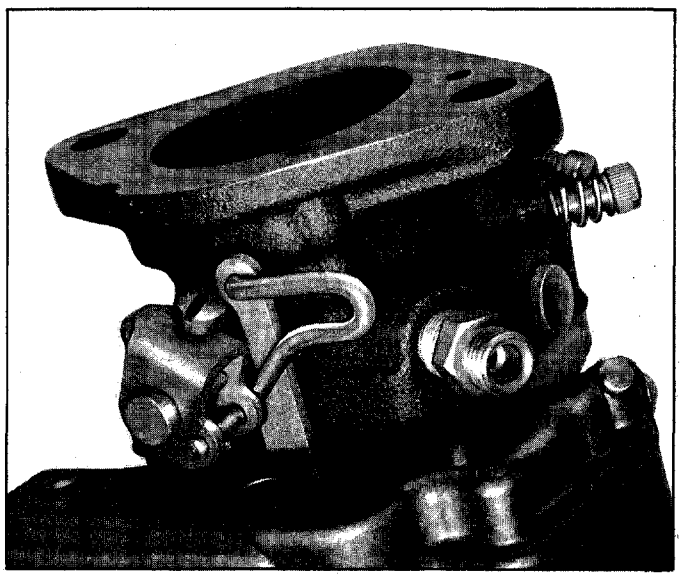


Fig. 4C—Pump Connector Link Installation

Assembly and Adjustments

Assemble Bowl and Throttle Body

1. If disassembled, install fast idle arm (with manual choke) over boss on throttle flange and slide shaft into flange.
2. Install throttle valve with lettering toward manifold side of flange and part number opposite idle port.
3. Install throttle valve screws; support the shaft at the screwhead and stake the other end of the screws.
4. Install idle adjustment screw and spring lightly to its seat and back out 1-1/2 turns as an initial adjustment.
5. Assemble throttle flange to body casting using a new gasket.
6. Install low speed jet assembly.
7. Assemble diaphragm and shaft into pump housing and install retaining ring on shaft, then install lower pump spring and retainer.
8. Assemble pump lifter link, then metering rod arm, upper spring(s) and spring retainer onto pump shaft.
9. If idle vent screw assembly was replaced, install new assembly onto pump lifter link.
10. Align diaphragm with holes in housing, then install screws (4) through housing and thread into diaphragm 2 or 3 threads.

    NOTE: Refer to Figure 3C for pump and metering rod assembly.

11. Install diaphragm assembly in place in carburetor body and tighten screws securely.
12. Install pump connector link in throttle shaft pump arm, then install arm over throttle shaft, guiding connector link end into pump lifter link, and tighten lock screw (fig. 4C).

    NOTE: Linkage must not bind in any throttle position. If binding occurs, loosen lock screw, adjust slightly and retighten screw.

13. Install pump discharge needle.

    NOTE: Figure 5C shows the carburetor at this stage of assembly.

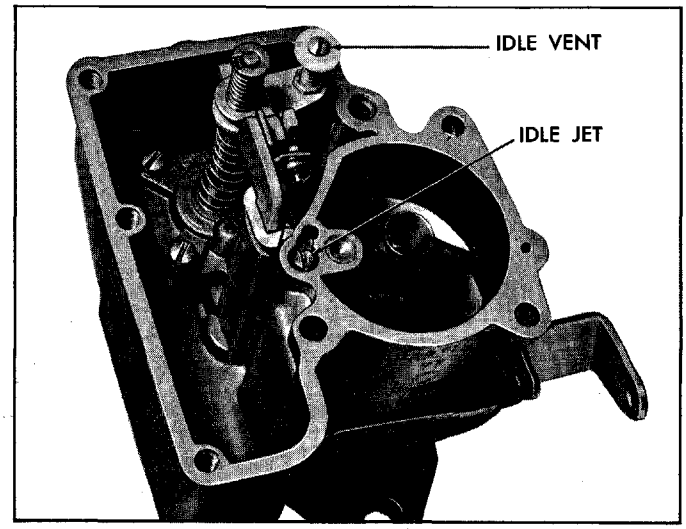


Fig. 5C—Bowl and Throttle Body—Assembled

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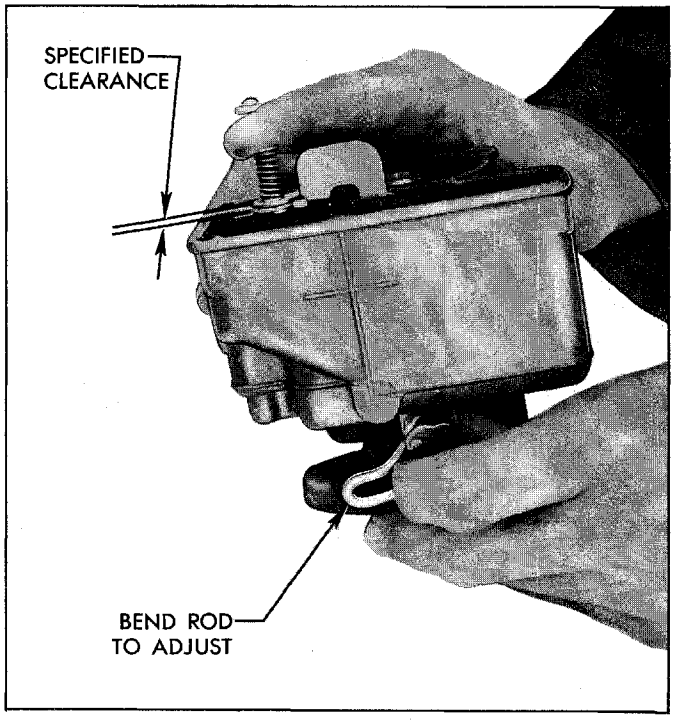


Fig. 6C—Accelerator Pump Adjustment

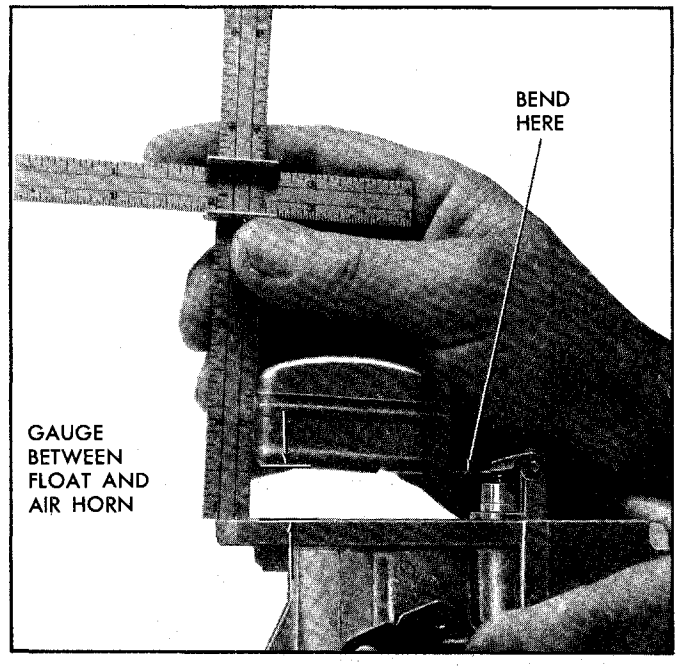


Fig. 8C—Float Level Adjustment

Adjust Accelerator Pump

1. Back off idle speed screw until throttle valve is seated in bore. Hold throttle valve closed.
2. Press down on diaphragm shaft until it is in its bottom position. Check contact of upper pump spring lower retainer and lifter link (Fig. 6C).
3. The upper pump spring lower retainer should just contact the pump lifter link (do not compress upper pump spring). If necessary to adjust, bend pump connector link at "U" bend.

Assemble and Adjust Metering Rod

1. Place metering end through metering jet then bottom rod in casting and, with throttle valve closed, press down on upper pump spring until pump bottoms out (fig. 7C). Metering rod arm should rest parallel on pump lifter link and metering rod eye should just slide over metering rod arm pin.
2. Adjust by bending metering rod arm.

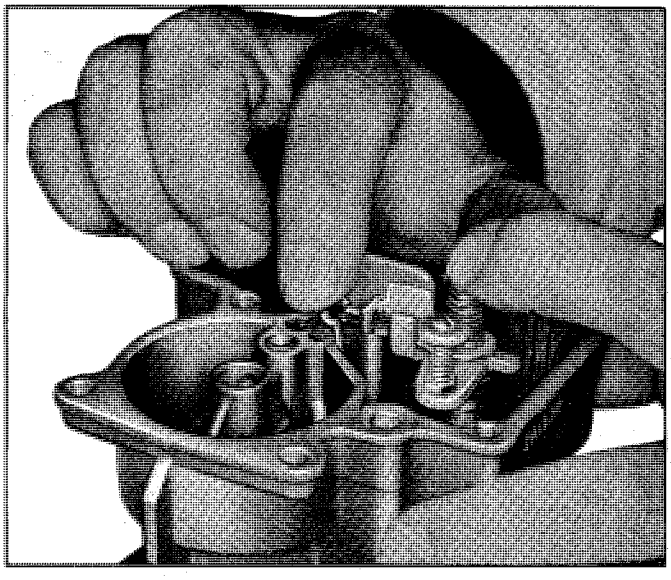


Fig. 7C—Metering Rod Adjustment

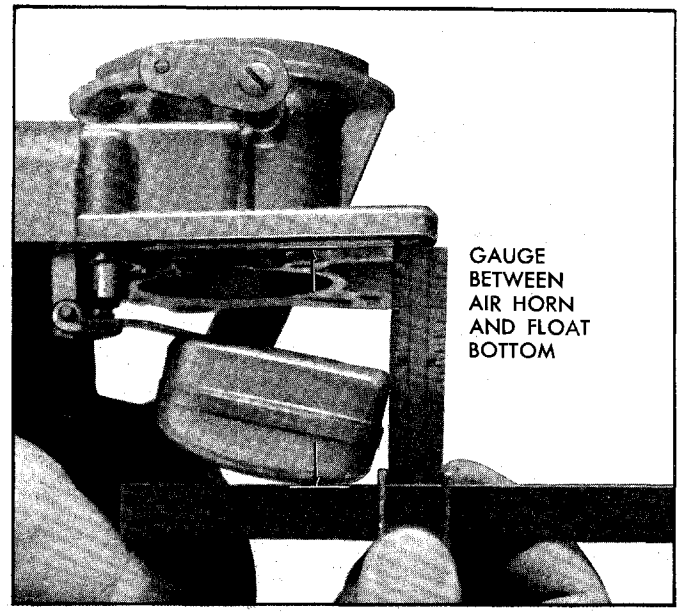


Fig. 9C—Float Drop Adjustment

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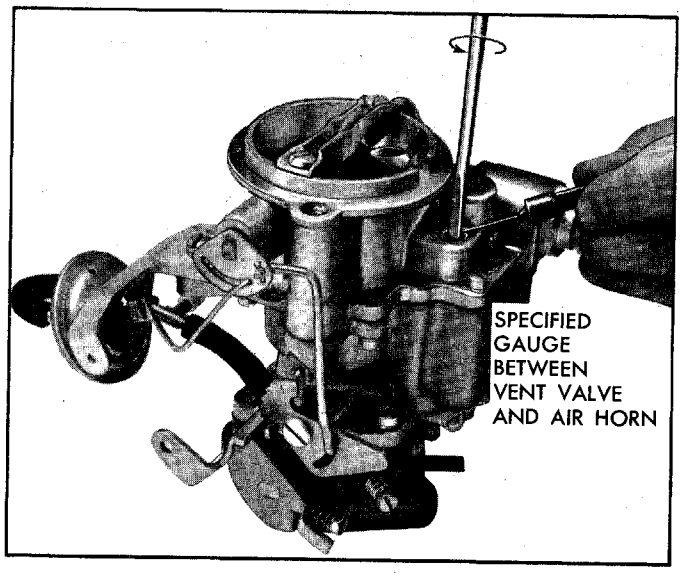


Fig. 10C—Idle Vent Adjustment

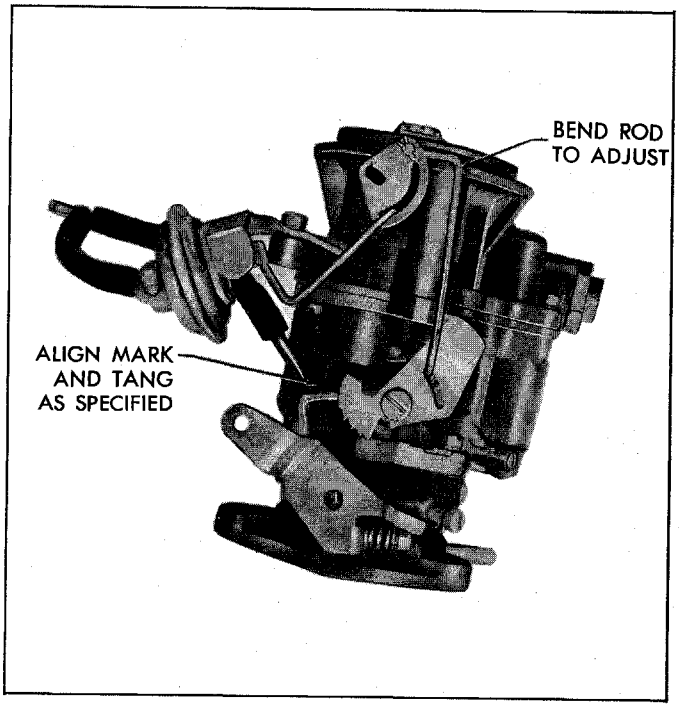


Fig. 11C—Choke Rod Adjustment



Fig. 12C—Choke Unloader Adjustment

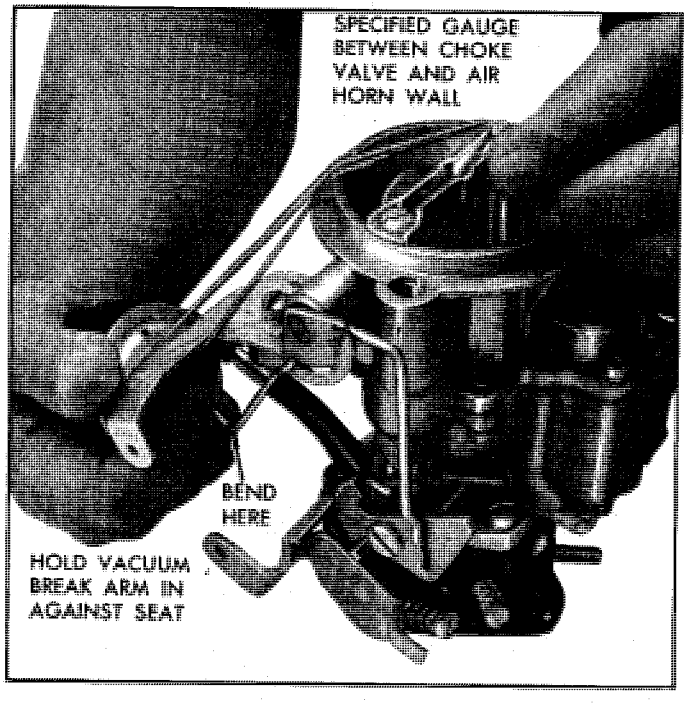


Fig. 13C—Vacuum Break Adjustment

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Assemble Air Horn

1. Install needle seat and gasket assembly, needle, float and float hinge pin with stop shoulder on hinge pin on side opposite carburetor bore.
2. Install air horn gasket.
3. Install fuel filter spring, filter and inlet nut using new gaskets.

Adjust Float

1. Invert bowl cover and measure float level (the distance between float and cover at free end of float) (fig. 8C). Adjust by bending lip of float (not float arm) that rests on needle.
2. Hold cover in upright position (allowing float to hang down) and measure float drop from cover to float at end opposite hinge (fig. 9C).
3. Adjust by bending stop tab on float arm.

Assemble Air Horn to Bowl

1. Install air horn assembly and 6 attaching screws (one long screw installed through flange and body into air horn).
2. Install choke rod and vacuum break assembly (if so equipped).

Adjust Idle Vent (Fig. 10C)

1. Back idle speed screw out until free (choke open). This assures closed throttle valve.
2. Check clearance between air horn and vent valve.
3. If necessary, adjust using screw driver.

Adjust Choke Rod (Fast Idle)

1. Hold choke valve in closed position.
2. Close throttle and check relationship of fast idle tang on throttle lever and mark on fast idel lever (Fig. 11C).
3. Mark on fast idle lever should be in alignment with upper edge of tang on throttle lever. If necessary to adjust, bend choke rod.

Choke Unloader Adjustment

With the throttle valve held wide open and the choke valve held toward the closed position with a rubber band, bend unloader tang on throttle lever to obtain the specified clearance between the lower edge of the choke valve and the air horn wall (fig. 12C).

Vacuum Break Adjustment

With the vacuum break arm held in against its stop and the choke valve held toward the closed position with a rubber band, bend the vacuum break link to obtain the specified clearance between the lower edge of the choke valve and the air horn wall (fig. 13C).

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HOLLEY 2300 AND 2300C

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GENERAL DESCRIPTION

A compound installation of three Holley two barrel carburetors mounted on a common inlet manifold is used on the 427 cu. in. (400 hp. and 435 hp. Corvette) engines.

This system utilizes two types of Holley two barrel carburetors, primary, 2300C (Fig. 1H) mounted in the center and secondarys 2300 (Fig. 2H) mounted fore and aft. These carburetors contain all the usual regulatory systems with the exception of chokes, power enrichment, and accelerating pump systems in the secondary carburetors.

The choke used in the primary carburetor 2300C, is controlled by a temperature sensing choke coil mounted on the intake manifold over the exhaust crossover passage.

Throttle operation of the primary carburetor is conventional whereas the secondary carburetor throttles are operated by vacuum.

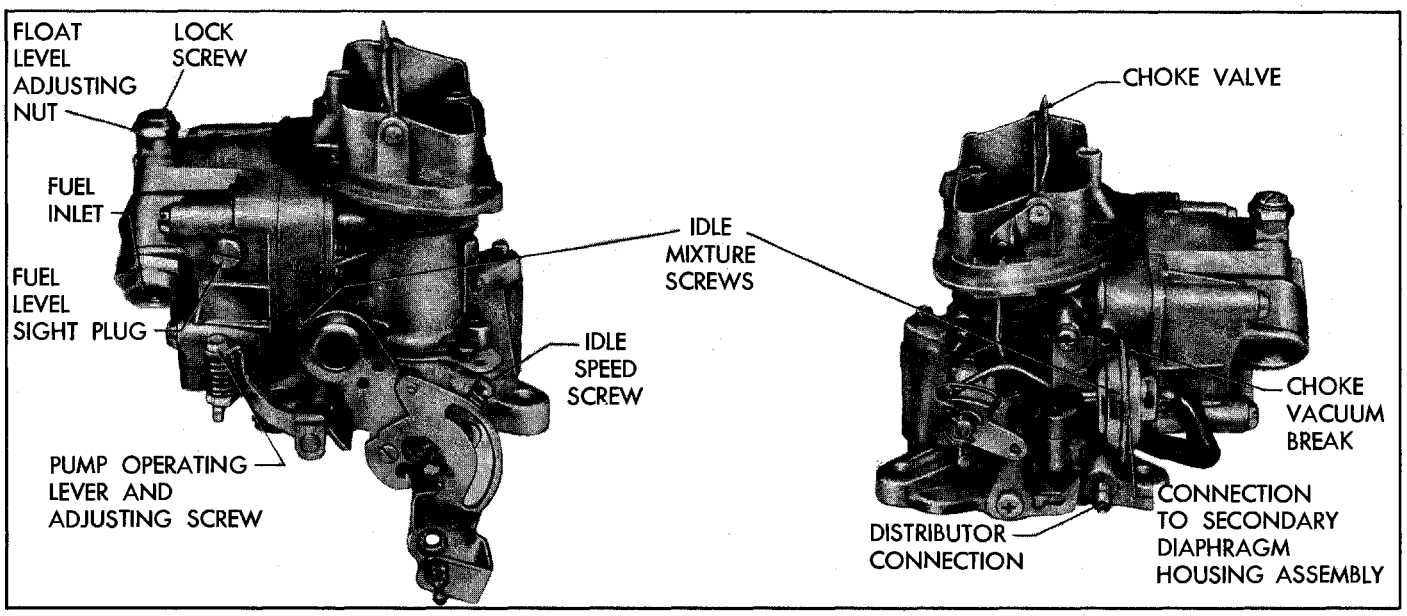


Fig. 1H—Holley Primary Carburetor

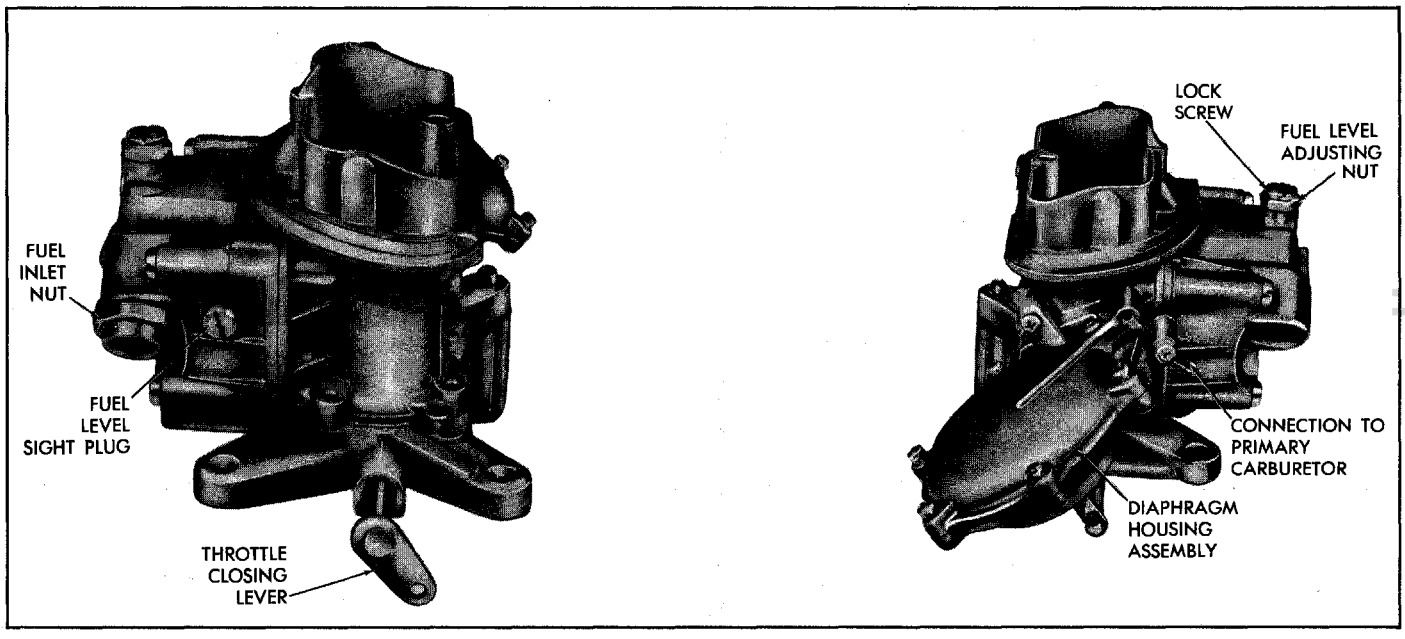


Fig. 2H—Holley Secondary Carburetor

REPAIR PROCEDURES

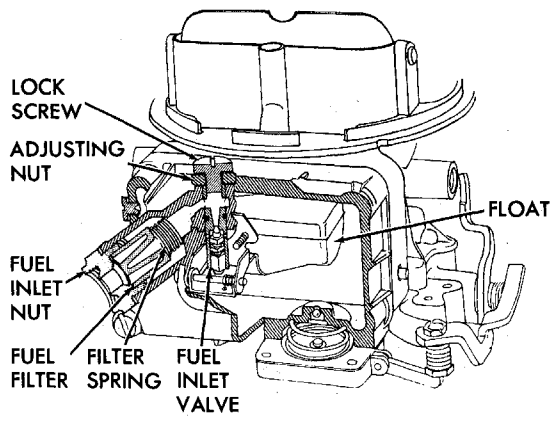
Disassembly

Disassemble Into Subassemblies (Figs. 4H and 5H)

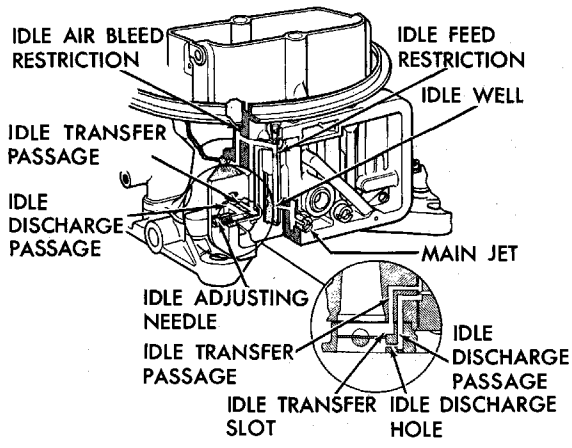
NOTE: Before disassembly, loosen the fuel inlet fitting, fuel bowl sight plugs and needle and seat assembly lock screws.

1. Remove primary fuel bowl screws and remove fuel bowl, metering body (on primary carburetor), splash shield and gasket.
2. On secondary carburetors remove metering block screws and remove metering body and gasket.
3. On primary carburetor disconnect vacuum break hose at vacuum break.
4. On secondary carburetors disconnect secondary diaphragm housing assembly at throttle lever.
5. Remove secondary diaphragm housing assembly and gasket from secondary carburetor body.
6. Remove throttle body to main body screws and then remove throttle body and gasket.

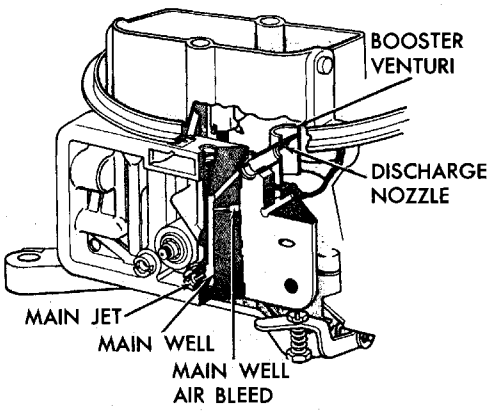
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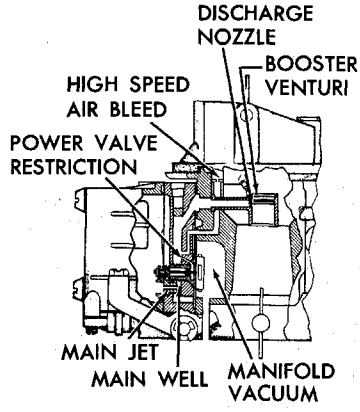
FUEL INLET SYSTEM



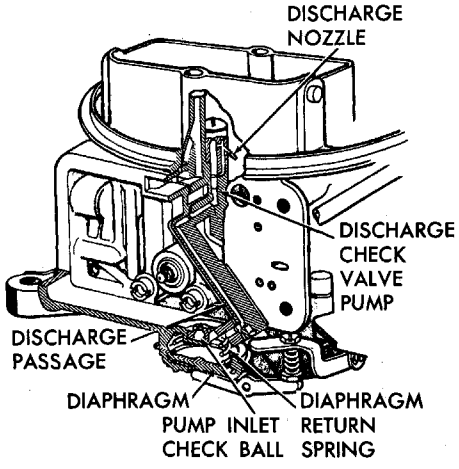
IDLE SYSTEM (PRIMARY)



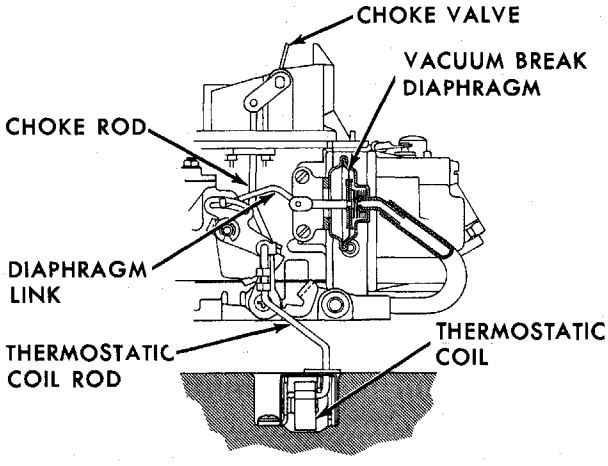
MAIN METERING SYSTEM



POWER SYSTEM (TYPICAL)



PUMP SYSTEM (PRIMARY)



CHOKE SYSTEM (PRIMARY)

Fig. 3H—Fuel Systems

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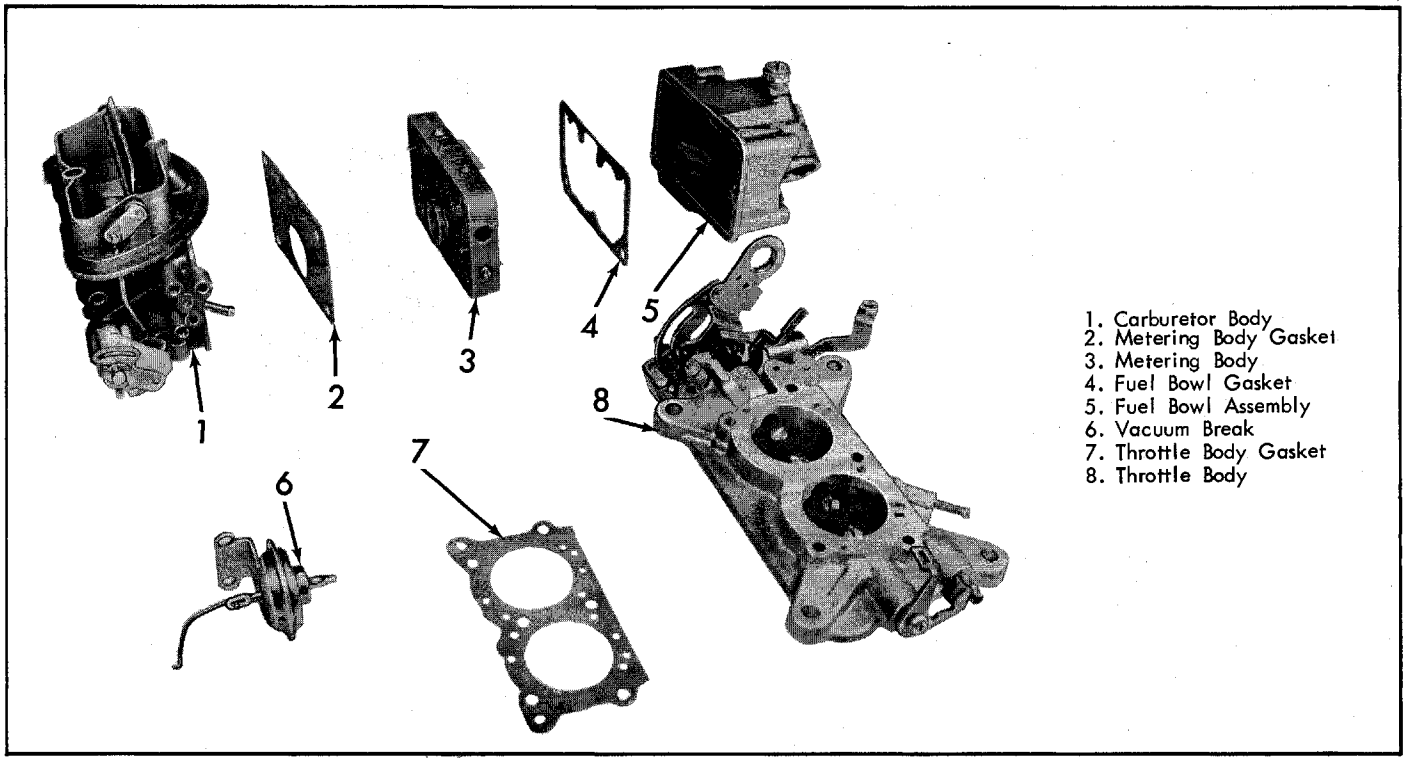


Fig. 4H—Subassemblies Primary

Disassemble Fuel Bowls (Figs. 6H and 7H)

1. Remove fuel inlet baffle.
2. Remove float hinge screws and remove float from bowl.

NOTE: Primary carburetor uses a brass float and secondary carburetors use a plastic float.

3. Loosen inlet needle and seat lock screw, then turn

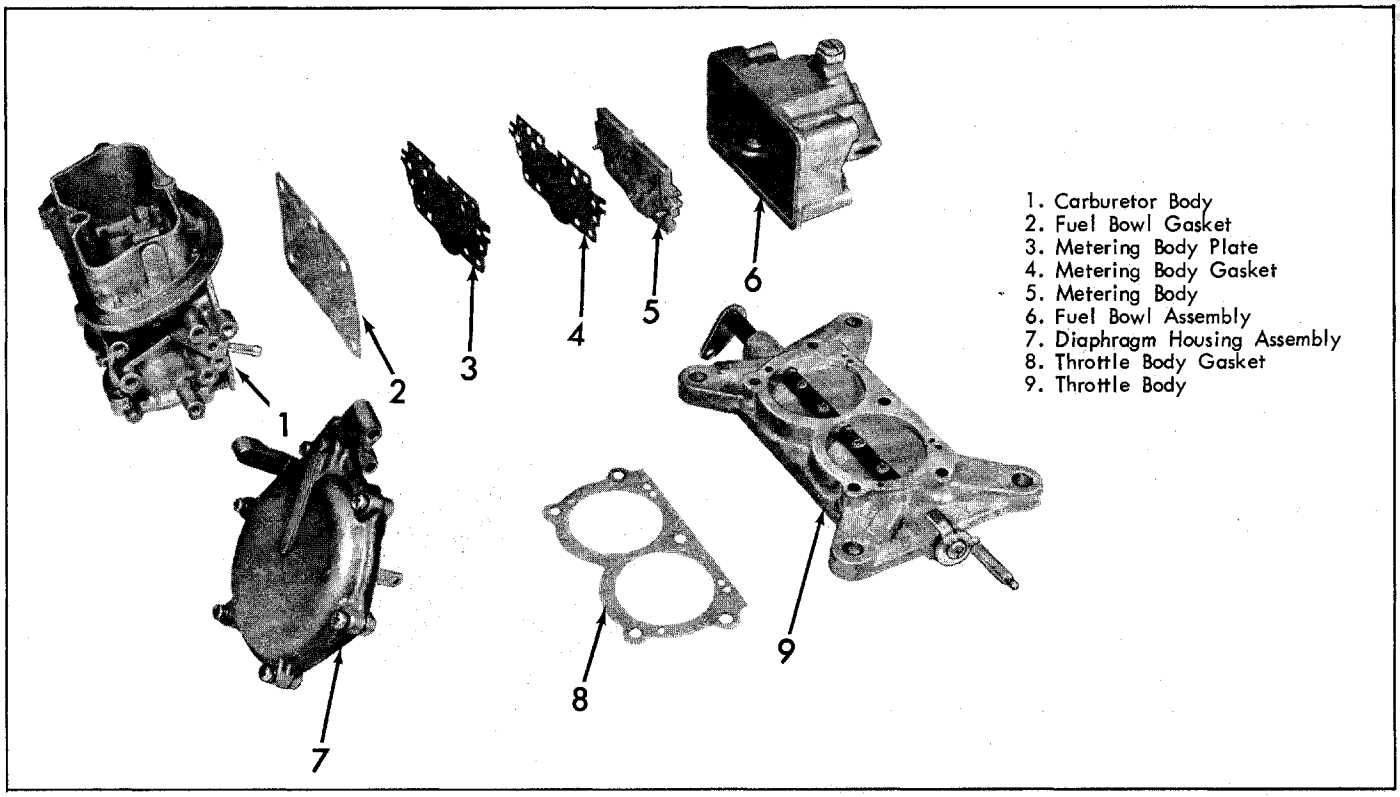


Fig. 5H—Subassemblies Secondary

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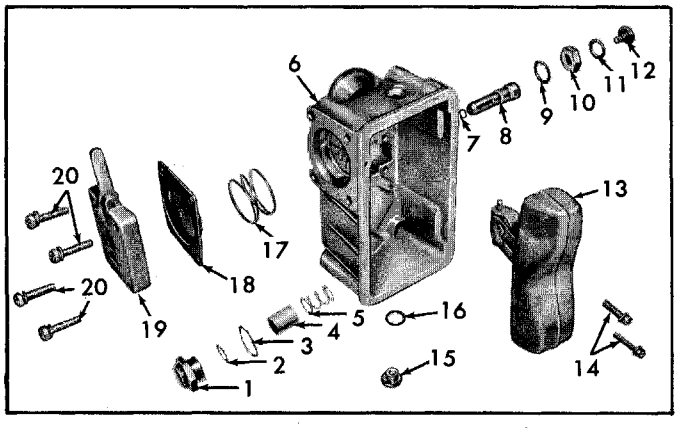


Fig. 6H—Fuel Bowl Assembly (Primary)

1. Nut - Fuel Inlet
2. Gasket - Fuel Filter
3. Gasket - Inlet Nut
4. Fuel Filter
5. Spring Fuel Filter
6. Fuel Bowl
7. Seal - Inlet Needle and Seat Assembly
8. Inlet Needle and Seat Assembly
9. Gasket - Inlet Adjusting Nut
10. Nut - Inlet Adjusting
11. Gasket - Inlet Lock Screw
12. Screw - Inlet Lock
13. Float Assembly
14. Screw - Float Hinge
15. Fuel Level Sight Plug
16. Gasket - Sight Plug
17. Spring - Pump Diaphragm
18. Pump Diaphragm
19. Cover Assembly - Pump Diaphragm
20. Screw - Pump Diaphragm Cover

adjusting nut counterclockwise to remove the needle and seat assembly.

4. Remove sight plug and gasket.
5. Remove fuel inlet fitting, fuel filter, spring and gasket.
6. On primary carburetor remove pump diaphragm cover screws and then pump cover, diaphragm, and spring.
7. On primary carburetor check pump inlet ball for free movement and damage. Damage to ball, passage or retainer requires new bowl assembly.

Disassemble Metering Bodies

1. On primary carburetor (fig. 8H) remove main metering jets (with a wide blade screw driver to avoid damage to the jets), and the power valve (using 1" 12 point socket).
2. On primary carburetors remove the vacuum fitting and the idle mixture needles and seals.
3. On secondary carburetors (fig. 9H) remove plate and gasket from secondary metering body dowel pins.

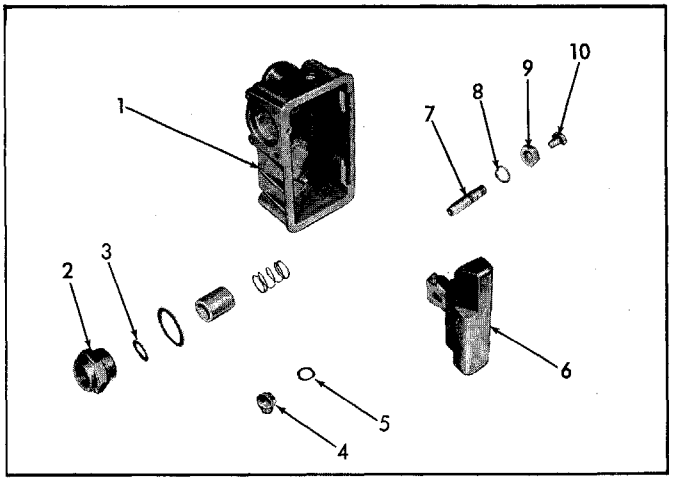


Fig. 7H—Fuel Bowl Assembly (Secondary)

1. Float Bowl
2. Inlet Nut
3. Inlet Nut Gasket
4. Sight Plug
5. Sight Plug Gasket
6. Float
7. Needle and Seat Assembly
8. Gasket
9. Adjusting Nut
10. Lockscrew

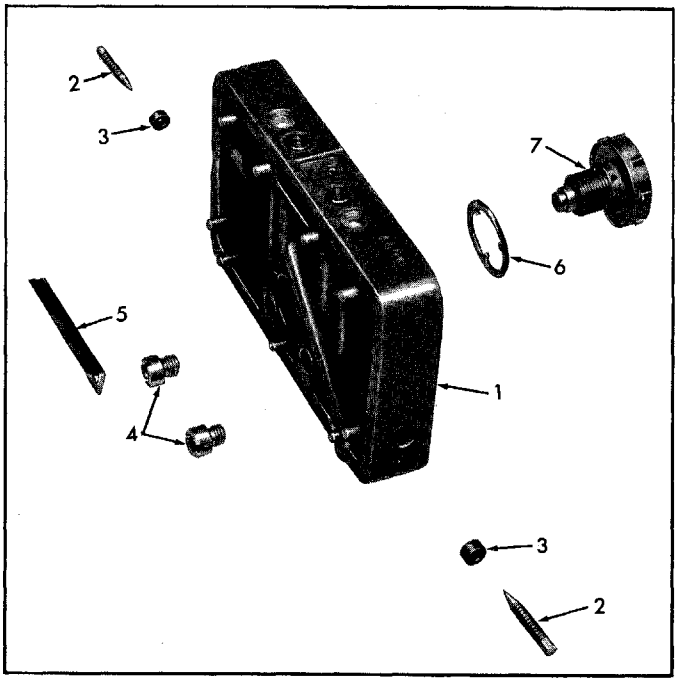


Fig. 8H—Metering Body Assembly (Primary)

1. Metering Body
2. Needle - Idle Mixture
3. Seal - Idle Mixture Needle
4. Metering Jet
5. Splash Shield
6. Gasket - Power Valve
7. Power Valve

Disassemble Secondary Throttle Operating Assembly (Fig. 10H)

1. Remove diaphragm cover.
2. Remove spring and diaphragm.

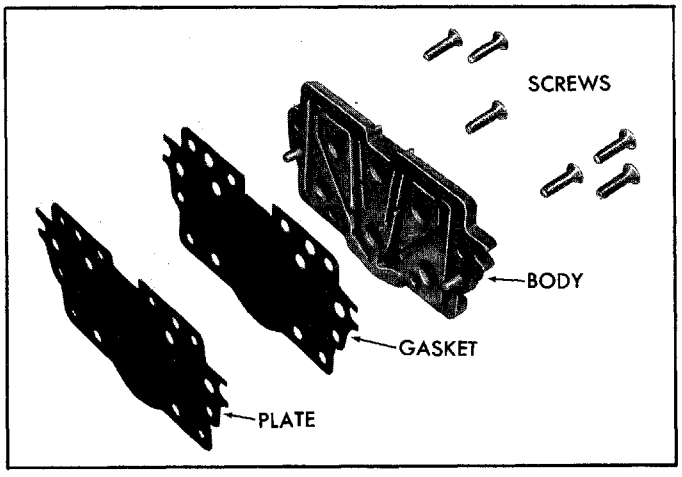


Fig. 9H—Metering Body Assembly (Secondary)

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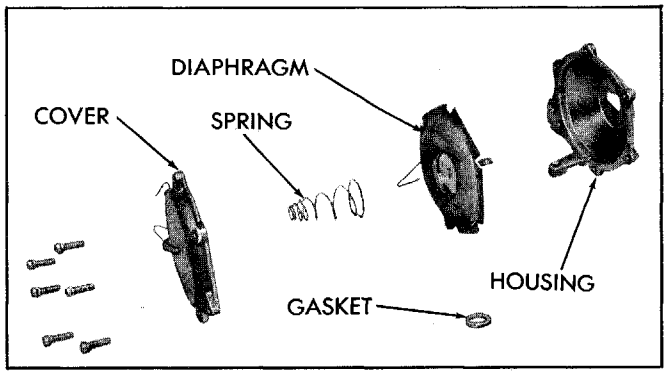


Fig. 10H—Secondary Diaphragm Housing Assembly

Disassemble Main Body (Primary Carburetor) (Fig. 11H)

NOTE: Secondary carburetor main bodies cannot be disassembled.

1. Remove choke vacuum break retaining screws and remove choke vacuum break by disconnecting link at choke lever.
2. Remove choke lever retaining clip then remove choke lever and fast idle cam.
3. Remove pump discharge nozzle screw, nozzle and gasket then up-end the body assembly to remove pump discharge check valve.

NOTE: The choke rod seal will withstand normal cleaning in carburetor cleaner, therefore, further disassembly of the main body is not required for cleaning purposes. If parts replacement is required, proceed as follows:

4. File off the staked ends of the throttle plate attaching screws, then remove the screws and throttle plates. Slide the throttle shaft out of throttle body.

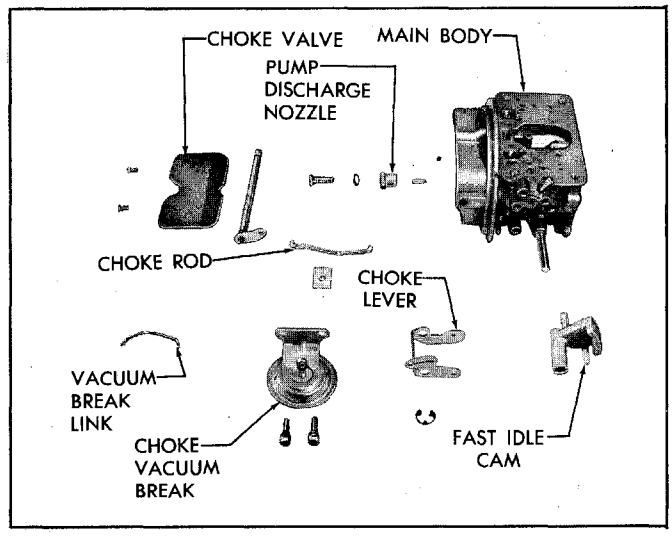


Fig. 11H—Main Body Assembly

5. On primary carburetor remove accelerator pump cam from throttle lever shaft.

Cleaning and Inspection

NOTE: The most frequent causes of carburetor malfunction are gum, carbon, and water. Carefully clean and inspect all parts and castings as the carburetor is being serviced as follows:

1. Clean throttle body (if not disassembled), vacuum break and all non-metallic parts in alcohol or gasoline.
2. Wash all other parts in cleaning solvent.
3. Inspect holes in all operating levers and castings for excessive wear.

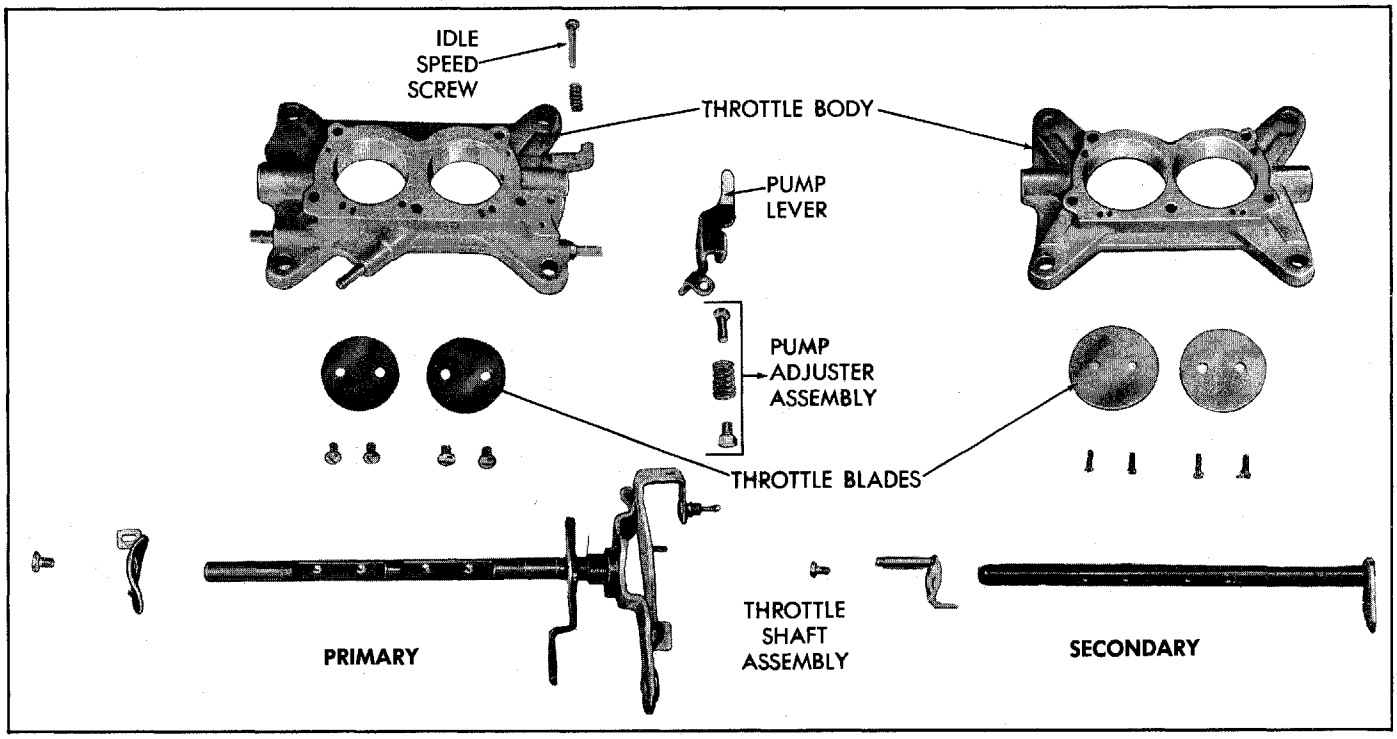


Fig. 12H—Throttle Body Assemblies

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4. Inspect bearing surfaces of all shafts for excessive clearance. It is not necessary to remove shafts and plates to inspect.

   NOTE: If wear is excessive to the extent of improper operation of the carburetor, the worn parts should be replaced.

5. Inspect primary float for bad dents and/or possible leaks.
6. Inspect pump diaphragm for damage.
7. Inspect float needle and seat for burrs and ridges; if present, replace both needle and seat. Never replace either alone as these are an assembly.
8. Inspect the edges of the throttle valves for gouges and any other deformation. If these or any other condition exists which would prevent full seating, replace the faulty valve.
9. Inspect all mating surfaces of fuel bowl, main body, and throttle body for burrs, gouges, or other surface irregularities. All surfaces must be smooth and square to prevent leaks.
10. Check secondary carburetor throttle operating diaphragm for free operation and leakage by moving diaphragm rod to the up position then covering vacuum passage opening in housing with thumb. The diaphragm should hold upward. Remove thumb from vacuum passage and diaphragm rod should move down readily.
11. After washing in solvent, clear all passages in the metering body and main body with compressed air.
12. Check fuel filter element for restriction by blowing on cone end, element should allow air to pass freely.
13. Clean element by washing in solvent and blowing out. Blow in opposite direction of fuel flow.

Assembly and Adjustments

Assemble Throttle Body

1. On primary carburetor install accelerator cam on throttle lever shaft.
2. Install throttle shaft in throttle body.
3. Install throttle valves on throttle shaft. Do not tighten retaining screws.
4. Center the throttle valves on the shafts by holding the valves closed while tightening the screws.

   NOTE: The throttle valves are installed with identification numbers down (to manifold side).

5. Support the throttle shafts and stake the throttle valve screws.
6. Install secondary throttle diaphragm lever on secondary carburetor.
7. On primary carburetor install fast idle cam lever on vacuum break hose on fitting.
8. Install idle speed screw and spring on primary carburetor. Turn idle speed screw clockwise until contact with throttle lever is made and turn 1-1/2 additional turns for preliminary adjustment.
9. Install accelerator pump actuating lever assembly and assemble screw, spring, and nut if disassembled.

Assemble Main Body (Primary Carburetor)

1. Install pump discharge valve.
2. Install pump discharge nozzle. Use new gaskets.
3. Install choke rod seal and choke rod in main body.
4. Install choke shaft in main body and connect upper end of choke rod.
5. Install choke rod on choke shaft (do not tighten retaining screws).
6. Center choke valve on shaft by holding valve closed while tightening screws.
7. Stake screw ends with pliers.

   NOTE: The choke valve is offset and should fall freely to wide open position from its own weight.

8. Install choke lever and fast idle cam then retainer.
9. Connect vacuum break link to choke lever then install vacuum break with two retaining screws.

Assemble Secondary Diaphragm Housing Assembly

1. Install diaphragm assembly and spring in housing.
2. Install diaphragm cover and tighten securely.

   NOTE: Diaphragm may be checked for leaks by pushing in on rod then holding finger over vacuum hole. Rod should remain in.

Assemble Metering Body

1. On primary carburetor install vacuum fitting idle mixture needles and new needle seals. Make a preliminary adjustment of idle mixture screws by turning needles lightly to their seats and back out one turn.

   CAUTION: Do not turn screw tightly against seat or damage may result.

2. On secondary carburetor install a new gasket and then metering plate over metering body dowel pins.

Assemble Fuel Bowls

1. Install fuel level sight plug with new gasket.
2. Install fuel inlet needle and seat with a new gasket. Leave lock screw loose.
3. Install fuel inlet fitting, fuel filter, spring and new gasket.
4. Place fuel float in bowl and install float hinge screws.
5. Install fuel inlet baffle.
6. On primary carburetor install accelerator pump spring, diaphragm and cover.

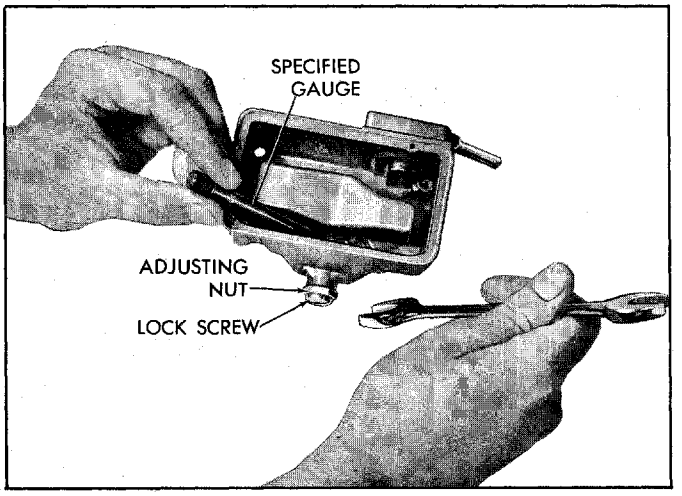


Fig. 13H—Preliminary Float Adjustment

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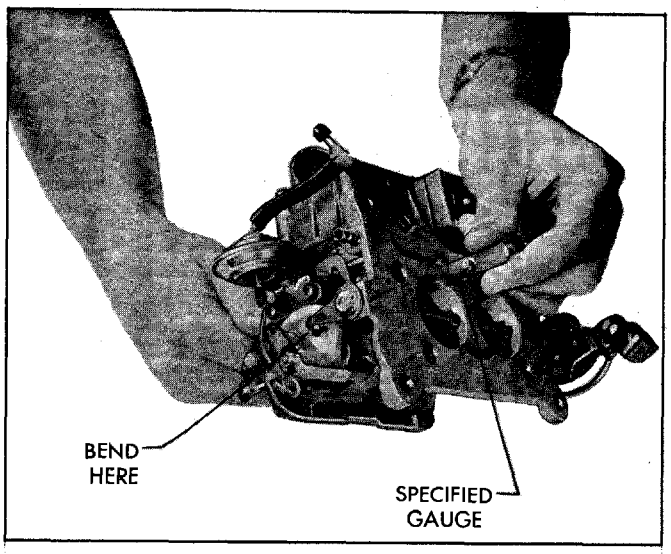


Fig. 14H—Fast Idle Cam Adjustment

Adjust Float (Fig. 13H)

1. Make a preliminary float adjustment by inverting fuel bowl and turn adjustable needle and seat until top of float is specified distance from top of fuel bowl.
2. Do not fully tighten lock screw. Snug screw to temporarily retain adjustment.

NOTE: Final adjustment of the float is made on the vehicle. Refer to Section 6M of the Chassis Service Manual.

Assemble Subassemblies

1. Invert the main body, align new throttle body to main body gasket, then install screws and tighten securely.
2. On secondary carburetors install throttle operating assembly with new gasket and connect rod to throttle lever.
3. On primary carburetor connect vacuum break hose to vacuum break.

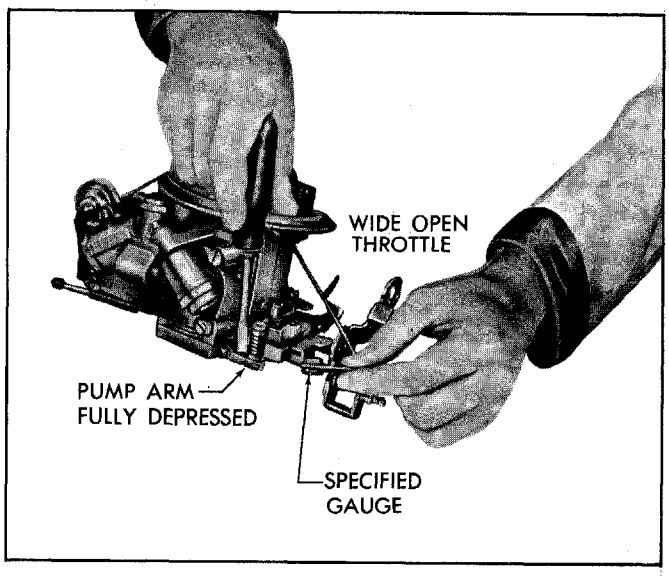


Fig. 15H—Accelerator Pump Adjustment

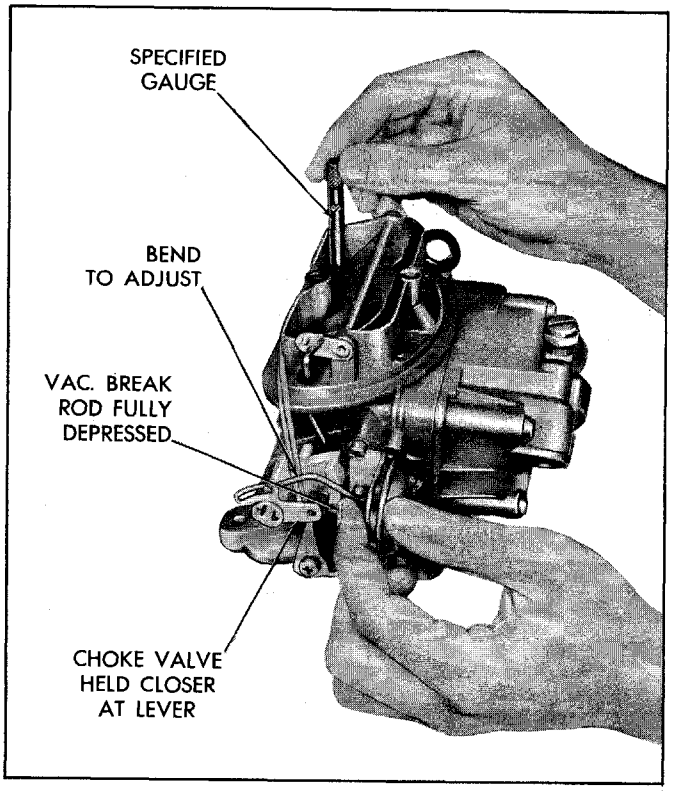


Fig. 16H—Vacuum Break Adjustment

4. On secondary carburetor install new fuel bowl gaskets on main body, align metering body to main body and install six retaining screws tightening securely.
5. On secondary carburetor install fuel bowl with new retaining screw gaskets.

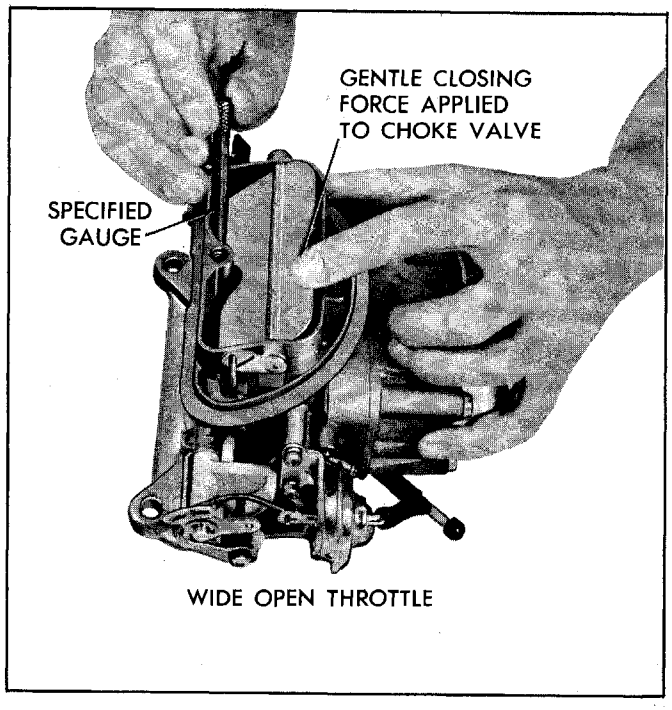


Fig. 17H—Choke Unloader Adjustment

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6. On primary carburetor place fuel bowl gasket splash shield, metering body and metering body gasket in alignment. Insert screws and new gaskets through fuel bowl and metering body.
7. Install fuel and metering body to main body keeping pump lever in alignment under operating lever duration spring then finish installing fuel bowl retaining screws and tighten securely.

Preliminary Idle Speed Adjustment

1. Turn idle screw in until contact is made with throttle lever, then turn screw in 1-1/2 additional turns for preliminary idle speed adjustment.

Adjust Fast Idle Cam (Primary Carburetor) (Fig. 14H)

1. Open throttle slightly, close choke plate positioning fast idle lever against top step of fast idle cam.
2. Adjust fast idle to give specified opening of throttle plate on idle transfer slot side of carburetor (see specifications). Bend fast idle lever to adjust.

Adjust Accelerator Pump (Primary Carburetor) (Fig. 15H)

1. Hold throttle lever in wide open position with a rubber band and hold pump lever fully compressed (down). Measure the clearance between spring adjusting nut and arm of the pump lever.
2. Adjust to specified clearance by turning nut or screw as required while holding opposite end. (The pump operating lever is not threaded.)
3. After adjustment is made, rotate the throttle lever to fully closed and partly open again. Any movement of the throttle lever should be noticed at operating lever spring end, indicating correct pump tip-in.

Adjust Vacuum Break (Primary Carburetor) (Fig. 16H)

1. Hold choke valve closed with rubber band.
2. Hold vacuum break in against stop.
3. Measure distance between choke valve lower edge and main body.
4. Bend vacuum break rod to adjust.

Adjust Choke Unloader (Primary Carburetor) (Fig. 17H)

1. Hold throttle lever in wide open throttle position with rubber band.
2. Hold choke valve toward closed position against unloader tang of throttle shaft, then measure opening between choke valve lower edge and main body (see specifications).
3. If necessary to adjust, bend choke rod (at off-set bend). Recheck after adjusting.

HOLLEY 4150 AND 4160

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GENERAL DESCRIPTION

The Holley 4150 and 4160 Carburetors (fig. 18H), used in conjunction with a temperature sensing choke coil (mounted on the intake manifold over the exhaust crossover passage), are used on V8 engines. The Model 4150 is used on 327 cu. in. (325 hp Chevelle) engines, and on 427 cu. in. (425 hp Corvette) engines. The Model 4160 is used on 327 cu. in. (300 and 350 hp. Corvette) engines, on 396 cu. in. (350 hp Chevelle) engines and on 427 cu. in. (385 hp Corvette) engines.

These four barrel, two stage, carburetors consist of seven sub-assemblies; the throttle body, the main body, primary and secondary fuel bowls, primary and secondary metering bodies and the secondary throttle operating assembly. The secondary metering body on the Model 4150 Carburetor is similar to the primary metering body while the secondary metering body on the Model 4160 Carburetor consists of a cast body a plate and a gasket which are attached to the main body by six screws and covered by the secondary fuel bowl. The secondary throttle operating assembly on both Models 4150 and 4160 is vacuum operated (fig. 19H).

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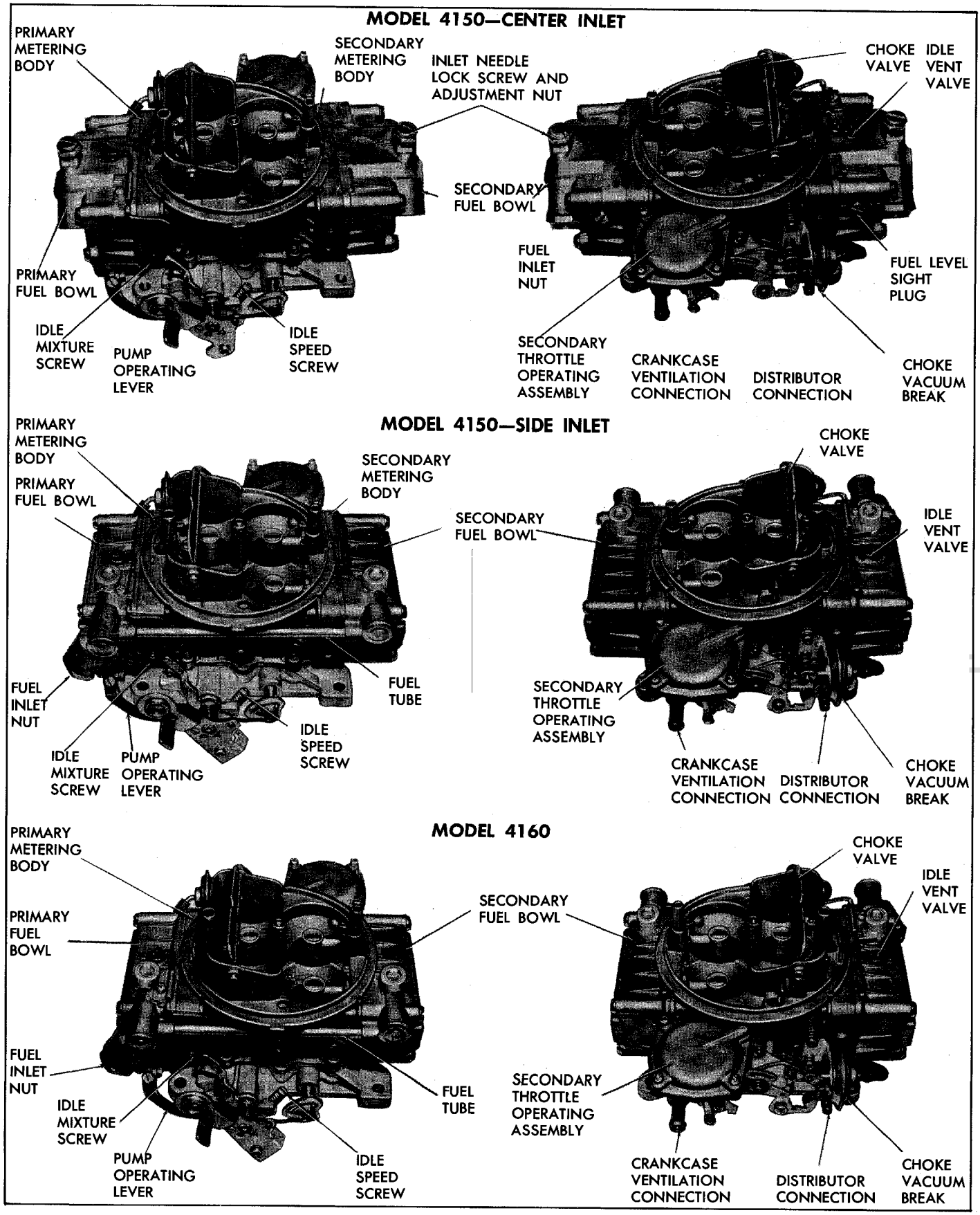
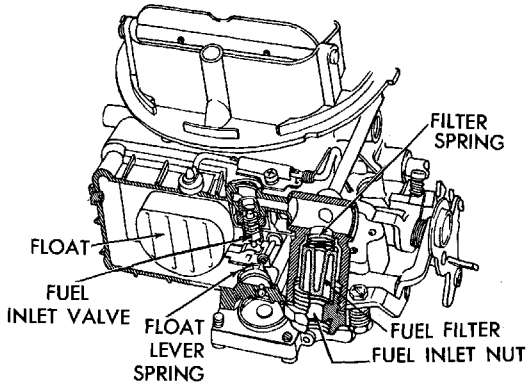
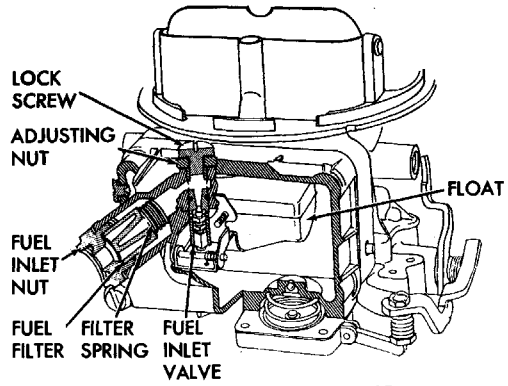


Fig. 18H—Holley Carburetors

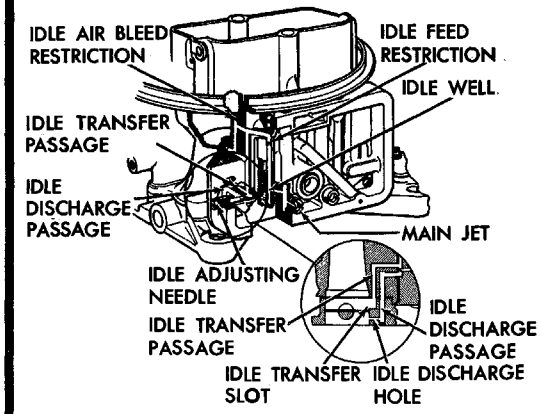
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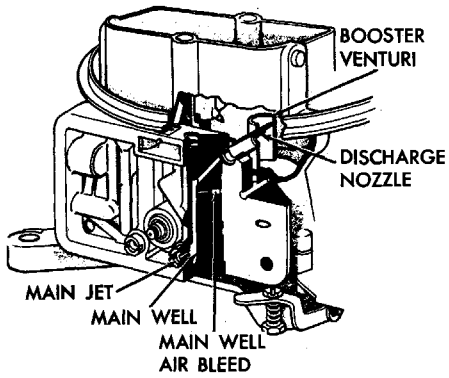
FUEL INLET **SYSTEM** (SIDE INLET)



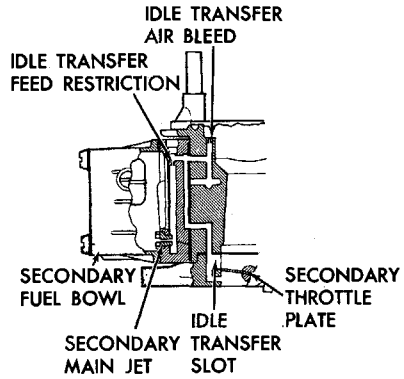
FUEL INLET SYSTEM (END INLET)



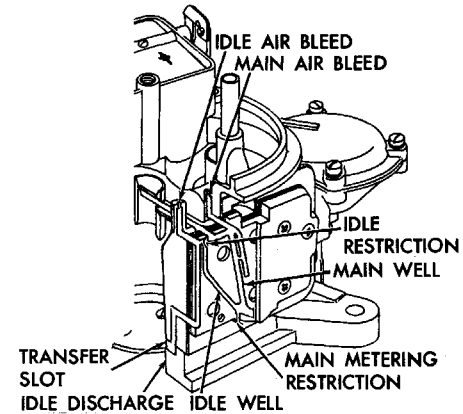
IDLE SYSTEM (TYPICAL)



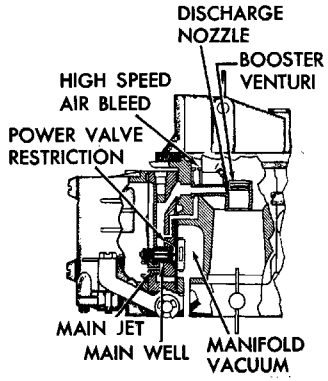
MAIN METERING SYSTEM (TYPICAL)

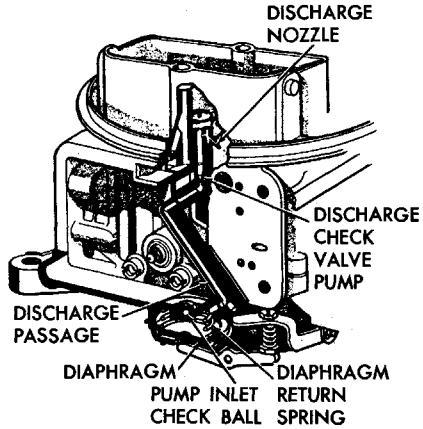


4150 SECONDARY SYSTEM (IDLE & LOW SPEED)

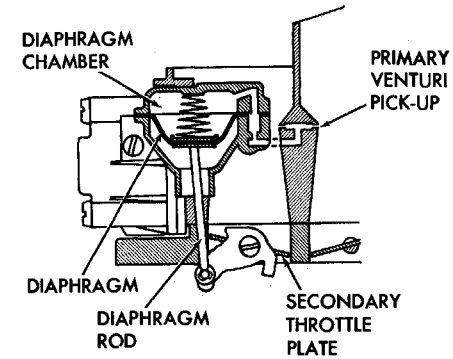


4160 SECONDARY SYSTEM (IDLE & LOW SPEED)





PUMP SYSTEM (TYPICAL)



SECONDARY THROTTLE OPERATING SYSTEM (TYPICAL)

Fig. 19H—Fuel Systems

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REPAIR PROCEDURES

Disassembly

Disassemble Into Subassemblies (Figs. 20H and 21H)

NOTE: Before disassembly, loosen the fuel inlet fitting, fuel bowl sight plugs and needle and seat assembly lock screws.

1. Remove primary fuel bowl screws (4) and remove fuel bowl, metering body, splash shield and gaskets, then remove fuel tube (if so equipped).
2. Remove secondary fuel bowl screws (4) then remove bowl and on Model 4150 Carburetors, the metering body and gasket.
3. On Model 4160 Carburetors, remove secondary metering body screws (6) and remove metering body assembly and fuel bowl gasket.
4. Disconnect secondary throttle operating rod at throttle lever.
5. Remove secondary throttle operating assembly and gasket from main body.
6. Disconnect vacuum break hose at vacuum break.
7. Remove throttle body to main body screws, then remove throttle body and gasket.

Disassemble Fuel Bowls (Figs. 22H and 23H)

1. Remove float hinge pin retainer and slide float from bowl then, if necessary, remove spring from float assembly.
2. If so equipped, remove inlet baffle from bowl.
3. On center fuel inlet model loosen inlet needle and seat lock screw, then turn adjusting nut counter-clockwise to remove the needle and seat assembly.
4. On center fuel inlet model remove sight plug and gasket.
5. Remove inlet fitting, fuel filter, spring and gaskets.
6. PRIMARY BOWL ONLY--
   - Remove air vent valve assembly.
   - Remove pump diaphragm screws and lift pump housing, diaphragm and spring from fuel bowl.
   - Check pump inlet ball for free movement and damage. Damage to ball, passage or retainer requires new bowl assembly.

Disassemble Metering Bodies

1. On all except 4160 secondary (fig. 24H): Remove main metering jets with a jet wrench or a wide blade screw driver (a small screw driver will damage the jets). Remove the power valves using a 1" 12 pt. socket.
   PRIMARY SIDE ONLY--
   Remove idle mixture screws and seals.
2. On 4160 secondary (fig. 25H): Remove plate then gasket from secondary metering body dowl pins.

Disassemble Secondary Throttle Operating Assembly (Fig. 26H)

1. Remove diaphragm cover.
2. Remove spring and diaphragm.

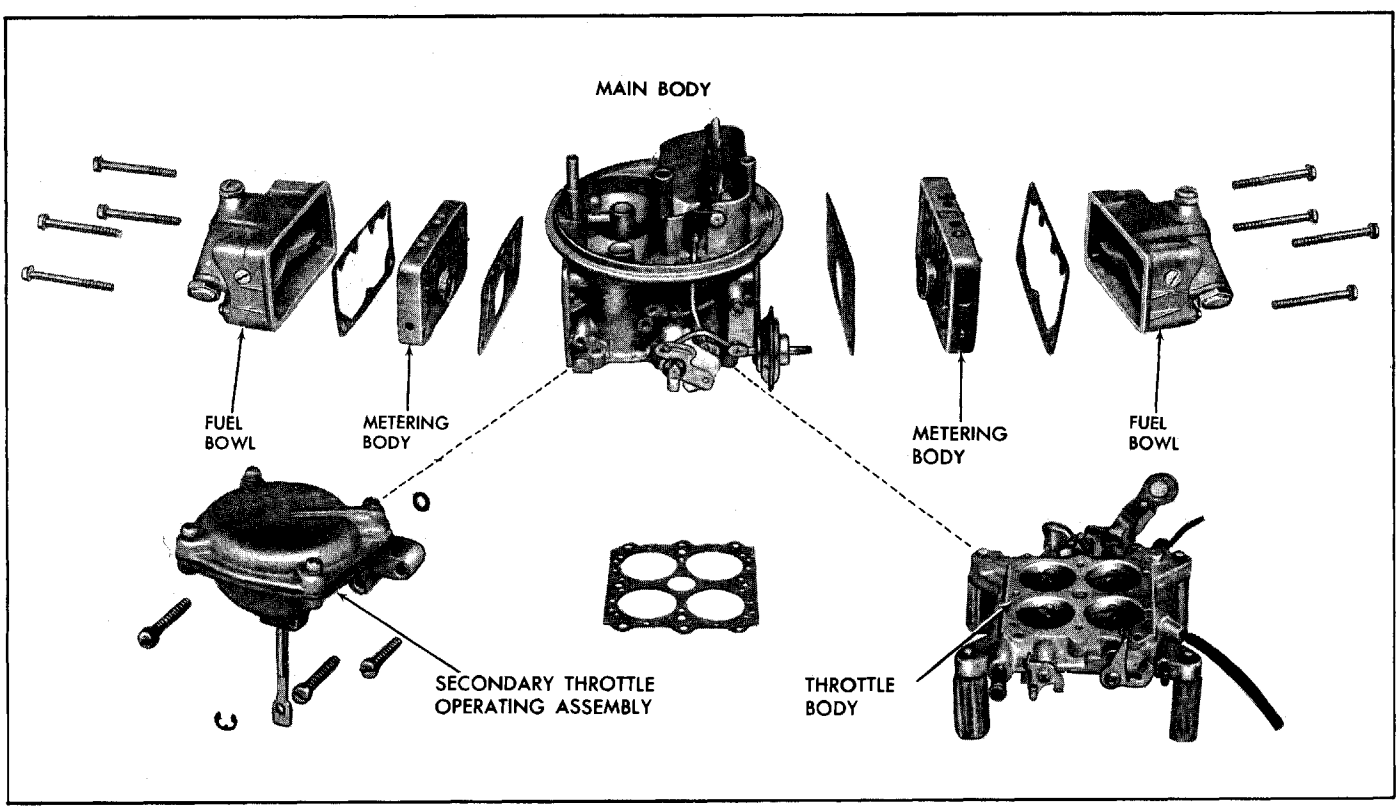


Fig. 20H—Subassemblies (4150) (Typical)

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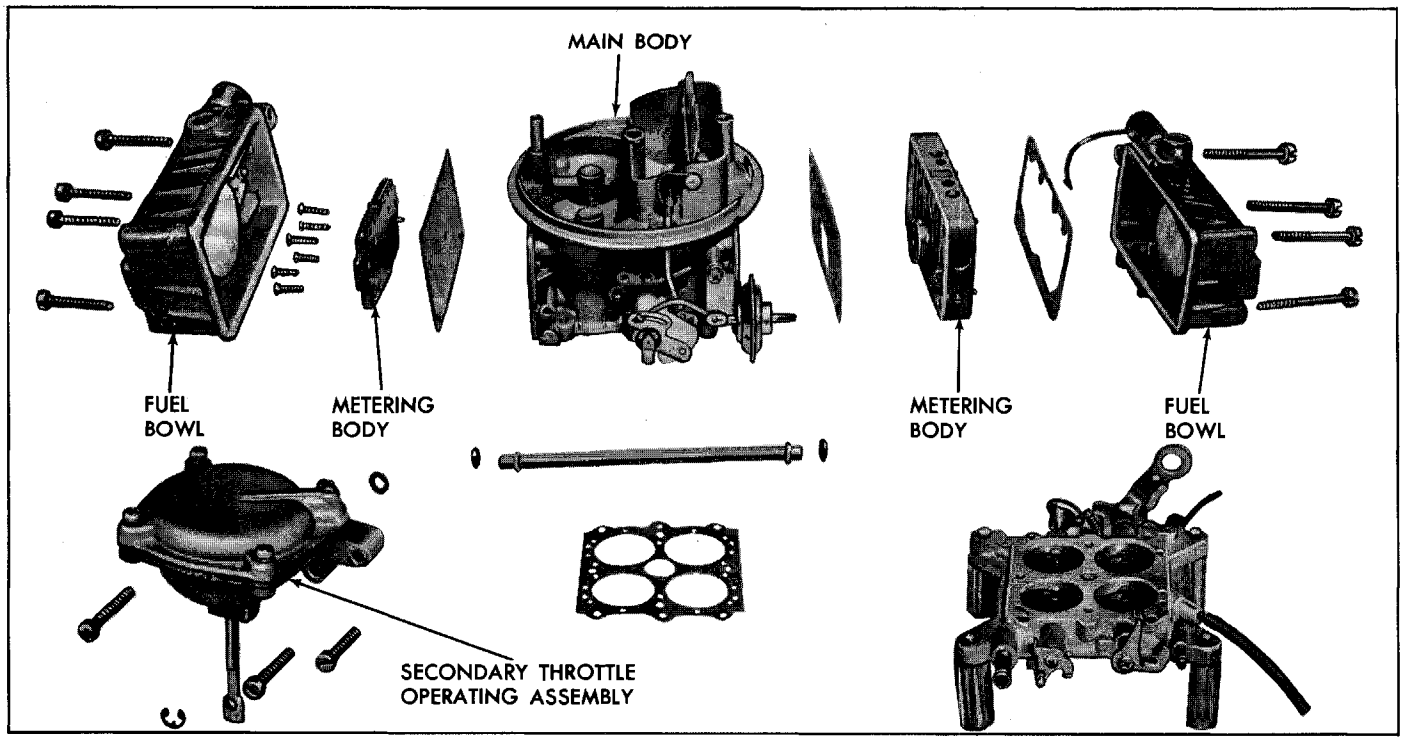


Fig. 21H—Subassemblies (4160)

Disassemble Main Body (Fig. 27H)

1. Remove choke vacuum break retaining screws then remove choke vacuum break disconnecting link at choke lever.
2. Remove choke lever retaining clip then remove choke lever and fast idle cam.
3. Remove pump discharge nozzle screw, nozzle and gasket, then up-end the body assembly to remove pump discharge check valve.

NOTE: The choke rod seal will withstand normal cleaning in carburetor cleaner, therefore, further disassembly of the main body is not required for cleaning purposes. If part replacement is required, proceed as follows.

- File off the staked ends of shaft screws then remove screws.
- Remove valve from shaft slot and slide shaft from main body.
- Remove choke rod (upward through seal) and remove seal from main body.

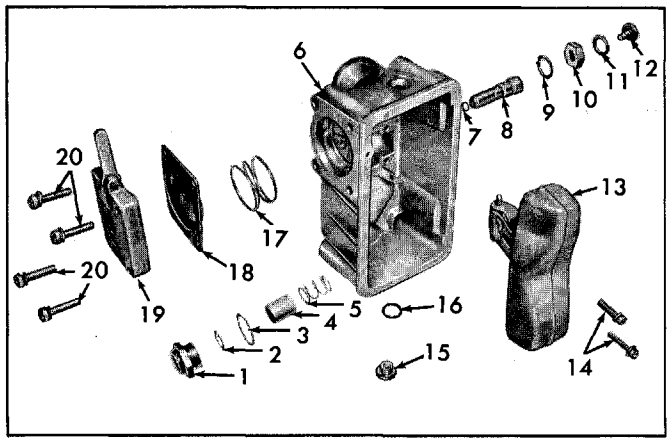


Fig. 22H—Fuel Bowl Assembly (End Inlet)

1. Nut - Fuel Inlet
2. Gasket - Fuel Filter
3. Gasket - Inlet Nut
4. Fuel Filter
5. Spring Fuel Filter
6. Fuel Bowl
7. Seal - Inlet Needle and Seat Assembly
8. Inlet Needle and Seat Assembly
9. Gasket - Inlet Adjusting Nut
10. Nut - Inlet Adjusting
11. Gasket - Inlet Lock Screw
12. Screw - Inlet Lock
13. Float Assembly
14. Screw - Float Hinge
15. Fuel Level Sight Plug
16. Gasket - Sight Plug
17. Spring - Pump Diaphragm*
18. Pump Diaphragm*
19. Cover Assembly - Pump Diaphragm*
20. Screw - Pump Diaphragm Cover*

*Primary Side Only

Disassemble Throttle Body (Fig. 28H)

NOTE: Ordinarily the throttle body need not be disassembled for cleaning and inspection purposes. If necessary, disassemble for part replacement as follows:

1. Remove pump operating lever assembly. Disassemble spring, bolt and nut if needed.
2. Remove idle speed screw and spring.
3. Remove diaphragm lever from secondary throttle shaft and fast idle cam lever from primary throttle shaft.
4. Remove cotter keys and disconnect throttle connecting link (secondary lockout) from shaft levers.
5. File off the staked ends of the throttle plate attaching screws, then remove the screws and throttle

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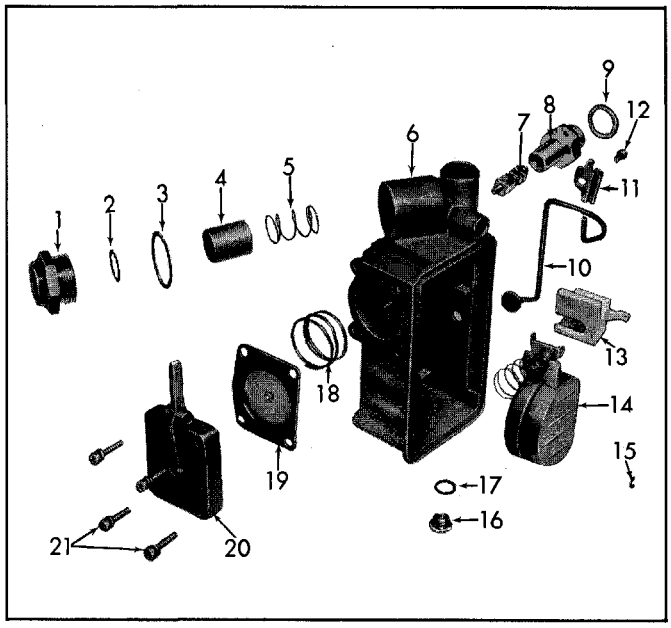


Fig. 23H—Fuel Bowl Assembly (Side Inlet)

1. Nut - Fuel Inlet*
2. Gasket - Fuel Filter*
3. Gasket - Inlet Nut*
4. Fuel Filter*
5. Spring - Fuel Filter*
6. Fuel Bowl
7. Inlet Needle
8. Inlet Seat
9. Gasket - Inlet
10. Idle Vent Valve Assembly*
11. Bracket - Idle Vent Valve*
12. Screw - Idle Vent Valve Bracket*
13. Fuel Baffle
14. Float (With Spring)
15. Retainer - Float
16. Fuel Level Sight Plug
17. Gasket - Sight Plug
18. Spring - Pump Diaphragm*
19. Pump Diaphragm*
20. Cover Assembly - Pump Diaphragm*
21. Screw - Pump Diaphragm Cover*

*Primary Side Only

plates. Remove burrs from throttle shaft and slide the shafts out of flange.

7. Remove accelerator pump cam from throttle lever.
8. Remove vacuum break hose from fitting.

Cleaning and Inspection

NOTE: The most frequent causes of carburetor malfunction are gum, carbon, and water. Carefully clean and inspect all parts and castings as the carburetor is being serviced as follows:

1. Clean throttle flange (if not disassembled), vacuum break and all non-metallic parts, in alcohol or gasoline.

   NOTE: Secondary throttle shaft bushings and accelerator pump cam are plastic.

2. Wash all other parts in cleaning solvent.
3. Inspect holes in all operating levers and castings for excessive wear.
4. Inspect bearing surfaces of all shafts for excessive clearance. It is not necessary to remove shafts and plate to inspect.

   NOTE: If wear is excessive to the extent of

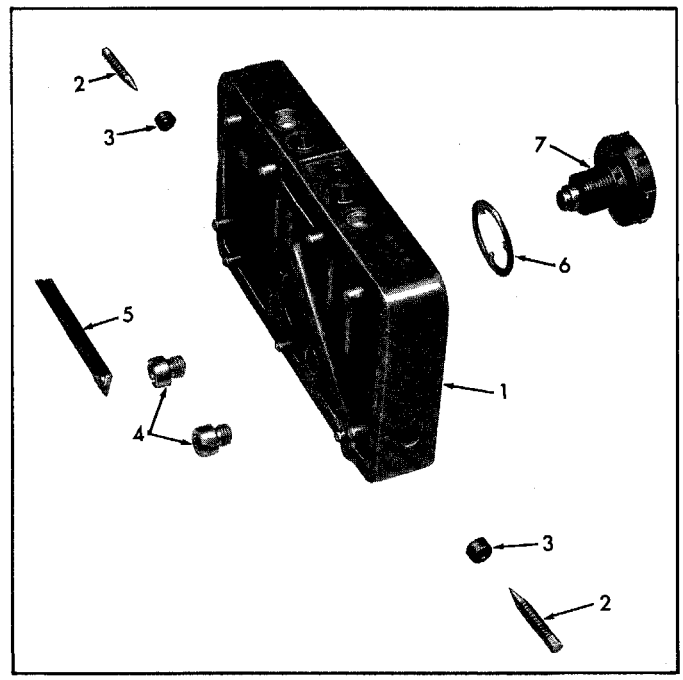


Fig. 24H—Metering Body Assemblies (exc. 4160 Secondary)

1. Metering Body
2. Needle - Idle Mixture*
3. Seal - Idle Mixture Needle*
4. Metering Jet
5. Splash Shield*
6. Gasket - Power Valve
7. Power Valve

*Primary Side Only

improper operation of the carburetor, the worn parts should be replaced.

5. Inspect floats for bad dents and/or possible leaks.
6. Inspect pump diaphragm for damage.
7. Inspect float needles and seats for burrs and ridges; if present, replace both the needle and seat. Never replace either alone as these are an assembly.
8. Inspect edges of primary and secondary throttle valves for gouges and other deformations. If these

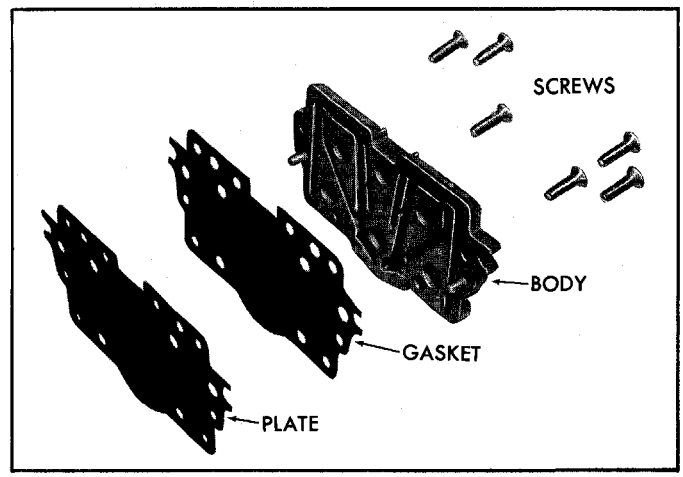


Fig. 25H—Metering Body Assembly (4160 Secondary)

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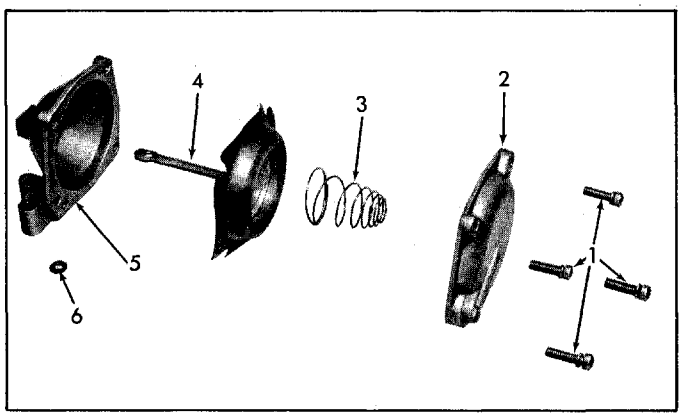


Fig. 26H—Secondary Throttle Operating Assembly

1. Screw
2. Cover
3. Spring
4. Diaphragm
5. Housing
6. Gasket

or any other conditions exist which would prevent full seating, replace the faulty valve.

9. Inspect all mating surfaces of fuel bowl, carburetor body, and throttle flange for burrs, gouges, or other surface irregularities. All surfaces must be smooth and square to prevent leaks.
10. Check secondary throttle operating diaphragm for free operation and leakage by moving diaphragm rod to the up position then covering vacuum passage opening in housing with thumb. The diaphragm should hold upward. Remove thumb from vacuum passage and diaphragm rod should move down readily.
11. After washing in solvent, clear all passages in the metering body and main body with compressed air. If passages or welsh plugs in either body are damaged, the body must be replaced.
12. Check fudl filter element for restriction by blowing on cone end, element should allow air to pass freely.
13. Clean element by washing in solvent and blowing out. Blow in opposite direction of fuel flow.

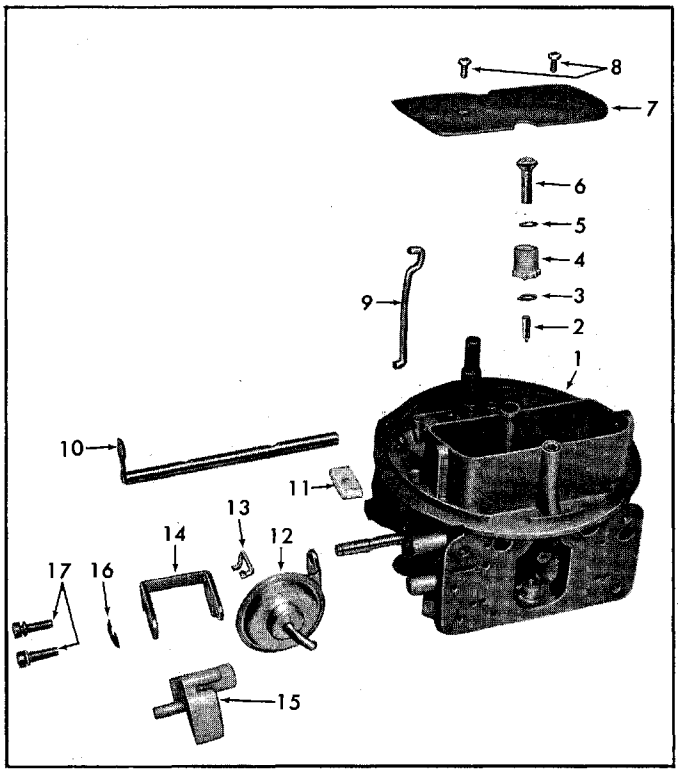


Fig. 27H—Main Body Assembly

1. Main Body Assembly
2. Pump Discharge Needle
3. Gasket - Pump Discharge Nozzle
4. Pump Discharge Nozzle
5. Gasket - Pump Discharge Nozzle Screw
6. Screw - Pump Discharge Nozzle
7. Choke Valve
8. Screw - Choke Valve
9. Choke Rod
10. Choke Shaft and Lever
11. Seal - Choke Rod
12. Vacuum Break
13. Link - Vacuum Break
14. Choke Lever
15. Fast Idle Cam
16. Retainer - Choke Lever
17. Screw - Vacuum Break

Assembly and Adjustments

Assemble Throttle Body

1. Install secondary throttle stop screw (if removed).
2. Install throttle shafts in throttle body.

   NOTE: The throttle shafts have plastic bushings. Roll new bushing between thumb and first finger to help shape the bushing on the shaft for easier installation.

3. Install the throttle valves on the shaft (do not tighten retaining screws).
4. Center the throttle valves on the shafts by holding the valves closed while tightening the screws.

   NOTE: The throttle valves are installed with identification numbers down (to manifold side).

5. Support the throttle shafts and stake the throttle valve screws.
6. Install the throttle connecting link (secondary lockout) to the throttle shaft levers.
7. Install fast idle cam lever on primary throttle shaft and diaphragm lever on secondary throttle shaft.
8. Install idle speed screw and spring. Turn idle speed screw clockwise until contact with throttle lever is made and turn 1-1/2 additional turns for preliminary adjustment.
9. Install accelerator pump cam on throttle lever.
10. Assemble and install pump operating lever assembly.
11. Install vacuum break hose on fitting.

Assemble Main Body

1. Install pump discharge valve.
2. Install pump discharge nozzle. Use new gaskets.
3. Install choke rod seal and choke rod in main body.
4. Install choke shaft in main body and connect upper end of choke rod.
5. Install choke valve on choke shaft (do not tighten retaining screws).
6. Center choke valve on shaft by holding valve closed while tightening screws.
7. Stake screw ends with pliers.

   NOTE: The choke valve is offset and should fall freely to wide open position from its own weight.

8. Install choke lever and fast idle cam then retainer.

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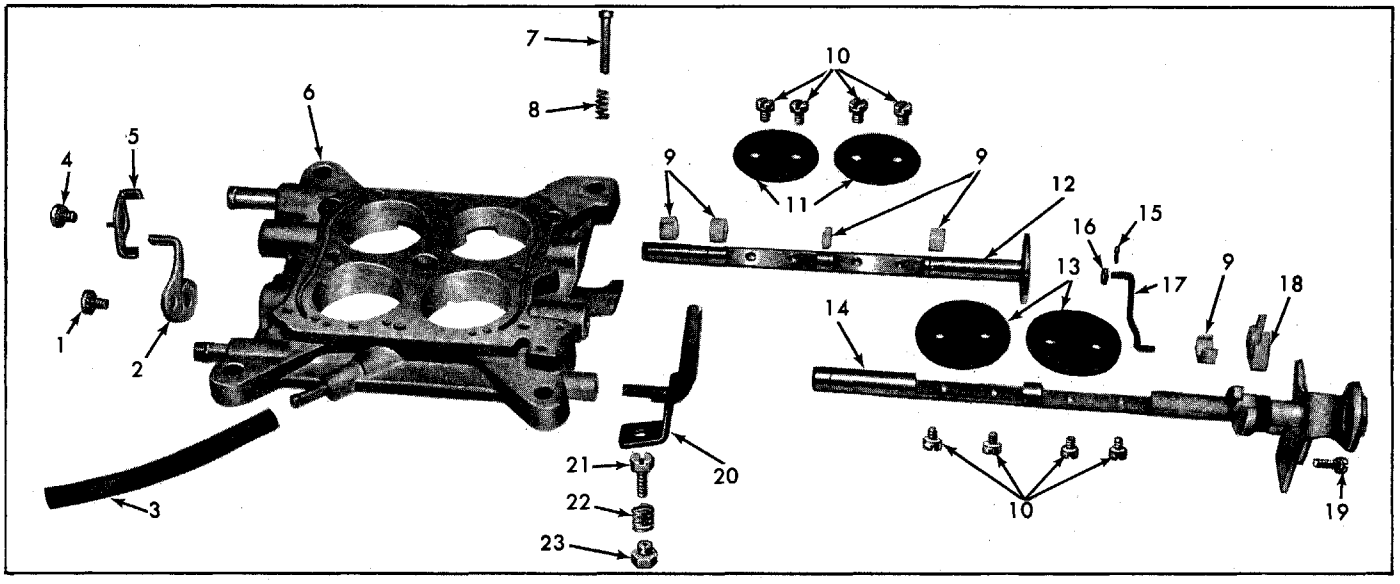


Fig. 28H—Throttle Body Assembly

1. Screw - Fast Idle Cam Lever
2. Fast Idle Cam Lever
3. Hose - Vacuum Break
4. Screw - Secondary Throttle Lever
5. Lever - Secondary Throttle Operating
6. Throttle Body
7. Screw - Idle Speed
8. Spring - Idle Speed Screw
9. Bushing - Throttle Shaft
10. Screw - Throttle Plate
11. Throttle Plate - Secondary
12. Throttle Shaft - Secondary
13. Throttle Plate - Primary
14. Throttle Shaft - Primary
15. Cotter Pin - Throttle Link
16. Washer - Throttle Link
17. Link - Throttle Connector
18. Cam - Accelerator Pump
19. Screw - Accelerator Pump Cam
20. Pump Operating Lever
21. Screw - Pump Lever Adjusting
22. Spring - Pump Lever Adjusting Screw
23. Nut - Pump Lever Adjusting

9. Connect vacuum break link to choke lever then install vacuum break with two retaining screws.

Assemble Secondary Diaphragm Housing Assembly

1. Install diaphragm assembly and spring in housing.
2. Install diaphragm cover and tighten securely.

NOTE: Diaphragm may be checked for leaks by pushing in on rod then holding finger over vacuum hole. Rod should remain in.

Assemble Metering Bodies

1. On all except 4160secondarys: Using a new gasket, install power valve and tighten securely. (Use a 1" 12 pt. socket). Install main metering jets with a wide blade screw driver.
   PRIMARY ONLY--
   Using new seals install idle mixture screws and make preliminary adjustment of idle mixture screws by turning lightly to seat and back out one turn.

   CAUTION: Do not turn screw tightly against seat.
2. On 4160 secondarys: Install gasket (new), then metering plate over secondary metering body dowel pins.

Assemble Fuel Bowls

1. PRIMARY AND SECONDARY BOWL
   - On center inlet model install sight plugs with new gaskets.
   - Install inlet needle and seats leaving locknuts loose on center inlet models. Use new gaskets.
   - Install inlet fitting, fuel filter, spring and gaskets (new).
   - Assemble spring to float, slide float into bowl and install float hinge pin retainer.
   - Install inlet baffle in bowl.
2. PRIMARY BOWL ONLY
   - Install pump spring and diaphragm in fuel bowl.
   - Install air vent valve assembly.

Adjust Float (Fig. 29H)

(All Models Except Center Inlet)

1. Invert fuel bowl allowing float to drop to the fully closed position.
2. Using specified pin gauge from universal carburetor gauge set, check float level setting from lower edge of float bowl to lower edge of float.
3. To adjust float level, bend small tab in float lever with screw driver or other suitable tool.

Adjust Float (Fig. 30H) (Center Inlet Model)

1. Make a preliminary float adjustment by inverting primary fuel bowl and turning adjustable needle-seat until top of float is specified distance from top of fuel bowl.
2. Repeat Step one for secondary float.

NOTE: Final adjustment of the float is made on the vehicle. Refer to Section 6M of the Chassis Service Manual.

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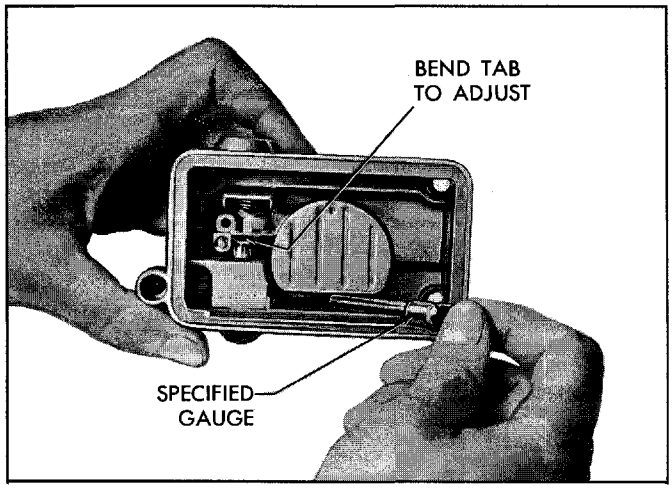


Fig. 29H—Float Adjustment

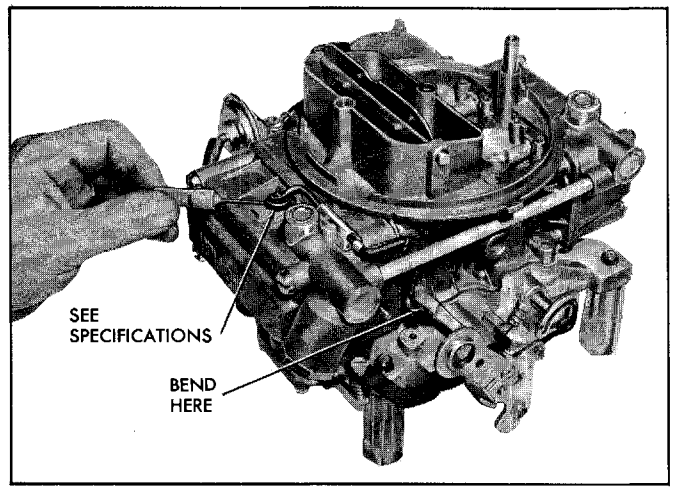


Fig. 32H—Air Vent Valve Adjustment

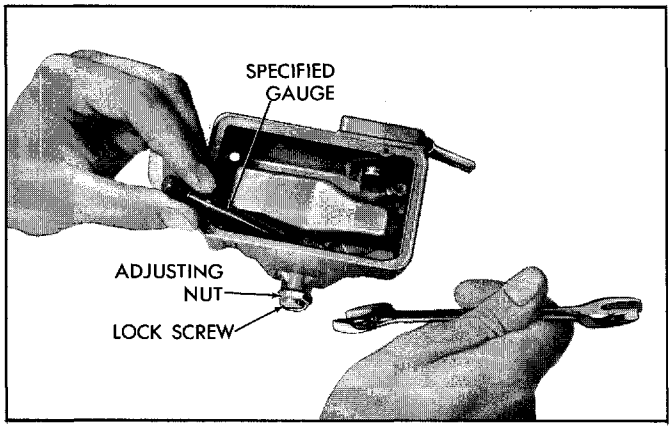


Fig. 30H—Preliminary Float Adjustment

Assemble Subassemblies

1. Invert the main body, align new throttle body to main body gasket, then position throttle flange assembly and install the screws and tighten securely. (On Model 4160 Carburetors the two center holes do not have screws.)
2. Using a new gasket, install secondary throttle operating assembly on main body and tighten securely.
3. Lay flange and main body on primary side then install new fuel bowl gasket and secondary metering body assembly onto main body aligning dowel pins and holes. On Model 4160 Carburetors install six retaining screws and tighten securely.
4. Install secondary fuel bowl and retaining screws with new gaskets under heads.
5. Lay assembly on secondary bowl then install primary metering body and gasket on main body.

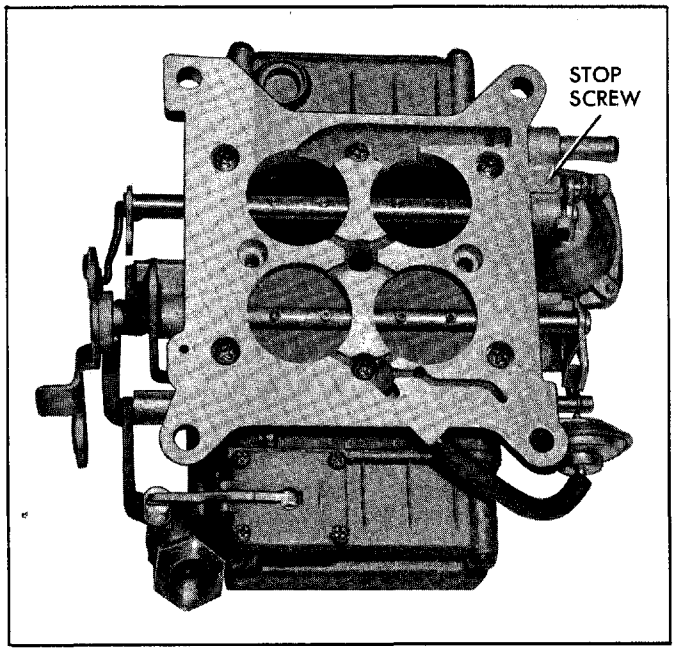


Fig. 31H—Secondary Throttle Stop Screw Adjustment

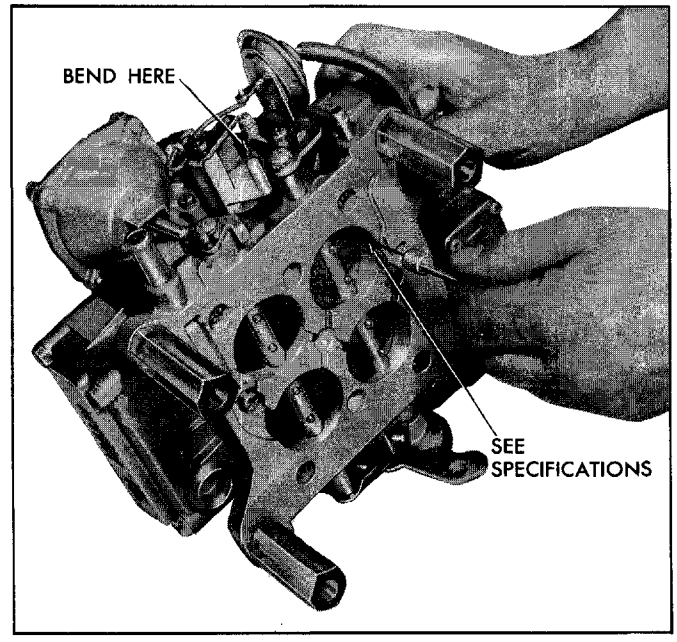


Fig. 33H—Fast Idle Cam Adjustment

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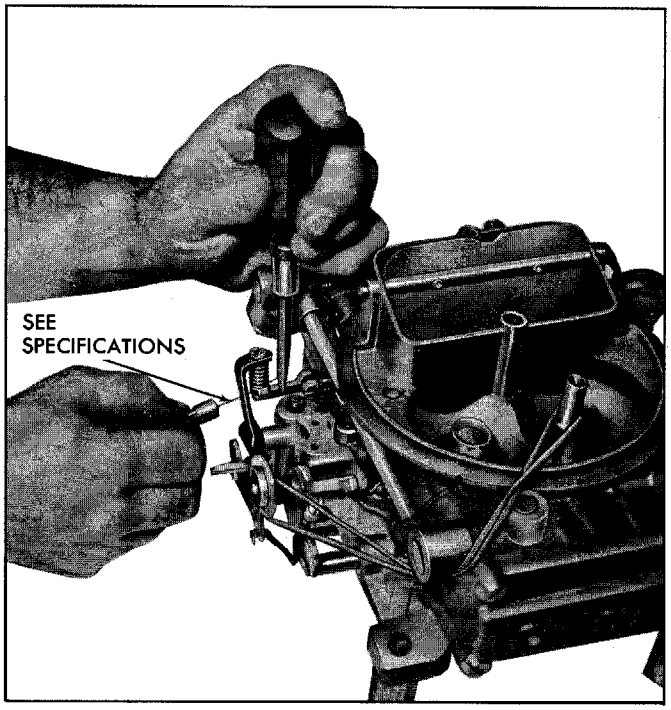


Fig. 34H—Accelerator Pump Adjustment

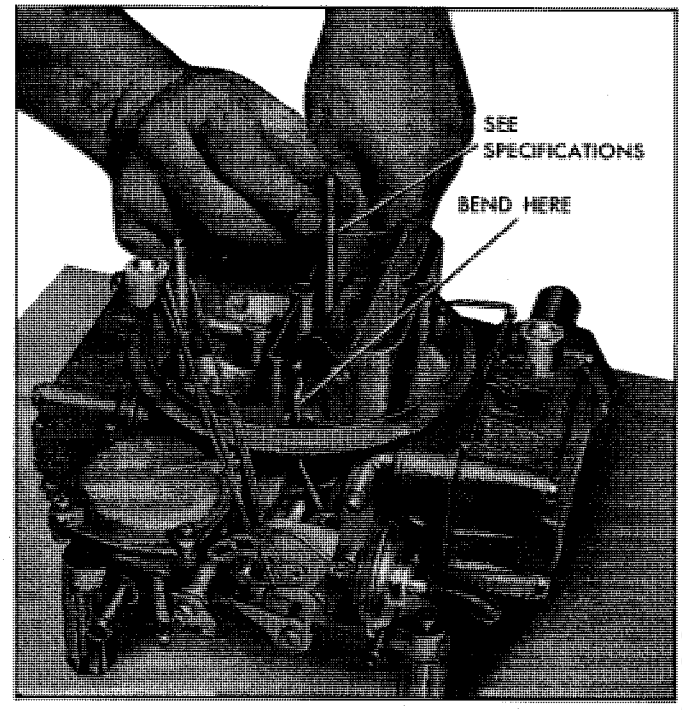


Fig. 35H—Choke Unloader Adjustment

6. If so equipped, lubricate "O" ring seals and install on fuel tube at very end. (They will roll into position during installation.) Then install fuel tube into secondary bowl inlet.
7. Install splash shield, new gasket and primary fuel bowl. If so equipped, align fuel tube into inlet.
8. Align pump lever under operating lever duration spring, then install fuel bowl retaining screws with new gaskets under heads and tighten securely.

Adjust Secondary Throttle Valve Stop Screw (Fig. 31H)

1. Back off on adjustment screw until throttle plates are fully closed.
2. Turn adjustment screw until it just touches the throttle lever and turn one-half turn more to position the valves.

Adjust Air Vent Valve (Fig. 32H)

1. Back off idle speed screw until throttle valves are fully closed. (Choke valve open and throttle arm off idle screw.)
2. Check clearance between choke valve and seat.
3. Bend air vent valve rod to adjust.
4. Turn idle screw in until contact is made with throttle lever, then turn screw in 1-1/2 additional turns for preliminary idle speed adjustment.

Adjust Fast Idle Cam (Fig. 33H)

1. Open throttle slightly, close choke plate positioning fast idle lever against top step of fast idle cam.
2. Adjust fast idle to give specified opening of throttle plates on idle transfer slot side of carb (see specifications). Bend fast idle lever to adjust.

Adjust Accelerator Pump (Fig. 34H)

1. Hold throttle lever in wide open position with a rubber band and hold pump lever fully compressed (down), then measure the clearance between spring adjusting nut and arm of the pump lever.
2. Clearance should be .015"; adjust by turning nut or screw as required while holding opposite end. (The pump operating lever is not threaded.)
3. After adjustment is made, rotate the throttle lever to fully closed and partly open again. Any movement of the throttle lever should be noticed at operating lever spring end, indicating correct pump tip-in.

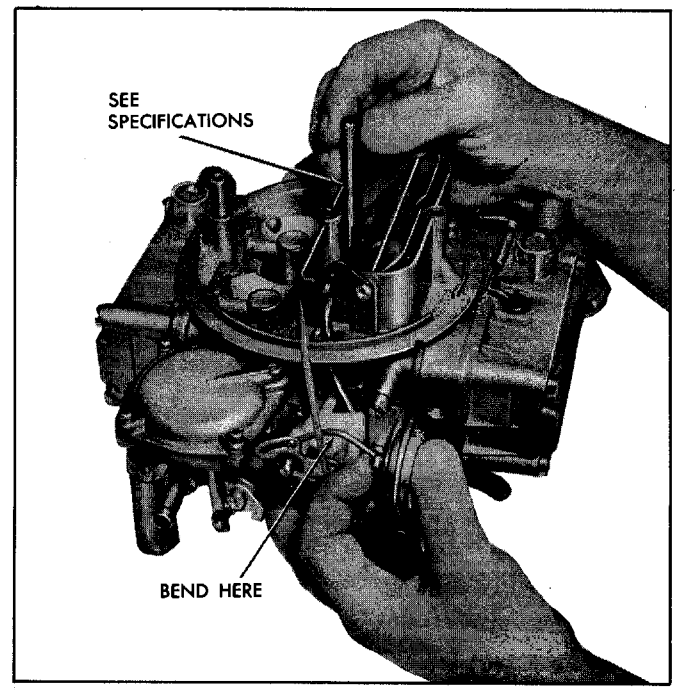


Fig. 36H—Vacuum Break Adjustment

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Adjust Choke Unloader (Fig. 35H)

1. Hold throttle lever in wide open throttle position with a rubber band.
2. Hold choke valve toward closed position against unloader tang of throttle shaft, then measure opening between choke valve lower edge and main body (see specifications).
3. If necessary to adjust, bend choke rod (at off-set bend). Recheck after adjusting.

Adjust Vacuum Break (Fig. 36H)

1. Hold choke valve closed with a rubber band attached to linkage.
2. Hold vacuum break in against stop.
3. Measure distance between choke valve lower edge and main body.
4. Bend vacuum break link to adjust.

SPECIAL TOOLS

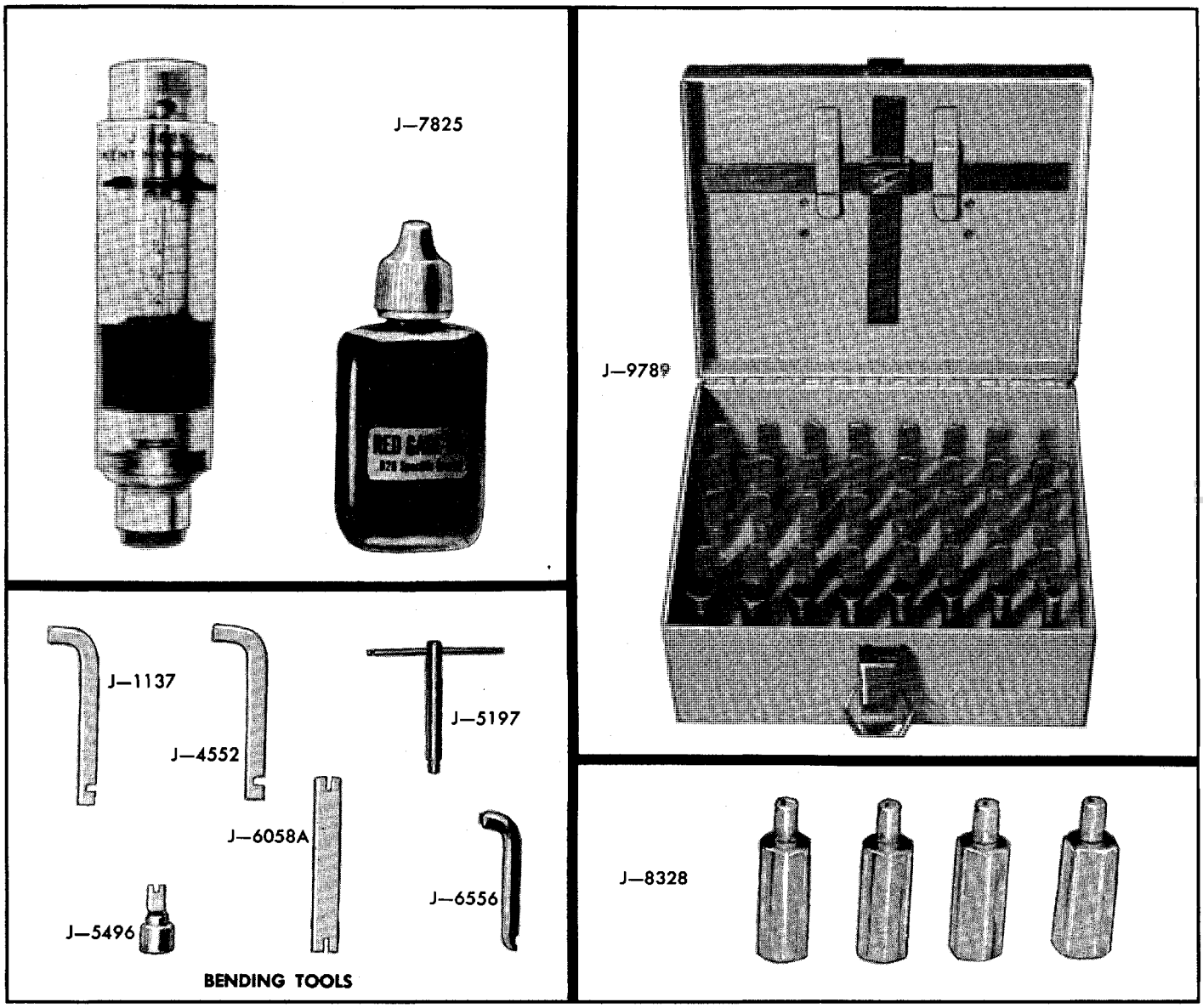


Fig. 1T—Engine Fuel Special Tools

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SECTION 6T
AIR INJECTION PUMP

INDEX

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GENERAL DESCRIPTION

This section covers the Air Injection Pump (fig. 1) used in conjunction with the Air Injection Reactor System on liquid cooled passenger car engines. All illustrations are typical. Although outward appearance may vary, repair procedures will remain the same.

The vane type Air Injection Pump (fig. 2) consists of: cover assembly, rear rotor ring and bearing assembly, rear carbon seal, vane assemblies, vane shoes, shoe springs and the housing and rotor assembly. If required, the pressure relief valve and rear bearing may also be replaced.

To maintain the close tolerances required for an efficient air pump, the rear rotor ring is manufactured as a part of the rotor assembly and the rotor assembly is fitted to the housing with a selective spacer (ground to maintain the required clearances) therefore, the rotor and housing assembly (with rear rotor ring) are serviced as an assembly and parts from one assembly must never be interchanged with another assembly.

The front ball bearing (part of the rotor and housing assembly), the rear needle bearing and the vane needle bearings are lubricated for the life of the bearings and require no periodic service.

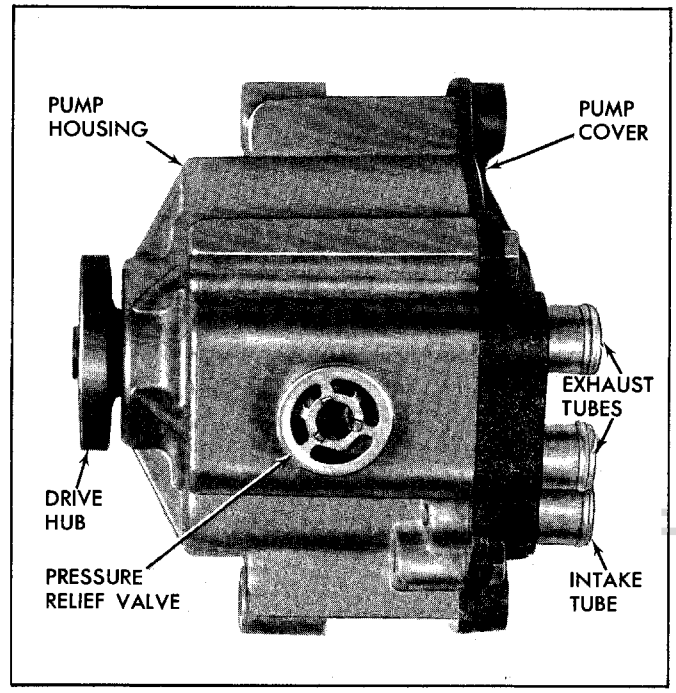


Fig. 1—Air Injection Pump

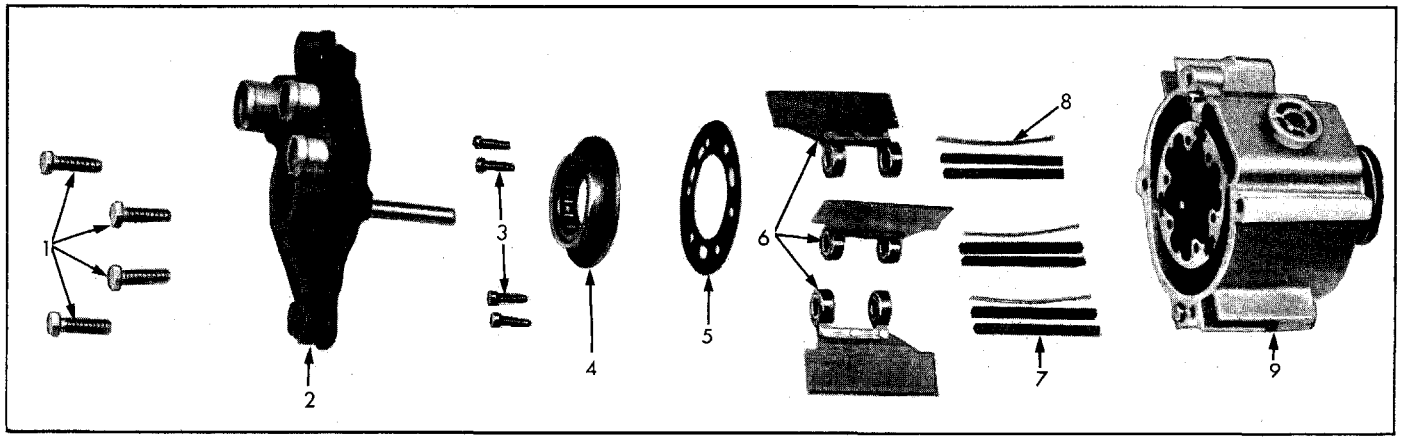


Fig. 2—Air Injection Pump - Exploded View

1. Cover Attaching Bolts
2. Cover Assembly
3. Rear Rotor Ring Screws
4. Rear Rotor Ring and Bearing Assembly
5. Rear Carbon Seal
6. Vane Assemblies
7. Vane Shoes
8. Shoe Springs
9. Housing and Rotor Assembly

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REPAIR PROCEDURES

Disassembly

NOTE: Before disassembly, rotate the drive hub quickly, first three-quarter turn clockwise then one-quarter turn counter-clockwise. Roughness or bumps may indicate vane bearing failure.

1. Support the drive hub in a vise and remove the cover attaching bolts then remove the cover assembly by tapping straight up with a plastic mallet (fig. 3).

   CAUTION: Never clamp the air injection pump on the aluminum housing.

2. Remove the rear rotor ring attaching screws (fig. 4) then remove the rear rotor ring and bearing assembly and rear carbon seal. Discard the rear carbon seal.
3. Remove the vane assemblies (fig. 5).
4. Remove the vane shoes with tweezers or needle nose pliers (fig. 6) then remove the shoe springs.

   CAUTION: Carbon shoes chip easily. Do not use excessive pressure when removing.

   NOTE: Unless the rear bearing and/or the pressure relief valve need replacing, no further disassembly of the pump is recommended.

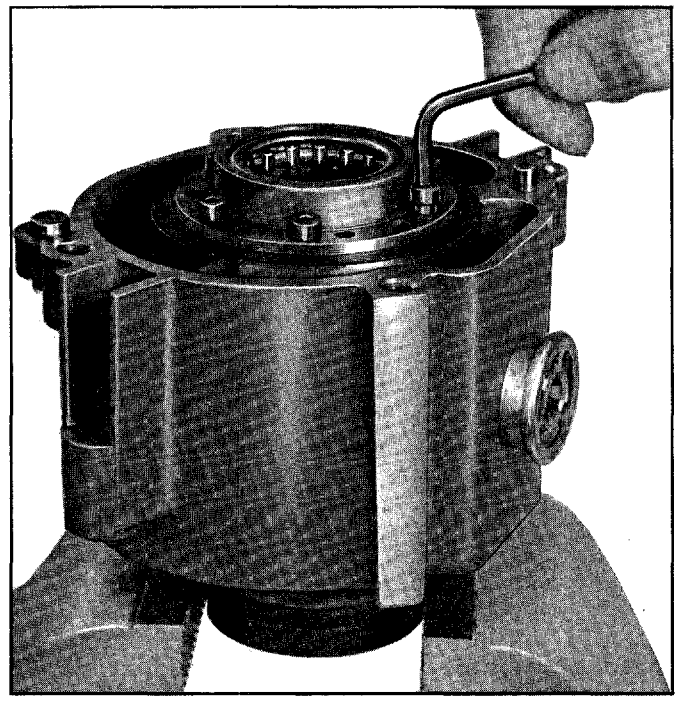


Fig. 4—Removing Rear Rotor Ring

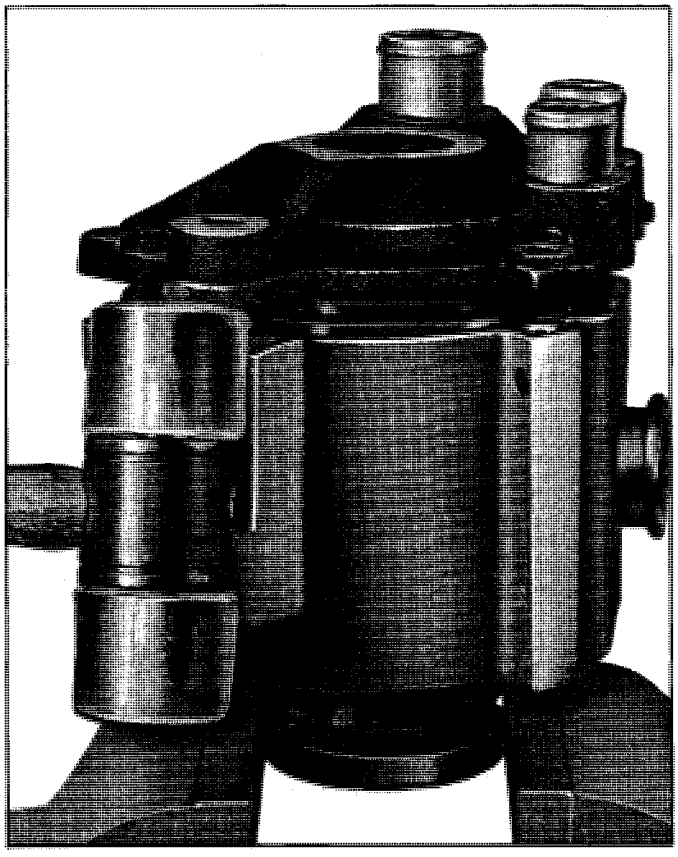


Fig. 3—Removing Cover Assembly

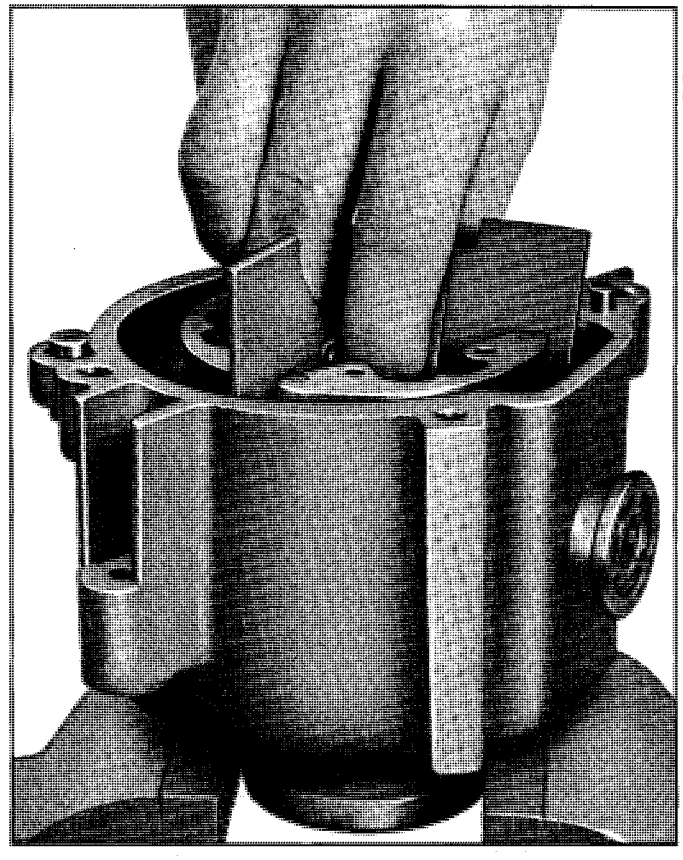


Fig. 5—Removing Vane Assemblies

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Cleaning and Inspection

CAUTION: Under no circumstances should the housing and rotor assembly or the cover assembly be immersed in cleaning solvent.

1. Clean carbon dust from housing and rotor assembly and from cover assembly with compressed air.
2. Wipe grease and/or dirt from the housing and rotor assembly and from the cover assembly with a cloth saturated with petroleum base cleaning solvent, then clean any remaining film from assemblies with a cloth saturated with denatured alcohol.
3. Check inside of the housing for vane and/or rotor wear. Excessive wear indicates the housing and rotor assembly must be replaced.
4. Inspect the rear cover as follows:
   - Inspect the rear bearing inner race for grooves or scratches. These blemishes indicate rear bearing failure, and the bearing and cover assembly must be replaced.
   - Inspect the vane pivot pin. This pin has been precision ground. Grooves, scratches, or discoloration indicate vane bearing failure. If bearings have failed, a new vane assembly and cover assembly are required.
5. Clean rear rotor ring and bearing assembly in petroleum solvent then dry with compressed air. Check the rear bearing for failure. Rear bearing failure is also indicated by the absence of grease in the bearing, caked grease, discoloration of bearing cage, or rollers falling out of cage. Extensive failure of this bearing may necessitate replacing rotor and housing.
6. Clean vane assemblies in petroleum solvent then dry with compressed air. Check the vanes and vane bearings for wear or damage. Vane bearing failure

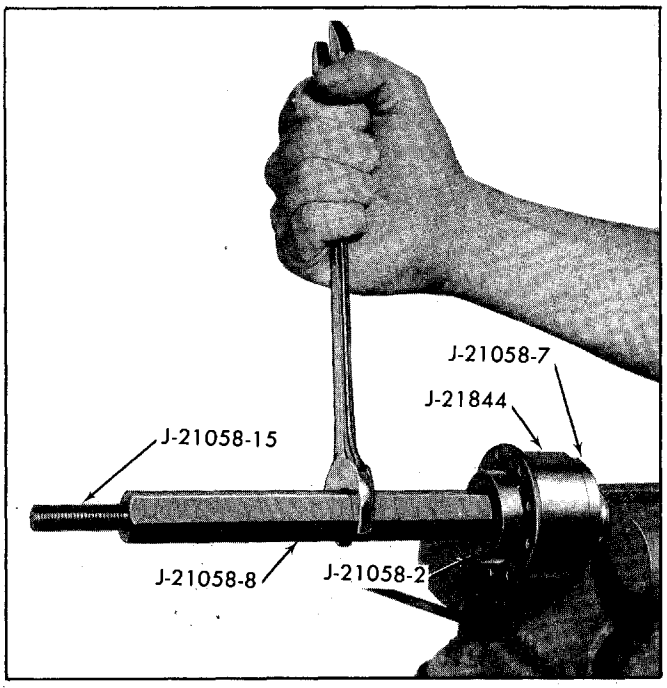


Fig. 7—Removing and Installing Rear Bearing

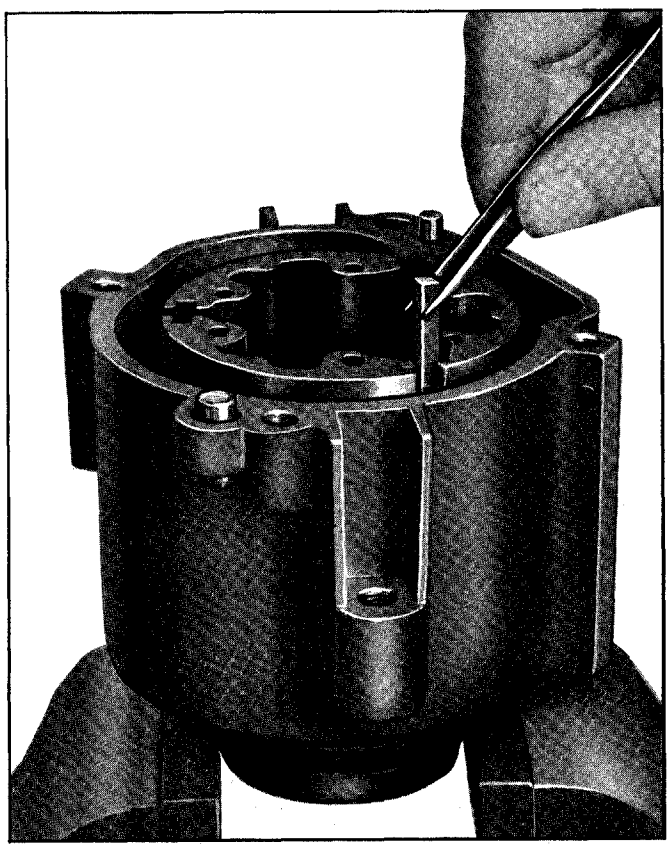


Fig. 6—Removing Vane Shoes

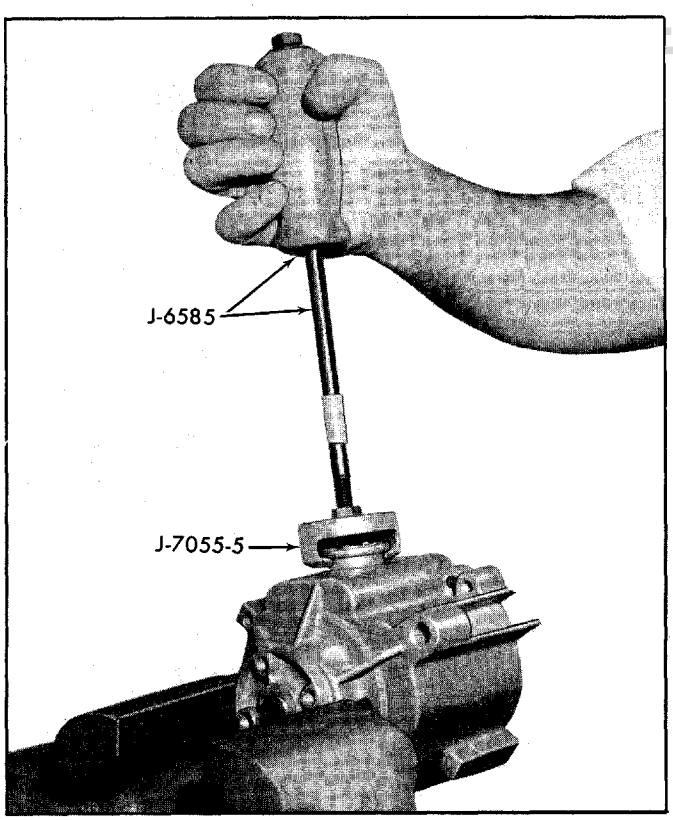


Fig. 8—Removing Pressure Relief Valve

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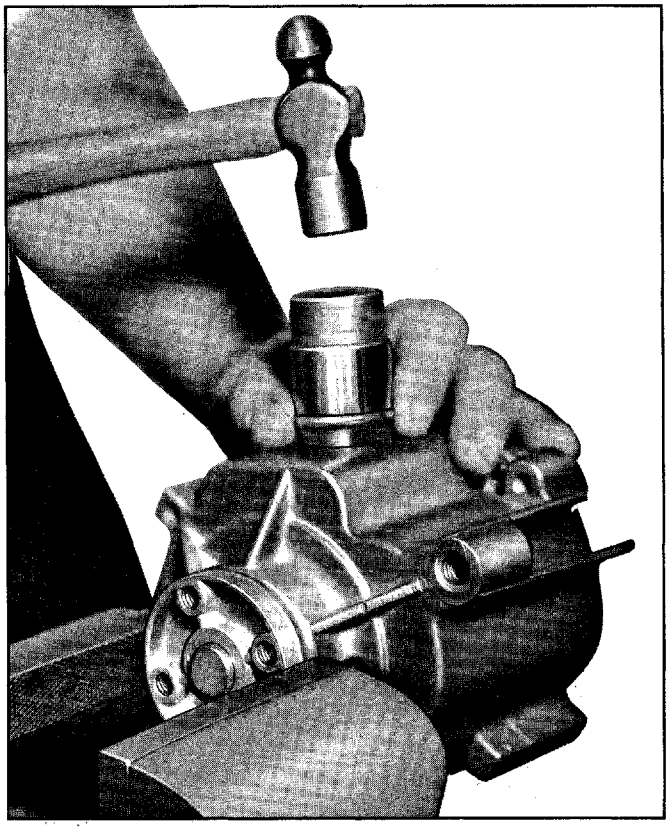


Fig. 9—Installing Pressure Relief Valve

is also indicated by an absence of grease or caked grease. Inspect the pivot pin again to confirm this bearing failure. All corners of the vanes should be square. Broken edges require the vanes be replaced.

7. Check the carbon shoes for excessive wear or chipping. Inspect the surface contacting the vane. The shoes will have small grooves from action of the thread structure of the vanes. This washboard condition is normal, but chipped or broken shoes must be replaced.

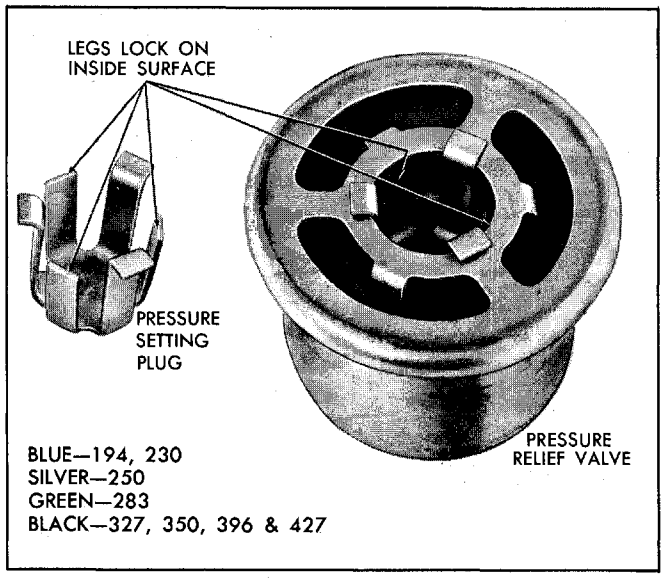


Fig. 10—Pressure Setting Plug

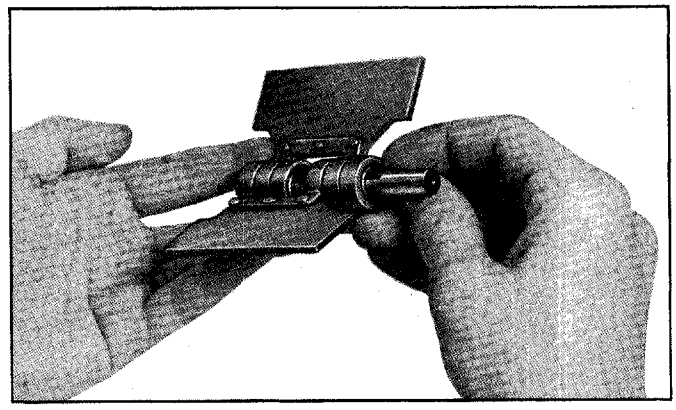


Fig. 11—Assemble Vane Assemblies on Rod

Rear Bearing Replacement

1. Using J-21058 and J-21844 pull the rear bearing out of rotor ring (fig. 7).
2. Using J-21058 and J-21844 pull the rear bearing into rotor ring until bearing is 1/32" beneath the rotor ring surface (fig. 7). Pull on lettered end of bearing.

Pressure Relief Valve Replacement

1. Using J-7055-5 and J-6585 pull relief valve from housing (fig. 8).
2. Using a 15/16" socket tap the relief valve into housing until the valve shoulders on the housing (fig. 9).

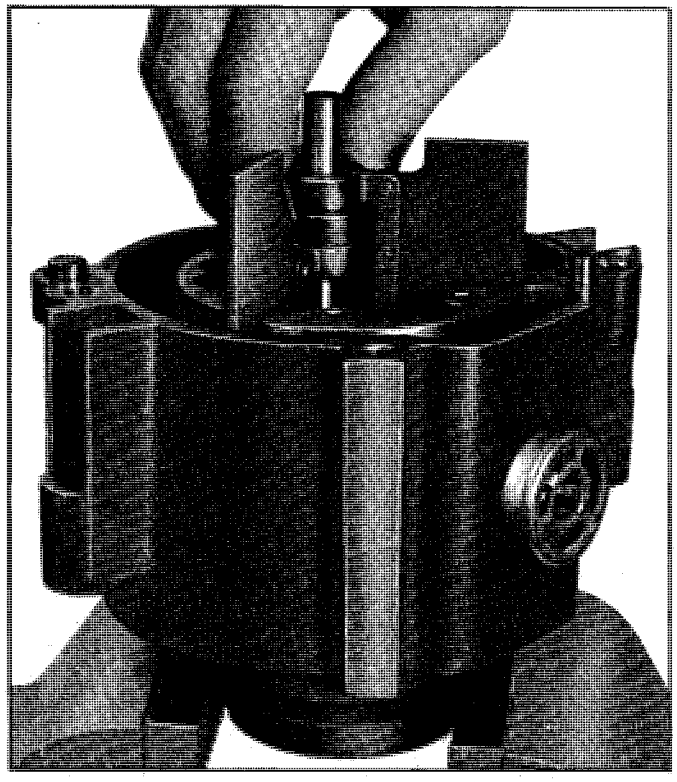


Fig. 12—Installing Vane Assemblies

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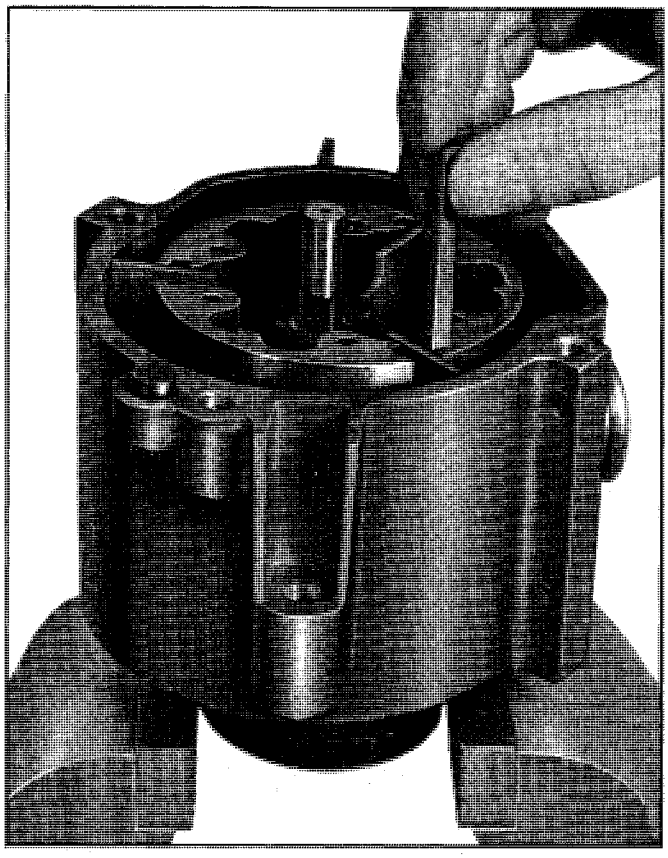


Fig. 13—Installing Vane Shoes

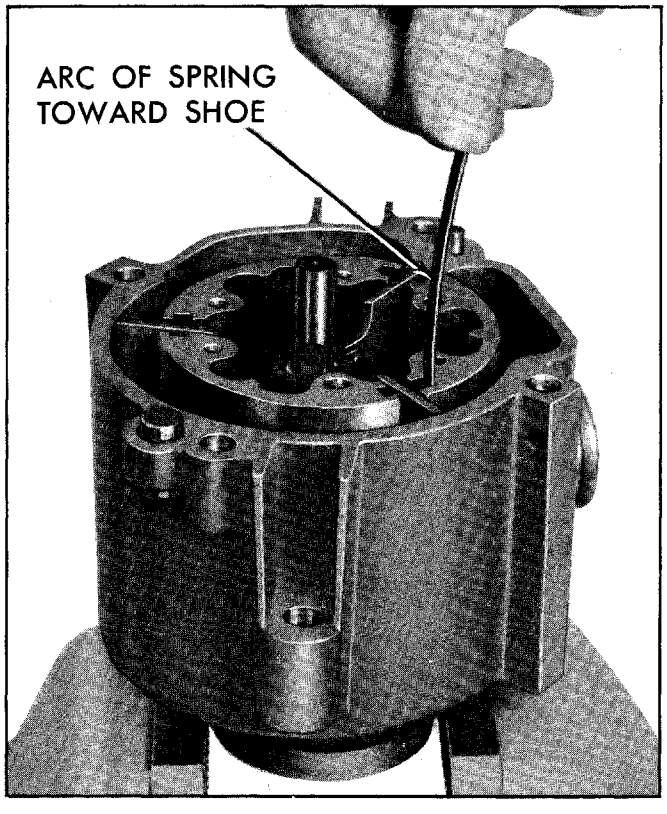


Fig. 14—Installing Shoe Springs

CAUTION: Use extreme care to avoid distorting housing.

NOTE: Various length pressure setting plugs (fig. 10), designed for the particular requirements of vehicle - engine combinations, determine the pressure required to open the relief valve. For identification, the pressure setting plugs are color coded. To remove the pressure setting plug, carefully unlock legs from inside surface of relief valve with a small screw driver. To install the pressure setting plug, carefully push into relief valve until legs lock. If a pressure setting plug is to be reused be sure leg angles are sufficient for the pressure setting plug to lock in place.

Assembly

1. Thoroughly lubricate vane bearings and rear bearing with special air injection pump grease or its equivalent. Work grease well into bearings then carefully wipe away any excess grease.
2. Position vanes on a 3/8" x 4" rod as shown (fig. 11).
3. Position rotor with one vane slot at stripper (fig. 15), then support the housing in a vise by the drive hub and install the vanes (with rod) (fig. 12).
4. Install one carbon shoe on each side of every vane (fig. 13). Shoes must be installed with bearing surface against vane and with radiused point of contact toward O.D. of rotor (fig. 15).
5. Install the shoe springs into the deepest of the two shoe slots. Ark of spring installed toward shoe (fig. 14). Push shoe spring flush with or below rotor surface.

   NOTE: Figure 15 shows the air pump at this stage of assembly.

6. Position a new carbon seal with cupped lip toward rear cover and the rear rotor ring on the end of the rotor. Carbon seal and rear rotor ring bolt hole pattern permit installation at only one position.

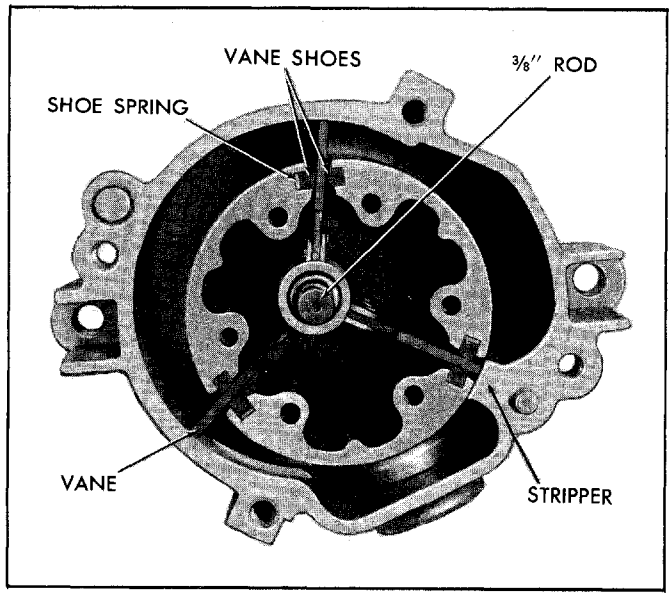


Fig. 15—Vanes, Vane Shoes and Shoe Springs Installed

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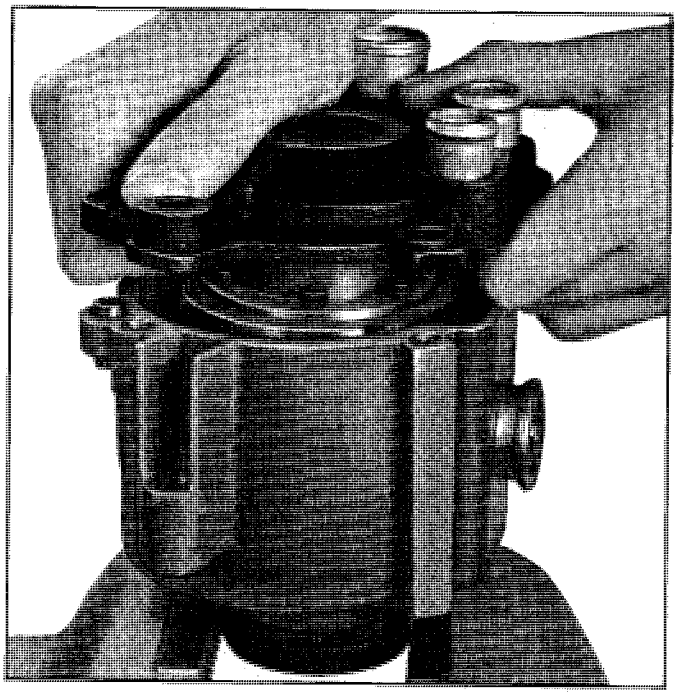


Fig. 16—Installing Cover Assembly

7. Apply Loctite or its equivalent to the rear rotor ring attaching screw thread then install screws and evenly torque to 37 in. lbs.
8. Remove the 3/8" rod from the vanes then start the cover into position. Jockey the cover to locate the pin in the vane bearings (fig. 16).
9. Install cover attaching bolts and torque to 10 ft. lbs. while holding the housing from rotating with one hand.

NOTE: Installation of a new vane set in the Air Injection Pump may result in the vanes chirping or squeaking during initial operation. The new vanes require wear-in running time to eliminate vane chirping. After pump installation, the vehicle should be driven five to ten miles. Should slight squeaking still persist, run vehicle through two or three full throttle shift points. In most cases the five to ten miles will be sufficient for wear-in.

SPECIAL TOOLS

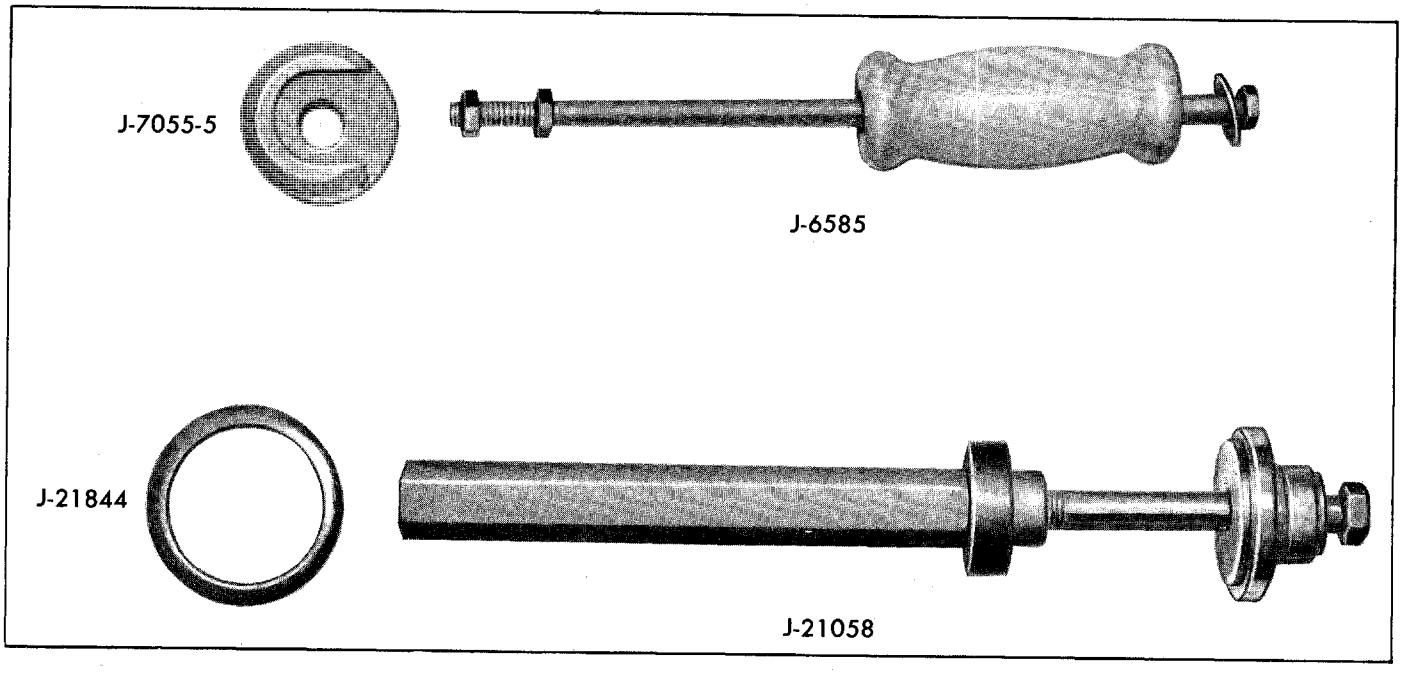


Fig. 17—Special Tools

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SECTION 6Y
ENGINE ELECTRICAL
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STARTING MOTOR

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DISASSEMBLY

Refer to Figures 1s and 2s.

1. Disconnect the field coil connector(s) from the motor solenoid terminal.
2. Remove through bolts.
3. Remove commutator end frame, field frame assembly and armature assembly from drive housing.
4. Remove overrunning clutch from armature shaft as follows:
   a. Slide thrust collar off end of armature shaft.
   b. Slide a standard half-inch pipe coupling or other metal cylinder of suitable size (an old pinion of suitable size can be used if available) onto shaft so end of coupling or cylinder butts against edge of retainer (fig. 3s). Tap end of coupling with hammer, driving retainer towards armature end of snap ring.
   c. Remove snap ring from groove in shaft using pliers or other suitable tool. If the snap ring is too badly distorted during removal, it may be necessary to use a new one when reassembling clutch.
   d. Slide retainer and clutch from armature shaft.
5. Disassemble brush rigging from field frame.
   a. Release "V" spring from slot in brush holder support.
   b. Remove support pin.
   c. Lift brush holders, brushes and spring upward as a unit.
   d. Disconnect leads from each brush.
   e. Repeat operation for other set of brushes.

CLEANING AND INSPECTION

With the starting motor completely disassembled except for removal of field coils, the component parts

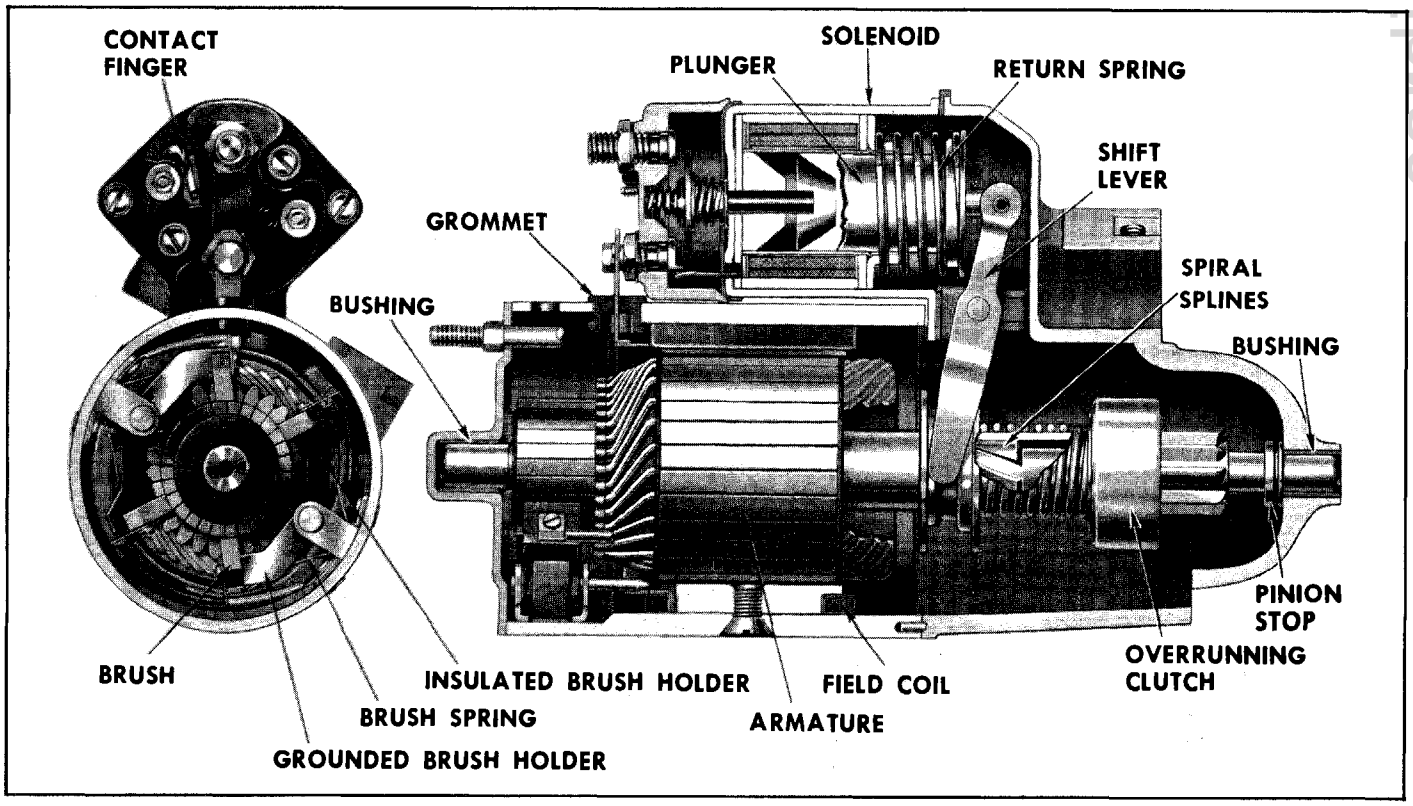


Fig. 1s—Starting Motor Cross Section

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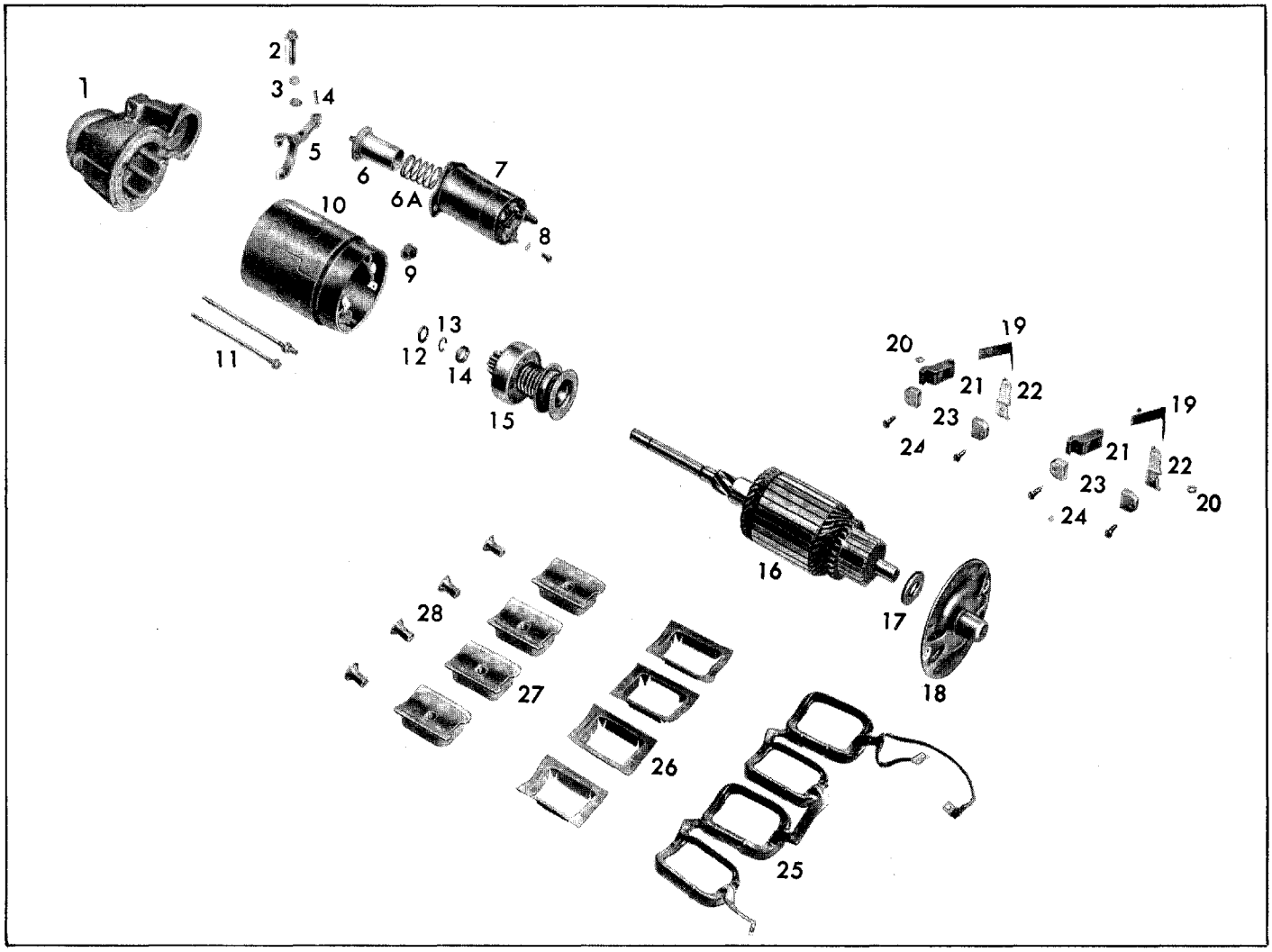


Fig. 2s—Starting Motor Parts Layout

1. Drive Housing
2. Shift Lever Bolt
3. Shift Lever Nut and Lock Washer
4. Pin
5. Shift Lever
6. Solenoid Plunger
6A. Solenoid Return Spring
7. Solenoid Case
8. Screw and Lock Washer
9. Grommet
10. Field Frame
11. Through Bolts
12. Thrust Collar
13. Snap Ring
14. Retainer
15. Overrunning Clutch Assembly
16. Armature
17. Braking Washer
18. Commutator End Frame
19. Brush Springs
20. Washer
21. Insulated Brush Holders
22. Grounded Brush Holders
23. Brushes
24. Screws
25. Field Coils
26. Insulators
27. Pole Shoes
28. Screws

should be cleaned and inspected as described below. Field coils need be removed only where defects in the coils are indicated by the tests described below, in which case the pole shoe screws should be removed and the pole shoes and field coils disassembled. Any defective parts should be replaced or repaired (see Repairs).

1. Clean all starting motor parts, but do not use grease dissolving solvent for cleaning the overrunning clutch, armature, and field coils since such a solvent would dissolve the grease packed in the clutch mechanism and would damage armature and field coil insulation.
2. Test overrunning clutch action. The pinion should turn freely in the overrunning direction and must not slip in the cranking direction. Check pinion teeth to see that they have not been chipped, cracked, or excessively worn. Check the spring for normal tension and the drive collar for wear. If necessary the spring or collar can be replaced by forcing the collar toward the clutch and removing lock ring from end of tube.
3. Check brush holders to see that they are not deformed or bent, but will properly hold brushes against the commutator.
4. Check the condition of the brushes and if pitted or worn to one-half their original length, they should be replaced.
5. Check fit of armature shaft in bushing of drive housing. Shaft should fit snugly in the bushing. If the bushing is worn, it should be replaced. Apply a silicon lubricant to this bushing before reassembly. Avoid excessive lubrication.
6. Check fit of bushing in commutator end frame. If this bushing is damaged or worn excessively, the end frame assembly must be replaced. Apply a silicone lubricant to this bushing before reassembly.

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Avoid excessive lubrication. Lubricant forced onto the commutator would gum and cause poor commutation with a resulting decrease in cranking motor performance.

7. Inspect armature commutator. If commutator is rough or out of round, it should be turned down and undercut. Inspect the points where the armature conductors join the commutator bars to make sure that it is a good firm connection. A burned commutator bar is usually evidence of a poor connection. See "Turning the Commutator," described under Testing and Repairs.

   NOTE: Some starter motor models use a molded armature commutator design and no attempt to undercut the insulation should be made or serious damage may result to the commutator.

TESTING AND REPAIRS

Armature Test for Shorts

Check the armature for short circuit by placing on growler and holding hack saw blade over armature core while armature is rotated (fig. 4s). If saw blade vibrates, armature is shorted. Recheck after cleaning between the commutator bars. If saw blade still vibrates, replace the armature.

Armature Test for Ground

Place one lead on the armature core or shaft and the other on the commutator (fig. 5s). If the lamp lights, the armature is grounded and must be replaced.

Field Coil Test for Open Circuit

Place one lead on the insulated brush and the other to the field connector bar (fig. 6s). If the lamp does not light, the field coils are open and will require replacement.

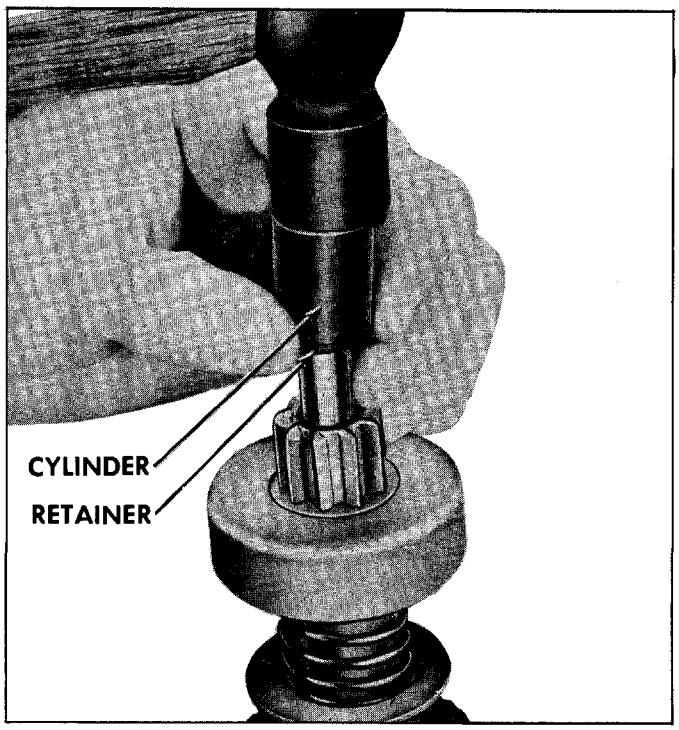


Fig. 3s—Driving Retainer off Snap Ring

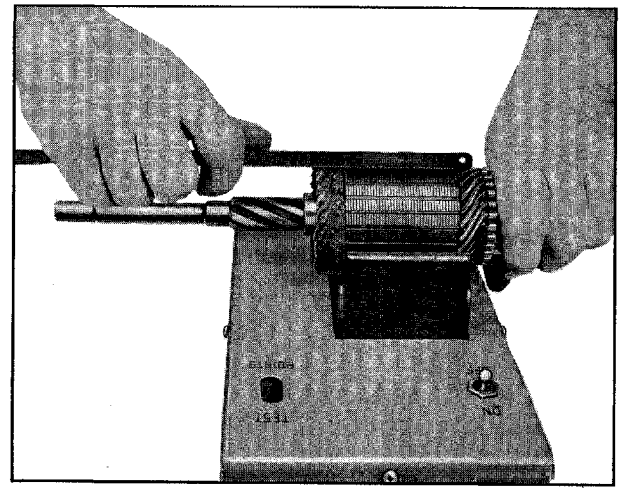


Fig. 4s—Armature Short Circuit Test

Field Coil Test for Ground

Place one lead on the connector bar and the other on the grounded brush (fig. 7s). If the lamp lights, the field coils are grounded.

NOTE: Be sure to disconnect the shunt coil before performing this test.

Loose Electrical Connections

When an open soldered connection of the armature to commutator leads is found during inspection, it may be resoldered provided resin flux is used for soldering.

CAUTION: Acid flux must never be used on electrical connections.

When inspection shows commutator roughness, it should be cleaned as follows:

Turning the Commutator

1. Turn down commutator in a lathe until it is thoroughly cleaned.

   CAUTION: Do not cut beyond section previously turned.

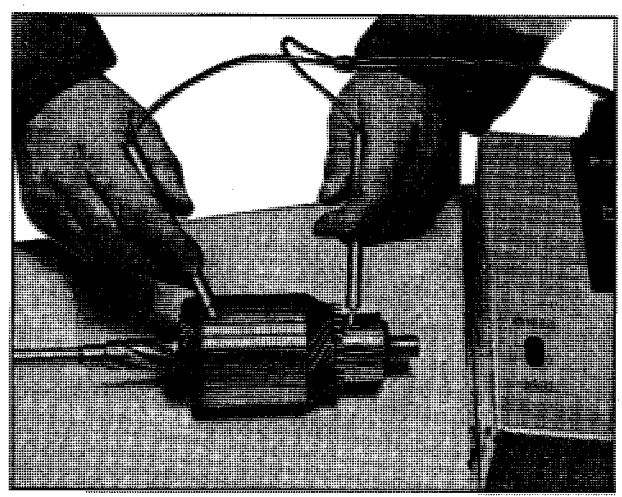


Fig. 5s—Armature Ground Test

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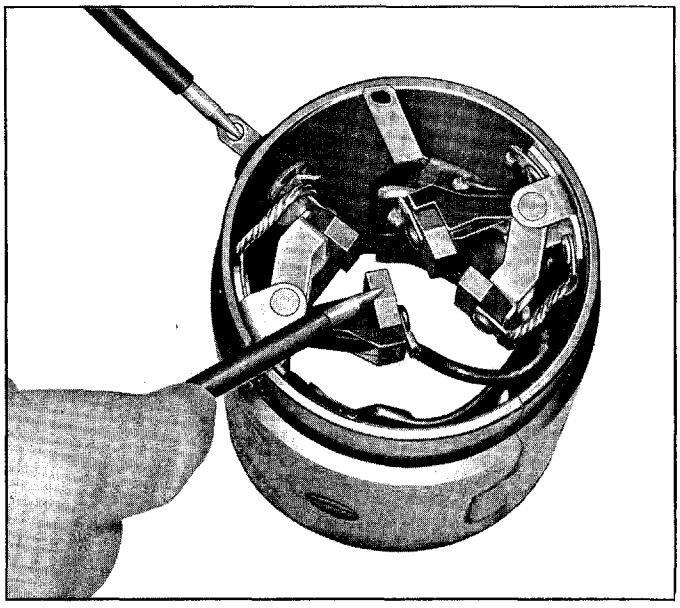


Fig. 6s—Field Coil Open Circuit Test

2. Undercut insulation between commutator bars 1/32". This undercut must be the full width of insulation and flat at the bottom; a triangular groove will not be satisfactory. After undercutting, the slots should be cleaned out carefully to remove any dirt and copper dust.
3. Sand the commutator lightly with No. 00 sandpaper to remove any slight burrs left from undercutting.
4. Recheck armature on growler for short circuits.

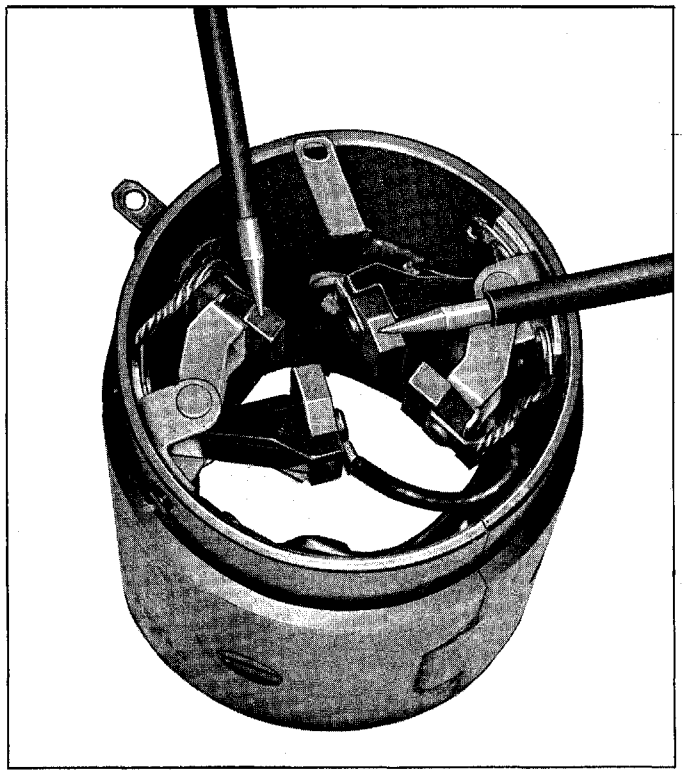


Fig. 7s—Field Coil Ground Test

Brush Holder Replacement

If brush holders are damaged, they can be replaced by special service units which are attached with screws and nuts.

ASSEMBLY

After all parts have been thoroughly tested and inspected and worn or damaged parts replaced, the starter should be reassembled.

1. Assemble brush rigging to field frame.
   a. Assemble brushes to brush holders.
   b. Assemble insulated and grounded brush holder together with the "V" spring and position as unit on the support pin. Push holders and spring to bottom of support and rotate spring to engage the "V" in slot in support.
   c. Attach ground wire to grounded brush and field lead wire to insulated brush.
   d. Repeat for other set of brushes.
2. Assemble overrunning clutch assembly to armature shaft.
   a. Lubricate drive end of armature shaft with a silicone lubricant.
   b. Slide clutch assembly onto armature shaft with pinion outward.
   c. Slide retainer onto shaft with cupped surface facing end of shaft (away from pinion).
   d. Stand armature on end on wood surface with commutator down. Position snap ring on upper end of shaft and hold in place with a block of wood. Hit wood block a blow with hammer forcing snap ring over end of shaft (fig. 8s). Slide snap ring down into groove.
   e. Assemble thrust collar on shaft with shoulder next to snap ring.

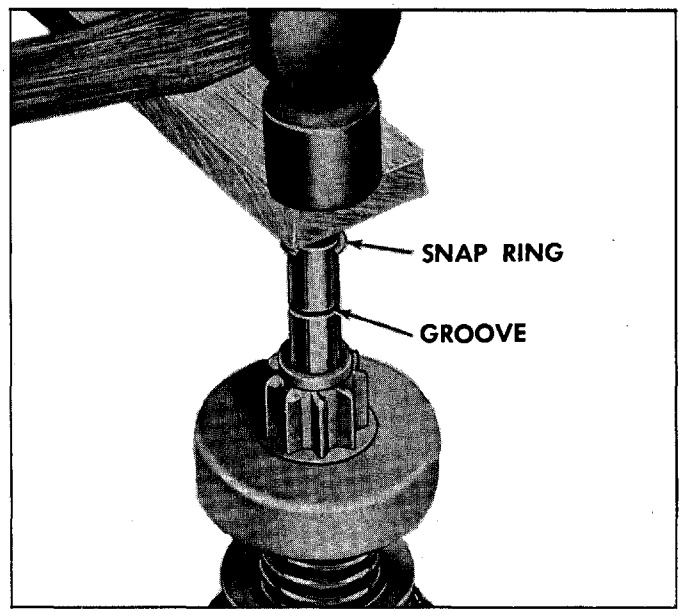


Fig. 8s—Forcing Snap Ring over Shaft

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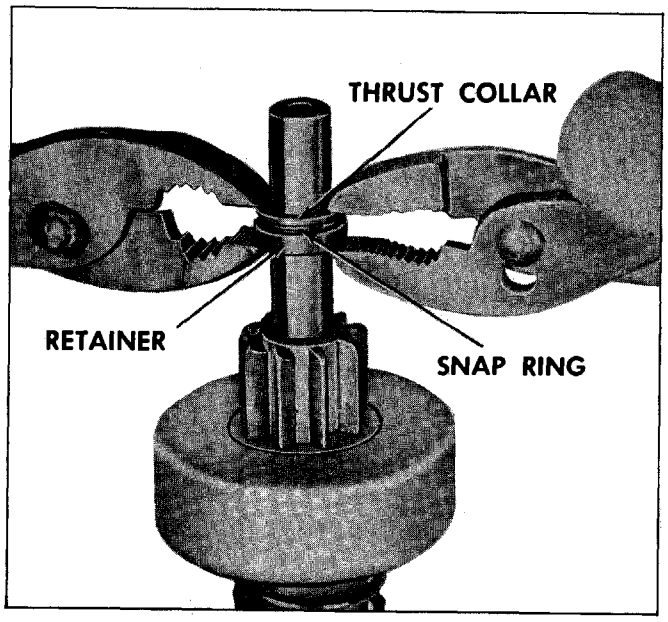


Fig. 9s—Forcing Snap Ring into Retainer

f. Place armature flat on work bench, and position retainer and thrust collar next to snap ring. Then, using two pair of pliers at the same time (one pair on either side of shaft), grip retainer and thrust collar and squeeze until snap ring is forced into retainer (fig. 9s).

3. Lubricate the drive housing bushing with a silicone lubricant. Make sure thrust collar is in place against snap ring and retainer and slide armature and clutch assembly into place in drive housing engaging shift lever with clutch.

4. Position field frame over armature and apply special sealing compound between frame and solenoid case. Position frame against drive housing using care to prevent damage to the brushes.

5. Lubricate the bushing in the commutator end frame with a silicone lubricant. Place leather brake washer on armature shaft and slide commutator end frame onto shaft.

6. Reconnect the field coil connectors to the "motor" solenoid terminal.

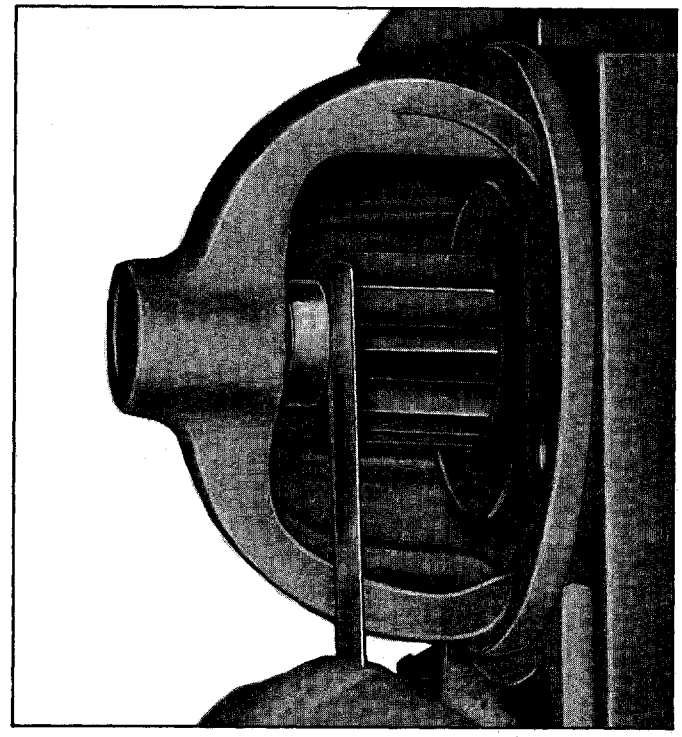


Fig. 10s—Checking Pinion Clearance

After reassembly, a "Free Speed" check of the starting motor may be made if equipment is available. To make this check, connect a 12 volt battery in series with an ammeter to the starting motor terminal and ground. Use a mechanical drive type tachometer to determine the speed reached by the starting motor. Failure of the starting motor to perform according to specifications may be due to tight or dirty bushings, or high resistance connections.

PINION CLEARANCE

The pinion clearance should be checked (fig. 10s) after motor has been disassembled and then reassembled. If clearance is not within specified limits, (.010-.140) it may indicate excessive wear of solenoid linkage shift lever yoke buttons or improper assembly of the shift lever mechanism. Worn or defective parts should be replaced since no provision is made for adjusting of pinion clearance.

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STARTING SOLENOID

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REMOVAL

1. Remove starting motor as previously described.
2. Remove the outer screw and washer from the motor connector strap terminal.
3. Remove the two screws retaining solenoid housing to end frame assembly.
4. Twist solenoid clockwise to remove flange key from keyway slot in housing; then remove solenoid assembly.

INSTALLATION

1. With solenoid return spring installed on plunger, position solenoid body to drive housing and turn counterclockwise to engage the flange key in the keyway slot.
2. Install two screws retaining solenoid housing to end frame.

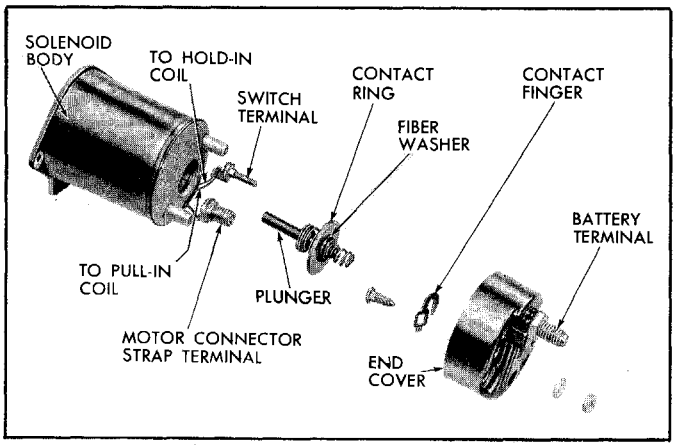


Fig. 11s—Exploded View of Solenoid

3. Install outer screw and washer securing motor connector strap terminal.
4. Install starter motor as previously described.

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DELCOTRON

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Overhaul Procedures described in this section are for the 5.5" Series 1D and 6.2" Series 2D, Type 100 Delcotrons (fig. 1c). Where important differences in testing and/or overhaul operations are encountered separate mention will be made of the two generators.

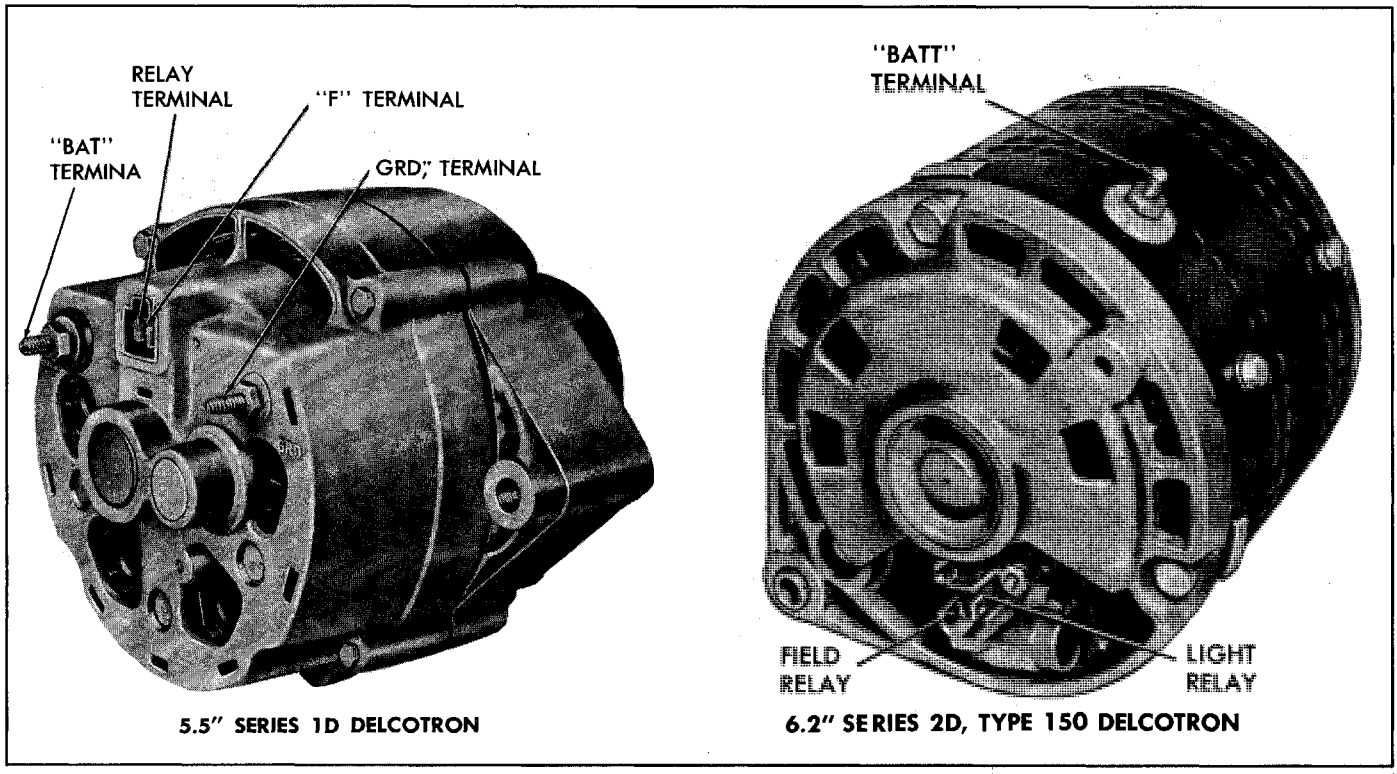
DISASSEMBLY (Fig. 2c)

5.5" Delcotron

1. Hold generator in a vise, clamping the mounting flange lengthwise.
2. Remove 4 thru bolts then break loose the end frames by prying at bolt locations.
3. Remove the slip-ring end frame and stator (as an assembly) from drive end and rotor assembly.
4. Place a piece of tape over the slip ring end frame bearing to prevent entry of dirt or other foreign matter.

   CAUTION: Brushes may drop onto rotor shaft and become contaminated with bearing lubricant. Clean brushes prior to installing with a non-toxic cleaner such as tri-chlorethylene.

5. Remove the three stator lead attaching nuts and separate stator from end frame.
6. Remove screws, brushes and holder assembly.
7. Remove heat sink from end frame by removing



5.5" SERIES 1D DELCOTRON

6.2" SERIES 2D, TYPE 150 DELCOTRON

Fig. 1c—Delcotrons—Full View

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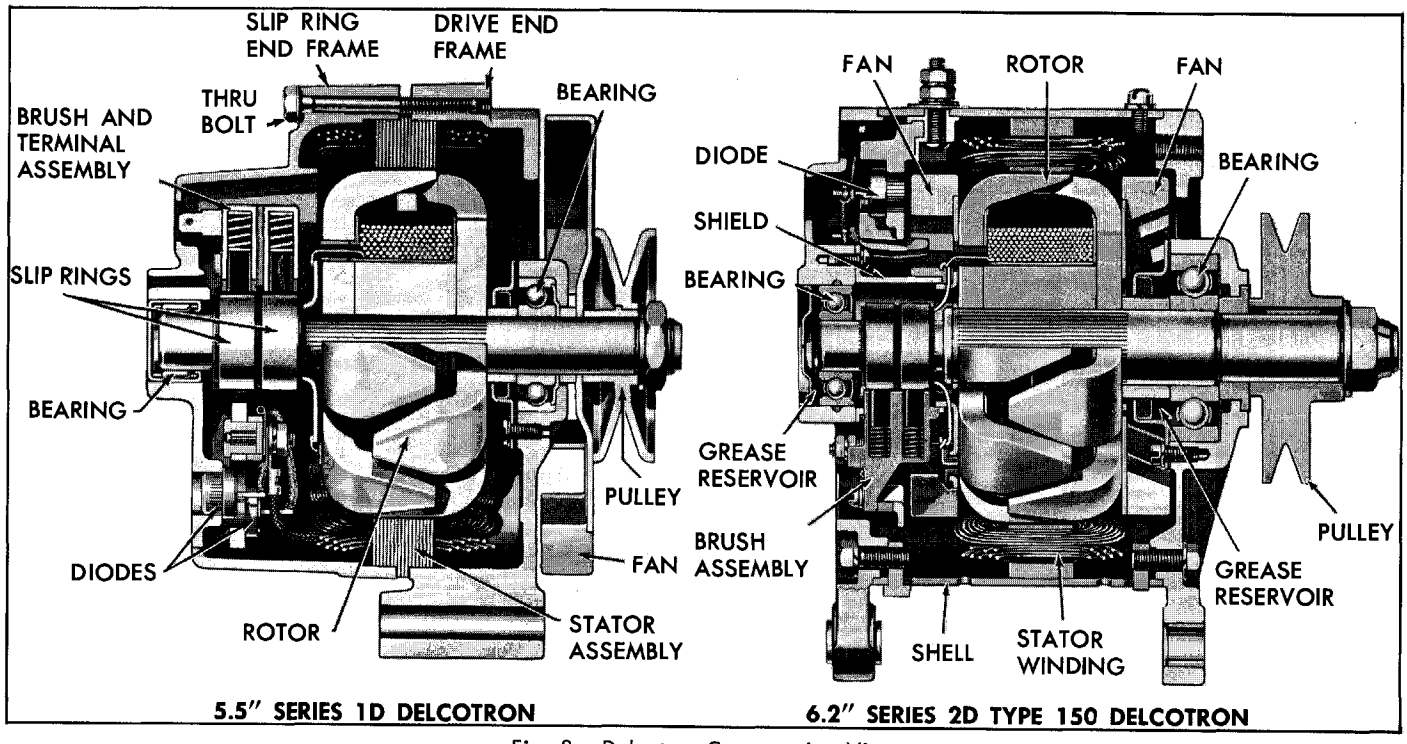


Fig. 2c—Delcotron Cross-section View

"batt" and "grd" terminals and one attaching screw (fig. 9c).

8. Remove slip ring end frame bearing (if necessary) by removing inner seal and slide.
9. Remove pulley retaining nut and slide washer, pulley and fan from shaft.
   a. Single Groove Pulley—Place 15/16" box wrench on retaining nut and insert a 5/16" allen wrench into shaft to hold shaft while removing nut (fig. 3c).
   b. Double Groove Pulley—Place a 15/16" socket (with wrench flats on the drive end or use Adapter J-21501 and a box wrench) on retaining nut, insert a 5/16" allen wrench through socket and adapter into hex on shaft to hold the shaft while removing the nut.
10. Remove rotor and spacers from end frame assembly.
11. Remove drive end frame bearing retainer plate and bearing assembly from frame.

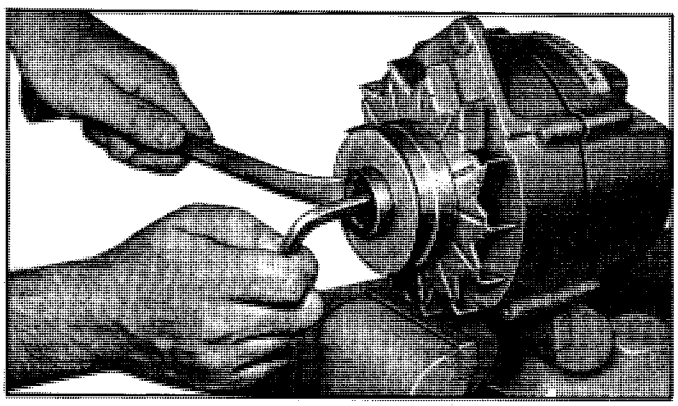


Fig. 3c—Pulley Removal

6.2" Delcotron

1. Hold generator in a vise, clamping the drive end mounting flange lengthwise.
2. Remove two screws securing the cover to the brush holder and remove cover (fig. 4c).
3. Remove the nut retaining indicator light wire to the blade connector post and disconnect wire lead from post.
4. Remove two screws retaining the capacitor and brush holder to rear end frame. Remove brush holder.

NOTE: Capacitor lead is connected inside the generator. Allow capacitor to remain with the

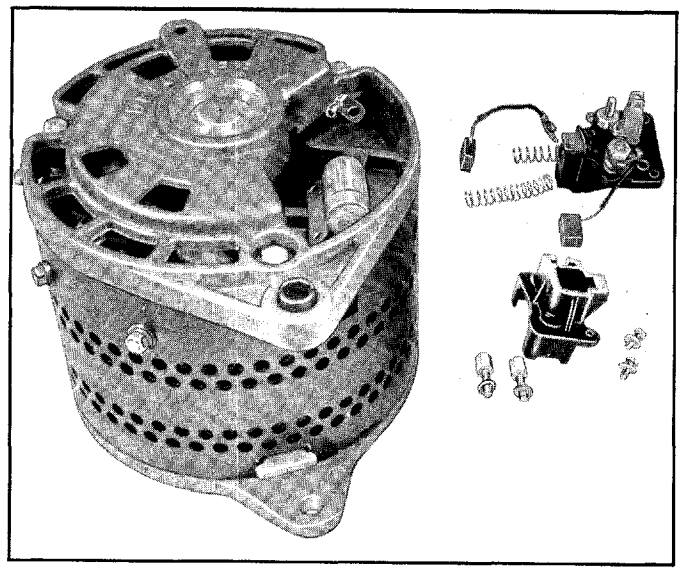


Fig. 4c—6.2" Delcotron Brush Holder Assy.

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generator to avoid undue strain on the lead wire.

5. Remove three slip ring end frame attaching bolts and tab nuts.
6. Carefully pry the end frame and case apart (using a screw driver) slowly all the way around the circumference to remove the end frame.
7. Remove the three drive end frame attaching bolts and tab nuts and remove the end frame, rotor and pulley as an assembly.
8. Remove shaft nut, washer, pulley and woodruff key from rotor shaft, then slide rotor from end frame.
9. Remove drive end frame bearing retainer plate and bearing from end frame.
10. To remove slip ring end frame bearing from rotor shaft, use Tool J-6627 as shown in Figure 11c.
11. Disconnect the three stator leads by cutting the leads between coil and diodes. An alternate method is to scrape epoxy coating from lead connections and unsolder stator leads, using a minimum amount of heat to avoid damage to diodes.

    NOTE: Separating these three leads will allow diode and stator tests outlined in this section.

12. Remove heat sink-to-case retaining screws and remove heat sinks. Insulated heat sink (with batt terminal) holds positive diodes.

CLEANING AND INSPECTION

With generator completely disassembled, except for removal of diodes, the components should be cleaned and inspected. Be sure testing equipment is in good working order before attempting to check the generator.

1. Wash all metal parts except stator and rotor assemblies.
2. Clean bearings and inspect for sealing, pitting or roughness.
3. Inspect rotor slip rings, they may be cleaned with 400 grain polishing cloth. Rotate rotor for this operation to prevent creating flat spots on slip rings.
4. Slip rings which are out of round may be trued in a lathe to .001" maximum indicator reading. Remove only enough material to make the rings smooth and concentric. Finish with 400 grain polishing cloth and blow dry.
5. Slip rings are not replaceable--excessive damage will require rotor assembly replacement.
6. Inspect brushes for wear. If they are worn halfway, replace. Inspect brush springs for distortion or weakening. If brushes appear satisfactory and move freely in brush holder, springs may be reused.

TESTING ROTOR

The rotor may be checked electrically with a 110-volt test lamp or an ohmmeter.

Grounds

Connect test lamp or ohmmeter from either slip ring to the rotor shaft or to the rotor poles. If the lamp lights or if the ohmmeter reading is low, the field windings are grounded (fig. 5c).

Opens

Connect one test lamp or ohmmeter lead to each slip ring. If the lamp fails to light or if the ohmmeter reading is high, the windings are open (fig. 5c).

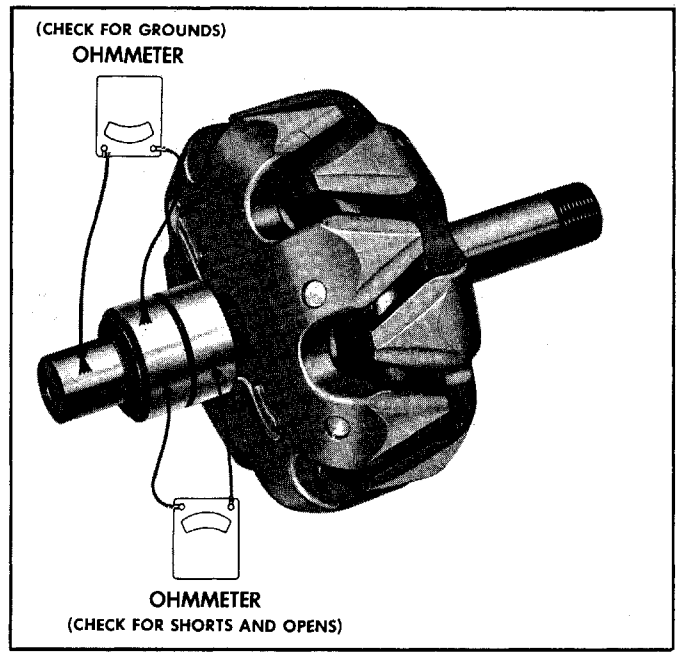


Fig. 5c—Checking Rotor for Grounds or Opens

Short Circuits

The windings are checked for shorts by connecting a 12 volt battery and an ammeter in series with the two slip rings. Note the ammeter reading. An ammeter reading above the specified field amperage draw indicates shorted windings. Refer to Specifications at the end of this manual.

TESTING STATOR

Grounds

Connect a 110-volt test lamp or an ohmmeter from any stator lead to the stator frame. If test lamp lights or if ohmmeter reads low, the windings are grounded (fig. 6c).

Opens

If lamp fails to light or if ohmmeter reads high when successively connected between each pair of stator leads, the windings are open (fig. 6c).

Short Circuit

A short in the stator windings is difficult to locate without special test equipment due to the low resistance of the windings. However, if all other electrical checks are normal and the generator fails to supply rated output, shorted stator windings are indicated. Also, look for heat discoloration on the windings.

TESTING DIODES

Two methods may be used to check diodes for shorts or opens, a test lamp of not more than 12 volts or an ohmmeter.

CAUTION: Do not use a 110-volt test lamp to test diodes.

TEST LAMP METHOD

Diode in Heat Sink

With the stator previously disconnected connect one of the lamp leads to the heat sink and other lead to the diode

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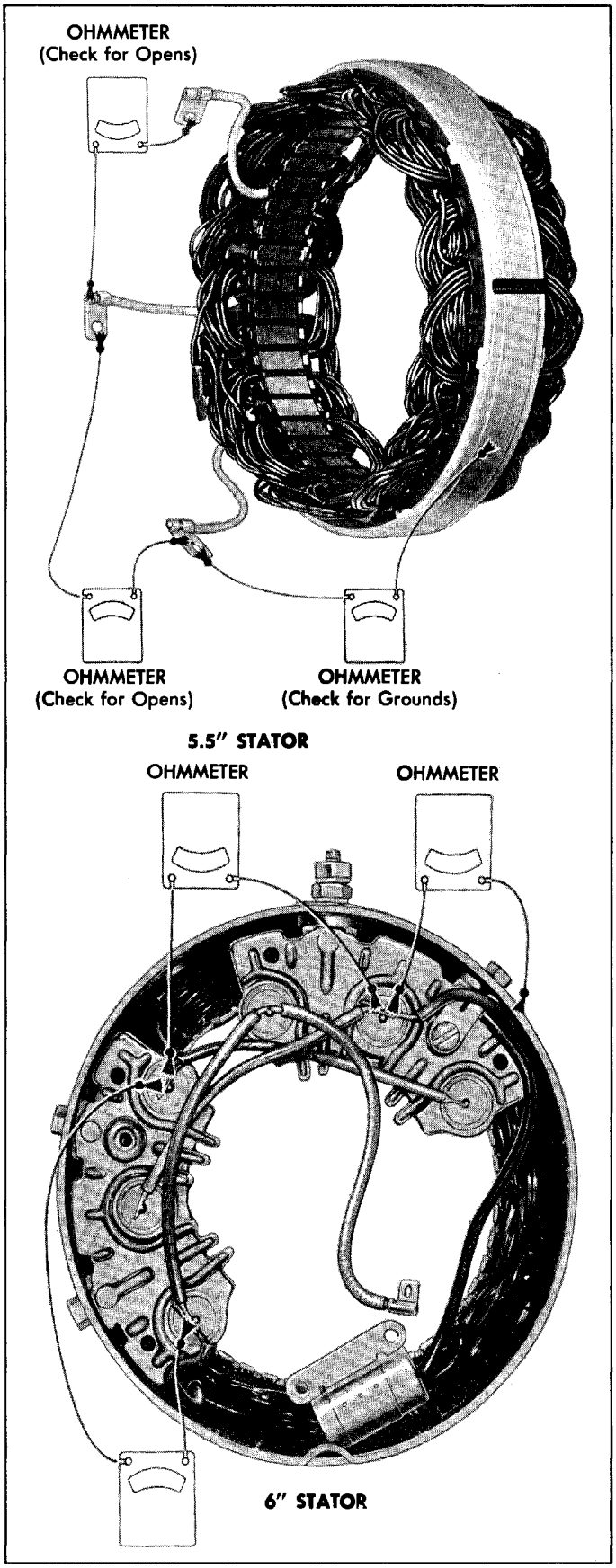


Fig. 6c—Checking Stator for Grounds or Opens

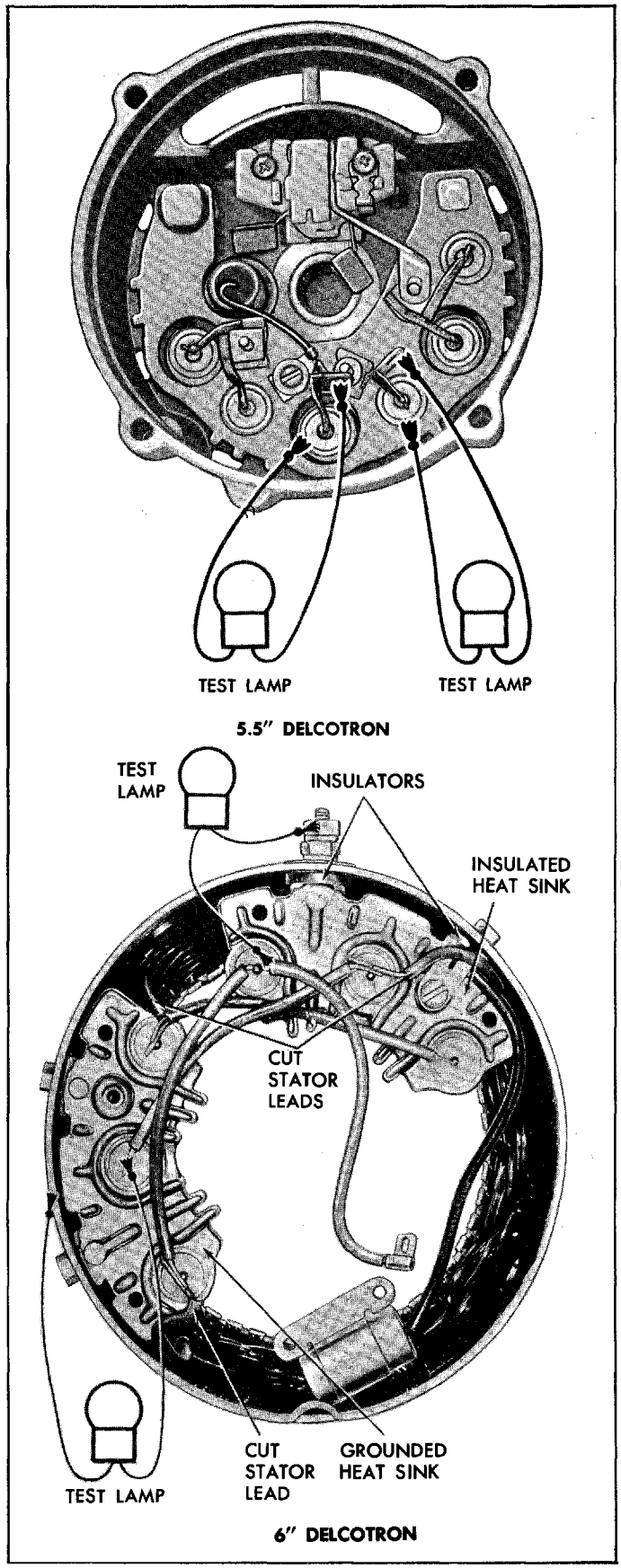


Fig. 7c—Checking Diodes

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lead (fig. 7c). Observe condition of lamp. Reverse the lamp leads and observe condition of lamp. A good diode will allow the lamp to light in only one of the test directions. If lamp lights in both directions or fails to light at all, the diode is defective.

Diode in the End Frame

Connect one lamp lead to the end frame and the other lamp lead to the diode lead (fig. 7c), and observe lamp condition. Reverse the lamp lead connections and observe the lamp condition. A good diode will allow lamp to light in only one direction. If lamp lights in both directions or fails to light at all, the diode is defective.

OHMMETER METHOD

Use an ohmmeter with a 1 1/2 volt cell and use the lowest range scale.

Connect the ohmmeter leads at each diode as previously described using a test lamp first in one direction and then the other (fig. 7c). Note the readings. If both readings are identical (very high or very low), the diode is defective. A good diode will give one high and one low reading.

REPAIRS

Diode Replacement

5.5" Delcotron

1. Support end frame with support Tool J-9717-2 and press out diode with diode removal Tool J-9717-1 and an arbor press or vise (fig. 8c).

   CAUTION: Do not strike diode as shock may damage other diodes.

2. Select diode with proper color marking.

   NOTE: Diodes in the heat sink are positive (red markings) and those in the end frame are negative (black markings).

3. Support outside end frame around diode hole on a flat, smooth surface and press diode into position with J-9600-2 and an arbor press or vise. Make sure diode is square with end frame and started straight (fig. 8c).

   CAUTION: Avoid bending or moving diode stem as excessive movement can cause internal damage and result in diode failure.

6.2" Delcotron

1. Chip away all epoxy from around diode stem, then cut leads connected to diode stem as close to stem as possible, if not previously done during disassembly.
2. Support end frame with support Tool J-9717-2 and press out diode with diode removal Tool J-9717-1 and an arbor press or vise (fig. 8c).

   CAUTION: Do not strike diode as shock may damage other diodes.

3. Select diode with proper color marking.

   NOTE: Diodes in the heat sink (with batt terminal) are positive (red markings) and those in the heat sink grounded to the case are negative (black markings).

4. Support outside end of frame around diode hole on a flat, smooth surface and press diode into position with J-9600-2 and an arbor press or vise. Make sure diode is square with end frame and started straight (fig. 8c).

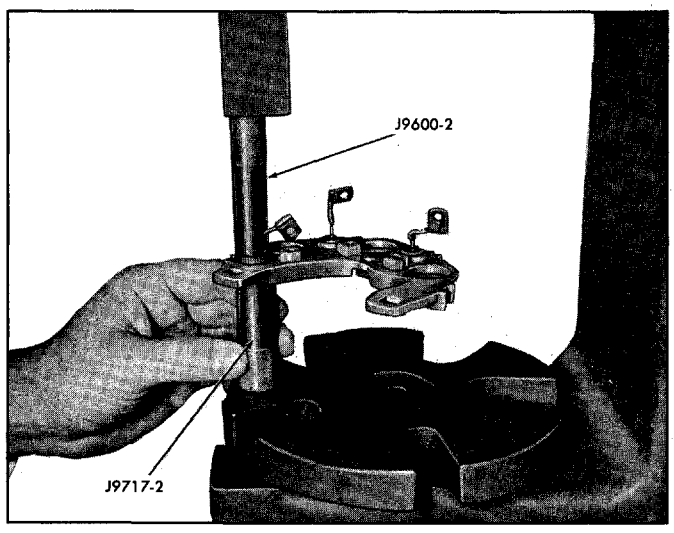


Fig. 8c—Installing Diodes with Press Tools

   CAUTION: Avoid bending or moving diode stem as excessive movement can cause internal damage and result in diode failure.

5. Scrape enough insulation from diode stem and leads to insure good contact. Locate a sleeve over the diode and place the "T" clip from the diode package over the diode stem.
6. Place the flexible lead and, if applicable, the stator lead into the "T" connector. Crimp and solder securely using 60% tin, 40% lead solder.

   CAUTION: Do not heat excessively, and avoid bending or moving diode stem as excessive heat and movement can cause internal damage and result in diode failure.

7. Fill the area around the diode stem and "T" clip with epoxy so as to completely cover the stem and "T" clip.

Heat Sink Replacement

1. Detach heat sink from end frame by removing the two attaching bolts. Note carefully the proper stack up of parts so the "BAT" and "GRD" terminal bolts can be reassembled in the same manner (fig. 9c). On 6.2" Delcotrons chip away all epoxy, then cut all leads on each side of the three diode stems as close to the stems as possible.
2. Replace diodes, if necessary, as outlined in Diode Replacement.
3. Assemble heat sink to the end frame, following carefully the proper stack up of parts as noted in Step 1. On 6.2" Delcotron reconnect leads as described under diode replacement.

Brush Replacement

5.5" Delcotron—(Fig. 10c)

1. After through bolt removal and Delcotron separation, remove stator lead nut that also holds relay terminal connector.
2. Remove 2 mounting screws and brush holder assembly.

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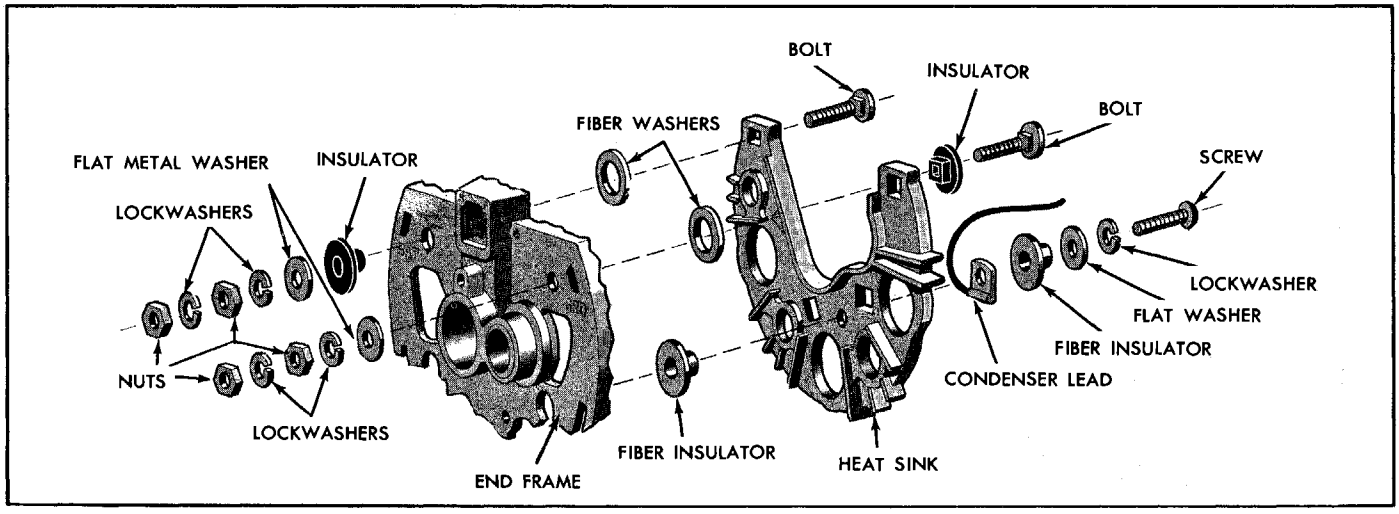


Fig. 9c—Heat Sink—Parts Location 5.5" Delcotron

3. Position new brush holder assembly and install retaining screws.
4. Connect relay terminal wire lead and install stator lead nut.

6.2" Delcotron

Refer to disassembly and assembly procedures.

End Frame Replacement

1. Remove heat sink as outlined in Heat Sink Replacement.
2. Attach brush holder assembly to the new end frame and insert pin or wire through the hole to hold the brushes in the holder (5.5" Delcotron). After the Delcotron unit has been completely assembled, withdraw the pin or wire from the end frame hole to allow the brushes to drop down onto the slip rings.
3. Replace heat sinks to end frame as outlined in Heat Sink Replacement.

Bearing Replacement—Drive End Frame

1. The drive end frame bearing can be removed by detaching the retainer plate bolts and separating retainer plate and seal assembly from end frame, and then pressing bearing out using suitable tube or pipe on outer race.

   NOTE: 5.5" Delcotron uses staked retainer plate bolts.

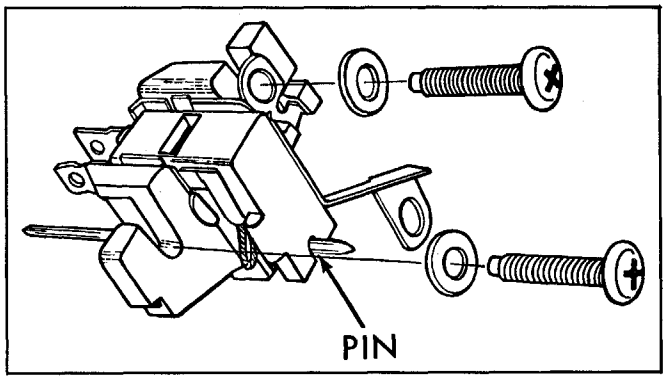


Fig. 10c—Brush Assembly—5.5" Delcotron

2. Refill bearing one-quarter full with Delco-Remy No. 1948791 grease or equivalent. Do not overfill.
3. Press bearing into end frame using tube or pipe as in Step 1.
4. Install retainer plate. Use new retainer plate if felt seal is hardened or excessively worn.

   NOTE: On 5.5" Delcotron stake retainer plate bolts to plate.

Bearing Replacement—Slip Ring End Frame

5.5" Delcotron

1. Replace the bearing if the grease supply is exhausted. Make no attempt to re-lubricate and reuse the bearing.

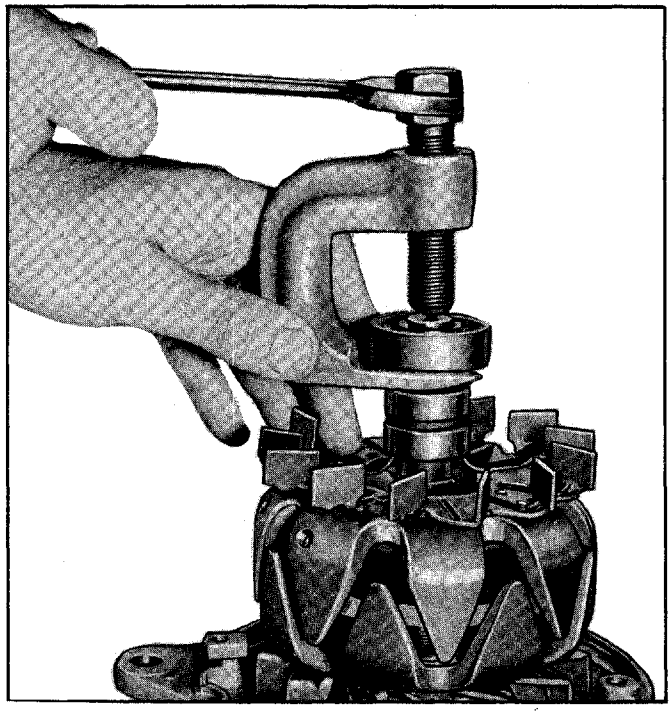


Fig. 11c—Removing Bearing

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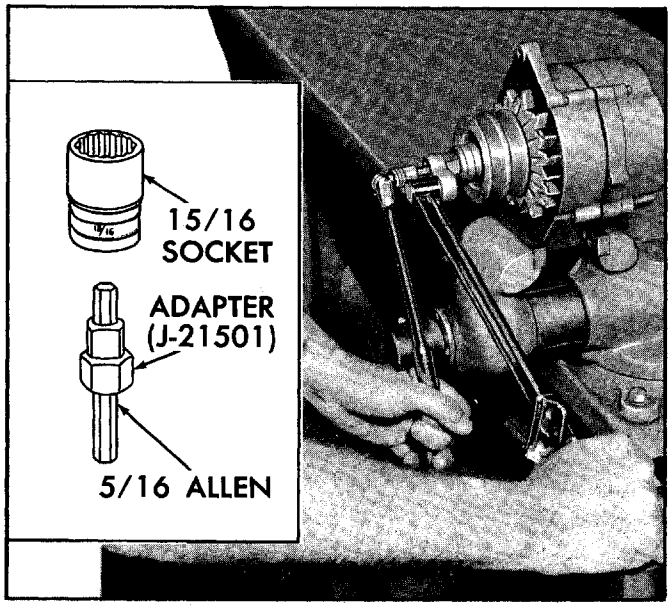


Fig. 12c—Torquing Pulley Nut

2. Press out from inside of housing, using suitable tool over outer race of bearing.
3. To install, place a flat plate over the bearing and press in from outside of housing until bearing is flush with the outside of the end frame. Support inside of end frame around bearing bore with a suitable tool to prevent distortion. Use extreme care to avoid misalignment
4. Saturate felt seal with S.A.E. #20 engine oil and install seal and steel retainer at inner end of bearing assembly.

6.2" Delcotron

1. Remove bearing from rotor shaft using Tool J-6627 as shown in Figure 11c.
2. Install bearing over shaft using Tool J-9610 or tube or pipe of suitable diameter over inner race and press to locate bearing even with end of shaft.

ASSEMBLY

5.5" Delcotron

1. Install stator assembly in slip ring end frame and locate diode connectors over the relay, diode and stator leads, and tighten terminal nuts.
2. Install rotor in drive end frame.
3. Install fan, spacer, pulley washer and nut.
4. Place torque wrench and adapter (J-21501) on shaft nut and insert allen wrench into opening at end of drive shaft. Tighten shaft nut to 40-50 ft. lbs. (fig. 12c).
5. Assemble slip ring end frame and stator assembly to drive end frame and rotor assembly.
6. Install 4 through bolts in the end frame assemblies.

6.2" Delcotron

1. Install stator assembly in slip ring end frame and locate diode connectors over the relay, diode and stator leads, and tighten terminal nuts.
2. Install the front frame over rotor.
3. Install fan, spacer, woodruff key, pulley, washer and nut.
4. Clamp pulley in soft jaw vise and tighten shaft nut to 50-60 ft. lbs.

   NOTE: Do not clamp rotor since this may cause rotor segment deformation.

5. Position rotor and drive end frame assembly into slip ring end frame and stator. Install and tighten through bolts.
6. To install brushes, push brushes into holder and install pin to keep the brushes in holder.
7. Attach brush assembly and condenser to the end frame with hex-head stud on the left side only.
8. Rearrange leads as shown in Figure 13c with right-hand brush lead connected under the right hand hex-head stud.
9. Remove pin and attach terminal cover with two screws, making sure leads are not caught underneath the cover.

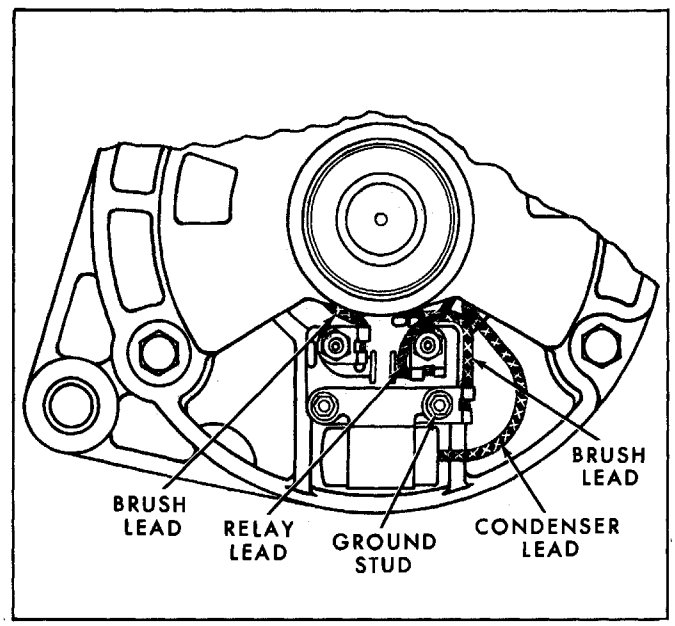
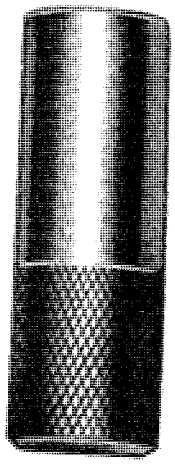


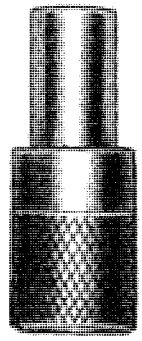
Fig. 13c—Lead Arrangement After Assembly

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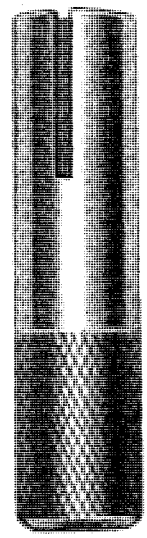
SPECIAL TOOLS



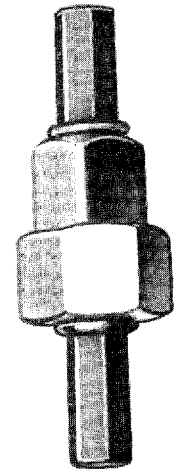
J-9717-2
SUPPORT
TOOL



J-9717-1
PRESS
TOOL



J-9600-2
SHOULDERED
INSTALLER



J-21501
PULLY
ADAPTER

Fig. 14c—Special Tools

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SECTION 7
CLUTCH AND TRANSMISSIONS

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CLUTCH

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CLUTCH ASSEMBLY

Two designs of the diaphragm spring clutch are used with the different engine-transmission combinations. One design has a flat-finger diaphragm spring (fig. 1) and the other design has a bent-finger diaphragm spring (fig. 2). The following overhaul procedures apply to both designs.

Disassembly (Fig. 3)

1. Remove three drive-strap to pressure plate bolts and retracting springs and remove pressure plate from clutch cover.

   NOTE: When disassembling, prick punch edge of pressure plate and cover. These marks must be aligned in assembly to maintain balance.

2. The clutch diaphragm spring and two pivot rings are riveted to the clutch cover. Spring, rings and cover should be inspected for excessive wear or damage and if there is a defect, it is necessary to replace the complete cover assembly.

Inspection and Repair

1. Wash all parts, except driven disk and throwout bearing, in cleaning solvent.

   NOTE: The throwout bearing is permanently packed with lubricant and should not be soaked in cleaning solvent as this will dissolve the lubricant.

2. Inspect pressure plate and flywheel for scores on the contact surfaces. Use a straight-edge and check for flatness of contact surfaces.
3. Check retracting springs for looseness at the clutch cover and evidence of looseness at pressure plate bolt holes.
4. Check throwout bearing for roughness and free fit on the sleeve of the transmission clutch gear bearing retainer. Replace retainer if rough.
5. Inspect clutch disc for worn, loose or oil soaked facings, broken springs, loose rivets or riding.
6. Examine splines in hub and make sure they slide

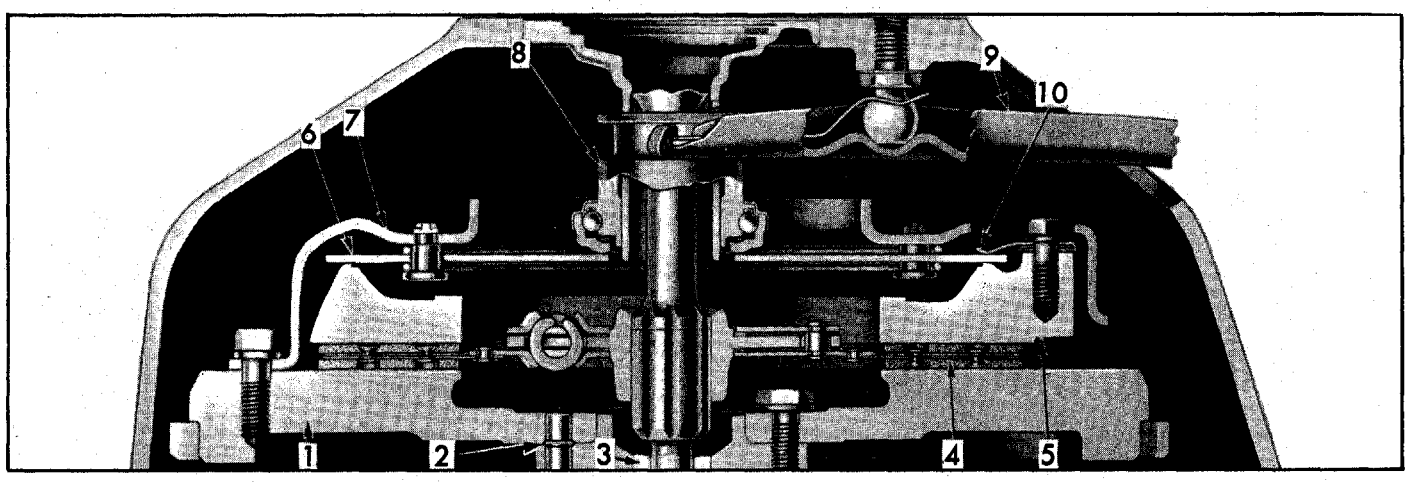


Fig. 1—Flat Finger Clutch Cross-Section (Typical)

1. Flywheel
2. Dowel-hole
3. Pilot Bushing
4. Driven Disc
5. Pressure Plate
6. Diaphragm Spring
7. Cover
8. Throwout Bearing
9. Fork
10. Retracting Spring

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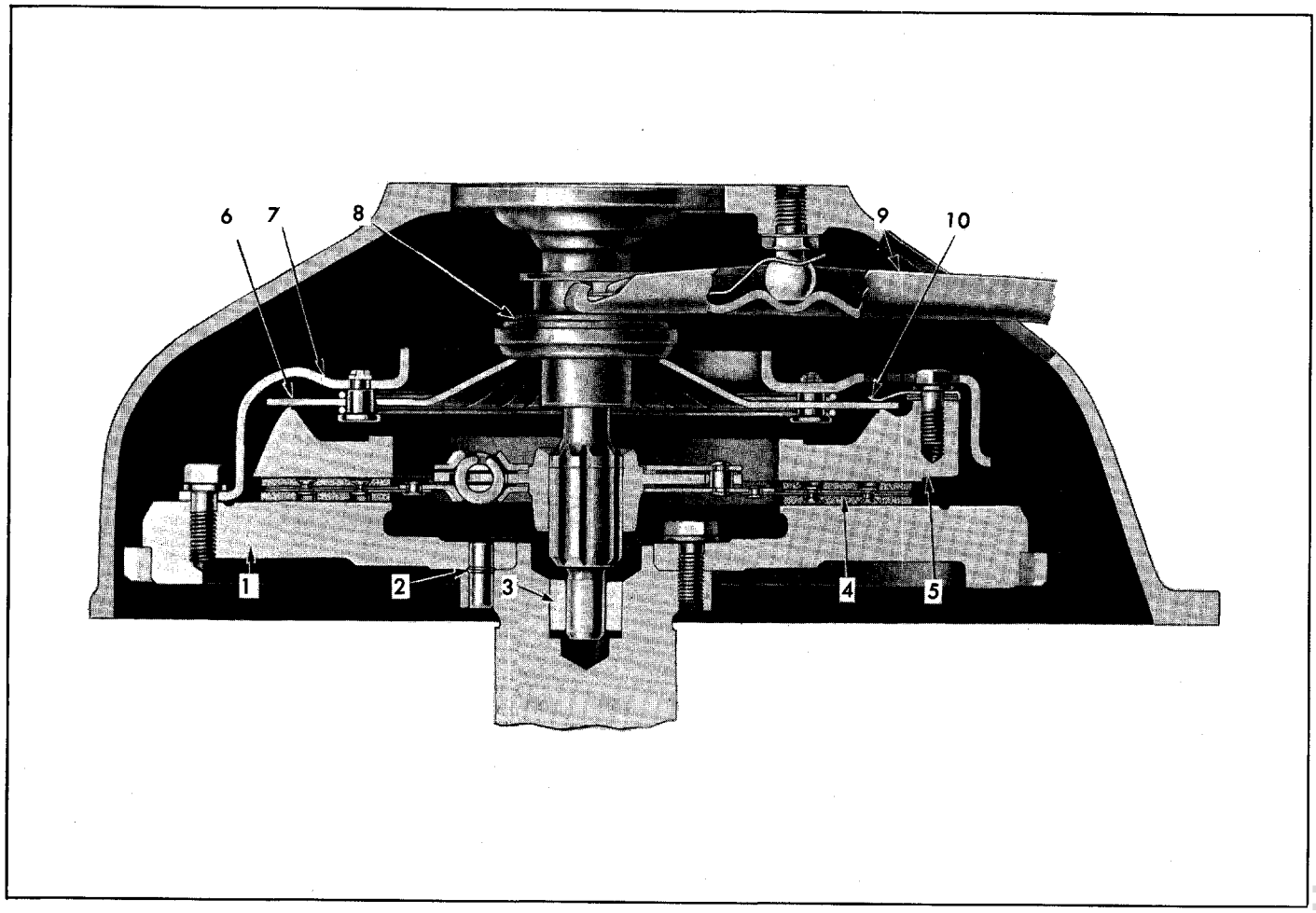


Fig. 2—Bent Finger Clutch Cross-Section (Typical)

1. Flywheel
2. Dowel-hole
3. Pilot Bushing
4. Driven Disc
5. Pressure Plate
6. Diaphragm Spring
7. Cover
8. Throwout Bearing
9. Fork
10. Retracting Spring

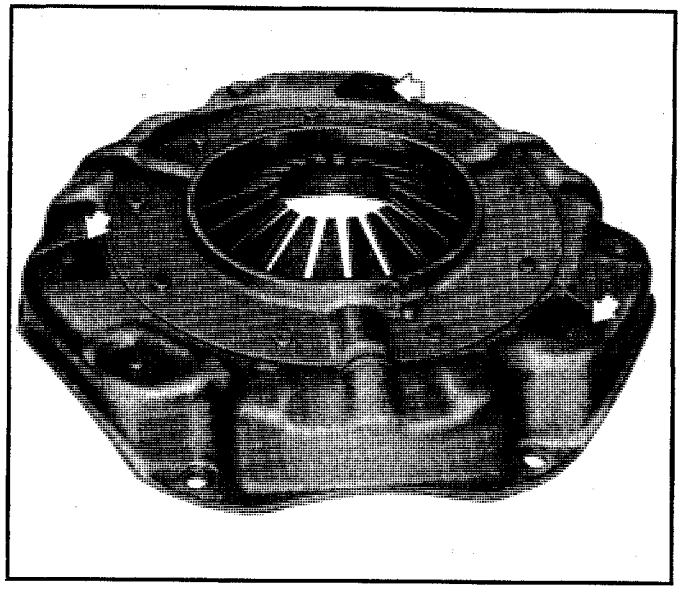


Fig. 3—Retracting Spring Location (Typical)

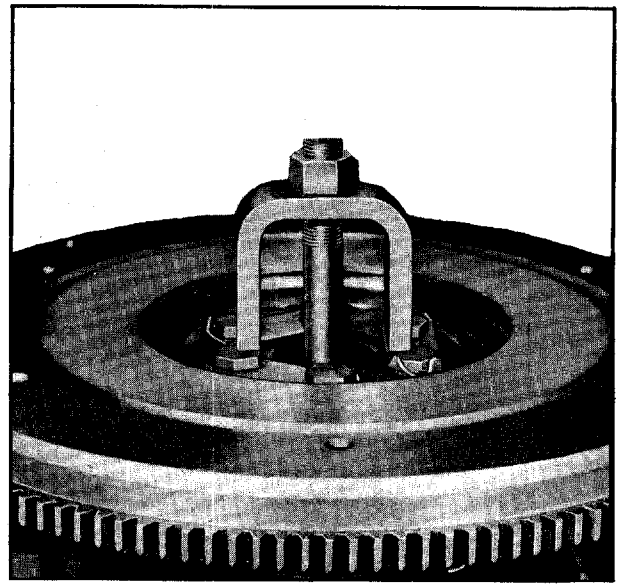


Fig. 4—Clutch Pilot Bearing Removal (Typical)

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freely on splines of transmission clutch shaft. If splines are worn, the clutch disc or clutch gear should be replaced as necessary.

7. Inspect clutch fork ball socket and fingers for wear and ball retaining spring for damage.

   NOTE: Ball spring on fork may be bent in toward fork if necessary.

8. Inspect ball stud for wear.

Pilot Bearing

The clutch pilot bearing is an oil impregnated type bearing pressed into the crankshaft. This bearing requires attention only when the clutch is removed from the vehicle, at which time it should be cleaned and inspected for excessive wear or damage and should be replaced if necessary. To remove, install Tool J-1448 and remove bearing from crankshaft (fig. 4). In replacing this bearing, use Tool J-1522. Place bearing on pilot of tool with radius in bore of bearing next to shoulder on tool and drive into crankshaft.

Assembly

1. Install the pressure plate in the cover assembly, lining up the punch marks on the edge of the pressure plate with the punch marks on the edge of the cover.
2. Install pressure plate retracting springs and drive-strap to pressure plate bolts and lock washers and tighten to 11 ft. lbs. torque. The clutch is now ready to be installed.

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THREE-SPEED (SAGINAW) FULLY SYNCHRONIZED TRANSMISSION

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TRANSMISSION ASSEMBLY

NOTE: Maintenance and adjustment items along with transmission replacement operations are outlined in the Passenger Service Manual.

Disassembly of Case Components

1. Remove side cover attaching screws and remove side cover assembly and shift forks.
2. Remove clutch gear bearing retainer.
3. Remove clutch gear bearing to gear stem snap ring, then remove clutch gear bearing by pulling outward on clutch gear until a screw driver or other suitable tool can be inserted between bearing large snap ring and case to complete removal. The clutch gear bearing is a slip fit on the gear and into the case bore. (This provides clearance for removal of clutch gear and mainshaft assembly.)
4. Remove extension to case attaching bolts.
5. Remove the reverse idler shaft snap ring.
6. Remove clutch gear, mainshaft and extension assembly together through the rear case opening.
7. Using snap ring pliers, expand the snap ring in the extension which retains the mainshaft rear bearing (fig. 2A) and remove the extension.
8. Using J-22246 at the front of the countershaft, drive the shaft and its woodruff key out the rear of the case. Tool J-22246 will now hold the roller bearings in position within the countergear bore. Remove the gear and bearings.
9. Use a long drift or punch through the front bearing case bore and drive the reverse idler shaft and woodruff key through the rear of the case (fig. 3A).

MAINSHAFT

Disassembly

1. Using snap ring pliers, remove the 2nd and 3rd speed sliding clutch hub snap ring from mainshaft and remove clutch assembly, second speed blocker ring and second speed gear from front of mainshaft.
2. Remove rear bearing snap ring from mainshaft groove.
3. Support reverse gear with press plates and press on rear of mainshaft to remove reverse gear, thrust washer, spring washer, rear bearing, snap ring and finally the speedo drive gear from rear of mainshaft.

   CAUTION: When pressing rear bearing be careful to center gear, washers, bearings and snap ring on mainshaft before attempting to press off the speedo drive gear.
4. Remove the 1st and Reverse sliding clutch hub snap ring from the mainshaft and remove the clutch assembly, 1st speed blocker ring and first speed gear from the rear of the mainshaft.

   This completes the disassembly of the mainshaft.

Cleaning and Inspection

Transmission Case

1. Wash the transmission thoroughly inside and outside with cleaning solvent, then inspect the case for cracks.
2. Check the front and rear faces for burrs, and if present, dress them off with a fine mill file.
3. Check bearing bores in case and, if damaged, replace case.

Front and Rear Bearings

1. Wash the front and rear ball bearings thoroughly in a cleaning solvent.
2. Blow out bearings with compressed air.

   CAUTION: Do not allow the bearings to spin, turn them slowly by hand. Spinning bearings will damage the race and balls.
3. Make sure bearings are clean, then lubricate with light engine oil and check them for roughness by slowly turning the race by hand.

Bearing Rollers

All clutch gear and countergear bearing rollers should be inspected closely and replaced if they show wear. Inspect counter shaft and reverse idler shaft at the same time, replace if necessary. Replace all worn washers.

Gears

1. Inspect all gears for excessive wear, chips or cracks and replace any that are worn or damaged.
2. Inspect reverse gear bushing and if worn or damaged replace the entire gear.

   NOTE: Reverse gear bushing is not serviced separately.
3. Check both clutch sleeves to see that they slide freely on their hubs.

Reverse Idler Gearing Bushing

The bushing used in the idler gear is pressed into the

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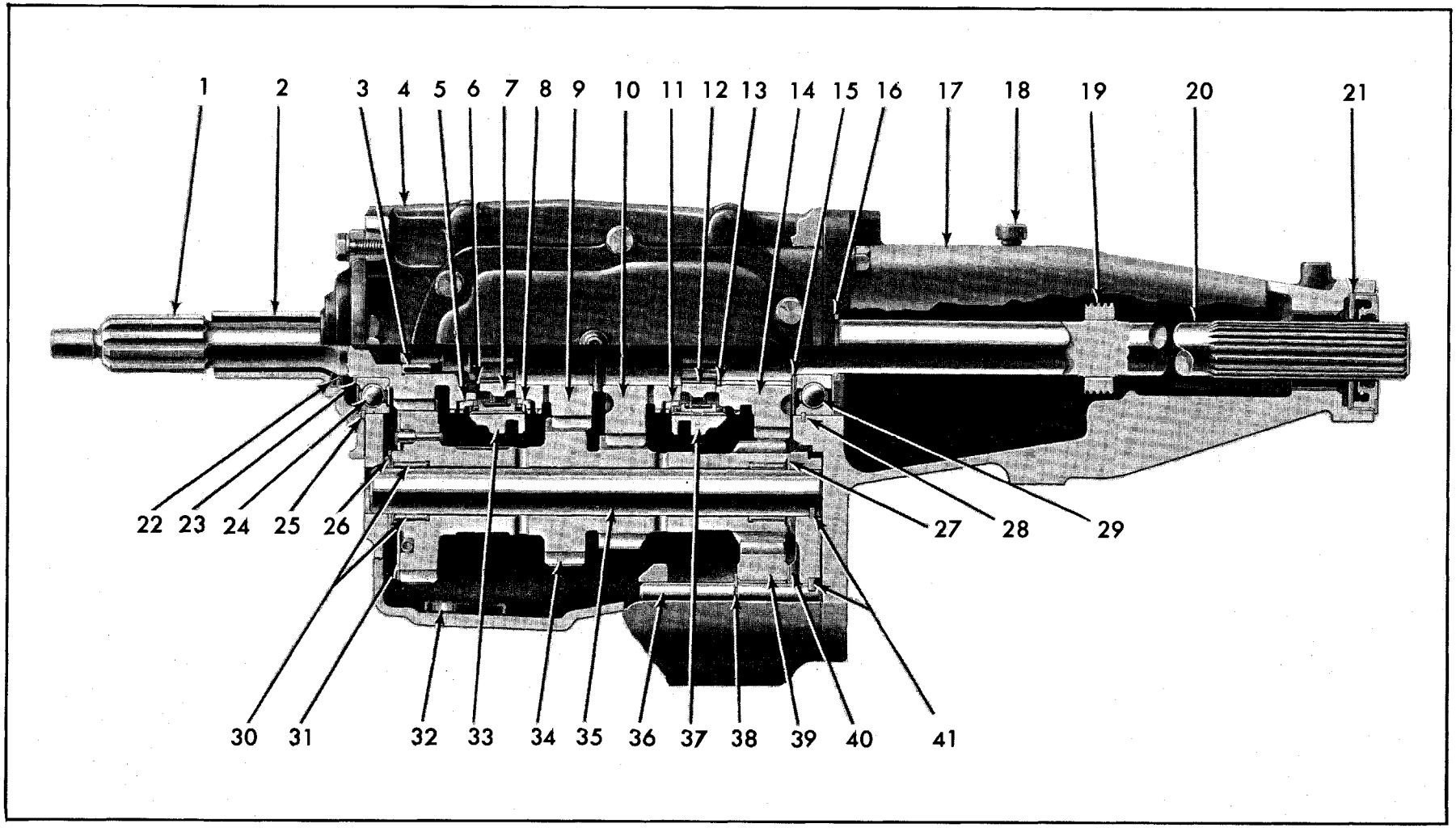


Fig. 1A—Three Speed Transmission (Cross Section)

1. Clutch Gear
2. Bearing Retainer
3. Pilot Bearings
4. Case
5. 3rd Speed Blocker Ring
6. 2-3 Synch. Snap Ring
7. 2-3 Synch. Hub
8. 2nd Speed Blocker Ring
9. 2nd Speed Gear
10. 1st Speed Gear
11. 1st Speed Blocker Ring
12. 1st Speed Synch. Hub
13. 1st Speed Synch. Snap Ring
14. Reverse Gear
15. Reverse Gear Thrust & Spring Washers
16. Snap Ring - Bearing to Mainshaft
17. Extension
18. Vent
19. Speedometer Drive Gear
20. Mainshaft
21. Rear Oil Seal
22. Retainer Oil Seal
23. Snap Ring - Bearing to Gear
24. Clutch Gear Bearing
25. Snap Ring - Bearing to Case
26. Thrust Washer - Front
27. Thrust Washer - Rear
28. Snap Ring - Bearing to Extension
29. Rear Bearing
30. Countergear Roller Bearings
31. Anti-Lash Plate Assembly
32. Magnet
33. 2-3 Synch. Sleeve
34. Countergear
35. Counter Shaft
36. Reverse Idler Shaft
37. 1st Speed Synch. Sleeve
38. "E" Ring
39. Reverse Idler Gear
40. Thrust Washer (Tanged)
41. Woodruff Key

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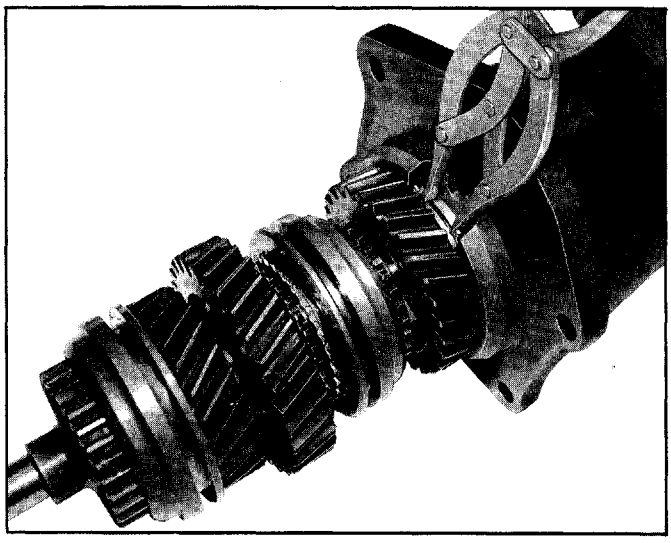


Fig. 2A—Extension to Rear Bearing Snap Ring

gear and finish bored in place. This insures the positive alignment of the bushing and shaft as well as proper meshing of the gears. Because of the high degree of accuracy to which these parts are machined, the bushing is not serviced separately.

Countergear Anti-Lash Plate

Inspect the plate teeth for wear or other damage. The plate and two damper springs are retained to the countergear by three rivets. Disassembly is not recommended (fig. 6A).

Repairs

Clutch Keys and Springs

NOTE: The clutch hubs and sliding sleeves are a selected assembly and should be kept together as originally assembled, but the keys and two springs may be replaced if worn or broken.

Replacement

1. Mark hub and sleeve so they can be matched upon reassembly.
2. Push the hub from the sliding sleeve, the keys and the springs may be easily removed.
3. Place the three keys and two springs in position

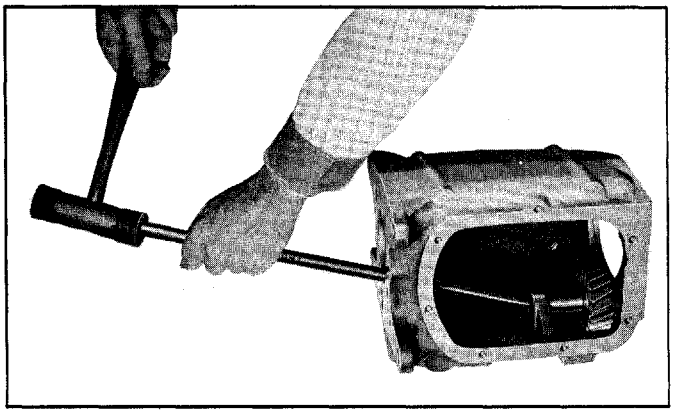


Fig. 3A—Removing Reverse Idler Shaft

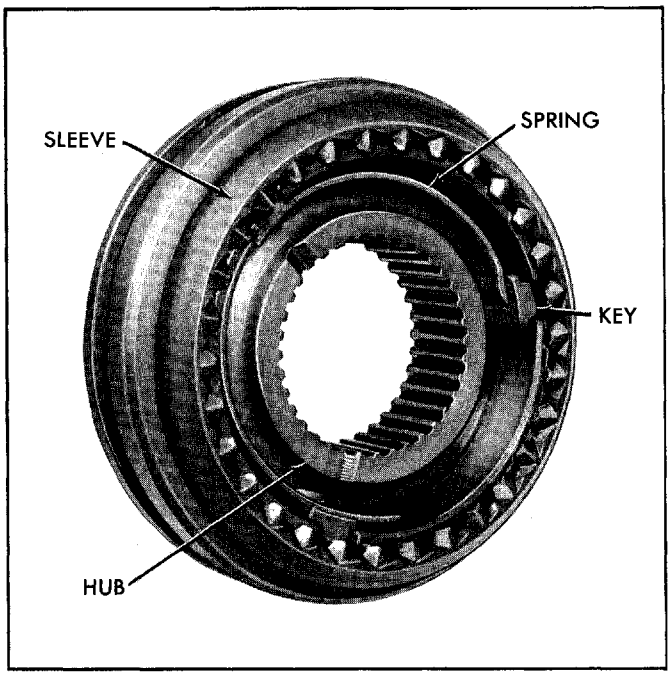


Fig. 4A—Synchronizer Assembly

(one on each side of hub), so all three keys are engaged by both springs (fig. 4A). The tanged end of each synchronizer spring should be installed into different key cavities on either side. Slide the sleeve onto the hub aligning the marks made before disassembly.

NOTE: A groove around the outside of the synchronizer hub identifies the end that must be opposite the fork slot in the sleeve when assembled. This groove indicates the end of the hub with a .07" greater recess depth.

Extension Oil Seal or Bushing

If bushing in rear of extension requires replacement, remove seal and use Tool J-5778 to drive bushing into extension housing. Using the same tool, drive new bushing in from the rear. Coat I.D. of bushing and seal with transmission lubricant, then install new oil seal using Tool J-5154.

Clutch Bearing Retainer Oil Seal

If the lip seal in the retainer needs replacement; pry the old seal out and replace with a new seal using Installer Tool J-7785, or similar tool, until seal seats in its bore.

MAINSHAFT

Assembly (Fig. 5A)

Turn the front of the mainshaft upward. Install the following components on the mainshaft:

1. Install the second speed gear with clutching teeth upward; the rear face of the gear will butt against the flange on the mainshaft.
2. Install a blocking ring with clutching teeth downward over the synchronizing surface of the second speed gear. All three blocker rings used in this transmission are identical.
3. Install the second and third synchronizer assembly

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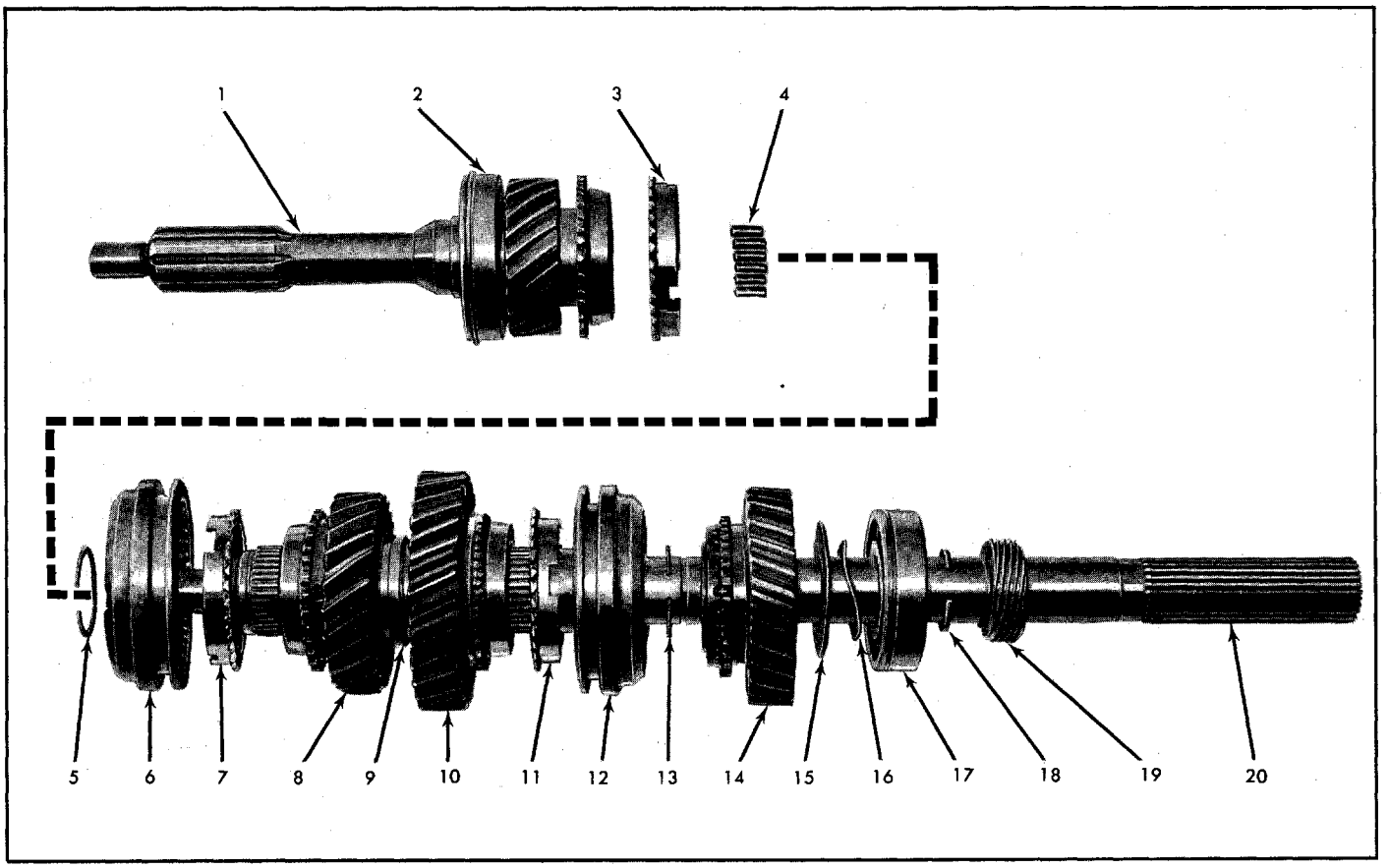


Fig. 5A—Clutch Gear and Mainshaft Assembly - Exploded

1. Clutch Gear
2. Clutch Gear Bearing
3. 3rd Speed Blocker Ring
4. Mainshaft Pilot Bearings (14)
5. Snap Ring
6. 2-3 Synchronizer Assembly
7. 2nd Speed Blocker Ring
8. 2nd Speed Gear
9. Shoulder (Part of Mainshaft)
10. 1st Speed Gear
11. 1st Speed Blocker Ring
12. 1st Speed Synchronizer Assembly
13. Snap Ring
14. Reverse Gear
15. Reverse Gear Thrust Washer
16. Spring Washer
17. Rear Bearing
18. Snap Ring
19. Speedo Drive Gear
20. Mainshaft

with the fork slot downward; press it onto splines on the mainshaft until it bottoms out. Both synchronizer assemblies used in this transmission are identical. (If sleeve becomes removed from 2-3 hub; notches on hub O.D. face forward end of mainshaft).

CAUTION: Be sure the notches of the blocker ring align with the keys of the synchronizer assembly.

4. Install synchronizer hub to mainshaft snap ring. Both synchronizer snap rings are identical.

Turn the rear of the mainshaft upward. Install the following components on the mainshaft:

5. Install the first speed gear with clutching teeth upward; the front face of the gear will butt against the flange on the mainshaft.
6. Install a blocker ring with clutching teeth downward over synchronizing surface of the first speed gear.
7. Install the first and reverse synchronizer assembly with fork slot downward; press it onto splines on the mainshaft.

CAUTION: Be sure the notches of the blocker ring align with the keys of the synchronizer assembly.

8. Install synchronizer hub to mainshaft snap ring.
9. Install reverse gear with clutching teeth downward.
10. Install reverse gear thrust washer (steel).
11. Install reverse gear spring washer.
12. Install rear ball bearing with snap ring slot downward; press onto mainshaft.
13. Install rear bearing to mainshaft snap ring.
14. Install speedometer drive gear. Press on the mainshaft until the upper face of the gear is 6 inches above upper face of rear bearing.

This completes the assembly of the mainshaft.

TRANSMISSION ASSEMBLY

Assembly of Case Components

1. Using Tool J-22246 load a row of roller bearings (27) and a bearing thrust washer at each end of the countergear. Use heavy grease to hold them in place (fig. 6A).
2. Place countergear assembly through case rear opening along with a tanged thrust washer (tang away from gear) at each end and install countergear shaft and woodruff key from rear of case.

CAUTION: Be sure countershaft picks up both thrust washers and that the tangs are aligned with their notches in the case.

3. Install reverse idler gear thrust washer, gear and shaft with its woodruff key from the rear of case.

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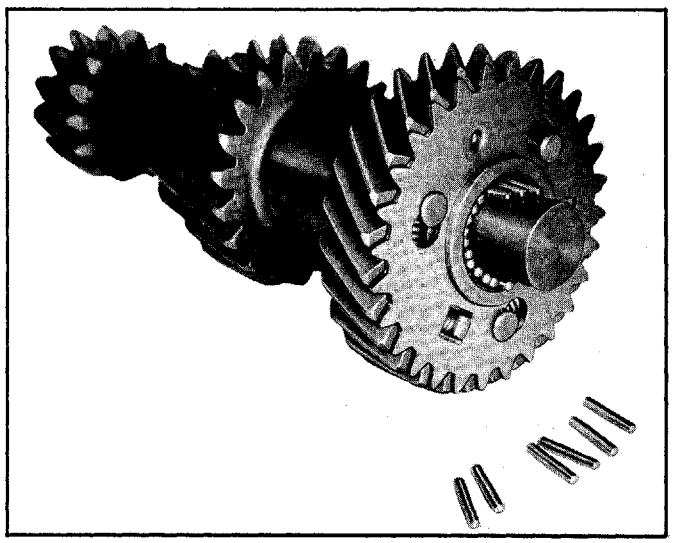


Fig. 6A—Loading Countergear Bearings with Tool J-22246

Be sure the thrust washer is between the gear and rear of case with its tang toward notch in case. Do not install idler shaft snap ring yet.

4. Using snap ring pliers, expand the snap ring in the extension and assembly extension over rear of mainshaft and onto rear bearing. Seat snap ring in rear bearing groove (fig. 2A).
5. Load the mainshaft pilot bearings (14) into the clutch gear cavity and assemble the 3rd speed blocker ring onto the clutch gear clutching surface with its teeth toward the gear.
6. Pilot the clutch gear, pilot bearings and 3rd speed blocker ring assembly over the front of the mainshaft assembly. Do not assemble bearing to gear yet.

   CAUTION: Be sure the notches in the blocker ring align with the keys in the 2 - 3 synchronizer assembly.

7. Place extension to case gasket at rear of case holding in place with grease and, from the rear of case, assemble the clutch gear, mainshaft and extension to case as an assembly.

   CAUTION: Be sure the clutch gear engages the teeth of the countergear anti-lash plate.

8. Install extension to case retaining bolts.
9. Install front bearing outer snap ring to bearing and position bearing over stem of clutch gear and into front case bore.
10. Install snap ring to clutch gear stem, and clutch gear bearing retainer and gasket to case.

    NOTE: The retainer oil return hole should be at the bottom.

11. Install reverse idler gear retainer "E" ring to shaft. Be sure thrust washer tang engages notch in case.
12. Shift synchronizer sleeves to neutral positions and install cover, gasket and fork assembly to case. Be sure forks align with their synchronizer sleeve grooves.
13. Tighten all bolts to specified torque.

TRANSMISSION ALIGNMENT

In some instances where "excessive" gear whine or high gear hop out, particularly at 50 MPH and up, are encountered; and after all other probable causes have been checked, an alignment check of the transmission and clutch housing may be helpful.

A special tool, on which a dial indicator is mounted, is necessary to check the transmission case rear bore alignment. This tool may be made from a new or good used clutch gear which has a good bearing surface on the crankshaft pilot end and at the front main bearing location.

The splines on the clutch gear shaft and the teeth on the clutch gear should be ground off so the shaft may be rotated in a clutch disc hub without interference when assembled in the car. Weld a piece of 1/4" rod in the mainshaft pilot bore long enough to extend out the case rear bore (fig. 8A). Assemble a good bearing on the clutch gear shaft and secure it with the clutch gear bearing snap ring. Attach a suitable dial indicator to the rod.

Procedure

1. Remove the transmission from the car and completely disassemble, except for the reverse idler gear.

   NOTE: In any case where the clutch gear pilot or pilot bearing is excessively loose or worn, the pilot bearing should be replaced before checking the transmission case rear bore alignment by the dial indicator method.

2. Carefully install the special tool with the dial indicator in the transmission case with the face of the indicator to the rear of the case and with the tracing finger contacting the I.D. of the case rear bore. Secure in place with a clutch gear bearing retainer (fig. 9A).

3. Assemble the transmission case to the clutch housing and tighten the four transmission mounting bolts securely.

   NOTE: Be sure to clean off any paint or other foreign material on the mating faces of the clutch housing and transmission as any foreign material on these faces will change alignment; also, check carefully for dings or burrs on these mating surfaces and remove carefully as necessary.

4. Dial indicate the transmission case rear bore and record the indicator readings in the 12, 3, 6 and 9 o'clock positions.

   NOTE: It is best to start the reading at the 3, 6, 9 or 12 o'clock position closest to the point where the indicator plunger reaches its maximum outward travel. Set the dial indicator at "0" at this location and then record the 3, 6, 9 and 12 o'clock readings in rotation.

5. Install temporary slotted shims between the transmission case and the clutch housing in the quantities and at the bolt locations as necessary to bring misalignment at the transmission case rear bore to a

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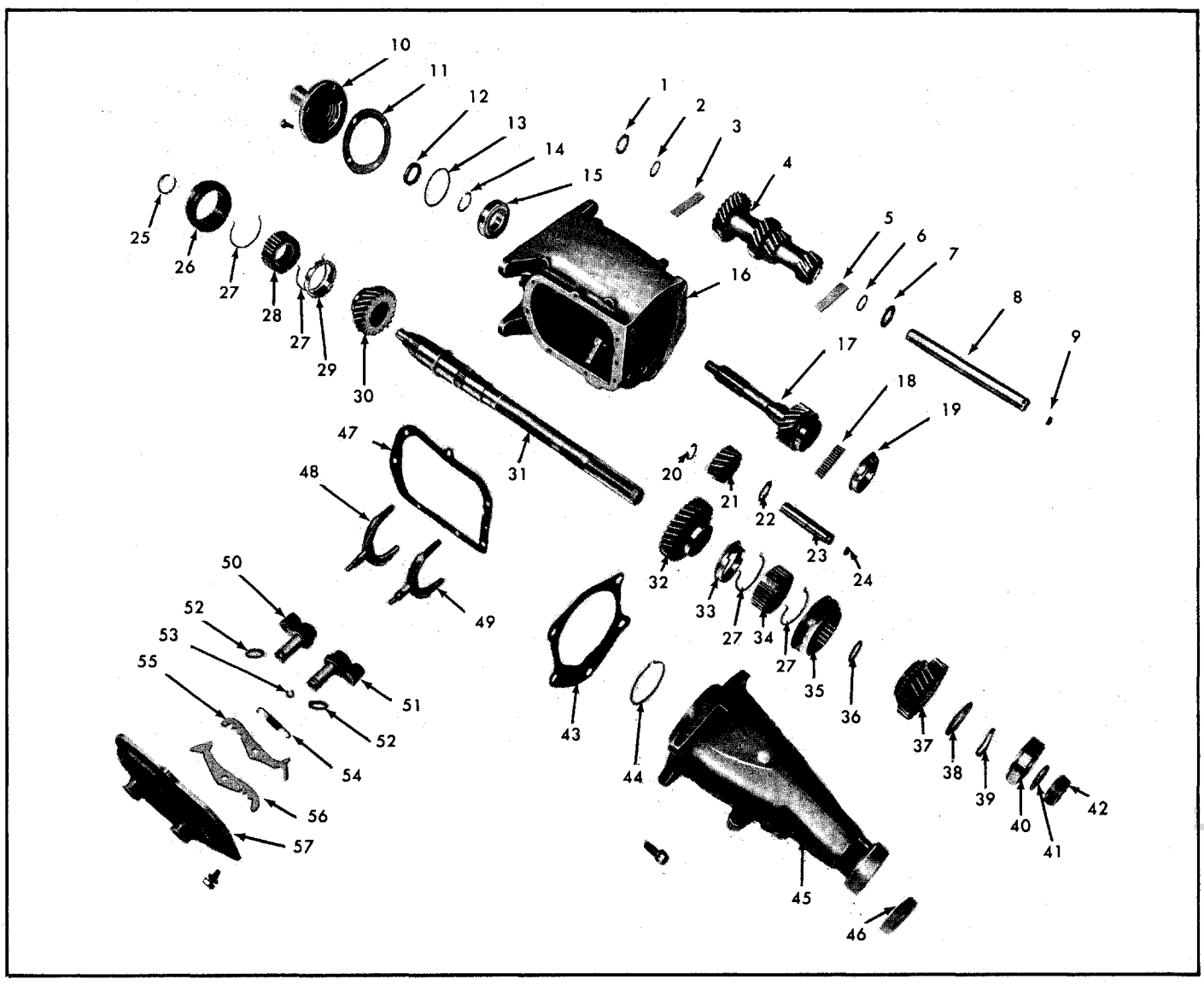


Fig. 7A—3-Speed (Saginaw) - Exploded

1. Thrust Washer - Front
2. Bearing Washer
3. Needle Bearings
4. Countergear
5. Needle Bearings
6. Bearing Washer
7. Thrust Washer - Rear
8. Counter Shaft
9. Woodruff Key
10. Bearing Retainer
11. Gasket
12. Oil Seal
13. Snap Ring - Bearing to Case
14. Snap Ring - Bearing to Gear
15. Clutch Gear Bearing
16. Case
17. Clutch Gear
18. Pilot Bearings
19. 3rd Speed Blocker Ring
20. Retainer "E" Ring
21. Reverse Idler Gear
22. Thrust Washer (Tanged)
23. Reverse Idler Shaft
24. Woodruff Key
25. Snap Ring - Hub to Shaft
26. 2-3 Synchronizer Sleeve
27. Synchronizer Key Spring
28. 2-3 Synchronizer Hub Assembly
29. 2nd Speed Blocker Ring
30. 2nd Speed Gear
31. Mainshaft
32. 1st Speed Gear
33. 1st Speed Blocker Ring
34. 1-2 Synchronizer Hub Assembly
35. 1-2 Synchronizer Sleeve
36. Snap Ring - Hub to Shaft
37. Reverse Gear
38. Thrust Washer
39. Spring Washer
40. Rear Bearing
41. Snap Ring - Bearing to Shaft
42. Speedometer Drive Gear
43. Gasket
44. Snap Ring - Rear Bearing to Extension
45. Extension
46. Oil Seal
47. Gasket
48. 2-3 Shift Fork
49. 1st and Reverse Shift Fork
50. 2-3 Shifter Shaft Assembly
51. 1st and Reverse Shifter Shaft Assembly
52. "O" Ring Seal
53. "E" Ring
54. Spring
55. 2nd and 3rd Detent Cam
56. 1st and Reverse Detent Cam
57. Side Cover

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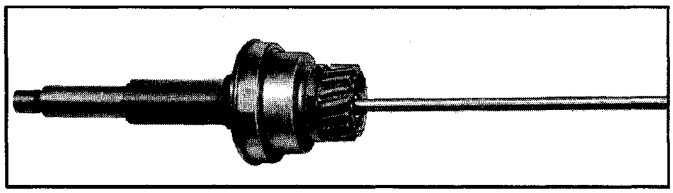


Fig. 8A—Alignment Checking Special Tool

maximum of .005" indicator reading in either the vertical or horizontal direction.

EXAMPLE: If the maximum indicator reading is at the 12 o'clock position, put shims on the two bottom bolts.

6. After the position and quantity of shims has been determined and recorded the transmission case may be removed.

   NOTE: The clutch housing should then be stamped, showing the position where shims are to be installed and the thickness of shims at each location.

7. Inspect the external clutching teeth of the clutch gear and second speed gear. Inspect the second and third speed clutch internal clutching teeth. If the teeth are worn or tapered, even slightly, the gears should be replaced. Reassemble the transmission.
8. Install the transmission assembly to the clutch housing, using the correct number of shims at the proper locations as previously determined. Shims

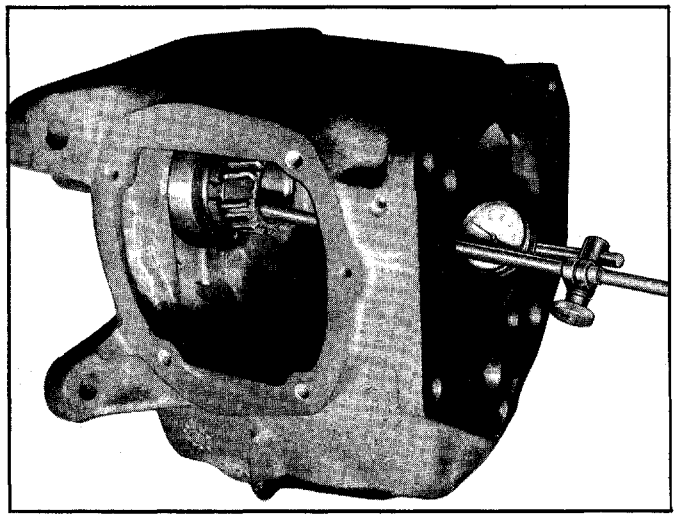


Fig. 9A—Checking Case Rear Bore

are available by unit part number 3694977 each unit consisting of the following shims:

4--.002" shims Identification--two corners cut off.

2--.005" shims Identification--one corner cut off.

1--.010" shim Identification--all corners square.

NOTE: These special shims have a tab on one end for ease of installation. Do not slot the shims for the permanent installation.

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TRANSMISSION OVERDRIVE

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OVERDRIVE HOUSING

Removal from Adapter

1. Place car on stand jacks.
2. Remove drain plug and drain overdrive.
3. Disconnect wires from solenoid and from governor switch.
4. Disconnect speedometer cable from driven gear fitting.
5. Remove propeller shaft as outlined in Section 4.

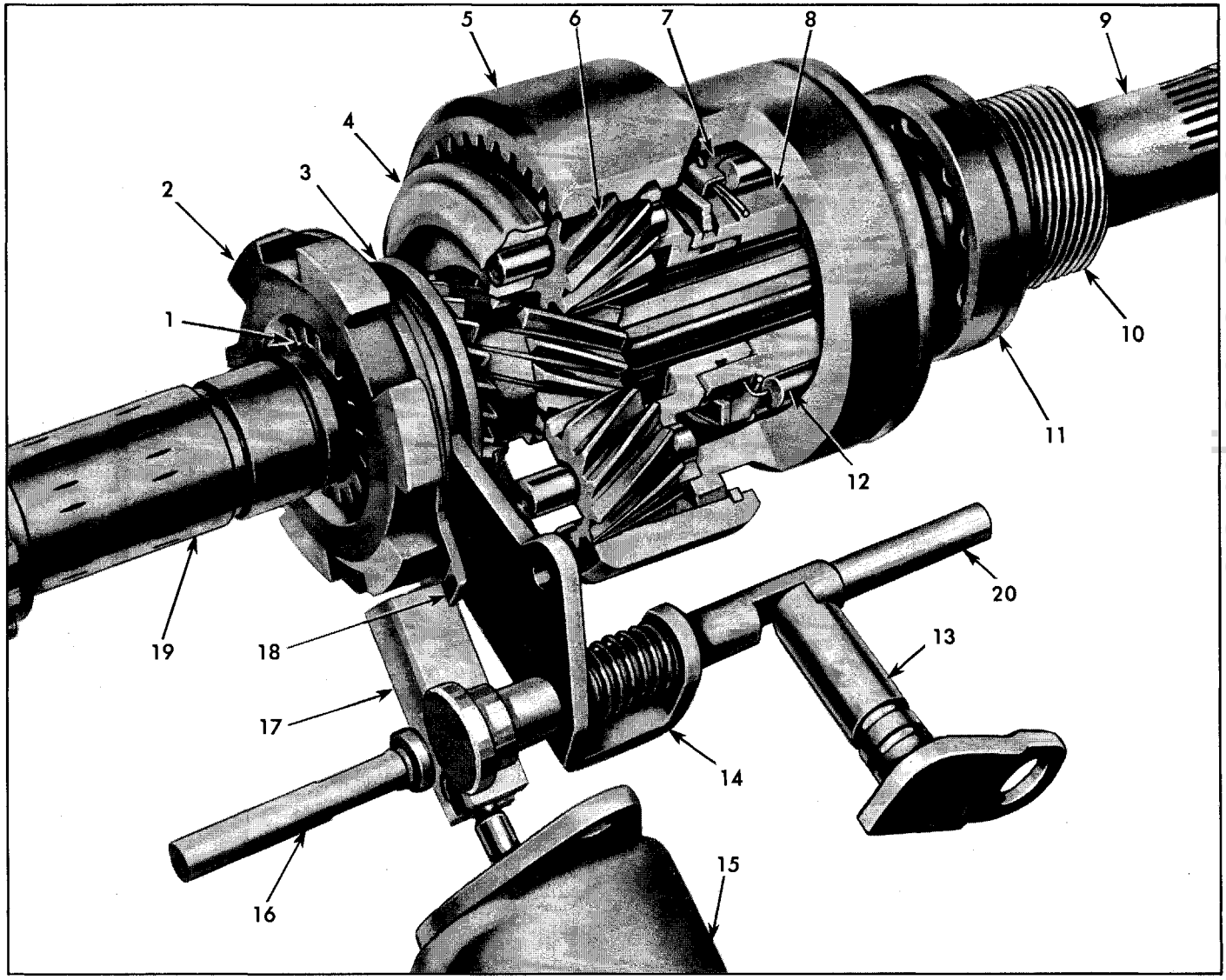


Fig. 1B—Overdrive Cross Section

1. Sun Gear
2. Sun Gear Control Plate
3. Sun Gear Shift Collar
4. Pinion Cage Assembly
5. Output Shaft Ring Gear
6. Pinion
7. Clutch Cam Roller Retainer
8. Cam
9. Output Shaft
10. Speedometer and Governor Drive Gear
11. Output Shaft Bearing
12. Clutch Cam Roller
13. Control Shaft and Lever
14. Shift Fork
15. Solenoid Assembly
16. Plunger
17. Sun Gear Pawl
18. Blocker Ring
19. Transmission Mainshaft (Typical)
20. Shift Rail

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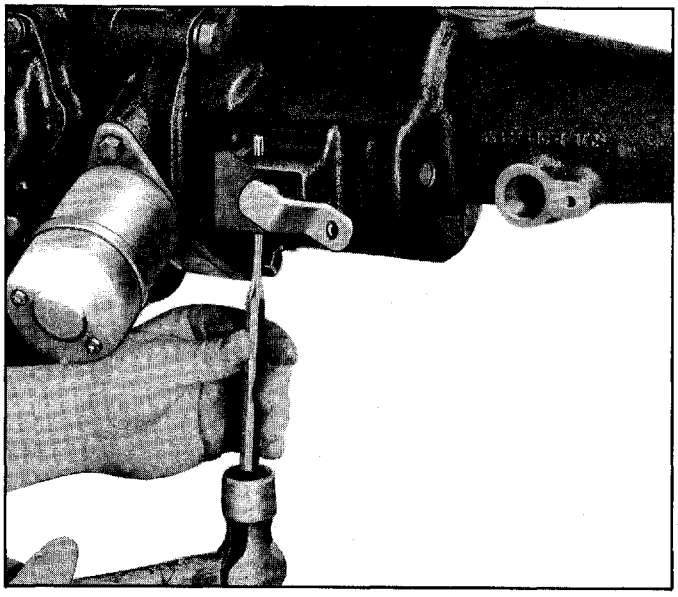


Fig. 2B—Removing Control Shaft Tapered Pin

6. Remove speedometer driven gear fitting, gear and shaft.
7. Disconnect control cable from control lever.
8. Drive out the control shaft tapered pin (fig. 2B) and pull control shaft out.
9. Support rear of engine and remove transmission support bracket to mount bolts and washers. Remove support to frame bolts, lock washers and nuts (also plain washers beneath bolt heads on left side only): Then remove transmission support.
10. Remove seven bolts and lock washers attaching the overdrive housing to the transmission case and adapter.
11. Pull overdrive housing including overdrive output shaft and ring gear assembly to rear, being careful to keep adapter from pulling away from transmission case (fig. 3B) (catch the clutch rollers as they drop out of the retainer).

CAUTION: If adapter moves away from transmission case the transmission mainshaft pilot needle bearings will drop out of clutch gear and necessitate disassembly of transmission.

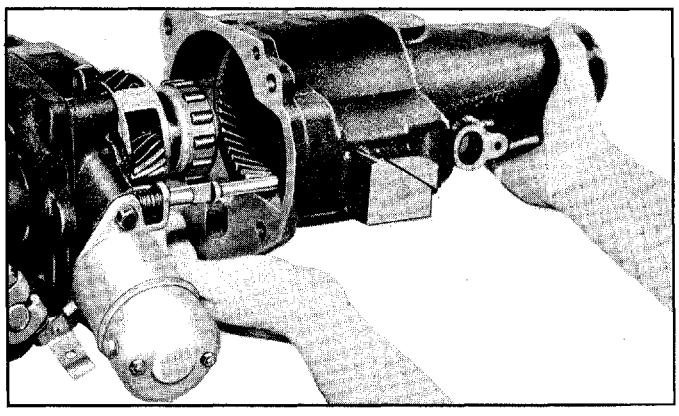


Fig. 3B—Removing Overdrive Housing and Shaft Assembly

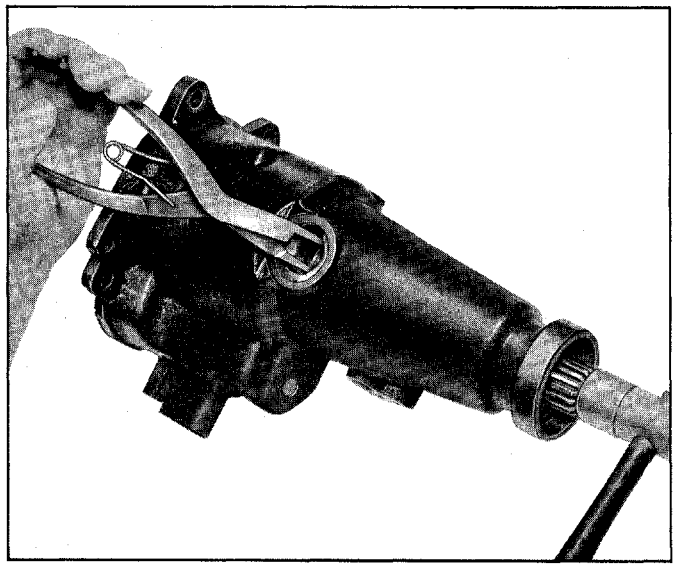


Fig. 4B—Removing Output Shaft from Housing

12. Remove gasket from adapter and install one bolt removed from housing to hold the adapter to the transmission case.

Disassembly

1. Remove governor and pinion if not previously removed.
2. Pierce plug in rear bearing snap ring access hole in top of housing and pry plug out of housing.
3. Spread rear bearing snap ring with snap ring pliers and lightly tap end of shaft with a soft hammer to free bearing from snap ring (fig. 4B), then pull shaft, including ring gear, speedometer drive gear and rear bearing, from housing.
4. Remove shift rail retractor spring from housing.
5. Remove output shaft rear bearing snap ring from housing.
6. Remove oil seal and press bushing from rear of housing, using Tool J-5778.
7. Remove ring gear snap ring (large) and slide ring gear off shaft (fig. 5B). The oil collector ring is spun securely to the shaft to form an oil tight seal.

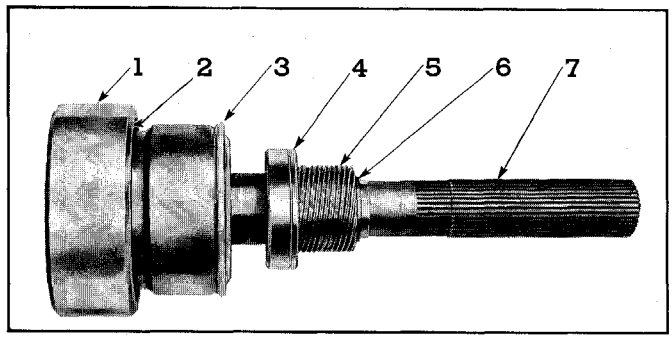


Fig. 5B—Overdrive Output Shaft Assembly

1. Ring Gear
2. Snap Ring
3. Oil Collector Ring (Part of Shaft)
4. Rear Bearing
5. Speedometer and Governor Drive Gear
6. Snap Ring
7. Output Shaft

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8. Remove speedometer drive gear (small) snap ring from output shaft.
9. Support front face of bearing and tap end of shaft to start speedometer drive gear off shaft. If necessary to use arbor press to start gear (fig. 6B) do not press shaft more than 3/8" through bearing or woodruff key in shaft may gouge bearing. Pull gear off shaft.
10. Remove woodruff key and slide bearing off shaft.

Cleaning and Inspection

As each part is removed from the housing assembly, wash in cleaning solvent, dry, and protect from subsequent dirt accumulation.

Inspect housing, shift rail retractor spring, shift fork spring, snap rings, gears and bearings for cracks, defects or damage and substitute new parts where necessary.

If clutch rollers show surface markings of any kind they should be replaced.

A general inspection of the overdrive parts remaining on the transmission mainshaft, particularly the clutch cam and roller retainer assembly and the shift rail and fork assembly, should be made at this time.

Assembly

1. Slide rear bearing straight on shaft with snap ring groove in bearing away from ring gear end of shaft.
2. Install woodruff key in shaft, start speedometer drive gear onto shaft and align keyway in gear with key in shaft. Tap gear tight against bearing and install small snap ring.
3. Engage ring gear on teeth of overdrive shaft and install large snap ring in ring gear.
4. Using Tool J-5778, press bushing into housing flush with bore for seal. Coat I.D. of bushing with transmission lubricant. Coat new oil seal with Permatex

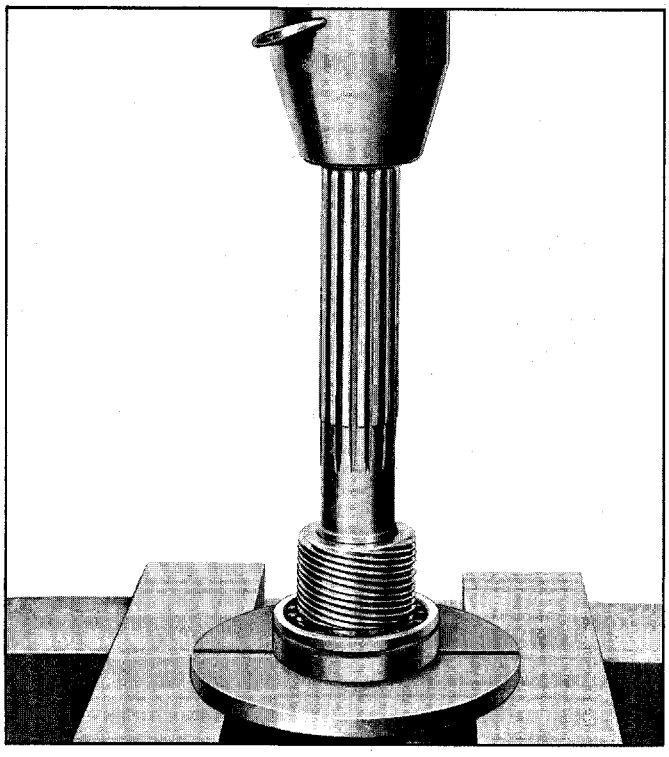


Fig. 6B—Removing Speedometer Drive Gear

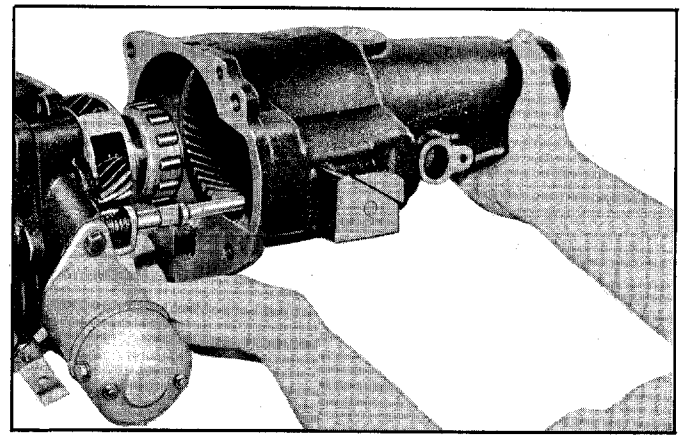


Fig. 7B—Installing Housing and Shaft Assembly

or equivalent and install in housing, using Tool J-5154. Prelubricate new seal between lips with cup grease.

5. Install output shaft rear bearing snap ring in slot in housing.
6. Install shift rail retractor spring inside housing and insert long 3/8" drift pin through spring to align spring with holes in housing.
7. Slide output shaft assembly into housing until rear bearing contacts snap ring. Spread snap ring and push shaft in until snap ring engages bearing.
8. Install new plug in snap ring access hole in top of housing.

Installation to Adapter

1. Snap a tight fitting rubber band around clutch cam roller retainer, insert rollers under rubber band in retainer and, with low gear of transmission engaged, turn retainer and rollers counter-clockwise until rollers are in their low position.
2. Remove the one bolt holding adapter to transmission case and install gasket on case.
3. Position shift rail so flat for control shaft faces outward, then start housing, output shaft and ring gear assembly into place with shift rail entering spring in housing (fig. 7B) while the output shaft is being turned counter-clockwise as it assembles over the clutch rollers. Slide housing against adapter. Install seven bolts and lock washers to adapter and case.
4. Install control shaft lever "O" ring seals, shaft and lever, clutch shaft locating pin and connect control wire to lever.
5. Install governor assembly and speedometer driven gear, shaft and fitting.
6. Notice the transmission support (Crossmember) is shaped so the upper surface has a slight slant when the bottom is flat. Position the support so the slant is down toward the rear of the vehicle, align the mounting holes with the holes in the frame and install the support-to-frame bolts, washers and nuts.
7. Install the support-to-mounting block bolts and washers.
8. Install propeller shaft as outlined in Section 4.

PARTS AT REAR OF ADAPTER

Removal

1. Remove overdrive housing, output shaft and ring

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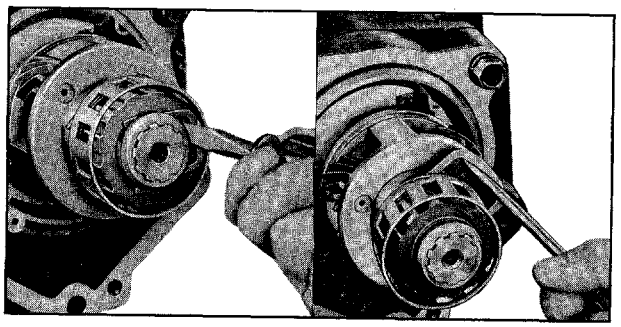


Fig. 8B—Removing Clutch Cam Retaining Clips

gear assemblies as outlined in preceding pages.

2. Pull "U" clips at each end of clutch cam (fig. 8B) and slide the cam and roller retainer from pinion cage hub and transmission mainshaft. If roller retainer or cam is to be replaced separate these pieces by pulling retainer out until the hooked ends of spring can be pulled out of holes in cam.
3. Slide pinion cage assembly off sun gear and mainshaft.
4. Remove sun gear and shift rail assemblies from shaft (fig. 9B). Shift rail collar may be separated from sun gear by removing snap rings at either end of collar. Shift rail, fork, and spring may be separated by removing snap ring between cupped washer and shift fork.
5. Remove sun gear solenoid, oil seal and cable bracket (fig. 10B).
6. Remove large snap ring from adapter (fig. 11B) and remove sun gear control plate retainer. Then slide control plate and blocker ring out of adapter (fig. 12B). If control plate or blocker ring is to be replaced they may be separated by pulling blocker ring off plate.
7. Lift sun gear pawl out of adapter.

Cleaning and Inspection

As each part is removed from the rear of the transmission, wash in cleaning solvent, dry, and protect from subsequent dirt accumulation.

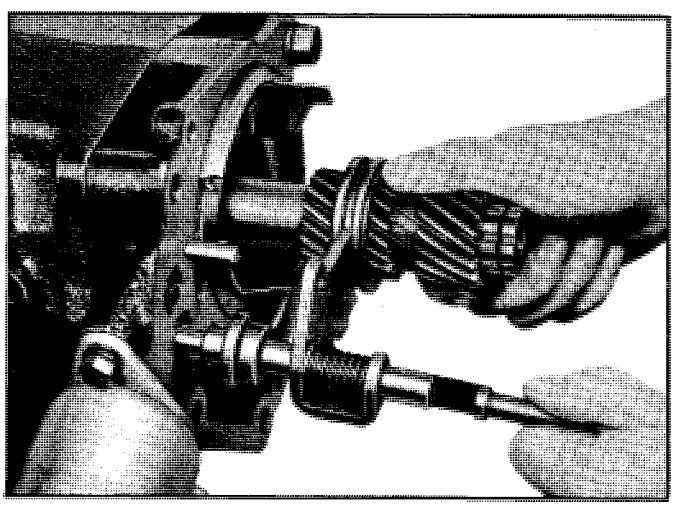


Fig. 9B—Removing Sun Gear, Shift Rail and Plunger Assemblies

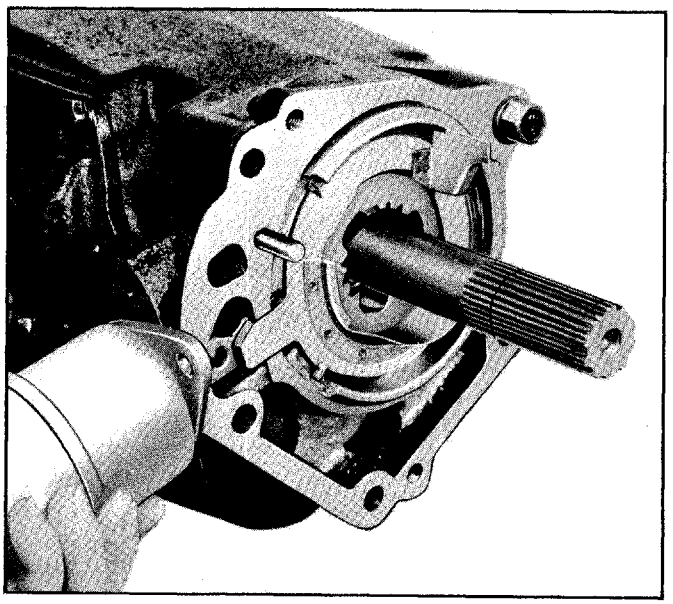


Fig. 10B—Removing Solenoid

1. Inspect "U" clips, control plate retainer, control plate, blocker ring and pawl for defects or damage and substitute new parts where necessary.
2. Inspect the fit and tension of the blocker ring on hub as follows:
   a. Push one end of ring toward the other. The ring should grip and hold to the hub. If the ring does not hold when correctly installed (flat surface of ring facing out), it should be replaced.
   b. Push one end of ring away from opposite end and check the frictional drag required to slide the ring around the hub as follows:
      (1) Hold one lug of control plate in a soft jawed vise and hook a spring balance into the notch of the nearest blocker ring lug (fig. 15B).
      (2) Measure the pull required to rotate the ring

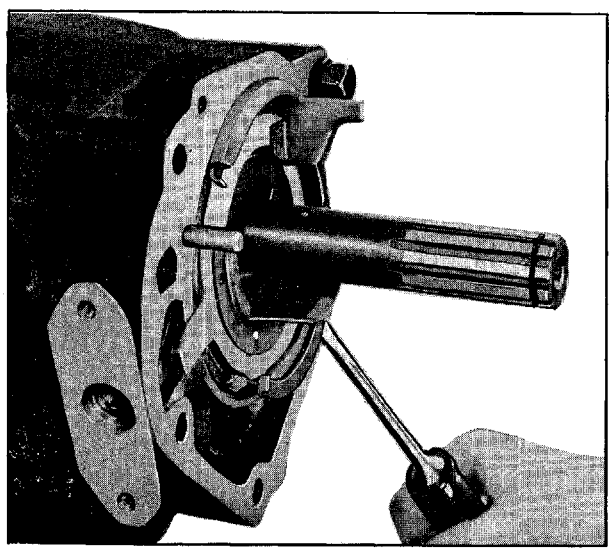


Fig. 11B—Removing Control Plate Retainer Snap Ring

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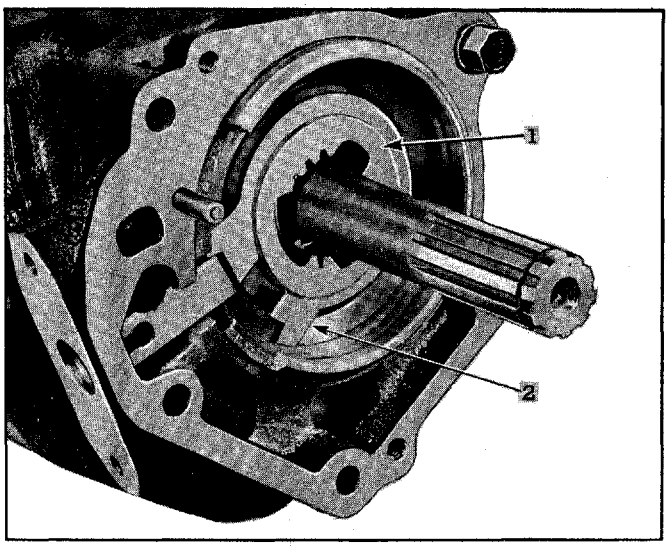


Fig. 12B—Control Plate, Blocker Ring and Pawl Positions for Assembly

1. Control Plate 2. Blocker Ring

after it has started moving. The pull should be 4-6 pounds on new parts, which will fall to 1-1 1/2 pounds when thoroughly broken in. While low friction may be corrected by squeezing the ring together for a tighter fit, installation of new parts is recommended.

3. Inspect the clutch cam and if the 12 flat surfaces show slight lengthwise indentations, replace the cam. If rollers show markings of any kind, they should all be replaced.
4. Test the tension of the cam retaining springs after the assembly has been thoroughly washed. (The springs are designed to twist the cam to return the rollers to the high side of the cam). Hold hub of cam and turn roller retainer counter-clockwise, then release retainer. The retainer should snap back quickly. If the action is slow or retarded, replace the springs or the complete assembly.

NOTE: If the spring tension is weak or retarded, the unit will free-wheel at all times.

5. When installing springs be sure both springs are coiled in the same direction (clockwise when looking toward flanged end of retainer), with "S" end of springs hooked into holes in retainer (fig. 16B) and opposite ends hooked into holes in cam.
6. Inspect the shift rail, fork, and spring for cracks, burrs or damage and replace defective parts.
7. When shift rail, fork and spring are assembled, make sure the parts bear the correct relationship as shown in Figure 17B, with snap ring inside cupped washer.

Installation

1. Insert sun gear pawl in adapter with notched side up.
2. If blocker ring was removed from control plate, position ring on plate with flat surface of ring facing out, then start the assembly over transmission mainshaft with ring toward rear. Slide the assembly into position with slot in ring toward sun gear pawl (fig. 12B).

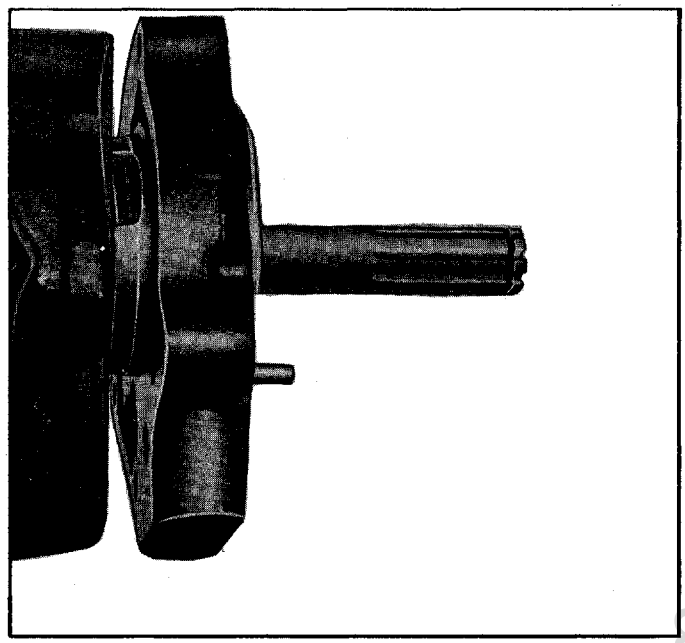


Fig. 13B—Removing Adapter from Transmission Case

3. Slide control plate retainer over mainshaft, against control plate and install snap ring in adapter.
4. Install solenoid oil seal, solenoid, and cable bracket.
5. Start the sun gear onto the mainshaft. Hold shift rail so arm of fork fits in collar on sun gear and forward end of shift rail enters opening in adapter and transmission case (fig. 9B). Slide both assemblies forward so pin in adapter locates the fork, and sun gear engages control plate.
6. Install pinion cage assembly over mainshaft and sun gear, turning cage assembly clockwise to engage sun gear.
7. If free wheeling cam and roller retainer were separated, assemble these parts by positioning springs so both are coiled clockwise when looking at flanged end of retainer (fig. 16B), then place retainer over slotted end of cam, hook free ends of springs in holes in cam, turn retainer clockwise and push springs into place around cam.
8. Slide cam and roller retainer assembly over mainshaft and pinion cage hub. Install "U" clips at each end of free wheeling cam.

Lubrication

The transmission and overdrive unit are connected with oil passages so the same oil is used for both. However, the following precautions must be used in the filling, in order that the proper amount of oil may be carried.

1. In making the initial filling, first fill the overdrive unit with the proper oil until oil runs out the filling hole, then replace plug. Fill the transmission with the same type of oil, until oil runs out the filling hole, then replace plug.
2. In subsequent filling (at each chassis lubrication), inspect the transmission only, for oil level, and fill as necessary.

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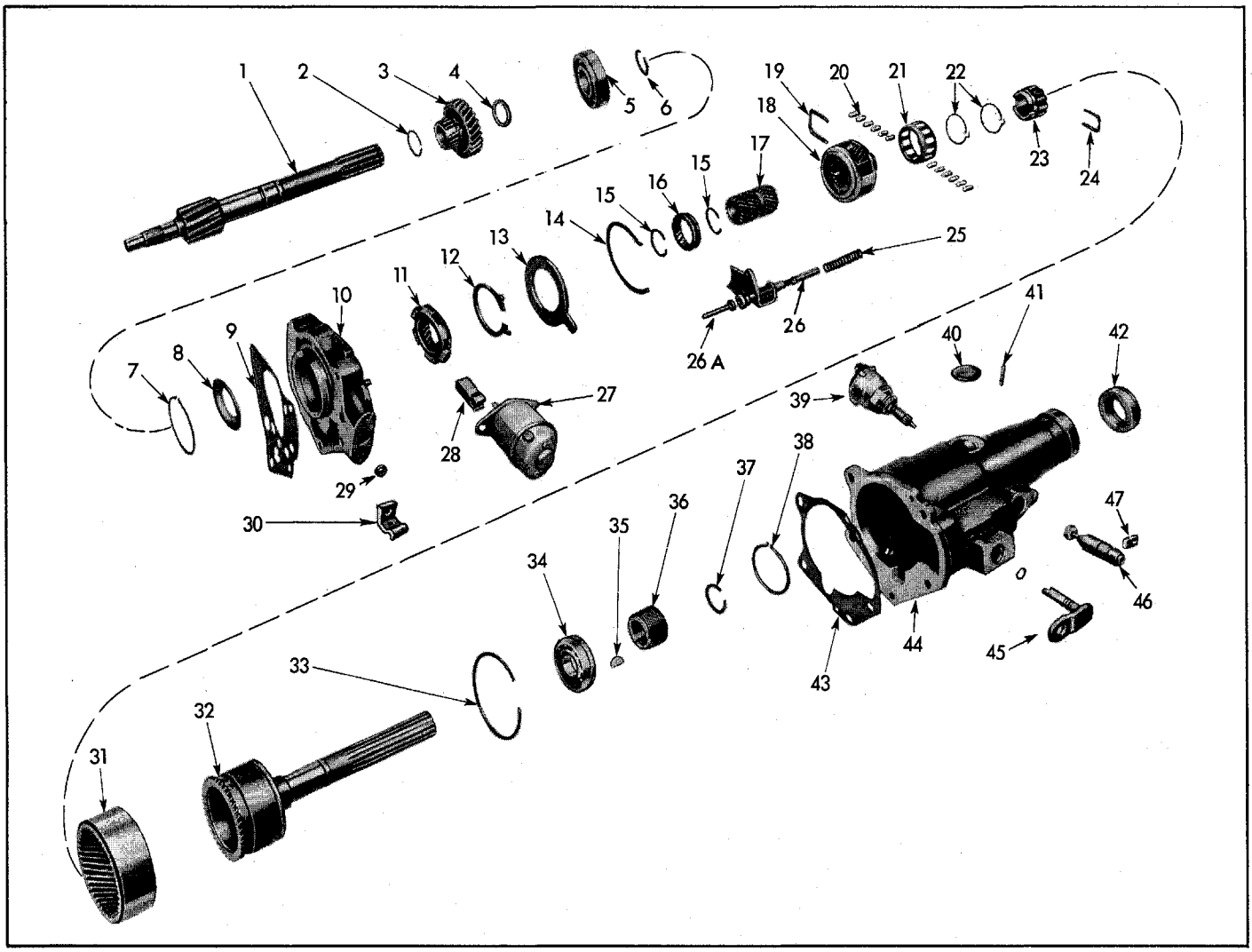


Fig. 14B—Layout of Overdrive Parts (Typical)

1. Transmission Mainshaft
2. Energizing Spring
3. Second Speed Gear
4. Thrust Washer
5. Mainshaft Bearing
6. Snap Ring
7. Snap Ring
8. Oil Baffle
9. Gasket
10. Adapter
11. Sun Gear Control Plate
12. Blocker Ring
13. Control Plate Retainer
14. Control Plate Retainer Snap Ring
15. Shift Rail Collar Snap Ring
16. Shift Rail Collar
17. Sun Gear
18. Pinion Cage Assembly
19. Cam Retaining "U" Clip (Large)
20. Cam Rollers
21. Cam Roller Cage
22. Roller Cage Retracting Spring
23. Free-Wheeling Cam
24. Cam Retaining "U" Clip (Small)
25. Shift Rail Retractor Spring
26. Shift Rail Assembly (Also see Fig. 17B)
26a. Plunger
27. Sun Gear Solenoid
28. Sun Gear Pawl
29. Sun Gear Pawl Rod Oil Seal
30. Control Cable Bracket
31. Ring Gear
32. Output Shaft
33. Ring Gear Snap Ring
34. Output Shaft Bearing
35. Woodruff Key
36. Speedometer Drive Gear
37. Drive Gear Snap Ring
38. Bearing Snap Ring
39. Governor Switch
40. Plug
41. Control Shaft Locating Pin
42. Oil Seal
43. Gasket
44. Overdrive Housing
45. Shift Rail Control Shaft and Lever
46. Speedometer Driven Gear and Fitting
47. Lock Plate

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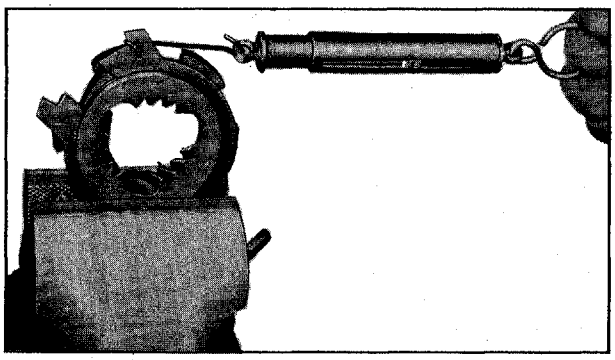


Fig. 15B—Measuring Blocker Ring Tension

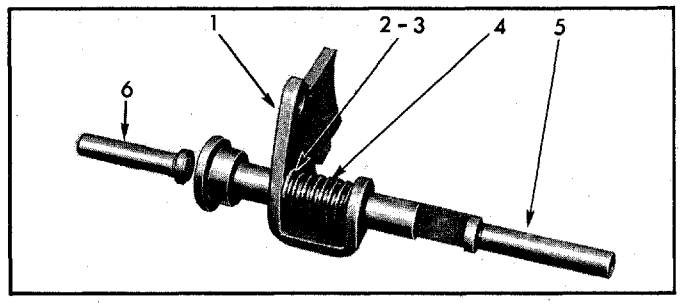


Fig. 17B—Shift Rail, Plunger, Fork and Spring Assembly

1. Fork
2. Snap Ring
3. Washer
4. Spring
5. Shift Rail
6. Plunger

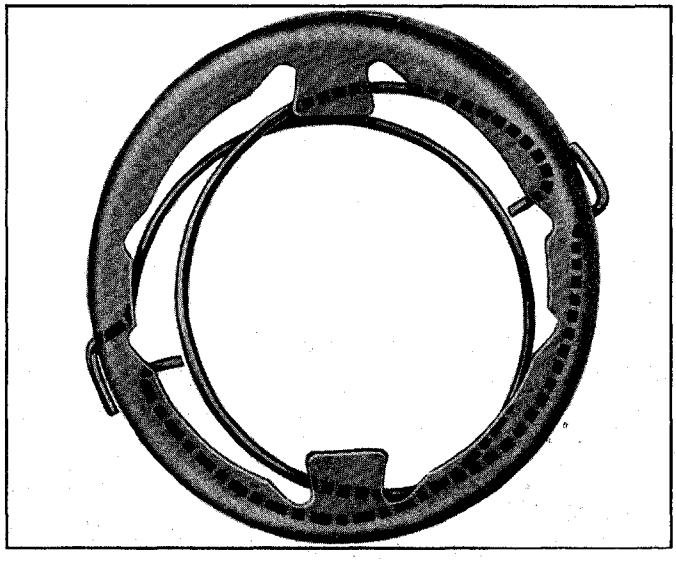


Fig. 16B—Installation of Cam Roller Retaining Springs

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THREE-SPEED HEAVY DUTY TRANSMISSION

(WARNER MODEL T-16)

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TRANSMISSION ASSEMBLY

Disassembly of Case Components

1. Remove side cover attaching screws and remove side cover assembly and shift forks. (fig. 25C)
2. Remove extension attaching screws and rotate extension clockwise to expose reverse idler gear shaft.
3. Use a long drift or punch through the side cover opening and drive the reverse idler shaft and its woodruff key through the rear of the case (fig. 2C).

   CAUTION: Do not damage the roller bearings.
4. Rotate the extension counter-clockwise to expose

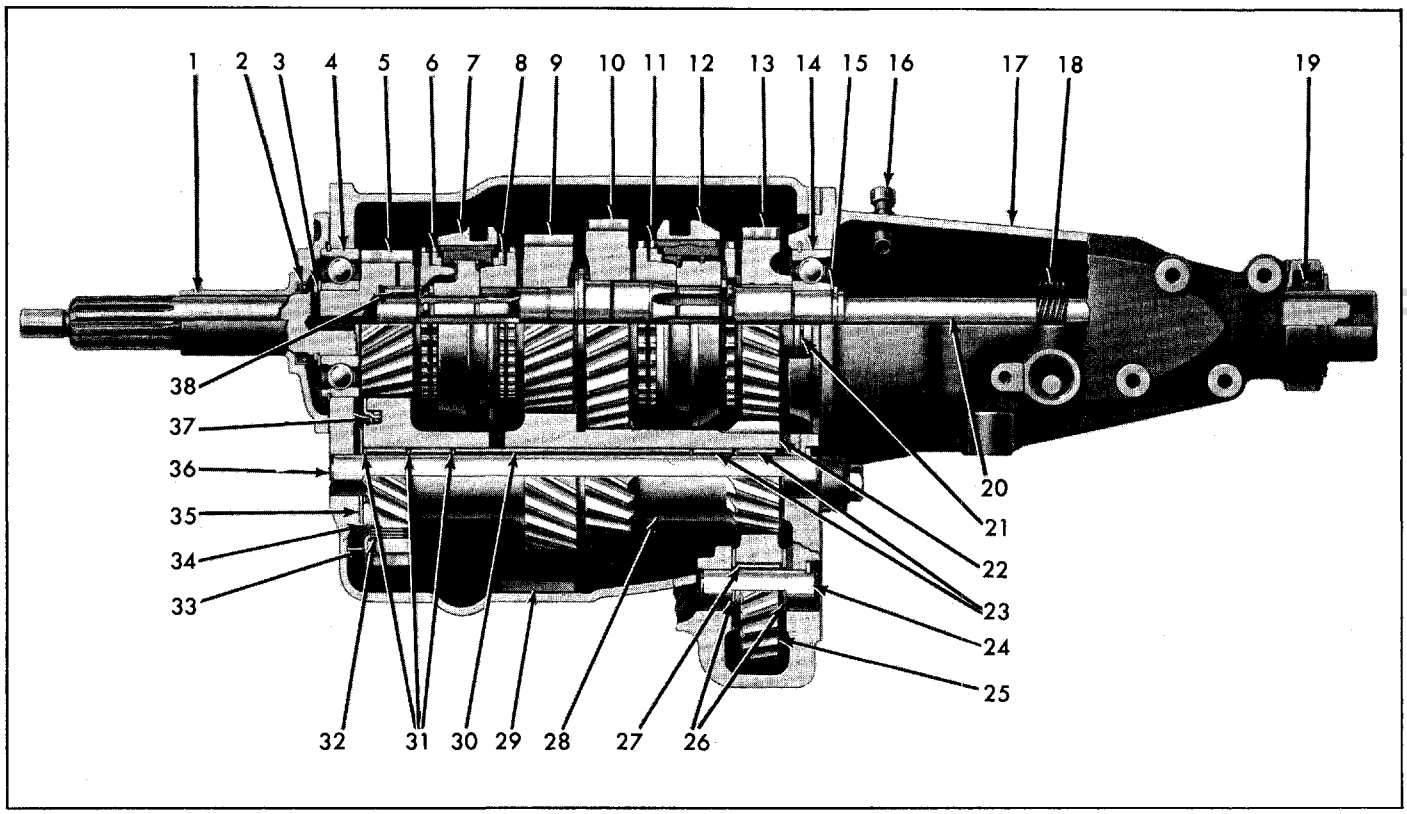


Fig. 1c—3-Speed Cross Section

1. Bearing Retainer
2. Lip Oil Seal
3. Snap Ring and Special Washer
4. Clutch Gear Bearing
5. Clutch Gear
6. 3rd Speed Blocker Ring
7. 2-3 Sliding Clutch Sleeve
8. 2nd Speed Blocker Ring
9. Second Speed Gear
10. First Speed Gear
11. 1st Speed Blocker Ring
12. 1st and Reverse Sliding Clutch Sleeve
13. Reverse Gear
14. Mainshaft Rear Bearing
15. Snap Ring and Special Washer
16. Vent
17. Extension
18. Speedo Drive Gear
19. Extension Oil Seal
20. Mainshaft
21. Extension to Bearing Retainer Ring
22. Countergear Thrust Washer
23. Roller Bearings
24. Reverse Idler Shaft
25. Reverse Idler Gear
26. Thrust Washer
27. Roller Bearings
28. Countergear
29. Magnet
30. Tube Spacer
31. Washers
32. Roll Pin
33. Dampener Plate
34. Spiral-Lox Retainer
35. Countergear Thrust Washer
36. Countergear Shaft
37. Dampener Spring
38. Mainshaft Pilot Bearings

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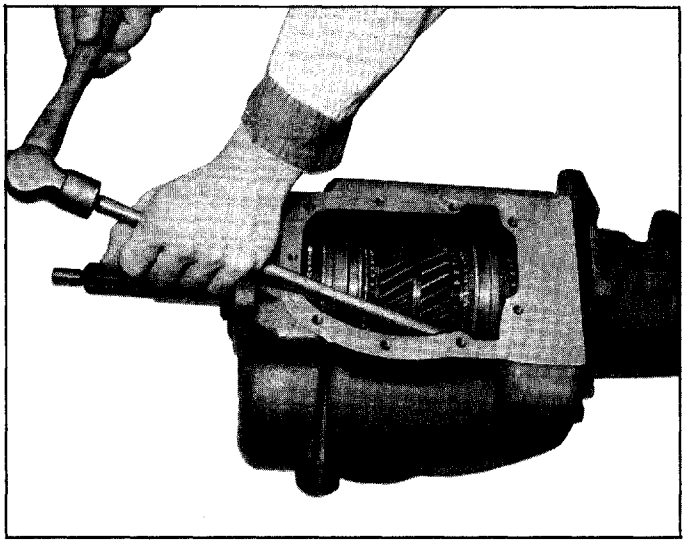


Fig. 2c—Removing Reverse Idler Shaft

the countergear shaft and use a brass drift or J-21629 at the front of the shaft to drive the shaft and its woodruff key out the rear of the case (fig. 3C).

5. With the countergear dropped to the bottom of the case remove the entire mainshaft and extension assembly through the rear of the case (fig. 4C). Remove the mainshaft pilot roller bearings from the clutch gear.
6. Using Snap Ring Pliers J-8059 expand the snap ring in the extension which retains the mainshaft rear bearing and remove the extension from the rear bearing and mainshaft by tapping on end of mainshaft (fig. 5C).
7. Remove the clutch gear bearing retainer and clutch gear bearing snap ring and washer from the mainshaft (fig. 6C).
8. Drive the clutch gear through its bearing into the case (fig. 7C) and remove the bearing by tapping out the front from inside the case.
9. Remove countergear and roller bearings, both countergear thrust washers, reverse idler gear and

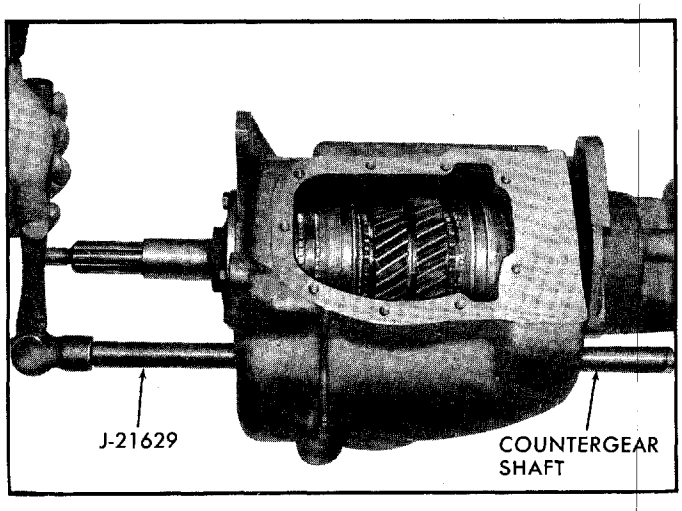


Fig. 3c—Removing Countergear Shaft Using J-21629

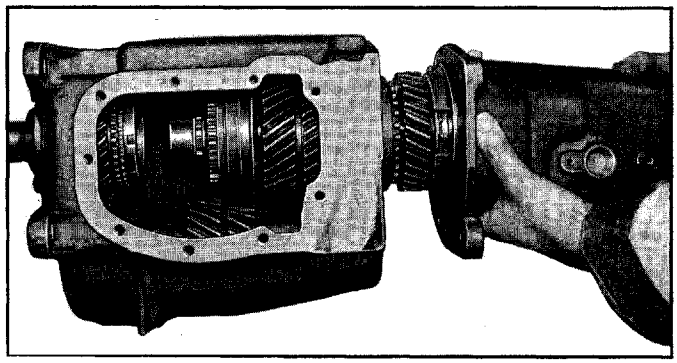


Fig. 4c—Removing Mainshaft and Extension from Case

25 roller bearings, and both idler gear thrust washers from the case.

MAINSHAFT

Disassembly

1. Using snap ring pliers, remove the 2nd and 3rd speed sliding clutch hub snap ring from mainshaft (fig. 8C) and remove clutch assembly, second speed blocker ring and second speed gear from front of mainshaft.
2. Remove rear bearing snap ring from mainshaft groove (fig. 9C).
3. Support reverse gear with press plates and press on rear of mainshaft to remove reverse gear, rear bearing, special washer, snap ring and finally the speedo drive gear from rear of mainshaft (figs. 10C and 11C).

   CAUTION: When pressing rear bearing be sure the special washer is clear of the snap ring groove. Also be careful to center gear, bearing, washer and snap ring on mainshaft before attempting to press off the speedo drive gear (fig. 11C).

4. Remove the 1st and Reverse sliding clutch hub snap ring from the mainshaft (fig. 12C) and remove the

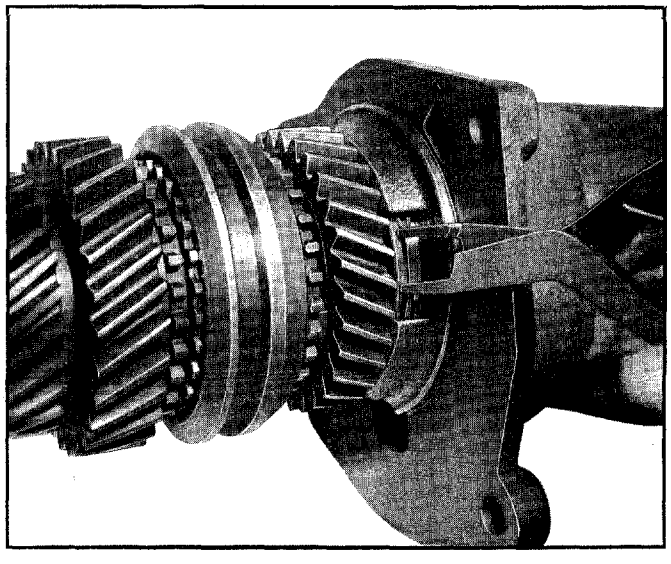


Fig. 5c—Extension to Rear Bearing Retaining Snap Ring

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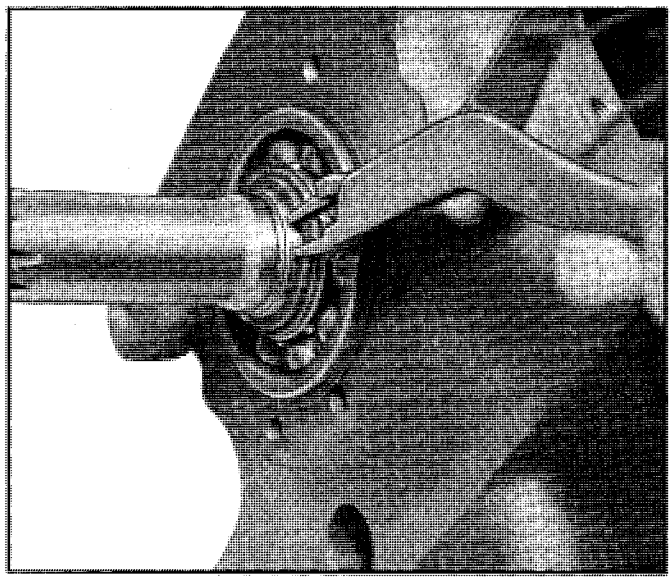


Fig. 6c—Clutch Gear Bearing to Gear Snap Ring Replacement

clutch assembly, 1st speed blocker ring and first speed gear from the rear of mainshaft.

This completes the disassembly of the mainshaft.

CLEANING AND INSPECTION

Transmission Case

1. Wash the transmission thoroughly inside and outside with cleaning solvent, then inspect the case for cracks.
2. Check the front and rear faces for burrs, and if present, dress them off with a fine mill file.
3. Check bearing bores in case and, if damaged, replace case.

Front and Rear Bearings

1. Wash the front and rear ball bearings thoroughly in a cleaning solvent.

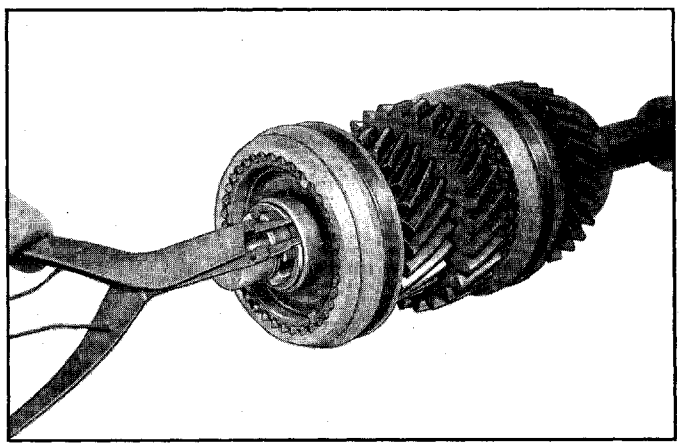


Fig. 8c—2nd and 3rd Clutch Hub Snap Ring Replacement

2. Blow out bearings with compressed air.

   CAUTION: Do not allow the bearings to spin, turn them slowly by hand. Spinning bearings will damage the race and balls.

3. Make sure bearings are clean, then lubricate with light engine oil and check them for roughness by slowly turning the race by hand.

Bearing Rollers and Spacers

All main drive gear, countergear and reverse idler gear bearing rollers should be inspected closely and replaced if they show wear. Inspect counter shaft and reverse idler shaft at the same time, replace if necessary. Replace all worn spacers.

Gears

1. Inspect all gears for excessive wear, chips or cracks and replace any that are worn or damaged.
2. Inspect reverse gear bushing and if worn or damaged replace the entire gear.

   NOTE: Reverse gear bushing is not serviced separately.

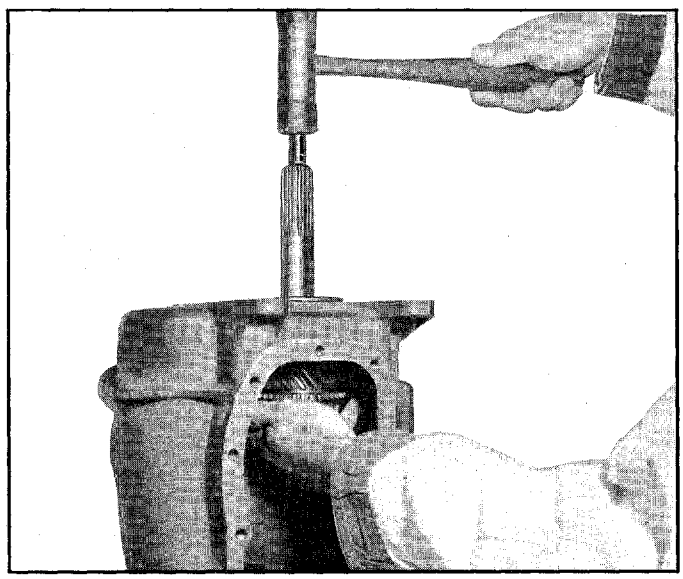


Fig. 7c—Removing Clutch Gear from Bearing and Case

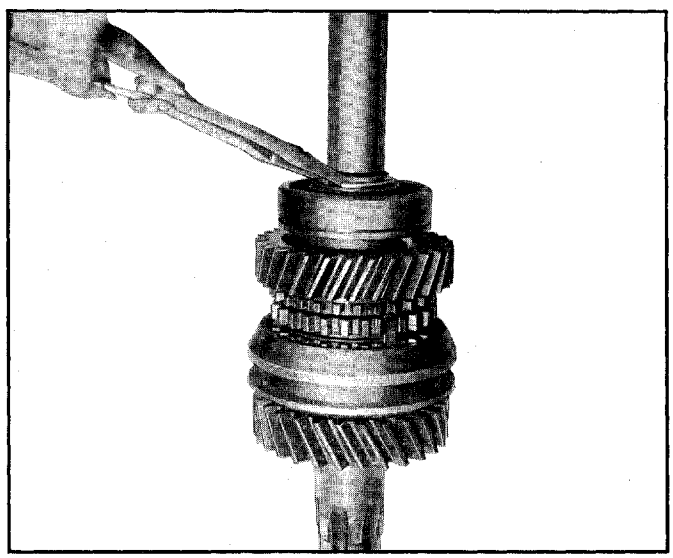


Fig. 9c—Rear Bearing to Mainshaft Snap Ring Replacement

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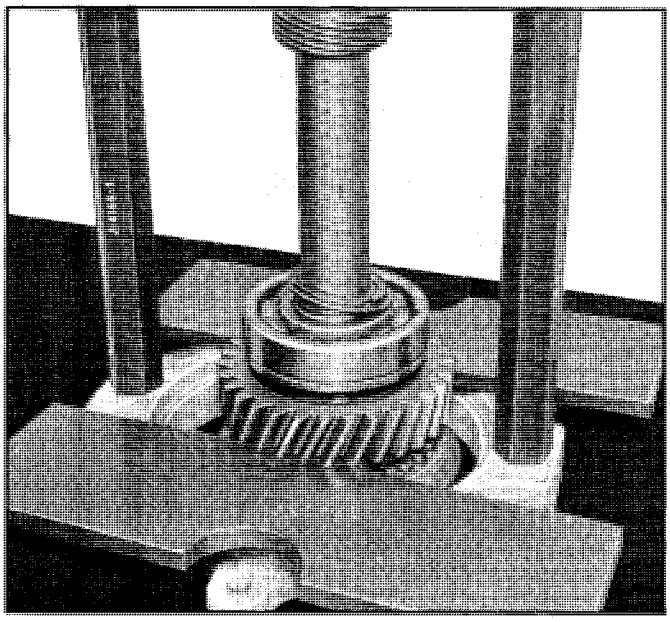


Fig. 10c—Removing Reverse Gear and Rear Bearing

3. Check both clutch sleeves to see that they slide freely on their hubs.

Countergear Anti-Lash Plate

Inspect the plate teeth for wear or other damage. If removal is desired, remove the retaining spirallox and remove the plate and/or spring.

REPAIRS

Clutch Keys and Springs

NOTE: The clutch hubs and sliding sleeves are a selected assembly and should be kept together as originally assembled, but the keys and two springs may be replaced if worn or broken.

Replacement

1. If relation of hub and sleeve are not already marked, mark for assembly purposes.
2. Push the hub from the sliding sleeve, the keys will fall free and the springs may be easily removed.
3. Place the two springs in position (one on each side of hub), so all three keys are engaged by both springs (fig. 13C). Place the keys in position and holding them in place, slide the sleeve onto the hub aligning the marks made before disassembly.

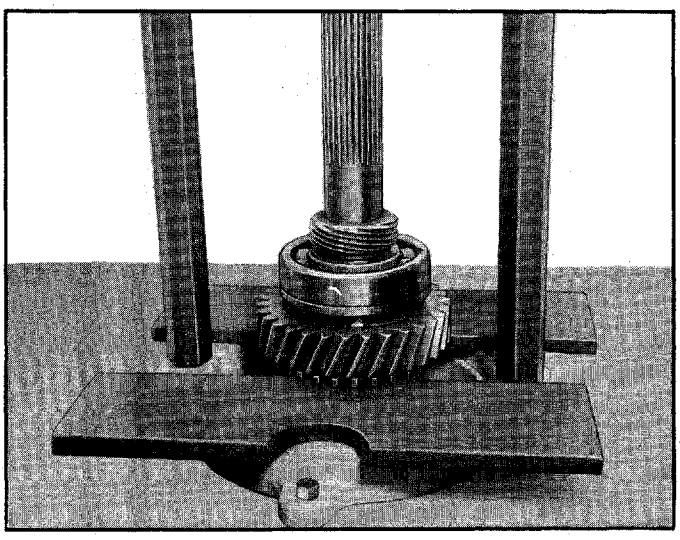


Fig. 11c—Removing Speedo Drive Gear

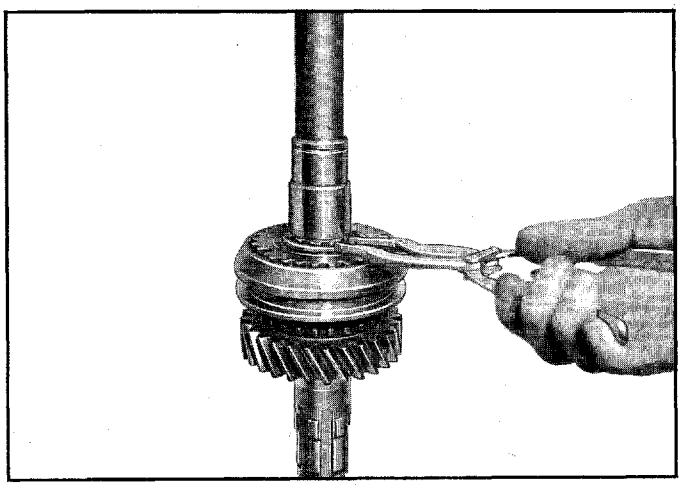


Fig. 12c—1st and Reverse Clutch Hub Snap Ring Replacement

Extension Oil Seal or Bushing

If bushing in rear of extension requires replacement, remove seal and use Tool J-5778 to drive bushing into extension housing (fig. 14C). Using the same tool, drive new bushing in from the rear. Coat I.D. of bushing and seal with transmission lubricant, then install new oil seal using Tool J-5154 (fig. 15C).

Clutch Bearing Retainer Oil Seal

If the lip seal in the retainer needs replacement; pry the old seal out and replace with a new seal using Installer Tool J-7785, or similar tool, until seal seats in its bore.

MAINSHAFT

Assembly (Fig. 18C)

1. Install 1st speed gear on the rear of mainshaft with the gear clutching teeth to the rear.

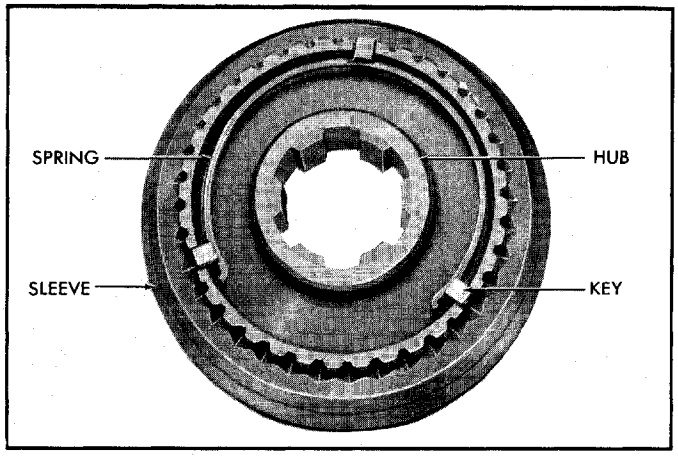


Fig. 13c—2nd and 3rd Clutch Assembly

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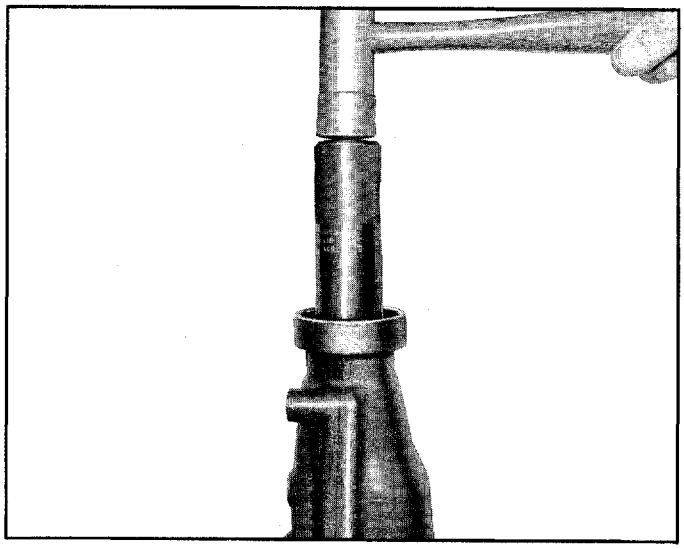


Fig. 14c—Extension Bushing Replacement Using J-5589

2. Install 1st speed gear blocker ring over the first speed gear tapered cone end area (clutch key notches toward the rear).
3. Install the 1st and reverse sliding clutch assembly over rear of mainshaft being careful to engage the three keys with the notches of the 1st speed blocker ring. Properly installed the straightest side of the clutch hub and the taper of the sliding sleeve should both be toward the rear of the mainshaft (fig. 1C).
4. Install the 1st and reverse clutch hub snap ring to the mainshaft groove (fig. 12C).

   NOTE: The snap ring is available in three thicknesses. Use thickest snap ring that will assemble with all parts stacked tight endwise.

5. Install reverse gear over rear of mainshaft with the gear clutching teeth toward the front.
6. Press mainshaft rear bearing on over rear of mainshaft (fig. 16C) with its outer race snap ring groove closest to reverse gear.
7. Install rear bearing special washer and snap ring to mainshaft (fig. 9C).

   NOTE: This snap ring is available in six thicknesses. Use thickest snap ring that will assemble with all parts stacked tight endwise.

8. Press the speedo drive gear onto the rear of mainshaft until centered on the shaft boss (fig. 17C).

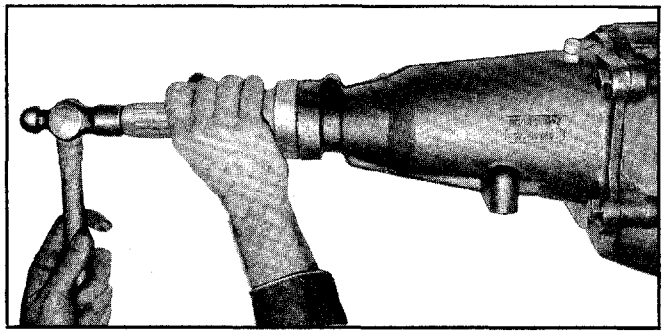


Fig. 15c—Installing Extension Oil Seal Using J-5154

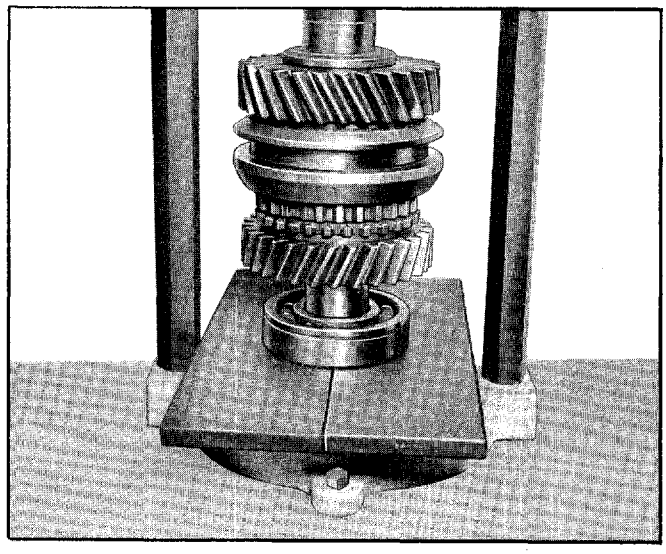


Fig. 16c—Installing Rear Bearing to Mainshaft

9. Install the second speed gear over the front of the mainshaft with the gear clutching teeth toward the front.
10. Install the 2nd speed gear blocker ring over the 2nd speed gear tapered cone end (clutch key notches toward the front).
11. Install the 2nd and 3rd sliding clutch assembly over the front of mainshaft, engaging the clutch keys with the notches of the 2nd speed blocker ring. Properly installed the straightest side of the clutch hub should be toward the rear and the clutch sliding sleeve taper should be toward the front of the mainshaft (fig. 1C).
12. Install the 2nd and 3rd speed clutch hub retaining snap ring to the mainshaft (fig. 8C).

    NOTE: This snap ring is available in four thicknesses. Use thickest snap ring that will assemble with all parts stacked tight endwise.

This completes the assembly of the mainshaft.

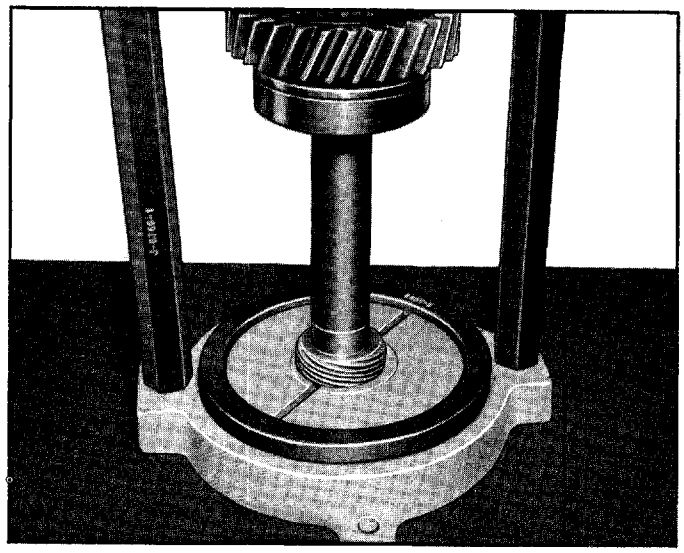


Fig. 17c—Installing Speedo Drive Gear to Mainshaft

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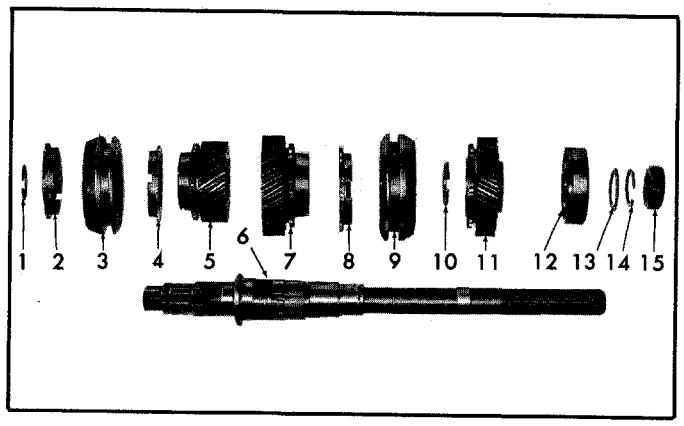


Fig. 18c—Mainshaft Assembly—Layout

1. Snap Ring
2. 3rd Speed Blocker Ring
3. 2-3 Clutch Assembly
4. 2nd Speed Blocker Ring
5. 2nd Speed Gear
6. Mainshaft
7. 1st Speed Gear
8. 1st Speed Blocker Ring
9. 1st Reverse Clutch Assembly
10. Snap Ring
11. Reverse Gear
12. Rear Bearing
13. Special Washer
14. Snap Ring
15. Speedo Drive Gear

TRANSMISSION ASSEMBLY

Assembly of Case Components

1. Insert tube spacer and a double row of roller bearings and bearing retainer washers at each end of the countergear using heavy grease to hold them in place (figs. 1C and 20C).
2. Place countergear assembly through case rear opening along with a tanged countergear thrust washer (tang away from gear) at each end (large washer at front) and install countergear shaft and woodruff key from the rear of case (fig. 21C).

   CAUTION: Be sure that countershaft picks up both thrust washers and that the washer tangs are aligned with their notches in the case.

   Attach a dial indicator as shown in Figure 22C and check end play of the countergear. If end play is greater than .025" new thrust washers must be installed.
3. Use heavy grease to hold the 25 reverse idler gear roller bearings in position and place the gear and bearings along with a thrust washer on each end into position inside case, so the bevelled edge of gear teeth face toward the front of case.
4. Load pilot bearing rollers and spacer into clutch gear using heavy grease to hold into place and position gear inside case. Do not install clutch gear bearing at this time.
5. Stand case on end with clutch gear shaft through hole in bench or stand, and place 3rd speed blocker ring over clutch gear.

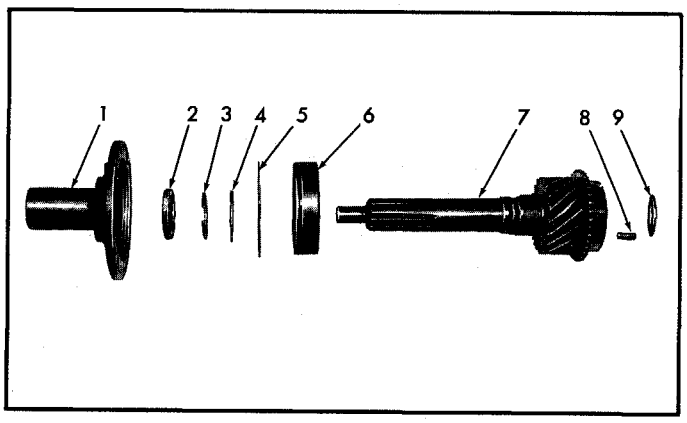


Fig. 19c—Clutch Gear, Bearing, Retainer and Components

1. Retainer
2. Lip Seal
3. Snap Ring
4. Special Washer
5. Snap Ring
6. Clutch Gear Bearing
7. Clutch Gear
8. Mainshaft Pilot Bearings
9. Bearing Spacer

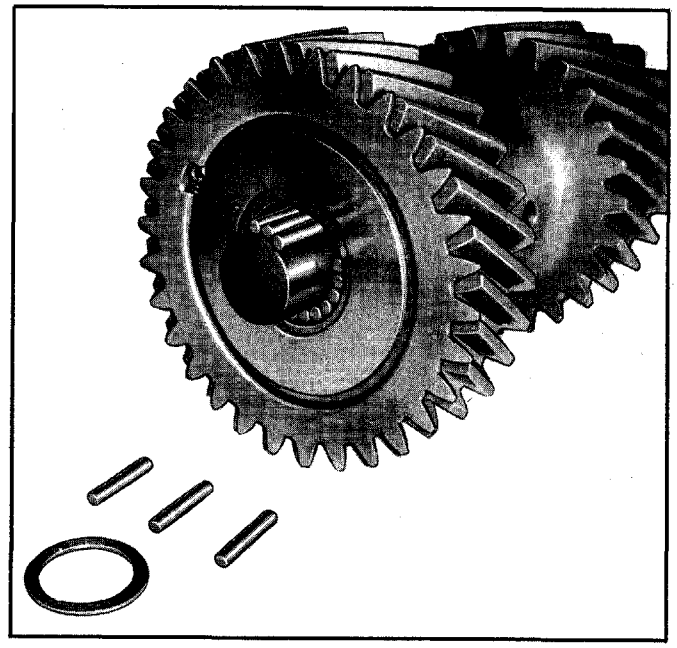


Fig. 20c—Loading Countergear Bearings Using J-21629

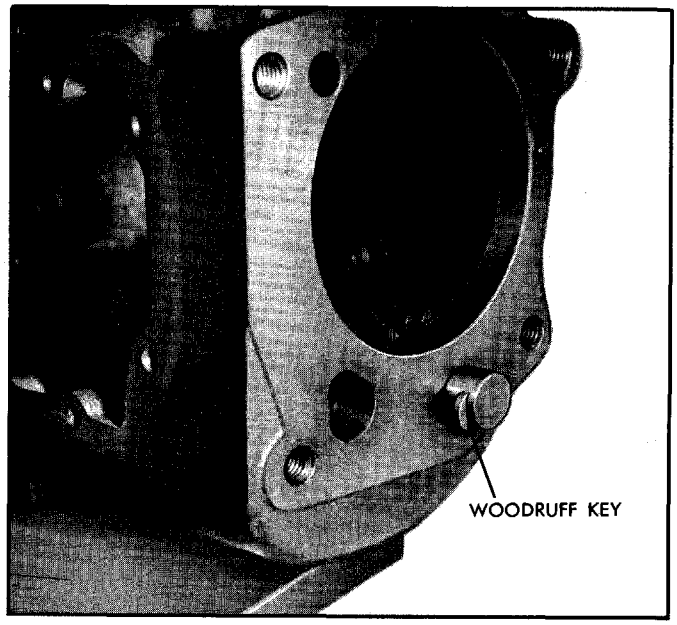


Fig. 21c—Installing Countergear Shaft

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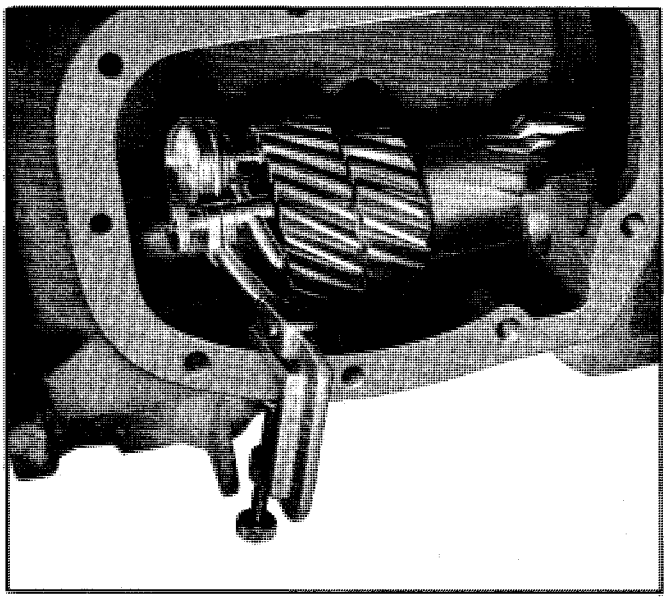


Fig. 22c—Checking Countergear End Play

6. Install the mainshaft assembly from the rear of the case picking up the spacer, pilot bearings and third speed blocker ring (fig. 23C).

   CAUTION: Be sure the clutch gear engages the teeth of the countergear anti-lash plate.

7. Install reverse idler gear shaft and woodruff key.

   CAUTION: Be sure that idler gear shaft picks up both thrust washers during installation.

8. Install extension gasket to rear of case and using snap ring pliers expand the extension to bearing snap ring and install extension over mainshaft and rear bearing. Be sure snap ring has started over the rear bearing, then install and tighten extension to case bolts to specified torque (fig. 5C). Use graphite sealer on the two lower attaching bolts.

   CAUTION: Care should be taken not to damage the extension bearing or oil seal during installation.

9. Tap on front of clutch gear shaft to force rear bearing to extension snap ring to seat in its groove.
10. Using Tool J-5590 drive the clutch gear bearing onto the clutch shaft and into the case (fig. 24C). Install washer and snap ring to input shaft (fig. 6C).

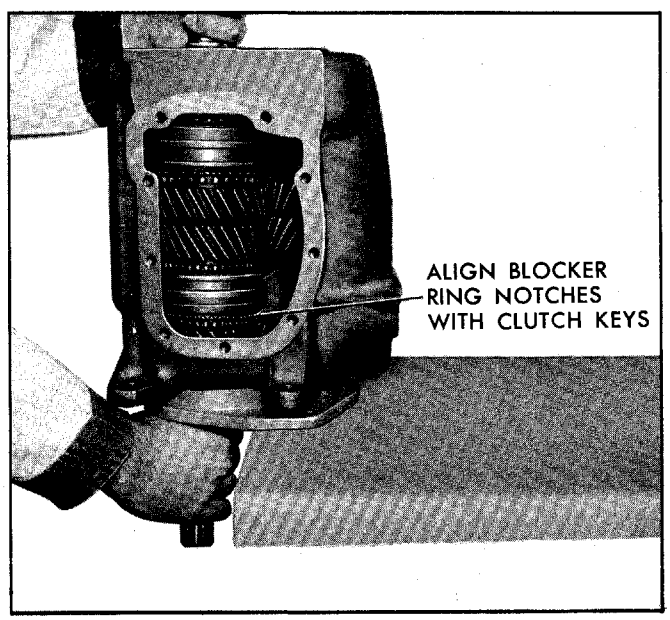


Fig. 23c—Installing Mainshaft Assembly to Case

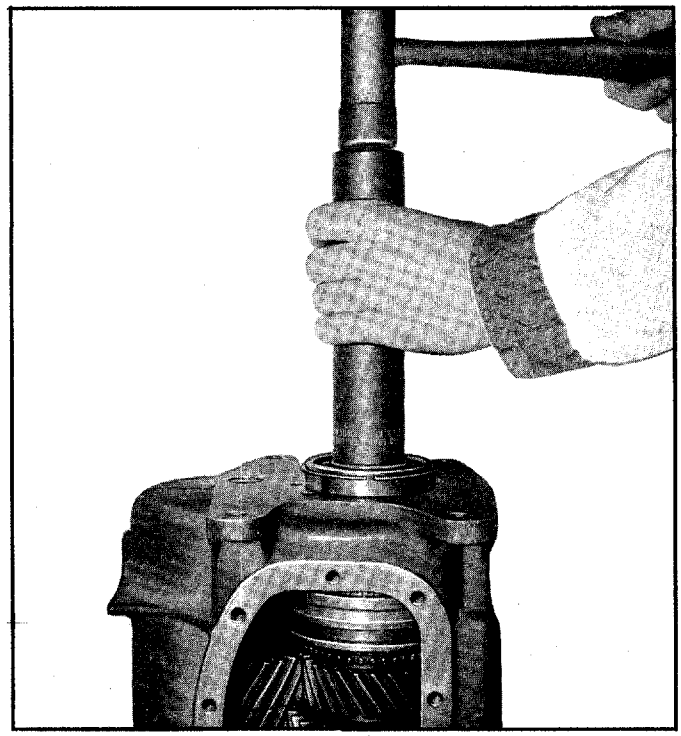


Fig. 24c—Installing Clutch Gear Bearing Using J-5590

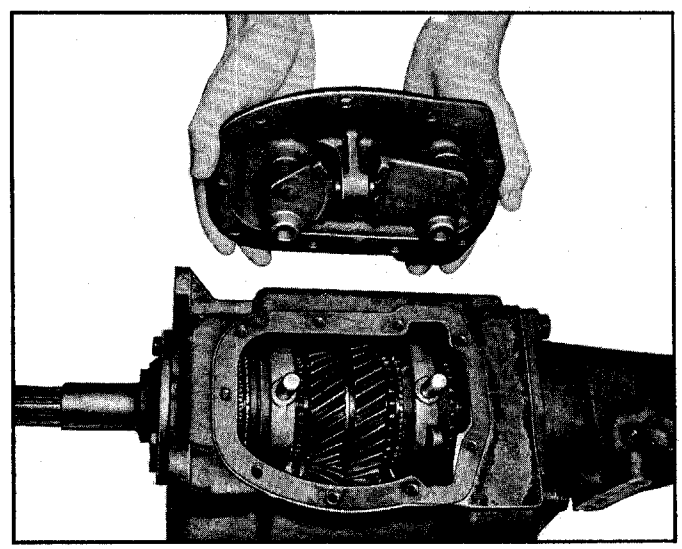


Fig. 25c—Installing Side Cover and Shift Forks

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NOTE: This snap ring is available in five thicknesses. Use thickest snap ring that will assemble with all parts stacked tight endwise.

Install snap ring to outer race of clutch gear bearing. If bearing snap ring groove is partially inside case opening, tap on inside bearing outer race with a long drift used through side cover opening.

NOTE: If mainshaft does not turn freely, check the clutch sliding sleeves for neutral positions and that the blocker rings are free on their gear cone surfaces.

11. Install gaskets and clutch gear bearing retainer and lip seal assembly with oil drain passages at bottom and tighten to specified torque. Use graphite sealer on threads of retainer bolts.

    NOTE: Install two retainer to case gasket (.010" and .015") to replace the one .025" production gasket removed.

12. Install the shift forks to the clutch sleeve grooves with the first and reverse fork "hump" toward bottom (fig. 25C).
13. Install side cover and gasket, torque retaining bolts to specified torque.

    NOTE: The two rear side cover to case retaining bolts have special oil sealing splines and must be used at these two "through" hole locations.

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FOUR SPEED (SAGINAW) FULLY SYNCHRONIZED TRANSMISSION

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TRANSMISSION ASSEMBLY

NOTE: Maintenance and adjustment items along with transmission replacement operations are outlined in the Passenger Service Manual.

Disassembly of Case Components

1. Remove side cover attaching screws and remove side cover assembly and shift forks.
2. Remove clutch gear bearing retainer.
3. Remove clutch gear bearing to gear stem snap ring, then remove clutch gear bearing by pulling outward on clutch gear until a screw driver or other suitable tool can be inserted between bearing large snap ring and case to complete removal. The clutch gear bearing is a slip fit on the gear and into the case bore. (This provides clearance for removal of clutch gear and mainshaft assembly). (Fig. 3X).
4. Remove extension to case attaching bolts.
5. Remove clutch gear, mainshaft and extension assembly together through the rear case opening (fig. 4X).
6. Using snap ring pliers, expand the snap ring in the extension which retains the mainshaft rear bearing (fig. 5X) and remove the extension.
7. Using J-22246 at the front of the countershaft, drive the shaft and its woodruff key out the rear of the case. Tool J-22246 will now hold the roller bearings in position within the countergear bore. Remove the gear and bearings (fig. 6X).
8. Remove reverse idler gear stop ring. Use a long drift or punch through the front bearing case bore and drive the reverse idler shaft and woodruff key through the rear of the case (fig. 7X).

MAINSHAFT

Disassembly

1. Using snap ring pliers, remove the 3rd and 4th speed sliding clutch hub snap ring from mainshaft and remove clutch assembly, third gear blocker ring and third speed gear from front of mainshaft (figs. 8X and 9X).
2. Remove rear bearing snap ring from mainshaft groove (fig. 10X).
3. Support first gear with press plates and press on rear of mainshaft to remove first gear, thrust washer, spring washer, rear bearing, snap ring and finally the speedo drive gear from rear of mainshaft (figs. 11X and 12X).

CAUTION: When pressing rear bearing be careful to center gear, washers, bearings and snap ring on mainshaft before attempting to press off the speedo drive gear.

4. Remove the 1st and second sliding clutch hub snap ring from the mainshaft and remove the clutch assembly, 2nd speed blocker ring and second speed gear from the rear of the mainshaft (figs. 13X and 14X).

This completes the disassembly of the mainshaft.

Cleaning and Inspection

Transmission Case

1. Wash the transmission thoroughly inside and outside with cleaning solvent, then inspect the case for cracks.
2. Check the front and rear faces for burrs, and if present, dress them off with a fine mill file.
3. Check bearing bores in case and, if damaged, replace case.

Front and Rear Bearings

1. Wash the front and rear ball bearings thoroughly in a cleaning solvent.
2. Blow out bearings with compressed air.

CAUTION: Do not allow the bearings to spin, turn them slowly by hand. Spinning bearings will damage the race and balls.

3. Make sure bearings are clean, then lubricate with light engine oil and check them for roughness by slowly turning the race by hand.

Bearing Rollers

All clutch gear and countergear bearing rollers should be inspected closely and replaced if they show wear. Inspect counter shaft and reverse idler shaft at the same time, replace if necessary. Replace all worn washers.

Gears

1. Inspect all gears for excessive wear, chips or cracks and replace any that are worn or damaged.
2. Check both clutch sleeves to see that they slide freely on their hubs.

Reverse Idler Gear Bushings

The bushing used in the idler gear is pressed into the gear and finish bored in place. This insures the positive alignment of the bushing and shaft as well as proper

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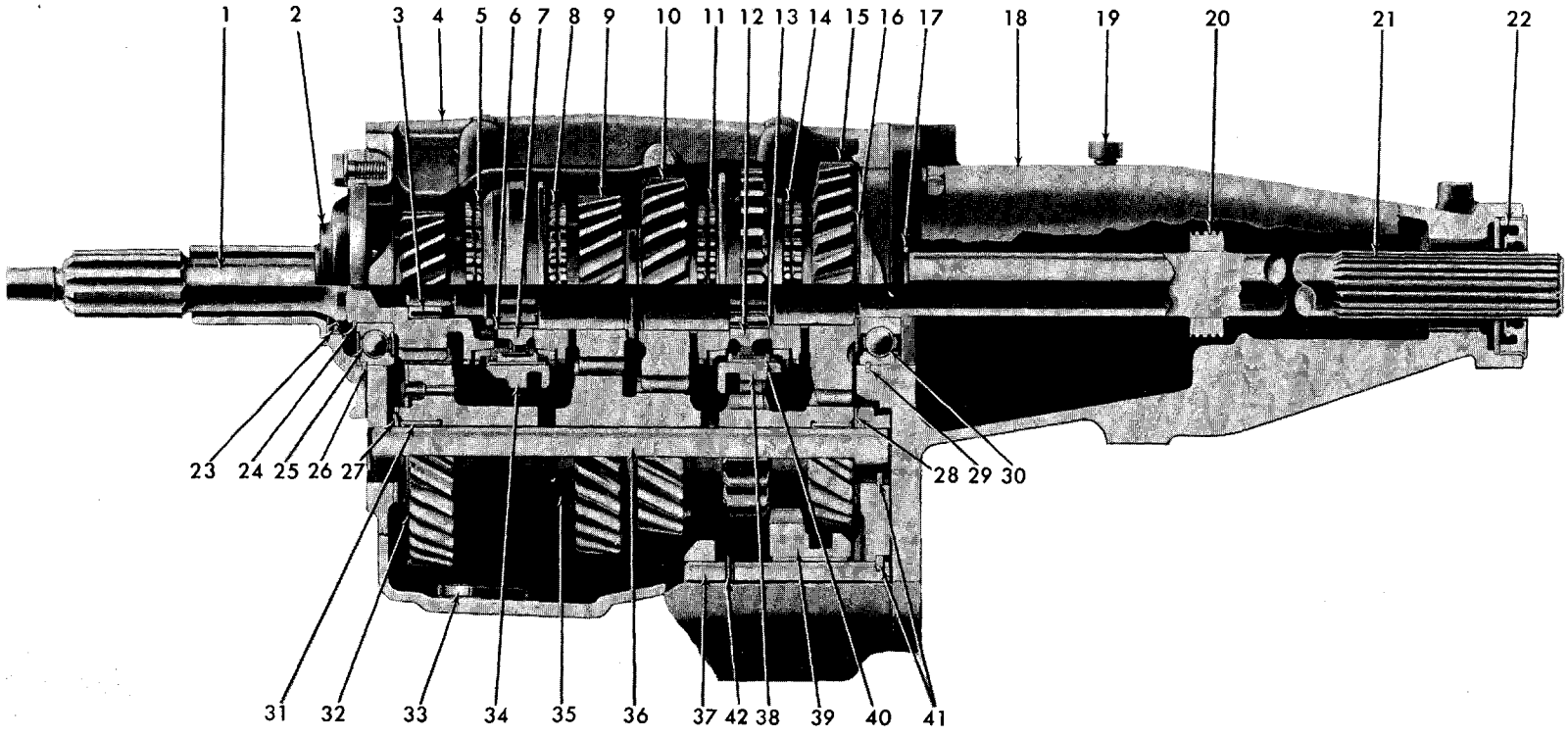


Fig. 1X—4-Speed (Saginaw) Transmission - Cross Section

1. Clutch Gear
2. Bearing Retainer
3. Pilot Bearings
4. Case
5. 4th Speed Blocker Ring
6. 4-3 Synch. Snap Ring
7. 4-3 Synch. Hub
8. 3rd Speed Blocker Ring
9. 3rd Speed Gear
10. 2nd Speed Gear
11. 2nd Speed Blocker Ring
12. 1-2 Speed Synch. Hub
13. 1-2 Speed Synch. Snap Ring
14. 1st Speed Blocker Ring
15. First Gear
16. Reverse Gear Thrust and Spring Washers
17. Snap Ring - Bearing to Mainshaft
18. Extension
19. Vent
20. Speedometer Drive Gear
21. Mainshaft
22. Rear Oil Seal
23. Retainer Oil Seal
24. Snap Ring - Bearing to Gear
25. Clutch Gear Bearing
26. Snap Ring - Bearing to Case
27. Thrust Washer - Front
28. Thrust Washer - Rear
29. Snap Ring - Bearing to Extension
30. Rear Bearing
31. Countergear Roller Bearings
32. Anti-Lash Plate Assembly
33. Magnet
34. 4-3 Synch. Sleeve
35. Countergear Assembly
36. Counter Shaft
37. Reverse Idler Shaft
38. 1-2 Speed Synch. Sleeve and Reverse Gear
39. Reverse Idler Gear (Sliding)
40. Clutch Key
41. Woodruff Key
42. Ring - Reverse Idler Gear Stop

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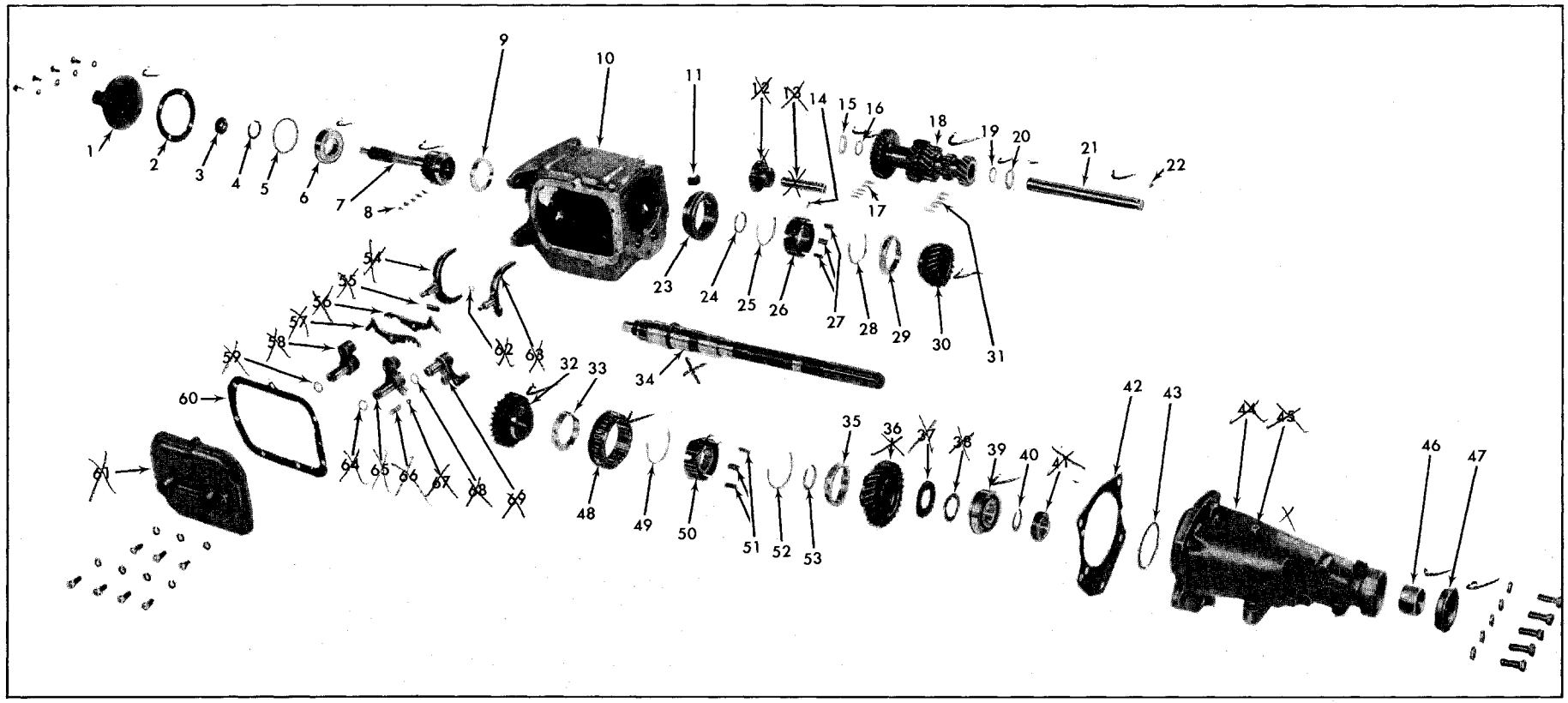


Fig. 2X—4-Speed (Saginaw) - Exploded

1. Bearing Retainer
2. Gasket - Retainer to Case
3. Oil Seal
4. Snap Ring - Bearing to Gear
5. Snap Ring - Bearing to Case
6. Clutch Gear Bearing
7. Clutch Gear
8. Mainshaft Pilot Bearings
9. 4th Speed Blocker Ring
10. Case
11. Filler Plug
12. Reverse Idler Gear
13. Reverse Idler Shaft
14. Woodruff Key
15. Thrust Washer - Front Gear
16. Needle Retainer Washer
17. Needle Bearings
18. Countergear
19. Needle Retainer Washer
20. Thrust Washer - Rear Gear
21. Countershaft
22. Woodruff Key
23. Synchronizer Sleeve
24. Snap Ring - Hub to Shaft
25. Key Retainer
26. 3-4 Synchronizer Hub
27. Clutch Keys
28. Key Retainer
29. 3rd Speed Blocker Ring
30. 3rd Speed Gear
31. Needle Bearings
32. Second Speed Gear
33. 2nd Speed Blocker Ring
34. Mainshaft
35. 1st Speed Blocker Ring
36. First Speed Gear
37. Thrust Washer
38. Wave Washer
39. Rear Bearing
40. Snap Ring - Bearing to Shaft
41. Speedo Drive Gear
42. Gasket - Extension to Case
43. Snap Ring - Extension to Rear Bearing
44. Extension
45. Vent
46. Bushing
47. Oil Seal
48. 1-2 Synchronizer Sleeve & Reverse Gear
49. Key Retainer
50. 1-2 Synchronizer Hub
51. Clutch Keys
52. Key Retainer
53. Snap Ring - Hub to Shaft
54. 3-4 Shift Fork
55. Detent Spring
56. 3-4 Detent Cam
57. 1-2 Detent Cam
58. 3-4 Shifter Shaft
59. "O" Ring
60. Gasket - Cover to Case
61. Cover
62. Detent Cam Retainer
63. 1-2 Shift Fork
64. "O" Ring
65. 1-2 Shifter Shaft
66. Spring
67. Ball
68. "O" Ring
69. Reverse Shifter Shaft & Fork

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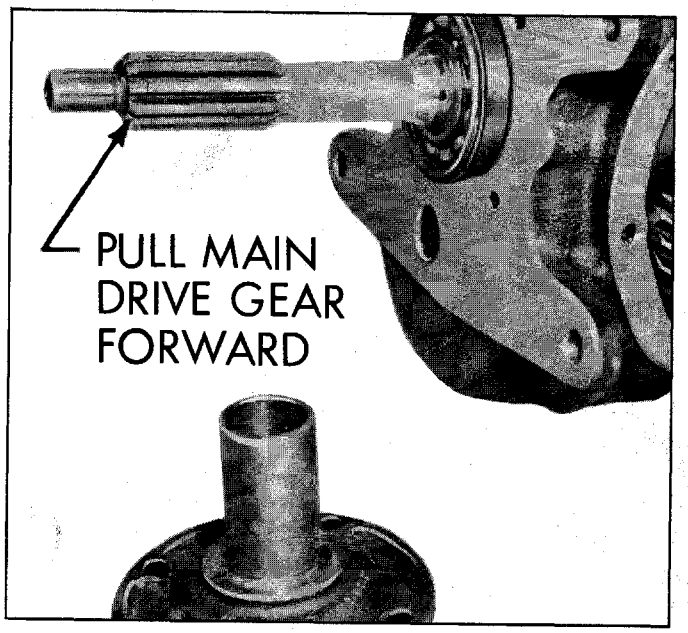


Fig. 3X—Removing Clutch Gear Bearing

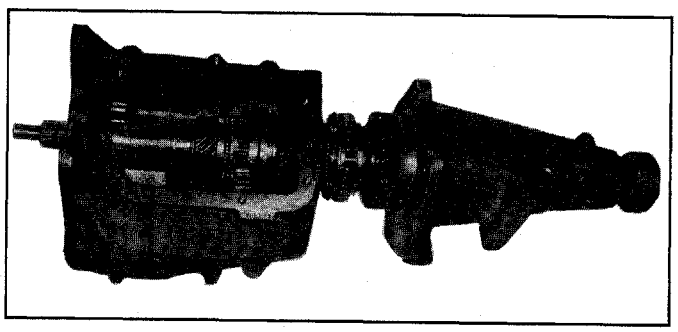


Fig. 4X—Removing Clutch Gear & Mainshaft Assembly

meshing of the gears. Because of the high degree of accuracy to which these parts are machined, the bushing is not serviced separately.

Countergear Anti-Lash Plate

Inspect the plate teeth for wear or other damage. The

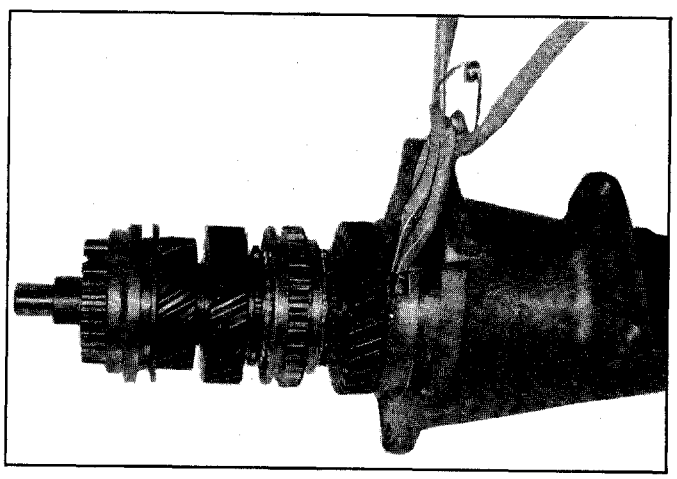


Fig. 5X—Extension to Rear Bearing Snap Ring

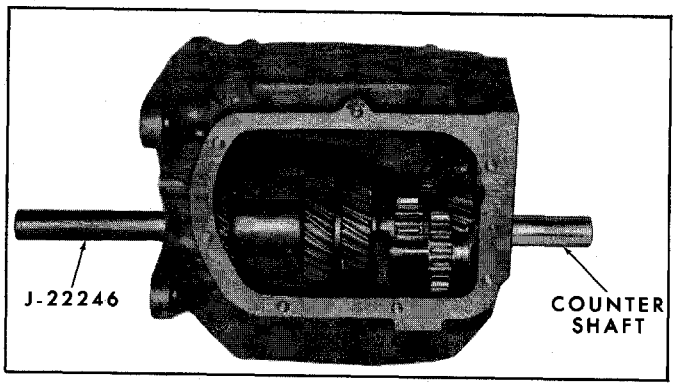


Fig. 6X—Removing Countershaft

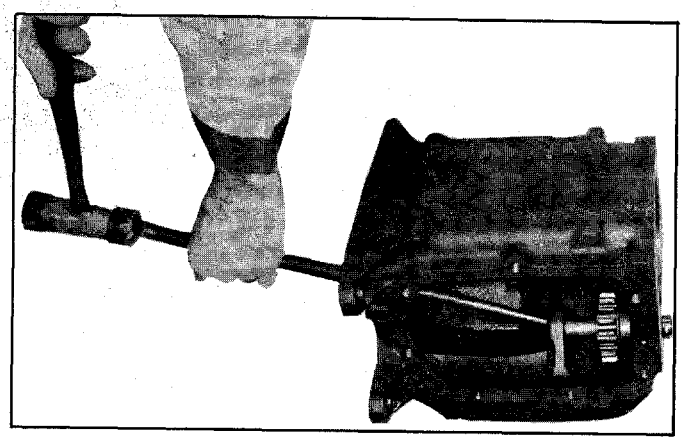


Fig. 7X—Removing Reverse Idler Gear Shaft

plate and two damper springs are retained to the countergear by three rivets. Disassembly is not recommended (fig. 25X).

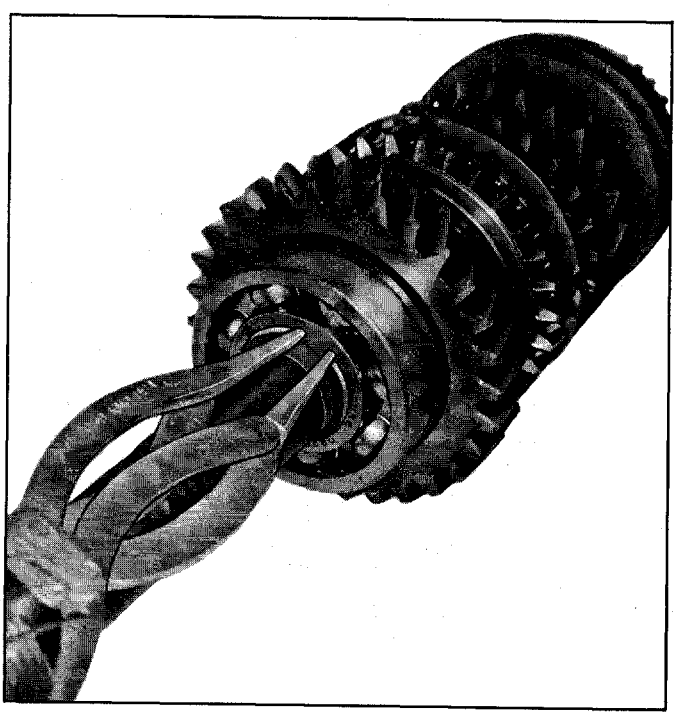


Fig. 8X—Third & Fourth Synchronizer Snap Ring

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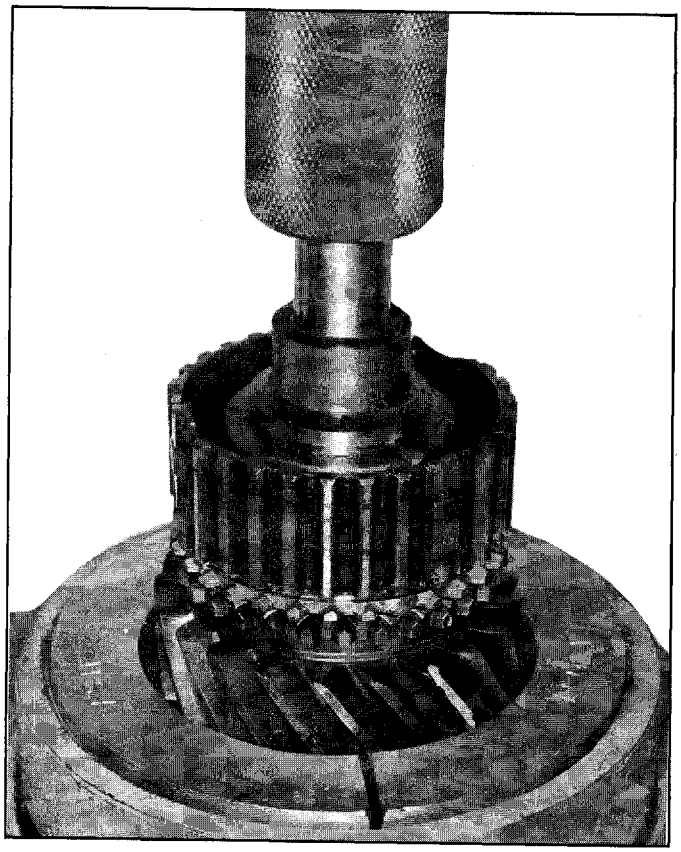


Fig. 9X—Removing 3-4 Synchronizer & Third Speed Gear

Repairs

Clutch Keys and Springs

NOTE: The clutch hubs and sliding sleeves are a selected assembly and should be kept together as originally assembled, but the keys and two springs may be replaced if worn or broken.

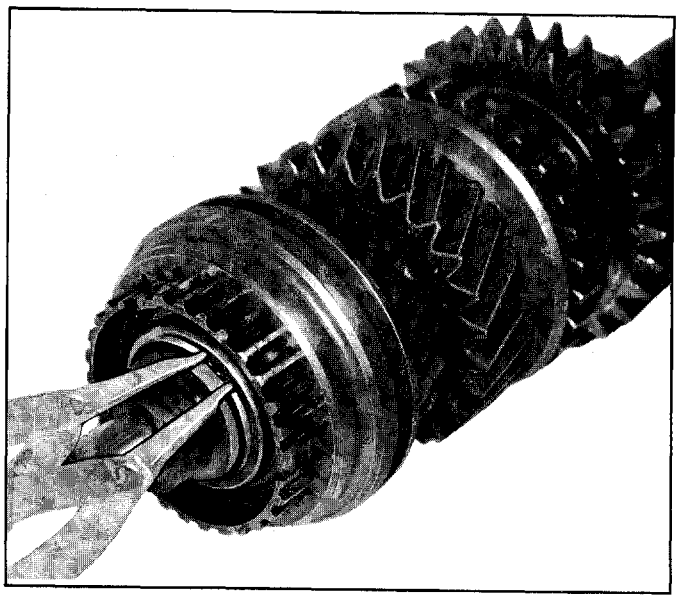


Fig. 10X—Rear Bearing to Mainshaft Snap Ring

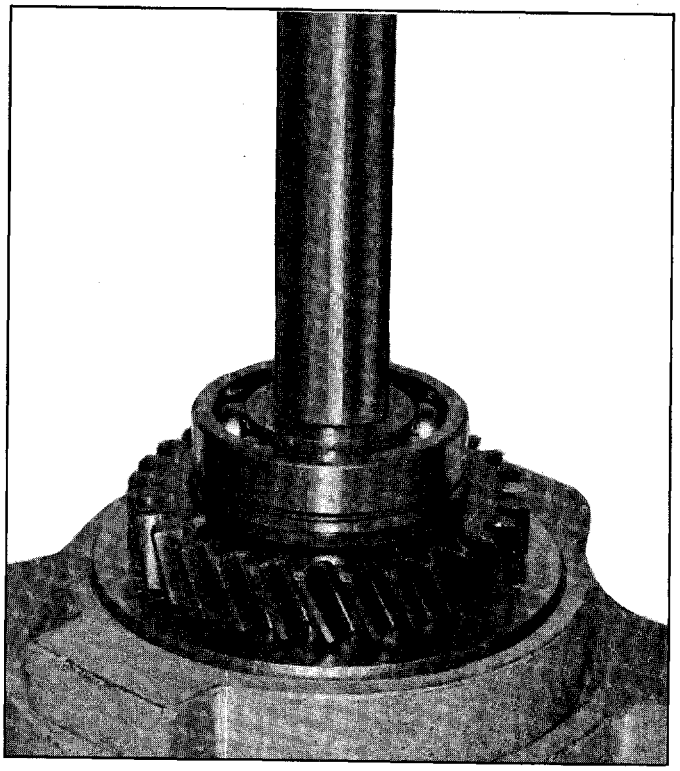


Fig. 11X—Removing Rear Bearing & First Speed Gear

Replacement

1. Mark hub and sleeve so they can be matched upon reassembly.
2. Push the hub from the sliding sleeve, the keys and the springs may be easily removed.
3. Place the three keys and two springs in position (one

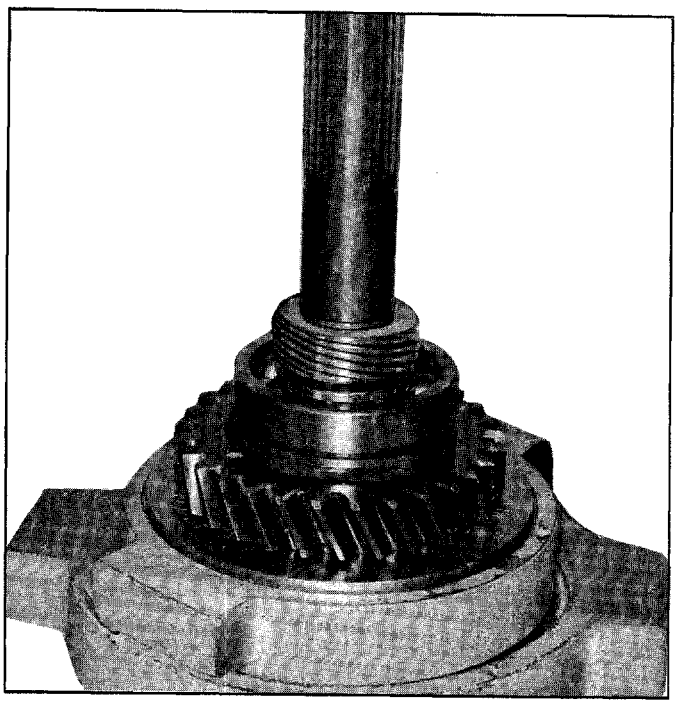


Fig. 12X—Removing Speedo Drive Gear

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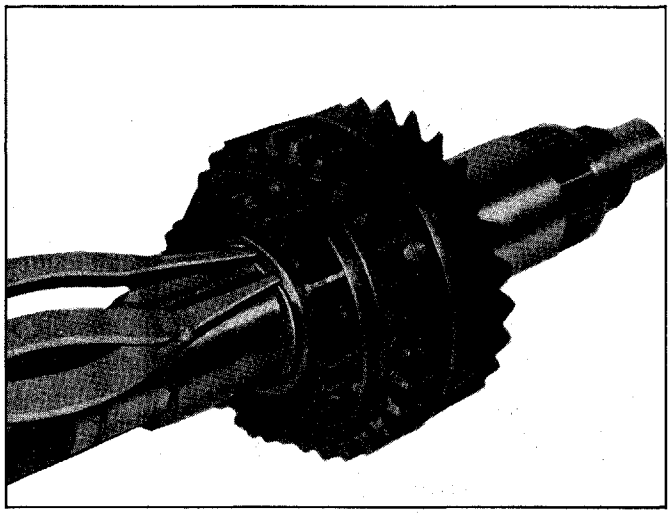


Fig. 13X—First & Second Synchronizer Snap Ring

on each side of hub), so all three keys are engaged by both springs (fig. 15X). The tanged end of each synchronizer spring should be installed into different key cavities on either side. Slide the sleeve onto the hub aligning the marks made before disassembly.

NOTE: A groove around the outside of the synchronizer hub identifies the end that must be opposite the fork slot in the sleeve when assembled. This groove indicates the end of the hub with a .07" greater recess depth.

Extension Oil Seal or Bushing

If bushing in rear of extension requires replacement, remove seal and use Tool J-5778 to drive bushing into extension housing (fig. 16X). Using the same tool, drive new bushing in from the rear. Coat I.D. of bushing and

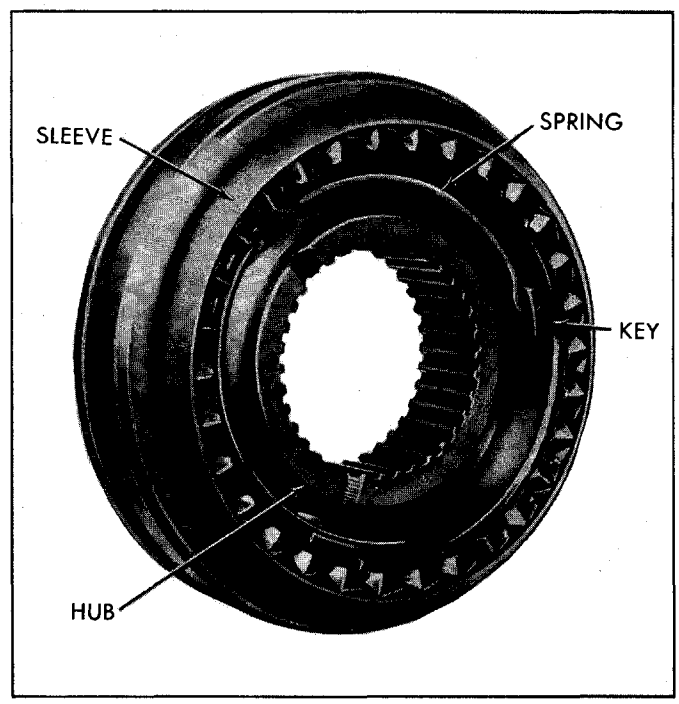


Fig. 15X—Three-Four Synchronizer Assembly

seal with transmission lubricant, then install new oil seal using Tool J-5154 (fig. 17X).

Clutch Bearing Retainer Oil Seal

If the lip seal in the retainer needs replacement; pry the old seal out and replace with a new seal using a flat plate or similar tool, until seal seats in its bore (figs. 18X and 19X).

NOTE: Lip of seal must face rear of bearing retainer.

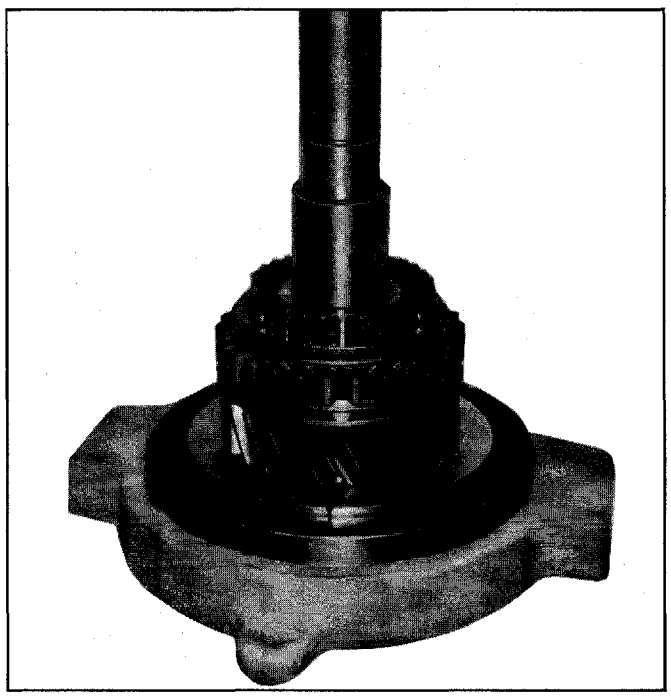


Fig. 14X—Removing 1-2 Synchronizer & Second Speed Gear

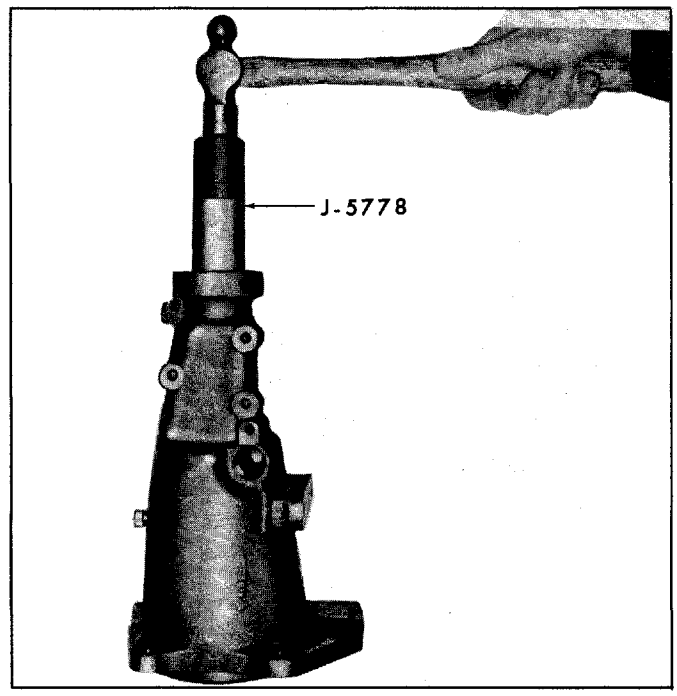


Fig. 16X—Extension Bushing Replacement

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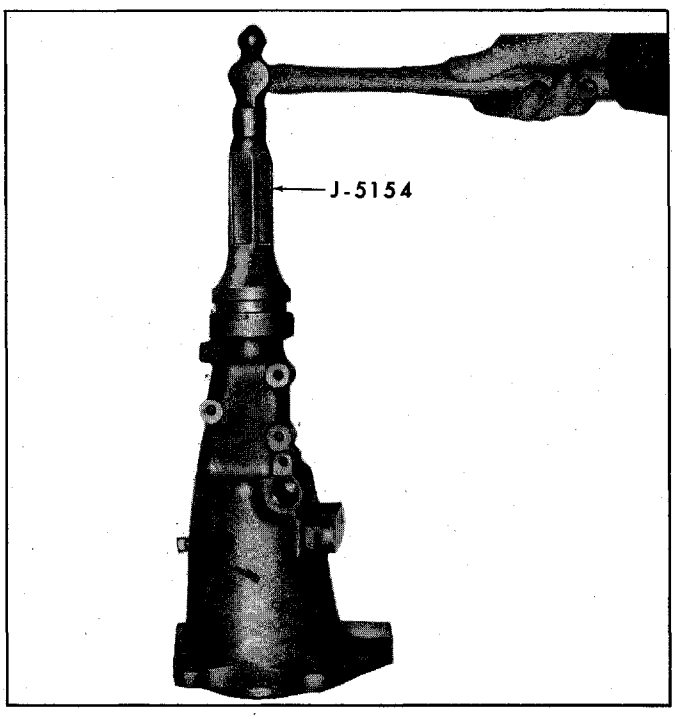


Fig. 17X—Installing Extension Oil Seal

MAINSHAFT

Assembly (Fig. 20X)

Turn the front of the mainshaft upward. Install the following components on the mainshaft:

1. Install the third speed gear with clutching teeth upward; the rear face of the gear will butt against the flange on the mainshaft.
2. Install a blocking ring with clutching teeth downward over the synchronizing surface of the third speed gear. All four blocker rings used in this transmission are identical.

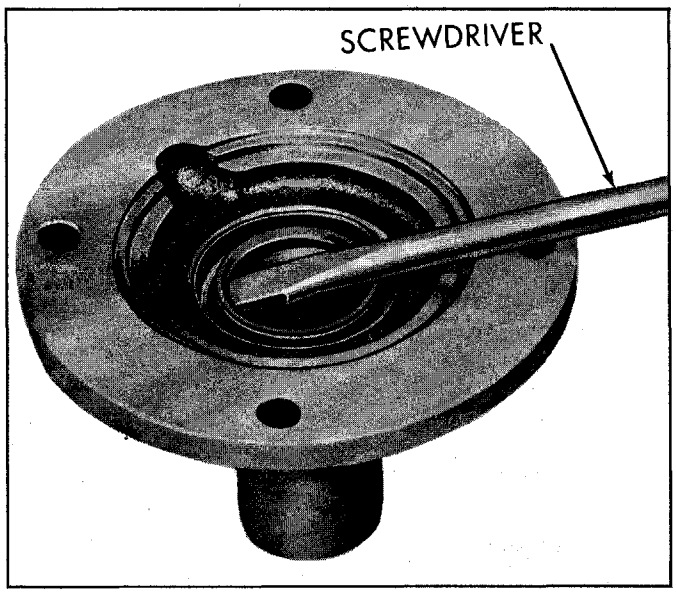


Fig. 18X—Removing Bearing Retainer Oil Seal

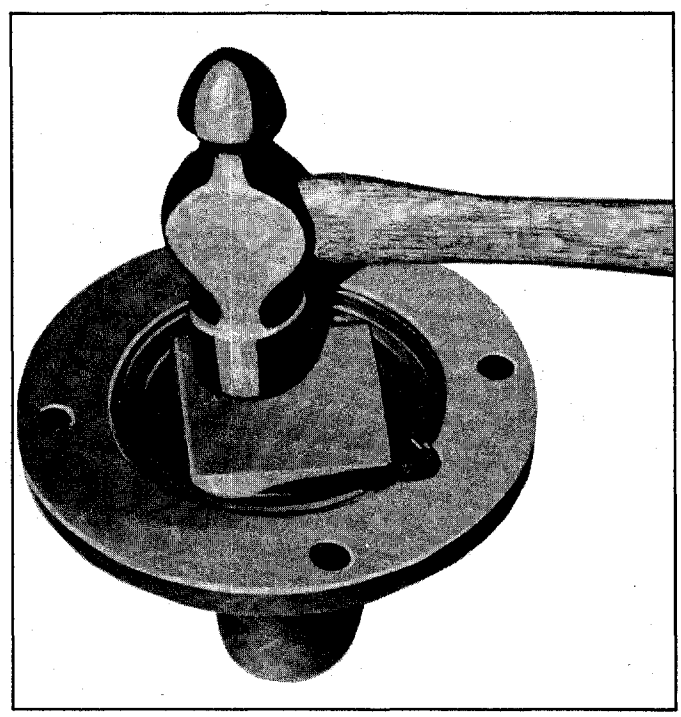


Fig. 19X—Installing Bearing Retainer Oil Seal

3. Install the 3rd and 4th synchronizer assembly with the fork slot downward; press it onto splines on the mainshaft until it bottoms out (fig. 21X).

   CAUTION: Be sure the notches of the blocker ring align with the keys of the synchronizer assembly.

4. Install synchronizer hub to mainshaft snap ring (fig. 8X). Both synchronizer snap rings are identical.

Turn the rear of the mainshaft upward. Install the following components on the mainshaft:

5. Install the second speed gear with clutching teeth upward; the front face of the gear will butt against the flange on the mainshaft.

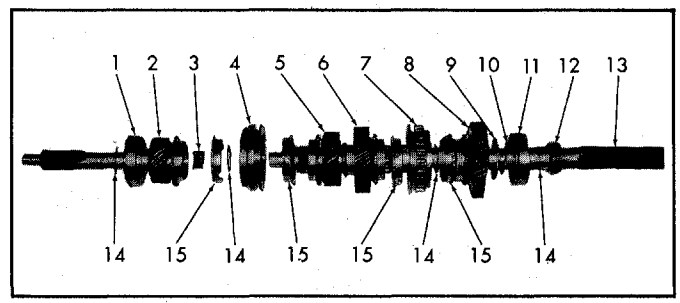


Fig. 20X—Clutch Gear & Mainshaft Details

1. Clutch Gear Bearing
2. Clutch Gear
3. Mainshaft Pilot Bearings
4. 3-4 Synchronizer Assembly
5. Third Speed Gear
6. Second Speed Gear
7. 1-2 Synchronizer & Reverse Gear Assy.
8. First Speed Gear
9. Thrust Washer
10. Spring Washer
11. Rear Bearing
12. Speedo Drive Gear
13. Mainshaft
14. Snap Ring
15. Synchronizing "Blocker" Ring

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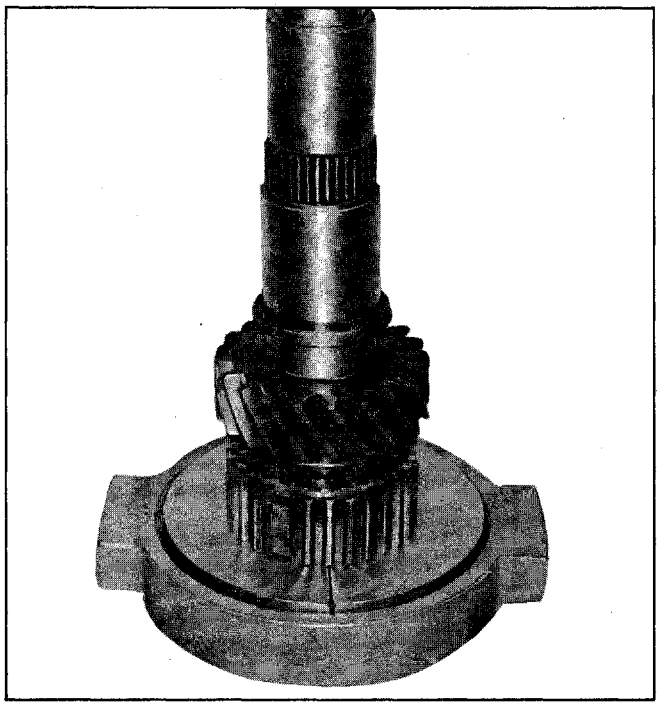


Fig. 21X—Installing 3-4 Synchronizer & Third Gear

6. Install a blocker ring with clutching teeth downward over synchronizing surface of the second speed gear.
7. Install the first and second synchronizer assembly with fork slot downward; press it onto splines on the mainshaft (fig. 22X).

CAUTION: Be sure the notches of the blocker ring align with the keys of the synchronizer assembly.

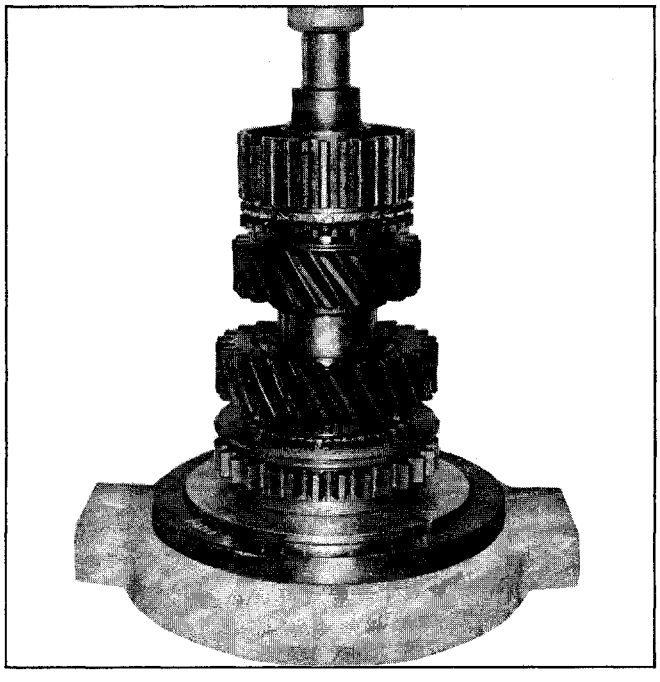


Fig. 22X—Installing 1-2 Synchronizer & Second Speed Gear

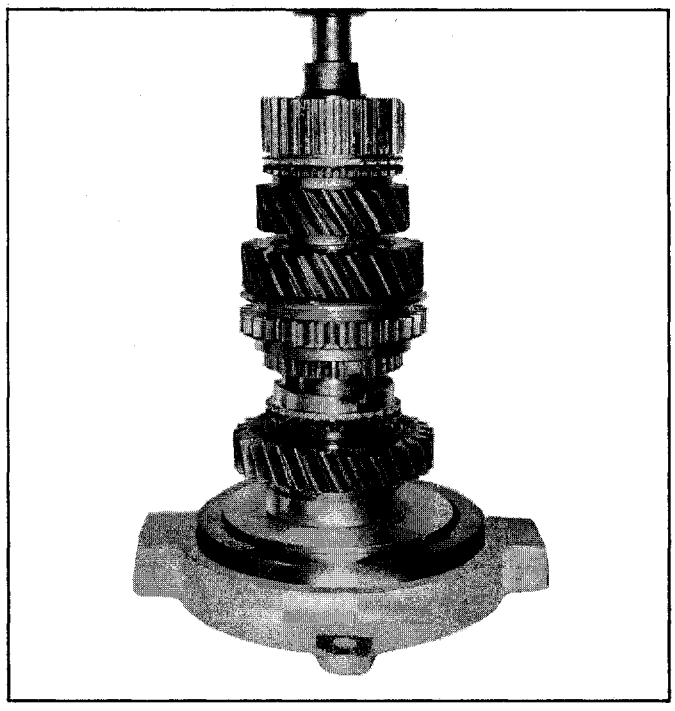


Fig. 23X—Installing Rear Bearing

8. Install synchronizer hub to mainshaft snap ring (fig. 13X).
9. Install a blocker ring with notches downward so they align with the keys of the 1-2 synchronizer assembly.
10. Install first gear with clutching teeth downward.
11. Install first gear thrust washer (steel).
12. Install first gear spring washer.
13. Install rear ball bearing with snap ring slot downward; press onto mainshaft (fig. 23X).

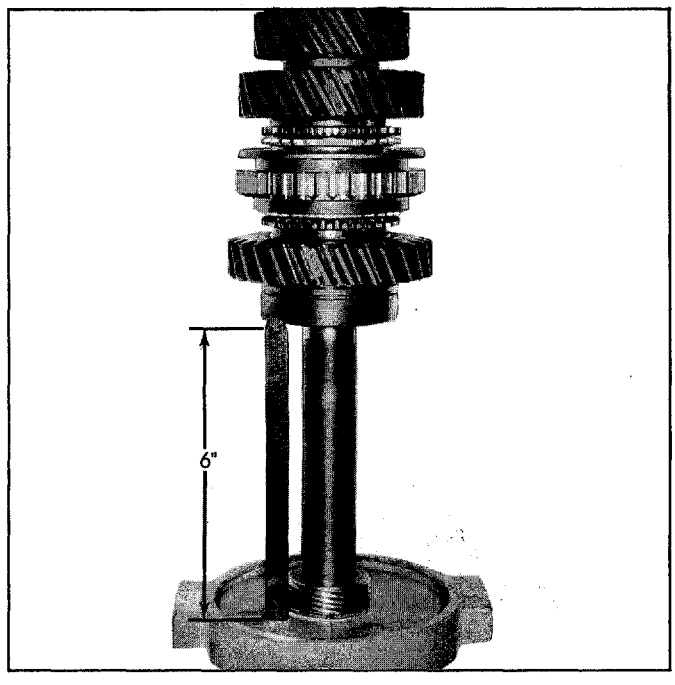


Fig. 24X—Installing Speedometer Drive Gear

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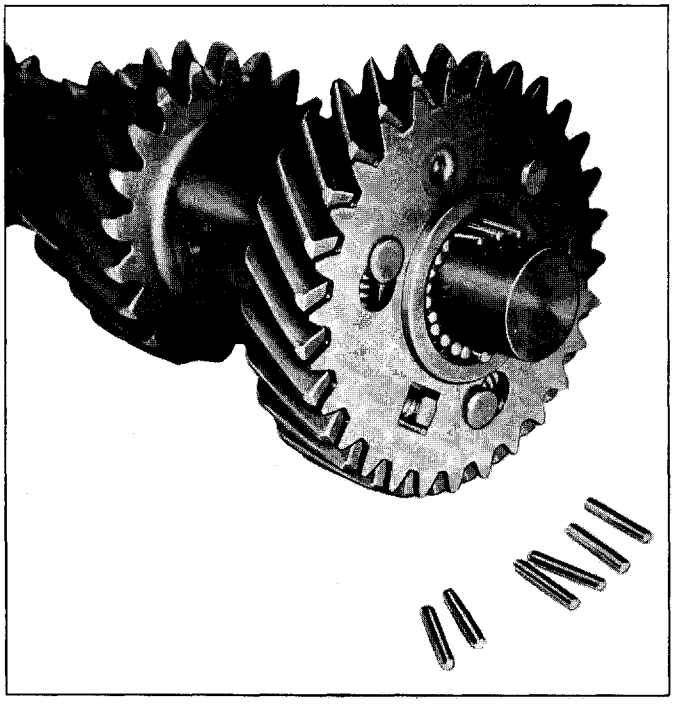


Fig. 25X—Loading Countergear Bearings

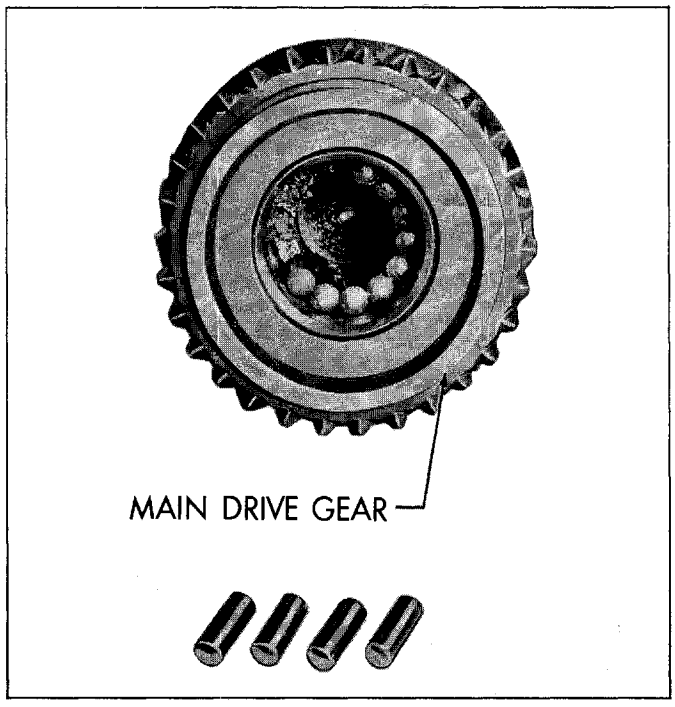


Fig. 26X—Loading Mainshaft Pilot Bearings

14. Install rear bearing to mainshaft snap ring (fig. 10X).
15. Install speedometer drive gear. Press on the mainshaft until the upper face of the gear is 6 inches above upper face of rear bearing (fig. 24X).

This completes the assembly of the mainshaft.

TRANSMISSION ASSEMBLY

Assembly of Case Components

1. Using Tool J-22246 load a row of roller bearings (27) and a bearing thrust washer at each end of the countergear. Use heavy grease to hold them in place (fig. 25X).
2. Place countergear assembly through case rear opening along with a tanged thrust washer (tang away from gear) at each end and install countergear shaft and woodruff key from rear of case.

   CAUTION: Be sure countershaft picks up both thrust washers and that the tangs are aligned with their notches in the case.

3. Install reverse idler gear and shaft with its woodruff key from the rear of case.
4. Using snap ring pliers, expand the snap ring in the extension and assembly extension over rear of mainshaft and onto rear bearing. Seat snap ring in rear bearing groove (fig. 5X).
5. Load the mainshaft pilot bearings (14) into the clutch gear cavity and assemble the 4th speed blocker ring onto the clutch gear clutching surface with its clutching teeth toward the gear (fig. 26X).
6. Pilot the clutch gear, pilot bearings and 4th speed blocker ring assembly over the front of the mainshaft assembly. Do not assemble bearing to gear yet.

   CAUTION: Be sure the notches in the blocker ring align with the keys in the 3-4 synchronizer assembly.

7. Place extension to case gasket at rear of case holding in place with grease and, from the rear of case, assemble the clutch gear, mainshaft and extension to case as an assembly.
8. Install extension to case retaining bolts. Use sealing cement on bottom bolt only.
9. Install front bearing outer snap ring to bearing and position bearing over stem of clutch gear and into front case bore.
10. Install snap ring to clutch gear stem, and clutch gear bearing retainer and gasket to case.

    NOTE: The retainer oil return hole should be at the bottom.

11. Shift synchronizer sleeves to neutral positions and install cover, gasket and fork assembly to case. Be sure forks align with their synchronizer sleeve grooves.
12. Tighten all bolts to specified torque.

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FOUR-SPEED TRANSMISSION (MUNCIE)

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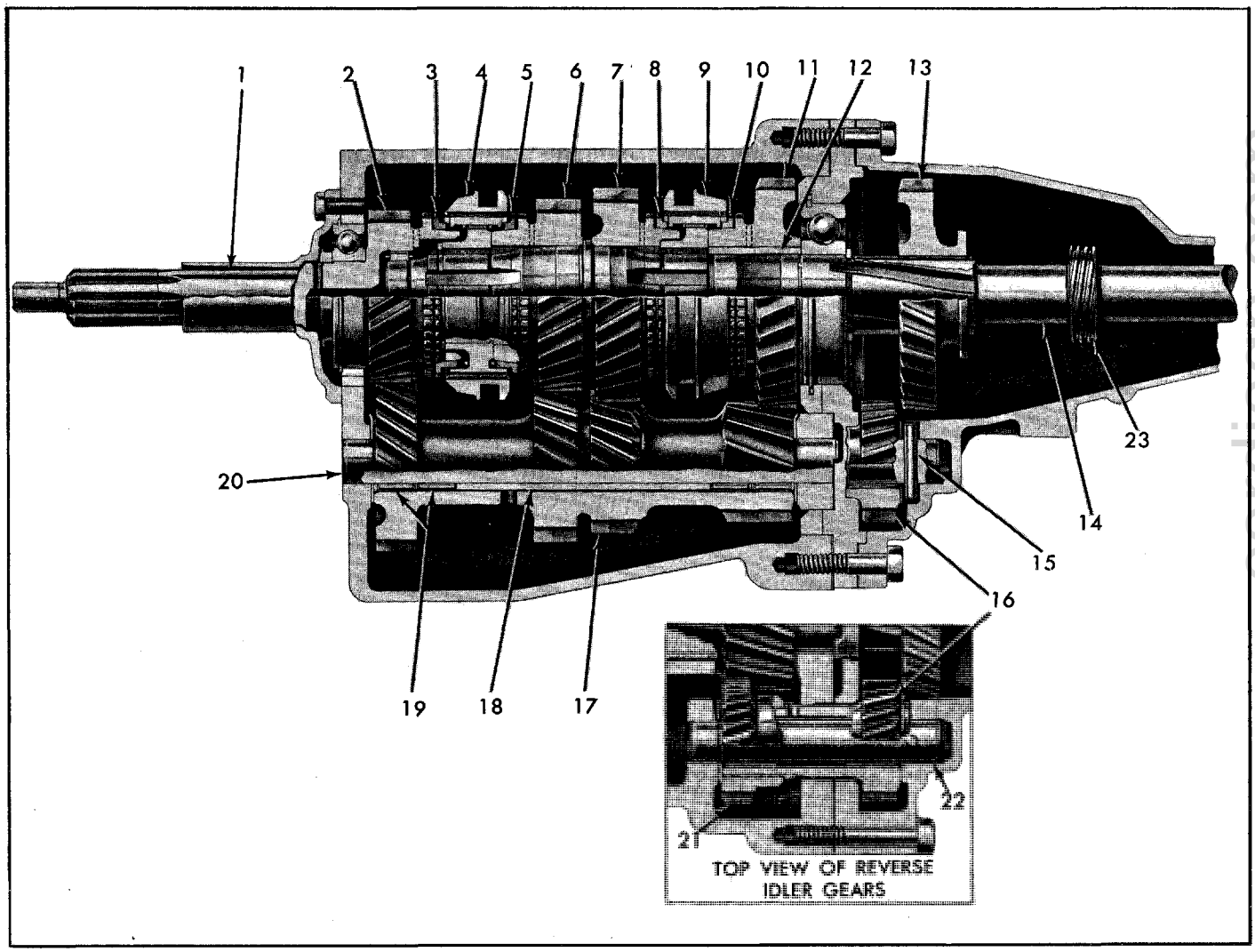


Fig. 1M—Four-Speed Transmission Cross Section (Close Ratio Shown)

1. Bearing Retainer
2. Main Drive Gear
3. Fourth Speed Synchronizing Ring
4. Third and Fourth Speed Clutch Assembly
5. Third Speed Synchronizing Ring
6. Third Speed Gear
7. Second Speed Gear
8. Second Speed Synchronizing Ring
9. First and Second Speed Clutch Assembly
10. First Speed Synchronizing Ring
11. First Speed Gear
12. First Speed Gear Sleeve
13. Reverse Gear
14. Mainshaft
15. Reverse Idler Shaft Roll Pin
16. Reverse Idler Gear (Rear)
17. Countergear
18. Countershaft Bearing Roller Spacer
19. Countershaft Bearing Roller
20. Countershaft
21. Reverse Idler Gear (Front)
22. Reverse Idler Shaft
23. Speedo Drive Gear

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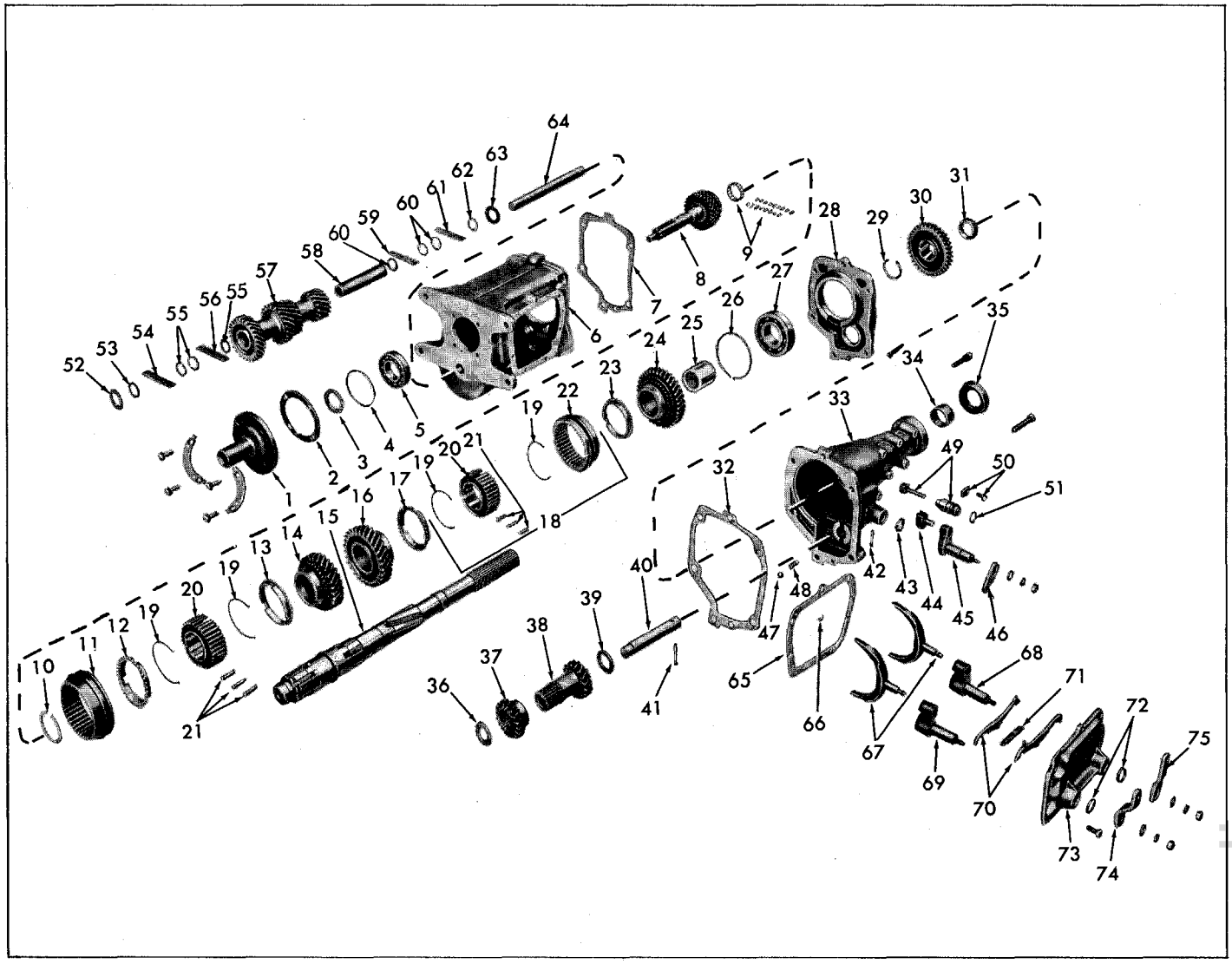


Fig. 2M—Four-Speed Transmission—Exploded View (Close Ratio Shown)

1. Bearing Retainer
2. Gasket
3. Bearing Retaining Nut
4. Bearing Snap Ring
5. Main Drive Gear Bearing
6. Transmission Case
7. Rear Bearing Retainer Gasket
8. Main Drive Gear
9. Bearing Rollers (17) and Cage
10. Snap Ring
11. Third and Fourth Speed Clutch Sliding Sleeve
12. Fourth Speed Gear Synchronizing Ring
13. Third Speed Synchronizing Ring
14. Third Speed Gear
15. Mainshaft
16. Second Speed Gear
17. Second Speed Gear Synchronizing Ring
18. First and Second Speed Clutch Assembly
19. Clutch Key Spring
20. Clutch Hub
21. Clutch Keys
22. First and Second Speed Clutch Sliding Sleeve
23. First Speed Gear Synchronizing Ring
24. First Speed Gear
25. First Speed Gear Sleeve
26. Rear Bearing Snap Ring
27. Rear Bearing
28. Rear Bearing Retainer
29. Selective Fit Snap Ring
30. Reverse Gear**
31. Speedometer Drive Gear
32. Rear Bearing Retainer to Case Extension-Gasket
33. Case Extension
34. Extension Bushing
35. Rear Oil Seal
36. Reverse Idler Front Thrust Washer (Tanged)
37. Reverse Idler Gear (Front)
38. Reverse Idler Gear (Rear)
39. Flat Thrust Washer
40. Reverse Idler Shaft
41. Reverse Idler Shaft Roll Pin
42. Reverse Shifter Shaft Lock Pin
43. Reverse Shifter Shaft Lip Seal
44. Reverse Shift Fork
45. Reverse Shifter Shaft and Detent Plate
46. Reverse Shifter Lever
47. Reverse Shifter Shaft Detent Ball
48. Reverse Shifter Shaft Ball Detent Spring
49. Speedometer Driven Gear and Fitting
50. Retainer and Bolt
51. "O" Ring Seal
52. Tanged Washer
53. Spacer
54. Bearing Rollers (28)
55. Spacer
56. Bearing Rollers (28)
57. Countergear*
58. Countergear Roller Spacer (New Seam Type)
59. Bearing Rollers (28)
60. Spacer
61. Bearing Rollers (28)
62. Spacer
63. Tanged Washer
64. Countershaft
65. Gasket
66. Detent Cams Retainer Ring
67. Forward Speed Shift Forks
68. First and Second Speed Gear Shifter Shaft and Detent Plate
69. Third and Fourth Speed Gear Shifter Shaft and Detent Plate
70. Detent Cams
71. Detent Cam Spring
72. Lip Seals
73. Transmission Side Cover
74. Third and Fourth Speed Shifter Lever
75. First and Second Speed Shifter Lever

*2.52:1 Ratio Models incorporate an anti-lash Plate Assembly
**2.52:1 Ratio Models incorporate 2 anti-lash springs on Reverse Gear Spline.

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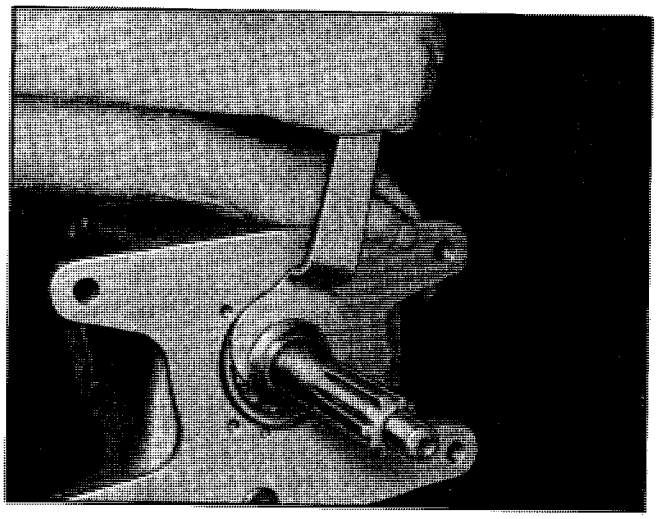


Fig. 3M—Removing Main Drive Gear Retaining Nut

TRANSMISSION

Disassembly

1. Remove transmission side cover as outlined under "Maintenance and Adjustments," Section 7 of the Service Manual.
2. Remove four bolts and (2) bolt lock strips from front bearing retainer and remove retainer and gasket.
3. Remove the main drive gear retaining nut (fig. 3M) using Tool J-0933, after locking up transmission by shifting into two gears.
4. With transmission gears in neutral, drive lock pin from reverse shifter lever boss, as shown in Figure 4M, and pull shifter shaft out about 1/8". This disengages the reverse shift fork from reverse gear.
5. Remove six bolts attaching the case extension to the case. Tap extension with soft hammer in a rearward direction to start. When the reverse idler shaft is out as far as it will go, move extension to left so reverse fork clears reverse gear and remove extension and gasket.
6. The rear reverse idler gear, flat thrust washer, shaft and roll spring pin may now be removed.

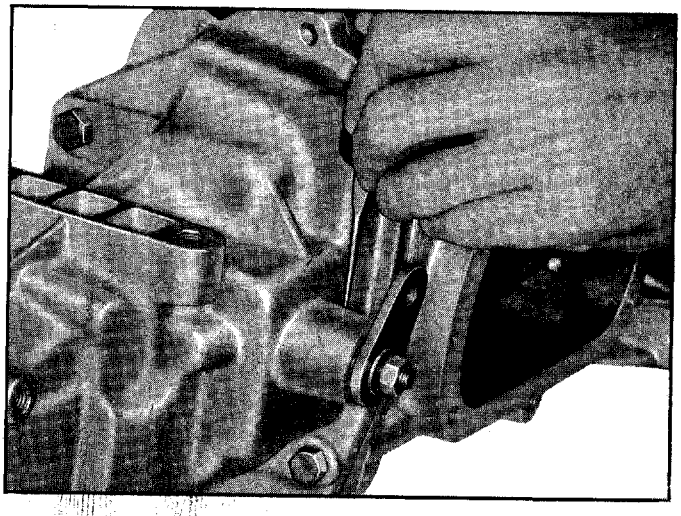


Fig. 4M—Removing Reverse Shifter Shaft Lock Pin

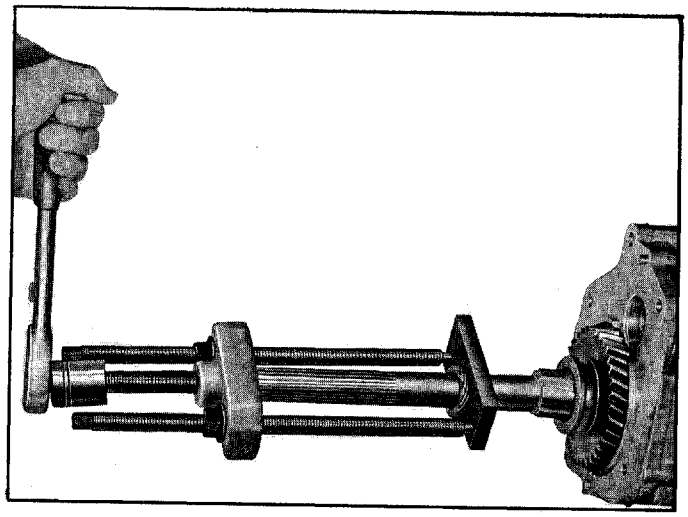


Fig. 5M—Removing Speedometer Gear with J-5814

7. Remove speedometer gear and reverse gear. The speedometer gear may be removed using Tool J-5814 as shown in Figure 5M.

   NOTE: Slide 3-4 synchronizer clutch sleeve to 4th speed gear position (forward) before trying to remove mainshaft assembly from case (fig. 6M).

8. Carefully remove the rear bearing retainer and entire mainshaft assembly from the case by tapping bearing retainer with a soft hammer.
9. Unload bearing rollers from main drive gear and remove fourth speed synchronizer blocker ring.
10. Lift the front half of reverse idler gear and its tanged thrust washer from case.
11. Press main drive gear down from front bearing (fig. 7M).
12. From inside case, tap out front bearing and snap ring.
13. From the front of the case, press out the countershaft (fig. 8M) using Tool J-22246; then remove the countergear and both tanged washers.

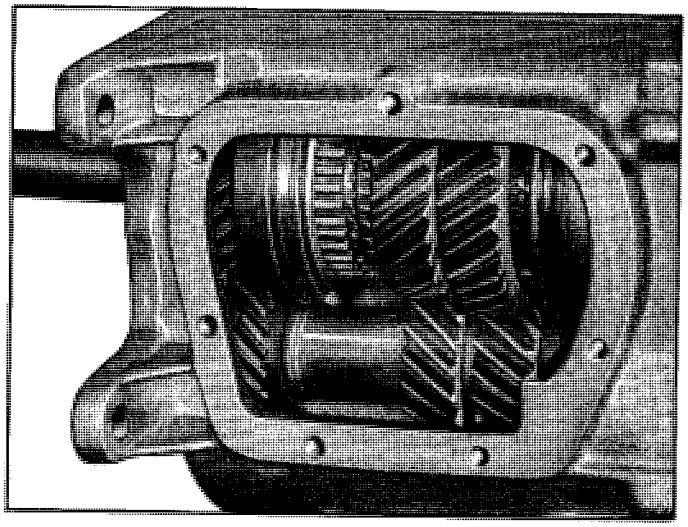


Fig. 6M—Third and Fourth Speed Synchronizer Clutch Sleeve in Fourth Gear Position

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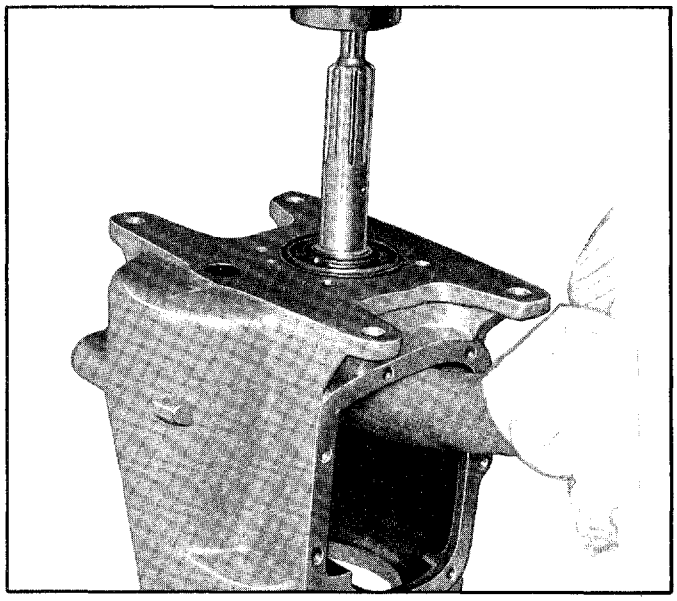


Fig. 7M—Removing Main Drive Gear

14. Remove the 112 rollers, four .050" spacers and roller spacer from countergear.
15. Remove mainshaft front snap ring as shown in Figure 9M and slide third and fourth speed clutch assembly, third speed gear and synchronizing ring from front of mainshaft.
16. Spread rear bearing retainer snap ring and press mainshaft out of the retainer (fig. 10M).
17. Remove the mainshaft rear snap ring. Support second speed gear and press on rear of mainshaft to remove rear bearing, 1st speed gear and sleeve, 1st speed synchronizing ring, 1-2 speed synchronizer clutch assembly, 2nd speed synchronizer ring and second speed gear.

Cleaning and Inspection

Transmission Case

Wash the transmission case inside and out, with a cleaning solvent and inspect for cracks.

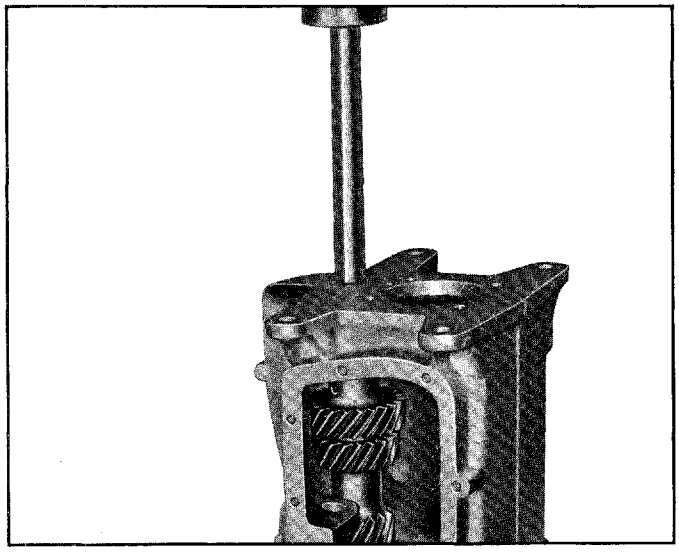


Fig. 8M—Removing Countershaft with J-22246

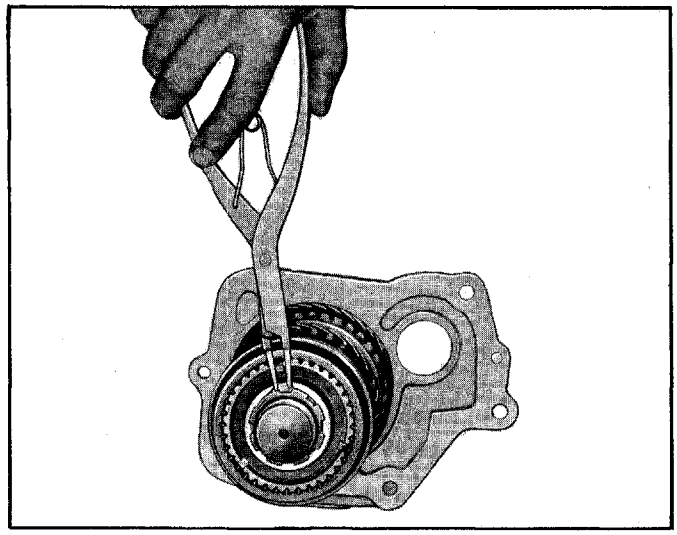


Fig. 9M—Removing Mainshaft Front Snap Ring

Inspect the front face which fits against clutch housing for burrs and if any are present, dress them off with a fine cut mill file.

Front and Rear Bearings

1. Wash the front and rear bearings thoroughly in a cleaning solvent.
2. Blow out bearings with compressed air.

   CAUTION: Do not allow the bearings to spin, but turn them slowly by hand. Spinning bearings will damage the race and balls.

3. Make sure bearings are clean, then lubricate them with light engine oil and check them for roughness. Roughness may be determined by slowly turning the outer race by hand.

Bearing Rollers and Spacers

All main drive gear and countergear bearing rollers should be inspected closely and replaced if they show wear. Inspect countershaft at the same time and replace if necessary. Replace all worn spacers.

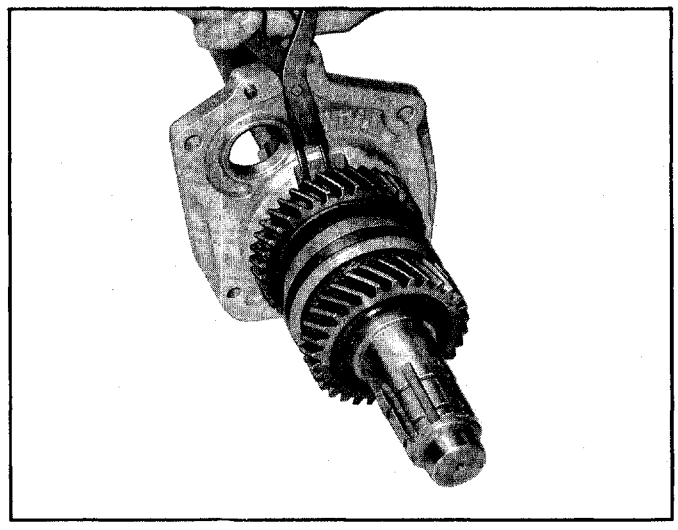


Fig. 10M—Removing Rear Bearing Retainer

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Gears

Inspect all gears and replace all that are worn or damaged.

Reverse Idler

1. The bushings used in the idler gear are pressed into the gear then peened into holes in the bores, and are bored in place. This insures the positive alignment of the bushings and their shafts, as well as proper meshing of the gears. Because of the high degree of accuracy to which these parts are machined, the bushings are not serviced separately.
2. Check bushings for excessive wear by using a narrow feeler gauge between the shaft and the bushing or use a micrometer. The proper clearance is from .003" to .005".

Repairs

Reverse Shifter Shaft and Seal Replacement

1. With case extension removed from transmission the reverse shifter shaft lock pin will already be removed. (See Step 4 under Disassembly.)
2. Remove shift fork.
3. Carefully drive shifter shaft into case extension, allowing ball detent to drop into case. Remove shaft and ball detent spring.
4. Place ball detent spring into detent spring hole and from inside extension install shifter shaft fully into its opening until the detent plate is butted against inside of extension housing.
5. Place detent ball on spring (fig. 11M) and, holding ball down with your thumb or a suitable tool push the shifter shaft back in away from case until it is directly over the ball and turn until the ball drops into detent on the shaft detent plate.
6. Install shift fork.

NOTE: Do not drive the shifter shaft lock pin into place until the extension has been installed on the transmission case.

Extension Oil Seal or Bushing

If bushing in rear of extension requires replacement, remove oil seal and use Tool J-5778 to drive bushing into case extension. Using the same tool, drive new bushing in from the rear. Coat I.D. of bushing with transmission lubricant, then install new oil seal using Tool J-5154. Prelubricate seal between lips with cup grease.

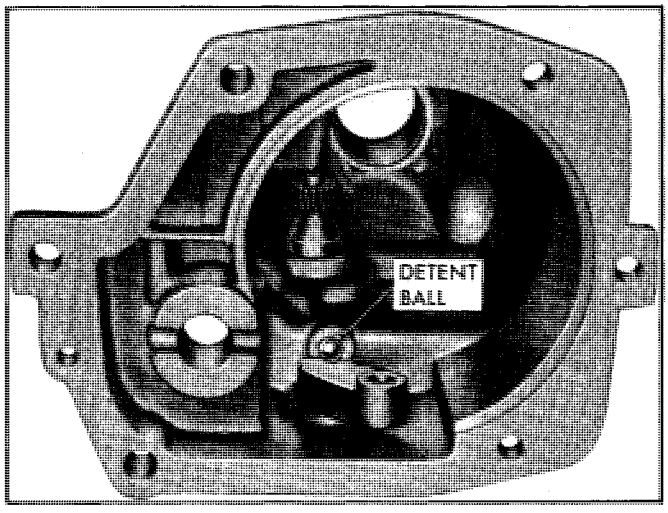


Fig. 11M—Installing Reverse Shifter Shaft and Detent Ball

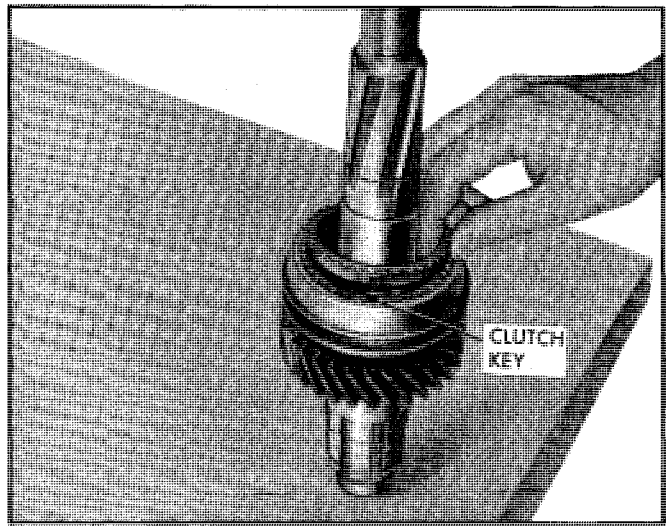


Fig. 12M—Installing Synchronizing Ring

Clutch Keys and Springs Replacement

NOTE: The clutch hubs and sliding sleeves are a select fit assembly and should be kept together as originally assembled, but the three keys and two springs may be replaced if worn or broken.

1. Push the hub from the sliding sleeve. The keys will fall free and the springs may be easily removed.
2. Place the two springs in position (one on each side of the hub), so all three keys are engaged by both springs. Place the keys in position and, holding them in place, slide the hub into the sleeve.

NOTE: The sleeve with the chamfered edge opposite the fork groove identifies the 3-4 synchronizer sleeve.

Assembly

Mainshaft Assembly

1. From the rear of the mainshaft, assemble the second speed gear (with hub of gear toward rear of shaft).
2. Install 1-2 Synchronizer clutch assembly to mainshaft (sliding clutch sleeve taper toward the rear, hub to the front); together with a synchronizing ring on either side of clutch assembly so their keyways line up with the clutch keys (fig. 12M).
3. Press the 1st gear sleeve onto the mainshaft using a 1-3/4 I.D. pipe cut to a convenient length or other suitable tool.
4. Install the first speed gear (with hub toward front) and using 1-5/8" I.D. pipe cut to a suitable length, press on the rear bearing with the snap ring groove toward the front of the transmission (fig. 13M). Firmly seat the bearing.
5. Choose the correct selective fit snap ring (.087", .090", .093", or .096") and install it in the groove in mainshaft behind the rear bearing. With proper ring, maximum distance between snap ring and rear face of bearing will be from zero to .005".

NOTE: Always use new snap rings when reassembling transmission and do not expand

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the snap ring further than is necessary for assembly.

6. Install the third speed gear (hub to front of transmission) and the third speed gear synchronizing ring (notches to front of transmission).
7. Install the third and fourth speed gear clutch assembly (hub and sliding sleeve) with both sleeve taper and hub toward the front, making sure the keys in the hub correspond to the notches in the third speed gear synchronizing ring.
8. Install snap ring in the groove in mainshaft in front of the third and fourth speed clutch assembly, with ends of snap ring seated behind spline teeth.
9. Install the rear bearing retainer (fig. 10M). Spread the snap ring in the plate to allow the snap ring to drop around the rear bearing and press on the end of the mainshaft until the snap ring engages the groove in the rear bearing.
10. Install the reverse gear (shift collar to rear).
11. Press speedometer drive gear onto the mainshaft using a suitable press plate such as J-1453. Position the speedometer gear to get a measurement of 4-7/8" from the forward side of the gear to the flat surface of the rear bearing retainer (fig. 14M).

Countergear Assembly

1. Install roller spacer (seam type) in countergear.
2. Using heavy grease to retain the rollers, install a spacer, 28 rollers in either end of the countergear, a spacer, 28 more rollers, then another spacer. Install in the other end of the countergear, a spacer, 28 rollers, a spacer, 28 more rollers, and another spacer (fig. 15M).
3. Insert Tool J-22246 into countergear.

Transmission Assembly

1. Rest the transmission case on its side with the side cover opening toward the assembler. Put countergear tanged thrust washers in place, retaining them with heavy grease, making sure the tangs are resting in the notches of the case.
2. Set countergear in place in bottom of transmission case, making sure that tanged thrust washers are not knocked out of place.

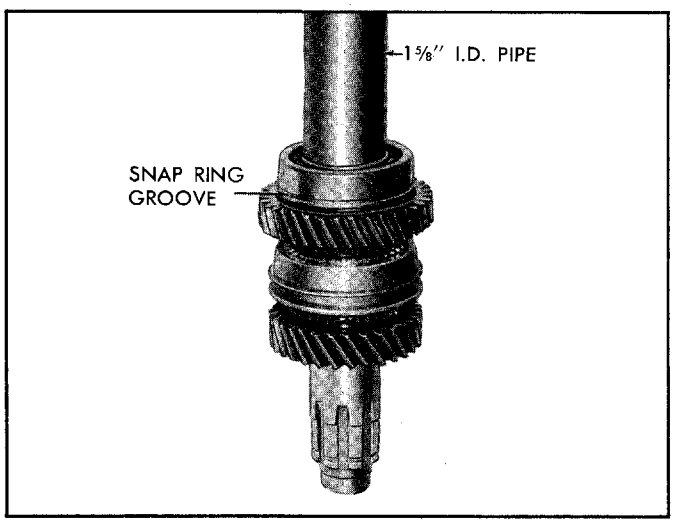


Fig. 13M—Installing Rear Bearing

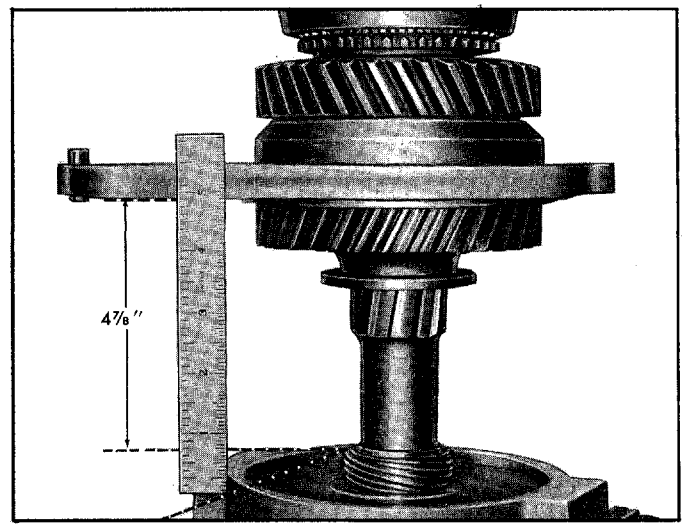


Fig. 14M—Installing Speedometer Drive Gear

3. Position the transmission case resting on its front face.
4. Lubricate and insert countershaft in rear of case. Turn countershaft so flat on end of shaft is horizontal and facing bottom of case.

   NOTE: The flat on shaft must be horizontal and toward the bottom to mate with rear bearing retainer when installed.

5. Align countergear with shaft in rear and hole in front of case, and press countershaft into case (pushing assembly tool out front of case) until flat on shaft is flush with rear of case. Be sure thrust washers remain in place (fig. 16M).
6. Attach a dial indicator as shown in Figure 17M and check end play of the countergear. If end play is greater than .025" new thrust washers must be installed.
7. Install cage and the seventeen roller bearings into main drive gear, using heavy grease to hold the bearings in place.

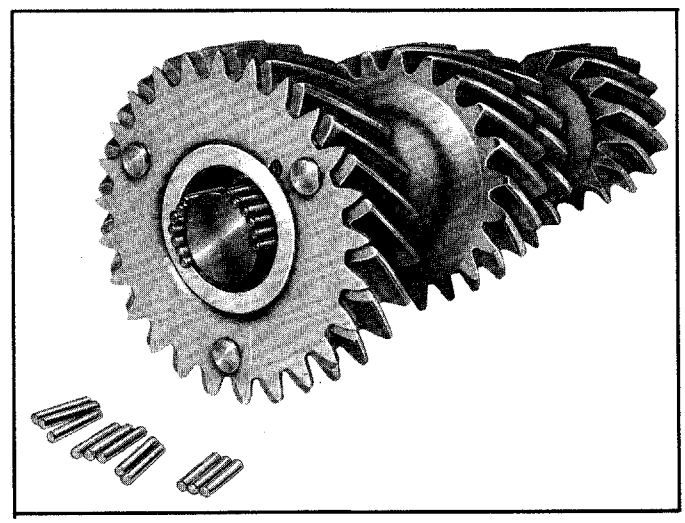


Fig. 15M—Loading Countergear Bearings using J-22246

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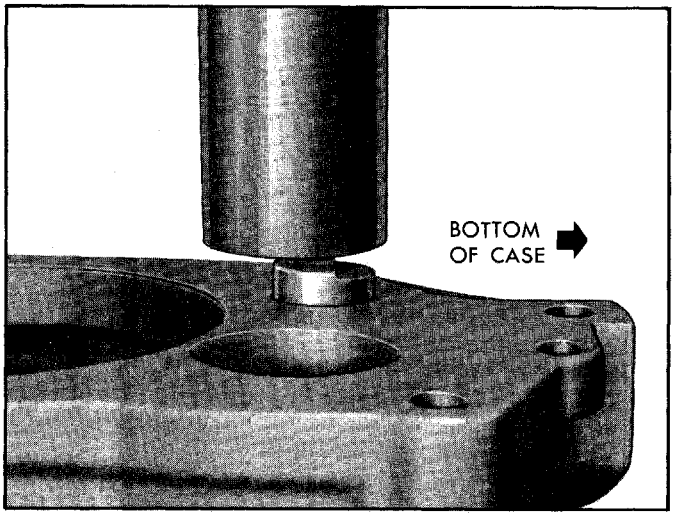


Fig. 16M—Installing Countershaft

8. Install main drive gear and pilot bearings through the side cover opening and into position in transmission front bore.
9. Place gasket in position on front face of rear bearing retainer.
10. Install the fourth speed synchronizing ring on main drive gear with the notches toward the rear of the transmission.
11. Position the reverse idler gear thrust washer (tanged) on the machined face of the ear cast in the case for the reverse idler shaft and hold with heavy grease. Position the front reverse idler gear next to the thrust washer, with the hub facing toward rear of the case.

CAUTION: Before attempting to install mainshaft assembly to case, slide the 3-4 synchronizing clutch sleeve forward into fourth speed detent position (fig. 6M).

12. Lower the mainshaft assembly into the case making certain the notches on the fourth speed synchronizing ring correspond to the keys in the clutch assembly (fig. 18M).

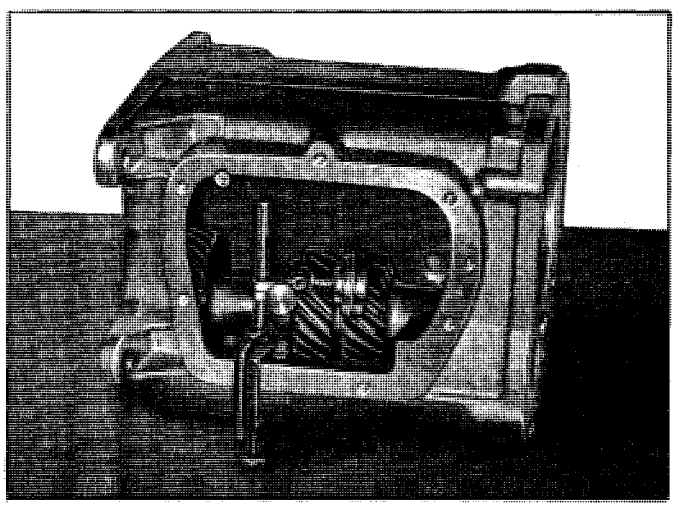


Fig. 17M—Checking Countergear End Play

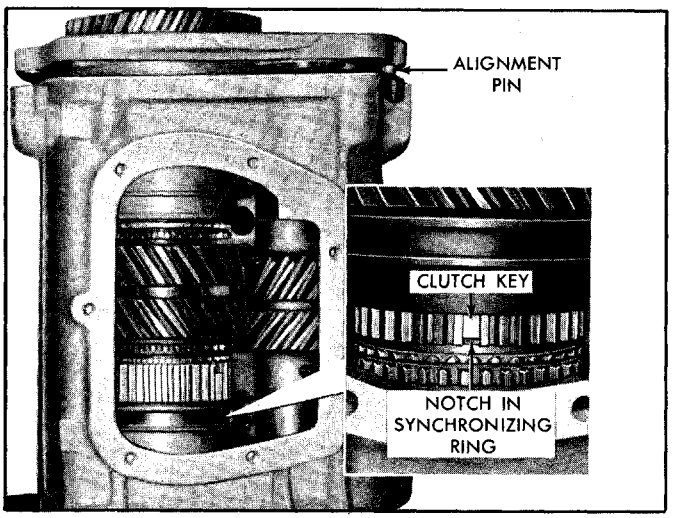


Fig. 18M—Installing Mainshaft Assembly

CAUTION: Be sure main drive gear engages both the countergear and anti-lash plate on standard ratio models.

13. With the guide pin in rear bearing retainer aligned with hole in rear of case, tap rear bearing retainer into position with a soft hammer.
14. From the rear of the case, insert the rear reverse idler gear, engaging the splines with the portion of the front gear inside the case.
15. Using heavy grease, place gasket in position on rear face of rear bearing retainer.
16. Install the remaining flat thrust washer on reverse idler shaft. If new idler shaft is being used, drive out the roll pin and press it into new shaft.
17. Install reverse idler shaft, roll pin, and thrust washer into gears and front boss of case. Make sure to pickup front tanged thrust washer.

NOTE: Roll pin should be in a vertical position.

18. Pull reverse shifter shaft to left side of extension and rotate shaft to bring reverse shift fork forward

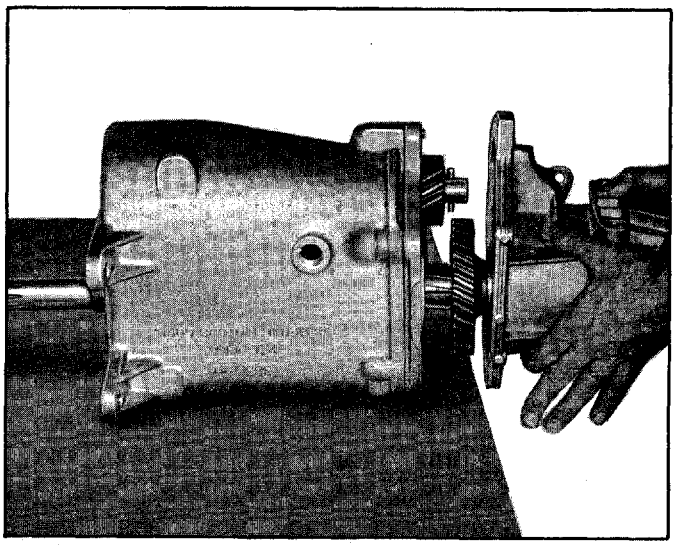


Fig. 19M—Installing Case Extension

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in extension (reverse detent position). Start the extension onto the transmission case (fig. 19M), while slowly pushing in on the shifter shaft to engage the shift fork with the reverse gear shift collar. Then pilot the reverse idler shaft into the extension housing permitting the extension to slide onto the transmission case.

19. Install 6 extension and retainer-to-case attaching bolts. Torque upper 3 bolts and lower 3 bolts to specification.
20. Push or pull reverse shifter shaft to line up groove in the shaft with the holes in the boss and drive in the lock pin. Install shifter lever.
21. Press bearing onto main drive gear (snap ring groove to front) and into case until several main drive gear retaining nut threads are exposed.
22. Lock transmission up by shifting into two gears. Install main drive gear retaining nut on the gear shaft and draw it up tight using Tool J-0933. Be sure bearing fully seats against shoulder on gear. Torque retaining nut to 40 ft. lbs. and lock in place by staking securely into main drive gear shaft hole with a center punch. Care must be used to avoid damaging the threads on the shaft.
23. Install the main drive gear bearing retainer, gasket, four attaching bolts and (2) strip bolt lock retainers, using a suitable sealer on bolts. Torque to specification.
24. Shift mainshaft 3-4 sliding clutch sleeve into neutral position and 1-2 sliding clutch sleeve into second gear (forward) detent position. Shift side cover 3-4 shifter lever into neutral detent and 1-2 shifter lever into second gear detent position.
25. Install side cover gasket and carefully position side cover into place. There is a dowel pin in the cover to assure proper alignment with the case. Install attaching bolts and tighten evenly to avoid side cover distortion. Torque to specification.

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ALUMINUM POWERGLIDE

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TRANSMISSION

Disassembly

1. Place transmission in Holding Fixture J-3289-01 and Adapters J-9506 (fig. 2PG).

NOTE: Cleanliness is an important factor in the overhaul of the transmission. Before attempting any disassembly operation, the exterior of the case should be thoroughly cleaned to prevent the possibility of dirt entering the transmission internal mechanism. During disassembly, all parts should be thoroughly cleaned in cleaning fluid and then air dried. Wiping cloths or rags should not be used to dry parts as lint may be deposited on the parts which may cause later trouble.

CAUTION: Do not use solvents which could damage rubber seals or clutch plate facings.

2. Remove converter holding tool previously installed and remove converter assembly.

NOTE: When the overhaul is due to transmission clutch failure it is mandatory that the converter be replaced.

Extension, Governor and Governor Support

3. If replacement is necessary, remove speedometer driven gear. Loosen capscrew and retainer clip holding speedometer driven gear in extension and remove gear.
4. Remove transmission extension by removing five bolts retaining extension to case. Note seal ring on governor support.
5. Remove the speedometer drive gear from output shaft, using J-5814 (fig. 3PG).
6. Remove the "C" clip from the governor shaft on the weight side of the governor, then remove the shaft and governor valve from the opposite side of the governor assembly (fig. 4PG) and the urethane washer.
7. Loosen the governor drive screw and remove the governor assembly over the end of the output shaft (fig. 5PG).
8. Remove the four bolts retaining the governor support to the transmission case and remove the support body, gasket and extension seal ring.

Transmission Internal Components

9. Rotate the holding fixture until the front of the transmission is pointing up and remove the seven oil pump bolts. The bolt holes are offset to facilitate proper location upon installation.
10. Remove the oil pump and stator shaft assembly and the selective fit thrust washer using J-9539 (or two 3/8"-16 x 10" stove bolts) and the slide weights from Tool J-6585 (fig. 7PG). Note the two threaded holes to mount the pullers. Remove the ring seal and gasket.

NOTE: The pump bolts have special sealing washers which must be in place upon installation.

11. Release the tension on the low band adjustment, then, with transmission horizontal, grasp the transmission input shaft and carefully work it and the clutch assembly out of the case (fig. 8PG). Use care so as not to lose the low sun gear (splined) bushing from the input shaft. The low sun gear thrust washer will probably remain in the planet carrier.

CAUTION: Use care so as not to damage the machined face on the front of the clutch drum.

12. The low brake band and struts may now be removed.
13. Remove the planet carrier and the output shaft thrust caged bearing from the front of the transmission.

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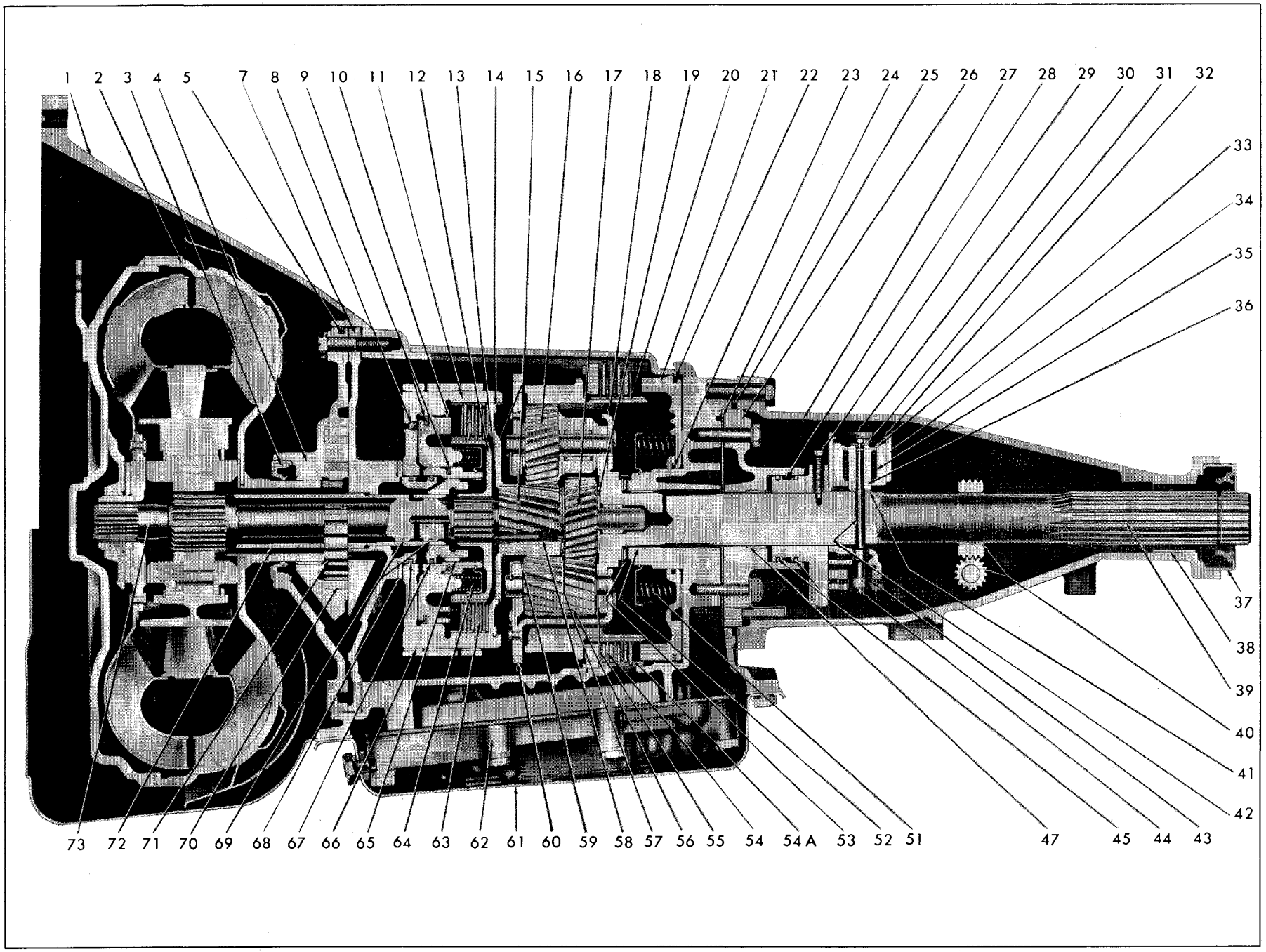


Fig. 1PG—Aluminum Powerglide—Typical Sectioned View

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Fig. 1PG—Aluminum Powerglide—Sectioned View

1. Transmission Case
2. Welded Converter
3. Oil Pump Seal Assembly
4. Oil Pump Body
5. Oil Pump Body Square Ring Seal
7. Oil Pump Cover
8. Clutch Relief Valve Ball
9. Clutch Piston Inner and Outer Seal
10. Clutch Piston
11. Clutch Drum
12. Clutch Hub
13. Clutch Hub Thrust Washer
14. Clutch Flange Retainer Ring
15. Low Sun Gear and Clutch Flange Assembly
16. Planet Short Pinion
17. Planet Input Sun Gear
18. Planet Carrier
19. Planet Input Sun Gear Thrust Washer
20. Ring Gear
21. Reverse Piston
22. Reverse Piston Outer Seal
23. Reverse Piston Inner Seal
24. Governor Support Gasket
25. Extension Seal Ring
26. Governor Support
27. Extension
28. Governor Hub
29. Governor Hub Drive Screw
30. Governor Body
31. Governor Shaft Retainer Clip
32. Governor Outer Weight Retainer Ring
33. Governor Inner Weight Retainer Ring
34. Governor Outer Weight
35. Governor Spring
36. Governor Inner Weight
37. Extension Rear Oil Seal
38. Extension Rear Bushing
39. Output Shaft
40. Speedometer Drive and Driven Gear
41. Governor Shaft Urethane Washer
42. Governor Shaft
43. Governor Valve
44. Governor Valve Retaining Clip
45. Governor Hub Seal Rings
47. Governor Support Bushing
51. Reverse Piston Return Springs, Retainer and Retainer Ring
52. Transmission Rear Case Bushing
53. Output Shaft Thrust Bearing
54. Reverse Clutch Pack
54A. Reverse Clutch Cushion Spring (Waved)
55. Pinion Thrust Washer
56. Planet Long Pinion
57. Low Sun Gear Needle Thrust Bearing
58. Low Sun Gear Bushing (Splined)
59. Pinion Thrust Washer
60. Parking Lock Gear
61. Transmission Oil Pan
62. Valve Body
63. High Clutch Pack
64. Clutch Piston Return Spring, Retainer and Retainer Ring
65. Clutch Drum Bushing
66. Low Brake Band
67. High Clutch Seal Rings
68. Clutch Drum Thrust Washer (Selective)
69. Turbine Shaft Seal Rings
70. Oil Pump Driven Gear
71. Oil Pump Drive Gear
72. Stator Shaft
73. Input Shaft

14. Remove the reverse ring gear if it did not come out with the planet carrier.
15. Using a large screw driver remove the reverse clutch pack retainer ring and then lift out the reverse clutch plates and the (waved) cushion spring.

    NOTE: If difficulty is experienced in getting the snap ring past the shoulder on the reverse pack pressure plate, a feeler gauge may be used as a guide.

16. Install Tool J-9542 through the rear bore of the case with the flat plate on the rear face of the case and turn down the wing nut to compress the rear piston spring retainer and springs, then remove the snap ring (fig. 9PG). Tool J-8039 may be used to remove the snap ring if desired.

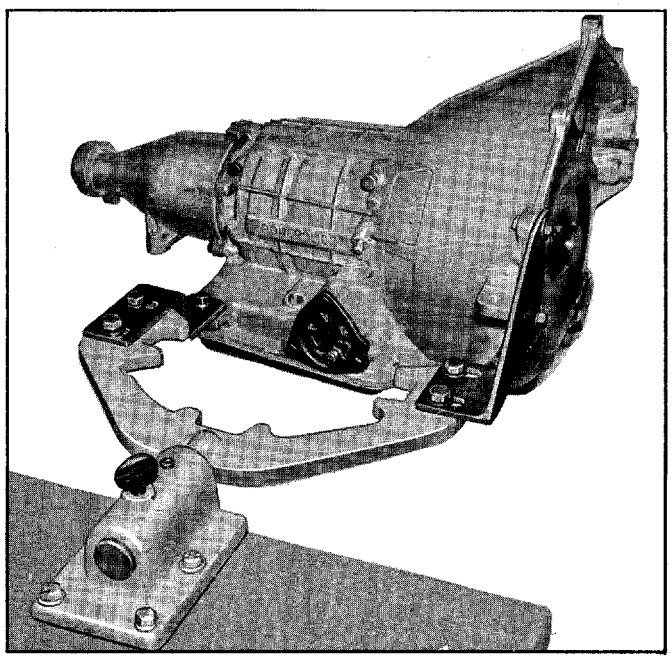


Fig. 2PG—Transmission Mounted in Fixture

17. Remove Tool J-9542, the reverse piston spring retainer and the 17 piston return springs.
18. Remove the rear piston by applying air to the reverse port in the rear of the transmission case as shown in Figure 10PG. Remove the inner and outer seals.

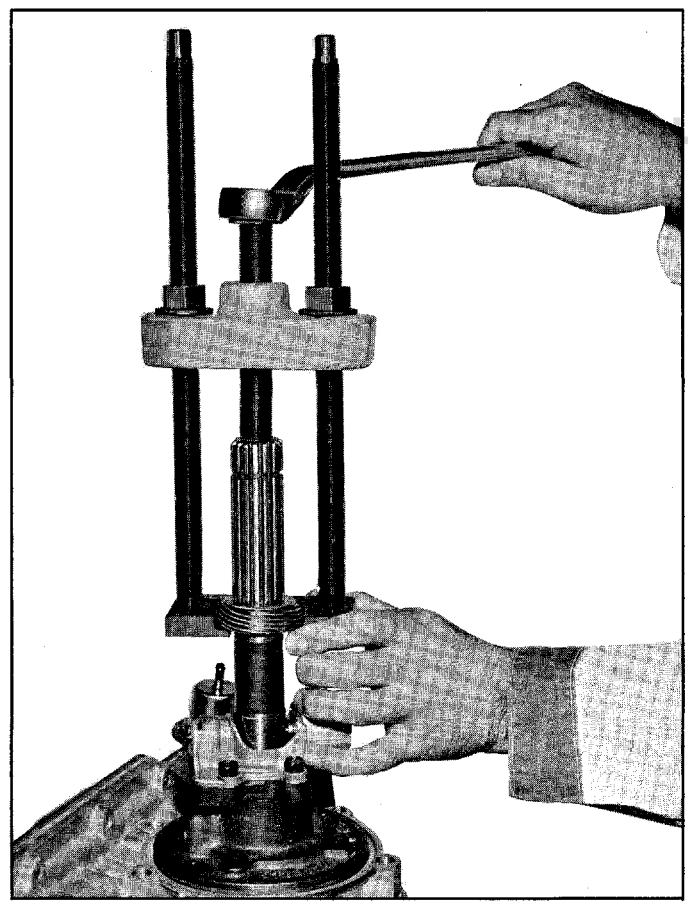


Fig. 3PG—Removing Speedometer Drive Gear

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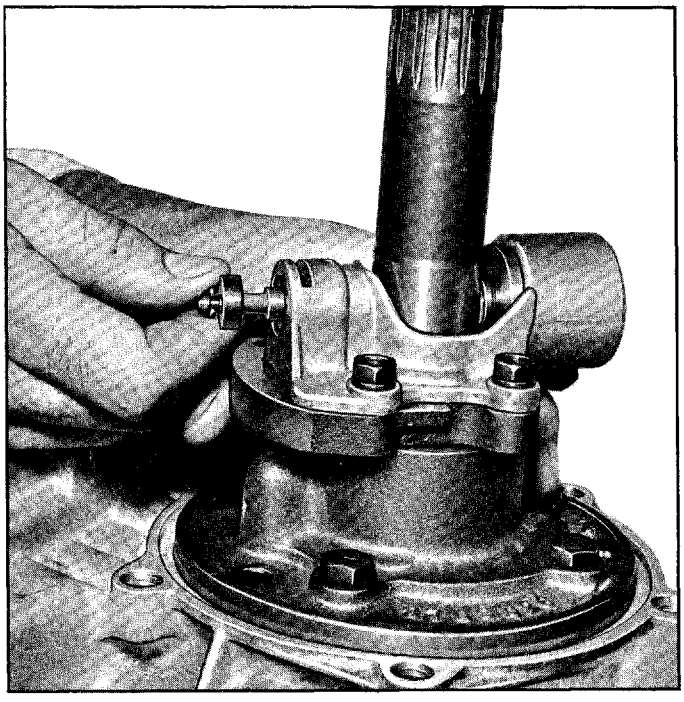


Fig. 4PG—Removing Governor Valve and Shaft

19. Remove the three servo cover bolts, servo cover, piston and spring.

Oil Pan and Valve Body

NOTE: The oil pan and valve body may be serviced without the necessity of removing the extension and internal components covered in the preceding steps.

20. Rotate the holding fixture until the transmission is upside down and the oil pan is at the top. Remove the oil pan attaching bolts, oil pan and gasket.
21. Remove the vacuum modulator and gasket, and the vacuum modulator plunger, dampening spring (except L-4 & L-194 models) and valve (fig. 11PG).
22. Remove the two bolts attaching the detent guide plate to the valve body and the transmission case. Remove the guide plate and the range selector detent roller spring.
23. Remove the remaining valve body-to-transmission case attaching bolts (indicated by arrows in Figure 12PG) and carefully lift out the valve body and gasket, disengaging the servo apply tube from the transmission case as the valve body is removed.
24. If necessary, the TV, shift and parking actuator assembly levers, and the parking pawl and bracket (fig. 13PG) may be removed.

This completes the entire transmission disassembly procedure. Component parts disassembly and repair procedures will be found in succeeding pages of this manual.

OVERHAULING UNIT ASSEMBLIES

CONVERTOR AND STATOR

The converter is a welded assembly and no internal repairs are possible. Check the seams for stress or breaks and replace converter if necessary.

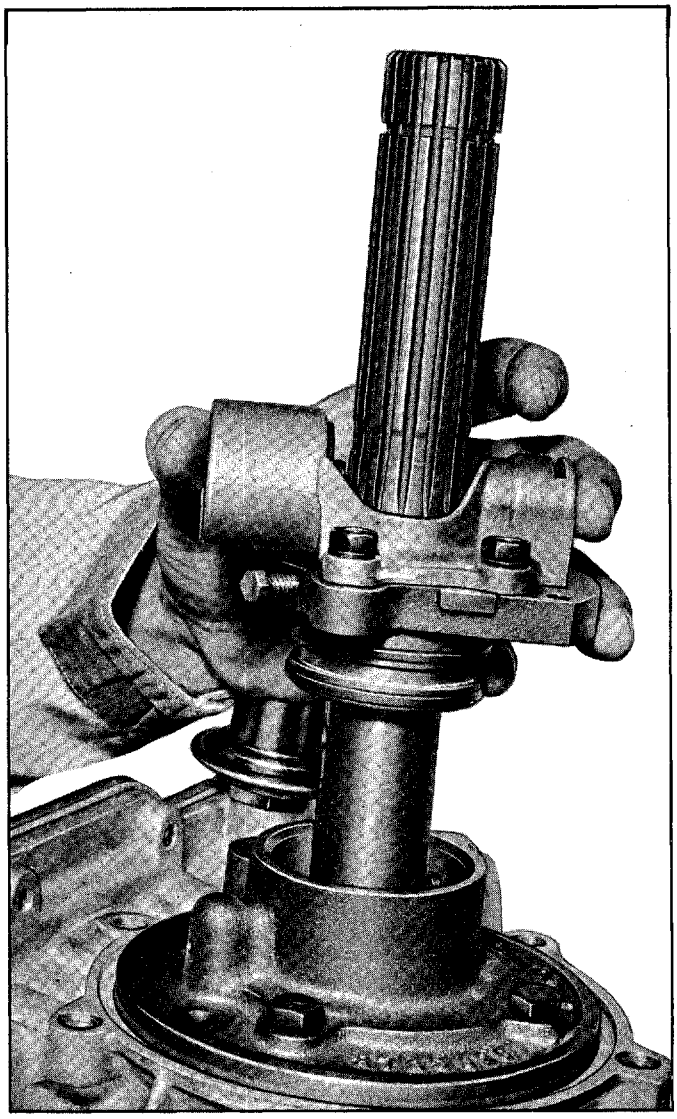


Fig. 5PG—Removing Governor Assembly

OIL PUMP

Seal Replacement

If the pump seal requires replacement, remove the pump from the transmission, pry out and replace the seal. (Drive new seal into place, fully seated in counterbore, using J-6839.) Then, if no further work is required on the pump, reinstall it in the case.

NOTE: Outer diameter of the seal should be coated with non-hardening sealer prior to installation.

Disassembly

1. Remove bolts attaching pump cover to body and remove the cover.
2. Remove pump gears from body.

CAUTION: Do not drop or nick gears. These gears are not heat treated.

3. Remove the rubber seal ring from the pump body.

NOTE: See Figure 15PG for a layout of pump parts.

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Inspection

1. Wash all parts in cleaning solvent and blow out all oil passages. DO NOT USE RAGS TO DRY PARTS.

   CAUTION: Some solvents may be harmful to rubber seals.

2. Inspect pump gears for nicks or damage.
3. Inspect body and cover faces for nicks or scoring. Inspect cover hub O.D. for nicks or burrs which might damage clutch drum bushing journal.
4. Check for free operation of the priming valve and replace if necessary.
5. Inspect body bushing for galling or scoring. Check clearance between body bushing and converter pump hub (fig. 17PG). Maximum clearance is .005". If the bushing is damaged, the oil pump body should be replaced.
6. Inspect converter housing hub O.D. for nicks or burrs which might damage pump seal or bushing. Repair or replace as necessary.
7. If oil seal is damaged or is leaking (and the pump body is otherwise suitable for reuse), pry out and install a new seal, fully seated in counterbore, using Seal Driver J-6839.

   NOTE: Outer diameter of seal should be coated with a non-hardening sealer prior to installation.

8. On water cooled models so equipped, check condition of oil cooler by-pass valve and replace if valve leaks excessively. For removal, an "Easy Out" or its equivalent may be used.

For installation tap seat in place with soft hammer or brass drift so it is flush to .010" below the surface.

9. With parts clean and dry, install pump gears and check:
   a. Clearance between O.D. of driven gear and body should be .0035"-.0065" (fig. 18PG).

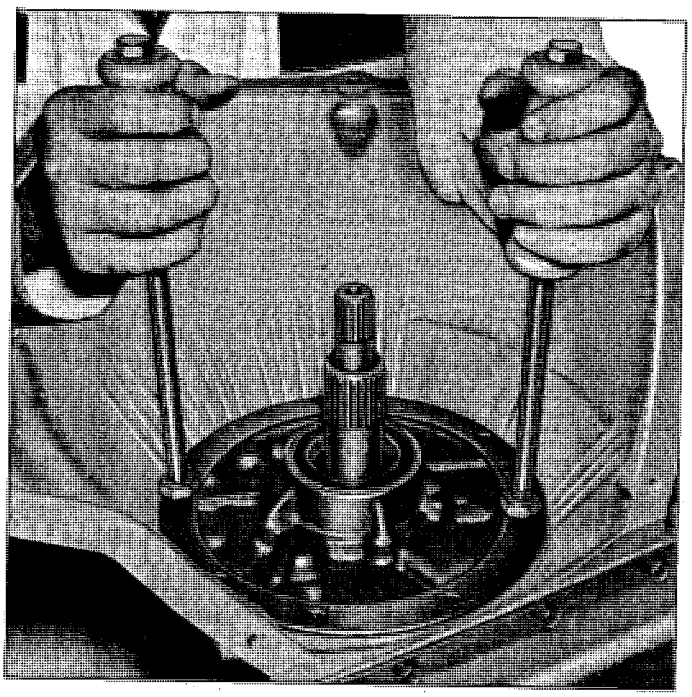


Fig. 7PG—Removing Front Oil Pump

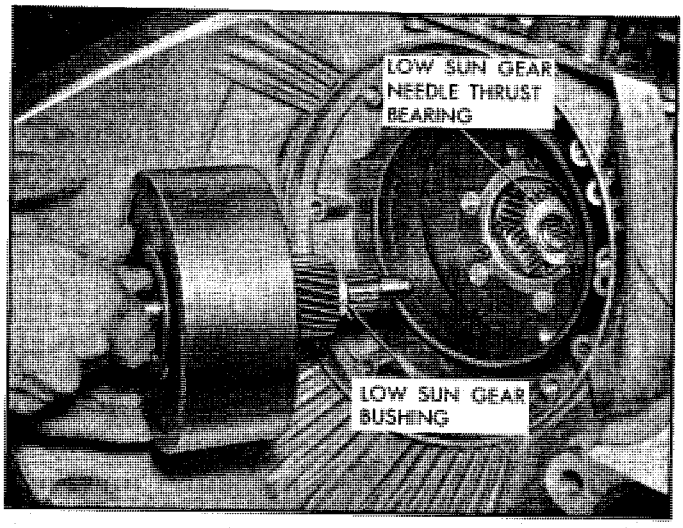


Fig. 8PG—Removing Clutch Drum and Input Shaft

   b. Clearance between I.D. of driven gear and crescent should be .003"-.009" (fig. 19PG).
   c. Gear end clearance (fig. 20PG) should be .0005"-.0015".

Assembly

With the transmission facing up, proceed as follows:

1. Remove the input shaft, clutch drum, low band and struts as outlined under "Transmission - Disassembly."
2. Install the downshift timing valve, conical end out, into place in the pump cover to a height of 17/32"

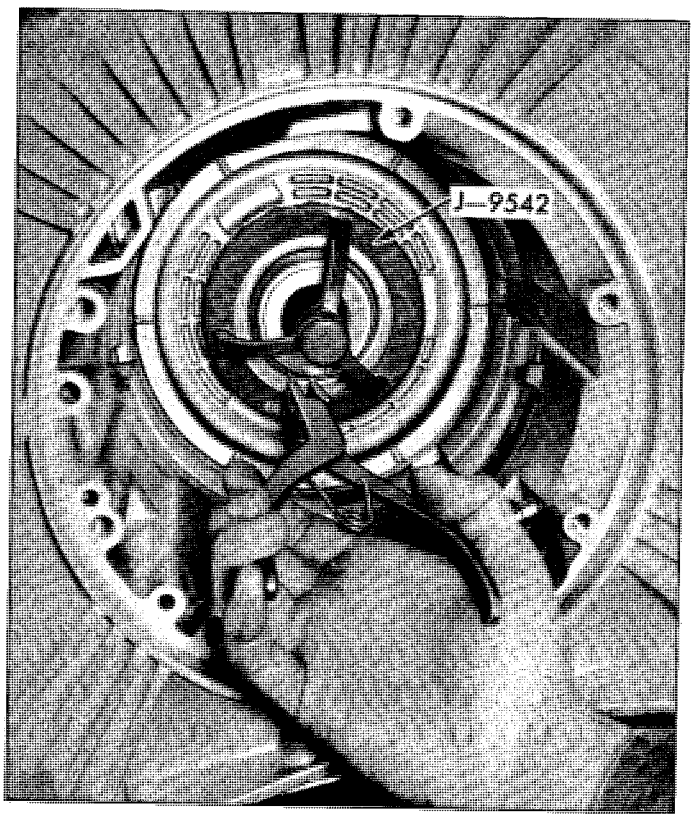


Fig. 9PG—Removing Rear Piston Spring Retainer Snap Ring

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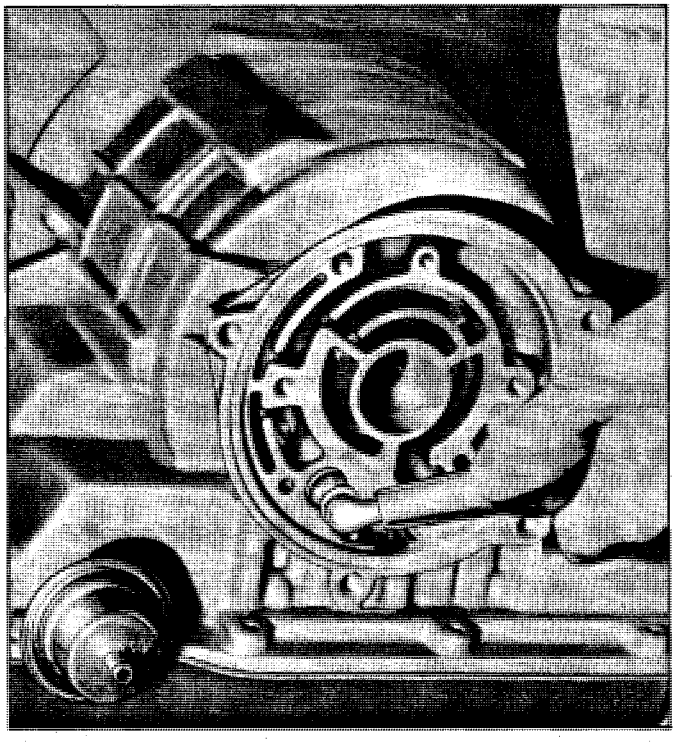


Fig. 10PG—Applying Air to Remove Rear Piston

measured from the shoulder of the valve assembly to face of pump cover.

3. Oil drive and driven gears generously and install in the pump body.

   CAUTION: Assemble drive gear with recessed side of the drive lugs downward - facing the converter.

4. Carefully set the pump cover in place over the body and loosely install 2 attaching bolts.

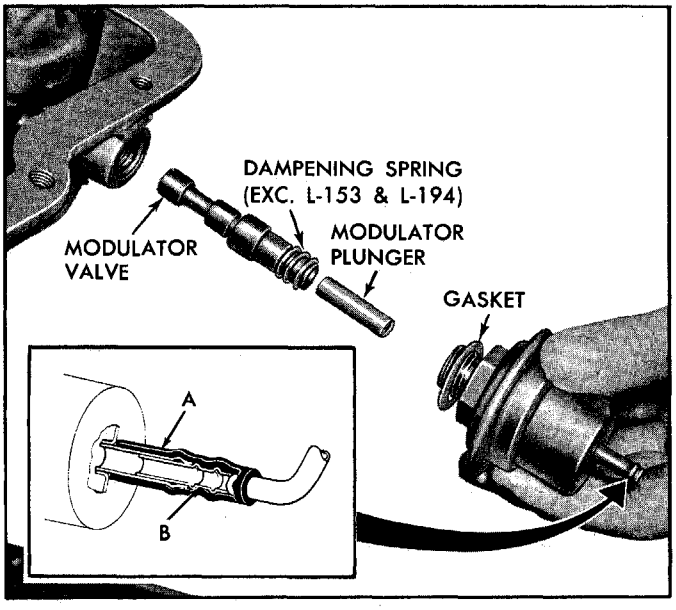


Fig. 11PG—Vacuum Modulator, Dampening Spring, Plunger and Valve

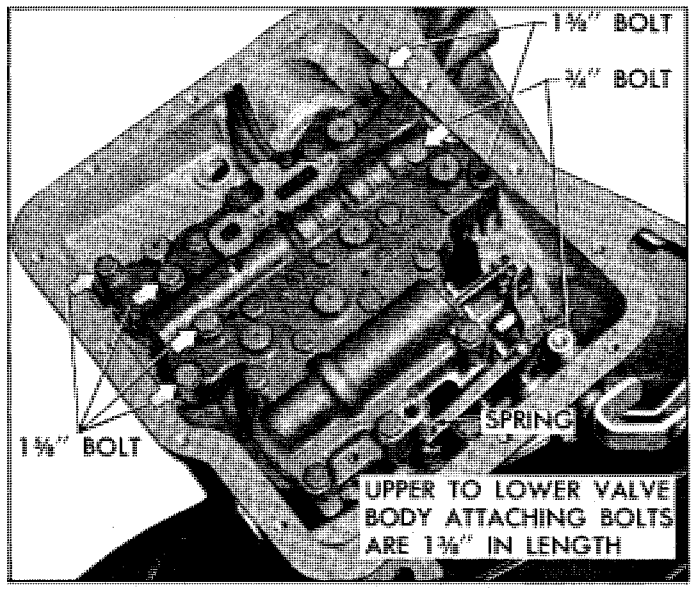


Fig. 12PG—Valve Body Removal

5. Place the pump assembly, less the rubber seal ring, upside down into the pump bore of the case (use guide pins if desired). Install remaining attaching bolts and torque to specification.
6. Remove pump assembly from case bore. Replace the clutch drum and input shaft, low band and struts as outlined under "Transmission-Assembly."

   NOTE: If necessary, remove two bolts and use J-6585 pullers and J-6585-3 adapters to remove pump assembly. Replace and retorque bolts.

7. Replace rubber seal ring in its groove in the pump body and install the pump assembly properly in place

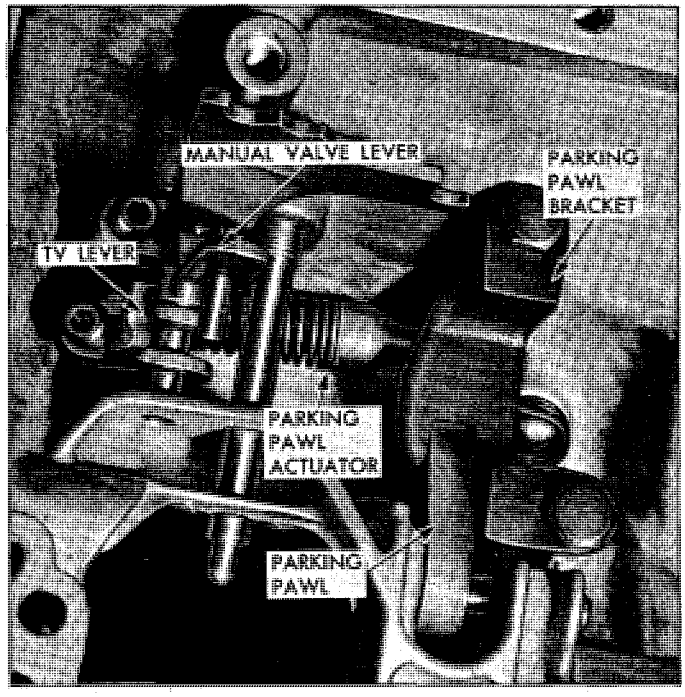


Fig. 13PG—Inner Control Levers, Parking Pawl and Bracket

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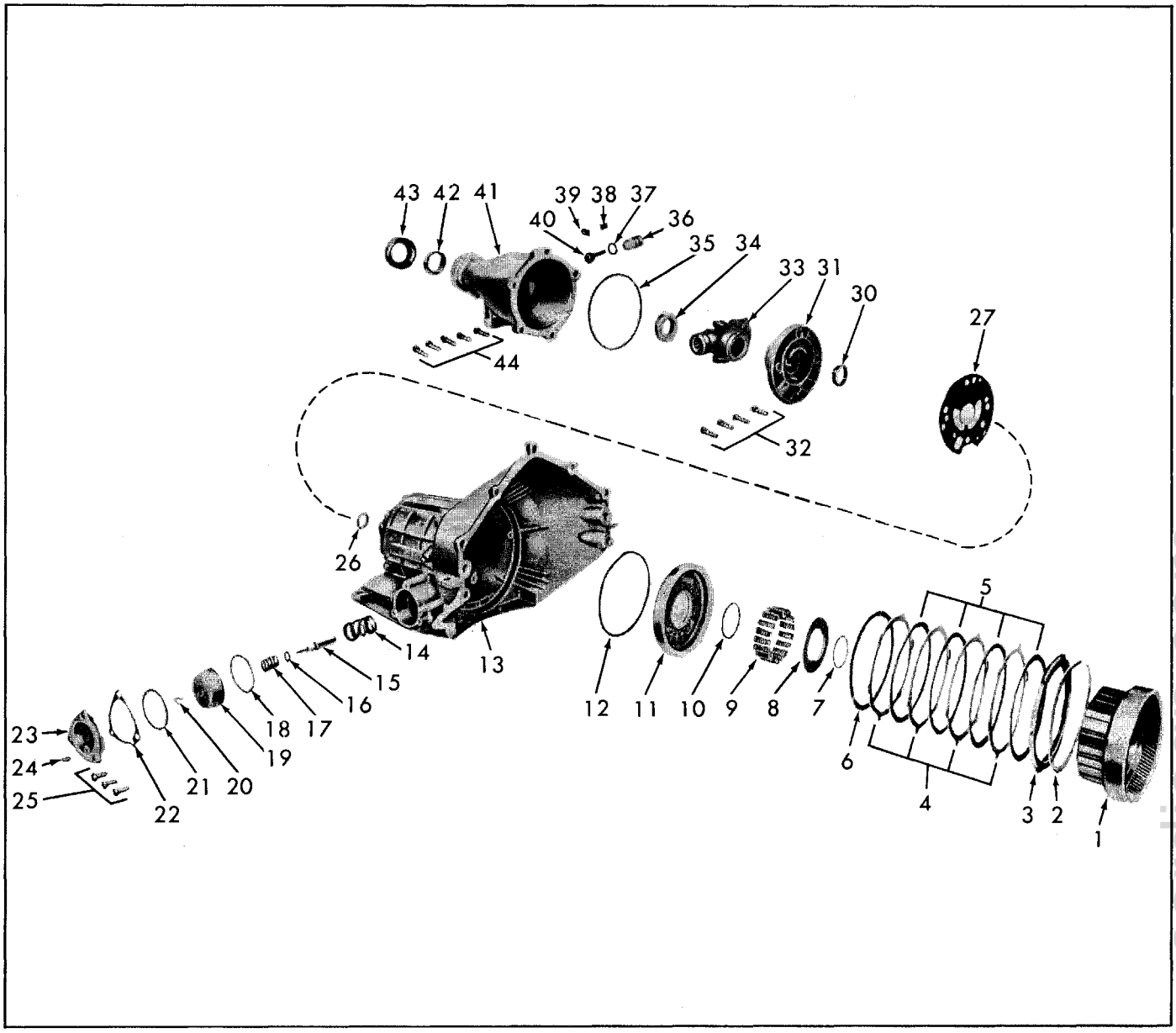


Fig. 14PG—Transmission Case—Exploded View (Typical)

1. Reverse Ring Gear
2. Reverse Clutch Pack Snap Ring
3. Reverse Clutch Pressure Plate
4. Reverse Clutch Reaction Plates
5. Reverse Clutch Drive Plates
6. Reverse Clutch Cushion Spring
7. Reverse Clutch Piston Return Spring Retainer Snap Ring
8. Reverse Clutch Piston Return Spring Retainer
9. Reverse Clutch Piston Return Springs
10. Reverse Clutch Piston Inner Seal
11. Reverse Clutch Piston
12. Reverse Clutch Piston Outer Seal
13. Transmission Case
14. Servo Piston Return Spring
15. Servo Piston Rod
16. Servo Piston Apply Spring Seat
17. Servo Piston Apply Spring
18. Servo Piston Seal Ring
19. Servo Piston
20. Servo Piston Rod Spring Retainer
21. Servo Cover Seal
22. Servo Cover Gasket
23. Servo Cover
24. Servo Cover Plug
25. Servo Cover Bolts
26. Transmission Case Bushing
27. Gasket
30. Governor Support Bushing
31. Governor Support
32. Governor Support to Case Attaching Bolts
33. Governor Assembly
34. Speedometer Drive Gear
35. Seal
36. Speedometer Shaft Fitting
37. Speedometer Shaft Fitting Oil Seal
38. Lock Plate Attaching Screw
39. Lock Plate
40. Speedometer Driven Gear
41. Transmission Extension
42. Extension Bushing
43. Extension Oil Seal
44. Extension to Case Attaching Screws

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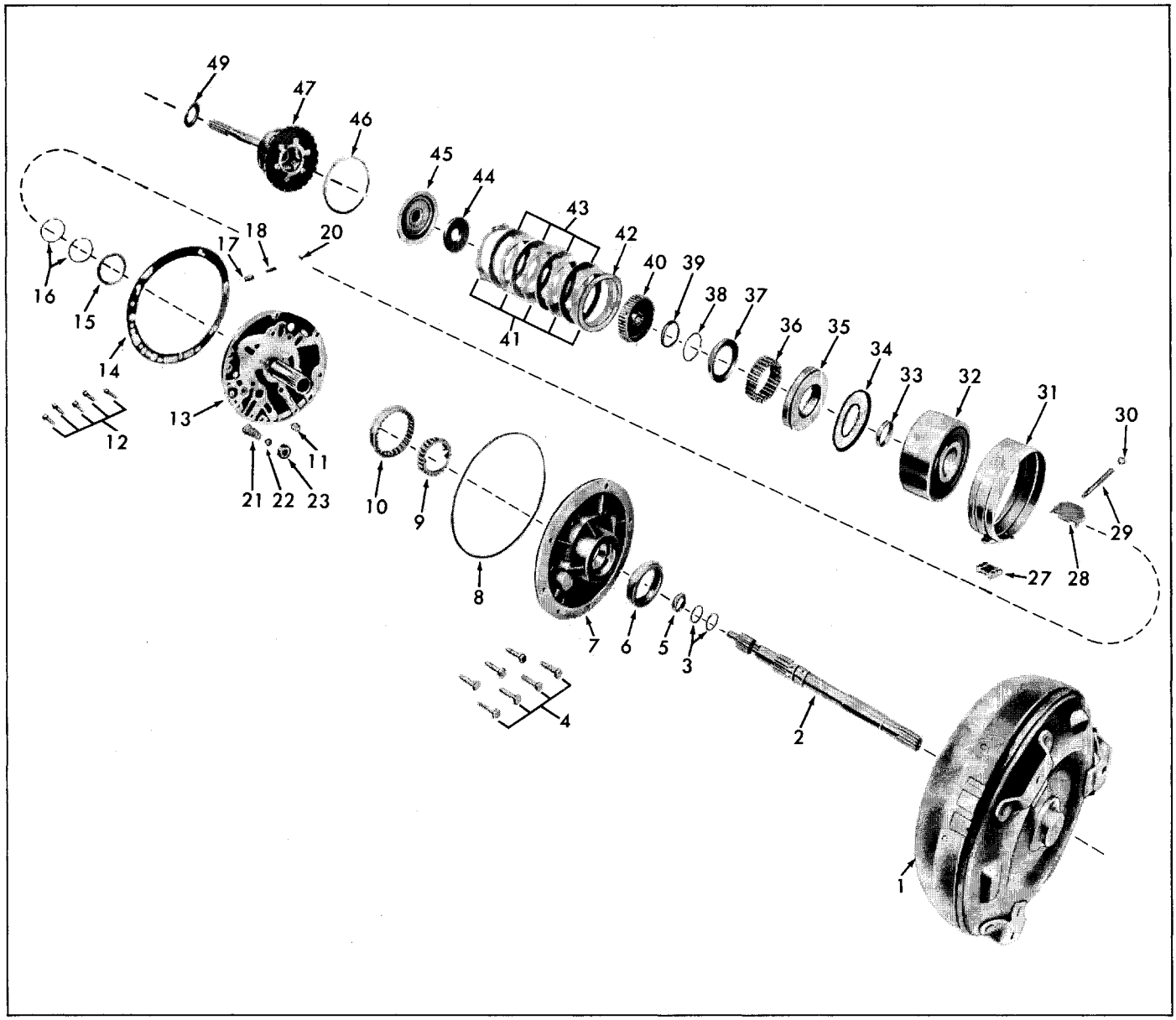


Fig. 15PG—Internal Mechanism—Exploded View (Typical)

1. Converter Assembly
2. Input Shaft
3. Input Shaft Oil Seals
4. Oil Pump to Case Attaching Bolts and Sealing Washers
5. Low Sun Gear Bushing
6. Pump Oil Seal
7. Oil Pump Body
8. Pump to Case Oil Seal
9. Oil Pump Drive Gear
10. Oil Pump Driven Gear
11. Downshift Timing Valve
12. Oil Pump Cover to Pump Body Attaching Screws
13. Oil Pump Cover and Converter Stator Shaft
14. Oil Pump Gasket
15. Clutch Drum Thrust Washer (Selective Fit)
16. High Clutch Seal Rings
17. Pump Priming Valve
18. Pump Priming Valve Spring
20. Pump Priming Valve Spring Retaining Pin
*21. Oil Cooler By-Pass Valve Spring
*22. Oil Cooler By-Pass Valve
*23. Oil Cooler By-Pass Valve Seat
27. Band Apply Strut
28. Band Anchor Strut
29. Band Anchor Adjusting Screw
30. Band Anchor Adjusting Screw Nut
31. Low Brake Band
32. Clutch Drum
33. Clutch Drum Bushing
34. Clutch Piston Outer and Inner Seals
35. Clutch Piston
36. Clutch Return Springs
37. Clutch Spring Retainer
38. Clutch Spring Retainer Snap Ring
39. Clutch Hub Front Thrust Washer
40. Clutch Hub
41. Clutch Driven Plates (Flat)
42. Clutch Cushion Spring (Waved)
43. Clutch Drive Plates (Waved)
44. Clutch Hub Rear Thrust Washer
45. Low Sun Gear and Clutch Flange Assembly
46. Clutch Flange Retainer Ring
47. Planet Carrier and Output Shaft Assembly
49. Output Shaft Thrust Bearing

*Except air cooled and 11" converter models

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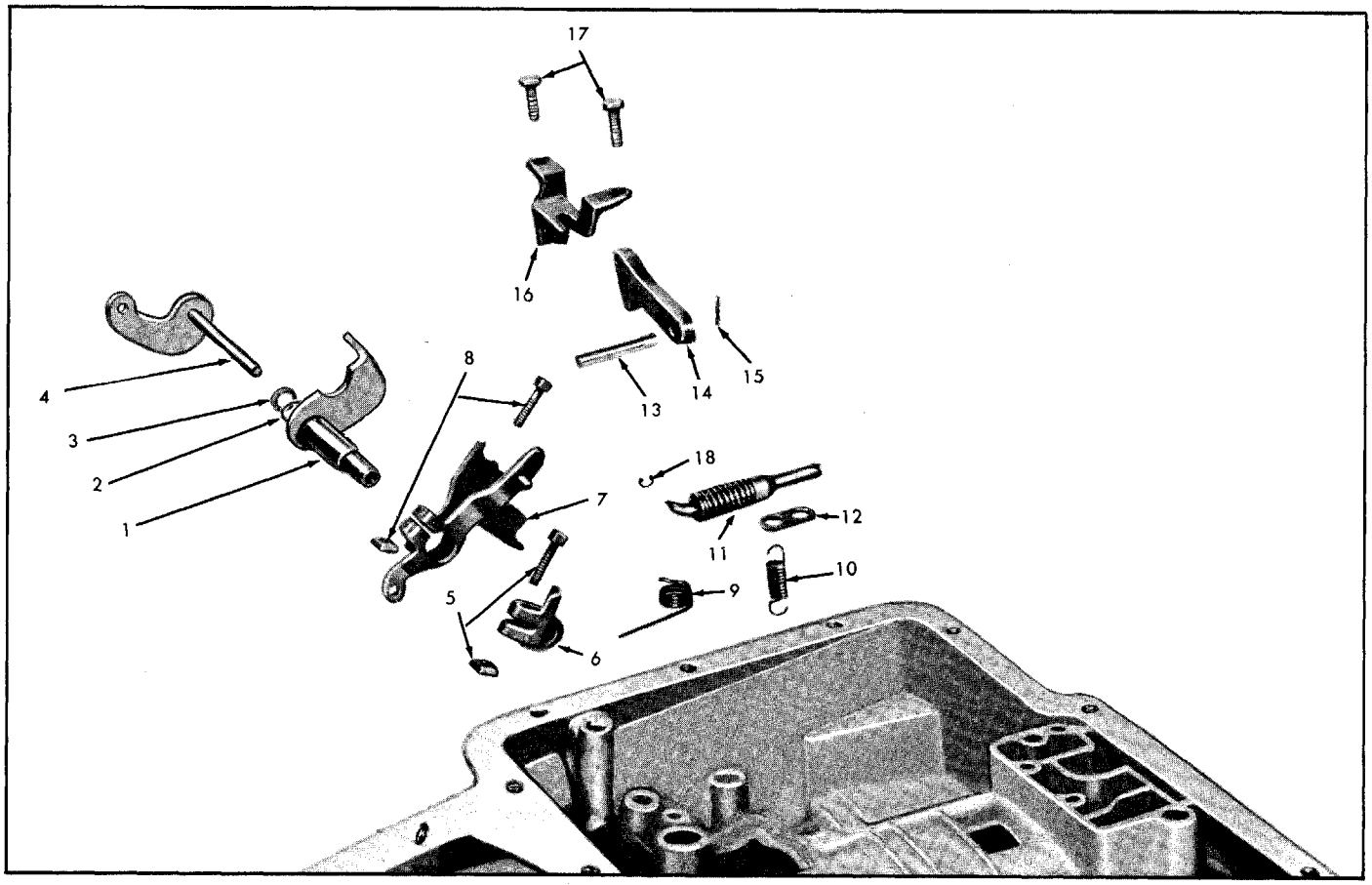


Fig. 16PG—Manual Levers—Typical Exploded View

1. Park Lock and Range Selector Outer Lever and Shaft
2. Throttle Valve Control Shaft Oil Seal
3. Throttle Valve Control Shaft Washer
4. Throttle Valve Control Lever and Shaft
5. Throttle Valve Control Inner Lever to Control Shaft Attaching Screw and Nut
6. Throttle Valve Control Inner Lever
7. Park Lock and Range Selector Inner Lever
8. Park Lock and Range Selector Inner Lever Attaching Screw and Nut
9. Park Lock Pawl Disengaging Spring
10. Range Selector Detent Roller Spring
11. Park Lock Actuator Assembly
12. Range Selector Detent Roller Spring Retainer
13. Park Lock Pawl Shaft
14. Park Lock Pawl
15. Park Lock Pawl Shaft Retaining Ring
16. Park Lock Pawl Reaction Bracket
17. Park Lock Pawl Reaction Bracket Attaching Bolts
18. Park Lock Actuator to Park Lock and Range Selector Inner Lever Retaining Clip

in the case bore, using a new gasket, being sure that the selective fit thrust washer is in place.

8. Install the attaching bolts, using new bolt sealing washers if necessary.

Governor Support Bushing Replacement

If the governor support bushing must be replaced, it may be removed using Tool J-9557 (and Handle J-7079) and reinstalled using Tool J-6582, pressing or driving the bushing in from the front of the pump.

CLUTCH DRUM

Disassembly

CAUTION: When working with the clutch drum, use extreme care that the machined face on the front of the drum (fig. 21PG) not be scratched, scored, nicked or otherwise damaged during any of the following service operations. This machined face must be protected whenever it must be brought to bear on a press or tool of any sort.

1. Remove retainer ring and low sun gear and clutch flange assembly from the clutch drum.
2. Remove the hub rear thrust washer.
3. Lift out the clutch hub, then remove the clutch pack and the hub front thrust washer.
4. Remove the spring retainer using J-9542 as shown in Figure 21PG, or if using an arbor press, use J-5133 and J-7782 adapter ring. Compress the springs far enough to allow removal of the retainer snap ring; then, releasing pressure on the springs, remove the retainer and the springs.

   NOTE: When using J-9542, place a piece of cloth or cardboard between the tool and the front side of the clutch drum as protection for the machined face.

5. Lift up on the piston with a twisting motion to remove from the drum, then remove the inner and outer seals.

Inspection

1. Wash all parts in cleaning solvent (air dry).

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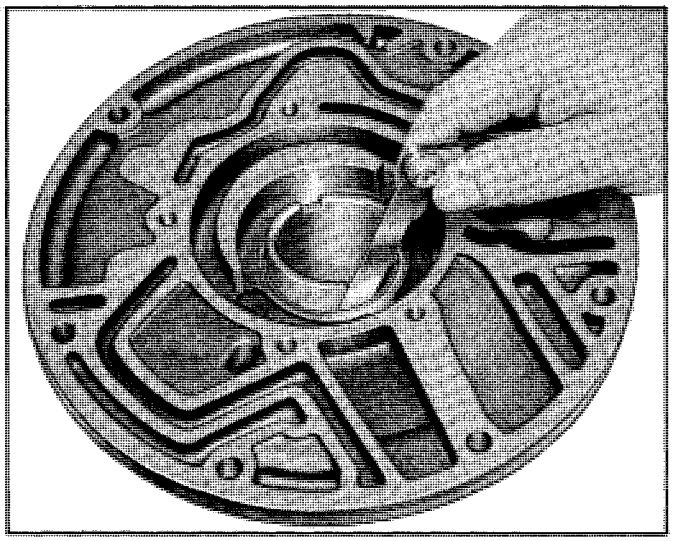


Fig. 17PG—Checking Pump Body Bushing to Converter Pump Hub Clearance

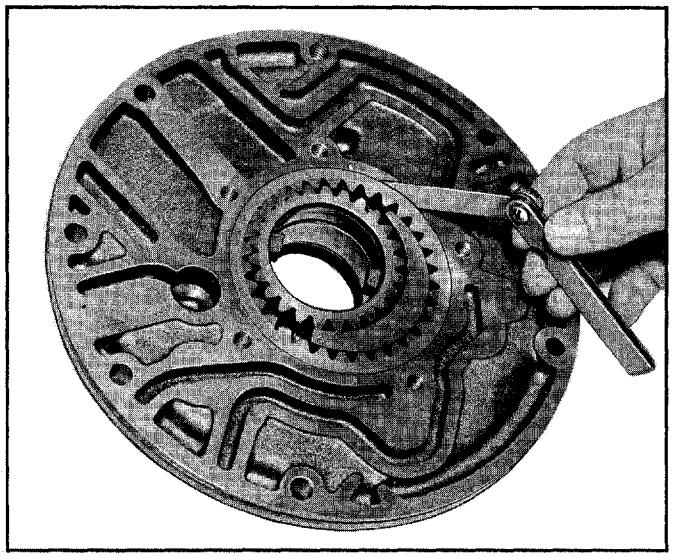


Fig. 18PG—Checking Driven Gear to Pump Body Clearance

CAUTION: Do not use rags to dry parts.

2. Check drum bushing for scoring or excessive wear.
3. Check the steel ball in the clutch drum that acts as a relief valve. Be sure that it is free to move in the hole and that the orifice leading to the front of the drum is open. If the clutch relief valve check ball in the clutch drum is loose enough to come out or not loose enough to rattle, replace the clutch drum as an assembly. Replacement or restaking of the ball should not be attempted.
4. Check fit of clutch flange in drum slots. There should be no appreciable radial play between these two parts. Also check low sun gear for nicks or burrs and bushing for wear.
5. Check clutch plates for burning and wear.

Bushing Replacement (Fig. 22PG)

1. Remove the old bushing with Tool J-9546 using care not to damage the bushing bore or the machined face on the front of the clutch drum.

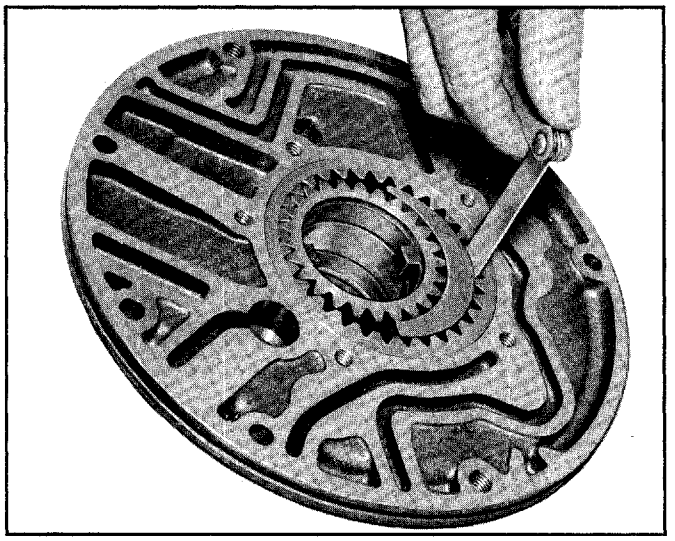


Fig. 19PG—Driven Gear to Crescent Clearance

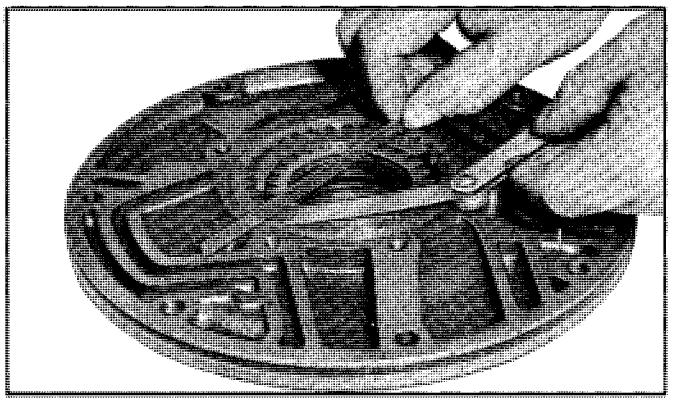


Fig. 20PG—Checking Gear End Clearance

2. Use the same tool to install the new bushing. Press (do not hammer) the bushing into the clutch drum from the machined face side of clutch drum. Press only far enough so that the tool meets the clutch drum. Do not force the tool against the clutch drum machined face.

Assembly

1. Install new piston inner seal in hub of clutch drum with seal lip downward (toward front of transmission).
2. Install a new piston seal in clutch piston. Seal lips must be pointed toward the clutch drum (front of transmission). Lubricate seals generously and install piston in clutch drum with a twisting motion.
3. Place the springs in position on the piston, then place the retainer in place on the springs.
4. Using Tools J-5133 and J-7782 and a press, or J-9542 as a hand operation, depress the retainer plate and springs far enough to allow installation of the spring retainer snap ring in its groove on the clutch drum hub.
5. Install the hub front washer with its lip toward the clutch drum, then install the clutch hub.
6. Install (wave) cushion spring wherever used, see chart.

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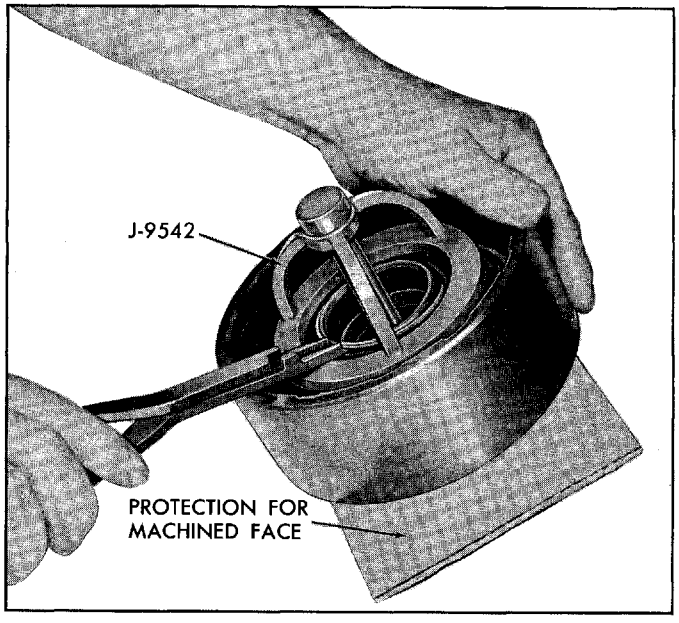


Fig. 21PG—Removing Clutch Spring Retainer Snap Ring

NOTE: On 350, 396 and 427 V-8 models only, the first driven plate to the rear of the cushion spring is a selective fit. Before installing plates to clutch drum, stack the (5) drive and (5) driven (exc. selective fit) plates and measure this stack height. Now refer to chart and select the proper selective driven plate and install it into clutch drum on top of the cushion spring.

7. Install the steel reaction plates and faced drive plates alternately, beginning with a steel reaction plate (fig. 23PG). See clutch chart.
8. Install the rear hub thrust washer with its flange toward the low sun gear, then install the low sun gear and flange assembly and secure with retainer ring. When installed, the openings in the retainer ring should be adjacent to one of the lands of the clutch drum.
9. Check the assembly by turning the clutch hub to be sure it is free to rotate.

Clutch Assemblies

	L-4 & 194L-6 (exc. Chevelle Taxi & Hvy. Duty Chassis); 230L-6 Pass. Cars.	194L-6 Taxi & Hvy. Duty Chassis; 230L-6 Trk.; 250L-6 Trk.; 283V-8; 292L-6 Trk.; 327V-8 Pass. Car, Corvette; 250L-6 Pass. Cars (exc. Taxi & Hvy. Duty Chassis)	250L-6 Taxi & Hvy. Duty Chassis; 396V-8 Pass. Cars. 327V-8 Trk.	350V-8 396V-8 427V-8 Corvette
Drive Plate	3	4	5	5
Driven Plate	4	5	6	6
Cushion Spring	1	1	None	1

350, 396 & 427 V-8 Selective Driven Plate Chart

Plate Stack Height (Less Selective Plate)	Plate Part Number	Color Code	Plate Thickness
.903-.872	3883903	Orange	.060 ± .0025
.872-.798	3883904	Blue	.090 ± .0025

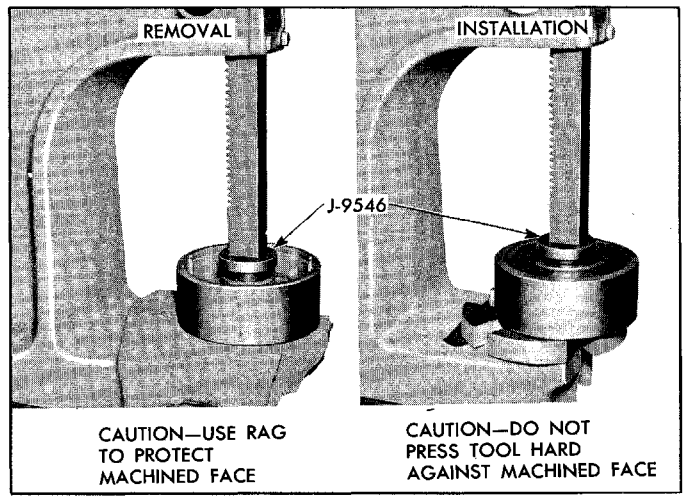


Fig. 22PG—Removing and Installing Clutch Drum Bushing

LOW BAND

The brake band used in the Aluminum Powerglide transmission has bonded linings which, due to the transmission characteristics and band usage, should require very little attention. However, whenever a transmission is disassembled the band should be cleaned of metal particles and inspected.

1. Check lining for evidence of scoring or burning.
2. Check band and lining for cracks.
3. Check all band linkage for excessive wear.

PLANET ASSEMBLY AND INPUT SHAFT

Inspection

1. Wash planet carrier and input shaft in cleaning solvent, blow out all oil passages and air dry.

   CAUTION: Do not use rags to dry parts.

2. Inspect planet pinions for nicks or other tooth damage.
3. Check end clearance of planet gears. This clearance should be .006"-.030" (fig. 24PG).
4. Check input sun gear for tooth damage, also check input sun gear rear thrust washer for damage.
5. Inspect output shaft bearing surface for nicks or scoring and inspect input pilot bushing.
6. Inspect input shaft splines for nicks or damage and check fit in clutch hub and input sun gear. Also check fit of splines in turbine hub.
7. Check oil seal rings for damage; rings must be free in input shaft ring grooves. Remove rings and insert in stator support bore and check to see that hooked ring ends have clearance. Replace rings on shaft.

Repairs

NOTE: The large planet carrier assembly now has the pinion shafts flared at each end for retention into the carrier. No overhaul of the large planet carrier assembly should be attempted.

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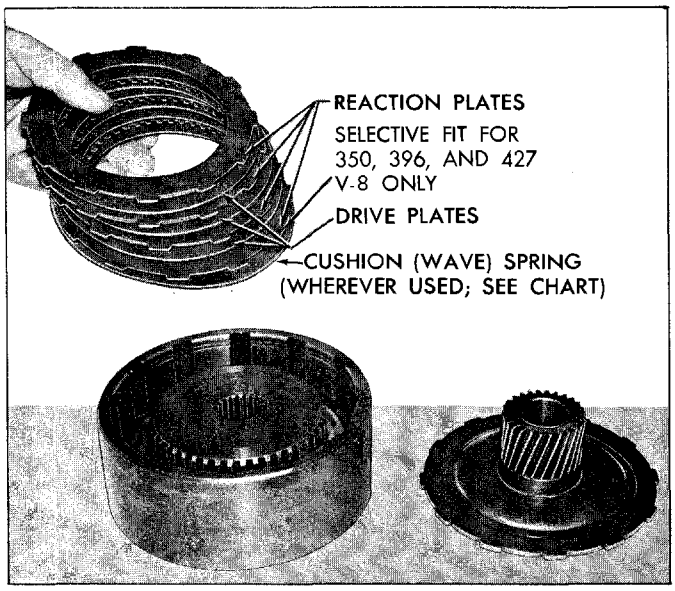


Fig. 23PG—Installing Clutch Drum Plates (Typical)

Small Planet Carrier Assembly—Overhaul

If during inspection, the planet pinions, pinion needle bearing, pinion thrust washers, input sun gear, and/or input sun gear thrust washer should show evidence of excessive wear or damage, they should be replaced using the following procedure:

Refer to Figure 25PG.

1. Place the planet carrier assembly in a fixture or vise so that the front (parking lock gear, end) of the assembly faces up.
2. Using prick punches or other similar means, mark each pinion shaft and also the planet carrier assembly (fig. 26PG), so that reassembling, each pinion shaft will be reinstalled in the same location from which it was removed.

   NOTE: The pinion shafts are not selectively fit but it is good practice to reinstall them in their original locations.

3. Remove the pinion shaft lock plate screws and rotate the lock plate counter-clockwise sufficiently to remove it.
4. Starting with a short planet pinion, and using a soft steel drift, drive on the lower end of the pinion shaft until the pinion shaft is raised above the press fit area of the output shaft flange. Feed J-4599 into the short planet pinion from the lower end, pushing the planet pinion shaft ahead of it until the tool is centered in the pinion and the pinion shaft is removed from the assembly.

   NOTE: Planet pinion remover and replacer Tool, J-4599, comes in two pieces, both alike. Only one is used when removing the planet pinion; two, however, must be used when reassembling.

5. Remove the short planet pinion from the assembly.
6. Remove J-4599, needle bearings and needle bearing spacers (3) from short planet pinion.

   CAUTION: Use care so as not to lose any of the planet pinion needle bearings. Twenty needle bearings are used in each end and are separated by a bearing spacer in the center.

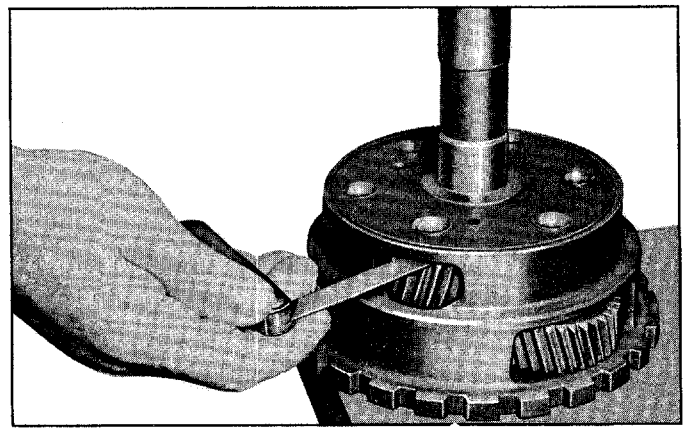


Fig. 24PG—Checking Planet Gear End Clearance

7. By following the procedure as outlined in Steps 4, 5, and 6, remove the adjacent long planet pinion that was paired by thrust washers to the short planet pinion now removed.

   NOTE: Twenty needle bearings are used in each end of the long pinion, separated by a bearing spacer in the center.

8. Remove the upper and lower thrust washers.
9. Remove and disassemble the remaining planet pinions, in pairs, by first removing a short planet pinion and then the adjacent long planet pinion.
10. Remove low sun gear needle thrust bearing, input sun gear and input sun gear thrust washer.
11. Wash all parts in cleaning solvent and air dry.
12. Recheck the planet pinion gears and input sun gear for nicks or other tooth damage; also check the planet pinion thrust washers and input sun gear thrust washer. Check low sun gear needle thrust bearing for spalled needles. Replace worn or damaged parts.
13. Inspect the planet pinion needle bearings closely and if there is indication of excessive wear, all the needle bearings must be replaced. Also inspect pinion shafts closely and, if worn, replace the worn shafts.
14. Inspect the input shaft bushing installed in the base of the output shaft. If damaged, it may be removed by threading Tool J-9534 into the bushing and pulling the bushing out using Slide Hammer J-6585. New bearing can be installed by pressing in flush or below thrust surface with the pilot end of input shaft as press tool.
15. Using J-4599, assemble needle bearing spacer and needle bearings (20 in each path) in one of the long planet pinions (fig. 25PG). Use petroleum jelly to aid in assembling and holding the needle bearings in position.
16. Position the long planet pinion with J-4599, centered in the pinion assembly and with thrust washers at each end, in the planet carrier. Oil grooves on thrust washers must be toward gears.

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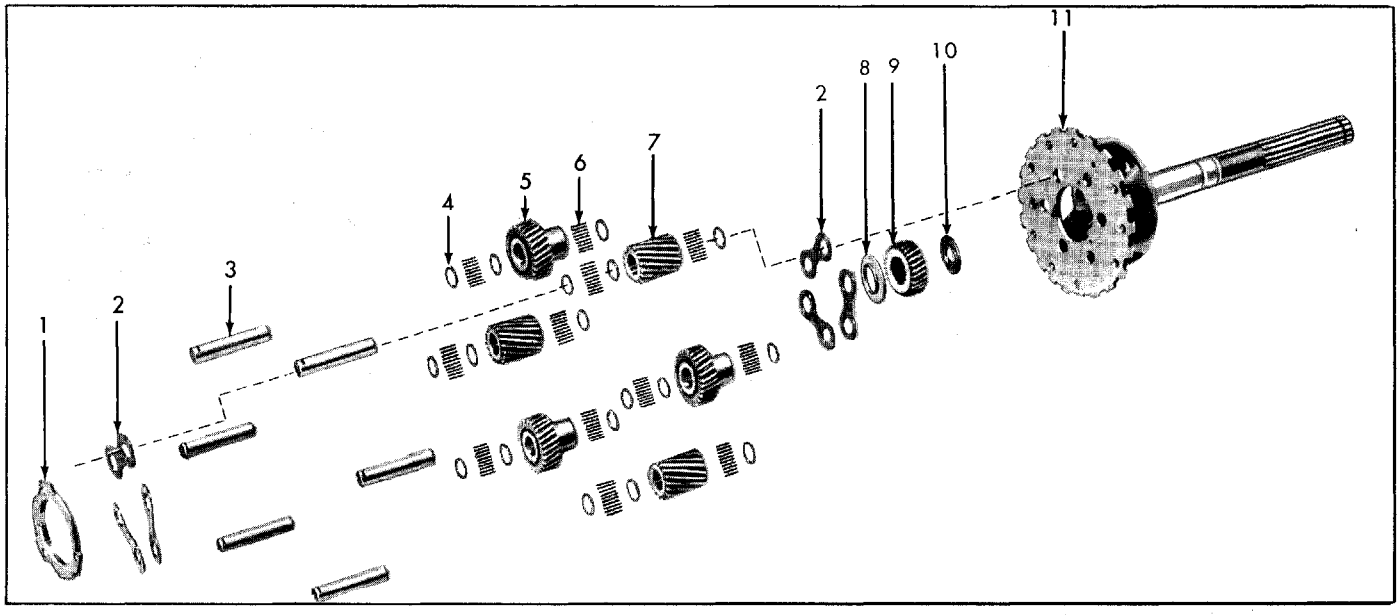


Fig. 25PG—Small Planet Carrier Assembly—Exploded View

1. Pinion Shaft Lock Plate
2. Pinion Thrust Washer
3. Pinion Shaft
4. Needle Bearing Washer
5. Short Planet Pinion Gear
6. Needle Bearings
7. Long Planet Pinion Gear
8. Low Sun Gear Thrust Bearing
9. Input Sun Gear
10. Input Sun Gear Thrust Washer
11. Carrier and Output Shaft

NOTE: The long planet pinions are located opposite the closed portions of the carrier, while the short planet pinions are located in the openings.

17. Feed the second J-4599 in from the top picking up the upper thrust washer and the planet pinion and pushing the already installed Tool J-4599 out the lower end. As the first tool is pushed down, check that it picks up the lower thrust washer.

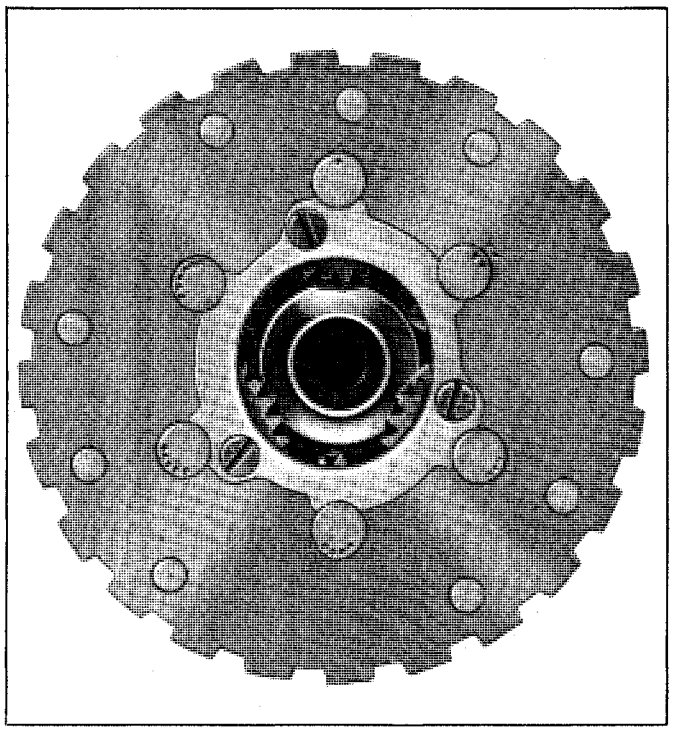


Fig. 26PG—Suggested Pinion Shaft Markings

18. Select the proper pinion shaft, as marked in Step 2, lubricate the shaft and install it from the top, pushing the assembling tools ahead of it.
19. Turn the pinion shaft so that the slot or groove at the upper end faces the center of the assembly.
20. With a brass or soft steel drift, drive the pinion shaft in until the lower end is flush with the lower face of the planet carrier.
21. Following the same general procedure as outlined in Steps 15 through 20, assemble and install a short planet pinion in the planet carrier adjacent to the long planet pinion now installed.

NOTE: The thrust washers already installed with the long planet pinion also suffice for this short planet pinion as the two pinions are paired together on one set of thrust washers.

22. Install the input sun gear thrust washer, the input sun gear and low sun gear needle thrust bearing.
23. Assemble and install the remaining planet pinions, in pairs, by first installing the long planet pinion and then the adjacent short planet pinion.
24. Check end clearance of planet gears. This clearance should be .005"-.030" (fig. 24PG).
25. Place the pinion shaft lock plate in position, then with the extended portions of the lock plate aligned with slots in the planet pinion shafts, rotate the lock plate clockwise until the three attaching screw holes are accessible.
26. Install the pinion shaft lock plate attaching screws and tighten to specification.

GOVERNOR

The governor assembly is a factory balanced unit. If

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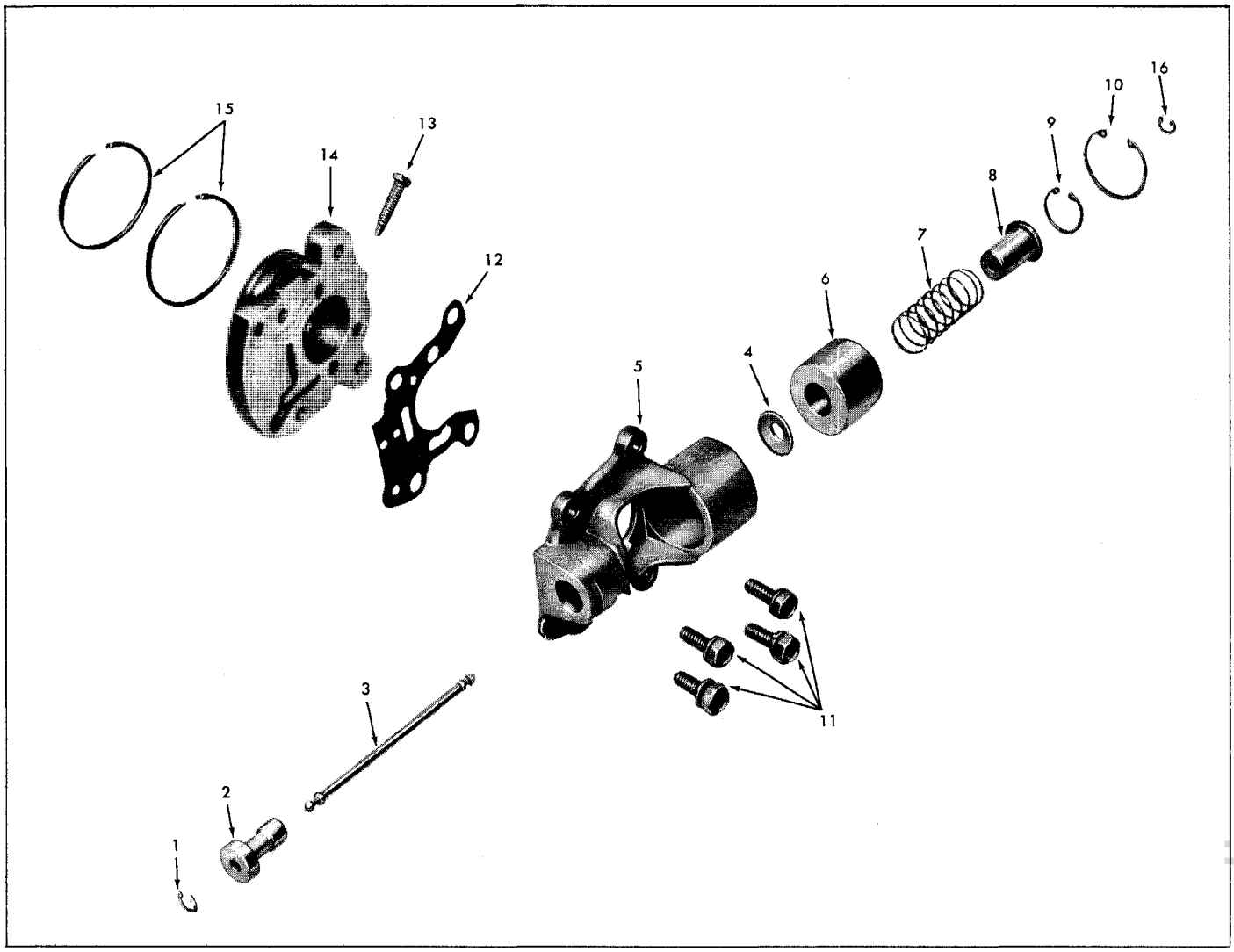


Fig. 27PG—Governor—Exploded View

1. Valve to Shaft Retaining Snap Ring
2. Valve
3. Shaft
4. Urethane Washer
5. Body
6. Outer Weight
7. Spring
8. Inner Weight
9. Inner Weight to Outer Weight Retaining Snap Ring
10. Outer Weight to Body Retaining Snap Ring
11. Body to Hub Screws and Lock Washers
12. Gasket
13. Hub Drive Screw
14. Hub
15. Hub Oil Seal Rings
16. Inner Weight to Shaft Retaining Snap Ring

body replacement is necessary, the two sections must be replaced as a unit. Remove the governor as outlined under "Transmission-Disassembly."

Disassembly

NOTE: The governor valve and shaft were already disassembled from the assembly during the removal procedures.

1. Remove the outer weight assembly by sliding toward center of body.
2. Remove the smaller inner weight retaining snap ring and remove the inner weight and spring.
3. If it is considered necessary, remove the four body assembly bolts and separate the body, hub and gasket. Remove the two seal rings.

Inspection

Clean all parts thoroughly in a solvent and air dry. Check condition of all component parts of the assembly. Replace any bent, damaged or scored parts. Body and hub must be replaced as a unit.

Assembly

1. Reassemble governor weights and reinstall in body bore. Replace seal rings on hub.
2. Slide hub into place on output shaft and lock into place with the drive screw. Install gasket and governor body over output shaft, install governor shaft, line up properly with output shaft and install body attaching bolts. Torque to specification.

NOTE: Place transmission selector lever in PARK to keep shaft from turning while tightening these bolts.

3. Check the governor weight for free fit in body after

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the four attaching bolts are torqued. If the weight sticks or binds, loosen the bolts and retorque.

VALVE BODY

Removal

Remove valve body as described under "Transmission-Disassembly." If performing the operation on the vehicle, the vacuum modulator and valve, oil pan and gasket, guide detent plate and range selector detent roller spring must be removed in order to remove the valve body from the transmission.

Disassembly

1. Remove the manual valve, suction screen and gasket.
2. Remove valve body bolts and carefully remove lower valve body and transfer plate from upper valve body. Discard gaskets.
3. From the upper valve body, remove the TV and detent valves and the downshift timing valve as follows:
   a. TV and Detent Valve - Remove the retaining pin by wedging a thin screw driver between its head and the valve body, then remove the detent valve assembly and throttle valve spring. Tilt the valve body to allow the throttle valve to fall out. If necessary, remove the "C" clip and disassemble the detent valve assembly.

      CAUTION: Do not disturb the setting of the adjustment hex nut on the detent valve assembly. This is a factory adjustment and should not normally be changed. However, some adjustment is possible if desired. See "Throttle Valve Adjustment."

   b. Downshift Timing Valve - Drive out the roll pin, remove the valve spring and the downshift timing valve.
4. From the lower valve body, remove the low-drive shift valve and the pressure regulator valve as follows:
   a. Low-Drive Shift Valve - Remove the snap ring and tilt the valve body to remove the low-drive regulator valve sleeve and valve assembly, valve springs and the shifter valve.
   b. Pressure Regulator Valve - Remove the snap ring, then tilt valve body to remove the hydraulic modulator valve sleeve and valve, pressure regulator valve spring retainer, spring and pressure regulator valve assembly.

Inspection

Since most valve failures are caused initially by dirt or other foreign material preventing a valve from functioning properly, a thorough cleaning of all parts in clean solvent is mandatory. Check all valves and their bores for burrs or other deformities which could result in valve hang-up.

Assembly

1. Replace valve components in the proper bores, reversing the disassembly procedures given above and checking Figure 28PG, if necessary.

   NOTE: Upper and lower valve body gaskets are the same.

2. Carefully install the lower valve body and gasket and install 15 1-3/8" attaching bolts. Torque to specification.

Installation

Install the valve body onto the transmission as outlined under "Transmission-Assembly."

VACUUM MODULATOR

The vacuum modulator is mounted on the left rear of the transmission and can be serviced from beneath the vehicle.

Removal

1. Remove the vacuum line at the vacuum modulator.
2. Unscrew the vacuum modulator from the transmission using J-9543, if available, or any thin 1" tappet type wrench.
3. Remove the vacuum modulator plunger, dampening spring (except L-4 & 194 L-6 models) and valve (fig. 11PG) from the transmission case.

Inspection and Repairs

Check the vacuum modulator plunger and valve for nicks and burrs. If such cannot be repaired with a slip stone, replace the part.

The vacuum modulator can be checked with a vacuum source for leakage. However, leakage normally results in transmission oil pull-over and results in oil smoky exhaust and continually low transmission oil. No vacuum modulator repairs are possible; replace as an assembly.

Installation

1. Install vacuum modulator valve, dampening spring (except L-4 & 194 L-6 models) and plunger in bore of transmission.
2. Place a new gasket on vacuum modulator. The gasket has centering tabs to hold it centered during installation.
3. Install vacuum modulator, tighten firmly, and install vacuum line as follows (fig. 11PG): Rubber tubing "A" should bottom against modulator cam. Pipe assembly "B" should bottom against the modulator extension.

TRANSMISSION CASE

Inspection

1. Wash case thoroughly with cleaning solvent, air dry and blow out all oil passages.

   CAUTION: Do not use rags to dry parts.

2. Inspect case for cracks which may contribute to leakage.
3. Inspect case rear bushing for damage or excessive wear.

   NOTE: This is a precision bushing and if damaged or worn excessively must be replaced.

4. Check shifter shaft seal. If it shows signs of damage or leaking, pry it out and install a new seal. The new seal must be firmly seated in case counterbore.

Repairs

Rear Bushing—Replacement

Transmission case rear bushing is a precision bushing which requires no reaming or finishing after assembly.

1. Remove bushing by driving or pressing from within case using J-9557 and Handle J-7079.
2. To install new bushing, drive or press bushing into place from rear of case using Tool J-9557 and Handle J-7079 (fig. 29PG).

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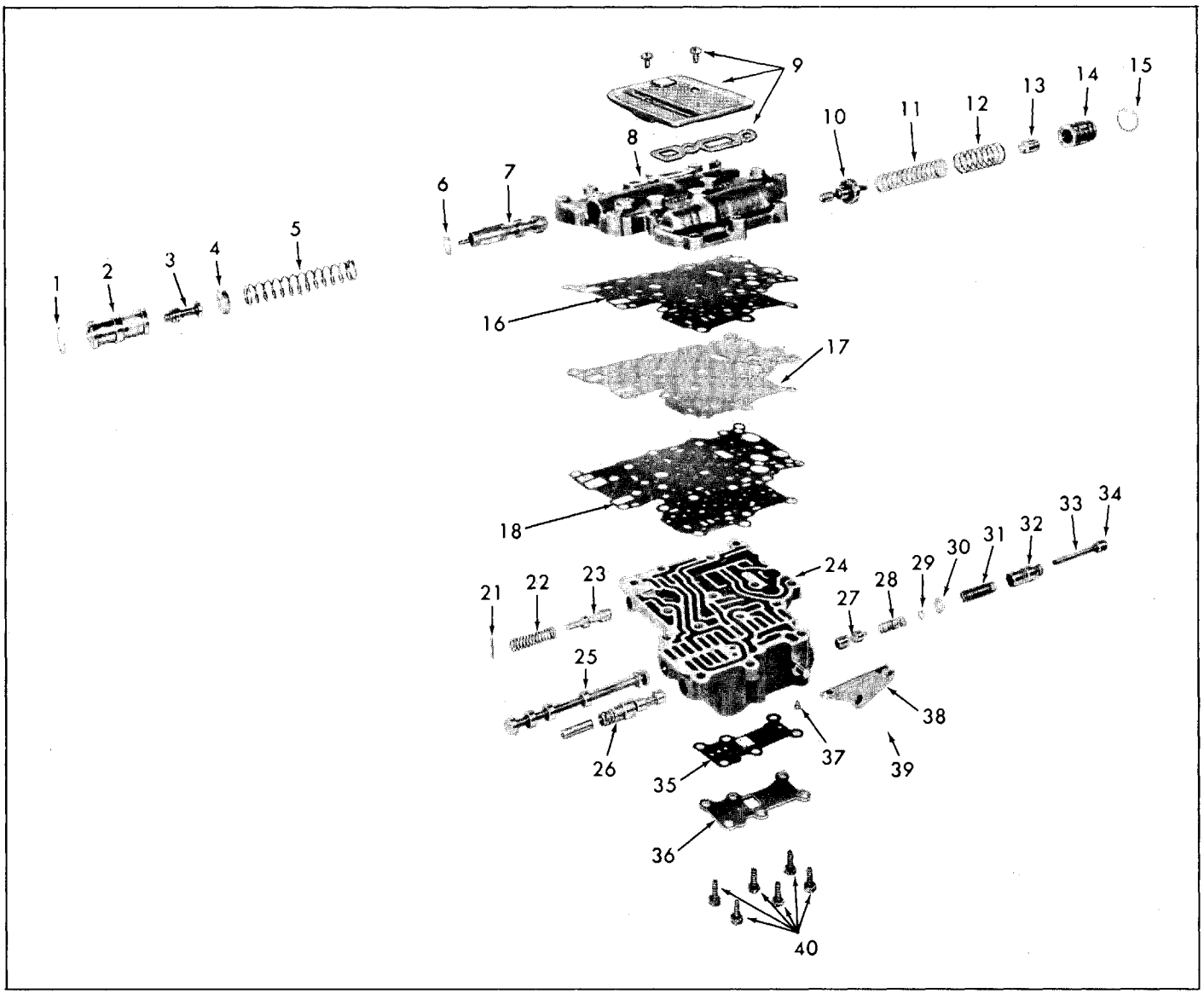


Fig. 28PG—Valve Body—Exploded View

1. Snap Ring
2. Hydraulic Modulator Valve Sleeve
3. Hydraulic Modulator Valve
4. Pressure Regulator Spring Retainer
5. Pressure Regulator Spring
6. Pressure Regulator Spring Seat
7. Pressure Regulator Valve
8. Lower Valve Body
9. Suction Screen, Gasket and Attaching Screws
10. Low and Drive Valve
11. Low and Drive Valve Inner Spring
12. Low and Drive Valve Outer Spring
13. Low and Drive Regulator Valve
14. Low and Drive Regulator Valve Sleeve and Cap
15. Snap Ring
16. Transfer Plate to Lower Valve Body Gasket
17. Transfer Plate
18. Transfer Plate to Upper Valve Body Gasket
21. High Speed Down Shift Timing Valve Stop Pin
22. High Speed Down Shift Timing Valve Spring
23. High Speed Down Shift Timing Valve
24. Upper Valve Body
25. Manual Control Valve
26. Vacuum Modulator Valve, Plunger and Spring (exc. L-4 & L-194)
27. Throttle Valve
28. Throttle Valve Spring
29. Throttle Valve Spring Seat
30. Throttle Valve Spring Regulator Guide Washer
31. Detent Valve Spring
32. Detent Valve
33. Throttle Valve Spring Regulator
34. Throttle Valve Spring Regulator Nut
35. Upper Valve Body Plate Gasket
36. Upper Valve Body Plate
37. Detent Valve and Spring Retaining Stud
38. Range Selector Detent Lever
39. Snap Ring
40. Upper Valve Body Plate to Upper Valve Body Attaching Bolts and Washers

CAUTION: Install bushing only until shoulder of J-9557 contacts the rear face of the case. Excessive force, either hammering or pressing may crack or otherwise damage the aluminum case.

TRANSMISSION EXTENSION

Inspection

1. Wash extension thoroughly with cleaning solvent and air dry.

CAUTION: Do not use rags to dry parts.

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2. Inspect extension for cracks that may contribute to leakage.
3. Inspect extension rear bushing for damage or excessive wear.
4. Inspect rear oil seal and replace if damaged or worn.

Repairs

Rear Bushing—Replacement

For service, the transmission extension rear bushing is of a precision type which requires no reaming or finishing after installation.

1. Place transmission extension in an arbor press rear end up.
2. Using J-5778, press old bushing from extension.
3. Place new bushing on pilot end of J-5778 and press it into place.
4. Replace extension rear oil seal, using Seal Installer J-5154. Prelubricate between lips of seal with cup grease.

TRANSMISSION

Assembly

NOTE: Use only transmission oil or petroleum jelly as lubricants to retain bearings or races during assembly. Lubricate all bearings, seal rings and clutch plates prior to assembly.

If removed, assemble manual linkage to case as described in Step 1-7.

1. Install the parking lock pawl and shaft and insert a new "E" ring retainer.

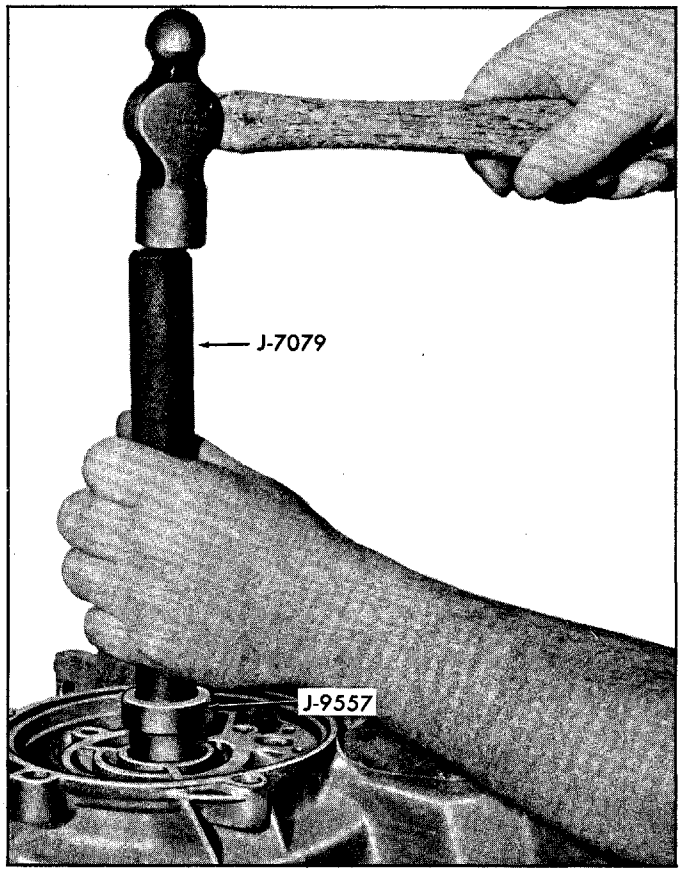


Fig. 29PG—Installing Case Rear Bushing

2. Install the parking lock pawl pull-back spring over its boss to the rear of the pawl. The short leg of the spring should locate in the hole in the parking pawl.
3. Install the parking lock pawl reaction bracket with its two bolts.
4. Fit the actuator assembly between the parking lock pawl and the bracket.
5. Insert the outer shift lever into the case, being careful of the shaft seal, and pick up the inner shift lever and parking lock assembly and tighten allen head screw. Lubricate the shaft and seal with oil.
6. Insert outer TV lever and shaft, special washer and "O" ring into case and pick up inner TV lever. Tighten allen head nut.

   NOTE: To prevent possible binding between throttle and range selector controls; .010 to .020" clearance must exist between inner TV lever and inner shift lever after assembly.

7. Thread the low band adjusting screw into case.

   NOTE: The above internal components are shown in their proper relationship in Figure 16PG.

Transmission Internal Components

8. Install the inner and outer seals on the reverse piston and, lubricating the piston and case with transmission oil, install the piston into the case (fig. 30PG). If necessary, carefully slide a feeler gauge around the outer diameter of the piston to start the seal ring into the bore.
9. With the support fixture turned so that the transmission case is facing up, install the 17 reverse piston return springs and their retainer ring.
10. Carefully install Tool J-9542 over the retainer ring and through the rear bore of the case. With the flat plate on the rear face of the case, turn down on the wing nut to compress the return springs and allow the retaining ring snap ring to be installed. Remove Tool J-9542.

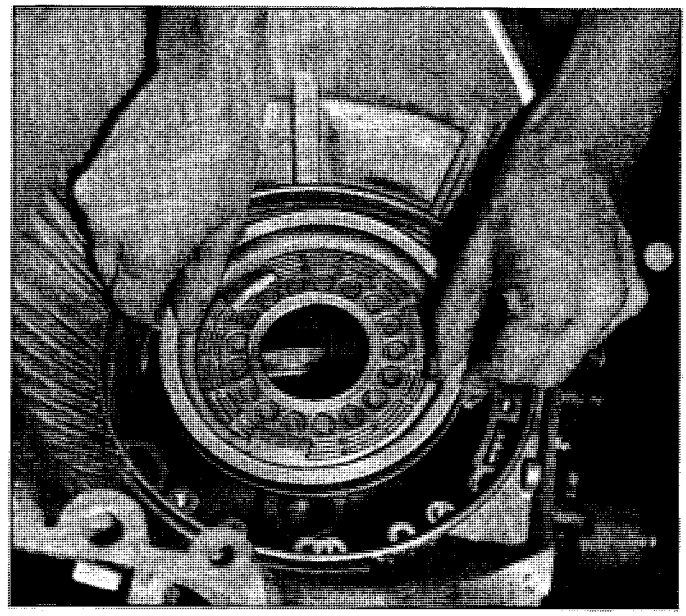


Fig. 30PG—Installing Reverse Piston

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CAUTION: Use care when performing this operation that the spring retainer is correctly guided over the case internal hub and is not damaged by catching on the edge of the hub or in the snap ring groove.

11. Install the large (waved) cushion spring.
12. Lubricate and install the reverse clutch pack (fig. 31PG) beginning with a reaction (spacer) plate and alternating with the drive plates (faced) until all reaction plates and all drive plates are in place. The notched lug on each reaction plate is installed in the groove at the 7 o'clock position in the case. Then install the thick pressure plate which has a "dimple" in one lug to align with the same slot in the case as the notched lugs on the other reaction plates.

    L-4, L-6 and 283 V-8 engine models have 4 reaction and 4 drive plates. The 327 cu. in. V-8 engine models have 5 reaction and 5 drive plates. 427, 396 and 350 cu. in. V-8 models have 6 reaction and 6 drive plates.
13. Install the clutch plate retaining ring.
14. With the rear of the transmission case downward, align the internal lands and grooves of the reverse clutch pack faced plates, then engage the reverse ring gear with these plates. This engagement must be made by "feel" while jiggling and turning the ring gear.
15. Place the output shaft thrust bearing over the output shaft and install the planetary carrier and output shaft into the transmission case (fig. 32PG).
16. Move the transmission into a horizontal position. The two input shaft seal rings should be in place on the shaft. Install the clutch drum (machined face first) onto the input shaft and install the low sun gear bushing (splined) against shoulder on shaft.
17. Install clutch drum and input shaft assembly into case, aligning thrust needle bearing on input shaft and indexing low sun gear with the short pinions on the planet carrier.
18. Remove the rubber seal ring from the oil pump body and, using guide studs from J-3387 set, install clutch drum selective thrust washer, oil pump gasket and oil pump to case. Install two pump-to-case bolts.
19. To check for correct thickness of the selective fit thrust washer, move transmission so that output shaft points down and proceed as follows:
    a. Mount a dial indicator so that plunger of indicator is resting on end of the input shaft. J-5492 may be used to support the dial indicator as shown in Figure 33PG. Zero the indicator.
    b. Push up on the transmission output shaft and observe the total indicator movement.
    c. The indicator should read .028" to .059". If the reading is within limits, the proper selective fit washer is being used. If the reading is not within limits, it will be necessary to remove the front pump, change to a thicker or thinner selective fit thrust washer, as required to obtain the specified clearance, and repeat the above checking procedure.

NOTE: Clutch drum selective thrust washers are available in thicknesses of .061", .078", .092" and .106".

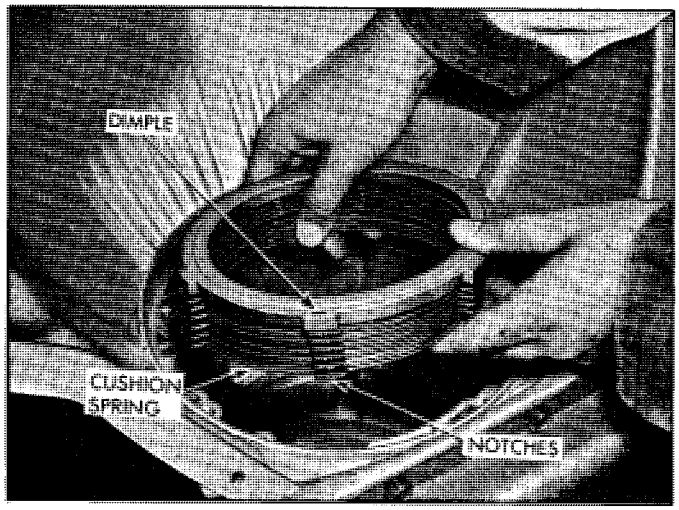


Fig. 31PG—Installing Clutch Plates (Typical)

20. Install the servo piston, piston ring, and spring into the servo bore. Then, using a new gasket and "O" ring, install the servo cover. See that gasket is properly aligned with the three bolt holes and the drain back passage in the case.
21. Remove the oil pump and the selective fit washer from the case, and install the low brake band, anchor and apply struts into the case. Tighten the low band adjusting screw enough to prevent struts from falling out of case.
22. Place the seal ring in the groove around the oil pump body and the two seal rings on the pump cover extension. Install clutch drum selective thrust washer, oil pump gasket and oil pump to case. Remove guide pins and install all pump bolts, replacing any damaged bolt sealing washers necessary and torque bolts to specification.

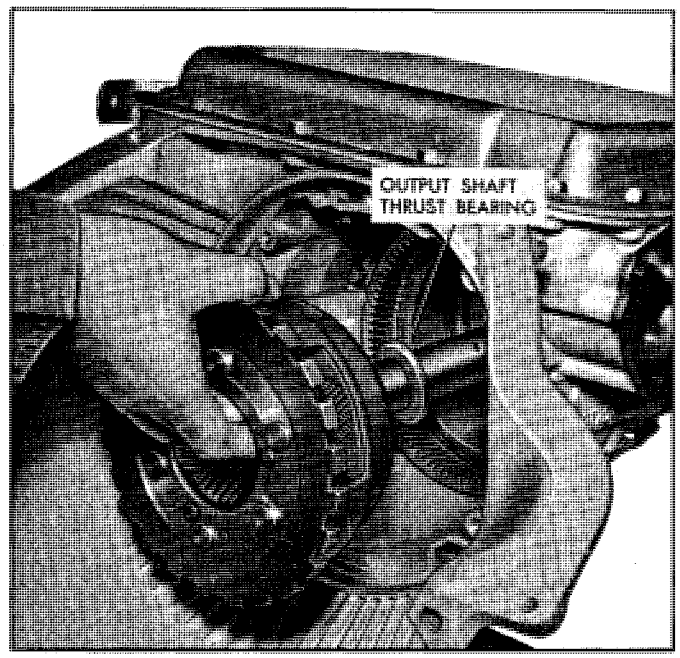


Fig. 32PG—Installing Gearset

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Extension, Governor and Governor Support

23. Turn transmission so that shaft points upward.
24. Install governor support and gasket, drain back baffle, and support to case attaching bolts. Bolt holes are positioned so that the support may be assembled only in the proper position.
25. Install governor over output shaft (See "Governor-Assembly" for body to hub installation.) Install governor shaft and valve, urethane washer, and retaining "C" clips. Center shaft in output shaft bore and tighten governor hub drive screw.
26. Using Tool J-5814, install speedometer gear into output shaft.
27. Place extension seal ring over governor support and install transmission extension and five retaining bolts.
28. If removed, replace speedometer driven gear.

Oil Pan and Valve Body

29. With transmission upside down, and manual linkage installed as previously described, and the selector lever detent roller installed, install the valve body (servo apply tube installed) and a new gasket. Carefully guide the servo apply line into its boss in the case as the valve body is set into place (fig. 34PG). Install six mounting bolts and range selector detent roller spring shown in Figure 12PG.

    NOTE: Position the manual valve actuating lever fully forward when installing valve body to more easily pick up the manual valve.

30. Install the guide plate (fig. 35PG) making sure that the inner lever properly picks up the manual valve. Install attaching bolts.
31. Install the vacuum modulator valve and the vacuum modulator and gasket.
32. Install the oil pan, using a new gasket, and the oil pan attaching bolts.
33. Install converter and Safety Holding Strap J-9549 or a suitable substitute.

LOW BAND ADJUSTMENT

Tighten the low servo adjusting screw to 70 inch lbs. using torque wrench, J-5853 and a 7/32" hex head driver (fig. 36PG) or J-21848. The input and output shaft must be rotated simultaneously to properly center the low band on the clutch drum. Then back off four (4) complete turns for a band which has been in use for 1,000 miles or more, or 3 turns for a new band. Tighten the locknut to specified torque.

CAUTION: The amount of back-off is not an approximate figure, it must be exact.

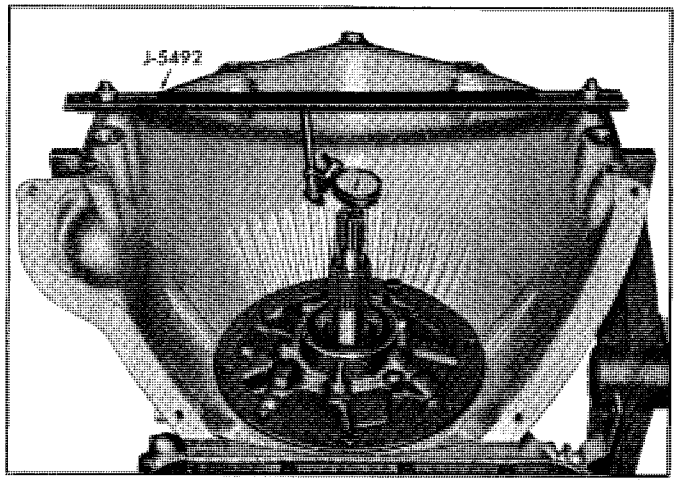


Fig. 33PG—Checking End Play for Proper Thrust Washer Selection

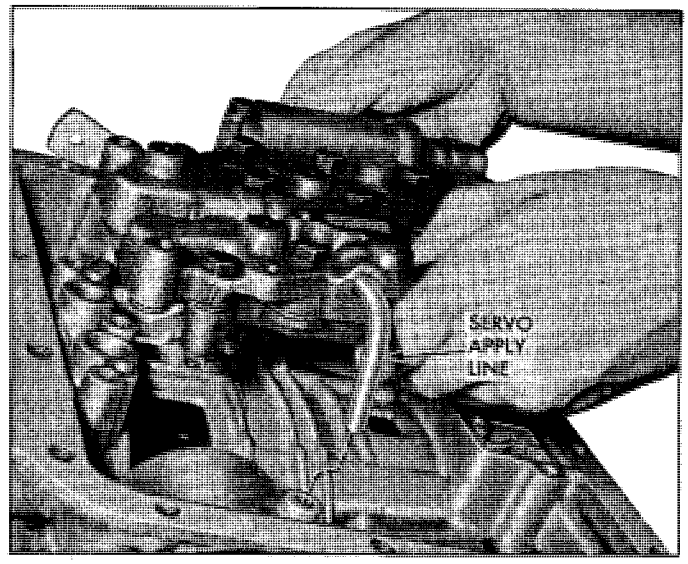


Fig. 34PG—Installing Valve Body

THROTTLE VALVE ADJUSTMENT

No provision is made for checking TV pressures. However, if operation of the transmission is such that some adjustment of the TV is indicated, pressures may be raised or lowered by adjusting the position of the jam nut on the throttle valve assembly (fig. 37PG). To raise TV pressure 3 psi, backoff the jam nut one (1) full turn. This increases the dimension from the jam nut to the throttle valve assembly stop. Conversely, tightening the jam nut one (1) full turn lowers TV pressure 3 psi. A

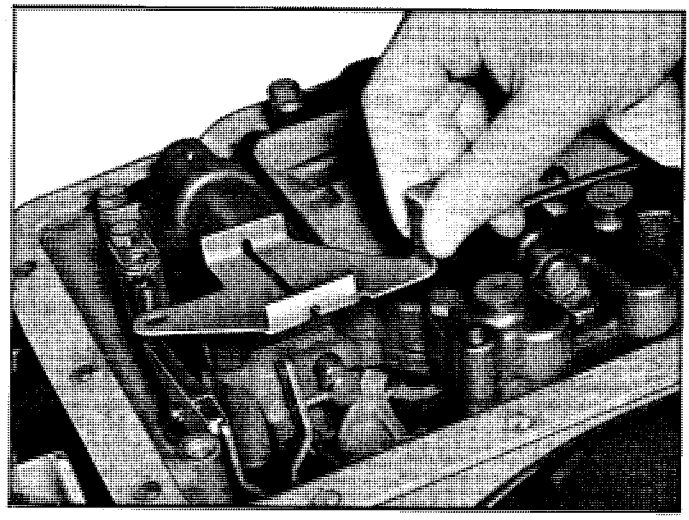


Fig. 35PG—Installing Detent Guide Plate

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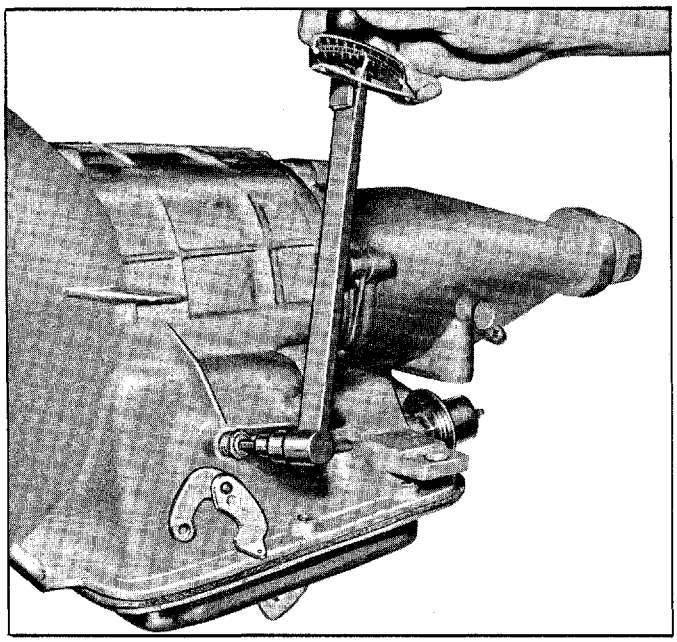


Fig. 36PG—Low Band Adjustment

difference of 3 psi in TV pressure will cause a change of approximately 2 to 3 MPH in the wide open throttle upshift point. Smaller pressure adjustments can be made by partial turns of the jam nut. The end of TV adjusting screw has an allen head so the screw may be held stationary while the jam nut is moved.

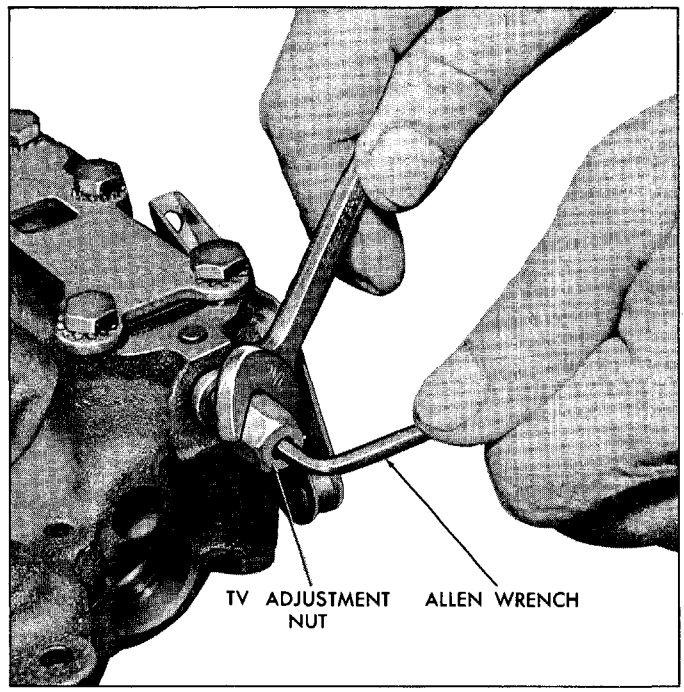


Fig. 37PG—TV Adjustment Nut

NOTE: Use care when making this adjustment since no pressure tap is provided to check TV pressure.

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TURBO HYDRA-MATIC TRANSMISSION

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TRANSMISSION DISASSEMBLY AND REASSEMBLY

DISASSEMBLY OF MAJOR UNITS

1. With transmission in cradle on portable jack, remove converter assembly by pulling straight out.

   NOTE: Converter contains a large amount of oil.

2. Install holding Fixture J-8763-01 on transmission so that modulator assembly will be located on side of holding fixture nearest bench.

   NOTE: Do not over-torque holding screw. This will bind case center support.

3. Install fixture and transmission into holding Tool Base J-3289-14 with bottom pan facing up (fig. 2T).
4. Remove modulator assembly attaching screw and retainer (fig. 3T).
5. Remove modulator assembly and "O" ring seal from case (fig. 4T).
6. Remove modulator valve from transmission case.

Removal of Governor, Speedometer Driven Gear, Pan, Strainer and Intake Pipe

1. Remove attaching screws, governor cover and gasket (fig. 5T).
2. Withdraw governor assembly from case.
3. Remove speedometer driven gear attaching screw and retainer (fig. 6T).
4. Withdraw speedometer driven gear assembly from case.
5. Remove bottom pan attaching screws, bottom pan, and bottom pan gasket (fig. 7T).
6. Remove strainer assembly (fig. 8T).
7. Remove intake pipe to case "O" ring seal from strainer assembly or case.

Removal of Control Valve Assembly, Solenoid Connector, Governor Pipes and Detent Spring Assembly

1. Remove control valve body attaching screws and detent roller and spring assembly (fig. 9T).

   NOTE: Do not remove solenoid attaching screws.

2. Disconnect solenoid lead from connector terminal.
3. Remove control valve body assembly and governor pipes (fig. 10T).

   CAUTION: Do not drop manual valve.

4. Remove governor pipes from control valve assembly.
5. Remove control valve assembly to spacer gasket.

Removal of Rear Servo, Valve Body Spacer, Gasket and Front Servo

1. Remove rear servo cover attaching screws, servo cover and gasket. Discard gasket (fig. 11T).
2. Remove rear servo assembly from case (fig. 12T).
3. Remove rear servo accumulator spring.
4. Make band apply pin selection check to determine possible cause of malfunction (fig. 13T).

Rear Band Apply Pin Selection

a. Attach band apply pin selection Gauge J-21370-5 and J-21370-6 to transmission case with attaching screws checking to make certain the gauge pin does not bind in servo pin hole (fig. 13T).

b. Apply 25 ft. lb. torque and select proper pin to be used during assembly of transmission.

Selecting proper length pin is equivalent to adjusting band. The band lug end of each selective apply pin bears identification in the form of one, two or three rings.

c. If both steps of J-21370-5 are below the gauge surface, the long pin, identified by 3 rings, should be used.

d. If the gauge surface is between the steps, the medium pin, identified by 2 rings, should be used.

e. If both steps are above the gauge surface, the short pin, identified by 1 ring, should be used.

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Fig. 1T—Side Cross Section Typical

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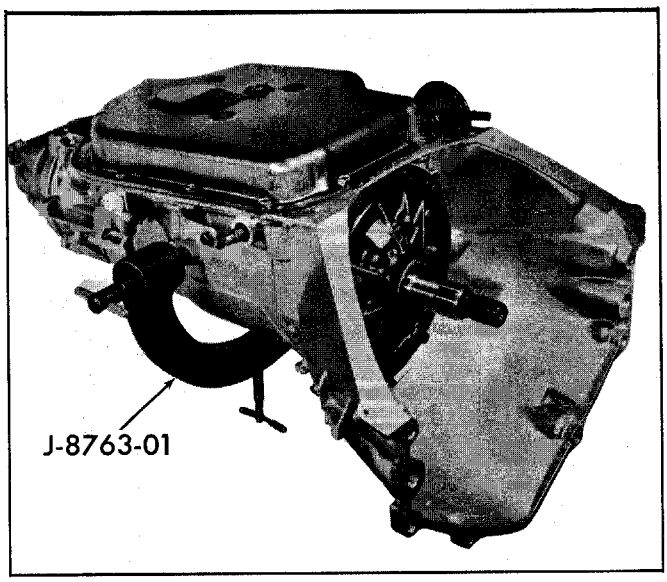


Fig. 2T—Transmission in Holding Fixture

5. Remove solenoid attaching screws, solenoid assembly and gasket (fig. 14T).
6. Withdraw detent solenoid case sleeve connector and "O" ring seal (fig. 15T).
7. Remove control valve assembly spacer plate and gasket.
8. Remove six (6) check balls from cored passages in transmission case (fig. 142T).
9. Remove front servo piston, washer, pin, retainer and spring from transmission case (fig. 17T).

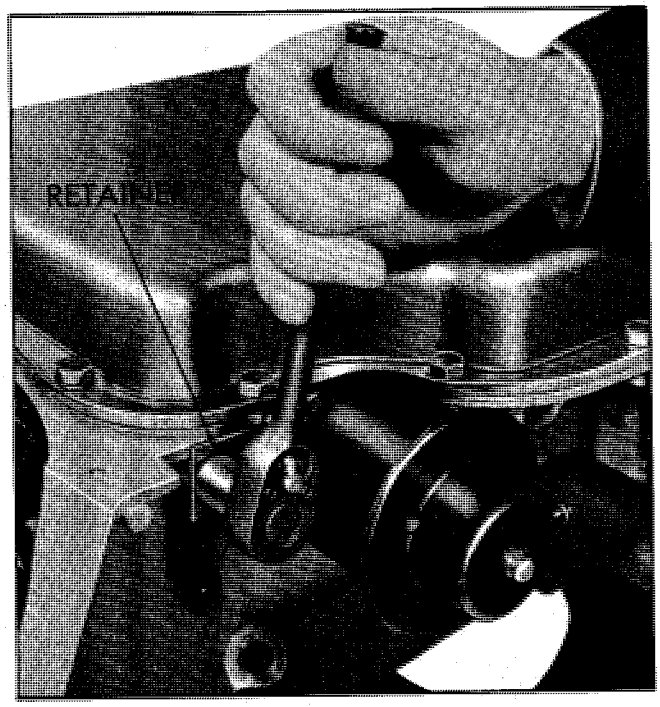


Fig. 3T—Removing Modulator Retainer



Fig. 4T—Removing Vacuum Modulator and Valve

Removal of Rear Oil Seal and Extension Housing

1. If necessary to replace, pry rear oil seal from extension housing (fig. 18T).
2. Remove extension housing to case attaching bolts.
3. Remove extension housing and extension housing to case gasket (fig. 19T).
4. Make front unit end play check as follows: (fig. 20T).

Front Unit End Play Checking Procedure

a. Remove one front pump attaching bolt, and bolt seal. (See Figure 20T for location)

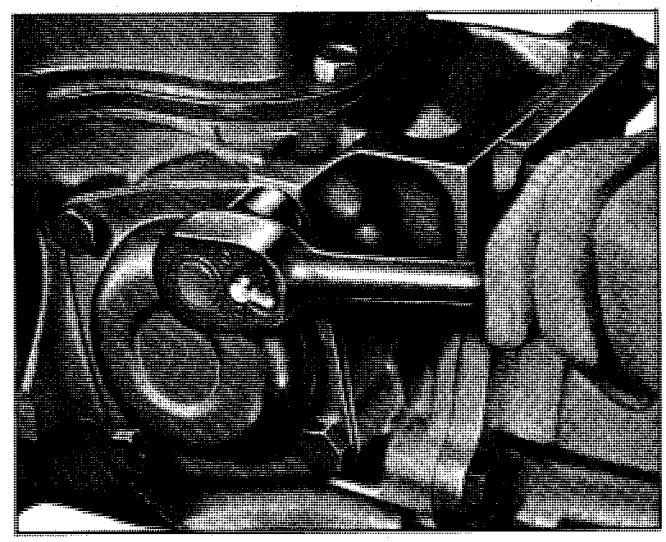


Fig. 5T—Removing Governor Cover Attaching Screws

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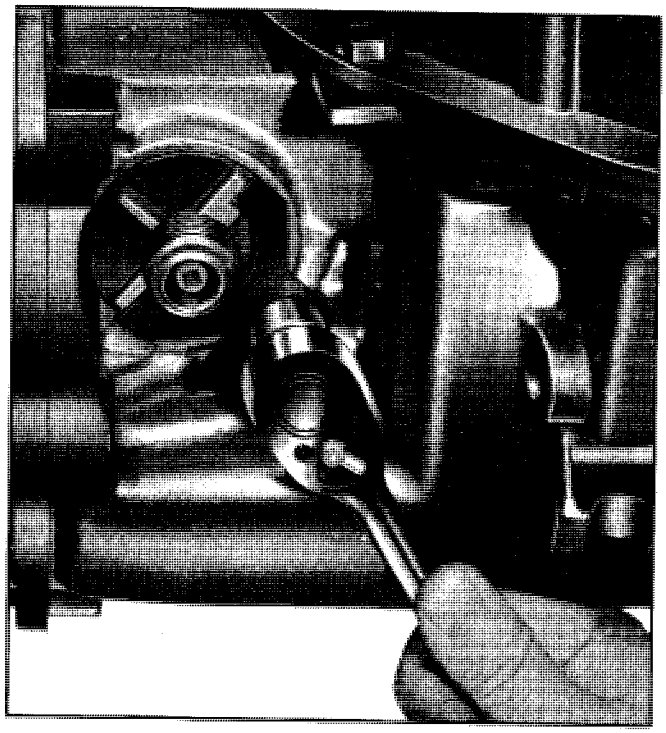


Fig. 6T—Removing Speedometer Driven Gear Retainer

b. Install a 3/8"-16 threaded slide hammer bolt or J-9539, into bolt hole.
c. Mount a dial indicator on rod and index indicator to register with end of turbine shaft.
d. Push on turbine shaft rearward.
e. Push output shaft forward.
f. Set dial indicator to Zero.
g. Pull turbine shaft forward.

Read resulting travel or end play. Should be .003"-.024".

Selective washer controlling this end play is the phenolic resin washer located between pump cover and forward clutch housing. If more or less washer thickness is required to bring end play within specifications, select proper washer from the following chart:

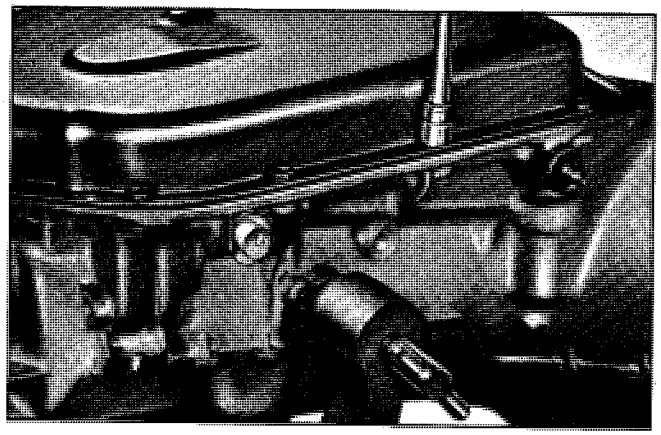


Fig. 7T—Removing Transmission Oil Pan Attaching Screws

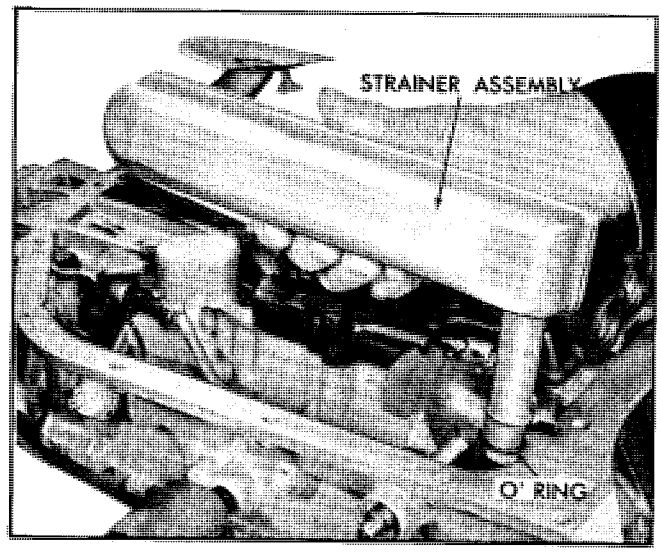


Fig. 8T—Removing Strainer Assembly and "O" Ring

Thickness	Color
.060 - .064	Yellow
.071 - .075	Blue
.082 - .086	Red
.093 - .097	Brown
.104 - .108	Green
.115 - .119	Black
.126 - .130	Purple

NOTE: An oil soaked washer may tend to discolor, so it will be necessary to measure washer for its actual thickness.

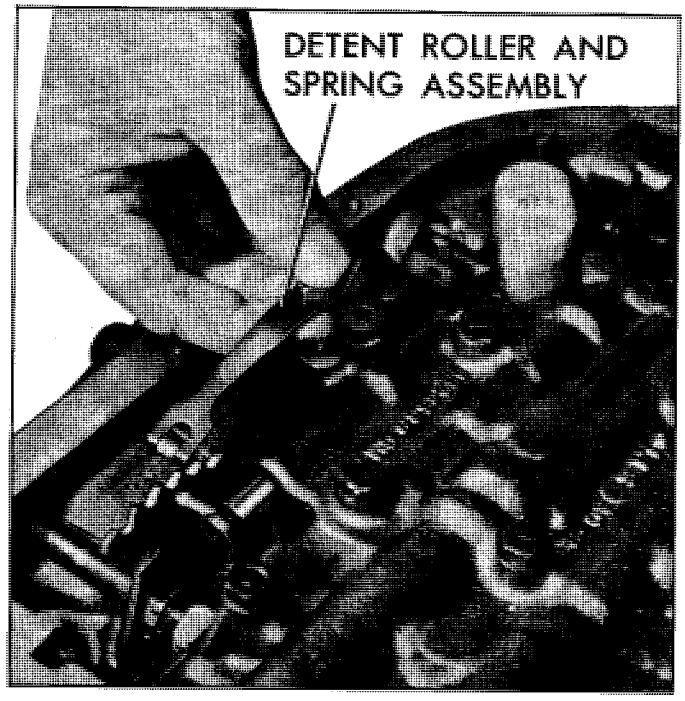


Fig. 9T—Removing Detent Roller and Spring Assembly

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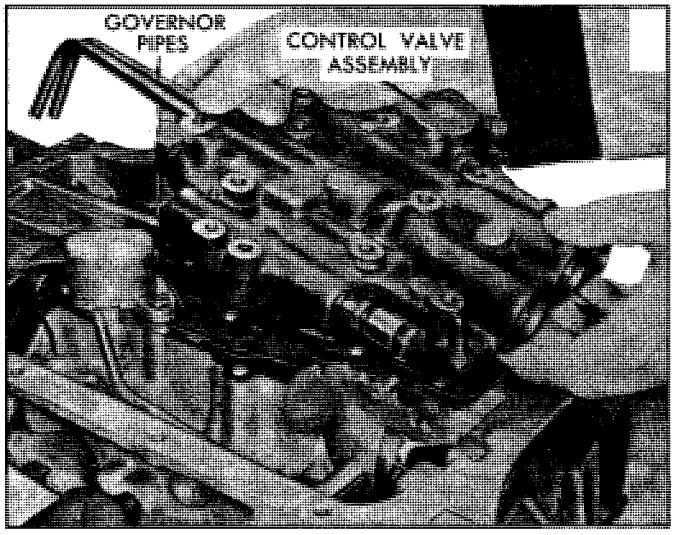


Fig. 10T—Removing Control Valve Assembly and Governor Pipes from Case

Removal of Oil Pump and Internal Case Components

1. If necessary to replace, pry front seal from pump (fig. 21T).
2. Remove pump attaching bolts.
3. Install two 3/8"-16 threaded slide hammer bolts, J-9539 with weights J-6585-01, into bolt holes in pump body and remove pump assembly from case (fig. 22T). (See illustration for location of threaded holes.)
4. Remove and discard pump to case seal ring and gasket.
5. Remove forward clutch assembly and turbine shaft from transmission (fig. 23T).
6. Remove forward clutch hub to direct clutch housing phenolic thrust washer, if it did not come out with forward clutch housing assembly.
7. Remove direct clutch assembly (fig. 24T).

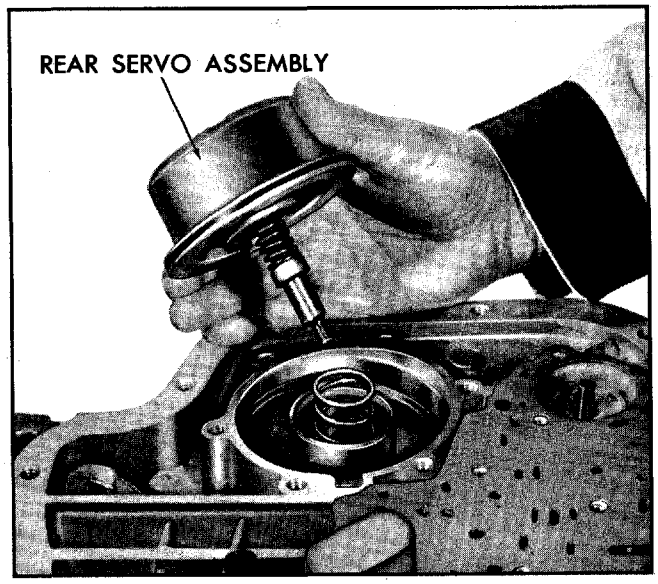


Fig. 12T—Removing Rear Servo Assembly

NOTE: If necessary, remove manual linkage as follows:

a. Unthread jam nut holding detent lever to manual shaft.
b. Remove manual shaft retaining pin from case (fig. 25T).

CAUTION: Do not lose jam nut as it becomes free from manual shaft.

c. Remove manual shaft and jam nut from case (fig. 26T).

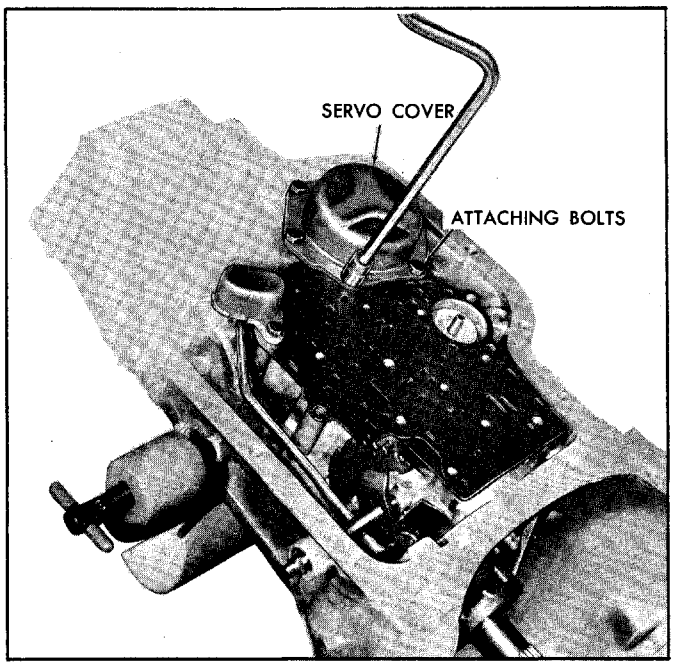


Fig. 11T—Removing Rear Servo Cover Attaching Bolts

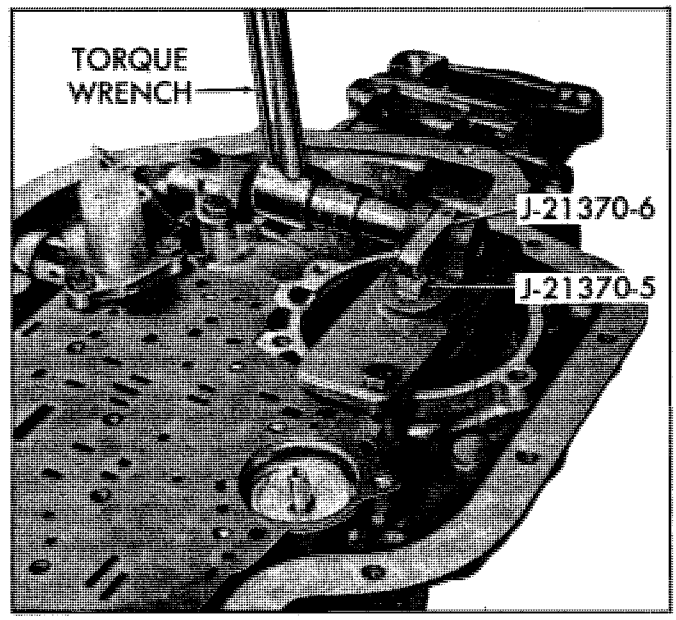


Fig. 13T—Checking Rear Band Pin

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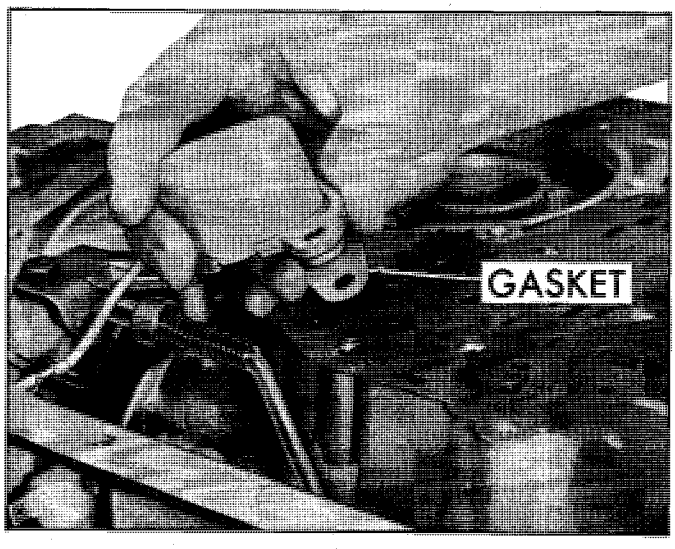


Fig. 14T—Removing Detent Solenoid and Gasket

NOTE: Manual shaft should NOT be removed from the case unless replacement is required.

d. Remove parking actuator rod and detent lever assembly.
e. Remove attaching screws and parking bracket (fig. 28T).
f. Remove parking pawl return spring (fig. 29T).

NOTE: The following steps are to be completed only if 1 or more of the parts involved require replacement.

g. Remove parking pawl shaft retainer (fig. 30T).
h. Remove parking pawl shaft cup plug by inserting a screwdriver, between the parking pawl shaft and the case rib, and prying outwards. (Fig. 31T)
i. Remove parking pawl shaft and parking pawl. (Fig. 31T)

8. Remove front band assembly (fig. 32T).
9. Remove sun gear shaft (fig. 33T).

Check Rear End Play as Follows (Fig. 34T)

a. Install J-9539 or a 3/8"-16 threaded bolt into an extension housing attaching bolt hole (fig. 34T).
b. Mount a dial indicator on rod and index with end of output shaft.
c. Move output shaft in and out to read end play. End play should be from .003"-.019". Selective washer controlling this end play is a steel washer having 3 lugs that is located between output shaft thrust washer and rear face of transmission case.

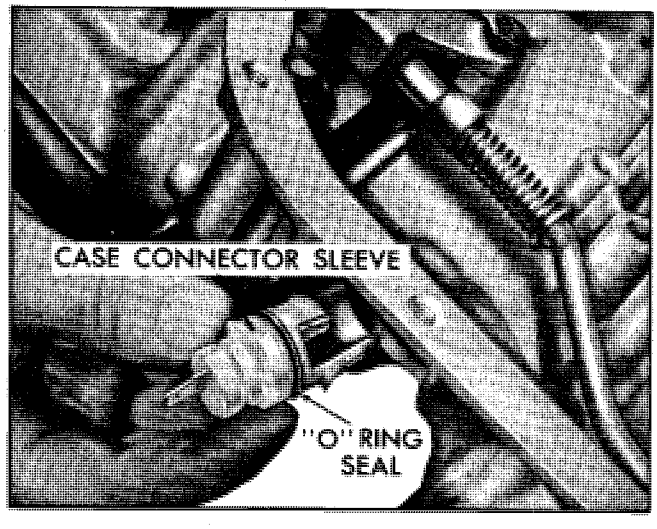


Fig. 15T—Removing Case Connector Sleeve and "O" Ring

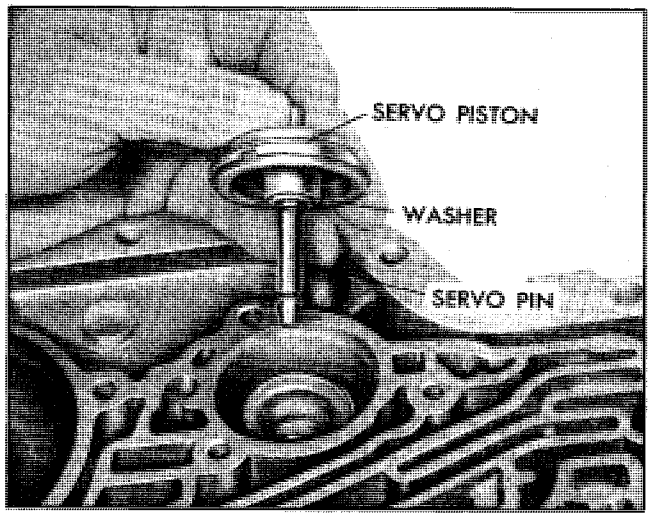


Fig. 17T—Removing Front Servo Piston, Washer, and Pin

If a different washer thickness is required to bring end play within specification, it can be selected from the following chart.

Thickness	Notches
.078 - .082	None
.086 - .090	1 Tab Side
.094 - .098	2 Tab Side
.102 - .106	1 Tab O.D.
.110 - .114	2 Tabs O.D.
.118 - .122	3 Tabs O.D.

10. Remove case center support to case bolt (fig. 27T).
11. Remove intermediate clutch backing plate to case snap ring.
12. Remove intermediate clutch backing plate, three (3) composition, and three (3) steel clutch plates (fig. 35T).
13. Remove center support to case retaining snap ring (fig. 36T).

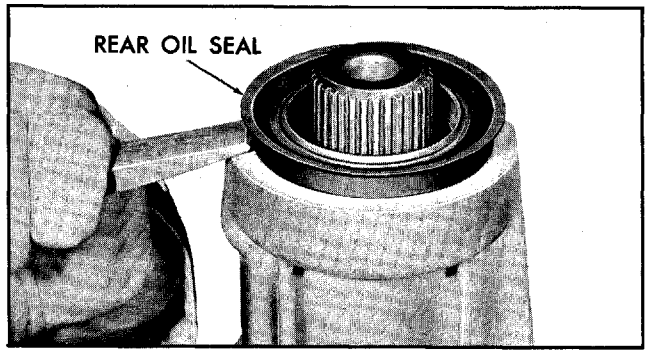


Fig. 18T—Removing Rear Oil Seal from Case Extension

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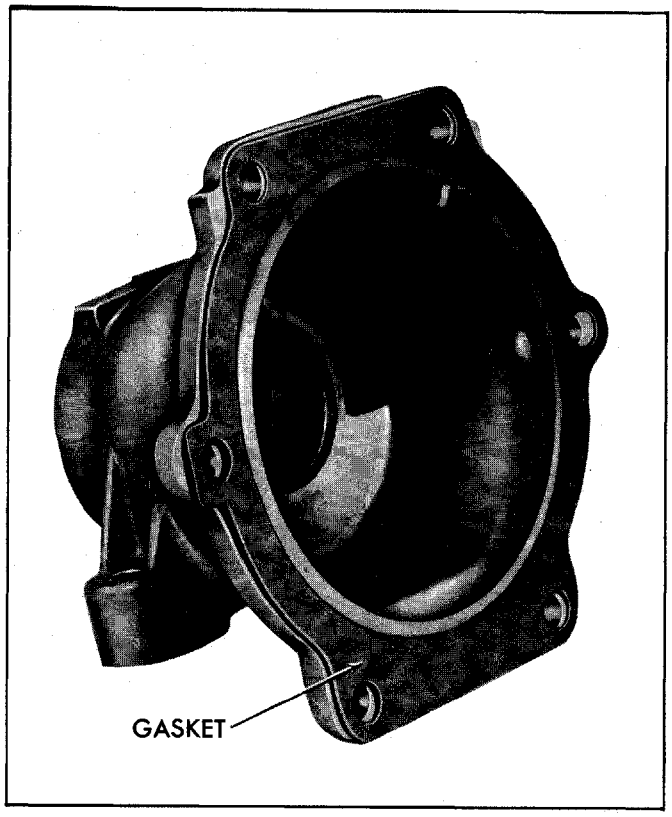


Fig. 19T—Case Extension and Gasket

14. Remove entire gear unit assembly by lifting with gear assembly installing and removing Tool J-21795 with J-9539 slide hammer (fig. 37T).
15. Remove output shaft to case thrust washer from rear of output shaft or inside case.
16. Place gear unit assembly, with output shaft facing down through hole in work bench or Holding Fixtures J-6116 with J-21364 adapter.
17. Remove rear unit selective washer from transmission case (fig. 38T).
18. Remove rear band assembly (fig. 39T).

Disassembly of Gear Unit Assembly

1. Remove case center support assembly (fig. 40T).

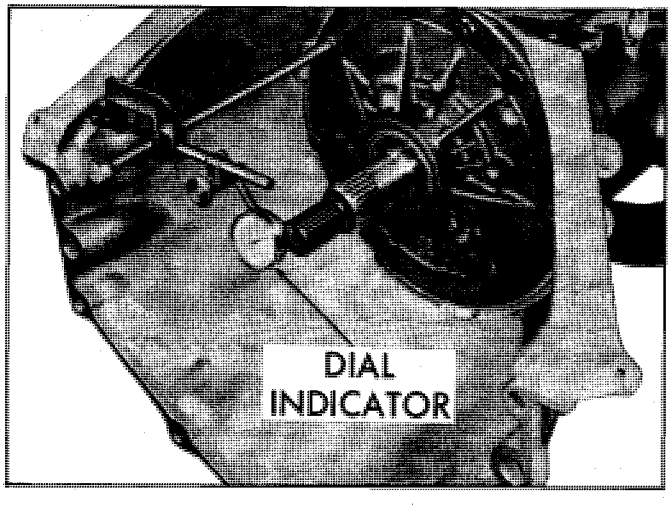


Fig. 20T—Checking Front Unit End Play

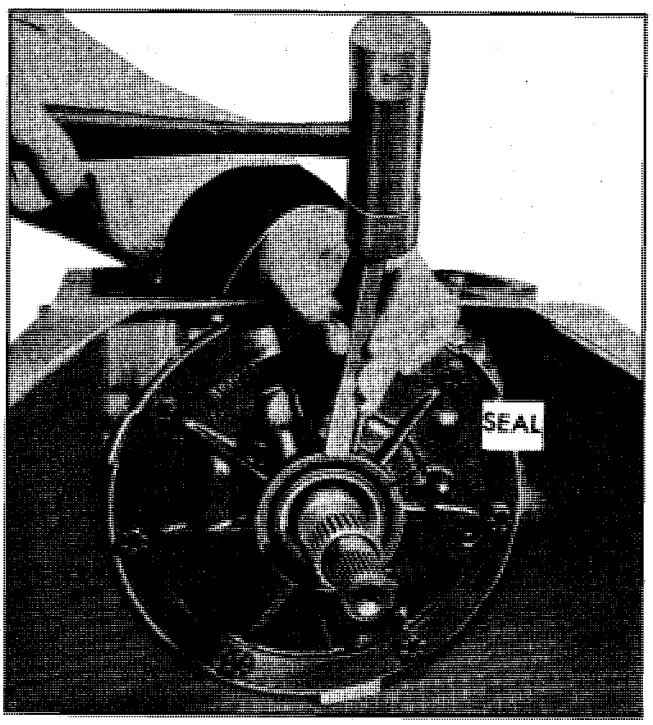


Fig. 21T—Removing Front Seal

2. Remove center support to reaction carrier bronze or phenolic thrust washer (fig. 41T).
3. Remove center support to sun gear races and thrust bearing.

NOTE: One race may have been removed with center support.

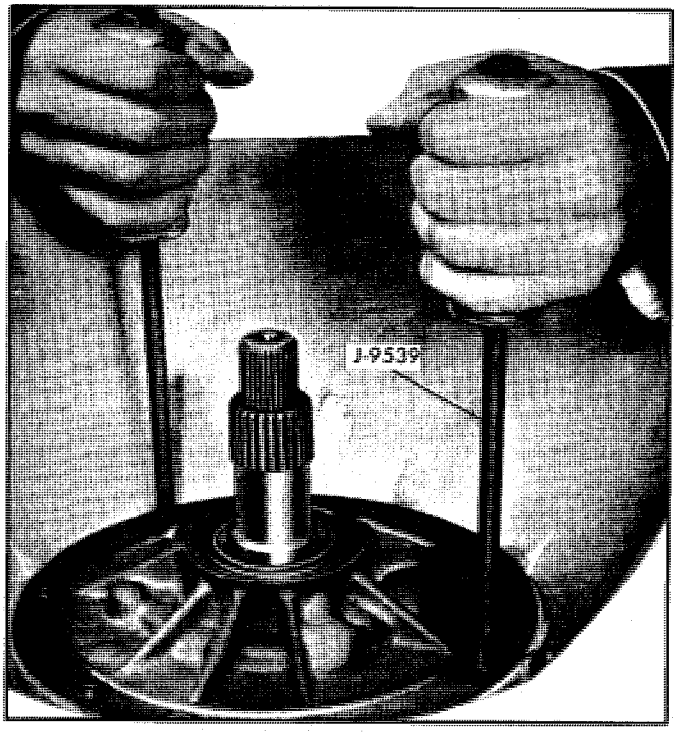


Fig. 22T—Removing Pump Assembly

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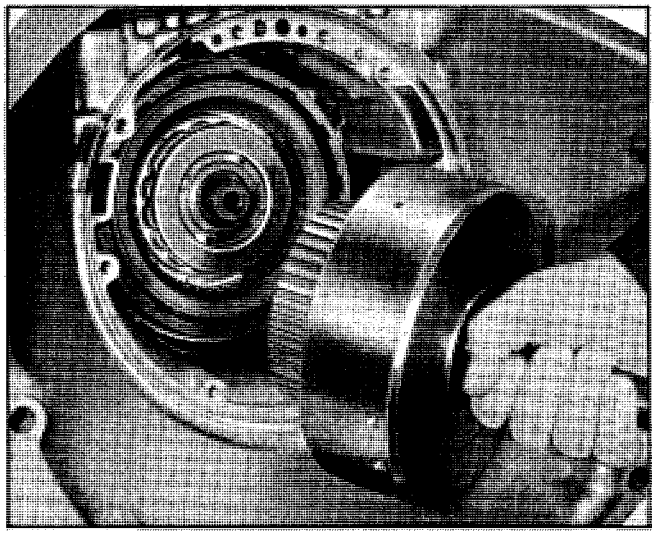


Fig. 23T—Removing Forward Clutch Assembly and Turbine Shaft

4. Remove reaction carrier and roller clutch assembly (fig. 42T). Lift roller clutch assembly out of carrier.
5. Remove front internal gear ring from output carrier assembly.
6. Remove sun gear (fig. 43T).
7. Remove reaction carrier to output carrier thrust washer.
8. Turn assembly over.
9. Remove output shaft to output carrier snap ring (fig. 44T).
10. Remove output shaft.

NOTE: If replacement of drive speedo gear is necessary, remove in following manner:

a. Install speedo gear removing Tool, J-21427-01 and J-9539 bolts with J-8105 or suitable puller on output shaft, and remove speedo drive gear (fig. 45T).

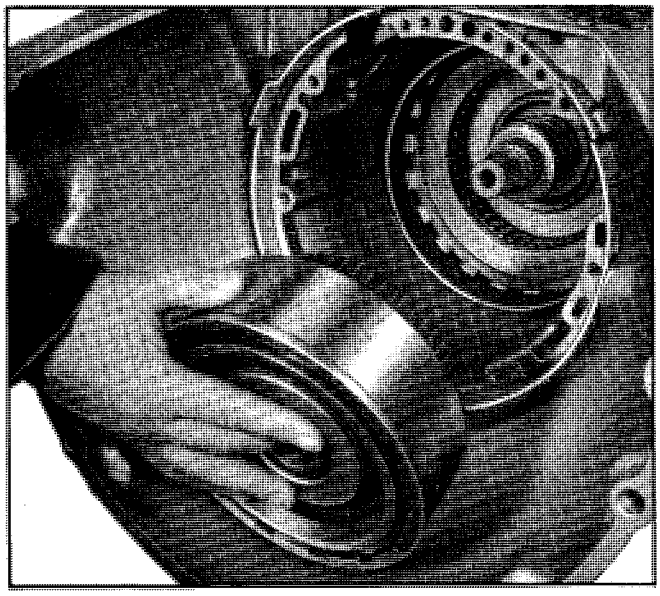


Fig. 24T—Removing Direct Clutch Assembly

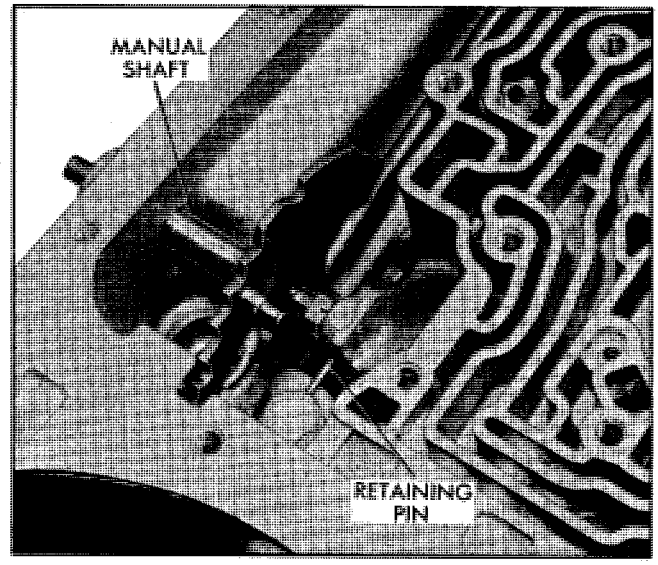


Fig. 25T—Removing Manual Shaft Retaining Pin from Case

b. Install new speedo drive gear and drive rear side to location (5-43/64" below end of output shaft) using J-5590 (fig. 46T).

11. Remove output shaft to rear internal gear thrust bearing and two (2) races.
12. Remove rear internal gear and mainshaft (fig. 47T).

NOTE: Do not drop bearings.

13. Remove rear internal gear to sun gear thrust bearing and two (2) races.
14. If necessary, remove rear internal gear to mainshaft snap ring, to remove mainshaft (fig. 48T).

GOVERNOR ASSEMBLY

All components of governor assembly, with exception of driven gear, are a select fit and each assembly is calibrated. The governor, including the driven gear, is serviced as a complete assembly. However, the driven gear can also be serviced separately.

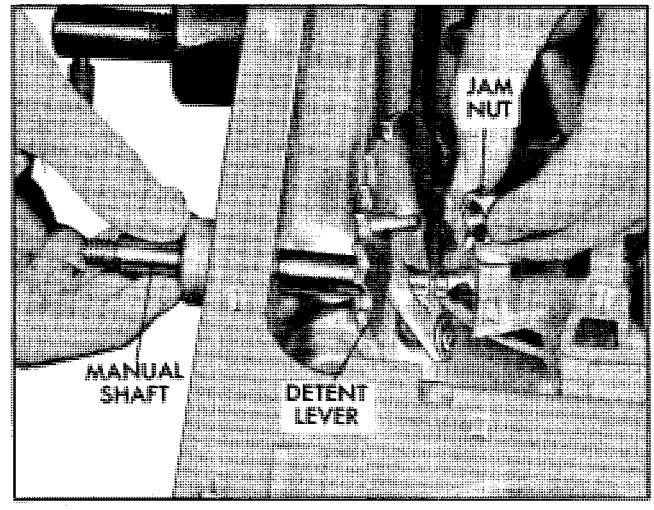


Fig. 26T—Removing Detent Lever and Jam Nut from Manual Shaft

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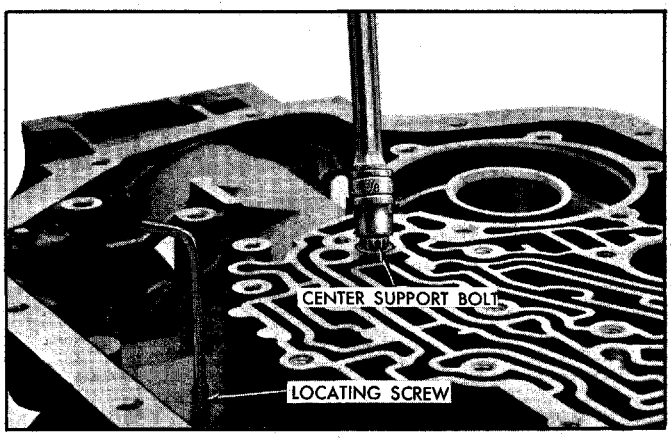


Fig. 27T—Case Center Support Locating Bolt

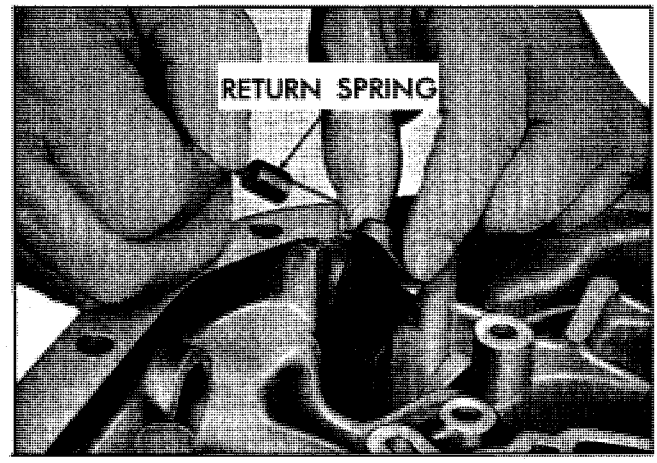


Fig. 29T—Removing Parking Pawl Return Spring

It is necessary to disassemble governor assembly in order to replace driven gear. Disassembly may also be necessary due to foreign material causing improper operation. In such cases, proceed as follows:

Disassembly

1. Cut off one end of each governor weight pin and remove pins, governor thrust cap, governor weights, and springs. Governor weights are interchangeable from side to side and need not be identified. (fig. 49T).
2. Remove governor valve from governor sleeve. Be careful not to damage valve.
3. Perform following inspections and replace governor driven gear, if necessary.

Inspection

1. Wash all parts in cleaning solvent, air dry and blow out all passages.
2. Inspect governor sleeve for nicks, burrs, scoring or galling.
3. Check governor sleeve for free operation in bore of transmission case.
4. Inspect governor valve for nicks, burrs, scoring or galling.
5. Check governor valve for free operation in bore of governor sleeve.
6. Inspect governor driven gear for nicks, burrs, or damage.
7. Check governor driven gear for looseness on governor sleeve.
8. Inspect governor weight springs for distortion or damage.
9. Check governor weights for free operation in their retainers.
10. Check valve opening at entry and exhaust (.020 inch minimum).

Governor Driven Gear Replacement

To facilitate governor repair in the field, a governor driven gear and replacement pins are available for service use. The service package contains a nylon driven gear, two governor weight retaining pins and one governor gear retainer split pin. Replacement of gear must be performed with care in the following manner:

1. Drive out governor gear retaining split pin using small punch. (fig. 50T).
2. Support governor on 3/16 inch plates installed in exhaust slots of governor sleeve, place in arbor press, and with a long punch, press gear out of sleeve.

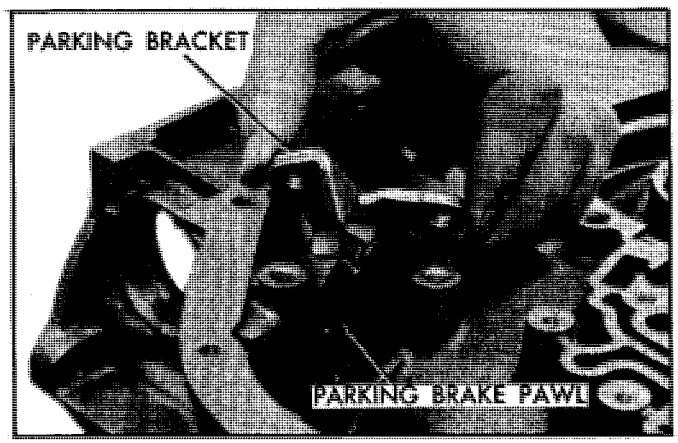


Fig. 28T—Removing Parking Bracket

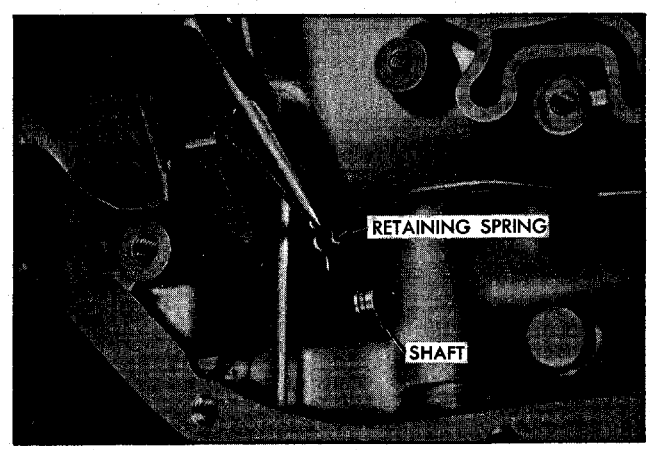


Fig. 30T—Removing Parking Shaft Retaining Spring

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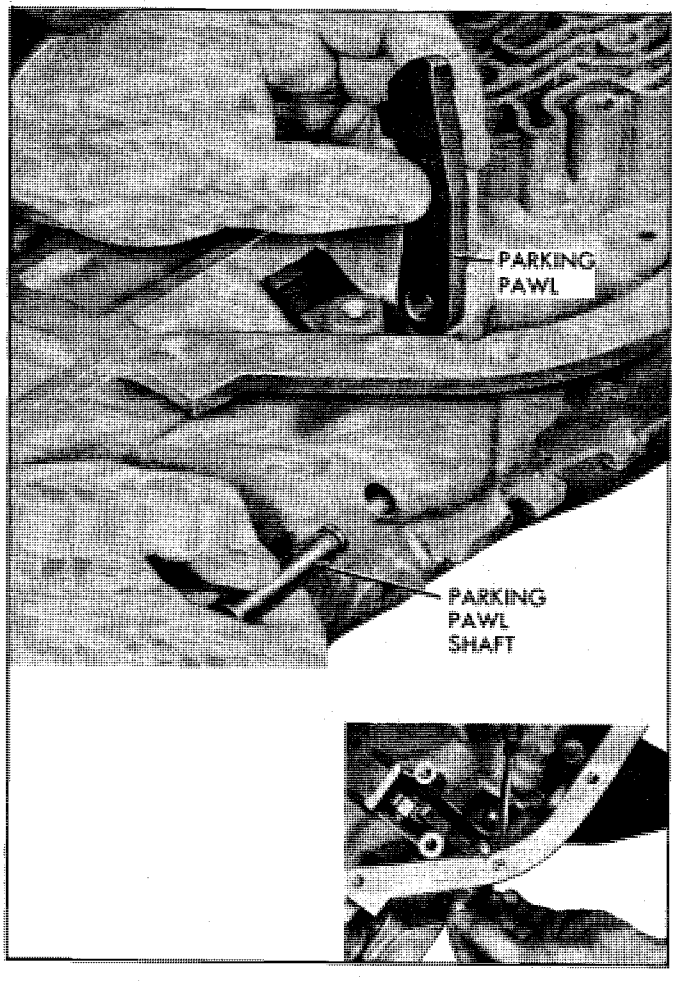


Fig. 31T—Removing Parking Brake Pawl, Shaft and Cup Plug

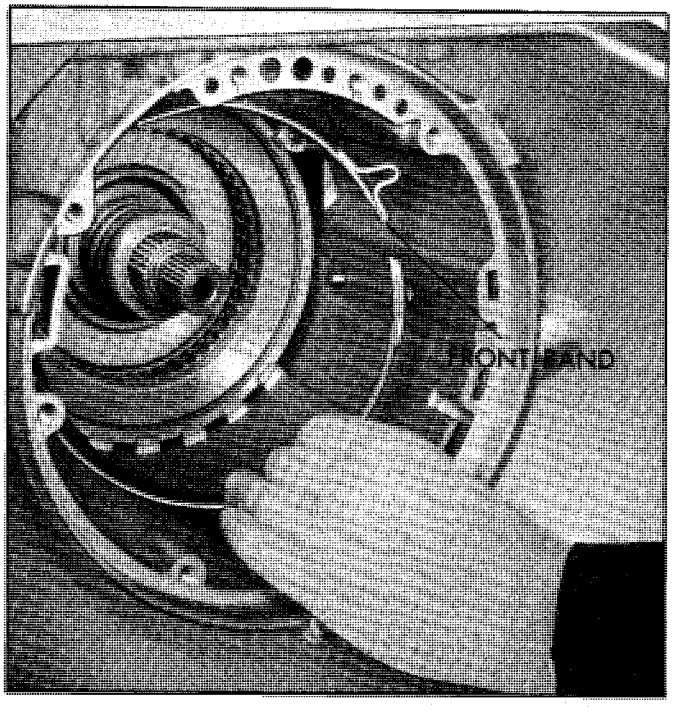


Fig. 32T—Removing Front Band

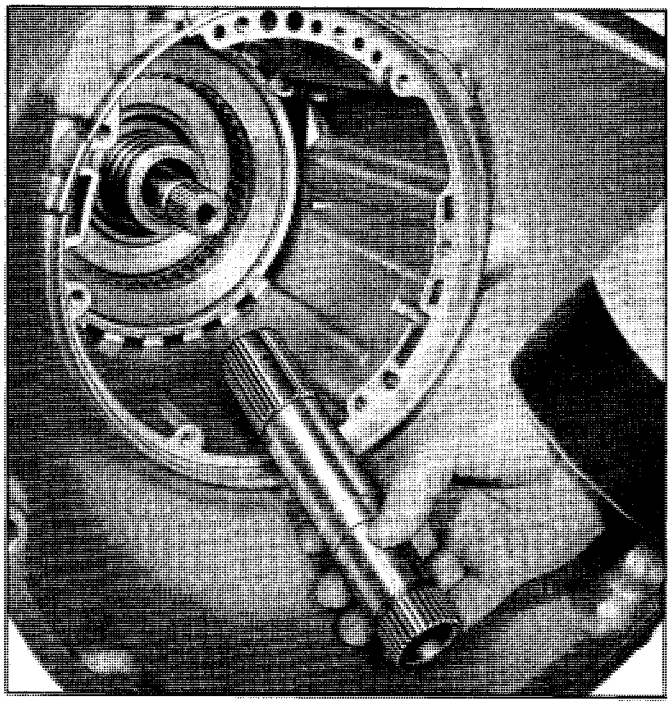


Fig. 33T—Removing Sun Gear Shaft

3. Carefully clean governor sleeve of chips that remain from original gear installation.
4. Support governor on 3/16 inch plates installed in exhaust slots of sleeve, position new gear in sleeve and, with a suitable socket, press gear into sleeve until nearly seated. Carefully remove any chips that may have shaved off gear hub and press gear in until it bottoms on shoulder.
5. A new pin hole must be drilled through sleeve and gear. Locate hole position 90° from existing hole, center punch and then, while supporting governor in press, drill new hole through sleeve and gear using a standard (1/8 inch) drill.

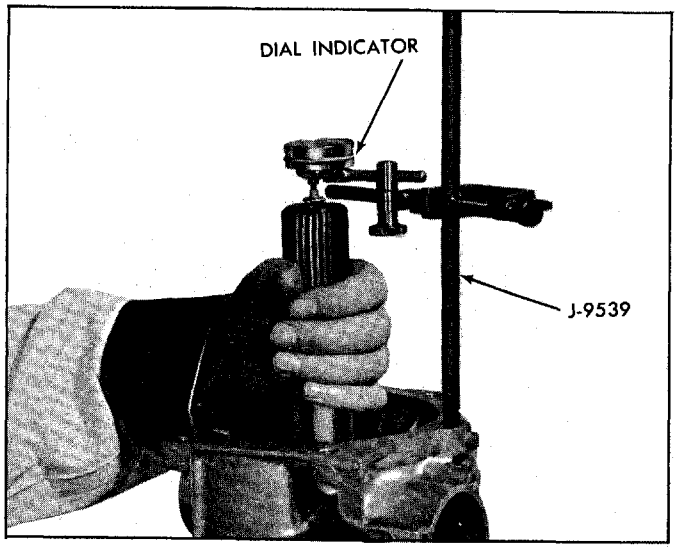


Fig. 34T—Checking Rear Unit End Play

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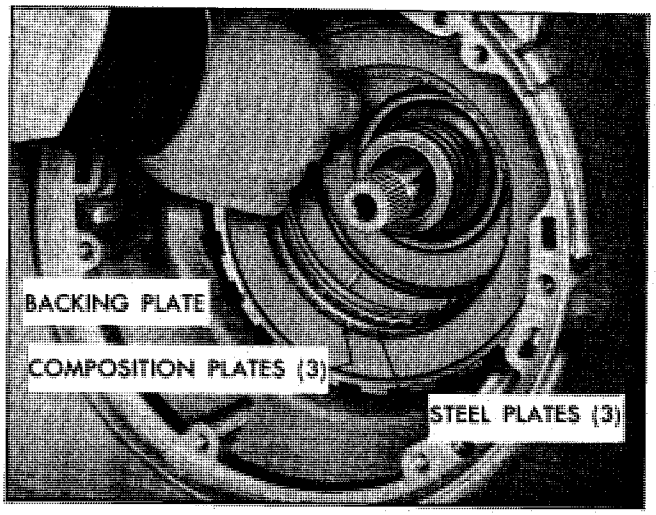


Fig. 35T—Removing Intermediate Backing Plate and Clutch Plates

6. Install split retaining pin.
7. Wash governor assembly thoroughly to remove any chips that may have collected.

Assembly

1. Install governor valve in bore of governor sleeve.
2. Install governor weights and springs, and thrust cap on governor sleeve.
3. Align pin holes in thrust cap, governor weight assemblies and governor sleeve, and install new pins. Crimp both ends of pins to prevent them from falling out.
4. Check governor weight assemblies for free operation on pins.
5. Check governor valve for free movement in governor sleeve.

FRONT SERVO PARTS INSPECTION

1. Inspect servo pin for damage.
2. Inspect piston for damage "D" oil ring groove, check freedom of ring in groove. (fig. 17T).

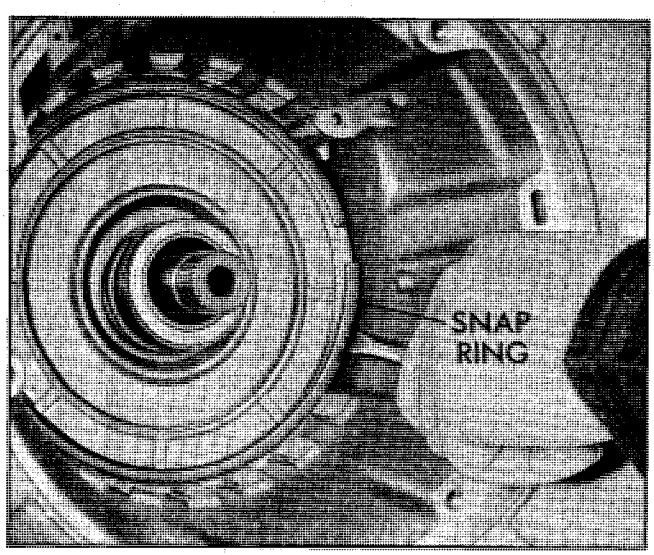


Fig. 36T—Removing Case Center Support to Case Snap Ring

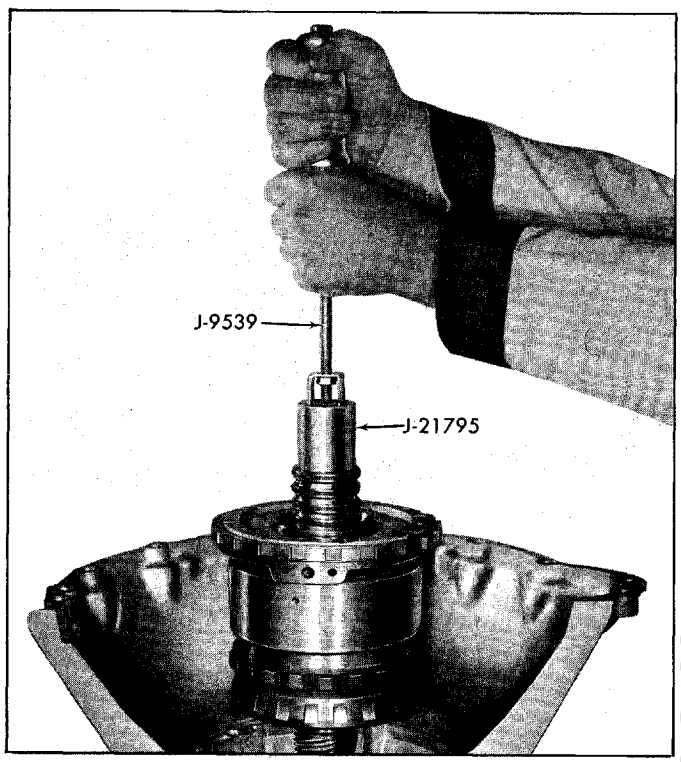


Fig. 37T—Removing Case Center Support and Gear Unit from Case

3. Inspect piston for cracks or porosity.
4. Check fit of servo pin in piston.

DISASSEMBLY OF REAR SERVO ASSEMBLY

1. Remove rear accumulator piston from rear servo piston. (Fig. 51T)

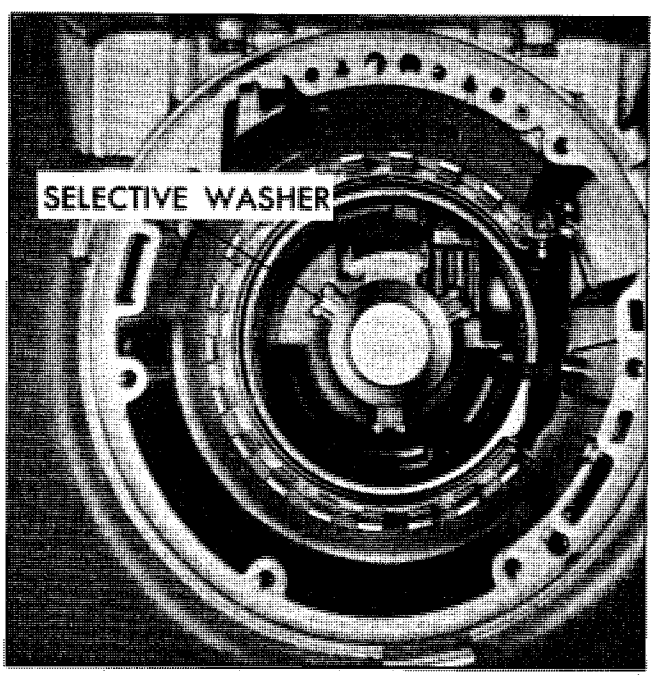


Fig. 38T—Removing Selective Washer

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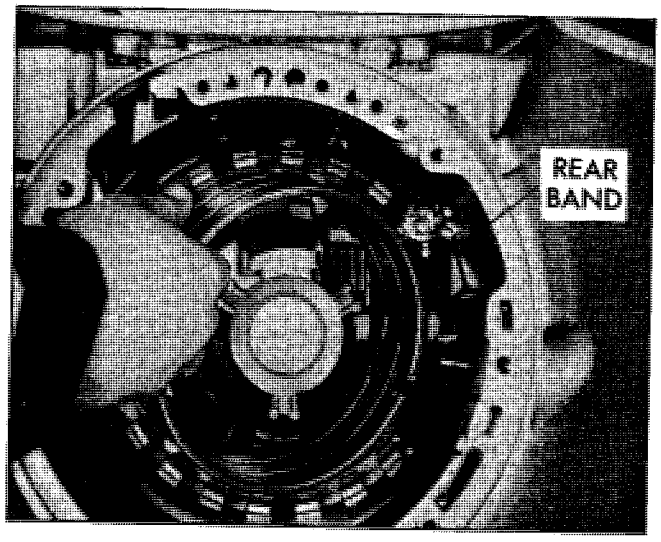


Fig. 39T—Removing Rear Band

2. Remove "E" ring retaining rear servo piston to band apply pin (fig. 52T).
3. Remove rear servo piston and seal from band apply pin (fig. 53T). (Exploded view)
4. Remove washer, spring, and retainer.

Inspection

1. Inspect freedom of accumulator rings in piston.
2. Inspect fit of band apply pin in servo piston.
3. Inspect band apply pin for scores or cracks.
4. Inspect accumulator and servo pistons for scoring or cracks.

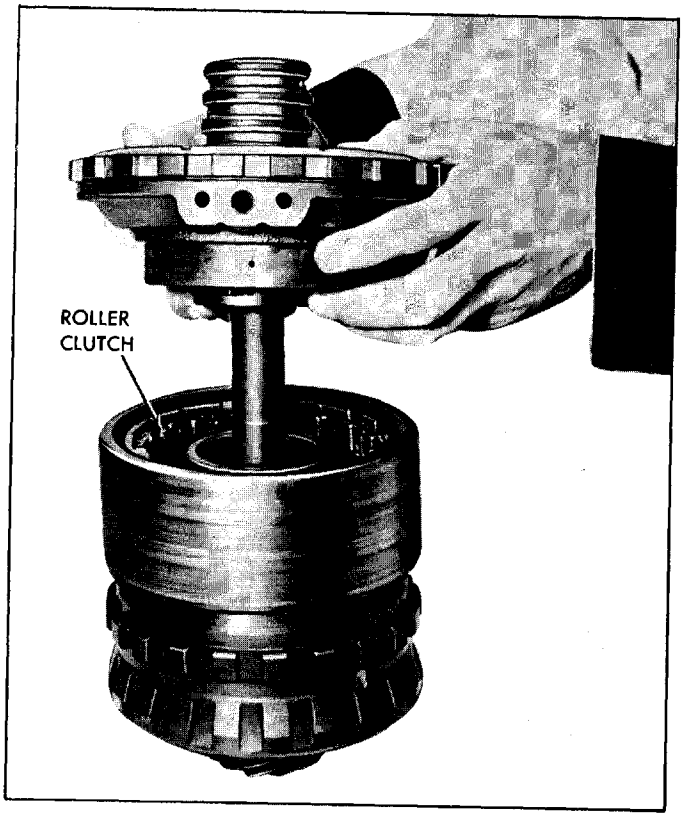


Fig. 40T—Removing Case Center Support Assembly

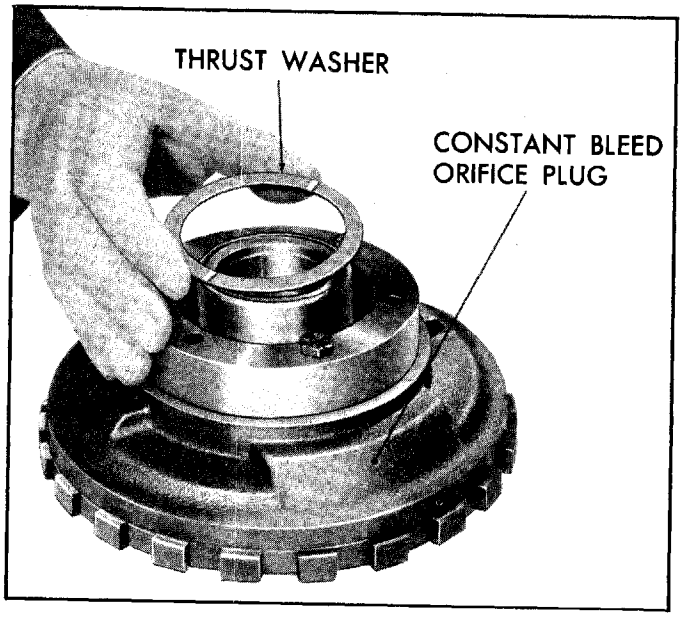


Fig. 41T—Removing Center Support Thrust Washer

Re-Assembly

1. Install spring retainer cup side down, spring and washer on band apply pin.
2. Install band apply pin, retainer, spring and washer, into bore of servo piston and secure with "E" ring.
3. Install oil seal ring on servo piston, if removed.
4. Install outer and inner oil rings on accumulator piston, if removed, and assemble into bore of servo piston.

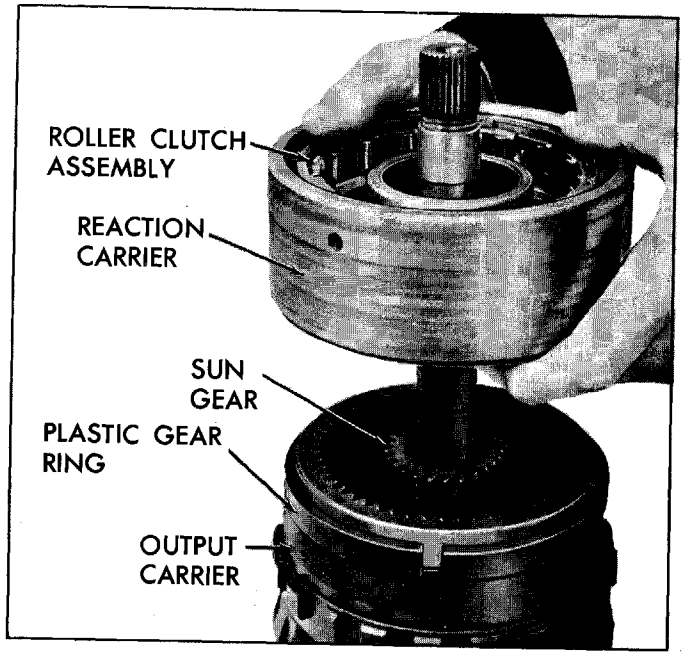


Fig. 42T—Removing Reaction Carrier and Roller Clutch from Output Carrier

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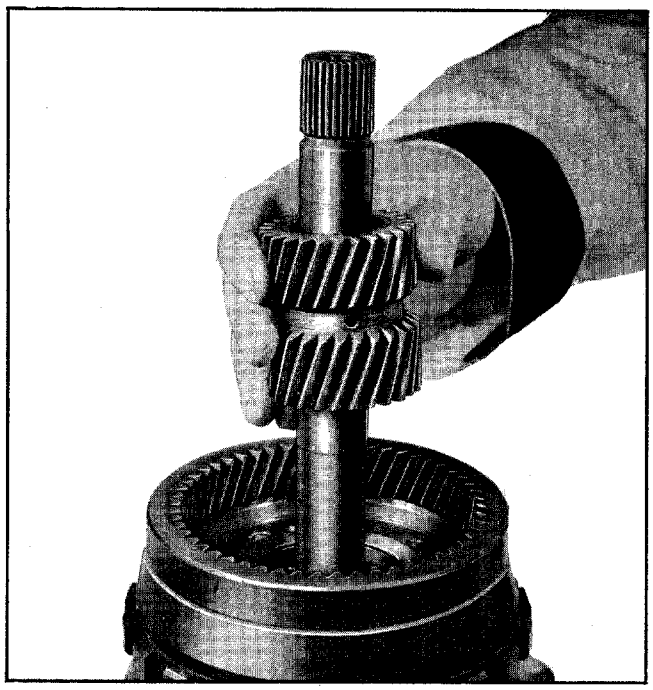


Fig. 43T—Removing Sun Gear

CONTROL VALVE, DISASSEMBLY, INSPECTION AND RE-ASSEMBLY (Fig. 56T)

a. Disassembly

1. Position control valve assembly with cored face up and accumulator pocket nearest operator.
2. Remove manual valve from upper bore.
3. Install special Tool J-21885, on accumulator piston and remove retaining ring (fig. 54T).
4. Remove front accumulator piston and spring. (fig. 55T).
5. On the right side adjacent to the manual valve, remove the 1-2 valve train as follows:
   a. (Models CA, CB, and CC) Remove retaining pin, 1-2 modulator bushing, 1-2 valve spring, 1-2 modulator valve and 1-2 shift valve.
   b. (Models CD and CT) Remove retaining pin, 1-2 modulator bushing, 1-2 regulator valve, 1-2 regulator spring, 1-2 detent valve, and 1-2 shift valve.
6. From next bore, remove retaining pin, 2-3 shift valve spring, modulator valve bushing, 2-3 modulator valve, 3-2 intermediate spring, and 2-3 shift valve.
7. From next bore remove retaining pin, bore plug, spring, spacer, and 3-2 valve.
8. At other end of assembly, top bore, remove retaining pin, and bore plug, detent valve, detent regulator valve, spring and spacer.
9. From the next bore down, remove the 1-2 Accumulator Valve train as follows:
   a. (Models CB, CD, and CT) Remove the grooved retaining pin, bore plug, 1-2 accumulator valve and spring.
   b. (Models CA and CC) Remove the grooved retaining pin, bore plug, 1-2 secondary spring, 1-2

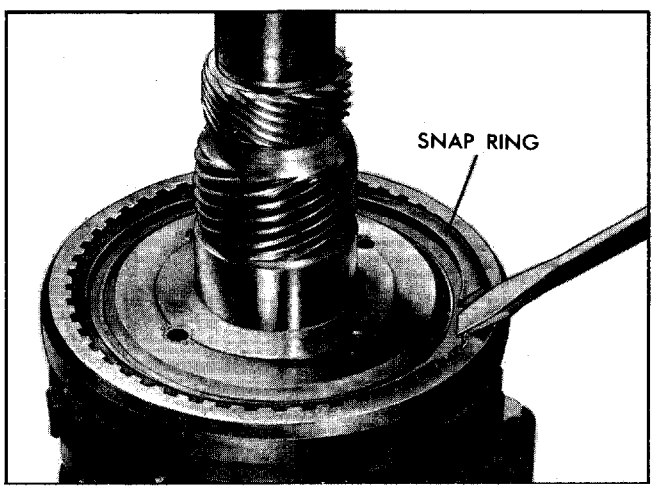


Fig. 44T—Removing Output Shaft to Carrier Snap Ring

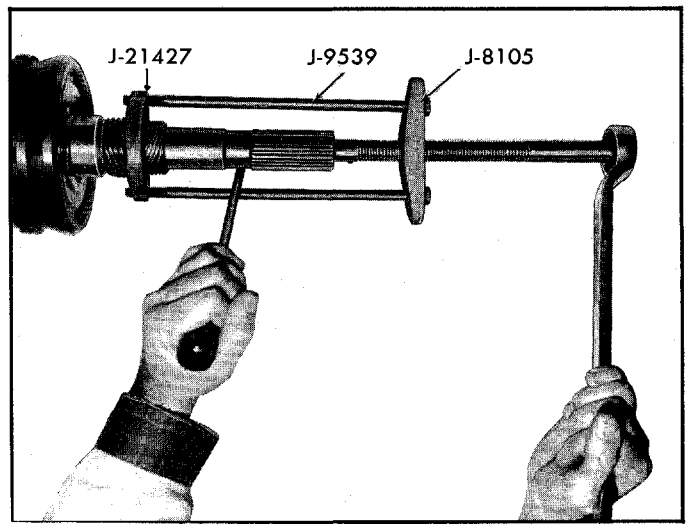


Fig. 45T—Removing Speedometer Drive Gear

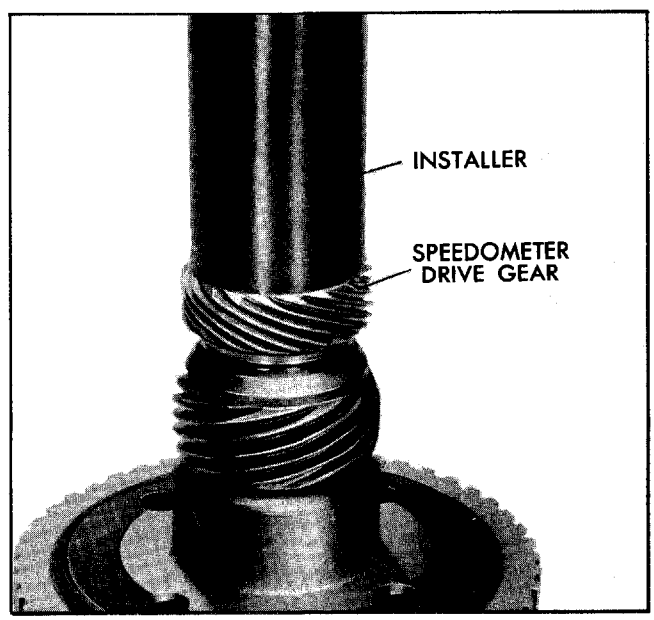


Fig. 46T—Installing Speedometer Drive Gear

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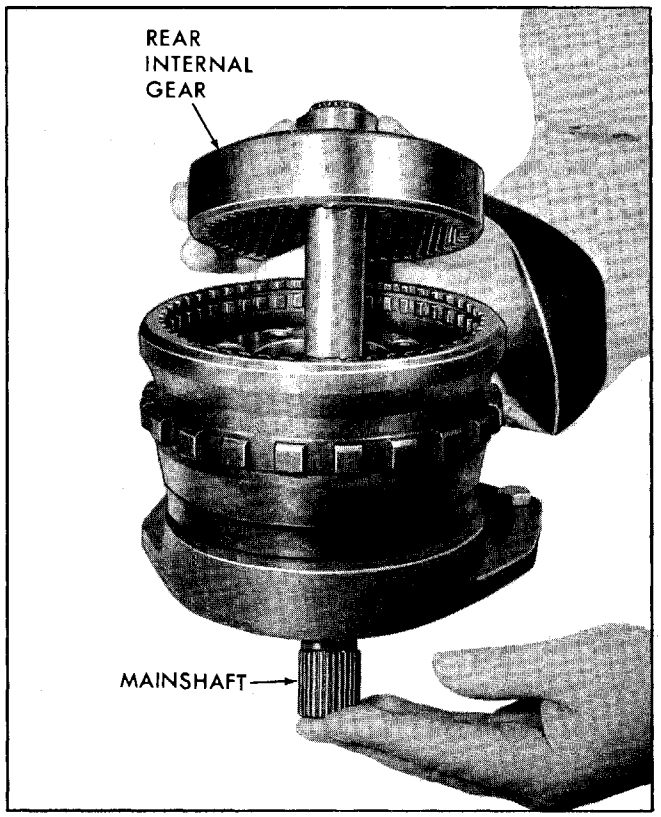


Fig. 47T—Removing Rear Internal Gear and Mainshaft

secondary valve, 1-2 accumulator bushing, 1-2 primary accumulator valve and primary spring.

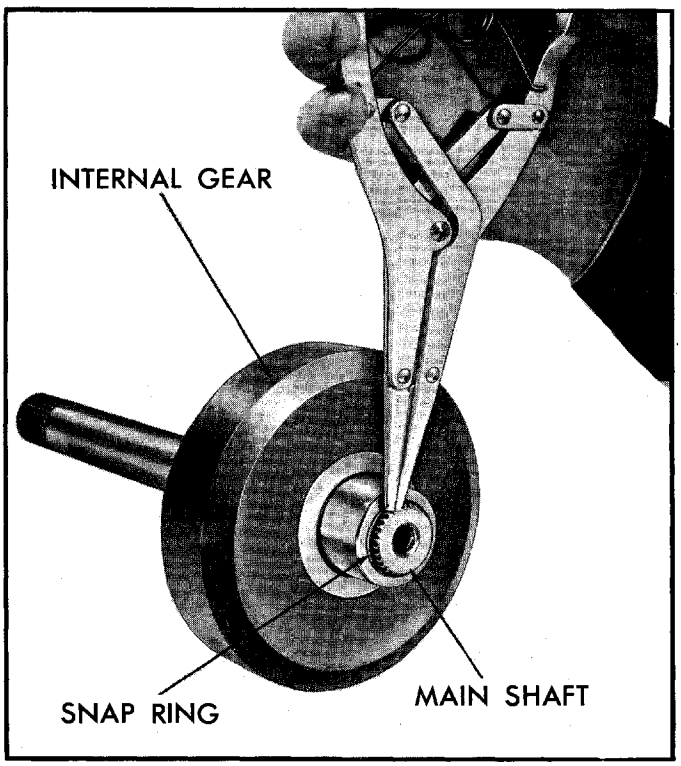


Fig. 48T—Removing Rear Internal Gear to Main Shaft Snap Ring

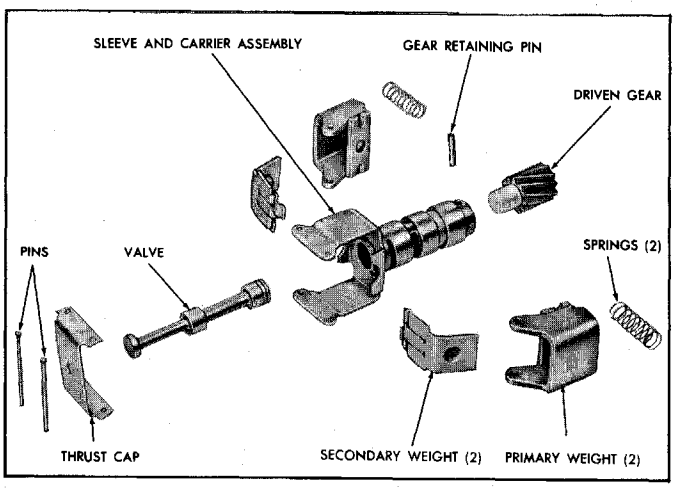


Fig. 49T—Govemor - Exploded

10. Remove the screen assembly from the governor oil feed hole. (fig. 57T)

b. Inspection

1. Inspect all valves for scoring, cracks and free movement in their respective bore.
2. Inspect bushing for cracks, scratches or distortion.
3. Inspect body for cracks, or scored bores.
4. Check all springs for distortion or collapsed coils.

c. Reassembly

1. Install front accumulator spring and piston into valve body.
2. Install special Tool J-21885 and compress spring and piston and secure with retaining "E" ring.
3. Install the 1-2 accumulator valve train into the lower left hand bore as follows:
   a. (Models CB, CD, and CT) Install the 1-2 accumulator spring and 1-2 accumulator valve, stem end out, into the valve bore. Place the bore plug on end of the valve and compress spring until

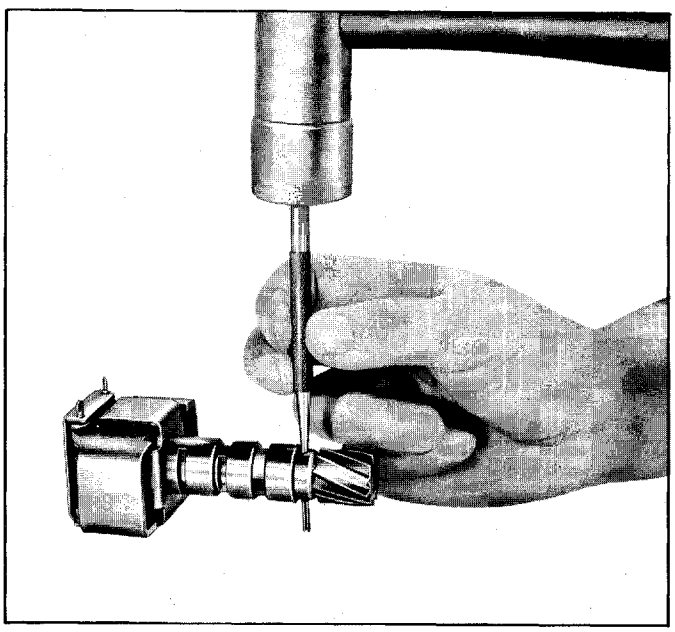


Fig. 50T—Removing Governor Gear Retaining Pin

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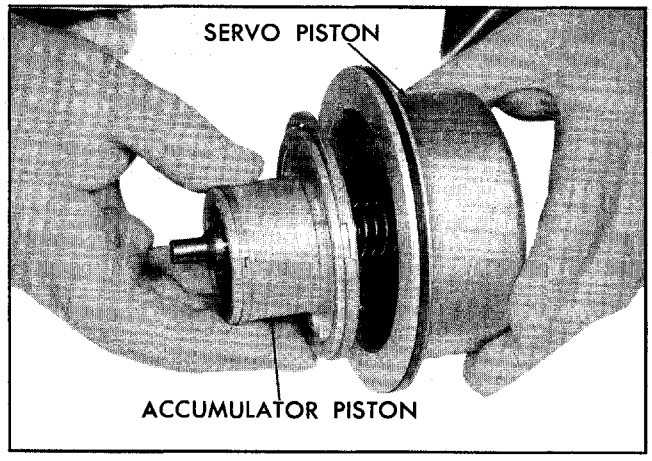


Fig. 51T—Removing Rear Accumulator Piston from Rear Servo Assembly

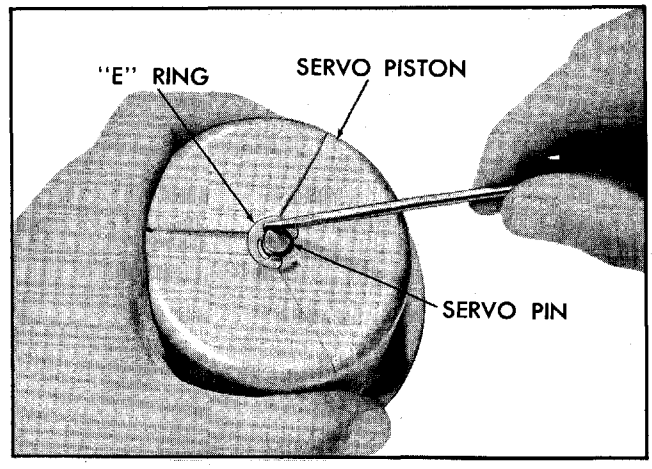


Fig. 52T—Removing Retaining "E" Ring from Rear Servo Pin

grooved retaining pin can be inserted from the cast surface side of the valve body, with the grooves entering the pin hole last. Tap pin with a hammer until flush with cast surface.

b. (Models CA and CC) Install the 1-2 primary accumulator spring and valve into the valve bore using a retaining pin as a temporary retractor to hold the spring and valve in their operating position. Install the 1-2 secondary accumulator valve, stem end out, and the 1-2 secondary spring into the 1-2 accumulator valve bushing. Install the bushing into the bore and using the bore plug, compress the spring until the grooved retaining pin can be inserted from the cast surface side of the valve body with the grooves entering the pin hole last. Tap the retaining pin with a hammer until it is flush with the cast surface of the valve body. Remove the temporary retractor pin.

4. In next bore up, install detent spring and spacer. Compress spring and secure with small screw driver (fig. 59T).
5. Install detent regulator valve, wide land first.
6. Install detent valve, narrow land first.
7. Install bore plug (hole out), depress spring by pressing in on plug, install retaining pin, and remove screw driver.
8. In lower right hand bore, install 3-2 valve.

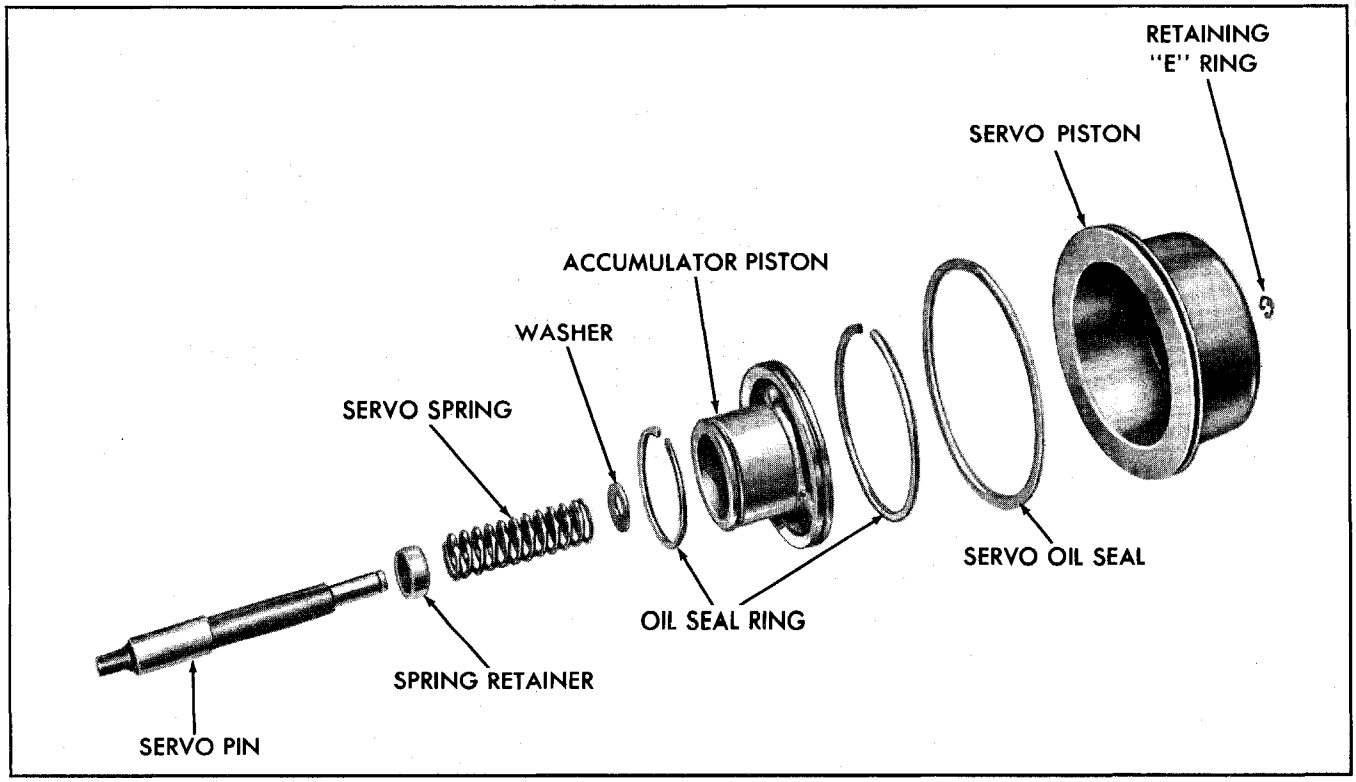


Fig. 53T—Rear Servo and Accumulator Assembly - Exploded View

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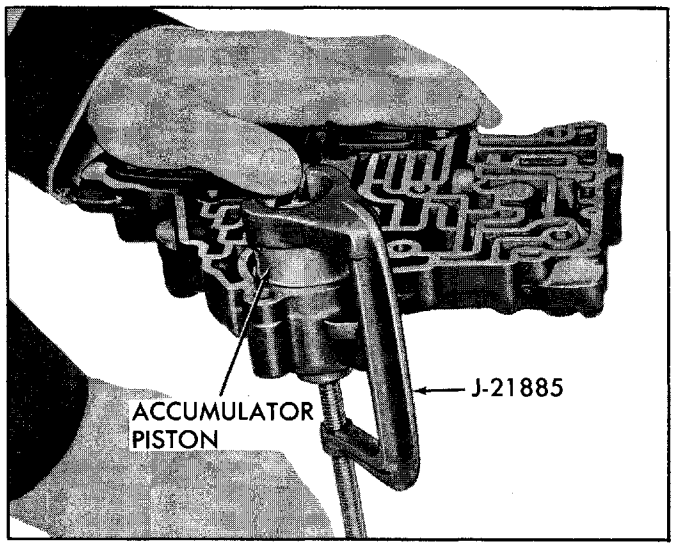


Fig. 54T—Installing Compressor Tool to Front Accumulator Piston

9. Install 3-2 spring, spacer, bore plug (hole out) and retaining pin.
10. In next bore up, install 2-3 valve, stem end out, and 3-2 intermediate spring.
11. Install 2-3 modulator valve into bushing and install both parts into valve body bore.
12. Install 2-3 valve spring and retaining pin.
13. In next bore, install 1-2 valve, stem end out. (Small land first).
14. a. (Models CA, CB, and CC) Install the 1-2 valve spring and 1-2 modulator valve into the 1-2 modulator bushing, aligning the spring in the bore of the modulator valve. Install parts into the valve body bore.

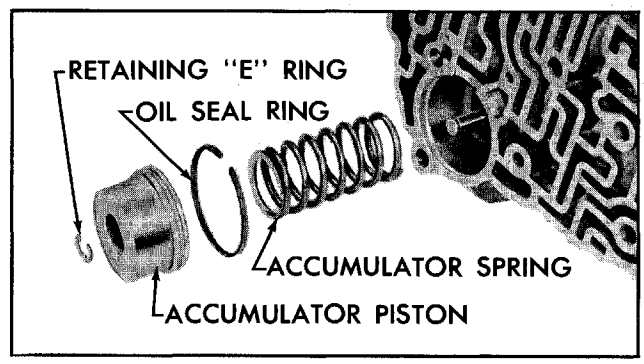


Fig. 55T—Removing Front Accumulator Piston and Spring

b. (Models CD and CT) Install the 1-2 regulator valve, regulator spring, and 1-2 detent valve into the 1-2 modulator bushing, aligning the spring in the bore of the detent valve. Install the parts in the valve body bore.

15. Compress bushing against spring and install retaining pin.
16. Install the governor oil screen assembly into the governor oil feed hole, pinched end first. (fig. 57T)

NOTE: Screen is held in place by the governor feed pipe when installed on the transmission case.

17. Install manual valve with detent pin groove to the right.

OIL PUMP DISASSEMBLY, INSPECTION AND RE-ASSEMBLY

a. Disassembly

1. Place oil pump assembly in hole in bench or holding fixture, J-6116 with J-21364 adapter.

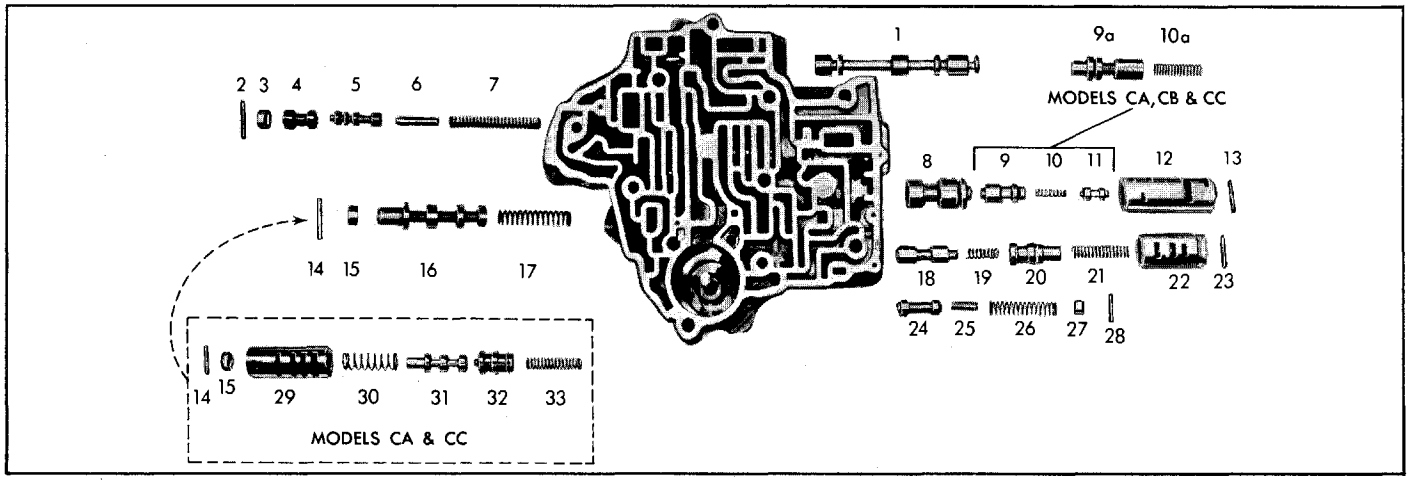


Fig. 56T—Control Valve Assembly - Exploded View (Legend)

1. Manual Valve
2. Retaining Pin
3. Bore Plug
4. Detent Valve
5. Detent Regulator Valve
6. Spacer
7. Detent Regulator Valve Spring
8. 1-2 Shift Valve
9. 1-2 Modulator Valve
10. 1-2 Regulator Valve Spring
11. 1-2 Modulator Bushing
12. Retaining Pin
13. 1-2 Accumulator Plug
14. 1-2 Accumulator Adjusting Spring
15. 1-2 Accumulator Valve
16. Retaining Pin
17. 1-2 Primary Accumulator Spring
18. 2-3 Shift Valve
19. 3-2 Intermediate Spring
20. 2-3 Modulator Valve
21. 2-3 Shift Valve Spring
22. 2-3 Modulator Bushing
23. Retaining Pin
24. 3-2 Valve
25. Spacer
26. 3-2 Valve Spring
27. Bore Plug
28. Retaining Pin

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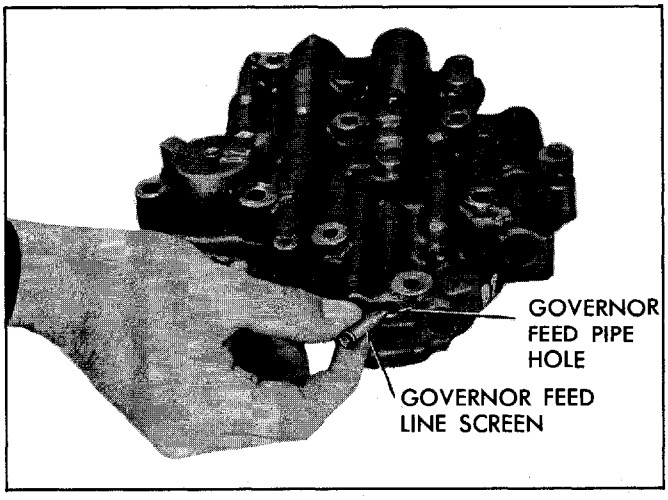


Fig. 57T—Removing Governor Feed Line Screen

2. Compress regulator boost valve bushing against pressure regulator spring and remove snap ring, using J-5403 pliers (fig. 61T).
3. Remove regulator boost valve bushing and valve.
4. Remove pressure regulator spring.
5. Remove regulator valve, spring retainer and spacer(s), if present (fig. 62T).
6. Remove pump cover to body attaching bolts.
7. Remove pump cover from body.
8. Remove retaining pin and bore plug from pressure regulator bore (fig. 63T).
9. Remove hook type oil rings from pump cover.
10. Remove pump to forward clutch housing selective washer (fiber).
11. Remove drive and driven gears from the pump body.

b. Inspection of Pump Body and Pump Cover

1. Inspect drive and driven gear pocket and crescent for scoring, galling or other damage.
2. Place pump gears in pump body and check pump body face to gear face clearance, should be .0008"-.0015" (fig. 66T).
3. Check face of pump body for scores or nicks.
4. Check oil passages.
5. Check for damaged cover bolt attaching threads.
6. Check for overall flatness of pump body face.
7. Check bushing for scores or nicks. If replacement is necessary proceed as follows:
   a. Using Tool J-21465-17 remove bushing.
   b. From front side of pump, using J-21465-17 install new bushing flush to .010" below machined surface for seal.
8. Inspect pump attaching bolt seals for damage, replace if necessary.
9. Inspect pump cover face for overall flatness.
10. Check for scores or chips in pressure regulator bore.
11. Check that all passages are open and not interconnected.
12. Check for scoring or damage at pump gear face.
13. Inspect stator shaft for damaged splines, or scored bushings. If replacement of bushing is necessary proceed as follows:
    a. Thread J-21465-15 into stator shaft bushing. Thread Slide Hammer J-2619 into remover. Clamp slide hammer handle into vise. Grasp stator shaft and remove.
    b. Using Installer J-21465-3 (front) or J-21465-2 (rear) install bushing.
14. Inspect oil ring grooves for damage or wear.
15. Inspect selective washer thrust face for wear or damage.
16. Inspect pressure regulator and boost valve for free operation.

c. Reassembly

1. Install drive and driven pump gears into pump body with (fig. 65T). Drive gear tangs up.
2. Protect stator shaft and install pump in vise.
3. Install spacer(s) if used, retainer and spring, into pressure regulator bore (fig. 60T).
4. Install pressure regulator valve from opposite end of bore, stem end first.
5. Install boost valve into bushing, stem end out, and

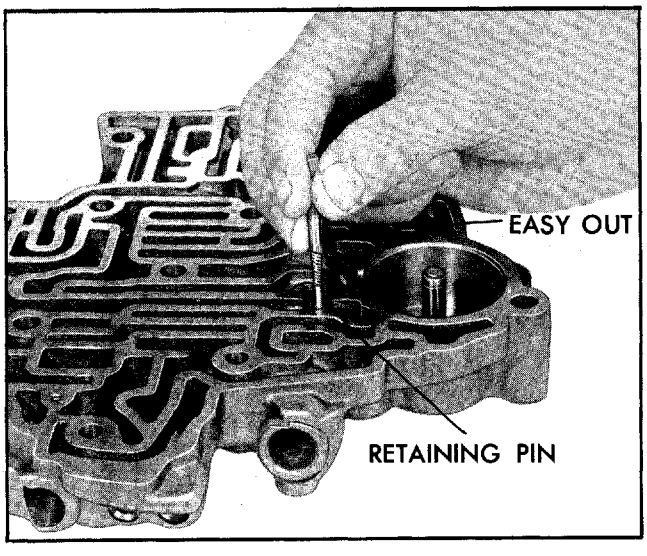


Fig. 58T—Removing Retaining Pin from 1-2 Accumulator Bore

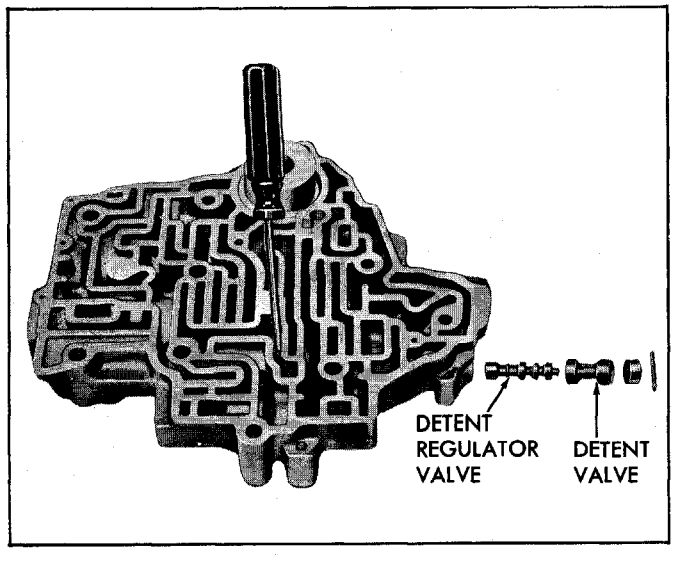


Fig. 59T—Installing Detent Regulator Valve and Detent Valve

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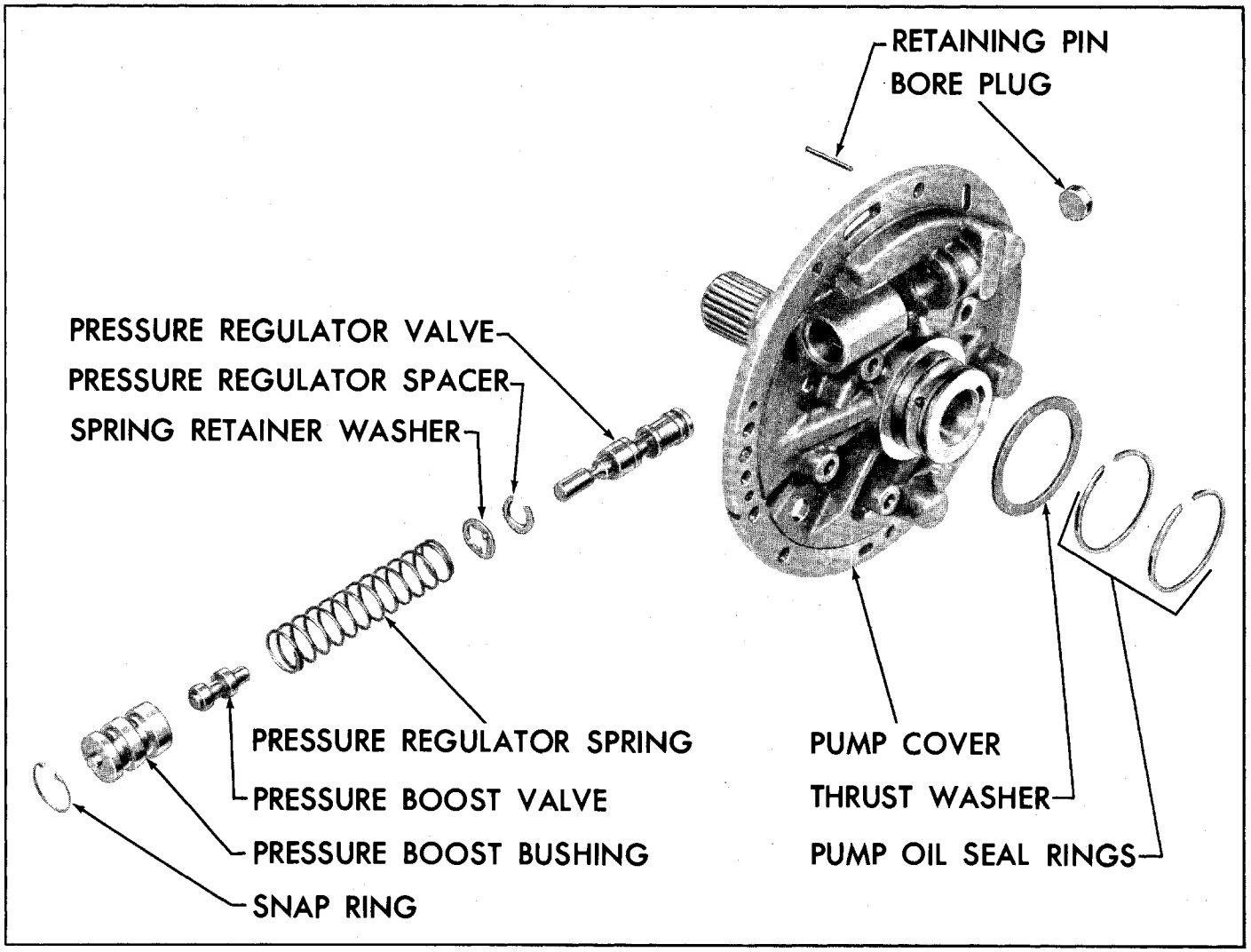


Fig. 60T—Pump Cover - Exploded View

install both parts into pump cover by compressing bushing against spring.

6. Install retaining snap ring.
7. Install pressure regulator valve bore plug and retaining pin into opposite end of bore.

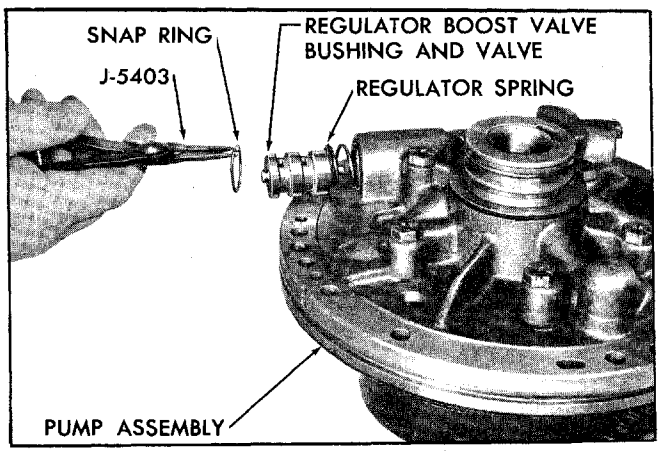


Fig. 61T—Removing Pump Regulator Valve Snap Ring

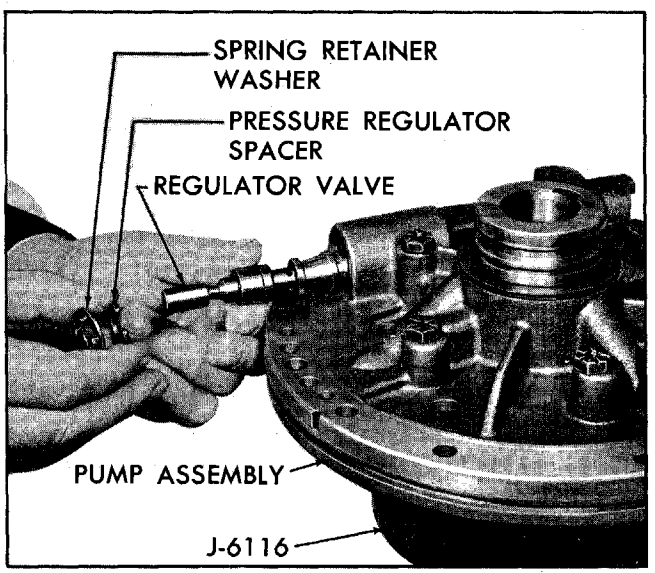


Fig. 62T—Removing Pressure Regulator Valve

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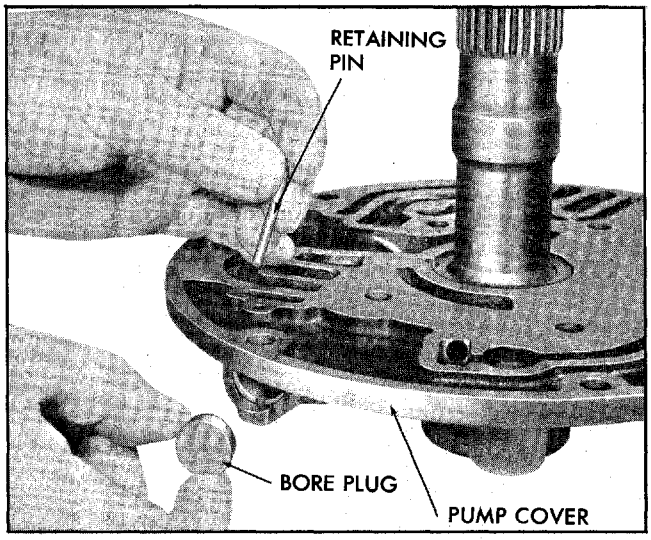


Fig. 63T—Installing Pressure Regulator Retaining Pin and Bore Plug

8. Install previously selected front unit selective thrust washer (fiber) over pump cover delivery sleeve.
9. Install two (2) hook type oil seal rings.
10. Assemble pump cover to pump body with attaching bolts.

NOTE: Leave bolts one turn loose at this time.

11. To align the pump body and cover, place the pump assembly, less rubber seal ring, upside down into the pump bore of the case. (fig. 68T).
12. Tighten pump cover bolts to 18 foot pounds. Remove pump assembly from case bore.
13. Install pump to case "O" ring seal.
14. Install and align pump to case gasket.

FORWARD CLUTCH DISASSEMBLY, INSPECTION AND RE-ASSEMBLY

a. Disassembly

1. Place forward clutch and turbine shaft through hole in bench or Holding Fixture J-6116, and remove forward clutch housing to direct clutch hub snap ring (fig. 69T).
2. Remove direct clutch hub.
3. Remove forward clutch hub and thrust washers (fig. 70T).
4. Remove five (5) radial grooved composition and five (5) steel clutch plates.
5. If necessary place forward clutch and turbine shaft in arbor press and remove turbine shaft (fig. 71T).
6. Using J-4670 clutch spring compressor in arbor press with Adapter J-21664, compress spring retainer and remove snap ring (fig. 72T).
7. Remove spring retainer and sixteen (16) clutch release springs.
8. Remove forward clutch piston.
9. Remove inner and outer clutch piston seals (fig. 73T).
10. Remove center piston seal from forward clutch housing (fig. 74T).

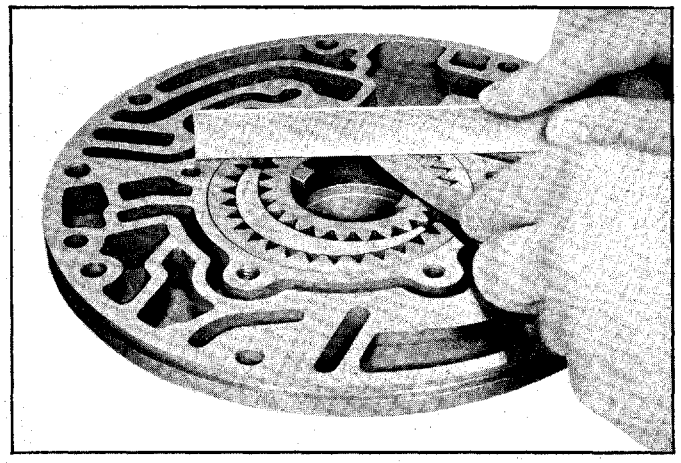


Fig. 66T—Checking Pump Body Face to Gear Face Clearance

b. Inspection

1. Inspect drive and driven clutch plates for signs of burning, scoring or wear.

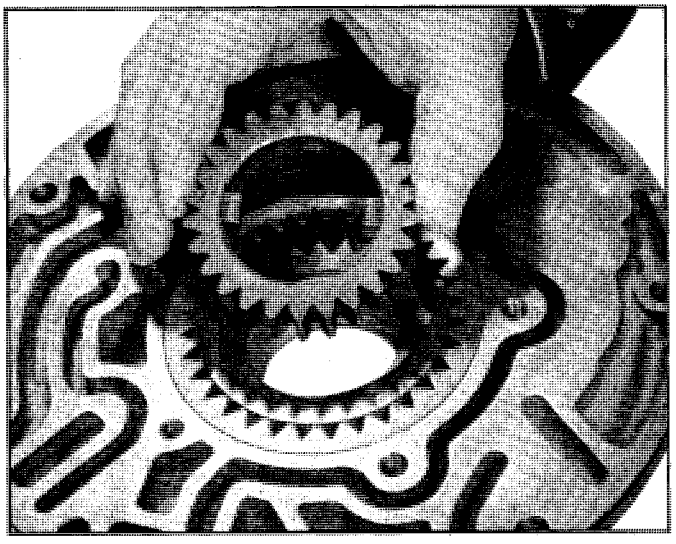


Fig. 65T—Installing Pump Drive Gear

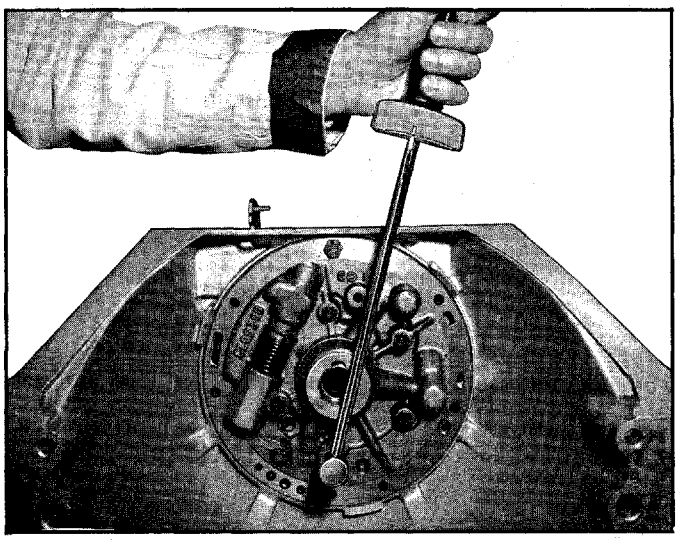


Fig. 68T—Installing Pump Cover to Pump Body

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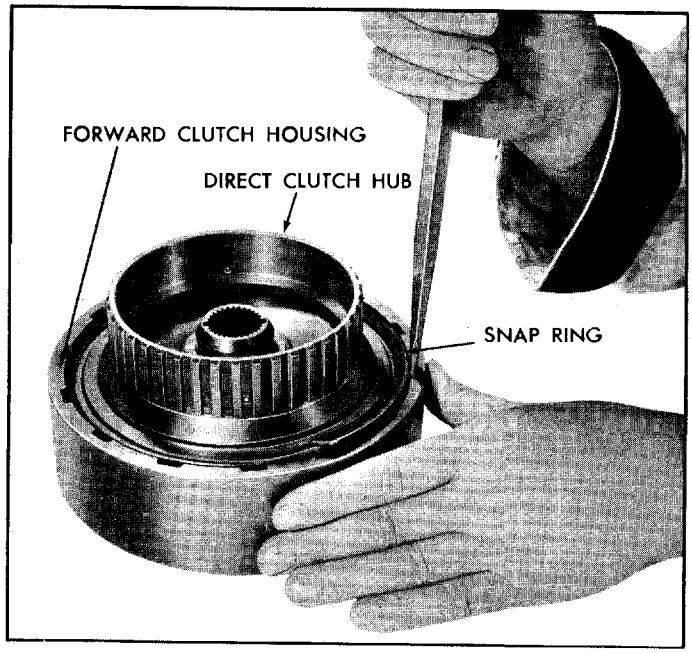


Fig. 69T—Removing Forward Clutch Housing to Direct Clutch Hub Snap Ring

2. Inspect sixteen (16) springs for collapsed coils or signs of distortion.
3. Inspect clutch hubs for worn splines, proper lubrication holes or scored thrust faces.
4. Inspect piston for cracks.
5. Inspect clutch housing for wear, scoring, open oil passages and free operation of ball check.
6. Inspect turbine shaft.
   a. Inspect for open lubrication passages at each end.
   b. Inspect splines for damage.
   c. Inspect ground bushing journals for damage.
   d. Inspect shaft for cracks or distortion.

NOTE: Turbine shaft and clutch housing are serviced separately. Shaft may be removed from

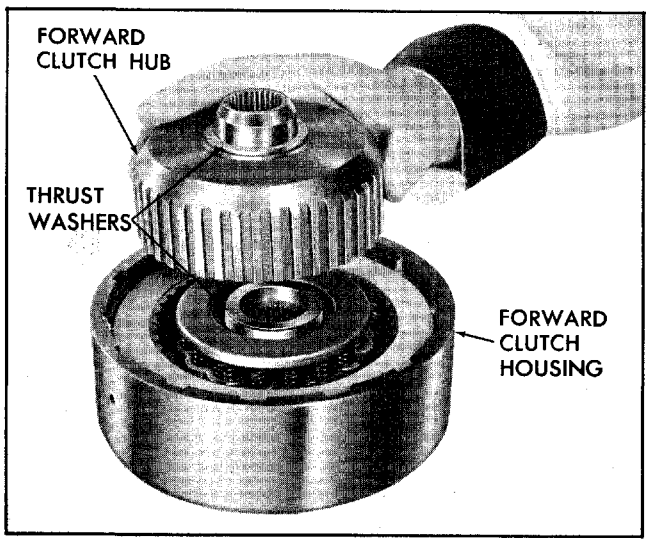


Fig. 70T—Removing Forward Clutch Hub and Thrust Washers

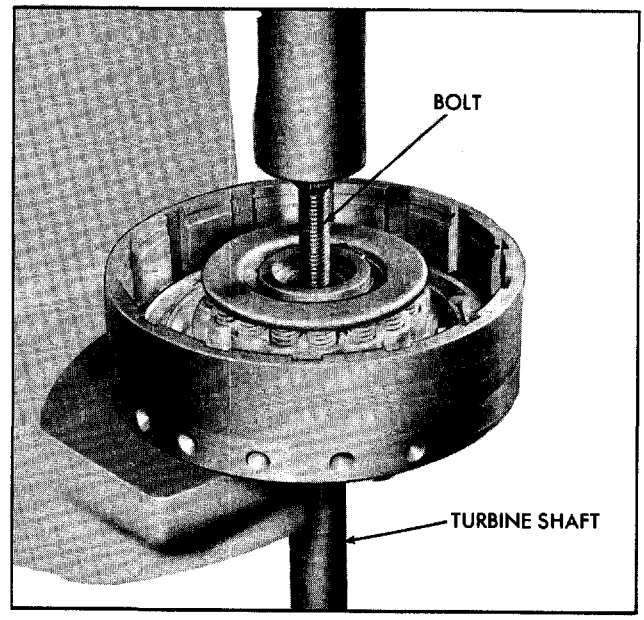


Fig. 71T—Removing Turbine Shaft from Forward Clutch Housing

housing by using a suitable size socket in an arbor press (fig. 71T).

c. Reassembly

NOTE: The Turbo Hydra-Matic forward and direct clutch pistons have identical inside and outside diameters.

It is possible to reverse the pistons during reassembly, therefore, care should be exercised

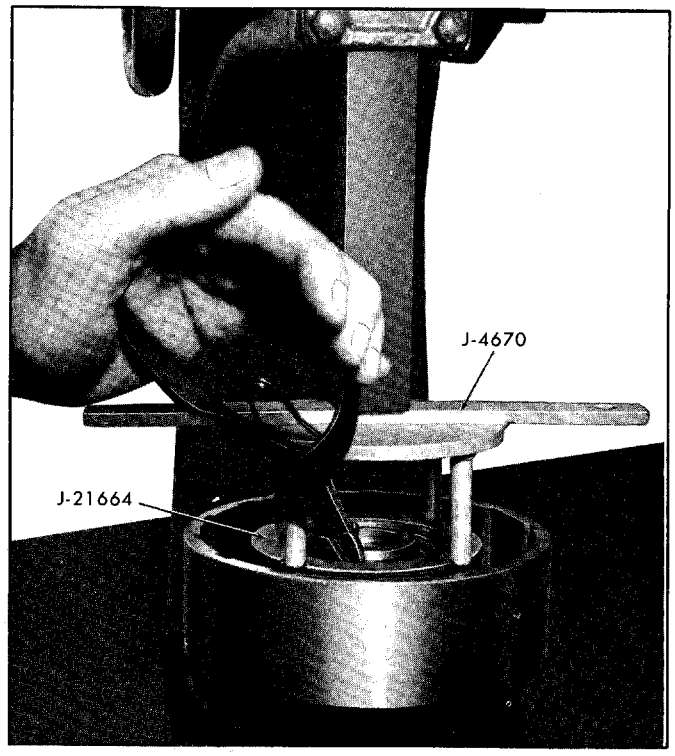


Fig. 72T—Removing Forward Clutch Spring Retaining Snap Ring

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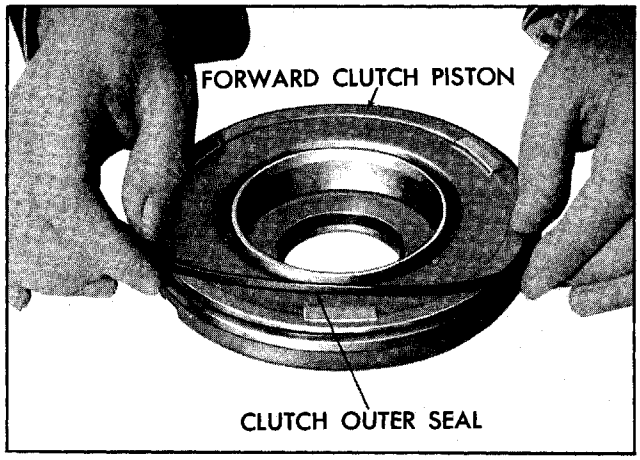


Fig. 73T—Removing Forward Clutch Piston Outer Seal

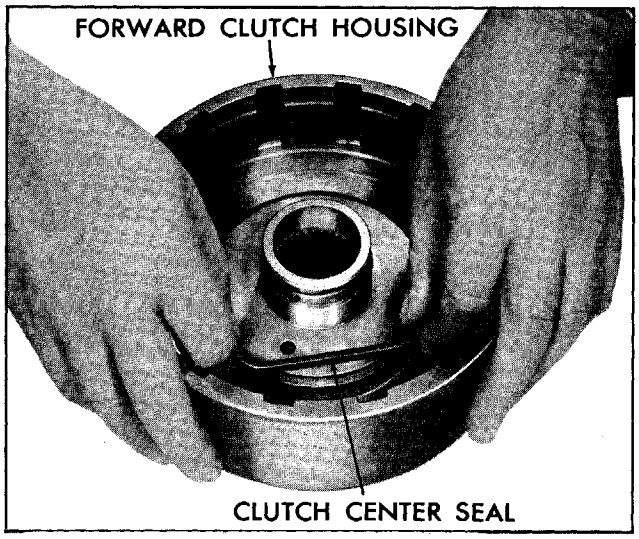


Fig. 74T—Removing Forward Clutch Center Seal

to make certain the proper piston be installed in the clutch assemblies.

As shown in Figure 90T, the direct clutch piston can be identified by the check ball.

1. Place new inner and outer oil seals on clutch piston, lips face away from spring pockets (fig. 73T).
2. Place a new center seal on clutch housing, lip faces up (fig. 74T).
3. Place seal protector Tool J-21362, over clutch hub and install outer clutch piston seal Protector J-21409, into clutch drum and install piston, rotating piston on drum until seated (fig. 76T).
4. Install sixteen (16) clutch release springs (green) into pockets in piston.
5. Place spring retainer and snap ring on springs.

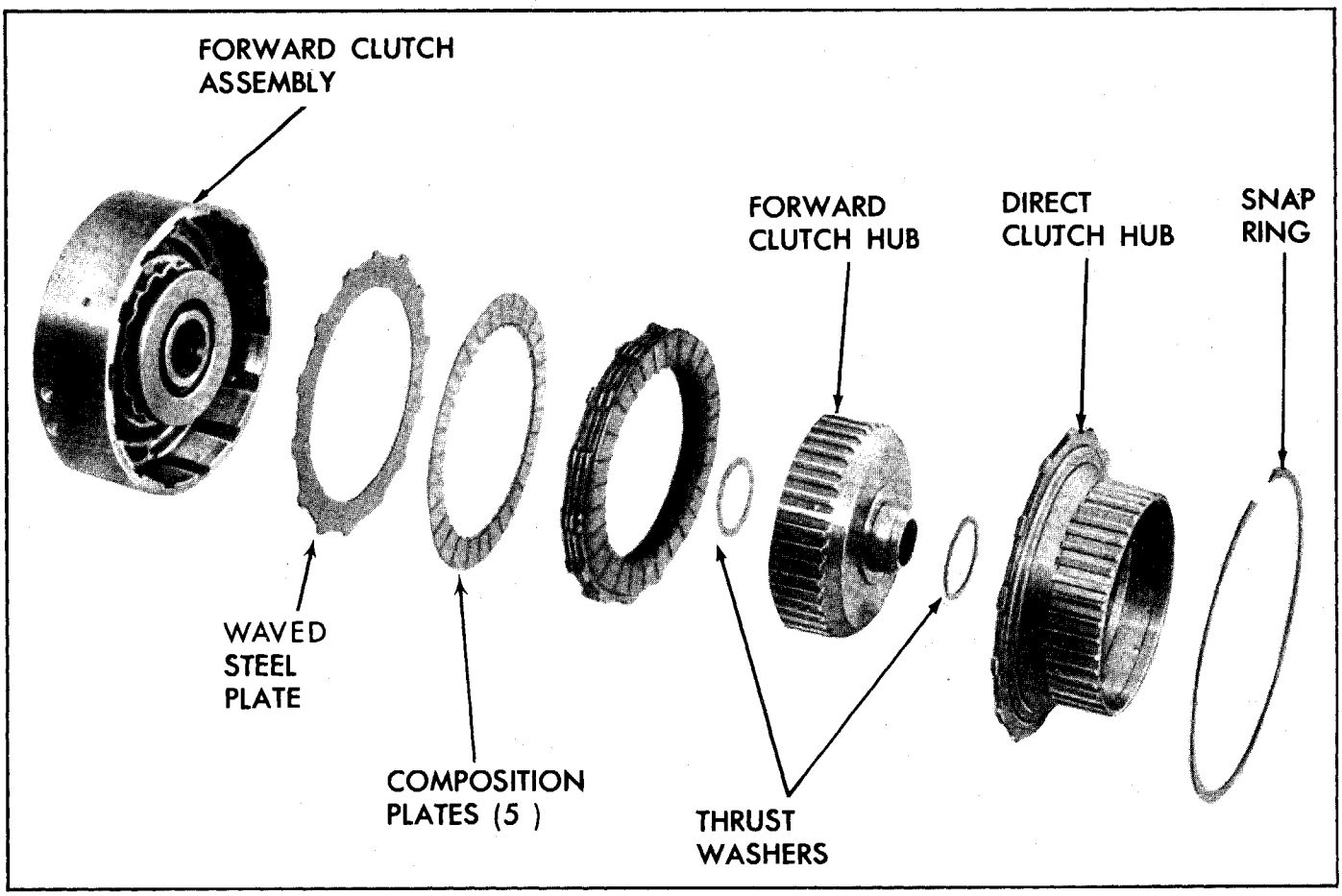


Fig. 75T—Forward Clutch Assembly - Exploded View

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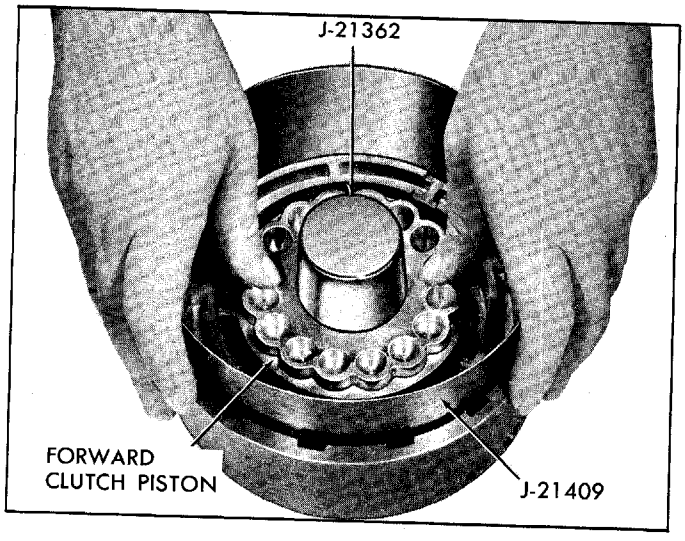


Fig. 76T—Installing Forward Clutch Piston

6. Compress springs in arbor press, using clutch compressor Tools J-4670 and J-21664, install snap ring.
7. If removed, install turbine shaft in forward clutch housing, using arbor press.
8. Install forward clutch hub washers on forward clutch hub. Retain with petrolatum.
9. Place forward clutch hub into forward clutch housing.
10. Oil and install five (5) radial grooved composition and four (4) flat steel and one (1) waved steel clutch plate (plate with notches) starting with waved steel and alternating steel and composition (fig. 77T).
11. Install direct clutch hub and retaining snap ring (fig. 78T).
12. Place forward clutch housing on pump delivery sleeve and air check clutch operation (fig. 79T).

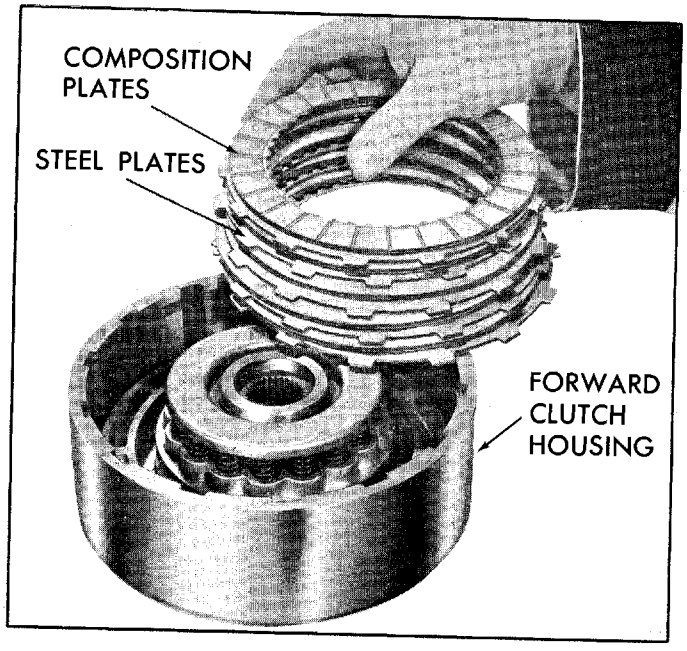


Fig. 77T—Installing Forward Clutch Composition and Steel Plates

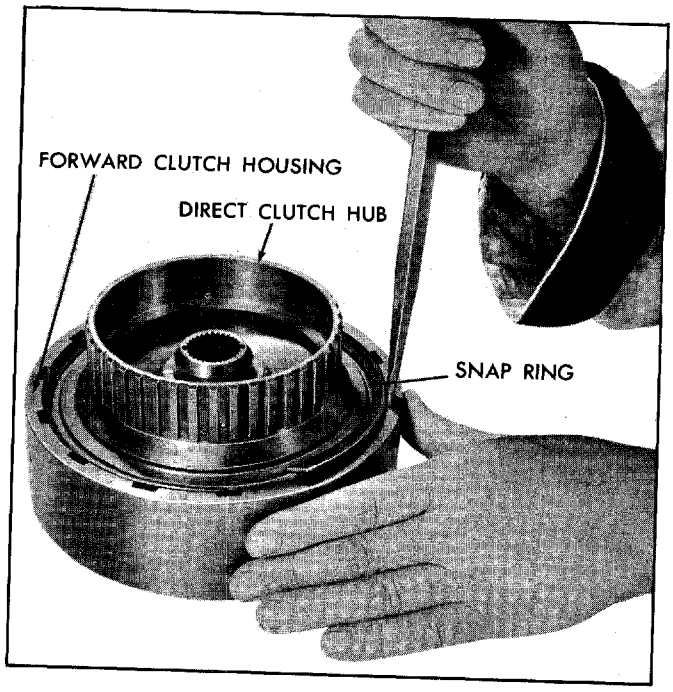


Fig. 78T—Installing Forward Clutch Housing to Direct Clutch Hub Snap Ring

DIRECT CLUTCH AND INTERMEDIATE SPRAG DISASSEMBLY, INSPECTION AND RE-ASSEMBLY

a. Disassembly

1. Remove intermediate sprag retainer snap ring and retainer (fig. 80T).
2. Remove sprag outer race, bushings and sprag assembly.
3. Turn unit over and remove backing plate to direct clutch housing snap ring (fig. 81T).

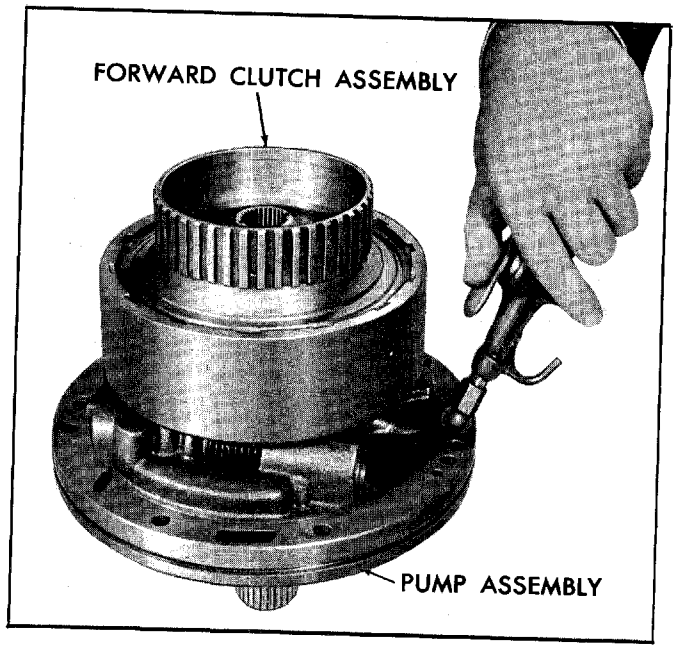


Fig. 79T—Air Checking Forward Clutch Assembly

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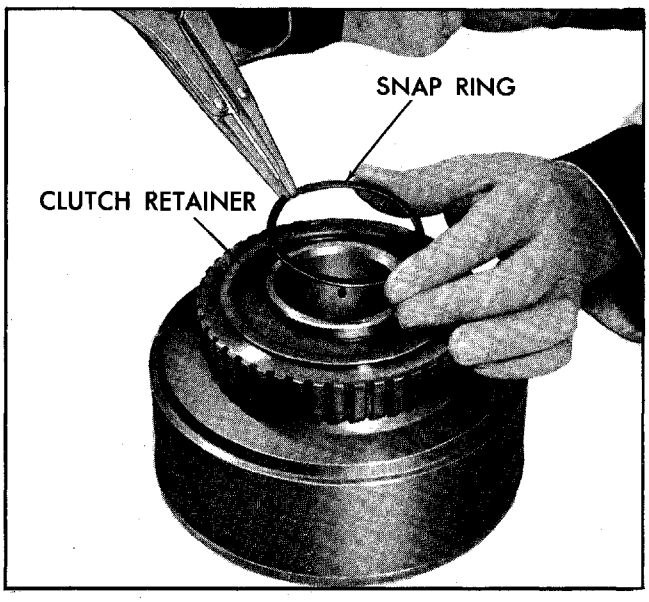


Fig. 80T—Removing Intermediate Clutch Retainer Snap Ring

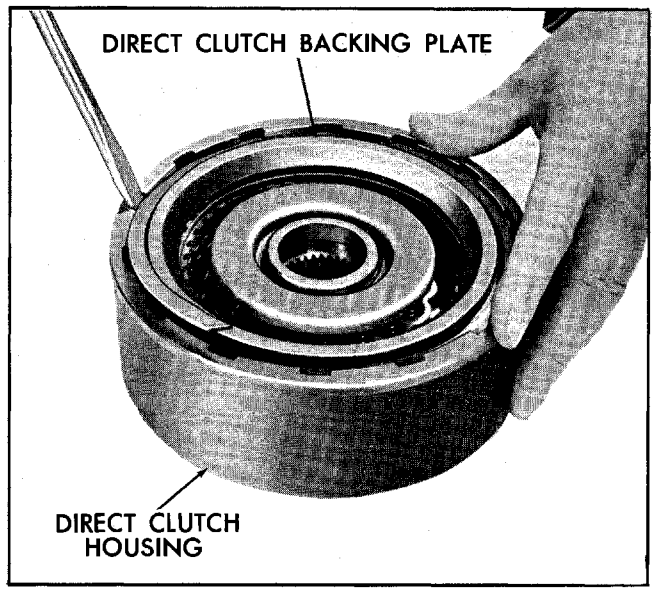


Fig. 81T—Removing Direct Clutch Back Plate Snap Ring

4. Remove direct clutch backing plate (five) 5 composition, and (five) 5 steel clutch plates.

   NOTE: Radial grooved composition plates should never be used in this clutch pack.

5. Using clutch compressor Tool J-4670 and J-21664, compress spring retainer in arbor press and remove snap ring (fig. 83T).
6. Remove retainer and sixteen (16) piston release springs.
7. Remove direct clutch piston (Fig. 84T).
8. Remove outer seal from piston.
9. Remove inner seal from piston.
10. Remove center piston seal from direct clutch housing.

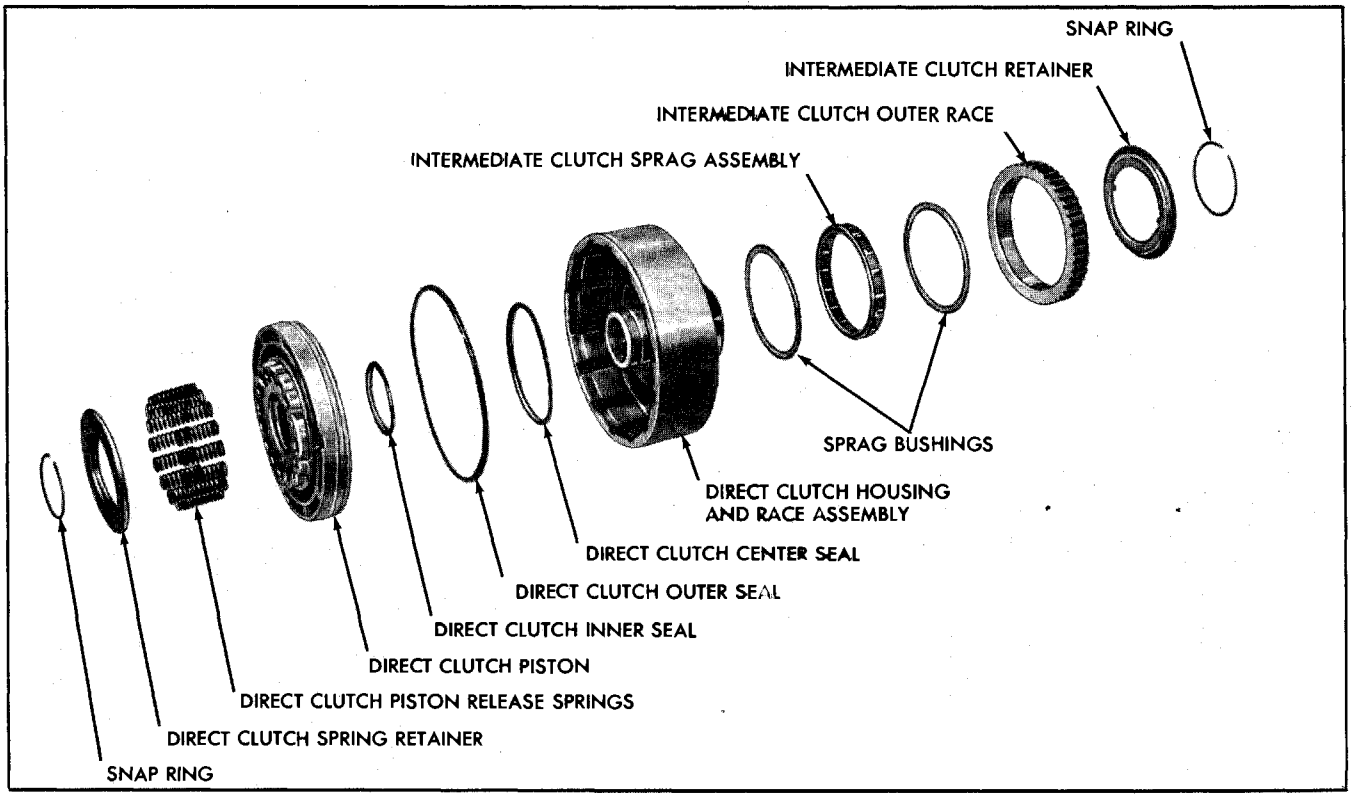


Fig. 82T—Direct Clutch and Intermediate Sprag - Exploded View

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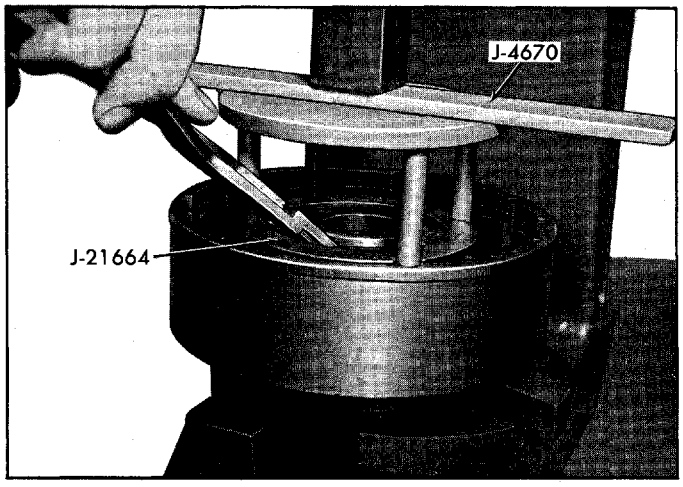


Fig. 83T—Removing or Installing Direct Clutch Snap Ring

b. Inspection

1. Inspect sprag assembly for popped or loose sprags.
2. Inspect sprag bushings for wear or distortion.
3. Inspect inner and outer races for scratches or wear.
4. Inspect clutch housing for cracks, wear, proper opening of oil passages or wear on clutch plate drive lugs.
5. Inspect drive and driven clutch plates for sign of wear or burning.
6. Inspect backing plate for scratches or other damage.
7. Inspect clutch piston for cracks and free operation of ball checks.

c. Assembly

NOTE: The Turbo Hydra-Matic forward and direct clutch pistons have identical inside and outside diameters.

It is possible to reverse the pistons during re-assembly, therefore, care should be exercised to make certain the proper piston be installed in the clutch assemblies.

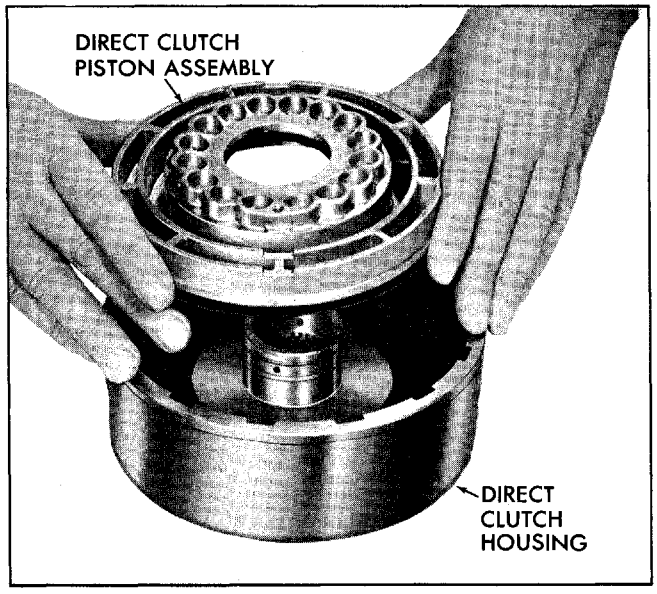


Fig. 84T—Removing Direct Clutch Piston Assembly

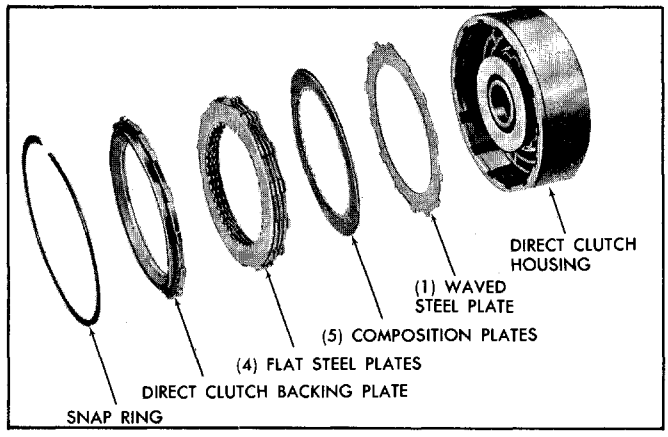


Fig. 85T—Direct Clutch Assembly Exploded

As shown in Figure 90T, the direct clutch piston can be identified by the check ball.

1. Install a new inner clutch piston seal on piston with lip facing away from spring pockets (fig. 86T).
2. Install a new outer clutch piston seal with lip facing away from spring pockets. (fig. 87T).
3. Install a new center seal on clutch housing with lip of seal facing up (fig. 88T).

NOTE: Apply automatic transmission oil to all seals.

4. Place seal protectors, Tools J-21362 Inner, J-21409 Outer, over hub and clutch housing and install clutch piston, with a rotating motion (fig. 89T).
5. Install sixteen (16) springs (plain) into piston.
6. Place spring retainer and snap ring on retainer.
7. Using an arbor press and Tool J-4670, with J-21664, compress springs and install snap ring (fig. 83T).
8. Install five (5) composition and five (5) steel clutch plates, starting with the waved steel plate (U notch) and alternating steel and composition. (fig. 91T).
9. Install clutch backing plate.
10. Install backing plate retaining snap ring (fig. 92T).
11. Turn unit over and install one sprag bushing, cup side up, over inner race.

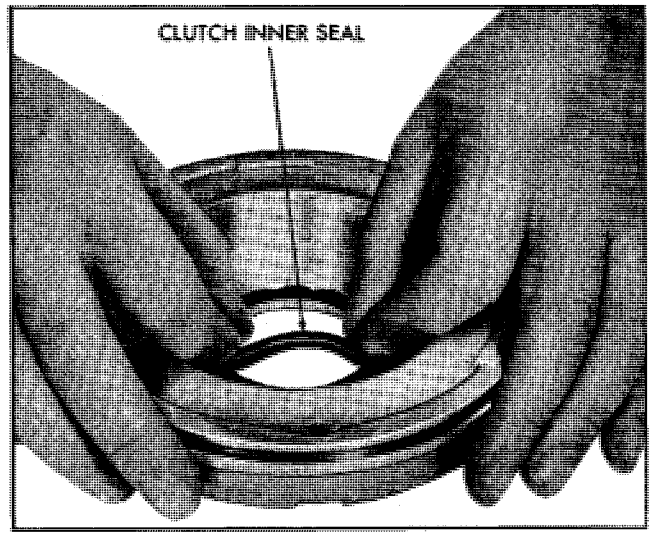


Fig. 86T—Installing Direct Clutch Inner Seal

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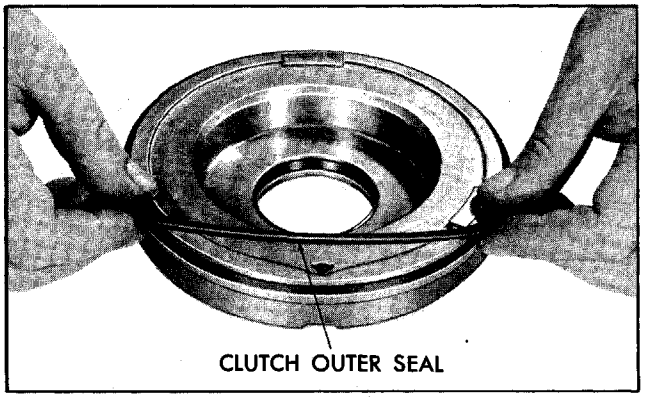


Fig. 87T—Installing Direct Clutch Outer Seal

12. Install sprag assembly into outer race.
13. With ridge or shoulder on inner cage down, start sprag and outer race over inner race with clockwise turning motion (fig. 93T).

    NOTE: Outer race should not turn counter-clockwise after installation.

14. Install sprag bushing over sprag, cup side down.
15. Install sprag retainer and snap ring (fig. 94T and 95T).
16. Place direct clutch assembly over center support and air check operation of direct clutch (fig. 96T).

    NOTE: If air is applied through reverse passage it will escape from direct clutch passage. This is normal.

DISASSEMBLY, INSPECTION AND RE-ASSEMBLY OF CASE CENTER SUPPORT

a. Disassembly

1. Remove four (4) hook type oil seal rings from center support.
2. Using clutch compressor, J-4670 in arbor press compress spring retainer and remove snap ring (fig. 97T).
3. Remove spring retainer and three (3) clutch release springs.

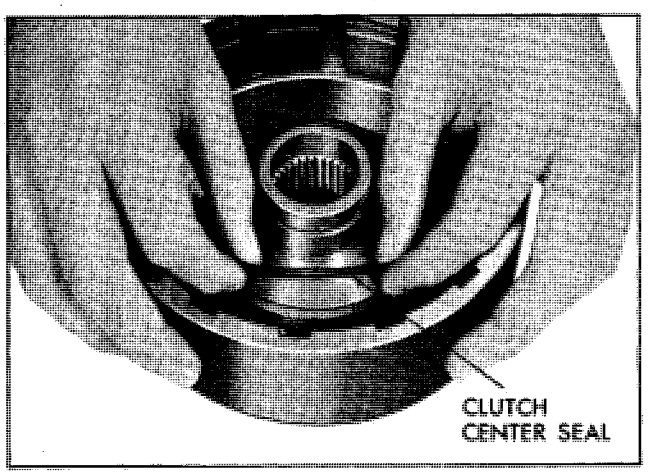


Fig. 88T—Installing Direct Clutch Center Seal

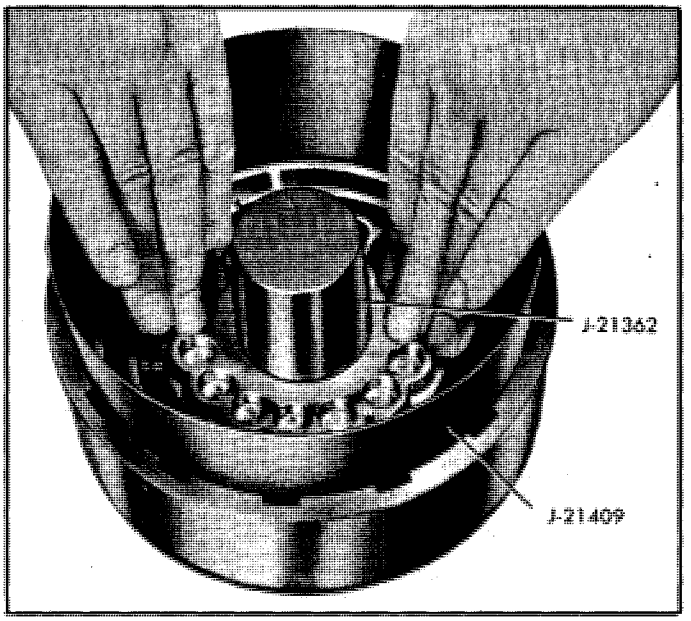


Fig. 89T—Installing Direct Clutch Piston

4. Remove intermediate clutch piston.
5. Remove inner and outer piston seal.

CAUTION: Do not remove three (3) screws retaining roller clutch inner race to center support.

b. Inspection

1. Inspect roller clutch inner race for scratches or indentations. Be sure lubrication hole is open. Be sure constant bleed plug orifice, (approx. .020 dia.), is open (fig. 41T).

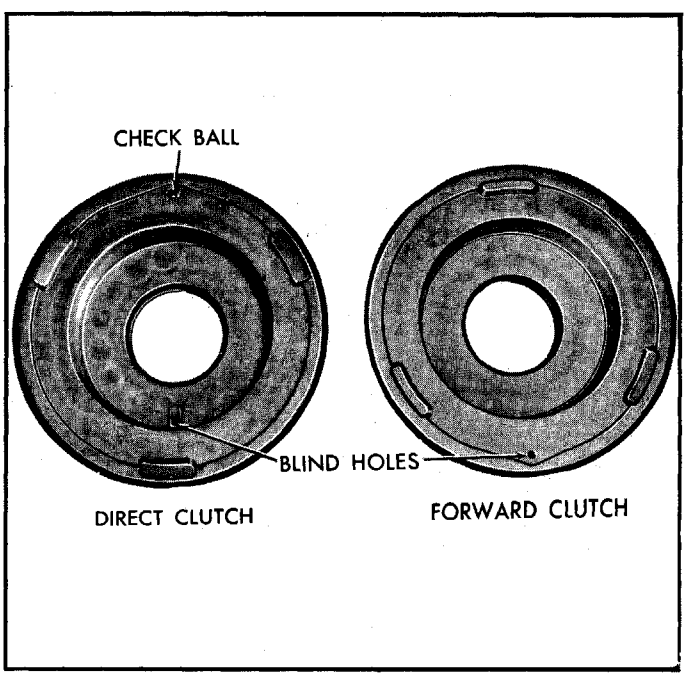


Fig. 90T—Forward and Direct Clutch Piston Identification

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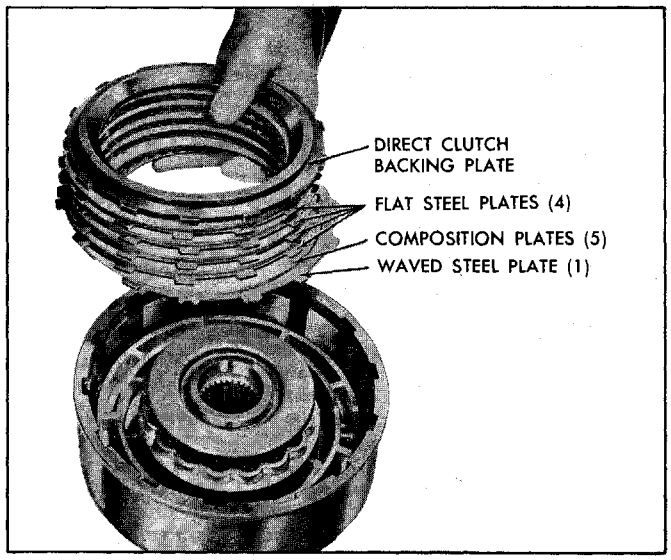


Fig. 91T—Install Direct Clutch Backing Plate, Composition Plates, and Steel Plates

2. Inspect bushing for scoring, wear or galling. If replacement is necessary, proceed as follows:
   a. Using Tool J-21465-6 remove bushing.
   b. From rear side of support, install bushing using Tool J-21465-6. Install bushing flush to .010" below counter bore.
3. Check oil ring grooves for damage.
4. Air check oil passages to be sure they are not interconnected.
5. Inspect piston sealing surfaces for scratches.
6. Inspect piston seal grooves for nicks or other damage.
7. Inspect piston for cracks or porosity.
8. Inspect release springs for distortion.

c. Assembly

1. Install new inner and outer seals on piston with lip of seal facing away from spring pocket (fig. 99T and 100T).
2. Install inner seal protector, Tool J-21363, on center support hub, install piston, indexing spring pockets of piston into cored areas of the center support. (fig. 101T).
3. Install three (3) release springs into counterbores of piston. Space equally during assembly.
4. Place spring retainer and snap ring over springs.
5. Using Clutch Spring Compressor, J-4670, in arbor press compress springs and install snap ring (fig. 102T).
6. Install four (4) hook type oil rings.
7. Air check operation of intermediate clutch piston (fig. 103T).

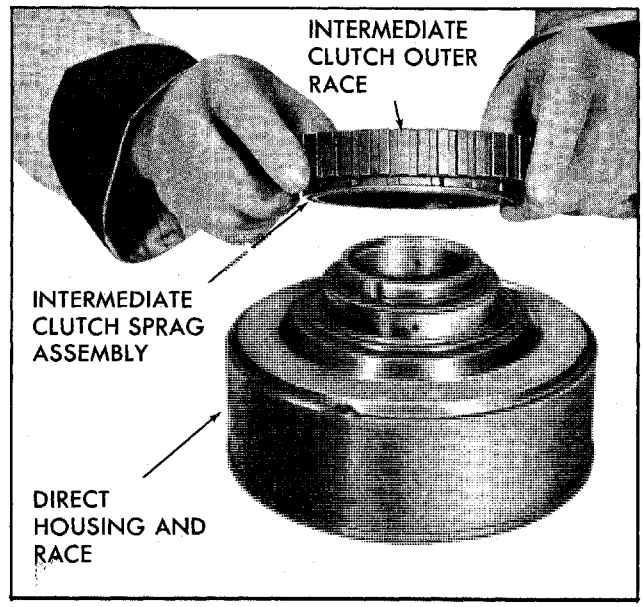


Fig. 93T—Installing Intermediate Sprag to Direct Clutch

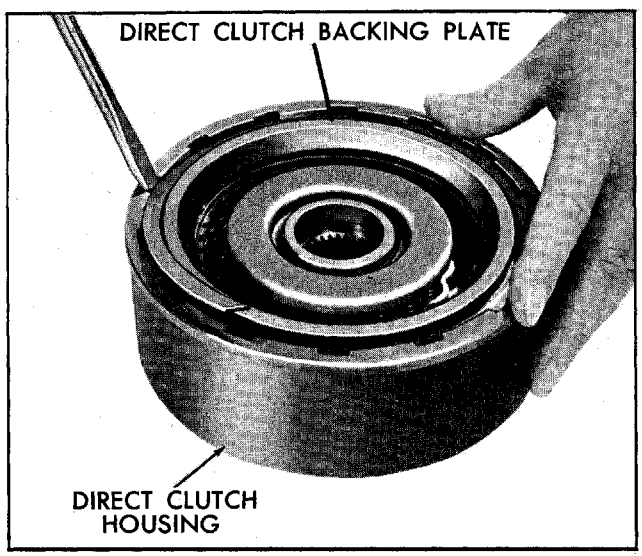


Fig. 92T—Installing Direct Clutch Housing to Backing Plate Snap Ring

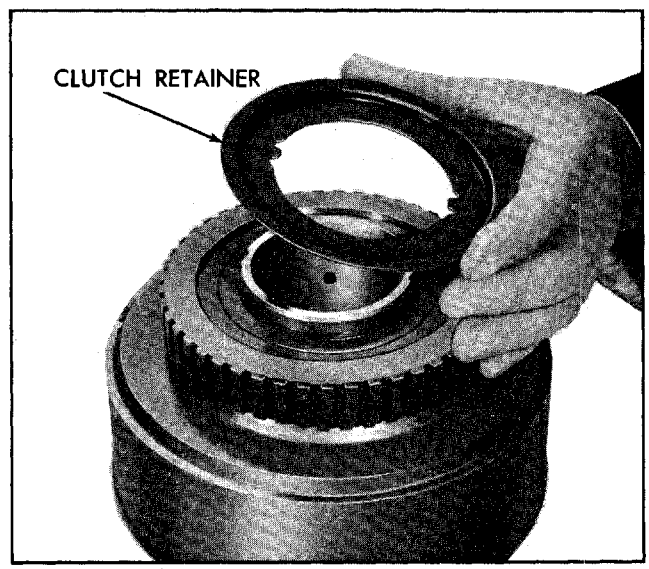


Fig. 94T—Installing Intermediate Clutch Retainer

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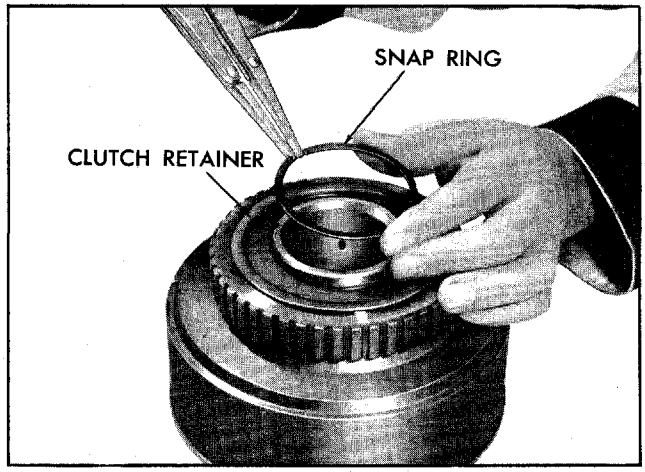


Fig. 95T—Installing Intermediate Clutch Retainer Snap Ring

INSPECTION OF REACTION CARRIER, REAR SPRAG, AND OUTPUT CARRIER ASSEMBLY

1. Inspect band surface on reaction carrier for signs of burning or scoring.
2. Inspect roller clutch outer race for scoring or wear.
3. Inspect thrust washer surfaces for signs of scoring or wear.
4. Inspect bushing for damage. If bushing is damaged reaction carrier must be replaced.
5. Inspect reaction carrier pinions for damage, rough bearings, or excessive tilt.
6. Check pinion end play. Pinion end play should be .009"-.024" (fig. 104T).
7. Inspect roller clutch for damaged rollers.
8. Inspect roller clutch cage and springs for damage.
9. Inspect front internal gear (output carrier) for damaged teeth.
10. Inspect output carrier pinions for damage, rough bearings or excessive tilt.
11. Check pinion end play. Pinion end play should be .009"-.024" (fig. 105T).
12. Inspect parking pawl lugs for cracks or damage.
13. Inspect output locating splines for damage.
14. Inspect front internal gear ring for flaking. (fig. 42T)

Pinion Replacement Procedure

1. Support carrier assembly on its front face.
2. Using a tapered punch, drive or press pinion pins out of carrier (fig. 106T).
3. Remove pinions, thrust washers and roller needle bearings.
4. Inspect pinion pocket thrust faces for burrs and remove if present.
5. Install nineteen (19) needle bearings into each pinion using petrolatum to hold bearings in place. Use pinion pin as guide (fig. 107T).
6. Place a bronze and steel washer on each side of pinion so steel washer is against pinion, hold them in place with petrolatum.
7. Place pinion assembly in position in carrier and install a pilot shaft through rear face of assembly to hold parts in place.
8. Drive a new pinion pin into place while rotating pinion from front, being sure that headed end is flush or below face of carrier (fig. 108T).
9. Place a large punch in a bench vise to be used as an anvil while staking opposite end of pinion pin in three places.

NOTE: Both ends of pinion pins must lie below face of carrier or interference may occur.

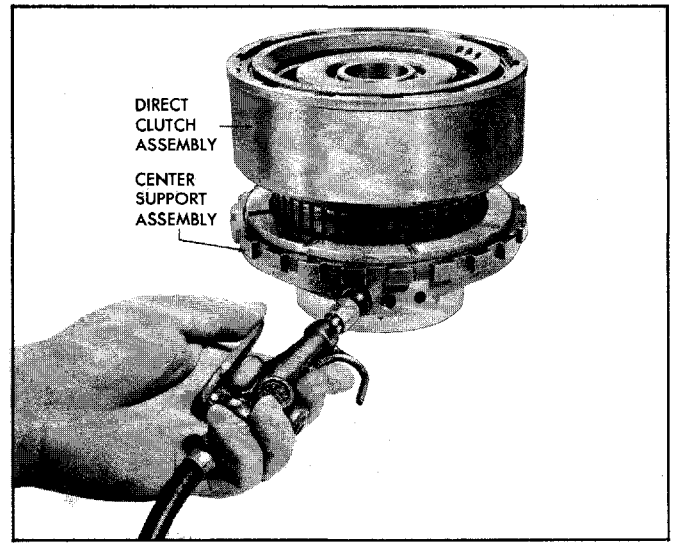


Fig. 96T—Air Checking Direct Clutch Assembly

OUTPUT SHAFT, REAR INTERNAL GEAR, SUN GEAR AND SHAFT

a. Output Shaft

1. Inspect bushing for wear or galling. If Replacement is necessary, proceed as follows:
   a. Thread Tool J-21465-16 into bushing and using Slide Hammer J-2619, remove bushing.
   b. Using Tool J-21465-1, install bushing to .070 below thrust washer face.
2. Inspect bearing and thrust washer surfaces for damage.

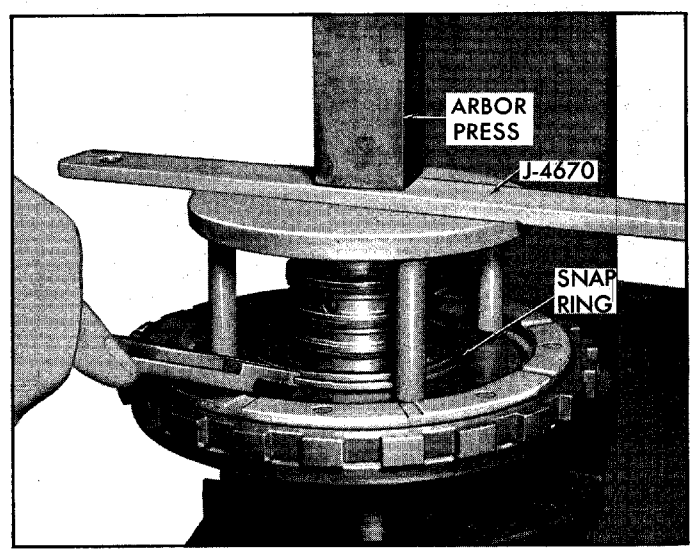


Fig. 97T—Removing Intermediate Clutch Piston Snap Ring

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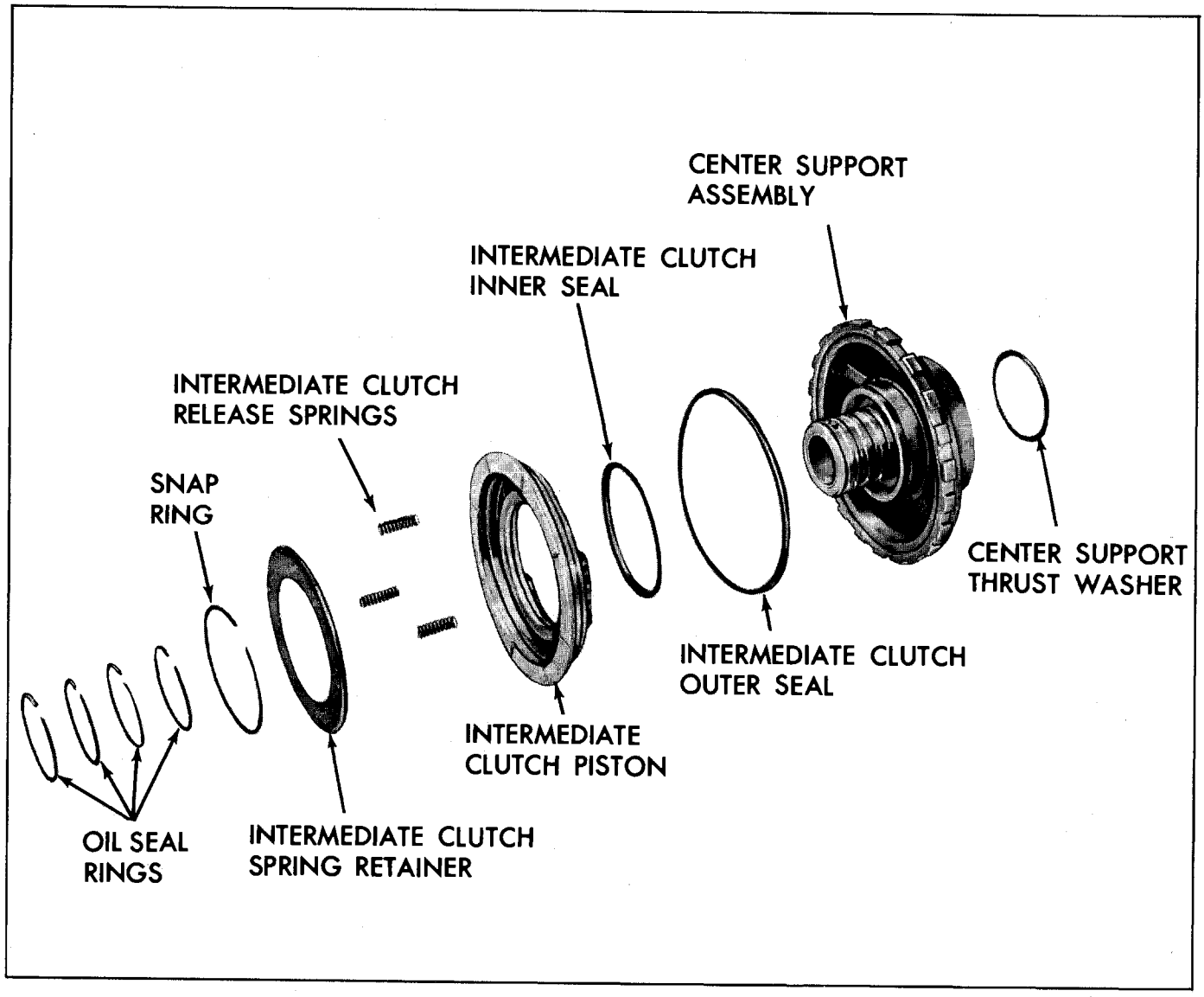


Fig. 98T—Center Support Assembly - Exploded View

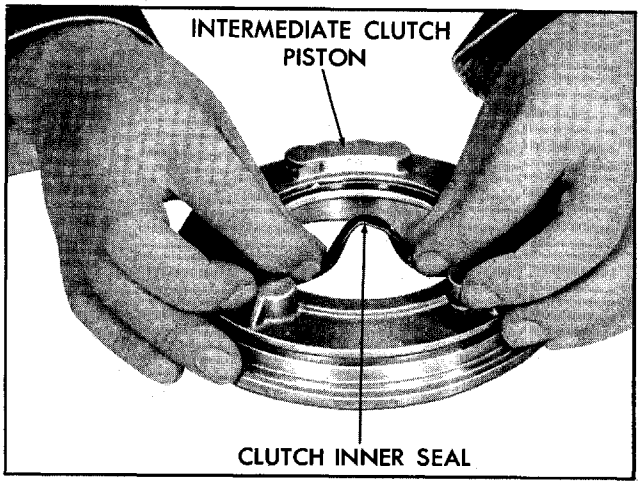


Fig. 99T—Installing Intermediate Clutch Inner Seal

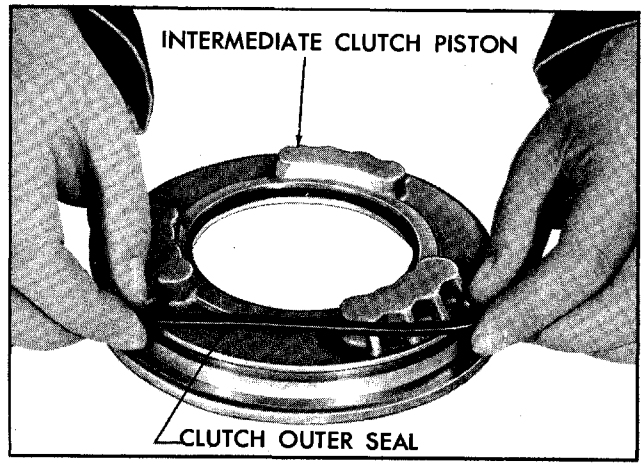


Fig. 100T—Installing Intermediate Clutch Outer Seal

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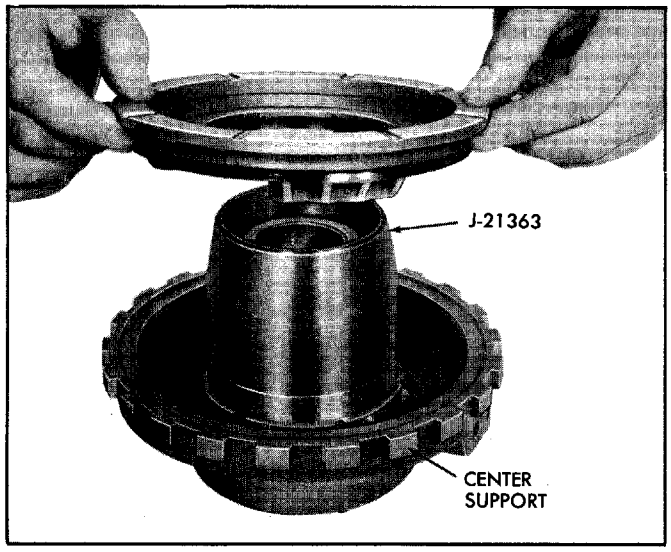


Fig. 101T—Installing Intermediate Clutch Piston

3. Inspect governor drive gear for rough or damaged teeth.
4. Inspect splines for damage.
5. Inspect orificed cup plug in lubrication passage.
6. Inspect drive lugs for damage.

b. Inspection of Rear Internal Gear

1. Inspect gear teeth for damage or wear.
2. Inspect splines for damage.
3. Inspect gear for cracks.

c. Inspection of Sun Gear

1. Inspect gear teeth for damage or wear.
2. Inspect splines for damage.
3. Be sure oil lubrication hole is open.

d. Inspection of Sun Gear Shaft

1. Inspect shaft for cracks or splits.
2. Inspect splines for damage.
3. Inspect bushings for scoring or galling. If necessary to replace, proceed as follows:

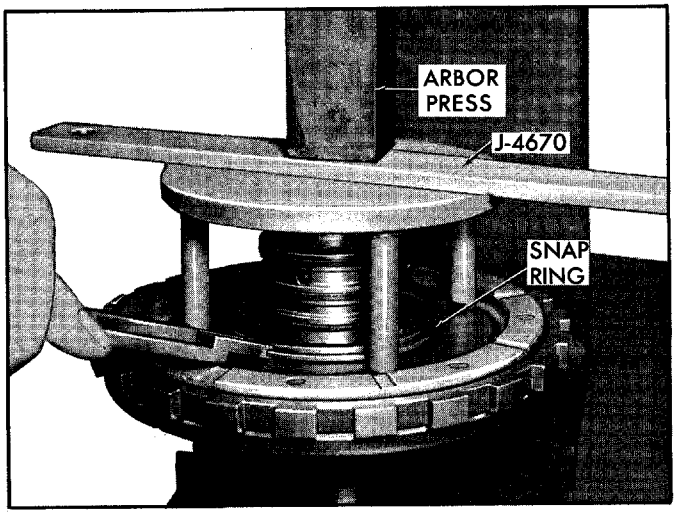


Fig. 102T—Installing Intermediate Clutch Piston Snap Ring

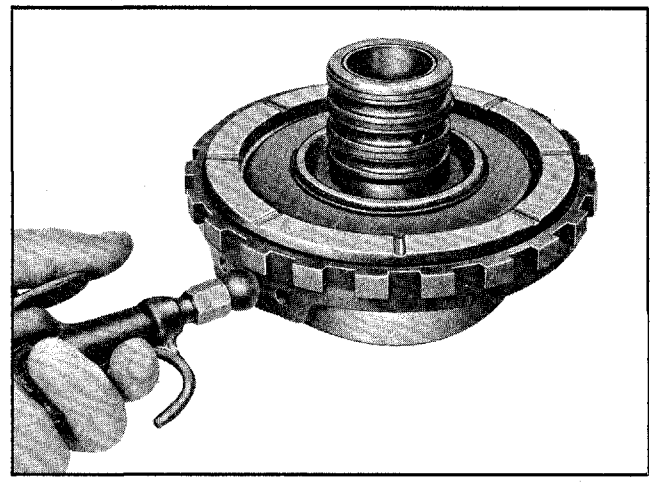


Fig. 103T—Air Checking Intermediate Clutch Piston

Sun Gear Shaft Bushing—Front

Remove

With sun gear shaft properly supported, using Tool J-21465-15, with slide hammer and Adapter J-2619, remove bushing.

Replace

Using Tool J-21465-5 with Adapter J-8092 press or drive replacement bushing into place until tool bottoms.

Sun Gear Shaft Bushing—Rear

Remove

With sun gear shaft properly supported, using Tool J-21465-15, remove bushing.

Replace

Using Tool J-21465-5, with Adapter J-8092, press or drive replacement bushing into place until tool bottoms.

4. Inspect ground bushing journals for damage.
5. Be sure oil lubrication hole is open.

INSPECTION OF MAIN SHAFT

1. Inspect shaft for cracks or distortion.
2. Inspect splines for damage.
3. Inspect ground bushing journals for damage.
4. Inspect snap ring groove for damage.

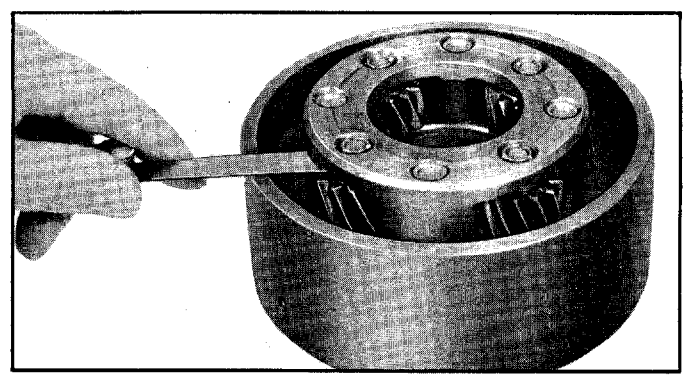


Fig. 104T—Checking Pinion End Play

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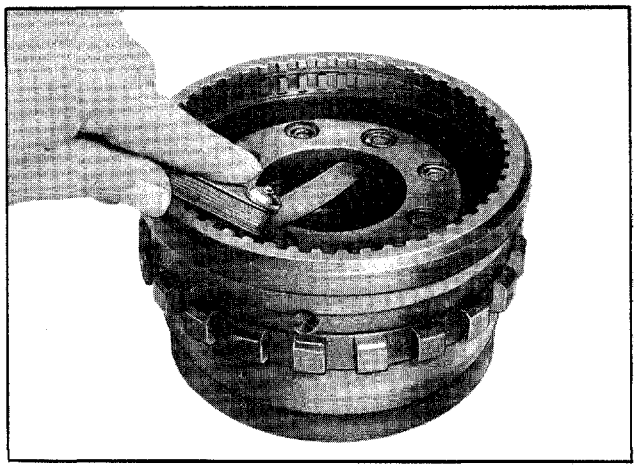


Fig. 105T—Checking Output Carrier Pinion End Play

5. Inspect orificed cup plug pressed into one end of mainshaft. Be sure it is not plugged.

INSPECTION OF FRONT AND REAR BANDS

1. Inspect lining for cracks, flaking, burning, or looseness.
2. Inspect bands for cracks or distortion.
3. Inspect end for damage at anchor lugs or apply lugs.

INSPECTION OF CASE EXTENSION

1. Inspect bushing for excessive wear or damage. If replacement is necessary proceed as follows:
   a. Install Tool J-22182 and remove.
   b. Using Tool J-22182 install bushing, flush to .010" below rear chamfer.
   c. Stake bushing in place using Tool J-21465-10 in diamond area of bushing lube groove.
2. Inspect gasket mounting face for damage.
3. Inspect housing for cracks or porosity.
4. Be sure rear seal drain back port is not obstructed.

INSPECTION OF MODULATOR AND VALVE

1. Inspect modulator assembly for any signs of bending or distortion (fig. 109T).

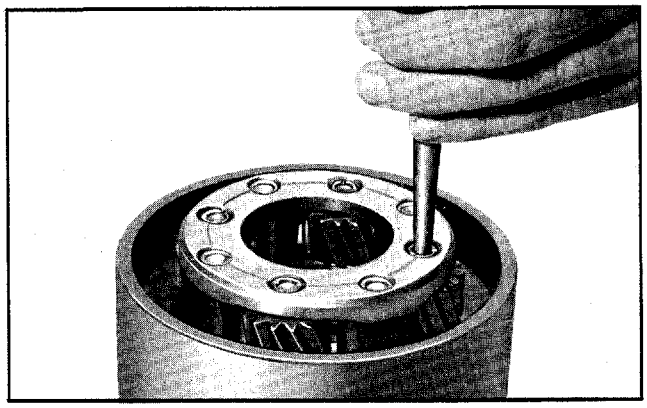


Fig. 106T—Removing Planet Pinion Pin

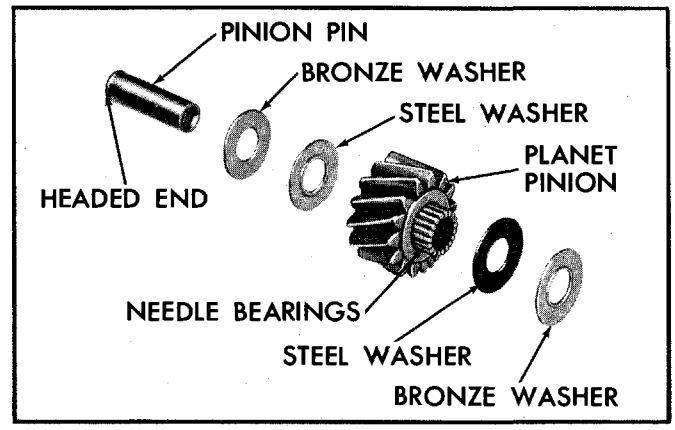


Fig. 107T—Plant Pinion Assembly - Exploded View

2. Inspect "O" ring seal seat for damage.
3. Apply suction to vacuum tube and check for diaphragm leaks.
4. Check modulator bellows (modulator plunger is under pressure - 16 lbs.). If bellows is damaged plunger will have very little pressure.
5. Inspect modulator valve for nicks or damage.
6. Check freeness of valve operation in case bore.

INSPECTION OF MANUAL AND PARKING LINKAGE

1. Inspect parking actuator rod for cracks, or broken spring retainer lugs (fig. 110T).
2. Inspect actuator spring for damage.
3. Inspect actuator for free fit on actuator rod.
4. Inspect parking pawl for cracks or wear.
5. Inspect manual shaft for damaged threads, rough oil seal surface or loose lever.
6. Inspect inside detent lever for cracks or a loose pin.
7. Inspect parking pawl shaft if removed for damaged retainer groove.
8. Inspect parking pawl return spring for deformed coils or ends.
9. Inspect parking bracket for cracks or wear.
10. Inspect detent roller and spring assembly.

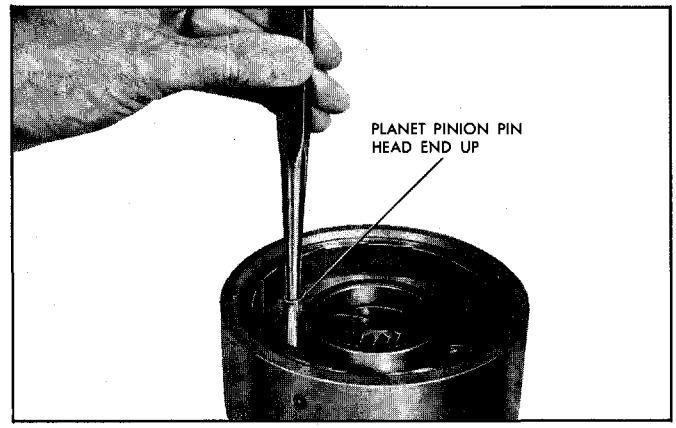


Fig. 108T—Installing Planet Pinion Pin

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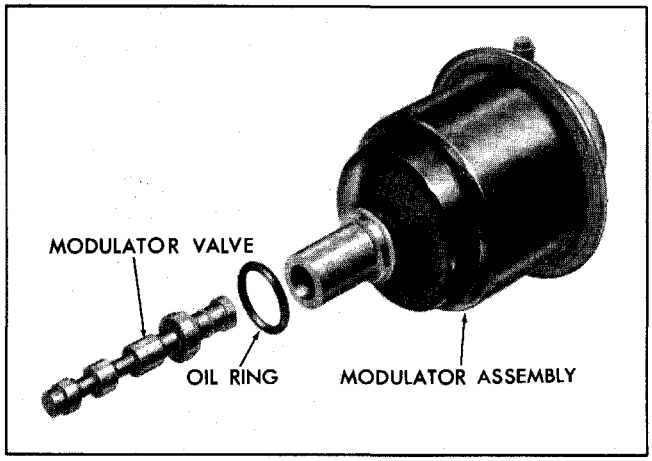


Fig. 109T—Modulator Assembly and Valve

INSPECTION OF CASE ASSEMBLY (Figs. 111T and 112T)

1. Inspect case assembly for cracks, porosity or interconnected passages.
2. Check for good retention of band anchor pins.
3. Inspect all threaded holes for thread damage.
4. Inspect intermediate clutch driven plate lugs for damage or brinneling.
5. Inspect snap ring grooves for damage.
6. Inspect bore for governor assembly for scratches or scoring.
7. Inspect modulator valve bore for scoring or damage.
8. Inspect cup plug inside case for good staking and sealing.
9. Inspect case bushing. If necessary to replace, proceed as follows:

CASE BUSHING

Remove

With case properly supported, using Tool J-21465-8, with Handle J-8092 remove bushing.

Replace

Using Tool J-21465-8, Ring Adapter J-21465-9, Handle J-8092, and Extension J-21465-13, drive replacement bushing into place. Stake bushing with Tool J-21465-10, stake marks in lube grooves.

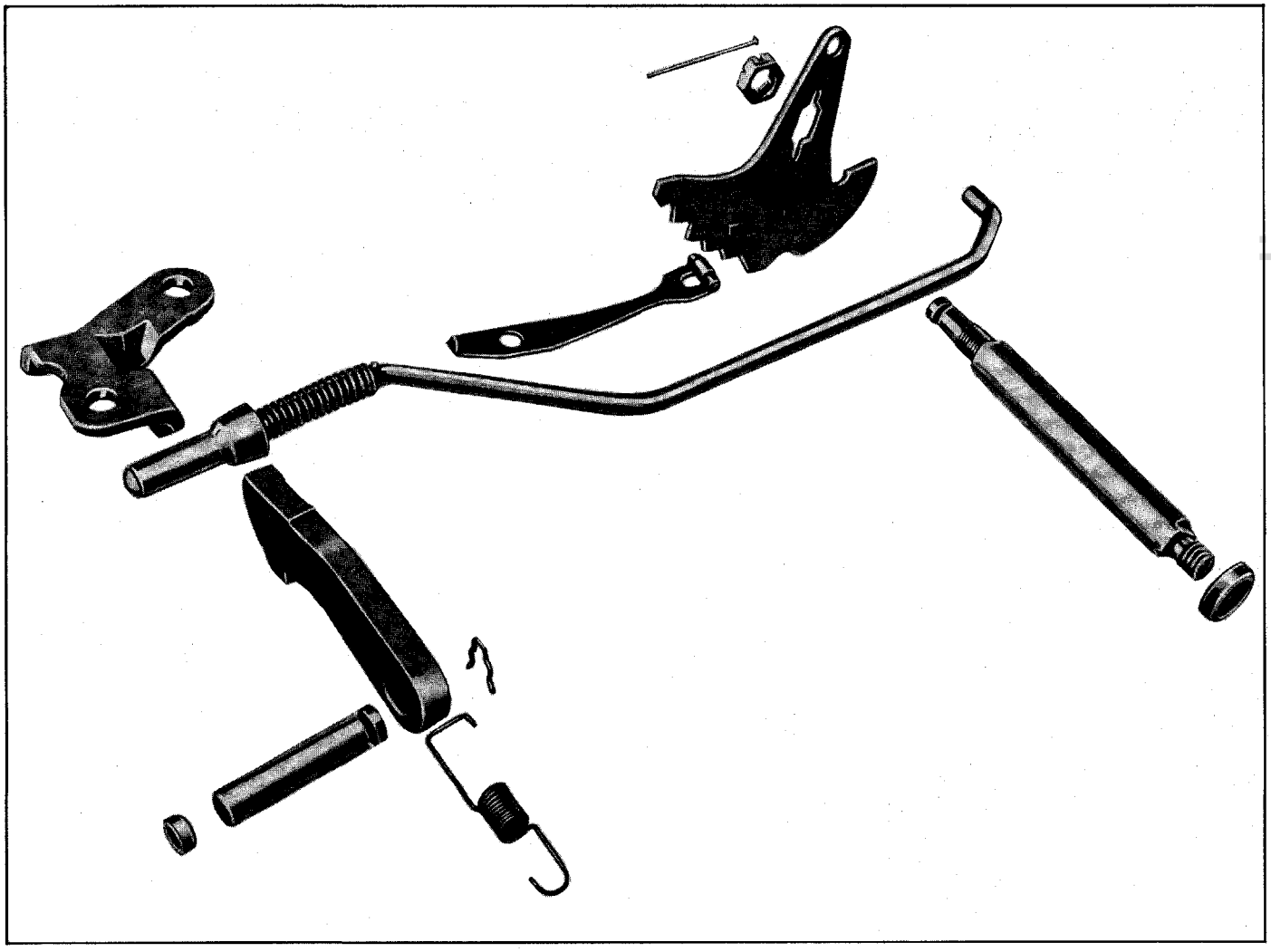


Fig. 110T—Manual and Parking Linkage - Exploded View

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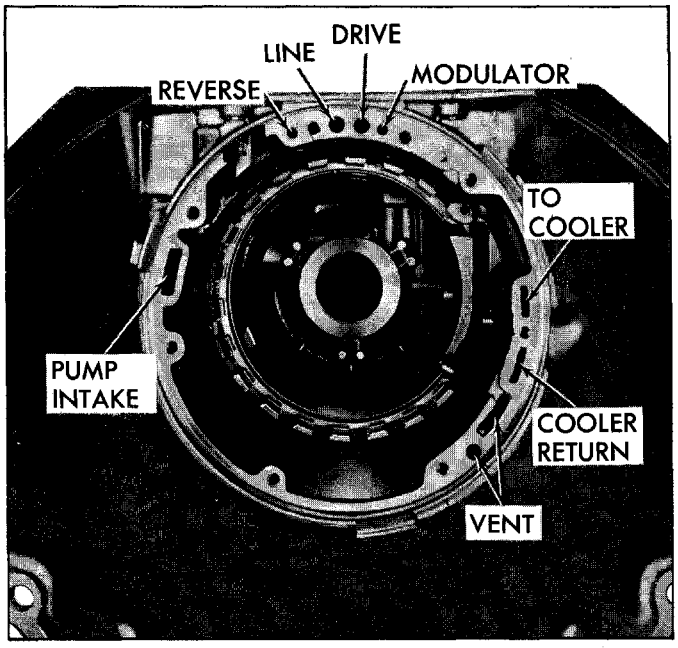


Fig. 111T—Case - Front View Passage Identification

INSPECTION OF CONVERTER

1. Check converter for leaks as follows (fig. 113T).
   a. Install Tool J-21369 and tighten.
   b. Apply 80 psi air pressure to tool.
   c. Submerge in water and check for leaks.
2. Check converter hub surfaces for signs of scoring or wear.

ASSEMBLY OF REAR UNIT

1. Install rear internal gear on end of mainshaft.
2. Install internal gear retaining snap ring (fig. 115T).
3. Install sun gear to internal gear thrust races and bearings against inner face of rear internal gear as follows, and retain with petrolatum.
   a. Place large race against internal gear with outer flange facing forward or up (fig. 116T).
   b. Place thrust bearing against race.
   c. Place small race against bearing with inner flange facing into bearing or down.
4. Install output carrier over mainshaft so that pinions mesh with rear internal gear.
5. Place above portion of "build-up" through hole in bench so that mainshaft hangs downward.
6. Install rear internal gear to output shaft thrust races and bearings as follows and retain with petrolatum (fig. 117T).
   a. Place small diameter race against internal gear with center flange facing up.
   b. Place bearing on race.
   c. Place second race on bearing with outer flange cupped over bearing.
7. Install output shaft into output carrier assembly (fig. 118T).
8. Install output shaft to output carrier snap ring with bevel side up.
9. Turn assembly over and support so that output shaft hangs downward.
10. Install reaction carrier to output carrier thrust washer with tabs facing down in pockets of output carrier.
11. Install sun gear, splines with chamfer down.
12. Install composition ring over output carrier (fig. 119T).
13. Install sun gear shaft with long splined end down.
14. Install reaction carrier (fig. 120T).
15. Install center support to sun gear thrust races and bearings as follows:
    a. Install large race, center flange up over sun gear shaft.
    b. Install thrust bearing against race.

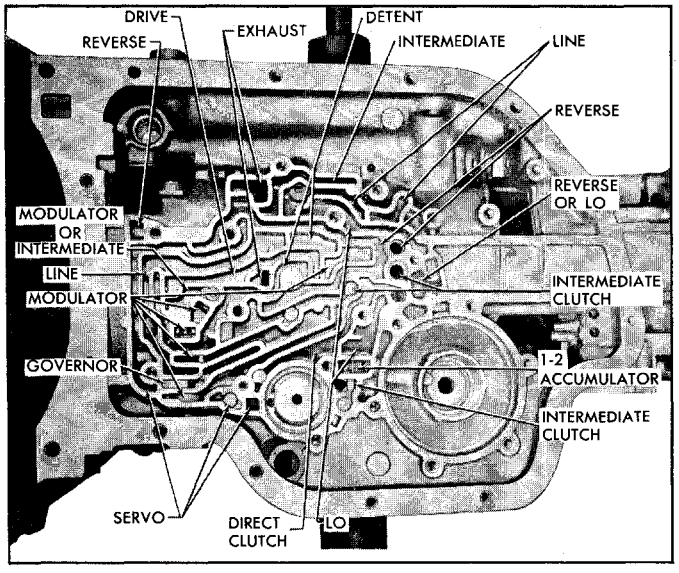


Fig. 112T—Inspect Transmission Case

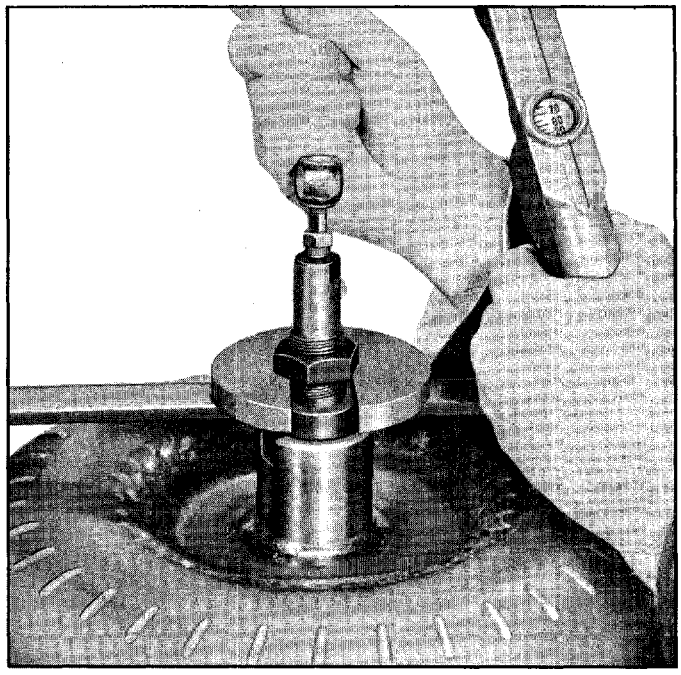


Fig. 113T—Air Checking Converter

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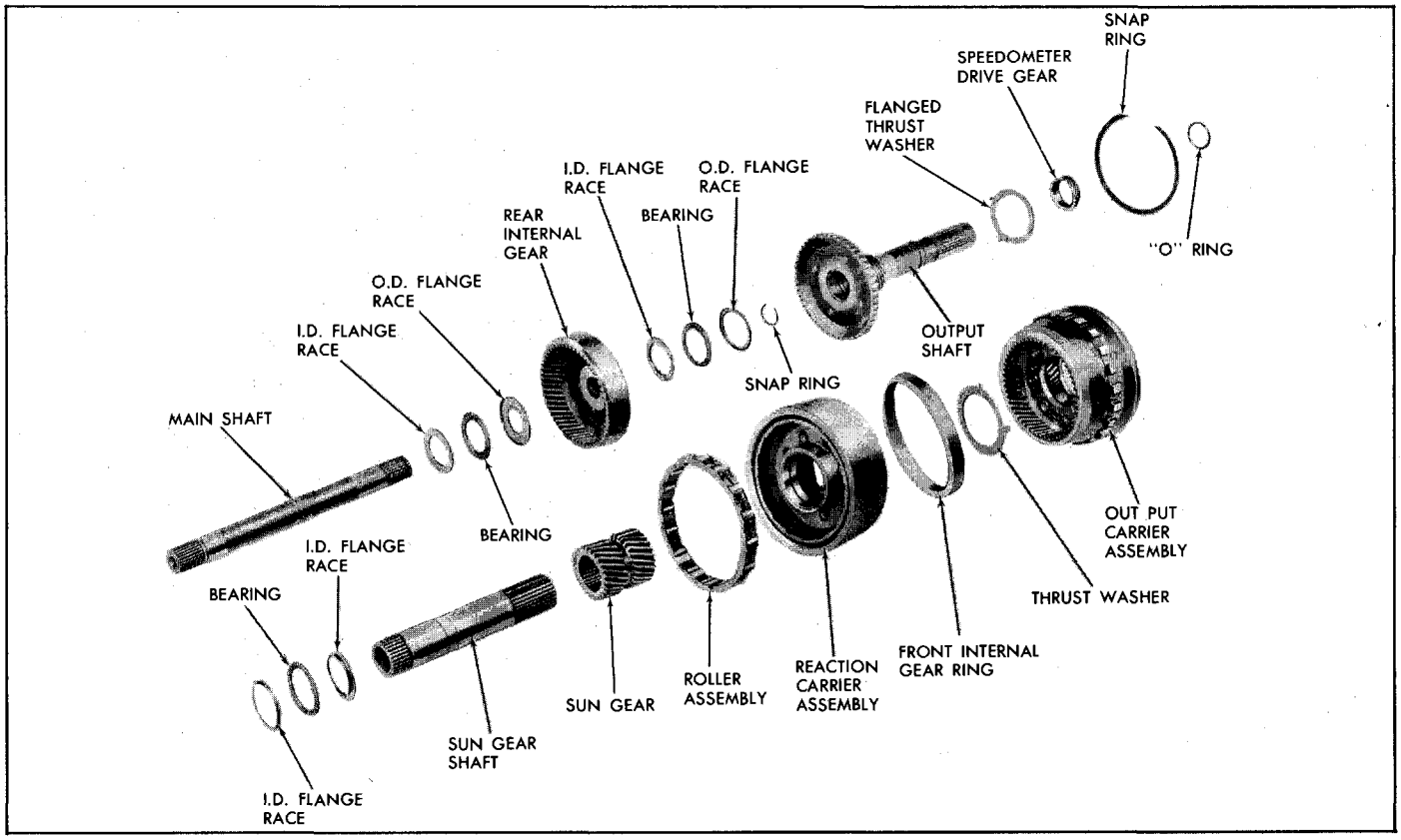


Fig. 114T—Gear Unit Assembly - Exploded View

c. Install second race, center flange up (fig. 121T).

16. Install rollers that may have come out of the roller clutch cage, by compressing the energizing spring with forefinger and inserting roller from the outer edge. (fig. 122T)

17. Install roller clutch assembly (fig. 123T) into reaction carrier.

18. Install center support to reaction carrier phenolic thrust washer into recess in center support. Retain with petrolatum (fig. 41T).

19. Install case center support into roller clutch in reaction carrier (fig. 124T).

NOTE: With reaction carrier held, case center support should only turn counter-clockwise after installation.

20. Install J-21795 on gear unit assembly to hold units in place.

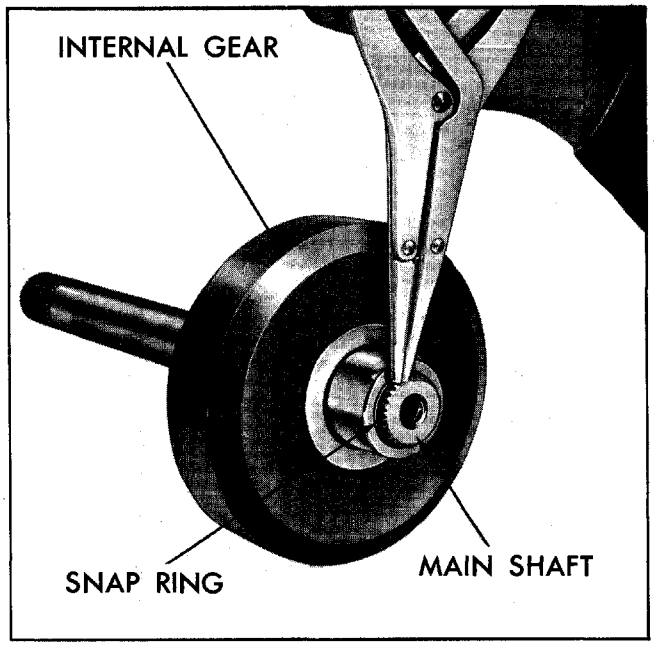


Fig. 115T—Installing Rear Internal Gear to Main Shaft Snap Ring

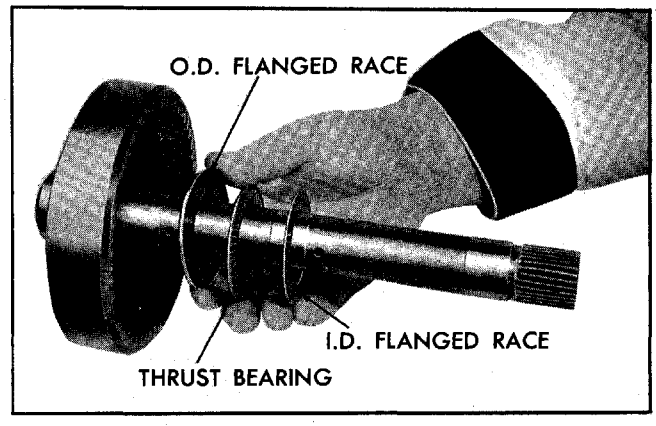


Fig. 116T—Installing Rear Internal Gear to Sun Gear Bearing and Races

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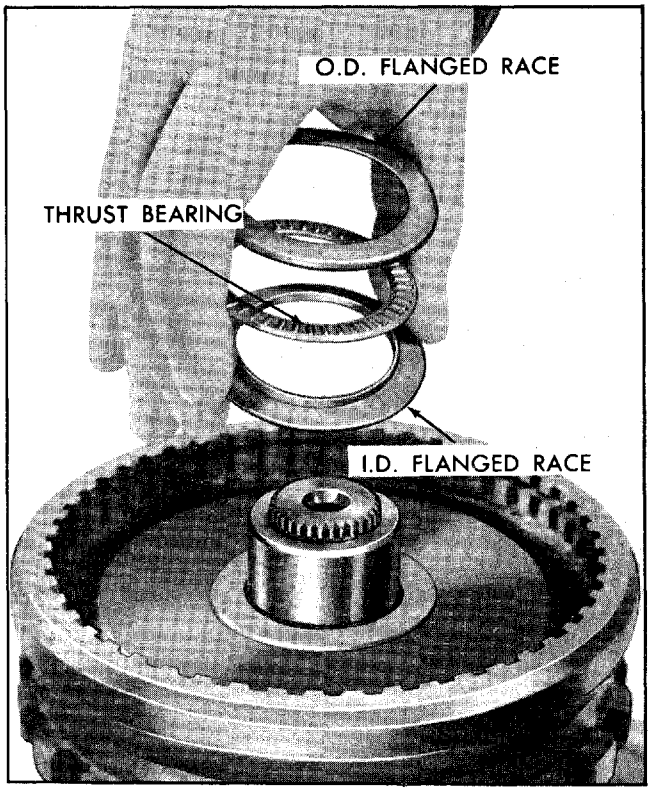


Fig. 117T—Installing Rear Internal Gear to Output Shaft Bearing and Races

21. Install output shaft to case thrust washer tabs in pockets (fig. 125T).

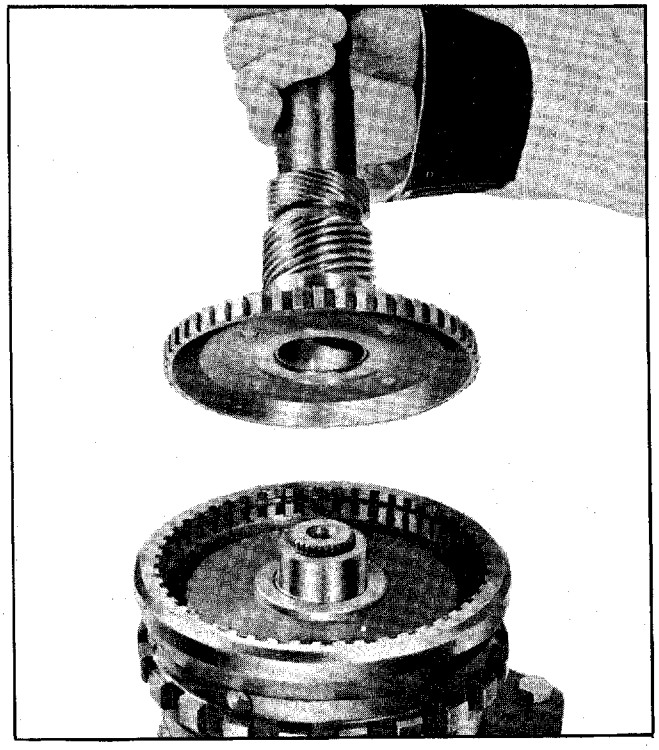


Fig. 118T—Installing Output Shaft

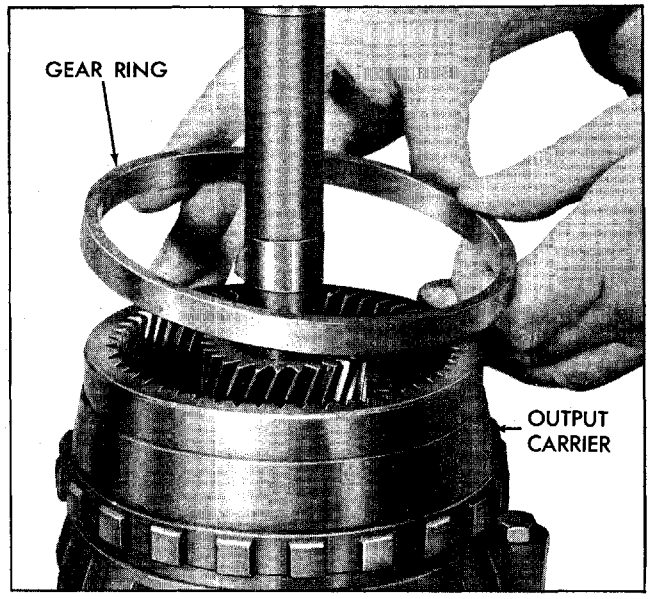


Fig. 119T—Installing Front Internal Gear Ring to Output Carrier

ASSEMBLY OF UNITS TO TRANSMISSION CASE

NOTE: The first three steps can be omitted if the parts involved were not removed on disassembly.

1. Install parking pawl, tooth toward inside of case, and parking pawl shaft (fig. 126T).

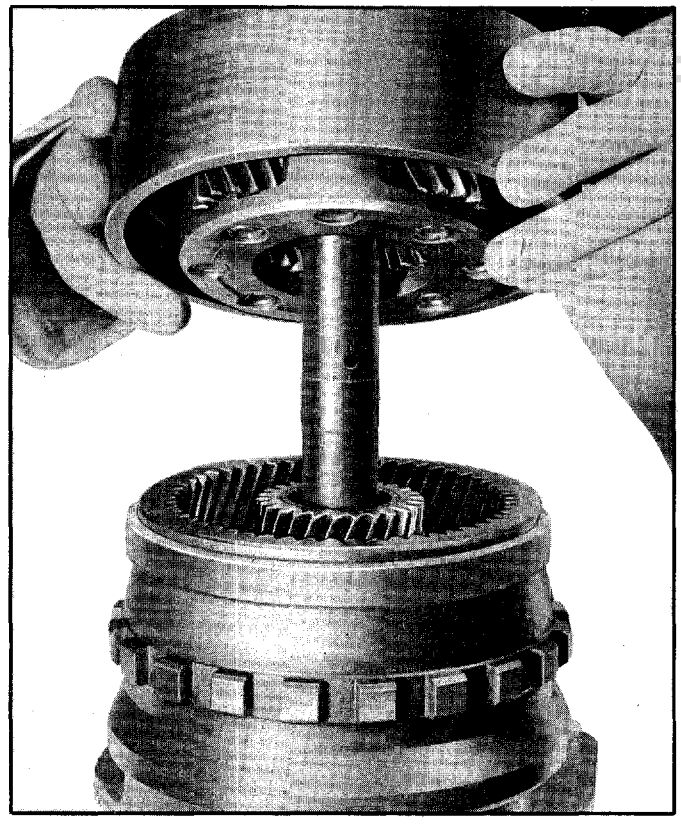


Fig. 120T—Installing Reaction Carrier and Roller Assembly

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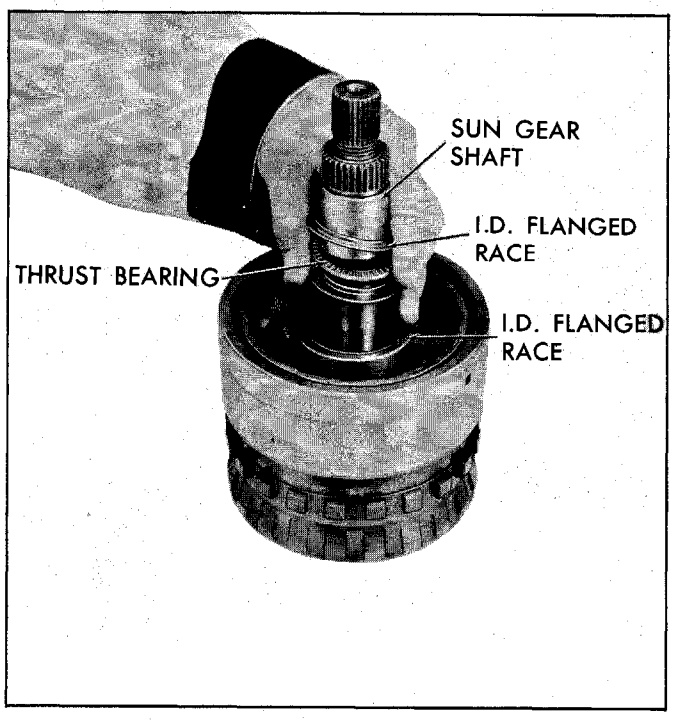


Fig. 121T—Installing Center Support to Sun Gear Thrust Bearing and Races

2. Install parking pawl shaft retainer clip (fig. 127T).
3. Install parking pawl shaft cup plug and drive into the case, using a 3/8 dia. rod, until the parking pawl shaft bottoms on the case rib (fig. 126T).
4. Install parking pawl return spring, square end hooked on pawl and other end on case.
5. Install parking brake bracket with guides over parking pawl using two attaching bolts, torque to 18 ft. lbs.
6. Install rear band assembly so that two lugs index with two anchor pins. Check to make sure band is seated on lugs (fig. 128T).

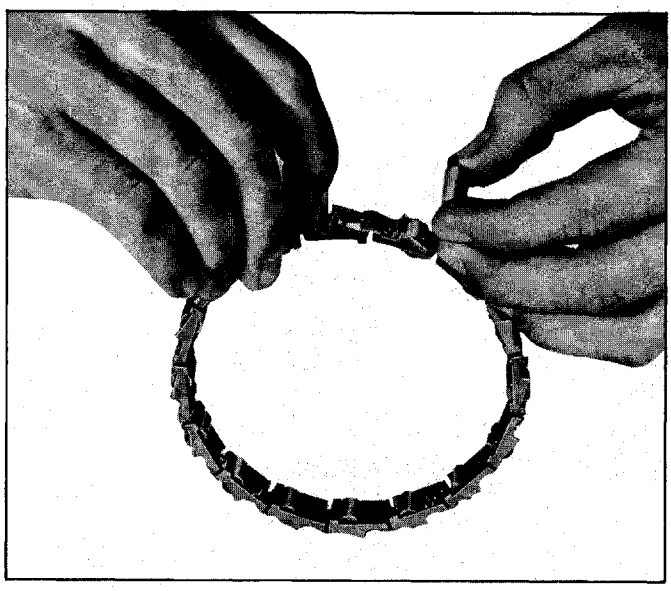


Fig. 122T—Install Roller into Roller Cage

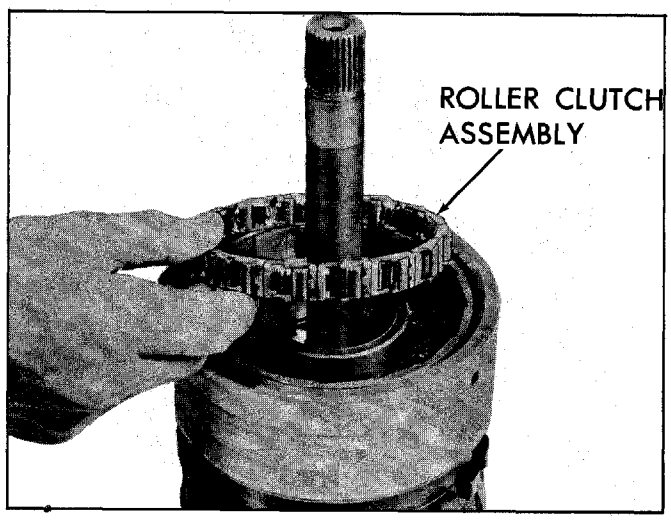


Fig. 123T—Installing Roller Clutch to Reaction Carrier

7. Install proper rear selective washer (proper washer determined by previous end play check) into slots provided inside rear of transmission case.
8. Install complete gear unit assembly into case, using Tool J-21795 (fig. 129T).
9. Oil and install center support to case retaining snap ring with bevel side up and locating gap adjacent to band anchor pin. Make certain ring is properly seated in case (fig. 130T).
10. Install case to center support locating screw (part #8623498) and torque to 5 ft. lbs. (fig. 132T). Lubricate and install case to center support bolt and torque to 23 ft. lbs.

    NOTE: Use a material like lok-tite (type AU or AA) on the first 1/4" of the bolt from the lead thread back toward the head. (optional)

    Remove locating screw (part #8623498) and keep for use on future rebuild jobs to properly locate the case center support.
11. Install three (3) steel and three (3) composition intermediate clutch plates. Start with waved steel, plate and alternate plates (fig. 131T).

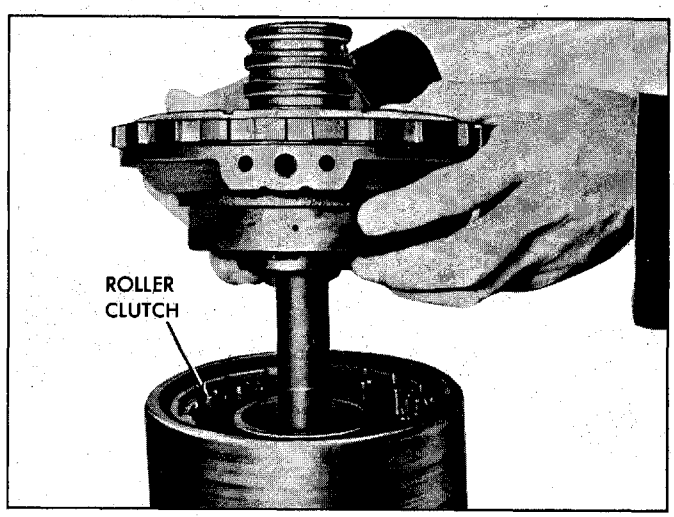


Fig. 124T—Installing Center Support to Reaction Carrier

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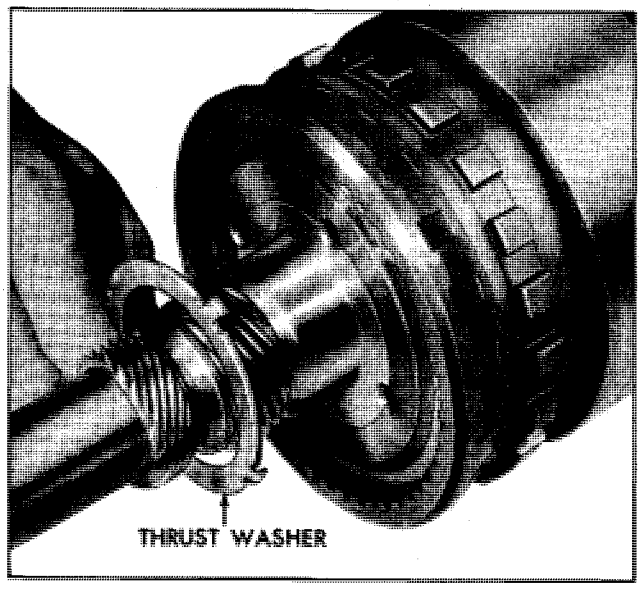


Fig. 125T—Installing Case to Output Shaft Thrust Washer

12. Install intermediate clutch backing plate, ridge up.
13. Install backing plate to case snap ring, locating gap opposite band anchor pin.
14. Check rear end play as follows:
    a. Install a 3/8"-16 bolt or J-9539, into an extension housing attaching bolt hole (fig. 34T).
    b. Mount a Dial Indicator on a rod and index with end of output shaft.
    c. Move output shaft in and out to read end play. End play should be from .003"-.019". The selective washer controlling this end play is steel washer having 3 lugs that is located between thrust washer and rear face of transmission case.

If a different washer thickness is required to bring end play within specifications, it can be selected from the following chart:

Thickness	Notches
.078-.082	None
.086-.090	1 Tab Side
.094-.098	2 Tabs Side
.102-.106	1 Tab O.D.
.110-.114	2 Tabs O.D.
.118-.122	3 Tabs O.D.

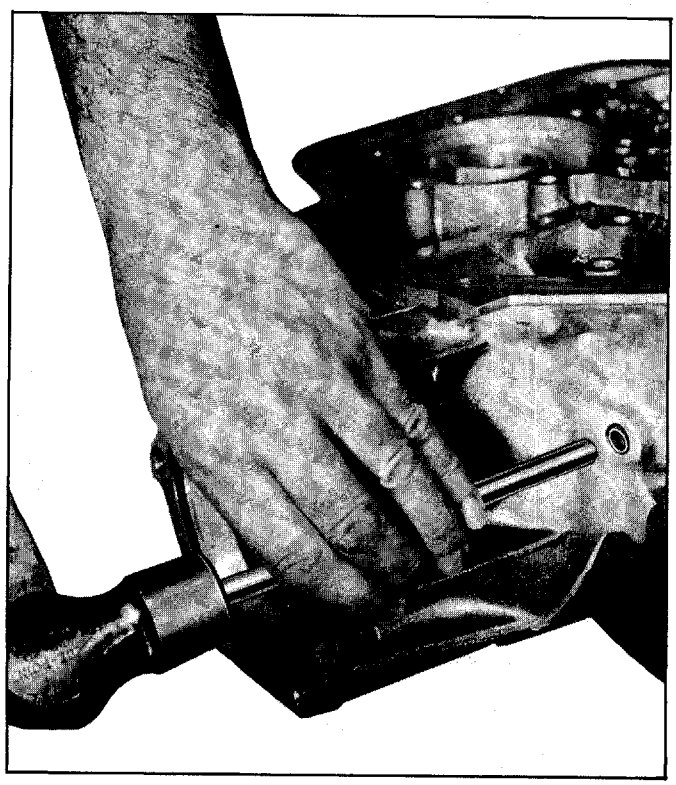


Fig. 126T—Installing Parking Brake Pawl Shaft Cup Plug

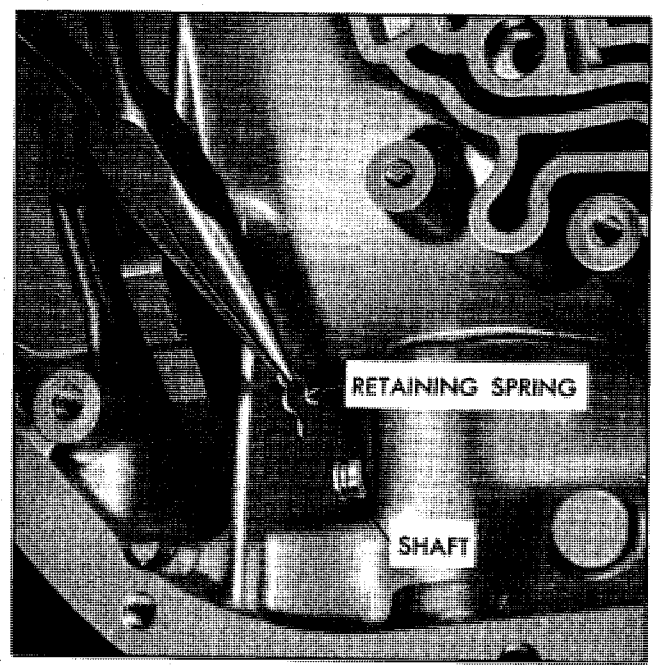


Fig. 127T—Installing Parking Shaft Retaining Spring

Fig. 127T—Installing Parking Shaft Retaining Spring

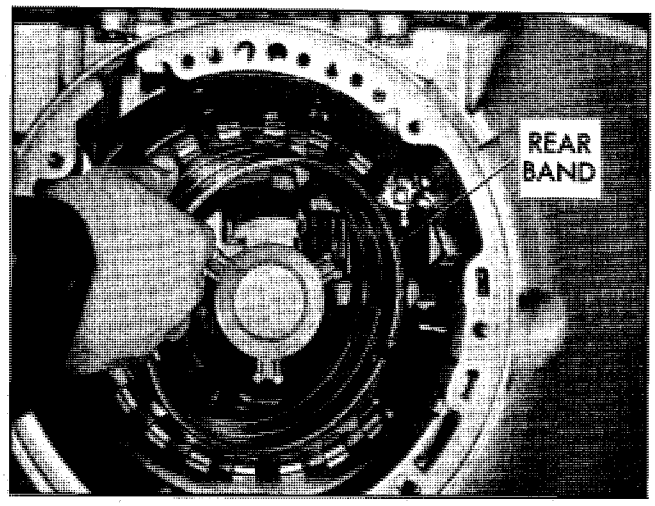


Fig. 128T—Installing Rear Band

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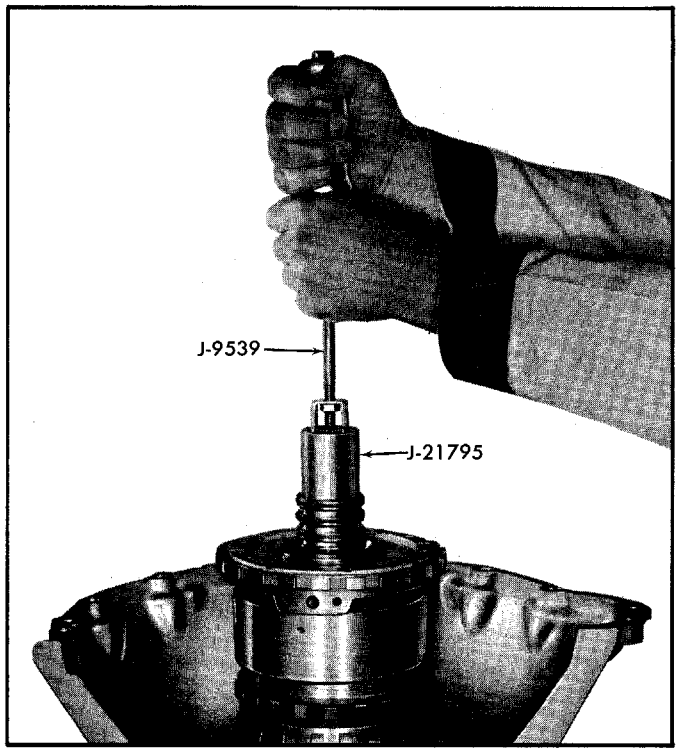


Fig. 129T—Installing Case Support and Gear Unit

15. Install front band with anchor hole placed over band anchor pin and apply lug facing servo hole (fig. 133T).

Install Manual Linkage

a. If removed, insert actuator rod into manual detent lever from side opposite pin.
b. Install actuator rod plunger under parking bracket and over parking pawl.
c. Install manual shaft through case and detent lever. (fig. 134T)
d. Install detent retaining hex locknut on manual shaft, and tighten (fig. 135T).
e. Install retaining pin indexing with groove in manual shaft. Rotate transmission to vertical position and remove J-21795.

16. With converter end of transmission up, carefully install direct clutch and intermediate sprag assembly. It will be necessary to tap, shake and slightly twist housing to allow sprag outer race to index with clutch drive plates. Housing hub will bottom on sun gear shaft (fig. 136T).

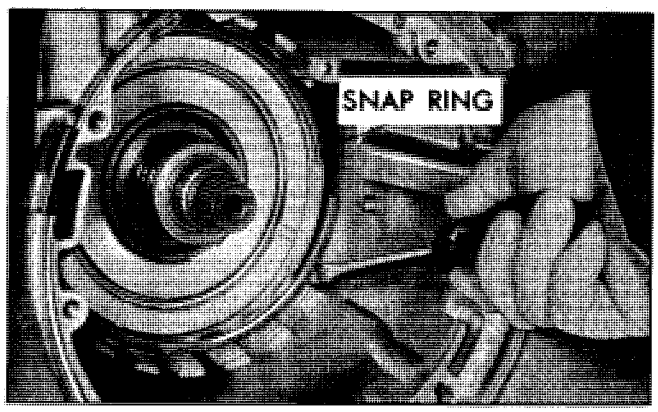


Fig. 130T—Installing Center Support to Case Snap Ring

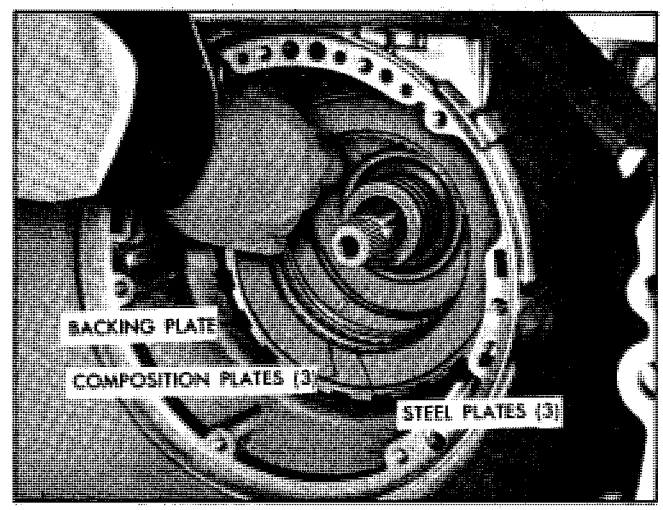


Fig. 131T—Installing Intermediate Backing Plate and Clutch Plates

NOTE: First visually line up the intermediate clutch drive lugs, one above the other to help engagement of housing hub splines. It also may be helpful to remove the direct clutch plates while installing housing.

17. Install forward clutch hub to direct clutch housing phenolic thrust washer on forward clutch hub. Retain with petrolatum.
18. Install forward clutch assembly and turbine shaft, indexing direct clutch hub so end of mainshaft will bottom on end of forward clutch hub. When forward clutch is seated it will be approximately 1-1/4" from pump face in case (fig. 137T).
19. Install front pump assembly.

NOTE: If turbine shaft cannot be rotated as pump is being pulled into place, forward or direct clutch housings have not been properly installed to index with all clutch plates. This condition must be corrected before pump is pulled fully into place.

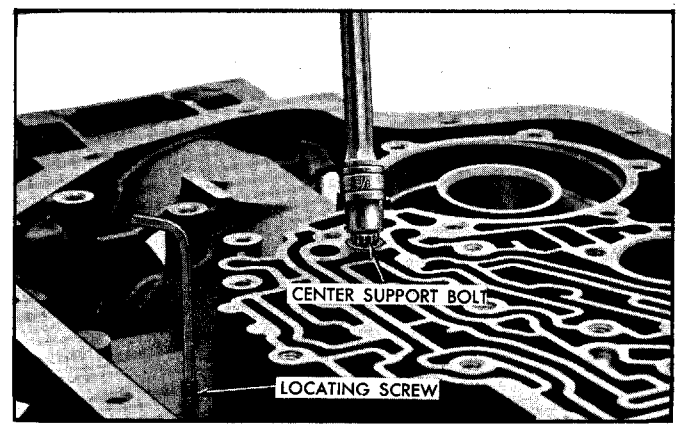


Fig. 132T—Center Support Locating Screw

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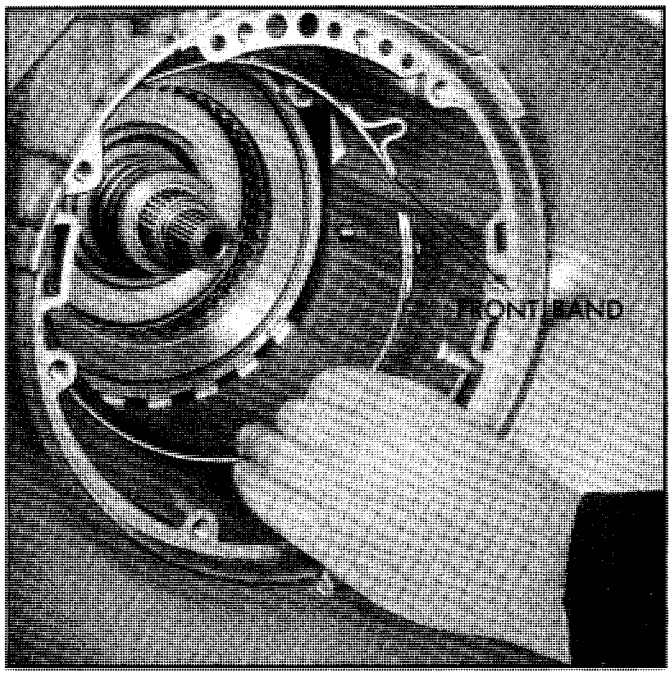


Fig. 133T—Installing Front Band

20. Install all but one pump attaching bolts and seals. Torque to 18 ft. lbs. (See Figure 139T for location of omitted bolt.)
21. If necessary, install a new front seal using Tool J-21359 to drive seal in place (fig. 138T).
22. Check front unit end play as follows (fig. 139T).
    a. Install a 3/8"-16 threaded bolt or a Slide Hammer Bolt J-9539 into bolt hole in pump.
    b. Mount a dial indicator on rod and index indicator to register with end of turbine shaft.

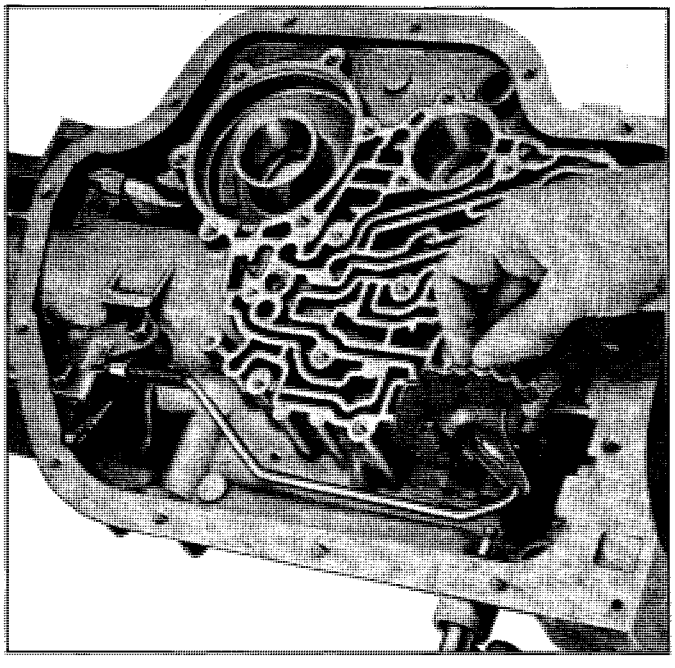


Fig. 134T—Installing Manual Shaft to Case

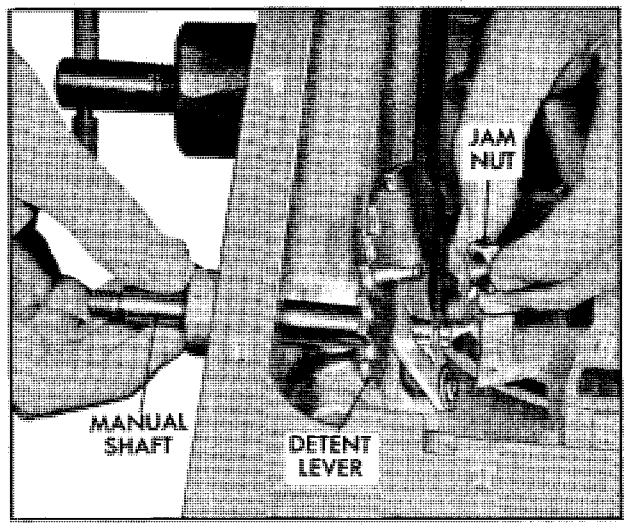


Fig. 135T—Installing Detent Lever and Jam Nut to Manual Shaft

    c. Push turbine shaft rearward.
    d. Push output shaft forward.
    e. Set dial indicator to zero.
    f. Pull turbine shaft forward.

Read resulting travel or end play which should be .003"-.024". Selective washer controlling this end play is phenolic resin washer located between pump cover and forward clutch housing. If more or less washer thickness is required to bring end play within specifications, select proper washer from the chart below:

Thickness	Color
.060-.064	Yellow
.071-.075	Blue
.082-.086	Red
.093-.097	Brown
.104-.108	Green
.115-.119	Black
.126-.130	Purple

NOTE: An oil soaked washer may tend to discolor. It will be necessary to measure washer for its actual thickness.

23. Install remaining front pump attaching bolt and seal. Torque 18 ft. lbs.

Rear Extension Assembly

1. Install extension housing to case gasket on extension housing.
2. Attach extension housing to case using attaching bolts. Torque bolts to 20-25 ft. lbs.
3. If necessary, install new seal with Tool J-5154 (CT Models) or J-21359 (fig. 140T).

Installation of Check Balls, Front Servo, Gaskets, Spacer and Solenoid

1. Install front servo spring and retainer into transmission case.
2. Install flat washer on front servo pin on end opposite taper.

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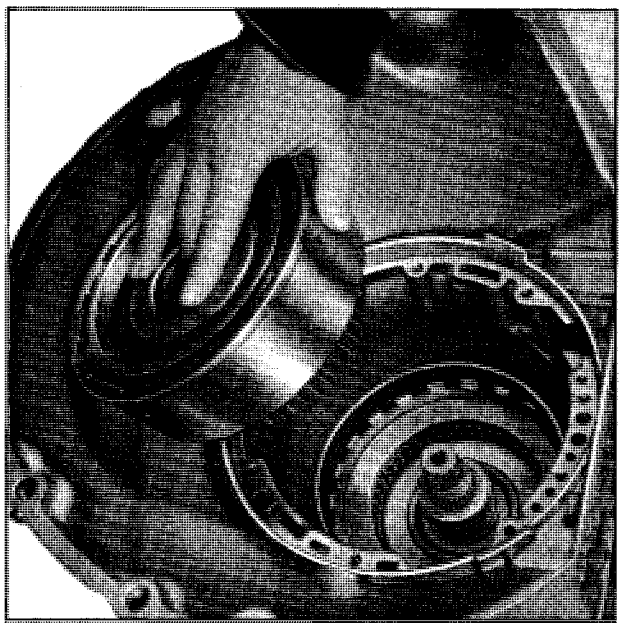


Fig. 136T—Installing Direct Clutch Assembly

3. Install oil seal ring on front servo piston, if removed, and install on apply pin so that identification numbers on shoulders are exposed.
4. Install pin, washer and piston into case so that tapered end is contacting band (fig. 141T).
5. Check freeness of piston by stroking piston in bore.
6. Install six (6) check balls into transmission on case pockets (fig. 142T).
7. Install valve body spacer to case gasket (gasket with extension for solenoid)(fig. 143T).
8. Install valve body to case spacer plate.
9. Install detent solenoid assembly and gasket with connector facing outer edge of case (fig. 144T).

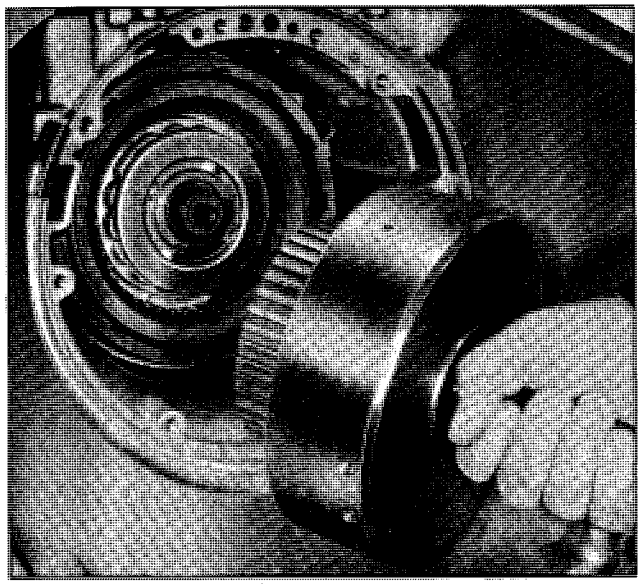


Fig. 137T—Installing Forward Clutch Assembly and Turbine Shaft

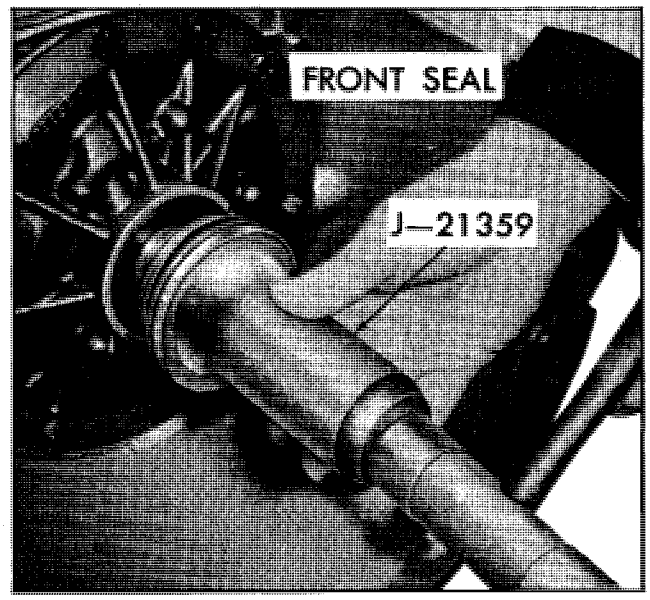


Fig. 138T—Installing Pump Seal

NOTE: Do not tighten bolts at this time.

10. Install "O" ring seal on solenoid connector.
11. Lubricate and install case connector with lock tabs facing into case, positioning locator tab in notch on side of case (fig. 145T).
12. Install detent connector into case sleeve connector.

Installation of Rear Servo Assembly

NOTE: Before installing rear servo assembly, check band apply pin using Tool J-21370-5 and 6 as follows (fig. 146T).

a. Attach band apply pin selection Gauge J-21370-6 and J-21370-5 to Transmission Case (lever pivot pin to rear) with attaching screws.

NOTE: Attach tool attaching screws finger tight and check freeness of selective pin. Torque attaching screws to 15 ft. lbs. and recheck pin to make certain it does not bind.

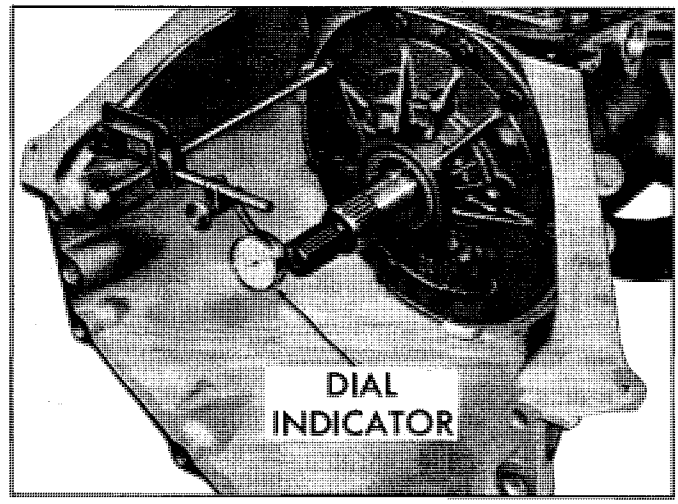


Fig. 139T—Checking Front Unit End Play

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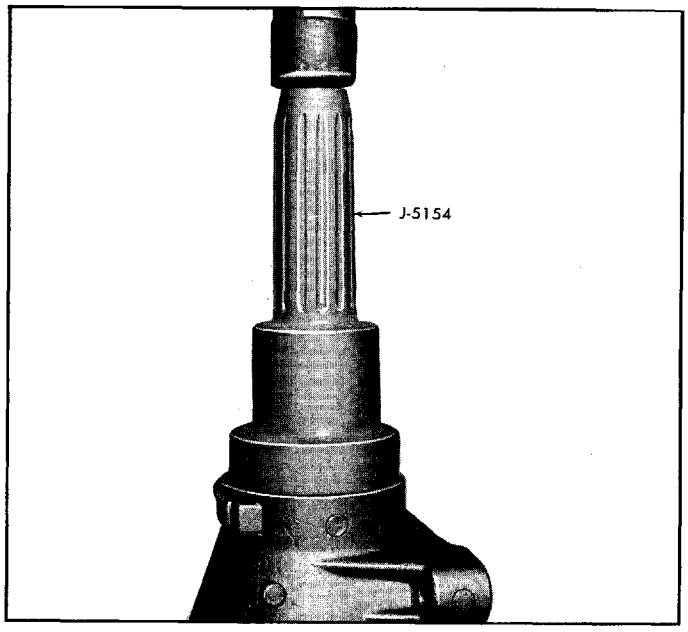


Fig. 140T—Installing Extension Oil Seal (Typical)

b. Apply 25 ft. lb. torque and select proper servo pin to be used from scale on tool.

Selecting proper length pin is equivalent to adjusting band. The band lug end of each selective apply pin bears identification in the form of one, two or three rings. There are three selective pins identified as follows:

c. If both steps are below the gauge surface, the long pin, identified by 3 rings, should be used.
d. If the gauge surface is between the steps, the medium pin, identified by 2 rings, should be used.
e. If both steps are above the gauge surface, the short pin, identified by 1 ring, should be used.

1. Install rear accumulator spring into case (fig. 147T).
2. Lubricate and install rear servo assembly into case (fig. 148T).

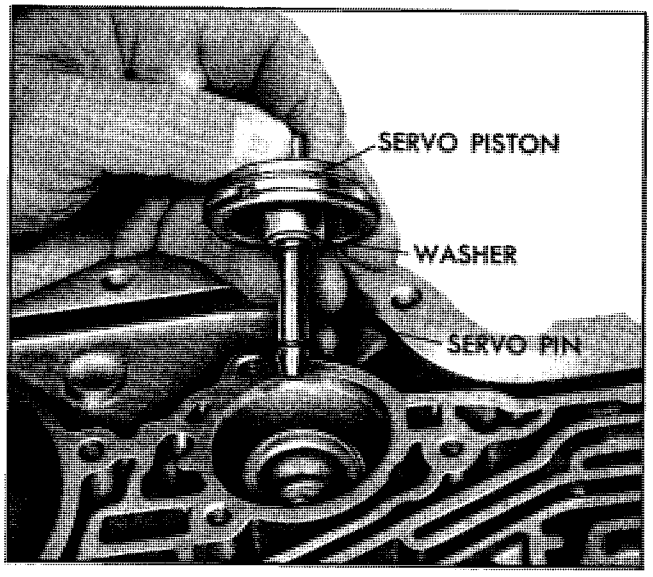


Fig. 141T—Installing Front Servo Piston, Washer and Pin

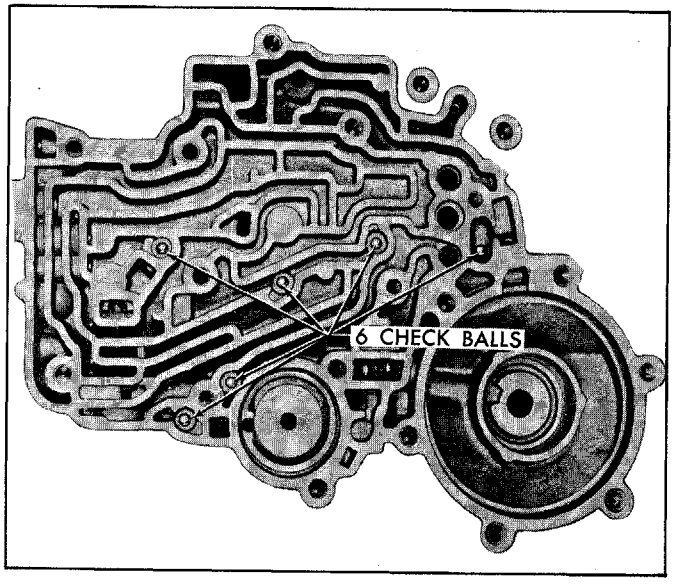


Fig. 142T—Location of Check Balls

3. Install rear servo gasket and cover (fig. 149T).
4. Install attaching screws. Torque bolts to 15-20 ft. lbs.

Installation of Control Valve Assembly and Governor Pipes

1. Install control valve to spacer gasket (fig. 150T).
2. Install governor pipes into valve body.
3. Install two guide pins (control valve assembly attaching screws, with heads removed) (fig. 151T).
4. Install control valve assembly and governor pipes to transmission.

NOTE: Be sure manual valve is properly indexed with pin on manual detent lever and governor pipes are properly installed in case.

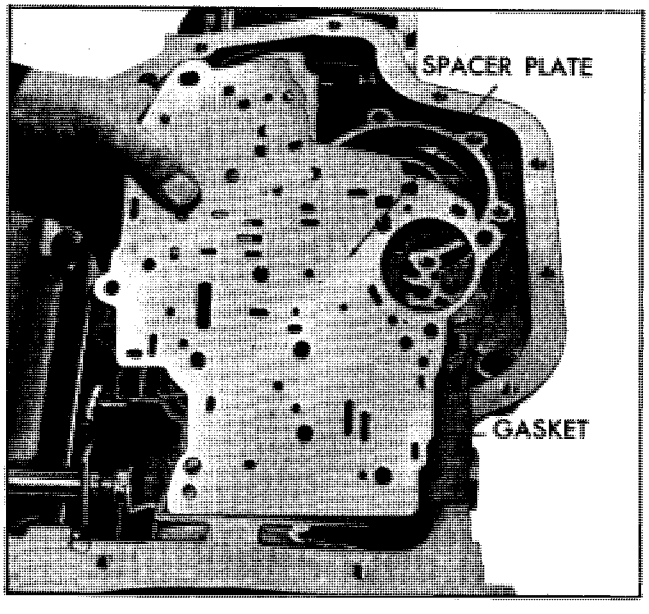


Fig. 143T—Installing Control Valve Assembly Spacer Plate and Gasket

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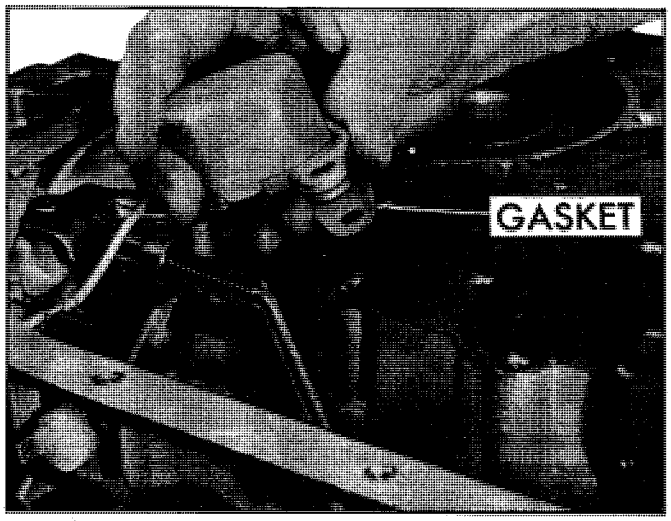


Fig. 144T—Installing Detent Solenoid and Gasket

5. Install control valve assembly attaching bolts, manual detent and roller assembly (fig. 152T).
6. Tighten detent solenoid and control valve attaching bolts. Torque valve body bolts and solenoid bolts as shown in the Specifications Section.

Installation of Strainer and Intake Pipe

1. Install case to intake pipe "O" ring seal on strainer and intake pipe assembly.
2. Install strainer and intake pipe assembly.

   NOTE: It is recommended that the strainer be replaced, rather than cleaned, whenever the transmission is disassembled because of a major failure.

3. Install new bottom pan gasket and bottom pan, with attaching screws. Torque to 12 ft. lbs.

Installation of Modulator Valve and Vacuum Modulator

1. Install modulator valve into case, stem end out (fig. 153T).

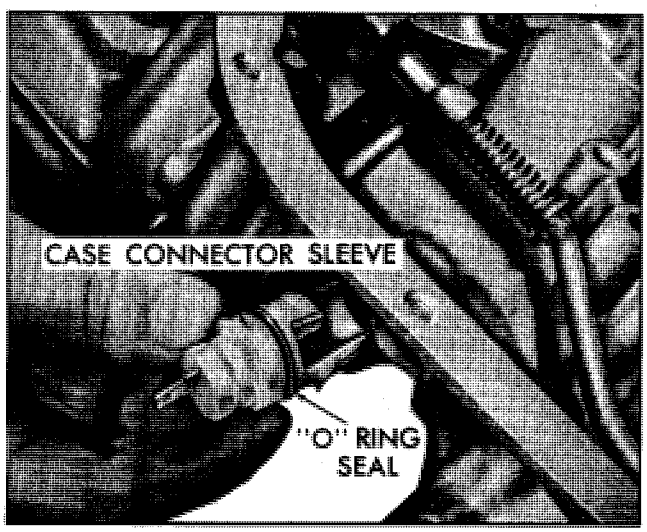


Fig. 145T—Installing Case Connector Sleeve and "O" Ring

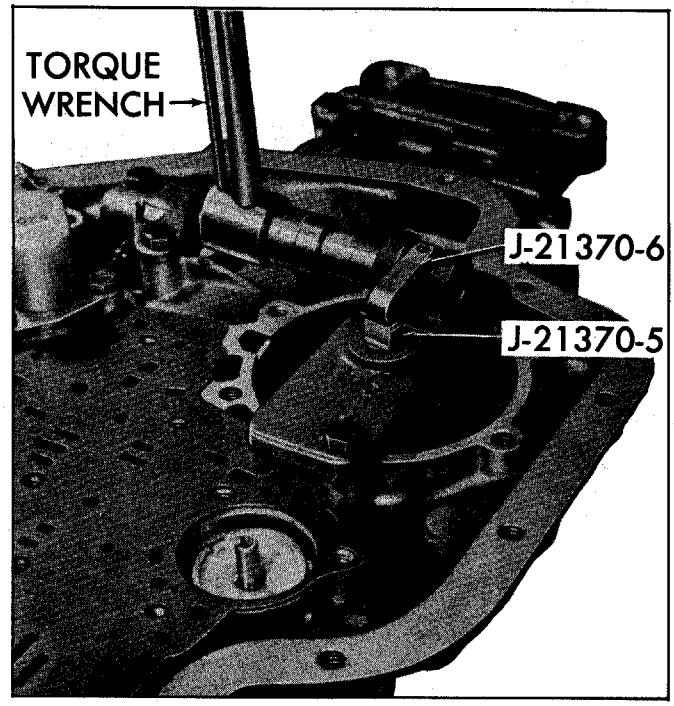


Fig. 146T—Checking Rear Band Pin

2. Install "O" ring seal on vacuum modulator.
3. Install vacuum modulator into case.
4. Install modulator retainer and attaching bolt. Torque bolt 18 ft. lbs.

Installation of Governor Assembly

1. Install governor assembly into case (fig. 154T).
2. Attach governor cover and gasket with four (4) attaching bolts. Torque bolts to 18 ft. lbs.

Installation of Speedometer Driven Gear Assembly

1. Install speedometer driven gear assembly (fig. 155T).
2. Install speedometer driven gear retainer and attaching bolt.

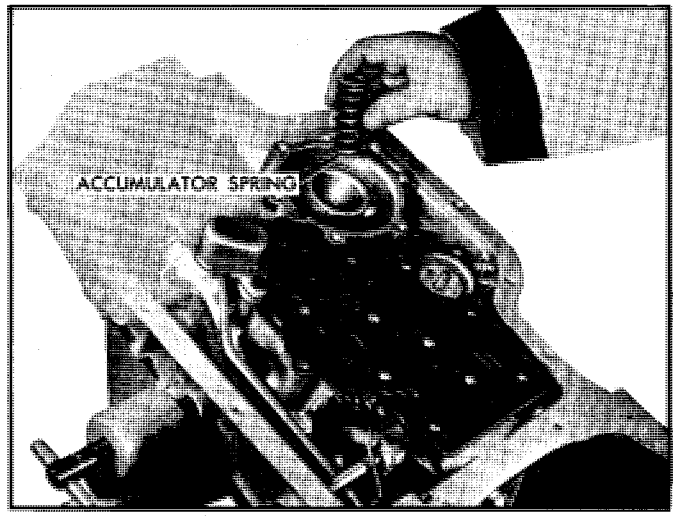


Fig. 147T—Installing Rear Accumulator Spring

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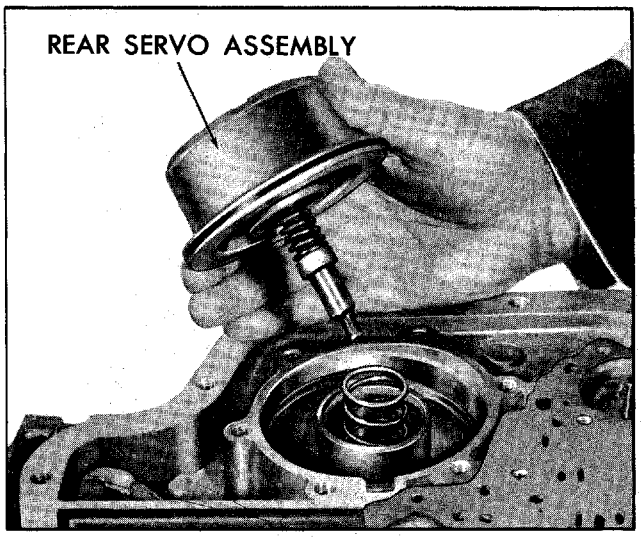


Fig. 148T—Installing Rear Servo Assembly

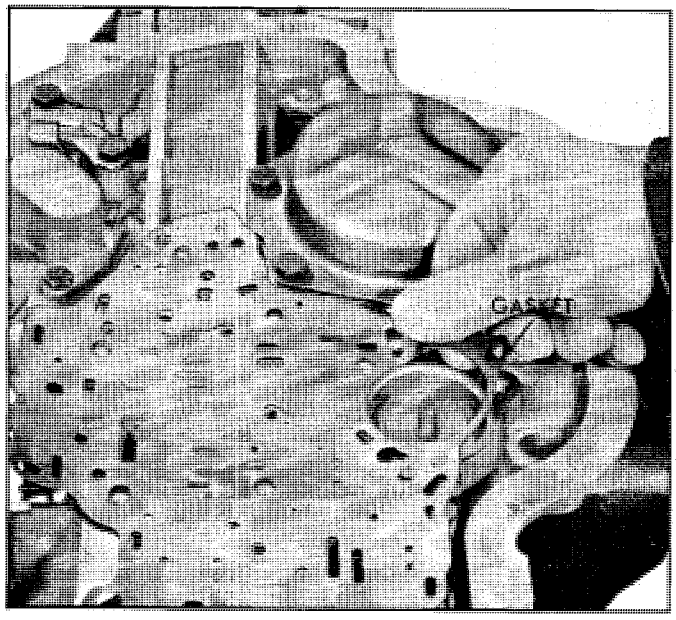


Fig. 150T—Installing Control Valve Assembly to Spacer Gasket

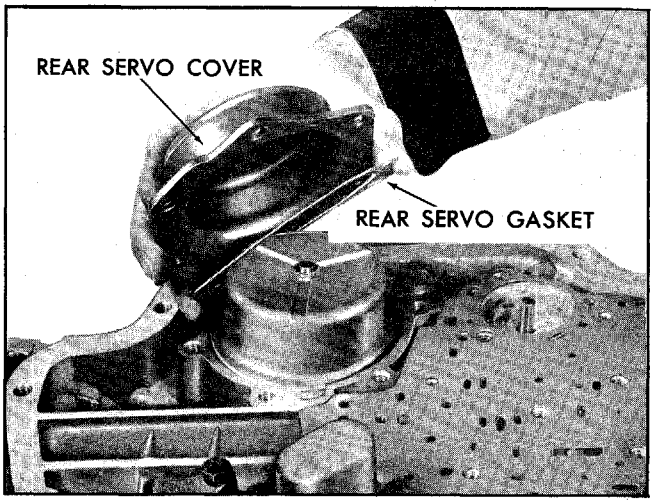


Fig. 149T—Installing Rear Servo Cover and Gasket

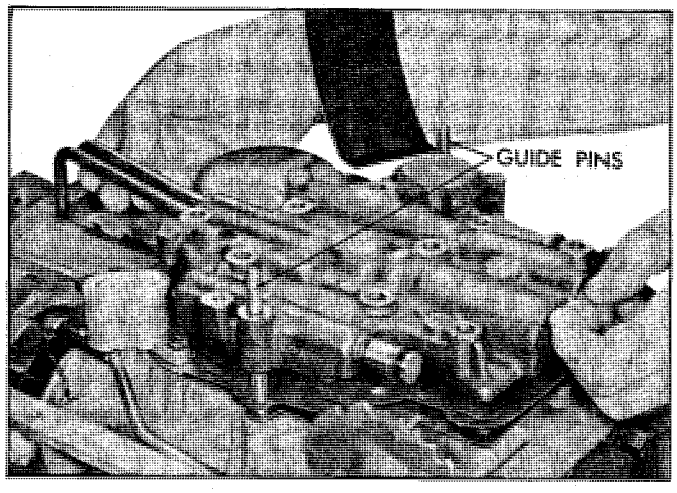


Fig. 151T—Installing Control Valve Assembly and Governor Pipes

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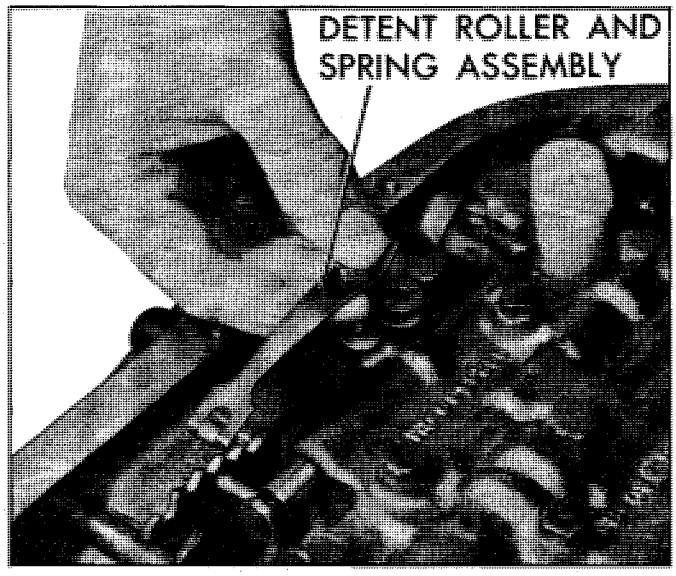


Fig. 152T—Installing Detent Roller and Spring Assembly

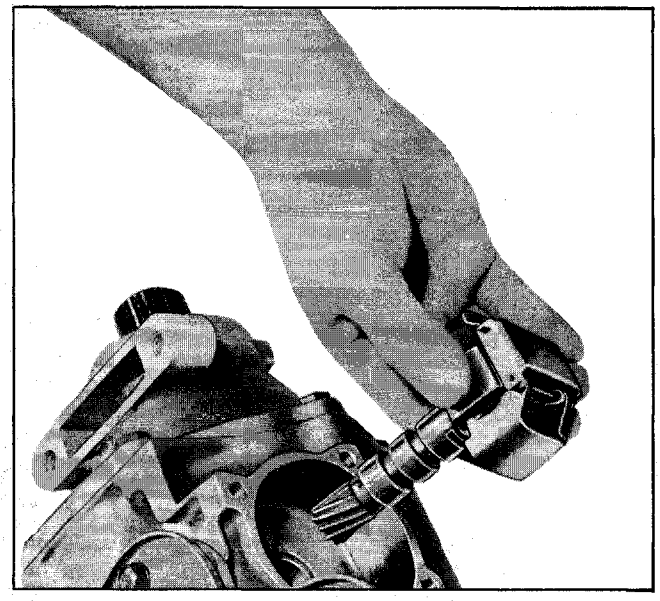


Fig. 154T—Installing Governor Assembly

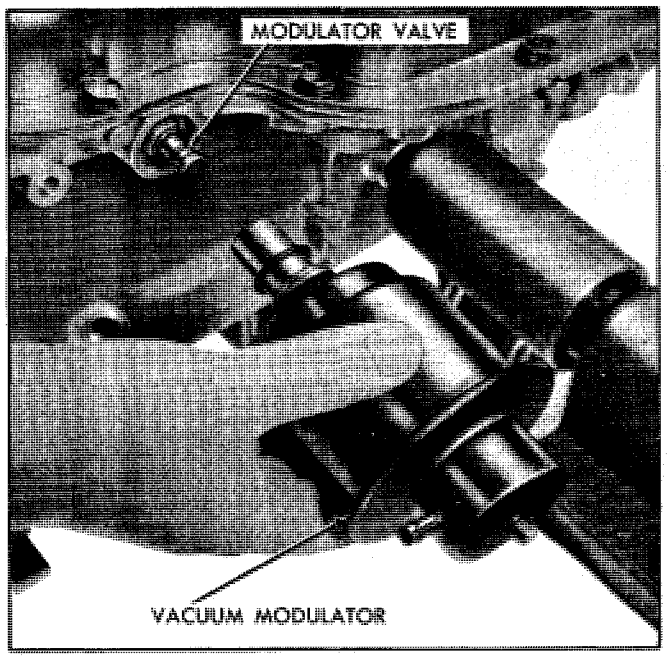


Fig. 153T—Installing Vacuum Modulator and Valve

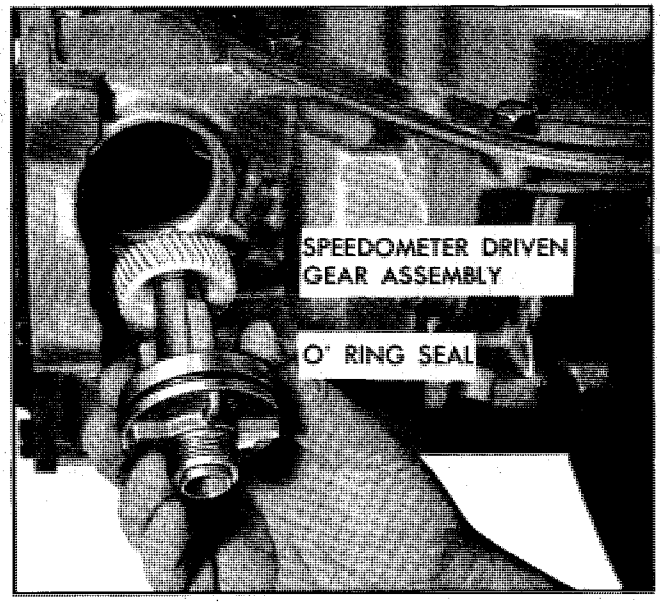


Fig. 155T—Installing Speedometer Driven Gear and Sleeve

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SPECIAL TOOLS

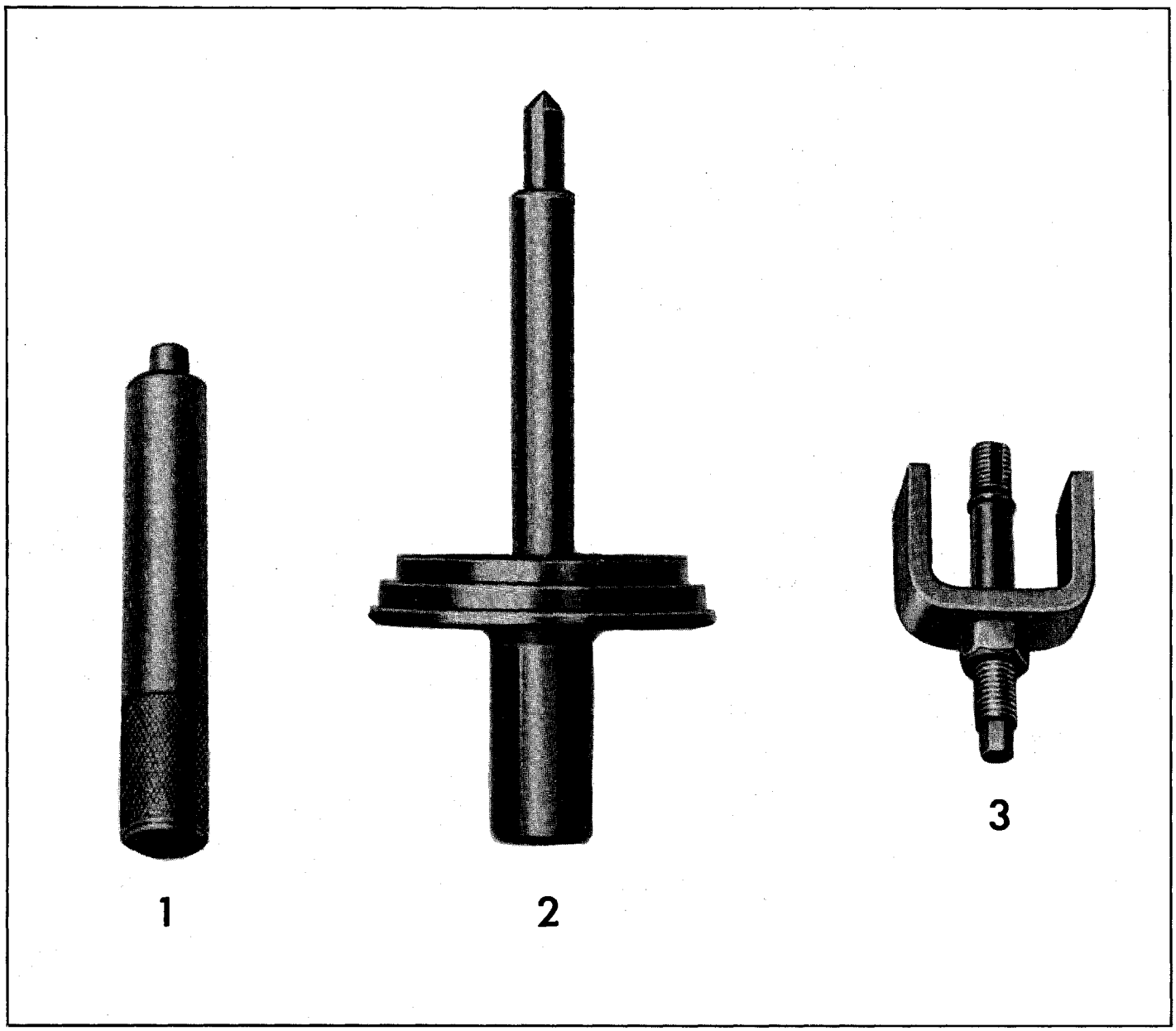


Fig. 156T—Clutch—Special Tools

1. J-1522 Pilot Bearing Driver
2. J-5824 Clutch Pilot Tool
3. J-1448 Pilot Bearing Puller

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SPECIAL TOOLS

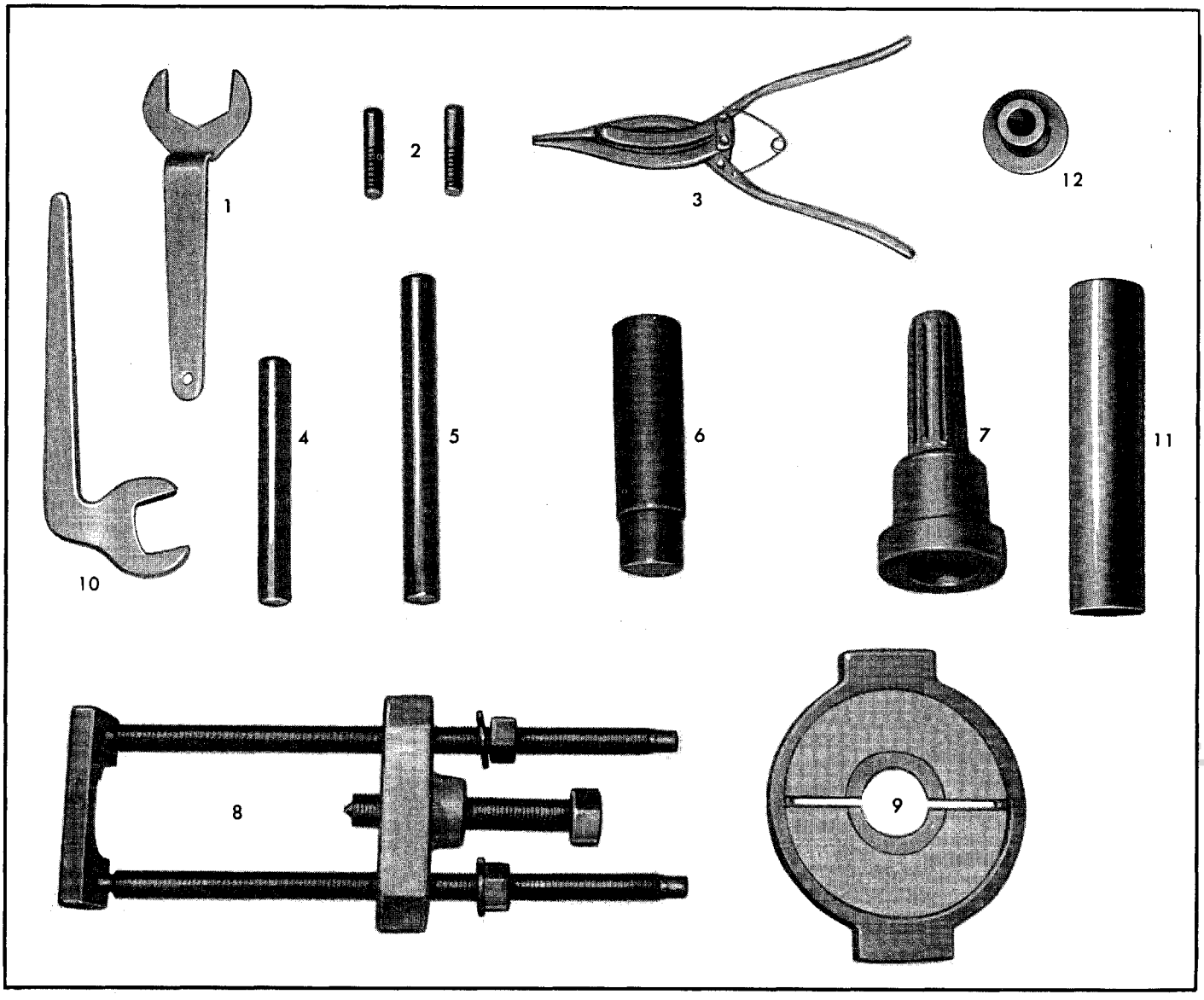


Fig. 157T—Manual Transmission Special Tools

1. J-0933 Clutch Gear Bearing Retainer Wrench
2. J-1126 Transmission Guide Pins
3. J-8059 Retainer Snap Ring Pliers
4. J-21629 Countergear Loading Tool
5. J-22246 Countergear Loading Tool
6. J-5778 Extension Housing Bushing Remover and Installer
7. J-5154 Extension Housing Seal Installer
8. J-5814-15 Speedometer Drive Gear Remover
9. J-1453-01 Speedometer Drive Gear Press Plates
   J-9771 Press Plates (Not Illustrated)
   J-358-1 Press Plate Holder
10. J-4653 Overdrive Governor Wrench
11. J-5590 Clutch Gear Bearing Installer
12. J-7785 Clutch Gear Retainer Lip Seal Installer

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SPECIAL TOOLS

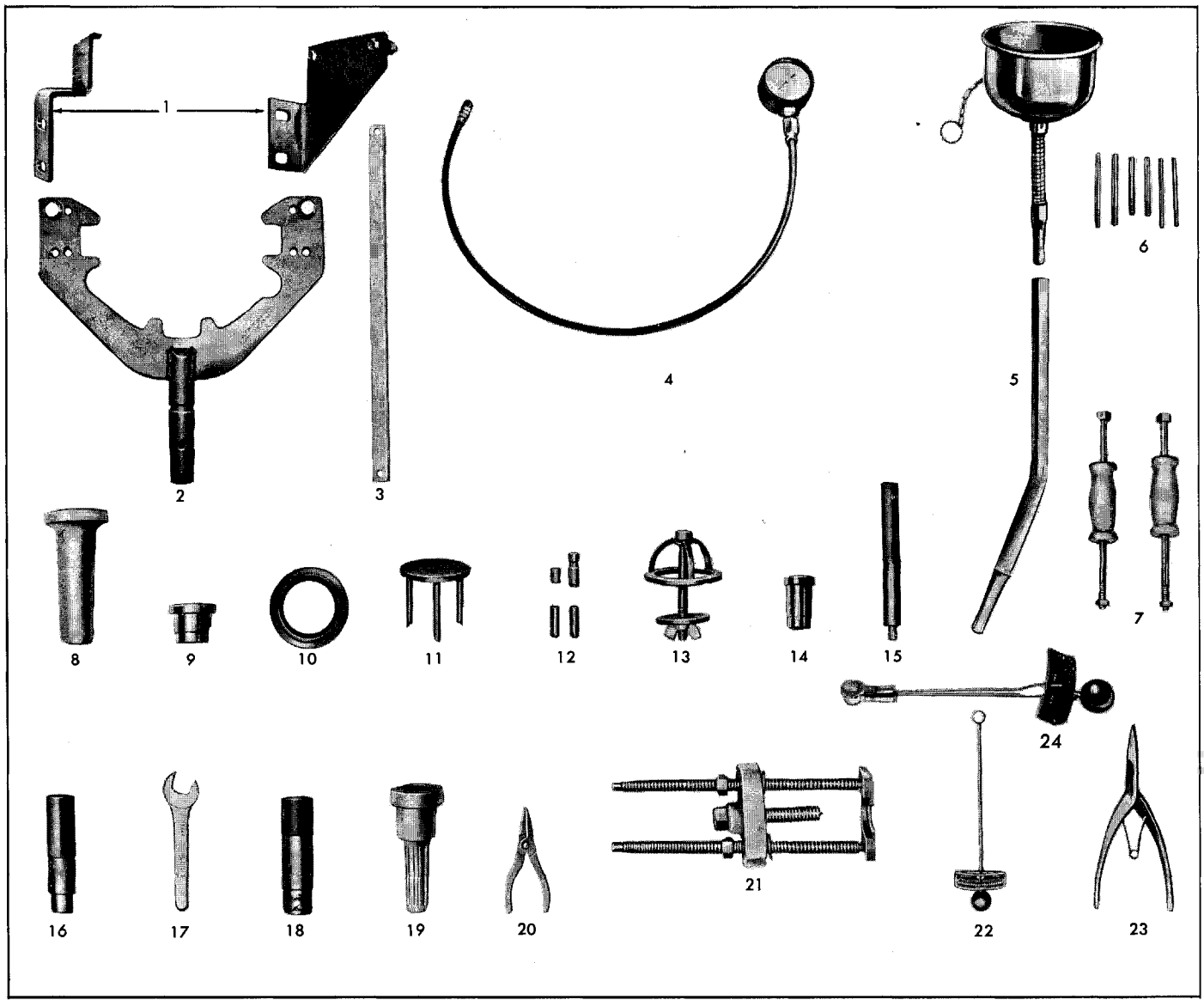


Fig. 158T—Aluminum Powerglide Special Tools

1. J-9506 Holding Fixture Adapters
2. J-3289-01 Holding Fixture (Use with J-3289-20 Base)
3. J-9549 Converter Safety Strap
4. J-21867 Transmission Pressure Gauge and Hose
5. J-4264 Oil Filler Tube and Funnel
6. J-3387 Pilot Stud Set
7. J-9539 Front Pump Puller Bolts (Use with Weights from Slide Hammers J-6585)
8. J-6839 Front Pump Seal Driver
9. J-9546 Clutch Drum Bushing Remover and Installer
10. J-7782 Clutch Spring Compressor Adapter Plate
11. J-5133 Clutch Spring Compressor
12. J-4599 Planet Pinion Assembly Tool Set
13. J-9542 Reverse Piston Spring Compressor
14. J-9557 Transmission Case Rear Bushing Remover and Installer and Rear Pump Bushing Remover
15. J-7079 Handle
16. J-6582 Rear Pump Bushing Installer
17. J-9543 Vacuum Modulator Wrench
18. J-5778 Extension Bushing Remover and Installer
19. J-5154 Extension Oil Seal Installer
20. J-5403 Snap Ring Pliers
21. J-5814 Speedometer Drive Gear Remover and Installer
22. J-5853 Torque Wrench
23. J-8039 Snap Ring Pliers
24. J-21848 Low Band Adjuster

J-8001 Dial Indicator (Not Illustrated)
J-5492 Dial Indicator Support Strap (Not Illustrated)
J-6585 Slide Hammers (Not Illustrated
J-6585-3 Slide Hammer Adapters (Not Illustrated)
J-9534 Bushing Remover (Not Illustrated)

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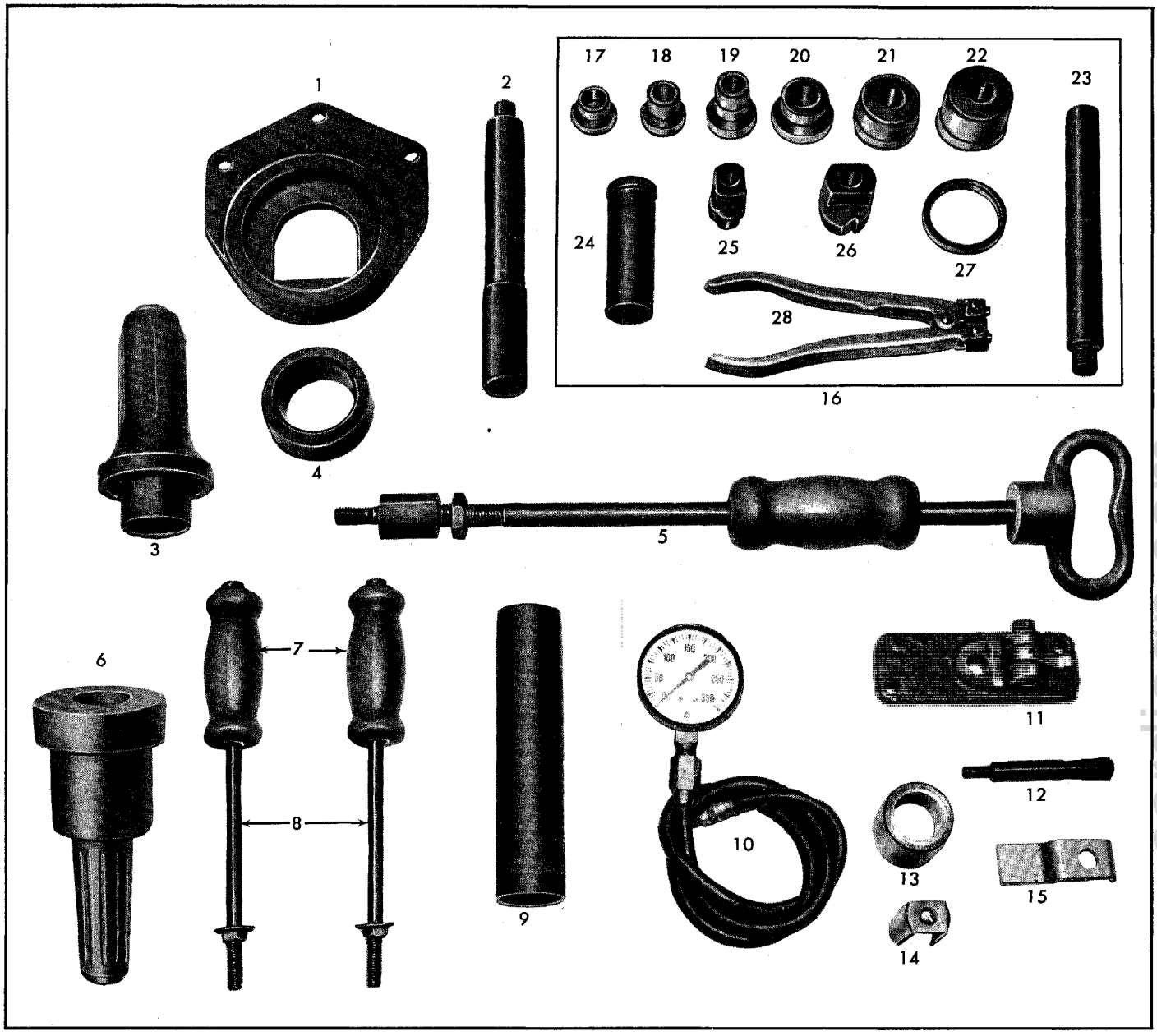


Fig. 159T—Turbo Hydra-Matic Special Tools

1. J-6116-01 Rear Unit Holding Fixture
2. J-8092 Driver Handle
3. J-21359 Pump Oil Seal Installer
4. J-21364 Holding Fixture Adapter (Used with J-6116-01 Fixture)
5. J-2619 Slide Hammer (Used with 2619-4 Adapter and Remover Tools J-21465-01)
6. J-5154 Extension Oil Seal Installer
7. J-6585 Slide Hammer Weights
8. J-9539 Slide Hammer Bolts (3/8 - 16 Threads)
9. J-5590 Speedo Gear Installer
10. J-21867 Pressure Gauge and Hose
11. J-21370-6 Rear Band Apply Fixture
12. J-21370-5 Rear Band Apply Pin
13. J-21795-1 Gear Unit Assembly Holding Tool
14. J-21795-2 Part of Above Holding Tool
15. J-5384 Converter Holding Strap
16. J-21465-01 Bushing Tool Set
17. J-21465-5 Part of Bushing Tool Set
18. J-21465-3 Part of Bushing Tool Set
19. J-21465-2 Part of Bushing Tool Set
20. J-21465-1 Part of Bushing Tool Set
21. J-21465-17 Part of Bushing Tool Set
22. J-21465-8 Part of Bushing Tool Set
23. J-21465-13 Part of Bushing Tool Set
24. J-21465-6 Part of Bushing Tool Set
25. J-21465-15 Part of Bushing Tool Set
26. J-21465-16 Part of Bushing Tool Set
27. J-21465-9 Part of Bushing Tool Set
28. J-21465-10 Part of Bushing Tool Set
29. J-22182 Extension Bushing Remover and Installer (Not Illustrated)

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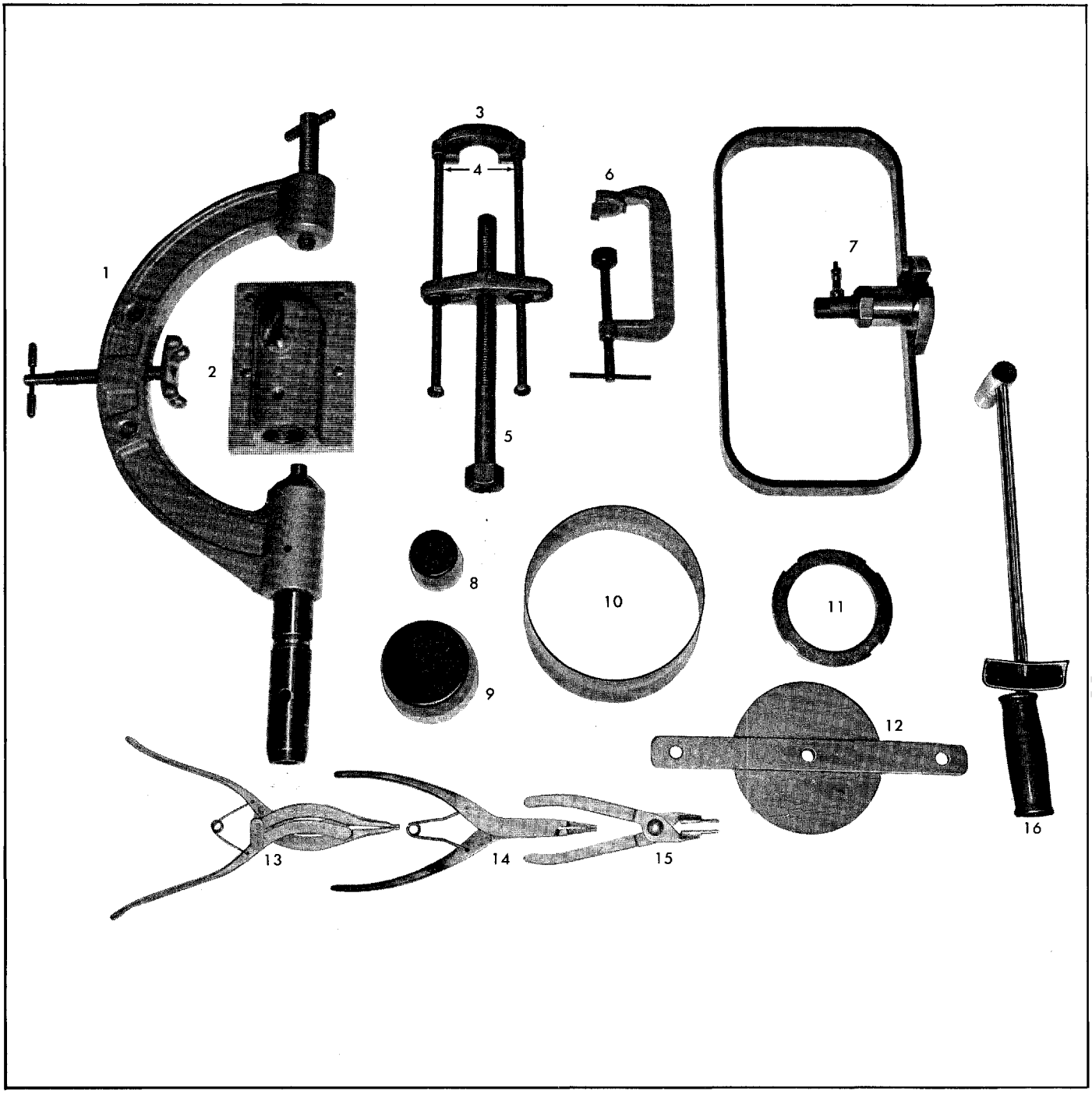


Fig. 160T—Turbo Hydra-Matic Special Tools

1. J-8763 Transmission Holding Fixture
2. J-3289-14 Holding Fixture Base
3. J-21427-1 Speedo Gear Remover
4. J-9539 Slide Hammer Bolts (3/8" - 16 Threads)
5. J-8105 Speedo Gear Remover Puller
6. J-21885 Accumulator Piston Installer
7. J-21369 Converter Pressure Check Fixture
8. J-21362 Seal Protector - Forward and Direct Clutch - Inner
9. J-21363 Seal Protector - Intermediate Clutch - Inner
10. J-21409 Seal Protector - Forward Clutch - Outer
11. J-21664 Clutch Spring Compressor Adapter Ring
12. J-4670 Clutch Spring Compressor
13. J-8059 Snap Ring Pliers
14. J-5586 Snap Ring Pliers
15. J-5403 Snap Ring Pliers
16. J-1313 Torque Wrench 0-140 Ft. Lbs.

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SECTION 9

STEERING

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STEERING GEAR

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GENERAL DESCRIPTION

The steering gears are of the recirculating ball type. Two designs are used, one for Chevrolet, Chevelle and Camaro, and one for Chevy II and Corvette. Both gears are overhauled in the same manner, except for disassembly and assembly procedures.

OVERHAUL OPERATIONS

Disassembly

Chevrolet, Chevelle, and Camaro (Fig. 1)

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

1. Loosen locknut on end of sector shaft and turn the lash adjuster a few turns counter-clockwise. This will remove the load from the worm bearings caused by the close meshing of the rack and sector teeth.
2. Loosen the locknut on the worm bearing adjuster and turn the adjuster counter-clockwise a few turns.
3. Place a pan under the assembly to catch the lubricant and remove the three bolts and washers attaching side cover to housing.
4. Pull the side cover with the sector shaft from the housing (fig. 2).

   NOTE: If the sector does not clear the opening in the housing easily, turn the wormshaft by hand until the sector will pass through the opening in the housing.

5. Remove the worm bearing adjuster, adjuster locknut and lower ball bearing from housing.
6. Draw wormshaft and nut assembly from housing (fig. 3). Remove upper ball bearing.

CAUTION: Use care that the ball nut does not run down to either end of the worm. Damage will be done to the ends of the ball guides if the

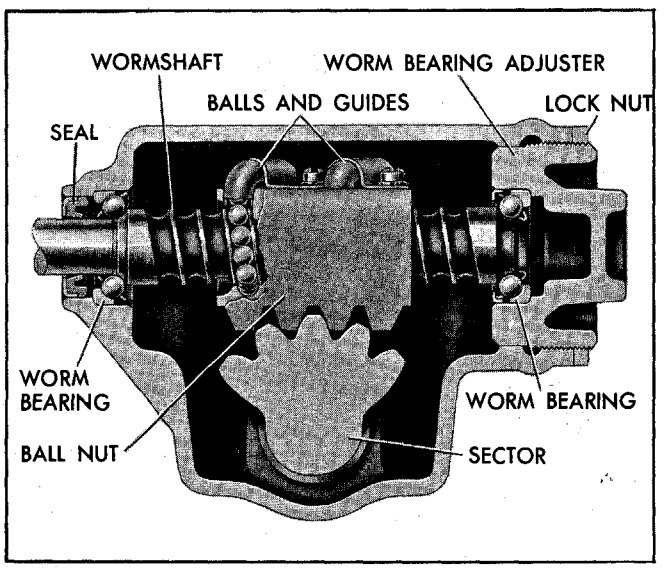


Fig. 1—Steering Gear—Chevrolet Shown

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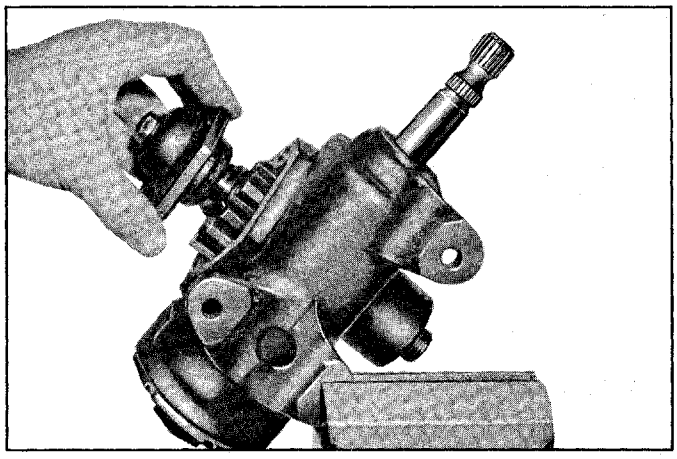


Fig. 2—Removing Sector Shaft

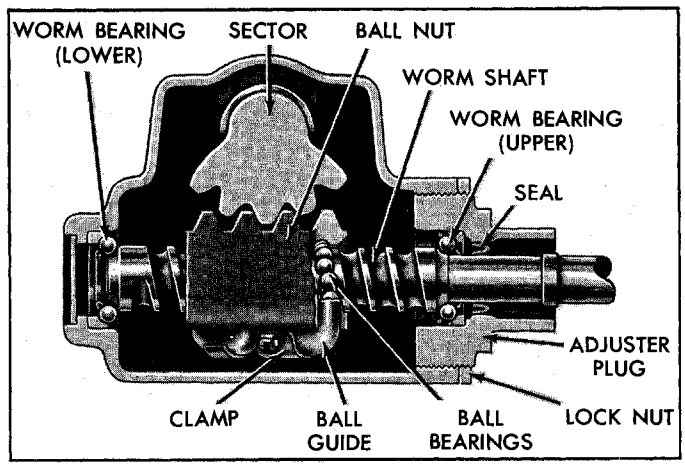


Fig. 4—Steering Gear—Chevy II and Corvette

nut is allowed to rotate until stopped at the end of the worm.

7. Remove locknut from lash adjuster and unscrew adjuster from side cover by turning adjuster clockwise. Slide adjuster and shim out of slot in end of sector shaft.
8. Remove and discard sector shaft seal.

Chevy II and Corvette (Fig. 4)

Care must be taken to keep all foreign matter out of steering gear assembly during overhaul. Work bench should be covered with clean paper or rags and tools should be wiped clean. Exterior of gear assembly must be clean of dirt, grease and loose scale before disassembly.

1. Support gear in vise by clamping lower mounting ear. Loosen lash adjuster locknut and turn lash adjuster screw several turns counter-clockwise. Remove three cap screws retaining side cover assembly and pull side cover-sector shaft assembly from gear housing (fig. 5).

NOTE: If the sector does not clear the opening in the housing easily, turn the wormshaft by hand until the sector will pass through the opening.

2. Remove the worm bearing adjuster, adjuster locknut and upper ball bearing from housing.
3. Draw wormshaft and ball nut assembly from housing (fig. 6). Remove lower ball bearing.

CAUTION: Use care that the ball nut does not run down to either end of the worm. Damage will be done to the ends of the ball guides if the nut is allowed to rotate until stopped at the end of the worm.

4. Remove locknut from lash adjuster and unscrew adjuster from side cover by turning adjuster clockwise. Slide adjuster and shim out of slot in end of sector shaft.
5. Remove sector shaft seal.
6. Remove wormshaft seal.

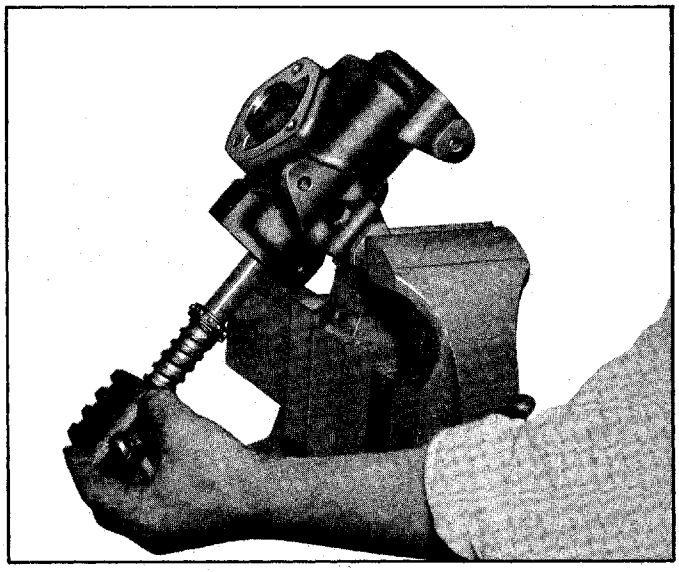


Fig. 3—Removing Wormshaft and Ball Nut

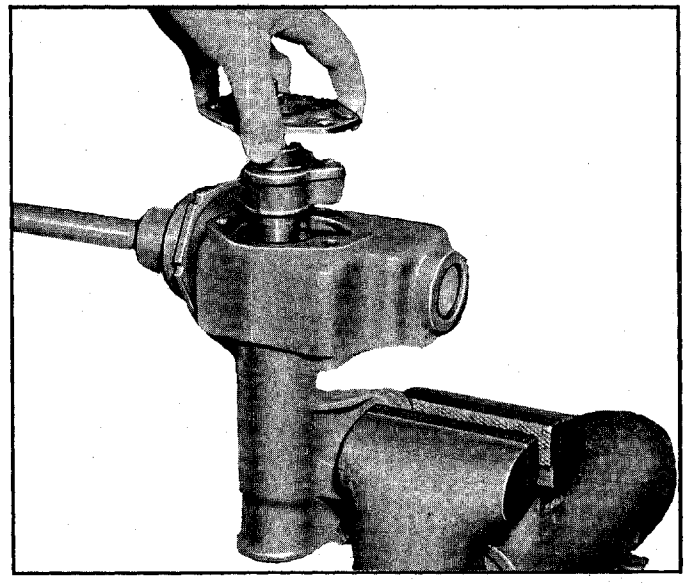


Fig. 5—Removing Sector Shaft

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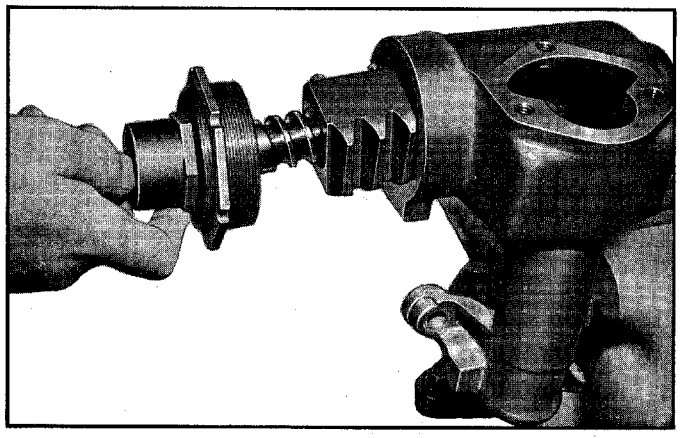


Fig. 6—Removing Wormshaft and Ball Nut

Inspection

With the steering gear completely disassembled, wash all parts in cleaning solvent. Dry them thoroughly with air. With a magnifying glass inspect the bearings and bearing cups for signs of indentation. Also check for any signs of chipping or breakdown of the surface. Any parts that show signs of damage should be replaced.

Inspect all seals. Any seal that is worn or has been removed should be replaced.

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

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

Check steering gear wormshaft assembly for bent or damaged shaft. Never attempt to salvage steering parts by welding or straightening.

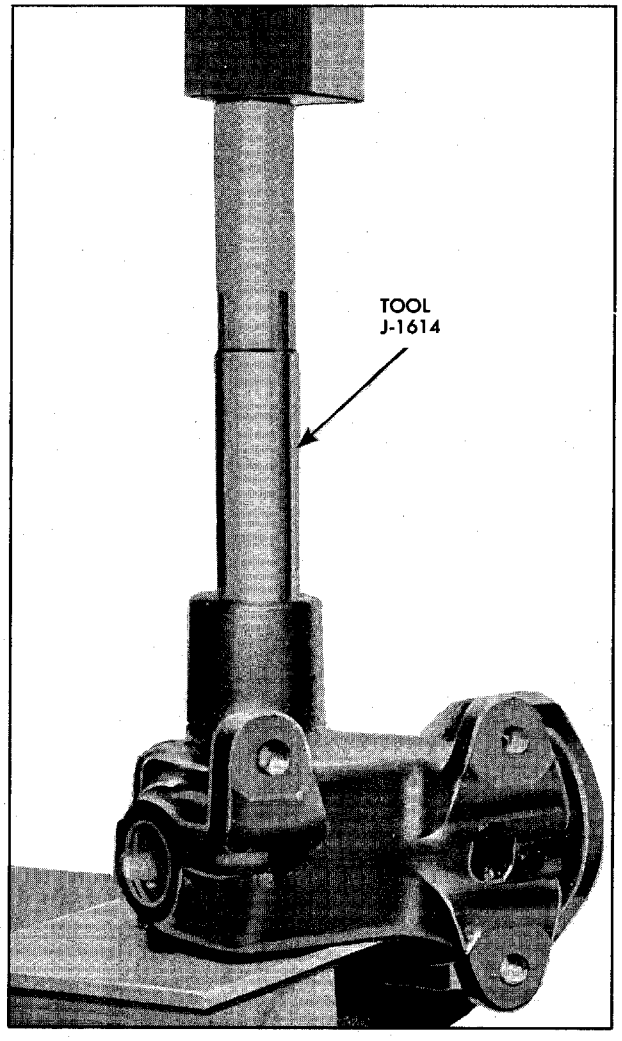


Fig. 7—Removing Sector Shaft Bushing—Chevrolet Shown

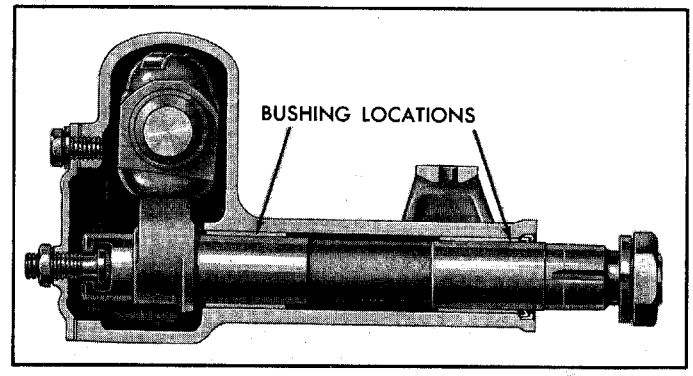


Fig. 8—Sector Shaft Bushings Installed—Chevy II and Corvette

Repairs

Sector Shaft Bushing Replacement

1. Support steering gear housing in an arbor press and press sector shaft bushing (2 bushings for Chevy II and Corvette) from housing with Tool J-1614, inserted from lower end of housing as shown (fig. 7).
2. Press new bushing or bushings into position using the same sector shaft bushing driver as used for removal. Check position of 2 bushings for Chevy II and Corvette in Figure 8.

NOTE: Service bushings are diamond bored to size and require no further reaming.

Wormshaft Seal Replacement

If the wormshaft seal indicates need of replacement, it should be removed and a new seal pressed into position. A suitable socket pressing on outer diameter of seal may be used.

NOTE: Care should be taken to insure that seal is not assembled in a cocked position.

CAUTION: On Chevy II and Corvette vehicles check the upper wormshaft bearing cup before installing the new seal.

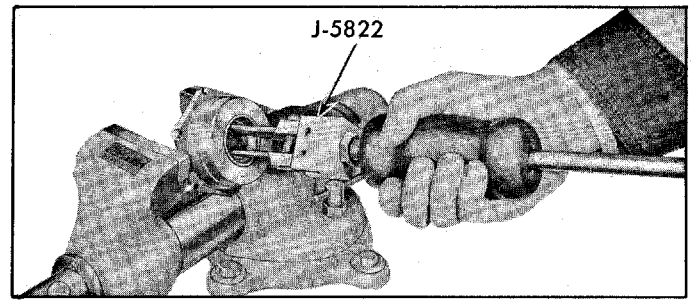


Fig. 9—Removing Wormshaft Bearing Cup

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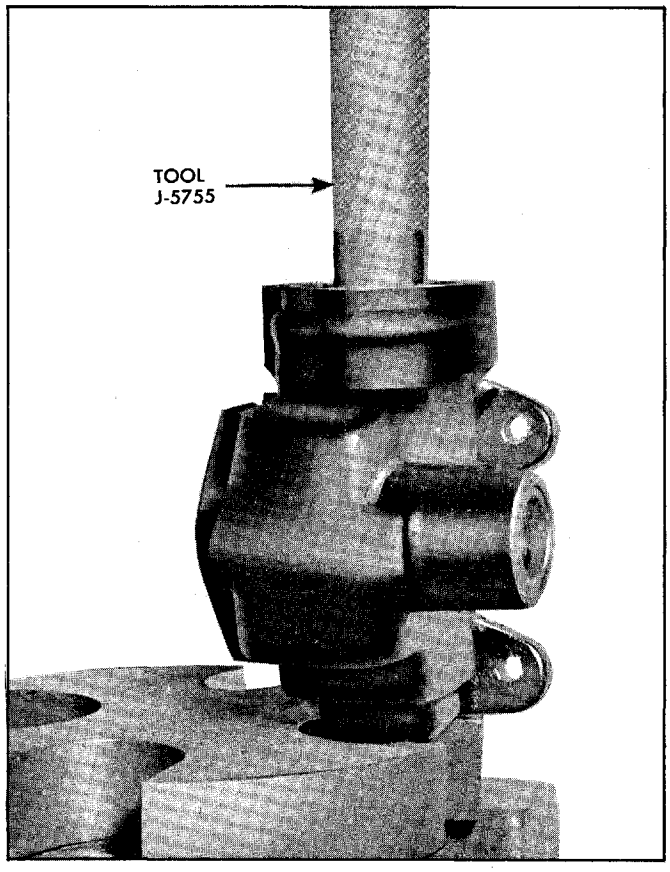


Fig. 10—Installing Bearing Cup—Chevrolet Shown

Side Cover Bushing Replacement

The entire side cover assembly, including bushing for Chevrolet and Chevelle, is serviced as a unit and should be replaced when it is desired to replace the bushing.

Sector Shaft Seal Replacement

The sector shaft seal must be replaced each time a defective seal is indicated or the steering gear is disassembled. This operation is similar to Wormshaft Seal Replacement.

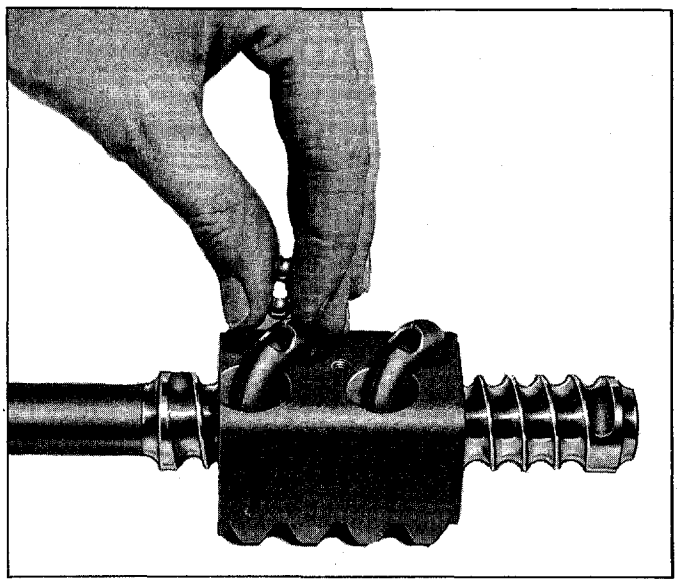


Fig. 11—Filling Ball Circuits—Chevrolet Shown

Wormshaft Bearing Cup Replacement

1. Remove wormshaft bearing cups using Tool J-5822 with Tool J-2619 (fig. 9).
2. Press new bearing cups into position using Tool J-5755 (fig. 10).

Ball Nut Servicing

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

1. Remove screw and clamp retaining ball guides in nut. Draw guides out of nut.
2. Turn the nut upside down and rotate the wormshaft back and forth until all the balls have dropped out of the nut into a clean pan. With the balls removed the nut can be pulled endwise off the worm.
3. Wash all parts in cleaning solvent and dry them thoroughly with air. Using a magnifying glass inspect the worm and nut grooves and the surface of all balls for signs of indentation. Check ball guides for damage at ends where they deflect or pick up the balls from the helical path. Any parts that show signs of damage should be replaced.
4. For Chevrolet, Chevelle and Camaro only (fig. 11):
   a. Place the wormshaft flat on the bench and slip the nut over the worm with the ball guide holes up and the shallow end of the rack teeth to the right from the steering wheel position. Align the grooves in the worm and nut by sighting through the ball guide holes.
   b. Position the ball guides in the ball nut and place the balls into the guide holes while turning the worm gradually away from that hole. Continue until ball circuit is full from bottom of one guide hole to bottom of the other. Total number of balls is 50.
5. For Chevy II and Corvette only (figs. 12 and 13):
   a. Place the wormshaft flat on the bench and slip the nut over the worm with the ball guide holes up and the shallow end of the rack teeth to the left from the steering wheel position. Align the grooves in the worm and nut by sighting through the ball guide holes.

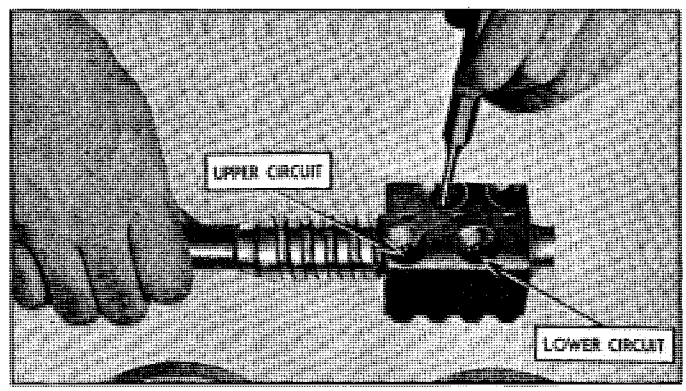


Fig. 12—Filling Ball Circuits—Chevy II and Corvette

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b. Count 27 balls into a suitable container. This is the proper number of balls for half the circuit. Place these balls into one of the guide holes while turning the worm gradually away from that hole.
c. Lay one-half of the ball guide, groove up, on the bench and place the remaining balls from the count container in it.
d. Close this half of guide with the other half. Hold the two halves together and plug each open end with petroleum jelly so that balls will not drop out while installing guide.
e. Push the guide into the guide holes of the nut. This completes one circuit of balls. If the guide does not push all the way down easily, tap it lightly into place with the wooden handle of a screw driver.
f. Fill second ball circuit in the same manner. Continue until ball circuit is full from bottom of one guide hole to bottom of the other or until stopped by reaching the end of the worm.

NOTE: In cases where the balls are stopped by the end of the worm, hold down those balls already dropped into the nut with the blunt end of a clean rod or punch (fig. 12) and turn the worm in the reverse direction a few turns. The filling of the circuit can then be continued. It may be necessary to work the worm back and forth, holding the balls down first in one hole then the other, to close up the spaces between the balls and fill the circuit completely and solidly.

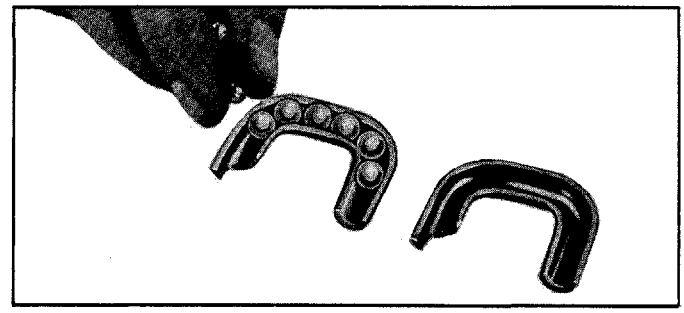


Fig. 13—Filling Ball Guides—Chevy II and Corvette

6. Assemble the ball guide clamp to the nut, being sure to use a lock washer under the clamp screw, then tighten the screw securely.

Check the assembly by rotating the nut on the worm to see that it moves freely. Do not rotate the nut to the end of the worm threads as this may damage the ball guides. If there is any "stickiness" in the motion of the nut, some slight damage to the ends of the ball guides or to other gear components may have been overlooked.

Assembly

After a major service overhaul where all of the original factory installed lubricant has been washed out of the steering gear assembly, the threads of the adjuster, side cover bolts and lash adjuster should be coated with a suitable non-drying, oil resistant sealing compound such as Permatex No. 2. This is to prevent leakage of gear

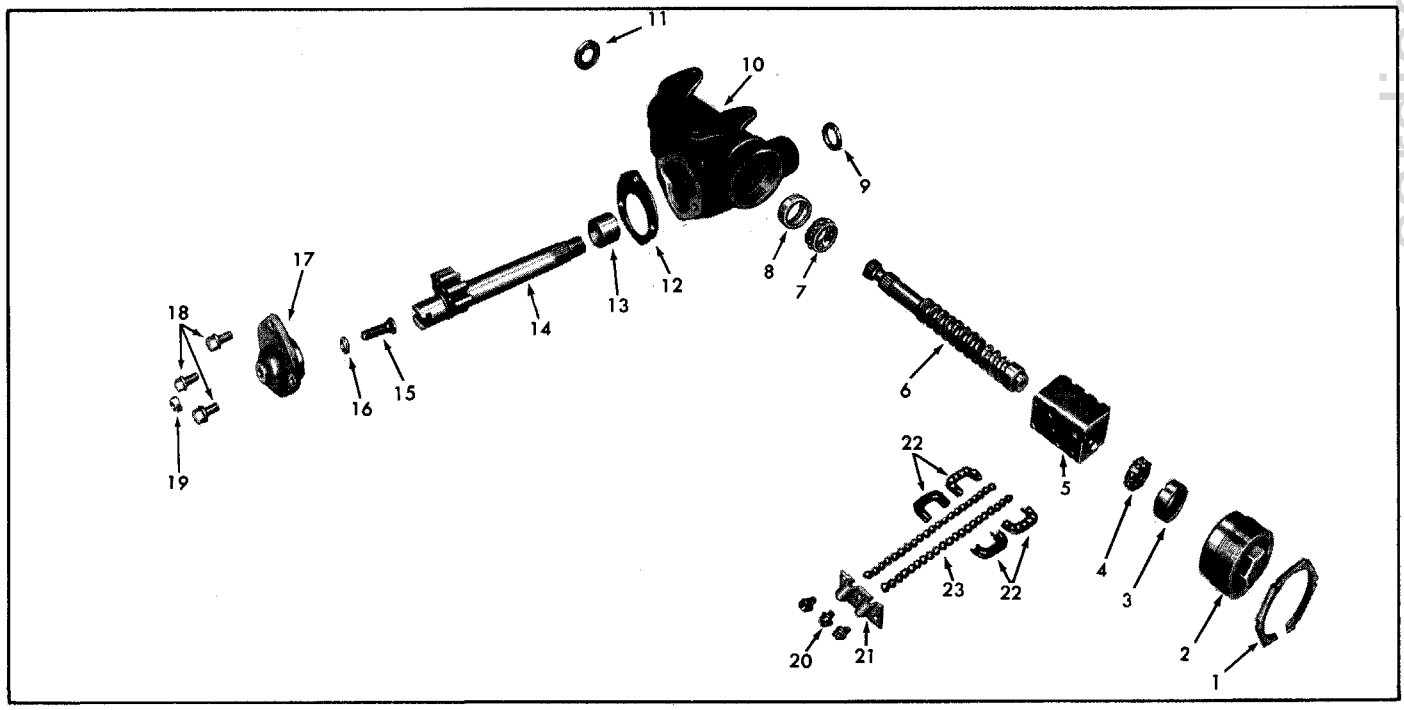


Fig. 14—Steering Gear (Chevrolet, Chevelle and Camaro)

1. Worm Bearing Adjuster Locknut
2. Worm Bearing Adjuster
3. Lower Worm Bearing Cup
4. Lower Ball Bearing
5. Ball Nut
6. Wormshaft
7. Upper Ball Bearing
8. Upper Worm Bearing Cup
9. Seal
10. Housing
11. Seal
12. Gasket
13. Sector Shaft Bushing
14. Sector Shaft
15. Lash Adjuster
16. Lash Adjust Shim
17. Housing Side Cover and Bushing Assembly
18. Side Cover Bolts
19. Lash Adjuster Locknut
20. Ball Guide Clamp Screw
21. Ball Guide Clamp
22. Ball Guides
23. Balls

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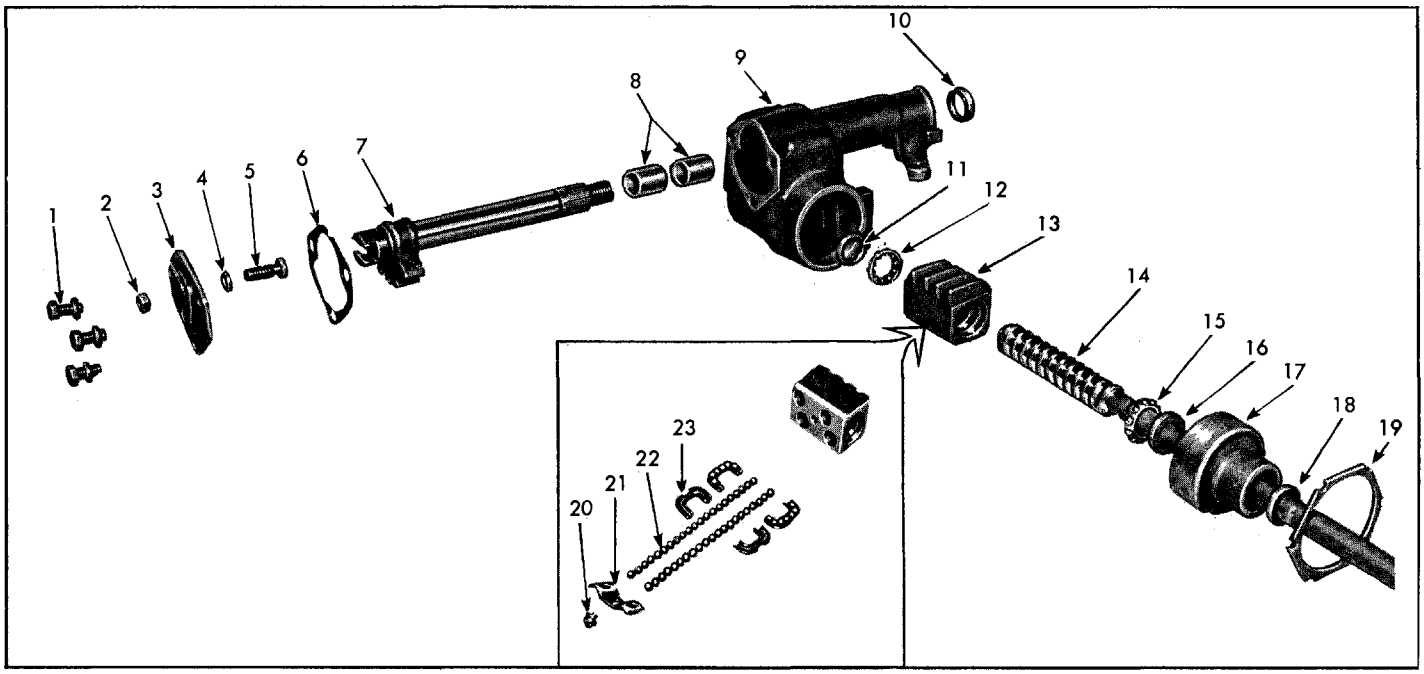


Fig. 15—Steering Gear—(Chevy II and Corvette)

1. Side Cover Screws
2. Lash Adjuster Locknut
3. Side Cover
4. Lash Adjuster Shim
5. Lash Adjuster Screw
6. Side Cover Gasket
7. Sector Shaft
8. Sector Shaft Bushings
9. Steering Gear Housing
10. Sector Shaft Seal
11. Worm Bearing Cup—Lower
12. Worm Bearing—Lower
13. Ball Nut
14. Worm Nut
15. Worm Bearing—Upper
16. Worm Bearing Cup—Upper
17. Worm Bearing Adjuster
18. Worm Shaft Seal
19. Worm Bearing Adjuster Locknut
20. Clamp Screw
21. Ball Guide Clamp
22. Balls
23. Ball Guides

lubricant from the steering gear assembly. The compound should not be applied to female threads and extreme care should be exercised in applying this compound to the bearing adjuster, as the compound must be kept away from the wormshaft bearing. Also apply grease to the bearings, pitman shaft bushings, and ball nut teeth.

Chevrolet, Chevelle and Camaro (Fig. 14)

1. With wormshaft seal, bushings and bearing cups installed and ball nut assembly installed on wormshaft, slip upper ball bearing over wormshaft and insert wormshaft and nut assembly into housing, feeding end of shaft through upper ball bearing cup and seal.
2. Place ball bearing in adjuster cup, press stamped retainer into place using a suitable socket, and install adjuster and locknut in lower end of housing.
3. Position the lash adjuster with shim in the slotted end of sector shaft. Check the end clearance which should not be greater than .002" (fig. 16). If clearance is greater than .002", a steering gear lash adjuster shim unit is available. It contains four shims - .063", .065", .067" and .069" thick.
4. After lash adjuster and clearance has been adjusted, start sector shaft pilot into bushing in side cover. Then, using a screw driver, through the hole in cover, turn lash adjuster in a counter-clockwise direction to pull sector shaft pilot into its bushing as far as it will go.
5. Rotate wormshaft by hand until ball nut is about in the center of travel. This is to make sure that the rack and sector will engage properly with center tooth of the sector entering center tooth space of the nut.
6. Place a new gasket on side cover, then push side cover assembly including sector shaft into place. After making sure there is some lash between rack and sector teeth, assemble and tighten side cover bolts.

Chevy II and Corvette

1. Place steering gear housing in vise with wormshaft bore horizontal and side cover opening up.
2. Place a wormshaft bearing in housing cup. Slide adjuster assembly with bearing over end of wormshaft and lower wormshaft into housing, being careful to index end of shaft in bearing.

   NOTE: Keep ball nut away from end of worm threads. This may be accomplished by taping nut in place.

3. Thread worm bearing adjuster into housing until nearly all slack is out of wormshaft bearings.
4. Assemble the lash adjuster with shim in the slot in the end of sector shaft. Check the end clearance which should not be greater than .002" (fig. 16). For the purpose of adjusting this end clearance, a steering gear lash adjuster shim unit is available. It contains four shims-.063", .065", .067" and .069" thick.

   After correct lash adjuster clearance has been obtained, install gasket on side cover and insert

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sector shaft into housing, being careful not to damage sector shaft seal with serrations. This damage may be avoided by taping serrations before assembly. When engaging ball nut with sector teeth, be sure to index center tooth of sector in center space of ball nut rack.

5. Align holes in side cover with those in housing and install the three cap screws.

Adjustment on Bench

1. With the sector lash adjuster backed off, tighten the worm bearing adjuster until all end play has been removed. Then tighten the locknut.
2. Using an 11/16" 12 point socket and a lb. in. torque wrench, carefully turn the wormshaft all the way to one stop and then turn back about one turn.
3. Measure the amount of torque required to keep the shaft in motion. If necessary, adjust the worm bearing adjuster until the proper preload is obtained. (See Specifications.)
4. Turn the steering shaft from one stop all the way to the other, counting the number of turns. Then turn the shaft back exactly half the number of turns to the center position.
5. Turn the sector lash adjuster screw clockwise to remove all lash between rack and sector teeth. Tighten the locknut.
6. Again use the 11/16" 12 point socket and a lb. in. torque wrench and observe the highest reading while gear is turned through center position. See Specifications for proper sector lash adjustment.
7. If necessary, readjust lash adjuster screw to obtain proper torque. Tighten locknut to 23 lb. ft. torque and again check torque reading through center of travel.
8. After installation of the gear assembly be sure to fill it with the recommended lubricant to the proper level as outlined in the service manual.

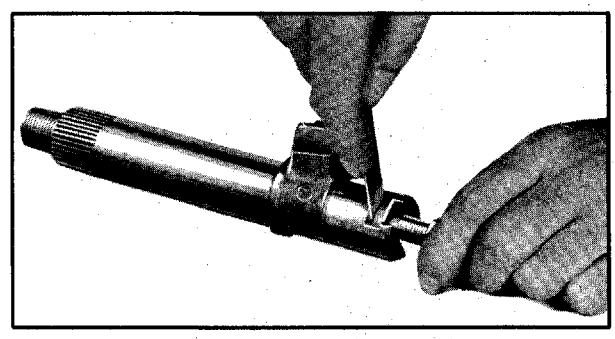


Fig. 16—Checking Sector Shaft End Clearance

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POWER STEERING PUMP

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GENERAL DESCRIPTION

A vane-type power steering pump is used on all models. The Overhaul procedure is outlined below. The differences between vehicles is in the amount of pressure delivered as shown in the specifications chart, which is accomplished by the use of different flow control valves. When replacing this valve be sure the correct one is used. Also the power steering pump for the Chevy II and Corvette uses a filter and cage assembly which is not used on Chevrolet, Chevelle, or Camaro.

OVERHAUL OPERATIONS

Disassembly (Fig. 17)

Clean outside of pump in a Nontoxic Solvent before disassembly.

1. Remove pulley using Tool J-21239-1 for stamped pulleys and Tool J-8433-1 with J-8433-2 adapter for cast pulleys.
2. Remove union and seal.

   CAUTION: In clamping pump in vise, be careful not to exert excessive force on front hub of pump as this may distort the bushing.

3. Remove pump reservoir retaining studs.
4. Remove reservoir from housing.
5. Remove mounting bolt "O" rings and union "O" rings.
6. On Chevy II and Corvette remove filter and filter cage; discard filter element.
7. Remove end plate retaining ring. Compress end plate retaining ring by inserting small punch in 1/8 diameter hole in pump housing. When ring is in compressed position, remove with screw driver as shown (fig. 18).
8. Remove end plate. End plate is spring-loaded and will generally sit above the housing level. If sticking should occur, a slight rocking action or light tapping with hammer will free the plate.

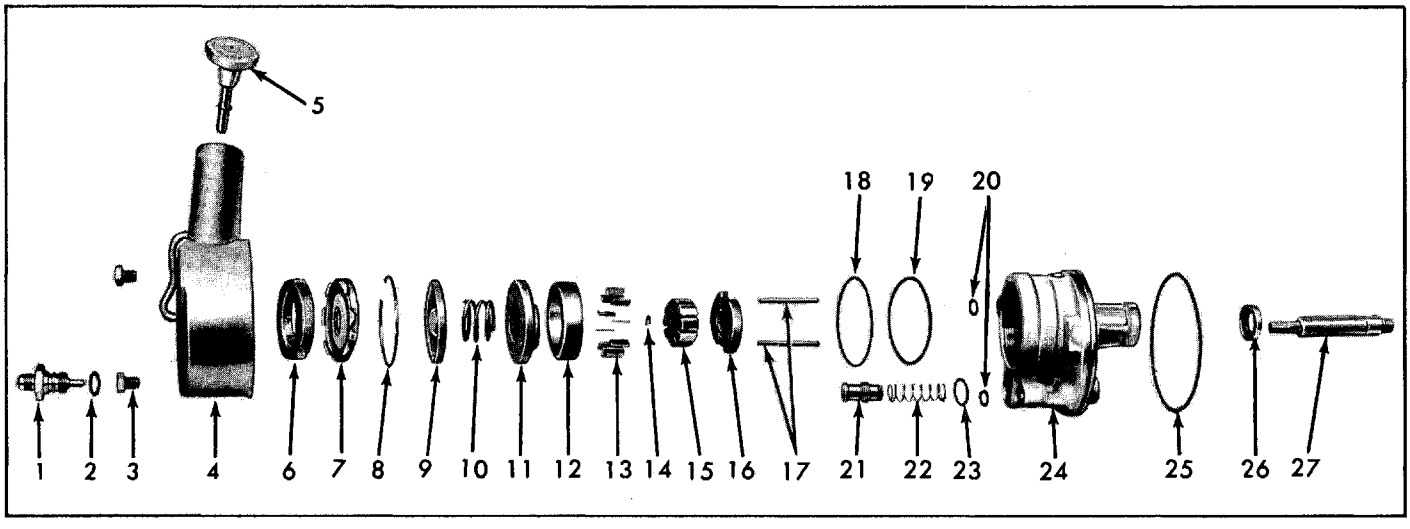


Fig. 17—Power Steering Pump—Chevy II—Exploded View

1. Union
2. Seal
3. Mounting Studs
4. Reservoir
5. Dip Stick and Cover
6. Element (Chevy II and Corvette)
7. Filter Assembly (Chevy II and Corvette)
8. End Plate Retaining Ring
9. End Plate
10. Spring
11. Pressure Plate
12. Pump Ring
13. Vanes
14. Drive Shaft Retaining Ring
15. Rotor
16. Thrust Plate
17. Dowel Pins
18. End Plate "O" Ring
19. Pressure Plate "O" Ring
20. Mounting Stud "O" Ring Seals
21. Flow Control Valve
22. Flow Control Valve Spring
23. Flow Control Valve "O" Ring Seal
24. Pump Housing
25. Reservoir "O" Ring Seal
26. Shaft Seal
27. Shaft

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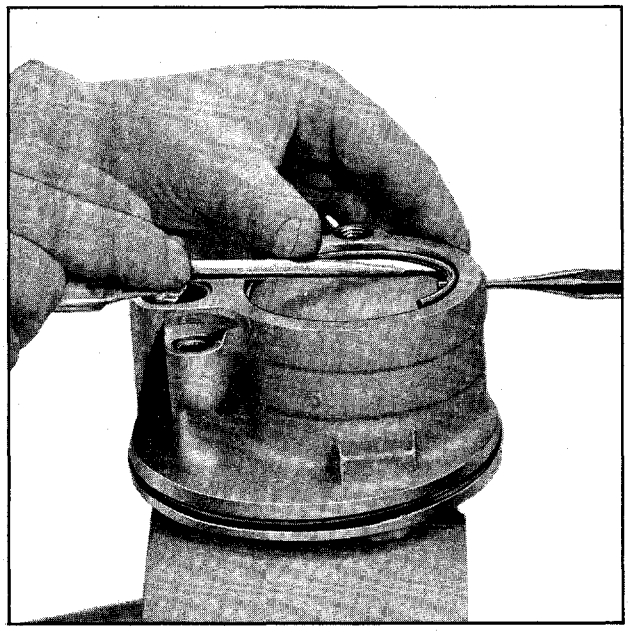


Fig. 18—Removing End Plate Ring

9. With pump in vise, remove shaft woodruff key and tap end of shaft gently with soft hammer until pressure plate, pump ring, rotor assembly and thrust plate may be removed as a unit (fig. 19).
10. Remove end plate "O" ring.
11. Separate the parts removed in Step 8. If inspection shows shaft to be defective, separate it from rotor by removing retaining snap ring.

Inspection

Clean all metal parts in a nontoxic solvent and inspect as follows:

1. Flow control valve must slide freely in housing bore. If sticking is observed, check for dirt and burrs.

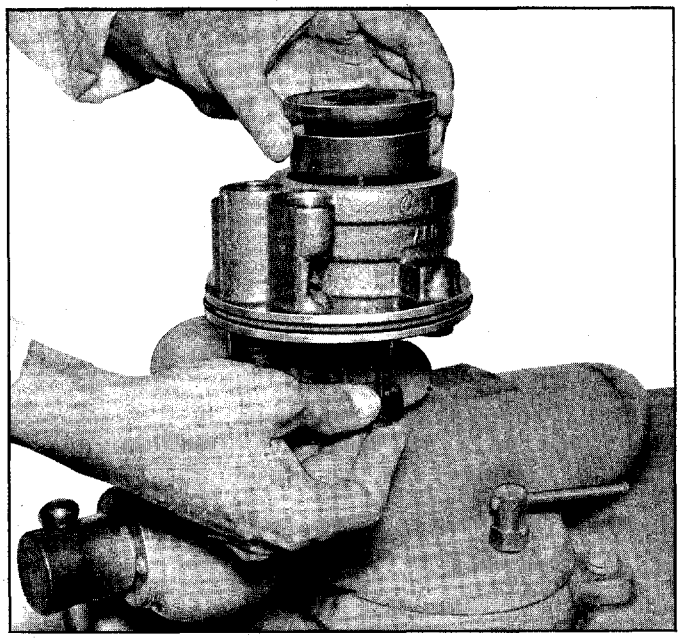


Fig. 19—Impeller Unit Removal

2. Check cap screw in the end of the flow control valve for looseness; if loose, tighten, being careful not to damage machined surfaces.
3. Be sure that pressure plate and pump plate surfaces are flat and parallel with pump ring. Check all of these parts for cracks and scoring.

   NOTE: A high polish is always present on rotor pressure plate and thrust plate as a result of normal wear. Do not confuse this with scoring.

4. Make certain vanes were installed with rounded edge toward pump ring and see that they move freely in rotor slots.
5. If the flow control plunger is suspected of being faulty, install a new part. This part is serviced as a unit only and is factory calibrated.
6. Check drive shaft for worn splines, breaks, bushing material pickup, etc.
7. Always replace all rubber seals and "O" rings when pump is dismantled.

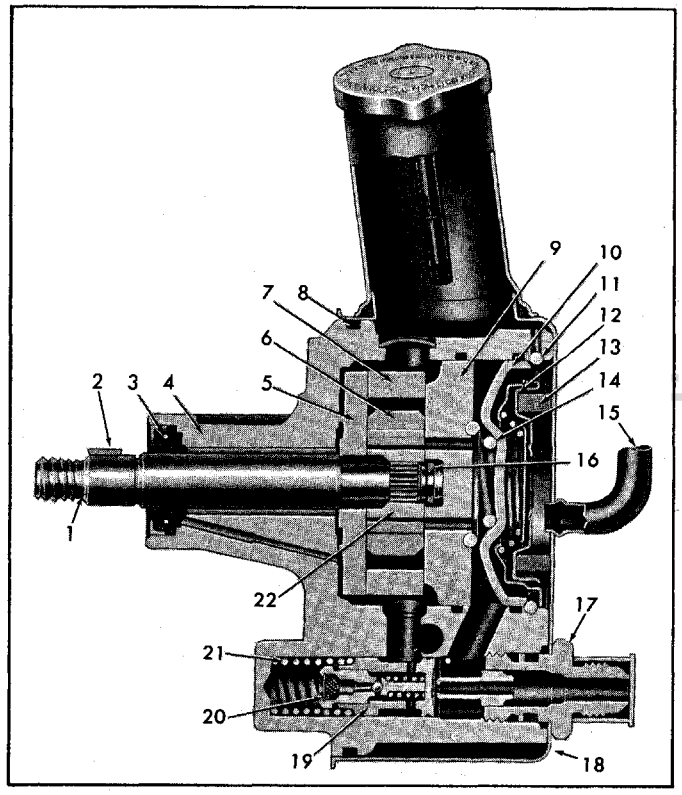


Fig. 20—Power Steering Pump—Chevy II—Exploded View

1. Shaft
2. Woodruff Key
3. Shaft Seal
4. Pump Housing
5. Thrust Plate
6. Vanes
7. Pump Ring
8. Reservoir "O" Ring Seal
9. Pressure Plate
10. End Plate Retaining Ring
11. End Plate
12. Cage Assembly (Chevy II and Corvette)
13. Filter (Chevy II and Corvette)
14. Pressure Plate Spring
15. Pump Inlet Tube
16. Rotor-to-Drive Shaft Retaining Ring
17. Pump Outlet Union
18. Reservoir
19. Flow Control Valve
20. Flow Control Valve Cap Screw
21. Flow Control Valve Spring
22. Rotor

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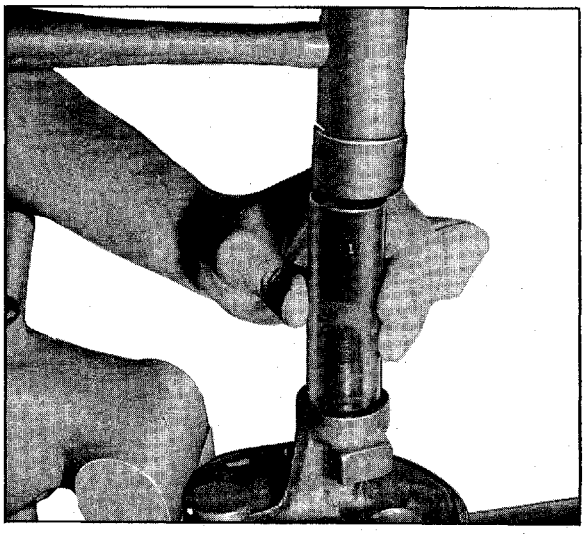


Fig. 21—Installing Seal Using Tool J-22670

8. Check reservoir, studs, casting, etc. for burrs and other faults which would impair proper operation.

Assembly (Fig 20)

Be sure all parts are clean during re-assembly.

1. Install new shaft seal, using Tool J-22670 as shown in Figure 21 and insert shaft at hub end of housing, spline end entering mounting face side (fig. 22).
2. Install thrust plate on dowel pins with ported face to rear of pump housing (fig. 23).
3. Install rotor, which must be free on splines, on pump shaft over splined end.

   NOTE: Assemble rotor with countersunk side toward shaft.

4. Using suitable tool, install shaft retaining ring (fig. 24).
5. Install pump ring on dowel pins with direction of rotation arrow to the rear of the pump housing (fig. 25). Rotation is clockwise as viewed from pulley.
6. Install vanes in rotor slots with radius edge towards outside as shown in Figures 26 and 27.
7. Lubricate outside diameter and chamfer of pressure plate with petroleum jelly to insure against damaging

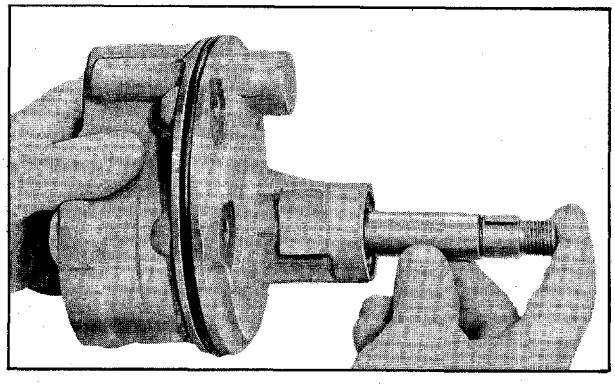


Fig. 22—Shaft Installation

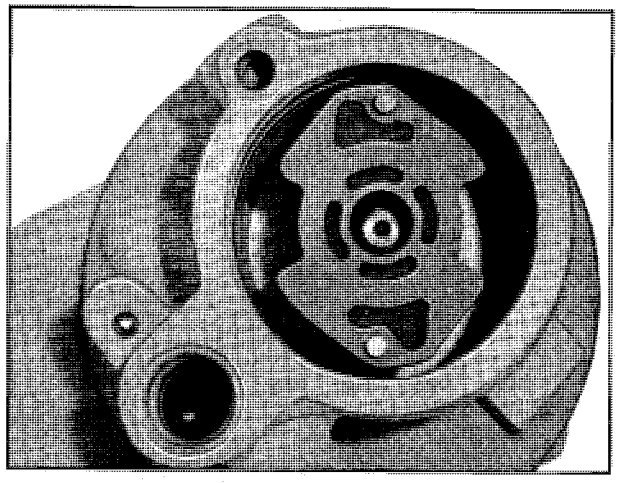


Fig. 23—Installing Thrust Plate

"O" ring and install on dowel pins with ported face toward the pump ring. Seat pressure plate by placing large socket on top of plate and pushing down with hand. (Pressure plate will travel about 1/16" to seat).

8. Install pressure plate spring in center groove of pressure plate (fig. 28).
9. Install end plate "O" ring.
10. Lubricate outside diameter and chamfer of end plate with petroleum jelly to insure against damaging "O" ring and install in housing using an arbor press as shown in Figure 29.
11. Install end plate retaining ring while pump is in arbor press. Be sure it is completely seated in the groove of the housing and that ring gap is in position shown in Figure 29.
12. Install flow control spring and flow control plunger. Be sure hex head screw goes into bore first (fig. 30).
13. On Chevy II and Corvette install filter cage and a new filter.
14. Install stud seals and union seal.
15. Place reservoir in normal position and press down until reservoir seats on housing; check position of stud seals and union seal.

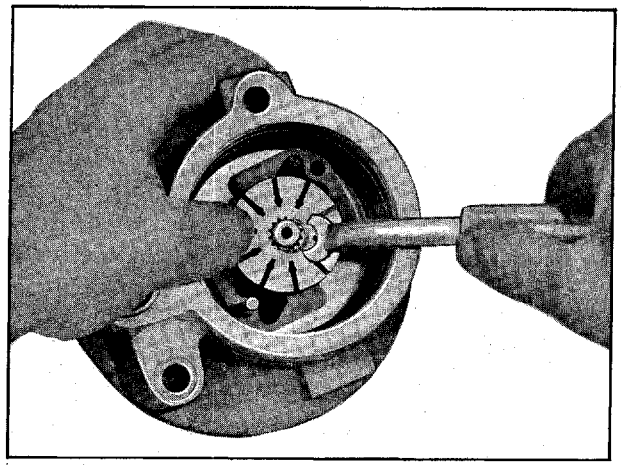


Fig. 24—Installing Shaft Snap Ring

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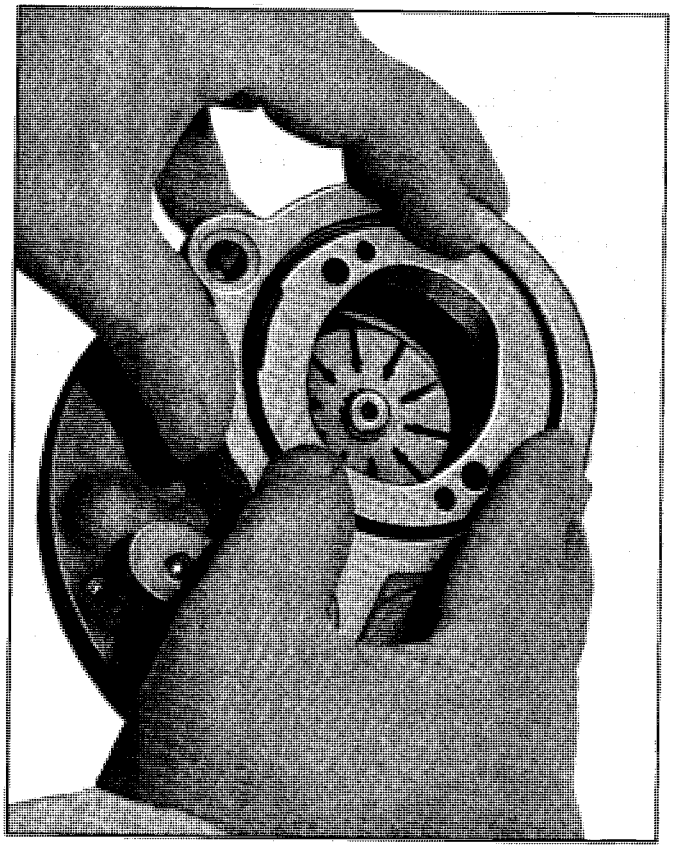


Fig. 25—Installing Pump Ring

16. Install studs, union, and drive shaft woodruff key. Support the shaft on the opposite side of key when tapping key into place.

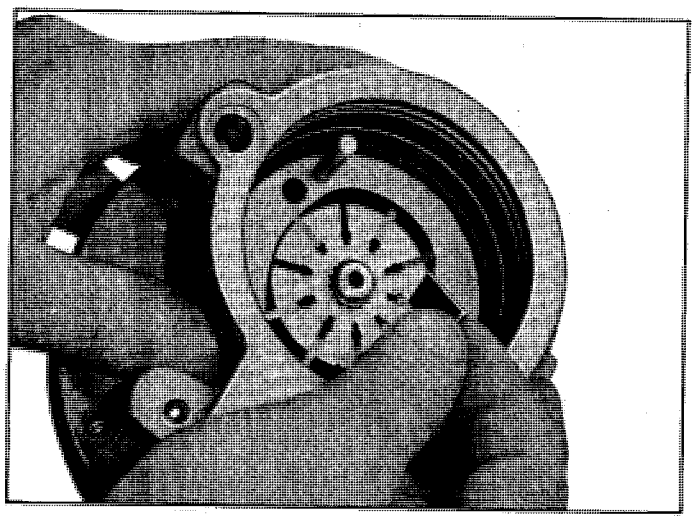


Fig. 26—Installing Vanes

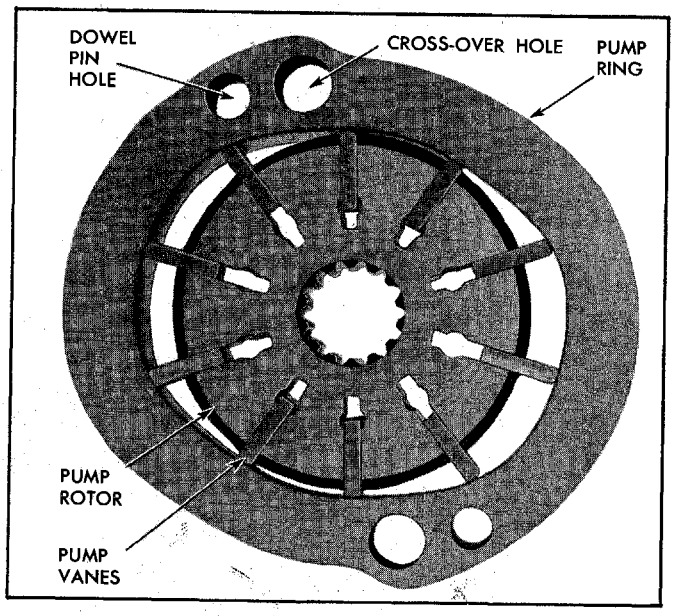


Fig. 27—Correct Vane Assembly

17. Slide pulley on shaft. Do not hammer pulley.
18. Install pulley nut and torque to 60 ft. lbs.

NOTE: Always use a new pulley nut.

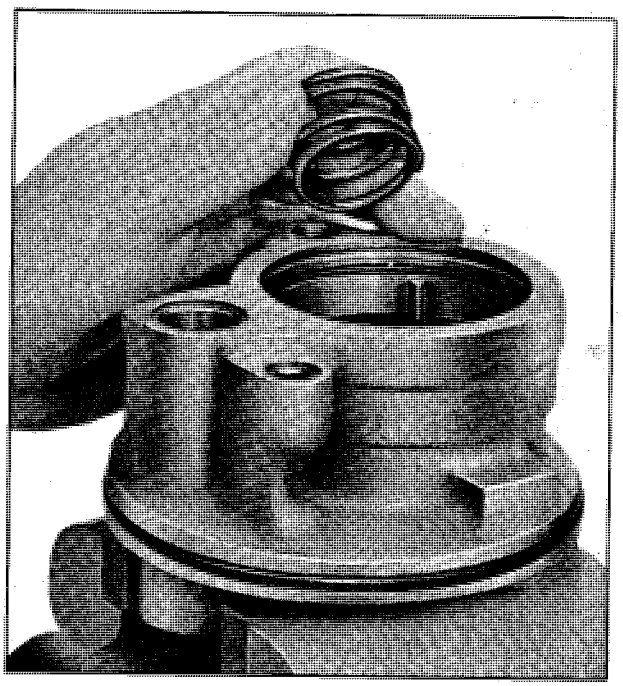


Fig. 28—Installing Pressure Plate Spring

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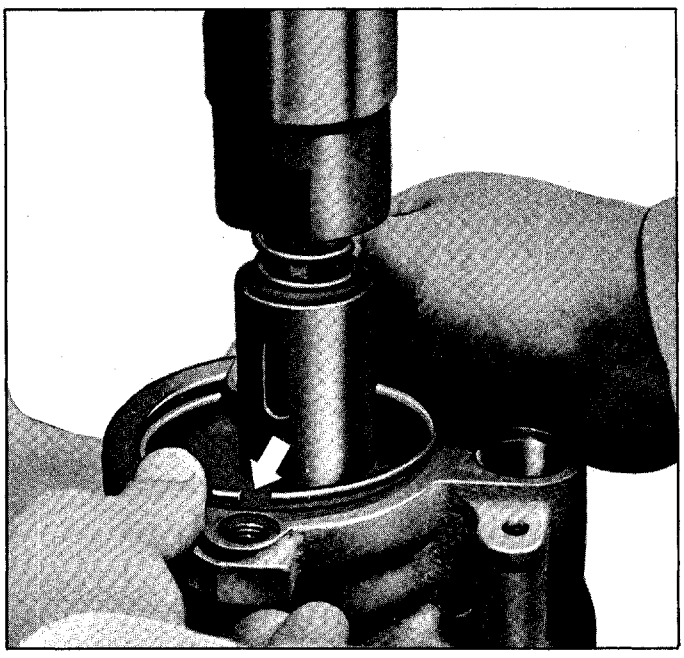


Fig. 29—Installing End Plate Retaining Ring

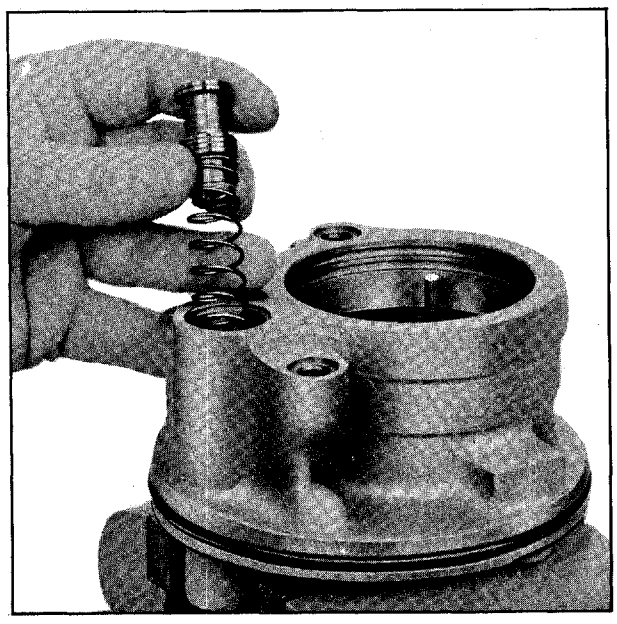


Fig. 30—Installing Flow Control Valve

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POWER STEERING GEAR (CHEVROLET, CHEVELLE AND CAMARO)

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GENERAL DESCRIPTION

The power steering gear used on Chevrolet, Chevelle and Camaro are of the same design and are overhauled in a like manner. The following procedure outlines the disassembly of the gear, overhaul of the individual components, and assembly of the gear.

In many cases, complete disassembly of the gear will not be necessary since most of the component parts can be removed without complete disassembly.

OVERHAUL OPERATIONS

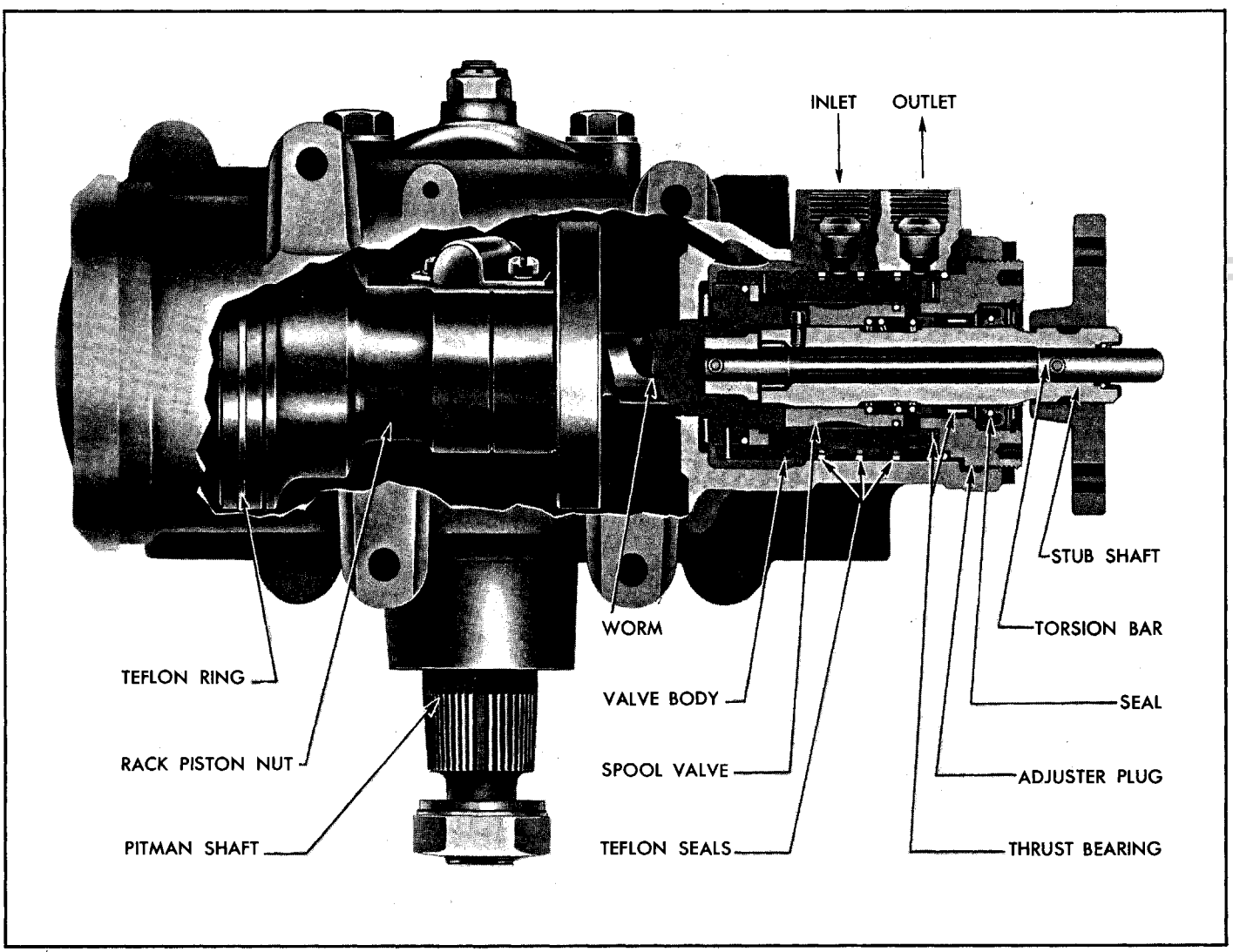


Fig. 31—Power Steering Gear—Chevrolet, Chevelle and Camaro

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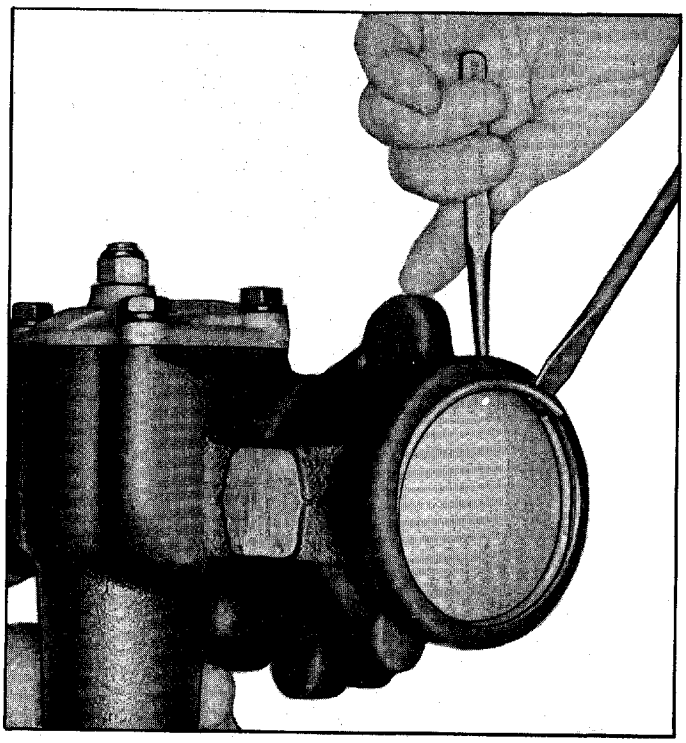


Fig. 32—Removing End Cover Retaining Ring

Disassembly

1. Rotate end cover retainer ring so that one end of the ring is over hole in side of housing then force end of ring from its groove and remove ring (fig. 32).
2. Turn the coupling flange counter-clockwise 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 end plug as shown in Figure 33.
4. Remove the pitman shaft and side cover as follows:
   a. Loosen the over-center adjusting screw locknut and remove the 4 side cover attaching bolts and lock washers.
   b. Rotate side cover until the rack-piston and pitman shaft teeth are visible, then turn the coupling flange until the pitman shaft teeth are centered in the housing opening. Tap pitman shaft with a soft hammer and remove the pitman shaft and side cover from the housing. Remove the side cover "O" ring and discard.
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. 35). Turn coupling flange counter-clockwise while holding tool tightly against worm. The rack-piston will be forced onto the tool.
   b. Remove the rack-piston with Ball Retainer Tool J-7539 from gear housing.
6. Remove the adjuster plug as follows:
   a. Remove coupling flange attaching bolt and flange.
   b. Loosen the adjuster plug locknut with Spanner Wrench J-972.
   c. Remove adjuster plug assembly with Spanner Wrench J-7624 (fig. 36). 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.
8. If the worm or lower thrust bearing and race remained in the gear housing, remove them at this time.

Overhauling Individual Units

Adjuster Plug Assembly

Disassembly

1. If the seal ONLY is to be replaced and not the bearing, remove the retaining ring with the Internal Pliers J-5403, then remove the dust seal. Pry the seal from the bore of the adjuster plug (fig. 37).
2. Remove the thrust bearing retainer by prying at the two raised areas with a small screw driver, remove the spacer, thrust bearing washer, thrust bearing and washer (fig. 38).
3. If the needle bearing is to be replaced, remove the retaining ring using Internal Pliers J-5403, then drive the dust seal, seal and bearing from the adjuster plug with Tool J-8524-2 and Driver J-7079-2 (fig. 39).
4. Wash all parts in clean solvent and dry parts with compressed air.
5. Inspect thrust bearing spacer for wear or cracks. Replace if damaged.
6. Inspect thrust bearing rollers and washers for wear, pitting or scores. If any of these conditions exist, replace the bearing and washers.

Assembly

1. If the needle bearing was removed, place new needle bearing over Tool J-8524-1 and J-7079-2 with the

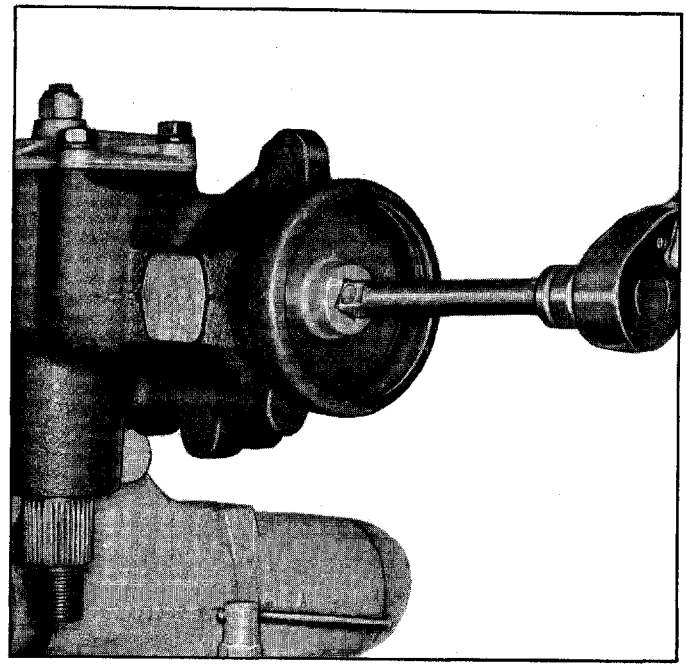


Fig. 33—Removing End Plug

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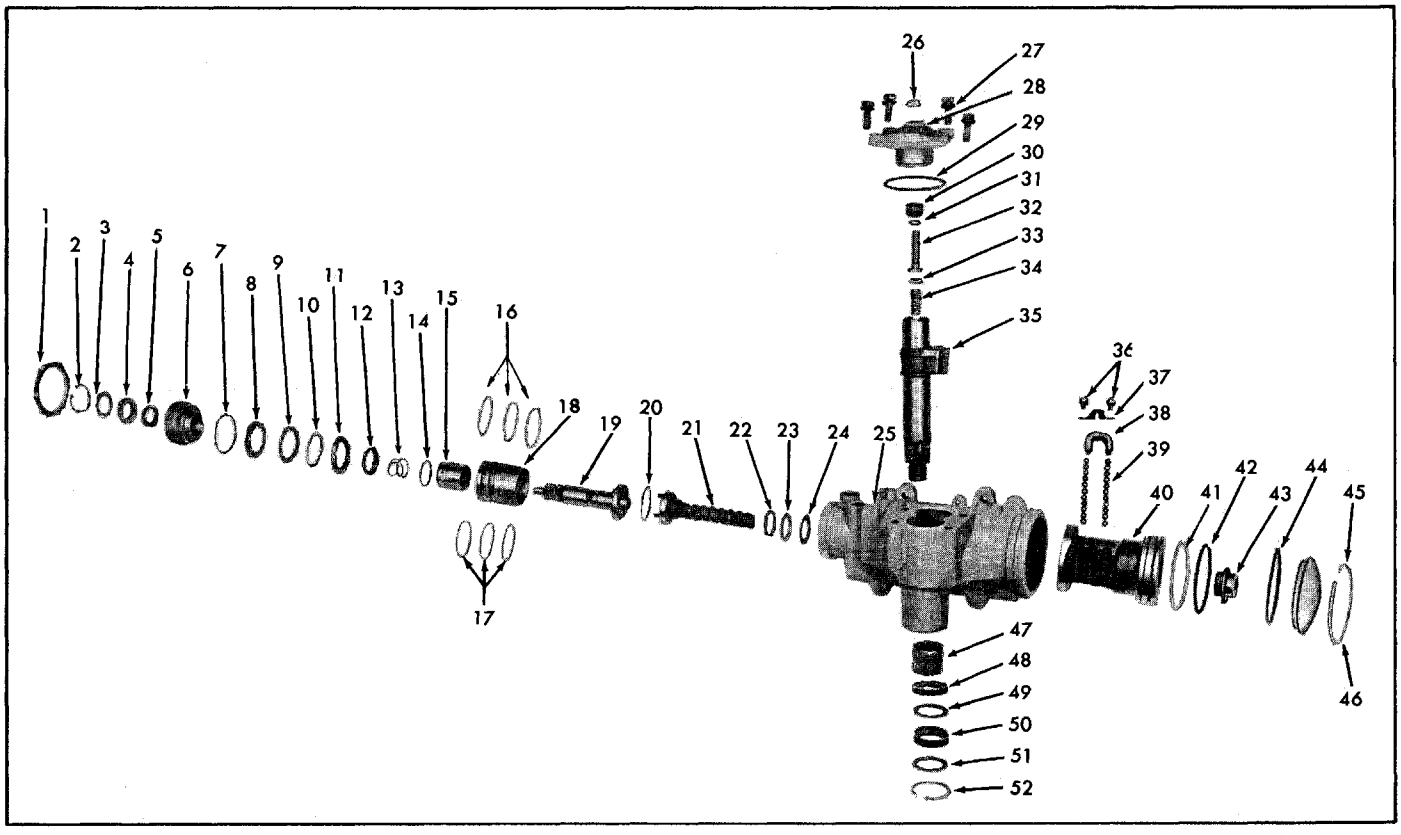


Fig. 34—Power Steering Gear—Exploded View

1. Locknut
2. Retaining Ring
3. Dust Seal
4. Oil Seal
5. Bearing
6. Adjuster Plug
7. "O" Ring
8. Thrust Washer (Large)
9. Thrust Bearing
10. Thrust Washer (Small)
11. Spacer
12. Retainer
13. Spool Valve Spring
14. "O" Ring
15. Spool Valve
16. Teflon Oil Rings
17. "O" Rings
18. Valve Body
19. Stud Shaft
20. "O" Ring
21. Worm Shaft
22. Thrust Washer
23. Thrust Bearing
24. Thrust Washer
25. Housing
26. Locknut
27. Attaching Bolts and Washers
28. Side Cover
29. "O" Ring
30. Adjuster Retainer
31. Shim
32. Adjuster Screw
33. Thrust Washer
34. Spring
35. Pitman Shaft
36. Screws and Lock Washers
37. Clamp
38. Ball Return Guide
39. Balls
40. Rack-Piston
41. Teflon Oil Seal
42. "O" Ring
43. Plug
44. "O" Ring
45. Housing End Cover
46. Retainer Ring
47. Needle Bearing
48. Oil Seal
49. Back Up Washer
50. Oil Seal
51. Back Up Washer
52. Retaining Ring

bearing manufacturer's identification away from the tool and drive bearing into plug until the tool bottoms in the housing (fig. 40).

CAUTION: Place block of wood under adjuster plug to protect thrust bearing surface.

2. Temporarily install the adjuster plug in the gear housing and place dust seal and a new oil seal on Tool J-8524-1 (lip of seal away from tool). Lubricate seal with Type "A" Transmission Fluid and drive or press seal into adjuster plug until seated (fig. 41).
3. Install retaining ring with Internal Pliers J-5403. Then remove the adjuster plug from the housing.
4. Lubricate the thrust bearing assembly with Type "A" Transmission Fluid. 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).

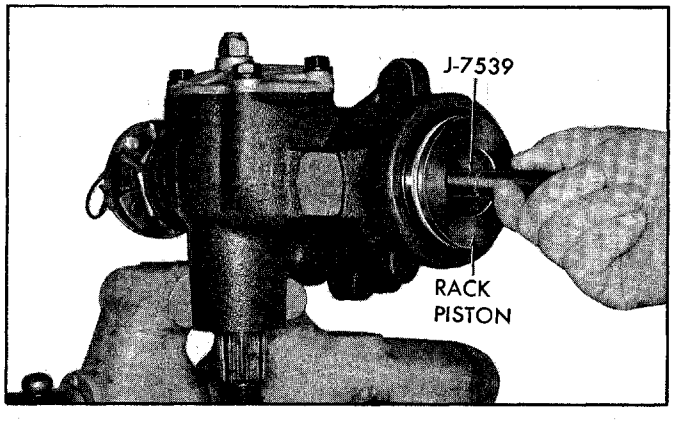


Fig. 35—Removing Rack Piston

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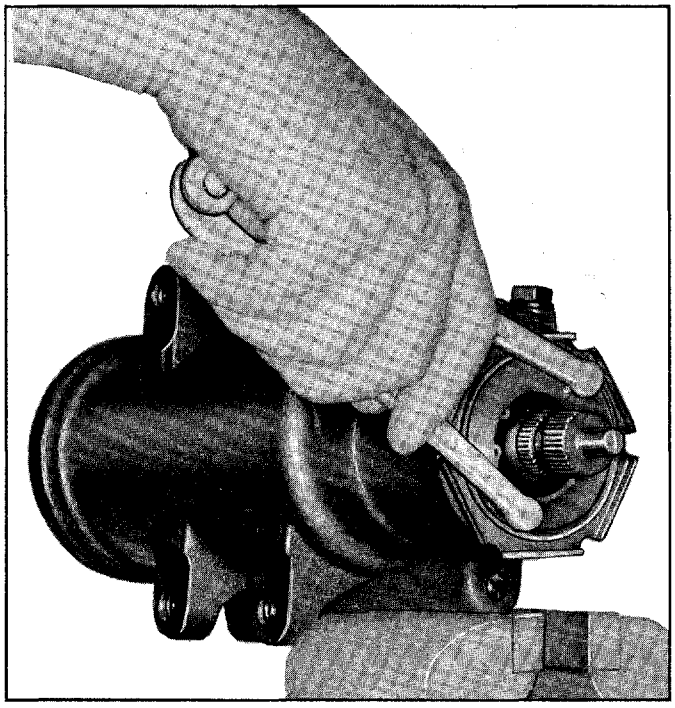


Fig. 36—Removing Adjuster Plug

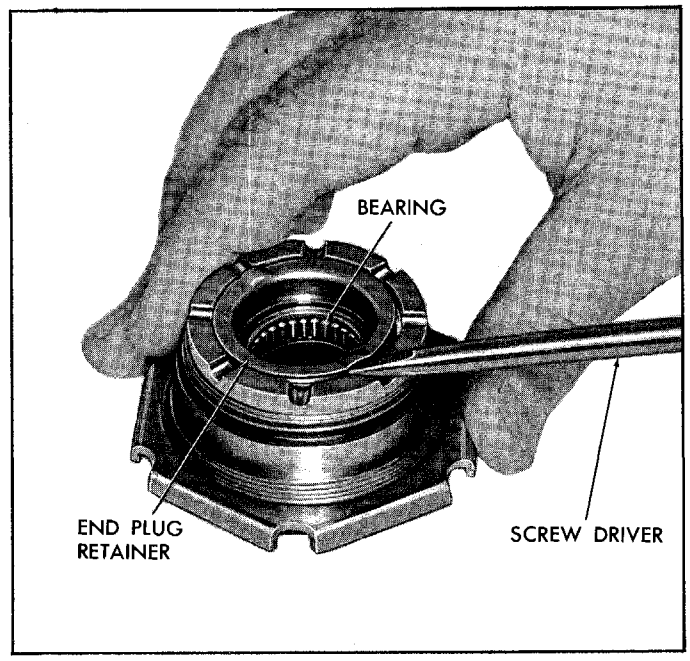


Fig. 38—Removing Retainer

5. Install a new bearing retainer on the adjuster plug by carefully tapping on the flat surface of the retainer (fig. 42).

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

Valve and Lower Shaft Assembly

Disassembly

1. Remove the spool valve spring by carefully prying top coil out of groove in the lower shaft, then slide the spring from the shaft. Be careful not to distort spring.
2. To remove the lower shaft assembly from the valve body, proceed as follows:
   a. While holding the assembly (lower shaft down), lightly tap the stub shaft against the bench until the shaft cap is free from the valve body (fig. 43). 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.

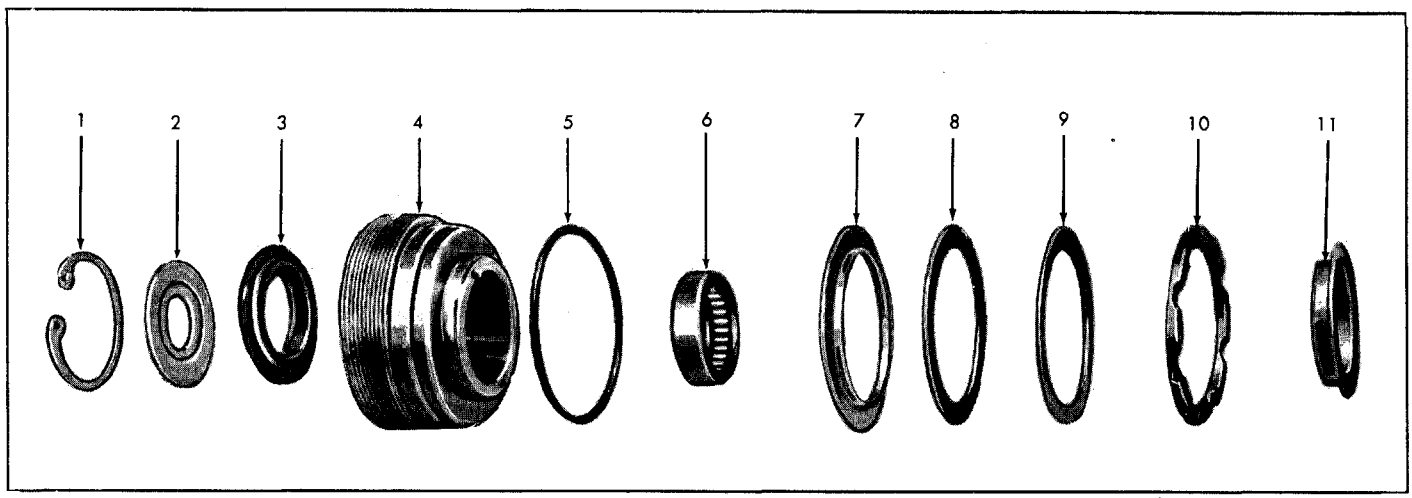


Fig. 37—Adjuster Plug—Exploded View

1. Retaining Ring
2. Dust Seal
3. Oil Seal
4. Adjuster Plug
5. "O" Ring
6. Needle Bearing
7. Thrust Washer (Large)
8. Thrust Bearing
9. Thrust Washer (Small)
10. Spacer
11. Retainer

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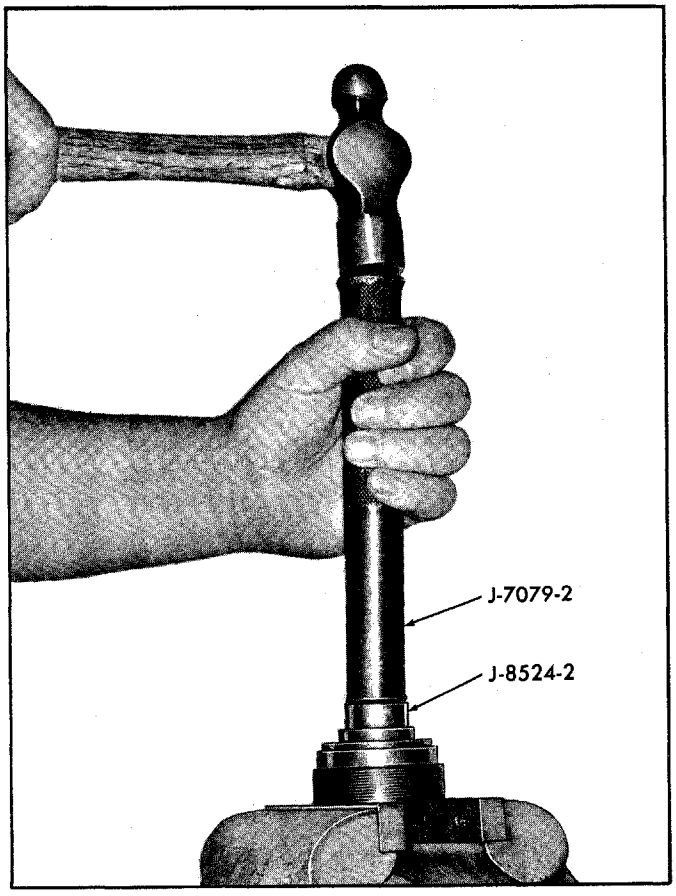


Fig. 39—Removing Bearing and Seal

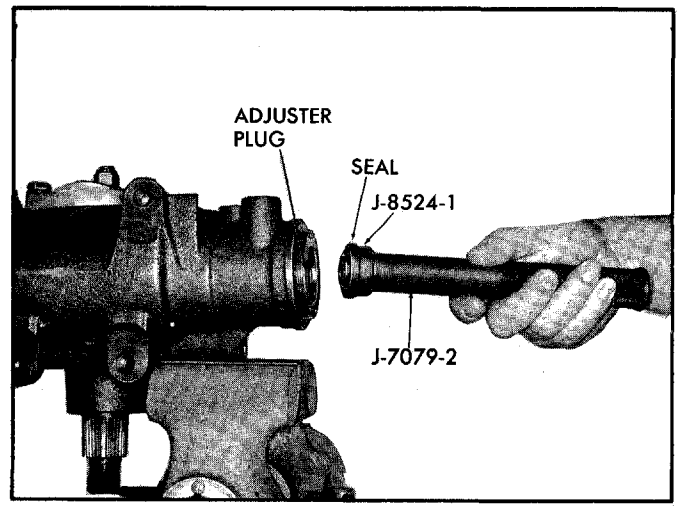


Fig. 41—Installing Seal

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. 44). If the spool valve becomes cocked, carefully realign the spool valve then remove.
4. Remove the dampener "O" ring from the spool valve and discard.
5. If the teflon oil rings are to be replaced, cut the 3 teflon oil rings and "O" rings from the valve body and discard.

Cleaning and Inspection

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

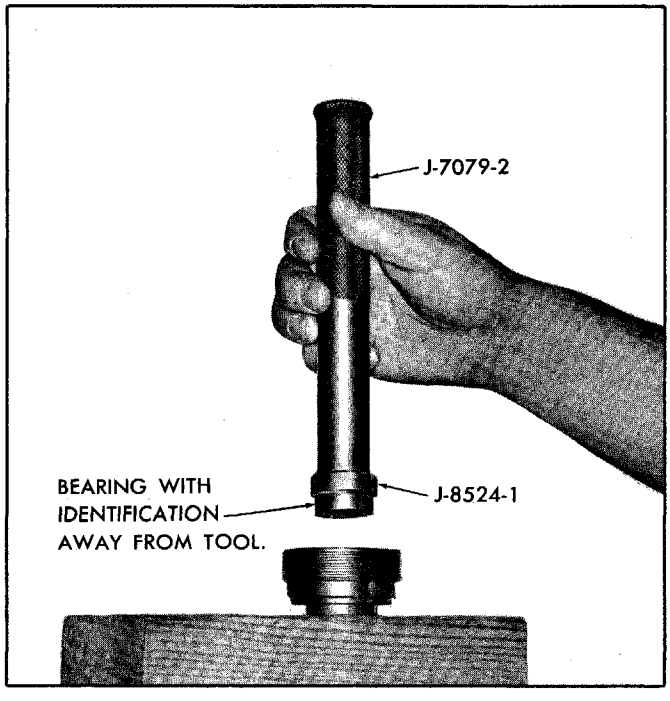


Fig. 40—Installing Bearing

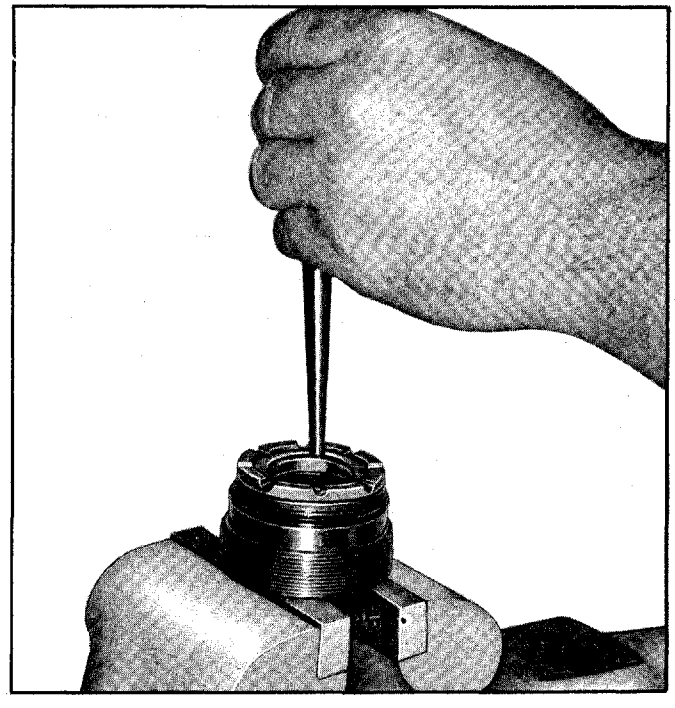


Fig. 42—Installing Retainer

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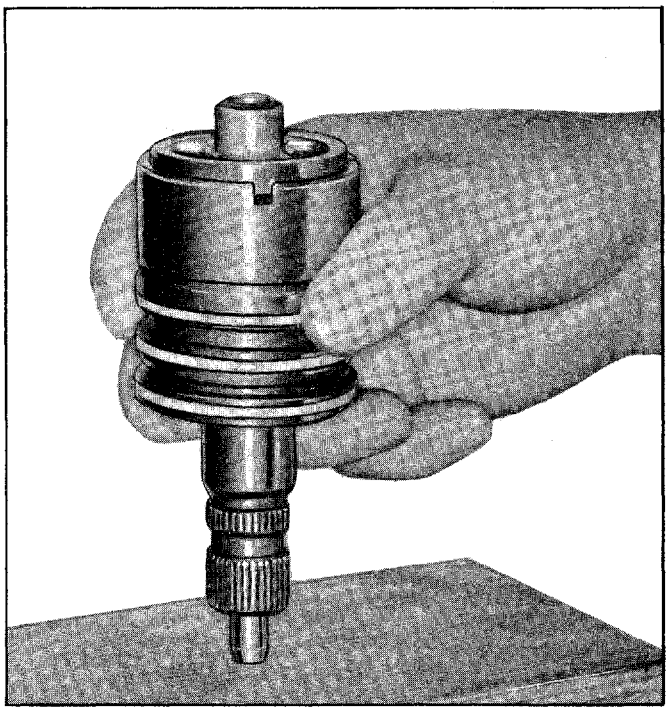


Fig. 43—Removing Stub Shaft

2. If the drive pin in the lower shaft or valve body is cracked, excessively worn or broken, replace the complete valve and shaft assembly.
3. If there is evidence of leakage between the torsion bar and the lower shaft, or scores, nicks, or burrs on the ground surface of the lower shaft that cannot be cleaned up with crocus cloth, the entire valve and shaft assembly must be replaced.
4. Check the outside diameter of the spool valve and the inside diameter of the valve body for nicks, burrs, or bad wear spots. If the irregularities cannot be cleaned up by the use of crocus cloth, the complete valve and shaft assembly will have to be replaced.
5. If the small notch in the skirt of the valve body is excessively worn, the complete valve and shaft assembly will have to be replaced.
6. Lubricate the spool valve with Type "A" Transmission 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 .860". If it is less than .830", replace the spring.

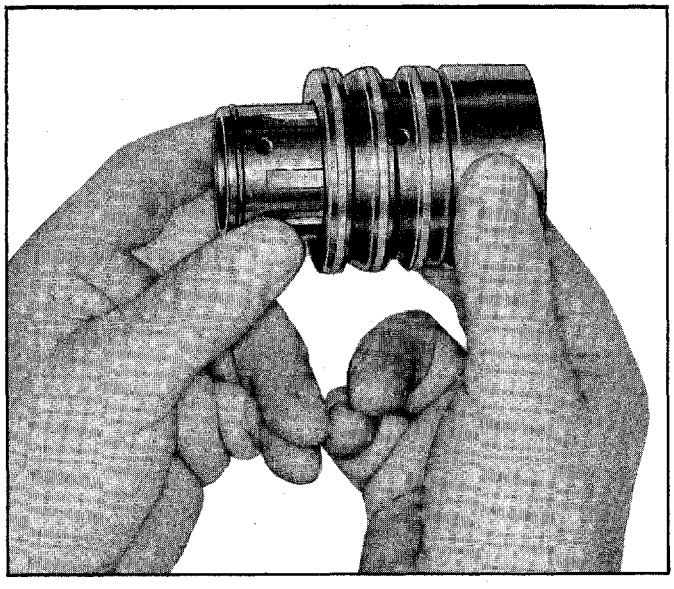


Fig. 44—Removing Spool Valve

Assembly

1. If valve body "O" rings and teflon rings were removed, install "O" rings in the oil ring grooves and lubricate with Type "A" Transmission Fluid.
2. Lubricate the 3 teflon oil rings with petroleum and install in grooves over "O" rings.

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

3. Assemble the lower shaft assembly in the valve body so the notch in the lower shaft cap engages with the pin in the valve body and is seated (fig. 45).
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 Type "A" Transmission fluid and slide the valve over the lower shaft. (Notch in spool towards the valve body). Rotate the spool valve while pushing valve into valve body to align notch in spool with the pin in the lower shaft (fig. 45).
   c. Carefully press spool valve into body, engaging notch on pin. Extreme care must be taken not to cut "O" ring. The spool valve is properly seated when it is flush with the top of valve body.
5. Place a piece of shim stock over the shaft to protect the seal surface from spring ends.
6. Slide the valve spring over the lower shaft and down into the spool valve until the top coil of the spring is in the shaft groove (fig. 46).

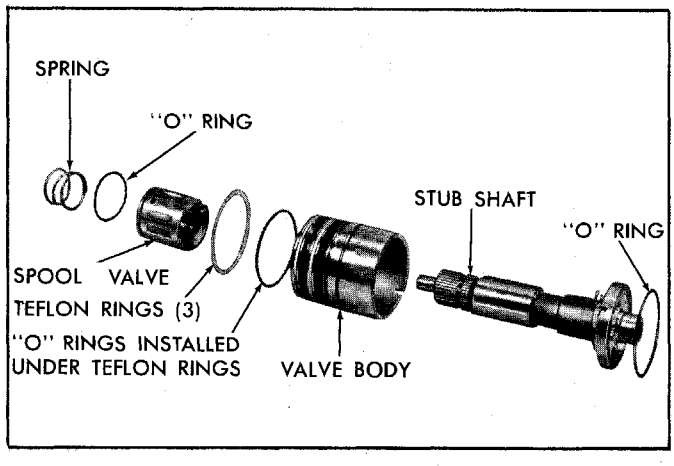


Fig. 45—Valve Body and Shaft Assembly

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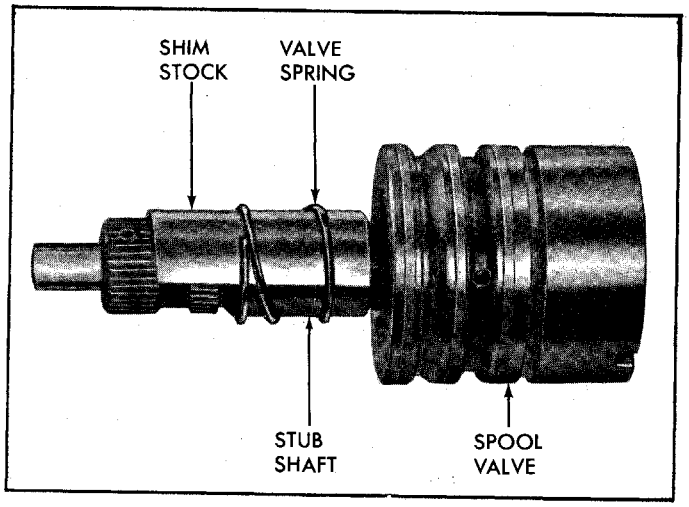


Fig. 46—Installing Valve Spring

Pitman Shaft and Side Cover

Disassembly

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

Cleaning and Inspection

1. Wash all parts in clean solvent and dry parts with compressed air.
2. Check pitman shaft bearing surface in the side cover for scoring. If badly worn or scored, replace the side cover.
3. Check the sealing and bearing surfaces of the pitman shaft for roughness, nicks, etc. If minor irregularities in surface cannot be cleaned by use of crocus cloth, replace the pitman shaft.
4. Replace pitman shaft assembly if teeth are damaged or if the bearing surfaces are pitted or scored.
5. Check pitman shaft adjusting screw lash. It must be free to turn with no perceptible end play. If adjusting screw is loose replace the pitman shaft assembly.

Assembly

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

Rack-Piston

Disassembly

1. Check the worm to ball drag 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 drag while rotating the torque wrench in a 120° arc. The reading should not exceed 3 in. lbs. (fig. 47).

      If a drag can be felt while rotating worm by hand, but it cannot be measured on a torque wrench, it will be acceptable.
   e. If the drag is not within limits, a new set of balls must be installed upon reassembly. Note the ball size stamped on the rack-piston and install the next size larger balls to increase the drag or the next size smaller balls to decrease the drag; black balls need not be replaced unless they are defective. A change of one ball size will change the drag approximately 1 in. lb.

NOTE: If no number is apparent, the ball size is number 7.

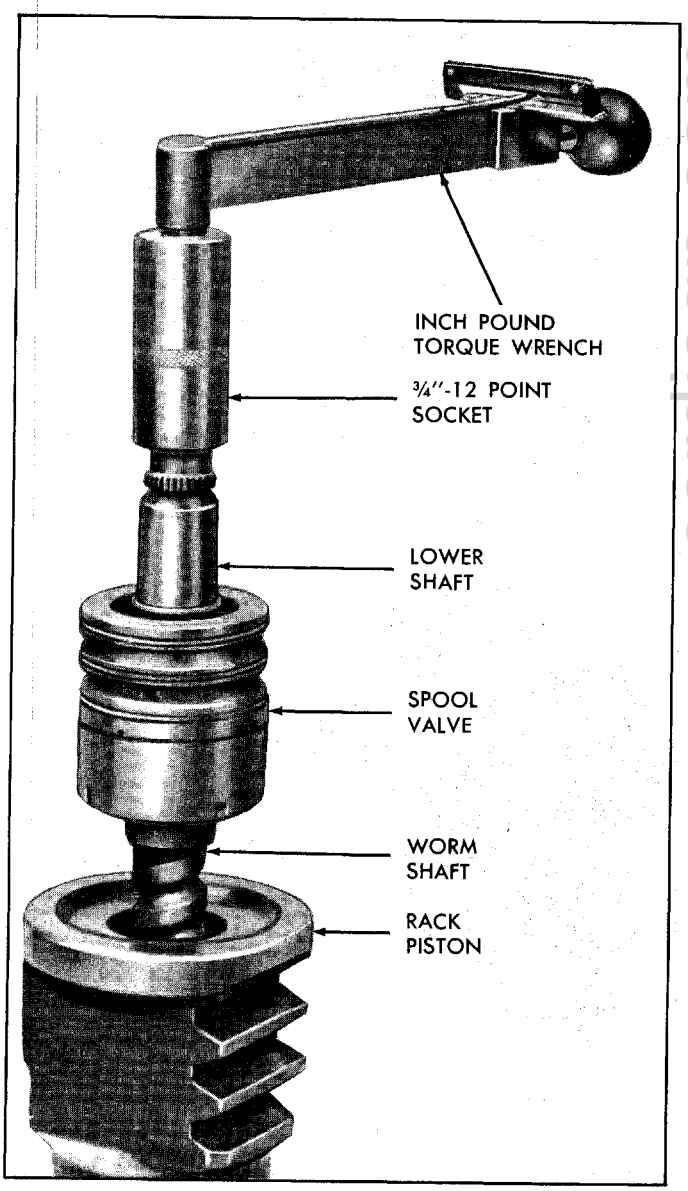


Fig. 47—Checking Ball Drag

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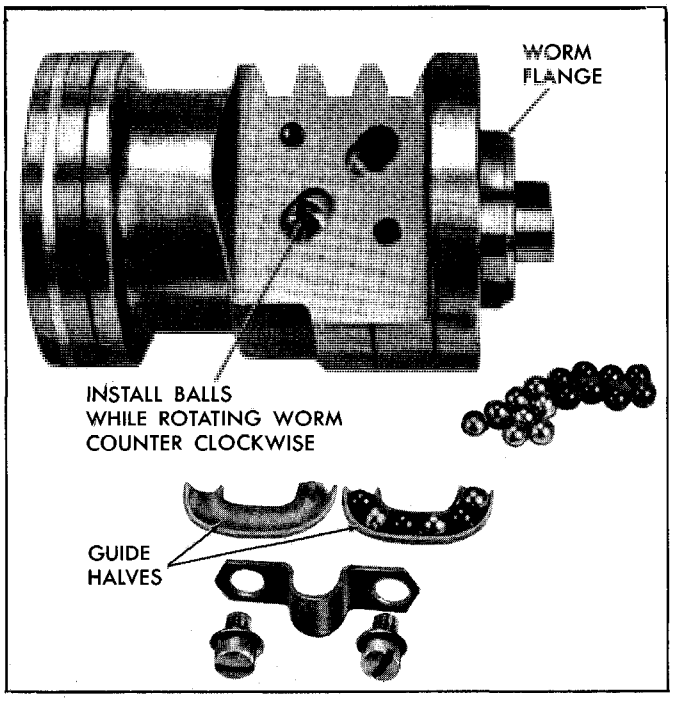


Fig. 48—Installing Balls in Rack-Piston

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

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

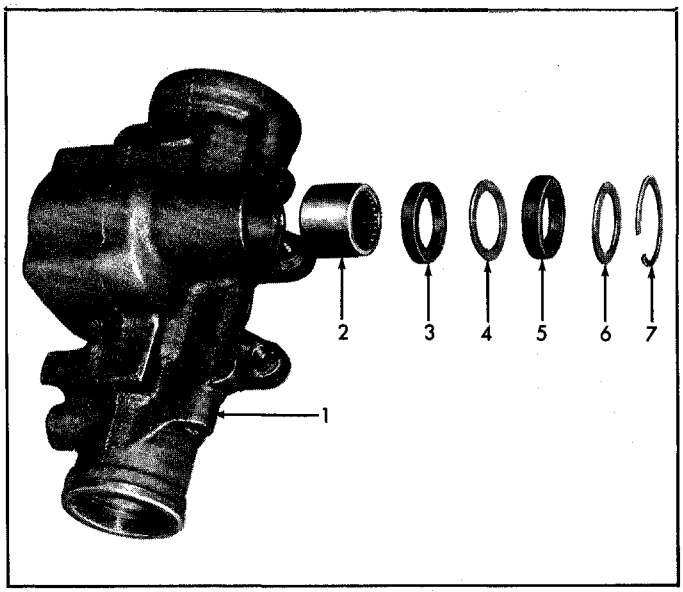


Fig. 49—Pitman Shaft Seals

1. Housing
2. Bearing
3. Oil Seal
4. Steel Washer
5. Oil Seal (Double Lip)
6. Steel Washer
7. Retaining Ring

2. Inspect the worm and rack-piston grooves and all the balls for scoring. If either the worm or rack-piston needs replacing, both must be replaced as a matched assembly.
3. Inspect ball return guide halves, making sure that the ends where the balls enter and leave the guides are not damaged.
4. Inspect lower thrust bearing and washers for scores or excessive wear. If any of these conditions are found, replace the thrust bearing and washers.
5. Inspect rack-piston teeth for scores or excessive wear. Inspect the external ground surfaces for wear, scoring or burrs.

Assembly

1. If the teflon oil seal and "O" ring was removed, install a new "O" ring and seal lubricated with Type "A" Transmission Fluid in the groove of the rack-piston.
2. Slide the worm all the way into the rack-piston. It is not necessary to have the thrust bearing assembly on the worm at this time.
3. Turn the worm until the worm groove is aligned with the lower ball return guide hole (fig. 48).
4. Lubricate the balls with Type "A" Transmission Fluid, then feed 16 balls into the rack-piston, while slowly rotating the worm counter-clockwise.

   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 6 balls into the return guide and retain with petrolatum. Install balance of balls into piston alternating black and silver. It will be necessary to rotate worm while installing balls. Install the return guide assembly onto the rack-piston. Install the return guide clamp and tighten the 2 clamp screws 10 ft. lbs.
6. Check the ball drag if a new set of balls were installed. Refer to RACK-PISTON -- DISASSEMBLY, Step 1c.

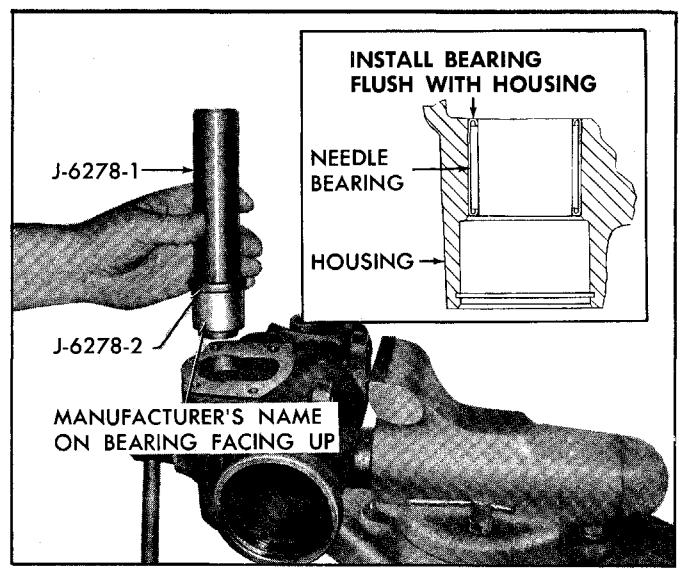


Fig. 50—Installing Pitman Shaft Bearing

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

Pitman Shaft Needle Bearing and Seals

Removal

1. If pitman shaft seals ONLY are to be replaced, remove the seal retaining ring and outer steel washer, then pry out the outer seal. Remove the inner steel washer, then pry out the inner seal (fig. 49).
2. If pitman shaft needle bearing replacement is necessary, remove with Tool J-6278.

Installation

1. If the pitman shaft needle bearing was removed, place Adapter J-6728-2 over Tool J-6278; slide the new needle bearing on the tool with the bearing manufacturer's identification against the adapter and drive the bearing into the housing until adapter bottoms in housing (fig. 50).
2. Lubricate the lips of the oil seals with Type "A" Transmission Fluid.
3. Install the pitman shaft oil seals as follows:
   a. Place Adapter J-6278-2 over Tool J-6278, then, install the outer seal (double lip), inner steel washer, and inner seal with the lips of 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. 51).
   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 with Adapter J-6278-2 and continue driving the seals until the retaining ring seats in its groove (Refer to Inset, Figure 51), then remove the tool adapter.

Assembly

1. Lubricate the worm, lower thrust bearing and the two thrust washers with Type "A" Transmission Fluid, then install one thrust washer, the bearing, and the other thrust washer over the end of the worm (fig. 52).
2. Lubricate the valve body teflon rings and a new lower shaft cap "O" ring with petrolatum. Install the lower shaft cap "O" ring in the valve body so it is seated against the lower shaft cap. Align the NARROW NOTCH in the valve body with the pin in the worm, then install the valve and shaft assembly in the gear housing (fig. 53). 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 (fig. 54).

   NOTE: The valve body is properly seated when the oil return hole in the housing is entirely uncovered (fig. 55).

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. 55). Remove Seal

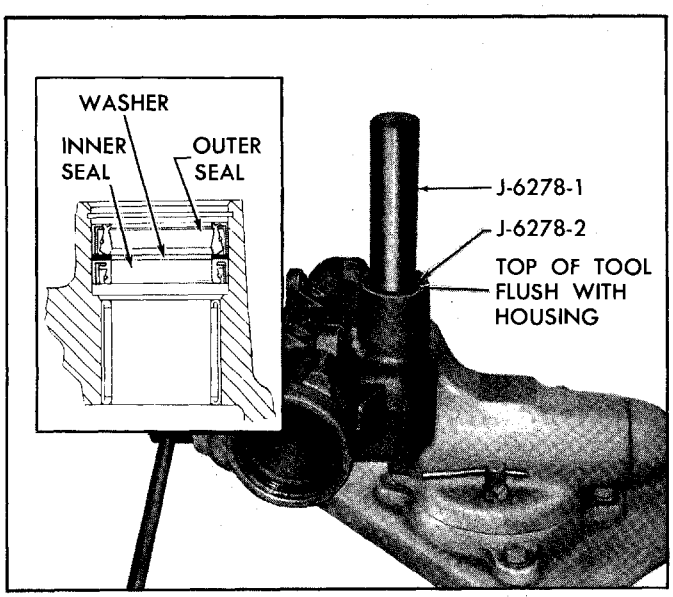


Fig. 51—Installing Pitman Shaft Seals

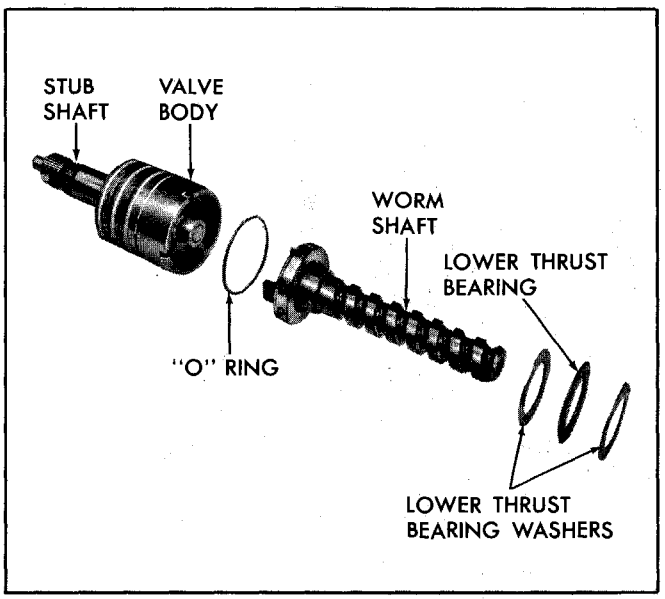


Fig. 52—Worm and Valve Body—Exploded View

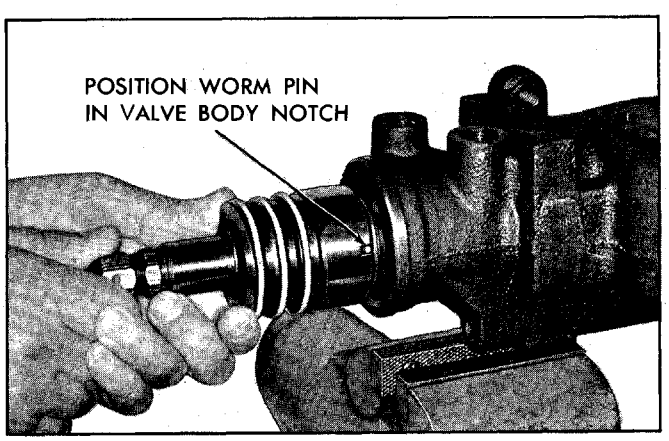


Fig. 53—Valve to Worm Alignment

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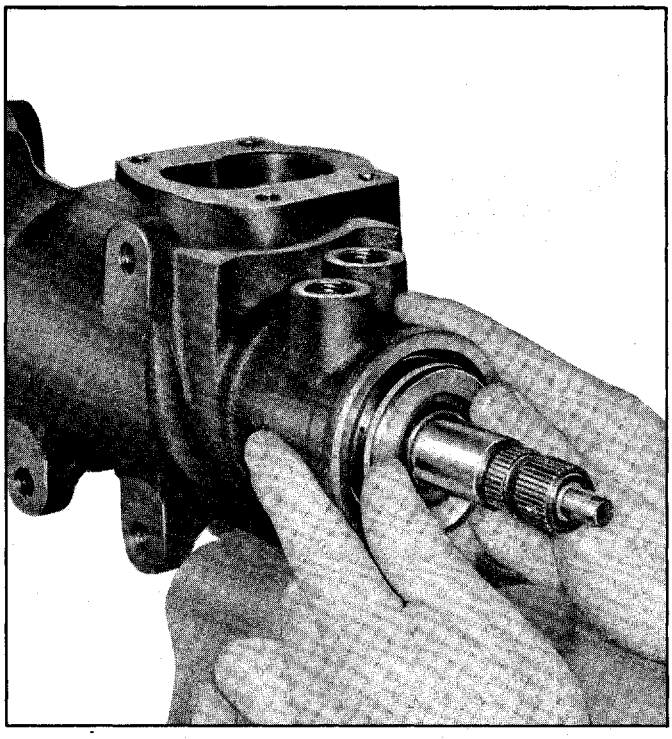


Fig. 54—Installing Valve Body

Protector. Do not adjust the thrust bearing preload at this time.

4. Install the rack-piston as follows:
   a. Lubricate the rack-piston teflon seal with petrolatum, and install on rack-piston (fig. 57).
   b. Position Seal Compressor J-8947 against the shoulder in the housing.
   c. With Ball Retainer J-7539 in place in the rack-piston, push the rack-piston (with teeth toward pitman shaft opening), into the housing until Tool J-7539 contacts the center of worm (fig. 58).
   d. Turn the lower shaft clockwise with a 3/4" twelve point socket or box end wrench to thread the rack-piston onto the worm while holding Tool J-7539 against the end of the worm.
   e. When the rack-piston is completely threaded on the worm, remove Ball Retainer J-7539 and Seal Compressor J-8947.
5. 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.

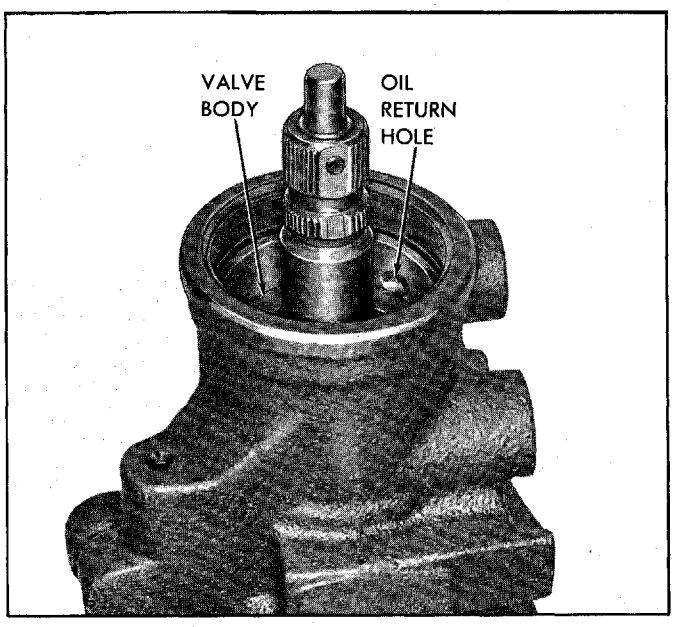


Fig. 55—Valve Body Position in Housing

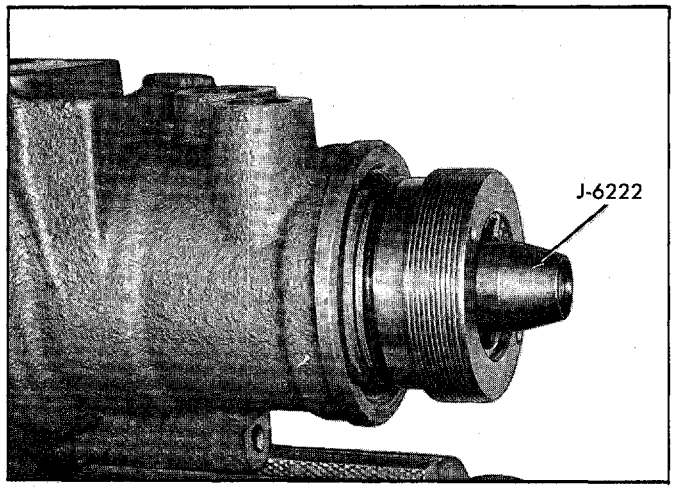


Fig. 56—Installing Adjuster Plug

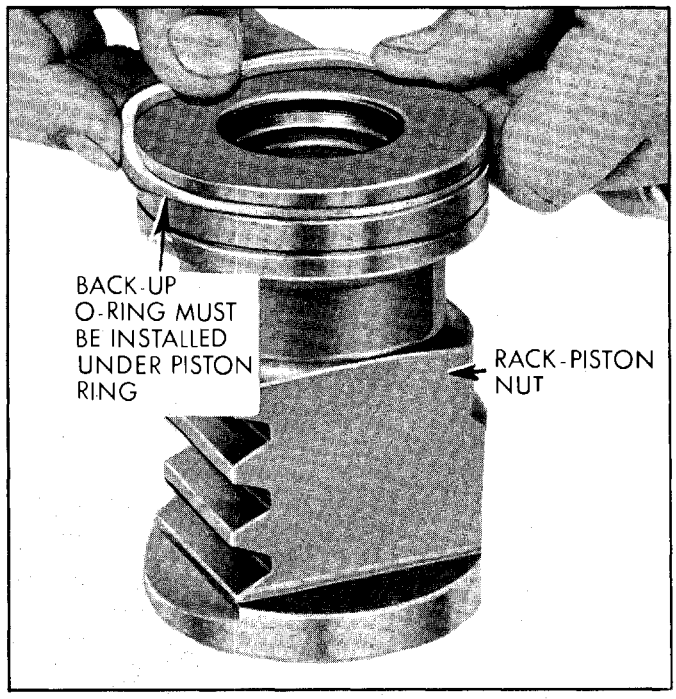


Fig. 57—Installing Ring on Rack-Piston

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c. Install the side cover bolts and lock washers and tighten 30 ft. lbs.

6. Install the rack-piston plug in the rack-piston.
7. Install a new housing end cover "O" ring and lubricate it with petrolatum, then install the end cover and retaining ring.
8. Adjust the thrust bearing preload as follows:
   a. Using Spanner Wrench J-7624, tighten adjuster plug up snug (clockwise). Back adjuster plug off 1/8 turn and measure valve drag.
   b. Adjust thrust bearing preload to obtain 1/2 to 2 in. lbs. in excess of valve assembly drag. Tighten adjuster plug locknut 80 ft. lbs. using Spanner Wrench J-972 while holding adjuster plug in position with Tool J-7624 (fig. 59).
9. Adjust the over-center preload 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 3/4", 12 point socket on the lower shaft splines.
   c. Rotate the lower shaft from one stop to the other. Count the number of turns and locate the center of travel, then check the combined ball and thrust bearing preload by rotating the torque wrench through the center of travel. Note the highest reading.

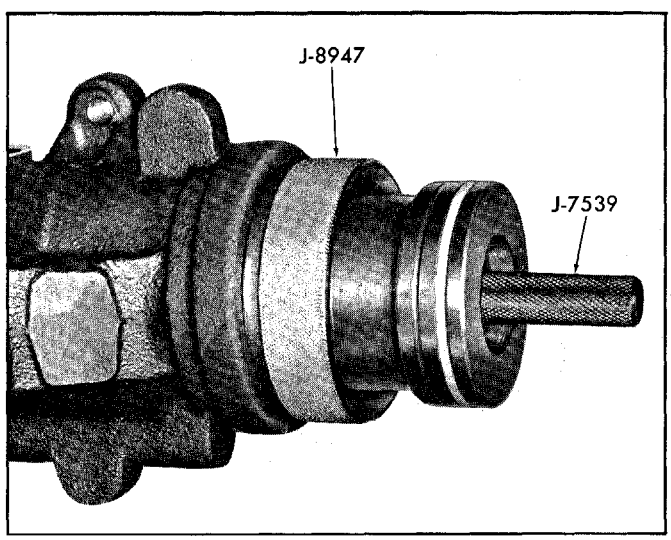


Fig. 58—Installing Rack-Piston

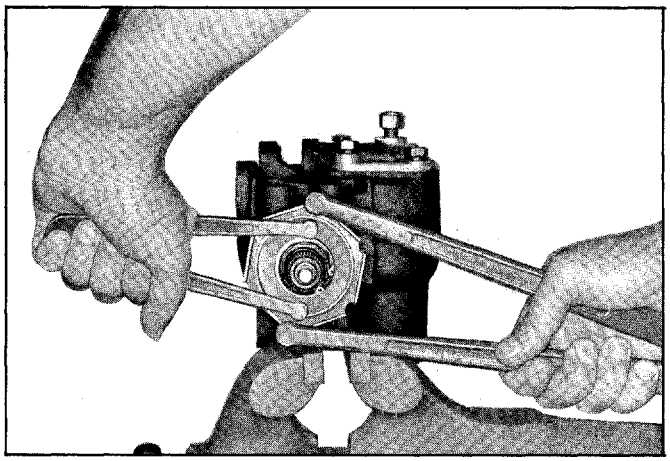


Fig. 59—Locking Preload Adjustment

   d. Tighten the pitman shaft over-center adjusting screw until the torque wrench reads 3-6 in. lbs. higher than the reading noted in Step c. The total reading should not exceed 14 lb. in.
   e. While holding the adjusting screw, tighten the locknut 25 ft. lbs. using Adapter J-5860 (fig. 60) and recheck the adjustment.
10. Position the coupling flange onto the lower shaft, then install the flange attaching bolt and lock washer. Tighten the coupling flange attaching bolt 30 ft. lbs.

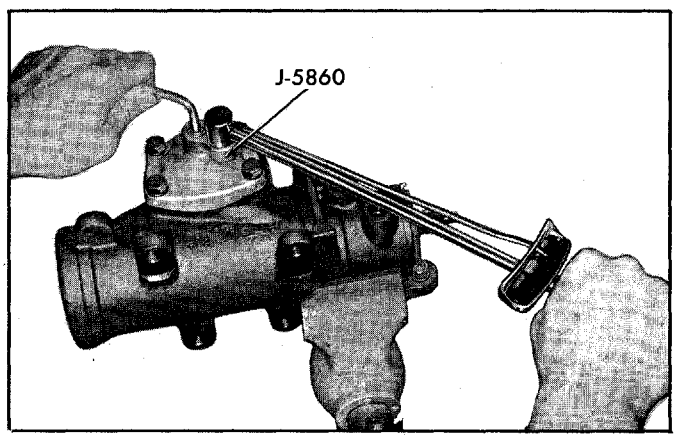


Fig. 60—Torquing over Center Locknut

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CONTROL VALVE (CHEVY II AND CORVETTE)

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GENERAL DESCRIPTION

The control valve used on the Chevy II and Corvette linkage type power assist steering is overhauled in the following manner. As in all other hydraulic units cleanliness is an important factor when servicing the unit.

OVERHAUL OPERATIONS

Disassembly

1. Place the valve in a vise as shown and remove dust cover (fig. 61).
2. Remove adjusting nut (fig. 62).
3. Remove valve to adapter bolts and remove valve housing and spool from adapter.
4. Remove spool from housing (fig. 63).
5. Remove spring, reaction spool, washer reaction spring, spring retainer, and seal (fig. 64), "O" ring may now be removed from the reaction spool.
6. Remove the annulus spacer valve shaft washer and plug to sleeve key (See Figure 65).
7. Remove clamp by removing nut, bolt and spacer or, if crimped type clamp is used, straighten clamp end and pull clamp and seal off end of stud (fig. 65).
8. Carefully, so as not to nick the top surface, turn adjuster plug out of sleeve (fig. 67).
9. Remove the adapter from the vise and invert, permitting the spring and one of the two ball seats to fall free.
10. Remove the ball stud and the other ball set and the sleeve will fall free.

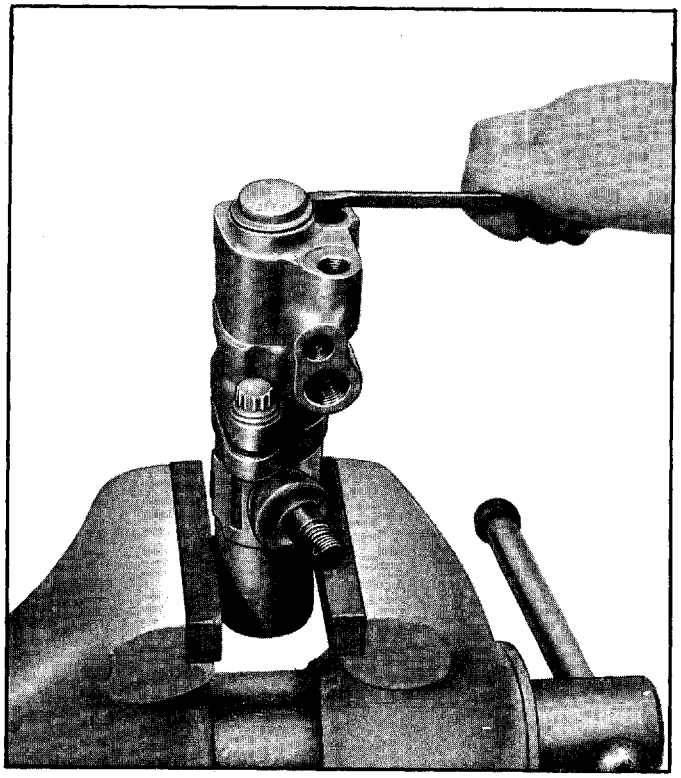


Fig. 61—Dust Cap Removal

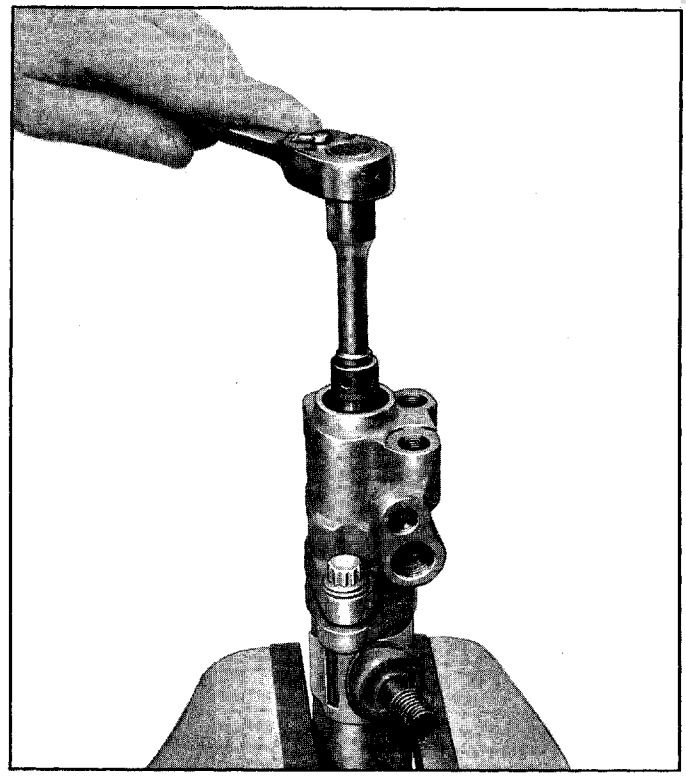


Fig. 62—Removing Adjusting Nut

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Fig. 63—Removing Spool from Housing

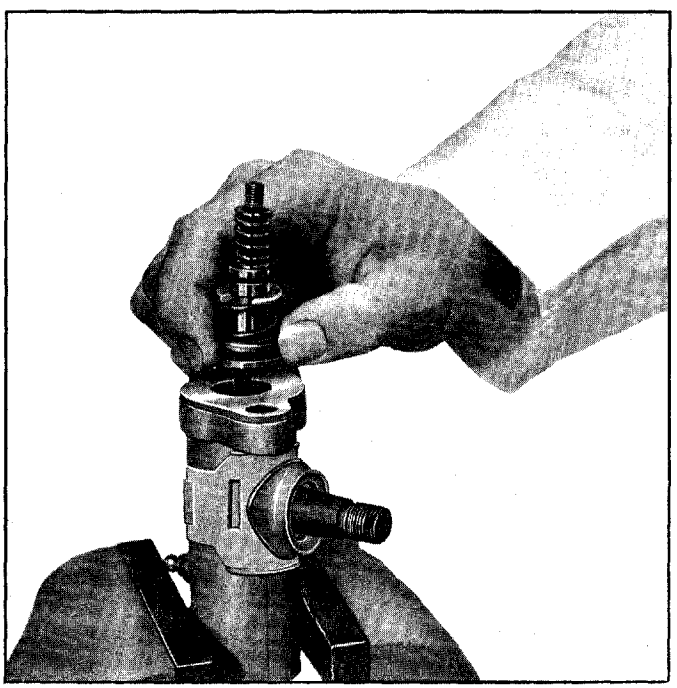


Fig. 64—Removing Valve Parts from Shaft

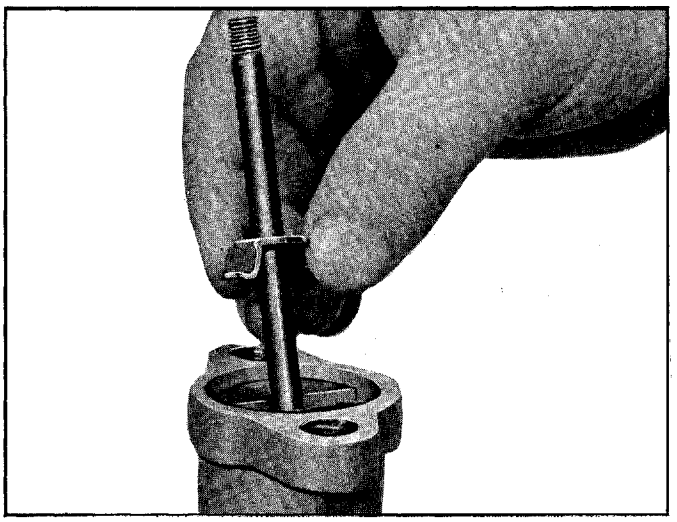


Fig. 65—Removing Plug-to-Sleeve Key

Inspection

1. Wash all metal parts in nontoxic solvent and blow dry with compressed air.
2. Inspect all parts for scratches, burrs, distortion, evidence of wear and replace all worn or damaged parts, including mating parts when necessary.
3. Replace all seals, gaskets, covers with approved service parts.

Repairs

NOTE: Corvette valve incorporates a 55 lb. centering spring which is physically but not functionally interchangeable with the Chevy II spring, which is a 30 lb. spring. The Corvette valve incorporating this spring is identified by an "X" stamped on the dust cover.

In case a connector seat becomes damaged, proceed as follows:

To remove connector seat, tap threads in center hole using a 5/16-18 tap. Thread a bolt with nut and flat washer attached into tapped hole so that the washer rides against the face of the port boss and the nut rides against

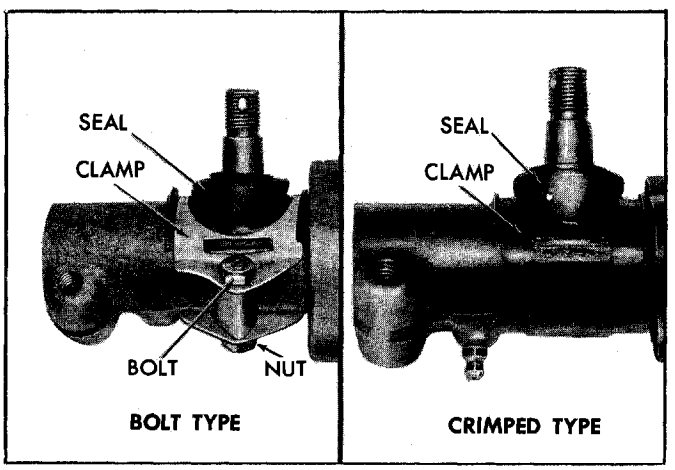


Fig. 66—Seal with Clamp Attachment

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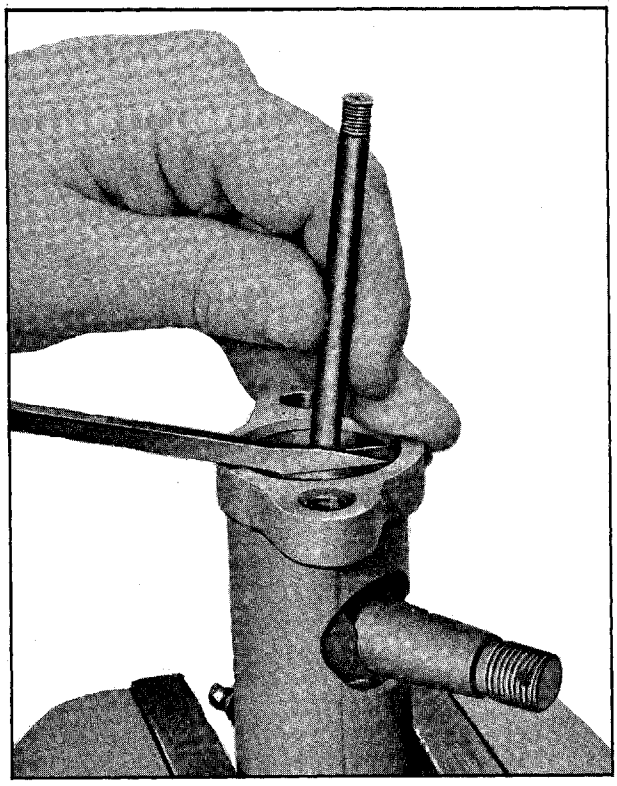


Fig. 67—Turning Adjuster Plug out of Sleeve

2. Clamp the adapter in vise, put the shaft through the seat in the adjuster plug and screw adjuster plug in sleeve (fig. 71).
3. Turn the plug in until it is tight, then back it off until the slot lines up with notches in the sleeve.
4. Install new seal and clamp over stud so lips on seal mate with clamp. (A nut and bolt attachment type clamp replaces the crimped type for service fig. 60).
5. Center the ball stud, seal and clamp at opening in adapter housing, then install spacer, bolt and nut.
6. Insert the key, making sure that the small tangs on the ends of the key fit into the notches in the sleeve (fig. 72).
7. Install the valve shaft washer, annulus spacer, and the reaction seal (lip up), spring retainer, reaction spring and spool, washer and adjustment spring. (Install "O" ring seal on reaction spool before installing spool on shaft.) Install the washer with the chamfer "up".
8. Install the seal on the valve spool (lip down), then install spool in housing being careful not to jam spool in housing.
9. Install housing and spool onto adapter. The side ports should be on the same side as the ball stud. Bolt the housing to the adapter.
10. Depress the valve spool and turn the locknut onto the shaft about four turns with a clean wrench or socket.

NOTE: Always use a new nut.

the washer. Hold the bolt from rotating while turning the nut off the bolt. This will force the washer against the port boss face and will back out the bolt thus drawing the connector seat from the top cover housing (fig. 68). Discard the connector seat. Clean the housing out thoroughly to remove any tapping chips.

Drive new connector seat against housing seat, using Tool J-6217, being careful not to damage either the connector seat or the housing seat (fig. 69).

Assembly (Fig. 70)

1. Replace the sleeve and ball seat in the adapter, then the ball stud, and finally the other ball seat and the spring, small coil down.

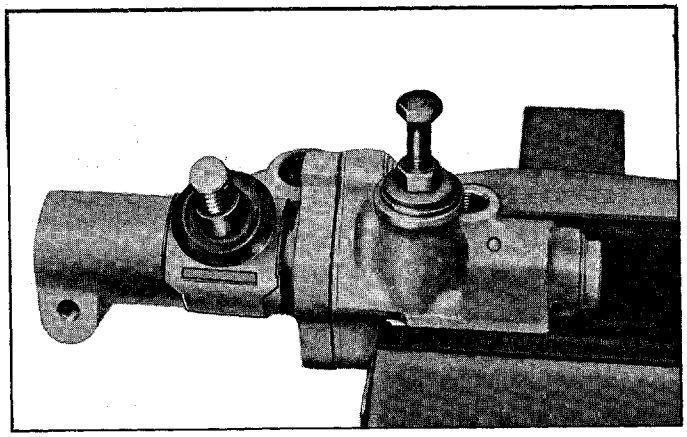


Fig. 68—Removing Connector Seat

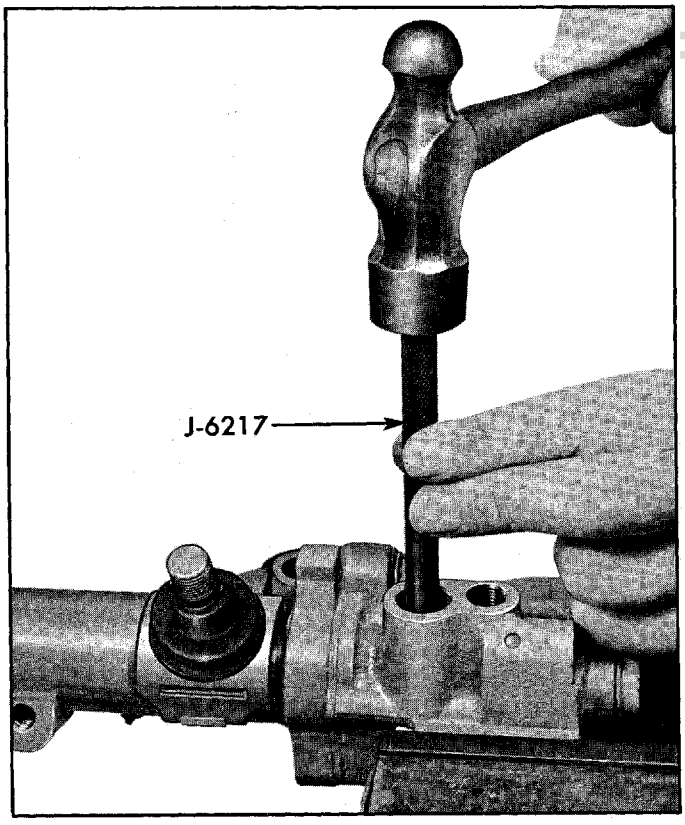


Fig. 69—Installing Connector Seat

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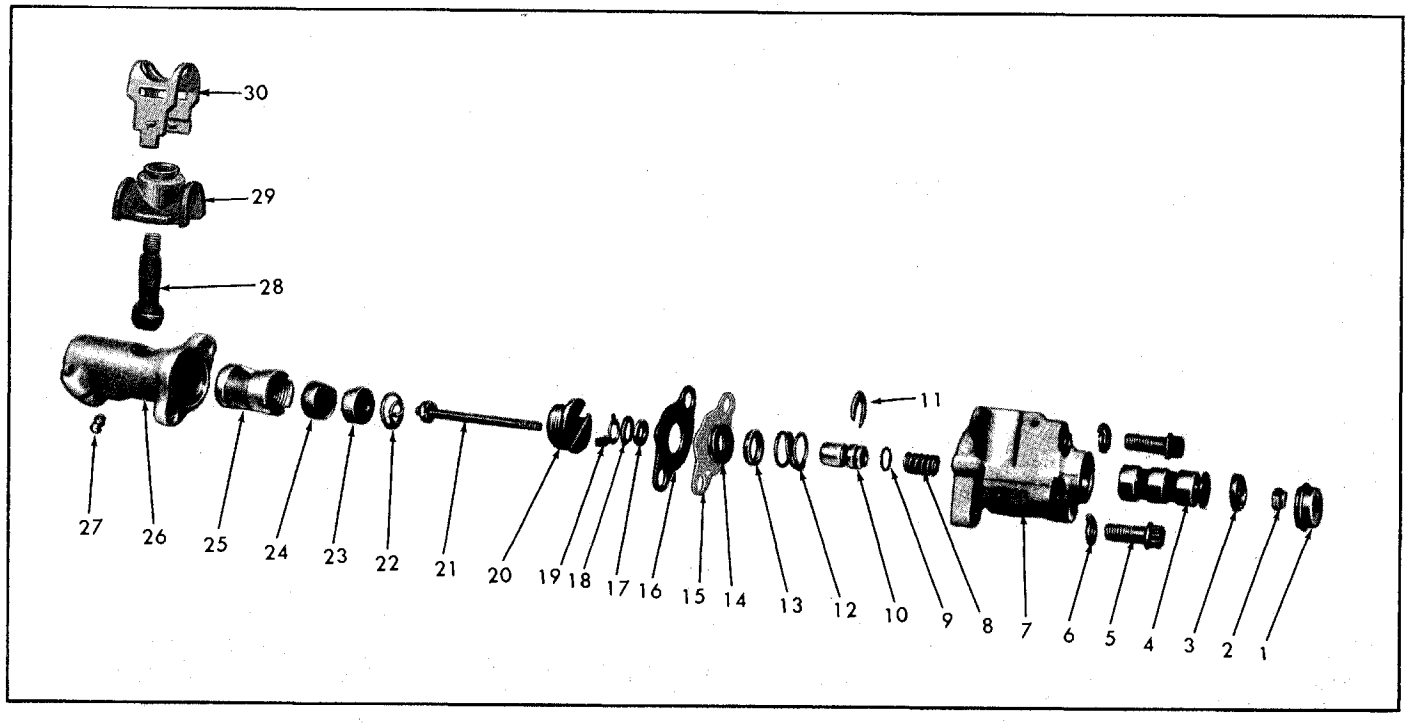


Fig. 70—Power Steering Control Valve and Adapter—Exploded View

1. Dust Cover
2. Adjusting Nut
3. Vee Block Seal
4. Valve Spool
5. Valve Mounting Bolts
6. Lock Washer
7. Valve Housing
8. Valve Adjustment Spring
9. "O" Ring Seal
10. Valve Reaction Spool
11. Spring Thrust Washer
12. Valve Spring
13. Spring Retainer
14. Annulus Seal
15. Annulus Spacer
16. Gasket
17. Valve Shaft Washer
18. "O" Ring Seal
19. Plug to Sleeve Key
20. Ball Adjuster Nut
21. Valve Shaft
22. Ball Seat Spring
23. Ball Seat
24. Ball Seat
25. Sleeve Bearing
26. Adapter Housing
27. Lubrication Fitting
28. Ball Stud
29. Seal
30. Clamp

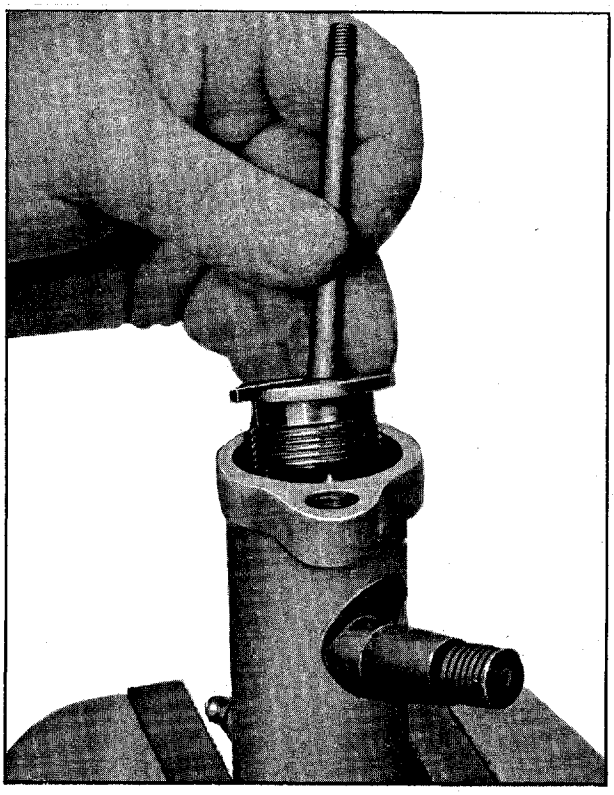


Fig. 71—Replacing Adjuster Plug and Shaft

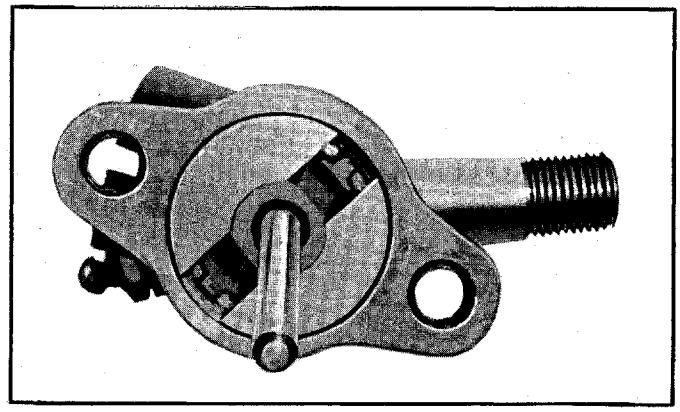


Fig. 72—Proper Key Installation

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SPECIAL TOOLS

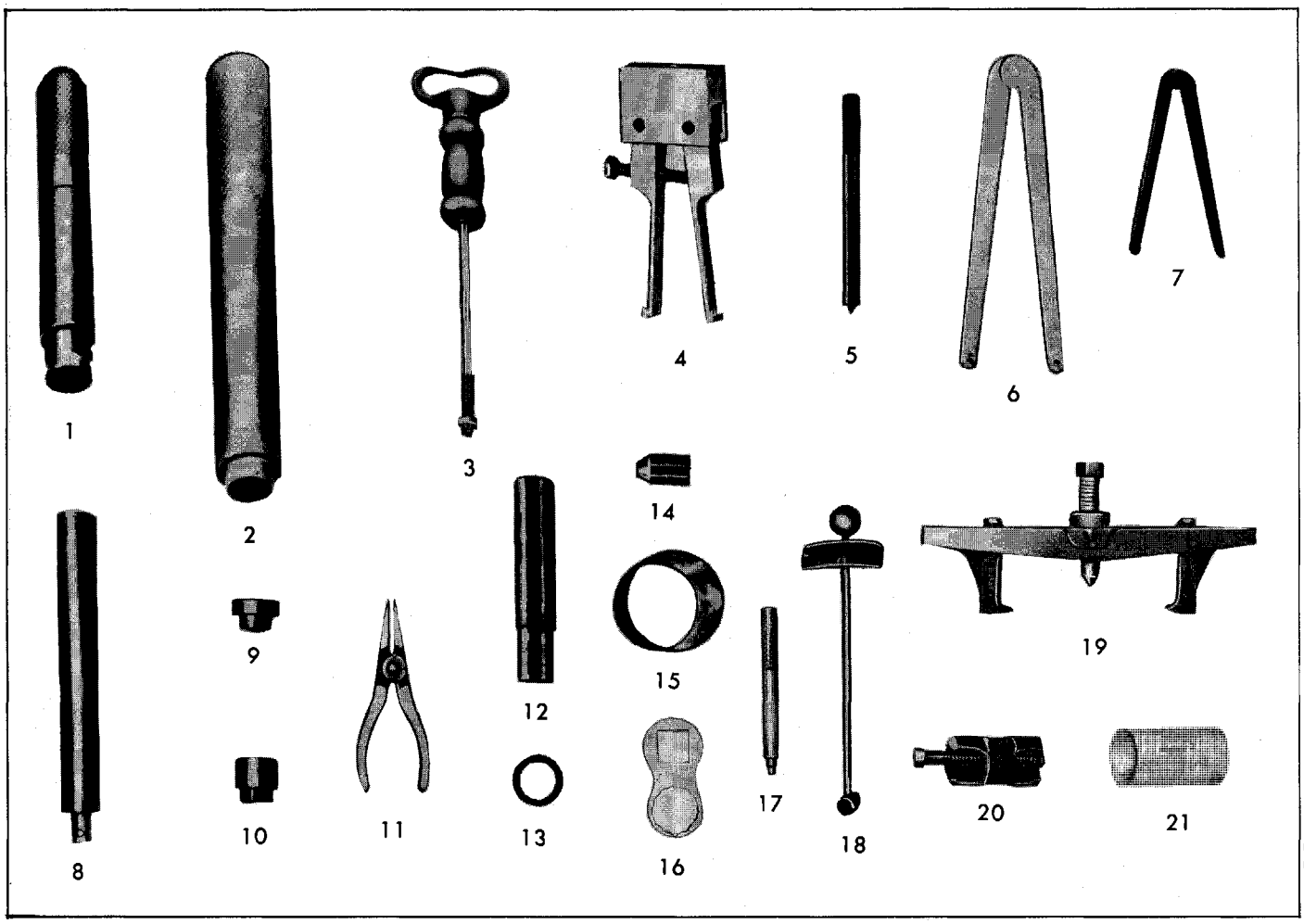


Fig. 73—Special Tools

1.	J-1614	Pitman Shaft Bushing Remover and Installer
2.	J-5755	Steering Shaft Bearing Cup Installer
3.	J-2619	Slide Hammer Assembly
4.	J-5822	Wormshaft Bearing Cup Remover
5.	J-7539	Rack-Piston Arbor
6.	J-972	Spanner Wrench
7.	J-7624	Spanner Wrench
8.	J-7079-2	Drive Handle
9.	J-8524-1	Adjuster Plug Bearing and Seal Installer
10.	J-8524-2	Adjuster Plug Bearing and Seal Remover
11.	J-5403	Snap Ring Pliers
12.	J-6278	Pitman Shaft Bearing and Seal Remover
13.	J-6278-2	Pitman Shaft Bearing and Seal Installer
14.	J-6222	Adjuster Plug Seal Protector
15.	J-8947	Rack-Piston Ring Compressor
16.	J-5860	Torque Wrench Adapter
17.	J-6217	Connector Seat Installer
18.	J-1315	Torque Wrench (in. lbs.)
19.	J-8433-1	Power Steering Pump Pulley
	J-8433-2	Remover (Cast Iron Pulleys)
20.	J-21239	Power Steering Pump Pulley Remover (Stamped Pulleys)
21.	J-22670	Pump Shaft Seal Installer

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SPECIFICATIONS

HEATING AND AIR CONDITIONING

SECTION 1A

Compressor	
Make	Frigidaire
Type	6 Cylinder Axial
Displacement	
Four-Season	12.6 Cu. In.
Universal and All-Weather	10.8 Cu. In.
Rotation	Clockwise
Compressor Suction and Discharge Connector Bolt Torque	25 ft. lbs.
Compressor Clutch Coil	
Ohms (at 80°F.)	4.18-4.38
Amps (at 80°F.)	2.86 @ 12 Volts
Torques	
Rear Head to Shell Stud Nut	23 lb. ft.
Shaft Mounting Nut	15 lb. ft.
Belt Tension	See Tune-Up Chart

System Capacities	
Refrigerant	R-12
Four-Season and Comfortron Systems	3 lbs., 12 oz.
Universal Systems	
Chevrolet, Chevelle, and Camaro	3 lbs.
Chevy II	2 lbs. 8 oz.
All-Weather System	2 lbs. 8 oz.
Compressor Oil	525 Viscosity
All Systems	11 oz.

Fuses	Fuse Block	In Line
Comfortron Systems	25 amp.	30 amp.
Four-Season Systems	25 amp.	30 amp.
Universal Systems	25 amp.	20 amp.
All-Weather System	25 amp.	20 amp.

FRONT SUSPENSION

SECTION 3

WHEEL ALIGNMENT SPECIFICATIONS (Vehicle at Curb Weight)

	Chevrolet	Chevelle	Chevy II	Corvette	Camaro
Caster*	Pos. 3/4° ± 1/2°	(SS and El Camino) Neg. 1/2° ± 1/2° (All others) Neg. 1° ± 1/2°	Pos. 1° ± 1/2°	Pos. 1° ± 1/2°	Pos. 1/2° ± 1/2°
Camber*	Pos. 1/4° ± 1/2°	Pos. 1/2° ± 1/2°	Pos. 1/2° ± 1/2°	Pos. 3/4° ± 1/2°	Pos. 1/4° ± 1/2°
Steering Axis Inclination	7-1/2° ± 1/2°	8-1/4° ± 1/2°	7° ± 1/2°	7° ± 1/2°	8 3/4° ± 1/2°
†Toe-In (Total)	@1/8" to 1/4"	1/8" to 1/4"	1/4" to 3/8"	3/16" to 5/16"	1/8" to 1/4"
Wheel Bearing Adjustment Preload End Movement	12 ft. lbs. zero .001" to .008"	12 ft. lbs. zero .001" to .008"	12 ft. lbs. zero .000" to .004"	12 ft. lbs. zero .001" to .008"	12 ft. lbs. zero .001" to .008"

*Must not vary more than 1/2° from side to side.
@Toe-In (Total) should be 5/16" to 7/16" after rebuild using new bushings and ball joints.
†Adjust Toe-in with steering gear on straight ahead location after camber and caster have been set. Any change in caster and camber settings will affect toe; always recheck and set toe to specifications.

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RIDING HEIGHT MEASUREMENT*

Chevrolet	All Biscayne and Bel Air 2 and 4 Doors, All Impala and Caprice 4 Doors and All Station Wagons	5-1/8" ± 1/2"
	All Impala and Caprice 2 Doors	5-3/8" ± 1/2"
Chevelle	All Sedans	1-3/8" ± 1/2"
	SS Coupe and Convertible	1-1/8" ± 1/2"
	El Camino and Station Wagons	2" ± 1/2"
Chevy II	All 4 and 6 Cylinder Standard 2 and 4 Doors, All Station Wagons, and 6 Cylinder Nova 4 Door	3-3/4" ± 1/2"
	All 8 Cylinder Standard 2 and 4 Doors, All Nova 2 Doors and 8 Cylinder Nova 4 Door	3-1/4" ± 1/2"
Corvette	With 327 or 427 Engine	2-1/2" ± 1/2"
	327 Engine with A/C or 427 Engine with A/C, P.S., and P.B.	2" ± 1/2"
	Convertible with 327 Engine, Hardtop, A/C, P.S., P.B., and Powerglide	1-1/2" ± 1/2"
	427 Engine with Optional Suspension	1-1/2" ± 1/2"
Camaro	With 230 Engine	2-3/4" ± 1/2"
	With 250 Engine	2-7/8" ± 1/2"
	With 283 - 327 and 350 Engine	2-5/8" ± 1/2"

*Must be within 1/2" from side to side

BOLT TORQUES

TORQUES	Chevrolet	Chevelle	Chevy II	Corvette	Camaro
Spherical Joint					
Upper Stud Nut	50 ft. lbs.	50 ft. lbs.	45 ft. lbs.	45 ft. lbs.	50 ft. lbs.
Lower Stud Nut	80 ft. lbs.	80 ft. lbs.	45 ft. lbs.	20 ft. lbs.	65 ft. lbs.
Stud to Control Arm Nuts (Service)	25 ft. lbs.	25 ft. lbs.	25 ft. lbs.	20 ft. lbs.	25 ft. lbs.
Lower Forging Nut	40 ft. lbs.	—	—	—	—
Steering Arm Attaching Nuts	50 ft. lbs.	85 ft. lbs.	65 ft. lbs.	—	85 ft. lbs.
Shock Absorber					
Upper Shaft Nut	8 ft. lbs.	8 ft. lbs.	8 ft. lbs.	20 ft. lbs.	8 ft. lbs.
Lower Attachment	15 ft. lbs.	20 ft. lbs.	9 ft. lbs.	10 ft. lbs.	20 ft. lbs.
Bracket to Spring Tower	—	—	9 ft. lbs.	—	—
Stabilizer Bar					
Frame Bracket Bolts	15 ft. lbs.	15 ft. lbs.	9 ft. lbs.	10 ft. lbs.	15 ft. lbs.
Link Nuts	8 ft. lbs.	8 ft. lbs.	10 ft. lbs.	10 ft. lbs.	8 ft. lbs.
Strut Rod					
Rod to Arm Nut	70 ft. lbs.	—	45 ft. lbs.	—	—
Adjustment Nut	80 ft. lbs.	—	80 ft. lbs.	—	—
Front Spring					
Spring Seat to Control Arm Nuts	—	—	30 ft. lbs.	—	—
Lower Control Arm					
Inner Pivot Nuts	115 ft. lbs.	80 ft. lbs.	65 ft. lbs.	95 ft. lbs.	85 ft. lbs.
Upper Control Arm					
Attaching Nuts	75 ft. lbs.	50 ft. lbs.	50 ft. lbs.	35 ft. lbs.	50 ft. lbs.
Collar Bolts	45 ft. lbs.	45 ft. lbs.	50 ft. lbs.	40 ft. lbs.	45 ft. lbs.
Brake Anchor Pin					
Drum Brakes	130 ft. lbs.	130 ft. lbs.	130 ft. lbs.	—	130 ft. lbs.
Brake Anchor Bolt					
Disk Brakes	—	—	—	75 ft. lbs.	—
Lower Control Arm Cross Shaft Bolts					
Front	—	—	—	70 ft. lbs.	—
Rear	—	—	—	135 ft. lbs.	—
Wheel Stud Nuts	65 ft. lbs.	65 ft. lbs.	65 ft. lbs.	75 ft. lbs.	65 ft. lbs.

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REAR SUSPENSION

REAR AXLE

SECTION 4

CHEVROLET, CAMARO, CHEVELLE AND CHEVY II

Gear Backlash . . (.005"-.008" preferred) .003"-.010"
Pinion Bearing Preload (in. lbs.)
- New 20-30
- Used 5-15

Lubricant Capacity
- Large Carrier . . . . . 4-1/2 pints
- Small Carrier . . . . . 3-1/2 pints

Bolt Torques (Ft. Lbs.)
- Carrier Cover 20
- Ring Gear 50
- Differential Bearing Caps 55
- Filler Plug 20
- Differential Pinion Lock 20

CORVETTE

Gear Backlash . (.005"-.008" preferred) . . .003"-.010"
Pinion Bearing Preload (in. lbs.)
- New 20-25
- Used 5-15

Lubricant Capacity . . . . . 3-3/4 pints
Bolt Torques (Ft. Lbs.)
- Carrier Cover 50
- Ring Gear 50
- Differential Bearing Caps 55
- Filler Plug 20
- Differential Pinion Lock 20

	Chevrolet	Chevelle	Chevy II	Camaro	Corvette
Type Heavy Duty Axle Light Duty Axle	4-Link System 3-Link System	4-Link System	Semi-Elliptic Tapered Single Leaf	Semi-Elliptic Tapered Single Leaf	Independent Three-Link System
Bolt Torque (ft. lbs.) Spring Retainer	25		40	50	65
Control Arm Upper Front Bracket	55				
Upper Bushings	70	80			
Lower Bushings	110	80			
Shock Absorber Upper Nut	15	12	10	8	50
Upper Bracket			10	10	
Lower Nut	65	65	50	45	35
Spring Shackle Front			55	100	
Rear			50	50	
Tie Rod Attaching Nuts	65				
Stud to Axle Bracket	110				
Universal Joint Companion Flange	15	15	15	15	15
Transmission Yoke					15
Wheel Stud Nuts	65	65	65	65	75
Axle Drive Shaft to Spindle					75
to Yoke					15

@ Station Wagon all 4-Link System

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	Chevrolet	Chevelle	Chevy II	Camaro	Corvette
Stabilizer Shaft Bracket to Frame					120
Bracket to Torque Arm					120
Link Bushings					25
Rebound Bumper to Frame					20
Crossmember to Frame					25
Crossmember to Carrier					60
Carrier Front Support to Crossmember					65
Front Bolt					50*
Rear Bolt					50
Drive Spindle Nut					100*
Drive Spindle Support to Torque Arm					30
Strut Rod to Spindle Support					80*
Bracket to Carrier					45
Camber Cam					65
Torque Arm Pivot					50
Spring Link Bolt to Torque Arm				Install nut to expose hole (Corvette only) then insert cotter pin.	
Wheel Alignment # Camber (Degrees)					Neg. 1/2° ± 1/2°
Toe-In (Total)					1/32" to 3/32"

@Station Wagon All 4-Link System
* Plus additional torque necessary to line up cotter pin hole.
Camber must not vary more than 1/2 degree from side to side. Toe setting must be made after camber is set.

RIDING HEIGHT

Body Style				
2 Door Sedan	6-1/2" ± 3/8"	5.0" ± 3/8"	6-1/8" ± 3/8"	
4 Door Sedan	6-7/16" ± 3/8"	5.0" ± 3/8"	6-1/16" ± 3/8"	
4 Door Sport Sedan	6-7/16" ± 3/8"	5.0" ± 3/8"		
Sport Coupe	6-1/2" ± 3/8"	4-3/4" ± 3/8"	4-15/16" ± 3/8"	5-1/4" ± 3/8"
Convertible	6-7/16" ± 3/8"	6-1/2" ± 3/8"		5-3/16" ± 3/8"
Station Wagon	6-7/8" ± 3/8"	6-1/4" ± 3/8"	5-13/16" ± 3/8"	
Sedan Pickup		6-3/8" ± 3/8"		
Super Sport Coupe & Convertible		3-3/8" ± 3/8"		

All settings are made at curb weight.

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BRAKES

SECTION 5

	Chevrolet	Chevelle	Chevy II	Camaro	Corvette
Type	Duo Servo Self Adjusting				Disc
Brake Drums Diameter	11"	9-1/2		9-1/2	—
Maximum Out of Round	.008"				—
Maximum Rebore	.060"				—
Brake Shoes Width Front	2-3/4	2-1/2		2-1/2	2-7/32
Rear	2	2		2	
Length Primary	9-1/4	9		9	5-31/32
Secondary	11-41/64	9-3/4		9-3/4	
Wheel Cylinder Diameter Front	1-3/16	1-1/8	1-1/16	1-1/8	1-7/8
Rear	1	15/16	7/8	15/16	1-3/8

TORQUE CHART

APPLICATION	Chevrolet	Chevelle	Chevy II	Camaro	Corvette
Brake Pipe Distribution and Switch Assembly Mounting Screws	—	60 lb. in.	150 lb. in.	—	90 lb. in.
Main Cylinder to Firewall Mounting Nuts	24 lb. ft.	24 lb. ft.	24 lb. ft.	24 lb. ft.	24 lb. ft.
Push Rod Clevis Nut	14 lb. ft.	14 lb. ft.	14 lb. ft.	14 lb. ft.	14 lb. ft.
Brake Hydraulic Pipe to Main Cylinder and Switch Connections	100 lb. in. (Front Line) 115 lb. in. (Rear Line)	115 lb. in.	115 lb. in.	115 lb. in.	115 lb. in.
Brake Hose to Brake Assembly Connection	23 lb. ft.	23 lb. ft.	23 lb. ft.	23 lb. ft.	23 lb. ft.
Parking Brake Equalizer Check Nut	85 lb. in.	85 lb. in.	—	85 lb. in.	70 lb. in.
Hydraulic Brake Pipe Connections	110 lb. in.	100 lb. in. (Front) 120 lb. in. (Rear)	100 lb. in.	100 lb. in.	100 lb. in.
Rear Brake Hose to Rear Brake Line "T" Connection	113 lb. in.	113 lb. in.	65 lb. in.	113 lb. in.	113 lb. in.
Caliper Half Retaining Bolts	130 lb. ft.	130 lb. ft.	130 lb. ft.	130 lb. ft.	130 lb. ft.
Caliper to Mounting Bracket Retaining Bolts	130 lb. ft.	130 lb. ft.	130 lb. ft.	130 lb. ft.	130 lb. ft.

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ENGINE

SECTION 6

GENERAL DATA:																				
Type			IN LINE				V8													
Displacement			153	194	230	250	283	327					350	396		427				
Horsepower @ rpm			90 @ 4000	120 @ 4400	140 @ 4400	155 @ 4200	195 @ 4600	210 @ 4600	275 @ 4800	300 @ 5000	325 @ 5600	350 @ 5800	295 @ 4800	325 @ 4800	350 @ 5200	385 @ 5200	390 @ 5400	400 @ 5400	425 @ N.A.	435 @ 5800
Torque @ rpm			152 @ 2400	177 @ 2400	220 @ 1600	235 @ 1600	285 @ 2400	320 @ 2400	355 @ 3200	360 @ 3400	355 @ 3600	360 @ 3600	380 @ 3200	410 @ 3200	415 @ 3400	460 @ 3400	460 @ 3600	460 @ 3600	N.A.	460 @ 4000
Bore			3-7/8"	3-9/16"	3-7/8"		4"							4-3/32"		4-1/4"				
Stroke			3.25"			3.53"	3"	3.25"					3.48"	3.76"						
Compression Ratio			8.5:1				9.25:1	8.75:1	10.0:1		11.0:1		10.25:1					N.A.	11.0:1	
Firing Order			1-3-4-2	1-5-3-6-2-4			1-8-4-3-6-5-7-2													
CYLINDER BORE:																				
Diameter			3.8745" 3.8775"	3.5620" 3.5650"	3.8745"-3.8775"		3.9995"-4.0025"							4.0925" 4.0995"		4.2495"-4.2525"				
Out of Round	Production		.005" (Max.)				.001" (Max.)													
	Service		.002" (Max.)																	
Taper	Production	Thrust Side	.0005" (Max.)																	
		Relief Side	.0005" (Max.)				.001" (Max.)													
Service			.005" (Max.)																	
PISTON:																				
Clearance	Production		.0005"-.0011"								.0024" .0030"	.0005" .0011"		.0007" .0013"		.0009" .0015"		.0054" .0063"		.0037" .0043"
	Service		.0025" (Max.)								.0050" (Max.)	.0025 (Max.)						.0085" (Max.)		.0065" (Max.)
PISTON RING:																				
COMPRESSION	Clearance Groove	Production	Top	.0012"-.0027"		.0020" .0035"	.0012"-.0027"				.0012"-.0032"			.0012"-.0032"						
			2nd	.0012"-.0032"		.0020" .0040"	.0012"-.0032"				.0012"-.0027"			.0012"-.0032"						
		Service		Hi Limit Production .001"																
	Gap	Production	Top	.010"-.020"				.013"-.023"			.010"-.020"			.010"-.020"						
			2nd	.010"-.020"				.013"-.025"			.013"-.023"			.010"-.020"						
		Service		Hi Limit Production .01"																
OIL	Groove Clearance	Production		.000"-.005"										.0012"-.0060"						
		Service		Hi Limit Production .001"																
	Gap	Production		.015"-.055"										.010"-.030"						
		Service		Hi Limit Production .01"																

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Displacement		153	194	230	250	283	327					350	396		427					
Horsepower		90	120	140	155	195	210	275	300	325	350	295	325	350	385	390	400	425	435	
PISTON PIN:																				
Diameter		.9270"-.9273"											.9895"-.9898"							
Clearance	Production	.00015"-.00025"								.00045" .00055"		.0015" .0025"	.00025"-.00035"					.00030" .00040"		
	Service	.001" (Max.)																		
Fit In Rod		.0008"-.0016" (Interference)																		
CRANKSHAFT:																				
Main Journal	Diameter	All 2.2983"-2.2993"				#1 2.2984"-2.2993" #2-3-4 2.2983"-2.2993" #5 2.2978"-2.2988"						#1-2-3-4 2.4483"-2.4493" #5 2.4478" 2.4488"	#1-2 2.7487"-2.7497" #3-4 2.7482"-2.7492" #5 2.7478"-2.7488"							
	Taper Production	.0002" (Max.)																		
	Taper Service	.001" (Max.)																		
	Out of Round Production	.0002" (Max.)																		
	Out of Round Service	.001" (Max.)																		
Main Bearing Clearance	Production	All .0003"-.0029"				#1 .0008"-.0020"						#1-2-3-4 .0008"-.0020"	#1-2 .0004"-.0020"							
						#2-3-4 .0018"-.0020"							#3-4 .0009"-.0025"							
						#5 .0010"-.0036"						#5 .0018"-.0034"	#5 .0013"-.0029"							
	Service	.004" (Max.)																		
Crankshaft End Play		.002"-.006"				.003"-.011"							.006"-.010"							
Crank-	Diameter	1.999"-2.000"										2.099"-2.100"	2.199"-2.200"							
	Taper Production	.0003" (Max.)																		
	Taper Service	.001" (Max.)																		
	Out of Round Production	.002" (Max.)																		
	Out of Round Service	.001" (Max.)																		
Rod Bearing Clearance	Production	.0007"-.0027"								.0007"-.0028"										
	Service	.004" (Max.)																		
Rod Side Clearance		.0085"-.0135"				.009"-.013"							.015"-.021"					.019"-.025"		
CAMSHAFT:																				
Lobe Lift ± .002"	Intake	.1712"	.1896"	.2217"		.260"				.2981"		.260"	.2714"					.3286"	.3057"	
	Exhaust	.1712"	.1896"	.2217"		.2733"				.2981"		.2733"	.2714"					.3412"	.3057"	
Journal Diameter		1.8682"-1.8692"										1.9482"-.1.9492								
Camshaft Runout		.0015" (Max.)																		

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Displacement			153	194	230	250	283	327				350	396		427					
Horsepower			90	120	140	155	195	210	275	300	325	350	295	325	350	385	390	400	425	435
VALVE SYSTEM:																				
Lifter			Hydraulic																Mechanical	
Rocker Arm Ratio			1.75:1				1.50:1						1.70:1							
Valve Lash	Intake		One Turn Down From Zero Lash																.022"*	.024"*
	Exhaust		One Turn Down From Zero Lash																.024"*	.028"*
Face Angle (Int. & Exh.)			45°																	
Seat Angle (Int. & Exh.)			46°**																	
Seat Runout (Int. & Exh.)			.002" (Max.)																	
Seat Width	Intake		1/32" - 1/16"																	
	Exhaust		1/16" - 3/32"																	
Stem Clearance	Production	Int.	.0010"-.0027"										.0010"-.0025"							
		Exh.	.0015"-.0032"				.0010"-.0027"						.0012"-.0027"							
	Service		Hi Limit Production + .001" Intake - .002" Exhaust																	
Valve Spring (Outer)	Free Length		2.08"	1.92"		1.90"	2.03"						2.11"	2.09"					2.21"	2.09"
	Pressure lbs. @ in.	Closed	78-86 @ 1.66"	54-64 @ 1.66"			N.A.						84-96 @ 1.88"	94-106 @ 1.88"					69-81 @ 1.88"	94-106 @ 1.88"
		Open	170-180 @ 1.26"	170-184 @ 1.33"		180-192 @ 1.27"	N.A.						210-230 @ 1.46"	303-327 @ 1.38"					181-205 @ 1.32"	303-327 @ 1.38"
	Installed Height ± 1/32"		1 21/32				1 5/32						1 7/8							
Valve Spring (Inner)	Free Length		N.A.																2.12"	N.A.
	Pressure lbs. @ in.	Closed	N.A.																37-45 @ 1.78"	N.A.
		Open	N.A.																92-110 @ 1.22"	N.A.
	Installed Height ± 1/32"			N.A.															1 3/4	N.A.
Damper	Free Length		1.94"	N.A.			1.94"						1.94"-2.00"						2.07"-1.95"	1.94"-2.00"
	Approx. # of Coils		4	N.A.			4						3 3/4						4 1/3	3 3/4

*Engine at operating temperature and running.

**Aluminum Heads 45°

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		CARTER							HOLLEY														
Carburetor		One Barrel YF				①	①	①	Four Barrel 4150		①	Four Barrel 4160				①		①		Two Barrel 2100		
																				Prim.	Sec.	Prim.
Engine Displacement (Horsepower)		153		250		194 230 250	230 250	194	327 (325)	427 (425)	327 (325)	396 (350)		327 (300) 327 (350)	427 (390)	396 (350)		327 (300) 327 (350)	427 (390)	427 (400) 427 (435)	427 (400) 427 (435)	427 (400)
Transmission		Auto.	Syn.	Auto.	Syn.	Auto.	Syn.	Syn.	Syn.	Syn.	Syn.	Auto.	Syn.	All	Syn.	Auto.	Syn.	All	All	Syn.	All	Auto.
Part Number (Mfg. Number)		3905972 (4374S)	3905971 (4373S)	3905974 (4378S)	3905973 (4377S)	3905976 (4368S)	3905975 (4367S)	3909405 (4387S)	3903389 (R3806A)	3886091 (R3418A)	3903391 (3807)	3908956 (R3836A)	3908957 (R3837A)	3906631 (R3810A)	3906633 (R3811A)	3908958 (R3838A)	3908959 (R3839A)	3906635 (R3814A)	3906637 (R3815A)	3902355 (R3660A)	3902353 (R3659A)	3909872 (R3888A)
Float Level	Mechanical Primary	7/32"							.170"	.350"	.170"									.350"		
	Mechanical Secondary	—							.300"	.450"	.300"											
	Final	—							Use Sight Plug		—									Use Sight Plug		
Float Drip		1-3/16"							—													
Accelerator Pump		—							.015"													
Idle Vent				.065"					.065"											—		
Fast Idle	Mechanical	—							.025"			.035"								.025"		
	Final	—							2200 RPM					2000 RPM	2200 RPM			2000 RPM	2200 RPM			
Choke Vacuum Break				.220"	.240"	.220"	.240"	.240"	.190"	.350"	.190"	.175"		.190"	.175"			.175"	.175"	.250"	—	.250"
Choke Unloader		.250"							.265"	.350"	.265"									.275"	—	.275"
Thermostat Choke Rod		—		1/2 to 1 Rod Diameter Interference																		
Secondary Stop		—							1/2 Turn After Contact													
Main Metering Jet	Primary	.096	.096	.1015	.1015	.1023	.104	.104	#67	②	#67	#69	#70	#65	#65	#70	#71	#63	#67	#64	.076	#62
	Secondary								#74	③	#72	.073	.073	.076	.073	.073	.073	.076	.073	—		
Metering Rod		.0645 .047	.071 .049	.076 .051	.074 .048	.078 .051 .040	.078 .052 .045	.078 .052 .045	—													
Throttle Bore	Primary	1-11/16"							1-9/16	1-3/4	1-9/16									1-1/2	1-3/4	1-1/2
	Secondary	—							1-9/16	1-3/4	1-9/16									—		

① With Air Injection Reactor System
② #74 - Choke Side, #78 - Throttle Lever Side
③ #82 - Choke Side, #80 - Throttle Lever Side

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Carburetor	ROCHESTER																			
	One Barrel BV						Two Barrel 2GV								Quadra-Jet Four Barrel 4MV							
							②	②	①	①	①②	①②					①	①	①	①
Engine Displacement (Horsepower)	194	194	230	230	250	250	283 327 (210)	283 327 (210)	283 327 (210)	283 327 (210)	283 327 (210)	283 327 (210)	283 327 (210)	283 327 (210)	327 (275) 350 (295)	327 (275) 350 (295)	396 (325) 427 (385)	396 (325) 427 (385)	327 (275) 350 (295)	327 (275) 350 (295)	396 (325) 427 (385)	396 (325) 427 (385)
Transmission	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.	Auto.	Syn.
Part Number	7025108	7025105	7025000	7022503	7026028	7026027	7027110	7027101	7027112	7027103	7037110	7037101	7037112	7037103	7027202	7027203	7027200	7027201	7037202	7037203	7037200	7037201
Float Level	1-9/32"						3/4"								9/32"							
Float Drop	1-3/4"						1-3/4"															
Accelerator Pump	———						1-1/8"								13/32" Inner Hole							
Idle Vent	.050"						1"								3/8"							
Fast Idle — Mechanical	———						———								3 Turns After Contact							
Fast Idle — Running	———						———								2200 RPM		2000 RPM		2200 RPM		2200 RPM	
Carburetor Choke Rod	.90"	.100"	.90"	.100"	.90"	.100"	.060"								.100"							
Choke Vacuum Break	.140"	.160"	.140"	.160"	.140"	.160"	.110"	.120"	.110"	.120"	.110"	.130"	.110"	.130"	.160"	.200"	.160"	.240"	.160"	.200"	.160"	.240"
Choke Unloader	.350"						.215"								.260"		.300"		.260"		.300"	
Thermostat Choke Rod	1/2 to 1 Rod Diameter Interference														1/2 to 1 Rod Diameter Interference							
Air Valve Spring	———						———								7/8 Turn							
Air Valve Lockout	———						———								.015" (Auto. Trans. Only)							
Secondary Opening	———						———								75% Min. Contact (Syn. Trans. Only)							
Secondary Lockout	———						———								.010" (Syn. Trans. Only)							
Main Metering Jet — Primary	.059"	.060"	.058"	.059"	.058"	.060"	.052"	.054"	.052"	.054"	.052"	.054"	.052"	.054"	.071"							
Throttle Bore — Primary	1-9/16"						1-7/16"								1-3/8"							
Throttle Bore — Secondary	———						———								2-1/4"							
Air Valve Dashpot	———						———								.015"							

① With Air Injection Reactor System
② With Air Conditioning

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ENGINE TORQUES

SIZE	USAGE	IN LINE				V-8				
		153	194	230	250	283	327	350	396	427
1/4-20	Camshaft Thrust Plate	80 in. lb.								
	Crankcase Front Cover					80 in. lb.				
	Flywheel Housing Pans					80 in. lb.				
	Oil Filter Bypass Valve							80 in. lb.		
	Oil Pan (To Crankcase)			80 in. lb.						
	Oil Pan (To Front Cover)		55 in. lb.						80 in. lb.	
	Oil Pump Cover		70 in. lb.					80 in. lb.		
	Rocker Arm Cover			55 in. lb.					50 in. lb.	
11/32-24	Connecting Rod Cap			35 ft. lb.						
5/16-18	Camshaft Sprocket							20 ft. lb.		
	Clutch Pressure Plate		20 ft. lb.							
	Oil Pan (To Crankcase)		125 in. lb.				65 in. lb.		135 in. lb.	
	Oil Pump		115 in. lb.							
	Push Rod Cover		80 in. lb.							
	Water Pump		15 ft. lb.							
3/8-16	Clutch Pressure Plate							35 ft. lb.		
	Distributor Clamp					10 ft. lb.				
	Flywheel Housing					30 ft. lb.				
	Manifold (Exhaust)							20 ft. lb.		
	Manifold (Exhaust to Inlet)		25 ft. lb.							
	Manifold (Inlet)							30 ft. lb.		
	Manifold Clamp (L6 Outer)		20 ft. lb.							
	Manifold Clamp (All Others)		30 ft. lb.							
	Thermostat Housing		30 ft. lb.							
	Water Outlet					20 ft. lb.				
	Water Pump							30 ft. lb.		
3/8-24	Connecting Rod Cap								50 ft. lb.	
7/16-14	Cylinder Head						65 ft. lb.		80 ft. lb.*	
	Main Bearing Cap		65 ft. lb.				80 ft. lb.			
	Oil Pump							65 ft. lb.		
	Rocker Arm Stud								50 ft. lb.*	
7/16-20	Flywheel					60 ft. lb.				
	Torsional Damper						60 ft. lb.			
1/2-13	Cylinder Head		95 ft. lb.							
	Main Bearing Cap (2 bolt)								95 ft. lb.	
	Main Bearing Cap (4 bolt)									115 ft. lb.
1/2-14	Temperature Sending Unit					20 ft. lb.				
1/2-20	Torsional Damper								85 ft. lb.	
	Oil Filter		Hand Tight					25 ft. lb.		
	Oil Pan Drain Plug					20 ft. lb.				
14mm	Spark Plug					25 ft. lb.				

*RPO L88, L89 - (Aluminum Cylinder Head) - Short Head Bolts 65 ft. lb. - Long Head Bolts 75 ft. lb. Rocker Arm Studs 60 ft. lbs.

ENGINE MOUNT TORQUE CHART

ATTACHING PARTS	TORQUE IN FT. LBS;			
	Chevrolet Chevelle	Chevy II	Camaro	Corvette
Mount Through Bolt	55	30	55	30
Mount-to-Engine	25 (V8)	45 (V8)	30 (V8)	25
Mount-to-Bracket	30 (L6)	30 (L6) 45 (L4)	30 (L6)	—
Bracket-to-Engine	25 (L6)	25 (L6) 65 (L4) L/H 45 (L4) R/H	25 (L6)	—
Bracket-to-Frame	25	25 (L6-V8) 20 (L4)	30	—
Mount-to-Transmission	40	30 (L6-V8) 45 (L4)	30	45
Crossmember-to-Mount	40	30	30	40
Crossmember-to-Frame	25	25	25	25

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TUNE UP CHART

ENGINE	Type		In Line				V8																
	Displacement		153	194	230	250	283	327					350	396			427						
	Horsepower		90	120	140	155	195	210	275	300	325	350	295	325	350	385	390	400	425	435			
Compression ①			130				150	160			150		160						150				
SPARK PLUG	Make & Number	Standard	AC 46N				AC 45	AC 44					AC 43N										
		Cold	AC 44N				AC 44	AC 43					AC C42N										
	Gap		.035																				
DISTRIBUTOR	Point Dwell		31° - 34°				28° - 32°																
	Point Gap		.016" (Used) .019" (New)																				
	Arm Spring Tension		19 - 23 Ounces														28 - 32 oz.		19 - 23 oz.				
	Condenser		.18 - .23 Microfarad																				
	TIMING ②	Exc. A.I.R. Syn.	4°B	4°B	4°B	4°B	4°B	2°B	8°B	6°B	10°B	10°B	4°B	4°B	4°B	4°B	4°B	4°B	10°B	5°B			
		Exc. A.I.R. Auto.	4°B	4°B	4°B	4°B	4°B	2°B	8°B	6°B	X	X	4°B	4°B	4°B	4°B	4°B	4°B	X	X			
		A.I.R. Syn.	X	2°B	4°B	4°B	0°B	2°B	6°B	6°B	10°B	10°B	4°B	4°B	4°B	4°B	4°B	4°B	X	5°B			
		A.I.R. Auto.	X	4°B	4°B	4°B	4°B	2°B	6°B	4°A	X	X	4°B	4°B	4°B	4°B	4°B	4°B	X	X			
Drive Belts	Fan & P/S		50 lb. Min. 75 ± 5 lbs. (Used) 125 ± 5 lbs. (New) Using Strand Tension Gauge																				
	A/C Compressor		65 lb. Min. 95 ± 5 lbs. (Used) 140 ± 5 lbs. (New) Using Strand Tension Gauge																				
	A.I.R. Pump		35 lb. Min. 55 ± 5 lbs. (Used) 75 ± 5 lbs. (New) Using Strand Tension Gauge																				
Air Cleaner			③																				
Valve Lash	Inlet ④		Hydraulic - One Turn Down From Zero Lash																.022"	.024"			
	Exhaust ④		Hydraulic - One Turn Down From Zero Lash																.024"	.028"			
Idle RPM ⑤	Exc. A.I.R.	Syn.	500				500	500	700		500	500	550	550	550	550	1000	750					
		Auto.	500				600	500	X		500	500	550	550	550	550	X	X					
	A.I.R.	Syn.	X	700*	700*		700*		750		700	700	700	700	700	750	X	750					
		Auto.	X	600*	500*		600*		X		500	500	500	550	550	600	X	X					
Fuel Pump	Pressure		3 to 4-1/2				5 to 6-1/2																
	Volume		One Pint in 30 - 45 Seconds																				
Crankcase Vent			Service at 12,000 Miles																				

① Psi at cranking speed, throttle wide open - Maximum variation, 20 lbs. between cylinders.
② At idle speed with vacuum advance line disconnected and plugged. A = A.T.D.C.; B = B.T.D.C.
③ Paper Element - Service at 12,000 miles initially - Check every 6,000 miles thereafter, until replaced.
Polyurethane - Service every 12,000 miles.
Oil Bath - Change oil at regular engine oil change intervals.
④ Mechanical - Set with engine at operating temperature and running.
⑤ Automatic Transmission - Set idle with transmission in drive.
Air Conditioned Vehicles - Set idle with air conditioning turned "ON" except on specifications indicated by *.

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ENGINE ELECTRICAL

SECTION 6Y

BATTERY

Battery Model	1980032*	1980030*	1980036*
Application	153L-4, 194, 230, 250L-6 & 283 V-8	327, 350, 396 & 427 V-8	396 & 427 V-8 w/AC & M-40 Trans.
Ground	Neg.	Neg.	Neg.
Plates	54	66	66
Cranking Power @ 0°F. (Watts)	2300	2900	3150

*65° Side Recess and One Piece Cover Construction

GENERATOR

Generator Model	1100695	1100693	1100696	1100742	1100750	1117754	1117777
Application	Chevy II Exc. V-8, Sta. Wgn. or AC	Chevy II w/V-8, Camaro, Chevelle, Chevrolet and Corvette w/AC	Chevy II w/AC & RPO K-66	Chevrolet w/AC & Turbo-Hydramatic	All A/C except w/RPO M-40 and Chevy II	Optional	Optional
Field Amp. Draw	2.2-2.6	2.2-2.6	2.2-2.6	2.8-3.2	2.2-2.6	3.7-4.4	4.14-4.62
Hot Output — Amps.	32	37	42	63	61	62	62
Cold Output — Volts	14	14	14	14	14	14	14

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REGULATOR

Regulator Model		1119515	1119519	1116378
Application		Base All Except with Generator 1117765 and 1100742	Base with Generator 1100742	Base with Generator 1117754
Field Relay:	Air Gap	.015	.015	.011-.018
	Point Opening	.030	.030	.020-.030
	Closing Voltage	1.5-3.2	1.5-3.2	2.5-3.5
Voltage Regulator:	Air Gap	.067	.067	—
	Point Opening	.014	.014	—
Voltage Setting		13.8-14.8 @ 85°F.	13.8-14.8 @ 85°F.	13.7-14.4 @ 85°F. "O" Position of Adjusting Screw

STARTING MOTOR

Starting Motor Model		1107399	1107400	1107496	1107320	1107372	1107365	1107388
Application		153L-4 194L-6 & 230L-6 w/Manual Trans. 230L-6 w/Auto. Trans. 250L-6 All Trans.	153L-4 & 194L-6 w/Auto. Trans.	283 Cu. In. V-8 All Trans.	327 Cu. In. V-8 Auto. Trans.	250L-6 Hvy. Duty & Taxi Chevrolet	396 & 427 Cu. In. V-8 All Trans. Chevelle, Chevrolet & Corvette w/14" Ring Gear	283 & 327 V-8 w/H.D. Clutch, 350 Cu. In. V-8
Brush Spring Tension, oz.		35	35	35	35	35	35	35
Free Speed	Volts	10.6	10.6	10.6	10.6	10.6	10.6	10.6
	Amperes	49-87*	49-87*	49-87*	65-100*	55-95*	70-99*	65-100*
	RPM	6200-10700	6200-10700	6200-10700	3600-5100	3800-6000	7800-12000	3600-5100
Resistance Test Armature Locked	Volts	4.2	4.2	4.2	3.5	3.5	3.0	3.5
	Amperes	290-425*	290-425*	290-425*	300-360*	300-360	410-480*	300-360

*Includes Solenoid

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DISTRIBUTORS

Engine Description and Availability	Ignition Distributor (Product Part No.)	Centrifugal Advance (Crank Degrees @ Engine RPM)	Vacuum Advance (In Crank Degrees)	Point Dwell Setting	Ignition Timing BTDC at Engine Idle	Engine Idle Setting (RPM)			Original Equipment Spark Plug
						Trans.	Prod.	A.I.R. (RPO K-19)	
4 Cyl.-153 Cu. In. Chevy II	1110292	0° @ 600 14° @ 1500 28° @ 3700	0° @ 6" Hg. 23° @ 12" Hg.	31-34°	4°	Manual Auto.	500 500	— —	AC-46N
6 Cyl.-194 Cu. In. Chevy II, with or without RPO K-19	1110388	0° @ 900 20° @ 2000 28° @ 3800	0° @ 6" Hg. 21° @ 14.5" Hg.	31-34°	4° (2° w/K-19 & Man. Tran.)	Manual Auto.	500 500	700 600	AC-46N
6 Cyl.-230 Cu. In. Chevelle & Camaro	1110362	0° @ 900 10° @ 1200 30° @ 3200	0° @ 6" Hg. 21° @ 14.5" Hg.	31-34°	4°	Manual Auto.	500 500	— —	AC-46N
6 Cyl.-230 Cu. In. Chevelle & Camaro With RPO K-19	1110387	0° @ 950 17° @ 2100 26° @ 4000	0° @ 6" Hg. 21° @ 14.5" Hg.	31-34°	4°	Manual Auto.	500 500	700 500	AC-46N
6 Cyl.-250 Cu. In. Chevrolet	1110351	0° @ 900 15° @ 1600 23° @ 2300 28° @ 2800	0° @ 6" Hg. 21° @ 14.5" Hg.	31-34°	4°	Manual Auto.	500 500	700 500	AC-46N
8 Cyl.-283 Cu. In., 195 H.P. Chevy II, Chevelle, Chevrolet Exc. w/Man. Trans. & RPO K-19	1111150	0° @ 900 10° @ 1500 15° @ 2000 28° @ 4200	0° @ 8" Hg. 15° @ 15.5" Hg.	28-32°	4°	Manual Auto.	500 500	— 600	AC-45
8 Cyl.-283 Cu. In., 195 H.P. Chevy II, Chevelle, Chevrolet, w/Man. Trans. & RPO K-19	1111256	0° @ 900 15.5° @ 1600 30° @ 4100	0° @ 8" Hg. 15° @ 15.5" Hg.	28-32°	TDC	Manual	—	700	AC-45
8 Cyl.-327 Cu. In. 2 Bbl, (210 H.P.) Camaro	1111101	0° @ 900 32° @ 3950	0° @ 8" Hg. 15° @ 15.5" Hg.	28-32°	2°	Manual Auto.	500 600	700 600	AC-44
8 Cyl.-327 Cu. In. 4 Bbl. (275 H.P.) Chevy II, Chevelle, Chevrolet, & Camaro Exc. w/RPO K-19	1111249	0° @ 900 11° @ 1500 26° @ 4100	0° @ 8" Hg. 15° @ 15.5" Hg.	28-32°	8°	Manual Auto.	500 500	— —	AC-44
8 Cyl.-327 Cu. In. 4 Bbl. (275 H.P.) Chevy II, Camaro, Chevelle & Chevrolet w/RPO K-19	1111150	0° @ 900 10° @ 1500 15° @ 2000 28° @ 4200	0° @ 8" Hg. 15° @ 15.5" Hg.	28-32°	6°	Manual Auto.	— —	700 600	AC-44
8 Cyl.-327 Cu. In. (300 H.P.) Corvette Incl. RPO K-19 w/Man. Trans.	1111194 (Tach. Drive)	0° @ 900 9° @ 1200 15° @ 1500 30° @ 5100	0° @ 6" Hg. 15° @ 12" Hg.	28-32°	6°	Manual Auto.	500 500	700	AC-44
8 Cyl.-327 Cu. In. Corvette (300 H.P.) Auto. Trans. w/RPO K-19	1111117	0° @ 900 19° @ 1200 25° @ 1500 40° @ 5100	0° @ 6" Hg. 15° @ 12" Hg.	28-32°	4° ATDC	Auto.	—	600	AC-44
8 Cyl.-327 Cu. In. Chevelle (325 H.P.)	1111195	0° @ 900 9° @ 1200 15° @ 1500 30° @ 5100	0° @ 6" Hg. 15° @ 12" Hg.	28-32°	10°	Manual	700	750	AC-44
8 Cyl.-327 Cu. In. Corvette (350 H.P.)	1111196 Tach. Drive	0° @ 900 9° @ 1200 15° @ 1500 30° @ 5100	0° @ 4" Hg. 16° @ 7" Hg.	28-32°	10°	Manual	700	750	AC-44
8 Cyl.-350 Cu. In. Camaro	1111168	0° @ 900 9° @ 1300 15° @ 1700 26° @ 4700	0° @ 10" Hg. 15° @ 17" Hg.	28-32°	4°	Manual Auto.	500 500	700 500	AC-44
8 Cyl.-396 Cu. In. Chevrolet, Chevelle, (325 H.P.) RPO L-34 & RPO L-36 w/RPO K-19	1111169	0° @ 900 8.5° @ 1250 17° @ 2000 32° @ 5000	0° @ 8" Hg. 15° @ 15.5" Hg.	28-32°	4°	Manual Auto. (L-35) Auto. (L-35 & L-36)	500 500	700 500 550	AC-43N
8 Cyl.-396 Cu. In. Chevelle (350 H.P.) 8 Cyl.-427 Cu. In. Chevrolet (385 H.P.) Exc. RPO K-19	1111170	0° @ 900 8.5° @ 1250 17° @ 2000 32° @ 5000	0° @ 7" Hg. 12° @ 12" Hg.	28-32°	4°	Manual Auto.	550 550	— —	AC-43N
8 Cyl.-427 Cu. In. Corvette (390 H.P. RPO L-36, 400 H.P. 3 x 2 RPO L-68)	1111247	0° @ 900 8.5° @ 1250 17° @ 2000 32° @ 5000	0° @ 7" Hg. 12° @ 12" Hg.	28-32°	4°	Manual Auto. Manual Auto.	550 550 — —	700 (L-36) 550 (L-36) 750 (L-68) 600 (L-68)	AC-43N
8 Cyl.-427 Cu. In. RPO L-71 (435 H.P.)	1111258 Tran. Ign. w/Tach. Drive	0° @ 900 30° @ 3800	0° @ 8" Hg. 15° @ 15.5" Hg.	—	5°	Manual	750	750	AC-43N
8 Cyl.-327 Cu. In. Corvette (350 H.P.)	1111157 Tran. Ign. Tach. Drive	0° @ 900 17° @ 1600 28° @ 4600	0° @ 4" Hg. 16° @ 7" Hg.	—	10°	Manual	700	700	AC-44
8 Cyl.-427 Cu. In. RPO L-36 & L-68	1111248 Tach. Drive	0° @ 900 8.5° @ 1250 17° @ 2000 32° @ 5000	0° @ 7" Hg. 12° @ 12" Hg.	28-32°	4°	Manual Auto. Manual Auto.	550 550 — —	700 (L-36) 550 (L-36) 750 (L-68) 600 (L-68)	AC-43N

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COIL

Ignition Coil / Application		L-4 & L-6	V-8 (Non-Transistor)	V-8 (Transistor)
Primary Resistance-Ohms		1.45-1.63	1.24-1.46	.38-.51
Secondary Resistance-Ohms		5600-6900	6500-9500	8200-12,400
Ignition Resistor:	Type		Fixed (In Wiring Harness)	
	Ohms	1.8	1.8	.43 & .68

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TRANSMISSION AND CLUTCH

SECTION 7

THREE SPEED (SAGINAW)

Clutch Gear Retainer to Case Bolts	22 ft. lbs.
Side Cover to Case Bolts	22 ft. lbs.
Extension to Case Bolts (except overdrive)	45 ft. lbs.
Overdrive Attaching Lower Left Hand Bolt (Marked X)	30 ft. lbs.
Shift Lever to Shifter Shaft Bolts	20 ft. lbs.
Lubrication Filler Plug	15 ft. lbs.
Transmission Case to Clutch Housing Bolts	55 ft. lbs.
Crossmember to Frame Nuts	25 ft. lbs.
Crossmember to Mount and Mount to Extension Bolts	40 ft. lbs.

THREE SPEED (WARNER)

Clutch Gear Retainer to Case Bolts	20 ft. lbs.
Side Cover to Case Bolts	20 ft. lbs.
Extension to Case Bolts	40 ft. lbs.
Shift Lever to Shifter Shaft Nut	25 ft. lbs.
Lubrication Filler and Drain Plugs	20 ft. lbs.
Transmission Case to Clutch Housing Bolts	55 ft. lbs.
Crossmember to Frame Nuts	25 ft. lbs.
Crossmember to Mount Bolts	40 ft. lbs.

FOUR SPEED (SAGINAW)

Clutch Gear Retainer to Case Bolts	22 ft. lbs.
Side Cover to Case Bolts	22 ft. lbs.
Extension to Case Bolts (except overdrive)	45 ft. lbs.
Shift Lever to Shifter Shaft Bolts	20 ft. lbs.
Lubrication Filler Plug	15 ft. lbs.
Transmission Case to Clutch Housing Bolts	55 ft. lbs.
Crossmember to Frame Nuts	25 ft. lbs.
Crossmember to Mount and Mount to Extension Bolts	40 ft. lbs.

FOUR SPEED (MUNCIE)

Clutch Gear Bearing Retainer to Case Bolts	25 ft. lbs.
Cover to Case Bolts	20 ft. lbs.
Extension and Retainer to Case Bolts-(Upper)	20 ft. lbs.
-(Lower)	30 ft. lbs.
Lubrication Filler Plug	30 ft. lbs.
Shift Lever to Shifter Shaft Nut	20 ft. lbs.

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POWERGLIDE

Transmission Case to Engine	35 ft. lbs.
Transmission Oil Pan to Case	8 ft. lbs.
Transmission Extension to Case	25 ft. lbs.
Speedometer Driven Gear Fitting Retainer	4 ft. lbs.
Servo Cover to Transmission Case Bolts	20 ft. lbs.
Front Pump to Transmission Case Bolts	15 ft. lbs.
Front Pump Cover to Body Attaching Bolts	20 ft. lbs.
Pinion Shaft Lock Plate Attaching Screws	2-1/2 ft. lbs.
Governor Body to Hub Attaching Bolts	7 ft. lbs.
Governor Hub Drive Screw	8 ft. lbs.
Rear Pump to Transmission Case Bolts	10 ft. lbs.
Valve Body to Transmission Case Bolts	15 ft. lbs.
Valve Body Suction Screen Attaching Screws	2-1/2 ft. lbs.
Upper Valve Body Plate Bolts	5 ft. lbs.
Lower to Upper Valve Body Attaching Bolts	15 ft. lbs.
Inner Control Lever Allen Head Screw	2-1/2 ft. lbs.
Parking Lock Pawl Reaction Bracket Attaching Bolts	10 ft. lbs.
Oil Cooler Plugs at Transmission Case	5 ft. lbs.
Pressure Test Point Plugs	5 ft. lbs.
Low Band Adjustment Locknut	15 ft. lbs.
Converter to Engine Bolts	35 ft. lbs.
Under Pan to Transmission Case	7-1/2 ft. lbs.
Oil Cooler Pipe Connectors to Transmission Case or Radiator	10 ft. lbs.
Oil Cooler Pipe to Connectors	10 ft. lbs.
Vacuum Modulator to Transmission Case	15 ft. lbs.
Oil Pan Drain Plug	20 ft. lbs.
Converter Drain Plug (Taxies)	20 ft. lbs.
Parking Brake Lock & Range Selector Inner Lever Allen Head Screw	2-1/2 ft. lbs.

TURBO-HYDRAMATIC

Pump Cover Bolts	18 lb. ft.
Parking Pawl Bracket Bolts	18 lb. ft.
Case Center Support Bolt	23 lb. ft.
Pump to Case Attaching Bolts	18 lb. ft.
Extension Housing to Case Attaching Bolts	23 lb. ft.
Rear Servo Cover Bolts	18 lb. ft.
Detent Solenoid Bolts	7 lb. ft.
Control Valve Body Bolts	8 lb. ft.
Bottom Pan Attaching Screws	12 lb. ft.
Modulator Retainer Bolt	18 lb. ft.
Governor Cover Bolts	18 lb. ft.
Manual Lever to Manual Shaft Nut	8 lb. ft.
Manual Shaft to Inside Detent Lever	18 lb. ft.
Linkage Swivel Clamp Nut	43 lb. ft.
Converter Dust Shield Screws	93 lb. ft.
Transmission to Engine Mounting Bolts	28 lb. ft.
Converter to Flywheel Bolts	33 lb. ft.
Rear Mount to Transmission Bolts	40 lb. ft.
Rear Mount to Crossmember Bolt	40 lb. ft.
Crossmember Mounting Bolts	25 lb. ft.
Oil Cooler Line	113 lb. In.
Line Pressure Take-Off Plug	13 lb. ft.

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STEERING

SECTION 9

STANDARD STEERING

Item			Chevrolet	Chevelle	Chevy II	Camaro	Corvette
Steering Gear	Type		Recirculating Ball				
	Ratio	Gear	24:1	24:1	20:1	(*)	16:1
		Overall	31:4.1	28:1	25.4:1		Road 20.2:1 Fast 17.6:1
Linkage	Type		Parallel Relay Rod				
	Location		Rear	Front	Rear	Rear	Rear
	# Tie Rods		2				

(*)

Model and/or Option	Gear Ratio	Overall Ratio
L6- All, 327 V-8 Sed., A/C	28:1	28:1
327 V-8 Cpe	24:1	24:1
350 V-8 All	24:1	24:1
Special Steering	24:1	21.6:1

POWER STEERING

Pump	Type		Vane Impeller				
	Pressure		1000-1100	870-1000 900-1000	870-1000	900-1000	870-1000
Steering Gear	Type		Integral Recirculating Ball		Recirculating Ball	Integ. Recirc. Ball	Recirculating Ball
	Ratio	Gear	17.5:1	17.5:1		17.5:1	
		Overall	21.3:1	20.4:1		17.5:1	17.6:1 Only

ADJUSTMENT SPECIFICATIONS— STANDARD STEERING

Adjustment	Torque to Turn Worm Shaft
Worm Bearing Preload	5 - 8 Lb. In.
Sector Lash Adjustment	4 - 10 Lb. In. in excess of above
Total Steering Gear Preload	16 Lb. In. Maximum

ADJUSTMENT SPECIFICATIONS—POWER STEERING

	Chevrolet, Chevelle, Camaro	
Ball Drag	3 Lb. In. Max.	
Thrust Bearing Preload	1/2 - 2 Lb. In. in excess of valve assy. drag	
Over Center Preload	3 - 6 Lb. In. in excess of above	
Total Steering Gear Preload	14 Lb. In. Max.	
	Chevy II	Corvette
Worm Bearing Preload	1-1/2 - 5-1/2 Lb. In.	Same as Standard Steering
Sector Lash Adjustment	3 - 7 Lb. In. in excess of above	
Total Steering Gear Preload	11 Lb. In. Max.	

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TORQUE CHART

	Chevrolet	Chevelle	Chevy II	Camaro	Corvette
Steering Gear Mounting Bolts	70 lb. ft.	70 lb. ft.	30 lb. ft.	68 lb. ft.	30 lb. ft.
Pitman Shaft Nut	140 lb. ft.				
Steering Wheel Nut	35 lb. ft.				
Steering Wheel Nut-Tilt	1 lb. in.	1 lb. in.	—	1 lb. in.	—
Steering Coupling Nuts	18 lb. ft.		—	18 lb. ft.	
Steering Coupling Clamp Bolts	30 lb. ft.		—	30 lb. ft.	—
Tie Rod End Nut	35 lb. ft.				
Tie Rod Clamp Nut	130 lb. in.				
Idler Arm Mounting Nut	40 lb. ft.				
Steering Wheel to Hub (Wood)	25 lb. in.		—	25 lb. in.	
Steering Damper Bracket Frame Nut	—	—	—	—	18 lb. ft.
Steering Damper Bracket Relay End Nut	—	—	—	—	25 lb. ft.
Steering Damper to Bracket Nut	—	—	—	—	30 lb. ft.
Steering Damper Bracket Relay Rod Bolt	—	—	—	—	25 lb. ft.
Power Steering Pump Pulley	60 lb. ft.				
Power Steering Mounting Bolt	20 lb. ft.				
Power Steering Mounting Nut	25 lb. ft.				
Power Cylinder to Relay Rod Nut	—	—	45 lb. ft.	—	45 lb. ft.
Power Cylinder to Frame Bracket	—	—	30 lb. ft.	—	25 lb. ft.
Control Valve to Pitman Arm	—	—	45 lb. ft.	—	45 lb. ft.
Control Valve Clamp Bolt	—	—	20 lb. ft.	—	20 lb. ft.
Steering Shaft to Gear Clamp Nut	—	—	35 lb. ft.	—	—

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WHEELS AND TIRES

SECTION 10

CHEVY II

Tire Usage and Recommended Tire Inflation Pressures
Pounds per Square Inch (PSI) Cool

Models	Tire Ply	Tire Usage	Standard Inflation Pressure for all Loads including Full Rated		Optional Inflation Pressure for Reduced Load	
All Models Except Station Wagon	4 Ply Rating 2 Ply	6.95 x 14	1 to 6 passengers +200 lbs. luggage (1,100 lbs. load)		1 to 5 passengers (750 lbs. load)	
			Front 26**	Rear 26**	Front 24	Rear 24
Station Wagon	8 Ply Rating 4 Ply	6.95 x 14	1 to 6 passengers +300 lbs. cargo (1,200 lbs. load)		1 to 5 passengers (750 lbs. load)	
			Front 24	Rear 40	Front 22	Rear 28

*Optional tires are not available.
**Add 2 psi when vehicle is equipped with V-8 engine.

1. Tire inflation pressures may increase as much as six (6) pounds per square inch (PSI) when hot.
2. For continuous high speed operation (over 75 MPH) increase tire inflation pressures four (4) pounds per square inch over the recommended pressures up to a maximum of 32 pounds per square inch cool for 4-ply rating tires or 40 pounds per square inch for 8-ply rating tires. Sustained speeds above 75 MPH are not recommended when the 4 pounds per square inch adjustment would require pressures greater than the maximums stated above.
3. Cool tire inflation pressure: after vehicle has been inoperative for three (3) hours or more, or driven less than one (1) mile.
   Hot tire inflation pressure: after vehicle has been driven ten (10) miles or more at 60-70 MPH.
4. Station Wagon loads should be distributed as far forward as possible.
5. Vehicles with luggage racks do not have a load limit greater than the 1,100# load (1,200# load for station wagons) specified above.
6. When towing trailers, the allowable passenger and cargo load must be reduced by an amount equal to the trailer tongue load on the trailer hitch.

CHEVELLE

Tire Usage

Engine and Body Styles	Standard 14 Inch		Optional 14 Inch	
	With A/C*	Without A/C*	With A/C*	Without A/C*
L-6, All styles except Station Wagon 283 V-8, All styles except Station Wagon, Spt. Sedan and Convertible	7.35	7.35	7.75	7.75
283 V-8, Sport Sedan and Convertible 327 V-8 Std., except Sport Sedan and Convertible	7.75	7.35	—	7.75
327 V-8 Std., Sport Sedan and Convertible 327 V-8 H.P., All styles	7.75	7.75	—	—
396 V-8, Pick-Up Delivery	7.75	7.75	—	—
396 V-8, Super Sport Convertible and 2-Door Coupe	F70	F70	—	—
All engines, Station Wagon	7.75	7.75	7.75 (8-Ply Rating, 4-Ply)	7.75 (8-Ply Rating, 4-Ply)

*A/C (Air Conditioning)
All tires listed are 4-ply rating, 2-ply unless otherwise specified.

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CHEVELLE (CONT'D)

Recommended Tire Inflation Pressures
Pounds per Square Inch (Cool)

Models	Tire Ply	Standard Inflation for all Loads including Full Rated	Optional Inflation for Reduced Loads
All Models Except Those Shown Below		1 to 6 passengers +200 lbs. luggage (1,100 lbs. load)	1 to 5 passengers (750 lbs. load)
	4 Ply Rating—2 Ply	Front 26 / Rear 26	Front 24 / Rear 22
Station Wagons		1 to 6 passengers (2 Seat) + 300 lbs. cargo (1,200 lbs. load)	1 to 5 passengers (750 lbs. load)
	4 Ply Rating—2 Ply 8 Ply Rating—4 Ply	Front 22 / Rear 30 22 / 30	Front 22 / Rear 26 22 / 26
El Camino		1 to 3 passengers +800 lbs. cargo (1,250 lbs. load)	1 to 3 passengers + 300 lbs. cargo (750 lbs. load)
	4 Ply Rating—2 Ply	Front 24 / Rear 30	Front 24 / Rear 24

1. Tire inflation pressures may increase as much as six (6) pounds per square inch (PSI) when hot.
2. For continuous high speed operation (over 75 MPH) increase tire inflation pressures four (4) pounds per square inch over the recommended pressures up to a maximum of 32 pounds per square inch cool for 4-ply rating tires or 40 pounds per square inch for 8-ply rating tires. Sustained speeds above 75 MPH are not recommended when the 4 pounds per square inch adjustment would require pressures greater than the maximums stated above.
3. Cool tire inflation pressure: after vehicle has been inoperative for three (3) hours or more, or driven less than one (1) mile.

   Hot tire inflation pressure: after vehicle has been driven ten (10) miles or more at 60-70 MPH.
4. Station Wagon and El Camino loads should be distributed as far forward as possible.
5. Vehicles with luggage racks do not have a load limit greater than the 1,100# load (1,200# for Station Wagons or 1,250# for El Camino) specified in the Tire Inflation Pressure Table.
6. When towing trailers, the allowable passenger and cargo load must be reduced by an amount equal to the trailer tongue load on the trailer hitch.

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CAMARO

Tire Usage and Recommended Tire Inflation Pressures

Pounds per Square Inch (PSI) Cool

Models		Tire Ply	Tire Usage	Standard Inflation Pressure for all Loads including Full Rated	
				Front	Rear
All Except Super Sport	1 to 5 passengers +200 lbs. luggage (950 lbs. load)	4 Ply Rating— 2 Ply*	7.35 x 14	24**	24**
Super Sport			D70—14	26	26

*Optional tires not available.

**Add 2 psi. when vehicle is equipped with 327 V-8 and air conditioning.

1. Tire inflation pressures may increase as much as six (6) pounds per square inch (PSI) when hot.
2. For continuous high speed operation (over 75 MPH) increase tire inflation pressures four (4) pounds per square inch over the recommended pressures up to a maximum of 32 pounds per square inch cool for 4-ply rating tires.
3. Cool tire inflation pressure: after vehicle has been inoperative for three (3) hours or more, or driven less than one (1) mile.
   Hot tire inflation pressure: after vehicle has been driven ten (10) miles or more at 60-70 MPH.
4. Vehicles with luggage racks do not have a load limit greater than the 950 lbs. load specified above.
5. When towing trailers, the allowable passenger and cargo load must be reduced by an amount equal to the trailer tongue load on the trailer hitch.

CORVETTE

Tire Usage and Recommended Tire Inflation Pressures

Pounds per Square Inch (PSI) Cool

Models		Tire Ply	Tire Usage	Standard Inflation Pressure for all Loads including Full Rated	
				Front	Rear
All Models	1 to 2 passengers +150 lbs. luggage (450 lbs. load)	4 Ply Rating— 2 Ply*	7.75-15*	24	24

*Optional tires are not available.

1. Tire inflation pressures may increase as much as six (6) pounds per square inch (PSI) when hot.
2. For continuous high speed operation (over 75 MPH) increase tire inflation pressures four (4) pounds per square inch over the recommended pressures up to a maximum of 32 pounds per square inch cool for 4-ply rating tires.
3. Cool tire inflation pressure: after vehicle has been inoperative for three (3) hours or more, or driven less than one (1) mile.
   Hot tire inflation pressure: after vehicle has been driven ten (10) miles or more at 60-70 MPH.
4. Vehicles with luggage racks do not have a load limit greater than the 450# load specified above.
5. When towing trailers, the allowable passenger and cargo load must be reduced by an amount equal to the trailer tongue load on the trailer hitch.

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CHEVROLET

Tire Usage

Engine and Body Styles	STANDARD TIRE		OPTIONAL TIRE
	14 Inch	15 Inch (With Disc Brakes)	14 Inch
All Engines, All Styles except Those Shown Below	8.25	8.15	8.25 (8-Ply Rating, 4-Ply)
427 V-8 Super Sport 2-Door Coupe and Convertible (Z-24 Option)	8.25	G70-15	—
All Engines, Station Wagon	8.55	8.45 (8-Ply Rating, 4-Ply)	8.55 (8-Ply Rating, 4-Ply)

All tires listed are 4-Ply Rating, 2-Ply except where indicated.

Recommended Tire Inflation Pressures—Pounds per Square Inch (Cool)

Models	Tire Ply	Standard Inflation for All Loads Including Full Rated		Optional Inflation for Reduced Loads	
All Models Except Station Wagons		1 to 6 Passengers +200 lbs. luggage (1100 lbs. load)		1 to 5 passengers (750 lbs. load)	
	4 Ply Rating—2 Ply 8 Ply Rating—4 Ply	Front 24 24	Rear 28 28	Front 24 24	Rear 24 24
Station Wagons (Without Disc Brakes—14" Wheels		1 to 6 passengers (2 Seat) + 300 lbs. cargo or 1 to 8 pass. (3 Seat) (1200 lbs. load)		1 to 5 passengers (750 lbs. load)	
	4 Ply Raging—2 Ply 8 Ply Rating—4 Ply	Front 22 22	Rear 32 32	Front 22 22	Rear 26 26
Station Wagons (With Disc Brakes—15" Wheels)		1 to 6 passengers (2 Seat) + 300 lbs. cargo or 1 to 8 pass. (3 Seat) (1200 lbs. load)		1 to 5 passengers (750 lbs. load)	
	8 Ply Rating—4 Ply	Front 22	Rear 34	Front 22	Rear 26

1. Tire inflation pressures may increase as much as six (6) pounds per square inch (PSI) when hot.
2. For continuous high speed operation (over 75 MPH) increase tire inflation pressures four (4) pounds per square inch over the recommended pressures up to a maximum of 32 pounds per square inch cool for 4-ply rating tires or 40 pounds per square inch for 8-ply rating tires. Sustained speeds above 75 MPH are not recommended when the 4 pounds per square inch adjustment would require pressures greater than the maximums stated above.
3. Cool tire inflation pressure: after vehicle has been inoperative for three (3) hours or more, or driven less than one (1) mile.

Hot tire inflation pressure: after vehicle has been driven ten (10) miles or more at 60-70 MPH.

4. Station Wagon loads should be distributed as far forward as possible.
5. Vehicles with luggage racks do not have a load limit greater than the 1,000# loads (1,200# for Station Wagons) specified in the Tire Inflation Pressure Table.
6. When towing trailers, the allowable passenger and cargo load must be reduced by an amount equal to the trailer tongue load on the trailer hitch.

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BODY AND CHASSIS ELECTRICAL

SECTION 12

LAMP USAGE	CANDLE POWER	BULB NUMBER
Headlamp Unit		
Chevrolet, Chevelle & Corvette		
Outer - High Beam	37 1/2 Watts	4002
Outer - Low Beam	55 Watts	4002
Inner - High Beam only	37 1/2 Watts	4001
Chevy II		
High Beam	55 Watts	6012
Low Beam	45 Watts	
Parking Lamp and Directional Signal		
All Exc. Camaro	4-32	1157
Camaro	4-32	1034-A
Tail, Stop and Directional Signal (Exc. Bel Air)	4-32	1157
Backing Lamp	32	1156
Instrument Illumination Lamps		
Chevrolet & Camaro	2	194
Chevelle and Chevy II	2	1895
Corvette	3	1816
Temperature Indicator		
Chevrolet & Camaro	2	194
Chevelle and Chevy II	2	1895
Oil Pressure Indicator		
Chevrolet & Camaro	2	194
Chevelle and Chevy II	2	1895
Generator Indicator		
Chevrolet & Camaro	2	194
Chevelle and Chevy II	2	1895
Hi-Beam Indicator		
Chevrolet & Camaro	2	194
Chevelle and Chevy II	2	1895
Corvette	1	1445
Directional Indicator		
Chevrolet & Camaro	2	194
Chevelle & Chevy II	2	1895
Corvette	3	1816
Cigarette Lighter Lamp		
Corvette	1	1445
Ignition Lock Lamp		
Chevrolet	Special Fiber Optic Wiring	
Corvette	1	1445
Heater or A/C Control Panel		
Chevrolet, Chevelle, Chevy II & Camaro	2	1895
Corvette	3	1893
Glove Box Lamps		
Chevrolet, Chevelle, Chevy II & Camaro	2	1895
Corvette	3	1893
Dome and Courtesy Lamps		
Cartridge Type (All)	12	211
Bayonet Type (Exc. Corvette)	6	89, 212
Corvette	6	90
Convertible	6	631

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LAMP USAGE (Cont'd.)	CANDLE POWER	BULB NUMBER
Seat Separator-Compartment Lamp	1	1445
-Courtesy Lamp	6	212
License Plate Lamp	4	67
Radio Dial Lamp		
Chevrolet, Chevelle, Chevy II & Camaro	2	1893
Corvette	3	1816
Brake Alarm Lamp		
Chevrolet & Camaro	2	194
Chevelle & Chevy II	2	1895
Corvette	3	1816
Headlamp Motor Warning Lamp (Flashing)	2	257
Clock Lamp (Corvette)	3	1816
Luggage Compartment Lamp	15	1003
Underhood	15	93

FUSES AND CIRCUIT BREAKER

A circuit breaker in the light control switch protects the headlamp circuit, thus eliminating one fuse. A separate circuit breaker protects the power window, seat and top circuits. On Corvettes the headlamp motor circuit is also protected by a separate circuit breaker. Where current load is too heavy, the circuit breaker rapidly opens and closes, protecting the circuit until the cause is found and eliminated.

Fuses located in the Fuse Panel under the instrument panel are:

Wiper (Chevrolet, Chevelle, and "F" Car)	3AF/AGC 20 Amp.
Back-up Lamp and Gauges	3AG/AGC 10 Amp.
Heater - Air Conditioning	3AG/AGC 25 Amp.
Radio	3AG/AGC 10 Amp.
Radio - Wiper (Chevy II and Corvette)	3AG/AGC 20 Amp.
Instrument Lamps	3AG/AGC 4 Amp.
Stop and Tail Lamps	3AG/AGC 20 Amp.
Clock, Lighter, Courtesy Lamps, and Hazard Warning	3AG/AGC 20 Amp.
In-Line Fuses:	
Air Conditioning High Blower Speed Fuse located in wire running from horn relay to A/C Relay	
Comforton and Four Season	SAE 30 Amp.
Universal & All Weather (Chevy II)	SAE 20 Amp.
Fusible Links:	
Pigtail lead at battery positive cable (except Corvette)	14 gage brown wire
Molded splice at Solenoid "Bat" terminal (Corvette only)	14 gage brown wire
Molded Splice Located at the horn relay	16 gage black wire
Molded splice in Voltage Regulator #3 terminal wire	20 gage orange wire
Molded splice in Ammeter circuit (Both sides of meter)	20 gage orange wire

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WINDSHIELD WIPERS

Non-Depressed Park	Two Speed
Operation	
Test Voltage	12 V.
Crank Arm Rotation	CCW
Current Draw	
No Load	3.6 Max.
Dry W/S	4.5 Max.
Stall	12 Max.
Crank Arm Speed (RPM's)	
Low	34 Min.
Hi	65 Min.

Depressed Park—Chevrolet & Corvette	Two Speed
Operating Voltage	12 VDC
Gear Ratio	3.36:1
Crank Arm Rotation (Looking at Crank Arm)	Clockwise
Crank Arm Speed (No Load)	
Lo	34 RPM/min.
Hi	65 RPM/min.
Current Draw (amperes)	
No load (low speed)	3.6
Installed in Car (dry windshield)	4.5
Stall	12
Shunt Field Resistance (OHMS)	24

WASHER PUMP

Number of "squirts" at full pressure	12
Pressure (PSI)	11-15
Coil Resistance (OHMS)	20

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BUMPERS

SECTION 14

TORQUE SPECIFICATIONS

Application	Chevrolet	Chevelle	Chevy II	Corvette	Camaro
Front Bumper to Bumper Bracket Nuts	30 lb. ft.	24 lb. ft.	30 lb. ft.	—	25 lb. ft.
Front Bumper to Bumper Brace Nuts	30 lb. ft.	24 lb. ft.	30 lb. ft.	—	25 lb. ft.
Front Bumper to Bumper Brace Lower Nuts	—	39 lb. ft.	—	—	—
Front Bumper to Center Brace Bolts	—	—	—	30 lb. ft.	—
Front Bumper to Outer Brace Bolts	—	—	—	30 lb. ft.	—
Front Bumper to Inner Brace Bolts	—	—	—	43 lb. ft.	—
Front Bumper to License Plate Bracket Nuts	—	—	—	85 lb. ft.	—
Front Bumper Bracket to Frame Bolts	—	—	—	—	50 lb. ft.
Front Bumper Bracket & Brace to Frame Nuts	53 lb. ft.	—	—	—	—
Front Bumper Bracket & Brace to Frame Bolts	—	53 lb. ft.	28 lb. ft.	—	—
Front Inner Brace to Frame Crossmember Nuts	—	—	—	30 lb. ft.	—
Front Bumper Bracket to Frame Nuts	53 lb. ft.	53 lb. ft.	—	—	50 lb. ft.
Front Outer Brace & Center Brace to Frame Bolts	—	—	—	30 lb. ft.	—
Gas Tank Filler Door to Rear Bumper Nuts	43 lb. ft.	43 lb. ft.	—	—	—
Rear Bumper to Frame Crossmember Nuts	30 lb. ft.	—	—	—	—
Rear Bumper to Bumper Bracket Nuts	30 lb. ft.	30 lb. ft. (45 lb. ft. for station wagon & El Camino)	30 lb. ft.	30 lb. ft.	17 lb. ft.
Rear Bumper to Bumper Brace Nuts	—	30 lb. ft.	—	30 lb. ft.	17 lb. ft.

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TORQUE SPECIFICATIONS (CONT'D)

Application	Chevrolet	Chevelle	Chevy II	Corvette	Camaro
Rear Center Reinforcement to Frame Nuts	–	30 lb. ft. (45 lb. ft. for station wagon & El Camino)	–	–	–
Rear Bumper Bracket to Frame Nuts	50 lb. ft.	53 lb. ft.	28 lb. ft.	–	–
Rear Bumper Braces to Frame Nuts	–	–	–	30 lb. ft.	–
Rear Bumper Bracket & Brace to Frame Nuts	–	53 lb. ft.	–	–	–
Rear Bumper Bracket & Brace to Frame Bolts	–	–	28 lb. ft.	–	–
Rear Bumper Spacer to Bumper Nuts	25 lb. ft.	–	–	–	–
Rear License Plate Bezel to Body Screws	–	–	–	13 lb. in.	–

ACCESSORIES

SECTION 15

CRUISE—MASTER

Solenoid Resistance	5 ohms 1/4 ohm
Solenoid Wire Resistance	40 ohms
Maximum allowable Vacuum Leahage Rate for Servo Unit	5 inches of Vacuum
Operational Test Speed	50 mph

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