

1968



**CHEVROLET TRUCK
CHASSIS
OVERHAUL MANUAL**



**SERIES
10-60**

ST 134 68

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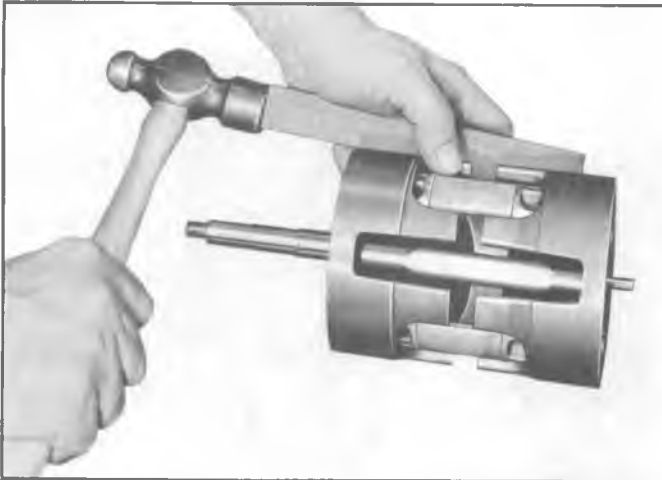


Fig. 19—Separating Cylinder Halves

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 (fig. 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.
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.

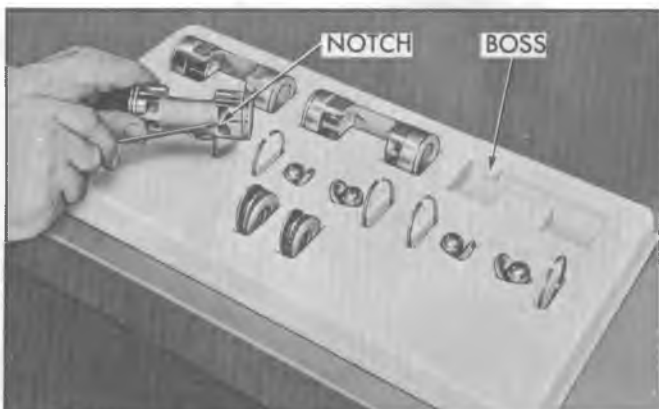


Fig. 20—Notch Identifying Front End of Piston

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.

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 clean 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 clean 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.
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

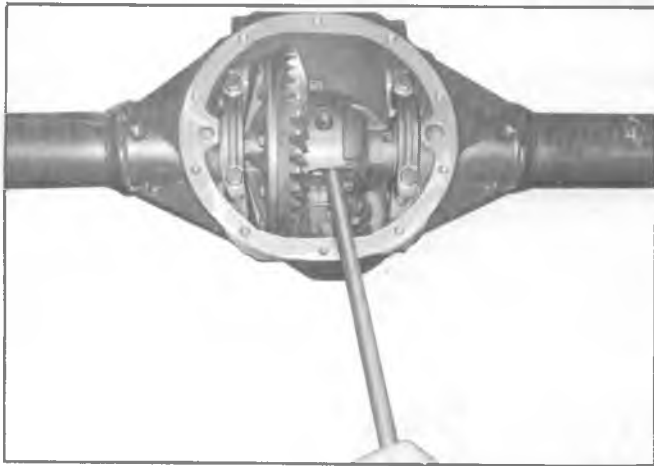


Fig. 1—Differential Case Removal

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 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

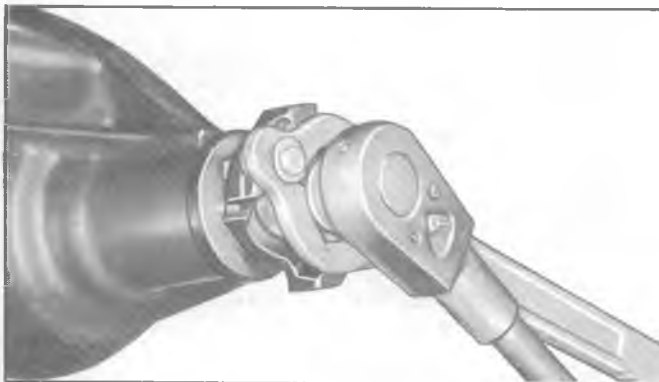


Fig. 2—Drive Pinion Nut Removal



Fig. 3—Drive Pinion Flange Removal

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 (fig. 5) and (split plate) J-22734 in conjunction with a heavy-duty ring gear used as a split plate holder (fig. 6) for heavy-duty axles. 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



Fig. 31—Removing Clutch Pack

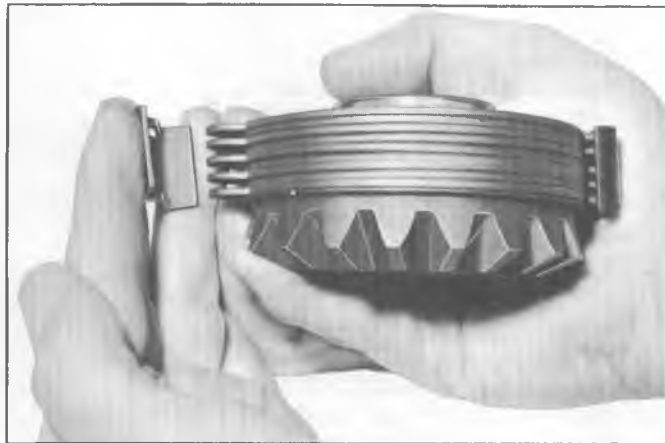


Fig. 32—Assembling Clutch Pack

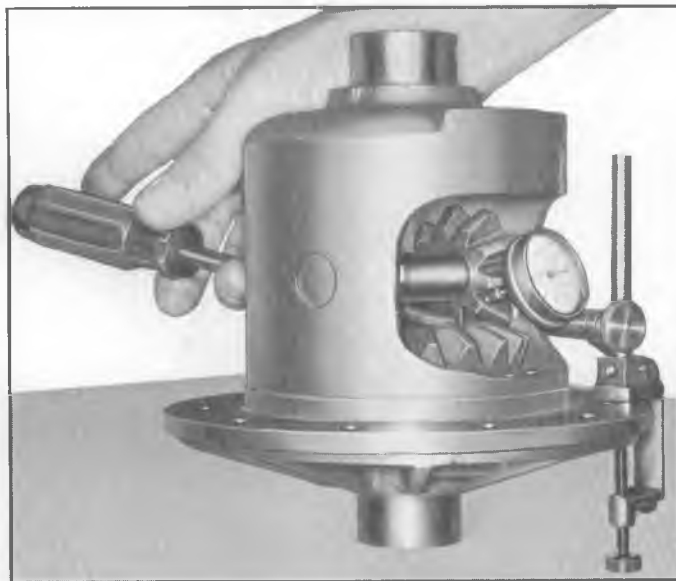


Fig. 33—Measuring Pinion Gear Tooth Clearance

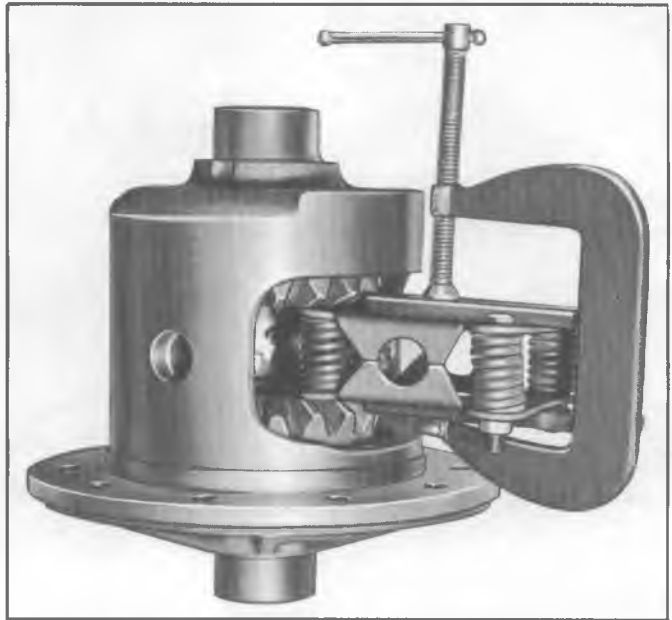


Fig. 34—Spring Pack Compressed for Installing

17. 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. 35).
18. Install the pinion shaft and lock screw. Torque lock screw to specifications.
19. Check alignment of spring retainer with side gears. Slight movement of the spring pack can be made if necessary.
20. Install side bearings and ring gear to case using procedure outlined for the conventional differential.



Fig. 35—Installing Spring Pack



Fig. 59—Removing Drive Pinion Nut (Typical)

3. Inspect bearing retainer for cracks, and any imperfections such as corrosion, pits and grooves in the oil seal area.
4. Replace defective parts as required.

NOTE: The pinion and ring gear are serviced in matched sets only. Therefore, if replacement is required both new components must be installed.

REASSEMBLY

1. Position pinion front bearing outer race in the bearing retainer with the thick edge of race toward internal shoulder in retainer. Using Tool J-22306 and Driver Handle J-8092 press race into retainer until it is firmly seated against shoulder.

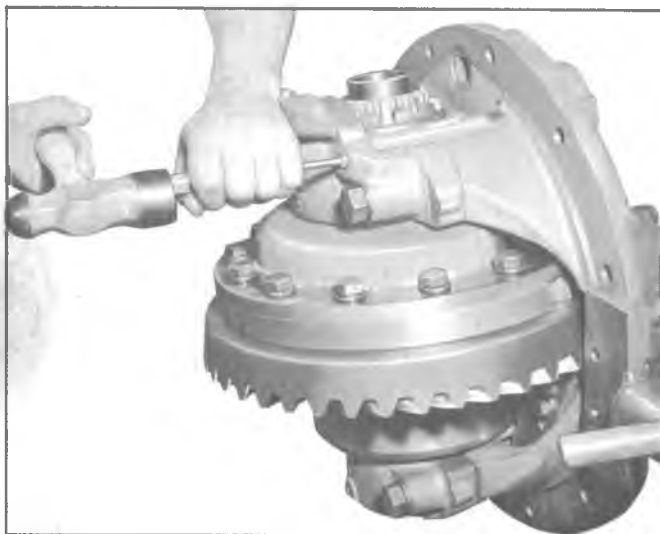


Fig. 60—Removing Shifter Yoke Shaft



Fig. 61—Removing Shifter Yoke and Sleeve

2. Position pinion intermediate bearing outer race in retainer as described in Step 1; then, using Tool J-22377 and Driver Handle J-8092, install race as above until it seats firmly against shoulder (fig. 70).
3. Install pinion intermediate bearing inner race on pinion with thick end of race toward pinion head, using a suitable length of 2 inch I.D. pipe to press against inner race (fig. 71).
4. Place pinion bearing spacer over pinion and against bearing, then position pinion in retainer and install front

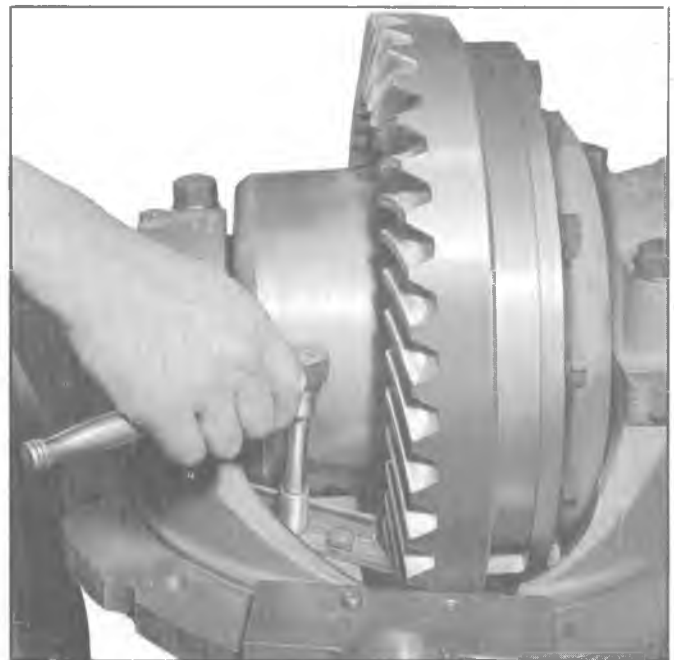


Fig. 62—Removing Oil Trough

REAR AXLE DIFFERENTIAL CARRIER 4-32

2. Position pinion and cage assembly on carrier over housing bolt holes. Align oil passages in shims, cage and carrier.
3. Install bolts and lock washers. Tighten bolts to torque shown in "Rear Axle Specifications."

DIFFERENTIAL DISASSEMBLY

1. Place differential assembly on bench. If original identification marks on case halves are not clear, punch mark both halves to assist in properly matching at reassembly.
2. Cut lock wires, then remove cap screws holding together the two-piece case, and separate case (fig. 88).
3. Remove four pinions (16) and thrust washers (15) from spider (17). Remove differential side gears (14 and 18) and thrust washers (13 and 19) from case.
4. If differential bearings require replacement, use Tool J-3493 in manner shown in Figure 89 to remove bearings.

DIFFERENTIAL INSPECTION

1. Wash all parts thoroughly in cleaning solvent.
2. Inspect ring gear for chipped or worn teeth and loosened bolts.
3. Check radial clearance between differential side gears and differential case, also fit of differential pinions on spider.
4. Inspect spider arms for wear and distortion.
5. Inspect splines and teeth of differential side gears and pinions for chipping or excessive wear.
6. Check thrust washers for wear and replace if even slight wear is indicated.
7. Check differential bearings and cups for broken races, discoloration or roughness.
8. Inspect differential case for cracks or distortion.

RING GEAR REPLACEMENT

Whenever inspection reveals that the ring gear must be replaced, it is also necessary to install a new pinion as these parts are serviced in matched sets.

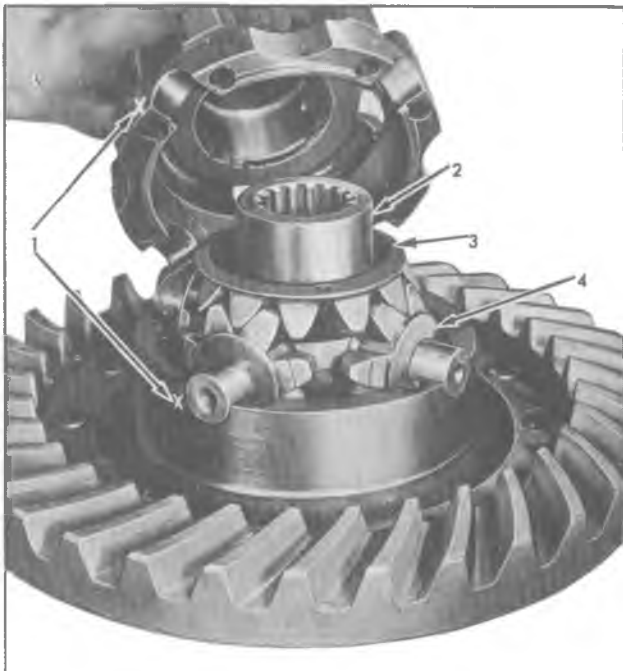


Fig. 88—Removing Differential Case

- | | |
|--------------------|------------------|
| 1. Alignment Marks | 3. Thrust Washer |
| 2. Side Gear | 4. Thrust Washer |

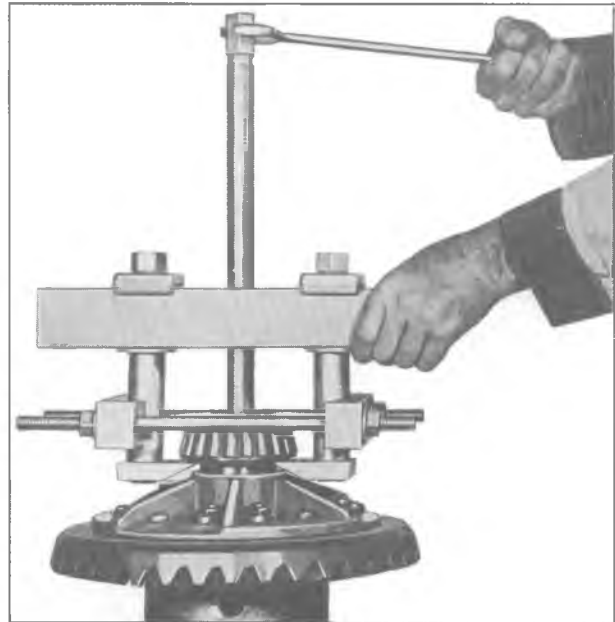


Fig. 89—Removing Differential Bearing, Using Tool J-3493

1. Remove locknuts and bolts, ring gear and differential case.
2. After cleaning differential case thoroughly, position ring gear on case and install bolts and locknuts. Tighten bolt nuts to specifications.

DIFFERENTIAL REASSEMBLY

1. Lubricate differential case inner walls and all the component parts with recommended axle lubricant.
2. Press differential side bearings (8 and 24) onto differential case.
3. Position new thrust washer (13 and 19) and side gear (14 and 18) in ring gear half of case. Install spider (17) with pinions (16) in position, using all new thrust washers (15). Install remaining side gear and new thrust washer.
4. Install other half of case over assembly. Align mating marks on differential case halves (fig. 88). Install four bolts holding two halves of case together. Draw the two halves together firmly. Check assembly for free rotation of gears; then install remaining bolts. Tighten bolts to correct torque; then install lock wire.

Reassembly

1. Lubricate side bearings and cups with recommended axle lubricant. Place cups over bearings and position differential assembly in carrier housing.
2. Install differential bearing adjusters (6 and 26) into place on carrier. Thread adjusters hand-tight against bearing cups. Install bearing caps in original positions according to marks made at disassembly.

CAUTION: If bearing caps do not seat properly, adjusters may be cross-threaded. Remove caps and reposition adjusting nuts. Do not force into position or threads will be damaged.

3. Install bearing cap bolts. Tighten snugly; then back off only enough to permit turning adjusting nuts.

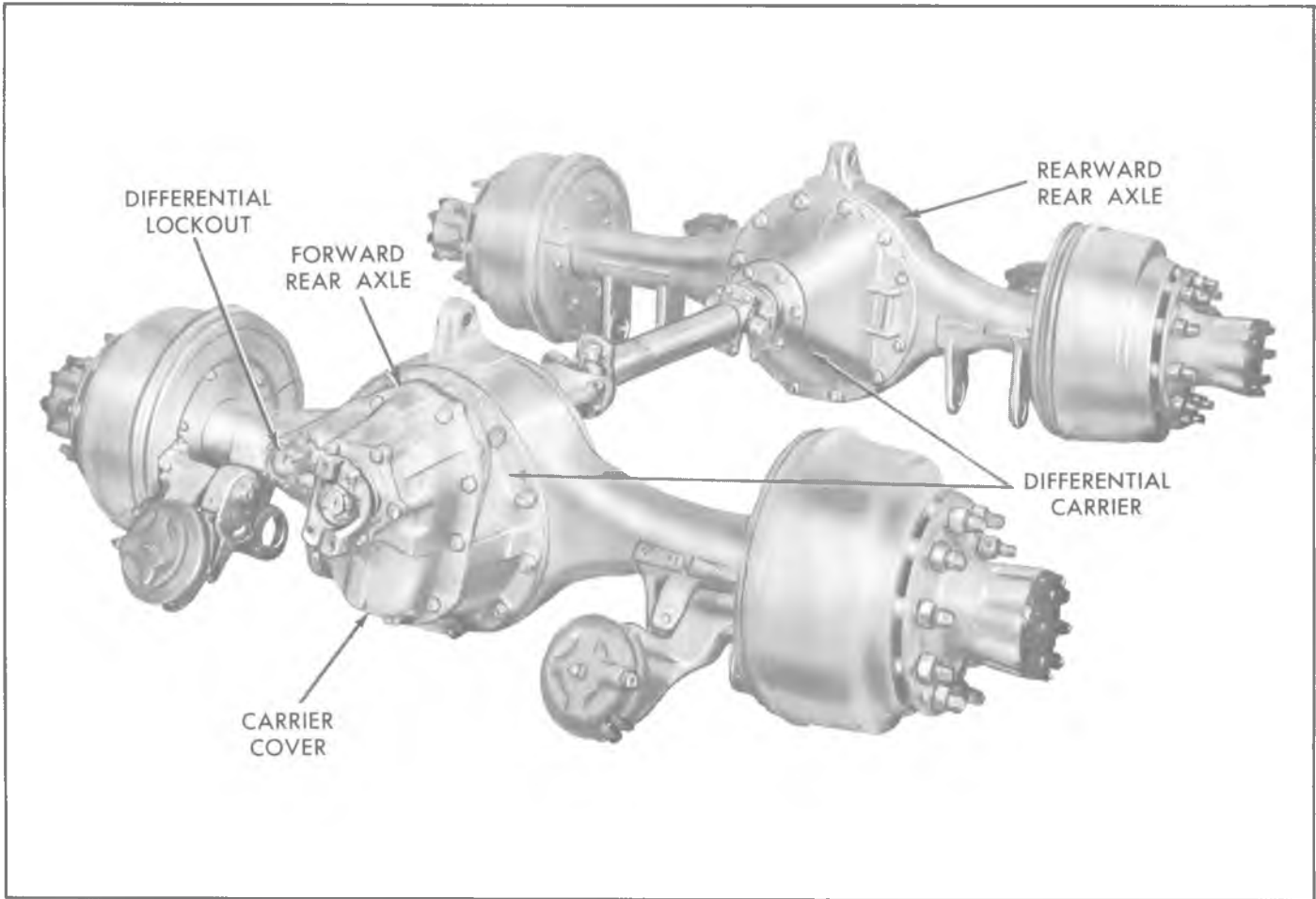


Fig. 100—Tandem Rear Axles and Power Divider

6. Start companion flange and slinger on output shaft splines, hold flange from turning and install nut. Tighten nut to 500-700 ft. lbs. torque and install cotter pin.
7. Install "D" washer on rear of input shaft so flat in I.D. of washer rests on flat of shaft (fig. 103).
8. Install bronze washer in clutch end of helical and differential side gear, install gear on rear of shaft making sure "D" washer remains in position, and install wire snap ring (fig. 103).

DIFFERENTIAL CARRIER

Disassembly

1. Remove unit from vehicle and remove differential carrier cover assembly as outlined previously.



Fig. 101—Removing Input Shaft Flange Nut

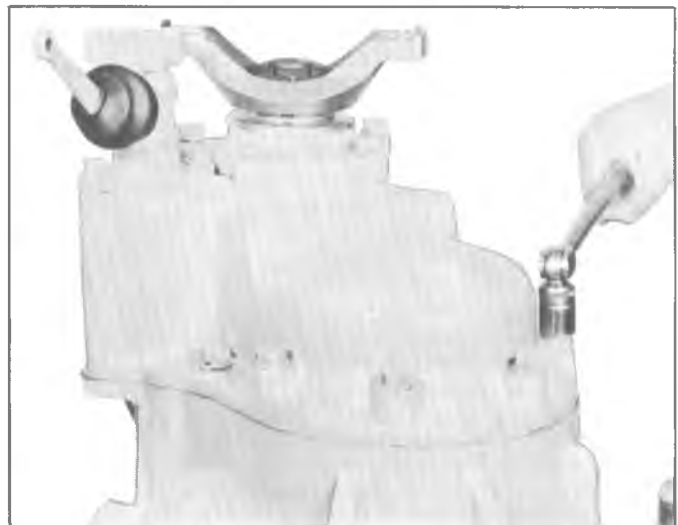


Fig. 102—Removing Differential Carrier Cover Bolts

DIFFERENTIAL CASE AND DRIVE PINION DANA 60-1 AND 60-3 SERIES

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GENERAL DESCRIPTION

The Dana Spicer 60 axle used on 10 (Dana 60-3) and 20 (Dana 60-1) Series Trucks, with 396 cu. in. engines, is similar in design to the Chevrolet Salisbury-type axle with the following exceptions:

1. The differential side bearing shims are located between the side bearing cone and roller assembly and the differential case. These bearings are of the tapered roller design and are preloaded. In order to remove the differential case the carrier must be spread.
2. The pinion assembly incorporates an inner and outer bearing shim. The inner shim is used to maintain proper pinion depth. While the outer shim is used to maintain proper preload on the pinion bearing.

DIFFERENTIAL CASE

Removal

1. Place vehicle on hoist with rear axle hanging free.
2. Remove wheel and tire assemblies.
3. Remove axles shafts as follows:
 - a. 10 Series--The axle shaft on the 10 Series are the semi-floating type. Outer end of shaft is supported by a tapered roller bearing.
 1. Remove brake drum.
 2. Remove four bolts holding wheel bearing flange plate to axle shaft flange.
 3. Install Puller J-21579 with Slide Hammer J-2619 and remove axle shafts.
 - b. 20 Series--The axle shafts on the 20 Series are full-floating type with flanged outer end of shaft attached to wheel hub by studs and nuts. Wheel is supported by tapered roller bearings at outer end of axle housing.
 1. Remove axle shaft to hub attaching nuts.
 2. Rap on axle shaft to loosen shaft from hub and remove shafts.
4. Remove plug in carrier and drain lubricant.
5. Remove cap screws and lock washers attaching cover to carrier. Remove cover and gasket.
6. Mark one side of carrier and matching cap for reassembly. Remove cap screws attaching bearing caps to carrier.
7. Using spreader Tool J-5231-01 and dial indicator as shown in Figure 134, spread carrier a maximum of .020".

NOTE: Do not exceed this dimension as carrier may be permanently damaged.

8. Remove dial indicator and with the use of a pry bar remove differential case from carrier. Remove spreader.

Disassembly

1. Remove differential bearing cups and identify with a tag for reassembly.
2. Place differential in vise and drive out pinion shaft lock pin.
3. Remove differential bearing cone and roller using Puller J-22888, with Plug J-8107-3, Figure 135. Tag cone and rollers for assembly.

NOTE: If ring gear and pinion are to be reassembled, note position of shims and replace accordingly.

4. Remove spacer (10 Series only), pinion shaft, pinions, side gears and thrust washers from differential case.
5. Remove screws attaching ring gear to differential case. Remove gear.

DRIVE PINION

Removal

1. Separate rear universal joint, tape trunnion bearings to joint, position propeller shaft to one side and tie propeller shaft to frame side rail.
2. Using Holding Bar J-8614-1, attached to pinion shaft flange, remove self-locking nut and washer from pinion shaft.
3. Install Tool J-8614-2 and 3 into holding bar as shown in Figure 136 and remove flange from drive pinion. Remove drive pinion from carrier.
4. With a long drift, tap on inner race of outer pinion bearing to remove pinion oil seal, slinger, gasket, outer pinion cone and roller and shim pack. Tag shim pack for reassembly.
5. Should inspection indicate necessity, pinion bearing cups can be removed from carrier using a long drift and hammer. Remove shims and oil slinger which are located behind the inner bearing cup. Tag shims for reassembly.

SPECIAL TOOLS

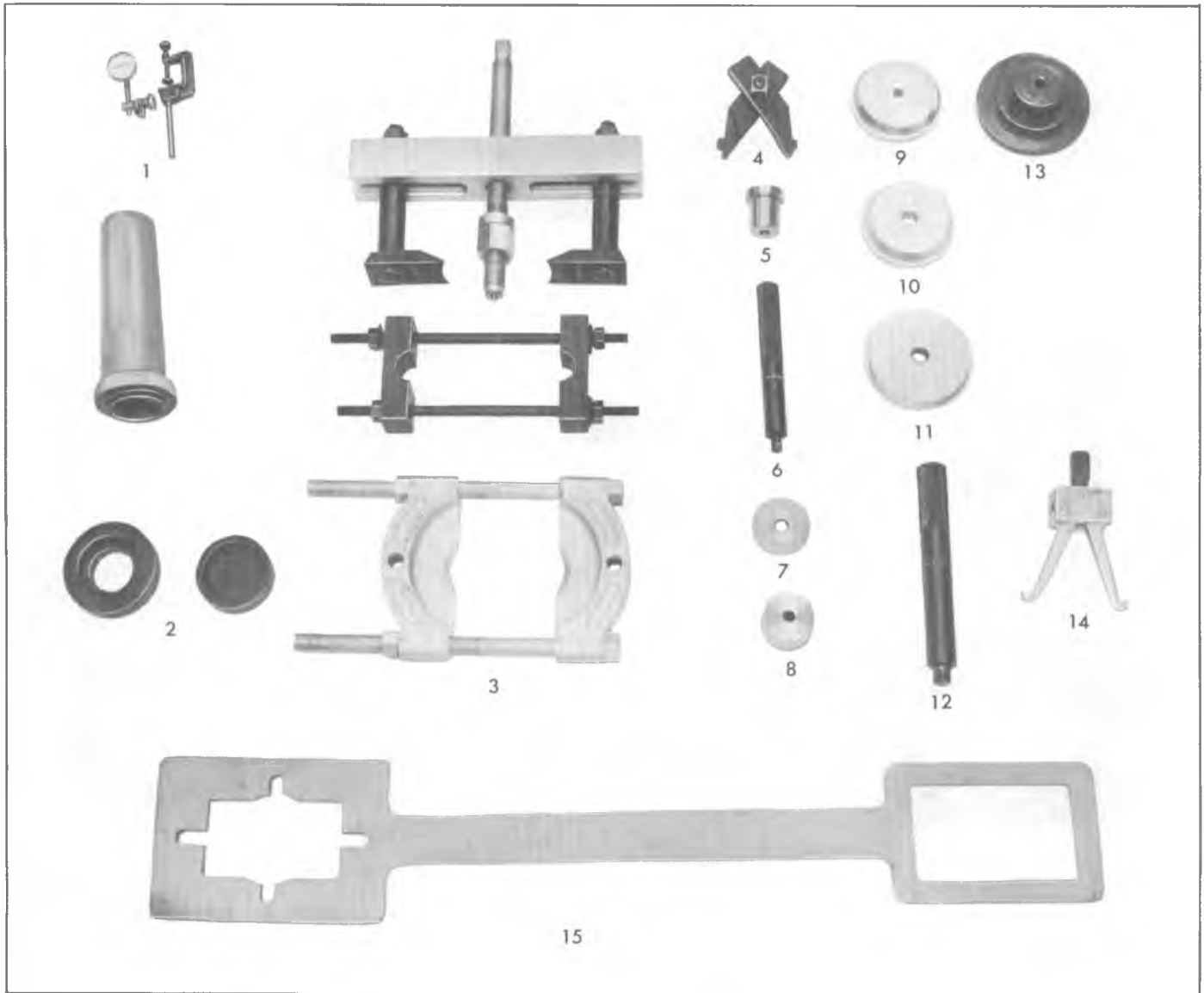


Fig. 147—Eaton Special Tools

- | | |
|---|---|
| 1. J-8001 - Dial Indicator | 9. J-3941 - Differential Case Support Fixture |
| 2. J-6419-1 2 and 4, Installer | 10. J-22377 - Cup Installer Used With J-8092 |
| 3. J-3493 - Universal Puller Set | 11. J-21106 - Cup Installer Used With J-8092 |
| 4. J-3940 - Bearing Cup Remover | 12. J-8092 - Drive Handle |
| 5. J-8476 - Bushing Installer | 13. J-8477 - Seal Installer Used With J-7079-2 |
| 6. J-7079-2 Drive Handle | 14. J-8119 - Bushing Remover Used With Slide Hammer |
| 7. J-8474-1 and 2 Bushing Remover and Installer | 15. J-3453 - Pinion Flange Holding Bar |
| 8. J-8479 - Bearing Cup Installer | |

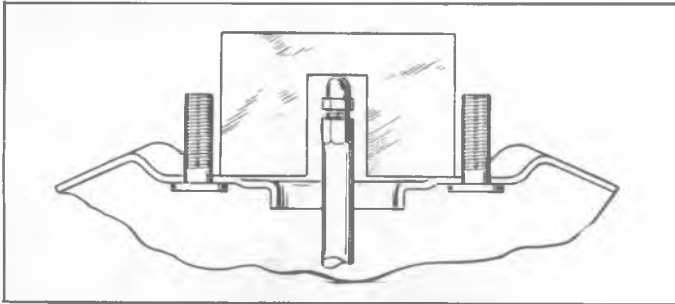


Fig. 16—Adjustment of Push Rod

38. Dip end of vacuum check valve in alcohol and install valve through grommet.
39. Apply liberal coat of silicone lubricant to entire surface of reaction disc and to piston end of hydraulic push rod; apply a light coat of silicone lubricant to push rod stem. Keep lubricant away from adjusting screw end of push rod.
40. Insert reaction disc and push rod in opening of front shell and into bore of front diaphragm plate hub. Twist push rod to make certain reaction disc is seated in bore and there are no air pockets between disc and end of push rod.
41. Install front vacuum seal, metal support plate side first, over adjustment screw end of push rod, pressing seal until it bottoms in recess of front shell.
42. Assemble main cylinder to front shell and securely tighten retaining nuts.
43. Install backing plate on rear shell and thread clip nut on stud marked during disassembly.

NOTE: The push rod is designed with a self-locking adjustment screw to provide the correction relationship between vacuum piston and main cylinder piston. The adjustment is important as it provides for the compensating port being kept open while unit is in released position. Adjustment screw is set to the correct height when assembled, and under normal service, will not require further adjustment. After unit has been disassembled however, the height should be checked as follows.

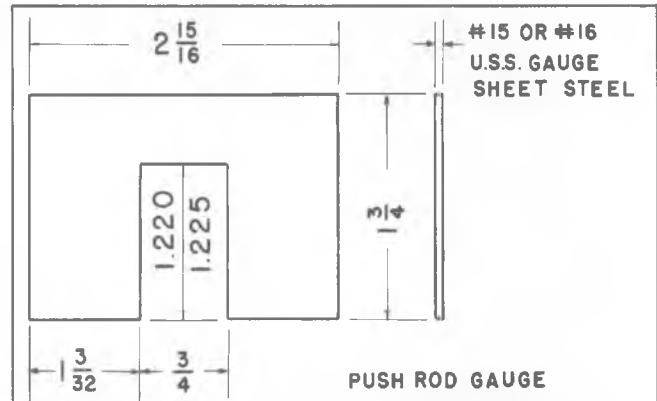


Fig. 17—Push Rod Gauge

Hydraulic Push Rod Adjustment

If adjustment is necessary, grasp push rod with pliers at serrated end and turn adjusting screw either in or out as required.

1. Place top of Push Rod Height Gauge J-21183 over push rod with legs of gauge resting on front of rear shell Figure 16. Top of screw should touch gauge.

Installation

1. Mount the power brake assembly in place and install four attaching nuts and lock washers. Be certain to place push rod through cutout in fire wall.
2. Attach vacuum line to check valve.
3. Secure hydraulic line to main cylinder.
4. Adjust push rod clevis to brake pedal assembly. Adjust pedal height by means of clevis on brake pedal push rod at pedal. Pedal height is obtained by measuring from floor covering at toe pan to top of pedal pad.

NOTE: Check operation of stoplight after adjusting pedal height.

5. Bleed brakes as outlined in the service manual.

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

MIDLAND-ROSS POWER BRAKES SINGLE DIAPHRAGM

The Model C-4274-F is a vacuum suspended push-thru booster designed for use with the single master cylinder.

Figure 18 is a sectional view of the booster in a non-actuated position. Air is evacuated through the vacuum check valve assembly to the engine manifold creating a vacuum in chambers B and C which connect by way of the open valve assembly. Activation of the brake pedal moves the valve rod assembly forward. The valve rod assembly moves the plunger forward compressing the plunger return spring. At the same time, the pre-loaded valve spring is expanding moving the valve assembly forward. At approximately .040" valve rod assembly travel, the valve assembly seals against the valve seat and unseats from the plunger, cutting off passage between chambers C and B, and allowing air from the inside of the valve body to enter chamber C. This creates a pressure differential across the diaphragm-plate as-

sembly moving the valve body forward against the diaphragm return spring until the valve assembly seals against the plunger. At this point the valve assembly is in a "lap" or hold position seating against the plunger and the valve seat. The valve assembly will remain in this position as long as the operator does not move the valve rod assembly. Further activation of the valve rod assembly will cause a repeat of the previous events providing a force through the push rod assembly into the master cylinder.

Reaction force from the master cylinder is transmitted to the operator through the reaction lever assembly providing the correct brake "feel".

Upon release of the valve rod assembly, the force of the plunger return spring and the force on the reaction lever assembly act to push the plunger backward unseating the valve assembly from the valve seat, opening passage between

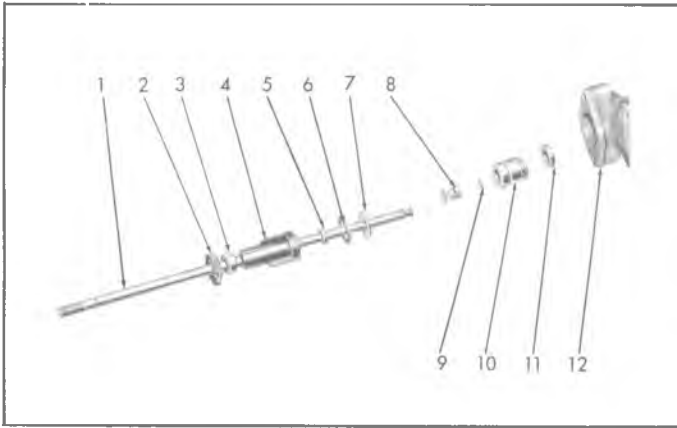


Fig. 29—Hydraulic Piston

- | | |
|----------------------|--------------------------------|
| 1. Push Rod | 7. Valve Body (Hex) |
| 2. Retainer Nut | 8. Seal Valve Body |
| 3. Push Rod Bearing | 9. Piston |
| 4. Push Rod Seal Cup | 10. Cup |
| 5. "O"Ring Seal | 11. Hydraulic Cylinder Housing |
| 6. Stop Washer | |

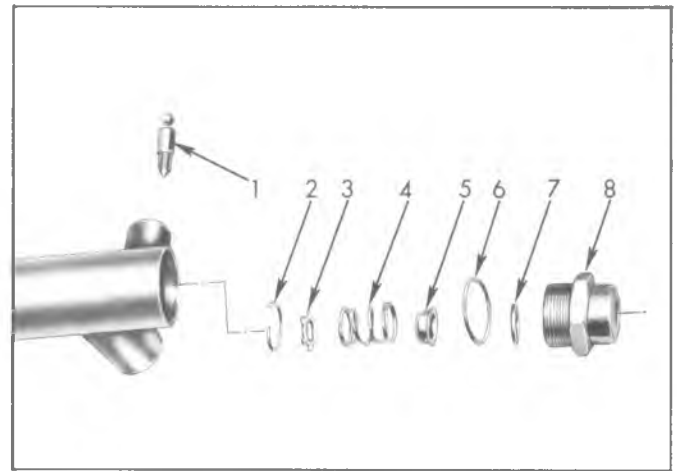


Fig. 31—Residual Check Valve

- | | |
|--------------------|------------------|
| 1. Bleed Screw | 5. Check Valve |
| 2. Snap Ring | 6. Rubber Washer |
| 3. Spring Retainer | 7. Cap Seal |
| 4. Spring | 8. End Cap |

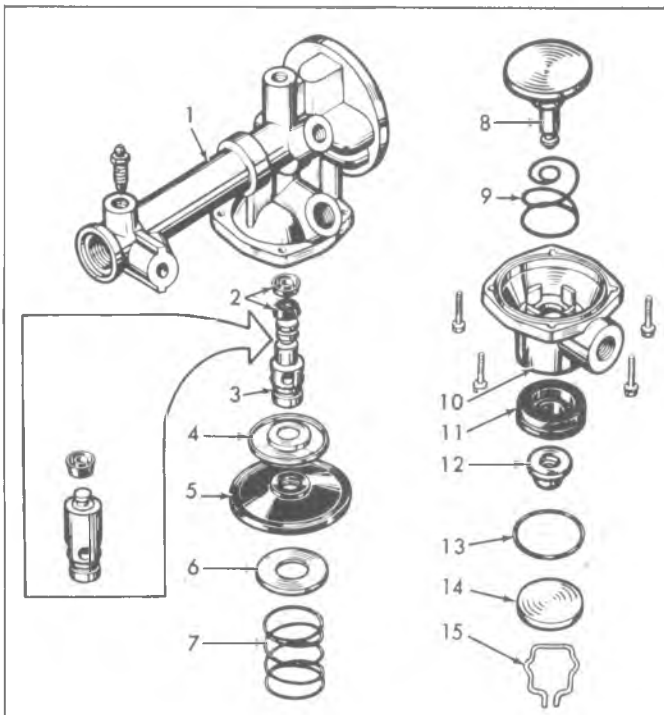


Fig. 30—Control Valve Explode

- | | |
|-------------------------------|-----------------------------------|
| 1. Hydraulic Cylinder Housing | 9. Poppet Spring |
| 2. Valve Piston Cups | 10. Valve Body |
| 3. Valve Piston | 11. Atmospheric Poppet Valve Seat |
| 4. Washer | 12. Poppet Retainer |
| 5. Diaphragm | 13. Valve Body Cover Seal |
| 6. Retainer | 14. Cover Plate |
| 7. Spring | 15. Snap Ring |
| 8. Vacuum Poppet | |

- must be tapped into the retaining groove on the bushing.
- Assemble front diaphragm onto diaphragm push rod as follows:
Install snap ring on front end of piston rod (the end without holes).
Install collar against snap ring.
Install diaphragm and plate assembly with flat side against collar and install retaining nut onto piston rod.
 - Assemble diaphragm piston rod through center housing bushing from front, then slide the assembly carefully over slave cylinder push rod until the front chamber halves are in contact.
 - Align front diaphragm lip in place between halves and align the disassembly scribe marks on the housing halves, then install the clampband, screw and nut.
 - Move the diaphragm piston rod forward, then install the "O" ring on the hydraulic cylinder push rod and the snap ring on the diaphragm piston rod.
 - Install diaphragm return spring retainer and spring over the piston rod with large end toward center housing.
 - Install collar against piston rod snap ring. Then install rear diaphragm and plate assembly against collar with the lip side forward and carefully thread the end plug over hydraulic cylinder push rod and into hollow diaphragm piston rod.
 - Adjust slave cylinder push rod as follows:
With a screw driver turn the push rod counter-clockwise until the diaphragm just begins to move.
Turn push rod 1/2 to 1 full turn more. This assures hydraulic cylinder piston is returned before diaphragm bottoms.
Install jam nut and tighten while holding the push rod.
 - Install vacuum control tube "O" rings in the tee and elbow then install rear tube into tee.
 - Lay the clampband over the center housing rear shell.
 - Install rear housing shell being careful to align diaphragm lip, the housing scribe marks, and the vacuum tube into place, then install and tighten clampband, screw and nut.

- Using cap screws with lock washers, secure cylinder block to crankcase.

INSTALLING CRANKSHAFT

- Press ball bearing on drive end of crankshaft with suitable tool.
- Position ball bearing and crankshaft in crankcase making sure the drive end of the crankshaft is positioned as marked before disassembly.
- Front end of the crankcase is counterbored for holding a bearing; be sure the crankshaft is installed through the correct end of the crankcase.
- Carefully press crankshaft and bearing into crankcase using arbor press.
- Insert thrust washer in crankshaft at rear cover end making sure oil grooves are toward crankshaft shoulder.
- Position rear end cover and bushing with oil seal ring installed over crankcase.
- Secure rear end cover to crankcase with cap screws and lock washers.
- Press new oil seal into front end cover after cover is cleaned.
- Position new front end cover gasket and carefully install front end cover over crankshaft and to crankcase avoiding damage to the seal.
- Secure front end cover with cap screw and lock washers.

PISTONS AND CONNECTING RODS

If new wrist pin bushings are to be used, they should be pressed into the connecting rods so that the oil hole in the bushing lines up with the one in the rod. The new bushings should then be reamed or honed to provide between 0.0001" and 0.0006" clearance on the wrist pin. Position connecting rod in piston and press in wrist pin so that lockwire hole in the pin aligns with that of the piston. Install new lockwire through piston and wrist pin and lock same by snapping short end into lockwire hole at the bottom of the piston.

- Install piston rings in correct location with ring pipemarks up. Stagger the position of the ring gaps.
- Prelubricate piston, piston rings, wrist pin and connecting rod bearings with clean engine oil before installing them in the compressor.
- Remove connecting bolts and bearing cap from one connecting rod. Turn crankshaft so one of its connecting rod journals is in the downward position.
- Insert the connecting rod with piston through the top of the cylinder whose journal is down.
- Position and attach the bearing cap to the connecting rod making sure the bolt lock washers are properly positioned on the cap.
- Tighten connecting rod bolts evenly and bend the two new lock washer prongs up against the hex head of the bolt.
- Install the other connecting rod and piston in the same manner.

UNLOADER MECHANISM (Fig. 45)

- The unloader pistons and their bores must be lubricated with special Chevrolet approved lubricant prior to installation. If new unloader kits are being installed, the pistons in the kit are already lubricated.
- Install the unloader pistons in their bores with caution against cutting the grommets or distorting the back-up rings.
- Position unloader plungers in their guides and slip them in and over the tops of the pistons.
- Install the unloader spring seat in the cylinder block; a small hole is drilled in the block for this purpose.

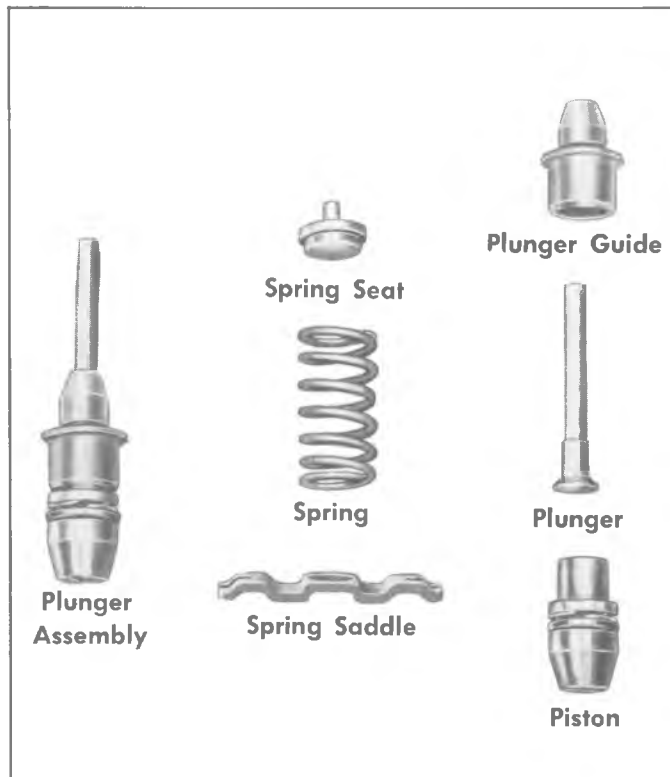


Fig. 45—Unloader Mechanism Components

- Position the saddle between unloader piston guides so its forks are centered on the guides.
- Install the unloader spring making sure it seats over the spring seats both in the block and on the saddle.
- Position and install inlet valve guides, then drop inlet valves in their guides. There should be a loose sliding fit between guides and valves.

CYLINDER HEAD ASSEMBLY

- If previously removed the discharge valve seats should be installed.
- Drop discharge valves into their seats.
- Install discharge valve springs and cap nuts.
- Stick the inlet valve springs in the cylinder head.
- Use a small quantity of grease to hold them in place, just enough grease to keep the springs from falling out.
- Place cylinder head gasket on cylinder block.
- Carefully align cylinder head assembly on block and install cap screws with lock washers.
- Tighten securely and evenly cap screw that holds cylinder head to block.

AIR STRAINER

The air strainer assembly is a three-piece unit with a mounting plate, paper element air cleaner and a retainer cover and clip assembly.

The air cleaner is serviced by removing the clipped-on cover and inspecting the air cleaner element every 20,000 miles. The element must be cleaned if dirty each 5,000 miles.

Inspection After Assembly

Check to be sure that covers, plugs or masking tape are used to protect all ports if compressor is not to be installed immediately.

Fit the end of all crankshafts with keys, nuts and cotter

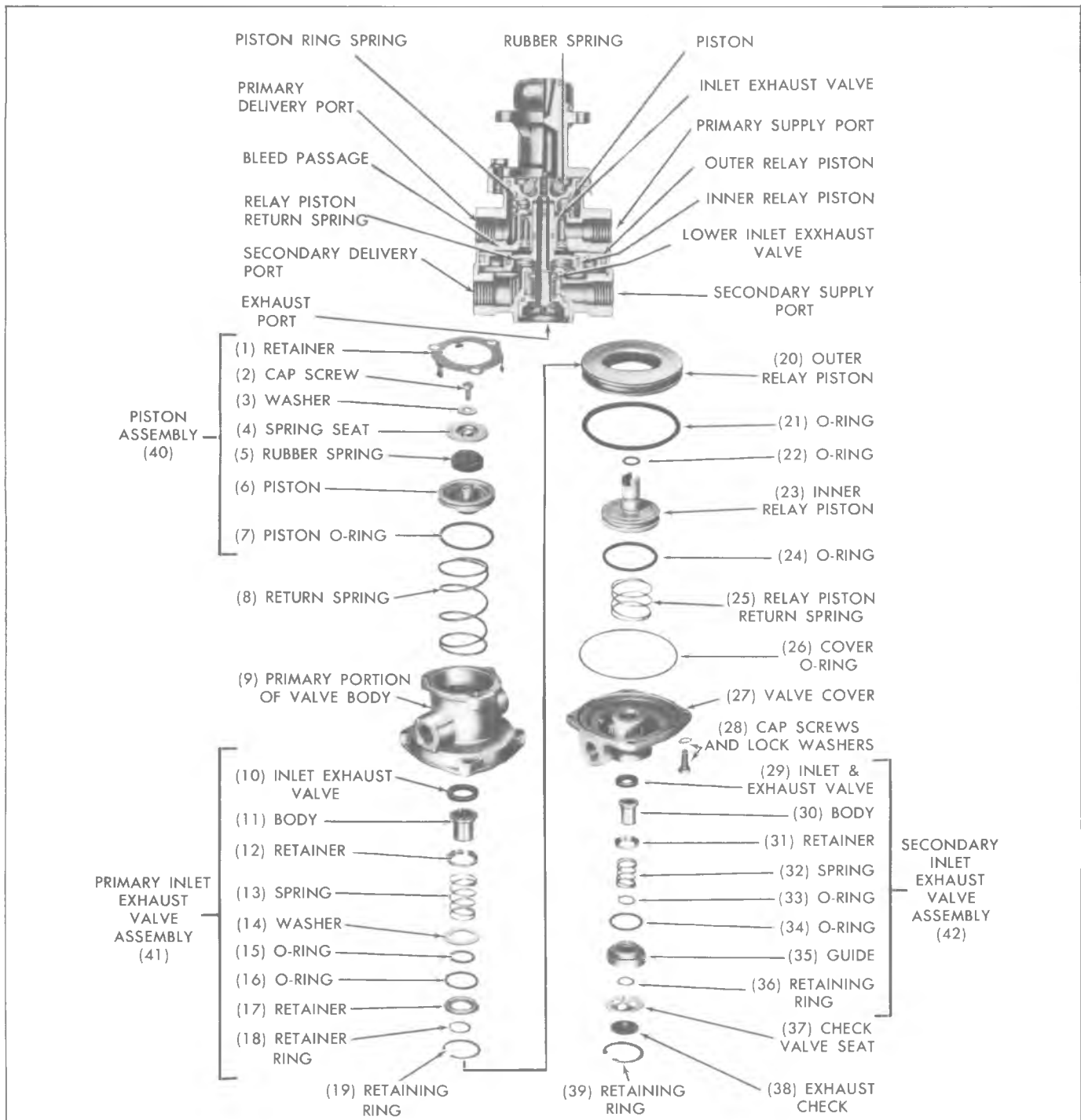


Fig. 59—Air Brake Control Valve Components

body (9). Disassemble piston assembly (40) further as required.

Secondary Inlet and Exhaust Valve Assembly

- Using tru-arc pliers, remove retaining ring (39) in exhaust port.
- Remove exhaust check (38).
- Remove lower inlet and exhaust valve assembly (42) by removing retaining ring (36).
- Remove four (4) cap screws and lock washers (28) from cover (27).

- Remove cover "O" ring (26).

- Remove relay piston return spring (25).
- Remove inner relay piston (23), being careful not to damage exhaust seat. Remove large inner relay piston "O" ring (24) and small inner relay piston "O" ring (22).
- Remove outer relay piston (20) and outer relay piston "O" ring (21).

Primary Inlet and Exhaust Assembly

- Using tru-arc pliers, remove upper valve retaining ring (19).

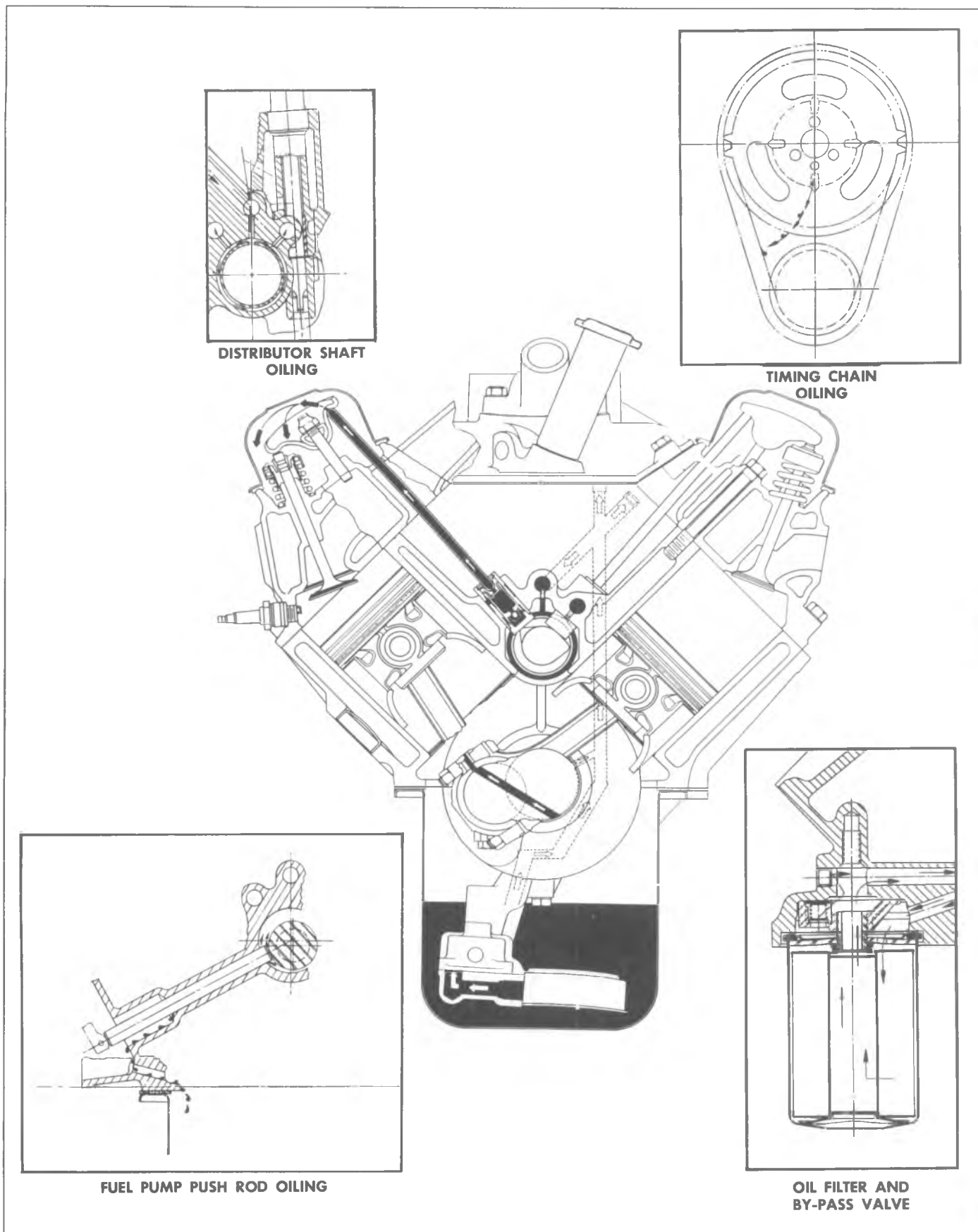


Fig 2—V8 Engine Lubrication (307 and 327)

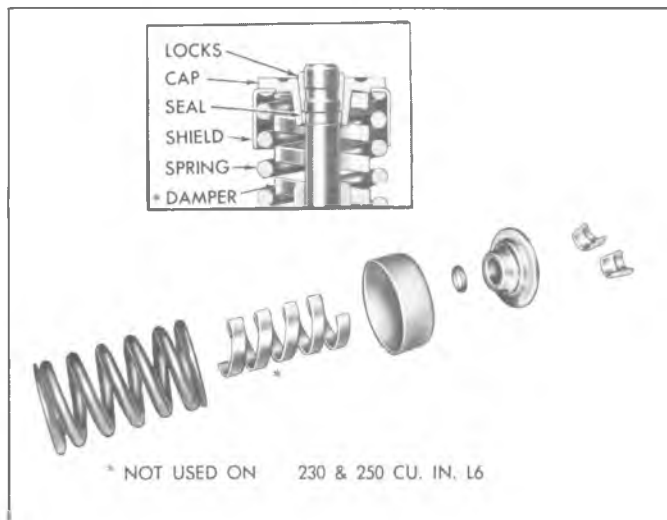


Fig. 26—Valve Spring Installation (In Line and 307, 327 V8)

marks have not been removed at the point of contact with the valve seat, it will be necessary to repeat the re-facing operation and again recheck for proper seating.

9. Grind and check the remaining valves in the same manner.

Assembly

1. Insert a valve in the proper port.
2. Assemble the valve spring and related parts as follows:
 - a. Set the valve spring shim, valve spring (with damper if used), valve shield and valve cap or rotator in place (fig. 26). 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.

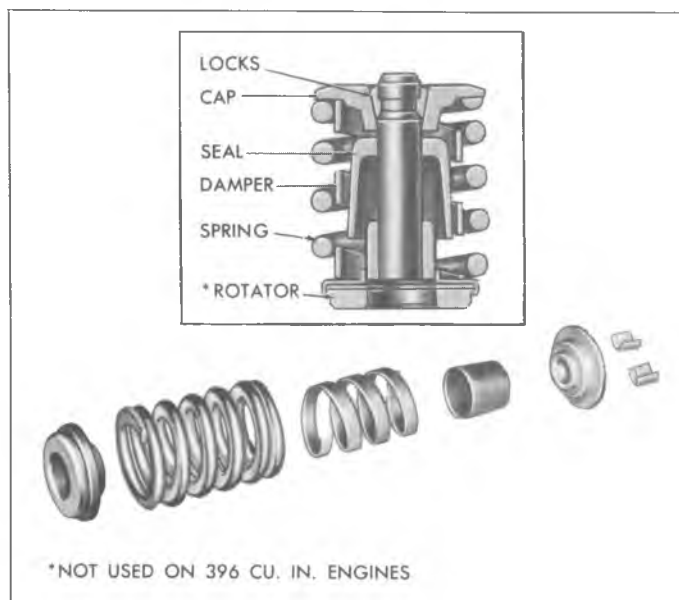


Fig. 27—Valve Spring Installation (366, 396 and 427 V8)



Fig. 28—Vacuum Cup

366, 396 AND 427 CU. IN. V8

- a. Install valve spring shim and/or exhaust valve rotator 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. 27).
- 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.

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 307, 327 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. 28).
5. Check the installed height of the valve springs, using a narrow thin scale. A cutaway scale will help (fig. 29). Measure from the top of the shim or the spring seat to the top of the valve spring or valve spring shield (fig. 30). 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

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. 31).

Disassembly

1. Hold the plunger down with a push rod, and using the 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. 31).

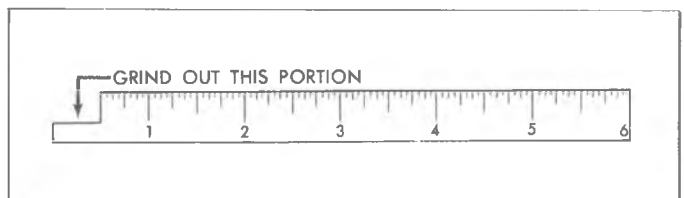


Fig. 29—Cutaway Scale

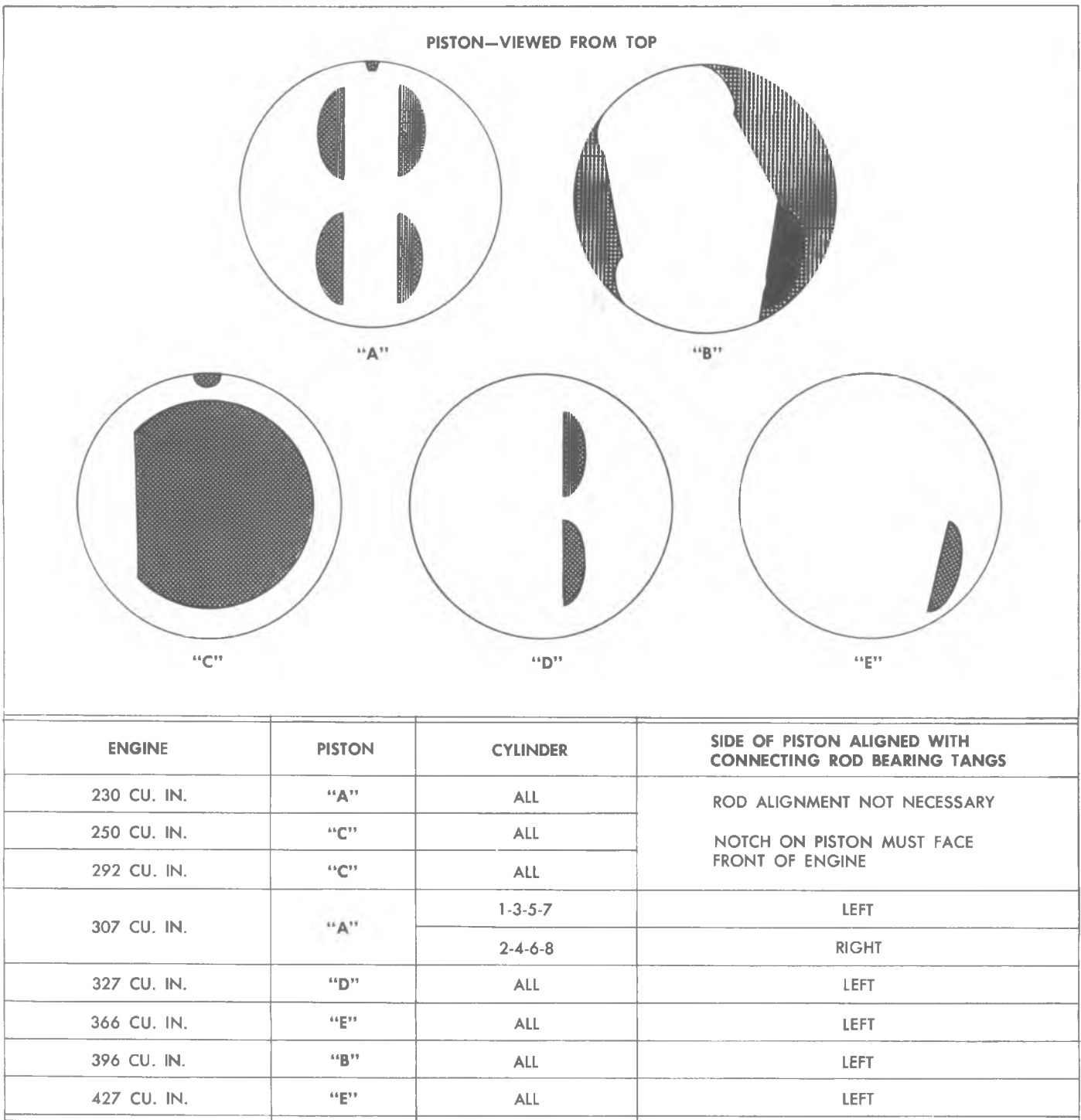


Fig. 55—Connecting Rod and Piston Relationship

- 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. 59). (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.

SPECIAL TOOLS

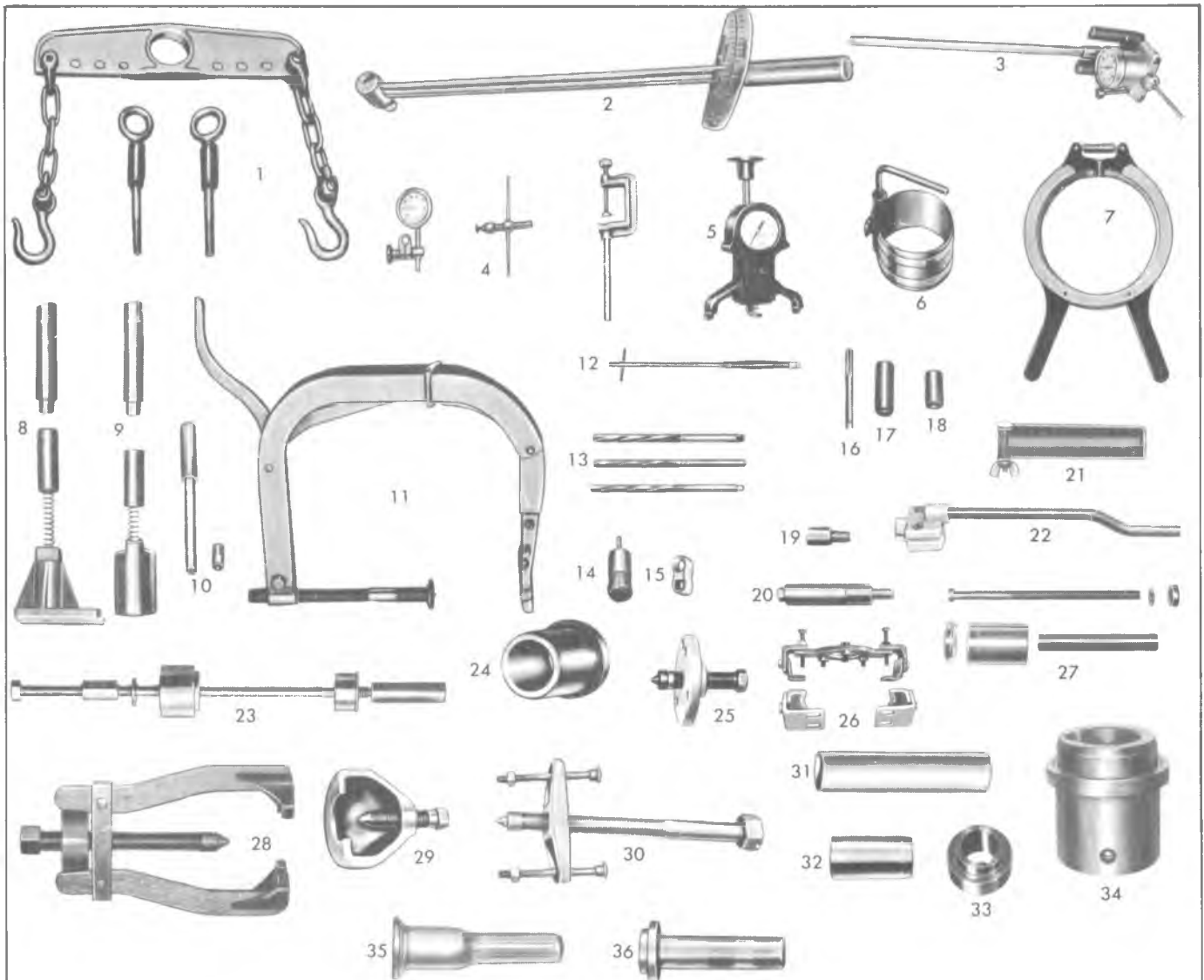


Fig. 77—Engine Special Tools

- | | | |
|--|--|---|
| 1. J-4536 Engine Lift Kit | 10. J-5239 (3/8") Connecting Rod Guide Set | 23. J-6098 Cam Bearing Tool |
| 2. J-1264 (0-200 Ft. Lb.) Torque Wrench | J-6305 (11/32") | 24. J-0971 Camshaft Gear Support |
| J-8058 (0-50 ft. lb.) | 11. J-8062 Valve Spring Compressor | 25. J-6987 Torsional Damper Puller |
| J-5853 (0-100 in. lb.) | 12. J-8101 Valve Guide Cleaner | 26. J-22197 Torsional Damper Installer |
| 3. J-8087 Indicator Set (Cylinder Bore) | 13. J-5830 (11/32") Valve Guide Reamer Set | 27. J-21058 Torsional Damper and Sprocket Installer |
| 4. J-8001 Indicator Set (Universal) | J-7049 (3/8") | 28. J-1619 Crankshaft Sprocket Puller |
| 5. J-7316 Belt Tension Gauge | 14. J-8089 Carbon Removing Brush | 29. J-5825 Crankshaft Sprocket Puller |
| 6. J-8037 Piston Ring Compressor | 15. J-5860 Cylinder Head Bolt Wrench | 30. J-8105 Crankshaft Gear Puller |
| 7. J-8020 (3 9/16") Piston Ring Expander | 16. J-5715 (.003") Rocker Arm Stud Reamer | 31. J-5590 Crankshaft Sprocket or Gear Installer |
| J-8021 (3 7/8") | J-6036 (.013") | 32. J-0966 Crankcase Cover Centering Gauge |
| J-8032 (4") | J-6880 Rocker Arm Stud Installer | 33. J-21742 Crankcase Cover Centering Gauge |
| J-22249 (3 15/16") | 18. J-5802 Rocker Arm Stud Remover | 34. J-22102 Crankcase Cover Tool |
| J-22147 (4 3/32") | 19. J-9534 Distributor Lower Bushing Remover | 35. J-8340 Crankcase Cover Seal Installer |
| J-22250 (4 1/4") | 20. J-9535 Distributor Lower Bushing Installer | 36. J-0995 Crankcase Cover Seal Installer |
| 8. J-6994 Piston Pin Assembly Tool | 21. J-22144 Oil Pick-up Screen Installer | |
| 9. J-9510 Piston Pin Assembly Tool | 22. J-8369 Oil Pick-up Screen Installer | |



Fig. 4R—Exploded View—Air Horn

rod assembly and actuating rod into float bowl. End of metering rod must enter jet orifice.

9. Install drive link into keyhole in actuating lever.
 10. Hold complete assembly downward in bowl, then install upper end of power piston drive link into hole in lower end of power piston actuating rod. Align "D" hole in actuating lever with flats on throttle shaft and install lever on end of throttle shaft. Install retaining screw in end of throttle shaft and tighten securely.
- NOTE:** Before installing air horn, check operation of entire drive mechanism, metering rod and accelerator pump to ensure free operation from closed to wide open throttle.
11. Install idle tube into cavity in float bowl.
 12. Install pump discharge ball, spring and spring retainer. Make sure spring retainer is flush with top of bowl casting.
 13. Install fuel filter relief spring, fuel inlet filter, filter nut

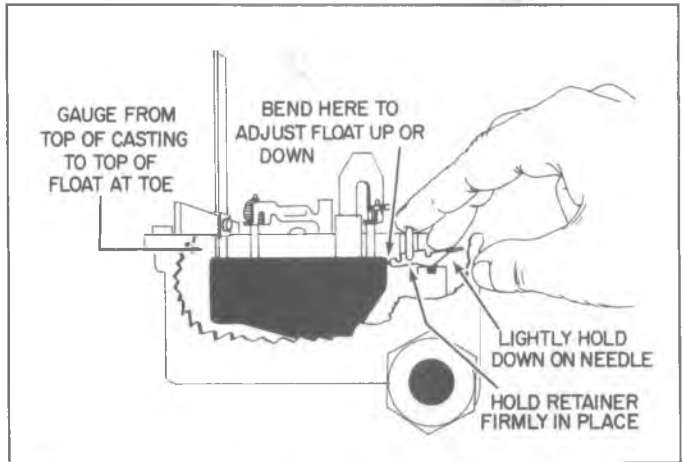


Fig. 5R—Float Level Adjustment

and gasket. Tighten securely. Open end of filter should face hole in fuel inlet nut.

14. Install float needle seat and gasket. Tighten securely and carefully to avoid damage to seat.
15. Install float needle valve into needle seat.
16. Insert straight portion of float hinge pin into float arm. Install float and hinge pin into float bowl.

FLOAT LEVEL ADJUSTMENT (FIG. 5R)

1. Hold float retaining pin firmly in place and float arm against top of float needle.
2. With adjustable T-scale, measure distance from top of float at toe to float bowl gasket surface (gasket removed). Measurement should be made at point 1/16" in from end of flat surface at float toe (not on radius).
3. Bend float pontoon up or down at float arm junction to adjust.

METERING ROD ADJUSTMENT (FIG. 6R)

1. To check adjustment back out idle adjusting screw to ensure closed throttle valve. Rotate last idle cam so that last idle cam follower is not contacting cam (if installed).
2. With throttle valve completely closed apply pressure to hanger directly above power piston and hold piston down against its stop.
3. Holding downward pressure on power piston, swing metering rod holder over flat surface of bowl casting until metering rod rests lightly against inside edge of bowl.
4. Use specified plug gauge and insert between bowl casting and lower surface of metering rod holder against metering rod. Gauge should have a slide fit between both surfaces, as shown.
5. To adjust, carefully bend metering rod holder up or down at point shown.
6. Install air horn gasket on float bowl by carefully sliding slit portion of gasket over metering rod holder. Then align gasket with dowels provided on top of bowl casting and press gasket firmly in place.

NOTE: Before installing air horn, check operation of entire drive mechanism, metering rod and accelerator pump to ensure free operation from closed to wide open throttle.

AIR HORN ASSEMBLY AND INSTALLATION

1. Install idle vent valve assembly, if removed.
2. Install choke shaft and choke valve, if removed. Align choke valve, tighten two retaining screws and stake securely.

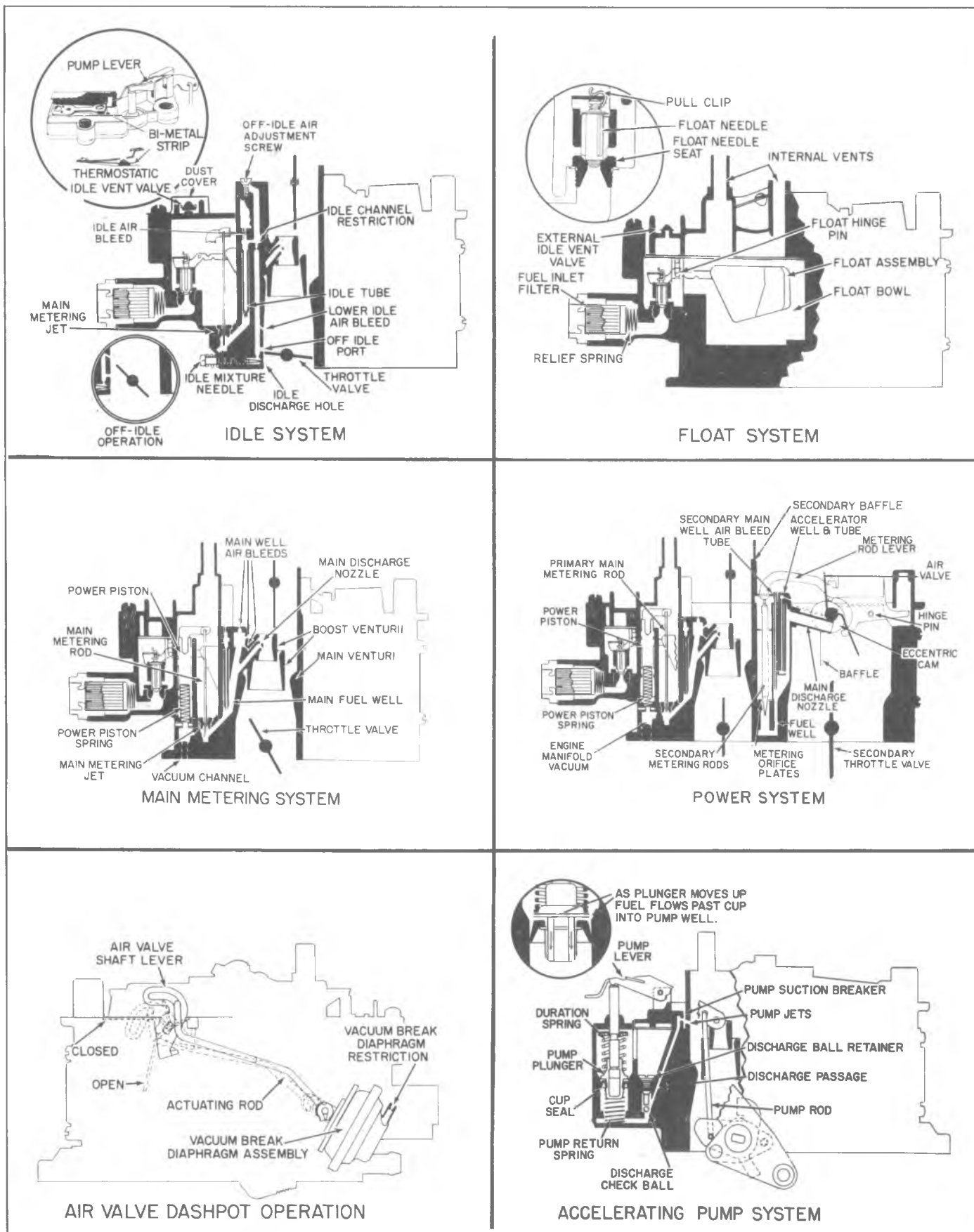


Fig. 22R—Rochester 4MV Fuel Systems

SPECIAL TOOLS

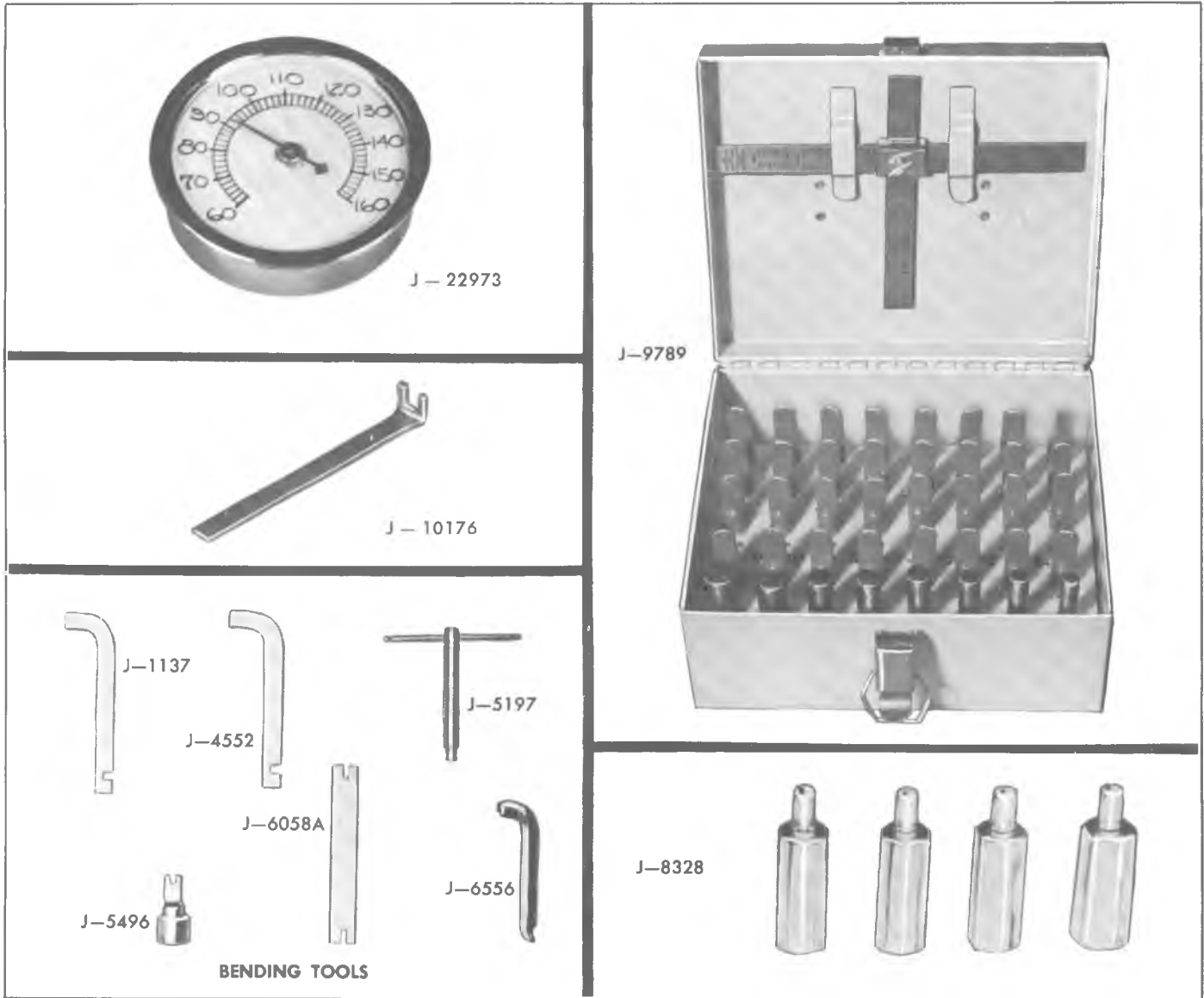


Fig. 1T—Engine Fuel Special Tools

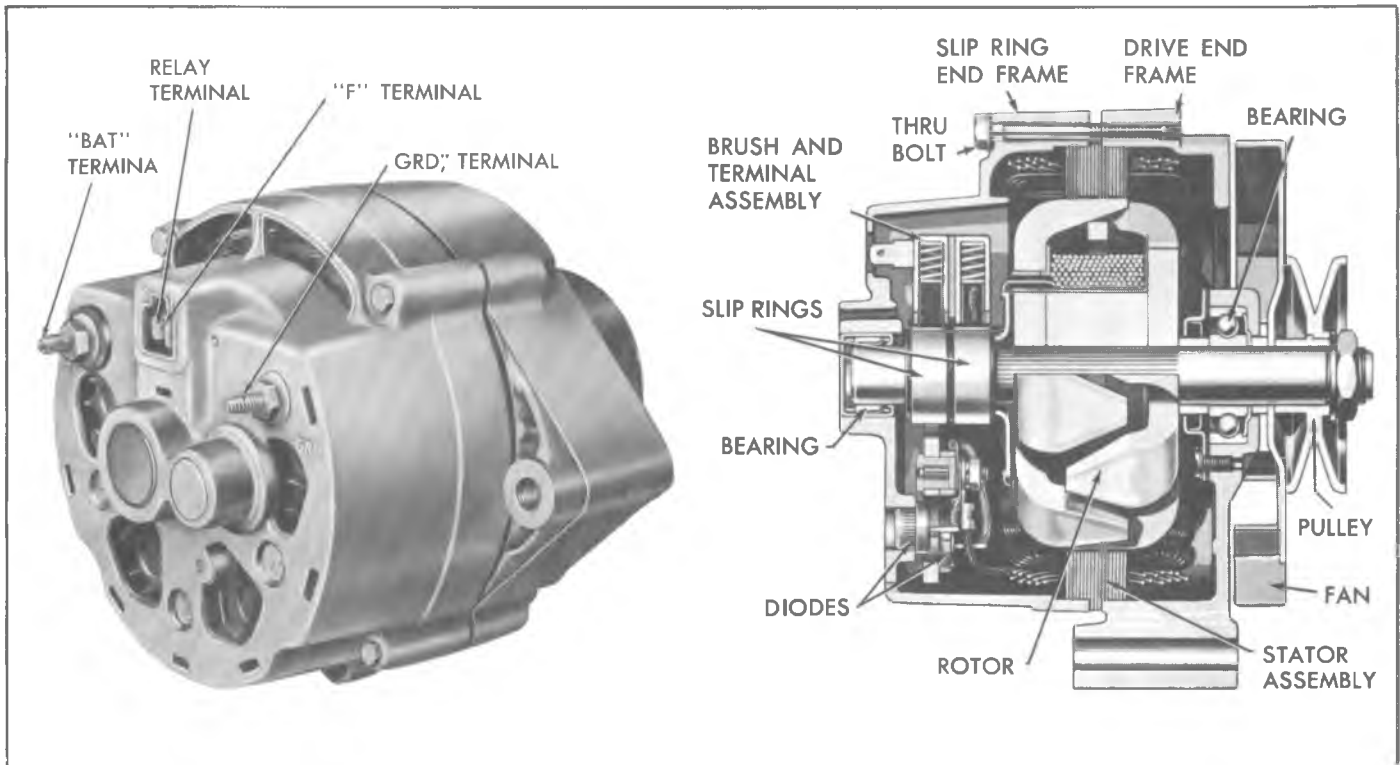


Fig. 1c—5.5" Series 1D Delcotron

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 (Fig. 3c)

The rotor may be checked electrically with a 110-volt test lamp or an ohmmeter.

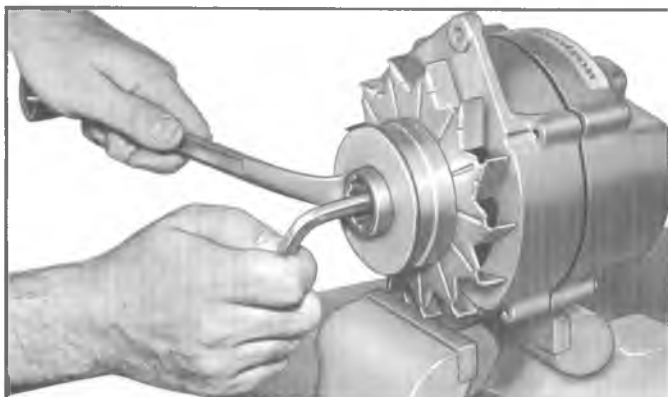


Fig. 2c—Pulley Removal

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.

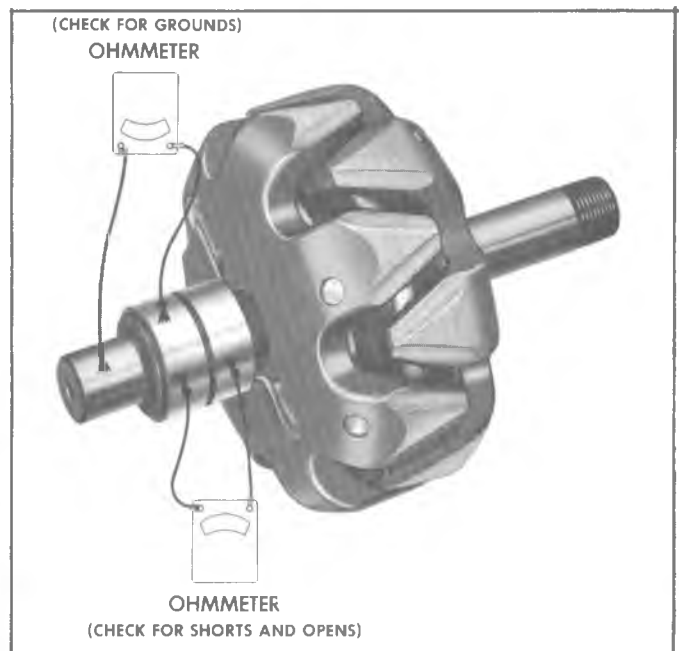


Fig. 3c—Checking Rotor for Grounds or Opens

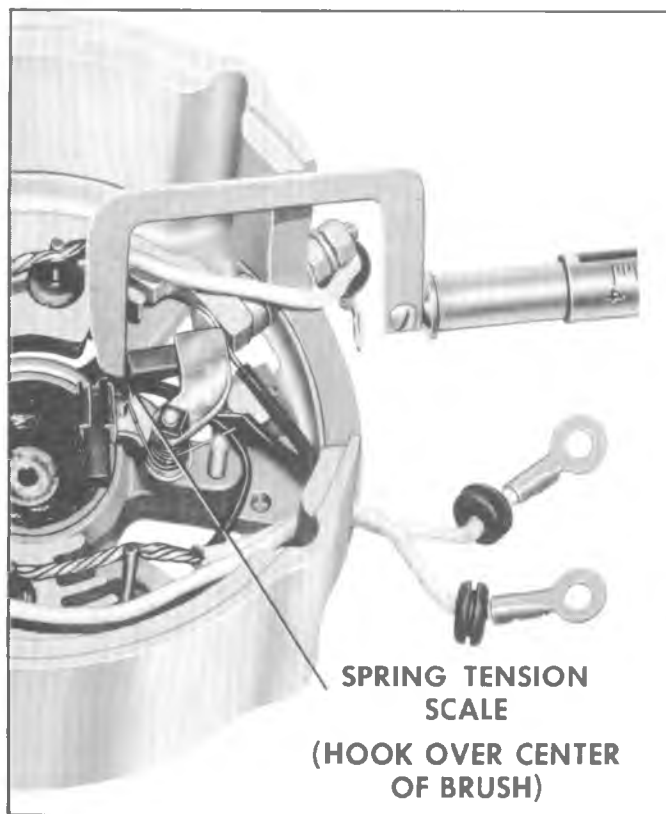


Fig. 24c—Checking Brush Spring Tension

NOTE: Brush spring tension should be checked as shown in Figure 24c. Excessive tension will cause rapid wear, whereas low tension results in erratic generator output and burning of slip rings. Defective springs must be replaced.

End Frame Replacement

1. Remove heat sink as outlined in Heat Sink Replacement.
2. Attach brush holder assembly to the new end frame.
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.
2. Refill bearing one-quarter full with DelcoRemy 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.

ASSEMBLY

1. Reassemble bearing retainer and grease reservoir assembly to drive end frame.
2. Assemble rotor unit to drive end frame and install spacer, fan, woodruff key, pulley, washer and shaft nut.

NOTE: Torque shaft nut to 60 lb. ft.

3. Assemble stator unit to slip ring end frame, connect lead wires to the three external terminals, and install terminal nuts.
4. Assemble rotor and drive end frame assembly to stator and slip ring end frame assembly.

CAUTION: To prevent damage to brush units, physically lift brushes away from the slip rings.

5. Install the four frame through bolts.

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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. Depress speedometer retaining clip and slide gear from mainshaft.
3. Remove rear bearing snap ring from mainshaft groove.
4. Support reverse gear with press plates and press on rear of mainshaft to remove reverse gear, thrust washer, spring washer, rear bearing, and snap ring from rear of mainshaft.

CAUTION: When pressing rear bearing be careful to center gear, washers, bearings and snap ring on mainshaft.

5. 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 Gear Bushing

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 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 (one on each side of hub), so all three keys are engaged by both springs (fig. 4A). The tapered 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 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.

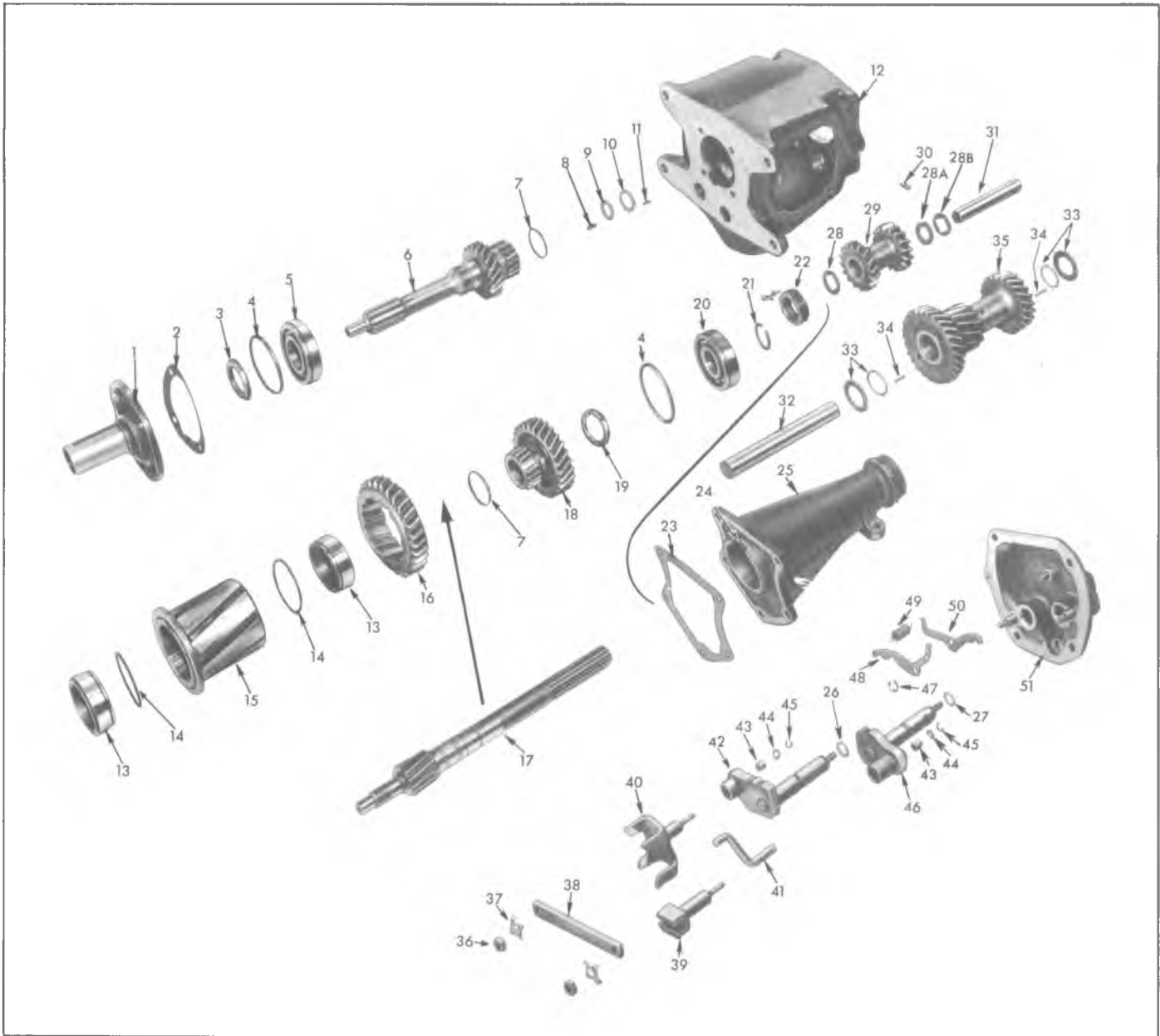


Fig. 6G—Layout of Transmission Parts

- | | | |
|------------------------------------|--|---|
| 1. Clutch Gear Bearing Retainer | 19. Thrust Washer | 35. Countergear |
| 2. Bearing Retainer Gasket | 20. Mainshaft Rear Bearing | 36. Shifter Interlock Retainer Stud Nut |
| 3. Bearing Nut and Oil Slinger | 21. Snap Ring | 37. Shifter Interlock Retainer Stud Nut Lock |
| 4. Bearing Snap Ring | 22. Speedometer Drive Gear and Clip | 38. Shifter Interlock Retainer |
| 5. Clutch Gear Bearing | 23. Extension Gasket | 39. Second and Third Shifter Fork |
| 6. Clutch Gear | 24. Rear Bearing Snap Ring Groove | 40. First and Reverse Shifter Fork |
| 7. Energizing Spring | 25. Extension | 41. Shifter Interlock |
| 8. Front Pilot Bearing Roller | 26. First and Reverse Shifter Shaft "O" Ring | 42. First and Reverse Shifter Shaft and Plate Assy. |
| 9. Thrust Washer | 27. Second and Third Shifter Shaft "O" Ring | 43. Shifter Fork Roller |
| 10. Thrust Washer | 28. Thrust Washer | 44. Shifter Fork Washer |
| 11. Rear Pilot Bearing Rollers | 28a. Thrust Bearing | 45. Shifter Fork Retainer |
| 12. Transmission Case | 28b. Thrust Bearing Washer | 46. Second and Third Shifter Shaft and Plate Assy. |
| 13. Synchronizer Ring | 29. Reverse Idler Gear | 47. Detent Cam Retainer |
| 14. Snap Ring | 30. Reverse Idler Shaft Pin | 48. First and Reverse Detent Cam |
| 15. Second and Third Speed Clutch | 31. Reverse Idler Shaft | |
| 16. First and Reverse Sliding Gear | 32. Countershaft | |
| 17. Mainshaft | 33. Countergear and Roller Thrust Washers | |
| 18. Second Speed Gear | 34. Bearing Roller | |

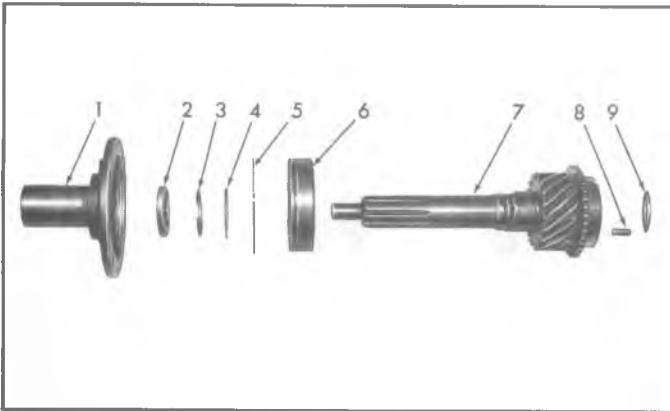


Fig. 19C—Clutch Gear, Bearing, Retainer and Components

- | | |
|-------------------|-----------------------------|
| 1. Retainer | 6. Clutch Gear Bearing |
| 2. Lip Seal | 7. Clutch Gear |
| 3. Snap Ring | 8. Mainshaft Pilot Bearings |
| 4. Special Washer | 9. Bearing Spacer |
| 5. Snap Ring | |

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.

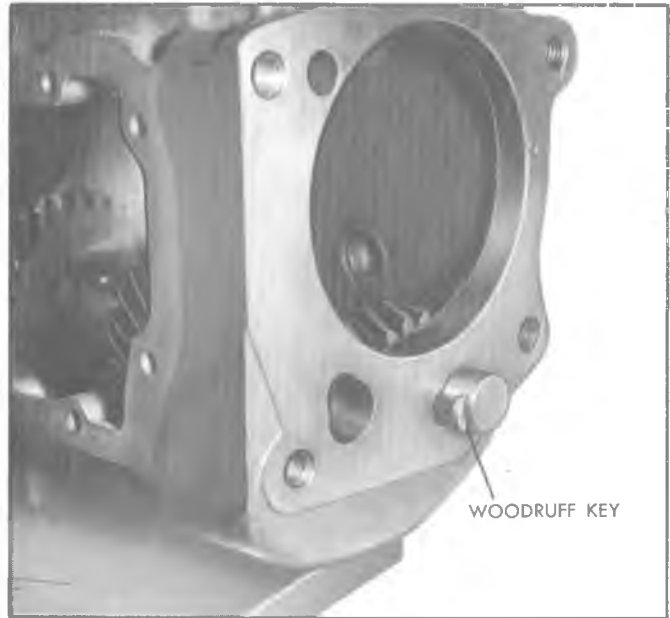


Fig. 21C—Installing Countergear Shaft

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).

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.



Fig. 20C—Loading Countergear Bearings w/J-21629

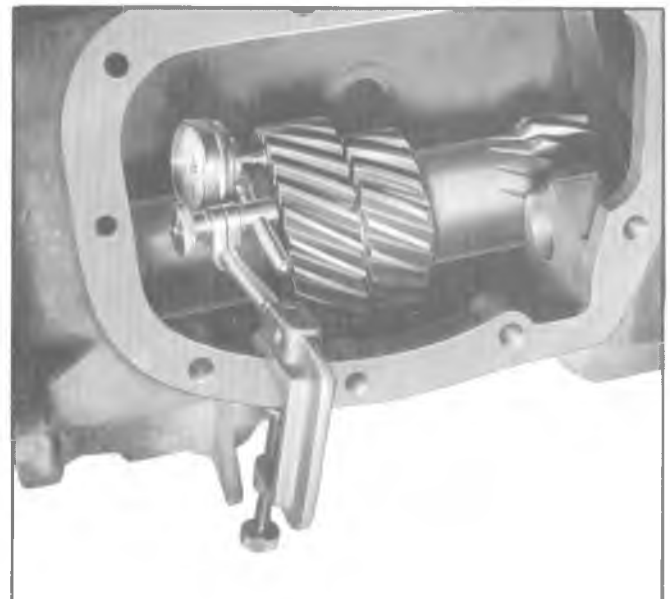


Fig. 22C—Checking Countergear End Plan

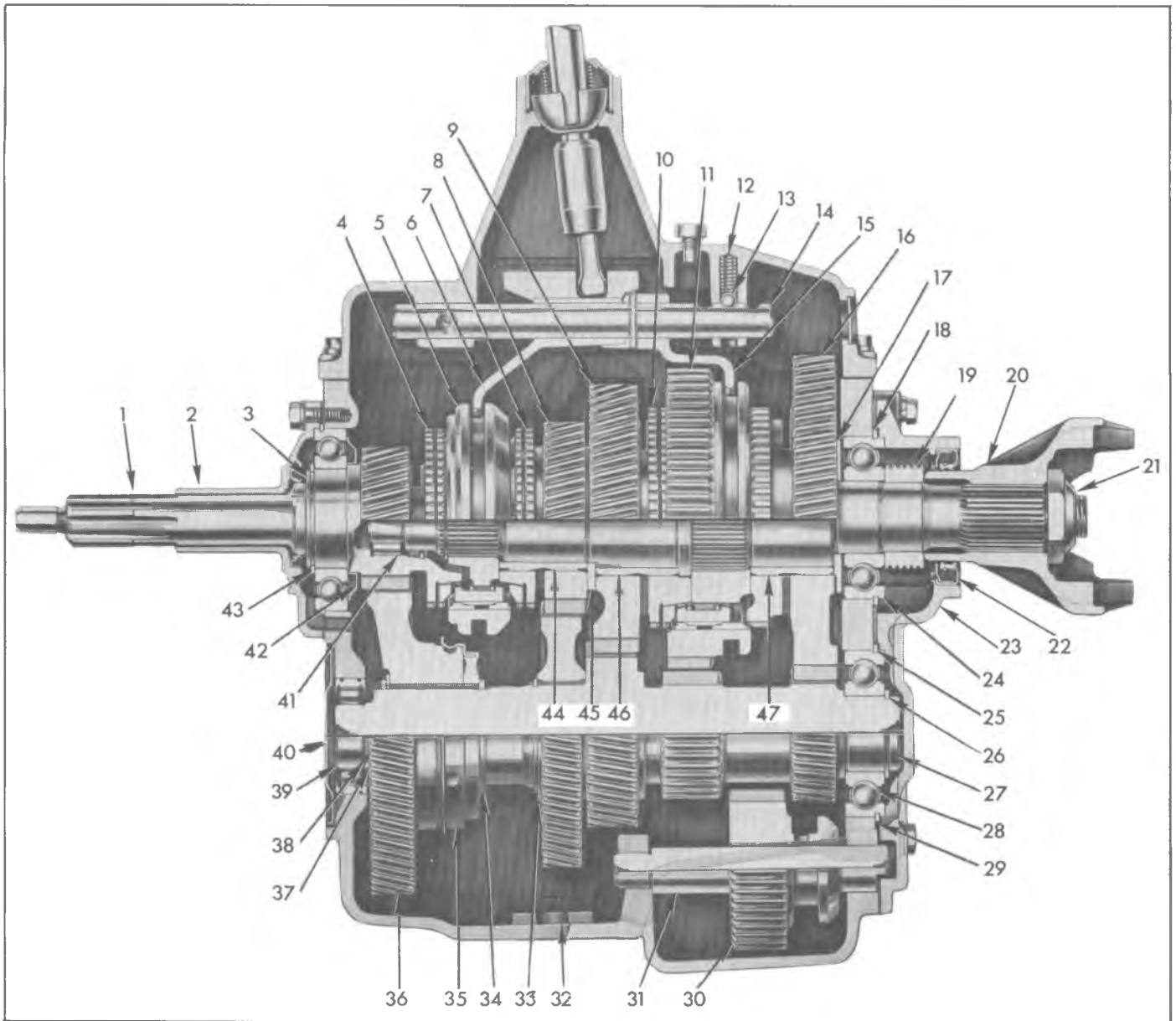


Fig. 1M—Transmission Assembly—Cross Section

- | | | | |
|--|------------------------------------|----------------------------|-----------------------------|
| 1. Main Drive Clutch Gear | 11. Reverse Driven Gear | 25. Rear Bearing Snap Ring | 39. Front Countershaft |
| 2. Drive Gear Bearing Retainer | 12. Poppet Spring | 26. Snap Ring | Bearing |
| 3. Snap Ring--Outer | 13. Poppet Ball | 27. Countershaft | 40. Countergear Front |
| 4. 3rd and 4th Synchronizer Ring | 14. Shift Rail | 28. Countershaft Rear | Cover |
| 5. 3rd and 4th Synchronizer Collar | 15. 1st and 2nd Shift Fork | 29. Bearing Snap Ring | 41. Pilot Bearing Rollers |
| 6. 3rd and 4th Shift Fork | 16. 1st Speed Gear | 30. Reverse Idler Gear | 42. Clutch Gear Oil Slinger |
| 7. 3rd and 4th Speed Synchronizer Ring | 17. Thrust Washer | 31. Reverse Idler Shaft | 43. Snap Ring |
| 8. 3rd Speed Gear | 18. Bearing Snap Ring | 32. Case Magnet | 44. 3rd Speed Gear |
| 9. 2nd Speed Gear | 19. Speedometer Drive Gear | 33. Snap Ring | Bushing |
| 10. 1st and 2nd Synchronizer Assembly | 20. Output Yoke | 34. Snap Ring | 45. Thrust Washer |
| | 21. Flange Nut | 35. Damper Assembly | 46. 2nd Speed Gear |
| | 22. Rear Bearing Retainer Oil Seal | 36. Countergear | Bushing |
| | 23. Rear Bearing Retainer | 37. Thrust Washer | 47. 1st Speed Gear |
| | 24. Mainshaft Rear Bearing | 38. Snap Ring | Bushing |

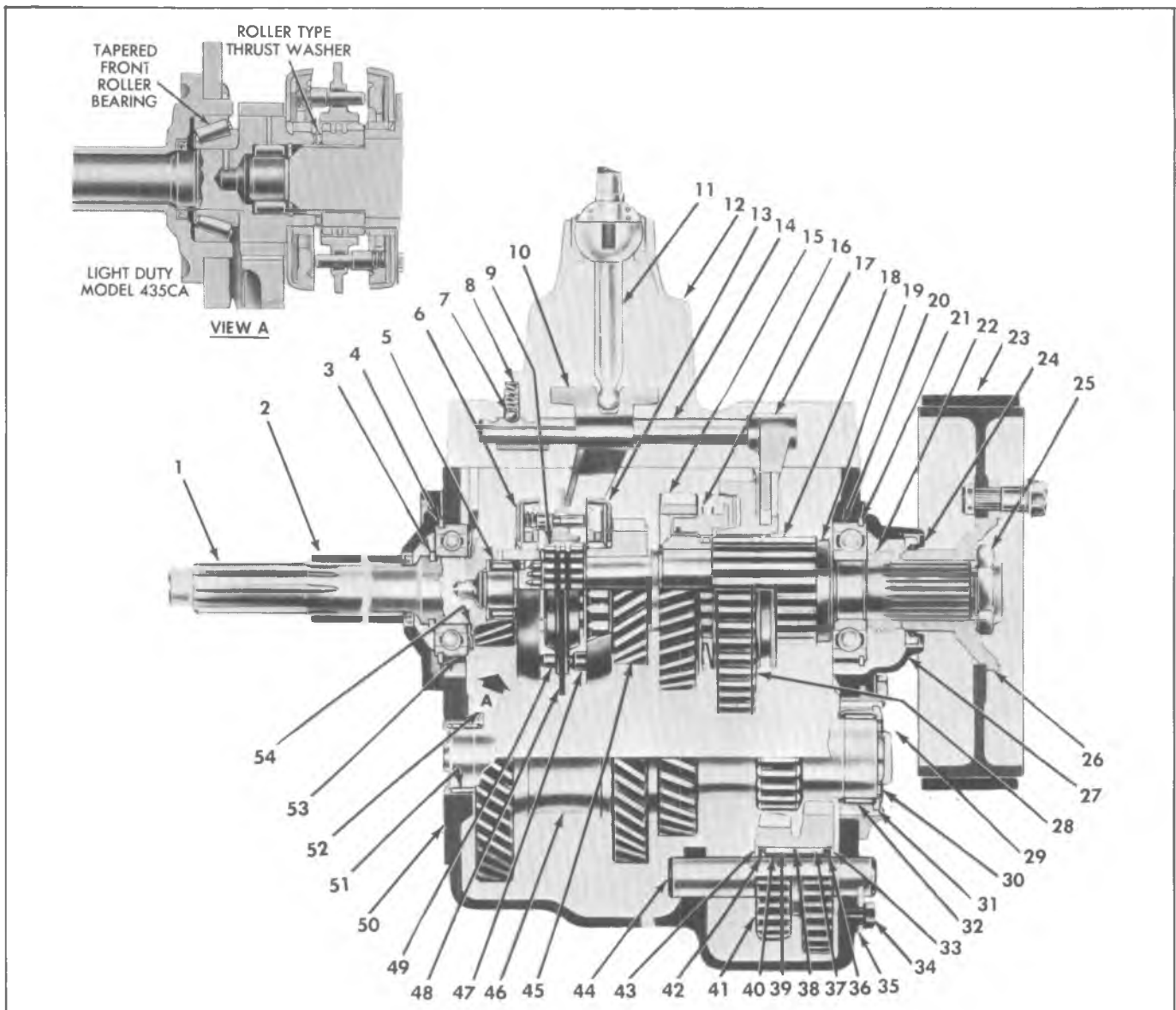


Fig. 1K—Transmission Cross Section

- | | | | |
|---|--|--------------------------------------|---|
| 1. Main Drive (Clutch) Gear | 15. 2nd Speed Gear | 31. Countershaft Rear Thrust Bearing | 44. Reverse Idler Gear Shaft |
| 2. Drive Gear Bearing Retainer | 16. 2nd Speed Synchronizer Spring | 32. Countershaft Rear Bearing Assy. | 45. Mainshaft 3rd Speed Gear |
| 3. Snap Ring (Selective) | 17. 1st and 2nd Shift Fork | 33. Snap Ring | 46. Countershaft and Gear Cluster |
| 4. Snap Ring | 18. Mainshaft | 34. Lock Plate Retaining Screw | 47. 3rd Speed Synchronizer Inner Ring and Pin Assy. |
| 5. Needle Bearing Rollers (14) | 19. Mainshaft Rear Spacer | 35. Lock Plate | 48. 3rd and 4th Speed Synchronizer Sliding Clutch |
| 6. 4th Speed Synchronizer Outer Stop Ring | 20. Mainshaft Rear Bearing Assy. | 36. Roller Retaining Washer | 49. 4th Speed Synchronizer Inner Ring and Pin Assy. |
| 7. Poppet Ball | 21. Snap Ring | 37. Needle Bearing Rollers (34) | 50. Transmission Case |
| 8. Poppet Spring | 22. Speedometer Drive Gear | 38. Bearing Roller Separator | 51. Countershaft Front Bearing Assy. |
| 9. 3rd and 4th Speed Synchronizer Clutch Gear | 23. Parking Brake Assy. | 39. Needle Bearing Rollers (34) | 52. Thrust Washer |
| 10. 3rd and 4th Shift Fork | 24. Mainshaft Rear Oil Seal | 40. Needle Bearing Roller Inner Race | 53. Main Drive Gear Front Bearing |
| 11. Gearshift Lever | 25. Yoke Retaining Nut | 41. Reverse Idler Gear | 54. Oil Slinger |
| 12. Transmission Cover | 26. Output Yoke | 42. Roller Retaining Washer | |
| 13. 3rd Speed Synchronizer Outer Stop Ring | 27. Mainshaft Rear Bearing Retainer | 43. Snap Ring | |
| 14. Shift Rail | 28. Mainshaft 1st Speed Sliding Gear | | |
| | 29. Countershaft Rear Bearing Retainer | | |
| | 30. Thrust Bearing Race | | |

* 4.56:1 Ratio Models incorporate an anti-rattle spline spring.

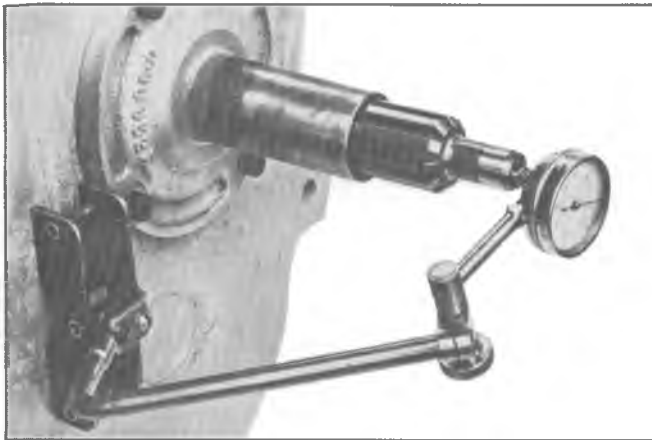


Fig. 16K—Input Shaft Bearing End Play

Main Drive Gear Installation

1. With part of clutch gear with missing teeth down allow for passage over countershaft gear, guide main drive gear assembly into transmission case and over front end of mainshaft. Be sure front synchronizer stop ring (40) engages teeth of drive gear. Push the assembly in until snap ring on bearing (5) is against transmission case.
2. Position main drive gear bearing retainer (2) (without gasket), over drive gear shaft and against the transmission case.
3. While holding bearing retainer (2) in place and using a feeler gauge, check gap between retainer and transmission case. Remove bearing retainer (2); then reinstall bearing retainer, two new gaskets and sufficient shims to obtain a thickness approximately .010-.015" greater than previously measured.
4. Install four self-sealing, self-locking screws (1) attaching drive gear bearing retainer (2) to transmission case (15). Tighten screws firmly (25-35 lb. ft.).
5. Using a dial indicator, check end play of the input gear Figure 16K. If end play is not .007 to .017", remove or add shims as required.
6. Using feeler gauges, check float in 3rd and 4th speed synchronizer assembly. Insert feeler gauges between mainshaft 3rd speed gear (44) and 3rd and 4th speed synchronizer outer stop ring (40) as shown in Figure 15K. Float should be 0.050"-0.070". If necessary, disassemble the unit and add or subtract synchronizer adjust-

ing shims (43) as necessary to bring float within limits.

CAUTION: Mainshaft must be seated on bearing and bearing correctly installed in case.

Rear Bearing Retainer and Parking Brake Installation

1. Position speedometer drive gear (54) on rear end of mainshaft (50).
2. Install rear bearing retainer (56) and new gasket (55). Use sealing cement on the four screw and lock washer assemblies (57). Tighten screws firmly.
3. Install parking brake parts (if used) as described in BRAKES (SEC. 5).

NOTE: When installing output yoke, shift transmission into two speeds at one time. Torque on yoke attaching nut is 110 foot-pounds.

Transmission Cover Installation

1. Place all transmission and cover parts in "Neutral" position.
2. Using a new gasket, install transmission cover and gasket. Tighten the eight attaching screws firmly.

Remote Control Assembly Installation

1. On transmissions having remote controls, position remote control assembly and new gasket on transmission cover.
2. Install four attaching screws and lock washers. Tighten screws firmly.
3. Secure bell crank to stud in boss of transmission cover with retaining clip.

NOTE: On transmissions having a conventional gearshift lever, install gearshift lever on transmission cover.

Miscellaneous (Fig. 2K)

1. If previously removed, install power take-off cover (13) and new gasket (14). Tighten six attaching screws (12) firmly.
2. Install drain (10) plug in transmission case. Tighten plug firmly.
3. Refill transmission with lubricant as directed in LUBRICATION (SEC. 0) of this supplement, and install filler plug (11). Tighten plug securely.

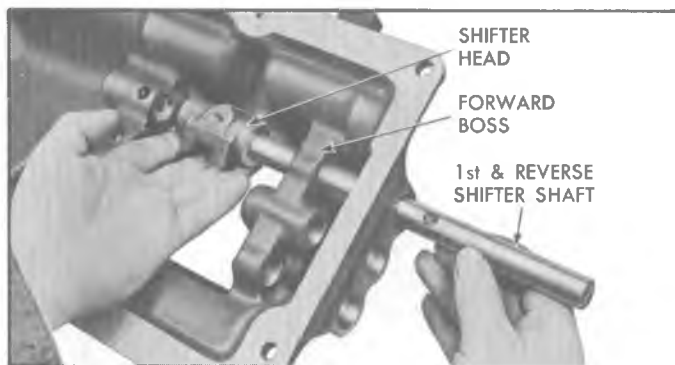


Fig. 8S—Installing Shifter Lead

10. Place cover right side up on bench and install poppet balls and springs in holes in cover (fig. 10S).
11. Position first-and-reverse shifter lever in control lever housing with boss next to housing and install stud from inside housing. Secure stud with nut and lock washer, then insert plunger pin in first-and-reverse shifter lever (fig. 3S). Assemble new gasket on cover and install housing so lever fits in slot in shifter head.
12. Insert outer plunger pin in cover and install spring and retainer as shown in Figure 2S.

Installation

1. Remove cardboard covering from transmission case.
2. Make sure all transmission gears are in neutral and install cover assembly with new gasket to transmission case, making sure shifter forks slide over their proper gears and that reverse shifter lever properly engages reverse shifter head.
3. Install transmission cover attaching bolts and tighten to 20-25 ft. lbs.
4. Install gearshift lever and check operation by shifting into all gears.
5. Install transmission cover to body floor, install floor mat and replace accelerator pedal.

TRANSMISSION ASSEMBLY

DISASSEMBLY

1. Mount transmission in suitable holding fixture and

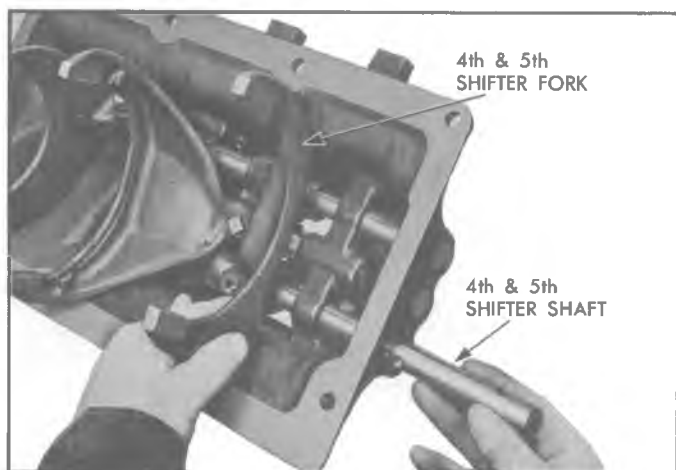


Fig. 9S—Installing 4th and 5th Shifter Fork



Fig. 10S—Installing Poppet Balls and Springs

2. Remove transmission cover and gasket as outlined under, "Maintenance and Adjustments".
3. Remove speedometer driven gear from rear bearing retainer and remove retainer.
4. Remove speedometer drive gear and thrust washer from rear of mainshaft.
5. Slide mainshaft assembly to rear to bring rear bearing out of case. Remove snap ring, and using Tool J-1619, pull bearing from shaft as shown in Figure 11S.
6. Holding first-and-reverse gear and fourth-and-fifth speed synchronizer to keep them from sliding off shaft, lift assembly out top of case.
7. Pick bearing rollers out of clutch gear, remove clutch gear bearing retainer from front of case and tap gear and bearing from case.
8. Remove countershaft assembly and reverse idler gear assembly as follows:
 - a. Remove countershaft rear bearing retainer and gasket.
 - b. Install adapter Tool J-4761 in end of idler gear shaft and using slide hammer as shown in Figure 12S, pull idler gear shaft. Lift idler gear from case and remove thrust washers.

NOTE: Hold gear horizontal to avoid dropping bearings from either end.



Fig. 11S—Removing Mainshaft Rear Bearing

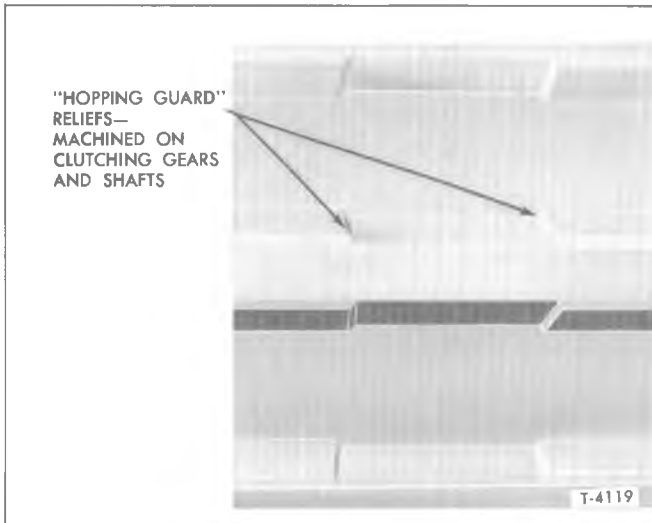


Fig. 6R—Spicer Hopping Guard

Gaskets, Thrust Washers, Etc.

1. Replace all gaskets, oil seals, lock wire, cotter pins and snap rings.

NOTE: If snap rings are not damaged or distorted and are not used for sealing as well as retaining, they may be reused.

2. Check all threaded fasteners and mating parts for damaged, stripped, or crossed threads. Correct as necessary.
3. Check keys and keyways for condition and fit.
4. Check surfaces of all thrust washers. Washers scored or reduced in thickness should be replaced.
5. Inspect the breather assembly to see that it is open and not damaged.

REPAIRS

Mainshaft

Disassembly (See Fig. 7R)

1. Slide fourth-and-fifth speed synchronizer assembly off forward end of shaft and slide first-and-reverse gear off rear end of shaft.
2. Remove snap ring from mainshaft and slide thrust washer and fourth speed gear off gear sleeve.
3. Support rear face of third speed gear on suitable press

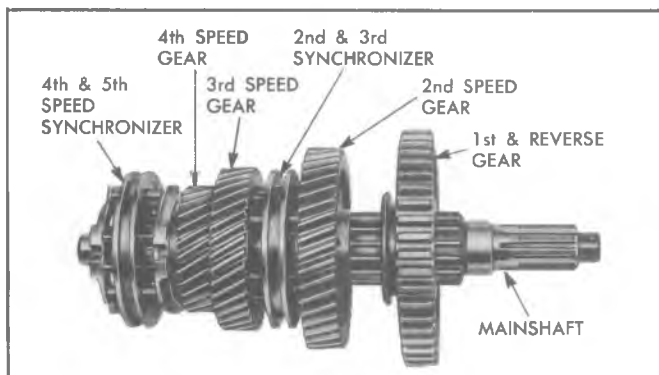


Fig. 7R—Mainshaft Assembly

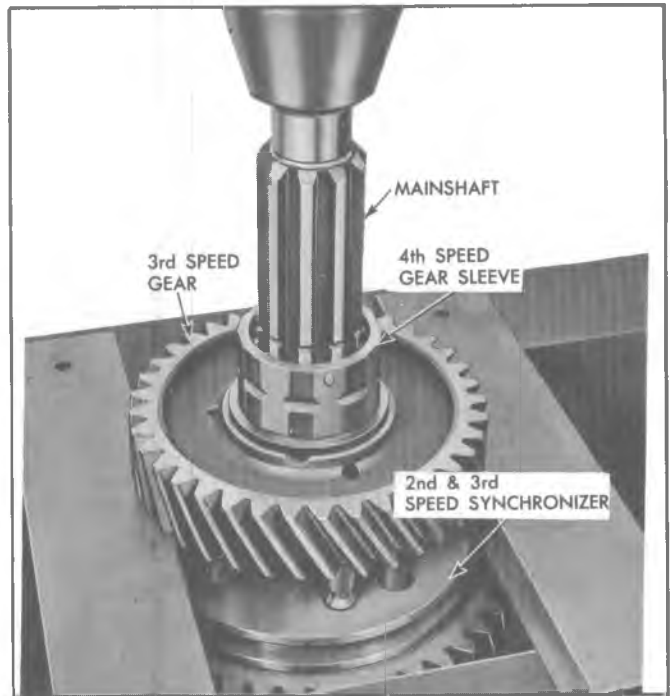


Fig. 8R—Removing Mainshaft from 3rd Gear

plates and press shaft from gear. Fourth speed gear sleeve will be pushed off ahead of gear.

NOTE: Second-and-third speed synchronizer may be shifted to engage second speed gear to obtain maximum space for placement of press plates (fig. 7R).

4. Slide second-and-third speed synchronizer off shaft.
5. If inspection shows the need for replacement of second speed gear, second-and-third synchronizer hub, or mainshaft, proceed as follows:
 - a. Remove synchronizer hub snap ring from shaft.
 - b. Support rear face of second speed gear on suitable press plates and press shaft to obtain 5/16" clearance between rear hub of second speed gear and forward end of splines on mainshaft (fig. 9R).

CAUTION: If shaft is pressed further than shown, forward hub of gear will wedge on Woodruff Keys of synchronizer hub.

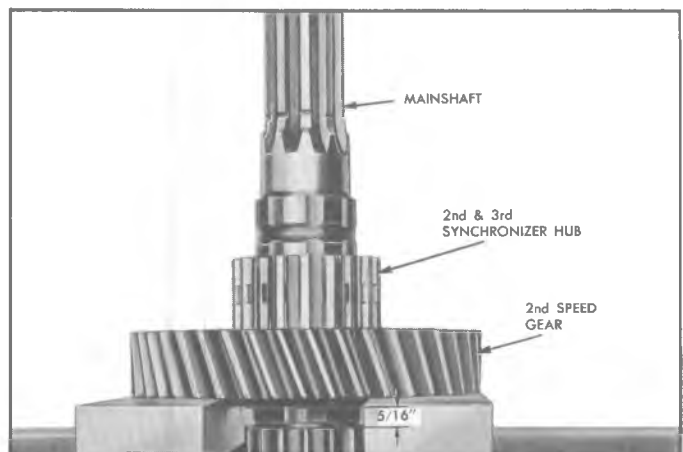


Fig. 9R—Removing Synchronizer Hub (Step 1)

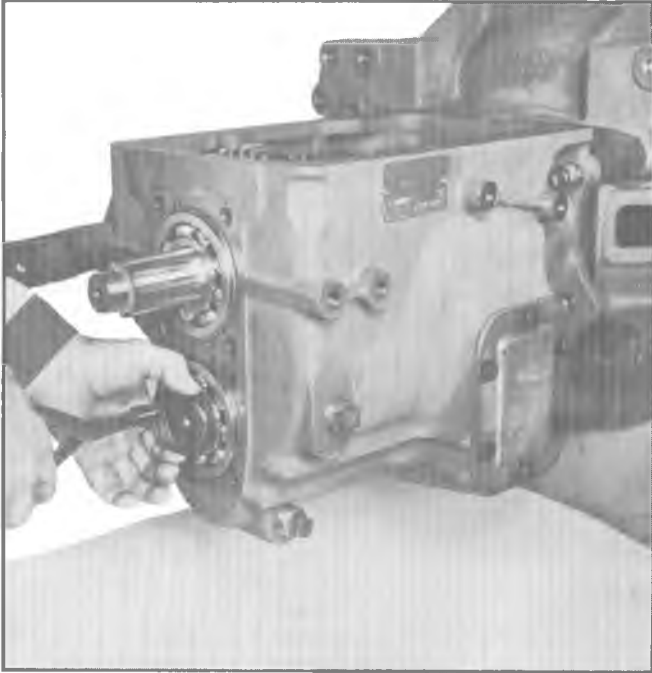


Fig. 6N—Removing Countershaft Rear Bearing Retainer Ring

pection, dip bearings in clean oil and wrap in clean lintless cloth or paper to protect them until installed.

Oil Seals, Gaskets, Etc.:

Replacement of spring load oil seals, gaskets and snap rings is more economical when unit is disassembled than premature overhaul to replace these parts at a future time. Further, loss of lubricant through a worn seal may result in failure of other more expensive parts of the assembly. Sealing members



Fig. 8N—Removing Mainshaft Rear Bearing

should be handled carefully, particularly when being installed. Cutting, scratching, or curling under of lip of seal seriously impairs its efficiency.

Gears and Shafts:

If magno-flux process is available, use process to check parts. Examine teeth on all gears carefully for wear, pitting, chipping, nicks, cracks, or scores. If gear teeth show spots where case hardening is worn through or cracked, replace

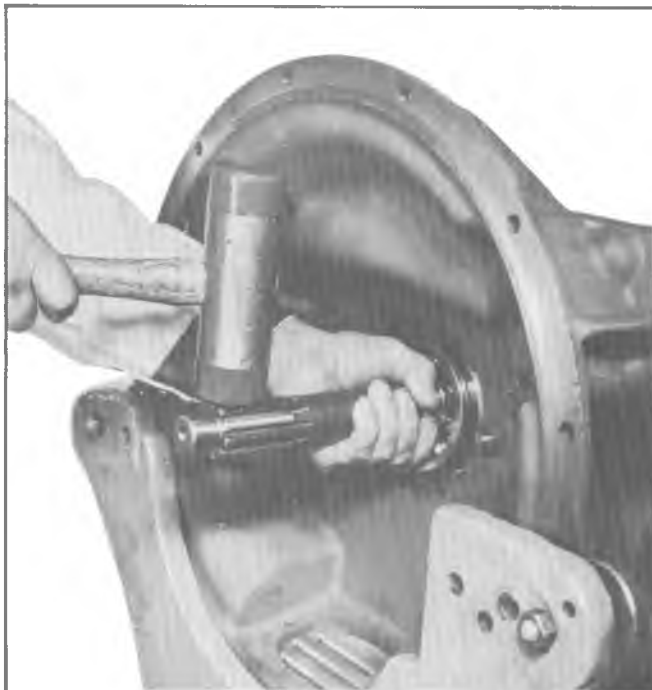


Fig. 7N—Removing Main Drive Gear



Fig. 9N—Removing Reverse Idler Shaft

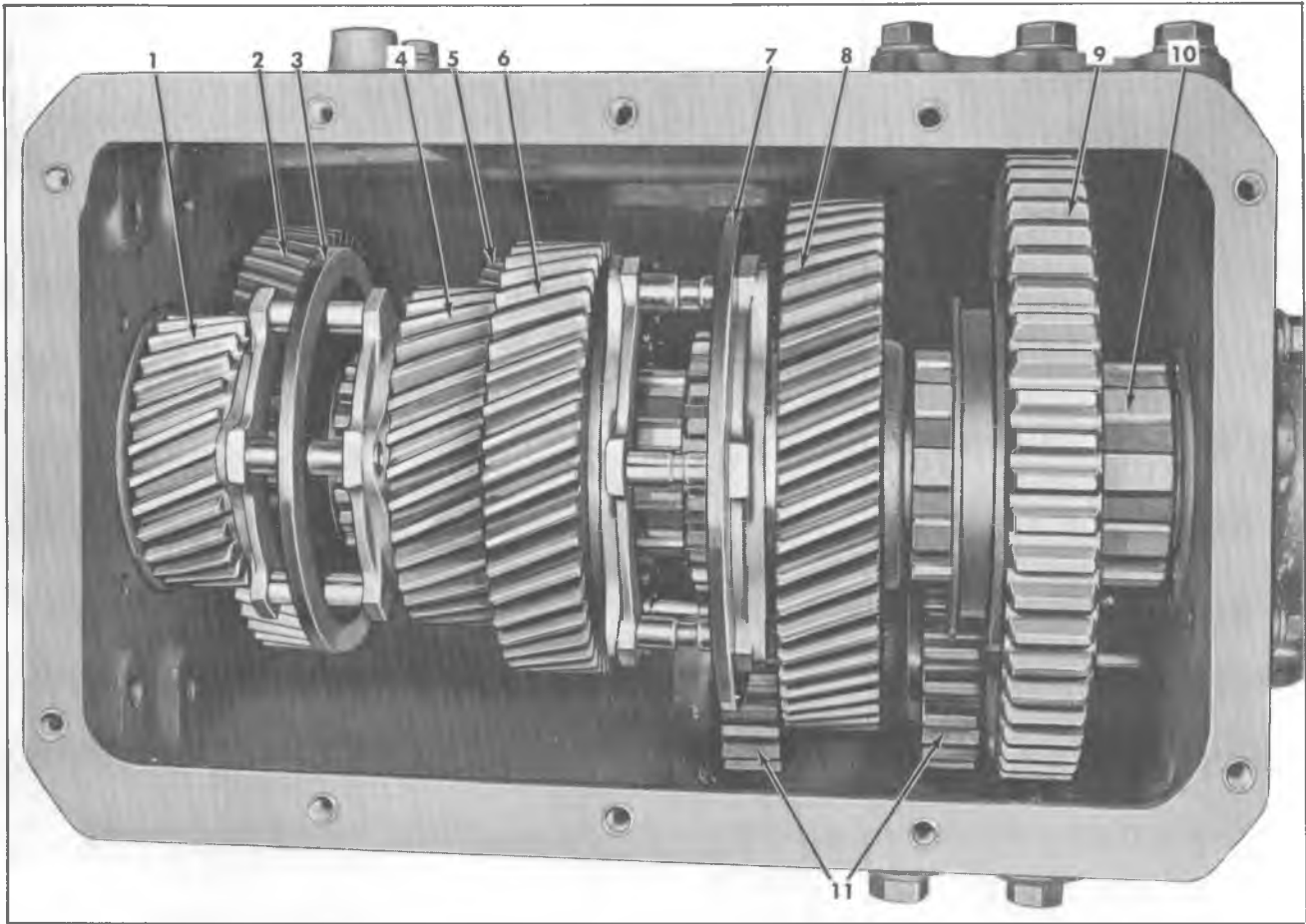


Fig. 2P—Transmission w/Shift Bar Removed

- | | |
|-----------------------------------|---|
| 1. Main Drive Gear | 7. 2nd and 3rd Speed Synchronizer Assy. |
| 2. Countershaft Drive Gear | 8. Mainshaft 2nd Speed Gear |
| 3. 4th and 5th Synchronizer Assy. | 9. Mainshaft 1st and Reverse Gear |
| 4. Mainshaft 4th Speed Gear | 10. Mainshaft |
| 5. Countershaft 4th Speed Gear | 11. Reverse Idler Gear |
| 6. Mainshaft 3rd Speed Gear | |

3. Push gearshift lever (3) out through bottom of control tower top (6). Remove shift lever pivot pins (4)

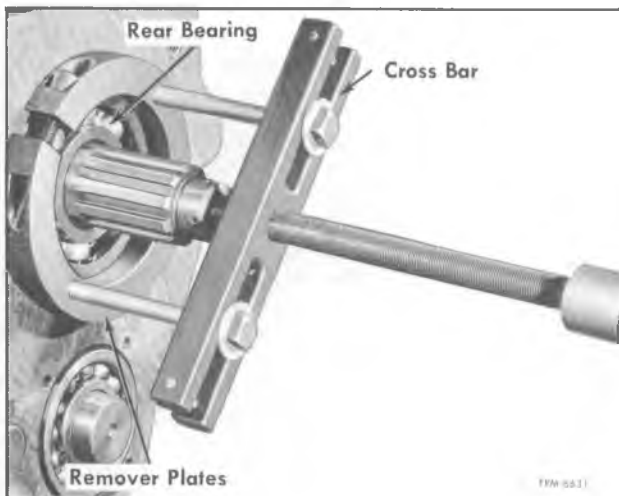


Fig. 3P—Removing Mainshaft Rear Bearing

SHIFTER BAR HOUSING DISASSEMBLY

Key numbers in text refer to Figure 9P.

1. It is suggested that each shift rod, shift fork, and shift lug be tagged so they can be properly positioned when the shift bar housing is reassembled.
2. Place shift bar housing on bench upside down with Welch plug openings toward repairman. Remove three shift rod hole Welch plugs.
3. Remove lock wire (5) from shifter lugs and shift forks; then shift all rods into "Neutral" position.
4. Remove lock screw (4) from 2nd and 3rd shift fork (8) and from 2nd and 3rd shift lug (18).
5. While holding hand over poppet ball hole in housing rod support to prevent loss of poppet ball and spring, remove 2nd and 3rd shift rod (17), lug (18), and fork (8), from housing. Remove poppet ball and spring.
6. Remove lock screw (4) from 4th and 5th shift fork (2).
7. While holding hand over poppet ball hole to prevent loss of poppet ball and springs, remove 4th and 5th shift rod (7), and fork (2) from housing. Remove poppet ball, springs, and interlock cross pin (16).
8. Remove lock screw (4) securing 1st and reverse shift bar (13) in housing.

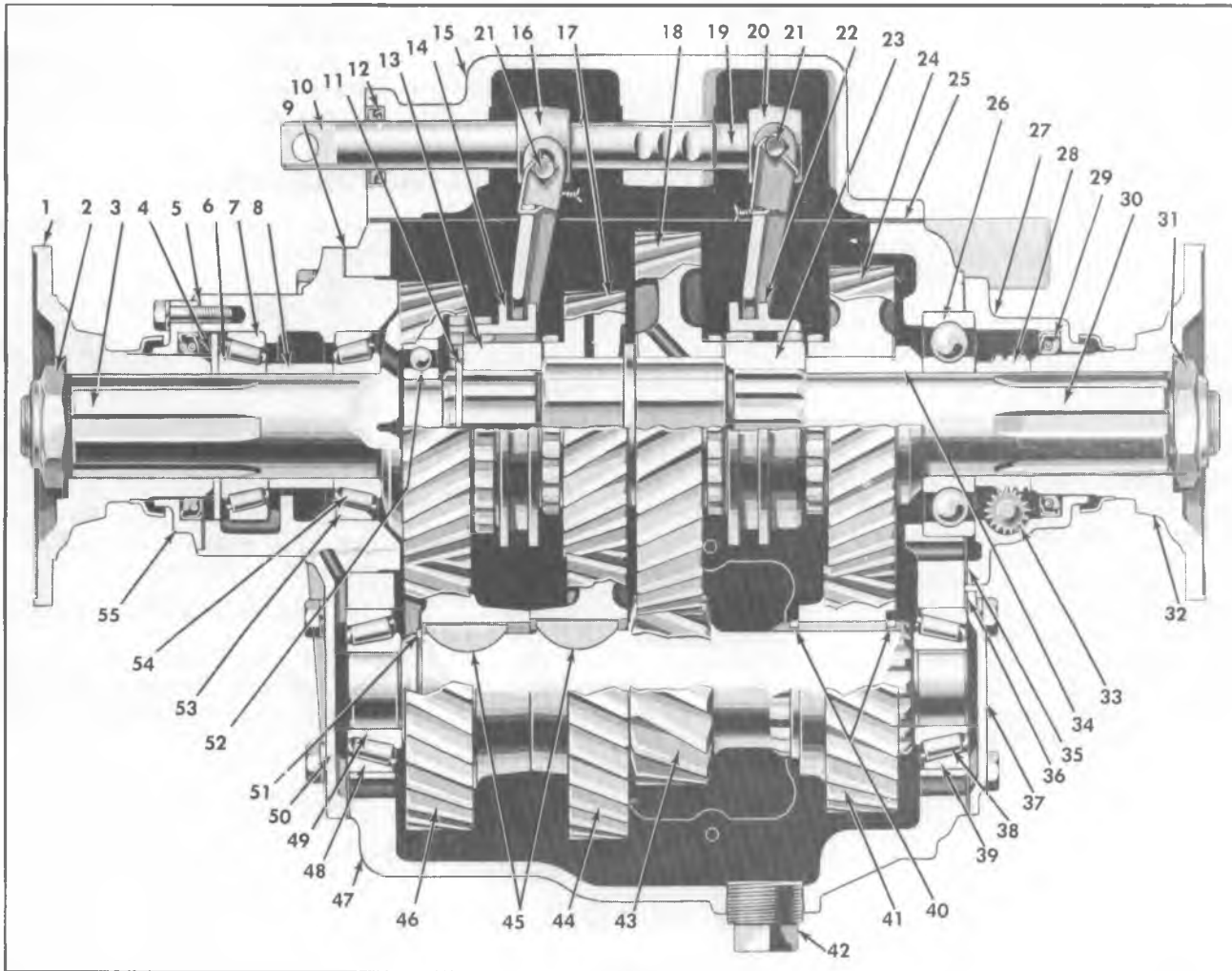


Fig. 1—Auxiliary Transmission Cross-Section

- | | | |
|--|---|--|
| 1. Propeller Shaft Flange | 20. 1st and 2nd Shift Fork | 38. Countershaft Rear Bearing Cone |
| 2. Main Drive Gear Nut | 21. Shift Fork Screw | 39. Countershaft Rear Bearing Cup |
| 3. Main Drive Gear | 22. 1st and 2nd Speed Clutch Gear Collar | 40. Countershaft 2nd Speed Gear Snap Rings |
| 4. Companion Flange Washer | 23. 1st and 2nd Speed Clutch Gear | 41. Countershaft 2nd Speed Gear |
| 5. Seal Gasket | 24. Mainshaft 2nd Speed Gear | 42. Drain Plug |
| 6. Outer Bearing Cone | 25. Shifter Housing Gasket | 43. Countershaft 1st Speed Gear |
| 7. Outer Bearing Cup | 26. Mainshaft Rear Bearing Assy. | 44. Countershaft Overdrive Gear |
| 8. Drive Gear Bearing Spacer | 27. Mainshaft Rear Retainer Cap Assy. | 45. Countershaft Keys |
| 9. Bearing Cap Gasket | 28. Speedometer Drive Gear | 46. Countershaft Drive Gear |
| 10. Direct and Overdrive Shift Rod | 29. Oil Seal | 47. Transmission Case |
| 11. Mainshaft Overdrive Gear Snap Ring | 30. Mainshaft | 48. Countershaft Front Bearing Cup |
| 12. Shift Rod Oil Seal | 31. Mainshaft Nut | 49. Countershaft Front Bearing Cone |
| 13. Overdrive and Direct Clutch Gear | 32. Flange | 50. Main Drive Gear Bearing Cup |
| 14. Overdrive and Direct Clutch Collar | 33. Speedometer Driven Gear | 51. Countershaft Drive Gear Snap Ring |
| 15. Shift Housing (Cover) | 34. Mainshaft 2nd Spd. Gear Sleeve | 52. Mainshaft Front Bearing |
| 16. Direct and Overdrive Shift Fork | 35. Retainer Cap Gasket | 53. Bearing Cup |
| 17. Mainshaft Overdrive Gear | 36. Rear Bearing Cap Adjusting Shims (0.003, 0.010 and 0.030) | 54. Bearing Cone |
| 18. Mainshaft 1st Speed Gear | 37. Countershaft Rear Bearing Cap | 55. Seal Cap |
| 19. 1st and 2nd Shift Rod | | |

8. Remove mainshaft rear bearing assembly (26) from transmission case.
9. Drive countershaft toward rear far enough to force rear bearing cup (39) out of case. Using snap ring pliers, remove countershaft 2nd speed gear front snap ring (40)

from groove, slide 2nd speed gear (41) forward, then lift countershaft assembly out of case.

10. Remove countershaft front bearing cup (48) from case.
11. Remove power take-off covers, and filler plug from case.



Fig. 4PG—Removing Governor Valve and Shaft

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. Remove screen; replace at assembly using new transmission case screen.
21. Remove the vacuum modulator and gasket, and the vacuum modulator plunger, dampening spring and valve (fig. 10PG).
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 11PG) 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. 12PG) 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.

OIL PUMP

Seal Replacement

If the pump seal requires replacement, remove the pump

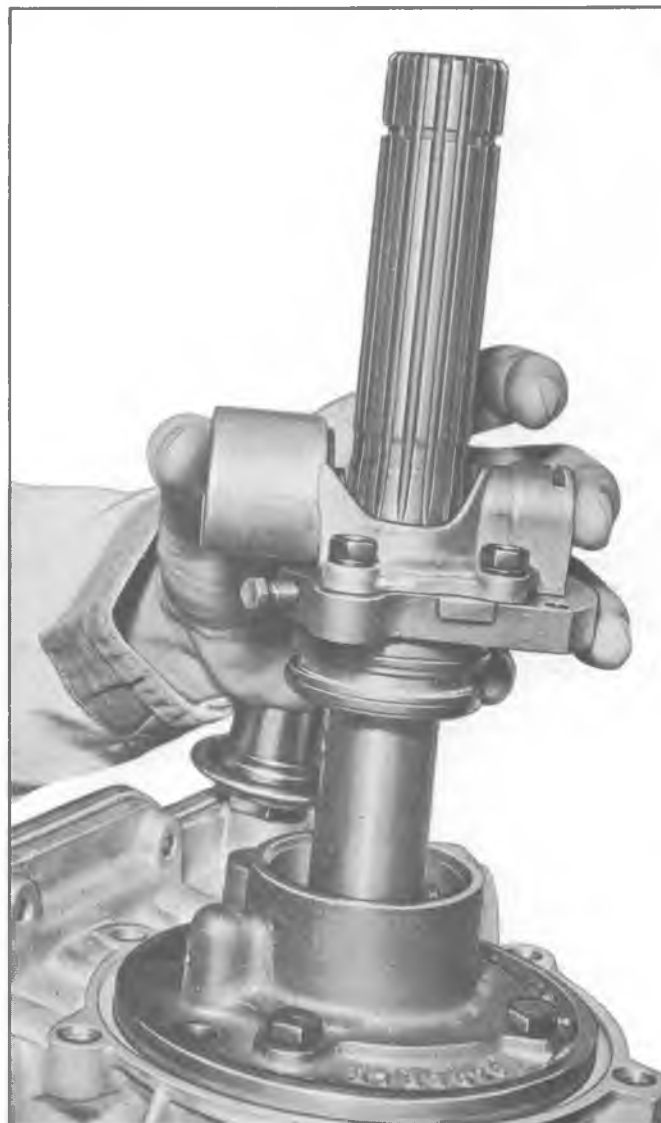


Fig. 5PG—Removing Governor Assembly

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 14PG for a layout of pump parts.

Inspection

1. Wash all parts in cleaning solvent and blow out all oil passages. **DO NOT USE RAGS TO DRY PARTS.**

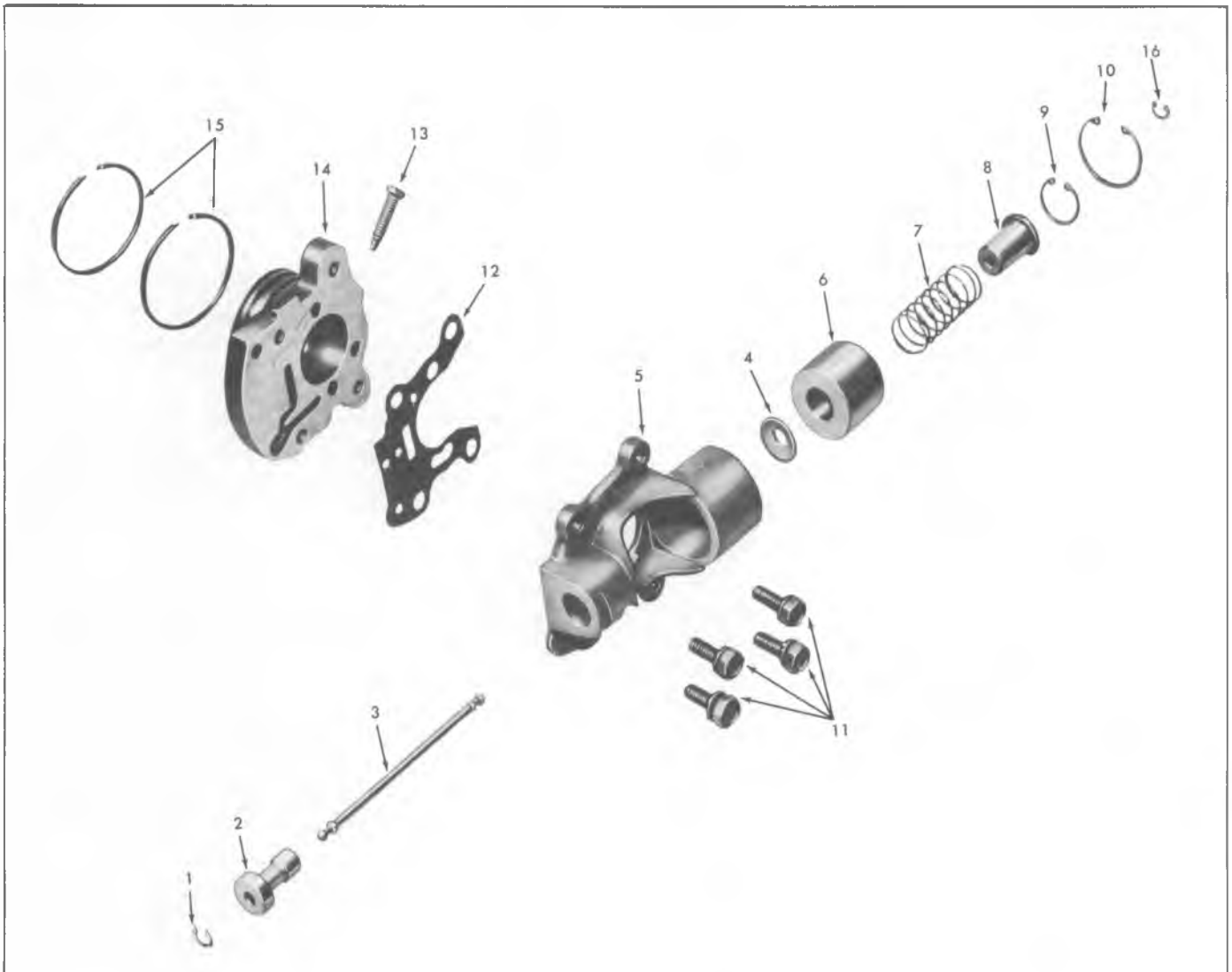


Fig. 26PG—Governor—Exploded View

- | | | | |
|---------------------------------------|---|--|---|
| 1. Valve to Shaft Retaining Snap Ring | 6. Outer Weight | 10. Outer Weight to Body Retaining Snap Ring | 13. Hub Drive Screw |
| 2. Valve | 7. Spring | 11. Body to Hub Screws and Lock Washers | 14. Hub |
| 3. Shaft | 8. Inner Weight | 12. Gasket | 15. Hub Oil Seal Rings |
| 4. Urethane Washer | 9. Inner Weight to Outer Weight Retaining Snap Ring | | 16. Inner Weight to Shaft Retaining Snap Ring |
| 5. Body | | | |

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 adjust-

ment 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

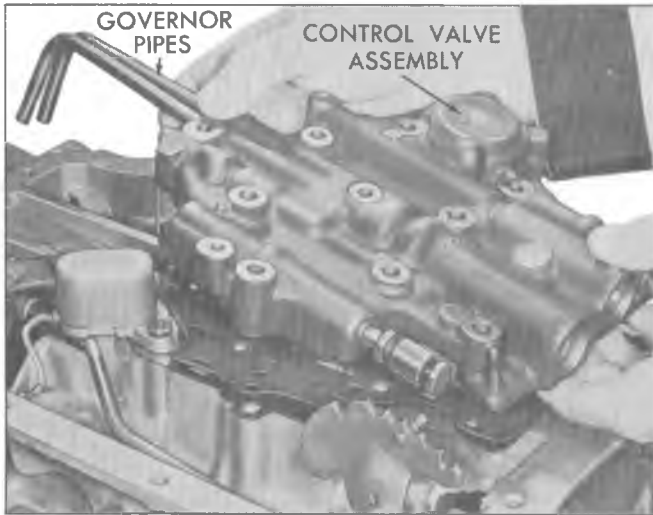


Fig. 10T—Removing Control Valve Assembly and Governor Pipe from Case

NOTE: An oil soaked washer may tend to discolor, so it will be necessary to measure washer for its actual thickness.

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).

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 as it becomes free from manual shaft.

- c. Remove manual shaft and jam nut from case (fig. 26T).

NOTE: Manual shaft seal 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. 27T).
- f. Remove parking pawl return spring (fig. 28T).

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. 29T).

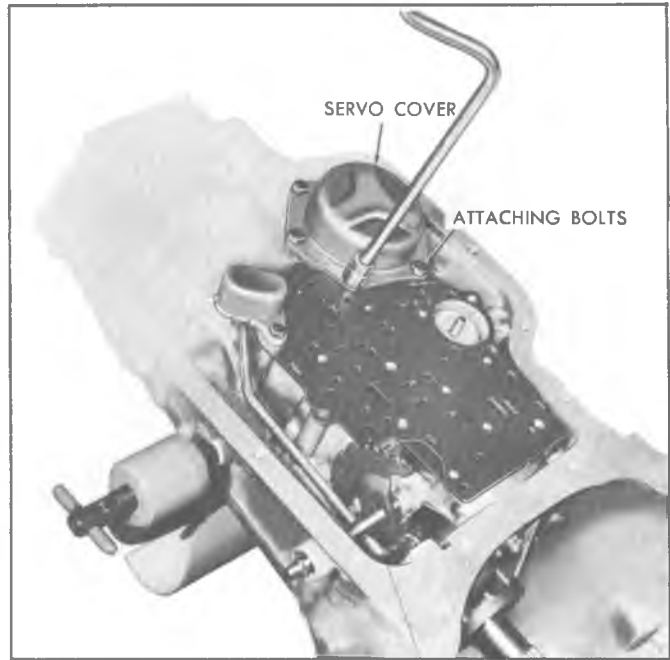


Fig. 11T—Removing Rear Servo Cover Attaching Bolts

- h. Remove parking pawl shaft cup plug by inserting a screw driver, between the parking pawl shaft and the case rib, and prying outwards (fig. 30T).
- i. Remove parking pawl shaft and parking pawl (fig. 30T).
8. Remove front band assembly (fig. 31T).
9. Remove sun gear shaft (fig. 32T).

Check Rear End Play as Follows (Fig. 33T)

- 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

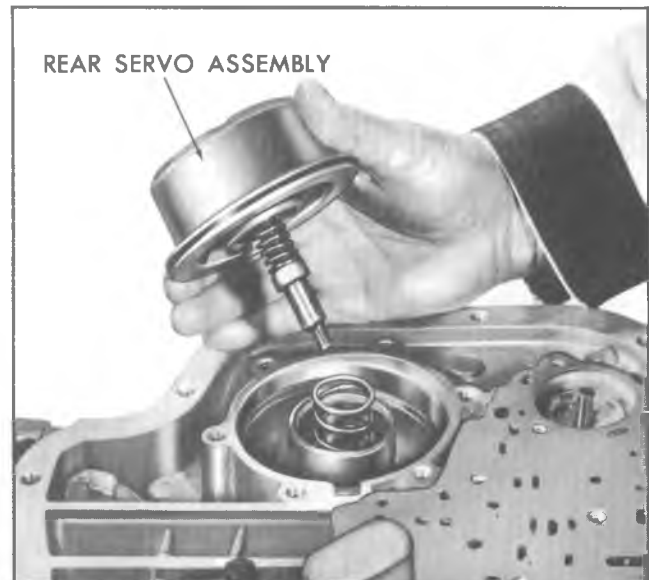


Fig. 12T—Removing Rear Servo Assembly



Fig. 50T—Removing Governor Gear Retaining Pin

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 gear pocket side of pump, using J-21465-17 install new bushing flush to .010" below machined surface.
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.



Fig. 51T—Removing Rear Accumulator Piston from Rear Servo Assembly

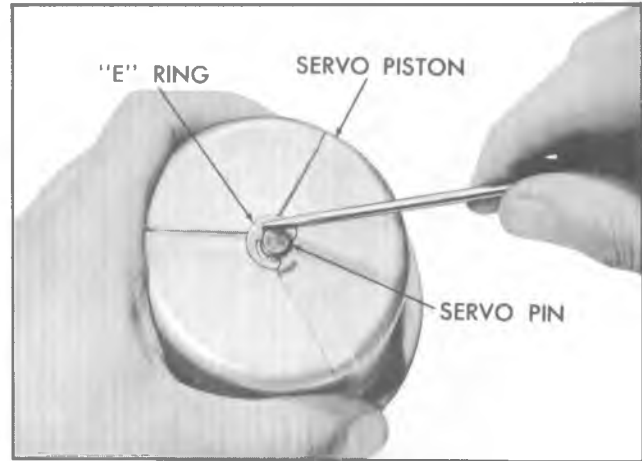


Fig. 52T—Removing Retaining "E" Ring from Rear Servo Pin

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 in their respective bores.

Reassembly

1. Install drive and driven pump gears into pump body with drive gear tangs up (fig. 65T).
2. Protect stator shaft and install pump cover 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 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.
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 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.

FORWARD CLUTCH DISASSEMBLY, INSPECTION AND REASSEMBLY

Disassembly

1. Place forward clutch assembly with 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).

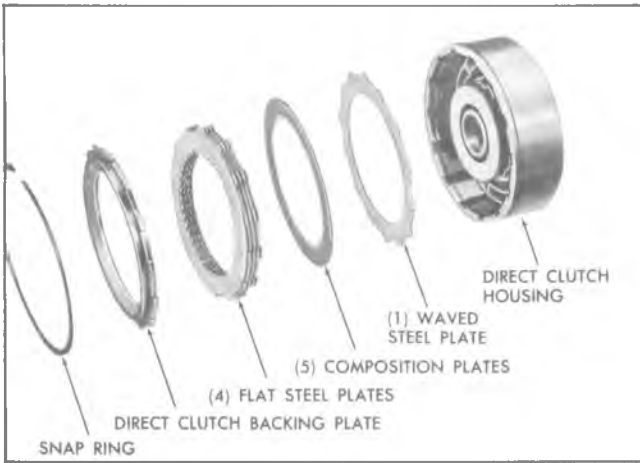


Fig. 85T—Direct Clutch Assembly—Exploded View



Fig. 86T—Installing Direct Clutch Inner Seal

6. Install nineteen (19) needle bearings into each pinion using petrolatum to hold bearings in place. Use pinion pin as guide (fig. 107T).
7. Place a bronze and steel washer on each side of pinion so steel washer is against pinion, hold them in place with petrolatum.



Fig. 87T—Installing Direct Clutch Outer Seal



Fig. 88T—Installing Direct Clutch Center Seal

8. Place pinion assembly in position in carrier and install a pilot shaft through rear face of assembly to hold parts in place.
9. 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).
10. Place a large punch in a bench vise to be used as an anvil while staking opposite end of pinion in three places.

NOTE: Both ends of pinion pins must lie below face of carrier or interference may occur.

OUTPUT SHAFT, REAR INTERNAL GEAR, SUN GEAR AND SHAFT

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.

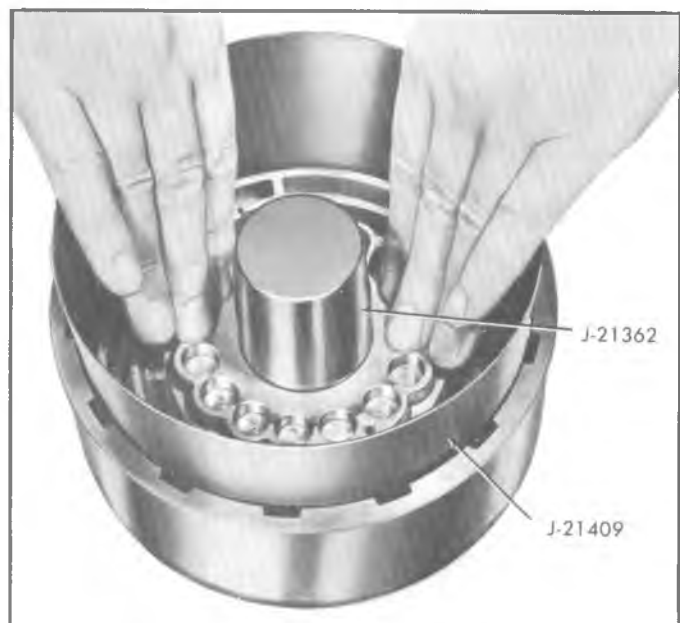


Fig. 89T—Installing Direct Clutch Piston

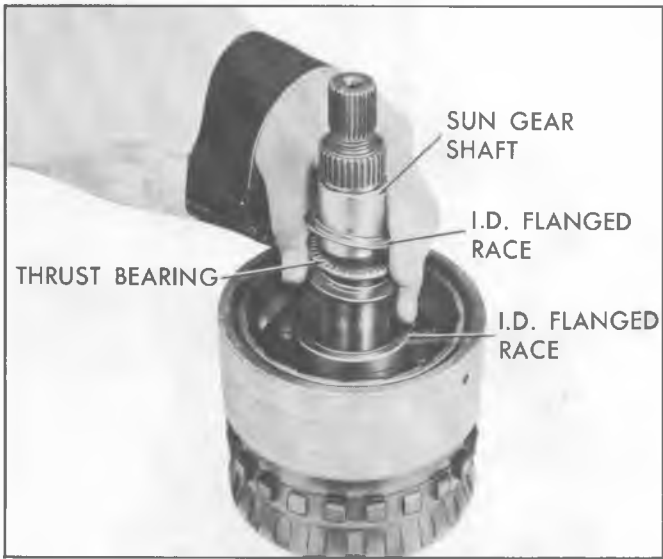


Fig. 121T—Installing Center Support to Sun Gear Thrust Bearing and Races

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
.074-.078	None
.082-.086	1 Tab Side
.090-.094	2 Tabs Side
.098-.102	1 Tab O.D.
.106-.110	2 Tabs O.D.
.114-.118	3 Tabs O.D.

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.

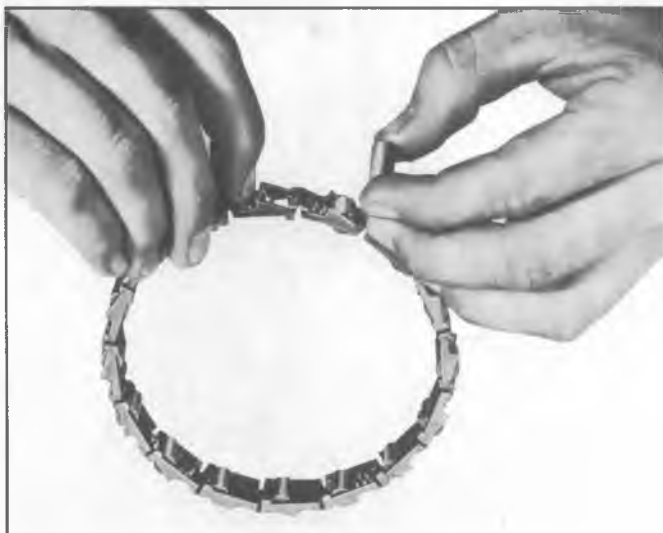


Fig. 122T—Installing Roller into Roller Cage

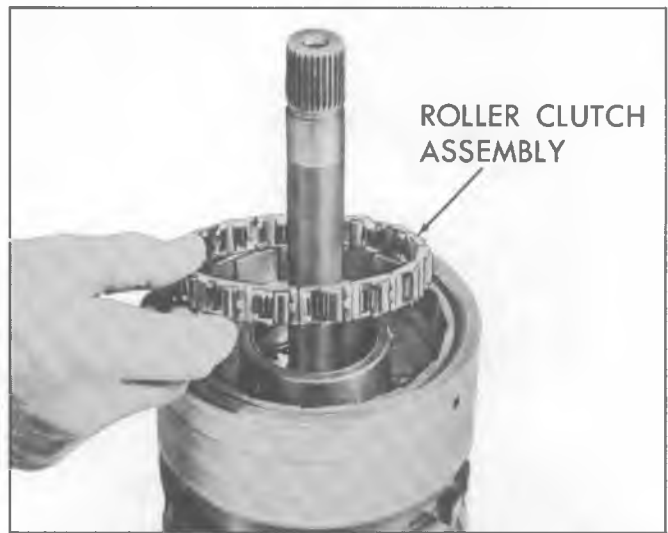


Fig. 123T—Installing Roller Clutch to Reaction Carrier

- 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 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).

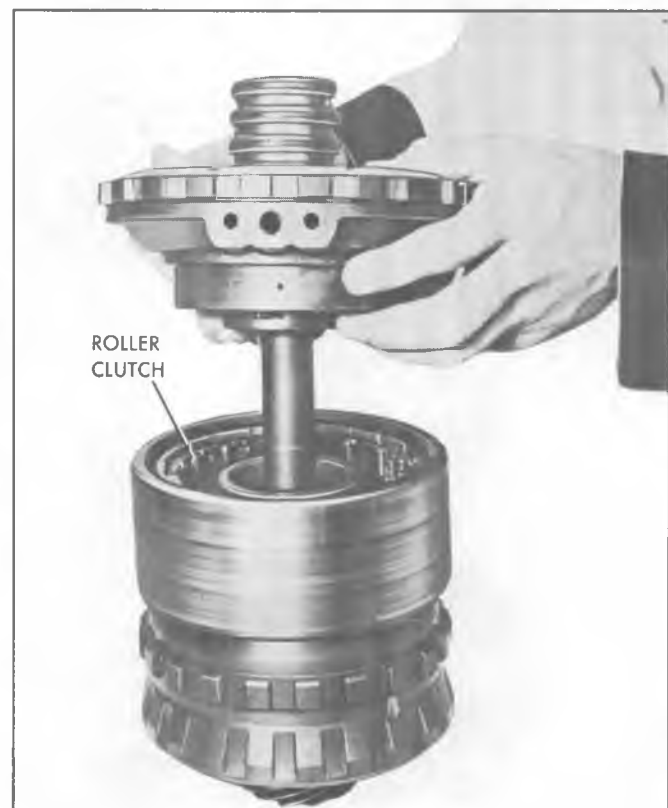


Fig. 124T—Installing Center Support to Reaction Carrier

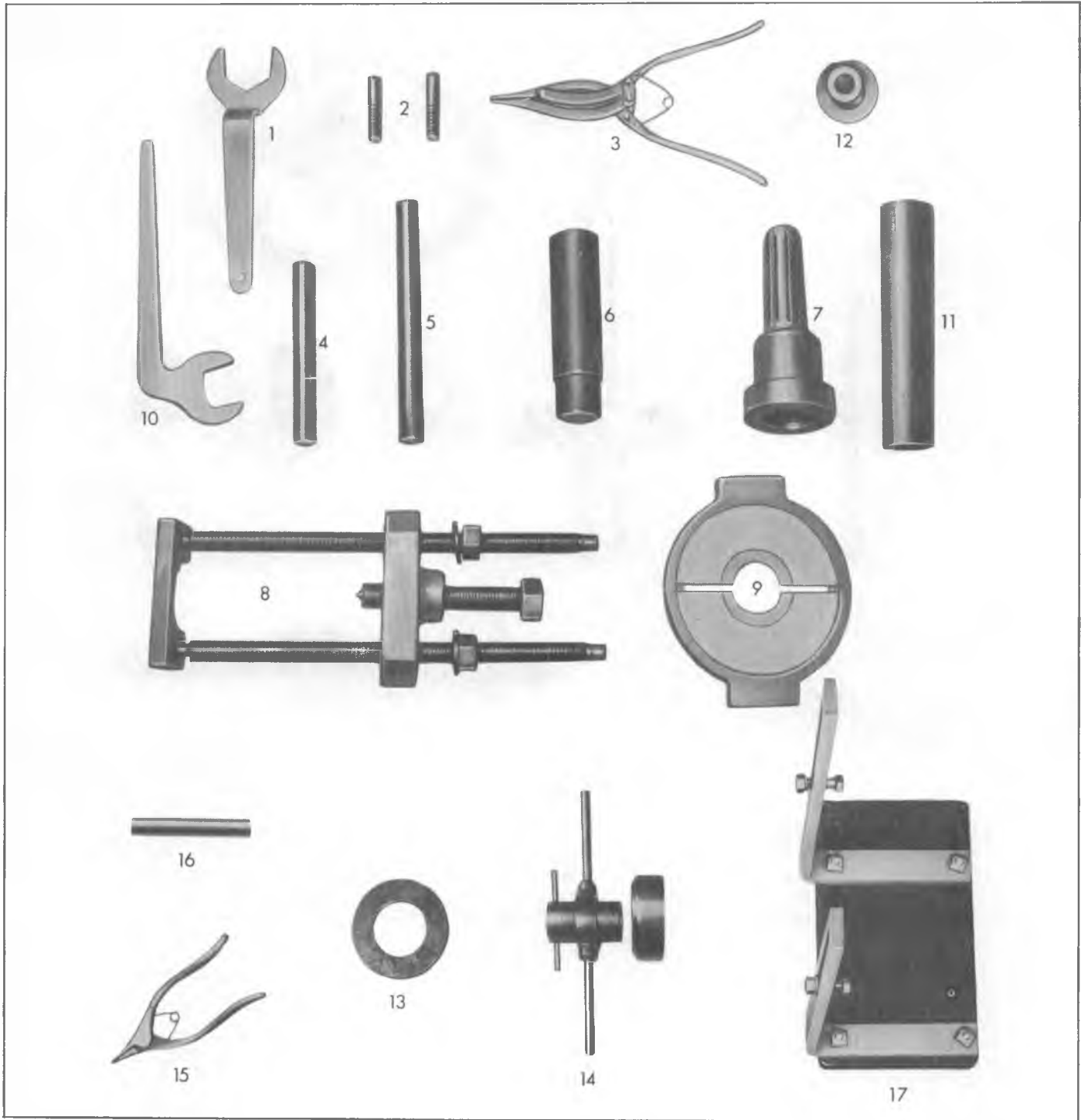


Fig. 2ST—Three-Speed Transmission Special Tools

- | | | | |
|--------------|---|------------|---|
| 1. J-0933 | Clutch Gear Bearing Retainer Wrench | 11. J-5590 | Clutch Gear Bearing Installer |
| 2. J-1126 | Transmission Guide Pins | 12. J-7785 | Clutch Gear Retainer Lip Seal Installer |
| 3. J-8059 | Retainer Snap Ring Pliers | 13. J-0936 | Clutch Gear Bearing Remover |
| 4. J-21629 | Countergear Loading Tool | 14. J-0937 | Clutch Gear and Bearing Puller |
| 5. J-22246 | Countergear Loading Tool | 15. J-0932 | Synchronizer Ring Retainer Spring Remover and Replacer |
| 6. J-5778 | Extension Housing Bushing Remover and Installer | 16. J-5777 | Countergear Assembly Tool |
| 7. J-5154 | Extension Housing Seal Installer | 17. J-5752 | Transmission Holding Fixture |
| 8. J-5814-15 | Speedometer Drive Gear Remover | J-4869 | Speedometer Gear Remover and Replacer Set (Not Illustrated) |
| 9. J-1453-01 | Speedometer Drive Gear Press Plates | J-5589 | Countershaft Assembly Tool (Not Illustrated) |
| J-358-1 | Press Plate Holder | | |
| 10. J-4653 | Overdrive Governor Wrench | | |

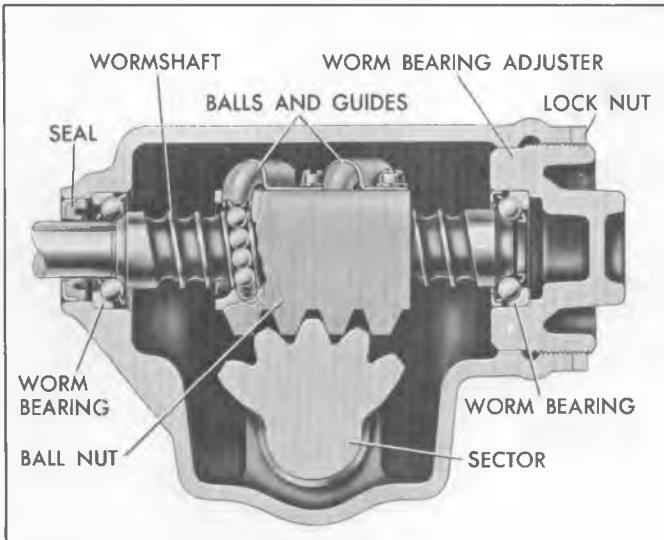


Fig. 3—Steering Gear—10 Through 30 Series

within these grooves when the steering wheel is turned. There are two complete circuits using tubular ball guides to deflect the balls away from their helical path at one end of the grooves and guide them back to the other end.

OVERHAUL OPERATIONS -

CP10, 20 and 30 Series (Fig. 3)

Disassembly

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

1. 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.

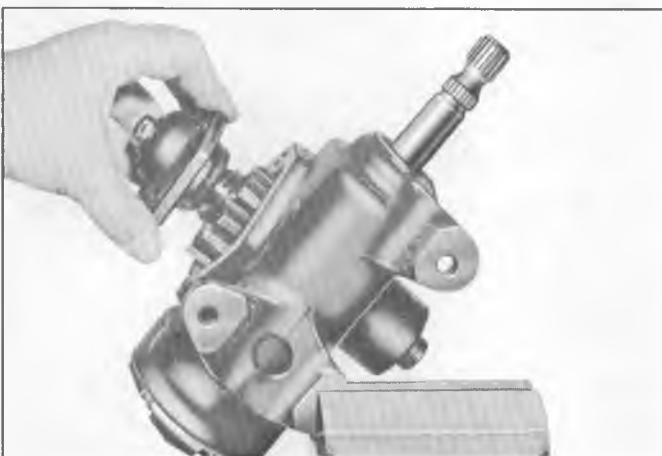


Fig. 4—Removing Sector Shaft

4. Pull the side cover with the sector shaft from the housing (fig. 4).

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 bearing from housing.
6. Draw wormshaft and nut assembly from housing (fig. 5). Remove upper bearing.

CAUTION: Use care that the ball nut does not run down to either end of the worm. Damage will be done to the ends of the ball guides if the nut is allowed to rotate until stopped at the end of the worm.

7. Remove 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.

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.

Repairs

SECTOR SHAFT BUSHING REPLACEMENT

1. Support steering gear housing in an arbor press and press



Fig. 5—Removing Wormshaft and Ball Nut

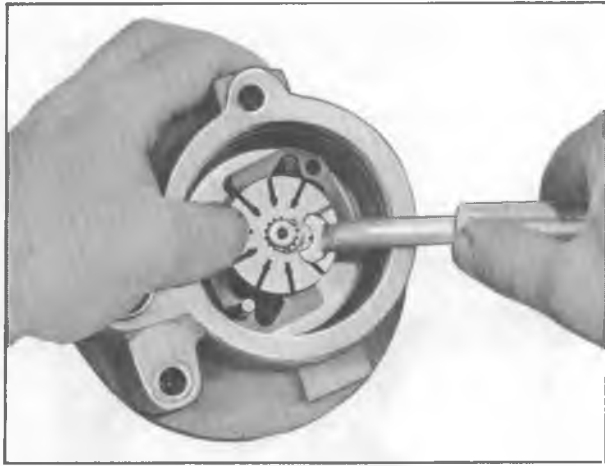


Fig. 29—Installing Shaft Snap Ring

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. 31—Installing Vanes

8. Check reservoir, studs, casting, etc. for burrs and other faults which would impair proper operation.

Assembly (Fig. 25)

Be sure all parts are clean during re-assembly.

1. Install new shaft seal, using Tool J-8818 as shown in Figure 26 and insert shaft at hub end of housing with spline end entering mounting face side (fig. 27).
2. Install thrust plate on dowel pins with ported face to rear of pump housing (fig. 28).
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. 29).
5. Install pump ring on dowel pins with direction of rotation arrow to the rear of the pump housing (fig. 30). Rotation is clockwise as viewed from pulley.
6. Install vanes in rotor slots with radius edge towards outside as shown in Figures 31 and 32.

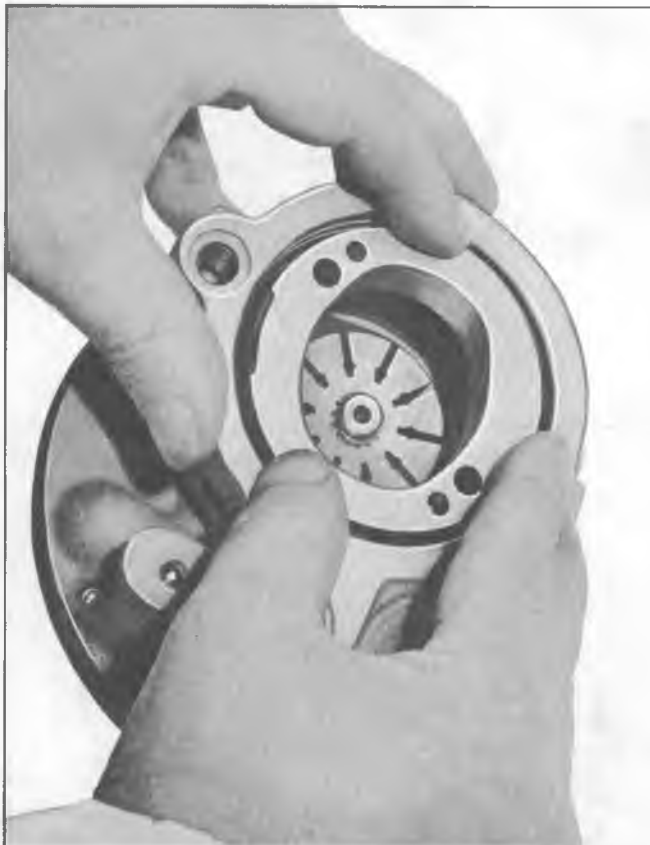


Fig. 30—Installing Pump Ring

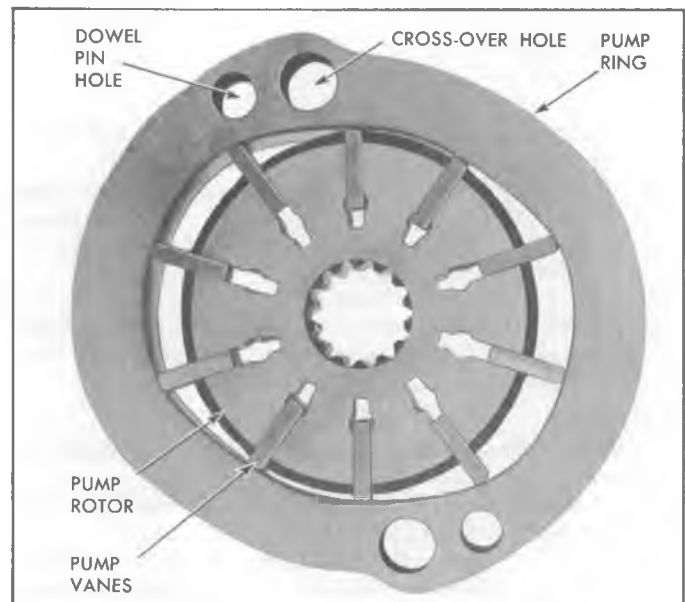


Fig. 32—Correct Vane Assembly

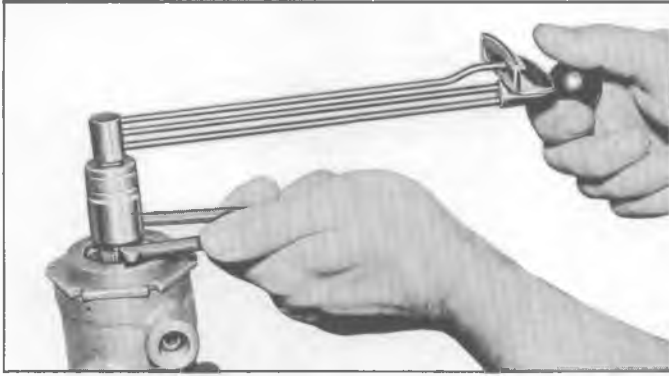


Fig. 56—Adjusting Adjuster Plug

nut return guide clamp faces the back-up adjuster opening in the top of the housing. Bolt top cover to gear housing.

Pitman Shaft and Side Cover

1. Reposition gear housing in vise or holding fixture so that worm shaft is horizontal. While holding worm nut, turn worm shaft to move nut to center of worm. This is necessary so that worm nut and pitman shaft will mesh properly when shaft is installed. Install worm shaft into

- housing, being careful not to damage bushing with serrated end of shaft.
2. Position new gasket on housing side cover opening.
3. Apply lubricant to side cover bushing. Place side cover on lash adjuster screw in pitman shaft. With screw driver through hole in side cover, thread lash adjuster screw through cover until pitman shaft is pulled tight to the side cover, then turn lash adjuster screw 1 or 2 turn clockwise. Install and tighten side cover bolts and lock washers. Center tooth on pitman shaft sector must enter center space in worm nut. Install adjuster screw locknut loosely.
4. Install pitman shaft seal carefully over pitman shaft so that serrations do not damage seal. Lips of seal should face the inside of housing body.
5. After worm thrust bearing preload has been adjusted as previously outlined under "Adjuster Plug Assembly" adjust pitman shaft lash adjuster screw so that preload is 4 to 8 inch-pounds in excess of bearing preload and valve drag readings combined. This pitman shaft preload reading should be taken with the gear on center and while rotating the steering shaft through an angle of not more than 20° (fig. 56). Tighten lash adjuster locknut. The final overcenter reading which represents the total of the valve and seal drag, the worm bearing preload, and the lash adjuster preload, should not exceed 16 inch-pounds.

CONTROL VALVE AND ADAPTER

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Inspection	9-22	Valve Balancing	9-24

OVERHAUL OPERATIONS

Disassembly

1. Place the valve in a vise as shown and remove dust cover (fig. 57).
2. Remove adjusting nut (fig. 58).
3. Remove valve to adapter bolts and remove valve housing and spool from adapter.
4. Remove spool from housing (fig. 59).
5. Remove spring, reaction spool, washer, reaction spring, spring retainer, and seal (fig. 60). "O" ring may now be removed from the reaction spool.
6. Remove the annulus spacer valve shaft washer and plug to sleeve key.
7. Carefully, so as not to nick the top surface, turn adjuster plug out of sleeve (fig. 61).
8. Remove the adapter from the vise and invert, permitting the spring and one of the two ball seats to fall free.
9. Remove the ball stud and the other ball seat and the sleeve will fall free.

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

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 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

REAR SUSPENSION**SECTION 4****TORQUE SPECIFICATIONS (FT. LBS.)**

Axle Capacity	Axle Shaft To Hub Bolts	Hub Cap Bolts	Brake Flange Backing Plate	Wheel Stud Nut	Carrier Cover
2400 through 3600	—	—	35	65	20
5200 through 7200	90		90	75	20
11,000	—	15	155	350	—
13,000	—	15	150	350	—
15,000 with 15 x 4 inch Brakes	—	15	150	350	—
15,000 with 15 x 5 inch Brakes	—	20	150	350	—
17,000 Single Speed 18,500 Single and Two Speed Eaton	35	—	150	200 @	—
15,000 and 17,000 Two Speed	—	20	150	200 @	—
23,000 Single and Two Speed Eaton	35	—	150	200 @	—

@Trucks equipped with Disc Wheels Torque to 475
All Torques given in Foot Pounds

WHEEL BEARING ADJUSTMENT SPECIFICATIONS

Rear Axle Capacity	Bearing Adjusting Nut Torque	Adjusting Nut Back-off	Outer Locknut Torque	Resulting Bearing Adjustment	Type of Bearing
5,200# and 7,200#	50-60 Lbs. Ft.	1/8 *	175 Lbs. Ft.	Slight Preloaded	Barrel Roller
11,000# and 13,500#	75-100 Lbs. Ft.	1/8 *	250 Lbs. Ft.	Slight Preloaded	Barrel Roller
15,000# and 28,000# Single Speed With 15x4 Brakes	75-100 Lbs. Ft.	1/8 *	250 Lbs. Ft.	Slight Preloaded	Barrel Roller
15,000# Single Speed With 15x5 Brakes, and 15,000# Two Speed 28,000# Two Speed	50-55 Lbs. Ft.	1/8 to 1/4 ☺	135 Lbs. Ft.	.001 to .010 End Play	Tapered Roller
17,000# Single and Two Speed and 30,000# Tandem	60-65 Lbs. Ft.	1/8 to 1/4 ☺	135 Lbs. Ft.	.001 to .010 End Play	Tapered Roller
18,500# Single and Two Speed and 34,000# Tandem	65-70 Lbs. Ft.	1/4 to 1/3 ☺	135 Lbs. Ft.	.001 to .010 End Play	Tapered Roller
23,000# Single and Two Speed	70-75 Lbs. Ft.	1/4 to 1/3 ☺	135 Lbs. Ft.	.001 to .010 End Play	Tapered Roller

* If necessary to align tang on adjusting nut lock with slot in adjusting nut rotate adjusting nut slightly in clockwise direction.

☺ If necessary to align tang on adjusting nut lock with slot in adjusting nut rotate adjusting nut slightly in counter-clockwise direction.

CARBURETOR

(SECTION 6M)

		ROCHESTER															HOLLEY					
Carburetor		M						2G						4MV			Carburetor		4150G			
Engine Displacement		230	230	250	250	292	292	307	307	307	307	307	307	307	307	327	327	396	Engine Displacement		366	427
Transmission		All	All	All	All	All	All	①	②	All	All	All	All	All	All	All	All	All	Transmission		All	All
Part Number		7028006	7028010	7028007	7028011	7028012	7028013	7028015	7028100	7028107	7028106	7028111	7028125	7028127	7028108	7028213	7028211	Part Number (Mfg. Number)		3928604 (R4086A)	3924592 (R3887A)	
Float Level		11/32						3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	9/32	3/16	Float Level				
Float Drop								1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	1-3/4	-	-	Float Level	Mechanical	Primary	.195"	.195"
Accelerator Pump								1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	9/32	9/32		Secondary	.205"	.205"	
Idle Vent		.50	.50	.50	.50	.50	.50							1"	1"				3/8	3/8	Final	Sight Plug
Fast Idle	Mechanical	1-1/2 Turn												2 Turns			Accelerator Pump		.015"	.015"		
	Running	2400 rpm						1800 - 2000 rpm						2400 rpm			Idle Vent		.060"	.060"		
Carburetor Choke Rod		.150	.150	.150	.150	.150	.150										.100	.100	Fast Idle	Mechanical	.035	.035
Choke Vacuum Break																	.245	.245		Final	1800 - 2000	
Choke Unloader																	.300	.300	Secondary Stop		1/2 Turn Open	
Thermostat Choke Rod																	1 Rod Dia. Interference		Main Metering Jet	Primary	#66	#66
Air Valve Spring																	3/8	7/8		Secondary	#68	#68
Secondary Closing																	.020	.020	Throttle Bore	Primary	1-9/16	1-9/16
Secondary Opening																	.070	.070		Secondary	1-9/16	1-9/16
Secondary Lockout																	.010	.010				
Main Metering Jet	Primary	.103	.103	.109	.109	.128	.128	.053	.053	.055	.055	.053	.053	.055	.055	.071	.071					
Throttle Bore	Primary	1-11/16						1-7/16						1-3/8								
	Secondary													2-1/4								
Air Valve Dashpot																	.015	.015				
Secondary Metering Rod																	27/32	27/32				

① All Except Overdrive
② Overdrive

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