

and expand starter ring gear for installation on the converter:

**Oven:** Place ring gear in Oven and set temperature at 200 degrees F. Allow ring gear to remain in oven for 15 to 20 minutes.

**Boiling Water:** Place ring gear in a shallow container, add water, and heat for approximately eight minutes after water has come to a boil.

**Steam:** Place ring gear on a flat surface and direct a steam flow around gear for approximately two minutes.

**Flame:** Place ring gear squarely on a flat surface. Using a medium size tip, direct a slow flame evenly around inner rim of the gear. **Do not apply flame to the gear teeth.** Place a few drops of water on face of gear at intervals during heating process. When gear is hot enough to just boil the water, installation of gear on the torque converter can be made.

(1) After ring gear is expanded by heating, place the gear in position on converter front cover. Tap gear on the cover evenly with a plastic or rawhide mallet until face of gear is even with scribed line (made during removal) on the front cover. Make sure gear is even with scribed line around full circumference of the front cover.

(2) Reweld ring gear to torque converter front cover, being careful to place, as nearly as possible, same amount of weld material in exactly same location as was used in original weld. This is necessary in order to maintain proper balance of the unit. Place welds alternately on opposite sides of converter to minimize distortion.

(3) The following suggestions are offered as an aid in making the weld:

- a. **Do not gas weld**
- b. Use a D.C. welder that is set at straight polarity or an A.C. welder if the proper electrode is available.

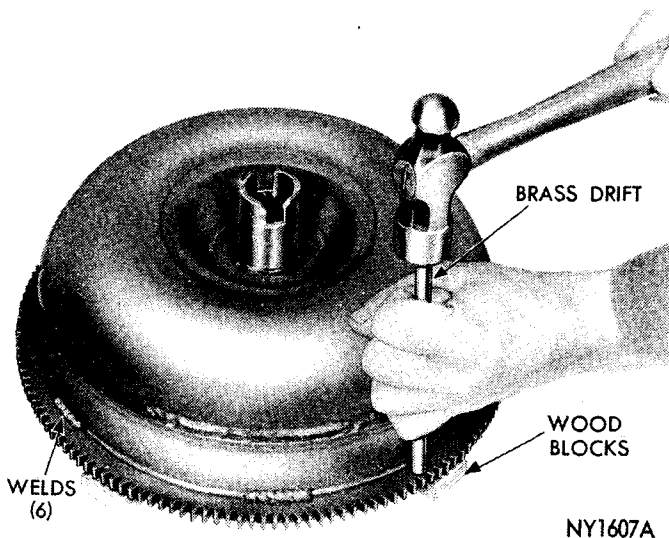


Fig. 2—Removing Starter Ring Gear

c. Use a 1/8 inch diameter welding rod, and a welding current of 80 to 125 amps.

d. Direct the arc at intersection of the gear and front cover from an angle of 45 degrees from rear face of the gear.

(4) Inspect gear teeth and remove all nicks where metal is raised, weld metal splatter, etc., in order to ensure quiet starter operation.

## TORQUE CONVERTER FLUSHING

When a transmission failure has contaminated the fluid, the torque converter, oil coolers, and tubes should be flushed to insure that metal particles or sludged oil are not later transferred back into the reconditioned transmission.

### Hand Flushing

(1) Place converter in horizontal position and pour two quarts of new clean solvent or kerosene into converter through the impeller hub.

(2) Turn and shake converter so as to swirl solvent through the internal parts. Turn the turbine and stator with transmission input and reaction shafts to dislodge foreign material.

(3) Position converter in its normal operation position with drain plug at the lowest point. Remove drain plug and drain solvent. Rotate turbine and stator, and shake converter while draining to prevent dirt particles from settling. Tool C-3963-A is available to do this job faster and more effectively.

This tool adapts a drill motor to an input shaft to spin the turbine and includes a drawing for a simple wooden fixture to hold the converter. This fixture will hold the converter upright for the spinning and draining operations.

(4) Repeat flushing operation at least once, or as many times as required until solvent or kerosene drained out is clear.

(5) After flushing, shake and rotate converter several times with drain plug out to remove any residual solvent and dirt. **Flush any remaining solvent from converter with two quarts of new transmission fluid.** This will prevent any adverse effect the solvent may have on the transmission seals. Reinstall drain plug and tighten to 90 inch-pounds.

(6) Flush and blow out the oil cooler and its lines (see "Oil Coolers and Tubes Flushing").

### Machine Flushing

Machine cleaning is recommended; using the type which rotates the converter while pumping cleaning fluid through it. The machine automatically adds timed blasts of compressed air to the cleaning fluid as it enters the converter, providing more thorough cleaning than the hand flushing operation.

## OIL COOLERS AND TUBES FLUSHING

When a transmission failure has contaminated the fluid, the oil cooler(s) should be flushed to insure that metal particles or sludged oil are not later transferred back into the reconditioned transmission.

- (1) Place a length of hose over the end of the most rearward oil cooler tube. Insert hose securely into a waste oil container.
- (2) Apply compressed air to the forward oil cooler tube in very short, sharp blasts.
- (3) Pump approximately one pint of "DEXRON" type automatic transmission fluid into the forward oil cooler tube.
- (4) Repeat step (2). Remove hose.

## PUMP OIL SEAL

### Replacement

The pump oil seal can be replaced without removing pump and reaction shaft support assembly from the transmission case.

- (1) Screw seal remover, Tool C-3861 into the seal (Fig. 3). Tighten screw portion of tool to withdraw the seal.
- (2) To install a new seal, place seal in opening of the pump housing (lip side facing inward). Using Tool C-3860, drive seal into the housing until tool bottoms (Fig. 4).

## DISASSEMBLY—SUBASSEMBLY REMOVAL

Prior to removing any transmission sub-assemblies, plug all openings and thoroughly clean exterior of the unit, preferably by steam. Cleanliness through entire disassembly and assembly cannot be over-emphasized. When disassembling, each part should be washed in a suitable solvent, then dried by compressed air. **Do not wipe parts with shop towels.** All mating surfaces in the transmission are accurately machined; therefore, careful handling of parts must be exercised to avoid nicks or burrs.

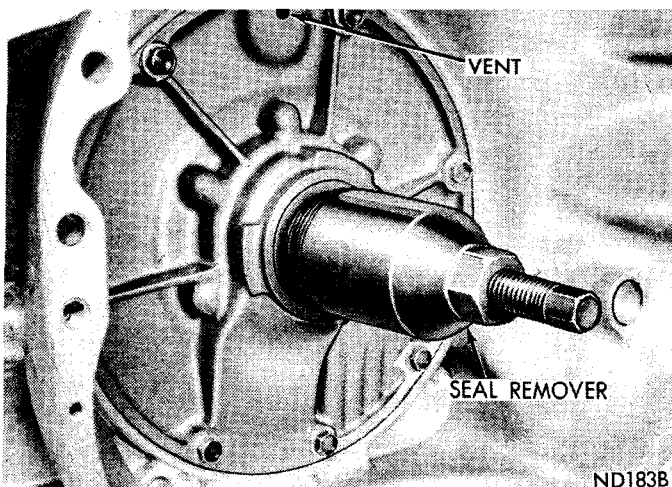


Fig. 3—Removing Pump Oil Seal

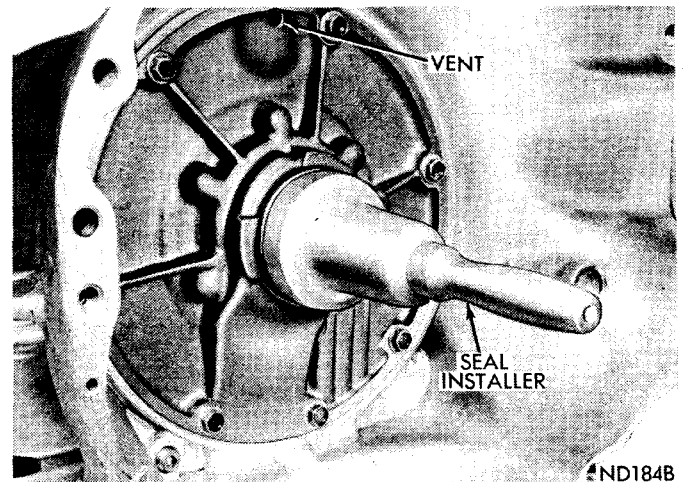


Fig. 4—Installing Pump Oil Seal

### Input Shaft End Play

Measuring input shaft end play before disassembly will usually indicate when a thrust washer change is required, (except when major parts are replaced). **The thrust washer is located between reaction shaft support and front clutch retainer on A-727 transmissions.**

- (1) Attach a dial indicator to transmission bell housing with its plunger seated against end of input shaft (Fig. 5).

Move input shaft in and out to obtain end play reading. End play specifications are .036 to .084 inch for A-727 transmissions.

- (2) Record indicator reading for reference when reassembling the transmission.

### Oil Pan

- (1) Place transmission assembly in repair stand, Tool C-3750-A (Fig. 6).
- (2) Unscrew oil pan bolts and remove oil pan and gasket.

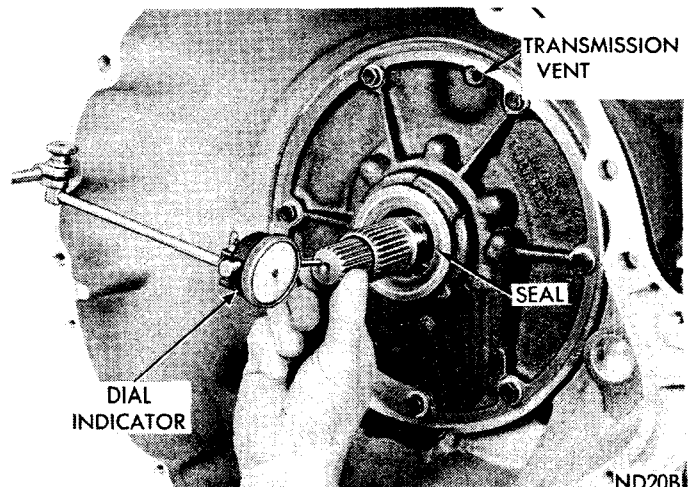
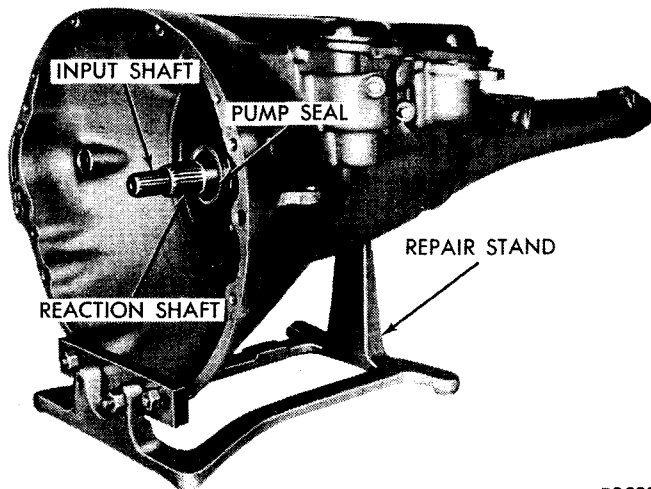


Fig. 5—Measuring Input Shaft End Play



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**Fig. 6—Transmission Installed in Repair Stand**

### Valve Body Assembly

- (1) Loosen clamp bolts and remove throttle and gearshift levers from the transmission.
- (2) Remove Back-Up Light and Neutral Start Switch.
- (3) Remove the ten hex-head valve body to transmission bolts. Remove E-clip securing parking lock rod to the valve body manual lever.
- (4) While lifting valve body upward out of transmission case, disconnect parking lock rod from the lever.

### Accumulator Piston and Spring

- (1) Lift spring off accumulator piston and withdraw piston from the case.

### Extension Housing and Output Shaft Bearing

Before removing extension housing, pull parking lock rod forward out of the case. Rotate propeller shaft if necessary to align parking gear and sprag to permit knob on end of control rod to pass the sprag.

- (1) Remove speedometer pinion and adapter assembly.

#### (2) Models with short extension housing.

Remove extension housing to transmission bolts and tap the housing lightly to break it loose, then remove housing and bearing assembly.

#### (3) Models with long extension housing.

Remove extension housing to transmission bolts. Remove access plate and gasket from bottom or side of the extension housing mounting pad. Spread large snap ring from the output shaft bearing with snap ring pliers. With snap ring spread as far as possible, carefully tap extension housing off the output shaft and bearing.

- (4) Using heavy duty snap ring pliers remove output shaft bearing rear snap ring. Remove bearing from shaft, then remove front snap ring.

### Governor and Support

- (1) Carefully pry small snap ring from weight end

of governor valve shaft. Slide valve and shaft assembly out of the governor body.

- (2) Remove snap ring from behind governor body, then slide governor body and support assembly off the output shaft.

### Oil Pump and Reaction Shaft Support

- (1) Tighten front band adjusting screw until band is tight on front clutch retainer. This prevents clutch retainer from coming out with pump which might cause unnecessary damage to the clutches.

- (2) Remove oil pump housing retaining bolts.

- (3) Attach Tool C-3752 to pump housing flange, (Fig. 7), in threaded holes in the flange.

- (4) Bump outward evenly with the two "knocker weights" to withdraw pump and reaction shaft support assembly from the case.

### Front Band and Front Clutch

- (1) Loosen front band adjuster, remove band strut and slide band out of the case.
- (2) Slide front clutch assembly out of the case.

### Input Shaft and Rear Clutch

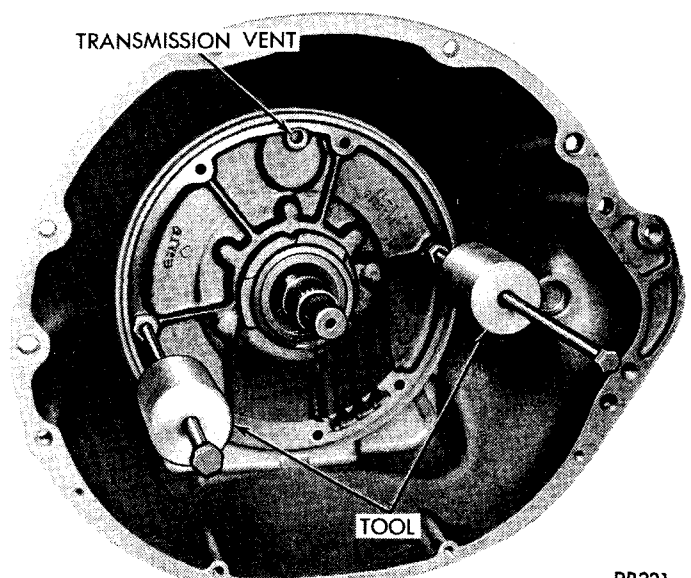
- (1) Grasp input shaft, and slide input shaft and rear clutch assembly out of the case.

**Be careful not to lose thrust washer located between rear end of input shaft and forward end of the output shaft.**

### Planetary Gear Assemblies, Sun Gear and Driving Shell

- (1) While supporting output shaft and driving shell, carefully slide assembly forward and out through the case.

**Be very careful not to damage ground surfaces on output shaft during removal.**



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**Fig. 7—Removing Pump and Reaction Shaft Support Assembly**

### Rear Band and Low-Reverse Drum

(1) Remove low-reverse drum, then loosen rear band adjuster, remove band strut and link, then remove band from the case.

### Overrunning Clutch

(1) Note position of overrunning clutch rollers and springs before disassembly to assist in reassembly.

(2) Carefully slide out clutch hub and remove rollers and springs. If the overrunning clutch cam and/or roller spring retainer are found damaged or worn, refer to index for replacement procedures.

### Kickdown Servo (Front)

(1) Compress kickdown servo spring by using engine valve spring compressor, Tool C-3422-A, then remove snap ring (Fig. 8).

(2) Remove rod guide, springs and piston rod from the case. Be careful not to damage piston rod or guide during removal.

(3) Withdraw piston from the transmission case. (See Fig. 30 or 31).

(4) If so equipped, disassemble "Controlled Load" Servo piston assembly by removing small snap ring from servo piston then remove washer, spring and piston rod from servo piston.

### Low and Reverse Servo (Rear)

(1) Compress low and reverse servo piston spring by using engine valve spring compressor, Tool C-3422-A, then remove the snap ring.

(2) Remove spring retainer, spring, and servo piston and plug assembly from the case.

## RECONDITION SUBASSEMBLIES

The following procedures cover disassembly, inspection, repair, and assembly of each subassembly as removed from the transmission.

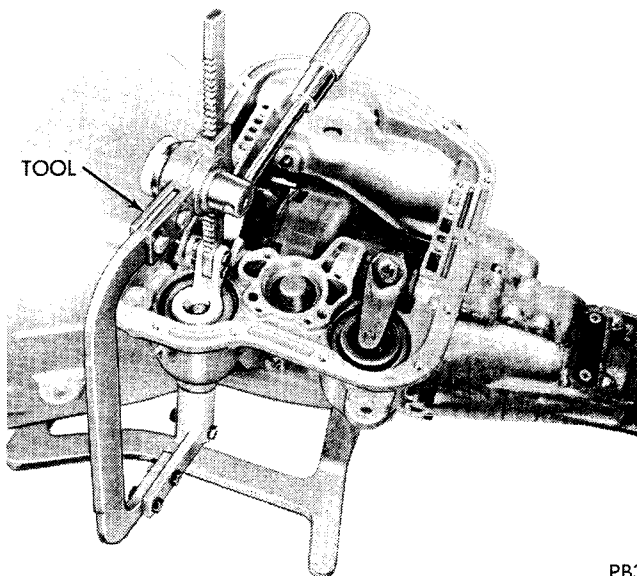


Fig. 8—Compressing Kickdown Servo Spring

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Heli-Coil or equivalent inserts are recommended for repairing damaged, stripped or worn threads in aluminum parts.

Pre-sized service bushings are available for replacement for most all bushings in the Load Flite transmission. The two bushings in sun gear are not serviced because of the low cost of sun gear assembly. If bushings are found worn or scored, they should be replaced as outlined in the following reconditioning procedures.

The bushing replacement tools listed by "SP" numbers are part of Tool Kit C-3887-A.

The use of crocus cloth is permissible where necessary, providing it is used carefully. When used on valves, use extreme care to avoid rounding off the sharp edges. The sharp edge is vitally important to this type of valve. Sharp edges prevent dirt and foreign matter from getting between the valve and body, thus reducing possibility of sticking. When it becomes necessary to recondition transmission, and vehicle has accumulated considerable mileage, install new seal rings on parts requiring their usage. Coat each part with "DEXRON" type Automatic Transmission Fluid during assembly.

## OIL PUMP AND REACTION SHAFT SUPPORT

### Disassembly

Figure 9 shows the oil pump and reaction shaft support disassembled.

(1) Remove bolts from rear side of reaction shaft support, and lift support off the pump.

(2) Remove rubber seal ring from pump body flange.

(3) Drive out oil seal with a blunt punch.

### Inspection

Inspect interlocking steel rings (Fig. 9) on reaction shaft support for wear or broken locks, make sure they turn freely in the grooves. Inspect machined surfaces on pump body and reaction shaft support for nicks and burrs. Inspect pump body and reaction shaft support bushings for wear or scores. Inspect pump rotors for scoring or pitting. With rotors cleaned and installed in pump body, place a straight edge across face of rotors and pump body. Use a feeler gauge to measure clearance between straight edge and face of rotors. Clearance limits are from .0015 to .003 inch. Also, measure rotor tip clearance between inner and outer teeth. Clearance limits are from .005 to .010 inch. Clearance between outer rotor and its bore in oil pump body should be from .004 to .008 inch.

### Pump Bushing Replacement

(1) Place pump housing on a clean smooth surface with rotor cavity down.



(2) Place removing head Tool SP-3550 in the bushing, and install handle Tool SP-3549 in the removing head (Fig. 10).

(3) Drive bushing straight down and out of the bore. Be careful not to cock tool in the bore.

(4) Position a new bushing on installing head Tool SP-5118.

(5) With pump housing on a smooth clean surface (hub end down), start bushing and installing head in the bushing bore. Install handle Tool SP-3549 in installing head (Fig. 10).

(6) Drive bushing into housing until tool bottoms in the pump cavity. Be careful not to cock tool during installation.

(7) Stake the bushing in place by using a blunt punch or similar tool (Fig. 11). A gentle tap at each stake slot location will suffice.

(8) Using a narrow-bladed knife or similar tool, remove high points or burrs around staked area (Fig. 11). Do not use a file or similar tool that will remove more metal than is necessary.

(9) Thoroughly clean pump housing before installation.

### Reaction Shaft Bushing Replacement

(1) Assemble remover Tool SP-5301, cup Tool SP-3633, and hex nut Tool SP-1191 (Fig. 12).

**Do not clamp any part of reaction shaft or support in a vise.**

(2) With cup held firmly against reaction shaft, thread remover into bushing as far as possible by hand.

(3) Using a wrench to screw remover into bushing 3 to 4 additional turns to firmly engage threads in the bushing.

(4) Turn hex nut down against the cup to pull bushing from reaction shaft. Thoroughly clean reaction shaft to remove chips made by remover threads.

(5) Lightly grip bushing in a vise or with pliers and back tool out of the bushing. Be careful not to damage threads on bushing remover.

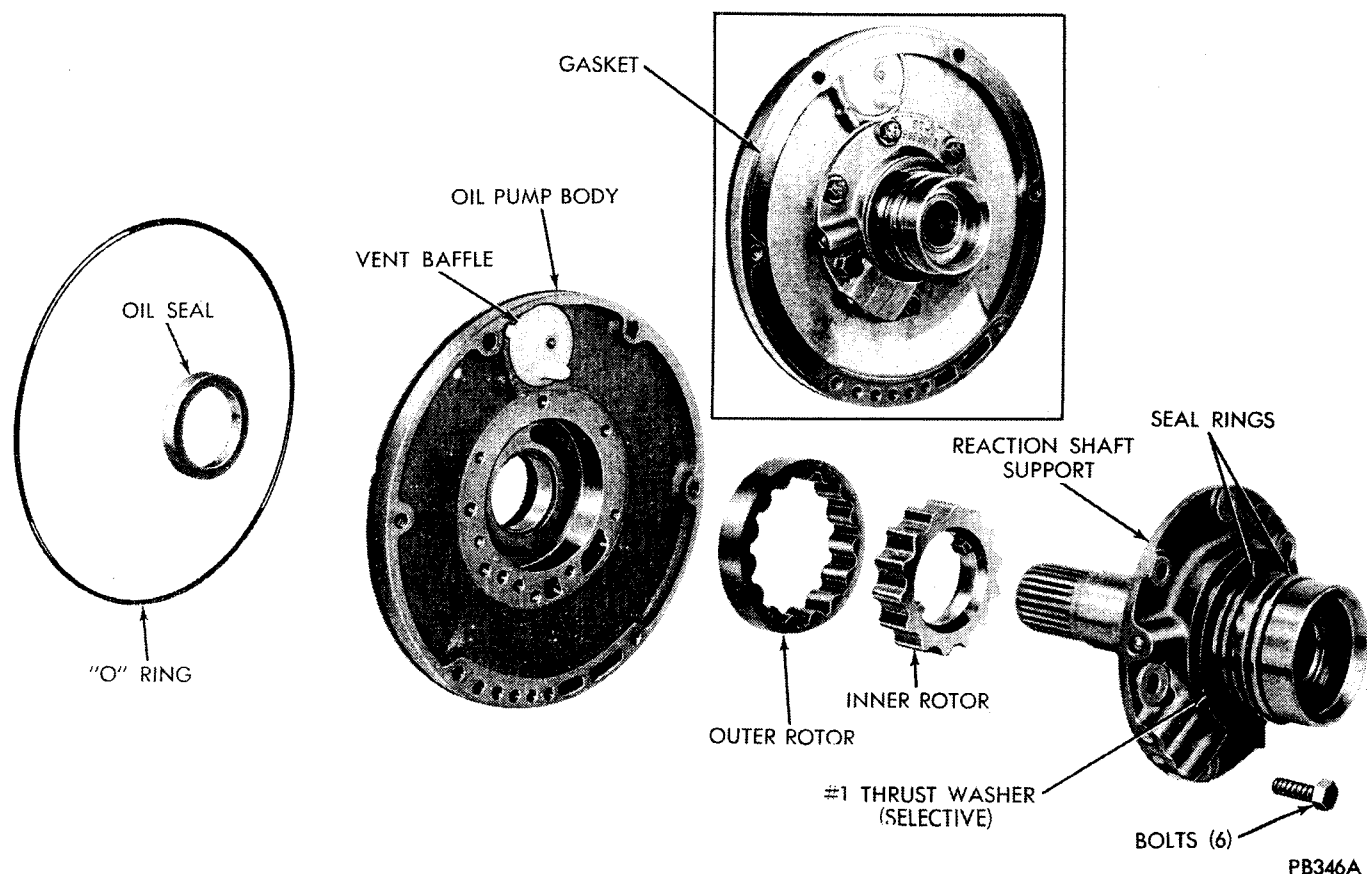
(6) Slide a new bushing (chamfered end first) on installing head Tool SP-5302, and start them in the bore of reaction shaft (Fig. 12).

(7) Support reaction shaft upright on a clean smooth surface and install handle Tool SP-3549 in installing head. Drive bushing into shaft until tool bottoms.

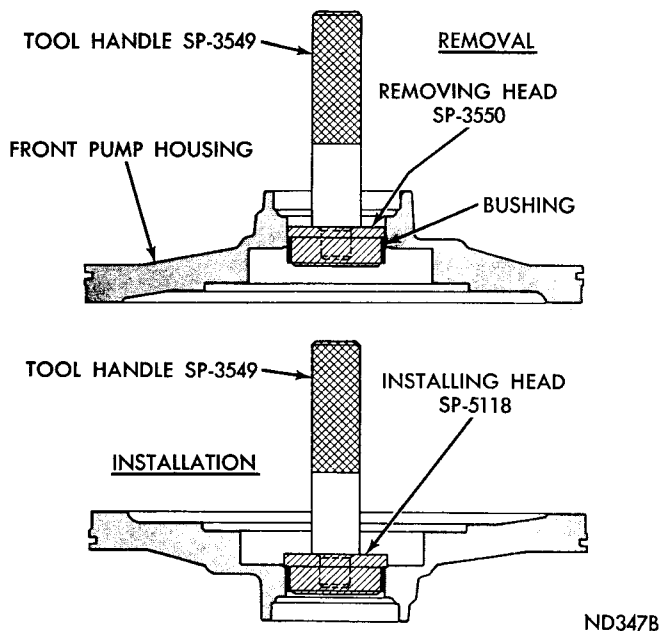
(8) Thoroughly clean reaction shaft support assembly before installation.

### Assembly

(1) Assemble pump rotors and "O" ring in the pump housing (Fig. 9).



**Fig. 9—Oil Pump and Reaction Shaft Support**



**Fig. 10—Replacing Pump Bushing**

(2) Install reaction shaft support. Install retaining bolts and tighten to 160 inch-pounds.

(3) Place a new oil seal in opening of pump housing (lip of seal facing inward) using Tool C-3860 drive seal into housing until tool bottoms.

## FRONT CLUTCH

### Disassembly

Figure 13 shows a disassembled view of the front clutch assembly.

(1) Remove large waved snap ring that secures pressure plate in clutch piston retainer. Lift pressure plate and clutch plates out of the retainer.

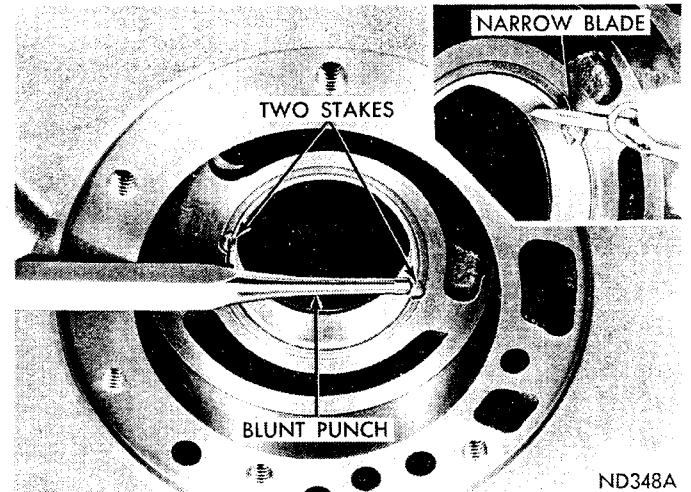
(2) Install compressor, Tool C-3863-A over piston spring retainer, (Fig. 14). Compress springs and remove snap ring, then slowly release tool until spring retainer is free of hub. Remove tool, retainer and springs.

(3) Invert clutch retainer assembly and bump it on a wood block to remove piston. Remove seals from piston and clutch retainer hub.

### Inspection

Inspect plates and discs for flatness. They must not be warped or cone shaped. Inspect facing material on all driving discs. Replace discs that are charred, glazed or heavily pitted. Disc should also be replaced if they show evidence of material flaking off or if facing material can be scraped off easily. Inspect driving disc splines for wear or other damage. Inspect steel plate and pressure plate surfaces for burning, scoring or damaged driving lugs. Replace if necessary.

Inspect steel plate lug grooves in clutch retainer for smooth surfaces, plates must travel freely in the grooves. Inspect band contacting surface on clutch



**Fig. 11—Staking Pump Bushing**

retainer for scores. Note ball check in clutch retainer, make sure ball moves freely. Inspect seal surfaces in clutch retainer for nicks or deep scratches, light scratches will not interfere with sealing of neoprene seals. Inspect clutch retainer bushing for wear or scores.

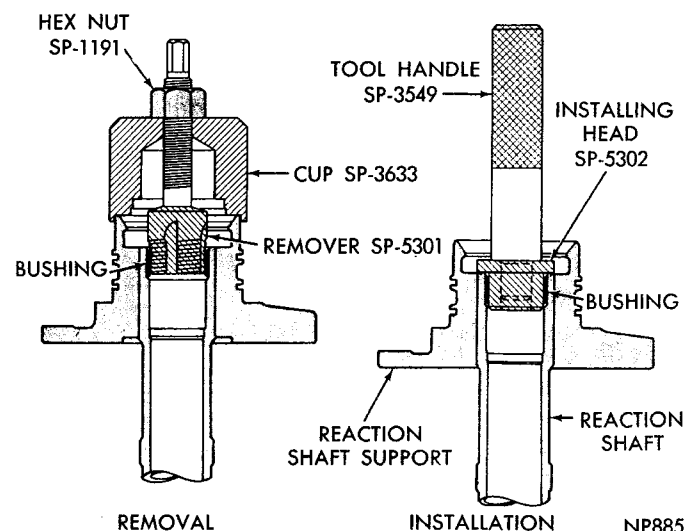
Inspect inside bore of piston for score marks, if light, remove with crocus cloth. Inspect seal grooves for nicks and burrs. Inspect neoprene seals for deterioration, wear, and hardness. Inspect piston springs, retainer and snap ring for distortion.

### Front Clutch Retainer Bushing Replacement

(1) Lay clutch retainer (open end down) on a clean smooth surface and place removing head Tool SP-3629 in the bushing. Install handle Tool SP-3549 in removing head (Fig. 15).

(2) Drive bushing straight down and out of clutch retainer bore. Be careful not to cock tool in the bore.

(3) Lay clutch retainer (open end up) on a clean smooth surface. Slide a new bushing on installing



**Fig. 12—Replacing Reaction Shaft Bushing**

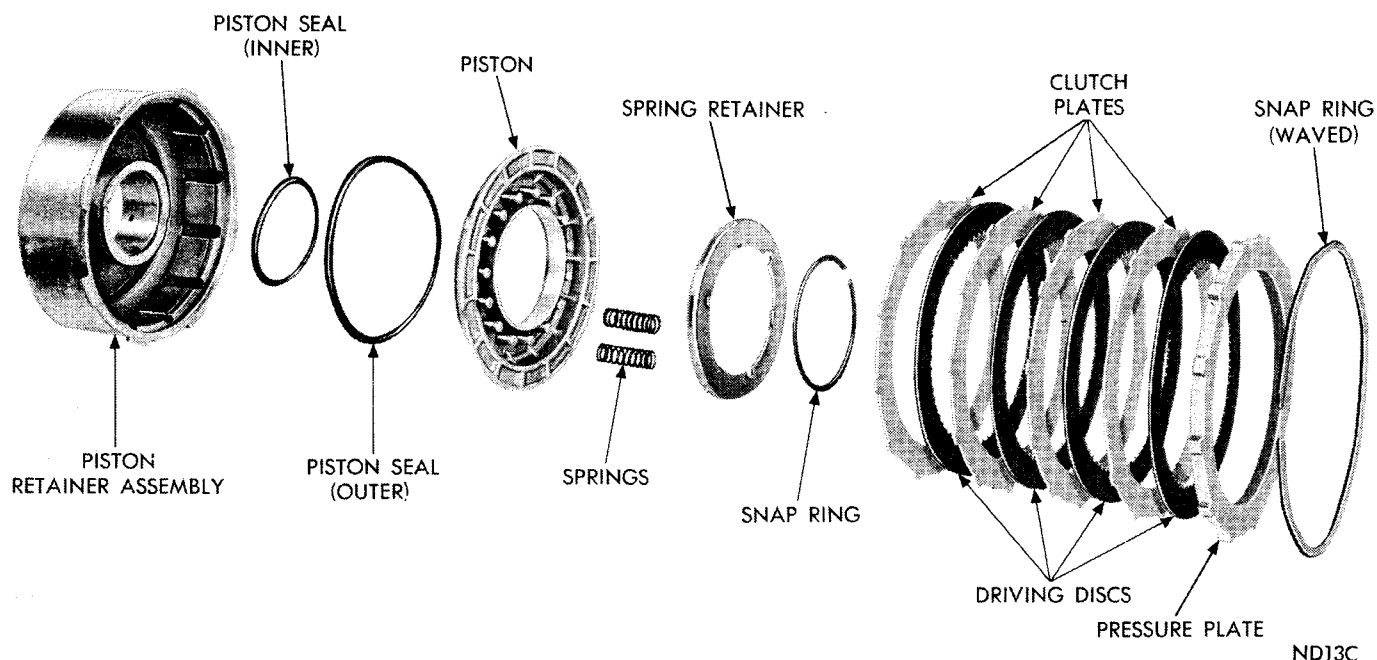


Fig. 13—Front Clutch Disassembled

head Tool SP-5511, and start them in clutch retainer bore.

(4) Install handle Tool SP-3549 in the installer (Fig. 15). Drive bushing into clutch retainer until tool bottoms.

(5) Thoroughly clean clutch retainer before assembly and installation.

### Assembly

(1) Lubricate and install inner seal on hub of clutch retainer. Make sure lip of seal faces down and is properly seated in the groove.

(2) Install outer seal on the clutch piston, with lip of seal toward bottom of clutch retainer. Apply a coating of wax type lubricant or Door Ease to outer edge of seals for easier installation of piston assembly. Place piston assembly in retainer and carefully seat piston in bottom of retainer.

(3) Refer to "Front Clutch Data" in specifications, and install springs on piston exactly as shown (Fig. 16 or 17).

Position spring retainer and snap ring over the springs. Compress springs with Tool C-3863-A (Fig. 14), and seat snap ring in hub groove. (Remove compressor tool).

(4) Lubricate all clutch plates, install one steel plate followed by a lined plate (disc) until the number given in the chart is installed. Install pressure plate and snap ring. Make sure snap ring is properly seated.

(5) With front clutch completely assembled, insert a feeler gauge between pressure plate and snap ring (Fig. 18). The maximum clearance should be within limits given in the chart.

## REAR CLUTCH

### Disassembly

Figure 19 shows a disassembled view of the rear clutch assembly.

(1) Remove large selective snap ring that secures pressure plate in clutch retainer. Lift pressure plate, clutch plates, and inner pressure plate out of the retainer.

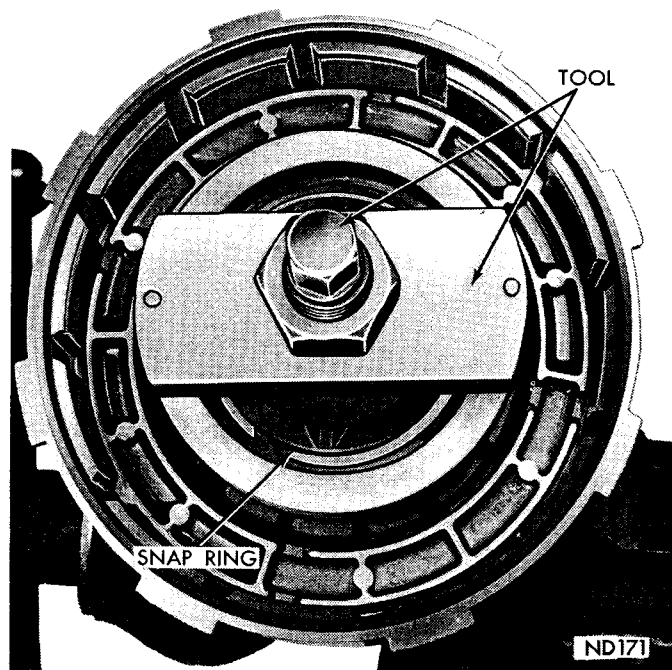
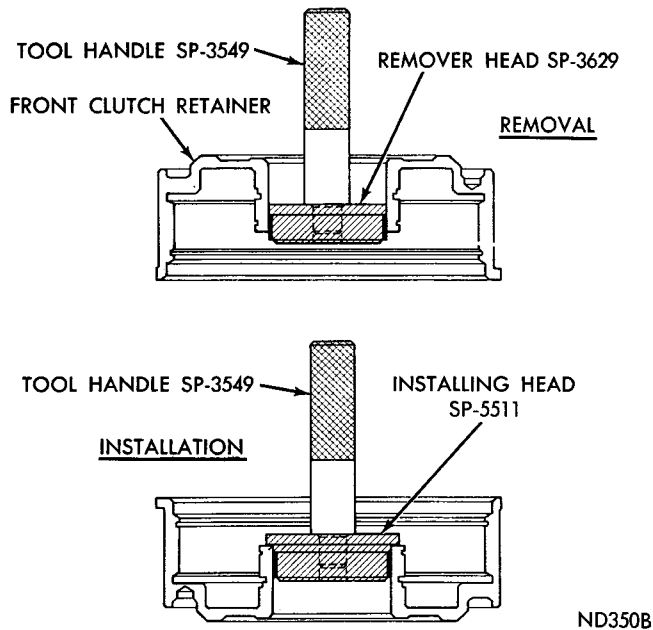


Fig. 14—Removing or Installing Front Clutch Spring Retainer Snap Ring



**Fig. 15—Replacing Front Clutch Retainer Bushing**

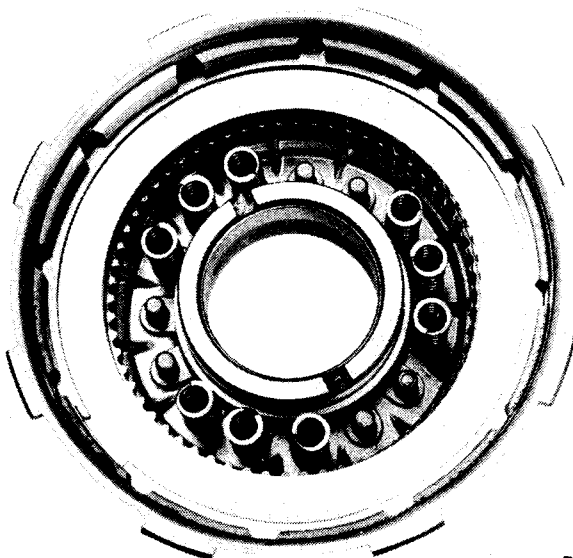
(2) Carefully pry one end of wave spring out of its groove in clutch retainer, then remove wave spring, spacer ring and clutch piston spring.

(3) Invert clutch piston retainer assembly and bump it on a wood block to remove piston. Remove seals from the piston.

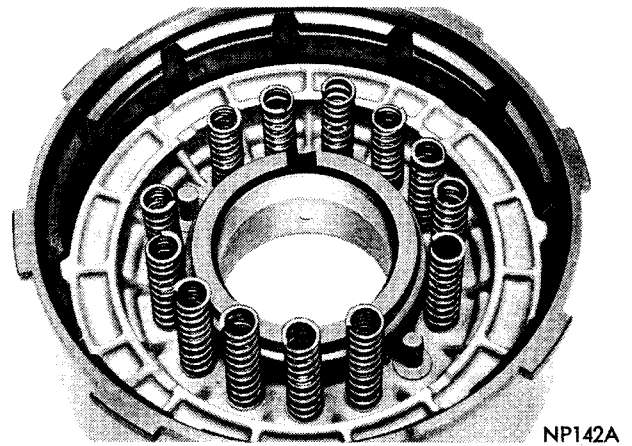
(4) If necessary, remove snap ring and press input shaft from clutch piston retainer.

### Inspection

Inspect facing material on all driving discs. Replace discs that are charred, glazed or heavily pitted. Discs should also be replaced if they show evidence of material flaking off or if facing material can be scraped off easily. Inspect driving disc splines for wear



**Fig. 16—Front Clutch Spring Location (9 Springs)**

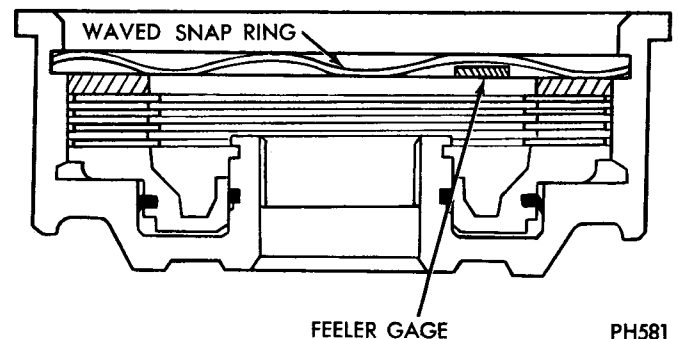
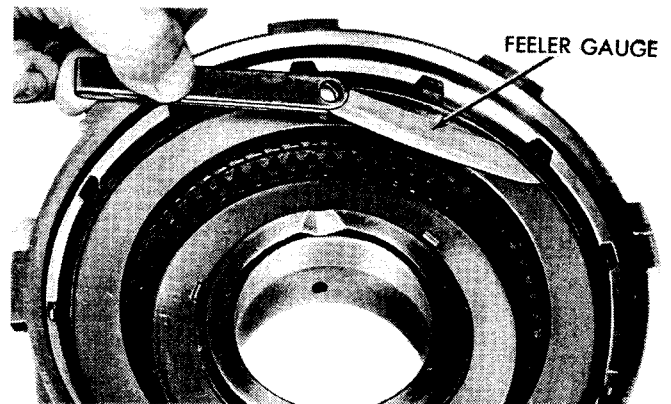


**Fig. 17—Front Clutch Spring Location (13 Springs)**

or other damage. Inspect steel plate and pressure plate surfaces for burning, scoring or damaged driving lugs. Replace if necessary.

Inspect steel plate lug grooves in clutch retainer for smooth surfaces, plates must travel freely in the grooves. Note ball check in the piston, make sure ball moves freely. Inspect seal surfaces in clutch retainer for nicks or deep scratches, light scratches will not interfere with sealing of neoprene seals. Inspect neoprene seals for deterioration, wear, and hardness. Inspect piston spring, wave spring, and spacer for distortion or breakage.

Inspect interlocking seal rings (Fig. 19) on input shaft for wear or broken locks, make sure they turn freely in the grooves. Do not remove rings unless con-



**Fig. 18—Measuring Front Clutch Plate Clearance**

ditions warrant. Inspect bushing in input shaft for wear on scores. Inspect rear clutch to front clutch thrust washer for wear. Washer thickness should be .061 to .063 inch, replace if necessary.

### Input Shaft Bushing Replacement

(1) Clamp input shaft in a vise with soft jaws, being careful not to clamp on seal ring lands or bearing journals.

(2) Assemble remover Tool SP-3630, cup Tool SP-3633, and hex nut Tool SP-1191 (Fig. 20).

(3) With cup held firmly against clutch piston retainer, thread remover into bushing as far as possible by hand.

(4) Using a wrench, screw remover into bushing 3 to 4 additional turns to firmly engage threads in the bushing.

(5) Turn hex nut down against cup to pull bushing from input shaft.

(6) Thoroughly clean input shaft to remove chips made by remover threads. Make certain small lubrication hole next to ball in end of shaft is not plugged with chips. Be sure no chips are lodged next to the steel ball.

(7) Slide a new bushing on installing head Tool SP-3636 and start them in the bore of input shaft.

(8) Stand input shaft upright on a clean smooth surface and install handle Tool SP-3549 in the installing head (Fig. 20). Drive bushing into shaft until tool bottoms.

(9) Thoroughly clean input shaft and clutch piston retainer before assembly and installation.

### Assembly

(1) If removed, press input shaft into clutch piston retainer and install snap ring.

(2) Lubricate and install inner and outer seal rings on clutch piston. Make sure lip of seals face toward head of clutch retainer, and are properly seated in piston grooves (Fig. 19).

(3) Place piston assembly in retainer and, with a twisting motion, seat piston in bottom of the retainer.

(4) Position clutch retainer over piston retainer splines and support the assembly so clutch retainer remains in place.

(5) Place clutch piston spring and spacer ring on top of piston in clutch retainer, make sure spring and spacer ring are positioned in the retainer recess. Start one end of wave spring in retainer groove (Fig. 21), then progressively push or tap spring into place making sure it is fully seated in the groove.

(6) Install inner pressure plate in clutch retainer with raised portion of plate resting on the spring.

(7) Lubricate all clutch plates, install one lined plate followed by a steel plate until all plates are installed. Install outer pressure plate and selective snap ring.

(8) Measure rear clutch plate clearance by having an assistant press downward firmly on outer pressure plate, then insert a feeler gauge between the plate and snap ring (Fig. 22). The clearance should be between .025 to .045 inch. If not, install a snap ring of proper thickness to obtain specified clearance. Low limit clearance is desirable. **Rear clutch plate clearance is very important in obtaining proper clutch operation. The clearance can be adjusted by the use of**

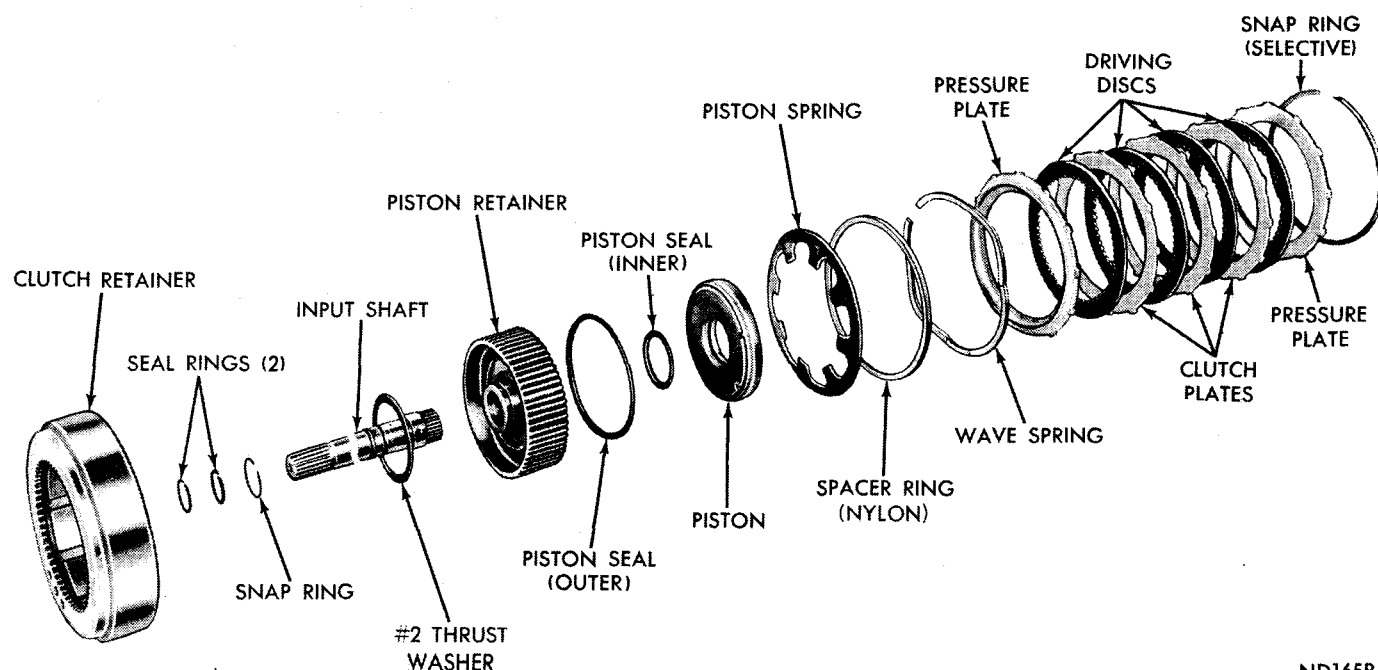
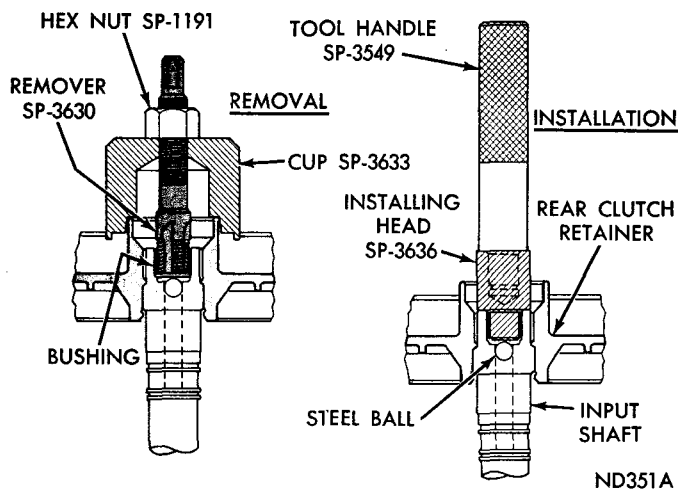


Fig. 19—Rear Clutch Disassembled



**Fig. 20—Replacing Input Shaft Bushing**

various thickness outer snap rings. Snap rings are available in .060, .074, .088 and .106 inch thickness.

## PLANETARY GEAR TRAIN

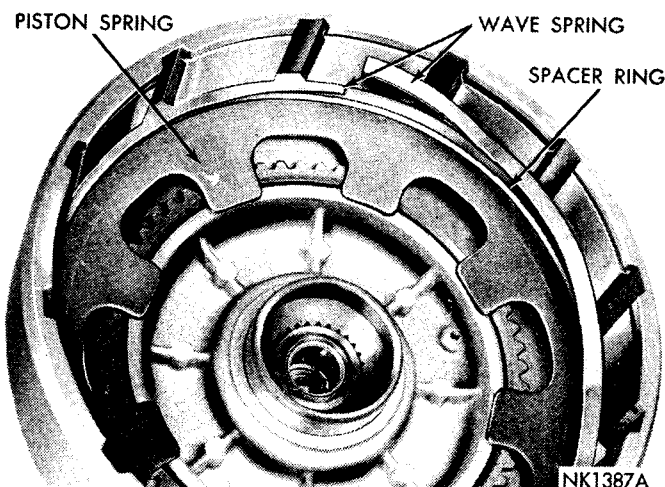
### End Play

Measure end play of planetary gear assemblies, sun gear and driving shell before removing these parts from output shaft. With assembly in an upright position, push rear annulus gear support downward on output shaft. Insert a feeler gauge between rear annulus gear support hub and shoulder on output shaft (Fig. 23). The clearance should be .010 to .025 inch. If clearance exceeds specifications, replace thrust washers and/or necessary parts.

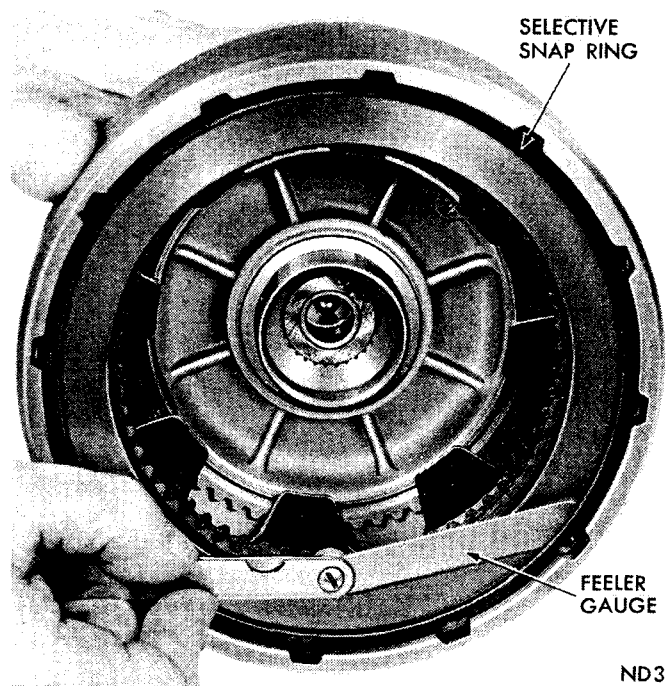
### Disassembly

(1) Remove thrust washer from forward end of output shaft (Fig. 24 or 25).

(2) Remove selective snap ring from forward end of output shaft, then slide front planetary assembly off the shaft.



**Fig. 21—Installing Rear Clutch Spring, Spacer Ring and Wave Spring**



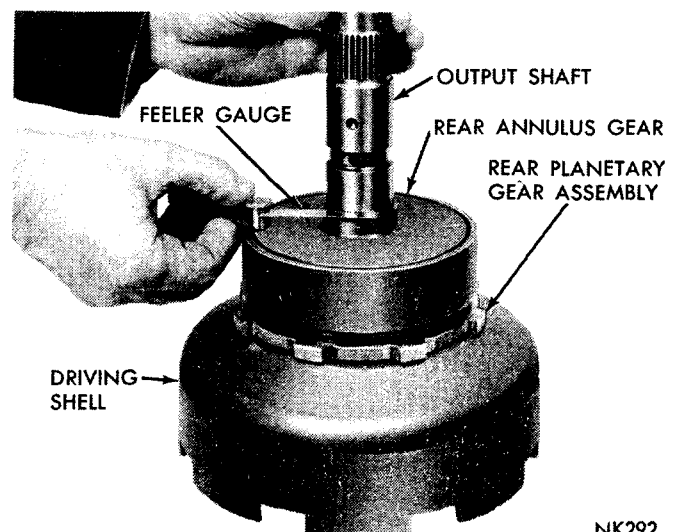
**Fig. 22—Measuring Rear Clutch Plate Clearance**

(3) Slide front annulus gear off planetary gear set. Remove thrust washer from rear side of planetary gear set.

(4) Slide sun gear, driving shell and rear planetary assembly off output shaft.

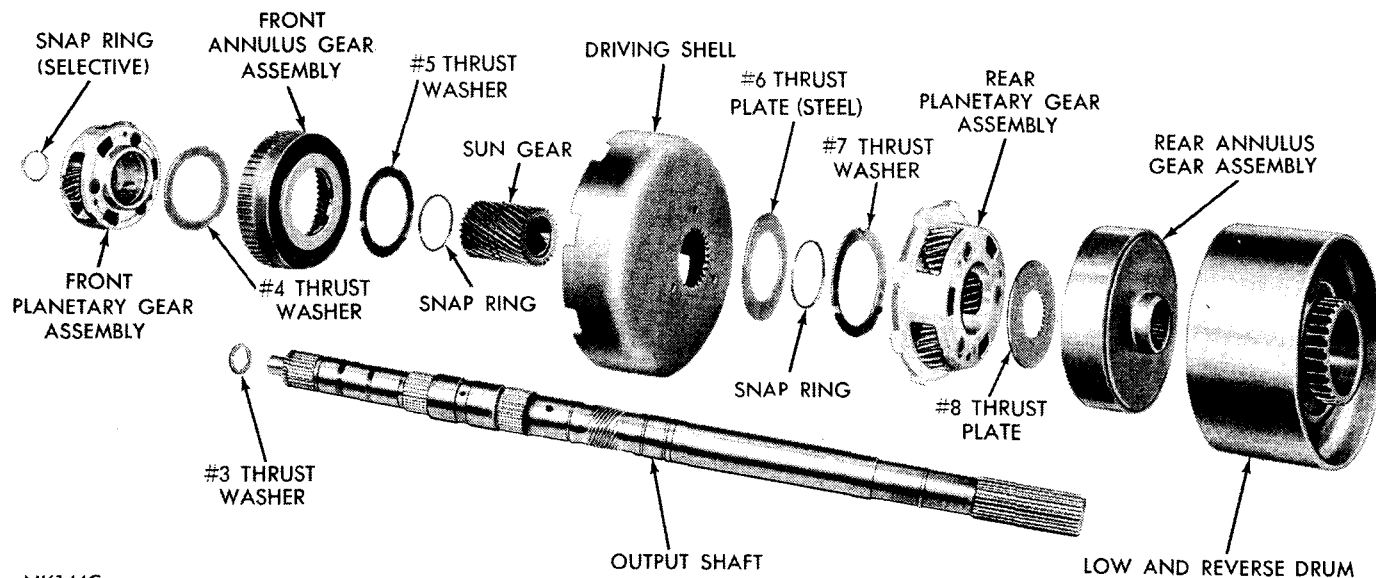
(5) Lift sun gear and driving shell off rear planetary gear assembly. Remove thrust washer from inside the driving shell. Remove snap ring and steel washer from sun gear (rear side of driving shell) and slide sun gear out of the shell. Remove front snap ring from sun gear if necessary. Note that front end of sun gear is longer than rear.

(6) Remove thrust washer from forward side of rear planetary gear assembly, remove planetary gear set and thrust plate from rear annulus gear.



**Fig. 23—Measuring End Play of Planetary Gear Train**





NK144C

**Fig. 24—Planetary Gear Train and Output Shaft Disassembled (Long Extension Housing)**

### Inspection

Inspect bearing surfaces on output shaft for nicks, burrs, scores or other damage. Light scratches, small nicks or burrs can be removed with crocus cloth or a fine stone. Inspect speedometer drive gear for any nicks or burrs, and remove with a sharp edged stone. Make sure all oil passages in shaft are open and clean.

Inspect bushings in sun gear for wear or scores, replace sun gear assembly if bushings are damaged. Inspect all thrust washers for wear and scores, replace if damaged or worn below specifications. Inspect thrust faces of planetary gear carriers for wear, scores or other damage, replace as required. Inspect planetary gear carrier for cracks and pinions for broken or worn gear teeth and for broken pinion shaft

lock pins. Inspect annulus gear and driving gear teeth for damage. Replace distorted lock rings.

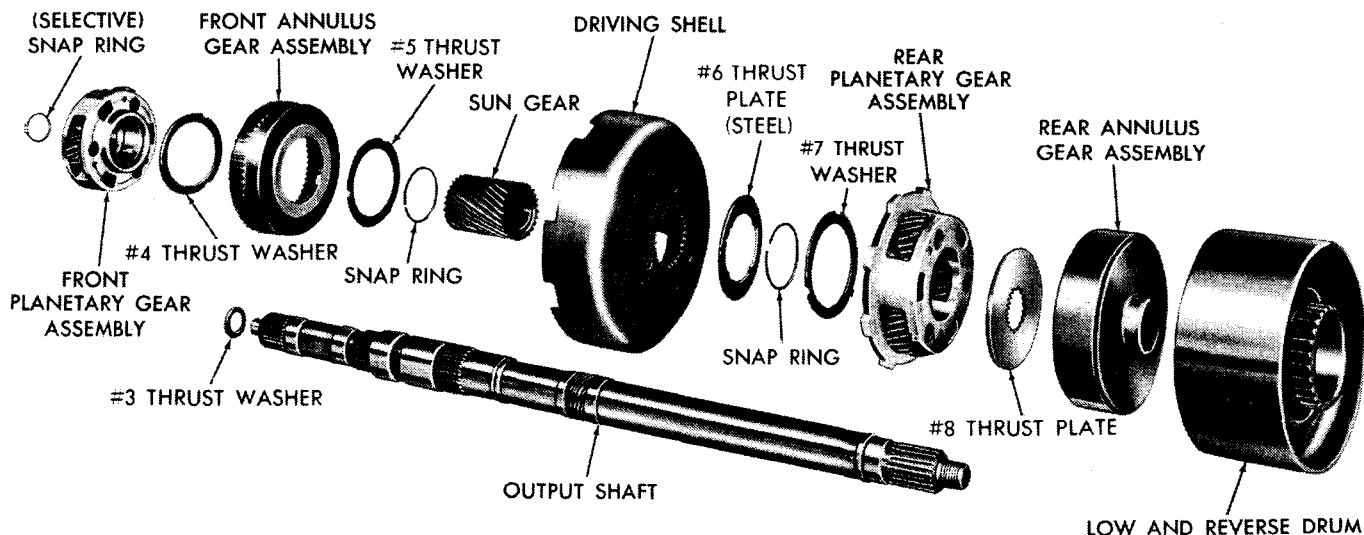
### Assembly

Refer to Figure 24 for parts identification.

(1) Install rear annulus gear on the output shaft. Apply a thin coat of grease on thrust plate, place it on the shaft and in the annulus gear making sure teeth are over the shaft splines.

(2) Position rear planetary gear assembly in the rear annulus gear. Place thrust washer on front side of planetary gear assembly.

(3) Install snap ring in front groove of sun gear (long end of gear). Insert sun gear through front side of driving shell, install rear steel washer and snap ring.



ND15C

**Fig. 25—Planetary Gear Train and Output Shaft Disassembled (Short Extension Housing)**

(4) Carefully slide driving shell and sun gear assembly on output shaft, engaging sun gear teeth with rear planetary pinion teeth. Place thrust washer inside the front driving shell.

(5) Place thrust washer on rear hub of front planetary gear set, then slide assembly into front annulus gear.

(6) Carefully work front planetary and annulus gear assembly on output shaft, meshing planetary pinions with the sun gear teeth.

(7) With all components properly positioned, install selective snap ring on front end of output shaft. Remeasure end play of the assembly. **The clearance can be adjusted by the use of various thickness snap rings. Snap rings are available in .048, .055, and .062 inch thickness.**

## OVERRUNNING CLUTCH

### Inspection

Inspect clutch rollers for smooth round surfaces, they must be free of flat spots and chipped edges. Inspect roller contacting surfaces in the cam and race for brinelling. Inspect roller springs for distortion, wear or other damage. Inspect cam set screw for tightness. If loose, tighten and restake the case around the screw.

### Overrunning Clutch Cam Replacement

If overrunning clutch cam and/or roller spring retainer are found damaged, replace cam and spring retainer in the following manner:

(1) Remove set screw from the case below clutch cam.

(2) Remove four bolts securing output shaft support to rear of transmission case. Insert a punch through bolt holes and drive cam from the case (Fig. 26). Alternate punch from one bolt hole to another so cam will be driven evenly from the case.

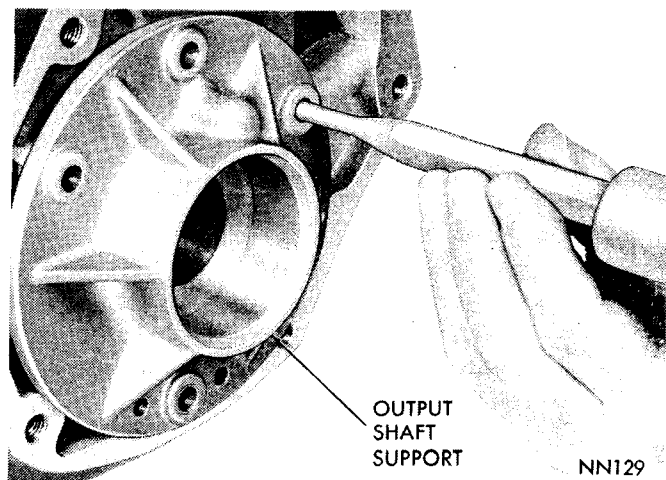


Fig. 26—Removing Overrunning Clutch Cam

The output shaft support must be in the case to install the overrunning clutch cam.

If the support requires replacement, drive it rearward out of the case with a wood block and hammer. To install, screw two C3288-B pilot studs into the case (Fig. 27). Chill the support with ice (preferably dry ice). Quickly position support over the pilot studs, and drive it firmly into the case with a wood block and hammer.

(3) Clean all burrs and chips from cam area in the case.

(4) Place spring retainer on the cam, making sure retainer lugs snap firmly into notches on the cam.

(5) Position cam in the case with cam serrations aligned with those in the case. Tap cam **evenly** into the case as far as possible with a soft mallet.

(6) Install Tool C-3863-A and Adapter SP-5124 as shown in Figure 28, tighten nut on tool to seat cam into the case. Make sure cam is firmly bottomed, then install cam retaining set screw. Stake the case around set screw to prevent it coming loose.

(7) Remove cam installing tool. Install and tighten support retaining screws to 140 inch-pounds. Stake the case around cam in twelve places with a blunt chisel (Fig. 29).

## KICKDOWN SERVO AND BAND

### Disassembly

Disassemble controlled load servo piston by removing small snap ring from servo piston. Then remove washer, spring and piston rod from servo piston.

### Inspection (Fig. 30 or 31)

Inspect piston and guide seal rings for wear, and make sure they turn freely in the grooves. It is not necessary to remove seal rings unless conditions warrant. Inspect piston for nicks, burrs, scores and wear. Inspect piston bore in the case for scores or other damage. Inspect fit of guide on piston rod. Inspect piston spring for distortion.

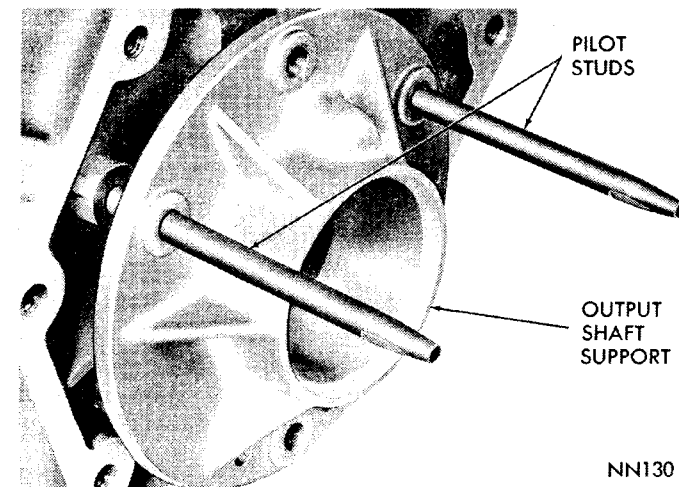
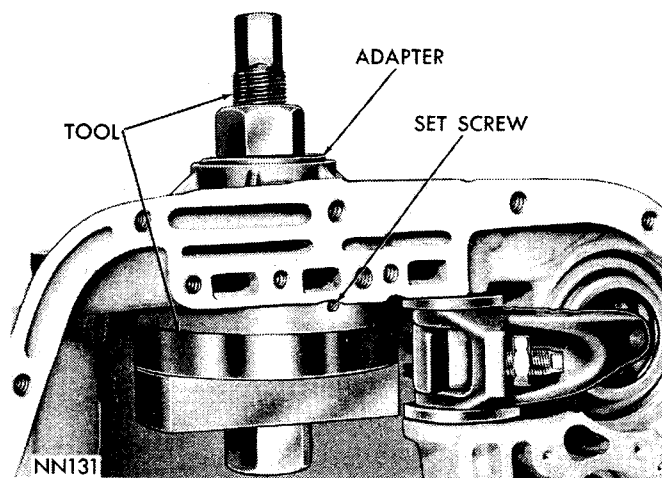


Fig. 27—Installing Output Shaft Support



**Fig. 28—Installing Overrunning Clutch Cam**

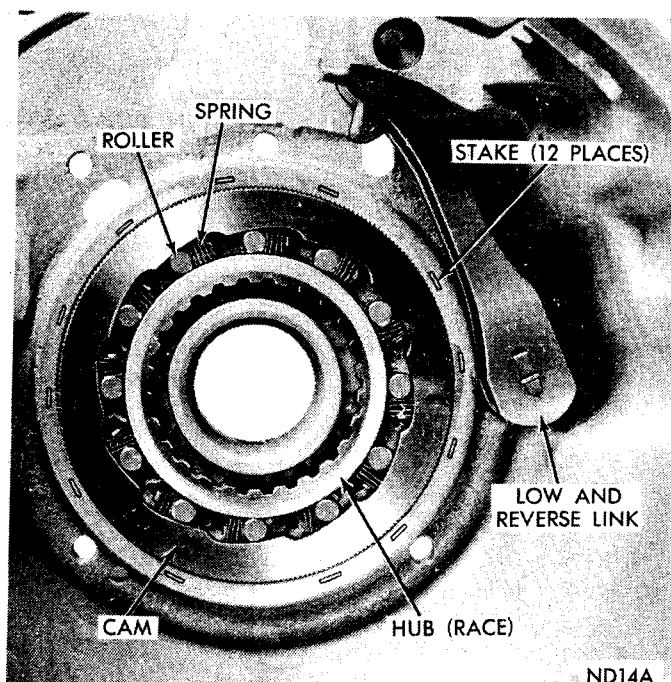
If equipped with controlled load servo piston, inspect bore in piston and "O" ring on piston rod.

Inspect band lining for wear and bond of lining to the band. Inspect lining for black burn marks, glazing, non-uniform wear pattern and flaking. If lining is worn so grooves are not visible at ends or any portion of the bands, replace the band. Inspect band for distortion or cracked ends.

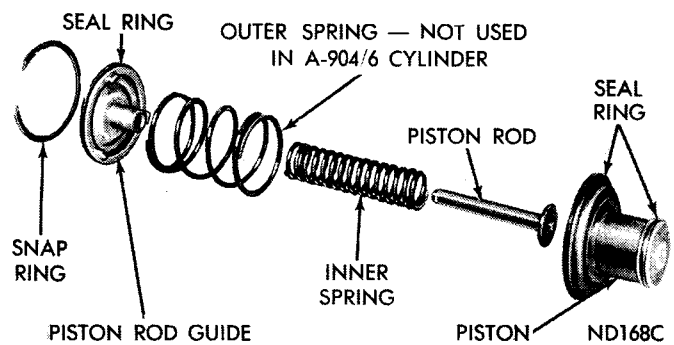
#### Assembly

Assemble controlled load servo piston as follows (Fig. 31).

- (1) Grease "O" ring and install on piston rod.
- (2) Install piston rod into servo piston.
- (3) Install spring, flat washer and snap ring to complete the assembly.



**Fig. 29—Overrunning Clutch, Low and Reverse Band Link**



**Fig. 30—Kickdown Servo—Disassembled**  
**LOW—REVERSE SERVO AND BAND**

#### Disassembly

- (1) Remove snap ring from piston and remove the piston plug and spring (Fig. 32).

#### Inspection

Inspect seal for deterioration, wear and hardness. Inspect piston and piston plug for nicks, burrs, scores and wear; piston plug must operate freely in the piston. Inspect piston bore in the case for scores or other damage. Inspect springs for distortion.

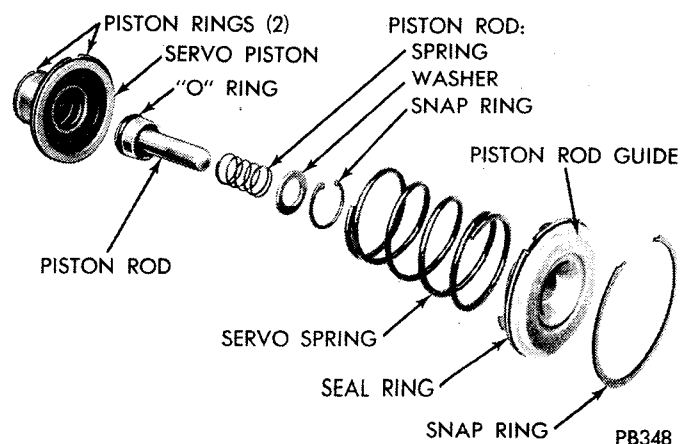
Inspect band lining for wear and bond of lining to the band. If lining is worn so grooves are not visible at ends or any portion of the band, replace the band. Inspect band for distortion or cracked ends.

#### Assembly

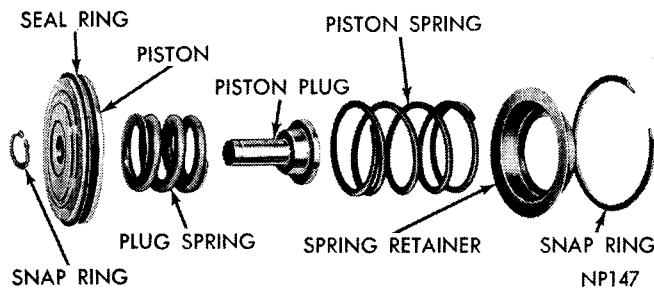
- (1) Lubricate and insert piston plug and spring in the piston, and secure with snap ring.

### ASSEMBLY—SUBASSEMBLY INSTALLATION

The assembly procedures given here include installation of subassemblies in the transmission case and adjusting drive train end play. Do not use force to assemble mating parts. If parts do not assemble freely investigate the cause, and correct the trouble before proceeding with assembly procedures. Always use new gaskets during assembly operations.



**Fig. 31—Kickdown Servo (Controlled Load)**



**Fig. 32—Low and Reverse Servo**

Use only "Dexron" type Automatic Transmission Fluid to lubricate transmission parts during assembly.

### Overrunning Clutch

(1) With transmission case in an upright position, insert clutch hub inside the cam. Install overrunning clutch rollers and springs exactly as shown in Figure 29.

### Low Reverse Servo and Band

(1) Carefully work servo piston assembly into the case with a twisting motion. Place spring, retainer and snap ring over the piston (Fig. 32).

(2) Compress low and reverse servo piston spring by using engine valve spring compressor Tool C-3422-A, then install snap ring.

(3) Position rear band in the case, install short strut, then connect long link and anchor to the band (Fig. 33). Screw in band adjuster just enough to hold strut in place. Install low-reverse drum. Be sure long link and anchor assembly is installed, as shown in Figure 29 to provide running clearance for the low and reverse drum.

### Kickdown Servo (Figs. 30 or 31)

(1) If equipped with controlled load servo piston, sub-assemble it as follows:

- (a) Grease "O" ring and install on piston rod.
- (b) Install piston rod into servo piston.
- (c) Install spring, flat washer and snap ring to complete the sub-assembly.

(2) Carefully push servo piston into the case bore. Install piston rod, springs and guide.

(3) Compress kickdown servo springs by using engine valve spring compressor Tool C-3422-A, then install snap ring.

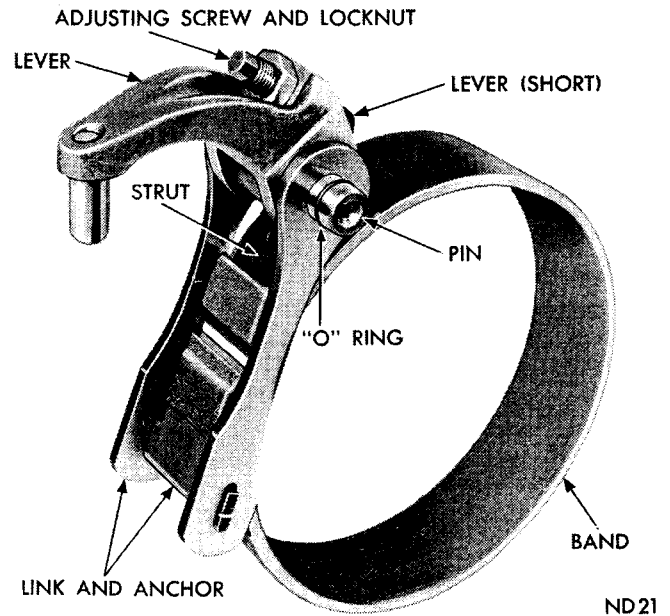
### Planetary Gear Assemblies, Sun Gear, and Driving Shell

(1) While supporting assembly in the case, insert output shaft through rear support. Carefully work assembly rearward engaging rear planetary carrier lugs into low-reverse drum slots.

**Be very careful not to damage ground surfaces on output shaft during installation.**

### Front and Rear Clutch Assemblies

The front and rear clutches, front band, oil pump



**Fig. 33—Low-Reverse Band and Linkage**

and reaction shaft support are more easily installed with transmission in an upright position.

One method to support transmission, is outlined in Steps 1 and 2.

(1) Cut a 3-1/2 inch diameter hole in a bench, in the end of a small oil drum or a large wooden box strong enough to support transmission. Cut or file notches at edge of the 3-1/2 inch hole so output shaft support will fit and lay flat in the hole.

(2) Carefully insert output shaft into hole to support the transmission upright, with its weight resting on flange of the output shaft support.

(3) Apply a coat of grease on input to output shaft thrust washer (Fig. 24 or 25), and install washer on front end of the output shaft.

(4) Align front clutch plate inner splines, and place assembly in position on the rear clutch. Make sure front clutch plate splines are fully engaged on rear clutch splines.

(5) Align rear clutch plate inner splines, grasp input shaft and lower the two clutch assemblies into transmission case.

(6) Carefully work clutch assemblies in a circular motion to engage rear clutch splines over splines of front annulus gear. Make sure front clutch drive lugs are fully engaged in slots in the driving shell.

### Front Band

Figure 34 shows a disassembled view of the kick-down band assembly.

(1) Slide band over front clutch assembly.

(2) Install band strut, screw in adjuster just enough to hold strut and anchor in place.

### Oil Pump and Reaction Shaft Support

If difficulty was encountered in removing pump as-

sembly due to an exceptionally tight fit in the case, it may be necessary to expand the case with heat during pump installation. Using a suitable heat lamp, heat the case in area of pump for a few minutes prior to installing pump and reaction shaft support assembly.

If input shaft end play was not within specifications (.036 to .082 inch) when measured before disassembly, replace thrust washer on reaction shaft support hub with one of proper thickness (Fig. 9). Refer to thrust washer No. 1 in "Specifications" for sizes available.

(1) Screw two pilot studs, Tool C-3288B in pump opening in the case (Fig. 35). Install a new gasket over the pilot studs.

(2) Place a new rubber seal ring in the groove on outer flange of pump housing. Make sure seal ring is not twisted. Coat seal ring with grease for easy installation.

(3) Install pump assembly in the case; tap it lightly with a soft mallet, if necessary. Install four pump body bolts. Remove pilot studs, install remaining bolts and snug down evenly.

Rotate input and output shafts to see if any binding exists, then tighten bolts to 175 inch-pounds. Check shafts again for free rotation. Adjust both bands.

### Governor and Support

(1) Position support and governor body assembly on the output shaft. Align assembly so governor valve shaft hole in governor body aligns with hole in output shaft, then slide assembly into place. Install snap ring behind the governor body. Tighten body to support bolts to 100 inch-pounds. Bend ends of lock straps against bolt heads.

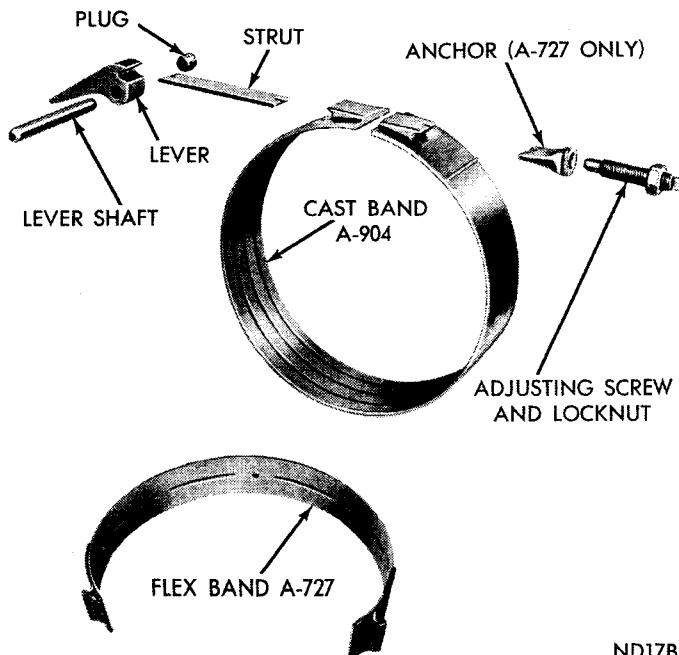


Fig. 34—Kickdown Band and Linkage

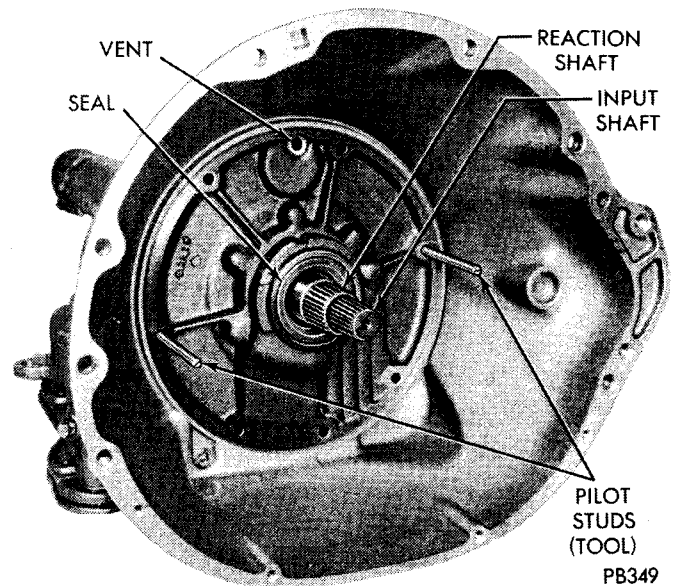


Fig. 35—Installing Pump and Reaction Shaft Support Assembly

(2) Place governor valve on valve shaft, insert assembly into body and through governor weights. Install valve shaft retaining snap ring.

### Extension Housing—Short

(1) Using a new gasket, carefully slide extension housing into place. Install retaining bolts and washers, tighten bolts to 24 foot-pounds.

(2) Install transmission yoke, position washer with its three projections toward yoke. Install nut with its convoluted surface toward the washer. Hold yoke with Tool C-3281, and tighten nut to 175 foot-pounds.

(3) Install speedometer pinion and adapter assembly.

Measure input shaft end play; correct if necessary.

### Extension Housing—Long

(1) Install a snap ring in the front groove on output shaft. Install bearing on the shaft with its outer race ring groove toward the front. Press or tap bearing tight against front snap ring, then install rear snap ring.

(2) Place a new extension housing gasket on the transmission case. Position output shaft bearing retaining snap ring in the extension housing. Spread snap ring as far as possible, then carefully tap extension housing into place. **Make sure snap ring is fully**

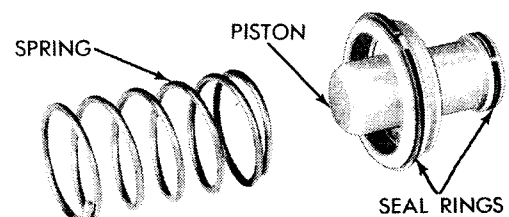


Fig. 36—Accumulator Piston and Spring

seated in the bearing groove.

(3) Install and tighten extension housing bolts to 24 foot-pounds.

(4) Install gasket and access plate on the side or bottom of extension housing mounting pad.

(5) Install speedometer pinion and adapter assembly.

Measure input shaft end play; correct if necessary.

### Valve Body Assembly and Accumulator Piston

(1) Clean mating surfaces and inspect for burrs on both the transmission case and valve body steel plate.

(2) Install accumulator piston in transmission case and place piston spring on the accumulator piston (Fig. 36). (No spring used with 440 cu. in. engine).

(3) Make sure Back-Up Light and Neutral Start Switch has been removed.

(4) Insert parking lock rod through opening in rear of case with the knob positioned against the reaction plug and sprag. Move front end of rod toward center of transmission while exerting rearward pressure on rod to force it past the sprag (rotate output shaft if necessary).

(5) Place valve body manual lever in **low** position. Place valve body in its approximate position in the case, connect parking lock rod to manual lever and secure with E-clip. Align valve body in the case, install retaining bolts finger tight.

(6) With neutral starting switch installed, place manual valve in the neutral position. Shift valve body if necessary to center neutral finger over the neutral switch plunger. Snug bolts down evenly, then tighten to 100 inch-pounds.

(7) Install gearshift lever and tighten clamp bolt. Check lever shaft for binding in the case by moving lever through all detent positions. If binding exists, loosen valve body bolts and re-align.

(8) Install flat washer and throttle lever, then tighten lever clamp bolt.

(9) Adjust kickdown and low-reverse bands.

(10) Install oil pan, using a new gasket. Tighten pan bolts to 150 inch-pounds.

### TRANSMISSION, CONVERTER AND DRIVE PLATE INSTALLATION

The transmission and converter must be installed as an assembly; otherwise, the converter drive plate, pump bushing, and oil seal may be damaged. The drive plate will not support a load; therefore, none of the weight of transmission should be allowed to rest on the plate during installation.

(1) Rotate pump rotors with Tool C-3881 (A-727) until the two small holes in handle are vertical (Fig. 37).

(2) Carefully slide converter assembly over input shaft and reaction shaft. Make sure converter hub slots are also vertical and fully engage pump inner

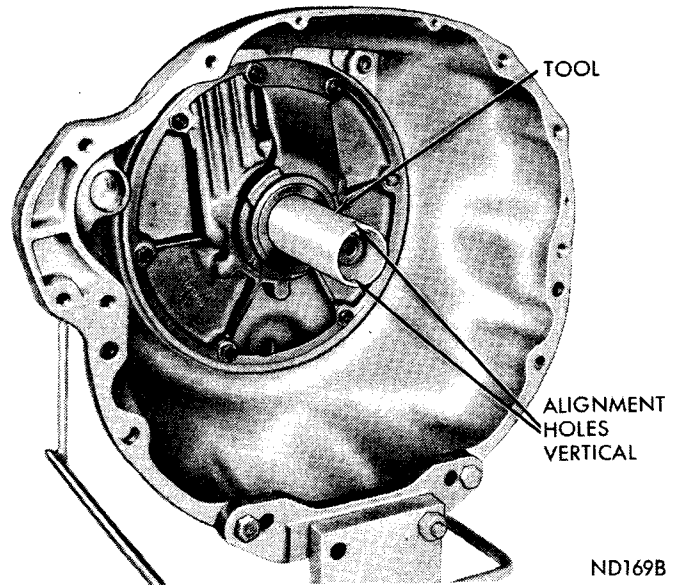


Fig. 37—Aligning Pump Rotors

rotor lugs.

Test for full engagement by placing a straight edge on face of the case (Fig. 38). The surface of converter front cover lug should be at least 1/2 inch to rear of straight edge when converter is pushed all way into the transmission.

(3) Attach a small "C" clamp to edge of converter housing to hold converter in place during transmission installation.

(4) Inspect converter drive plate for distortion or cracks and replace if necessary. Torque drive plate to crankshaft bolts to 55 foot-pounds. **When Drive Plate replacement has been necessary, make sure both transmission dowel pins are in engine block and they are protruding far enough to hold transmission in alignment.**

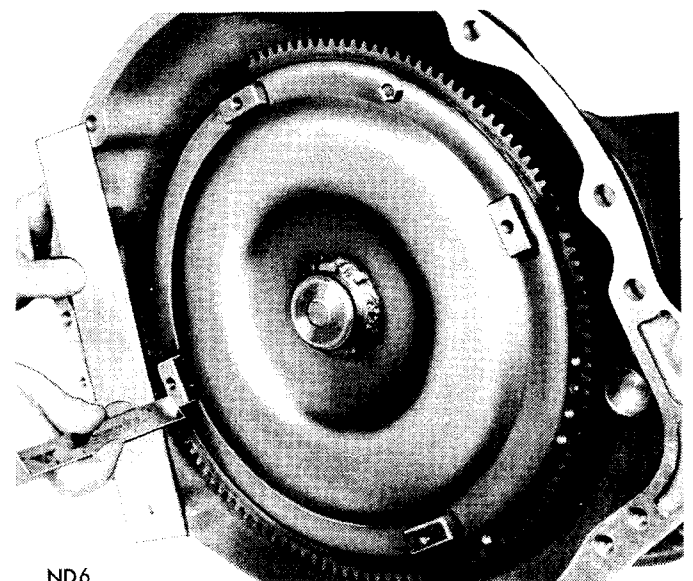


Fig. 38—Measuring Converter for Full Engagement in Transmission



(5) Coat converter hub hole in crankshaft with wheel bearing grease. Place transmission and converter assembly on a service jack and position assembly under vehicle for installation. Raise or tilt as necessary until transmission is aligned with engine.

(6) Rotate converter so mark on converter (made during removal) will align with mark on drive plate. The offset holes in plate are located next to 1/8 inch hole in the inner circle of plate. A stamped V mark identifies the offset hole in converter front cover (Fig. 39). Carefully work transmission assembly forward over engine block dowels with converter hub entering the crankshaft opening.

(7) After transmission is in position, install converter housing bolts and tighten to 28 foot-pounds.

(8) Install crossmember to frame and lower transmission to install mount on extension to the crossmember.

(9) The engine support fixture (Fig. 1), may now be removed.

(10) Install oil filler tube and speedometer cable.

(11) Connect throttle rod to transmission lever.

(12) Connect gearshift rod and torque shaft assembly to transmission lever and frame.

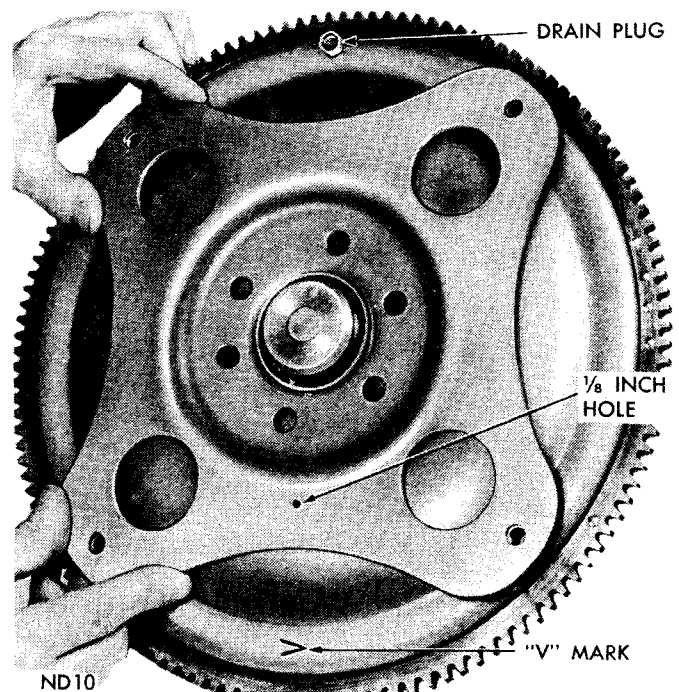
(13) Place wire connector on the combination back-up light and neutral/park starter switch.

(14) Install propeller shaft, and center mount if so equipped (Group 16).

(15) Rotate engine clockwise with socket wrench on vibration dampener bolt, as needed to install converter to drive plate bolts, matching marks made at removal. Tighten to 270 inch-pounds.

(16) Install converter access cover.

(17) Install starter motor and cooler line bracket.



**Fig. 39—Converter and Drive Plate Markings**

(18) Tighten cooler lines to transmission fittings.

(19) Install engine to transmission struts, if so equipped. Tighten bolts holding strut to transmission before strut to engine bolts.

(20) Replace exhaust system if it was disturbed for clearance.

(21) Adjust shift and throttle linkage.

(22) Refill transmission with "DEXRON" type automatic transmission fluid.

## NEW PROCESS AUTOMATIC TRANSMISSION (A-345)

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### GENERAL INFORMATION

Service procedures for the New Process A-345 Four Speed Automatic Transmission are essentially the same as LOADFLITE A-727 except for the COM-

POUNDER and the LOWER VALVE BODY of valve body assembly.

**When assembling transmission, always assemble the**

compounder last. This will prevent the #2 thrust washer, a front clutch disc, or a rear clutch disc from dropping out of proper location.

For parts replacement, refer to the seven digit part number stamped on left side of the transmission case oil pan flange.

The New Process A-345 transmission system consists of a sealed torque converter and a fully automatic four speed transmission (Figures 1 and 2).

The transmission consists of four multiple disc clutches, two overrunning clutches, two servos and bands, three planetary gear sets, and a hydraulic system. The planetary gear sets, friction elements, and the hydraulic system consisting of a pump and valve body are enclosed in an aluminum case and cast iron hydraulic circuit housing (compounder adapter). A bell housing is integral with the case and encloses the torque converter. An aluminum extension which supports the output shaft and governor assembly and provides mounting for the parking brake, is attached to the rear face of the hydraulic circuit housing. A steel oil pan encloses the hydraulic control system at the bottom of the case and acts as a reservoir for the transmission fluid.

Venting of the transmission is accomplished by a cast passage through the upper part of the oil pump housing.

The torque converter is attached to the crankshaft through a flexible driving plate. Cooling of the converter is accomplished by circulating the transmission fluid through an oil-to-water heat exchanger. The torque converter assembly is a sealed unit which cannot be disassembled.

The transmission fluid is filtered by an internal DA-CRON TYPE filter attached to the lower side of the lower valve body assembly.

Engine torque is transmitted to the torque converter, then through the input shaft to the multiple disc clutches in the transmission and compounder. The power flow depends on the application of the clutches and bands. Refer to "Clutch Engagement and Band Application Chart".

### HYDRAULIC CONTROL SYSTEM

The hydraulic control circuits (Figures 3 through 13) show the position of the various valves with color coded passages to indicate those under hydraulic pressure for all operation of the transmission.

The hydraulic control system makes the transmission fully automatic, and has four important functions to perform. In a general way, the components of any automatic control system may be grouped into the following basic groups:

The pressure supply system, the pressure regulat-

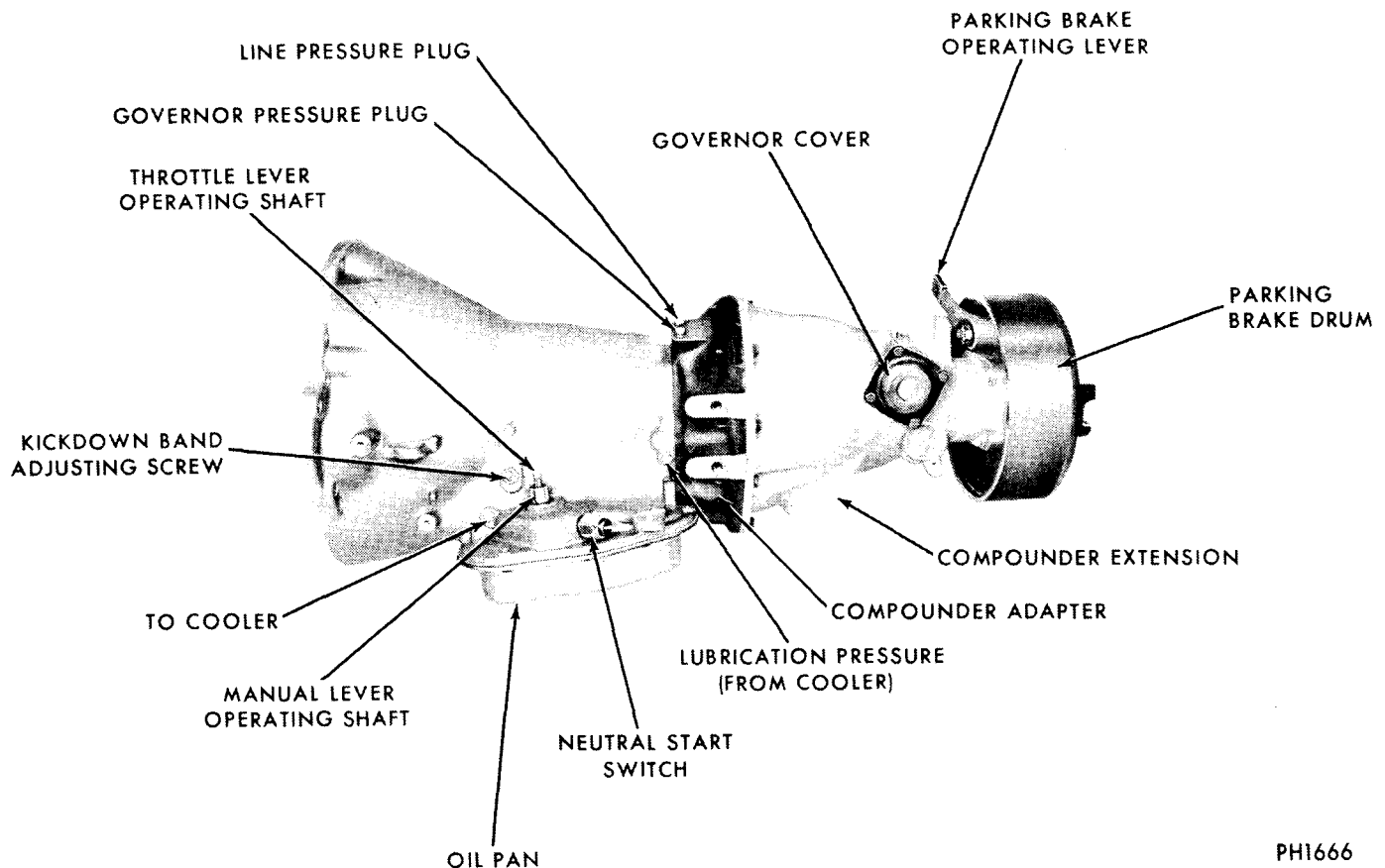
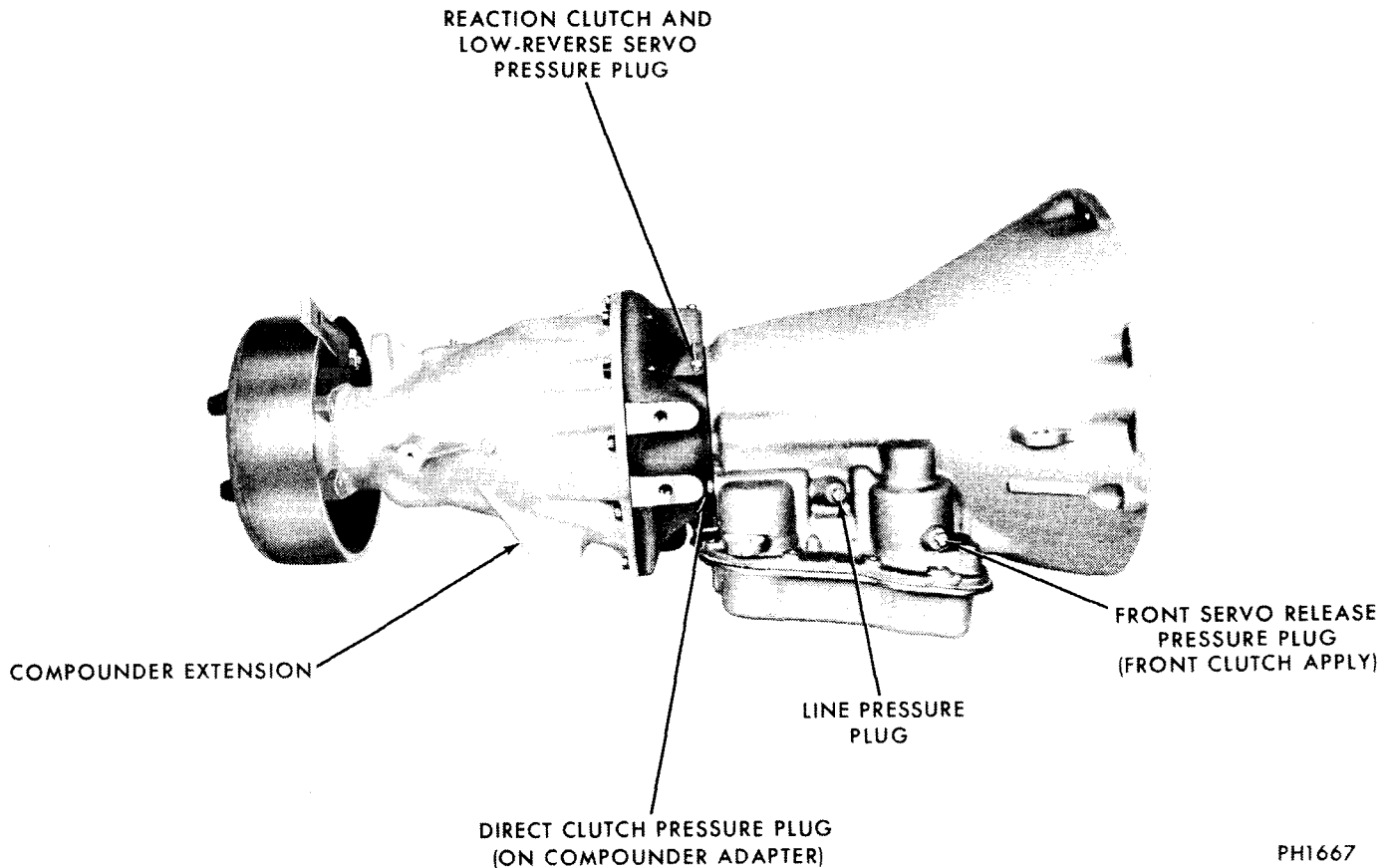


Fig. 1—Transmission Assembly (Left Side)



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**Fig. 2—Transmission Assembly (Right Side)**

ing valves, the flow control valves, and the clutches and band servos.

Taking each of these basic groups or systems in turn, the control system may be described as follows:

### **Pressure Supply System**

The pressure supply system consists of an oil pump driven by the engine through the torque converter. The single front pump furnishes pressure for all the hydraulic and lubrication requirements.

### **Pressure Regulating Valves**

The pressure regulating valves consist of a regulator valve which controls line pressure at a value dependent on throttle opening.

The torque converter control valve maintains torque converter operating pressure and transmission lubricating pressure.

The governor assembly transmits regulated pressure to the transmission (in conjunction with vehicle speed) to control upshift and downshift speeds.

The throttle valve transmits regulated pressure to the transmission (in conjunction with throttle position) to control upshift and downshift speeds.

The 1-2 governor modulator valve regulates line pressure as a function of governor pressure to the 1-2 shift valve governor plug.

### **Flow Control Valves**

The manual valve provides the different transmission drive ranges as selected by the vehicle operator.

The 1-2 shift valve automatically shifts the transmission from first to second or from second to first depending on the vehicle operation.

The 2-3 shift valve automatically shifts the transmission from second to third or from third to second depending on the vehicle operation.

The 3-4 shift valve automatically shifts the transmission from third to direct or from direct to third depending on vehicle operation.

The kickdown valve makes possible a forced downshift from direct to third, direct to second, third to second, third to breakaway, second to breakaway or direct to breakaway (depending on vehicle speed) by depressing the accelerator pedal past the detent "feel" near wide open throttle.

The throttle pressure plug at the end of the 3-4 shift valve, provides a 4-3 downshift with varying throttle openings depending upon vehicle speed.

The 1-2 shift control valve transmits 1-2 shift control pressure to the transmission accumulator piston to control the kickdown band capacity on 1-2 upshifts and 3-2 downshifts.

The shuttle valve has two separate functions and performs each independently of the other. The first is

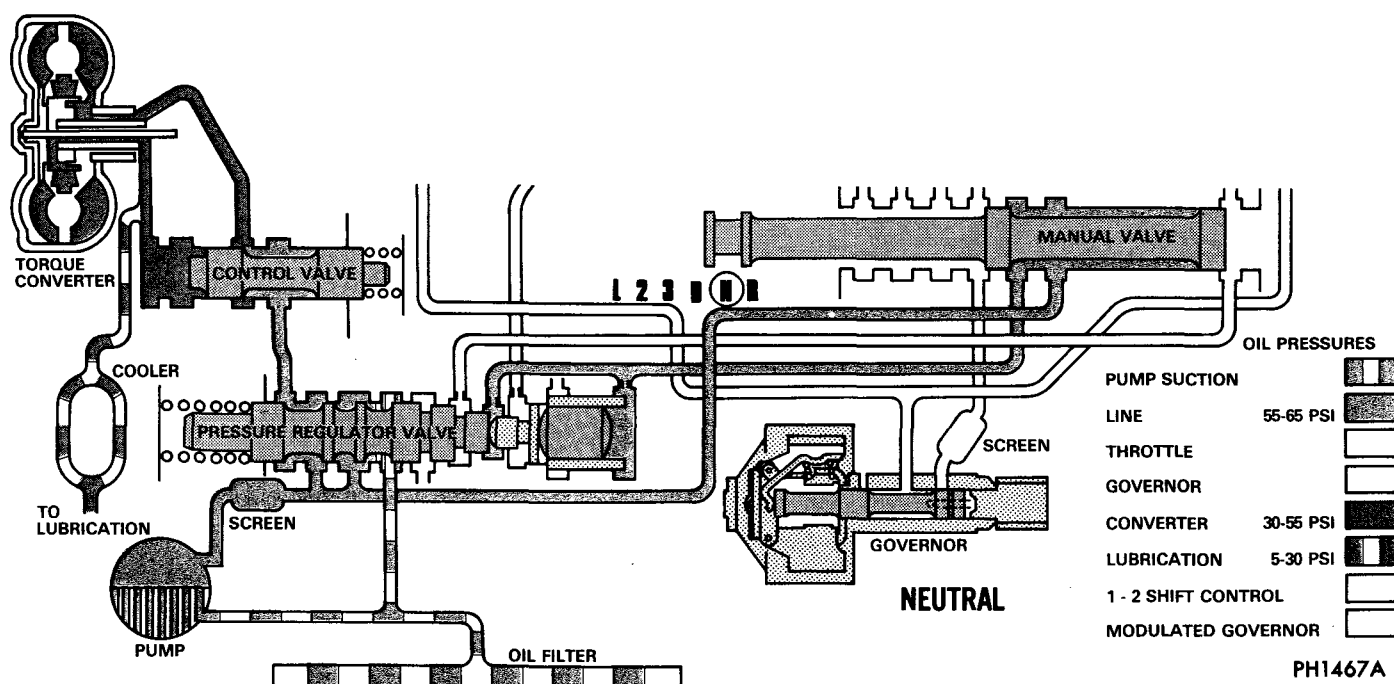


Fig. 3—Hydraulic Control Diagrams

that of providing fast release of the kickdown band, and smooth front clutch engagement when the driver make a "lift-foot" upshift from second to third, or direct. The second function of the shuttle valve is to regulate the application of the kickdown servo and band when making direct or third to second kickdowns.

### Clutches, Band Servos and Accumulator

The front, rear, reaction, and direct clutch pistons, and both servo pistons are moved hydraulically to engage the clutches and apply the bands. The pistons are released by spring tension when hydraulic pressure is released. On the 2-3 upshift, the kickdown servo piston is released by spring tension and hydraulic pressure.

The accumulator controls the hydraulic pressure on the apply side of the kickdown servo during the 1-2 shift; thereby, cushioning the kickdown band application at any throttle position.

## OPERATING INSTRUCTIONS

### "R" Reverse

Use this range only after the vehicle has been stopped. Engagement during forward motion can result in damage to the transmission.

### "N" Neutral

As a safety feature, the engine can only be started in neutral. Shift to neutral and apply parking brake when the vehicle will be standing for prolonged periods with the engine running.

### "D" Drive

For most city and highway driving. The transmission will automatically upshift and downshift, depending upon load and speed requirements.

### "3" Third

For driving slowly in heavy city traffic or on mountain roads. Use it also when climbing long grades, and for engine braking when descending moderately steep hills. To prevent excessive engine speed, do not engage at speeds above 35 mph.

### "2" Second

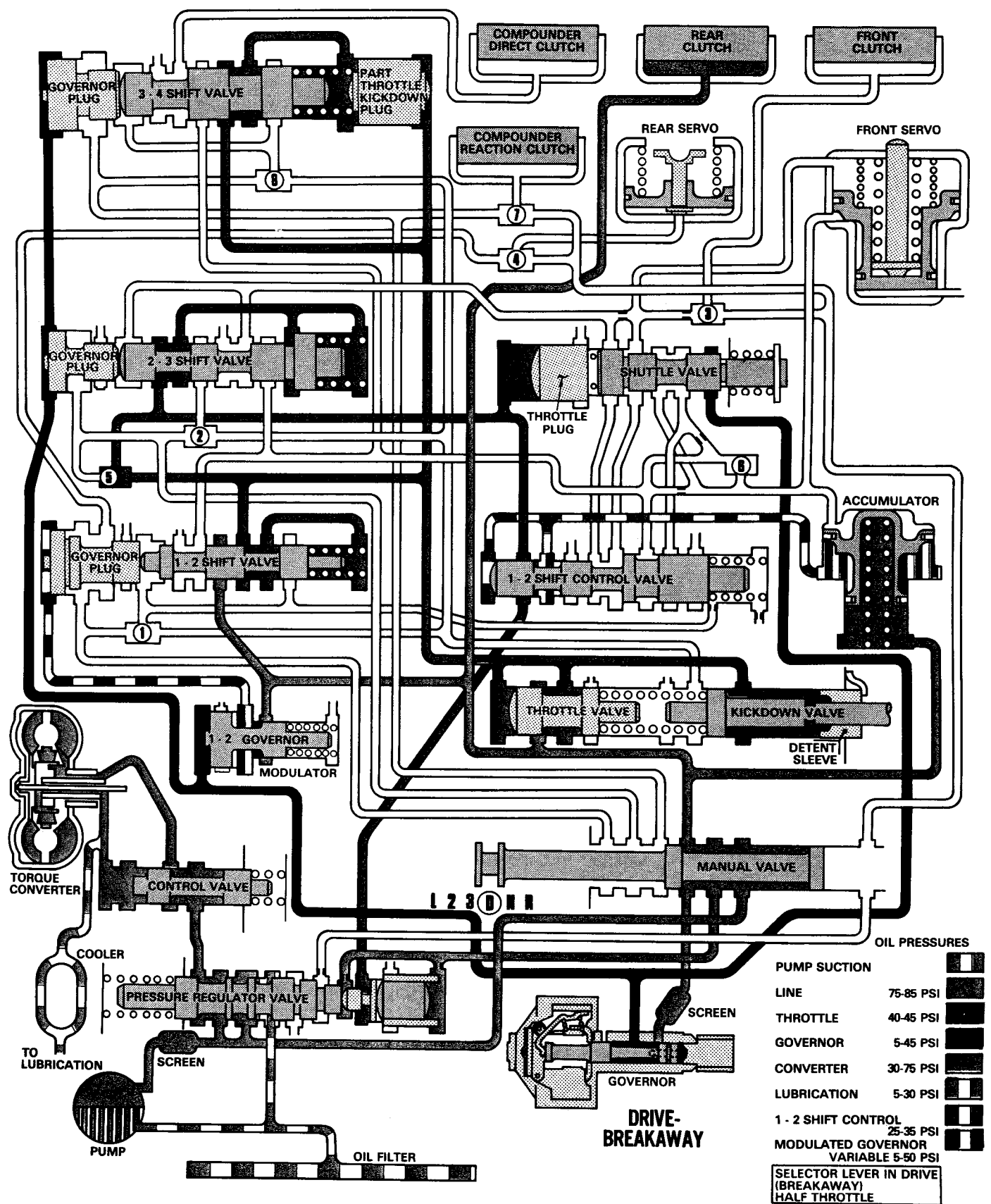
For driving up steep hills and for "engine braking" at low speeds. To prevent engine overspeed, the transmission has an inhibitor to prevent a downshift to second at speeds above approximately 24 mph.

### "1" First

For driving up very steep hills and for "engine braking" at low speeds. To prevent engine overspeed, the transmission has an inhibitor to prevent a downshift to low at speeds above approximately 18 mph.

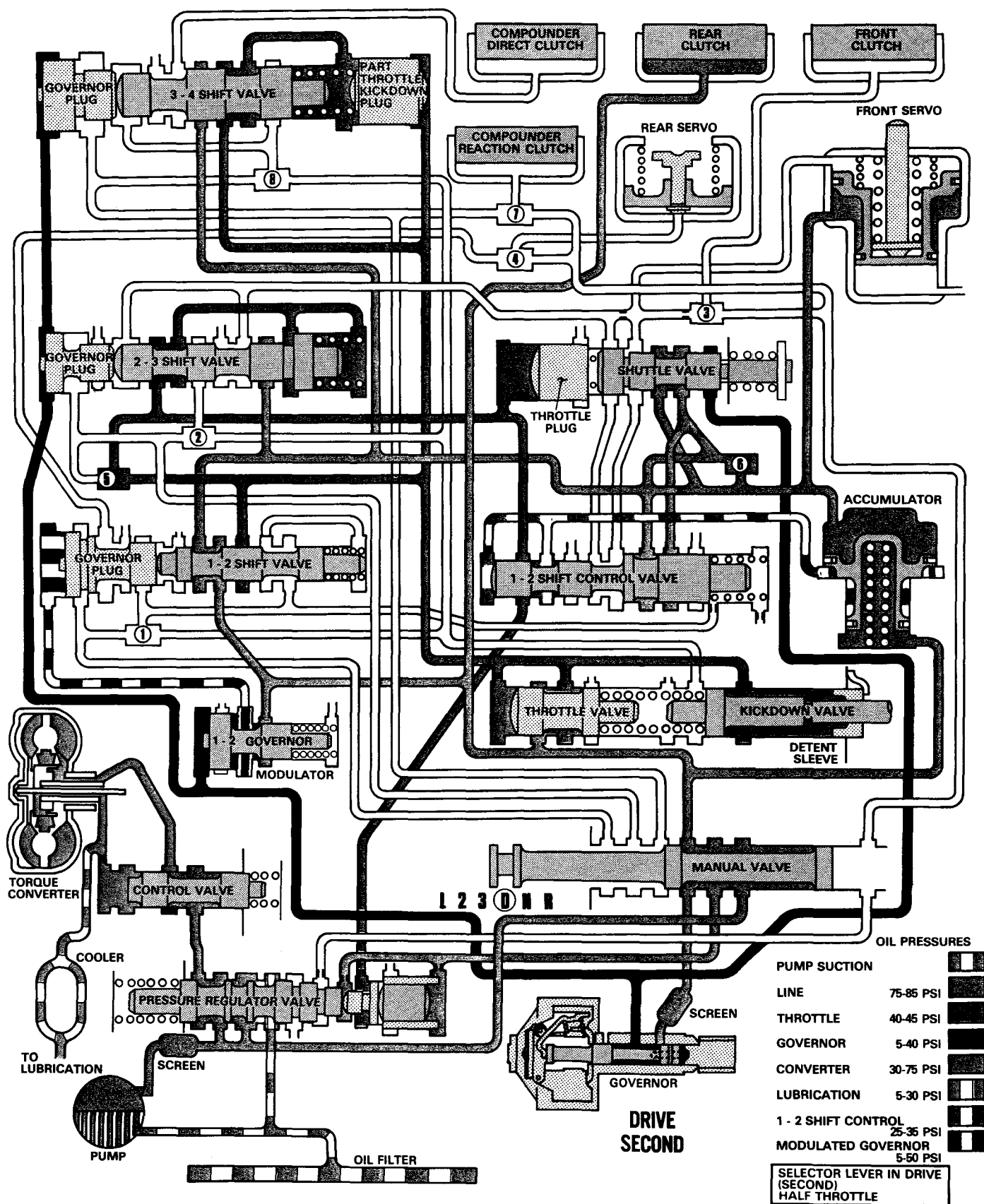
### Passing Acceleration

By depressing the accelerator pedal to the floor, you can automatically shift the transmission to a lower gear for passing or improved acceleration (effective below approximately 30 mph). The transmission also has a feature to obtain improved acceleration without resorting to wide open throttle in situations such as city traffic lane changing or accelerating after slowing for a corner. This 4-3 downshift is made auto-



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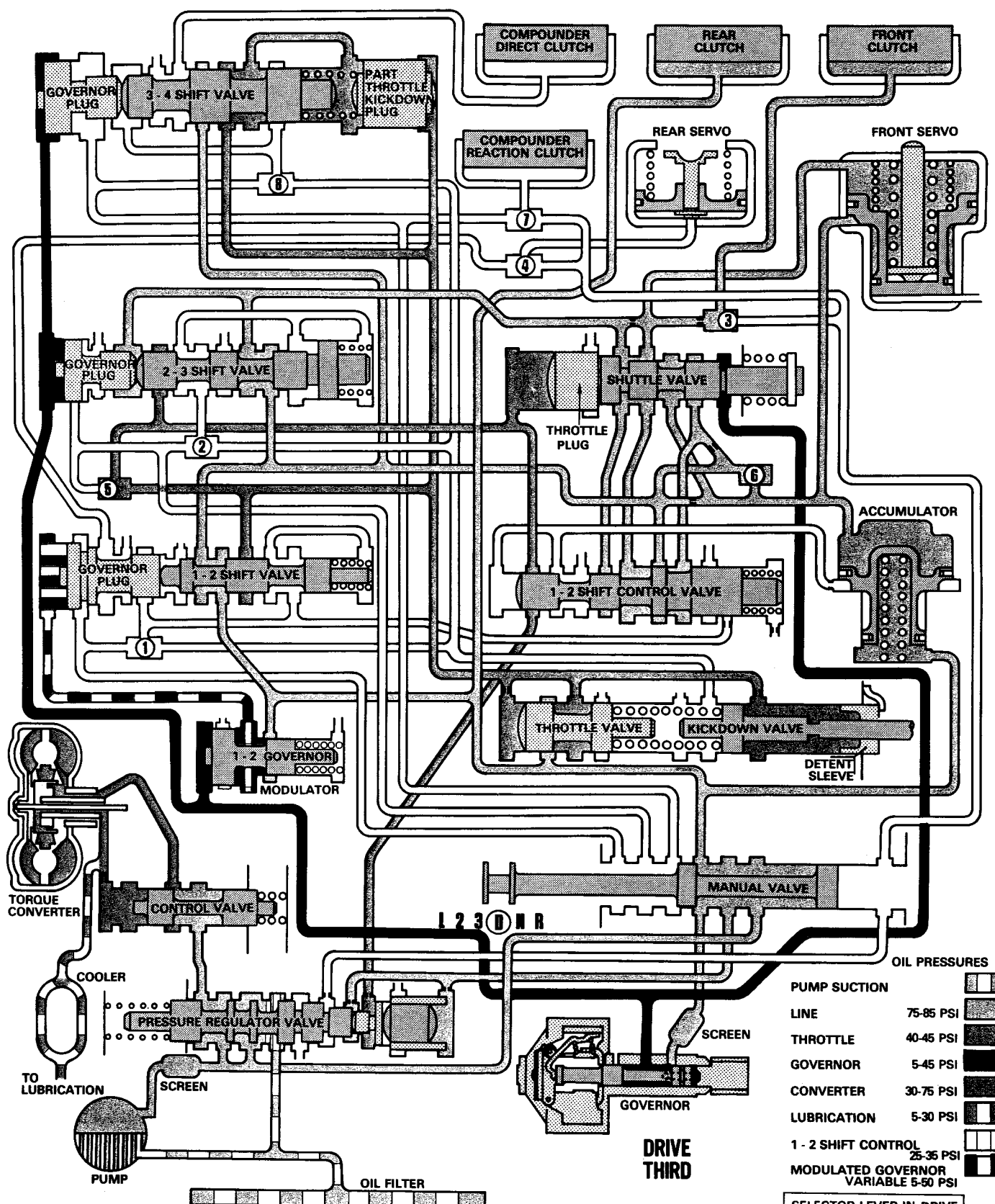
Fig. 4—Hydraulic Control Diagrams



### Fig. 5—Hydraulic Control Diagrams

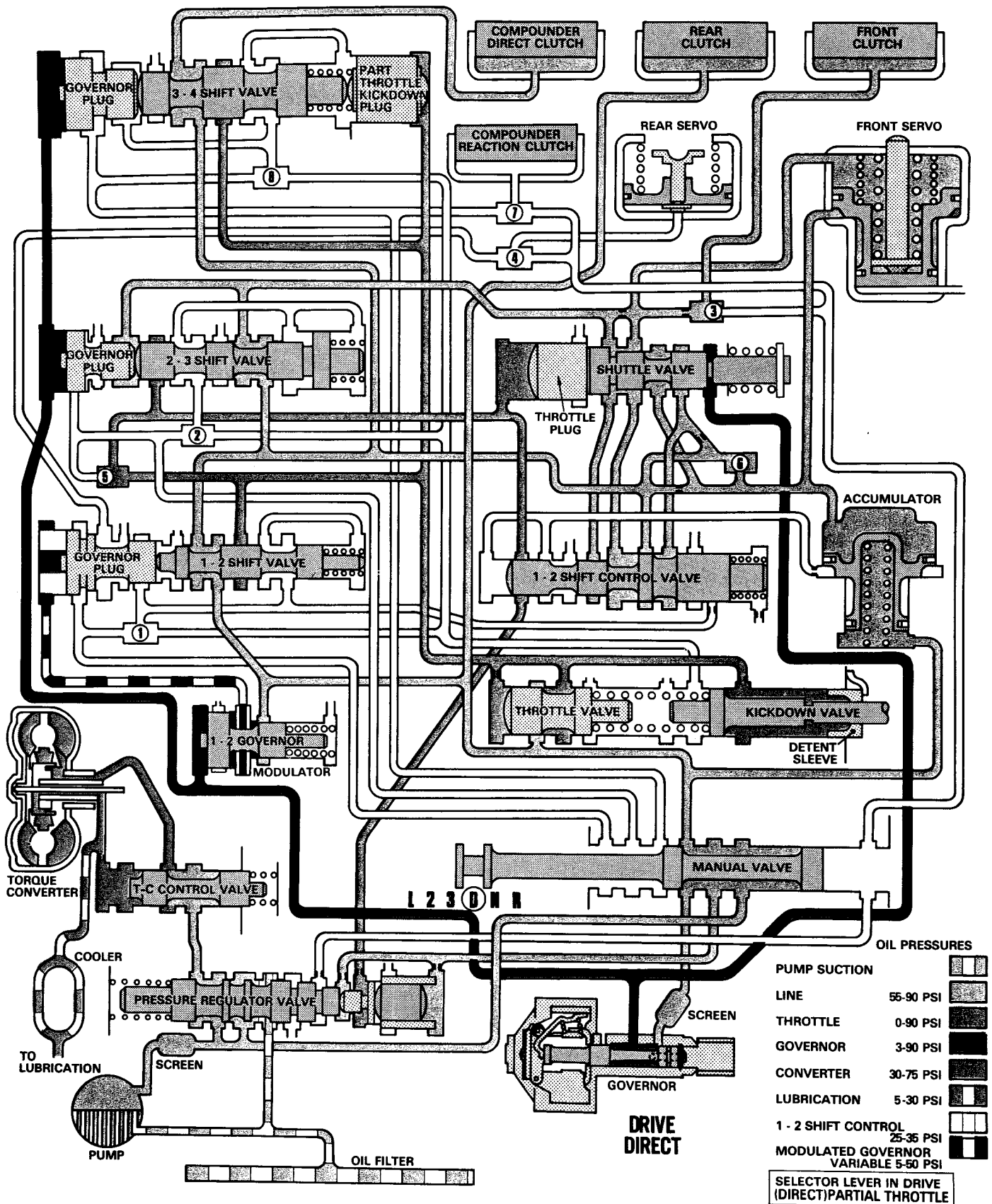
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Fig. 6—Hydraulic Control Diagrams

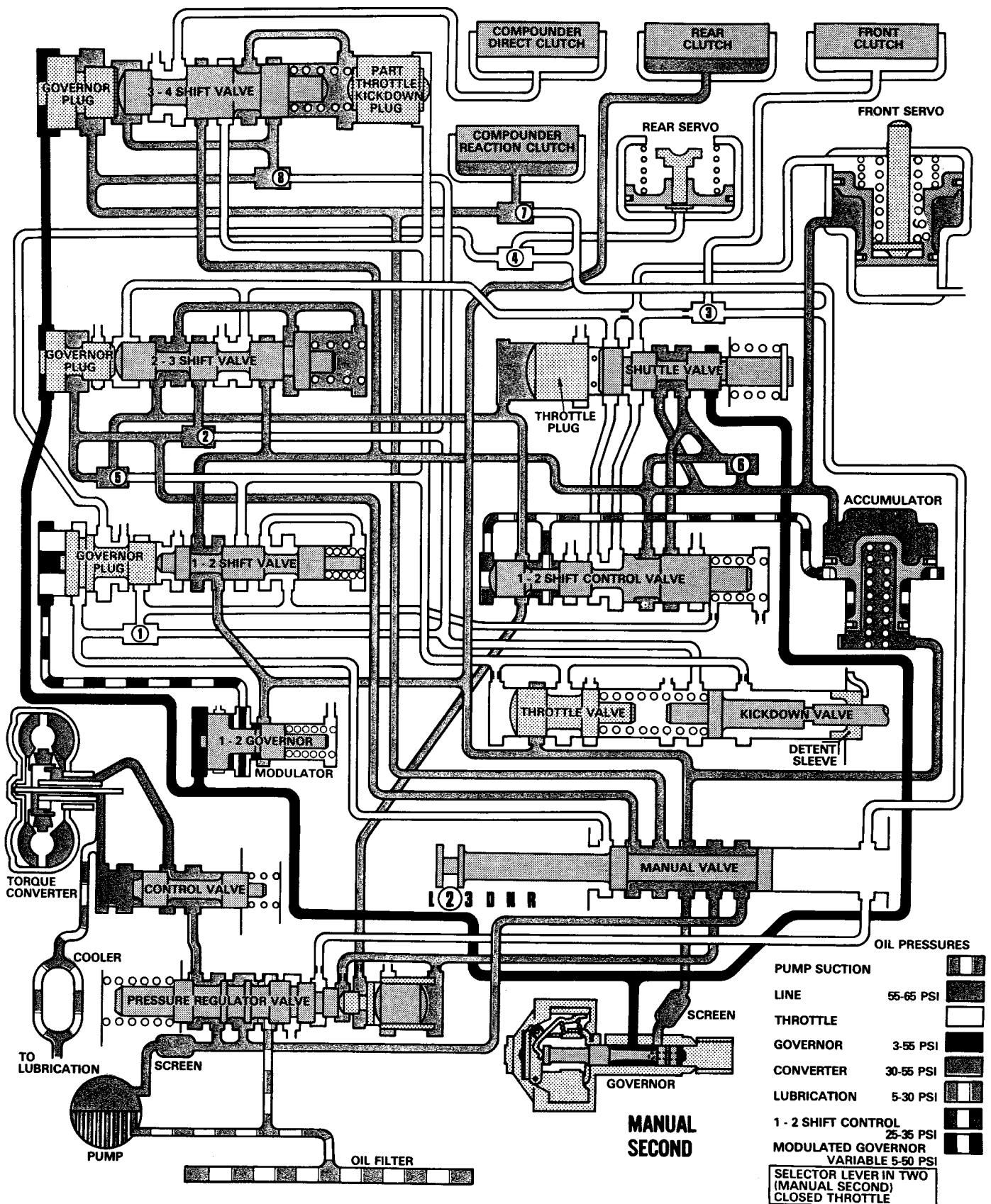


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Fig. 7—Hydraulic Control Diagrams

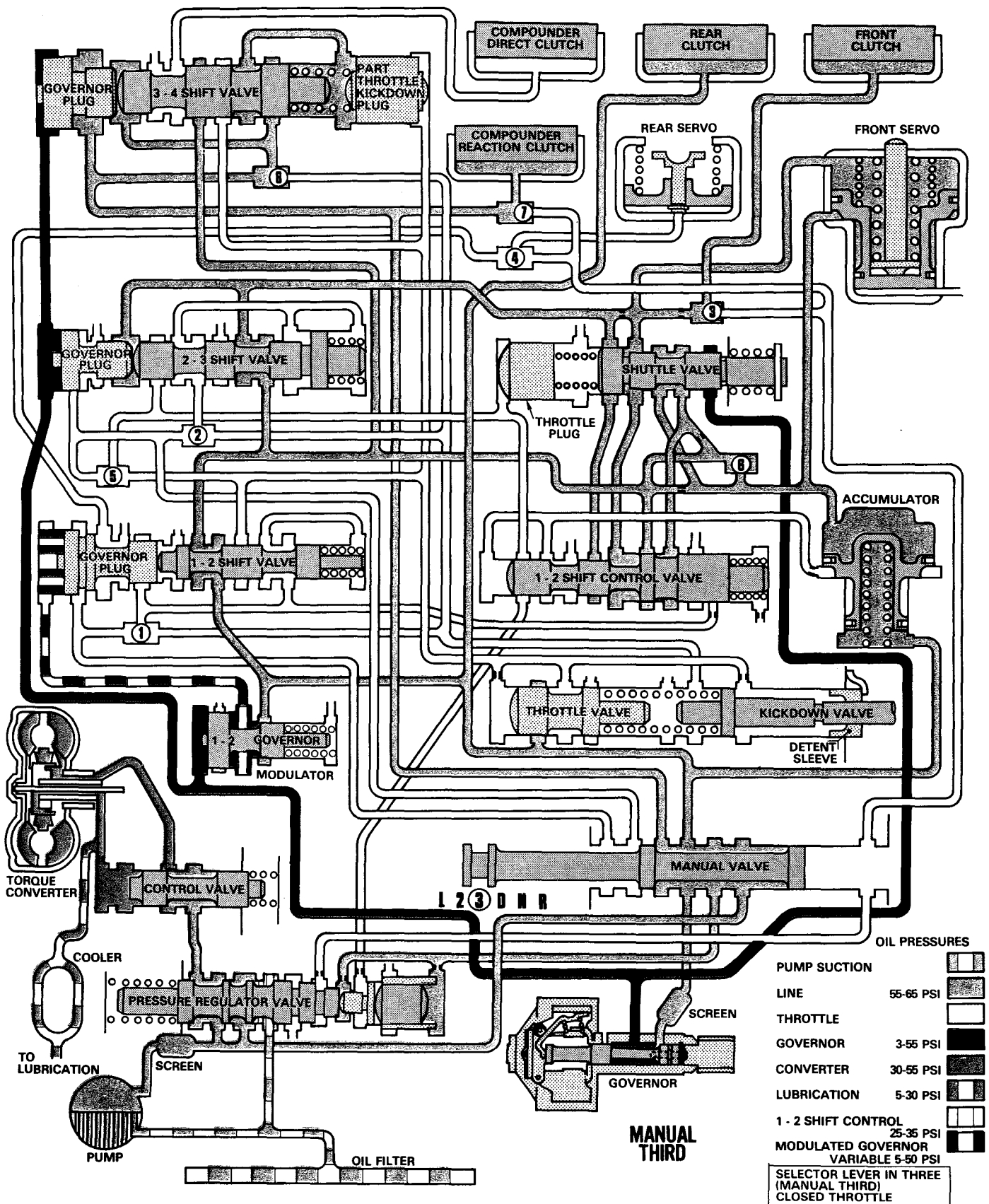


### Fig. 8—Hydraulic Control Diagrams



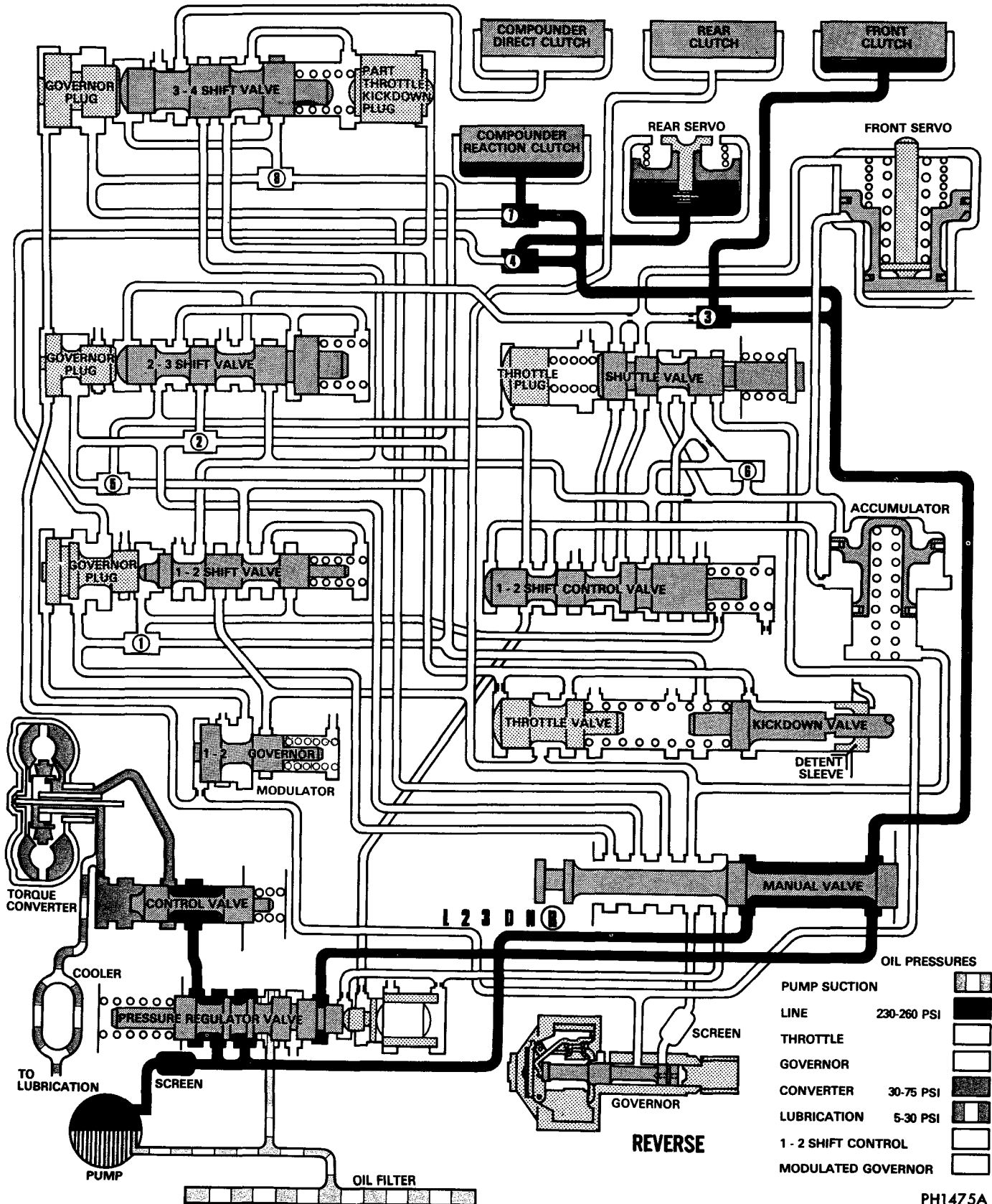
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Fig. 9—Hydraulic Control Diagrams



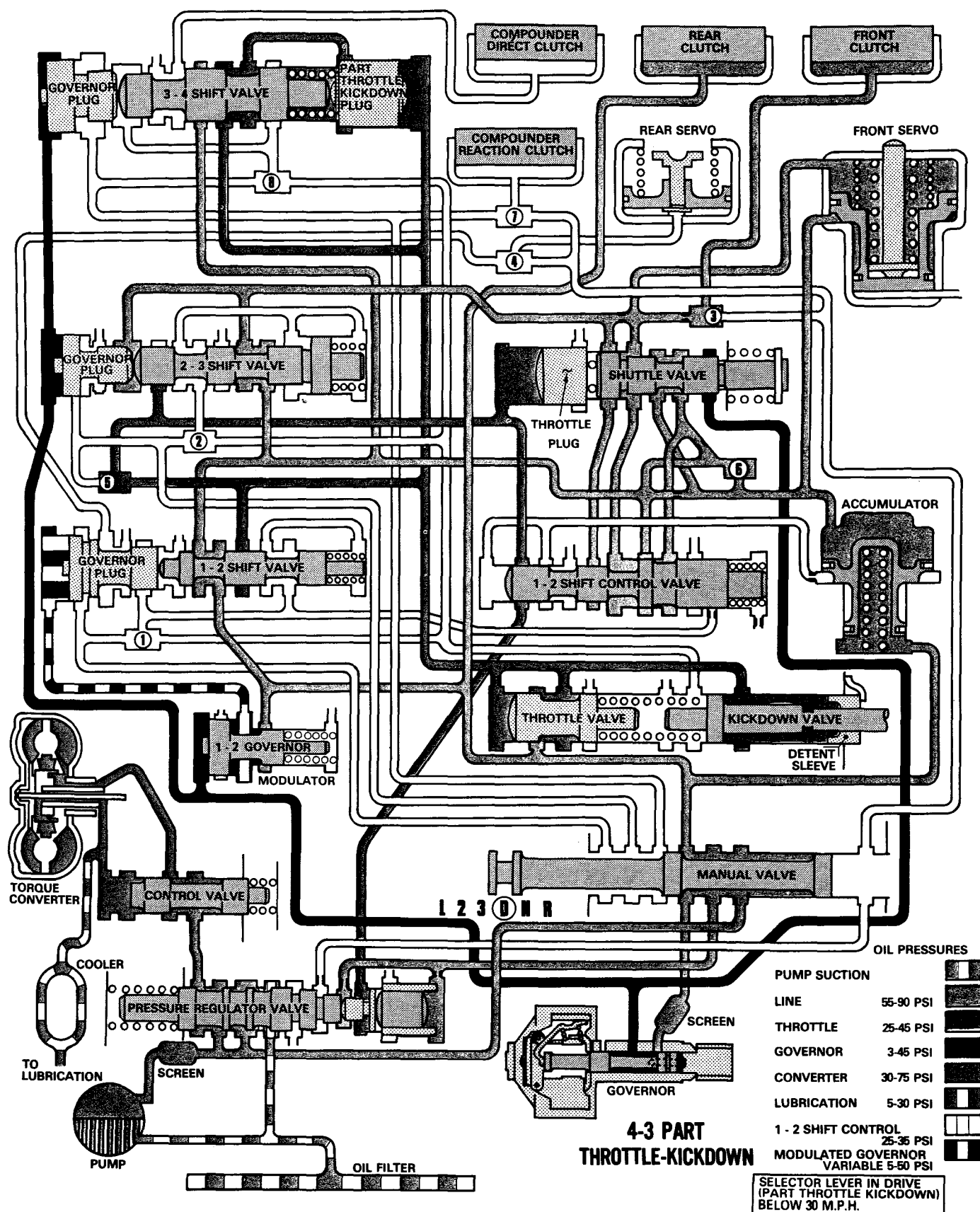
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Fig. 10—Hydraulic Control Diagrams



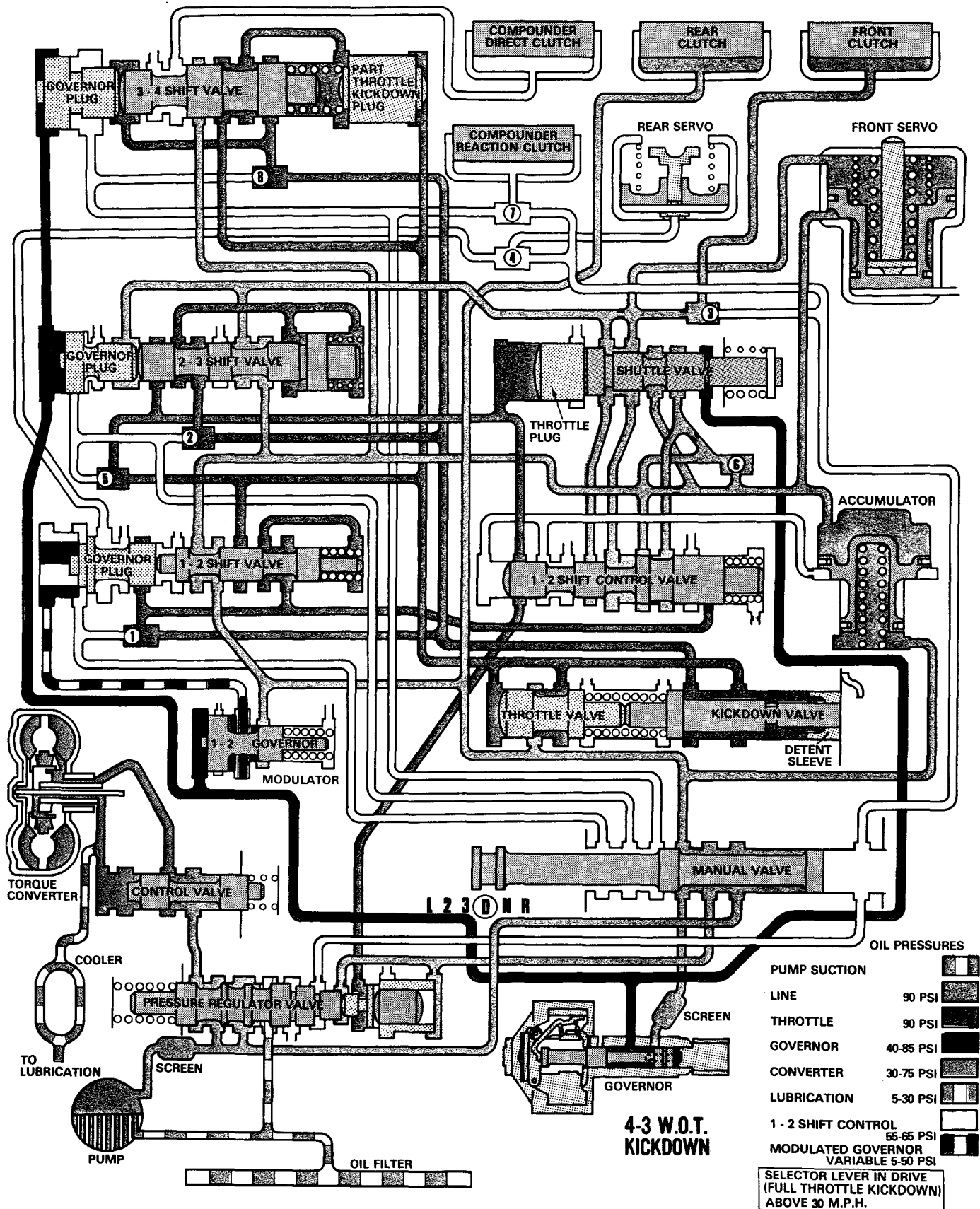
**Fig. 11—Hydraulic Control Diagrams**





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Fig. 12—Hydraulic Control Diagrams



PH1477A

Fig. 13—Hydraulic Control Diagrams

matically when the accelerator pedal is partially depressed in the 6 to 28 mph range.

### **Parking**

The transmission does not contain an internal parking mechanism. When the vehicle is parked, the parking brake, operated by the handle below the dash at the left, must be used.

### **Gearshift Control**

The transmission is controlled by a "lever type" gearshift unit. The control unit has six selector lever positions: R (Reverse), N (Neutral), D (Drive), 3 (Third), 2 (Second) and 1 (Low).

### **Starting The Engine**

The engine will start only with the selector lever in N (Neutral) position.

- (1) As a safety precaution, apply parking brake when starting engine.
- (2) Depress the accelerator pedal one-third of travel to insure proper choke operation.
- (3) Turn the ignition key all the way to the right to START position. When the engine starts, release the

key and it will return to the ON position. **The New Process A-345 transmission will not permit starting the engine by pushing or towing.**

### **Mountain Driving**

When driving in the mountains with either heavy loads or when pulling trailers, the 3 (third), 2 (second) or 1 (low) position should be selected on upgrades which require heavy throttle for ½ mile or more. This reduces possibility of overheating the transmission and converter under these conditions.

### **Towing Vehicle**

**Transmission Inoperative:** Tow the vehicle with a rear end pickup or remove the propeller shaft.

**Transmission Operating Properly:** The vehicle may be towed safely in N (neutral) with rear wheels on the ground at a speed not to exceed 30 mph. **If the vehicle is to be towed for extended distances, it should be done with a rear end pickup or the propeller shaft removed.** Because the transmission receives lubrication only when the engine is running, **it is good practice to always tow a disabled vehicle with a rear end pickup or remove the propeller shaft.**

## **DIAGNOSIS AND TESTS**

### **GENERAL INFORMATION**

Automatic transmission malfunctions may be caused by four general conditions: poor engine performance, improper adjustments, hydraulic malfunctions, and mechanical malfunctions. Diagnosis of these problems should always begin by checking the easily accessible variables: fluid level and condition, manual linkage adjustment, and throttle linkage adjustment. Then perform a road test to determine whether the problem has been corrected or that more diagnosis is necessary. If the problem exists after the preliminary tests and corrections are completed, hydraulic pressure tests should be performed.

### **Service Diagnosis**

The transmission should not be removed or disassembled until a careful diagnosis is made, the definite cause determined and all possible external corrections performed. In diagnosing any abnormal shift condition, always make the hydraulic pressure tests before disassembly or replacement of parts.

### **Fluid Level and Condition**

Before removing the dipstick, wipe all dirt off of the protective cap and top of the filler tube.

Place the selector lever in "N" Neutral to be sure that the fluid level check is accurate. The engine should be running at idle speed. The fluid should be at normal operating temperature (approximately 175° F). The fluid level is correct if it is between the

"Full" and "Add One Pint" marks on the dipstick.

Low fluid level can cause a variety of conditions because it allows the pump to take in air along with the fluid. As in any hydraulic system, air bubbles make the fluid spongy, therefore, pressures will be low and build up slowly.

Improper filling can also raise the fluid level too high. When the transmission has too much fluid, the gears churn up foam and cause the same conditions which occur with a low fluid level.

In either case, the air bubbles can cause overheating, fluid oxidation and varnish which can interfere with normal valve, clutch and servo operation. Foaming can also result in fluid escaping from the transmission vent where it may be mistaken for a leak.

Along with fluid level, it is important to check the condition of the fluid. When the fluid smells burned, and is contaminated with metal or friction material particles, a complete transmission overhaul is needed. Be sure to examine the fluid on the dipstick closely. If there is any doubt about its condition, drain out a sample for a double check.

After the fluid has been checked, seat the dipstick fully to seal out water and dirt.

### **Manual Linkage**

Normal operation of the neutral safety switch

provides a quick check to confirm proper manual linkage adjustment.

Move the selector slowly toward "N" Neutral position until the lever stops at the end of the "N" selector gate. If the starter will operate at this point the manual linkage is properly adjusted. If adjustment is required, refer to "Gearshift Linkage Adjustment" in "Maintenance and Adjustments."

### **Throttle Linkage**

The throttle rod adjustment is very important to proper transmission operation. This adjustment positions a valve which controls shift speed, shift quality and part throttle down shift sensitivity. If the setting is too short, early shifts and slippage between shifts may occur. If the setting is too long, shifts may be delayed and part throttle down shifts may be very sensitive.

In fact, this adjustment is so critical that the use of a throttle lever holding spring is necessary to remove slack in the linkage during adjustment. Refer to "Throttle Rod Adjustment" in "Maintenance and Adjustments".

### **Road Test**

Prior to performing a road test, be certain that the fluid level and condition, and control linkage adjustments have been checked and approved.

During the road test the transmission should be operated in each position to check for slipping and any variation in shifting. Note whether the shifts are harsh or spongy and check the speeds where the upshifts and downshifts occur. Approximate shift speeds for the various modes of operation are shown in the "Automatic Shift Speeds" chart.

Observe closely for slipping or engine speed flare-up. Slipping or flare-up in any gear usually indicates clutch, band or overrunning clutch problems. If the condition is far advanced, an overhaul will probably be necessary to restore normal operation.

In most cases, the clutch or band that is slipping can be determined by noting the transmission operation in all selector positions and by comparing which internal units are applied in those positions. The "Clutch and Band Application Chart" provides a basis for road test analysis.

## **SEQUENCE OF OPERATION**

### **"D" Drive Breakaway**

In drive breakaway the rear clutch is applied and both front and rear overrunning clutches hold.

### **"D" Drive Second**

In drive second the rear clutch is applied, the kickdown band is applied, and the rear overrunning clutch holds.

### **"D" Drive Third**

In drive third, the front and rear clutches are applied and the rear overrunning clutch holds.

### **"D" Drive Fourth**

In drive fourth the front and rear clutches are applied and the compounder direct clutch is applied.

### **"1" Manual Low**

In manual low the rear clutch is applied, the low-reverse band is applied and the compounder reaction clutch is applied.

### **"2" Manual Second**

In manual second the rear clutch is applied, the kickdown band is applied, and the compounder reaction clutch is applied.

### **"3" Manual Third**

In manual third, the front and rear clutches are applied and the compounder reaction clutch is applied.

### **"R" Reverse**

In reverse the front clutch is applied, the low-reverse band is applied and the compounder reaction clutch is applied.

## **HYDRAULIC PRESSURE TESTS**

Pressure testing is a very important step in the diagnostic procedure. These tests usually reveal the cause of most transmission problems.

Before performing pressure tests, be certain that fluid level and condition, and control linkage adjustments have been checked and approved. Fluid must be at operating temperature (150 to 200 degrees F.).

Install an engine tachometer, raise vehicle on hoist which allows rear wheels to turn, and position tachometer so it can be read under the vehicle.

Disconnect throttle rod and shift rod from transmission levers so they can be controlled under the vehicle.

Attach 100 psi gauges (C-3292) to ports required for test being conducted. A 300 psi gauge (C-3293) is required for "reverse" pressure test for rear servo pressure and reaction clutch port.

Test port locations are shown in (Figs. 1 and 2).

### **Test One (Selector in "1")**

(1) Attach gauges to "line", and "rear servo reaction clutch" ports.

(2) Operate engine at 1000 rpm for test.

(3) Move selector lever on transmission all the way forward ("1" position).

(4) Read pressures on both gauges as throttle lever on transmission is moved from full forward position to full rearward position.

(5) Line pressure should read 85 to 95 psi with throttle lever forward or rearward.

## 21-164 TRANSMISSION—A-345

(6) Rear servo and reaction clutch pressure should read the same as line pressure within 3 psi.

(7) This tests pump output, pressure regulation, and condition of rear clutch and rear servo-reaction clutch hydraulic circuits.

(8) Lubrication pressure should be 5 to 30 psi.

### Test Two (Selector in "2")

(1) Attach gauge to "line pressure" port, reaction

clutch and "tee" into rear cooler line fitting to read "lubrication" pressure.

(2) Operate engine at 1000 rpm for test.

(3) Move selector lever on transmission one "detent" rearward from full forward position. This is selector "2" position.

(4) Read pressures on both gauges as throttle lever on transmission is moved from full forward position to full rearward "detent" position.

## A-345

### CLUTCH AND BAND APPLICATION CHART

Lever Position	Front Clutch	Rear Clutch	Reaction Clutch	Direct Clutch	Front (Kickdown) Band	Rear (Low-Rev.) Band	Front Overrunning Clutch	Rear Overrunning Clutch
Drive-Ratio								
"N" NEUTRAL							NO MOVEMENT	
"D" DRIVE (Breakaway)								
3.56 to 1		X					HOLDS	HOLDS
(Second)								
2.11 to 1		X			X		OVERRUNS	HOLDS
(Third)								
1.45 to 1	X	X					OVERRUNS	HOLDS
(Fourth)								
1.00 to 1	X	X		X			OVERRUNS	OVERRUNS
"3" THIRD								
1.45 to 1	X	X	X				OVERRUNS	PARTIAL HOLD
"2" SECOND								
2.11 to 1		X	X		X		OVERRUNS	PARTIAL HOLD
"1" FIRST								
3.56 to 1		X	X			X	PARTIAL HOLD	PARTIAL HOLD
"R" REVERSE								
3.20 to 1	X		X			X	NO MOVEMENT	

X = Applied

### AUTOMATIC SHIFT SPEEDS CHART (Approximate Miles Per Hour)

Models	318	360/361	413
Engine Cubic Inch			
Axle Ratio	6.2	7.17	7.17
Tire Size	7.00 x 20	9.00 x 20	9.00 x 20
Throttle Closed			
1-2 Upshift	6.5-7.5 MPH	6-7 MPH	6-7 MPH
2-3 Upshift	7-9 MPH	7-9 MPH	7-9 MPH
3-4 Upshift	10-12 MPH	10-12 MPH	10-12 MPH
4-3 Downshift	6-7 MPH	6-7 MPH	6-7 MPH
Wide Open Throttle			
1-2 Upshift	15-17 MPH	14.5-16.5 MPH	14.5-16.5 MPH
2-3 Upshift	25-29 MPH	24.5-28.5 MPH	24.5-28.5 MPH
3-4 Upshift	35-39 MPH	34.5-38.5 MPH	34.5-38.5 MPH
Kickdown Range	6-31 MPH	6-30 MPH	6-30 MPH
Part Throttle Upshift			
1-2 Upshift	6.5-14.5 MPH	6-14 MPH	6-14 MPH
2-3 Upshift	7-29 MPH	7-28.5 MPH	7-28.5 MPH
3-4 Upshift	10-35.5 MPH	10-35 MPH	10-35 MPH

NOTE: Changes in tire size or axle ratio will cause shift points to occur at corresponding higher or lower vehicle speeds.

(5) Line pressure should read 85 to 95 psi with throttle lever forward or rearward.

(6) Lubrication pressure should be 5 to 30 psi.

(7) This tests pump output, pressure regulation, and condition of rear clutch, reaction clutch and lubrication hydraulic circuits.

### **Test Three (Selector in "3")**

(1) Attach gauge to "line pressure", "front servo release" and "reaction clutch" ports.

(2) Operate engine at 1000 rpm for test.

(3) Move selector lever on transmission two "detents" rearward from full forward position. This is selector "3" position.

(4) Read pressures on the gauges as throttle lever on transmission is moved from full forward position to full rearward "detent" position.

(5) Line pressure should read 54 to 60 psi with throttle lever forward and gradually increase, as lever is moved rearward, to 85 to 96 psi.

(6) Front servo release and reaction clutch should be same as line pressure within 3 psi, up to downshift point.

(7) This tests pump output, pressure regulation and condition of front clutch, rear clutch and reaction clutch hydraulic circuits.

(8) Lubrication pressure should be 5 to 30 psi.

### **Test Four (Selector in "D")**

(1) Attach gauges to "line", "front servo release", and "direct clutch" ports.

(2) Operate engine at 1000 rpm for test.

(3) Move selector lever on transmission three "detents" rearward from full forward position. This is selector "D" position.

(4) Read pressures on all gauges as throttle lever on transmission is moved from full forward position to full rearward position.

(5) Line pressure should read 54 to 60 psi with throttle lever forward and gradually increase, as lever is moved rearward, to 90 to 96 psi.

(6) Front servo release and direct clutch should be same as line pressure within 3 psi, up to downshift point.

(7) This tests pump output, pressure regulation, and condition of rear clutch, front clutch, and direct clutch hydraulic circuits.

(8) Lubrication pressure should be 5 to 30 psi.

### **Test Five (Selector in Reverse)**

(1) Attach 300 psi gauge to "line pressure", "rear servo apply", and "reaction clutch" ports.

(2) Operate engine at 1600 rpm for test.

(3) Move selector lever on transmission five "detents" rearward from full forward position. This is selector "R" position.

(4) Rear servo pressure should read 230 to 260 psi.

(5) This tests pump output, pressure regulation, and condition of front clutch, rear servo, and reaction clutch hydraulic circuits.

(6) Move selector lever on transmission to "D" position to check that reaction clutch pressure drops to zero.

(7) This tests for leakage into rear servo, due to case porosity, which can cause reverse band burn out.

### **Governor Pressure**

Test only if transmission shifts at wrong vehicle speeds when throttle rod is correctly adjusted.

(1) Connect a 0-100 psi pressure gauge, to governor pressure take-off point, located at top of compounding adapter (Fig. 1).

(2) Operate transmission in fourth gear to read pressures. The governor pressure should gain approximately 2 psi for every mph gained. For example, 10 mph should read 20 psi and 40 mph should read 80 psi on the governor pressure gauge.

If governor pressures are incorrect at the given vehicle speeds, the governor valve and/or weights are probably sticking. **The governor pressure should respond smoothly to changes in mph and should return to 0 to 1-1/2 psi when vehicle is stopped. High pressure at stand still (above 2 psi) will prevent the transmission from downshifting.**

### **Throttle Pressure**

No gauge port is provided for the throttle pressure. Incorrect throttle pressure should only be suspected if part throttle up-shift speeds are either delayed or occur too early in relation to vehicle speeds. Engine runaway on either up shifts or down shifts can also be an indicator of incorrect (low) throttle pressure setting.

**In no case should throttle pressure be adjusted until transmission throttle linkage adjustment has been verified to be correct.**

### **CONVERTER STALL TEST**

**WARNING: During test let no one stand in front of vehicle.**

The stall test consists of determining the engine speed obtained at full throttle in D position. This test checks the torque converter stator clutch operation, and the holding ability of the transmission clutches. The transmission oil level should be checked and the engine brought to normal operating temperature before stall operation. **Both the parking and service brakes must be fully applied and front wheels blocked while making this test.**

Do not hold the throttle open any longer than is necessary to obtain a maximum engine speed reading, **and never longer than five seconds at a time.** If more than one stall check is required, operate the en-

**A-345 TRANSMISSION APPLICATION AND STALL SPEED**

Transmission Assembly No*	Stall R.P.M.	Cycle	Converter Diameter	Engine Cu. In.
4028831	318	LDC	10-3/4	1775-2075
4028831	360	LDC	10-3/4	1825-2125
4028832	361	HDC	10-3/4	1950-2250
4028832	413	HDC	10-3/4	2125-2425

\* Part numbers subject to change during model year.  
Number is found on left side of transmission oil pan rail.

gine at approximately 1,000 rpm in neutral for 20 seconds to cool the transmission fluid between runs. If engine speed exceeds the maximum limits shown, release the accelerator immediately since transmission clutch slippage is indicated.

**Stall Speed Above Specification**

If stall speeds exceeds the maximum specified in chart by more than 200 rpm, transmission clutch slippage is indicated. Follow the transmission oil pressure and air pressure checks outlined in this section to determine the cause of slippage.

**Stall Speed Below Specification**

Low stall speeds with a properly tuned engine indicate torque converter stator clutch problems. A road test will be necessary to identify the exact problem.

If stall speeds are 250-350 rpm below specification, and the vehicle operates properly at highway speeds, but has poor through-gear acceleration, the stator overrunning clutch is slipping.

If stall speed and acceleration are normal, but abnormally high throttle opening is required to maintain highway speeds, the stator clutch has seized.

Both of these stator defects require replacement of the torque converter.

**Noise**

A whining or siren-like noise due to fluid flow is normal during stall operation with some converters; however, loud metallic noises from loose parts or interference within the assembly indicate a defective torque converter. To confirm that the noise originates within the converter, operate the vehicle at light throttle in D and N on a hoist and listen under the transmission bell housing.

**CLUTCH AND SERVO AIR PRESSURE TESTS**

A "NO DRIVE" condition might exist even with correct fluid pressure, because of inoperative clutches or bands. The inoperative units, clutches, bands and servos can be located through a series of tests by substituting air pressure for fluid pressure (Fig. 14).

All clutches, kickdown servo, and low-reverse servo

may be tested by applying air pressure to their respective passages after the valve body assembly has been removed. To make air pressure tests, proceed as follows:

**Compressed air supply must be free of all dirt and moisture. Use a pressure of 30 psi.**

**Front Clutch**

Apply air pressure to front clutch "apply" passage and listen for a dull "thud" which indicates that front clutch is operating. Hold air pressure on for a few seconds and inspect system for excessive oil leaks.

**Rear Clutch**

Apply air pressure to rear clutch "apply" passage and listen for a dull "thud" which indicates that rear clutch is operating. Also inspect for excessive oil leaks. If a dull "thud" cannot be heard in the clutches, place finger tips on clutch housing and again apply air pressure. Movement of piston can be felt as the clutch is applied.

**Reaction Clutch**

Apply air pressure to reaction clutch "apply" passage and listen for a dull "thud" which indicates that the reaction clutch is operating.

**Direct Clutch**

Apply air pressure to direct clutch "apply" passage and listen for a dull "thud" which indicates that the direct clutch is operating.

**Kickdown Servo (Front)**

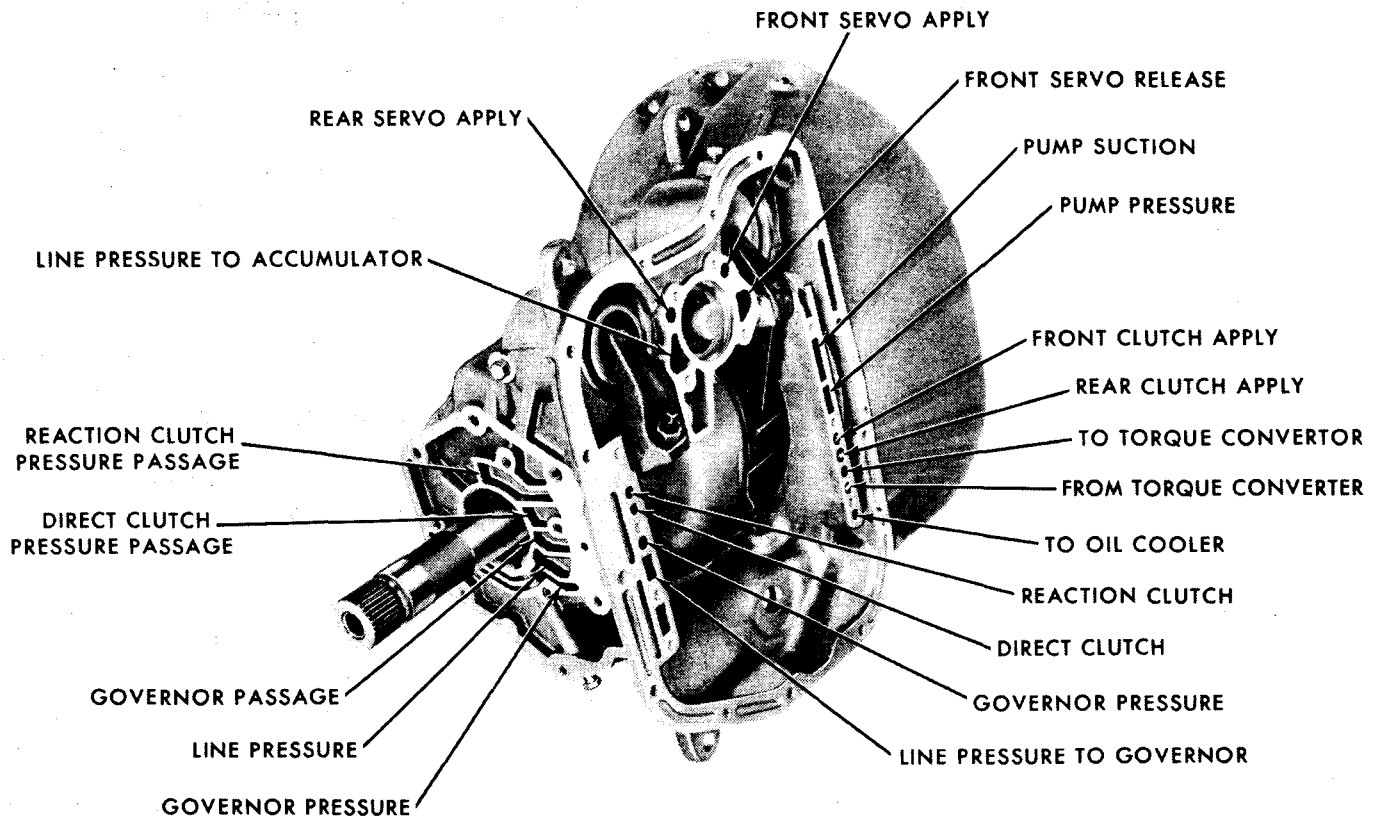
Direct air pressure into front servo "apply" passage. Operation of servo is indicated by a tightening of front band. Spring tension on servo piston should release the band when air pressure is removed.

**Low and Reverse Servo (Rear)**

Direct air pressure into rear servo "apply" passage. Operation of servo is indicated by a tightening of rear band. Spring tension on servo piston should release the band when air pressure is removed.

If clutches and servos operate properly, no up-shift or erratic shift conditions indicate that malfunctions exist in the valve body.





PH1672

**Fig. 14—Air Pressure Tests**

### FLUID LEAKAGE—TRANSMISSION CONVERTER HOUSING AREA

#### (1) Check for Source of Leakage.

Since fluid leakage at or around the converter area may originate from an engine oil leak, the area should be examined closely.

(2) Prior to removing the transmission, perform the following checks:

When leakage is determined to originate from the transmission, check fluid level and torque converter drain plug torque prior to removal of the transmission and torque converter.

High oil level can result in oil leakage out the vent located at the top of the front pump housing. If the fluid level is high, adjust to proper level.

Oil leakage can also occur at the torque converter drain plug. Tighten the drain plug to 90 inch-pounds.

After performing these two operations, re-check for leakage. If a leak persists, perform the following operation on the vehicle to determine whether it is the **converter or transmission** that is leaking.

#### Leakage Test Probe

(1) Remove converter housing dust shield.

(2) Position vehicle with front lower than back so that accumulated fluid in converter housing will drain out. Wipe bottom inside of converter housing as dry as possible. A solvent spray followed by com-

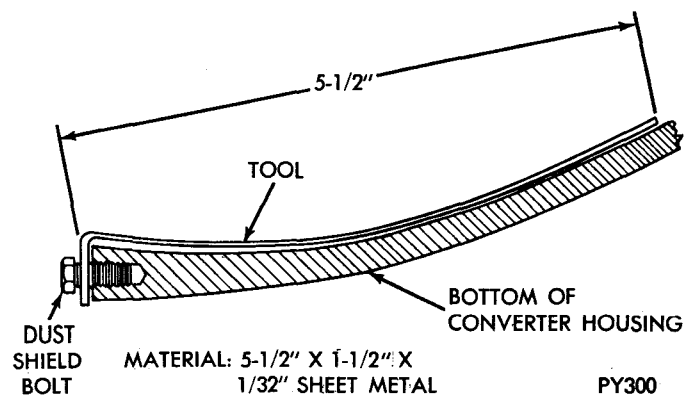
pressed air drying is preferable.

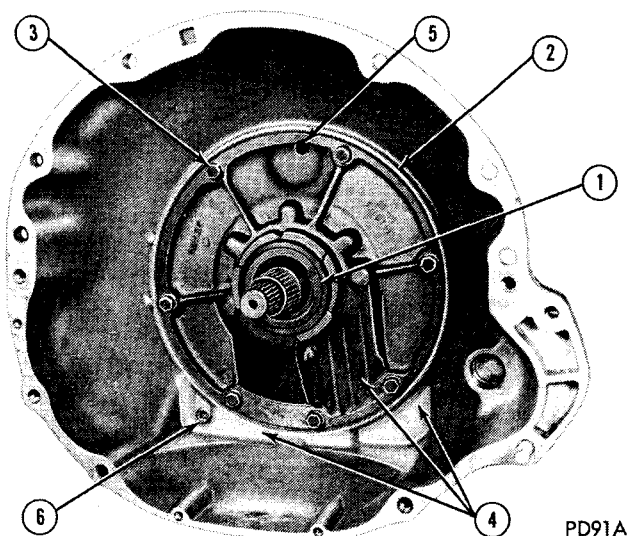
(3) Fabricate and fasten test probe (Fig. 15) securely to convenient dust shield bolt hole. Make certain converter is clear by test probe. Tool must be clean and dry.

(4) Run engine at approximately 2,500 rpm with transmission in neutral, for about 2 minutes. Transmission must be at operating temperature.

(5) Stop engine and carefully remove tool.

(6) If upper surface of test probe is dry, there is no converter leak. A path of fluid across probe indicates a converter leak. Oil leaking under the probe is coming from the transmission converter area (Fig. 16).

**Fig. 15—Leak Locating Test Probe Tool**



**Fig. 16—Transmission Converter Area**

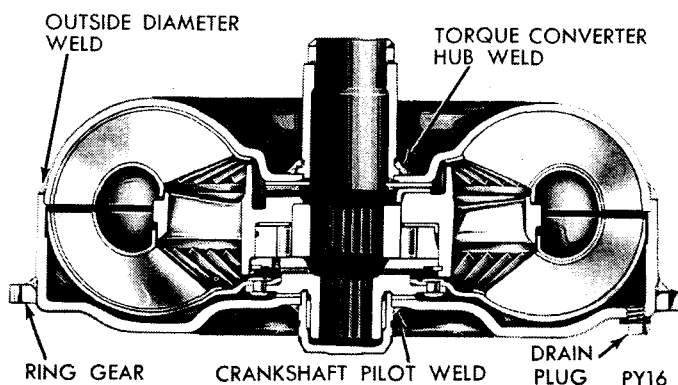
(7) Remove transmission and torque converter assembly from vehicle for further investigation. The fluid should be drained from the transmission and converter. Re-install converter drain plug and oil pan (with new gasket) at specified torque.

Possible sources of transmission converter area fluid leakage shown in (Fig. 16) are:

- (1) Converter Hub Seal.
  - (a) Seal lip cut, check converter hub finish.
  - (b) Bushing moved and/or worn.
  - (c) Oil return hole in front pump housing plugged or omitted.
  - (d) Seal worn out (high mileage vehicles).
- (2) Fluid leakage at the outside diameter from pump housing "O" ring seal.
- (3) Fluid leakage at the front pump to case bolts.
- (4) Fluid leakage due to case or front pump housing porosity.
- (5) Oil leakage out the vent.
- (6) Kickdown lever shaft access plug.

### Converter Leakage (Fig. 17)

Possible sources of converter leakage are:



**Fig. 17—Torque Converter Cross Section**

(a) Torque converter weld leaks at the outside diameter (peripheral) weld.

(b) Front pump hub weld.

(c) Crankshaft pilot weld.

(d) Fluid leakage from the converter drain plug. These leaks appear at the outside diameter of the converter on the engine side.

### Air Pressure Test of Transmission

Fabricate equipment needed for test as shown in (Figs. 18, 19, and 20).

The transmission should be prepared for pressure test as follows after removal of the torque converter:

(1) Install filler tube bore plug, pipe plug (for front cooler line fitting), and pipe nipple (in case at rear cooler line fitting).

(2) Install vent plug (rubber stopper), and vent plug retainer preferably using longer bolts than those removed.

(3) With rotary motion, install converter hub seal cup over input shaft, and through the converter hub seal until the cup bottoms against the pump rotor lugs. Secure with cup retainer strap (Fig. 21), using converter housing to engine block retaining bolts.

(4) Attach and clamp hose from nozzle of Tool C-4080 to pipe nipple, which is in the rear cooler line fitting position in case (Fig. 22).

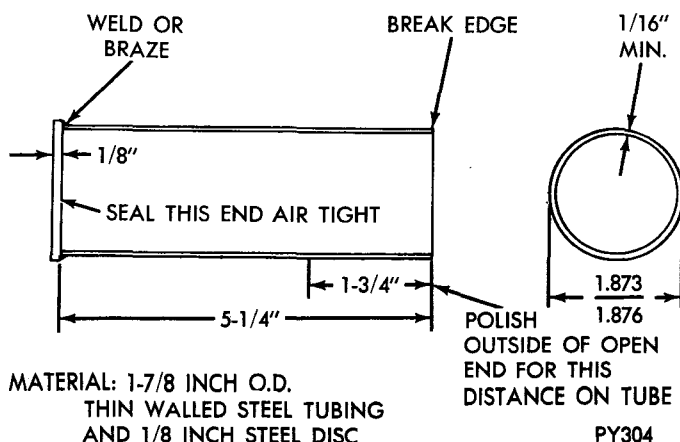
(5) Pressurize the transmission using Tool C-4080 until the pressure gauge reads 8 psi. Position transmission so that pump housing and case front may be covered with soapy solution or water. Leaks are sometimes caused by porosity in the case or pump housing.

**CAUTION: Do not, under any circumstances, pressurize a transmission to more than 10 psi.**

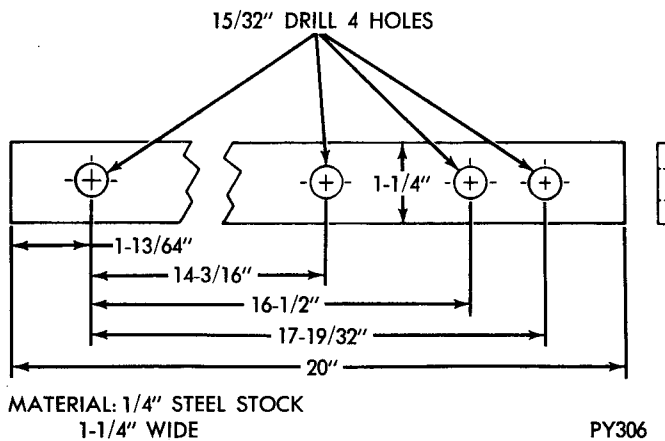
If a leak source is located, that part and all associated seals and gaskets should be replaced with new parts.

### Torque Converter Pressure Test

If fluid leakage has occurred in the bell housing



**Fig. 18—Converter Hub Seal Cup**



**Fig. 19—Hub Seal Cup Retainer Strap**

area, the torque converter can be leak checked as follows after removal from the transmission:

(1) Drain all oil from the converter. If flushing is required, flush before checking for leakage.

(2) Install Tool C-4102 and tighten.

(3) Apply a maximum of 100 psi air pressure to the converter.

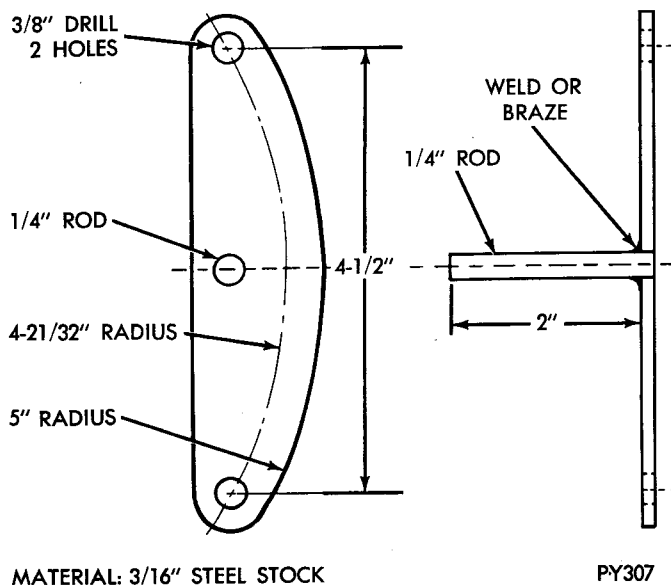
(4) Submerge the converter in a tank of water and observe the hub, ring gear, and seam welds for bubbles. Five to ten minutes may be required for bubbles to develop from small leaks.

If no bubbles are observed, it can be assumed that the welds are not leaking. If leakage occurs, the converter should be replaced.

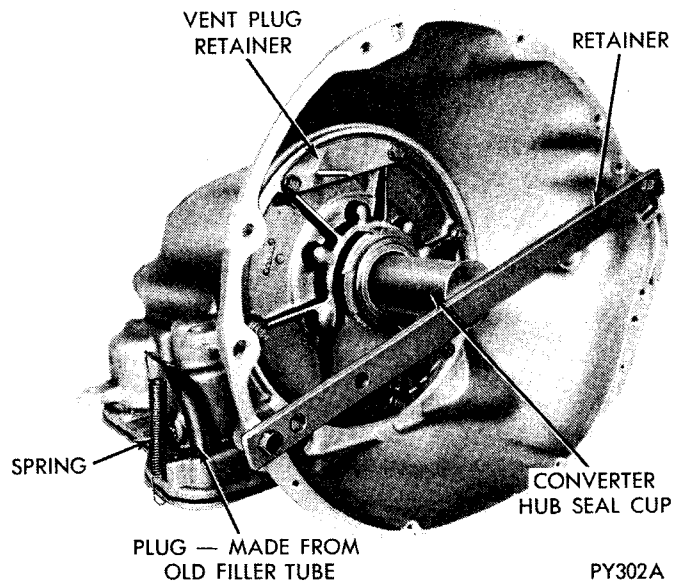
## MAINTENANCE AND ADJUSTMENTS

### LUBRICATION

Inspect fluid level on dipstick at every engine oil change (Fig. 23) with engine idling and transmission in neutral position. A properly filled transmission will



**Fig. 20—Vent Plug Retainer**



**Fig. 21—Transmission Prepared for Test**

read near the "add one pint" mark when fluid temperature is 70 degrees and near (but not over) the "full" mark at 180 degrees (average operating temperature).

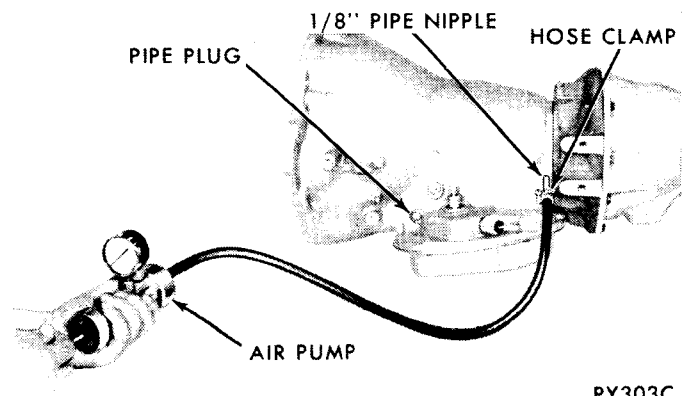
## PERIODIC MAINTENANCE

**NORMAL SERVICE**—Transmission fluid and filter to be changed each 32,000 miles. At same time adjust bands and check throttle linkage.

**SEVERE SERVICE**—Prolonged operation with heavy loads, especially in hot weather, trailer towing, or off highway operations require more frequent fluid and filter changes and adjustments. 20,000 mile intervals are recommended.

(1) When the factory fill fluid is changed as recommended above, only fluids of the type labeled "DEXRON" Automatic Transmission Fluid should be used. A band adjustment and filter change should be made at the time of the oil change.

(2) If the transmission is disassembled for any reason, the fluid and filter should be changed, and the bands adjusted.



**Fig. 22—Pressurizing Transmission**

**Drain and Refill**

(1) Raise vehicle on a hoist. Place a drain container with a large opening, under transmission oil pan.

(2) Remove the drain plug from the transmission oil pan and allow transmission to drain. Replace the drain plug. Tighten to 24 foot-pounds. Remove transmission oil pan.

(3) Remove access plate in front of converter and remove drain plug allowing fluid to drain (Fig. 24). Install and tighten converter drain plug to 90 inch-pounds and install the access plate.

(4) Remove drain plug from compounder allowing fluid to drain. Install and tighten compounder drain plug to 110 inch-pounds.

(5) Adjust both bands (see "Band Adjustments").

(6) Install a new filter on bottom of valve body, and tighten retaining screws to 35 inch-pounds.

(7) Clean the oil pan, and reinstall using a new gasket. Tighten oil pan bolts to 150 inch-pounds.

(8) Pour eight quarts of "DEXRON" type Automatic Transmission Fluid through the filler tube.

(9) Start engine and allow to idle for at least two minutes. Then, with parking brake on, move selector lever momentarily to each position, ending in the **neutral** position.

(10) Add sufficient fluid to bring level to the "ADD ONE PINT" mark.

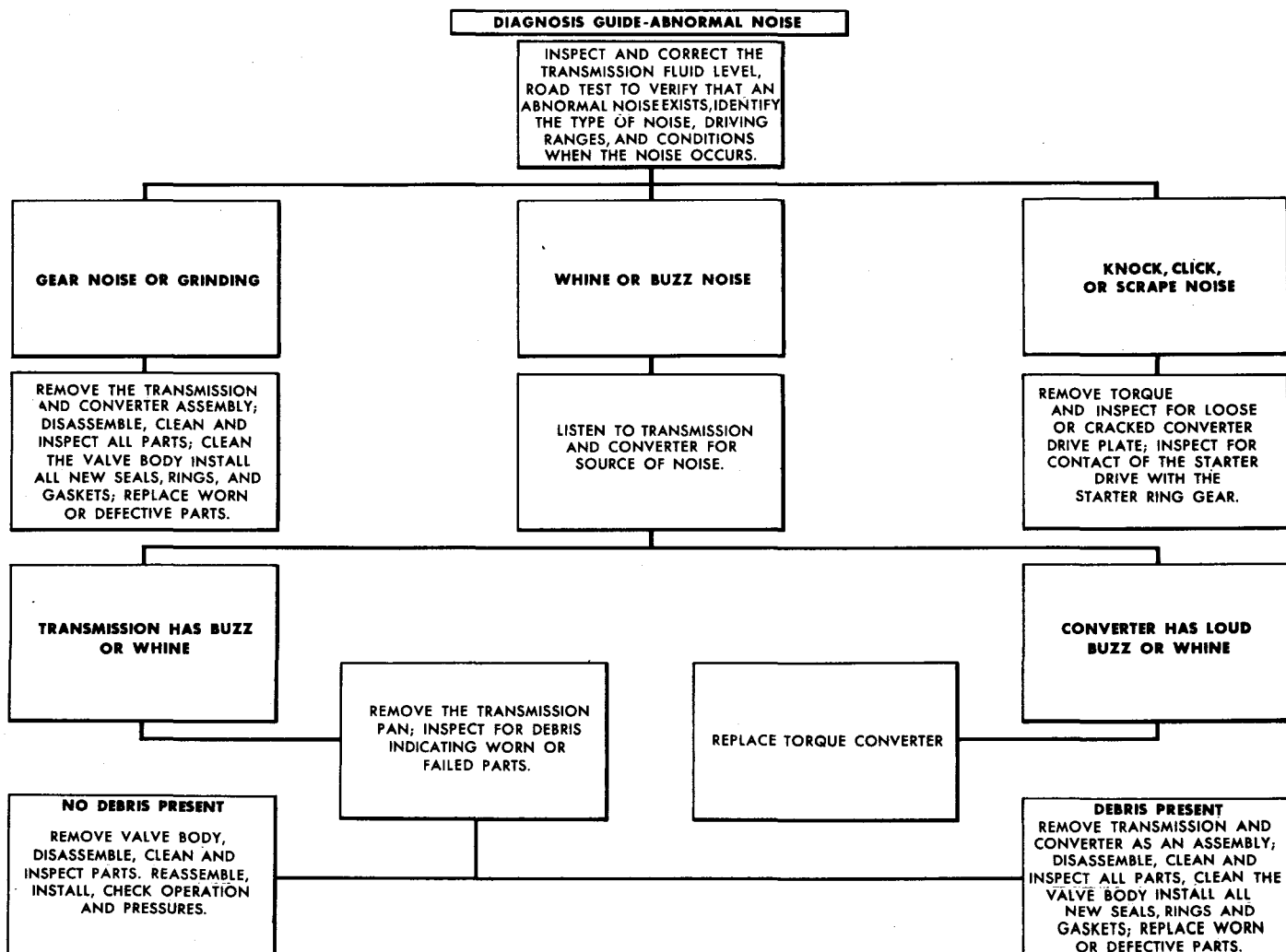
Recheck fluid level after transmission is at normal operating temperature. The level should be between the "FULL" mark and "ADD ONE PINT" mark (Fig. 23).

To prevent dirt from entering transmission, make certain that dip stick cap is fully seated onto the filler tube.

**Gearshift Control Adjustment (Fig. 25)****(Floor Shift and Instrument Panel Shift)**

(1) Assemble (if disassembled) all the shifter parts at floor or instrument panel shifter lever controls and attach the control cable at the control panel side.

(2) Route the cable (if removed) eliminate all kinks and anchor the cable on the transmission bracket



(Fig. 25) and install cable lock retainer. **DO NOT** attach clevis to transmission lever.

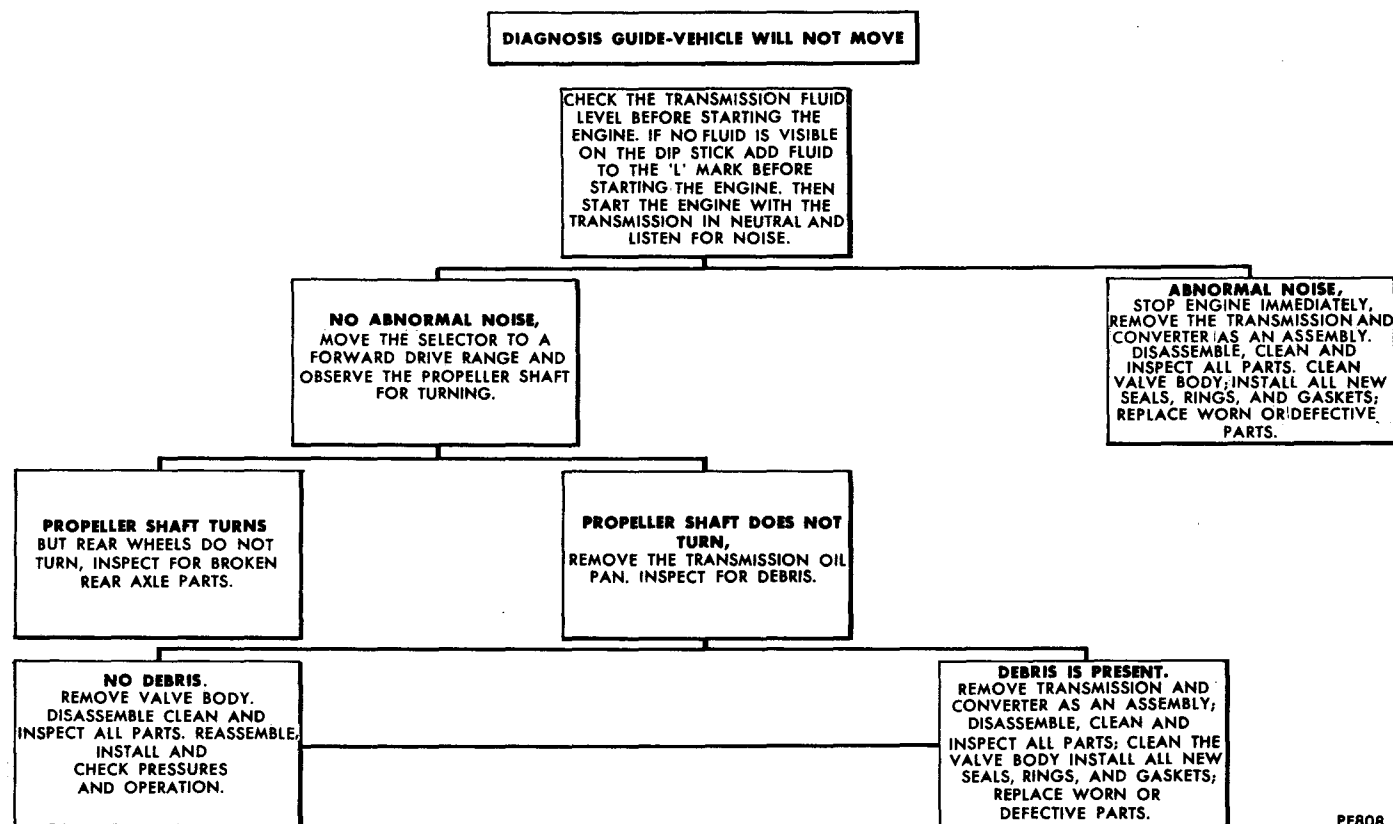
(3) Place gear shift selector lever in the neutral position and move the control lever on transmission to the neutral position (second detent from rear).

(4) Adjust cable clevis to align it with the hole in the transmission lever.

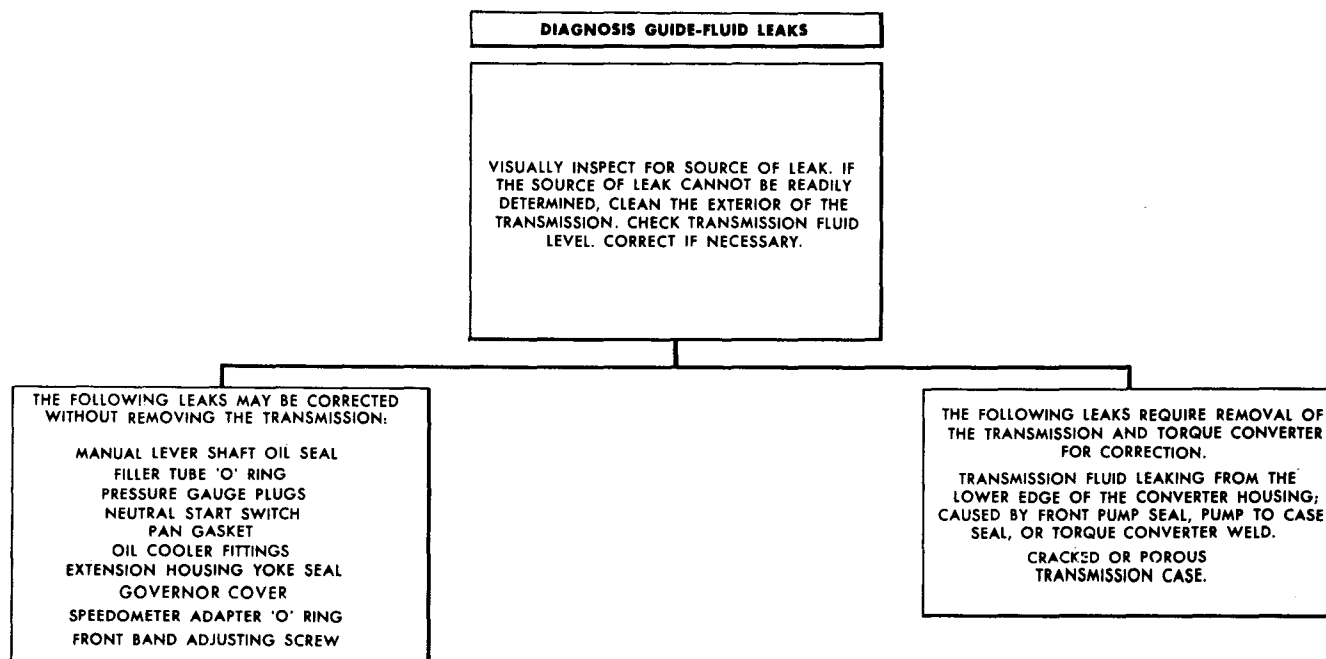
(5) Install the clevis pin into clevis and transmission and secure with a cotter pin.

(6) Recheck the adjustment as follows:

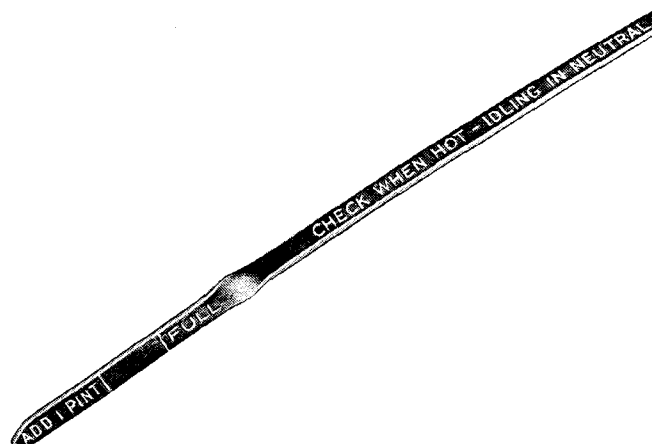
(a) Detent position must be close enough to gate stops in neutral and drive to assure that gear shift lever will not remain out of detent position when it is placed against the gate and then released.



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Fig. 23—Dipstick Markings

(b) Ignition key start must occur **only** when gear shift selector lever is in the neutral position.

(c) If the key start does not occur in the neutral position, perform steps 3 through 5 again.

(d) After proper adjustment is done; place selector lever in neutral position, start engine. Check that the vehicle does not move rearward.

### Transmission Throttle Linkage Adjustment (Fig. 26)

(1) Check for correct throttle opening and closing positions by operating the accelerator pedal. If any binding is present check for correct cable routing, or pedal interference with carpet.

(2) Lubricate linkage as outlined in the "Lubrication Section".

(3) Disconnect choke rod at carburetor or block choke valve in the full open position. Open throttle slightly to release fast idle cam, then return carburetor to curb idle.

(4) Hold transmission throttle lever forward against its stop while adjusting the linkage, **make sure** there is no other force exerted against the lower end of the rod.

(5) Remove spring from stabilizer and retainer (Fig. 26) and loosen bolt attaching upper end of rod (slotted) to retainer.

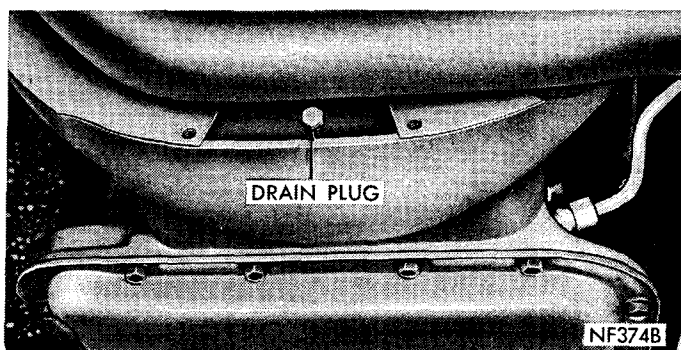
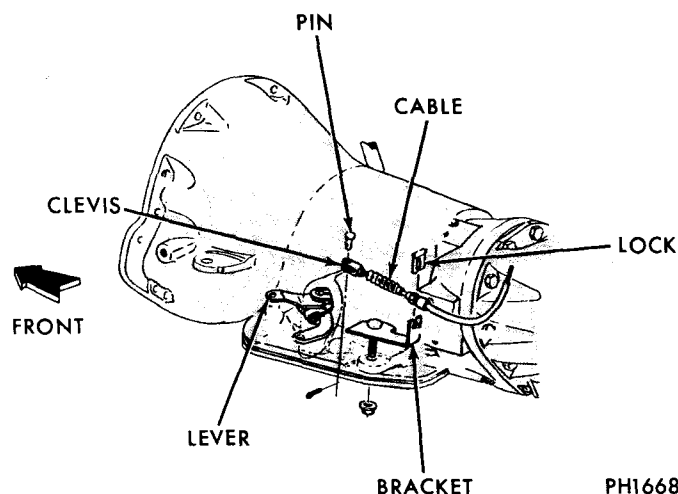


Fig. 24—Converter Drain Plug



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Fig. 25—Gearshift Controls

(6) Push rearward on rod with slight effort (to remove all backlash) make sure throttle lever is not disturbed during this operation.

(7) Tighten bolt at retainer and install spring at stabilizer and retainer and recheck freedom of linkage operation.

(8) Connect choke rod or remove blocking fixture.

## BAND ADJUSTMENTS

### Kickdown Band

The kickdown band adjusting screw is located on left side of the transmission case.

(1) Loosen lock nut and back off approximately five turns. Test adjusting screw for free turning in the transmission case.

(2) Using wrench, Tool C-3380-A with adapter C-3705, tighten band adjusting screw 47 to 50 inch-pounds. If adapter C-3705 is not used, tighten adjusting screw to 72 inch-pounds which is the true torque.

(3) Back off adjusting screw 2 turns. Hold adjusting screw in this position and tighten lock nut to 35 foot-pounds.

### Low and Reverse Band

(1) Raise vehicle, drain transmission fluid from oil pan and remove the oil pan.

(2) Loosen adjusting screw lock nut and back off nut approximately five turns (Fig. 27). Test adjusting screw for free turning in the lever.

(3) Using wrench, Tool C-3380-A with adapter C-3705, tighten band adjusting screw 47 to 50 inch-pounds. If adapter C-3705 is not used, tighten adjusting screw to 72 inch-pounds which is the true torque.

(4) Back off adjusting screw 2 turns. Hold adjusting screw in this position and tighten lock nut to 30 foot-pounds.

(5) Reinstall oil pan using a new gasket. Tighten oil pan bolts to 150 inch-pounds.

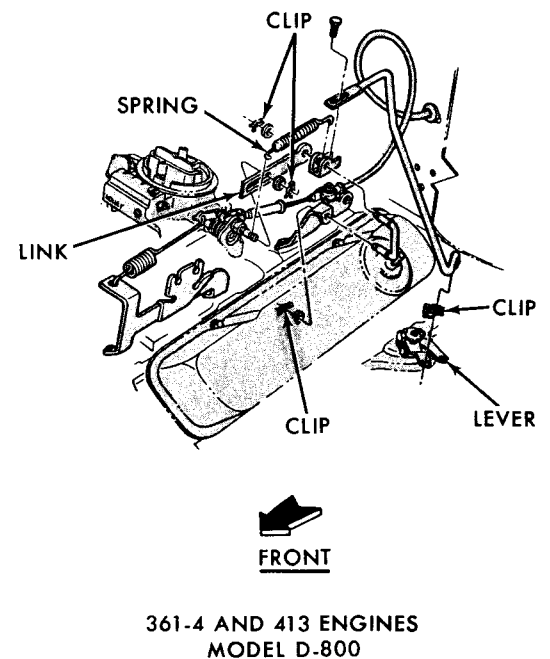
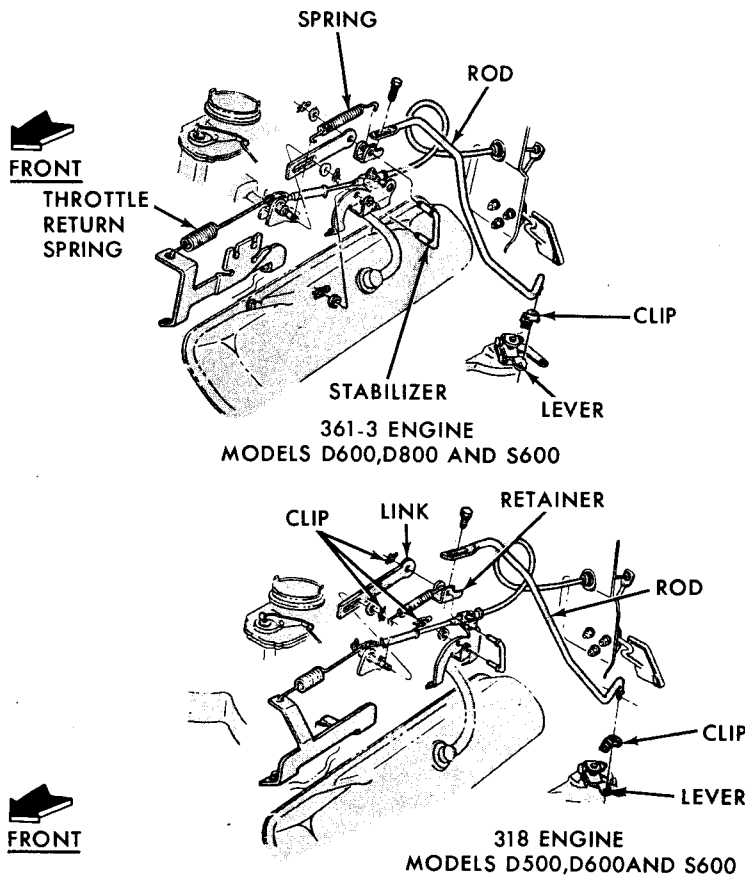


Fig. 26—Throttle Controls

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(6) Fill transmission with "DEXRON" type Automatic Transmission Fluid.

## HYDRAULIC CONTROL PRESSURE ADJUSTMENTS

### Line Pressure

An incorrect throttle pressure setting will cause incorrect line pressure readings even though line pressure adjustment is correct. Always inspect and correct throttle pressure adjustment before adjusting the line pressure.

The adjusting screw may be turned with an Allen wrench. One complete turn of adjusting screw chang-

es closed throttle line pressure approximately 1-2/3 psi. Turning adjusting screw counterclockwise increases pressure, and clockwise decreases pressure.

### Throttle Pressure

Throttle pressures cannot be tested accurately; therefore, the adjustment should be measured if a malfunction is evident.

(1) Insert gauge pin of Tool C-4233 between the throttle lever cam and kickdown valve (Fig. 28).

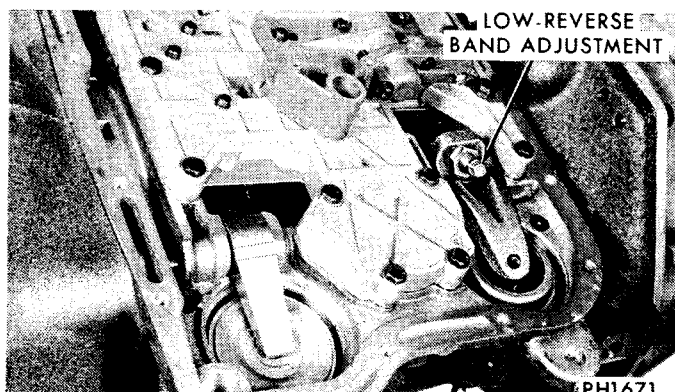


Fig. 27—Low-Reverse Band Adjustment

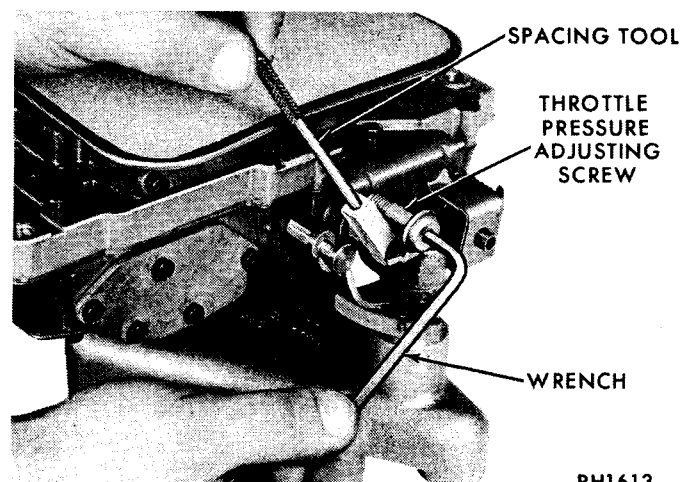


Fig. 28—Throttle Pressure Adjustment



(2) By pushing in on tool, compress kickdown valve against its spring so throttle valve is completely bottomed inside the valve body.

(3) As force is being exerted to compress spring, turn throttle lever stop screw with allen wrench until head of screw touches the throttle lever tang with throttle lever cam touching tool and the throttle valve bottomed. **Be sure adjustment is made with spring fully compressed and valve bottomed in the valve body.**

## SERVICE OUT OF VEHICLE

### Transmission Assembly

#### Removal

The compounder, transmission and torque converter is removed as an assembly. The drive plate will not support any load, therefore, none of the weight of the transmission should be allowed to rest on the drive plate during removal as damage to the drive plate, pump bushing and oil seal will result.

(1) Remove converter access cover plate. Three drain plugs are provided to drain the hydraulic fluid from the system: torque converter, transmission and compounder. Drain the system before removing any attaching screws or fittings.

(2) Connect a Remote Control Switch, Tool C-3763 to the starter solenoid and position the switch so the engine can be rotated from under the vehicle. Disconnect secondary (high tension) cable from ignition coil.

(3) Rotate engine with the remote control switch to bring drain plug to the "6 o'clock" position. Drain converter, transmission and compounder.

(4) Position floor jack under transmission oil pan and secure transmission on jack with snubber chain or cable. Apply just enough pressure to relieve transmission weight.

(5) Install engine support fixture, Tool C-3487-A with truck frame hooks, or a suitable substitute that will support rear of engine without damaging engine oil pan.

(6) Mark converter and drive plate to aid in reassembly.

**NOTE:** The crankshaft flange bolt circle, inner and outer circle of holes in the drive plate and the four tapped holes in front face of the converter all have one hole offset so these parts will be installed in the original position. This maintains balance of the engine and converter.

(7) Rotate engine with the remote control switch to locate two converter to drive plate at "5 and 7 o'clock" positions. Remove the two bolts, rotate engine with remote switch and remove the other two bolts. **Do not rotate converter or drive plate with a screw driver or similar tool as the drive plate may become distorted. Also, the starter should never be**

**engaged if drive plate is not attached to the converter with at least one bolt or if transmission case to engine bolts have been loosened.**

(8) Disconnect negative (ground) cable from the battery.

(9) Remove the starter motor assembly. Remove oil filler tube.

(10) Disconnect connector from the back-up light and neutral start switch.

(11) Disconnect gearshift cable at transmission. Disconnect speedometer cable.

(12) Disconnect throttle rod from lever at transmission.

(13) Remove bolts securing transmission mount to crossmember and crossmember to frame, then remove crossmember.

(14) Disconnect propeller shaft at transmission yoke and tie shaft to frame side rail.

(15) Remove all bell housing bolts and carefully work transmission and converter assembly rearward off engine block dowels and disengage converter hub from end of crankshaft. Attach a small "C" clamp to edge of bell housing to hold converter in place during transmission removal to prevent damage to the front pump bushing.

(16) Lower the transmission and remove transmission with floor jack from under the vehicle.

(17) To remove the converter assembly, remove "C" clamp from edge of bell housing, then carefully slide converter out of the transmission.

#### Installation

The transmission and converter must be installed as an assembly, otherwise, the converter drive plate, pump bushing and oil seal may be damaged. The drive plate will not support a load, therefore, none of the weight of transmission should be allowed to rest on the plate during installation.

(1) Rotate pump rotors with Tool C-3881 until the two small holes in the tool handle are vertical (Fig. 1).

(2) Carefully slide converter assembly over input shaft and reaction shaft. Make sure converter hub slots are also vertical and fully engage pump inner rotor lugs.

**NOTE:** Test for full engagement by placing a straight edge on face of the case (Fig. 2). The surface of converter front cover nut lug should be at least ½ inch to rear of straight edge when converter is pushed all the way into the transmission.

(3) Attach a small "C" clamp to edge of converter housing to hold converter in place during transmission installation.

(4) Inspect converter drive plate for distortion or cracks and replace if necessary. **Make sure both transmission dowels are in the engine block and that**

they are protruding far enough to hold transmission in alignment.

(5) Coat converter hub hole in crankshaft with wheel bearing grease.

(6) Install transmission on hydraulic floor jack, make sure the transmission is properly secured in the jack cradle.

(7) Move floor jack and transmission into position under the vehicle for installation. Raise or tilt jack as necessary until the transmission is aligned with the engine.

(8) Carefully work transmission assembly forward over engine block dowels with converter hub entering the crankshaft opening. After transmission is in position, install bell housing bolts and tighten to 28 foot pounds torque.

(9) Rotate converter so the mark on the converter (made during removal) will align with the mark on drive plate. The offset holes in the plate are located next to the 1/8 inch hole in the inner circle of the plate. A stamped "V" mark identifies the offset hole in the converter front cover.

(10) Install starter motor and connect battery ground cable.

(11) Install the two lower drive plate to converter bolts and tighten to 270 inch-pounds.

(12) Rotate engine with a remote control switch and install the other two converter to drive plate bolts. Tighten bolts to 270 inch-pounds.

(13) Install crossmember, using the holes in the frame rails for the specific engine. Tighten bolt nuts to 85 foot-pounds. Lower the transmission so extension housing is aligned and rests on the rear mount. Install attaching bolts and tighten to 40 foot-pounds.

(14) Remove transmission jack and engine support frame.

(15) Connect propeller shaft to the transmission yoke. Tighten strap bolt nuts to 17-21 foot-pounds.

(16) Connect oil cooler lines to the transmission. Install the oil filler tube. Connect the speedometer cable.

(17) Connect the gearshift cable to the transmission lever on transmission.

(18) Connect the throttle rod to the transmission throttle lever.

(19) Install wire connector to the back-up and neutral start switch.

(20) Install cover plate in front of the converter assembly.

(21) Refill transmission with Automatic Transmission Fluid "Dexron".

(22) Adjust throttle linkage. (See Maintenance and Adjustments).

(23) Adjust gearshift linkage. (See Maintenance and Adjustments).

(24) Lower the vehicle.

## STARTER RING GEAR REPLACEMENT

The starter ring gear is mounted directly on outer diameter of the torque converter front cover.

With torque converter removed from vehicle, replacement of the gear is as follows:

### Removal

(1) Cut through weld material at rear side of ring gear with a hack saw or grinding wheel. Be careful not to cut or grind into front cover stamping.

(2) Scribe a heavy line on front cover next to front face of ring gear to aid in locating the new gear.

(3) Support converter with the front lug faces resting on blocks of wood. **The converter must not rest**

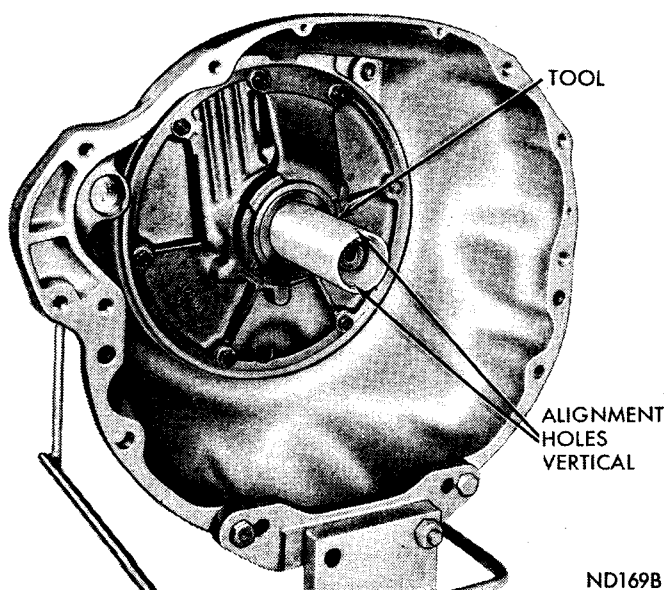


Fig. 1—Aligning Pump Rotors

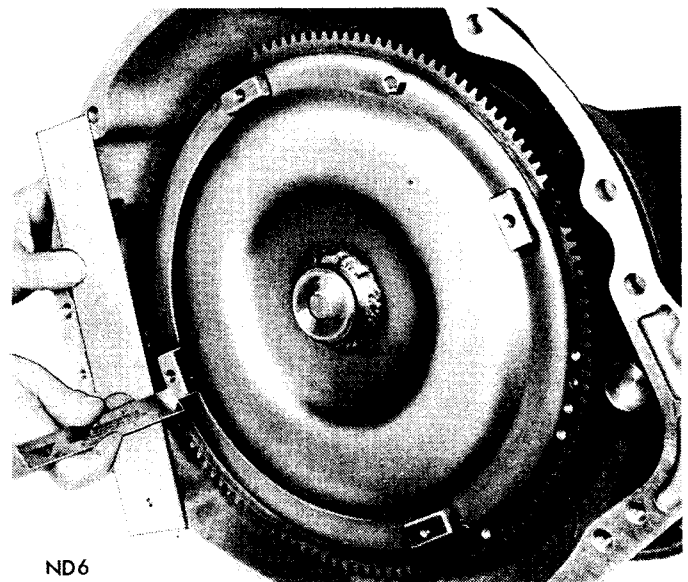


Fig. 2—Measuring Converter for Full Engagement in Transmission

on the front cover hub during this operation. Using a blunt chisel or drift and hammer, tap downward on ring gear near welded areas to break any remaining weld material (Fig. 3). Tap around ring gear until it comes off the converter.

(4) Smooth off weld areas on the cover with a file.

### Installation

Any of the following methods may be used to heat and expand starter ring gear for installation on the converter:

**Oven:** Place ring gear in Oven and set temperature at 200 degrees F. Allow ring gear to remain in oven for 15 to 20 minutes.

**Boiling Water:** Place ring gear in a shallow container, add water, and heat for approximately eight minutes after water has come to a boil.

**Steam:** Place ring gear on a flat surface and direct a steam flow around gear for approximately two minutes.

**Flame:** Place ring gear squarely on a flat surface. Using a medium size tip, direct a slow flame evenly around inner rim of the gear. **Do not apply flame to the gear teeth.** Place a few drops of water on face of gear at intervals during heating process. When gear is hot enough to just boil the water, installation of gear on the torque converter can be made.

(1) After ring gear is expanded by heating, place the gear in position on converter front cover. Tap gear on the cover evenly with a plastic or rawhide mallet until face of gear is even with scribed line (made during removal) on the front cover. Make sure gear is even with scribed line around full circumference of the front cover.

(2) Reweld ring gear to torque converter front cover, being careful to place, as nearly as possible, same amount of weld material in exactly same location as was used in original weld. This is necessary in

order to maintain proper balance of the unit. Place welds alternately on opposite sides of converter to minimize distortion.

(3) The following suggestions are offered as an aid in making the weld:

a. **Do not gas weld.**

b. Use a D.C. welder that is set at straight polarity or an A.C. welder if the proper electrode is available.

c. Use a 1/8 inch diameter welding rod, and a welding current of 80 to 125 amps.

d. Direct the arc at intersection of the gear and front cover from an angle of 45 degrees from rear face of the gear.

(4) Inspect gear teeth and remove all nicks where metal is raised, weld metal splatter, etc., in order to ensure quiet starter operation.

### TORQUE CONVERTER FLUSHING

When a transmission failure has contaminated the fluid, the torque converter, oil coolers, and tubes should be flushed to insure that metal particles or sludged oil are not later transferred back into the reconditioned transmission.

#### Hand Flushing

(1) Place converter in horizontal position and pour two quarts of new clean solvent or kerosene into converter through the impeller hub.

(2) Turn and shake converter so as to swirl solvent through the internal parts. Turn the turbine and stator with transmission input and reaction shafts to dislodge foreign material.

(3) Position converter in its normal operation position with drain plug at the lowest point. Remove drain plug and drain solvent. Rotate turbine and stator, and shake converter while draining to prevent dirt particles from settling. Tool C-3963-A is available to do this job faster and more effectively.

The tool adapts a drill motor to an input shaft to spin the turbine and includes a drawing for a simple wooden fixture to hold the converter. This fixture will hold the converter upright for the spinning and draining operations.

(4) Repeat flushing operation at least once, or as many times as required until solvent or kerosene drained out is clear.

(5) After flushing, shake and rotate converter several times with drain plug out to remove any residual solvent and dirt. **Flush any remaining solvent from converter with two quarts of new transmission fluid.** This will prevent any adverse effect the solvent may have on the transmission seals. Reinstall drain plug and tighten to 90 inch-pounds.

(6) Flush and blow out the oil cooler and its lines. (see "Oil Coolers and Tubes Flushing").

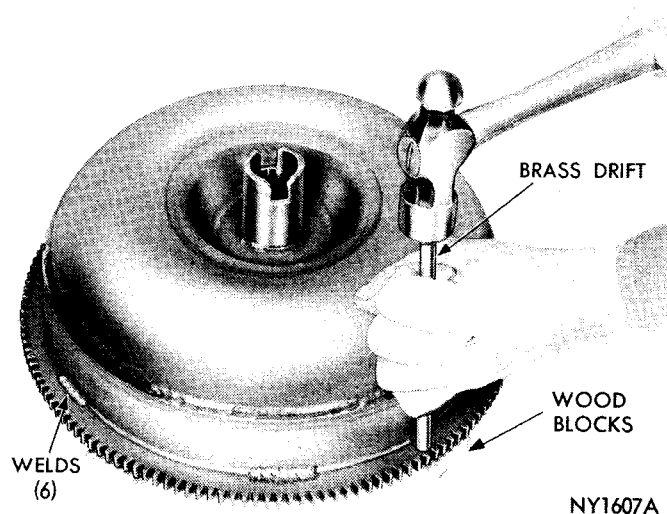


Fig. 3—Removing Starter Ring Gear

### Machine Flushing

Machine cleaning is recommended; using the type which rotates the converter while pumping cleaning fluid through it. The machine automatically adds timed blasts of compressed air to the cleaning fluid as it enters the converter, providing more thorough cleaning than the hand flushing operation.

### OIL COOLERS AND TUBES FLUSHING

When a transmission failure has contaminated the fluid, the oil cooler(s) should be flushed to insure that metal particles or sludged oil are not later transferred back into the reconditioned transmission.

(1) Place a length of hose over the end of the most rearward oil cooler tube. Insert hose securely into a waste oil container.

(2) Apply compressed air to the forward oil cooler tube in very short, sharp blasts.

(3) Pump approximately one pint of "DEXRON" type automatic transmission fluid into the forward oil cooler tube.

(4) Repeat step (2). Remove hose.

### PUMP OIL SEAL

#### Replacement

The pump oil seal can be replaced without removing pump and reaction shaft support assembly from the transmission case.

(1) Screw seal remover, Tool C-3861 into the seal (Fig. 4). Tighten screw portion of tool to withdraw the seal.

(2) To install a new seal, place seal in opening of the pump housing (lip side facing inward). Using Tool C-3860, drive seal into the housing until tool bottoms (Fig. 5).

### DISASSEMBLY—SUBASSEMBLY REMOVAL

Prior to removing any transmission subassemblies, plug all openings and thoroughly clean exterior of

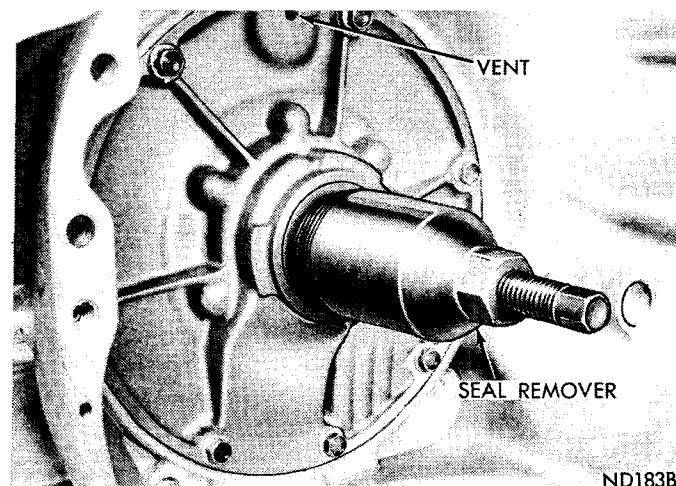


Fig. 4—Removing Pump Oil Seal

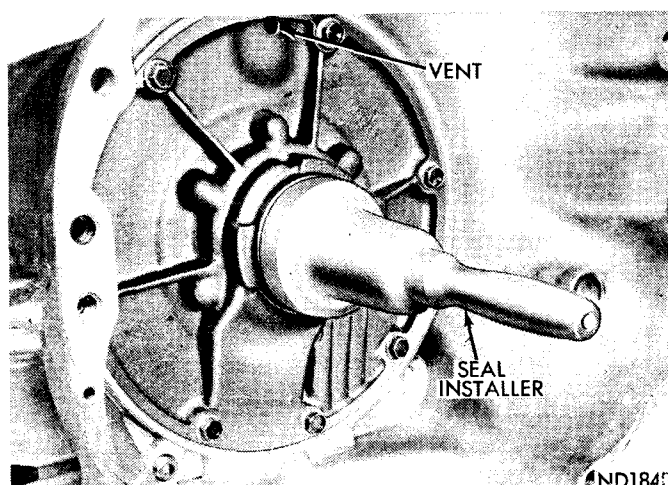


Fig. 5—Installing Pump Oil Seal

the unit, preferably by steam. Cleanliness through entire disassembly and assembly cannot be over-emphasized. When disassembling, each part should be washed in a suitable solvent, then dried by compressed air. **Do not wipe parts with shop towels.** All mating surfaces in the transmission are accurately machined; therefore, careful handling of parts must be exercised to avoid nicks or burrs.

#### Input Shaft End Play

Measuring input shaft end play before disassembly will usually indicate when a thrust washer change is required, (except when major parts are replaced). **The thrust washer is located between reaction shaft support and front clutch retainer.**

(1) Attach a dial indicator to transmission bell housing with its plunger seated against end of input shaft (Fig. 7).

Move input shaft in and out to obtain end play reading. End play specifications are .018 to .062 inch for A-345 transmissions.

(2) Record indicator reading for reference when reassembling the transmission.

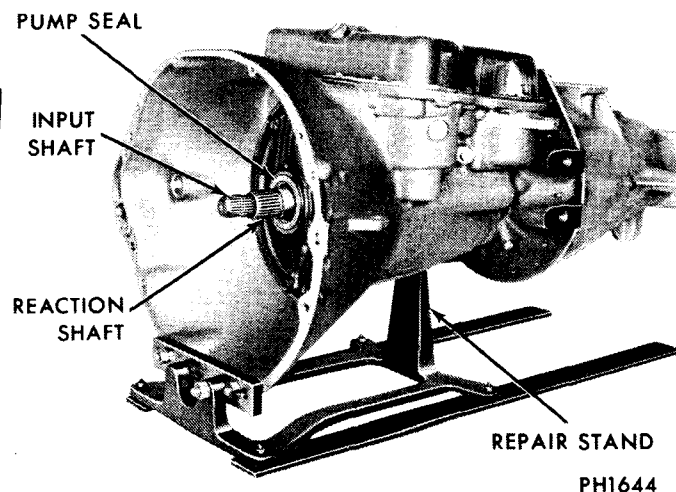
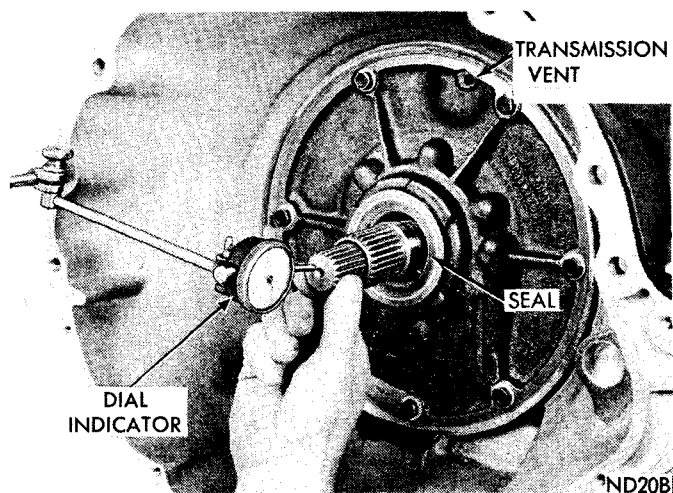


Fig. 6—Transmission Installed in Repair Stand



**Fig. 7—Measuring Input Shaft End Play**

### Oil Pan

- (1) Place transmission assembly in repair stand, Tool C-3750-A (Fig. 6).
- (2) Unscrew oil pan bolts and remove oil pan and gasket.

### Valve Body Assembly

- (1) Loosen clamp bolts and remove throttle and gearshift levers from the transmission.
- (2) Remove Back-Up Light and Neutral Start Switch.
- (3) Remove the hex-head valve body to transmission bolts.

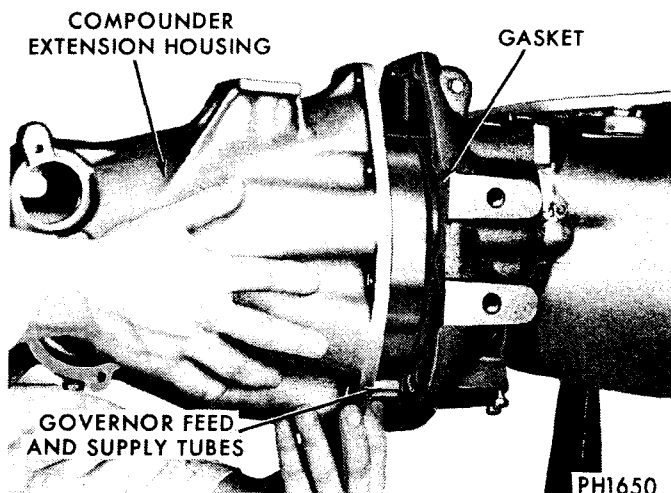
### Accumulator Piston and Spring

- (1) Remove accumulator piston from case and lift spring from the case.

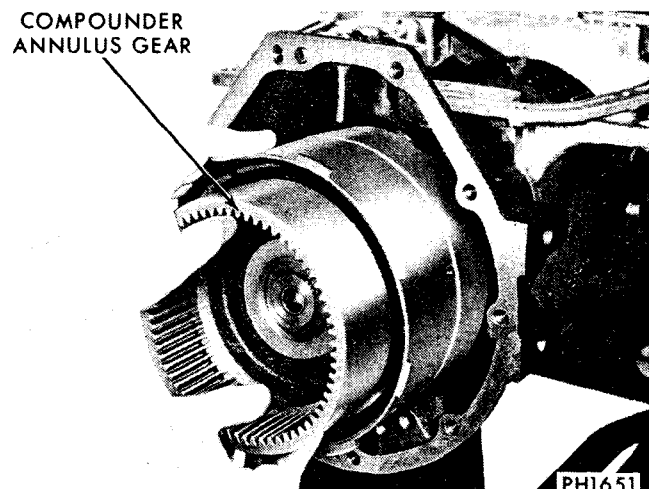
## TRANSMISSION COMPOUNDER

### Disassembly

Before removing the compounder, reduce the input shaft end play to zero by inserting and wedging a flat



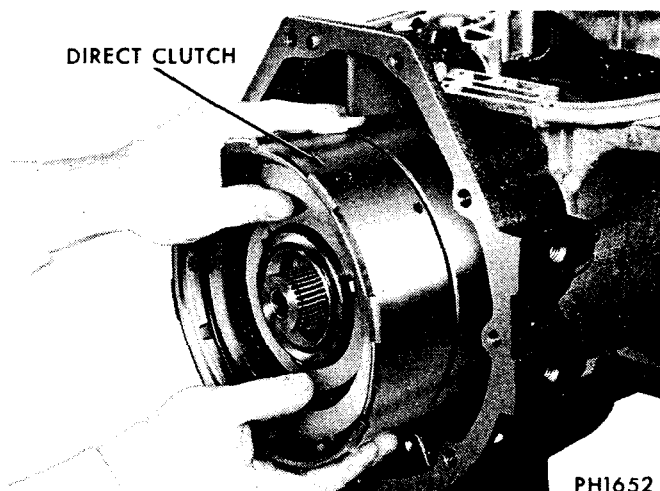
**Fig. 8—Removing or Installing Compounder Extension Housing**



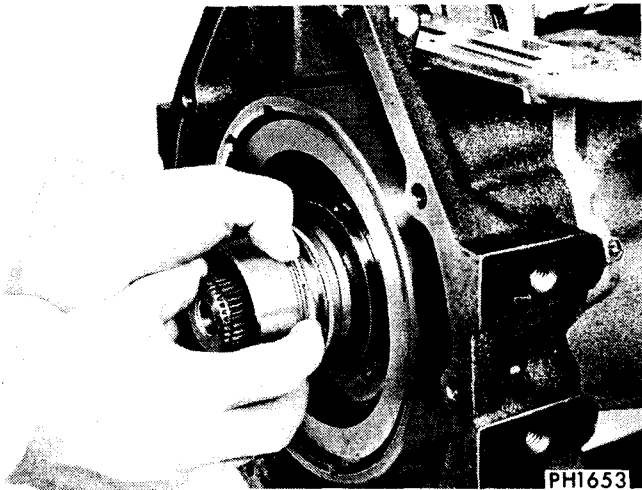
**Fig. 9—Removing or Installing Compounder Annulus Gear**

screw driver between low-reverse drum and transmission case. When the low-reverse drum is as far forward as possible, tighten the rear band adjusting screw until band is tight on the low-reverse drum. Remove screw driver. This prevents the #2 thrust washer or one of the clutch discs from coming out of position.

- (1) Remove propeller shaft companion flange and yoke retaining nut and washer from output shaft and remove drum and yoke. Carefully pull shaft yoke out of the transmission extension housing. Remove parking brake assembly.
- (2) Remove speedometer pinion and governor cover and gasket.
- (3) Remove governor assembly from extension housing.
- (4) Remove the compounder extension to compounder adapter screws and remove the compounder extension for further disassembly on workbench.
- (5) Remove the snap ring retaining the compounder annulus gear to the intermediate shaft and re-



**Fig. 10—Removing or Installing Direct Clutch**



**Fig. 11—Removing or Installing Direct Clutch Seal Rings**

move the annulus gear and fiber thrust washer and direct clutch (Figs. 9 and 10).

(6) Remove the two seal rings from the adapter. Unlock the seal ring hooks by compressing the rings (Fig. 11).

(7) Spread the seal rings just enough so that they can be removed without scratching the adapter hub. The two seal rings for the direct clutch are a different metal than the two seal rings for the reaction clutch. **DO NOT INTERMIX THESE SEAL RINGS.**

(8) Remove the snap ring retaining the reaction clutch to the adapter clutch hub using tool C-4249 (Fig. 12). Remove fiber thrust washer.

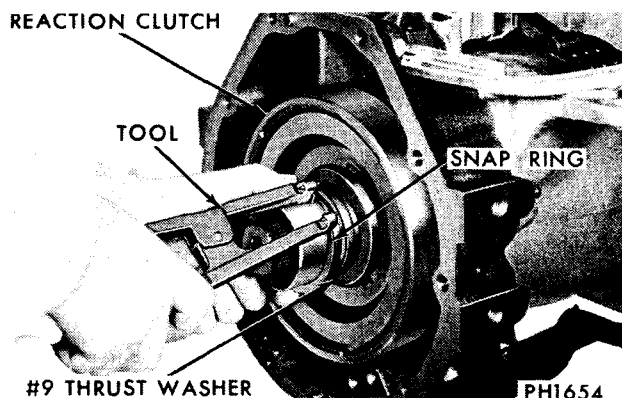
(9) Remove the reaction clutch assembly (Fig. 13).

(10) **DO NOT** remove the reaction clutch seal rings unless they are worn or damaged.

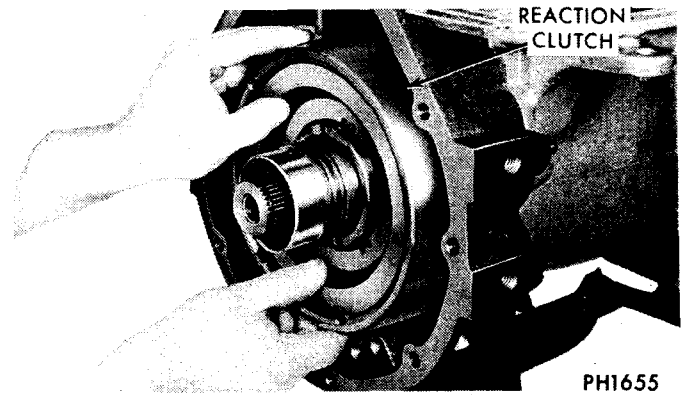
(11) Remove the snap ring retaining the compounder planetary gear assembly to the output shaft (Fig. 16).

(12) Remove the planetary gear assembly.

(13) Remove driving shell and sun gear assembly with thrust washer and governor and line pressure tubes from extension housing (Fig. 17).



**Fig. 12—Removing or Installing Reaction Clutch Retaining Snap Ring**



**Fig. 13—Removing or Installing Reaction Clutch**

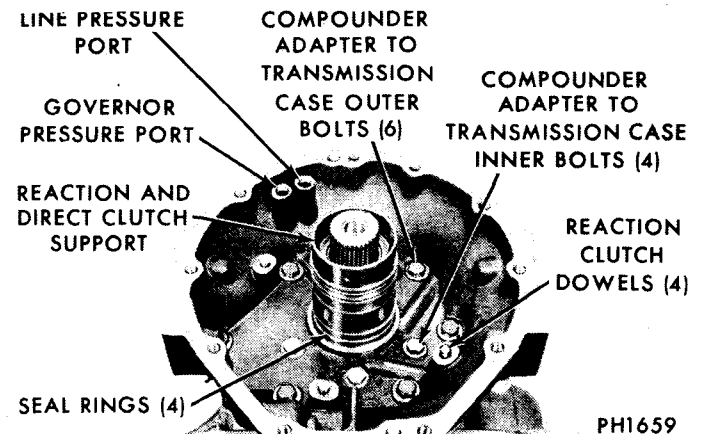
(14) Remove the rear overrunning clutch hub rollers and springs. Note position of overrunning clutch rollers and springs before disassembly to assist in reassembly (Fig. 18).

(15) Remove output shaft oil seal with suitable hook type slide hammer tool.

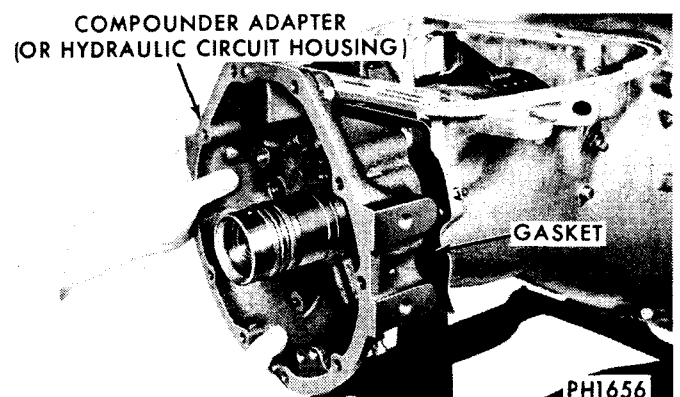
**Place puller hooks between output shaft and under side of seal so that hooks do not damage housing bore.**

(16) Remove output shaft bearing snap ring with Special Tool C-4249 (Fig. 19).

(17) Remove output shaft rearward from compounder extension.

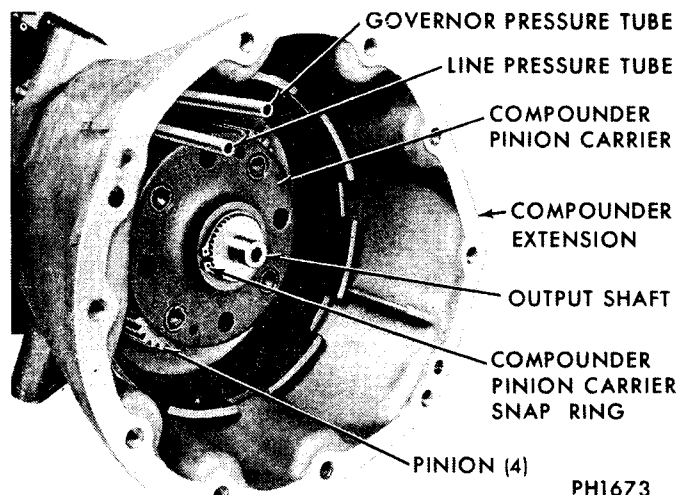


**Fig. 14—Compounder Adapter Installed**



**Fig. 15—Removing or Installing Compounder Adapter**





**Fig. 16—Compounder Pinion Carrier Snap Ring**

**NOTE:** The output shaft bearing is a sliding fit in the housing bore and an interference fit on the output shaft.

The overrunning clutch cam and spring retainer (Fig. 18) cannot be removed from the extension housing. If the clutch cam and/or roller spring retainer are found to be damaged it will be necessary to replace the extension housing with cam and retainer as an assembly.

(18) Remove output shaft bearing by bumping threaded end of output shaft on hard wood block or press. Note position, then remove the snap ring, governor drive gear, the drive ball and the speedometer drive gear from the output shaft.

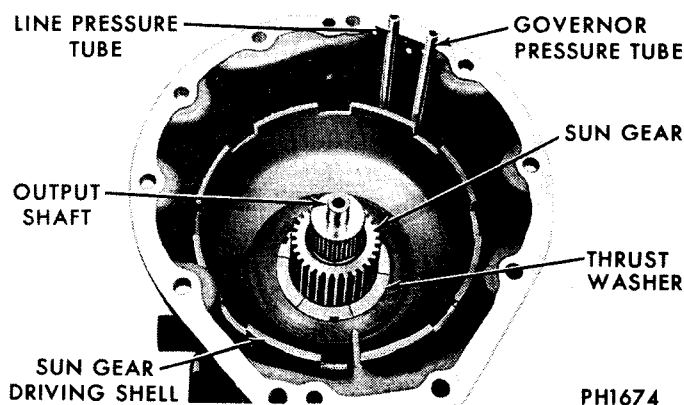
(19) Remove line pressure plug and remove governor screen retainer clip and screen (Fig. 20).

(20) Thoroughly clean inside of compounder extension housing with a good solvent. Blow out all passages and blow dry with compressed air. Reinstall or replace the governor screen, retainer and line pressure plug.

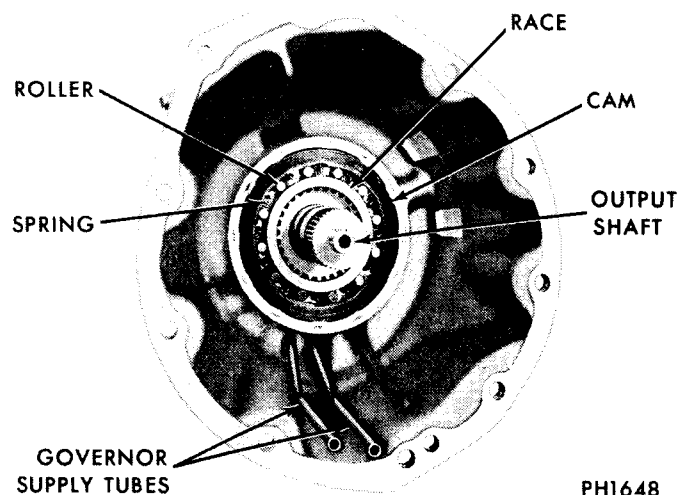
## DIRECT CLUTCH

### Disassembly

(1) Remove large waved snap ring that secures



**Fig. 17—Removing or Installing Rear Driving Shell**



**Fig. 18—Rear Overrunning Clutch and Output Shaft**

pressure plate in clutch piston retainer. Lift pressure plate and clutch plates out of retainer.

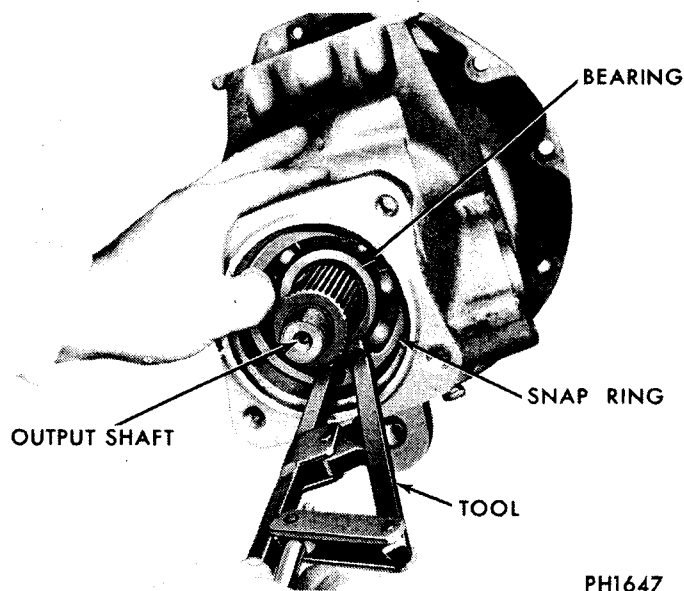
(2) Install compressor, Tool C-3863-A, over piston spring retainer. Compress springs and remove snap ring, then slowly release tool until spring retainer is free of hub. Remove tool, retainer and springs.

(3) Invert clutch retainer assembly and bump it on a wood block to remove piston. Remove seals from piston and clutch retainer hub.

### Inspection

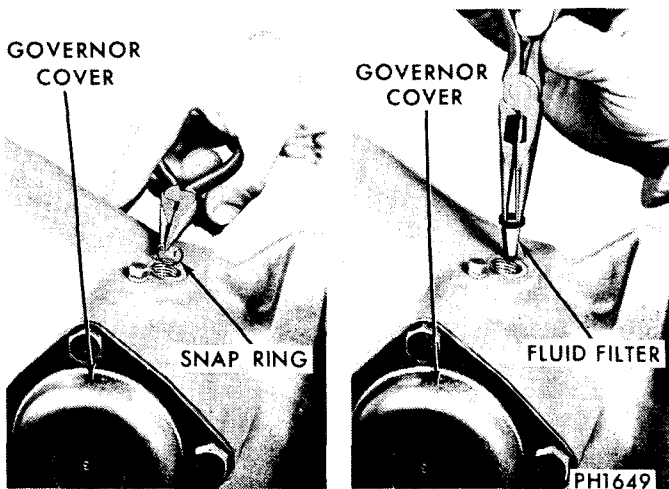
Inspect plates and discs for flatness. They must not be warped or cone shaped.

Inspect facing material on all driving discs. Replace discs that are charred, glazed or heavily pitted. Discs should also be replaced if they show evidence of material flaking off or if facing material can be scraped off easily. Inspect driving disc splines for



**Fig. 19—Removing or Installing Output Shaft Bearing Snap Ring**





**Fig. 20—Removing or Installing Governor Fluid Filter**

wear or other damage. Inspect steel plate and pressure plate surfaces for burning, scoring or damaged driving lugs. Replace if necessary.

Inspect steel plate lug grooves in clutch retainer for smooth surfaces, plates must travel freely in the grooves. Note ball check in the retainer, make sure ball moves freely. Inspect seal surfaces in clutch retainer for nicks or deep scratches, light scratches will not interfere with sealing of neoprene seals. Inspect neoprene seals for deterioration, wear, and hardness. Inspect piston spring, wave spring, and spacer for distortion or breakage.

### Assembly

(1) Lubricate and install inner seal on hub of clutch retainer. Make sure lip of seal faces down and is properly seated in the groove.

(2) Install outer seal on the clutch piston and with lip of seal toward bottom of clutch retainer apply a coating of wax type lubricant (Door Ease) to outer edge of seals. Place piston assembly in retainer and carefully seat piston in retainer.

(3) Install eight springs on piston as removed. Position spring retainer and snap ring over springs. Compress springs with Tool C-3863-A and seat snap ring in hub groove. Remove compressor tool.

(4) Lubricate all clutch plates. Install one steel plate by a friction disc (waffle type) until four discs are installed. Install pressure plate and snap ring. Make sure snap ring is properly seated.

(5) Push downward on pressure plate and insert a feeler gauge between pressure plate and waved snap ring to measure maximum clearance where snap ring is waved away from pressure plate. Clearance to be .088 to .145 inch.

## REACTION CLUTCH

### Disassembly

(1) Remove large waved snap ring that secures

pressure plate in clutch piston retainer. Lift pressure plate and clutch plates out of retainer.

(2) Install compressor, Tool C-3863-A, over piston spring retainer. Compress springs and remove snap ring, then slowly release tool until spring retainer is free of hub. Remove tool, retainer and springs.

(3) Invert clutch retainer assembly and bump it on a wood block to remove piston. Remove seals from piston and clutch retainer hub.

### Inspection

Inspect plates and discs for flatness. They must not be warped or cone shaped.

Inspect facing material on all driving discs. Replace discs that are charred, glazed or heavily pitted. Discs should also be replaced if they show evidence of material flaking off or if facing material can be scraped off easily. Inspect driving disc splines for wear or other damage. Inspect steel plate and pressure plate surfaces for burning, scoring or damaged driving lugs. Replace if necessary.

Inspect steel plate lug grooves in clutch retainer for smooth surfaces, plates must travel freely in the grooves. Inspect seal surfaces in clutch retainer for nicks or deep scratches; light scratches will not interfere with sealing of neoprene seals. Inspect neoprene seals for deterioration, wear and harness. Inspect piston spring, wave spring and spacer for distortion or breakage.

### Assembly

(1) Lubricate and install inner seal on hub of clutch retainer. Make sure lip of seal faces down and is properly seated in the groove.

(2) Install outer seal on the clutch piston with lip of seal toward bottom of clutch retainer. Apply a coating of wax type lubricant (Door Ease) to outer edge of seals. Place piston assembly in retainer and carefully seat piston in retainer.

(3) Install eight springs on piston as removed. Position spring retainer and snap ring over springs. Compress springs with Tool C-3863-A and seat snap ring in hub groove. Remove compressor tool.

(4) Lubricate all clutch plates. Install one steel plate by a friction disc (plain grey) until four discs are installed. Install pressure plate and snap ring. Make sure snap ring is properly seated.

(5) Push downward on pressure plate and insert a feeler gauge between pressure plate and waved snap ring to measure away from pressure plate. Clearance to be .088 to .145 inch.

## INSTALLATION OF GOVERNOR BUSHING

(1) Loosely bolt the reamer fixture C-4245 to the compounder extension.

(2) Place the alignment arbor into the reamer fixture and down into the governor bore.

(3) Tighten screws on the reamer fixture to 8-12 foot-pounds.

**CAUTION:** Do not over-torque and strip the threads.

**NOTE:** Be sure the alignment arbor rotates freely after the screws are properly tightened.

(4) Remove the alignment arbor.

(5) Using reamer C-4245 and drive ratchet, hand ream the governor bore using the following procedure: (Hand ream only.)

(a) Oil the reamer, reamer fixture, and governor bore.

(b) Using a 5-10 pounds of feeding force on the reamer, ream until the reamer bottoms in the extension and then continue to rotate reamer ten (10) complete revolutions.

(c) Remove the reamer using a **clockwise rotation** and 5-10 pounds force upward.

**CAUTION:** Pulling the reamer out without rotating it may score the bore causing a leak between the extension and the bushing.

(6) Remove the reamer fixture from the extension.

(7) Thoroughly clean the chips from the extension, visually check the governor feed holes to insure that they are free from chips.

(8) Install the bushing using the following procedure:

(a) Note the two (2) notches at one end of the bushing.

(b) Position the notches so that one notch is at the 11 o'clock position and the other is at the 2 o'clock position viewing the extension in its normal installed, parallel position.

(c) Use tool C-4245 alignment arbor and bushing installer to drive the bushing into the extension. A brass hammer should be used to strike the hardened steel bushing installer tool.

(d) Drive the bushing until it is flush with the top of the bore.

(9) Oil a new governor and insert it into the installed bushing. The governor should spin freely. If slight honing on the bushing is necessary, use crocus or fine emery cloth around your finger and rotate the cloth within the new bushing.

## TRANSMISSION COMPOUNDER

### Preparing for Compounder Assembly

Be sure the #2 thrust washer, front clutch discs, and rear clutch discs are in proper location.

(1) Push the intermediate shaft forward to reduce input shaft end play to zero.

(2) Insert and wedge a flat screw driver between low-reverse drum and transmission case, moving the low-reverse drum forward as far as possible.

(3) Tighten the rear (low-reverse) band adjusting screw until band is tight on the low-reverse drum. Remove screw driver.

### Assembly

(1) Install two seal rings on the forward grooves of the adapter hub.

(2) Inspect for wear or broken hook locks. Be sure the rings turn freely in the grooves.

(3) Install reaction clutch assembly on the adapter hub (Fig. 13).

(4) Install fiber thrust washer. Install snap ring using tool C-4249 (Fig. 12).

(5) Install two seal rings on the rear grooves of the adapter hub (Fig. 11). Inspect for wear of broken hook locks. Be sure the rings turn freely in the grooves.

(6) Install direct clutch assembly on adapter (Fig. 10) with direct clutch drum gear teeth engaging all the clutch discs in the reaction clutch.

(7) Use C-4222 thrust washer selection tool and feeler gauge to select the proper thrust washer thickness (Fig. 21).

(8) Assemble compounder annulus gear to annulus gear support and retain with snap ring.

(9) Install fiber thrust washer (selective) on compounder annulus gear support.

(10) Install annulus gear assembly into the direct clutch, engaging all the clutch discs in the direct clutch, then install snap ring in groove on intermediate shaft.

(11) Install speedometer drive gear, drive ball, governor drive gear and snap ring on the output shaft.

(12) Assemble bearing to the output shaft, then install output shaft and bearing into the extension housing.

(13) Install the bearing retaining snap ring with tool C-4249 (Fig. 19), to avoid scoring the housing bore.

(14) Install a new output shaft oil seal with seal driver tool C-4220.

(15) Place extension housing in an upright position, insert overrunning clutch hub (race) inside the clutch cam.

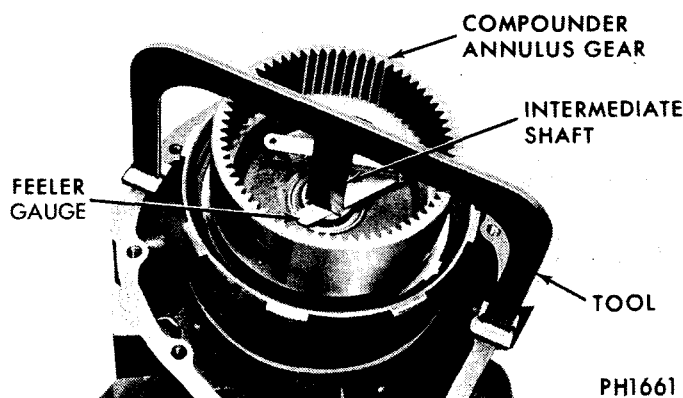


Fig. 21—Selecting Proper Thrust Washer Thickness Using Tool C-4222 and Feeler Gauge

(16) Install the overrunning clutch rollers and springs as shown in Figure 18.

(17) Install governor pressure and line pressure tubes into extension.

(18) Assemble sun gear and overrunning clutch roller retainer to driving shell and install snap ring.

(19) Install driving shell and sun gear assembly on output shaft.

(20) Install bronze thrust washer in driving shell (Fig. 17). Install planetary carrier assembly and install selective snap ring.

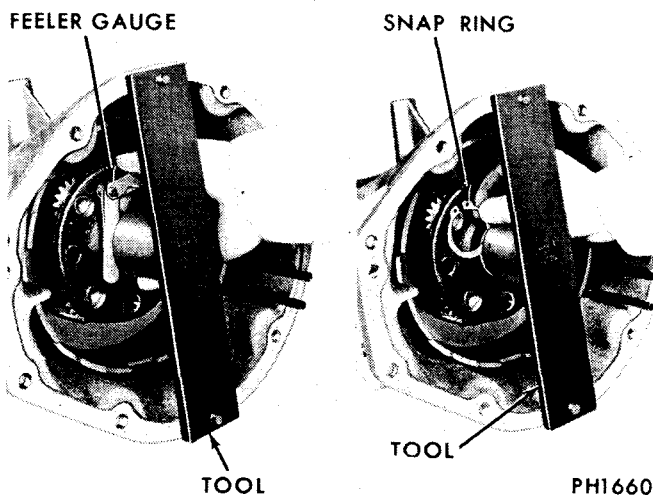
**NOTE:** Use snap ring selector tool C-4221 and feeler gauge to measure clearance between pinion carrier and selector tool hub with feeler gauge in output shaft snap ring groove. **DO NOT rest extension housing assembly on output shaft (Fig. 22).**

(21) Install speedometer gear and governor assembly into the extension housing. Install governor cover with a new gasket. Tighten screws to 12 foot-pounds torque.

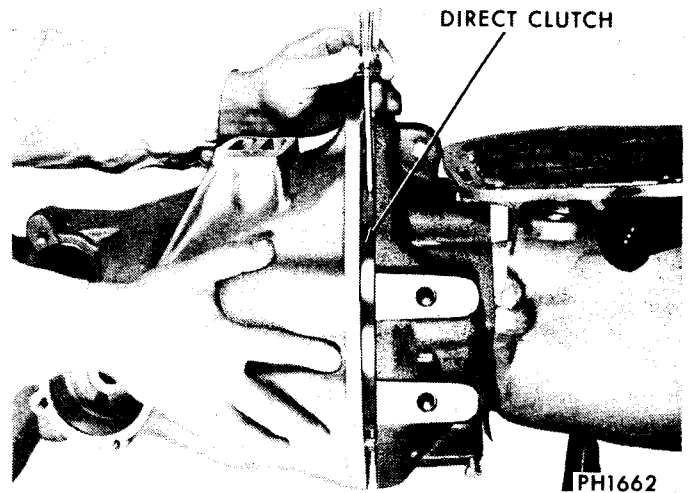
(22) Install gasket and position extension housing assembly on the compounder adapter using pilot studs. Carefully align pressure tubes with the matching holes in the adapter. With light pressure against the extension housing, use a 3/16 inch diameter phillips head screw driver in the hole in the direct clutch drum (Fig. 23) and rotate the drum to align the tangs of the drum with the slots in the driving shell and the compounder annulus gear with the compounder planetary pinions.

(23) Install the compounder extension housing to compounder adapter screws. Tighten screws to 30 foot-pounds.

(24) Install parking brake assembly, drum and yoke on compounder extension housing. Tighten output shaft nut to 175 foot-pounds.



**Fig. 22—Using Tool C-4221 and Feeler Gauge to Select Proper Snap Ring**



**Fig. 23—Aligning Direct Clutch with Driving Shell and Annulus Gear with Companion Planetary Pinions**

## TRANSMISSION DISASSEMBLY

### Oil Pump and Reaction Shaft Support

(1) Tighten front band adjusting screw until band is tight on front clutch retainer. This prevents clutch retainer from coming out with pump which might cause unnecessary damage to the clutches.

(2) Remove oil pump housing retaining bolts.

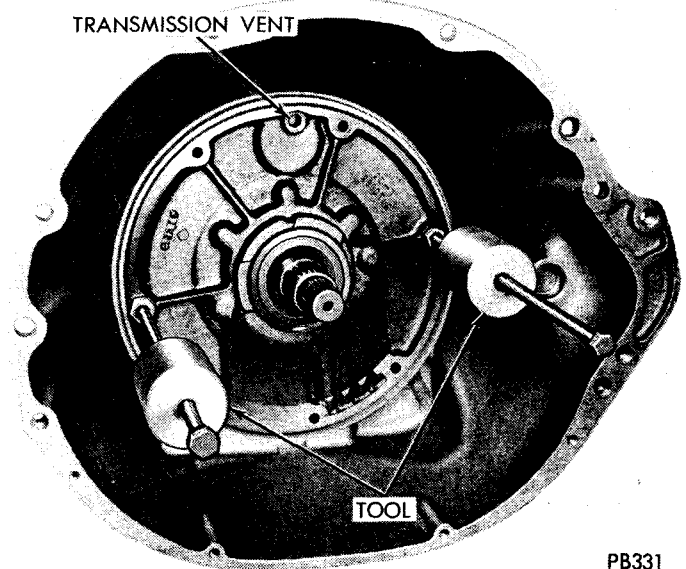
(3) Attach Tool C-3752 to pump housing flange, (Fig. 24), in threaded holes in the flange.

(4) Bump outward evenly with the two "knocker weights" to withdraw pump and reaction shaft support assembly from the case.

### Front Band and Front Clutch

(1) Loosen front band adjuster, remove band strut and slide band out of the case.

(2) Slide front clutch assembly out of the case.



**Fig. 24—Removing Pump Reaction Shaft Support Assembly**

**Input Shaft and Rear Clutch**

(1) Grasp input shaft, and slide input shaft and rear clutch assembly out of the case.

Be careful not to lose thrust washer located between rear end of input shaft and forward end of the intermediate shaft.

**Planetary Gear Assemblies, Sun Gear and Driving Shell**

(1) While supporting intermediate shaft and drive shell, carefully slide assembly forward and out through the case.

**Rear Band and Low-Reverse Drum**

(1) Loosen rear band adjuster, remove low-reverse drum, remove band strut and link, then remove band from case.

**Front Overrunning Clutch**

(1) Note position of overrunning clutch rollers and springs before disassembly to assist in reassembly.

(2) Carefully slide out clutch hub and remove rollers and springs. If the overrunning clutch cam and/or roller spring retainer are found damaged or worn, refer to index for replacement procedures.

**Kickdown Servo (Front)**

(1) Compress kickdown servo spring by using engine valve spring compressor, Tool C-3422-A, then remove snap ring (Fig. 25).

(2) Remove rod guide, springs and piston rod from the case. Be careful not to damage piston rod or guide during removal.

(3) Withdraw piston from the transmission case.

**Low and Reverse Servo (Rear)**

(1) Compress low and reverse servo piston spring by using engine valve spring compressor, Tool C-3422-A, then remove the snap ring.

(2) Remove spring retainer, spring, and servo piston and plug assembly from the case.

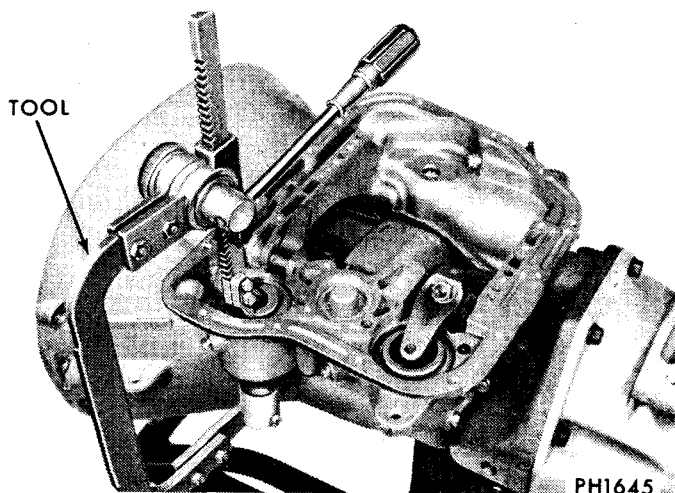


Fig. 25—Compressing Kickdown Servo Spring

**Compounder Adapter**

(1) Remove the ten compounder adapter to case screws and remove the adapter and gasket (Fig. 15).

(2) Inspect intermediate shaft bushings and replace if required.

## RECONDITION SUBASSEMBLIES

### ACCUMULATOR PISTON AND SPRING

**Inspection**

Inspect seal rings for wear and make sure they turn freely in piston grooves. It is not necessary to remove rings unless conditions warrant. Inspect piston for nicks, burrs, scores and wear. Inspect piston bore in the case for scores or other damage. Inspect piston spring for distortion. Replace parts as required.

## OIL PUMP AND REACTION SHAFT SUPPORT—FIG. 26

**Disassembly**

Figure 26 shows the oil pump and reaction shaft support disassembled.

(1) Remove bolts from rear side of reaction shaft support, and lift support off the pump.

(2) Remove rubber seal ring from pump body flange.

(3) Drive out oil seal with a blunt punch.

**Inspection**

Inspect interlocking steel rings (Fig. 26) on reaction shaft support for wear or broken locks, make sure they turn freely in the grooves. Inspect machined surfaces on pump body and reaction shaft support for nicks and burrs. Inspect pump body and reaction shaft support bushings for wear or scores. Inspect pump rotors for scoring or pitting. With rotors cleaned and installed in pump body, place a straight edge across face of rotors and pump body. Use a feeler gauge to measure clearance between straight edge and face of rotors. Clearance limits are from .0015 to .003 inch. Also, measure rotor tip clearance between inner and outer teeth. Clearance limits are from .005 to .010 inch. Clearance between outer rotor and its bore in oil pump body should be from .004 to .008 inch.

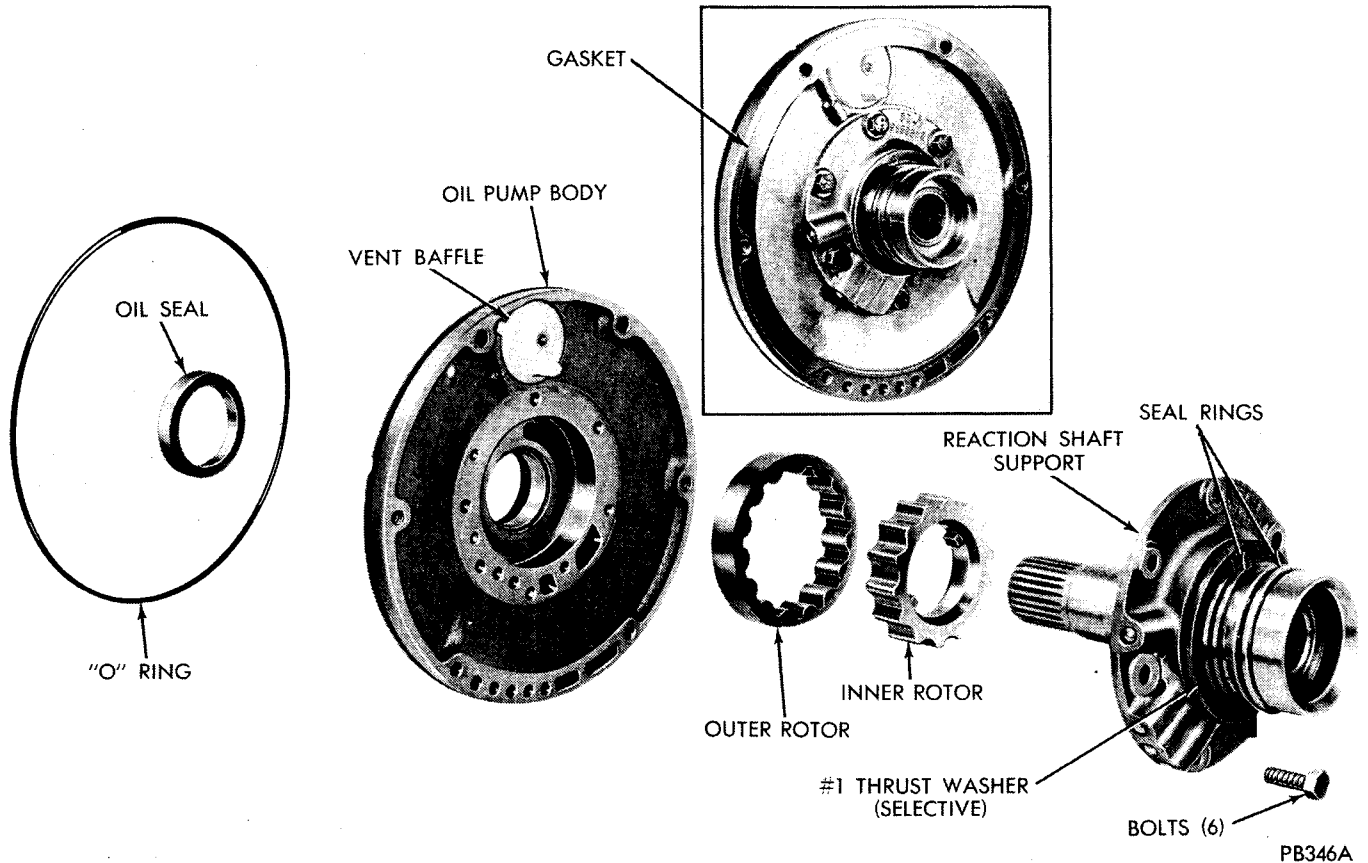
**Pump Bushing Replacement**

(1) Place pump housing on a clean smooth surface with rotor cavity down.

(2) Place removing head Tool SP-3550 in the bushing, and install handle Tool SP-3549 in the removing head (Fig. 27).

(3) Drive bushing straight down and out of the bore. Be careful not to cock tool in the bore.

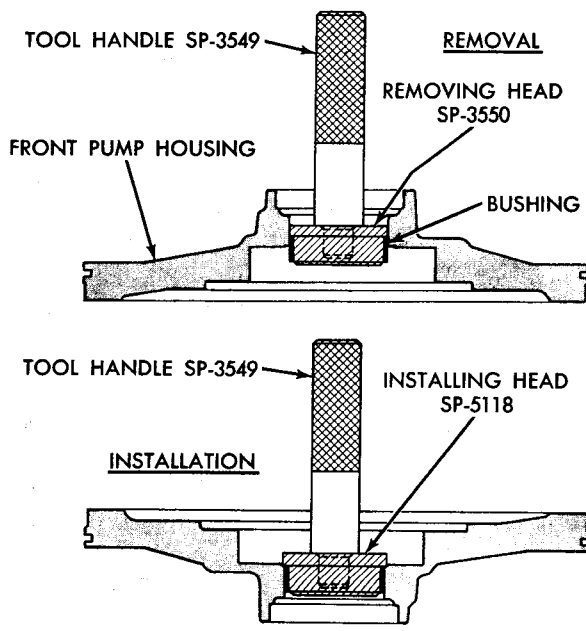
(4) Position a new bushing on installing head Tool SP-5118.



**Fig. 26—Oil Pump and Reaction Shaft Support**

(5) With pump housing on a smooth clean surface (hub end down), start bushing and installing head in the bushing bore. Install handle Tool SP-3549 in installing head (Fig. 27).

(6) Drive bushing into housing until tool bottoms in

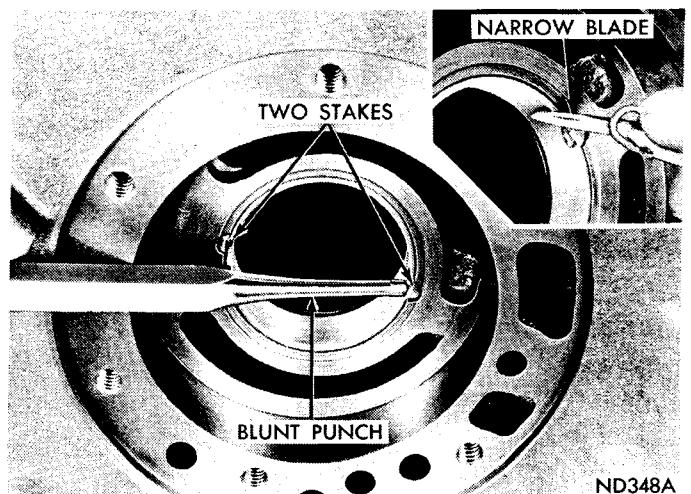


**Fig. 27—Replacing Pump Bushing**

the pump cavity. Be careful not to cock tool during installation.

(7) Stake the bushing in place by using a blunt punch or similar tool (Fig. 28). A gentle tap at each stake slot location will suffice.

(8) Using a narrow-bladed knife or similar tool, remove high points or burrs around staked area (Fig. 28). Do not use a file or similar tool that will remove more metal than is necessary.



**Fig. 28—Staking Pump Bushing**

(9) Thoroughly clean pump housing before installation.

### Reaction Shaft Bushing Replacement

(1) Assemble remover Tool SP-5301, cup Tool SP-3633, and hex nut Tool SP-1191 (Fig. 29).

**Do not clamp any part of reaction shaft or support in a vise.**

(2) With cup held firmly against reaction shaft, thread remover into bushing as far as possible by hand.

(3) Using a wrench to screw remover into bushing 3 to 4 additional turns to firmly engage threads in the bushing.

(4) Turn hex nut down against the cup to pull bushing from reaction shaft. Thoroughly clean reaction shaft to remove chips made by remover threads.

(5) Lightly grip bushing in a vise or with pliers and back tool out of the bushing. Be careful not to damage threads on bushing remover.

(6) Slide a new bushing (chamfered end first) on installing head Tool SP-5302, and start them in the bore of reaction shaft (Fig. 45).

(7) Support reaction shaft upright on a clean smooth surface and install handle Tool SP-3549 in installing head. Drive bushing into shaft until tool bottoms.

(8) Thoroughly clean reaction shaft support assembly before installation.

### Assembly

(1) Assemble pump rotors and "O" ring in the pump housing (Fig. 26).

(2) Install reaction shaft support. Install retaining bolts and tighten to 160 inch-pounds.

(3) Place a new oil seal in opening of pump housing (lip of seal facing inward) using Tool C-3860 drive seal into housing until tool bottoms.

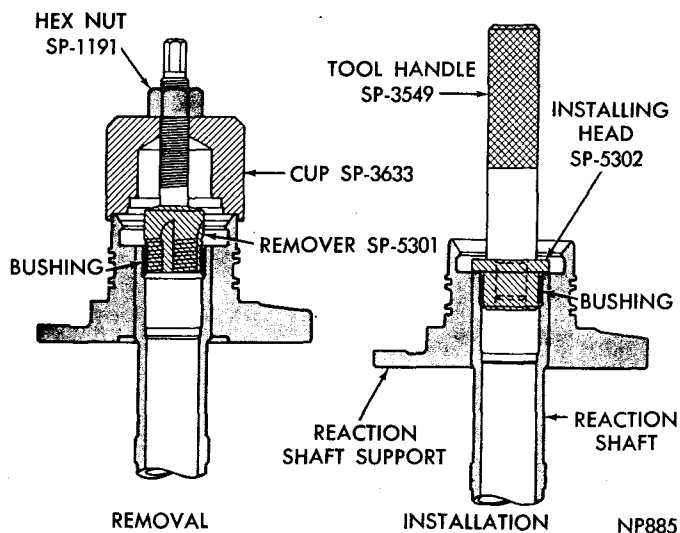


Fig. 29—Replacing Reaction Shaft Bushing

## FRONT CLUTCH

### Disassembly

Figure 30 shows a disassembled view of the front clutch assembly.

(1) Remove large waved snap ring that secures pressure plate in clutch piston retainer. Lift pressure plate and clutch plates out of the retainer.

(2) Install compressor, Tool C-3863-A over piston spring retainer, (Fig. 31). Compress springs and remove snap ring, then slowly release tool until spring retainer is free of hub. Remove tool, retainer and springs.

(3) Invert clutch retainer assembly and bump it on a wood block to remove piston. Remove seals from piston and clutch retainer hub.

### Inspection

Inspect facing material on all driving discs. Replace discs that are charred, glazed or heavily pitted. Disc should also be replaced if they show evidence of material flaking off or if facing material can be scraped off easily. Inspect driving disc spines for wear or other damage. Inspect steel plate and pressure plate surfaces for burning, scoring or damaged driving lugs. Replace if necessary.

Inspect steel plate lug grooves in clutch retainer for smooth surfaces, plates must travel freely in the grooves. Inspect band contacting surface on clutch retainer for scores. Note ball check in clutch retainer, make sure ball moves freely. Inspect seal surfaces in clutch retainer for nicks or deep scratches, light scratches will not interfere with sealing of neoprene seals. Inspect clutch retainer bushing for wear or scores.

Inspect inside bore of piston for score marks, if light, remove with crocus cloth. Inspect seal grooves for nicks and burrs. Inspect neoprene seals for deterioration, wear, and hardness. Inspect piston springs, retainer and snap ring for distortion.

(1) Lay clutch retainer (open end down) on a clean smooth surface and place removing head Tool SP-3629 in the bushing. Install handle Tool SP-3549 in removing head (Fig. 32).

(2) Drive bushing straight down and out of clutch retainer bore. Be careful not to cock tool in the bore.

(3) Lay clutch retainer (open end up) on a clean smooth surface. Slide a new bushing on installing head Tool SP-5511, and start them in clutch retainer bore.

(4) Install handle Tool SP-3549 in the installer (Fig. 32). Drive bushing into clutch retainer until tool bottoms.

(5) Thoroughly clean clutch retainer before assembly and installation.

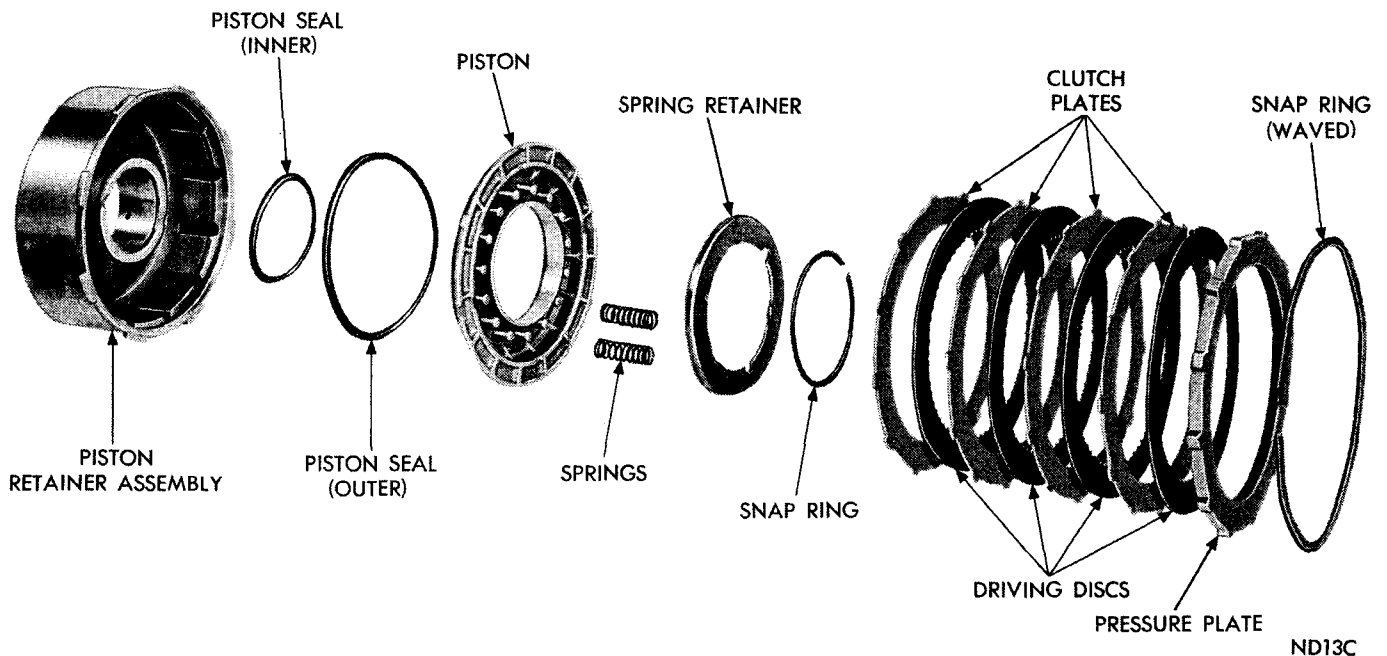


Fig. 30—Front Clutch Disassembled

**Assembly**

(1) Lubricate and install inner seal on hub of clutch retainer. Make sure lip of seal faces down and is properly seated in the groove.

(2) Install outer seal on the clutch piston, with lip of seal toward bottom of clutch retainer. Apply a coating of wax type lubricant or Door Ease to outer edge of seals for easier installation of piston assembly. Place piston assembly in retainer and carefully

seat piston in bottom of retainer.

(3) Install springs on piston exactly as shown in figure 33.

(4) Position spring retainer and snap ring over the springs. Compress springs with Tool C-3863-A (Fig. 31), and seat snap ring in hub groove. (Remove compressor tool).

(5) Lubricate all clutch plates, install one steel plate followed by a lined plate (disc) until all discs are installed. Install pressure plate and snap ring. Make sure snap ring is properly seated.

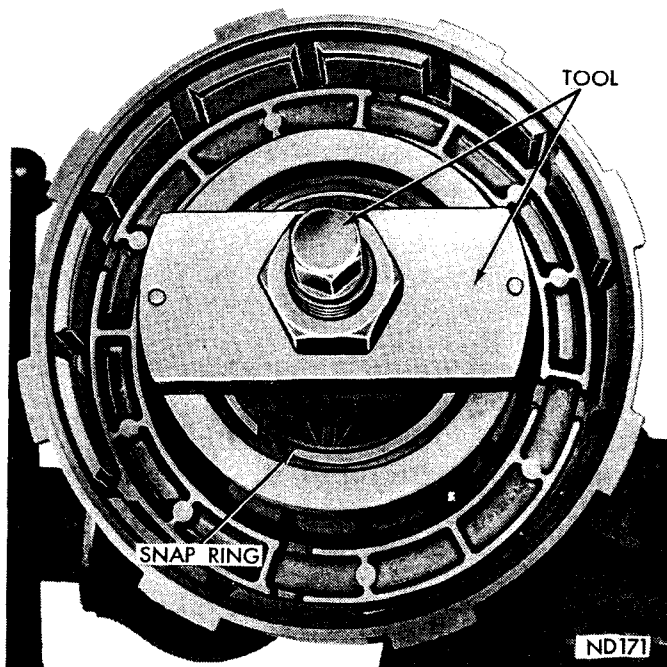


Fig. 31—Removing or Installing Front Clutch Spring Retainer Snap Ring

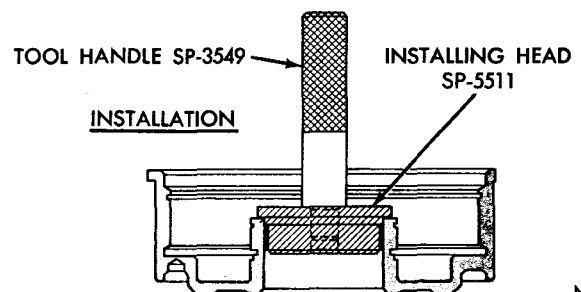
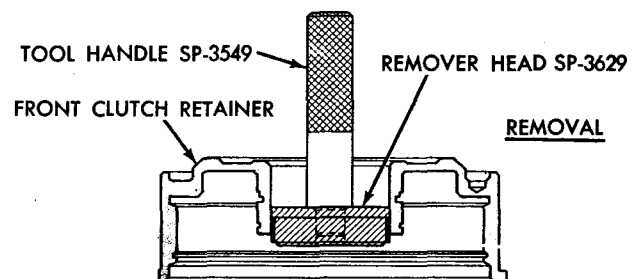
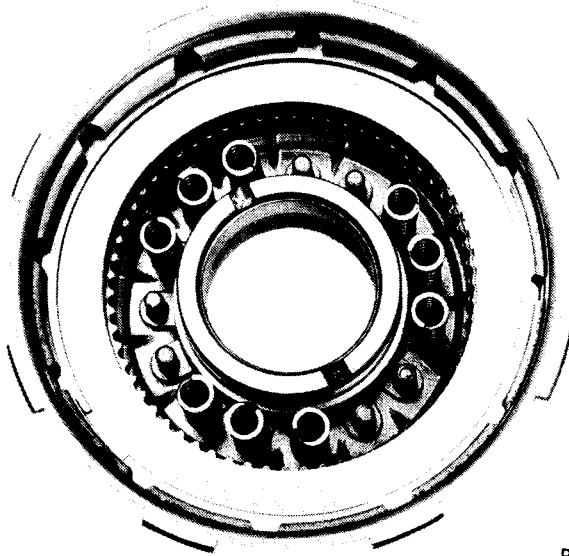


Fig. 32—Replacing Front Clutch Retainer Bushing

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**Fig. 33—Front Clutch Spring Location (9 Springs)**

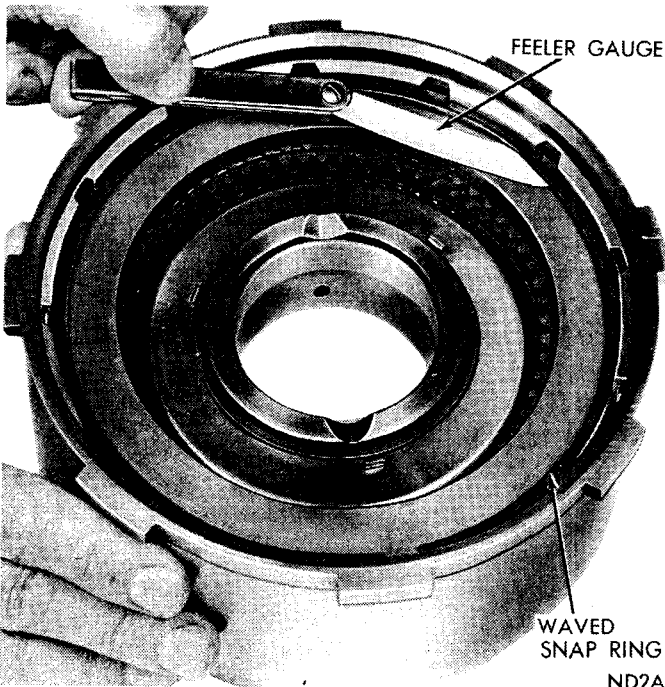
(6) With front clutch completely assembled, push downward on pressure plate and insert a feeler gauge between pressure plate and snap ring (Fig. 34). The maximum clearance should be .088" to .145 inch.

## REAR CLUTCH

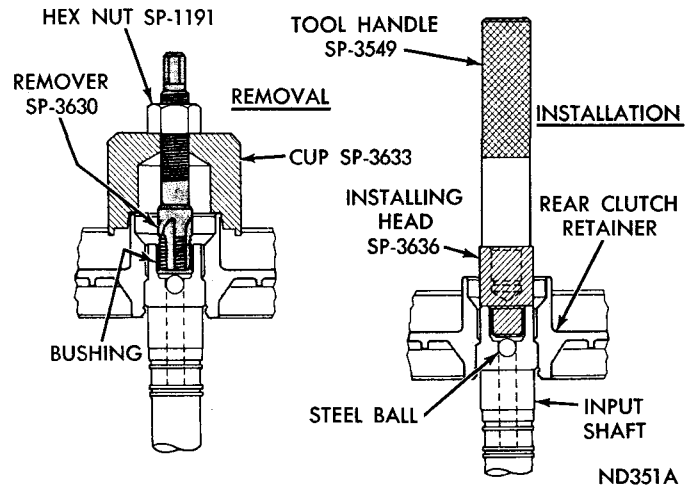
### Disassembly

Figure 36 shows a disassembled view of the rear clutch assembly.

(1) Remove large selective snap ring that secures pressure plate in clutch retainer. Lift pressure plate, clutch plates, and inner pressure plate out of the retainer.



**Fig. 34—Measuring Front Clutch Plate Clearance**



**Fig. 35—Replacing Input Shaft Bushing**

(2) Carefully pry one end of wave spring out of its groove in clutch retainer, then remove wave spring, spacer ring and clutch piston spring.

(3) Invert clutch piston retainer assembly and bump it on a wood block to remove piston. Remove seals from the piston.

(4) If necessary, remove snap ring and press input shaft from clutch piston retainer.

### Inspection

Inspect facing material on all driving discs. Replace discs that are charred, glazed or heavily pitted. Discs should also be replaced if they show evidence of material flaking off or if facing material can be scraped off easily. Inspect driving disc spines for wear or other damage. Inspect steel plate and pressure plate surface for burning, scoring or damaged driving lugs. Replace if necessary.

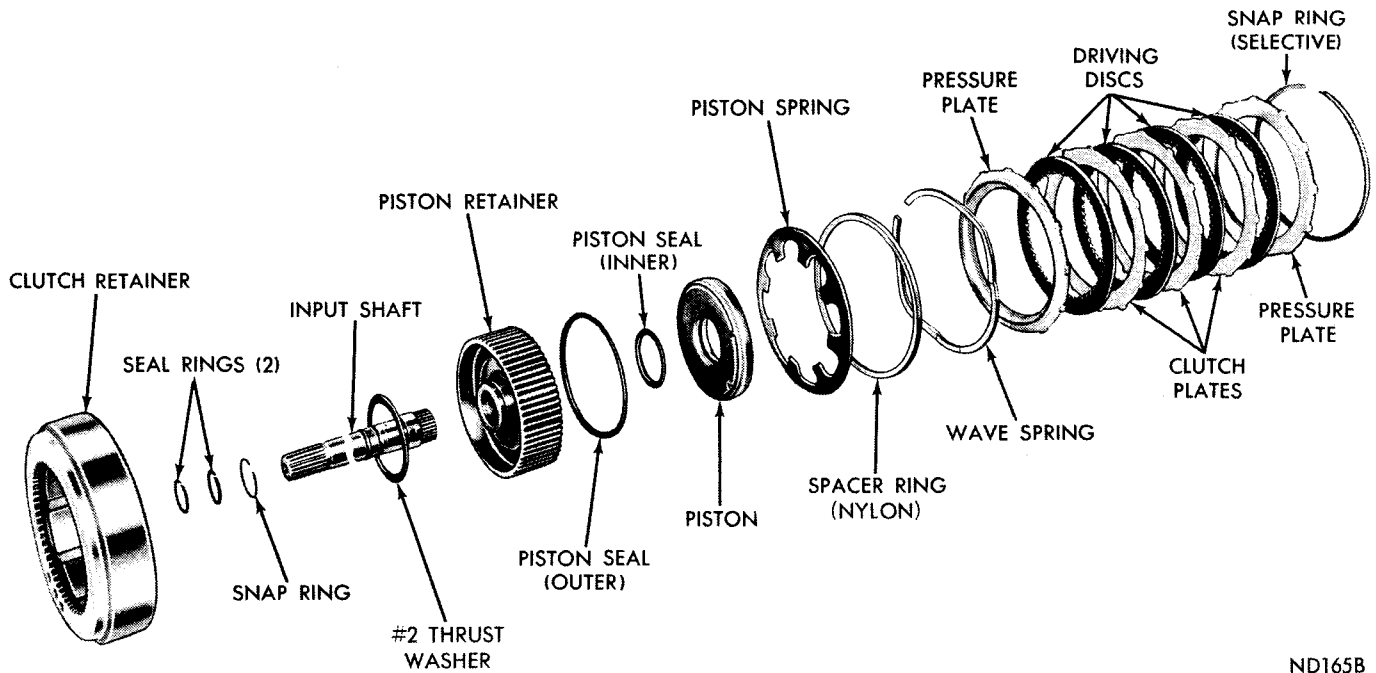
Inspect steel plate lug grooves in clutch retainer for smooth surfaces, plates must travel freely in the grooves. Note ball check in the piston, make sure ball moves freely. Inspect seal surfaces in clutch retainer for nicks or deep scratches, light scratches will not interfere with sealing of neoprene seals. Inspect neoprene seals for deterioration, wear, and hardness. Inspect piston spring, wave spring, and spacer for distortion or breakage.

Inspect interlocking seal rings (Fig. 36) on input shaft for wear or broken locks, make sure they turn freely in the grooves. Do not remove rings unless conditions warrant. Inspect bushing in input shaft for wear or scores. Inspect rear clutch to front clutch thrust washer for wear. Washer thickness should be .061 to .063 inch, replace if necessary.

### Input Shaft Bushing Replacement Only

(1) Clamp input shaft in a vise with soft jaws, being careful not to clamp on seal ring lands or bearing journals.

(2) Assemble remover Tool SP-3630, cup Tool SP-



ND165B

**Fig. 36—Rear Clutch Disassembled**

3633, and hex nut Tool SP-1191 (Fig. 35).

(3) With cup held firmly against clutch piston retainer, thread remover into bushing as far as possible by hand.

(4) Using a wrench, screw remover into bushing 3 to 4 additional turns to firmly engage threads in the bushing.

(5) Turn hex nut down against cup to pull bushing from input shaft.

(6) Thoroughly clean input shaft to remove chips made by remover threads. Make certain small lubrication hole next to ball in end of shaft is not plugged with chips. Be sure no chips are lodged next to the steel ball.

(7) Slide a new bushing on installing head Tool SP-3636 and start them in the bore of input shaft.

(8) Stand input shaft upright on a clean smooth surface and install handle Tool SP-3549 in the installing head (Fig. 35). Drive bushing into shaft until tool bottoms.

(9) Thoroughly clean input shaft and clutch piston retainer before assembly and installation.

### Assembly

(1) If removed, press input shaft into clutch piston retainer and install snap ring.

(2) Lubricate and install inner and outer seal rings on clutch piston. Make sure lip of seals face toward head of clutch retainer, and are properly seated in piston grooves (Fig. 36).

(3) Place piston assembly in retainer and, with a twisting motion, seat piston in bottom of the retainer.

(4) Position clutch retainer over piston retainer

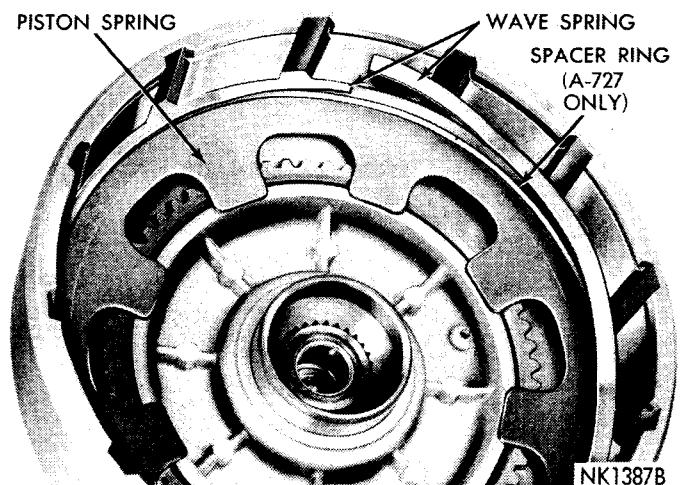
splines and support the assembly so clutch retainer remains in place.

(5) Place clutch piston spring and spacer ring on top of piston in clutch retainer, make sure spring and spacer ring are positioned in the retainer recess. Start one end of wave spring in retainer groove (Fig. 37), then progressively push or tap spring into place making sure it is fully seated in the groove.

(6) Install inner pressure plate in clutch retainer with raised portion of plate resting on the spring.

(7) Lubricate all clutch plates, install one lined plate followed by a steel plate until all plates are installed. Install outer pressure plate and selective snap ring.

(8) Measure rear clutch plate clearance by having



NK1387B

**Fig. 37—Installing Rear Clutch Spring, Spacer Ring and Wave Spring**

an assistant press downward firmly on outer pressure plate, then insert a feeler gauge between the plate and snap ring (Fig. 38). The clearance should be between .025 to .045 inch. If not, install a snap ring of proper thickness to obtain specified clearance. Low limit clearance is desirable. **Rear clutch plate clearance is very important in obtaining proper clutch operation. The clearance can be adjusted by the use of various thickness outer snap rings. Snap rings are available in .060, .074, .088 and .106 inch thickness.**

## PLANETARY GEAR TRAIN

### End Play

Measure end play of planetary gear assemblies, sun gear and driving shell before removing these parts from intermediate shaft. With assembly in an unright position, push rear annulus gear support downward on intermediate shaft. Insert a feeler gauge between rear annulus gear support hub and shoulder on intermediate shaft (Fig. 40). **The clearance should be .010 to .025 inch.** If clearance exceeds specifications, replace thrust washers and/or necessary parts.

### Disassembly

- (1) Remove thrust washer from forward end of intermediate shaft.
- (2) Remove selective snap ring from forward end of intermediate shaft, then slide front planetary assembly off the shaft.
- (3) Slide front annulus gear off planetary gear set. Remove thrust washer from rear side of planetary gear set.

(4) Slide sun gear, driving shell and rear planetary assembly off intermediate shaft.

(5) Lift sun gear and driving shell off rear planetary gear assembly. Remove thrust washer from inside the driving shell. Remove snap ring and steel washer from sun gear (rear side of driving shell) and slide sun gear out of the shell. Remove front snap ring from sun gear if necessary. Note that front end of sun gear is longer than rear.

(6) Remove thrust washer from forward side of rear planetary gear assembly, remove planetary gear set and thrust plate from rear annulus gear.

### Inspection

Inspect bearing surfaces on output shaft for nicks, burrs, scores or other damage. Light scratches, small nicks or burrs can be removed with crocus cloth or a fine stone. Make sure all oil passages in shaft are open and clean.

Inspect bushings in sun gear for wear or scores, replace sun gear assembly if bushings are damaged. Inspect all thrust washers for wear and scores, replace if damaged or worn below specifications. Inspect thrust faces of planetary gear carriers for wear, scores or other damage, replace as required. Inspect planetary gear carrier for cracks and pinions for broken or worn gear teeth and for broken pinion shaft lock pins. Inspect annulus gear and driving gear teeth for damage. Replace distorted lock rings.

### Assembly

Refer to Figure 39 for parts identification.

(1) Install rear annulus gear on the intermediate shaft. Apply a thin coat of grease on thrust plate, place it on the shaft and in the annulus gear making sure teeth are over the shaft splines.

(2) Position rear planetary gear assembly in the rear annulus gear. Place thrust washer on front side of planetary gear assembly.

(3) Install snap ring in front groove of sun gear (long end of gear). Insert sun gear through front side of driving shell, install rear steel washer and snap ring.

(4) Carefully slide driving shell and sun gear assembly on intermediate shaft, engaging sun gear teeth with rear planetary pinion teeth. Place thrust washer inside the front driving shell.

(5) Place thrust washer on rear hub of front planetary gear set, then slide assembly into front annulus gear.

(6) Carefully work front planetary and annulus gear assembly on output shaft, meshing planetary pinions with the sun gear teeth.

(7) With all components properly positioned, install selective snap ring on front end of intermediate shaft. Remeasure end play of the assembly. **The clearance can be adjusted by the use of various thickness snap**

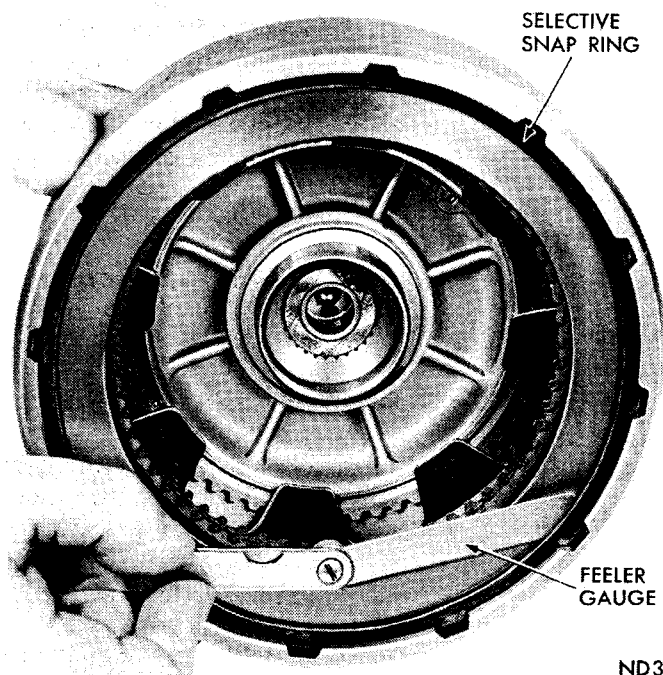
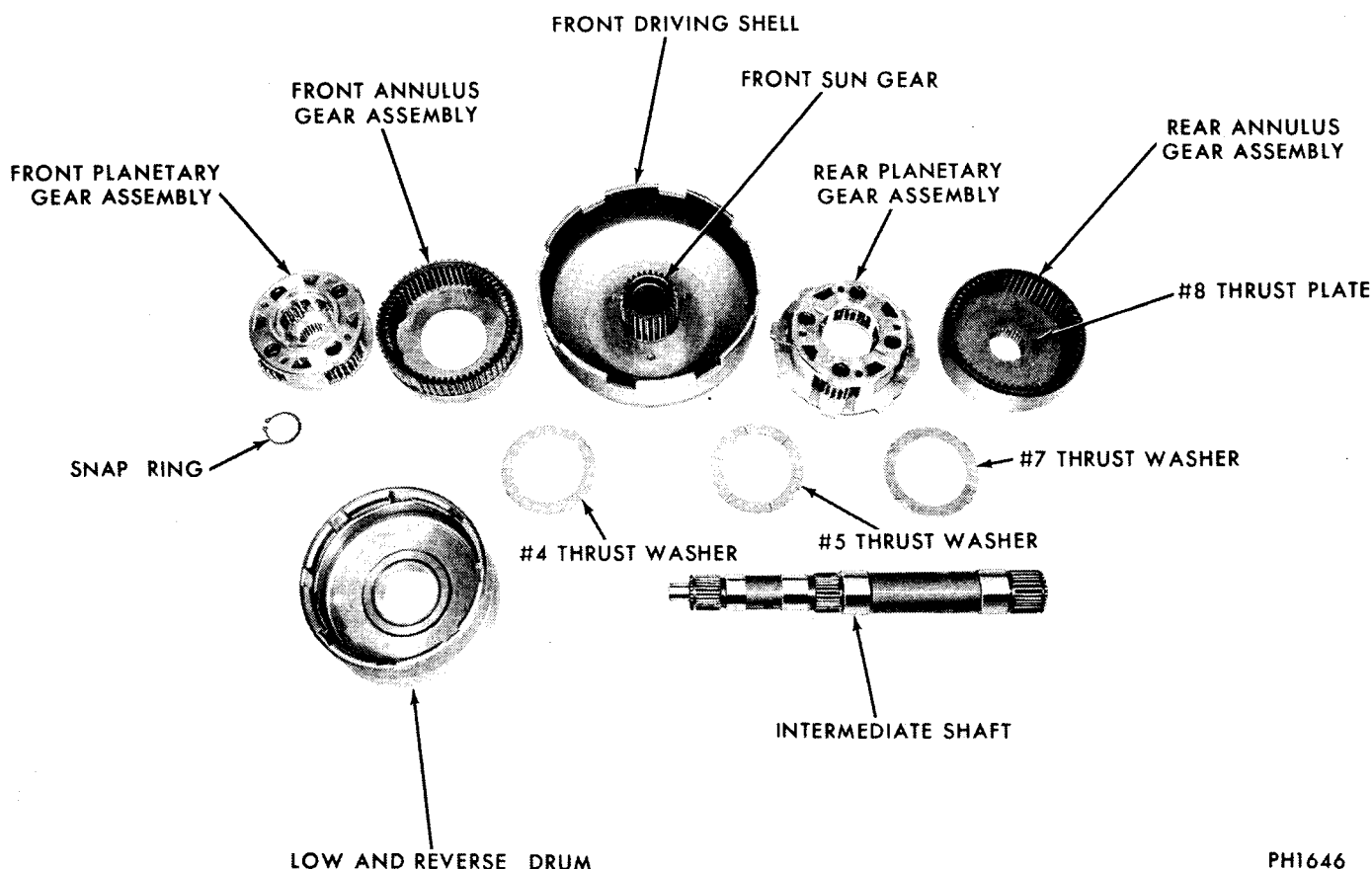


Fig. 38—Measuring Rear Clutch Plate Clearance



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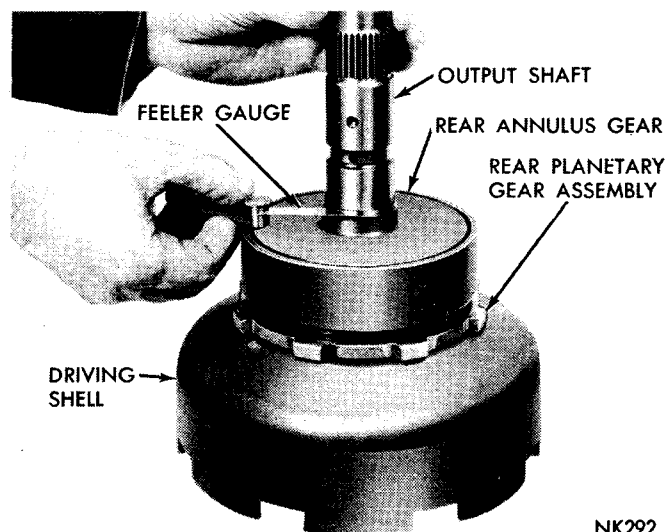
**Fig. 39—Front Planetary Gear Train and Intermediate Shaft Disassembled**

rings. Snap rings are available in .048, .055, and .062 inch thickness.

## TRANSMISSION COMPOUNDER ADAPTER

### Installation

(1) Before installing the compounder adapter, blow out all air passages with dry compressed air, then install adapter gasket to the transmission case. Install



NK292

**Fig. 40—Measuring End Play of Planetary Gear Train**

adapter and the attaching screws. Tighten the four 5/16 inch screws to 17 foot-pounds torque and the six 3/8 inch screws to 30 foot-pounds torque (Fig. 14).

## FRONT OVERRUNNING CLUTCH

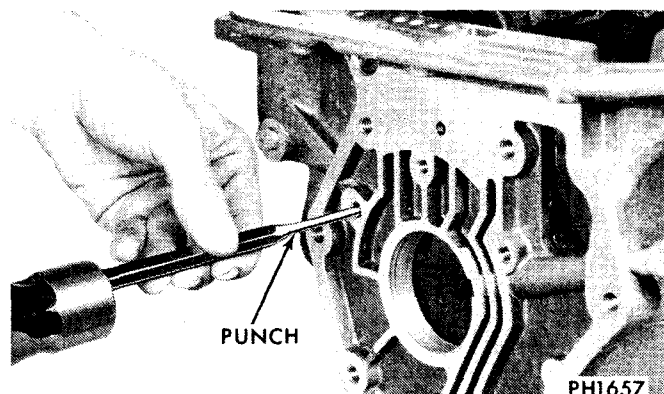
### Inspection

Inspect clutch rollers for smooth round surfaces, they must be free of flat spots and chipped edges. Inspect roller contacting surfaces in the cam and race for brinnelling. Inspect roller springs for distortion, wear or other damage. Inspect cam set screw for tightness. If loose, tighten and restake the case around the screw.

### Front Overrunning Clutch Cam Replacement

If overrunning clutch cam and/or roller spring retainer are found damaged, replace cam and spring retainer in the following manner:

- (1) Remove set screw from the case below clutch cam.
- (2) Insert a punch through bolt holes and drive cam from the case (Fig. 41). Alternate punch from one bolt hole to another so cam will be driven evenly from the case.
- (3) Clean all burrs and chips from cam area in the case.
- (4) Place spring retainer on the cam, making sure retainer lugs snap firmly into notches on the cam.



**Fig. 41—Removing Front Overrunning Clutch Cam**

(5) Position cam in the case with cam serrations aligned with those in the case. Tap cam **evenly** into the case as far as possible with a soft mallet.

(6) Install Tool C-3863-A and Adapter SP-5124 as shown in Figure 42, tighten nut on tool to seat cam into the case. Make sure cam is firmly bottomed, then install cam retaining set screw. Stake the case around set screw to prevent it coming loose.

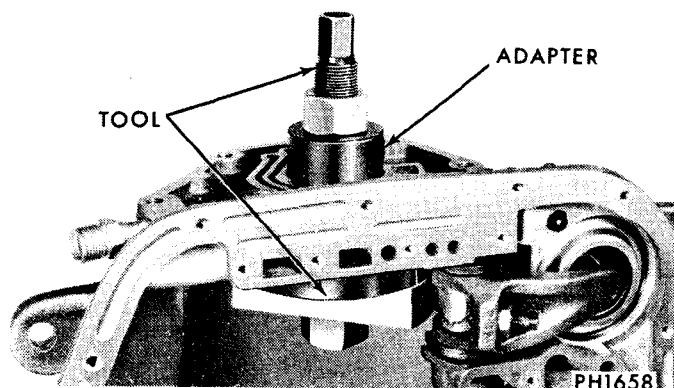
(7) Remove cam installing tool. Stake the case around cam in twelve places with a blunt chisel (Fig. 43).

## KICKDOWN SERVO AND BAND

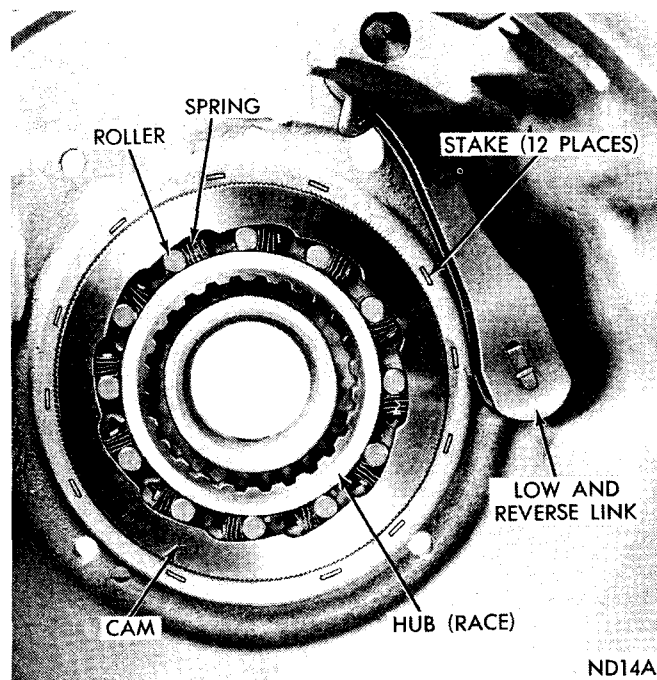
### Inspection (Fig. 44 or 47)

Inspect piston and guide seal rings for wear, and make sure they turn freely in the grooves. It is not necessary to remove seal rings unless conditions warrant. Inspect piston for nicks, burrs, scores and wear. Inspect piston bore in the case for scores or other damage. Inspect fit of guide on piston rod. Inspect piston spring for distortion.

Inspect band lining for wear and bond of lining to the band. Inspect lining for black burn marks, glazing, non-uniform wear pattern and flaking. If lining is worn so grooves are not visible at ends or any portion of the bands, replace the band. Inspect band for distortion or cracked ends.



**Fig. 42—Installing Front Overrunning Clutch Cam**



**Fig. 43—Overrunning Clutch, Low and Reverse Band Link**

## LOW—REVERSE SERVO AND BAND (Fig. 45 and 46)

### Disassembly

(1) Remove snap ring from piston and remove the piston plug. (Fig. 45).

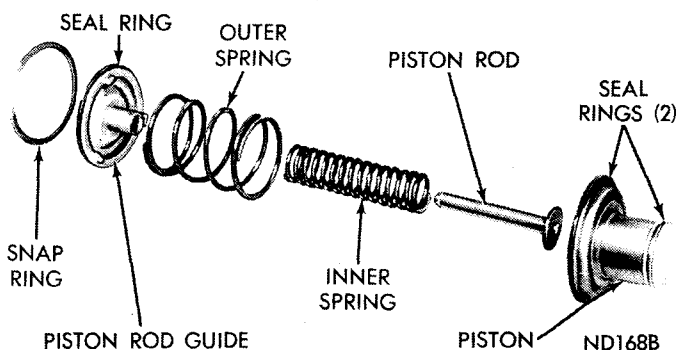
### Inspection

Inspect seal for deterioration, wear and hardness. Inspect piston and piston plug for nicks, burrs, scores and wear; piston plug must operate freely in the piston. Inspect piston bore in the case for scores or other damage. Inspect spring for distortion.

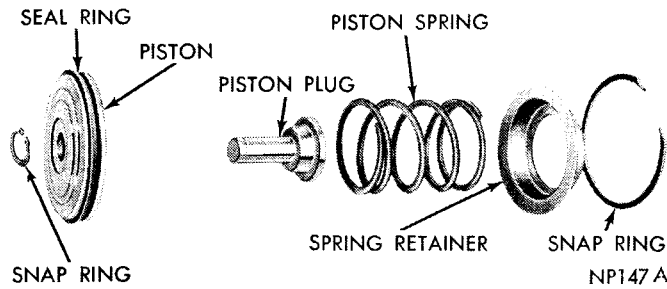
Inspect band lining for wear and bond of lining to the band. If lining is worn so grooves are not visible at ends or any portion of the band, replace the band. Inspect band for distortion or cracked ends.

### Assembly

(1) Lubricate and insert piston plug in the piston, and secure with snap ring.



**Fig. 44—Kickdown Servo—Disassembled**



**Fig. 45—Low-Reverse Servo—Disassembled ASSEMBLY—SUBASSEMBLY INSTALLATION**

The assembly procedures given here include installation of sub-assemblies in the transmission case and adjusting drive train end play. Do not use force to assemble mating parts. If parts do not assemble freely investigate the cause, and correct the trouble before proceeding with assembly procedures. Always use new gaskets during assembly operations. Use only "Dexron" type Automatic Transmission Fluid to lubricate transmission parts during assembly.

#### Overrunning Clutch

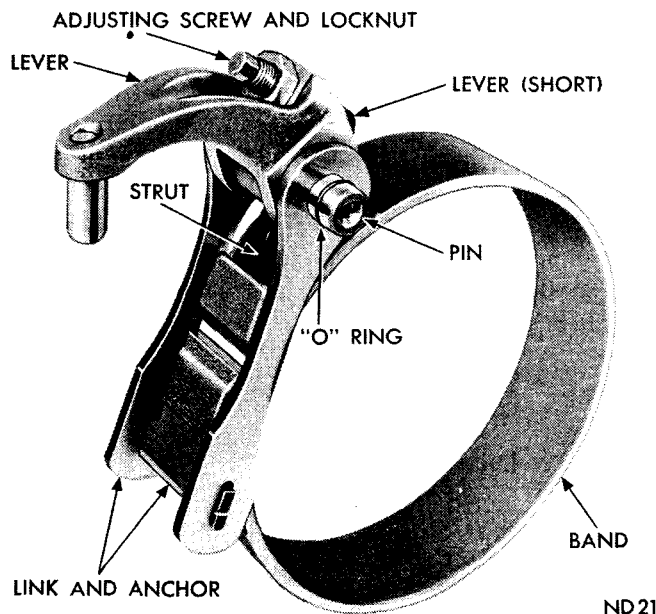
(1) Insert clutch hub inside the cam. Install overrunning clutch rollers and springs exactly as shown in Figure 43.

#### Low Reverse Servo and Band

(1) Carefully work servo piston assembly into the case with a twisting motion. Place spring, retainer and snap ring over the piston (Fig. 45).

(2) Compress low and reverse servo piston spring by using engine valve spring compressor Tool C-3422-A, then install snap ring.

(3) Position rear band in the case, install short



**Fig. 46—Low-Reverse Band and Linkage**

strut, then connect long link and anchor to the band (Fig. 46). Screw in band adjuster just enough to hold strut in place. Install low-reverse drum. Be sure long link and anchor assembly is installed as shown in Figure 46, to provide running clearance for the low and reverse drum.

#### Kickdown Servo (Fig. 44)

(1) Carefully push servo piston into the case bore. Install piston rod, springs and guide.

(2) Compress kickdown servo springs by using engine valve spring compressor Tool C-3422-A, then install snap ring.

#### Planetary Gear Assemblies, Sun Gear, and Driving Shell

(1) While supporting assembly in the case, carefully work assembly rearward, engaging rear planetary carrier lugs into low-reverse drum slots.

**Be very careful not to damage ground surfaces on intermediate shaft during installation.**

#### Front and Rear Clutch Assemblies

(1) Apply a coat of grease on input to intermediate shaft thrust washer and install thrust washer on rear end of the input shaft. The three tabs must seat properly in the rear clutch piston retainer.

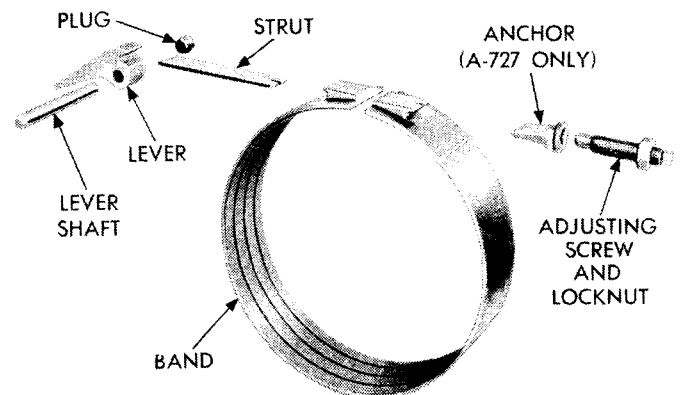
(2) Align front clutch plate inner splines, and place assembly in position on the rear clutch. Make sure front clutch plate splines are fully engaged on rear clutch splines.

(3) Align rear clutch plate inner splines, grasp input shaft and install the two clutch assemblies into transmission case.

(4) Carefully work clutch assemblies in a circular motion to engage rear clutch splines over splines of front annulus gear. Make sure front clutch drive lugs are fully engaged in slots in the driving shell.

#### Front Band

Figure 47 shows a disassembled view of the kickdown band assembly.



**Fig. 47—Kickdown Band and Linkage**

- (1) Slide band over front clutch assembly.
- (2) Install band strut, screw in adjuster just enough to hold strut and anchor in place.

### #1 Thrust Washer

The #1 thrust washer is not selective. Always use thinnest thrust washer. Input shaft end play is controlled by the thickness of the thrust washer between the output shaft and intermediate shaft (see Fig. 21).

### Oil Pump and Reaction Shaft Support

If difficulty was encountered in removing pump assembly due to an exceptionally tight fit in the case, it may be necessary to expand the case with heat during pump installation. Using a suitable heat lamp, heat the case in area of pump for a few minutes prior to installing pump and reaction shaft support assembly.

- (1) Screw two pilot studs, Tool C-3288-B in pump opening in the case (Fig. 48). Install a new gasket over the pilot studs.

- (2) Place a new rubber seal ring in the groove on outer flange of pump housing. Make sure seal ring is not twisted. Coat seal ring with grease for easy installation.

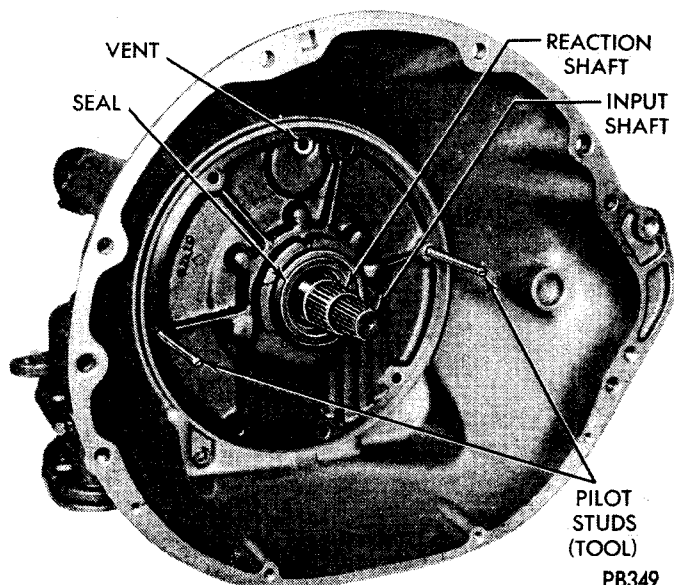
- (3) Install pump assembly in the case; tap it lightly with a soft mallet, if necessary. Install four pump body bolts. Remove pilot studs, install remaining bolts and snug down evenly.

- (4) Tighten bolts to 175 inch-pounds.

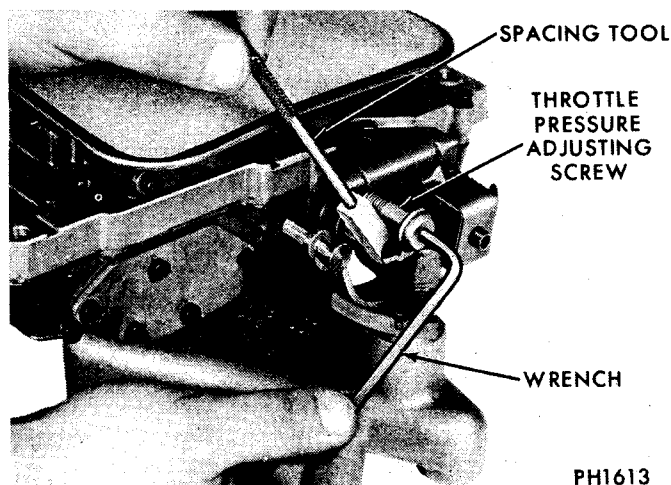
**Be sure the #2 thrust washer, front clutch discs, and rear clutch discs are in proper location.**

- (5) Push the intermediate shaft forward to reduce input shaft end play to zero.

- (6) Insert and wedge a flat screw driver between low-reverse drum and transmission case, moving the



**Fig. 48—Installing Pump and Reaction Shaft Support Assembly**



**Fig. 49—Throttle Pressure Adjustment**

low-reverse drum forward as far as possible.

- (7) Tighten the rear (low-reverse) band adjusting screw until band is tight on the low-reverse drum. Remove screw driver.

PROCEED to "COMPOUNDER assembly."

### THROTTLE PRESSURE SETTING

- (1) NOTE: Throttle pressures cannot be tested accurately if a malfunction is evident. Measure the throttle lever adjustment as follows:

- (a) Insert gauge block of Tool C-4233 between the throttle lever cam and kickdown valve (Fig. 49).

- (b) Push in on tool, compressing the kickdown valve against its spring so throttle valve is completely bottomed inside of the valve body.

- (c) As force is being applied to compress the spring, lightly tighten the throttle lever stop screw against the throttle lever tang with throttle lever cam touching the tool block and throttle valve bottomed. **Be sure the adjustment is made with spring fully compressed and valve bottomed in the valve body.**

- (d) Remove spacing tool.

- (2) Install valve body assembly. Install all screws finger tight, then tighten all screws to 100 inch-pounds.

- (3) Install oil filter. Install new oil pan gasket, oil pan and oil pan screws. Tighten screws to 150 inch-pounds.

### VALVE BODY AND ACCUMULATOR PISTON REMOVAL

- (1) Raise vehicle on a hoist.
- (2) Remove the drain plug from the transmission oil pan and allow transmission to drain.
- (3) Replace the drain plug. Tighten to 24 foot-pounds torque.
- (4) Remove the transmission oil pan.
- (5) Disconnect throttle and gearshift linkage from



levers on the transmission. Loosen clamp bolts and remove the levers.

(6) Remove Back-Up Light and Neutral Start Switch.

(7) Place a drain pan under transmission, then remove the hex-head valve body to transmission case bolts. Hold valve body in position while removing the bolts.

(8) Remove accumulator piston and spring from transmission case. Inspect piston for nicks, scores and wear. Inspect spring for distortion. Inspect rings for freedom in piston grooves and wear or breakage. Replace parts as required.

### Manual Lever Shaft Seal

(1) If valve body manual lever shaft seal requires replacement, drive it out of the case with a punch.

(2) Drive a new seal into the case with a 15/16 inch socket and hammer (Fig. 50).

**NOTE:** This seal can be replaced without removing the valve body from transmission by using a small screwdriver to pry seal out of its bore. Be careful not to scratch manual lever shaft or the seal bore in transmission.

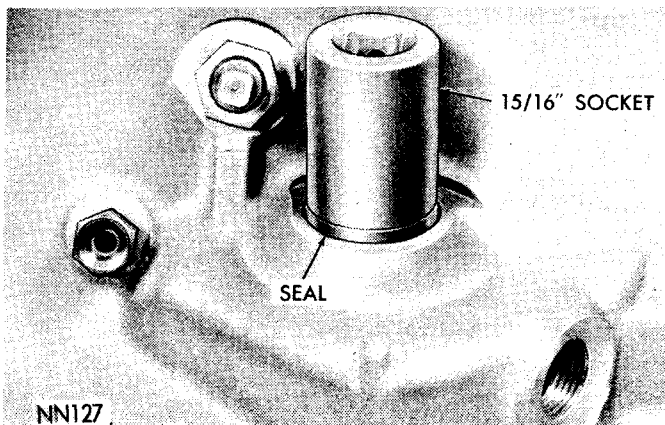
### VALVE BODY DISASSEMBLY (Fig. 1 and 2)

Do not clamp any portion of valve body or transfer plate in a vise. Any slight distortion of the aluminum body or transfer plate will result in sticking valves, excessive leakage or both. When removing or installing valves or plugs, slide them in or out carefully. Do not use force.

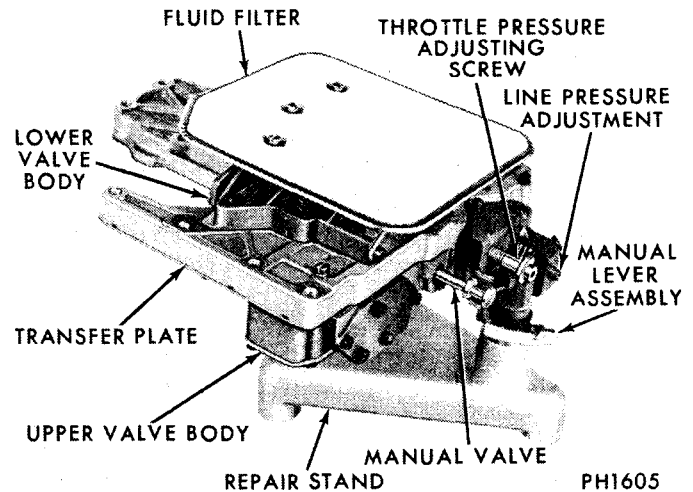
(1) Place valve body assembly on repair stand, Tool C-3749. Remove three screws from fluid filter and lift off the filter (Fig. 1).

(2) Remove lower valve body and steel plate from transfer plate. Observe the two (2) steel balls in the transfer plate for proper location (Fig. 3).

Tag all springs as they are removed for reassembly identification.



**Fig. 50—Installing Valve Body Manual Lever Shaft Oil Seal**



**Fig. 1—Valve Body Assembly in Stand**

(3) Remove flat end plate, 3-4 shift valve governor plug, 1-2 governor modulator valve, and 1-2 governor modulator valve spring (Fig. 4).

(4) From the other side of the lower valve body, remove the end cover.

(5) Remove part throttle downshift plug, 3-4 shift valve spring, and 3-4 shift valve (Fig. 5).

(6) Remove remaining transfer plate retaining screws and top and bottom spring retainer mounting screws.

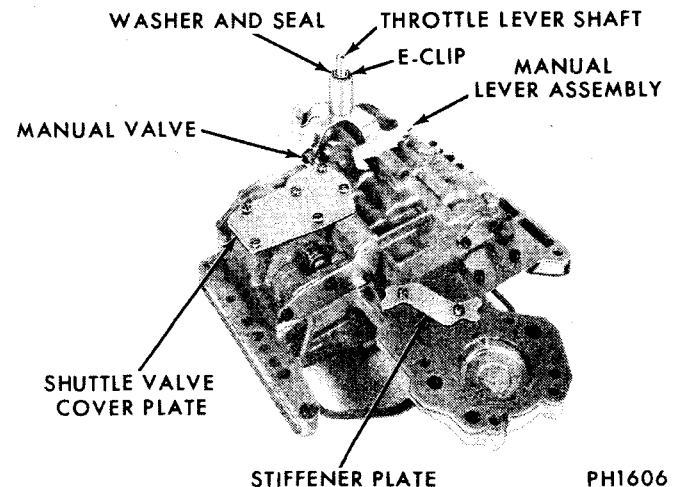
(7) Lift off transfer plate and separator plate assembly. Remove (4) screws from stiffener and separator plate and separate parts for cleaning (Fig. 6).

(8) Observe for proper location and remove the six (6) balls from valve body (Fig. 7).

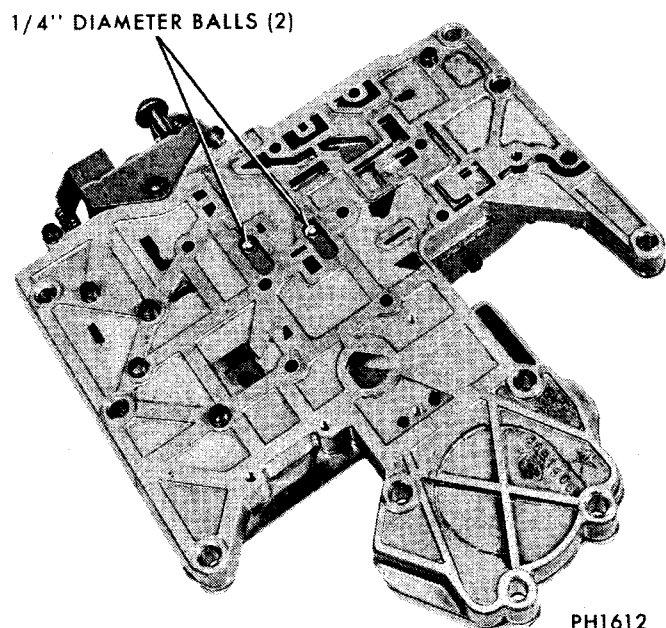
### Shuttle Valve and Governor Plugs (Fig. 8)

(1) Turn valve body over and remove shuttle valve cover plate.

(2) Remove governor plug end plate and slide out the shuttle valve throttle plug and spring, the 1-2



**Fig. 2—Valve Body Controls**



**Fig. 3—Steel Ball (2) Location**

shift valve governor plug and the 2-3 shift valve governor plug.

(3) Remove shuttle valve "E" clip and slide shuttle valve out of its bore. Also remove the secondary spring and guides which were retained by "E" clip.

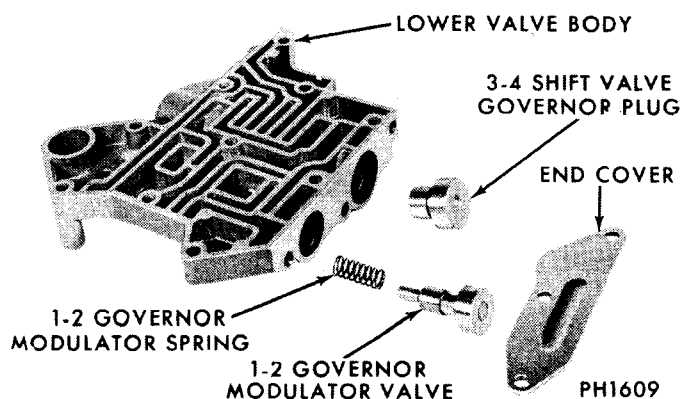
#### **Pressure Regulators and Manual Control**

(1) Hold spring retainer firmly against spring force while removing last retaining screw from side of valve body.

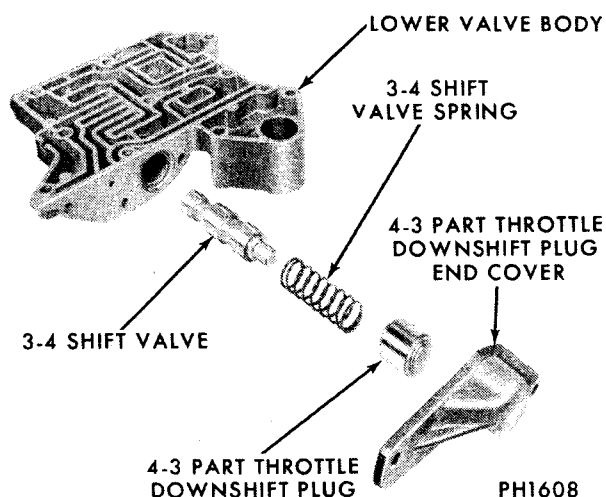
(2) Remove spring retainer, with line and throttle pressure adjusting screws (do not disturb setting) and the line pressure and torque converter regulator springs.

(3) Slide torque converter and line pressure valves out of their bores.

(4) Remove E-Clip and washer from throttle lever shaft. Remove any burrs from shaft, then while holding manual lever detent ball and spring in their bore with Tool C-3765 or similar tool, slide manual lever off the throttle shaft. Remove the detent ball and spring.



**Fig. 4—Governor Modulator and 3-4 Governor Plug**



**Fig. 5—3-4 Shift Valve and Downshift Plug**

(5) Slide manual valve out of its bore.

(6) Slide out the kickdown detent, kickdown valve, throttle valve spring and the throttle valve.

#### **Shift Valves and Regulator Valve Pressure Sensing Plugs**

(1) Remove the line pressure regulator valve end plate (Fig. 8) and slide out the regulator valve sleeve, line pressure plug, and throttle pressure plug.

(2) Remove shift valve end plate.

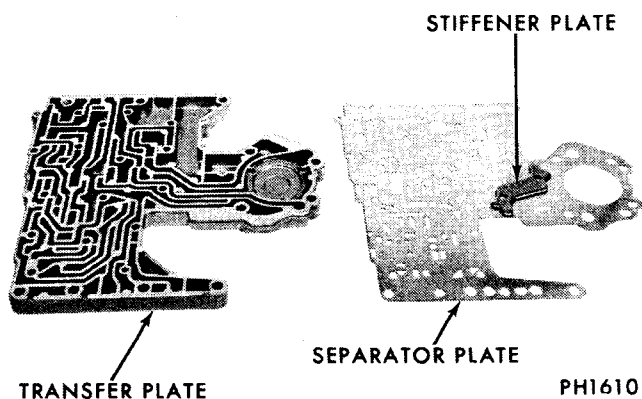
(3) Remove the three springs, two shift valves and 1-2 shift control valve from the valve body.

#### **Cleaning and Inspection**

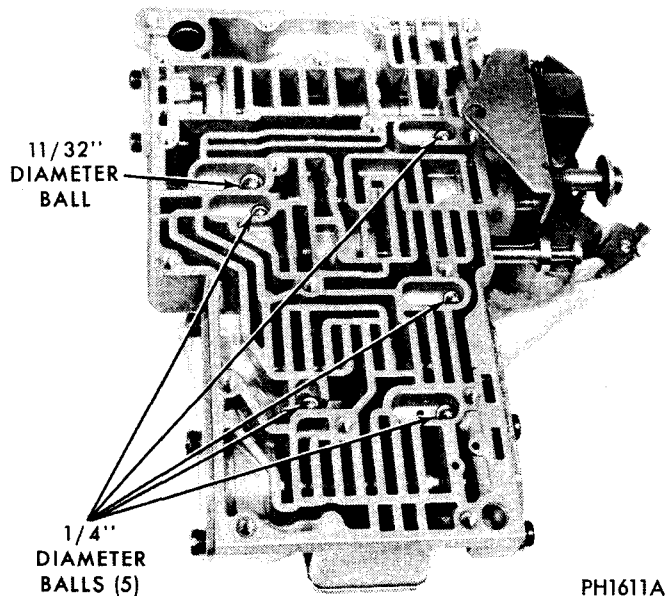
Allow all parts to soak a few minutes in a suitable clean solvent. Wash thoroughly and blow dry with compressed air. Make sure all passages are clean and free from obstructions.

Inspect manual and throttle valve operating levers and shafts for being bent, worn or loose. If a lever is loose on its shaft, it may be **silver soldered** only, or lever and shaft assembly should be replaced. **Do not attempt to straighten bent levers.**

Inspect all mating surfaces for burrs, nicks and scratches. Minor blemishes may be removed with crocus cloth, using only a very light pressure. Using a



**Fig. 6—Transfer and Separator Plates**



**Fig. 7—Steel Ball Locations**

straight edge, inspect all mating surfaces for warpage or distortion. Slight distortion may be corrected, using a surface plate. Make sure all metering holes in steel plate and valve body are open. Using a pen light, inspect bores in valve body for scores, scratches, pits and irregularities.

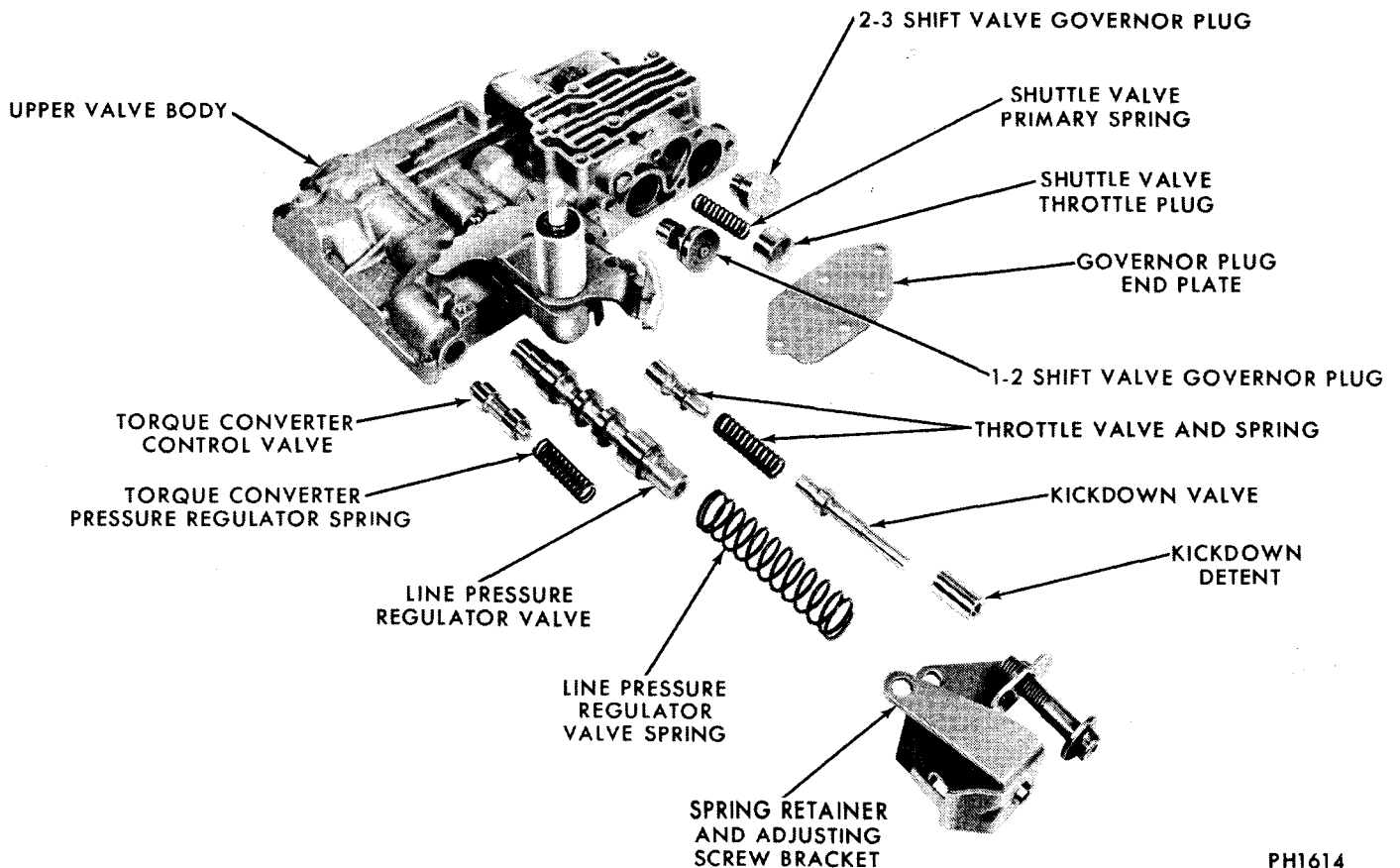
Inspect all valve springs for distortion and collapsed coils. Inspect all valves and plugs for burrs, nicks and scores. Small nicks and scores may be removed with crocus cloth, providing extreme care is taken not to round off sharp edges. The sharpness of these edges is vitally important because it prevents foreign matter for lodging between valve and valve body, thus reducing possibility of sticking. Inspect all valves and plugs for freedom of operation in valve body bores.

When bores, valves and plugs are clean and dry, the valves and plugs should fall freely in the bores. The valve body bores do not change dimensionally with use. Therefore, a valve body that was functioning properly when vehicle was new, will operate correctly if it is properly and thoroughly cleaned. There is no need to replace valve body unless it is damaged in handling.

## VALVE BODY REASSEMBLY

### Shift Valves and Regulator Valve Pressure Sensing Plugs (Fig. 9)

- (1) Slide shift valves, 1-2 shift control valve and springs into proper valve body bores.
- (2) Install end plate and tighten screws to 28 inch-pounds.
- (3) Install throttle pressure plug, line pressure



**Fig. 8—Pressure Regulators and Governor Plugs**

plug and sleeve, then fasten end plate to valve body. Torque to 28 inch-pounds.

### Pressure Regulators and Manual Control (Fig. 8)

(1) Install throttle valve, throttle valve spring, kickdown valve and kickdown detent.

(2) Slide manual valve into its bore.

(3) Install throttle lever and shaft on valve body. Insert detent spring and ball in its bore in valve body. Depress ball and spring with Tool C-3765 (Fig. 10) or similar tool and slide manual lever over throttle shaft so that it engages manual valve and detent ball. Install seal, retaining washer and E-clip on throttle shaft.

(4) Insert torque converter control valve and spring into valve body.

(5) Insert line pressure regulator valve and spring into valve body.

(6) Install pressure adjusting screw and bracket assembly on the springs and fasten with one screw for now. Use screw which goes into side of valve body. This screw is to be tightened first, after starting the top and bottom screws in a later step.

### Shuttle Valve and Governor Plugs (Fig. 8)

(1) Place 1-2 and 2-3 shift valve governor plugs in their respective bores.

(2) Install shuttle valve and hold it in bore with index finger while installing on the other end of it the secondary spring with guides and retaining "E" clip.

(3) Install primary shuttle valve spring and throttle plug.

(4) Install governor plug end plate and tighten the five retaining screws to 28 inch-pounds.

(5) Install shuttle valve cover plate and tighten the six retaining screws to 28 inch-pounds.

### LOWER VALVE BODY (Fig. 11)

(1) Install 3-4 shift valve and downshift valve spring. Install part throttle downshift plug into end cover. Install end cover and tighten screws to 28 inch-pounds.

(2) Install 1-2 governor modulator valve spring, 1-2 governor modulator valve, and 3-4 shift valve governor plug. Install end plate and tighten screws to 28 inch-pounds.

### Ball Valves, Transfer Plate and Filter

(1) Install the six balls in the valve body as shown in (Fig. 7).

(2) Place separator plate on the transfer plate (Fig. 6). Install stiffener plate and retaining screws exactly as shown. Make sure all bolt holes are aligned, then tighten two transfer plate screws and two stiffener plate screws to 28 inch-pounds.

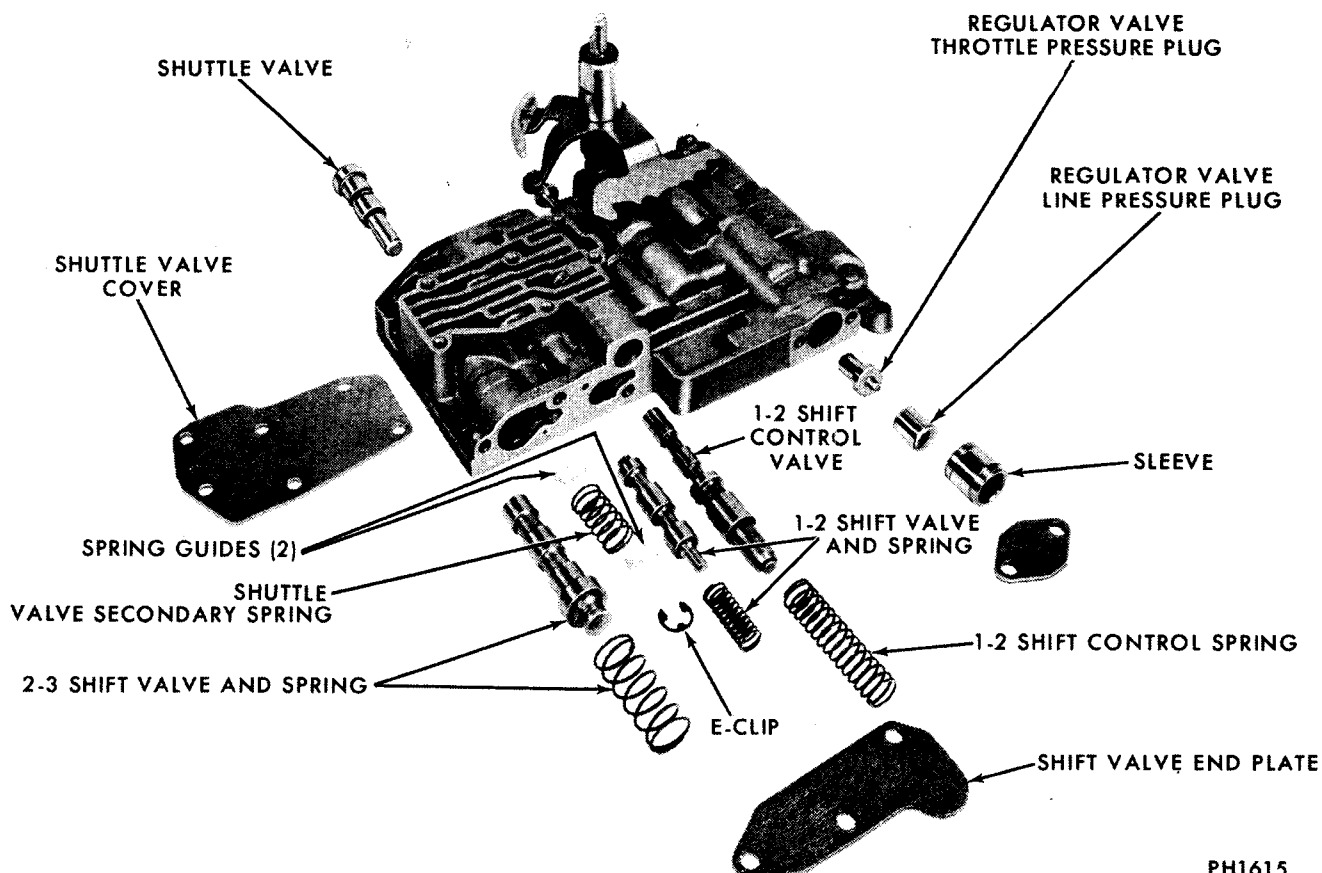
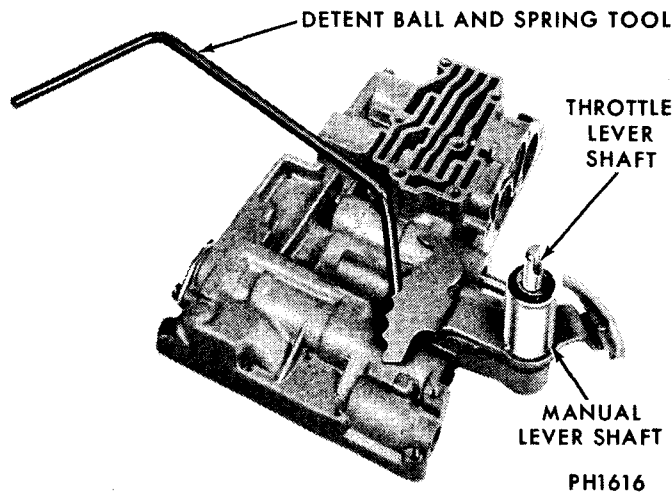


Fig. 9—Shift Valves and Pressure Regulator Valve Plugs



**Fig. 10—Installing Detent Ball, Spring and Control Levers**

(3) Place transfer plate assembly on valve body. Be careful to align the spring loaded ball as the shorter screws are installed (3 longer screws are for oil filter).

(4) Install two steel balls in transfer plate (Fig. 3). Place steel plate and lower valve body on transfer plate.

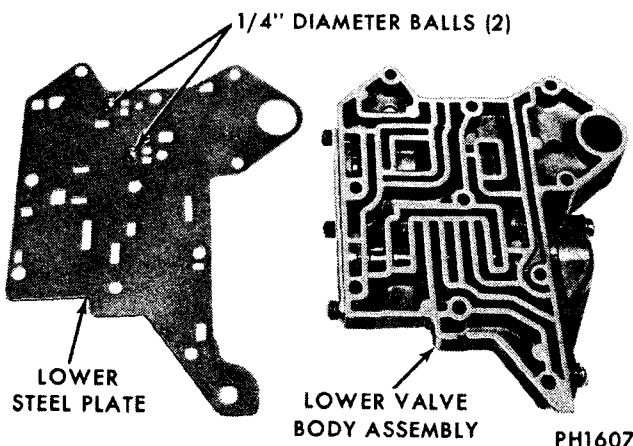
(5) Install eight screws attaching lower valve body to transfer plate and tighten screws, from center outward, to 35 inch-pounds.

(6) Install oil filter with the three long screws and tighten to 35 inch-pounds.

(7) Using Throttle Pressure Adjusting Tool C-4233 (Fig. 12) inserted between the stamped bracket and the throttle cam, adjust the throttle pressure. However, if pressures were satisfactory prior to disassembly, use original settings.

### VALVE BODY AND ACCUMULATOR PISTON INSTALLATION

(1) Make sure Back-Up Light and Neutral Start Switch has been removed.



**Fig. 11—Lower Valve Body and Steel Plate**

(2) Install accumulator spring and piston in the transmission case.

(3) Place valve body manual lever in **low** position. Lift valve body into its approximate position, install retaining bolts finger tight.

(4) With neutral starting switch installed, place manual lever in the neutral position. Shift valve body if necessary to center neutral finger over the neutral switch plunger. Snug bolts down evenly, then tighten to 100 inch-pounds.

(5) Install gearshift lever and tighten clamp bolt. Check lever shaft for binding in the case by moving lever through all detent positions. If binding exists, loosen valve body bolts and re-align.

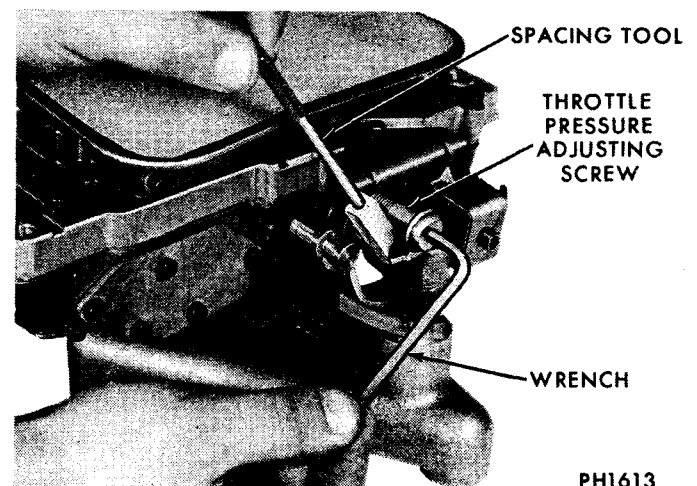
(6) Make sure throttle shaft seal is in place, then install flat washer, lever and tighten the clamp bolt. Connect throttle and gearshift linkage and adjust as required.

(7) Install oil pan, and a new gasket. Add transmission fluid to bring it up to proper level.

### ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils or equivalent. Essentially, this repair consists of drilling out the worn or damaged threads, tapping the hole with a special Heli-Coil or equivalent Tap, and installing a Heli-Coil or equivalent. Insert into the tapped hole. This brings the hole back to its original thread size.

The chart lists the threaded hole sizes which are used in the aluminum case and valve body, and the necessary tools and inserts for the repair of damaged or worn threads. Heli-Coil or equivalent tools and inserts are readily available from most automotive parts jobbers. Some thread drag may occur in screwing a bolt into the installed Heli-Coil or equivalent insert. Therefore, a torque reading should be taken of the thread drag with an inch-pound torque wrench and



**Fig. 12—Throttle Pressure Adjustment**

added to the specified bolt torque, so that all bolts securing a particular part will be tightened to the same torque.

## GOVERNOR ASSEMBLY

### Disassembly

(1) Cut off one end of each governor weight pin and remove pins, governor thrust cap, governor weights and springs.

(NOTE: Governor weights are interchangeable from side to side and need not be identified.)

(2) Remove governor valve from governor sleeve. Use care in not damaging valve.

### Inspect

(1) Wash all parts in cleaning solvent, air dry and blow out all passages.

(2) Inspect governor sleeve for nicks, burrs, scoring or galling.

(3) Check governor sleeve for free operation in bore of transmission case.

(4) Inspect governor valve for nicks, burrs, scoring or galling.

(5) Inspect governor valve for free operation in bore of governor sleeve.

(6) Inspect governor weights for free operation in their retainers.

(7) Check governor weight springs for distortion or damage.

(8) Check governor driven gear for looseness of governor sleeve, for nicks, burrs or damage. If replacement is necessary, follow replacement below.

### Replace Governor Driven Gear

To facilitate governor repair, a governor driven gear and weight pin are available for service use. The service package consists of a driven gear, governor weight retaining pins (2) and a governor gear retaining roll pin. Replacement of gear must be performed with care in the following manner:

(1) Drive out governor gear retaining roll pin, using a small punch.

(2) Support governor on 3/16 inch plates installed in exhaust slots of governor sleeve, place in arbor press and, with a long punch, press gear out of sleeve.

(3) Carefully clean governor sleeve of chips that remain from original gear installation.

(4) Support governor on 3/16 inch plates installed in exhaust slots of sleeve, position new gear in sleeve and, with a suitable socket, press gear into sleeve until nearly seated. Carefully remove any chips that may have shaved off gear hub and press gear in until it bottoms on shoulder.

(5) A new roll pin hole must be drilled through sleeve and gear. Locate hole position 90 degrees from existing hole, center punch and, while supporting governor, drill new hole through sleeve and gear, using a standard (1/8 inch) drill.

(6) Install new retaining roll pin.

(7) Wash governor assembly thoroughly to remove any chips that may have collected.

### Assembly

(1) Install governor valve in bore of governor sleeve, large end first.

(2) Install governor weights, springs and thrust cap on governor.

(NOTE: Lip of secondary weights must be over end of valve.)

(3) Align pin holes in thrust cap, governor weights, governor sleeve and install new pins. After installing, crimp both ends of pins to prevent their falling out.

(4) Check governor weight assemblies for free movement on pins.

(5) Check governor valve for free movement in governor sleeve.

(6) Suspending governor assembly by its driven gear (weights out), check valve opening at feed port. Opening must be a .020 inch minimum.

(7) Check governor valve opening at exhaust port while holding weights completely inward. Opening must be .020 inch minimum. If less than .020 inch minimum feed port or exhaust port is found, governor assembly must be replaced.

## SPECIFICATIONS MANUAL TRANSMISSIONS

Truck Model Designation	D100, D200	D100, D200	D100, D200 W100, W200	D100, D200, D300, D500, D600, S600, D700, S700 W100, W200, W300, W600,	D100, D200, D300, W100, W200, W300 (Extra Equip.)	D800 (Std. Equip.)
Type	Overdrive		Synchro-Shift	4-Speed Single P.T.O.	4-Speed Dual P.T.O.	5-Speed Dual P.T.O.
Model	Overdrive-4	A390	A230	435	445D	542
No. of Forward Speeds	4	3	3	4	4	5
Ratios in Transmission (to 1)						
5th						1.00
4th (Overdrive)	(0.71)			1.00	1.00	1.59
3rd	1.00	1.00	1.00	1.66	1.31	2.61
2nd	1.70	1.75	1.75	3.34	2.28	4.33
1st	3.09	2.99	3.02	6.68	4.56	7.24
Reverse			3.95	8.26	4.07	7.22
Power Take-off Location				Right Side	Both Sides	Both Sides
Type				6 Stud (S.A.E.)	6 Stud (S.A.E.)	6 Stud (S.A.E.)
Shift Lever	Floor Shift	Steering Column	Steering Column	On Trans.	On Trans.	On Trans.
Lubricant Capacity (Pts.) (U.S.)	7	3-1/2	4-1/4#	7	7-1/2	9
Imp. Measure (Pts.)	5-3/4	3	3-1/2	5-3/4	6	8.0

\*Club Cab only 5-1-4 Pts. 4-1/4 Imp. #Club Cab only 5 Pts.

Truck Model Designation	D800 (Std. Equip.)	D500, W600 D600, S600 D700, S700 (Extra Equip.)	D500, D600 (Extra Equip.)	D800 (Extra Equip.)	D800 (Extra Equip.)
Type	5-Speed Dual PTO	5-Speed Dual PTO	5-Speed Dual PTO	5-Speed Dual PTO	5-Speed Dual PTO
Model	542 (Short 4th)	540	540 Short 4th.	7550	7590 Short 4th.
No. of Forward Speeds	5	5	5	5	5
Ratios in Transmission					
5th	1.00	1.00	1.00	1.00	1.00
4th	1.17	1.48	1.16	1.18	1.50
3rd	1.86	2.40	1.84	1.86	2.43
2nd	3.30	4.05	3.31	3.31	4.05
1st	6.15	7.41	6.06	6.03	7.37
Reverse	6.13	7.85	6.42	6.03	7.37
Power Take-off Location	Both Sides	Both Sides	Both Sides	Both Sides	Both Sides
Type	6 Stud (S.A.E.)	6 Stud (S.A.E.)	6 Stud (S.A.E.)	6-8 Stud (S.A.E.)	6-8 Stud (S.A.E.)
Shaft Lever	On Trans.	On Trans.	On Trans.	On Trans.	On Trans.
Lubricant Capacity (Pts.) (U.S.)	9	9.5	9.5	13.5	13.5
Imp. Measure (Pts.)	7-1/2	8	8	11-1/4	11-1/4

### LOADFLITE TRANSMISSION A-727

Type	3-Speed, Fully Automatic
Model	A-727
Torque Converter Diameter	10-3/4 inches
Oil Capacity of Transmission and Torque Converter (Dry Fill)	U.S. Meas. 16-3/8 Pints
Use "DEXRON" Type Automatic Transmission Fluids.	(Imp. Meas. 14 Pints)
Method of Cooling	Oil Cooling Coil in Bottom Radiator Tank



## 21-202 SPECIFICATIONS

Lubrication .....	Pump (Rotor Type)
Gear Ratios	
1—Low .....	2.45 to 1
2—Second .....	1.45 to 1
D—Drive .....	1 to 1
R—Reverse .....	2.20 to 1
Pump Clearances	
Outer Rotor to Case Bore .....	.004" to .008"
Outer to Inner Tip .....	.005" to .010"
End Clearance—Rotors .....	.001" to .003"
Gear Train End Play .....	.009" to .044"
Input Shaft End Play .....	.036" to .084"
Snap Rings	
Rear Clutch Snap Ring (Selective) .....	.060 to .062 inch
.....	.074 to .076 inch
.....	.088 to .090 inch
.....	.106 to .108 inch
Output Shaft (Forward End) .....	.048 to .052 inch
	.055 to .059 inch
	.062 to .066 inch

Front Clutch Data Engine Cu. In.	No. of Discs	Clearance	No. of Springs
225	3	.076" to .123"	13
318	4	.088" to .145"	9
360	4	.088" to .145"	9
400	4	.088" to .145"	9
440	4	.088" to .145"	9

### Rear Clutch Data

All Engines	4	.025" to .045"			1
<b>Band Adjustments</b>	<b>Engine</b>	<b>225</b>	<b>318/360</b>	<b>400</b>	<b>440</b>
Kickdown Band (Front) .....	Turns*	2-1/2	2-1/2	2-1/2	2
Low-Reverse Band (Internal) ..	Turns*	2	2	2	2

\*Backed off from 72 inch-pounds

## THRUST WASHERS

Reaction Shaft Support to Front Clutch Retainer ....	#1 Selective .061" to .063" Natural .084" to .086" Red .102" to .104" Yellow
Front Clutch to Rear Clutch .....	#2 .061" to .063"
Input Shaft to Output Shaft .....	#3 .062" to .064"
Front Annulus Support to Front Carrier .....	#4 .060" to .062"
Front Annulus Support to Driving Shell .....	#5 .060" to .062"
Driving Shell Thrust Plate .....	#6 .034" to .036"
Rear Carrier to Driving Shell .....	#7 .060" to .062"
Rear Annulus Thrust Plate .....	#8 .034" to .036"

## HELI-COIL CHART

Thread Size	Mopar Part No.	Heli-Coil Part No.	Insert Length	Drill Size	Tap Part No. (Aluminum)	Tap Part No. Steel & Iron	Inserting Tool Part No.	Extracting Tool Part No.
10-24		1185-3CN	9/32"	13/64"	3CPB	1187-3	2288-3	1227-6
1/4-20	5-40	1185-4CN	3/8"	17/64"	4CPB	1187-4	2288-4	1227-6
5/16-18	5-41	1185-5CN	15/32"	21/64"	5CPB	42187-5	2288-5	1227-6
3/8-16	5-42	1185-6CN	9/16"	25/64"	6CPB	42187-6	2288-6	1227-6
7/16-14	5-43	1185-7CN	21/32"	29/64"	7CPB	42187-7	2288-7	1227-16
1/2-13	5-44	1185-8CN	3/4"	33-64"*	8CPB	42187-8	2288-8	1227-16
				17/32"***				

\*In Aluminum

\*\*In Cast Iron or Steel

## LOADFLITE TRANSMISSION (A-727)

### AUTOMATIC SHIFT POINTS AND GOVERNOR PRESSURE CHART (APPROXIMATE MILES PER HOUR)

Models	Typical—See Note Below					
Engine cu. in.	225		318/360		400	
Axle Ratio	4.10:1	4.56:1	4.10:1	4.56:1	3.54:1	4.10:1
Tire Size	8.75x16.5	8.75x16.5	8.00x16.5	8.00x16.5	8.00x16.5	8.00x16.5
Throttle Closed						
1-2 Upshift	8-10	7-9	8-10	7-9	9-12	8-10
2-3 Upshift	11-13	10-13	11-13	10-13	13-16	11-13
3-1 Downshift*	7-9	6-8	7-9	6-8	8-11	7-9
Throttle Wide Open						
1-2 Upshift	23-31	20-28	23-31	20-28	26-36	23-31
2-3 Upshift	49-56	44-50	49-56	44-50	56-64	49-56
Kickdown Range						
3-2 Downshift	42-51	38-45	42-51	38-45	48-58	42-51
3-1 Downshift	20-23	18-20	20-23	18-20	23-26	20-23
Governor Pressure						
15 psi	15-18	13-15	15-18	13-15	17-19	15-18
50 psi	36-39	32-35	36-39	32-35	41-45	36-39
75 psi	50-54	45-49	50-54	45-49	57-62	50-54

NOTE: Figures given are for D200 and D300 models and are typical for other models. Changes in tire size or axle ratio will cause shift points to occur at corresponding higher or lower vehicle speeds.

\*Governor pressure should be from zero to 1.5 psi at stand-still or downshift may not occur.

## NEW PROCESS A-345 TRANSMISSION (AUTOMATIC)

Type .....	4 Speed Fully Automatic
Oil Capacity of Transmission, Compounder and Torque Converter (Dry Fill) .....	25-1/4 Pints
(Use "DEXRON" Type Automatic Transmission Fluids)	
Method of Cooling .....	By circulating transmission fluid through a "water-to-oil" heat exchanger.
Lubrication .....	Pump (Rotor Type)
Gear Ratios:	
1—First .....	3.56 to 1
2—Second .....	2.11 to 1
3—Third .....	1.45 to 1
D—Drive .....	1.0 to 1
R—Reverse .....	3.20 to 1
Pump Clearances:	
Outer Rotor to Case Bore .....	.004"—.008"
Outer to Inner Tip .....	.005"—.010"
End Clearance—Rotors .....	.001"—.003"
Transmission Gear Train End Play .....	.010"—.025"
Transmission Input Shaft End Play .....	.018"—.062"

## MANUAL TRANSMISSIONS

SPEEDOMETER PINION USAGE CHART OVERDRIVE-4,  
A-230, A-390 TRANSMISSION

Tire Size	Axle Ratio	Gear Teeth	Pinion Teeth	Tire Size	Axle Ratio	Gear Teeth	Pinion Teeth
G78-15	2.94	13	28	7.50-16	3.54	13	30
	3.21/3.23	13	31		4.10	13	34
	3.55	13	34		4.56	13	39
	3.91	13	38		4.56	13	39
H78-15	2.94	13	28	8.00-16.5	3.54	13	34
	3.21/3.23	13	30		4.10	13	39
	3.55	13	33		4.56	13	43
	3.91	13	36		4.56	13	33
6.50-16	3.21/3.23	13	29	8.75-16.5	4.10	13	38
	3.55	13	32		4.56	13	43
	3.91	13	36		3.54	13	32
	4.10	13	36		4.56	13	41
7.00-15	3.91	13	36				
7.00-16	3.54	13	31				
	4.10	13	36				
	4.56	13	40				

## SPEEDOMETER PINION USAGE CHART-435 TRANSMISSION

Tire Size	Axle Ratio	Gear Teeth	Pinion Teeth	Tire Size	Axle Ratio	Gear Teeth	Pinion Teeth
G78-15	2.94	13	28	8.00-16.5	4.10	13	39
HR78-15	3.21	13	30		4.56	13	43
	3.23	13	30		4.88	13	45
	3.55	13	34	8.75-16.5	4.10	13	38
6.50-16	3.21	13	29		4.56	13	43
	3.23	13	29		4.88	13	45
	3.55	13	32	9.50-16	4.10	13	36
7.00-16	3.54	13	31		4.56	13	41
	4.10	13	36		4.88	13	43
	3.91	13	36	7.00-20	5.63	5	17
	3.55	13	31			5	16
	4.56	13	40			5	15
7.00-16	4.10	13	36	7.50-20	6.20	4	15
	4.56	13	40	8.25-20		4	14
	4.88	13	43	9.00-20		5	16
7.50-16	4.10	13	34	7.50-20	6.80	4	15
	4.56	13	39	8.25-20		4	15
	4.88	13	42	9.20-20		4	14

## SPEEDOMETER PINION USAGE CHART-445 TRANSMISSION

Tire Size	Axle Ratio	Gear Teeth	Pinion Teeth	Tire Size	Axle Ratio	Gear Teeth	Pinion Teeth
G78-15	2.94	13	28	7.50-16	3.54	13	30
	3.21	13	31		4.10	13	34
	3.23	13	31		4.56	13	39
	3.55	13	34	8.00-16.5	3.54	13	34
7.00-16	3.54	13	31		4.10	13	39
	4.10	13	36		4.56	13	43
	4.56	13	40				

**MANUAL TRANSMISSIONS (Continued)**  
**SPEEDOMETER PINION USAGE CHART-445 TRANSMISSION**

Tire Size	Axle Ratio	Gear Teeth	Pinion Teeth	Tire Size	Axle Ratio	Gear Teeth	Pinion Teeth
8.75-16.5	3.54	13	33	8.00-16.5	4.10	13	39
	4.10	13	38		4.56	13	43
	4.56	13	43		4.88	13	45
9.50-16.5	3.54	13	32	8.75-16.5	4.10	13	38
	4.10	13	36		4.56	13	43
	4.56	13	41		4.88	13	45
7.00-16	4.10	13	36	9.50-16.5	4.10	13	36
	4.56	13	40		4.56	13	41
	4.88	13	43		4.88	13	43
7.50-16	4.10	13	34				
	4.56	13	39				
	4.88	13	42				

**SPEEDOMETER PINION USAGE CHART**  
**435 FOUR SPEED 540-542 FIVE SPEED TRANSMISSION**

Axle Ratio	Tire Size	Gear	Pinion	Axle Ratio	Tire Size	Gear	Pinion
5.28/5.29	7.50-20	5	15	6.8	7.00-20	5	20
	8.25-20	5	14		7.50-20	5	19
	9.00-20	5	14		8.25-20	5	18
5.57	7.50-20	5	16		9.00-20	5	18
	8.25-20	5	15		10.00-20	5	17
	9.00-20	5	15		11.00-20	5	17
5.83	7.50-20	5	16		11.00-22	5	16
	8.25-20	5	16	7.1	7.50-20	5	20
	9.00-20	5	15		8.25-20	5	19
6.14/6.17	7.50-20	5	17		9.00-20	5	18
	8.25-20	5	17		10.00-20	5	18
	9.00-20	5	16		11.00-20	5	17
	10.00-20	5	15		11.00-22	5	17
	11.00-20	5	15	9.1/9.9	7.50-20	5	20
6.16/6.2	11.00-22	5	15		8.25-20	5	20
	7.00-20	5	18		9.00-20	5	19
	7.50-20	5	18	7.17/7.2	7.50-20	5	20
	8.25-20	5	17		8.25-20	5	19
	9.00-20	5	16		9.00-20	5	19
6.33	10.00-20	5	15		10.00-20	5	18
	7.50-20	5	18		11.00-20	5	18
	8.25-20	5	17		11.00-22	5	17
6.5	9.00-20	5	16	7.33	7.50-20	5	20
	7.50-20	5	18		8.25-20	5	20
	8.25-20	5	18		9.00-20	5	19
6.61/6.65	9.00-20	5	17		10.00-20	5	18
	10.00-20	5	16		11.00-20	5	18
	11.00-20	5	16		11.00-22	5	17
	11.00-22	5	15	7.6	8.25-20	5	20
	7.50-20	5	19		9.00-20	5	20
6.61/6.65	8.25-20	5	18		10.00-20	5	19
	9.00-20	5	17		11.00-20	5	19
	10.00-20	5	17		11.00-22	5	18
	11.00-20	5	16	7.75	8.25-20	5	20
	11.00-22	5	16		9.00-20	5	20
					10.00-20	5	19
					11.00-20	5	19
					11.00-22	5	19

### SPEEDOMETER PINION USAGE CHART 7550-7590 FIVE SPEED TRANSMISSION

Axle Ratio	Tire Size	Gear	Pinion	Axle Ratio	Tire Size	Gear	Pinion
6.14/6.17	8.25-20	5	17	6.36	8.25-20	5	17
	9.00-20	5	16		9.00-20	5	17
	10.00-20	5	16		10.00-20	5	16
	11.00-20	5	15		11.00-20	5	16
	11.00-22	5	15		11.00-22	5	15
6.5	8.25-20	4	14	7.20/7.21	8.25-20	4	16
	9.00-20	5	17		9.00-20	4	15
	10.00-20	5	16		10.00-20	4	15
	11.00-20	5	16		11.00-20	4	14
	11.00-22	5	15		11.00-22	5	17
6.65	12.00-20	4	15	7.33	12.00-20	5	17
	8.25-20	4	14		9.00-20	4	15
	9.00-20	4	14		10.00-20	4	15
	10.00-20	5	17		11.00-20	4	14
	11.00-20	5	16		11.00-22	4	14
6.79/6.8/6.83	11.00-22	5	16	7.60	12.00-20	5	16
	12.00-20	5	16		9.00-20	4	16
	8.25-20	4	15		10.00-20	4	15
	9.00-20	4	14		11.00-20	4	15
	10.00-20	5	17		11.00-22	4	14
7.1/7.17	11.00-20	5	17	7.80	12.00-20	5	16
	12.00-20	5	16		9.00-20	4	16
	8.25-20	4	15		10.00-20	4	16
	9.00-20	4	15		11.00-20	4	15
	10.00-20	4	14		11.00-22	4	14
	11.00-20	4	17	8.60	12.00-20	5	16
					9.00-20	4	17
					10.00-20	4	17
					11.00-20	4	17
					11.00-22	4	16

### SPEEDOMETER PINION CHART-203 TRANSFER CASE

		AXLE RATIO									
		3.23 & 3.21:1		3.54 & 3.55:1		3.90 & 3.91:1		4.10:1		4.88:1	
Tire Size	Material	Gear Teeth	Pinion Teeth	Gear Teeth	Pinion Teeth	Gear Teeth	Pinion Teeth	Gear Teeth	Pinion Teeth	Gear Teeth	Pinion Teeth
7.00-15(LT)	Nylon	5(4)	14	5(1)	15	5	14	5	14		
7.00-16(LT)	Nylon			5(1)	15	5(1)	16	5	14	5	17
7.50-16(LT)	Nylon			5(1)	14	5(1)	16	5	14	5	16
8.00-16.5	Nylon			5(1)	16	5	15	5	15	5	18
8.75-16.5	Nylon			5(1)	15	5	14	5	15	5	17
9.50-16.5	Nylon			5(1)	15	5	14	5	14	5	17
G78-15(PC)	P & G	5(4)	16	5(1)	16	5	15	5	15		
H78-15(PC)	P & G	5(1)	14	5(1)	16	5	14	5	15		
H78-15	P & S	5(1)	14	5(1)	16	5	15				
8.00-16.5*	Nylon	5(1)	14	5(4)	16	5	14	5	14	5	17
8.75-16.5*	Nylon	5(4)	14	5(1)	15	5(1)	16	5	14	5	17
9.50-16.5*	Nylon	5(4)	14	5(1)	15	5(1)	16	5	14	5	17
7.00-16(LT)*	Nylon	5(4)	14	5(4)	15	5(1)	16	5	14	5	17
7.50-16(LT)*	Nylon	5(4)	14	5(1)	14	5(4)	17	5	14	5	16

Alpha in parenthesis after tire size is used to indicate type of tire.

(PC) Passenger car tire

(LT) Light truck tire

\*Mud and snow

Numbers in parenthesis after gear teeth number indicates adapter to be used.

(1) Adapter Ratio = 1.202

(2) Adapter Ratio = .7352

(3) Adapter Ratio = .9444

(4) Adapter Ratio = 1.2844

Model	Tire Size	Gear Teeth	Pinion Teeth
W600	8.25-20	4	6.2 Axle 14(2)
	9.00-20	4	14(3)

Model	Tire Size	Gear Teeth	Pinion Teeth
W600	7.50-20	4	6.8 Axle 14(1)
	8.25-20	4	14(1)
	9.00-20	4	14
	11.00-20 (Sand)	4	14(2)

(1) Adapter Ratio = .9444	(2) Adapted Ratio = 1.04	(3) Adapter Ratio = 1.0888
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AXLE RATIOS								
Tire Size	2.94	3.21 3.23	3.54 3.55	3.73	3.90 3.91	4.10	4.56	4.88
G78 x 15	28	31	34	36	38	40	45	—
H78 x 15	28	30	33	35	36	—	43	—
L78 x 15	27	29	32	34	35	37	41	45
HR78 x 15	28	30	34	35	38	39	43	45
7.00 x 15LT	27	30	33	34	36	—	—	—
6.50 x 16LT	27	29	32	34	35	—	—	—
7.00 x 16LT	—	—	31	33	—	36	40	43
7.50 x 16LT	—	—	30	32	—	—	39	42
8.00 x 16.5	—	—	34	36	37	39	43	45
8.75 x 16.5	—	—	33	35	37	38	—	45
9.50 x 16.5	—	—	32	34	35	36	—	43

Truck Model Designation	W100, W200, W300	W600
Model .....	203	T223-E
No. of Speeds .....	2	2
Ratio		
High .....	1-1	1-1
Low .....	2.01:1	1.94-1
*Lubricant Capacity (Pts.) (U.S.) ...	9	4
(Pts.) Imperial .....	7.5	3-1/4

## TIGHTENING REFERENCE MANUAL TRANSMISSIONS

Location	Foot Pounds	Location	Foot Pounds
<b>MANUAL A-230, 3 SPEED</b>		Gearshift Fork Lock Bolt .....	30
Gearshift Rod and Swivel Assembly Nuts .....	6	Gearshift Housing Lower Bolt .....	15
Backup Light Switch Hole Plug .....	15	Gearshift Housing Upper Bolt .....	20
Case Drain Plug .....	20	Gearshift Operating Lever Nut .....	35
Case Filler Plug .....	30	Gearshift Selector Ball Spring Bolt .....	25
Case to Clutch Housing Bolt .....	50	Gearshift Selector Lever Washer Nut .....	20
Drive Pinion Bearing Retainer Bolt .....	15	Manual Remote Gearshift Lever Shaft Bolt ...	10
Extension Bolt .....	30	Shaft Flange Nut .....	175