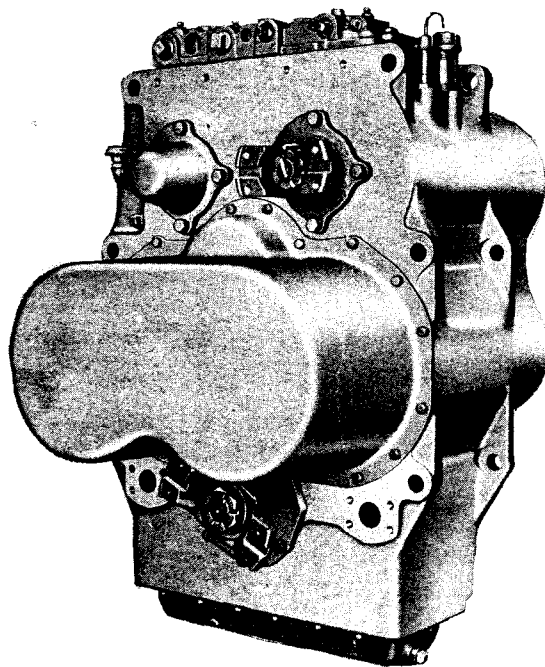


# CLARK<sup>®</sup>

## TRANSMISSION

### MAINTENANCE & SERVICE MANUAL

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SERIES

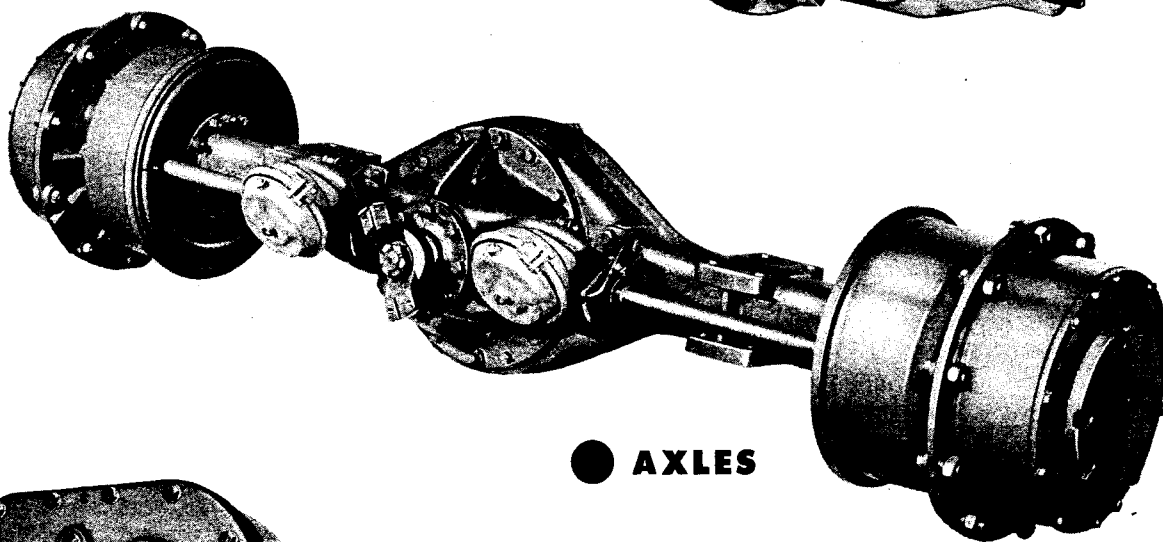
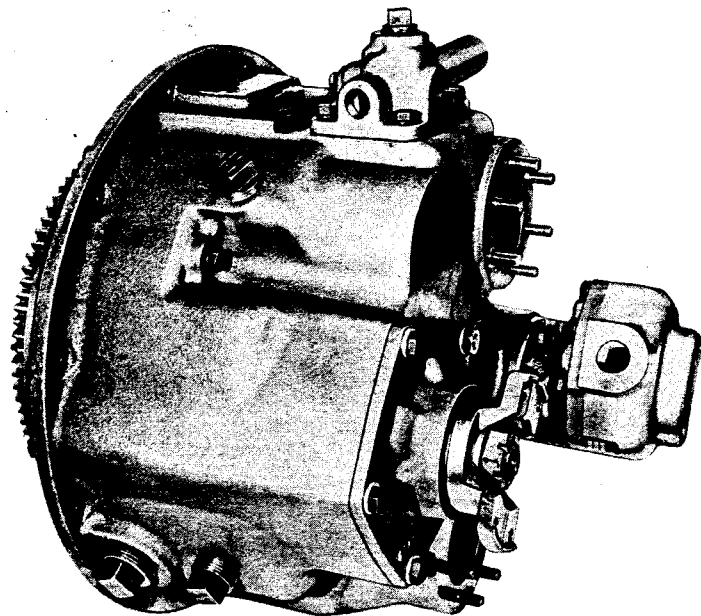
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## CLARK EQUIPMENT COMPANY

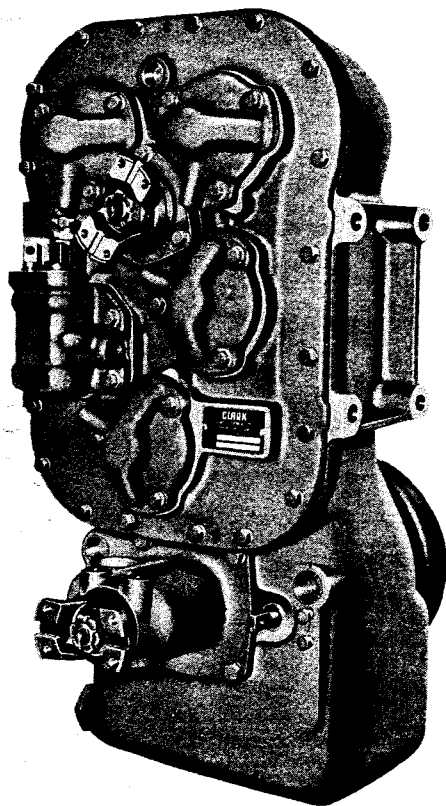
CUSTOMER SERVICE DIVISION

PUBLICATION DEPT.—JACKSON, MICHIGAN

● **TORQUE CONVERTERS  
UP TO 1000 HORSEPOWER**



● **AXLES**



● **TRANSMISSIONS  
UP TO 1000 HORSEPOWER**

# FOREWORD



This manual has been prepared to provide the customer and the maintenance personnel with information and instructions on the maintenance and repair of the **CLARK** Power Shift Transmission.

Extreme care has been exercised in the design, selection of materials and manufacturing of these units. The slight outlay in personal attention and cost required to provide regular and proper lubrication, inspection at stated intervals, and such adjustments as may be indicated will be reimbursed many times in low cost operation and trouble free service.

In order to become familiar with the various parts of the transmission, its principal of operation, trouble shooting and adjustments, it is urged that the mechanic study the instructions in this manual carefully and use it as a reference when performing maintenance and repair operations.

Whenever repair or replacement of component parts is required, only Clark-approved parts as listed in the applicable parts manual should be used. Use of "will-fit" or non-approved parts may endanger proper operation and performance of the equipment. The Clark Equipment Company does not warrant repair or replacement parts, nor failures resulting from the use thereof, which are not supplied by or approved by the Clark Equipment Company. **IMPORTANT: Always furnish the Distributor with the transmission serial and model number when ordering parts.**

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The transmission portion of the power train enacts an important role in delivering engine power to the driving wheels. In order to properly maintain and service these units it is important to first understand their function and how they operate.

The transmission and torque converter function together and operate through a common hydraulic system. To obtain maximum serviceability they have been designed and built as separate units. It is necessary, however, to consider both units in the study of their function and operation.

To supplement the text below, and for references use therewith, the following illustrations are provided:

Fig. A — Front and Rear View, Shaft Identification  
Fig. B — Transmission Case and Internal Tubing  
Fig. C — Control Cover Assembly  
Fig. D — Output Shaft Group — "O"  
Fig. E — Idler Shaft Group — "I"

Fig. F — Input and Forward Drive Shaft Group—"F"  
Fig. G — Reverse Drive Shaft Group — "R"  
Fig. H — 2nd and 4th Drive Shaft Group — "A"  
Fig. I — 1st and 3rd Drive Shaft Group — "B"  
Fig. J — External Oil Flow—Converter and Transmission.

### HOW THE UNITS OPERATE —

With the engine running, the converter charging pump draws oil from the transmission sump and directs it through oil filters to the regulating valve located on top of the transmission. From the regulating valve it is then directed through the control cover on the transmission to the converter and to the transmission clutches.

The pressure regulating valve mounted on the top of the transmission remains closed until required pressure is delivered to the transmission for actuating the direction and speed clutches. This regulator valve consists of a hardened valve spool operating in a closely fitted bore. The valve spool is backed up by a spring to hold the valve spool against its seat until the oil pressure builds up to the specified pressure. The valve spool then moves toward the spring until a port is exposed along the side of the bore. The oil can then flow through this port into a distributor which directs the oil into the converter inlet port.

After entering the converter, the oil is directed through the stator support to the converter cavity and exits between the turbine shaft and converter support. The oil then passes through an oil distributor which directs the oil out of the converter by way of a down stream regulator valve and then to the oil cooler. After leaving the cooler the oil is directed through a hose to the lubricating oil inlet on the transmission, then through a series of tubes to the transmission, bearings, and clutches. The oil then returns to the transmission sump.

A safety valve is built in the transmission control cover and will open to bypass oil only if an excessive pressure is built up due to a blocked passage.

The rear compartment of the converter unit also houses the converter output shaft. A flexible hose provides an overflow to the transmission sump.

The three members of the torque converter are composed of a series of blades. The blades are curved in such a manner as to force the oil to circulate from the impeller to the turbine, through the reaction member again into the impeller. This circulation causes the turbine to turn in the same direction as the impeller. Oil enters the inner side of the impeller and exits from the outer side into the outer side of the turbine. It then exits from the inner side of the turbine and after passing through the reaction member, again enters the inner side of the impeller.

Converter "Stall" is achieved whenever the turbine and impeller shaft are stationary and the engine is operating at full power or wide open throttle. CAUTION: Do not maintain "Stall" for more than 30 seconds at a time. Excessive heat will be generated and may cause converter or transmission seal damage.

In converters equipped with Lock-up clutches, a hydraulic clutch, similar to the transmission clutches is used to "lock" the engine mechanically to the output shaft. This is accomplished by hydraulic pressure actuating the lock-up clutch which in turn locks the impeller cover to the turbine hub. During lock-up the converter turns at 1 to 1 speed ratio.

The down stream regulator valve on the converter consists of a valve body and regulator spool. The spool is backed up by a spring to hold the valve until converter oil pressure builds up to specified pressure. The valve is used to maintain a given converter pressure to insure proper performance under all conditions.

The control valve assembly on the transmission consists of a valve body with selector valve spools connected to the steering column by exterior linkage. A detent ball and spring in the selector spool provides four positions, one position for each speed range. A detent ball and spring in the direction spool provides three positions, one each for forward, neutral, and reverse.

On certain models, this valve also contains a shut-off valve spool operated by an air or hydraulic cylinder located on the control cover. This valve is connected to the brake system by a hose line. When the wheel brakes are applied, air or hydraulic fluid enters the valve and overcomes a spring force. This forces the spool to shift over and block pressure from entering the directional clutches. In this manner a "neutral" is established without moving the control levers.

With the engine running and the directional control lever in neutral position, oil pressure is blocked at the control valve, and the transmission is in neutral. Movement of the forward and reverse spool will direct oil, under pressure, to either the forward or reverse direction clutch as desired, and the opposite one is open to relieve pressure.

The direction or speed clutch assembly consists of a drum with internal gear teeth and a bore to receive a hydraulically actuated piston. A piston is inserted into the bore of the drum. The piston is "oil tight" by the use of sealing rings. A bronze disc with internal teeth is inserted into the drum and rests against the piston. Next, a disc with splines at the outer diameter is inserted. Discs are alternated until the required total is achieved. After inserting the last disc, a series of springs and pins are assembled in such a manner that these springs rest on teeth of the piston. A heavy back-up plate is then inserted and secured by a snap ring. A hub with I.D. and O.D. splines is inserted into the splines of discs with teeth on the inner diameter and a splined shaft extending through the clutch support. This hub is retained by a snap ring. The discs and inner shaft are free to increase in speed or rotated in the opposite direction as long as no pressure is present in the direction or speed clutch.

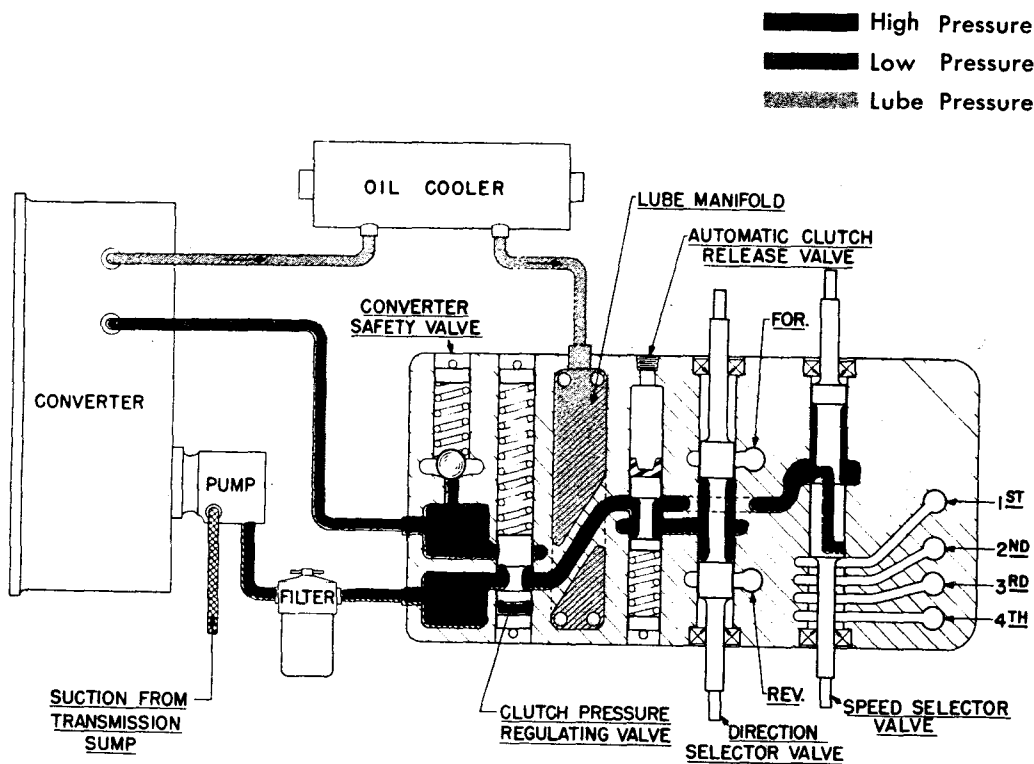
To engage the clutch, as previously stated, the control valve is placed in the desired position. This allows oil under pressure to flow from the control cover valve, through a tube in the transmission case, to a chosen clutch. Once into the drum, oil is directed through a drilled hole into the rear side of the piston bore. Pressure of the oil forces the piston and discs over against the heavy back-up plate. The discs, with teeth on the outer diameter, clamping against discs, with teeth on inner diameter, enables the clutch drum and drive shaft to be locked together and allows them to turn as a unit.

There are bleed balls in the clutch drums which allow quick escape for oil when the pressure to the piston is released.

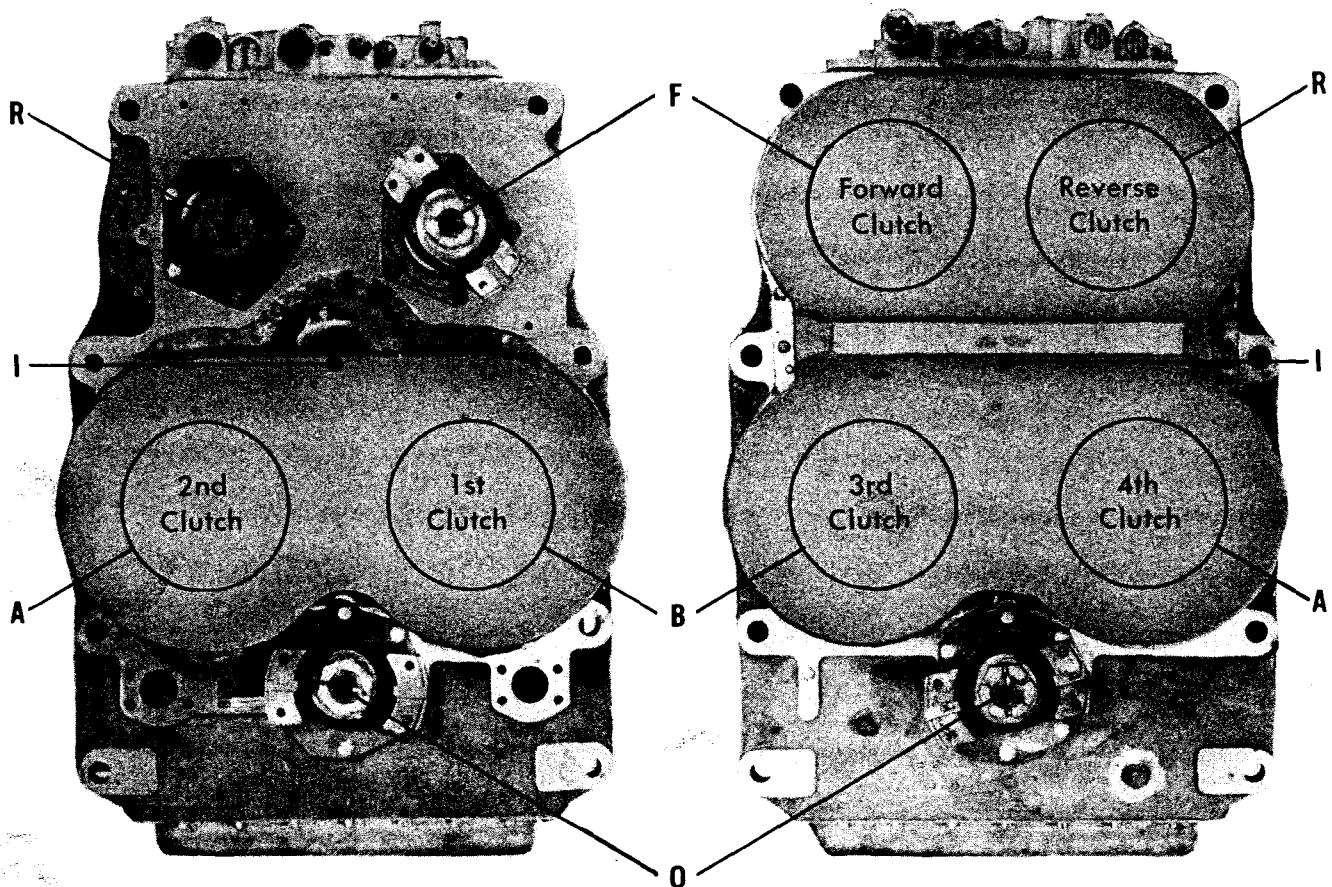
The transmission gear train consists of six shafts: (1) Input Shaft, (2) Reverse Shaft, (3) Idler Shaft, (4) First and Third Shaft, (5) Second and Fourth Shaft, (6) Output Shaft.

A screen mounted in a frame is positioned on the bottom of the transmission case, to screen out any foreign material. This screen is covered by the sump pan. This pan is provided with magnets to catch any metallic particles.

Some transmissions may have an axle declutching unit as optional equipment, this unit consists of a split output shaft with a sliding splined sleeve to engage or disengage the axle. This is accomplished by manually shifting a lever in the operator's compartment which is mechanically connected to the shift fork on the clutching unit sliding sleeve. This unit, of course, is only used on the four wheel drive machine. On the front drive only or the rear wheel drive only, the output shaft is a one piece type and an output flange assembled only on the required end.



TRANSMISSION CONTROL COVER INTERNAL OILFLOW



**FIG. A—TRANSMISSION ASSEMBLY SHAFT IDENTIFICATION**

For purpose of identification, illustration above indicates by alphabetical designation the individual shaft group location in transmisson. Code to alphabetical designation is given below. Alphabetical designation also appears in heading of each shaft group covered in parts listings herein.

A—Second & Fourth Drive Shaft Group

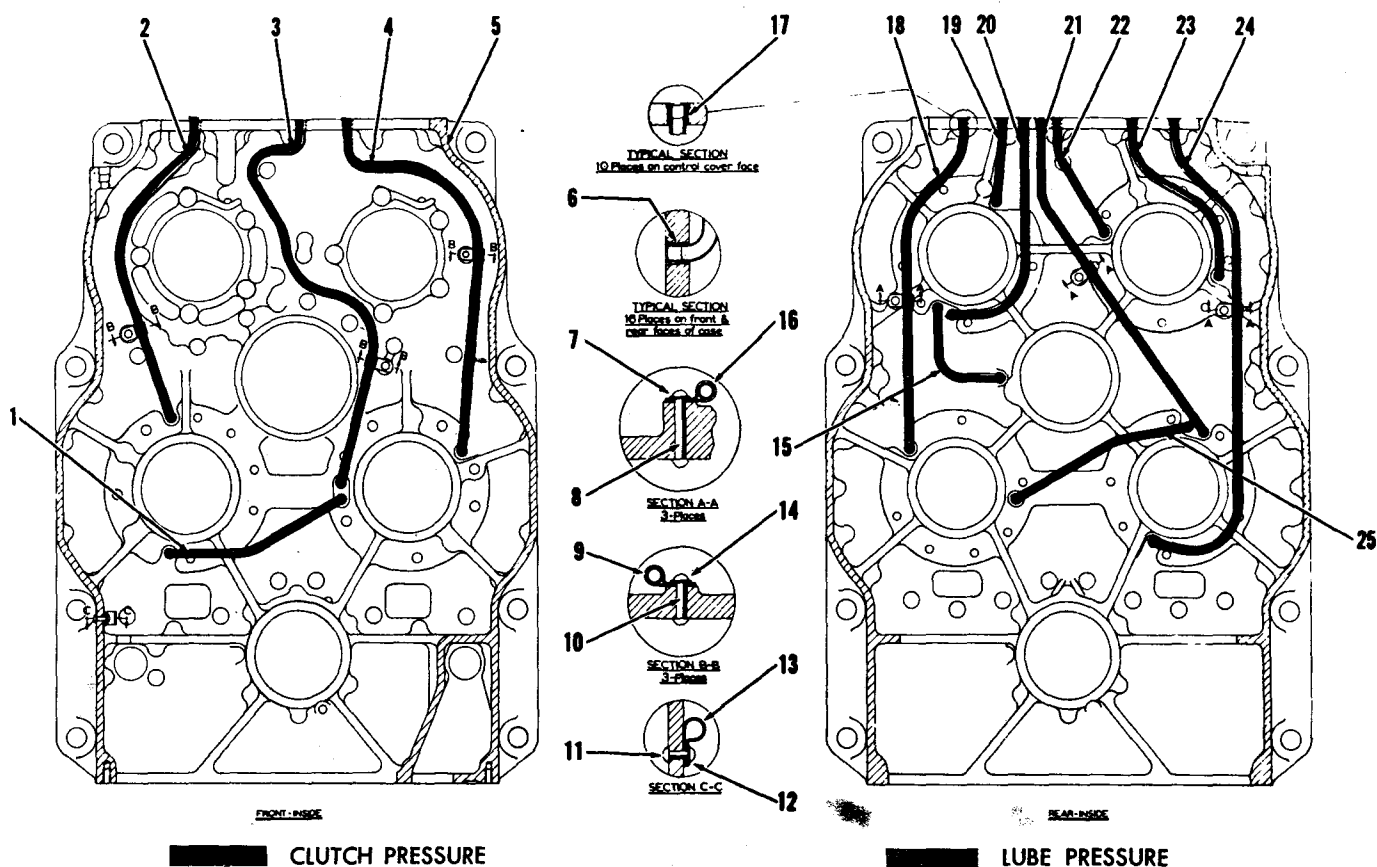
B—First & Third Drive Shaft Group

F—Input Drive Shaft & Forward Clutch Group

I—Idler Shaft Group

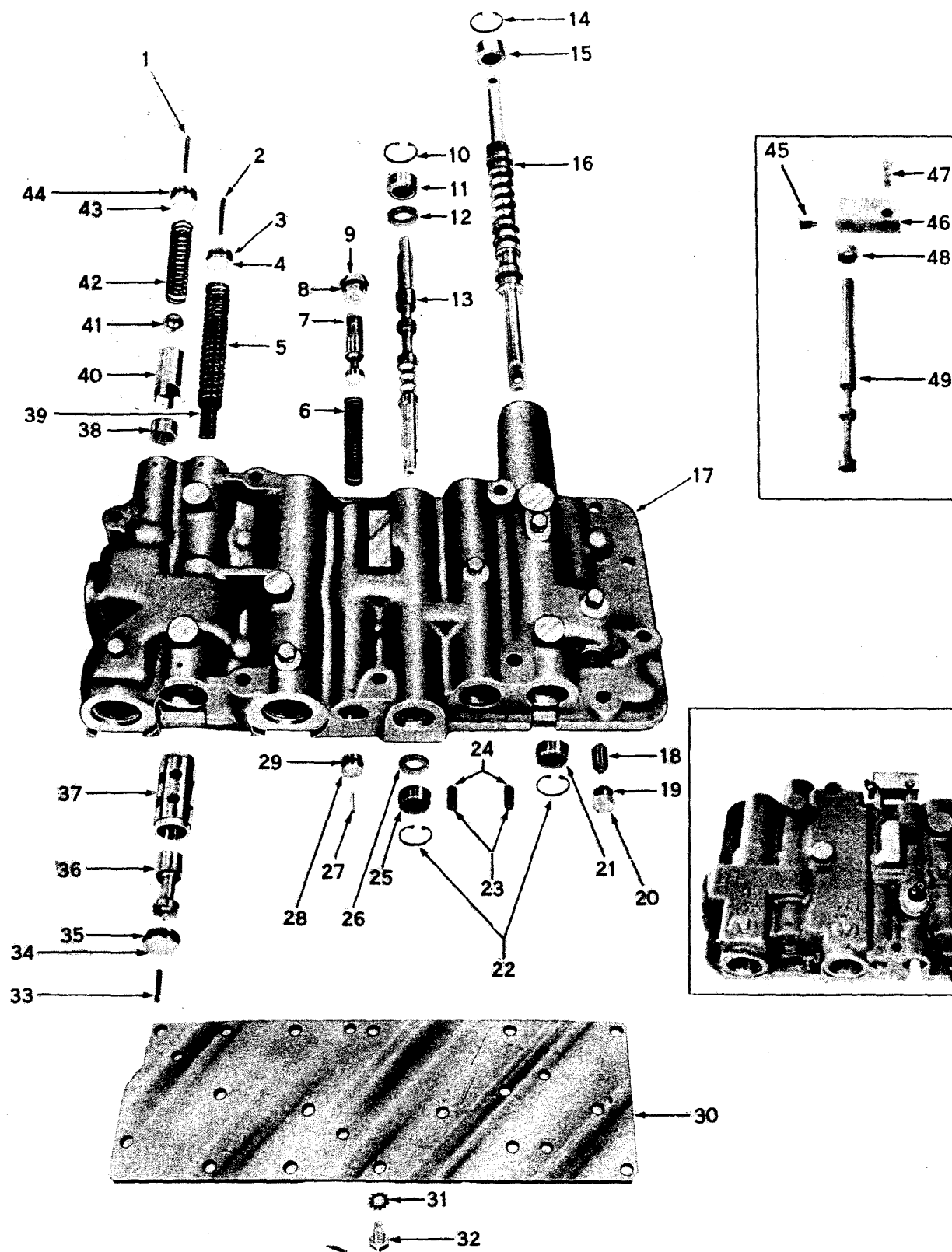
O—Output Shaft & Disconnect Assembly Group

R—Reverse Drive Shaft Group



## 8000 SERIES CASE ASSEMBLY

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	2nd and 1st Lube Tube.....	1	14	Washer .....	3
2	1st Clutch Pressure Tube.....	1	15	Reverse to Idler Lube Tube.....	1
3	2nd Clutch Lube Tube.....	1	16	Tube Clip .....	3
4	2nd Clutch Pressure Tube.....	1	17	Tube Sleeve .....	10
5	Transmission Case .....	1	18	4th Clutch Pressure Tube.....	1
6	Tube Sleeve .....	16	19	Reverse Clutch Pressure Tube.....	1
7	Washer .....	3	20	Reverse Clutch Lube Tube.....	1
8	Rivet .....	3	21	3rd Clutch Lube Tube.....	1
9	Tube Clip .....	3	22	Forward Clutch Lube Tube.....	1
10	Rivet .....	3	23	Forward Clutch Pressure Tube.....	1
11	Rivet .....	1	24	3rd Clutch Pressure Tube.....	1
12	Washer .....	1	25	3rd to 4th Lube Tube.....	1
13	Tube Clip .....	1			



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**FIG. C.. CONTROL COVER GROUP**

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Spring Stop Roll Pin.....	1	25	Valve Oil Seal .....	1
2	Spring Stop Roll Pin.....	1	26	Valve Stop Washer.....	1
3	Spring Stop .....	1	27	Shut-Off Valve Stop Roll Pin.....	1
4	Spring Stop "O" Ring.....	1	28	Pipe Plug.....	5
5	Regulating Valve Spool Spring (Outer)	1	29	Shut-Off Valve Stop "O" Ring.....	1
6*	Shut-Off Valve Spring.....	1	30	Control Cover Plate.....	1
7*	Shut-Off Valve Spool.....	1	31	Plate to Cover Screw Lockwasher.....	16
9*	Shut-Off Valve Plug "O" Ring.....	1	32	Plate to Cover Screw.....	16
8*	Shut-Off Valve Plug "O" Ring.....	1	33	Spring Stop Roll Pin.....	1
10	Valve Oil Seal, Snap Ring.....	1	34	Valve Spool Stop.....	1
11	Valve Oil Seal.....	1	35	Stop "O" Ring.....	1
12	Valve Stop Washer.....	1	36	Regulating Valve Spool.....	1
13	Forward-Reverse Selector Valve.....	1	37	Valve Spool Sleeve.....	1
14	Speed Selector Valve Oil Seal Snap Ring .....	1	38	Safety-Valve Seat .....	1
15	Speed Selector Valve Oil Seal.....	1	39	Regulating Valve Spool Spring (Inner)	1
16	Speed Selector Valve Assembly.....	1	40	Safety-Valve Spacer .....	1
17	Control Cover and Valve Housing....	1	41	Safety-Valve Ball .....	1
18	Shuttle Valve .....	1	42	Safety-Valve Spring .....	1
19	Pipe Plug "O" Ring.....	1	43	Spring Stop .....	2
20	Pipe Plug .....	1	44	Spring Stop "O" Ring.....	2
21	Speed Selector Valve Oil Seal.....	1	45**	Shift Link Lock Screw.....	1
22	Speed Selector Valve Oil Seal Snap Ring .....	2	46**	Shift Link .....	1
23	Poppet Spring .....	2	47**	Clevis Pin .....	1
24	Poppet Ball .....	2	48**	Shut-Off Valve Oil Seal.....	1
			49**	Shut-Off Valve Spool.....	1
			50**	Neutral Starting Switch.....	1

\*Not used with positive neutral.

\*\*Used with positive neutral.

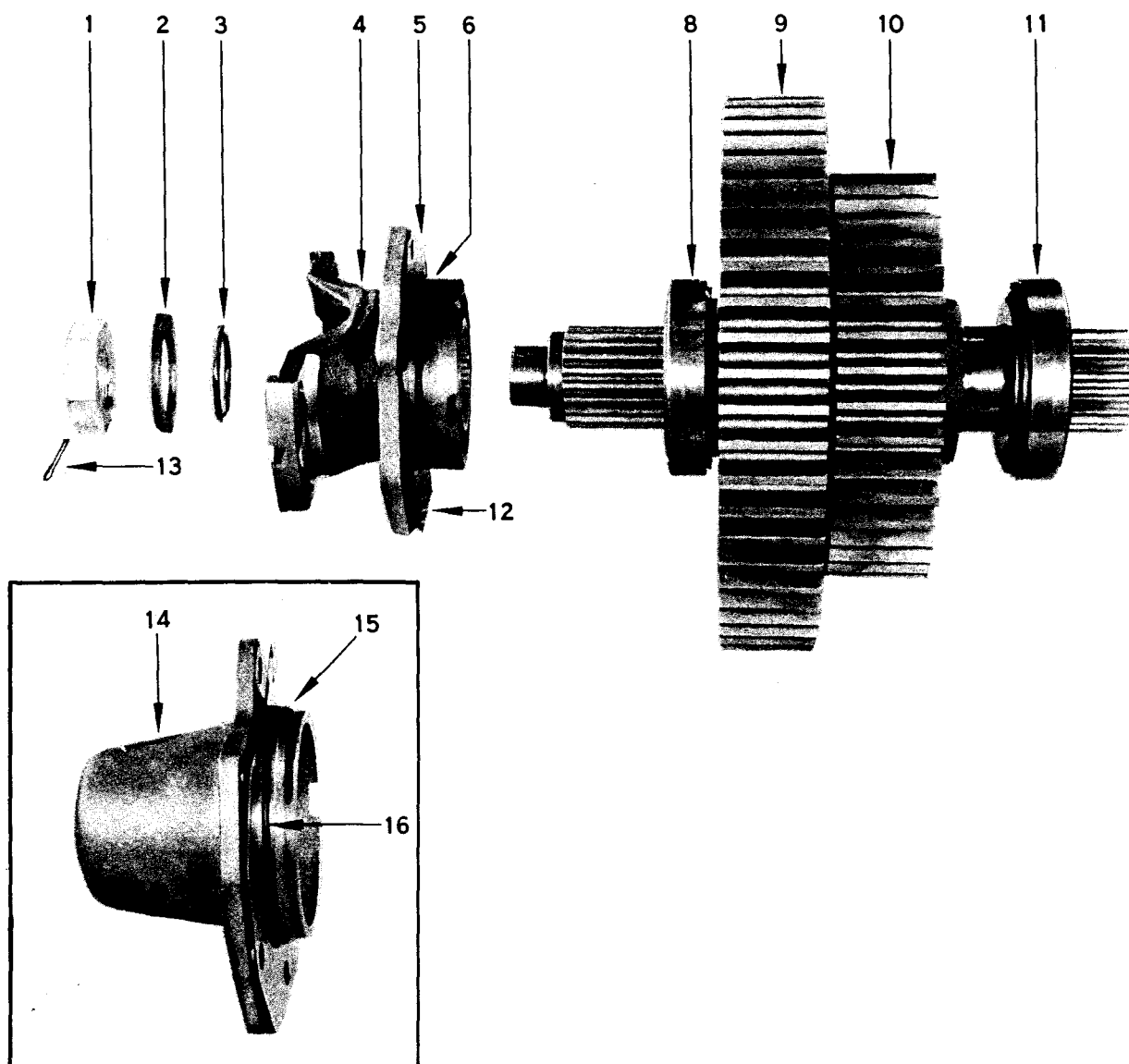


FIG. D OUTPUT SHAFT GROUP "O"

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Flange Nut .....	1	9	Output Gear .....	1
2	Flange Washer .....	1	10	Output Gear .....	1
3	Flange "O" Ring .....	1	11	Output Shaft Taper Bearing.....	1
4	Companion Flange .....	1	12	Bearing Cap Shim .....	1
5	Bearing Cap .....	1	13	Flange Nut Cotter .....	1
6	Bearing Cap "O" Ring .....	1	14	Optional Bearing Cap .....	1
7	Output Shaft .....	1	15	Bearing Cap Shim .....	1
8	Output Shaft Taper Bearing .....	1	16	Bearing Cap "O" Ring .....	1

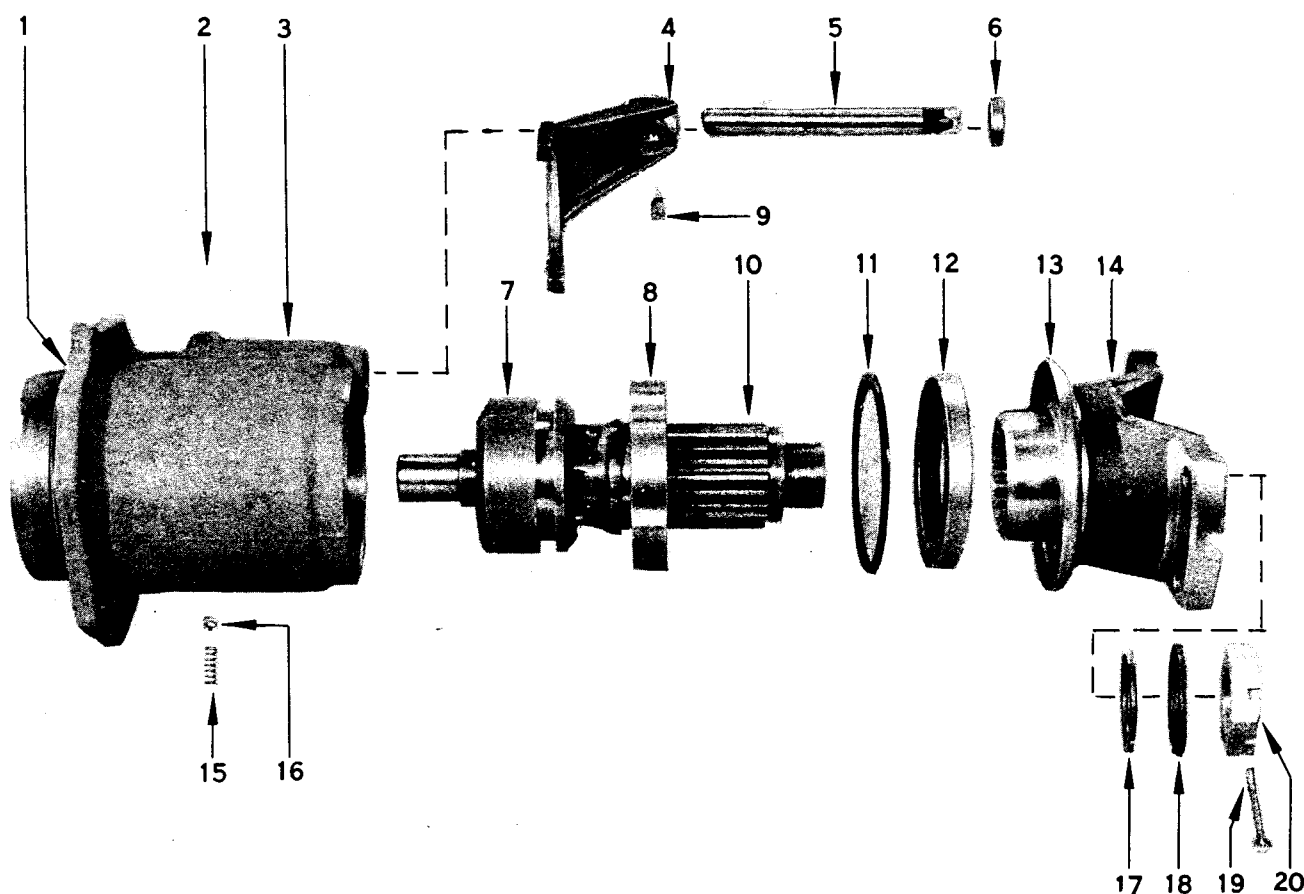
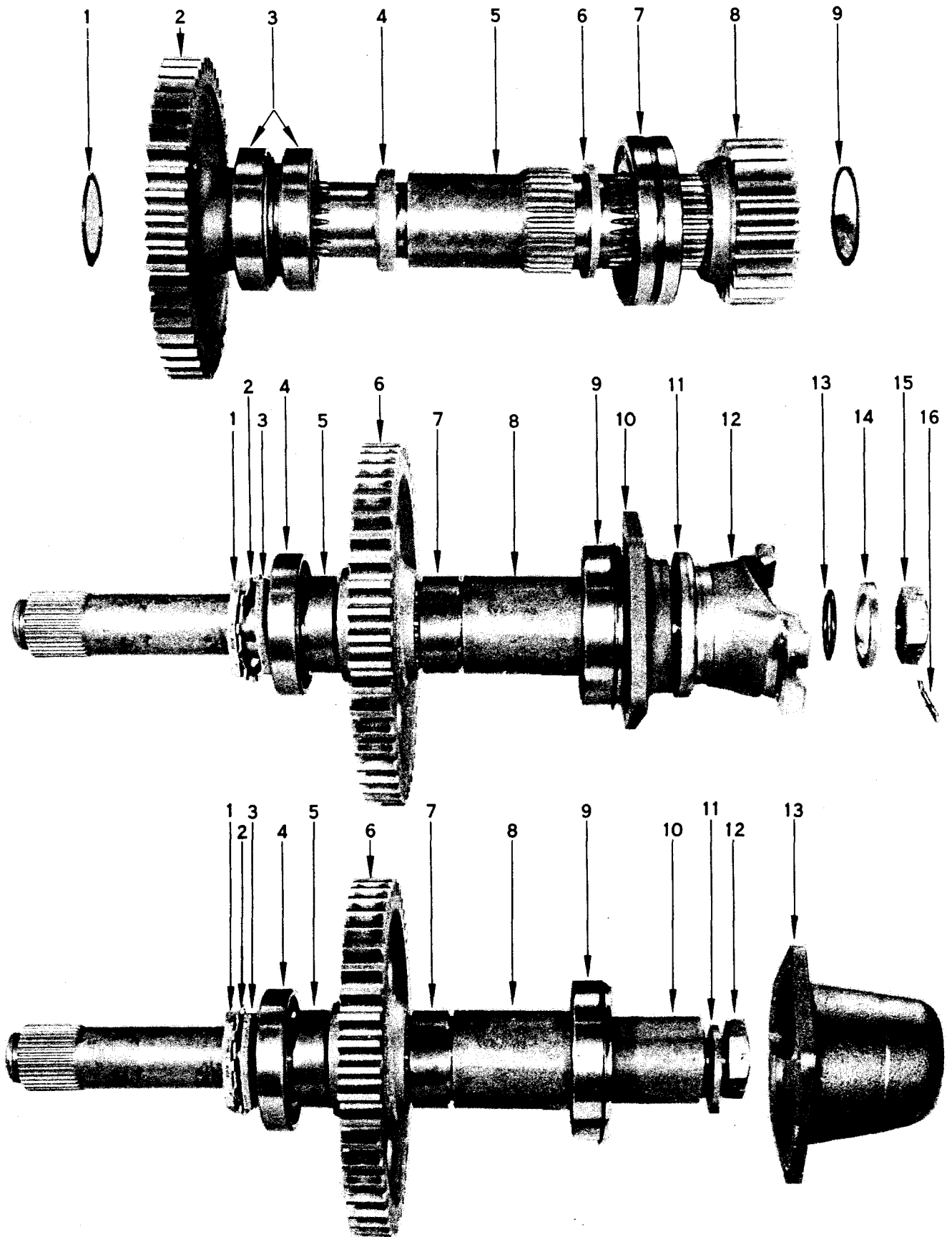


FIG. D DISCONNECT ASSEMBLY "O"

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Disconnect Housing "O" Ring.....	1	11	Bearing Locating Ring .....	1
2	Poppet Spring Plug .....	1	12	Oil Seal .....	1
3	Disconnect Housing .....	1	13	Flange Deflector .....	1
4	Shift Fork .....	1	14	Companion Flange .....	1
5	Shift Rail .....	1	15	Poppet Spring .....	1
6	Shift Rail Oil Seal.....	1	16	Poppet Ball .....	1
7	Shift Hub .....	1	17	Flange "O" Ring .....	1
8	Disconnect Bearing .....	1	18	Flange Washer .....	1
9	Shift Fork Lock Screw.....	1	19	Flange Nut Cotter .....	1
10	Disconnect Shaft .....	1	20	Flange Nut .....	1



**FIG. E. IDLER SHAFT GROUP "I"**

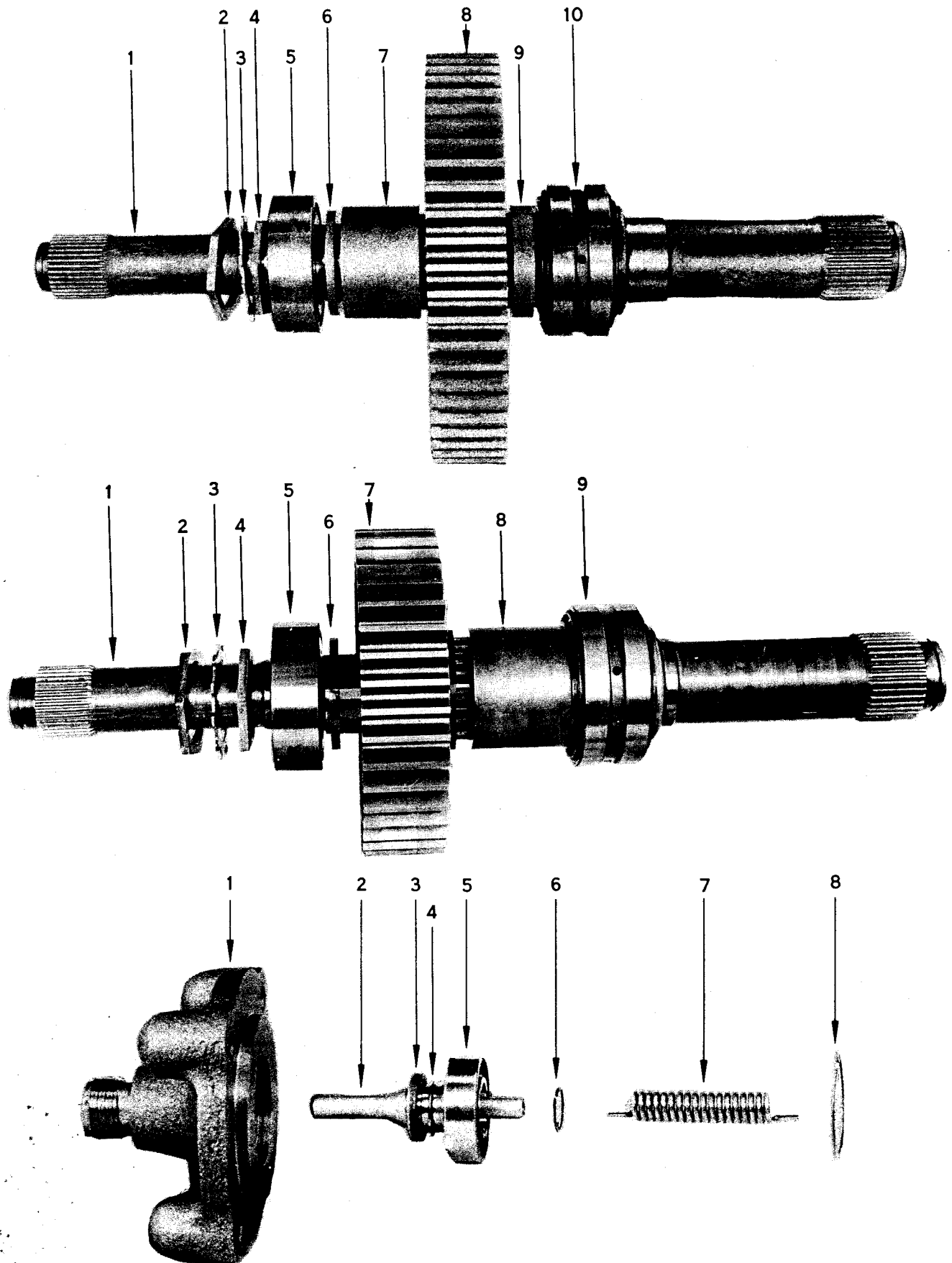
ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Gear Snap Ring.....	1	6	Roller Bearing Spacer.....	1
2	Idler Gear .....	1	7	Roller Bearing .....	1
3	Tapered Bearing .....	1	8	Idler Gear .....	1
4	Tapered Bearing Spacer.....	1	9	Gear Snap Ring.....	1
5	Idler Shaft .....	1			

**FIG. F INPUT SHAFT GROUP "F"**

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Outer Bearing Lock Nut.....	1	9	Ball Bearing .....	1
2	Bearing Nut Lock.....	1	10	Bearing Cap .....	1
3	Inner Bearing Lock Nut.....	1	11	Flange Deflector .....	1
4	Ball Bearing .....	1	12	Companion Flange .....	1
5	Gear Spacer (Short) .....	1	13	Flange "O" Ring .....	1
6	Input Gear .....	1	14	Flange Washer .....	1
7	Gear Spacer (Long) .....	1	15	Flange Nut .....	1
8	Input Shaft .....	1	16	Flange Nut Cotter .....	1

**FIG. G REVERSE SHAFT GROUP "R"**

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Outer Bearing Lock Nut.....	1	8	Reverse Shaft .....	1
2	Bearing Nut Lock.....	1	9	Ball Bearing .....	1
3	Inner Bearing Lock Nut .....	1	10	Bearing Spacer .....	1
4	Ball Bearing .....	1	11	Reverse Nut Washer .....	1
5	Gear Spacer (Short) .....	1	12	Reverse Nut .....	1
6	Reverse Gear .....	1	13	Bearing Cap .....	1
7	Gear Spacer (Long) .....	1			



**FIG. H   2nd and 4th SHAFT GROUP   "A"**

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	2nd & 4th Shaft.....	1	6	Gear Spacer (Thin).....	1
2	Outer Bearing Lock Nut.....	1	7	Gear Spacer (Long).....	1
3	Bearing Nut Lock .....	1	8	2nd & 4th Gear.....	1
4	Inner Bearing Lock Nut .....	1	9	Gear Spacer (Short).....	1
5	Roller Bearing .....	1	10	Tápered Bearing Assembly.....	1

**FIG. I   1st and 3rd SHAFT GROUP   "B"**

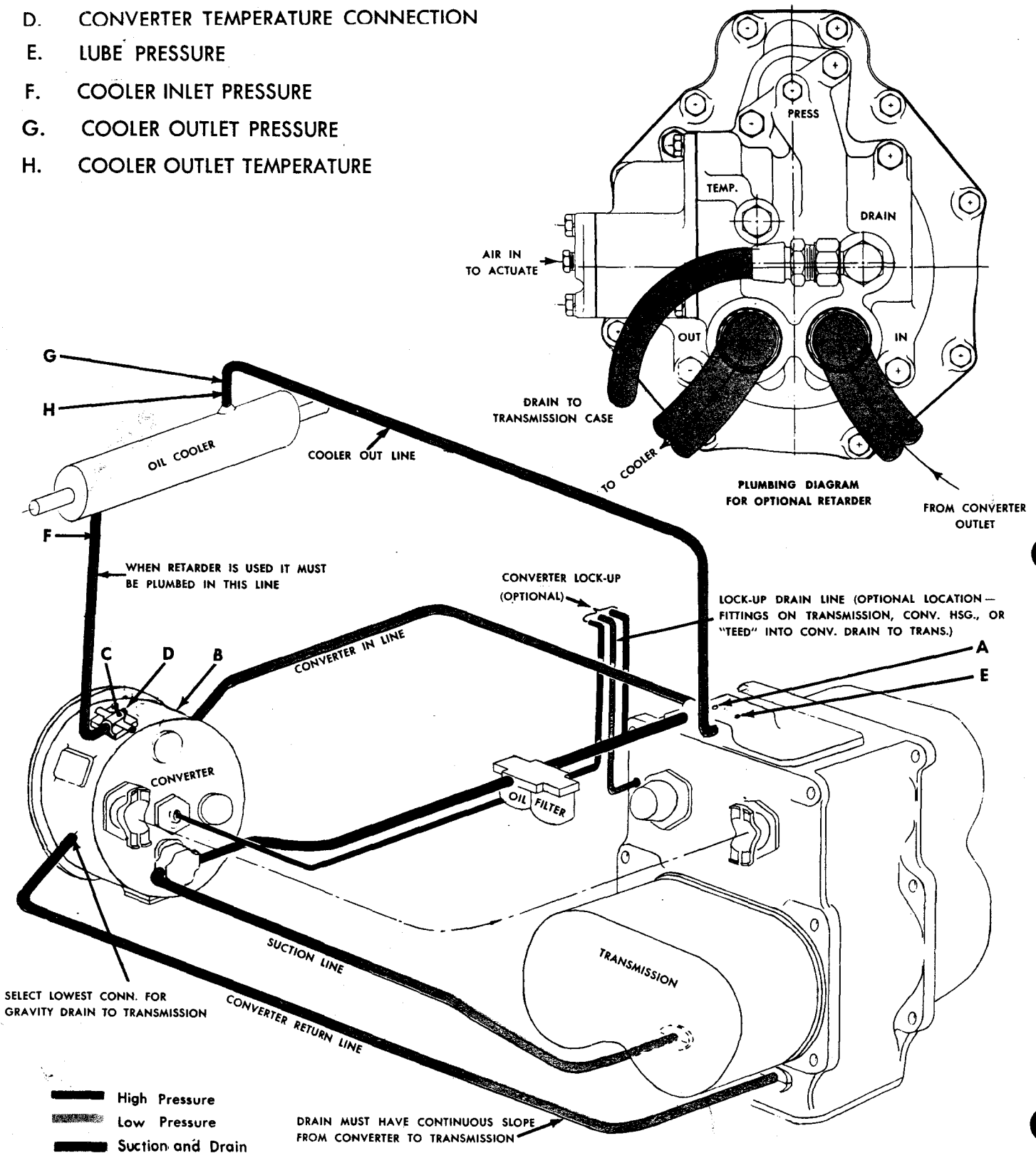
ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	1st & 3rd Shaft.....	1	6	Gear Spacer (Thin).....	1
2	Outer Bearing Lock Nut.....	1	7	1st & 3rd Gear.....	1
3	Bearing Nut Lock.....	1	8	Gear Spacer (Long).....	1
4	Inner Bearing Lock Nut.....	1	9	Tapered Bearing Assembly.....	1
5	Roller Bearing .....	1			

**SPEEDOMETER DRIVE GROUP**

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Speedometer Drive Housing.....	1	5	Speedometer Drive Bearing.....	1
2	Speedometer Drive Shaft.....	1	6	Bearing Snap Ring.....	1
3	Drive Shaft Oil Seal.....	1	7	Speedometer Drive Spring.....	1
4	Bearing Snap Ring.....	1	8	Bearing Snap Ring.....	1

FIG J CHECK POINTS

- A. CLUTCH PRESSURE
- B. CONVERTER INLET
- C. CONVERTER OUTLET
- D. CONVERTER TEMPERATURE CONNECTION
- E. LUBE PRESSURE
- F. COOLER INLET PRESSURE
- G. COOLER OUTLET PRESSURE
- H. COOLER OUTLET TEMPERATURE



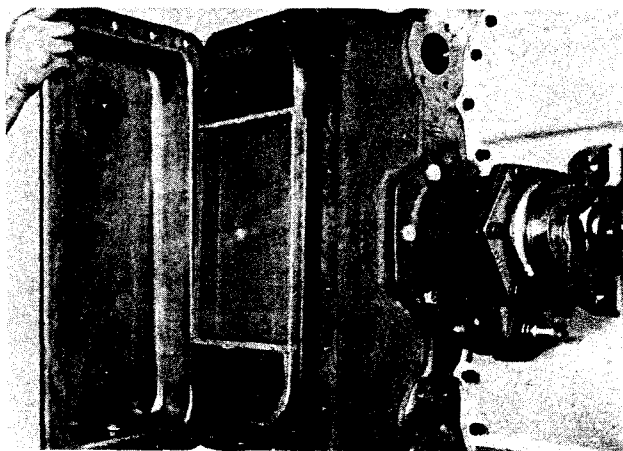
## OVERHAUL OF TRANSMISSION ASSEMBLY

The instructions contained herein cover the disassembly and reassembly of the transmission in a sequence that would normally be followed after the unit has been removed from the machine and is to be completely overhauled. It must also be understood that this is a basic 8000 series transmission with many options. Control covers, clutch covers, companion flanges and output shafts with and without disconnect assemblies may vary on specific models. The units are

very similar to trouble shoot, disassemble, repair and reassemble.

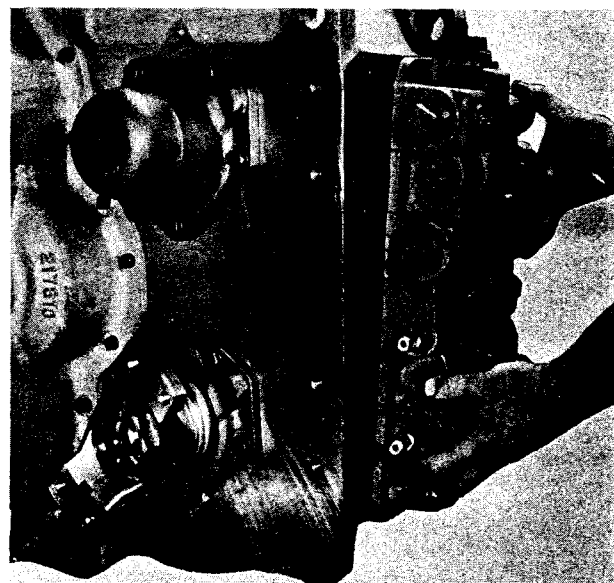
**CAUTION:** Cleanliness is of extreme importance and an absolute must in the repair and overhaul of this unit. Before attempting any repairs, the exterior of the unit must be thoroughly cleaned to prevent the possibility of dirt and foreign matter entering the mechanism.

## DISSASSEMBLY OF THE TRANSMISSION



**Figure 1**

Remove transmission sump pan bolts and sump pan.



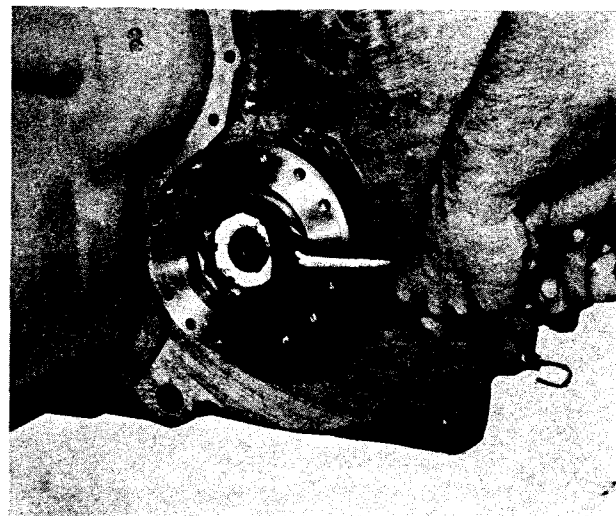
**Figure 3**

Remove transmission control cover from transmission.



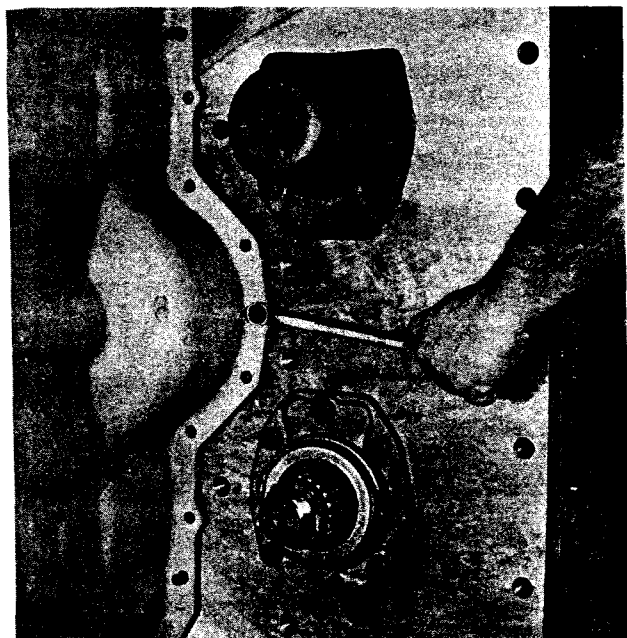
**Figure 2**

Remove sump screen and baffle assembly.



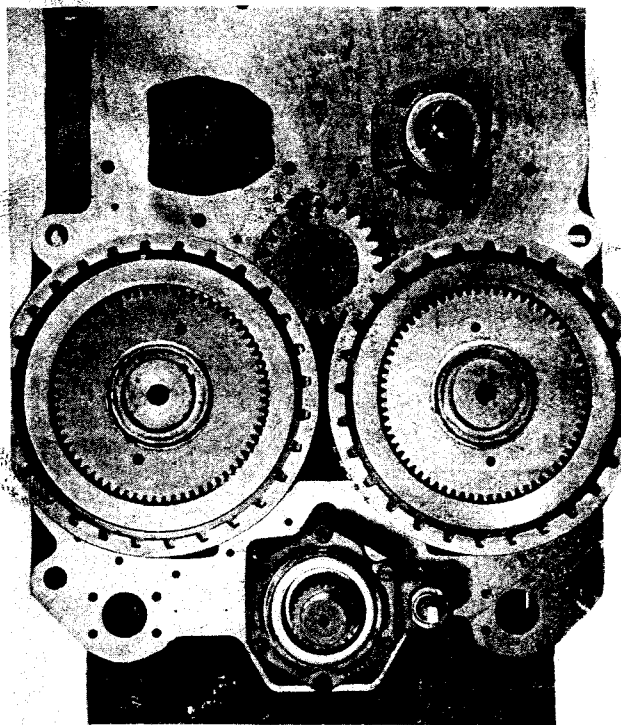
**Figure 4**

Lock transmission gears with a soft bar and remove input flange nut and flange.



**Figure 5**

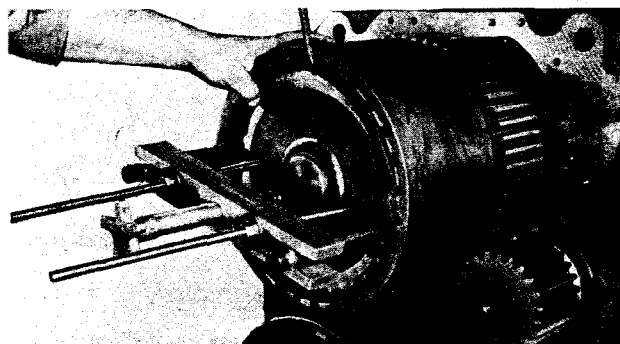
Remove 1st and 2nd clutch cover.



**Figure 6**

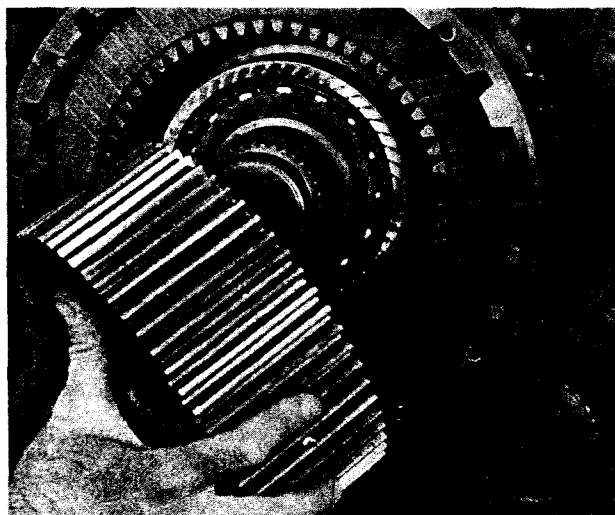
1st and 2nd clutch cover removed.

**NOTE:** All clutches are disassembled and assembled in a similar manner. However, the quantity of inner and outer clutch discs differ between the high and low clutches. Clutches shown being disassembled are the 1st and 2nd.



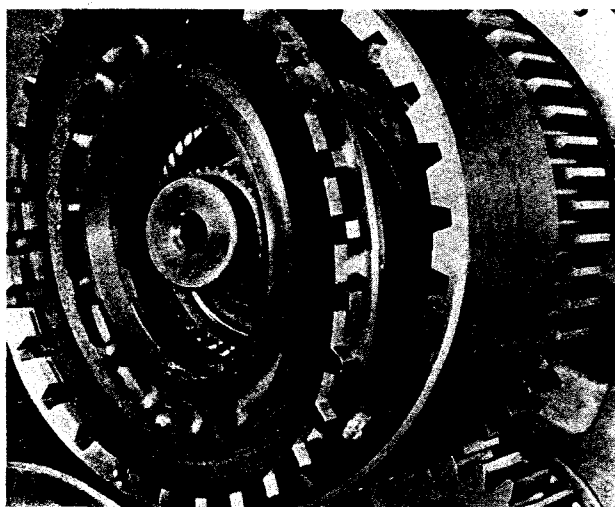
**Figure 7**

Depress end plate and remove retainer ring. Remove end plate.



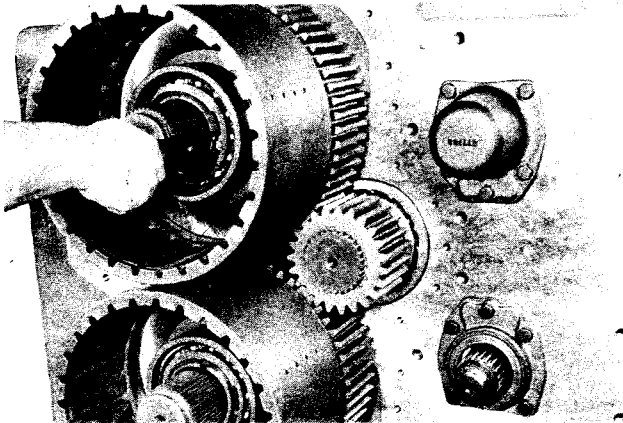
**Figure 8**

Remove clutch disc hub retainer ring. Remove clutch disc hub. Remove release springs, guide pins, and inner and outer clutch discs.



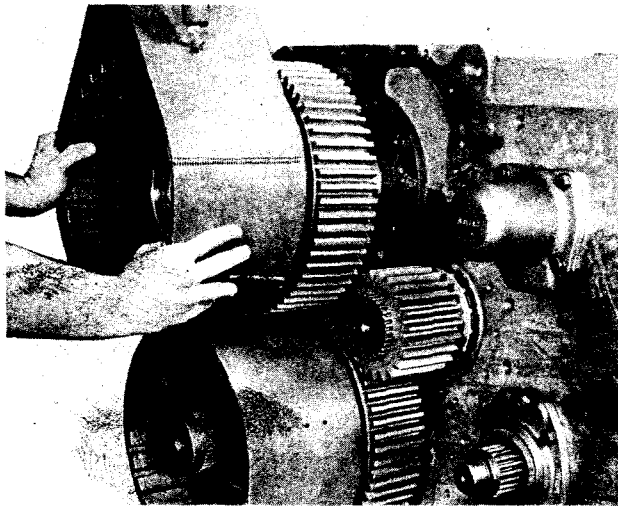
**Figure 9**

Remove clutch piston.



**Figure 10**

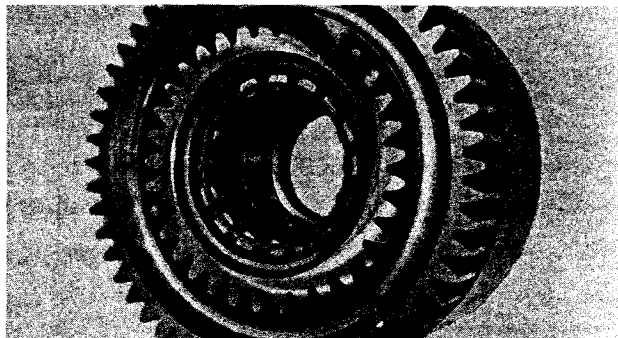
Remove clutch drum retainer ring and retainer washer.



**Figure 11**

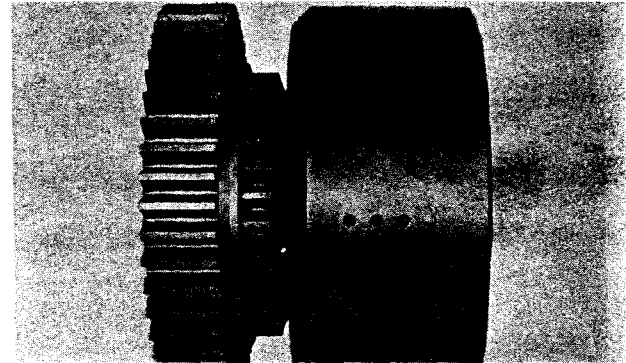
Remove clutch drum assembly from clutch support.

**NOTE:** If clutch drum hub gear, support bearings, or piston ring outer race are to be replaced, use Figure 12 through Figure 16; if replacement is not necessary, disregard and continue on with Figure 17.



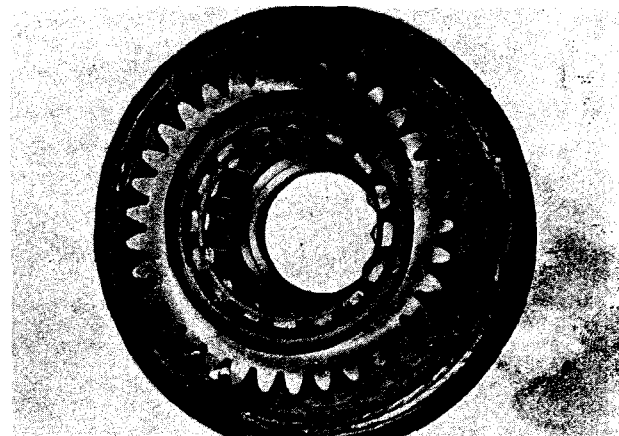
**Figure 12**

Remove clutch drum hub gear retainer ring.



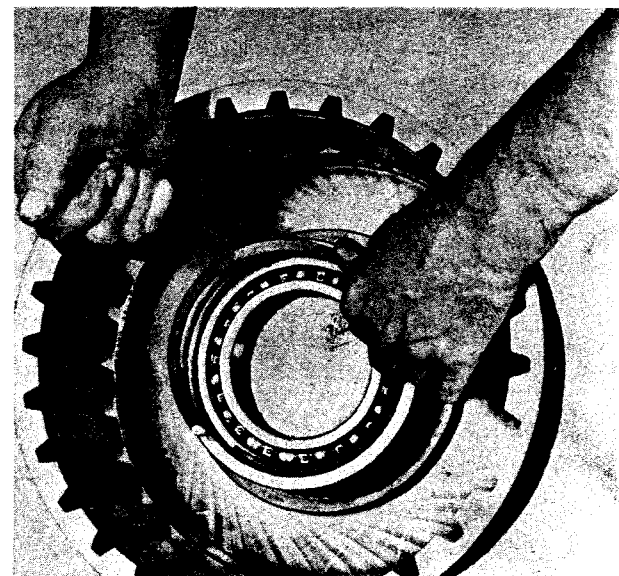
**Figure 13**

Remove clutch drum hub gear.



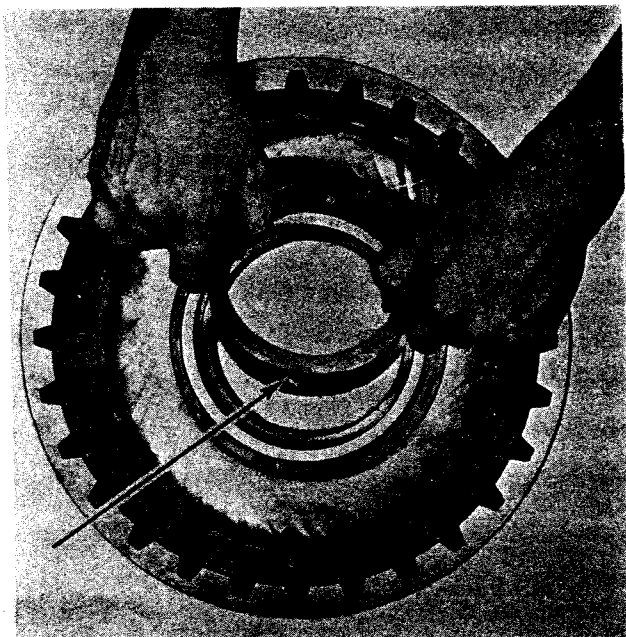
**Figure 14**

Remove drum support roller bearing retainer ring.



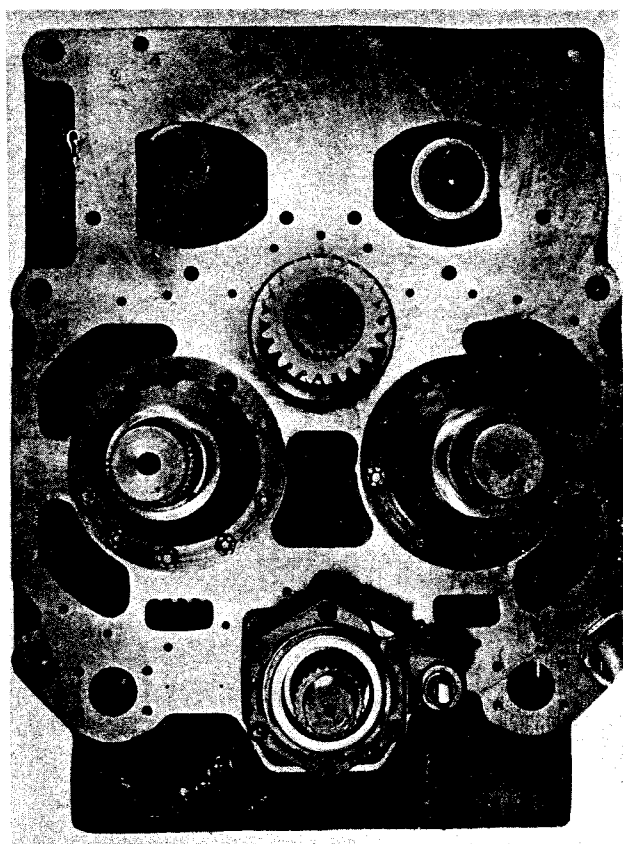
**Figure 15**

Remove drum support ball bearing retainer ring. Press or drive roller and ball bearing from clutch drum.



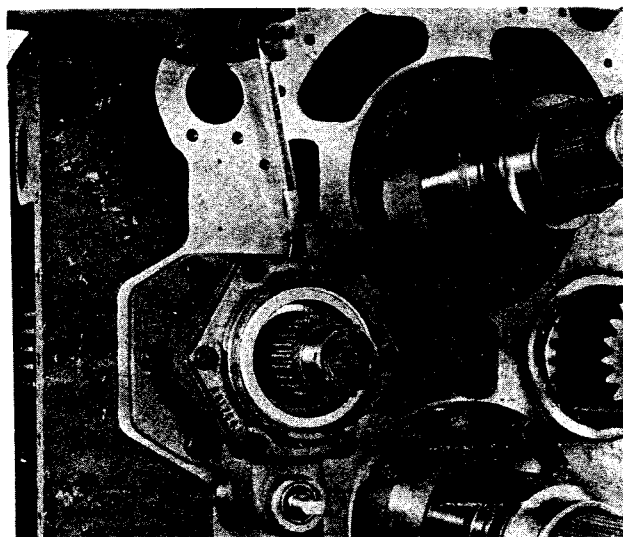
**Figure 16**

Press piston ring outer race from clutch drum. **CAUTION:** Do not lose ball (see arrow).



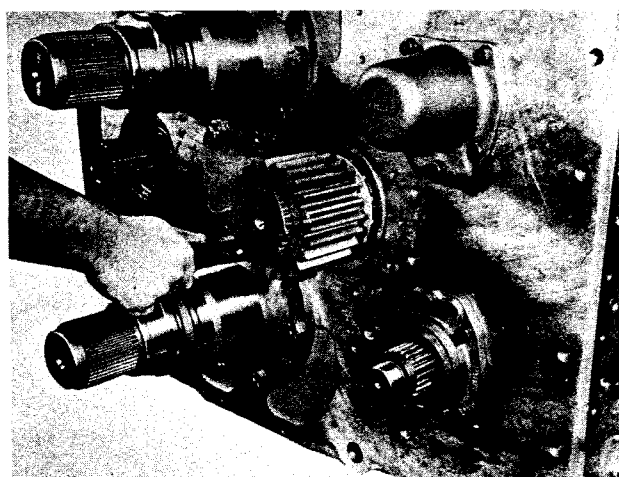
**Figure 17**

Low clutch side with clutches removed.



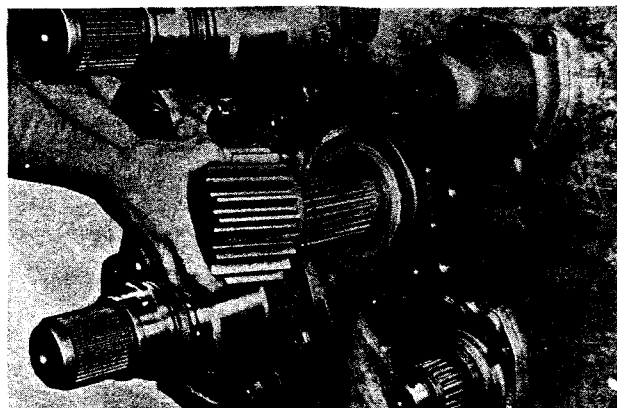
**Figure 18**

Remove bolts from disconnect housing. Remove disconnect housing.



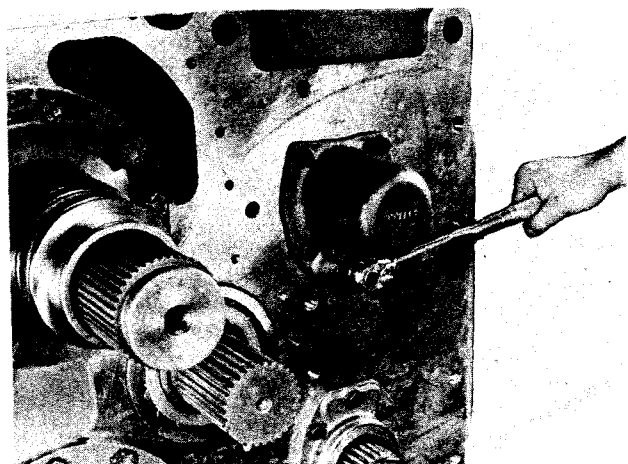
**Figure 19**

Remove idler gear retainer ring.

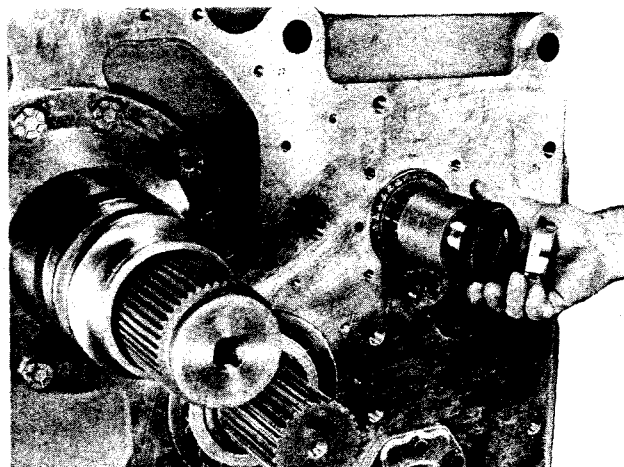


**Figure 20**

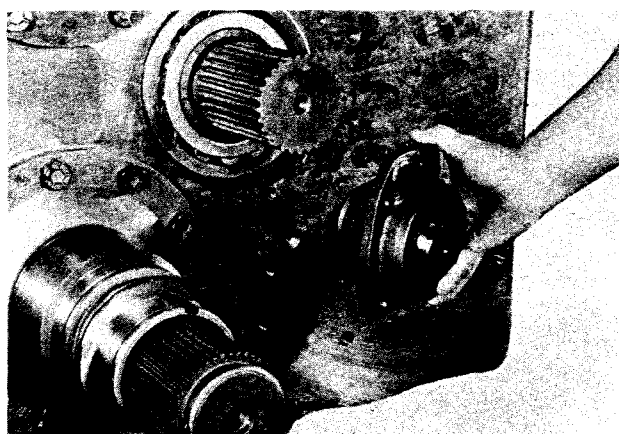
Remove idler gear.


**Figure 21**

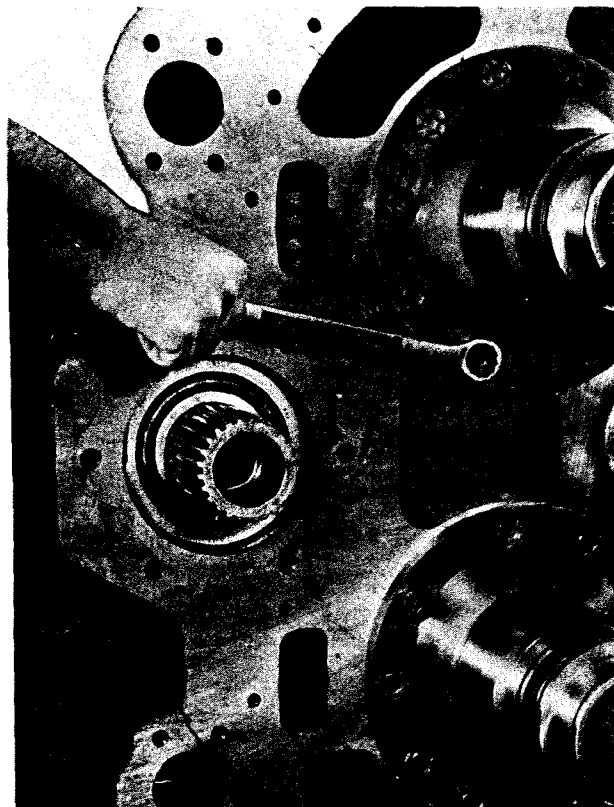
Remove reverse shaft bearing cap.


**Figure 22**

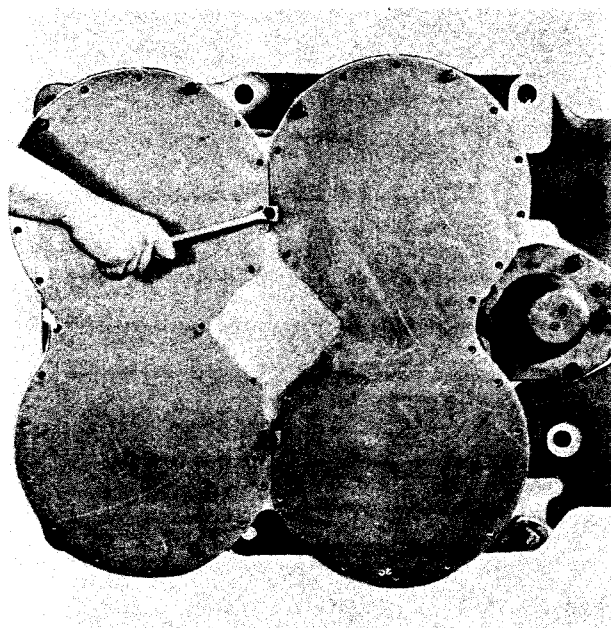
Remove reverse shaft nut cotter, nut, washer, and spacer.


**Figure 23**

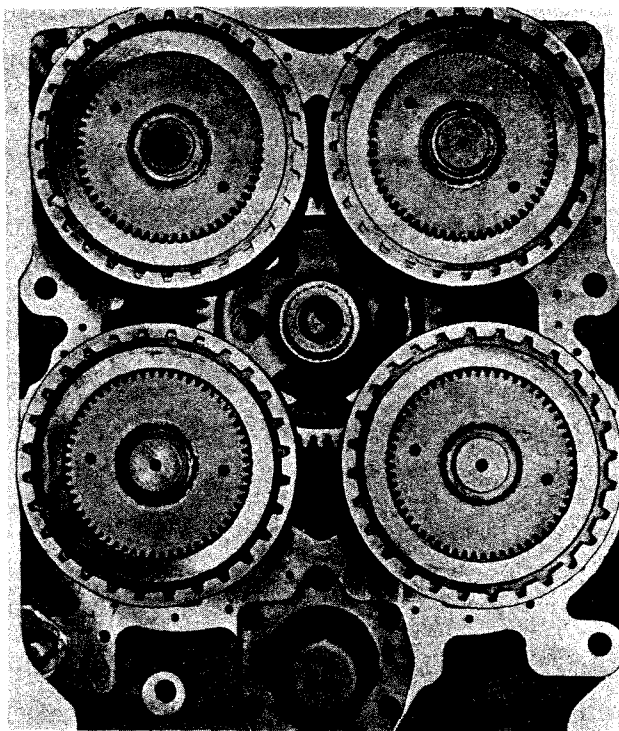
Remove input shaft bearing cap bolts. Remove bearing cap and oil seal assembly.


**Figure 24**

Remove clutch supports.

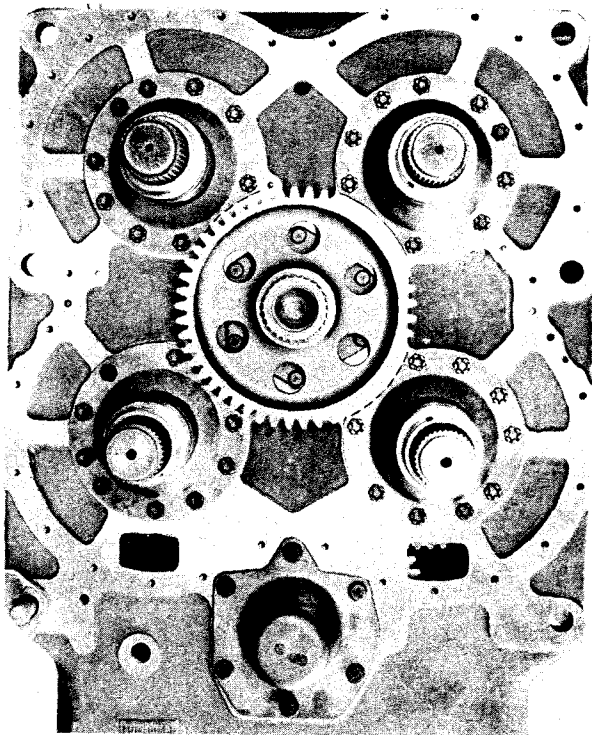

**Figure 25**

Remove input, reverse, 3rd and 4th clutch cover. Figure 25 shows cover plates being removed. On some models this will be a solid cover and will not have clutch cover plates.



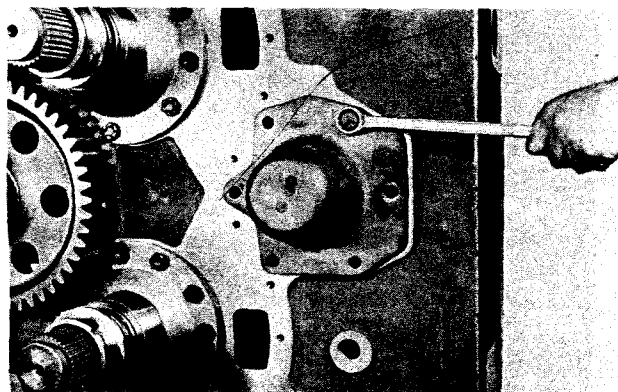
**Figure 26**

Clutch cover removed. Proceed with clutch disassembly as explained in previous text (Figure 7 through 11 and Figure 14 through 16).



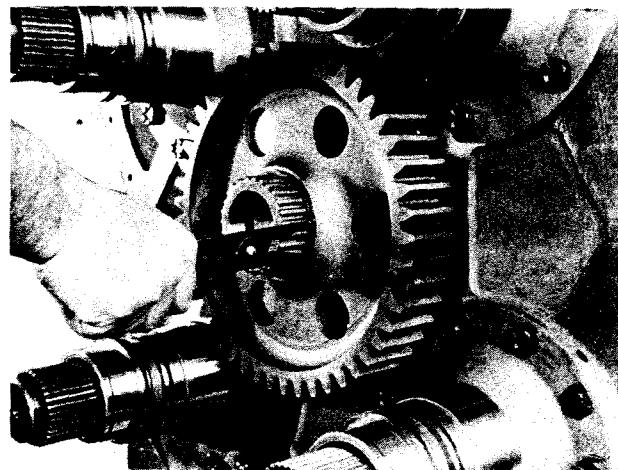
**Figure 27**

Clutch support and idler gear access.



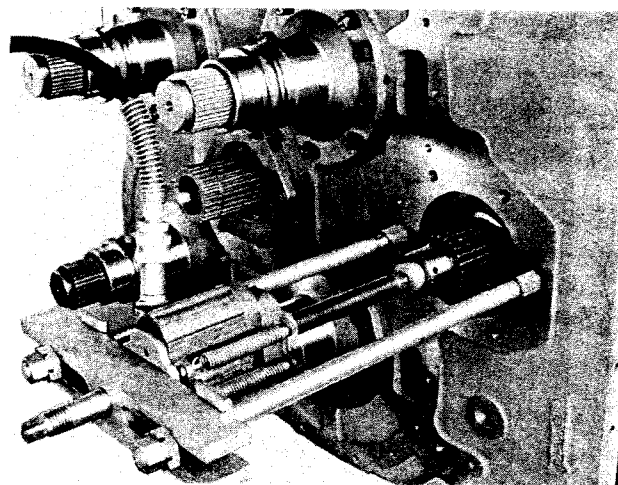
**Figure 28**

Remove output shaft bearing cap. When a companion flange is used, remove flange nut cotter, flange nut, washer and "O" ring.



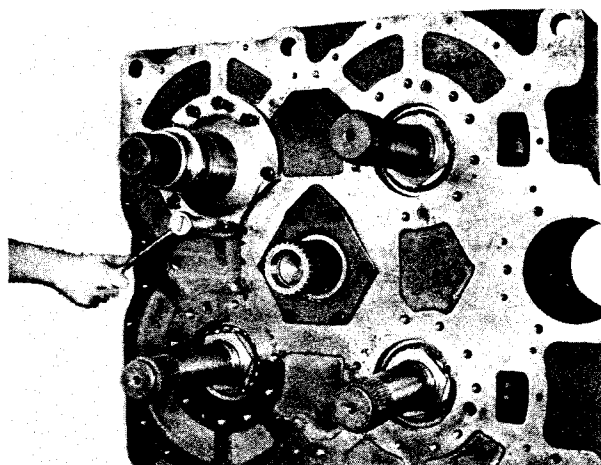
**Figure 29**

Remove idler gear retainer ring and idler gear.

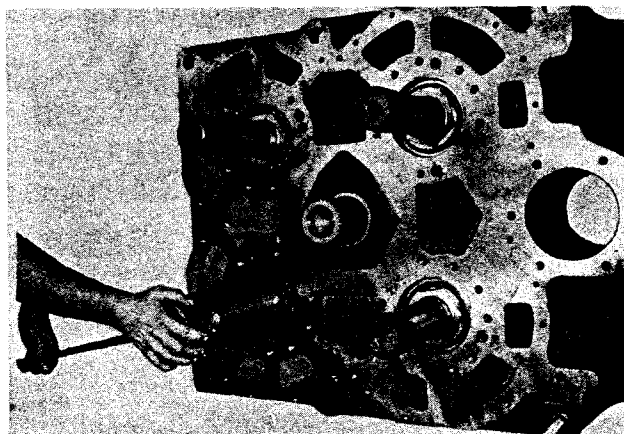


**Figure 30**

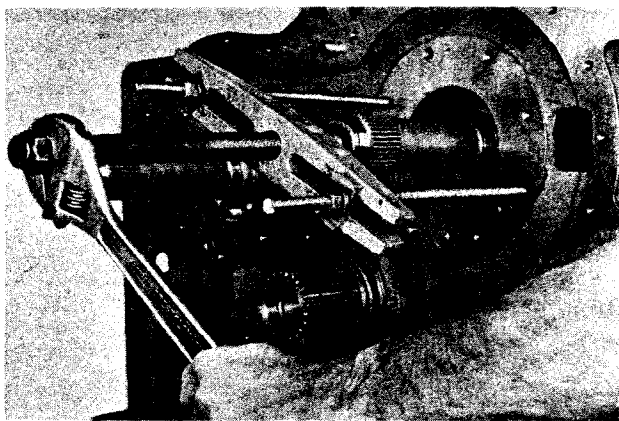
Press output shaft from case. Output shaft may be removed or installed from either side.


**Figure 31**

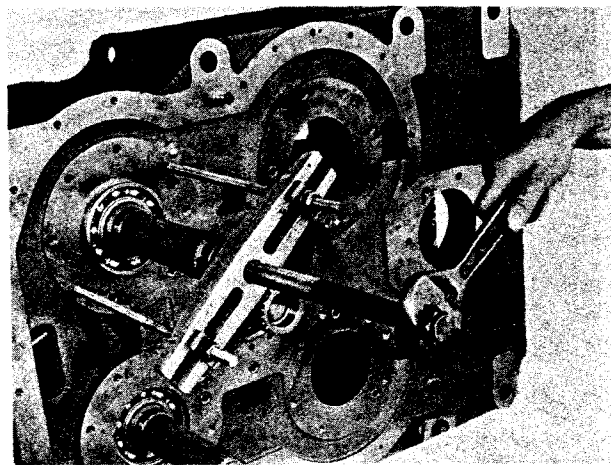
Remove clutch supports.


**Figure 32**

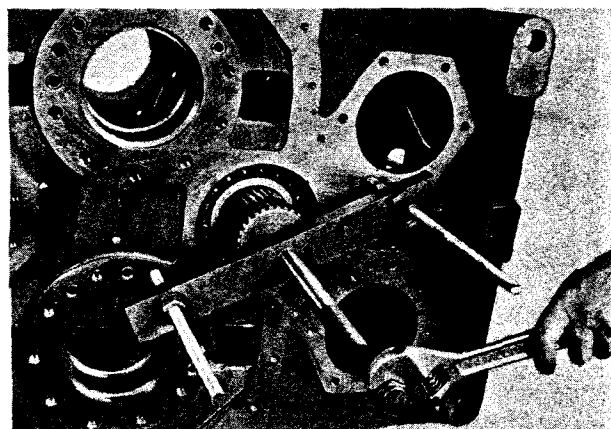
Straighten tangs on shaft nut locks. Lock gears with a soft bar and remove outer lock nut, nut lock, and inner lock nut.


**Figure 33**

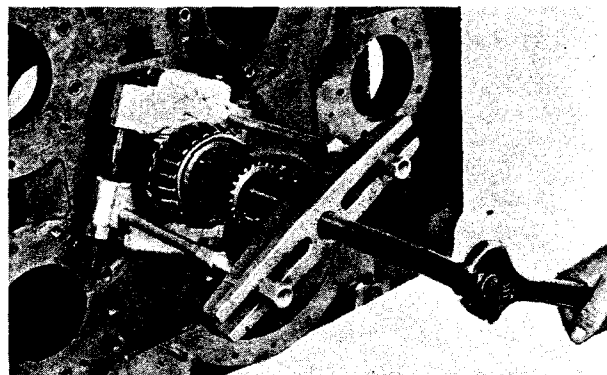
Using a suitable pusher tool, remove 1st and 3rd and 2nd and 4th shaft, pushing from the lock nut side. Remove gears and spacers from inside of case.


**Figure 34**

Using a suitable pusher tool, remove input and reverse shaft, pushing from lock nut side. Remove gears and spacers from inside of case.

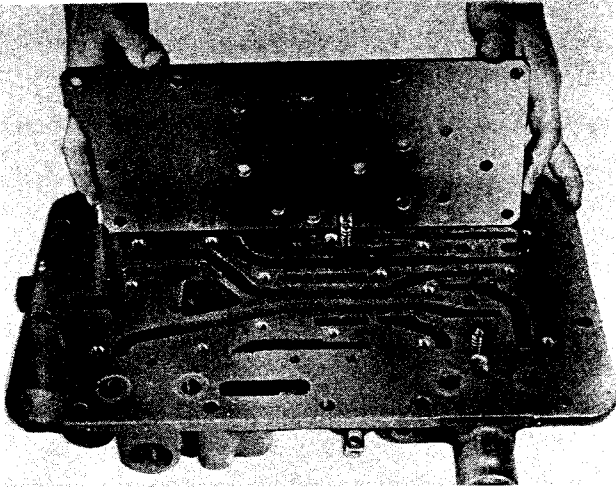

**Figure 35**

Remove idler shaft by pushing shaft out until double cone bearing and outer bearing race is exposed on opposite side.


**Figure 36**

Using a suitable puller remove double cone bearing from idler shaft. From cone bearing side push idler shaft and bearing from case.

# DISASSEMBLY OF CONTROL COVER



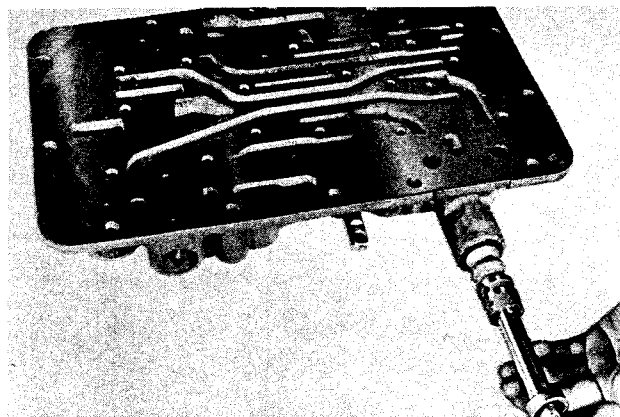
**Figure 37**

Remove bolts from oil circuit plate. Remove oil circuit plate. **CAUTION:** Do not lose detent springs.



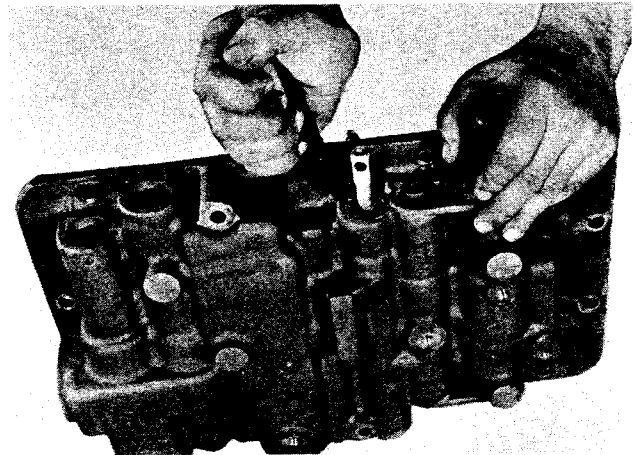
**Figure 38**

Remove speed selector valve assembly retainer ring.



**Figure 39**

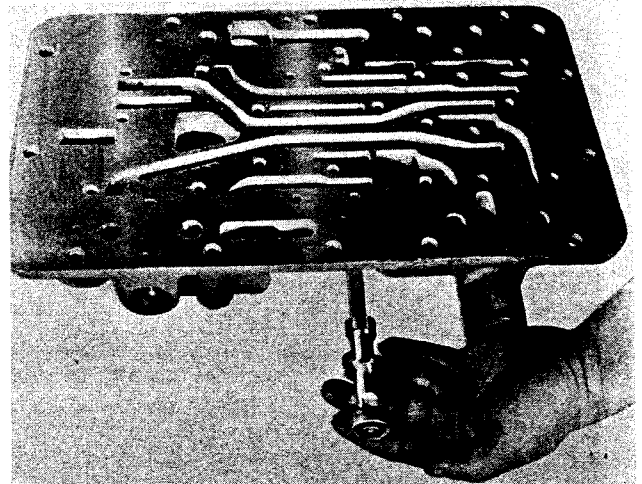
Tap lightly on opposite end of speed selector valve. Valve and valve oil seal will come out together.



**Figure 40**

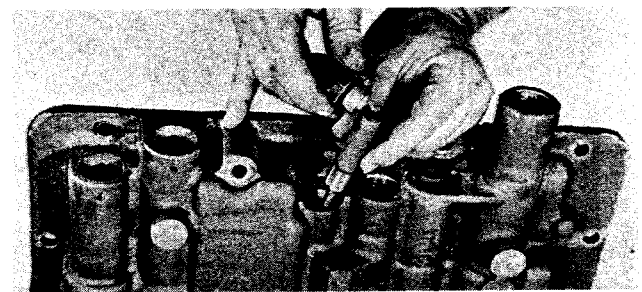
If positive neutral valve is used, disconnect shift link from forward and reverse valve (see Figure 44) and remove shift link, oil seal, and shut off valve spool from cover.

Remove forward and reverse selector valve retainer ring.



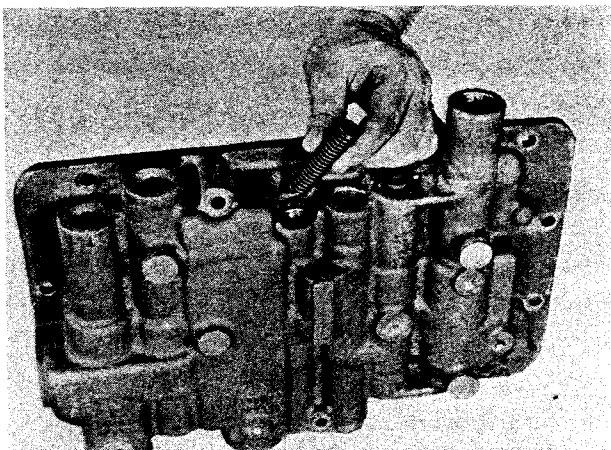
**Figure 41**

Tap lightly on opposite end of forward and reverse selector valve. Valve and valve oil seal will come out together.

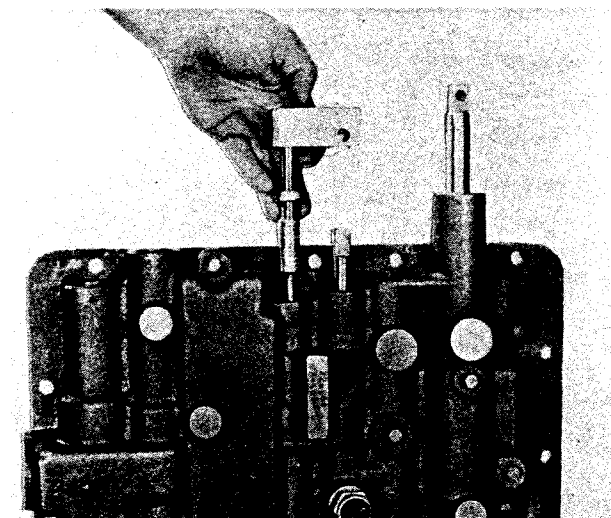


**Figure 42**

Remove shut-off valve plug and "O" ring. Remove shut-off valve. If positive neutral is used, see Fig. 44.

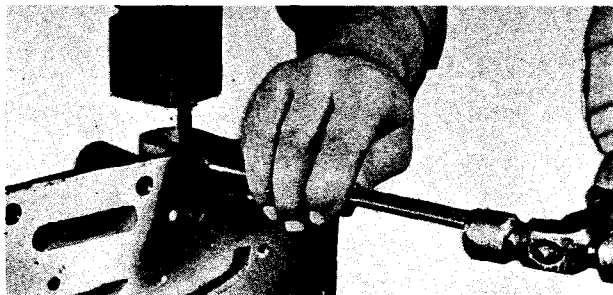

**Figure 43**

Remove shut-off valve spring. If positive neutral is used, see Figure 44.


**Figure 44**

If positive neutral shut-off valve is used, remove shut-off valve to forward and reverse selector link clevis pin. Remove link, oil seal, and spool from cover.

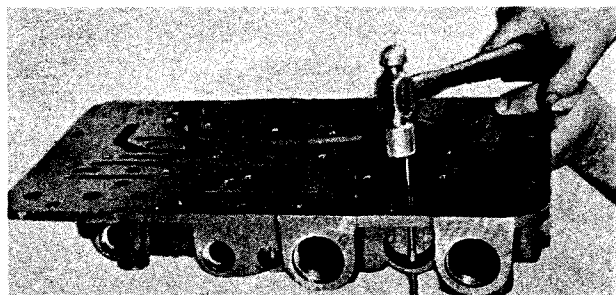
**CAUTION:** When removing roll pins, it is recommended a press be used to depress valve stop, valve and spool springs.


**Figure 45**

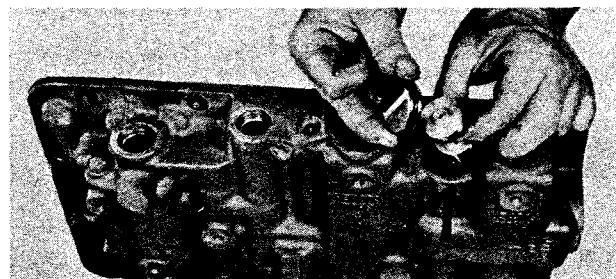
Depress regulating valve spring stop and spring. Remove roll pin.


**Figure 46**

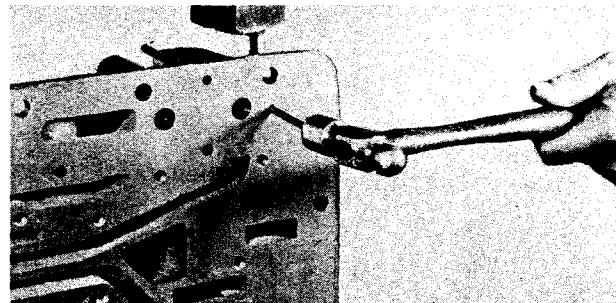
Release press slowly; springs will push spring stop from control housing. Remove spring stop and inner and outer spring.


**Figure 47**

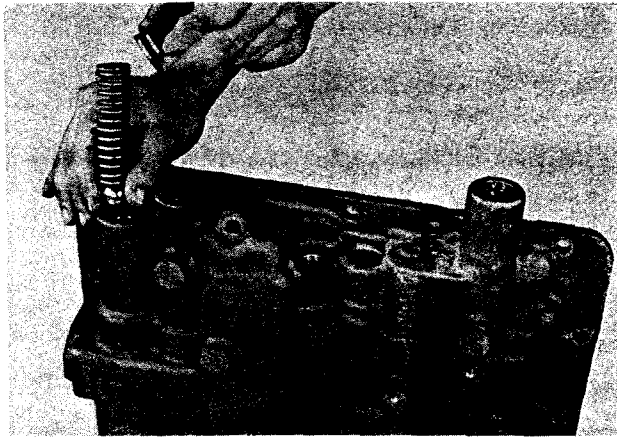
Remove roll pin on opposite end. Depressing valve stop is not necessary as the springs were removed in Figure 46.


**Figure 48**

Remove regulating valve stop and valve from control housing.


**Figure 49**

Depress safety valve spring and spring stop.


**Figure 50**

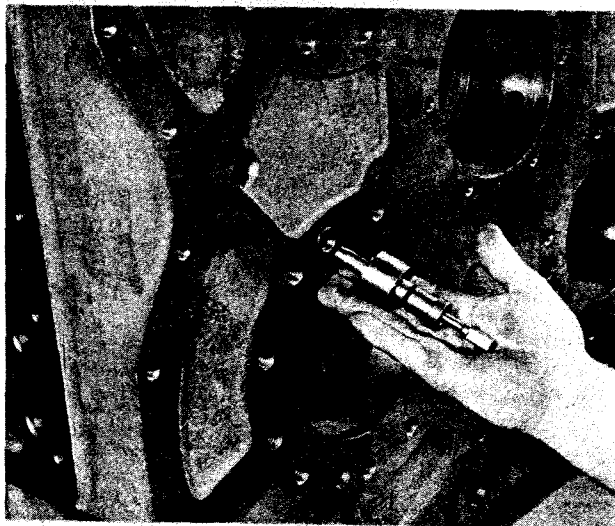
Remove safety valve spring stop, valve spring, and safety valve ball.

## TRANSMISSION INTERNAL TUBING

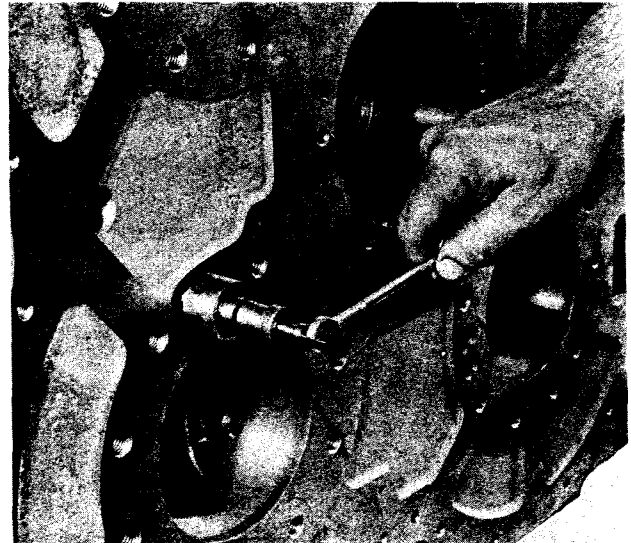
These tubes are not to be removed unless damaged. They should, however, be cleaned and checked for leaks when transmission is disassembled. The tubes are divided into two groups. The high pressure or clutch pressure lines and the low or lubricating pressure lines.

When necessary to replace any tubes, tool 943374 is required. The procedure for using tool is as follows:

1. Install tubing in housing with end flush with case.
2. Slide collar over end of tube and press into bore of case.


**Figure 51**

Pull mandrel on tool all the way back and insert tool in tube.


**Figure 52**

Turn mandrel with hand until tool is firmly seated in tube. Using a 3/8" wrench, turn mandrel as far as possible.

Use this procedure to install all tubes in housing.

### Principle of Tool

Tool has roller which expands when mandrel is inserted. As mandrel is turned, the rollers expand against the internal bore of tubing. This forces tube to expand against collar which has a groove on inside diameter. When tube is expanded into this groove it is locked into position.

### Cleaning and Repair of Tool

This tool is a precision instrument and must be treated as such. After each use, remove mandrel and rollers and flush tool with cleaning solvent. Inspect rollers and mandrel for chips and flaking. If rollers or mandrel need to be replaced, they may be purchased from CENTRAL PARTS DIVISION, 7300 SOUTH CICERO AVE., CHICAGO 29, ILLINOIS.

## CLEANING AND INSPECTION

### CLEANING

Clean all parts thoroughly using solvent type cleaning fluid. It is recommended that parts be immersed in cleaning fluid and slushed up and down slowly until all old lubricant and foreign material is dissolved and parts are thoroughly cleaned.

**CAUTION:** Care should be exercised to avoid skin rashes, fire hazards and inhalation of vapors when using solvent type cleaners.

### Bearings

Remove bearings from cleaning fluid and strike larger side of cone flat against a block of wood to dislodge solidified particles of lubricant. Immerse again in cleaning fluid to flush out particles. Repeat above operation until bearings are thoroughly clean. Dry bearings using moisture-free compressed air. Be careful to direct air stream across

bearing to avoid spinning. Do not spin bearings when drying. Bearings may be rotated slowly by hand to facilitate drying process.

### Housings

Clean interior and exterior of housings, bearing caps, etc., thoroughly. Cast parts may be cleaned in hot solution tanks with mild alkali solutions providing these parts do not have ground or polished surfaces. Parts should remain in solution long enough to be thoroughly cleaned and heated. This will aid the evaporation of the cleaning solution and rinse water. Parts cleaned in solution tanks must be thoroughly rinsed with clean water to remove all traces of alkali. Cast parts may also be cleaned with steam cleaner.

**CAUTION:** Care should be exercised to avoid inhalation of vapors and skin rashes when using alkali cleaners.

All parts cleaned must be thoroughly dried immediately by using moisture-free compressed air or soft, lintless absorbent wiping rags free of abrasive materials such as metal filings, contaminated oil or lapping compound.

### INSPECTION

The importance of careful and thorough inspection of all parts cannot be overstressed. Replacement of all parts showing indication of wear or stress will eliminate costly and avoidable failures at a later date.

### Bearings

Carefully inspect all rollers, cages and cups for wear, chipping or nicks to determine fitness of bearings for further use. Do not replace a bearing cone or cup individually without replacing the mating cup or cone at the same time. After inspection, dip bearings in Type "A" Automatic Transmission Fluid and wrap in clean lintless cloth or paper to protect them until installed.

### Oil Seals, Gaskets, Etc.

Replacement of spring load oil seals, "O" rings, metal sealing rings, gaskets and snap rings is more economical when unit is disassembled than premature overhaul to replace these parts at a future time. Further loss of lubricant through a worn seal may result in failure of other more expensive parts of the assembly. Sealing members should be handled carefully, particularly when being installed. Cutting, scratching, or curling under of lip of seal seriously impairs its efficiency. Apply a thin coat of Permatex No. 2 on the outer diameter of the oil seal to assure an oil tight fit into the retainer. When assembling new metal type sealing rings, same should be lubricated with coat of chassis grease to stabilize rings in their grooves for ease of assembly of mating members. Lubricate all "O" rings and seals with Type "A" Automatic Transmission Fluid before assembly.

### Gears and Shafts

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

suitable hone. Inspect shafts to make certain they are not sprung, bent, or splines twisted, and that shafts are true.

### Housing, Covers, etc.

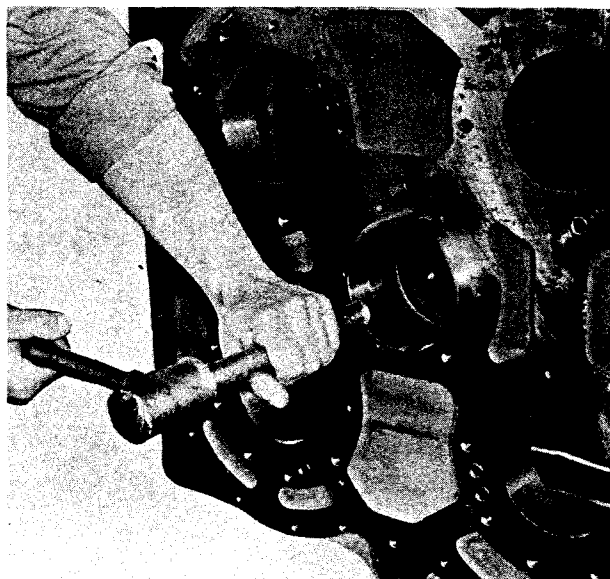
Inspect housings, covers and bearing caps to be certain they are thoroughly cleaned and that mating surfaces, bearing bores, etc., are free from nicks or burrs. Check all parts carefully for evidence of cracks or condition which would cause subsequent oil leaks or failures.

## REASSEMBLY OF TRANSMISSION

Instructions given below on reassembly of components of transmission assembly are given in the sequence that must be followed in rebuilding. Principle of operations cited and views shown are similar and parallel on all shafts. The various drive shafts are assembled in the following order:

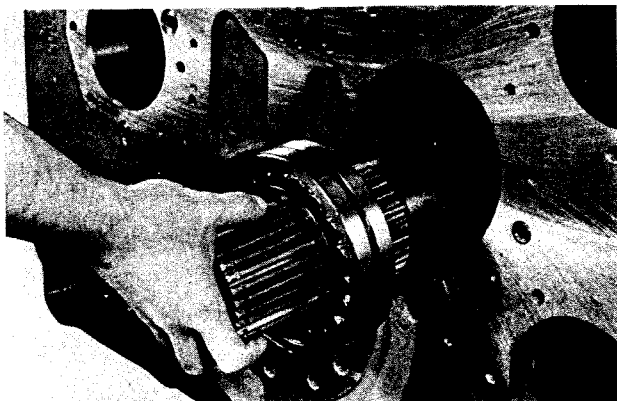
1. Idler Shaft—"I"
2. First and Third Shaft—"B"
3. Second and Fourth Shaft—"A"
4. Input Shaft—"F"
5. Reverse Shaft—"R"
6. Out Shaft—"O"

### REASSEMBLY OF IDLER SHAFT T



**Figure 53**

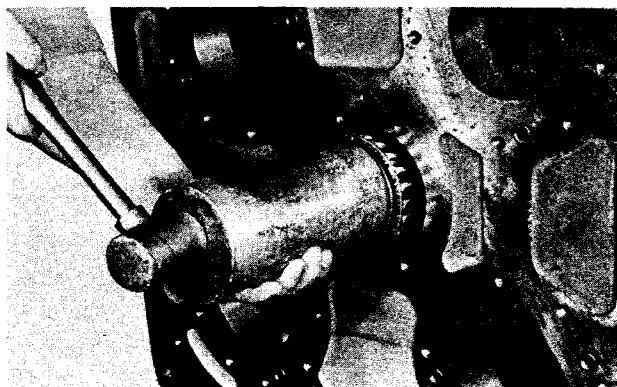
Install idler shaft inner cone bearing cup in transmission case.


**Figure 54**

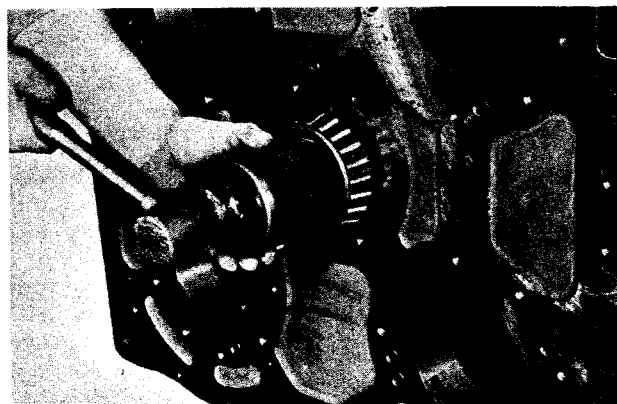
Install spherical bearing spacer on idler shaft. Press large spherical roller bearing on idler shaft. Install bearing and shaft in case. (Opposite side of inner bearing cup.)


**Figure 55**

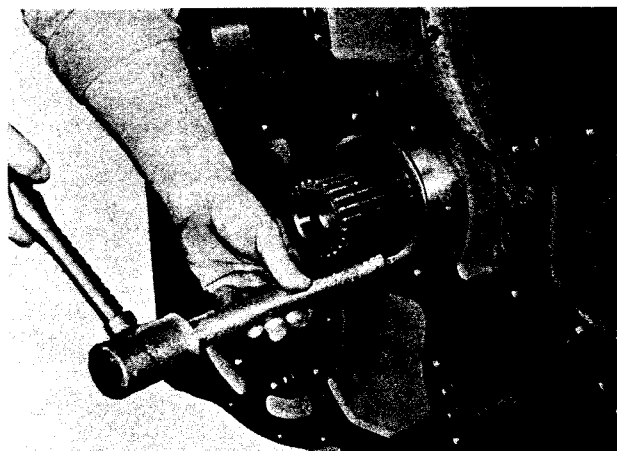
Tap bearing and shaft assembly in case. On taper bearing end of shaft install bearing spacer. **CAUTION:** This spacer has a taper on the outer edge. This taper must go towards taper bearing. If installed wrong the large idler gear snap ring will not seat in ring groove.


**Figure 56**

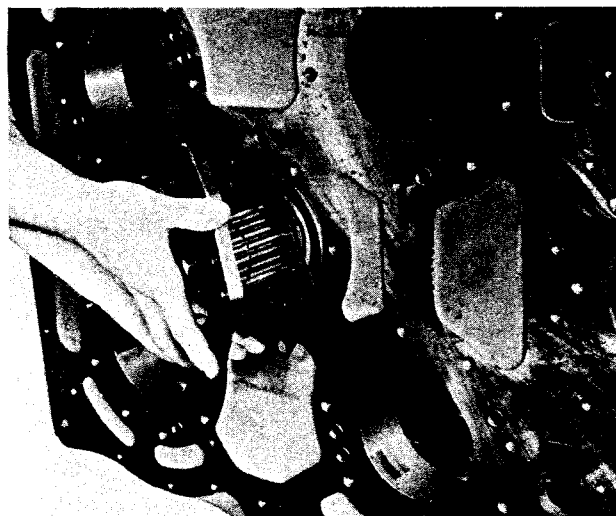
Install inner taper bearing on shaft with large diameter of taper outward.


**Figure 57**

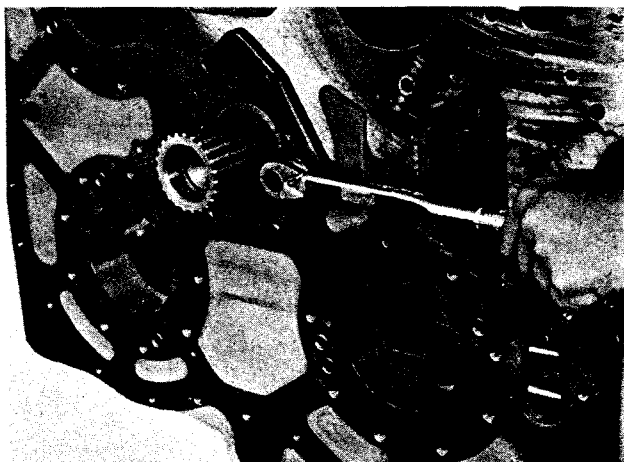
Install outer taper bearing on shaft with large diameter inward.


**Figure 58**

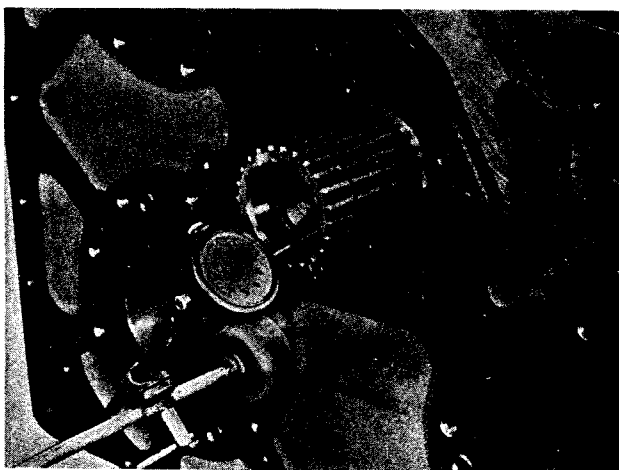
Install outer bearing cup against outer taper bearing.


**Figure 59**

Install idler shaft bearing cap and shims.


**Figure 60**

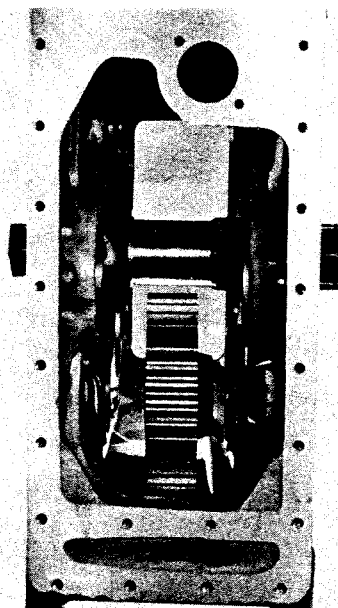
Install bearing cap bolts, torque bolt 45 to 55 ft. lbs.


**Figure 61**

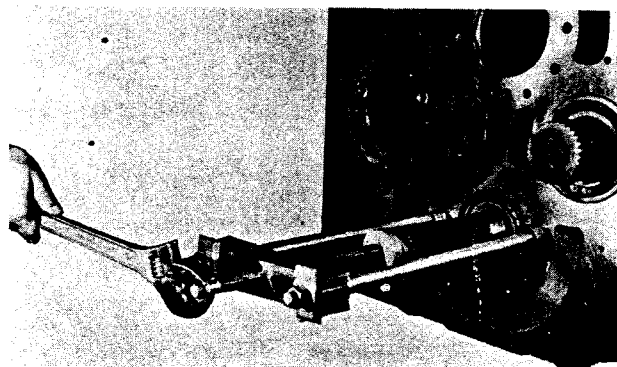
Adjust idler shaft taper bearing by adding or omitting shims. Check adjustment as shown in Figure 61. Adjust taper bearings .0 to .003 end play.

### REASSEMBLY OF 1st AND 3rd SHAFT

Press 1st and 3rd double taper bearing assembly on shaft. **CAUTION:** These bearings are in matched sets and under no circumstances can any of the four (4) parts be changed or mixed up with another bearing.


**Figure 62**

Position 1st and 3rd gear in transmission case with long hub of gear to the front (input) side. Install long gear spacer on shaft and against taper bearing assembly.


**Figure 63**

Insert shaft into bore of case and through 1st and 3rd gear. Use shaft pusher as shown in Figure 63. Push shaft assembly in case until taper bearing shoulders in bore of case. Do not remove shaft pusher.


**Figure 64**

On opposite end of shaft install short spacer against 1st and 3rd gear. Install roller bearing as shown in Figure 64. Remove shaft pusher. This was left on only to hold shaft while installing roller bearings.

**NOTE:** Bearings must be driven in tight. Check long spacer on shaft. When spacer can not be turned by hand, stack up between the front and rear bearing is tight. **DO NOT** attempt to draw bearing up tight with bearing lock nuts.

### REASSEMBLY OF 2nd AND 4th SHAFT

Press 2nd and 4th double taper bearing assembly on shaft. **CAUTION:** These bearings are in matched sets and under no circumstances can any of the four (4) parts be changed or mixed up with another bearing.

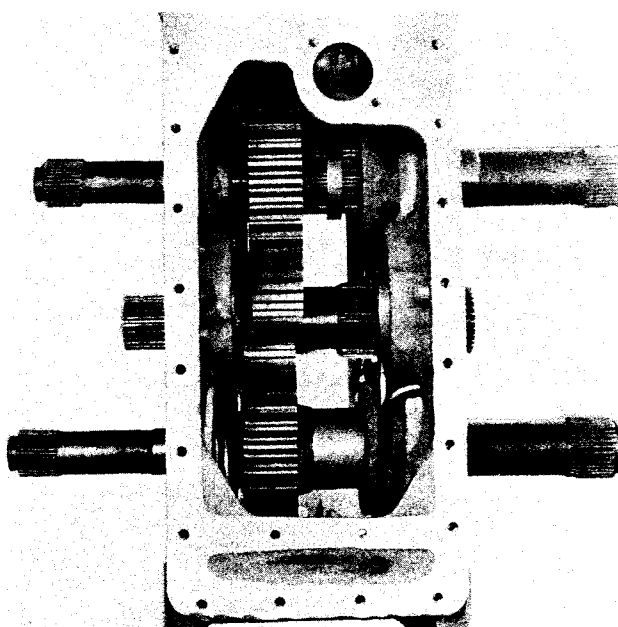


Figure 65

Position 2nd and 4th gear in transmission case. Install short gear spacer on shaft and against taper bearing assembly. Insert shaft into bore of case and through 2nd and 4th gear.

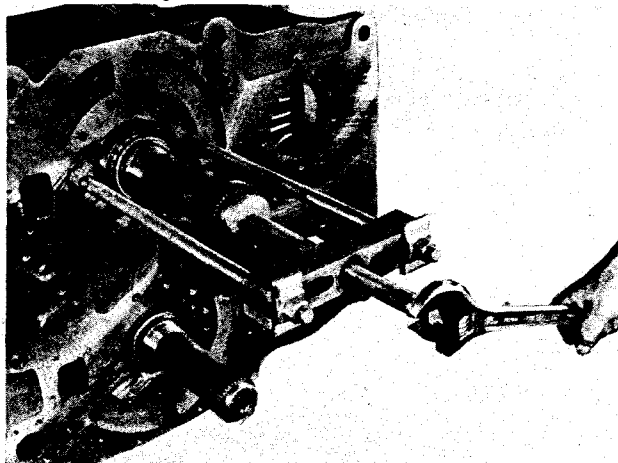


Figure 66

Use shaft as pusher as shown in Figure 66. Push shaft assembly in case until taper bearing shoulders in bore of case. Do not remove shaft pusher.

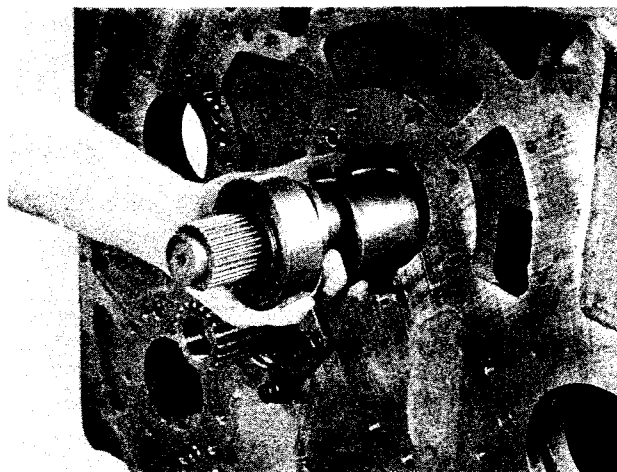


Figure 67

On opposite end of shaft install long gear spacer on shaft and against the 2nd and 4th gear. Install short spacer on shaft against long spacer. Install roller bearing as shown in Figure 67. Remove shaft pusher. This was left on only to hold shaft while installing roller bearing.

**NOTE:** Bearing must be driven in tight. Check long spacer on shaft. When spacer cannot be turned by hand, stack up between the front and rear bearing is tight. **DO NOT** attempt to draw bearing up tight with bearing lock nuts.

### REASSEMBLY OF INPUT AND REVERSE SHAFT

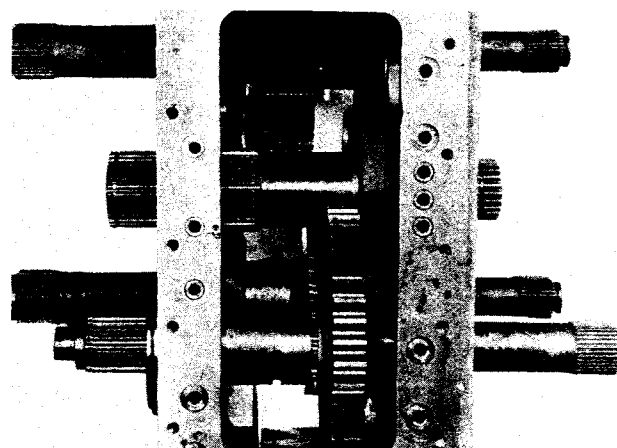
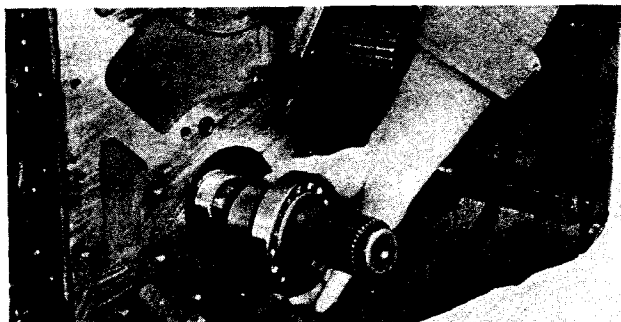
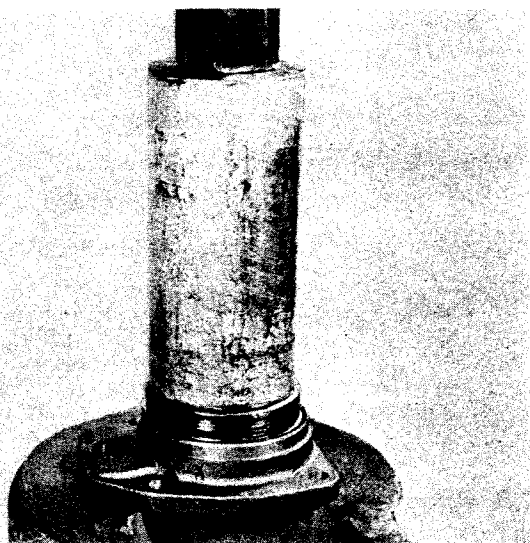


Figure 68

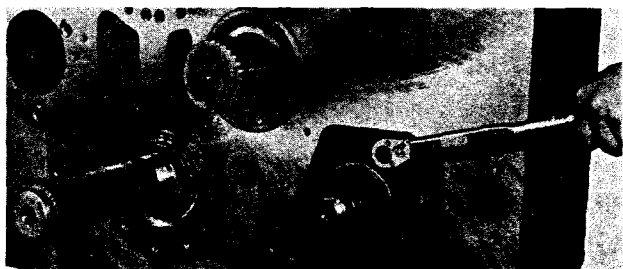
Position input gear in transmission case with long hub of gear to the rear. Place gear spacer on shaft. Insert shaft through case and input gear. Install front bearing.


**Figure 69**

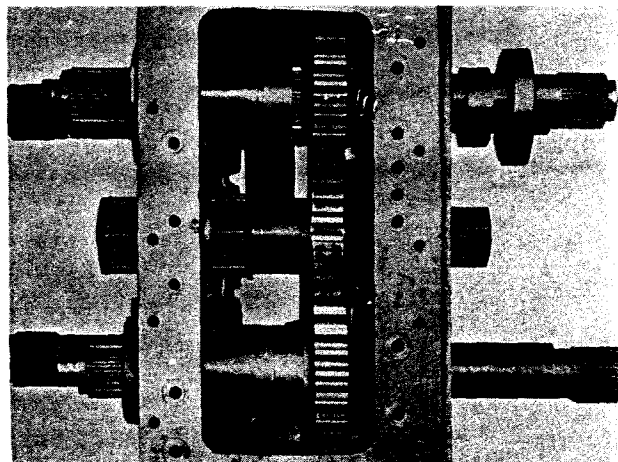
Use shaft pusher on front side of shaft for support. Install gear to bearing spacer. Drive rear bearing into position. **NOTE:** Bearings must be driven in tight. Check spacer on shaft. When spacer cannot be turned by hand, stack up between the input gear and bearing is tight. **DO NOT** attempt to draw bearing up tight with bearing lock nuts. Remove shaft pusher.


**Figure 70**

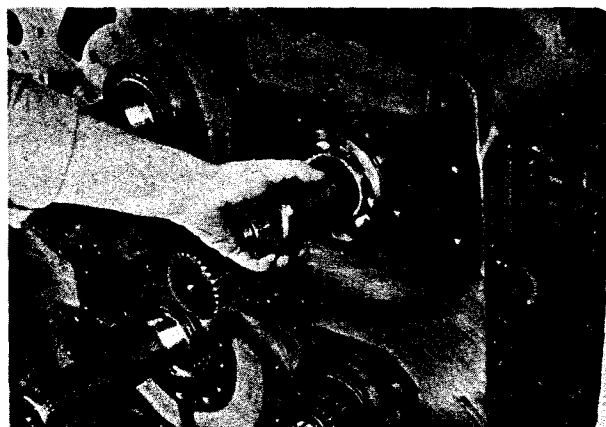
Apply a thin coat of Permatex No. 2 on the outer diameter of the input shaft oil seal. Press oil seal, lip of seal inward, into input shaft bearing cap.


**Figure 71**

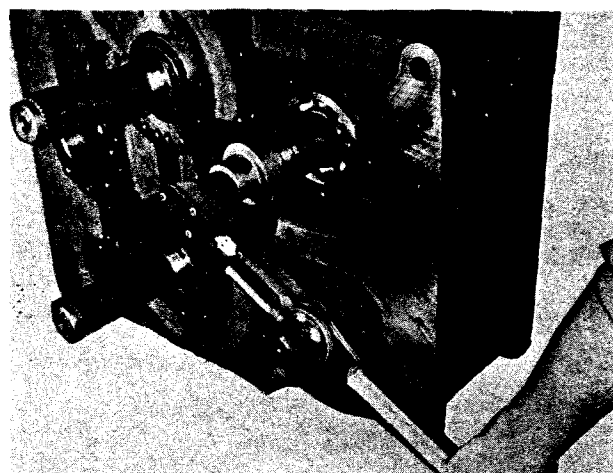
Install bearing cap and seal assembly to input shaft. Install bolts and lockwashers. Tighten 47 to 55 ft. lbs. torque.


**Figure 72**

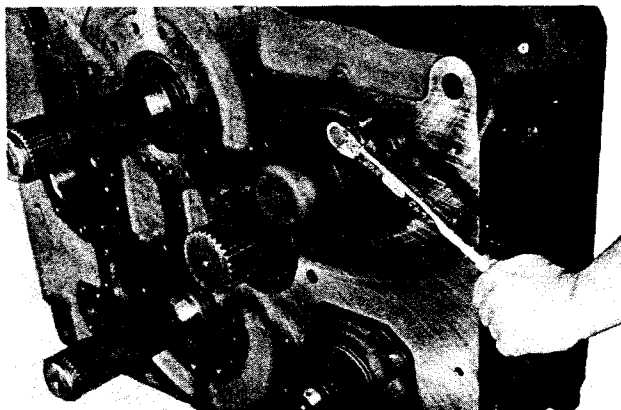
Reassembly of reverse shaft is identical to the input shaft. See Figures 68 and 69.


**Figure 73**

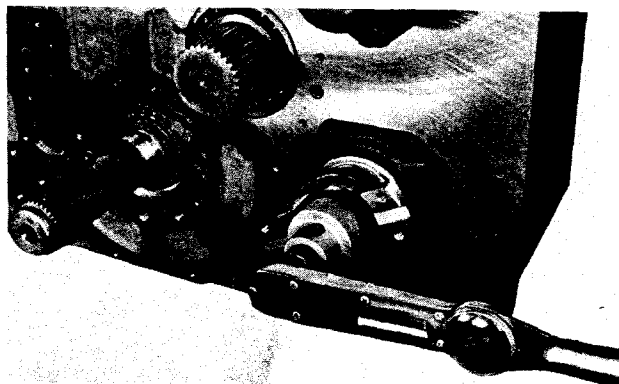
Install reverse shaft bearing spacer, washer and nut.


**Figure 74**

Lock transmission gears with a soft bar and tighten reverse shaft nut 250 to 300 ft. lbs. torque.


**Figure 75**

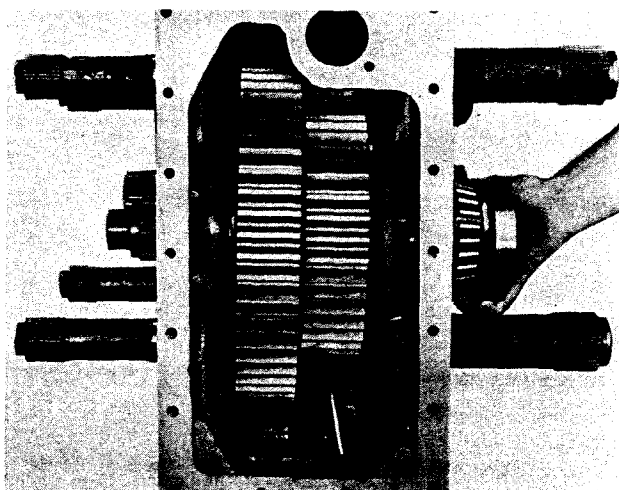
Install reverse shaft bearing cap. Install bolts and lock-washers. Tighten 47 to 55 ft. lbs. torque.


**Figure 76**

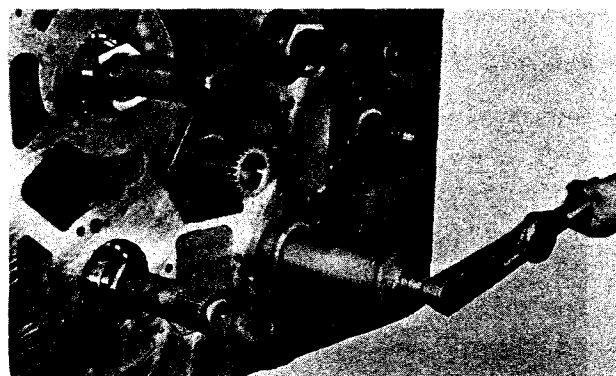
Install input companion flange, flange "O" ring, flange washer and nut. Tighten 250 to 300 ft. lbs. torque.

### REASSEMBLY OF OUTPUT SHAFT

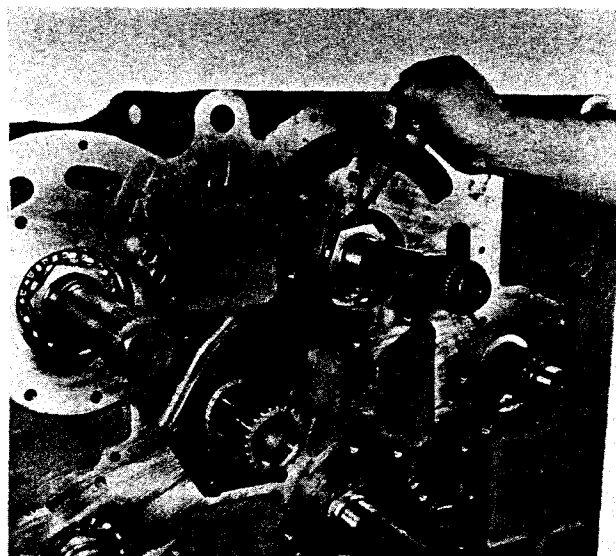
Assembly of output shaft is optional. In the following illustrations the threaded end of the output shaft is to the rear with the mechanical disconnect to the front.


**Figure 77**

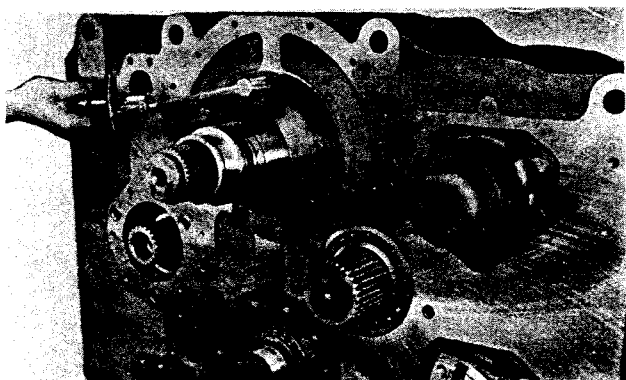
Press taper bearing (large diameter of taper inward) over threaded end of output shaft against shoulder on shaft. Position small output shaft gear in transmission case to the front, with longer offset of gear hub toward the front. Position large output shaft gear in transmission case to the rear. Insert output shaft through rear bore of case and through large and small output gears. Figure 77 shows proper stack up of gears. Drive front taper bearing (large diameter of taper inward) on output shaft until bearing shoulders against small gear. Install bearing cups over front and rear bearings.


**Figure 78**

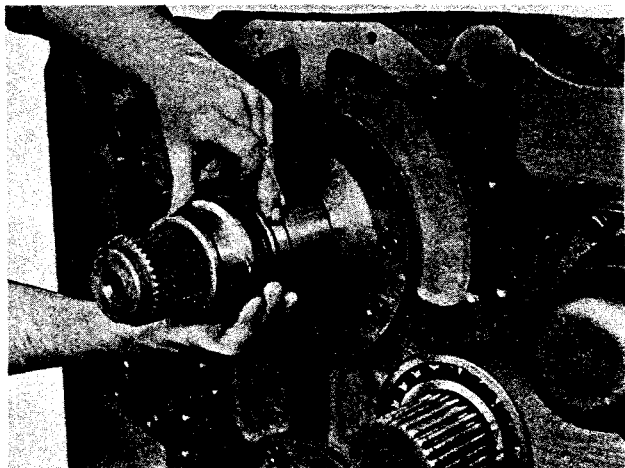
Lock gears using a soft bar, and install bearing inner lock nut (all four shafts). Tighten lock nuts 175 to 200 ft. lbs. torque. Install nut locks, and outer lock nuts. Tighten outer lock nuts 175 to 200 ft. lbs. torque.


**Figure 79**

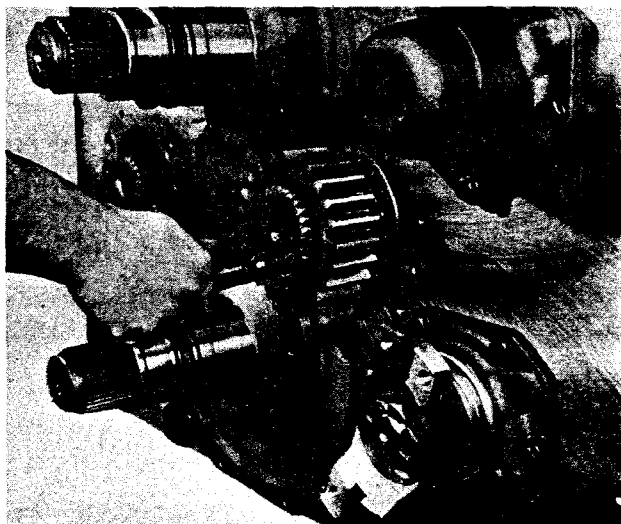
Bend a portion of the nut lock over one flat of the inner lock nut. Bend a portion of the nut lock over one flat of the outer lock nut.


**Figure 80**

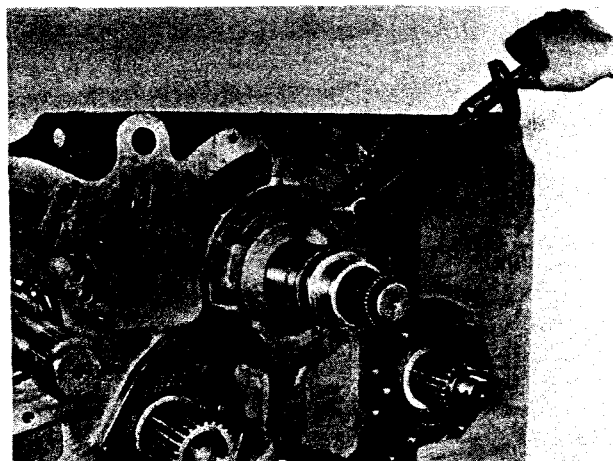
Install 1st and 2nd clutch supports. Align holes in clutch supports with holes in transmission case and install self locking bolts. Tighten bolts 150 to 175 ft. lbs. torque.


**Figure 81**

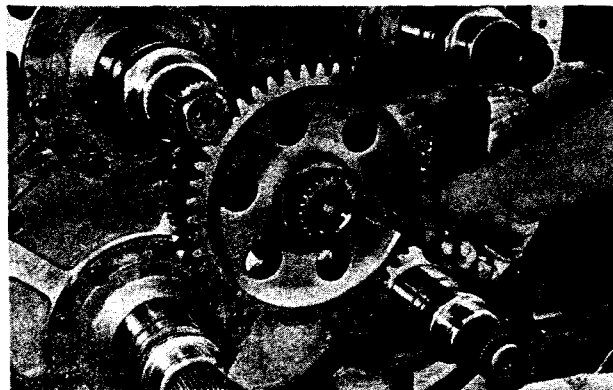
Install new clutch support piston rings. Lock rings in position. Lubricate piston rings with type "A" automatic transmission fluid.


**Figure 82**

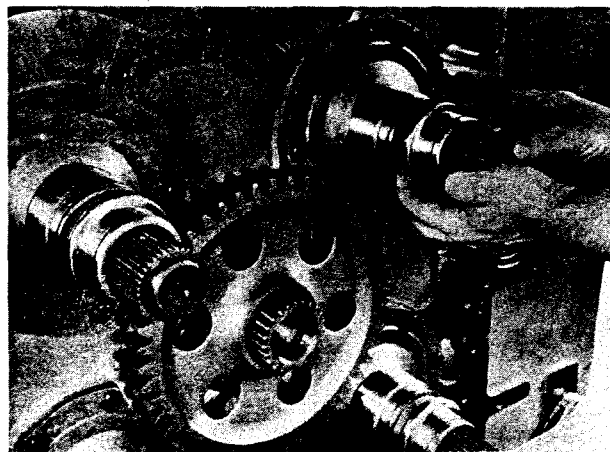
Install small idler gear on idler shaft with longer offset of gear hub inward. Install idler gear retainer ring. Make certain ring is in full position in ring groove.


**Figure 83**

Install input, reverse, 3rd and 4th clutch supports. Install self locking bolts and tighten 70 to 85 ft. lbs. torque.

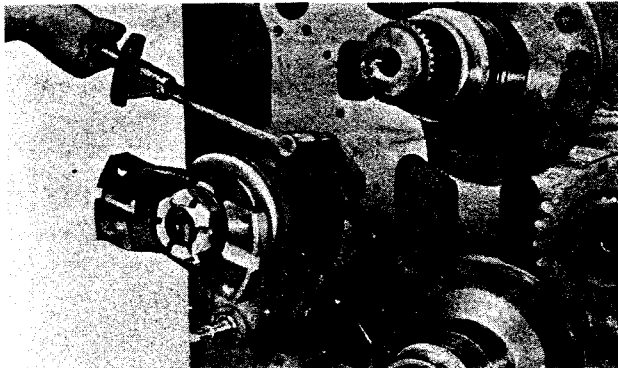

**Figure 84**

Install large idler on idler shaft with longer offset of gear hub inward. Install idler gear retainer ring.



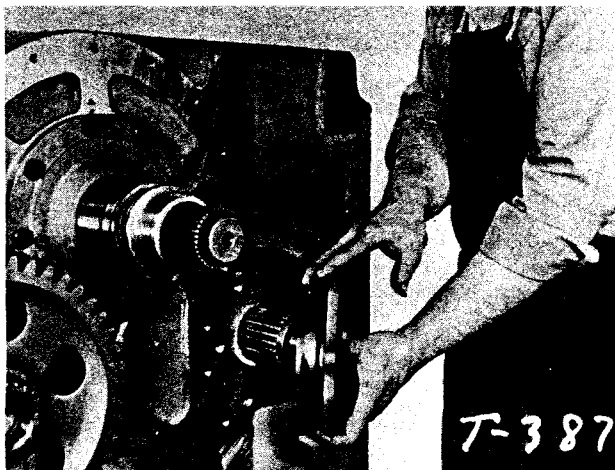
**Figure 85**

Install new clutch support piston rings. Lock rings in position. Lubricate piston rings with type "A" automatic transmission fluid.


**Figure 86**

Install new "O" ring on disconnect housing. Lubricate "O" ring with type "A" automatic transmission fluid. Install disconnect assembly on output shaft.

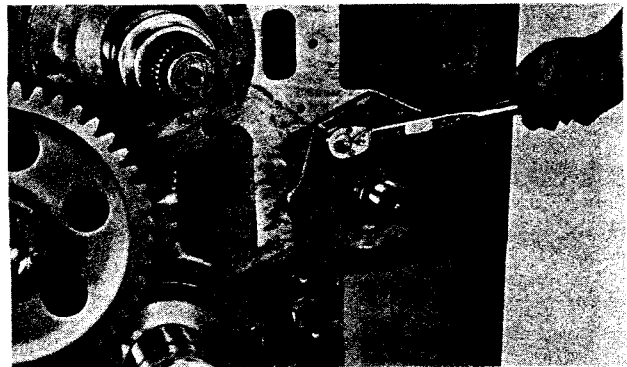
Secure disconnect assembly to transmission case with bolts and lockwashers. Tighten bolts 47 to 55 ft. lbs. torque.


**Figure 87**

Apply a thin coat of Permatex No. 2 on the outer diameter of the output shaft oil seal. Press oil seal, lip of seal inward, into output shaft bearing cap.

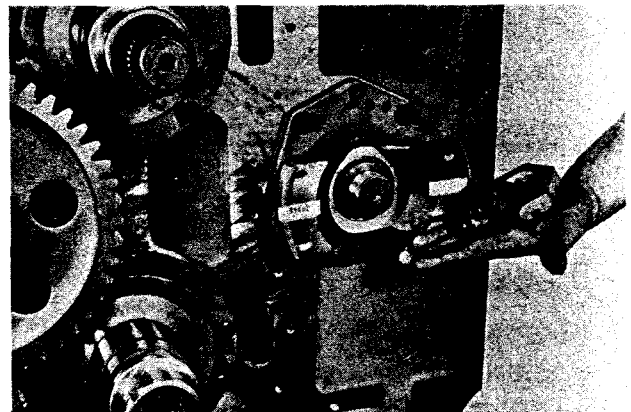
Install a new "O" ring on output shaft bearing cap. Lubricate ring with type "A" automatic transmission fluid. Install bearing cap and shims. Do not tighten bearing cap bolts. Disengage disconnect shaft from output shaft.

Using an inch pound torque wrench on the output flange nut, determine the amount of torque required to turn gear train.

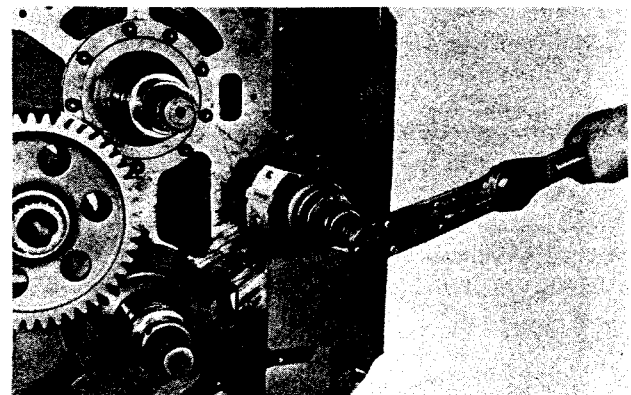

**Figure 88**

Tighten output shaft bearing cap bolts 47 to 55 ft. lbs. torque.

Add or remove shims from bearing cap to adjust pre-load. When bearings are adjusted properly, it will take 6 to 8 inch pounds more torque to turn gear train with cap bolts torqued than when bolts were loose.


**Figure 89**

Install output companion flange, flange "O" ring, washer and nut.

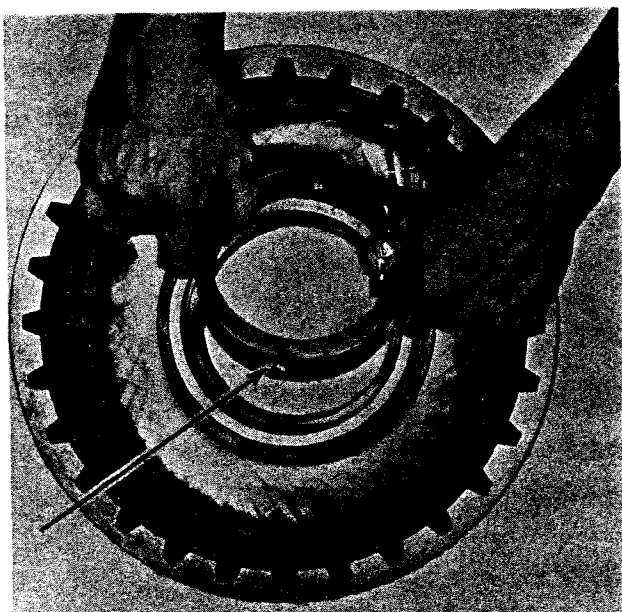

**Figure 90**

Lock transmission gears with a soft bar and tighten flange nut 400 to 450 ft. lbs. torque.

## REASSEMBLY OF CLUTCHES

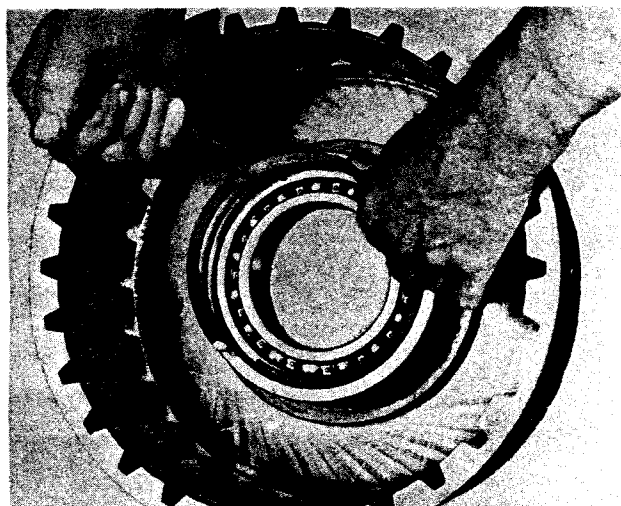
**NOTE:** All clutches are assembled in a similar manner. However, the 1st and 2nd speed clutches have a clutch drum hub gear and retainer ring. Also, the number of inner and outer clutch discs, release springs and guide pins will differ.

Clutch being assembled in the following illustrations is the 1st speed.



**Figure 91**

Insert lock ball in clutch piston ring outer race. Press outer race and ball in clutch drum. Outer race must be pressed from flush to 1/64" below shoulder in clutch drum.



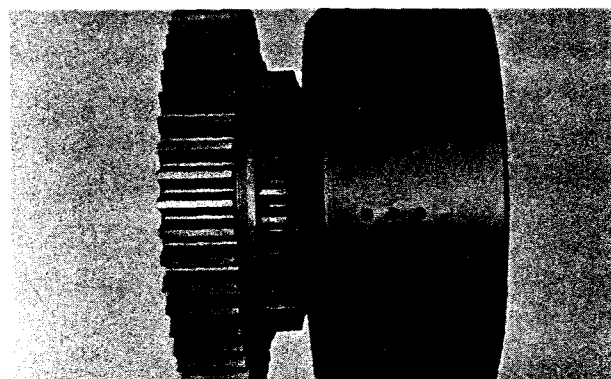
**Figure 92**

Press support ball bearing in clutch drum, and secure with bearing retainer ring



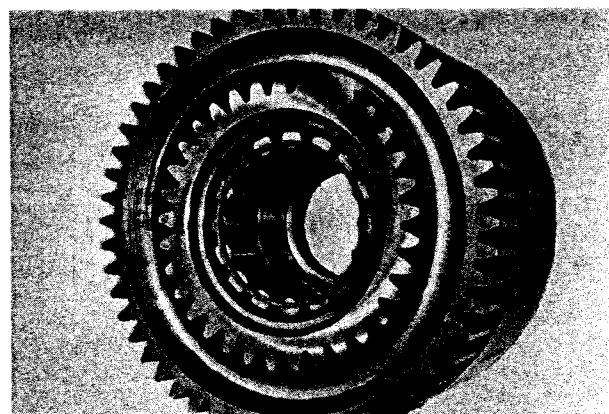
**Figure 93**

From rear end of clutch drum, press support roller bearing in drum secure with retainer ring.



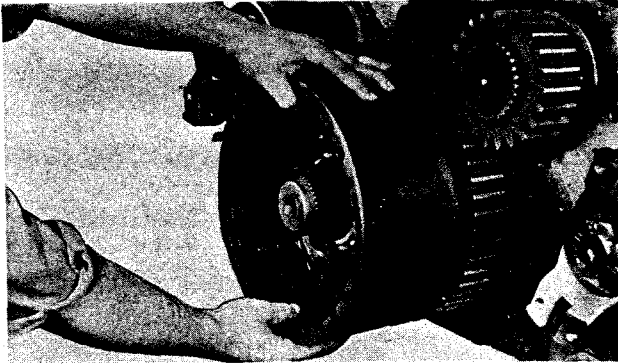
**Figure 94**

Press clutch drum hub gear on clutch drum with longer offset of gear hub inward. **NOTE:** clutch drum hub gear is used only on the 1st and 2nd clutch.



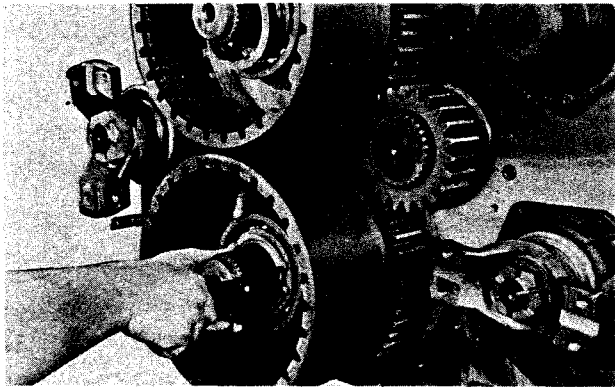
**Figure 95**

Secure clutch drum hub gear with retainer ring.



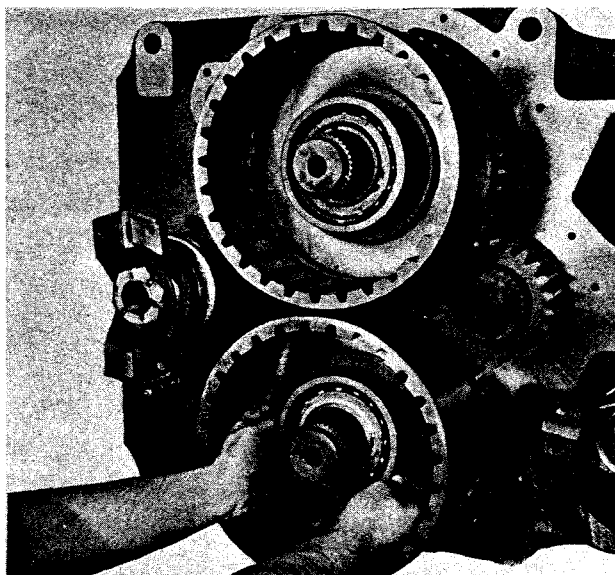
**Figure 96**

Install clutch drum assembly on clutch support. **CAUTION:** Do not damage clutch support piston rings.



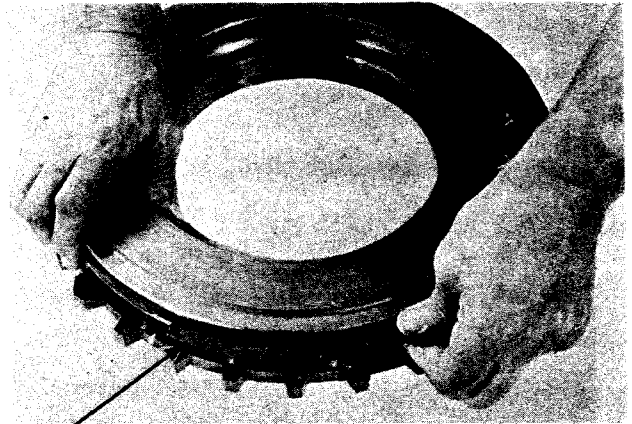
**Figure 97**

Install clutch drum hub bearing washer and retainer ring.



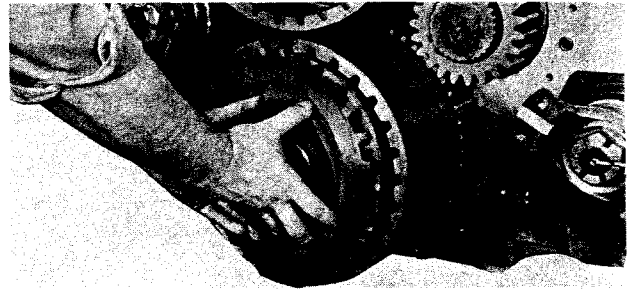
**Figure 98**

Install clutch piston inner sealing ring. Lubricate piston ring with type "A" automatic transmission fluid.



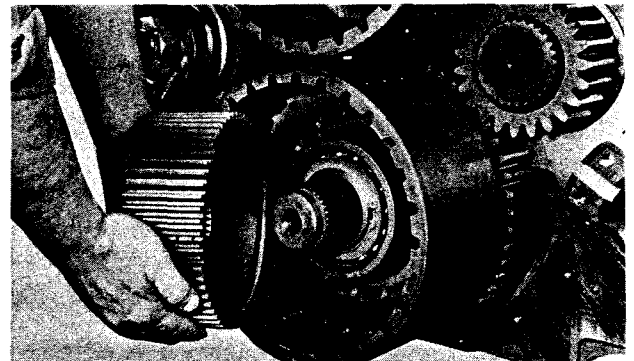
**Figure 99**

Install clutch piston outer sealing ring. Lubricate ring with type "A" automatic transmission fluid.



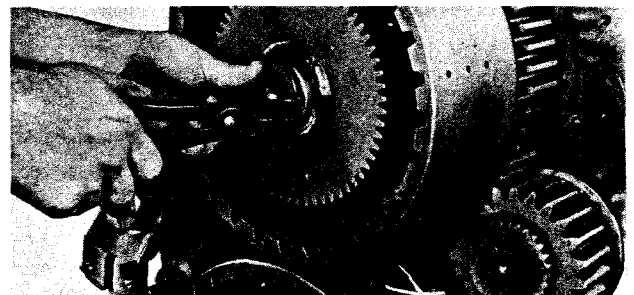
**Figure 100**

Slide clutch piston into position in clutch drum. **CAUTION:** Do not damage inner and outer sealing rings.



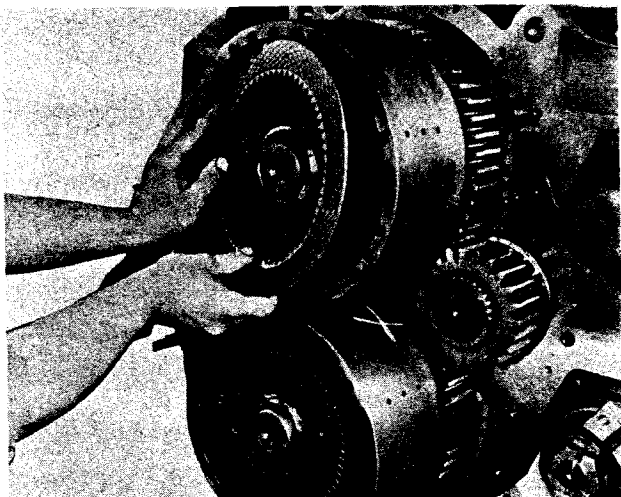
**Figure 101**

Install clutch disc hub.

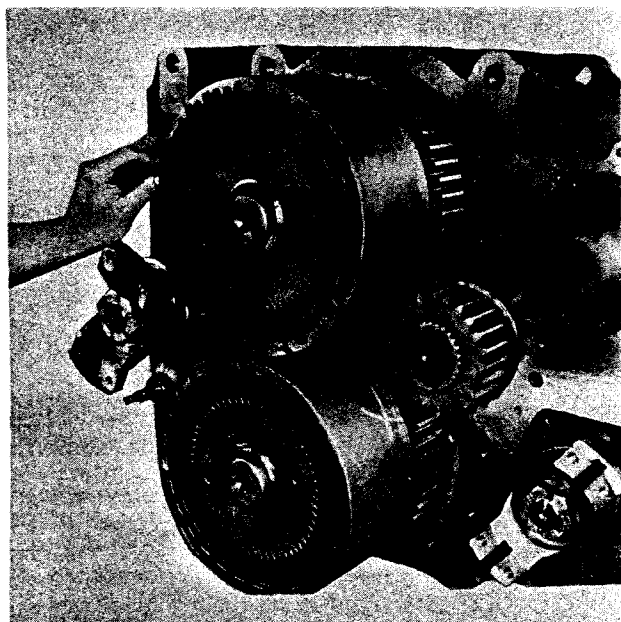


**Figure 102**

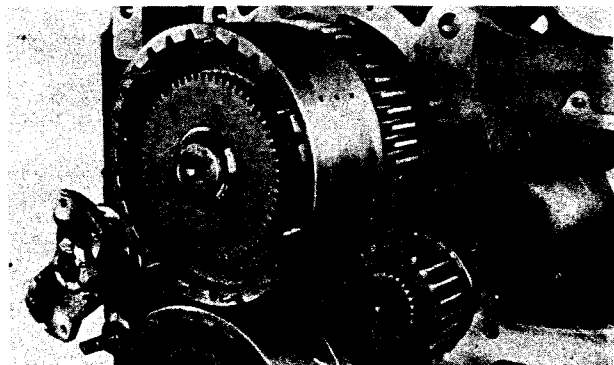
Install disc hub retainer ring.


**Figure 103**

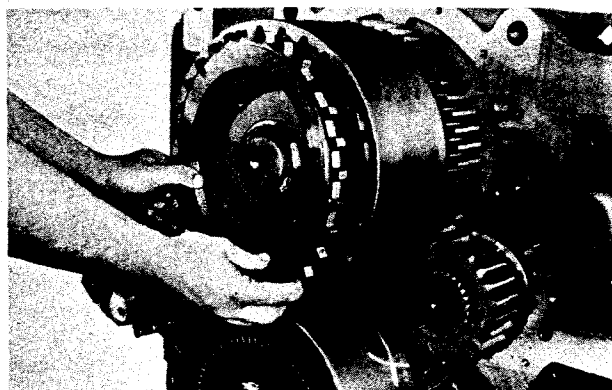
Install one bronze disc on clutch disc hub and against the clutch piston.


**Figure 104**

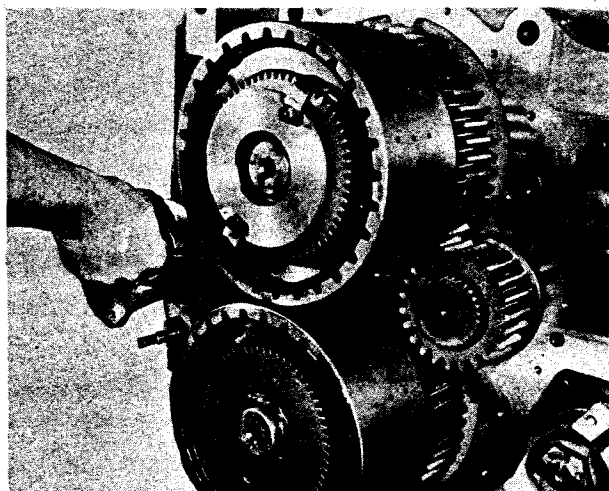
Install one steel disc in clutch drum. **NOTE:** The steel disc has teeth missing on the outer diameter. This is to allow passage for the clutch release springs. Insert two or more release springs in drum and against the teeth of the clutch piston. Install next bronzed disc. Alternate clutch discs, steel against bronze and always align the teeth on each steel disc with the teeth on the preceding steel disc. If assembly is correct each release spring is against a tooth on the clutch piston and you start with a bronze disc and end with a bronze disc.


**Figure 105**

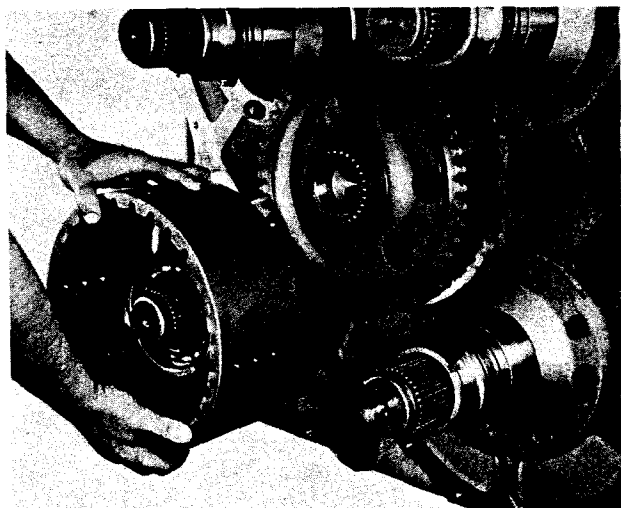
Insert all release springs and guide pins in clutch drum.


**Figure 106**

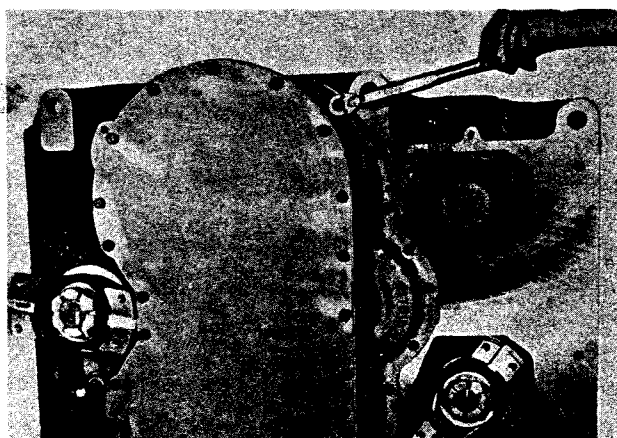
Install clutch end plate.


**Figure 107**

Compress clutch disc end plate and install end plate retainer ring.


**Figure 108**

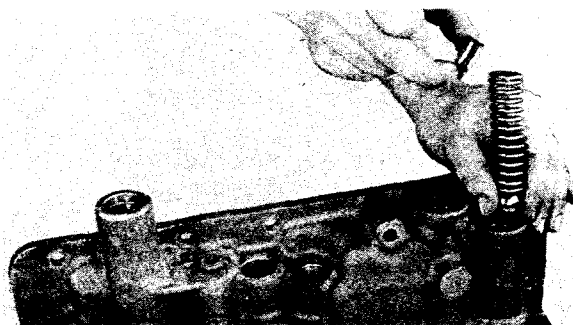
Install input, reverse, 3rd and 4th clutches as explained in Figures 91 thru 93 and Figures 96 thru 107.


**Figure 109**

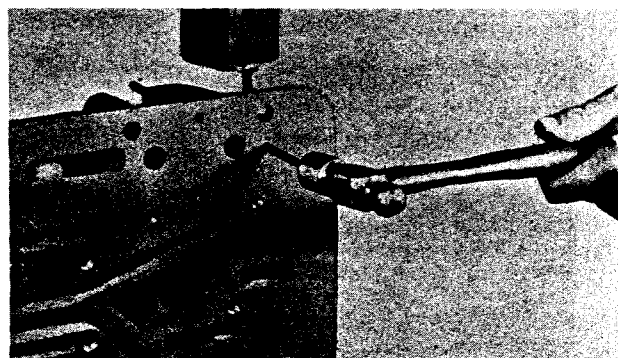
Install new gaskets on clutch cover plates. Install clutch cover plate to clutch cover, secure plates with bolts and lockwashers. Tighten 20 to 25 ft. lbs. torque. Optional clutch covers will not have cover plates, but will be a one piece stamped cover.

## REASSEMBLY OF CONTROL COVER

See figure "C" for sequence of parts and parts identification. **NOTE:** Lubricate all valves, springs, "O" rings, sleeves and oil seals with a light coat of type "A" automatic transmission fluid.


**Figure 110**

Install safety valve ball and spring in cover. With new "O" ring in position install spring stop on spring.


**Figure 111**

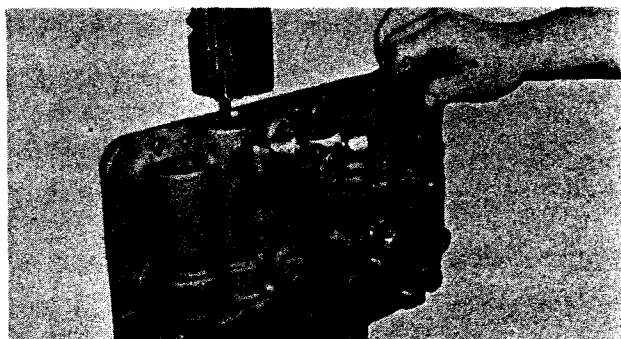
Depress spring stop and spring. Install spring stop roll pin.


**Figure 112**

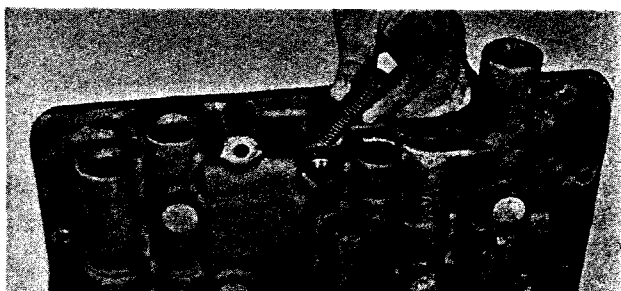
Install regulating valve spool in valve cover. Install new "O" ring on valve stop. Install valve stop in cover and retain with roll pin.


**Figure 113**

At opposite end of regulating valve install inner and outer valve spring. Install new "O" ring on spring stop. Install spring stop on springs.


**Figure 114**

Depress spring stop and spring. Install spring stop roll pin.

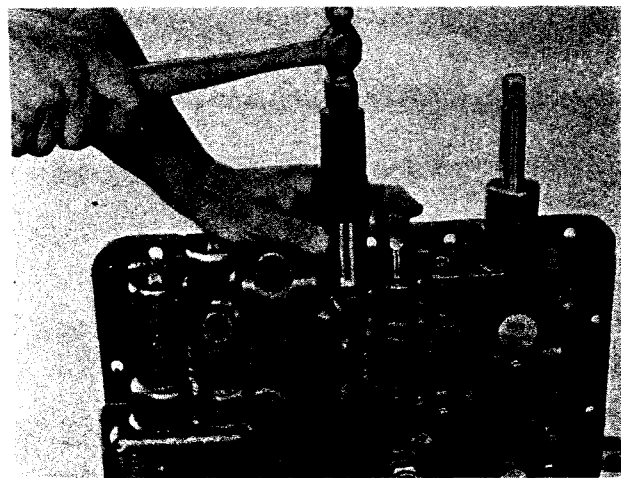

**Figure 115**

Install shut-off valve spring. This is not used with positive neutral control cover.

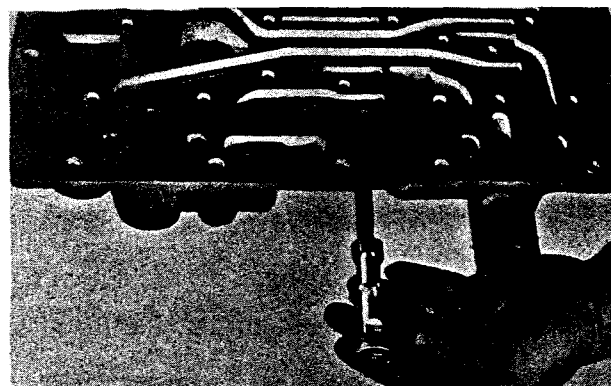

**Figure 116**

Install shut-off valve in housing. Depress valve and

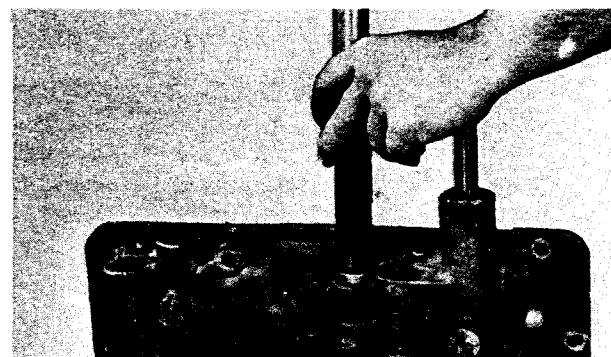
spring with valve plug. Tighten plug securely. If positive neutral is used see Figure 117.


**Figure 117**

Install shut-off valve and shut-off valve oil seal.


**Figure 118**

Install forward and reverse selector valve in housing. Install selector valve stop washer on selector valve. **NOTE:** with positive neutral the single notch on the valve must be installed toward the neutral starting switch.


**Figure 119**

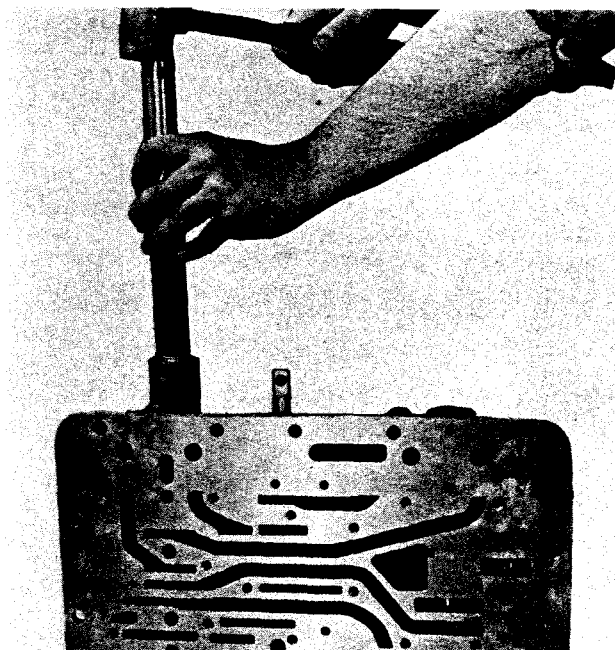
Apply a light coat of permatex No. 2 on the outer diameter of a new selector valve oil seal. Install oil seal in housing.


**Figure 120**

Install oil seal retainer ring. With positive neutral install shift link, clevis pin, and lock screw.


**Figure 121**

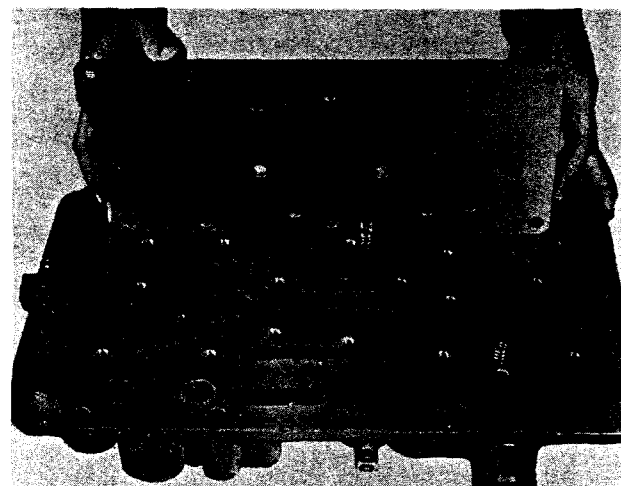
Install speed selector valve assembly in housing.


**Figure 122**

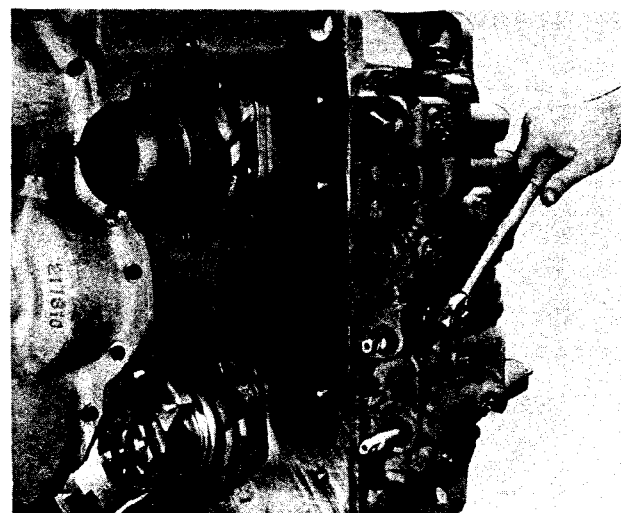
Apply a light coat of permatex No. 2 on the outer diameter of a new selector valve oil seal. Install oil seal in housing.


**Figure 123**

Install oil seal retainer ring.

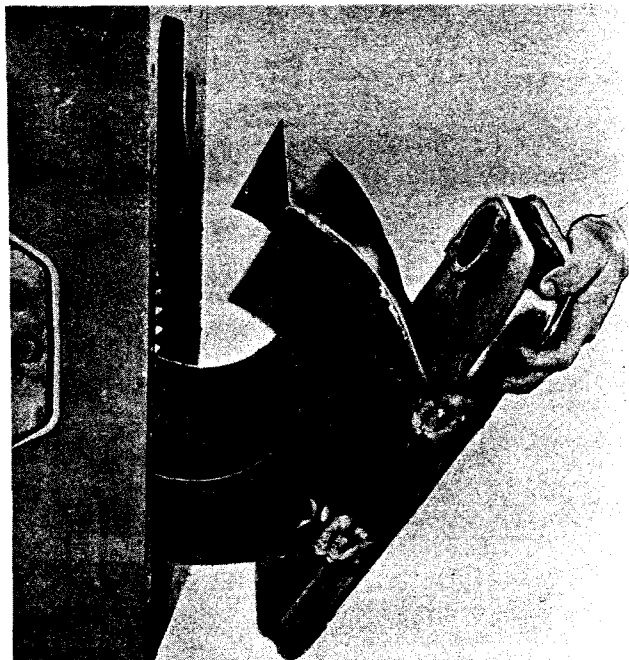

**Figure 124**

Install poppet balls and poppet springs in drilled ports in control cover. Install control cover plate. Secure with bolts and external shake proof washers. Tighten 20 to 25 ft. lbs. torque.

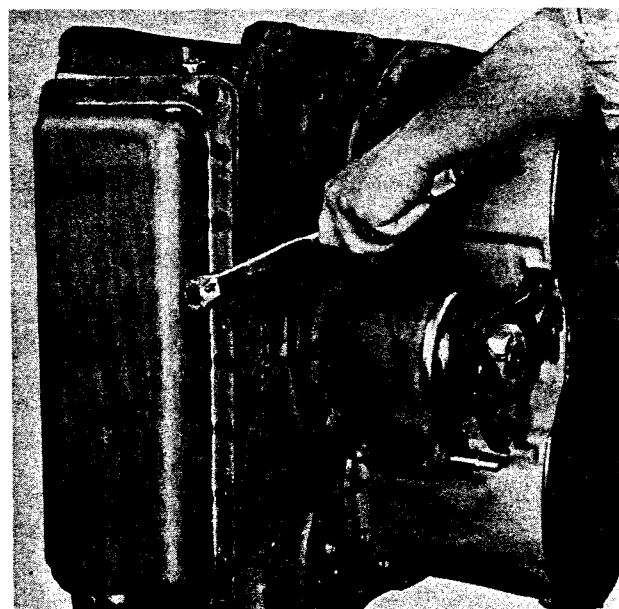


**Figure 125**

Using new control valve to case "O" rings and new gasket. Install control cover assembly on transmission case. Secure with bolts and lockwashers. Tighten 35 to 45 ft. lbs. torque.

**Figure 126**

Install sump screen and baffle assembly, secure with bolts and lockwashers. Tighten 20 to 25 ft. lbs. torque.

**Figure 127**

Install new gasket on transmission sump pan. Set pan magnets over welded washers in sump pan. Secure pan with bolts and lockwashers, tighten to 35 to 45 ft. lbs. torque.

## SERVICING MACHINE AFTER TRANSMISSION OVERHAUL

The transmission, torque converter and its allied hydraulic system are important links in the drive line between the engine and wheels. The proper operation of either unit depends greatly on the condition and operation of the other, therefore, whenever repair or overhaul of one unit is performed, the balance of the system must be considered before the job can be considered completed.

After the overhauled or repaired transmission has been installed in the machine, the torque converter, oil cooler, filter and connecting hydraulic system must be thoroughly cleaned. This can be accomplished in several manners and a degree of judgment must be exercised as to the method employed.

The following are considered the minimum steps to be taken:

1. Drain entire system thoroughly.
2. Disconnect and clean all hydraulic lines. Where feasible hydraulic lines should be removed from machine for cleaning.
3. Replace oil filter elements, cleaning out filter cases thoroughly.
4. The oil cooler at bottom of radiator must be thoroughly cleaned. The cooler should be "back flushed" with oil and compressed air until all foreign material has been removed. Flushing in direction of normal oil flow will not adequately clean the cooler. If necessary, radiator and cooler assembly should be removed from machine for cleaning, using oil, compressed air and steam cleaner for that purpose. **DO NOT** use flushing compounds for cleaning purposes.
5. Remove bottom drain cover and plug from torque converter and inspect interior of converter housing, gears, etc. If presence of considerable foreign material is noted, it will be necessary that converter be removed, disassembled and cleaned thoroughly. It is realized this entails extra labor, however, such labor cost is a minor cost compared to cost of difficulties which can result from presence of such foreign material in the system.
6. Reassemble all components and using only Type "A" Automatic Transmission Fluid, fill torque converter and transmission through filler opening until fluid comes up to FULL mark on transmission dip-stick. Reinstall fill plug and dipstick and run engine two minutes at 500 - 600 RPM to prime torque converter and hydraulic lines. Recheck level of fluid in transmission **with engine running** at idle (500-600 RPM) and add quantity necessary to bring level up to FULL mark on dipstick. Recheck with hot oil (180 to 200 degrees).
7. Recheck all drain plugs, lines, connections, etc., for leaks and tighten where necessary.

**SPECIFICATIONS AND SERVICE DATA — POWER SHIFT TRANSMISSION  
AND TORQUE CONVERTER**

GEAR TYPE	Spur	CLUTCH INNER DISC	Sintered Bronze
CONTROLS	Forward and Reverse — Manual Speed Selection — Manual	CLUTCH OUTER DISC	Steel
CLUTCH TYPE	Multiple discs, hydraulically actuated, spring released, automatic wear compensation and no adjustment. All clutches oil-cooled and lubricated.	CLUTCH PRESSURE	180-220
		OIL FILTRATION	Full flow oil filter safety by-pass, also strainer screen and magnets in sump at bottom of transmission case.

**LUBRICATION**

TYPE OF OIL	Type "A" Automatic Transmission Fluid	(b) Drain transmission and remove sump. Clean pan and screen thoroughly and replace using new gaskets.
CAPACITY	Consult Operator's Manual on applicable machine model for system capacity. Torque Converter, Transmission and allied hydraulic system must be considered as a whole to determine capacity.	(c) Drain oil filters, remove and discard filter elements. Clean filter shells and install new elements.
CHECK PERIOD	Check oil level DAILY with engine running at 500-600 RPM and oil at 180 degrees F. to 200 degrees F.	(d) Refill transmission to FULL mark on dipstick.
DRAIN PERIOD	Maintain oil level to FULL mark on dipstick. Every 250 hours change oil filter element. Every 500 hours, drain and refill system as follows: Drain with oil at 150 degrees F. to 200 degrees F. (a) Drain converter at bottom rear of converter housing.	(e) Run engine at 500-600 RPM to prime converter and lines.
		(f) Recheck level with engine running at 500-600 RPM and add oil to bring level to FULL mark on dipstick. When oil temperature is hot (180 degrees to 200 degrees), make final oil level check.

**TABLE OF TORQUE LIMITS**

	TORQUE IN FT. LBS.								
	Minimum				Maximum				
Transmission Series	3000	5000	8000	16,000	3000	5000	8000	16,000	
BOLT									ITEM
Self Locking	70	70	150	260	80	85	175	300	1st and 2nd CLUTCH SUPPORT
Self Locking	70	70	70	150	80	85	85	175	Fwd., Rev., 3rd and 4th CLUTCH SUPPORT
	150	150	250	250	175	175	300	300	INPUT FLANGE NUT
	175	250	400	400	200	300	450	450	OUTPUT FLANGE NUT

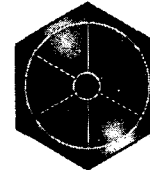
**TORQUE IN (LBS. — FT.)  
BOLTS, CAPSCREWS, STUDS AND NUTS**

Grade 5 Identification, 3 Radial  
Dashes 120° Apart on Head of Bolt



**Grade 5**

Grade 8 Identification, 6 Radial  
Dashes 60° Apart on Head of Bolt



**Grade 8**

**COARSE  
THREADS**

3/8 — 16  
7/16 — 14  
1/2 — 13  
9/16 — 12  
5/8 — 11

**Dry**

31 — 34  
49 — 54  
75 — 83  
109 — 120  
150 — 165

**Lubricated or  
Plated**

23 — 25  
37 — 41  
57 — 63  
82 — 90  
113 — 124

**Dry**

44 — 48  
70 — 77  
106 — 117  
153 — 168  
212 — 233

**Lubricated or  
Plated**

33 — 36  
52 — 57  
80 — 88  
115 — 127  
159 — 175

**PRESSURE AND OIL FLOW CHECK SPECIFICATIONS  
(180 DEGREES F. to 200 DEGREES F.)**

A. Temperature Gauge Connection	See external oil flow diagram.
B. Converter-Out Pressure	See Pressure and Oil Flow Checks (Paragraph A)
C. Converter Drain Back Line	See External Oil Flow Diagram.
D. Lubricating Pressure	25 p.s.i. Maximum at High Free Idle.
E. Converter Pump Output Line	See Pump Chart (Paragraph C).
F. Clutch Pressure at Transmission Control Cover	180-220 p.s.i. at Engine idle, each clutch and no more than a 5 p.s.i. variation between all clutches.
G. Transmission to Converter Line	See Pressure and Oil Flow Checks (Paragraph B.)

**TROUBLE SHOOTING GUIDE**

The following data is presented as an aid to locating the source of difficulty in a malfunctioning unit. It is necessary to consider the torque converter charging pump, transmission, oil cooler and connecting oil lines as a complete system when running down the source of trouble since the proper operation of any unit therein depends greatly on the condition and operations of the others. By studying the principles of operation together with data in this section, it may be possible to correct any malfunction which may occur in the system.

TROUBLE SHOOTING PROCEDURE BASICALLY CONSISTS OF TWO CLASSIFICATIONS: MECHANICAL AND HYDRAULIC.

**MECHANICAL CHECKS**

Prior to checking any part of the system from a hydraulic standpoint, the following mechanical checks should be made.

1. A check should be made to be sure all control lever linkage is properly connected and adjusted at all connecting points.
2. Check shift levers and rods for binding or restrictions in travel that would prevent full engagement. Shift levers by hand at transmission case, if full engagement cannot be obtained, difficulty may be in control cover and valve assembly.

**HYDRAULIC CHECKS**

Before checking on the torque converter, transmission, and allied hydraulic system for pressures and rate of oil flow, it is essential that the following preliminary checks be made:

1. Check oil level in transmission. This should be done with oil temperatures of 180 to 200 degrees F. — DO NOT ATTEMPT THESE CHECKS WITH COLD OIL. To bring the oil temperature to this specification it is necessary to either work the machine or "stall" out the converter. Where the former means is impractical, the latter means should be employed as follows:

Engage shift levers in forward and fourth speed and apply brakes. Accelerate engine half to three-quarter throttle.

Hold stall until desired converter outlet temperature is reached. CAUTION: FULL THROTTLE STALL SPEEDS FOR AN EXCESSIVE LENGTH OF TIME WILL OVERHEAT THE CONVERTER.

**PRESSURE AND OIL FLOW CHECKS**

Whenever improper performance is evident the following basic pressure and oil flow checks should be performed and recorded. It is also recommended that these checks be taken periodically as a preventative maintenance measure. Doing so will permit possible detection of difficulties in advance of actual breakdown, thus permitting scheduling of repair operation. Likewise repair of minor difficulties as they can be made at considerably less cost and down-time than when delayed until major and complete breakdowns occur.

Analyzing the results of these checks by comparison with specifications and with each other will indicate in most cases the basic item or assembly in the system as the source of difficulty. Further checking of that assembly will permit isolation of the specific cause of trouble.

(SEE PLUMBING AND CHECK POINT DIAGRAM)

#### A. OIL PRESSURE AT CONVERTER OUT PORT.

Install hydraulic pressure gauge at **PRESSURE** connection on Converter Regulator Valve or at **CONVERTER OUT** pressure tap. (all models do not have pressure regulating valves). Check and record oil pressure at 2000 RPM and at maximum speed (engine at full throttle) (see instructions on Stalling Converter previously listed.)

CONVERTER MODEL	MAXIMUM CONVERTER OUT PRESSURE
C-270.....	40 p.s.i.
C-8000.....	70 p.s.i.
C-16000.....	70 p.s.i.

B. If a flow meter is available, install in line between converter charging pump and oil filters. Flow meter must be able to withstand 300 p.s.i.

Disconnect hose between pump and filter at filter end and using suitable fittings connect to pressure port of tester. Install hose between filter and tester, connecting same to reservoir port of tester.

DO NOT USE TESTER LOAD VALVE AT ANY TIME DURING TEST. When taking flow reading, all readings should be taken on the first (left) half of flow gauge. Whenever the needle shows on the right half of gauge, correct by switching to higher scale.

C. If a flow meter is not available for checking converter pump output, proceed with manual transmission and converter checks. If the converter shows leakage within specifications and clutch pressures (180 to 220 p.s.i.) are all equal within 5 p.s.i. refer to paragraph on Low Converter Charging Pump Output.

PUMPS ARE RATED AT 2000 RPM—Refer to Vehicle Manufacture Manual for specific pump output.

D. NOMINAL PUMP RATINGS:	C-270	C-8000	C-16000
	11 G.P.M.	21 G.P.M.	40 G.P.M.
	15 G.P.M.	31 G.P.M.	50 G.P.M.
	21 G.P.M.	40 G.P.M.	65 G.P.M.
		50 G.P.M.	

Pump output listed applies to a new pump in each case. A 20% tolerance below this figure is permissible; however, if pump output is more than 20% below specification the pump must be replaced and not rebuilt.

#### E. TRANSMISSION CLUTCH LEAKAGE

Check clutch pressures at low engine idle with oil at operating temperatures 180° to 200°. Engine speed must remain constant during entire leakage check. Shift levers into forward and 1st speed, 2nd speed, 3rd speed, and 4th speed. Record pressures. Shift direction lever in reverse and record pressures. All pressure must be equal within 5 p.s.i. If clutch pressure varies in any one clutch more than 5 p.s.i., repair clutch. All pressures must be taken with two clutches engaged.

#### EXAMPLE:

Forward and 1st speed.....	200 p.s.i.	Forward and 3rd speed.....	200 p.s.i.
Forward and 2nd speed.....	200 p.s.i.	Forward and 4th speed.....	200 p.s.i.
Reverse and 1st speed.....	200 p.s.i.		

If a flow meter is available install in line coming out of converter pump. See flow diagram for location of pressure on flow checks. Check pump volume at 2000 RPM and at low engine idle, record readings. See pump volume specifications at 2000 RPM.

Install flow meter in the line coming from transmission to converter. Check oil volume at 2000 RPM and at low idle in the following speed selections. Record readings.

Forward — 1st speed  
Forward — 2nd speed

Forward — 3rd speed  
Forward — 4th speed  
Reverse — 1st speed

Subtract readings in each speed from pump volume reading to get transmission clutch leakage.

Example: Pump Volume at idle, 8 gal.

Forward—1st speed	6 gal.	Pump volume	8 gal.
Forward—2nd speed	6 gal.	Forward — 1st speed	6 gal.
Forward—3rd speed	6 gal.	Clutch leakage	2 gal.
Forward—4th speed	6 gal.		
Reverse — 1st speed	6 gal.		

If clutch leakage varies more than 1 gal. correct clutch.

#### LEAKAGE IN TRANSMISSION CLUTCHES

Leakage in 3000 series must not exceed 4 gal. max.

Leakage in 5000 series must not exceed 4 gal. max.

Leakage in 8000 series must not exceed 6 gal. max.

Leakage in 16000 series must not exceed 7 gal. max.

#### F. CONVERTER LUBE FLOW

Disconnect CONVERTER DRAIN BACK line at transmission with engine running at 2000 RPM, and measure oil into a gallon container. Measure oil leakage for 15 seconds and multiply the volume of oil by four to get gallons per minute leakage.

#### LEAKAGE IN CONVERTER

Leakage in C270 series not to exceed 2 gal. max.

Leakage in C8000 series not to exceed 5 gal. max.

Leakage in C16000 series not to exceed 5 gal. max.

#### LOW CLUTCH PRESSURE WITH NORMAL CLUTCH LEAKAGE

##### CAUSE

1. Low Oil Level.
2. Broken spring in transmission regulator valve.
3. Clutch pressure regulator valve spool stuck in open position.
4. Faulty charging pump.

##### REMEDY

1. Fill to proper level.
2. Replace spring.
3. Clean valve spool and sleeve.
4. See paragraph on charging pump output.

#### LOW CLUTCH PRESSURE WITH EXCESSIVE CLUTCH LEAKAGE

- |   |   |
|---|---|
| 1. Broken or worn clutch piston sealing rings.          | 1. Replace sealing rings.                 |
| 2. Clutch drum bleed valve ball stuck in open position. | 2. Clean bleed valve thoroughly.          |
| 3. Broken or worn sealing rings on clutch support.      | 3. Replace sealing rings.                 |
| 4. Low converter charging pump output.                  | 4. See paragraph on charging pump output. |

**LOW CONVERTER CHARGING PUMP OUTPUT****CAUSE****REMEDY**

- |   |  |
|---|--|
| 1. Low oil level.   | 1. Fill to proper level.                                 |
| 2. Sump screen plugged.   | 2. Clean screen and sump.                                |
| 3. Air leaks at pump intake hose and connections or collapsed hose. | 3. Tighten all connections or replace hose if necessary. |
| 4. Defective oil pump.  | 4. Replace pump.   |

**LOW FLOW THROUGH COOLER WITH LOW CONVERTER IN PRESSURE**

- |  |  |
|--|--|
| 1. Defective safety by-pass valve spring.  | 1. Replace spring.   |
| 2. Converter by-pass valve partially open.   | 2. Check for worn by-pass ball seat.   |
| 3. Excessive converter internal leakage. See paragraph E, check converter lube flow. | 3. Remove, disassemble, and rebuild converter assembly, replacing all worn or damaged parts. |
| 4. Broken or worn sealing rings in transmission clutches.                            | 4. See paragraph on Clutch leakage.  |

**LOW FLOW THROUGH COOLER WITH HIGH CONVERTER OUT PRESSURE**

- |   |                                       |
|---|---------------------------------------|
| 1. Plugged oil cooler. Indicated if transmission lube pressure is low.                      | 1. Back flush and clean oil cooler.   |
| 2. Restricted cooler return line.   | 2. Clean out lines.                   |
| 3. Lube oil ports in transmission plugged. Indicated if transmission lube pressure is high. | 3. Check lube lines for restrictions. |

**OVERHEATING**

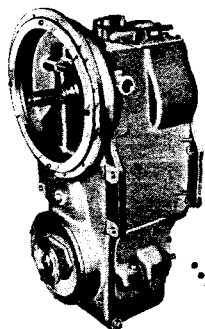
- |   |   |
|---|---|
| 1. Worn oil sealing rings. See paragraph E. | 1. Remove, disassemble, and rebuild converter assembly. |
| 2. Worn oil pump.                           | 2. Replace.   |
| 3. Low oil level.                           | 3. Fill to proper level.                                |
| 4. Pump suction line taking air.            | 4. Check oil line connections and tighten securely.     |

**NOISY CONVERTER**

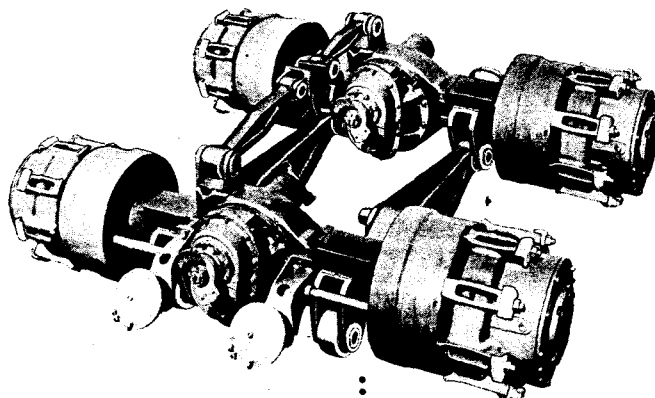
- |                              |  |
|------------------------------|--|
| 1. Worn coupling gears.      | 1. Replace.  |
| 2. Worn oil pump.            | 2. Replace.  |
| 3. Worn or damaged bearings. | 3. A complete disassembly will be necessary to determine what bearing is faulty. |

**LACK OF POWER**

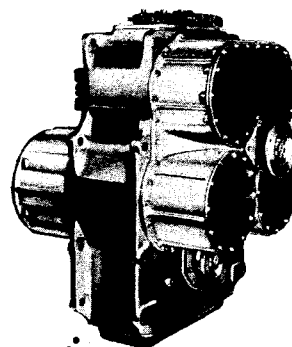
- |   |   |
|---|---|
| 1. Low engine RPM at converter stall.       | 1. Tune engine check governor.                      |
| 2. See "Over-heating" and make same checks. | 2. Make corrections as explained in "Over-Heating." |



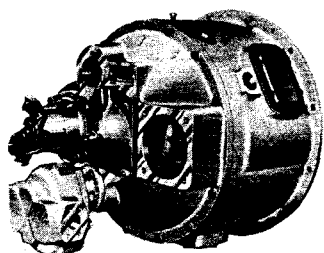
INDUSTRIAL TRANSMISSIONS



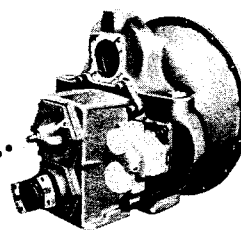
BOGIE DRIVES



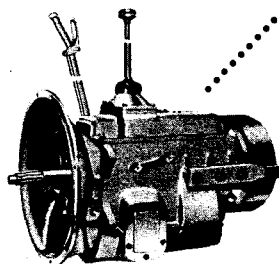
POWER SHIFT  
TRANSMISSIONS



8000 SERIES CONVERTERS  
14"-15" AND 16" DIAMETERS



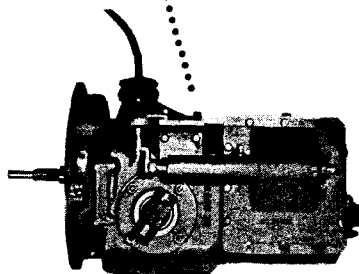
16000 SERIES CONVERTERS  
16"-17"-18" AND 19" DIAMETERS



TRUCK TRANSMISSIONS



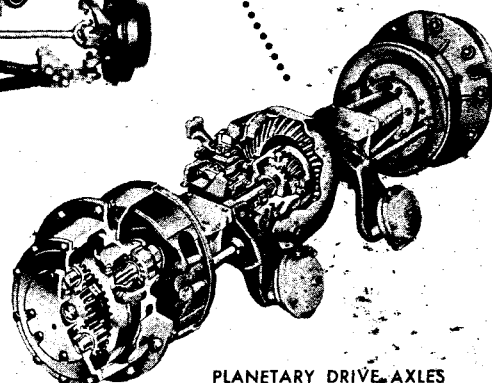
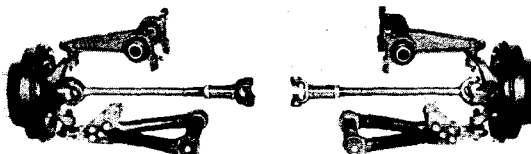
ONE-PIECE FORGED  
AXLE HOUSINGS



TRANS-AXLE UNITS



PLANETARY DRIVE—STEER AXLES



PLANETARY DRIVE AXLES

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