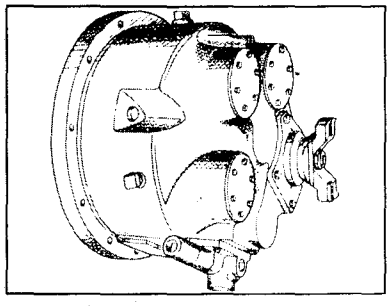
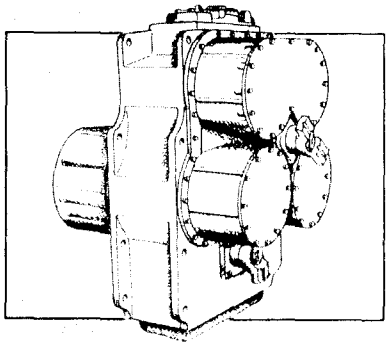
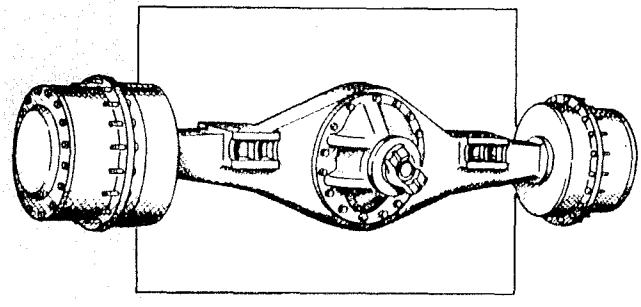
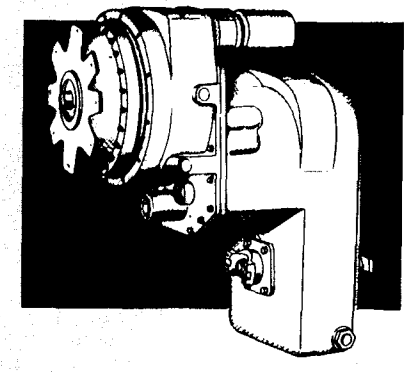
# Maintenance and Service Manual









# 28000 Powershift Transmission

## R-HR & MHR MODEL
## 4 SPEED LONG DROP

CLARK-HURTH COMPONENTS

SM R-HR-MHR284 Rev. 6-95

# Service Publications

# 1293 Glenway Drive

# Statesville, NC 28677

## TOWING OR PUSH STARTING

Before towing the vehicle, be sure to lift the rear wheels off the ground or disconnect the driveline to avoid damage to the transmission during towing.

**NOTE:** If the transmission has 4 wheel drive, disconnect both front and rear drivelines. Because of the design of the hydraulic system, the engine **cannot** be started by pushing or towing.

# 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-HURTH COMPONENTS** product.

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 product, its principle 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-Hurth Components**-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. **Clark-Hurth Components** does not warrant repair or replacement parts, nor failures resulting from the use of parts which are not supplied by or approved by **Clark-Hurth Components.** IMPORTANT: **Always furnish the Distributor with the serial and model number when ordering parts.**

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**NOTE:** Metric Dimensions Shown in Brackets [ ].

# TRANSMISSION ASSEMBLY

The transmission and hydraulic torque portion of the power train enacts an important role in transmitting 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. It is necessary to consider both units in the study of their function and operation.

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

Basic Design Silhouette
Converter Assembly
Converter and Transmission Case Group
Four Speed Case and Clutch Group
Clutch Group
Regulating Valve, Charging Pump and Filter Group
Control Valve
Axle Disconnect and Mechanical Parking Brake
Typical 28000 Cross Section
External Plumbing Diagram
Typical Four Speed Power Flow
Clutch and Gear Arrangement
Shielded Bearing Installation
Ring Gear Installation

The R, HR, and MHR Model Transmissions are of three basic designs.

The R Model consists of a separate torque converter, mounted to the engine with the powershift transmission remotely mounted and connected to the torque converter with a drive shaft.

The HR Model consists of a torque converter and powershifted transmission in one package mounted directly to the engine.

The MHR version is a mid-mount torque converter and transmission assembly connected to the engine by means of a drive shaft. (See Fig. A for basic design silhouette.)

The shift control valve assembly may be mounted directly on the side of the converter housing or front transmission cover, or remote mounted and connected to the transmission by means of flexible hoses. The function of the control valve assembly is to direct oil under pressure to the desired directional and speed clutch. A provision is made on certain models to neutralize the transmission when the brakes are applied. This is accomplished through use of a brake actuated shutoff valve. The speed and direction clutch assemblies are mounted inside the transmission case and are connected to the output shaft of the converter either by direct gearing or drive shaft. The purpose of the speed or directional clutches is to direct the power flow through the gear train to provide the desired speed range and direction.

An axle disconnect is optional and is located on the output shaft. The drive to the front or rear axle can be disconnected or connected by manual shifting.

## HOW THE UNITS OPERATE

'ith the engine running, the converter charging pump draws oil from the transmission sump through the emovable oil suction screen and directs it through the pressure regulating valve and oil filter.

The pressure regulating valve maintains pressure to the transmission control cover for actuating the direction and speed clutches. This requires a small portion of the total volume of oil used in the system. The remaining volume of oil is directed through the torque converter circuit to the oil cooler and returns to the transmission for positive lubrication. This regulator valve consists of a hardened valve spool operating in a closely fitted bore. The valve spool is spring loaded to hold the valve in a closed position. When a specific pressure is achieved, the valve spool works against the spring until a port is exposed along the side of the bore. This sequence of events provides the proper system pressure.

After entering the converter housing the oil is directed through the stator support to the converter blade cavity and exits in the passage between the turbine shaft and converter support. The oil then flows out of the converter to the oil cooler. After leaving the cooler, the oil is directed to a fitting on the transmission. Then through a series of tubes and passages lubricates the transmission bearings and clutches. The oil then gravity drains to the transmission sump.

The hydraulic torque converter consists basically of three elements and their related parts to multiply engine torque. The engine power is transmitted from the engine flywheel to the impeller element through the impeller cover. This element is the pump portion of the hydraulic torque converter and is the primary component which starts the oil flowing to the other components which results in torque multiplication. This element can be compared to a centrifugal pump in that it picks up fluid at its center and discharges at its outer diameter.

The torque converter turbine is mounted opposite the impeller and is connected to the output shaft of the torque converter. This element receives fluid at its outer diameter and discharges at its center. Fluid directed by the impeller out into the particular design of blading in the turbine and reaction member is the means by which the hydraulic torque converter multiplies torque.

The reaction member of the torque converter is located between and at the center or inner diameters of the impeller and turbine elements. Its function is to take the fluid which is exhausting from the inner portion of the turbine and change its direction to allow correct entry for recirculation into the impeller element.

The torque converter will multiply engine torque to its designed maximum multiplication ratio when the output shaft is at zero RPM. Therefore, we can say that as the output shaft is decreasing in speed the torque multiplication is increasing.

The shift control valve assembly consists of a valve body with selector valve spools. A detent ball and spring in the selector spool provides 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.

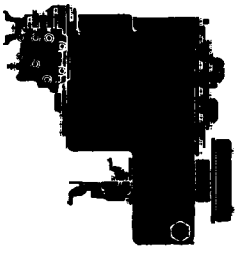
With the engine running and the directional control lever in neutral position, oil pressure from the regulating valve is blocked at the control valve, and the transmission is in neutral. Movement of the forward and reverse spool will direct oil, under pressure to either the forward or reverse direction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

When either directional clutch is selected the opposite clutch is relieved of pressure and vents back through the direction selector spool. The same procedure is used in the speed selector.

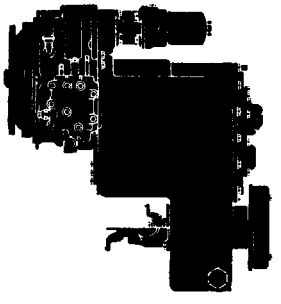
The direction or speed clutch assembly consists of a drum with internal splines and a bore to receive a hydraulically actuated piston. The piston is "oil tight" by the use of sealing rings. A steel disc with external splines is inserted into the drum and rests against the piston. Next, a friction disc with splines at the inner diameter is inserted. Discs are alternated until the required total is achieved. A heavy back-up plate is then inserted and secured with a snap ring. A Hub with O.D. splines is inserted into the splines of discs with teeth on the inner diameter The discs and hub are free to increase in speed or rotate in the opposite direction as long as no pressure is present in that specific 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 valve, through a tube, to a chosen clutch shaft. This shaft has a drilled passageway for oil under pressure to enter the shaft. Oil pressure sealing rings are located on the clutch shaft. These rings direct oil under pressure to a desired clutch. Pressure of the oil forces the piston and discs against the heavy back-up plate. The discs, with teeth on the outer diameter, clamping against discs with teeth on the inner diameter, enables the hub and clutch shaft to be locked together and allows them to drive as a unit.

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



R-28000



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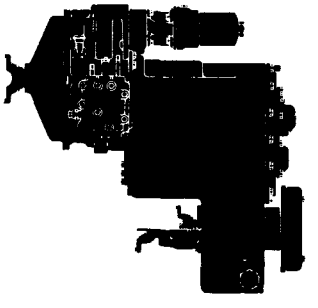

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FIG. A

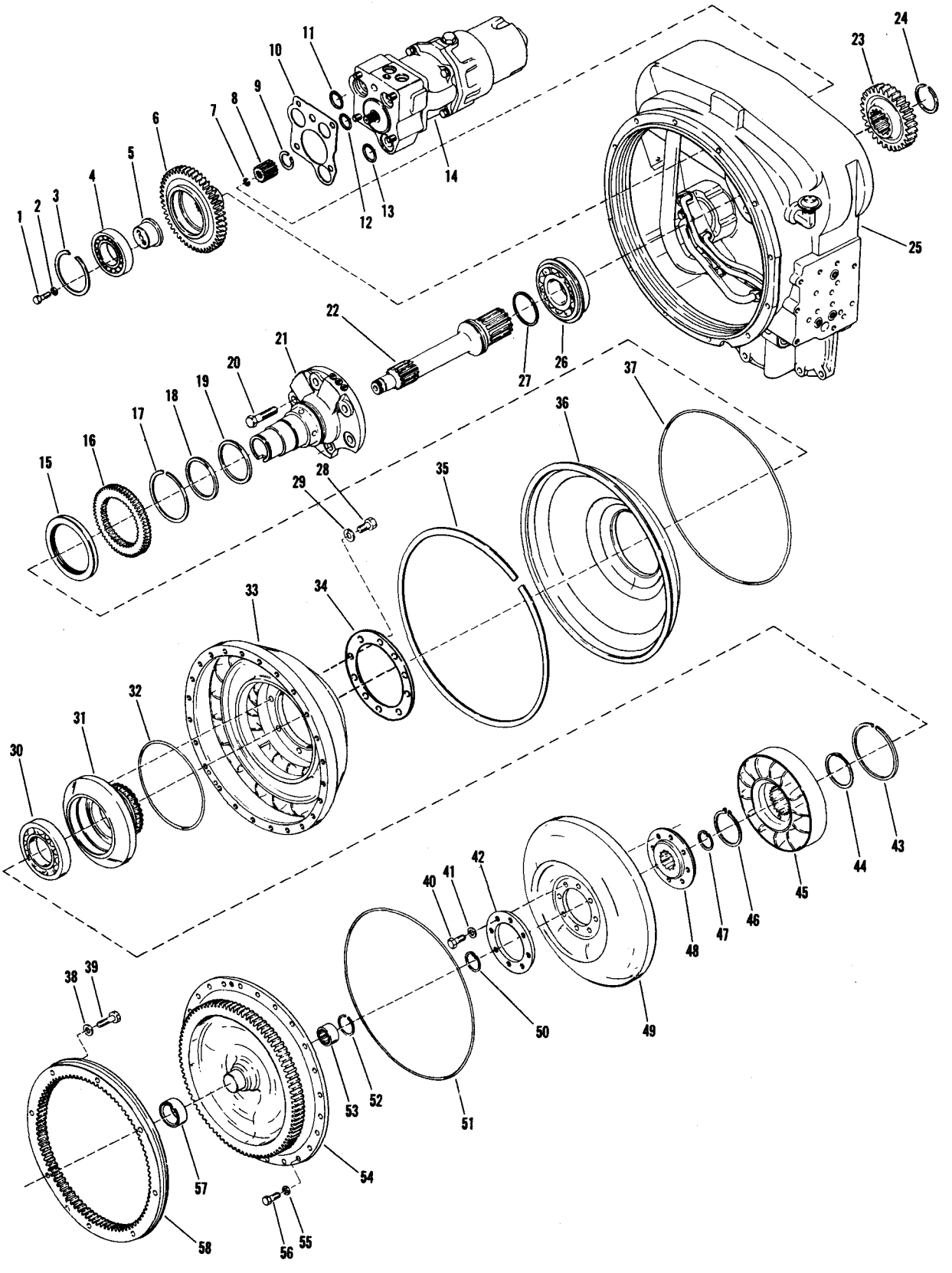
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Figure B

## HR 28000 CONVERTER GROUP

(See page 39 for R Model Front Cover Group)

| ITEM | DESCRIPTION | QTY. |
|---|---|---|
| 1 | Bearing Support Screw | 6 |
| 2 | Bearing Support Screw Lockwasher | 6 |
| 3 | Drive Gear Snap Ring | 3 |
| 4 | Pump Drive Gear Bearing | 3 |
| 5 | Pump Drive Bearing Support | 3 |
| 6 | Pump Drive Gear | 3 |
| 7 | Pump Sleeve Snap Ring | 1 |
| 8 | Charging Pump Drive Sleeve Assembly | 1 |
| 9 | Pump Sleeve Snap Ring | 1 |
| 10 | Valve to Housing Gasket | 1 |
| 11 | Valve Body "O" Ring | 1 |
| 12 | Valve Body "O" Ring | 1 |
| 13 | Valve Body "O" Ring | 1 |
| 14 | Regulator Valve, Charging Pump and Filter Assembly | 1 |
| 15 | Oil Baffle Oil Seal | 1 |
| 16 | Impeller Hub Gear | 1 |
| 17 | Impeller Hub Gear Snap Ring | 1 |
| 18 | Piston Ring Expander Spring | 1 |
| 19 | Piston Ring | 1 |
| 20 | Stator Support Screw | 6 |
| 21 | Stator Support | 1 |
| 22 | Turbine Shaft | 1 |
| 23 | Turbine Shaft Gear | 1 |
| 24 | Turbine Shaft Gear Snap Ring | 1 |
| 25 | Converter Housing and Tube Assembly | 1 |
| 26 | Turbine Shaft Bearing | 1 |
| 27 | Piston Ring | 1 |
| 28 | Hub to Impeller Screw | 8 |
| 29 | Hub to Impeller Screw Washer | 8 |
| 30 | Impeller Hub Bearing | 1 |
| 31 | Impeller Hub | 1 |
| 32 | Impeller Hub "O" Ring | 1 |
| 33 | Impeller | 1 |
| 34 | Impeller Hub Screw Backing Ring (Not used on all models) | 1 |
| 35 | Oil Baffle Retainer Ring | 1 |
| 36 | Oil Baffle | 1 |
| 37 | Oil Baffle Seal Ring | 1 |
| 38 | Ring Gear Screw Washer | 32 |
| 39 | Ring Gear Screw | 32 |
| 40 | Turbine Hub Screw | 8 |
| 41 | Turbine Hub Screw Washer | 8 |
| 42 | Turbine Hub Screw Backing Ring | 1 |
| 43 | Bearing Snap Ring | 1 |
| 44 | Reaction Member Spacer | 1 |
| 45 | Reaction Member | 1 |
| 46 | Reaction Member Snap Ring | 1 |
| 47 | Turbine Hub Locating Ring | 1 |
| 48 | Turbine Hub | 1 |
| 49 | Turbine | 1 |
| 50 | Turbine Hub Retaining Ring | 1 |
| 51 | Impeller to Cover "O" Ring | 1 |
| 52 | Bearing Snap Ring | 1 |
| 53 | Impeller Cover Bearing | 1 |
| 54 | Impeller Cover | 1 |
| 55 | Impeller to Cover Screw Lockwasher | 24 |
| 56 | Impeller to Cover Screw | 24 |
| 57 | Impeller Cover Sleeve | 1 |
| 58 | Flywheel Ring Gear | 1 |

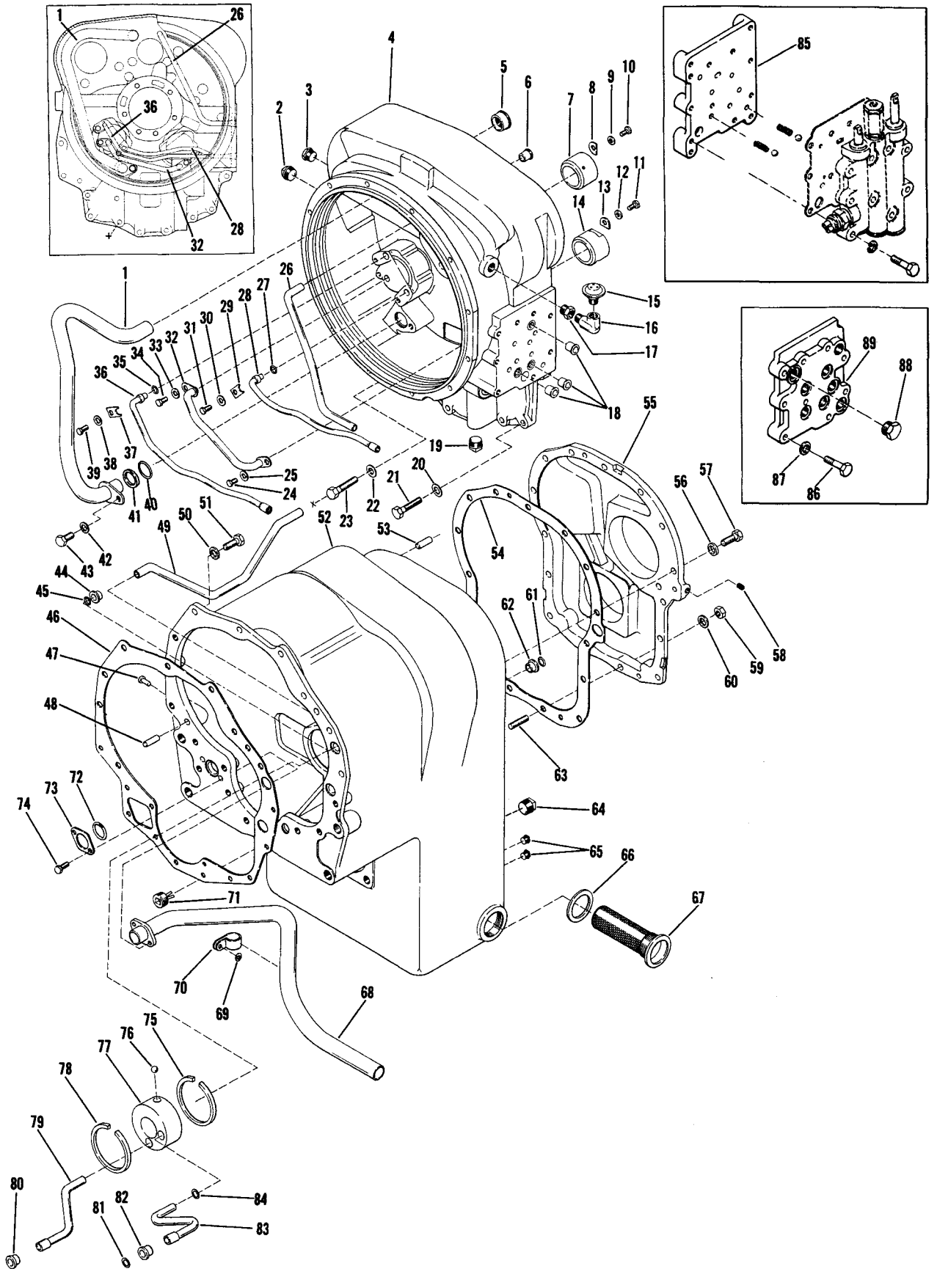
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Figure C

## HR 28000 CONVERTER AND TRANSMISSION CASE GROUP

| ITEM | DESCRIPTION | QTY |
|---|---|---|
| 1 | Suction Tube Assembly | 1 |
| 2 | Pipe Plug | 1 |
| 3 | Pipe Plug | 1 |
| 4 | Converter Housing and Tube Assembly | 1 |
| 5 | Tube Sleeve | 1 |
| 6 | Tube Sleeve | 1 |
| 7 | Converter Housing Sleeve | 1 |
| 8 | Converter Housing Sleeve Lock | 1 |
| 9 | Converter Housing Sleeve Screw Lockwasher | 1 |
| 10 | Converter Housing Sleeve Screw | 1 |
| 11 | Converter Housing Sleeve Screw | 1 |
| 12 | Converter Housing Sleeve Screw Lockwasher | 1 |
| 13 | Converter Housing Sleeve Lock | 1 |
| 14 | Converter Housing Sleeve | 1 |
| 15 | Breather | 1 |
| 16 | Street Ell | 1 |
| 17 | Tube Sleeve | 3 |
| 18 | Breather Reducing Bushing | 1 |
| 19 | Pipe Plug | 1 |
| 20 | Converter Housing to Transmission Housing Screw Lockwasher | 4 |
| 21 | Converter Housing to Transmission Housing Screw | 4 |
| 22 | Converter Housing to Transmission Housing Lockwasher | 4 |
| 23 | Converter Housing to Transmission Housing Screw | 4 |
| 24 | Lube Tube Retaining Screw | 1 |
| 25 | Lube Tube Retaining Screw Lockwasher | 1 |
| 26 | Valve Oil Supply Tube | 1 |
| 27 | 3rd Speed Tube "O" Ring | 1 |
| 28 | 3rd Speed Tube Assembly | 1 |
| 29 | Tube Clip | 1 |
| 30 | Tube Clip Screw Lockwasher | 1 |
| 31 | Tube Clip Screw | 1 |
| 32 | Lube Tube Assembly | 1 |
| 33 | Lube Tube Retainer Screw Lockwasher | 1 |
| 34 | Lube Tube Retainer Screw | 1 |
| 35 | Reverse Tube "O" Ring | 1 |
| 36 | Reverse Tube Assembly | 1 |
| 37 | Tube Clip | 1 |
| 38 | Tube Clip Screw Lockwasher | 1 |
| 39 | Tube Clip Screw | 1 |
| 40 | Suction Tube "O" Ring | 1 |
| 41 | Suction Tube Spacer Ring | 1 |
| 42 | Suction Tube Retainer Lockwasher | 1 |
| 43 | Suction Tube Retainer Screw | 1 |
| 44 | Tube Sleeve | 1 |
| 45 | Clutch Pressure Tube "O" Ring | 1 |

| ITEM | DESCRIPTION | QTY. |
|---|---|---|
| 46 | Converter Housing to Transmission Case Gasket | 1 |
| 47 | Suction Line Tube Clip Rivet | 1 |
| 48 | Converter Housing to Transmission Case Dowel Pin | 2 |
| 49 | Low Speed Clutch Pressure Tube | 1 |
| 50 | Transmission Case to Converter Housing Screw Lockwasher | 10 |
| 51 | Transmission Case to Converter Housing Screw | 10 |
| 52 | Transmission Case Assembly | 1 |
| 53 | Transmission Case to Rear Cover Dowel Pin | 2 |
| 54 | Transmission Case to Rear Cover Gasket | 1 |
| 55 | Transmission Case Rear Cover | 1 |
| 56 | Rear Cover to Case Screw Lockwasher | 13 |
| 57 | Rear Cover to Case Screw | 13 |
| 58 | Rear Cover Pipe Plug | 1 |
| 59 | Rear Cover to Transmission Case Stud Nut | 2 |
| 60 | Rear Cover to Transmission Case Lockwasher | 2 |
| 61 | Clutch Pressure Tube "O" Ring | 1 |
| 62 | Tube Sleeve | 1 |
| 63 | Transmission Case to Rear Cover Stud | 2 |
| 64 | Drain Plug | 1 |
| 65 | Oil Level Plug | 2 |
| 66 | Screen Assembly Gasket | 1 |
| 67 | Screen Assembly | 1 |
| 68 | Suction Tube Assembly | 1 |
| 69 | Suction Tube Clip Washer | 1 |
| 70 | Suction Tube Clip | 1 |
| 71 | Pipe Plug | 1 |
| 72 | Suction Tube "O" Ring | 1 |
| 73 | Suction Tube Retainer Washer | 1 |
| 74 | Suction Tube Retainer Washer Screw | 2 |
| 75 | Oil Distributor Retainer Ring | 1 |
| 76 | Oil Distributor Lock Ball | 1 |
| 77 | Oil Distributor | 1 |
| 78 | Oil Distributor Retainer Ring | 1 |
| 79 | 4th Clutch Lube Tube | 1 |
| 80 | Tube Sleeve | 1 |
| 81 | Clutch Pressure Tube "O" Ring | 1 |
| 82 | Tube Sleeve | 1 |
| 83 | 4th Speed Pressure Tube | 1 |
| 84 | 4th Speed Pressure Tube "O" Ring | 1 |
| 85 | Control Valve Mounting Plate | 1 |
| 86 | Remote Valve Plate Screw | 9 |
| 87 | Remote Valve Plate Screw Lockwasher | 9 |
| 88 | Control Valve Mounting Plate Plug | 1 |
| 89 | Valve Cover Plate | 1 |

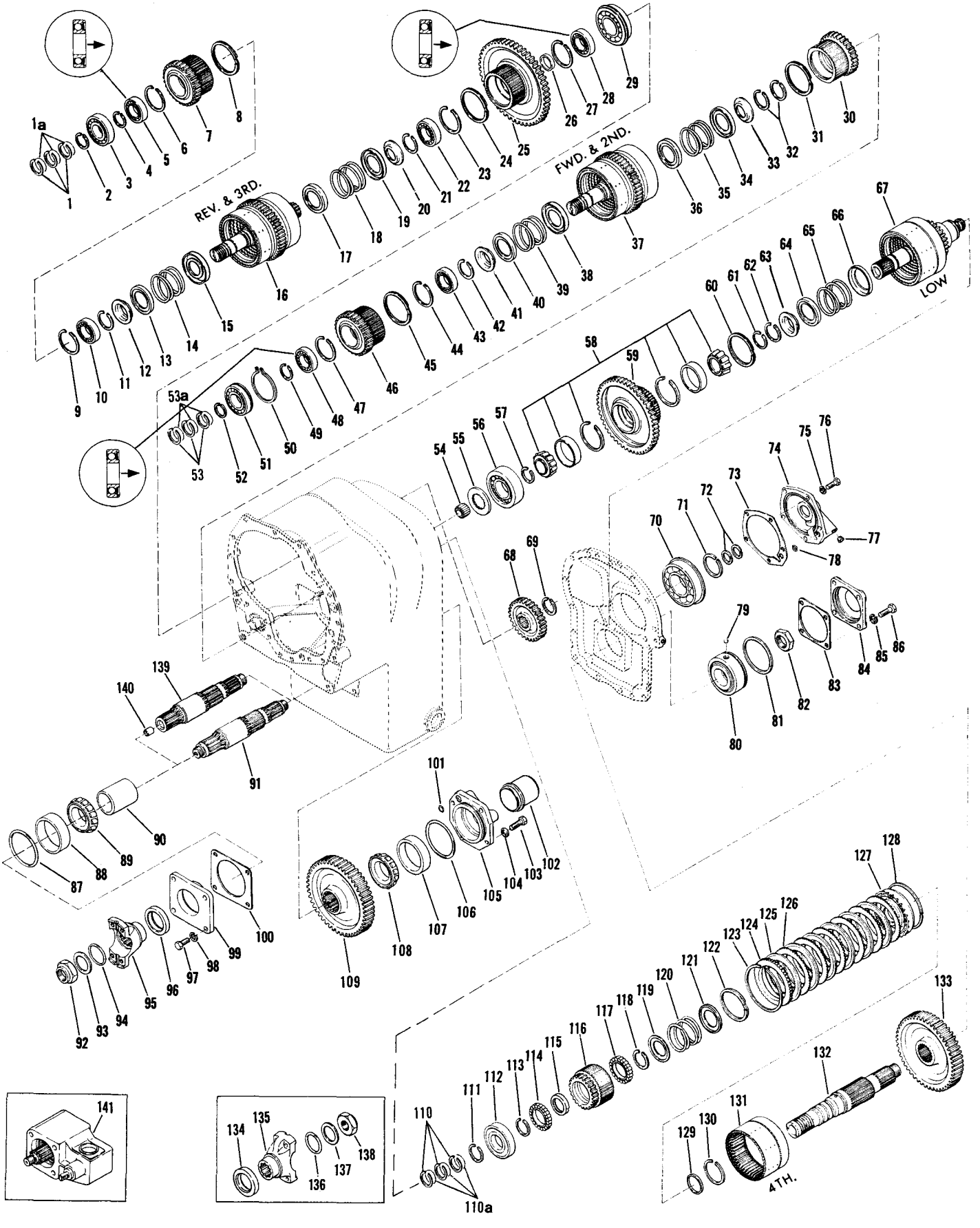
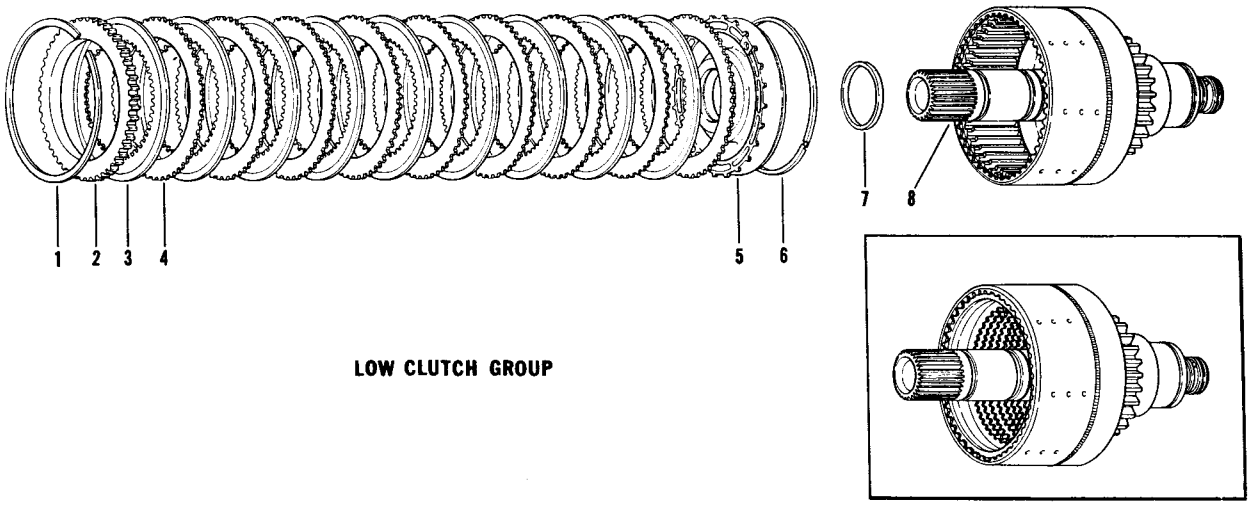


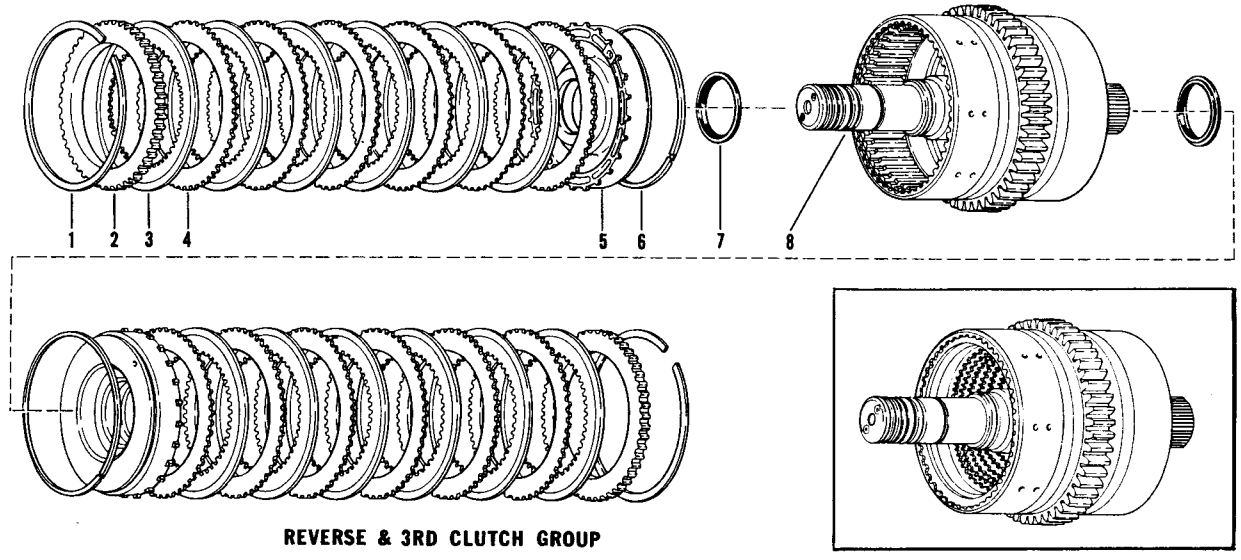

Figure D

# 28000 FOUR SPEED CASE AND CLUTCH GROUP

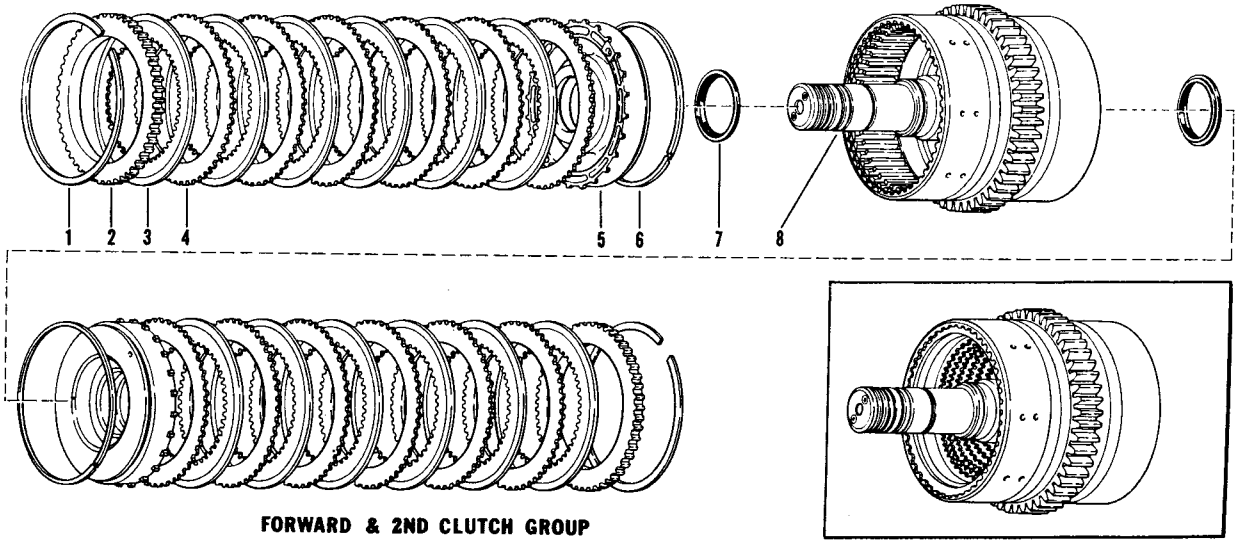
| ITEM | DESCRIPTION | QTY |
|---|---|---|
| 1 | Reverse and 3rd Clutch Shaft Piston Ring | 3 |
| 1A | Piston Ring Expander Spring | 3 |
| 2 | Front Bearing Retainer Ring | 1 |
| 3 | Reverse and 3rd Shaft Front Bearing | 1 |
| 4 | Front Bearing Retainer Ring | 1 |
| 5 | Clutch Driven Gear Bearing | 1 |
| 6 | Clutch Driven Gear Bearing Snap Ring | 1 |
| 7 | Clutch Driven Gear | 1 |
| 8 | Clutch Hub Oil Baffle Ring | 1 |
| 9 | Clutch Driven Gear Bearing Snap Ring | 1 |
| 10 | Clutch Driven Gear Bearing | 1 |
| 11 | Spring Retainer Snap Ring | 1 |
| 12 | Snap Ring Retainer | 1 |
| 13 | Spring Retainer | 1 |
| 14 | Piston Return Spring | 1 |
| 15 | Spring Retainer | 1 |
| 16 | Reverse & 3rd Clutch Shaft & Drum Assembly | 1 |
| 17 | Spring Retainer | 1 |
| 18 | Piston Return Spring | 1 |
| 19 | Spring Retainer | 1 |
| 20 | Snap Ring Retainer | 1 |
| 21 | Spring Retainer Snap Ring | 1 |
| 22 | 3rd Gear Bearing | 1 |
| 23 | 3rd Gear Bearing Snap Ring | 1 |
| 24 | Clutch Hub Oil Baffle Ring | 1 |
| 25 | 3rd Gear | 1 |
| 26 | 3rd Gear Bearing Spacer | 1 |
| 27 | 3rd Gear Bearing Snap Ring | 1 |
| 28 | 3rd Gear Bearing | 1 |
| 29 | Reverse and 3rd Shaft Rear Bearing | 1 |
| 30 | 2nd Gear | 1 |
| 31 | Clutch Hub Oil Baffle Ring | 1 |
| 32 | Gear & Spring Retainer Snap Ring | 2 |
| 33 | Snap Ring Retainer | 1 |
| 34 | Spring Retainer | 1 |
| 35 | Return Spring | 1 |
| 36 | Spring Retainer | 1 |
| 37 | Forward & 2nd Clutch Shaft & Drum Assembly | 1 |
| 38 | Spring Retainer | 1 |
| 39 | Return Spring | 1 |
| 40 | Spring Retainer | 1 |
| 41 | Snap Ring Retainer | 1 |
| 42 | Spring Retainer Snap Ring | 1 |
| 43 | Clutch Driven Gear Bearing | 1 |
| 44 | Clutch Driven Gear Snap Ring | 1 |
| 45 | Clutch Hub Oil Baffle Ring | 1 |
| 46 | Clutch Driven Gear | 1 |
| 47 | Clutch Driven Gear Bearing Snap Ring | 1 |
| 48 | Clutch Driven Gear Bearing | 1 |
| 49 | Front Bearing Retainer Ring | 1 |
| 50 | Front Bearing Locating Ring | 1 |
| 51 | Forward and 2nd Shaft Front Bearing | 1 |
| 52 | Front Bearing Retainer Ring | 1 |
| 53 | Forward and 2nd Shaft Piston Ring | 3 |
| 53A | Piston Ring Expander Ring | 3 |
| 54 | Low Speed Clutch Shaft Pilot Bearing | 1 |
| 55 | 2nd Gear Bearing End Plate | 1 |
| 56 | 2nd Gear Bearing | 1 |
| 57 | Low Speed Gear Bearing Retainer Ring | 1 |
| 58 | Low Speed Gear Bearing Assembly | 1 |
| 59 | Low Speed Gear | 1 |
| 60 | Clutch Hub Oil Baffle Ring | 1 |
| 61 | Bearing Retainer Ring | 1 |
| 62 | Spring Retainer Snap Ring | 1 |
| 63 | Snap Ring Retainer | 1 |
| 64 | Spring Retainer | 1 |
| 65 | Piston Return Spring | 1 |
| 66 | Spring Retainer | 1 |
| 67 | Low Speed Clutch Shaft & Drum Assembly | 1 |
| 68 | Low & 4th Clutch Drive Gear | 1 |
| 69 | Gear Retaining Ring | 1 |
| 70 | Low Speed Shaft Rear Bearing | 1 |
| 71 | Rear Bearing Retaining Ring | 1 |
| 72 | Clutch Shaft Piston Ring | 2 |
| 73 | Rear Bearing Cap Gasket | 1 |
| 74 | Rear Bearing Cap | 1 |
| 75 | Bearing Cap Screw Washer | 5 |
| 76 | Bearing Cap Screw | 5 |
| 77 | Bearing Cap Plug | 1 |
| 78 | Bearing Cap "O" Ring | 1 |
| 79 | Idler Shaft Rear Bearing Lock Ball | 1 |
| 80 | Idler Shaft Rear Bearing Assembly | 1 |
| 81 | Rear Bearing Locating Ring | 1 |
| 82 | Idler Shaft Nut | 1 |
| 83 | Bearing Cap Gasket | 1 |
| 84 | Rear Bearing Cap | 1 |
| 85 | Rear Bearing Cap Screw Washer | 4 |
| 86 | Bearing Cap Screw | 4 |
| 87 | Bearing Cap "O" Ring | 1 |
| 88 | Front Bearing Cap | 1 |
| 89 | Front Bearing Cap | 1 |
| 90 | Output Shaft Gear Spacer | 1 |
| 91 | Output Shaft | 1 |
| 92 | Flange Nut | 1 |
| 93 | Flange Washer | 1 |
| 94 | Flange "O" Ring | 1 |
| 95 | Output Flange | 1 |
| 96 | Bearing Cap Oil Seal | 1 |
| 97 | Bearing Cap Screw | 4 |
| 98 | Lockwasher | 4 |
| 99 | Bearing Cap | 1 |
| 100 | Bearing Cap Shim | AR |
| 101 | Bearing Cap "O" Ring | 1 |
| 102 | Rear Bearing Cap Bore Plug | 1 |
| 103 | Bearing Cap Screw | 4 |
| 104 | Bearing Cap Screw Lockwasher | 4 |
| 105 | Output Shaft Rear Bearing Cap | 1 |
| 106 | Bearing Cap "O" Ring | 1 |
| 107 | Rear Bearing Cup | 1 |
| 108 | Rear Bearing Cone | 1 |
| 109 | Output Shaft Gear | 1 |
| 110 | 4th Gear Piston Ring | 3 |
| 110A | Piston Ring Expander Spring | 3 |
| 111 | 4th Gear Bearing Snap Ring | 1 |
| 112 | 4th Gear Shaft Front Bearing | 1 |
| 113 | 4th Gear Front Bearing Locating Ring | 1 |
| 114 | 4th Gear Bearing | 1 |
| 115 | 4th Gear Spacer | 1 |
| 116 | 4th Gear | 1 |
| 117 | 4th Gear Bearing | 1 |
| 118 | Bearing Snap Ring | 1 |
| 119 | Spring Retainer | 1 |
| 120 | Piston Return Spring | 1 |
| 121 | Spring Retainer | 1 |
| 122 | Oil Baffle Ring | 1 |
| 123 | Backing Plate Snap Ring | 1 |
| 124 | Clutch Disc Backing Plate | 1 |
| 125 | Clutch Inner Disc | 6 |
| 126 | Clutch Outer Disc | 6 |
| 127 | Clutch Piston Assembly | 1 |
| 128 | Clutch Piston Outer Ring | 1 |
| 129 | Clutch Piston Inner Seal | 1 |
| 130 | 4th Clutch Drum Locating Ring | 1 |
| 131 | 4th Clutch Drum & Hub Assembly | 1 |
| 132 | Idler Shaft & Plug Assembly | 1 |
| 133 | Idler Shaft Gear | 1 |
| 134 | Oil Seal | 1 |
| 135 | Companion Flange | 1 |
| 136 | Flange "O" Ring | 1 |
| 137 | Flange Washer | 1 |
| 138 | Flange Nut | 1 |
| 139 | Output Shaft (used with disconnect only) | 1 |
| 140 | Bushing (used with disconnect only) | 1 |
| 141 | Disconnect (optional) | 1 |




LOW CLUTCH GROUP




REVERSE & 3RD CLUTCH GROUP




FORWARD & 2ND CLUTCH GROUP

Figure E

## LOW CLUTCH GROUP

| ITEM | DESCRIPTION | QTY. | ITEM | DESCRIPTION | QTY. |
|---|---|---|---|---|---|
| 1 | End Plate Retainer Ring | 1 | 5 | Clutch Piston | 1 |
| 2 | End Plate | 1 | 6 | Clutch Piston Outer Seal Ring | 1 |
| 3 | Clutch Inner Disc | 9 | 7 | Clutch Piston Inner Seal Ring | 1 |
| 4 | Clutch Outer Disc | 9 | 8 | Low Speed Clutch Drum and Shaft | 1 |

## REVERSE AND 3rd CLUTCH GROUP

| ITEM | DESCRIPTION | QTY. | ITEM | DESCRIPTION | QTY. |
|---|---|---|---|---|---|
| 1 | End Plate Retainer Ring | 2 | 5 | Clutch Piston | 2 |
| 2 | End Plate | 2 | 6 | Clutch Piston Outer Seal Ring | 2 |
| 3 | Clutch Inner Disc | 12 | 7 | Clutch Piston Inner Seal Ring | 2 |
| 4 | Clutch Outer Disc | 12 | 8 | Reverse and 3rd Clutch Drum and Shaft | 1 |

## FORWARD AND 2nd CLUTCH GROUP

| ITEM | DESCRIPTION | QTY. | ITEM | DESCRIPTION | QTY. |
|---|---|---|---|---|---|
| 1 | End Plate Retainer Ring | 2 | 5 | Clutch Piston | 2 |
| 2 | End Plate | 2 | 6 | Clutch Piston Outer Seal Ring | 2 |
| 3 | Clutch Inner Disc | 12 | 7 | Clutch Piston Inner Seal Ring | 2 |
| 4 | Clutch Outer Disc | 12 | 8 | Forward and 2nd Clutch Drum and Shaft | 1 |

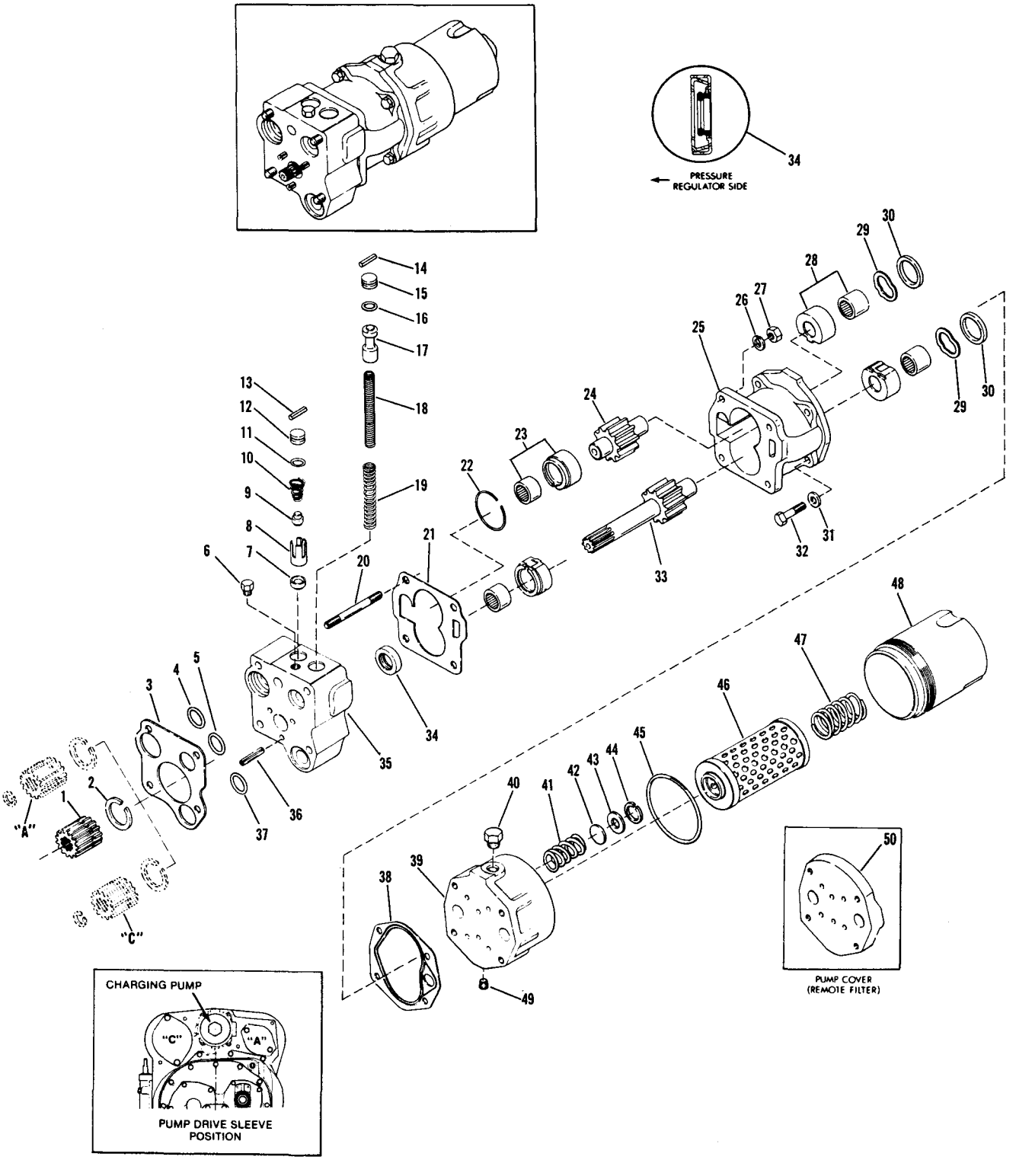

PRESSURE REGULATOR SIDE
CHARGING PUMP
"C"
"A"
PUMP DRIVE SLEEVE POSITION
PUMP COVER (REMOTE FILTER)

**Figure F**

## PRESSURE REGULATOR VALVE, CHARGING PUMP & OIL FILTER GROUP

| ITEM | DESCRIPTION | QTY. |
|---|---|---|
| 1 | Charging Pump Drive Sleeve | 1 |
| 2 | Pump Sleeve Snap Ring | 1 |
| 3 | Valve to Housing Gasket | 1 |
| 4 | Valve Body "O" Ring | 1 |
| 5 | Valve Body "O" Ring | 1 |
| 6 | Pipe Plug | 1 |
| 7 | Safety Valve Seat | 1 |
| 8 | Safety Valve Spacer | 1 |
| 9 | Safety Valve Plunger | 1 |
| 10 | Safety Valve Spring | 1 |
| 11 | Valve Stop "O" Ring | 1 |
| 12 | Valve Stop | 1 |
| 13 | Valve Stop Roll Pin | 1 |
| 14 | Valve Stop Roll Pin | 1 |
| 15 | Valve Stop | 1 |
| 16 | Valve Stop "O" Ring | 1 |
| 17 | Valve Piston | 1 |
| 18 | Valve Spring - Inner | 1 |
| 19 | Valve Spring - Outer | 1 |
| 20 | Valve to Converter Housing Stud | 4 |
| 21 | Valve Body to Pump Gasket | 1 |
| 22 | Pump Body Snap Ring | 1 |
| 23 | Thrust Plate & Bearing Assembly | 2 |
| 24 | Pump Driven Shaft Assembly | 1 |
| 25 | Charging Pump Housing | 1 |

| ITEM | DESCRIPTION | QTY. |
|---|---|---|
| 26 | Valve to Housing Stud Lockwasher | 4 |
| 27 | Valve to Housing Stud Nut | 4 |
| 28 | Thrust Plate & Bearing Assembly | 2 |
| 29 | Wave Spring | 2 |
| 30 | Pump Shaft Seal | 2 |
| 31 | Pump to Filter Adaptor Screw Lockwasher | 4 |
| 32 | Pump to Filter Adaptor Screw | 4 |
| 33 | Pump Drive Shaft Assembly | 1 |
| 34 | Pump Drive Shaft Oil Seal | 1 |
| 35 | Pressure Regulator Valve | 1 |
| 36 | Valve Body Roll Pin | 3 |
| 37 | Valve Body "O" Ring | 1 |
| 38 | Pump to Filter Gasket | 1 |
| 39 | Filter Adaptor | 1 |
| 40 | Filter Adaptor Plug | 1 |
| 41 | By-Pass Filter Disc Spring | 1 |
| 42 | By-Pass Filter Disc | 1 |
| 43 | By-Pass Filter Disc Seat | 1 |
| 44 | Filter Seat Retainer Ring | 1 |
| 45 | Filter Housing "O" Ring | 1 |
| 46 | Oil Filter Element Assembly | 1 |
| 47 | Oil Filter Element Spring | 1 |
| 48 | Filter Housing | 1 |
| 49 | Pipe Plug | 1 |
| 50 | Optional Adaptor for Remote Filter | 1 |

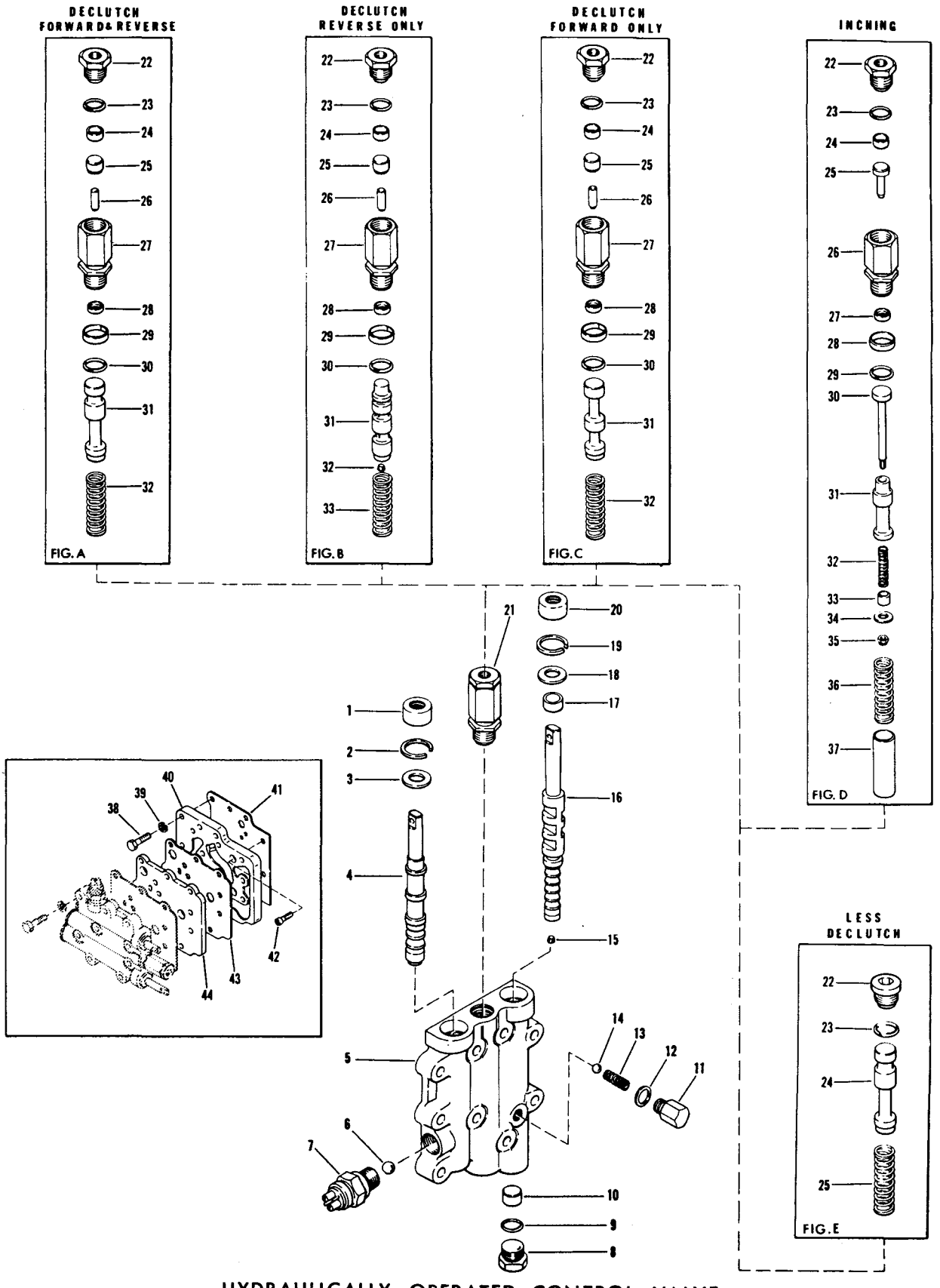
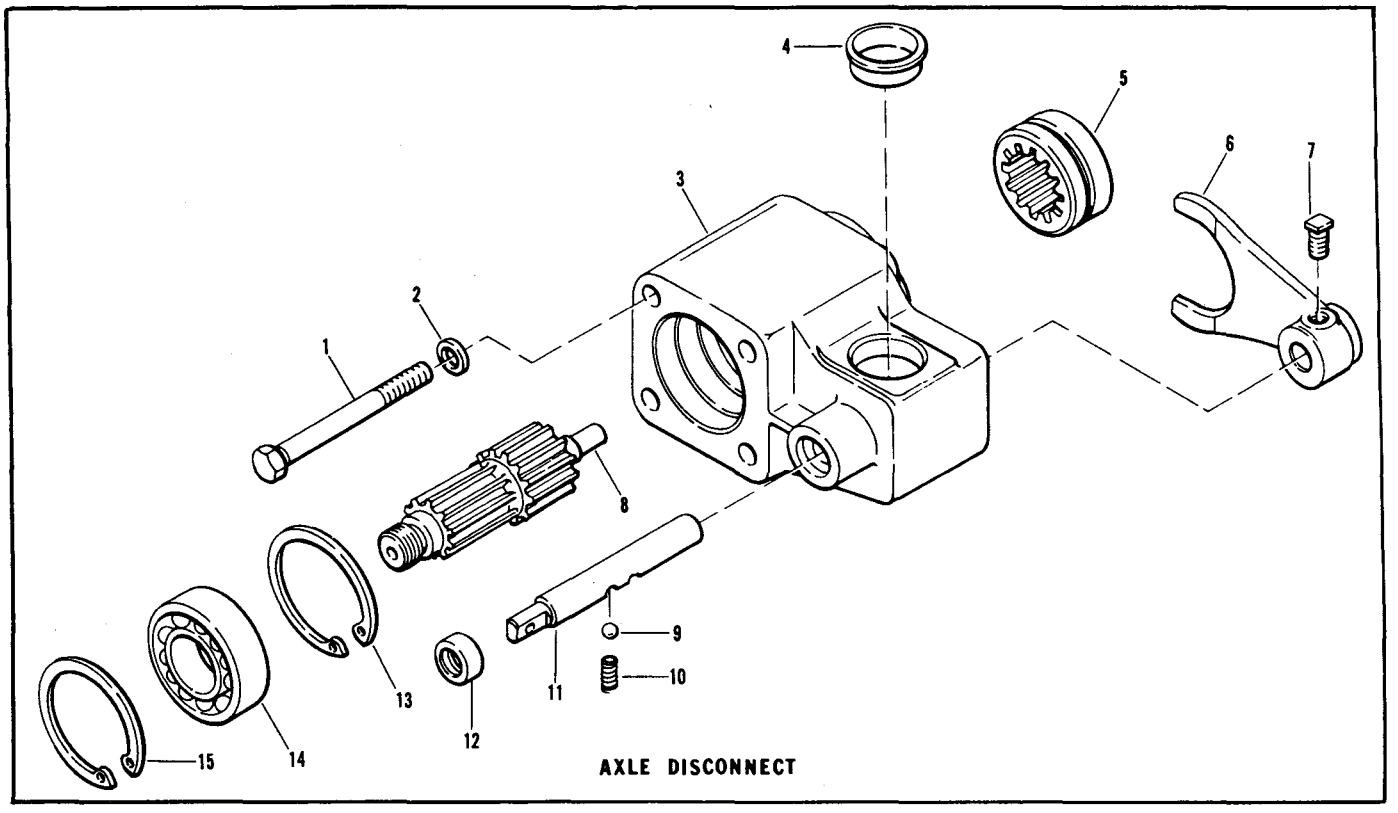

DECLUTCH FORWARD & REVERSE
DECLUTCH REVERSE ONLY
DECLUTCH FORWARD ONLY
INCHING
FIG. A
FIG. B
FIG. C
FIG. D
LESS DECLUTCH
FIG. E
HYDRAULICALLY OPERATED CONTROL VALVE

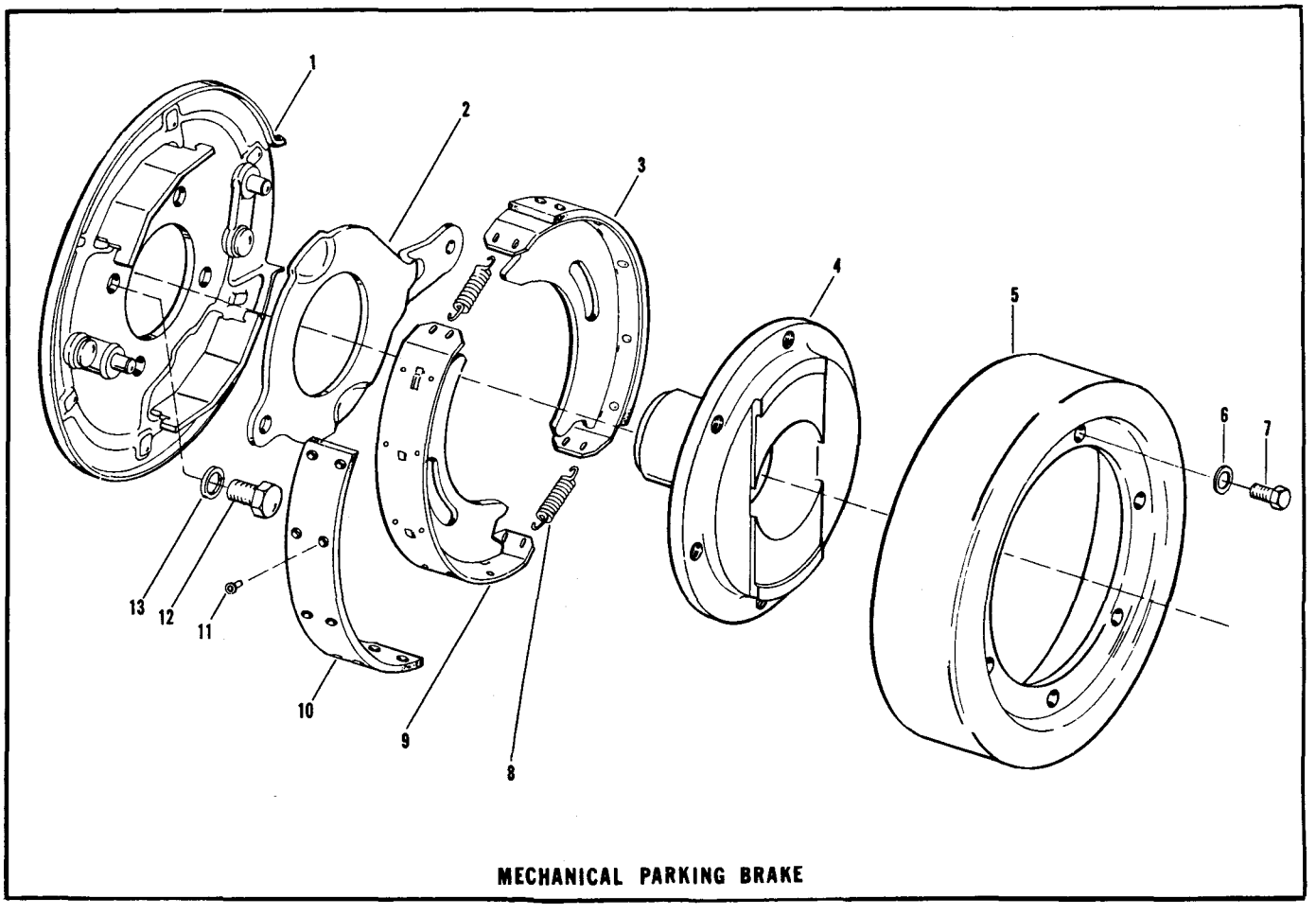
Figure G

## CONTROL VALVE ASSEMBLY

| ITEM | DESCRIPTION | QTY. |
|---|---|---|
| 1 | Valve Spool Oil Seal | 1 |
| 2 | Valve Spool Oil Seal Retainer Ring | 1 |
| 3 | Valve Spool Oil Seal Washer | 1 |
| 4 | Forward and Reverse Valve Spool | 1 |
| 5 | Control Valve Assembly — Incl. items 1 thru 9, 15, 16 and 18 thru 20 | 1 |
| 6 | Neutral Switch Detent Ball | 1 |
| 7 | Neutral Switch | 1 |
| 8 | Valve Housing Plug | 1 |
| 9 | Valve Housing Plug "O" Ring | 1 |
| 10 | Overshift Spacer | 1 |
| 11 | Detent Spring Plug (Optional) | 1 |
| 12 | Detent Spring Plug Washer (Optional) | 1 |
| 13 | Detent Spring (Optional) | 1 |
| 14 | Detent Ball (Optional) | 1 |
| 15 | Speed Selector Spool Pipe Plug | 1 |
| 16 | Speed Selector | 1 |
| 17 | Overshift Spacer | 1 |
| 18 | Valve Spool Oil Seal Washer | 1 |
| 19 | Valve Spool Oil Seal Retainer Ring | 1 |
| 20 | Valve Spool Oil Seal | 1 |
| 21 | Hydraulic Piston Housing Assembly | 1 |
| | NOTE: Items 22 thru 25, 32, 33 and 37 are various declutch options. | |
| 38 | Adaptor to Converter Housing Screw | 4 |
| 39 | Adaptor to Converter Housing Screw Lockwasher | 4 |
| 40 | Valve Adaptor Housing | 1 |
| 41 | Converter Housing to Valve Adaptor Housing Gasket | 1 |
| 42 | Adaptor Housing to Converter Housing Screw | 5 |
| 43 | Adaptor Housing to Adaptor Plate Gasket | 1 |
| 44 | Valve Adaptor Plate | 1 |




AXLE DISCONNECT




MECHANICAL PARKING BRAKE

Figure H

## AXLE DISCONNECT

| ITEM | DESCRIPTION | QTY. |
|---|---|---|
| 1 | Disconnect Housing Capscrew | 4 |
| 2 | Disconnect Housing Capscrew Lockwasher | 4 |
| 3 | Disconnect Housing | 1 |
| 4 | Disconnect Housing Plug | 1 |
| 5 | Shift Hub | 1 |
| 6 | Shift Fork | 1 |
| 7 | Shift Fork Lockscrew | 1 |
| 8 | Disconnect Shaft | 1 |
| 9 | Detent Ball | 1 |
| 10 | Detent Spring | 1 |
| 11 | Shift Rail | 1 |
| 12 | Shift Rail Oil Seal | 1 |
| 13 | Bearing Retainer Ring | 1 |
| 14 | Bearing | 1 |
| 15 | Bearing Retainer Ring | 1 |

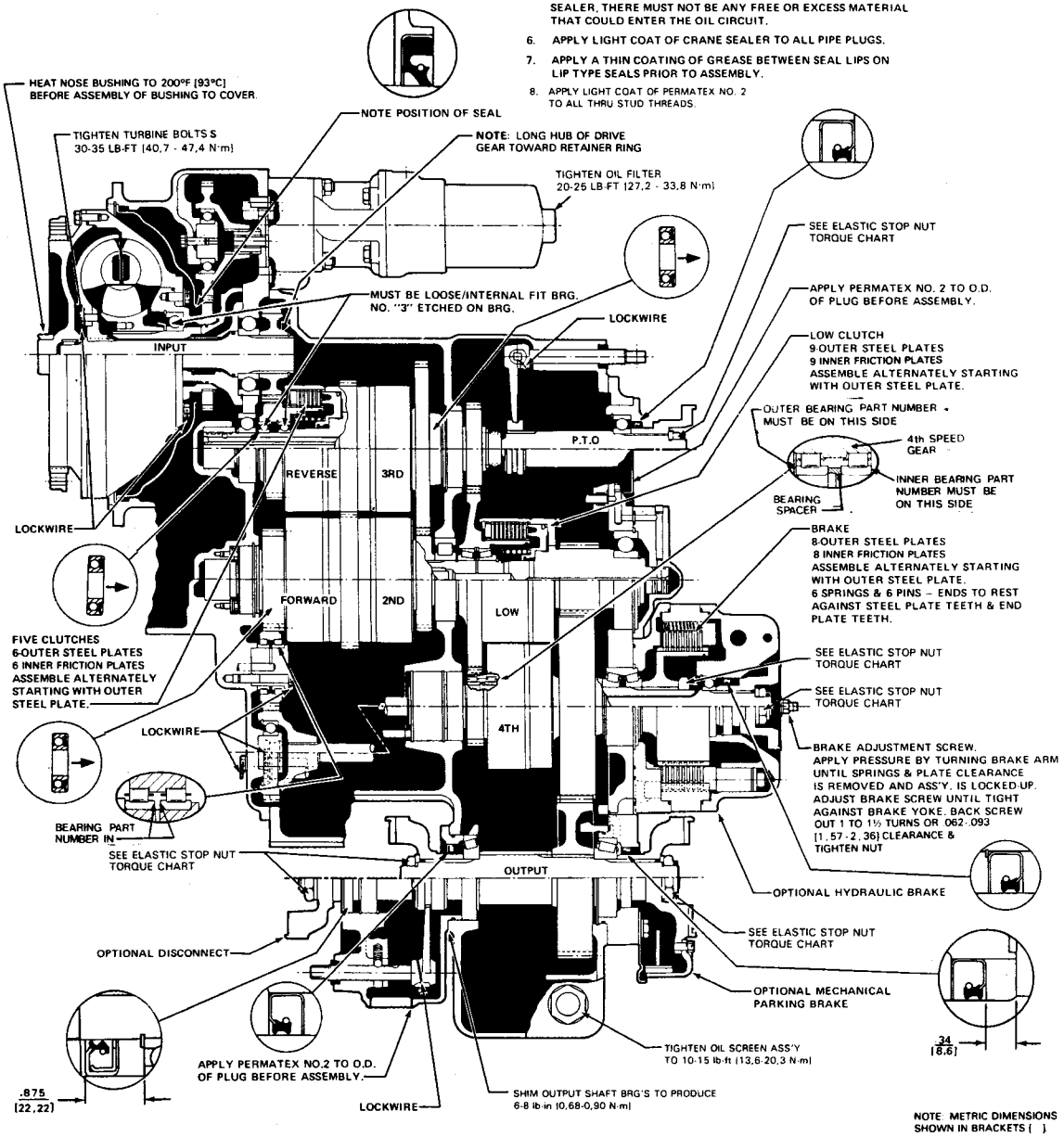
## MECHANICAL PARKING BRAKE

| ITEM | DESCRIPTION | QTY. |
|---|---|---|
| 1 | Backing Plate Assembly | 1 |
| 2 | Actuating Lever | 1 |
| 3 | Brake Shoe and Lining | 2 |
| 4 | Brake Flange | 1 |
| 5 | Brake Drum | 1 |
| 6 | Brake Drum to Flange Screw Lockwasher | 6 |
| 7 | Brake Drum to Flange Screw | 6 |
| 8 | Return Spring | 2 |
| 9 | Brake Shoe (see item 3) | |
| 10 | Brake Lining | 2 |
| 11 | Rivet | 20 |
| 12 | Backing Plate Screw | 4 |
| 13 | Backing Plate Screw Lockwasher | 4 |

## ELASTIC STOP NUT TORQUE

| THREAD SIZE | LB.-FT. | [N·m] |
|---|---|---|
| 1" - 20 | 150 - 200 | [203,4 - 271,1] |
| 1¼" - 18 | 200 - 250 | [271,2 - 338,9] |
| 1½" - 18 | 300 - 350 | [406,8 - 474,5] |
| 1¾" - 12 | 400 - 450 | [542,4 - 610,1] |

1. USE PERMATEX & CRANE SEALER ONLY WHERE SPECIFIED.
2. ALL LEAD IN CHAMFERS FOR OIL SEALS, PISTON RINGS & "O" RINGS MUST BE SMOOTH & FREE FROM BURRS. INSPECT AT ASSEMBLY.
3. LUBRICATE ALL PISTON RING GROOVES & "O" RINGS WITH OIL BEFORE ASSEMBLY.
4. APPLY VERY LIGHT COAT OF PERMATEX NO.2 TO O.D. OF ALL OIL SEALS BEFORE ASSEMBLY.
5. AFTER ASSEMBLY OF PARTS USING PERMATEX OR CRANE SEALER, THERE MUST NOT BE ANY FREE OR EXCESS MATERIAL THAT COULD ENTER THE OIL CIRCUIT.
6. APPLY LIGHT COAT OF CRANE SEALER TO ALL PIPE PLUGS.
7. APPLY A THIN COATING OF GREASE BETWEEN SEAL LIPS ON LIP TYPE SEALS PRIOR TO ASSEMBLY.
8. APPLY LIGHT COAT OF PERMATEX NO. 2 TO ALL THRU STUD THREADS.




28420 SERIES POWER SHIFT TRANSMISSION WITH VARIOUS OPTIONS

**Figure I**

## MAINTENANCE AND SERVICE

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 a basic 28000 transmission with many options. 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 obsolute must in the repair and overhaul of this unit. Before attempting any repair, the exteriors of the unit must be thoroughly cleaned to prevent the possibility of dirt an foreign matter entering the mechanism.

**NOTE: For R-Model (Remote Mounted) front cover removal, service and installation on transmission see page 42 Figure 2. For MHR front cover removal, service and installation on transmission see page 56 Figure 1.**

## DISASSEMBLY

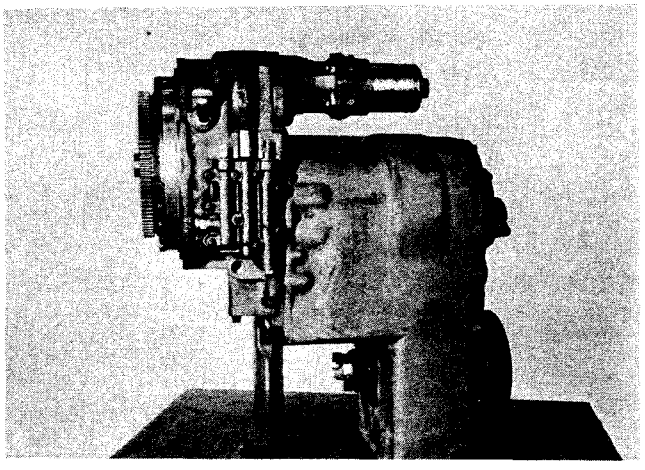


**Figure 1**
Side view of 4-speed transmission.

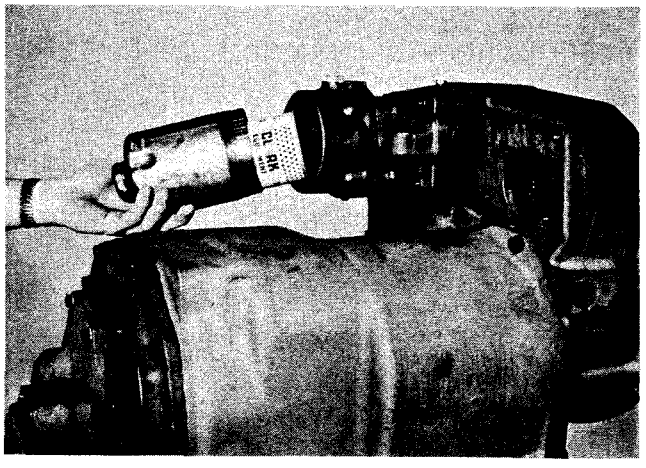


**Figure 2**

Remove filter housing and filter element.

**NOTE:** See lubrication section for filter cartridge change interval.

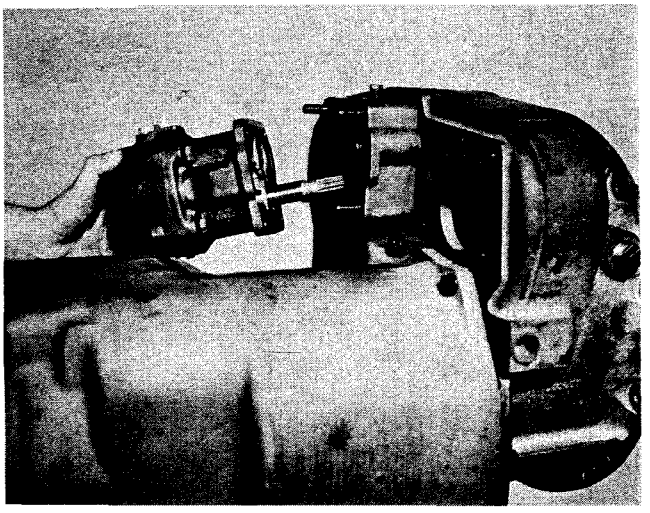


**Figure 3**
Remove charging pump to regulating valve stud nuts. Remove pump and filter adapter.

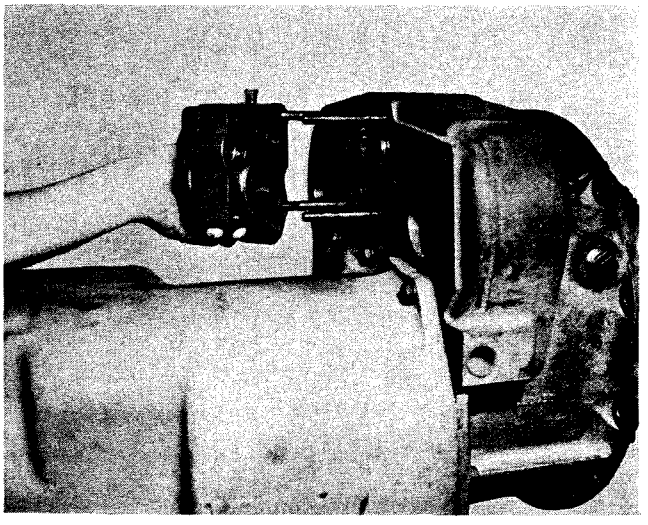


**Figure 4**
Remove pressure regulating valve assembly.

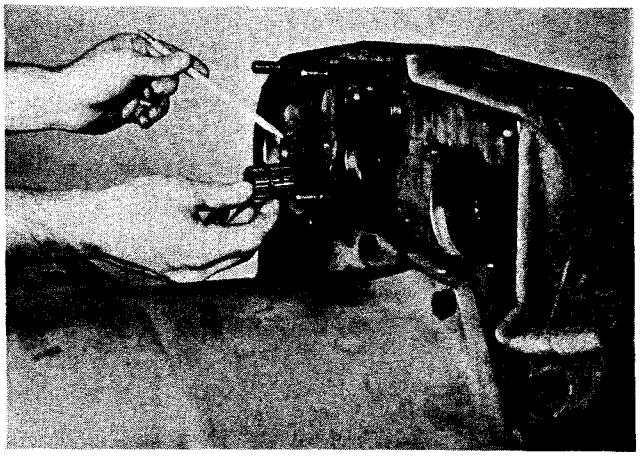


**Figure 5**
Remove pump drive sleeves.

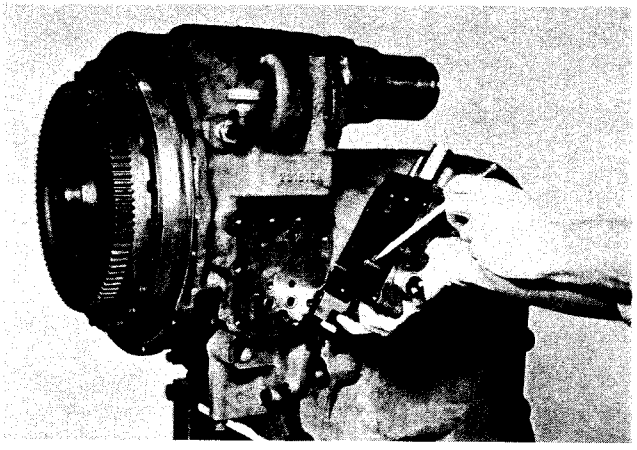


**Figure 6**
Remove control valve bolts and washers. Remove control valve. Use caution as not to lose detent springs and balls.

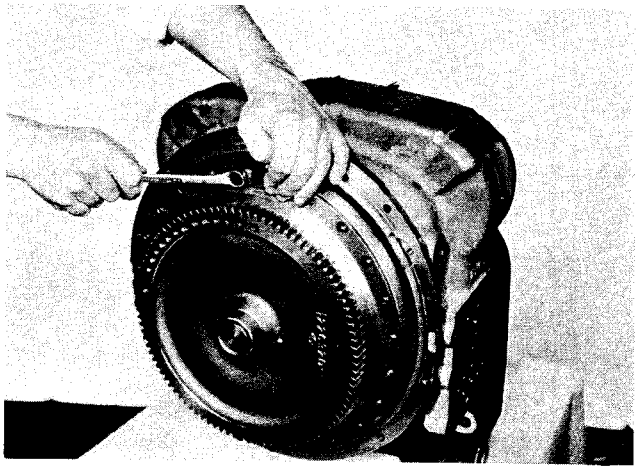


**Figure 7**
Remove impeller cover bolts.

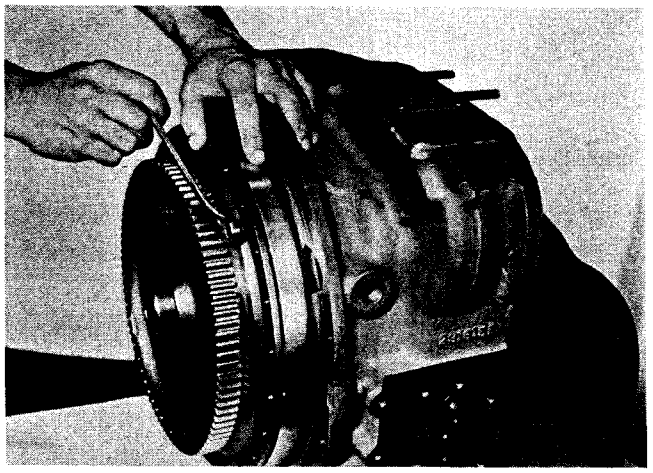


**Figure 8**
Install two bolts in threaded holes 180° apart to remove cover from impeller. **NOTE:** Some units may have pry slots instead of threaded holes.

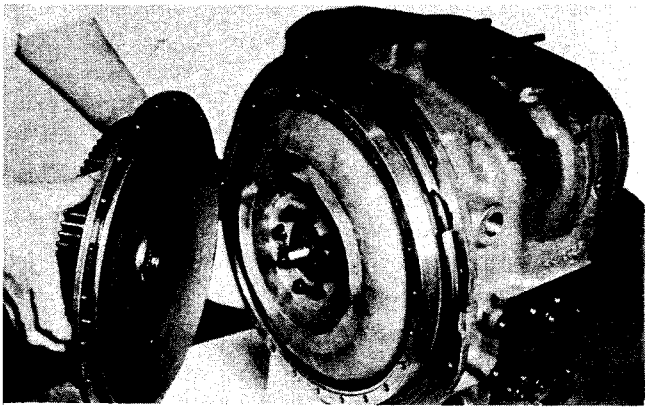


**Figure 9**
Remove impeller cover.

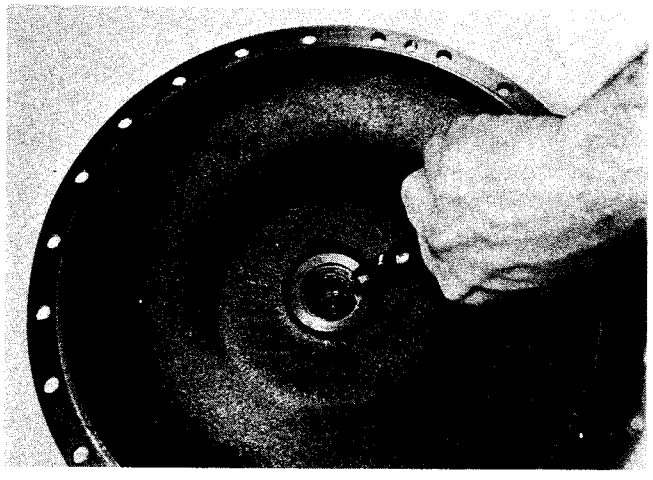


**Figure 10**
If impeller cover bearing is to be replaced remove retainer ring. Pry bearing from pocket.

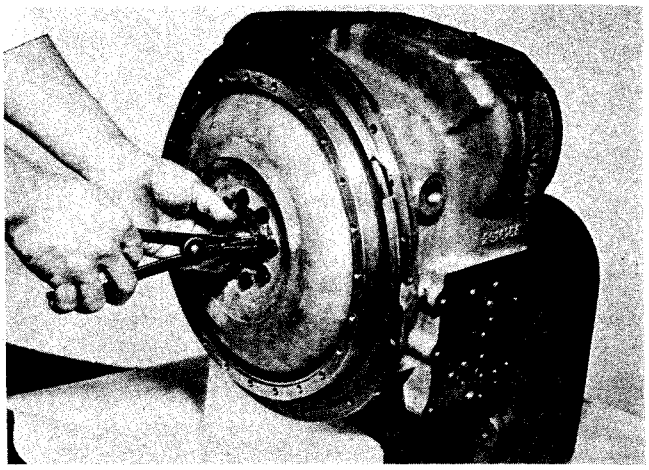


**Figure 11**
Remove turbine retaining ring.

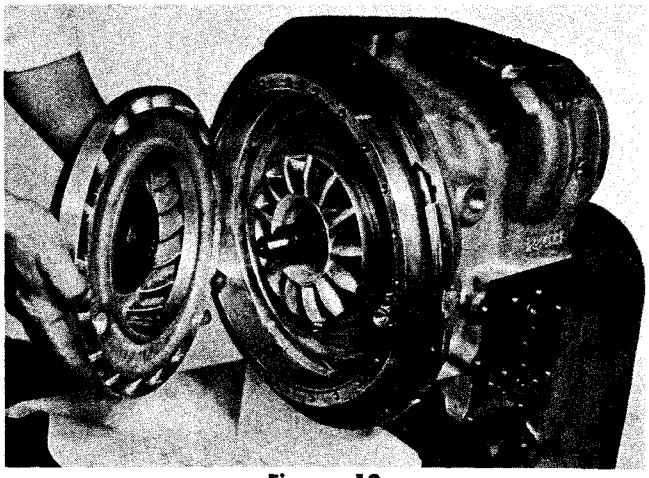


**Figure 12**
Remove turbine and hub assembly.

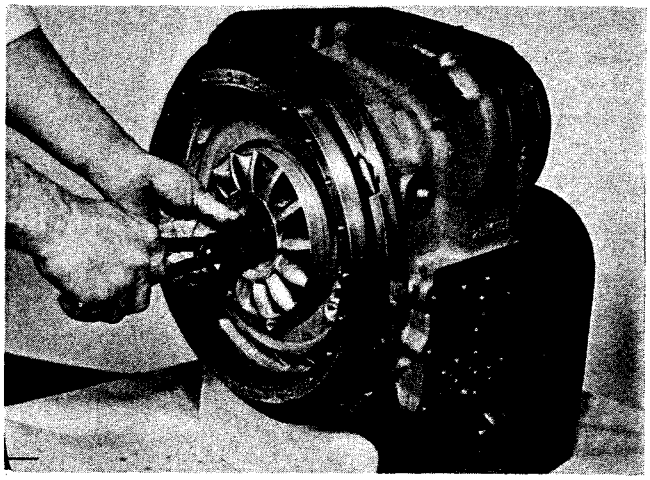


**Figure 13**
Remove turbine locating ring.

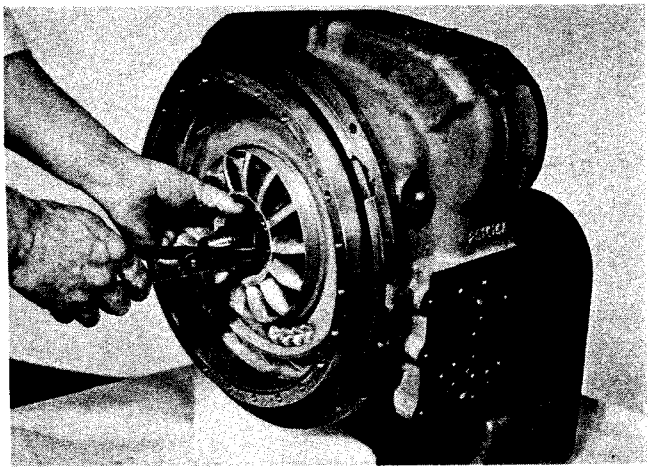


**Figure 14**
Remove reaction member retainer ring

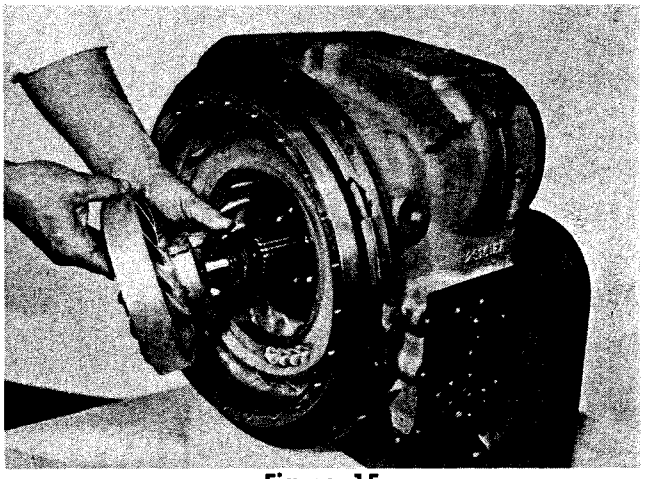


**Figure 15**
Remove reaction member and spacer.

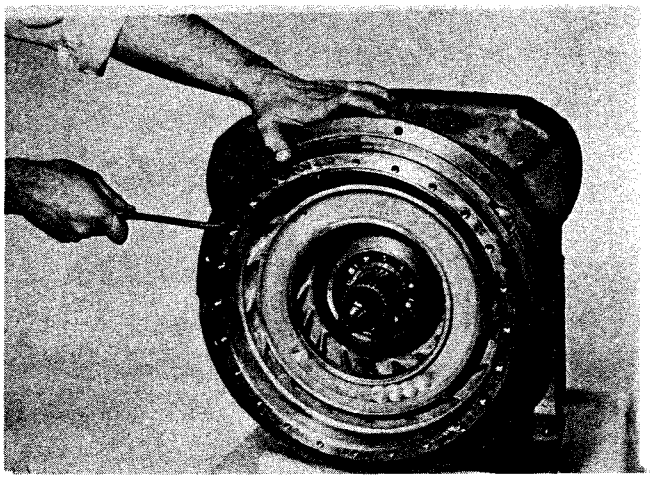


**Figure 16**
Remove oil baffle retainer ring.

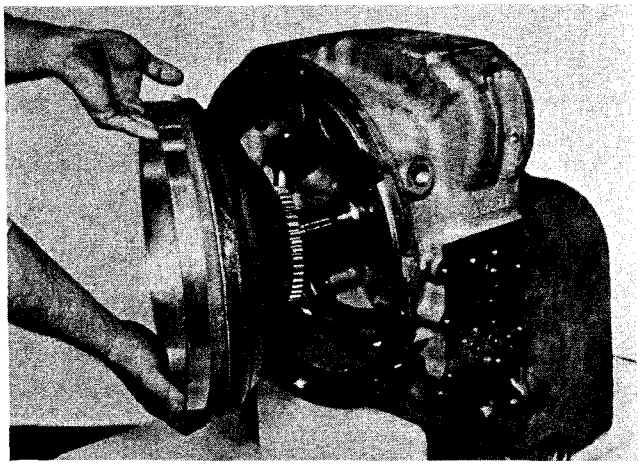


**Figure 17**

Using pry slots in converter housing, pry oil baffle and impeller from housing. **NOTE:** Impeller, oil baffle and impeller hub gear are removed as an assembly.

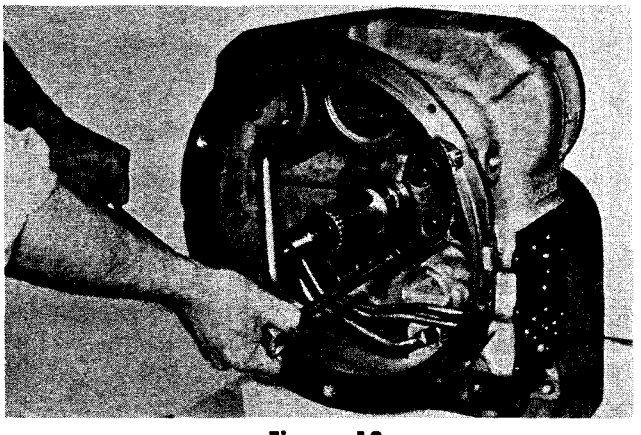


**Figure 18**

Remove stator support to housing bolts.

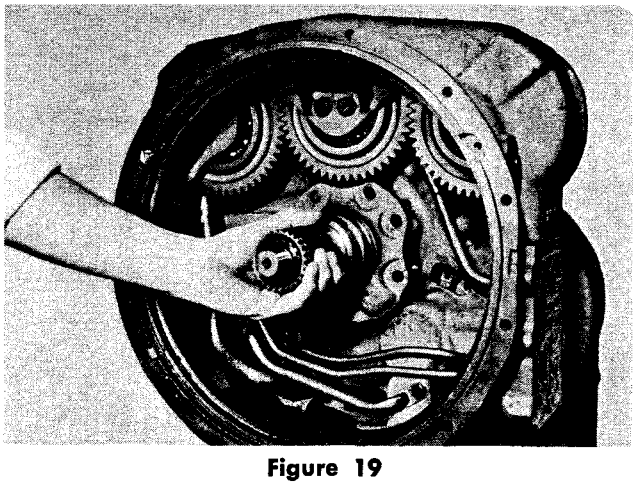


**Figure 19**

Remove stator support. **NOTE:** Support must be turned to clear pump drive gear.

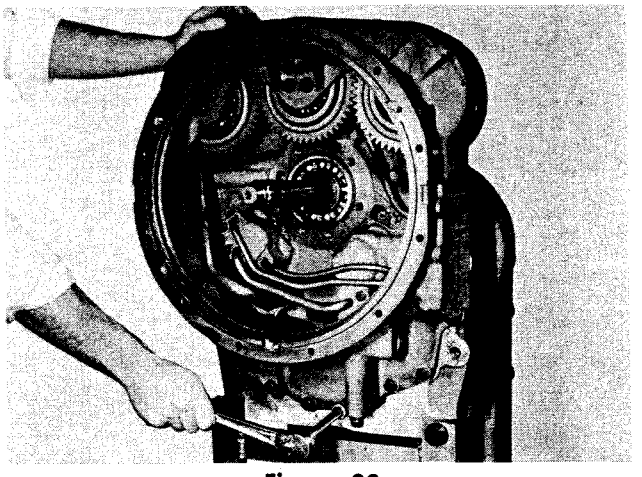


**Figure 20**

Remove bolts securing converter housing to transmission housing.

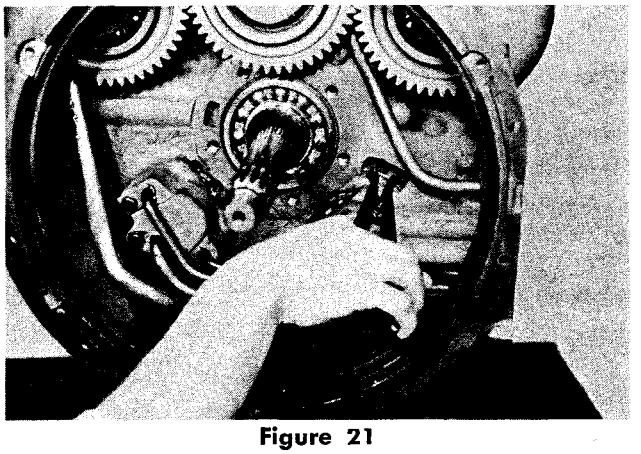


**Figure 21**

Support converter housing with a chain fall. Using spreading type snap ring pliers, spread ears on forward clutch front bearing retainer ring. Holding snap ring open tap converter housing from transmission housing.

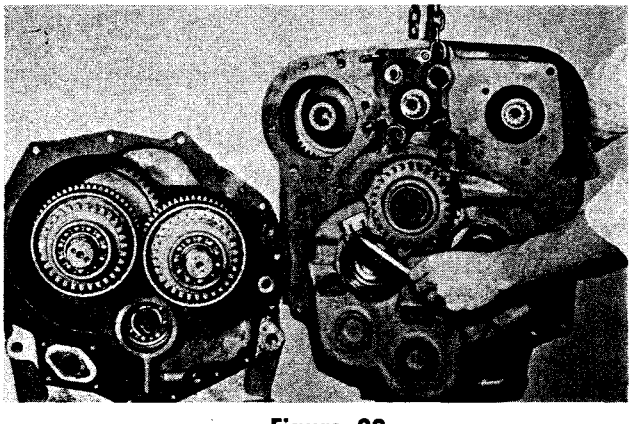


**Figure 22**

Converter housing removed. Note front bearing retaining ring relieved of front bearing.

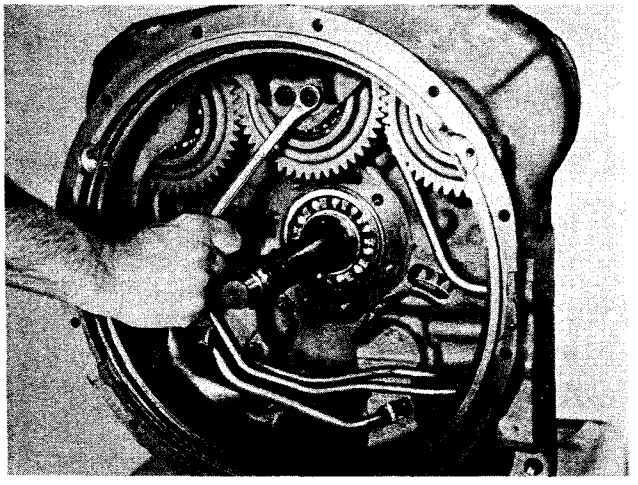


**Figure 23**
Remove pump drive gear bearing support bolts.

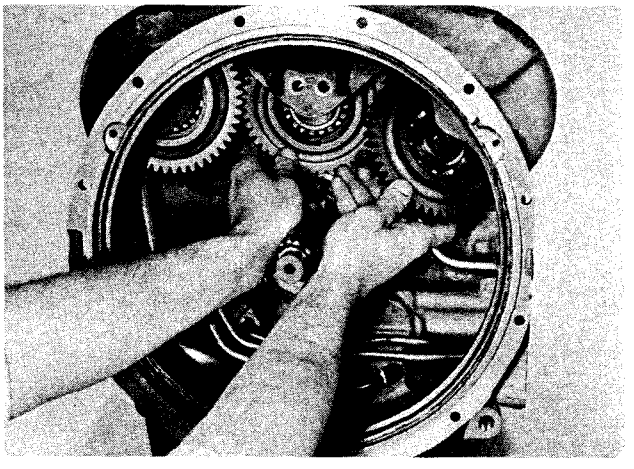


**Figure 24**
Move center gear toward the rear of converter housing. Remove pump drive gear on the right.

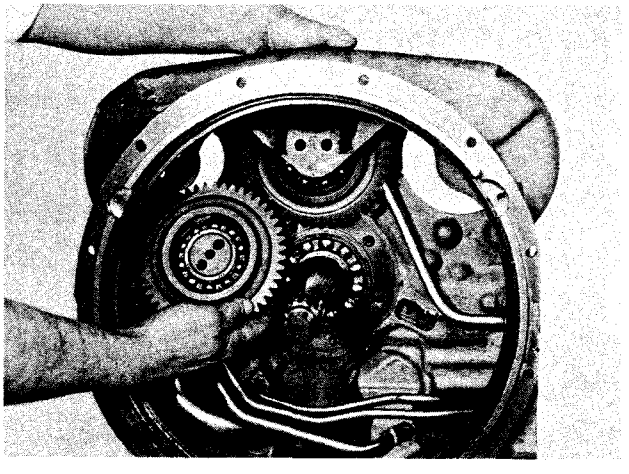


**Figure 25**
Remove pump drive gear on the left.

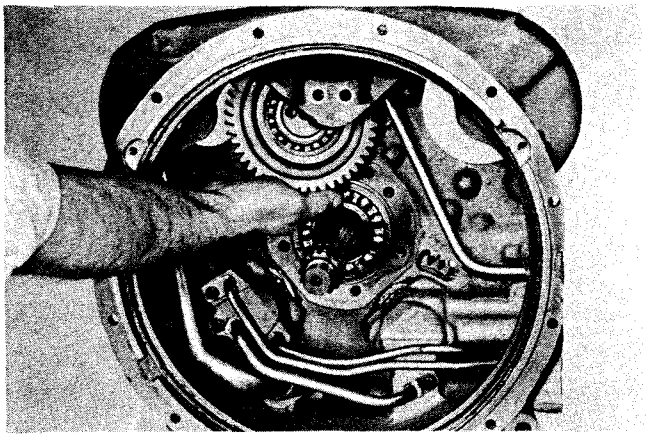


**Figure 26**
Remove center pump drive gear.

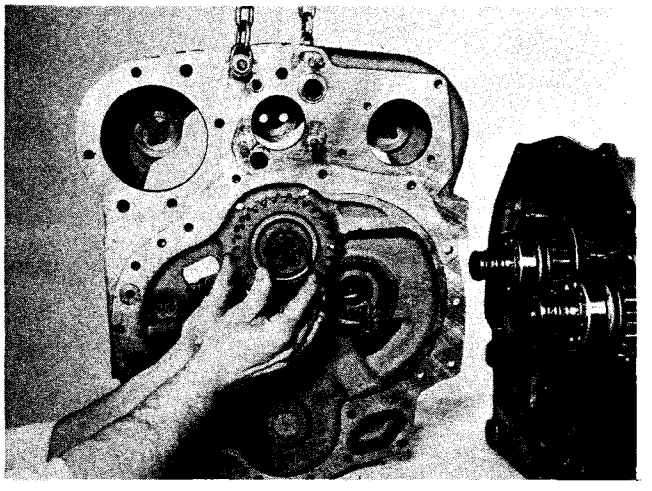


**Figure 27**
Remove turbine shaft gear retainer ring and gear.

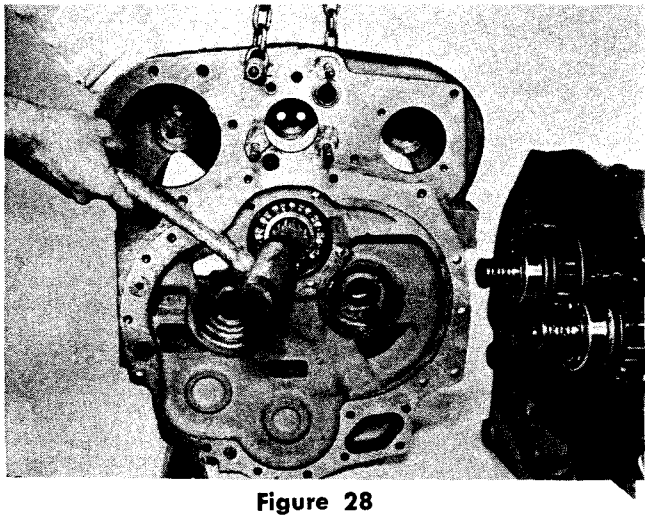


**Figure 28**
From rear of converter housing tap turbine shaft and bearing from housing.

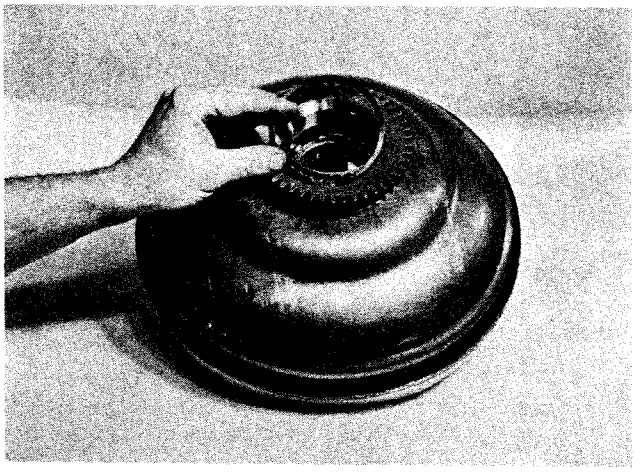


**Figure 29**
Remove impeller hub gear retainer ring.

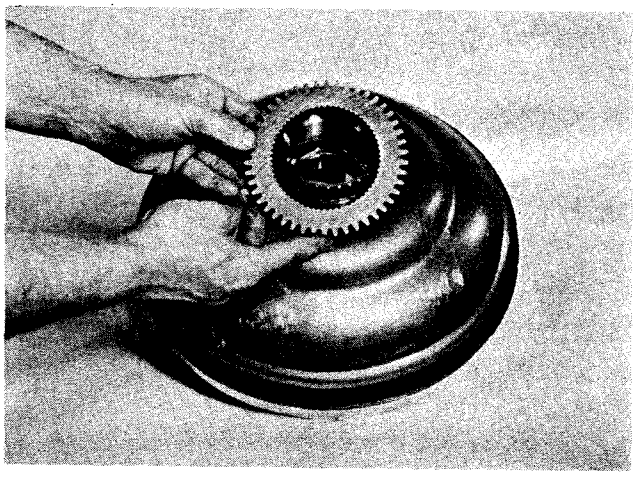


**Figure 30**
Remove impeller hub gear.

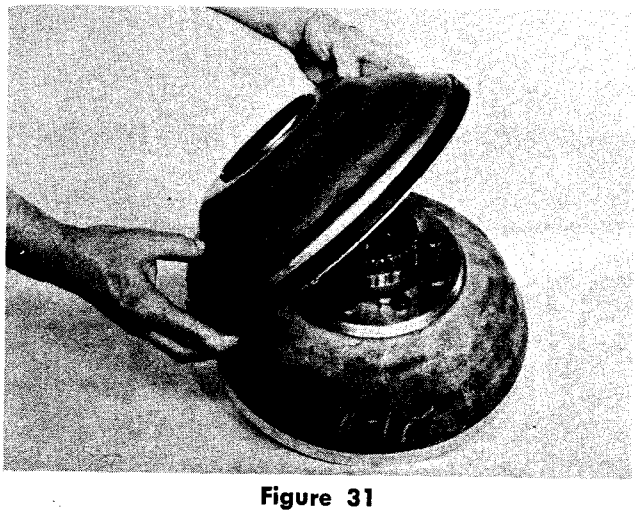


**Figure 31**
Lift oil baffle and oil seal assembly from impeller.

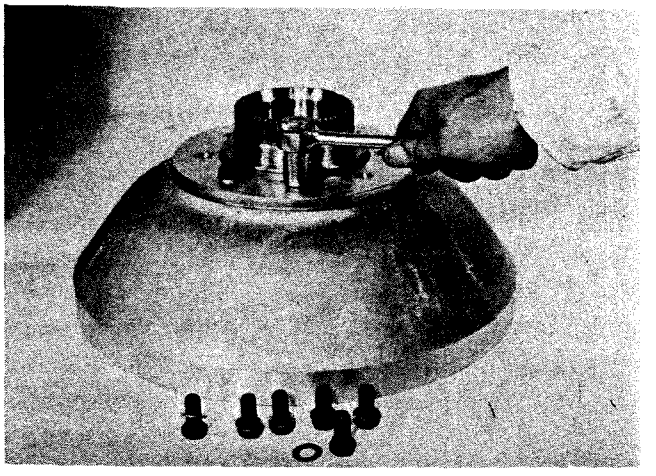


**Figure 32**
Remove impeller to hub bolts.

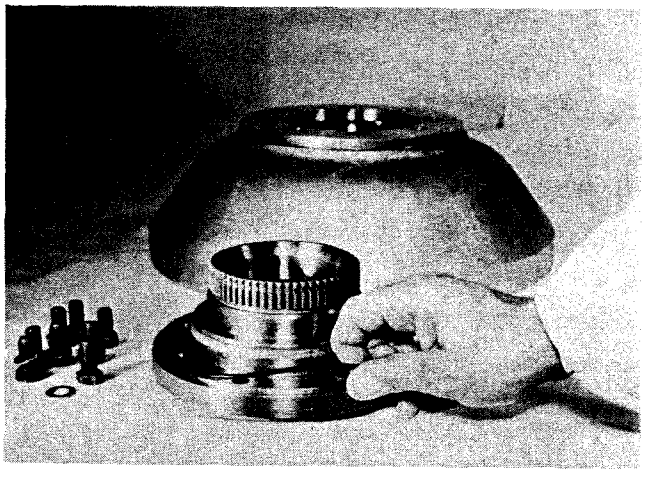


**Figure 33**
Remove impeller hub "O" ring.

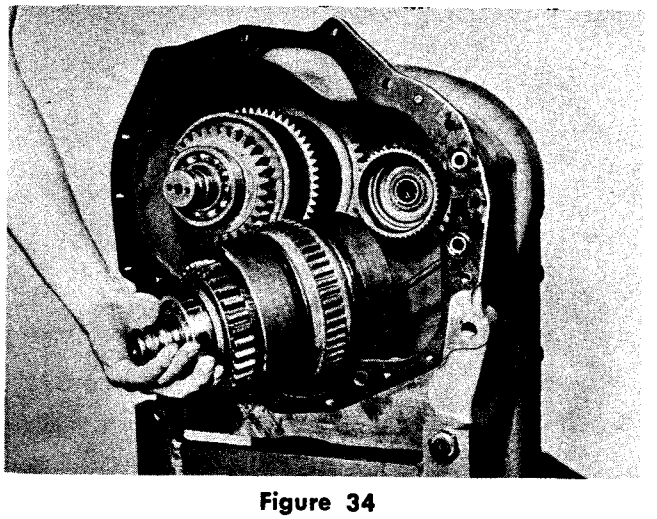


**Figure 34**
Remove forward and 2nd clutch assembly.

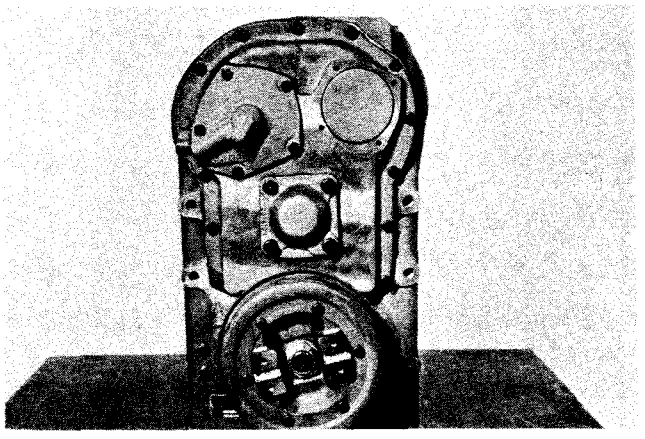


**Figure 35**

Rear view of transmission utilizing a mechanical parking brake option.

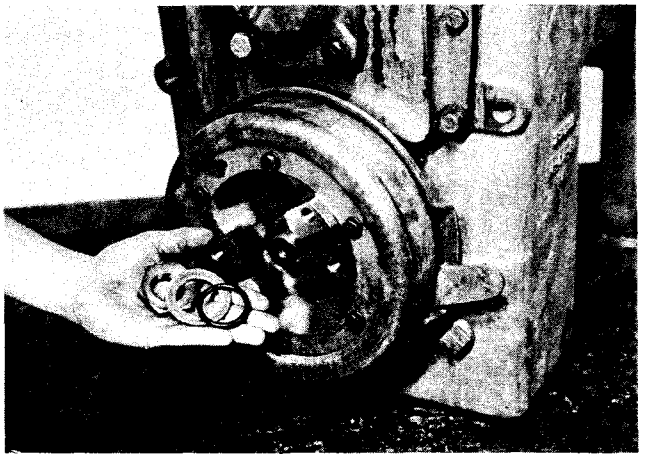


**Figure 36**

Remove output flange nut, washer and "O" ring. If parking brake is not used, remove companion flange and proceed to Figure 42.

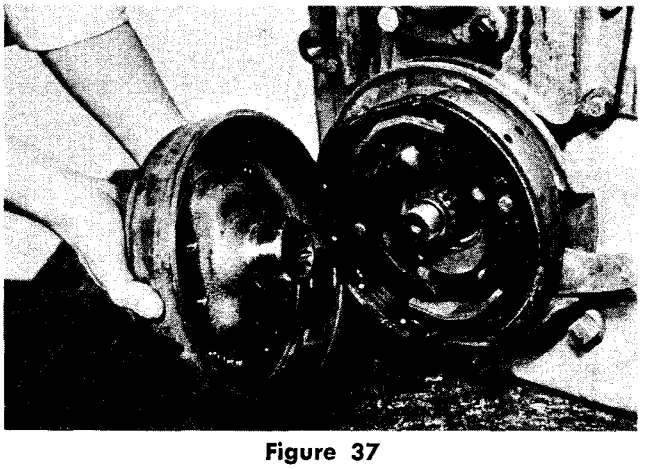


**Figure 37**

Remove parking brake drum and flange.

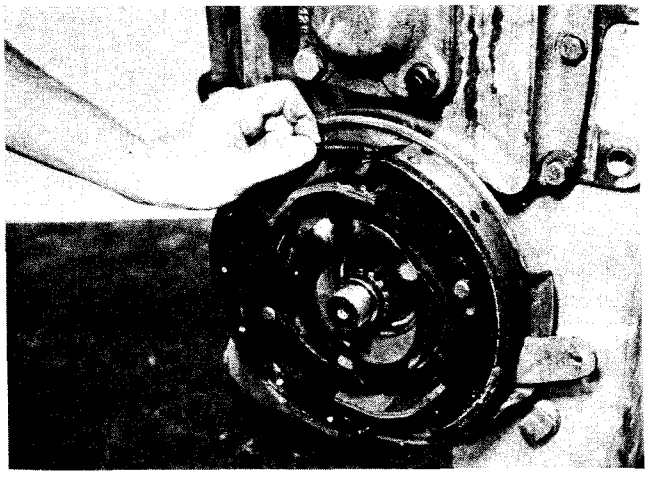


**Figure 38**

Remove upper and lower brake shoe return springs.

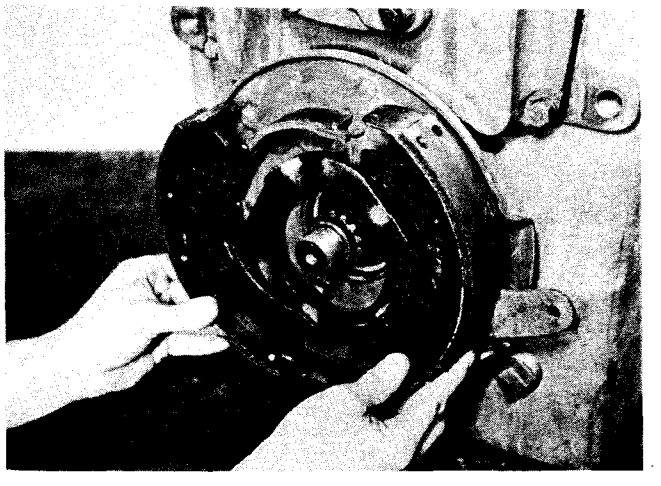


**Figure 39**

Remove brake shoes.

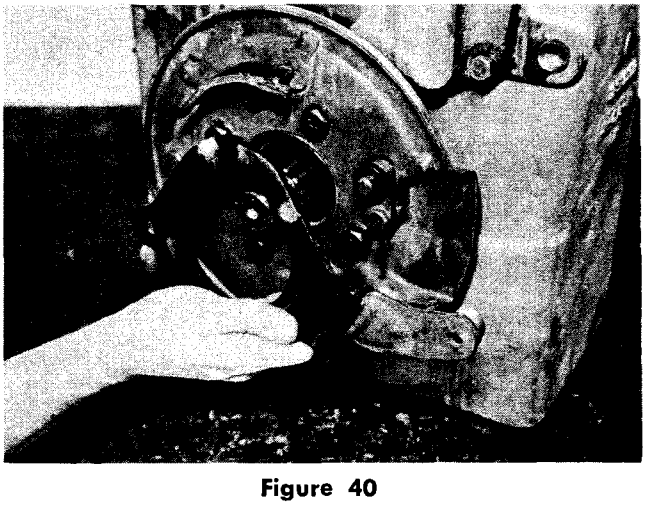


**Figure 40**

Remove brake actuator arm.

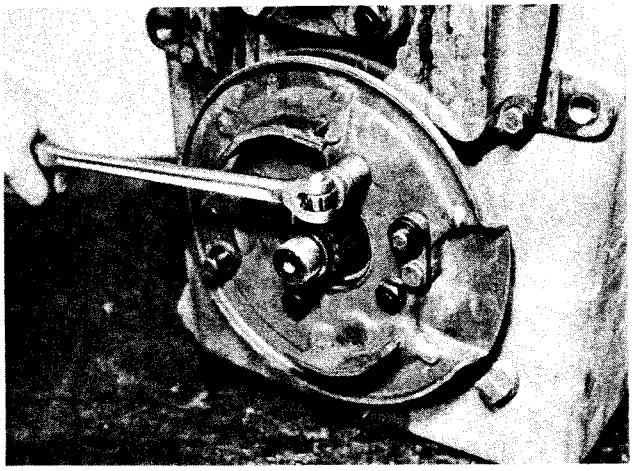


**Figure 41**
Remove brake backing plate bolts.

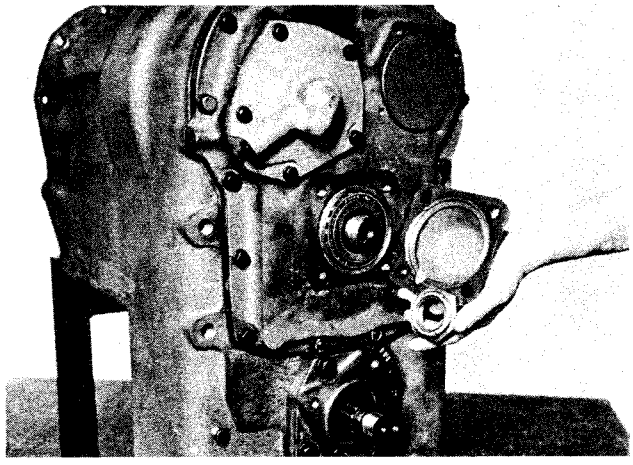


**Figure 42**
Remove idler shaft bearing cap bolts, bearing cap and idler shaft nut.

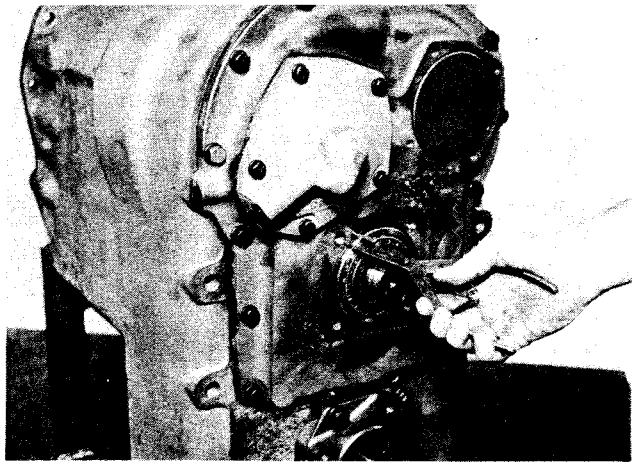


**Figure 43**
Remove idler shaft rear bearing locating ring.

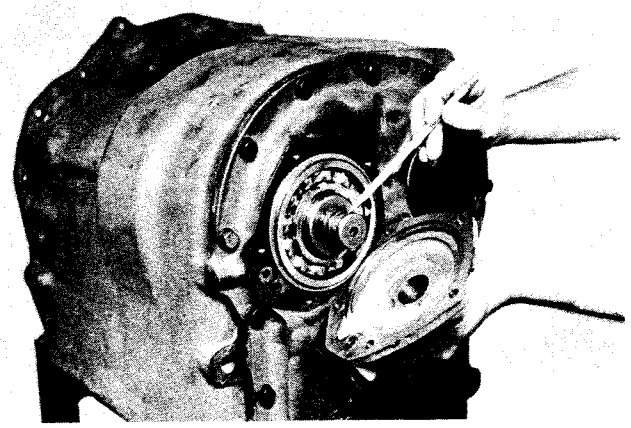


**Figure 44**
Remove low clutch rear bearing cap.

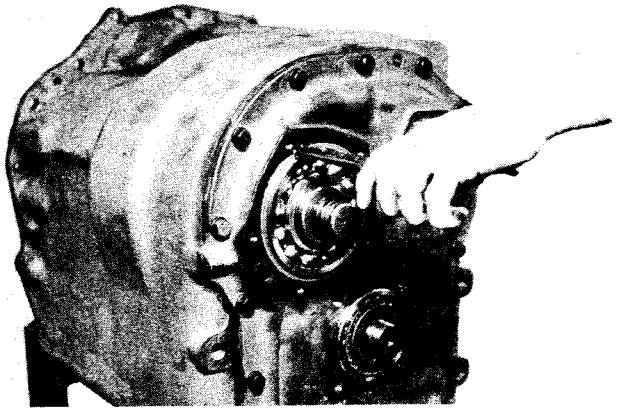


**Figure 45**
Remove low clutch rear bearing locating ring.

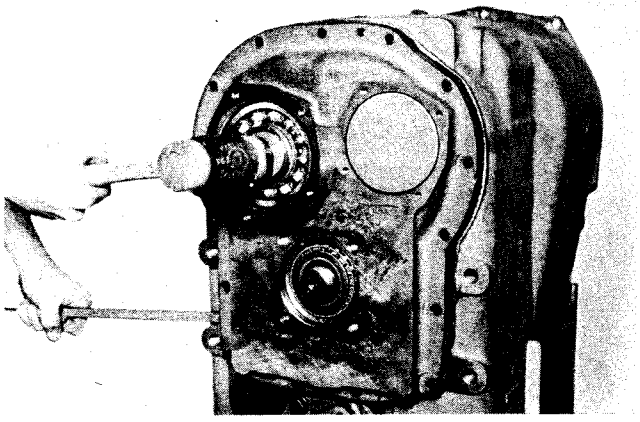


**Figure 46**
Remove rear cover bolts. Using pry slots provided, pry cover from transmission housing tapping on low clutch and idler shaft to allow cover to be removed without shaft binding.

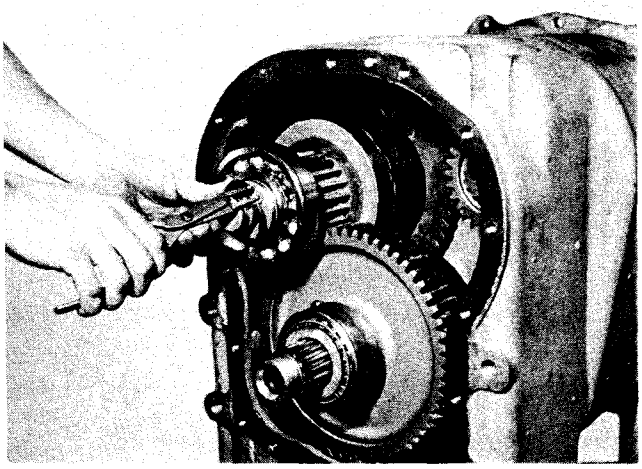


**Figure 47**

Remove low clutch rear bearing retaining ring.
**NOTE:** See page 33 for disassembly of low clutch utilizing a rear double taper bearing (helical gears).

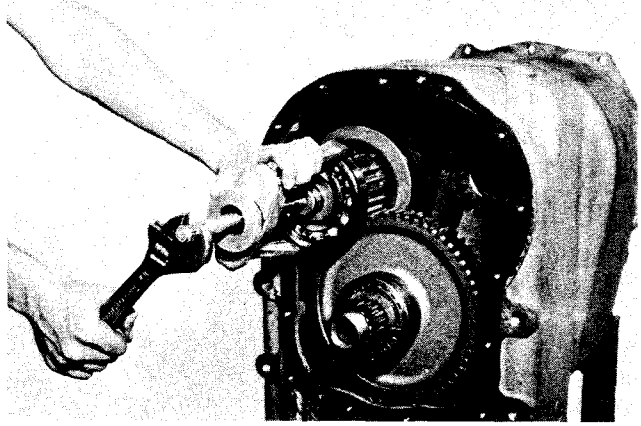


**Figure 48**

Remove low clutch rear bearing.

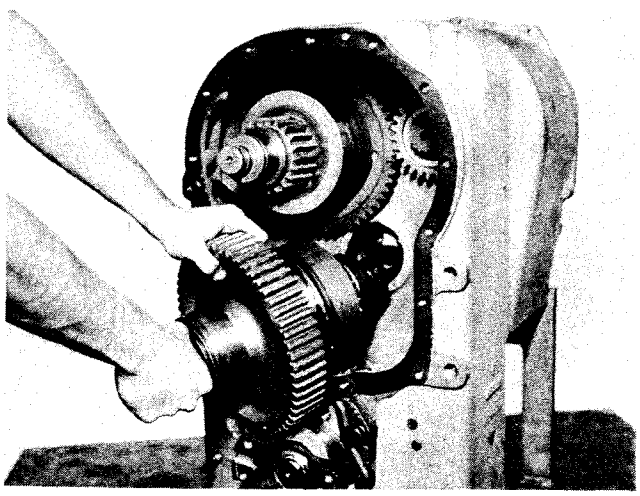


**Figure 49**

Remove idler shaft and 4th speed clutch from housing.
**NOTE:** Do not lose rear bearing lock ball.

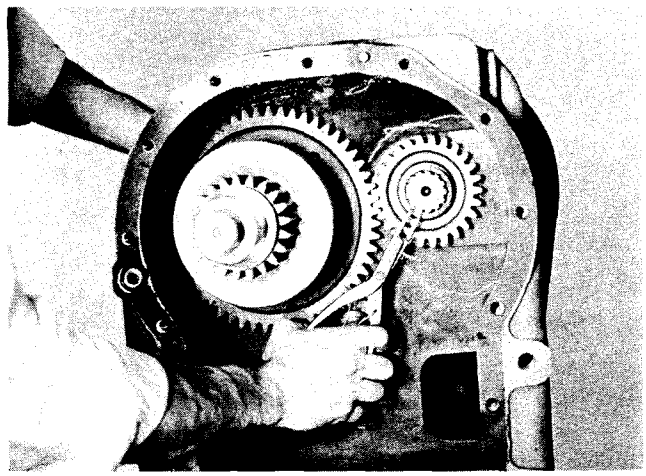


**Figure 50**

Remove low speed drive gear retainer ring and drive gear.

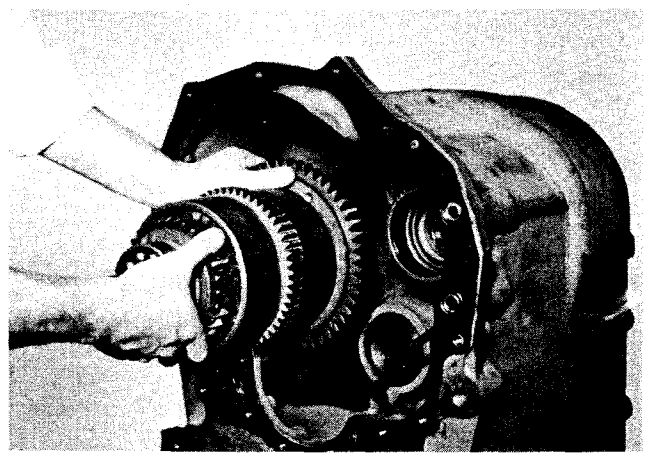


**Figure 51**

Remove reverse and 3rd clutch assembly.

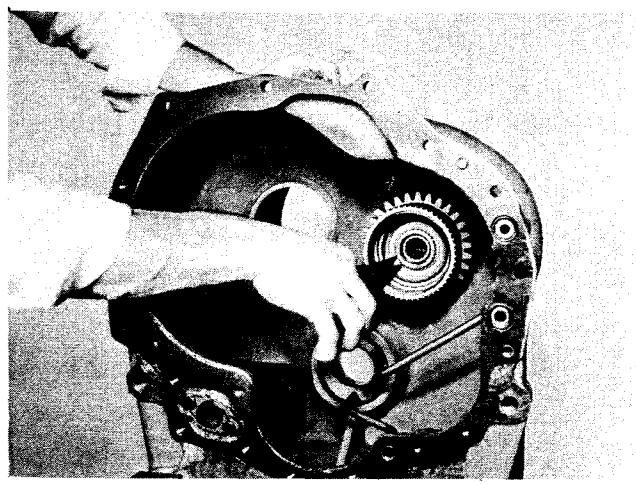


**Figure 52**

Remove 2nd gear retaining ring.

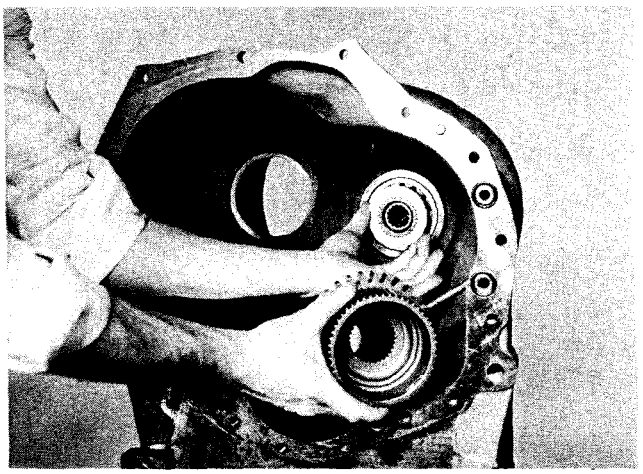


**Figure 53**
Remove 2nd gear and 2nd gear bearing end plate.

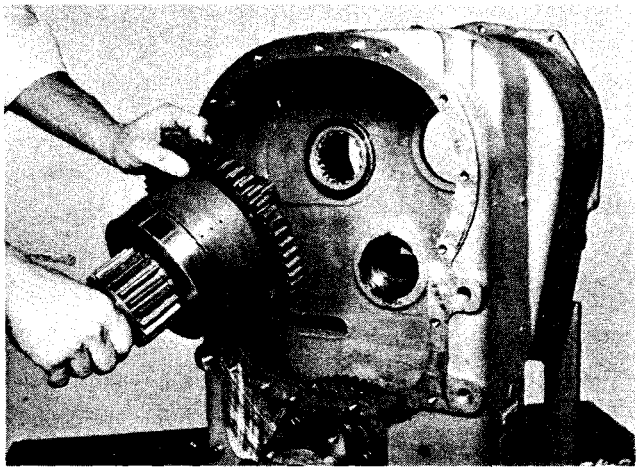


**Figure 54**
Remove low clutch assembly.

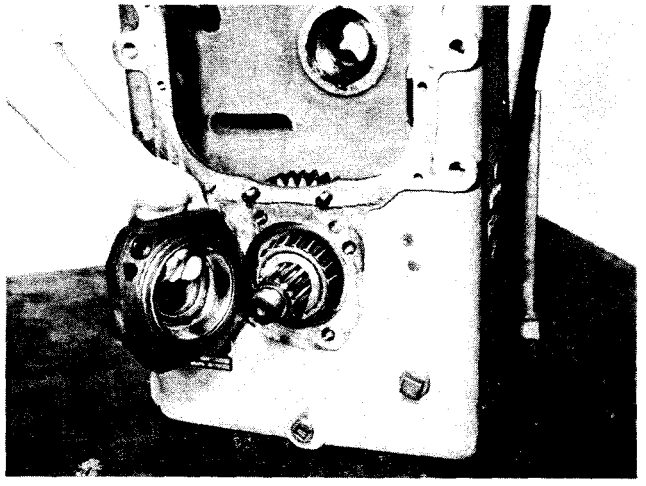


**Figure 55**
Remove rear output shaft bearing cap bolts and cap.

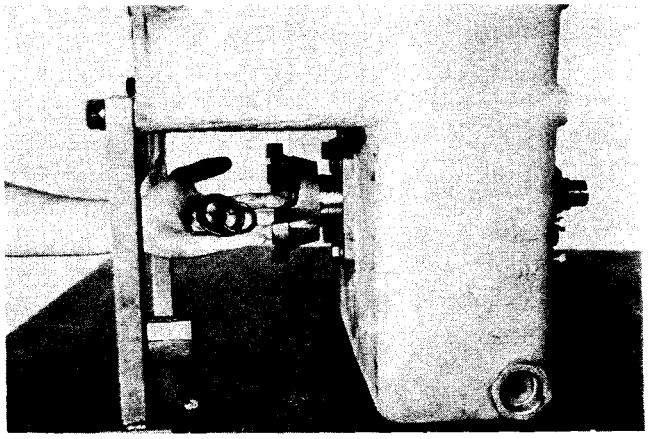


**Figure 56**
Remove front output flange nut, washer, "O" ring and companion flange.

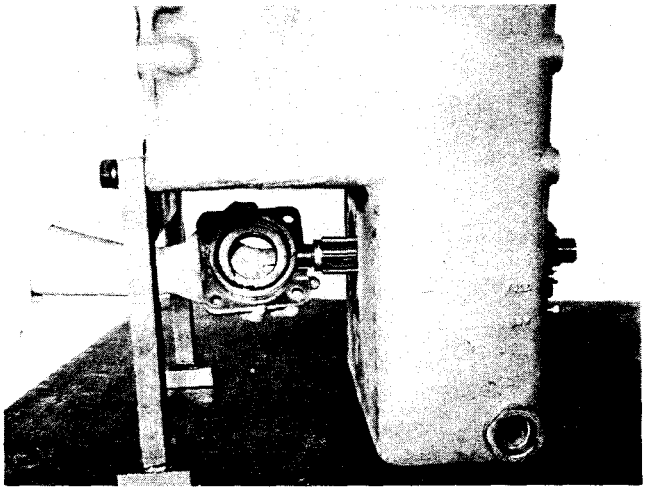


**Figure 57**
Remove output shaft front bearing cap bolts and cap.

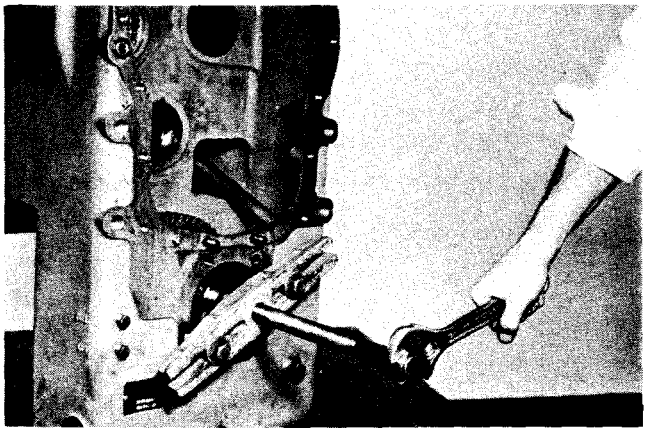


**Figure 58**
Block output gear. Push output shaft from rear through bearing and gear.

## CLUTCH DISASSEMBLY

**NOTE: DO NOT MIX THE FRICTION DISCS IN THE LOW CLUTCH WITH THE FRICTION DISCS OF ANY OF THE OTHER CLUTCHES. (SEE NOTE FOLLOWING FIGURE 95.)**

## LOW CLUTCH DISASSEMBLY

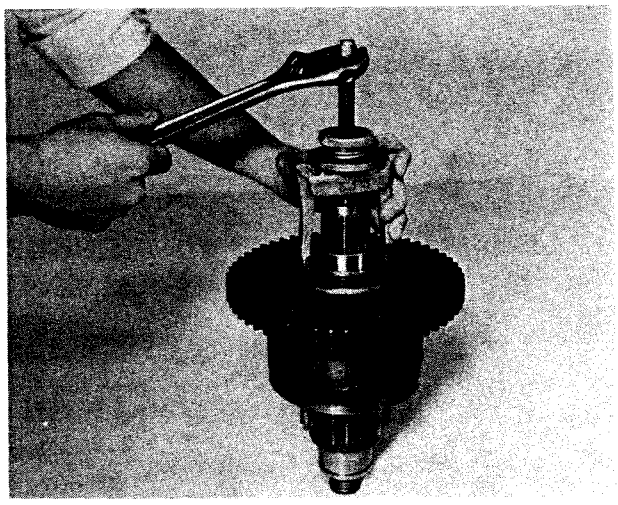


**Figure 59**
Remove low clutch shaft front bearing inner race.

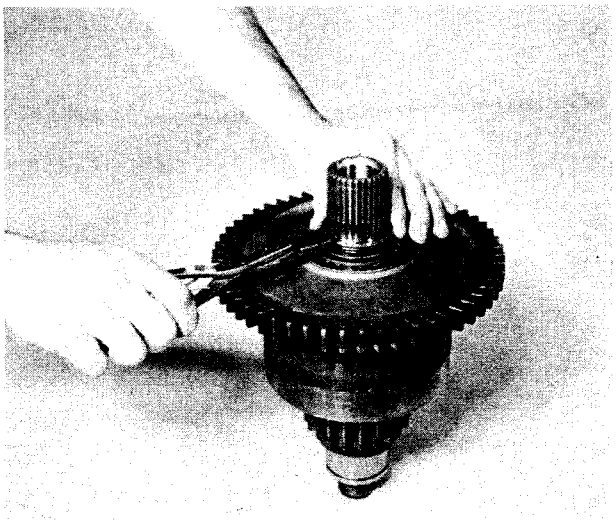


**Figure 60**
Remove low speed gear taper bearing retainer ring.

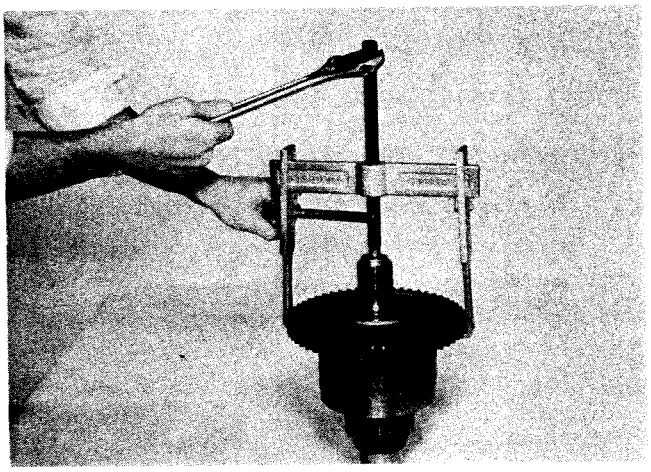


**Figure 61**
Remove low speed gear and outer taper bearing.

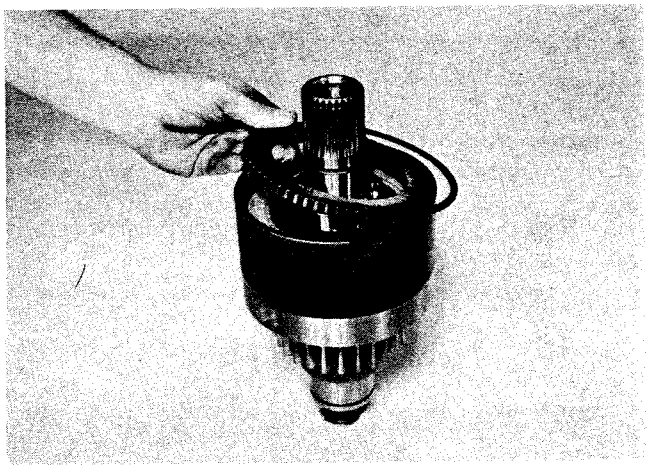


**Figure 62**
Remove clutch end plate retainer ring.
Remove clutch end plate and inner and outer clutch discs.

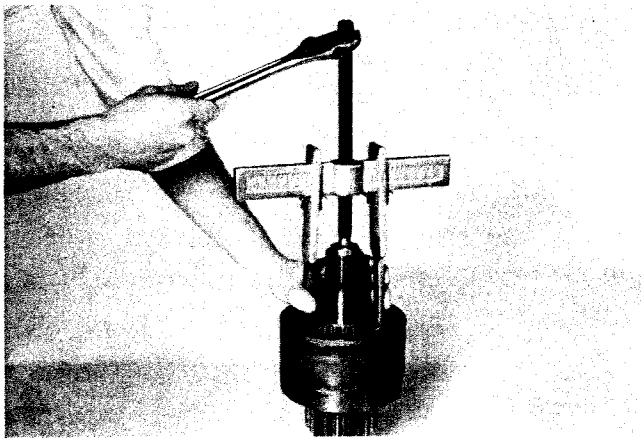


**Figure 63**
Remove low gear inner taper bearing.

**Figure 64**

Remove clutch piston return spring. A sleeve with a portion removed is recommended for removing the clutch piston return spring, washer, and retainer ring. Sleeve shown is a common pipe, with a 1-1/2 x 1 [39,0x26,0mm] opening. The pipe is 6 x 3-1/4 x 2-3/4 [155,0x85,0x78,0mm]. Compress spring retainer washer. Through opening remove spring retainer snap ring. Release tension on spring retainer. Remove spring retainer and spring. Turn clutch over and tap clutch shaft on a block of wood to remove clutch piston.

## FORWARD AND 2ND CLUTCH DISASSEMBLY (Forward being disassembled)

Forward and 2nd clutch and reverse and 3rd clutch disassemble and reassemble the same except when modulation is used. See page 46 for modulation cross section.

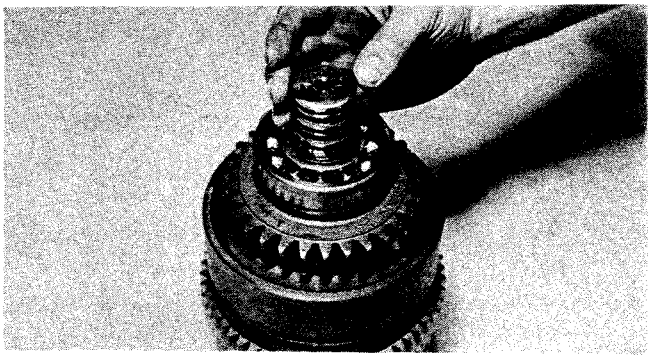


**Figure 65**

Remove clutch shaft piston rings and expander springs. See page 45 for proper piston ring and expander spring installation.

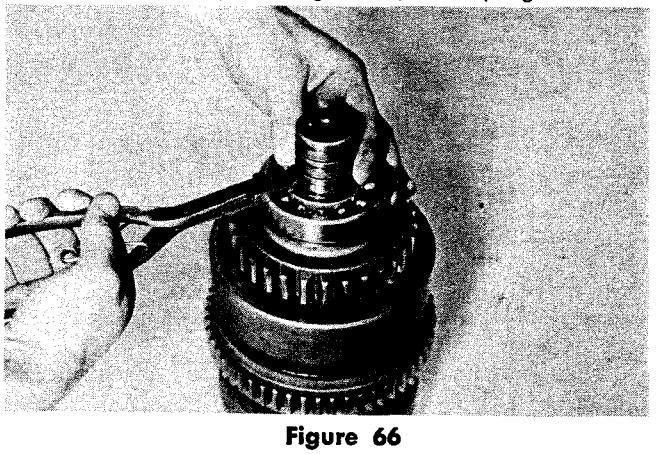


**Figure 66**

Remove front bearing retainer ring

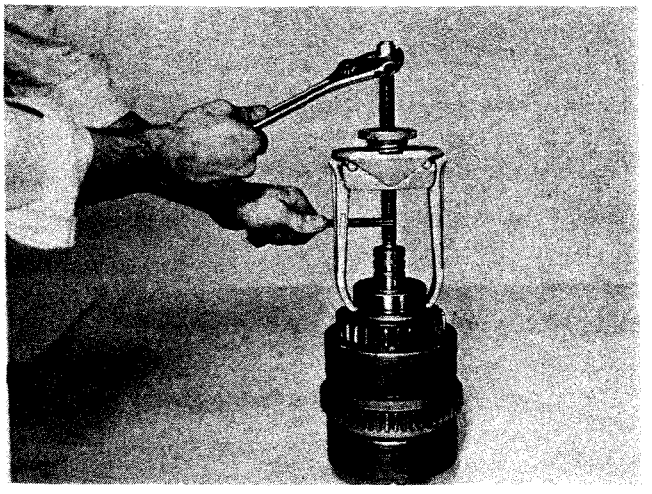


**Figure 67**

Remove front bearing.

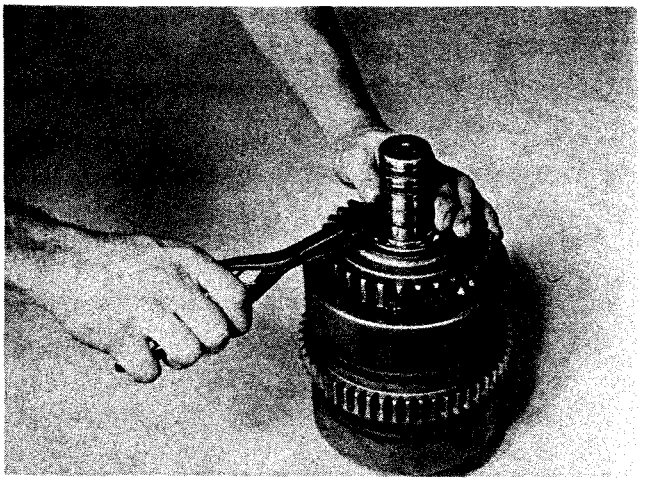


**Figure 68**

Remove front bearing locating ring.

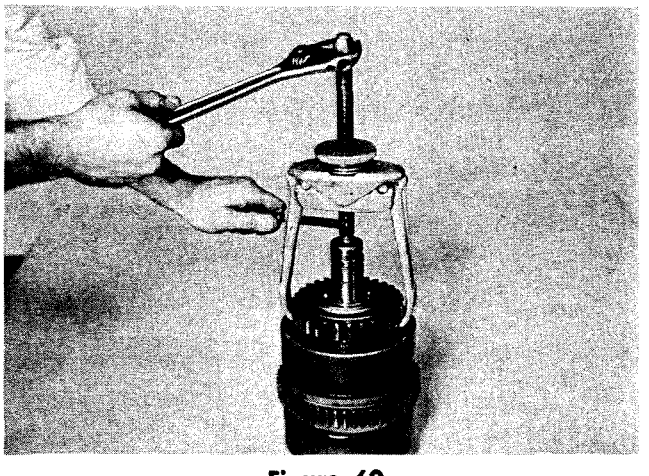


**Figure 69**

Remove clutch driven gear and outer bearing.

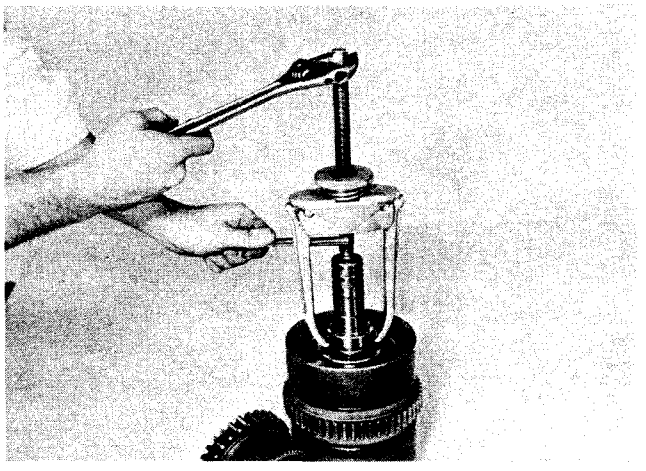


**Figure 70**
Remove inner bearing.

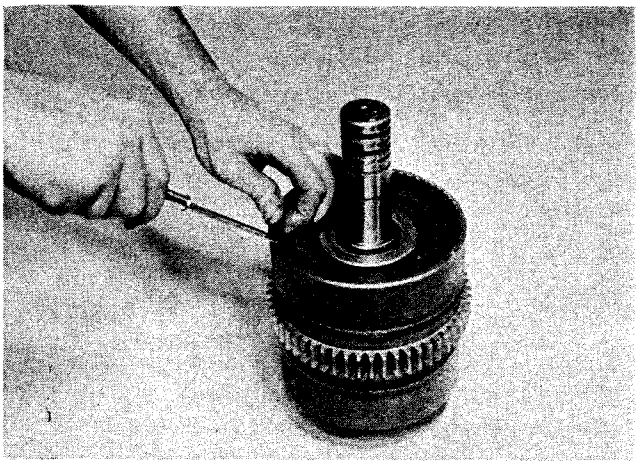


**Figure 71**
Remove end plate retainer ring.

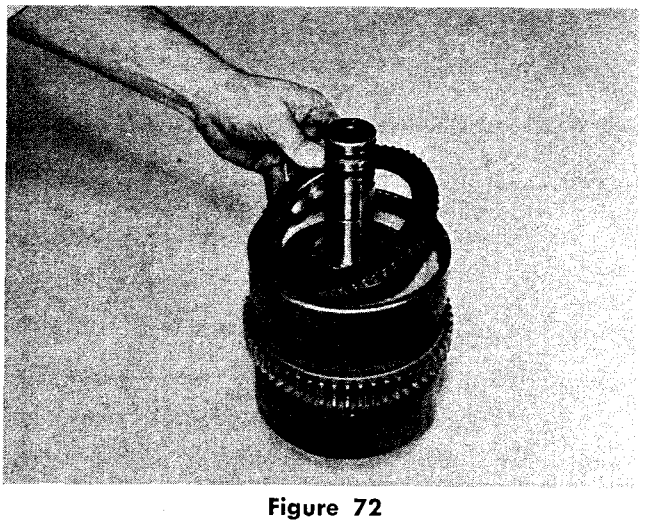


**Figure 72**
Remove end plate.

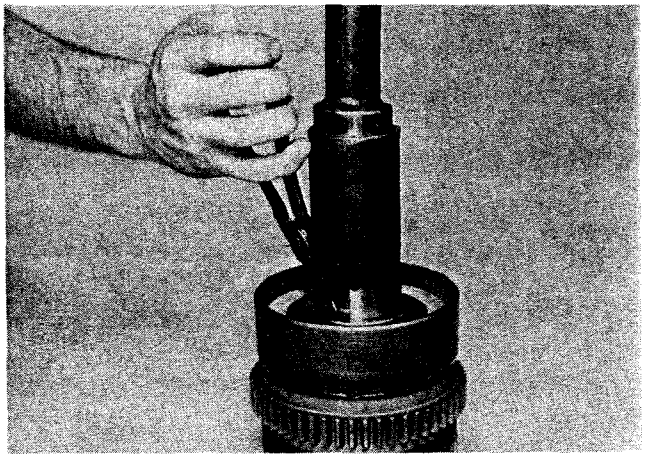


**Figure 73**
Compress return spring retainer. Remove retainer ring from groove.

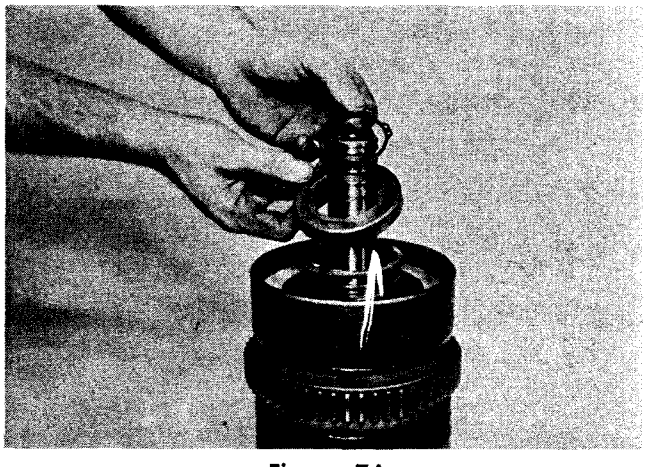


**Figure 74**
Relieve spring compression. Remove retainer ring, retainer and spring.

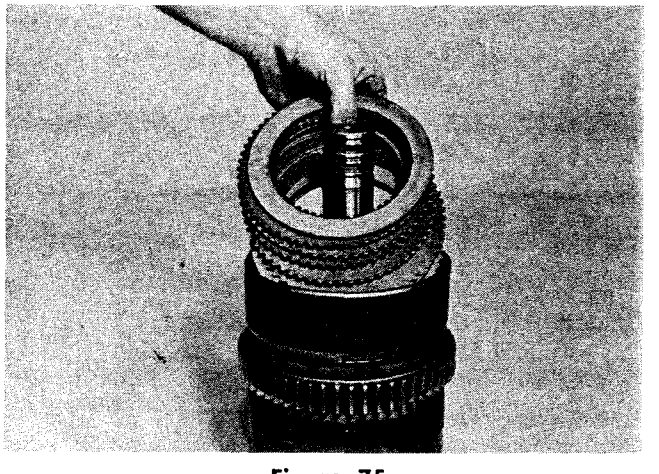


**Figure 75**
Remove inner and outer clutch discs. Turn clutch over and tap clutch shaft on a block of wood to remove clutch piston.

## 4th Clutch Disassembly

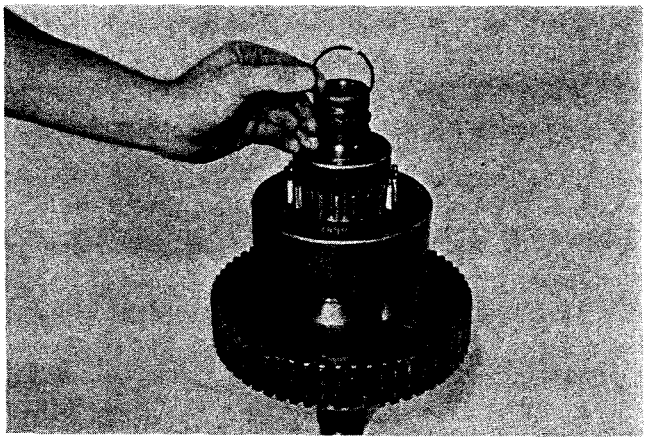


**Figure 76**
Remove clutch shaft piston rings and expander springs. See page 45 for proper piston ring and expander spring installation.

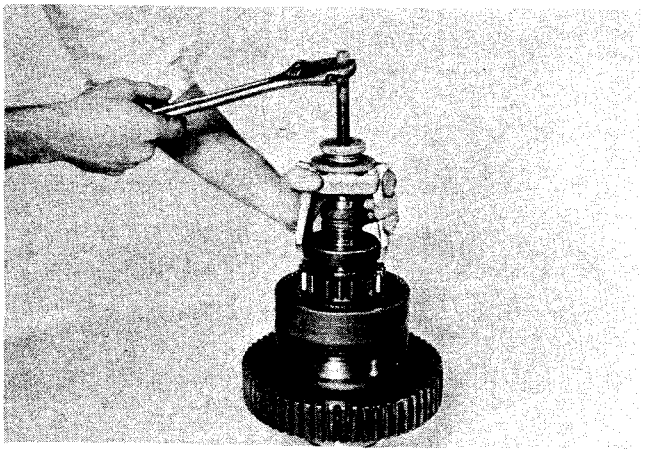


**Figure 77**
Remove front bearing retainer ring and front bearing.

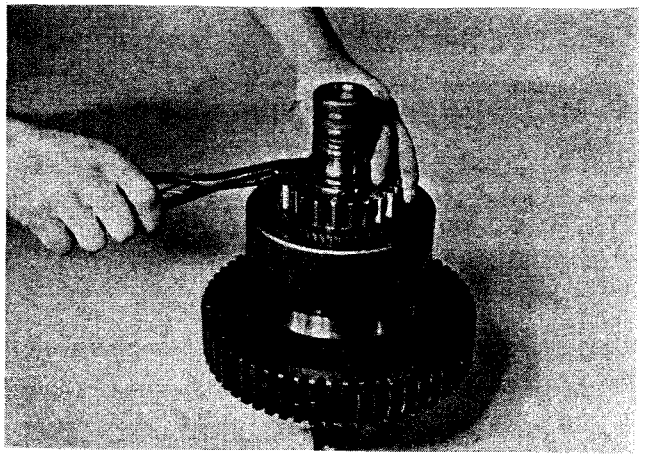


**Figure 78**
Remove front bearing locating ring.

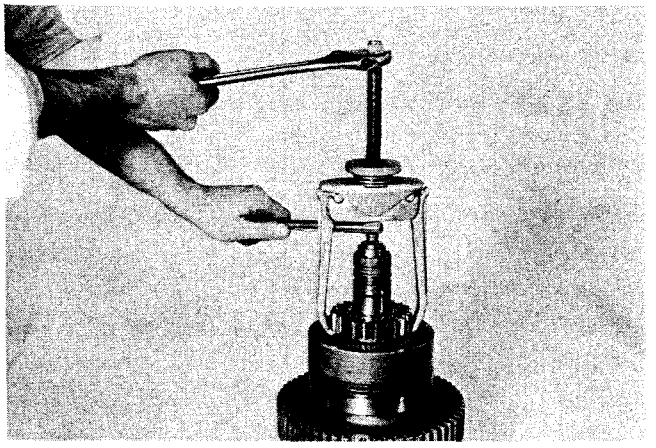


**Figure 79**
Remove 4th gear from clutch drum.

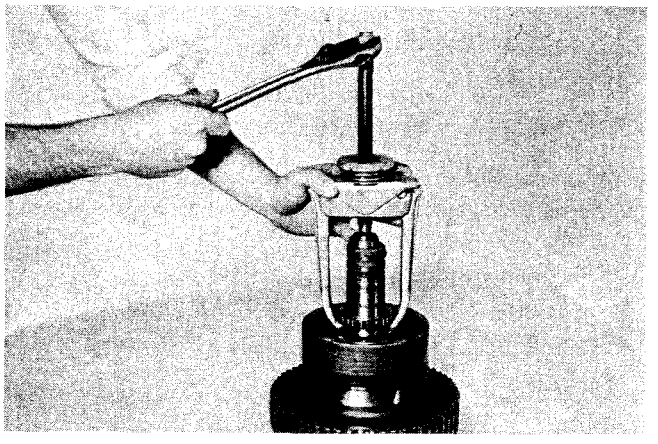


**Figure 80**
Remove inner bearing spacer and inner bearing. Disassemble clutch discs and piston as explained in Figure 71 through Figure 75.

## CLEANING AND INSPECTION

### CLEANING

Clean all parts thoroughly using solvent type cleaning fluid. It is recommended that parts be immersed in cleaning fluid and moved 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 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 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 recommended type 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 and quills 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

### Forward and 2nd Clutch Reassembly

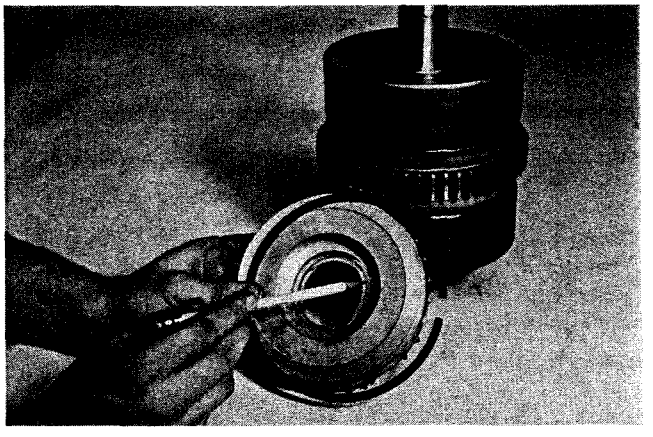


**Figure 81**

Install new clutch piston inner and outer sealing rings.

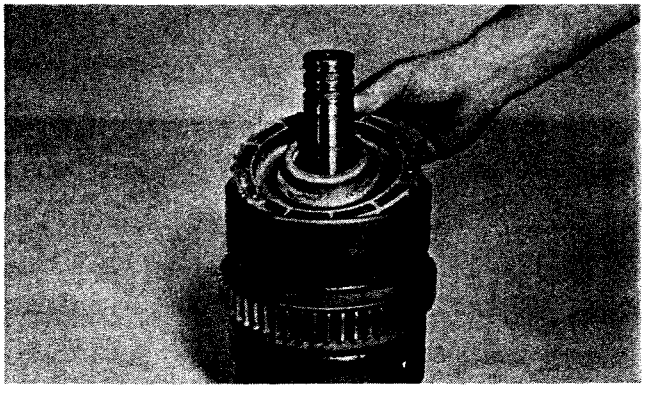


**Figure 82**

Insert clutch piston in clutch drum. Use caution as not to damage sealing rings.

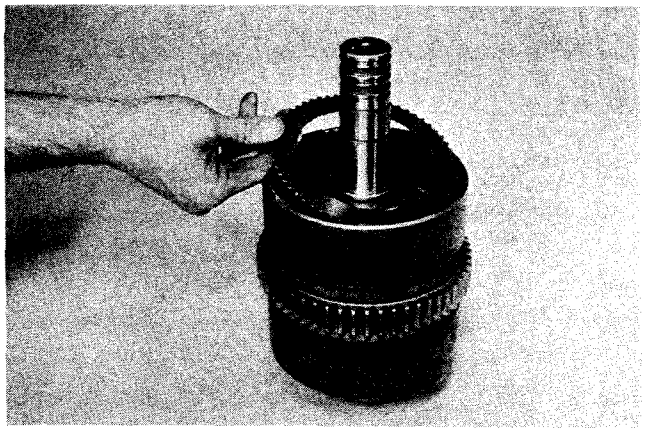


**Figure 83**

Install clutch piston return spring, spring retainer and retainer snap ring. Insert one steel disc. **NOTE: The 4th speed clutch does not use a snap ring retainer.**

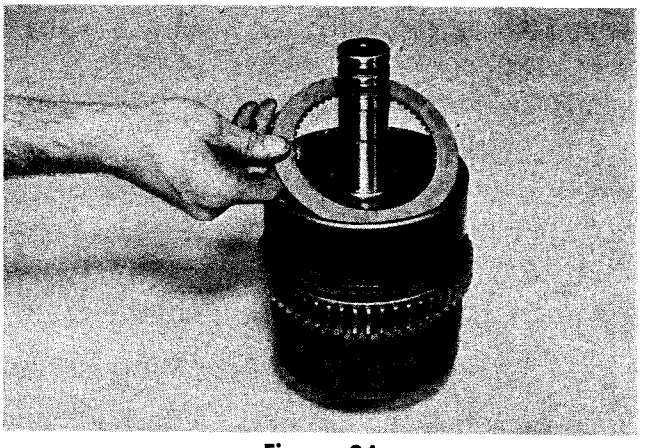


**Figure 84**

Install one friction disc. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed is friction.

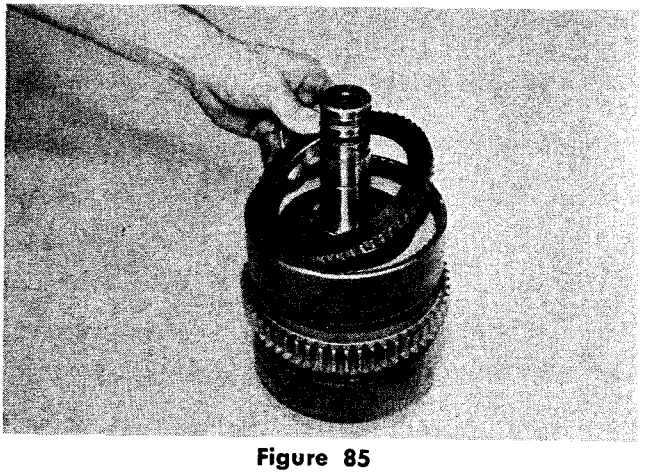


**Figure 85**

Install end plate.

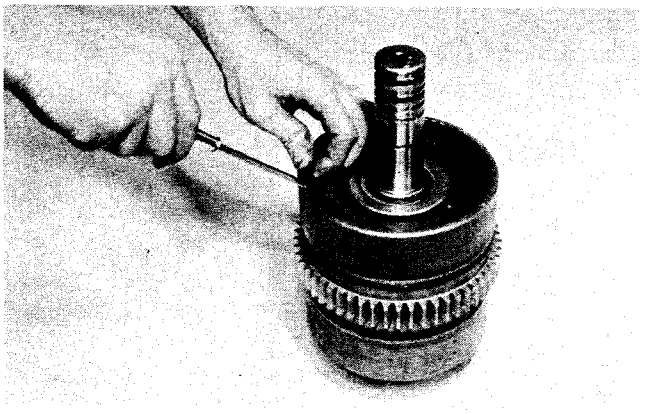


**Figure 86**

Install end plate retainer ring.

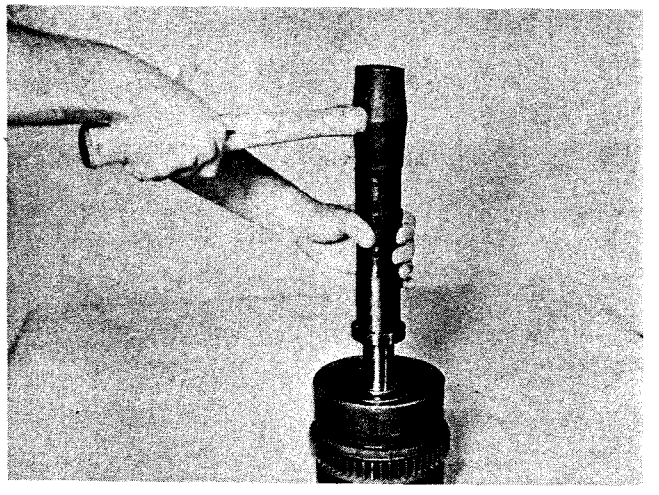


**Figure 87**

Install clutch driven gear inner bearing.

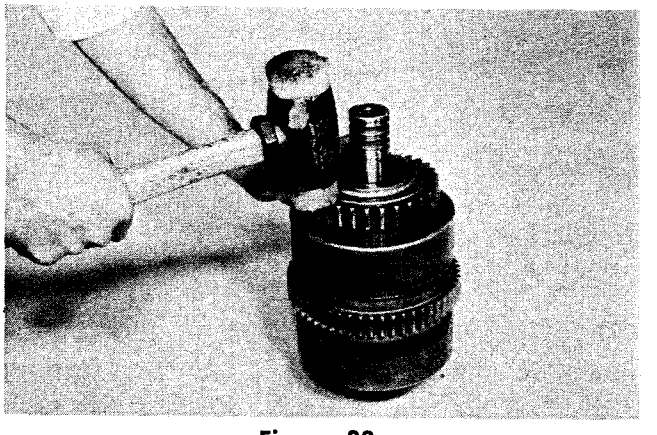


**Figure 88**

Install clutch driven gear into clutch drum. Align splines on clutch gear with internal teeth of friction discs. Tap gear into position. Do not force this operation. Gear splines must be in full position with internal teeth of all friction discs.

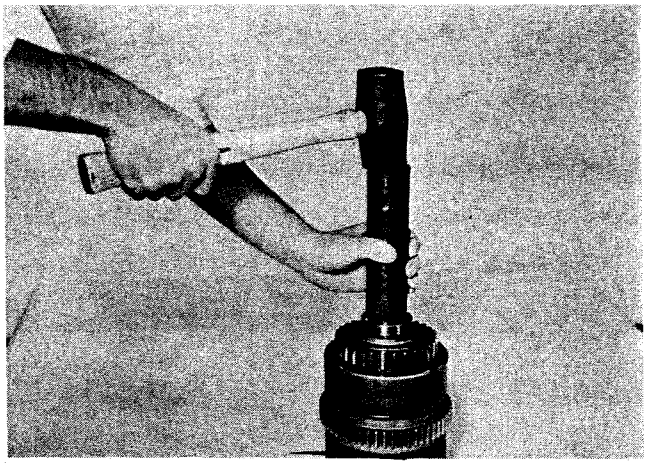


**Figure 89**
Install driven gear outer bearing.
**See Fig. M for proper Shielded Bearing Installation.**

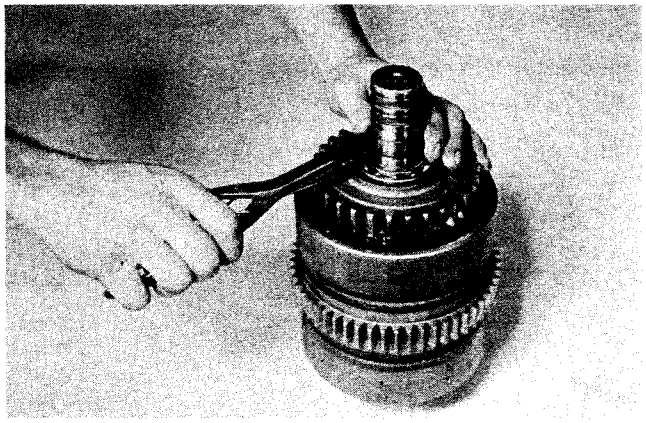


**Figure 90**
Install front bearing locating ring.

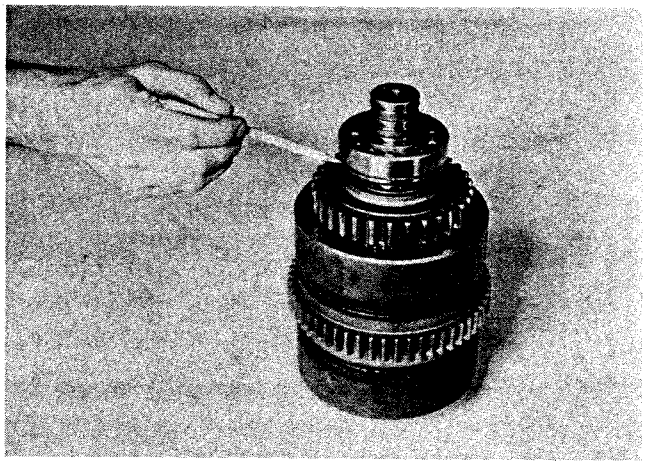


**Figure 91**
Install front bearing. **NOTE:** Snap ring groove in front bearing must be down.

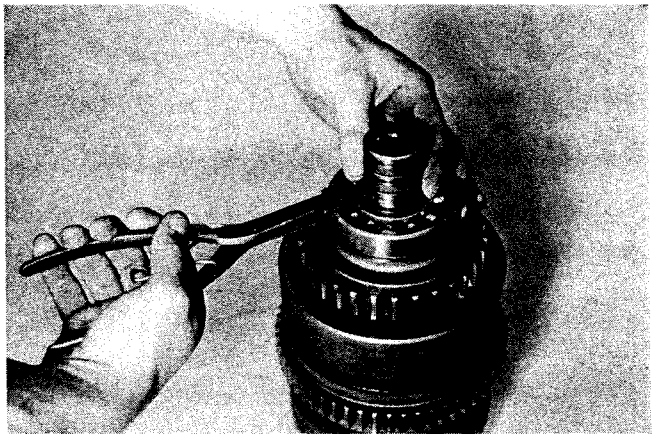


**Figure 92**
Install front bearing retaining ring.

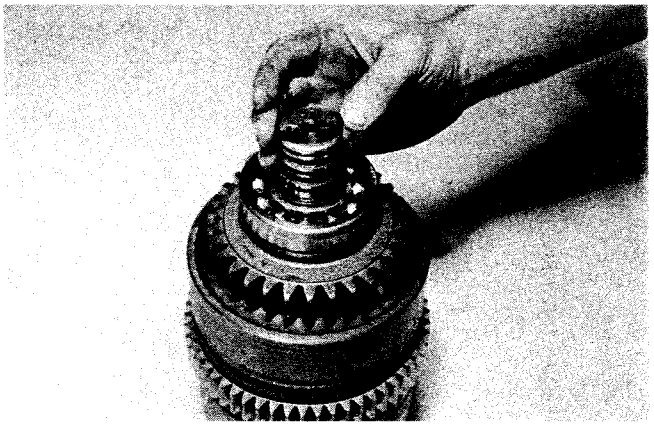


**Figure 93**
Install clutch shaft piston rings and expander springs per instructions on page 45.

## LOW CLUTCH REASSEMBLY

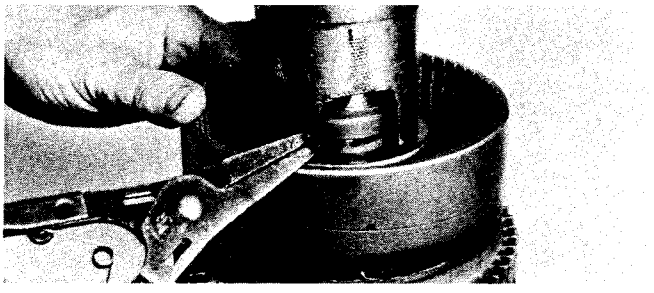


**Figure 94**
Install new clutch piston inner and outer sealing ring. Insert piston into clutch drum using caution as not to damage seals. Position piston return spring, spring retainer and retainer snap ring. Compress spring and retainer and install snap ring.

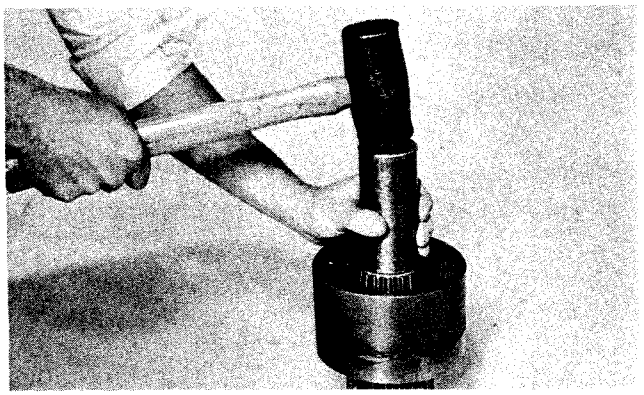


**Figure 95**

Install low gear inner taper bearing.

Install one steel disc.

Install one friction disc. **NOTE: The friction discs in the low clutch has a higher co-efficient rating than the friction discs in the other clutches, therefore the discs must not be mixed. The low clutch inner disc can be identified by an "X" stamped on one side of the inner teeth. The low clutch inner disc also has a strip of non-soluble yellow paint sprayed on the outer edge of the disc.** Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed is friction.

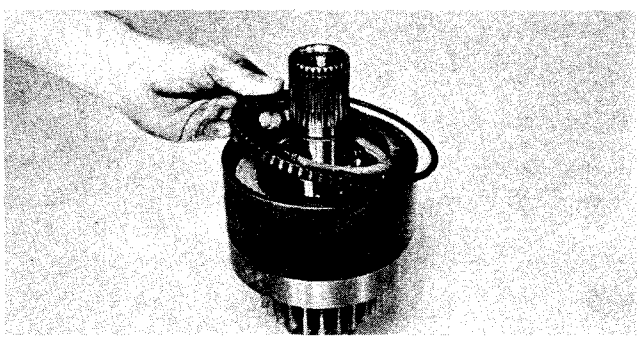


**Figure 96**

Install end plate and retainer ring.

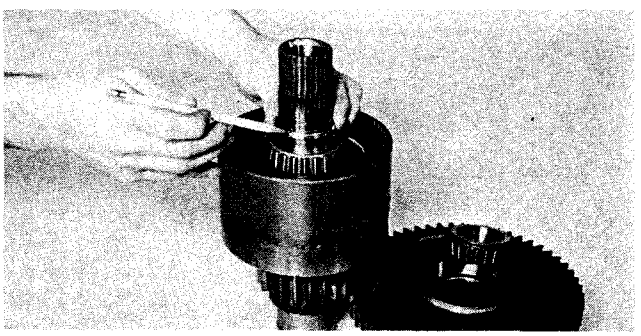


**Figure 97**

Install low clutch taper bearing spacer. **NOTE: When installing the 3rd gear in the 3rd speed clutch a bearing spacer is used between the inner and outer 3rd gear bearing also.**

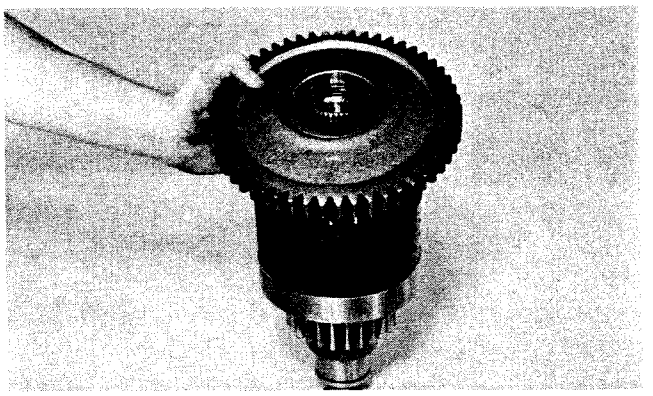


**Figure 98**

Install low gear into clutch drum. Align splines on low gear with internal teeth of friction discs. Tap gear into position. Do not force this operation. Gear splines must be in full position with internal teeth of all friction discs.

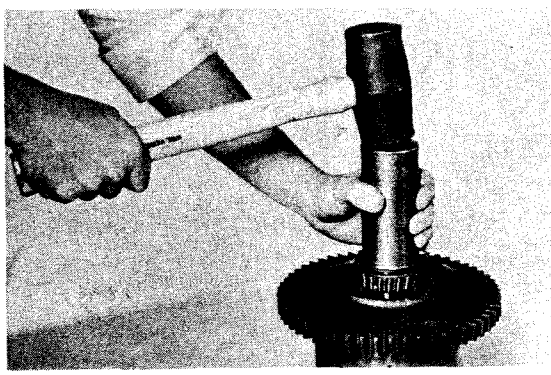


**Figure 99**

Install low gear outer taper bearing.

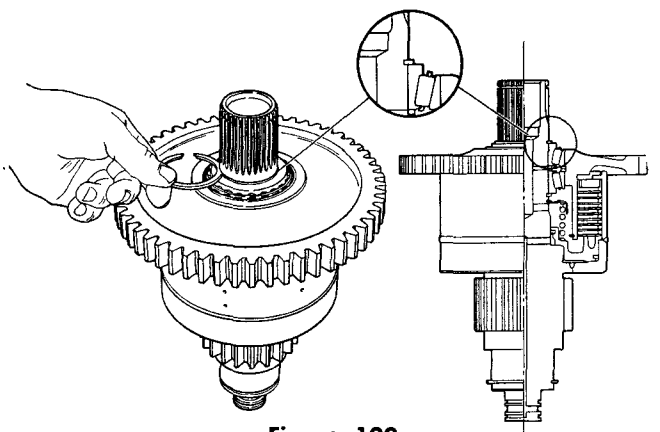


**Figure 100**

Install low clutch taper bearing retainer ring.

**NOTE: Retainer ring is selected at assembly for proper thickness. A snap ring kit is available. Select the thickest of the three rings in the kit that can be fitted into the snap ring groove to assure a proper taper bearing tightness. Check ring as shown for tight ring to bearing fit.**

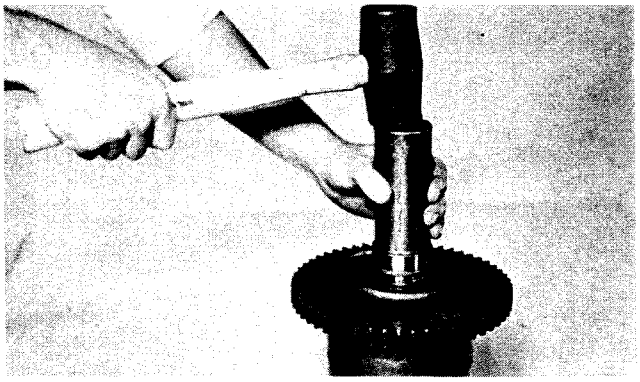


**Figure 101**

Install low clutch shaft front bearing inner race with large diameter of race down.

## 4th Speed Clutch Reassembly

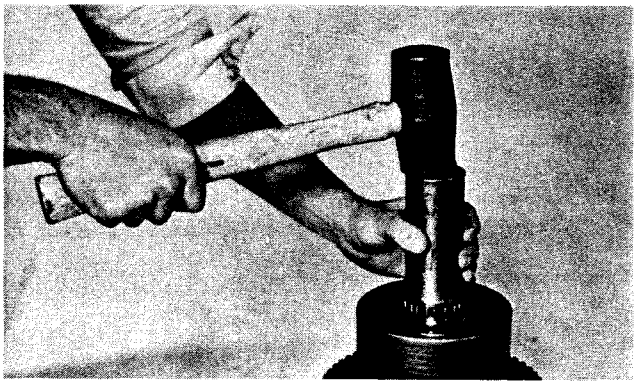


**Figure 102**

Install piston, piston return spring and inner and outer discs as explained in Fig. 81 through Fig. 86.

Install 4th speed gear inner bearing. **NOTE:** Bearing Part Number must go down. See Figure 104-A.

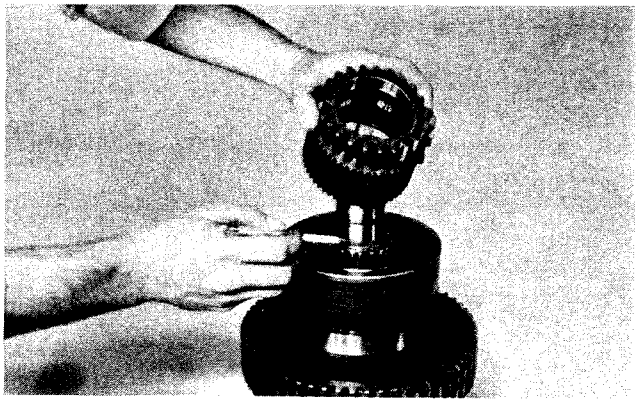


**Figure 103**

Install bearing spacer between inner and outer 4th speed gear bearings.

Install 4th speed gear into clutch drum. Align splines on clutch gear with internal teeth of friction discs. Tap gear into position. Do not force this operation. Gear splines must be in full position with internal teeth of all friction discs.

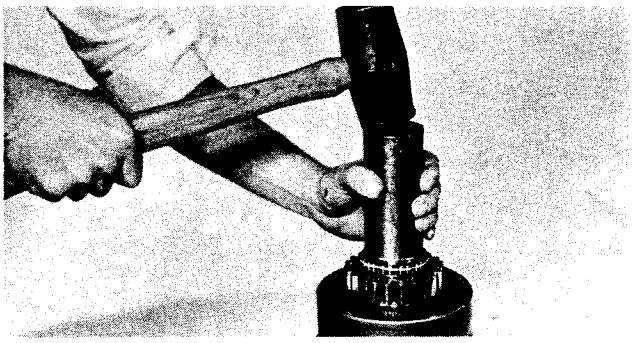


**Figure 104**

Install 4th speed gear outer bearing. **NOTE:** Bearing Part Number must go up. See Figure 104-A. It is recommended a rubber band be used to hold outer bearing rollers in position when installing bearing.

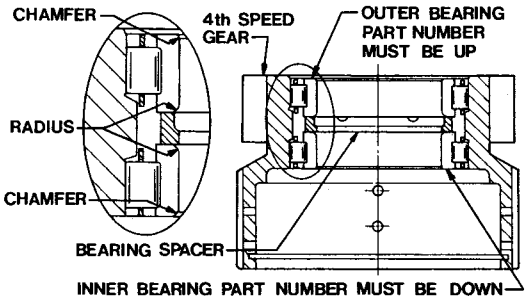



**Figure 104-A**

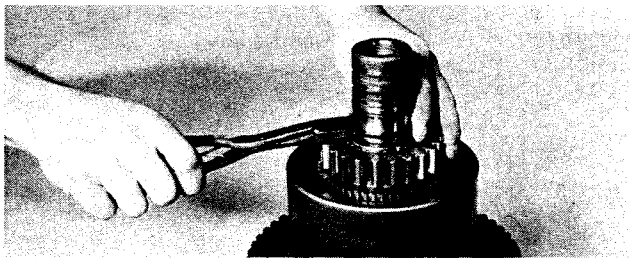


**Figure 105**

Install front bearing locating ring.

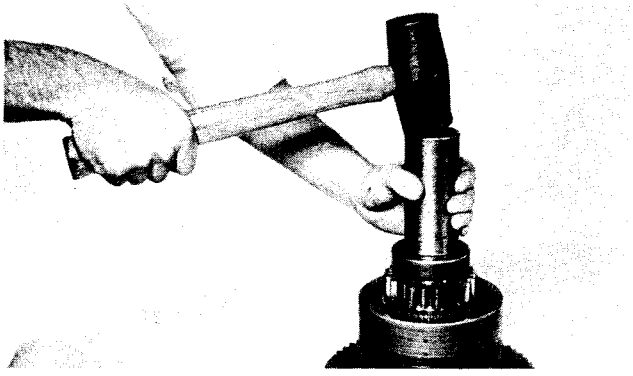


**Figure 106**

Install front bearing and bearing retainer ring.

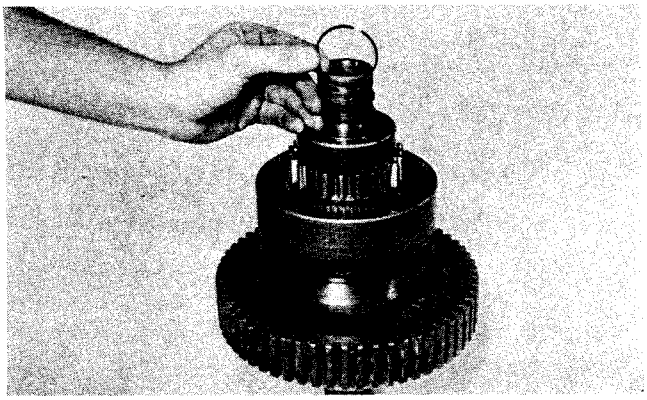


**Figure 107**

Install clutch shaft piston rings and expander springs per instructions on page 45.

## REASSEMBLY OF THE OUTPUT SHAFT

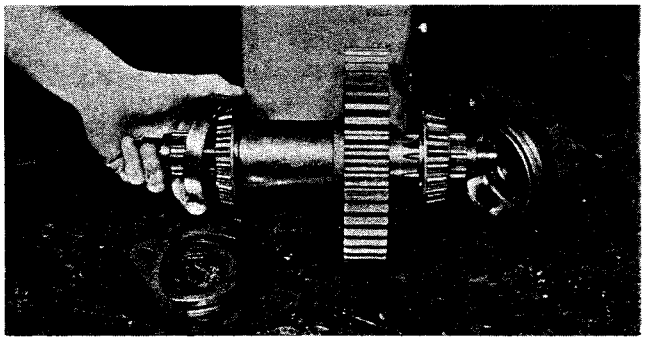


**Figure 108**

View of output shaft as it would be positioned in transmission case. Note front cone bearing shouldered on shaft with large diameter of bearing in.

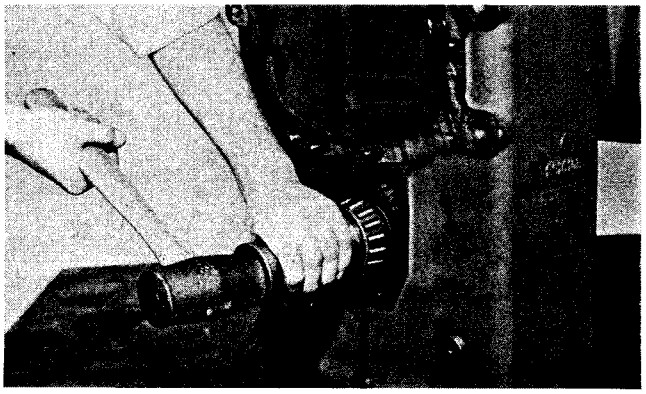


**Figure 109**

Position output gear in transmission case with protruding hub toward front of case. See Fig. 108. Insert output shaft, gear spacer and taper bearing from front of case and through output gear. Install front taper bearing cup. Block output shaft and install rear taper bearing with large diameter in.

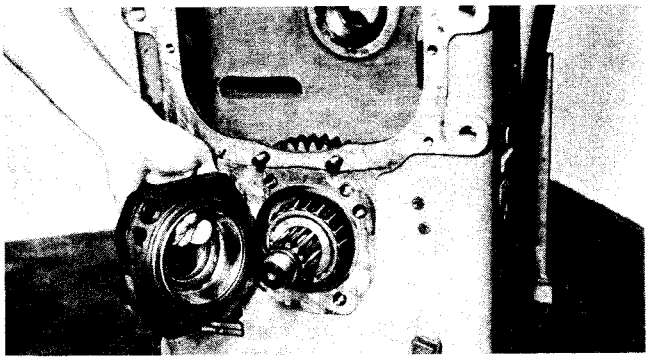


**Figure 110**

Install new oil seal (See Fig. I for position and depth). Using new "O" rings install rear output bearing cap, oil seal and taper bearing cup on transmission case. Lube opening in bearing cap must be aligned with lube opening in case. Tighten bearing cap bolts to specified torque. (See torque chart).

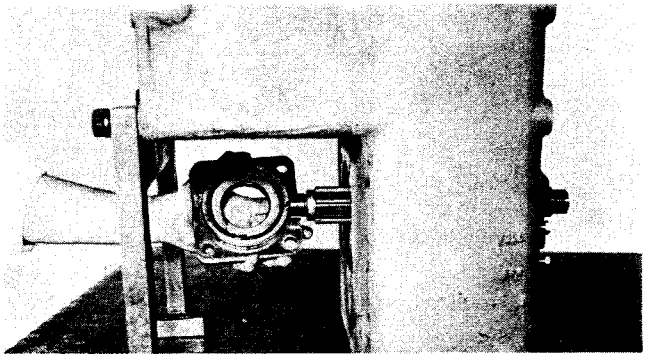


**Figure 111**

Install front bearing cap and shims. Tighten bolts to specified torque. Tap output shaft front and rear to seat taper bearings. Loosen front bearing cap bolts.

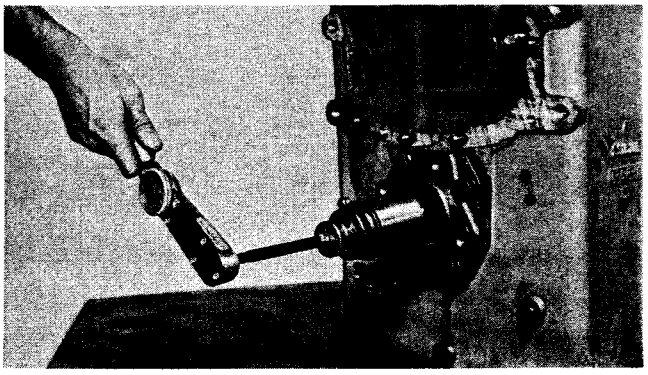


**Figure 112**

Using an inch lb. torque wrench, determine the rolling torque of the output shaft and record. Tighten front bearing cap bolts to specified torque. Check rolling torque with bolts tight. Torque must be 6 to 8 inch lbs. [0,68 - 0,90 N.m.] more than when bearing cap bolts were loose. Add or omit shims on the front bearing cap to achieve the proper preload.

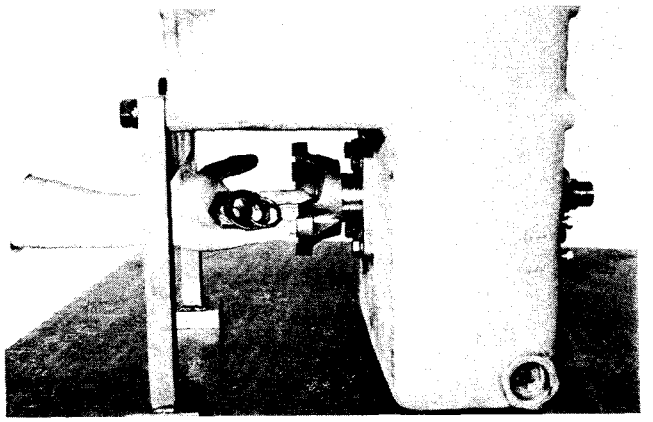


**Figure 113**

Install output shaft front companion flange, flange "O" ring, washer and flange nut. Block output gear. Tighten nut to specified torque. (See elastic stop nut torque chart.)

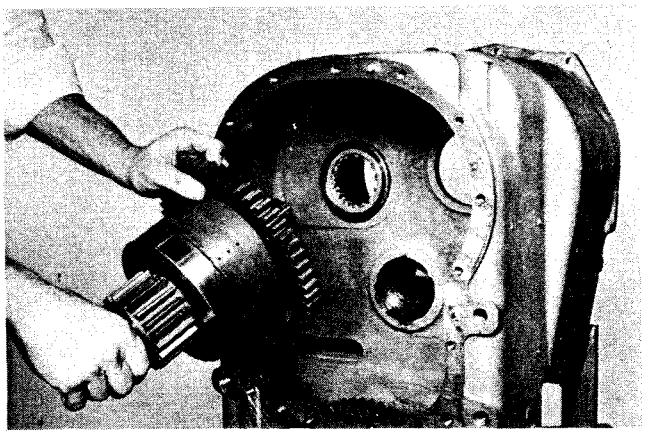


**Figure 114**

From the rear of the transmission case install the low clutch assembly.

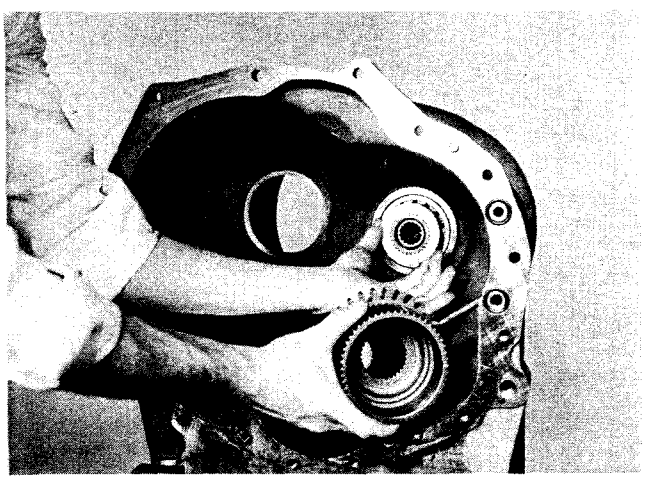


**Figure 115**

Install 2nd speed bearing end plate and 2nd speed gear on low clutch shaft.

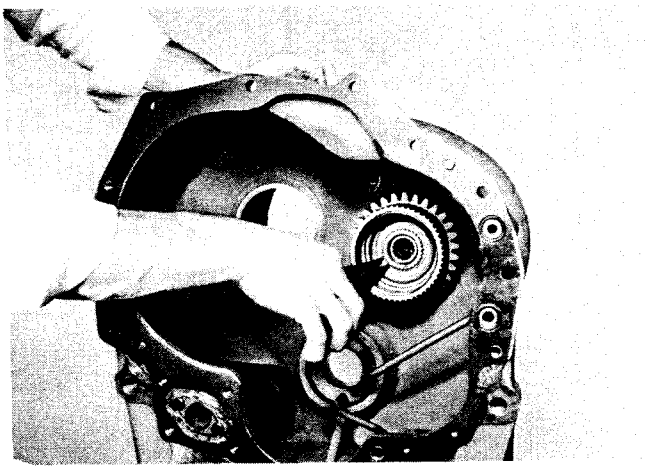


**Figure 116**

Install 2nd speed gear retainer ring.

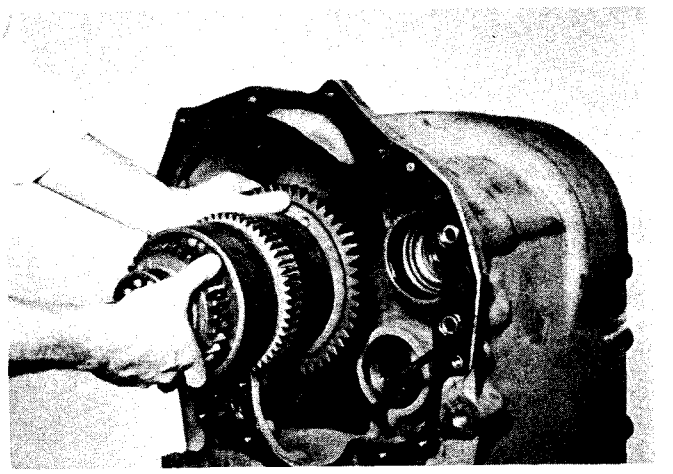


**Figure 117**

From the front of the transmission case install the reverse and 3rd clutch assembly.

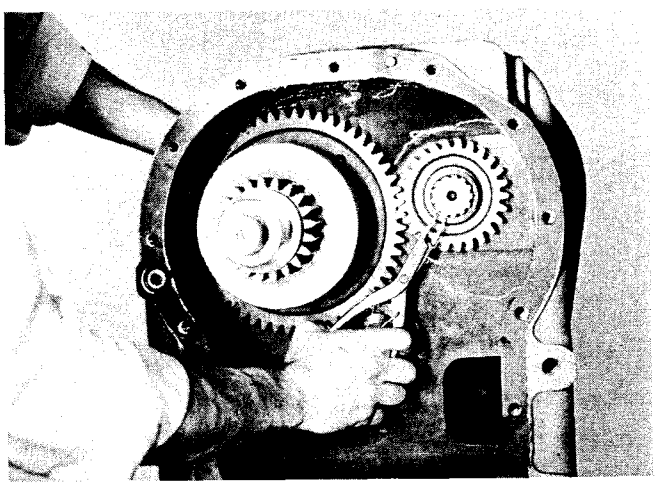


**Figure 118**

Install low speed drive gear and retainer ring.

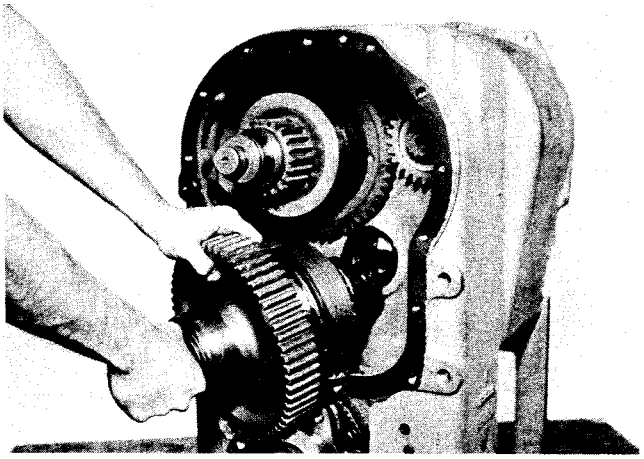


**Figure 119**
Install idler shaft and 4th speed clutch assembly.

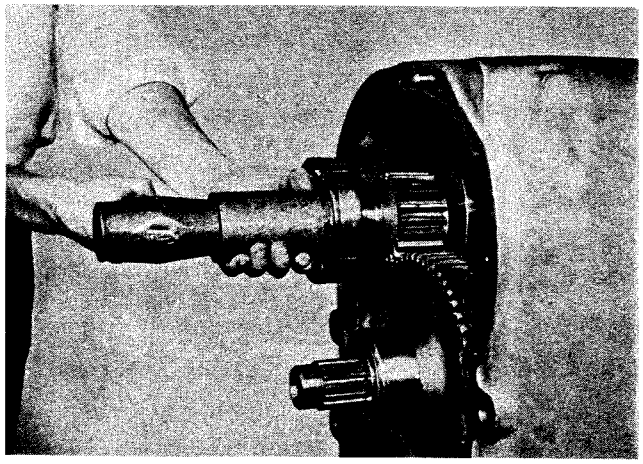


**Figure 120**
Install low clutch rear bearing with bearing ring groove to the rear. **NOTE:** For reassembly of low clutch utilizing rear double taper bearing see page 33 (helical gears).

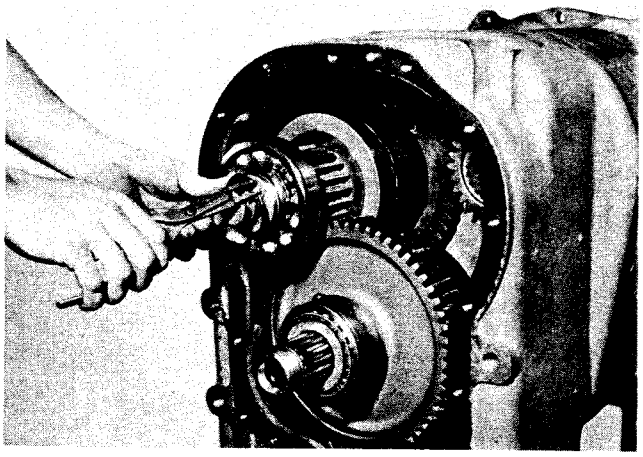


**Figure 121**
Install low clutch rear bearing retainer ring.

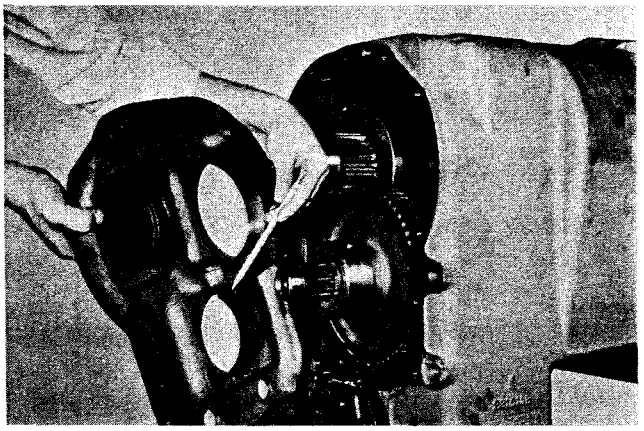


**Figure 122**
Position a new gasket on rear transmission case. Align lock ball in idler shaft rear bearing with notch in rear transmission cover. Tap cover in place and secure with bolts and lockwashers.

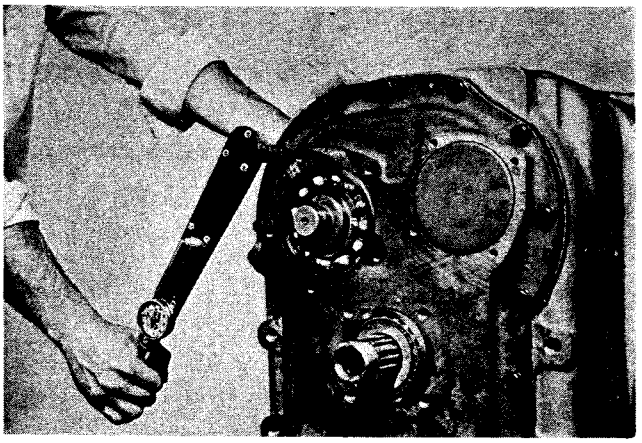


**Figure 123**
Torque rear cover bolts to specified torque.

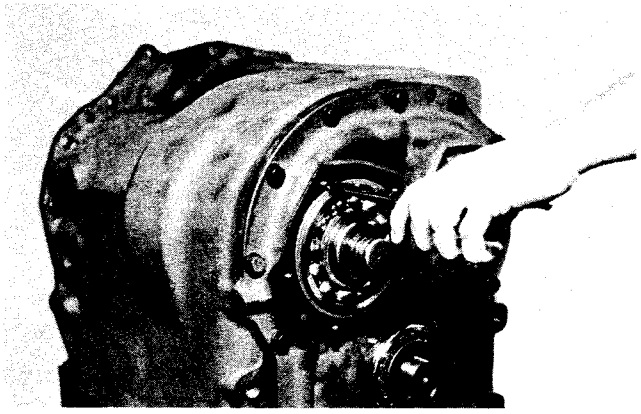


**Figure 124**
From front of transmission case tap low clutch and idler shaft to rear. This will allow clearance to install rear bearing snap ring.

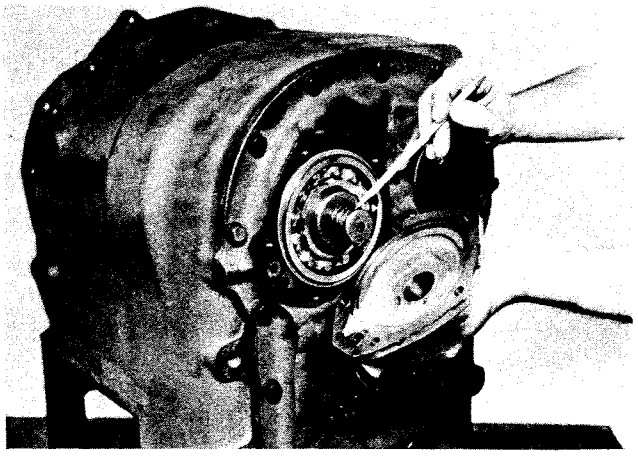


**Figure 125**

Install low clutch shaft piston rings. Install new gasket and "O" ring on low shaft bearing cap.

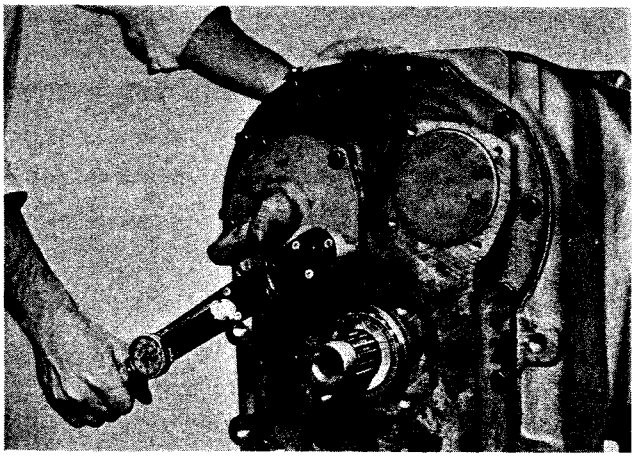


**Figure 126**

Install bearing cap and secure with lockwashers and bolts. Tighten to specified torque.

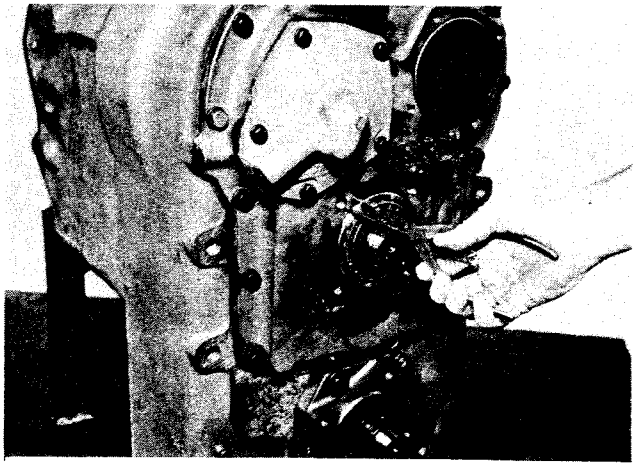


**Figure 127**

Install idler shaft rear bearing locating ring.

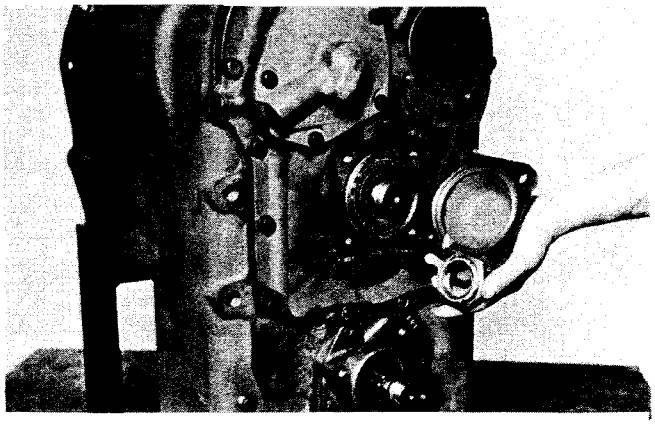


**Figure 128**

Install idler shaft nut. Block idler gear, tighten nut to specified torque. (See elastic stop nut torque chart.) With a new gasket in position install idler shaft bearing cap. Tighten bolts to specified torque.

If a mechanical parking brake is not used proceed to Figure 134.

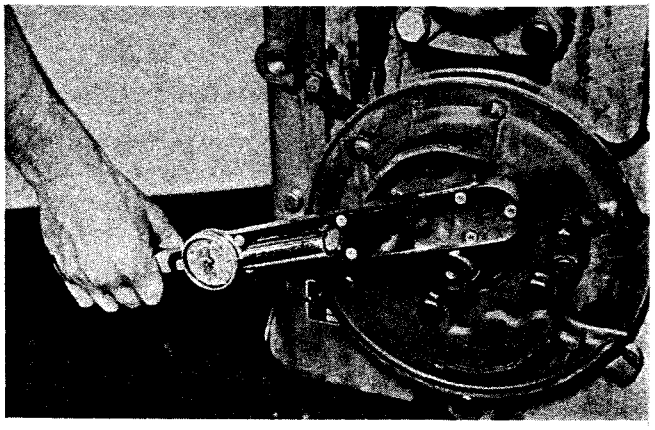


**Figure 129**

Install brake backing plate assembly. Tighten bolts to specified torque.

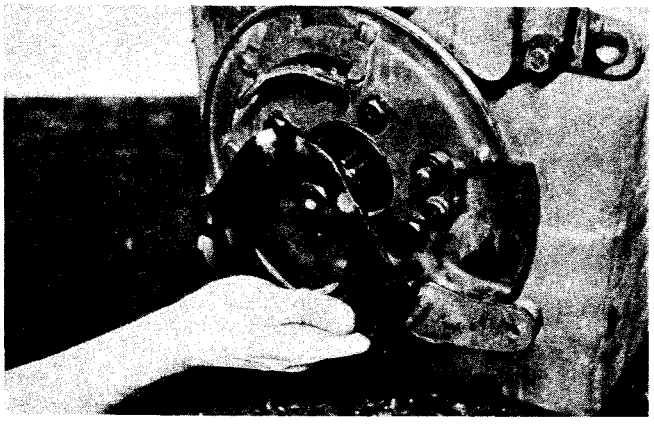


**Figure 130**

Position brake actuating arm.

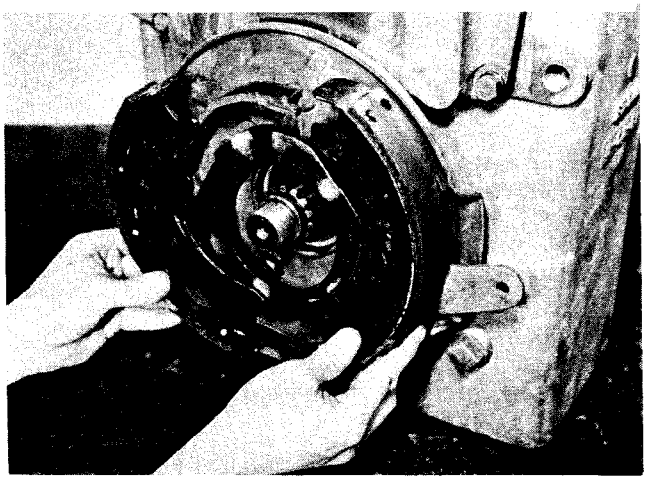


**Figure 131**
Locate brake shoes.

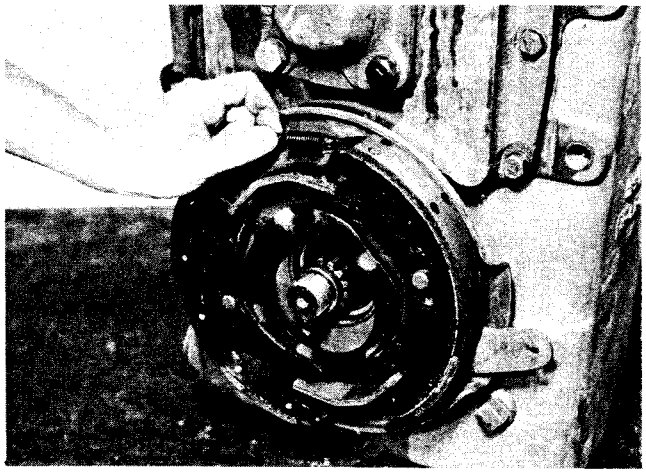


**Figure 132**
Install upper and lower brake shoe return springs.

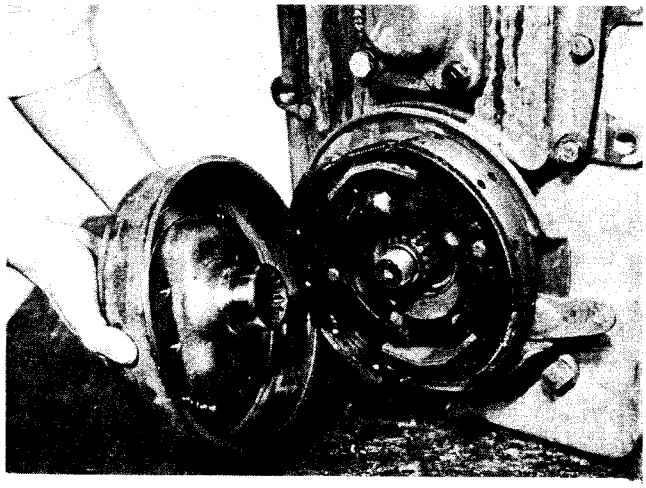


**Figure 133**
Install brake drum and flange assembly.

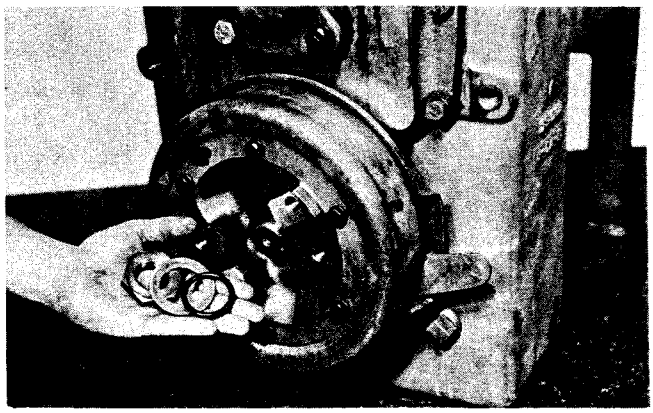


**Figure 134**
Secure flange with a new "O" ring, washer and flange nut. Block output shaft and tighten nut to specified torque. (See elastic stop nut torque chart.)

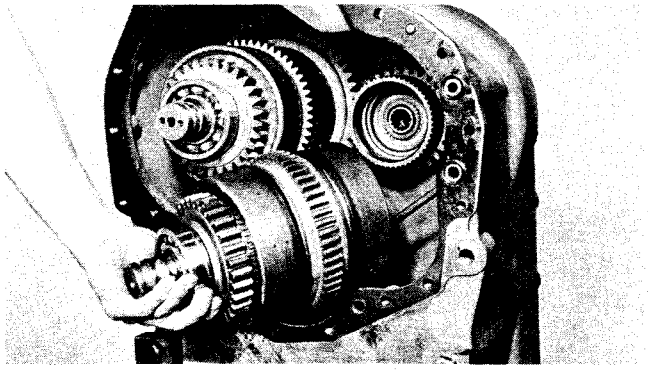


**Figure 135**
Position 2nd speed clutch shaft pilot bearing on shaft. From the front of the transmission case install the forward and 2nd clutch assembly. **NOTE: For R Model front end see page 43 Figure 10.**

**Figure 136**

**NOTE: See Fig. N for 13 inch special impeller hub bearing and 12 bolt assembly instructions.**

Install new "O" ring on impeller hub. Align holes in impeller hub with holes in impeller. Install bolts and tighten to specified torque. Lockwire in pairs to prevent loosening.

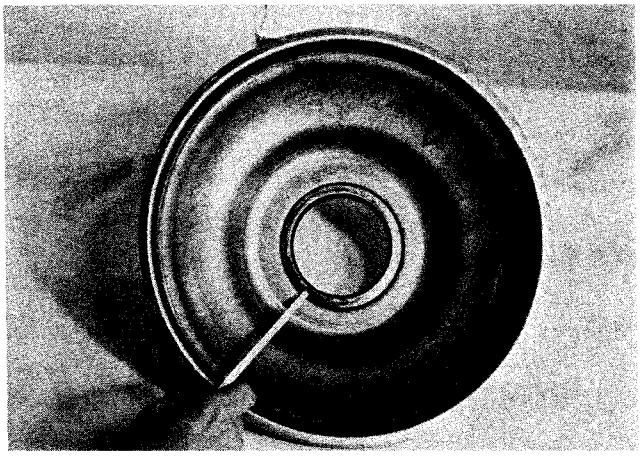


**Figure 137**
Apply a light coat of Permatex No. 2 on the outer diameter of the oil baffle seal. Press seal in oil baffle with lip of seal down.

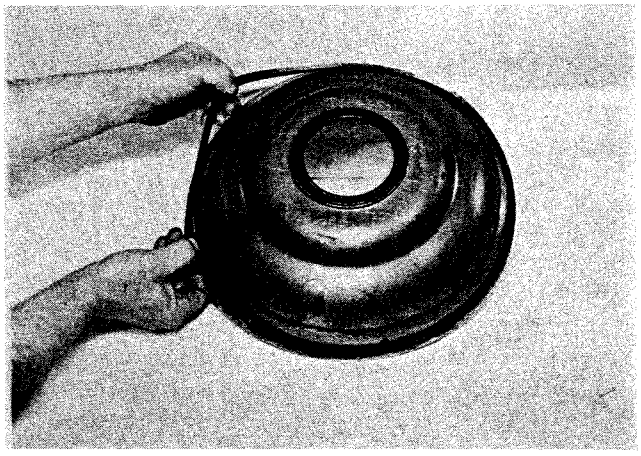


**Figure 138**
Install a new oil baffle seal ring.

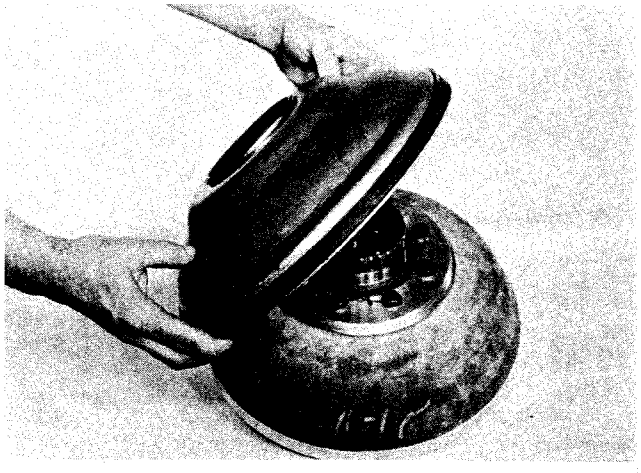


**Figure 139**
Install oil baffle on impeller assembly.

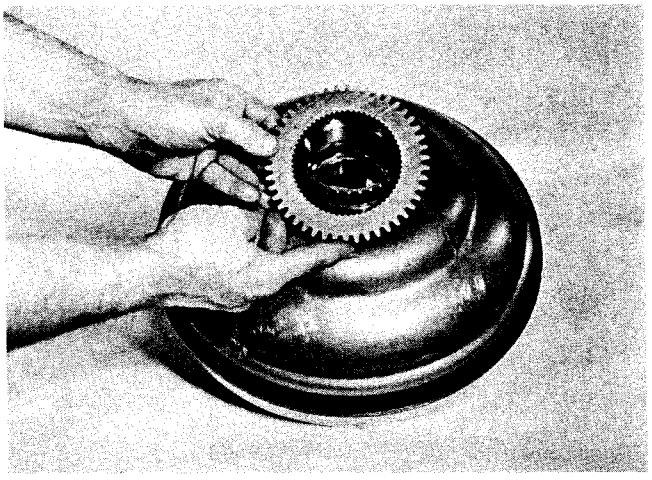


**Figure 140**
Install impeller hub gear.

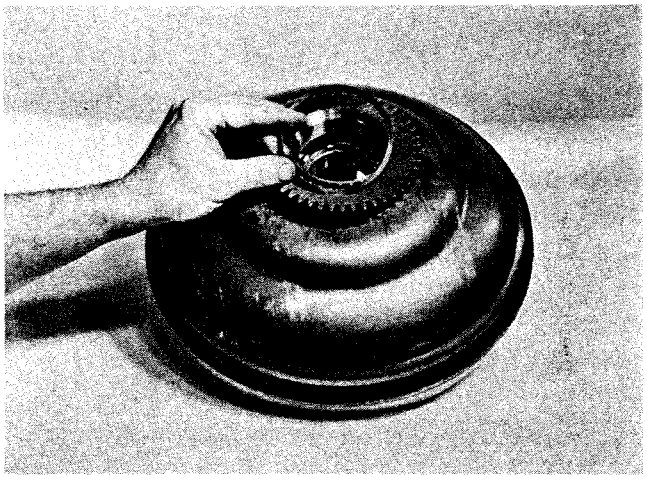


**Figure 141**
Secure impeller hub gear with retainer ring.

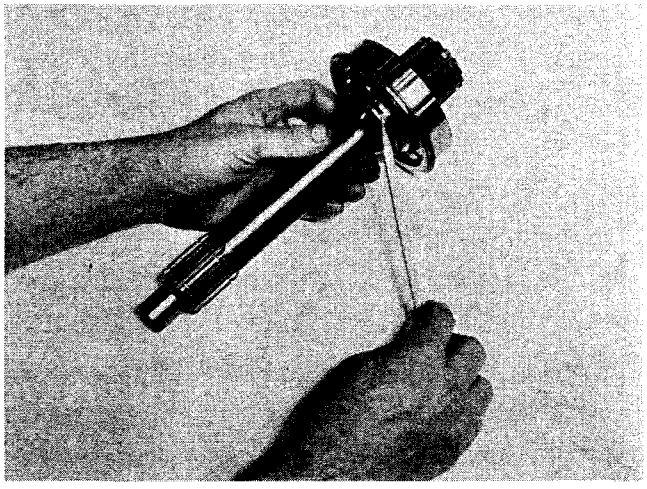


**Figure 142**
Install new turbine shaft piston ring.

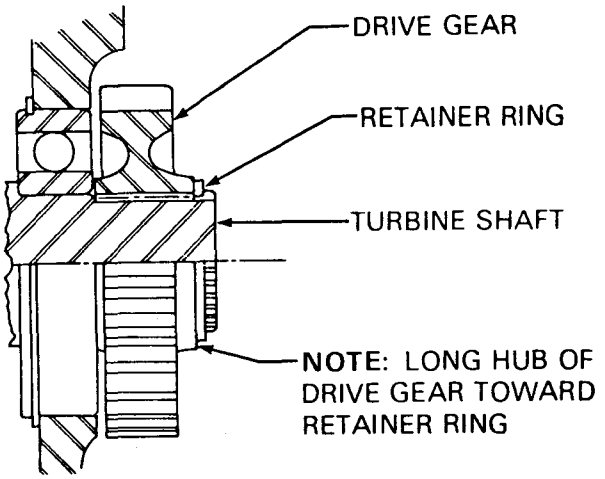



**Figure 143**

Tap turbine shaft and bearing assembly into converter housing from front. At the rear of the converter housing install turbine shaft gear and retainer ring as shown.

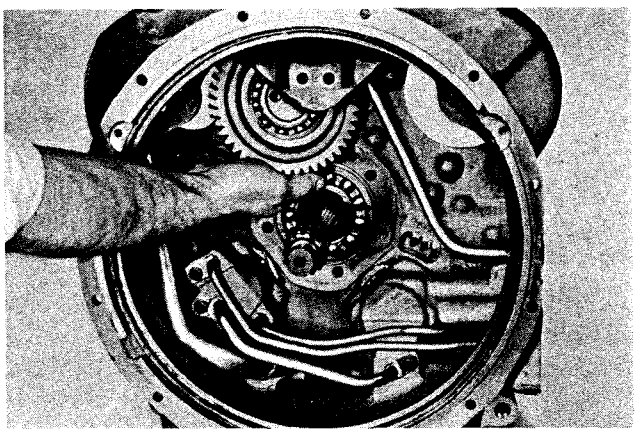


**Figure 144**

Position center pump drive gear.

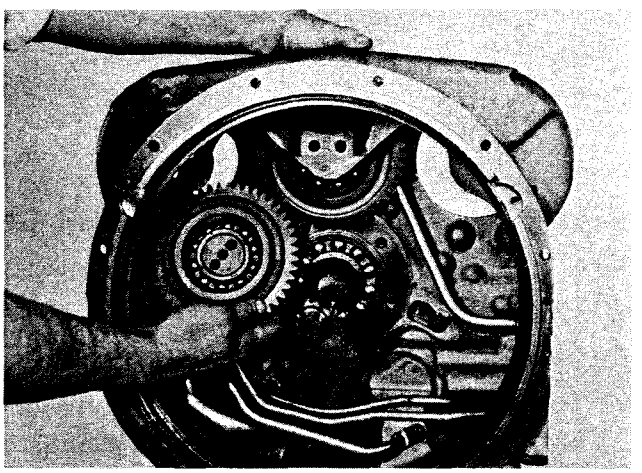


**Figure 145**

Install left pump drive gear.

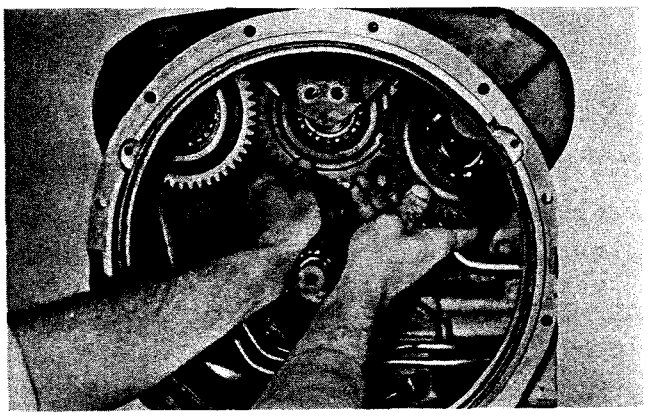


**Figure 146**

Install right pump drive gear.

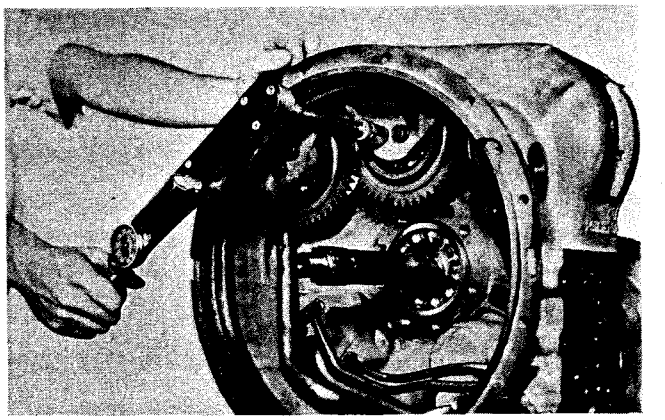


**Figure 147**

Align holes in pump drive gear bearing supports with holes in converter housing. Install bolts and washers and tighten to specified torque.

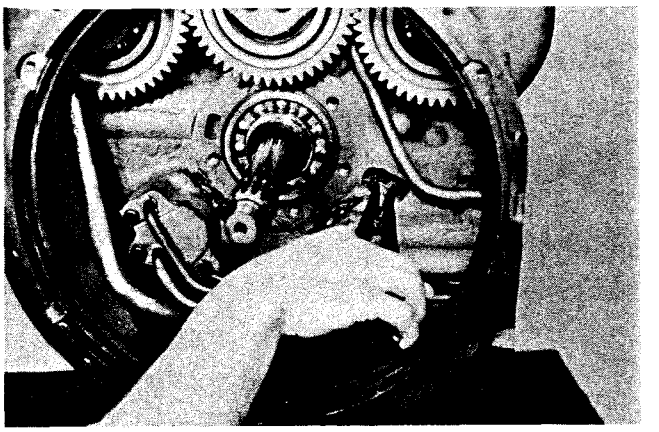


**Figure 148**

Support converter housing with a chain fall. Spread forward clutch front bearing retainer ring. Position converter housing to transmission case assembly. Tap housing into place using caution as not to damage any of the clutch shaft piston rings.

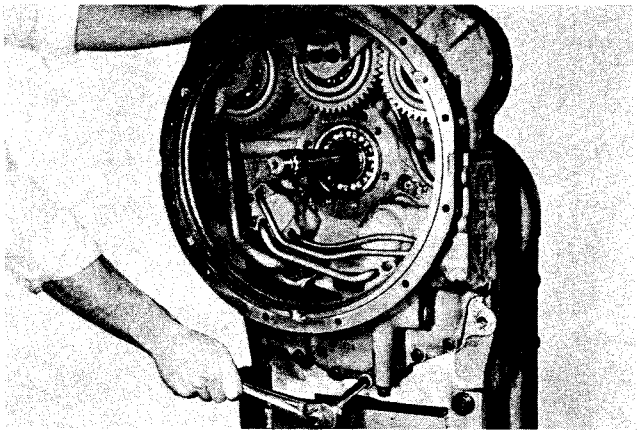


**Figure 149**

Secure converter housing to transmission case with bolts and washers. Tighten to specified torque.

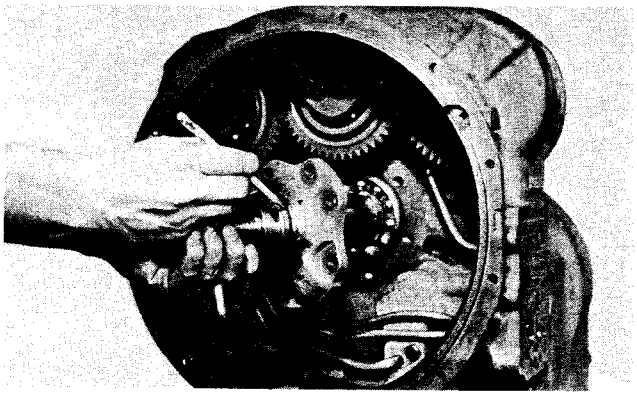


**Figure 150**

Install new sealing ring expander spring and oil sealing ring on support. **NOTE:** Expander spring gap to be 180° from sealing ring hook joint. Position support on turbine shaft to clear pump drive gear. Align support holes with converter housing.

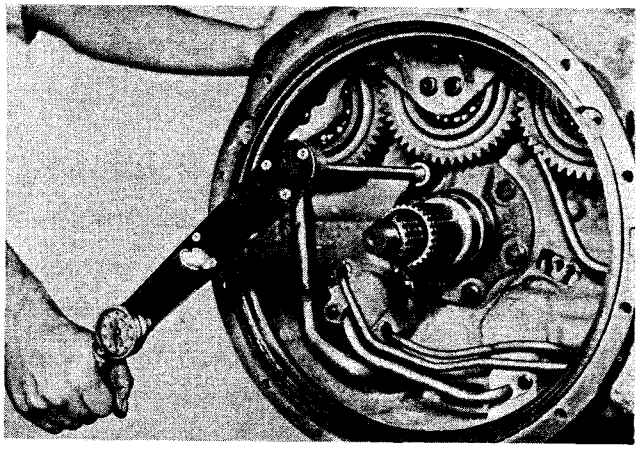


**Figure 151**

Install stator support bolts and tighten to specified torque.

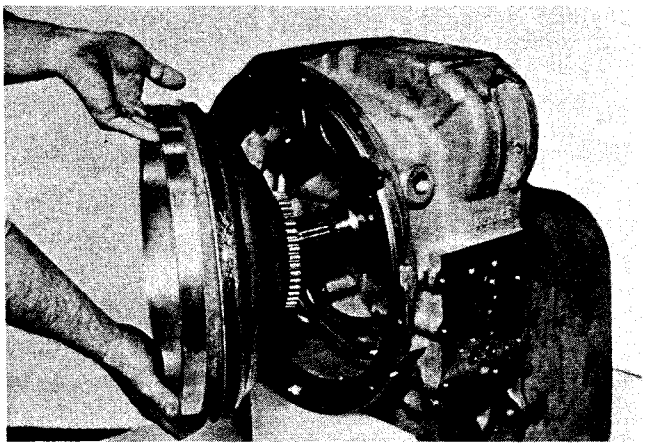


**Figure 152**

Grease stator support piston ring, oil baffle oil seal and seal ring to facilitate reassembly. Install impeller and oil baffle assembly in converter housing.

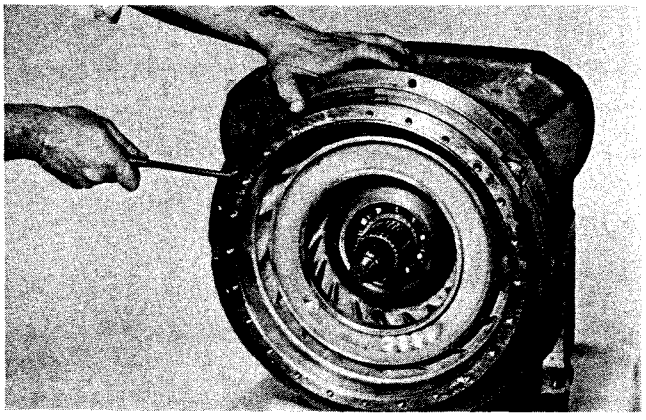


**Figure 153**

Position oil baffle in housing. Secure with oil baffle retainer ring, being sure ring is in full position in ring groove.

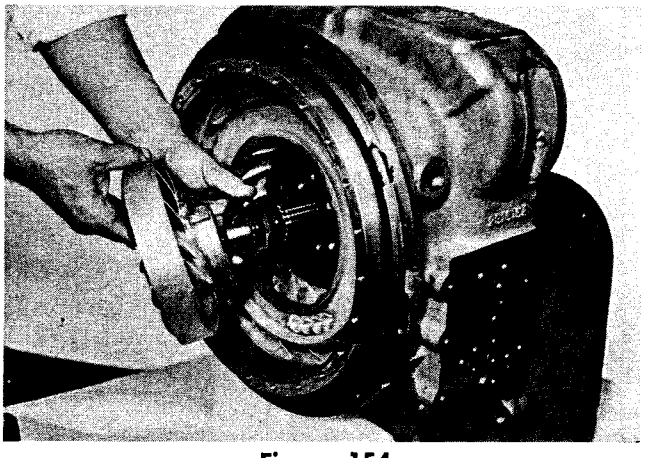


**Figure 154**

Install reaction member spacer with tang of spacer out. Install reaction member.

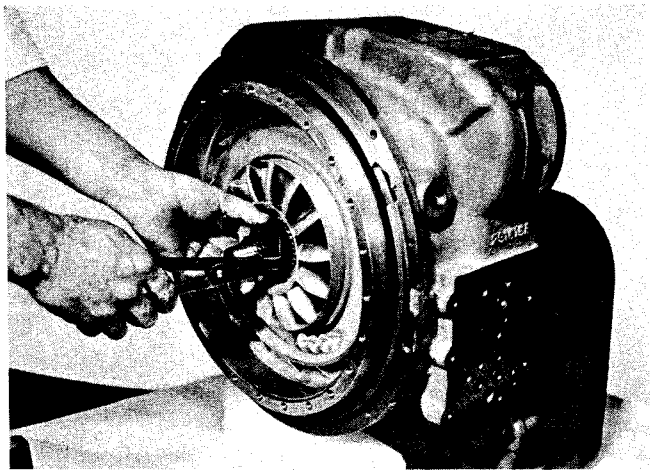


**Figure 155**
Install reaction member retainer ring.

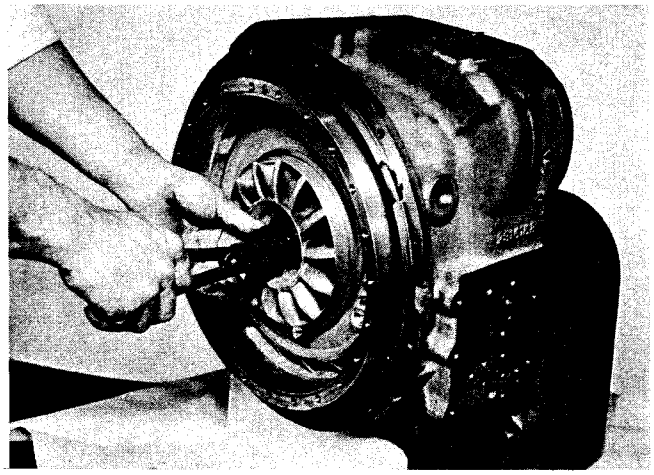


**Figure 156**
tall turbine locating ring on turbine shaft.

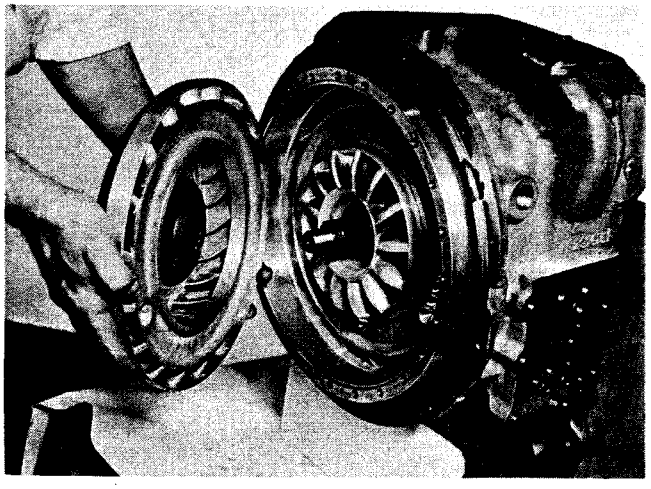


**Figure 157**
Install turbine.

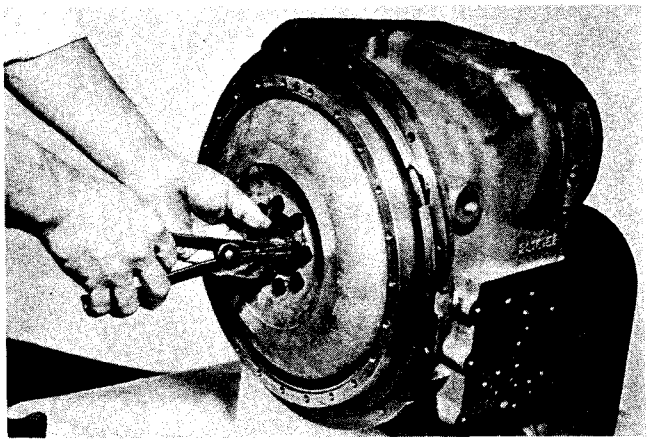


**Figure 158**
Install turbine to turbine shaft retainer ring.

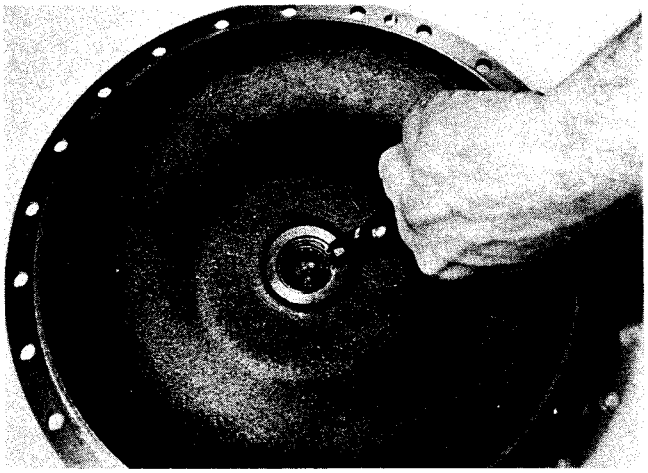


**Figure 159**
If impeller cover bearing was removed, press bearing in position and secure with retainer ring.

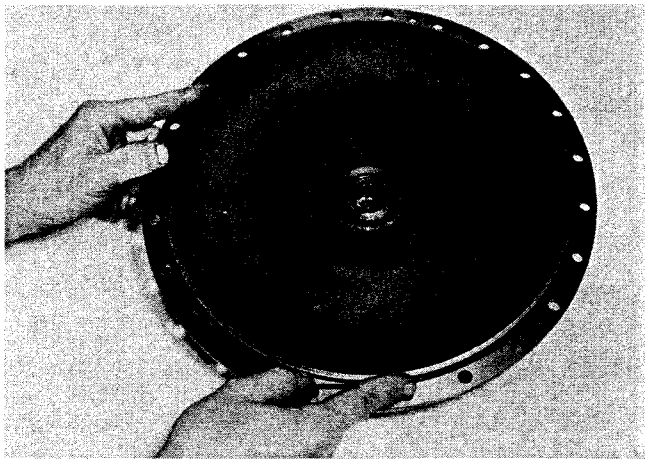


**Figure 160**
Install a new impeller cover "O" ring and grease lightly to facilitate reassembly.

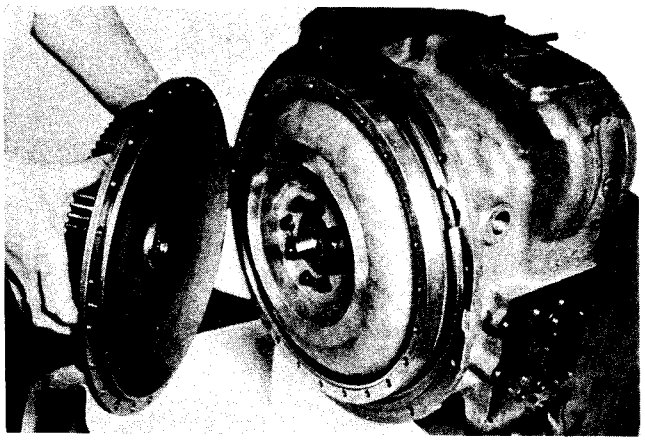


**Figure 161**

Align holes in impeller cover with holes in impeller. Install bolts and washers and tighten to specified torque.

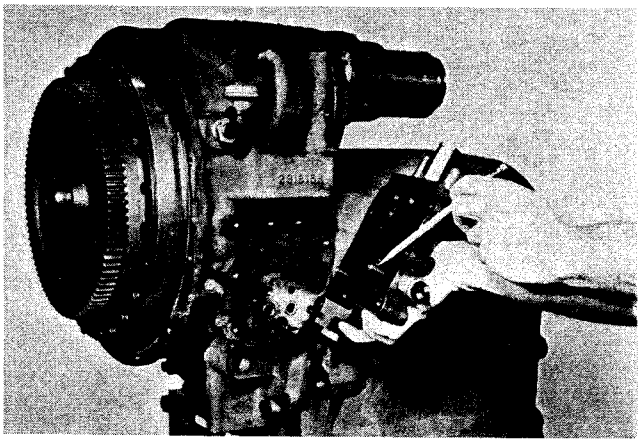


**Figure 162**

Locate detent balls and springs in control valve. Position new gasket. Secure valve with bolts and washers. Tighten to specified torque.

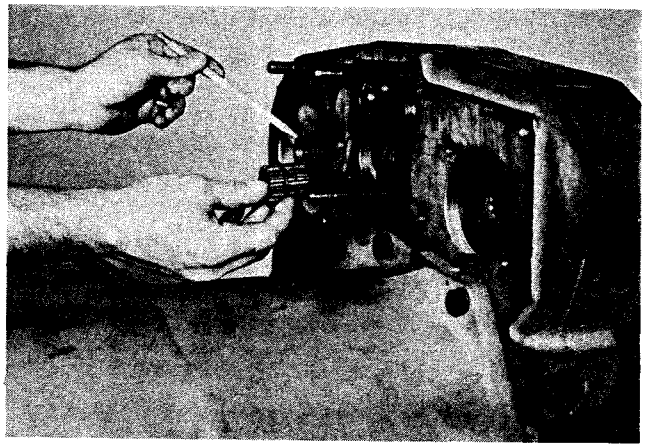


**Figure 163**

Install pump drive sleeves

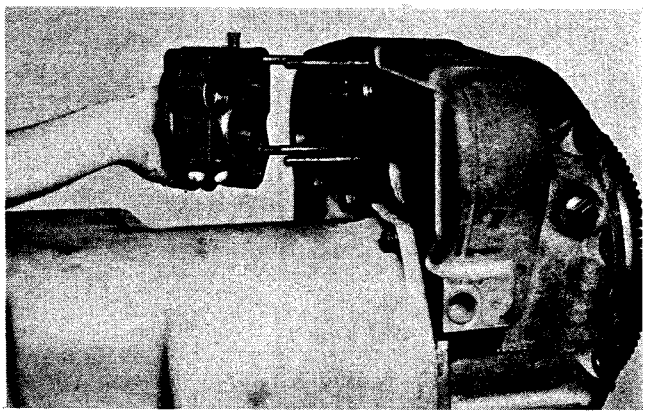


**Figure 164**

Position new gasket and "O" rings on pressure regulator valve. Install valve on studs.

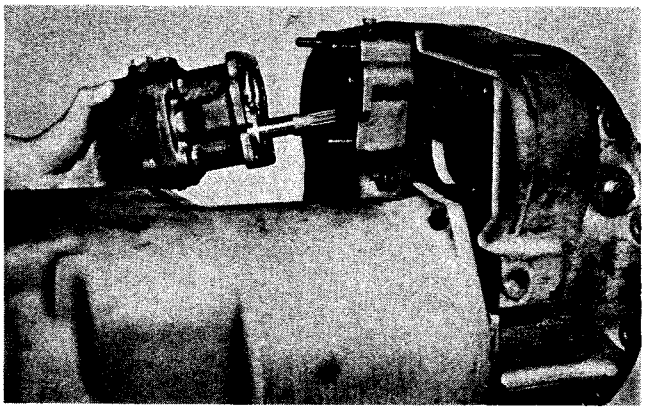


**Figure 165**

With new valve body to pump gasket in position insert pump drive shaft through valve body. Use caution as not to damage valve body oil seal. It may be necessary to turn impeller one way or the other to align pump shaft with drive sleeves.

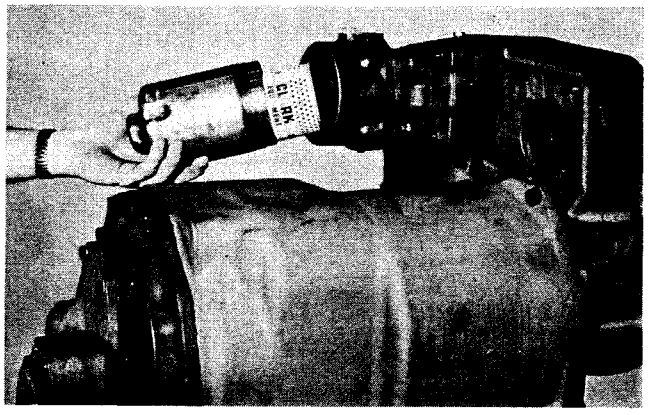


**Figure 166**

Install new "O" ring in filter adaptor housing. Install filter element and housing. Tighten filter housing 20 to 25 ft. lbs. torque. [27,2 - 33,8 N.m.]

## 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 the 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 oil cooler, 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 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, 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. On remote mounted torque converters remove drain 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 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 use only type oil recommended in lubrication section. Fill transmission through filler opening until fluid comes up to **LOW** mark on transmission dipstick. **NOTE:** If the dipstick is not accessible oil level check plugs are provided.

   Remove **LOWER** check plug, fill until oil runs from **LOWER** oil hole. Replace filler and level plug.

   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).

   Add quantity necessary to bring fluid level to **LOW** mark on dipstick or runs freely from **LOWER** oil level check plug hole. Install oil level plug or dipstick. Recheck with hot oil (180-200° F.) [82, 2-93, 3° C].

   Bring oil level to **FULL** mark on dipstick or runs freely from **UPPER** oil level plug.

7. Recheck all drain plugs, lines, connections, etc., for leaks and tighten where necessary.

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

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

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

Torque Specification for Lubricated or Plated Screw Threads

| NOM. SIZE | Grade 5 FINE THREAD LB-FT | [N·m] | Grade 5 COARSE THREAD LB-FT | [N·m] | Grade 8 FINE THREAD LB-FT | [N·m] | Grade 8 COARSE THREAD LB-FT | [N·m] |
|---|---|---|---|---|---|---|---|---|
| .2500 | 9 - 11 | [ 12,3 - 14,9] | 8 - 10 | [ 10,9 - 13,5] | 11 - 13 | [ 15,0 - 17,6] | 9 - 11 | [ 12,3 - 14,9] |
| .3125 | 16 - 20 | [ 21,7 - 27,1] | 12 - 16 | [ 16,3 - 21,6] | 28 - 32 | [ 38,0 - 43,3] | 26 - 30 | [ 35,3 - 40,6] |
| .3750 | 26 - 29 | [ 35,3 - 39,3] | 23 - 25 | [ 31,2 - 33,8] | 37 - 41 | [ 50,2 - 55,5] | 33 - 36 | [ 44,8 - 48,8] |
| .4375 | 41 - 45 | [ 55,6 - 61,0] | 37 - 41 | [ 50,2 - 55,5] | 58 - 64 | [ 78,7 - 86,7] | 52 - 57 | [ 70,6 - 77,2] |
| .5000 | 64 - 70 | [ 86,8 - 94,9] | 57 - 63 | [ 77,3 - 85,4] | 90 - 99 | [122,1 - 134,2] | 80 - 88 | [108,5 - 119,3] |
| .5625 | 91 - 100 | [123,4 - 135,5] | 82 - 90 | [111,2 - 122,0] | 128 - 141 | [173,6 - 191,1] | 115 - 127 | [156,0 - 172,2] |
| .6250 | 128 - 141 | [173,5 - 191,2] | 113 - 124 | [153,2 - 168,1] | 180 - 198 | [224,0 - 268,5] | 159 - 175 | [215,6 - 237,3] |
| .7500 | 223 - 245 | [302,3 - 332,2] | 200 - 220 | [271,2 - 298,3] | 315 - 347 | [427,1 - 470,5] | 282 - 310 | [382,3 - 420,3] |

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

| | |
|---|---|
| CONVERTER OUT PRESSURE | Converter outlet oil temp. 180° - 200° F. [82,3° - 93.3° C]. Transmission in **NEUTRAL.** Operating specifications: 25 P.S.I. [172,4 kPa] minimum pressure at 2000 R.P.M. engine speed **AND** a maximum of 70 P.S.I. [482,6 kPa] outlet pressure with engine operating at no-load governed speed. |
| CONTROLS | Forward and Reverse — Manual<br>Speed Selection — Manual |
| CLUTCH TYPE | Multiple discs, hydraulically actuated, spring released, automatic wear compensation and no adjustment. All clutches oil cooled and lubricated. |
| CLUTCH INNER DISC | Friction. |
| CLUTCH OUTER DISC | Steel. |
| OIL FILTRATION | Full flow oil filter safety by-pass, also strainer screen in sump at bottom of transmission case. |
| CLUTCH PRESSURE | 240 - 300 psi [1654,8 - 2068,4 kPa] — With parking brake set **(see note)**, oil temperature 180° - 200°F. [82,2° - 93,3°C], engine at idle (400 to 600 RPM), shift thru direction and speed clutches. All clutch pressure must be equal within 5 psi. [34,5 kPa]. If clutch pressure varies in any one clutch more than 5 psi [34,5 kPa] repair clutch.<br>**NOTE: Never use service brakes while making clutch pressure checks. Units having brake actuated declutching in forward and/or reverse will not give a true reading.**<br>**ALWAYS USE PARKING BRAKE WHEN MAKING CLUTCH PRESSURE CHECKS.** |

## LUBRICATION

**RECOMMENDED LUBRICANTS FOR CLARK POWER SHIFTED TRANSMISSION AND TORQUE CONVERTERS**

**Prevailing Ambient Temperature**

| | |
|---|---|
| TYPE OF OIL | See Lube Chart. |
| 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. |
| CHECK PERIOD | Check oil level DAILY with engine running at 500-600 RPM and oil at 180° to 200° F. [82,2 -93,3° C]. Maintain oil level to FULL Mark. |
| NORMAL * DRAIN PERIOD | Every 500 hours, change oil filter element. Every 1000 hours, drain and refill system as follows: Drain with oil at 150° to 200° F. [65,6 -93,3° C]. |

**NOTE: It is recommended that filter elements be changed after 50 and 100 hours of operation on new and rebuilt or repaired units.**

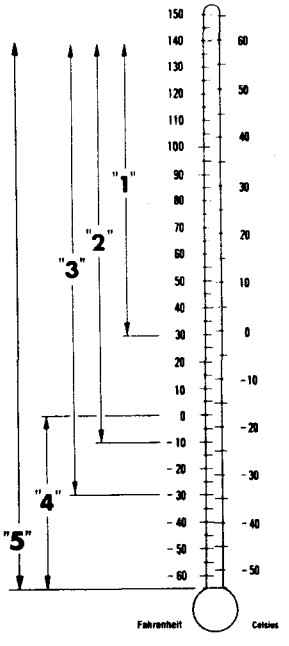
(a) **Drain transmission and remove sump screen. Clean screen thoroughly and replace, using new gaskets.**

(b) **Drain oil filters, remove and discard filter elements. Clean filter shells and install new elements.**

(c) **Refill transmission to LOW mark.**

(d) **Run engine at 500-600 RPM to prime converter and lines.**

(e) **Recheck level with engine running at 500-600 RPM and add oil to bring level to LOW mark. When oil temperature is hot (180-200° F.) [82,2-93,3° C] make final oil level check. BRING OIL LEVEL TO FULL MARK.**




*Dexron is a registered trademark of General Motors Corporation.

| | | |
|---|---|---|
| Temperature Range | "1" | C-2 Grade 30<br>C-3 Grade 30<br>Engine Oil:-Grade 30 API-CD/SE or CD/SF<br>MIL-L-2104C-Grade 30<br>MIL-L-2104D-Grade 30 |
| Temperature Range | "2" | MIL-L-2104C-Grade 10<br>MIL-L-2104D-Grade 10<br>C-2 Grade 10<br>C-3 Grade 10<br>Engine Oil:-Grade 10 API-CD/SE or CD/SF<br>Quintolubric 822-220 (Non Phosphate Ester Fire Resistant Fluid) |
| Temperature Range | "3" | *Dexron<br>*Dexron II D - **See Caution Below** |
| Temperature Range | "4" | MIL-L-46167<br>MIL-L-46167 A |
| Temperature Range | "5" | Conoco High-Performance Synthetic Motor Oil — Spec. No. 6718 |

**PREFERRED OIL VISCOSITY:** Select highest oil viscosity compatible with prevailing ambient temperatures and oil application chart.

Temperature ranges "2" and "3" may be used to lower ambient temperatures when sump preheaters are used.

Temperature range "4" should be used only in ambient temperature range shown.

**MODULATED SHIFT TRANSMISSIONS:** T12000, 18000, 24000, 28000 & 32000 series transmissions with modulated shift use only C-3 or temperature range 3 items (a) & (b) *Dexron or *Dexron II D. **SEE CAUTION BELOW.** 3000, 4000, 5000, 6000, 8000, 16000 & 34000 series transmissions with modulated shift use only C-3 or temperature range 3 item (a) only *Dexron. Do **NOT** use *Dexron II D. **SEE CAUTION BELOW.**

**CAUTION: *Dexron II D is not compatible with graphitic clutch plate friction material UNLESS IT MEETS THE APPROVED C-3 SPECIFICATIONS. *Dexron II D cannot be used in the 3000, 4000, 5000, 6000, 8000, 16000 or 34000 series power shift transmissions, or the HR28000 & HR32000 series having converter lock-up, or the C270 series converter having lock-up UNLESS IT MEETS THE APPROVED C-3 SPECIFICATIONS.**

Any deviation from this chart must have written approval from the application department of the Clark-Hurth Components Engineering and Marketing Department.

***Normal drain periods and filter change intervals are for average environmental and duty-cycle conditions. Severe or sustained high operating temperatures or very dusty atmospheric conditions will cause accelerated deterioration and contamination. For extreme conditions judgment must be used to determine the required change intervals.**

## TROUBLE SHOOTING GUIDE

**For The**

## R and HR Model, 28000 Transmission

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 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 control valve, 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:

Check oil level in transmission. This should be done with oil temperatures of 180 to 200° F. [82,2-93,3° C]. 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 high 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.

### LOW CLUTCH PRESSURE

| Cause | Remedy |
|---|---|
| 1. Low oil level. | 1. Fill to proper level. |
| 2. Clutch pressure regulating valve spool stuck open. | 2. Clean valve spool and housing. |
| 3. Faulty charging pump. | 3. Replace pump. |
| 4. Broken or worn clutch shaft or piston sealing rings. | 4. Replace sealing rings. |
| 5. Clutch piston bleed valve stuck open. | 5. Clean bleed valves thoroughly. |

### LOW CONVERTER CHARGING PUMP OUTPUT

| | |
|---|---|
| 1. Low oil level. | 1. Fill to proper level. |
| 2. Suction screen plugged. | 2. Clean suction screen. |
| 3. Air leaks at pump intake hose and connections or collapsed hose. (R-28000 only) | 3. Tighten all connections or replace hose if necessary. |
| 4. Defective oil pump. | 4. Replace pump. |

### OVERHEATING

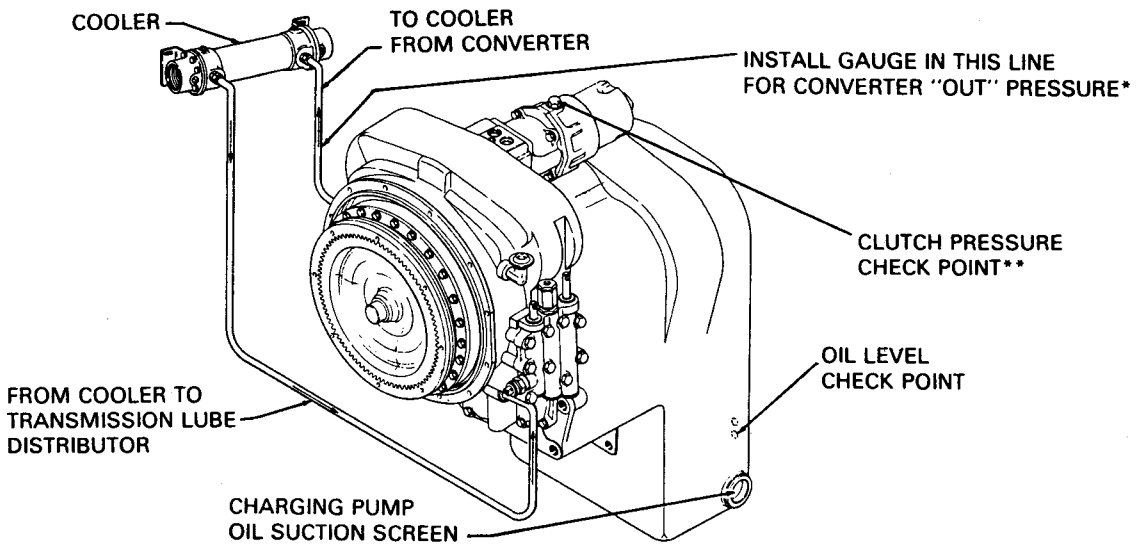
| | |
|---|---|
| 1. Worn oil sealing rings. | 1. Remove, disassemble, and rebuild converter assembly. |
| 2. Worn oil pump. | 2. Replace. |
| 3. Low oil level. | 3. Fill to proper level. |
| 4. Pump suction line taking air. (R-28000 only) | 4. Check oil line connections and tighten securely. |

### NOISY CONVERTER

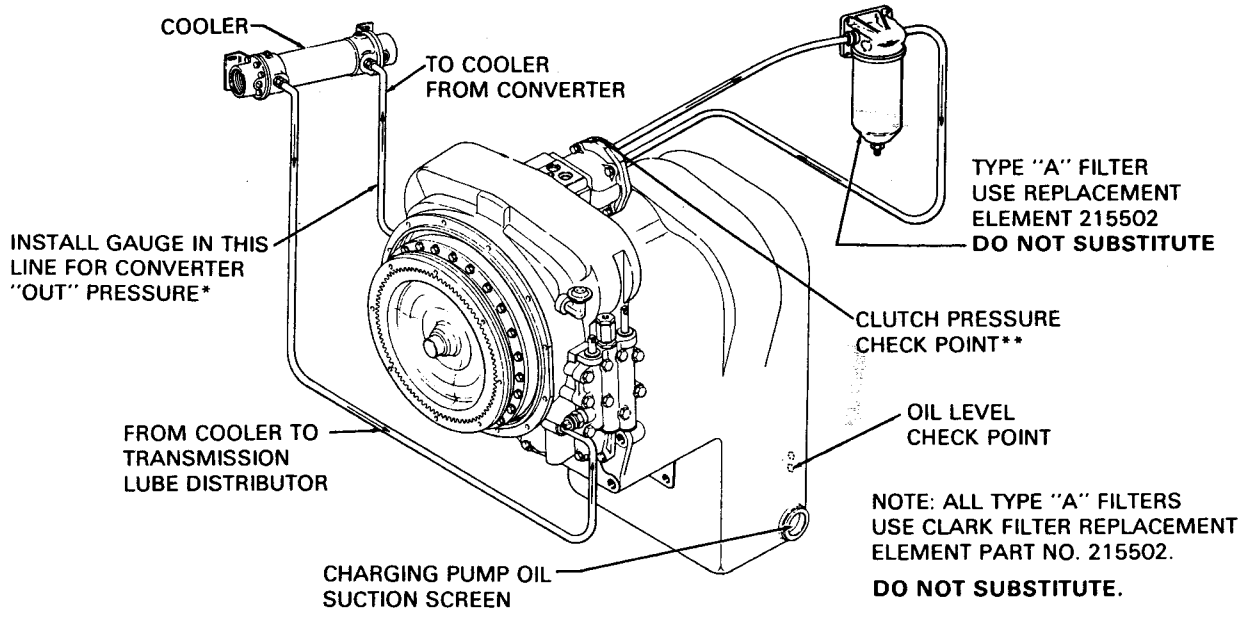
| | |
|---|---|
| 1. Worn coupling gears. | 1. Replace. |
| 2. Worn oil pump. | 2. Replace. |
| 3. Worn or damaged bearings. | 3. A complete disassembly will be necessary to determine what bearing is faulty. |

### LACK OF POWER

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




**28000 SERIES PLUMBING DIAGRAM**




**28000 SERIES PLUMBING DIAGRAM**
**(WITH REMOTE FILTER)**

**FIG. J**

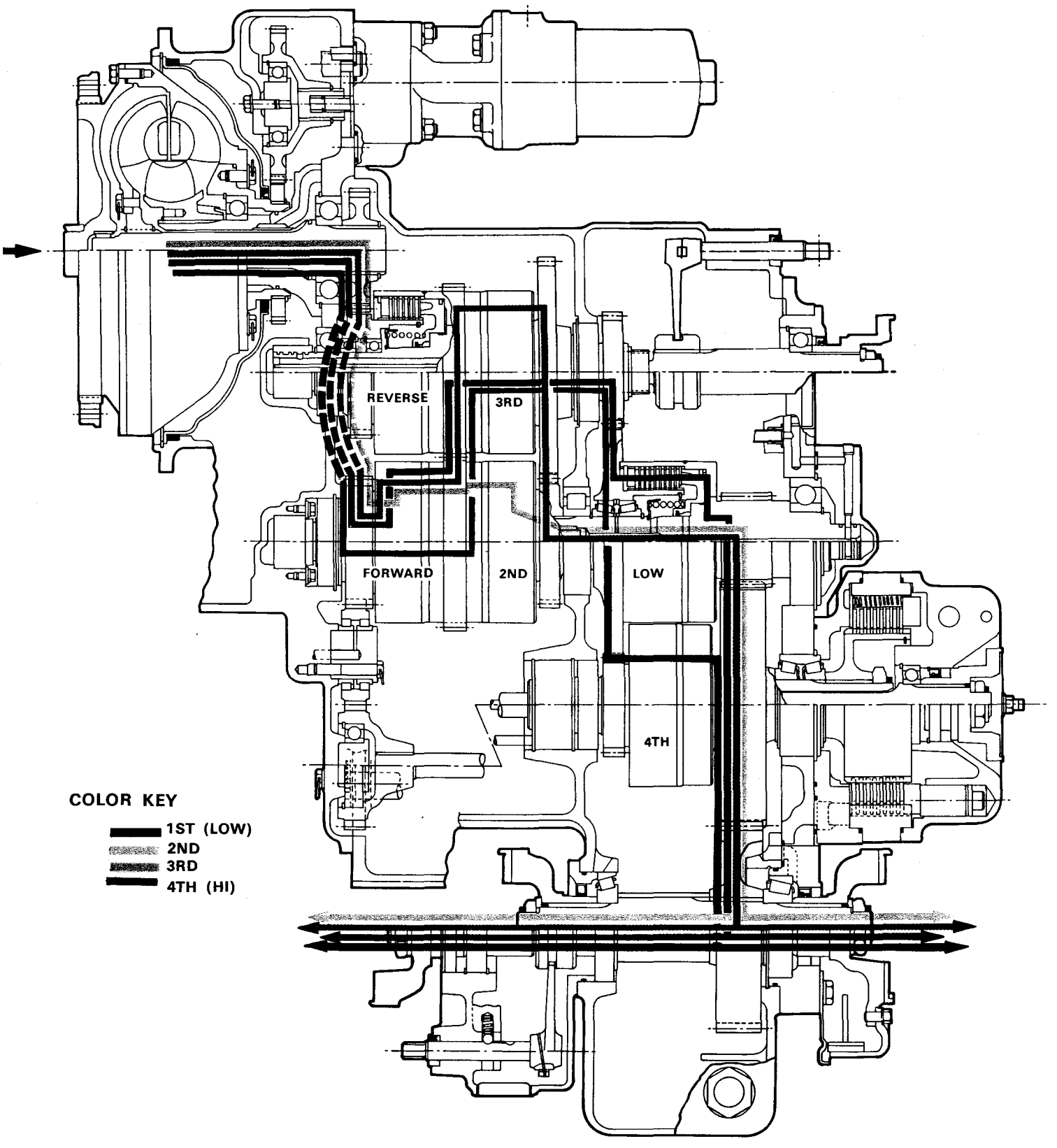
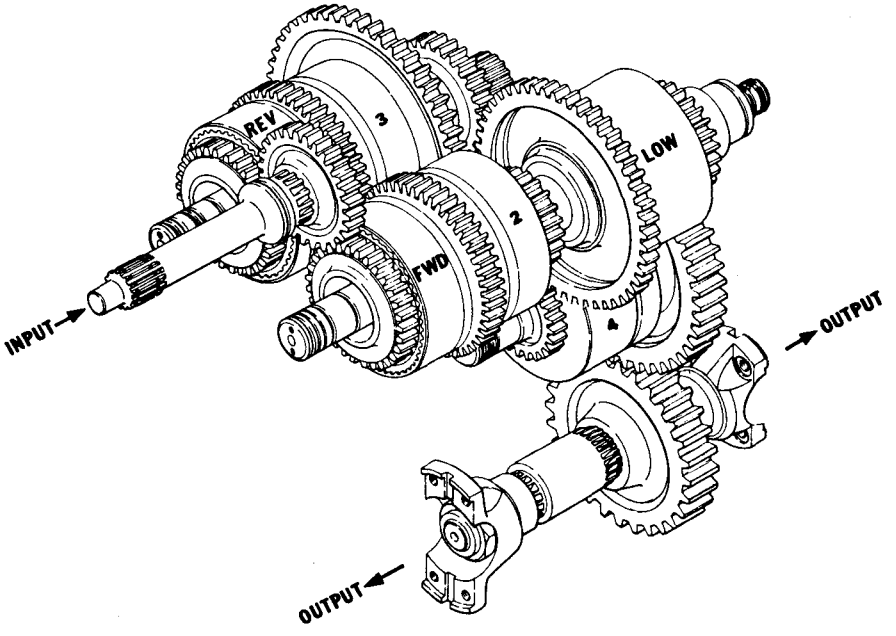



FIG. K

4 SPEED TRANSMISSION

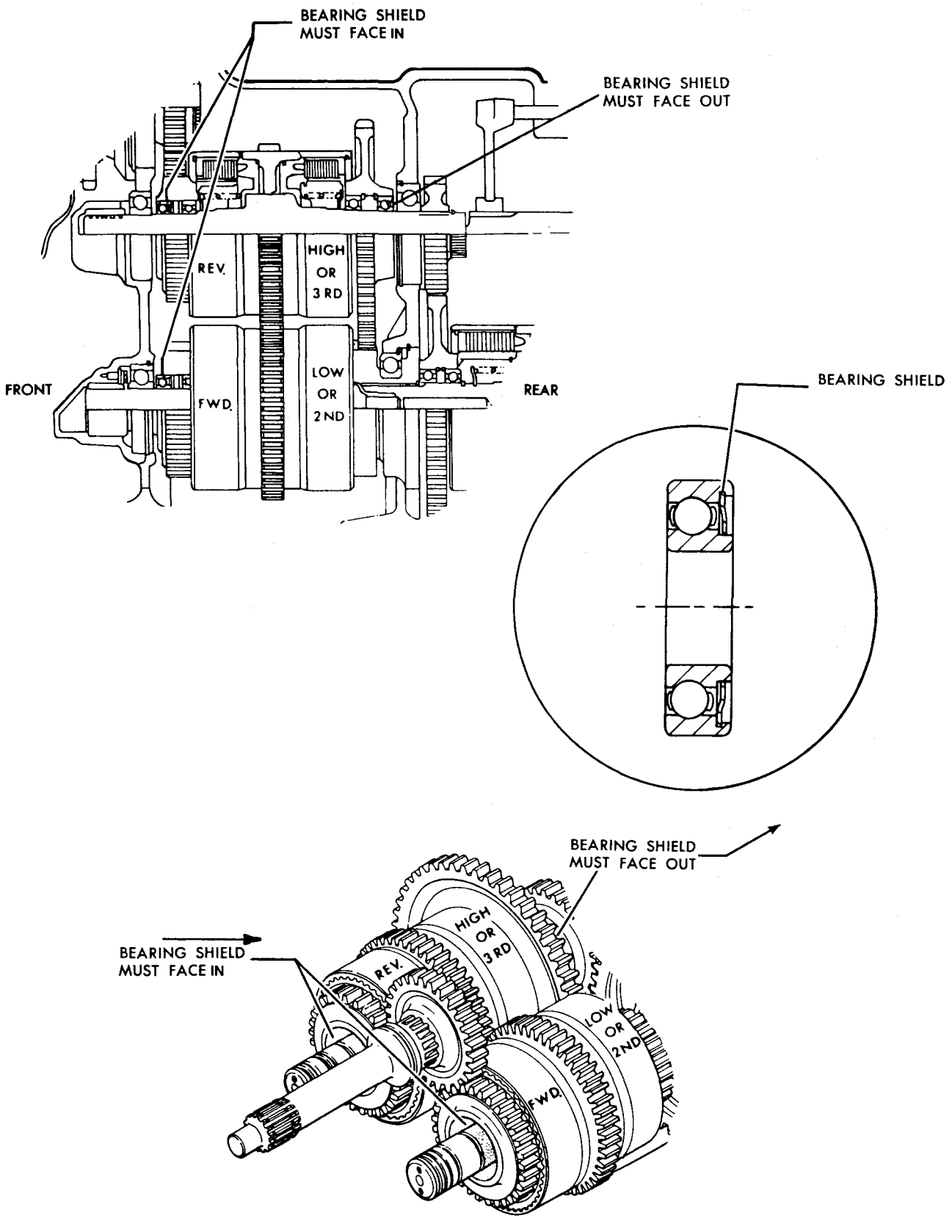



**28000 SERIES - 4 SPEED**
**CLUTCH & GEAR ARRANGEMENT**

## CONVERTER CHARGE PUMP REPLACEMENT AND PRIMING PROCEDURE

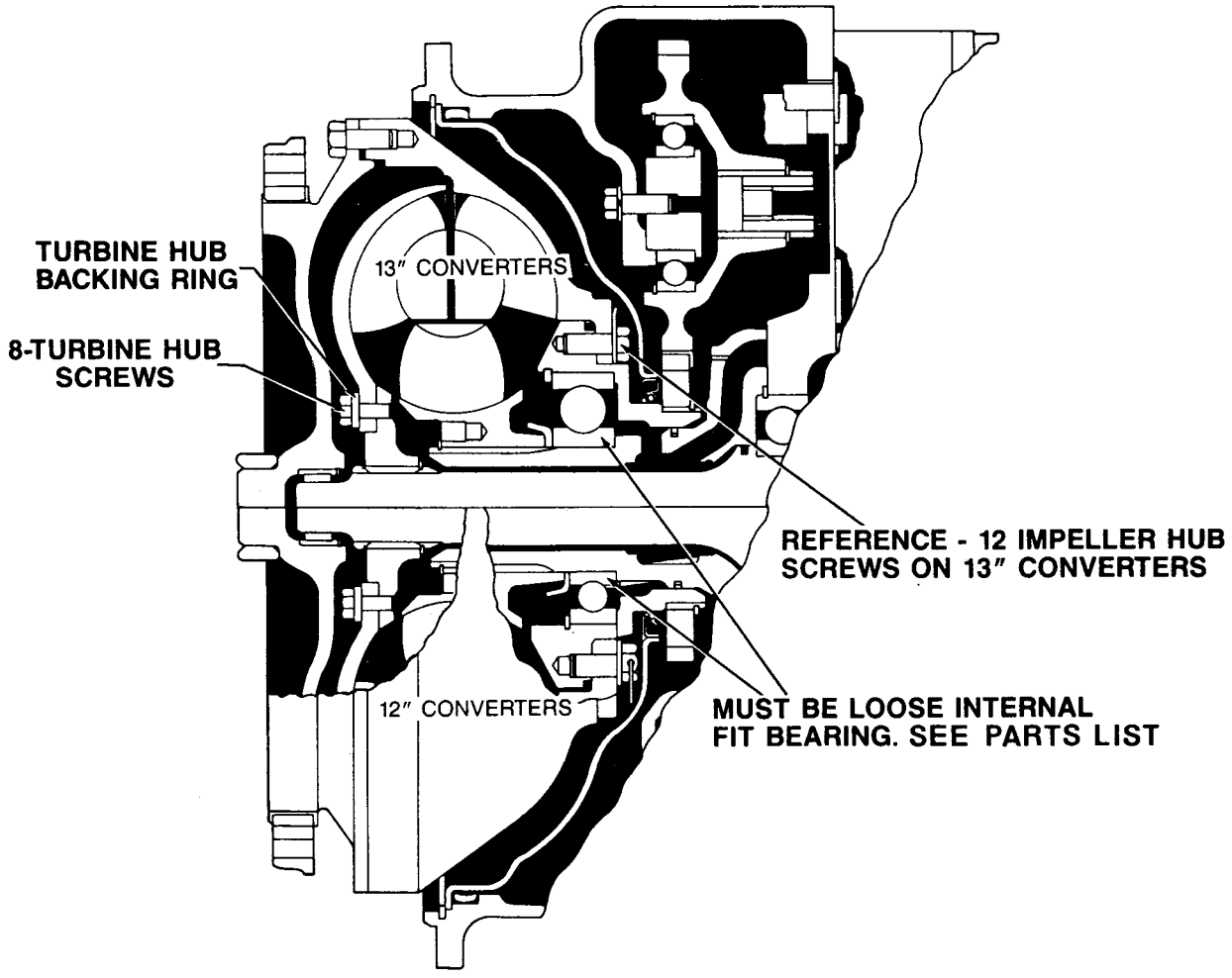
1. The cause for pump failure must be found and corrected before a replacement pump is installed. Check all of the hoses, tubes, "O" rings, adaptors and split flanges.
2. Replace any collapsed or damaged hoses, damaged split flange "O" rings, tube "O" rings and adaptors.
3. After all checks have been made and corrections completed install the pump.
4. See filling instructions on page 31.
5. Start the engine. Run the engine at low idle for two minutes, watch the clutch pressure gage and listen for cavitation of the pump.
6. If the pressure does not come up, check the oil level and bleed off air from system as follows.
7. To bleed off the air from the system, loosen the pressure gage line at the pressure regulating valve or loosen the pressure hose at the oil filter or pressure regulating valve. Crank the engine over until the air is displaced with oil. **DO NOT START THE ENGINE.**
8. If bleeding the lines does not correct the problem it may become necessary to prime the pump. Disconnect the suction hose or pressure hose, whichever is higher, and fill the port with transmission oil, reconnect the hose and tighten.
9. Start the engine and check pressure.
10. Recheck oil level with hot oil (180-200°F) with engine at idle. Add oil as necessary to bring oil level to full mark.

**FIG. L**




SHIELDED BEARING INSTALLATION

FIG. M




## IMPELLER HUB, TURBINE HUB AND BACKING RING WITH SPECIAL SCREWS

1. CLEAN HUB MOUNTING SURFACE AND TAPPED HOLES WITH SOLVENT. DRY THOROUGHLY BEING CERTAIN TAPPED HOLES ARE DRY AND CLEAN.

2. INSTALL BACKING RING AND SPECIAL SELF-LOCKING SCREWS TO APPROXIMATELY .06 INCH [1,5] OF SEATED POSITION. WITH A CALIBRATED TORQUE WRENCH, TIGHTEN SCREWS 40 TO 45 LBS. FT. [54,3 - 61,0 N·m.] TORQUE.
   NOTE: ASSEMBLY OF HUB MUST BE COMPLETED WITHIN A FIFTEEN MINUTE PERIOD FROM START OF SCREW INSTALLATION. THE SCREWS ARE PREPARED WITH AN EPOXY COATING WHICH BEGINS TO HARDEN AFTER INSTALLATION. IF NOT TIGHTENED TO PROPER TORQUE WITHIN THE FIFTEEN MINUTE PERIOD, INSUFFICIENT SCREW CLAMPING TENSION WILL RESULT.
   THIS SPECIAL SCREW IS TO BE USED FOR ONE INSTALLATION ONLY. IF THE SCREW IS REMOVED FOR ANY REASON IT MUST BE REPLACED.
   THE EPOXY LEFT IN THE HUB HOLES MUST BE REMOVED WITH THE PROPER TAP AND CLEANED WITH SOLVENT. DRY HOLE THOROUGHLY AND USE A NEW SCREW FOR REINSTALLATION.

## ASSEMBLY INSTRUCTIONS FOR 28000 CONVERTER WITH SPECIAL APPLICATION IMPELLER HUB BEARING.

FIG. N

## DISASSEMBLY OF LOW CLUTCH UTILIZING REAR DOUBLE TAPER BEARING (HELICAL GEARS)

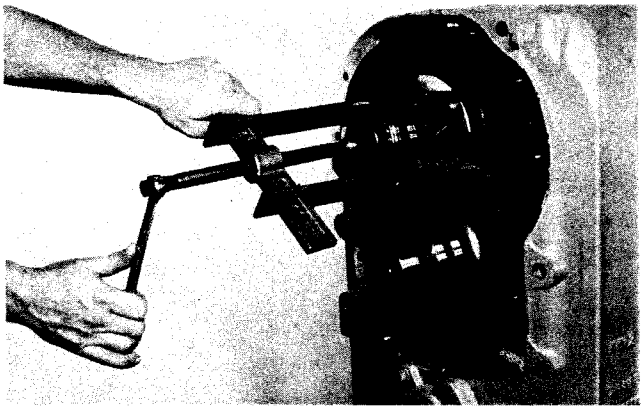


**Figure A**

Remove low clutch double bearing cup, outer cone and spacer.

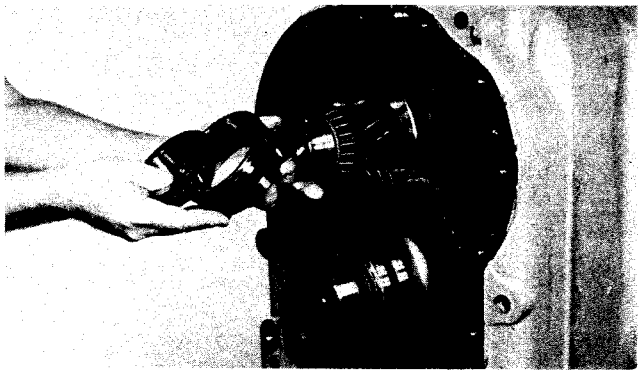


**Figure B**

**CAUTION:** Outer cone, double bearing cup, spacer and inner bearing cone are replaced as a set.

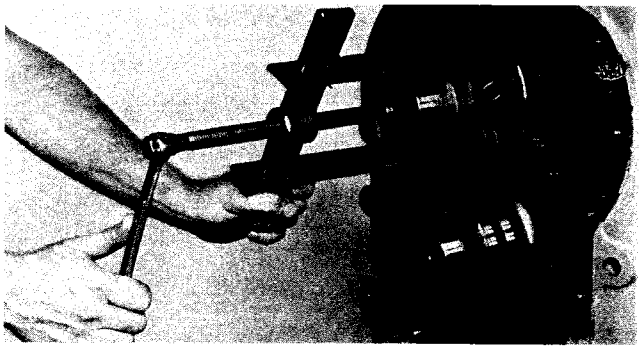


**Figure C**

Remove low clutch inner bearing cone. **NOTE:** To remove the inner cone bearing without damage, a special bearing puller must be made (see diagram Fig. D) or the outer cage and rollers may be pulled from the bearing inner race and the inner race can be removed after the low clutch assembly has been removed from the transmission. See caution in Figure B.

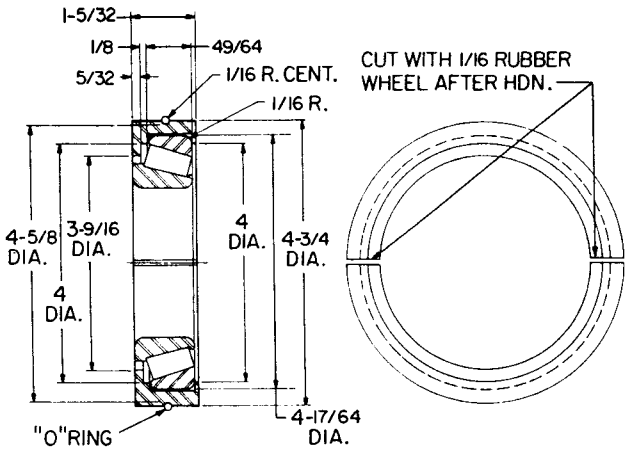



**Figure D**

A timken bearing cup, No. 29520 must be used with the above bearing puller.

## REASSEMBLY

**Figure E**

Install low clutch inner taper bearing. **NOTE:** Heat bearing in hot oil bath prior to installation.

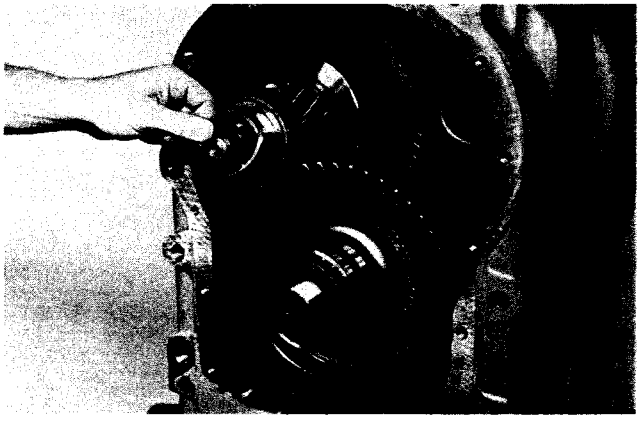


**Figure F**

Install bearing spacer.

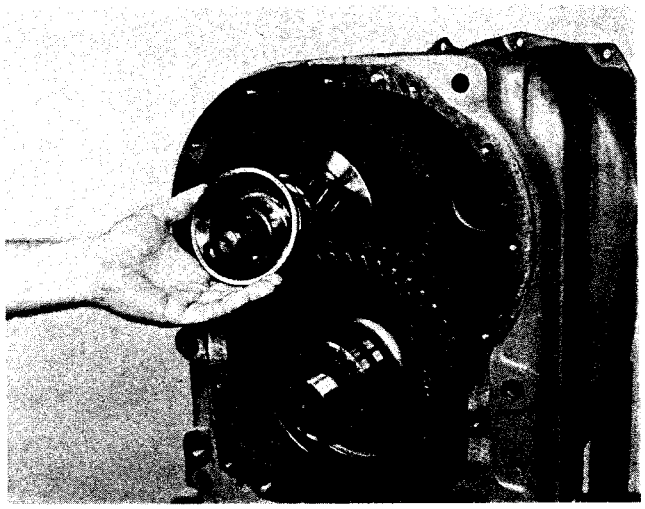


**Figure G**

Install bearing cup.

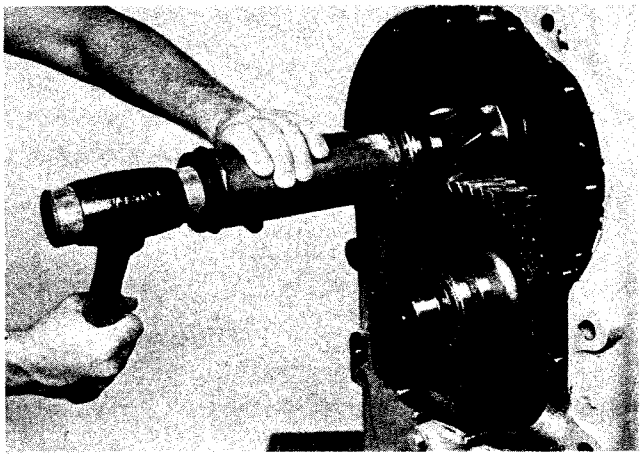


**Figure H**

Install outer taper bearing. **NOTE:** Heat bearing in hot oil bath prior to installation.

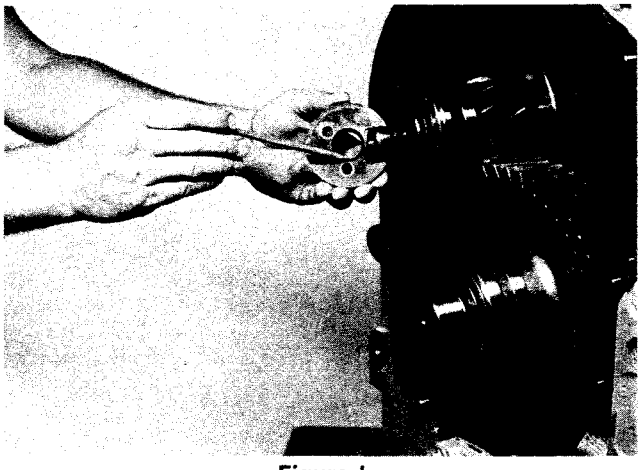


**Figure I**

Install retainer plate, inner diameter chamfer toward bearing.

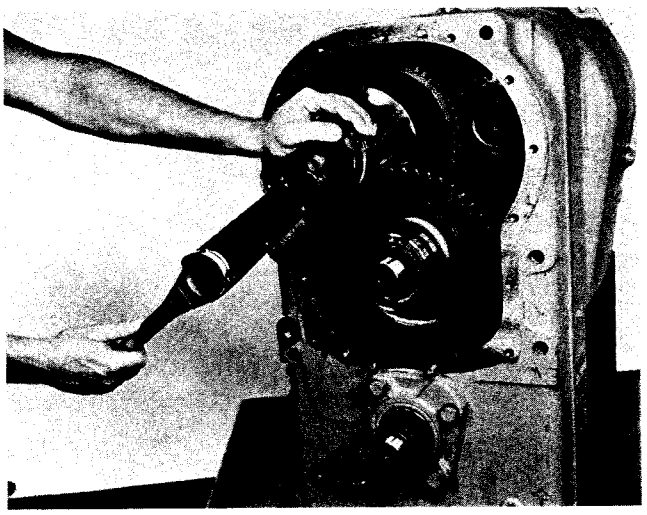


**Figure J**

Install bolts and block gears. Torque bolts to specifications and lock wire together.

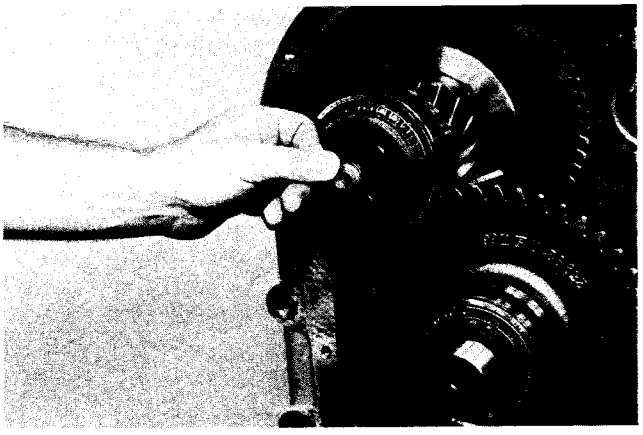


**Figure K**

Install low clutch shaft sealing ring.

## 16 SCREW RING GEAR INSTALLATION PROCEDURE
## (Non-Asbestos Ring Gear)

1. Remove all burrs from flywheel mounting face and pilot bores. Clean the torque converter ring gear flywheel mounting surface and the ring gear screw tapped holes with solvent. Dry thoroughly, being certain ring gear screw holes are dry and clean.

2. Check engine flywheel and housing or housing adaptor for conformance to standard S.A.E. No. 3 – SAE J927 and J1033 tolerance specifications for pilot bores size, pilot bores eccentricities and mounting face deviations. Measure and record engine crankshaft end play.

3. Install torque converter ring gear as shown.

   **NOTE: Assembly of the ring gear must be completed within a fifteen minute period from start of screw installation.** The screws are prepared with an epoxy coating which begins to harden after installation in the flywheel mounting holes. If not tightened to proper torque within the fifteen minute period insufficient screw clamping tension will result.

4. Install backing ring and sixteen (16) special screws to approximately .06 inch [1,5 mm] of seated position. It is permissible to use a power wrench for this installation phase. With a calibrated torque wrench tighten screws 30 to 33 pounds feet of torque [40,7 - 44,7 N.m].

   To obtain maximum effectiveness of the special screw's locking feature, a minimum time period after screw installation of twelve (12) hours is suggested before engine start-up.

   The special screw is to be used for **ONE** installation only. If the screw is removed for any reason it **MUST BE REPLACED.** It is recommended that the epoxy left in the flywheel hole be removed with the proper tap and cleaned with solvent. Dry hole thoroughly and use a **NEW** screw for re-installation.

5. Assemble torque converter to engine flywheel by sliding converter into position by hand before fastening housing attachment screws. This may require more than one trial to match the drive gear teeth. Pulling the converter into position with housing attachment bolts is not recommended.

6. Measure engine crankshaft end play after assembly of torque converter. This value must be within one thousandth (.001) of an inch [0,0254mm] of end play recorded (in Paragraph #2) before assembly of torque converter.

**802553 – 1.5 INCH [38,1] 16 SCREW RING GEAR KIT**

| | | |
|---|---|---|
| 1 | 249341 | Torque Converter Ring Gear |
| 16 | 236288 | Ring Gear Screw 1.5 Inch [38,1] |
| 1 | 802555 | Installation Instruction Sheet |

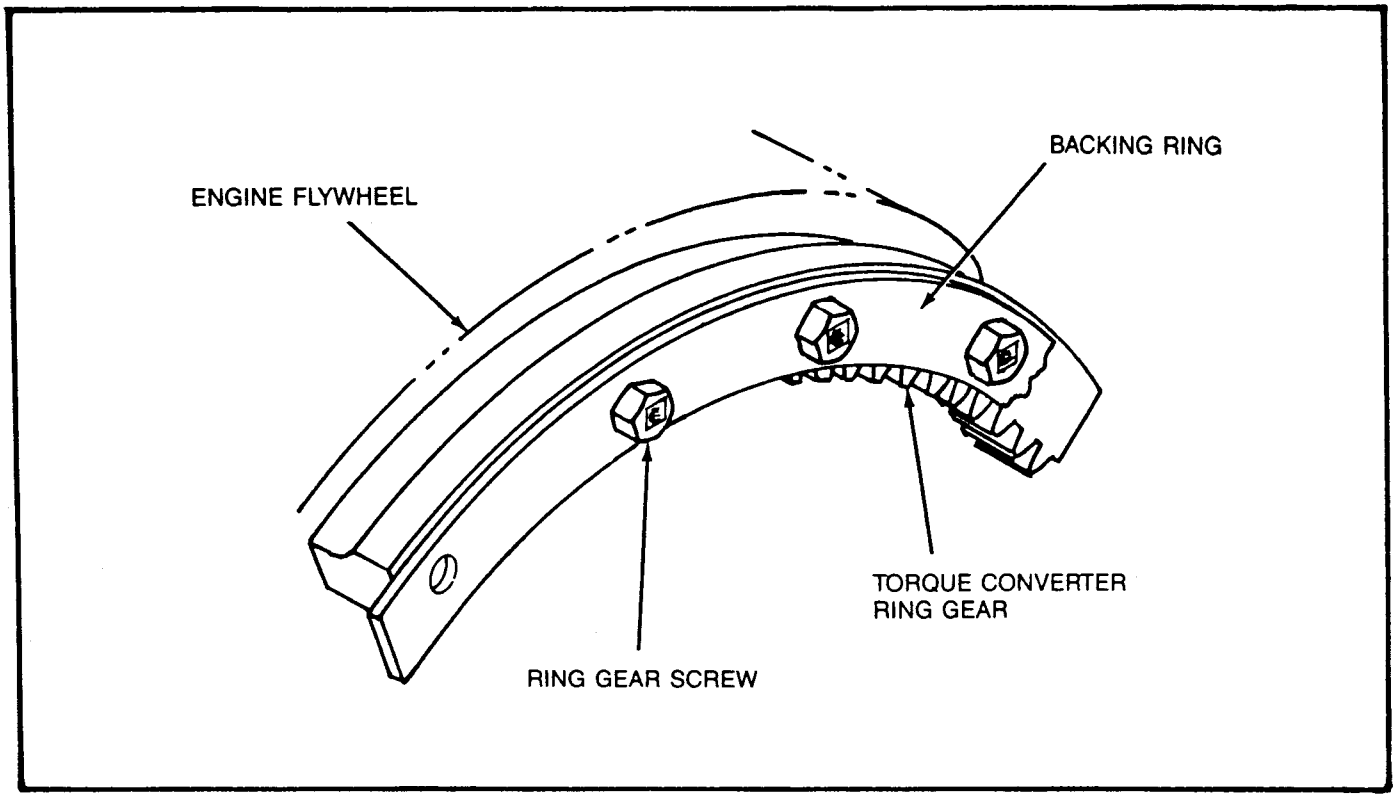
**802554 – 1.5 INCH [38,1] 16 SCREW RING GEAR KIT**

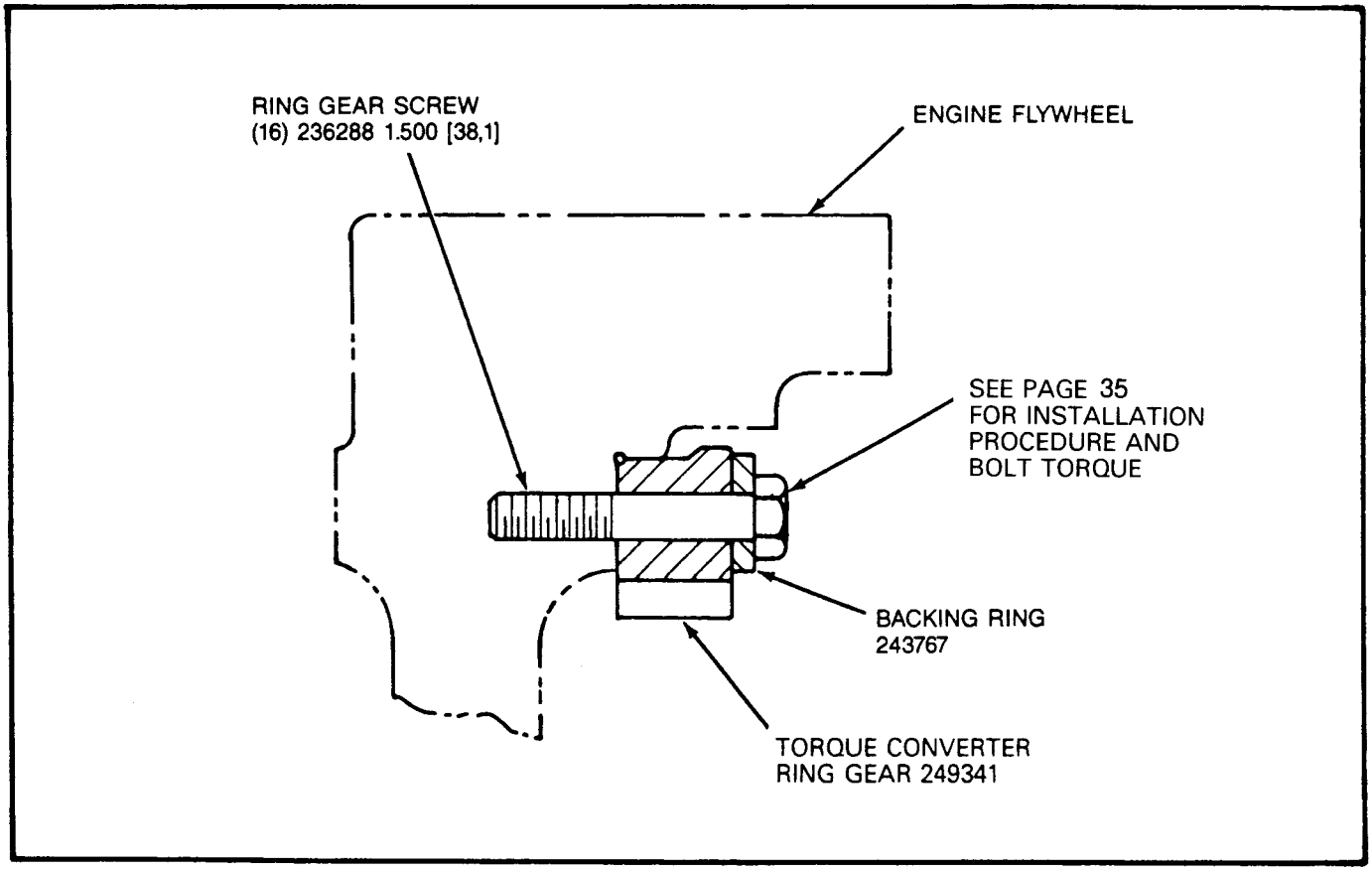
| | | |
|---|---|---|
| 1 | 249341 | Torque Converter Ring Gear |
| 16 | 236288 | Ring Gear Screw 1.5 Inch [38,1] |
| 1 | 243767 | Backing Ring |
| 1 | 802555 | Installation Instruction Sheet |

243767 Backing Ring not included in 802553 Ring Gear Kit. Must be Ordered Separately.

Dimensions are in inches – Dimensions in [ ] are mm.

**SEE PAGE 36 FOR INSTALLATION ILLUSTRATIONS**


BACKING RING
ENGINE FLYWHEEL
TORQUE CONVERTER
RING GEAR
RING GEAR SCREW


RING GEAR SCREW
(16) 236288 1.500 [38,1]
ENGINE FLYWHEEL
SEE PAGE 35
FOR INSTALLATION
PROCEDURE AND
BOLT TORQUE
BACKING RING
243767
TORQUE CONVERTER
RING GEAR 249341

## 32 SCREW RING GEAR INSTALLATION PROCEDURE
## (Non-Asbestos Ring Gear)

1. Remove all burrs from flywheel mounting face and pilot bores. Clean the torque converter ring gear flywheel mounting surface and the ring gear screw tapped holes with solvent. Dry thoroughly, being certain ring gear screw holes are dry and clean.

2. Check engine flywheel and housing or housing adaptor for conformance to standard S.A.E. No. 3 — SAE J927 and J1033 tolerance specifications for pilot bores size, pilot bores eccentricities and mounting face deviations. Measure and record engine crankshaft end play.

3. Install torque converter ring gear as shown.

   **NOTE: Assembly of the ring gear must be completed within a fifteen minute period from start of screw installation.** The screws are prepared with an epoxy coating which begins to harden after installation in the flywheel mounting holes. If not tightened to proper torque within the fifteen minute period insufficient screw clamping tension will result.

4. Install backing ring and thirty-two (32) special screws to approximately .06 inch [1,5 mm] of seated position. It is permissible to use a power wrench for this installation phase. With a calibrated torque wrench tighten screws 23 to 25 pounds feet of torque [31,2 - 33,8 N.m].

   To obtain maximum effectiveness of the special screw's locking feature, a minimum time period after screw installation of twelve (12) hours is suggested before engine start-up.

   The special screw is to be used for **ONE** installation only. If the screw is removed for any reason it **MUST BE REPLACED**. It is recommended that the epoxy left in the flywheel hole be removed with the proper tap and cleaned with solvent. Dry hole thoroughly and use a **NEW** screw for re-installation.

5. Assemble torque converter to engine flywheel by sliding converter into position by hand before fastening housing attachment screws. This may require more than one trial to match the drive gear teeth. Pulling the converter into position with housing attachment bolts is not recommended.

6. Measure engine crankshaft end play after assembly of torque converter. This value must be within one thousandth (.001) of an inch [0,0254mm] of end play recorded (in Paragraph #2) before assembly of torque converter.

**802544 — 1.5 INCH [38,1] 32 SCREW RING GEAR KIT**

| | | |
|---|---|---|
| 1 | 249265 | Torque Converter Ring Gear |
| 32 | 243970 | Ring Gear Screw 1.5 Inch [38,1] |
| 1 | 802550 | Installation Instruction Sheet |

**802545 — 1.75 INCH [44,4] 32 SCREW RING GEAR KIT**

| | | |
|---|---|---|
| 1 | 249265 | Torque Converter Ring Gear |
| 32 | 244903 | Ring Gear Screw 1.75 Inch [44,4] |
| 1 | 802550 | Installation Instruction Sheet |

**802546 — 2.0 INCH [50,8] 32 SCREW RING GEAR KIT**

| | | |
|---|---|---|
| 1 | 249265 | Torque Converter Ring Gear |
| 32 | 240318 | Ring Gear Screw 2.0 Inch [50,8] |
| 1 | 802550 | Installation Instruction Sheet |

**802547 — 2.5 INCH [63,5] 32 SCREW RING GEAR KIT**

| | | |
|---|---|---|
| 1 | 249265 | Torque Converter Ring Gear |
| 32 | 237153 | Ring Gear Screw 2.5 Inch [63,5] |
| 1 | 802550 | Installation Instruction Sheet |

**802548 — 3.0 INCH [76,2] 32 SCREW RING GEAR KIT**

| | | |
|---|---|---|
| 1 | 249265 | Torque Converter Ring Gear |
| 32 | 236938 | Ring Gear Screw 3.0 Inch [76,2] |
| 1 | 802550 | Installation Instruction Sheet |

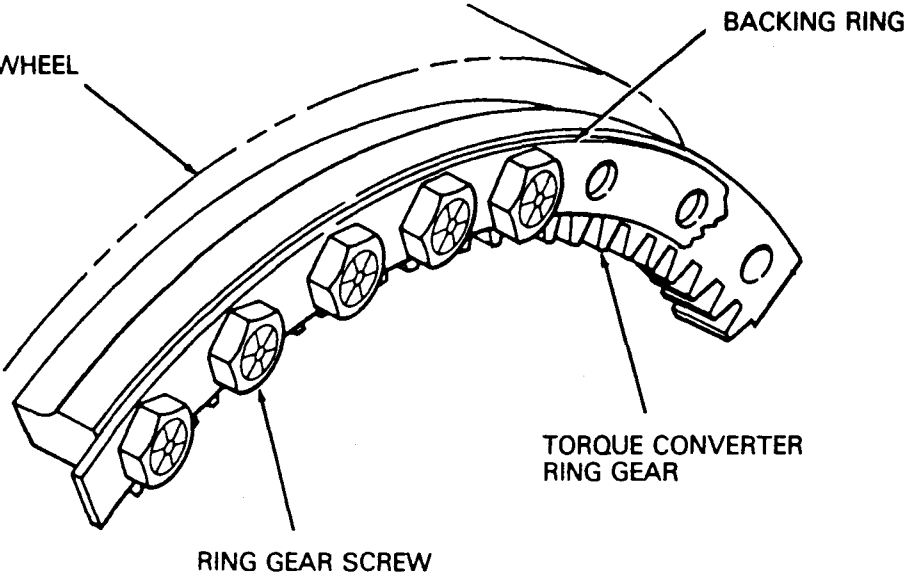
**802549 — M8-32 SCREW RING GEAR KIT**

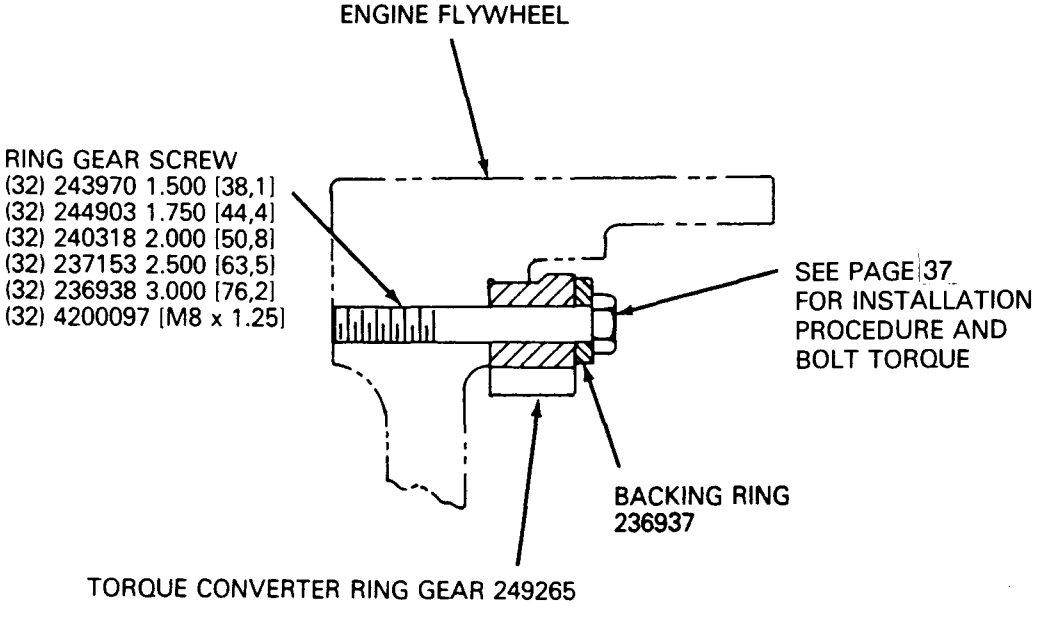
| | | |
|---|---|---|
| 1 | 249265 | Torque Converter Ring Gear |
| 32 | 4200097 | Ring Gear Screw [M8 x 1.25] |
| 1 | 802550 | Installation Instruction Sheet |

236937 Backing Ring Not Included in Ring Gear Kit. Must be Ordered Separately.

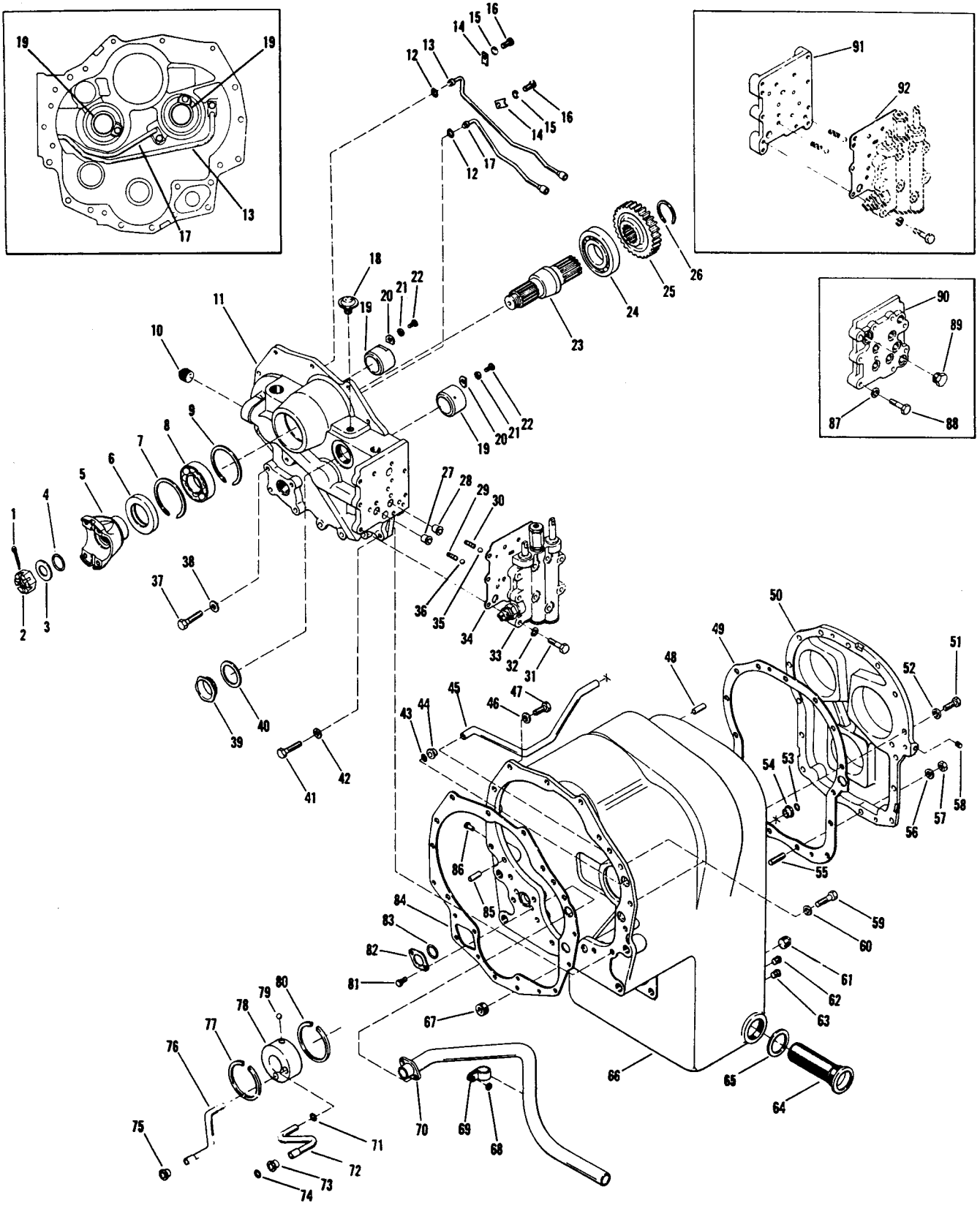
**NOTE:** The initial installation drive gear mounting kit includes a converter air breather. This breather is used on C & CL 270/C & CL 320 converters only and is not required for the HR & LHR 28000/HR & LHR 32000 applications.

**SEE PAGE 38 FOR INSTALLATION ILLUSTRATIONS**


ENGINE FLYWHEEL
BACKING RING
TORQUE CONVERTER
RING GEAR
RING GEAR SCREW


ENGINE FLYWHEEL
RING GEAR SCREW
(32) 243970 1.500 [38,1]
(32) 244903 1.750 [44,4]
(32) 240318 2.000 [50,8]
(32) 237153 2.500 [63,5]
(32) 236938 3.000 [76,2]
(32) 4200097 [M8 x 1.25]
SEE PAGE 37
FOR INSTALLATION
PROCEDURE AND
BOLT TORQUE
BACKING RING
236937
TORQUE CONVERTER RING GEAR 249265

# R-MODEL SECTION



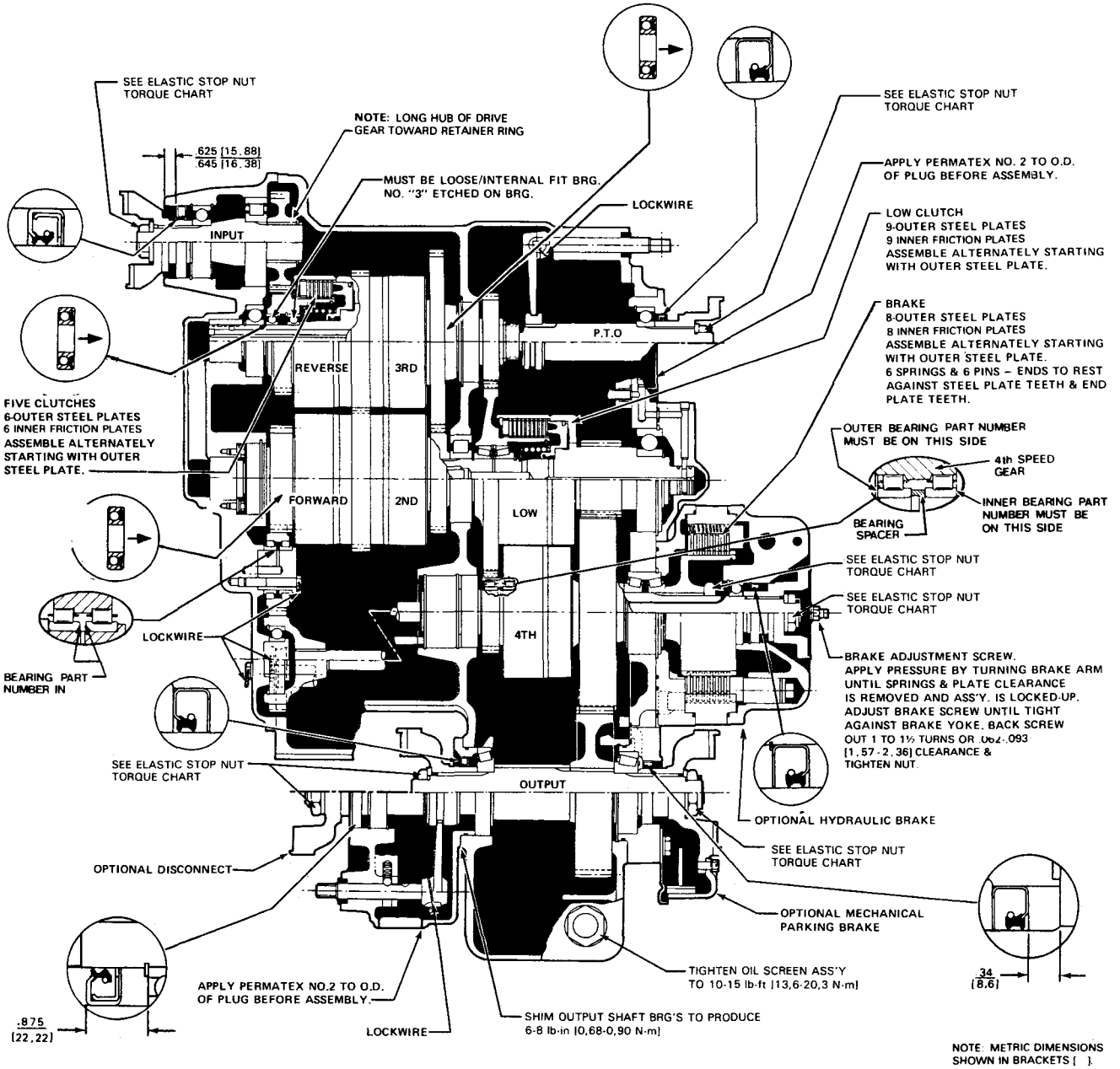
## R 28000 CASE AND FRONT COVER GROUP

| ITEM | DESCRIPTION | QTY. |
|---|---|---|
| 1 | Input Flange Nut Cotter | 1 |
| 2 | Flange Nut | 1 |
| 3 | Flange Nut Washer | 1 |
| 4 | Input Flange "O" Ring | 1 |
| 5 | Input Flange | 1 |
| 6 | Flange Oil Seal | 1 |
| 7 | Input Shaft Front Bearing Retainer Ring | 1 |
| 8 | Input Shaft Front Bearing | 1 |
| 9 | Input Shaft Front Bearing Retainer Ring | 1 |
| 10 | Pipe Plug | 1 |
| 11 | Front Cover and Tube Assembly | 1 |
| 12 | "O" Ring | 2 |
| 13 | 3rd Speed Tube Assembly | 1 |
| 14 | Tube Clip | 2 |
| 15 | Tube Clip Screw Lockwasher | 2 |
| 16 | Tube Clip Screw | 2 |
| 17 | Reverse Tube Assembly | 1 |
| 18 | Breather Assembly | 1 |
| 19 | Front Cover Sleeve | 2 |
| 20 | Front Cover Sleeve Lock | 2 |
| 21 | Sleeve Lock Screw Lockwasher | 2 |
| 22 | Sleeve Lock Screw | 2 |
| 23 | Input Shaft | 1 |
| 24 | Input Shaft Rear Bearing | 1 |
| 25 | Input Shaft Gear | 1 |
| 26 | Input Shaft Gear Retainer Ring | 1 |
| 27 | Tube Sleeve | 1 |
| 28 | Tube Sleeve | 1 |
| 29 | Detent Spring | 1 |
| 30 | Detent Spring | 1 |
| 31 | Valve to Housing Screw | 9 |
| 32 | Valve to Housing Screw Lockwasher | 9 |
| 33 | Control Valve Assembly | 1 |
| 34 | Control Valve Gasket | 1 |
| 35 | Detent Ball | 1 |
| 36 | Detent Ball | 1 |
| 37 | Front Cover to Transmission Case Screw | 4 |
| 38 | Front Cover to Transmission Case Screw Lockwasher | 4 |
| 39 | Front Cover Plug | 1 |
| 40 | Front Cover Plug Gasket | 1 |
| 41 | Front Cover to Transmission Case Screw | 4 |
| 42 | Front Cover to Transmission Case Screw Lockwasher | 4 |
| 43 | Clutch Pressure Tube "O" Ring | 1 |
| 44 | Tube Sleeve | 1 |
| 45 | Low Speed Clutch Pressure Tube | 1 |
| 46 | Front Cover to Case Screw Lockwasher | 5 |
| 47 | Front Cover to Case Screw | 5 |
| 48 | Rear Cover Dowel Pin | 2 |
| 49 | Rear Cover to Transmission Case Gasket | 1 |
| 50 | Rear Cover | 1 |
| 51 | Rear Cover to Transmission Case Screw | 13 |
| 52 | Rear Cover to Transmission Case Screw Lockwasher | 13 |
| 53 | Clutch Pressure Tube "O" Ring | 1 |
| 54 | Tube Sleeve | 1 |
| 55 | Rear Cover to Case Stud | 2 |
| 56 | Rear Cover to Case Stud Lockwasher | 2 |
| 57 | Rear Cover to Case Stud Nut | 2 |
| 58 | Rear Cover Pipe Plug | 1 |
| 59 | Front Cover to Transmission Case Screw | 5 |
| 60 | Front Cover to Transmission Case Screw Lockwasher | 5 |
| 61 | Magnetic Drain Plug | 1 |
| 62 | Oil Level Plug | 1 |
| 63 | Oil Level Plug | 1 |
| 64 | Screen Assembly | 1 |
| 65 | Screen Assembly Gasket | 1 |
| 66 | Transmission Case and Tube Assembly | 1 |
| 67 | Plug | 1 |
| 68 | Tube Clip Washer | 1 |
| 69 | Suction Line Tube Clip | 1 |
| 70 | Suction Tube Assembly | 1 |
| 71 | Pressure Tube "O" Ring | 1 |
| 72 | 4th Speed Pressure Tube | 1 |
| 73 | Tube Sleeve | 1 |
| 74 | Pressure Tube "O" Ring | 1 |
| 75 | Tube Sleeve | 1 |
| 76 | 4th Speed Clutch Lube Tube | 1 |
| 77 | Oil Distributor Retainer Ring | 1 |
| 78 | 4th Clutch Front Oil Distributor | 1 |
| 79 | Locking Ball | 1 |
| 80 | Oil Distributor Retainer Ring | 1 |
| 81 | Suction Line Screw | 2 |
| 82 | Suction Line Washer | 1 |
| 83 | Suction Line "O" Ring | 1 |
| 84 | Front Cover Gasket | 1 |
| 85 | Front Cover Dowel Pin | 2 |
| 86 | Rivet | 1 |
| 87 | Remote Valve Plate Screw Lockwasher | 9 |
| 88 | Remote Valve Plate Screw | 9 |
| 89 | Valve Plate Plug | 1 |
| 90 | Valve Plate | 1 |
| 91 | Control Valve Remote Mounting Plate | 1 |
| 92 | Control Valve to Plate Gasket | 1 |

## ELASTIC STOP NUT TORQUE

| THREAD SIZE | LB.-FT. | [N·m] |
|---|---|---|
| 1" - 20 | 150 - 200 | [203,4 - 271,1] |
| 1¼" - 18 | 200 - 250 | [271,2 - 338,9] |
| 1½" - 18 | 300 - 350 | [406,8 - 474,5] |
| 1¾" - 12 | 400 - 450 | [542,4 - 610,1] |

1. USE PERMATEX & CRANE SEALER ONLY WHERE SPECIFIED.
2. ALL LEAD IN CHAMFERS FOR OIL SEALS, PISTON RINGS & "O" RINGS MUST BE SMOOTH & FREE FROM BURRS. INSPECT AT ASSEMBLY.
3. LUBRICATE ALL PISTON RING GROOVES & "O" RINGS WITH OIL BEFORE ASSEMBLY.
4. APPLY VERY LIGHT COAT OF PERMATEX NO.2 TO O.D. OF ALL OIL SEALS BEFORE ASSEMBLY.
5. AFTER ASSEMBLY OF PARTS USING PERMATEX OR CRANE SEALER, THERE MUST NOT BE ANY FREE OR EXCESS MATERIAL THAT COULD ENTER THE OIL CIRCUIT.
6. APPLY LIGHT COAT OF CRANE SEALER TO ALL PIPE PLUGS.
7. APPLY A THIN COATING OF GREASE BETWEEN SEAL LIPS ON LIP TYPE SEALS PRIOR TO ASSEMBLY.
8. APPLY LIGHT COAT OF PERMATEX NO. 2 TO ALL THRU STUD THREADS.




NOTE: METRIC DIMENSIONS SHOWN IN BRACKETS [ ].

R-28420 SERIES POWER SHIFT TRANSMISSION WITH VARIOUS OPTIONS

## 28000 4 SPEED LONG DROP
## R MODEL (REMOTE MOUNTED) TRANSMISSION FRONT COVER REMOVAL, DISASSEMBLY, REASSEMBLY AND INSTALLATION ON TRANSMISSION

### FRONT COVER REMOVAL

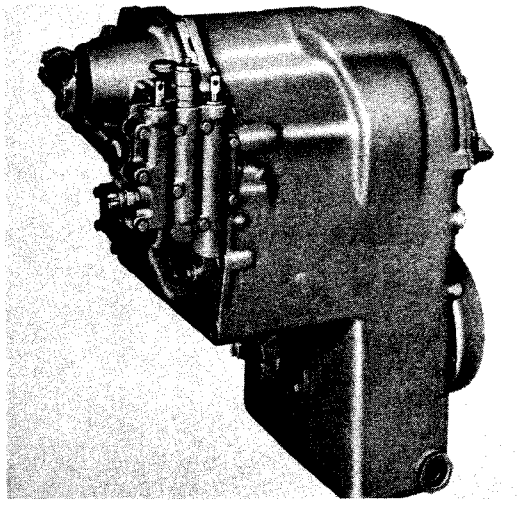


**Figure 1**
Side view of R 28000

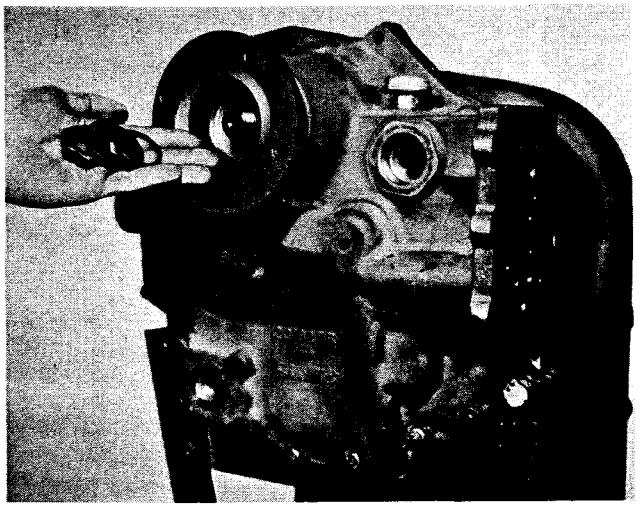


**Figure 3**
Remove companion flange nut, washer and "O" Ring.

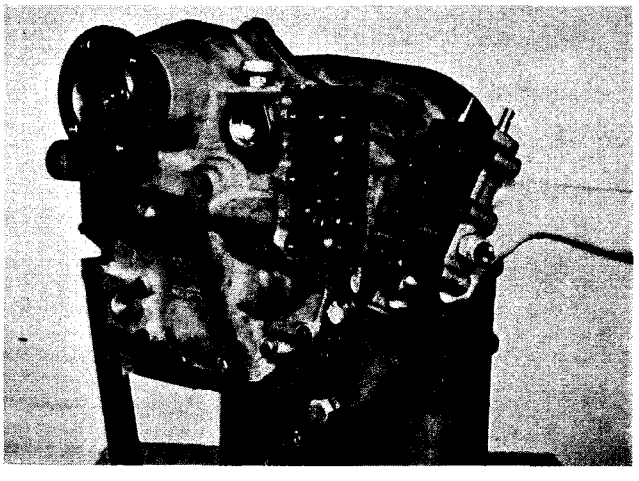


**Figure 2**
Remove control valve bolts and washers. Remove control valve. Use caution as not to lose detent springs and balls.

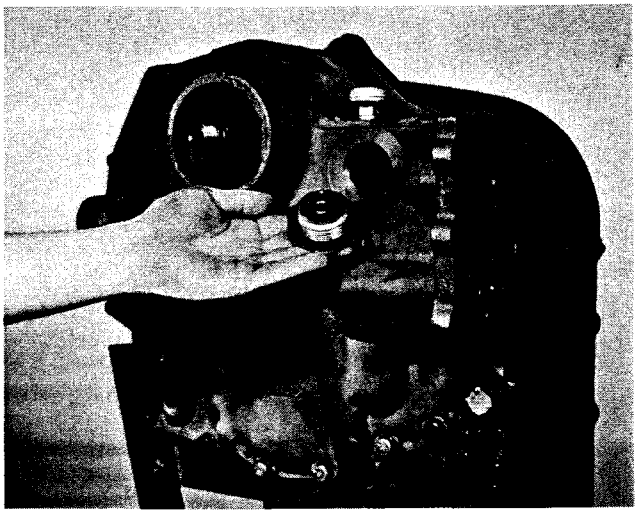


**Figure 4**
Remove front cover plug.

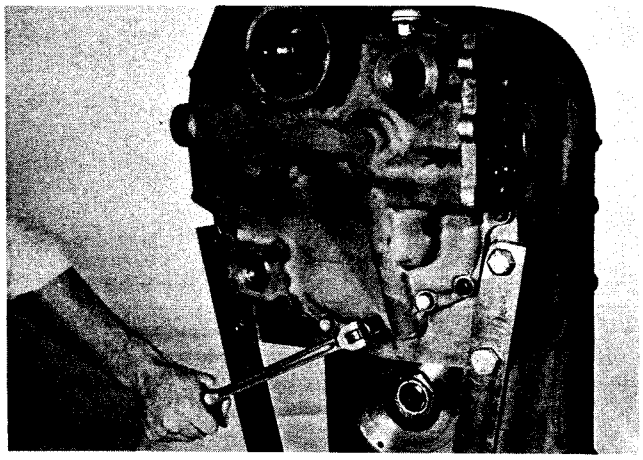


**Figure 5**
Remove bolts securing front cover to transmission housing.

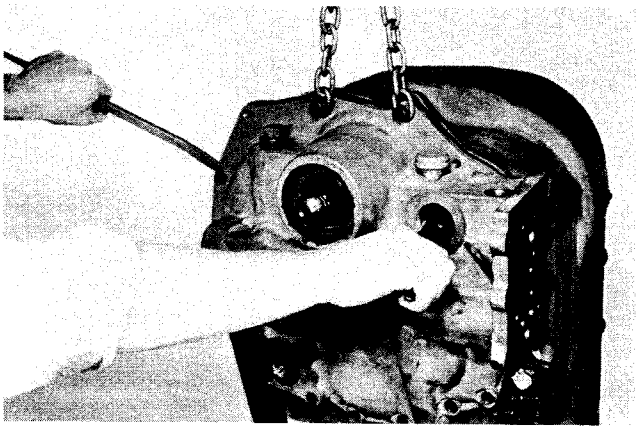


**Figure 6**
Support front cover with a chain fall. Using spreading type snap ring pliers, spread ears on forward clutch front bearing retaining ring. Holding snap ring open pry front cover from transmission housing.

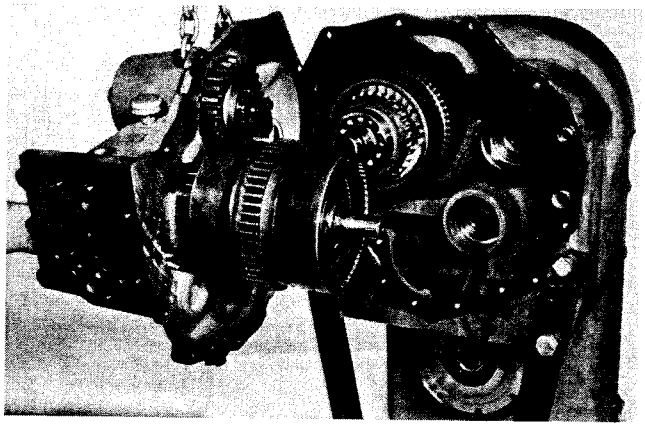


**Figure 7**
If forward and 2nd clutch comes out with front cover, spread ears on front bearing snap ring and separate clutch from front cover.

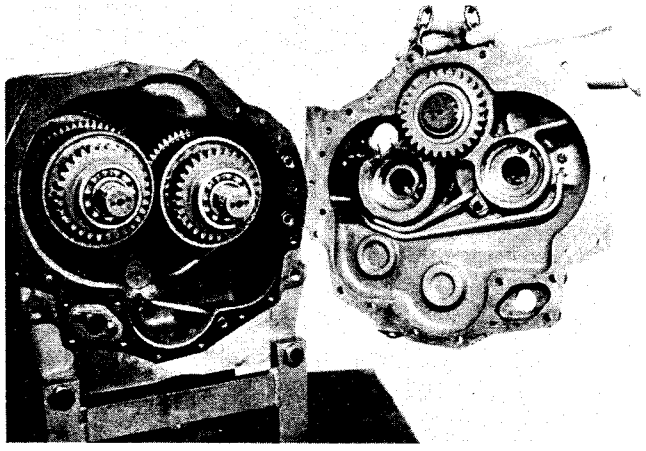


**Figure 8**
Front cover removed with forward and 2nd and reverse and 3rd clutch in transmission case.

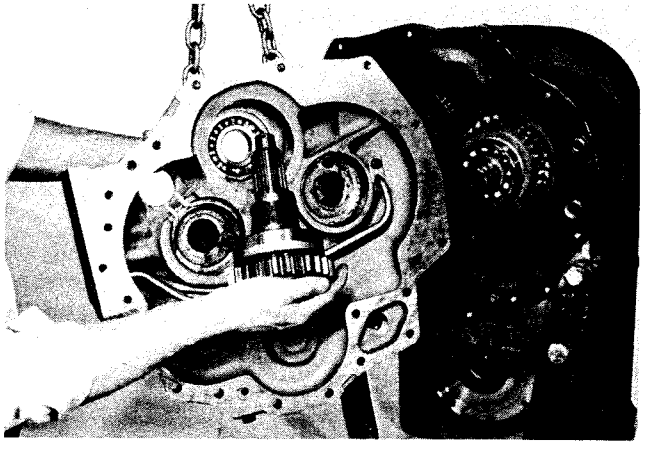


**Figure 9**
If input shaft is to be removed, tap on threaded end of shaft, remove input shaft, gear and bearing. See page 6, Figure 34 for complete transmission disassembly.

**FRONT COVER ASSEMBLY**

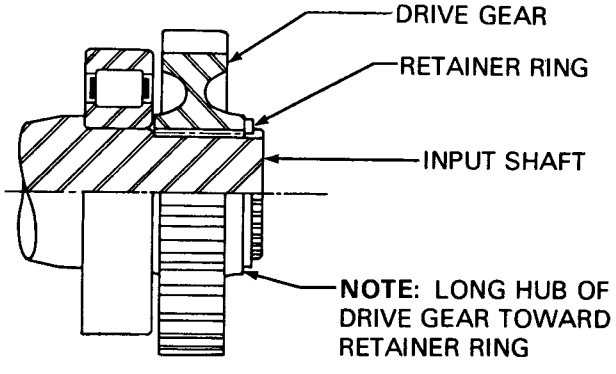



**Figure 10**
**Input shaft, rear bearing, drive gear and snap ring.**

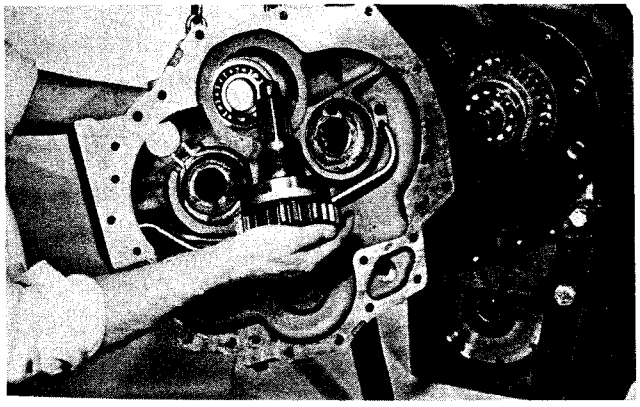


**Figure 11**
Install input shaft into front bearing.

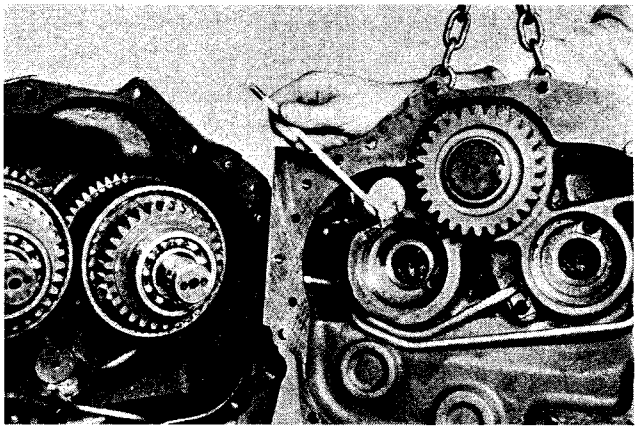


**Figure 12**
Forward clutch front bearing locating ring.

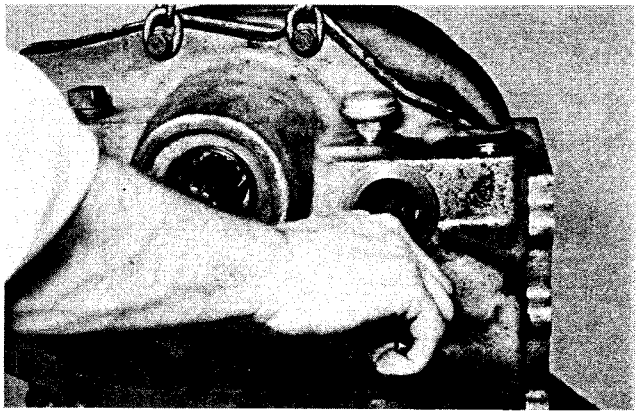


**Figure 13**
Support front cover with a chain fall. Spread forward clutch front bearing retainer ring. Position front cover to transmission case. Tap cover into place using caution as not to damage any of the clutch shaft piston rings.

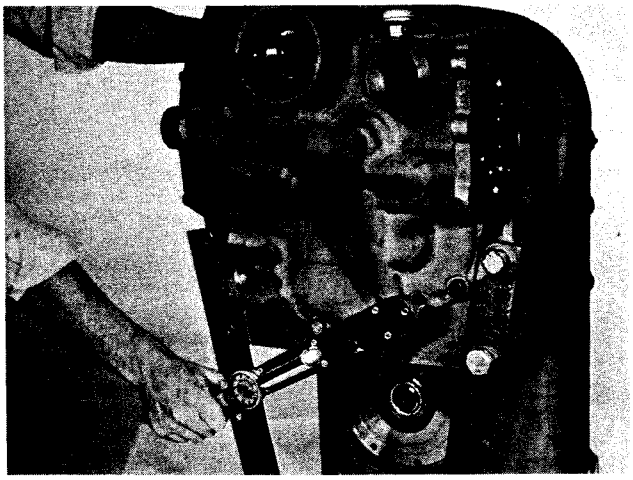


**Figure 14**
Install cover to case bolts. Tighten to specified torque.

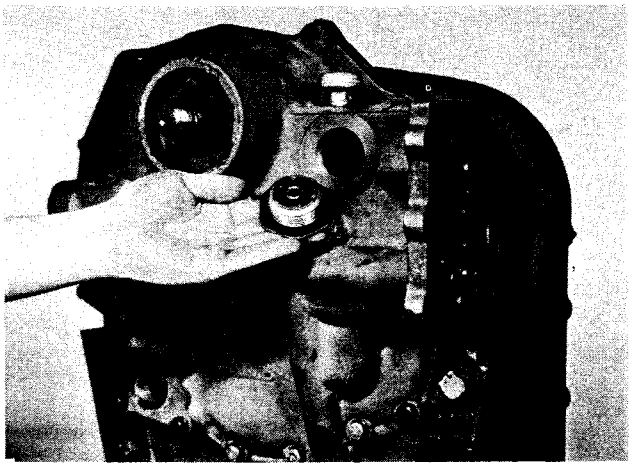


**Figure 15**
Install front cover plug.

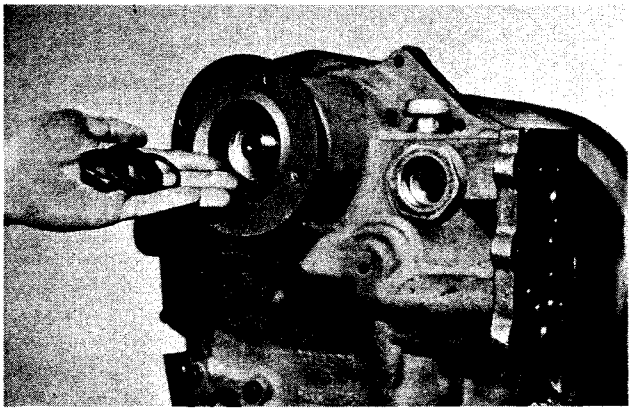


**Figure 16**
Install companion flange, flange "O" ring, washer and nut. Tighten standard slotted nut or elastic stop nut to specified torque. (See elastic stop nut torque chart.)

## PROPER INSTALLATION OF TEFLON PISTON RING AND PISTON RING EXPANDER SPRINGS

**NOTE: NOT ALL TRANSMISSIONS WILL HAVE TEFLON PISTON RINGS AND EXPANDER SPRINGS**

1. Fill the oil sealing ring grooves with a good grade of grease, this will help stabilize the teflon ring and expander spring in the ring groove for installation.

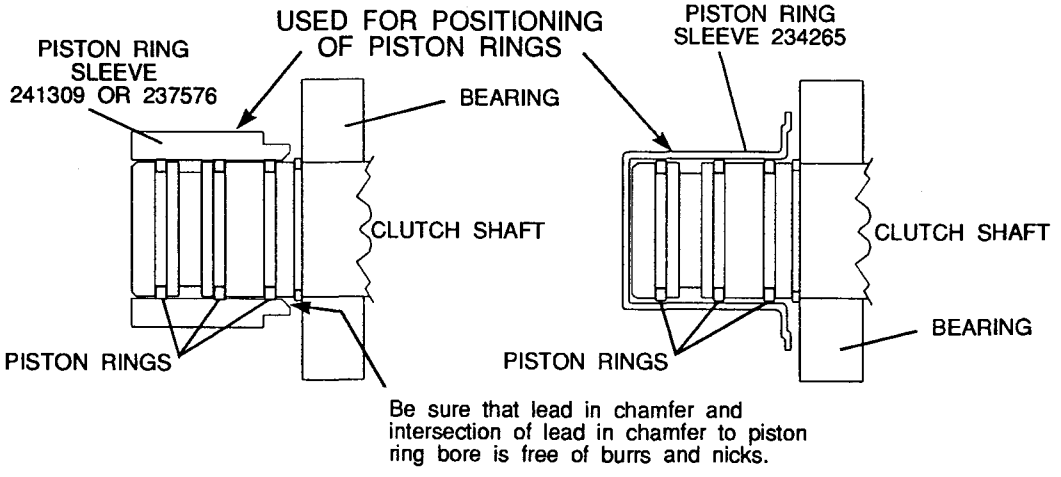
2. Position the expander spring in the inner groove of the new piston ring, with the expander spring gap 180° from the hook joint gap of the piston ring.

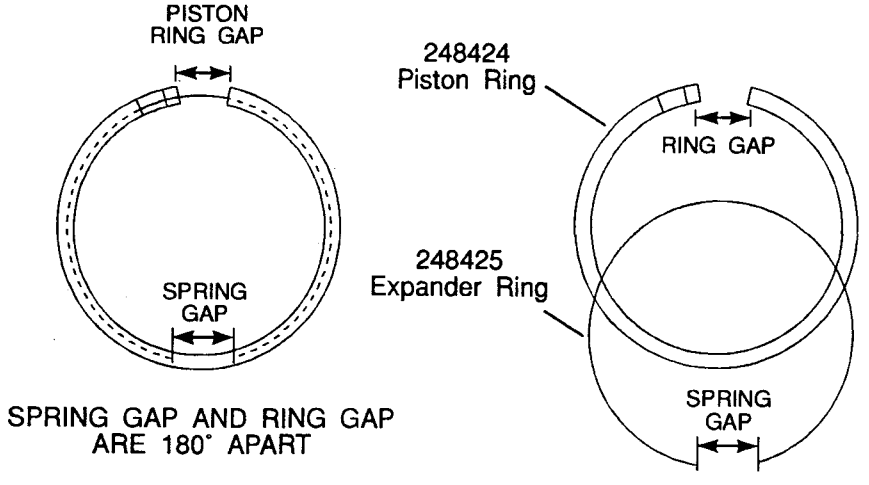
3. Carefully position the piston ring and expander spring on the clutch shaft in the inner most ring groove. Hook the piston piston ring joint.

4. Repeat steps 1, 2 and 3 for the remaining ring or rings making certain all hook joints are fastened securely.

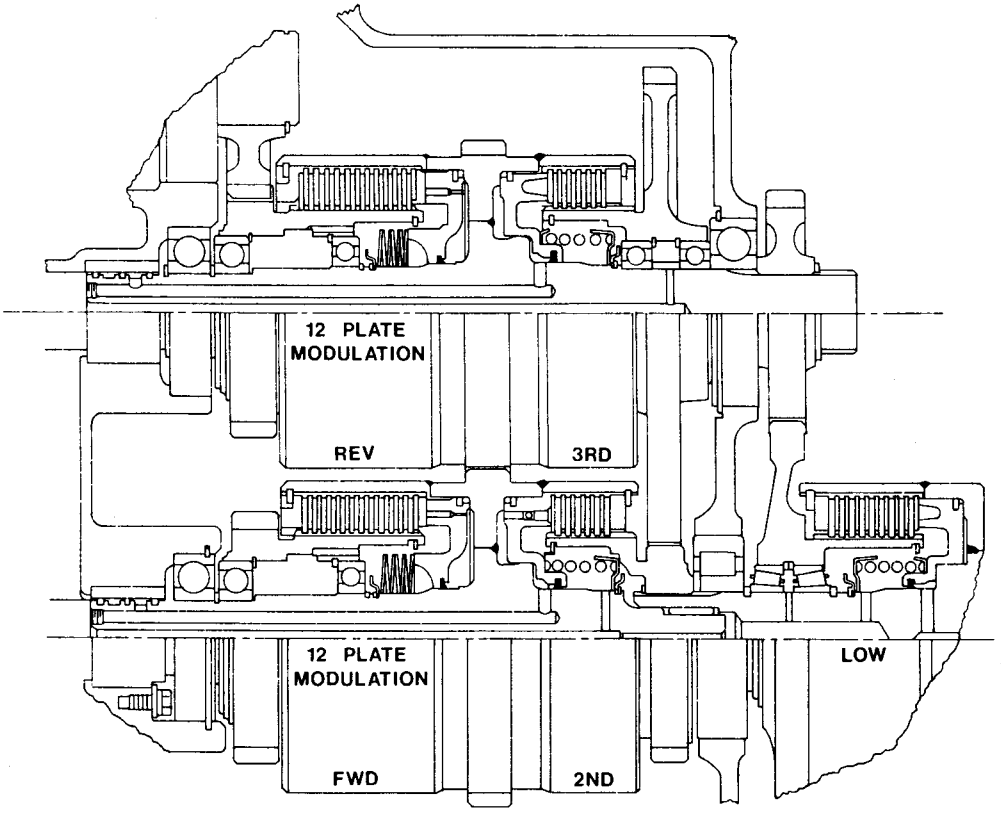
5. Apply a heavy coat of grease to the outer diameter of the rings and clutch shaft. Center the piston ring's in the ring groove.

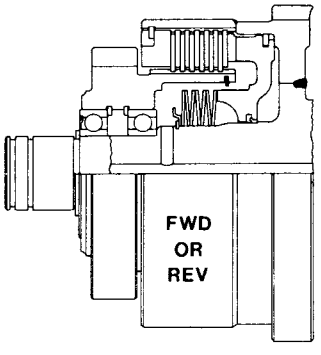
6. Before installing the clutch assembly in the front cover or converter housing it is recommended a piston ring sleeve P/N's 241309, 237576 or 234265 be used to center all of the piston rings in their respective ring grooves. Use extreme caution to not damage piston rings when installing the clutch shaft in the front trasnmission cover or converter housing.



## Clutch Modulation Cross Section

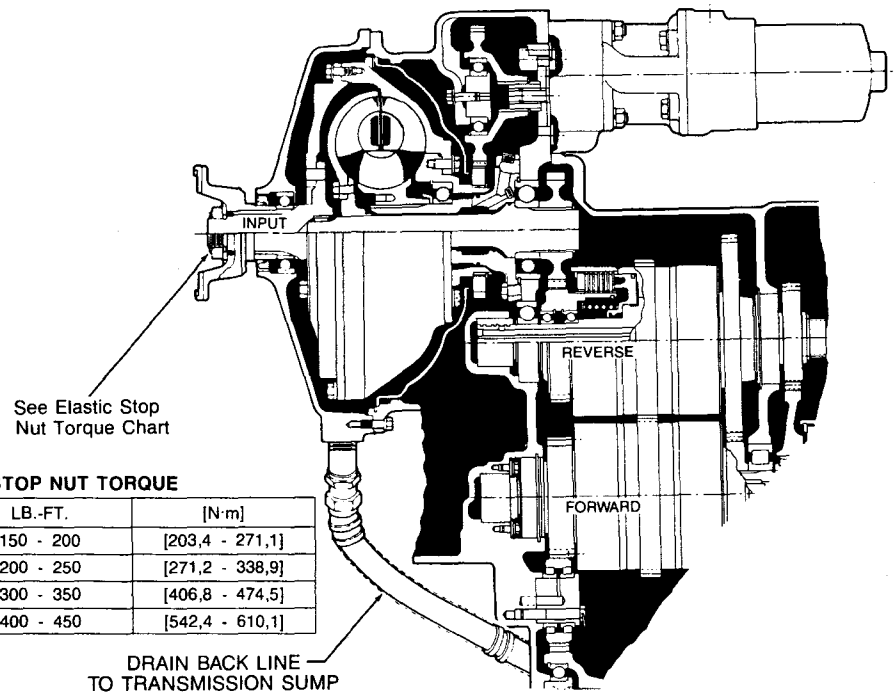



6 PLATE MODULATION

NOTE: The disc spring packs are to be used as complete assemblies and care should be taken not to intermix the individual disc springs with disc springs in another clutch or disc spring pack. Service replacement assemblies are banded together and must be replaced as assembly.

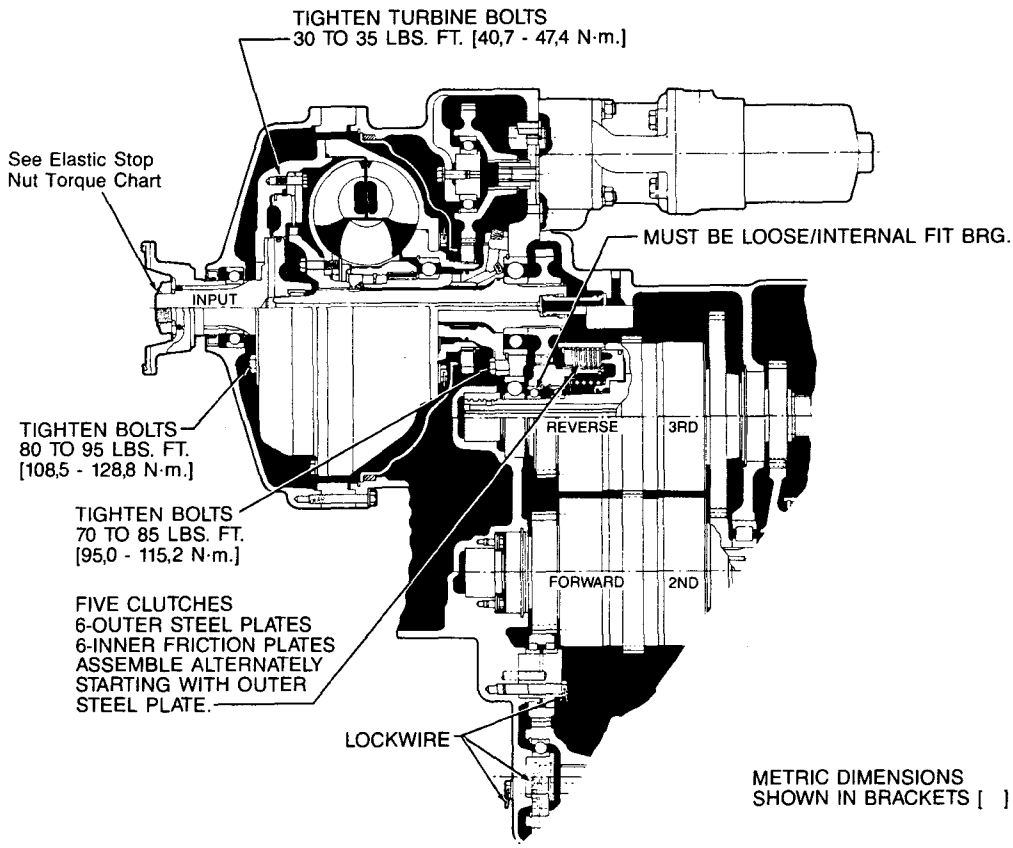
## MHR SECTION



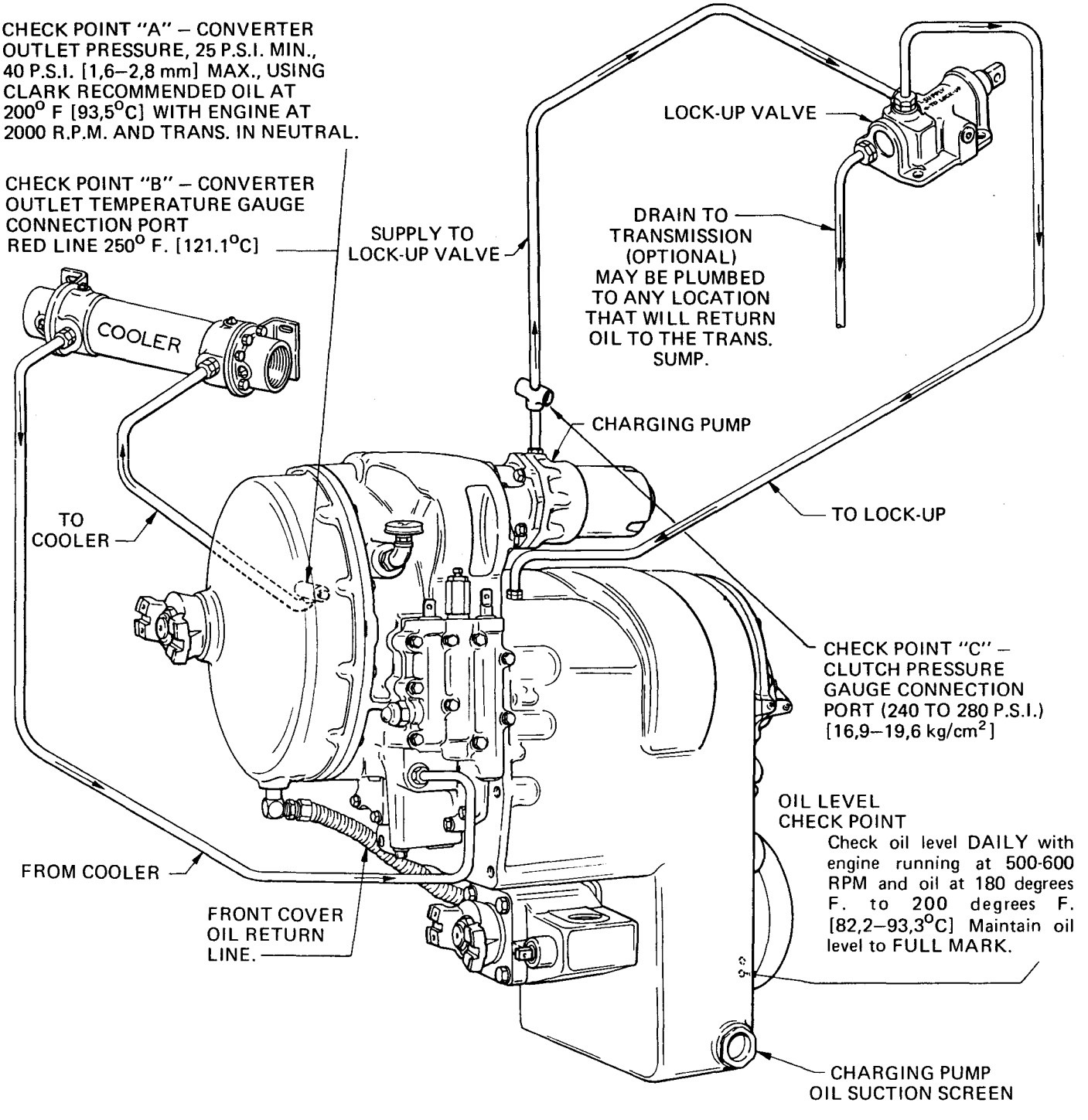

**ELASTIC STOP NUT TORQUE**

| THREAD SIZE | LB.-FT. | [N·m] |
|---|---|---|
| 1" - 20 | 150 - 200 | [203,4 - 271,1] |
| 1¼" - 18 | 200 - 250 | [271,2 - 338,9] |
| 1½" - 18 | 300 - 350 | [406,8 - 474,5] |
| 1¾" - 12 | 400 - 450 | [542,4 - 610,1] |

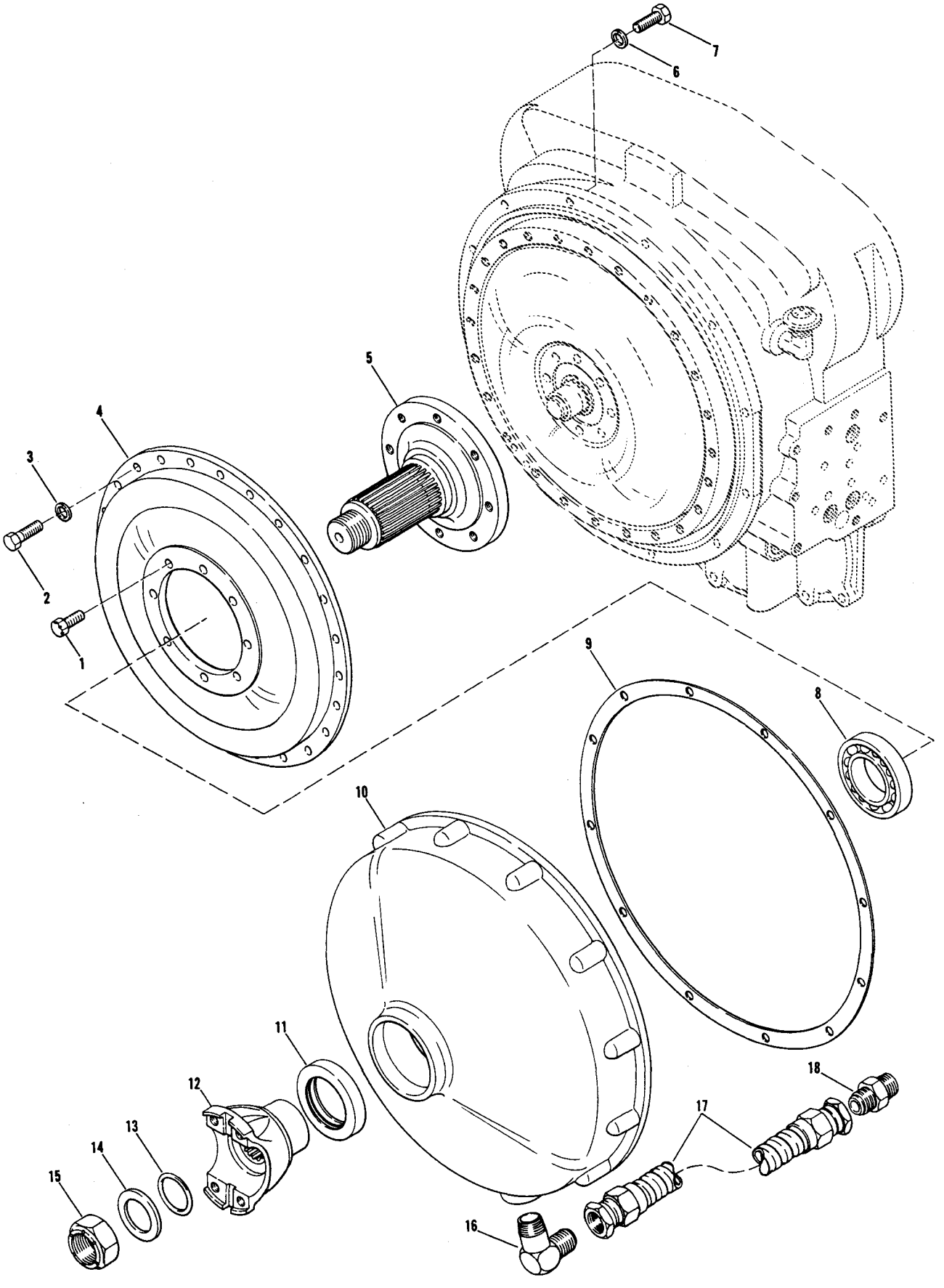
**MHR SERIES POWER SHIFT TRANSMISSION**




**FLMHR SERIES POWER SHIFT TRANSMISSION**




**LMHR 28000 SERIES PLUMBING DIAGRAM**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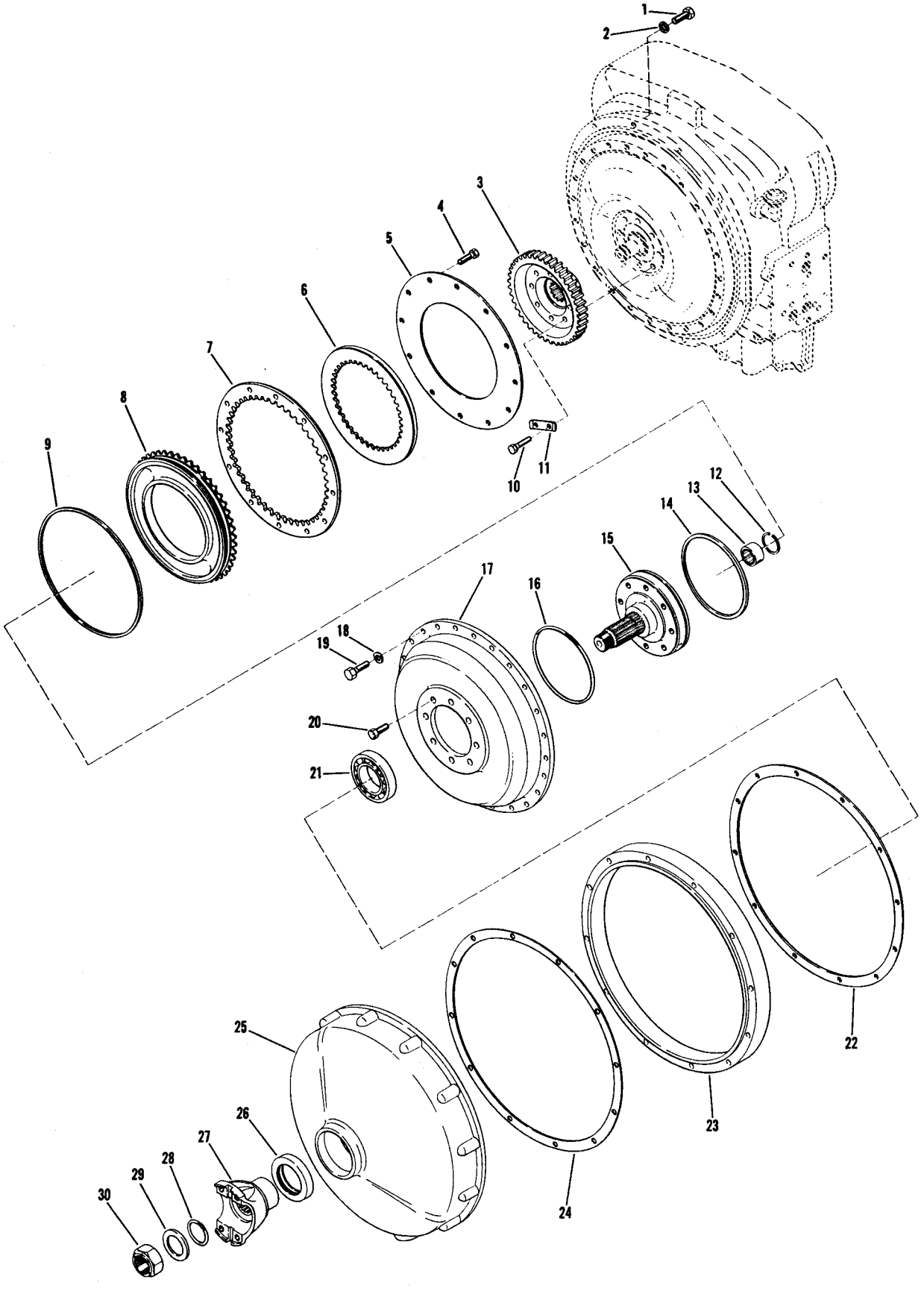
## MHR COVER GROUP

| Item | Description | Qty. |
|---|---|---|
| 1 | Input Shaft to Impeller Cover Screw | 8 |
| 2 | Impeller to Cover Screw | 24 |
| 3 | Impeller to Cover Screw Lockwasher | 24 |
| 4 | Impeller Cover | 1 |
| 5 | Input Shaft | 1 |
| 6 | Housing Cover Screw Lockwasher | 12 |
| 7 | Converter Housing to Cover Screw | 12 |
| 8 | Input Shaft Bearing | 1 |
| 9 | Converter Housing Front Cover Gasket | 1 |
| 10 | Converter Housing Front Cover | 1 |
| 11 | Front Cover Oil Seal | 1 |
| 12 | Input Flange | 1 |
| 13 | Flange O-Ring | 1 |
| 14 | Flange Washer | 1 |
| 15 | Flange Nut | 1 |
| 16 | Hose Fitting (Converter End) | 1 |
| 17 | Hose Assembly | 1 |
| 18 | Hose Fitting (Transmission End) | 1 |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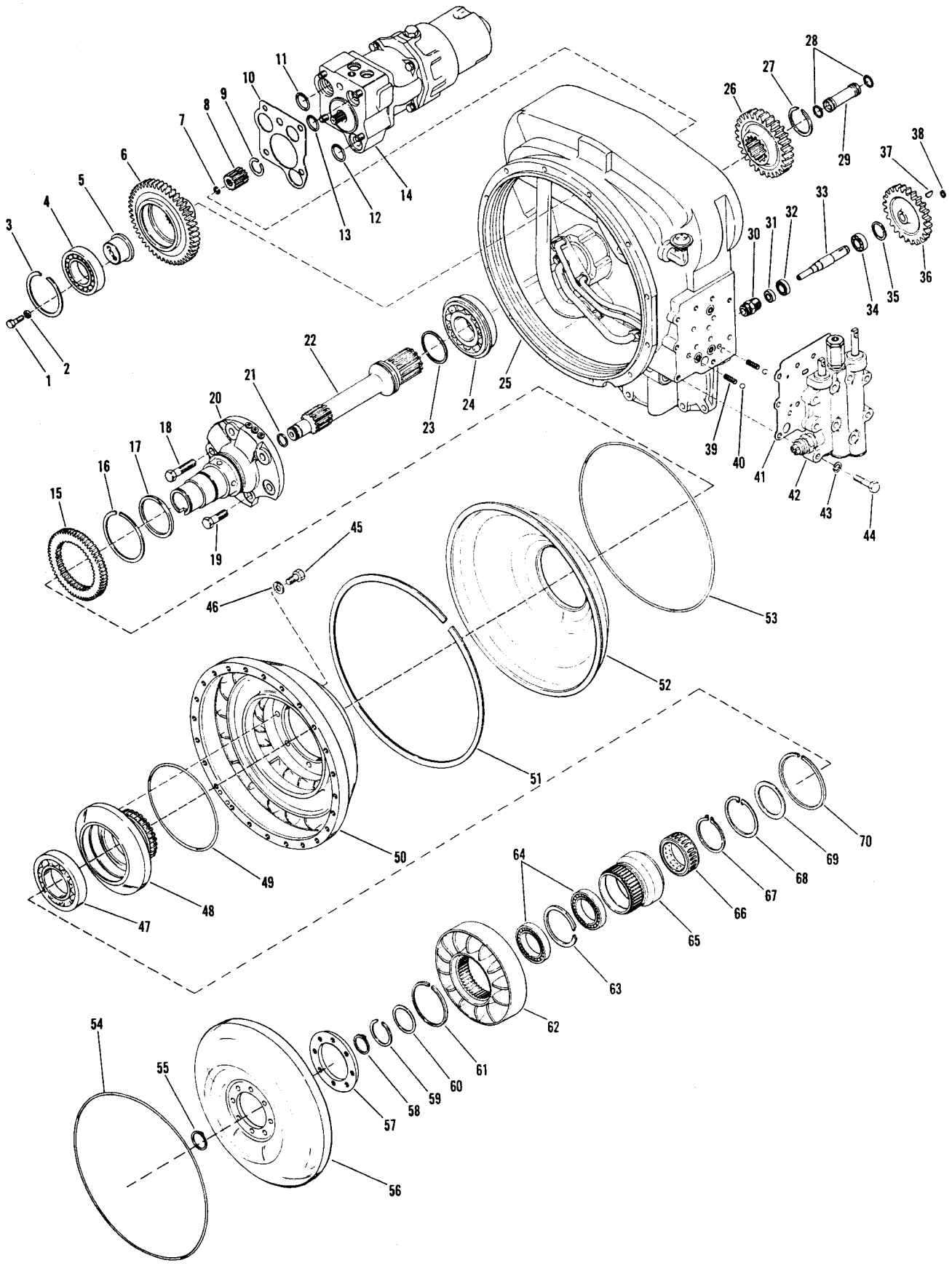
## CONVERTER HOUSING SECTION WITH LOCKUP

| Item | Description | Qty. |
|---|---|---|
| 1 | Converter Housing to Cover Screw | 7 |
| 2 | Converter Housing to Cover Screw Washer | 12 |
| | Converter Housing to Cover Studs & Nuts (Not Shown) | 5 |
| 3 | Turbine & Clutch Disc Hub | 1 |
| 4 | End Plate to Disc Screw | 12 |
| 5 | End Plate | 1 |
| 6 | Clutch Disc | 1 |
| 7 | Outer Drive Disc | 1 |
| 8 | Lock-Up Piston | 1 |
| 9 | Outer Piston Ring | 1 |
| 10 | Turbine & Clutch Disc Hub Screw | 8 |
| 11 | Disc Hub Screw Lock Plate | 4 |
| 12 | Bearing Snap Ring | 1 |
| 13 | Impeller Cover Bearing | 1 |
| 14 | Inner Piston Ring | 1 |
| 15 | Input Shaft | 1 |
| 16 | Input Shaft to Drive Disc O-Ring | 1 |
| 17 | Input Drive Disc | 1 |
| 18 | Impeller to Drive Disc Screw Washer | 24 |
| 19 | Impeller to Drive Disc Screw | 24 |
| 20 | Input Shaft to Drive Disc Screw | 8 |
| 21 | Input Shaft Bearing | 1 |
| 22 | Converter Housing Front Cover Gasket | 1 |
| 23 | Converter Housing Adaptor Ring | 1 |
| 24 | Converter Housing Front Cover Gasket | 1 |
| 25 | Converter Housing Front Cover | 1 |
| 26 | Front Cover Oil Seal | 1 |
| 27 | Input Flange | 1 |
| 28 | Input Flange O-Ring | 1 |
| 29 | Input Flange Washer | 1 |
| 30 | Input Flange Nut | 1 |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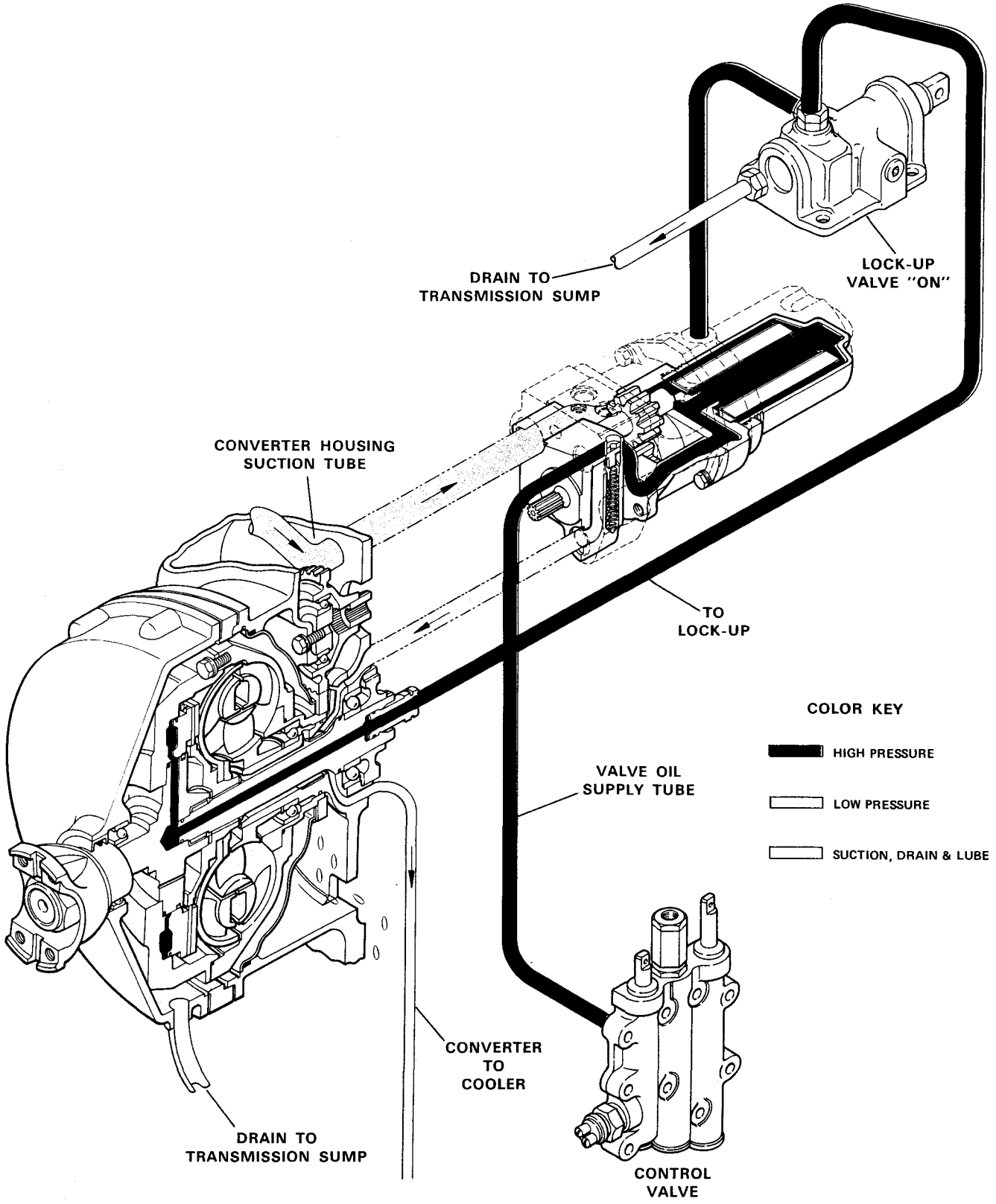
## CONVERTER SECTION WITH FREEWHEEL REACTION MEMBER

| Item | Description | Qty. |
|---|---|---|
| 1 | Bearing Support Screw | 2 |
| 2 | Lockwasher | 2 |
| 3 | Drive Gear Snap Ring | 1 |
| 4 | Drive Gear Bearing | 1 |
| 5 | Drive Gear Bearing Support | 1 |
| 6 | Drive Gear | 1 |
| 7 | Snap Ring (internal) —See item 8 | 1 |
| 8 | Pump Drive Sleeve Assembly — Inc. items 7 and 9 | 1 |
| 9 | Snap Ring (external) — See item 8 | 1 |
| 10 | Valve Body to Converter Housing Gasket | 1 |
| 11 | Valve Body O-Ring | 1 |
| 12 | Valve Body O-Ring | 1 |
| 13 | Valve Body O-Ring | 1 |
| 14 | Regulator Valve, Charging Pump & Filter Assy | 1 |
| 15 | Impeller Hub Gear | 1 |
| 16 | Impeller Hub Gear Snap Ring | 1 |
| 17 | Piston Ring | 1 |
| 18 | Stator Support Screw | 3 |
| 19 | Stator Support Screw | 3 |
| 20 | Stator Support & Sleeve Assembly | 1 |
| 21 | Turbine Shaft Piston Ring | 1 |
| 22 | Turbine Shaft | 1 |
| 23 | Piston Ring | 1 |
| 24 | Turbine Shaft Bearing | 1 |
| 25 | Converter Housing & Tube Assembly | 1 |
| 26 | Turbine Shaft Gear | 1 |
| 27 | Turbine Shaft Gear Snap Ring | 1 |
| 28 | Piston Ring | 2 |
| 29 | Turbine Shaft Piston Ring Race | 1 |
| 30 | Tachometer Drive Tube Nut | 1 |
| 31 | Drive Shaft Oil Seal | 1 |
| 32 | Drive Shaft Front Bearing | 1 |
| 33 | Drive Shaft | 1 |
| 34 | Drive Shaft Rear Bearing | 1 |
| 35 | Bearing Retaining Ring | 1 |
| 36 | Drive Gear | 1 |
| 37 | Woodruff Key | 1 |
| 38 | Gear Retaining Ring | 1 |
| 39 | Detent Spring | 2 |
| 40 | Detent Ball | 2 |
| 41 | Valve to Converter Gasket | 1 |
| 42 | Control Valve Assembly | 1 |
| 43 | Valve to Converter Housing Washer | 9 |
| 44 | Valve to Converter Housing Screw | 9 |
| 45 | Hub to Impeller Screw | 8 |
| 46 | Hub to Impeller Screw Washer | 8 |
| 47 | Impeller Hub Bearing | 1 |
| 48 | Impeller Hub | 1 |
| 49 | Impeller Hub O-Ring | 1 |
| 50 | Impeller | 1 |
| 51 | Oil Baffle Retainer Ring | 1 |
| 52 | Oil Baffle | 1 |
| 53 | Oil Baffle Seal Ring | 1 |
| 54 | Impeller to Drive Disc O-Ring | 1 |
| 55 | Snap Ring | 1 |
| 56 | Turbine | 1 |
| 57 | Turbine Ring | 1 |
| 58 | Snap Ring | 1 |
| 59 | Thrust Washer Snap Ring | 1 |
| 60 | Thrust Washer | 1 |
| 61 | Reaction Member Snap Ring | 1 |
| 62 | Reaction Member | 1 |
| 63 | Bearing Spacer | 1 |
| 64 | Bearing | 2 |
| 65 | Outer Race | 1 |
| 66 | Sprag Assembly | 1 |
| 67 | Snap Ring | 1 |
| 68 | Bearing Washer Snap Ring | 1 |
| 69 | Bearing Washer | 1 |
| 70 | Bearing Snap Ring | 1 |




## LMHR 28000 SERIES CONVERTER AND LOCK-UP OIL FLOW DIAGRAM

## MHR & LFMHR 28000 SERVICE INFORMATION

The information contained herein must be used in conjunction with the HR28000 4 speed maintenance and service section of this manual for complete disassembly and reassembly.

The MHR Model is the midship mounted 28000 series transmission with a integral torque converter unit.

The LFMHR is the midship mounted 28000 series transmission with a integral torque converter unit, including a lock-up and free-wheel option. Converter lock-up permits direct engine drive for high speed hauling. Converter free-wheel offers torque converter drive for vehicle heavy work cycles, as well as peak output performance for high speed travel cycles.

### MHR DISASSEMBLY

### Midship Mounted – Closed Front End

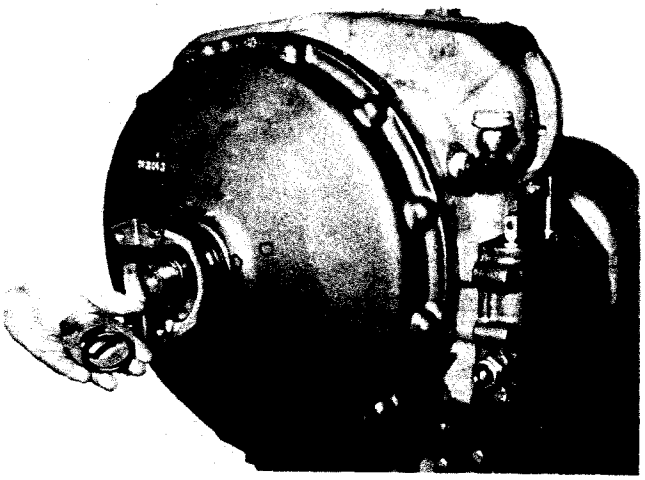


**Figure 1**
Remove front cover to transmission sump drain back line. Remove input flange retaining nut, washer, O-Ring, and flange.

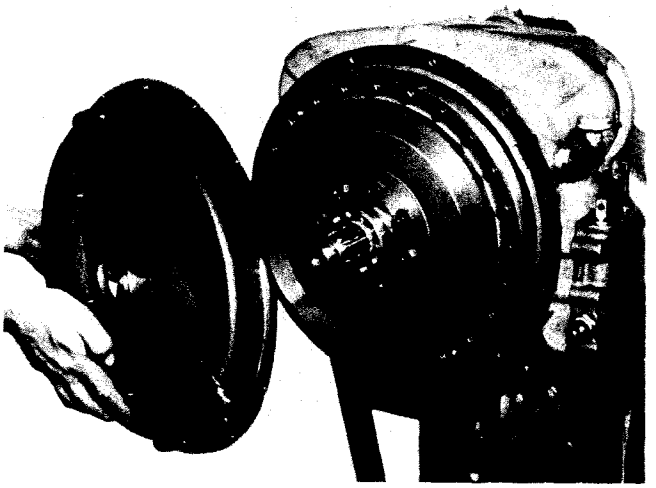


**Figure 3**
Remove converter housing front cover.

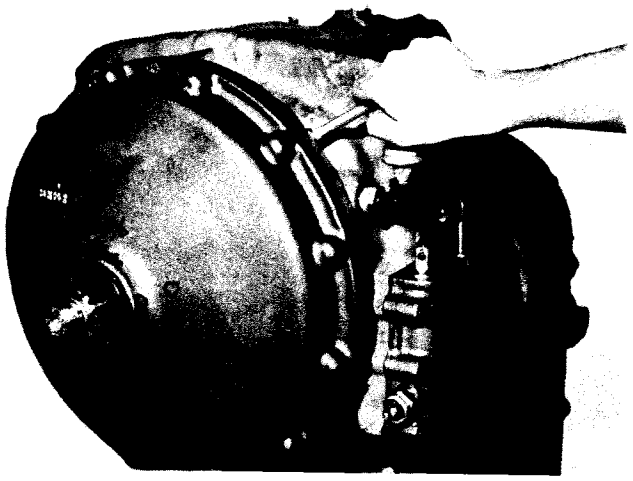


**Figure 2**
Remove bolts and washers securing converter housing front cover to converter housing.

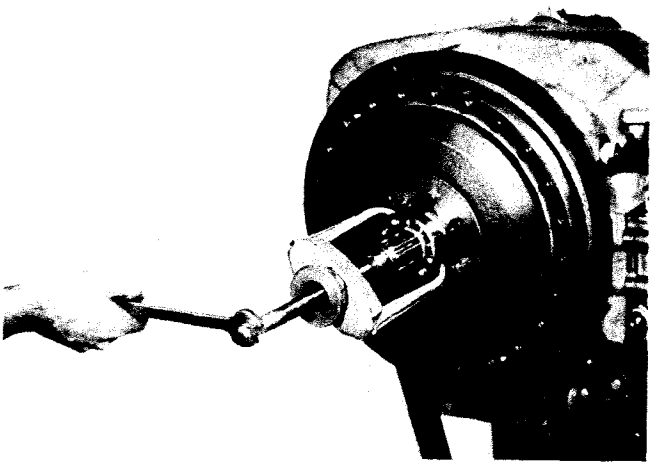


**Figure 4**
Remove input shaft support bearing.

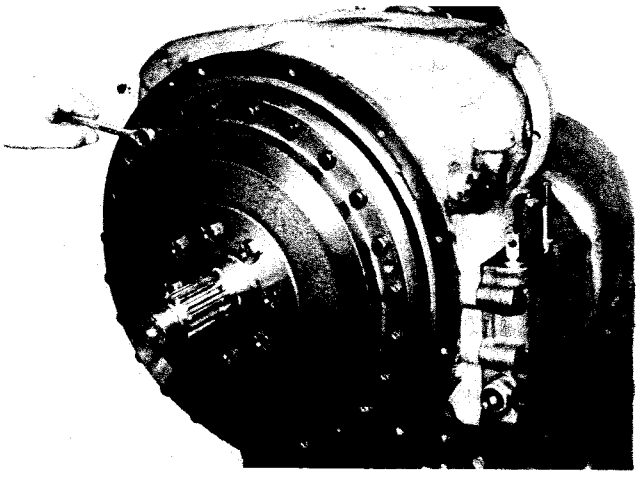


Figure 5
Remove impeller cover to impeller bolts.

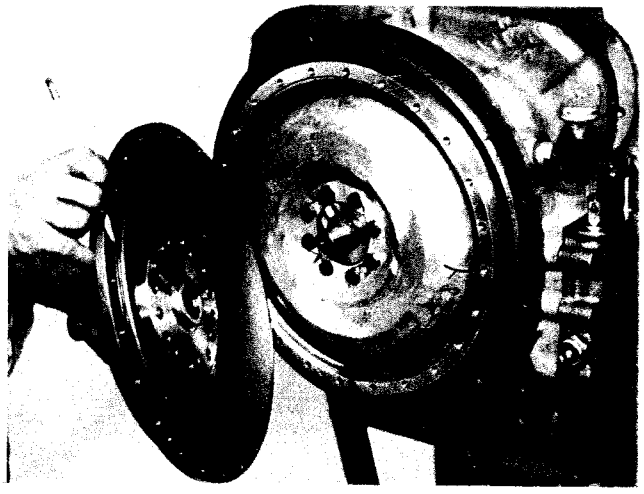


Figure 6
Remove impeller cover.

**Proceed with disassembly of the transmission by using the information explained in the specific 2, 3, 4 or 6 speed HR28000 series maintenance manual.**

## REASSEMBLY

**Reassemble transmission following step by step procedures as explained in the HR28000 manual up to and including "install turbine to turbine shaft retainer ring."**

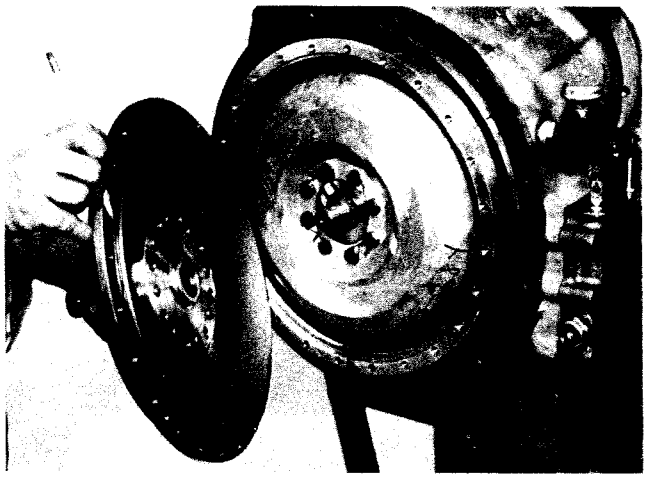


Figure 7
Position a new impeller cover O-Ring on cover and grease lightly to facilitate reassembly.

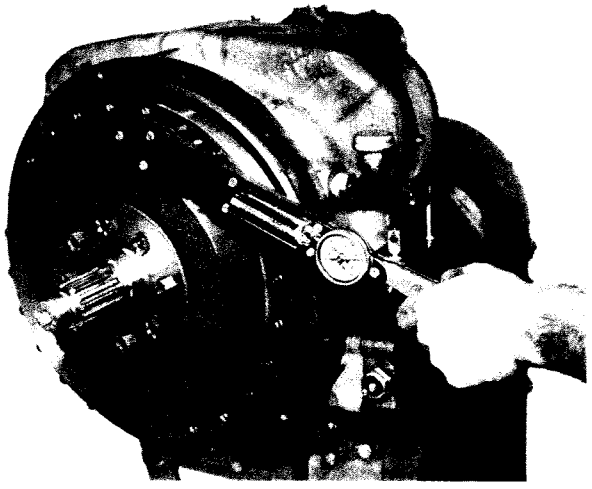


Figure 8
Align holes in impeller cover with holes in impeller. Install bolts and washers and tighten 23 to 25 lbs.ft. torque [31,2–33,9 N·m.]

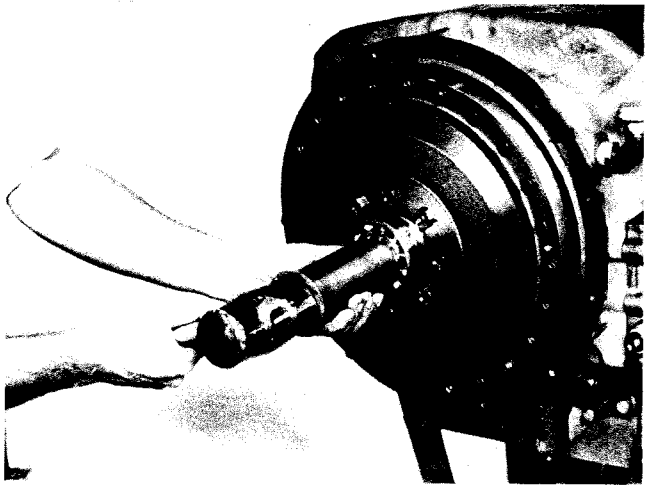


Figure 9
Install input shaft bearing on input shaft.

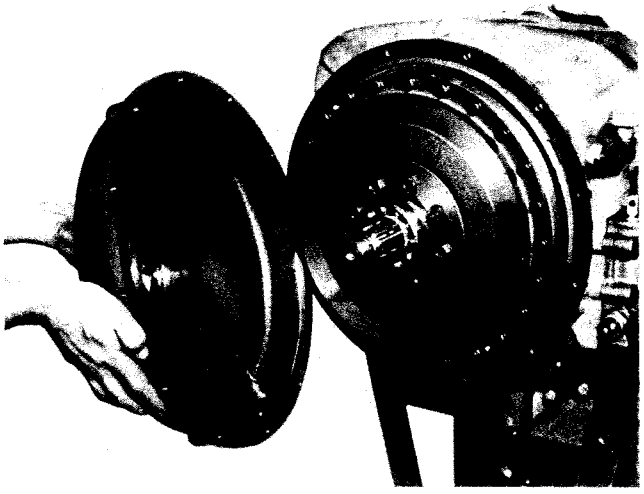


**Figure 10**

Install new converter housing to front cover gasket. Align holes in front cover with holes in converter housing.

*NOTE: Drain back hole in the front cover must be in the lowest position when the transmission is reinstalled in the machine. This is to allow leakage oil to return to the transmission oil sump.*

Install bolts and washers, tighten 23 to 25 lbs.ft. torque [31,2–33,9 N·m.]

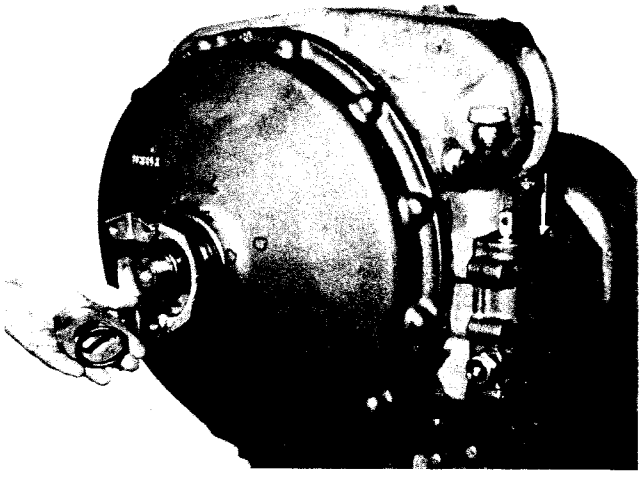


**Figure 11**

Install companion flange, flange O-Ring, washer and nut. Tighten nut 200 to 250 lbs.ft. torque [271,2–338,9 N·m.] Install front cover to transmission sump drain back line. (see note in Figure 10)

## LFMHR DISASSEMBLY

### Lock-up – Free-wheel Reaction Member – Midship Mounted – Closed Front End.

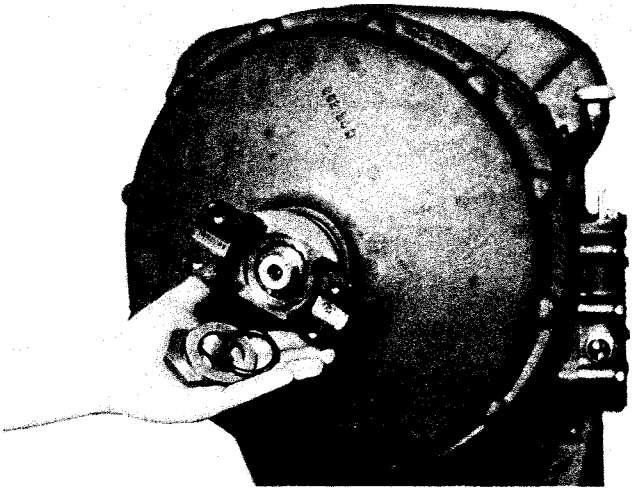


**Figure 1**

Remove front cover to transmission sump drain back line. Remove input flange retaining nut, washer, O-Ring and flange.

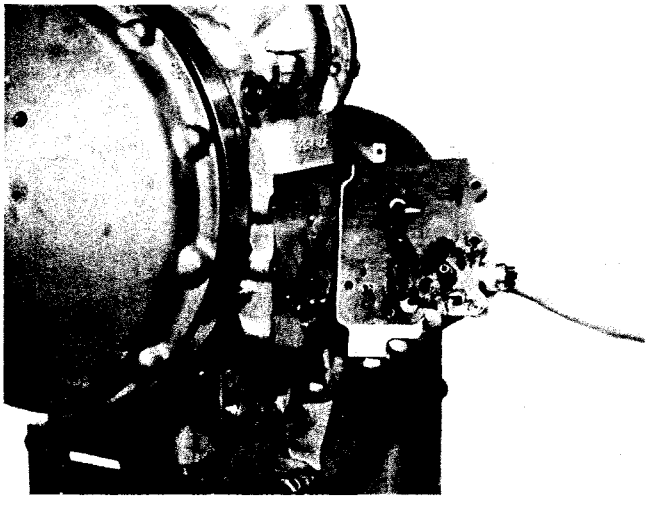


**Figure 2**

Remove control valve assembly.

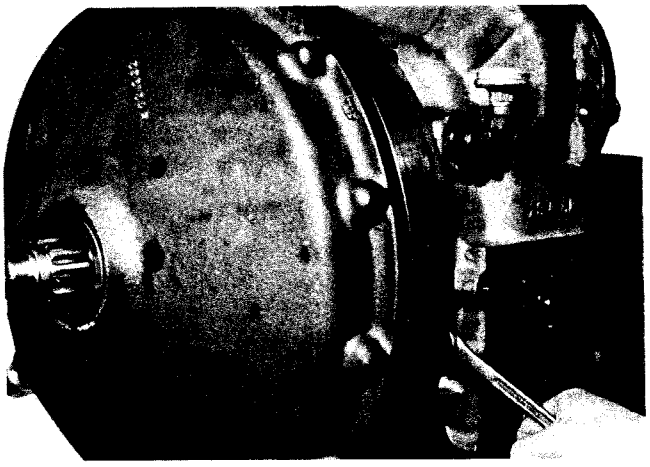


**Figure 3**
Remove front cover and adaptor ring bolts and stud nuts.

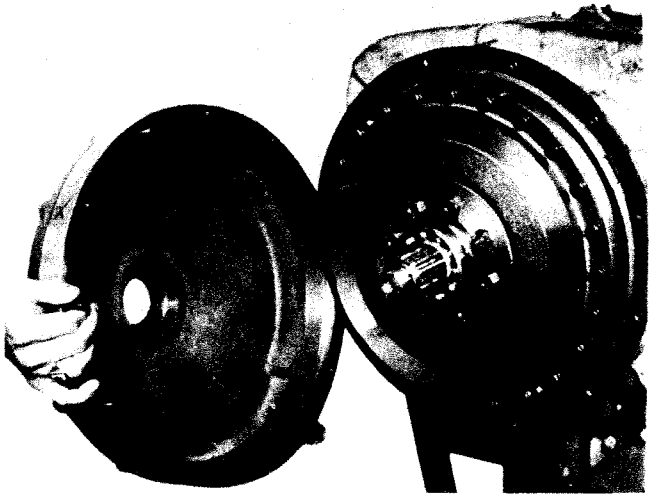


**Figure 4**
Remove front cover and adaptor ring.

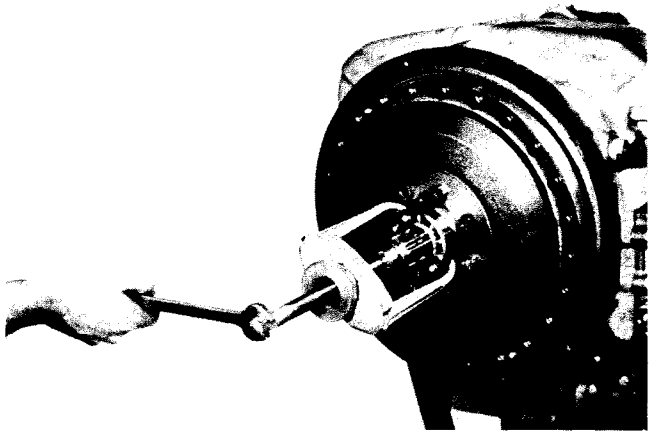


**Figure 5**
Remove input shaft bearing.

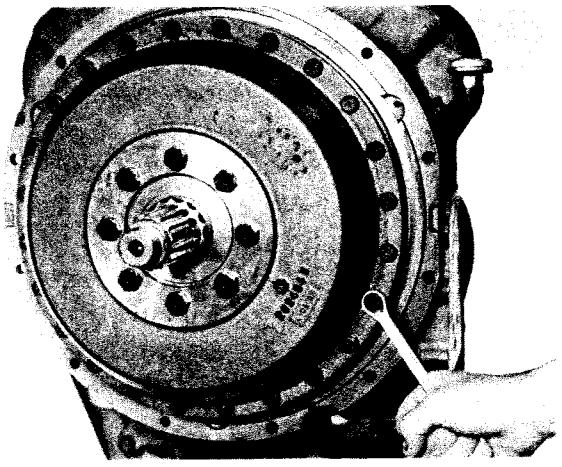


**Figure 6**
Remove impeller cover to impeller bolts.

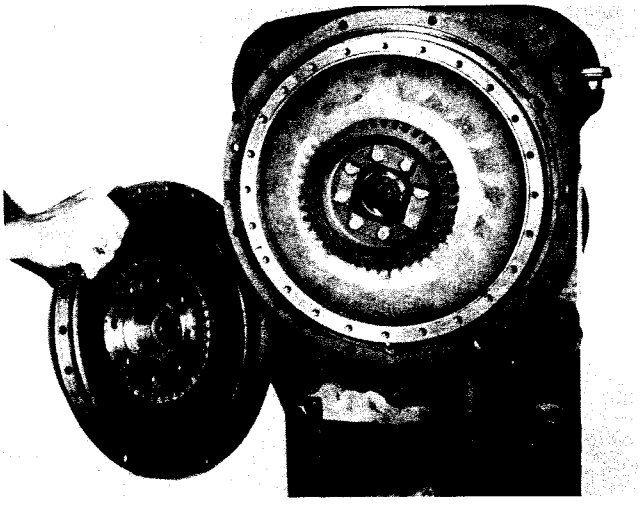


**Figure 7**
Remove impeller cover.

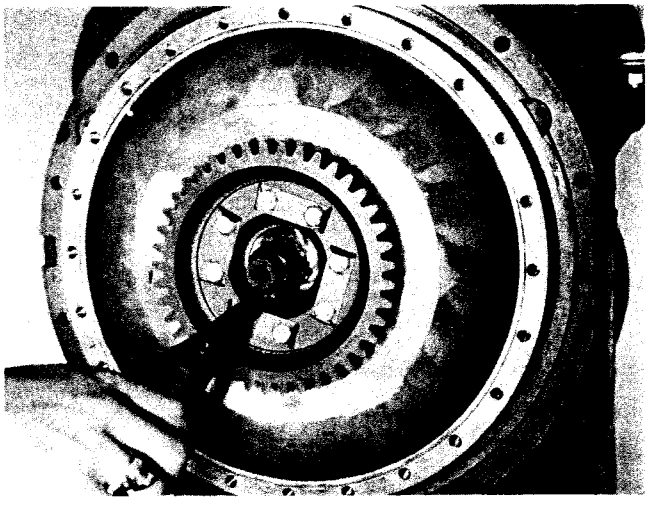


**Figure 8**
Remove turbine retainer ring.

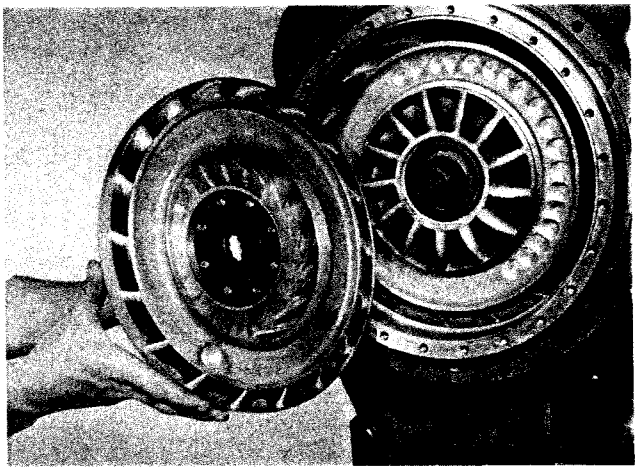


**Figure 9**
Remove turbine.

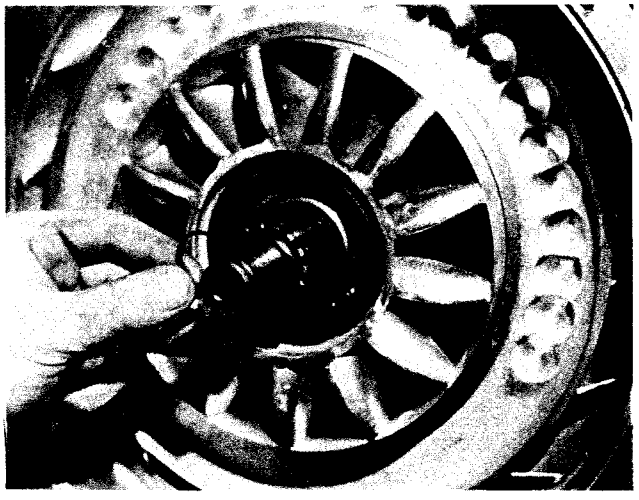


**Figure 10**
Remove turbine shaft front oil sealing ring. (Used with lock-up only)

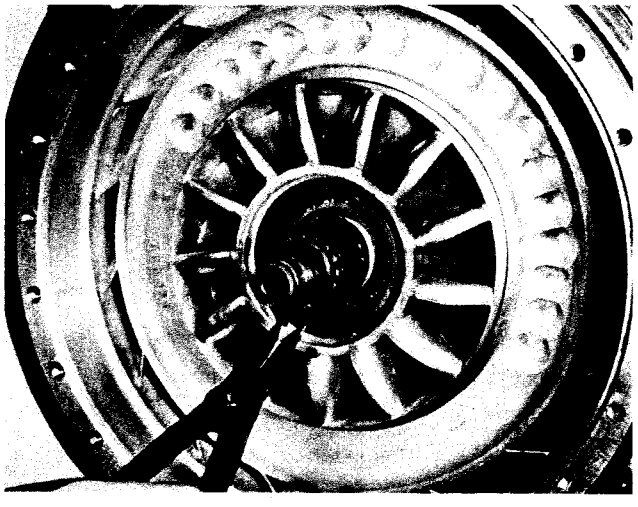


**Figure 11**
Remove turbine locating ring.

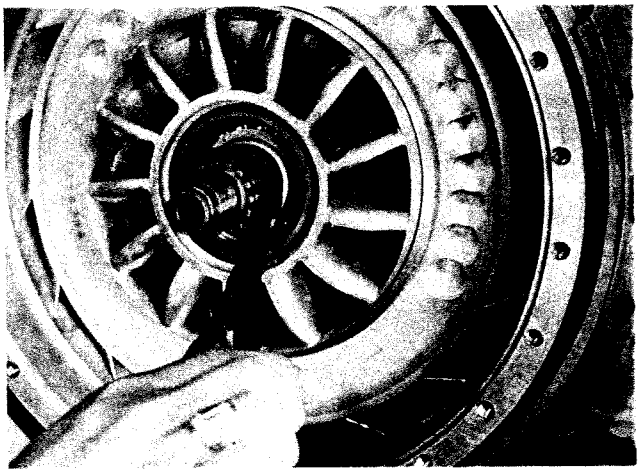


**Figure 12**
Remove reaction member retainer ring.

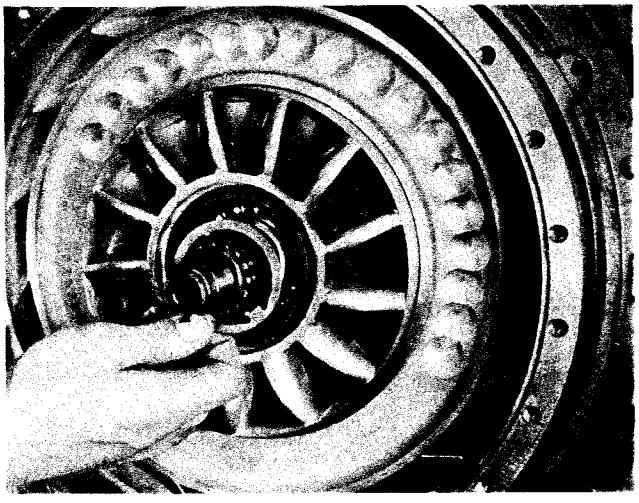


**Figure 13**
Remove reaction member thrust washer.

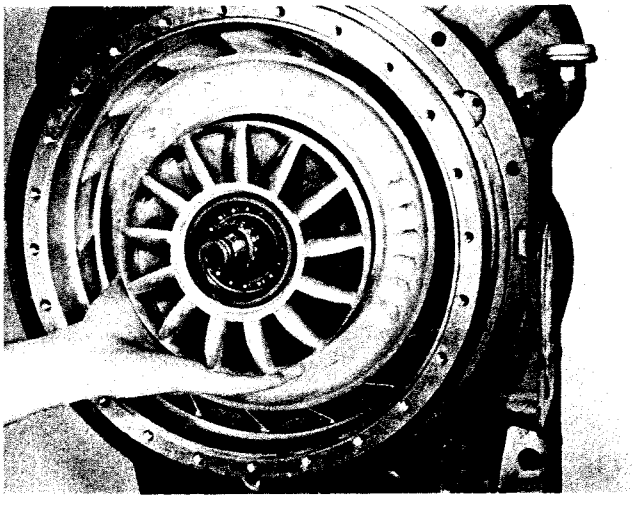


**Figure 14**
Remove reaction member, bearing and sprag assembly as a unit.

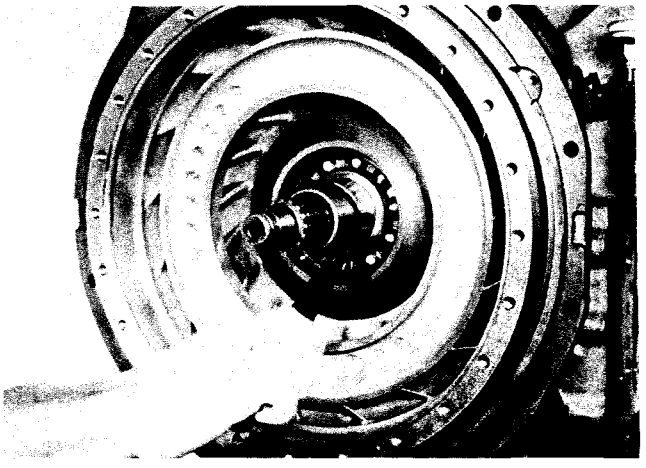


**Figure 15**
Remove impeller hub bearing washer retainer ring.

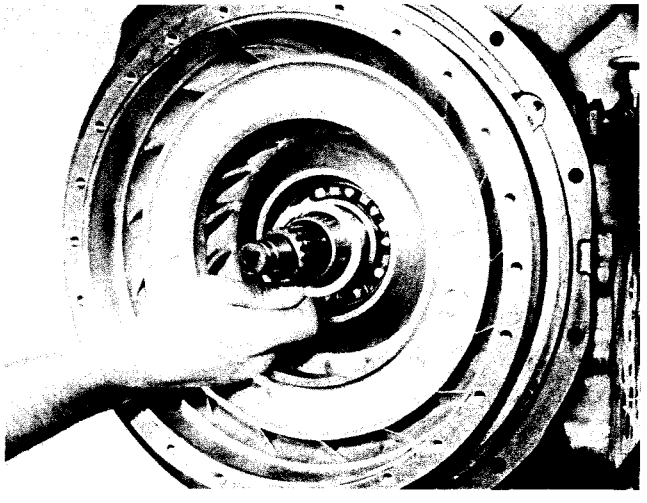


**Figure 16**
Remove hub bearing washer.

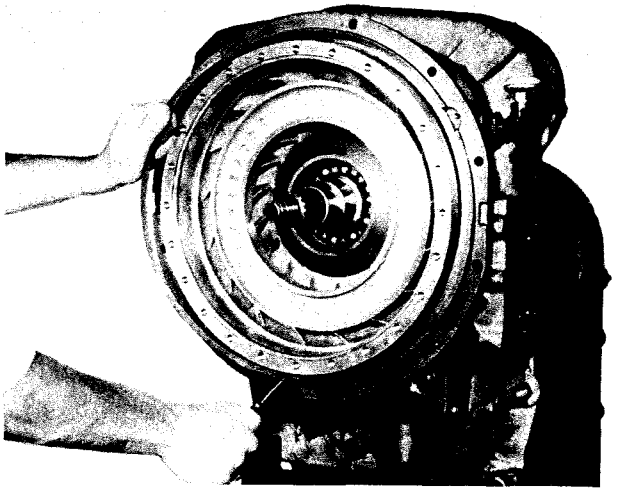


**Figure 17**
Remove oil baffle retainer ring.

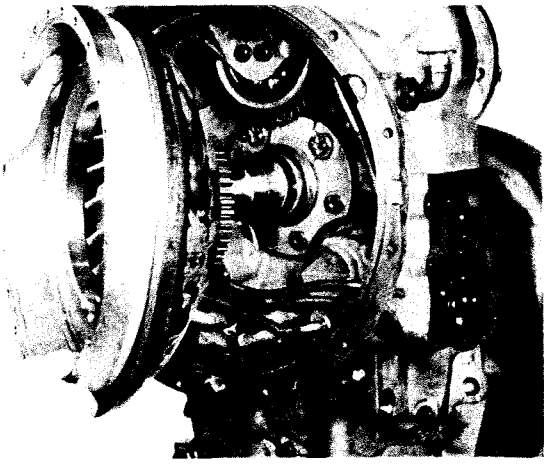


**Figure 18**
Pry oil baffle and impeller from housing.

*NOTE: Impeller, oil baffle and impeller hub gear are removed as an assembly.*

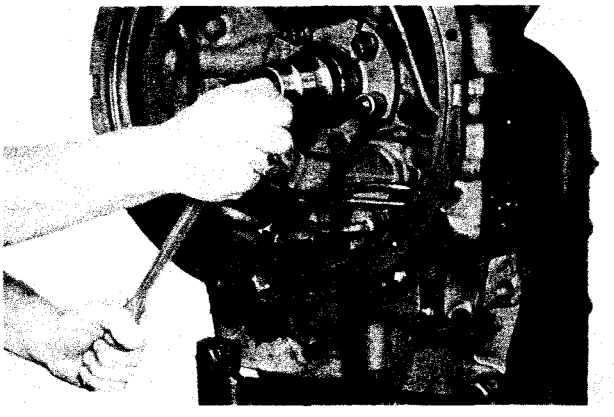


**Figure 19**
Remove stator support to housing bolts.

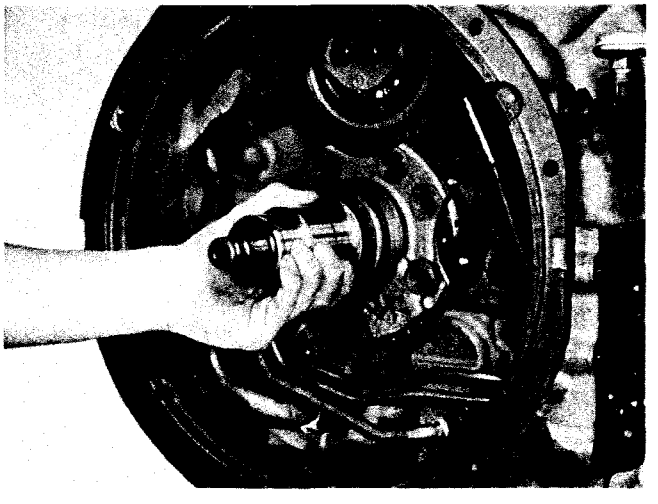


**Figure 20**
Remove stator support.

*NOTE: Support must be turned to clear pump drive gear.*

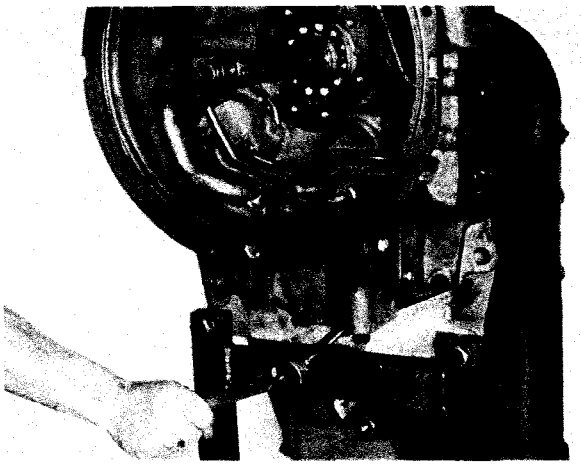


**Figure 21**
Remove bolts securing converter housing to transmission housing.

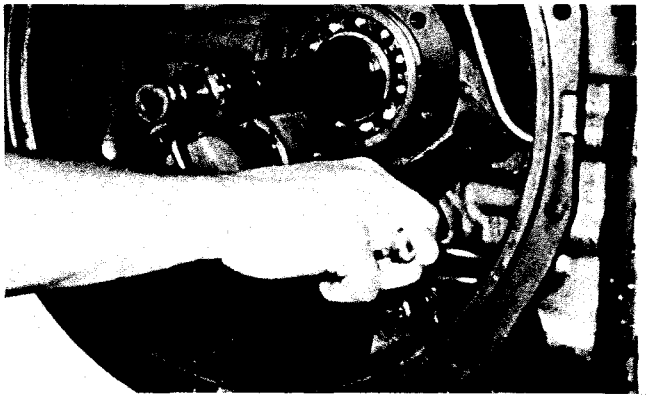


**Figure 22**
Support converter housing with a chain fall. Using spreading type snap ring pliers, spread ears on forward clutch front bearing retaining ring. Holding snap ring open tap converter housing from transmission housing.

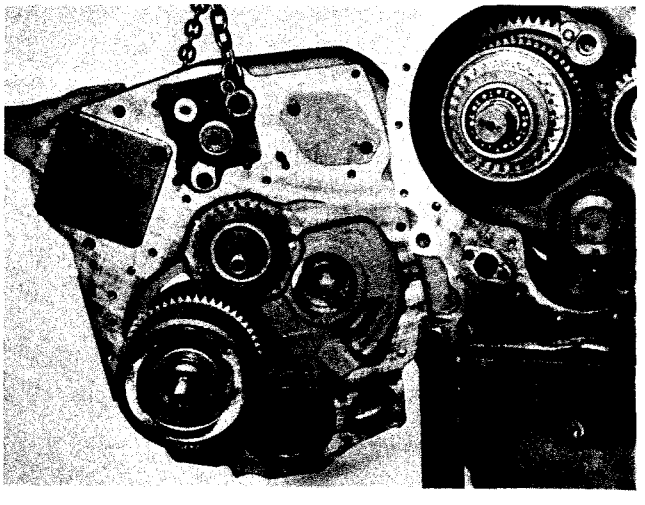


**Figure 23**
If forward and second clutch remains in converter housing, spread ears on the front bearing and pry clutch assembly from converter housing.

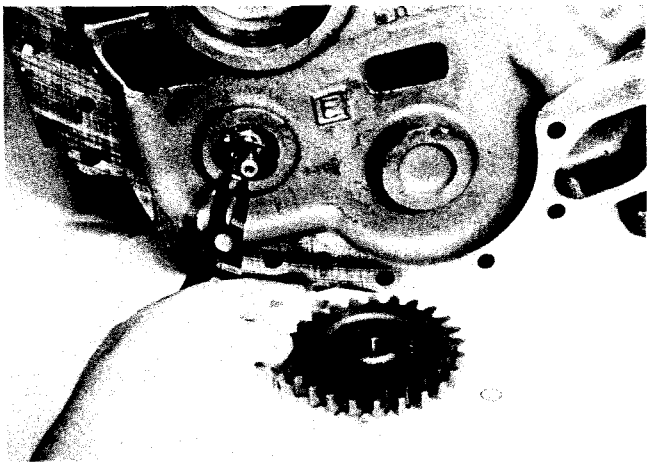


**Figure 24**
If a tachometer drive is incorporated, remove the tachometer drive gear retainer ring. Remove drive gear. Remove drive shaft bearing retaining ring.

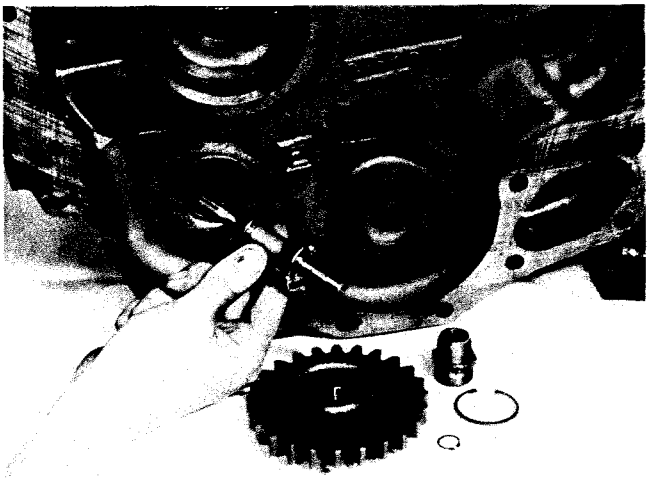


**Figure 25**
At the front of the converter housing remove tachometer drive tube nut. Tap drive shaft and bearing assembly from housing. Reverse procedure for reassembly.

**Proceed with disassembly of the transmission by using the information explained in HR28000 section of this maintenance manual.**

## DISASSEMBLY OF FREE-WHEEL UNIT

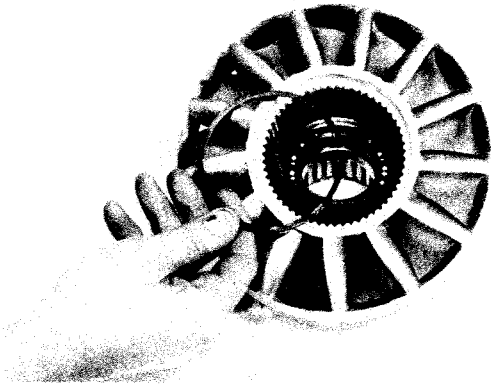


**Figure 26**
Remove outer race to reaction member retainer ring. Press outer race from reaction member.

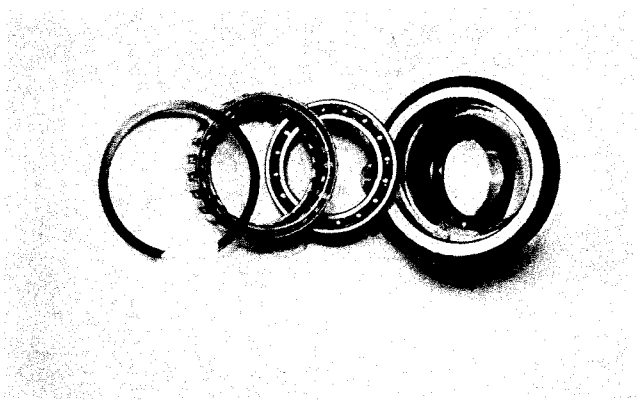


**Figure 27**
Remove sprag assembly to outer race retainer ring. Remove sprag assembly. Remove inner and outer bearings.

*NOTE: Bearings are separated by a locating ring and must be removed, inner bearing to the rear and outer bearing to the front.*

## REASSEMBLY OF FREE-WHEEL UNIT

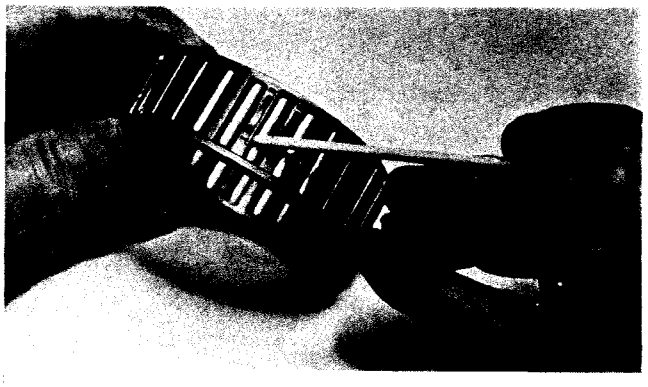


**Figure 28**
Free-wheel sprag assembly showing drag clip.

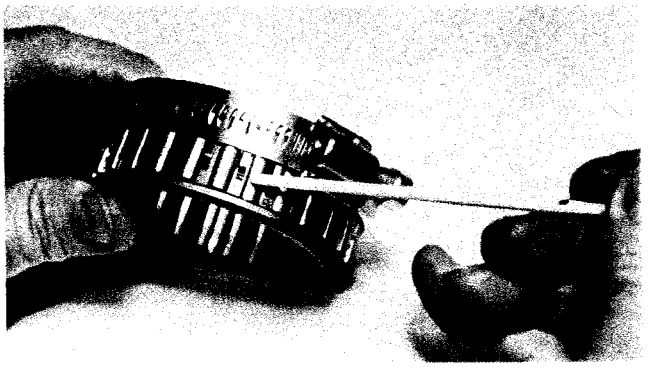


**Figure 29**
Sprag assembly drag clip lightly compressed with a hose clamp. This will prevent the ends of the drag clip from catching in the sprag assembly retainer ring groove.

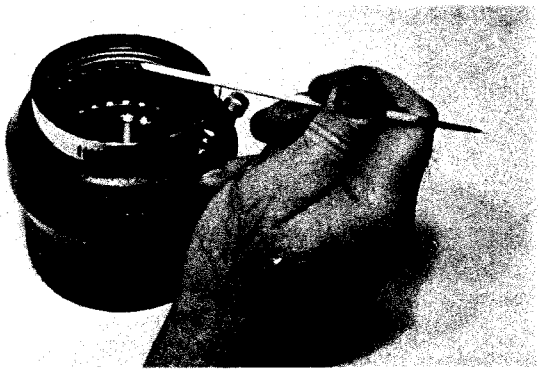


**Figure 30**
With the inner and outer bearings pressed in place against the locating ring, position sprag assembly and hose clamp on free-wheel outer race with the three drag strips at the top.

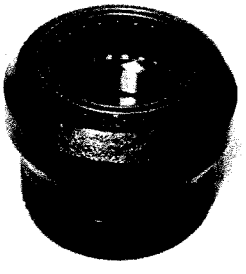


**Figure 31**
Press sprag assembly from hose clamp and into outer race.

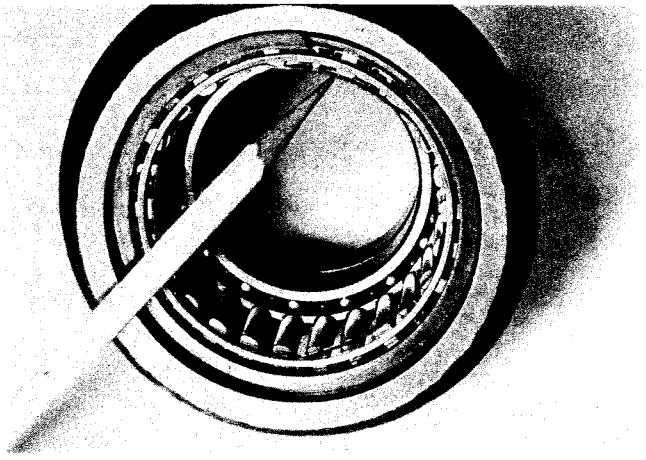


**Figure 32**
Install sprag assembly retainer ring. Note drag strips at top.

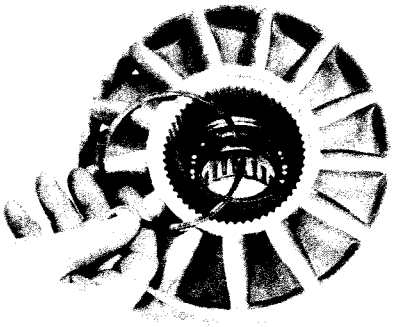


**Figure 33**
Press free-wheel race assembly into reaction member and secure with retainer ring.

## DISASSEMBLY OF LOCK-UP COVER

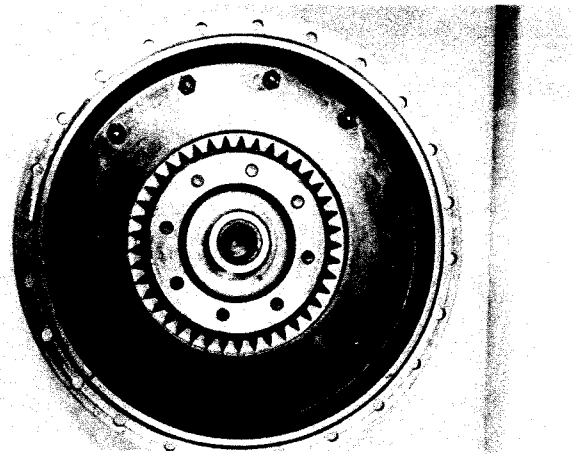


**Figure 34**
Remove end plate to lock-up cover bolts.

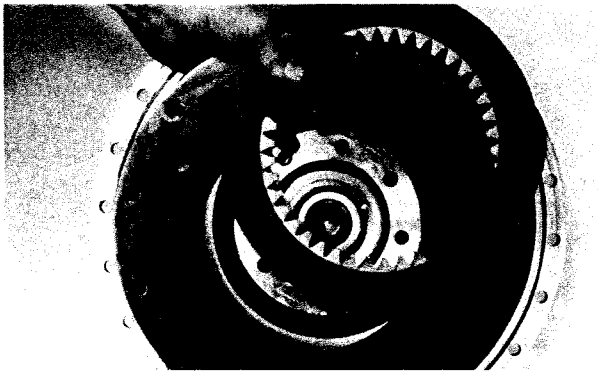


**Figure 35**
Remove end plate and clutch disc.

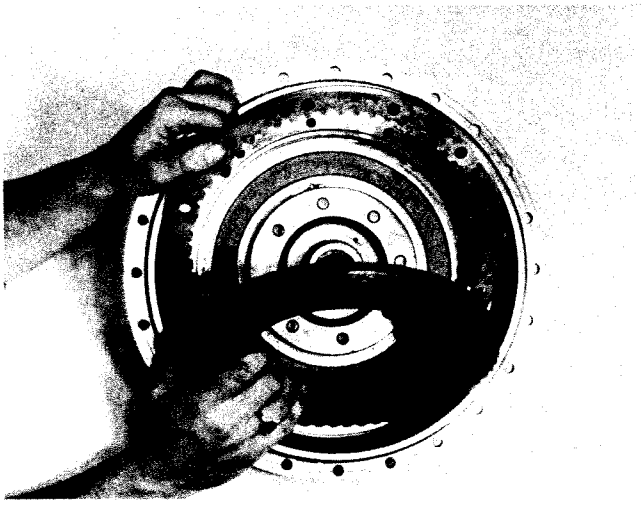


**Figure 36**
Remove piston and outer drive disc.

## REASSEMBLY OF LOCK-UP COVER

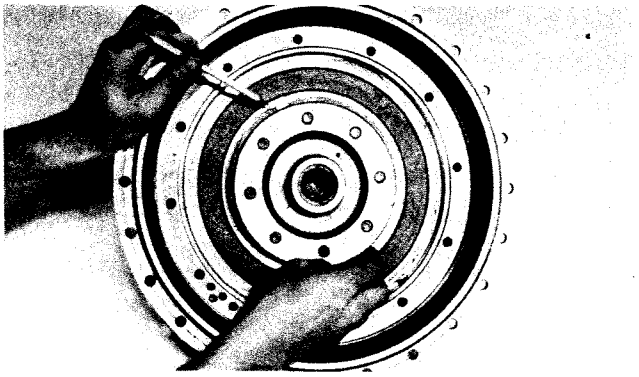


**Figure 37**

Position new oil sealing ring on input hub. Grease ring lightly to facilitate reassembly.

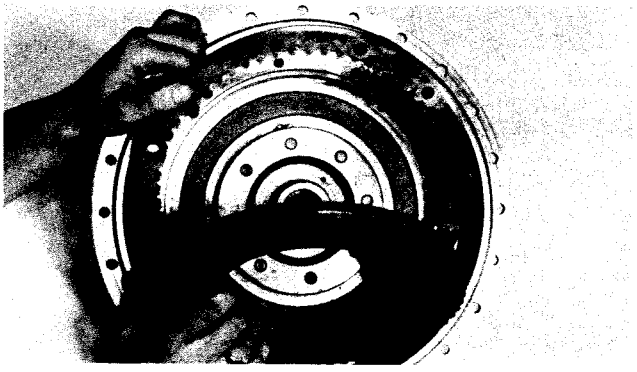


**Figure 38**

Install new oil sealing ring on outer diameter of actuating piston and grease lightly. Position piston over input hub, use caution as not to damage oil sealing rings. Locate outer drive disc teeth with teeth on the outer diameter of the piston.

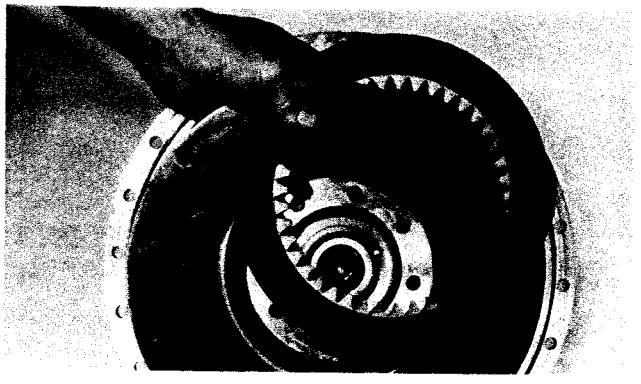


**Figure 39**

Lubricate clutch disc lightly and position in cover. Align holes of end plate with holes in driving disc and lock-up cover. Install bolts and tighten 30 to 35 lbs.ft. torque [40,7–27,4 N·m.]

## REASSEMBLY OF TRANSMISSION

**Reassemble transmission following step by step procedures as explained in the HR28000 manual up to and including "From the front of the transmission case install the forward and second clutch assembly."**

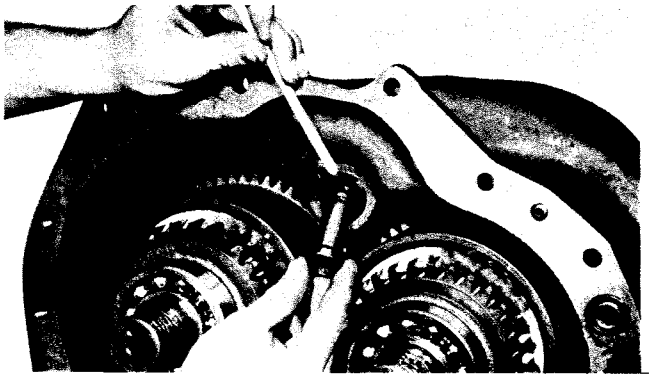


**Figure 40**

Install new oil sealing rings on the turbine shaft piston ring race. Grease rings lightly and position race in transmission housing.

**Position the converter housing on the transmission housing as explained in the HR28000 maintenance manual. Proceed with reassembly of transmission up to and including "Position oil baffle in housing. Secure with oil baffle retainer ring, being sure ring is in full position in ring groove."**

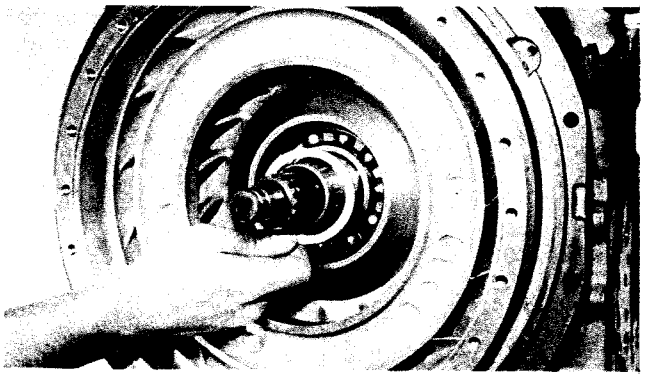


**Figure 41**

Install impeller hub bearing spacer.

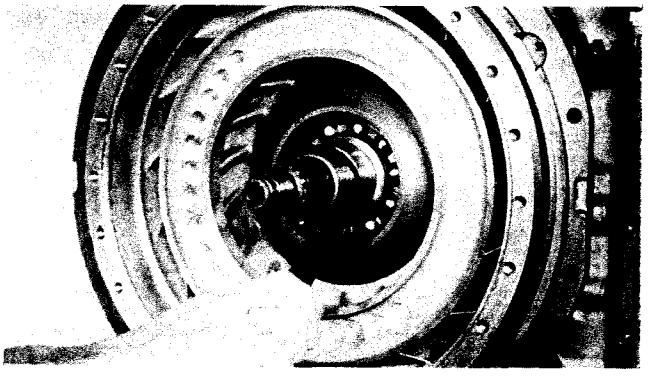


**Figure 42**

Install bearing spacer retainer ring.

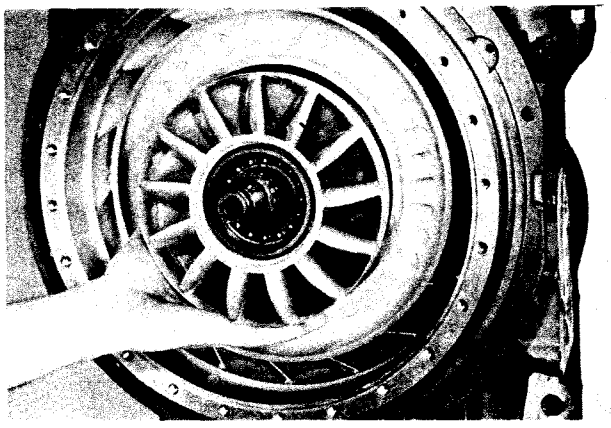


**Figure 43**
Install free-wheel assembly on free-wheel support.

*NOTE: With reaction member in full position on support it must free-wheel in a clockwise direction.*

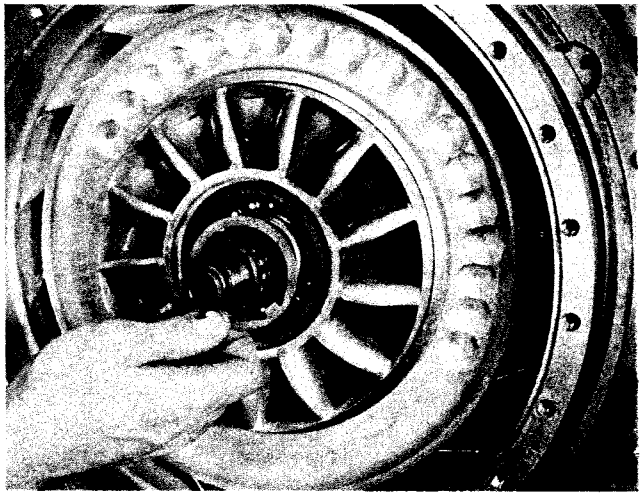


**Figure 44**
Install reaction member thrust washer.

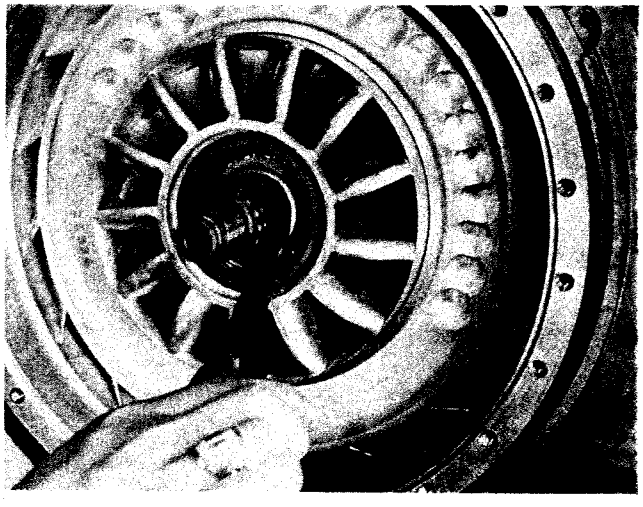


**Figure 45**
Install thrust washer retainer ring.

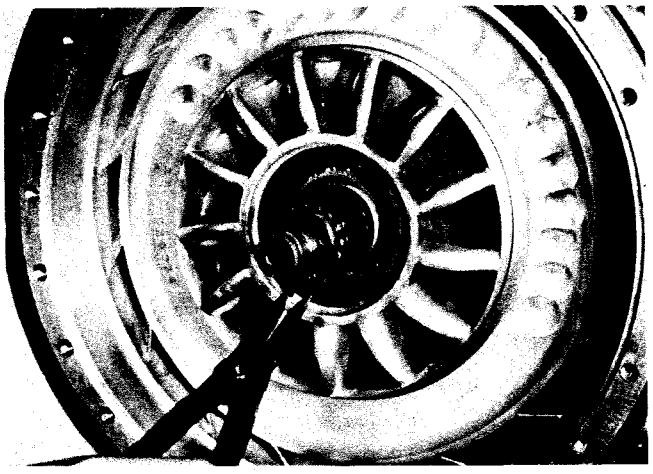


**Figure 46**
Install turbine locating ring.

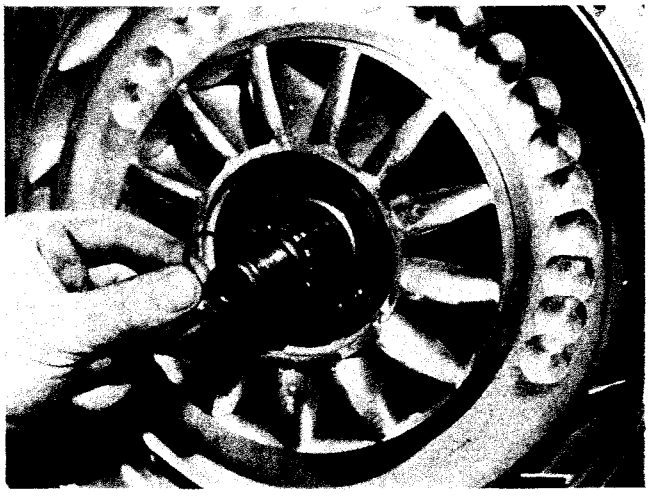


**Figure 47**
Install turbine shaft front piston ring.

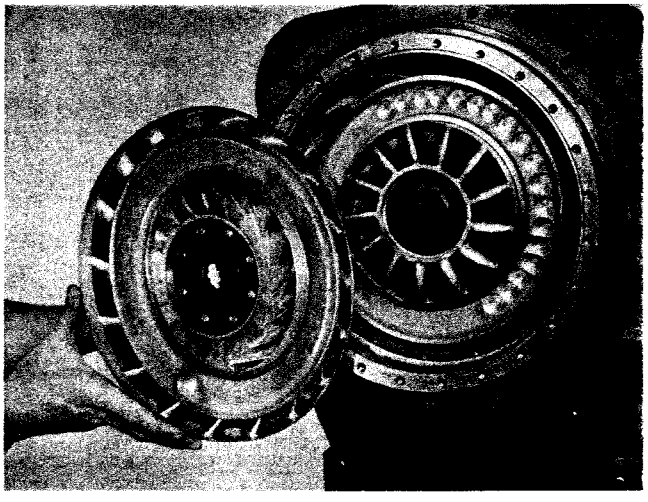


**Figure 48**
Position turbine on turbine shaft.

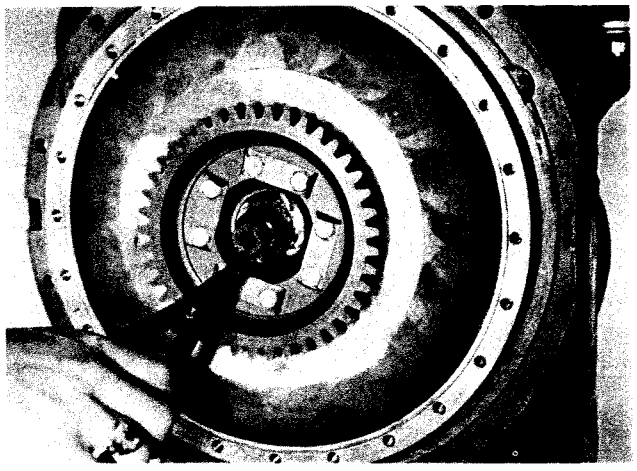


**Figure 49**
Install turbine retainer ring.

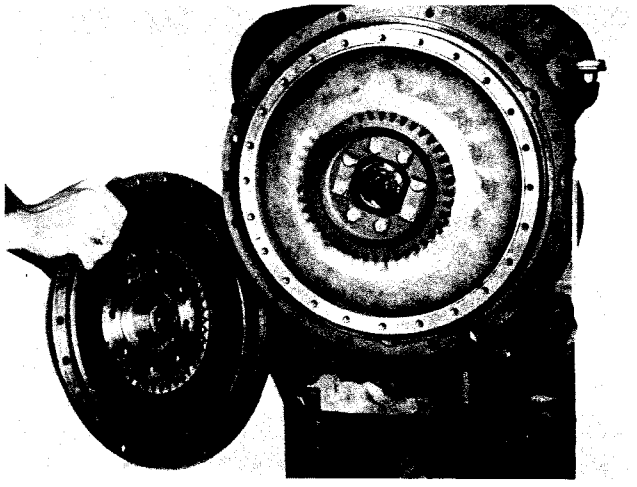


**Figure 50**
With new O-Ring in position and lightly lubricated, install lock-up cover to impeller. Align teeth on clutch disc turbine hub with internal teeth in clutch disc.

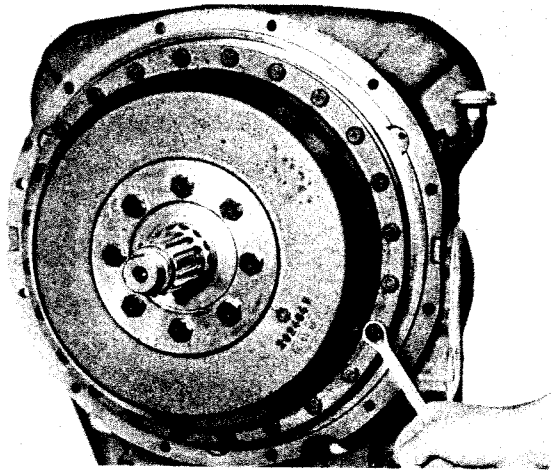


**Figure 51**
Install lock-up cover to impeller bolts and tighten to specified torque.

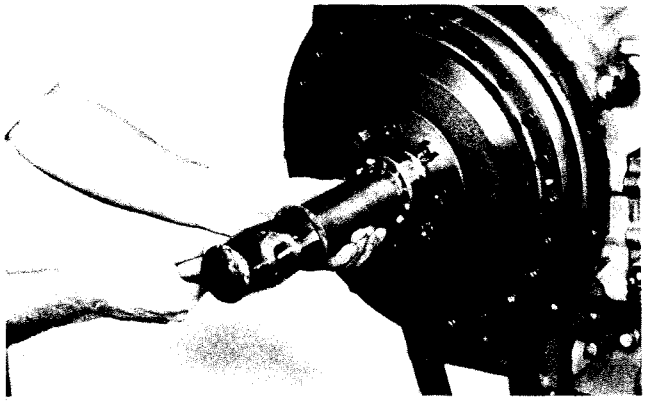


**Figure 52**
Install input shaft front bearing.

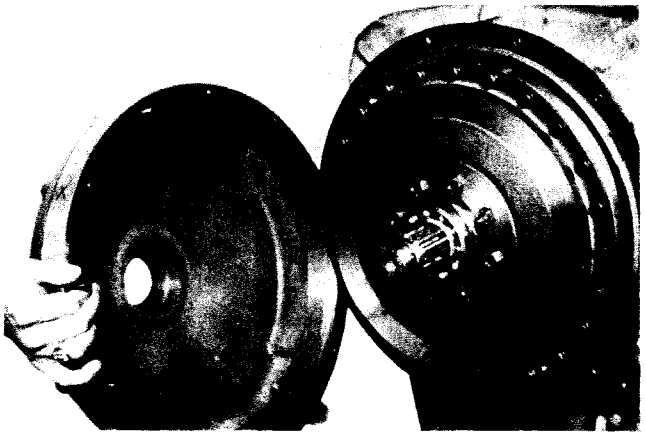


**Figure 53**
Using new gaskets install adaptor ring and front cover to converter housing.

*NOTE: Drain back hole in front cover must be in the lowest position when the transmission is reinstalled in the machine, this is to allow leakage oil to return to the transmission oil sump.*

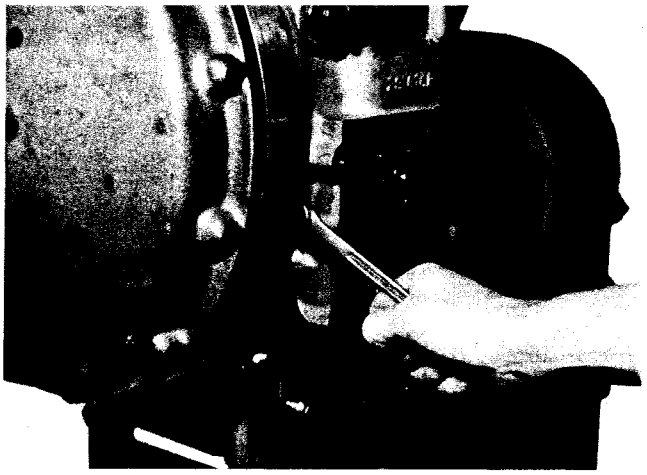


**Figure 54**
Install washers, bolts and nuts. Tighten 23 to 25 lbs.ft. torque [31,2–33,9 N·m.]

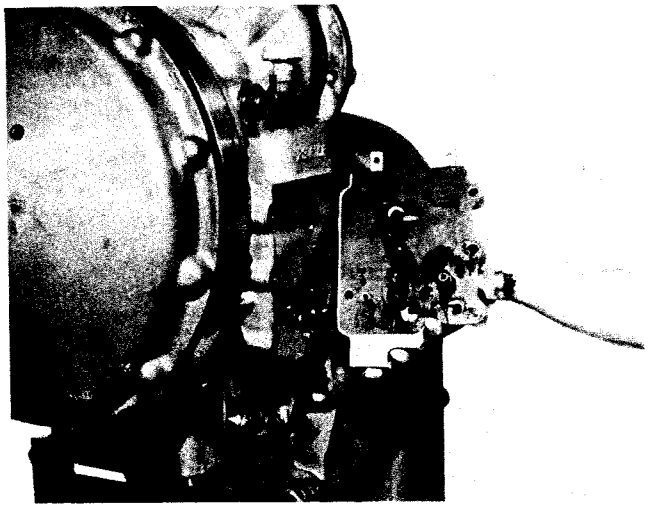


**Figure 55**

Locate detent balls and springs in control valve. Position new gasket. Secure valve with bolts and washers. Tighten to specified torque.

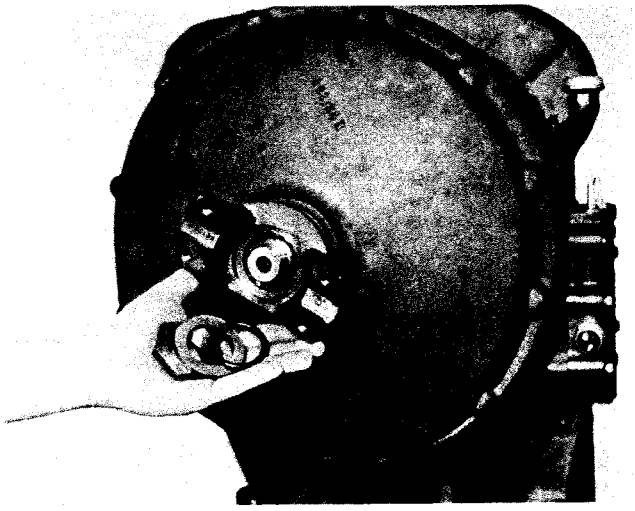


**Figure 56**

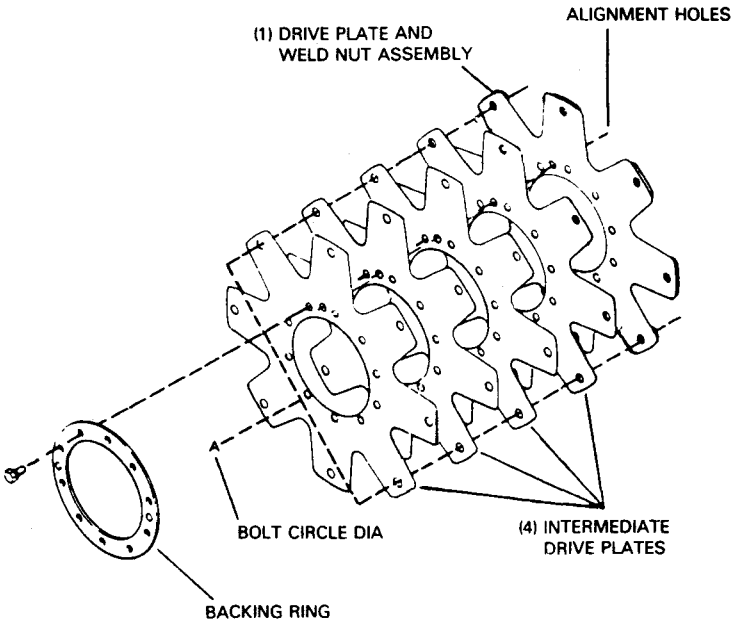
Install companion flange, flange O-Ring, washer and nut. Tighten nut 200 to 250 lbs.ft. torque [271,2–338,9 N·m.] Install front cover to transmission sump drain back line. (see note Figure 53)

## DRIVE PLATE INSTALLATION

**SUBJECT: 28000/32000 Series Transmission and C-270/C-320 Series Converter Drive Plate Kits.**

**REASON FOR BULLETIN: Proper Identification by Bolt Circle Diameter.**

Measure the "A" dimension (Bolt Circle diameter) and order Drive Plate Kit listed below.




**"A" Dimension (Bolt Circle Diameter)**

13.125" [333,375 mm] Diameter
Kit No. 802335

13.50" [342,900 mm] Diameter
Kit No. 802333

17.00" [431,800 mm] Diameter
Kit No. 802454

Each kit will include the following parts:

- 4 Intermediate Drive Plates
- 1 Drive Plate and Weld Nut Assembly.
- 1 Backing Ring.
- 10 Screw and Lockwasher Assembly.
- 1 Instruction Sheet.

TO FACILITATE ASSEMBLY, ALIGN SMALL HOLES IN DRIVE PLATES — SEE ILLUSTRATION ABOVE.

Position drive plate and weld nut assembly on impeller cover with weld nuts toward cover. Align intermediate drive plate and backing ring with holes in impeller cover. **NOTE:** Two dimples 180° apart in backing ring must be out (toward engine flywheel). Install capscrews and washers. Tighten 23 to 25 ft. lbs. torque [31,2 - 33,8 N.m].

**SEE PAGE 70 FOR TRANSMISSION TO ENGINE INSTALLATION PROCEDURE**

## TRANSMISSION TO ENGINE INSTALLATION PROCEDURE

1. Remove all burrs from flywheel mounting face and nose pilot bore. Clean drive plate surface with solvent.
2. Check engine flywheel and housing for conformance to standard S.A.E. #3 - S.A.E. J-927 tolerance specifications for pilot bore size, pilot bore runout and mounting face flatness. Measure and record engine crankshaft end play.
3. Install two 3.50 [88,90 mm] long transmission to flywheel housing guide studs in the engine flywheel housing as shown. Rotate the engine flywheel to align a drive plate mounting screw hole with the flywheel housing access hole.
4. Install a 4.00 [101,60 mm] long drive plate locating stud .3750-24 fine thread in a drive plate nut. Align the locating stud in the drive plate with the flywheel drive plate mounting screw hole positioned in step No. 3.
5. Locate transmission on flywheel housing aligning drive plate to flywheel and transmission to flywheel housing.

   Install transmission to flywheel housing screws. Tighten screws to specified torque. Remove transmission to engine guide studs. Install remaining screws and tighten to specified torque.
6. Remove drive plate locating stud.
7. Install drive plate attaching screw and washer. Snug screw but **do not tighten**. Some engine flywheel housings have a hole located on the flywheel housing circumference in line with the drive plate screw access hole. A screwdriver or pry bar used to hold the drive plate against the flywheel will facilitate installation of the drive plate screws. Rotate the engine flywheel and install the remaining seven (7) flywheel to drive plate attaching screws. Snug screws but do not tighten. After all eight (8) screws are installed torque each one 25 to 30 ft. lbs. torque [33,9 - 40,6 N.m.]. This will require torquing each screw and rotating the engine flywheel until the full amount of eight (8) screws have been tightened.
8. Measure engine crankshaft end play after transmission has been completely installed on engine flywheel. This value must be within .001 [0,025 mm] of the end play recorded in step No. 2.

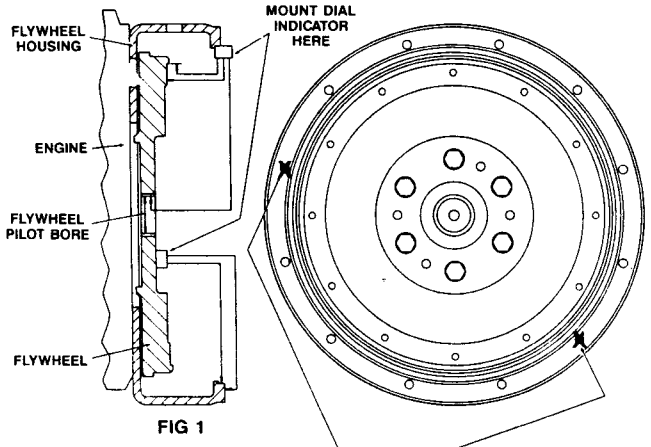


FIG 1

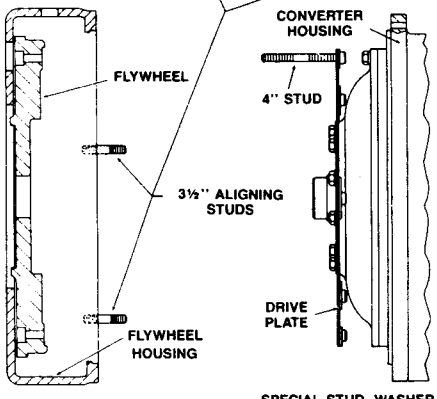


FIG 2

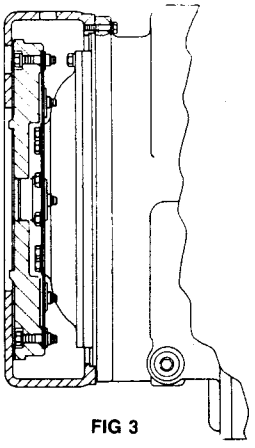


FIG 3

SPECIAL STUD, WASHER AND SELF LOCK NUT FURNISHED BY MACHINE MANUFACTURER.

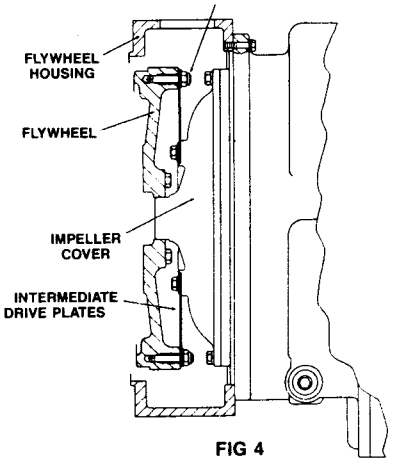
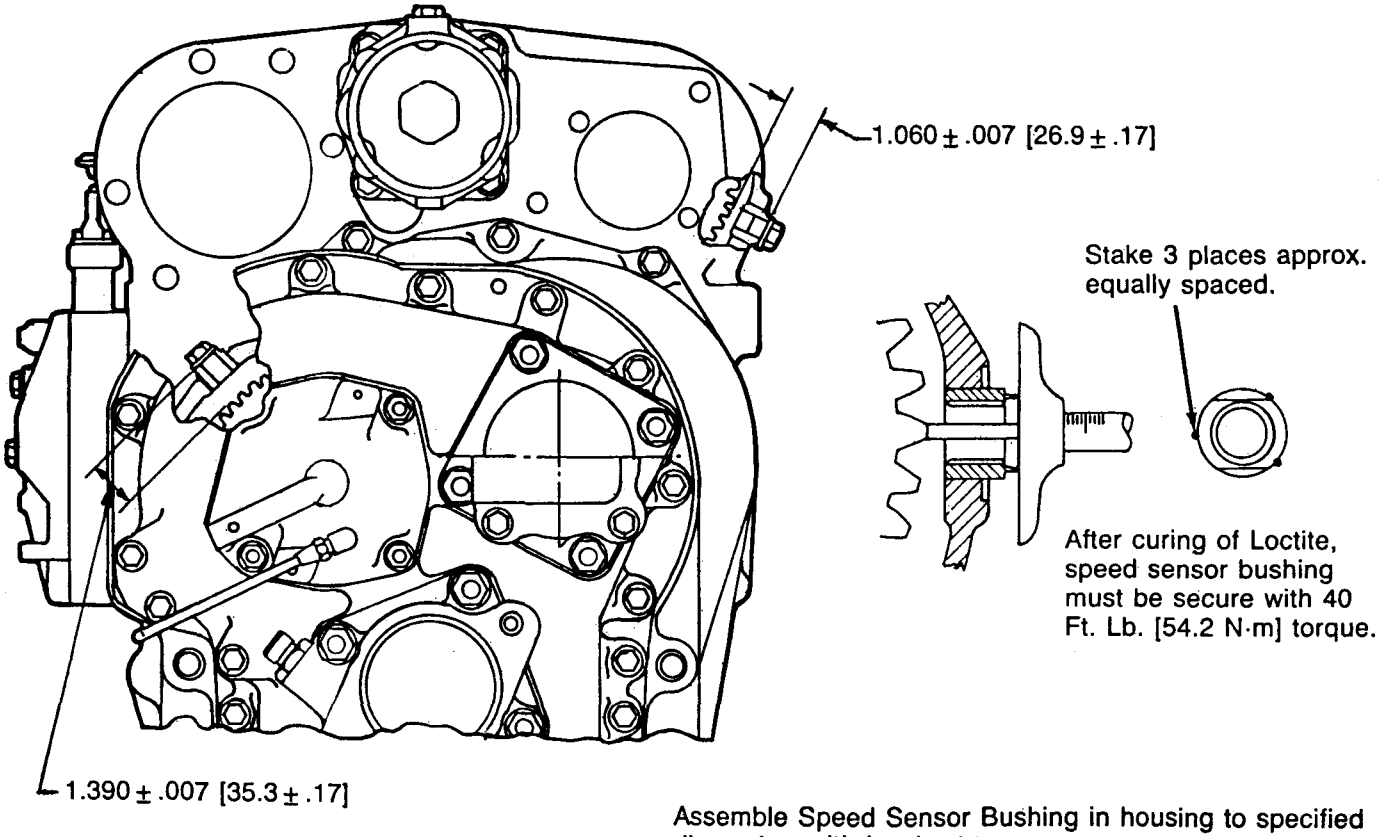


FIG 4




REAR VIEW

Assemble Speed Sensor Bushing in housing to specified dimension with Loctite 262 and stake (3) three places.

**SPEED SENSOR BUSHING INSTALLATION**