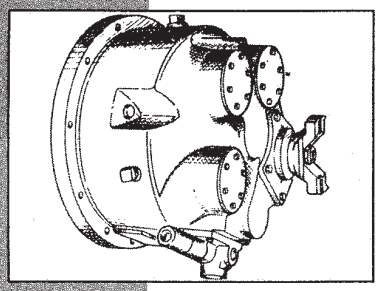
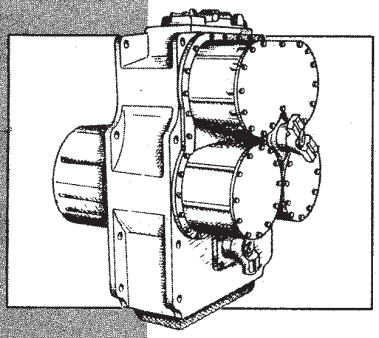
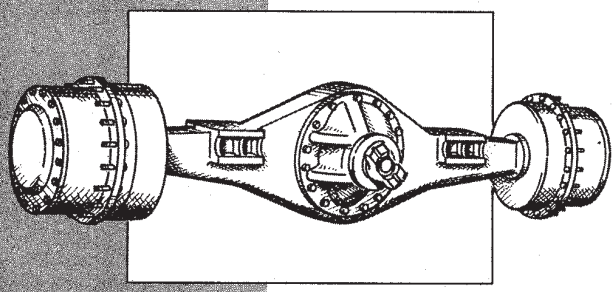
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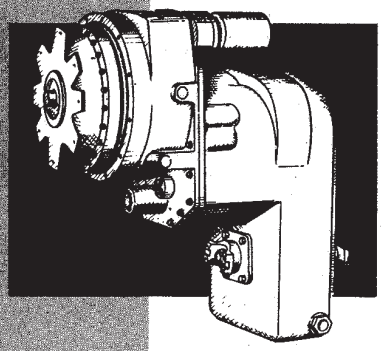
Maintenance and Service Manual

JULHO 1995









28000

Powershift Transmission

R & HR MODEL 3 & 6 SPEED LONG DROP WITH RANGE SHIFT

CLARK

CLARK-HURTH COMPONENTS

SM R-HR 283-6LD (Rev. 7-95)

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.

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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 [ ].

NOTES

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
Three Speed Clutch and Gear 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 Three-Speed Power Flow
Clutch and Gear Arrangement
Ring Gear Installation
Shielded Bearing 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

With the engine running, the converter charging pump draws oil from the transmission sump through the removable 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.

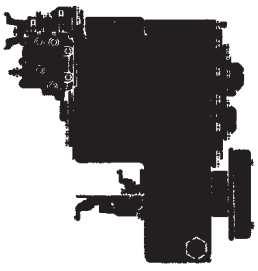
With the engine running and the directional control lever in neutral position, oil pressure from the regulating valve is blocked at the control valve, and the transmission is in neutral. Movement of the forward and reverse spool will direct oil, under pressure to either the forward or reverse direction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

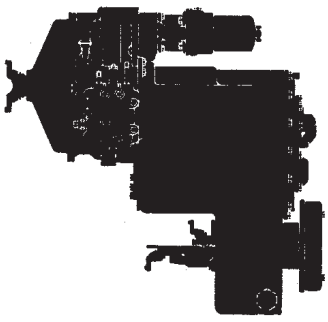
There are bleed balls in the clutch piston which allow quick escape for oil when the pressure to the piston is released.



R-28000



HR-28000



MHR-28000

FIG. A

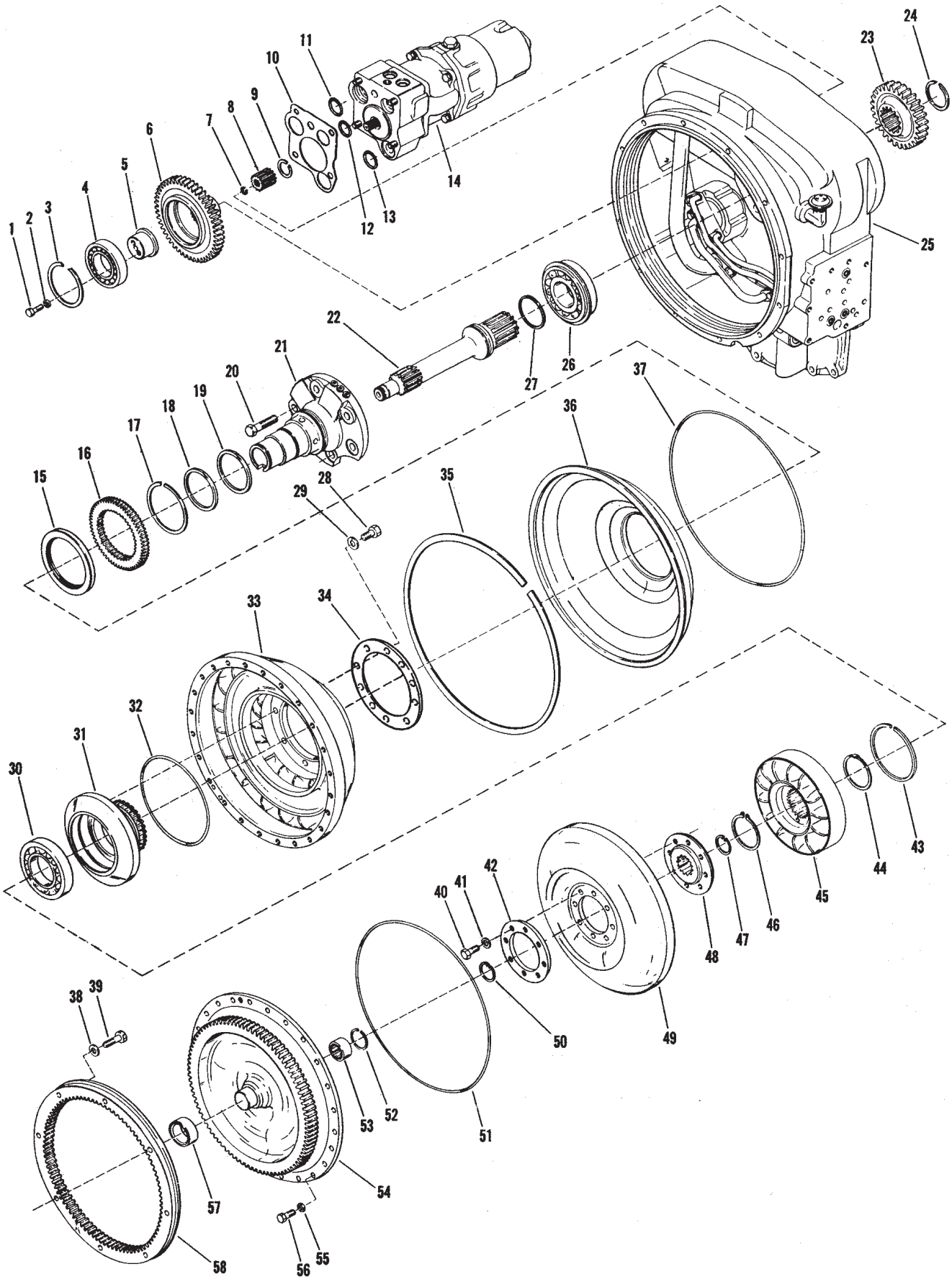

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Figure B

HR 28000 CONVERTER GROUP

(See page 56 for R Model Front Cover Group)

ITEM	DESCRIPTION	QTY.
1	Bearing Support Screw	6
2	Bearing Support Screw Lockwasher	6
3	Driving Gear Snap Ring	3
4	Drive Gear Bearing	3
5	Drive Gear Bearing Support	3
6	Drive Gear	3
7	Snap Ring (Internal—See item 8	1
8	Drive Gear Hub Sleeve and Snap Ring 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 to Converter Housing "O" Ring	1
12	Valve Body to Converter Housing "O" Ring	1
13	Valve Body to Converter Housing "O" Ring	1
14	Regulator Valve, Charging Pump and Filter Assembly	1
15	Oil Seal	1
16	Impeller Hub Gear	1
17	Impeller Hub Gear Snap Ring	1
18	Stator Support Oil Sealing Ring	1
19	Sealing Ring Expander Spring	1
20	Stator Support	1
21	Turbine Shaft	1
22	Turbine Shaft Gear	1
23	Turbine Shaft Gear Retainer Ring	1
24	Converter Housing and Tube Assembly	1
25	Turbine Shaft Bearing	1
26	Turbine Shaft Oil Sealing Ring	1
27	Stator Support Screw Lockwasher	6
28	Stator Support Screw	6
29	Hub to Impeller Screw	8
30	Hub to Impeller Screw Washer	8
31	Impeller Hub Bearing	1
32	Impeller Hub	1
33	Impeller Hub "O" Ring	1
34	Impeller	1
35	Oil Baffle Retainer Ring	1
36	Oil Baffle	1
37	Oil Baffle Seal Ring	1
38	Detent Spring	2
39	Detent Ball	2
40	Valve to Converter Gasket	1
41	Control Valve Housing Assembly	1
42	Valve to Converter Housing Screw Lockwasher	9
43	Valve to Converter Housing Screw	9
44	Turbine Hub Screw Washer	8
45	Turbine Hub Screw	8
46	Ring Gear Screw	16
47	Ring Gear Screw Plain Washer	16
48	Flywheel Ring Gear	1
49	Impeller Cover Sleeve	1
50	Impeller Cover to Impeller Screw and Lockwasher	24
51	Impeller Cover	1
52	Impeller Cover Bearing	1
53	Impeller Cover Bearing Retainer Ring	1
54	Impeller Cover "O" Ring	1
55	Turbine Retainer Ring	1
56	Turbine	1
57	Turbine Hub	1
58	Turbine Locating Ring	1
59	Reaction Member Retainer Ring	1
60	Reaction Member	1
61	Reaction Member Spacer	1
62	Impeller Hub Bearing Retainer Ring	1

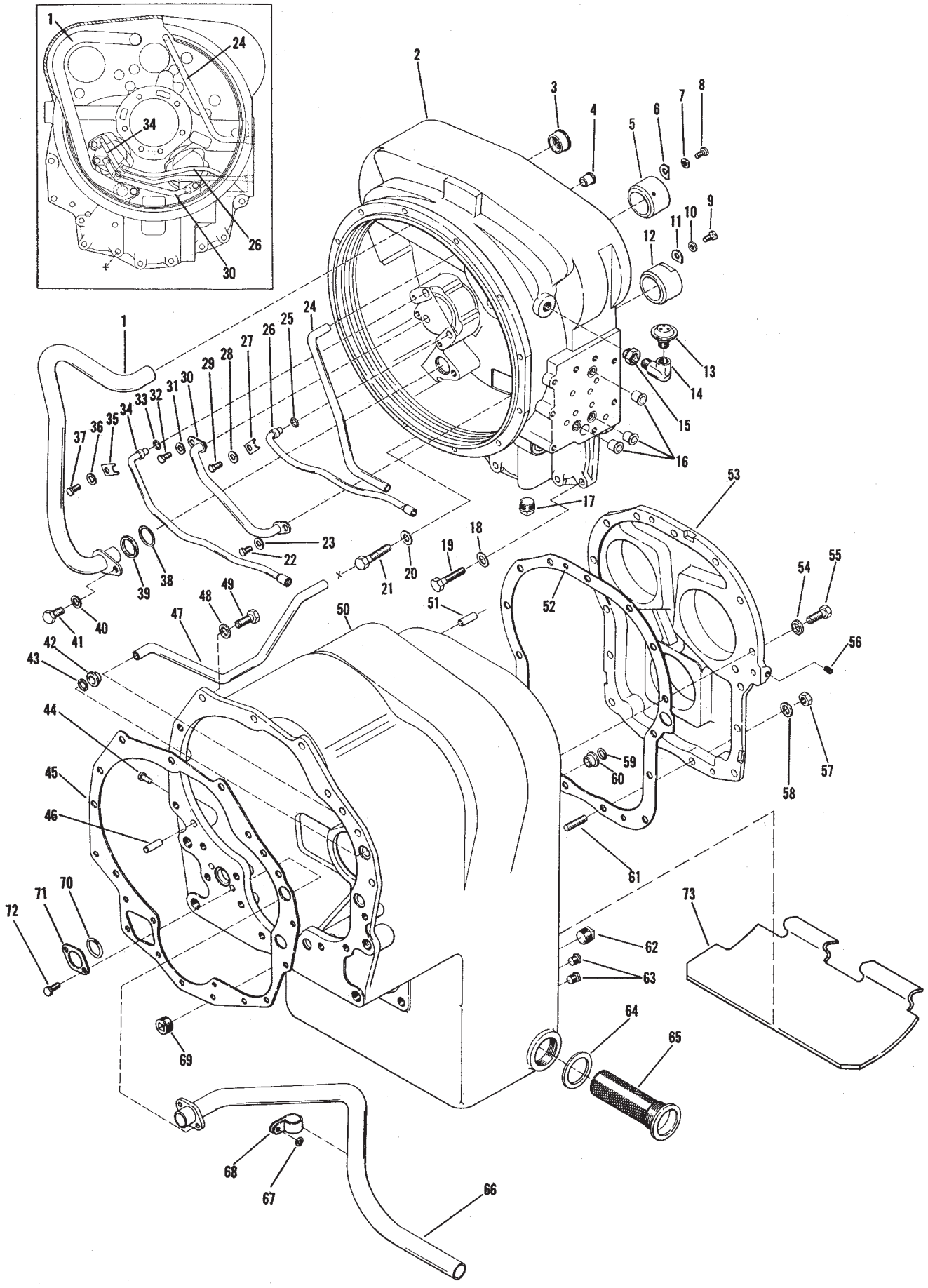

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Figure C

HR 28000 CONVERTER AND TRANSMISSION CASE GROUP

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

ITEM	DESCRIPTION	QTY.
38	Suction Tube "O" Ring	1
39	Suction Tube Spacer Ring	1
40	Suction Tube Retainer Lockwasher	1
41	Suction Tube Retainer Screw	1
42	Tube Sleeve	1
43	Pressure Tube "O" Ring	1
44	Suction Line Tube Clip Rivet	1
45	Conveter Housing to Transmission Case Gasket	1
46	Converter Housing to Transmission Case Dowel Pin	2
47	Low Speed Clutch Pressure Tube	1
48	Transmission Case to Converter Housing Screw Lockwasher	10
49	Transmission Case to Converter Housing Screw	10
50	Transmission Case Assembly	1
51	Transmission Case to Rear Cover Dowel Pin	2
52	Transmission Case to Rear Cover Gasket	1
53	Transmission Case Rear Cover	1
54	Rear Cover to Case Screw Lockwasher	13
55	Rear Cover to Case Screw	13
56	Rear Cover Pipe Plug	1
57	Rear Cover to Transmission Case Stud Nut	2
58	Rear Cover to Transmission Case Lockwasher	2
59	Tube Sleeve "O" Ring	1
60	Tube Sleeve	1
61	Transmission Case to Rear Cover Stud	2
62	Drain Plug	1
63	Oil Level Plug	2
64	Screen Assembly Gasket	1
65	Screen Assembly	1
66	Suction Tube Assembly	1
67	Suction Tube Clip Washer	1
68	Suction Tupe Clip	1
69	Pipe Plug	2
70	Suction Tube "O" Ring	1
71	Suction Tube Retainer Washer	1
72	Suction Tube Retainer Washer Screw	2
73	Oil Baffle (6 speed only)	1

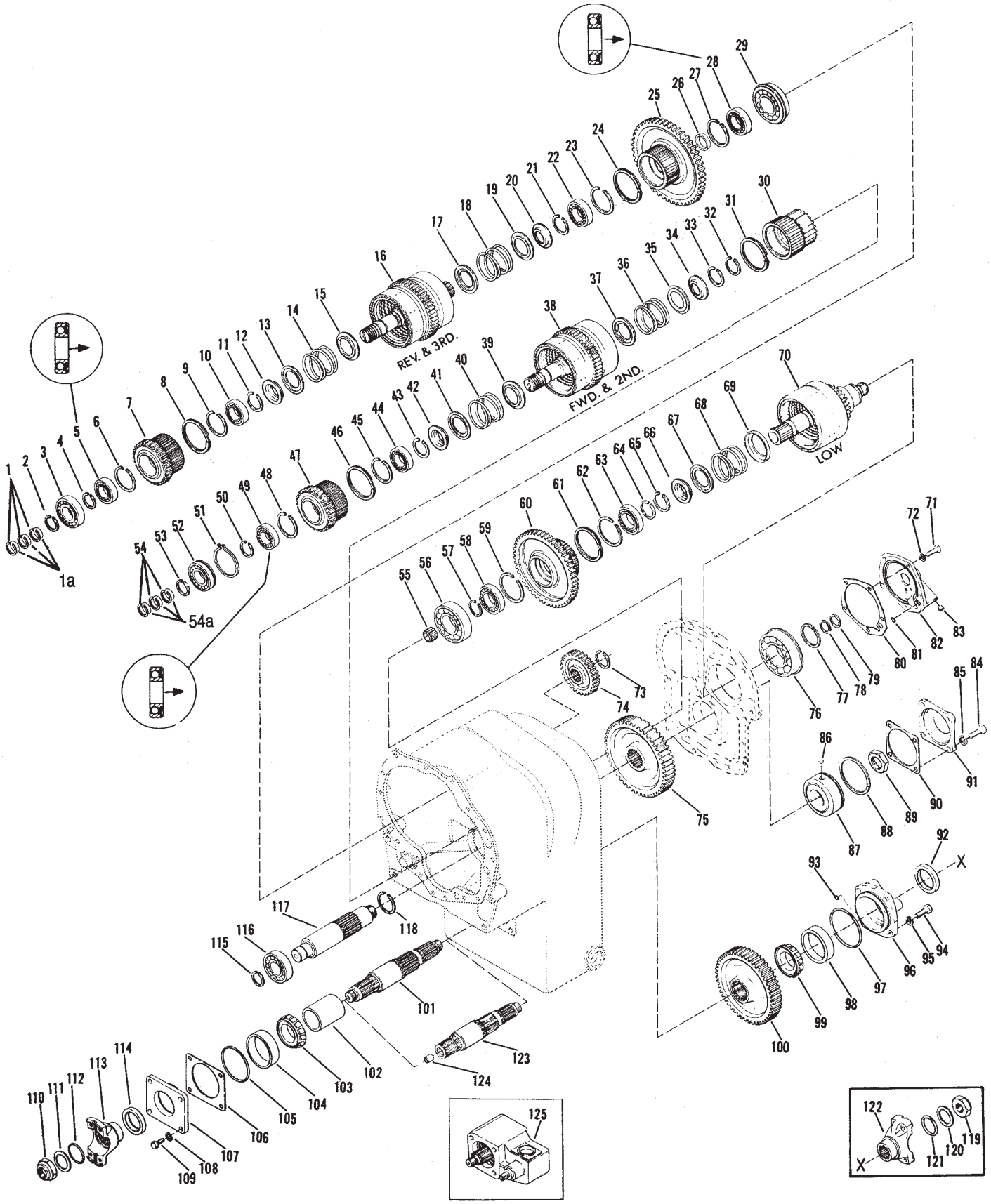
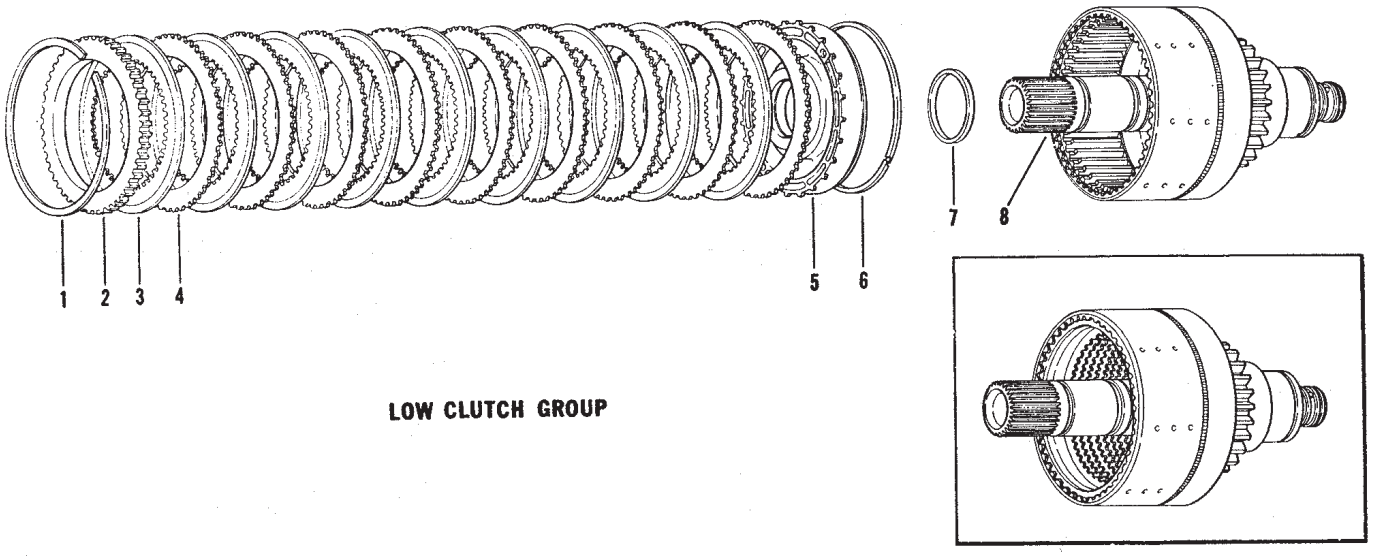


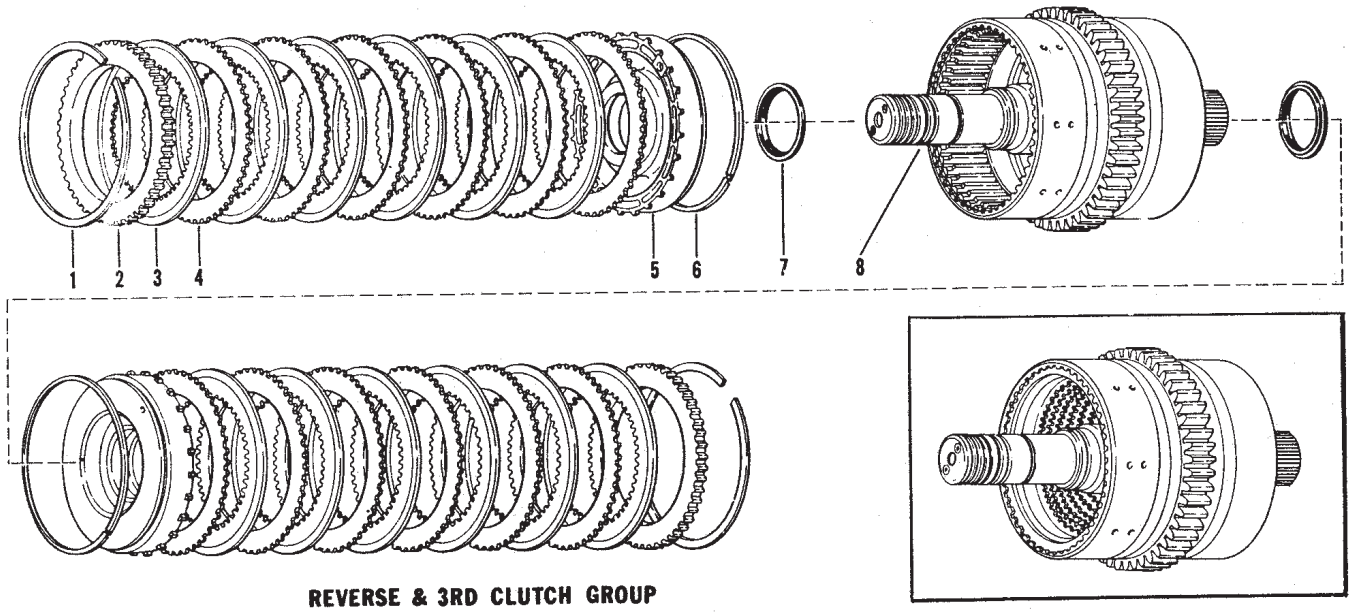
Figure D

28000 THREE SPEED CASE AND CLUTCH GROUP

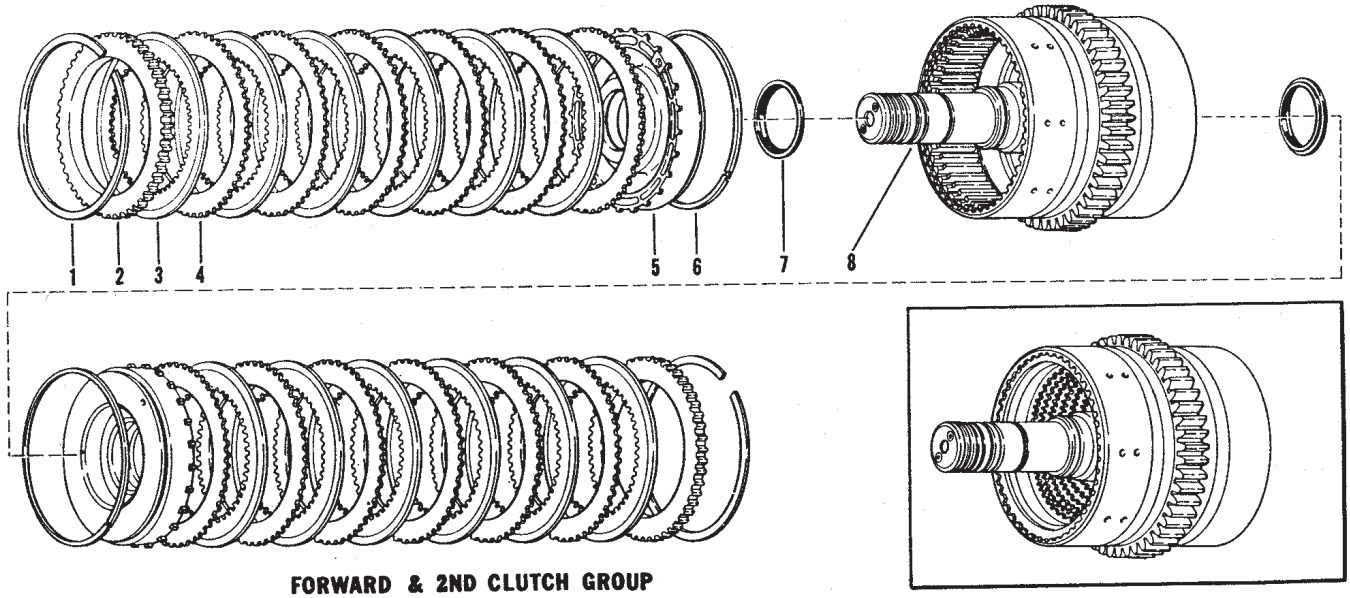
ITEM	DESCRIPTION	QTY
1	Reverse and 3rd Clutch Shaft Piston Ring	3
1A	Piston Ring Expander Spring	3
2	Reverse and 3rd Shaft Front Bearing	1
3	Reverse and 3rd Shaft Front Bearing	1
4	Front Bearing Retainer Ring	1
5	Clutch Driven Gear Bearing	1
6	Clutch Driven Gear Bearing Snap Ring	1
7	Clutch Driven Gear	1
8	Clutch Hub Oil Baffle Ring	1
9	Clutch Driven Gear Bearing Snap Ring	1
10	Clutch Driven Gear Bearing	1
11	Return 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 and 3rd Clutch Shaft and Drum	1
17	Spring Retainer	1
18	Piston Return Spring	1
19	Spring Retainer	1
20	Snap Ring Retainer	1
21	Return 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	2nd Gear Retainer Ring	1
33	Return Spring Retainer Snap Ring	1
34	Snap Ring Retainer	1
35	Spring Retainer	1
36	Piston Return Spring	1
37	Spring Retainer	1
38	Forward and 2nd Clutch Shaft and Drum	1
39	Spring Retainer	1
40	Piston Return Spring	1
41	Spring Retainer	1
42	Snap Ring Retainer	1
43	Return Spring Retainer Snap Ring	1
44	Clutch Driven Gear Bearing	1
45	Clutch Driven Gear Bearing Snap Ring	1
46	Clutch Hub Oil Baffle Ring	1
47	Clutch Driven Gear	1
48	Clutch Driven Gear Bearing Snap Ring	1
49	Clutch Driven Gear Bearing	1
50	Front Bearing Retainer Ring	1
51	Front Bearing Locating Ring	1
52	Forward and 2nd Shaft Front Bearing	1
53	Front Bearing Retainer Ring	1
54	Forward and 2nd Shaft Piston Ring	3
54A	Piston Ring Expander Springs	3
55	Low Speed Clutch Shaft Pilot Bearing	1
56	2nd Gear Bearing	1
57	Low Gear Bearing Retainer Ring	1
58	Low Gear Bearing	1
59	Low Gear Bearing Locating Ring	1
60	Low Gear	1
61	Low Gear Oil Baffle Ring	1
62	Low Gear Bearing Locating Ring	1
63	Low Gear Bearing	1
64	Low Gear Bearing Retainer Ring	1
65	Return Spring Retainer Snap Ring	1
66	Snap Ring Retainer	1
67	Return Spring Retainer	1
68	Return Spring	1
69	Return Spring Retainer	1
70	Low Speed Clutch Shaft and Drum	1
71	Bearing Cap Screw	5
72	Bearing Cap Screw Lockwasher	5
73	Drive Gear Retainer Ring	1
74	Low Speed Drive Gear	1
75	Idler Shaft Gear	1
76	Low Shaft Rear Bearing	1
77	Low Shaft Rear Bearing Retainer Ring	1
78	Low Shaft Piston Ring	1
79	Low Shaft Piston Ring	1
80	Rear Bearing Cap Gasket	1
81	Rear Bearing Cap "O" Ring	1
82	Low Shaft Rear Bearing Cap	1
83	Low Shaft Rear Bearing Cap Plug	1
84	Idler Shaft Bearing Cap Screw	1
85	Idler Shaft Bearing Cap Screw Lockwasher	1
86	Idler Shaft Rear Bearing Lock Ball	1
87	Idler Shaft Rear Bearing	1
88	Rear Bearing Locating Ring	1
89	Idler Shaft Nut	1
90	Idler Shaft Bearing Cap Gasket	1
91	Idler Shaft Bearing Cap	1
92	Rear Bearing Cap Oil Seal	1
93	Rear Bearing Cap "O" Ring	1
94	Rear Bearing Cap Screw	4
95	Rear Bearing Cap Screw Lockwasher	4
96	Output Shaft Rear Bearing Cap	1
97	Bearing Cap "O" Ring	1
98	Rear Bearing Cup	1
99	Rear Bearing Cone	1
100	Output Shaft Gear	1
101	Output Gear	1
102	Output Shaft Gear Spacer	1
103	Output Shaft Bearing Cone	1
104	Output Shaft Bearing Cup	1
105	Front Bearing Cap "O" Ring	1
106	Front Bearing Cap Shim	AR
107	Front Bearing Cap	1
108	Front Bearing Cap Screw Lockwasher	4
109	Front Bearing Cap Screw	4
110	Flange Nut	1
111	Flange Nut Washer	1
112	Flange Nut "O" Ring	1
113	Output Flange	1
114	Front Bearing Cap Oil Seal	1
115	Bearing Retaining Ring	1
116	Idler Shaft Front Bearing	1
117	Idler Shaft	1
118	Idler Shaft Gear Locating Ring	1
119	Flange Nut	1
120	Flange Nut Washer	1
121	Flange Nut "O" Ring	1
122	Companion Flange	1
123	Output Shaft (Used with Disconnect only)	1
124	Bushing (Used with Disconnect only)	1
125	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

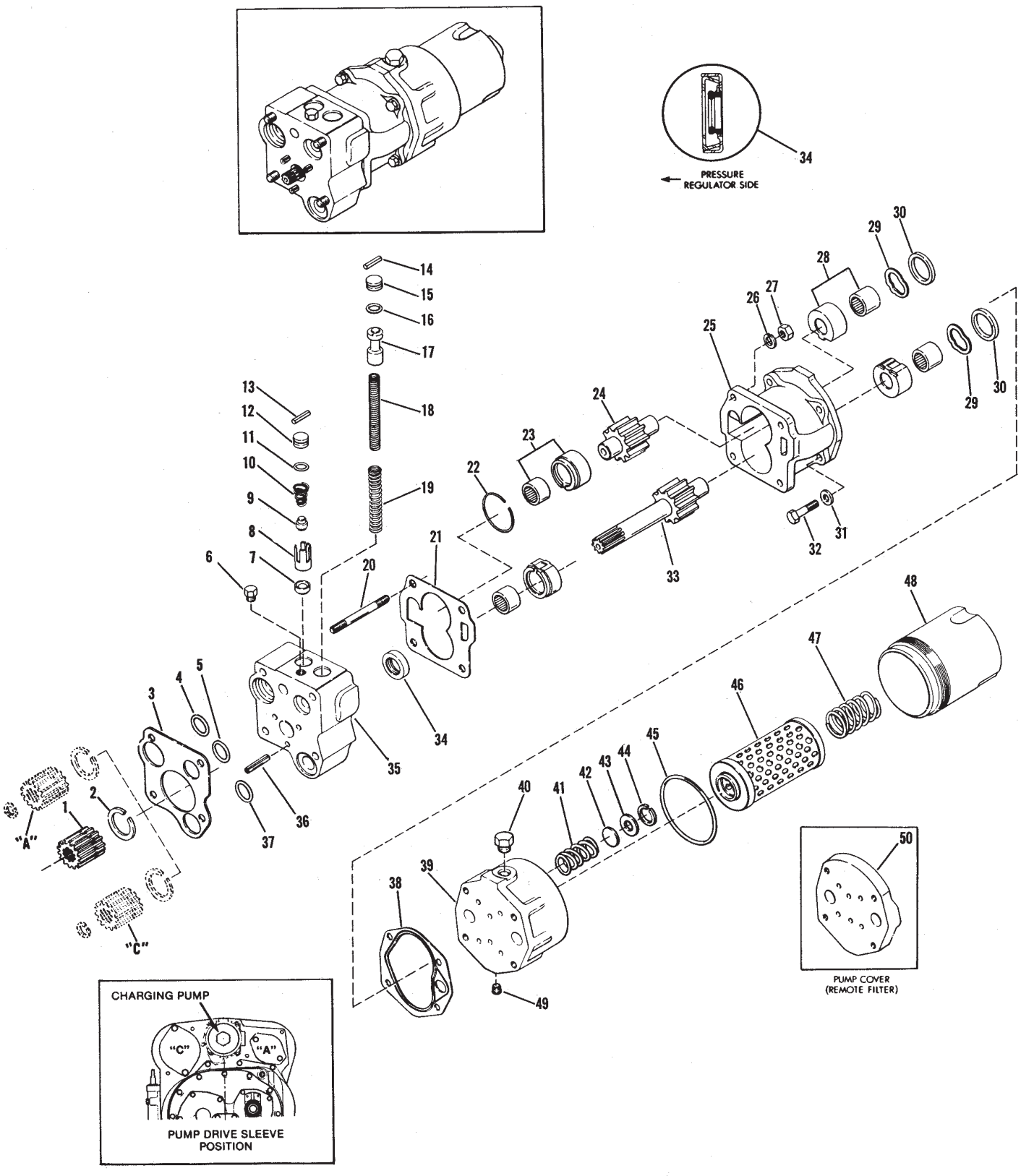
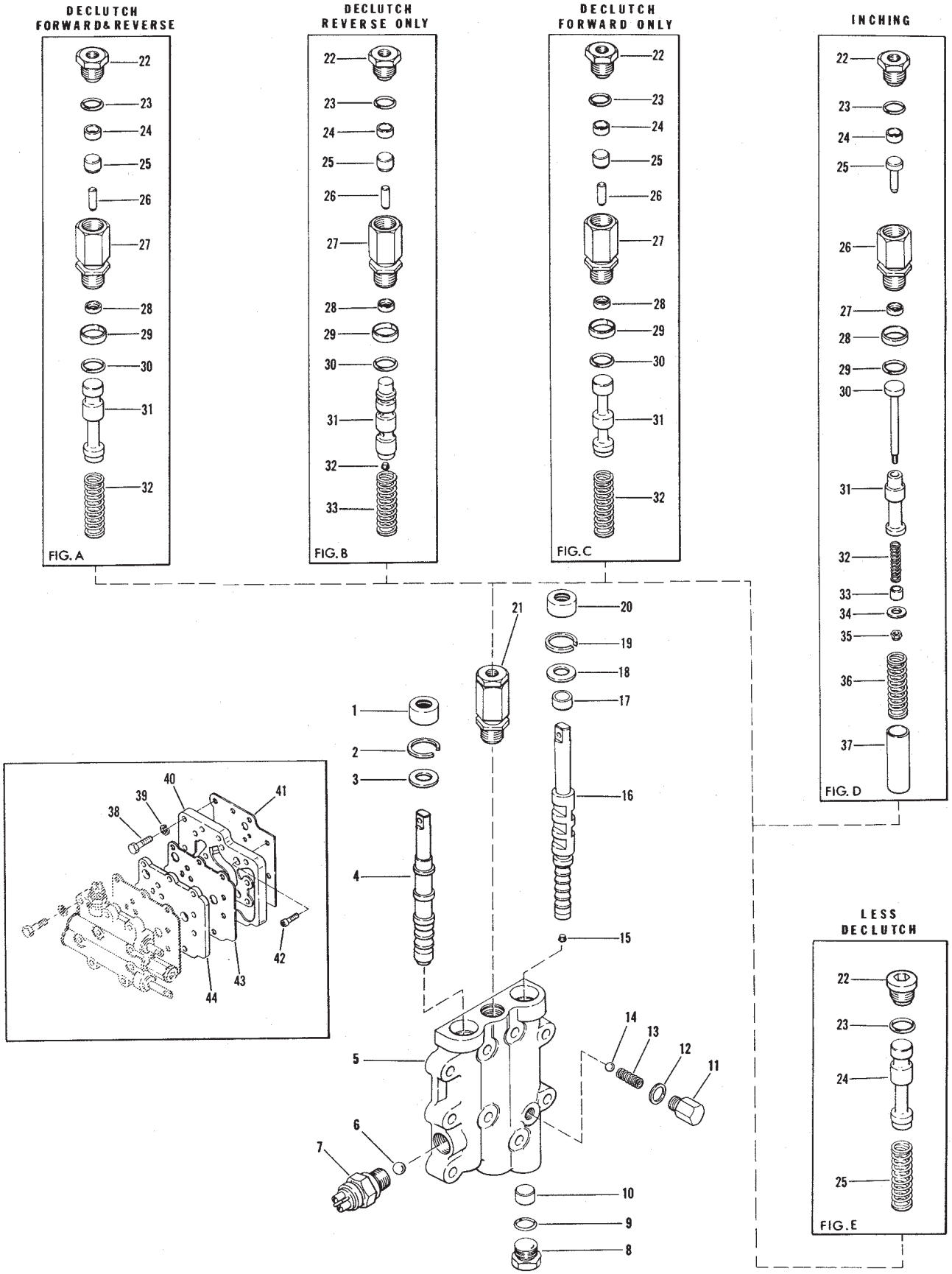

PRESSURE REGULATOR SIDE
34
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PUMP COVER (REMOTE FILTER)
3
4
5
35
34
36
37
2
1
"A"
"C"
CHARGING PUMP
"C"
"A"
PUMP DRIVE SLEEVE POSITION

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
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

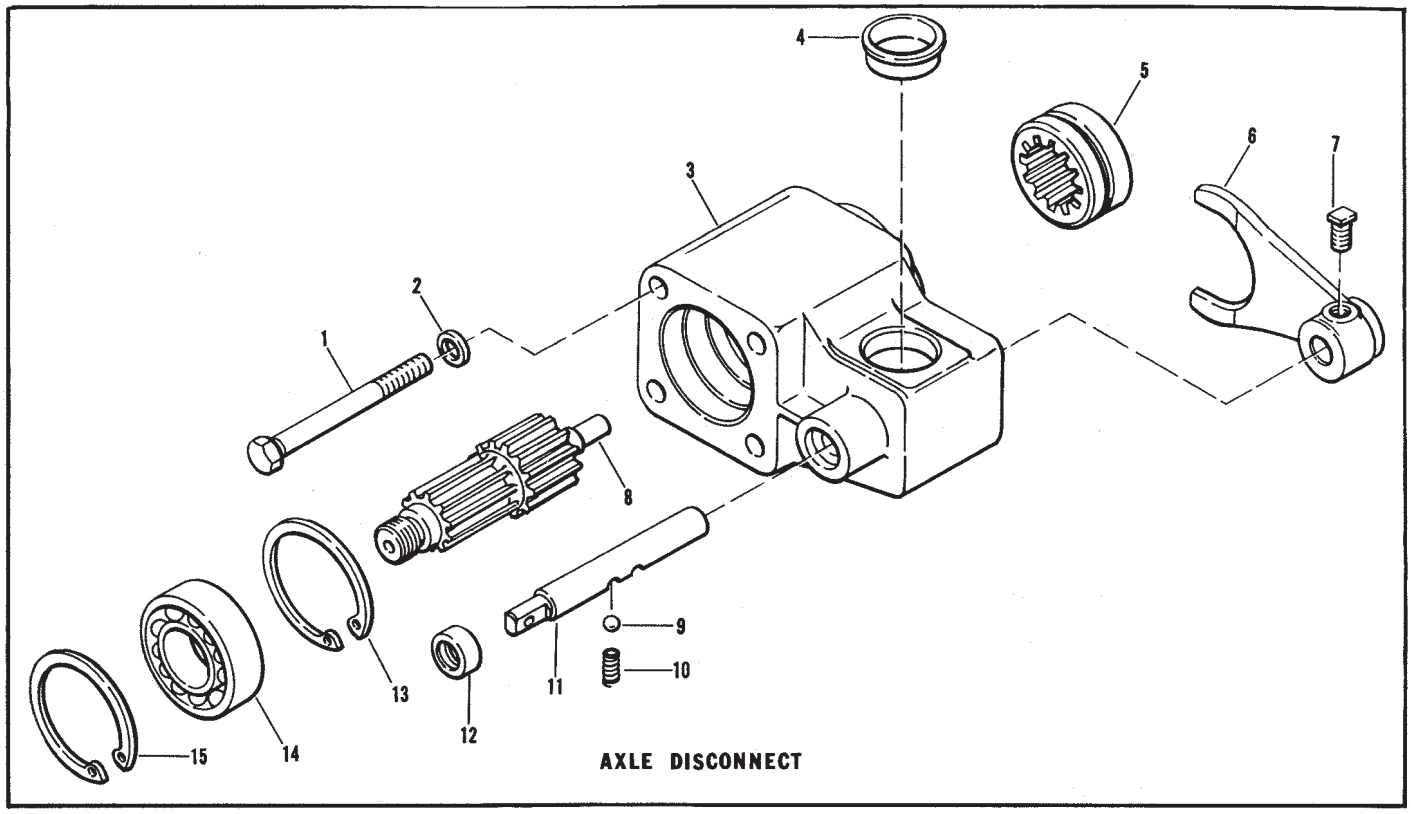


HYDRAULICALLY OPERATED CONTROL VALVE

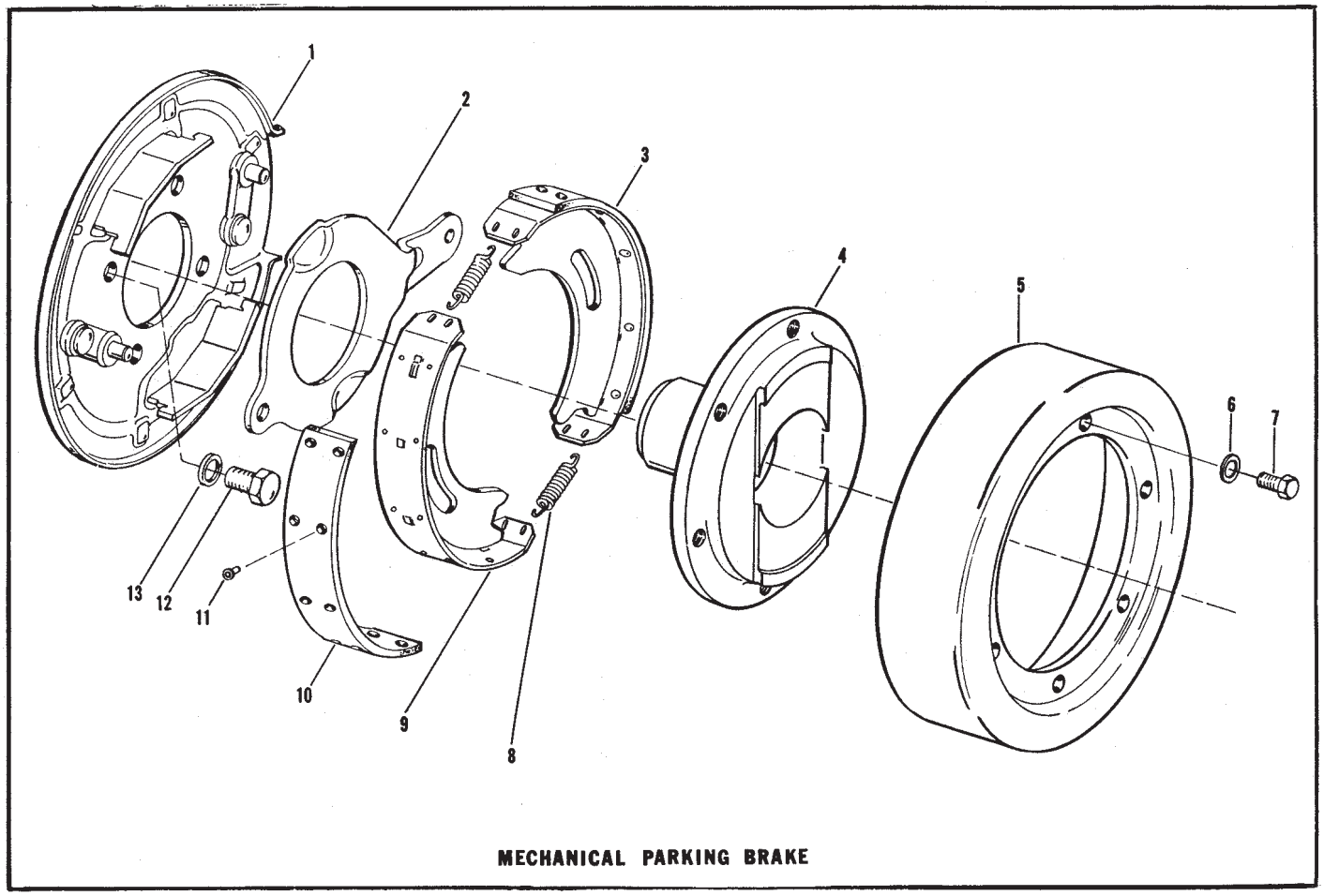
Figure G

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	1
12	Detent Spring Plug Washer	1
13	Detent Spring	1
14	Detent Ball	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

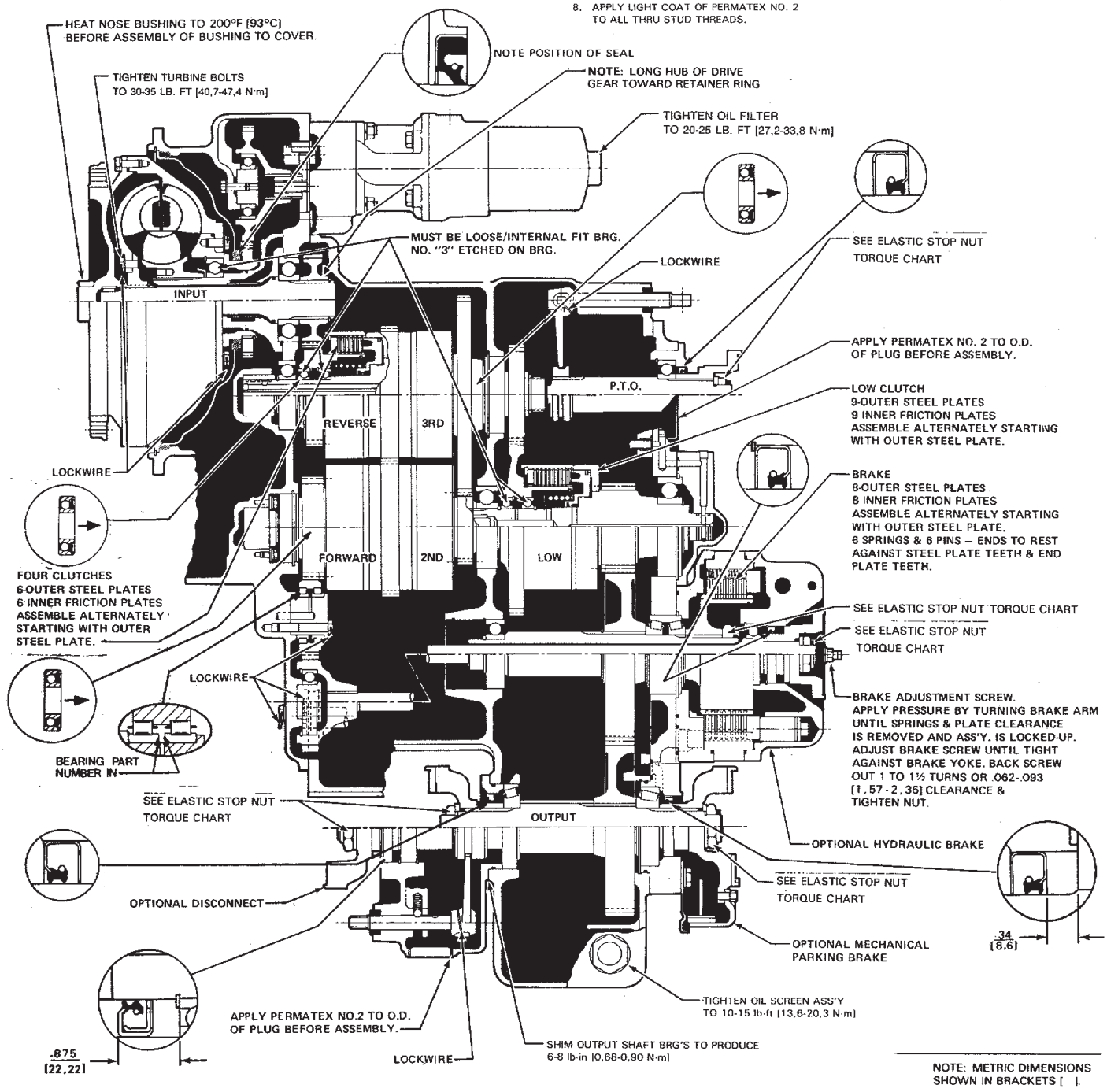
MECHANICAL PARKING BRAKE

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

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.

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]



28320 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 absolute must in the repair and overhaul of this unit. Before attempting any repairs, the exterior of the unit must be thoroughly cleaned to prevent the possibility of dirt and foreign matter entering the mechanism.

NOTE: For R-Model (remote mounted) front cover removal, service and installation on transmission see page 59 Figure 1.

DISASSEMBLY

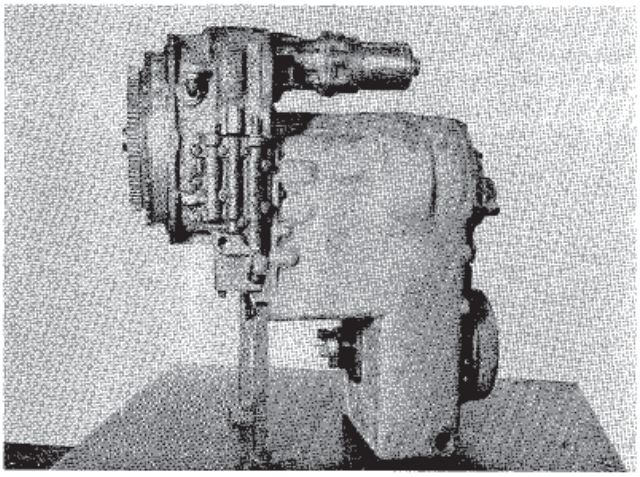


Figure 1
Side view of 3-speed transmission.

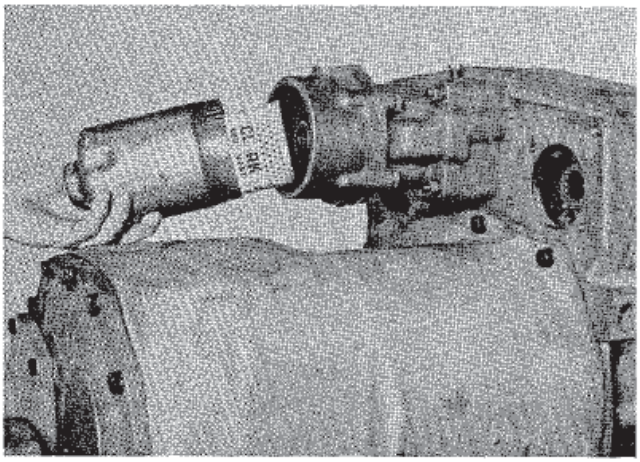


Figure 2

Remove filter housing and filter element.

NOTE: See lubrication section for filter cartridge change interval.

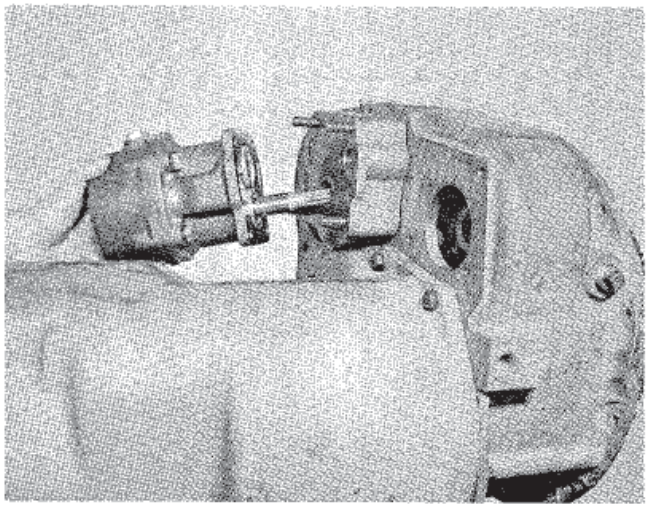


Figure 3

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

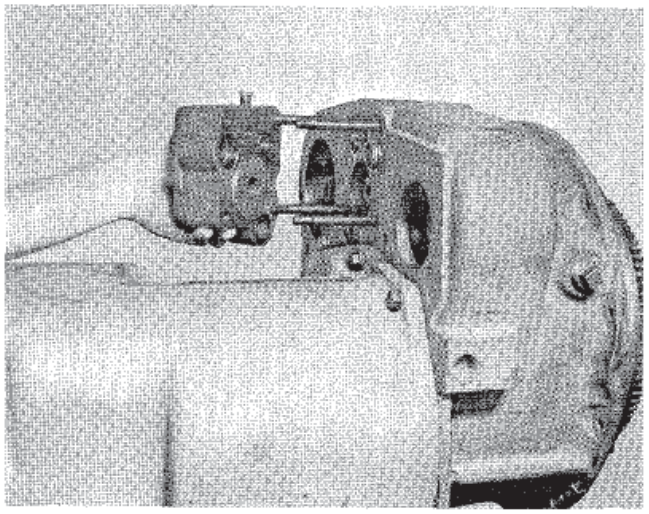


Figure 4
Remove pressure regulating valve assembly.

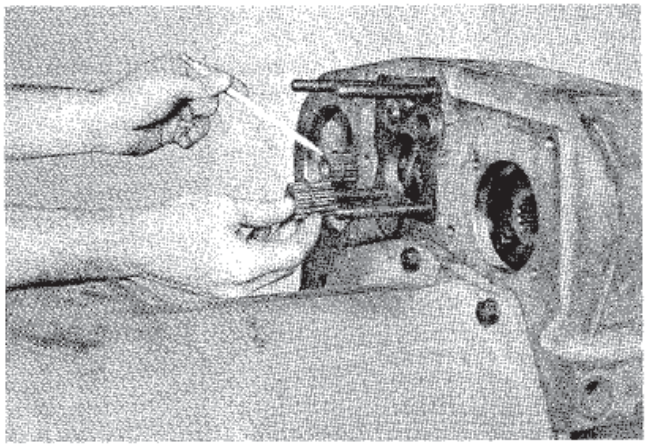


Figure 5
Remove pump drive sleeves.

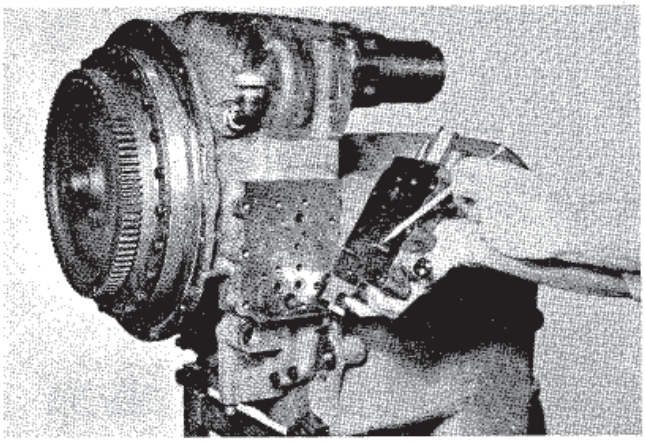


Figure 6
Remove control valve bolts and washers. Remove control valve. Use caution as not to lose detent springs and balls.

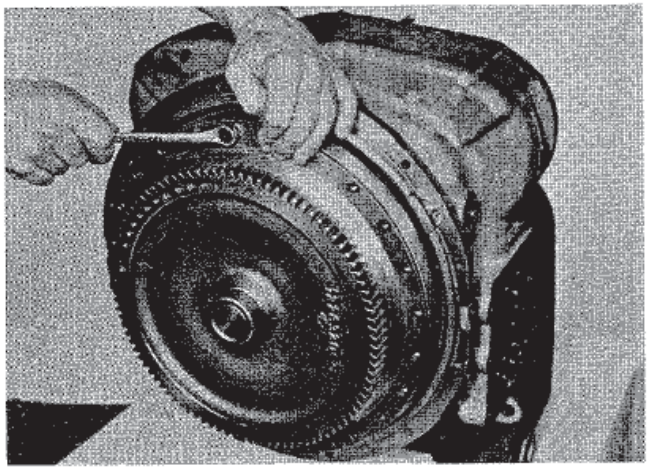


Figure 7
Remove impeller cover bolts.

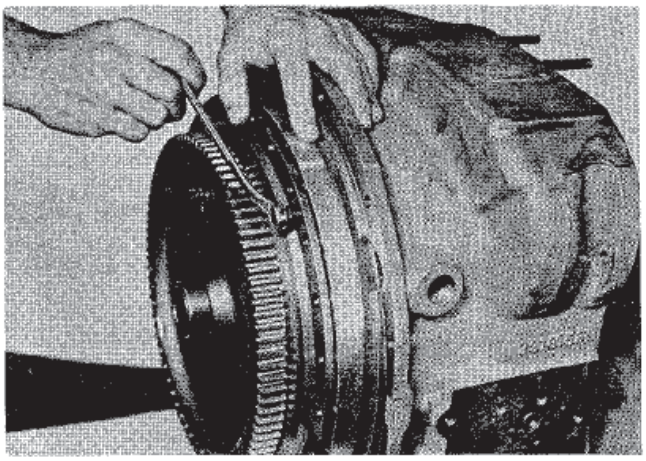


Figure 8
Install two bolts in threaded holes 180° apart to remove cover from impeller. **NOTE:** Some units may have pry slots instead of threaded holes.

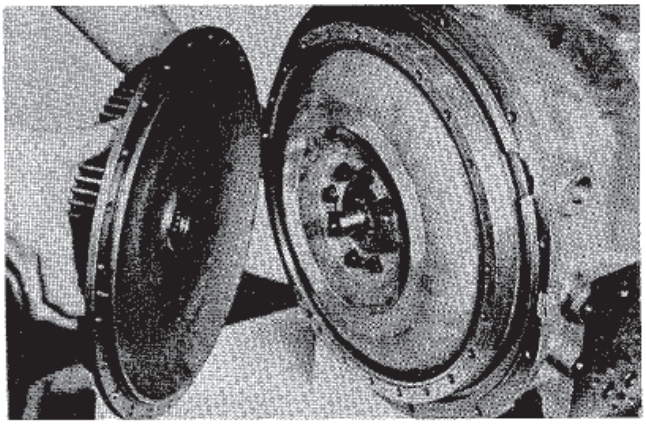


Figure 9
Remove impeller cover.

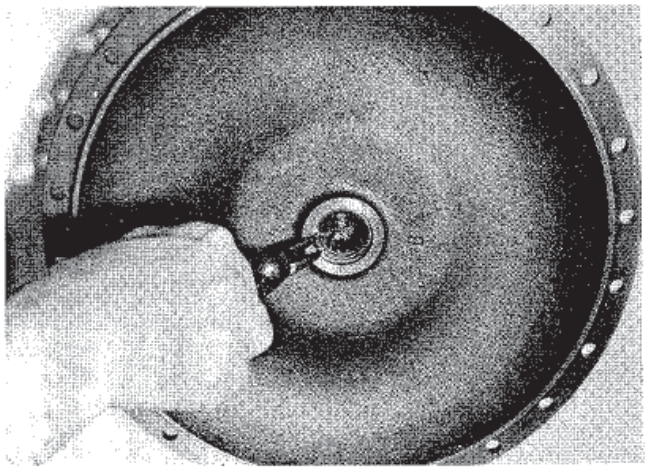


Figure 10
If impeller cover bearing is to be replaced remove retainer ring. Pry bearing from pocket.

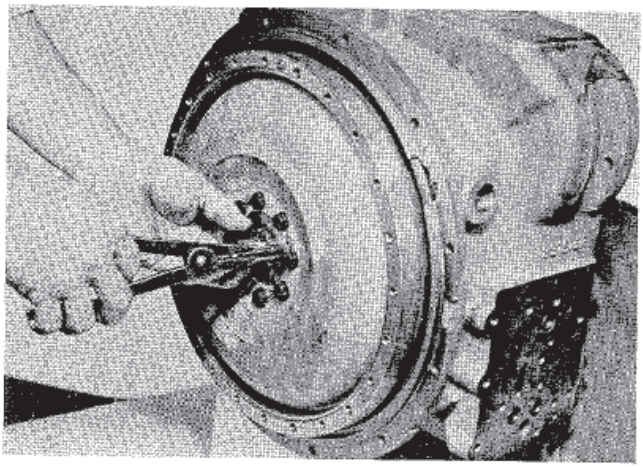


Figure 11
Remove turbine retaining ring.

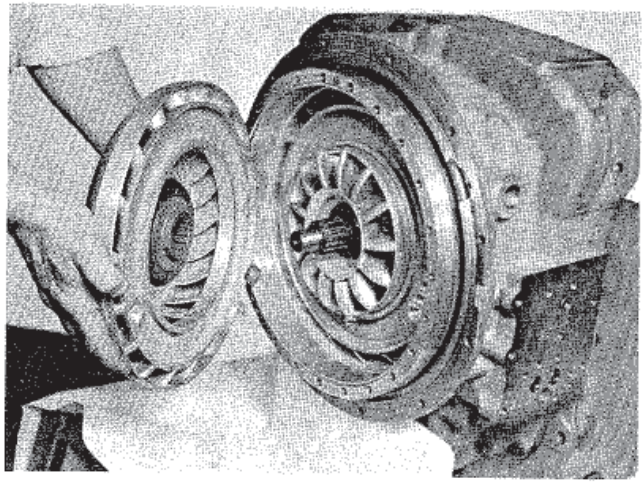


Figure 12
Remove turbine and hub assembly. **NOTE:** For special turbine to hub assembly see page 40.

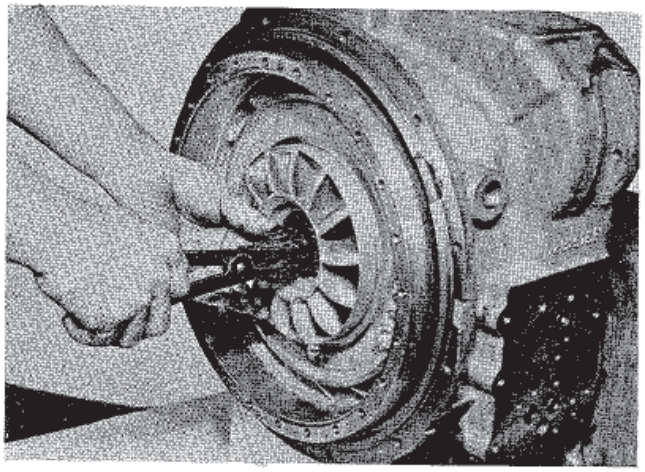


Figure 13
Remove turbine locating ring.

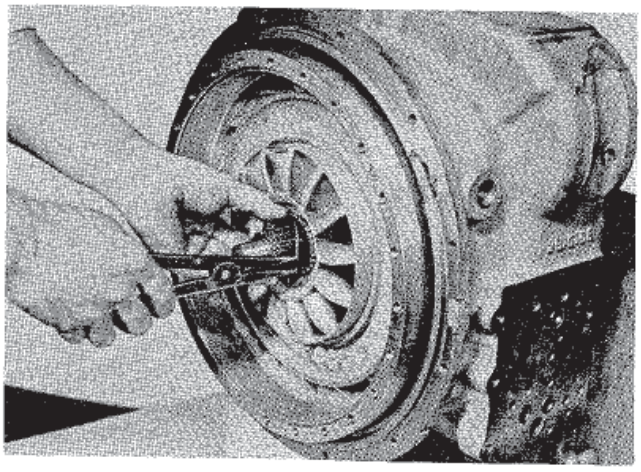


Figure 14
Remove reaction member retainer ring

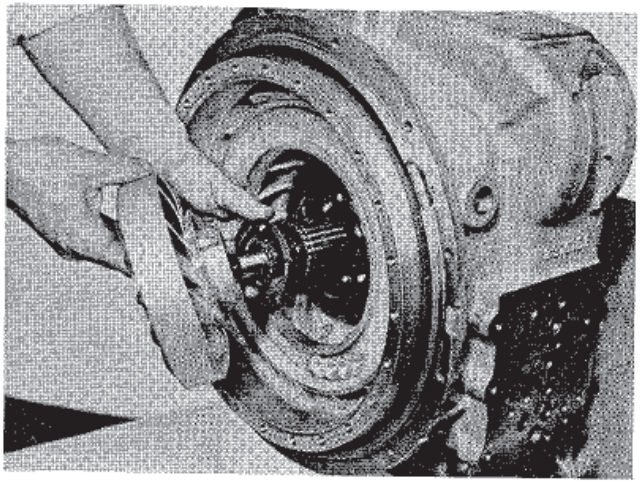


Figure 15
Remove reaction member and spacer.

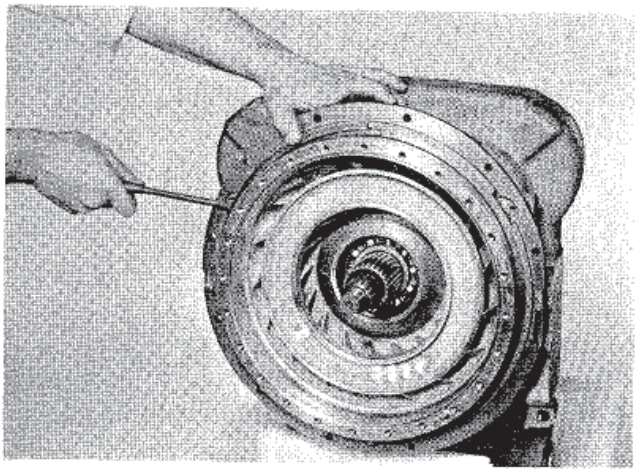


Figure 16
Remove oil baffle retainer ring.

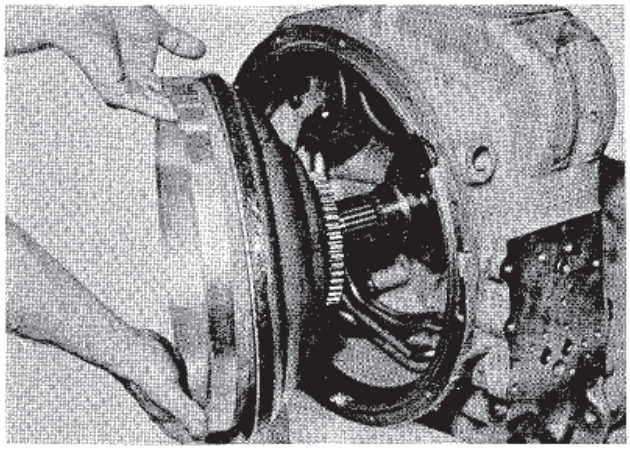


Figure 17

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.

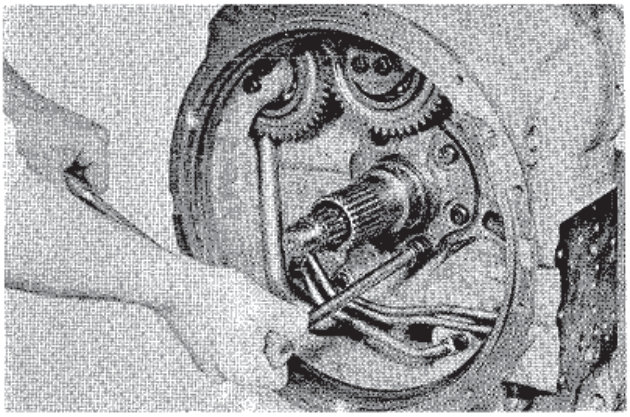


Figure 18

Remove stator support to housing bolts.

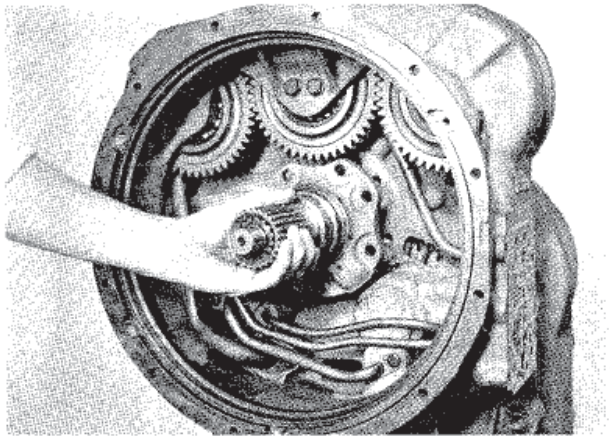


Figure 19

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

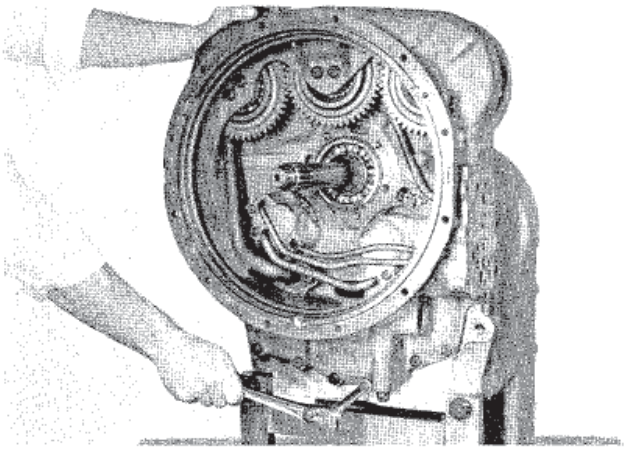


Figure 20

Remove bolts securing converter housing to transmission housing.

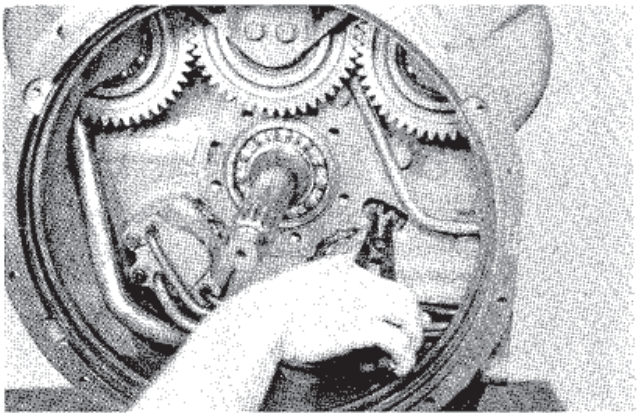


Figure 21

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

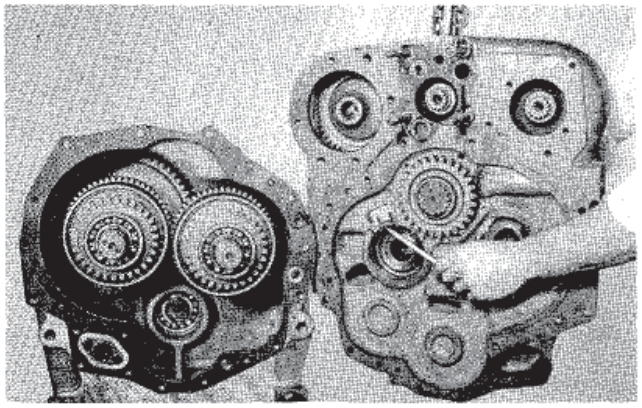


Figure 22

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

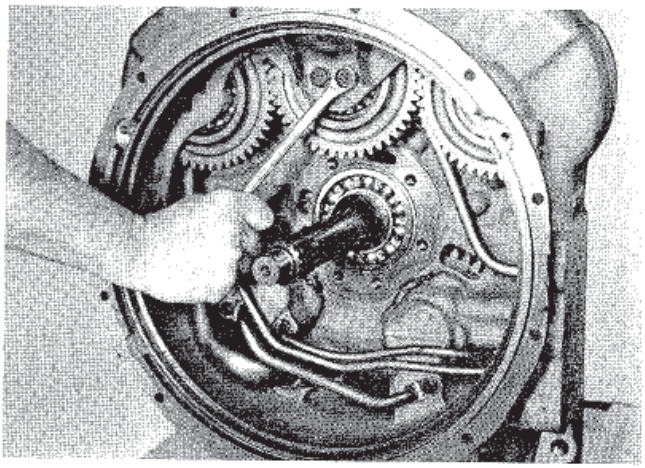


Figure 23
Remove pump drive gear bearing support bolts.

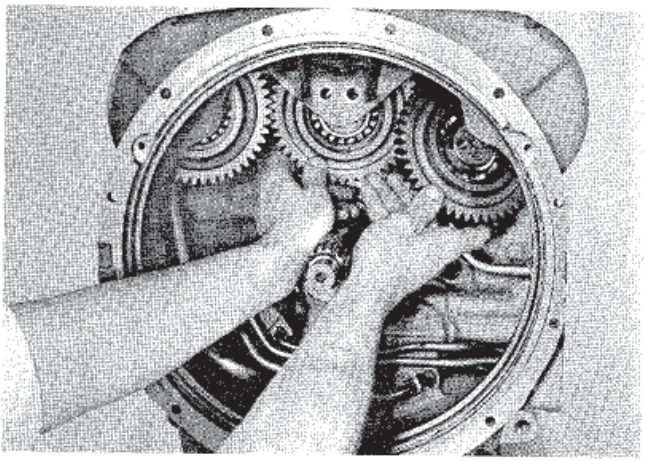


Figure 24
Move center gear toward the rear of converter housing. Remove pump drive gear on the right.

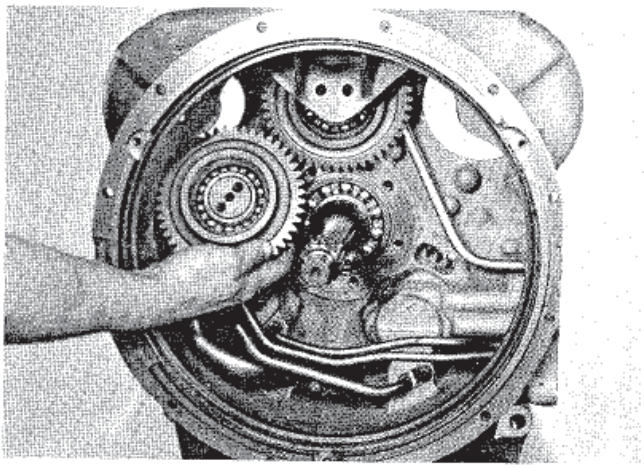


Figure 25
Remove pump drive gear on the left.

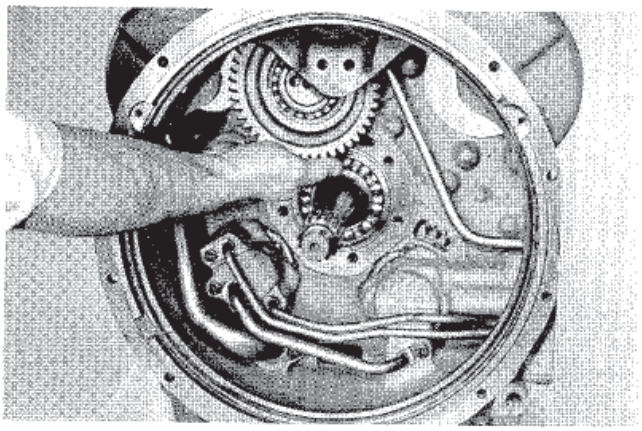


Figure 26
Remove center pump drive gear.

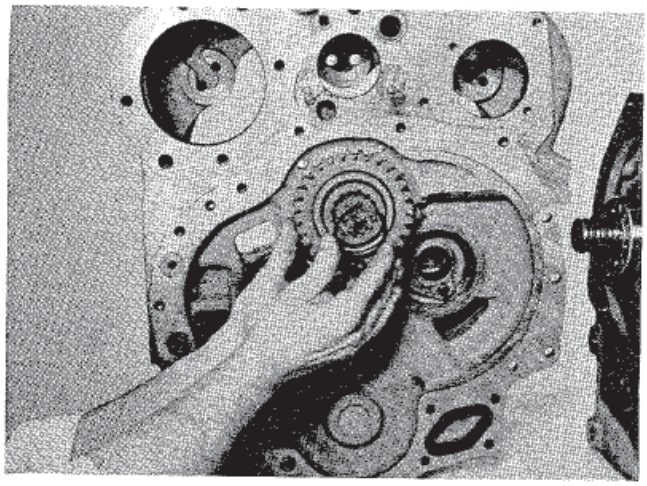


Figure 27
Remove turbine shaft gear retainer ring and gear.

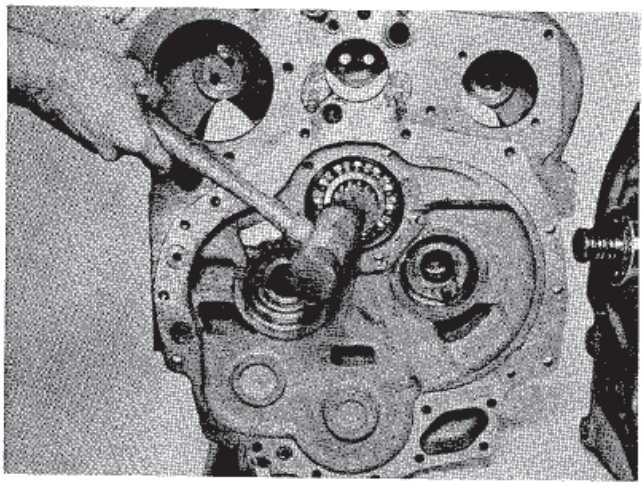


Figure 28
From rear of converter housing tap turbine shaft and bearing from housing.

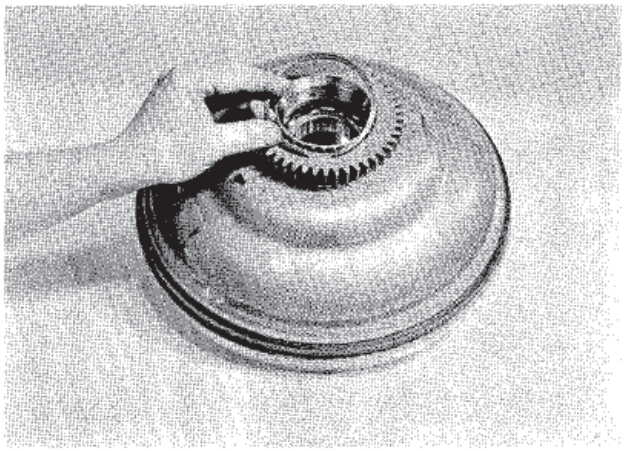


Figure 29
Remove impeller hub gear retainer ring.

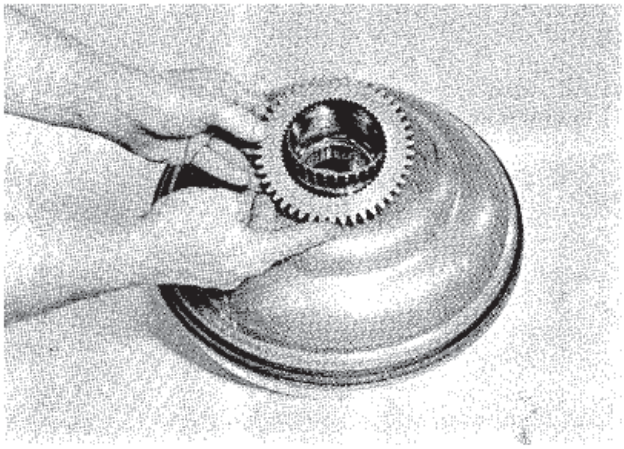


Figure 30
Remove impeller hub gear.

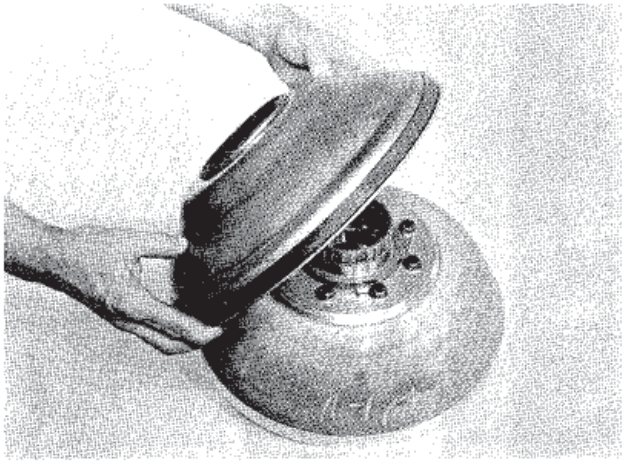


Figure 31
Lift oil baffle and oil seal assembly from impeller.

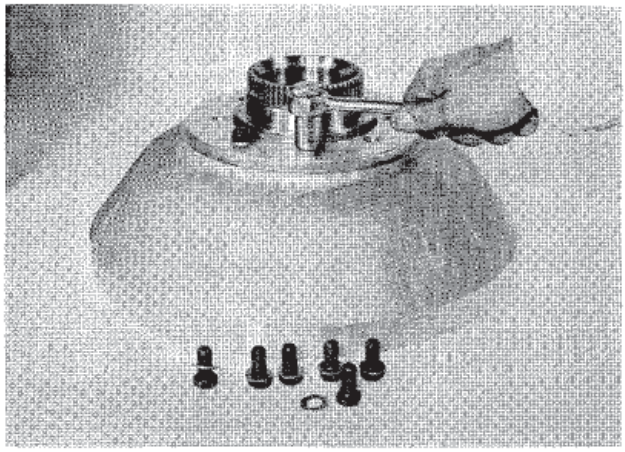


Figure 32
Remove impeller to hub bolts.

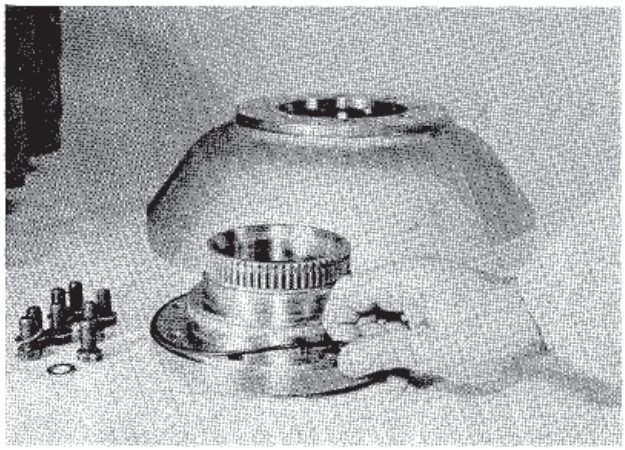


Figure 33
Remove impeller hub "O" ring.

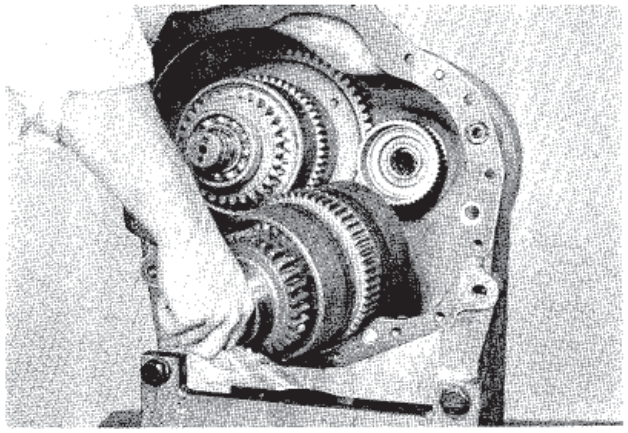


Figure 34
If forward and 2nd clutch assembly remained in transmission case, remove from case.

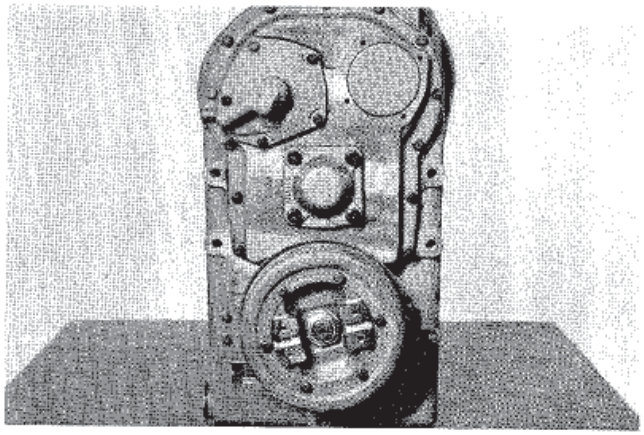


Figure 35
Rear view of transmission utilizing a mechanical parking brake option.

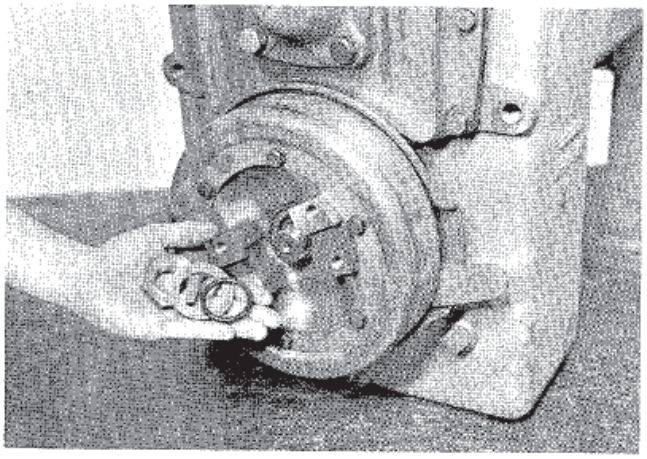


Figure 36
Remove output flange nut, washer and "O" ring. If parking brake is not used, remove companion flange and proceed to Figure 42.

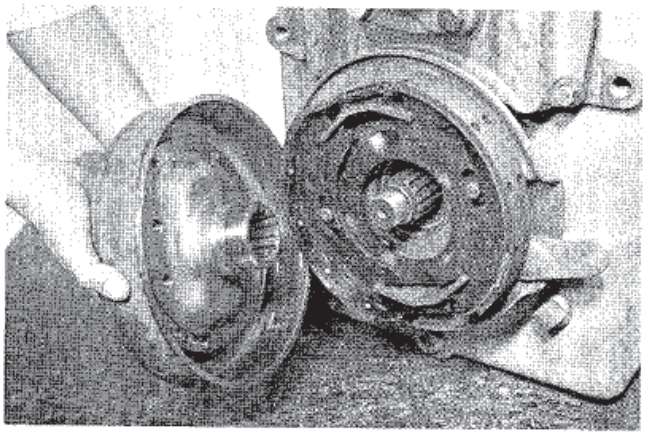


Figure 37
Remove parking brake drum and flange.

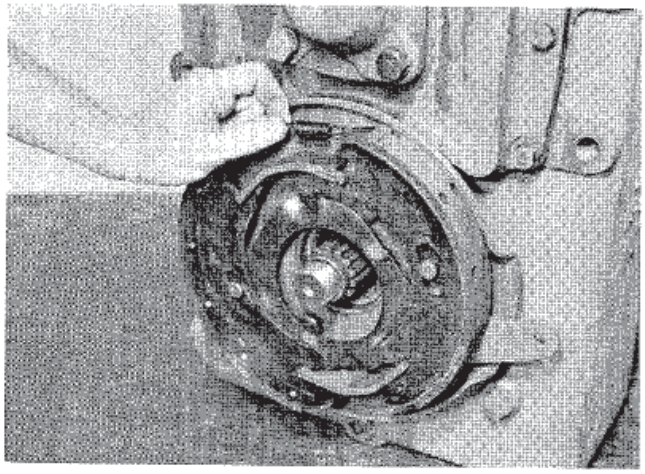


Figure 38
Remove upper and lower brake shoe return springs.

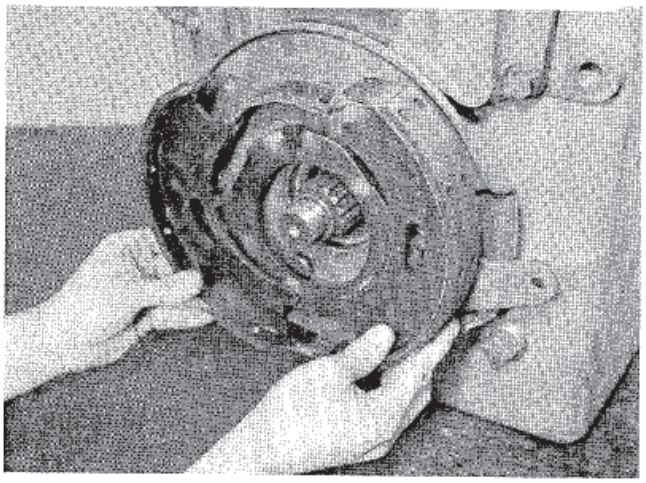


Figure 39
Remove brake shoes.

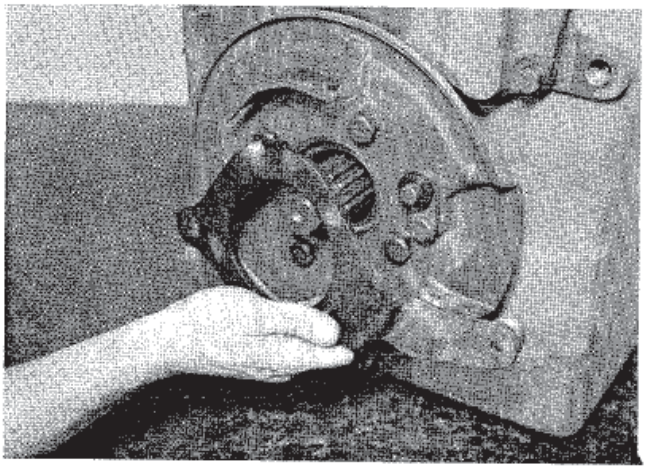


Figure 40
Remove brake actuator arm.

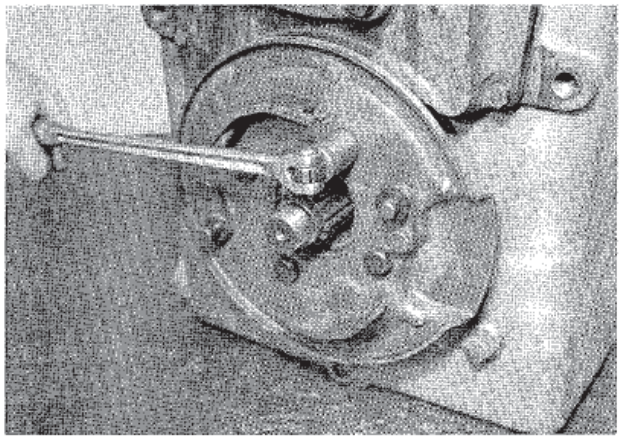


Figure 41
Remove brake backing plate bolts.

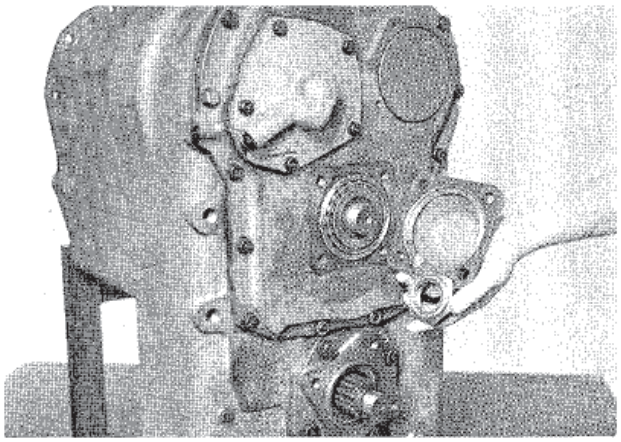


Figure 42
Remove idler shaft bearing cap bolts, bearing cap and idler shaft nut.

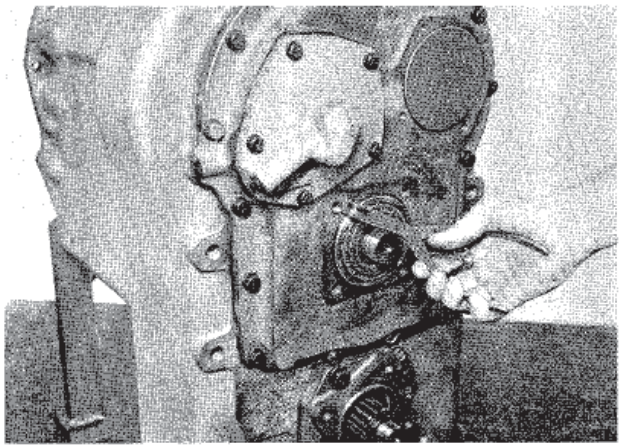


Figure 43
Remove idler shaft rear bearing locating ring.

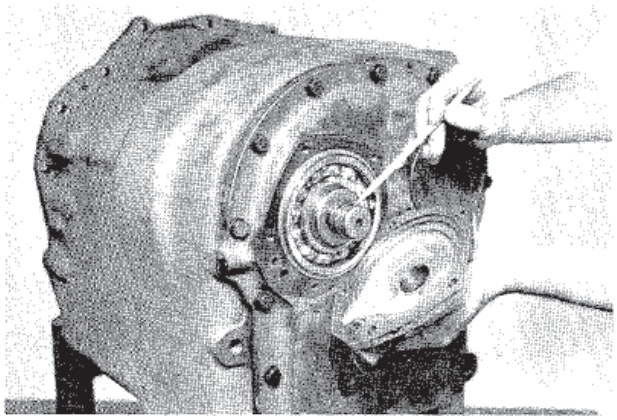


Figure 44
Remove low clutch rear bearing cap.

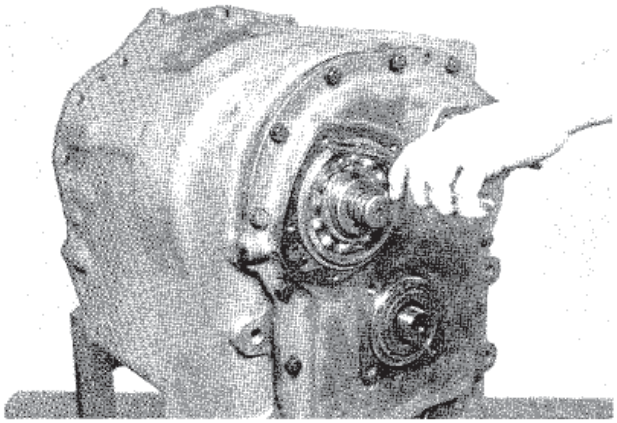


Figure 45
Remove low clutch rear bearing locating ring.

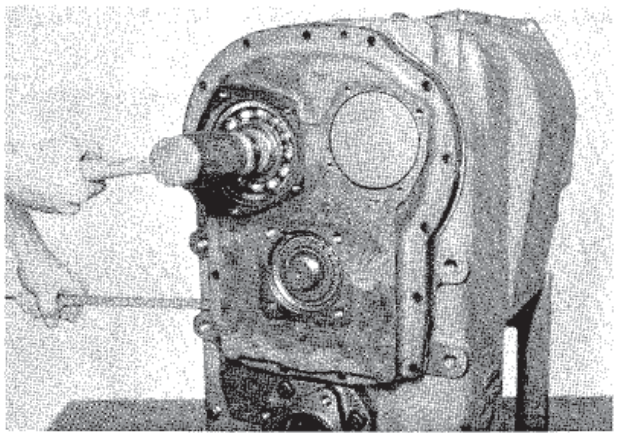


Figure 46
Remove rear cover bolts. Using pry slots provided, pry cover from transmission housing tapping on low clutch and idler shaft to allow cover to be removed without shaft binding.

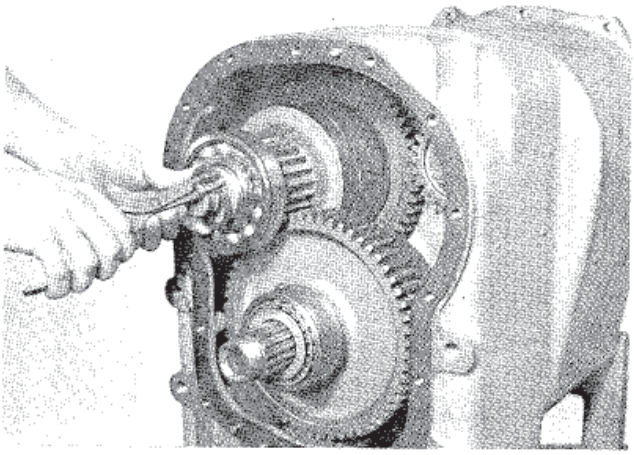


Figure 47

Remove low clutch rear bearing retaining ring.

NOTE: See page 42 for disassembly of low clutch utilizing a rear double taper bearing (helical gears).

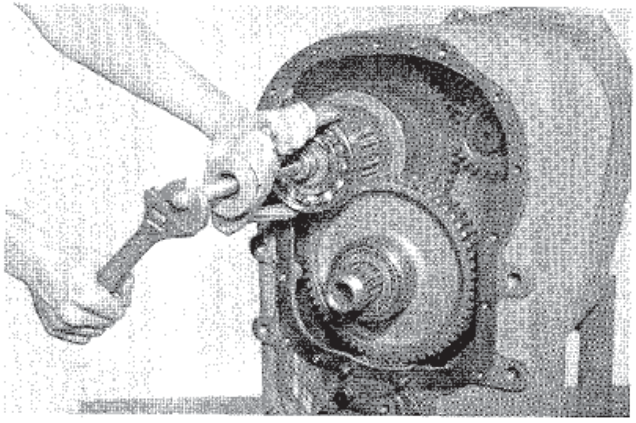


Figure 48

Remove low clutch rear bearing.

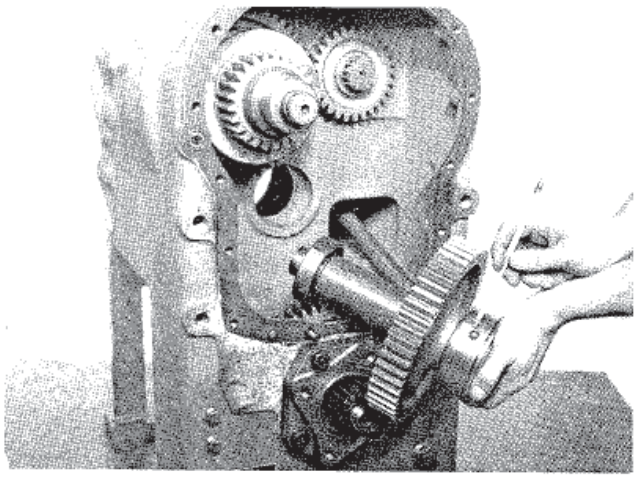


Figure 49

If transmission is a 6 speed see page 51 figure 49A for idler shaft and output shaft removal. Tap idler shaft from housing.

NOTE: Do not lose rear bearing lock ball.

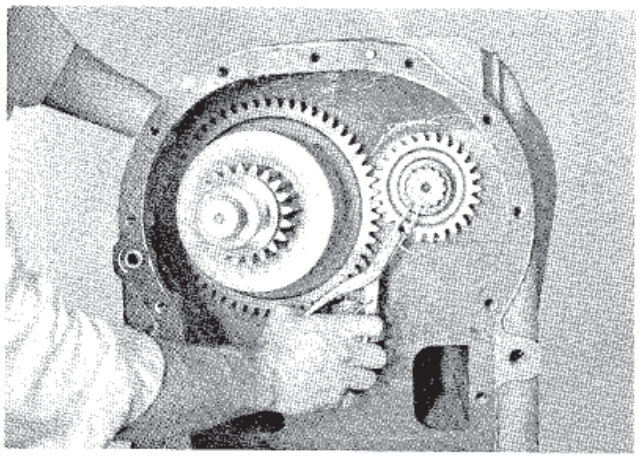


Figure 50

Remove low speed drive gear retainer ring and drive gear.

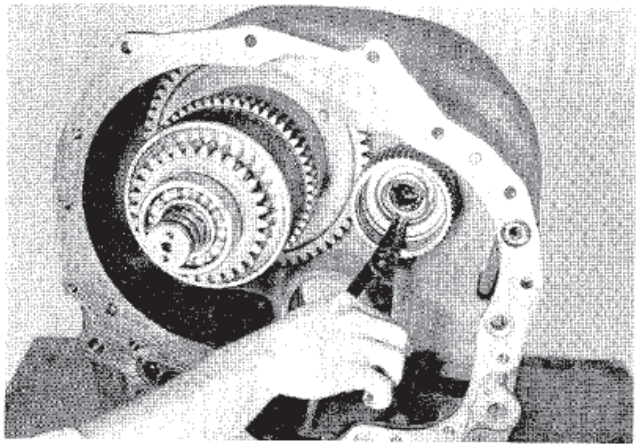


Figure 51

Remove 2nd gear retaining ring.

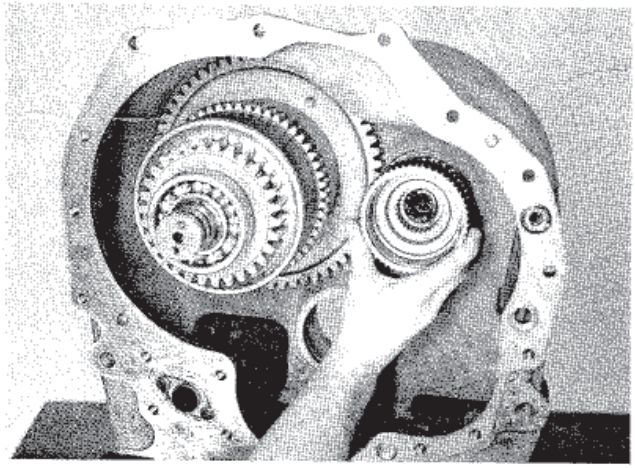


Figure 52

Remove 2nd gear.

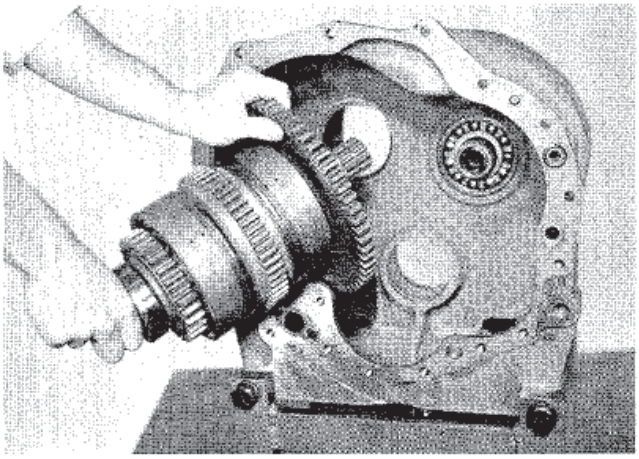


Figure 53
Remove reverse and 3rd clutch assembly.

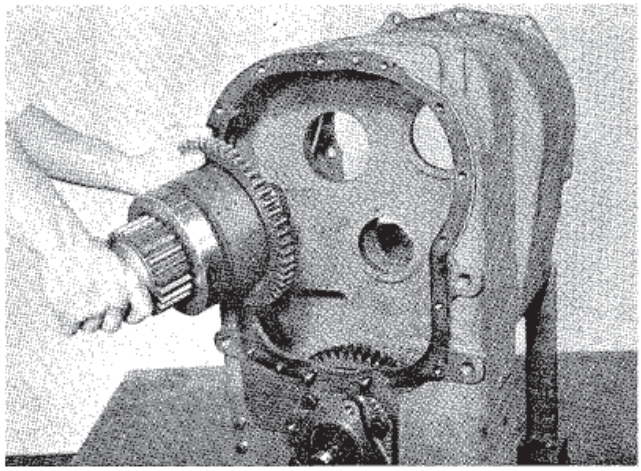


Figure 54
Remove low clutch assembly. See page 51 figure 1 for 6 speed output shaft removal.

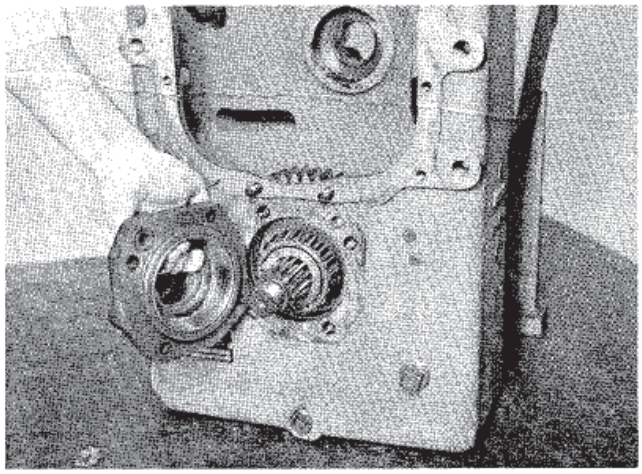


Figure 55
Remove rear output shaft bearing cap bolts and cap.

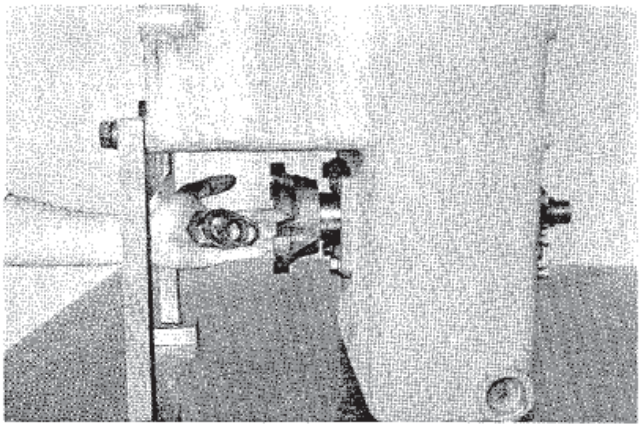


Figure 56
Remove front output flange nut, washer, "O" ring and companion flange.

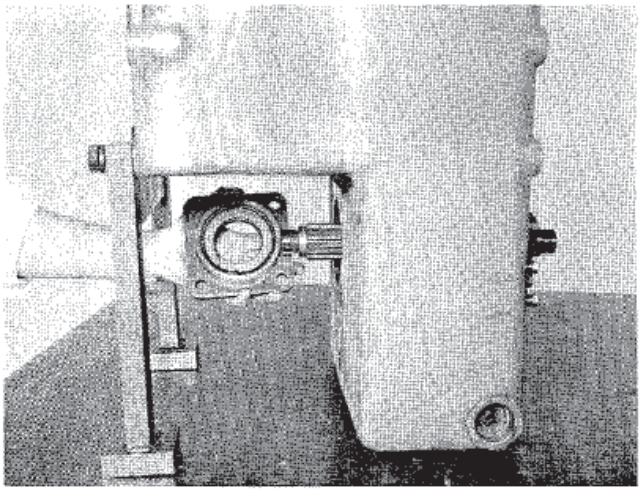


Figure 57
Remove output shaft front bearing cap bolts and cap.

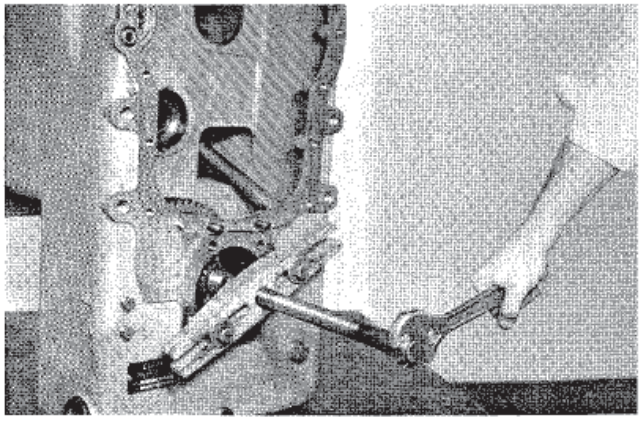


Figure 58
Block output gear. Push output shaft from rear through bearing and gear.

Clutch Disassembly

NOTE: Two clutches are shown being disassembled. The low clutch, and the forward and second. All clutches are disassembled in a similar manner. The quantity of clutch discs will differ between the low clutch and the forward, reverse, second and third. Do not mix the friction discs in the low clutch with the friction discs of any of the other clutches. **(See note, Figure 93).**

Low Clutch Disassembly

NOTE: See page 44 for disassembly of low clutch utilizing taper bearings in the low clutch gear.

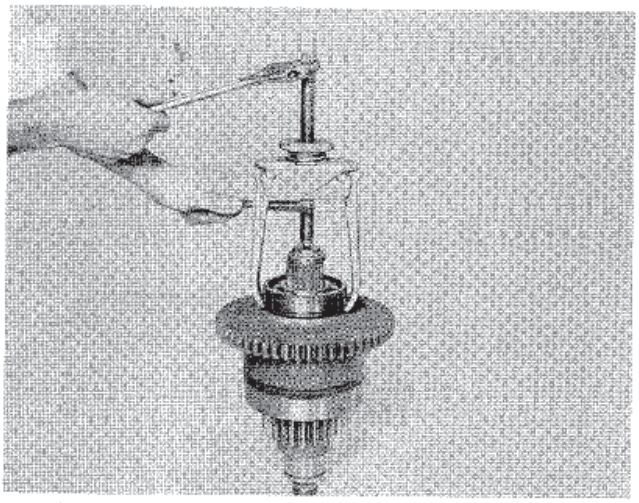


Figure 59
Remove low clutch shaft rear bearing.

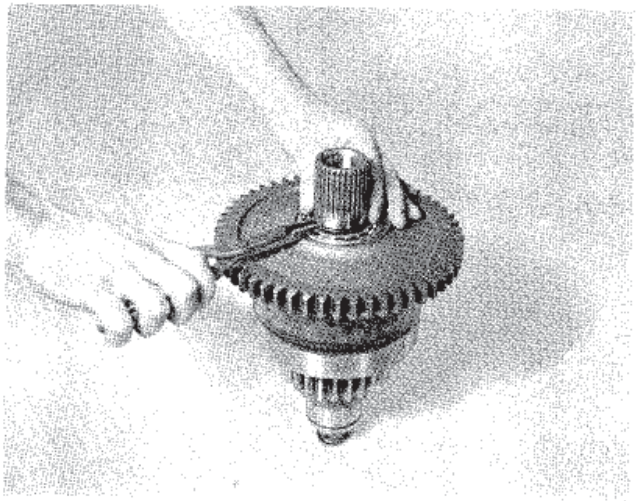


Figure 60
Remove low speed gear retainer ring.

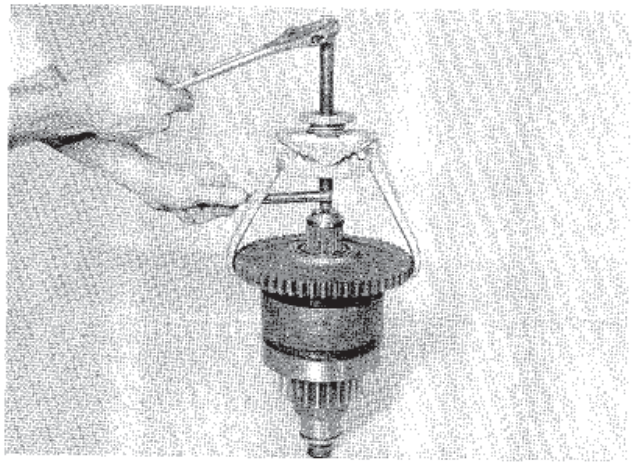


Figure 61
Remove low speed gear and outer bearing.

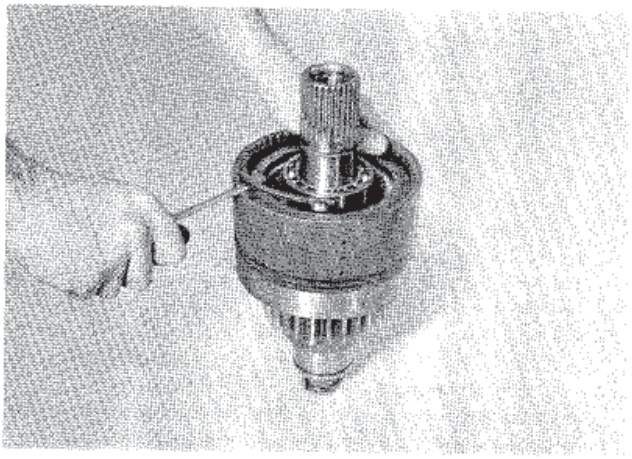


Figure 62
Remove clutch end plate retainer ring.

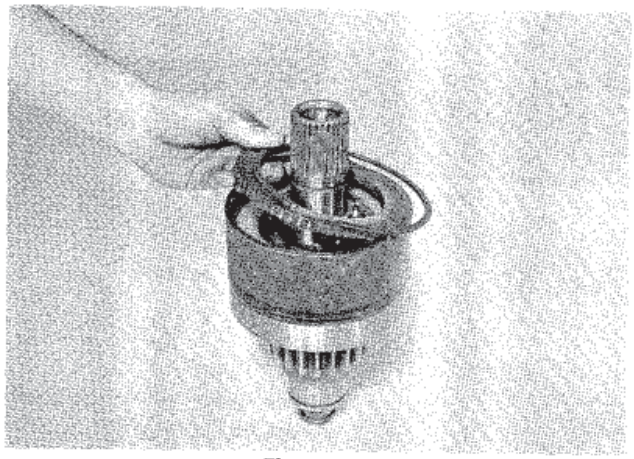


Figure 63
Remove clutch end plate and inner and outer clutch discs.

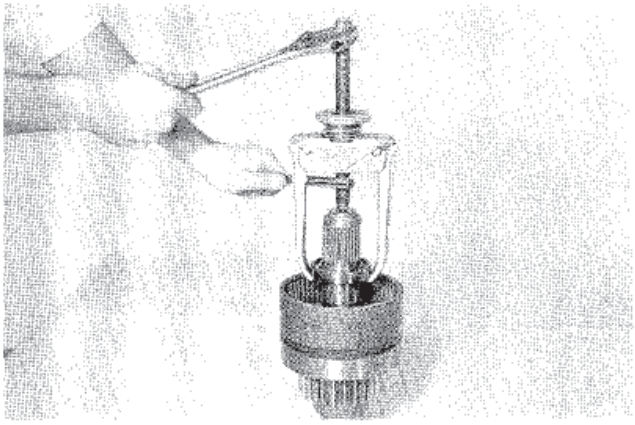


Figure 64
Remove low gear inner bearing.

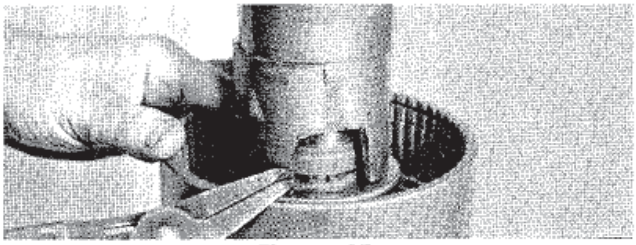


Figure 65

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

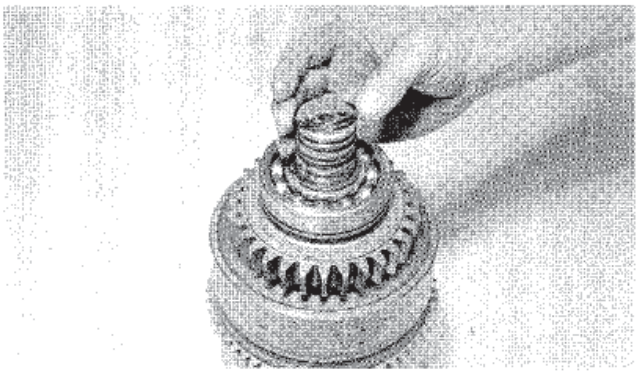


Figure 66

Remove clutch shaft piston rings and expander springs. Install piston rings and expander springs per instructions on page 66.

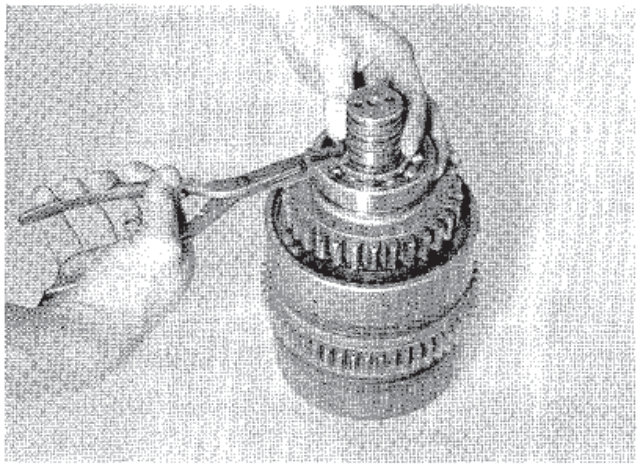


Figure 67
Remove front bearing retainer ring

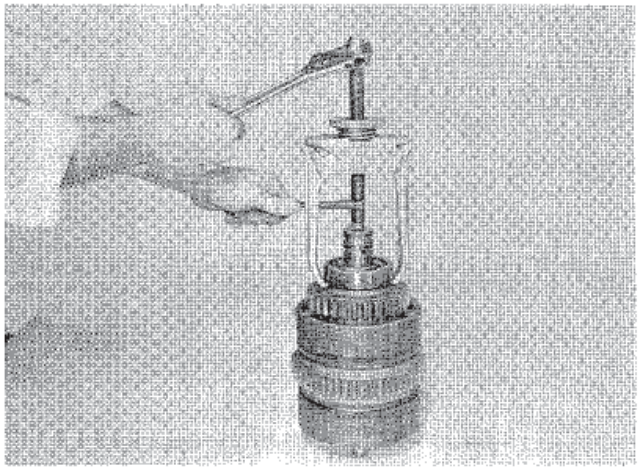


Figure 68
Remove front bearing.

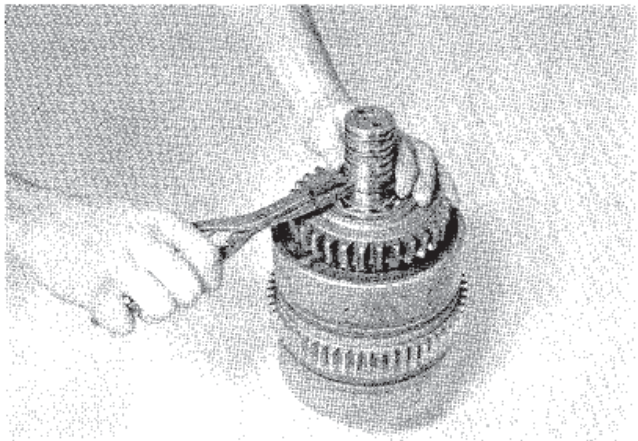


Figure 69
Remove front bearing locating ring.

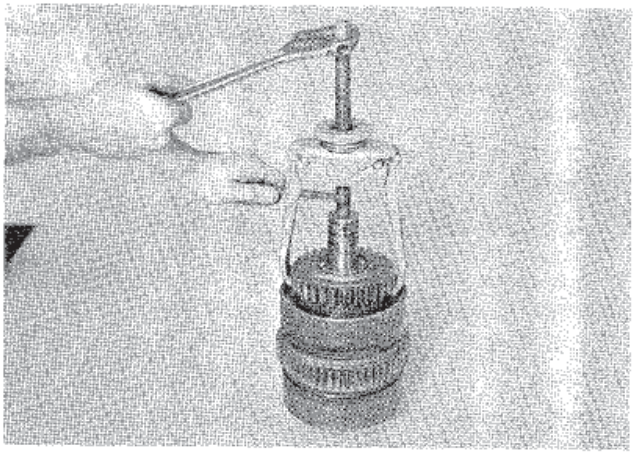


Figure 70
Remove clutch driven gear and outer bearing.

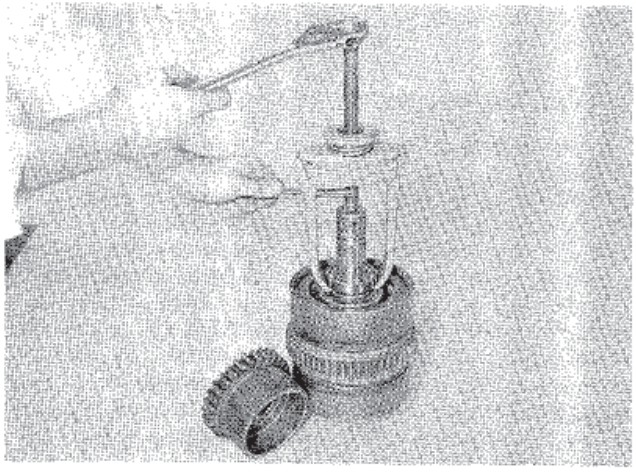


Figure 71
Remove inner bearing.

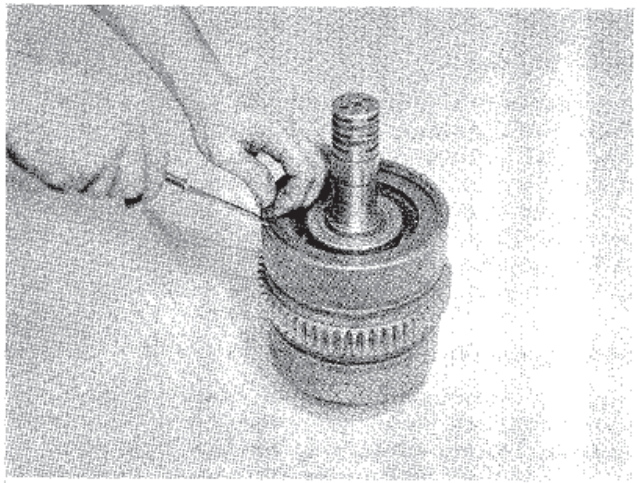


Figure 72
Remove end plate retainer ring.

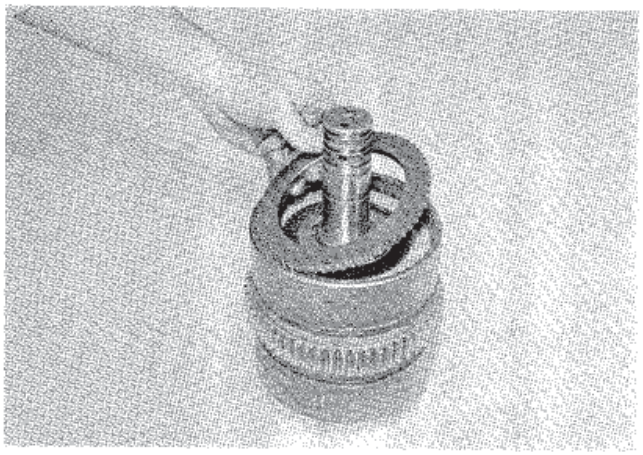


Figure 73
Remove end plate.

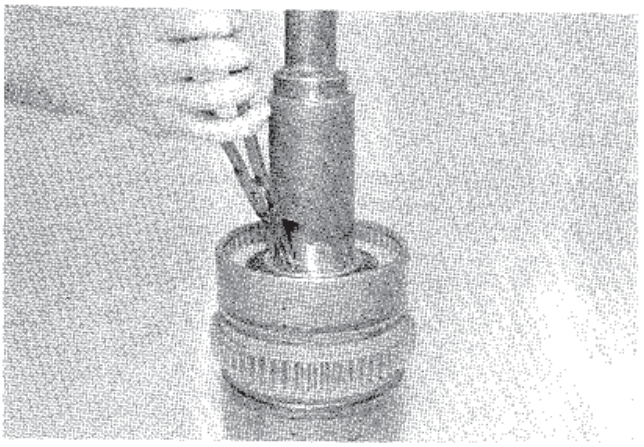


Figure 74
Compress return spring retainer. Remove retainer ring from groove.

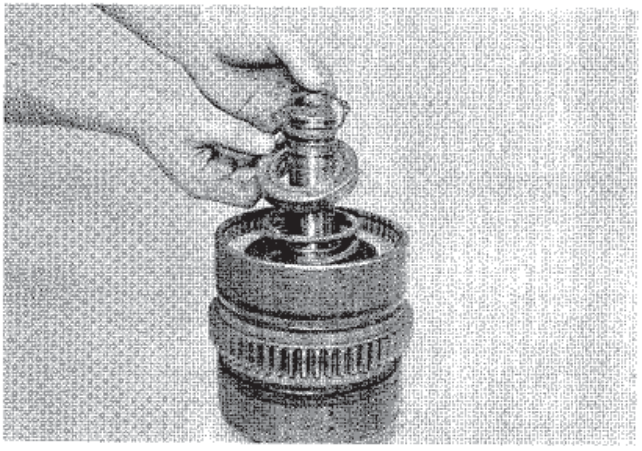


Figure 75
Relieve spring compression. Remove retainer ring, retainer and spring.

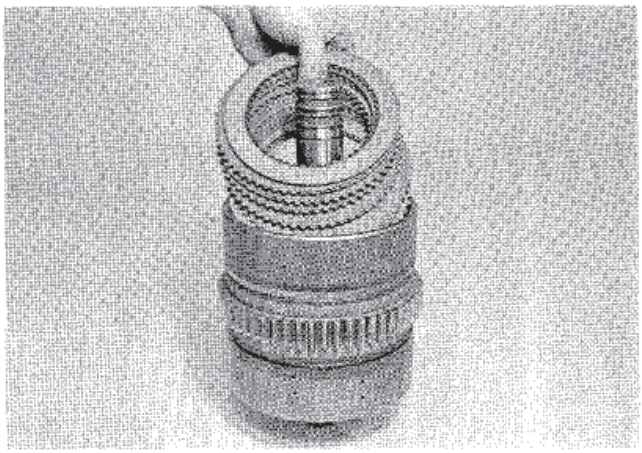


Figure 76

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

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

(See page 46 for modulated clutch cross section)

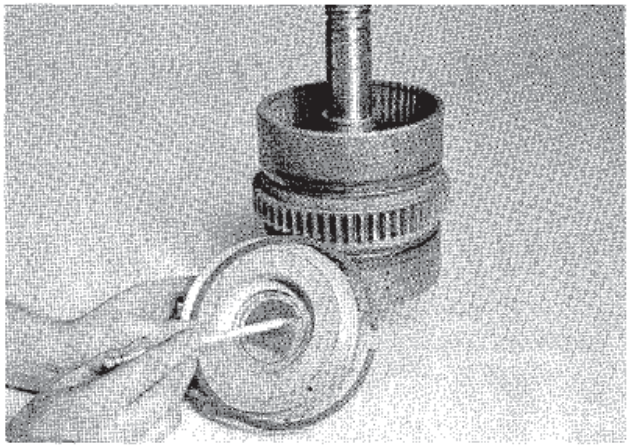


Figure 77

Install new clutch piston inner and outer sealing rings.

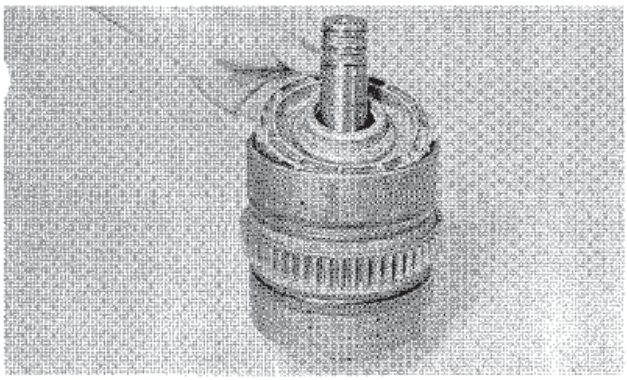


Figure 78

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

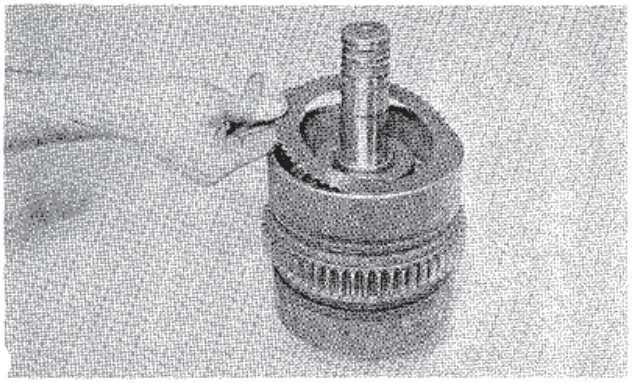


Figure 79

Install clutch piston return spring, spring retainer and retainer snap ring. Insert one steel disc.

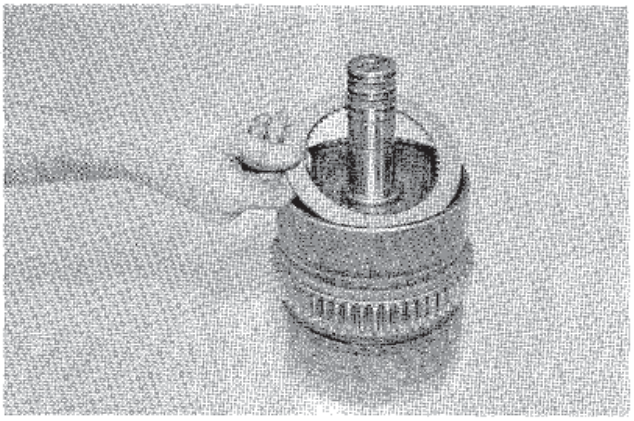


Figure 80

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.

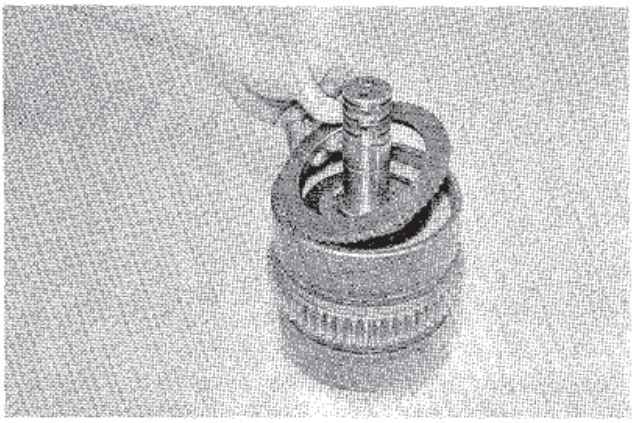


Figure 81

Install end plate.

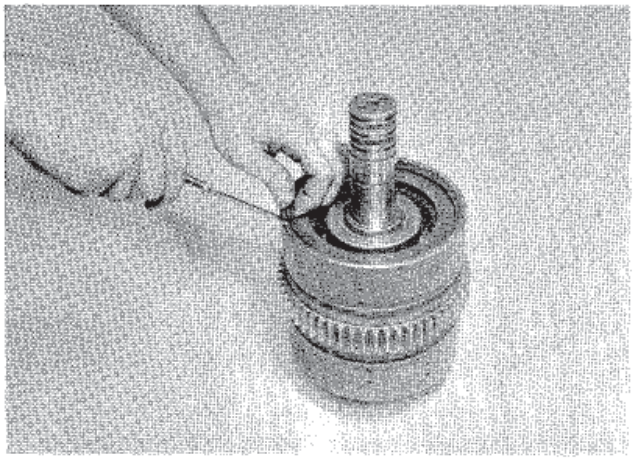


Figure 82

Install end plate retainer ring.

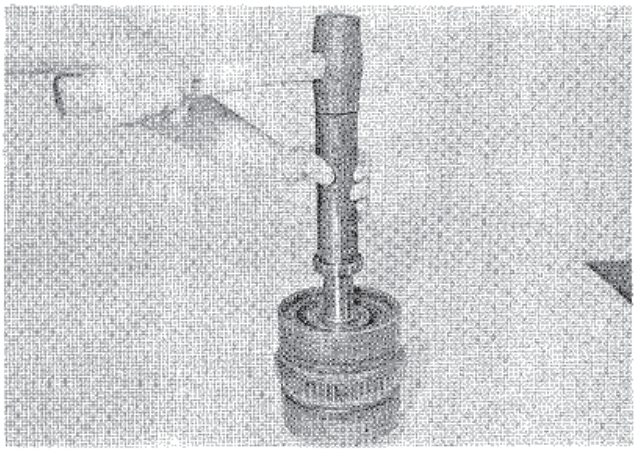


Figure 83
Install clutch driven gear inner bearing.

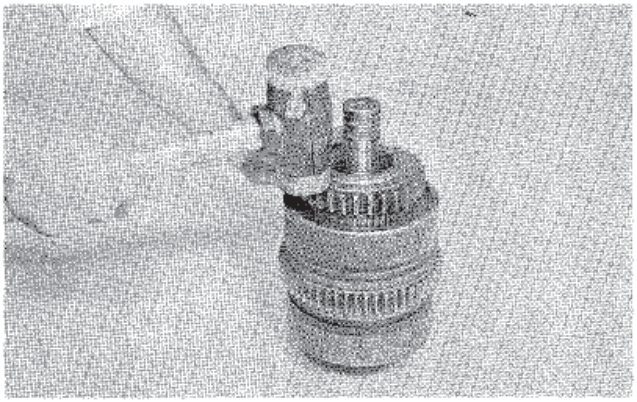


Figure 84

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.

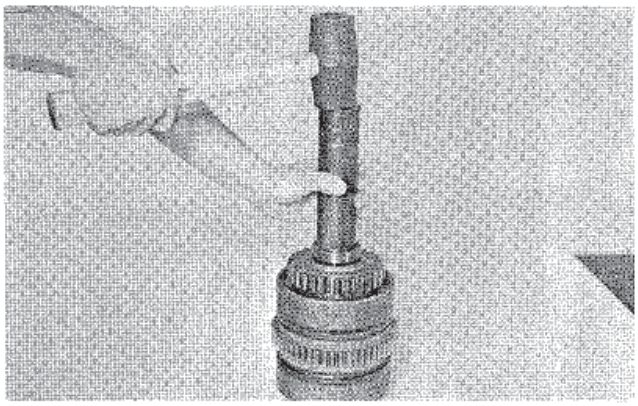


Figure 85
Install driven gear outer bearing. Bearing shield must face in.

SEE PAGE 35 FOR PROPER SHIELDED BEARING INSTALLATION

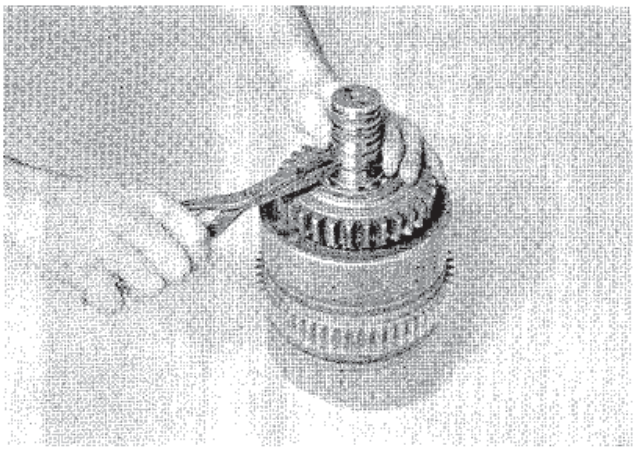


Figure 86
Install front bearing locating ring.

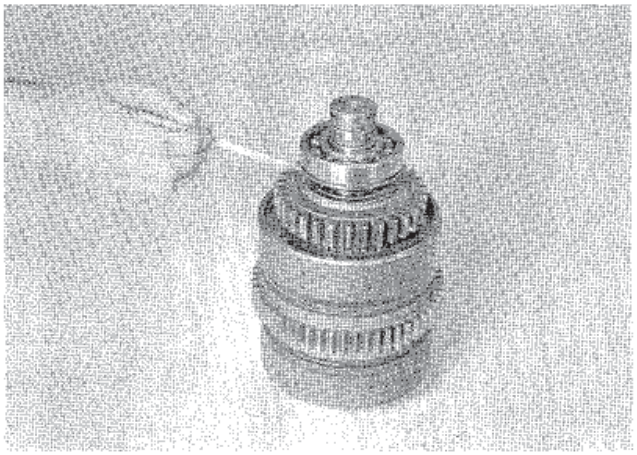


Figure 87

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

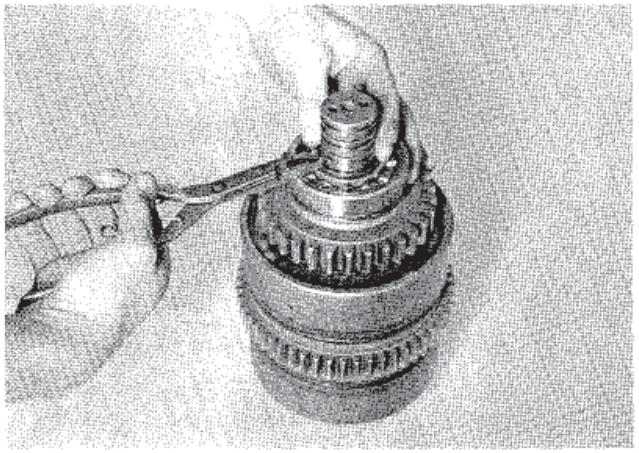


Figure 88
Install front bearing retaining ring.

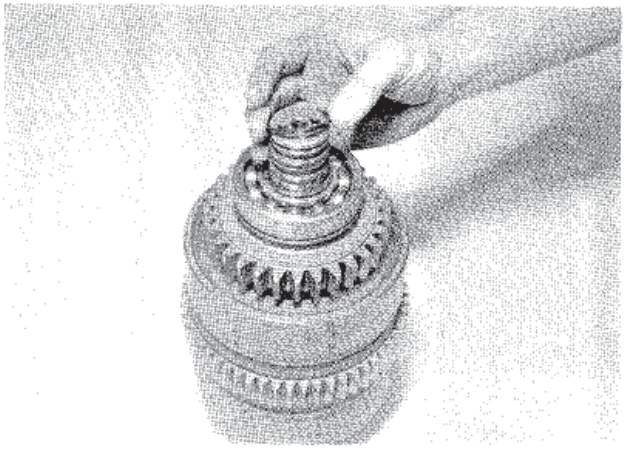


Figure 89
Install clutch shaft oil sealing rings and expander springs per instructions on page 66.

Low Clutch Reassembly

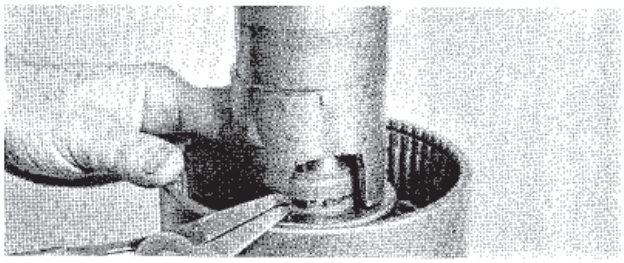


Figure 90
Install new clutch piston inner and outer sealing ring. Insert piston into clutch drum using caution as not to damage seals. Position piston return spring, spring retainer and retainer snap ring. Compress spring and retainer and install snap ring. NOTE: For reassembly of low clutch utilizing taper bearings in the low clutch gear see page 44.

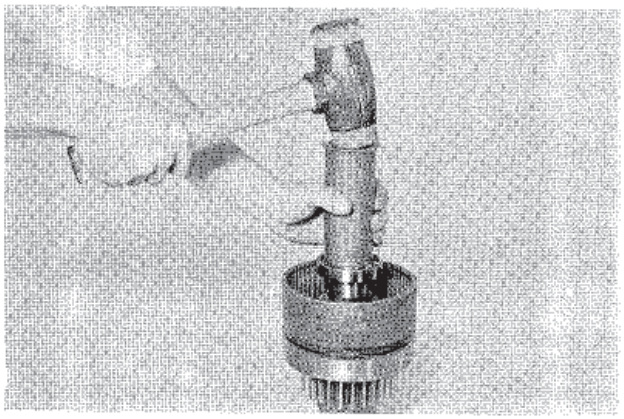


Figure 91
Install low gear inner bearing.

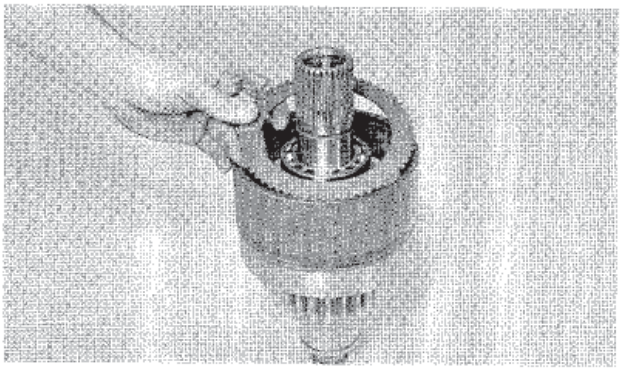


Figure 92
Install one steel disc.

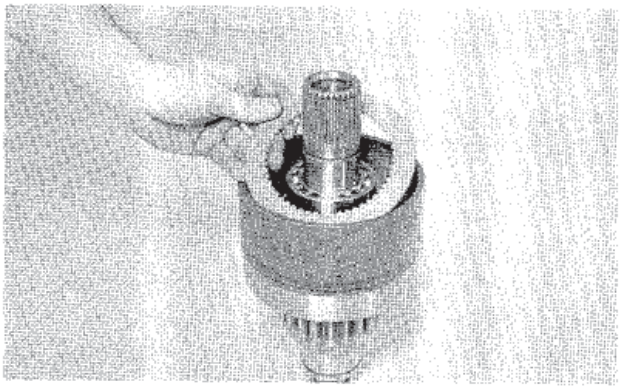


Figure 93
Install one friction disc. **NOTE: The friction discs in the low clutch has a higher co-efficient rating than the friction discs in the other clutches, therefore the discs must not be mixed. The low clutch inner disc can be identified by an "X" stamped on one side of the inner teeth. The low 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.

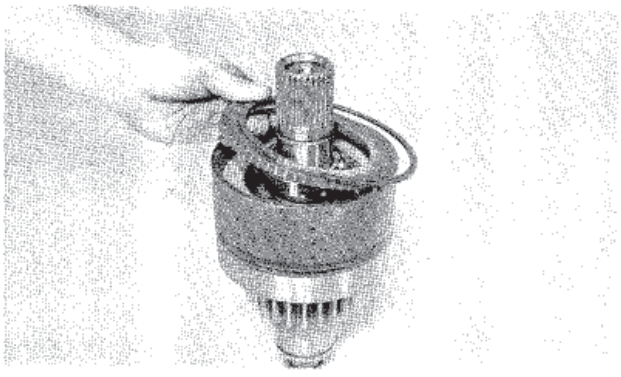


Figure 94
Install end plate and retainer ring.

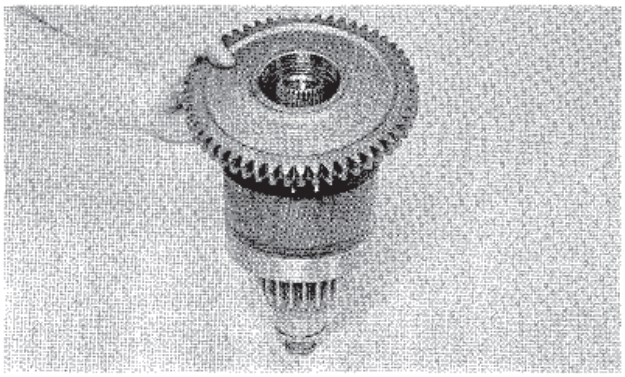


Figure 95

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.

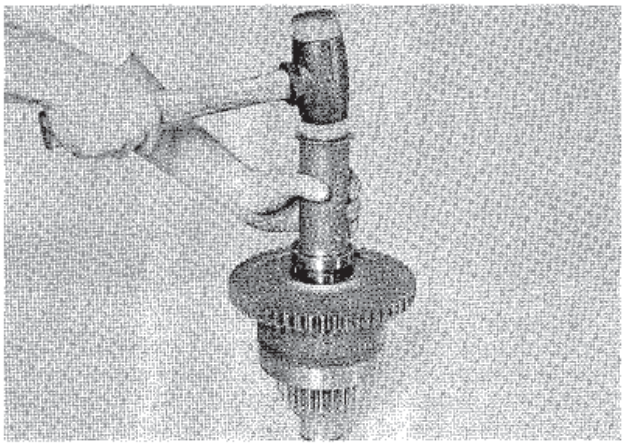


Figure 96

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

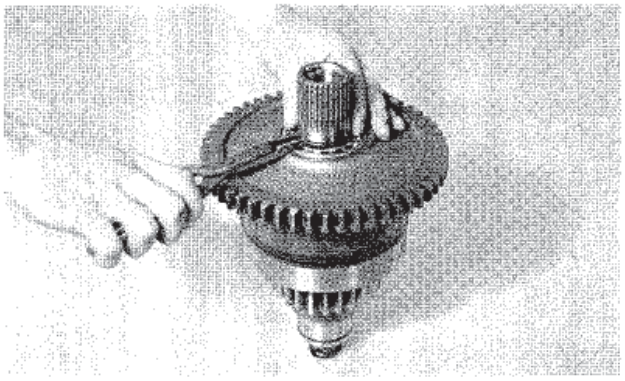


Figure 97

Install low gear retainer ring.

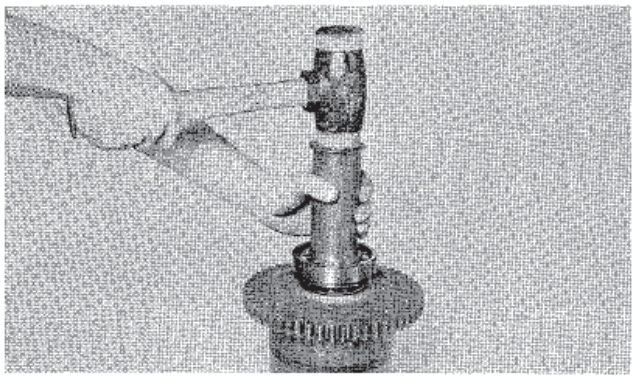


Figure 98

Install low clutch shaft rear bearing.

Reassembly of the Output Shaft

For 6 speed transmission see page 52 Fig. 5.

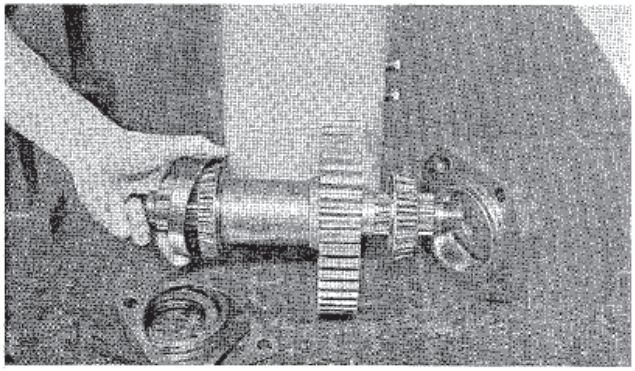


Figure 99

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

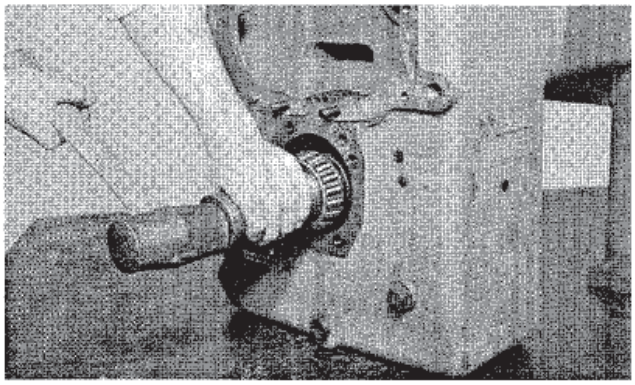


Figure 100

Position output gear in transmission case with protruding hub toward front of case. See Fig. 99. 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.

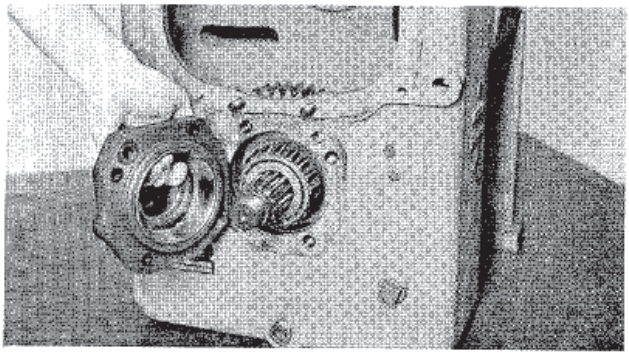


Figure 101

Using new "O" rings install rear output bearing cap 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).

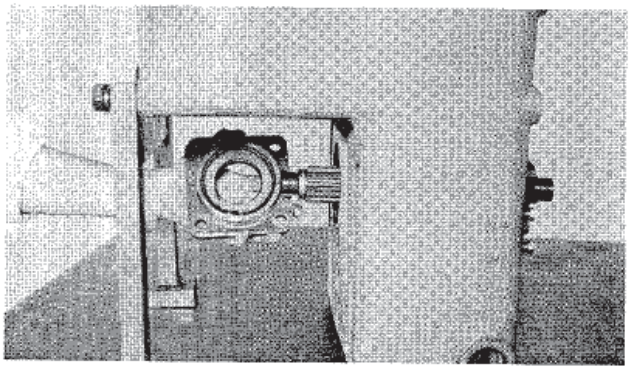


Figure 102

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.

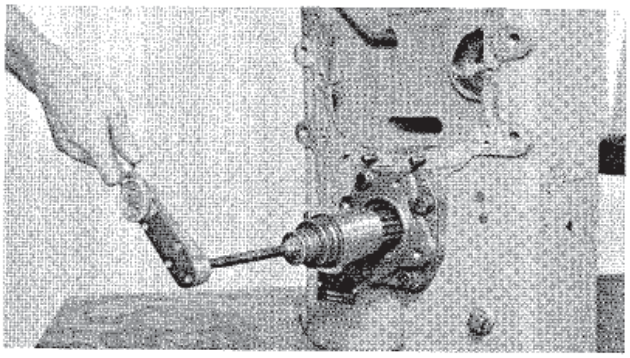


Figure 103

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.

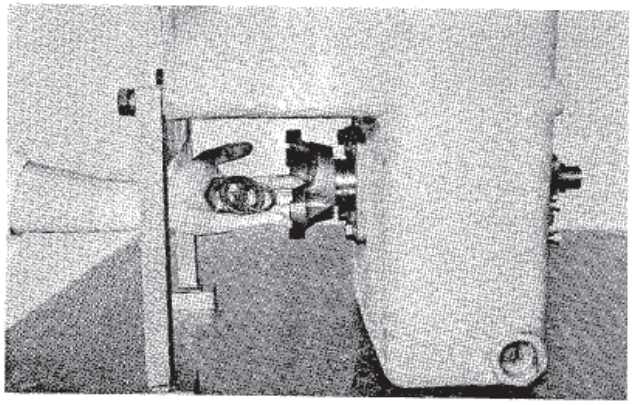


Figure 104

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

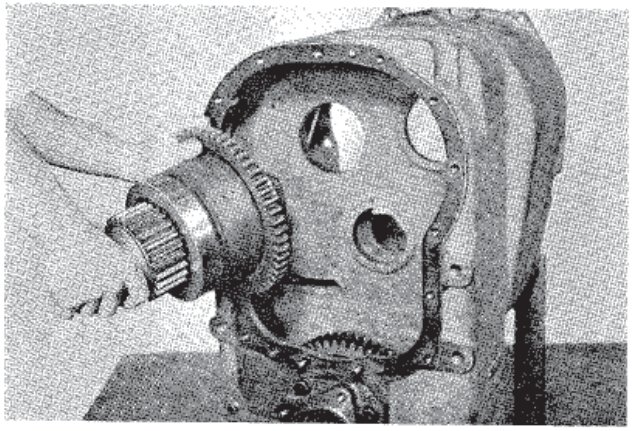


Figure 105

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

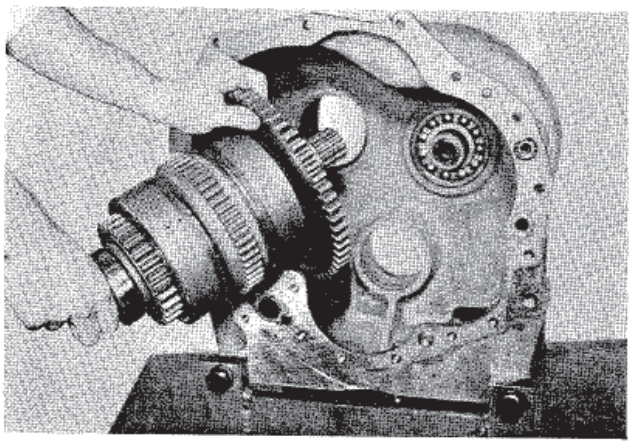


Figure 106

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

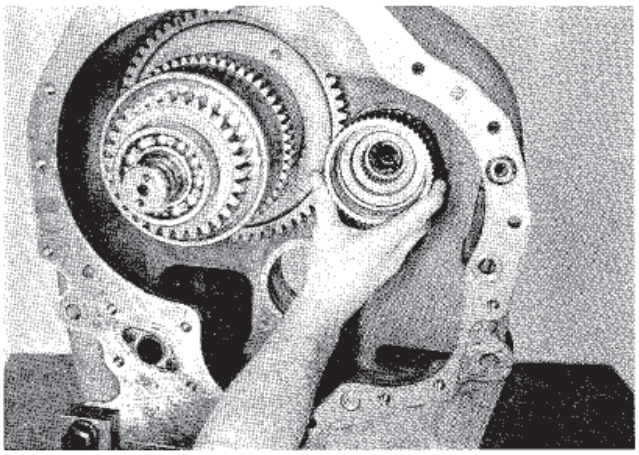


Figure 107
Install 2nd speed gear on low clutch shaft.

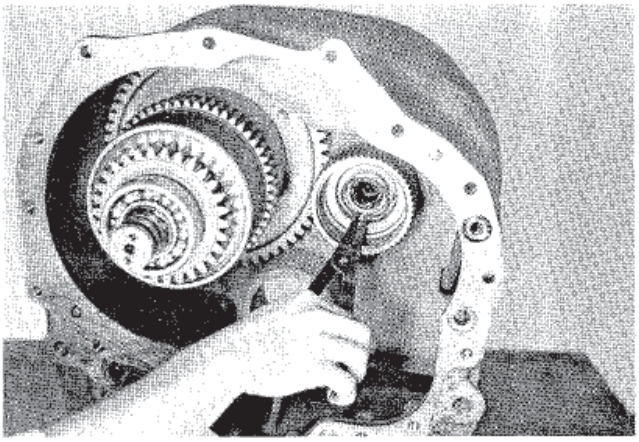


Figure 108
Install 2nd speed gear retainer ring.

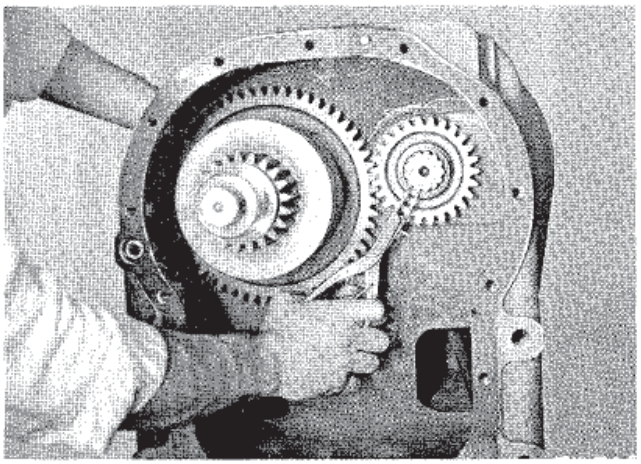


Figure 109
Install low speed drive gear and retainer ring.

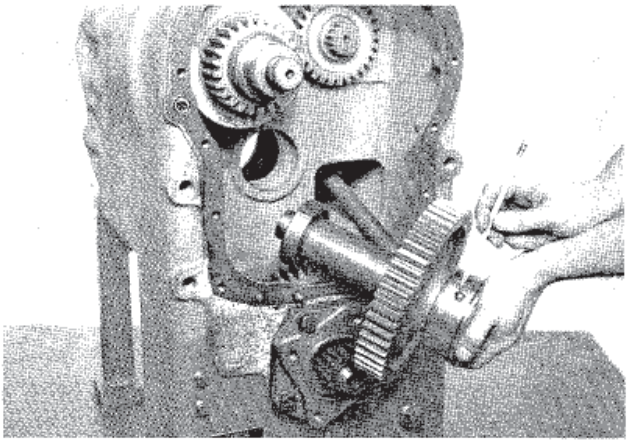


Figure 110
Install idler shaft and bearing assembly. **NOTE:** The 6 speed unit will have two gears and a heavier front bearing.

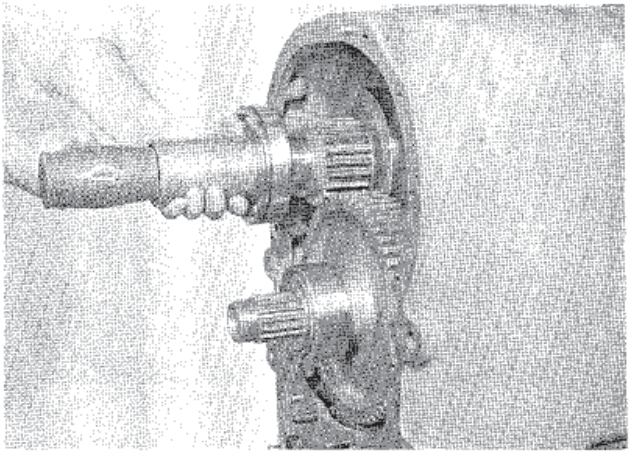


Figure 111
Install low clutch rear bearing with bearing ring groove to the rear. **NOTE:** For reassembly of low clutch utilizing rear double taper bearings see page 42, Figure E.

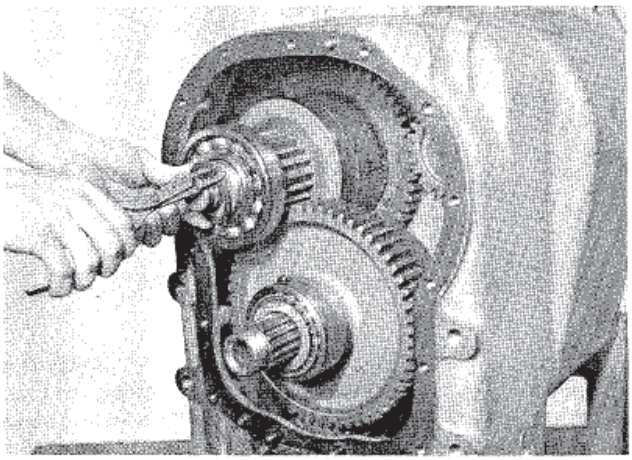


Figure 112
Install low clutch rear bearing retainer ring.

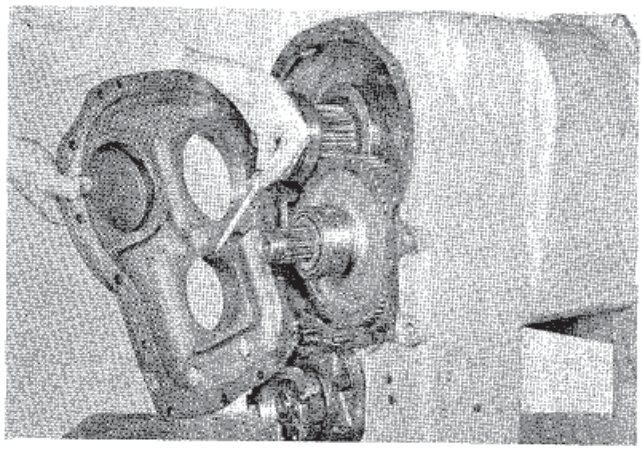


Figure 113

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.

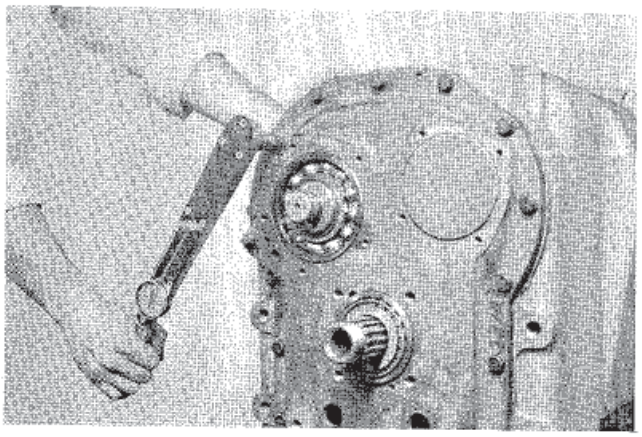


Figure 114

Torque rear cover bolts to specified torque.

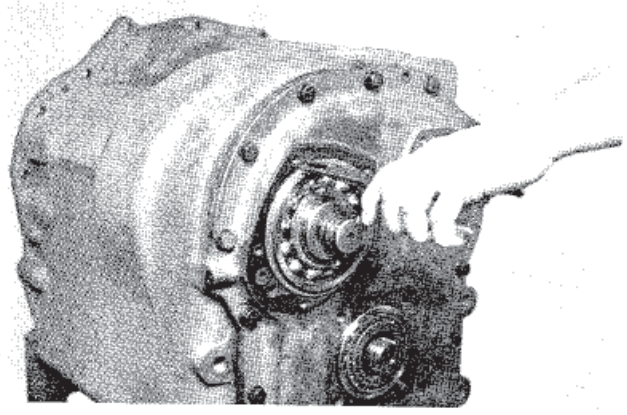


Figure 115

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

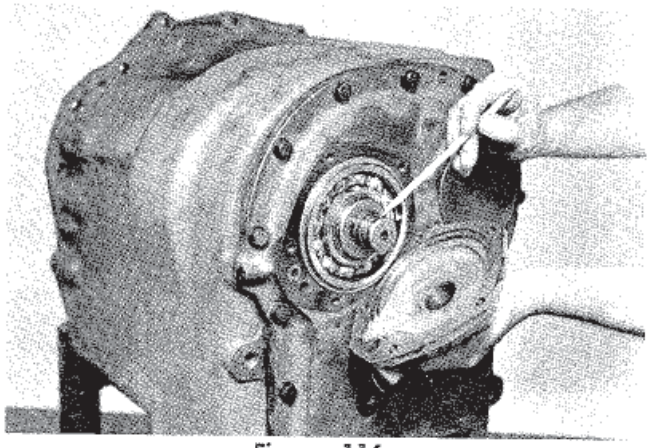


Figure 116

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

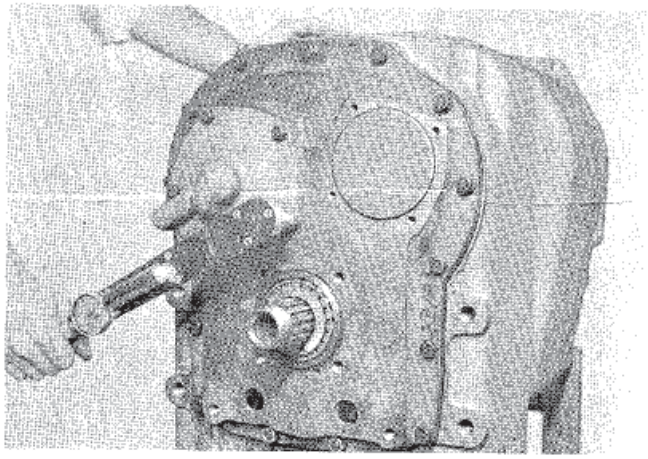


Figure 117

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

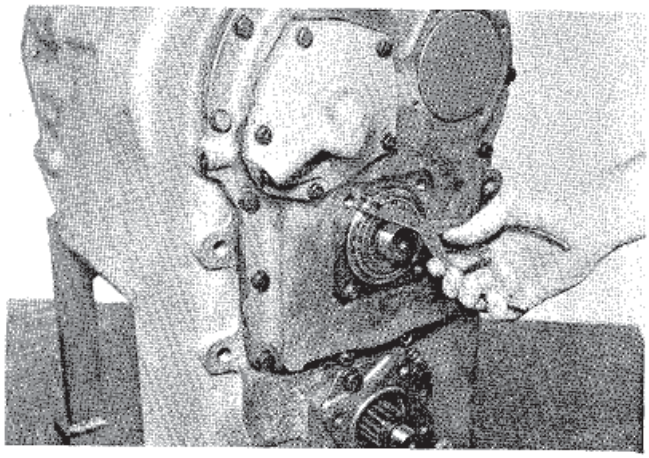


Figure 118

Install idler shaft rear bearing locating ring.

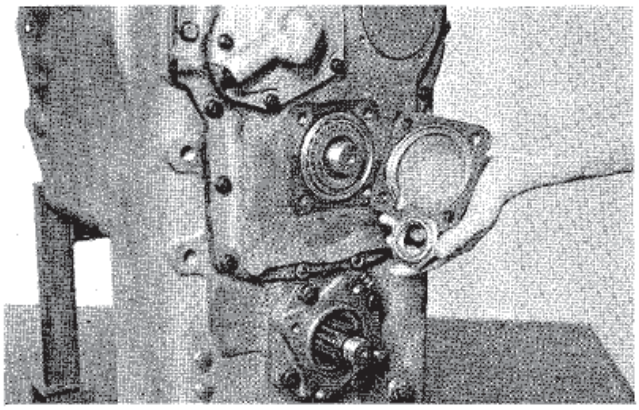


Figure 119

Install idler shaft nut. Block idler gear, tighten nut. 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 125.

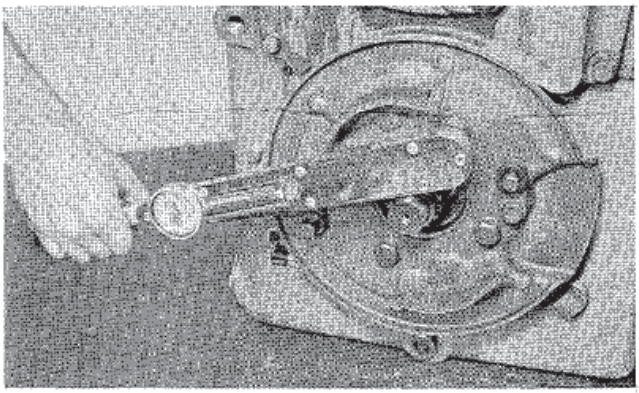


Figure 120

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

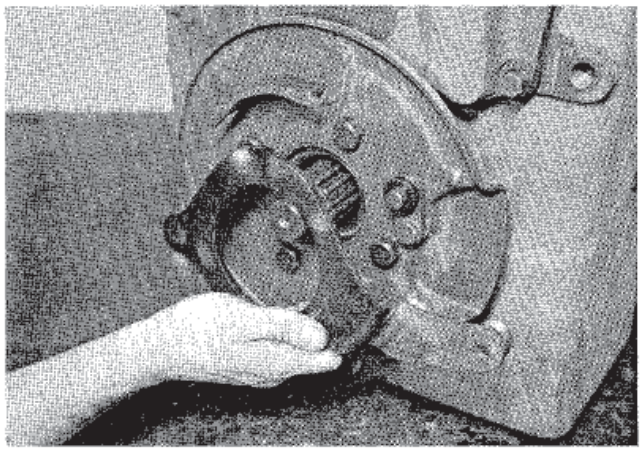


Figure 121

Position brake actuating arm.

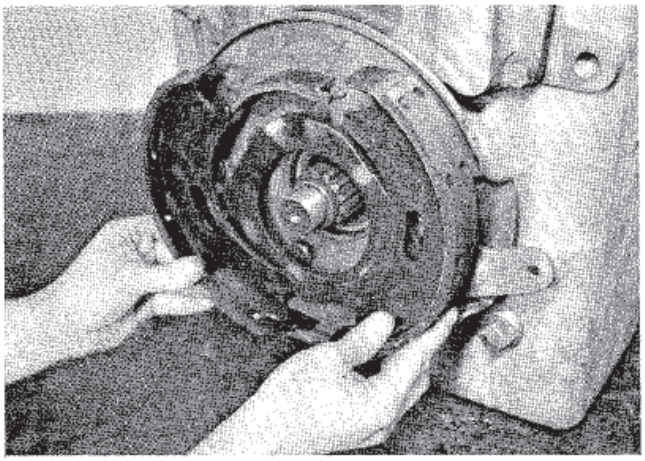


Figure 122

Locate brake shoes.

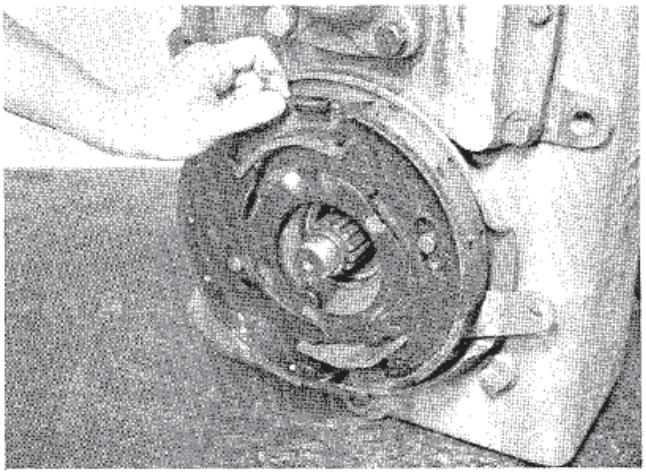


Figure 123

Install upper and lower brake shoe return springs.

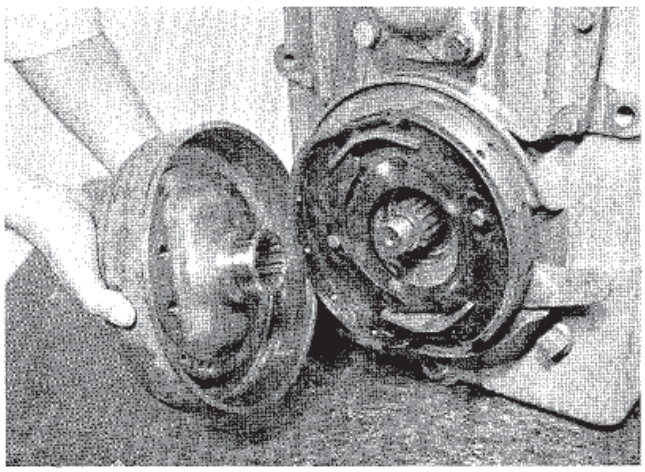


Figure 124

Install brake drum and flange assembly.

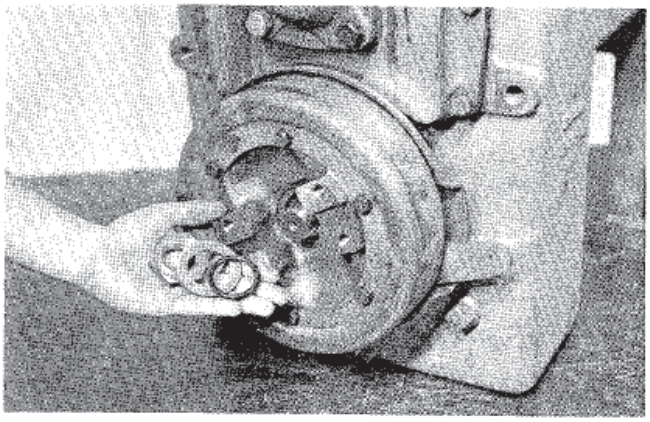


Figure 125

Secure flange with a new "O" ring, washer and flange nut. Block output shaft and tighten nut. See elastic stop nut torque chart.

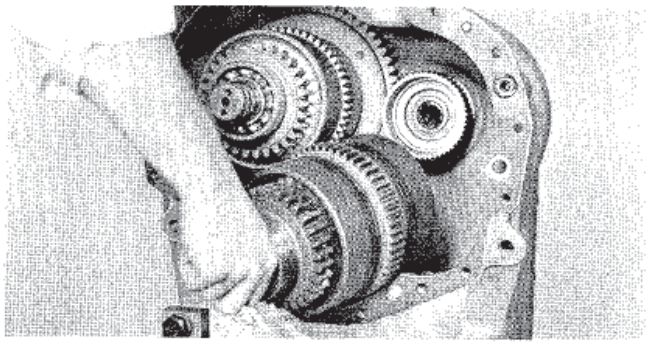


Figure 126

Position low speed clutch shaft front pilot bearing on 2nd clutch shaft, a light coat of grease will hold bearing in position.

From the front of the transmission case install the forward and 2nd clutch assembly. Use caution as not to damage pilot bearing. **NOTE:** For R Model front end see page 60, Fig. 9.

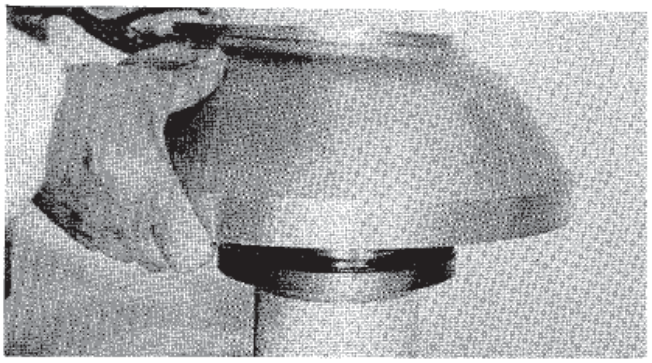


Figure 127

NOTE: See page 40 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.

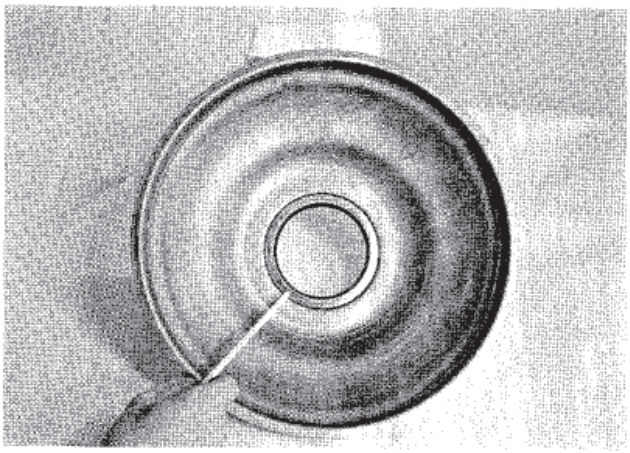


Figure 128

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.

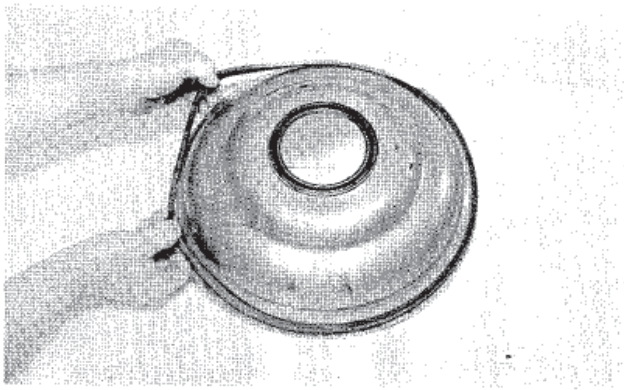


Figure 129

Install a new oil baffle seal ring.

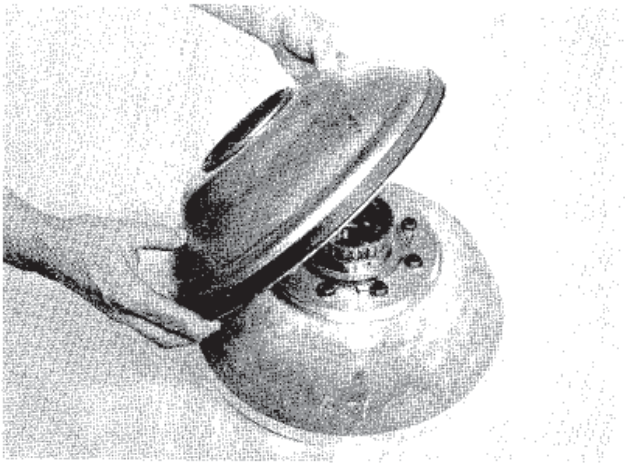


Figure 130

Install oil baffle on impeller assembly.

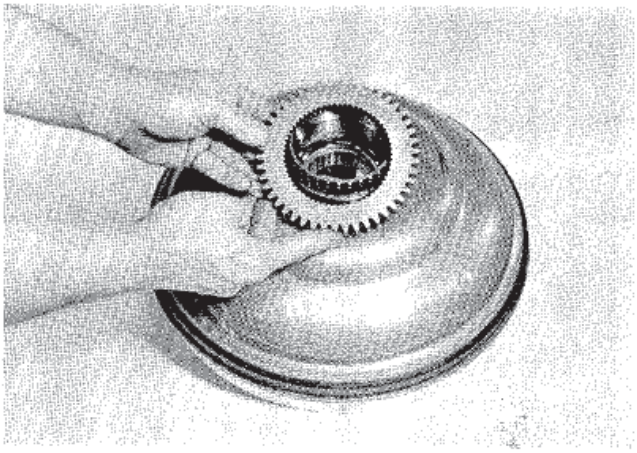


Figure 131
Install impeller hub gear.

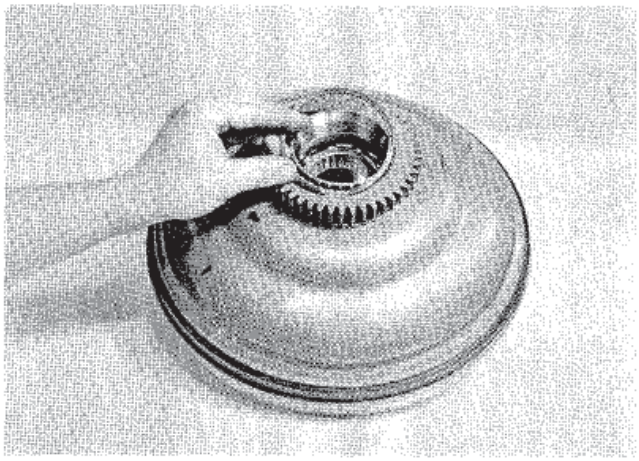


Figure 132
Secure impeller hub gear with retainer ring.

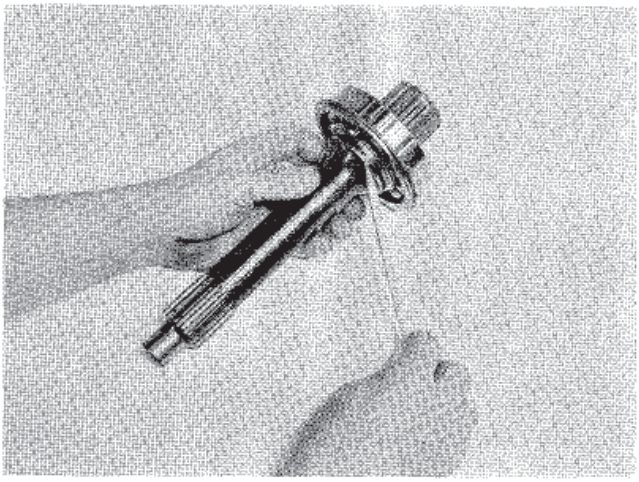


Figure 133
Install new turbine shaft piston ring.

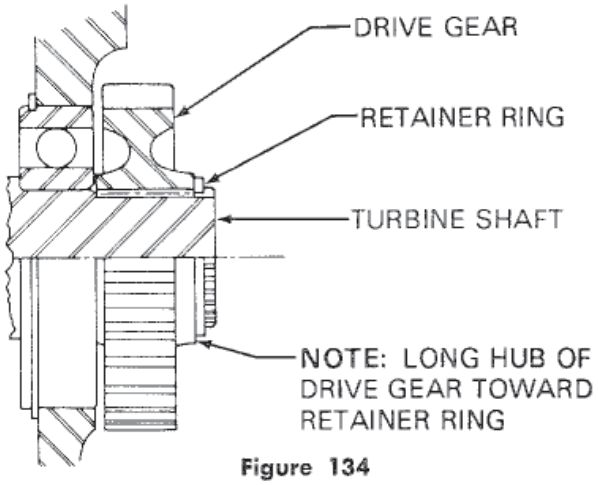


Figure 134
Tap turbine shaft and bearing assembly into converter housing from front. At the rear of the converter housing install turbine shaft gear and retainer ring as shown.

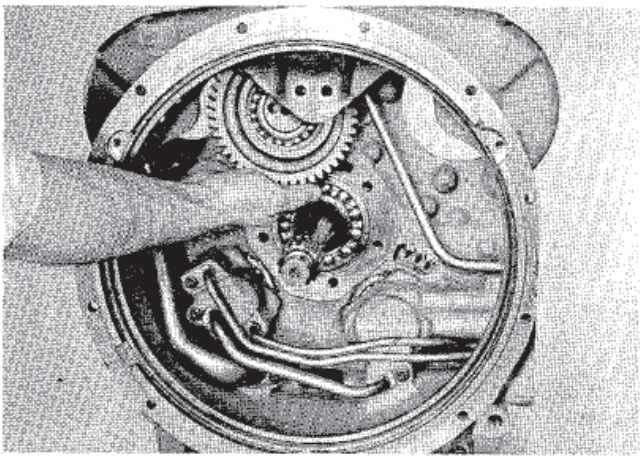


Figure 135
Position center pump drive gear.

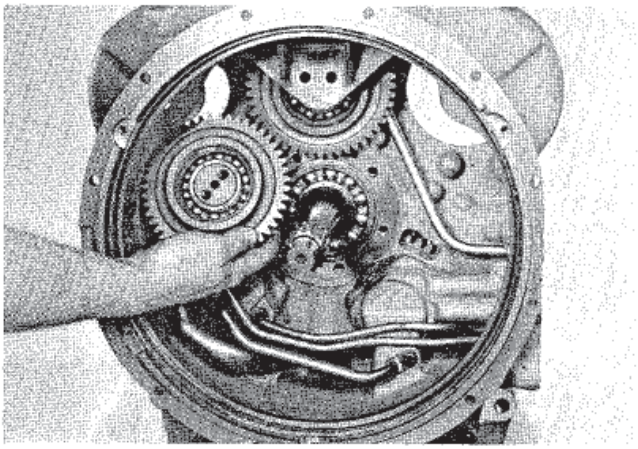


Figure 136
Install left pump drive gear.

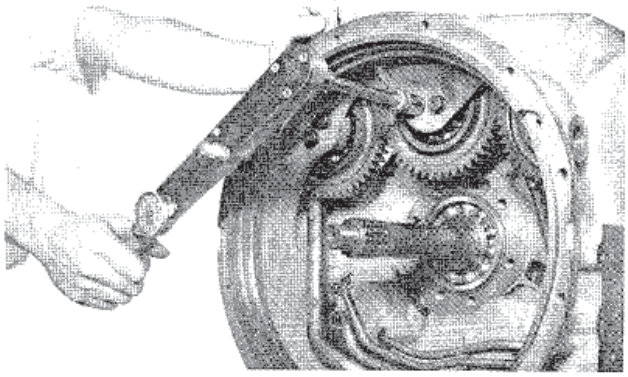


Figure 137

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

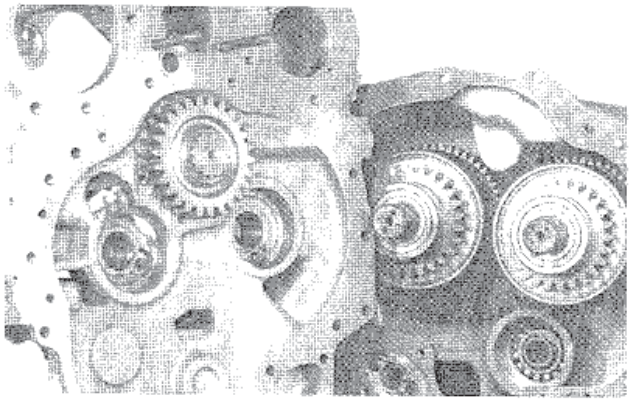


Figure 138

Position new gasket and "O" rings on housing. A light coat of grease will hold gasket and "O" rings in place. Install alignment studs in transmission housing to facilitate converter housing to transmission housing assembly.

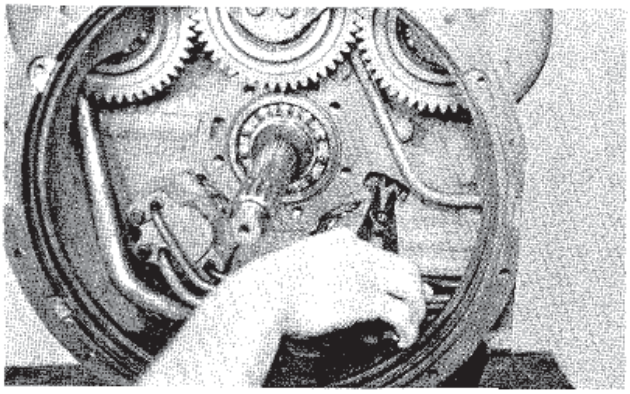


Figure 139

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.

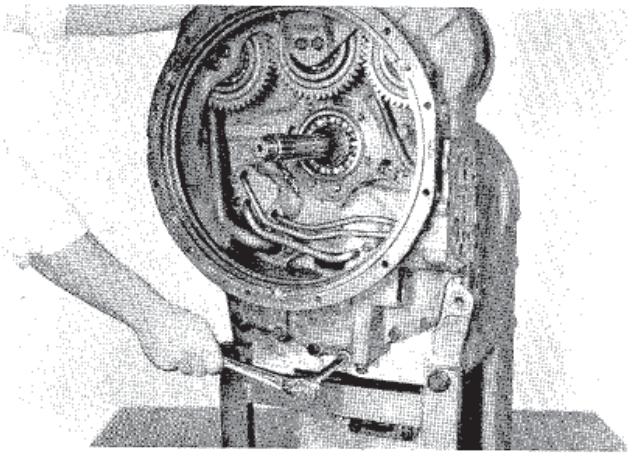


Figure 140

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

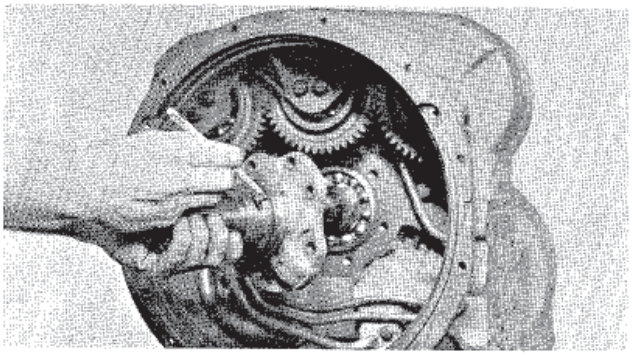


Figure 141

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.

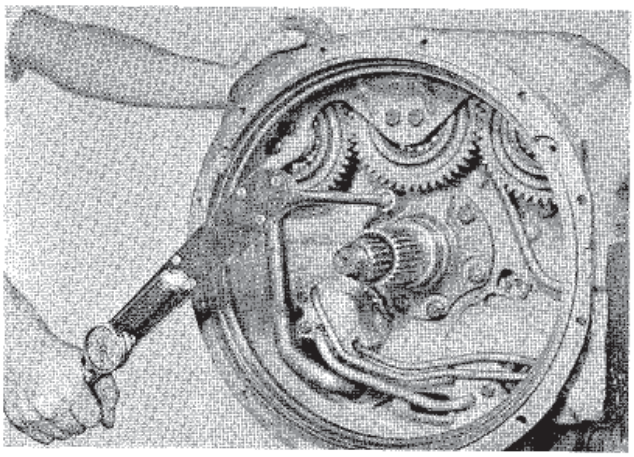


Figure 142

Install stator support bolts and tighten to specified torque.

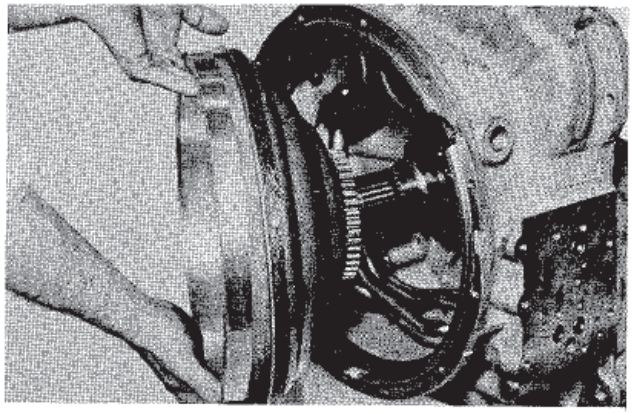


Figure 143

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

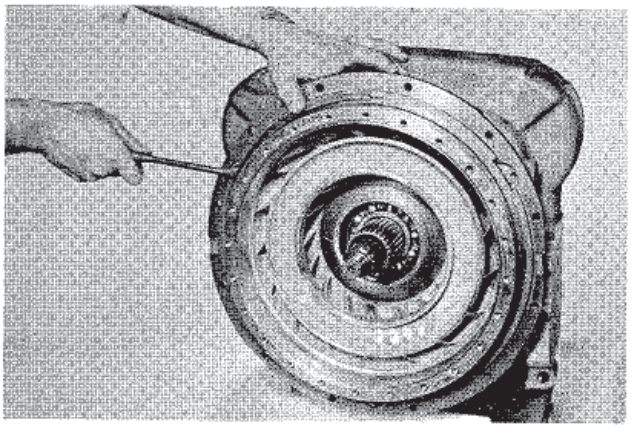


Figure 144

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

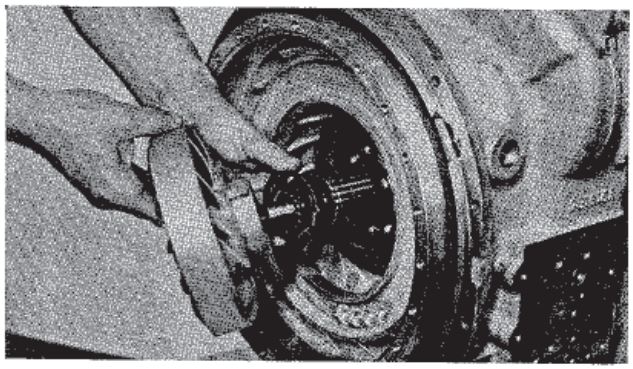


Figure 145

Install reaction member spacer with tang of spacer out. Install reaction member. **NOTE:** Casted knob on reaction member must be positioned between the 3 & 6 o'clock location on support, preferably between 4 & 5 o'clock.

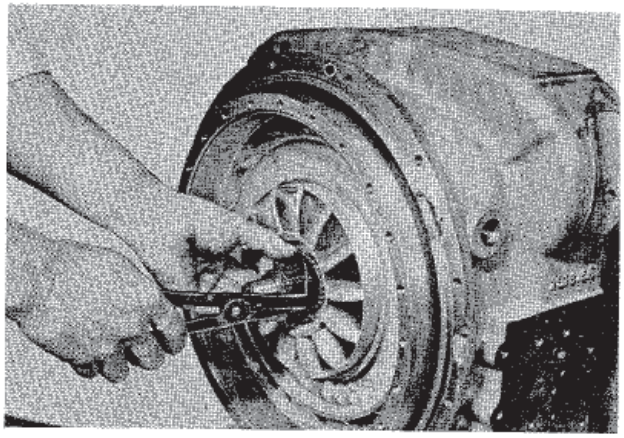


Figure 146

Install reaction member retainer ring.

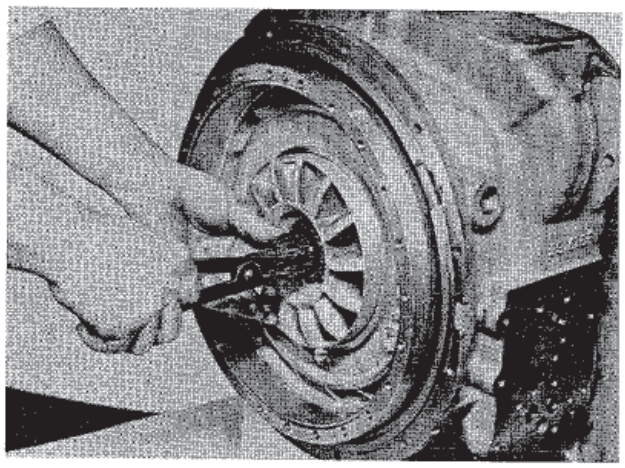


Figure 147

Install turbine locating ring on turbine shaft.

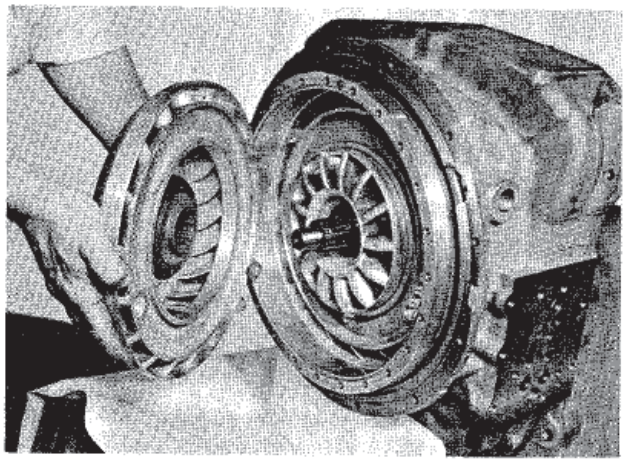


Figure 148

Install turbine.

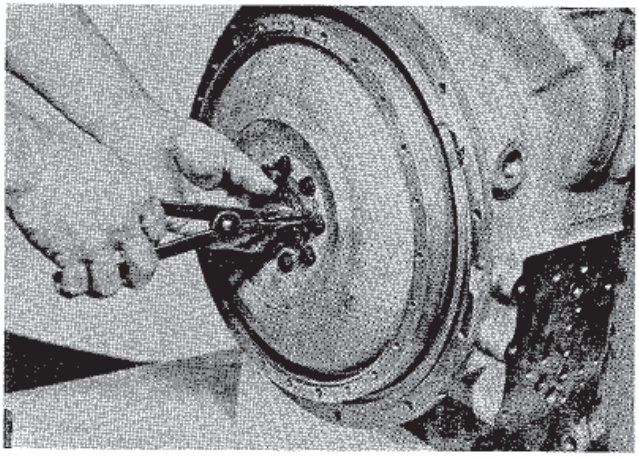


Figure 149
Install turbine to turbine shaft retainer ring.

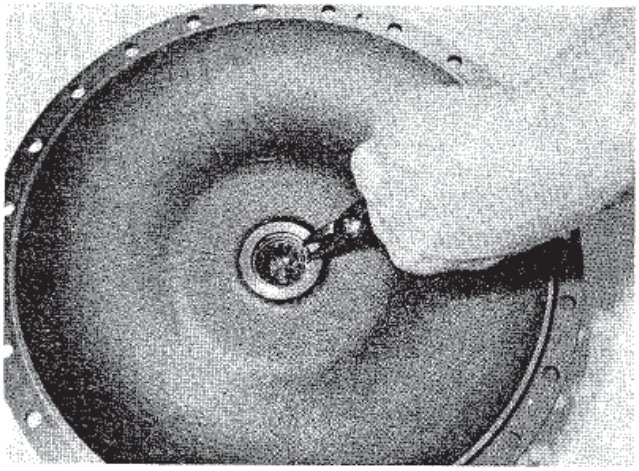


Figure 150
If impeller cover bearing was removed, press bearing in position and secure with retainer ring.

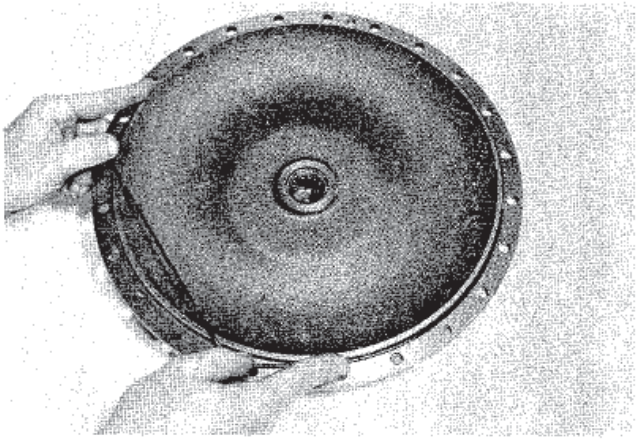


Figure 151
Install a new impeller cover "O" ring and grease lightly to facilitate reassembly.

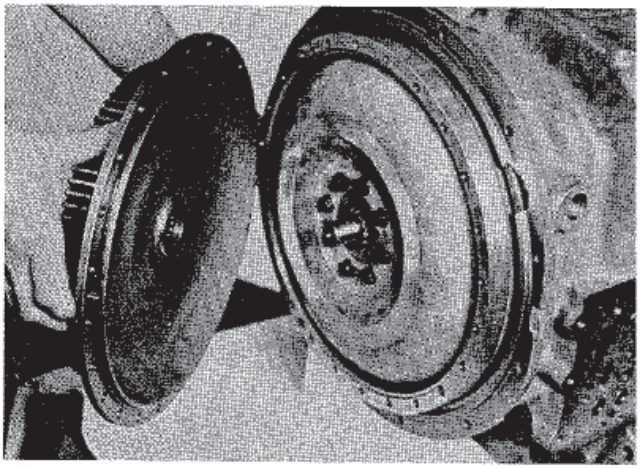


Figure 152
Align holes in impeller cover with holes in impeller. Install bolts and washers and tighten to specified torque.

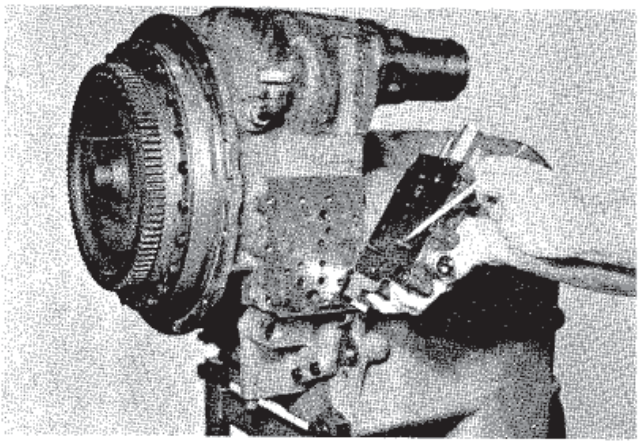


Figure 153
Locate detent balls and springs in control valve. Position new gasket. Secure valve with bolts and washers. Tighten to specified torque.

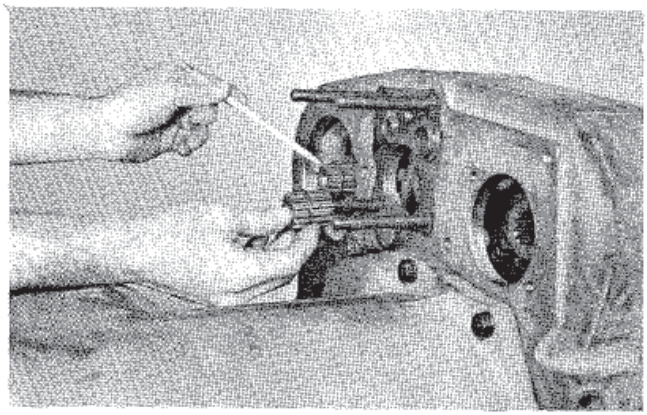


Figure 154
Install pump drive sleeves.

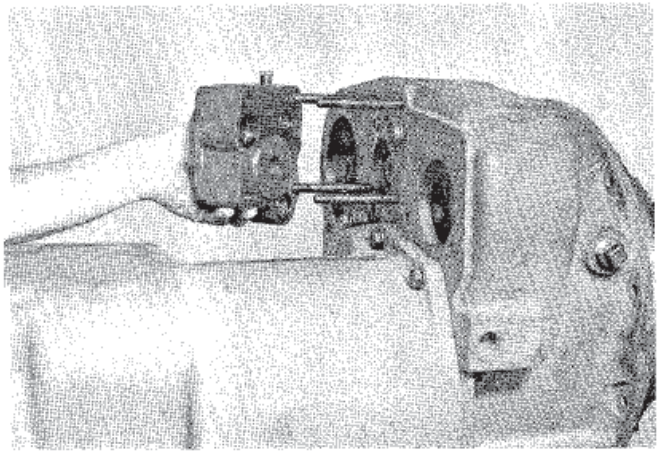


Figure 155

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

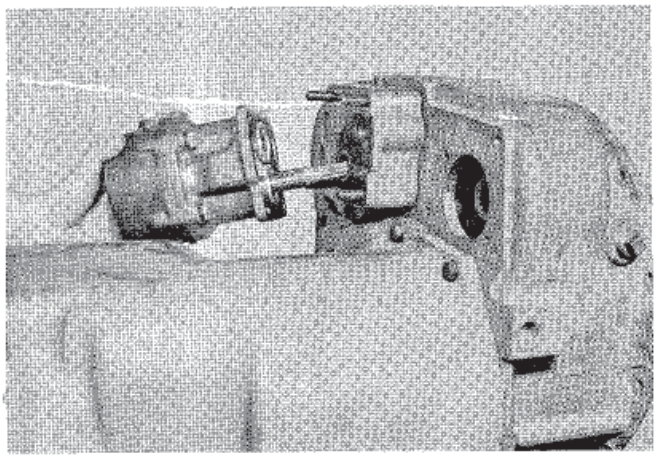


Figure 156

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.

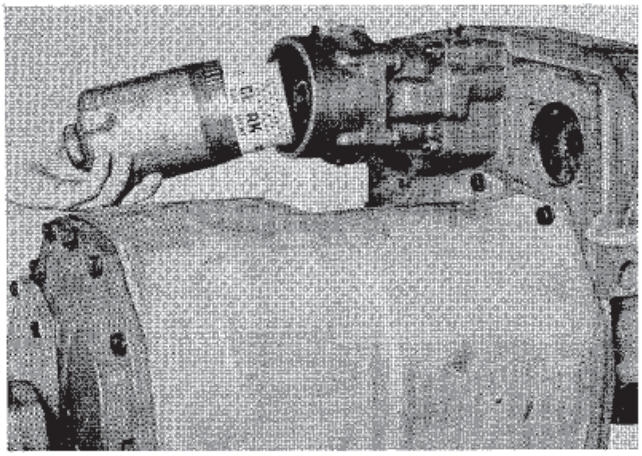


Figure 157

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

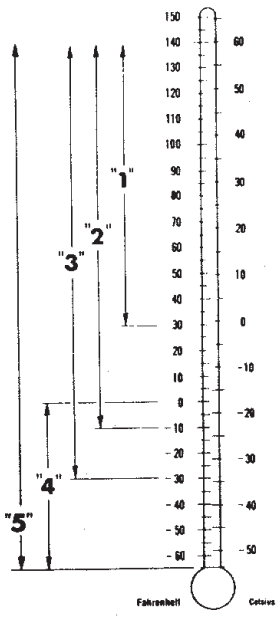
CONVERTER OUT PRESSURE	Converter outlet oil temp. 180° - 200° F. [82,3° - 93,3° C]. Transmission in **NEUTRAL**. Operating specifications: 25 P.S.I. [172,4 kPa] minimum pressure at 2000 R.P.M. engine speed **AND** a maximum of 70 P.S.I. [482,6 kPa] outlet pressure with engine operating at no-load governed speed.
CONTROLS	Forward and Reverse — Manual 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. **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.** **ALWAYS USE PARKING BRAKE WHEN MAKING CLUTCH PRESSURE CHECKS.**

LUBRICATION

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.**

RECOMMENDED LUBRICANTS FOR CLARK-HURTH COMPONENTS POWER SHIFTED TRANSMISSION AND TORQUE CONVERTERS

Prevailing Ambient Temperature



*Dexron is a registered trademark of General Motors Corporation.

Temperature Range	"1"	C-2 Grade 30 C-3 Grade 30 Engine Oil:-Grade 30 API-CD/SE or CD/SF MIL-L-2104C-Grade 30 MIL-L-2104D-Grade 30
Temperature Range	"2"	MIL-L-2104C-Grade 10 MIL-L-2104D-Grade 10 C-2 Grade 10 C-3 Grade 10 Engine Oil:-Grade 10 API-CD/SE or CD/SF Quintolubric 822-220 (Non Phosphate Ester Fire Resistant Fluid)
Temperature Range	"3"	*Dexron *Dexron II D - **See Caution Below**
Temperature Range	"4"	MIL-L-46167 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

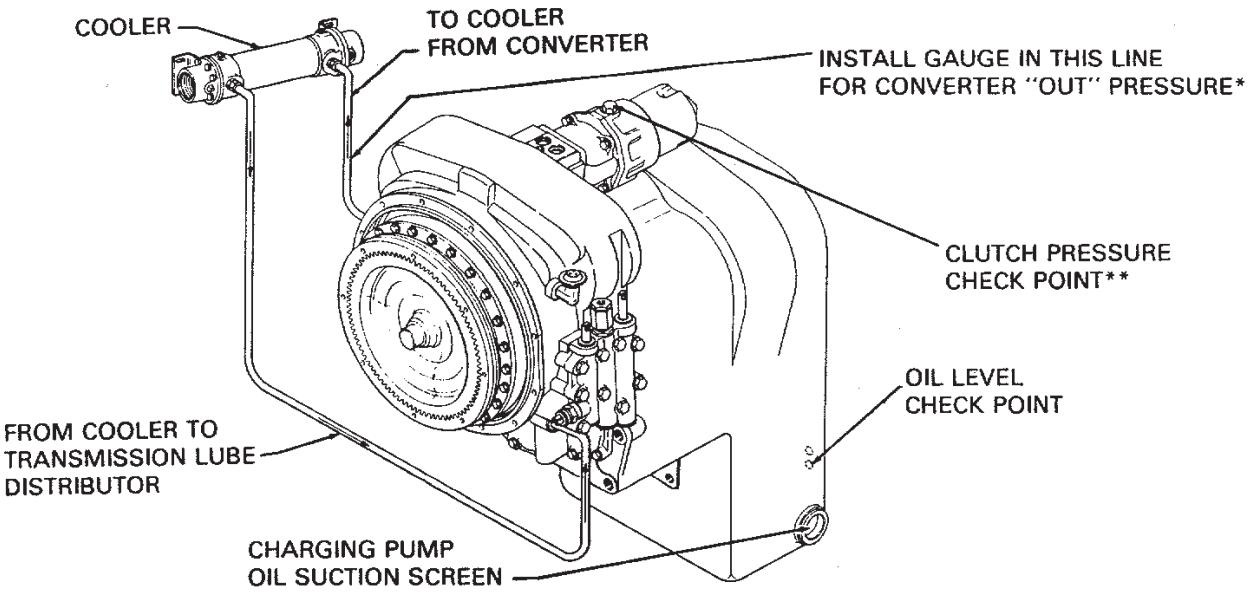
1. Worn oil sealing rings.	1. Remove, disassemble, and rebuild converter assembly.
2. Worn oil pump.	2. Replace.
3. Low oil level.	3. Fill to proper level.
4. Pump suction line taking air. (R-28000 only)	4. Check oil line connections and tighten securely.

NOISY CONVERTER

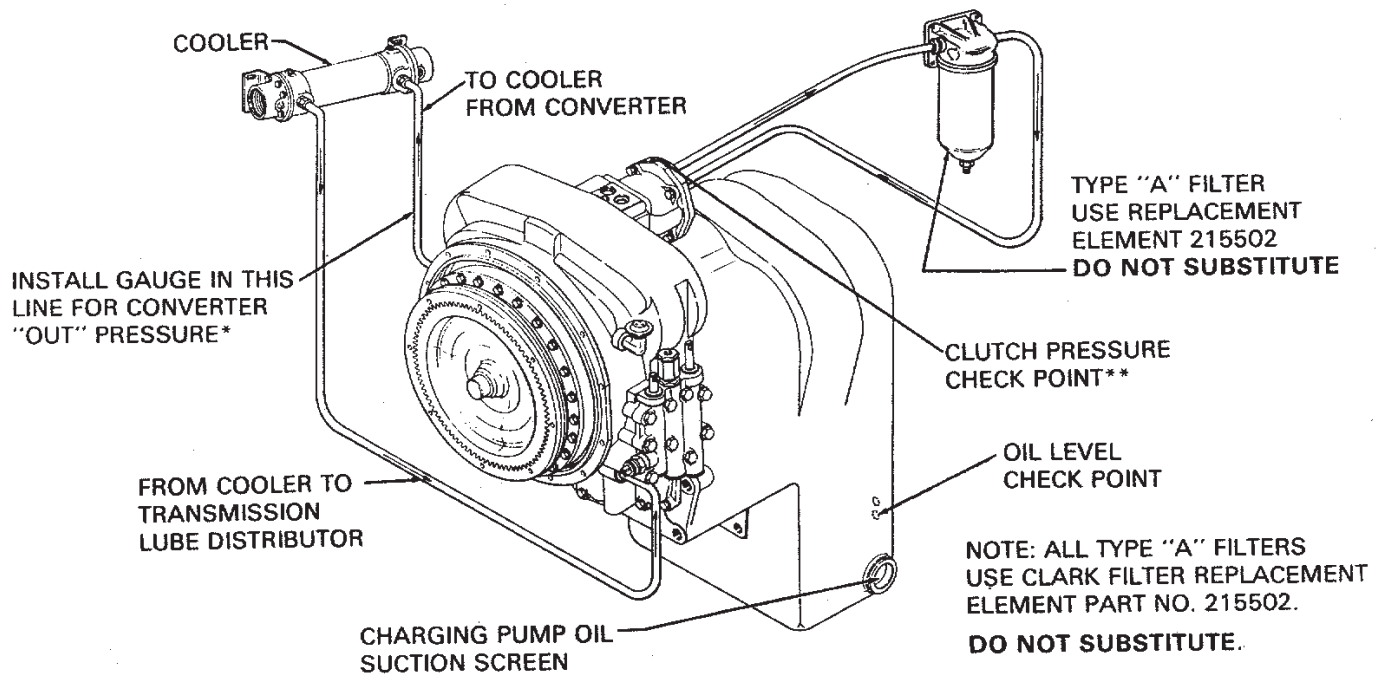
1. Worn coupling gears.	1. Replace.
2. Worn oil pump.	2. Replace.
3. Worn or damaged bearings.	3. A complete disassembly will be necessary to determine what bearing is faulty.

LACK OF POWER

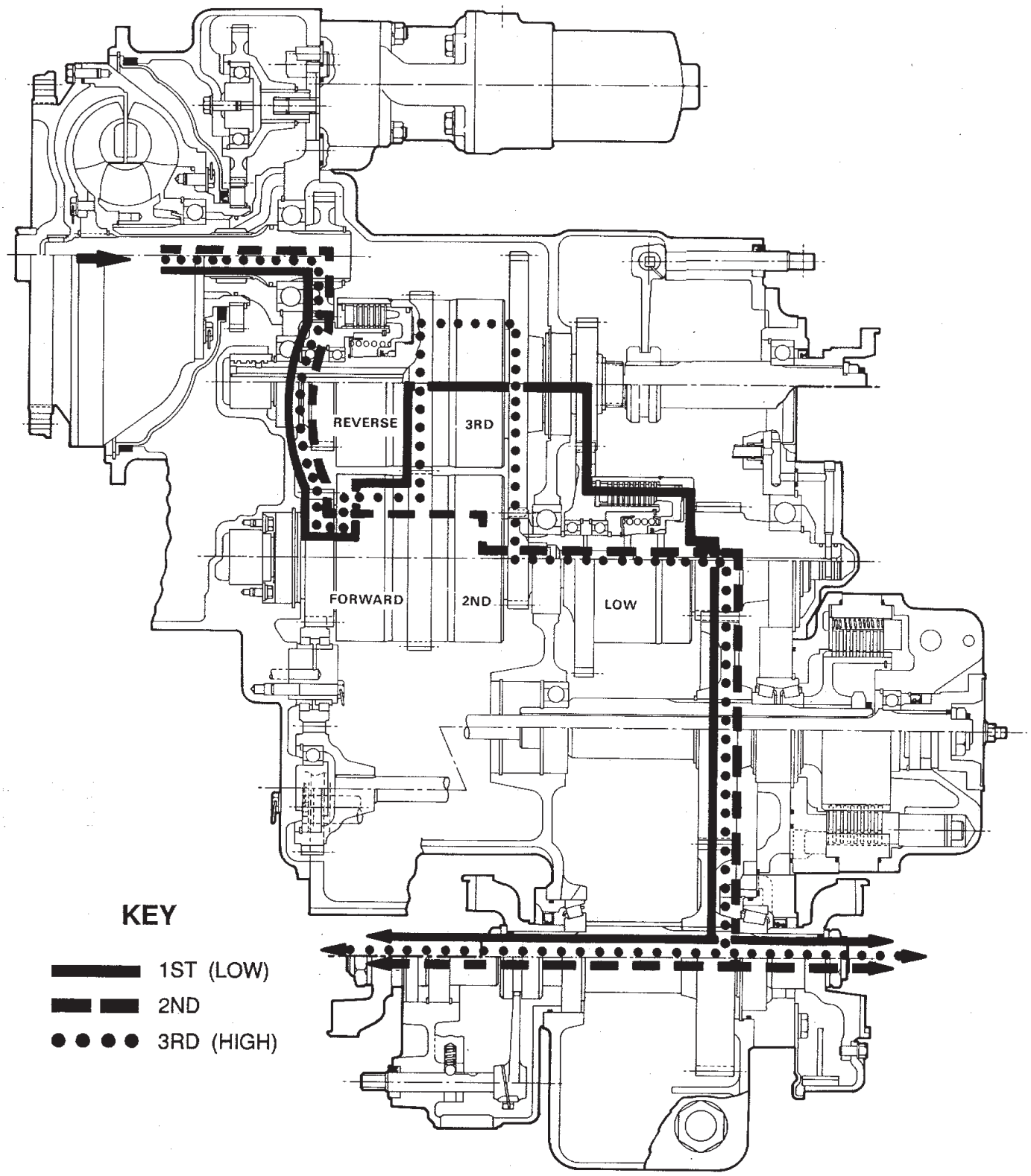
1. Low engine RPM at converter stall.	1. Tune engine check governor.
2. See "Overheating" and make same checks.	2. Make corrections as explained in "Overheating."



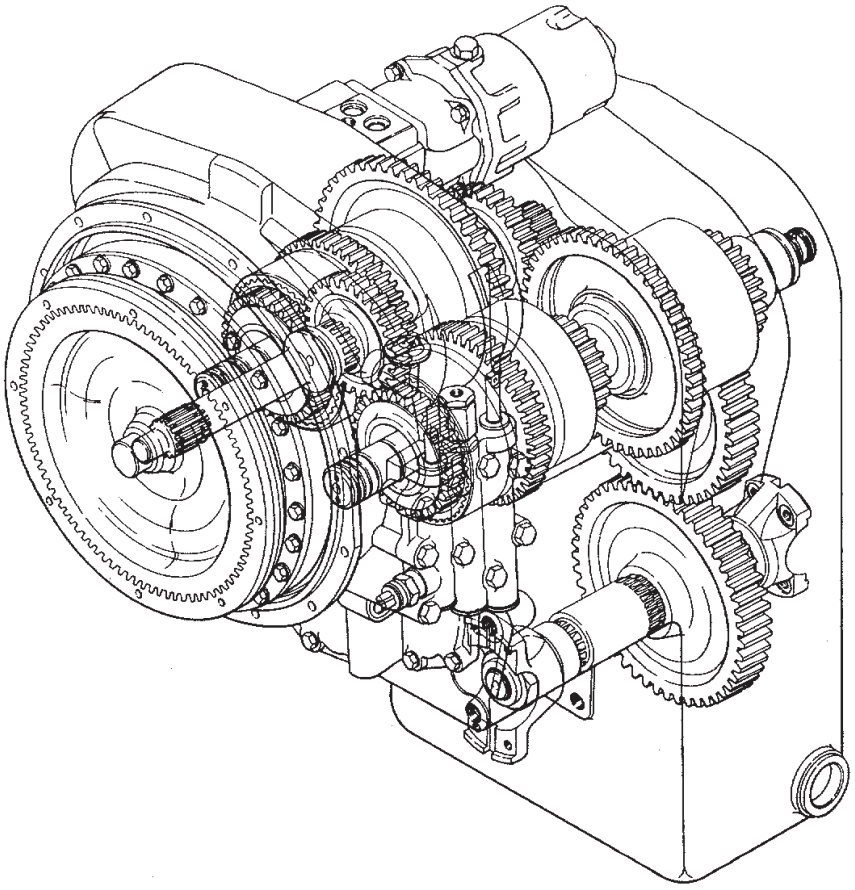
28000 SERIES PLUMBING DIAGRAM

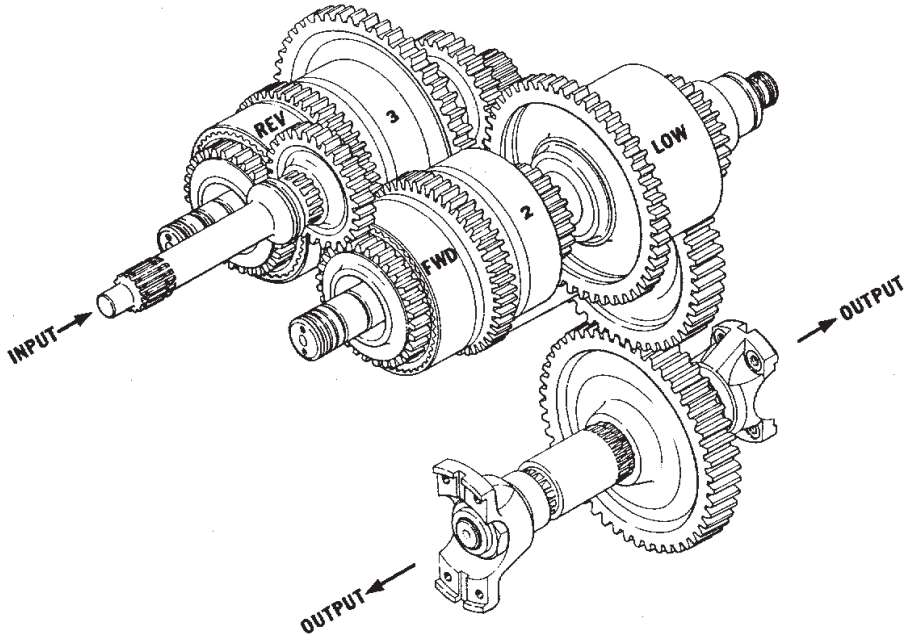


28000 SERIES PLUMBING DIAGRAM
(WITH REMOTE FILTER)

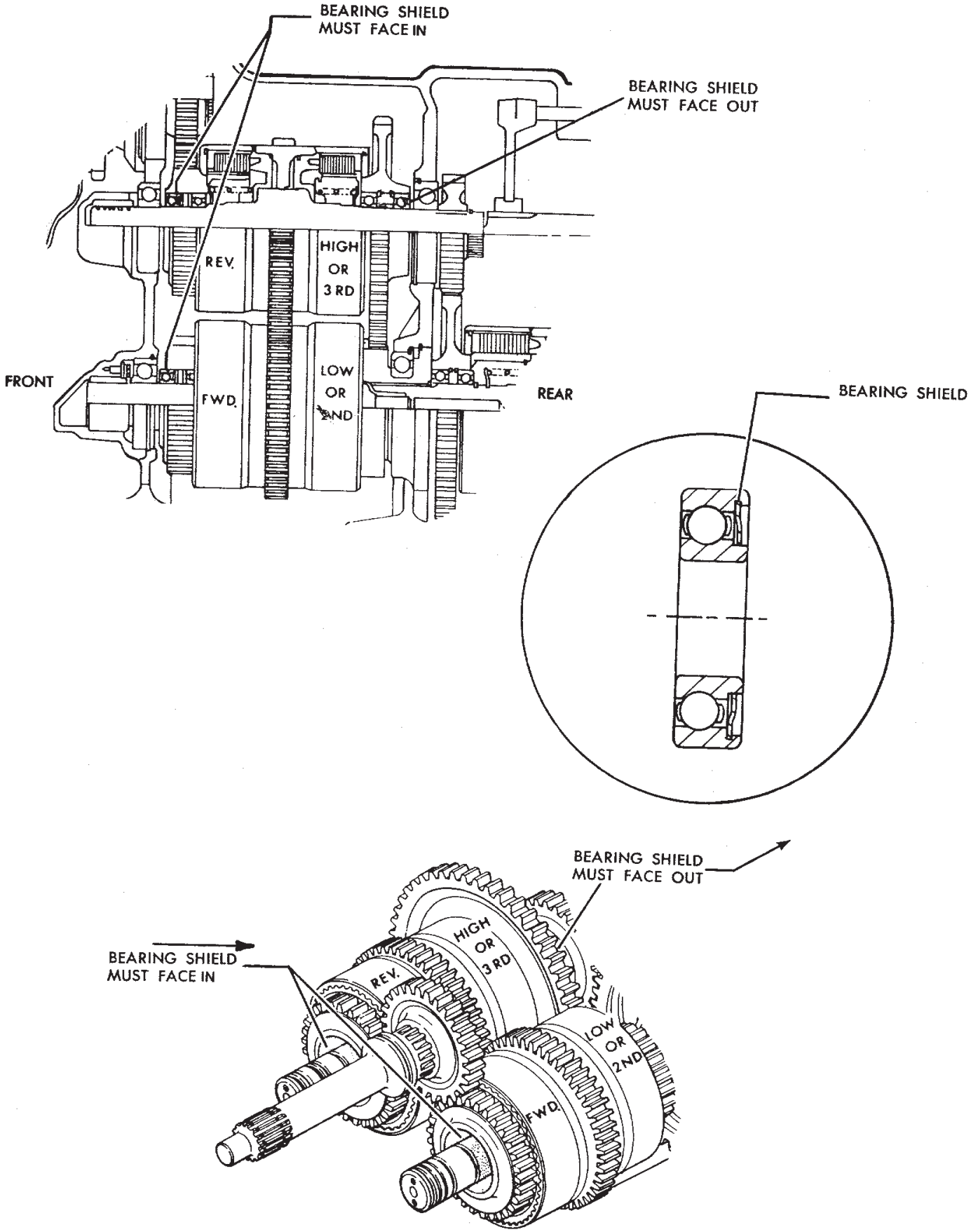


HR MODEL 3 SPEED TRANSMISSION





28000 SERIES - 3 SPEED
CLUTCH & GEAR ARRANGEMENT



SHIELDED BEARING INSTALLATION

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

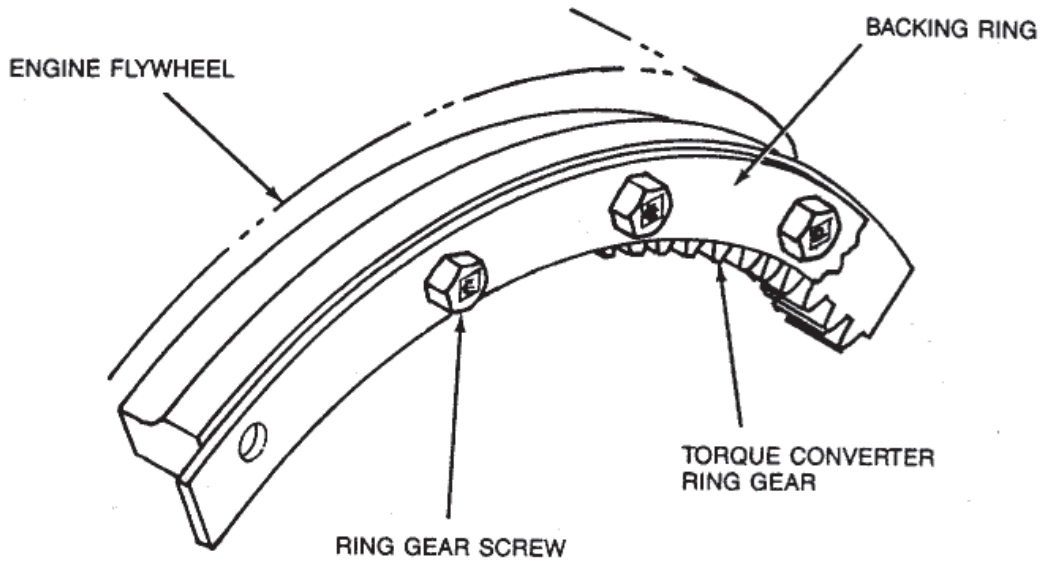
802554 — 1.5 INCH [38,1] 16 SCREW RING GEAR KIT

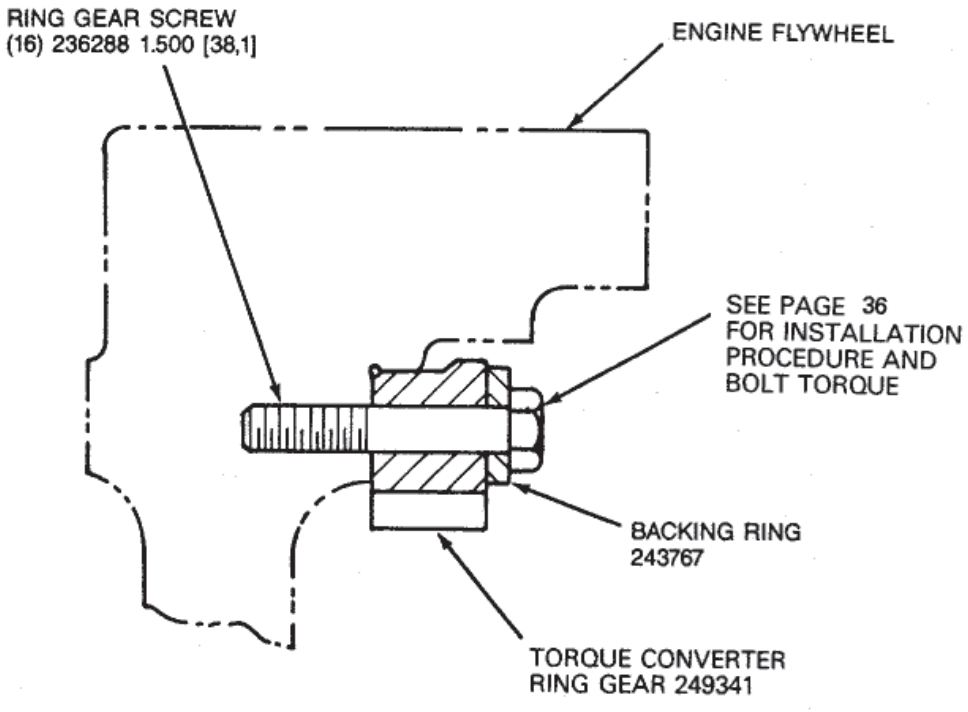
1	249341	Torque Converter Ring Gear
16	236288	Ring Gear Screw 1.5 Inch [38,1]
1	243767	Backing Ring
1	802555	Installation Instruction Sheet

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

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

SEE PAGE 37 FOR INSTALLATION ILLUSTRATIONS


ENGINE FLYWHEEL
BACKING RING
TORQUE CONVERTER
RING GEAR
RING GEAR SCREW


RING GEAR SCREW
(16) 236288 1.500 [38,1]
ENGINE FLYWHEEL
SEE PAGE 36
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

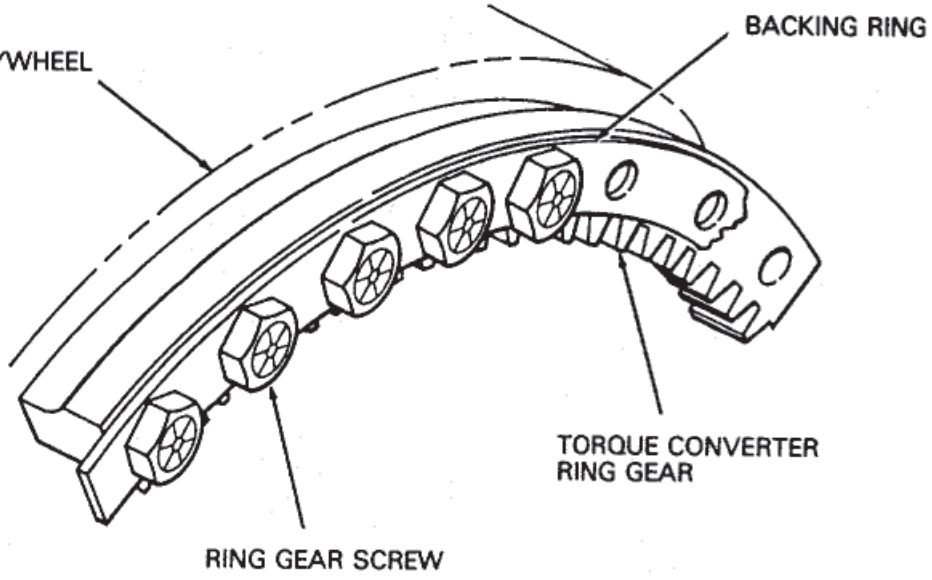
802549 – M8-32 SCREW RING GEAR KIT

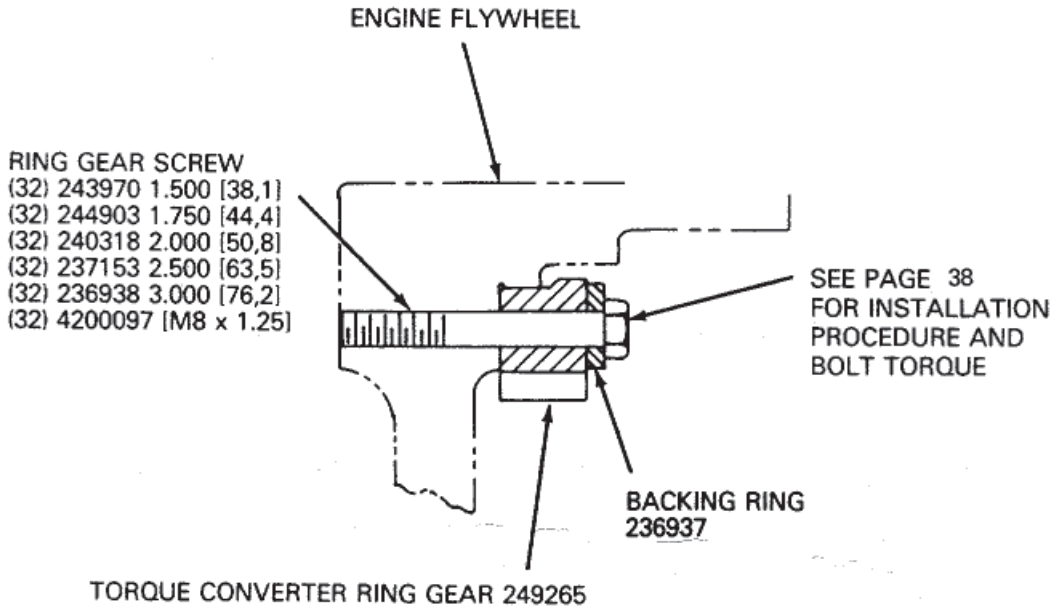
1	249265	Torque Converter Ring Gear
32	4200097	Ring Gear Screw [M8 x 1.25]
1	802550	Installation Instruction Sheet

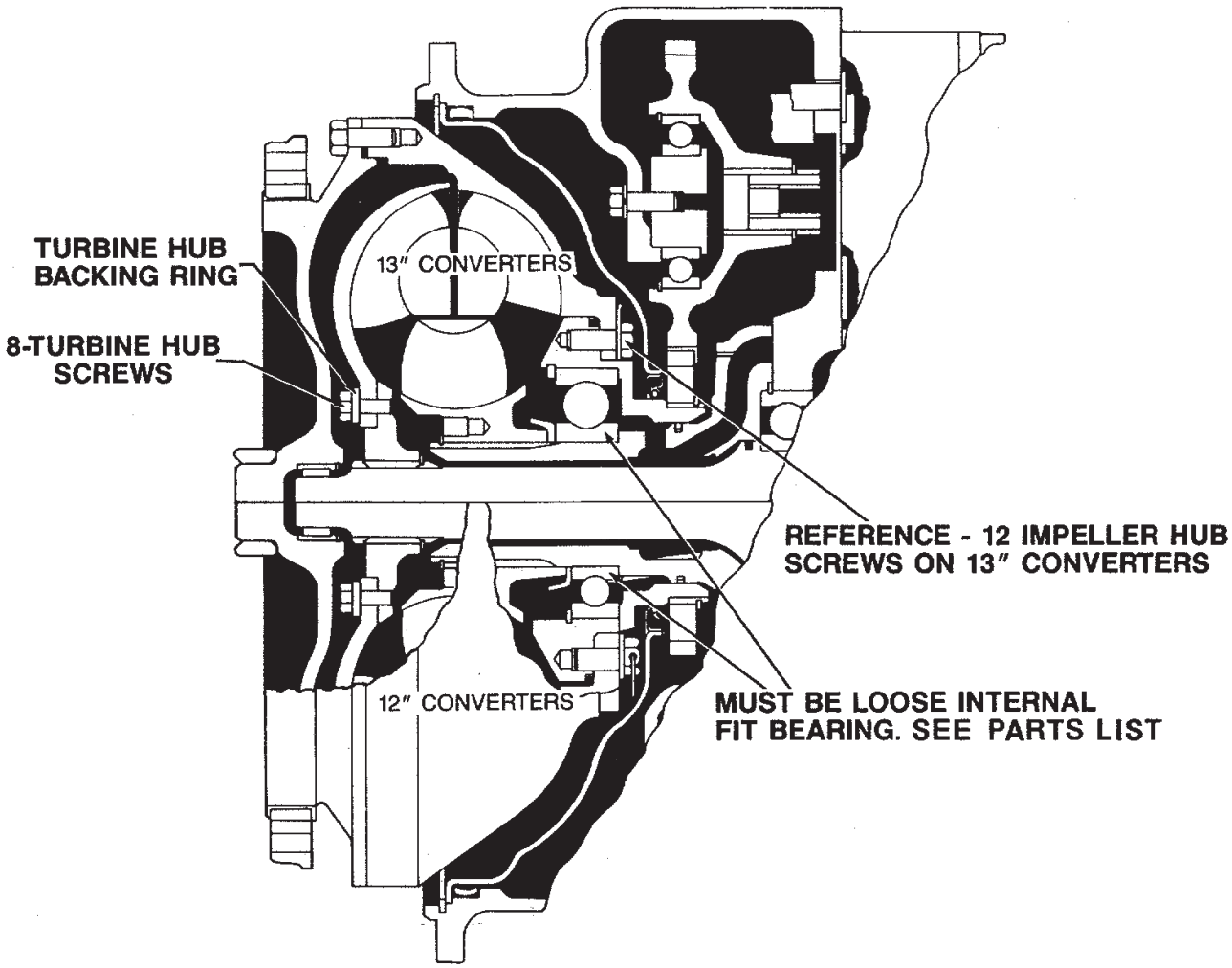
236937 Backing Ring Not Included in Ring Gear Kit. Must be Ordered Separately.

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 39 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 38
FOR INSTALLATION
PROCEDURE AND
BOLT TORQUE
BACKING RING
236937
TORQUE CONVERTER RING GEAR 249265

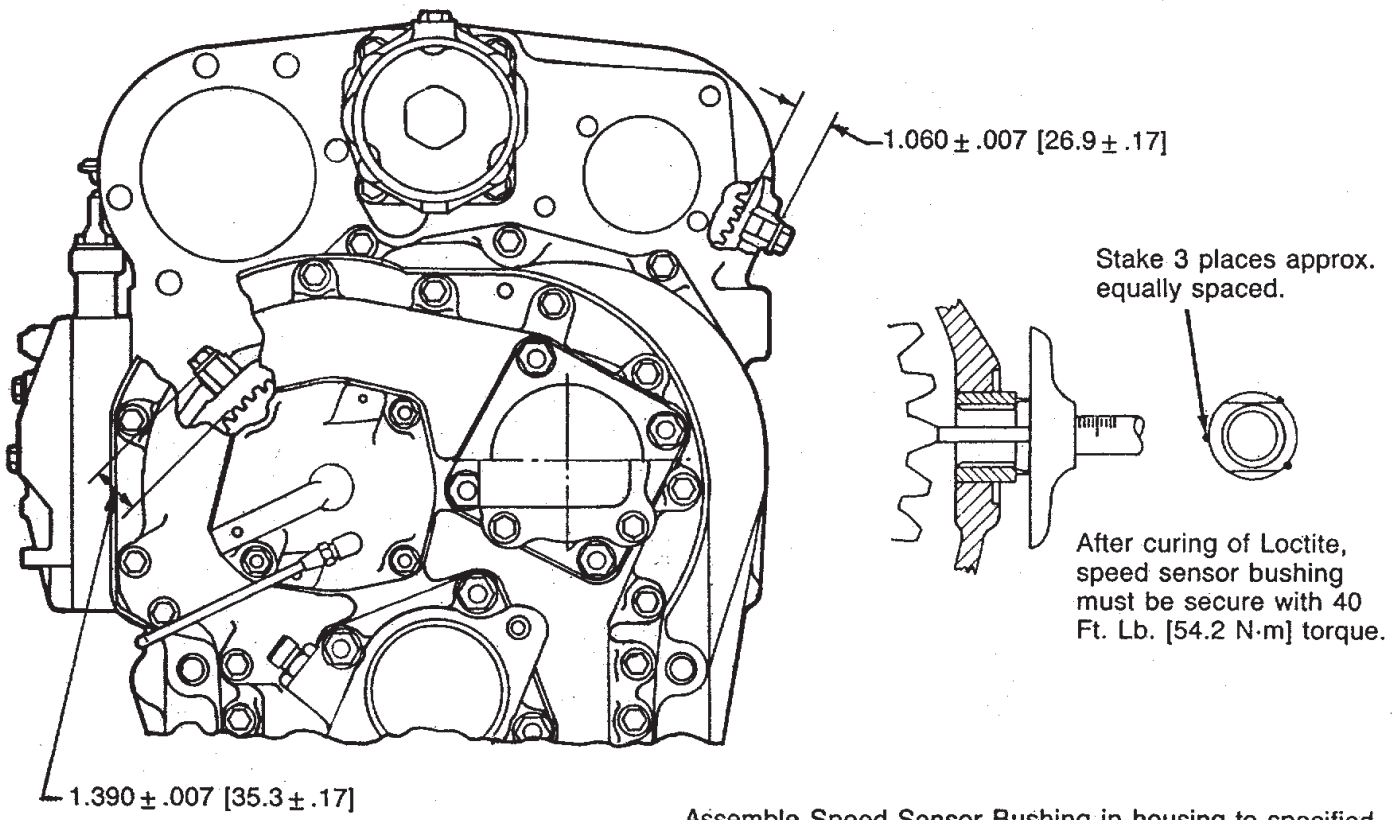


IMPELLER HUB, TURBINE HUB AND BACKING RING WITH SPECIAL SCREWS

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.



SPEED SENSOR BUSHING INSTALLATION

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

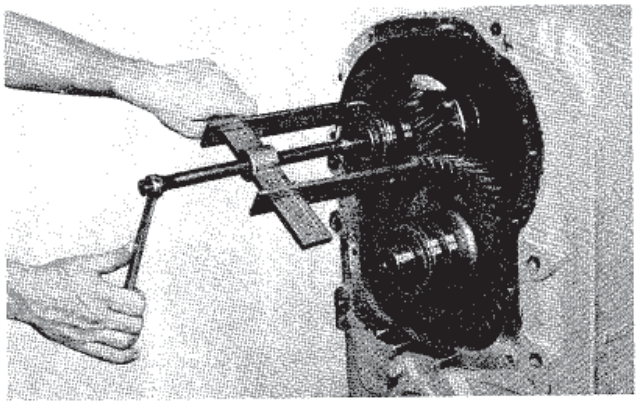


Figure A

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

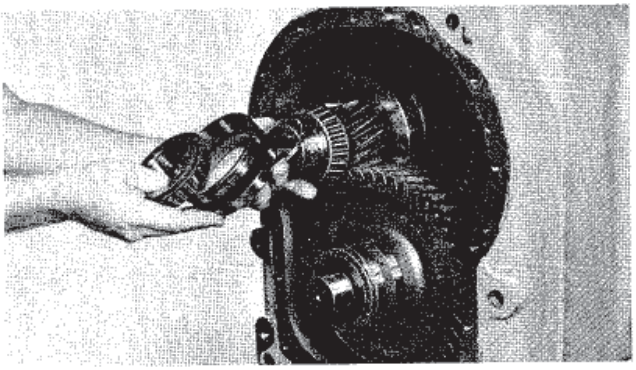


Figure B

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

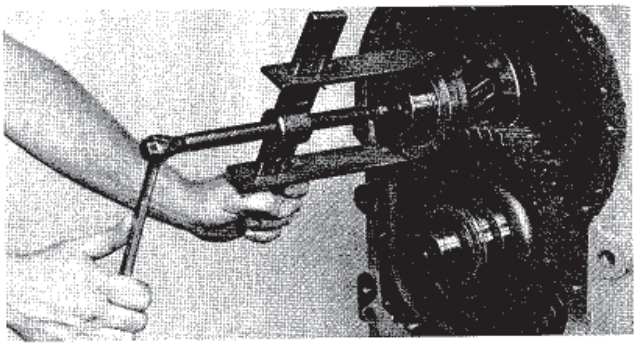


Figure C

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.

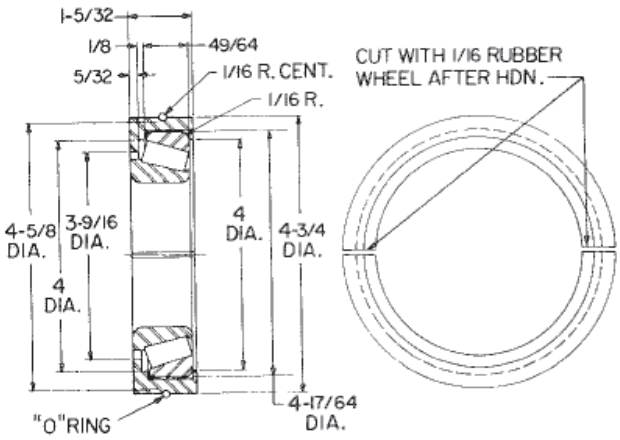


Figure D

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

REASSEMBLY

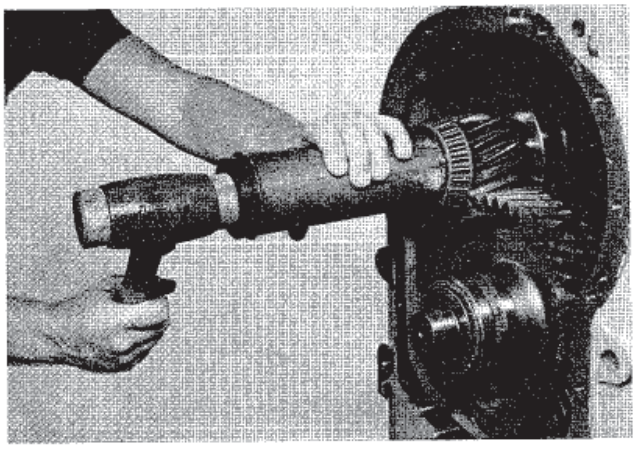


Figure E

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

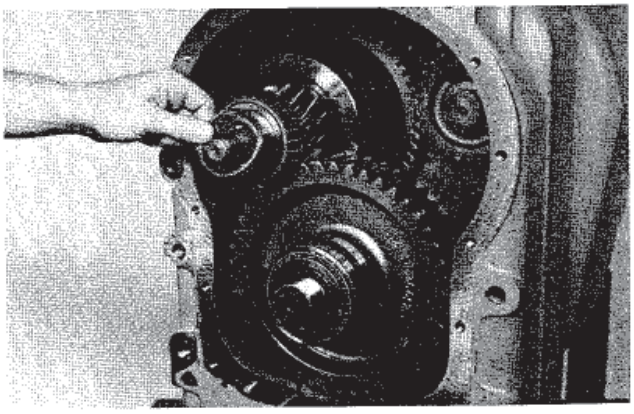


Figure F

Install bearing spacer.

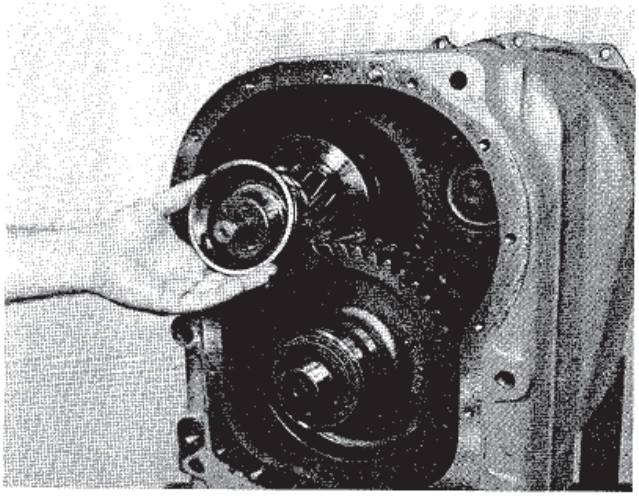


Figure G

Install bearing cup.

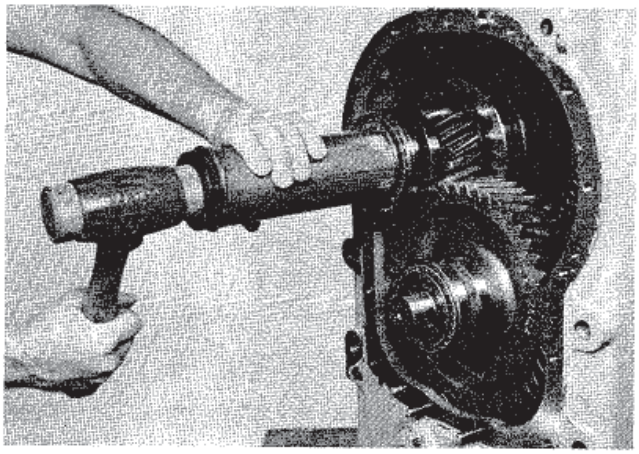


Figure H

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

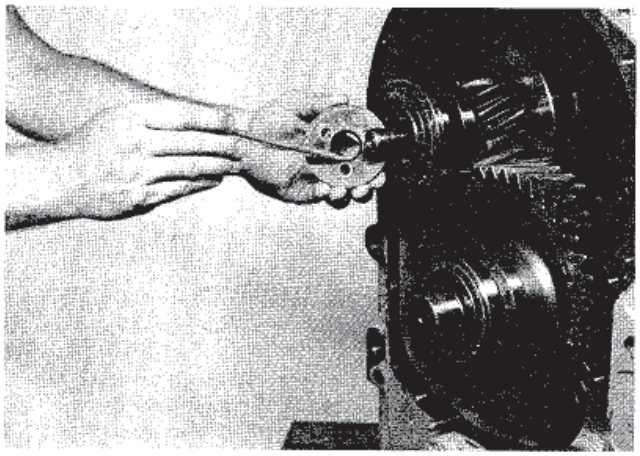


Figure I

Install retainer plate, inner diameter chamfer toward bearing.

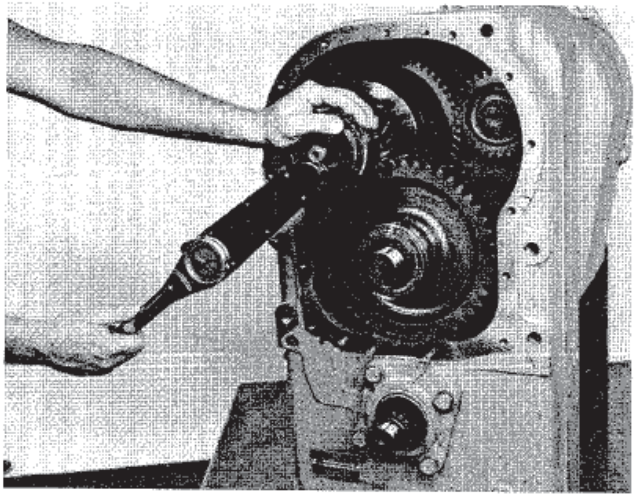


Figure J

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

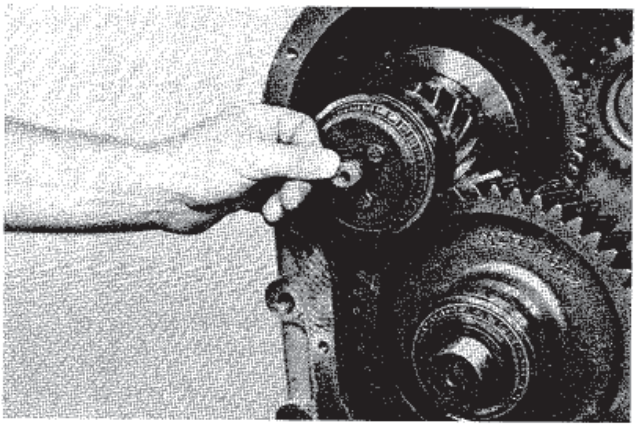


Figure K

Install low clutch shaft sealing ring.

LOW CLUTCH DISASSEMBLY UTILIZING TAPER BEARINGS IN LOW CLUTCH GEAR

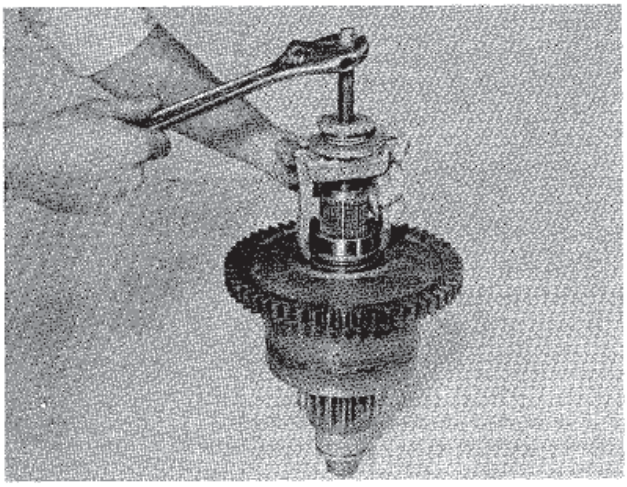


Figure 1
Remove low clutch shaft front bearing inner race.

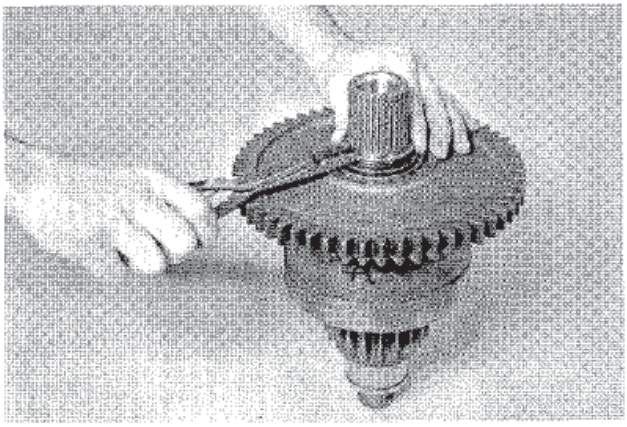


Figure 2
Remove low speed gear taper bearing retainer ring.

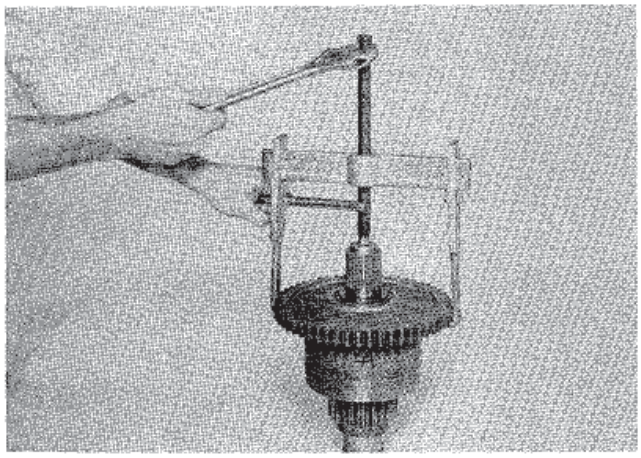


Figure 3
Remove low speed gear and outer taper bearing.

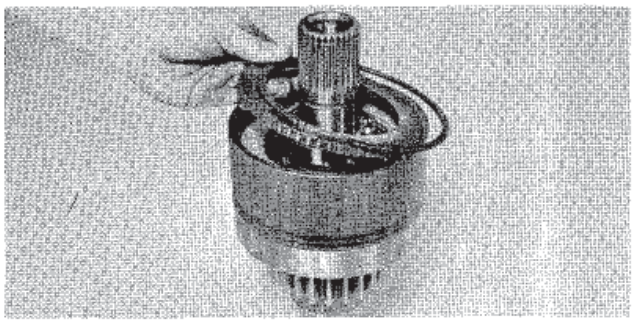


Figure 4
Remove clutch end plate retainer ring.
Remove clutch end plate and inner and outer clutch discs.

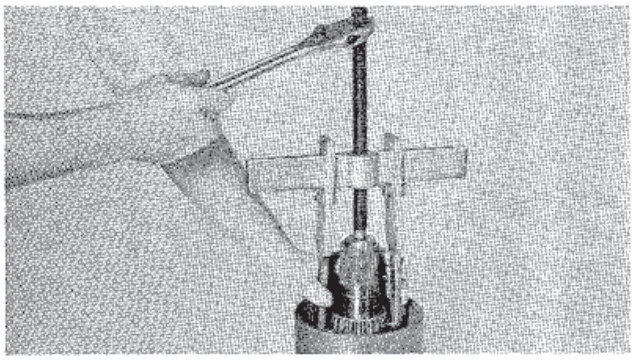


Figure 5
Remove low gear inner taper bearing.

REASSEMBLY

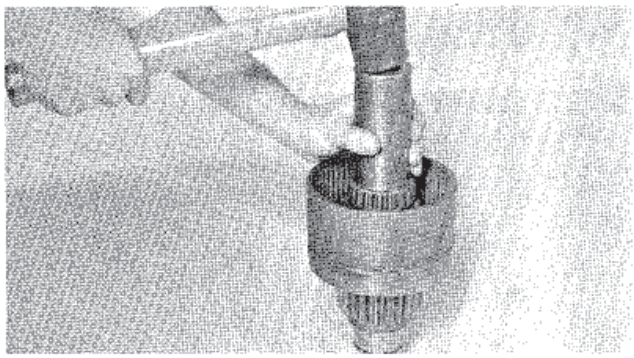


Figure 6
Install low gear inner taper bearing
Install one steel disc.

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.

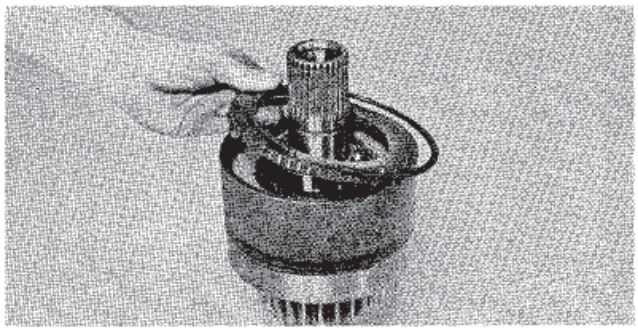


Figure 7
Install end plate and retainer ring.

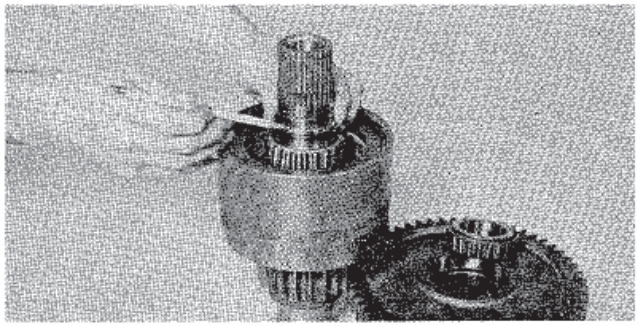


Figure 8
Install low clutch taper bearing spacer.

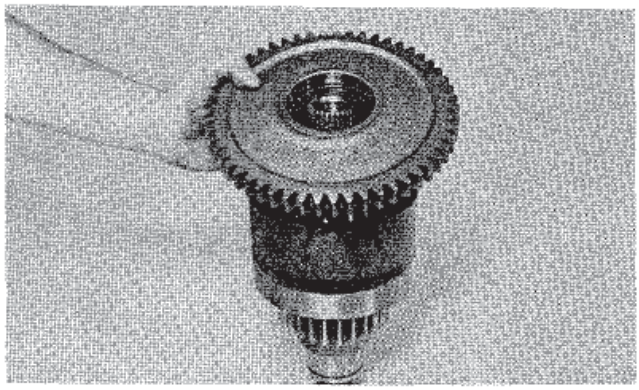


Figure 9
Install low gear into clutch drum. Align splines on low gear with internal teeth of friction discs. Tap gear into position. Do not force this operation. Gear splines must be in full position with internal teeth of all friction discs.

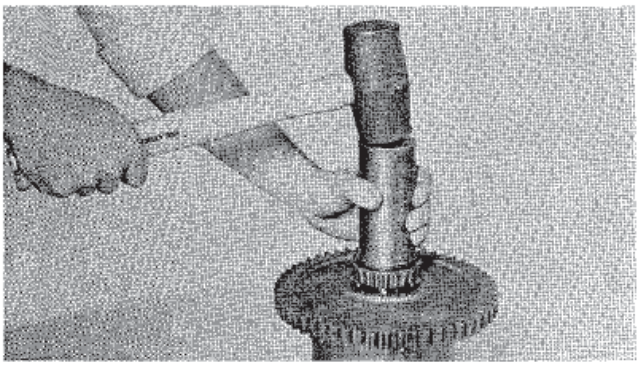


Figure 10
Install low gear outer taper bearing.

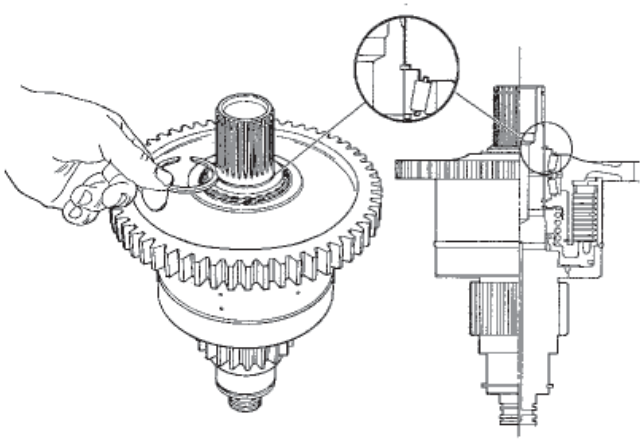


Figure 11
Install low clutch taper bearing retainer ring.
NOTE: Retainer ring is selected at assembly for proper thickness. A snap ring kit is available. Select the thickest of the three rings in the kit that can be fitted into the snap ring groove to assure a proper taper bearing tightness. Check ring as shown for tight ring to bearing fit.

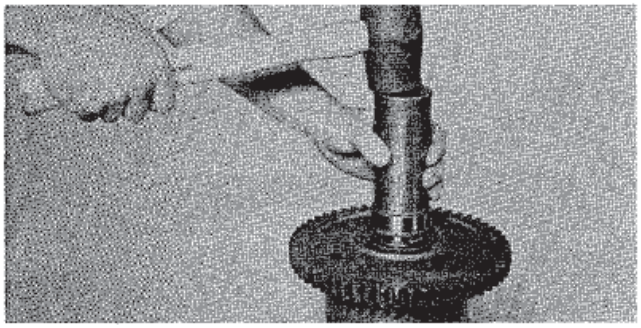
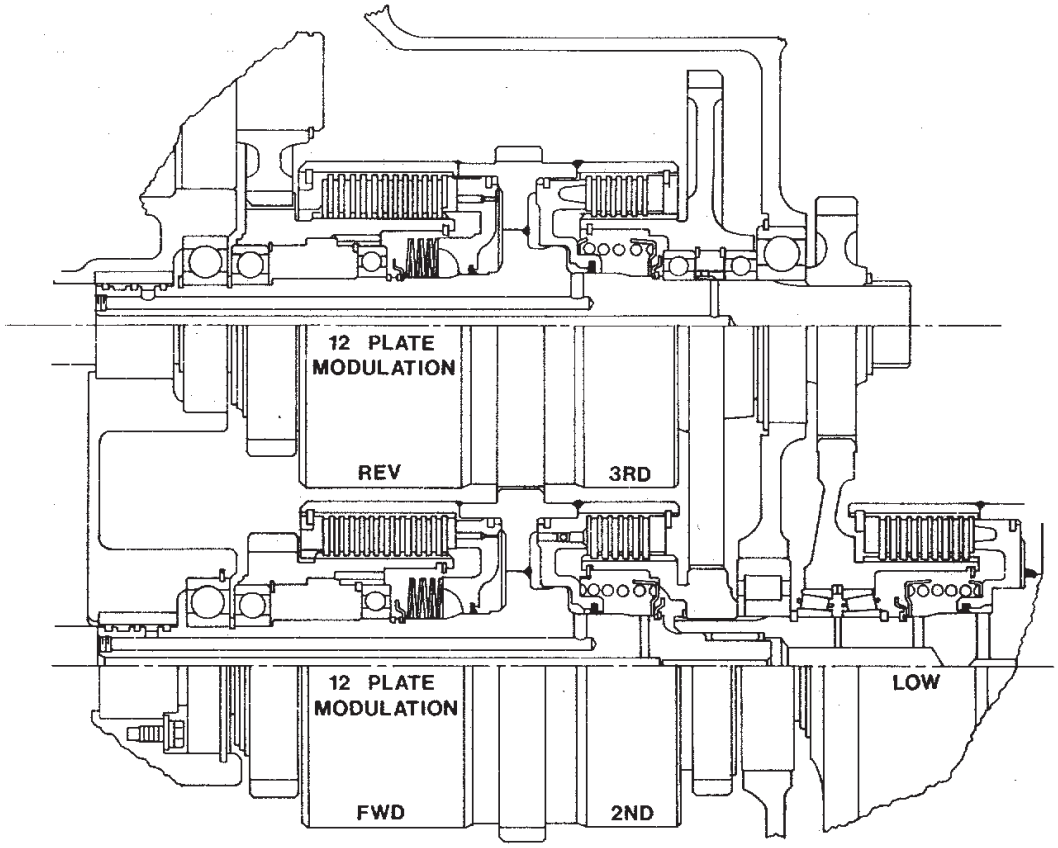
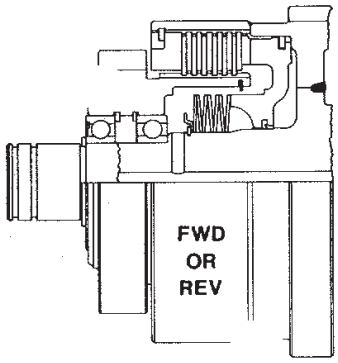


Figure 12
Install low clutch shaft front bearing inner race with large diameter of race down.

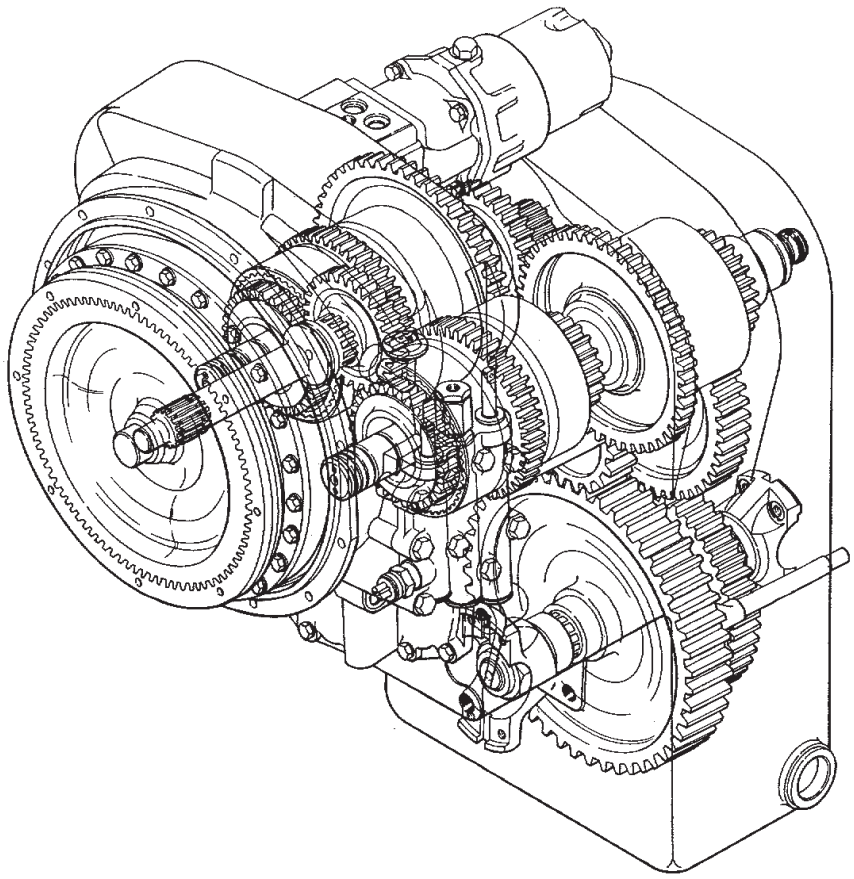
Clutch Modulation Cross Section

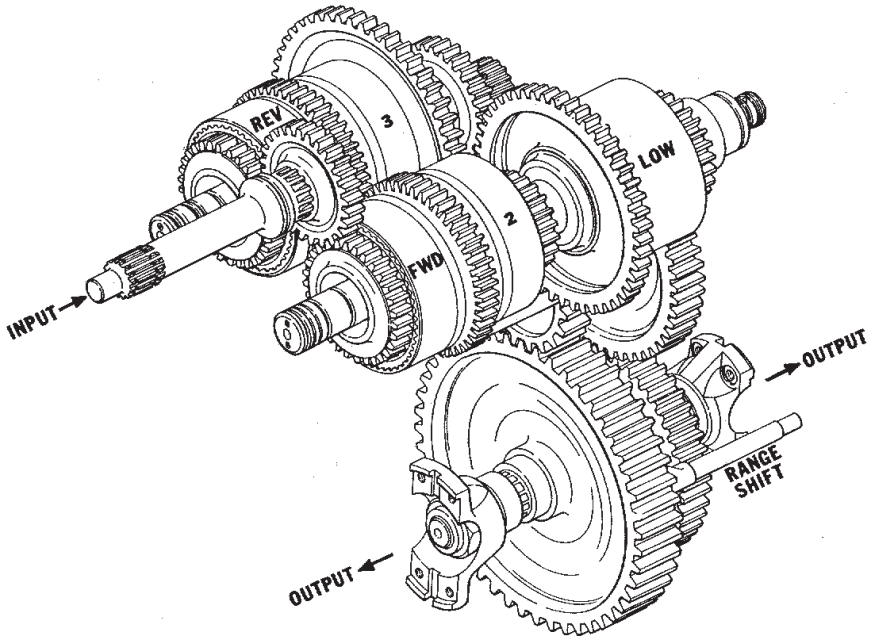


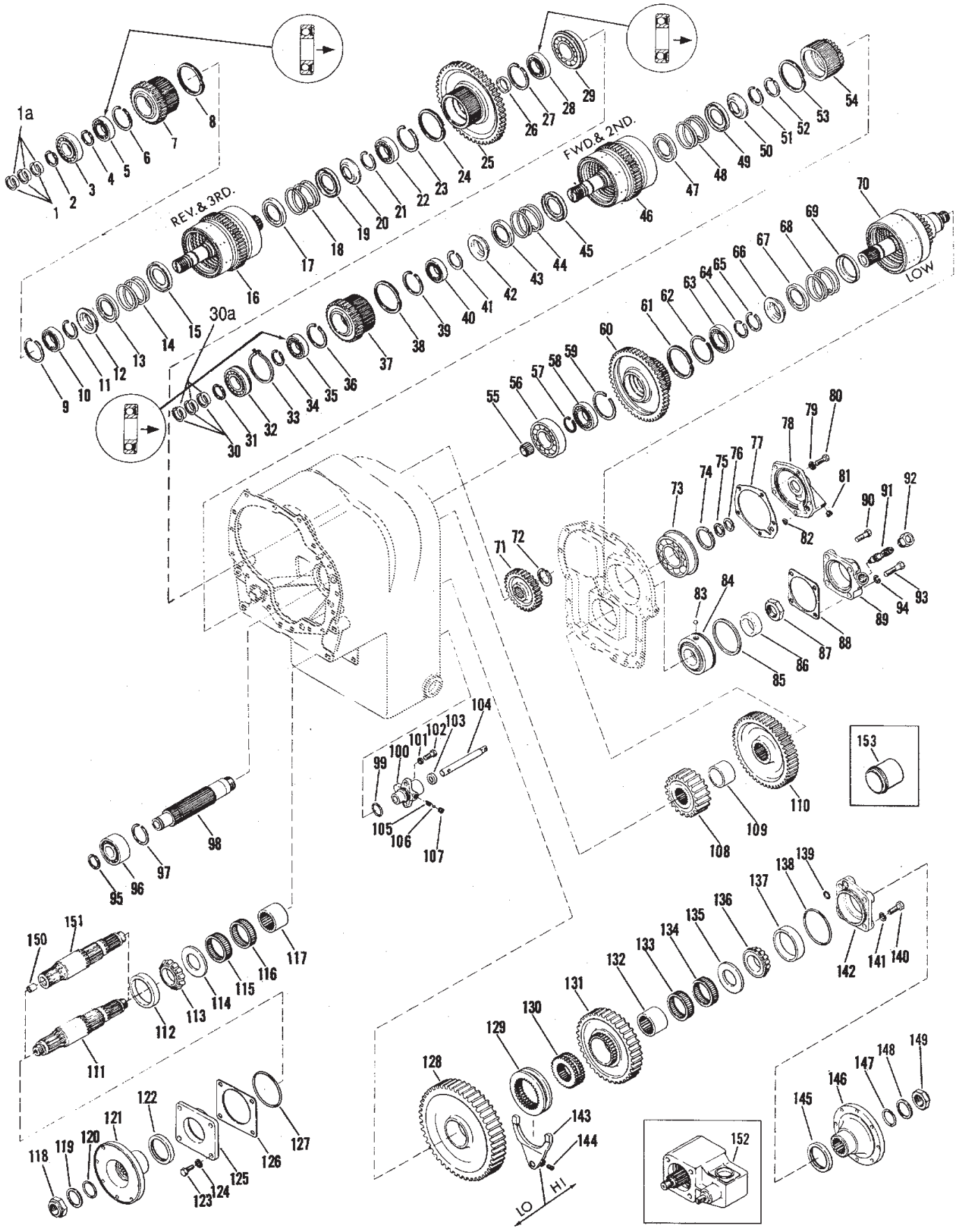


6 PLATE MODULATION

28000 6-SPEED SECTION



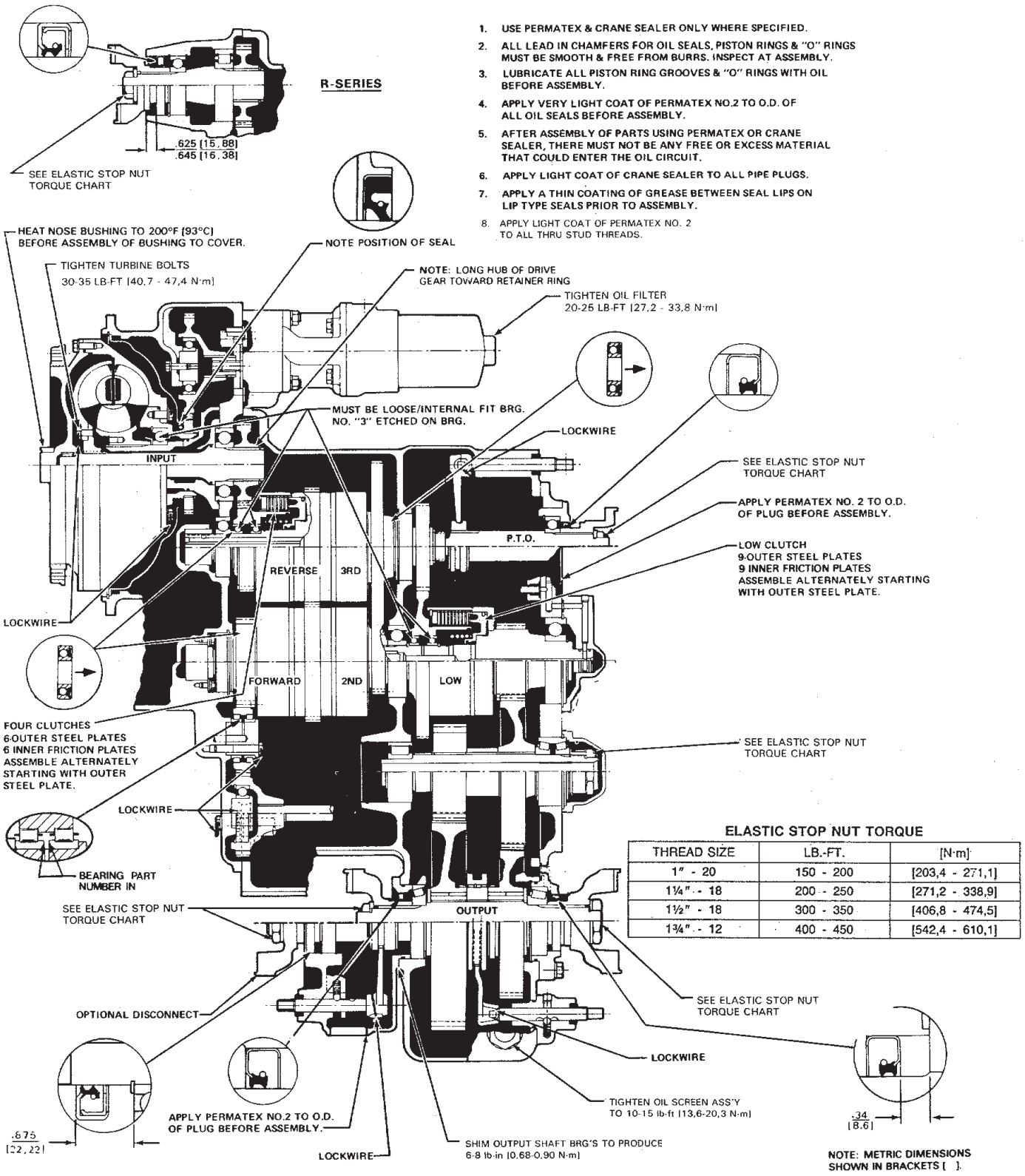



1a
REV.& 3RD.
FWD.& 2ND.
LOW
30a
LO
HI

6-SPEED CLUTCH AND GEAR GROUP

ITEM	DESCRIPTION	QTY
1	Reverse and 3rd Clutch Shaft Piston Ring	3
1A	Piston Ring Expander Springs	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	Return 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 and 3rd Clutch Shaft and Drum	1
17	Spring Retainer	1
18	Piston Return Spring	1
19	Spring Retainer	1
20	Snap Ring Retainer Snap Ring	1
21	Snap Ring Retainer	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	Forward and 2nd Shaft Piston Ring	3
30A	Piston Ring Expander Springs	3
31	Front Bearing Retainer Ring	1
32	Forward and 2nd Shaft Front Bearing	1
33	Front Bearing Locating Ring	1
34	Front Bearing Retainer Ring	1
35	Clutch Driven Gear Bearing	1
36	Clutch Driven Gear Bearing Snap Ring	1
37	Clutch Driven Gear	1
38	Clutch Hub Oil Baffle Ring	1
39	Clutch Driven Gear Bearing Snap Ring	1
40	Clutch Driven Gear Bearing	1
41	Return Spring Retainer Snap Ring	1
42	Snap Ring Retainer	1
43	Spring Retainer	1
44	Piston Return Spring	1
45	Spring Retainer	1
46	Forward and 2nd Clutch Shaft and Drum	1
47	Spring Retainer	1
48	Piston Return Spring	1
49	Spring Retainer	1
50	Snap Ring Retainer	1
51	Return Spring Retainer Snap Ring	1
52	2nd Gear Retainer Ring	1
53	Clutch Hub Oil Baffle Ring	1
54	2nd Gear	1
55	Low Speed Clutch Shaft Pilot Bearing	1
56	2nd Gear Bearing	1
57	Low Gear Bearing Retainer Ring	1
58	Low Gear Bearing	1
59	Low Gear Bearing Locating Ring	1
60	Low Gear	1
61	Low Gear Oil Baffle Ring	1
62	Low Gear Bearing Locating Ring	1
63	Low Gear Bearing	1
64	Low Gear Bearing Retainer Ring	1
65	Return Spring Retainer Snap Ring	1
66	Snap Ring Retainer	1
67	Spring Retainer	1
68	Piston Return Spring	1
69	Spring Retainer	1
70	Low Speed Clutch Shaft and Drum	1
71	Low Speed Drive Gear	1
72	Low Speed Drive Gear Retaining Ring	1
73	Low Shaft Rear Bearing	1
74	Low Shaft Rear Bearing Retainer Ring	1
75	Low Shaft Piston Ring	1

ITEM	DESCRIPTION	QTY
76	Low Shaft Piston Ring	1
77	Rear Bearing Cap Gasket	1
78	Rear Bearing Cap	1
79	Rear Bearing Cap Screw Lockwasher	5
80	Rear Bearing Cap Screw	5
81	Rear Bearing Cap Plus	1
82	Rear Bearing Cap "O" Ring	1
83	Idler Shaft Rear Bearing Lock Ball	1
84	Idler Shaft Rear Bearing	1
85	Idler Shaft Rear Bearing Locating Ring	1
86	Speedometer Drive Gear or Bearing Spacer	1
87	Idler Shaft Nut	1
88	Idler Shaft Bearing Cap Gasket	1
89	Idler Shaft Bearing Cap	1
90	Idler Shaft Bearing Cap Screw	3
91	Speedometer Driven Gear	1
92	Speedometer Tube Nut	1
93	Idler Shaft Bearing Capscrew	1
94	Idler Shaft Bearing Capscrew Lockwasher	4
95	Idler Shaft Front Bearing Retainer Ring	1
96	Idler Shaft Front Bearing	1
97	Idler Shaft Gear Locating Ring	1
98	Idler Shaft	1
99	Range Shift Rail Support "O" Ring	1
100	Range Shift Rail Support	1
101	Range Shift Rail Support Screw Lockwasher	2
102	Range Shift Rail Support Screw	2
103	Range Shift Rail Oil Seal	1
104	Range Shift Rail	1
105	Range Shift Rail Detent Spring	1
106	Range Shift Rail Detent Ball	1
107	Range Shift Rail Detent Plug	1
108	Idler Shaft Low Range Gear	1
109	Idler Shaft Gear Spacer	1
110	Idler Shaft Gear	1
111	Output Shaft	1
112	Output Shaft Front Bearing Cup	1
113	Output Shaft Front Bearing Cone	1
114	Output Gear Thrust Washer	1
115	Output Gear Bearing	1
116	Output Gear Bearing	1
117	Output Gear Bearing Inner Race	1
118	Output Flange Nut	1
119	Output Flange Washer	1
120	Output Flange "O" Ring	1
121	Output Flange	1
122	Output Shaft Front Bearing Cap Oil Seal	1
123	Output Shaft Front Bearing Cap Screw	4
124	Output Shaft Front Bearing Cap Lockwasher	4
125	Output Shaft Front Bearing Cap	1
126	Front Bearing Cap Shim	AR
127	Front Bearing Cap "O" Ring	1
128	Low Range Gear	1
129	High Low Shift Hub	1
130	Shift Hub Sleeve	1
131	High Range Gear	1
132	Output Gear Inner Race	1
133	Output Gear Bearing	1
134	Output Gear Bearing	1
135	Output Gear Thrust Washer	1
136	Output Shaft Rear Bearing Cone	1
137	Output Shaft Rear Bearing Cup	1
138	Output Shaft Rear Bearing Cap "O" Ring	1
139	Output Shaft Rear Bearing Cap "O" Ring	1
140	Output Shaft Rear Bearing Cap Screw	4
141	Output Shaft Rear Bearing Cap Screw Lockwasher	14
142	Output Shaft Rear Bearing Cap	1
143	High and Low Range Shift Fork	1
144	Shift Fork Lock Screw	1
145	Rear Bearing Cap Oil Seal	1
146	Rear Output Flange	1
147	Output Flange "O" Ring	1
148	Output Flange Washer	1
149	Output Flange Nut	1
150	Busing (Used with Disconnect Only)	1
151	Output Shaft (Used with Disconnect Only)	1
152	Disconnect (Optional)	1
153	Bearing Cap Bore Plug (Optional)	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]

28620 SERIES POWER SHIFT TRANSMISSION WITH VARIOUS OPTIONS

The R & HR 28000 6 speed transmission is the same as the 3 speed R & HR 28000 except the difference being in the idler and output shafts. The 6-speed unit has a gear added to the idler shaft and the output shaft has a high and low range shift.

The 6-speed transmission has 3 working range shifts and 3 travel range shifts.

Gear ratio determines working and travel ranges. They are as follows:

1st — 2nd and 4th working range. 3rd — 5th and 6th travel range.

NOTE: Range shift from low to high must be made with machine stopped.

For R-Model front end removal, see R-Model section, page 59

DISASSEMBLY

For HR Model front end removal, use Figures 1 through 34 and 36 and Figures 42 through 48 in the R & HR 28000 3-Speed Section. Figure 49 shows the idler shaft with one gear. The 6-speed unit will have two gears and a heavier front bearing. See Figure 49A below:

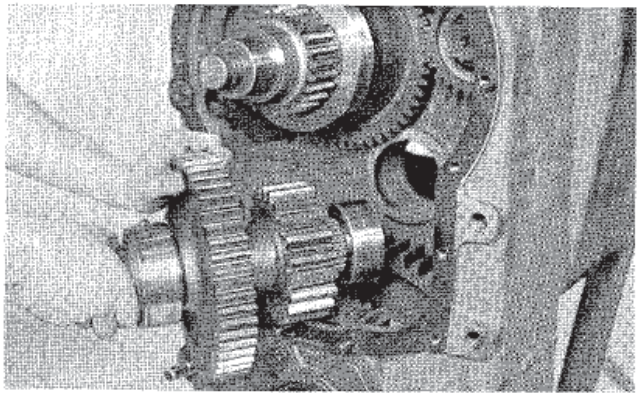


Figure 49A

6-speed idler shaft, gear and bearing assembly.

NOTE: Do not lose rear bearing lock ball.

Proceed with figure 50 through 54 in the R & HR 28000 3-Speed Section.

6-SPEED OUTPUT DISASSEMBLY

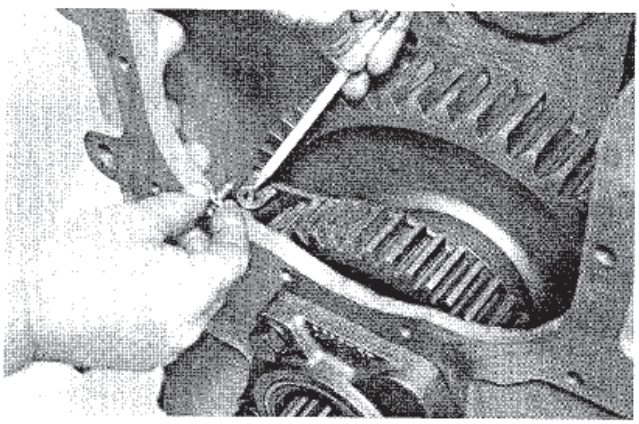


Figure 1

With all clutches and shafts removed, cut lockwire on range shift fork lockscrew. Remove fork lockscrew.

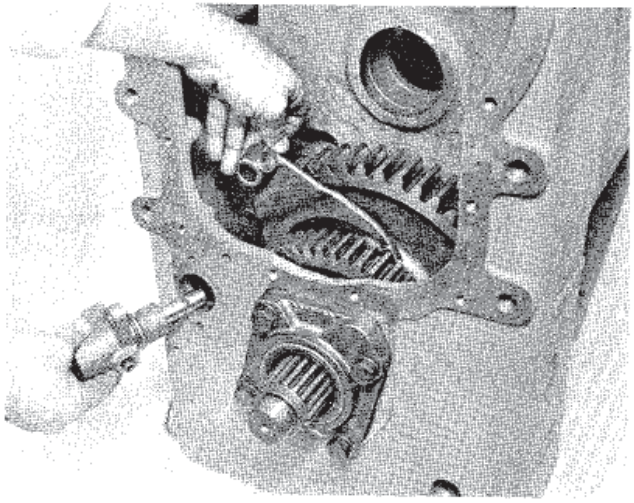


Figure 2

Remove range shift rail support bolts. Remove rail support, rail and range shift fork.

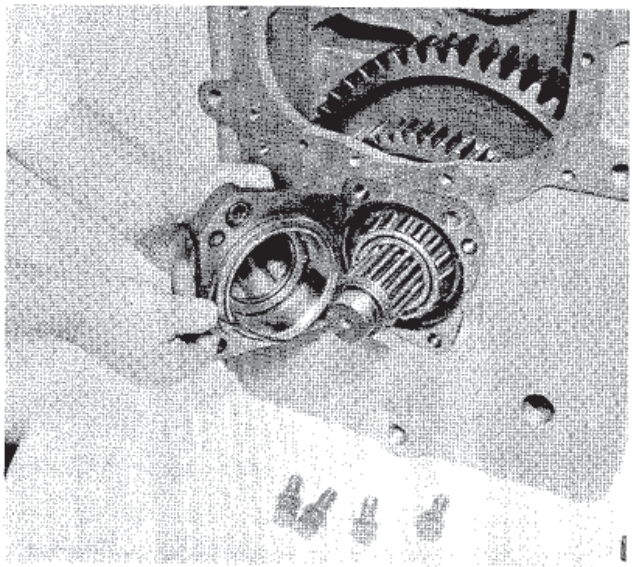


Figure 3

Remove output shaft rear bearing cap bolts and bearing cap.

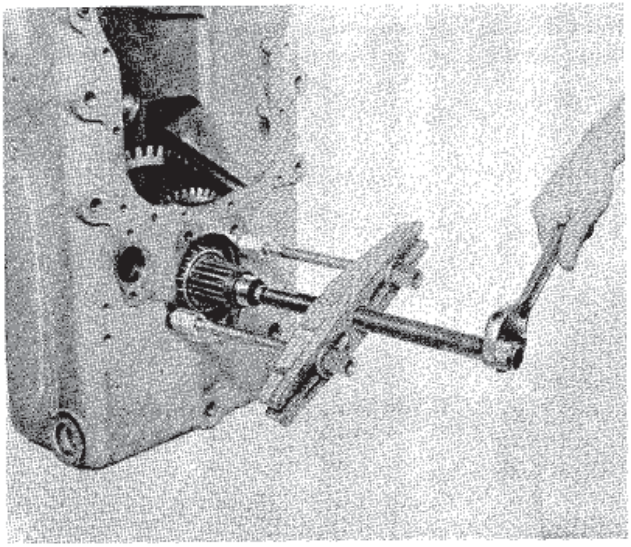


Figure 4

Remove front output flange nut, washer, "O" ring, flange and bearing cap from housing. Block output gears. Push output shaft from rear through gears and taper bearing.

Proceed with Figures 59 through 98 in the R & HR 28000 Series 3-Speed Maintenance Section then refer to Figure 5 below.

REASSEMBLY

(See cleaning and inspection page.)

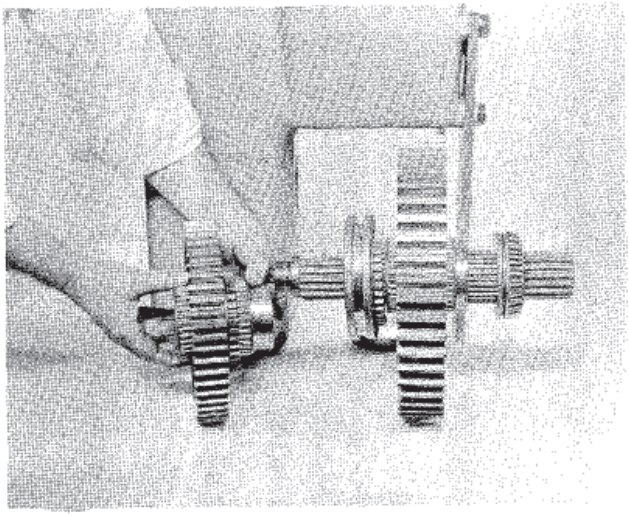


Figure 5

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

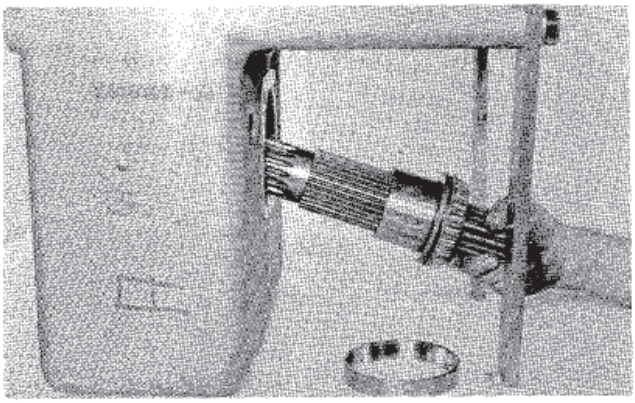


Figure 6

Position high and low range gears, shift hub, hub sleeve and needle bearings in transmission case as shown in Figure 5. Insert output shaft, front bearing and thrust washer through output gears. Use caution as not to damage high and low range gear needle bearings.

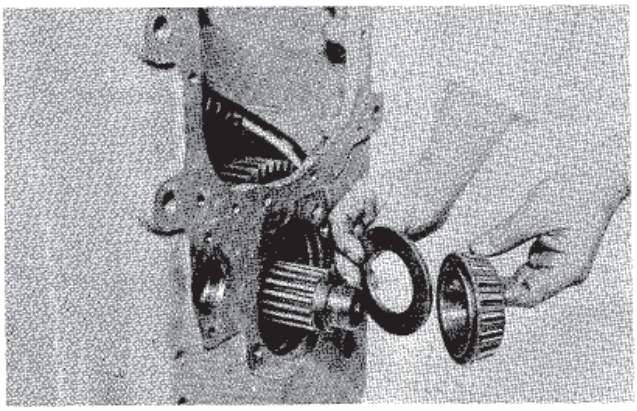


Figure 7

Position output gear thrust washer and rear taper bearing on output shaft.

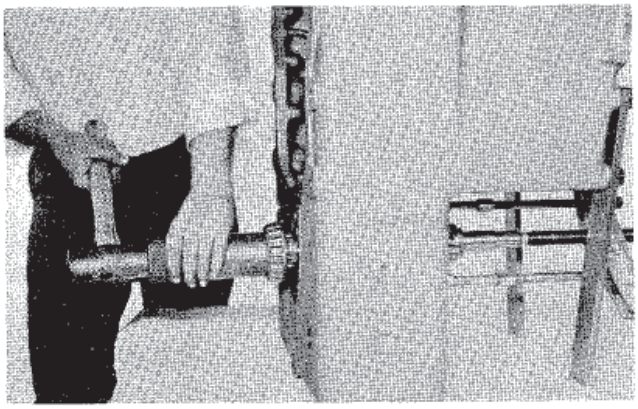


Figure 8

Block output shaft from the front and install rear taper bearing.

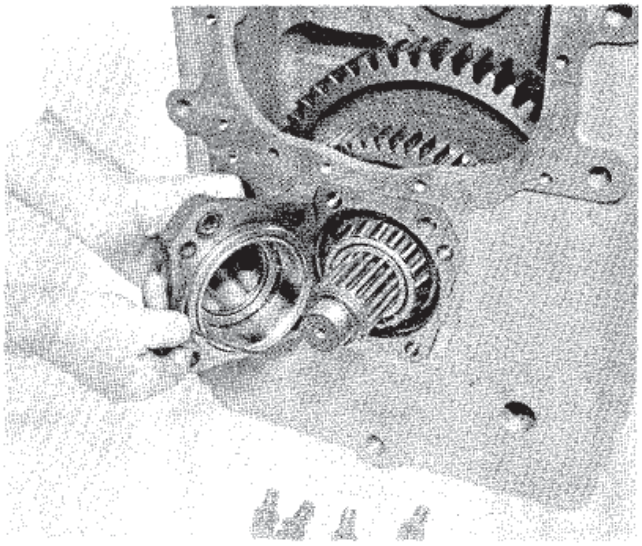


Figure 9

Using new "O" rings install rear output bearing cap 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.)

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.

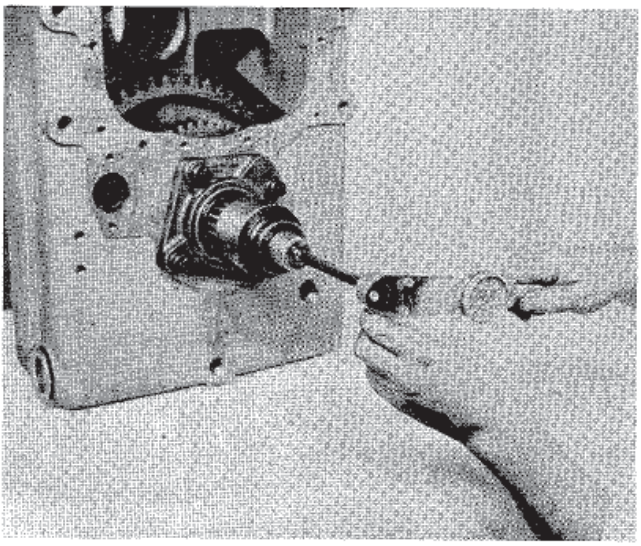


Figure 10

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.

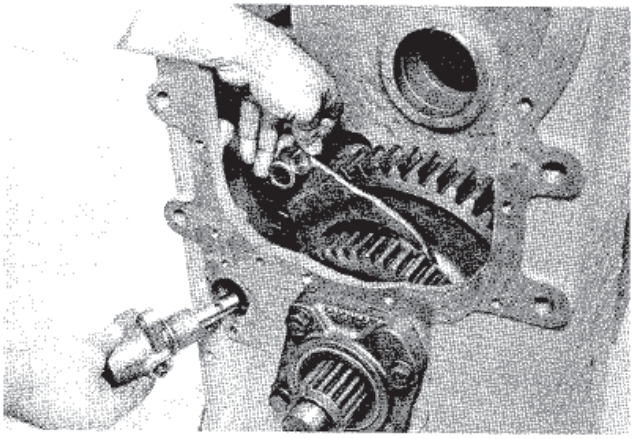


Figure 11

Locate high-low range shift fork in shift hub with offset of fork toward rear. Insert shift rail support and rail into bore in transmission housing and into shift fork.

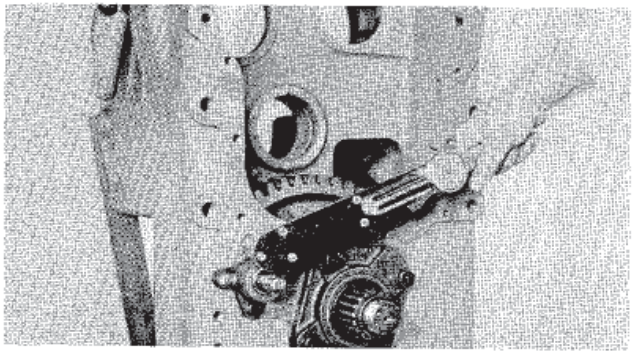


Figure 12

Tighten support bolts to specified torque. (See torque chart).

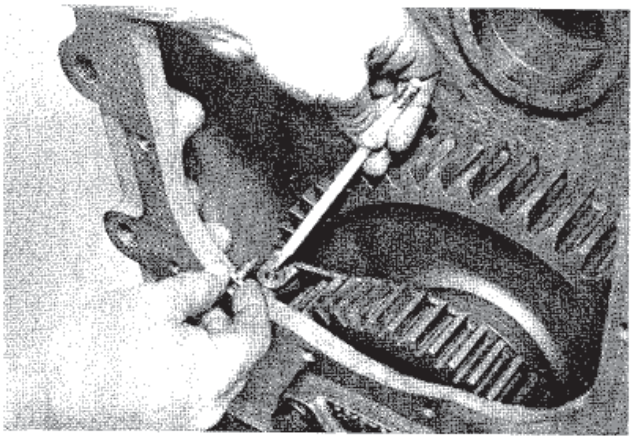
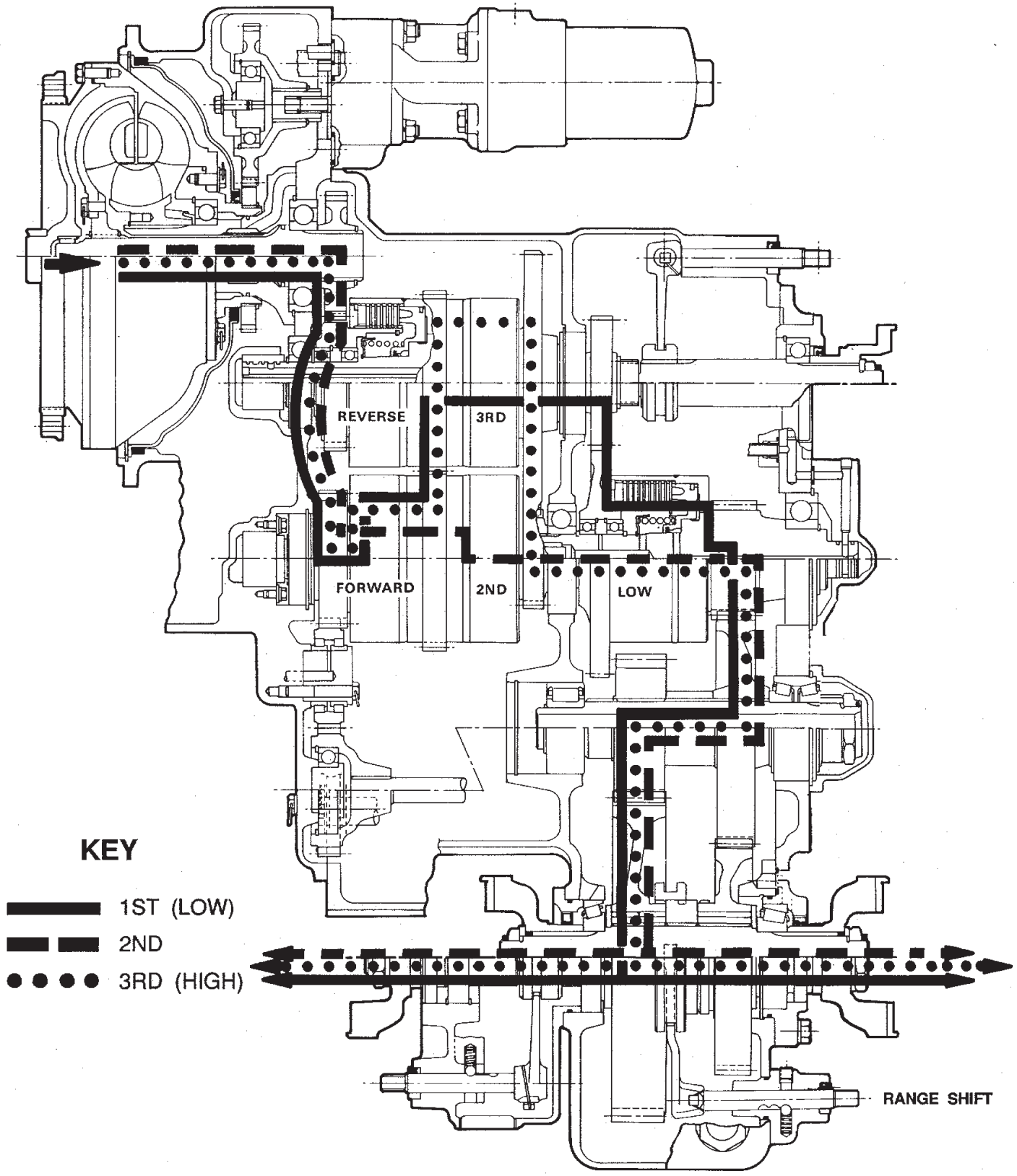


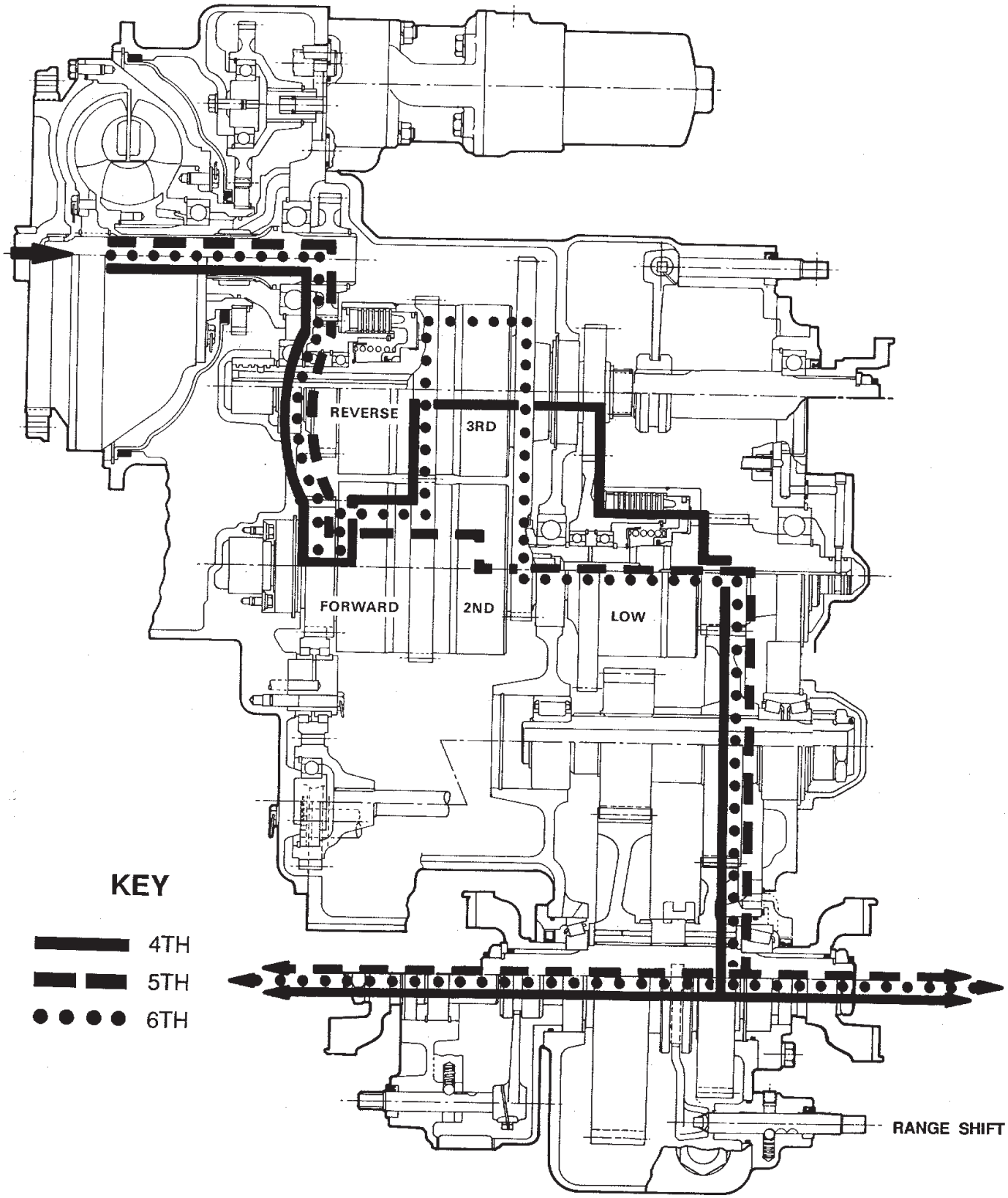
Figure 13

Locate lockscrew hole in shift rail with hole in shift fork. Install lockscrew, tighten securely and lockwire to prevent loosening.

Proceed with Figure 104 in the R & HR 28000 3-Speed Section.

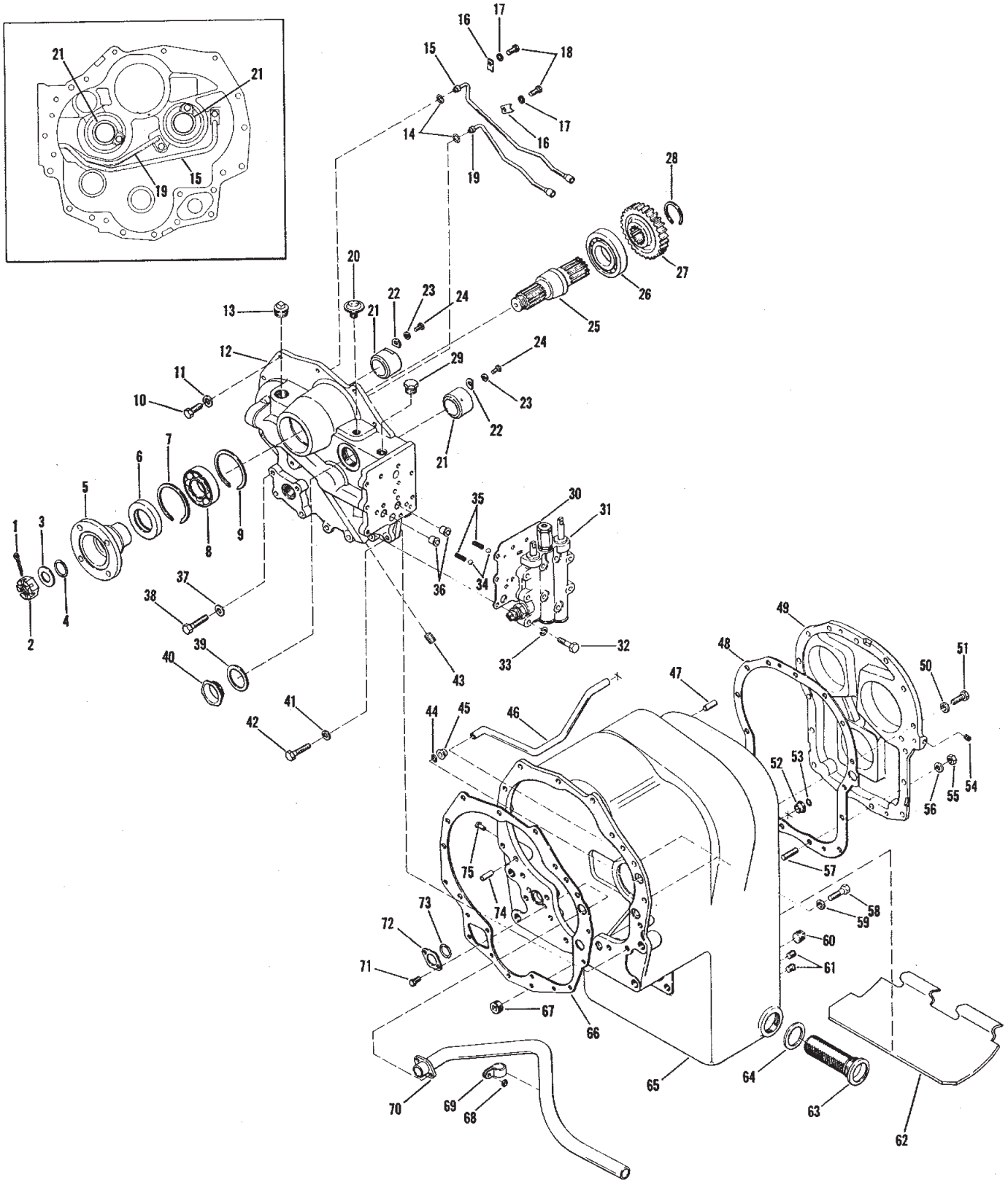


6 SPEED TRANSMISSION LOW RANGE



6 SPEED TRANSMISSION HI RANGE

R MODEL SECTION



R MODEL COVER AND CASE GROUP

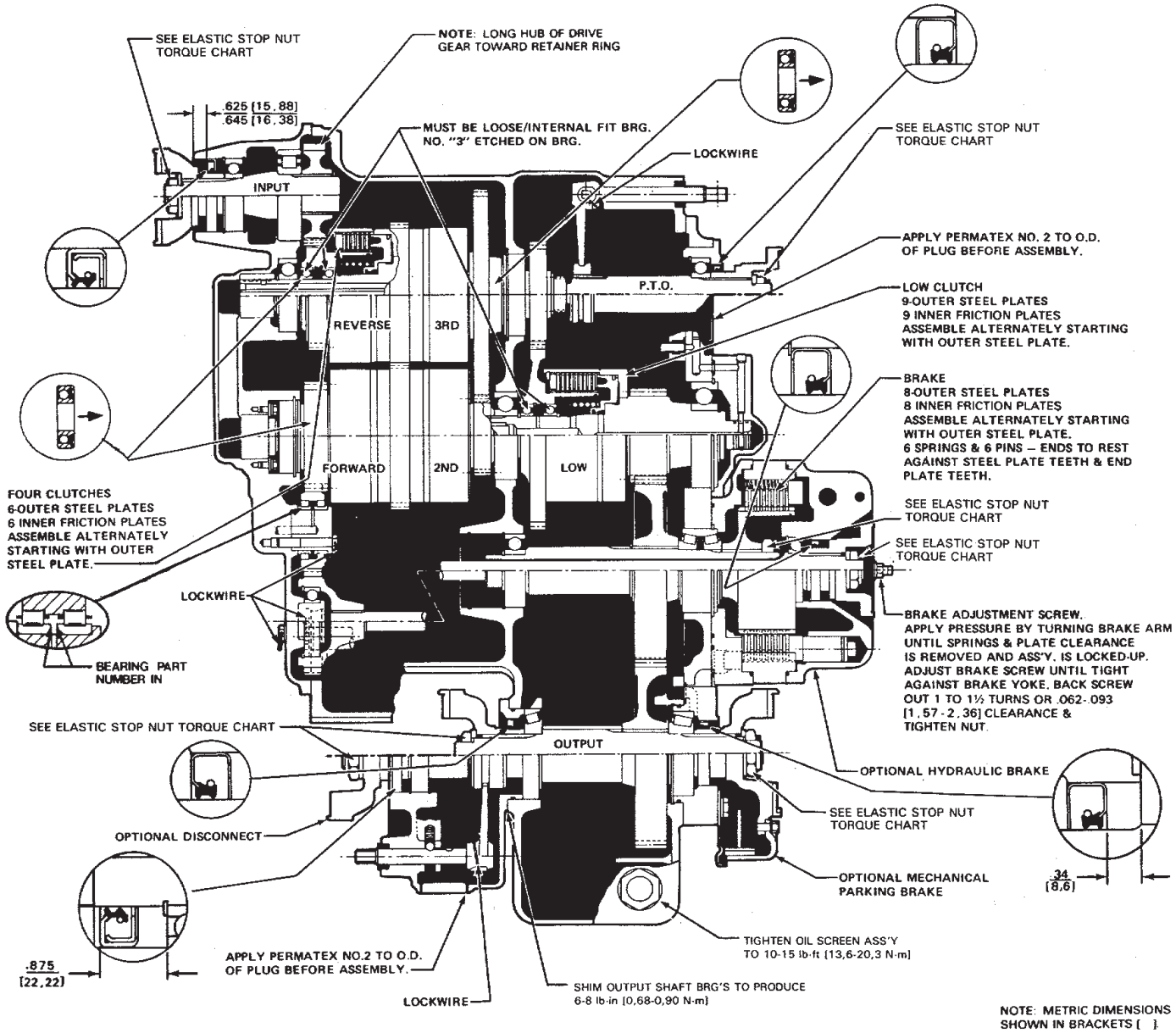
R MODEL COVER AND CASE GROUP

ITEM	DESCRIPTION	QTY.
1	Flange Nut Cotter	1
2	Flange Nut	1
3	Flange Nut Washer	1
4	Flange "O" Ring	1
5	Input Flange	1
6	Input 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	Cover to Case Screw	5
11	Cover to Case Screw Lockwasher	5
12	Front Cover and Tube Assembly	1
13	Pipe Plug	1
14	"O" Ring	2
15	3rd Speed Tube Assembly	1
16	Tube Clip	2
17	Tube Clip Screw Lockwasher	2
18	Tube Clip Screw	2
19	Reverse Tube Assembly	1
20	Breather	1
21	Front Cover Sleeve	2
22	Front Cover Sleeve Lock	2
23	Sleeve Lockscrew Lockwasher	2
24	Sleeve Lockscrew	2
25	Input Shaft	1
26	Input Shaft Rear Bearing	1
27	Input Shaft Gear	1
28	Input Shaft Gear Retainer Ring	1
29	Front Cover Plug	1
30	Control Valve Plate Gasket	1
31	Control Valve Assembly	1
32	Valve Screw	9
33	Valve Screw Lockwasher	9
34	Detent Ball	2
35	Detent Spring	2
36	Tube Sleeve	2
37	Cover to Case Screw Lockwasher	4
38	Cover to Case Screw	4
39	Front Cover Plug Gasket	1
40	Front Cover Plug	1
41	Cover to Case Screw Lockwasher	4
42	Cover to Case Screw	4
43	Pipe Plug	1
44	Clutch Pressure Tube "O" Ring	1
45	Tube Sleeve	1
46	Low Speed Clutch Pressure Tube	1
47	Rear Cover Dowel	2
48	Rear Cover to Transmission Case Gasket	1
49	Rear Cover	1
50	Rear Cover to Transmission Case Screw Lockwasher	13
51	Rear Cover to Transmission Case Screw	13
52	Tube Sleeve	1
53	Tube Sleeve "O" Ring	1
54	Rear Cover Pipe Plug	1
55	Rear Cover to Transmission Case Stud Nut	2
56	Rear Cover to Transmission Case Stud Lockwasher	2
57	Rear Cover to Transmission Case Stud	2
58	Front Cover to Transmission Case Screw	5
59	Front Cover to Transmission Case Screw Lockwasher	5
60	Drain Plug	1
61	Oil Level Plug	2
62	Oil Baffle (6 Speed only)	1
63	Screen Assembly	1
64	Screen Assembly Gasket	1
65	Transmission Case Assembly	1
66	Front Cover Gasket	1
67	Transmission Case Plug	1
68	Suction Tube Clip Washer	1
69	Suction Tube Clip	1
70	Suction Tube Assembly	1
71	Retainer Washer Screw	2
72	Retainer Washer	1
73	Suction Tube "O" Ring	1
74	Front Cover Dowel Pin	2
75	Suction Tube Clip Rivet	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-28320 SERIES POWER SHIFT TRANSMISSION WITH VARIOUS OPTIONS

R MODEL 3 & 6-SPEED

(REMOTE MOUNTED TRANSMISSION FROM CONVERTER)

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

DISASSEMBLY

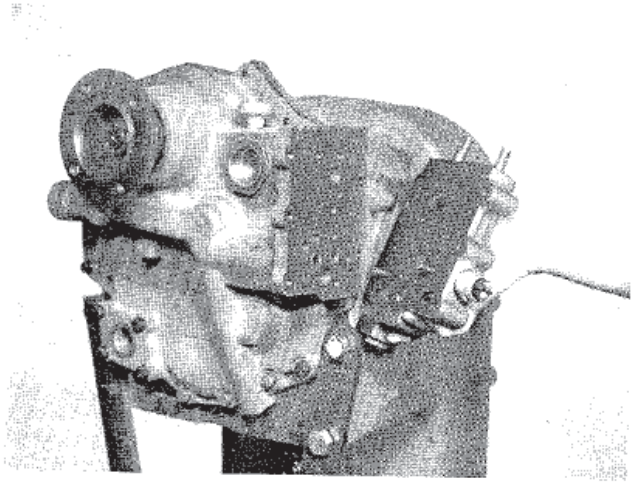


Figure 1

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

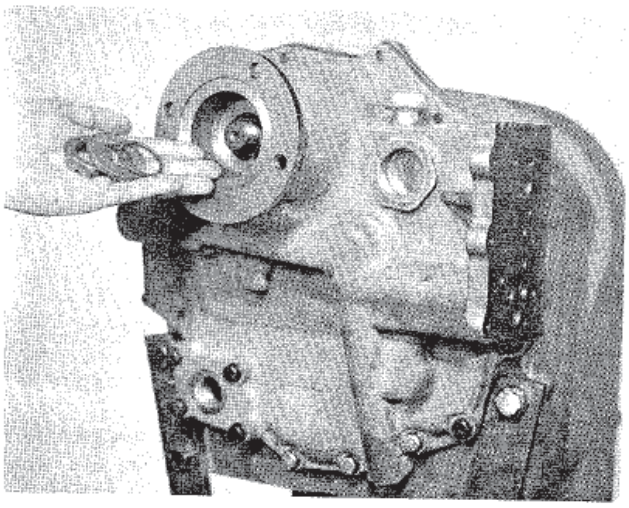


Figure 2

Remove companion flange nut, washer and "O" Ring.

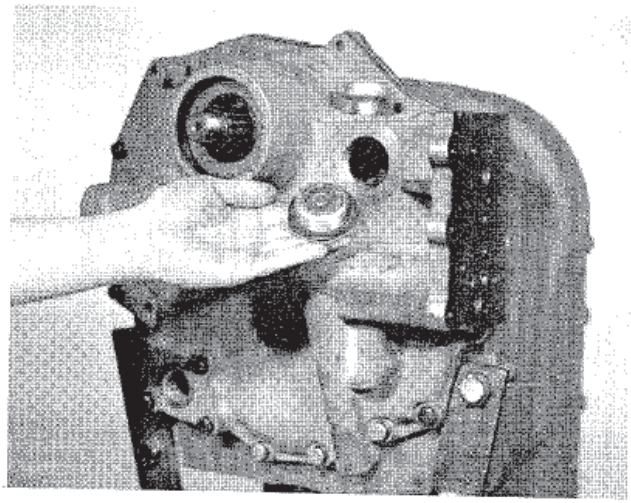


Figure 3

Remove front cover plug.

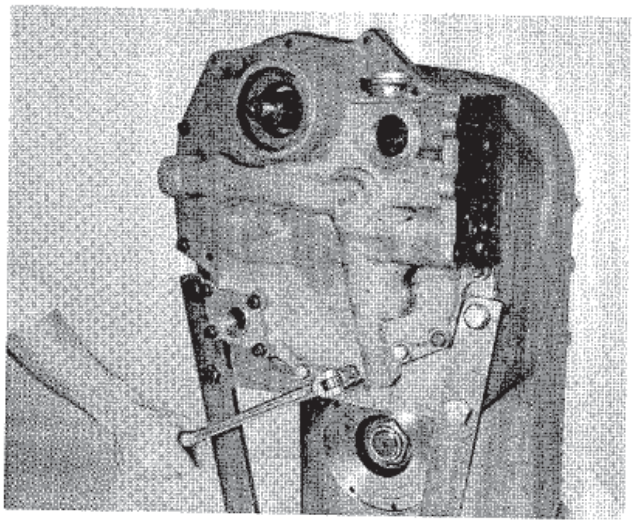


Figure 4

Remove bolts securing front cover to transmission housing.

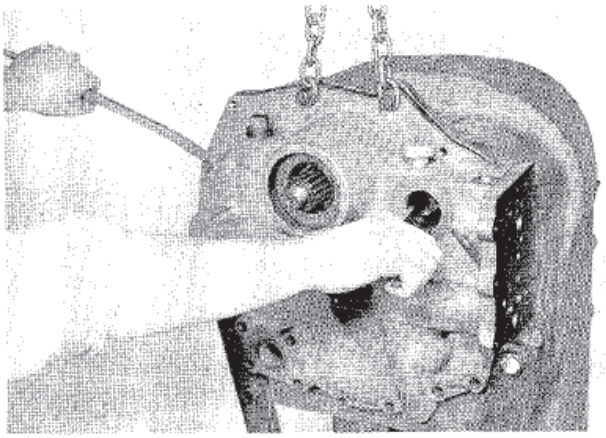


Figure 5

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.

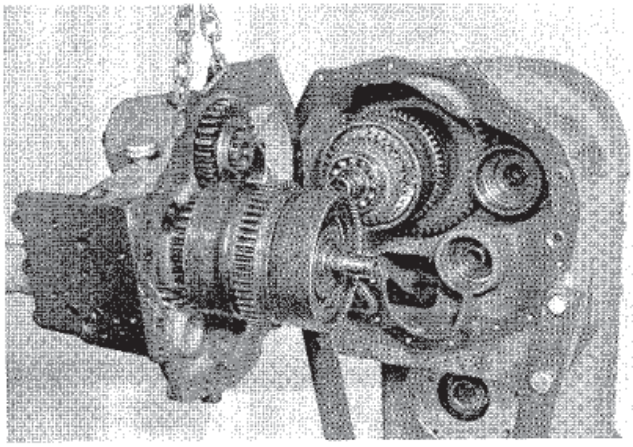


Figure 6

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

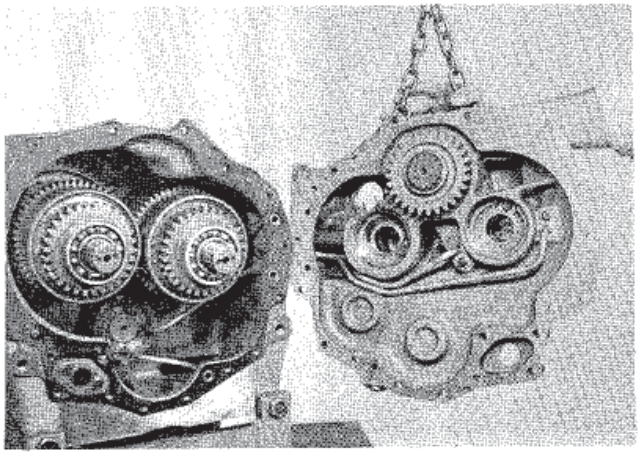


Figure 7

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

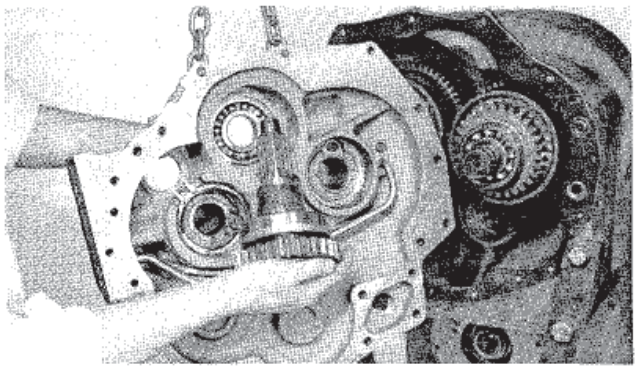


Figure 8

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.
See page 18 Figure 99 for transmission reassembly.

R MODEL FRONT END REASSEMBLY & INSTALLATION ON TRANSMISSION

(See cleaning & inspection page.)

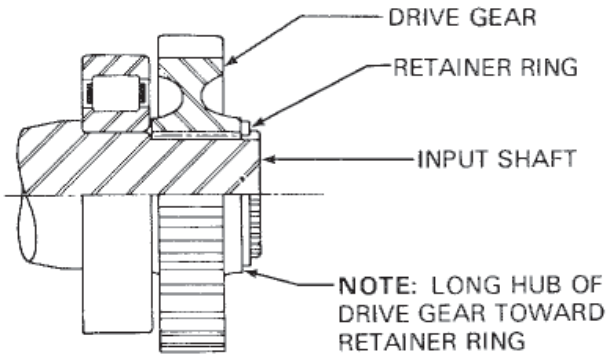


Figure 9

Input shaft, rear bearing, drive and snap ring.

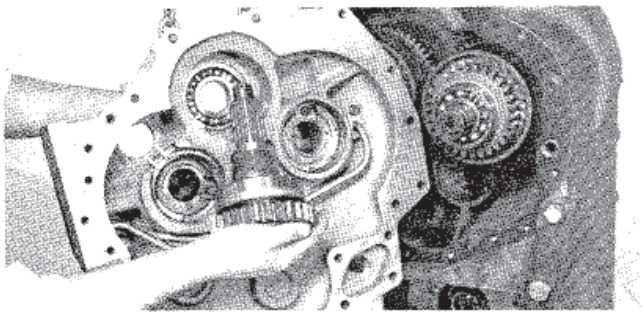


Figure 10

Install input shaft into front bearing. Position new gasket and "O" rings on housing. A light coat of grease will hold gasket and "O" rings in place. Install alignment studs in transmission housing to facilitate converter housing to transmission housing assembly.

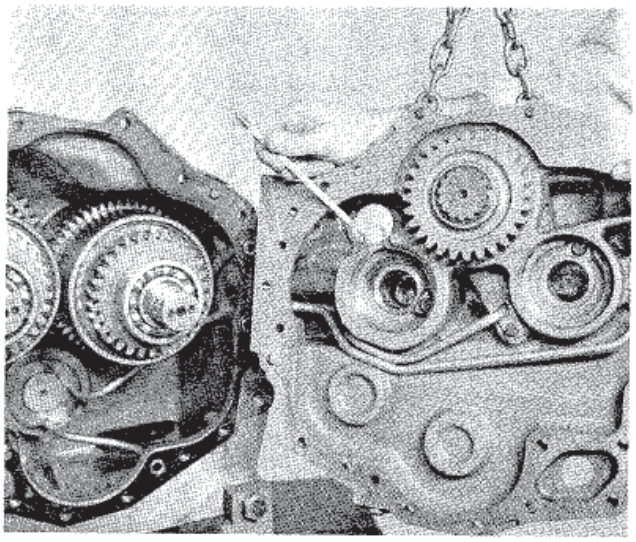


Figure 11
Position forward clutch front bearing locating ring in front cover.

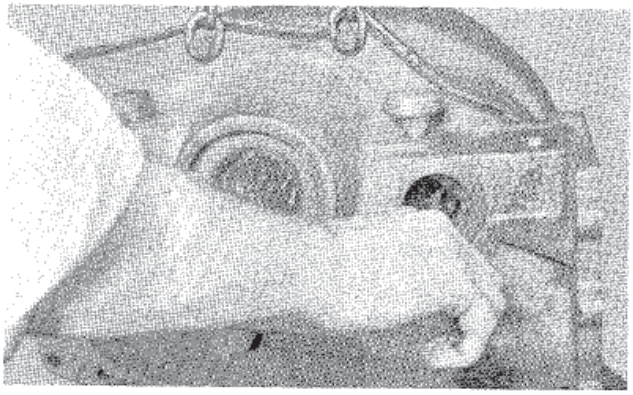


Figure 12
Support front cover with a chain fall. Spread forward clutch front bearing retainer ring. Position front cover to transmission case. Tap cover into place using caution as not to damage any of the clutch shaft piston rings.

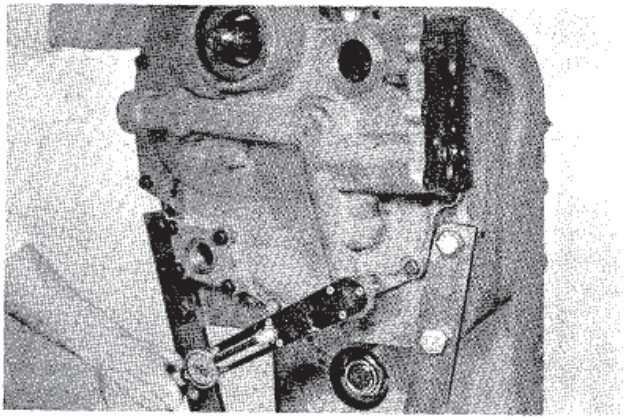


Figure 13
Install cover to case bolts. Tighten to specified torque.

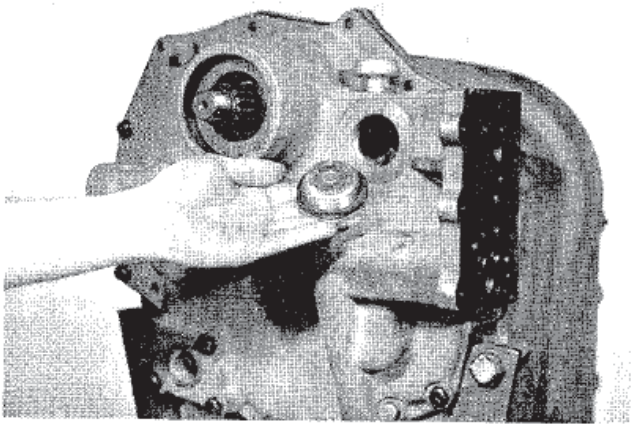


Figure 14
Install front cover plug.

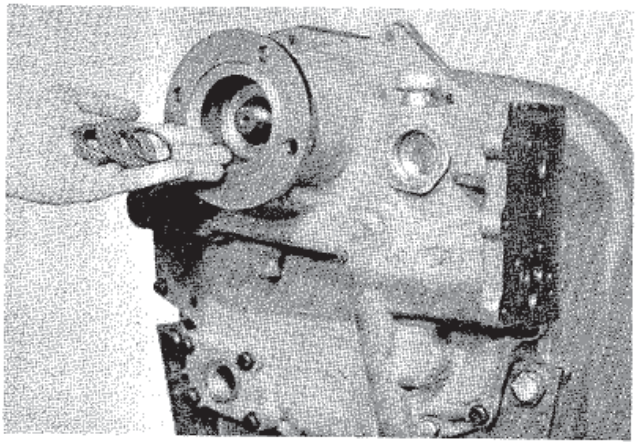


Figure 15
Install companion flange, flange "O" ring, washer and nut. Tighten standard slotted nut or elastic stop nut to specified torque. (See elastic stop nut torque chart.)

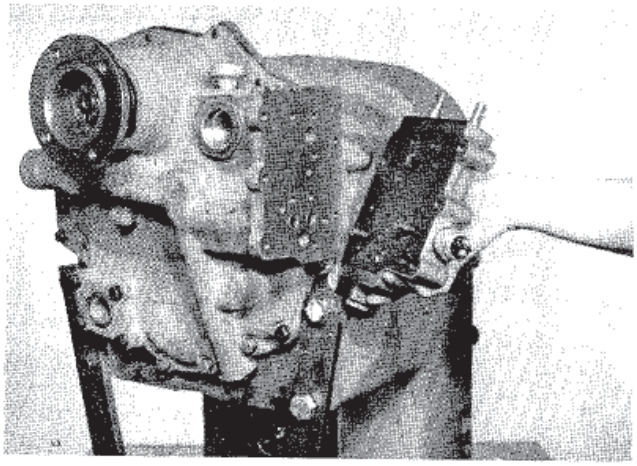
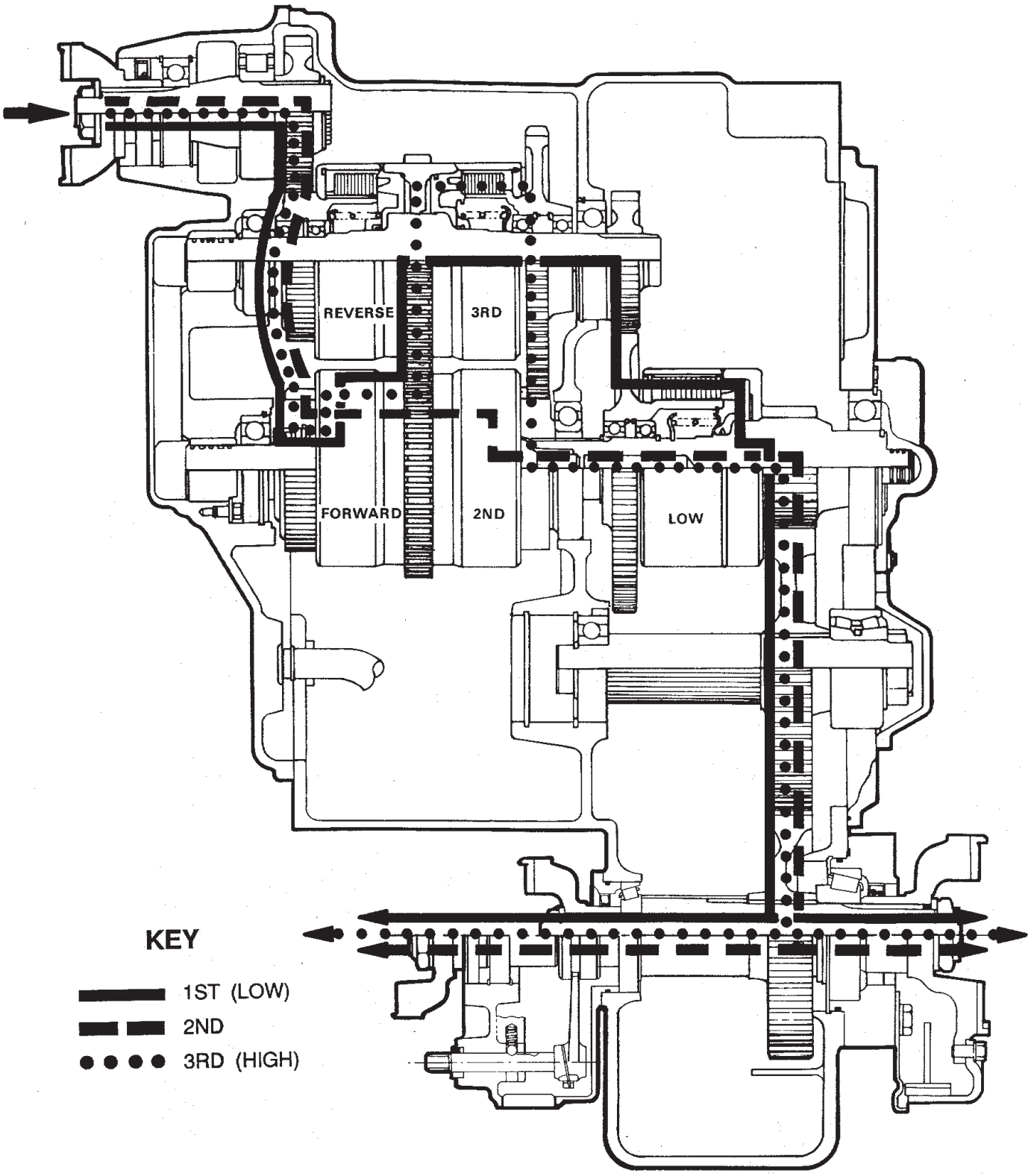
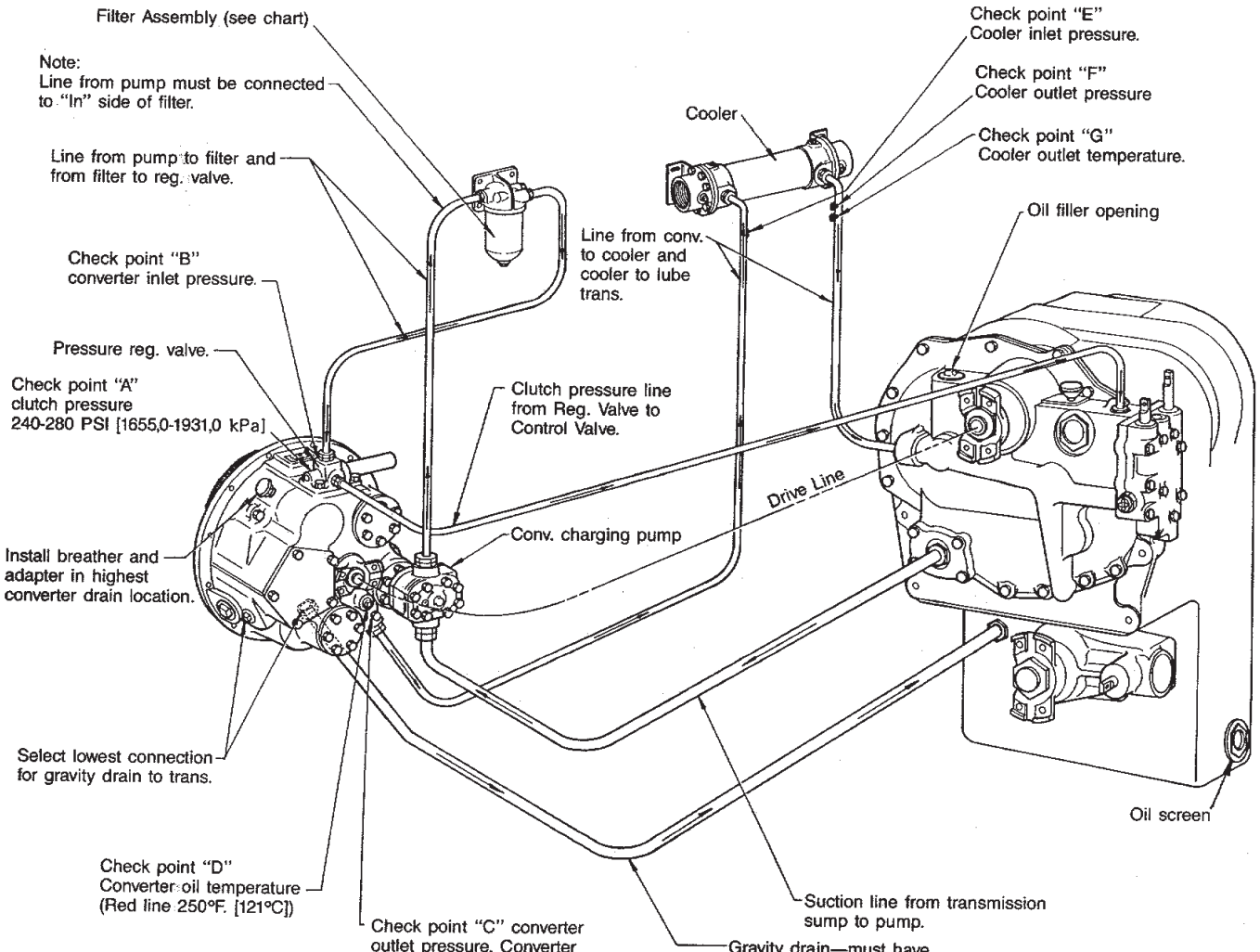


Figure 16
Locate detent balls and springs in control valve. Position new gasket. Secure valve with bolts and washers. Tighten to specified torque.



R MODEL 3 SPEED TRANSMISSION

R28000—C270 EXTERNAL PLUMBING DIAGRAM



Metric dimensions shown in brackets [ ].

Note: Do not deviate any line size.

Filter Type	Assembly No.	Cartridge No.	Spin-on Type	
			Assembly No.	Element
A	1533614 Single Can	215502	247055 Single Element	247052
B	234777 Dual Can	215502	246787 Dual Element	243622

Notes:
Hose line operating requirements.

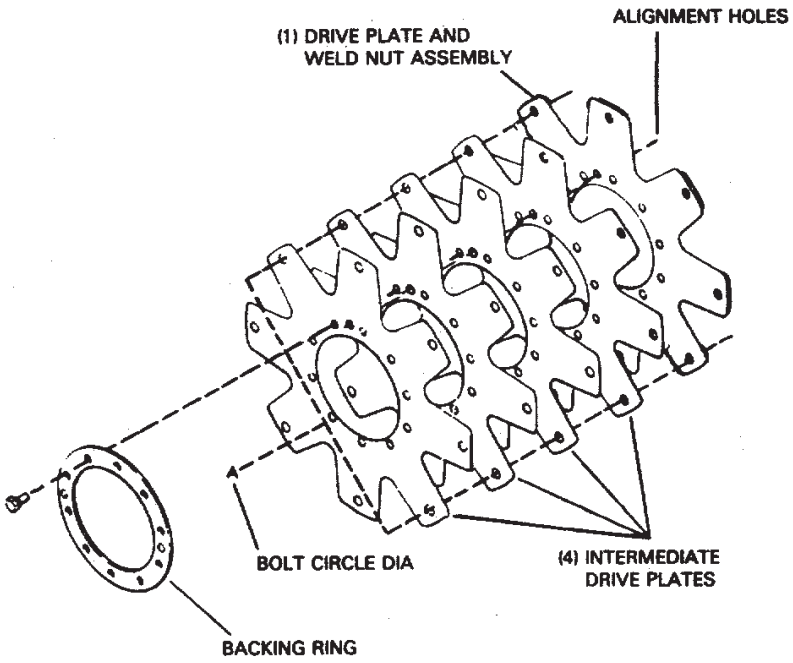
1. **Pressure Lines**—Suitable for operation from ambient to 250°F. [121,1°C] continuous operating temperature. Must withstand 300 PSI [2068 kPa] continuous pressure with 600 PSI [4137 kPa] intermittent surges. Ref. S.A.E. Spec. No. J517,100R1 Hydraulic Hose Specification.
2. **Suction Line**—To be protected from collapse by interwoven steel wire. Ref. S.A.E. Spec. No. J517,100R4 Hydraulic Hose Specification. Suitable for operation from ambient to 250°F. [121,1°C]. Continuous operating temperature.
3. **Gravity Drain Line**—Suitable for operation from ambient to 250°F. [121,1°C] continuous operating temperature. Ref. S.A.E. Spec. No. J517,100R1 Hydraulic Hose Specification.
4. **All Hose Lines** used must conform to S.A.E. Spec. No. J1019 Test Procedure for High Temp. Transmission Oil Hose.
5. See Lubrication Specifications.

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 65 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.

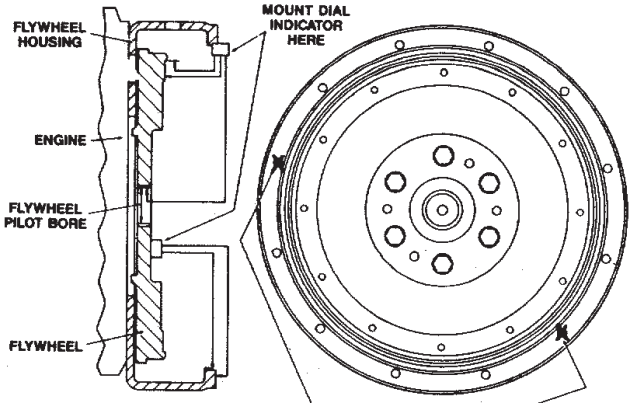


FIG 1

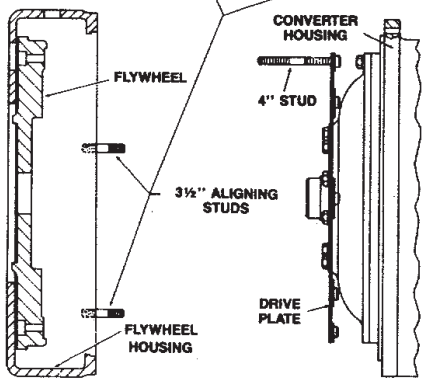
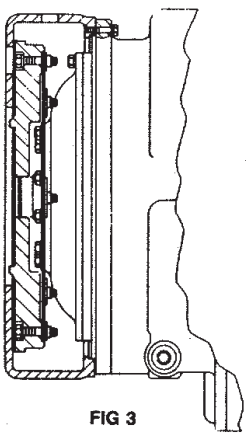


FIG 2


FIG 3

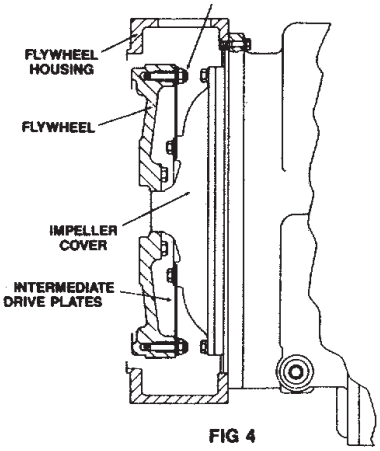


FIG 4

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.

