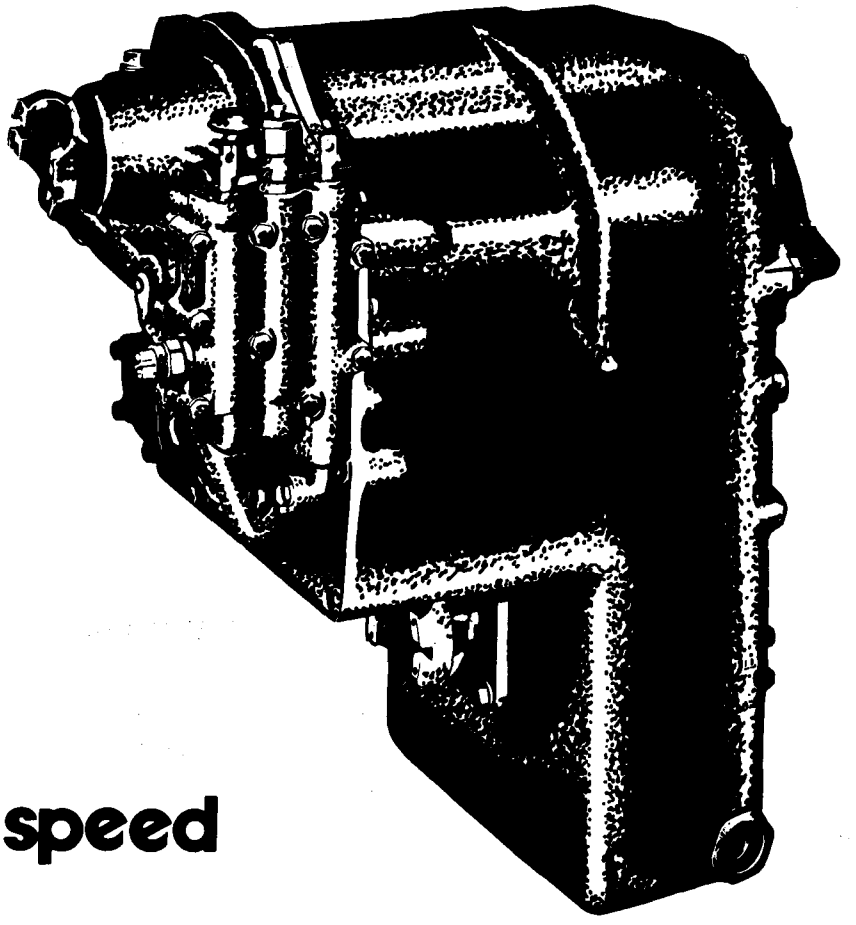
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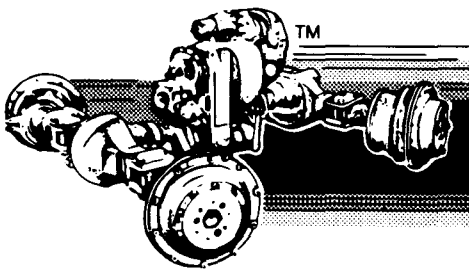
28000 powershift transmission

CLARK

maintenance & service manual



R model - 3 speed



CLARK COMPONENTS INTERNATIONAL INC.

Power Transfer Systems

A Business Unit of Clark Equipment Co.

SMR-283 REV. 9-89

FOREWORD

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

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

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

Whenever repair or replacement of component parts is required, only Clark Components International-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 Components International does not warrant repair or replacement parts, nor failures resulting from the use thereof, which are not supplied by or approved by Clark Components International. IMPORTANT: **Always furnish the Distributor with the transmission serial and model number when ordering parts.**

CLARK

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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	Fig. A
Case and Front Cover Group	Fig. B
Three-Speed Case and Clutch Group	Fig. C
Clutch Group	Fig. D
Control Valve	Fig. E
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Shielded Bearing Installation	Fig. L

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.

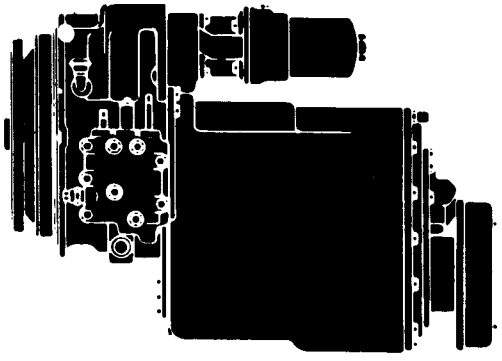
With the engine running and the directional control lever in neutral position, oil pressure from the regulating valve is blocked at the control valve, and the transmission is in neutral. Movement of the forward and reverse spool will direct oil, under pressure to either the forward or reverse direction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

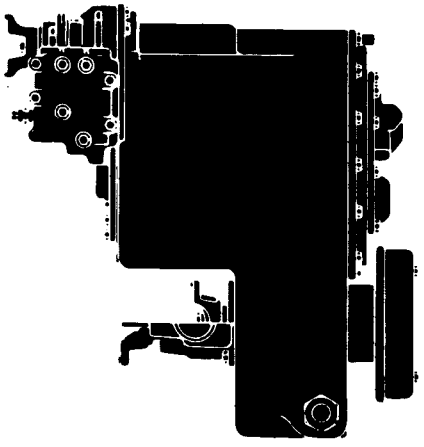
The direction or speed clutch assembly consists of a drum with internal splines and a bore to receive a hydraulically actuated piston. The piston is "oil tight" by the use of sealing rings. A steel disc with external splines is inserted into the drum and rests against the piston. Next, a friction disc 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.

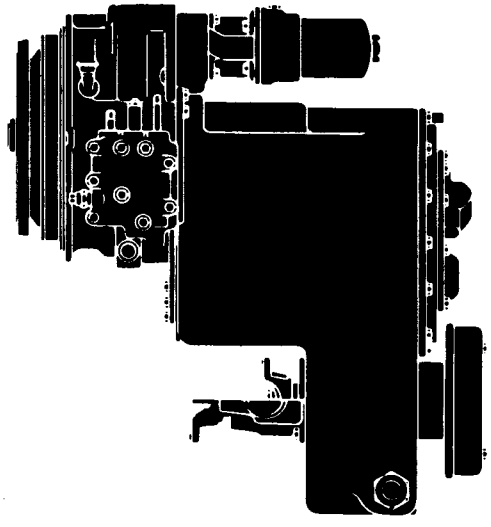
There are bleed balls in the clutch piston which allow quick escape for oil when the pressure to the piston is released.



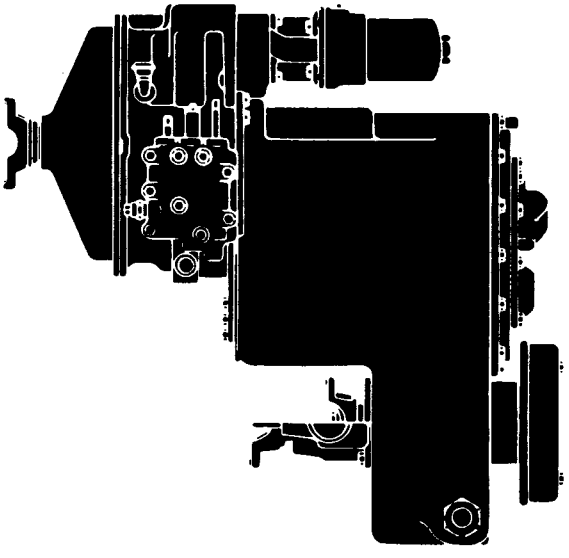
HR 28000
(SHORT DROP)
(OUTPUT)



R 28000



HR 28000



MHR 28000

FIGURE A

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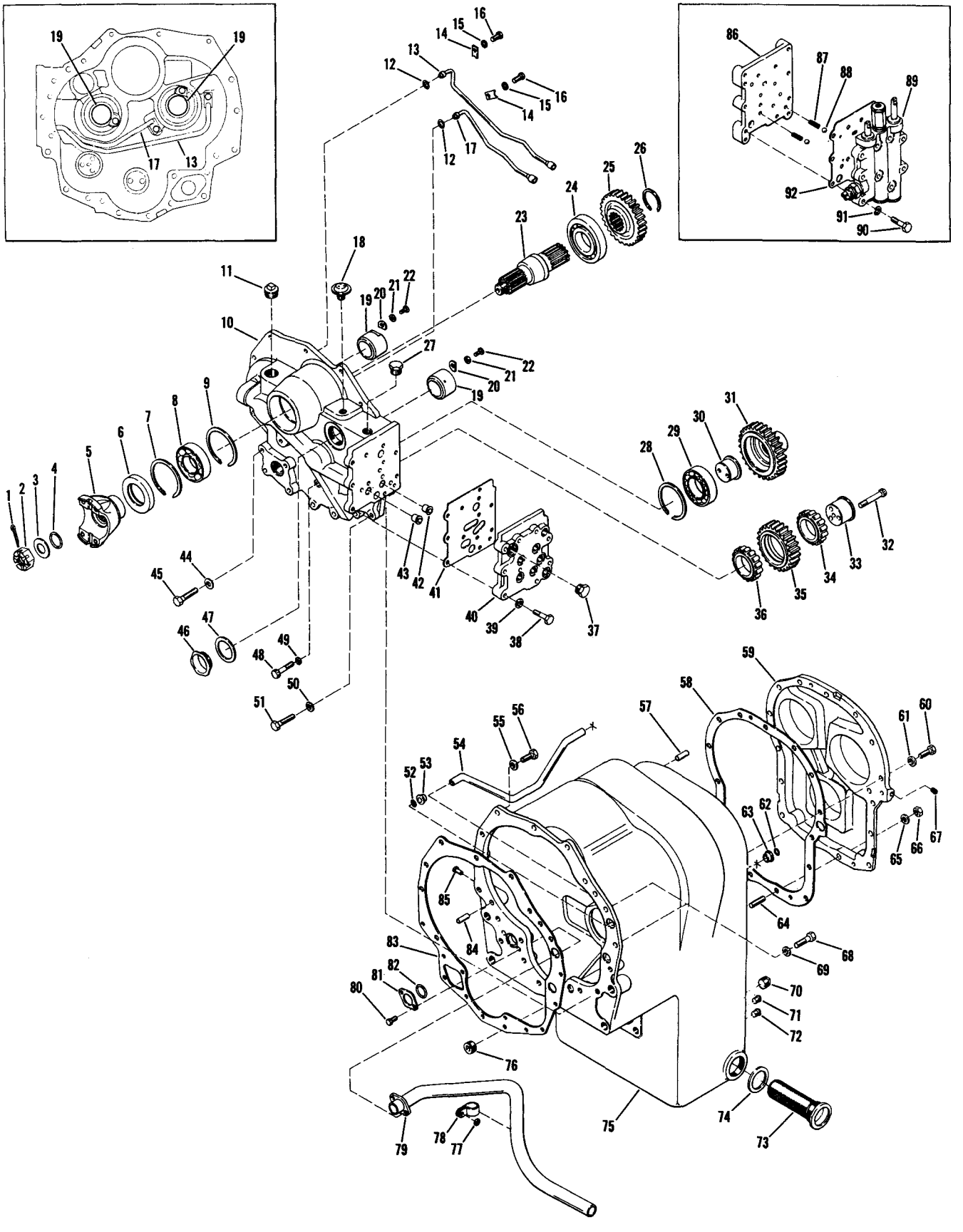


FIGURE B

R28000 CASE AND FRONT COVER GROUP

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

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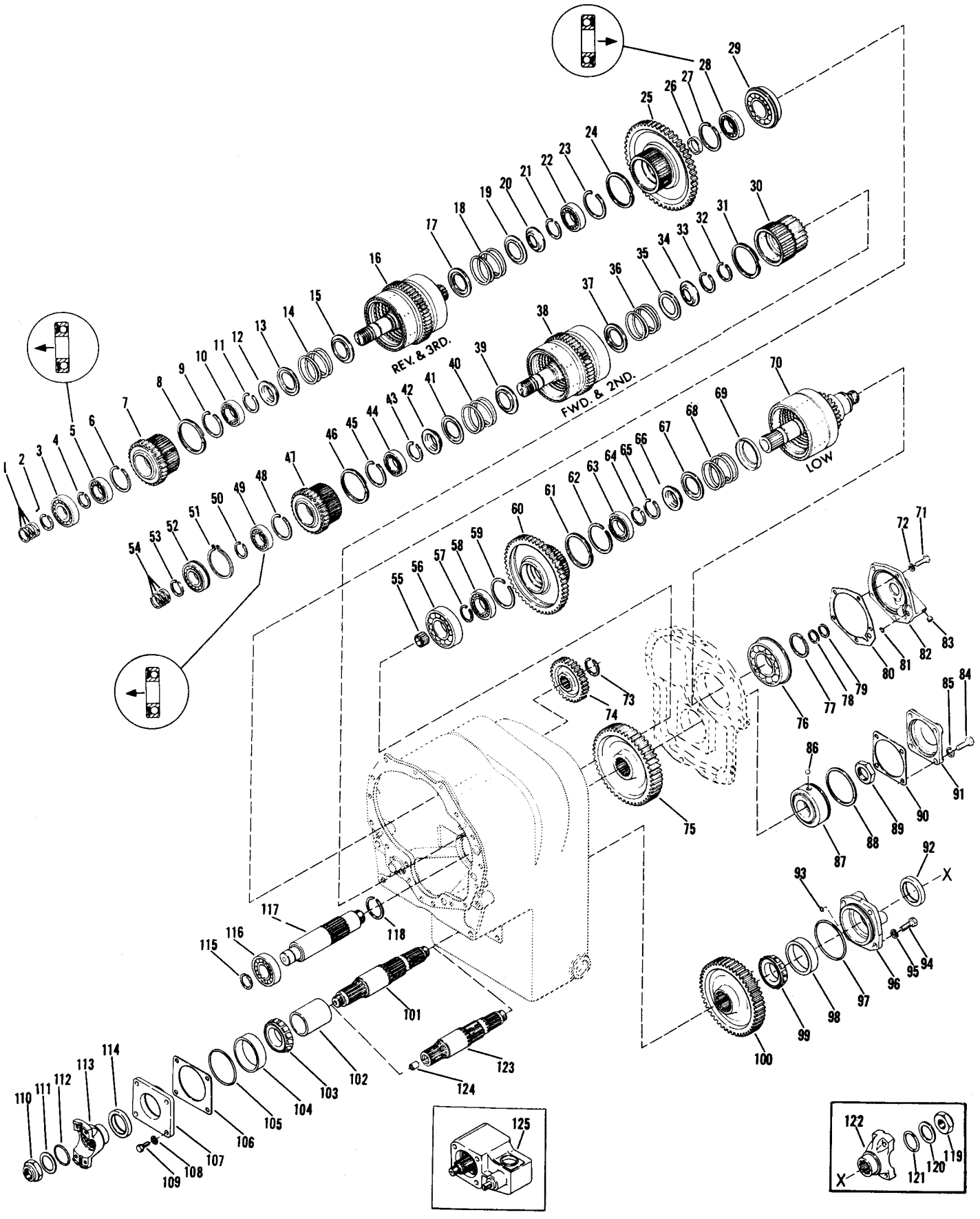
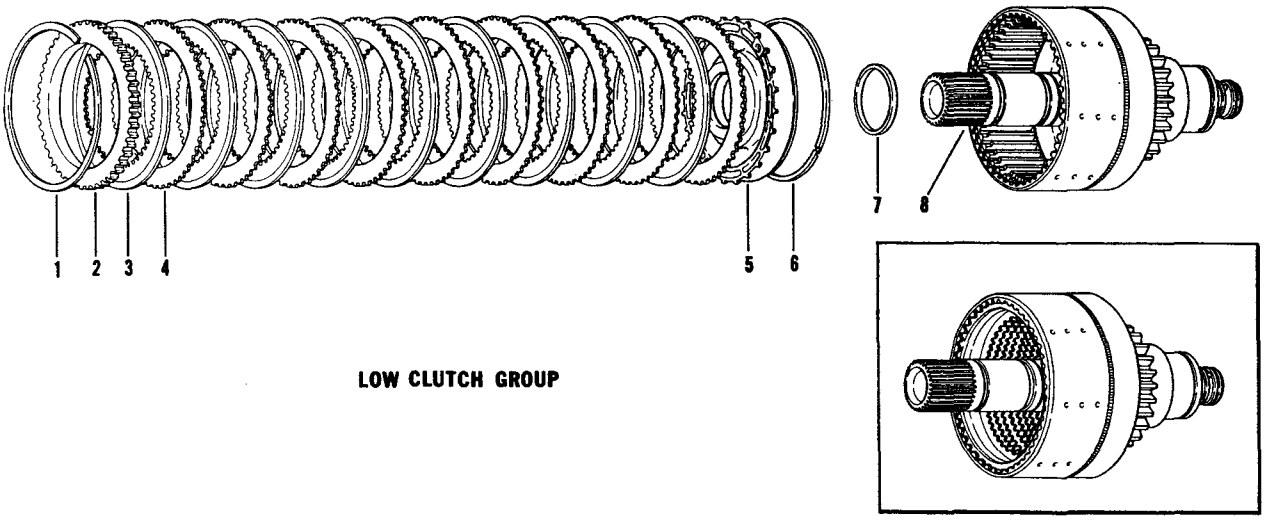


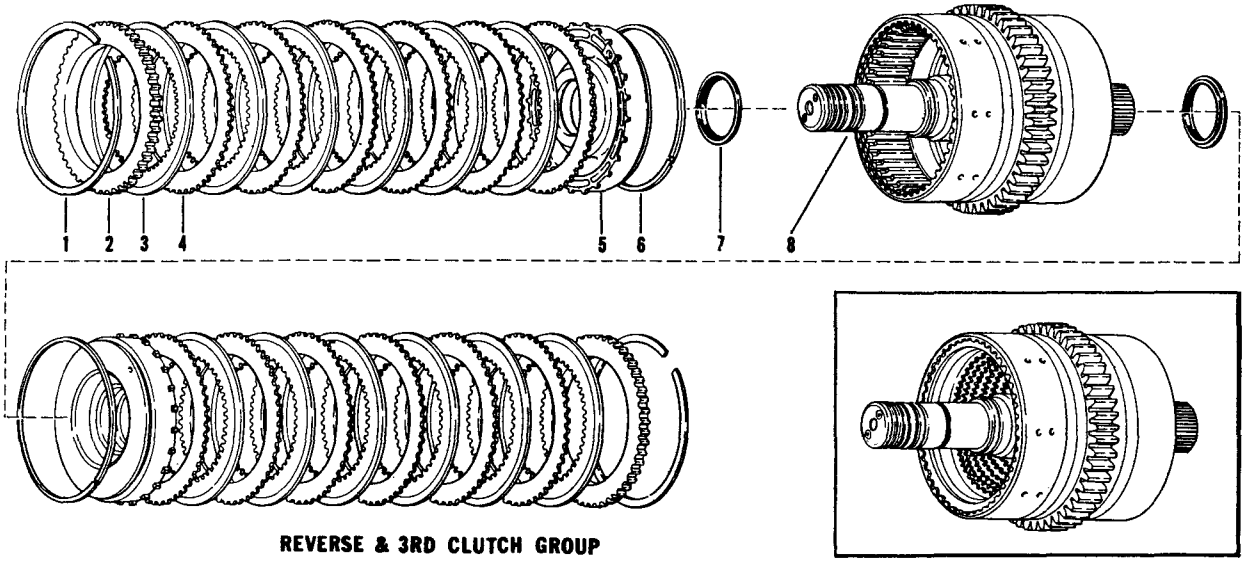
FIGURE C

R28000 THREE SPEED CASE AND CLUTCH GROUP

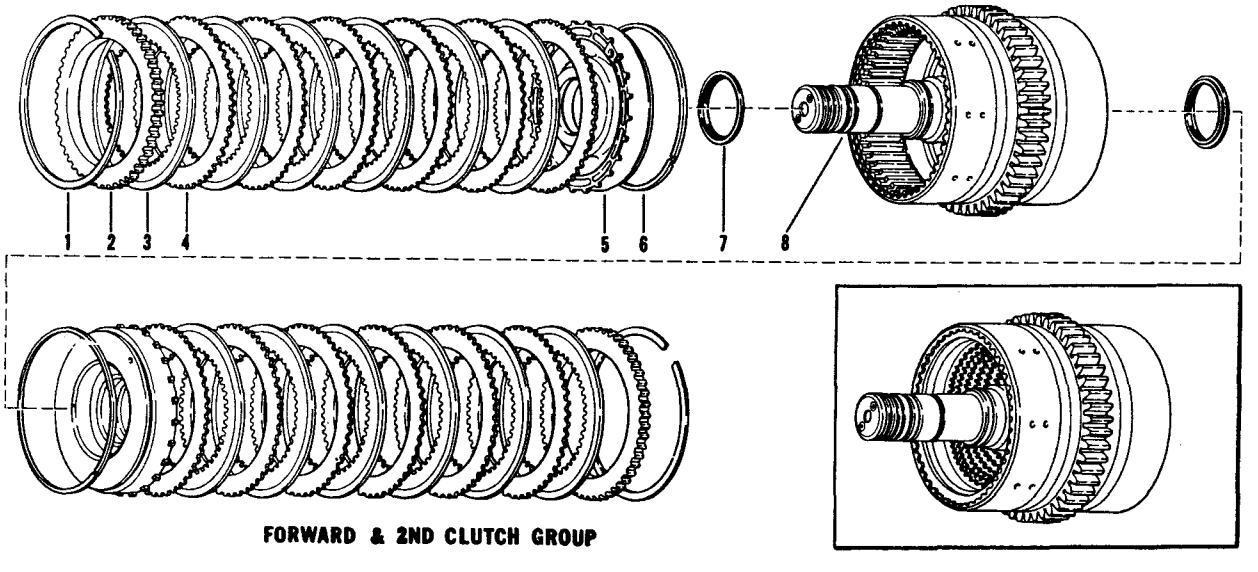
Item	Description	Qty.
1	Reverse and 3rd Clutch Shaft Piston Ring	3
2	Front Bearing Retainer Ring	1
3	Reverse and 3rd Shaft Front Bearing	1
4	Front Bearing Retainer Ring	1
5	Clutch Driven Gear Bearing	1
6	Clutch Driven Gear Bearing Snap Ring	1
7	Clutch Driven Gear	1
8	Clutch Hub Oil Baffle Ring	1
9	Clutch 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	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
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	4
85	Idler Shaft Bearing Cap Screw Lockwasher	4
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 Shaft	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 D

LOW CLUTCH GROUP

Item	Description	Qty.
1	End Plate Retainer Ring	1
2	End Plate	1
3	Clutch Inner Disc	9
4	Clutch Outer Disc	9
5	Clutch Piston	1
6	Clutch Piston Outer Seal Ring	1
7	Clutch Piston Inner Seal Ring	1
8	Low Speed Clutch Drum and Shaft	1

REVERSE AND 3rd CLUTCH GROUP

Item	Description	Qty.
1	End Plate Retainer Ring	2
2	End Plate	2
3	Clutch Inner Disc	12
4	Clutch Outer Disc	12
5	Clutch Piston	2
6	Clutch Piston Outer Seal Ring	2
7	Clutch Piston Inner Seal Ring	2
8	Reverse and 3rd Clutch Drum and Shaft	1

FORWARD AND 2nd CLUTCH GROUP

Item	Description	Qty.
1	End Plate Retainer Ring	2
2	End Plate	2
3	Clutch Inner Disc	12
4	Clutch Outer Disc	12
5	Clutch Piston	2
6	Clutch Piston Outer Seal Ring	2
7	Clutch Piston Inner Seal Ring	2
8	Forward and 2nd Clutch Drum and Shaft	1

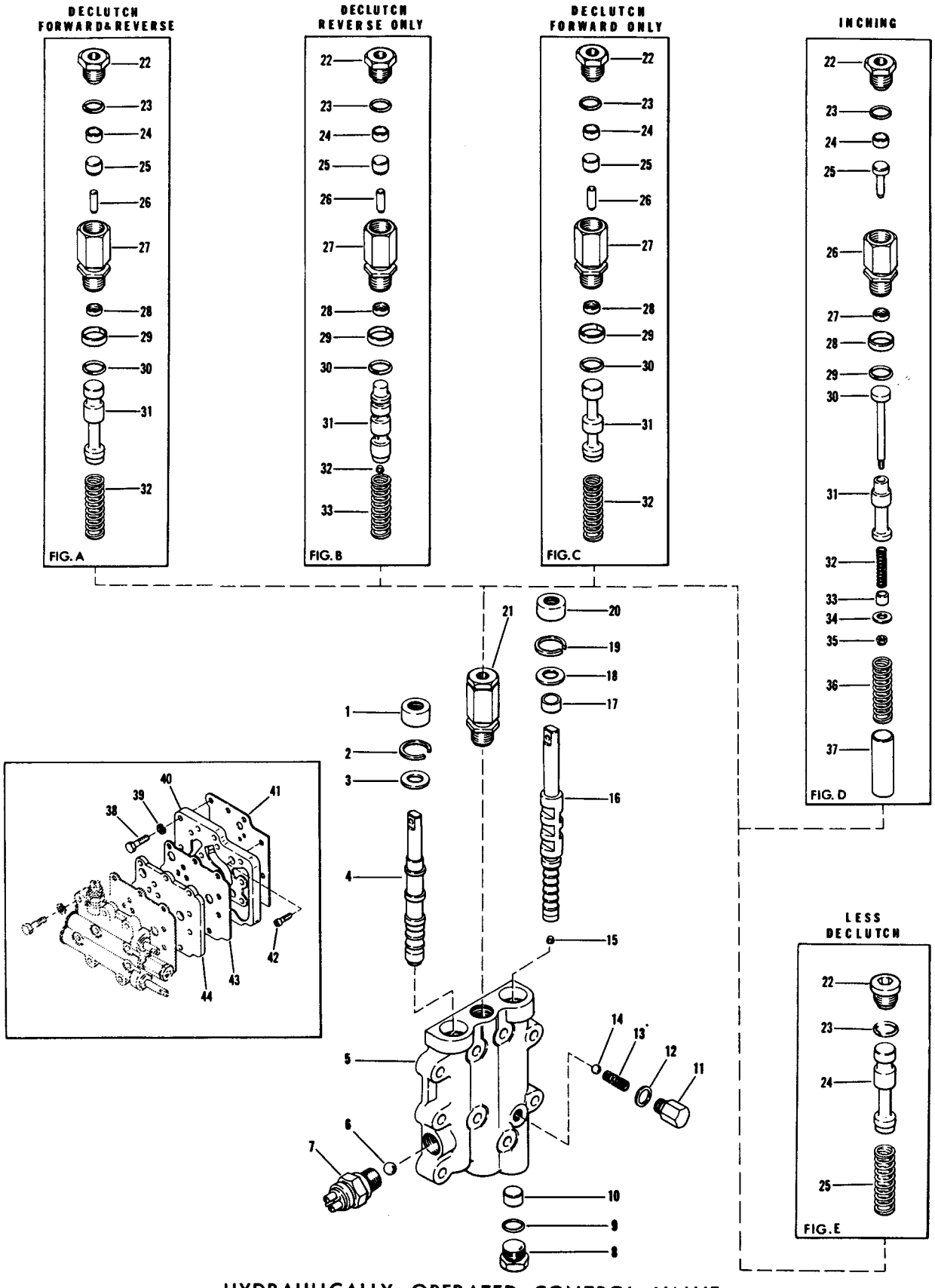
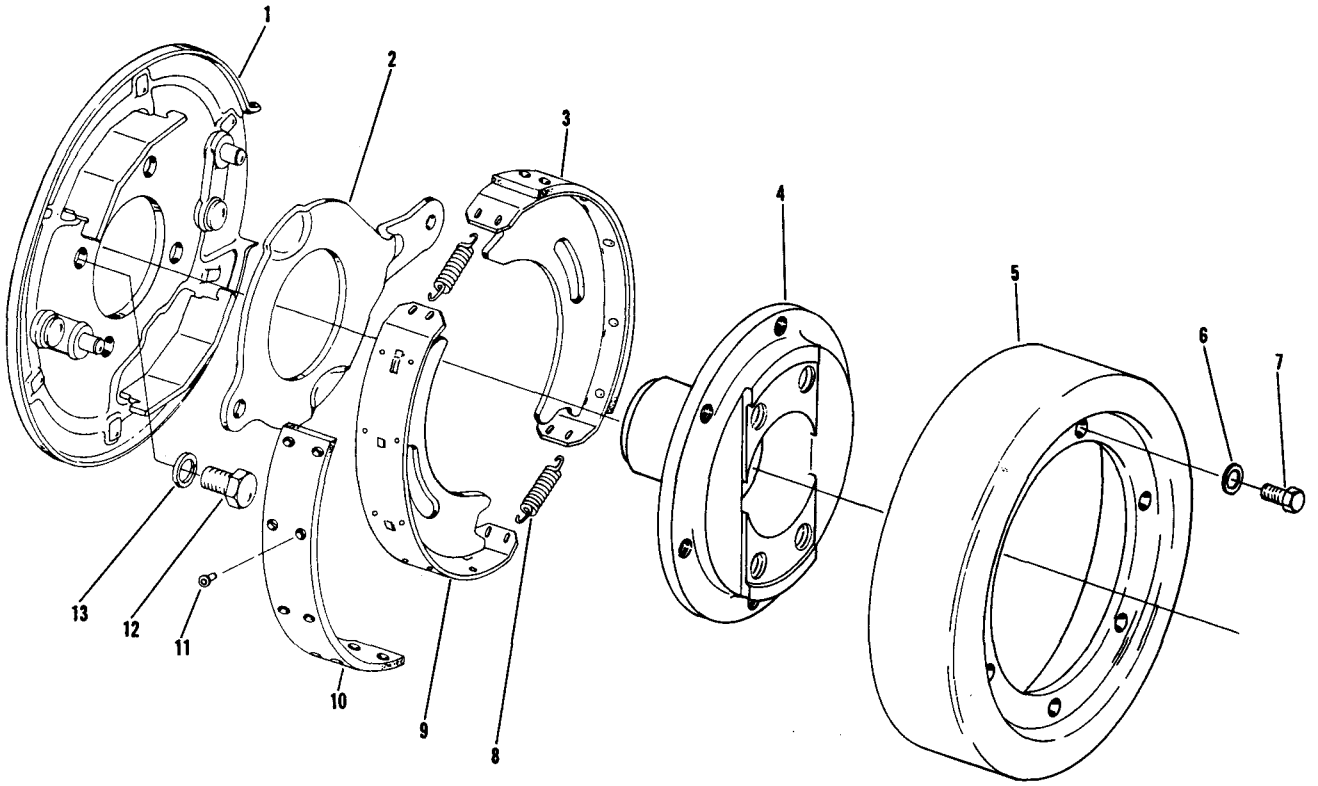

DECLUTCH FORWARD & REVERSE
DECLUTCH REVERSE ONLY
DECLUTCH FORWARD ONLY
INCHING
FIG. A
FIG. B
FIG. C
FIG. D
LESS DECLUTCH
FIG. E
HYDRAULICALLY OPERATED CONTROL VALVE

FIGURE E

CONTROL VALVE ASSEMBLY

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

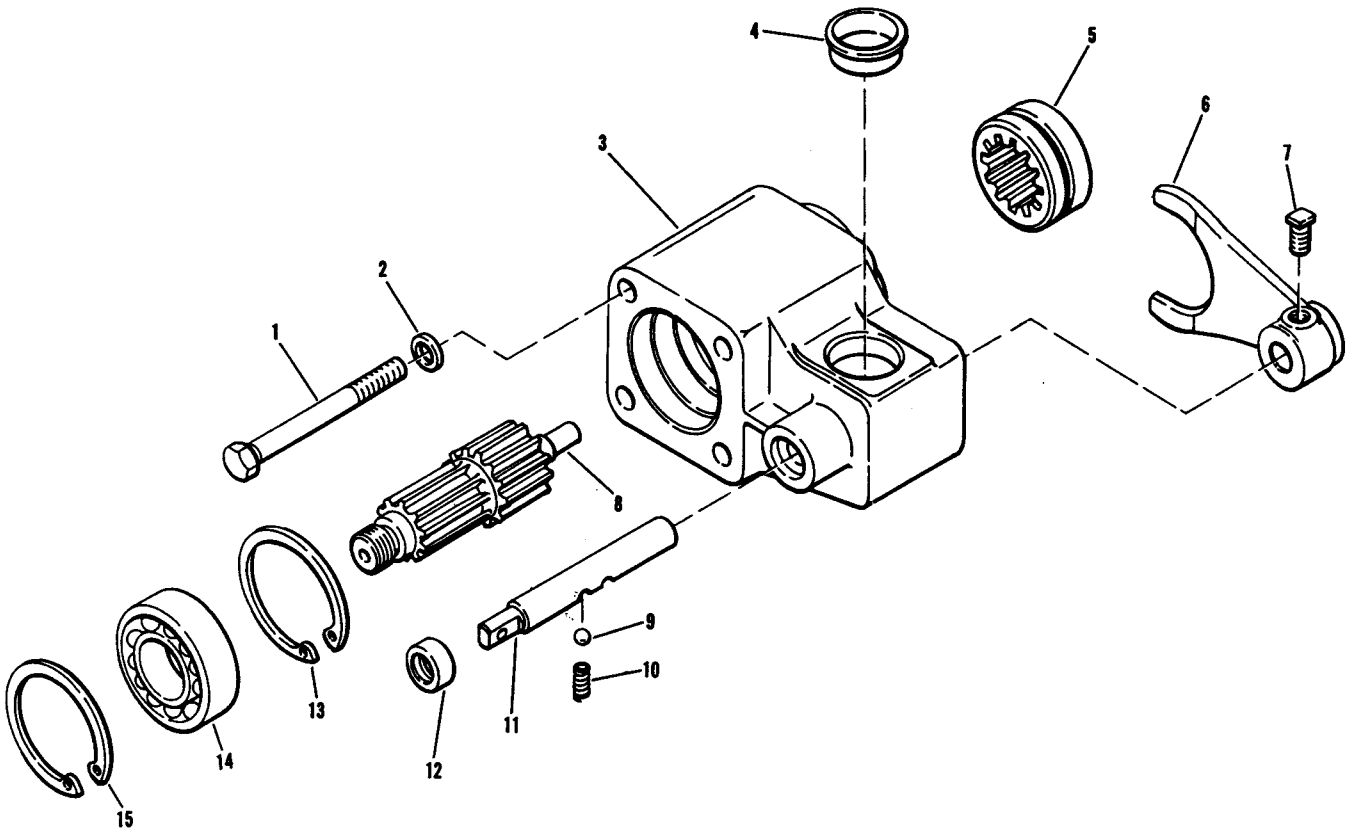
NOTES



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

FIGURE F



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

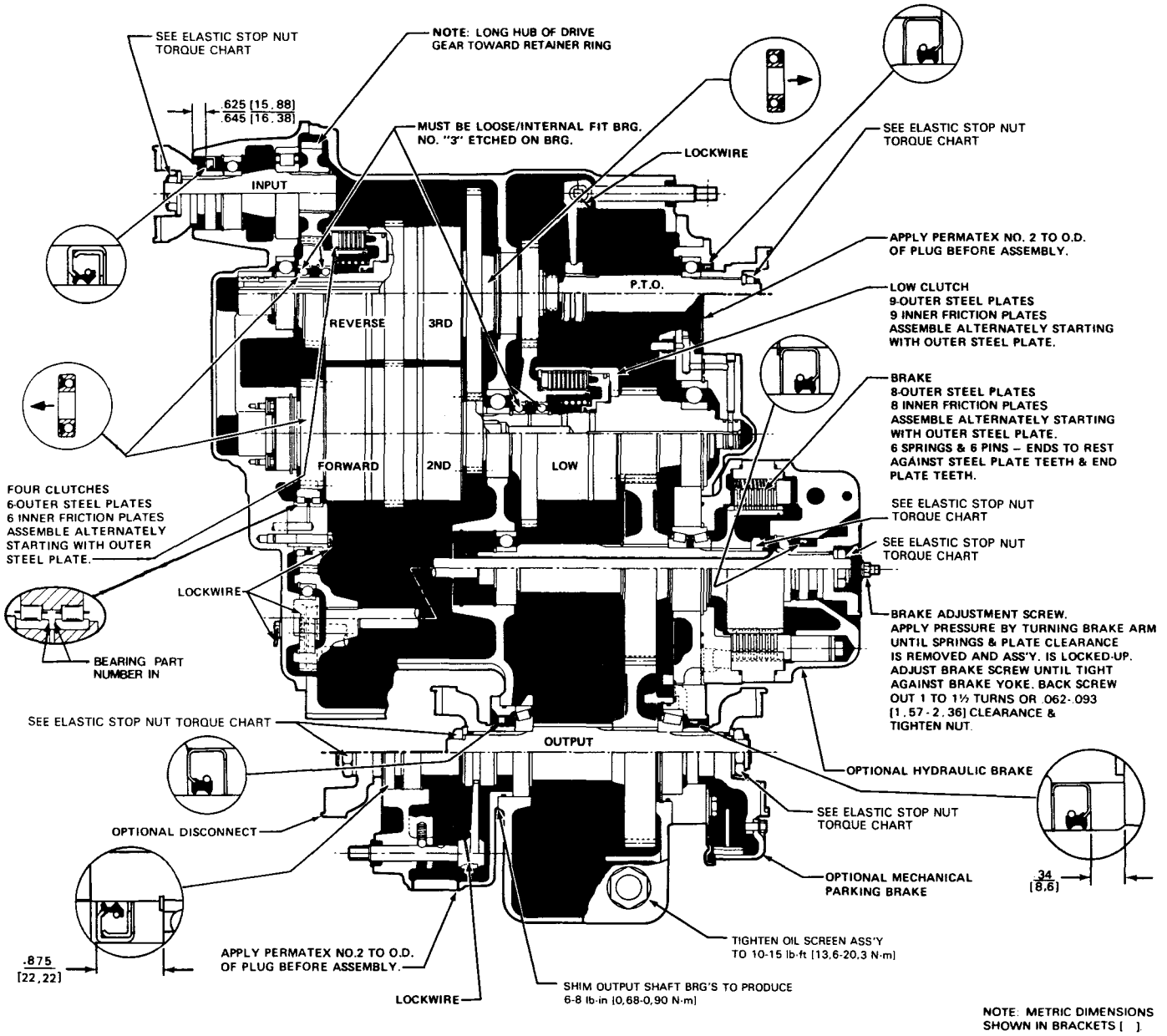
FIGURE G

CLARK

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

FIGURE H

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 is 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 of dirt and foreign matter entering the mechanism.

DISASSEMBLY

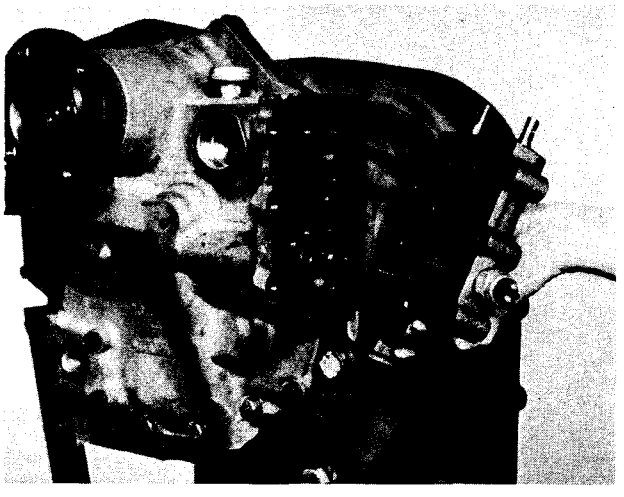


Figure 1
Remove control valve bolts and washers. Remove control valve. Use caution as not to lose detent springs and balls.

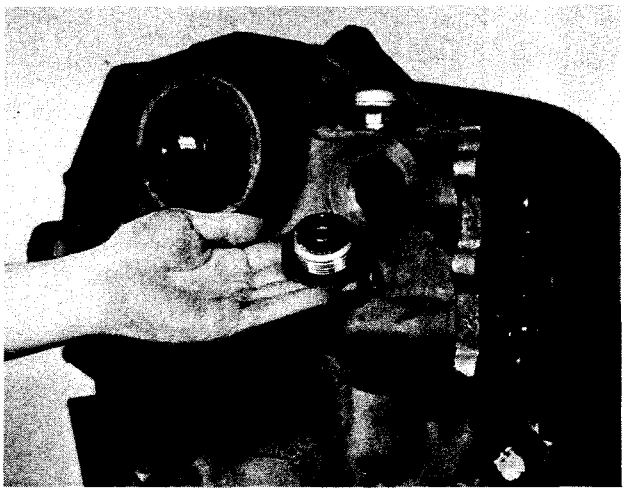


Figure 3
Remove front cover plug.

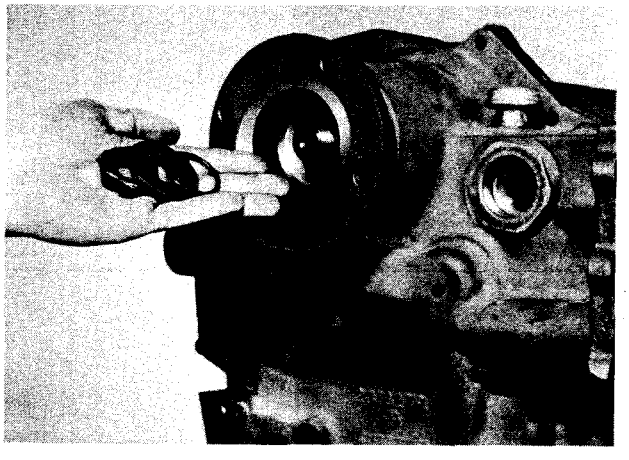


Figure 2
Remove companion flange nut, washer and O-ring.

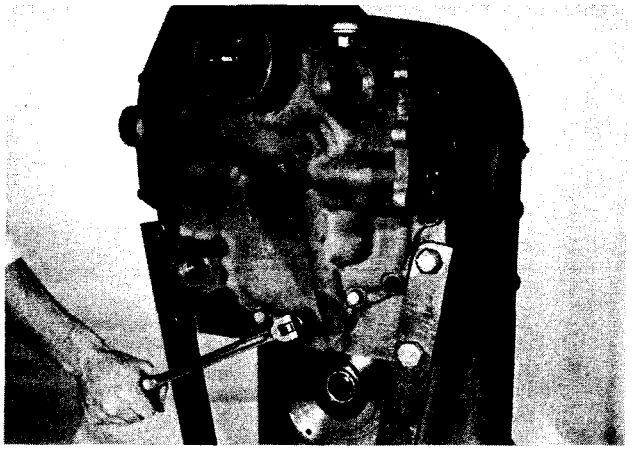


Figure 4
Remove bolts securing front cover to transmission housing.

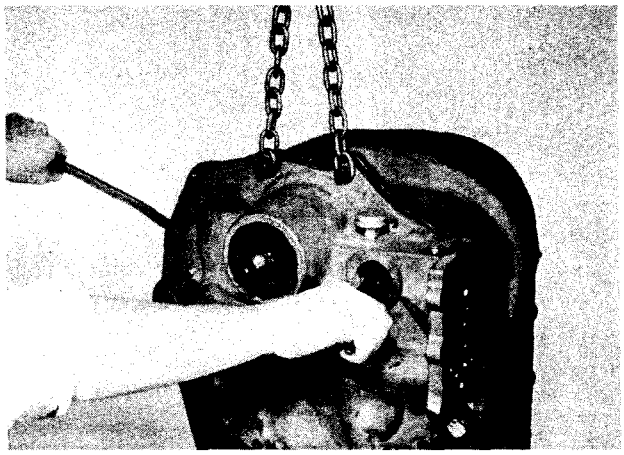


Figure 5

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.

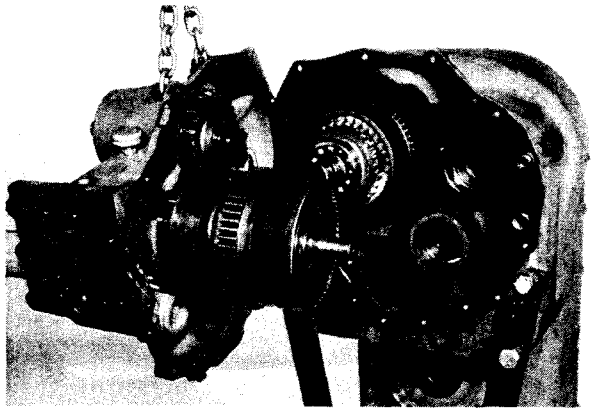


Figure 6

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

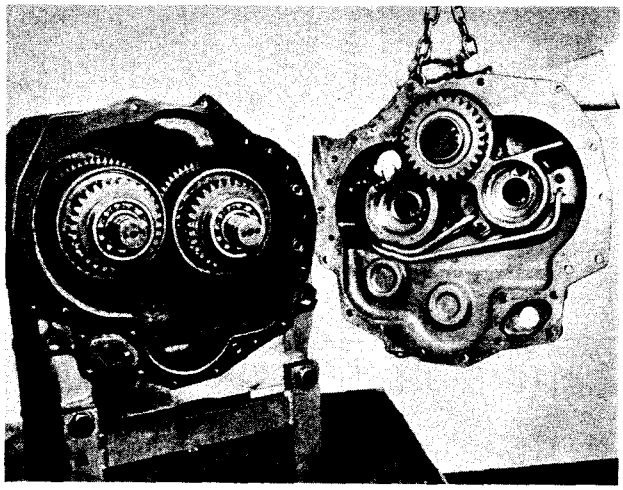


Figure 7

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

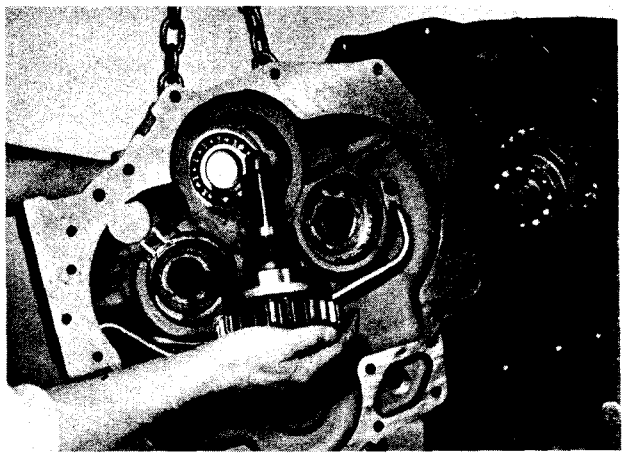


Figure 8

If input shaft is to be removed, tap on threaded end of shaft, remove input shaft, gear and bearing.

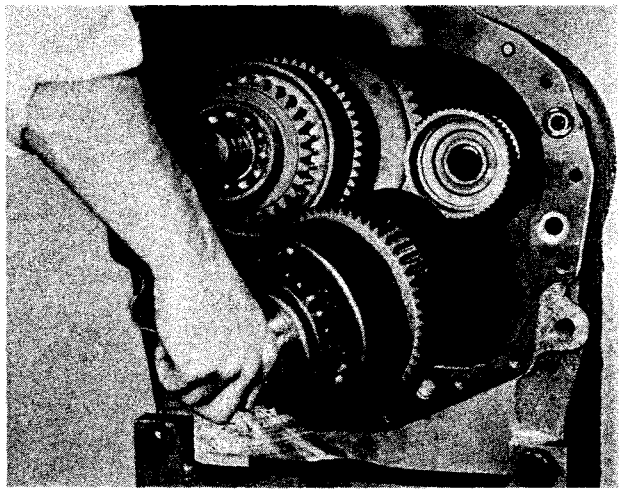


Figure 9

Remove forward and 2nd clutch assembly.

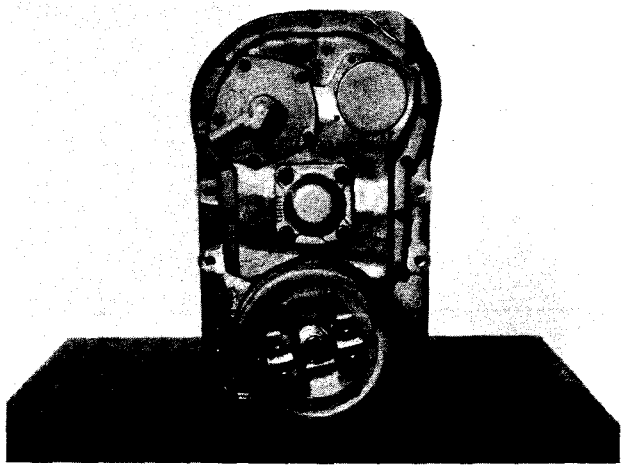


Figure 10

Rear view of transmission utilizing a mechanical parking brake option.

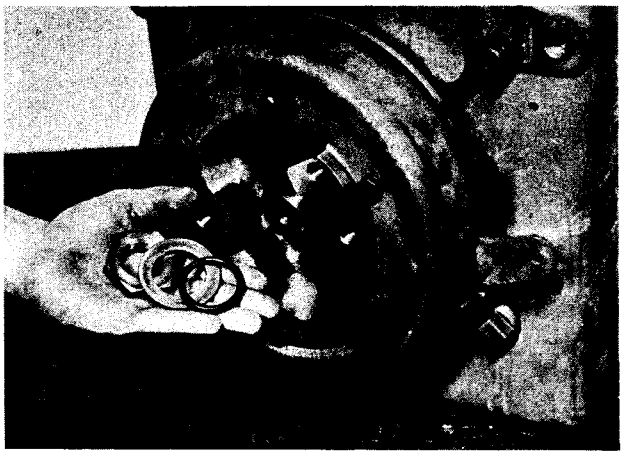


Figure 11
Remove output flange nut, washer and O-ring. If parking brake is not used, remove companion flange and proceed to Figure 17.

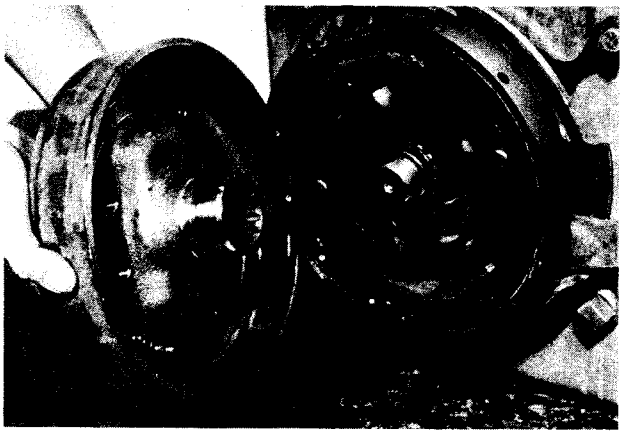


Figure 12
Remove parking brake drum and flange.

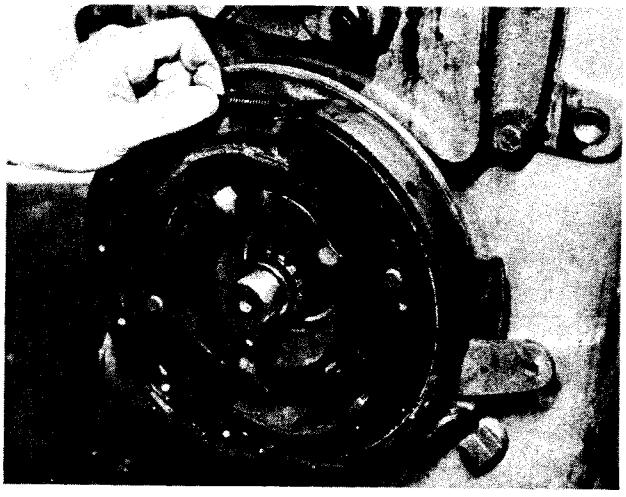


Figure 13
Remove upper and lower brake shoe return springs.

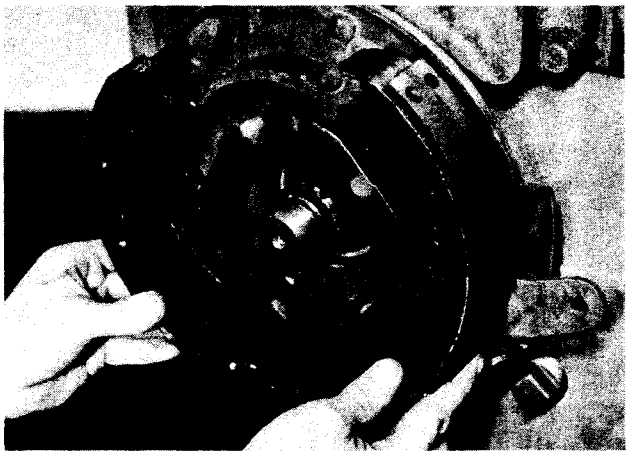


Figure 14
Remove brake shoes.

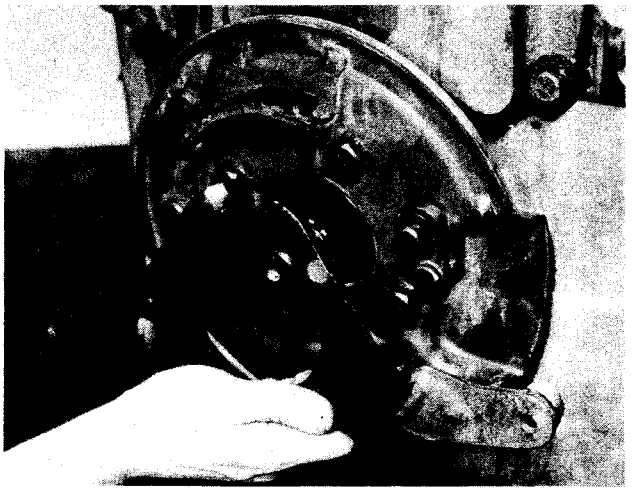


Figure 15
Remove brake actuator arm.

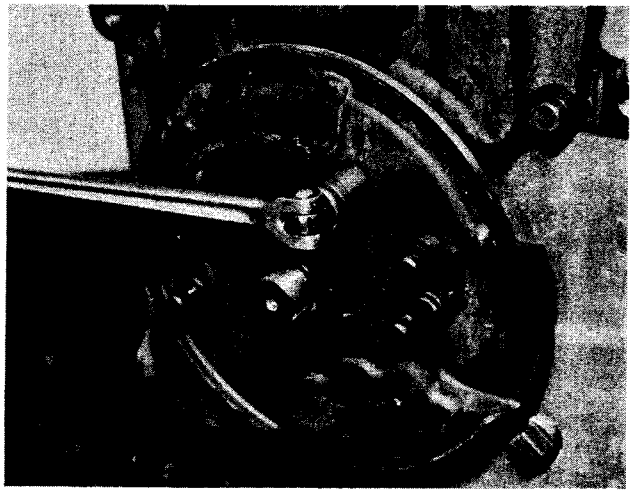


Figure 16
Remove brake backing plate bolts.

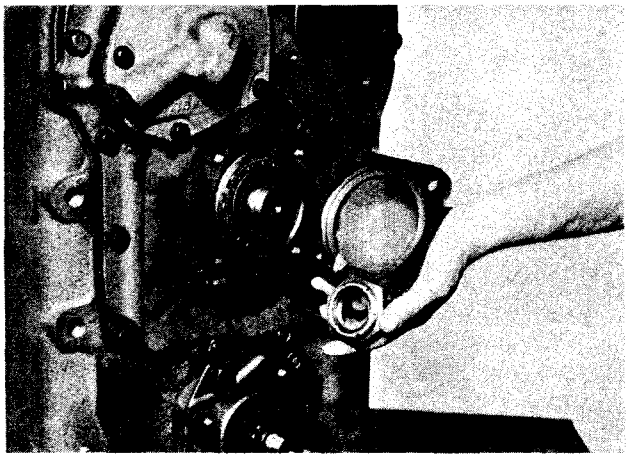


Figure 17
Remove idler shaft bearing cap bolts, bearing cap and idler shaft nut.

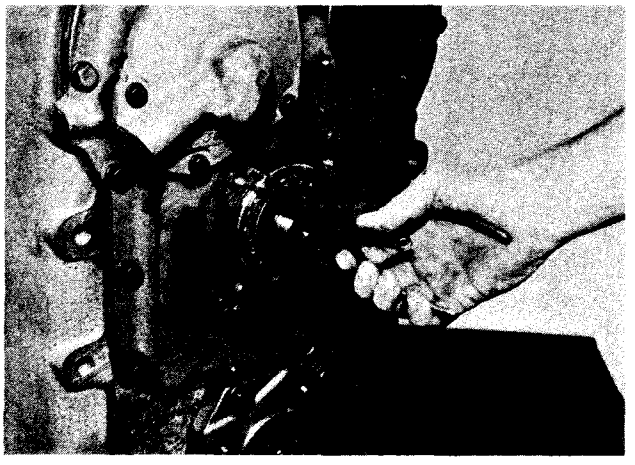


Figure 18
Remove idler shaft rear bearing locating ring.

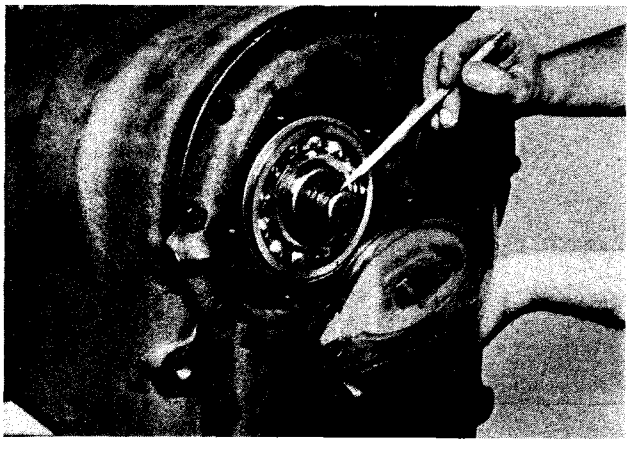


Figure 19
Remove low clutch rear bearing cap.

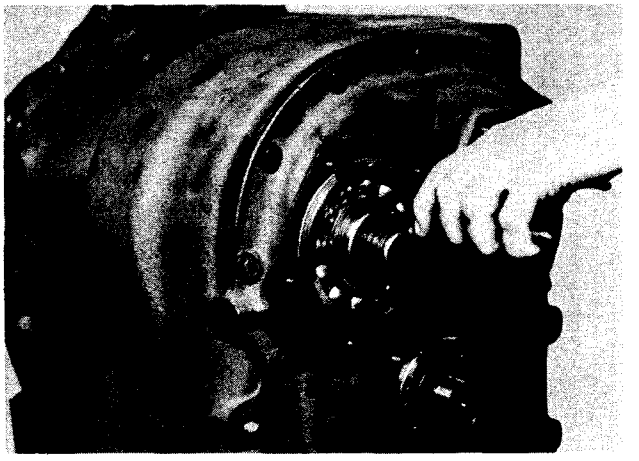


Figure 20
Remove low clutch rear bearing locating ring.

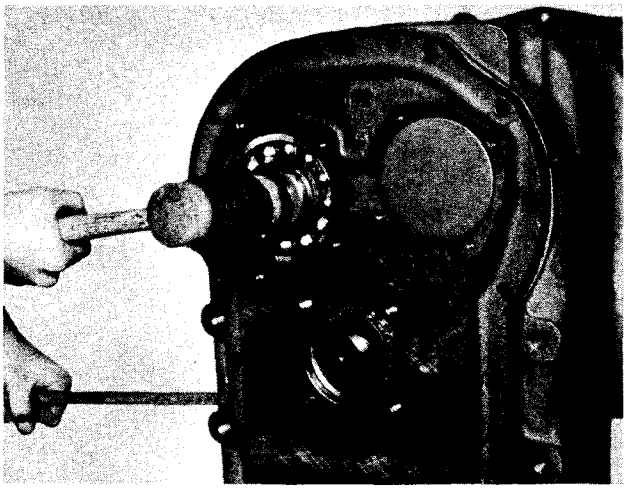


Figure 21
Remove rear cover bolts. Using pry slots provided, pry cover from transmission housing tapping on low clutch and idler shaft to allow cover to be removed without shaft binding.

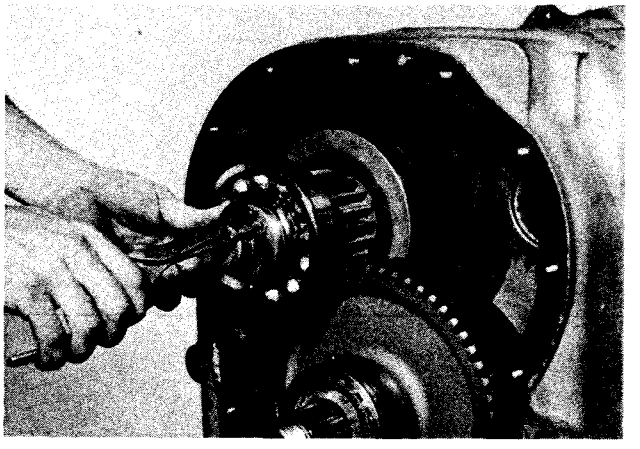


Figure 22
Remove low clutch rear bearing retaining Ring. *NOTE: See page 24 for disassembly of low clutch utilizing a rear double taper bearing (helical gears).*

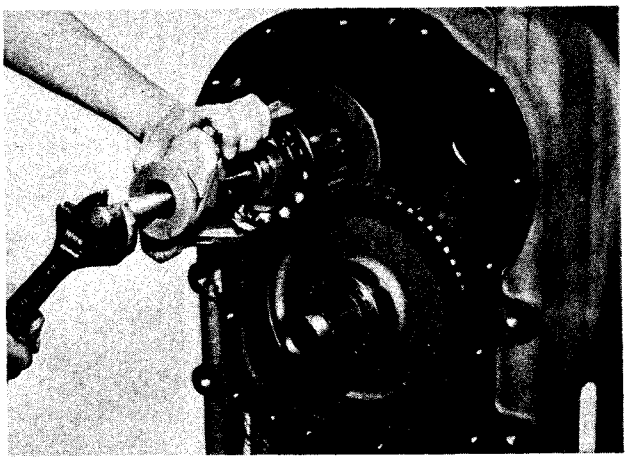


Figure 23
Remove low clutch rear bearing.

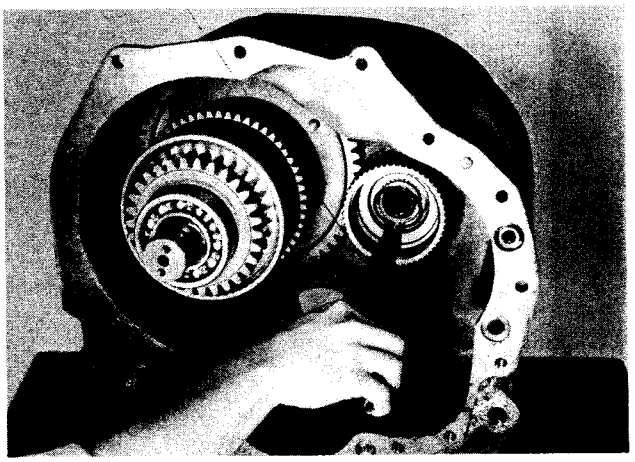


Figure 26
Remove 2nd gear retaining ring.

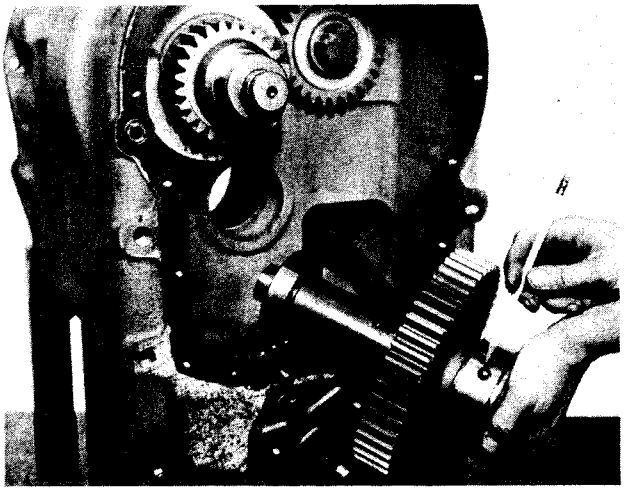


Figure 24
Tap idler shaft from housing. *NOTE: Do not lose rear bearing lock ball.*

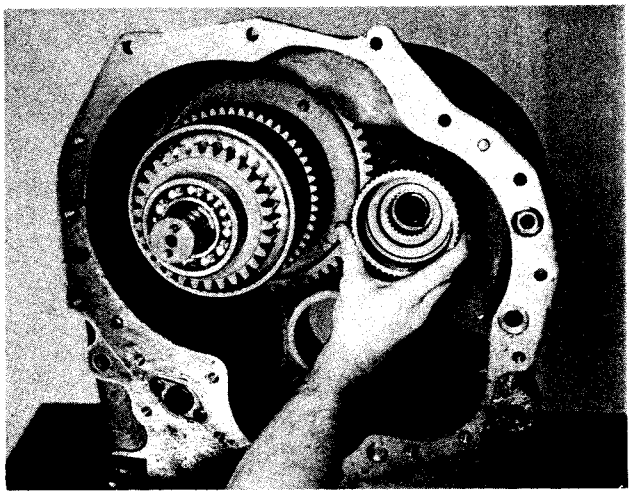


Figure 27
Remove 2nd gear.

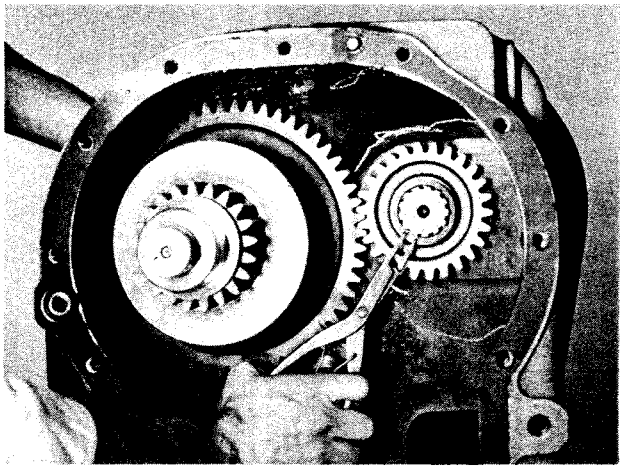


Figure 25
Remove low speed drive gear retainer ring and drive gear.

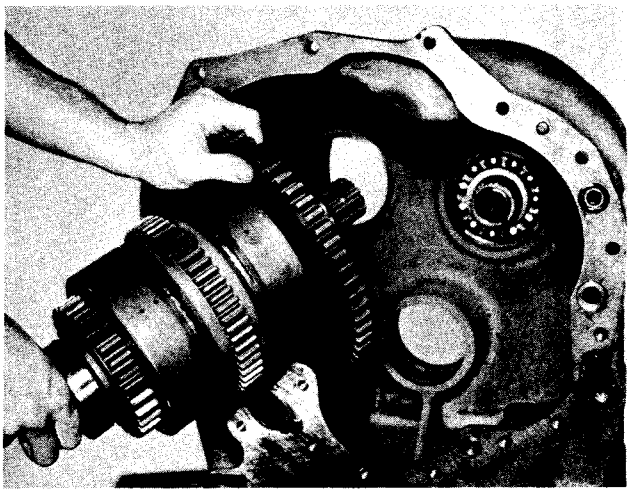


Figure 28
Remove reverse and 3rd clutch assembly.

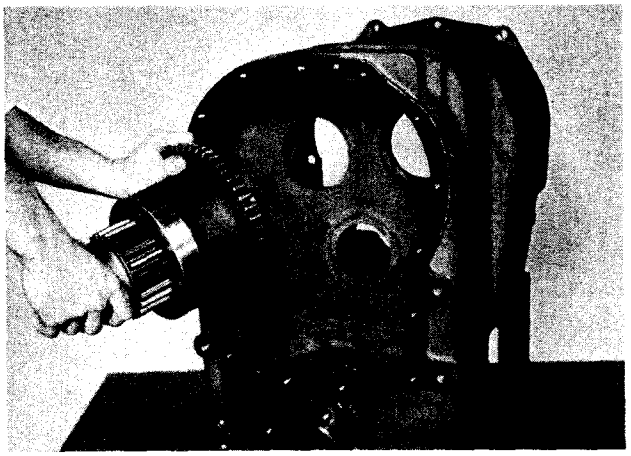


Figure 29
Remove low clutch assembly.

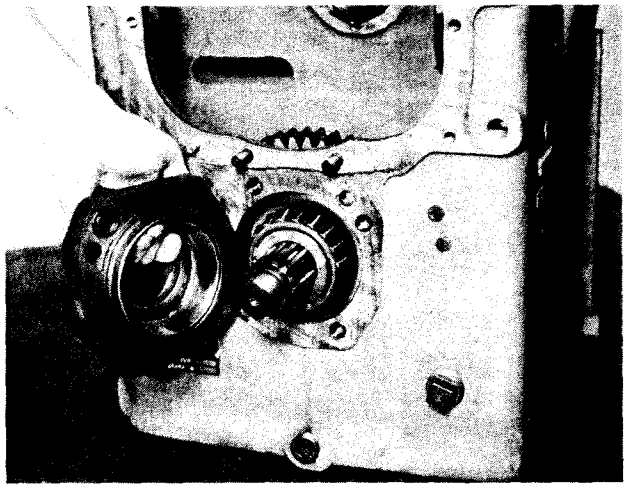


Figure 30
Remove rear output shaft bearing cap bolts and cap.

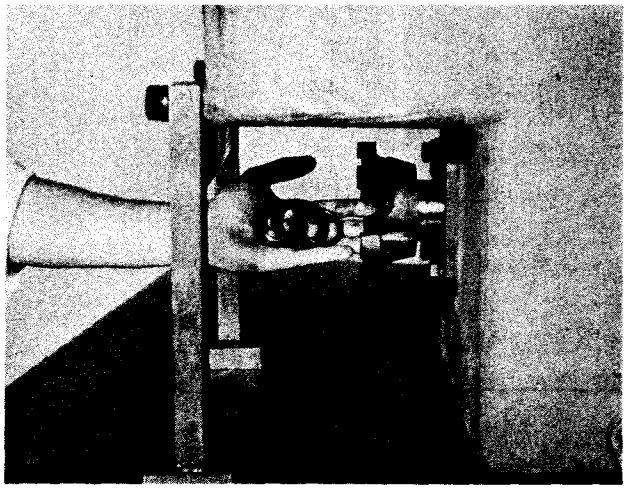


Figure 31
Remove front output flange nut, washer, O-ring and companion flange.

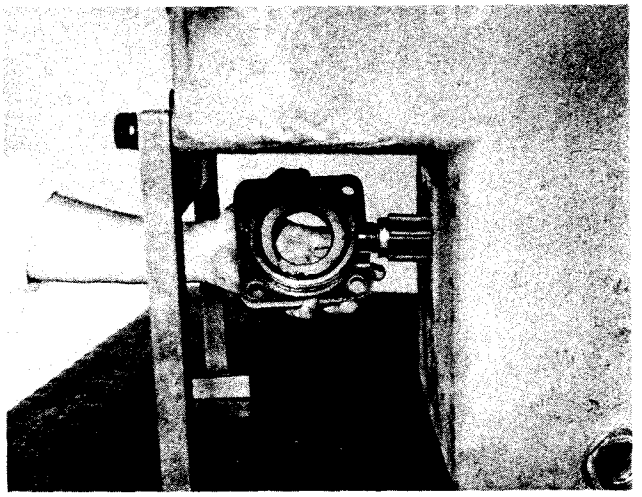


Figure 32
Remove output shaft front bearing cap bolts and cap.

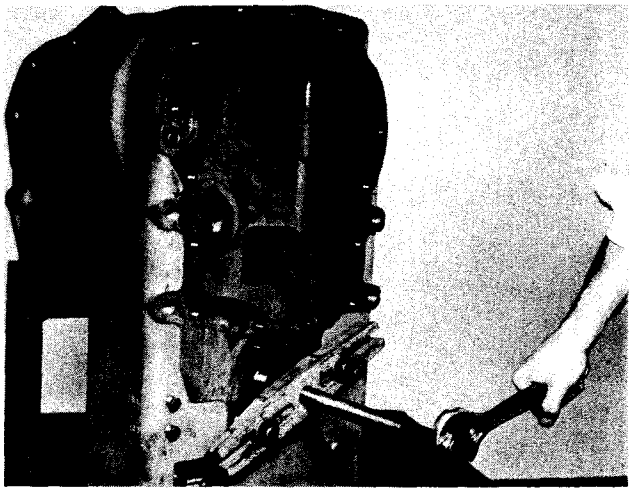


Figure 33
Block output gear. Push output shaft from rear through bearing and gear.

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 68).

LOW CLUTCH DISASSEMBLY

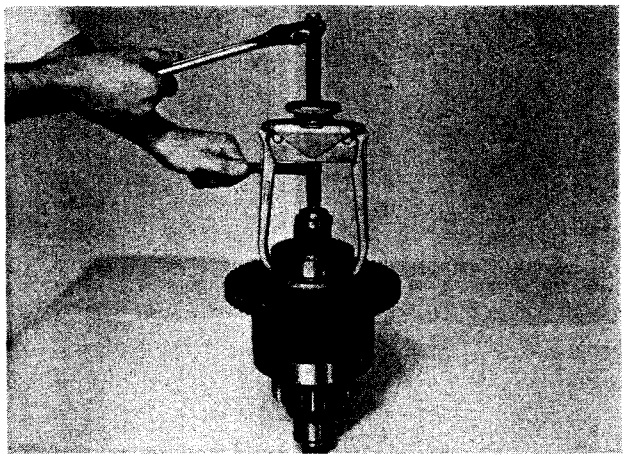


Figure 34
Remove low clutch shaft rear bearing.

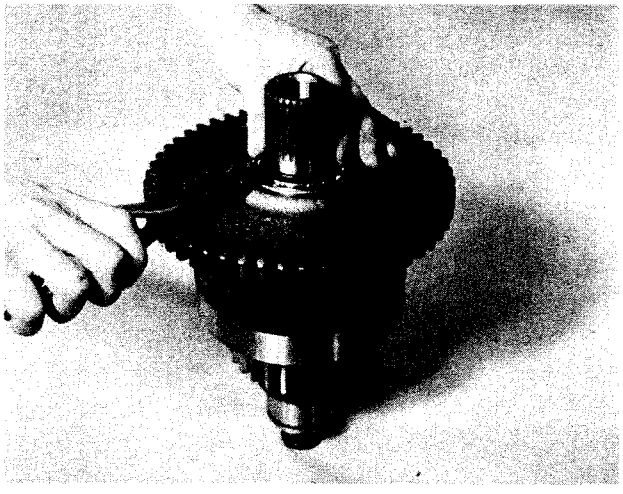


Figure 35
Remove low speed gear retainer ring.

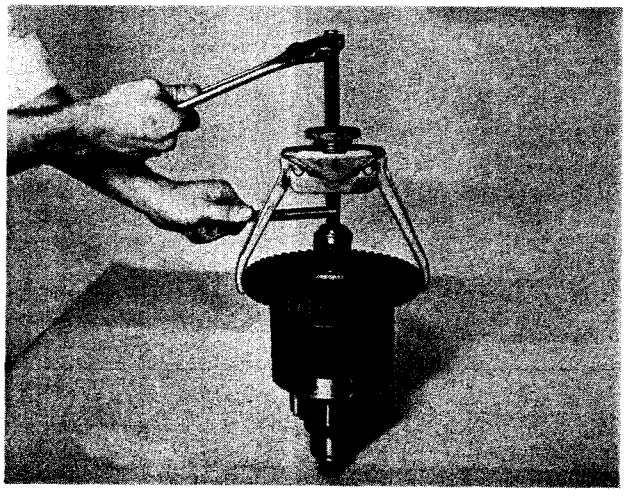


Figure 36
Remove low speed gear and outer bearing.

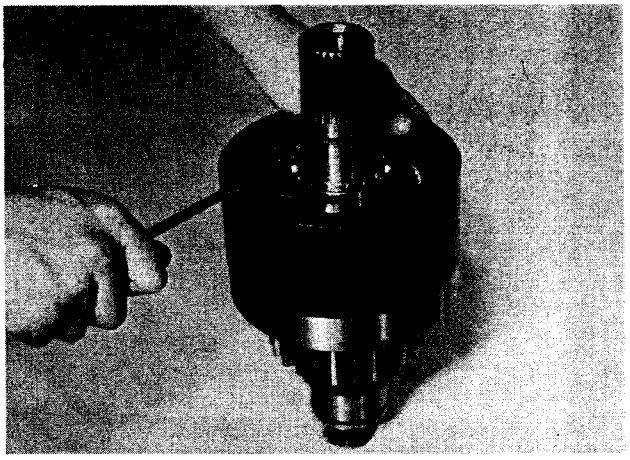


Figure 37
Remove clutch end plate retainer ring.

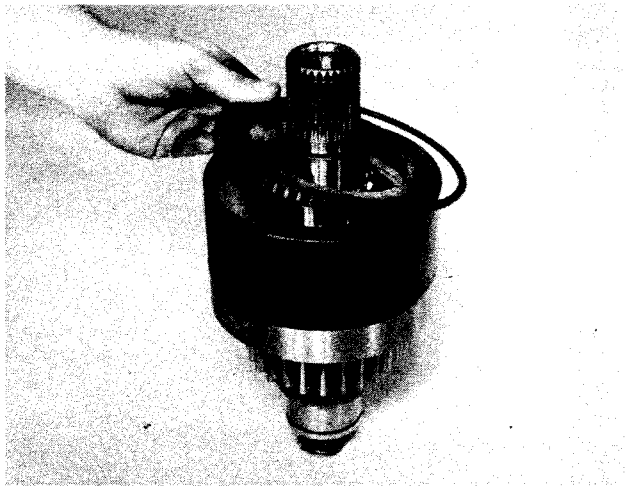


Figure 38
Remove clutch end plate and inner and outer clutch discs.

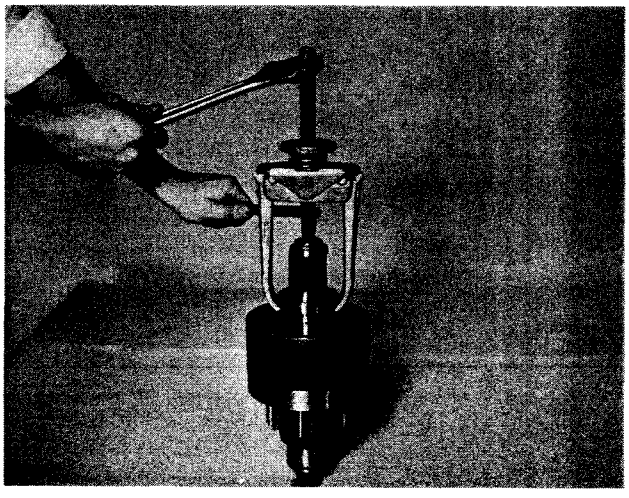


Figure 39
Remove low gear inner bearing.

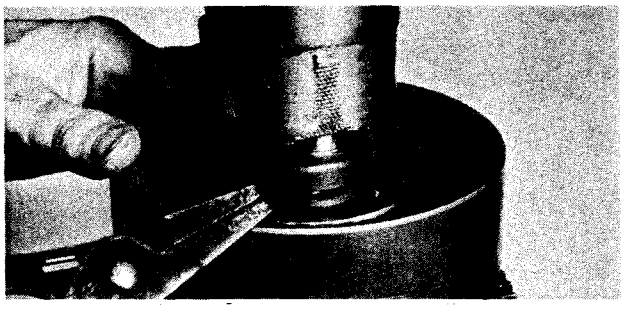


Figure 40

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″ wide × 1″ high [39,0 × 26,0mm] opening. The pipe is 6″ long, 3-1/4″ O.D., 2-3/4″ I.D. [155,0 × 85,0 × 78,0mm]. Compress snap ring retainer washer. Through opening remove spring retainer snap ring. Release tension on retainer washer. 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

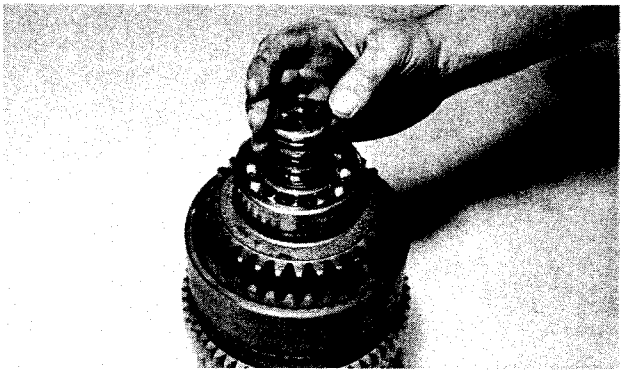


Figure 41

Remove clutch shaft piston rings.

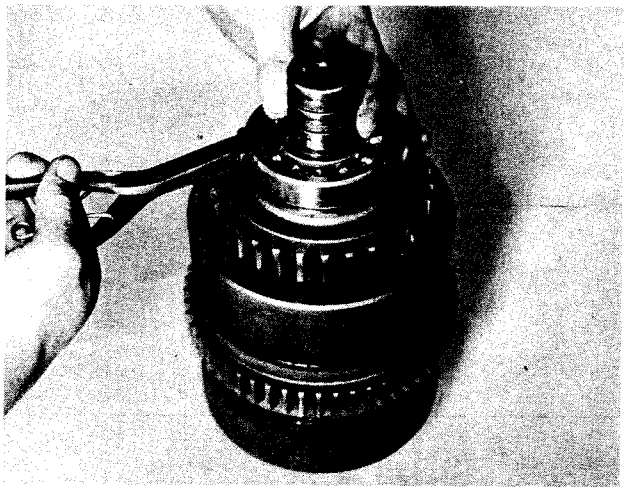


Figure 42

Remove front bearing retainer ring.



Figure 43

Remove front bearing.



Figure 44

Remove front bearing locating ring.

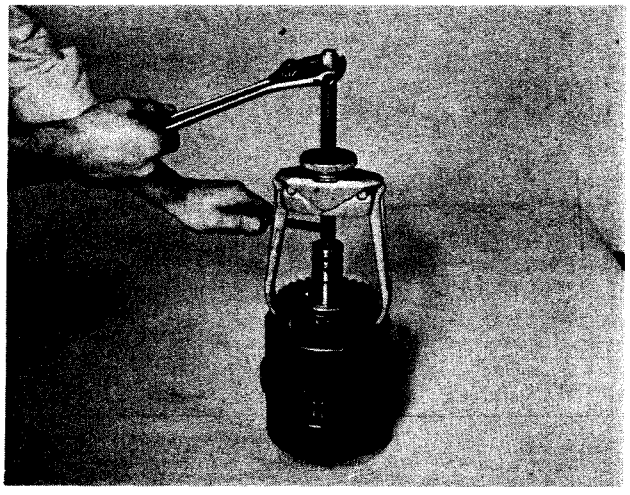


Figure 45

Remove clutch driven gear and outer bearing.

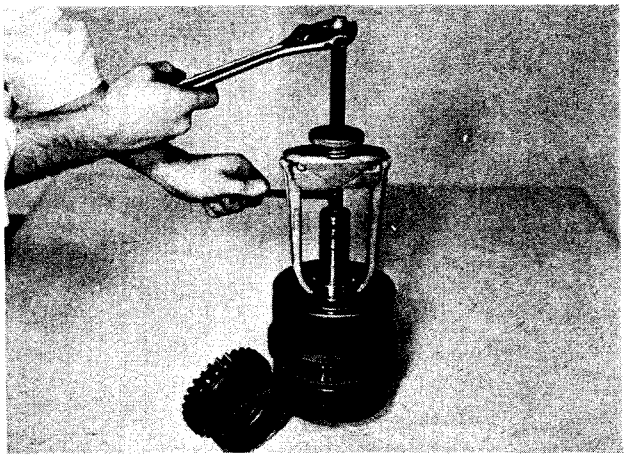


Figure 46

Remove inner bearing.

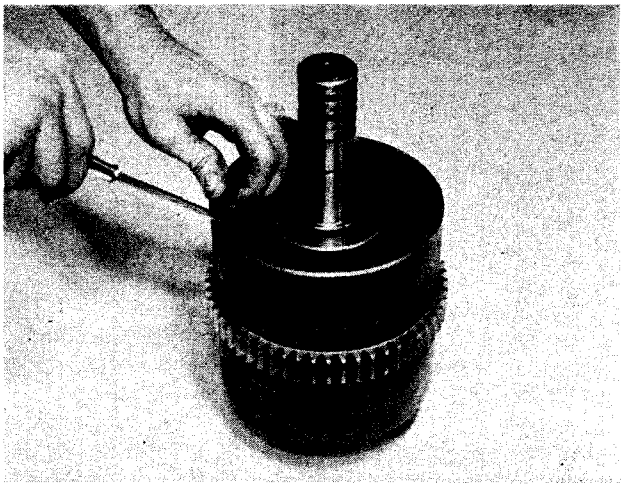


Figure 47

Remove end plate retainer ring.

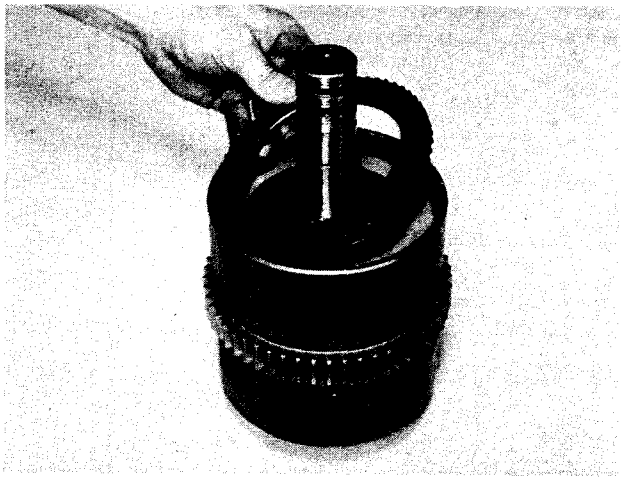


Figure 48

Remove end plate.

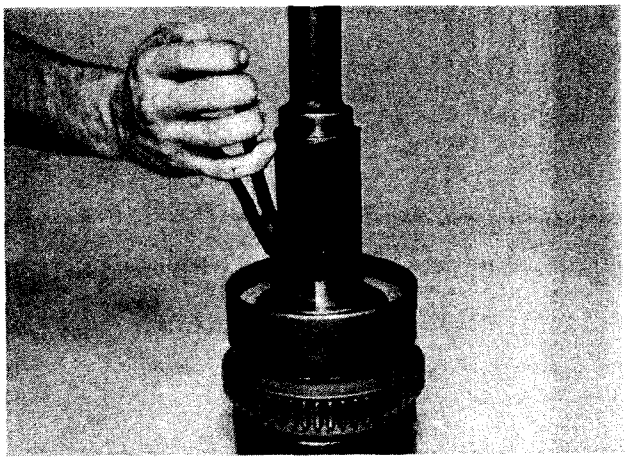


Figure 49

Compress return spring retainer. Remove retainer ring from groove.



Figure 50

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



Figure 51

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 inhalation of vapors and skin rashes when using alkali 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.

Suction Screen:
Remove suction screen located at the lower left hand side of the transmission housing. Clean screen thoroughly or replace if necessary. AFTER housing is cleaned, reinstall screen and gasket.

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 recommended type 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 & 2ND CLUTCH REASSEMBLY

(See page 28 for Modulated Clutch Cross Section.)

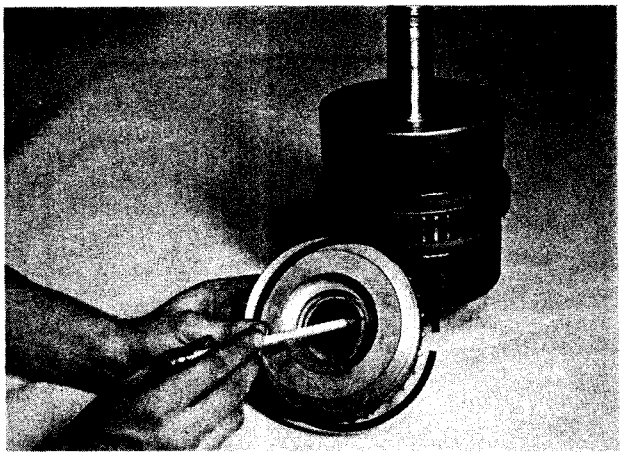


Figure 52

Install new clutch piston inner and outer sealing rings.

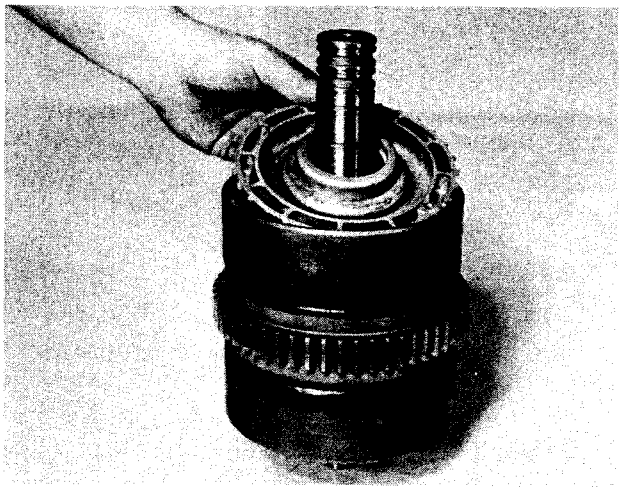


Figure 53

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

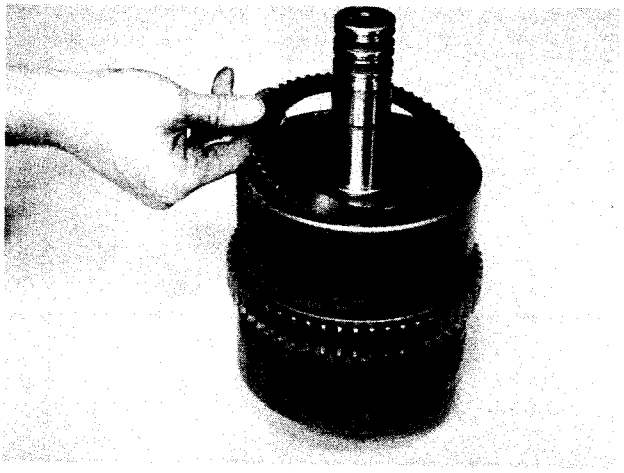


Figure 54

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

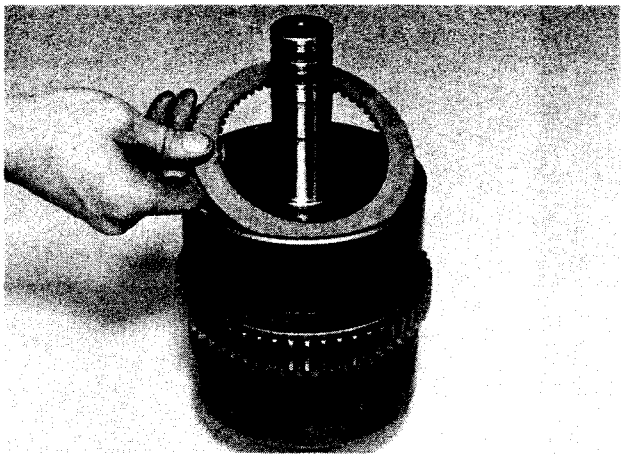


Figure 55

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.

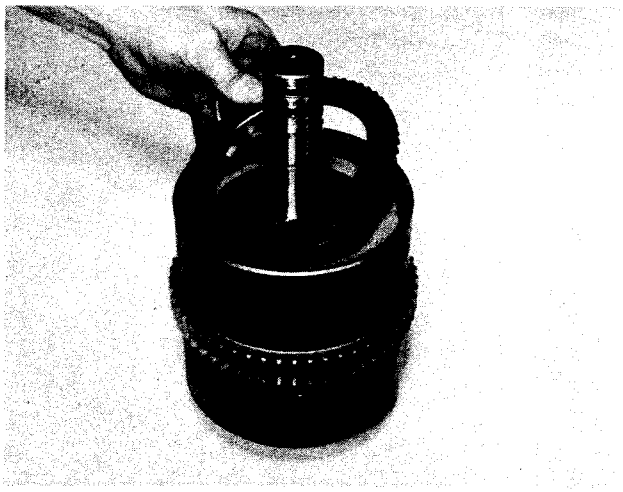


Figure 56

Install end plate.

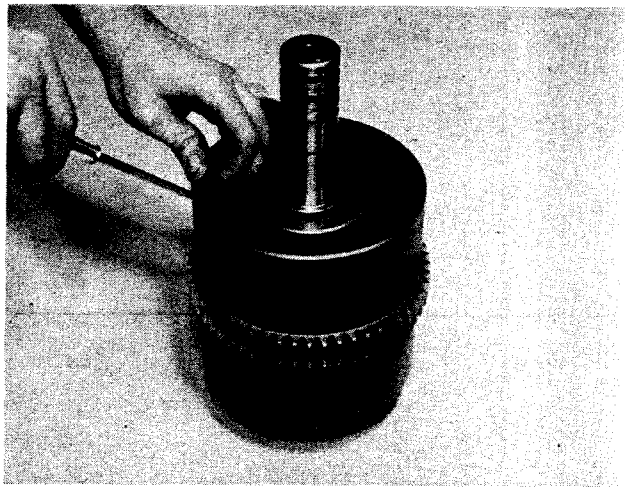


Figure 57

Install end plate retainer ring.

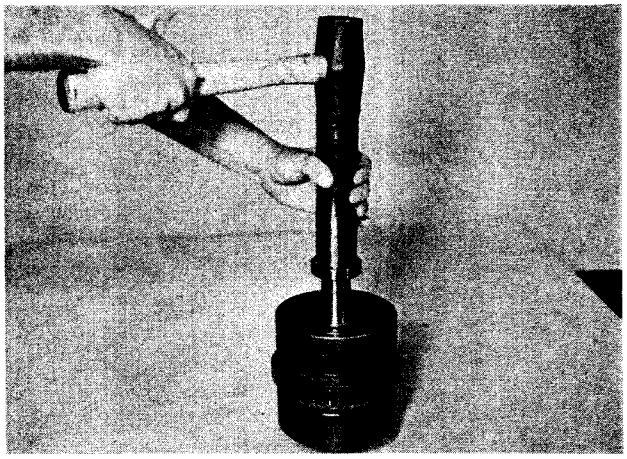


Figure 58
Install clutch driven gear inner bearing.

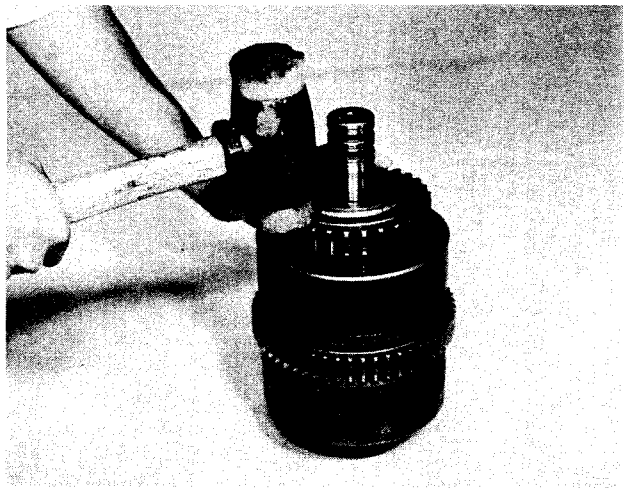


Figure 59
Install clutch driven gear into clutch drum. Align splines on clutch gear with internal teeth of friction discs. Tap gear into position. Do not force this operation. Gear splines must be in full position with internal teeth of all friction discs.

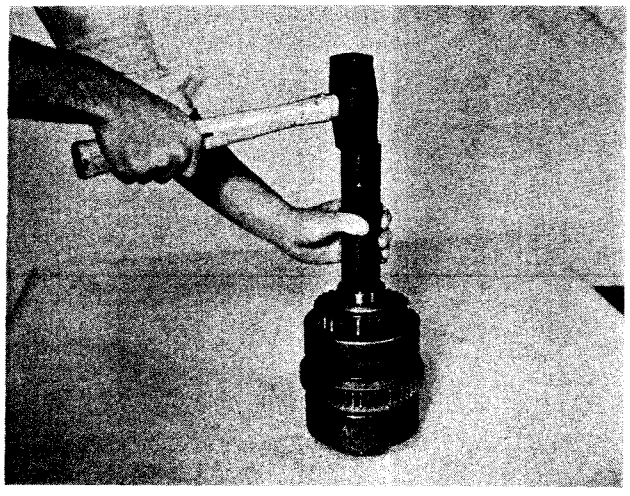


Figure 60
Install driven gear outer bearing.

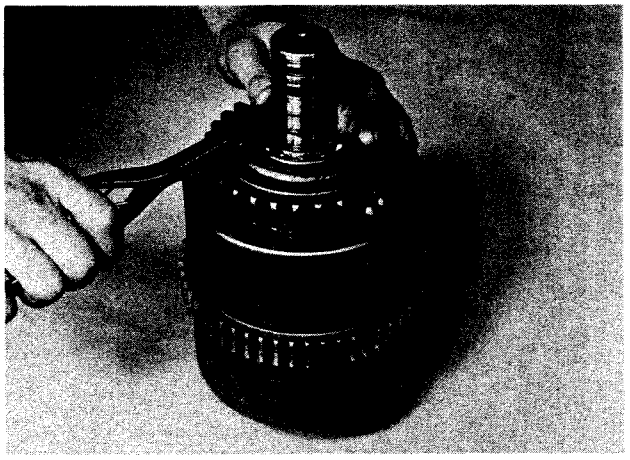


Figure 61
Install front bearing locating ring.

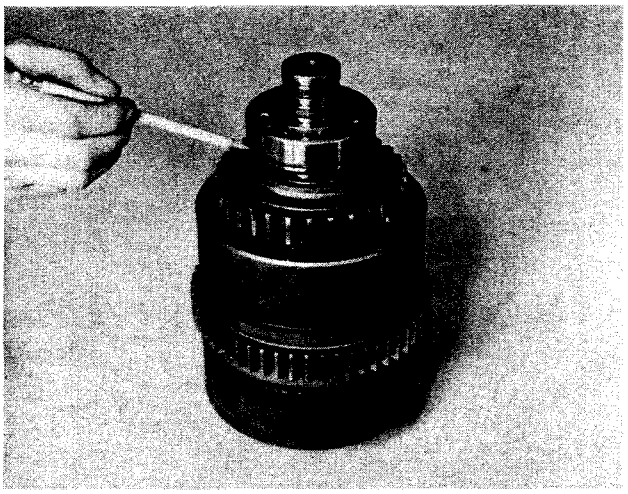


Figure 62
Install front bearing. *NOTE: Snap ring groove in front bearing must be down.*

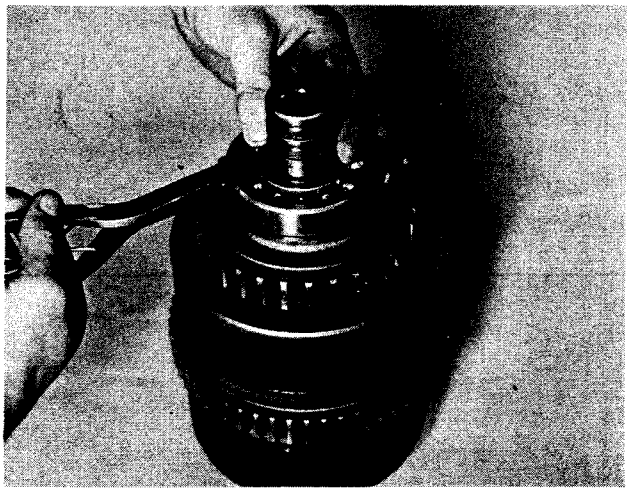


Figure 63
Install front bearing retaining ring.

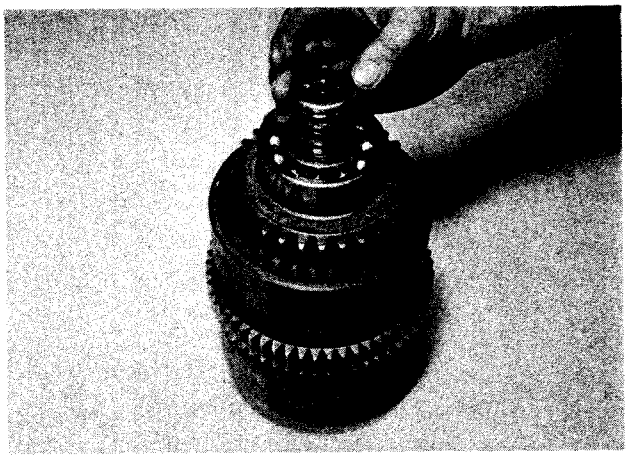


Figure 64

Install clutch shaft oil sealing rings. Grease rings to facilitate reassembly into front housings.

LOW CLUTCH REASSEMBLY

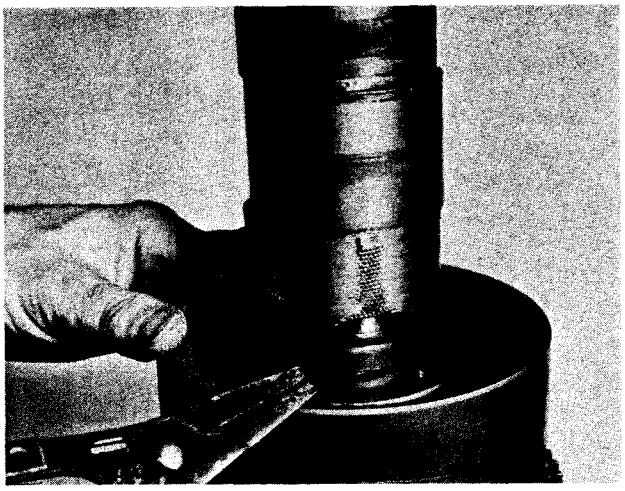


Figure 65

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

For reassembly of low clutch utilizing taper bearings in the low clutch gear see page 26.

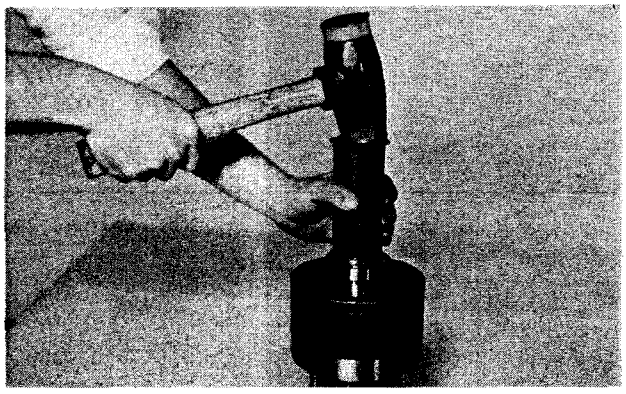


Figure 66

Install low gear inner bearing.

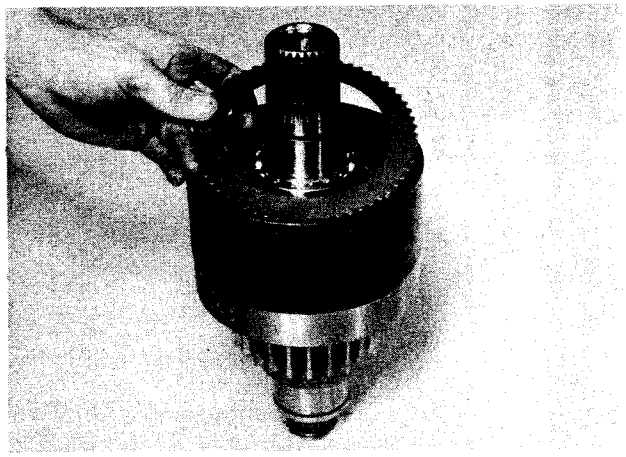


Figure 67

Install one steel disc.

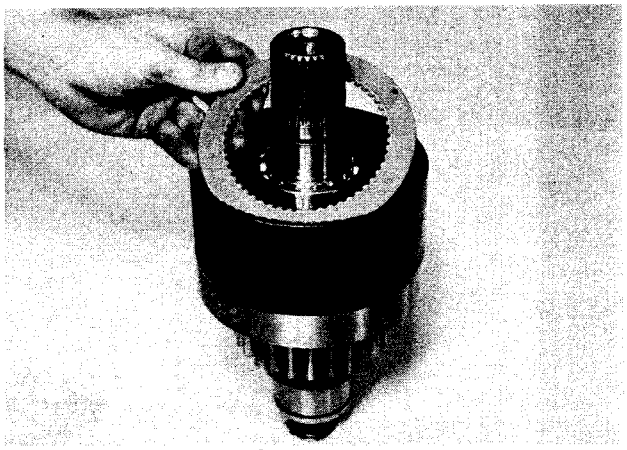


Figure 68

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.

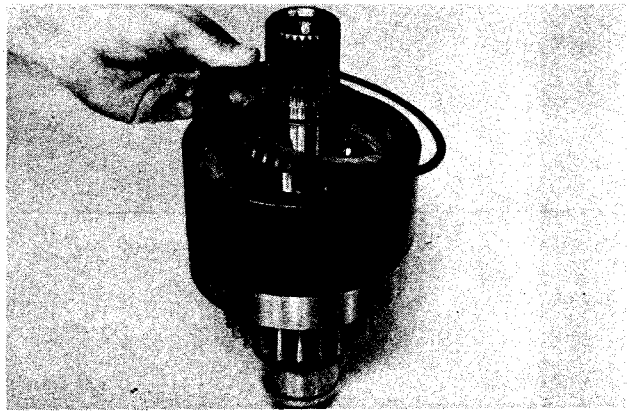


Figure 69

Install end plate and retainer ring.

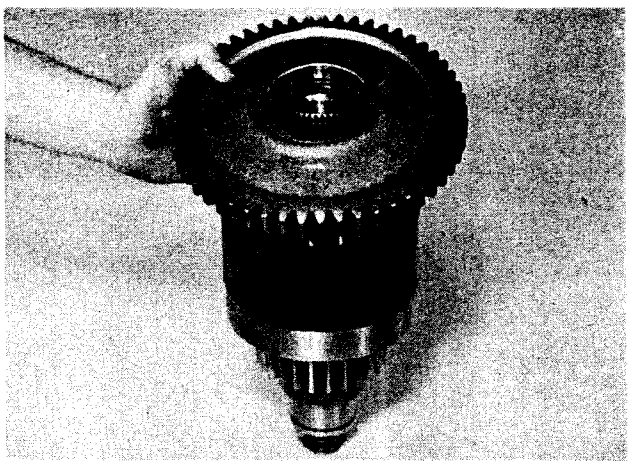


Figure 70

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.

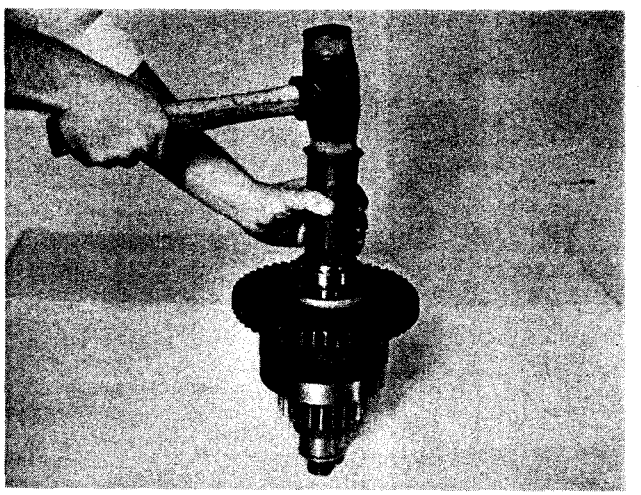


Figure 71

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.*

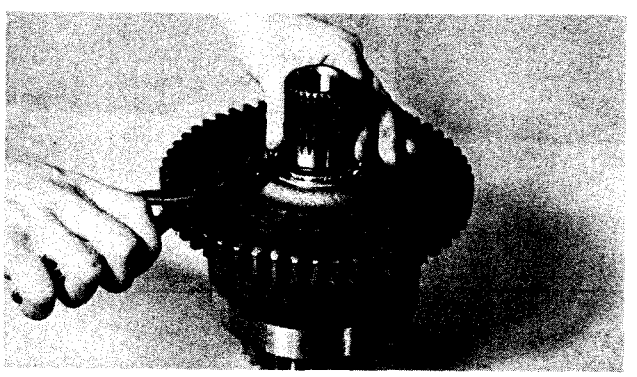


Figure 72

Install low gear retainer ring.

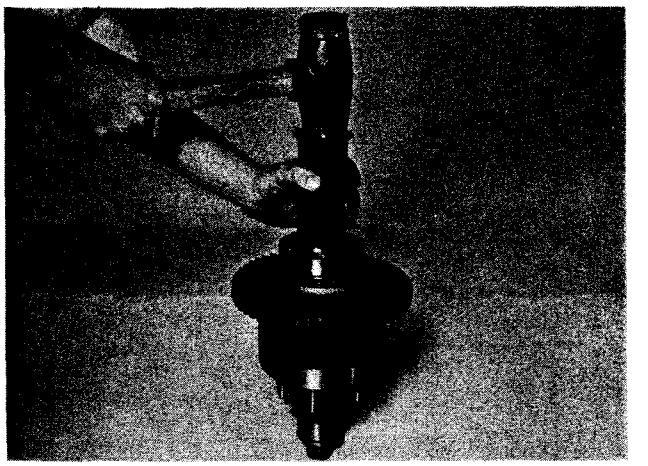


Figure 73

Install low clutch shaft rear bearing.

REASSEMBLY OF OUTPUT SHAFT

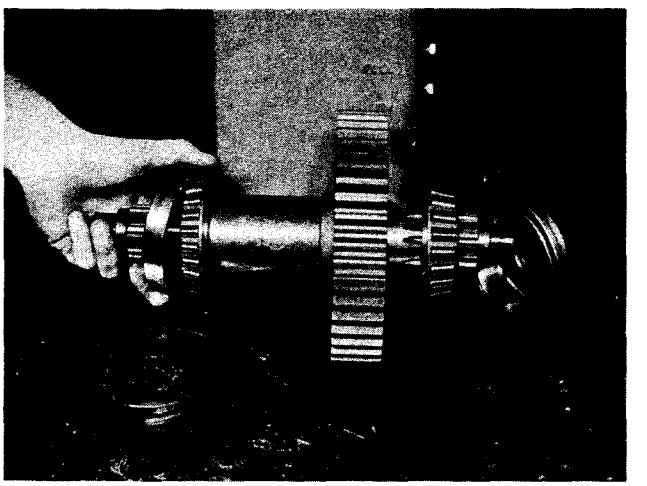


Figure 74

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

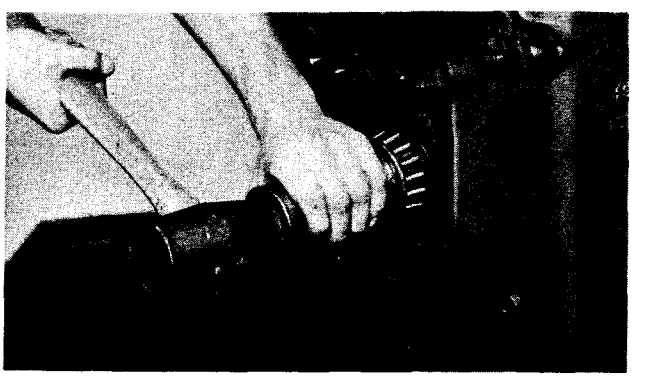


Figure 75

Position output gear in transmission case with protruding hub toward front of case. See Fig. 74. 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.

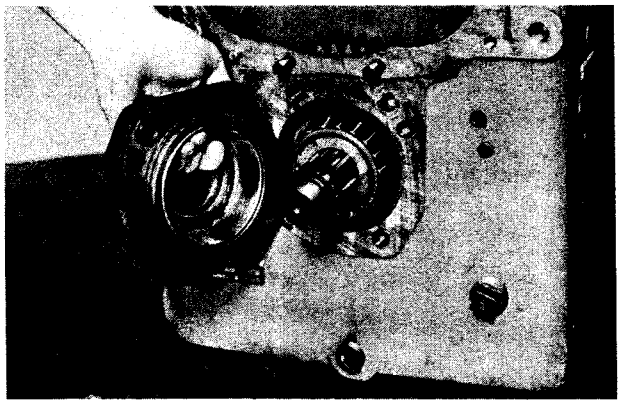


Figure 76

Install new oil seal (see Figure H for position & depth). Using new O-Rings, install rear output bearing cap, oil seal and taper bearing cup on transmission case. Lube opening in bearing cap must be aligned with lube opening in case. Tighten bearing cap bolts to specified torque. (See torque chart).

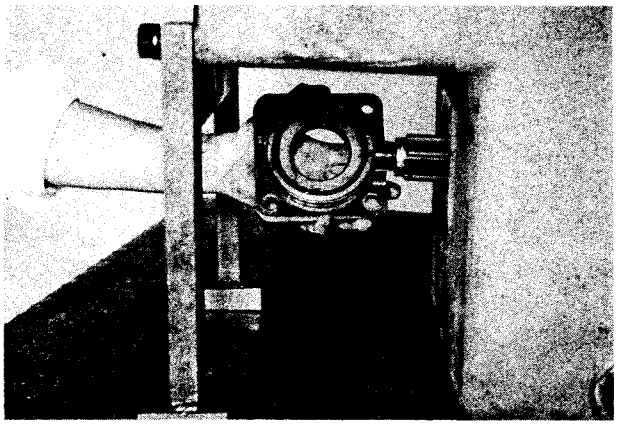


Figure 77

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.

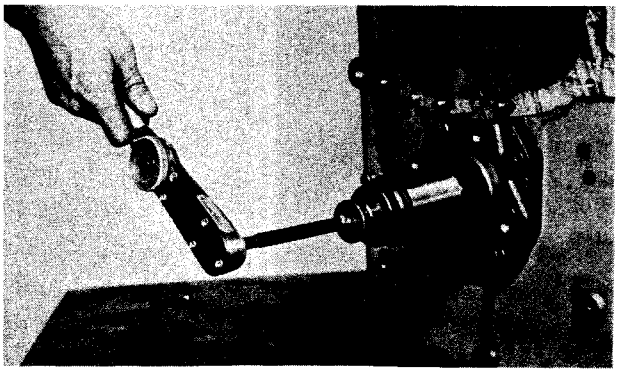


Figure 78

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.

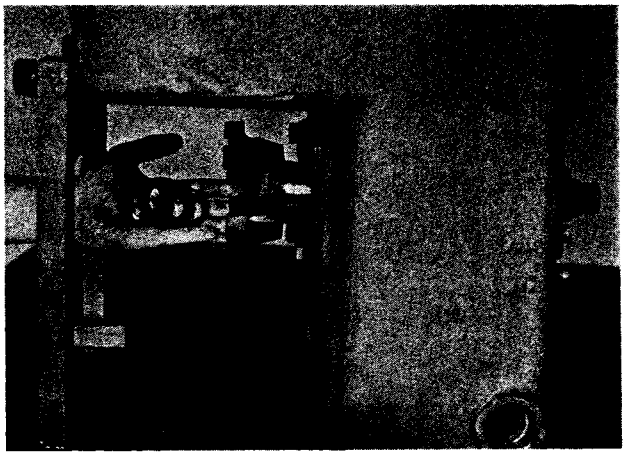


Figure 79

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

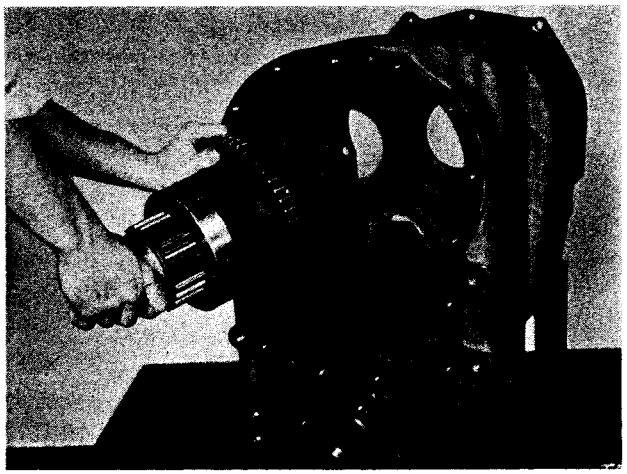


Figure 80

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

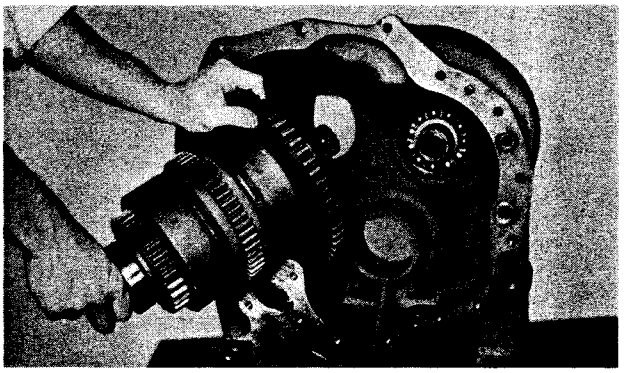


Figure 81

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

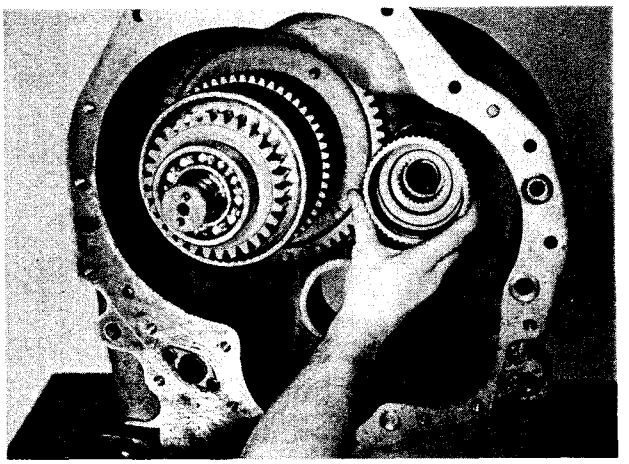


Figure 82
Install 2nd speed gear on low clutch shaft.

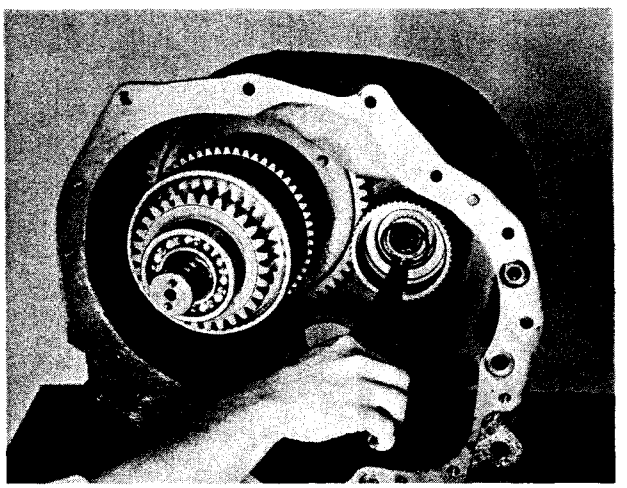


Figure 83
Install 2nd speed gear retainer ring.

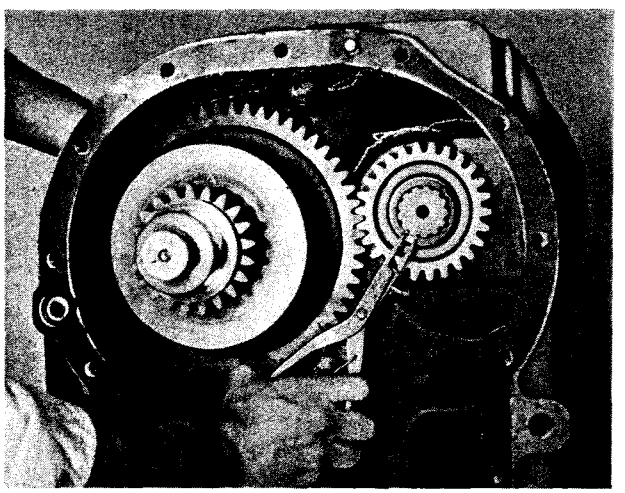


Figure 84
Install low speed drive gear and retainer ring.

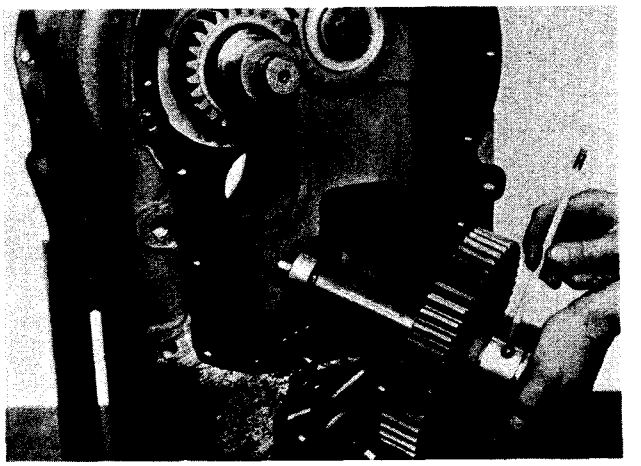


Figure 85
Install idler shaft and bearing assembly.

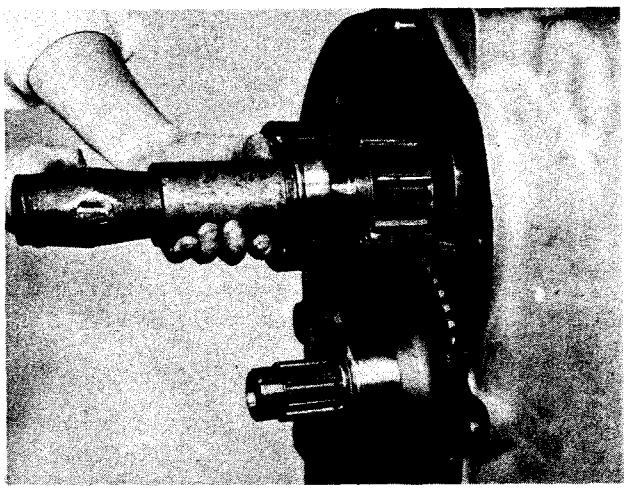


Figure 86
Install low clutch rear bearing with bearing ring groove to the rear. *NOTE: For reassembly of low clutch utilizing rear double taper bearings see page 24 (helical gears).*

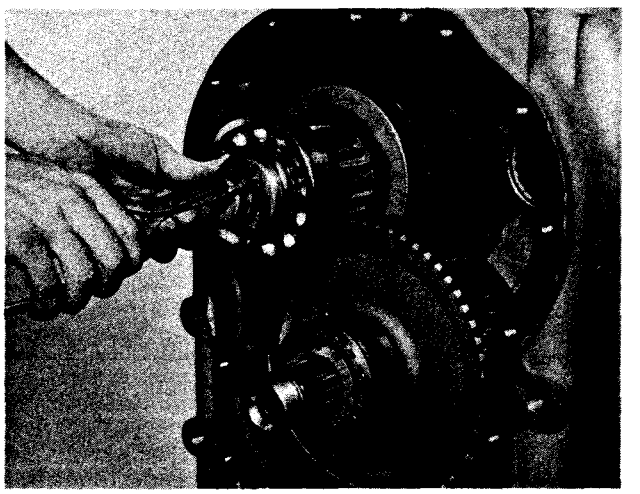


Figure 87
Install low clutch rear bearing retainer ring.

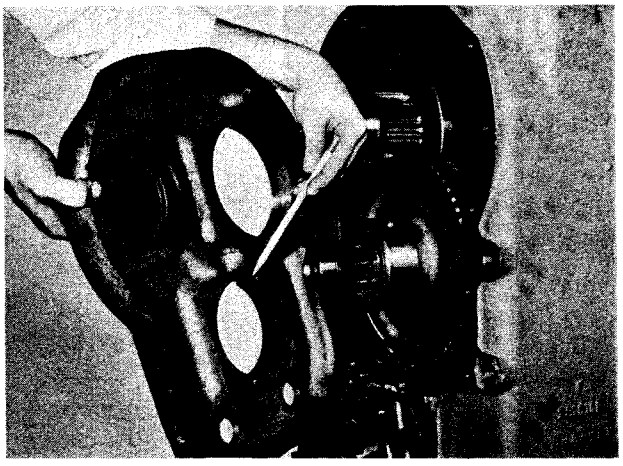


Figure 88
Position a new gasket on rear transmission case. Align lock ball in idler shaft rear bearing with notch in rear transmission cover. Tap cover in place and secure with bolts and lockwashers.

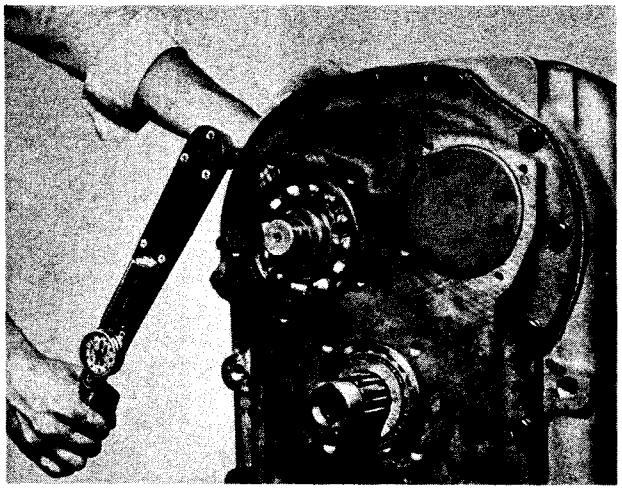


Figure 89
Torque rear cover bolts to specified torque.

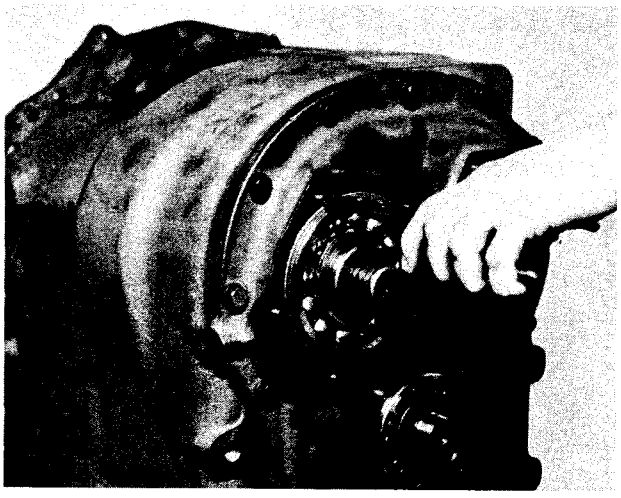


Figure 90
From front of transmission case, tap low clutch and idler shaft to rear. This will allow clearance to install rear bearing snap ring.

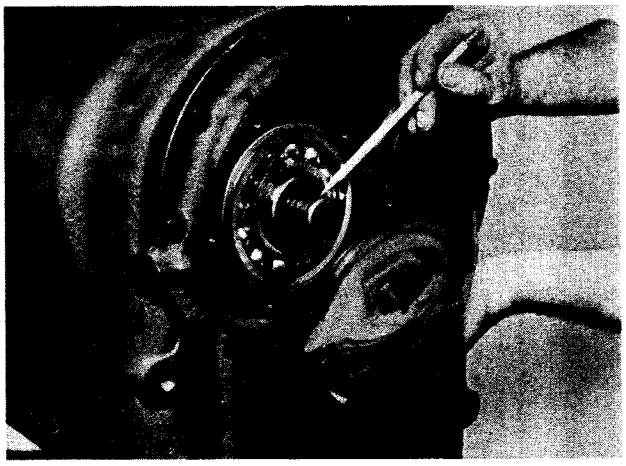


Figure 91
Install low clutch shaft piston rings. Install new gasket and O-Ring on low shaft bearing cap.

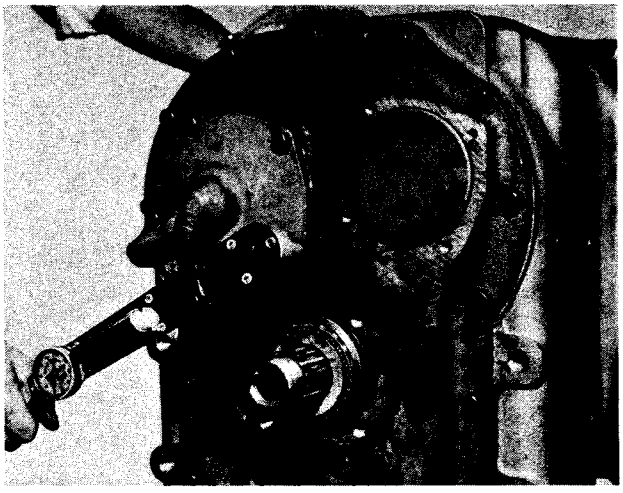


Figure 92
Install bearing cap and secure with lockwashers and bolts. Tighten to specified torque.

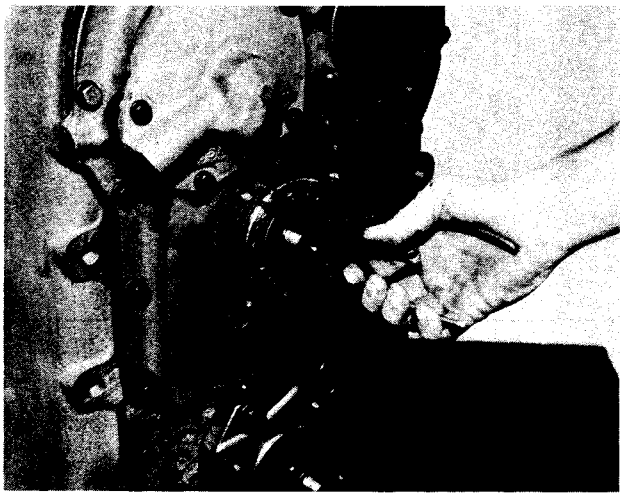


Figure 93
Install idler shaft rear bearing locating ring.

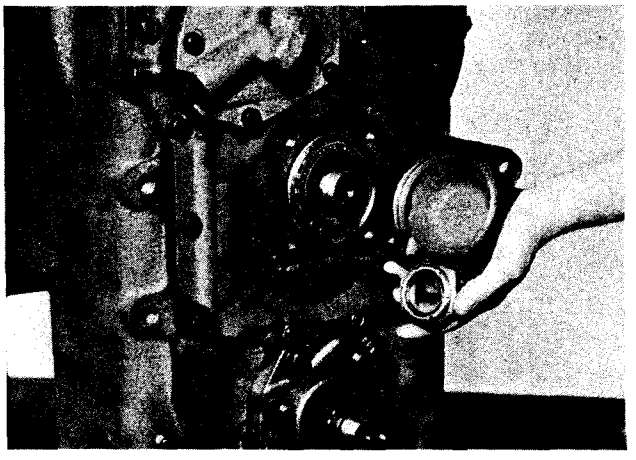


Figure 94

Install idler shaft nut. Block idler gear, tighten nut to specified torque. (See elastic stop nut torque chart.) With a new gasket in position, install idler shaft bearing cap. Tighten bolts to specified torque. If a mechanical parking brake is not used, proceed to Figure 100.

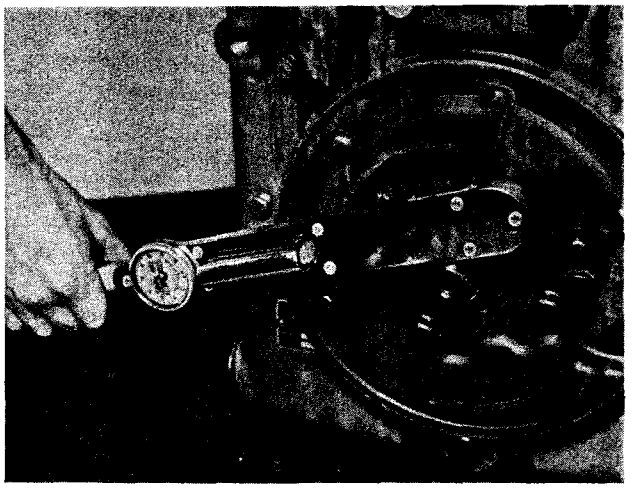


Figure 95

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



Figure 96

Position brake actuating arm.

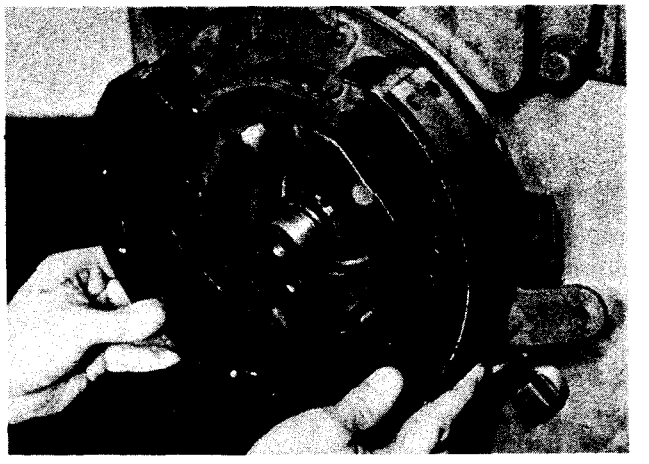


Figure 97

Locate brake shoes.

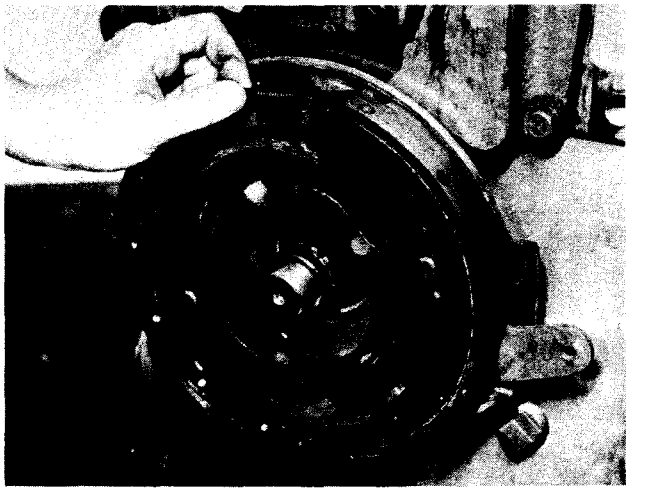


Figure 98

Install upper and lower brake shoe return springs.

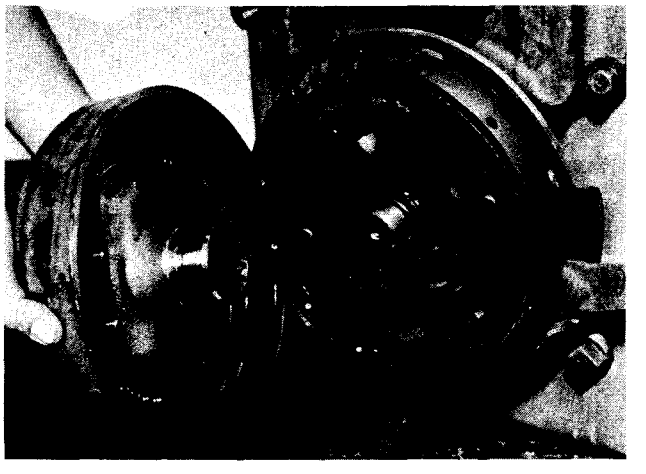


Figure 99

Install brake drum and flange assembly.

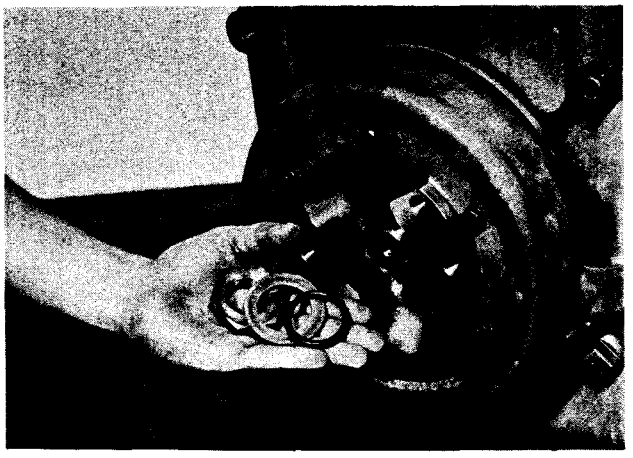


Figure 100
Secure flange with a new "O" ring, washer and flange nut. Block output shaft and tighten nut to specified torque. (See elastic stop nut torque chart.)

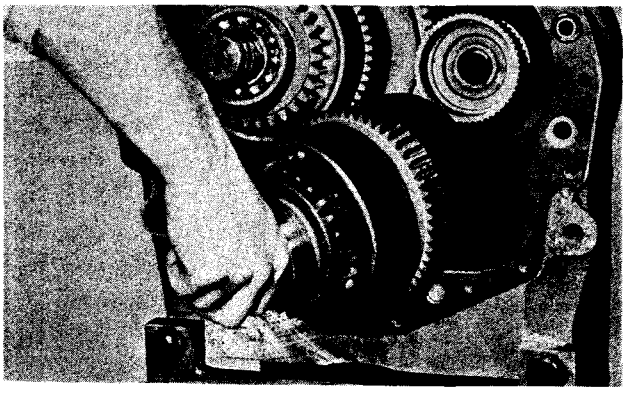


Figure 101
Install 2nd speed clutch shaft rear pilot bearing on shaft. Position forward and 2nd speed clutch on disc hub aligning splines of disc hub with internal teeth of 2nd speed clutch friction discs. Disc hub must be in full position with friction discs. Do not force this operation.

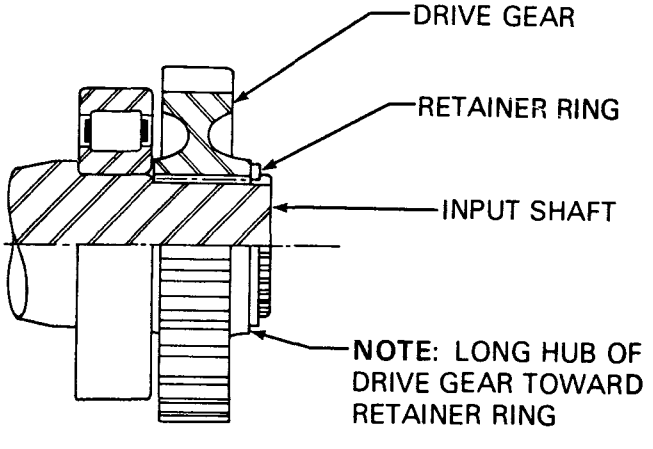


Figure 102
Input shaft, rear bearing, drive gear and snap ring.

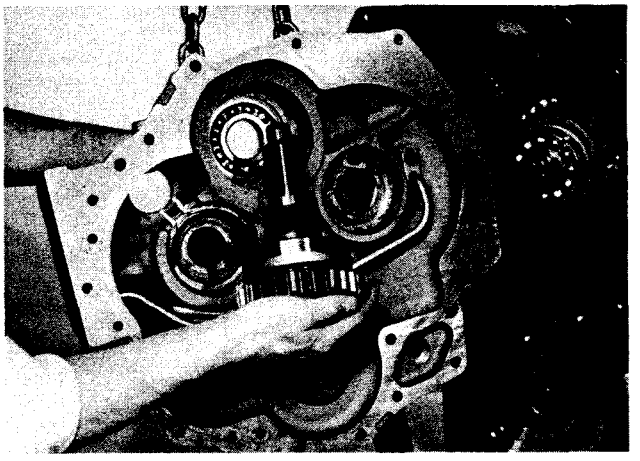


Figure 103
Install input shaft into front bearing.

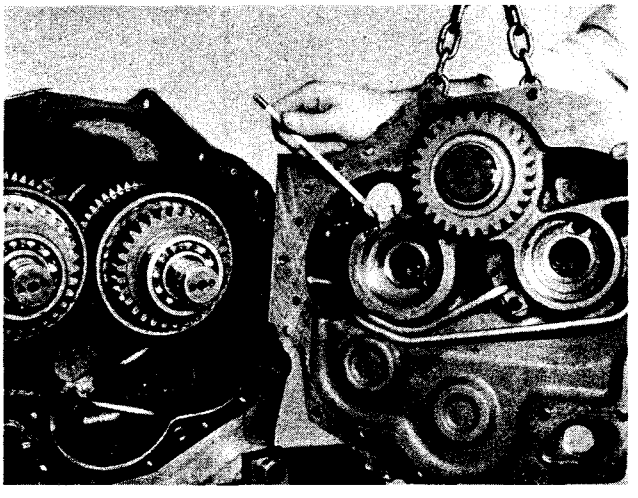


Figure 104
Forward clutch front bearing locating ring.

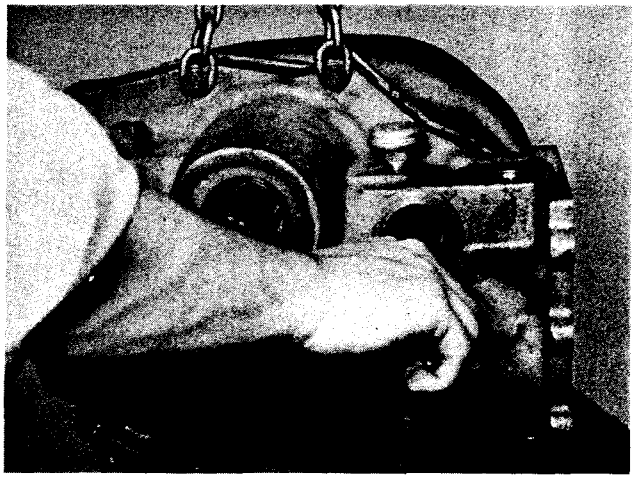


Figure 105
Support front cover with a chain fall. Spread forward clutch front bearing retainer ring. Position front cover to transmission case. Tap cover into place using caution as not to damage any of the clutch shaft piston rings.

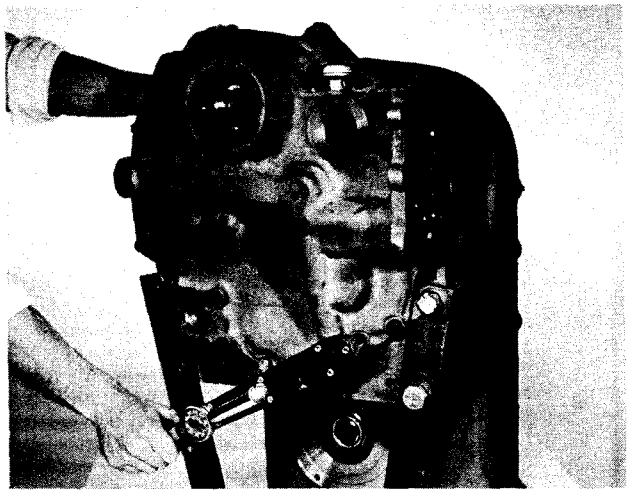


Figure 106
Install cover to case bolts. Tighten to specified torque.

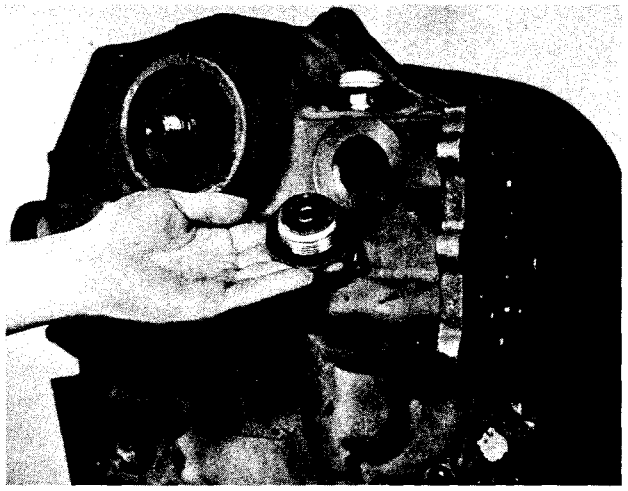


Figure 107
Install front cover plug.

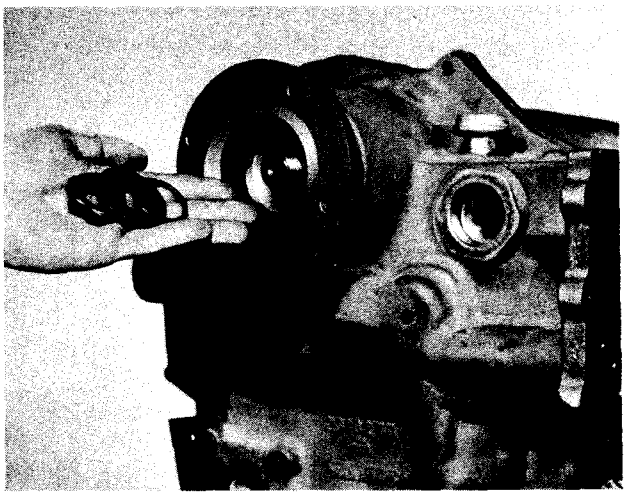


Figure 108
Install companion flange, flange "O" ring, washer and nut. Tighten standard slotted nut or elastic stop nut to specified torque. (See elastic stop nut torque chart.)

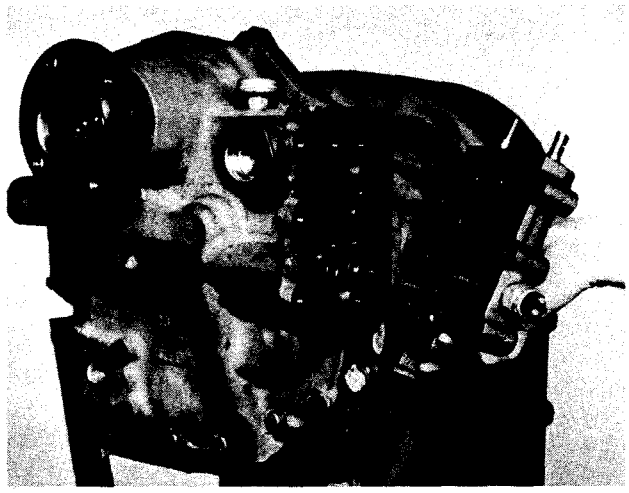


Figure 109
Locate detent balls and springs in control valve. Position new gasket. Secure valve with bolts and washers. Tighten to specified torque.

SERVICING MACHINE AFTER TRANSMISSION OVERHAUL

The transmission, torque converter, and its allied hydraulic system are important links in the drive line between the engine and 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).

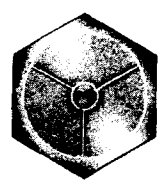
   Add quantity necessary to bring fluid level to **LOW** mark on dipstick or runs freely from **LOWER** oil level check plug hole. Install oil level plug or dipstick. Recheck with hot oil (180-200°F) [82, 2-93, 3°C].

   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

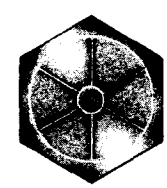
Grade 5 Identification, 3 Radial
Dashes 120° Apart on Head of Bolt



Grade 5

LUBRICATED OR PLATED

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



Grade 8

Nominal Size	Fine Thread Torque Lbs. Ft./N.m.	Coarse Thread Torque Lbs. Ft./N.m.	Fine Thread Torque Lbs. Ft./N.m.	Coarse Thread Torque Lbs. Ft./N.m.
.3125	16-20 [21,7-27,1]	12-16 [16,3-21,7]	28-32 [38,0-43,4]	26-30 [35,3-40,7]
.3750	26-29 [35,3-39,3]	23-25 [31,2-33,9]	37-41 [50,2-55,6]	33-36 [44,7-48,8]
.4375	41-45 [55,6-61,0]	37-41 [50,2-55,6]	58-64 [78,6-86,8]	52-57 [70,5-77,3]
.5000	64-70 [86,8-94,9]	57-63 [77,3-85,4]	90-99 [122,0-134,2]	80-88 [108,5-119,3]
.5625	91-100 [123,4-135,6]	82-90 [111,2-122,0]	128-141 [173,5-191,2]	115-127 [156,0-172,2]

SPECIFICATIONS AND SERVICE DATA—POWER SHIFT TRANSMISSION AND TORQUE CONVERTER

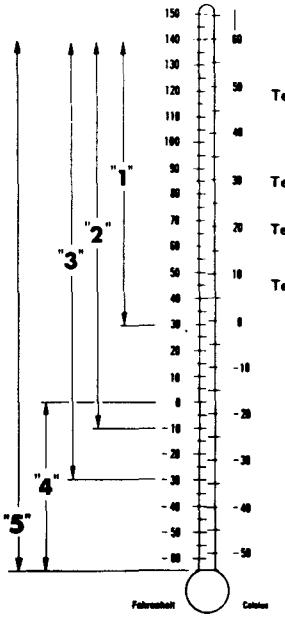
CONVERTER OUT PRESSURE	Converter outlet oil temp. 180° - 200° F. [82,3° - 93,3° C]. Transmission in **NEUTRAL.** Operating specifications: 25 P.S.I. [172,4 kPa] minimum pressure at 2000 R.P.M. engine speed **AND** a maximum of 70 P.S.I. [482,6 kPa] outlet pressure with engine operating at no-load governed 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 - 280 psi [1654,8 - 1930,5 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 POWER SHIFTED TRANSMISSION AND TORQUE CONVERTERS

Prevailing Ambient Temperature



*Dexron is a registered trademark of General Motors Corporation.

Temperature Range	"1"	(a) C-2 Grade 30 (b) C-3 Grade 30 (c) Engine Oil:-Grade 30 API-CD/SE or CD/SF (d) MIL-L-2104C-Grade 30 (e) MIL-L-2104D-Grade 30
Temperature Range	"2"	(a) MIL-L-2104C-Grade 10 (b) MIL-L-2104D-Grade 10 (c) C-2 Grade 10 (d) C-3 Grade 10 (e) Engine Oil:-Grade 10 API-CD/SE or CD/SF (f) Quintolubric 822-220 (Non Phosphate Ester Fire Resistant Fluid)
Temperature Range	"3"	(a) *Dexron (b) *Dexron II D - **See Caution Below**
Temperature Range	"4"	(a) MIL-L-46167 (b) MIL-L-46167 A
Temperature Range	"5"	(a) Conoco Polor Start DN-600 Fluid

NOTES: 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: H125, H200, H500, H600, 18000, 24000, 28000, 32000 & 34000 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 series transmissions with modulated shift use only C-3 or temperature range 3 items (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 or 16000 series power shift transmissions, or the HR28000, HR32000 & HR34000 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 Components International 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.

1. 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 parking 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 OVER-HEAT 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

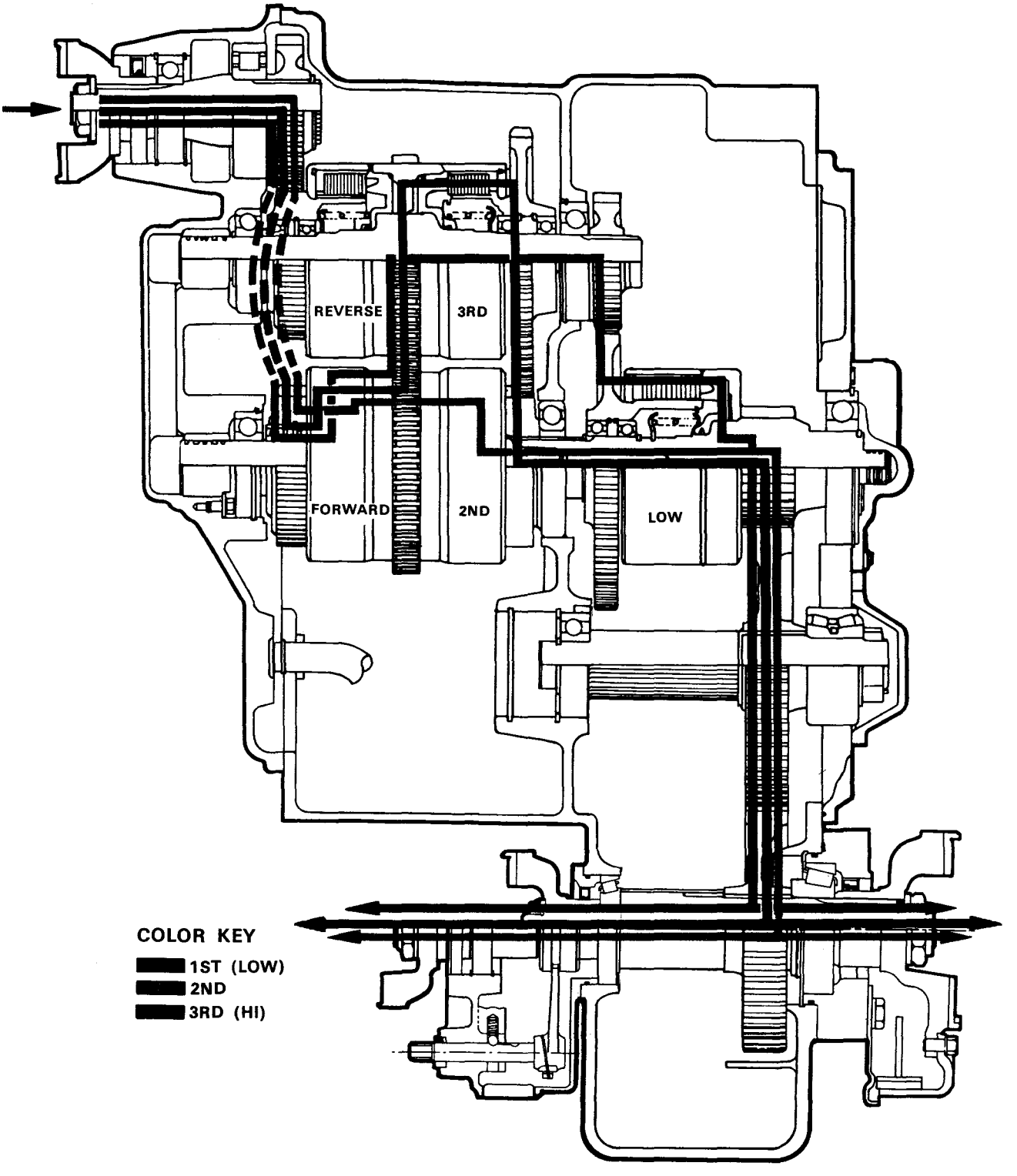
1. Worn oil sealing rings.	1. Remove, disassemble, and rebuild converter assembly.
2. Worn oil pump.	2. Replace.
3. Low oil level.	3. Fill to proper level.
4. Pump suction line taking air. (R-28000 only)	4. Check oil line connections and tighten securely.

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

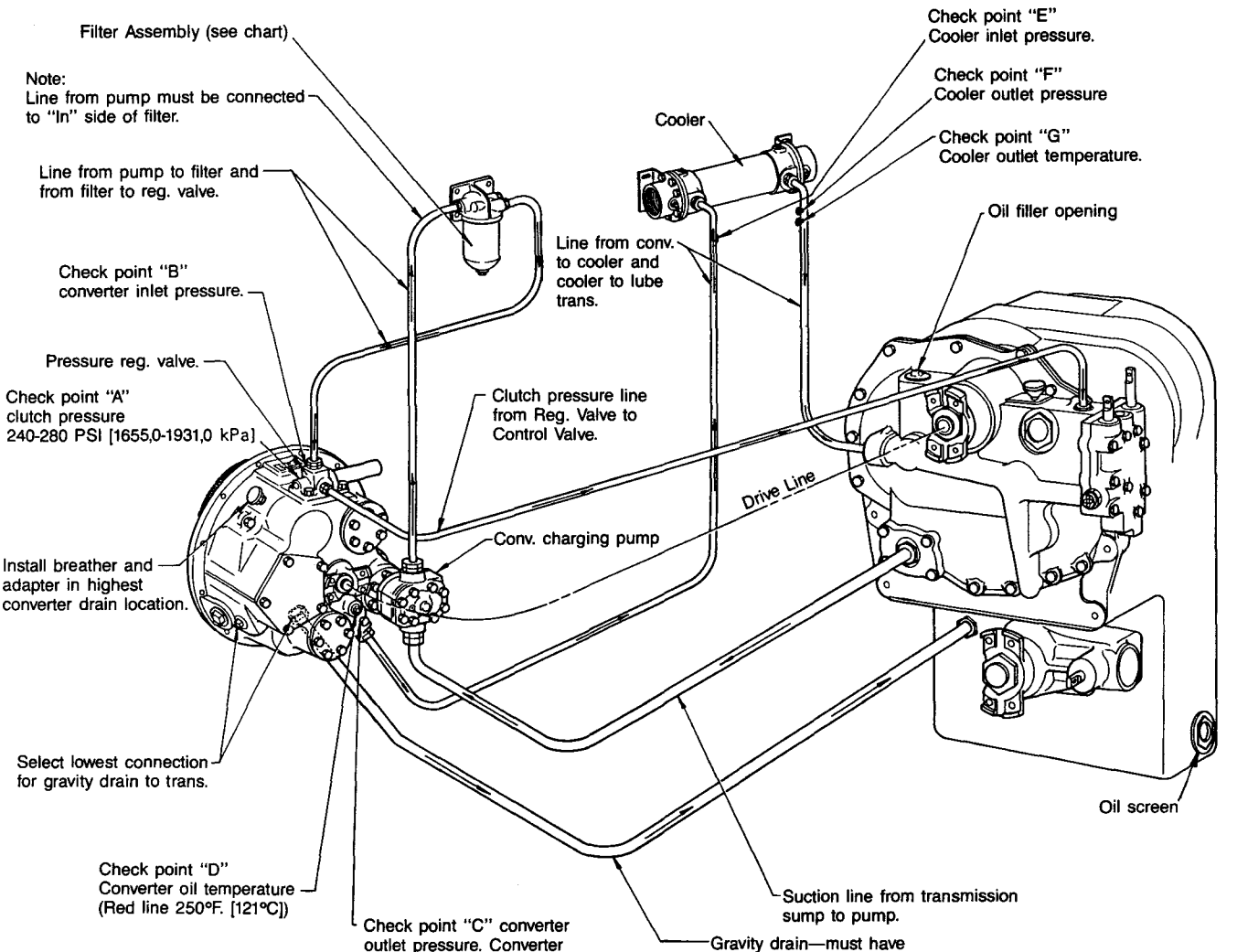
1. Low engine RPM at converter stall	1. Tune engine check governor.
2. See "Overheating" and make same checks.	2. Make corrections as explained in "Over-Heating."



R MODEL 3 SPEED TRANSMISSION

FIGURE I

R28000—C270 EXTERNAL PLUMBING DIAGRAM



Metric dimensions shown in brackets [ ].

Note: Do not deviate any line size.

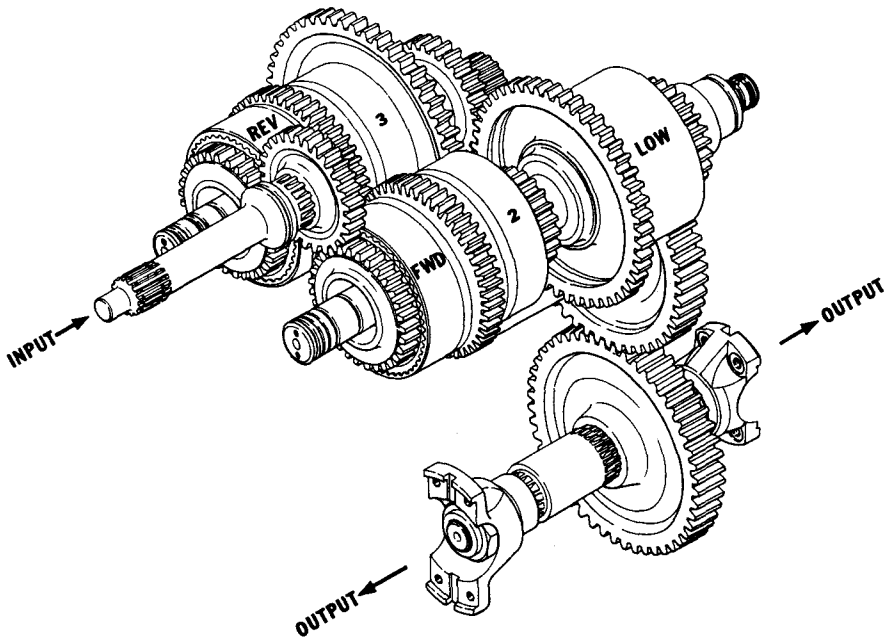
FILTER ASSEMBLY CHART

Filter Type	Assembly No.	Cartridge No.	Spin-on Type	
			Assembly No.	Element
A	1533614 Single Can	215502	243976 Single Element	243054
B	234777 Dual Can	215502	243621 Dual Element	243622

Notes:
Hose line operating requirements.

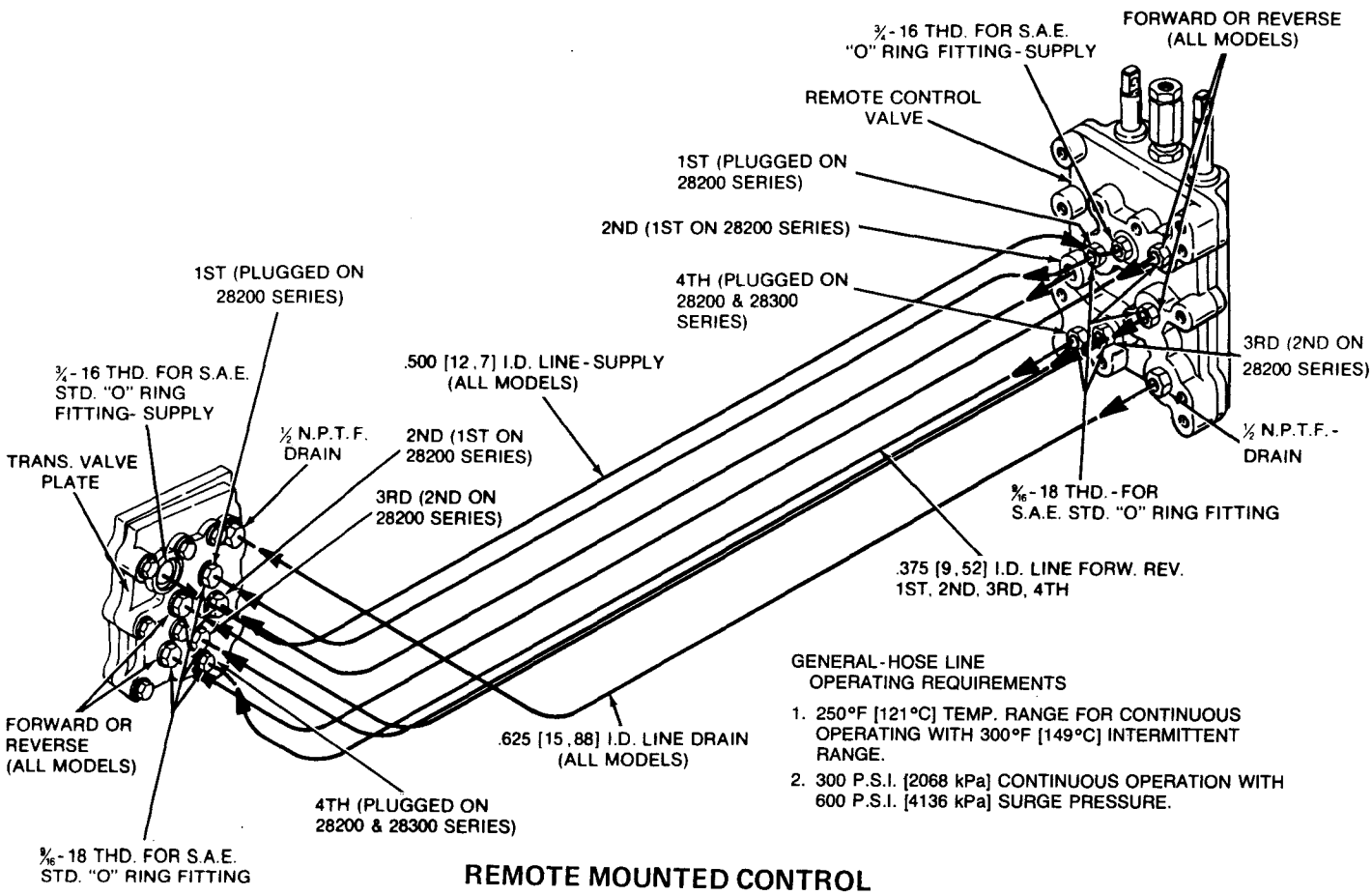
1. **Pressure Lines**—Suitable for operation from ambient to 250°F. [121,1°C] continuous operating temperature. Must withstand 300 PSI [2068 kPa] continuous pressure with 600 PSI [4137 kPa] intermittent surges. Ref. S.A.E. Spec. No. J517,100R1 Hydraulic Hose Specification.
2. **Suction Line**—To be protected 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.

FIGURE J

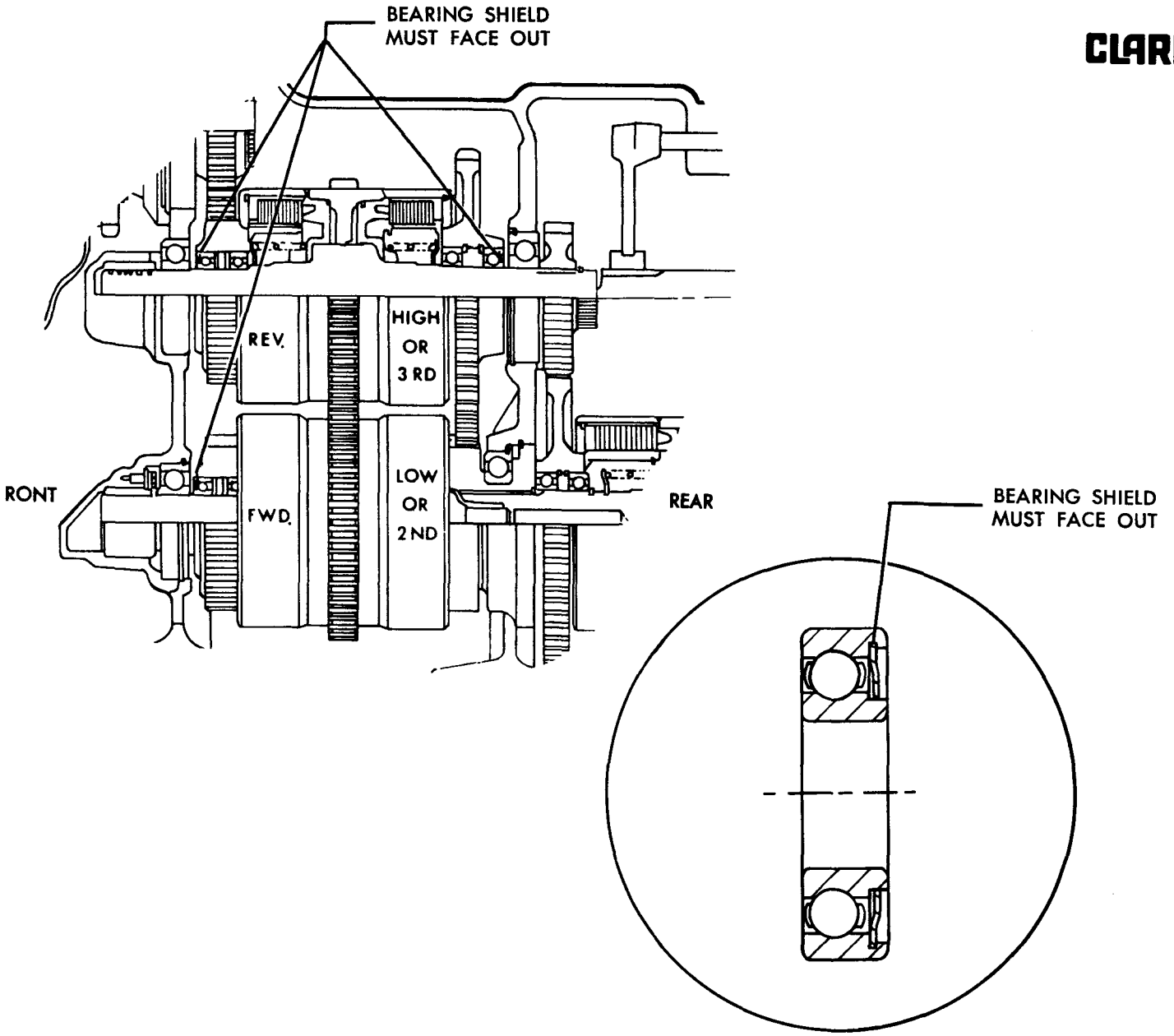


28000 SERIES - 3 SPEED
CLUTCH & GEAR ARRANGEMENT

FIGURE K



REMOTE MOUNTED CONTROL VALVE PLUMBING



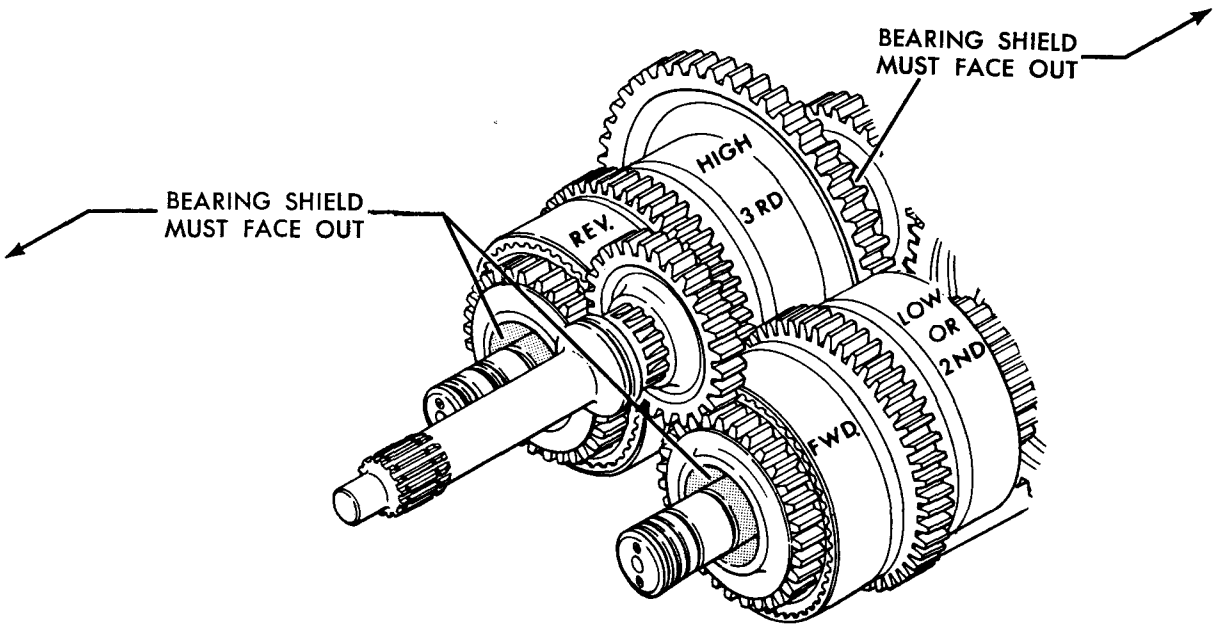


FIGURE L
SHIELDED BEARING INSTALLATION

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

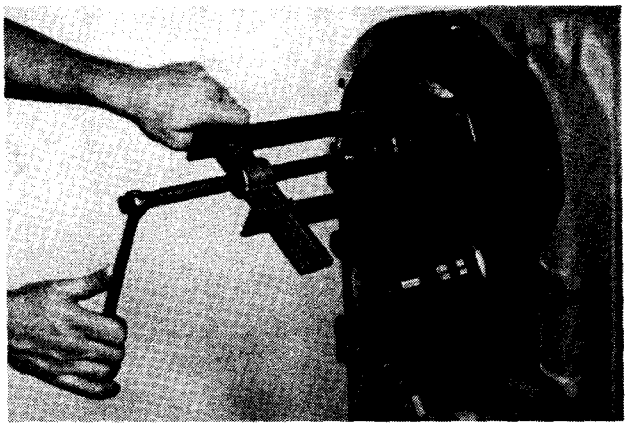


Figure A

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

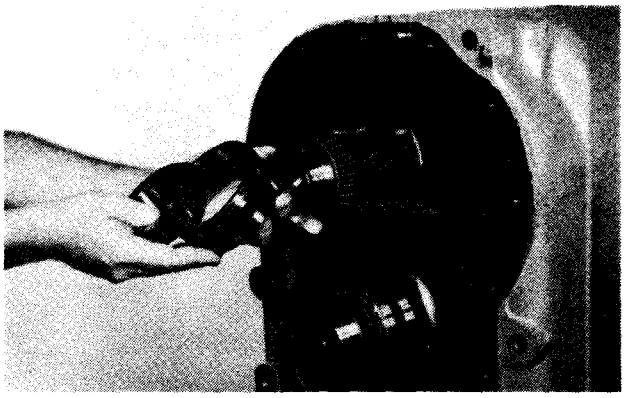


Figure B

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

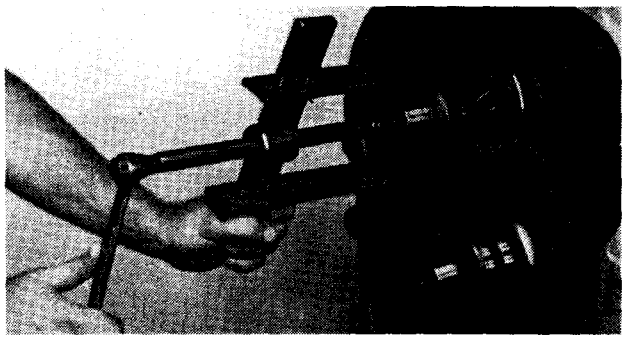


Figure C

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.

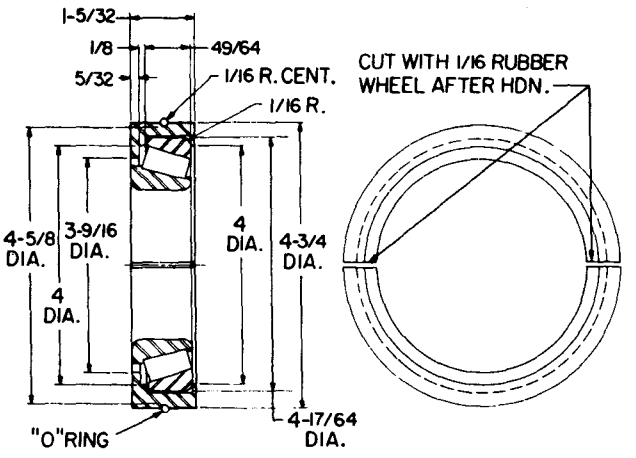


Figure D

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

REASSEMBLY

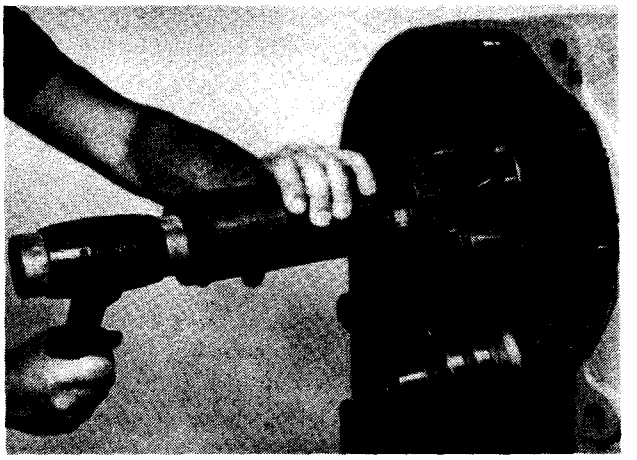


Figure E

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

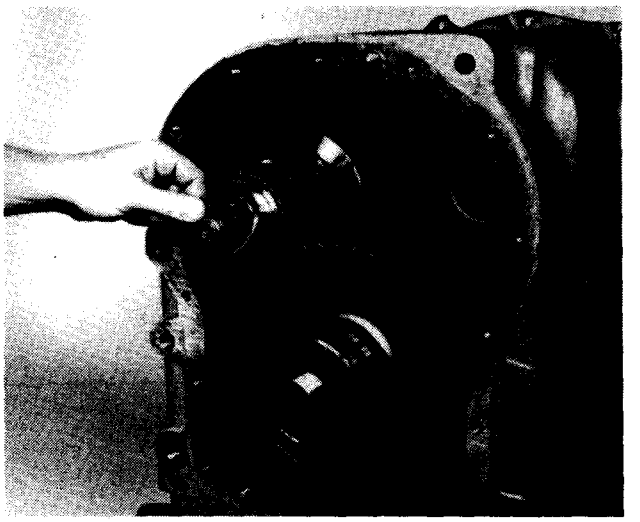


Figure F

Install bearing spacer.

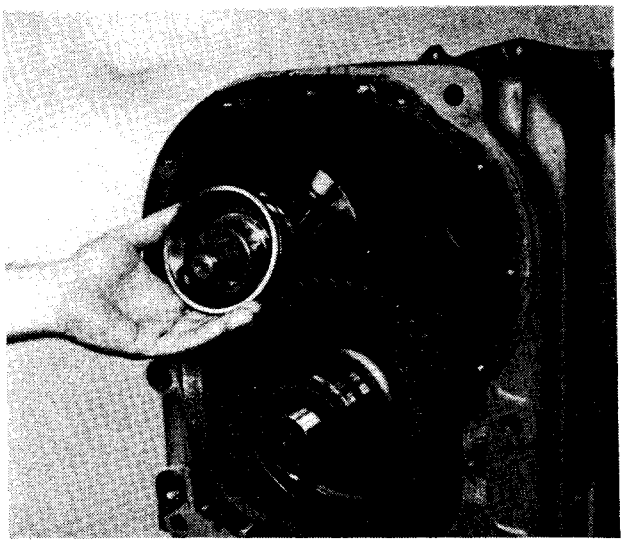


Figure G

Install bearing cup.

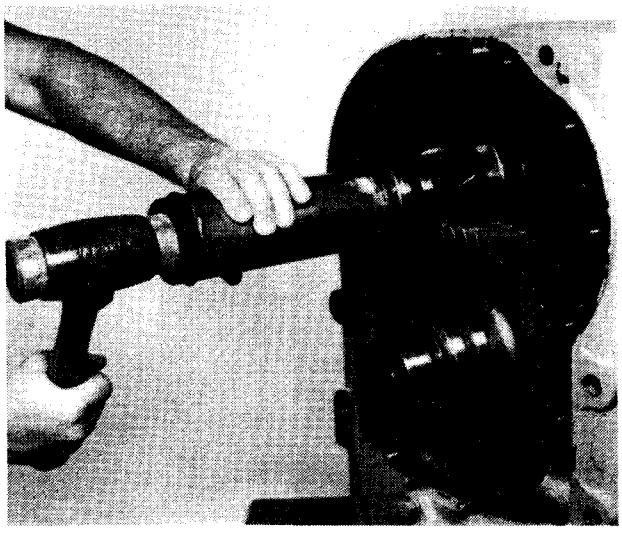


Figure H

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

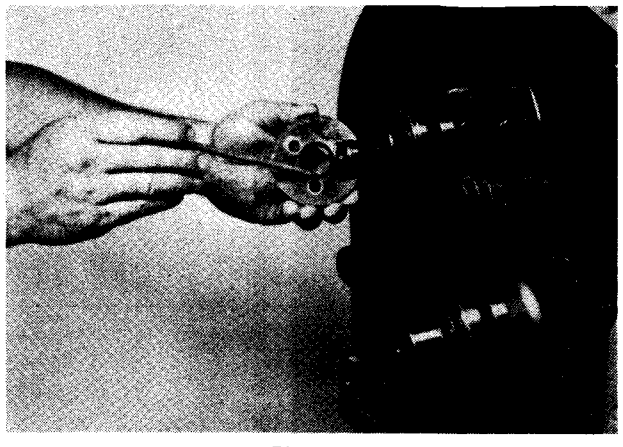


Figure I

Install retainer plate, inner diameter chamfer toward bearing.

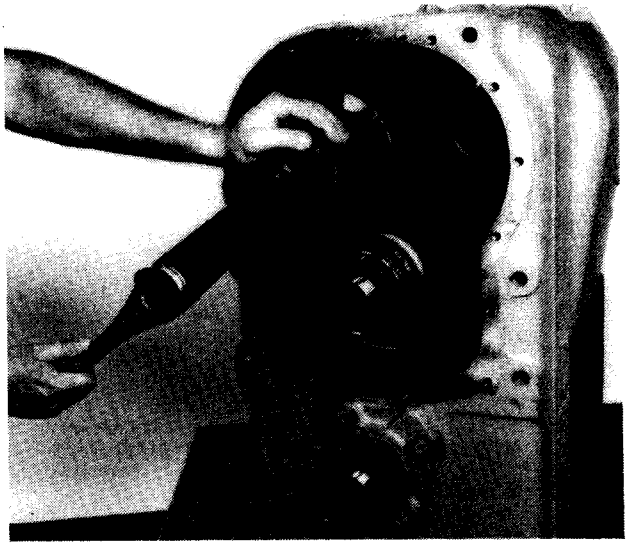


Figure J

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

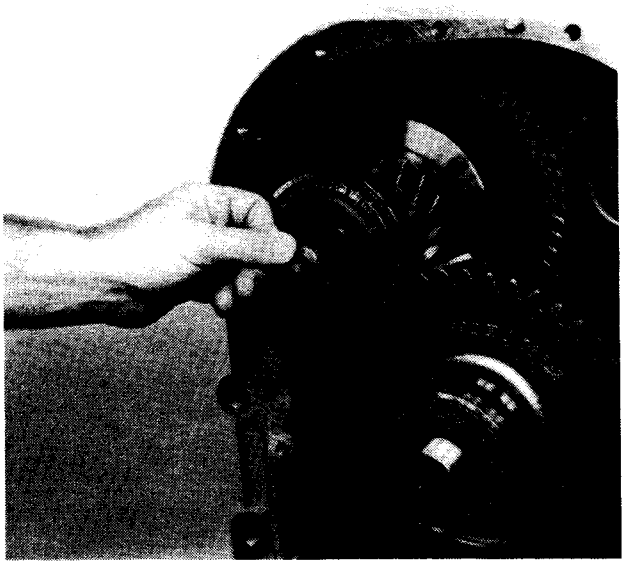


Figure K

Install low clutch shaft sealing ring.

LOW CLUTCH DISASSEMBLY UTILIZING TAPER BEARINGS IN LOW CLUTCH GEAR

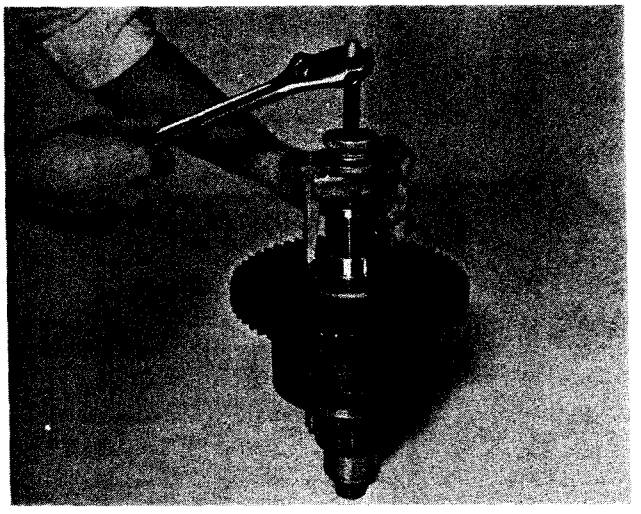


Figure 1
Remove low clutch shaft front bearing inner race.

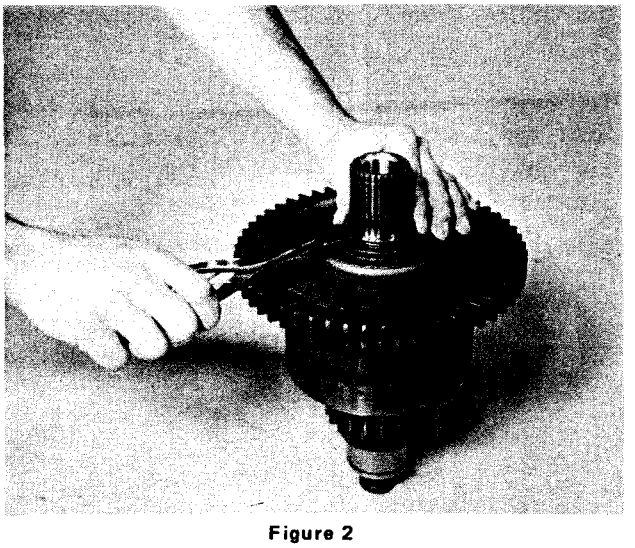


Figure 2
Remove low speed gear taper bearing retainer ring.

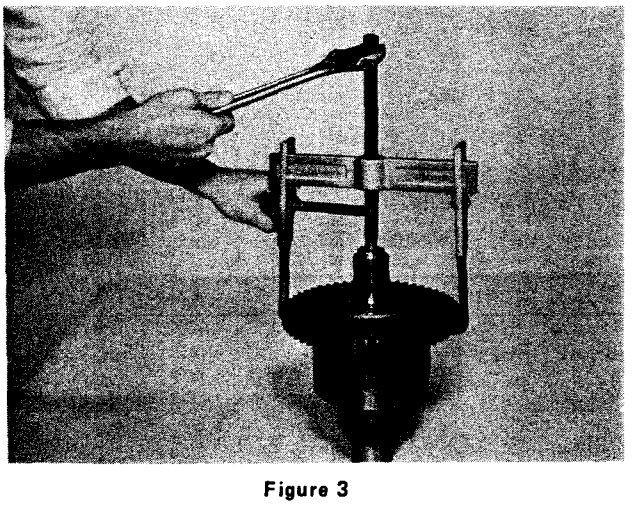


Figure 3
Remove low speed gear and outer taper bearing.

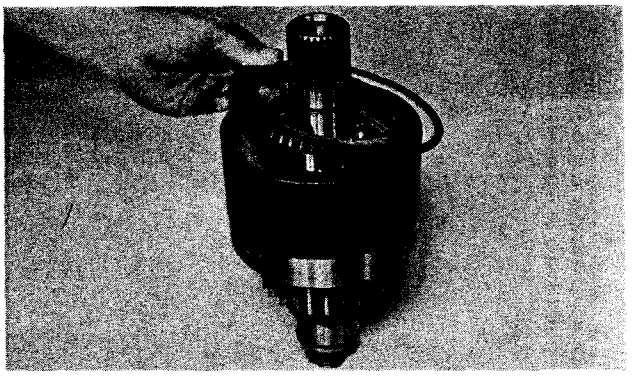


Figure 4
Remove clutch end plate retainer ring.
Remove clutch end plate and inner and outer clutch discs.

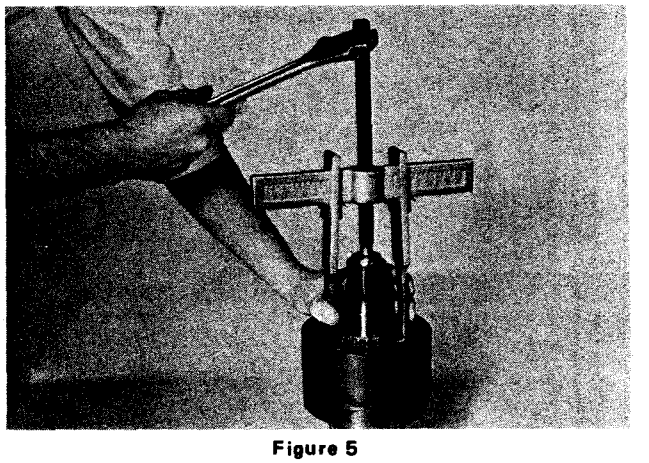


Figure 5
Remove low gear inner taper bearing.

REASSEMBLY

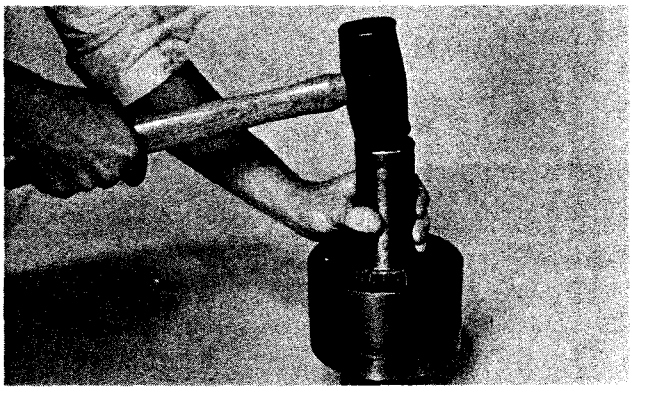


Figure 6
Install low gear inner taper bearing.
Install one steel disc.
Install one friction disc. *NOTE: The friction discs in the low clutch has a higher co-efficient rating than the friction discs in the other clutches, therefore the discs must not be mixed. The low clutch inner disc can be identified 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.

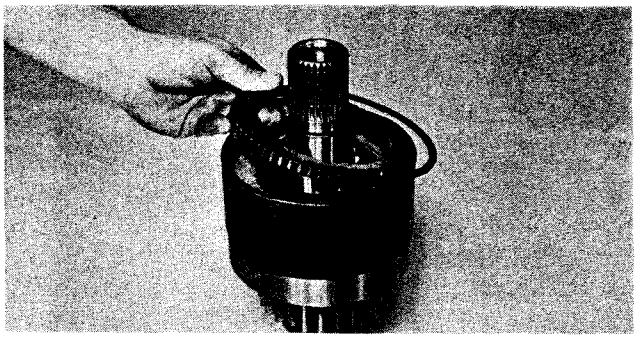


Figure 7
Install end plate and retainer ring.

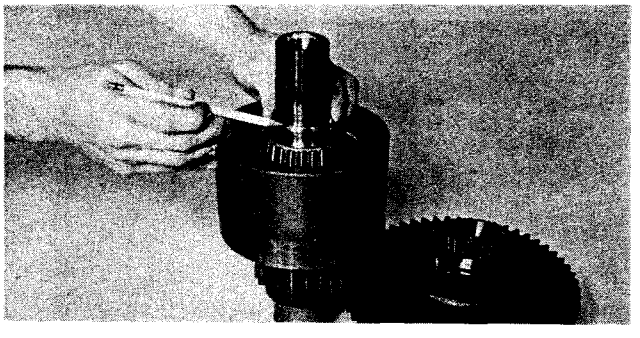


Figure 8
Install low clutch taper bearing spacer.

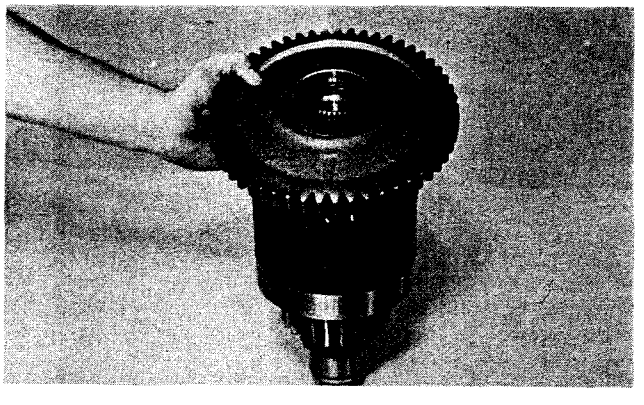


Figure 9
Install low gear into clutch drum. Align splines on low gear with internal teeth of friction discs. Tap gear into position. Do not force this operation. Gear splines must be in full position with internal teeth of all friction discs.

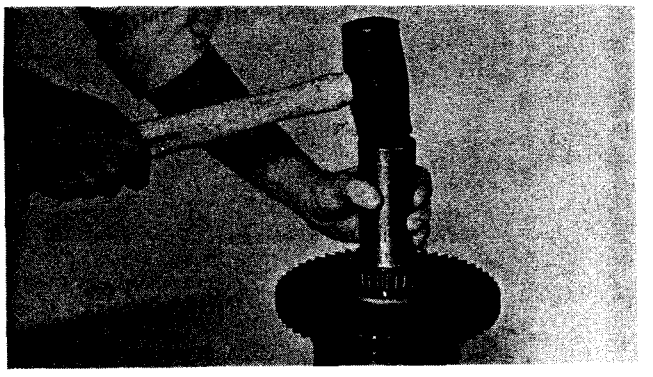


Figure 10
Install low gear outer taper bearing.

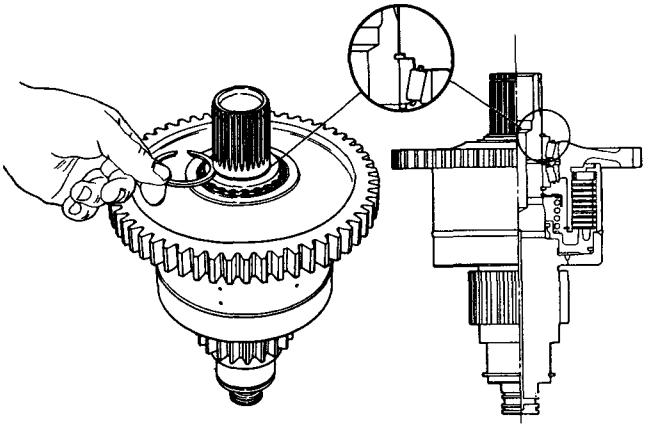


Figure 11
Install low clutch taper bearing retainer ring.
NOTE: Retainer ring is selected at assembly for proper thickness. A snap ring kit is available. Select the thickest of the three rings in the kit that can be fitted into the snap ring groove to assure a proper taper bearing tightness. Check ring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

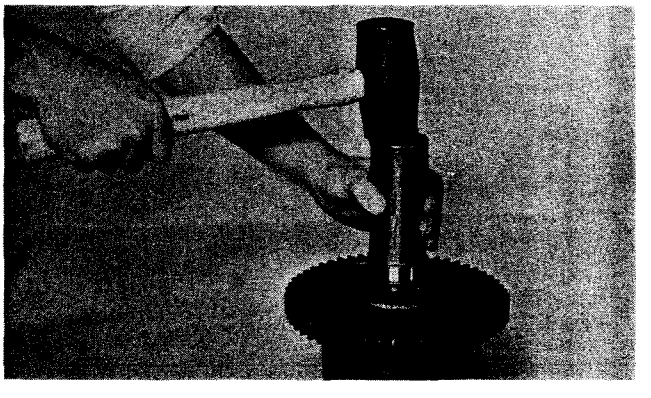
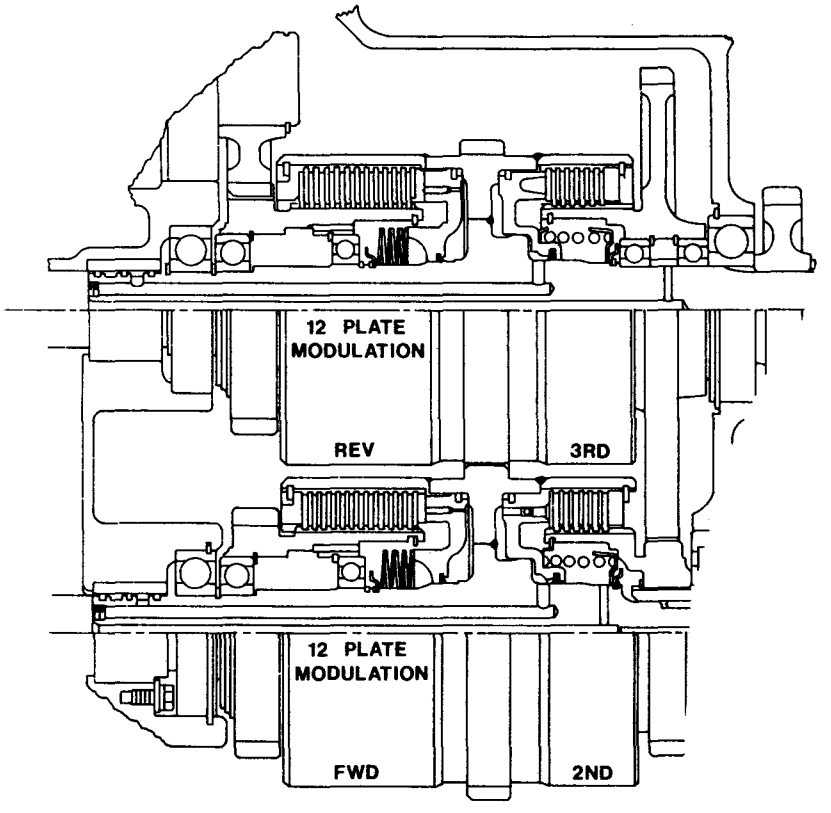
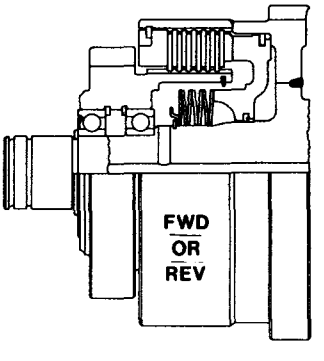


Figure 12
Install low clutch shaft front bearing inner race with large diameter of race down.

28000 CLUTCH MODULATION CROSS SECTION





6 PLATE MODULATION