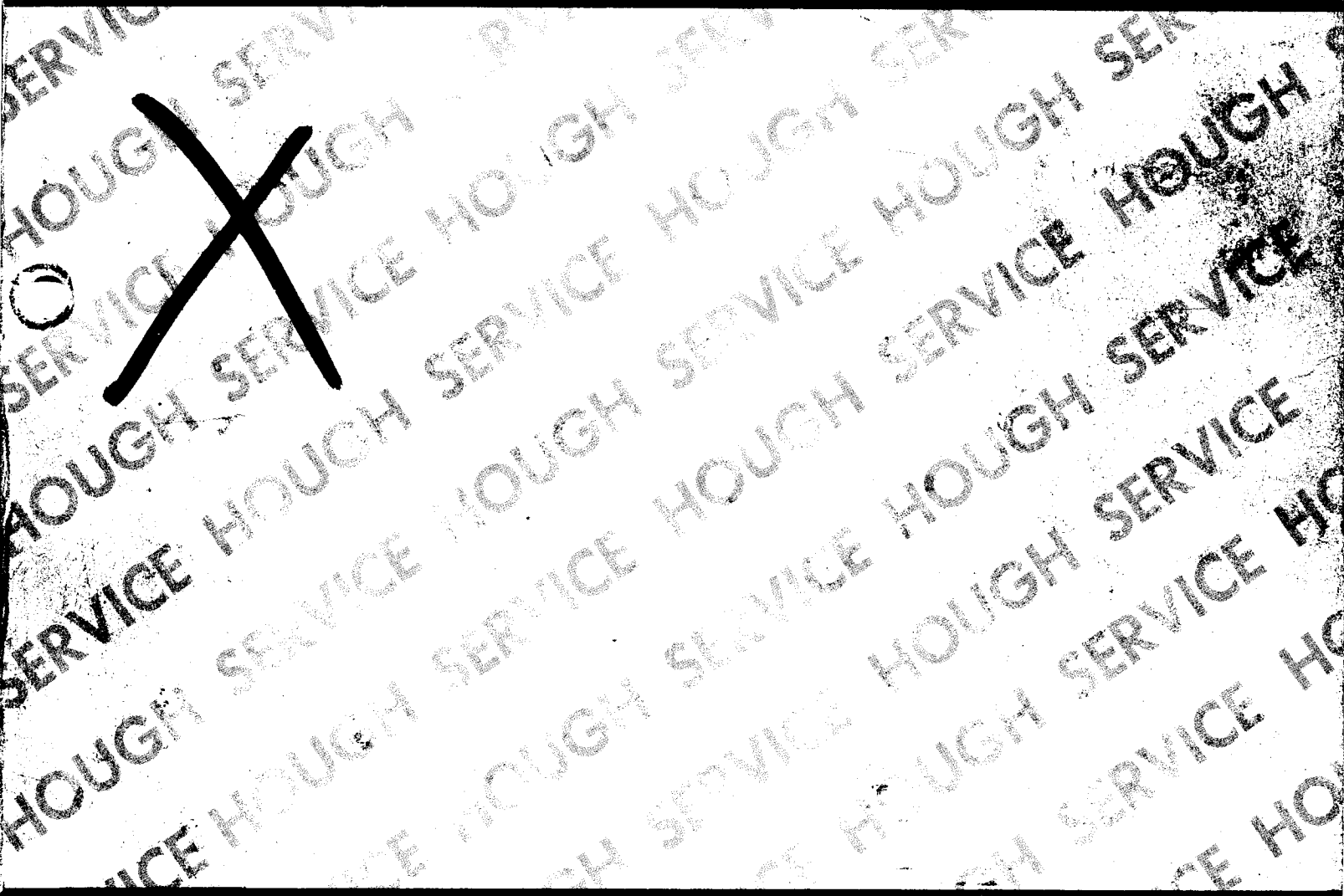
SERVICE MANUAL

ACCESSORY DRIVE AND P-2000 TRANSMISSION

MODELS

P-2001
P-2002
P-2003
P-2004



FORM
SM-TR-2000

DECEMBER 1966

INTERNATIONAL®
AND
HOUGH®
CONSTRUCTION EQUIPMENT
401 NORTH MICHIGAN AVENUE
CHICAGO, ILLINOIS 60611, U.S.A.

CONTENTS

CONTENTS

SECTION 1
GENERAL INFORMATION

TORQUE CONVERTER AND ACCESSORY DRIVE

1. DESCRIPTION

The accessory drive housing contains a single stage, single phase, three-element torque converter, an input pump and a power take-off to drive the loader system hydraulic pump and the combination power steering-cooling circuit hydraulic pump.

The torque converter couples the engine to the transmission. Understanding torque converter operation is necessary for success in isolating problems caused by the converter.

The engine exerts torque (a twisting or rotary effort) which is transmitted thru a coupling to the transmission. If the coupling is a torque con verter, it multiplies engine torque. With the converter filled with oil under pressure, the

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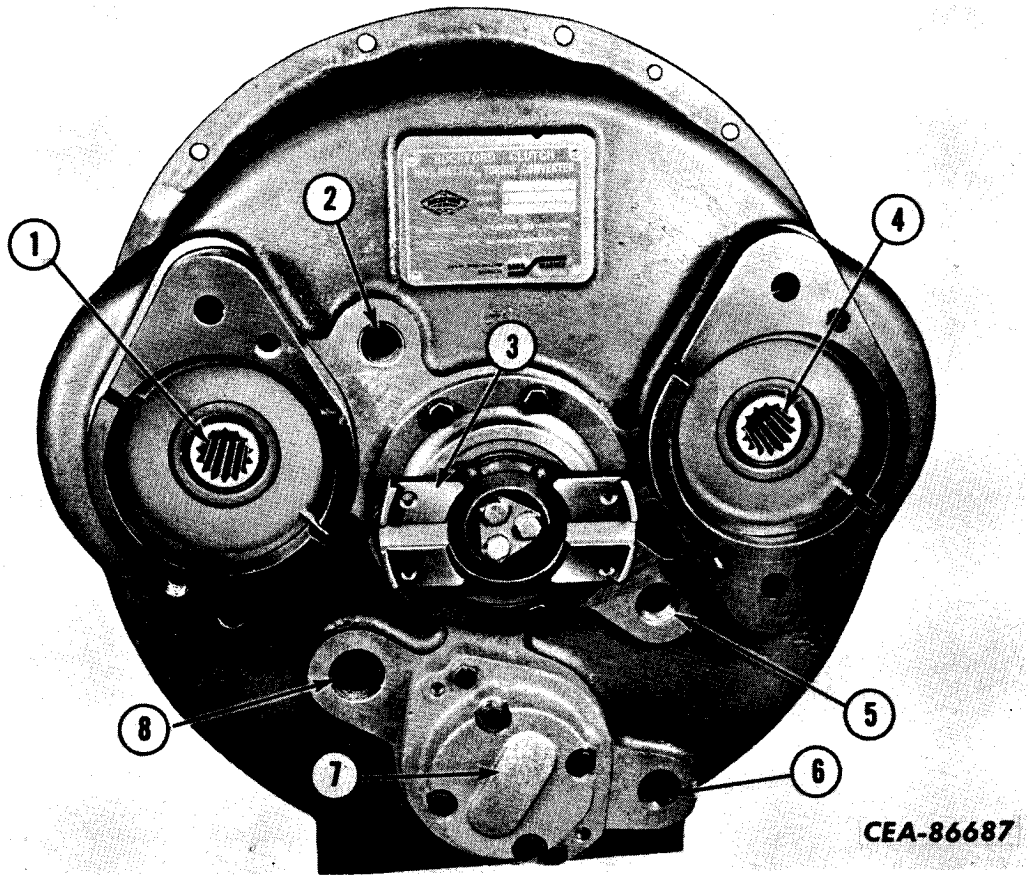

Figure 1 -1
Torque Converter and Accessory Drive - Front View.

1. Power take off for loader hydraulic pump.
2. Converter "out" port.
3. Output shaft yoke.
4. Power take off for power steering & cooling circuit hydraulic pump.
5. Converter "in" port.
6. Input pump pressure port.
7. Input charging pump.
8. Input pump suction port.

TORQUE CONVERTER AND ACCESSORY DRIVE

1. DESCRIPTION - Continued

engine drives the converter impeller. The oil is accelerated as it travels from inner to the outer diameter of the impeller, thereby imparting kinetic energy (energy due to the oils motion and weight) to the oil. This oil in motion is directed to the turbine. The force of the oil moves or attempts to move the turbine. At stall condition, with the turbine stationary and the impeller turning, the force of the oil on the turbine is maximum. With the turbine stationary, no power is transmitted to the transmission.

Oil leaving the turbine, contains kinetic energy. The stator redirects the flow of oil from the turbine to the impeller in a manner that adds speed to the imparted oil. This flow speed is at a maximum at stall condition. The pressurized fluid is received at the turbine entrance where the curve of the turbine blades changes the direction of flow to the exit. Oil entering and leaving the turbine applies pressure in the same direction of rotation. These two pressures plus the increasing speed of the oil through the impeller result in multiplication of engine torque at the turbine output shaft.

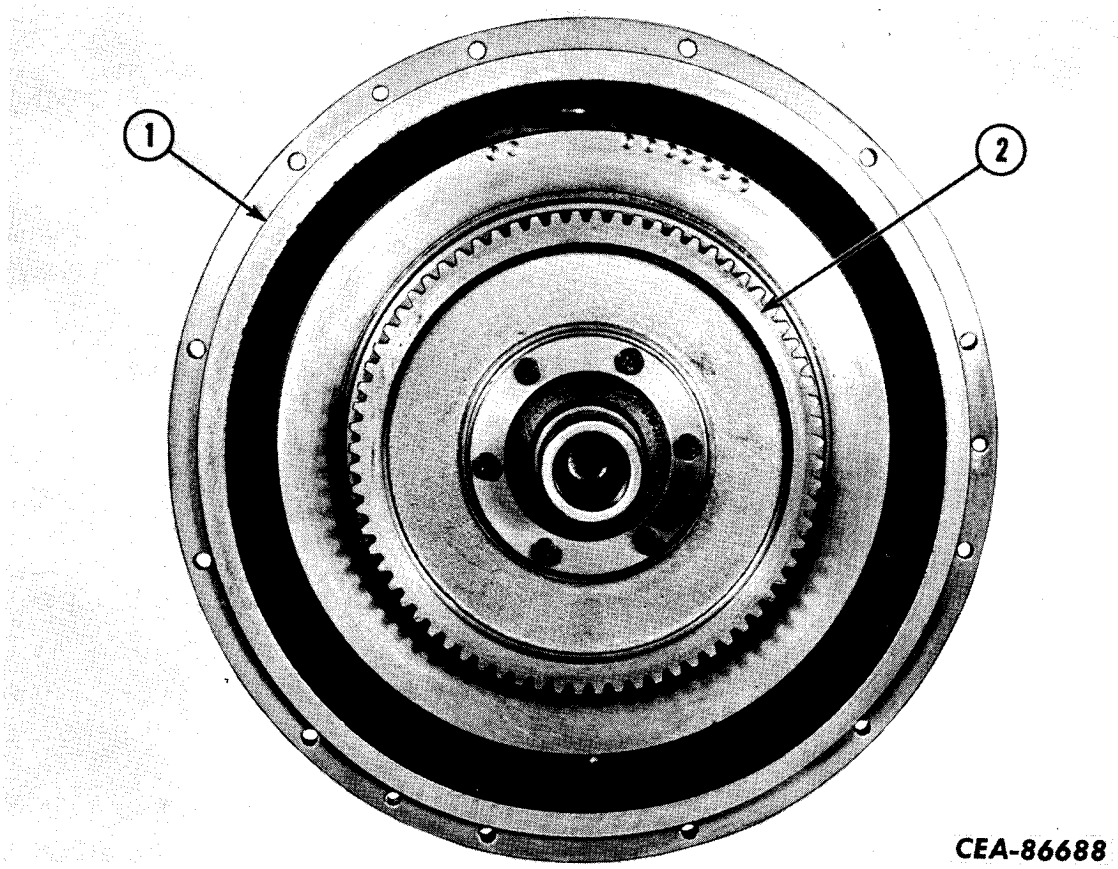

Figure 1 -2
Torque Converter and Accessory Drive - Rear View.

1. Converter Housing
2. Drive Housing

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As the turbine begins moving, output speed increases and torque multiplication decreases until turbine and impeller become a fluid coupling.

If a load is placed on the output shaft of the turbine, the turbine slows down and torque multiplication begins. The turbine will continue to slow down until torque multiplication meets load demands or maximum torque multiplication stall condition is reached. This automatic feature of the converter, always adjusting itself to the torque and speed demands of the output shaft, assures that load demands are being met in infinite variations.

As previously stated, this is a three element converter. The elements are impeller, turbine and stator (Fig. 1-3). The impeller is fixed to the engine drive shaft, and turns at engine rpm. It is the imput element. The turbine is fixed to an output shaft which, in turn, is attached to the transmission. The turbine is turned by oil flowing from the impeller and is the output element. The stator is fixed to the accessory drive housing and acts as a fulcrum on which torque multiplication becomes possible.

IMPELLER ELEMENT

The impeller is the input element of the converter. It is mechanically attached to the engine. The impeller contains blades which extend from the inner to the outer diameter. These blades impart power from the engine to the turbine through the movement of oil.

TURBINE ELEMENT

The turbine is opposite the impeller and is fixed to the output shaft of the converter. The curved blades of the turbine receive oil from the impeller element. Because of the design of the blades, pressure applied by the oil uses the blades as levers to impart torque to the output shaft.

STATOR ELEMENT

The stator is positioned between the inner diameter of the turbine and impeller and is fixed to the accessory drive housing. Oil leaves the turbine in the opposite direction to the flow of oil entering the impeller. The curved blades of the stator redirect the flow of oil back to the impeller in the direction the pump is turning.

2. OIL FLOW

CONVERTER CHARGING PUMP

An oil pump is mounted on the bottom front face of the accessory drive housing. It furnishes oil necessary to charge the main transmission clutch circuits and charge lube circuits. Oil also flows from this pump through the converter as follows:

Oil to cool and charge the converter follows a passage through the hub (42, Fig. 1-3) and emerges immediately in front of the forward turbine support bearing. Passing through the bearing the fluid enters the area at the back of the stator (5). A gap between the stator and impeller allows the fluid to enter the base of the impeller. From this point of entrance the fluid begins its circuit through the vaned members.

Fluid leaving the turbine passes between the turbine and the stator to the spacer (12) at the rear base of the stator. Slots in the spacer allows the oil to flow into the space between the O. D. of the output and the I. D. of the hub. Fluid leaves the converter through a passage in the hub base. This passage is connected to the converter out oil line.

TORQUE CONVERTER AND ACCESSORY DRIVE

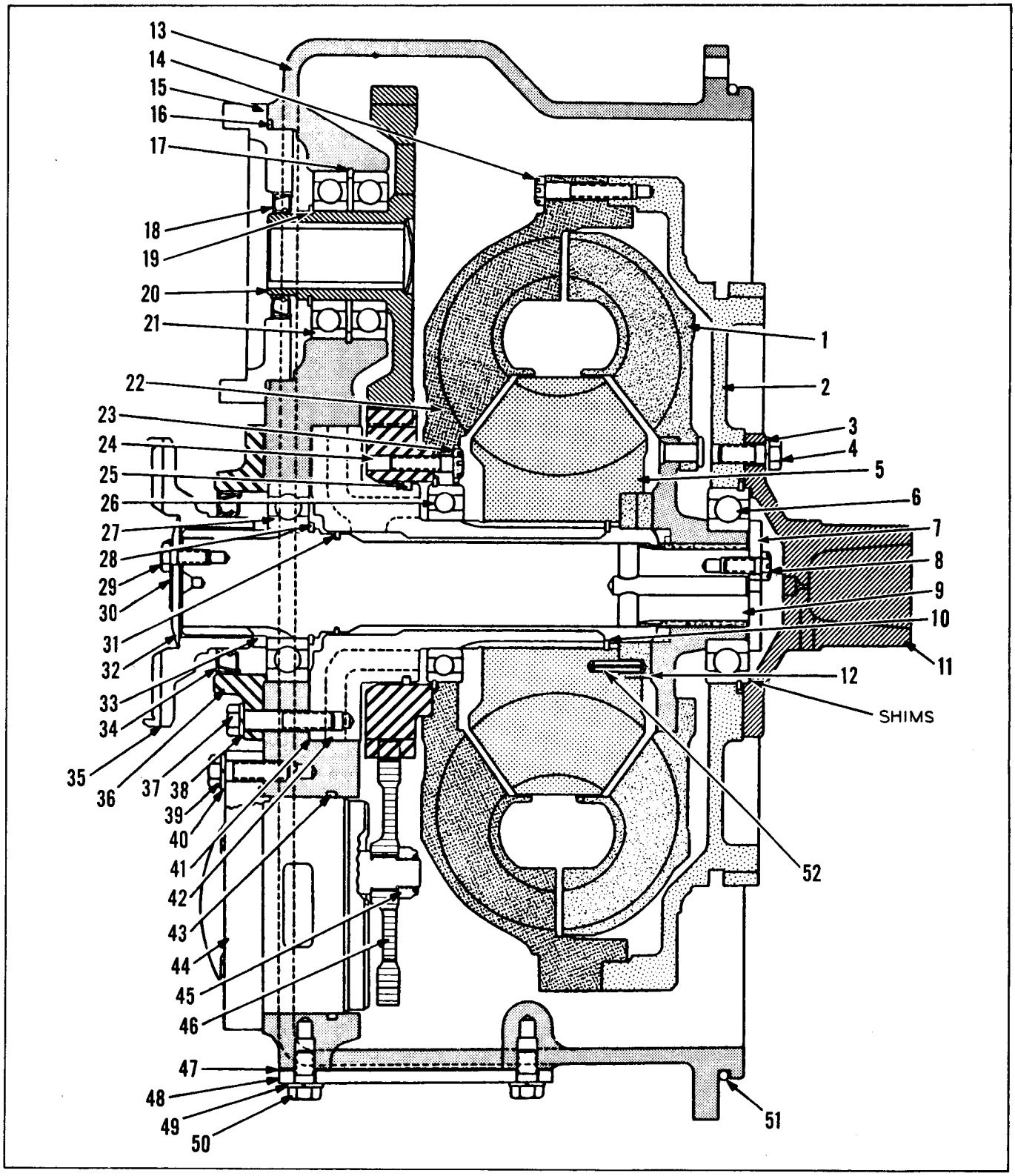


Figure 1-3
Torque Converter and Accessory Drive.

TORQUE CONVERTER AND ACCESSORY DRIVE

Legend for Fig. 1-3

1. Turbine.
2. Drive housing.
3. Lock washer.
4. Cap screw.
5. Stator.
6. Bearing.
7. Washer.
8. Cap screw.
9. Output shaft.
10. Snap ring.
11. Input hub.
12. Spacer.
13. Housing.
14. Cap screw.
15. Adapter.
16. "O" ring.
17. Snap ring.
18. Oil seal.
19. Snap ring.
20. Hydraulic pump drive gear assembly.
21. Bearing.
22. Impeller.
23. Cap screw.
24. Accessory drive gear.
25. Seal ring.
26. Bearing.
27. Bearing.
28. Snap ring.
29. Cap screw.
30. Locking plate.
31. Seal ring.
32. Washer.
33. Spacer.
34. Oil seal.
35. Output yoke.
36. Retainer.
37. Cap screw.
38. Lock washer.
39. Cap screw.
40. Lock washer.
41. Gasket.
42. Ground sleeve hub.
43. "O" ring.
44. Input charging pump.
45. Nut.
46. Input pump driving gear.
47. Gasket.
48. Inspection cover.
49. Lock washer.
50. Cap screw.
51. Seal ring.
52. Dowel pin.

3. POWER TAKE-OFF

The power take-off gear, fixed to the torque converter impeller drives a pair of pump gears mounted to the accessory drive housing. The loader system hydraulic pump and the power steering pump are splined to the hubs of the pump gears.

A drive ring, bolted to the engine flywheel, propels the converter drive housing through an integral gear (2). Bolted to the drive housing is the impeller (22). Enclosed within the drive housing and the impeller are the turbine (1) and the stator (5). The turbine is supported by a large ball bearing (6) and the output shaft (9). The stator is splined to the hub (42).

An accessory drive gear (24), bolted to the impeller, drives the two hydraulic pump drive gears (20). The converter charging pump (44) is also driven by the accessory drive gear.

TORQUE CONVERTER AND ACCESSORY DRIVE

4. IMPELLER SELECTION

Torque converters have to be matched to the engine and application. The H-120 "PAY-LOADER" converter uses impeller A which gives a torque multiplication of 3.5:1. The D-120 "PAYDOZER" converter uses impeller B with a 2.8:1 torque multiplication.

It is not practical to use impeller A in "PAY-DOZER" operations nor impeller B in "PAY-LOADER" operations.

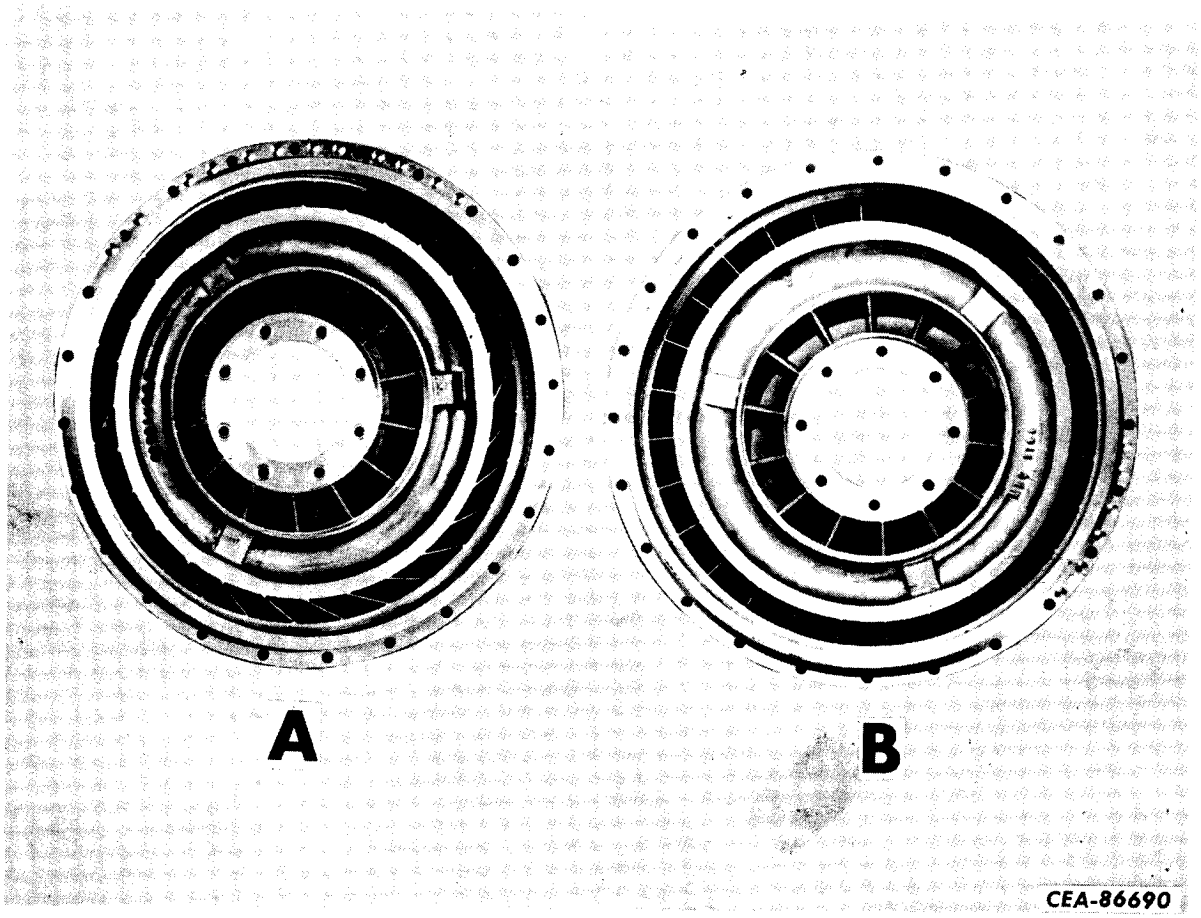
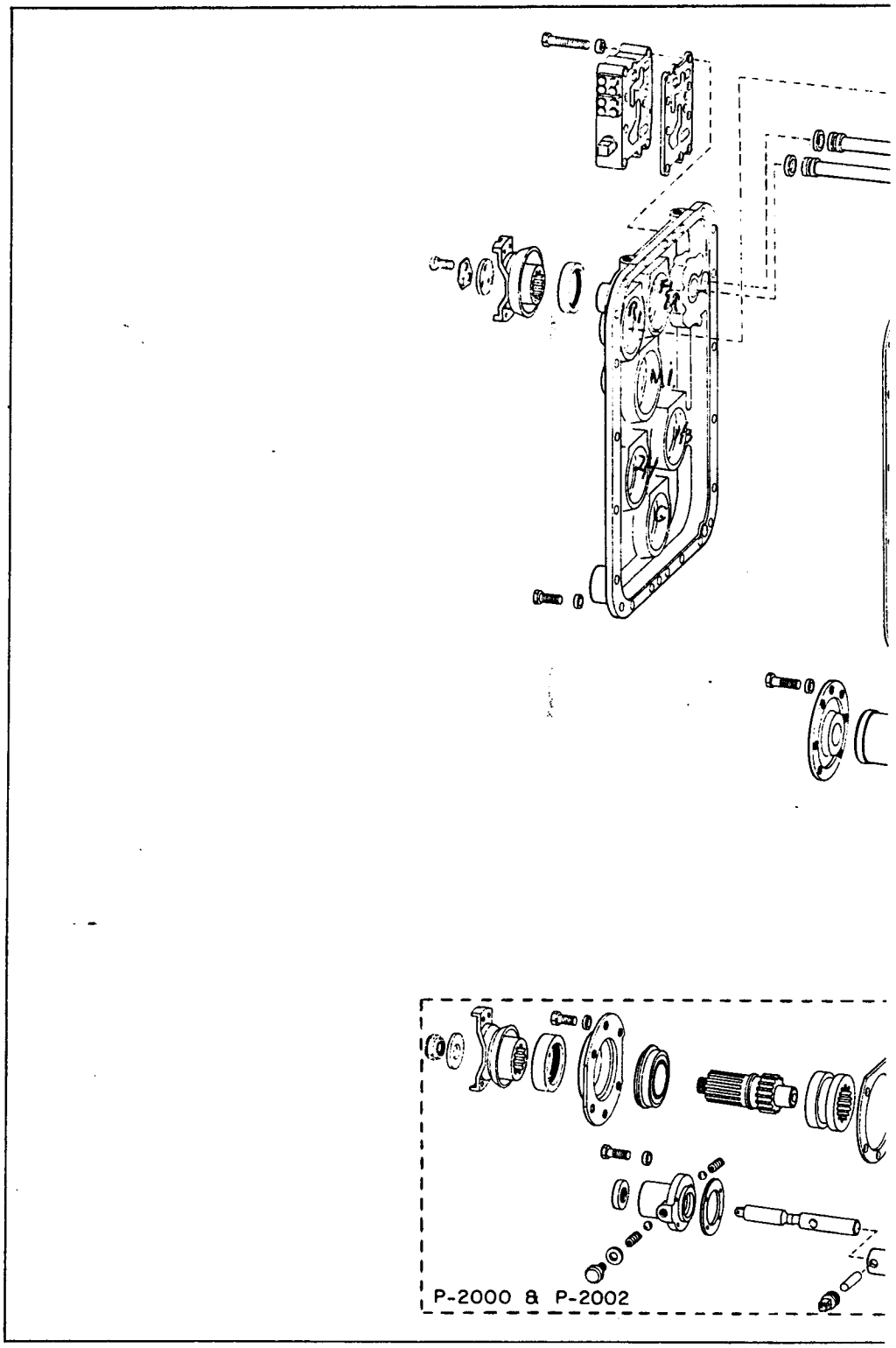


Figure 1-4
Impeller (Pump Element) Selection.


P-2000 & P-2002

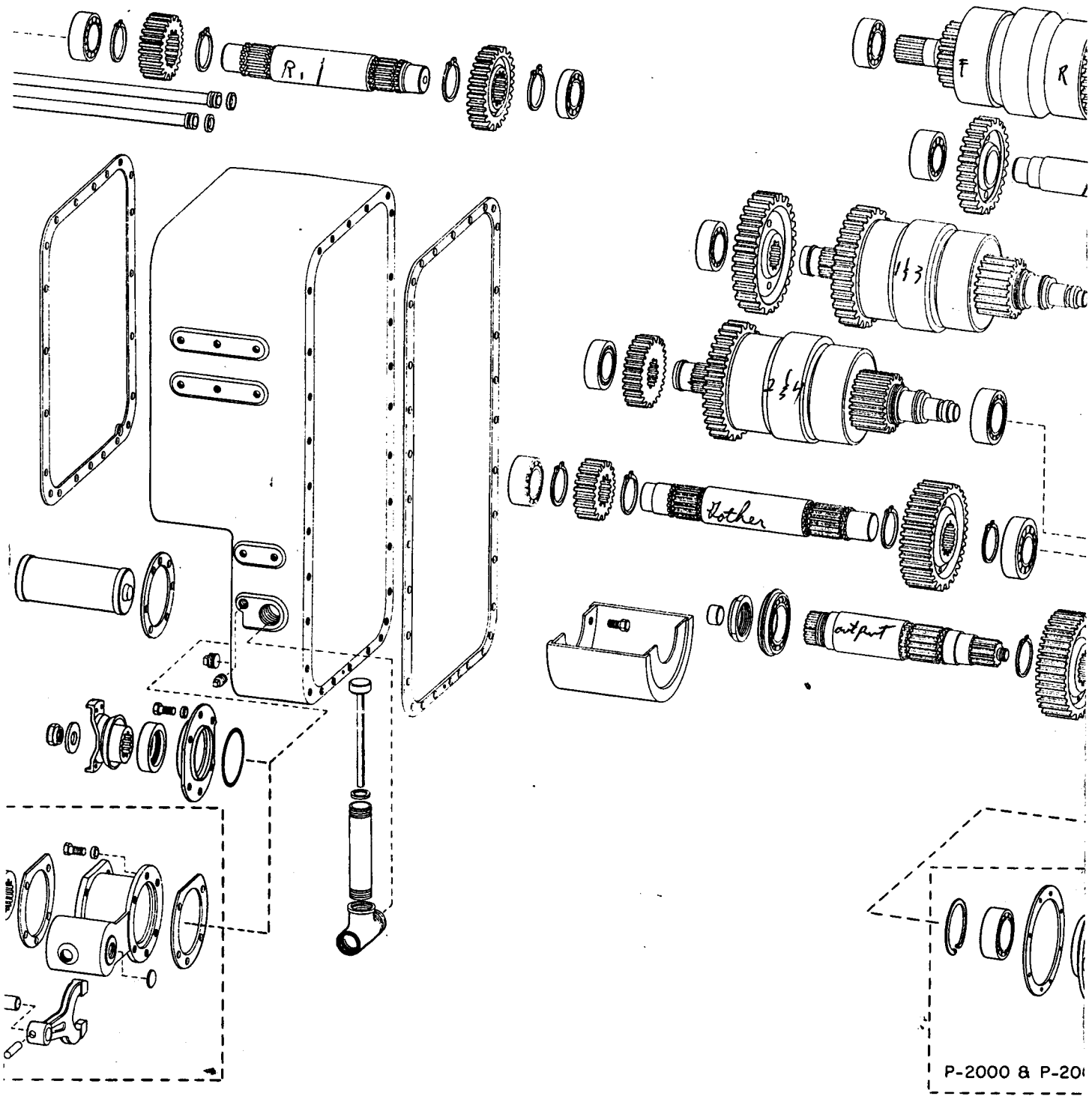
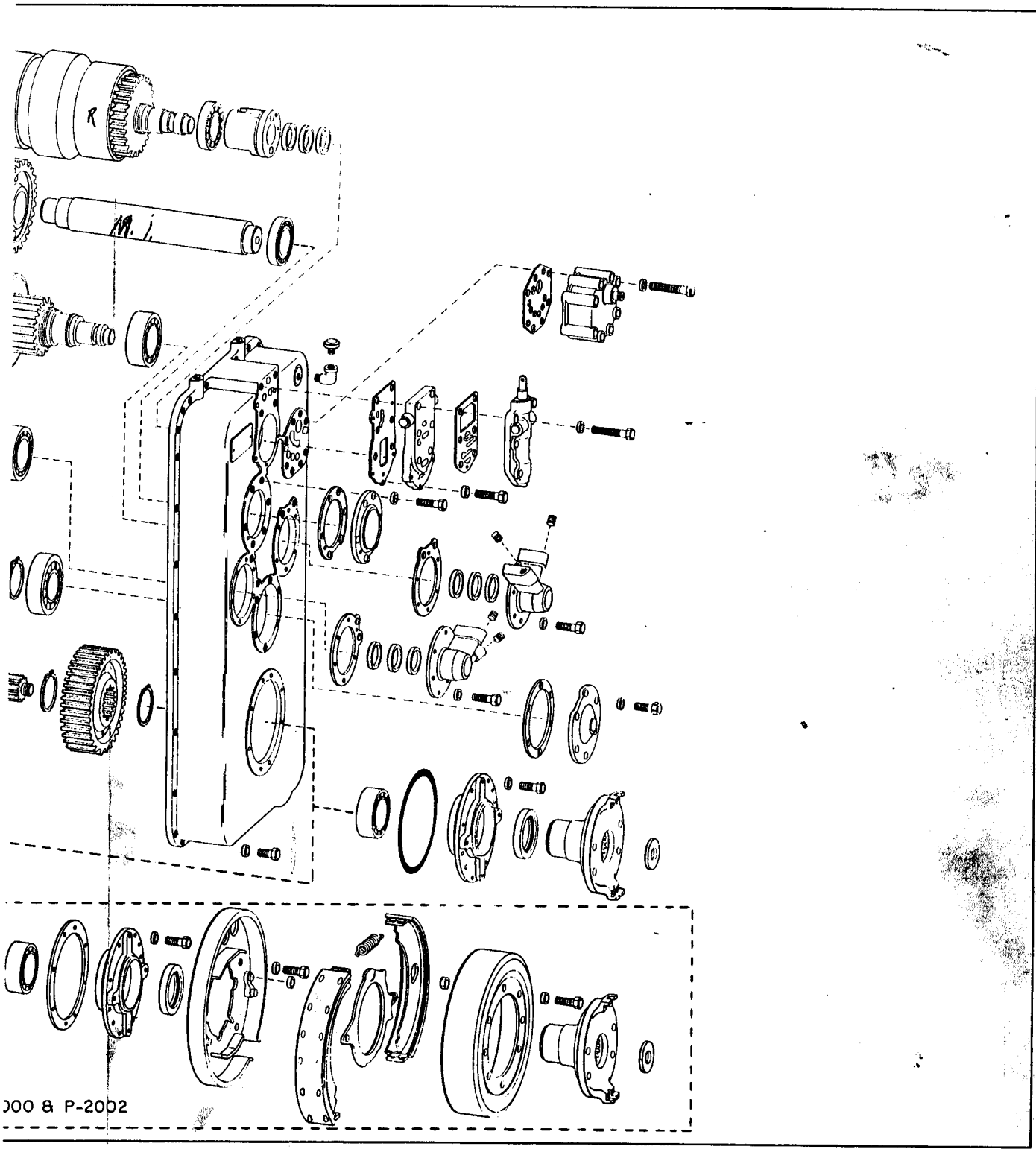


Figure 1-5
Exploded View of Transmission.



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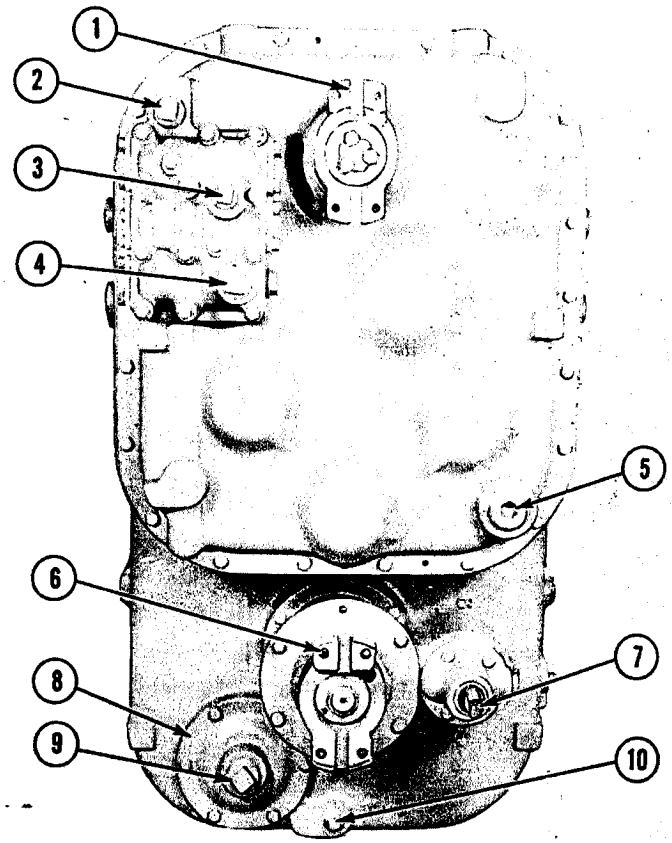

Figure 1-6
Rear View of Transmission.

1. Input Flange
2. Pump Discharge
3. Converter In
4. From Cooler
5. Converter Housing Drain
6. Rear Output Flange
7. Rear Axle Disconnect
8. Sump Oil Screen
9. Pump Suction
10. Transmission Drain

TORQUE CONVERTER AND ACCESSORY DRIVE

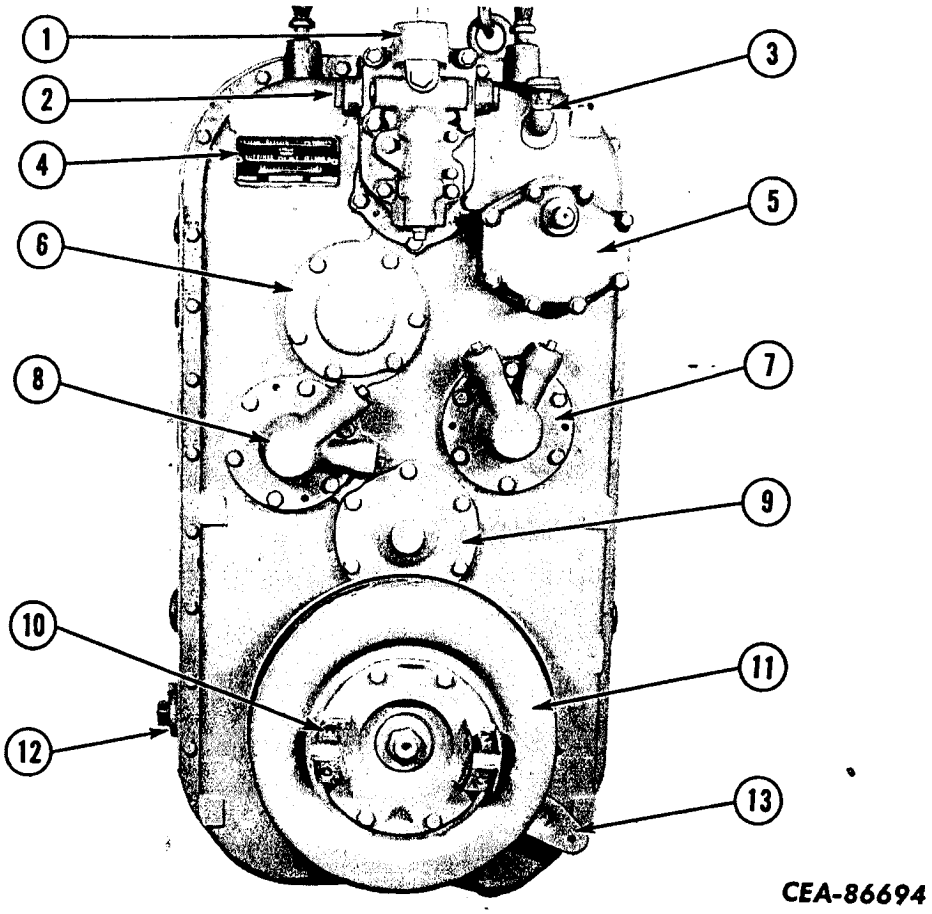

Figure 1-7
Front View of Transmission.

1. Directional Control Valve
2. Neutral Knockdown Valve
3. Breather
4. Name Plate
5. Range Selector Valve
6. Main Idler Shaft Bearing Cover
7. 1st & 3rd Oil Supply Cover
8. 2nd & 4th Oil Supply Cover
9. Gather Shaft Bearing Cover
10. Front Output Flange
11. Parking Brake Drum
12. Filler Tube Adaptor Port
13. Parking Brake Actuating Lever

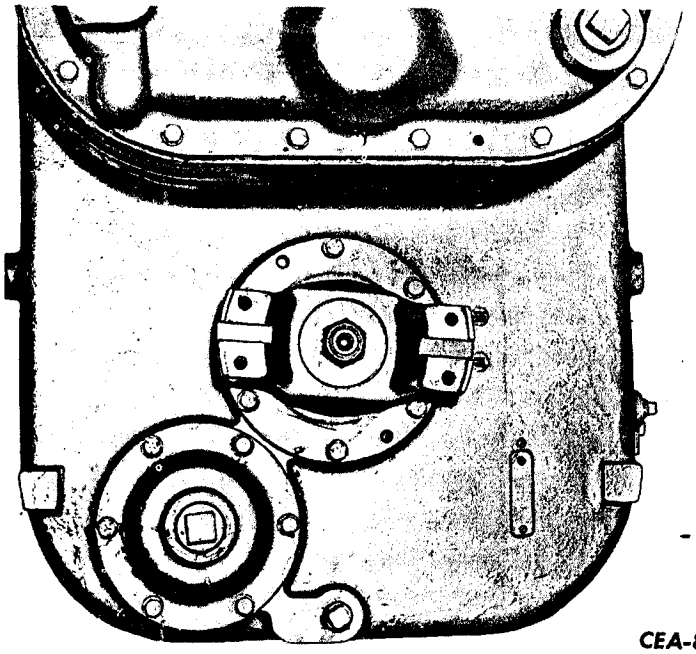

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Figure 1-6a
Transmission Without Rear Axle Disconnect (P-2001, P-2003, P-2004).

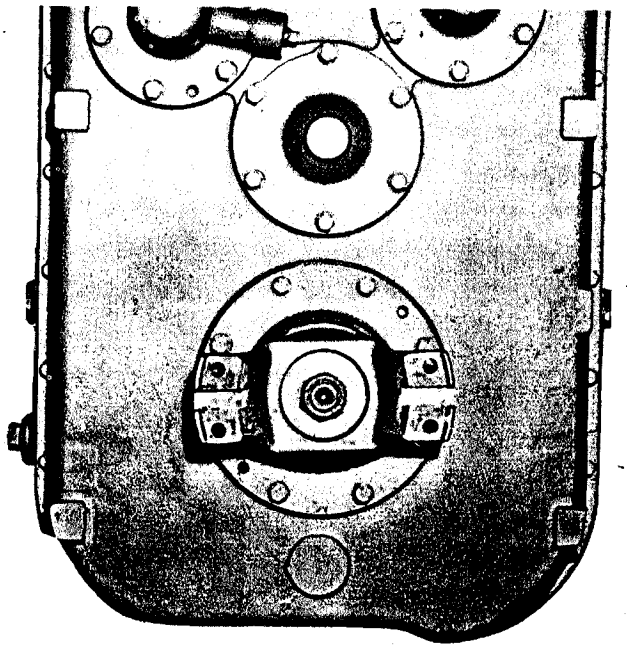

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Figure 1-7a
Transmission Without Transmission Mounted Parking Brake
(P-2001, P-2003, P-2004).

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TRANSMISSION

1. DESCRIPTION

The P-2000 series full power shift transmissions are designed to increase the useful range of the torque converter. A countershaft design with hydraulically actuated clutches is employed. First range increases power for starting and as the demand on the converter diminishes the transmission may be progressively shifted into higher ranges. The transmissions incorporate gearing ruggedly designed to "take it" in the extremely wide ranges and types of work performed in the construction industry.

The P-2000 series transmissions have four speeds in both forward and reverse and full power shift in all ranges.

The transmissions are of countershaft design. This design employs shafts parallel to, and driven by, the input shaft. Gears mounted on parallel shafts run free unless "clutched" to the shaft.

To assure smooth, high speed shifts, all clutches are mounted in pairs. Pairing the clutches affords compactness in design and hydraulic balance. The clutch design allows the transfer of oil from the disengaged clutch to the cavity created by the engaging clutch. Thus, a low volume of high pressure oil actuates the clutch for high speed shifting.

Only a small volume of oil is needed to fill the clutch cavity and pressurize the clutch. Large, high volume pumps are unnecessary in this design.

2. POWER TRANSMISSION

PURPOSE

The purpose of the transmission in the power train is twofold. First it must provide a selective power passage between the output of the engine and the input of the driving axle. Second, it must provide a means of reversing the direction of rotation at its output shaft while the direction of rotation of its input shaft remains the same.

OPERATION

To be selective, the transmission must allow the engine to develop full rated power regardless of the working load. When the load is high, engine power must be transmitted through a low gear ratio to utilize full engine power.

In a low ratio the driving gear is considerably smaller than the driven gear. This allows the engine to run at full governed rpm. It may be seen however, that the driving gear will be required to rotate more than once (depending upon the gear ratio) to turn the driven gear one complete revolution.

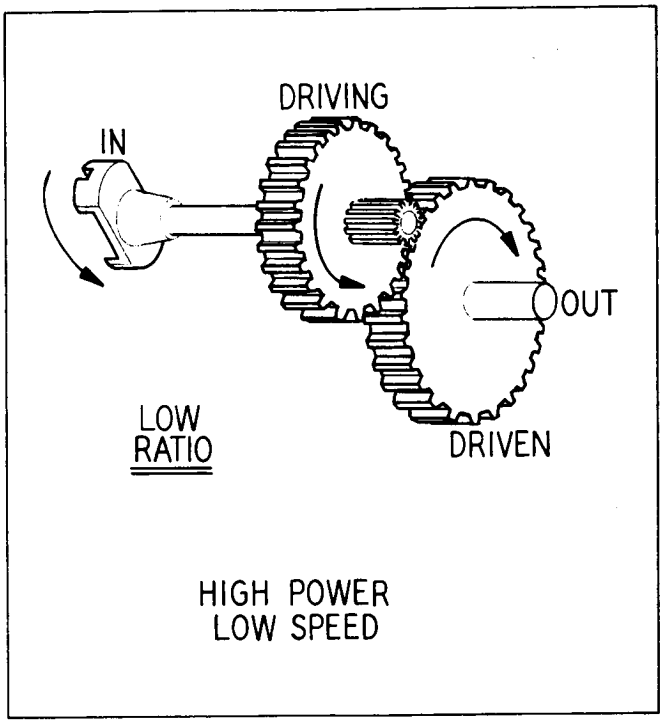

Figure 1-8
High Power, Low Speed.

For instance, in a 2:1 ratio the driving gear must rotate two times to turn the driven gear once. This arrangement allows a high power output at low speed.

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2. POWER TRANSMISSION - Continued

OPERATION – Continued

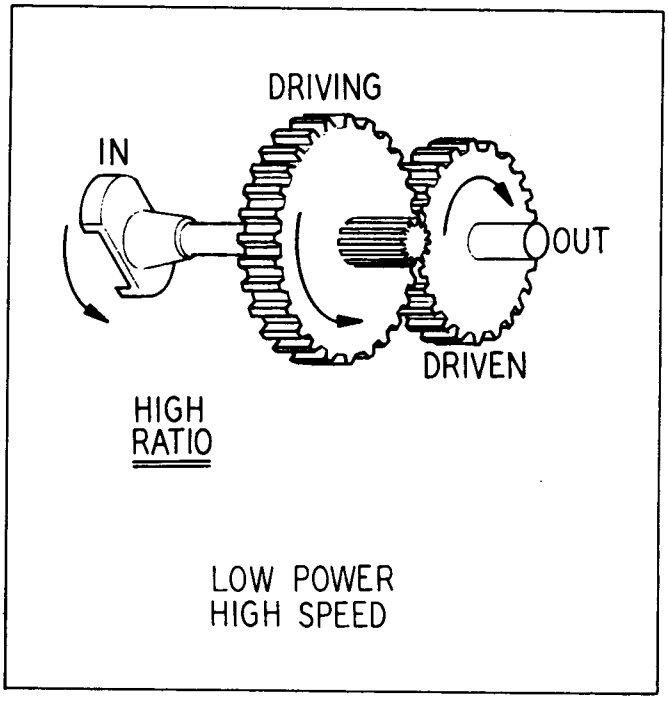

Figure 1 -9
Low Power, High Speed.

If the load is light and high speed is required a high gear ratio must be available. In theory we will assume the driving gear is now larger than the driven gear. If the ratio were .5:1 in high gear, one rotation of the driving gear will turn the driven gear two times. A more practical application of high gear in a vehicle however, is an approximate 1:1 ratio. A high gear ratio provides a higher output speed at the expense of lower power output.

To reverse the direction of the output shaft a third gear must be added to the gear train. If two gears are in mesh they will rotate in opposite directions. However, if the gears are in mesh with an intermediate gear, input and output gears rotate in the same direction (Fig. 1-10).

In addition to the two main requirements a transmission used in a moving vehicle must provide a neutral or "no-drive" position. This feature disconnects the output shaft from the input shaft. The engine may continue to run without transmitting power to the driving axles.

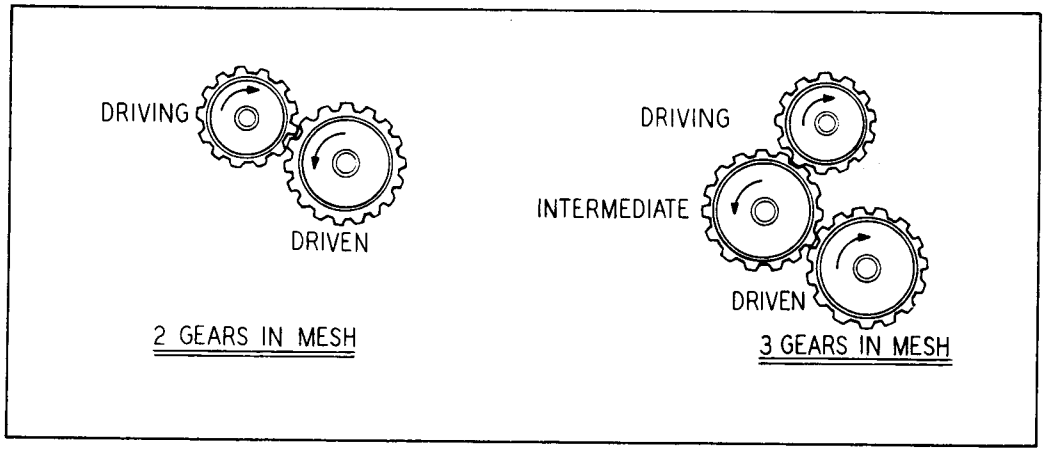

Figure 1 -10

TRANSMISSION

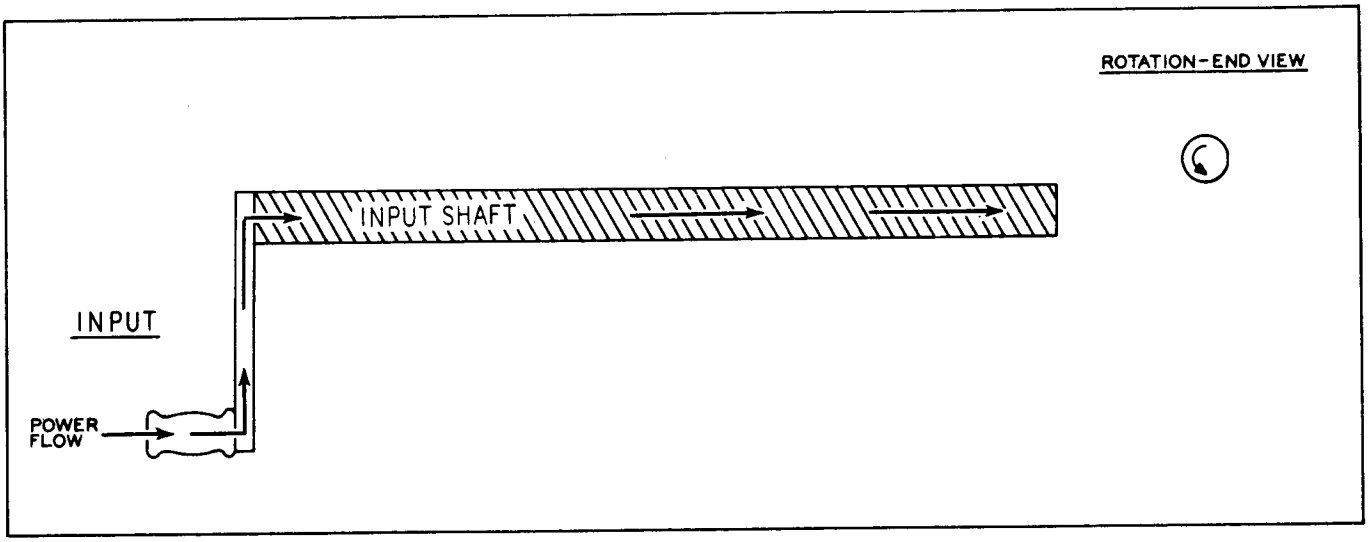

Figure 1-11

CONSTRUCTION OF SIMPLE TRANSMISSION

Let us construct a simple transmission to better understand its operation. The starting point will be an input shaft. To the input shaft we attach a hand crank. By turning the crank we supply the input power (Fig. 1-11).

Over the input shaft we install two sleeves with attached gears (1-2). These sleeves, riding on bearings, are supported by the input shaft. It will be noted that, while these gear assemblies fit over and are supported by the input shaft they are in no way fastened to it. We may rotate the input shaft without rotating the gear assemblies (Fig. 1-12).

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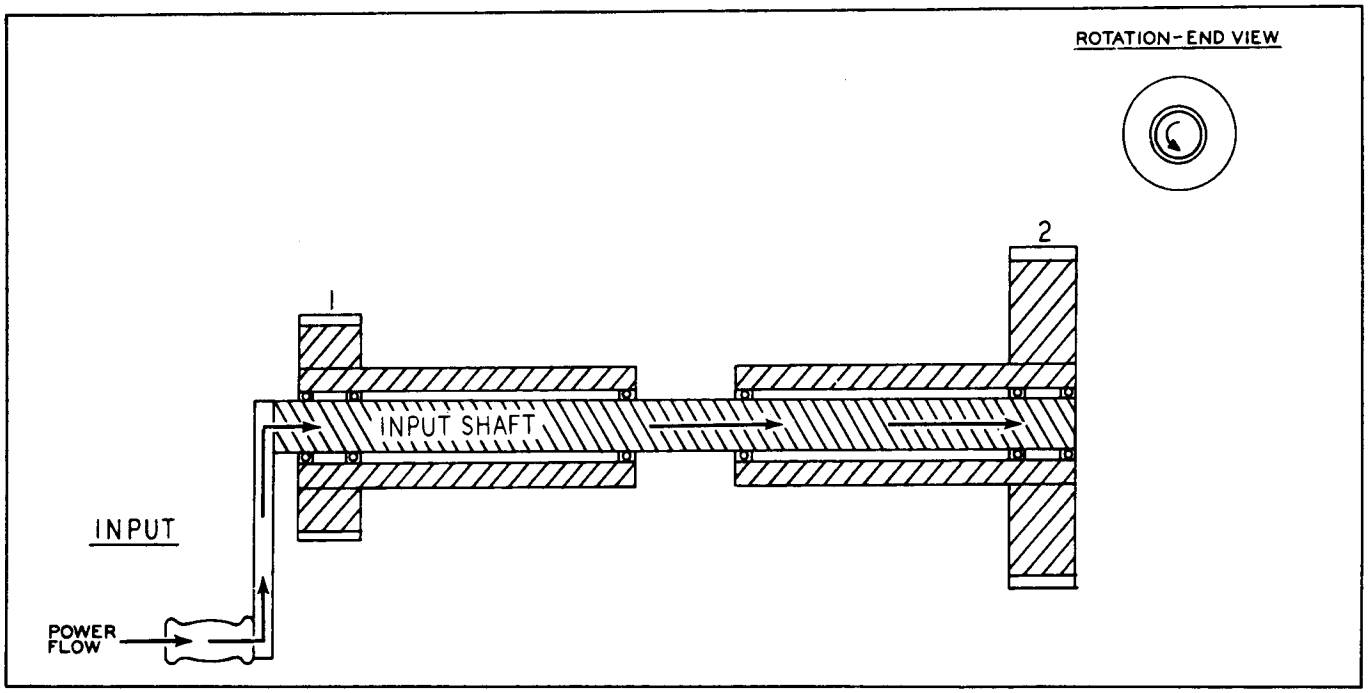

Figure 1-12

GENERAL INFORMATION

TRANSMISSION

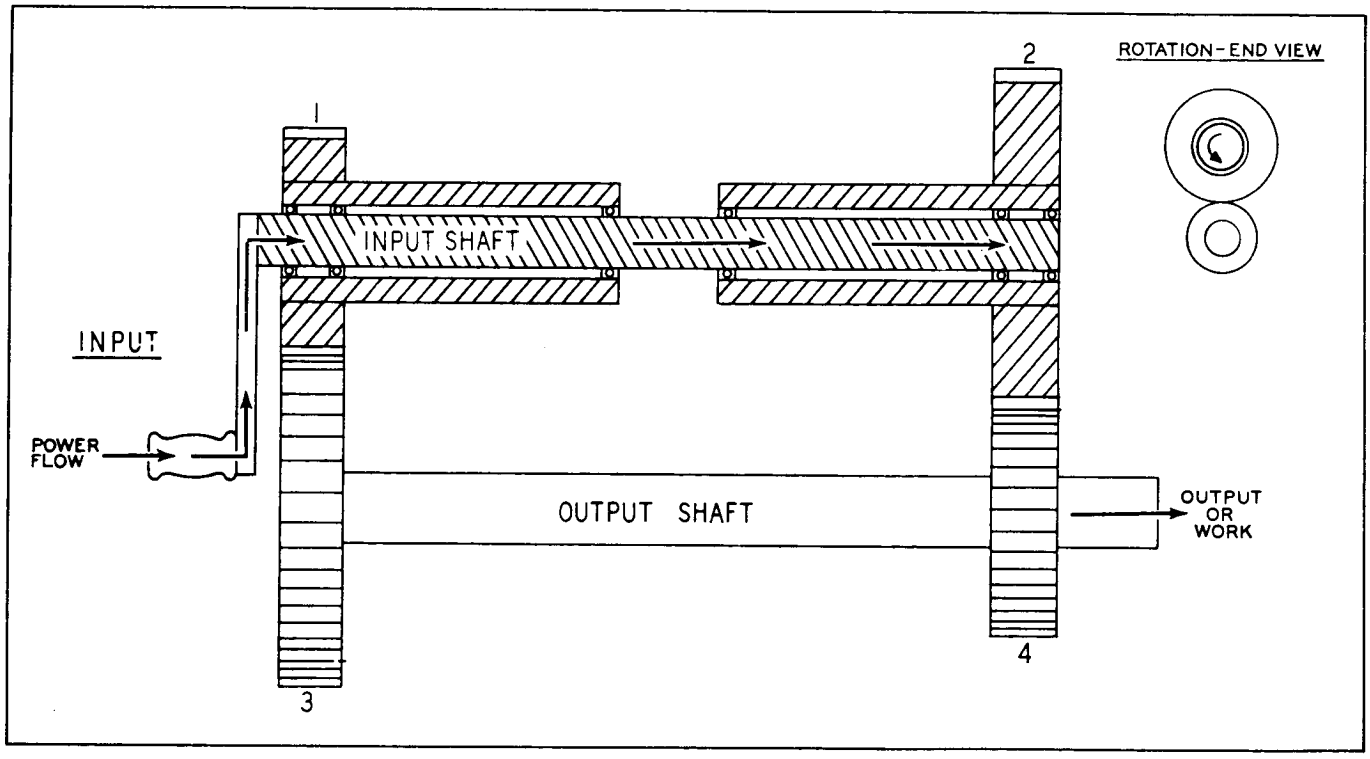

Figure 1-13

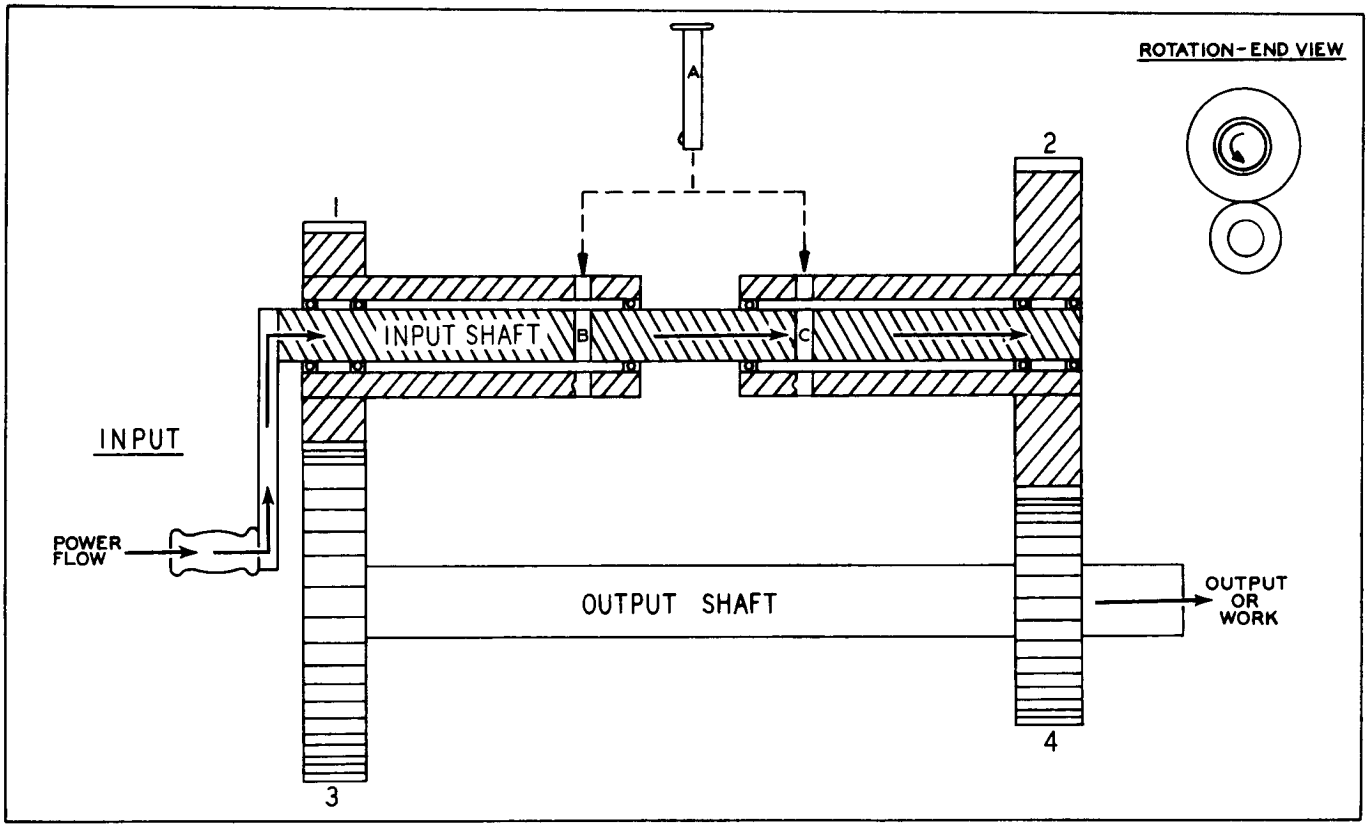

Figure 1-14

2. POWER TRANSMISSION - Continued

CONSTRUCTION OF SIMPLE TRANSMISSION – Continued

Below the input shaft we mount an output shaft with integral gears. These gears then, being a part of the output shaft, must rotate with the shaft. The small gear assembly (1) on the input shaft is in mesh with the large gear (3) on the output shaft and the large gear assembly (2) on the input shaft is in mesh with small gear (4) on the output shaft. If one gear rotates all the gears must rotate (Fig. 1-13).

We will note that although all gears are in mesh none will rotate if the crank is turned. None of the gears are fastened to the input shaft. In order to transfer the input power to the output shaft it will be necessary to fasten gear 1 or 2 to the input shaft.

Holes (B and C) are bored through the sleeves of gear 1 and gear 2 and through the input shaft. A pin (A) is provided (Fig. 1-14).

If we insert the pin (A) in the hole (B) in the sleeve of the small gear (1) and through the input shaft we now have a means of fastening the gear to the input shaft. Now when the crank is turned, the small gear (1) rotates with the input shaft and drives the large gear (3) and its output shaft. The driving gear (1) is smaller than the driven gear (3) therefore the transmission is in low range. The output shaft will rotate slower than the input shaft (Fig. 1-15).

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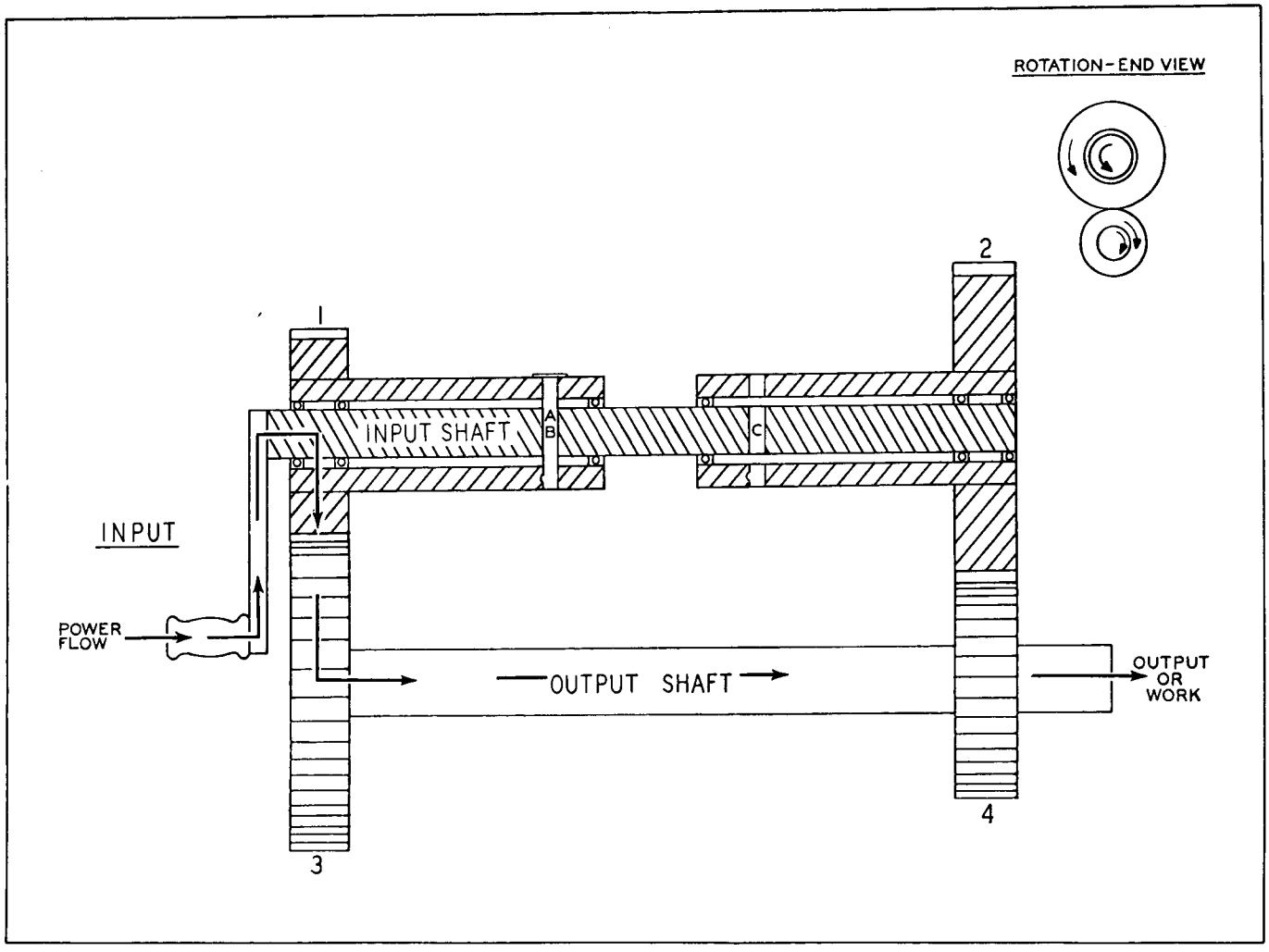

Figure 1-15

2. POWER TRANSMISSION - Continued

CONSTRUCTION OF SIMPLE TRANSMISSION – Continued

If we remove the pin (A) from the sleeve of the low driving gear (1) and place it in the hole (C) provided in the sleeve of the large driving gear (2), the rotating input shaft will drive the output shaft through the small driven gear (4). The driving gear (2) is larger than the driven gear (4), therefore the transmission is in high range (Fig. 1-16).

Although only one gear is pinned to the input shaft all gears will rotate. The unpinned gear will act as an idler gear.

If we were to place pins in both holes (B and C) the transmission would be inoperative. The output shaft would be jammed as each driving gear (1 and 2) attempted to turn it at different speeds. It is imperative that only one gear be pinned to the input shaft at one time.

It will be seen that as long as the pin is out of the sleeve bores a neutral or "no-drive" condition is provided.

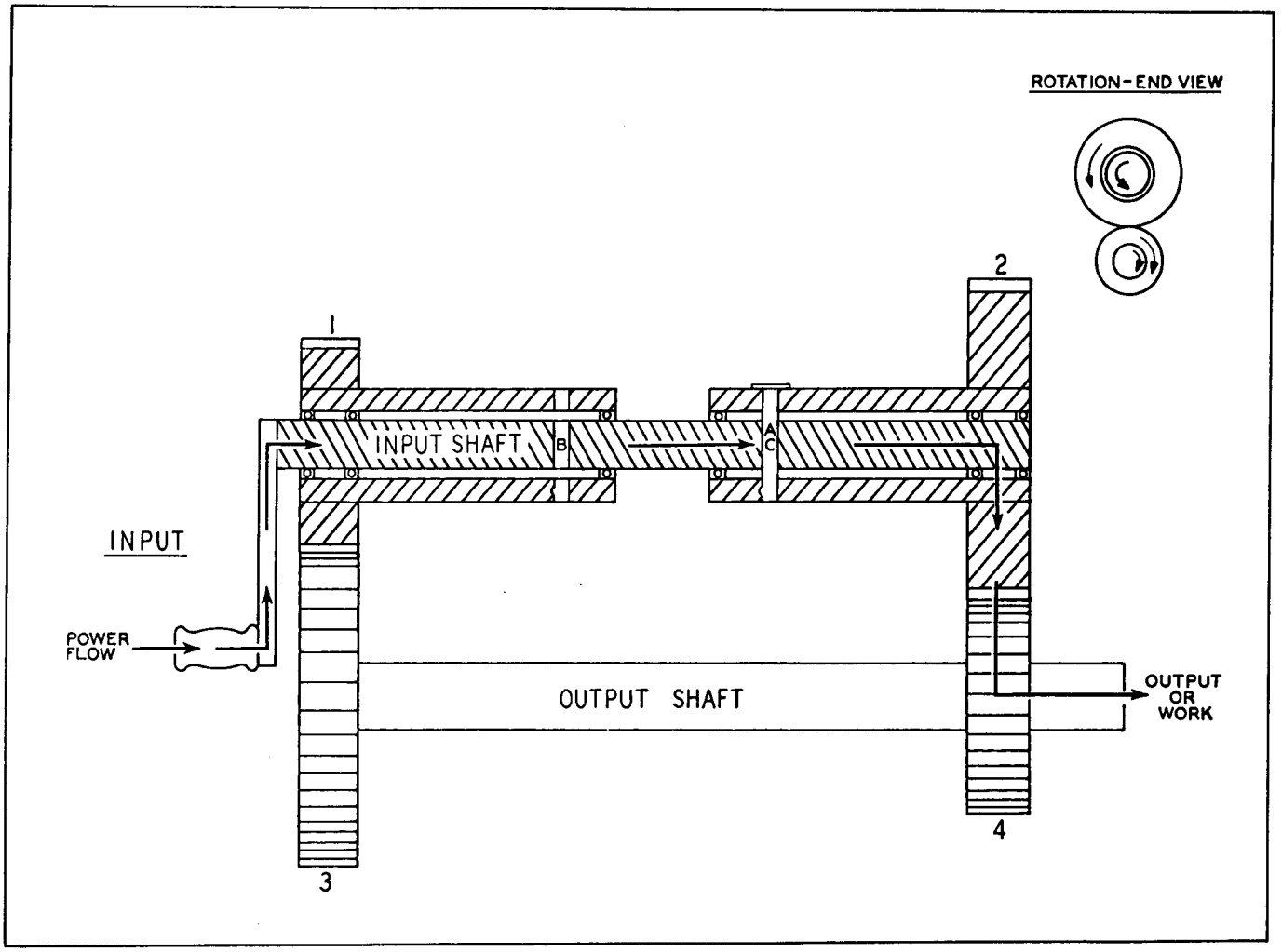

Figure 1-16

TRANSMISSION

To complete the transmission a reverse must be installed. To accomplish this let us first place a third gear (3A) on the output shaft as an integral part of the shaft; that is, when the gear turns the shaft must turn. This gear (3A) is identical to the low speed driven gear (3) (Fig. 1-17).

Now, alongside the output shaft we install an idler shaft. On the idler shaft we place an idler gear (5). This gear is the same diameter as the low range driving gear (1) and is in mesh with the reverse driven gear (3A). The idler gear (5) is supported by, and rotates on the idler shaft but is in no way connected to it (Fig. 1-18).

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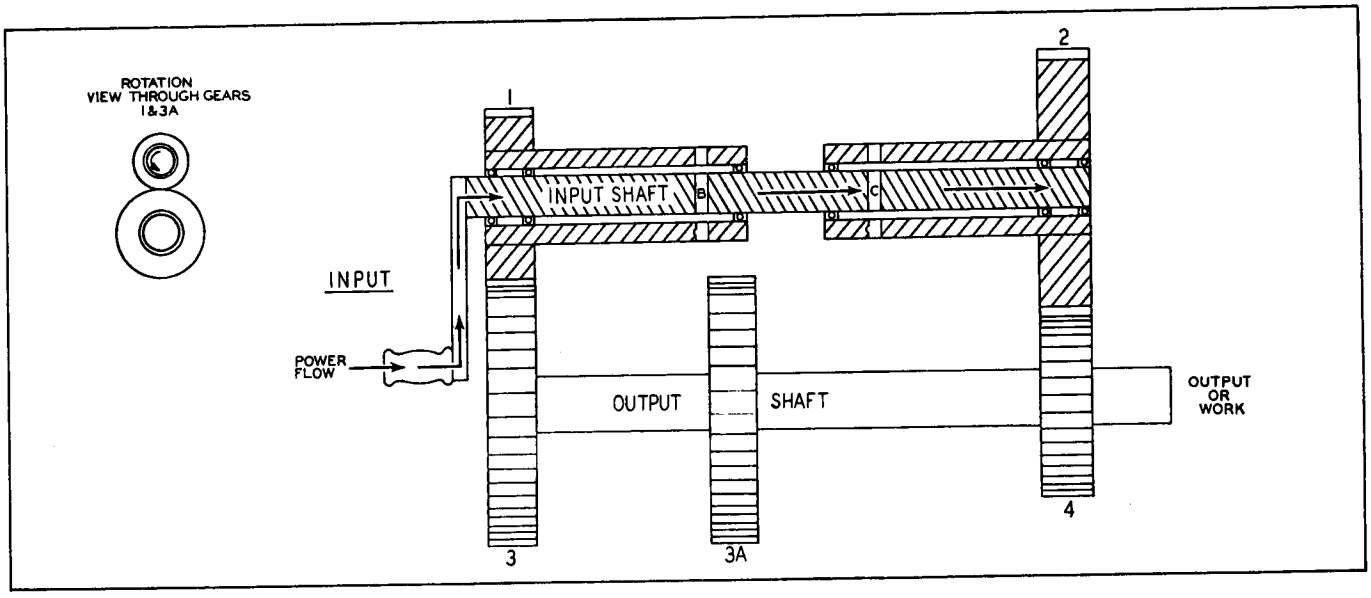

Figure 1-17

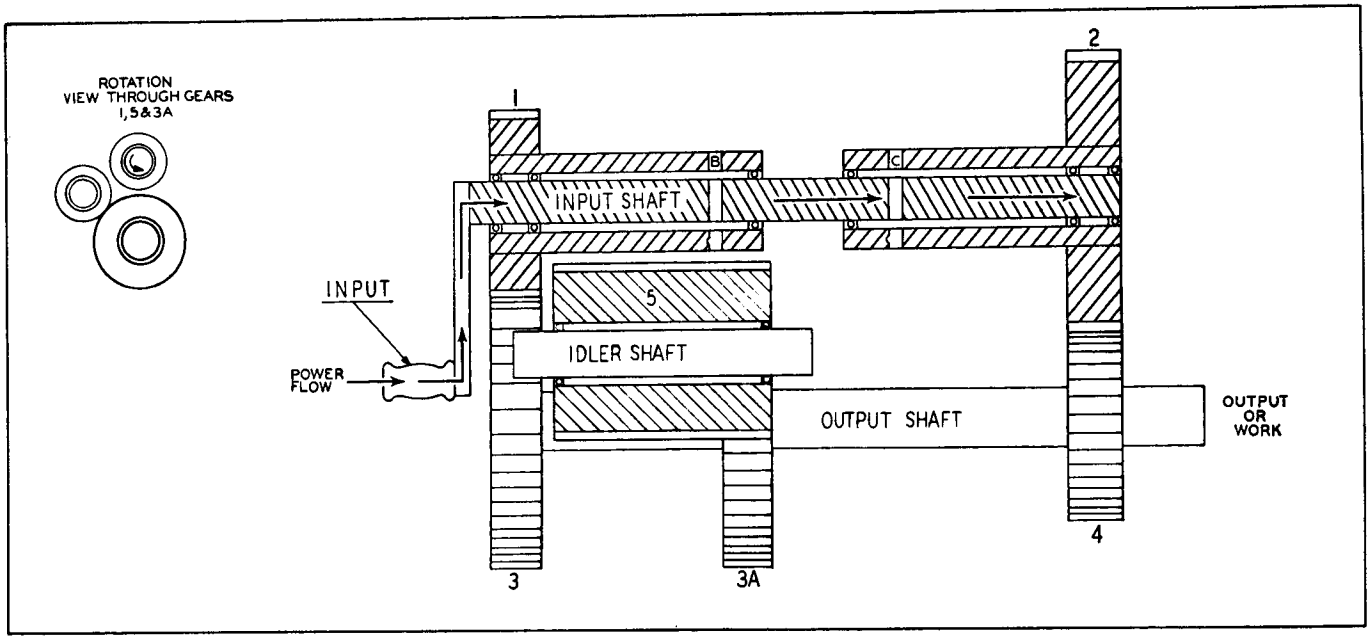

Figure 1-18

2. POWER TRANSMISSION - Continued

CONSTRUCTION OF SIMPLE TRANSMISSION – Continued

Let us slide the low range driving gear (1) along the input shaft until it meshes with the reverse idler gear (5). At this point we will have a hole (D) in the gear sleeve in line with the original hole in the input shaft and insert the pin (A). Now when the crank on the input shaft is turned, the low range driving gear (1) being pinned to the input shaft, turns with it. The low range driving gear (1) is in mesh with the reverse idler gear (5) and causes it to rotate. The reverse idler gear (5) is in mesh with the reverse driven gear (3A) and causes it and its integral output shaft to turn (Fig. 1-19).

As previously stated, when three gears are in mesh the first gear and the third gear will rotate in the same direction, thus, a reverse has been provided.

As the low range driving gear (1) and the reverse idler gear (5) are the same diameter as are the low range driven gear (3) and the reverse driven gear (3A), the ratio for reverse is identical to low range forward (Fig. 1-19).

DEVELOPMENT

With the knowledge of the operation of various components of the transmission the refinement of the simple transmission by combining additional components may be visualized. If more gear ranges are desired, additional sleeves and gears are placed in the gear train. Fig. 1-20 shows a layout of a refined transmission; separate forward and reverse, 4 gear ranges and a double ended output shaft with a disconnect feature. The second range shaft lies alongside the first shaft and is displayed at the right.

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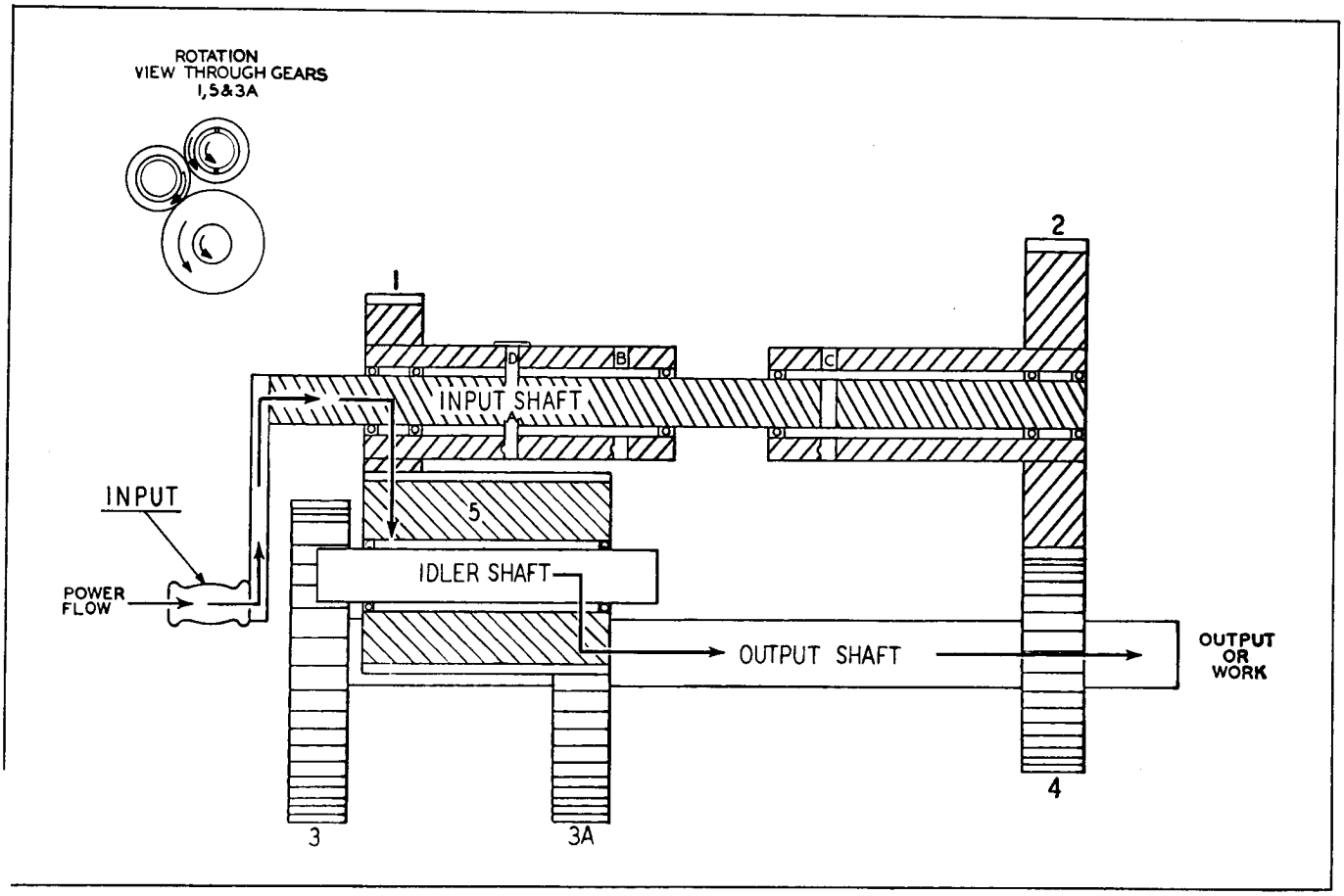


Figure 1-19

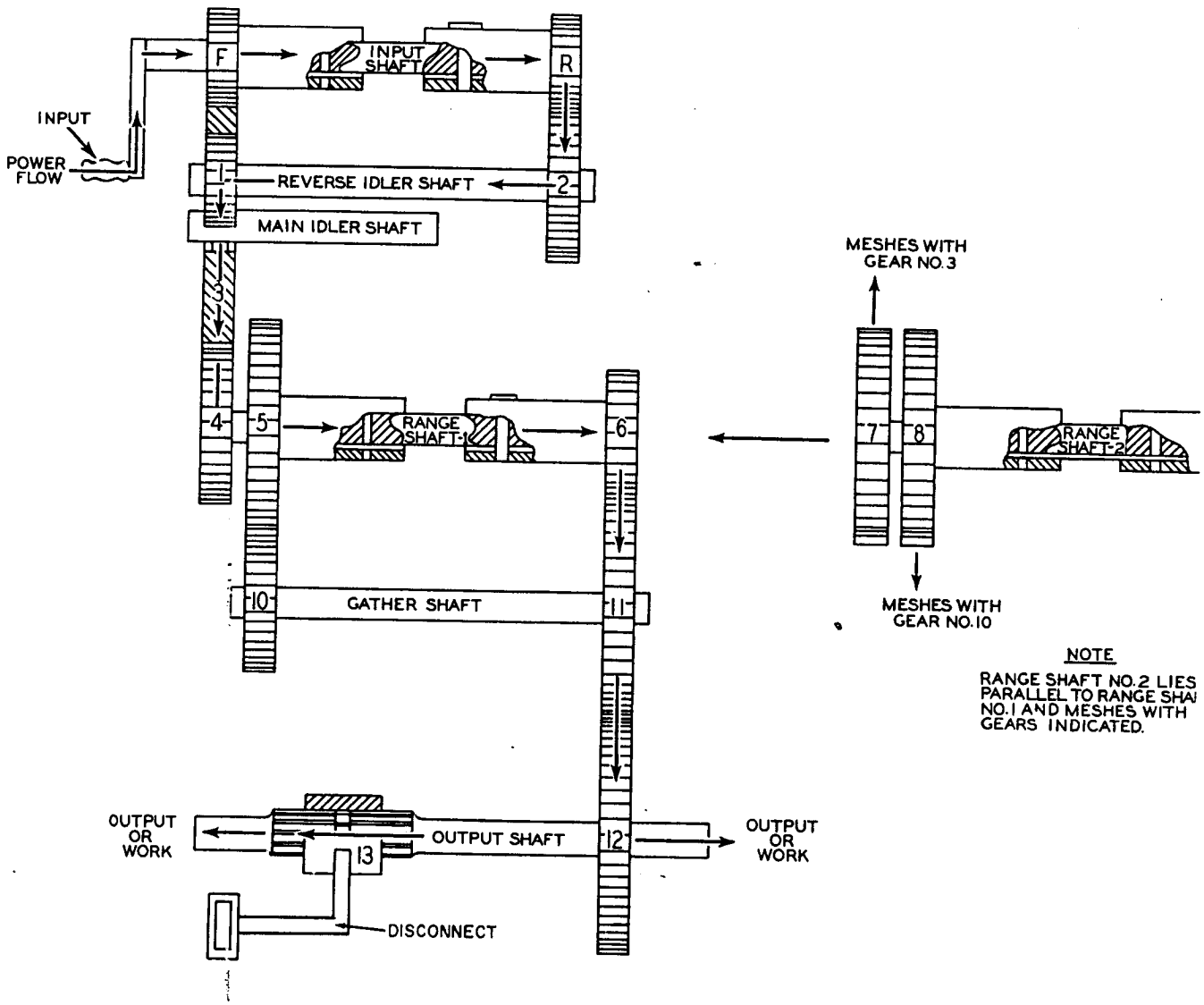
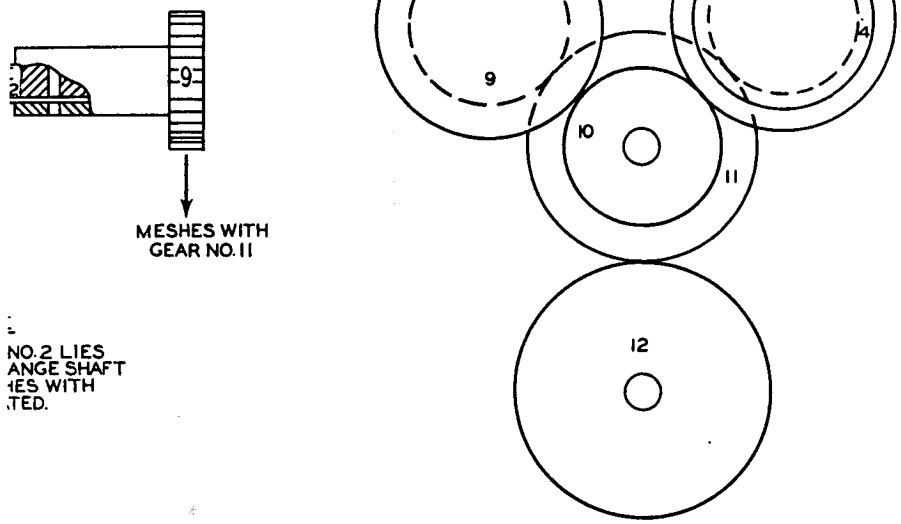

INPUT
POWER FLOW
F
INPUT SHAFT
R
1
REVERSE IDLER SHAFT
2
MAIN IDLER SHAFT
3
4
5
RANGE SHAFT-1
6
7
8
RANGE SHAFT-2
MESHES WITH GEAR NO. 3
MESHES WITH GEAR NO. 10
10
GATHER SHAFT
11
OUTPUT OR WORK
OUTPUT SHAFT
12
13
OUTPUT OR WORK
DISCONNECT
NOTE
RANGE SHAFT NO. 2 LIES PARALLEL TO RANGE SHAFT NO. 1 AND MESHES WITH GEARS INDICATED.

Figure 1-20

GEAR TRAIN-END VIEW



MESHES WITH
GEAR NO. 11

NO. 2 LIES
ANGE SHAFT
IES WITH
TED.

2. POWER TRANSMISSION - Continued

DEVELOPMENT – Continued

If pins (A) are inserted in the reverse (R) sleeve and the second range gear sleeve (6), the power flow will begin at the input shaft and pass through the reverse (12) gear to the reverse idler gear (2) and shaft. From the reverse idler gear (1) the power goes through the main idler gear (3) to the number 1 range shaft driving gear (4) and attached shaft. Leaving the range shaft the power flows from the second range driving gear (6) through the gather shaft gear (11) to the gear on the output shaft (12). Power then leaves the transmission through the ends of the output shaft. If a disconnect is employed the output may, if desired, be confined to one end of the output shaft by disengaging or "disconnecting" the opposite end (Fig. 1-20).

PRACTICAL APPLICATION

If we substitute an engine for the hand crank and connect the output shaft to a pair of driving axles the value of the transmission in the power train becomes apparent.

Although we have constructed a working transmission that will function in a power train it is not a practical transmission. The machine operator would soon tire of dismounting and opening hatches to shift pins to different holes or push gears back and forth. Some means is necessary to do this work mechanically and by remote control. In the P-2000 transmission this work is accomplished by hydraulic clutches. Each directional and range gear is equipped with its own clutch. With instant control over the clutches and attached gears, the operator may extract the maximum output from his machine regardless of varying working conditions.

Fig. 1-21 shows a clutch pack of the type used in the P-2000 Transmission. Although many refinements have been added the basic shaft, gear and sleeve remain. The shaft (11) and gears (1-8) are readily visible. The sleeve

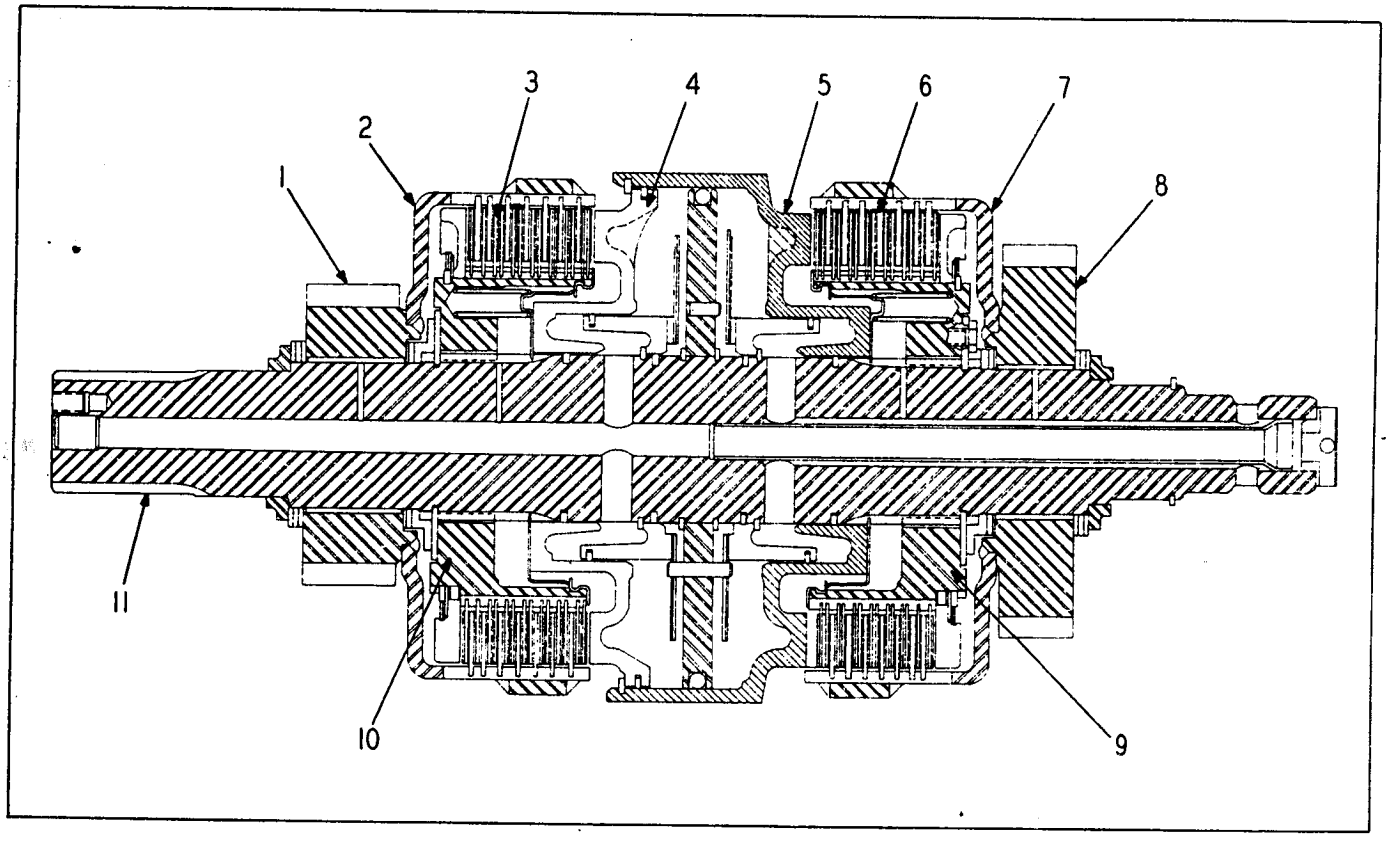


Figure 1-21

has been enlarged in diameter and cup shaped (2-7) to attach to and house the clutch. The steel clutch discs attach to the cup and sintered bronze discs are attached to the hubs (9-10). These hubs are splined to the shaft (11) and take the place of the pin bore in the shaft of the simple transmission (Fig. 1-14). A clutch is provided for each gear but, as in the case of the simple transmission, only one clutch may be applied at a time.

3. CLUTCH OPERATION

DESCRIPTION

To fully understand the operation of the P-2000 series clutch packs, a knowledge of the components and their function is required.

Each clutch assembly is actually two clutches on a single shaft (1, Fig. 1-22). The shaft contains two oil supply passages (2, 3), one for each clutch.

In addition, the shaft has an attached separator plate (4) which will be considered a part of the shaft.

In the separator plate there are six transfer ports (5) to transfer oil from one side of the separator plate to the other.

On each side of the separator plate (6, Fig. 1-23) there is a reinforcing disc (3) and a disc valve (2). The disc valve is made of a thin flexible material and functions as a one way valve. Three floating pins (7) pass through the separator plate (6). Their function is to hold the reinforcing discs (3) and valves (2) away from the separator plate when the opposite clutch is applied. In addition, the pins (7) properly position the discs and valves.

(Continued on next page)

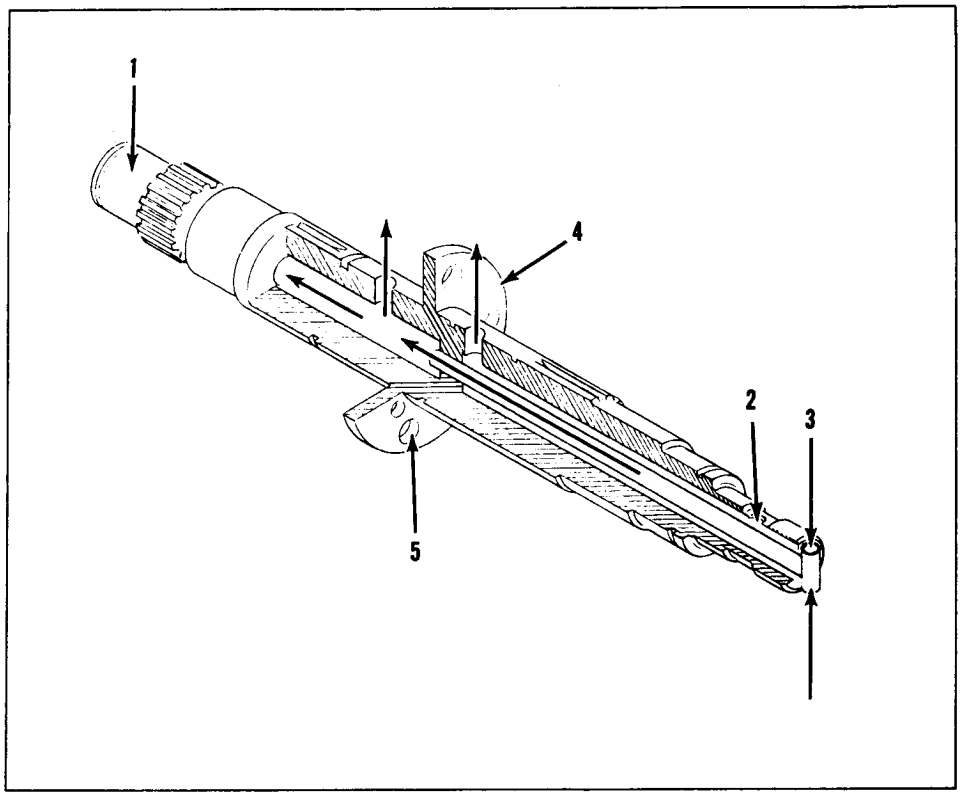


Figure 1-22

3. CLUTCH OPERATION - Continued

DESCRIPTION – Continued

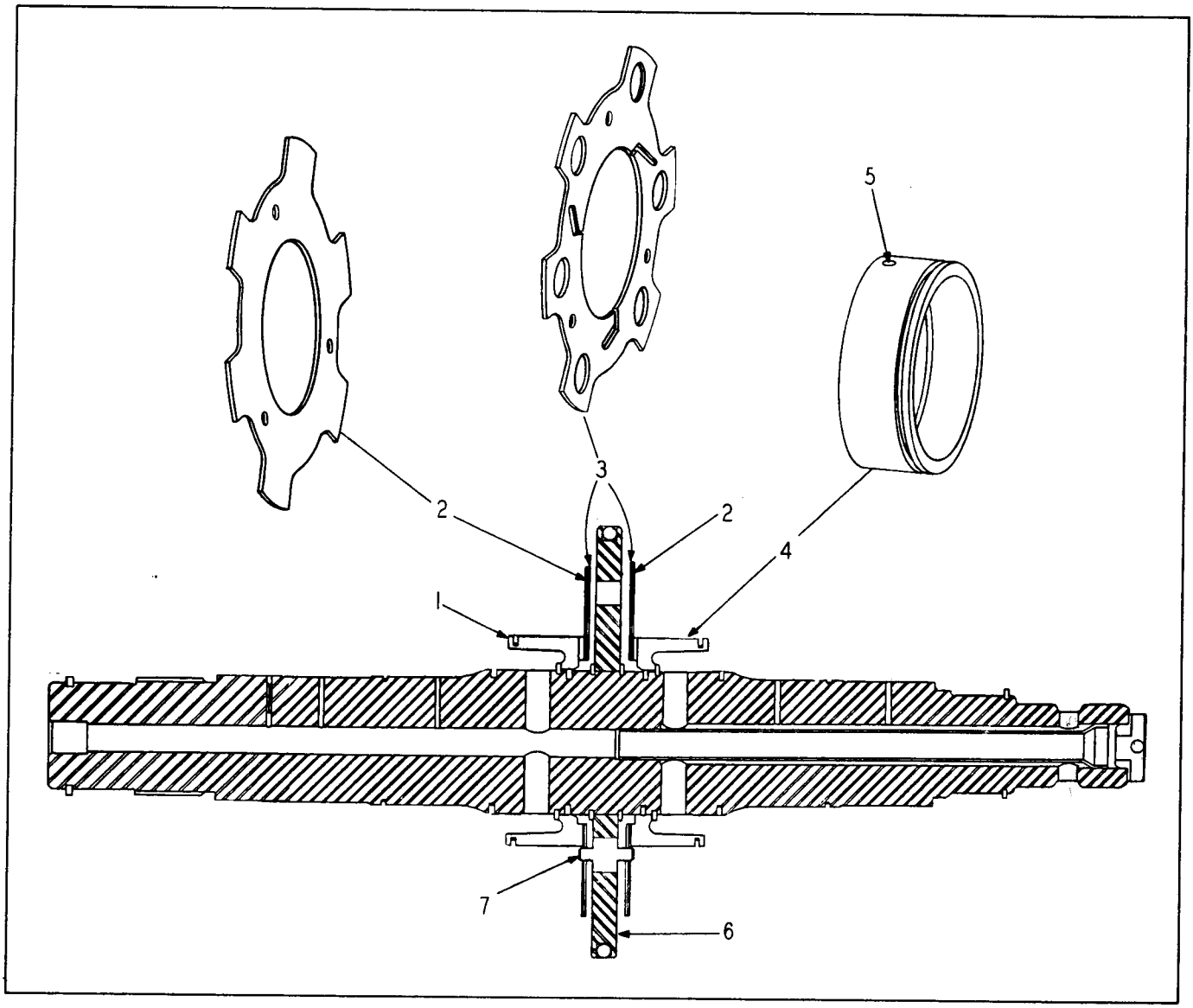


Figure 1-23

On each side of the separator plate (6) is an accelerator piston (1, 4). These accelerator pistons are free to move laterally on the shaft during clutch application and release. Each accelerator piston contains a small hole called an orifice (5).

A large cylinder called a piston housing (4, Fig. 1-24) encloses the separator plate (10), reinforcing disc (3), disc valve (2) and accelerator pistons (5, 13). The piston housing itself forms one of two clutch pistons employed in the clutch pack. The remaining clutch piston (1) occupies the open end of the clutch housing. As the clutch pistons (1, 4) are interconnected, the application of one will automatically disengage the other. The configuration of the clutch housing (4) and the clutch piston

(1) form a pair of cavities on either side of the separator plate (10); the clutch piston cavities (9, 11) and the accelerator piston cavities (8, 12). The oil supply passages (6, 7) open directly into their respective accelerator piston cavities.

A pair of hubs (3, 6, Fig. 1-25), one outboard of each clutch piston (4, 5) are splined to the shaft. Each hub contains several piston return springs (1, 2). These springs assist in neutralizing the clutch piston when the clutch is released.

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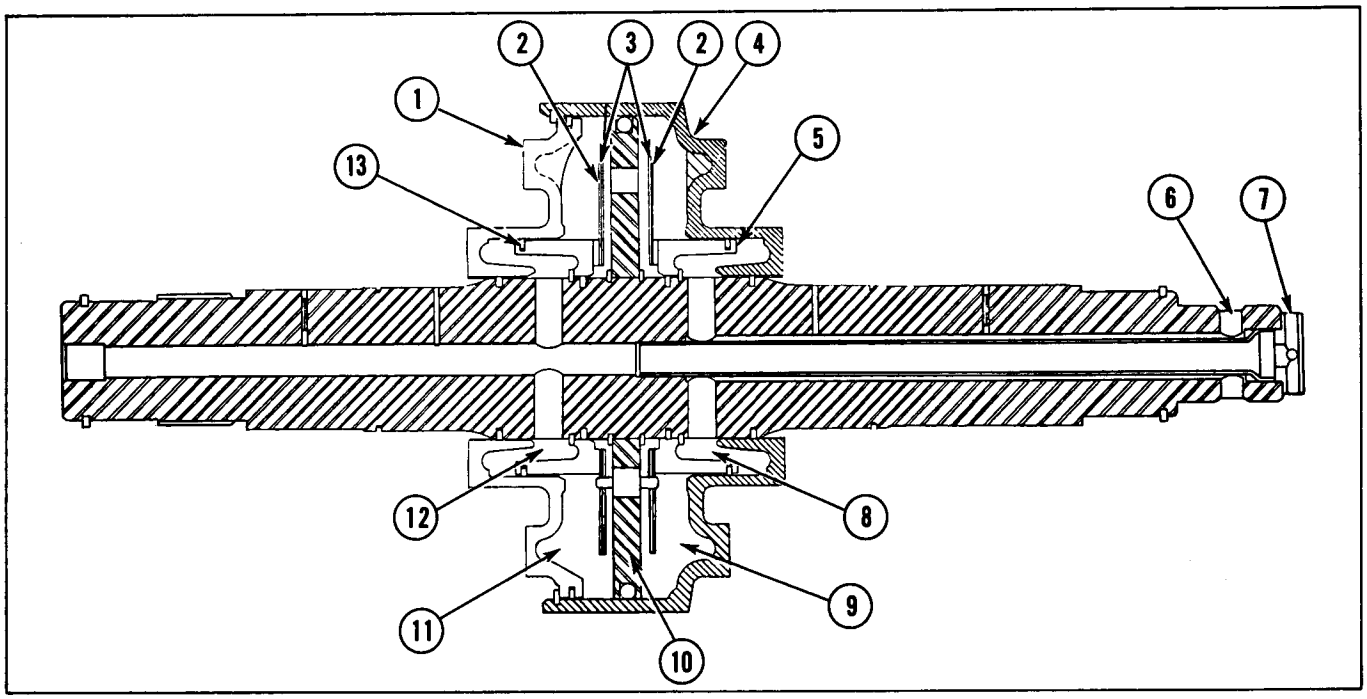

Figure 1-24

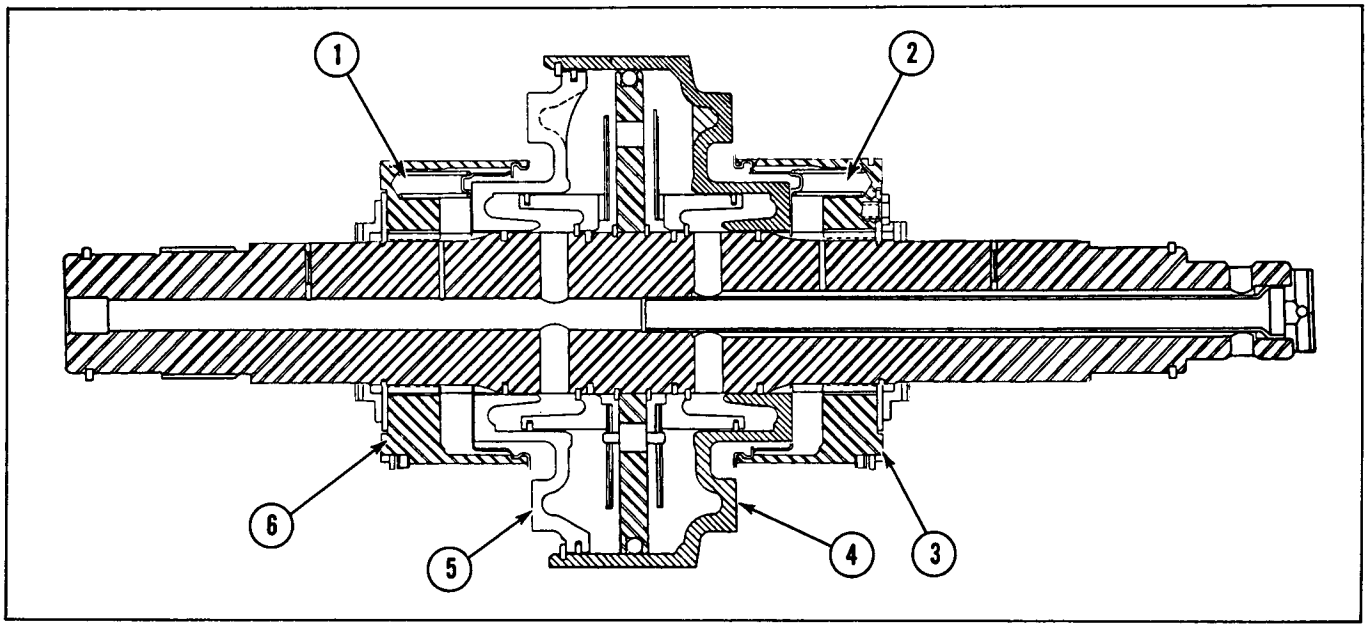

Figure 1-25

3. CLUTCH OPERATION - Continued

DESCRIPTION – Continued

A number of sintered bronze discs (8, 10, Fig. 1-26) are splined to each hub (7, 12) and backed up by a backing plate (4, 11). The hub, sintered bronze discs and backing plate rotate with the shaft.

Between each bronze disc (8, 10) is a steel disc (2, 3), externally splined to the drive gear and cup assembly (1, 5). The drive gear and cup assemblies are supported on the shaft by bearings (6, 13) and are completely independent of the shaft.

NOTE: Early drive gear and cup assemblies rotate on bushings. Late assemblies are equipped with needle bearings.

The shaft itself will be driven, depending upon its location in the transmission, by a yoke or spur gear. With both clutches released only the separator plate (9), hubs (7, 12) with sintered bronze discs (8, 10) and backing plates (4, 11) attached, will rotate with the shaft. The application of either clutch pack couples the driven members of the clutch pack (i. e. cup and driven gear assembly) with the driving member (i. e. the shaft) and completes the transmission of power through the clutch pack.

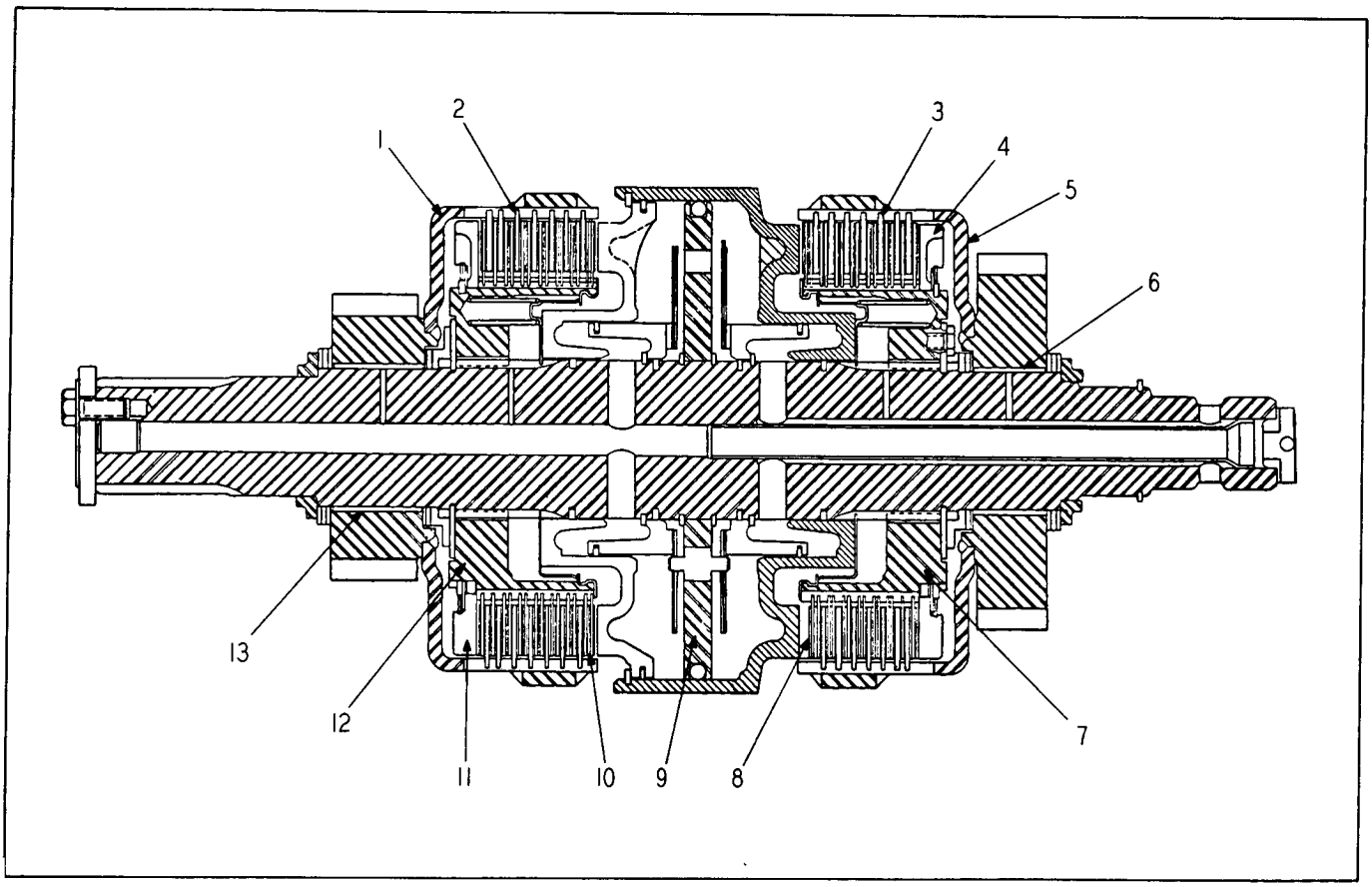

Figure 1 - 26

NEUTRAL POSITION

As soon as the engine crankshaft begins to rotate, the pump, located in the torque converter housing, picks up the oil from the transmission sump and directs it to the main regulator valve. The regulator valve in turn directs lube pressure to the directional selector valve and the range selector valve. With the directional selector valve in the neutral position, lube oil is sent through various passages to the oil supply covers and through additional passages in the shaft to the clutch packs. This fills the accelerator piston cavity (1, Fig. 1-27) and clutch piston cavity (2) with oil at lube pressure.

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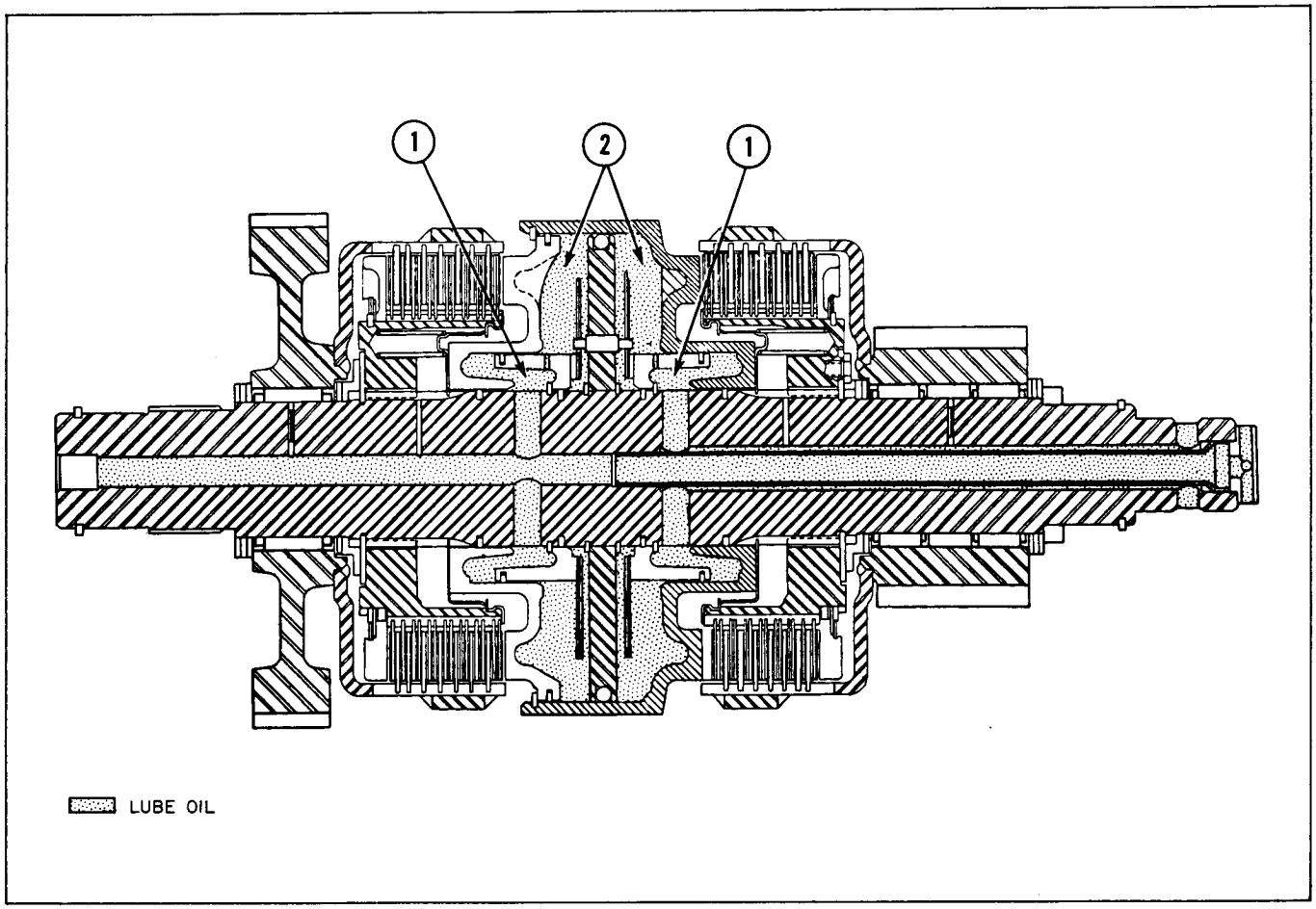

Figure 1-27
Neutral Position.

3. CLUTCH OPERATION - Continued

PRIMARY ENGAGEMENT POSITION

Upon clutch application the range selector valve or directional control valve, depending upon the clutch selected, directs high pressure oil through passages in the clutch shaft to the accelerator piston cavity (1, Fig. 1-28). The accelerator piston (2) immediately moves toward the separator plate (10), pushing the disc valve (3) and reinforcing disc (4) against the separator plate.

The three pins (7), floating laterally in the separator plate, hold the reinforcing disc (5) disc valve (6) and accelerator piston (8) on the opposite (released) side away from the separator plate. At the same time the clutch piston (12) begins to move toward the clutch. The clutch piston cavity (11) enlarges as the opposite piston cavity (9) becomes smaller. The oil expelled from the contracting cavity (9) pushes the opposite disc valve (3) off its seal and enters the enlarging cavity (11). This transfer of oil completes the primary engagement.

FULL ENGAGEMENT POSITION (Fig. 1-29)

The clutch piston cavity (4) is completely pressurized by high pressure oil passing through the orifice (5) in the accelerator piston (6).

Both the sintered bronze (3) and steel discs (2) are squeezed together, clutching the drive gear and cup assembly (1) to the shaft.

Each clutch is applied in the manner described. To return the clutch to neutral position, high pressure oil is released through the directional control or range selector valve, depending upon which clutch was applied. The compressed centering springs in the hub re-

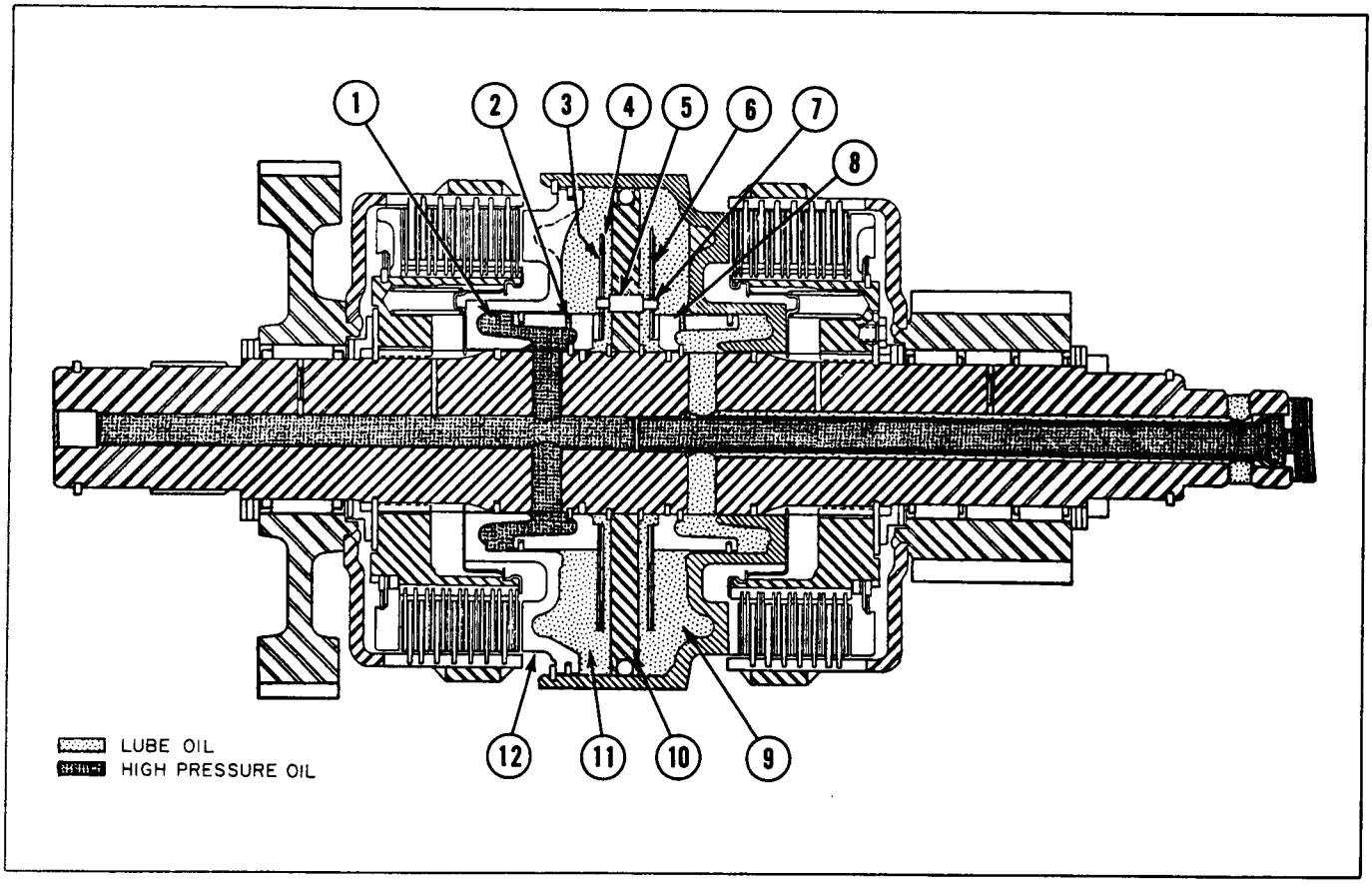

Figure 1-28
Primary Engagement Position.

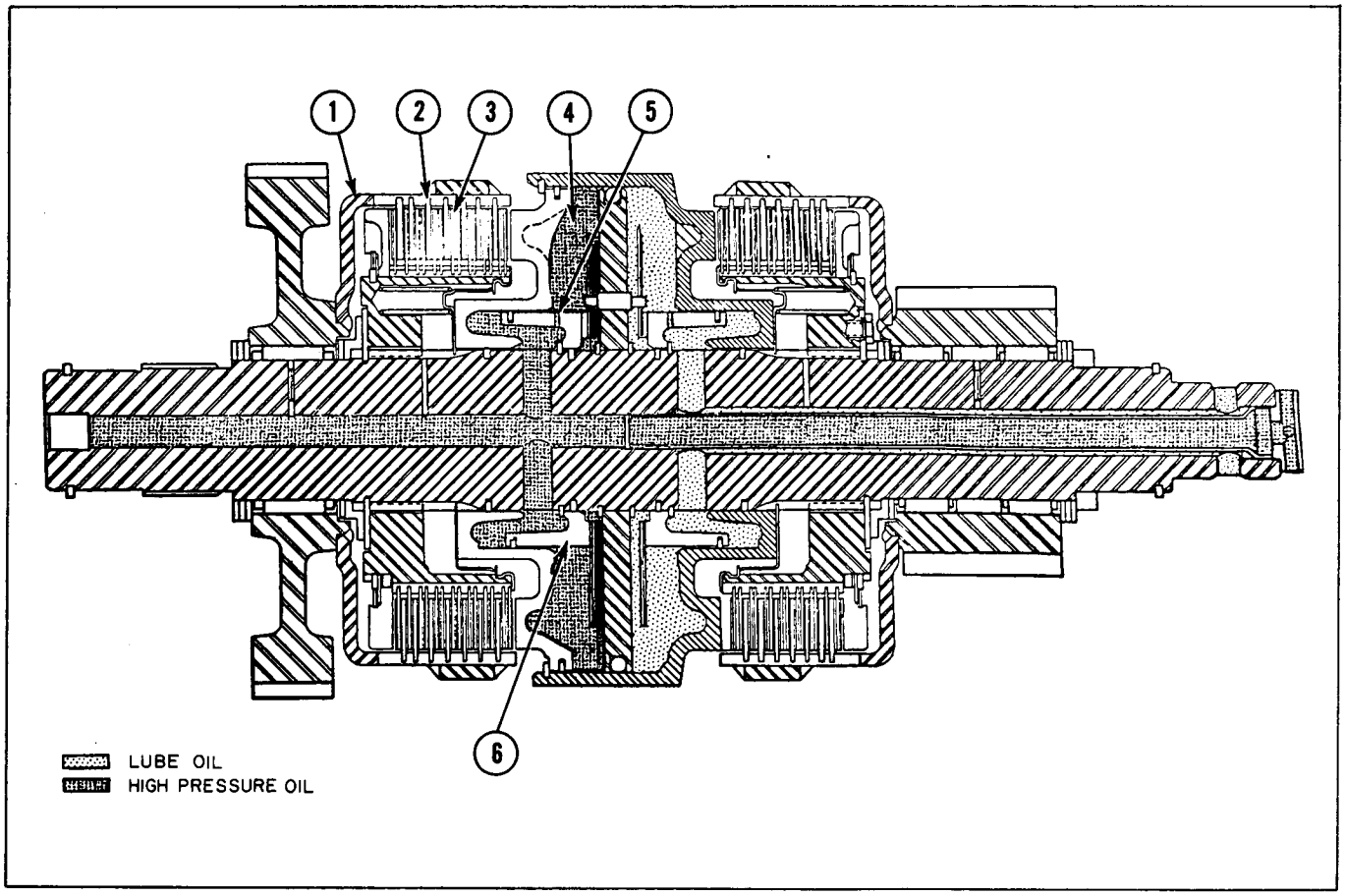

Figure 1-29
Full Engagement Position – Applied Clutch.

turn the clutch piston to the center of the shaft. The accelerator piston, disc valve and reinforcing disc move away from the separator plate and oil under tube pressure remains in the piston cavities.

4. GEAR TRAIN OPERATION

The P-2000 series transmissions utilize three double clutches (one direction clutch and two range clutches) mounted between the necessary gears and shafts to produce four speeds forward and four speeds reverse (See Fig. 1-30). Identical gear ratios exist in each range regardless of the direction. Engagement of two clutches, a direction clutch and a range clutch, is necessary to achieve a particular overall drive ratio. The directional clutches impart either transmission input rotation or counter input rotation to the range clutches. The range clutches impart, through the gather shaft, their respective gear ratios and rotation to the output shaft.

This is a full power shifting transmission and is designed to be shifted from range to range under full power.

a. Forward to Reverse Shift. A directional shift should be made after the vehicle movement has STOPPED. Before requiring a shaft to change direction, STOP!

b. Upshifting. To start the vehicle moving, select a range sufficient to give satisfactory movement. As the vehicle approaches its maximum speed in that range, shift to the next higher range. As an example: In an unloaded vehicle it is unnecessary to start in 1st range. Select either 2nd or 3rd range as conditions warrant.

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4. GEAR TRAIN OPERATION - Continued

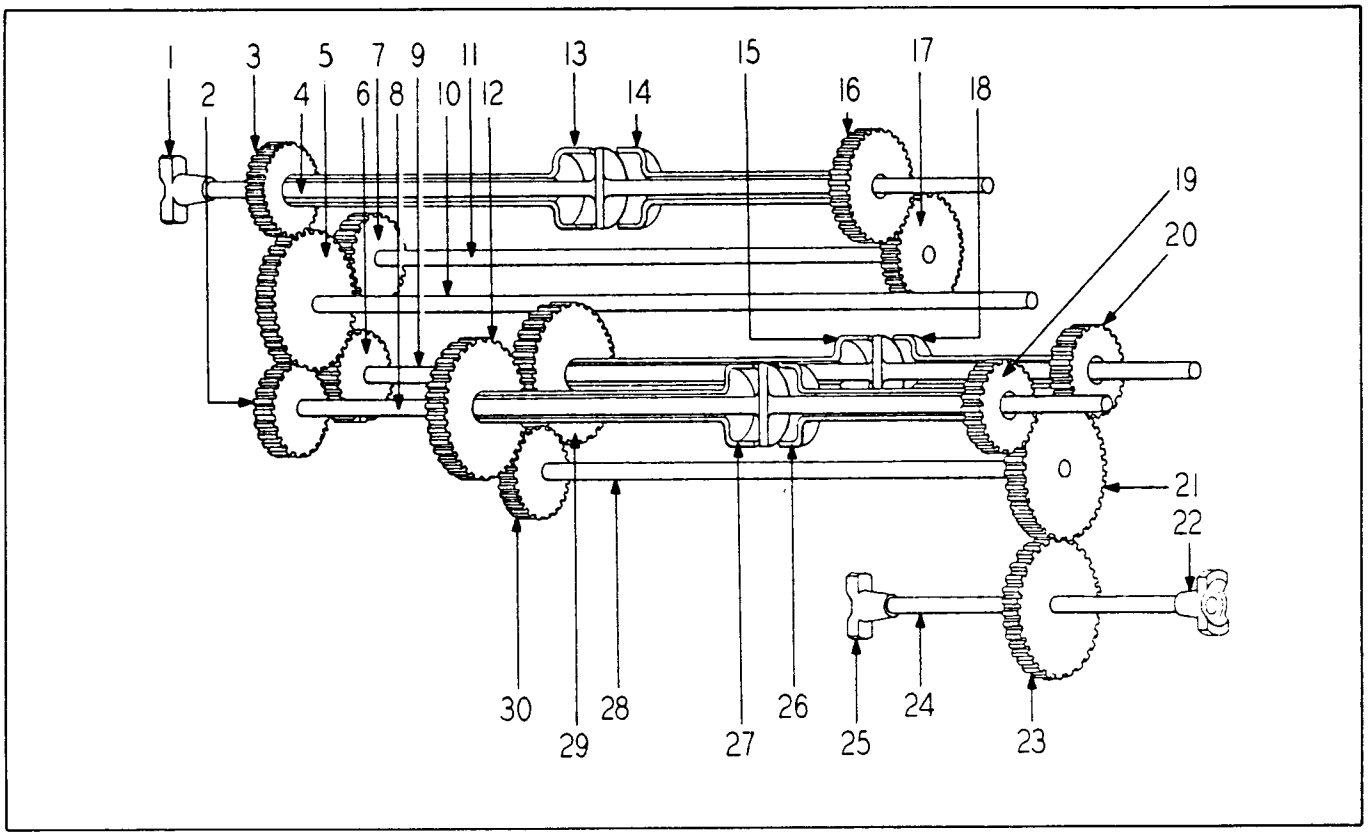

Figure 1-30
Gear Train.

1. Input flange.
2. 2-4 input gear.
3. Forward clutch gear.
4. Forward & reverse clutch shaft.
5. Main idler gear.
6. 1-3 input gear.
7. Reverse transfer driving gear.
8. 2-4 clutch shaft.
9. 1-3 clutch shaft.
10. Main idler shaft.
11. Reverse idler shaft.
12. 4th speed clutch gear.
13. Forward clutch.
14. Reverse clutch.
15. 3rd speed clutch.
16. Reverse clutch gear.
17. Reverse transfer driven gear.
18. 1st speed clutch.
19. 2nd speed clutch gear.
20. 1st speed clutch gear.
21. Low speed gather gear.
22. Front output flange.
23. Output gear.
24. Output shaft.
25. Rear output flange.
26. 2nd speed clutch.
27. 4th speed clutch.
28. Gather shaft.
29. 3rd speed clutch gear.
30. High speed gather gear.

c. Downshifting. Downshifting under load is done under full power. Whenever vehicle speed is reduced below the maximum speed of the next lower range, downshift to the next lowest range. If a downshift is required and the vehicle speed is above the maximum speed of the next lower range, apply the vehicle service brakes until the vehicle speed is less than the maximum speed of the range to which you are shifting. Never downshift at a speed higher than the lower range may obtain.

TRANSMISSION

The four forward and four reverse power paths through the transmission are as follows:

NEUTRAL

Neutral: In "neutral" no power is imparted from the transmission input to the output (See Fig. 1-31). Engagement of a direction and a range clutch is necessary for a particular drive ratio. "Neutral" does not allow main oil pressure to engage either directional clutch. Therefore, a drive through the transmission does not exist in the neutral position.

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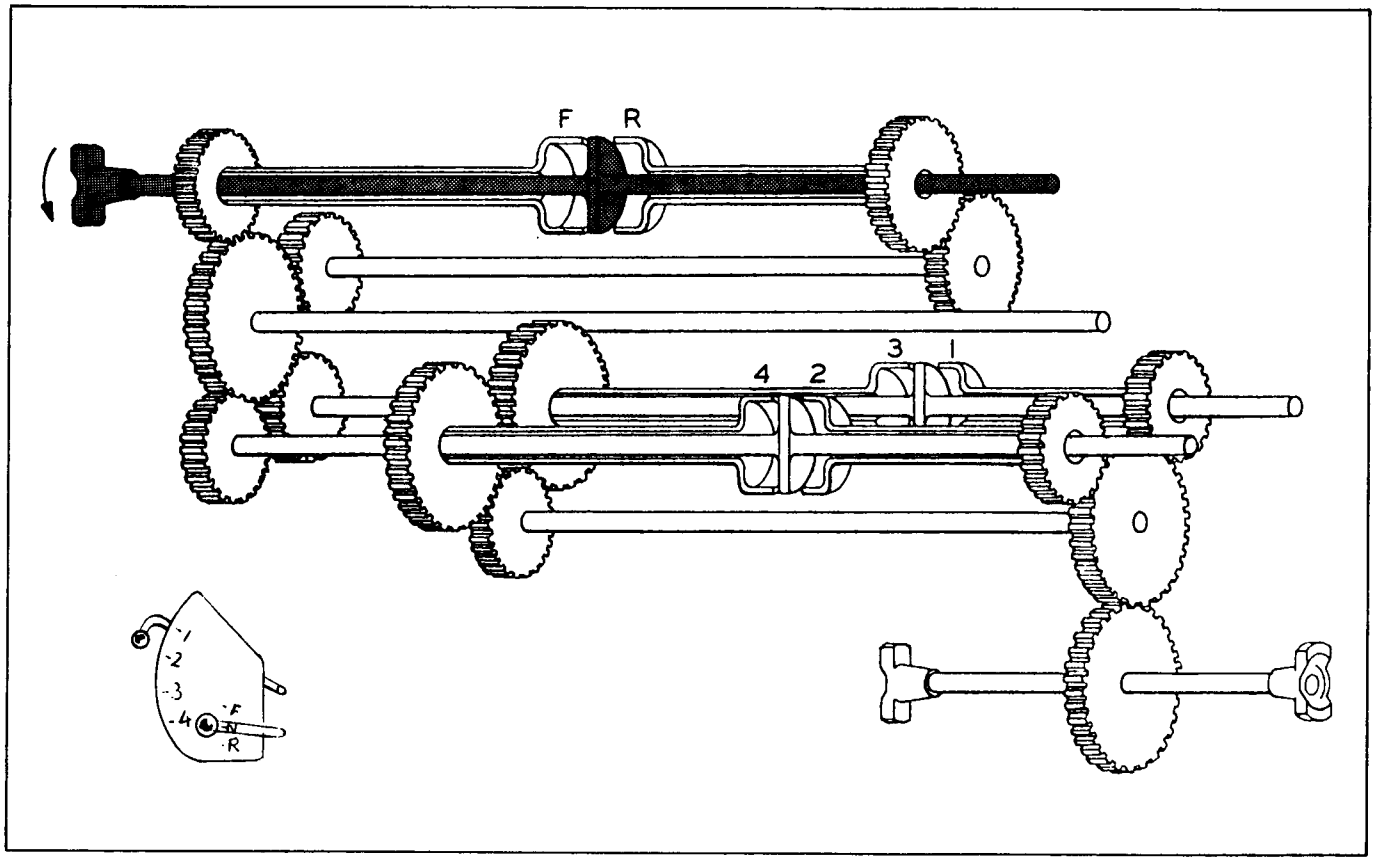

Figure 1-31
Neutral

4. GEAR TRAIN OPERATION - Continued

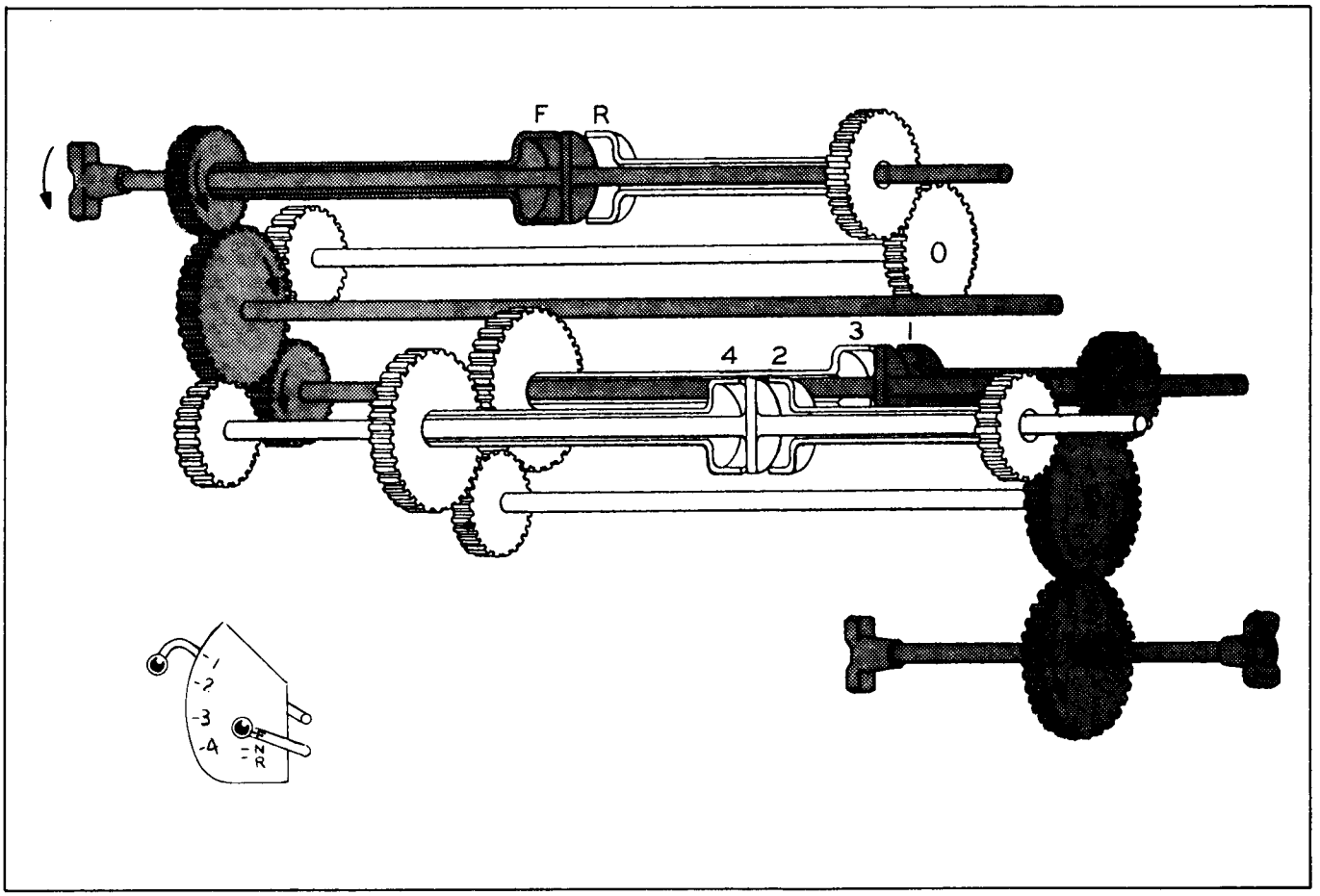

Figure 1-32
Forward, 1st Gear.

FORWARD, 1st GEAR

Forward Direction, First Gear: Input rotation is received through the input shaft by the forward clutch hub (See Fig. 1-32). With the forward clutch engaged, input rotation is imparted to the forward clutch gear which drives the main idler gear in counter input rotation. The main idler gear transmits power in the direction of rotation to the 1st-3rd shaft drive gear, 1st-3rd clutch shaft and third clutch hub. With the first range clutch engaged, power in the direction of engine rotation is transmitted to the first clutch gear. The first clutch gear drives the low speed gather gear in counter engine rotation. The low speed gather gear imparts engine rotation to the output shaft and gear at the maximum reduction of transmission input speed.

FORWARD, 2nd GEAR

Forward Direction, Second Gear: Input rotation is received through the input shaft by the forward clutch hub (See Fig. 1-33). With the forward clutch engaged, input rotation is imparted to the forward clutch gear which in turn, drives the main idler gear in counter input rotation. The main idler gear transmits power in the direction of engine rotation to the 2nd-4th shaft drive gear, 2nd-4th clutch shaft and second clutch hub. With the second range clutch engaged, the second range clutch gear is driven in the direction of engine rotation. The second range clutch gear transmits counter engine rotation to the high speed gather gear, gather shaft and low speed gather gear. The low speed gather gear imparts engine rotation to the output shaft and gear but at a lesser reduction of transmission input speed than 1st gear.

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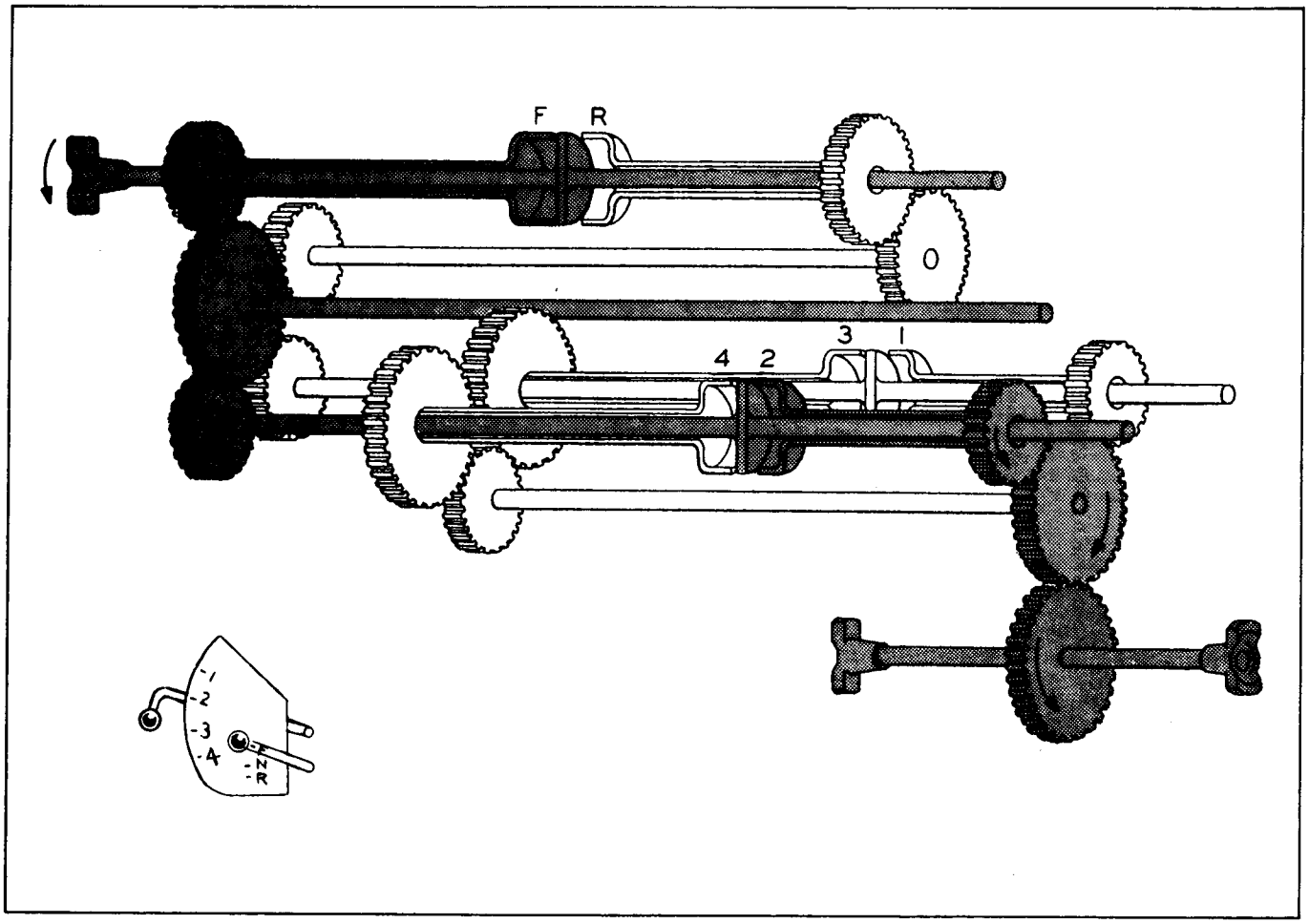

Figure 1-33
Forward, 2nd Gear.

4. GEAR TRAIN OPERATION - Continued

FORWARD, 3rd GEAR

Forward Direction, Third Gear: Input rotation is received through the input shaft by the forward clutch hub (See Fig. 1-34). With the forward clutch engaged, input rotation is imparted to the forward clutch gear which drives the main idler gear in counter input rotation. The main idler gear transmits power in the direction of engine rotation to the 1st-3rd shaft drive gear, 1st-3rd clutch shaft and third clutch hub. With the third range clutch engaged, power in the direction of input rotation drives the third clutch gear. The third clutch gear delivers counter input rotation to the high speed gather gear, gather shaft and low speed gather gear. The low speed gather gear transmits input rotation to the output shaft and gear at a slight increase over transmission input speed.

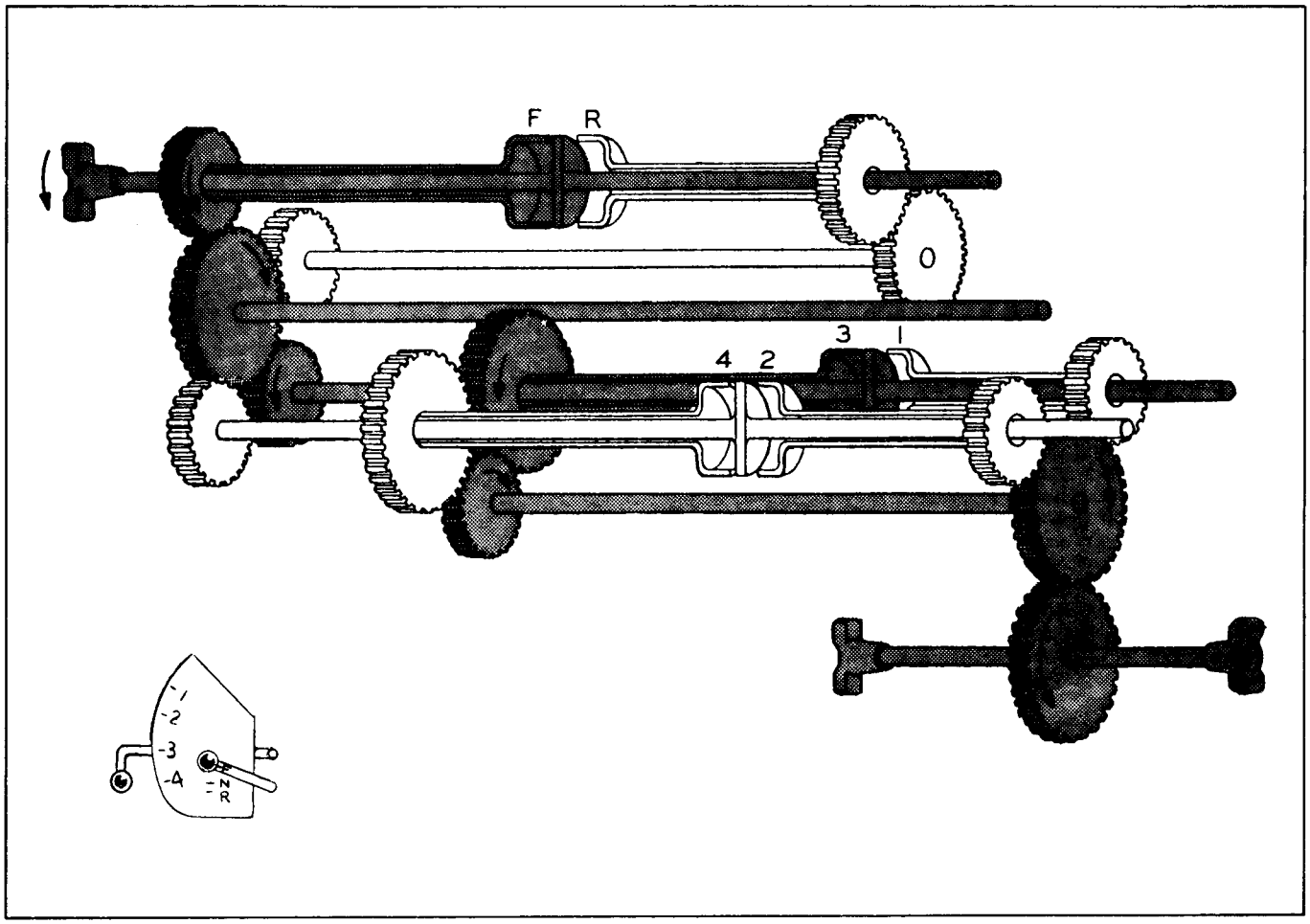

Figure 1-34
Forward, 3rd Gear.

FORWARD, 4th GEAR

Forward Direction, Fourth Gear: Input rotation is received through the input shaft by the forward clutch hub (See Fig. 1-35). With the forward clutch engaged, input rotation is imparted to the forward clutch gear. The forward clutch gear drives the main idler gear in counter input rotation. The main idler gear transmits input rotation to the 2nd-4th shaft drive gear, 2nd-4th clutch shaft and fourth clutch hub. With the fourth range clutch engaged, power in the direction of input rotation is delivered to the fourth clutch gear. The fourth clutch gear drives the high speed gather gear, gather shaft and low speed gather gear in counter input rotation. The low speed gather gear drives the output shaft and gear at input rotation and a maximum increase over transmission input speed.

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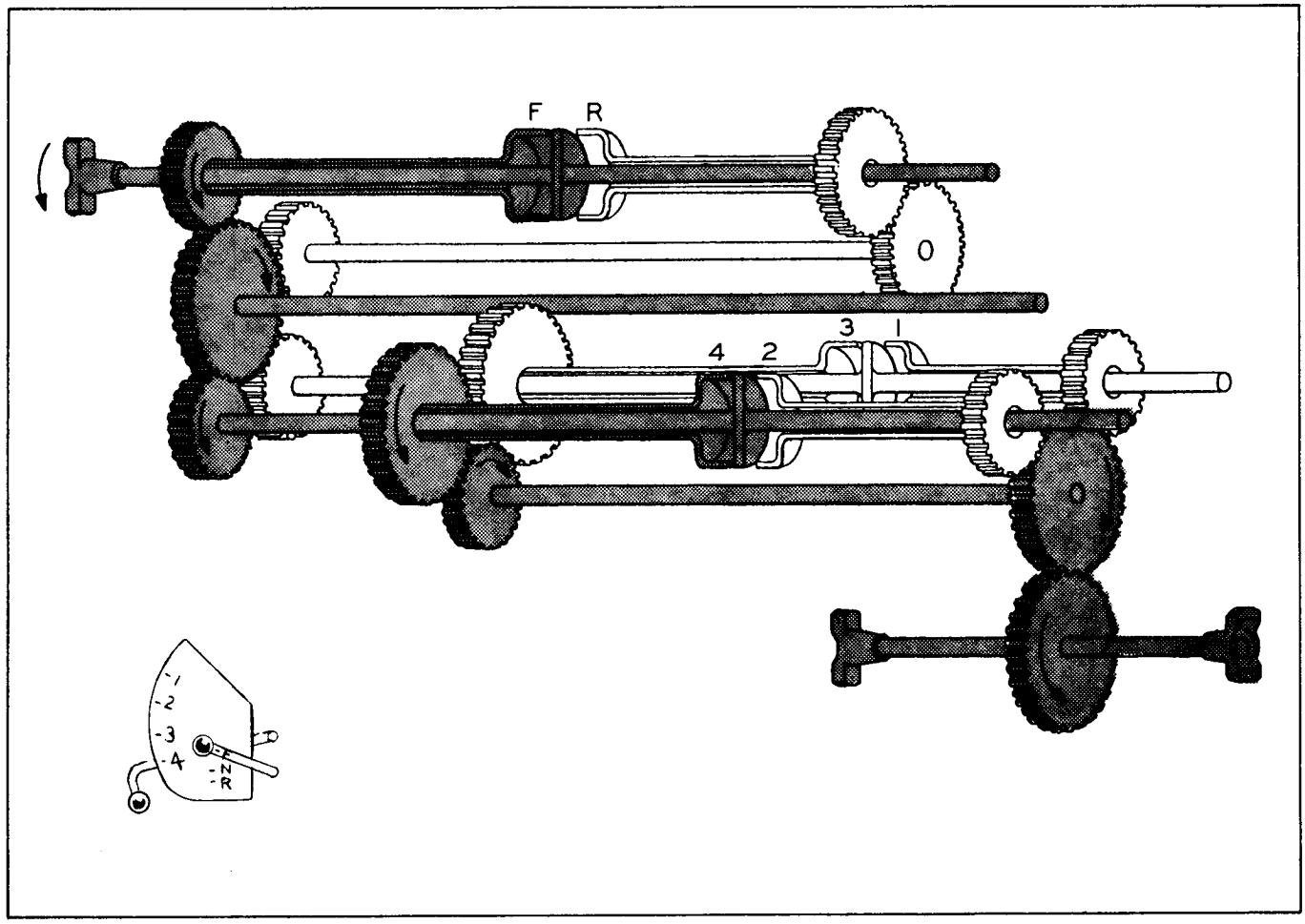

Figure 1-35
Forward, 4th Gear.

4. GEAR TRAIN OPERATION - Continued

REVERSE, 1st GEAR

Reverse Direction, First Gear: Input rotation is received by the input shaft. The reverse clutch is engaged and the reverse clutch gear drives the driving transfer gear (See Fig. 1-36). This gear in turn, imparts through the transfer shaft, counter input rotation to the transfer driven gear. The transfer driven gear delivers input rotation to the main idler gear which drives the 1st-3rd shaft drive gear with counter input rotation. The 1st-3rd shaft drive gear delivers counter input rotation to the first range clutch hub and with the first range clutch engaged, counter input rotation is delivered to the first clutch gear. The first clutch gear imparts input rotation to the low speed gather gear and the low speed gather gear drives the output shaft and gear at counter input rotation with a maximum reduction of transmission input speed.

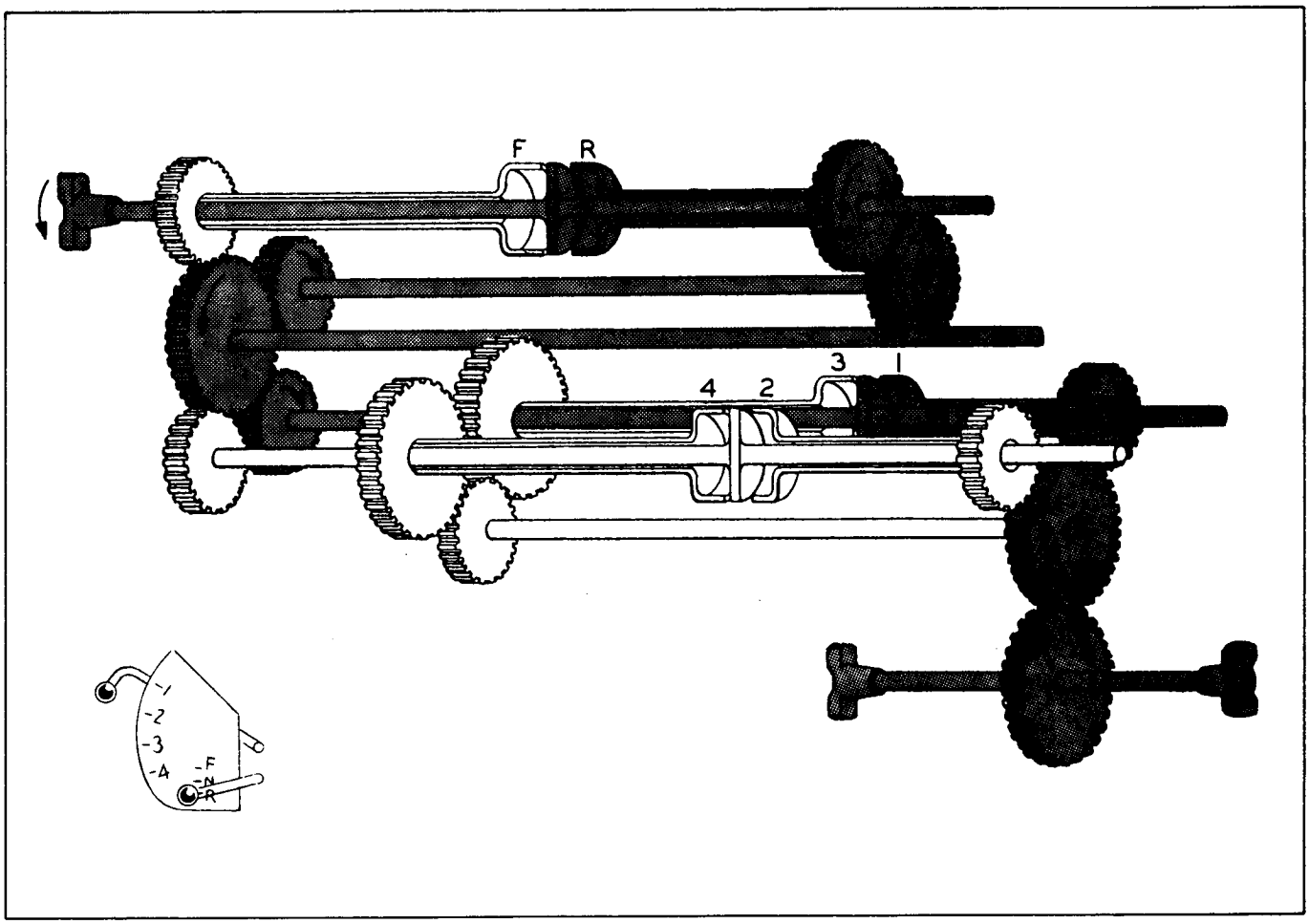

Figure 1-36
Reverse, 1st Gear.

REVERSE, 2nd GEAR

Reverse Direction, Second Gear: Input rotation is received by the input shaft. The reverse clutch is engaged and the reverse clutch gear drives the transfer driving gear. (See Fig. 1-37). This gear, in turn, imparts through the transfer shaft, counter input rotation to the transfer driven gear. The transfer driven gear delivers input rotation to the main idler gear which drives the 2nd-4th shaft drive gear with counter input rotation. This gear in turn, drives the 2nd-4th clutch shaft and hub with counter input rotation. With the second range clutch engaged, counter input rotation is delivered to the second range clutch gear. The second range clutch gear delivers input rotation to the high speed gather gear which, through the gather shaft, drives the low speed gather gear in the same rotation. The low speed gather gear imparts counter input rotation to the output shaft and gear but at a lesser reduction of transmission input speed than 1st gear.

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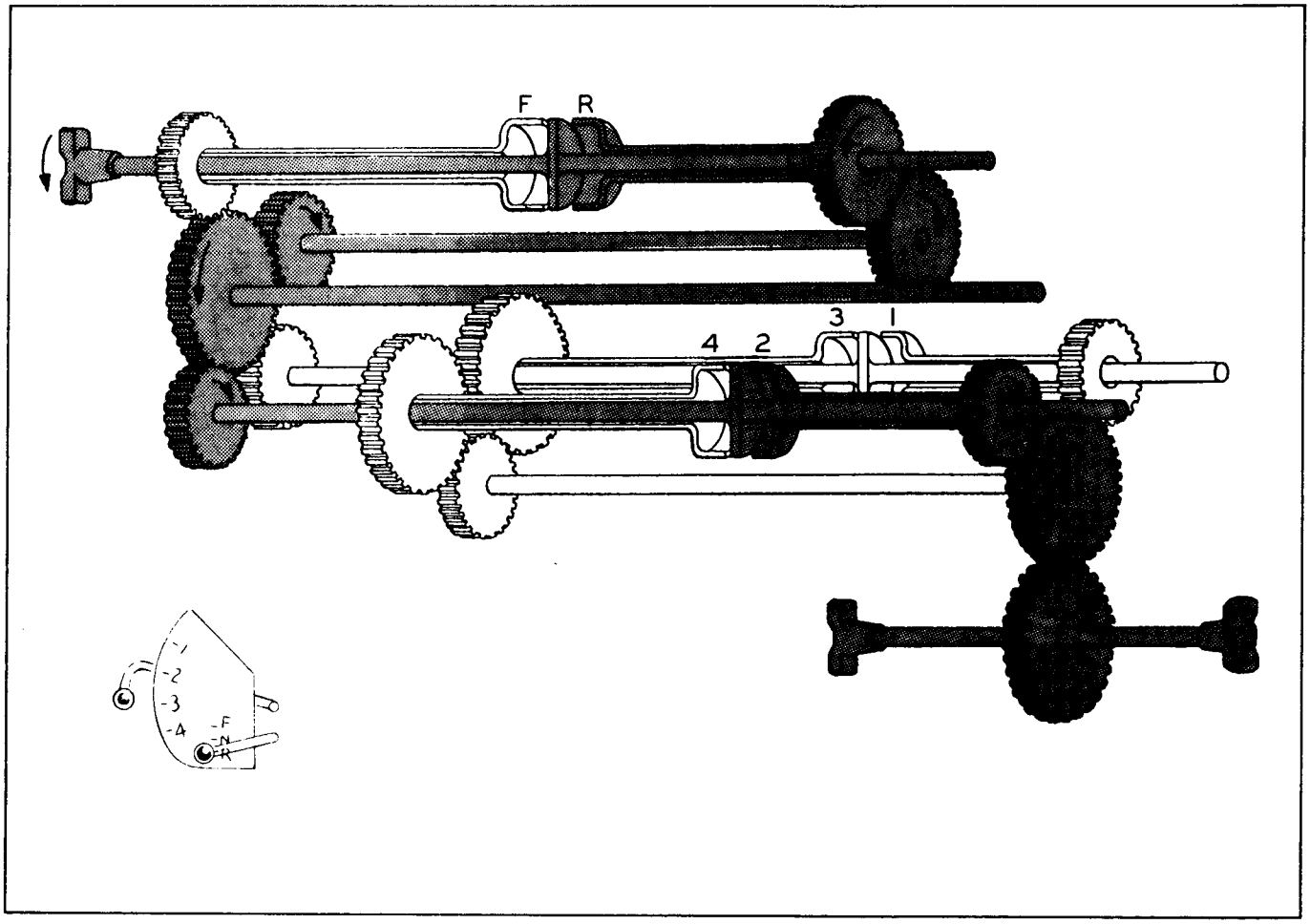

Figure 1-37
Reverse, 2nd Gear.

4. GEAR TRAIN OPERATION - Continued

REVERSE, 3rd GEAR

Reverse Direction, Third Gear: Input rotation is received by the input shaft (See Fig. 1-38). The reverse clutch is engaged and the reverse clutch gear drives the driving transfer gear. The driving transfer gear in turn, imparts through the transfer shaft counter input rotation to the driven transfer gear. The driven transfer gear sends input rotation to the main idler gear which drives the 1st-3rd shaft drive gear and third range clutch hub in counter input rotation. With the third range clutch engaged, counter input rotation is transmitted to third gear. The third clutch gear drives the high speed gather gear, gather shaft and low speed gather gear at input rotation. The low speed gather gear drives the output shaft and gear in counter input rotation at a slight increase over transmission input speed.

REVERSE, 4th GEAR

Reverse Direction, Fourth Gear: Input rotation is received by the input shaft (See Fig. 1-39). The reverse clutch is engaged and the reverse clutch gear drives the driving transfer gear. This gear, in turn, imparts counter input rotation through the transfer shaft to the driven transfer gear. The driven transfer gear transmits input rotation to the main idler gear which in turn drives the 2nd-4th shaft drive gear, 2nd-4th clutch shaft and fourth range clutch hub in counter input rotation. With the fourth range clutch engaged, counter input rotation is imparted to the fourth clutch gear. The fourth clutch gear drives the high speed gather gear, gather shaft and low speed gather gear in input rotation. The low speed gather gear delivers counter input rotation to the output shaft gear and the output shaft at the maximum increase over transmission input speed.

REAR AXLE DISCONNECT

The function of the rear axle disconnect (refer to "2000 SERIES TRANSMISSIONS CLASSIFICATION") on the transmission is to provide either a four wheel drive or a two wheel drive. When the disconnect is engaged, power is delivered to both front and rear output flanges; when the disconnect is disengaged, power is delivered only to the front output flange. There are no adjustments to make of this disconnect as the disconnect shaft movement is controlled by ball detents. The rear axle disconnect must be engaged or disengaged only when the vehicle is stationary.

CAUTION: NEVER ENGAGE OR DISENGAGE THE AXLE DISCONNECT WHILE THE VEHICLE IS MOVING.

PARKING BRAKE

The parking brake on the transmission is not a service or stopping brake and should not be used as such. It is designed as a holding brake and should be used to hold the vehicle after it has been stopped.

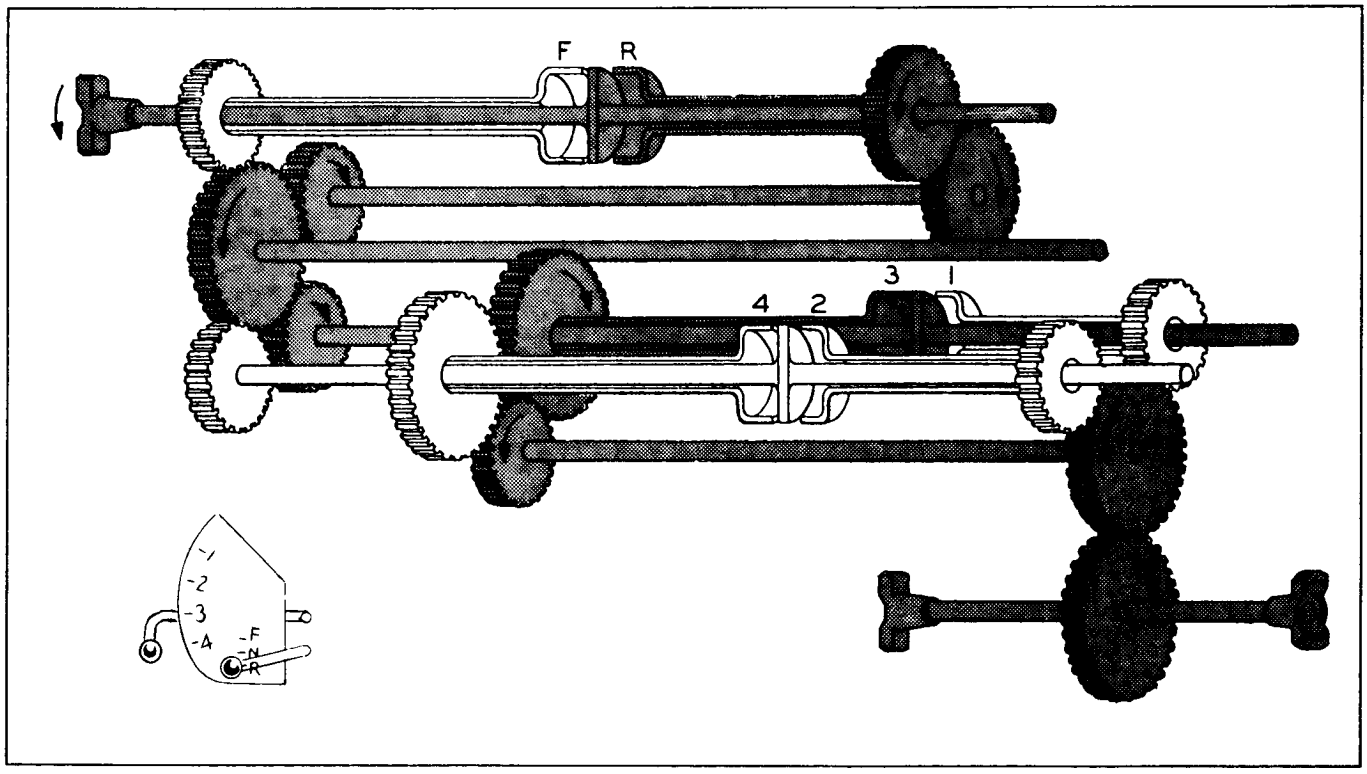

Figure 1-38
Reverse, 3rd Gear.

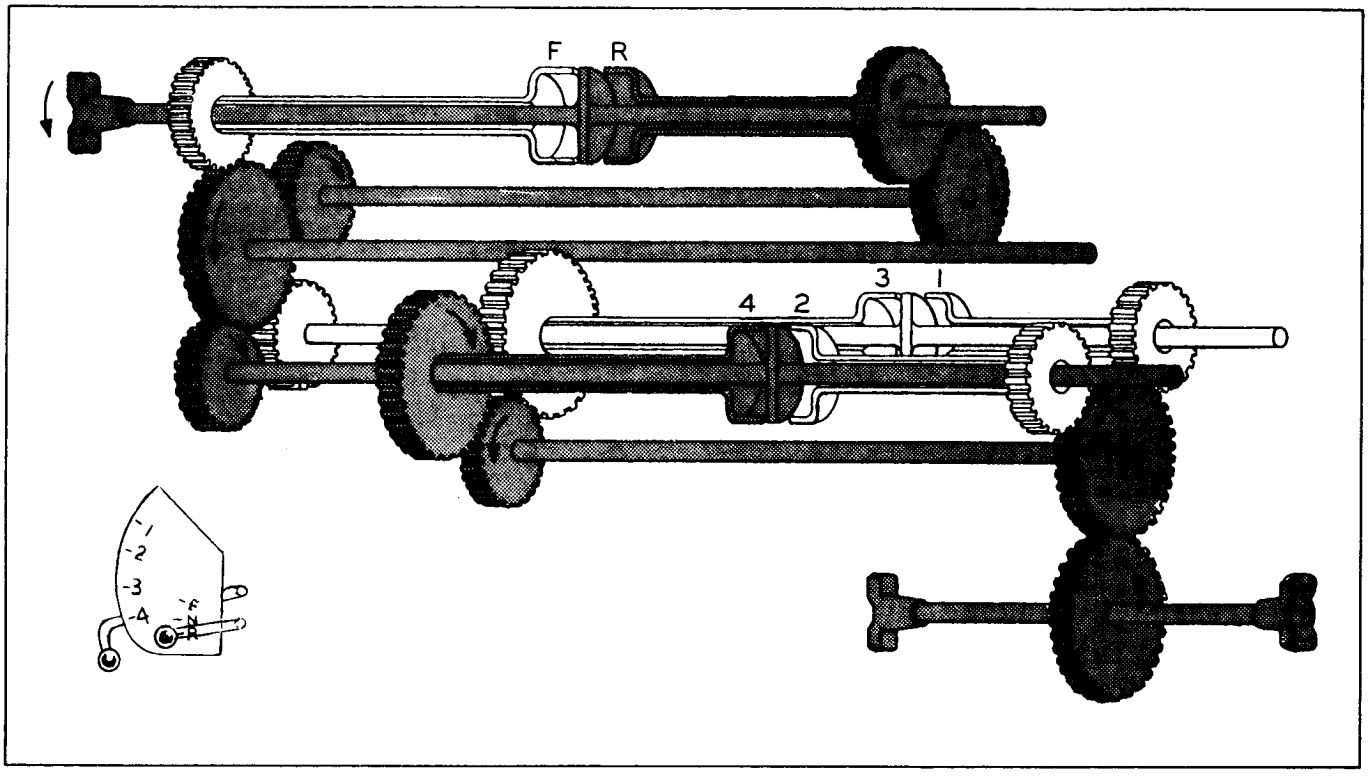

Figure 1-39
Reverse, 4th Gear.

External lines furnish the necessary connections to hydraulically integrate the separately mounted torque converter with accessory drive and transmission. The transmission sump acts as a reservoir for the system's oil supply. A line from the transmission sump screen connects to the input charging pump inlet in the torque converter housing. The charging pump draws oil from the sump of the transmission and directs it through the pump suction line and a cored passage in the torque converter housing. The charging pump discharges the oil through a cored passage in the torque converter housing and through a pump discharge line. Oil in this line passes through a full flow filter with a 10 psi maximum drop (oil at 150°F). The pump discharge line connects to an opening at the top of the transmission. The oil is distributed through the transmission by cored passageways and is regulated by the main pressure regulator valve. The main pressure regulator valve regulates converter "in" pressure. The converter "in" pressure exits from the main pressure regulator valve through a line to the torque converter housing. Oil is circulated through the converter and exits from the housing past the converter oil temperature sender through an external line to the oil cooler. From the cooler, fluid moves to the converter "out" opening on the main pressure regulator valve. Leakage from the converter elements inside the converter housing drains from the bottom of the converter housing or flywheel housing through lines to the transmission. Once inside the transmission the fluid flows to sump.

The hydraulic system of the transmission and converter consists of the following basic assemblies:

1. An input charging pump driven by a gear train attached to the rear of the converter impeller element. Charging pump speed is the same as engine speed. Refer to "CONVERTER CLASSIFICATION" for pump capacity.

2. The main regulator valve body consisting of three valves:

   a. Clutch pressure regulator valve

   b. Converter pressure regulator valve

   c. Lube pressure regulator valve

   These valves maintain regulated pressure within their individual circuits.

3. Two control valve bodies:

   a. Forward-reverse selector valve including the neutral knockdown valve

   b. Range selector valve

4. Supplementing the system are the:

   a. Sump suction screen contained in the transmission sump

   b. Full flow filter mounted externally and equipped with a by-pass valve set at 15-20 psi.

   c. Externally mounted oil cooler

The converter hub contains a by-pass orifice which connects converter "in" and converter "out" oil. This opening maintains uniform pressure within the converter and allows, upon demand, more oil to circulate through the converter. The converter pressure regulator valve limits converter "in" pressure. Oil is allowed to pass through an orifice in the front land of the valve to the head of the valve. Pressure on the valve head exerts a force against a spring at the rear of the valve. The spring limits converter "in" pressure to the recommended maximum (refer to "SYSTEM PRESSURES"). Pressure in excess of the recommended maximum causes the valve to compress the spring further and pass excess oil to the lube system.

The lube system receives its supply of oil from two sources:

1. The overage from the converter pressure regulator valve

2. The oil cooler return line to the main regulator valve body

HYDRAULICS

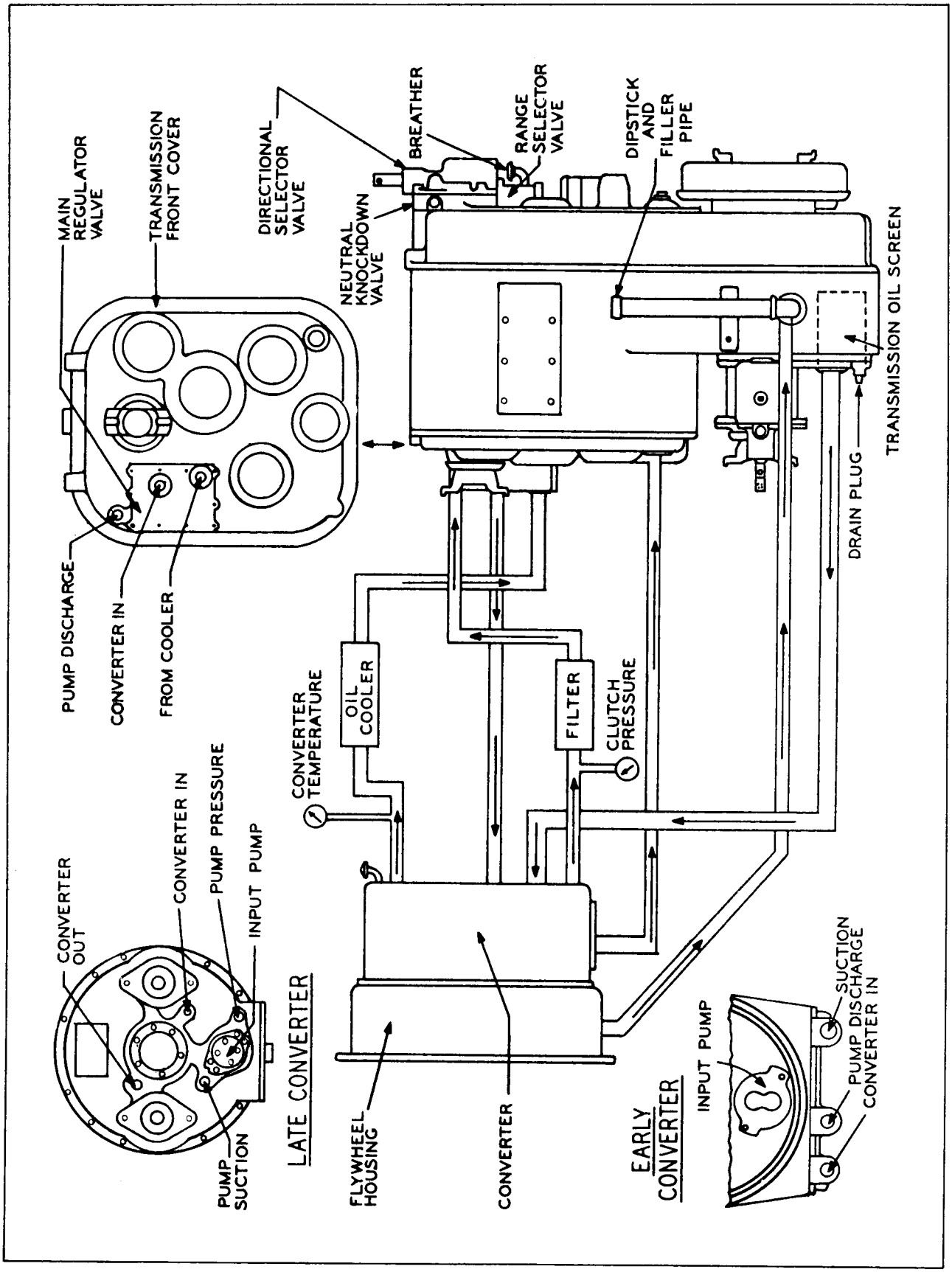

Figure 1-40
Hydraulic Lines.

GENERAL INFORMATION

HYDRAULICS

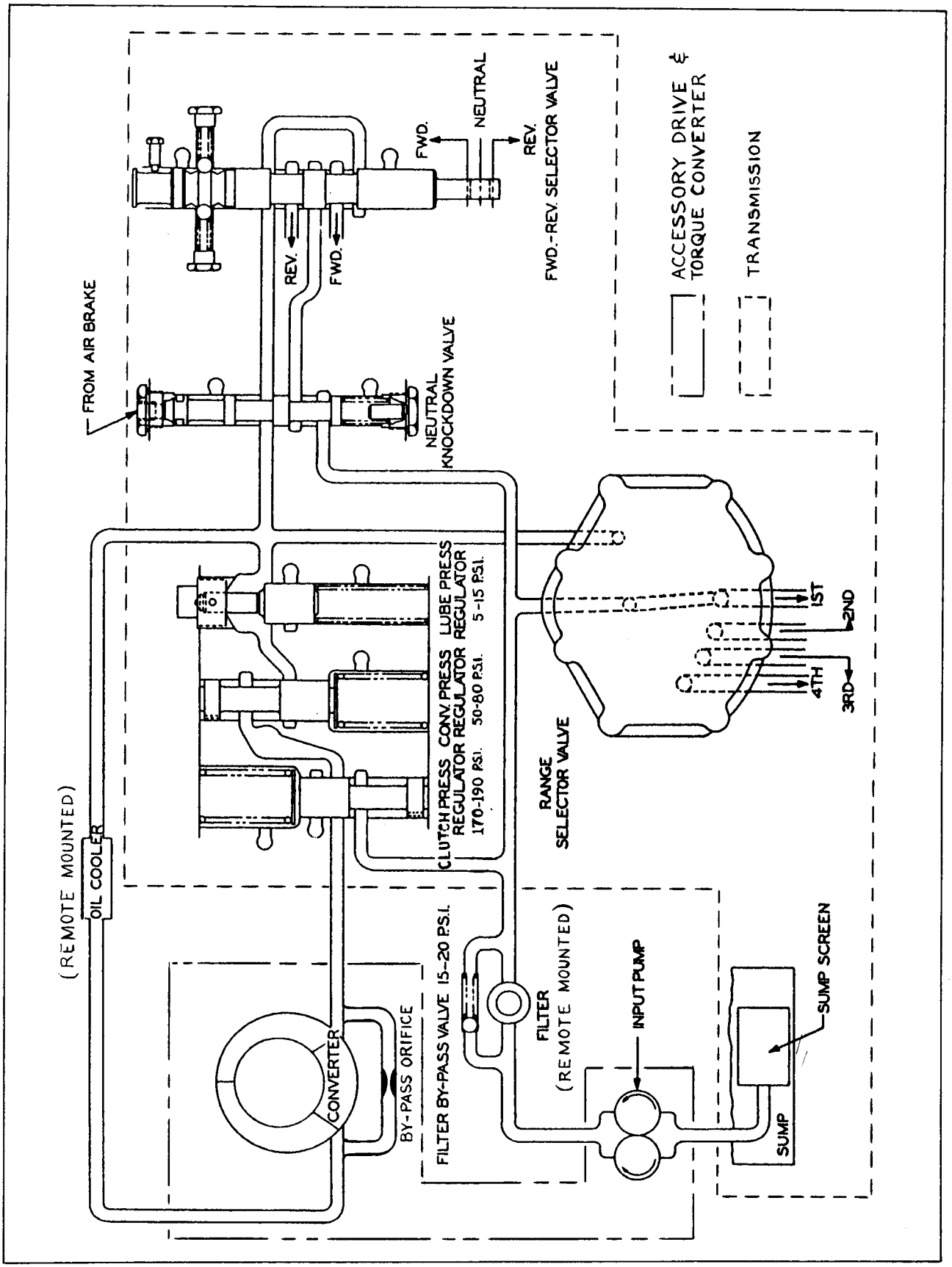

Figure 1-41
Flow Diagram.

The lube pressure regulator valve controls the lube system pressure. Excess oil in the lube system is directed to the sump of the transmission. Lube pressure above the recommended (refer to "SYSTEM PRESSURES") will force the lube pressure regulator valve deeper in its bore and open a passage to sump. Pressure regulation in the clutch and converter system is aided by the orifice in the front land of each valve. When a pressure drop occurs, the spring forces the valve forward against the pressure on the front land of the valve. Therefore to allow movement of either valve, the volume in the front of the valve must return through the orifice. The orifice or dashpot prevents rapid oscillation of the valve and radical oil pressure surges. When the system is charged, lube oil pressurizes the accelerator and clutch pistons in each clutch and furnishes lube oil through drilled passages for all clutch plates and bushings.

To charge the system, the input pump draws oil through the pump screen, forces it through the full flow filter to:

1. Main pressure regulator valve body

2. The range selector valve

3. To the neutral knockdown valve, and through that valve to the directional selector valve

Gears are splash lubricated. Lube oil, directed through the range selector valve, the neutral knockdown valve and the forward-reverse selector valve, furnishes lubrication for all range and direction clutch plates and accelerator and clutch pistons. When the range selector valve is positioned in one of the four ranges, main oil pressurizes the accelerator and clutch pistons of that range engaging the clutch plates. By positioning the directional selector valve in either forward or reverse, main pressure actuates the accelerator and clutch pistons of the selected direction. Shifting from range to range or forward to reverse redirects main oil to the range or direction desired.

An air line from the brake system is connected to the head of the neutral knockdown valve. When the left brake pedal is applied, air forces the neutral knockdown valve to its closed position. In this position, main pressure is prevented from entering either directional clutch. The vehicle is then in neutral. When the knockdown valve is actuated by the brake system, lube oil is directed to both directional pistons. This maintains lube pressure within the piston cavities and furnishes lube oil to the clutch plates and bushings. When the brake is released, the knockdown valve is returned, by spring pressure, to its normal position. Again main oil pressure is permitted to flow into the applied directional clutch, and the vehicle returns to its normal operation.

The clutch pressure regulator valve allows oil to pass through an orifice in the front land of the head of the valve exerting a force toward the spring end of the valve. The spring on the rear of the clutch pressure regulator valve regulates the clutch pressure. Pressure in excess of the recommended maximum (refer to "SYSTEM PRESSURES") causes the clutch pressure regulator valve to compress the spring further and by-pass the excess oil to the converter system. The oil by-passed by the clutch pressure regulator valve fills the converter system with oil. As the oil flows into the converter, it fills the cavity between the drive housing of the converter and the impeller. When the cavity is filled with oil, the oil exits from the converter through a converter out line to the oil cooler, and through the cooler back to the main pressure regulator valve body.

PREVENTIVE MAINTENANCE

1. OIL

BASIC

Description: Should be a heavy duty SAE 10W motor oil meeting U. S. Military test standard MIL-L-2104A and has a API service rating MS.

QUANTITY FOR ORIGINAL FILL

Refer to "SPECIFICATIONS."

2. CHANGE PERIODS

1. Oil change - 1000 hours of operation.

2. Clean transmission filter oil screen - 1000 hours of operation.

3. Change external filter - 500 hours of operation.

4. Change the oil and filter and clean the filter screen whenever traces of dirt or the effects of high operating temperatures are present as evidenced by discoloration or strong odors.

5. After any internal failure, change oil and completely flush and clean the converter and transmission including filter, lines, oil cooler and valve bodies. Failure to perform this service will result in additional failures through contamination.

6. Metal particles in the oil indicate a failed or wearing part and the entire system and units should be drained, flushed and thoroughly cleaned.

7. To drain the installation, remove the drain plug(s) in the bottom of the transmission housing.

3. OIL LEVEL CHECK

1. Oil level should be checked daily or at the beginning of each shift.

NOTE: Tractor must be on level ground when checking oil level.

2. Pre-Start Check: Insure sufficient oil in the system before starting the engine. Remove dipstick from oil filler tube located on right side of transmission sump. Oil in transmission sump should be above "OPERATING RANGE" (top mark) on the dipstick. If not, add oil to level of top mark.

3. Hot Oil Check: With engine and transmission at normal operating temperature, transmission in neutral, and engine idling, oil in the transmission sump should be level with the "OPERATING RANGE" mark. For greatest accuracy, oil level check should be made with engine idling at 1000 RPM. If the oil is not level with the "OPERATING RANGE" mark, add oil to bring it to this level.

4. OPERATING TEMPERATURE

1. Normal operating temperature - refer to "OPERATING RANGES".

2. Maximum operating temperature - refer to "OPERATING RANGES".

3. The operating temperature of the oil is registered as oil leaves the converter and is read on the temperature gauge on the vehicle dash. Converter "OUT" temperature check point is located on the converter housing (see Fig. 1-42).

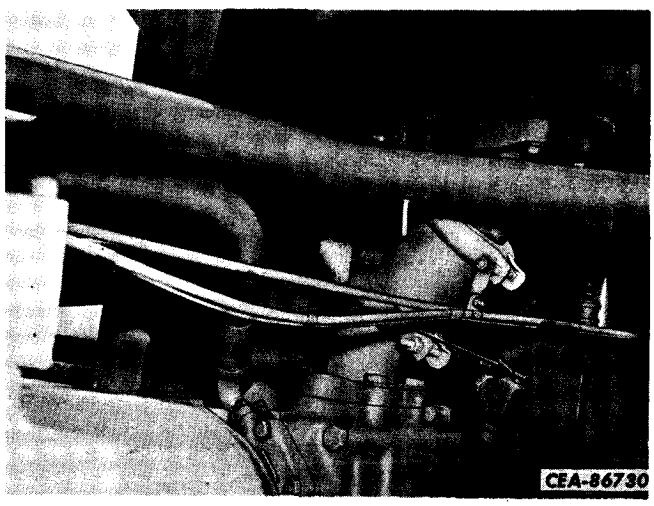

Figure 1-42
Converter "Out" Temperature Check Point.

4. To cool the oil, shift transmission into neutral, apply parking brake and accelerate engine to 1000 to 1500 RPM. The temperature of the oil should drop to a safe operating range.

5. OPERATING PRESSURE

1. Pressure checks should be made with engine and transmission at normal operating temperature. Transmission oil temperature should approximate minimum engine water temperature (refer to "OPERATING RANGES").

2. Pressure checks should be made at full power stall.

3. Clutch Pressure at Stall:

   a. Refer to "OPERATING RANGES" for clutch pressure limitations.

   b. Pressure may be read on dash gauge.

   c. Service gauge may be attached to clutch pressure tap on main regulator valve body (refer to Fig. 1-43).

4. Converter "IN" Pressure (High Idle)

   a. Refer to "OPERATING RANGES" for converter "IN" pressure limitations.

   b. Service gauge may be attached to converter "IN" tap on main regulator valve body (refer to Fig. 1-43).

5. Lube Pressure (High Idle)

   a. Refer to "OPERATING RANGES" for lube pressure limitations.

   b. Service gauge may be attached to lube pressure tap on main regulator valve body (refer to Fig. 1-43).

6. STALL CHECK

A full power stall check is made to determine whether or not the engine has rated power and if converter and transmission are operating correctly.

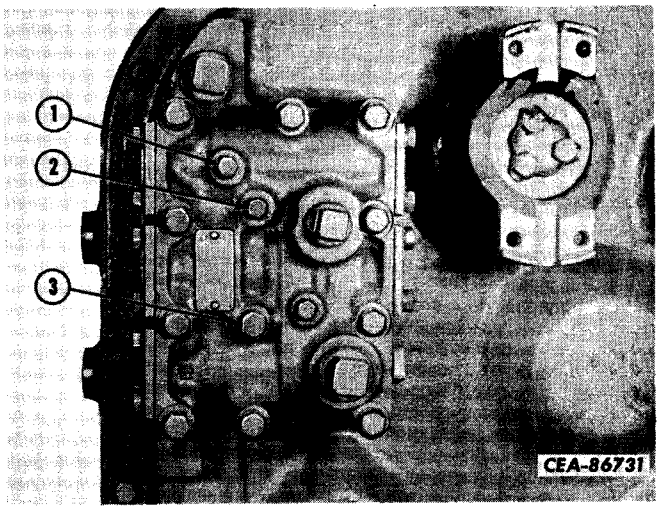

Figure 1-43
Main Regulator Valve Pressure Tap Points.

NOTE: Before making a stall check, accelerate the engine to 1000 rpm with transmission in neutral. At 1000 rpm, clutch pressure should equal recommended minimum (refer to "OPERATING RANGES"). If this minimum pressure is not obtained DO NOT MAKE THE STALL CHECK. If clutch pressure is below minimum clutches will slip and burn at full stall.

A stall check is accomplished by:

1. Engine and converter transmission operating at proper temperature.

2. Attach tachometer to engine tachometer drive receptacle (H-120B).

   a. I. H. UDT-817 located on engine front timing gear cover.

   b. Cummins NRT-6-C1 located on fuel injection pump.

   c. Detroit Diesel 8V71N located on the camshaft cover at the flywheel end of the machine.

3. Apply parking brake.

(Continued on next page)

6. STALL CHECK - Continued

4. Run the engine to be sure it will operate at high idle (refer to "OPERATING RANGES").

5. Shift transmission to either forward or reverse direction and fourth range.

6. Depress the accelerator to its maximum position and record the engine RPM. Refer to "OPERATING RANGES" for stall speed limitations.

7. LINKAGE ADJUSTMENTS

Both range and directional linkage must be adjusted to allow free movement and a definite "Detent" feel as the lever is moved from one position to another. Linkage should not bind or hold valves or levers between "Detent" position.

NOTE: Never position between detents.

8. EXTERNAL LINES

All external lines should be inspected periodically for:

1. Loose fittings that allow oil or air leaks.

2. Damaged, collapsed or worn hose.

9. WIRING

All wiring should be inspected periodically for loose connections and broken or damaged wires. Tape all frayed insulation.

10. PARKING BRAKE

Inspect the parking brake to be sure brake shoes are not dragging on the drum. This can be the result of improper linkage adjustment, that fails to allow full release. Check brake linkage periodically and especially if brake drag is suspected. Continued operation under these conditions will result in brake failure and loss of operating efficiency.

SECTION 11

TORQUE CONVERTER AND ACCESSORY DRIVE

DISASSEMBLY PREPARATION

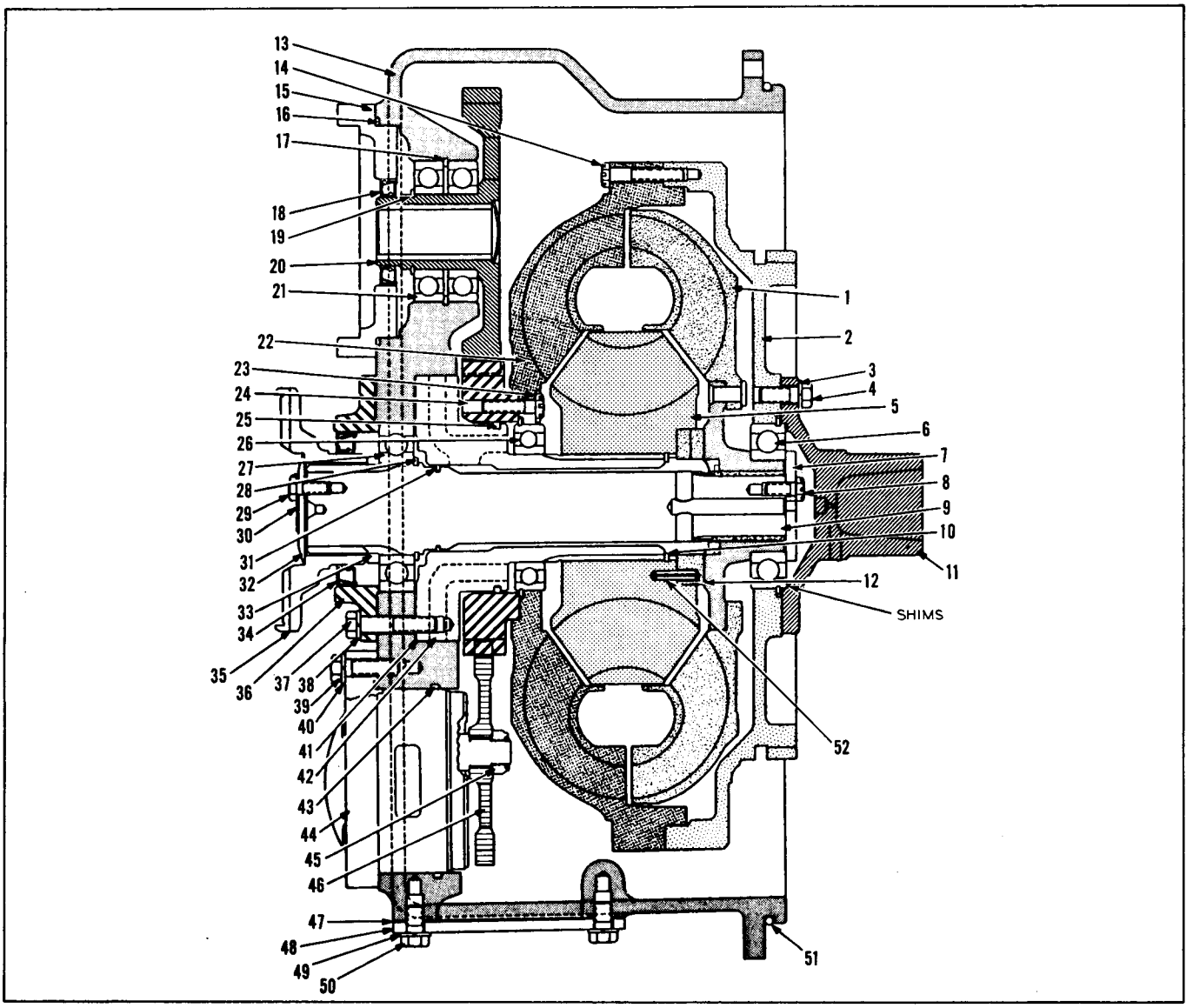

Figure 2-1
Torque Converter and Accessory Drive.

1. Turbine.
2. Drive housing.
3. Lock washer.
4. Cap screw.
5. Stator.
6. Bearing.
7. Washer.
8. Cap screw.
9. Output shaft.
10. Snap ring.
11. Input hub.
12. Spacer.
13. Housing.
14. Cap screw.
15. Adapter.
16. "O" ring.
17. Snap ring.
18. Oil seal.
19. Snap ring.
20. Hydraulic pump drive gear assembly.
21. Bearing.
22. Impeller.
23. Cap screw.
24. Gear.
25. Seal ring.
26. Bearing.
27. Bearing.
28. Snap ring.
29. Cap screw.
30. Locking plate.
31. Seal ring.
32. Washer.
33. Spacer
34. Oil seal.
35. Output yoke.
36. Retainer
37. Cap screw.
38. Lock washer.
39. Cap screw.
40. Lock washer.
41. Gasket.
42. Ground sleeve hub.
43. "O" ring.
44. Input pump.
45. Nut.
46. Input pump. driving gear.
47. Gasket.
48. Inspection cover.
49. Lock washer.
50. Cap screw.
51. Seal ring.
52. Dowel pin.

DISASSEMBLY PREPARATION

Disassembly should include:

1. Disconnecting all external lines from housing.

2. Provisions for steam cleaning the converter and surrounding area. Do not use caustic soda.

3. Preparing a dirt free work area at least 12 feet square.

4. A suitable hoist.

5. The following tools:

   a. Low table of bench for disassembly.

   b. Shop press.

   c. Solvent for cleaning parts.

   d. Standard set of mechanic's hand tools including:

   Snap ring pliers
   Torque wrench - 100 ft. lbs. capacity
   Mallet (preferably plastic)

   e. A steel tube 6-1/2" I. D. x 9" with at least 1/4" wall thickness.

   f. A steel plate 3-3/4" dia. x 3/4" thick.

6. Pans for holding small parts during disassembly.

DISASSEMBLY

Clean the exterior of the torque converter and the surrounding area thoroughly with plain steam (no caustic soda). Prepare a clean work area. Cleanliness is very important during converter overhaul.

When a converter is removed from the tractor, all open lines and ports on both the converter and its attaching lines must be plugged with plastic caps.

NOTE: Do not use rag to plug ports or lines.

Position converter on a bench with output yoke (1) facing down. Block housing so yoke will clear bench.

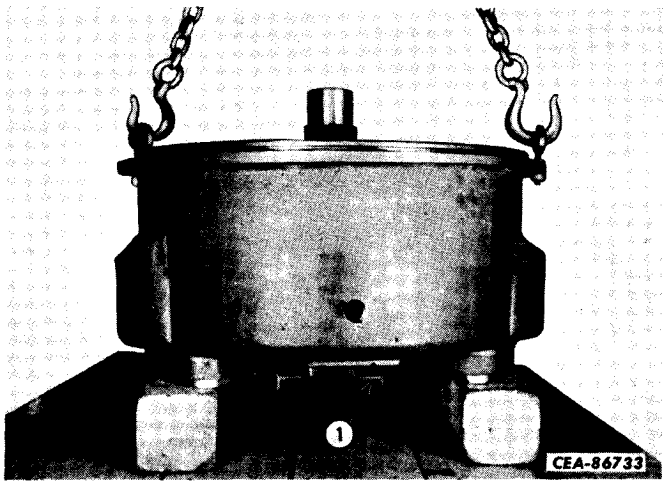

Figure 2-2

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DISASSEMBLY

Remove the seal ring (1) from the drive housing (2). Discard the seal ring.

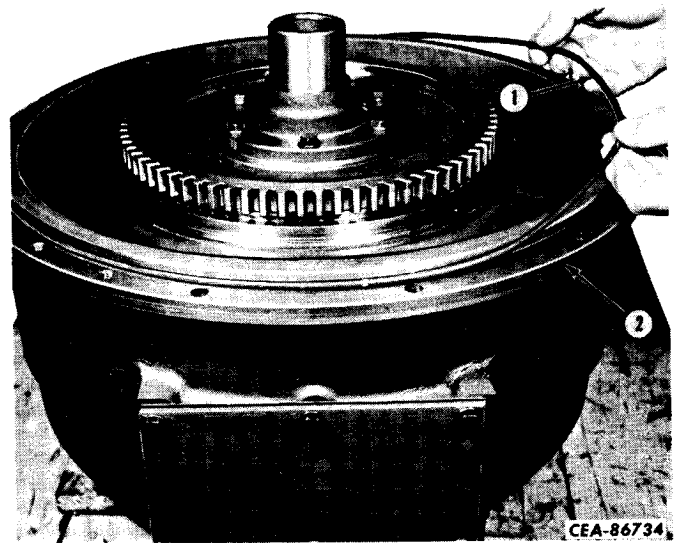

Figure 2-3

Remove cap screws and lock washers that secure the pump inspection cover (2). Remove cover and gasket (1) and discard gasket.

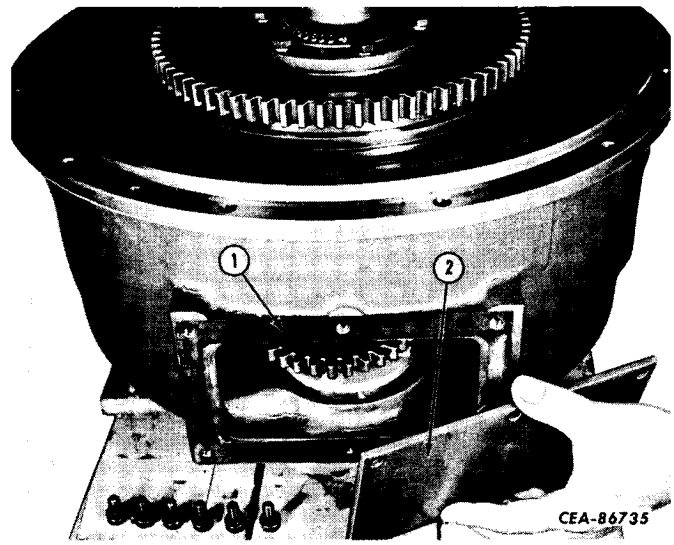

Figure 2-4

Remove the cap screws (4) and lock washers that secure the hub (1) to the drive housing (3). Remove the hub and shims (2). Tie shims together to facilitate assembly.

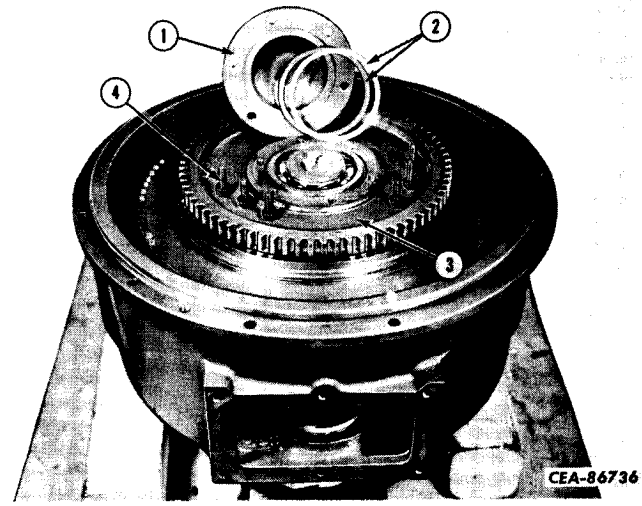

Figure 2-5

TORQUE CONVERTER AND ACCESSORY DRIVE

DISASSEMBLY

Remove the cap screws (1) and lockplate (2) that secure the retaining washer (3) to the output shaft. Remove the retaining washer and shims (4) (if any). Tie shims together to facilitate assembly. Discard cap screw locking plate.

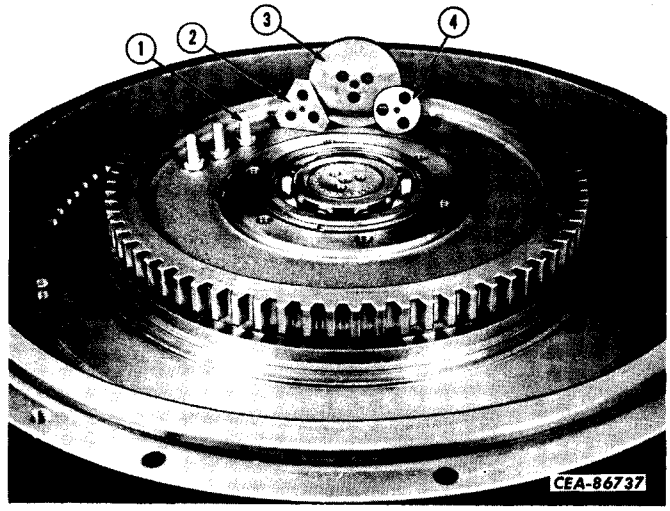

Figure 2-6

Using a suitable hoist, lift the converter assembly (1) from the converter housing (2).

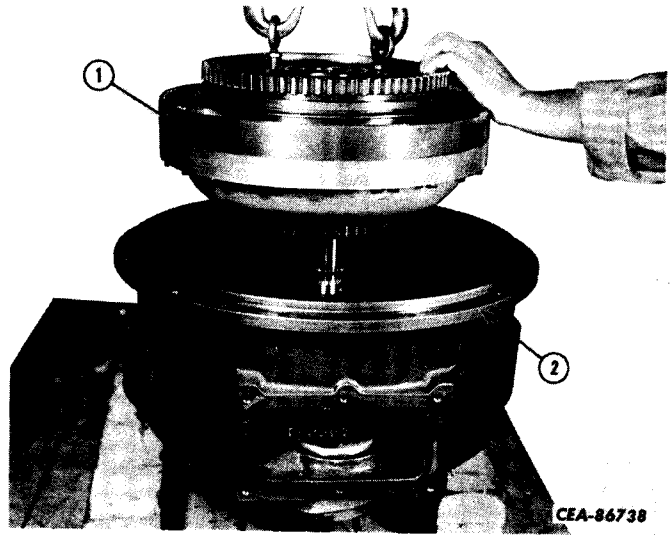

Figure 2-7

Place the converter assembly on the bench, drive housing (1) up. Block the impeller high enough to allow the accessory drive gear (2) to clear the bench.

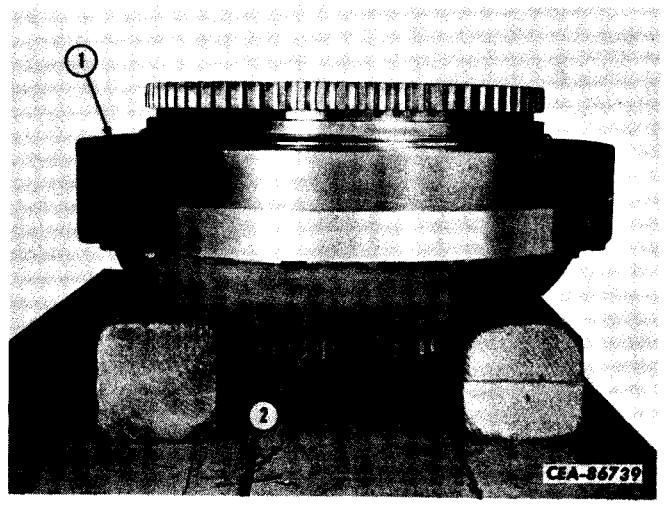

Figure 2-8

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DISASSEMBLY

Remove the cap screws (3) that secure the impeller (2) to the drive housing (1).

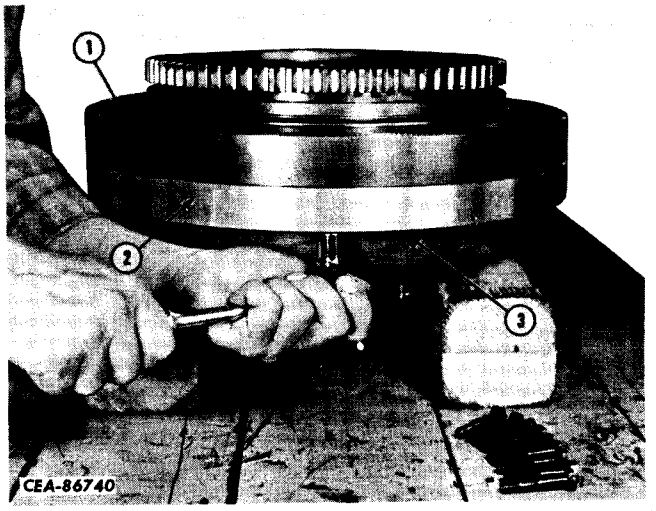

Figure 2-9

Using a suitable hoist lift the drive housing (1) and attached turbine from the converter assembly.

NOTE: Do not drop turbine as it is removed from converter assembly.

Invert the housing and turbine assembly and pull the turbine from the drive housing.

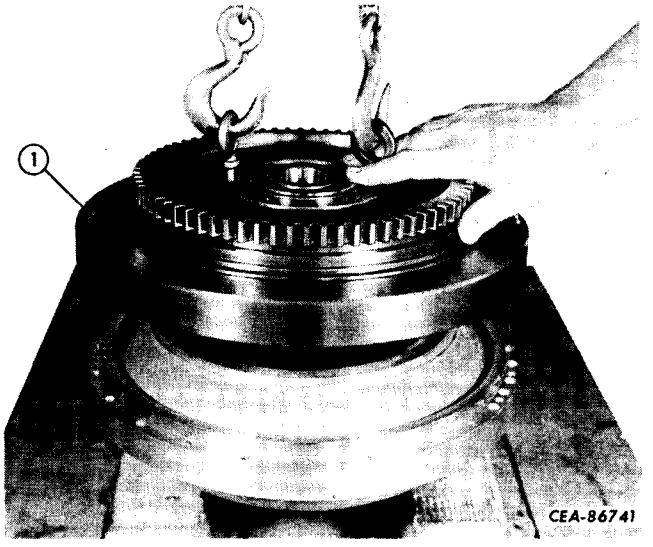

Figure 2-10

To remove the bearing (2) use a suitable driver (1) on the outer bearing race and drive the bearing from the drive housing.

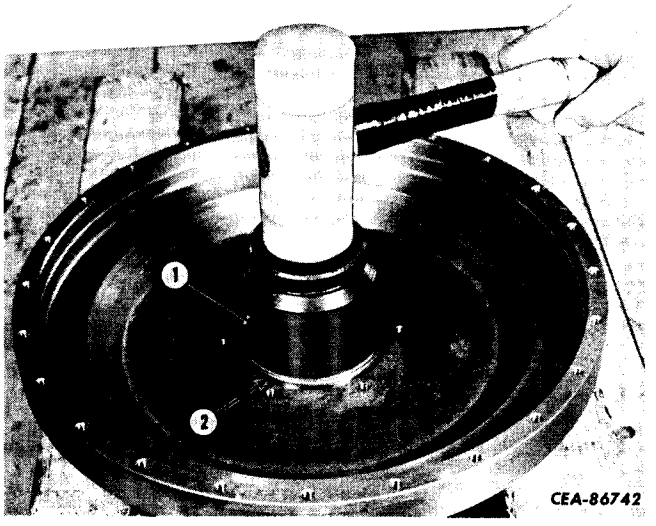

Figure 2-11

DISASSEMBLY

Remove the converter spacer (1) from the dowel (2) in the stator (3) and remove the stator.

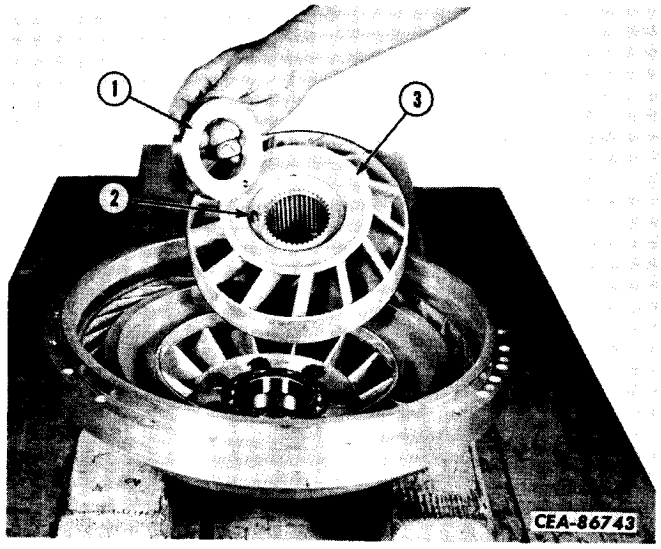

Figure 2-12

Remove the cap screws (2) that retain the accessory drive gear to the impeller (1). Tap the hub, bearing and gear from the impeller.

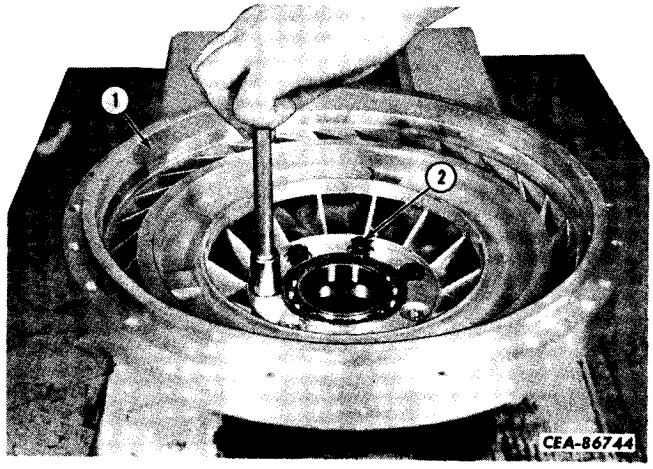

Figure 2-13

Position the converter housing (4) on the blocking with the output yoke (1) facing up.

Remove the cap screws (2) and locking plate (3) that secures the retaining washer to the output shaft. Remove the retaining washer and output yoke.

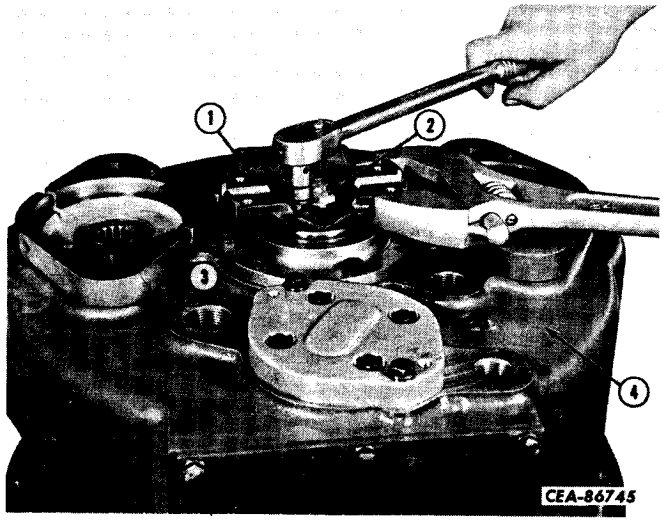

Figure 2-14

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DISASSEMBLY

Remove the cap screws and lock washers that secure the bearing retainer (1) and the ground sleeve hub to the converter housing (6). Remove the bearing retainer and seal assembly (1) and shims (2). Drive the seal (3) from the retainer. Discard the seal and the retainer gasket (4).

Tie shims to bearing retainer to prevent loss. Remove yoke spacer (5).

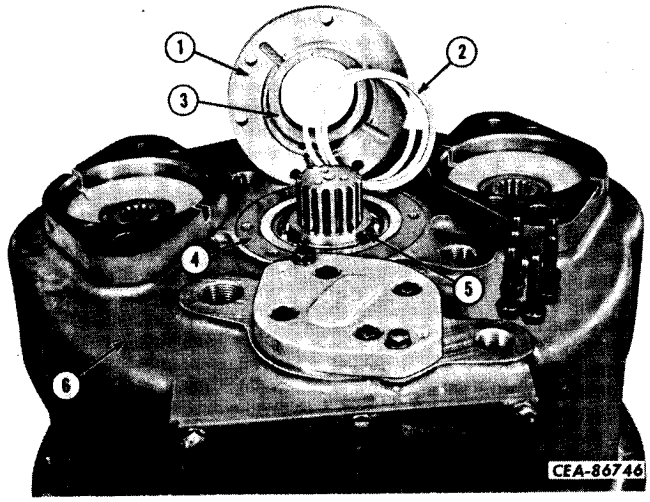

Figure 2-15

Invert the converter housing on the blocking with the open end up. Remove snap ring (2) from groove in upper end of output shaft. Tap on the output shaft (1) with a soft mallet or drift until the shaft bearing is free of the housing.

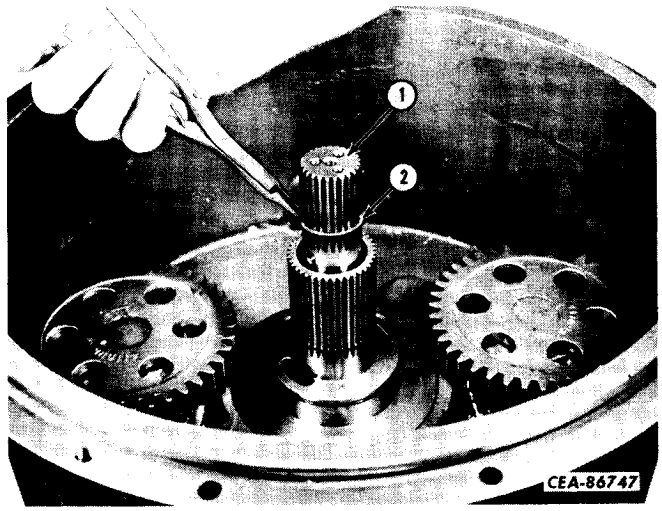

Figure 2-16

Remove the hook-type seal ring (1) and snap ring (2) from the output shaft.

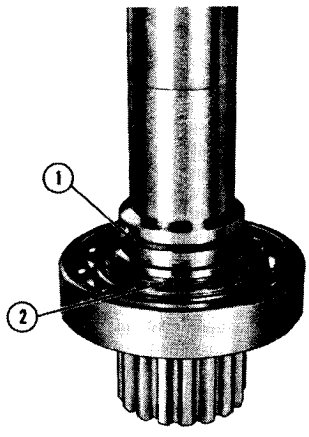

Figure 2-17

DISASSEMBLY

Support inner race (1) of bearing in a press and press output shaft out of bearing.

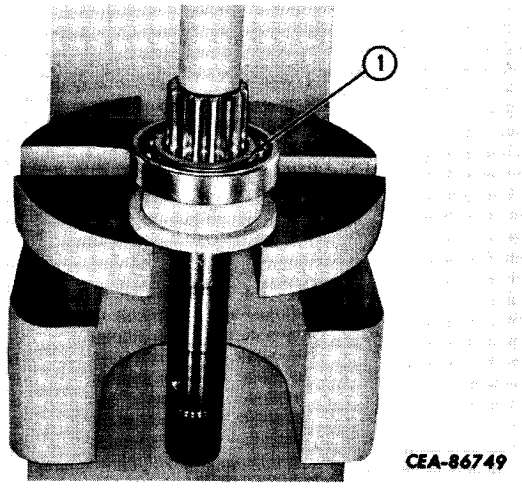

Figure 2-18

Remove the retaining nut and input charging pump drive gear (1). Use a punch to keep the drive gear from rotating.

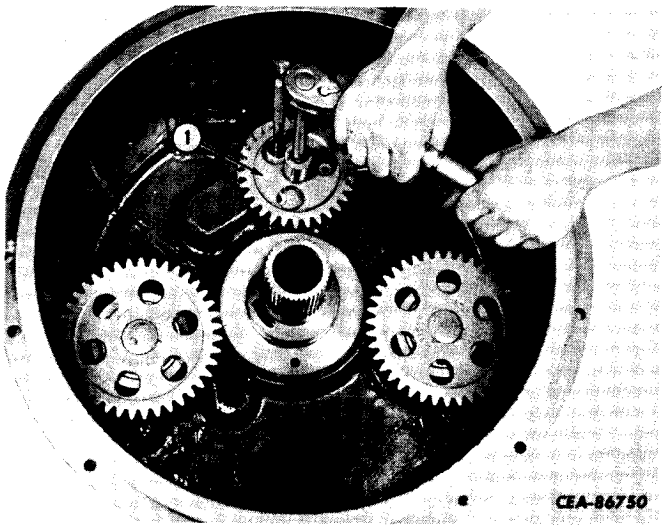

Figure 2-19

Invert the converter housing (1) and remove the pump retaining cap screws (2) and lock washers.

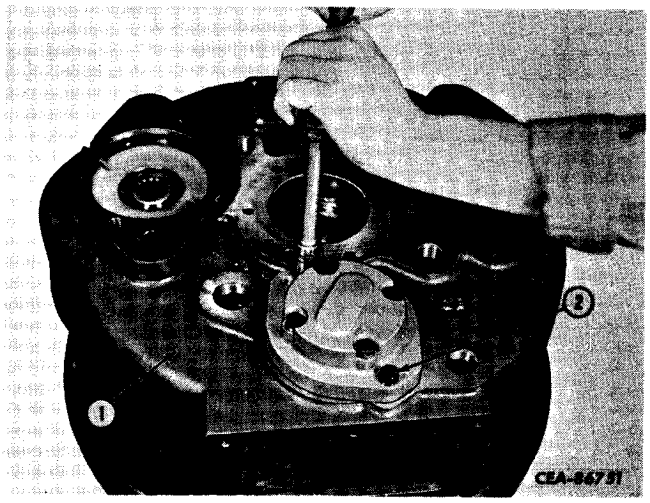

Figure 2-20

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DISASSEMBLY

Install 2-3/8" x 3" N. C. cap screws (1) in the threaded jack screw holes. Rotate the jack screws equally to remove the pump from the housing.

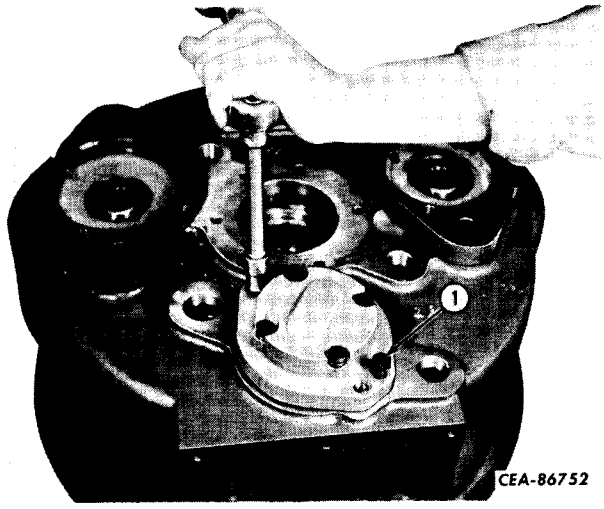

Figure 2-21

Remove the "O" rings from the pump flange (1) and the converter housing (2) and discard rings.

Refer to "F. Input Pump" in this section for pump overhaul.

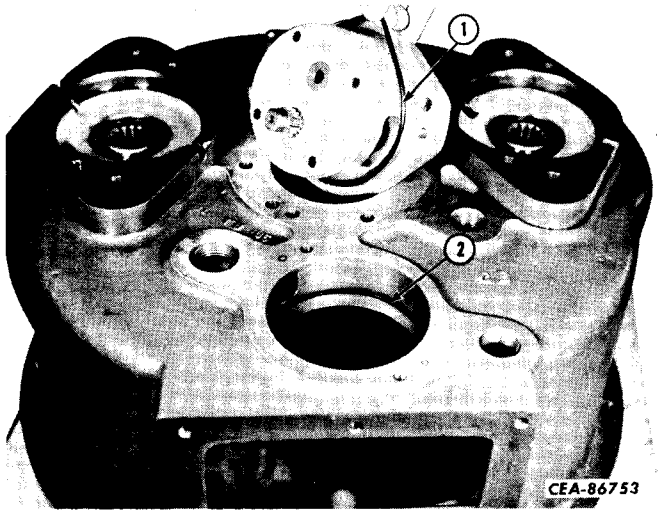

Figure 2-22

Insert the main hydraulic pump mounting cap screws in the threaded jackscrew holes in the pump mount adapter plate (1). Remove the plate and seal assembly by rotating the jackscrews equally. Remove the snap ring (4) from the gear shaft (3). Using a soft mallet or drift, drive the gear from the bearings. Drive the seal (2) from the adapter plate.

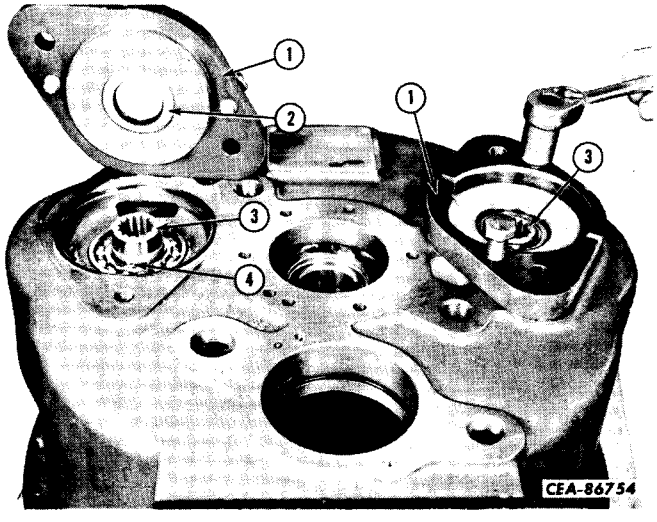

Figure 2-23

DISASSEMBLY

To remove the bearings tap the inner bearing out of the front of the housing and the outer bearing (2) out toward the rear of the housing. Do not remove the snap ring (1) unless it is chipped, cracked or broken.

NOTE: Repeat the above two operations for the remaining pump drive gear assembly.

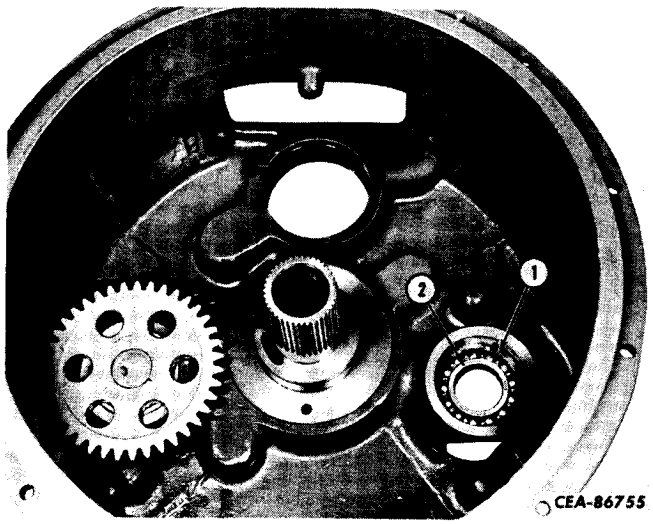

Figure 2-24

To remove the ground sleeve hub, remove the seal ring (5) from the hub (3). Place the converter housing in a press with splined end of ground sleeve hub down. Support the center of the housing with a steel sleeve (4) (6-1/2" I. D. x 9" long with 1/4" wall thickness). Sleeve must not contact hub. Place a steel disc (1) 3-3/4" x 3/4" in center of hub and press out hub. Discard gasket.

NOTE: Do not attempt to drive ground sleeve from converter housing as serious damage may be incurred by both housing and ground sleeve.

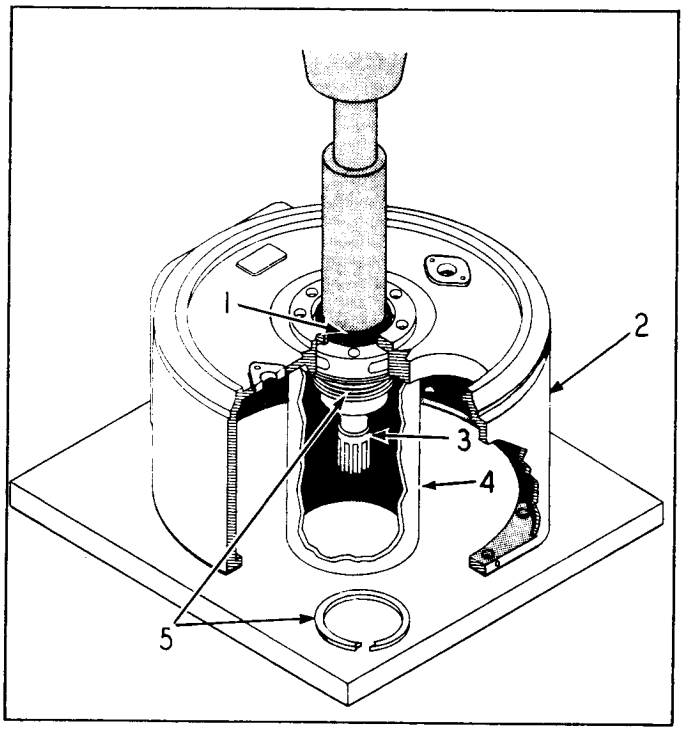

Figure 2-25

CLEANING AND INSPECTION

Thoroughly clean all parts in mineral spirits or with plain steam (no caustic soda) and dry with compressed air. Do not spin bearings with compressed air blasts. If cleaned with steam, oil parts immediately thereafter.

Inspect all bearings for excessive wear or damage and replace if necessary. Bearings that are to be re-used should be lubricated immediately with clean oil and wrapped in clean paper until assembled.

Inspect and clean all piping and hoses removed during converter removal.

Inspect the hook-type seal ring grooves and sealing surfaces for wear and grooving.

Inspect all splines and gear teeth for excessive wear burrs or damage and replace if necessary. Slight burrs can be removed with a fine oil stone. Be sure the dust shield is properly welded to the output yoke.

Inspect the impeller, stator and turbine for signs of rubbing. If this condition exists, it is an indication that one or more of the bearings in the converter must be replaced. If blades are excessively worn or damaged, the entire assembly must be replaced.

ASSEMBLY PREPARATION

Assembly preparation should include:

1. Cleaning all parts thoroughly in solvent. Dry with compressed air. Carefully inspect all parts for excessive wear, cracks and/or breakage.

2. Inspecting all bearings for pits and spalled areas. Replace pitted and/or spalled bearings.

3. Inspecting splines on all shafts for excessive wear.

4. Inspecting all sealing surfaces for wear and/or grooving.

5. Replace all seals and hook-type seal rings, gaskets, "O" rings and snap rings.

6. Obtaining a sufficient amount of dry ice to chill the converter ground sleeve.

NOTE: Dry ice is necessary only if the ground sleeve hub has been removed from the converter housing.

7. A heavy non-fibrous grease with a low melting point for use during assembly.

8. Fabricating guide bolts by cutting the heads from two 3/8" x 3" N. C. cap screws (Fig. 2-26).

NOTE: Special Torque recommendations are listed on a single page in Section V. This simplifies revision, when necessary. To eliminate constant referral, blank spaces are provided at points where special torques are required. These may be filled in by the manual holder, in pencil, and revised when necessary.

ASSEMBLY

NOTE: The ground sleeve hub must be packed in dry ice or chilled to a temperature of -25°F. for at least 30 minutes prior to assembly.

Place the converter housing in a press with the output side down. Position a new gasket in the housing.

Insert the two headless guide screws (1) (3/8" x 3" N. C.) into the chilled ground sleeve hub (2) and position hub in the converter housing aligning oil passages (3) and bolt holes. Press the hub into the converter housing.

NOTE: Care must be taken to be sure the ground sleeve is seated.

Remove the guide screws (1).

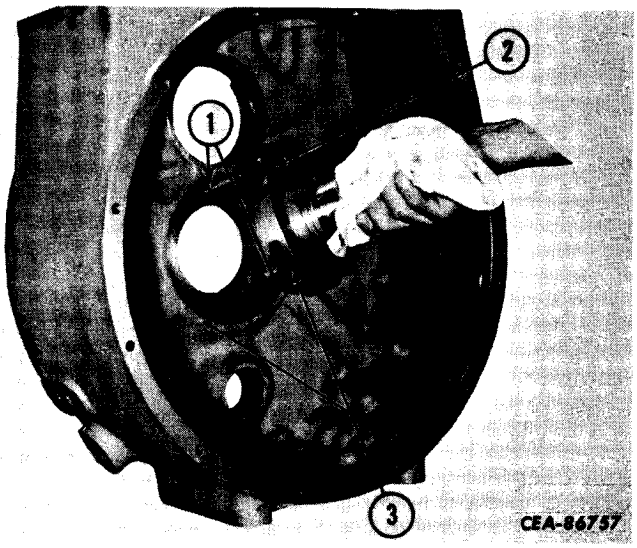

Figure 2-26

Install a new seal ring (2) on the hub (1). Be sure to hook the ring. Coat the ring lightly with heavy grease.

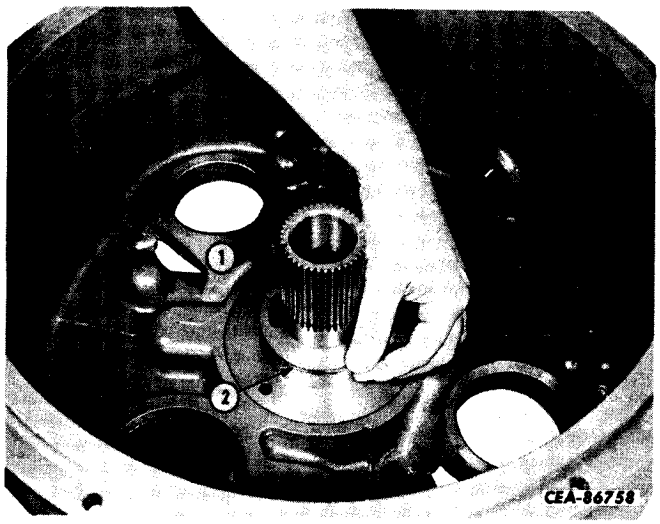

Figure 2-27

Install the snap rings (if removed) in the housing bores. Press the inner pump drive gear bearings into the housing until they bottom on their respective snap rings.

Invert the housing in the press and press in the outer bearings (1) until they bottom on the snap rings.

NOTE: Apply pressure to the outer bearing races only.

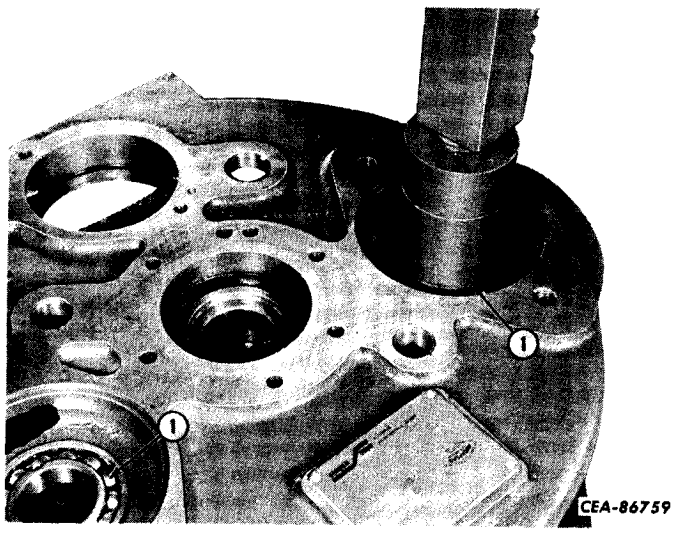

Figure 2-28

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ASSEMBLY

Position the converter housing (1) in a suitable press and press the accessory driven gear (2) into the bearings until the snap ring groove near the end of the shaft is exposed and the gear shoulder is bottomed on the inner race of the inner bearing. Install the snap ring. Repeat the operation for the remaining accessory driven gear.

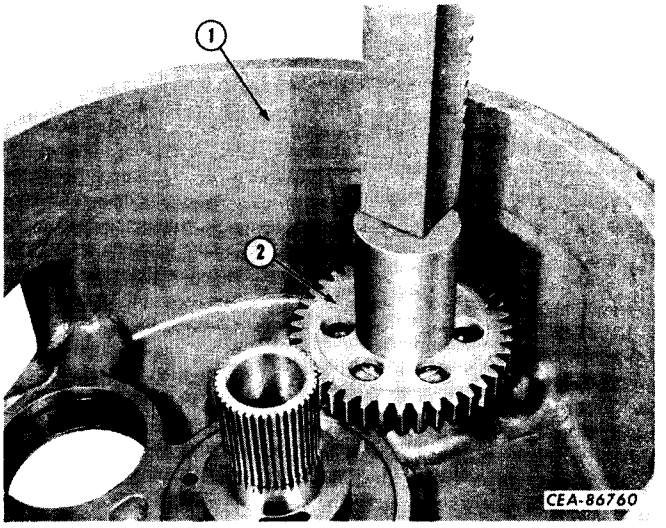

Figure 2-29

Install a new "O" ring (2) in the housing bore and apply a light coat of heavy grease to the bore and "O" ring.

Install new "O" ring (1) in groove in input pump cover.

Press pump in housing bore and retain with cap screws and lock washers. Tighten cap screws to recommended torque. Refer to "SPECIAL TORQUES."

Torque: 30

NOTE: Care must be taken during pump installation to avoid cutting "O" rings.

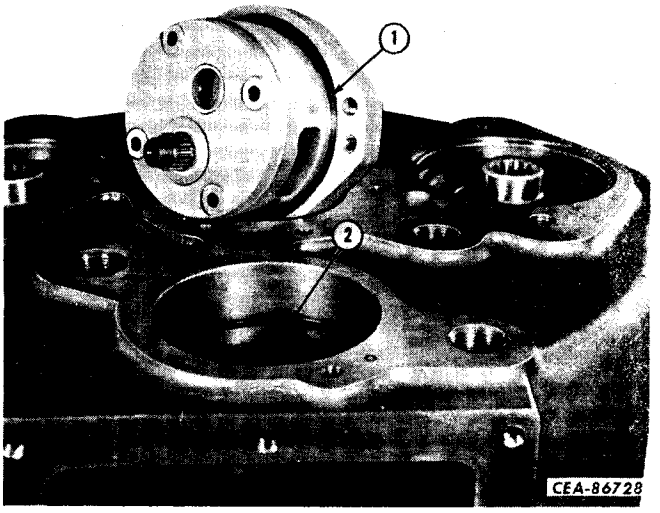

Figure 2-30

Install input pump drive gear (1) on pump shaft. In early models where a snap ring is used on the pump shaft, the drive gear counterbore must fit over the snap ring to be properly positioned. Install the retaining nut and tighten to recommended torque. Refer to "SPECIAL TORQUES."

Torque: 50

NOTE: Use a pin punch to keep gear from rotating.

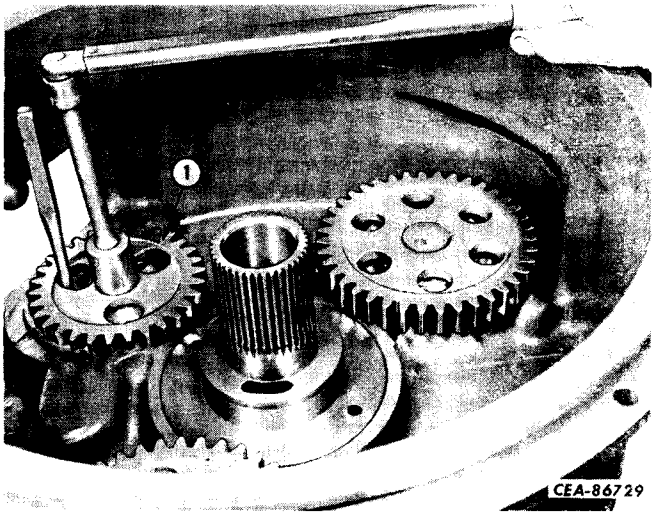

Figure 2-31

ASSEMBLY

Install the snap ring (2) in its groove in the output shaft (1). Press the shaft into the bearing (3) with the output end of the shaft entering the bearing and seating the bearing against the snap ring.

NOTE: Support the bearing inner race during pressing operation.

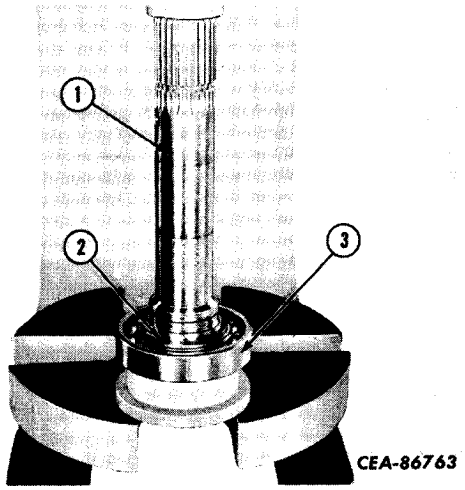

Figure 2-32

Install a new hook-type seal ring (2) in groove in output shaft (1). Be sure ring is hooked. Coat seal ring lightly with a heavy grease.

Place the housing in a press with the output end facing up. Insert the output shaft (1) through the hub of the converter housing until the bearing contacts the housing bore.

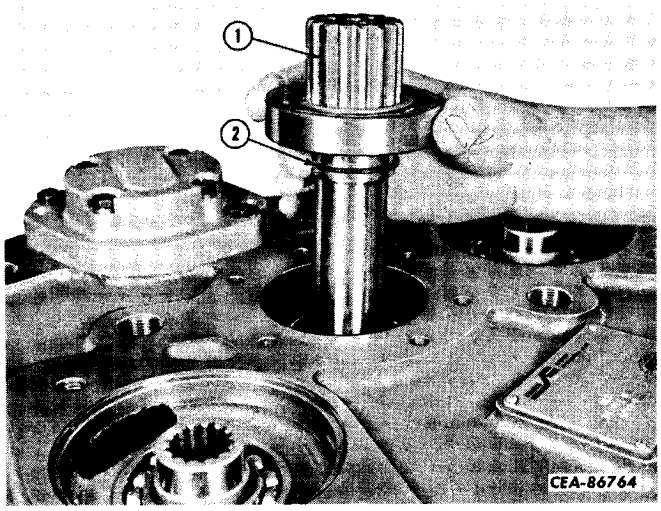

Figure 2-33

Using a suitable sleeve, press on the outer race of the bearing (1) until the shaft and bearing assembly bottom on the ground sleeve hub.

NOTE: Extreme care must be exercised to prevent breaking seal ring on shaft.

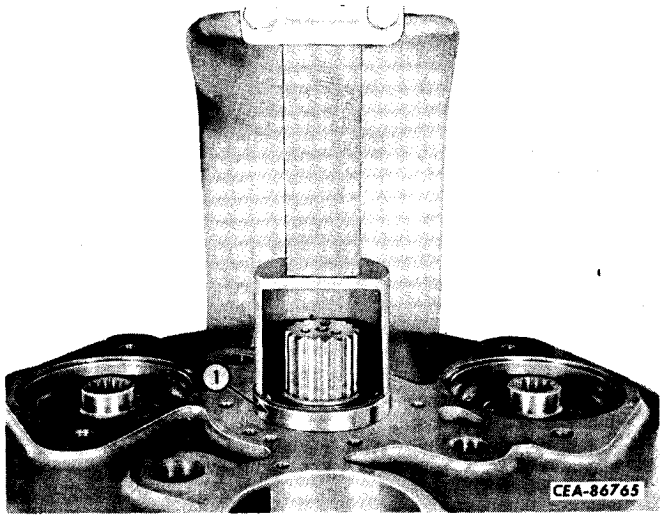

Figure 2-34

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ASSEMBLY

Coat the O. D. of a new output shaft seal (2) with Mar-Seal, or equivalent sealant. Using a suitable sleeve (1) between the press ram and the seal, press seal into bore of retainer.

NOTE: Large lip of seal should face down toward the large flange end of the bearing retainer.

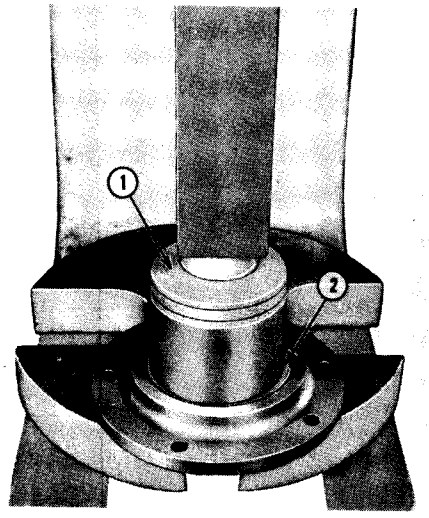

Figure 2-35

Install yoke spacer (1) on output shaft (2).

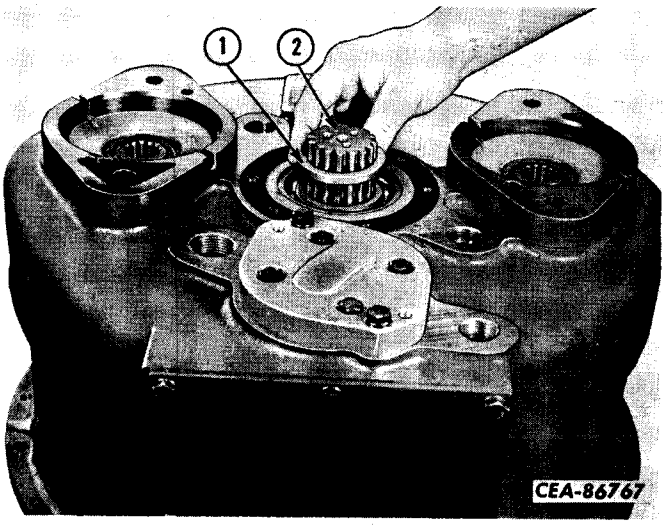

Figure 2-36

Center a new gasket on the converter housing and install the original shim pack and bearing retainer (1) with cap screws and lock washers. Tighten the cap screws to the recommended torque. Refer to "SPECIAL TORQUES."

Torque: 30

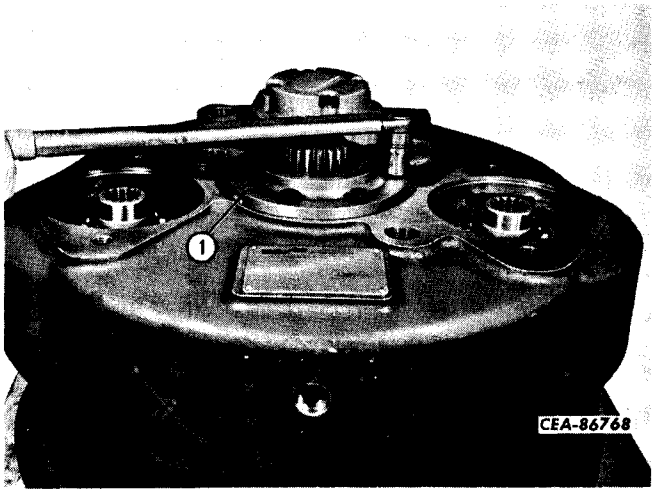

Figure 2-37

ASSEMBLY

Stand the converter housing (1) on the inspection cover opening. Attach a dial indicator (2) to one end of the output shaft. Check the end play in the output shaft.

NOTE: When checking the shaft end play be certain the shaft moves its entire distance. Moving in towards the converter housing the shaft must bottom on the ground sleeve hub; in the opposite direction it must bottom on the bearing retainer.

Refer to "TOLERANCES" for end play limitations. Add shims as required to obtain required end play.

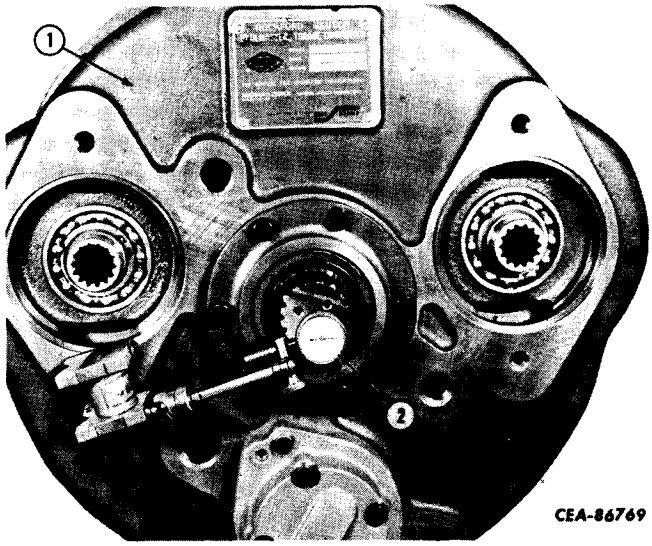

Figure 2-38

NOTE: Each time the bearing retainer is removed and shims added or subtracted, the bearing retainer cap screws must be correctly torqued before a dial indicator reading may be made.

Place the output yoke (1) over the splines of the output shaft. Install the retaining washer (2) and locking plate on the output shaft and secure with cap screws. Tighten cap screws to recommended torque. Refer to "SPECIAL TORQUES." Bend up tabs of locking plate to prevent cap screws from loosening.

Torque: 30

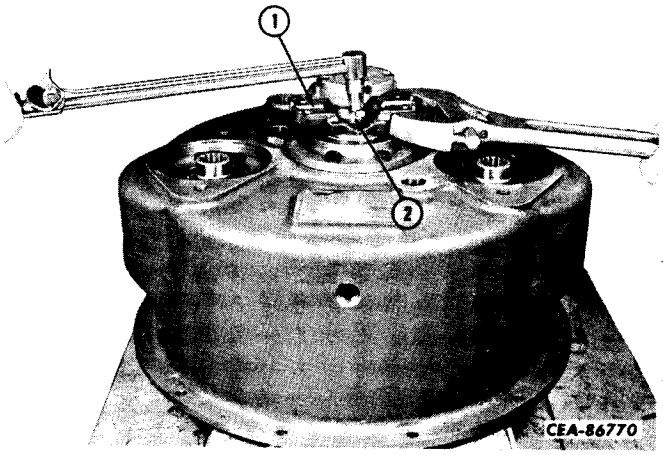

Figure 2-39

ASSEMBLY

Allow the housing and shaft assembly to rest on the output yoke (1) and block to avoid tipping.

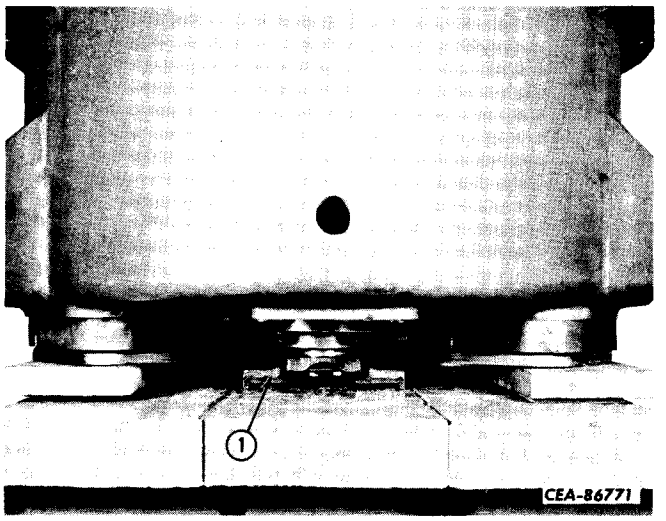

Figure 2-40

Install the snap ring (2) in the upper groove of the output shaft (1).

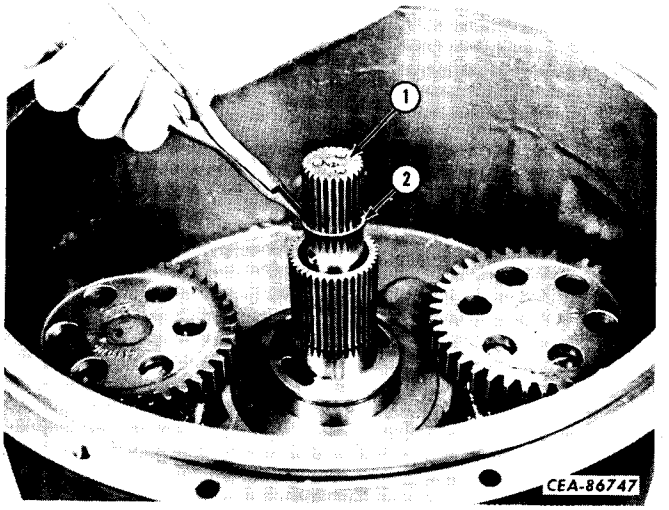

Figure 2-41

Block the outer flange of the impeller (4) with blades down. Using a suitable sleeve (1), drive the impeller bearing (2) into the bore until the snap ring (3) bottoms in its groove in the impeller.

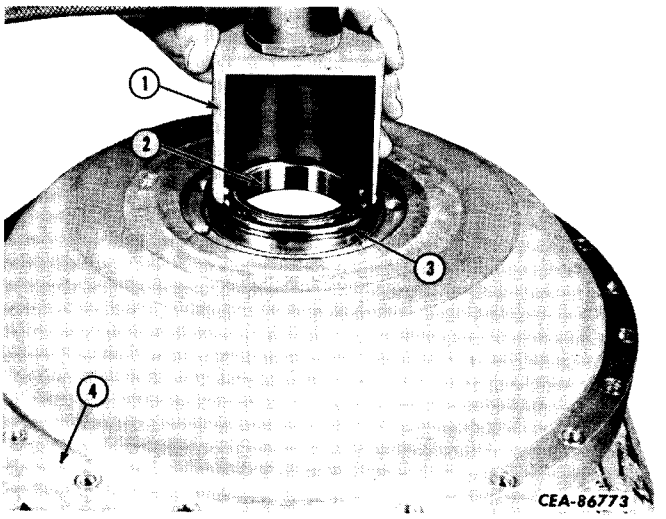

Figure 2-42

ASSEMBLY

Align the holes in the accessory drive gear (2) with those of the impeller, and tap the gear with a mallet until it bottoms in the recess of the impeller. Install the retaining cap screws (1) and tighten to recommended torque. Refer to "SPECIAL TORQUES."

NOTE: Units may be equipped with either 5/16" or 7/16" cap screws. Identify size prior to installation.

Torque - 5/16 cap screw: 40
Torque - 7/16 cap screw: 80

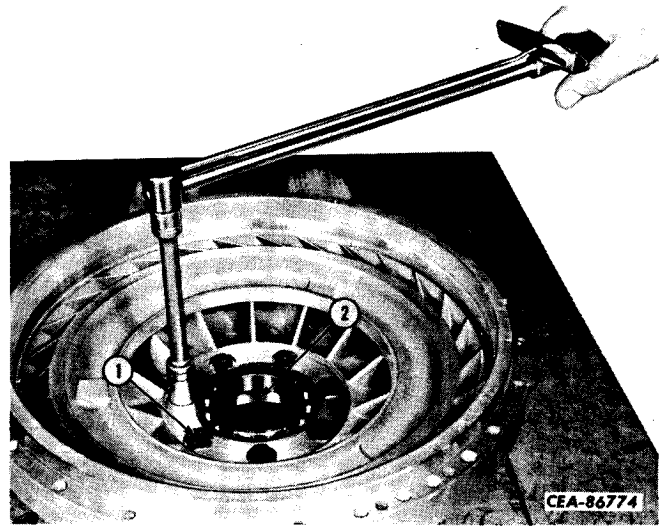

Figure 2-43

Place the drive housing (1) in press with gear teeth up. Press the turbine hub bearing into the drive housing until the snap ring (3) is bottomed. Use suitable sleeve (2) and press on the bearing outer race only.

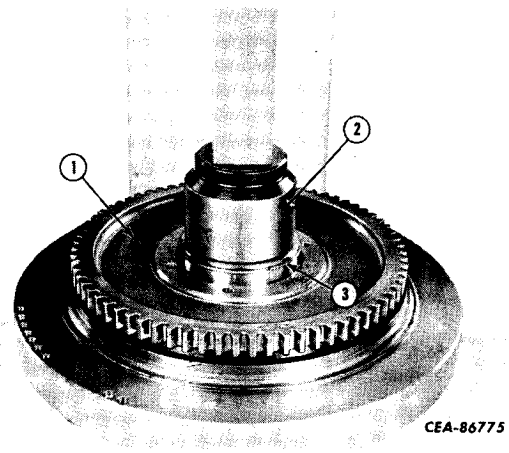

Figure 2-44

Place the drive housing (1, Fig. 2-45) on a bench with the gear teeth up. Snap ring (3) on bearing (4) must be bottomed in drive housing (1) groove. Place original shim pack in position (5) on outer race of bearing. Place input hub (2) in position over shims and bearing. Apply a firm hand pressure to the top of the hub and using a single .005" shim (2, Fig. 2-46) (or feeler gauge) check the clearance at "A" between hub and drive housing flange surfaces (Fig. 2-45).

ASSEMBLY

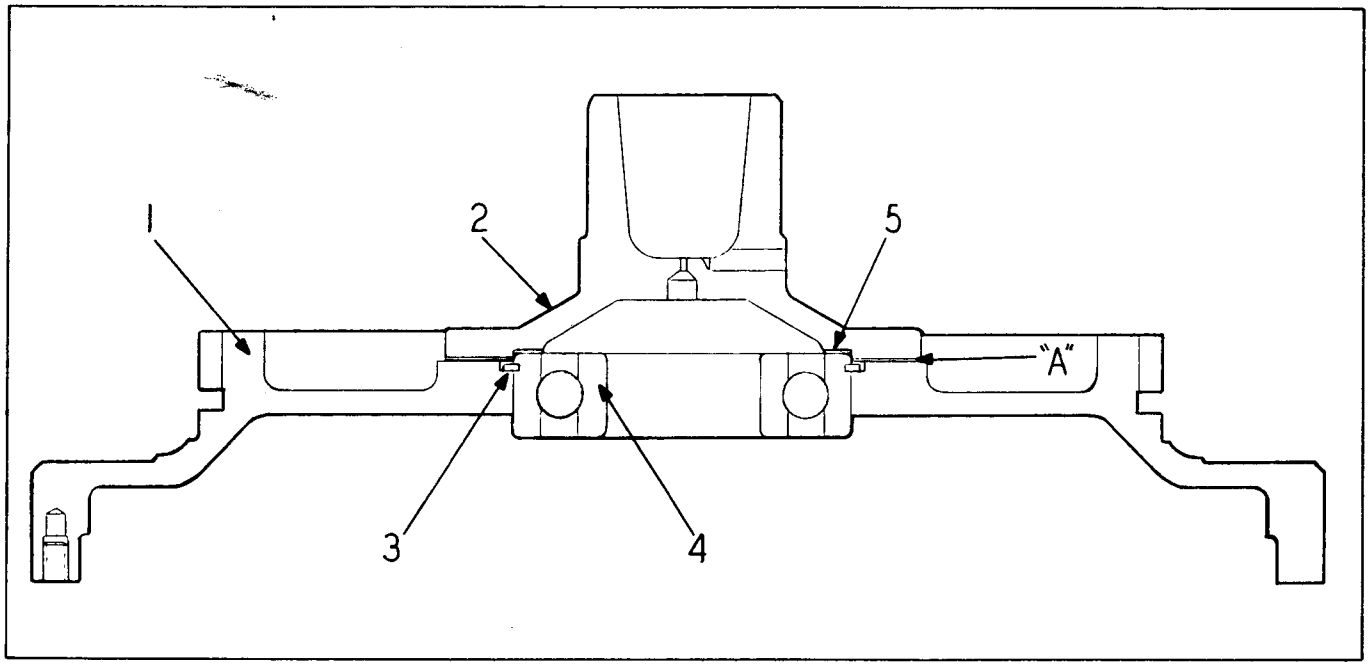

Figure 2-45
Drive Housing Assembly Cross Section.

1. Drive housing.
2. Input hub.
3. Snap ring.
4. Drive housing hub bearing.
5. Shims.

Add or subtract shims until a .005" shim (2) just passes between the two flanged surfaces. When the correct clearance is obtained, remove hub (1) and shims. Tie shim pack to hub and set aside.

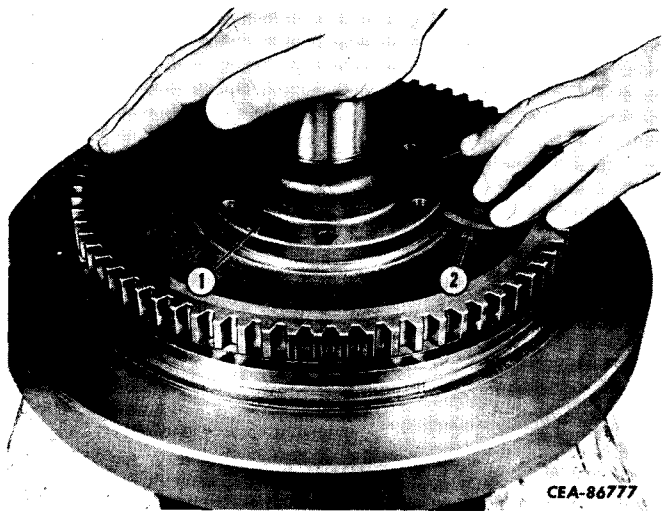

Figure 2-46

ASSEMBLY

Block the drive housing (2) on a bench with the gear teeth down. Support the outer hub bearing race from beneath. Install the turbine (1) in the drive housing. Be sure the shoulder of the turbine hub bottoms on the inner race of the hub bearing.

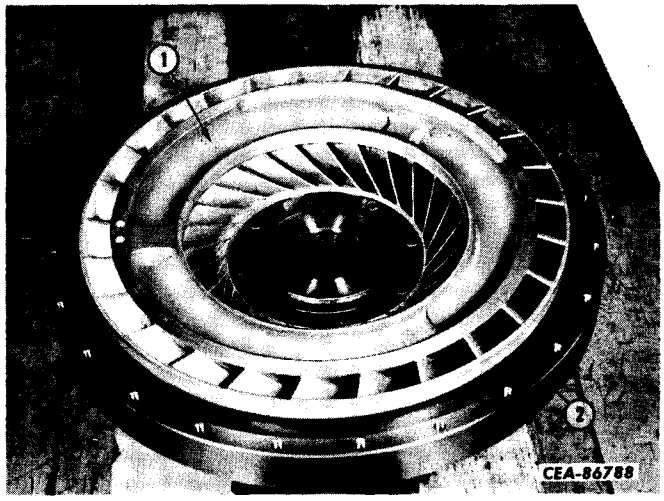

Figure 2-47

Align the pin (1) in the stator with the pin bore (2) in the spacer.

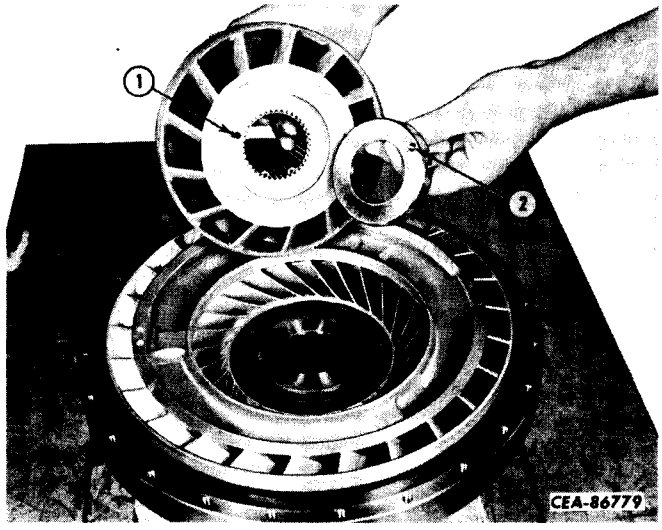

Figure 2-48

Be sure the snap ring (1) in the bore of the stator is correctly positioned. Install the spacer in the stator.

NOTE: Do not cock the spacer. It must make full contact with the bottom of its bore in the stator.

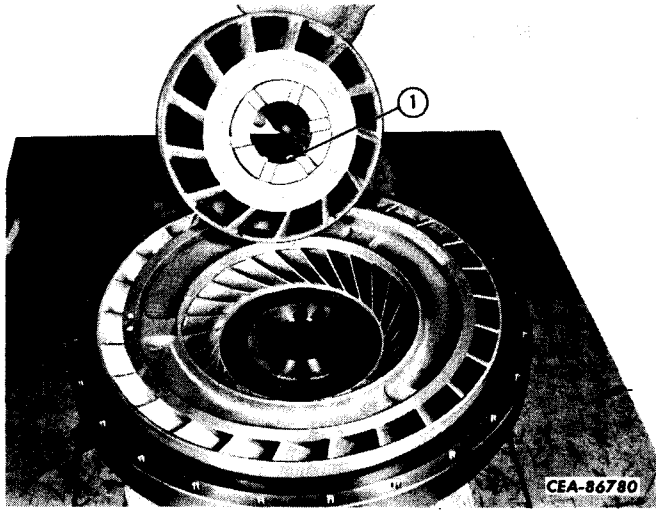

Figure 2-49

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ASSEMBLY

Install the stator (1) and spacer assembly in the turbine (2) with the spacer down.

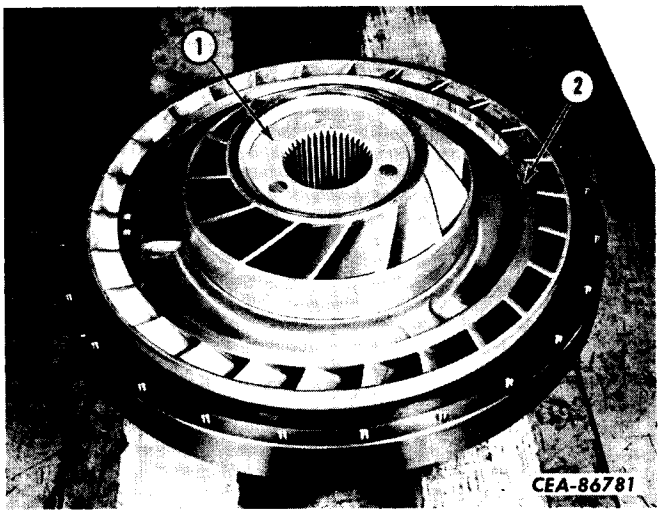


Figure 2-50

Place the impeller (1) on the drive housing (2) with the accessory gear (3) up. Secure the assembly with cap screws (4).

Tighten cap screws to recommended torque. Refer to "SPECIAL TORQUES."

Torque: _____

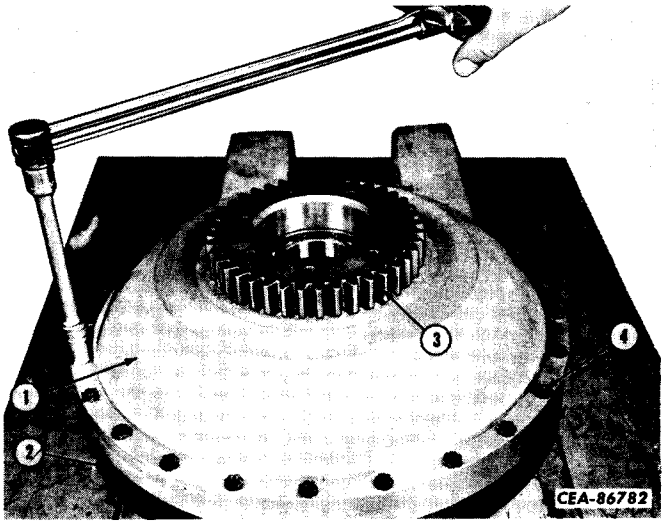


Figure 2-51

Invert the assembly, accessory drive gear (1) down, and attach a hoist to the input drive hub mounting holes. Lower the assembly into the converter housing (2).

While lowering the converter assembly into the housing, check the following:

a. The stator and ground sleeve hub must spline together.

b. The accessory drive gear must mesh with the accessory driven gears and input pump driven gear.

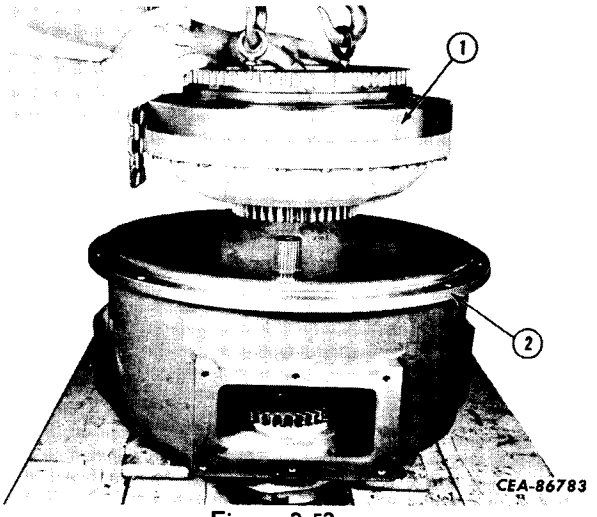


Figure 2-52

(Continued on next page)

ASSEMBLY

c. The accessory drive gear must also fit over the seal ring on the ground sleeve hub.

d. The output shaft must spline into the turbine hub.

Place the original shim pack (if any) (4) on end of output shaft (5). Install retaining washer (3) with cap screws (1) and new locking plate (2). Tighten cap screws hand tight.

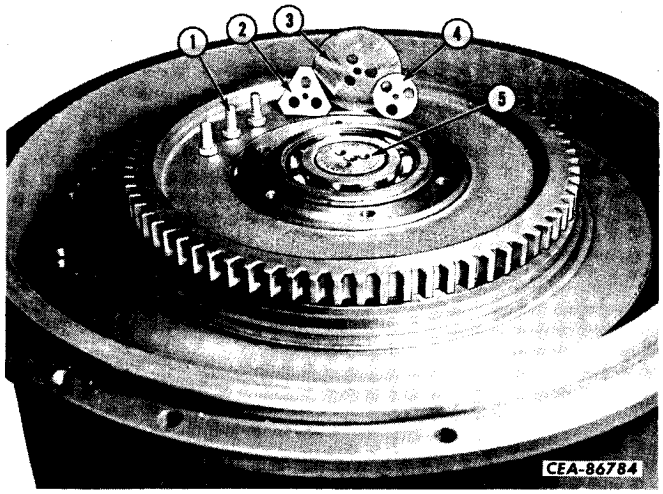


Figure 2-53

Using a feeler gauge (1) measure the clearance between the lower surface of the retaining washer and the drive housing bearing inner race. Add or subtract shims beneath the retaining washer until the clearance between the washer and the bearing is within recommended limitations (refer to SECTION VI "TOLERANCES").

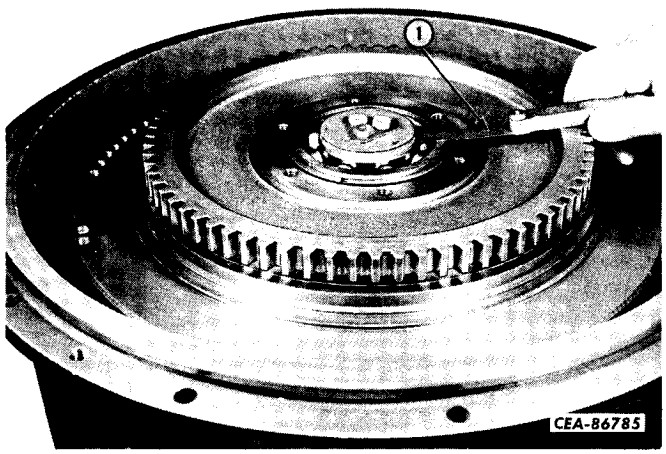


Figure 2-54

When the proper clearance is obtained, tighten the cap screws to the recommended torque (refer to "SPECIAL TORQUES"). Bend up tabs on locking plate (1).

Torque: 30

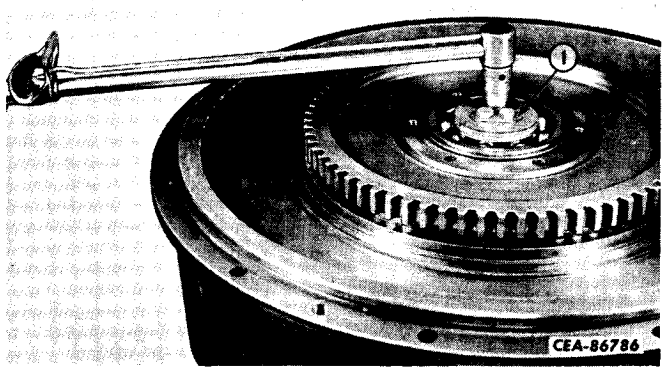
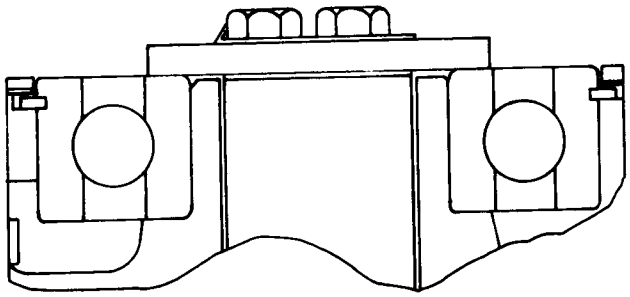


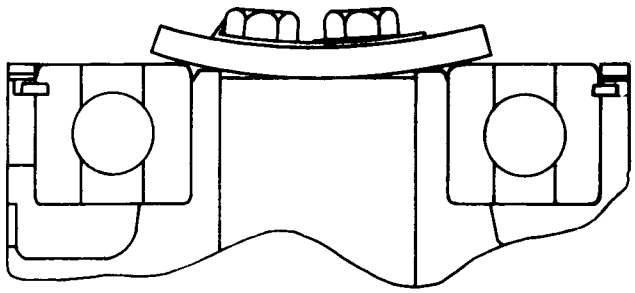
Figure 2-55

ASSEMBLY



CORRECT

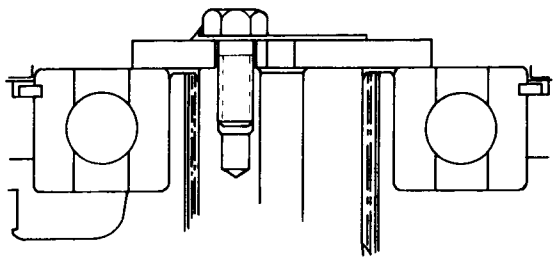
NOTE: The retaining washer must not be deflected.



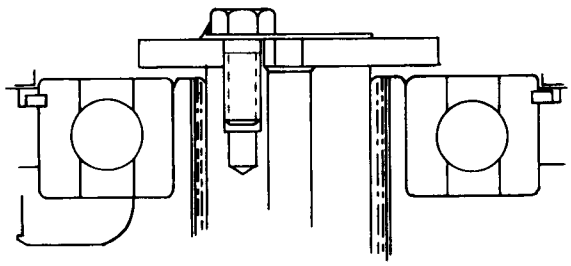
INCORRECT

Figure 2-56

NOTE: Late model converters are equipped with output shafts that extend beyond the inner race of the drive housing bearing. These shafts require no shimming. Refer to "TOLERANCES" for maximum allowable shaft extension.



EARLY TYPE



LATE TYPE

Figure 2-57

ASSEMBLY

Place the previously selected shim pack (1) on outer race of drive housing bearing (2).

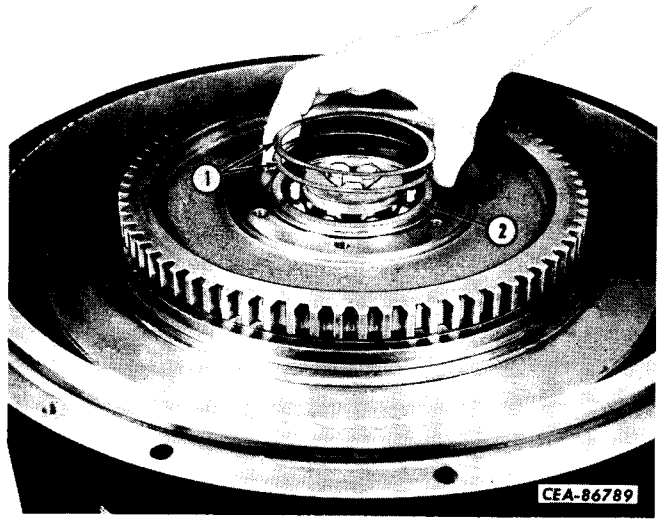


Figure 2-58

Install input hub (1) and secure with cap screws (2) and lock washers. Tighten the cap screws to the recommended torque. Refer to "SPECIAL TORQUES."

Torque: 30

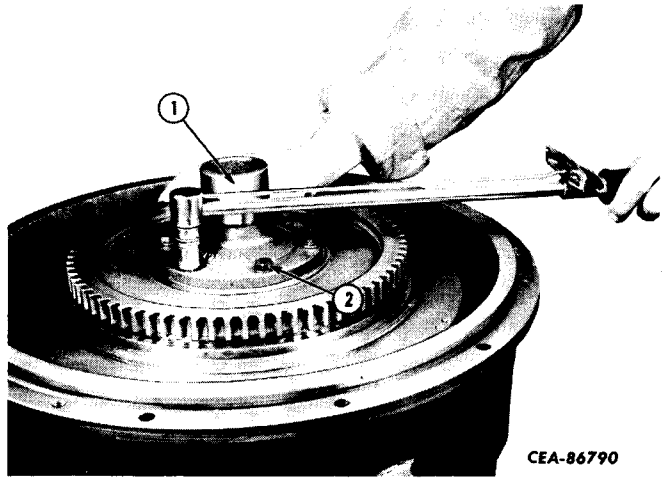


Figure 2-59

Center a new gasket (1) on the pump inspection cover opening. Install the inspection cover (2) and retain with cap screws and lock washers. Tighten cap screws to recommended torque. Refer to "SPECIAL TORQUES."

Torque: 30

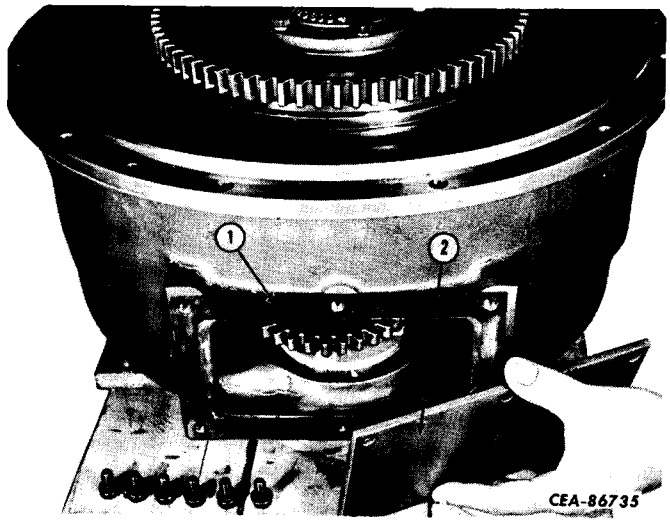


Figure 2-60

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ASSEMBLY

Install new "O" ring (1) in groove of converter housing (2).

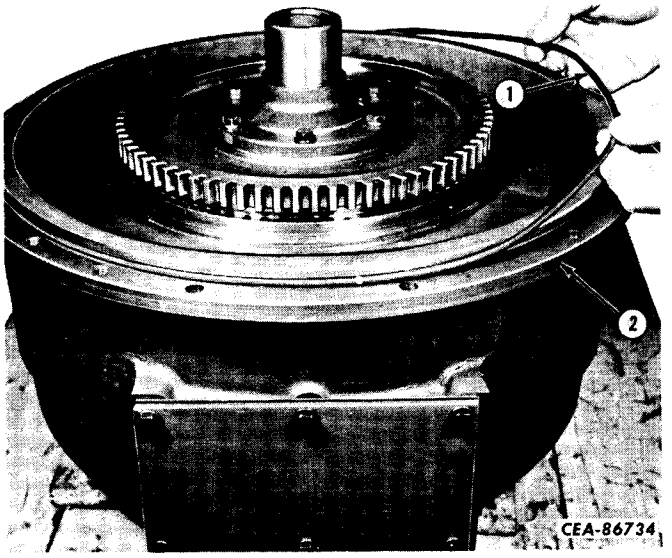

Figure 2-61

INPUT PUMP

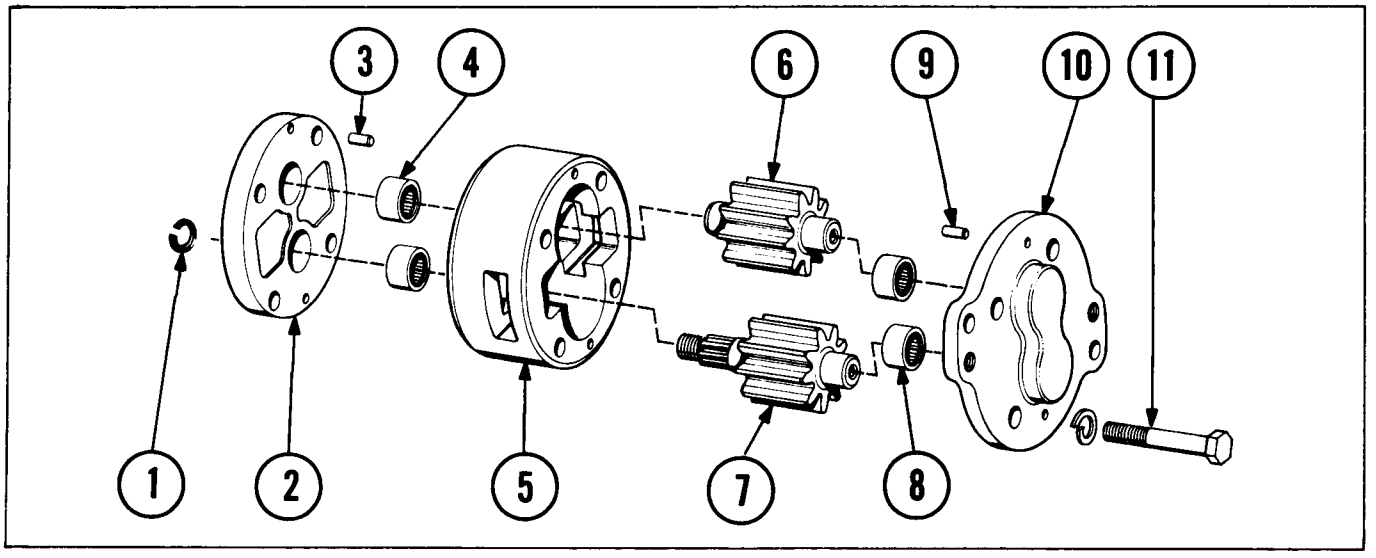

Figure 2-62
Input Charging Pump.

1. Snap ring.
2. Pump base.
3. Dowel pin.
4. Needle bearing.
5. Pump body.
6. Idler gear.
7. Input drive gear and shaft.
8. Needle bearing.
9. Dowel pin.
10. Pump cover.
11. Cap screw.

1. DISASSEMBLY

Remove the snap ring (1) (where used) from the drive gear shaft (7). Remove the cap screws (11) and lock washers from pump assembly. Using a soft mallet tap on the input drive gear and shaft (7) while holding the pump body (5) to separate the assembly. Remove the pump base (2), pump idler gear (6), pump drive gear and shaft (7) and pump cover (10) from pump body (5). Using a suitable puller, remove needle bearings (4, 8) from the pump base (2) and pump cover (10).

INPUT PUMP

2. CLEANING AND INSPECTION

Clean all parts thoroughly in mineral spirits. Inspect pump body, base, cover and gears for excessive wear and/or scoring. Inspect needle bearings for wear, discoloration and/or fatigue.

3. ASSEMBLY

Assemble pump cover (10) including needle bearings (8) to pump body (5). Align cover on dowels (9). Install drive gear and shaft (7) and idler gear (6). Assemble pump base (2) including needle bearings (4) to pump body (5).

NOTE: Lubricate bearings (4, 8) and gears (6, 7) with a heavy weight motor oil during assembly.

Install cap screws (11) and lock washers in pump assembly. Tighten cap screws to recommended torque. Refer to "SPECIAL TORQUES."

Torque: 30

Rotate pump drive shaft to be sure gears and shafts turn freely.

If shaft was equipped with a snap ring (1), install a new snap ring using tool 1 020 449 R91. (I. H. Service Tool Manual ISS-1002-C.)

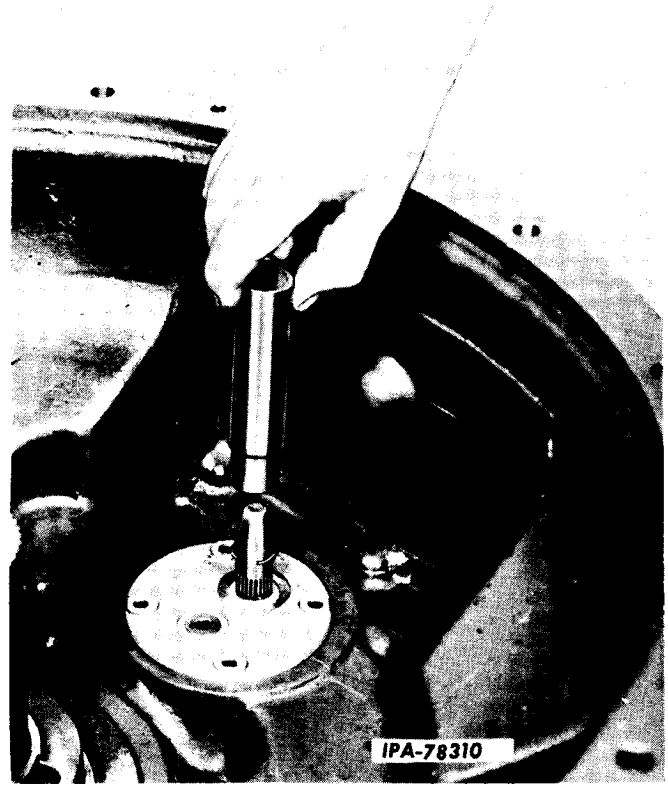

Figure 2-63

Install tool sleeve on pump shaft. Place a new snap ring on sleeve and using the tool driver, slowly tap the snap ring into the groove on the pump shaft.

SECTION III

TRANSMISSION

DISASSEMBLY PREPARATION

Disassembly preparation should include:

1. Disconnecting all external lines from the transmission housing.

2. Provisions for steam cleaning the transmission and surrounding area. Do not use caustic soda.

3. Preparing a dirt-free work area at least 12 ft. square.

4. A suitable hoist.

5. The following tools:

   a. Low table or bench for disassembly.

   b. Shop press.

   c. Hydraulic gear and bearing puller set, rated at a minimum of 17 tons.

   d. Mechanical gear and bearing puller set.

   e. Solvent for cleaning parts.

   f. Standard set of mechanics hand tools including:

   Snap ring pliers
   Brake spring pliers
   Torque wrench - 100 ft. lb capacity.
   Mallet (preferably plastic)

   g. Special lifting tool (refer to SECTION VI, SPECIAL TOOLS).

   h. Snap ring groove filler (refer to SECTION VI, SPECIAL TOOLS).

6. Pans for holding small parts during disassembly.

DISASSEMBLY

Clean exterior of transmission and surrounding area thoroughly with plain steam (no caustic soda). Use a clean work area. Cleanliness is very important during transmission overhaul.

Be sure transmission is thoroughly drained.

Remove the cap screws and lock washers that retain the main regulator valve (1). Remove the valve and gasket (2) and discard the gasket.

Refer to SECTION III, SUB-ASSEMBLY OVERHAUL for disassembly of main regulator valve.

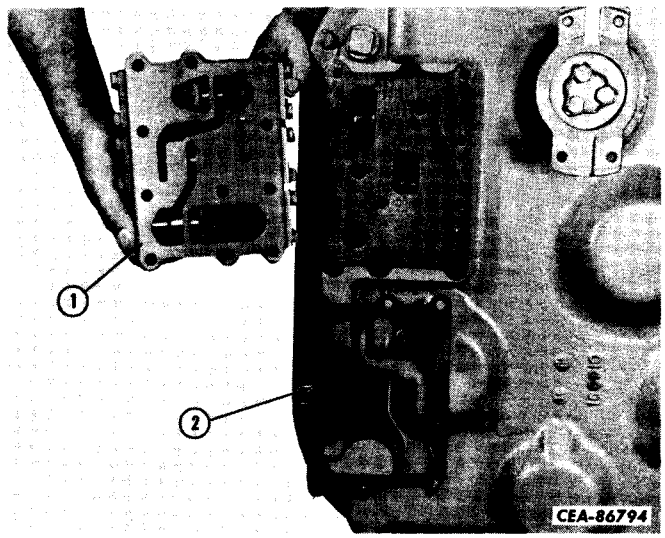

Figure 3-1

DISASSEMBLY

Unlock and remove input yoke retaining cap screws (1), locking plate (2), retaining washer (3) and yoke (4).

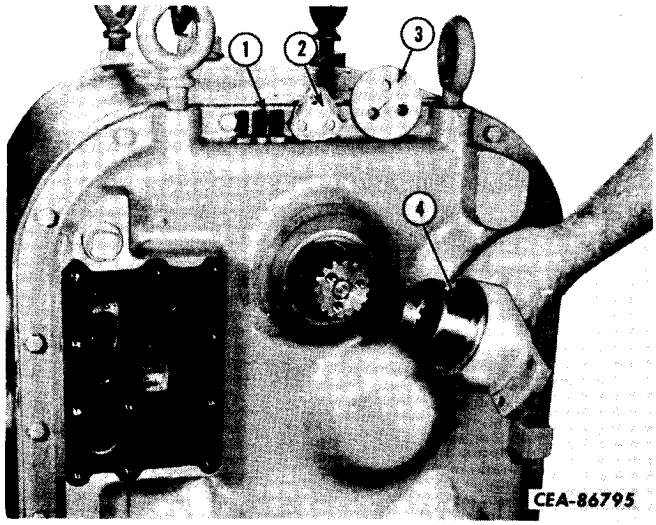

Figure 3-2

Place transmission in suitable stand or lay on its back, parking brake up. Use necessary blocking to level transmission.

Remove parking brake drum retaining nut (4), steel washer (3) and rubber washer (2). Using a sling and hoist, remove brake drum (1).

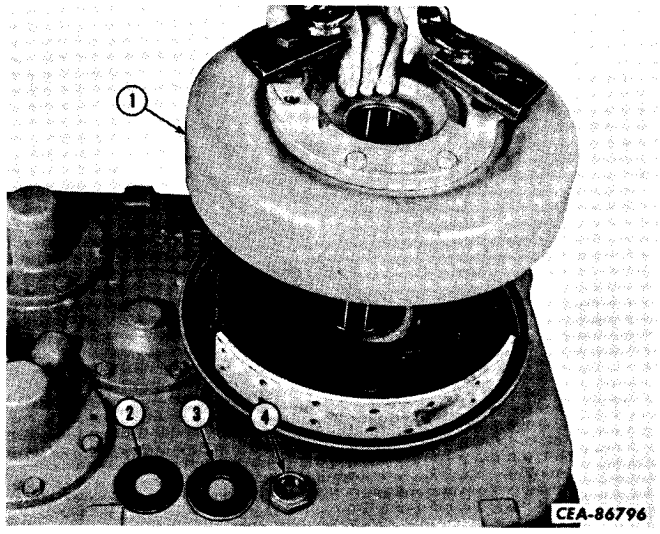

Figure 3-3

Using a brake spring pliers (1), remove brake shoe return springs (2) and brake shoes (3).

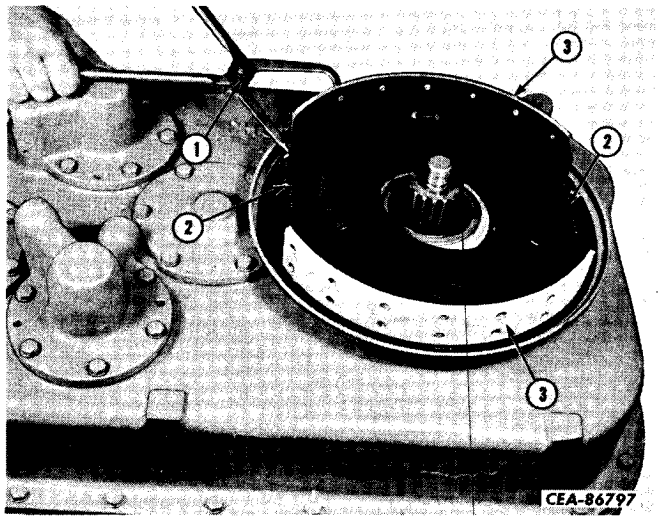

Figure 3-4

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DISASSEMBLY

Remove the brake actuating lever (1).

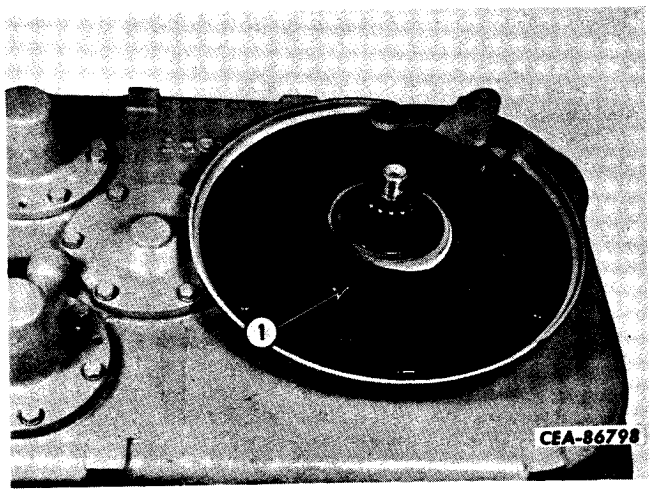

Figure 3-5

Remove brake roller (1) from right hand brake pawl. Remove retaining cap screws (2), lock washers and parking brake backing plate (3).

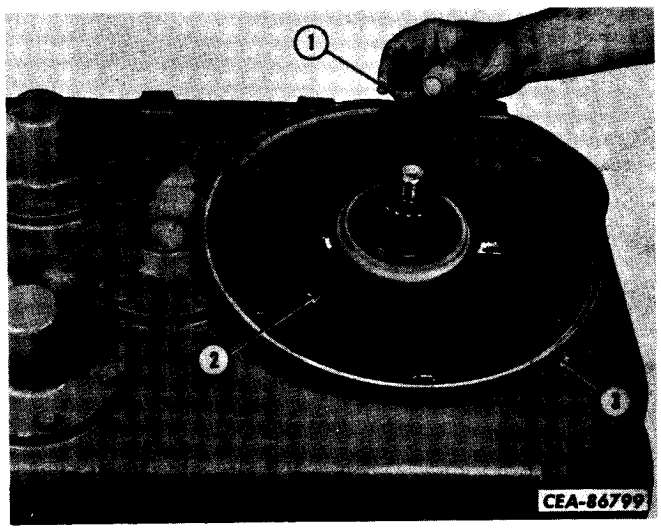

Figure 3-6

Remove retaining cap screws (1) from parking brake mounting cover (2) (output shaft bearing retainer).

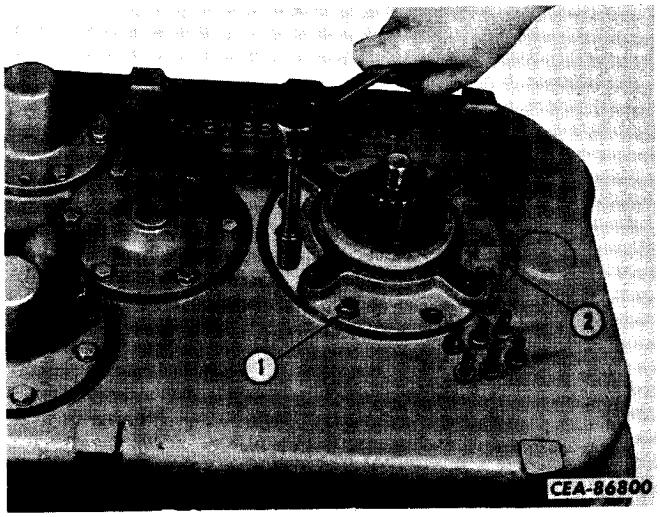

Figure 3-7

DISASSEMBLY

Insert two of the retaining cap screws in the threaded jackscrew holes provided in the cover (1, 2). Turn jackscrews evenly until cover is released.

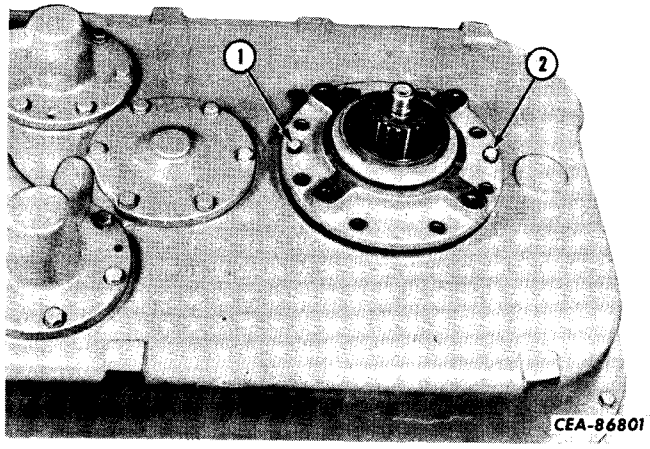

Figure 3-8

Remove parking brake mounting cover assembly (1) and gasket (2). Discard gasket.

Refer to SECTION III, SUB-ASSEMBLY OVERHAUL for disassembly of mounting cover.

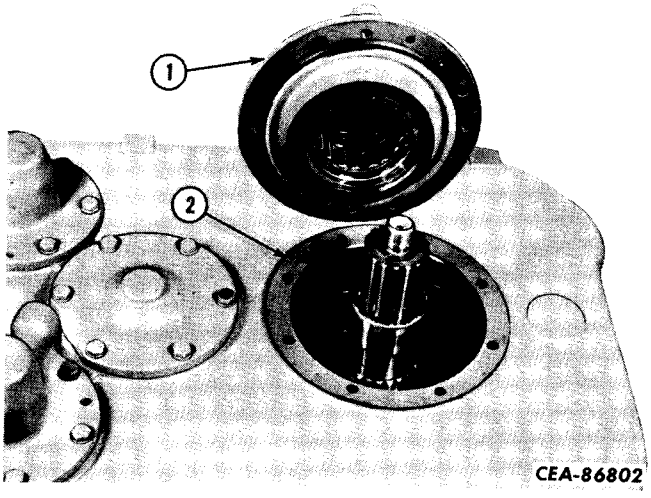

Figure 3-9

Remove the cap screws (1) and lock washers that secure the oil supply covers (2). Insert two of the retaining cap screws in the threaded jackscrew holes (4) provided in the covers. Tighten the jackscrews evenly to remove the supply covers. Discard cover gaskets (5) and "O" ring seals (3).

Refer to SECTION III, SUB-ASSEMBLY OVERHAUL for disassembly of oil supply covers.

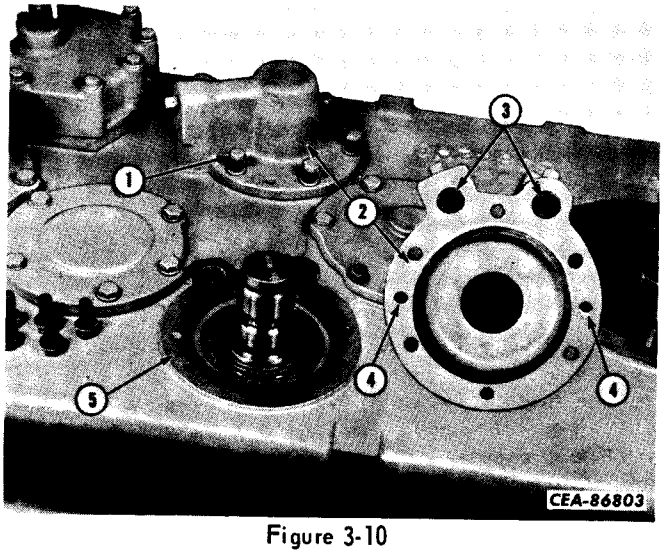

Figure 3-10

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DISASSEMBLY

Remove cap screws lock washers and gather shaft bearing retainer (3) with gasket (2). Discard gasket.

Repeat the above process to remove the main idler shaft bearing retainer (1).

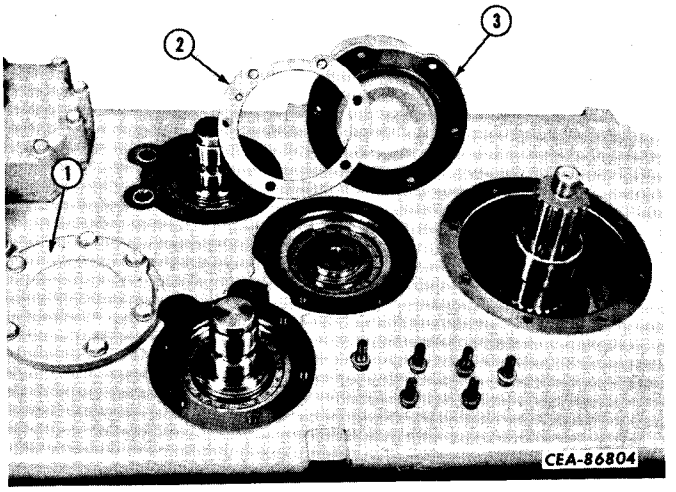

Figure 3-11

Remove the cap screws (3) and lock washers that secure the directional selector valve (1). Remove the valve and gasket (2). Discard the gasket.

Refer to SECTION III, SUB-ASSEMBLY OVERHAUL for disassembly of directional control valve.

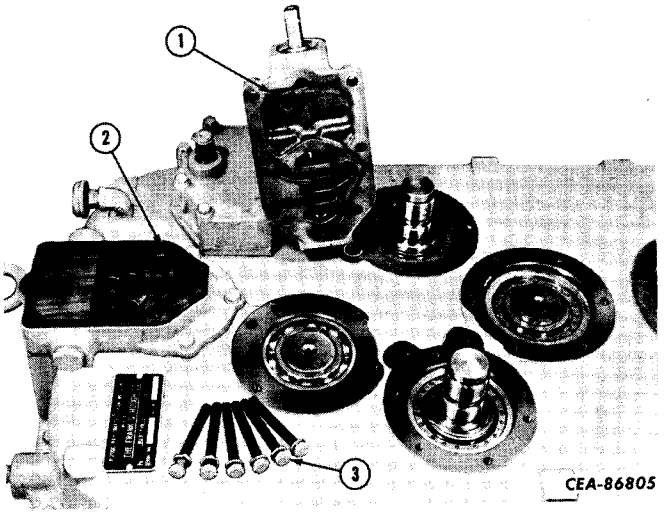

Figure 3-12

Remove the cap screws that secure the neutral knockdown valve (1) to the transmission rear cover (3). Remove the valve and gasket (2). Discard the gasket.

Refer to SECTION III, SUB-ASSEMBLY OVERHAUL for disassembly of neutral knock-down valve.

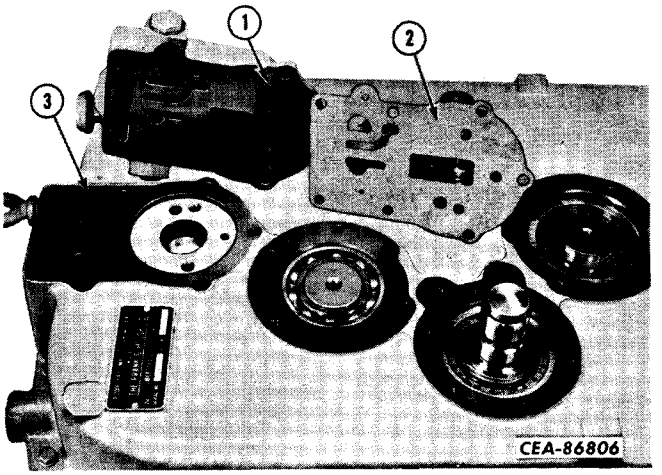

Figure 3-13

DISASSEMBLY

Remove cap screws that secure the range selector valve (2) to transmission rear cover (1). Remove valve and gasket (3) and discard gasket.

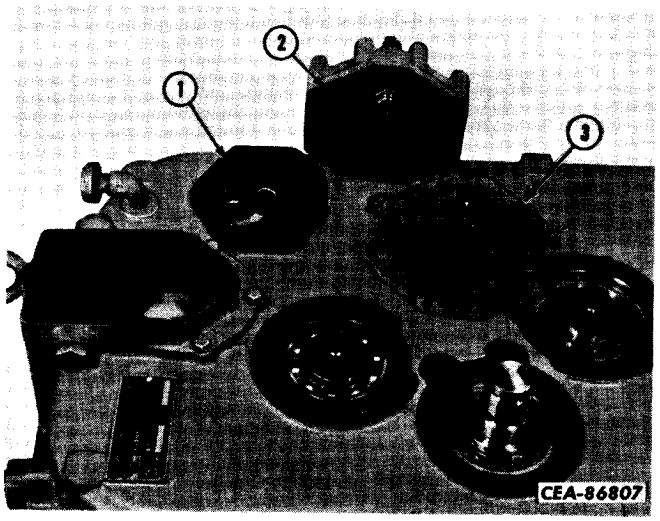

Figure 3-14

Remove cap screws and lock washers that retain transmission rear cover. Install three of the retaining cap screws in the threaded jackscrew holes provided in the cover. Tighten jackscrews (1) evenly to lift cover (2) from dowels (3) in transmission housing.

Attach a suitable sling and hoist and remove the rear cover. Discard gasket.

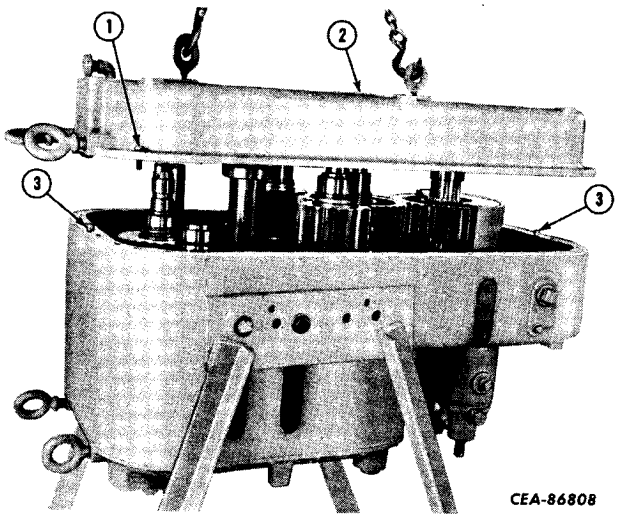

Figure 3-15

Remove oil transfer tubes (2). Discard "o" ring seals (1) from both ends of tubes.

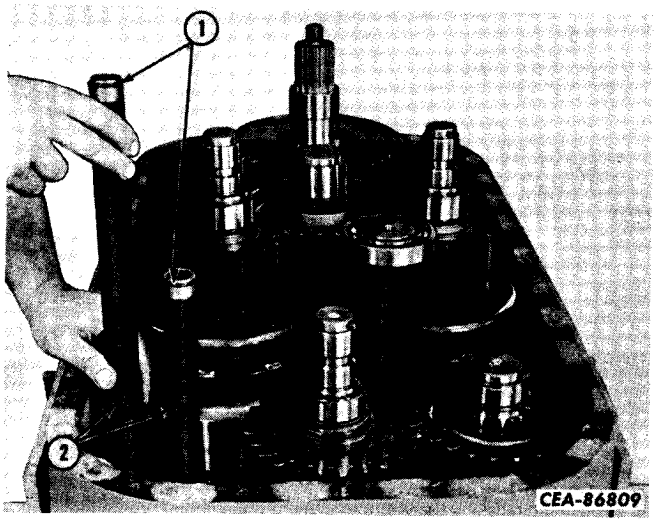

Figure 3-16

DISASSEMBLY

Attach special lifting tool (2) (refer to "SPECIAL TOOLS") to forward-reverse clutch pack (3) in oil supply groove. Using a suitable hoist, lift clutch pack. Reverse idler shaft assembly (1) must be lifted out with clutch pack.

NOTE: Do not attempt to lift clutch packs by oil supply ports. Serious damage may result.

Refer to SECTION III, SUB-ASSEMBLY OVERHAUL for disassembly of forward-reverse clutch pack and reverse idler shaft.

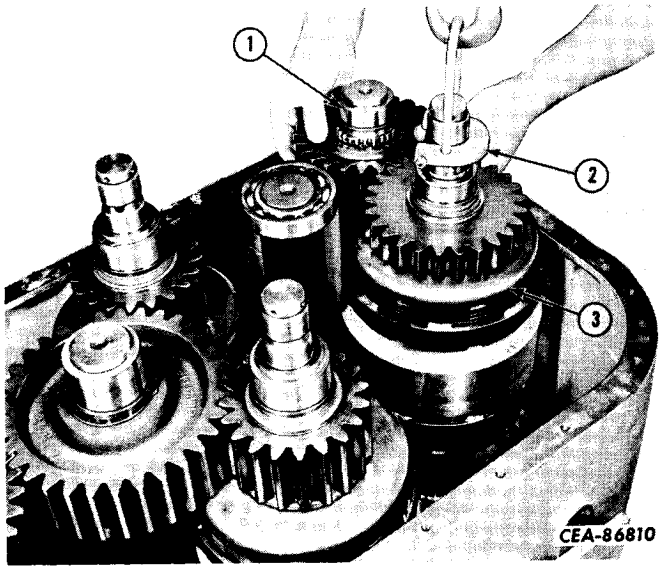

Figure 3-17

Remove gather shaft assembly (1) by grasping low speed gather gear (2), lifting and cocking it slightly toward the bottom of the transmission.

Refer to SECTION III, SUB-ASSEMBLY OVERHAUL for disassembly of gather shaft.

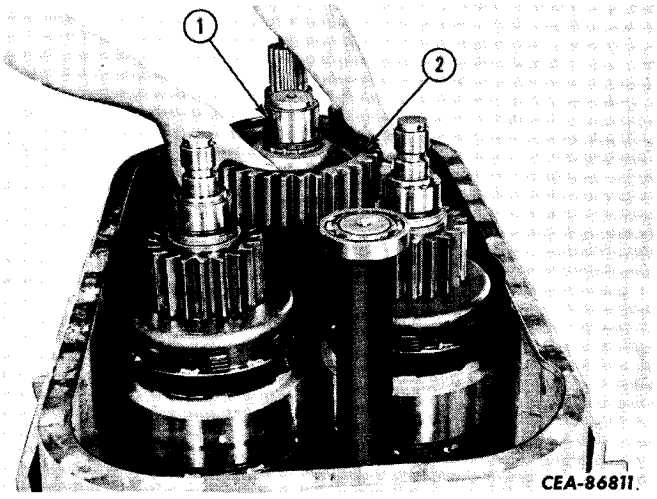

Figure 3-18

Attach special lifting tool (1) to 2nd-4th clutch pack (2) oil supply groove and remove the clutch pack with hoist.

Refer to SECTION III, SUB-ASSEMBLY OVERHAUL for disassembly of 2nd-4th clutch pack.

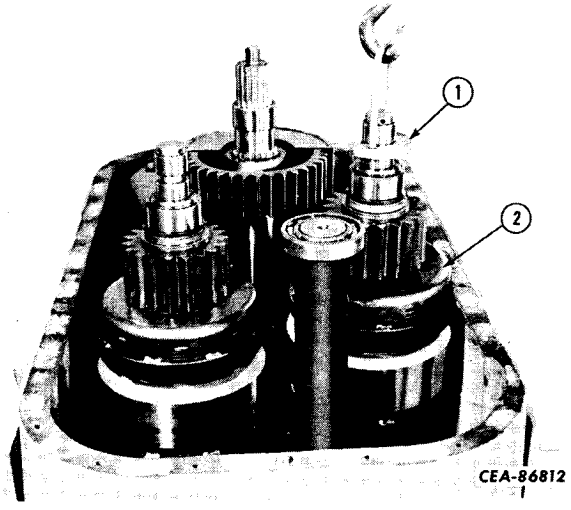

Figure 3-19

DISASSEMBLY

Attach special lifting tool (2) to 1st-3rd clutch pack oil supply groove and remove the clutch pack (1) with hoist.

Refer to SECTION III, SUB-ASSEMBLY OVERHAUL for disassembly of 1st-3rd clutch pack.

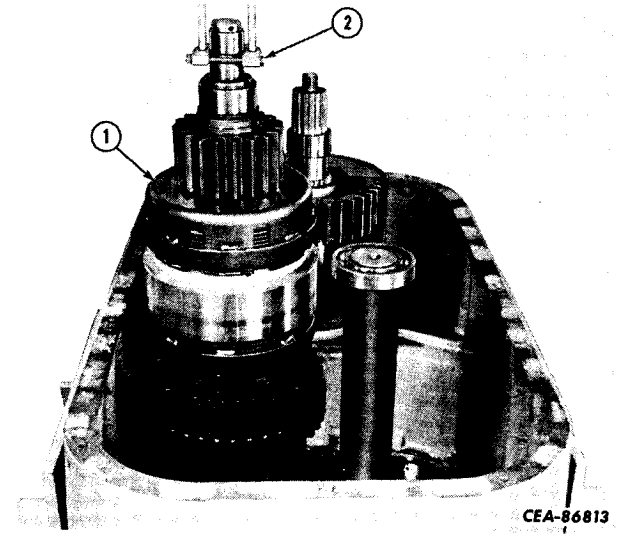

Figure 3-20

Pull straight up to remove the main idler shaft (1).

Refer to SECTION III, SUB-ASSEMBLY OVERHAUL for disassembly of main idler shaft.

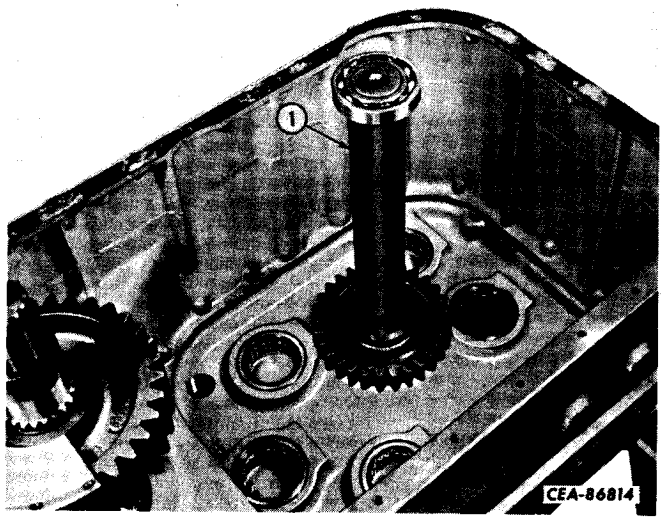

Figure 3-21

Remove the ny-lock retaining cap screws (2) and the oil baffle (1).

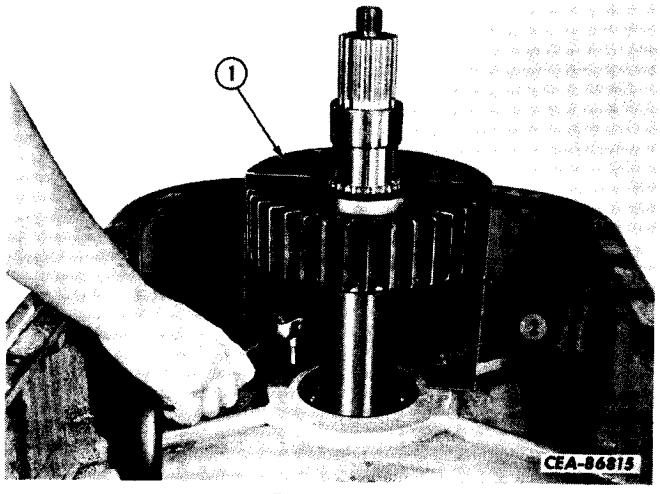

Figure 3-22

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DISASSEMBLY

Secure transmission housing in a vertical position.

Remove the output shaft gear retaining snap ring (1).

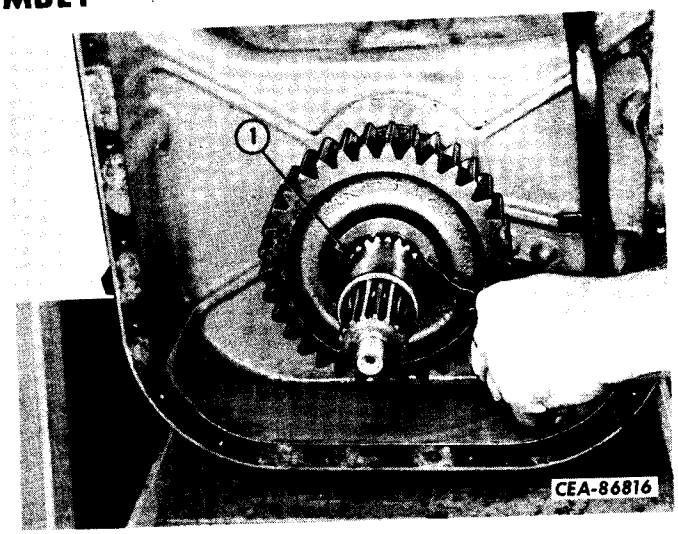

Figure 3-23

Attach a suitable large gear puller as shown, being sure to install a protective steel pad (3) between puller screw and output shaft.

Remove the output shaft gear (1) and bearing inner race (2) together.

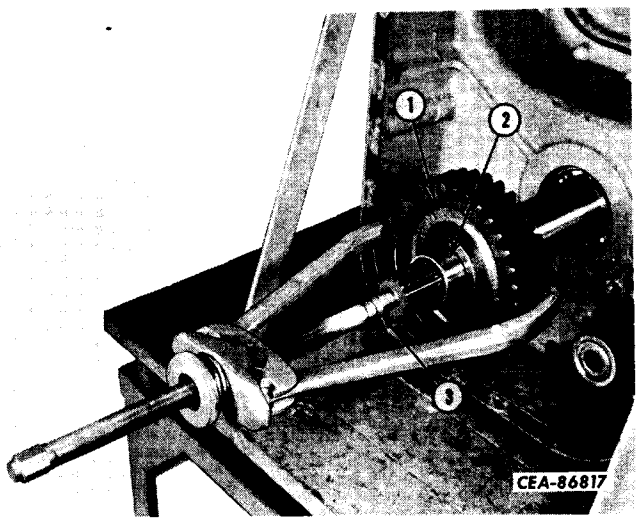

Figure 3-24

Remove self-locking nut (4), steel washer (3), rubber washer (2) and rear output shaft yoke (1).

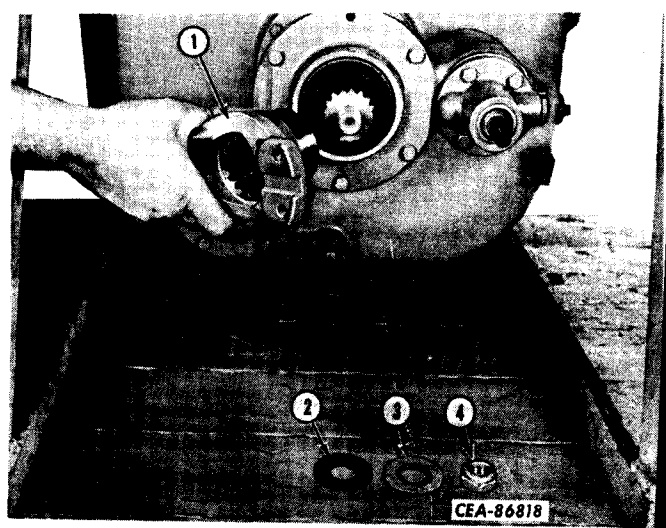

Figure 3-25

DISASSEMBLY

Remove cap screws (2) that secure the bearing retainer (1) to the output shaft-disconnect housing (3). Remove the retainer and gasket and discard gasket. Remove the output shaft seal (4) from the bearing retainer.

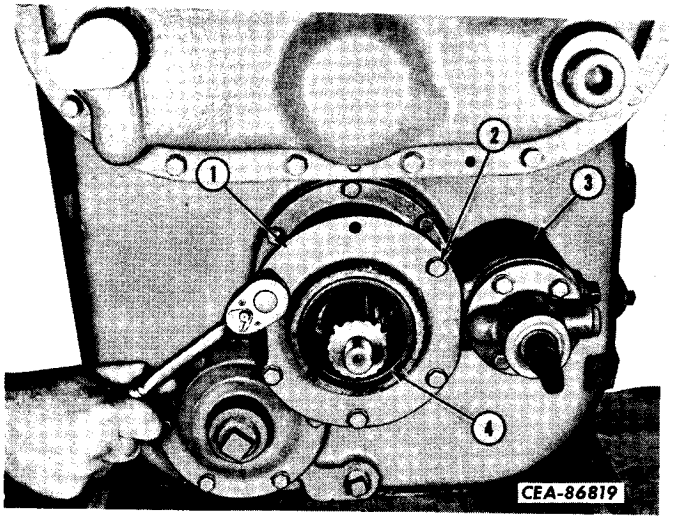

Figure 3-26

Install retaining washer (1) and hex nut (2) and using a suitable pry bar remove short output shaft.

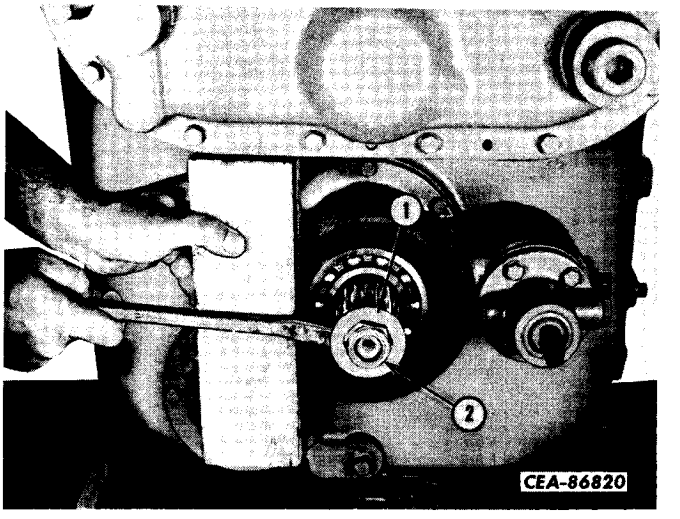

Figure 3-27

Remove the square head plug (2) from the disconnect housing (1).

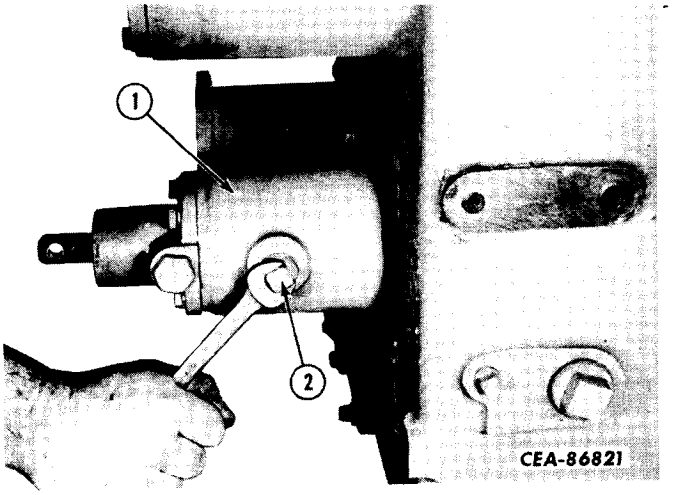

Figure 3-28

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DISASSEMBLY

Using a suitable punch, drive the roll pin (2) inward until it is free of disconnect shaft (1) and yoke.

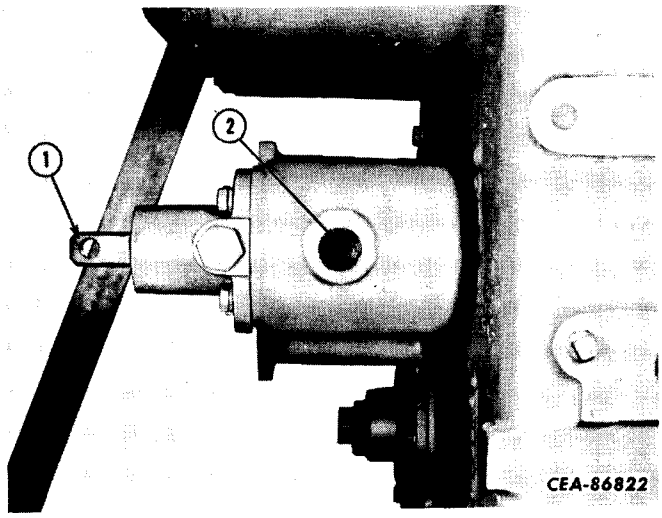

Figure 3-29

Remove cap screws that secure disconnect carrier (1) to disconnect housing (2) and remove disconnect assembly and gasket. Discard gasket.

Refer to SECTION III, SUB-ASSEMBLY OVERHAUL for disassembly of disconnect assembly.

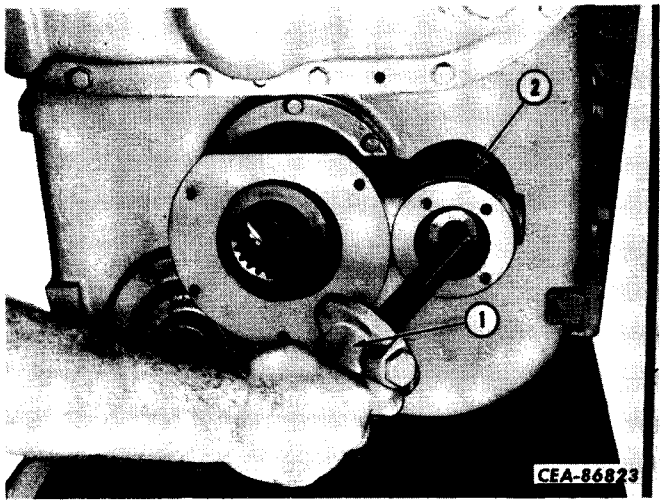

Figure 3-30

Remove cap screws that secure output shaft-disconnect housing (5) to transmission housing (2). Remove disconnect housing, gasket (1) and yoke (4) and collar (3) assembly. Discard gasket.

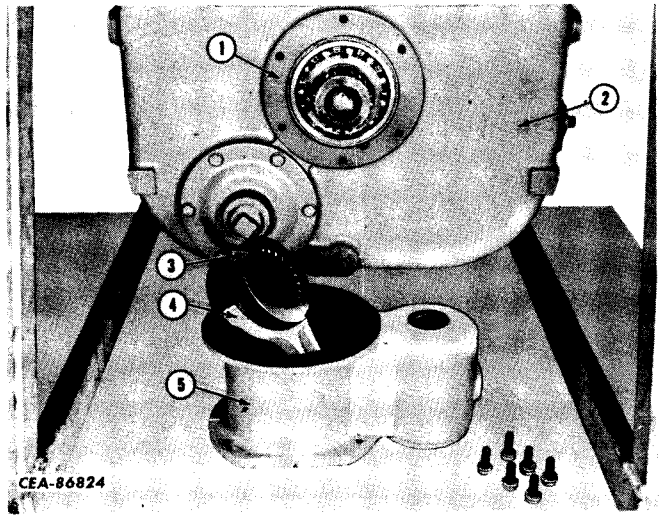

Figure 3-31

DISASSEMBLY

Remove long output shaft (1) using a plastic mallet.

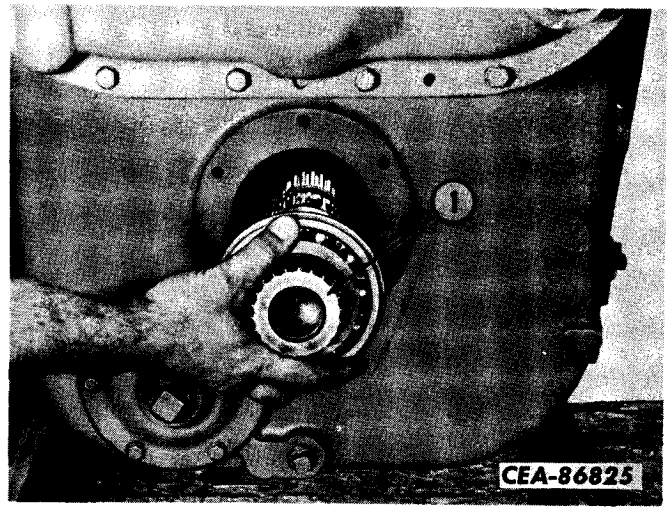

Figure 3-32

Remove the cap screws that retain the filter screen mounting cap (3) and remove the cap and screen assembly and gasket (1). Discard gasket. Filter screen (2) may be unscrewed from cap.

For further disassembly of front and rear transmission cover refer to SECTION III, SUB-ASSEMBLY OVERHAUL.

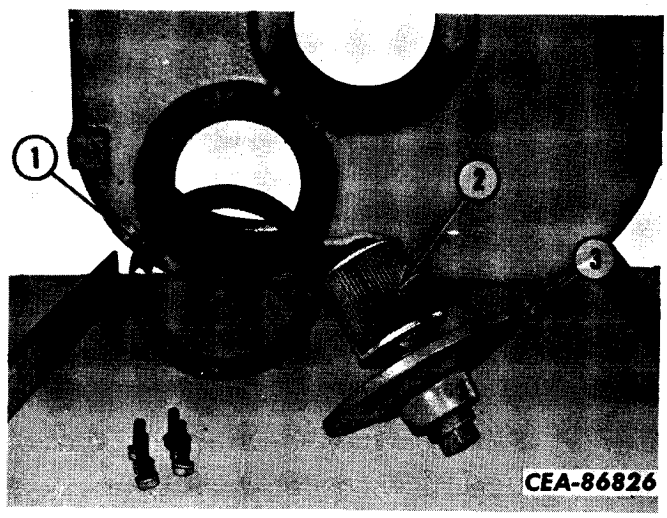

Figure 3-33

ASSEMBLY PREPARATION

Transmission assembly preparation should include:

1. Cleaning all parts thoroughly in solvent or plain steam. (Do not use caustic soda in the steam.) Use compressed air to dry parts. If steam is used to clean parts, oil immediately thereafter. Carefully inspect all parts for excessive wear, cracks and/or breakage.

2. Inspecting all bearings for pits and spalled areas. Replace pitted and/or spalled bearings.

3. Replacing all seals, hook type seal rings, gaskets, "O" rings and snap rings.

4. Inspecting all sealing surfaces for wear and/or grooving.

5. Inspecting housings for dirt particles, and flushing all passageways thoroughly.

6. Inspecting splines on all shafts and drive gears for wear.

7. A heavy, non-fibrous grease with a low melting point to use during assembly.

8. Provisions for heating bearing inner race, either in oil or an oven.

NOTE: Special Torque recommendations are listed on a single page in Section V. This simplifies revision, when necessary. To eliminate constant referral, blank spaces are provided at points where special torques are required. These may be filled in by the manual holder, in pencil, and revised when necessary.

ASSEMBLY

Thread filter screen (2) into cap (3) and tighten securely. Install new gasket (1) on transmission with cap screw holes correctly aligned. Install screen and cap assembly and secure with cap screws and lock washers. Tighten cap screws to specified torque. (Refer to "SPECIAL TORQUES").

Torque: _____

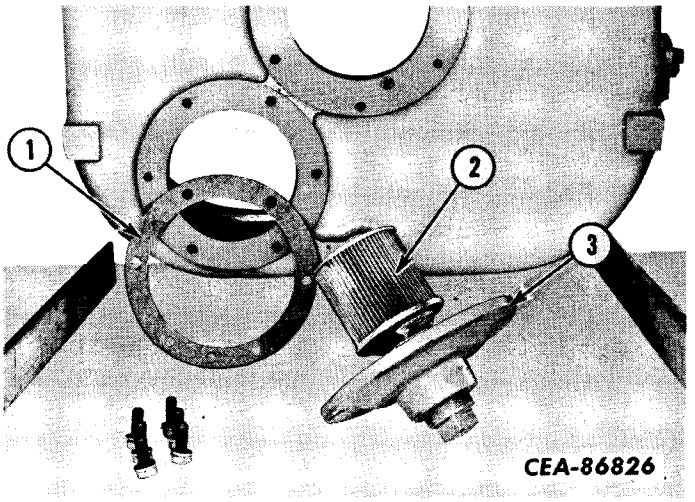

Figure 3-34

ASSEMBLY

Install long output shaft (1) in transmission. Drive on outside race of shaft bearing using a suitable sleeve and mallet.

Assemble disconnect collar (2) and yoke (3) and install in output shaft-disconnect housing (5).

NOTE: Roll pin hole (4) must face away from transmission housing.

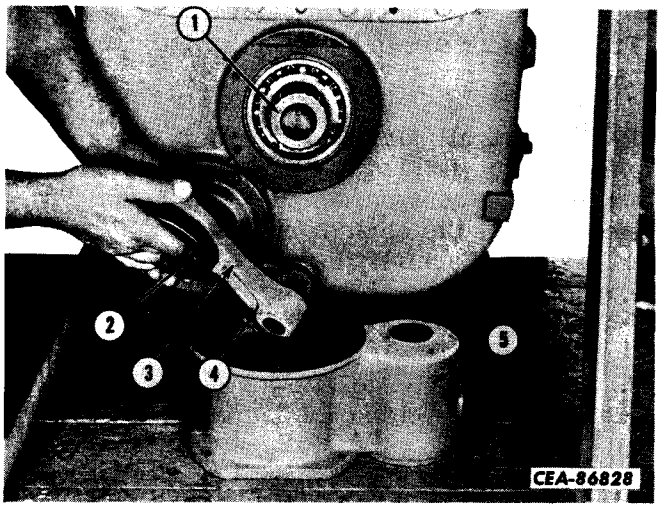

Figure 3-35

Install new gasket (1) on transmission housing, aligning cap screw holes. Install output shaft housing (2) with yoke-collar assembly, on transmission housing. Secure with cap screws and lock washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

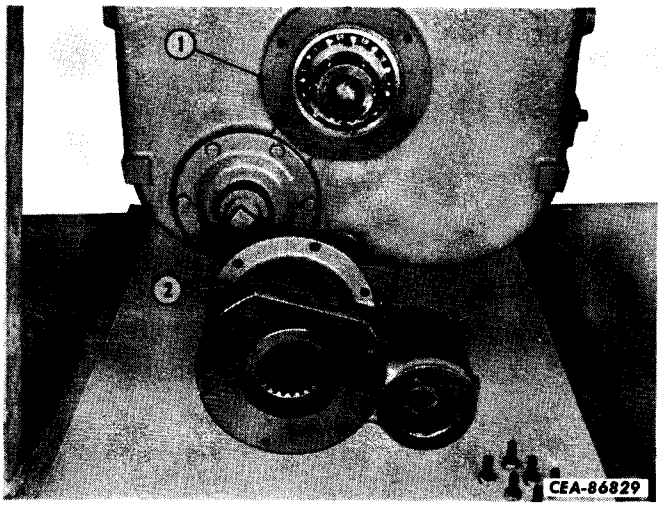

Figure 3-36

Using a new gasket (1), install the disconnect shaft assembly (2) in the disconnect housing. Secure with cap screws and lock washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

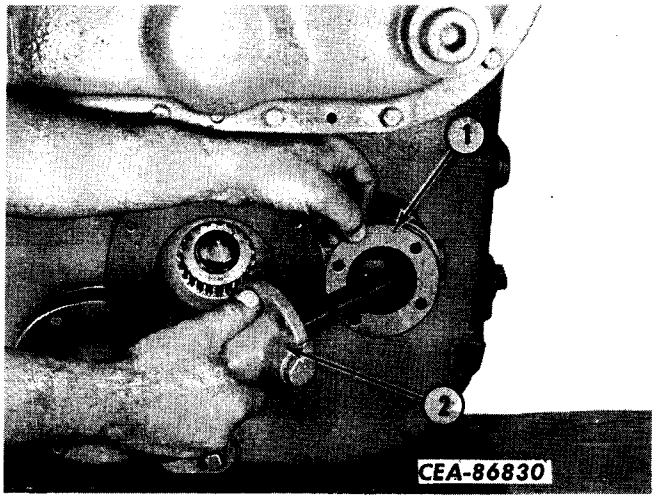

Figure 3-37

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ASSEMBLY

Align pin holes in shaft (1) and yoke and drive in roll pin (2) with punch.

Install square headed plug in roll pin access hole. Tighten plug securely.

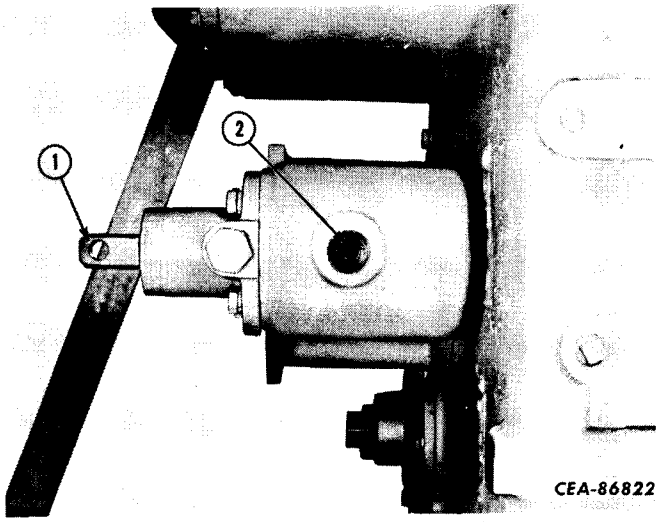


Figure 3-38

Install short output shaft assembly (1) in output shaft housing being sure splines on shaft are aligned with splines in disconnect collar.

Correctly position shaft assembly by driving on outer bearing race with a suitable sleeve and mallet until snap ring bottoms completely.

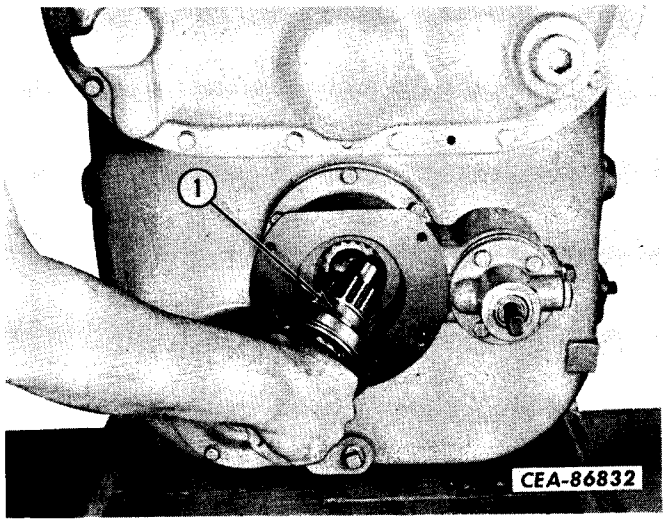


Figure 3-39

Coat the O. D. of the seal (2) with Mar-Seal or equivalent sealant. Press seal into bearing retainer (3). The large lip of the seal should face down and toward the large flange of the bearing retainer.

NOTE: Place a plate (1) with a larger diameter than the seal over the seal to avoid damage as it is pressed into position.

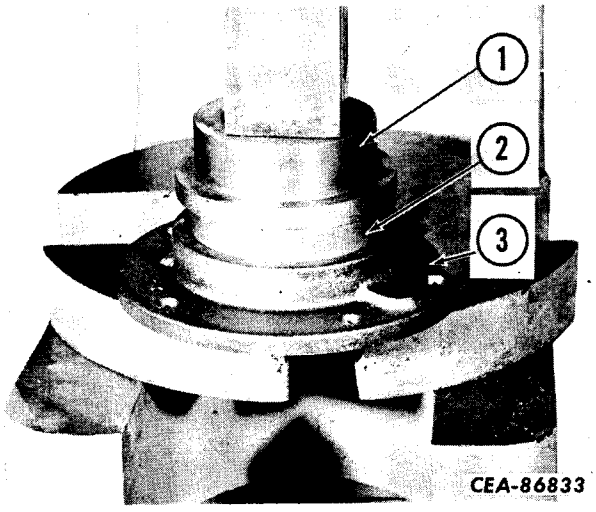


Figure 3-40

ASSEMBLY

Align seal drain hole (1) in housing, new gasket and retainer and assemble using cap screws and lock washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

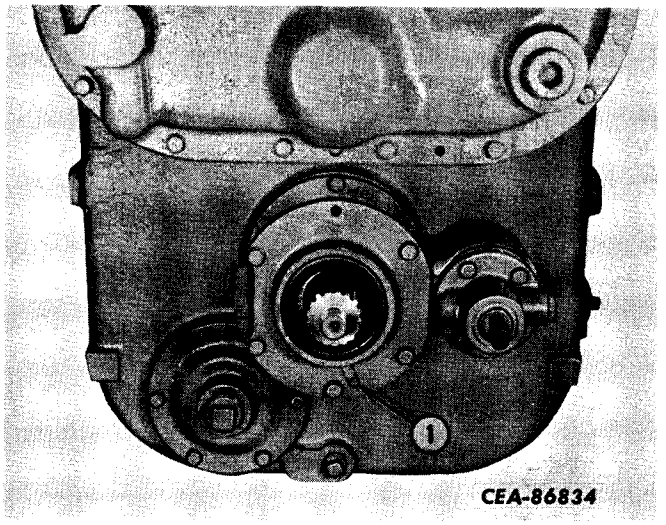


Figure 3-41

Apply a coating of grease to output yoke sealing surface. Install yoke (1), rubber washer (2), steel washer (3) and a new self-locking hex nut (4). Tighten the hex nut to the recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

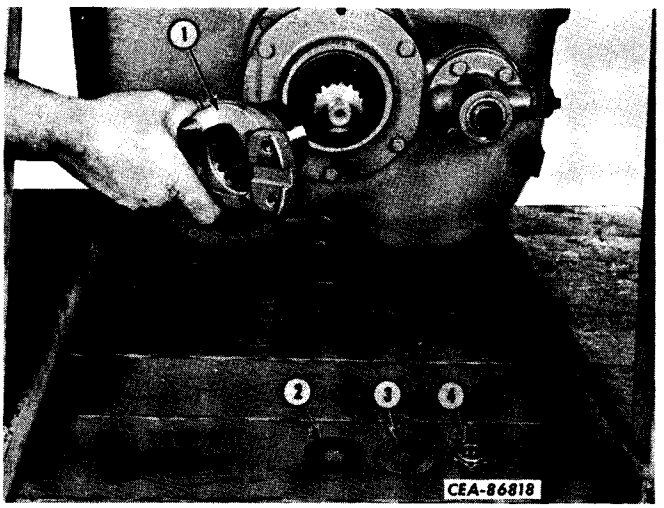


Figure 3-42

Install output shaft drive gear (2) and retaining snap ring (1) on output shaft.

Install heated bearing inner race (3) on output shaft being sure it bottoms on shoulder of shaft.

NOTE: Heat bearing inner race to 350°F. for 45 minutes in oil or in an oven prior to assembly.

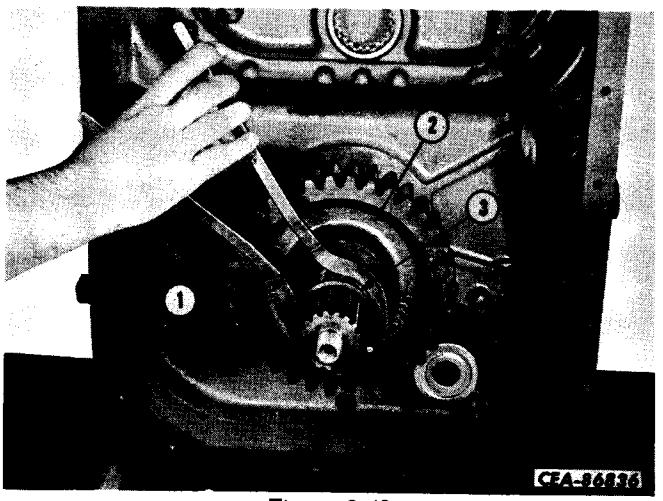


Figure 3-43

ASSEMBLY

Install oil baffle (2) using ny-lock retaining cap screws (1). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

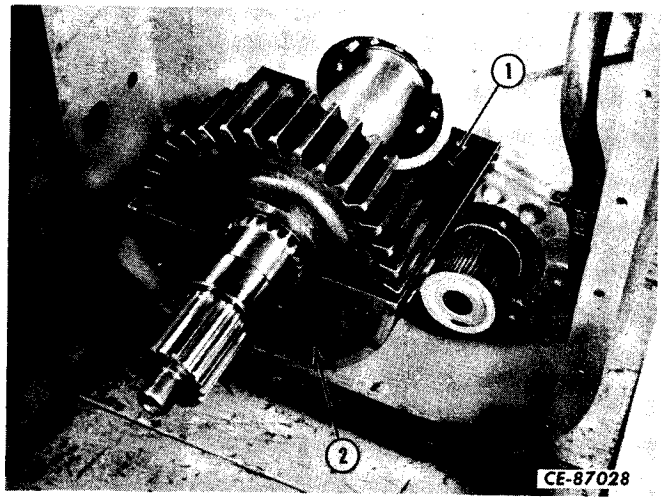


Figure 3-44

Position transmission horizontally. Install main idler shaft and gear assembly (1).

NOTE: Prior to installation in transmission, lubricate all shaft bearing surfaces and bearings with oil soluble grease.

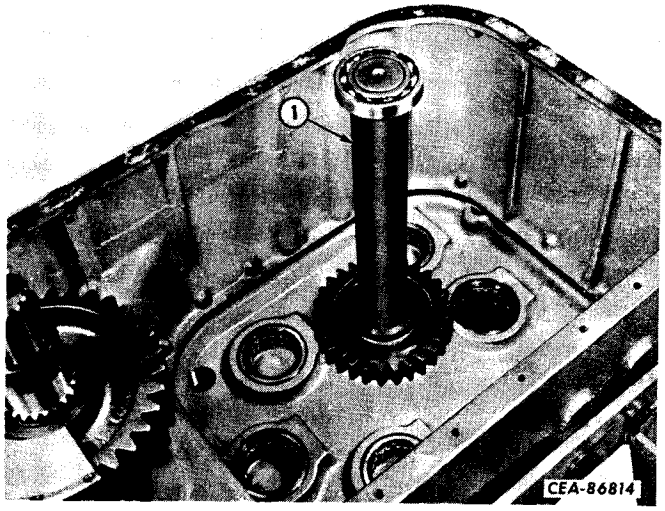


Figure 3-45

Attach special lifting tool (2) (refer to SECTION VI, LIFTING TOOL) in oil supply groove of 1st-3rd clutch pack (1) (pack with large input gear) and install assembly in transmission.

NOTE: Do not attempt to lift any of the clutch packs by the oil supply ports.

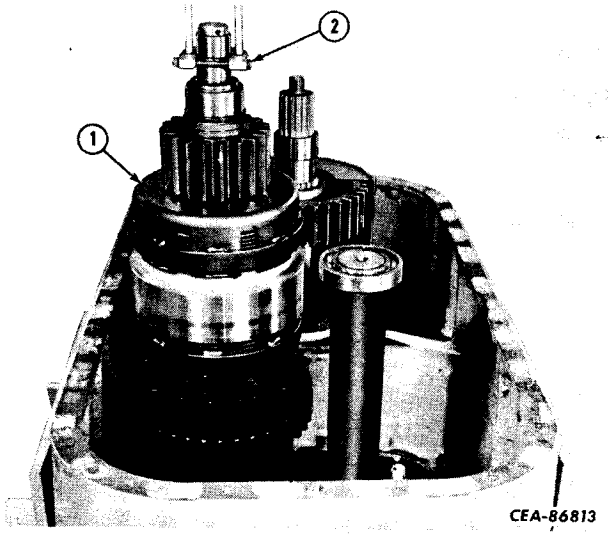


Figure 3-46

ASSEMBLY

Attach special lifting tool to oil supply groove in 2nd-4th clutch pack (1) and install assembly in transmission.

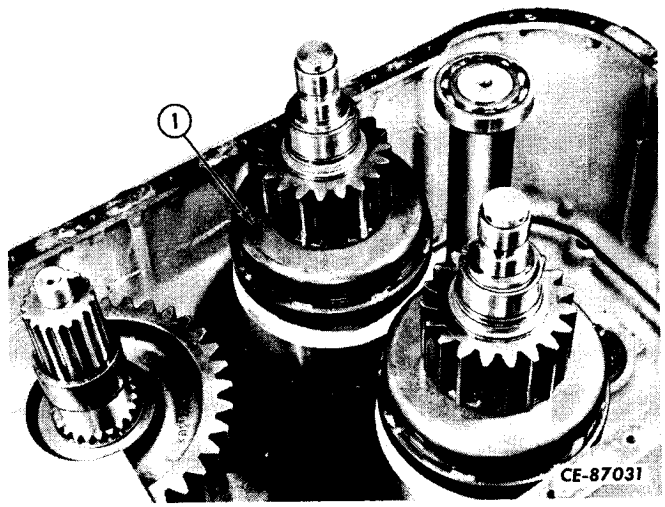


Figure 3-47

Grasp large (low speed) gear (1) on gather shaft (2) and install assembly in transmission by slightly turning shaft to align gear teeth and cocking low speed gather gear (1) toward bottom of housing.

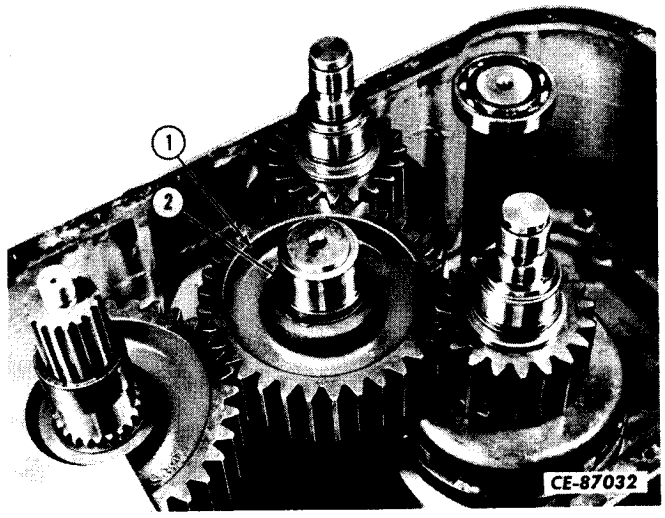


Figure 3-48

Attach lifting tool (1) to directional clutch pack (3) and lower clutch pack into transmission. At the same time install the reverse idler shaft assembly (2). The larger gear on the reverse idler shaft is in the up position.

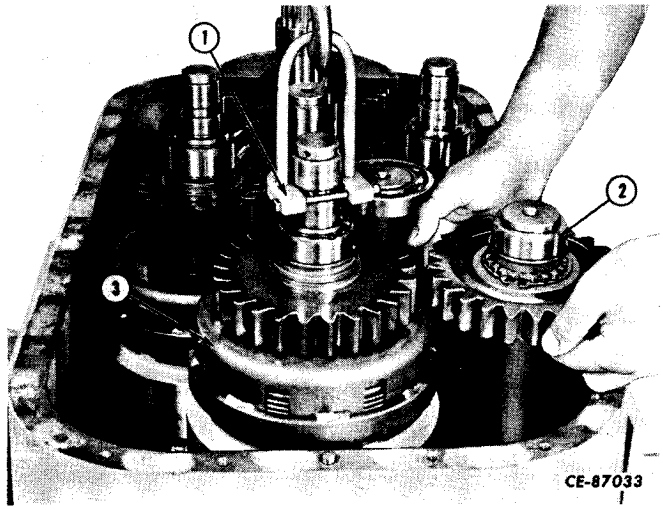


Figure 3-49

ASSEMBLY

Install new "O" rings (1) on oil transfer tubes (2). Coat "O" rings with grease and install transfer tubes in transmission. Be sure tubes are bottomed in their respective bores.

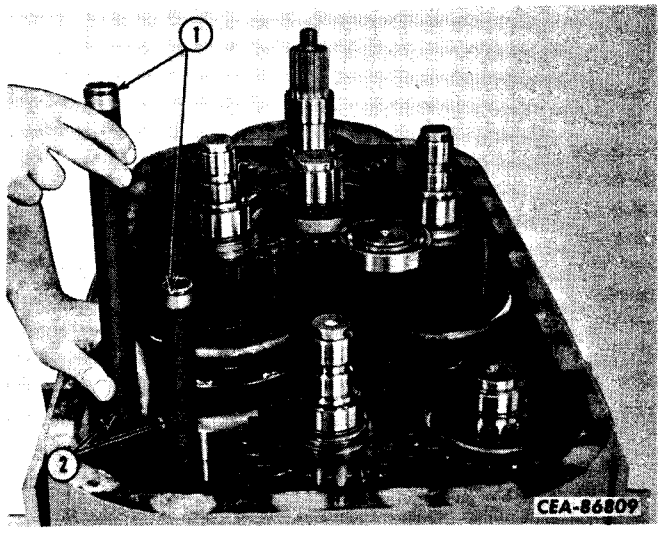


Figure 3-50

Before installing the cover check the following:

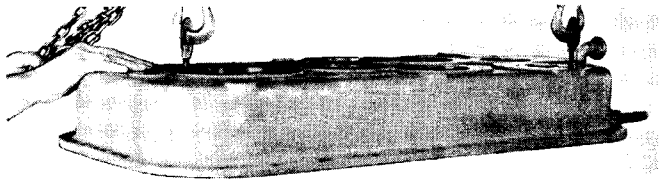
1. Be sure directional oil supply seal rings have been properly installed and are coated with

2. Be sure all gears are properly meshed.

3. Be sure all bearings are properly seated.

4. Transmission housing must be free of all foreign material, tools etc.

5. Be sure "O" rings on oil transfer tubes are well greased.



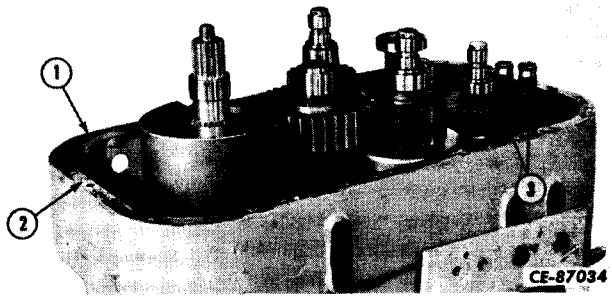


Figure 3-51

Place new gasket (1) on transmission housing, retaining it with grease. Support cover on hoist as level as possible. Lower cover slowly, aligning both range clutch shafts and bearings with their respective bearing bores in cover. Align the two oil transfer tubes (3) using a pair of screw drivers. Lower cover and align on dowels (2). Gently tap cover down with a mallet. Do not force cover by pulling in down with cap screws. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

ASSEMBLY

Align a new range selector valve gasket (4) on the valve mounting pad (1). Coat new seal ring (2) with grease and install on selector valve (3). Mount valve on transmission using cap screws and lock washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

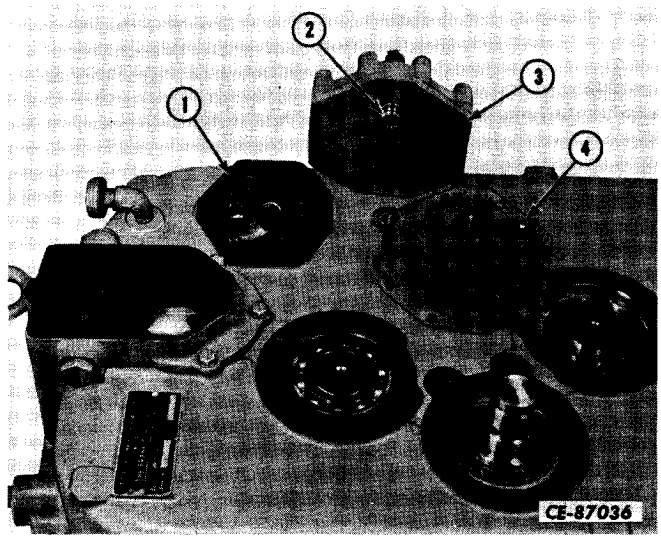


Figure 3-52

Install a new neutral knock down valve gasket (2) on the valve mounting pad. Be sure holes in gasket and transmission are correctly aligned.

NOTE: Be sure directional oil supply cover (3) is in correct alignment (refer to SECTION III, SUB-ASSEMBLY OVERHAUL).

Install valve body (1) with cap screws and lock washers.

NOTE: Do not tighten cap screws until directional selector valve has been installed.

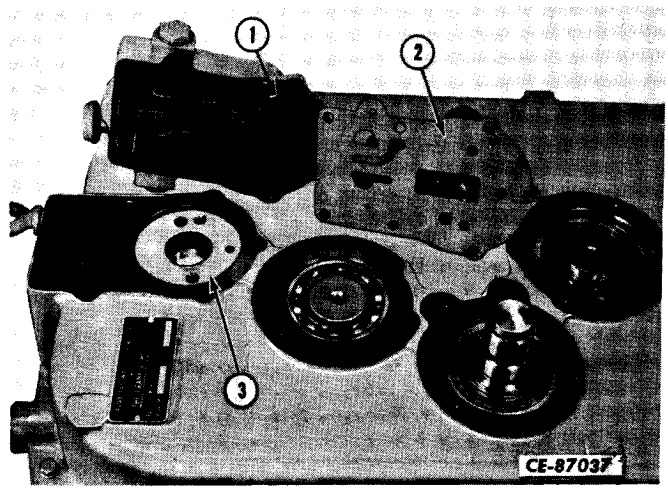


Figure 3-53

Install new directional selector valve gasket (2) on neutral knock down valve. Install directional selector valve (1) and secure with cap screws (3) and lock washers. Tighten all cap screws (knock down and selector valves) to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

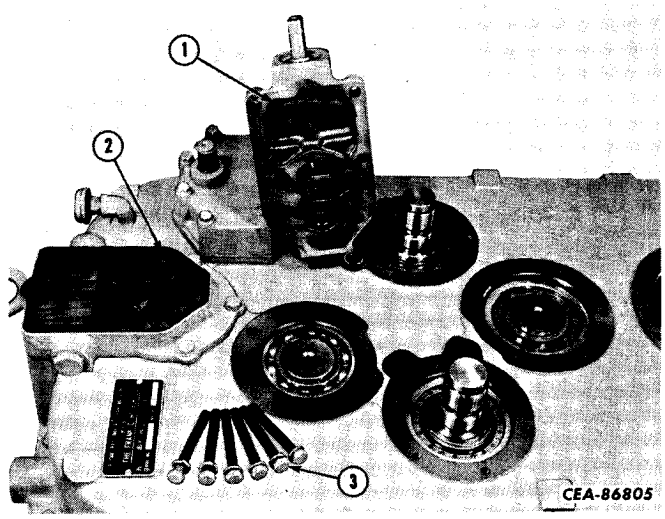


Figure 3-54

ASSEMBLY

Install new idler shaft gasket and gather shaft gasket (2). Align holes and install idler shaft cover (1) and gather shaft cover (3). Retain covers with cap screws and lock washers. Tighten all cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

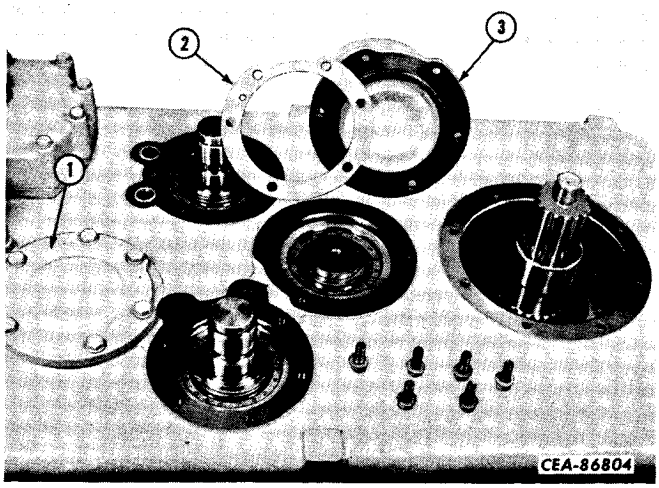


Figure 3-55

Install two new range clutch oil supply cover gaskets (1). Align holes in gaskets and transmission. Be sure new "O" rings (3) are installed in both oil supply covers (2). Secure "O" rings in their bores with an application of grease. Install oil supply covers and secure with cap screws and lock washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

NOTE: Install oil supply covers carefully to avoid damage to seals.

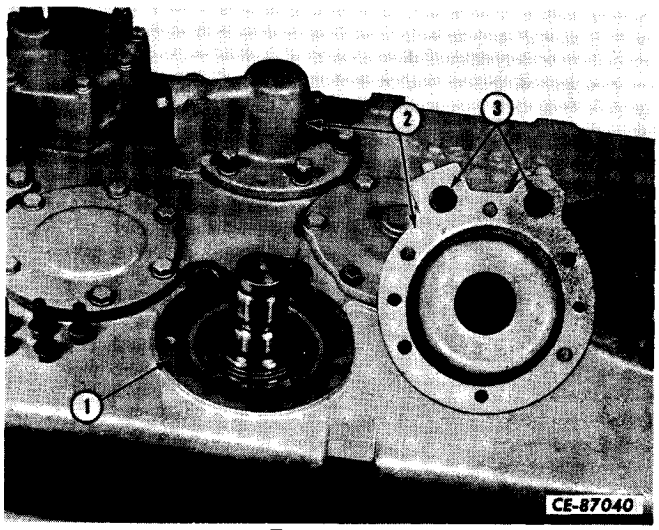


Figure 3-56

Align new parking brake mounting cover gasket (2) on transmission rear cover. Install cover assembly (1) with jackscrew holes perpendicular to the bottom of transmission housing. Install retaining cap screws and lock washers and tighten to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

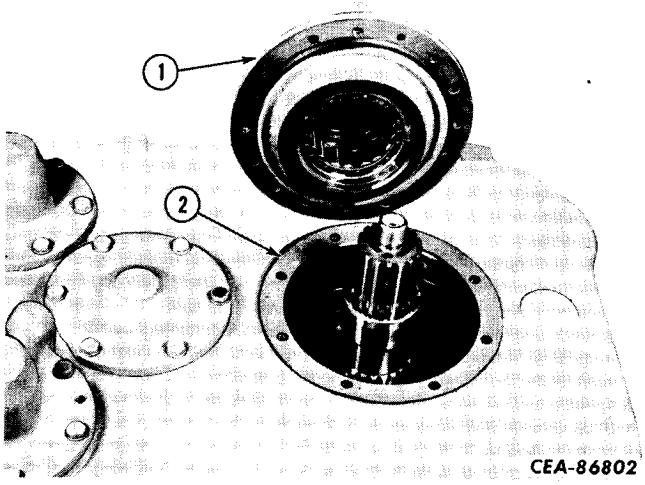


Figure 3-57

ASSEMBLY

Install parking brake backing plate (4) on brake mounting cover with cutout (2) for actuating lever in lower right hand corner of transmission. Secure backing plate with cap screws (3) and lock washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Install break roller (1) on right hand brake pawl.

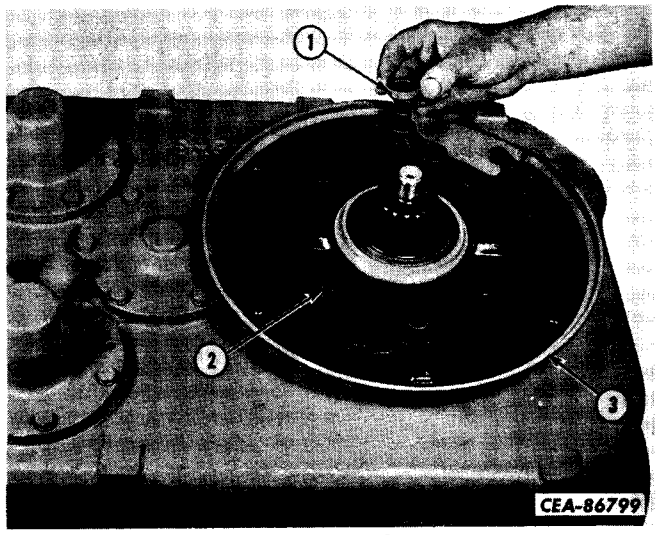


Figure 3-58

Install the parking brake actuating lever (2) with offset down. Position lever on left brake pawl pin (3) and on outside of roller (1) on right pawl.

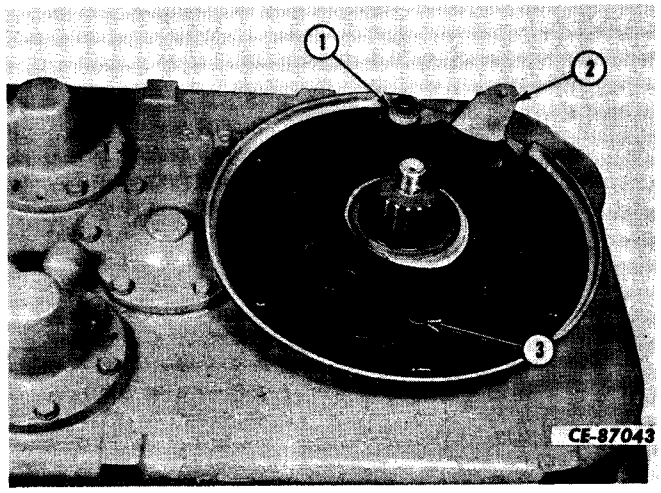


Figure 3-59

Position brake shoes (2) on pawl pins (1) with web of shoes under guide brackets (3). With a brake spring pliers install brake return springs in holes nearest backing plate.

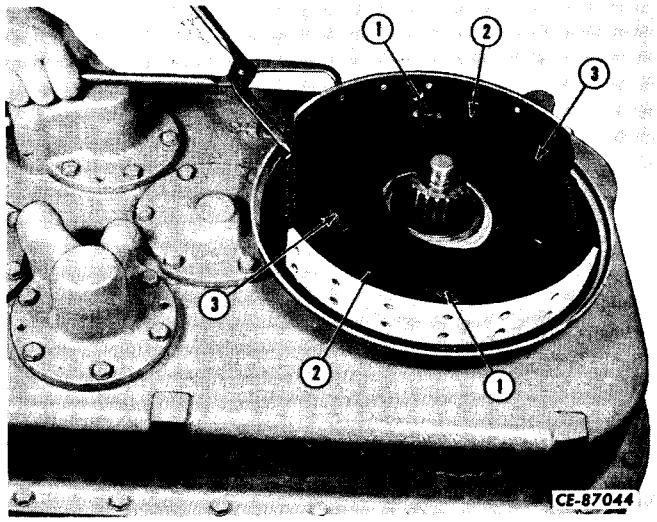


Figure 3-60

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ASSEMBLY

Coat seal and sealing surface of hub with grease. Lower brake drum (1) with hoist, aligning splines on drum hub and output shaft.

Install rubber washer (2), steel washer (3) and a new self-locking hex nut (4). Tighten hex nut to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

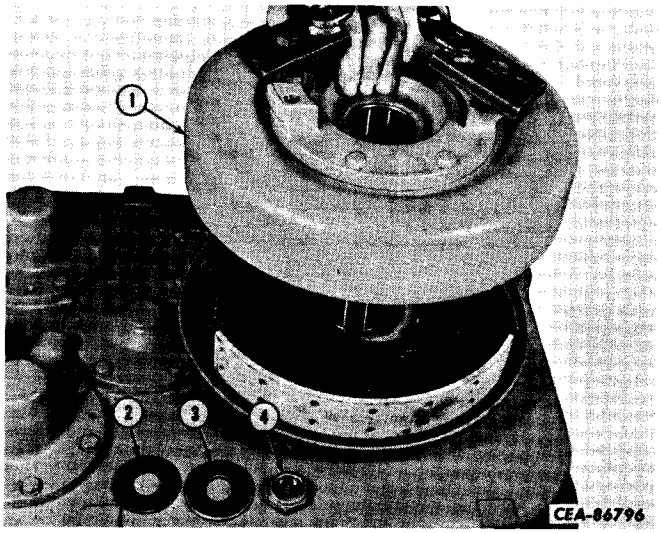

Figure 3-61

Place transmission upright. Lubricate input yoke sealing surface (4) and lips of seal with grease. Align splines of shaft and yoke and install yoke on input shaft. Install retaining washer (3) and new locking plate (2) and secure with cap screws (1). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES"). Lock cap screws by bending up tabs on locking plate.

Torque: _____

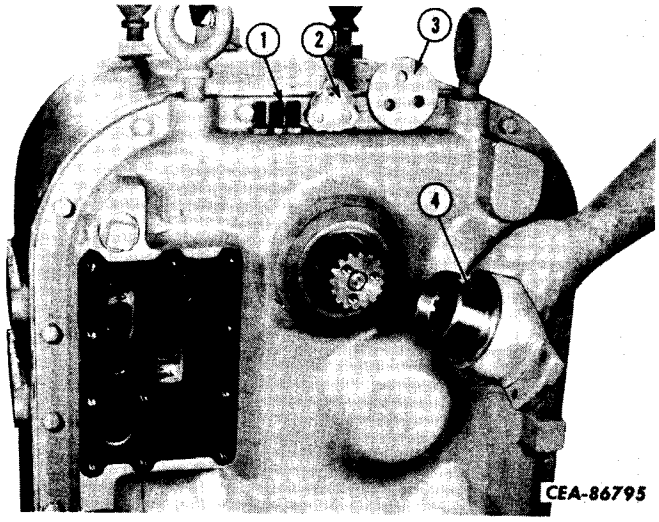

Figure 3-62

Align holes and install new main regulator valve gasket (2) and main regulator valve (1). Secure with cap screws and lock washers. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

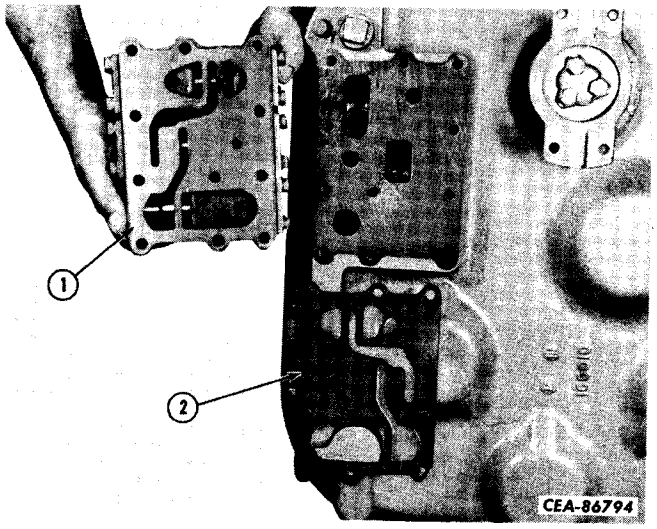

Figure 3-63

SPECIAL INSTRUCTIONS - P2001 & P2003 TRANSMISSIONS

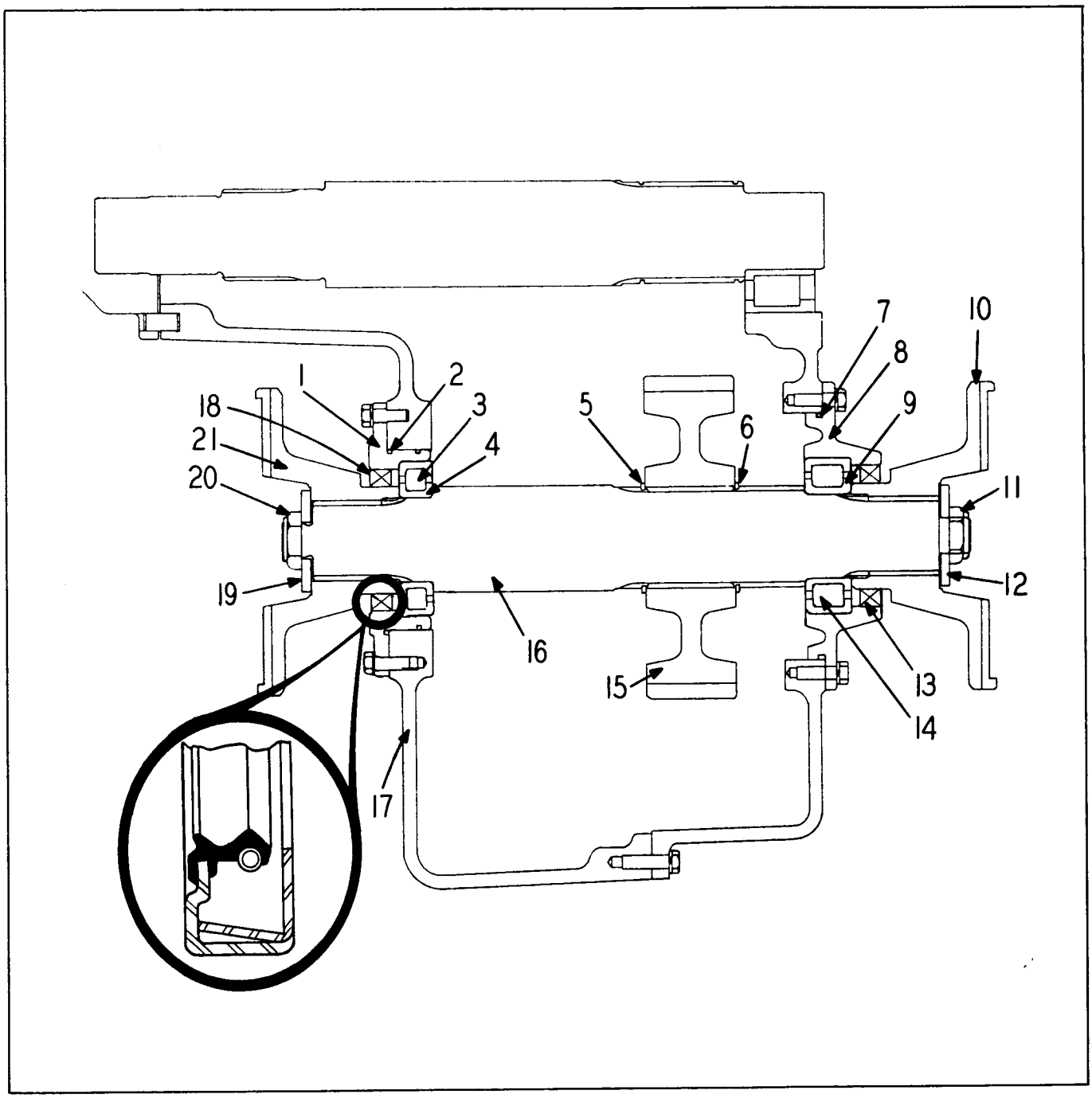

Figure 3-64
P-2001 & P-2003 Output Shaft.

1. Bearing retainer.
2. "O" ring.
3. Outer bearing race and rollers.
4. Inner bearing race.
5. Snap ring.
6. Snap ring.
7. "O" ring.
8. Bearing retainer.
9. Inner bearing race.
10. Forward output yoke.
11. Self-locking retaining nut.
12. Retaining washer.
13. Seal.
14. Outer bearing race & rollers.
15. Output shaft gear.
16. Output shaft.
17. Transmission housing.
18. Seal.
19. Retaining washer.
20. Self-locking retaining nut.
21. Rear output yoke.

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SPECIAL INSTRUCTIONS - P2001 & P2003 TRANSMISSIONS

1. GENERAL

The P-2001 and P-2003 transmissions differ primarily from the P-2000 and P-2002 models in the area of the output shaft. The P-2001 and P-2003 models do not have a transmission mounted parking brake or rear axle disconnect. They differ from each other in their gear ratios (refer to P-2000 SERIES TRANSMISSION CLASSIFICATION).

2. DISASSEMBLY

After removal of front output yoke (10, Fig. 3-64) refer to Fig. 3-7 and continue disassembly procedure. After removing bearing retainer caps (1, 8, Fig. 3-64), remove the "O" rings (2, 7) and discard. Remove the seals (13, 18, Fig. 3-64) from the retainer caps and discard. Bearing inner races (4, 9) must be removed with a hydraulic or mechanical puller. Remove snap ring (6) and using a suitable puller remove the output gear (15) from the shaft. Snap ring (5) need not be removed unless it is damaged.

3. ASSEMBLY

Coat O.D. of new seals (13, 18) with Mar-Seal or equivalent sealant and press seals into bearing retainers (1, 8) with large lip of seal facing in toward retainer flange. Press gear (15) on output shaft (16) and install snap ring (6). Bearing inner races must be heated before installation.

> NOTE: Prior to assembly, heat bearing inner races to 350°F. for 45 minutes in oil or an oven.

Install new "O" rings (2, 7) in grooves provided before installing bearing retainers (1, 8). Tighten bearing retainer cap screws and self-locking retaining nuts (11, 29) to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

SPECIAL INSTRUCTIONS - P-2004 TRANSMISSION

1. GENERAL

The P-2004 transmission is similar to the P-2003 unit; the output shaft however, is equipped with tapered roller bearings rather than the straight roller type used in the other transmissions.

2. DISASSEMBLY

After removal of front output yoke (9, Fig. 3-65) refer to Fig. 3-7 and continue disassembly procedure. After removing bearing retainer caps (5, 20, Fig. 3-65) remove "O" rings (6, 17) and discard.

NOTE: After removing rear output bearing retainer cap (20), tie original shim pack (2) together to facilitate assembly procedure. Do not loose shims.

Press out and discard seals (1, 12). Bearing inner races (8, 19) must be removed using a suitable hydraulic or mechanical puller. Remove snap ring (14) and using a gear puller, remove the output gear (4). The remaining snap ring (15) need not be removed unless it is damaged.

3. ASSEMBLY

Coat O.D. of new seals (1, 12) with Mar-Seal or equivalent sealant and press seals into bearing retainers (5, 20) with large lip of seal facing in toward bearing flange. Press gear (4) on output shaft (3) and install snap ring (14). Bearing inner races must be heated before installation.

(Continued on page 27)

SPECIAL INSTRUCTIONS - P-2004 TRANSMISSION

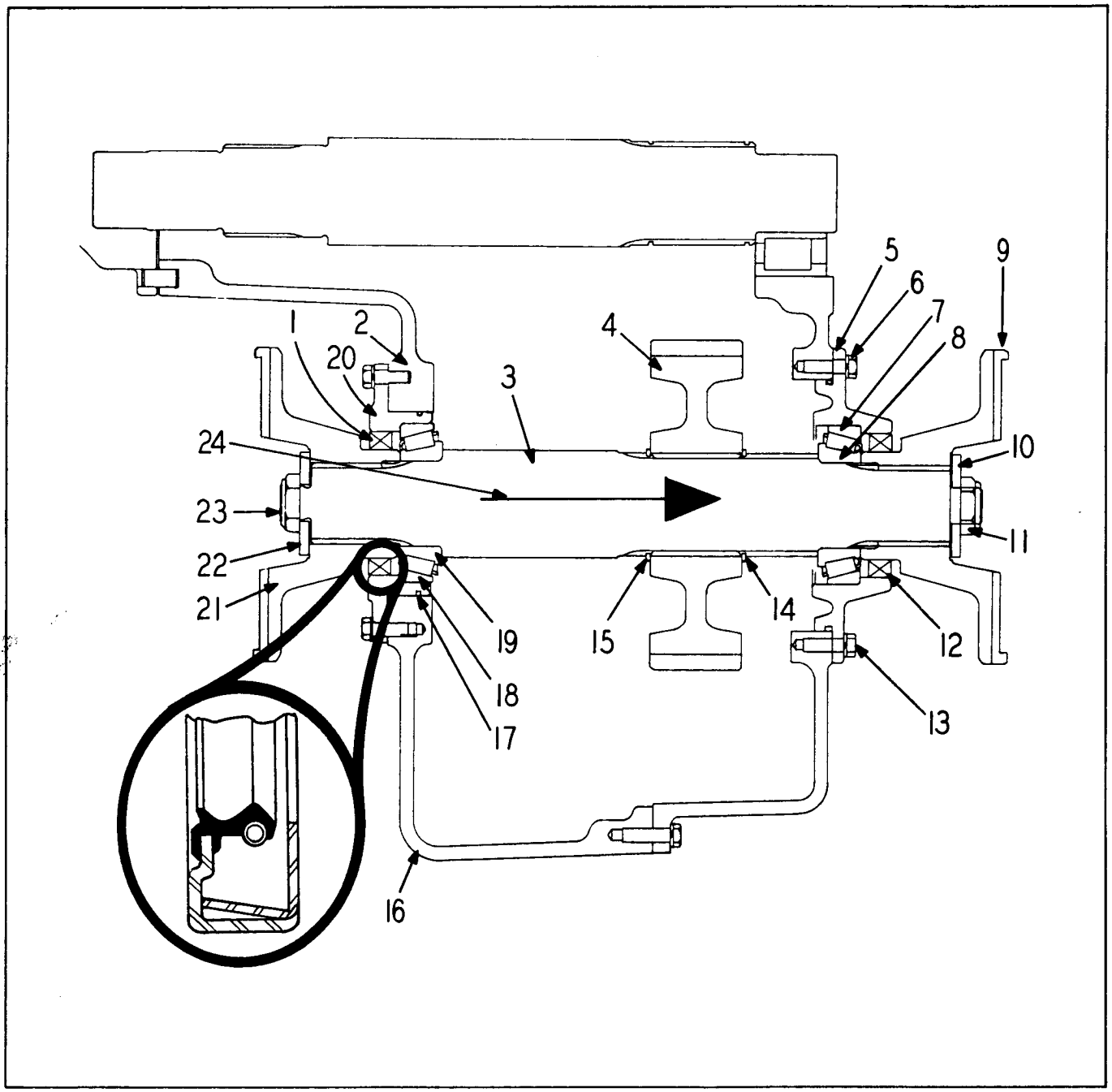

Figure 3-65
P-2004 Output Shaft.

1. Seal.
2. Shims.
3. Output shaft.
4. Output shaft gear.
5. Bearing retainer.
6. "O" ring.
7. Outer bearing race & rollers.
8. Inner bearing race.
9. Forward output yoke.
10. Retaining washer.
11. Self-locking retaining nut.
12. Seal.
13. Retaining cap screw - bearing retainer.
14. Snap ring.
15. Snap ring.
16. Transmission housing.
17. "O" ring.
18. Outer bearing race & rollers.
19. Inner bearing race.
20. Bearing retainer.
21. Rear output yoke.
22. Retaining washer.
23. Self-locking retaining nut.
24. Direction of thrust when "rolling" shaft in.

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SPECIAL INSTRUCTIONS - P-2004 TRANSMISSION

3. ASSEMBLY - Continued

NOTE: Prior to assembly, heat bearing inner races to 350°F. for 45 minutes in oil or an oven.

Install new "O" rings (6, 17) in grooves provided before installing bearing retainers (5, 20).

4. ADJUSTMENT

Shafts equipped with tapered roller bearings must have controlled end play. The following assembly adjustment procedure insures this control.

1. Do not install shims (2, Fig. 3-66) during installation of bearing retainer (20) on transmission housing (16). Use only two cap screws, 180° apart, to secure retainer. Do not tighten cap screws at this time.

2. Follow procedure described in general text for installation of opposite bearing retainer (5). Tighten all cap screws securing this retainer to the recommended torque (refer to "SPECIAL TORQUES"). Do not install the output yoke (9) at this time.

Torque: _____

3. Secure transmission in vertical position. Grasping the end of the output shaft (3) where it protrudes from the loose retainer (20), "roll" the shaft into the opposite (tightened) bearing retainer (5). Exert a heavy pressure (thrust) in the direction indicated by the large arrow (24). This "rolling in" procedure is designed to seat the bearing assembly (7, 8) squarely and firmly in its retainer (5).

4. With the shaft "rolled in" solidly, torque the two cap screws on the loose retainer (20) evenly to recommended preliminary torque (refer to "SPECIAL TORQUES").

Torque: _____

NOTE: Continue to "roll" output shaft while torquing cap screws.

5. Use a dial indicator on shaft to be certain it has reached a uniform depth.

6. Measure the gap between the transmission housing (16) and the bearing retainer (20). Take the measurement as close to the cap screws as possible.

7. To the gap average add .025". The total amount equals the thickness of the required shim pack (2).

8. Carefully remove the bearing retainer (20), install the required shim pack and reinstall the bearing retainer using all required cap screws. Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

9. Install output yoke (21) using retaining washer (22) and self-locking retaining nut (23). Tighten retaining nut securely.

10. Mounting a dial indicator on opposite end of output shaft (3), measure the shaft end play. End play must be within recommended limitations (refer to "TOLERANCES"). Add or subtract shims if necessary.

11. When correct end play is obtained, install remaining output yoke (9), retaining washer (10) and self-locking retaining nut (11). Tighten both output yoke retaining nuts (11, 23) to recommended torque (refer to "SPECIAL TORQUES").

Torque: _____

SUB-ASSEMBLY OVERHAUL

1. PARKING BRAKE DRUM (P-2000 & P-2002)

DISASSEMBLY

Remove output flange retaining cap screws (4) and nuts (1). Place parking brake drum assembly in press with output flange (3) down. Support drum (2) close to output flange and press output flange from drum.

CLEANING AND INSPECTION

Wash parts thoroughly in clean solvent and dry with compressed air. Inspect output flange sealing surface for wear and/or grooving.

ASSEMBLY

Place brake drum (2), small diameter bore up, in press and support drum under bolt circle. Align bolt holes in output flange (3) with those in drum. Press output flange into drum; install cap screws (4) and torque hex nuts (1). Refer to "SPECIAL TORQUES".

Torque: _____

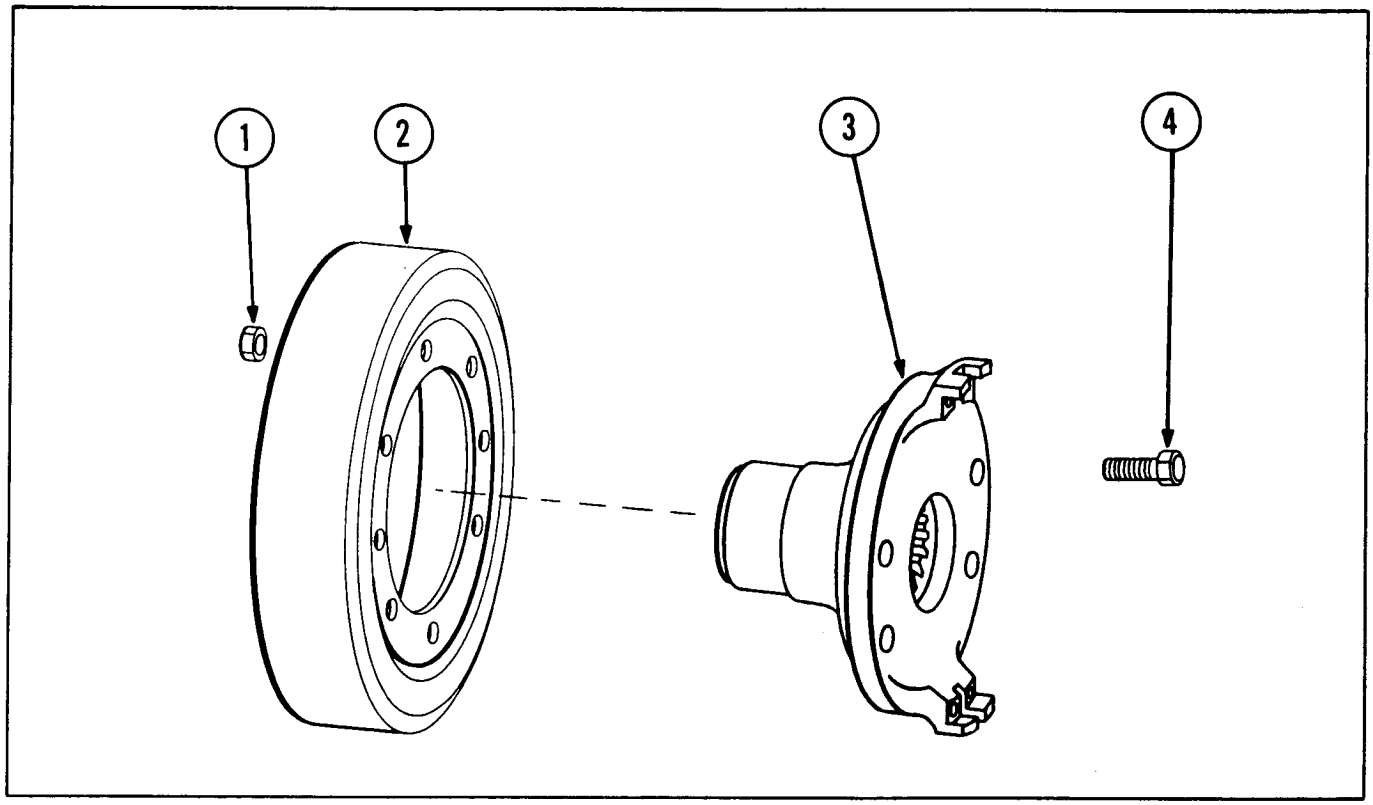

Figure 3-66
Parking Brake Drum.

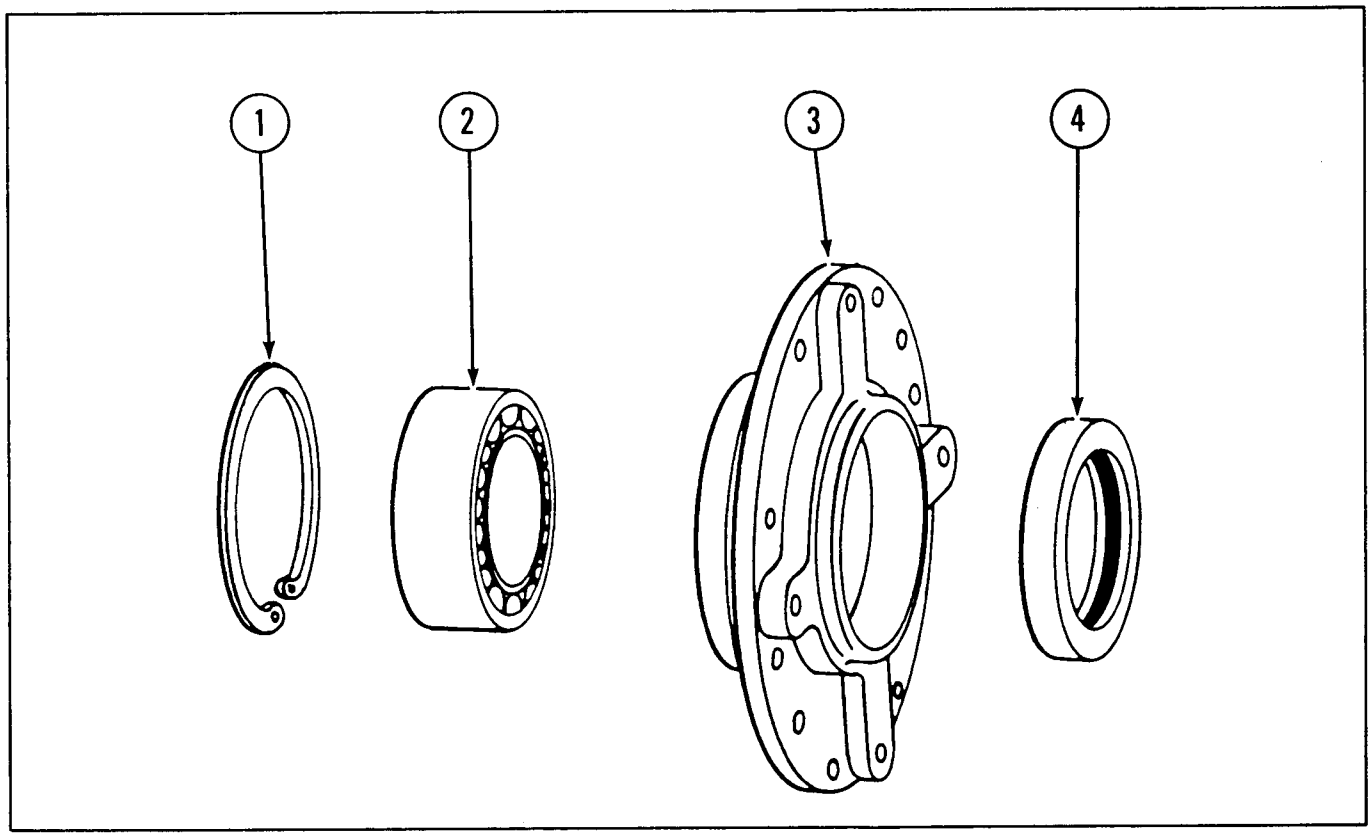

Figure 3-67
Parking Brake Mounting Cover.

2. PARKING BRAKE MOUNTING COVER AND/OR BEARING RETAINER

DISASSEMBLY

Using a suitable tool, remove seal (4) from mounting cover (3). Remove snap ring (1) (P-2000 & P-2002 units only). Place mounting cover in press with large diameter bore down. Using a steel plate with same outside diameter as bearing outer race, press bearing (2) from mounting cover.

CLEANING AND INSPECTION

Clean parts thoroughly in solvent and dry with compressed air.

NOTE: Do not spin bearing with air pressure.

Inspect bearing for excessive wear. Replace seal.

ASSEMBLY

Place mounting cover (3) in press with small bore down. Using a steel plate with the same outside diameter as the bearing outer race, press bearing (2) into mounting cover. Install snap ring (1) (P-2000 & P-2002 units only). Invert mounting cover. Coat the O. D. of the new seal (4) with Mar-Seal or equivalent sealant. Press seal into mounting cover with lip down toward bearing.

3. DIRECTIONAL SELECTOR VALVE

DISASSEMBLY

Remove detent plugs (6, 11) with annular gaskets (5, 12). Remove springs (4, 13) and balls (3, 14). Remove roll pin stop (15) from bottom of valve body (7). If pin does not come out freely, insert an "easy-out" and screw the pin out. This operation should be performed cautiously to prevent breaking off the "easy-out" in the pin.

Remove plunger (10) and seal (9). Remove expansion plug (1) only if damaged or leaking, and plug (8) for cleaning.

CLEANING AND INSPECTION

Clean all parts thoroughly in solvent. Dry with compressed air. Inspect plunger and valve body bore for scoring and/or excessive wear. Oil plunger liberally when assembling valve. Replace all seals and gaskets.

ASSEMBLY

Install expansion plug (1) plunger (10) and roll pin stop (15) in bottom of valve body (7). The pin should extend approximately 3/8 inch from valve body. Plunger should move freely in bore. Install balls (3, 14) springs (4, 13), annular gaskets (5, 12) with plugs (6, 11). Install plug (8) in valve body and tighten securely.

Pull plunger out until detent is in last land. Apply a liberal amount of grease to lips of seal (9). Coat O. D. of seal with Mar-Seal or equivalent. Start seal on plunger with lips toward valve body. Use a suitable driver to drive seal flush with body bore.

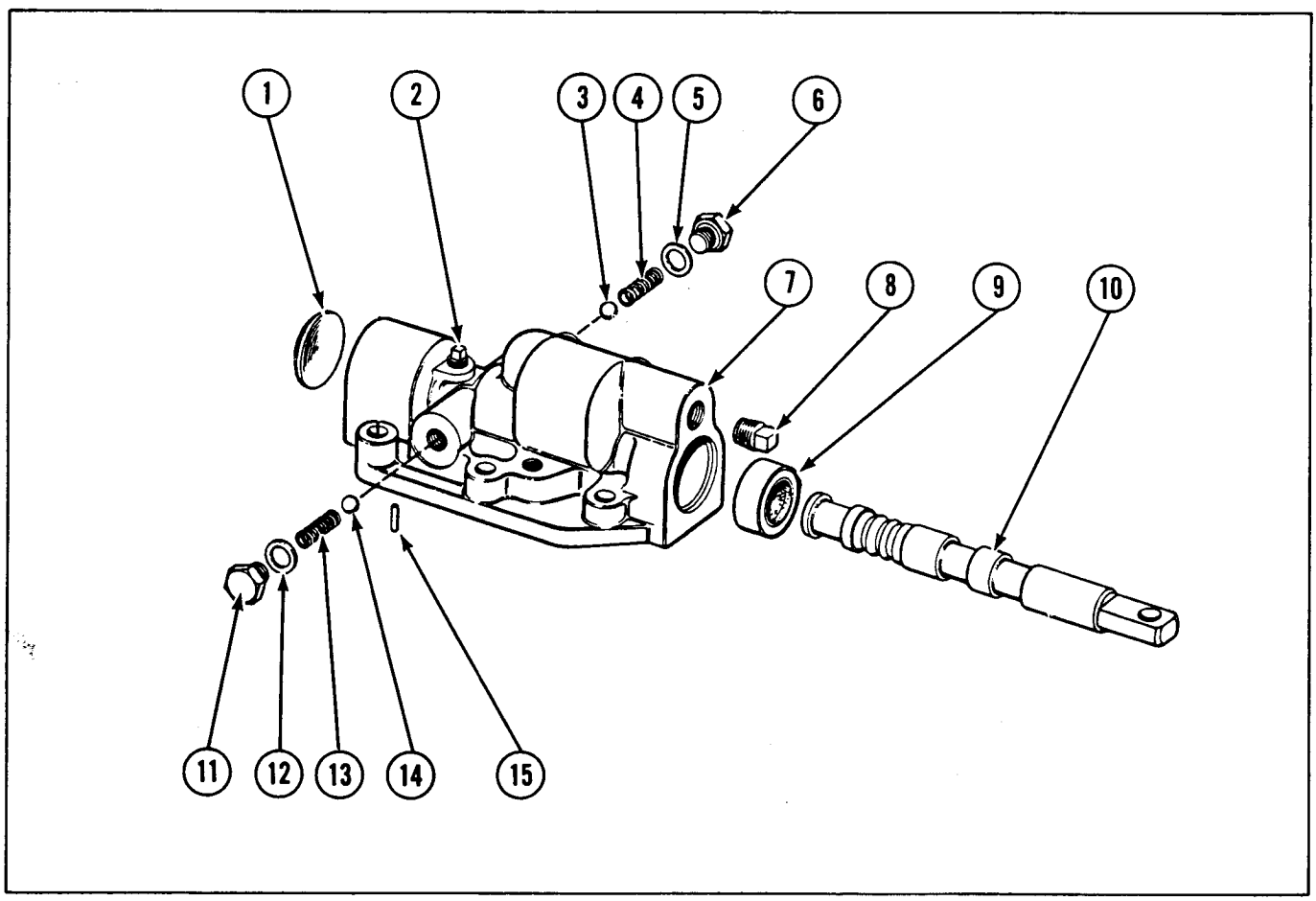

Figure 3-68
Directional Selector Valve.

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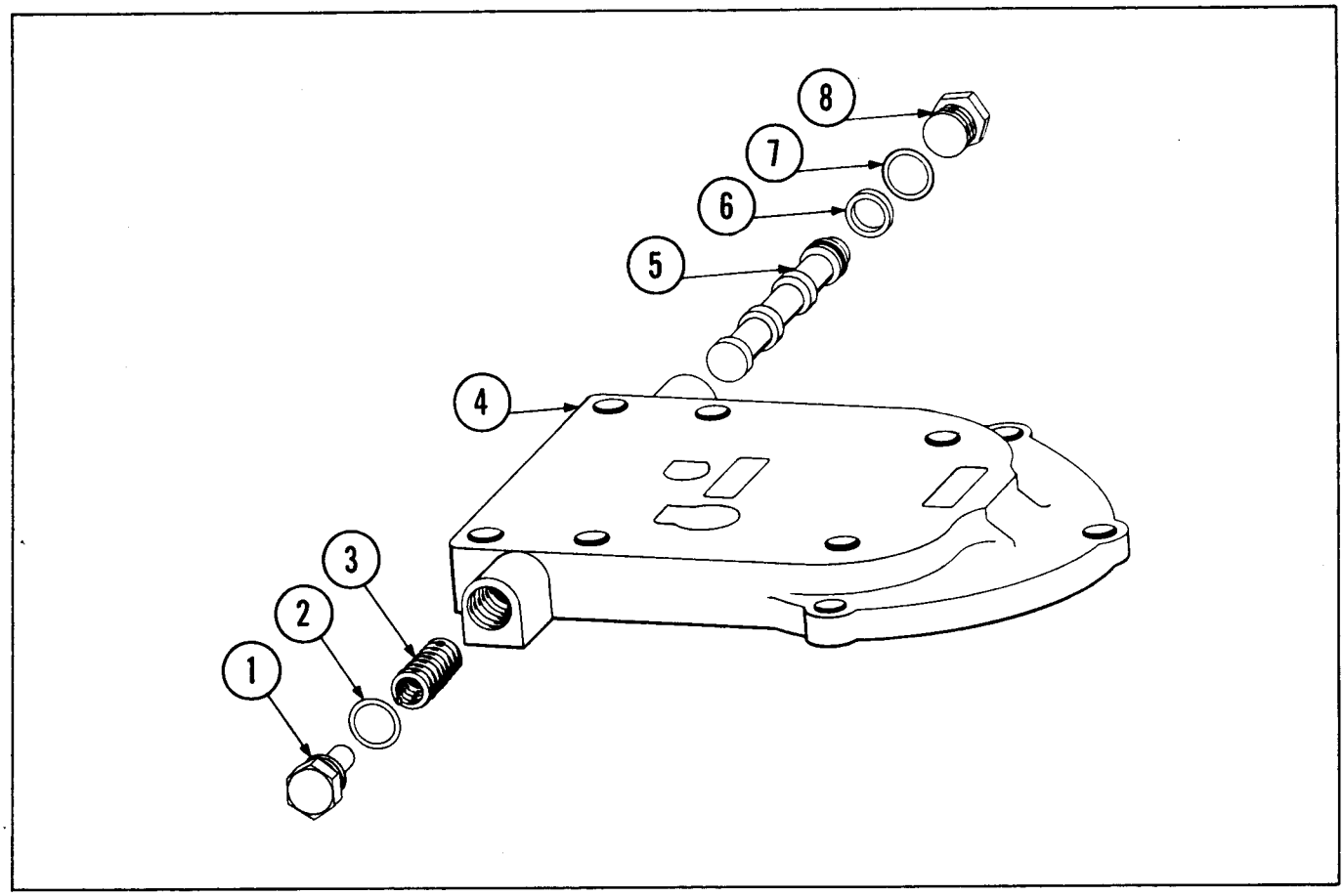

Figure 3-69
Neutral Knockdown Valve.

4. NEUTRAL KNOCKDOWN VALVE

DISASSEMBLY

Remove plug (8), annular gasket (7) and plunger (5). On opposite side of body (4), remove plug (1), annular gasket (2) and spring (3). Remove seal ring (6) from plunger.

CLEANING AND INSPECTION

Clean all parts thoroughly in solvent and dry with compressed air. Inspect plunger and body bore for scoring and excessive wear. Flush body passages with solvent and compressed air. Oil plunger liberally during assembly. Replace all gaskets and seals.

ASSEMBLY

Install spring (3), gasket (2) and plug (1). Tighten plug in body (4) and install seal ring (6) on plunger (5) with lip facing out or away from lands on plunger. Coat seal with grease and push plunger into bore. Install annular gasket (7) on plug (8) and tighten plug.

SUB-ASSEMBLY OVERHAUL

5. RANGE SELECTOR VALVE

DISASSEMBLY

Remove snap ring (17), lever (16), key (18), snap ring (19), seal ring (25) and screw (1) from selector valve cover plate assembly (2). Remove plate and press out needle bearing (24). Remove gasket (4), ball (22), spring (20), wiper (6), wiper seal (7), and spring (8). By gently tapping on end of shaft (21), remove valve (9) and shaft assembly. Remove "O" ring (14) thrust washer (12), thrust bearing (11) and thrust washer (10). Press shaft (21) from valve (9) if separation is required. Press dowel (5) from shaft. Remove needle bearing (13) and roll pins (3, 23) from cover (2) only if damaged.

NOTE: Care must be taken not to damage or scratch cover plate (2) or wiper sealing surface.

CLEANING AND INSPECTION

Wash all parts thoroughly in clean solvent and dry with compressed air. Inspect all parts for excessive wear, replace all gaskets, seal rings and "O" rings. Use clean transmission oil liberally during assembly.

ASSEMBLY

Press needle bearing (13) into selector valve cover (15). Press needle bearing (24) into cover plate (2) allowing bearing to extend .080" beyond plate.

NOTE: Press on flat, numbered side of bearing only.

Press roll pins (5, 6) into selector valve cover (15). Press dowel (5) into valve shaft (21). Press shaft into selector valve (9).

NOTE: Fluid passage port in shaft must face hole in long end of selector valve and dowel pin must be seated in groove in selector valve.

Assemble thrust washer (10), thrust bearing (11), thrust washer (12) and "O" ring seal (14) on valve shaft and install in selector valve cover (15).

NOTE: Coat "O" ring with a liberal amount of grease.

Install snap ring (19), key (18), lever (16) and snap ring (17). Coat seal ring (7) with grease and install on wiper (6). Place spring (8) and wiper (6) in valve (9). Install spring (20) and ball (22) in valve.

Center gasket (4) on valve cover (15) and install cover plate (4). Secure with screw (1). Install seal ring (25) on valve shaft.

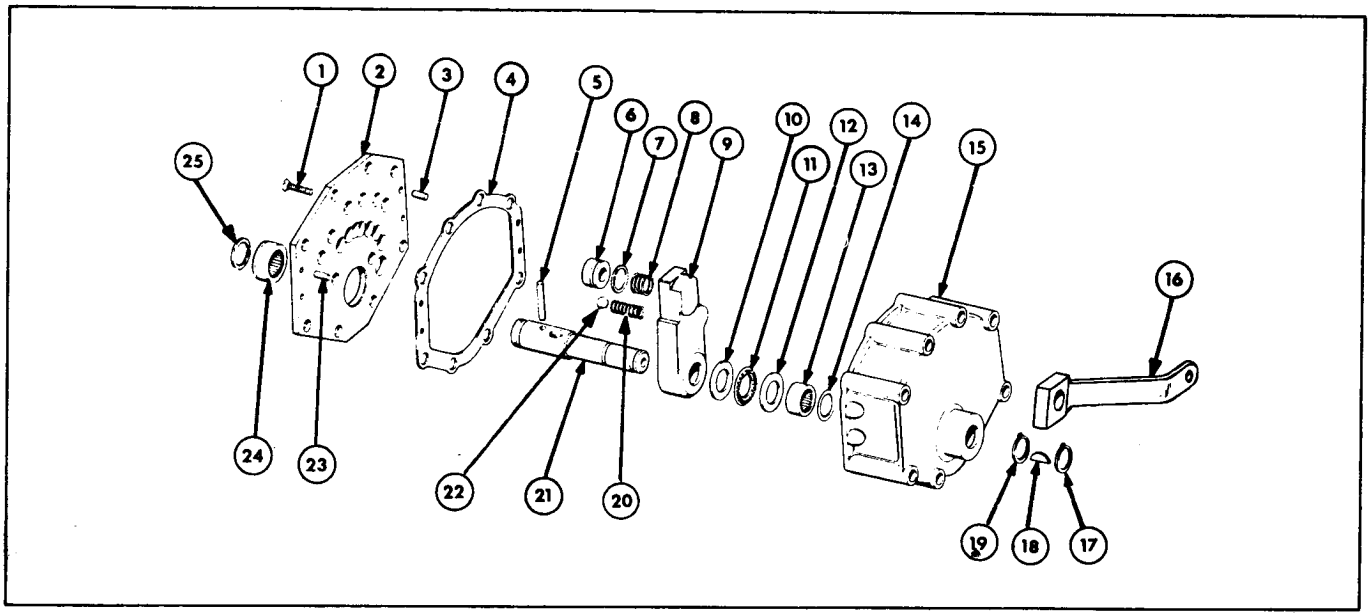

Figure 3-70
Range Selector Valve.

SUB-ASSEMBLY OVERHAUL

6. CLUTCHES - RANGE AND DIRECTIONAL

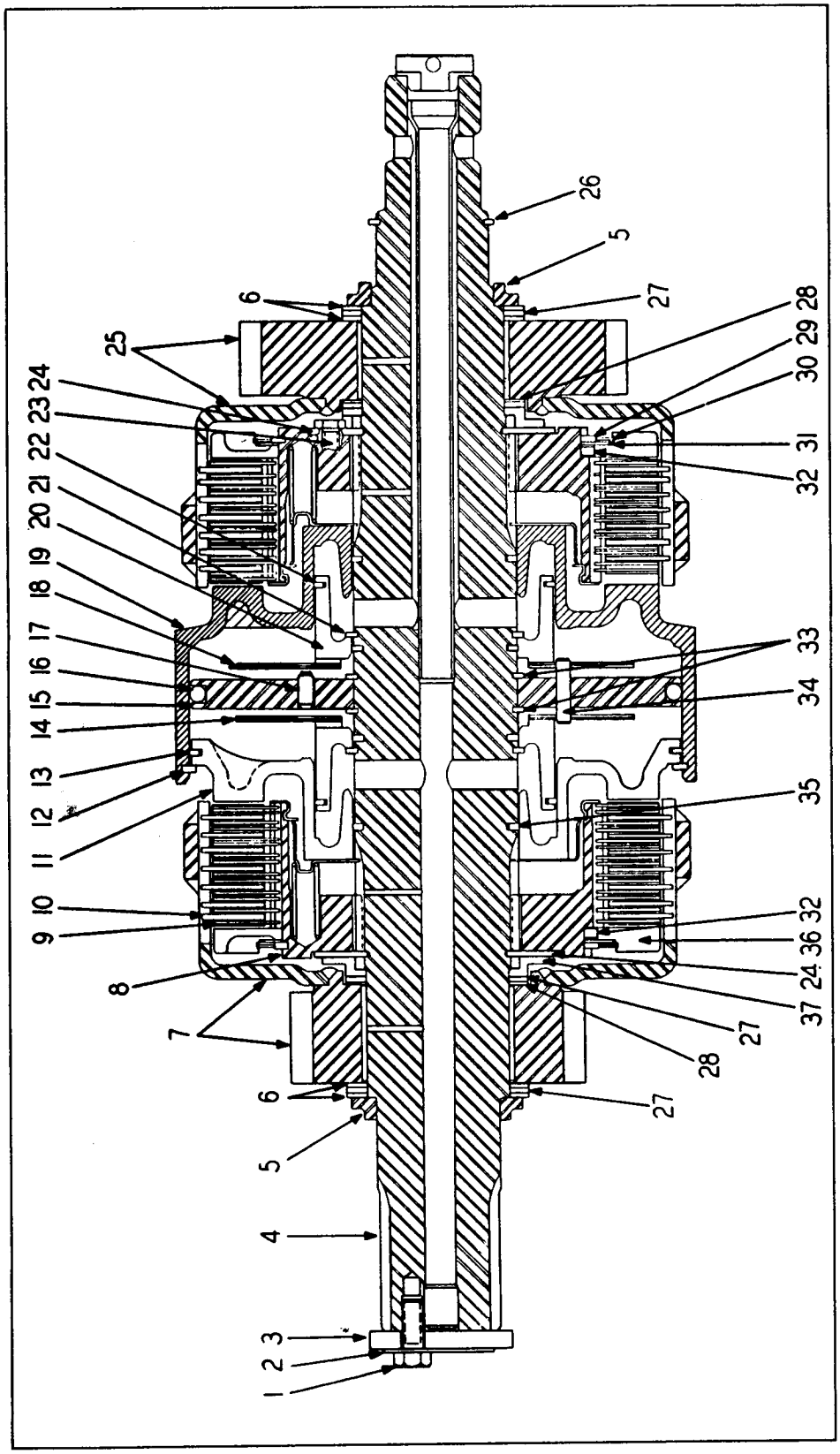

Figure 3-71
Directional Clutch Pack (Without Roller Bearings).

1. Cap screw.
2. Locking plate.
3. Retainer washer.
4. Clutch shaft.
5. Spacer-steel.
6. Spacer-steel.
7. Drive gear and cup assembly.
8. Clutch hub assembly.
9. Internal splined plate-bronze.
10. External splined plate-steel.
11. Clutch piston.
12. Snap ring.
13. Seal ring.
14. Disc valve.
15. Separator plate.
16. "O" ring.
17. Dowel pin.
18. Reinforcing disc.
19. Piston housing.
20. Accelerating piston.
21. External snap ring.
22. Seal ring.
23. Cap screw.
24. Retainer.
25. Drive cup and gear assembly.
26. External snap ring.
27. Thrust washer-bronze.
28. Roll pin.
29. External snap ring.
30. Internal snap ring.
31. Snap ring retainer.
32. Dowel pin.
33. Snap ring.
34. Dowel pin.
35. Seal ring.
36. Backing plate.
37. Spacer-steel.

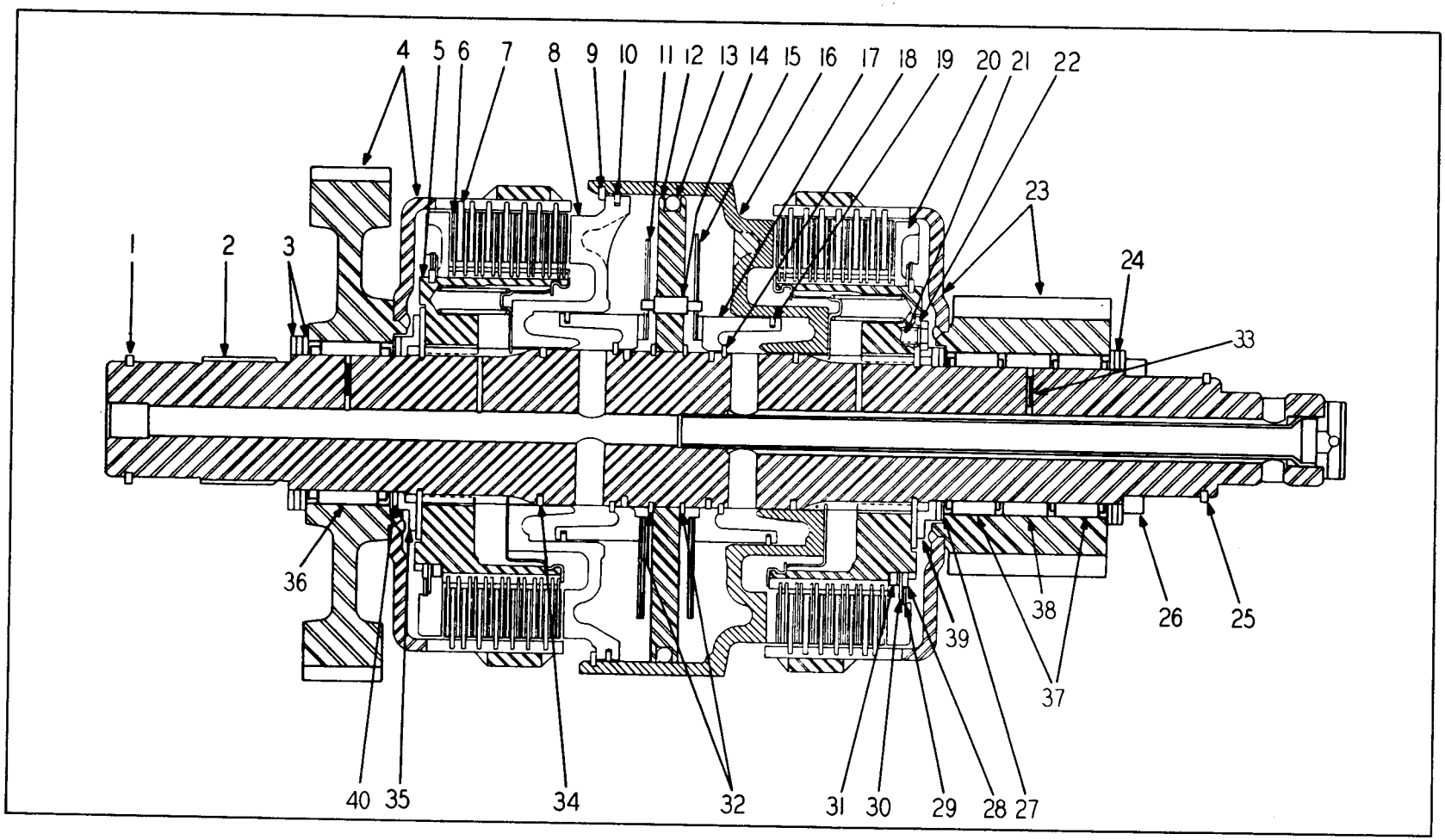

Figure 3-72
Range Clutch Pack (Roller Bearing Equipped).

1. External snap ring.
2. Clutch shaft.
3. Spacer-steel.
4. Drive gear and cup assembly.
5. Clutch hub assembly.
6. Internal splined plate-bronze.
7. External splined plate-steel.
8. Clutch piston.
9. Internal snap ring.
10. Disc valve.
11. Disc valve.
12. Separator plate.
13. "O" ring.
14. Dowel pin.
15. Reinforcing disc.
16. Piston housing.
17. Accelerating piston.
18. External snap ring.
19. Seal ring.
20. Backing plate.
21. Cap screw.
22. Retainer.
23. Drive cup and gear assembly.
24. Thrust washer-bronze.
25. Snap ring.
26. Spacer-steel.
27. Spacer-steel.
28. External snap ring.
29. Internal snap ring.
30. Snap ring retainer.
31. Dowel pin.
32. Snap ring.
33. Roll pin.
34. Seal ring.
35. Spacer-steel.
36. Bearing.
37. Bearing.
38. Spacer-steel.
39. Spacer-steel.
40. Thrust washer-bronze.

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6. CLUTCHES - RANGE AND DIRECTIONAL - Continued

DISASSEMBLY

Directional Clutches - Remove snap ring (1) from end of clutch shaft with oil supply ports. Using a hydraulic puller remove bearing inner race (2).

NOTE: Place a steel plate approximately 3" x 3" x 3/4" between puller and oil supply plug on end of shaft. Do not push directly on oil supply plug.

Remove inner bearing race from opposite end of clutch shaft.

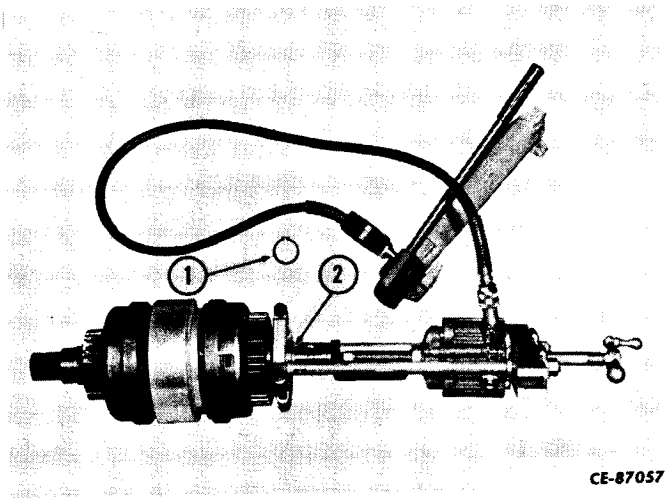

Figure 3-73

Range Clutches - Remove snap ring from input end of shaft. Using a hydraulic puller as shown, remove the input gear (1) and bearing inner race (2) together (see note above).

Remove snap ring from opposite end of shaft. Using a hydraulic puller as shown in Fig. 3-73 above, remove the bearing inner race.

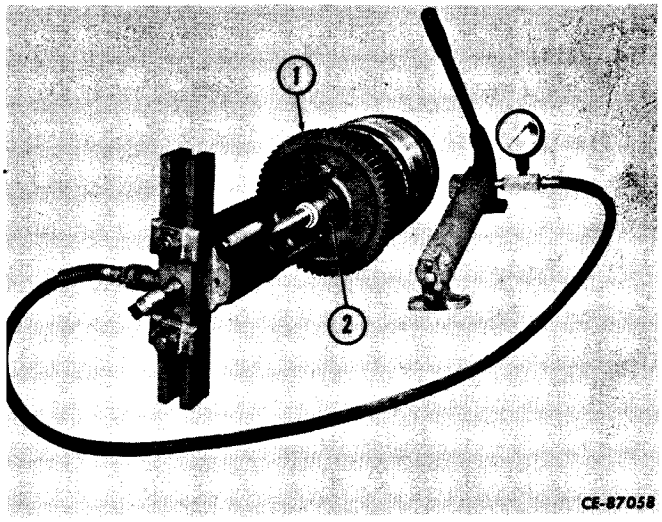

Figure 3-74

All Units - Remove spacer (8), spacer washer (7), bronze thrust washer (6) and spacer washer (5). Remove drive gear and cup assembly (4). Remove steel spacer washer (3), bronze thrust washer (2) and spacer (1).

NOTE: Do not attempt to separate drive gear and cup. They are serviced as an assembly only.

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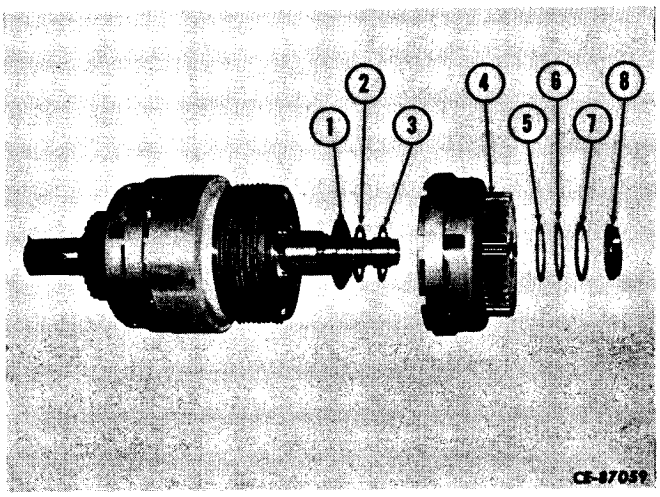

Figure 3-75

6. CLUTCHES - RANGE AND DIRECTIONAL - Continued

DISASSEMBLY – Continued

If unit is equipped with roller bearings (1, 2) bearings and spacer(s) (3) will separate from gear and cup assemblies as the assemblies are removed from the clutch shaft.

NOTE: Do not allow the bearings to fall on the bench.

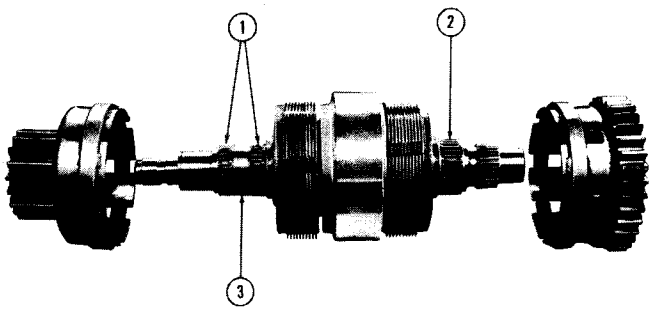

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Figure 3-76

Remove cap screws (2) that secure the clutch hub retainers (3). Remove retainers. Lift the hub and place assembly (4) from the shaft (1).

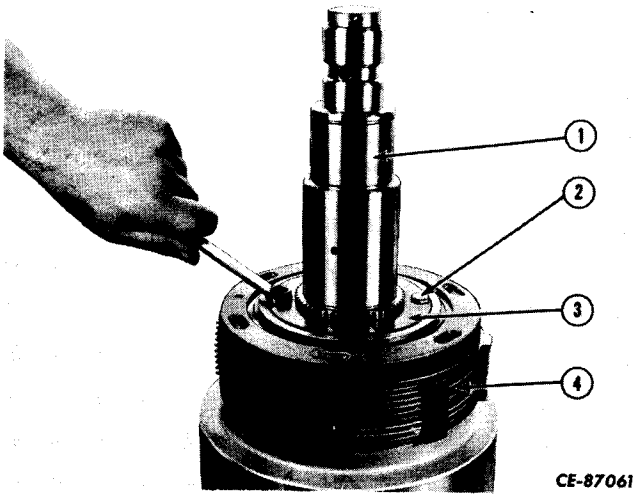

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Figure 3-77

Remove Spir-O-Lox retaining ring (1) from the hub and plate assembly (2).

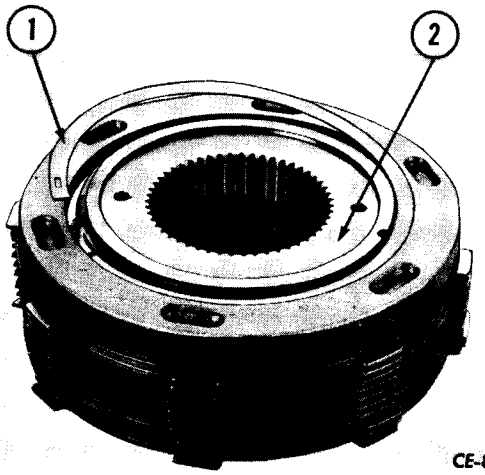

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Figure 3-78

Remove snap ring (1) from the hub and plate assembly.

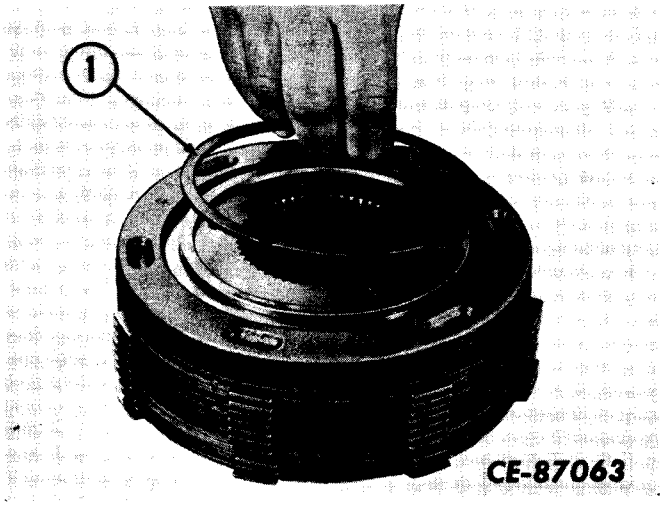

Figure 3-79

Remove snap ring retainer (1) and clutch backing plate (2) from hub and plate assembly. Remove dowel pin (3).

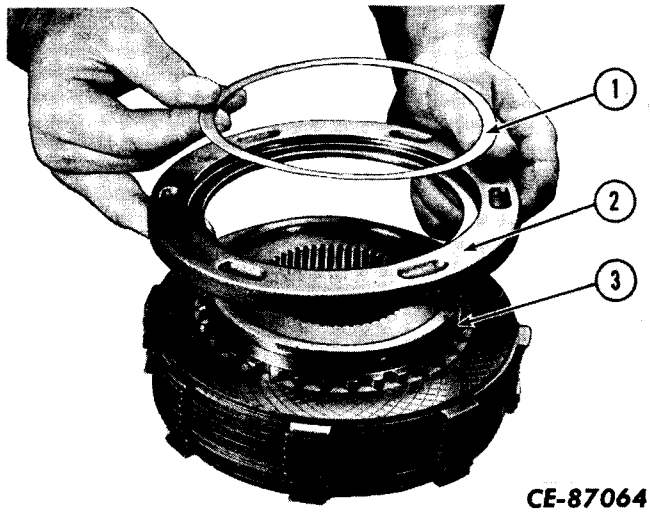

Figure 3-80

Clutch plates, bronze (1) and steel (2), may be lifted from the clutch hub assembly (3).

(Continued on next page)

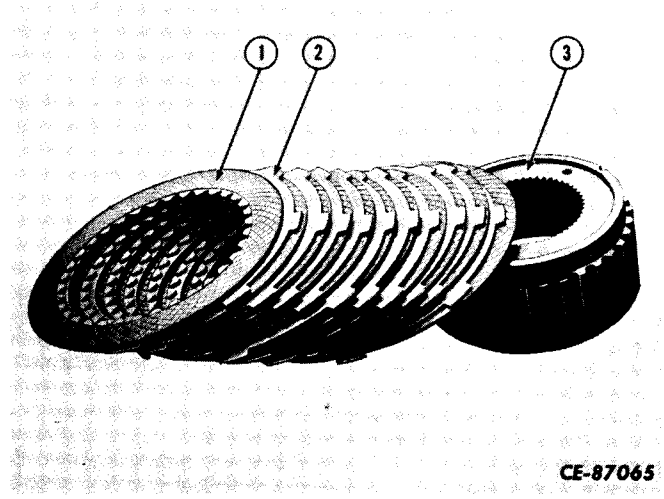

Figure 3-81

6. CLUTCHES - RANGE AND DIRECTIONAL - Continued

DISASSEMBLY – Continued

Using a plastic mallet, tap clutch piston (1) down making snap ring (2) accessible. Remove snap ring.

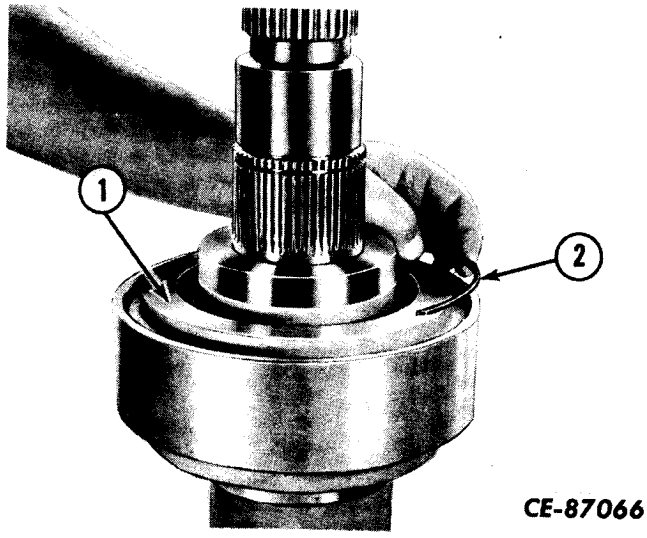

Figure 3-82

Install special snap ring groove filler (2) (refer to SECTION VI, SPECIAL TOOLS) with bevel edge down in piston housing (1) snap ring groove.

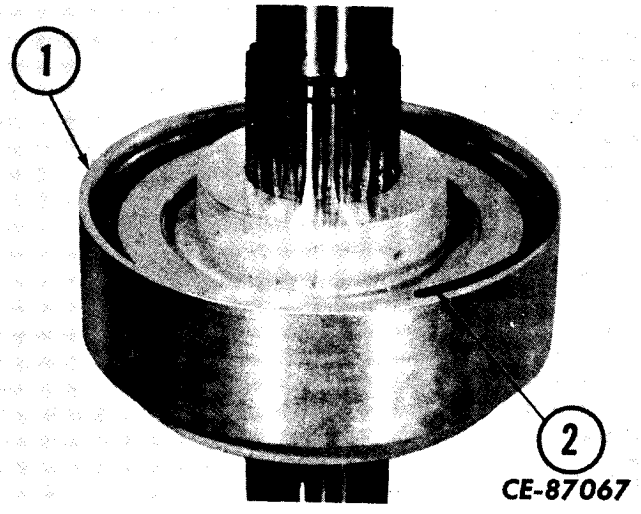

Figure 3-83

Using a plastic mallet, tap around outer edge of piston housing (1).

NOTE: Do not allow piston housing to fall on bench.

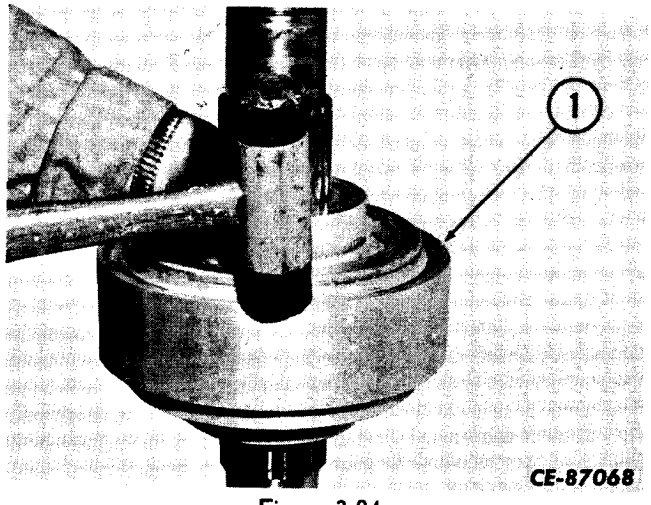

Figure 3-84

Remove clutch piston (1) and rectangular seal ring (2). Remove special tool.

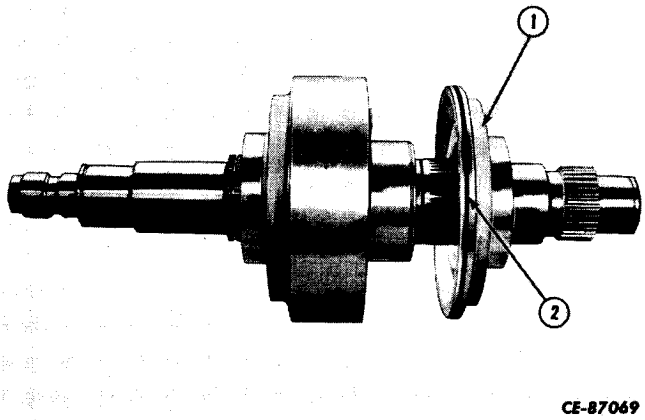

Figure 3-85

Remove piston housing (1) and "O" ring (2) from shaft.

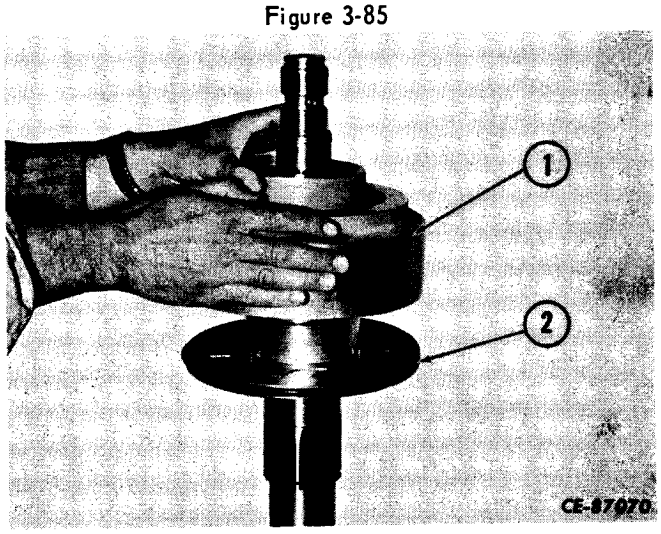

Figure 3-86

Remove the hook type seal rings (1) from the clutch shaft assembly.

(Continued on next page)

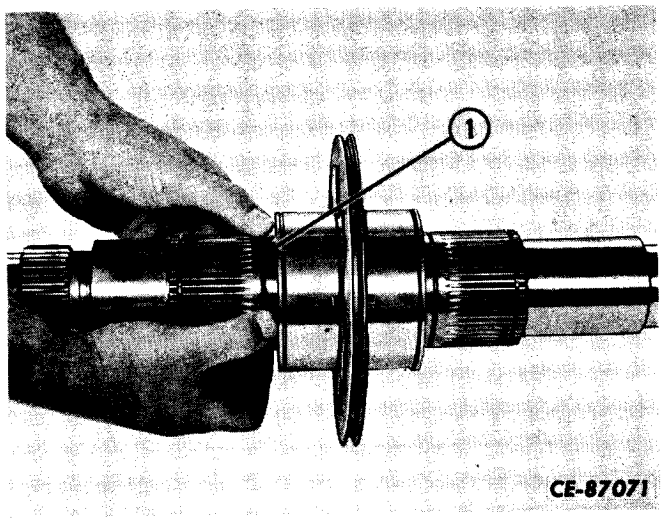

Figure 3-87

6. CLUTCHES - RANGE AND DIRECTIONAL - Continued

DISASSEMBLY – Continued

Remove the accelerating pistons retaining snap rings (3). Remove the accelerating pistons (1). Remove hook-type seal rings (2) from pistons.

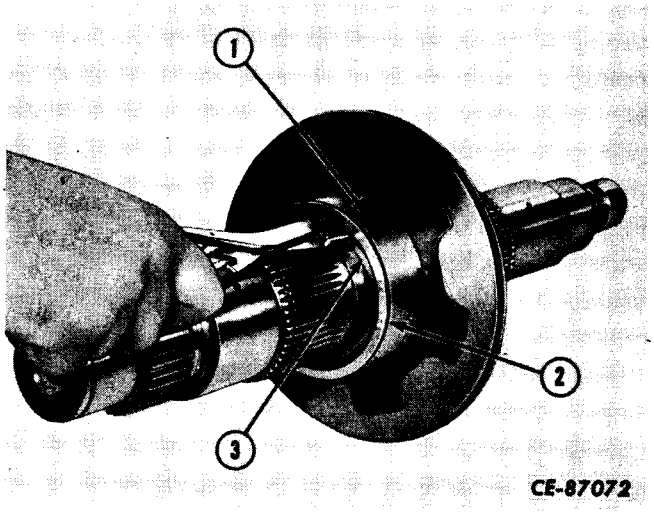

Figure 3-88

Remove disc valve (1), reinforcing disc (2), hook-type seal ring (3) and dowel pins (4).

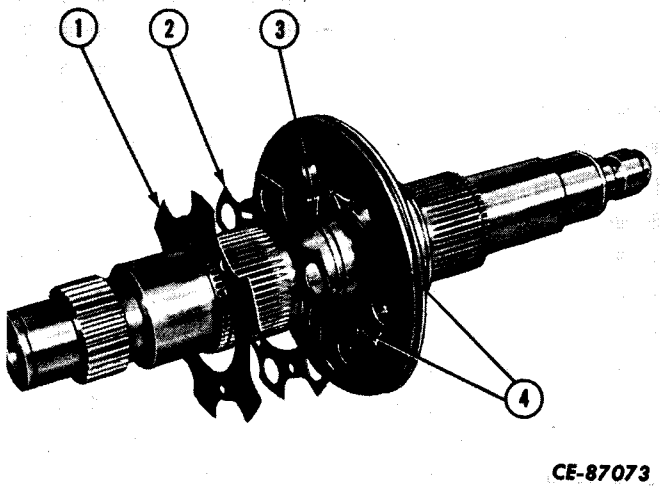

Figure 3-89

The following items are called-out for identification:

1. Reverse oil supply plug.
2. Reverse, oil supply port.
3. Forward oil supply port.
4. Lube oil holes.
5. Separator plate.
6. Separator plate locating snap ring.
7. Oil transfer holes.

NOTE: Shaft is serviced as an assembly only. If locating snap rings, shaft or separator plate are damaged, entire assembly must be replaced.

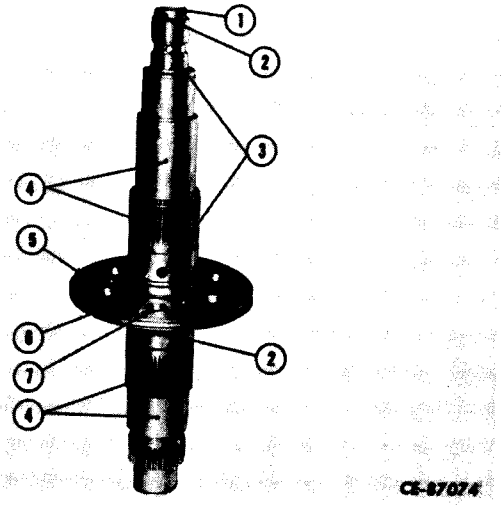

Figure 3-90

SUB-ASSEMBLY OVERHAUL

ASSEMBLY PREPARATION

Assembly preparation should include:

1. Cleaning all parts thoroughly in solvent. Use compressed air to dry parts. Carefully inspect, all parts for excessive wear, cracks and/or breakage. All bores must be perfectly clean.

2. Inspection of splines on all shafts and drive gears for excessive wear.

3. Inspection of all sealing surfaces for wear and/or grooving.

4. Inspection of bearing inner races and bushings for pits and spalled areas. Replace bearings and bushings that are pitted or spalled.

5. Inspection of sintered bronze and steel discs for wear, sings of burning and/or warping. Replace discs if any of these conditions exists.

6. Replacing all seals, hook-type seal rings, "O" rings and snap rings.

7. The use of a heavy non-fibrous grease with a low melting point during assembly.

NOTE: Drive gear and drive cup assembly bushing wear limits together with thrust washer wear limits are located in Section V.

NOTE: Special Torque recommendations are listed on a single page in Section V. This simplifies revision, when necessary. To eliminate constant referal, blank spaces are provided at points where special torques are required. These may be filled in by the manual holder, in pencil, and revised when necessary.

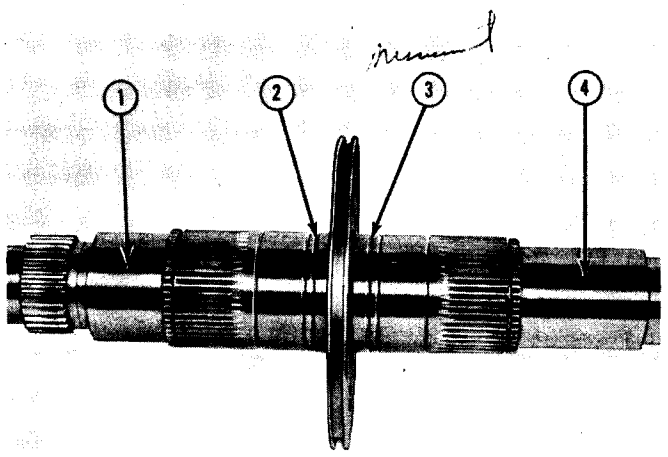

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Figure 3-91

ASSEMBLY

Place shaft horizontally on bench. Install new hook-type seal rings (2, 3) on inner shaft grooves.

NOTE: Use caution when installing hook-type seal rings to avoid breaking rings.

If unit is equipped with roller bearings, be sure roll pins (1, 4) are in place and bores are clean.

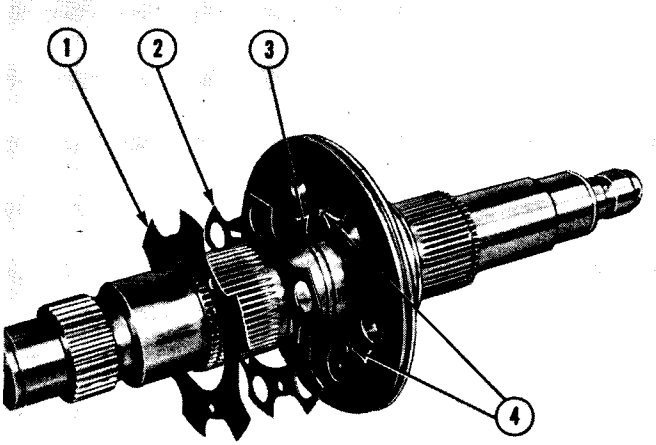
(Continued on next page)

6. CLUTCHES - RANGE AND DIRECTIONAL - Continued

ASSEMBLY – Continued

Install dowel pins (4) in separator plate. Install a reinforcing disc (2) on each side of the separator plate.

Install a disc valve (1) on each side of the separator plate. Align reinforcing discs and disc valves on dowel pins.



CE-87073

Figure 3-92

Install a hook-type seal ring (1) on each accelerating piston.

Install pistons on shaft.

NOTE: Use caution when installing pistons to prevent breaking hook-type seal rings on shaft. Lubricate seal rings and inner bore of accelerating pistons liberally with clean transmission fluid or grease before assembling.

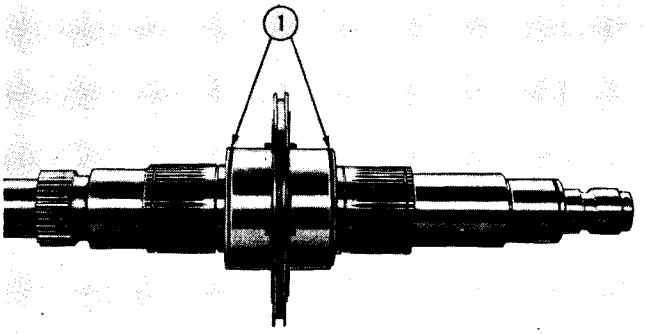


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Figure 3-93

Install the snap rings (3) that retain the accelerating pistons (1).

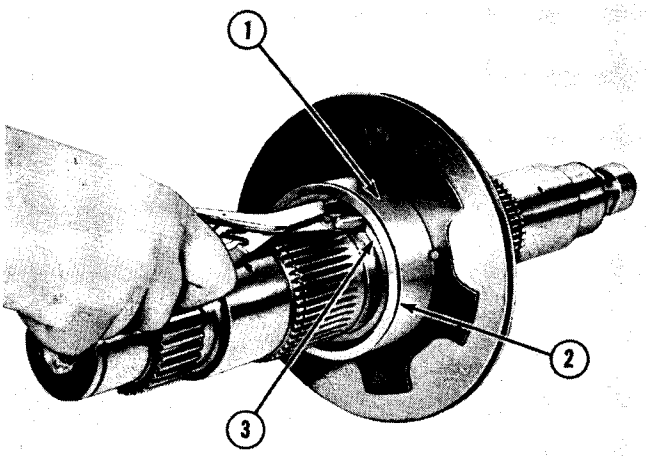

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Figure 3-94

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SUB-ASSEMBLY OVERHAUL

Place shaft in vertical position with reverse oil supply plug down. Install new hook-type seal ring (1) in groove on shaft.

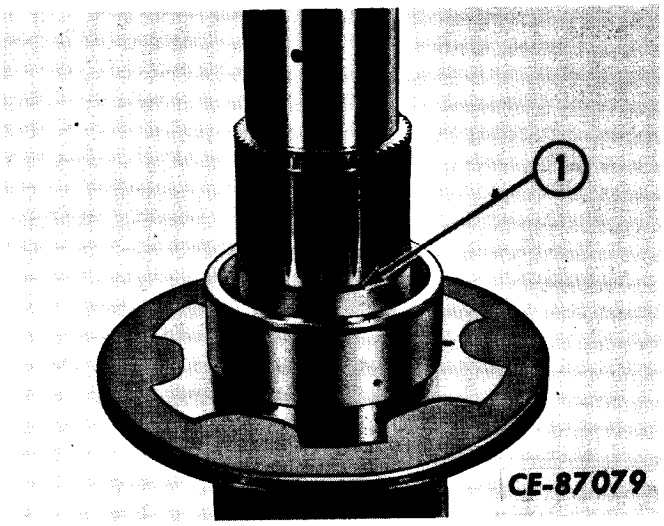


Figure 3-95

Install new rectangular seal ring (1) on clutch piston outer diameter. Coat seal ring on shaft and accelerating piston and inner bore of clutch piston with grease or clean transmission fluid. Install clutch piston (2) on shaft assembly being careful not to damage hook-type seal rings.

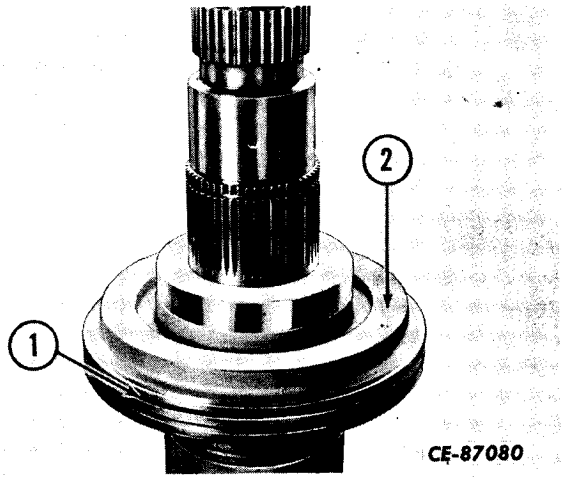


Figure 3-96

Invert shaft. Install new hook-type seal ring (2) in groove on shaft. Install new "O" ring (1) on outer diameter of separator plate. Coat both seals with heavy grease. Coat rectangular seal (3) on clutch piston with grease.

(Continued on next page)

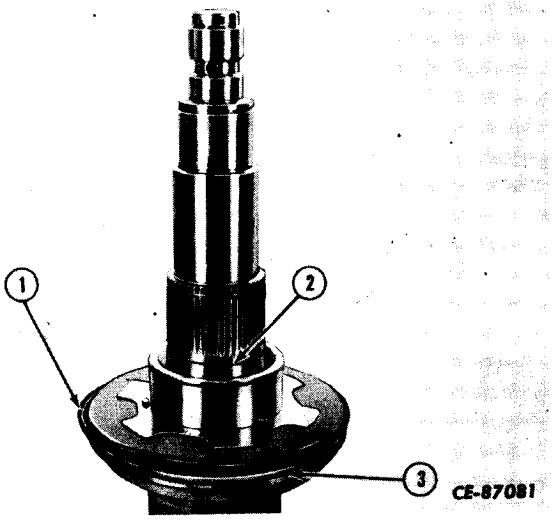


Figure 3-97

SUB-ASSEMBLY OVERHAUL

6. CLUTCHES - RANGE AND DIRECTIONAL - Continued

ASSEMBLY – Continued

Install special snap ring groove filler, (refer to Section VI) bevel edge up in groove of piston housing. Lubricate groove area and mouth of piston housing with heavy grease.

Install piston housing (1) on shaft assembly.

NOTE: The "O" ring (3) is larger in diameter than the separator plate. This design allows the inside diameter of the piston housing (1) to compress the seal ring to the proper fit.

Carefully "feed in" the "O" ring seal (3) while applying pressure to the piston housing (1). Push piston housing over "O" ring seal and clutch piston (2).

NOTE: Care must be taken during assembly to prevent cutting or otherwise damaging seal rings.

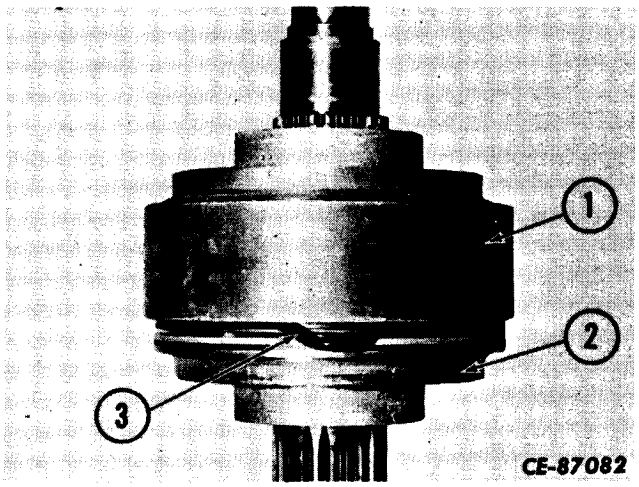


Figure 3-98

Invert the shaft assembly. Depress the clutch piston (1) into the piston housing. Remove the special snap ring groove filler. Install the snap ring (2).

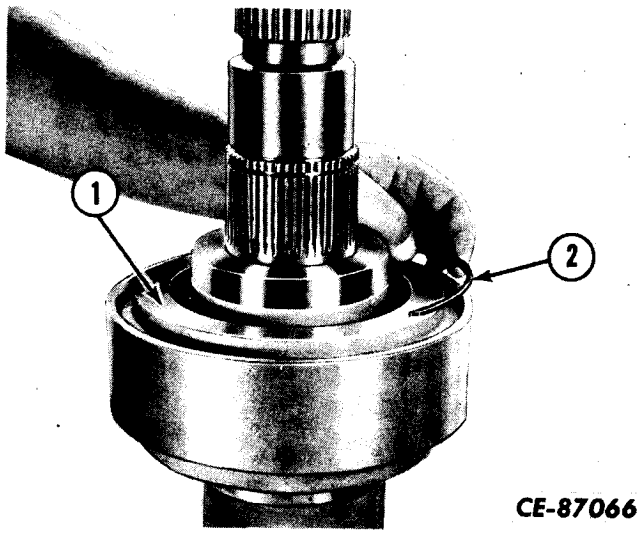


Figure 3-99

SUB-ASSEMBLY OVERHAUL

Apply air pressure to oil port holes to check operation of clutches. The clutch piston/piston housing assembly should move freely.

NOTE: DO NOT exceed 100 psi air pressure.

NOTE: The next five steps apply to both sides of clutch pack.

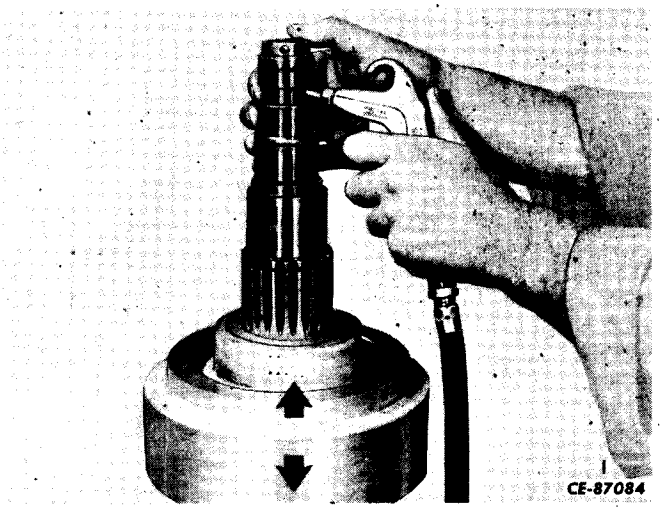


Figure 3-100

Install hub assembly (2) and hub retainers (1). Tighten the retaining cap screws (3) to the recommended torque (refer to "SPECIAL TORQUES").

Torque: 17-20

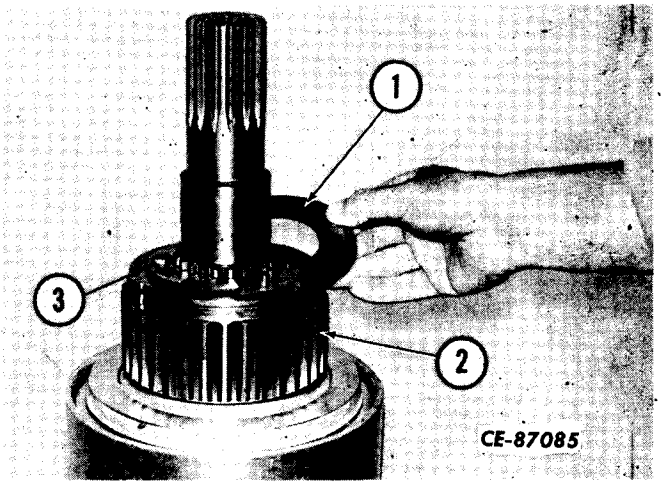


Figure 3-101

Install spacer (3), locking retainer bolts (4). Coat lightly with heavy grease and install bronze thrust washer (2) and thin spacer washer (1).

(Continued on next page)

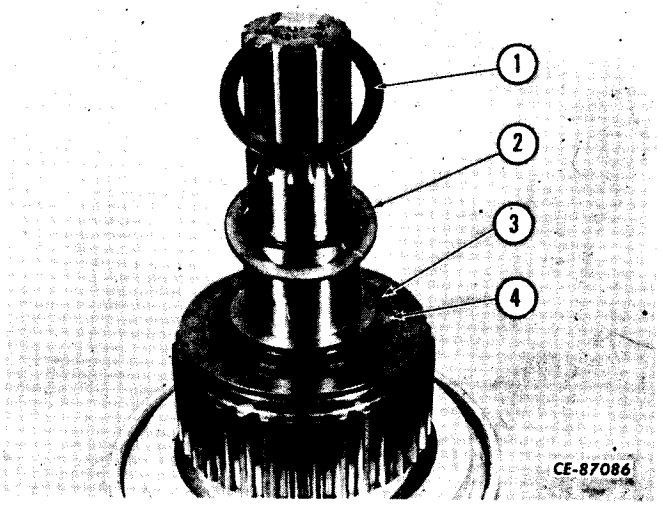


Figure 3-102

SUB-ASSEMBLY OVERHAUL

6. CLUTCHES - RANGE AND DIRECTIONAL - Continued

ASSEMBLY – Continued

Install the correct number of steel and bronze plates (3) (refer to SECTION V, SERVICE INFORMATION). Install the clutch backing plate (2) and dowel pin (1).

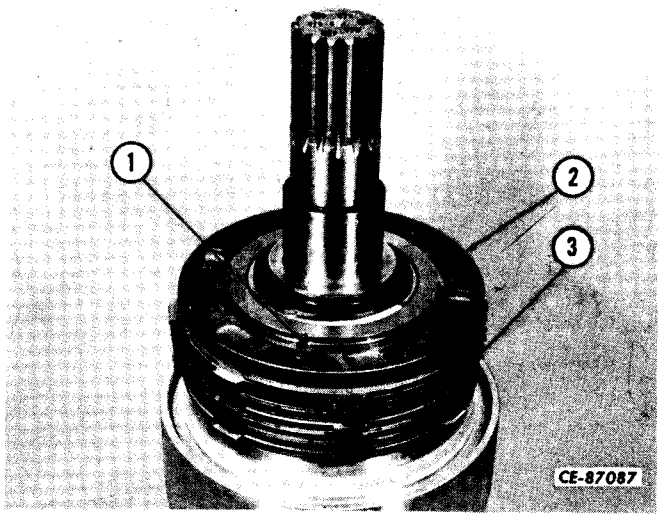


Figure 3-103

Install snap ring retainer (1) and external snap ring (3) in hub recess (2).

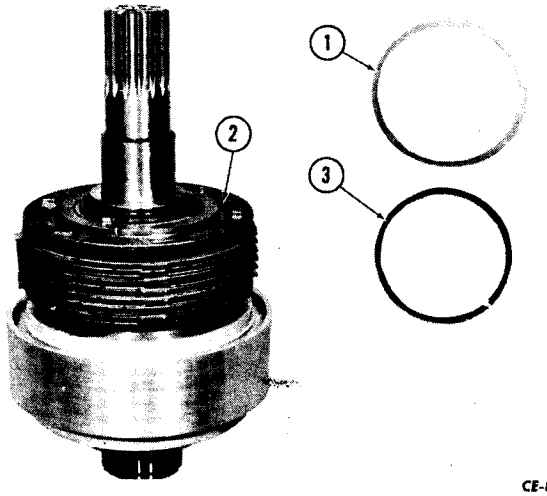


Figure 3-104

Install Spir-O-Lox retaining ring (1) in backing plate (3). This locks in the external snap ring (2).

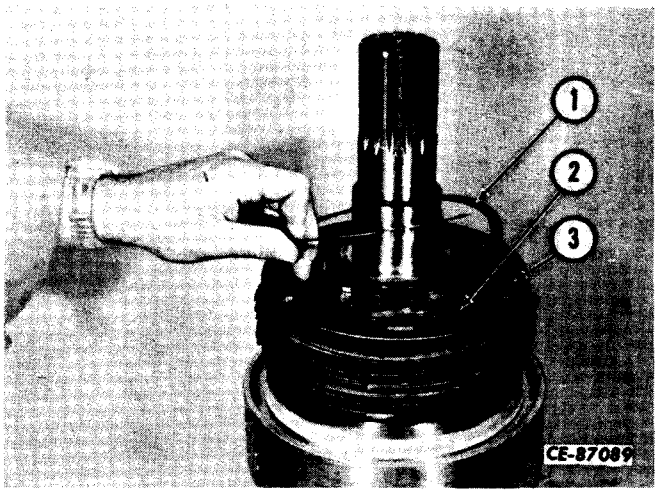


Figure 3-105

SUB-ASSEMBLY OVERHAUL

Directional Clutch - (without roller bearings)

Position clutch pack with splined end up. Install drive gear and cup assembly (4) (small diameter, wide gear) after coating bushing surface of drive gear with heavy grease. Install spacer washer (3), bronze thrust washer (2) and spacer washer (1). Install spacer (6) with large diameter shoulder toward thrust washer. Install heated bearing inner race (5).

NOTE: Heat bearing inner race to 350° for at least 45 minutes in oil or an oven.

Invert the clutch pack and repeat the above process for the opposite end.

Install retaining snap ring on clutch shaft at outer end of inner bearing race.

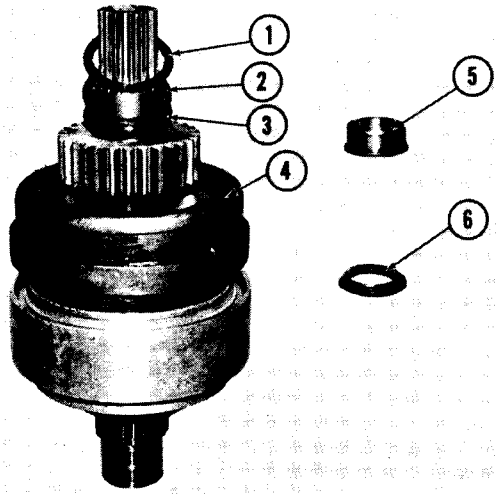


Figure 3-106

Directional Clutch - (with roller bearings)

Install spacer (3), roller bearing (2) and spacer (1) on splined end of clutch shaft. Cover rollers with a coat of heavy grease.

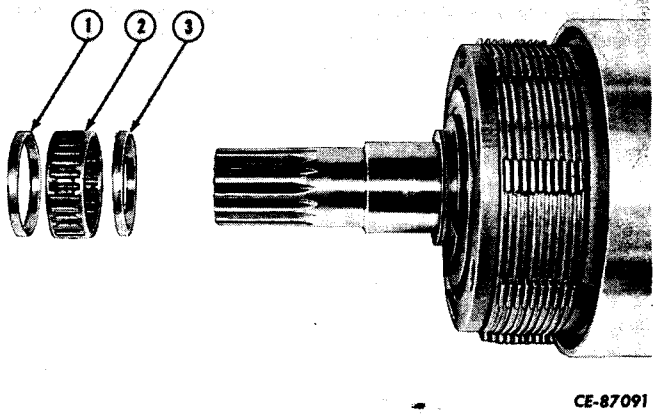


Figure 3-107

Install drive gear and cup assembly (4) (small diameter, wide gear). Install spacer washer (3), bronze thrust washer (2) and spacer washer (1). Install wide spacer (6) with large diameter shoulder toward spacer washer (1). Install heated bearing inner race (5).

NOTE: Bearing inner race must be heated to 350°F. for at least 45 minutes in oil or an oven prior to installing.

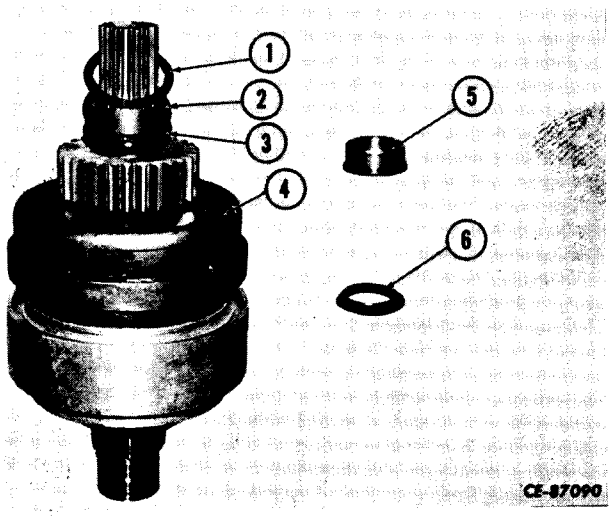


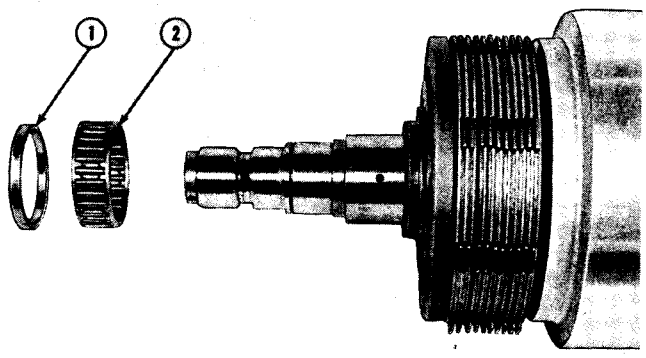
Figure 3-108

SUB-ASSEMBLY OVERHAUL

6. CLUTCHES - RANGE AND DIRECTIONAL - Continued

ASSEMBLY – Continued

Install roller bearing (2) and spacer (1) on oil supply port end of shaft. Cover rollers with a coat of heavy grease.

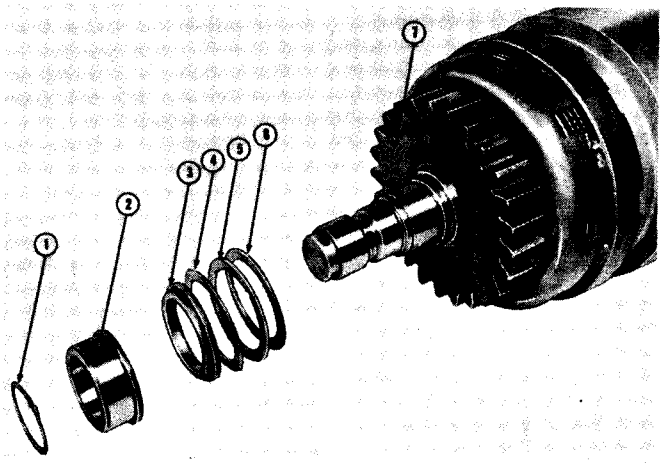


CE-87093

Figure 3-109

Install drive gear and cup assembly (7) (large diameter, narrow gear). Install spacer washer (6), bronze thrust washer (5) and spacer washer (4). Install spacer (3) with large diameter shoulder toward spacer washer (4). Install heated bearing inner race (2).

Install retaining snap ring (1).



CE-87094

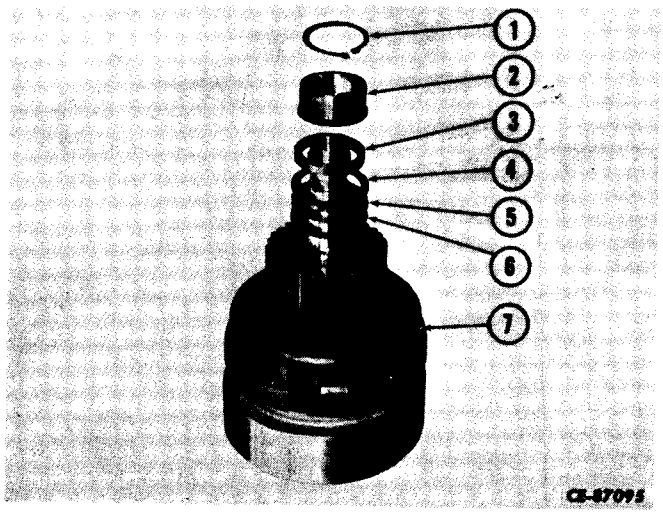
Figure 3-110

Range Clutch - (without roller bearings)

Position clutch pack with oil supply ports up. Lubricate drive gear bushing with a coat of heavy grease. Install drive gear and cup assembly (7). Install spacer washer (6), bronze thrust washer (5) and spacer washer (4). Install wide spacer (3). Install heated bearing inner race (2).

NOTE: Bearing inner race must be heated to 350°F. for at least 45 minutes in oil or an oven prior to installing.

Install snap ring (1) in groove.



CE-87095

Figure 3-111

SUB-ASSEMBLY OVERHAUL

Invert the clutch pack. Lubricate drive gear bushing with a coat of heavy grease. Install drive gear and cup assembly (4) (large diameter, narrow gear). Install spacer washer (3), bronze thrust washer (2) and spacer washer (1).

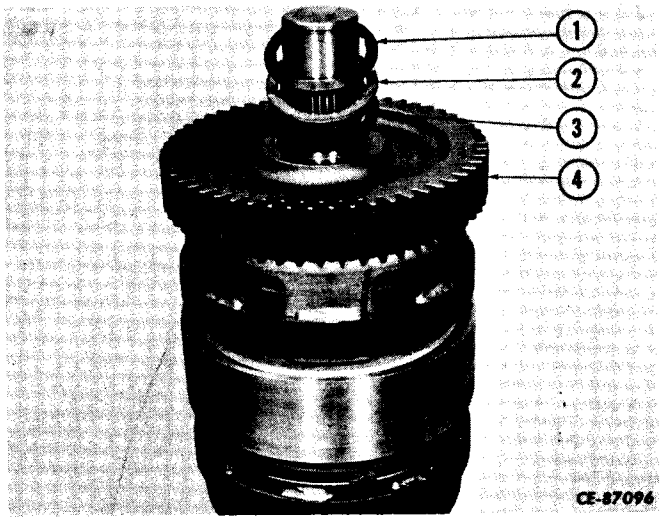


Figure 3-112

Install input gear (4), long boss (3) out, and heated bearing inner race (2) with large diameter shoulder toward gear.

Install snap ring (1) in groove.

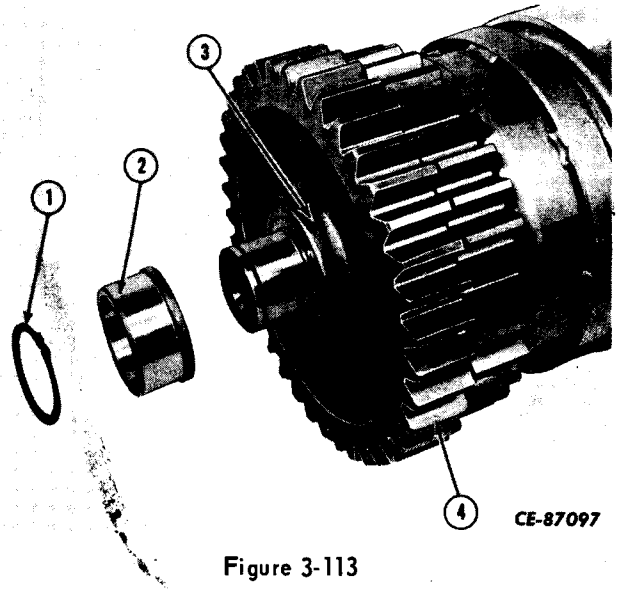


Figure 3-113

Range Clutch - (with roller bearings)

Install roller bearing (3), spacer (2) and roller bearing (1) on oil supply port end of clutch shaft. Cover rollers with a coat of heavy grease.

(Continued on next page)

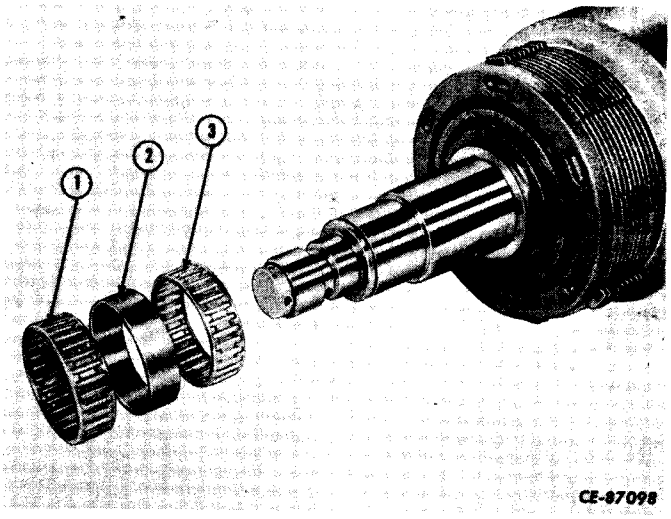


Figure 3-114

SUB-ASSEMBLY OVERHAUL

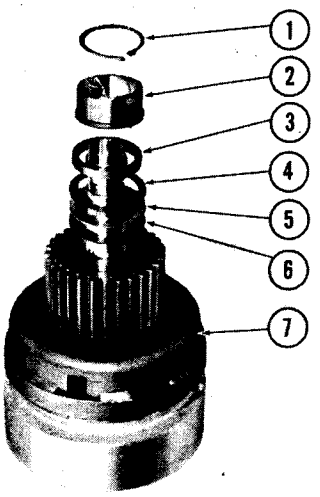
6. CLUTCHES - RANGE AND DIRECTIONAL - Continued

ASSEMBLY – Continued

Install drive gear and cup assembly (7) (small diameter, wide gear). Install spacer washer (6), bronze thrust washer (5) and spacer washer (4). Install spacer (3) with large diameter shoulder toward spacer washer (4), Install heated bearing inner race (2).

NOTE: Heat bearing inner race to 350°F. for at least 45 minutes in oil or an oven.

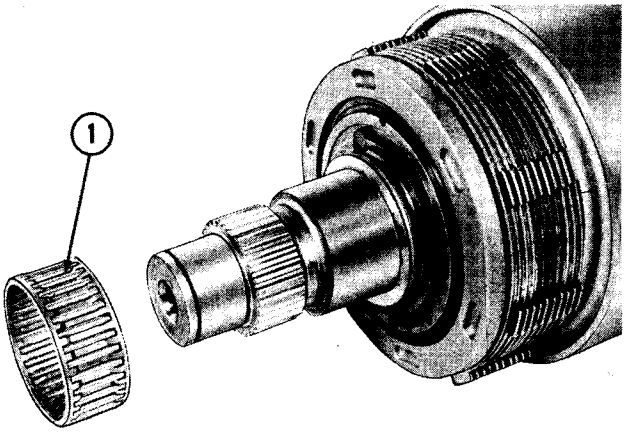
Install snap ring (1) in groove.



CE-87095

Figure 3-115

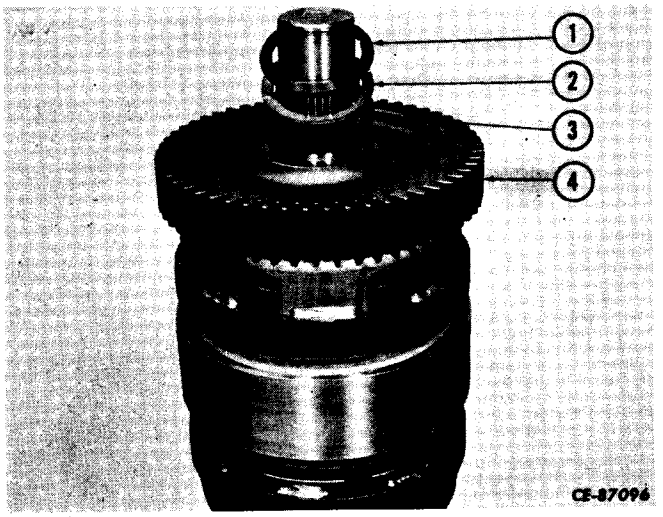
Install roller bearing (1) on splined end of clutch shaft. Cover rollers with a coat of heavy grease.



CE-87100

Figure 3-116

Install drive gear and cup assembly (4) (large diameter, narrow gear). Inspall spacer washer (3), bronze thrust washer (2) and spacer washer (1).



CE-87096

Figure 3-117

Install input gear (4), long boss (3) out. Install heated bearing inner race (2).

NOTE: Heat bearing inner race to 350°F. for at least 45 minutes in oil or an oven.

Install snap ring (1).

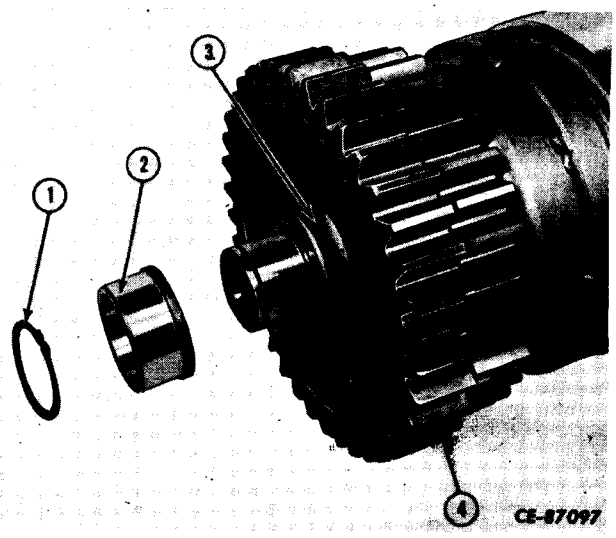


Figure 3-118

7. REVERSE IDLER SHAFT

DISASSEMBLY

Using a suitable hydraulic puller and adapter, remove bearing inner race (1). Remove snap rings (2, 8) and reverse transfer driven gear (3). Using the proper puller adapter, remove

(Continued on next page)

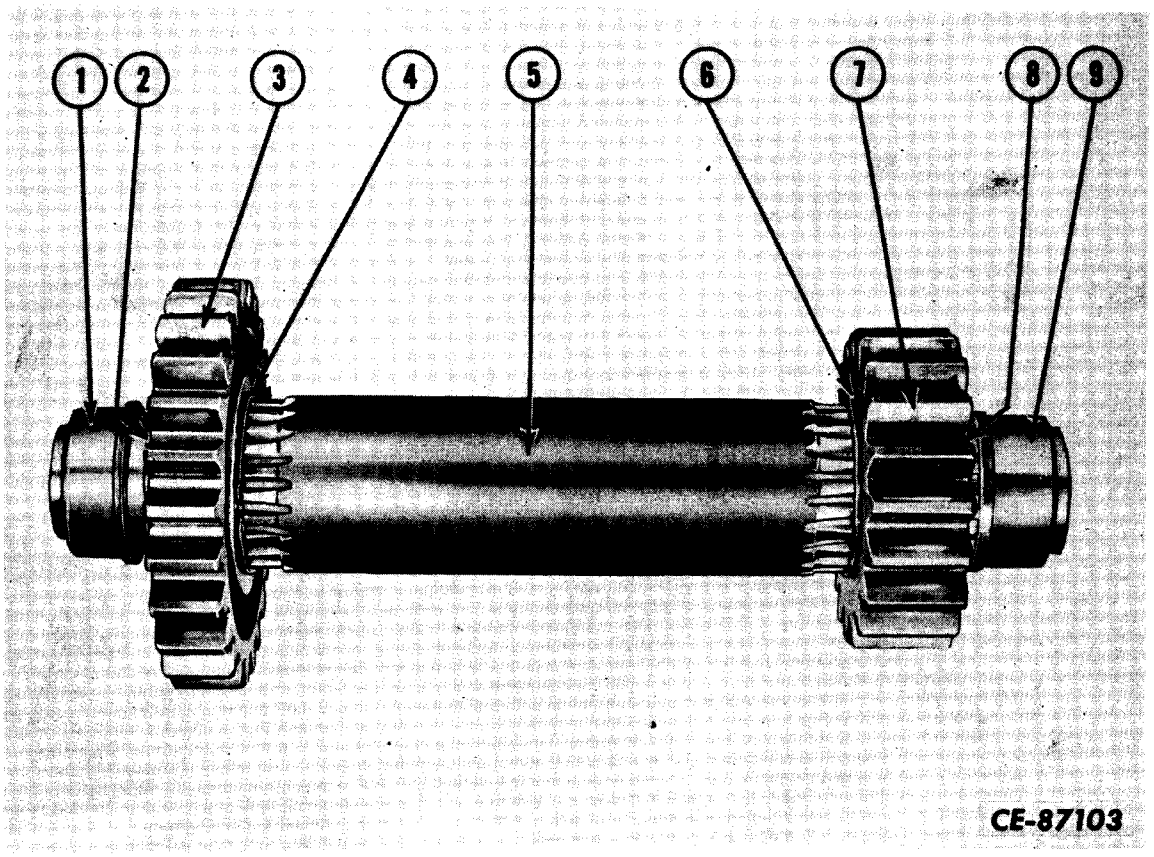


Figure 3-119
Reverse Idler Shaft.

7. REVERSE IDLER SHAFT - Continued

DISASSEMBLY – Continued

reverse transfer drive gear (7) and bearing inner race (9) together. Remove snap rings (4, 6) from shaft (5).

ASSEMBLY

NOTE: Prior to assembly, heat bearing inner races to 350°F. for 45 minutes in oil or an oven.

Install snap rings (4, 6) on shaft (5). Install reverse transfer driven gear (3), snap ring (2) and heated (smaller diameter) bearing inner race (1) with shoulder toward the gear.

Install reverse transfer drive gear (7), snap ring (8) and heated (larger diameter) bearing inner race (9) with shoulder toward the gear.

NOTE: Be sure bearing inner races are properly seated.

8. GATHER SHAFT - EARLY TYPE

DISASSEMBLY

Using a suitable hydraulic puller and adapter, remove bearing inner race (1). Remove snap ring (2) and transmission output high gear (3). Remove snap ring (8). Using the proper puller adapter, remove output idler and transfer gear (7) and inner bearing race (9) together. Remove snap rings (4, 6) from shaft (5).

ASSEMBLY

NOTE: Prior to assembly, heat bearing inner races to 350°F. for 45 minutes in oil or an oven.

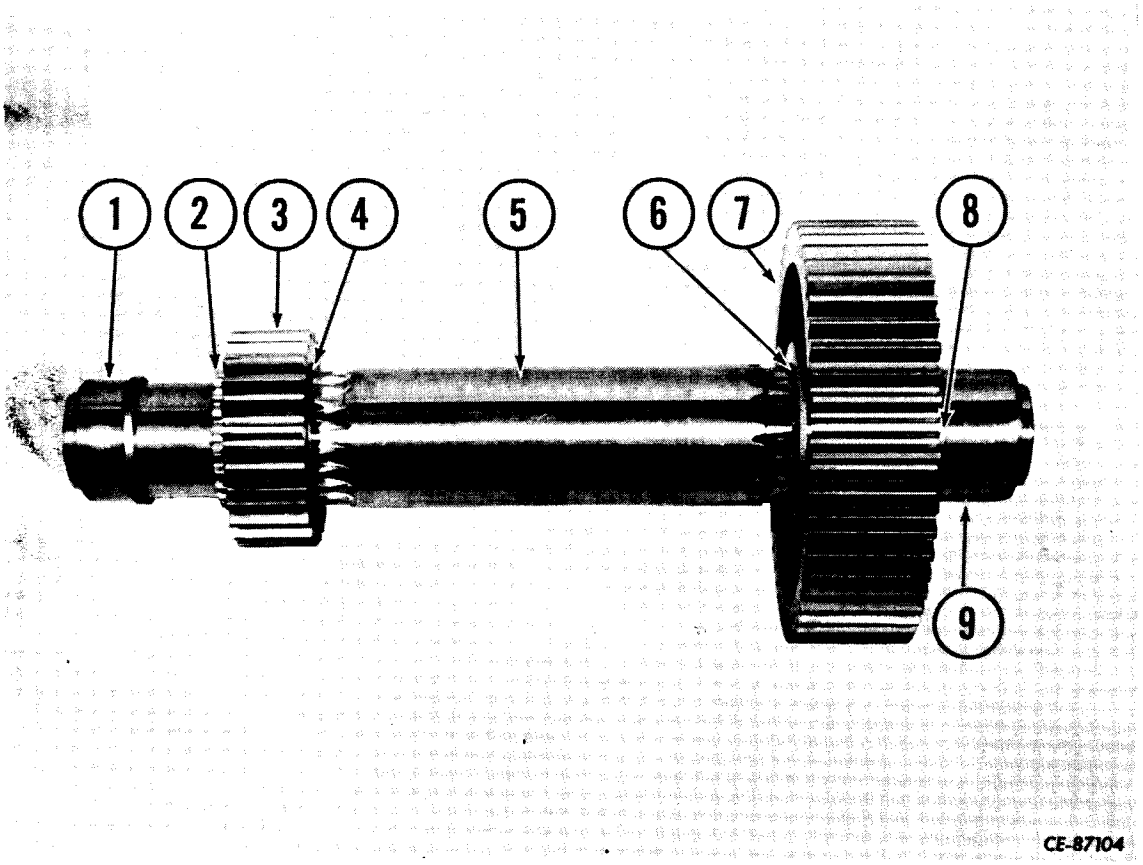


Figure 3-121
Gather Shaft – Early Type.

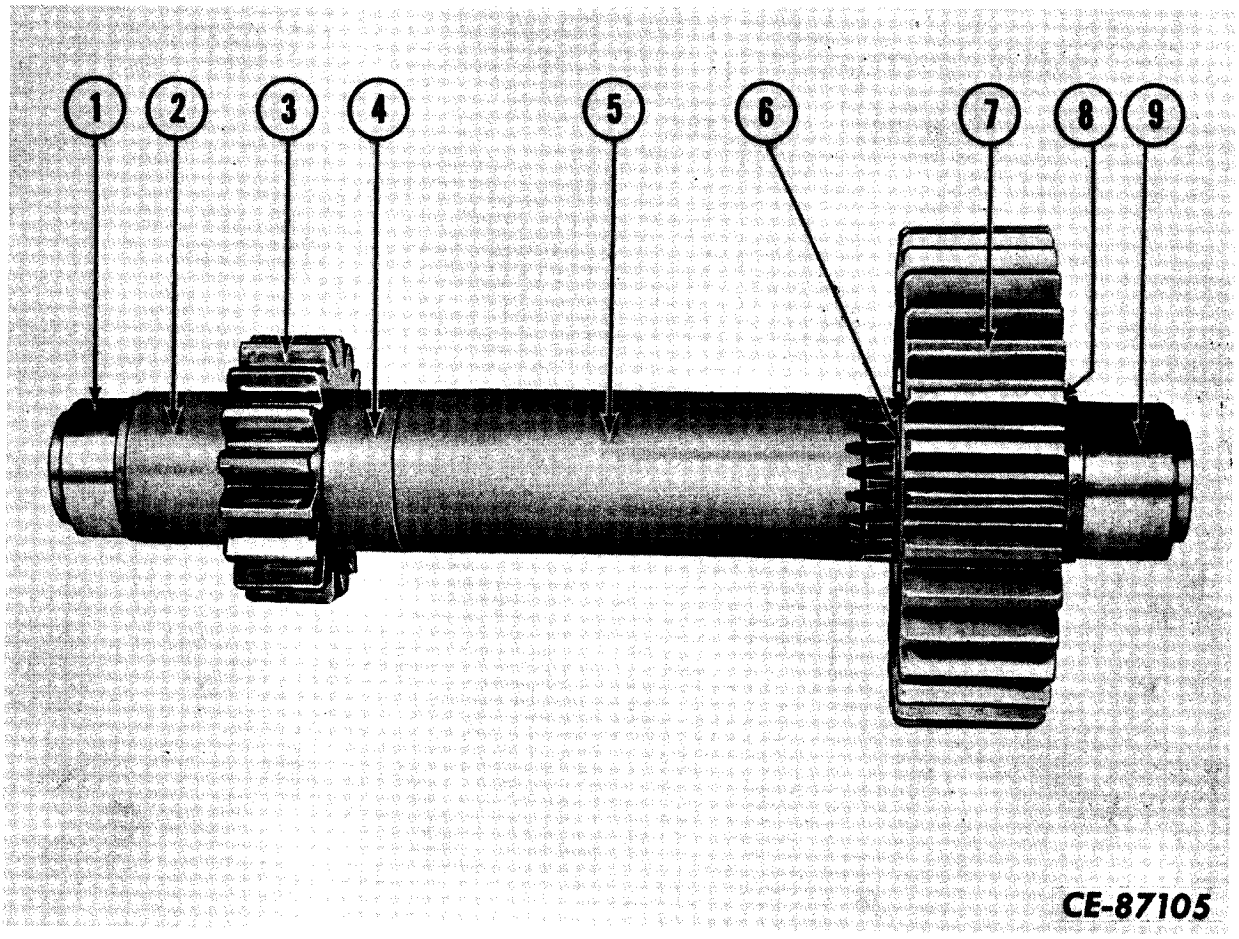


Figure 3-121
Gather Shaft – Late Type.

Install snap rings (4, 6), transmission output high gear (3), snap ring (2) and heated bearing inner race (1) with shoulder toward gear on shaft (5).

Install output idler and transfer gear (7), snap ring (8) and heated bearing inner race (9) (larger diameter) with shoulder toward gear.

NOTE: Be sure bearing inner races are properly seated.

8. GATHER SHAFT - LATE TYPE

DISASSEMBLY

Using a suitable hydraulic puller and adapter, remove bearing inner race (1) spacer (2) and transmission output high gear (3) as a unit. Remove the spacer (4). Remove snap ring (8). Using the proper puller adapter, remove output idler and transfer gear (7) and inner bearing race (9) together. Remove snap ring (6) from shaft (5).

ASSEMBLY

NOTE: Prior to assembly, heat bearing inner races to 350°F. for 45 minutes in oil or an oven.

Install spacer (4), transmission output high gear (3), spacer (2) and heated bearing inner race (1) with shoulder toward gear on shaft (5).

8. GATHER SHAFT - LATE TYPE - Continued

ASSEMBLY – Continued

Install snap ring (6), output idler and transfer gear (7), snap ring (8) and heated bearing inner race (9) with shoulder toward gear.

NOTE: Be sure bearing inner races are properly seated.

9. MAIN IDLER SHAFT

DISASSEMBLY

Using a suitable hydraulic puller and adapter, remove the main idler gear (3) and bearing inner race (4). Use puller holes provided in idler gear. With a suitable puller adapter remove bearing (1) from shaft (2).

ASSEMBLY

NOTE: Prior to assembly heat bearing inner race to 350°F. for 45 minutes in oil or an oven.

Place main idler gear (3) in press and press shaft (2) into gear.

NOTE: Shaft must be assembled into chamfered side of gear. Incorrect installation will result in gear and shaft failure.

Turn shaft over, place bearing (1) in press and press shaft (2) into bearing.

NOTE: Coat shaft with Molykote or equipment lubricant prior to installation of gear and bearing.

Install heated bearing inner race (4) with shoulder toward gear.

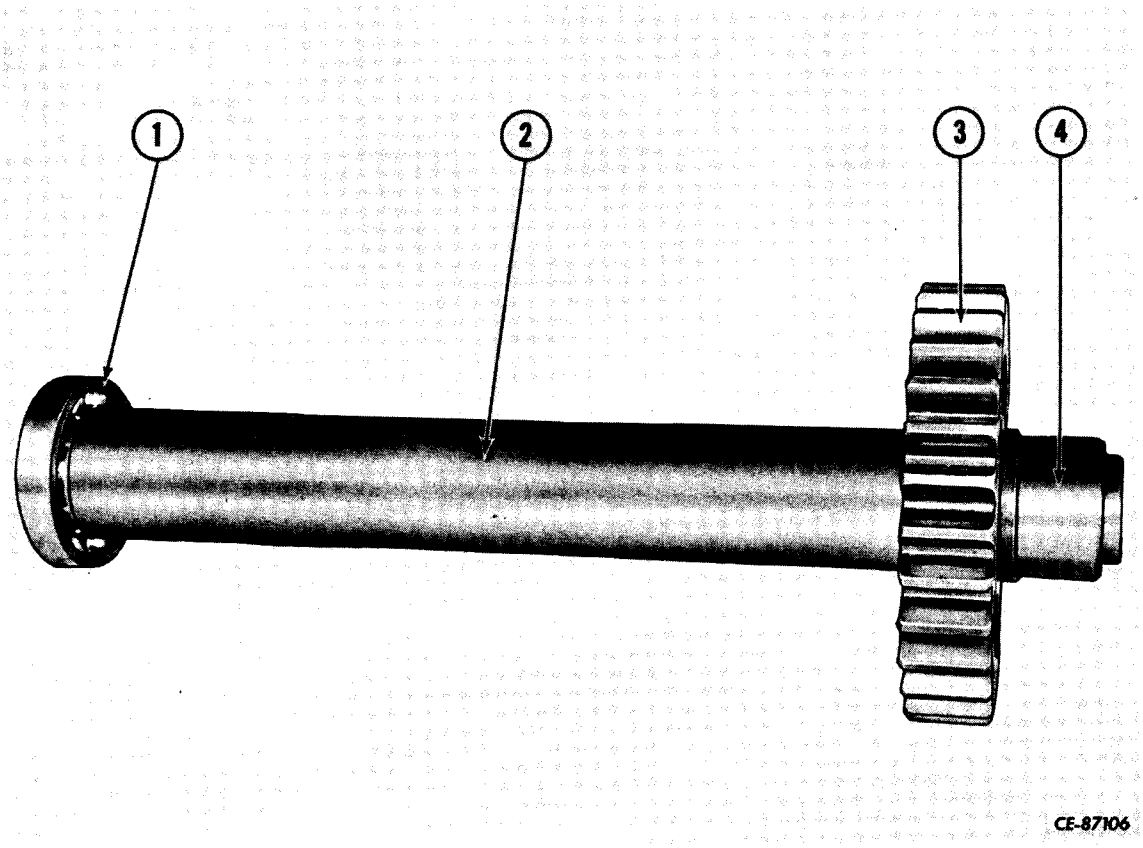


Figure 3-122
Main Idler Shaft.

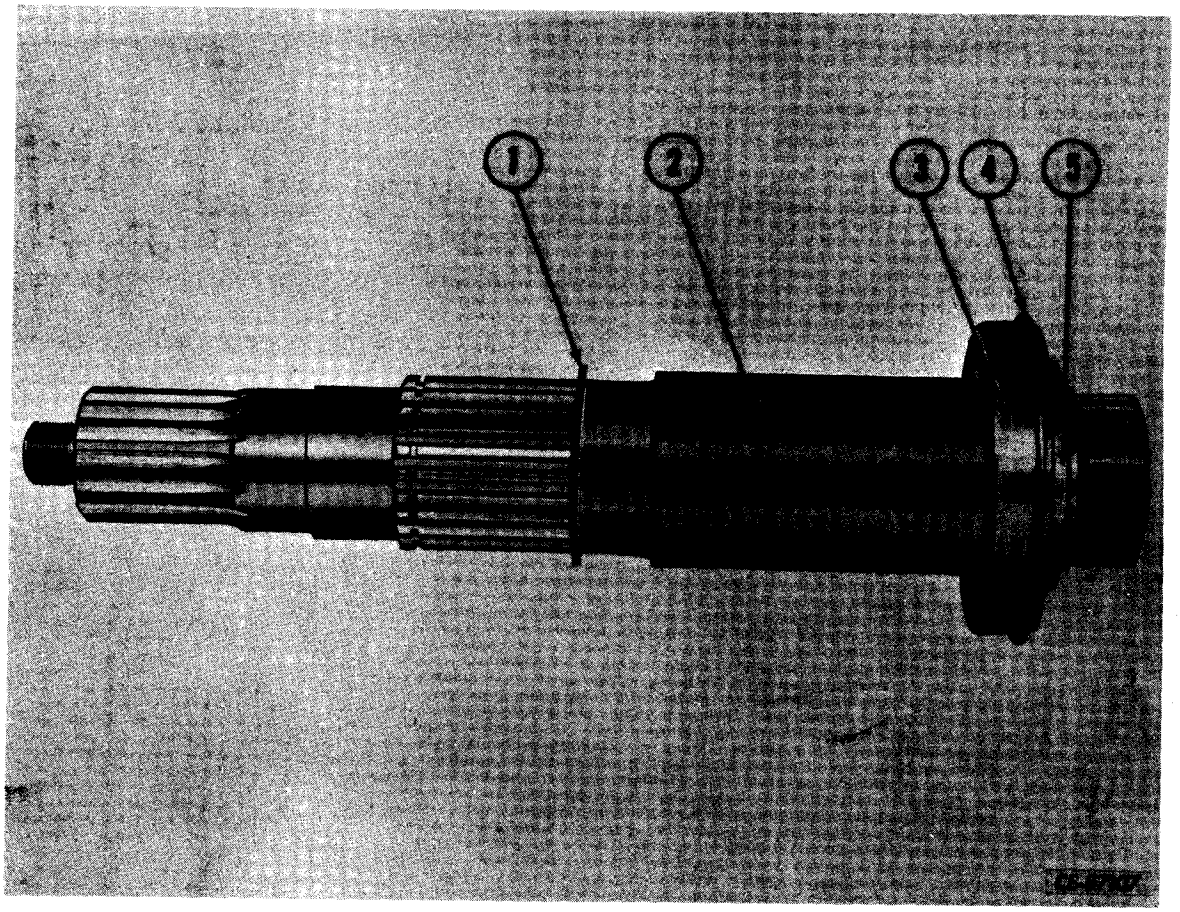


Figure 3-123
Output Shaft.

10. OUTPUT SHAFT (P-2000 & P-2002)

DISASSEMBLY

After relieving staked portion, remove output shaft bearing locknut (5). Using a suitable puller, remove bearing (3). Remove snap ring (1) from shaft (2).

NOTE: Place a steel plate between end of puller and shaft to avoid any damage to pilot bearing.

NOTE: Pilot bearing and shaft are serviced as an assembly.

ASSEMBLY

Install snap ring (1) on shaft (2). Place bearing (3) in press with snap ring (4) on outer race down, and press shaft into bearing.

NOTE: Coat shaft with Molykote or equivalent lubricant prior to pressing into bearing.

Install output shaft bearing retainer nut (5). Tighten nut securely with spanner and stake nut to shaft.

11. OUTPUT SHAFT - REAR AXLE DISCONNECT

DISASSEMBLY

Using a suitable bearing puller or a press, remove the bearing (2) from the shaft (1). Be sure to use a steel pad between the press arbor (or puller screw) and the threaded portion of the shaft (4).

NOTE: Pressure must be exerted on the bearing inner race only.

Remove the snap ring (3) only if it is damaged or broken.

ASSEMBLY

Install snap ring (3) on bearing (2). Place bearing in press with snap ring down and press shaft (1) into bearing.

NOTE: Coat shaft with Molykote or equipment lubricant prior to pressing into bearing.

Be sure bearing inner race bottoms on shoulder of shaft.

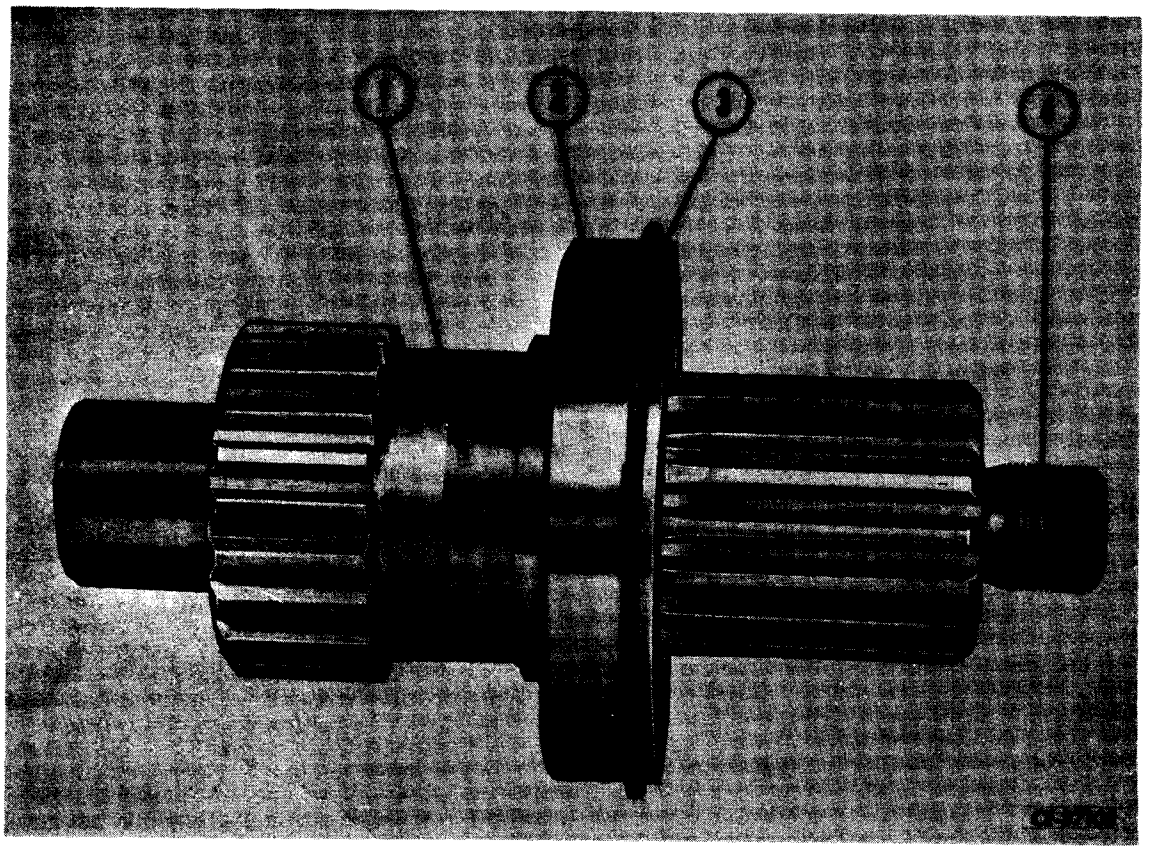


Figure 3-124
Output Shaft – Rear Axle Disconnect.

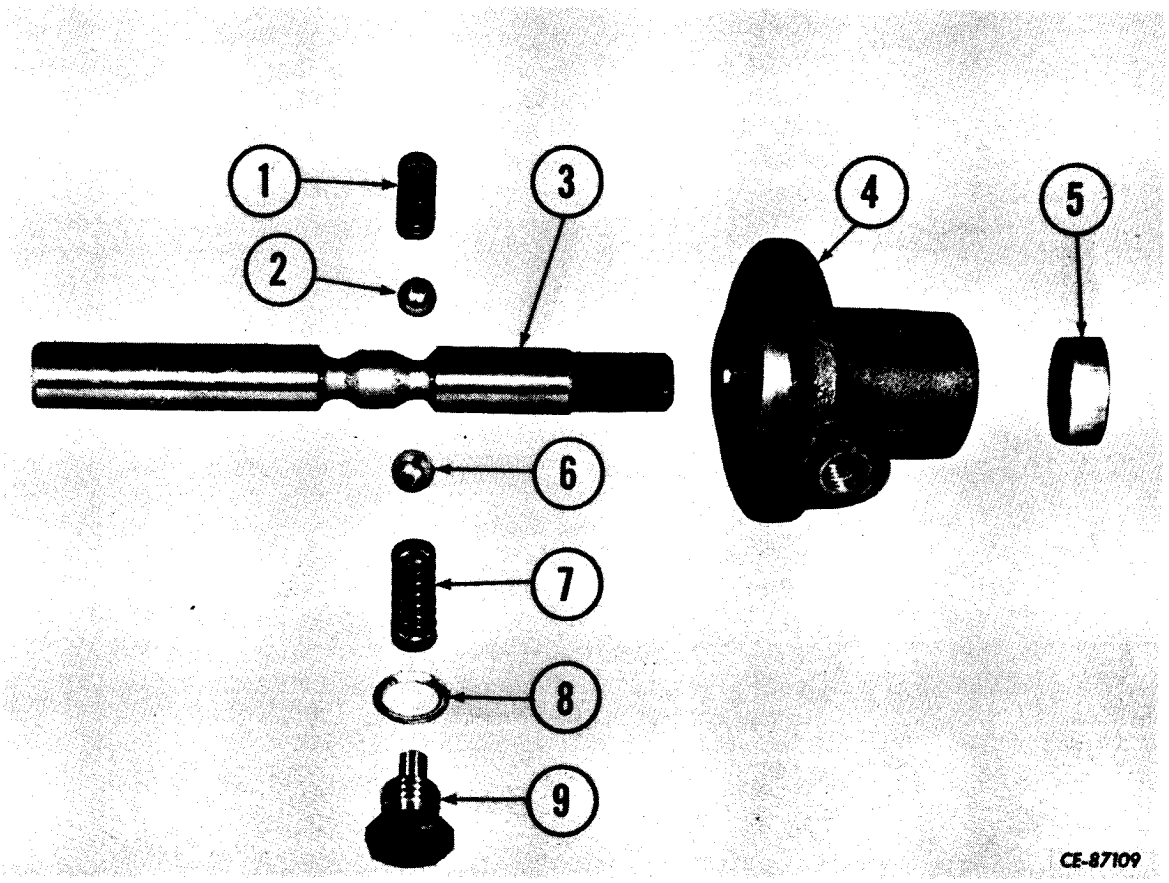


Figure 3-125
Rear Axle Disconnect Assembly.

12. REAR AXLE DISCONNECT ASSEMBLY

DISASSEMBLY

Remove plug (9), annular gasket (8), spring (7) and ball (6). Gently tap plunger (3) out of cap (4). Remove ball (2), spring (1) and drive seal (5) from cap.

CLEANING AND INSPECTION

Wash all parts thoroughly in clean solvent and dry with compressed air. Inspect plunger and balls for excessive wear. Replace gasket and seal.

ASSEMBLY

Install spring (1) and ball (2) in cap (4) using a short drift to push ball down while installing plunger (3). Install ball (6), spring (7), annular gasket (8) and plug (9). Pull plunger out to last detent. Coat O. D. of seal (5) with Mar-Seal or equivalent. Coat lips of seal with grease. Start seal on plunger, lip toward cap using a suitable driver. Drive seal flush with top of cap.

13. DIRECTIONAL OIL SUPPLY COVER

REMOVAL

Prior to removal mark the location of the oil supply cover (2) in the front cover (1) as an aid during assembly. Use a drift to remove the supply cover from the front cover. To remove and install seal rings, refer to Fig. 3-127.

REPLACE SEAL RINGS

With a sharp instrument, pierce and remove seal rings (Fig. 3-127) from oil supply cover.

CLEANING AND INSPECTION

Clean oil supply cover lands and passages with solvent and compressed air. Inspect oil supply cover for excessive wear. Replace seal rings.

ASSEMBLY

Install seal rings (1, Fig. 3-127) in oil supply cover (2) starting from rear of cover.

a. Lips facing rearward
b. Lips facing forward
c. Lips facing rearward

Coat lips of seal rings with grease.

(Continued on next page)

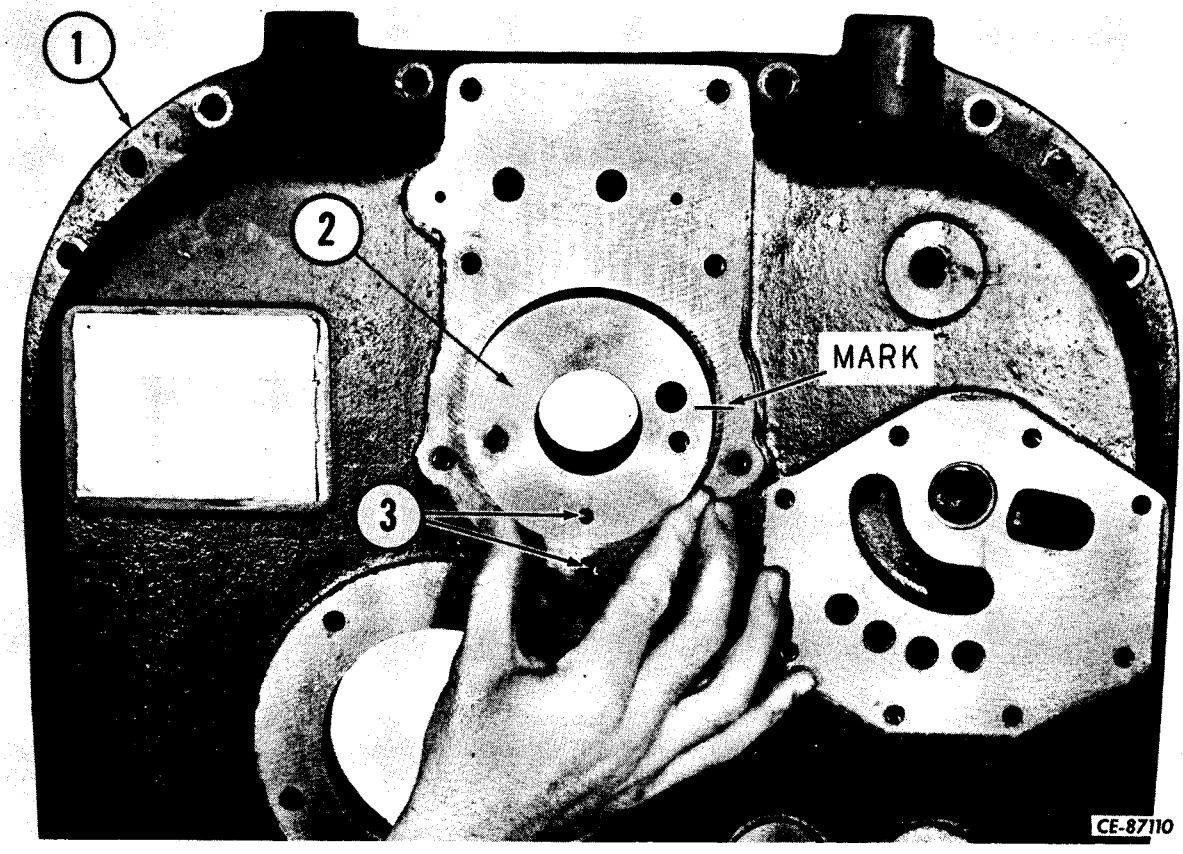


Figure 3-126
Removal of Directional Oil Supply Cover.

13. DIRECTIONAL OIL SUPPLY COVER - Continued

INSTALLATION

To install the oil supply cover, align the identification marks and using a mallet, drive the supply cover into the bore in the front cover. If replacement of the oil supply cover or front cover is required, align the lube hole in the oil supply cover with the cap screw hole (3, Fig. 3-126) in the front cover. Drive in oil supply cover with mallet.

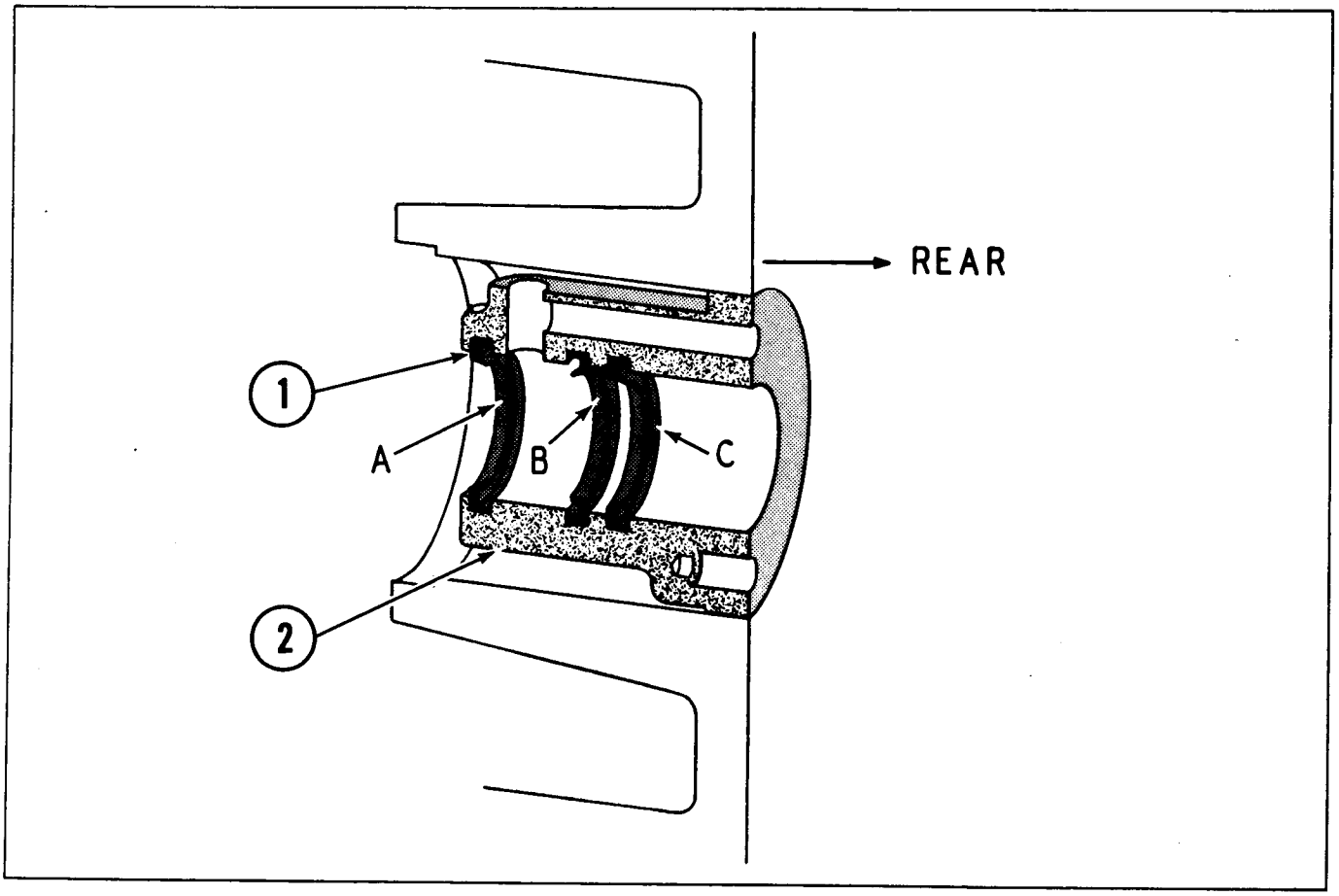


Figure 3-127
Seal Rings – Directional.

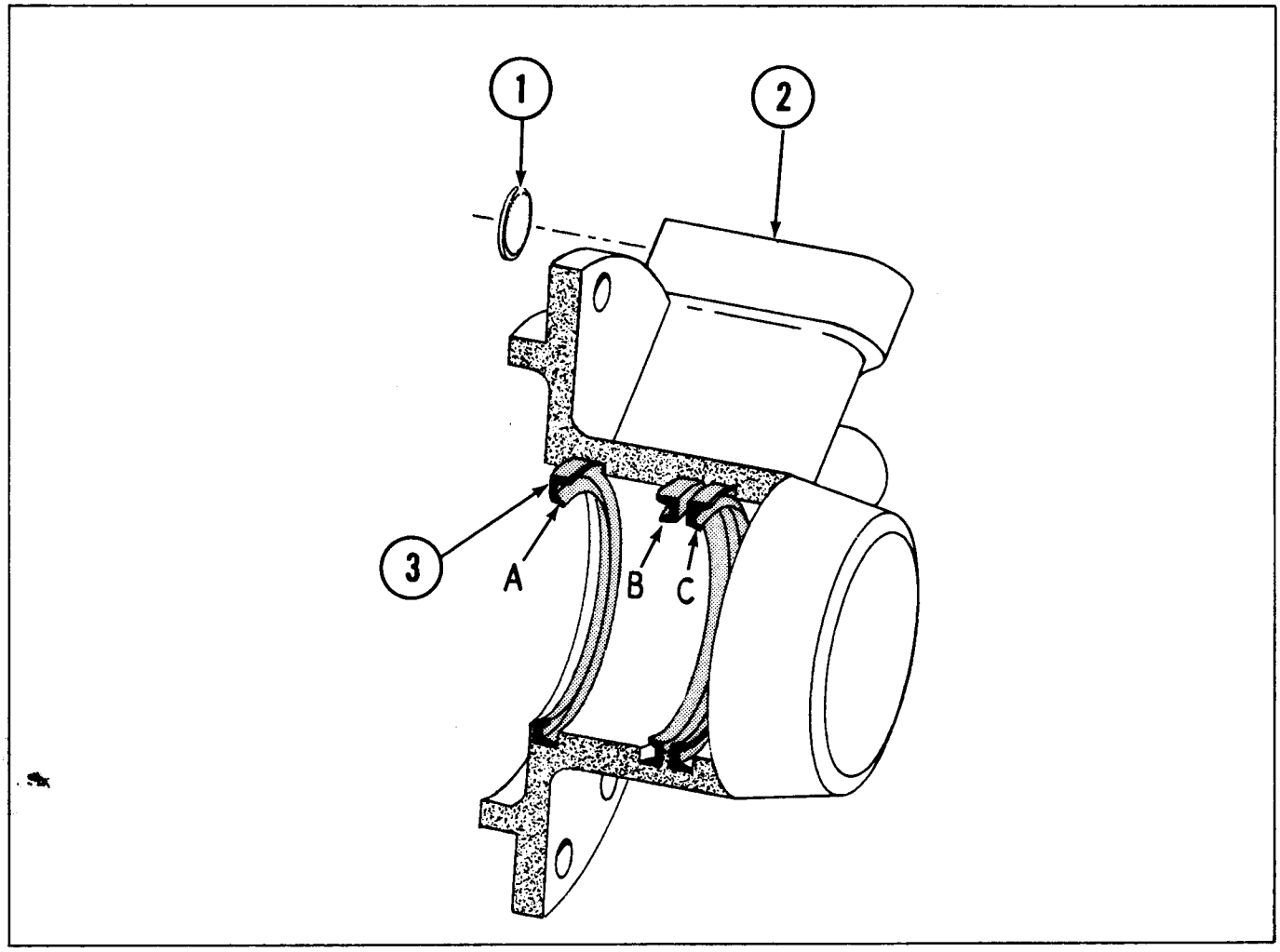


Figure 3-128
1st & 3rd and 2nd & 4th Range Oil Supply Cover.

14. RANGE OIL SUPPLY COVER

DISASSEMBLY

Remove "O" rings (1) from inlet port. Pierce seal rings (3) with a sharp instrument and remove the rings from the oil supply cover (2).

CLEANING AND INSPECTION

Clean all parts thoroughly in solvent and dry with compressed air. Inspect oil supply covers for excessive wear. Be sure inlet ports are clean. Replace seal rings.

ASSEMBLY

Install seal rings (3), starting from rear of oil supply covers (2) as follows:

c. Lips facing rearward
b. Lips facing forward
a. Lips facing rearward

Coat lips of seal rings with grease.

Install new "O" ring seals (1) in inlet ports. Retain "O" rings in position with small amount of grease.

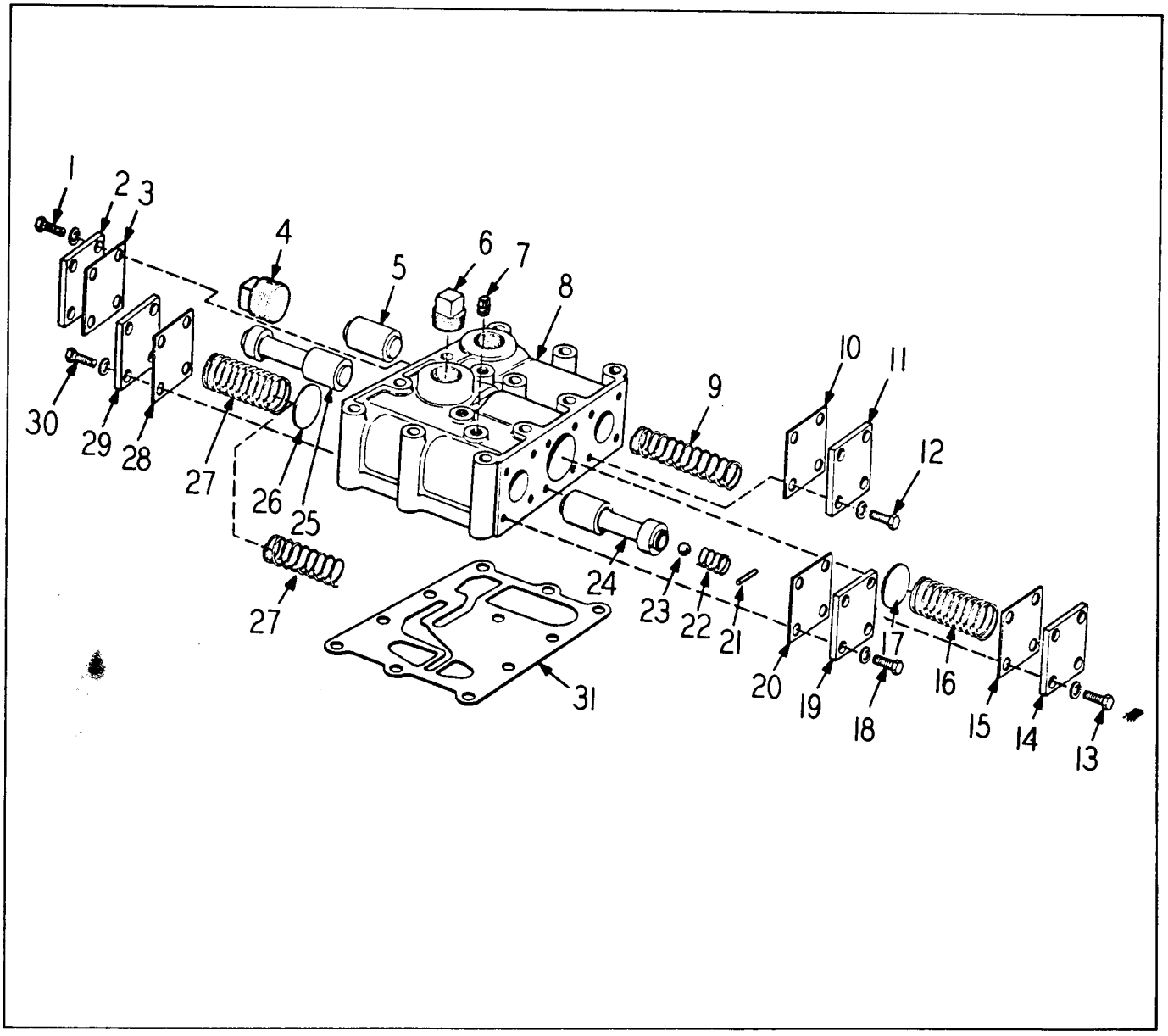


Figure 3-129
Main Regulator Valve.

1. Cap screw.
2. Cover.
3. Gasket.
4. Plug.
5. Lube valve plunger.
6. Plug.
7. Plug.
8. Valve body.
9. Lube valve spring.
10. Gasket.
11. Cover.
12. Cap screw.
13. Cap screw.
14. Cover.
15. Gasket.
16. Converter pressure regulator valve spring.
17. Spacer.
18. Cap screw.
19. Cover.
20. Gasket.
21. Pin.
22. Spring.
23. Ball.
24. Main pressure regulator valve plunger.
25. Converter pressure regulator valve plunger.
26. Washer.
27. Main pressure regulator valve spring.
28. Gasket.
29. Cover.
30. Cap screw.
31. Gasket.

15. MAIN REGULATOR VALVE

DISASSEMBLY

Remove the lube pressure regulator valve plug (4) and valve plunger (5).

Remove converter pressure regulator plunger (25) after removing cap screws (1) cover (2) and gasket (3).

The main pressure valve spring(s) (27) and washer (26) may be removed by first removing cap screws (30), cover (29) and gasket (28).

On the opposite end of the valve body, remove cap screws (18), cover (19), gasket (20) and main pressure regulator plunger (24). Press pin (21) from valve plunger (24) and remove spring (22) and ball (23). Remove cap screws (13), cover (14), gasket (15), converter pressure regulator valve spring (16) and washer (17). Remove cap screws (12), cover (11), gasket (10) and lube pressure regulator valve spring (9).

Remove the three pressure tap plugs (7) from valve body (8) to aid in cleaning.

CLEANING AND INSPECTION

Wash all parts thoroughly in a clean solvent and dry with compressed air. Flush valve body with clean solvent and compressed air. Inspect all valve plungers and bores for scoring and/or excessive wear. Replace all unserviceable parts and gaskets. Use a liberal amount of oil on plungers during assembly.

ASSEMBLY

Install lube valve plunger (5) with filleted boss (if so constructed) toward plug (4). Install and tighten plug (4). Install spring (9), gasket (10), cover (11) and cap screws (12). Tighten cap screws to recommended torque. Refer to SPECIAL TORQUES.

Torque: _____

PRESSURE REGULATING VALVE - SPRING IDENTIFICATION

ITEM	148830	148888	184621	148829	174653
Application	Lube Press.	Conv. Press.	Main Press.	Main Press.	Main Press.
Total Coils	11	10	10	8.93	12
Free Height (approx.)	4.19"	3.35"	3.333"	3"	3.076"
O.D.	.900"	1.20"	1.25"	1.25"	.860
Produce Load of	8 lbs. $\pm \frac{.50}{1.00}$	63.0 lbs. ± 6	127.5 lbs. ± 12.0	91.12 lbs. ± 9.0	31.5 lbs. ± 3.0
At Height of	2.32"	2.19"	2.15"	2.1563"	2.30"
Fig. callout	9	16	27	27	27

NOTE: Early transmissions were equipped with one-148829 Main pressure spring. (100-130 psi)

Later transmissions and field converted units were equipped with one 174653 spring inside of one-148829 main pressure spring (130-160 psi).

Current transmissions are equipped with one-184621 main pressure spring. (170-190 psi)

Install converter regulator plunger (25) with small land out toward cover (2). Install gasket (3), cover (2) and cap screws (1). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Install washer (17), spring (16), gasket (15), cover (14) and cap screws (13). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Install washer (26), spring (27), gasket (28), cover (29) and cap screws (30). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUE").

Torque:_____

Install ball (23) and spring (22) in main pressure plunger (24) and retain with pin (21). Place main pressure plunger (24) in valve body bore with small land out toward cover (19). Install gasket (20), cover (19) and capscrews (18). Tighten cap screws to recommended torque (refer to "SPECIAL TORQUES").

Torque:_____

Install pressure tap plugs (7) and pipe plug (6) in valve body (8) and tighten securely.

16. TRANSMISSION FRONT COVER

REMOVAL

Remove attaching cap screws and install two in jack screw holes (1) provided in cover. Pry

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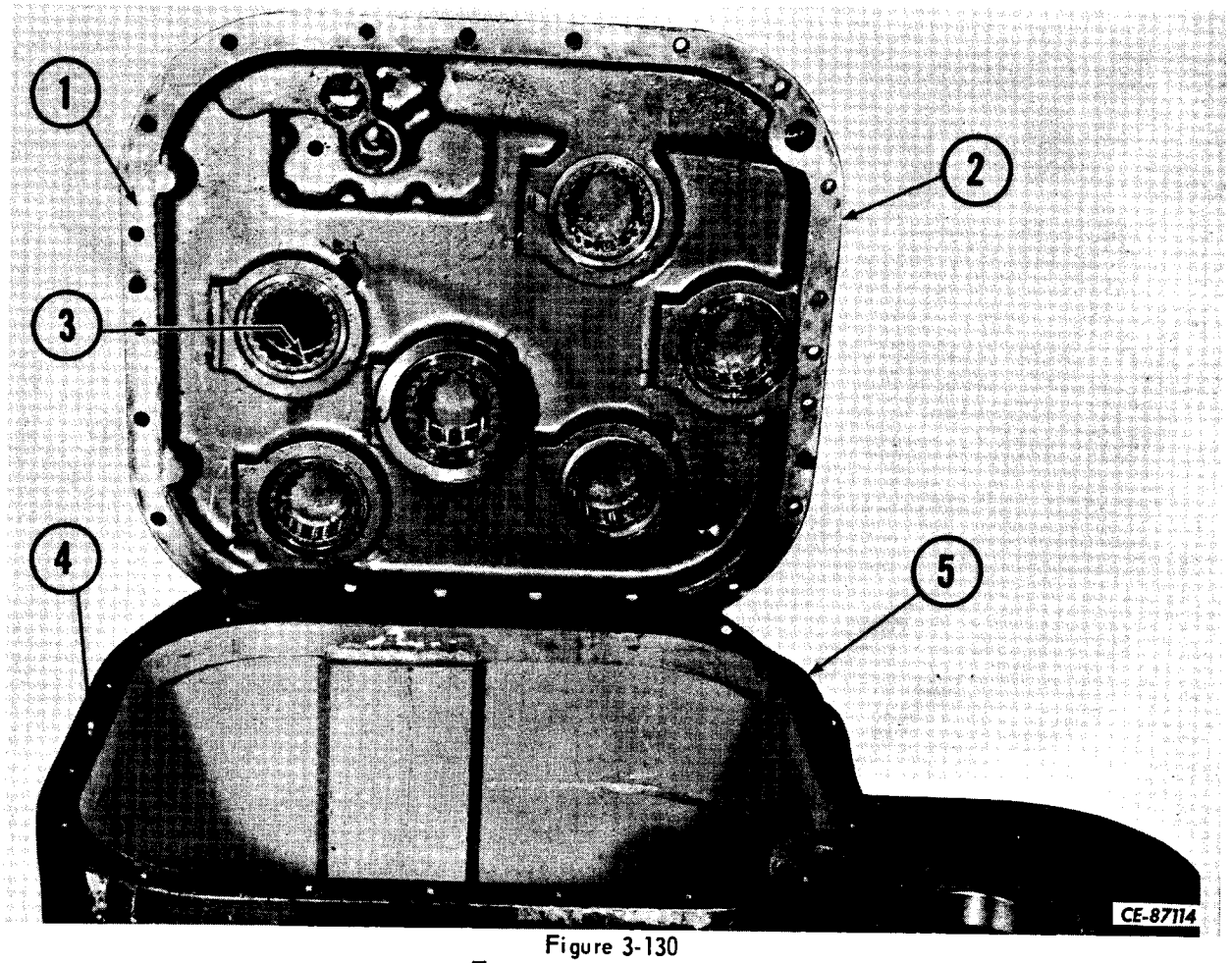

Figure 3-130
Transmission Front Cover.

16. TRANSMISSION FRONT COVER - Continued

REMOVAL – Continued

cover (2) from dowels (4) by rotating jack screws equally. Remove and discard gasket (3). If necessary, remove bearings using a suitable puller.

NOTE: Attach puller to bearing outer race only. Bearings are a light drive fit.

Remove input shaft seal (5) using a suitable driver.

CLEANING AND INSPECTION

Clean and flush cover passages with solvent and compressed air. Inspect cover casting for cracks. Inspect bearings for excessive wear or pitting.

ASSEMBLY

To install bearings, use a soft drift, mallet or press to drive bearings into bore.

NOTE: Drive on bearing outer race only. Be sure bearing is properly seated in bore.

Install new input shaft seal by placing cover in press. Coat O.D. of seal with Mar-Seal or equivalent sealant. Using a plate with larger diameter over seal, press seal into cover with lip facing down toward bearing.

Using a new gasket (3) install cover (2). Tighten retaining cap screws to recommended torque. Refer to "SPECIAL TORQUES".

Torque: _____

17. TRANSMISSION REAR COVER

DISASSEMBLY

If removal of one or all of the roller bearings is required, use a soft drift to drive bearing from cover.

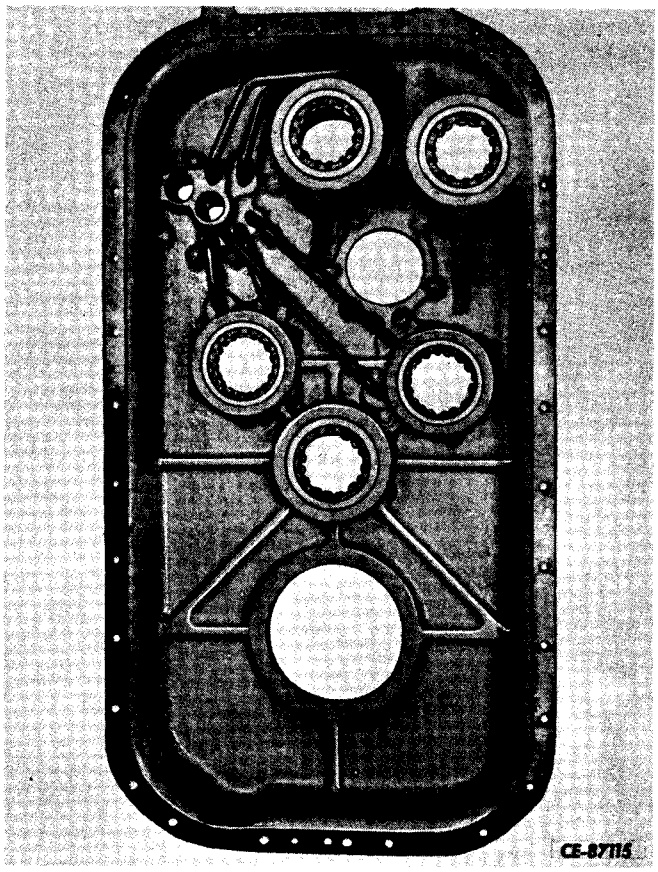

Figure 3-131
Transmission Rear Cover.

NOTE: Drive on bearing outer race only.

ASSEMBLY

Bearings are a light drive fit. To install, use a soft drift or mallet and drive bearings into bearing bore.

NOTE: Oil supply tubes are not replaceable. They are serviced with cover. Use caution to avoid damaging oil supply tubes.

SECTION IV
TROUBLE SHOOTING

Diagnostic Checks to be Made When Trouble Occurs:

(1) Transmission sump oil level.
(2) Cleanliness of oil and oil filter.
(3) Air flow through oil cooler.
(4) Condition of all oil lines and fittings.
(5) Condition of all wiring and connections.
(6) Engine-converter stall speed.
(7) Proper linkage positioning of all valves and levers.
(8) Converter and transmission oil pressures.
(9) All drive lines and mounting brackets for tightness.

COMPLAINT	CAUSE	REMEDY
High engine speed at converter stall.	1. Low transmission sump oil level.	1. Add oil to proper level.
	2. Low converter "IN" pressure at stall.	2. (a) Check external lines for leaks. (b) See low converter "IN" pressure.
	3. Slipping direction or range clutch.	3. (a) Cross check direction and range clutches by applying other clutches to varify slipping. (b) Observe movement in drive line between converter and transmission.
	4. Foaming oil.	4. (a) Low oil level. (b) Water in oil. (c) Oil line suction leak. (d) Improper oil.
	5. Neutral knockdown valve sticking.	5. (a) Clean and inspect valve body bore. (b) Inspect valve spring.
Low engine speed at converter stall.	1. Low engine output.	1. Tune engine and check output.
	2. Stator installed backwards.	2. Disassemble converter and check stator.
	3. Stators freewheeling backwards. In converter housing below S/N 171 only.	3. (a) Stator over-running clutch failure. (b) Disassemble converter and replace stator over running clutch with a solid hub.
	4. Excessive oil in converter housing.	4. (a) Converter pump hub seal worn. (b) Input pump seal failure. (c) Excessive input pump wear.
	5. Plugged or restricted accessory drive and torque converter housing drain line.	5. Clean or replace drain line.
High oil temperature.	1. Low transmission sump oil level.	1. Add oil to proper level.
	2. High transmission sump oil level.	2. Drain oil to proper level.
	3. Foamed oil.	3. (a) Check oil level. (b) Air leaks in suction lines.
	4. Clogged oil cooler.	4. Clean oil cooler.
	5. Low converter "IN" pressure.	5. See low converter "IN" pressure.

(Continued on next page)

TROUBLE SHOOTING

COMPLAINT	CAUSE	REMEDY
High oil temperature - Cont.	6. Improper vehicle operation. 7. Stator assembled in converter backwards. 8. Low oil flow thru converter.	6. (a) Operate in correct range. (b) Downshift into lower range. (c) Remaining in stall too long. 7. (a) Check converter stall. (b) Disassemble converter and check stator. 8. Check input pump for excessive wear.
Slow or erratic clutch engagement.	1. Low transmission sump oil level. 2. Clogged oil filter screen. 3. Foamed oil. 4. Improper linkage adjustment. 5. Low clutch pressure. 6. Clutch pressure regulator valve stuck. 7. Neutral knockdown valve sticking. 8. Internal oil leaks.	1. Add oil to proper level. 2. Remove and clean. 3. Eliminate air leak into pump suction line. 4. (a) Free linkage and adjust. (b) Check selector valve positioning. 5. See low clutch pressure. 6. (a) Clean and inspect valve body bore. (b) Inspect valve spring. 7. (a) Clean and inspect valve body bore. (b) Inspect valve spring. 8. (a) Cross check clutches by applying other clutches. (b) Damaged or worn seals in clutch pack. (c) Damaged oil transfer tubes. (d) Damaged oil worn shaft seals. (e) Overhaul transmission.
High clutch pressure.	1. Improper main pressure regulator valve operation. 2. Stuck converter regulator valve.	1. (a) Clean and inspect. (b) Inspect spring. (c) Inspect valve bore. 2. (a) Clean and inspect. (b) Inspect spring. (c) Inspect valve bore.
Low clutch pressure.	1. Low transmission sump oil level. 2. Clogged oil filter or transmission sump oil screen. 3. Foamed oil. 4. External oil leaks. 5. Improper clutch pressure regulator valve operation. 6. Worn input oil pump. 7. Neutral knockdown valve.	1. Add oil to proper level. 2. Clean and/or replace. 3. (a) Eliminate air leaks in suction line. (b) Tighten fittings. (c) Check oil level. 4. Check external oil lines. 5. (a) Clean and inspect. (b) Inspect spring. (c) Check valve body bore. 6. Overhaul input oil pump. 7. (a) Clean and inspect valve body bore. (b) Inspect valve spring.

COMPLAINT	CAUSE	REMEDY
Low clutch pressure - Cont.	8. Internal oil leaks.	8. (a) Watch for excessive pressure drop in a specific direction or range clutch. (b) Overhaul transmission.
High converter "IN" pressure.	1. Clogged oil cooler. 2. Stuck converter regulator valve. 3. Stuck lube pressure regulator valve.	1. Remove and clean. 2. (a) Clean and inspect valve body bore. (b) Inspect valve spring. 3. (a) Clean and inspect valve body bore. (b) Inspect valve spring.
Low converter "IN" pressure.	1. Low transmission sump oil level. 2. Low clutch pressure. 3. External oil leak. 4. Converter regulator valve sticking. 5. Internal oil leak.	1. Add oil to proper level. 2. See low clutch pressure. 3. Check external lines for leaks. 4. (a) Clean and inspect valve body bore. (b) Inspect valve spring. 5. Overhaul converter.
Low lube pressure.	1. Low oil level. 2. Worn input pump. 3. Stuck lube pressure regulator valve. 4. Internal leaks.	1. Correct oil level. 2. Overhaul input pump. 3. (a) Clean and inspect valve body bore. (b) Inspect valve spring. 4. Overhaul transmission.
High lube pressure.	1. Stuck lube pressure regulator valve.	1. (a) Clean and inspect valve body bore. (b) Inspect valve spring.
Loss of power.	1. Low engine output. 2. Stator assembled backward. 3. Stator fails to lock. In Accessory Drive below S/N 171 only. 4. Low converter "IN" pressure. 5. Direction or range selector valves inoperative. 6. Improper vehicle operation. 7. Parking brake dragging. 8. Foaming oil. 9. Slipping clutches. 10. Vehicle brakes dragging.	1. See low engine speed at converter stall. 2. Disassemble converter and check stator. 3. Disassemble converter and replace stator over-running clutch with solid hub. 4. See low converter "IN" pressure. 5. (a) Check linkage. (b) Disassemble valve bodies and inspect. 6. Operate in proper range for load and terrain. 7. (a) Adjust linkage to allow full release. (b) Release brake. 8. (a) Correct oil level. (b) Check for air leak in suction line. (c) Oil used not meeting specifications. 9. See low clutch pressure. 10. (a) Adjust brakes. (b) Check brake linkages.

(Continued on next page)

COMPLAINT	CAUSE	REMEDY
Vehicle drives in one direction and and creeps in that direction in neutral but stalls when shifted to the opposite direction.	1. Failed directional clutch.	1. Overhaul transmission.
Vehicle drives in one range but stalls when shifted to another range.	1. Failed range clutch.	1. Overhaul transmission.
All range pressures normal in one direction but all low in opposite direction.	1. Directional selector valve linkage out of adjustment. 2. Internal oil leaks in forward or reverse clutch.	1. Adjust linkage. 2. Overhaul transmission.
Low clutch pressure in one range clutch in either direction.	1. Linkage out of adjustment. 2. Internal oil leaks in clutch.	1. Adjust linkage. 2. Overhaul transmission.

SECTION V

SERVICE INFORMATION

SPECIFICATIONS

1. CONVERTER

Type: Single stage, single phase, three element converter

Torque Multiplication at Stall: 3.5 : 1 ratio PAY Loader
2.8 : 1 ratio PAY Dozer

Oil System: Integrated with transmission
Input Pump: Positive displacement, gear type
Pump Capacity: Refer to "CONVERTER CLASSIFICATION"
Accessory Drive Oil Capacity: 2.5 gallons

Oil Pressure: Refer to "OPERATING RANGES"

Oil Filter: Full flow - remote mounted

Oil Cooler: Remote mounted

Weight: 393 lbs. (dry)

2. TRANSMISSION

Ratios:

RANGE	FORWARD	REVERSE
1	3.58	3.58
2	1.98	1.98
3	.95	.95
4	.52	.52

Rating: Maximum input torque at converter stall - 2100 ft. lbs.
Maximum governed input speed - refer to "OPERATING RANGES"

Clutches: Three pair, self adjusting, multiple disc, oil cooled, pressure-balanced with sintered bronze plates on steel backing

Size: 1st - 3rd range clutches - 7.750
2nd - 4th range clutches - 7.750
Directional clutches - 7.750

Gearing: Countershaft design, spur type

Hydraulic System: Oil sump - integral
Capacity - 9.5 U.S. gallons initial fill
Type oil - SAE 10W heavy duty (MIL-L-2104A)
Oil temperature - refer to "OPERATING RANGES"
Oil pressure - refer to "OPERATING RANGES"
Regulator valves - integral
Control valves - integral
Oil screen - integral in sump
Oil filter - full flow, remote mount
Oil cooler - remote mounted

(Continued on next page)

SPECIFICATIONS

2. TRANSMISSION - Continued

Output Shafts: Double drop, with front and rear output yokes
Some models equipped with rear axle disconnect
Refer to "P-2000 SERIES TRANSMISSIONS - CLASSIFICATION"

Parking Brake: Front mounted with adjustment in operator's compartment

Weight: 1340 lbs.

CONVERTER CLASSIFICATION

H-120B	Conv. Model No.	148284H2			148284H3	
	Input Pump	149168H2	187588H2	187588H3	187588H3	
	Pump Capacity	20.4 GPM @ 2000 RPM & 200 PSI	30 GPM @ 2000 RPM & 200 PSI	30 GPM @ 2000 RPM & 200 PSI	30 GPM @ 2000 RPM & 200 PSI	
	Impeller	156272H1			156272H1	
H-120C	Conv. Model No.	198819H1			198819H2	219981H2
	Input Pump	199330H2			199330H2	187588H3
	Pump Capacity	20 GPM @ 2000 RPM & 200 PSI			20 GPM @ 2000 RPM & 200 PSI	30 GPM @ 2000 RPM & 200 PSI
	Impeller	199353H1			875575C1	875575C1
D-120C	Conv. Model No.	198818H1			198818H2	219982H2
	Input Pump	199330H2			199330H2	187588H3
	Pump Capacity	20 GPM @ 2000 RPM & 200 PSI			20 GPM @ 2000 RPM & 200 PSI	30 GPM @ 2000 RPM & 200 PSI
	Impeller	197979H1			875576C1	875576C1

P-2000 SERIES TRANSMISSION CLASSIFICATION

ITEM	P-2000	P-2001	P-2002	P-2003	P-2004
Part Number	161913H1	194280H1	214362H1	214364H1	875498C91
Main Regulator Valve:					
Original					
Current	148889H3	148889H3	148889H3	148889H3	148889H3
Directional Control Valve:					
Original	156342H-H1	149249H2	156342H1	149249H2	875023C91
Current	875022C91	875023C91	875022C91	875023C91	875023C91
Range Selector Valve:					
Original	161273H1	161273H1	207592H1	207592H1	207592H1
Current	207592H1	207592H1	207592H1	207592H1	207592H1
GEAR TEETH					
Directional Clutch Pack					
Forward Gear	29	29	19	19	19
Reverse	39	39	25	25	25
Reverse Idler Shaft					
Large Gear	39	39	25	25	25
Small Gear	29	29	19	19	19
Main Idler Shaft Gear	46	46	29	29	29
1st & 3rd Range Clutch Pack					
Driving Gear	58	58	38	38	38
1st Range Gear	29	29	19	19	19
3rd Range Gear	55	55	35	35	35
2nd & 4th Range Clutch Pack					
Driving Gear	32	32	21	21	21
2nd Range Gear	29	29	19	19	19
4th Range Gear	55	55	35	35	35
Gathering Shaft					
Large Gear	52	52	33	33	33
Small Gear	26	26	17	17	17
Output Shaft	52	52	34	34	34
Rear Axle Disconnect	Yes	No	Yes	No	No
Tapered Roller Bearings in Output Shaft	No	No	No	No	Yes
Parking Brake Mounted on Transmission Housing	Yes	No	Yes	No	No

SERVICE INFORMATION

OPERATING RANGES

ENGINE	MINIMUM	MAXIMUM	COMMENTS
H-120C			
Water Temperature (Degrees Fahrenheit)			
International Harvester - DT-817	180	195	
Cummins - NT-310-C1	180	200	
Detroit Diesel - 8V-71N	180	195	
D-120C			
Water Temperature (Degrees Fahrenheit)			
International Harvester - DT-817	180	190	
Cummins - NT-310-C1	180	200	
Detroit Diesel - 8V-71N	180	195	
H-120C D-120C			
Oil Pressure (PSI)			
International Harvester - DT-817	40	50	HIGH IDLE
Cummins - NT-310-C1	30	50	HIGH IDLE
Detroit Diesel - 8V-71N	45	50	HIGH IDLE

TACHOMETER (RPM)	LOW IDLE	HIGH IDLE	GOV. SPEED	CONV. STALL	HYD. STALL	FULL STALL
H-120C						
International Harvester - DT-817	600-650	2200	2100	2140	2150	2000
Cummins - NT-310-C1	600-650	2200	2100	2140	2150	2070
Detroit Diesel - 8V-71N	600-650	2200	2100	2140	2150	2000
D-120C						
International Harvester - DT-817	600-650	2200	2100	2000	2150	1900
Cummins - NT-310-C1	600-650	2200	2100	2000	2150	1900
Detroit Diesel - 8V-71N	600-650	2200	2100	2000	2150	1900

CONVERTER	MINIMUM	MAXIMUM	COMMENTS
H-120C D-120C			
Temperature (Degrees Fahrenheit)		250	
Charging Pressure (PSI)	50	80	HIGH IDLE
TRANSMISSION			
H-120C D-120C			
Clutch Pressure (PSI)	170	190	AT STALL
Lube Pressure (PSI)	5	15	HIGH IDLE

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SPECIAL TORQUES

ITEM	TORQUE
CONVERTER	
Input pump mounting cap screws	26-32 ft. lbs.
Input pump drive gear retaining nut	45-55 ft. lbs.
Output shaft bearing retainer cap screws	26-32 ft. lbs.
Output yoke retainer washer cap screws	26-32 ft. lbs.
Accessory drive gear-to-impeller cap screws:	
5/16" cap screws	36-43 ft. lbs.
7/16" cap screws	70-80 ft. lbs.
Drive housing-to-impeller	36-43 ft. lbs.
Retaining washer-output shaft to input drive bearing	26-32 ft. lbs.
Input hub retaining cap screws	26-32 ft. lbs.
Inspection cover retaining cap screws	26-32 ft. lbs.
Input pump assembly cap screws	26-32 ft. lbs.
TRANSMISSION	
Filter screen mounting cap retaining cap screws	26-32 ft. lbs.
Disconnect housing-to-transmission case cap screws	26-32 ft. lbs.
Disconnect carrier-to-disconnect housing cap screws	26-32 ft. lbs.
Output shaft bearing retainer-to-disconnect housing	26-32 ft. lbs.
Rear output yoke retaining hex nut	275 ft. lbs.
Oil baffle retaining cap screws	26-32 ft. lbs.
Transmission rear cover retaining cap screws	42-50 ft. lbs.
Range selector valve retaining cap screws	15-18 ft. lbs.
Directional control valve/knockdown valve retaining cap screws	26-32 ft. lbs.
Main idler shaft cover retaining cap screws	26-32 ft. lbs.
Gather shaft cover retaining cap screws	26-32 ft. lbs.
Range clutch oil supply covers retaining cap screws	26-32 ft. lbs.
Parking brake mounting cover-to-front cover cap screws	26-32 ft. lbs.
Parking brake backing plate-to-mounting cover cap screws	42-50 ft. lbs.
Output flange (with parking brake drum) retaining hex nut	275 ft. lbs.
Input yoke retaining cap screws	26-32 ft. lbs.
Main pressure regulator valve retaining cap screws	26-32 ft. lbs.
Output flange to parking brake drum	50-60 ft. lbs.
Clutch hub retaining cap screws	17-20 ft. lbs.
Plunger cover cap screws (all) - main pressure regulator valve	15-18 ft. lbs.
Front cover-to-transmission case cap screws	42-50 ft. lbs.
Output shaft bearing retainer-to-transmission housing-preliminary torque	50 inch lbs.

Threads clean and lubricated with oil or grease

SERVICE INFORMATION

STANDARD TORQUES

GENERAL SPECIFICATIONS

TORQUE IN FOOT-POUNDS (± 10% ALLOWABLE VARIATION)

Size	Grade 2		Grade 3		Grade 5		Grade 7		Grade 8	
	NC	NF	NC	NF	NC	NF	NC	NF	NC	NF
1/4	5.5	6.5	9	10	9	10	11	12	12	14
5/16	12	13	18	20	18	20	23	25	25	29
3/8	21	24	32	37	32	37	40	45	45	50
7/16	34	38	52	58	52	58	65	70	70	80
1/2	52	58	80	90	80	90	95	110	110	125
9/16	70	79	105	120	115	125	140	150	160	180
5/8	98	100	150	155	160	165	190	200	225	230
3/4	175	190			280	315	350	390	400	440
7/8	150	160	NO		420	460	560	620	650	700
1	225	250			625	700	800	950	950	1050
1-1/8	320	360	SAE		840	950	1200	1300	1350	1500
1-1/4	450	500			1150	1300	1650	1800	1900	2100
1-3/8	590	675	RATING		1500	1700	2200	2500	2500	2800
1-1/2	785	885			2000	2300	2900	3300	3350	3500

Threads Lubricated with Oil or Grease

Based on SAE Minimum Standards

TOLERANCES

ITEM	TOLERANCE
Clearance - converter input hub-to-converter drive housing	.005" (Before torquing cap screws)
* Clearance - lower face of retaining washer-to-inner race of drive housing bearing	.003" (Before torquing cap screws)
** Maximum Shaft Extension - measured from top surface of output shaft to inner race of drive housing bearing	.005" max.
Clearance - ground sleeve hub-to-output shaft bearing	.000" - .004" max.
End Play - Transmission output shaft - P-2004 transmission with tapered roller bearings	.005 - .009"

* This measurement used on early converters with output shafts that do not extend beyond drive housing bearing inner race.

** This measurement used on late model converters with output shafts that extend beyond drive housing bearing inner race.

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CLUTCH WEAR LIMITS

1. MODEL P-2000

A. (Steel Spacer Washer) . 073 minimum
B. (Bronze Thrust Washer) . 087 minimum
C. (Thin Steel Spacer Washer(. 026 minimum

NOTE: Washers below these limits should be replaced.

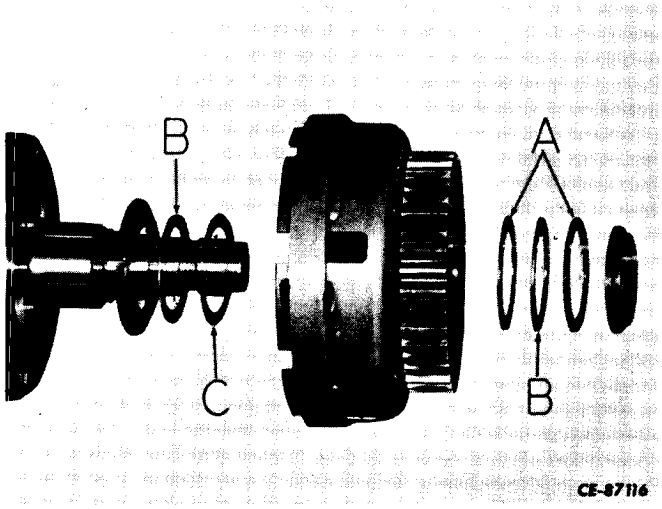

Figure 5-1

2. DRIVE GEAR AND DRIVE CUP ASSEMBLY BUSHING WEAR LIMITS

When measuring the bushing in a clutch drive gear and drive cup assembly, the bushing should be measured at the outer edge of the inner diameter of the bushing. The following are the maximum wear limits:

1. Forward and Reverse Shaft Assembly

   a. Bushing in drive gear and drive cup assembly has a maximum wear limit of 2.5135 - 2.5155.

   b. Bushing in drive gear and drive cup assembly has a maximum wear limit of 2.5135 - 2.5155.

2. 1-3 Shaft Assembly

   a. Bushing in drive gear and drive cup assembly has a maximum wear limit of 2.5135 - 2.5155.

   b. Bushing in drive gear and drive cup assembly has a maximum wear limit of 2.5135 - 2.5155.

3. 2-4 Clutch Shaft Assembly

   a. Bushing in drive gear and drive cup assembly has a maximum wear limit of 2.5135 - 2.5155.

   b. Bushing in drive gear and drive cup assembly has a maximum wear limit of 2.5135 - 2.5155.

Replace any of the drive gear and drive cup assembly in which the bushings exceed these limits.

3. CLUTCH PACK THRUST WASHER WEAR LIMITS

P-2000 models have 2 steel, 2 bronze and 1 thin steel washer assembly:

1 steel washer - . 073 minimum
1 bronze thrust washer - . 087 minimum
1 thin steel washer - . 026 minimum

SERVICE INFORMATION

CLUTCH PLATE STACKING PROCEDURE

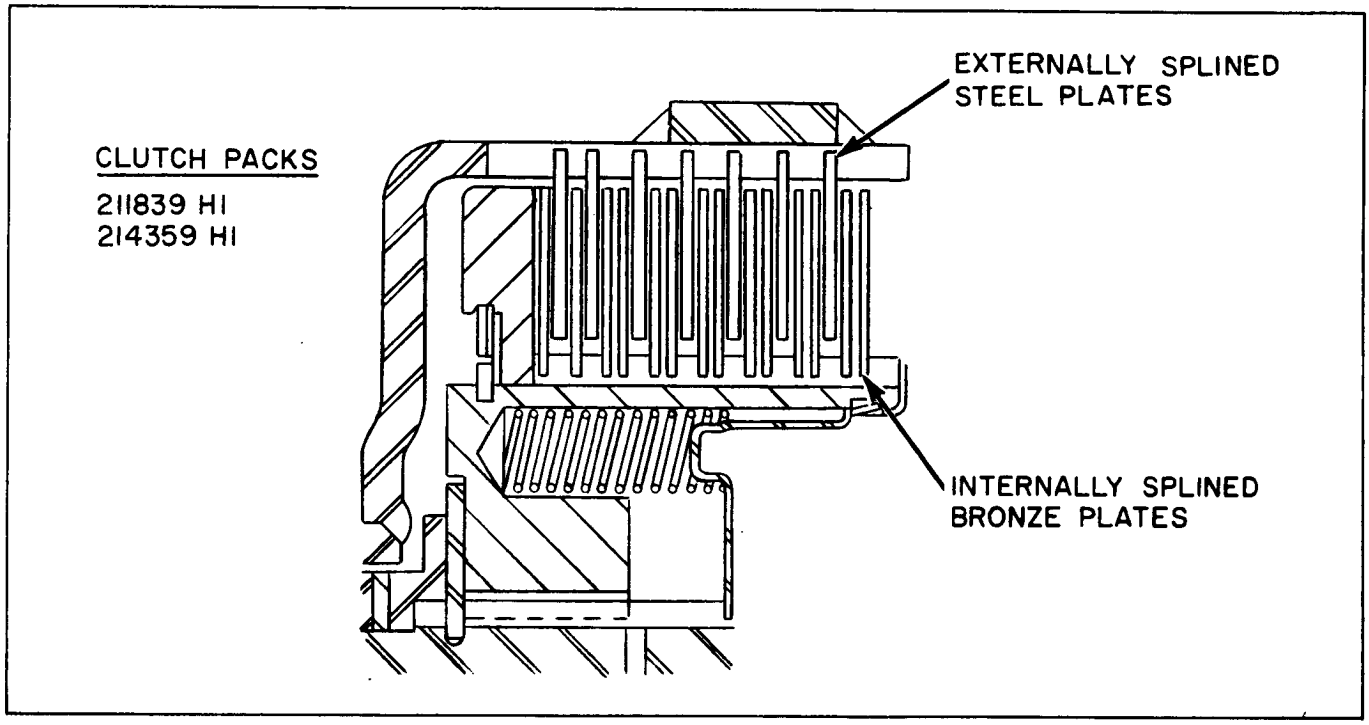

Figure 5-2

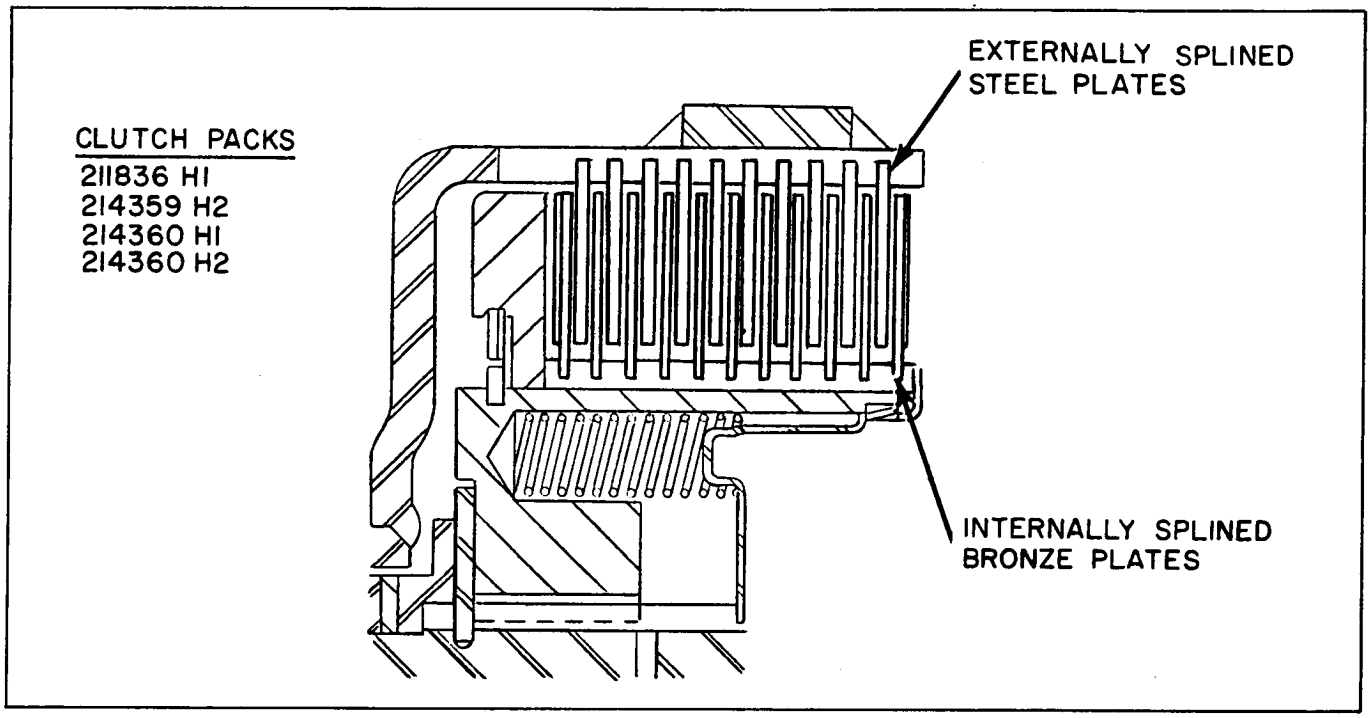

Figure 5-3

NOTE: Only clutch assemblies equipped with needle bearings may be stacked as shown in Fig. 5-3.

SECTION VI
SPECIAL TOOLS

LIFTING TOOL

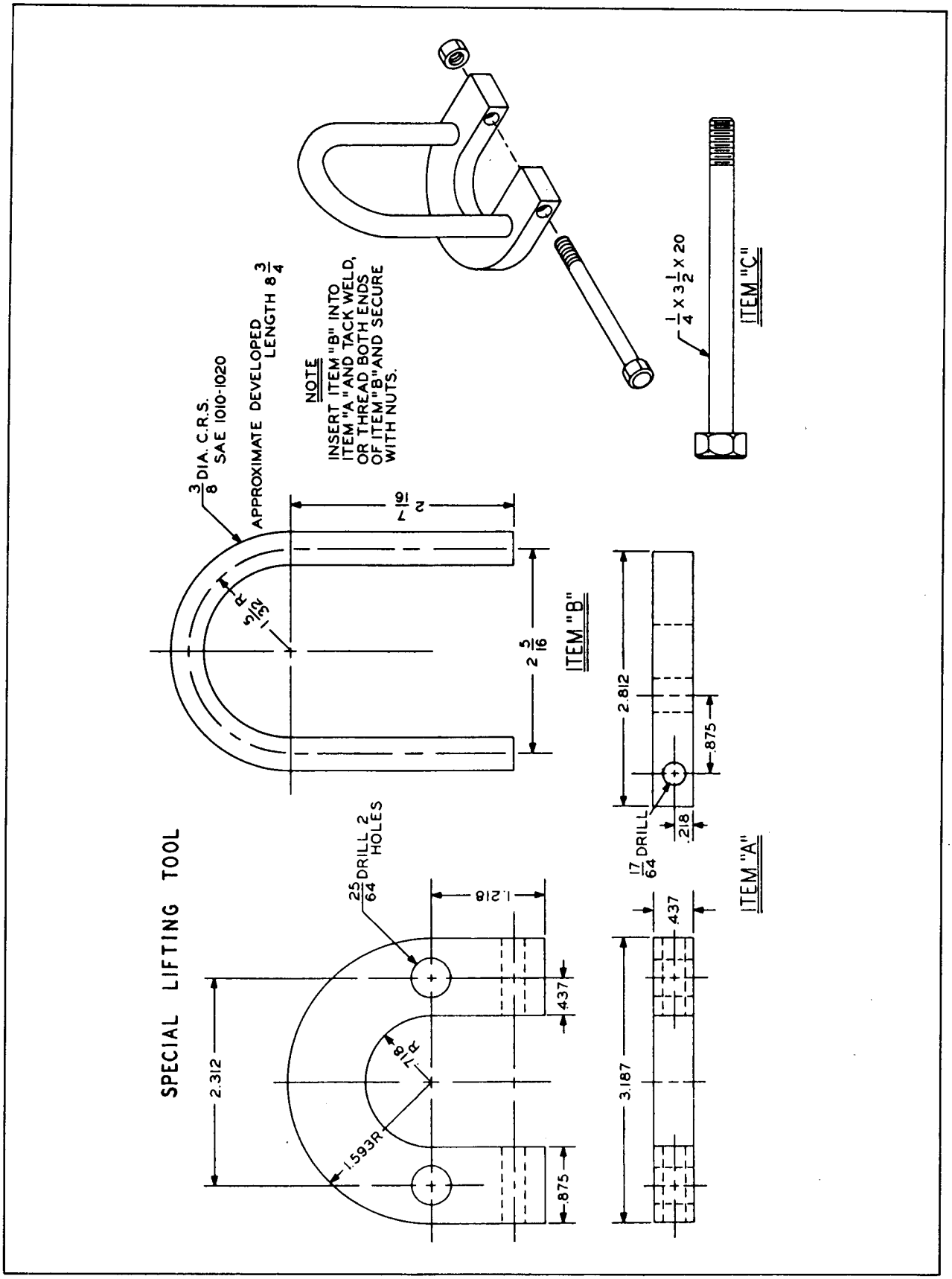

Figure 6-1
Lifting Tool.

SPECIAL TOOLS

SNAP RING GROOVE FILLER

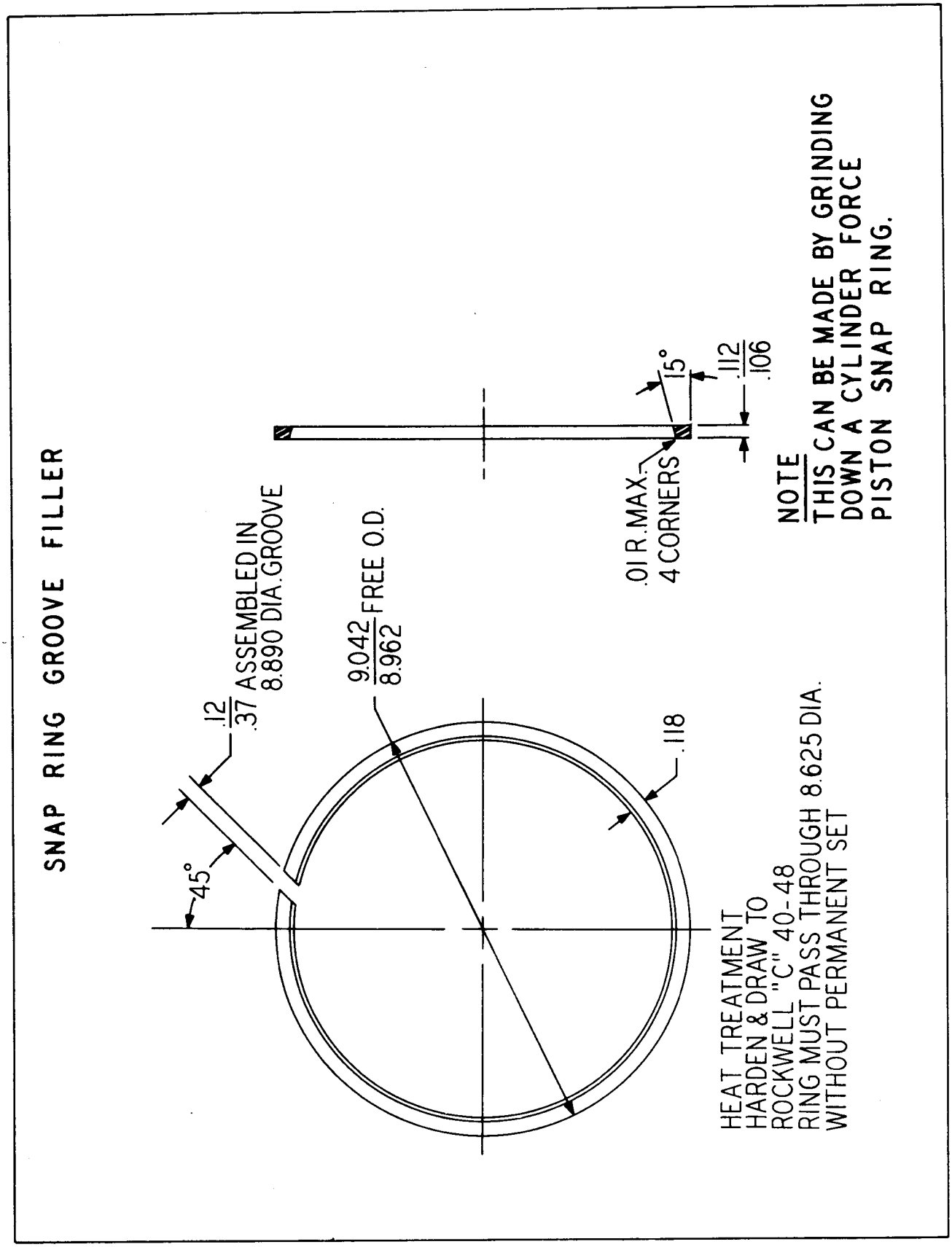

Figure 6-2
Snap Ring Groove Filler.

MEMORANDA

MEMORANDA

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