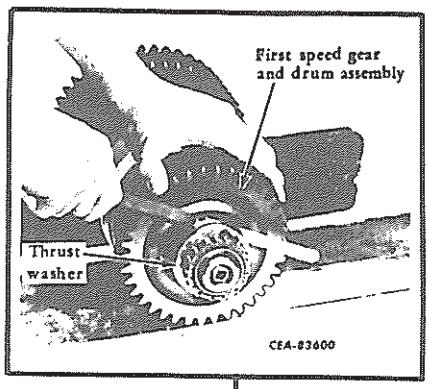
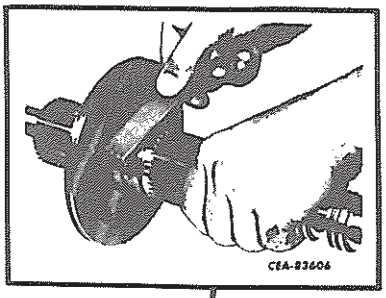
GENERAL

TD-15C AND MODEL 175C POWER SHIFT TRANSMISSION SERVICE CHART

HI-LO SHIFTER LEVER POPPET SPRING

Free Length	Test Length	Test Load	No. of
50.8 mm (2 in)	71.44 mm (1-13/16 in)	2.3-3.2 kg (5-7 lbs)	12 Coils

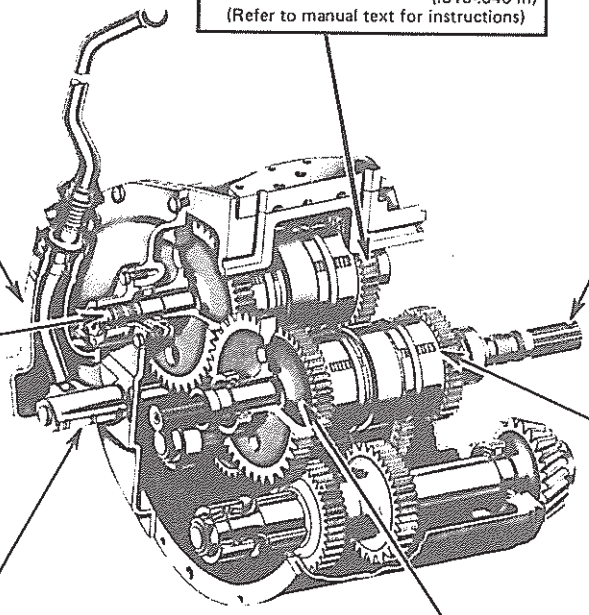


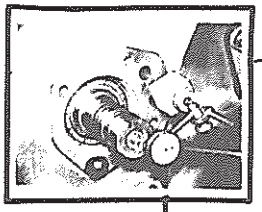


Clutch pack gear and drum assembly end play:
New clutch pack assy . . 0.254-0.762 mm (.010-.030 in)
Used clutch pack assy . 0.254-1.016 mm (.010-.040 in)
(Refer to manual text for instructions)

CLUTCH SHAFT

Using an oilstone, remove any burrs that might damage sealing surfaces or increase wear to close tolerance parts.

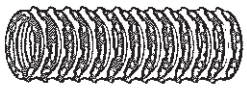




Reverse clutch shaft
end play . . . . . 0.762-1.016 mm (.030-.040 in)
(Refer to manual text for instructions.)

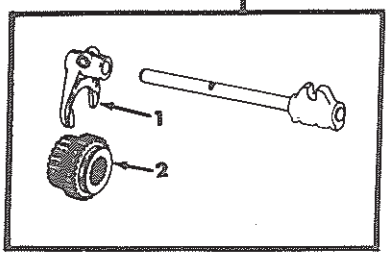
CLUTCH PLATES

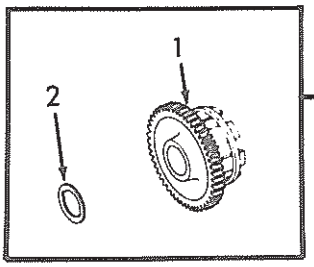
Inspect clutch plates for excessive wear and warpage.
Minimum allowable thickness for internally splined bronze clutch plates
. . . . . 1.27 mm (.050 in)



HI-LO SHIFTER FORK AND DRIVING GEAR

Inspect the hi-lo shifter fork fingers for misalignment or wear and the shifter fork slot in the driving gear for wear.
1. Width of shifter fork fingers . . 9.27-9.53 mm (.365-.375 in)
2. Width of slot in driving gear . . 9.65-9.91 mm (.380-.390 in)





FIRST AND SECOND SPEED DRIVE GEAR, BUSHING AND THRUST WASHER

1. Inspect the first and second speed drive gear and drum assemblies for excessive wear or damage.
2. Thrust washer minimum allowable thickness:
   First speed drive gear . . . . . .8.59 mm (.338 in)
   Second speed drive gear . . . . . .1.37 mm (.054 in)

PRINTED IN UNITED STATES OF AMERICA

CE-104088A

GENERAL

1. DESCRIPTION

The power shift transmission is designed to provide high speed shifting by the use of hydraulic actuated clutches. The transmission has two forward and two reverse speeds in low range and two forward and two reverse speeds in high range. Shifting from one range to another is controlled by the hi-lo shifting lever mounted on the transmission front cover.

The transmission is coupled by a universal joint to the torque converter which is attached to the flywheel on the engine. Gears are mounted on four shafts; the reverse clutch shaft, the forward clutch shaft, the spline shaft and the bevel pinion shaft.

The range selector valve which is hydraulically controlled is mounted on the transmission case. The transmission gear selector lever aligns ports in a pilot control valve which directs oil to operate the spool type range selector valve used to select the various transmission gear ranges.

Bevel Pinion Shaft

The shaft consists of the high and low range gears which are keyed to the shaft. The shaft is supported at the rear by a straight roller bearing and at the front by a double-row taper roller bearing. The pinion gear is splined to the rear of the pinion shaft and held in place by a nut.

Spline Shaft

The spline shaft rotates on two straight roller bearings. The rear bearing is mounted in the transmission case and the front bearing is in the transmission cover. The first and second speed driven gears are held in position on the spline shaft by snap rings and are in constant mesh with the first and second speed drive gears on the clutch shafts. The hi-lo driving gear slides freely on the shaft and drives the bevel pinion shaft when brought into mesh with the high or low range driven gear by the use of the hi-lo shifting lever.

Forward and Reverse Clutch Shafts

The forward clutch shaft rotates on a straight roller bearing at the rear and a ball bearing at the front. The reverse clutch shaft has a straight roller bearing at each end. The reverse drive gear is keyed to the front of the forward clutch shaft and the reverse driven gear is keyed to the front of the reverse clutch shaft.

Each shaft consists of first and second speed drive gears which ride on caged roller bearings and are welded to the dual hydraulic clutch pack assemblies.

Forward and Reverse Hydraulic Clutch Operation

The hydraulic clutch is actually two clutches on a common shaft with a common apply force piston between them. The clutches allow the simple transfer of oil from the disengaged clutch to the cavity created by the engaging clutch. This allows a low volume of main pressure to actuate the clutch for high speed shifting.

The heart of the clutch is contained in two pistons; the accelerator piston and the force piston. Pump oil volume is not needed to fill the applying clutch cavity and only a relatively low volume is needed to pressurize the clutch.

In neutral, all accelerator and force piston cavities are filled with oil at lube pressure 69 to 172 kPa (10 to 25 psi). A selector valve, located on the top of the transmission case, directs the oil to the accelerator piston cavities and, in turn, to the force piston cavities. From this valve, oil is directed through the inside of a tube pressed in the clutch shaft and a cross drilled shaft hole and on the outside of the tube and through a cross drilled shaft hole to fill both clutch piston cavities. Once the pistons are filled with oil, they remain full under lube pressure. Other small cross drilled shaft holes furnish a constant supply of lube oil to the bearings beneath the drive gear and drum assemblies and to the clutch hubs for distribution through the clutch plates. In neutral, neither clutch is engaged; the drive

TRANSMISSION (POWER SHIFT)

GENERAL

1. DESCRIPTION — Continued

Forward and Reverse Hydraulic Clutch Operation — Continued

gear and drum assemblies are free and no torque is transferred through the clutch (Fig. 1).

Upon application of a clutch, main oil pressure (approx. 1379-1586 kPa (200 to 300 psi) is directed through the clutch shaft for the specific side of the clutch desired and enters the accelerator piston cavity. In Fig. 2, main oil pressure enters the accelerator piston (A) through the cross drilled hole in the clutch shaft. During this phase, main pressure also lubricates the clutch plates and the bearings under the drive gear and drum assembly on the activated side.

NOTE: Lube oil pressure remains in the cavities (C and D) on the unapplied side and lubricates the clutch plates and bearings under the drive gear and drum assembly.

Oil entering the accelerator piston cavity (A) performs three functions: (1) Forces the accelerator piston, reinforcing disc and disc valve against the separator plate: (2) Forces the accelerator piston to push the guide pins against the opposite accelerator piston, positioning this piston, reinforcing disc and disc valve away from teh separator plate; (3) Starts to move the force piston to the right. As a result, the force piston cavity (B) expands and the area in the opposite force piston cavity (C) contracts in an equal amount. At this time, oil in the nonapplied force piston cavity (C) enters the holes in the separator plate, pushes open the disc valve and enters the applying force piston cavity (B). This fill pressure puts the clutch in its primary engagement position. Simultaneously, main oil pressure passes through the orifice in the applied accelerator piston and pressurizes the force piston cavity (B). When the force piston cavity is pressurized, the clutch is in its full engaged position. The reinforcing disc and disc valve in area "B" are now flat against the separator plate.

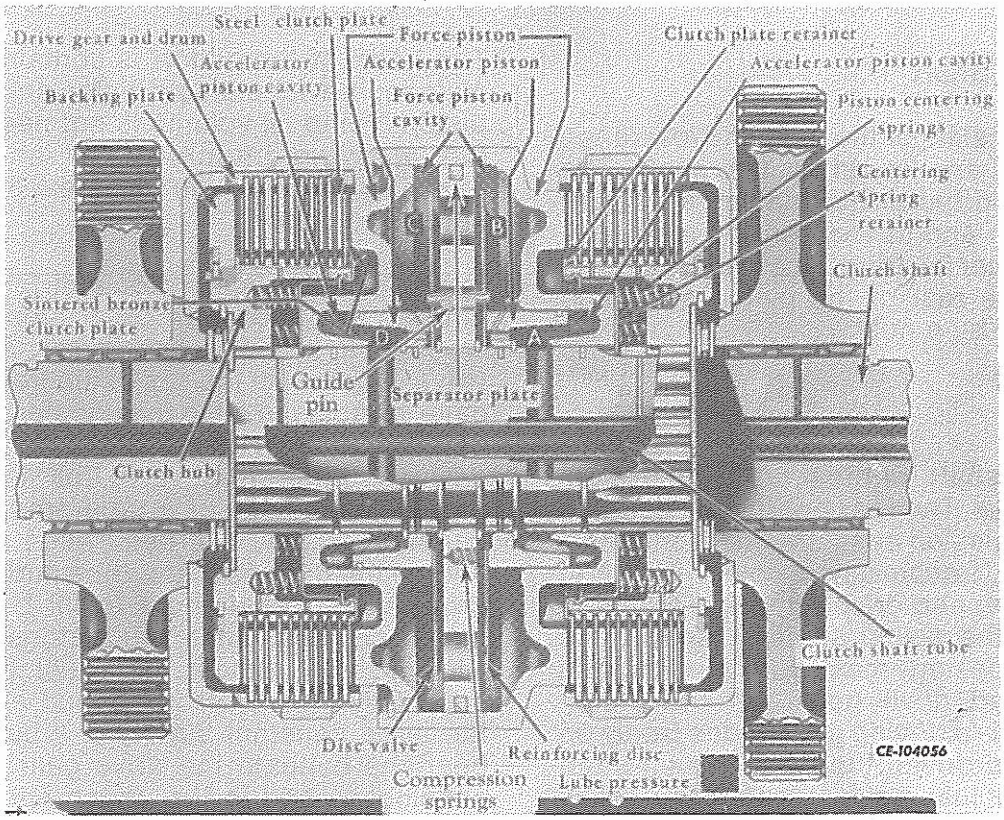


FIG. 1 — Flow of Oil Through Clutch in Neutral Position

GENERAL

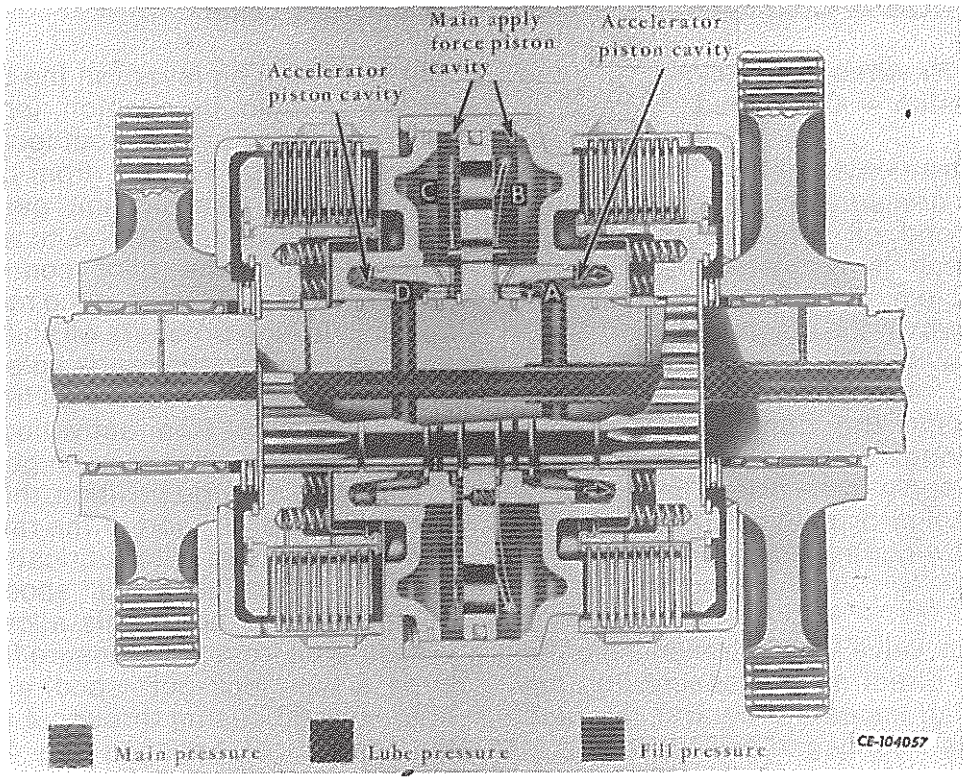


FIG. 2 — Flow of Oil Through Clutch in Travel Position

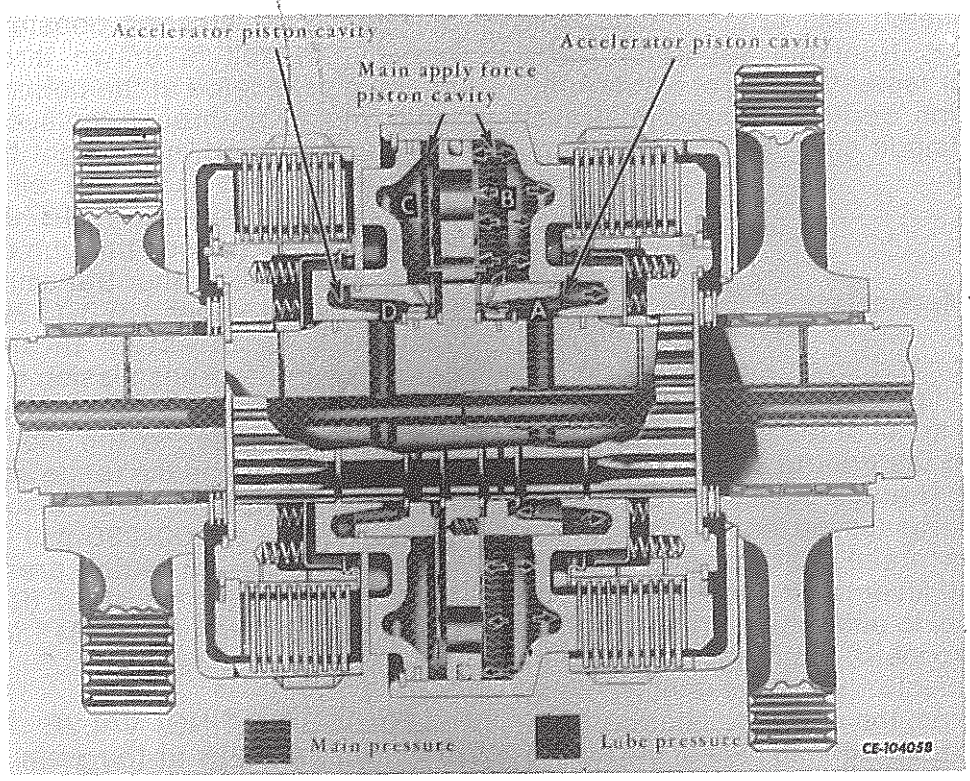


FIG. 3 — Flow of Oil Through Clutch in Engaged Position

TRANSMISSION (POWER SHIFT)

GENERAL

1. DESCRIPTION — Continued

Forward and Reverse Hydraulic Clutch Operation — Continued

When the transmission is returned to neutral, main pressure on the applied clutch is released and oil pressure in the disengaged clutch is regulated by the lube pressure system. An immediate pressure drop occurs within the disengaging accelerator piston cavity (A).

Simultaneously, the compressed piston centering springs in the clutch hub return the common apply force piston to its axially centered position or neutral. Lubrication of all parts is now controlled by the lube pressure system.

If the selector valve of the transmission is positioned to direct main pressure into the left hand clutch instead of neutral, the right hand clutch is disengaged and the left hand clutch is immediately applied.

NOTE: Compression springs located in bored holes in the separator plate are used to keep the reinforcing disc and disc valve on the unactivated side of the clutch pack assembly away from the separator plate. This allows for faster transfer of oil between the force piston cavities during the "travel phase" resulting in smoother clutch operation.

Gearshifter Mechanism

The gearshift hand lever, located at the left hand side of the operator, is directly connected to the spool of the pilot control valve located within the control tower. This valve is connected through hoses to the range selector valve assembly on the top of the transmission case. Movement of the gearshift hand lever positions the pilot control valve spool to allow main pressure oil to activate the spool (of the range selected) in the range selector valve assembly. Main pressure oil from the pressure filter outlet is then allowed to engage the side of the clutch pack selected (Fig. 4).

Hi-Lo Shift Lever

The hi-lo shifting lever (on the transmission cover) is held in position (only with the engine running by a poppet lock in the hi-lo shifter housing. To shift from one range to another, the transmission gearshift lever must be in "neutral." At this time, main pressure oil from the pilot control valve is directed to the "R" port of the range selector valve. This high pressure oil shifts the "lock-out" spool within the range selector valve to prevent the main pressure oil from the pressure filter outlet from activating the poppet lock. When the transmission gearshift lever is moved to a range position, the main pressure oil at the "R" port of the range selector valve is replaced with lubricating pressure oil allowing the "lock-out" spool to become centered in its bore. This allows the main pressure oil from the pressure filter outlet to bypass the "lock-out" spool and enter the hi-lo shifter housing through a tube to keep the poppet lock engaged (Fig. 4).

Hydraulic Oil Flow

The rear main frame is the source of supply for the oil that enters the transmission, torque converter, steering boosters and pivot brakes. The oil is drawn through an oil intake pipe located at the bottom of the rear main frame and through the suction filter by the pump located in the right hand side of the torque converter. The oil leaves the pump at approximately 1379-1586 kPa (200-230 psi), passes through the pressure filter, and enters the transmission case. From here, oil under 1379-1586 kPa (200-230 psi) is directed through drilled passages in the transmission case and the hydraulic valve spacer (mounted on the transmission case) to the main regulating valve assembly and the range selector valve assembly. Hydraulic lines also direct this 1379-1586 kPa (200-230 psi) pressure oil to the transmission clutch pressure gauge and to the steering boosters. (Refer to Section 8, "STEERING SYSTEM," for operation of the steering boosters.)

MAIN REGULATING VALVE ASSEMBLY: When oil pressure at the main spool valve exceeds 1586 kPa (230 psi), the valve

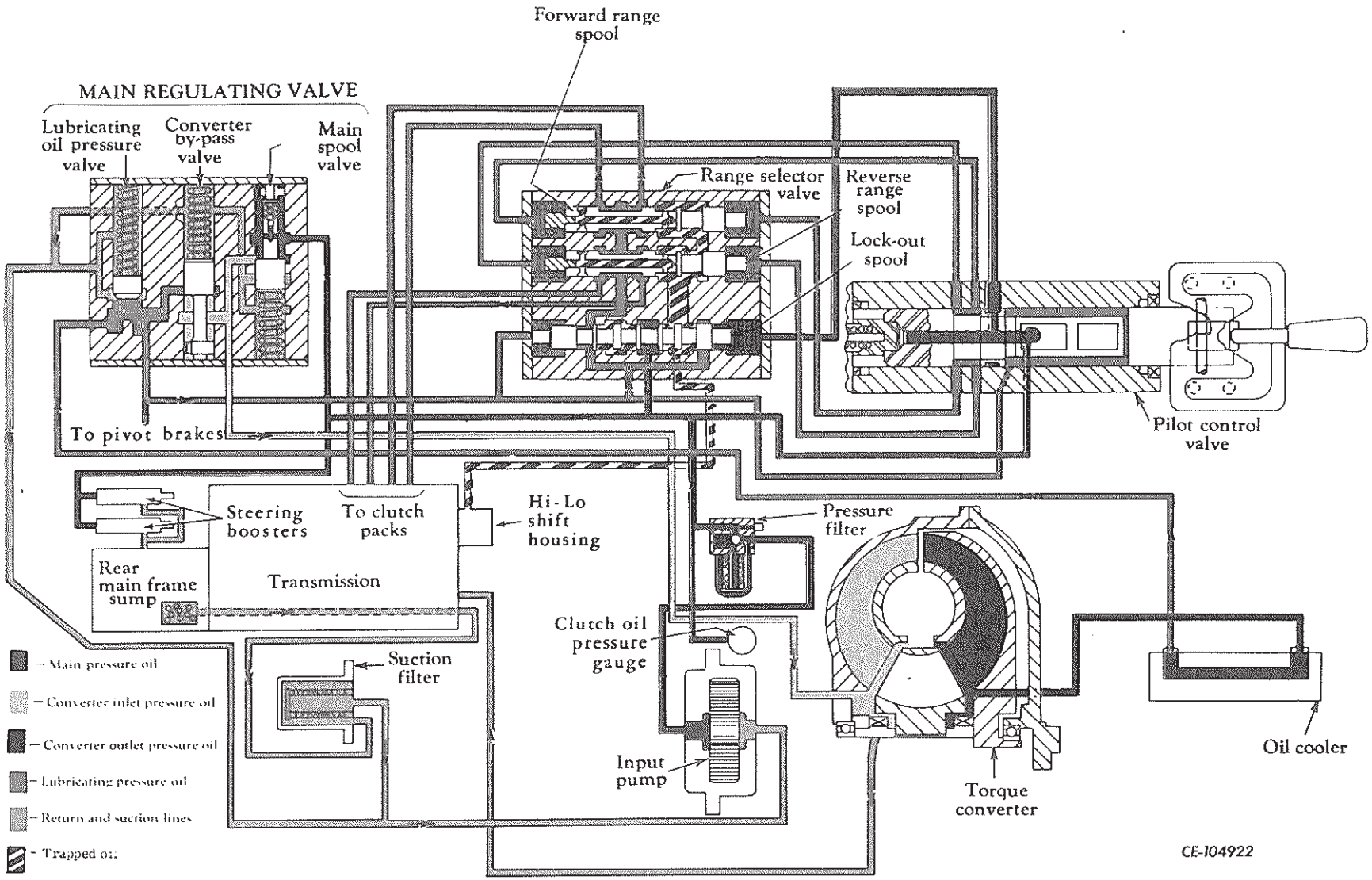


FIG. 4 — Hydraulic Oil Flow With Transmission in Neutral (Early Model)

TRANSMISSION (POWER SHIFT)

GENERAL

1. DESCRIPTION — Continued

Hydraulic Oil Flow — Continued

opens and allows the oil to enter the torque converter. The oil on the output side of the torque converter is directed through the oil cooler (mounted on the front of the radiator) and to the lubricating oil pressure valve in the main regulating valve housing. This oil cooler outlet oil along with any excess pressure oil from the converter bypass valve (in main regulating valve housing is directed through drilled passages to the range selector valve assembly. The lubricating oil pressure valve maintains the pressure of this oil between 69-172 kPa (10 to 25 psi). When the pressure exceeds 172 kPa (25 psi), the lubricating oil pressure valve opens and the excess oil is returned to the suction side of the converter input pump through a hose. Hydraulic lines connected to the top of the main regulating valve housing directs the lubricating pressure oil to the rear main frame for cooling the pivot brakes.

NOTE: For the flow of oil inside of the torque converter, refer to Section 6, "HYDRAULIC TORQUE CONVERTER."

RANGE SELECTOR VALVE ASSEMBLY: This assembly consists of a lock out spool and two range spools which are hydraulically controlled. The function of the lock out spool is to separate the lubricating pressure oil and the main pressure oil passages within the selector valve housing and to allow the main pressure oil to enter the range spools and the hi-lo shift housing when the transmission gearshift lever is placed in a speed range. With the gearshift lever in a speed range the lock out spool is centered in the housing by the springs and the equal oil pressure being exerted on each end of the spool. Under this condition, the main pressure oil from the pressure filter outlet is allowed to bypass the lock out spool to enter the range spools and the hi-lo shift housing. When the gearshift lever is moved to "neutral", the pilot control valve spool is positioned to allow main pressure oil to act on the end of the lock out spool. This pressure, being higher than the lubricating oil pressure at the opposite end of the spool, upsets the pressure balance and moves the spool to block the main pressure oil from the pressure filter outlet from entering the range selector valve assembley.

In "neutral", the range spools are centered in the housing by the springs and the equal oil pressure being exerted on each end of the spools. Under this condition, the oil from the lubricating oil pressure valve enters the openings not covered by the spoollands and, through internal passages, is diverted to the transmission clutch shafts to provide lubrication for cooling the clutch plates. Under all conditions, this lubricating pressure oil within the selector valve housing is also directed by a hose to the pilot control valve located inside the gearshifter tower. In "neutral", the main pressure oil supplied by the pressure filter outlet is kept from engaging the transmission clutch packs by the range spools and lockout spool. Under all conditions, main pressure oil from the range selector valve housing is directed by a hose to the pilot control valve.

PILOT CONTROL VALVE ASSEMBLY: This valve is manually operated by the gear selector hand lever. Main pressure oil from the range selector valve assembly enters the center of the control valve spool and exits through a cross drilled hole into the port of the valve housing to which it is aligned. Lubricating pressure oil from the range selector valve flows between the valve spool and the housing entering all ports not covered by the spool lands. This oil then exits through tubing and hoses to the ends of the range spools in the range selector valve assembly. In "neutral", the main pressure oil is directed through an outlet hose to the lock out spool in the range selector valve housing to shift the spool as described previously under "RANGE SELECTOR VALVE ASSEMBLY". When the gear selector hand lever is placed in a speed range, the pilot control valve spool is positioned to allow the main pressure oil to act upon the end of the range spool in the speed range selected. This pressure, being higher than the lubricating oil pressure at the opposite end of the spool, upsets the

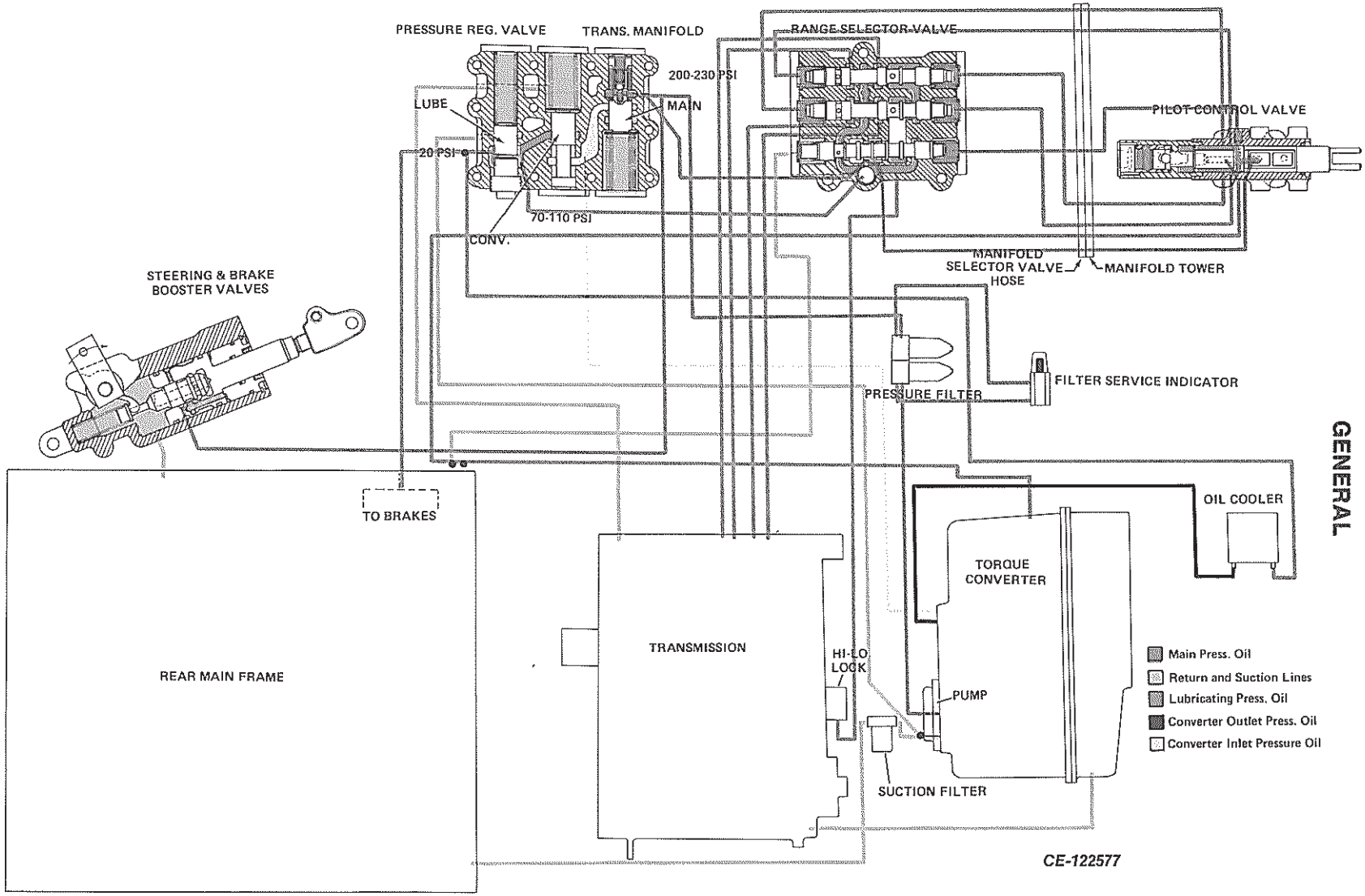


FIG. 4A — Hydraulic Oil Flow With Transmission in Neutral (Later Models)

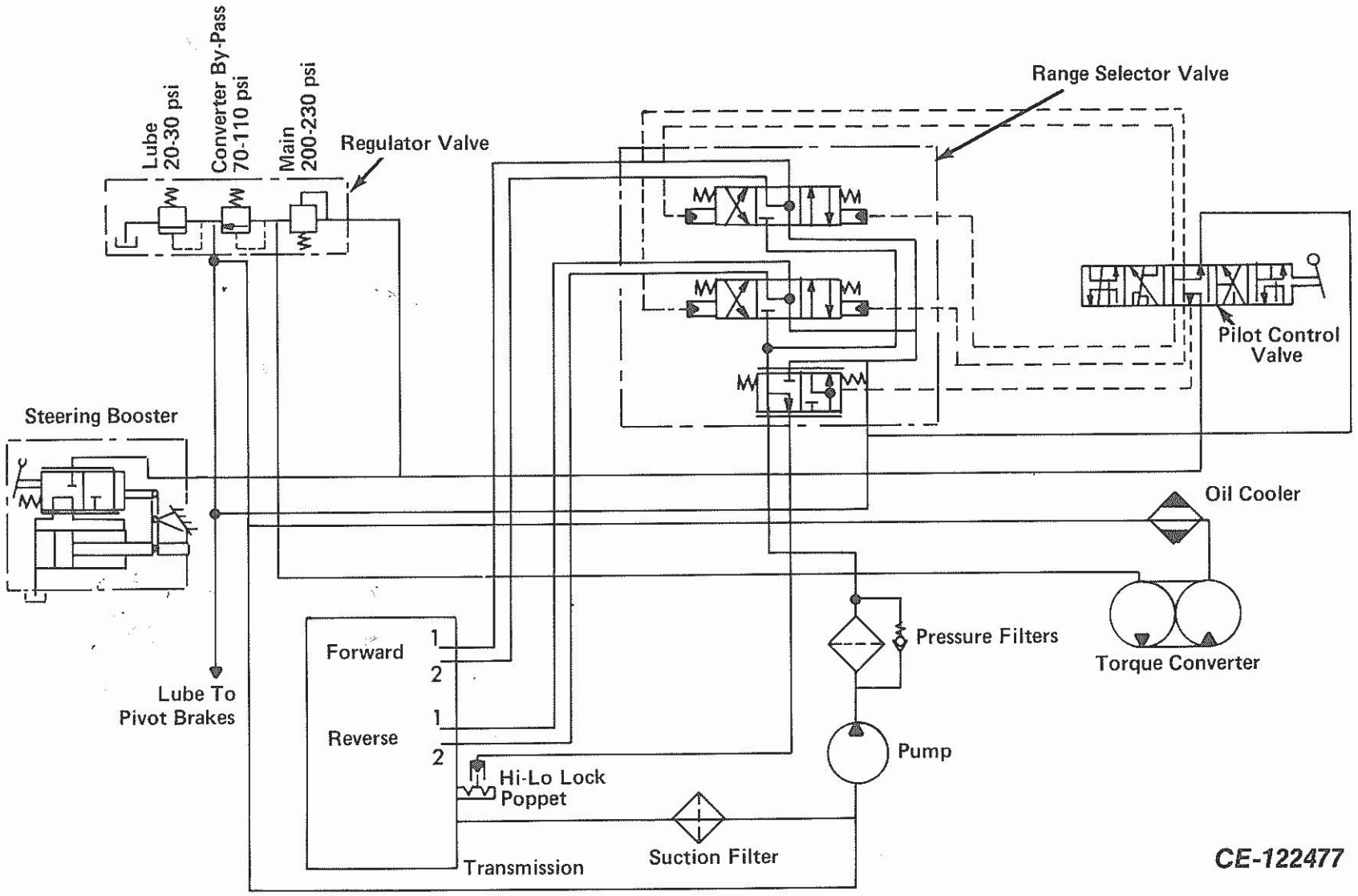


FIG. 4B — Transmission and Torque Converter Hydraulic Schematic

GENERAL

1. DESCRIPTION — Continued

Hydraulic Oil Flow — Continued

pressure balance and moves the spool. Also at this time, main pressure oil from the pressure filter outlet is allowed to bypass the lock out spool to enter the range selector valve housing. The main pressure oil within the range selector valve housing is then directed to the clutch shaft to engage the selected clutch pack (refer to "Forward and Reverse Hydraulic Clutch Operation" in this paragraph for the flow of oil after it enters the clutch shaft.)

2. SPECIFICATIONS

Transmission

Type	Power shift
Number of forward speeds	2*
Number of reverse speeds	2*

*Actually four speeds when used in conjunction with hi-lo shifting mechanism.

Forward and Reverse Clutch Packs

Number of internal splined clutch plates (sintered bronze):	
Forward clutch pack	26
Reverse clutch pack	22
Number of external splined clutch plates (steel):	
Forward clutch pack	24
Reverse clutch pack	20
Minimum allowable thickness for internally splined bronze clutch plates	1.27mm (0.050 in.)
Reverse clutch shaft end play	0.76-1.02mm (0.030-0.040 in.)
Second speed grive gear thrust washer minimum allowable thickness	1.37mm (0.054 in.)
First speed drive gear thrust washer minimum allowable thickness	8.59mm (0.338 in.)
Gear and drum assembly end play:	
New clutch pack assemblies	.254-.762mm (0.010-0.030 in.)
Used clutch pack assemblies	.254-1.016mm (0.010-0.040 in.)

Hi-Lo Shifter Fork and Driving Gear

Width of slot in driving gear	9.65-9.91mm (0.380-0.390 in.)
Width of shifter fork fingers	9.27-9.53mm (0.365-0.375 in.)

2. SPECIFICATIONS — Continued

Springs

	Free Length		Test Length		Test Load		Number
	Inches	mm	Inches	mm	lbf	N	of Coils
Main regulating valve:							
Main spool valve spring (internal)	59/64	23	21/32	16.7	3-1/2 to 4-1/2	15.6-20	12
Bypass valve spring	Approx. 3-21/32	93	2-15/64	56.7	74-1/2 to 82-1/2	331.4-367	10-3/4
Main regulating spring (outer)	3-21/64	84.5	2-5/32	54.8	121 to 134	538.2-596.1	10
Pressure regulating spring (inner)	3	76	2-5/32	54.8	43	191.3	13-1/2
Lube valve spring	4-1/8	105	2-13/64	56.0	13-1/2 to 15-1/2	60.1-69	15
Pilot control valve indexing spring	31/32	25	21/32	16.7	18-3/4	83	10
Range selector valve centering springs	1.323	33.60	1	25.4	20	89	6-1/2
Hi-lo shifter lever poppet spring	2	50.8	1-13/16	46.0	5-7	22.2-31	12
Clutch pack release springs:							
Inner	.299	7.60	.180	4.57	2	8.9	7
Outer	.250	6.35	.180	4.57	12	53.4	4

Special Bolt and Nut Torque Data
(Torques given are for bolts and nuts lubricated with SAE-30 engine oil)

Spline shaft nut	678-745 N.m (500-550 lbf ft)
Bevel pinion shaft front nut	678-745 N.m (500-550 lbf ft)
Bevel pinion shaft rear nut	678-745 N.m (500-550 lbf)
Bevel pinion shaft front bearing retainer	420-461 N.m (310-340 lbf ft)
Safety filter mounting bolts (if equipped)	22-24 N.m (16-18 lbf ft)
Suction filter mounting bolts	54-61 N.m (40-45 lbf)
Range selector valve range spool plugs	7-9 N.m (5-7 lbf ft)
Range selector valve mounting bolts	32-54 N.m (24 lbf ft)
Pilot control valve detent housing capscrews	26-28 N.m (19-21 lbf ft)
Pilot control valve spool extension	7-9 N.m (5-7 lbf ft)
Transmission mounting bolt	342-418 N.m (252-308 lbf ft)

GENERAL

3. SERVICE DIAGNOSIS

COMPLAINT	PROBABLE CAUSE	REMARKS
Low Clutch Pressure (Gauge on Dash)		
	1. Low oil level	Check level in rear main frame and fill as necessary. Check for excessive leaks and tighten or replace parts as necessary.
	2. Plugged suction or pressure filter	Clean suction filter, replace pressure filter elements.
	3. Air leakage into hydraulic suction lines	Apply shave cream to all connections and tighten connections where cream disappears.
	4. Low transmission pressures	Refer to Par. 4, "CHECKING DRIVE TRAIN OIL PRESSURE."
	5. Pressure gauge malfunction	Refer to Par. 4, "CHECKING DRIVE TRAIN OIL PRESSURE." If pressures are correct, replace gauge.
High Clutch Pressure (Gauge on Dash)		
	1. High transmission pressure	Refer to Par. 4, "CHECKING DRIVE TRAIN OIL PRESSURE."
	2. Pressure gauge malfunction	Refer to Par. 4, "CHECKING DRIVE TRAIN OIL PRESSURE." If pressures are correct, replace gauge.
High Torque Converter Oil Temperature (Gauge on Dash)		
	1. Operating too long in low efficiency ranges	Review operating instructions in the Operator's Manual.
	2. Low clutch pressure	Refer to "Low Clutch Pressure" in this chart.
	3. Clogged oil cooler	Remove and clean.
	4. Clogged transmission suction screen	Remove and clean.
	5. Clogged or restricted torque converter oil scavenge line	Clean and check for correct routing.
	6. Steering drive disc slipping	Refer to Par. 8, "DRIVE TRAIN FUNCTIONAL CHECK."
	7. Temperature gauge malfunctions	Replace gauge or sending unit.

TRANSMISSION (POWER SHIFT)

GENERAL

3. SERVICE DIAGNOSIS — Continued

COMPLAINT

PROBLEM	PROBABLE CAUSE
Loss of Power Under Load	
1. Low oil level	Check level in rear main frame and fill as necessary. Check for excessive leaks and tighten or replace parts as necessary.
2. Low transmission pressure	Refer to Par. 4, "CHECKING DRIVE TRAIN OIL PRESSURE."
3. Engine not up to rated performance	Refer to Par. 7, "TORQUE CONVERTER STALL SPEED CHECK."
4. Slipping transmission clutch packs	Refer to Par. 8, "DRIVE TRAIN FUNCTIONAL CHECK."
5. Steering drive disc slipping	Refer to Par. 8, "DRIVE TRRAIN FUNCTIONAL CHECK."
Slow or Erratic Clutch Engagement	
1. Low oil pressure	Refer to Par. 4, "CHECKING DRIVE TRAIN OIL PRESSURE."
2. Binding of main pressure spool in regulator valve housing	Check spool.
3. Sticky spools in selector valve	Clean valve bore and spools.
Transmission Shift Lever Jumps Out of Gear	
1. Clogged drain line on pilot control valve.	Remove and clean or replace.
No First or Second Forward Speed	
1. Pilot control valve malfunction	Refer to Par. 5, "DIRECTIONAL PRESSURE CHECK."
2. Binding forward spool in range selector valve	Remove covers and check spool movement.
3. Transmission forward clutch pack malfunction	Remove and check.

GENERAL

3. SERVICE DIAGNOSIS — Continued

COMPLAINT	PROBABLE CAUSE	REMARKS
No First or Second Reverse Speed		
	1. Pilot control valve malfunction	Refer to Par. 5, "DIRECTIONAL PRESSURE CHECK."
	2. Binding reverse spool in range selector valve	Remove covers and check spool movement.
	3. Transmission reverse clutch pack malfunction	Remove and check.
High Low Shift Lever Will Not Move in Neutral with Engine Running		
	1. Hydraulic detent not released	Refer to Par. 6, "LOCK OUT SPOOL PRESSURE TEST."
	2. High low shift machincal malfunction	Remove shifter housing and inspect.
Machine Fades to One Side		
	1. RH or LH steering disc slipping	Refer to Par. 8, "DRIVE TRAIN FUNCTIONAL CHECK."
Machine Will Not Pivot to One Side		
	1. Steering lever linkage out of adjustment	Refer to the Operator's Manual.
	2. Steering drive disc not being released	Refer to Par. 8, "DRIVE TRAIN FUNCTIONAL CHECK."
Machine Will Not Move		
	1. Low transmission oil pressures	Refer to Par. 4, "CHECKING DRIVE TRAIN OIL PRESSURES."
	2. Slipping transmission clutch packs	Refer to Par. 8, "DRIVE TRAIN FUNCTIONAL CHECK."
	3. Pivot brakes not releasing	Refer to Par. 8, "DRIVE TRAIN FUNCTIONAL CHECK."

TRANSMISSION (POWER SHIFT)

TESTS AND ADJUSTMENTS

4. CHECKING DRIVE TRAIN OIL PRESSURE

CAUTION: The brake pedal must be applied and locked and the manual hi-lo shift lever must be in neutral position until all pressure checks have been completed and the engine is shut off.

1. Remove the rear platform and connect the "Power Shift Test Kit" PLT-872 to the test parts shown in Fig. 4C or 4D.

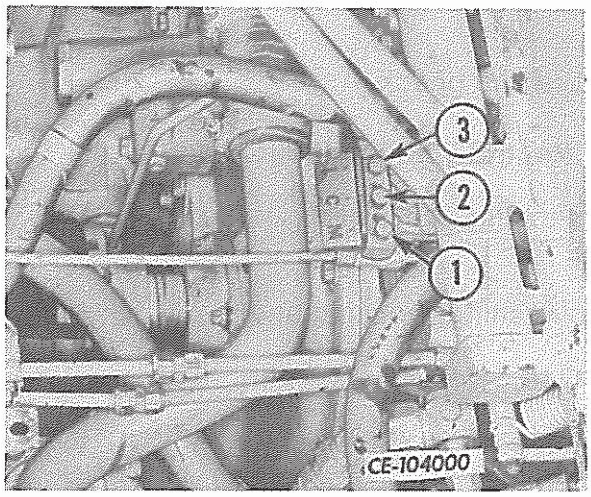


FIG. 4C — Transmission Oil Pressure Check Points With Plugs

1. Clutch main pressure
2. Converter inlet pressure
3. Lubricating oil pressure

IMPORTANT: *The following pressure checks should be performed with the engine running at full throttle and oil at operating temperature. To obtain operating temperature, shift the hi-lo shifter to "Hi" and the transmission to second forward with the foot brake applied until the temperature gauge pointer reaches the high side. Then shift to neutral until the temperature pointer drops to the midpoint. Repeat this procedure approximately ten times.*

2. Run the engine at full throttle in neutral, 1st forward, 2nd forward, 1st reverse and 2nd reverse and check the gauge readings in each gear range with those shown in the following chart.

3. If pressures meet specifications, proceed with Par. 5, "DIRECTIONAL PRESSURE CHECK."

4. If pressures do not meet specifications, refer to the following "DIAGNOSTIC CHECK".

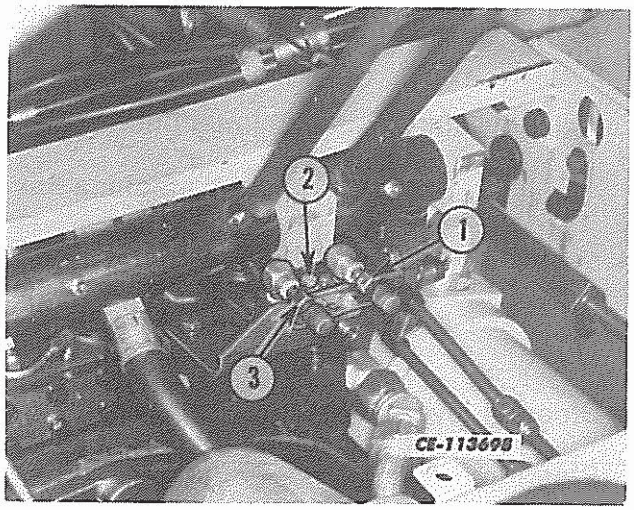


FIG. 4D — Transmission Oil Pressure Check Points With Quick Disconnects

1. Clutch main pressure
2. Converter inlet pressure
3. Lubricating oil pressure

TESTS AND ADJUSTMENTS

4. CHECKING DRIVE TRAIN OIL PRESSURE — Continued

Gear Range	Lub.	Conv.	Main
Neutral	140-240 kPa (20-35 psi)	485-825 kPa (70-120 psi)	1380-1585 kPa (200-230 psi)
1st Forward	140-240 kPa (20-35 psi)	485-755 kPa (70-110 psi)	1310-1515 kPa (190-220 psi)
2nd Forward	140-240 kPa (20-35 psi)	485-755 kPa (70-110 psi)	1310-1515 kPa (190-220 psi)
1st Reverse	140-240 kPa (20-35 psi)	485-755 kPa (70-110 psi)	1310-1515 kPa (190-220 psi)
2nd Reverse	140-240 kPa (20-35 psi)	485-755 kPa (70-110 psi)	1310-1515 kPa (190-220 psi)

DIAGNOSTIC CHART

PROBLEM	PROBLEM CAUSE
1. Low lube pressure in all gear ranges	a. Low converter inlet pressure (See Problem 3). b. Fatigued lube spring in regulator valve.
2. High lube pressure in all gear ranges	a. Range selector valve lock out spool malfunction. Refer to Par. 6, "LOCK OUT SPOOL PRESSURE TEST." b. Main regulating and range selector valve spacer mounting gasket leaking. c. Stuck lube bypass valve in regulator valve. d. Restricted regulator drain hose.
3. Low converter inlet pressure	a. Low main pressure (See Problem 5). b. Main regulator valve mounting gasket leaking c. Fatigued converter bypass spring in regulating value. d. Internal leak in converter. Check ground sleeve.
4. High converter inlet pressure	a. Blocked oil passage or lines. b. Restricted regular drain hose. c. Clogged oil cooler. d. Main regulating valve mounting gasket leaking.

TRANSMISSION

TESTS AND ADJUSTMENTS

4. CHECKING DRIVE TRAIN OIL PRESSURE—Continued

DIAGNOSTIC CHART

PROBLEM	PROBABLE CAUSE
4. High converter inlet pressure — Continued	e. Stuck converter bypass valve in regulating valve.
	f. Wrong number of shims at converter bypass spring. DO NOT USE MORE THAN ONE SHIM.
5. Low main pressure in all gear ranges	a. Low oil level
	b. Dirty suction or pressure filter.
	c. Leaking suction lines.
	d. Bad pump.
	e. Fatigued main springs in regulating valve.
	f. Wrong number of shims at main spring. Each shim will change the pressure approximately 34 kPa (psi). DO NOT USE MORE THAN A TOTAL OF FOUR SHIMS.
	g. Cold oil relief in regulator valve.
6. Low main pressure in 1st forward	a. Leaking seal ring (7 or 8, Fig. 4E)
7. Low main pressure in 2nd forward	a. Leaking seal ring (6 or 10, Fig. 4E)
8. Low main pressure and high lube pressure in 1st forward and 2nd forward	a. Leaking seal rings (9, Fig. 4E)
9. Low main pressure in 1st reverse	a. Leaking seal ring (1 or 5, Fig. 4E)
10. Low main pressure in 2nd reverse	a. Leaking seal ring (2 or 3, Fig. 4E)
11. Low main pressure and high pressure in 1st reverse and 2nd reverse	a. Leaking seal rings (4, Fig. 4E)

TRANSMISSION

4. CHECKING DRIVE TRAIN OIL PRESSURE — Continued

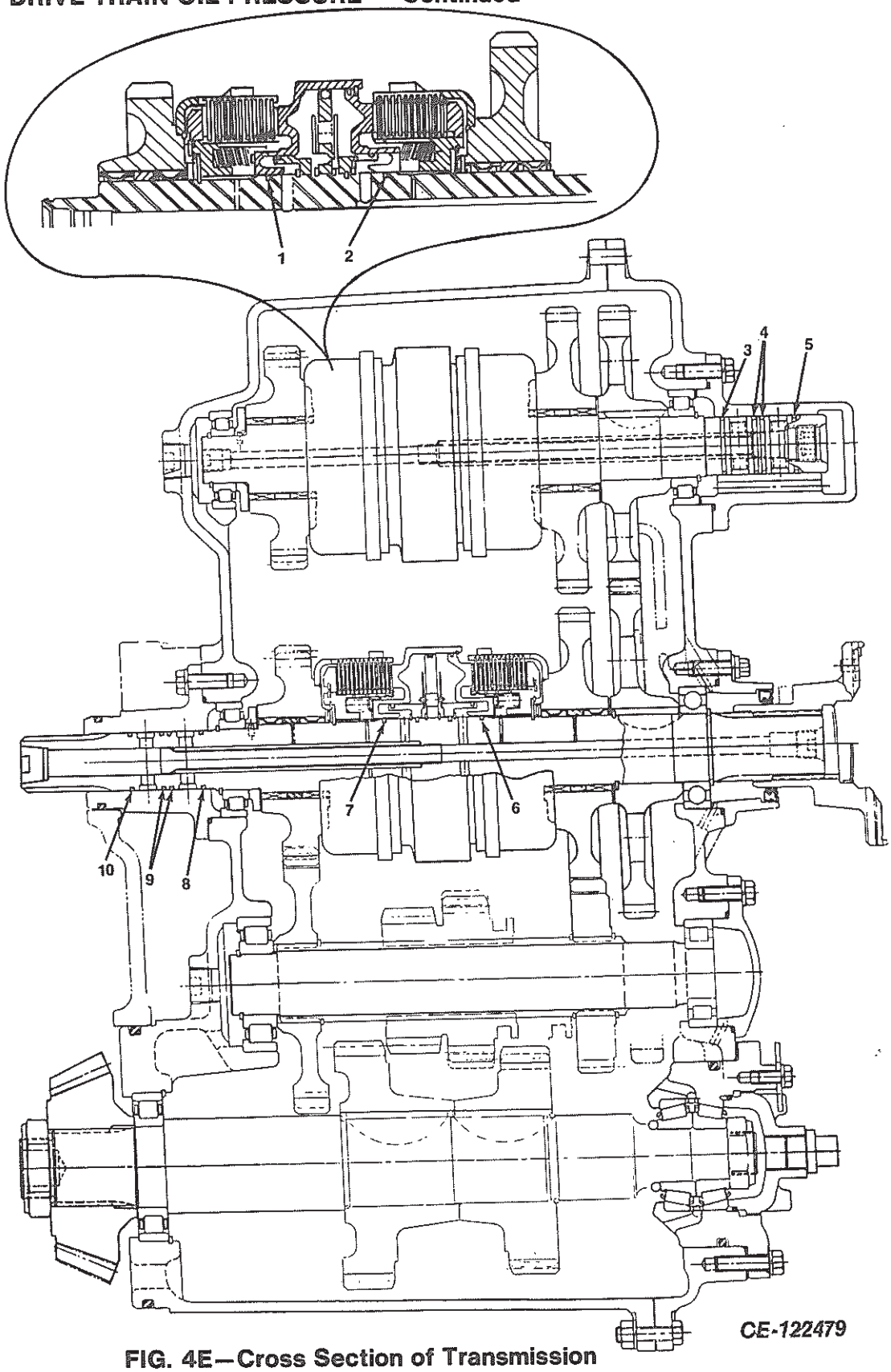


FIG. 4E—Cross Section of Transmission

TRANSMISSION

4. CHECKING DRIVE TRAIN OIL PRESSURE — Continued

Legend for Fig. 4E

1. 1st reverse piston seal ring
2. 2nd reverse piston seal ring
3. Manifold seal ring
4. Manifold seal ring
5. Manifold seal ring
6. 2nd forward piston seal ring
7. 1st forward piston seal ring
8. Manifold seal ring
9. Manifold seal ring
10. Manifold seal ring

5. DIRECTIONAL PRESSURE CHECK

CAUTION: The brake pedal must be applied and locked and the manual hi-lo shift lever must be in neutral position until all pressure checks here been completed and the engine is shut off.

1. Remove the rear platform and tee in the four 2758 kPa (400 psi) gauge of the "Power Shift Test Kit" PLT872 to the range selector "F1," "F2," "R1" and "R2" parts.

IMPORTANT *The following pressure checks should be performed with the engine running at full throttle and oil at operating temperature. To obtain operating temperature, shift the hi-lo shifter to "H," and the transmission to second forward with the foot brake applied until the temperature gauge pointer reaches the high side. Then shift to neutral until the temperature pointer drops to the midpoint. Repeat this procedure approximately ten times.*

2. Run the engine at full throttle in neutral, 1st forward, 2nd forward, 1st reverse and 2nd reverse and check the gauge readings in each gear range with those shown in the following chart.

3. If pressures meet specifications, the problem is in the range selector valve or in the transmission.

4. If pressures do not meet specifications, the problem is in the pilot control valve.

Gear Range	"F1" Port	"F2" Port	"R1" Port	"R2" Port
Neutral	140-240 kPa (20-35 psi)	140-240 kPa (20-35 psi)	140-240 kPa (20-35 psi)	140-240 kPa (20-35 psi)
1st Forward	1310-1515 kPa (190-220 psi)	140-240 kPa (20-35 psi)	140-240 kPa (20-35 psi)	140-240 kPa (20-35 psi)
2nd Forward	140-240 kPa (20-35 psi)	1310-1515 kPa (190-220 psi)	140-240 kPa (20-35 psi)	140-240 kPa (20-35 psi)
1st Reverse	140-240 kPa (20-35 psi)	140-240 kPa (20-35 psi)	1310-1515 kPa (190-220 psi)	140-240 kPa (20-35 psi)
2nd Reverse	140-240 kPa (20-35 psi)	140-240 kPa (20-35 psi)	140-240 kPa (20-35 psi)	1310-1515 kPa (190-220 psi)

TESTS AND ADJUSTMENTS

6. LOCKOUT SPOOL PRESSURE TEST

CAUTION: The brake pedal must be applied and locked and the manual hi-lo shift lever should be in neutral position until all pressure checks have been completed and the engine is shut off.

1. Remove the rear platform and tee in three of the 2758 kPa (400 psi) gauge of the "Power Shift Test Kit," PLT-872 to the range selector "S," "R" and "F" parts.

IMPORTANT: *The following pressure checks should be performed with the engine running at full throttle and oil at operating temperature. To obtain operating temperature, shift the hi-lo shifter to "Hi" and the transmission to second forward with the foot brake applied until the temperature gauge pointer reaches the high side. Then shift to neutral until the temperature pointer drops to the midpoint. Repeat this procedure approximately ten times.*

2. Run the engine at full throttle in neutral, 1st forward, 2nd forward, 1st reverse and 2nd reverse and check the gauge readings n each gear range with those shown in the following chart.

3. If pressures meet specifications, the problem is in the transmission.

4. If pressures do not meet specifications, refer to the following "DIAGNOSTIC CHART."

Gear Range	"S" Port	"R" Port	"F" Port
Neutral	0 kPa (0 psi)	Main Pressure 1380-1585 kPa (200-230 psi)	Lube Pressure 140-240 kPa (20-35 psi)
1st Forward, 2nd Forward, 1st Reverse, 2nd Reverse	Main Pressure 1310-1515 kPa (190-220 psi)	Lube Pressure 140-240 kPa (20-35 psi)	Lube Pressure 140-240 kPa (20-35 psi)

DIAGNOSTIC CHART

PROBLEM	PROBABLE CAUSE
1. Main pressure at "S" port, Lube pressure at "R" and "F" in Neutral	a. Pilot control valve malfunction
2. Main pressure at "S" and "R" Lube pressure at "F" in Neutral.....	a. Lock out spool binding
3. Higher pressure at "R" port than at "F" port in gear	a. Pilot control valve malfunction
4. Lube pressure at "R" and "F" port, 0 at "5" port in gear	a. Lock out spool binding

TRANSMISSION (POWER SHIFT)

TRANSMISSION

7. TORQUE CONVERTER STALL SPEED CHECK

1. Connect a "Snorkel Photo Tachometer" PLT-303-1.

CAUTION! Be sure the area in front and around the machine is clear of personel and obstructions as the machine may move during this check.

IMPORTANT: *The following check should be performed with the engine running at full throttle and oil at operating temperature. To obtain operating temperature, shift the hi-lo shifter to "Hi" and the transmission to second forward with the foot brake applied until the temperature gauge pointer reaches the high side. Then shift to neutral until the temperature pointer drops to the midpoint. Repeat this procedure approximately ten times.*

2. With the engine speed at full throttle and the foot brakes applied, shift the transmission into second forward and record the stall speed RPM. The correct stall speed for the TD-15C is 2150-2350 RPM and for the 175C is 2350-2500 RPM.

3. If the stall speed meet specifications, proceed with Par. 8, "DRIVE TRAIN FUNCTIONAL CHECK."

4. If the stall speed does not meet specifications, refer to the following "DIAGNOSTIC CHART."

DIAGNOSTIC CHART

PROBLEM	PROBABLE CAUSE
1. Stall speed too high	a. Wrong injection pump for application. b. Injection pump defective or improperly adjusted. c. Excessive injection pump fuel delivery (over fueling). d. Torque converter malfunction. e. Test equipment malfunctioning.
2. Stall speed too low	a. Wrong injection pump for application. b. Injection pump defective or improperly adjusted c. Aneroid inoperative. d. Insufficient injection pump fuel delivery (under fueling). e. Injection nozzle defective or wrong nozzle. f. Fuel injection lines wrong or defective. g. Fuel filter restricted. h. Insufficient fuel supply. i. Fuel not meeting specifications. j. Defective or incorrect turbocharger for application. k. Air induction system restricted. l. Excessive exhaust system restricted. m. Possible engine rebuild required. n. Torque converter malfunction.

TESTS AND ADJUSTMENTS

8. DRIVE TRAIN FUNCTIONAL CHECK

NOTE: Before performing the drive train functional check, the drive train oil pressures must be checked. Refer to Par. 4, "CHECKING DRIVE TRAIN OIL PRESSURES."

CAUTION: The machine may move during the following test.

1. Remove the platform.

2. Start the engine, set the engine speed at full throttle and fully apply the foot brake and shift the hi-lo shift lever to "Hi."

3. With the steering levers in the drive position and the transmission in second forward and second reverse, check for sprocket or "U" joint rotation.

4. With the steering levers in a pivot left turn and the transmission in second forward, check for sprocket or "U" joint rotation.

5. With the steering levers in a pivot right turn and the transmission in second forward, check for sprocket or "U" joint rotation.

6. The sprocket and "U" joint should not rotate during steps 3 through 5. If one or the other rotates refer to the following "DIAGNOSTIC CHART."

DIAGNOSTIC CHART

PROBLEM	PROBABLE CAUSE
1. Sprocket stationary but "U" joint turns in all transmission ranges when steering levers are in drive position	Steering drive disc slipping in rear main frame.
2. Sprocket stationary but "U" joint turns in second forward only	Second forward clutch pack slipping in transmission.
3. Sprocket stationary but "U" joint turns in second reverse only	Second reverse clutch pack slipping in transmission.
4. Sprocket stationary but "U" joint turns in pivot left turn only	Right hand steering drive disc slipping in rear main frame.
5. Sprocket stationary but "U" joint turns in pivot right turn only	Left hand steering drive disc slipping in rear main frame.
6. Sprocket rotates	Steering brake slipping.

TRANSMISSION

8A. REMOVAL

IMPORTANT: *Before removing the transmission, review Par. 3, "SERVICE DIAGNOSIS" and perform the tests in Par. 4, "CHECKING DRIVE TRAIN OIL PRESSURE," Par. 5, "DIRECTIONAL PRESSURE CHECK," Par. 6, "LOCK OUT SPOOL PRESSURE TEST," Par. 7, "TORQUE CONVERTER STALL SPEED CHECK" and Par. 8, "DRIVE TRAIN FUNCTIONAL CHECK." In this manner, hydraulic and mechanical malfunctions can be pinpointed and corrected at time of teardown.*

CAUTION! Be sure the blade or bucket has been lowered to the ground. Before removing the drain plug from the hydraulic tank loosen the filler cap slowly to relieve the built-up pressure.

NOTE: Disconnected hydraulic lines must be capped with the correct size plastic cap. If caps are not available, use tape or rubber stoppers. Openingshmust never be plugged with rags. This practice could introduce dirt or lint into critical hydraulic components. Tag disconnected lines to facilitate correct and faster installation.

1. Remove the torque converter assembly as directed in Section 6.

2. Remove the seat bottom cushion. Remove the seat frame mounting hardware and lift off the seat frame assembly (1, Fig. 5). Disconnect the battery cables (2) at one end to allow removal of the battery top support bgacket (3). Then mark the batteries to assure installation in the same location and remove the four batteries (4).

3. Remove the battery bottom support bracket (5, Fig. 5). The rear, LH mounting hardware also secures a clamp that holds the rear light wire (6).

4. Remove the seat front support (7, Fig. 5).

5. Remove the platform support bar with steering levers as an assembly (Fig. 6). Disconnect the lever rods (2) and steering booster rods (3) at the hand levers. Disconnect and remove the steering booster return springs (4). Remove the strap securing the transmission hoses to the platform support bar. Disconnect the equipment pump suction tube (1) at the hydraulic tank. Move the suction tube aside to gain access to the support bar RH rear mounting bolt. Remove the hardware securing the support bar to the frame and remove the bar with levers.

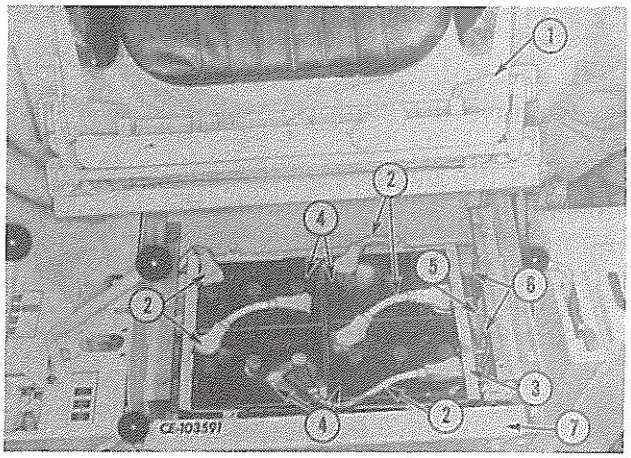


FIG. 5 — Removing the Seat Frame Assembly

6. Disconnect the torque converter vent tube (5, Fig. 6) at the rear main frame cover and remove the tube. Remove the equipment pump suction tube (1) from the machine.

7. Disconnect the flywheel-to-transmission hose (4, Fig. 7) and the pressure filter outlet hose (2) at the transmission.

8. Disconnect the torque converter inlet hose (5, Fig. 7) at the main regulating valve (6) and remove the hose.

9. Disconnect the oil cooler outlet hose (1, Fig. 7) at the main regulating valve (6).

10. Disconnect the diesel fuel tubes (3, Fig. 7) at the tank. Disconnect the fuel tube clamp (7) at the main regulating valve and the clamp at the rear mounting bolt on the rear main frame cover middle inspection cover. Remove the fuel tubes with clamps attached.

NOTE: For easier removal and installation of the diesel fuel tubes, disconnect the steer-

TRANSMISSION

8A. REMOVAL — Continued

ing booster hose (3, Fig. 8) at the steering booster and remove the booster hose clamp (2) from the forward mounting bolt of the rear main cover inspection cover (1).

11. Disconnect the steering booster hose (3, Fig. 8) at the range selector valve "M" port (earlier models disconnect at the transmission) and remove the hose.

12. Disconnect the main regulating valve drain hose (4, Fig. 8) at the transmission case and remove the hose.

13. Disconnect the pivot brake oil cooling tube (5, Fig. 8) at the rear main frame and at the main regulating valve. Remove the tube.

14. Remove the hardware securing the transmission hose and manifold assembly (3, Fig. 9) to the pilot control valve tube manifold (1) in the tower. Position the assembly on the transmission at this time. Remove and discard the "O" rings (2) from the manifold counterbores.

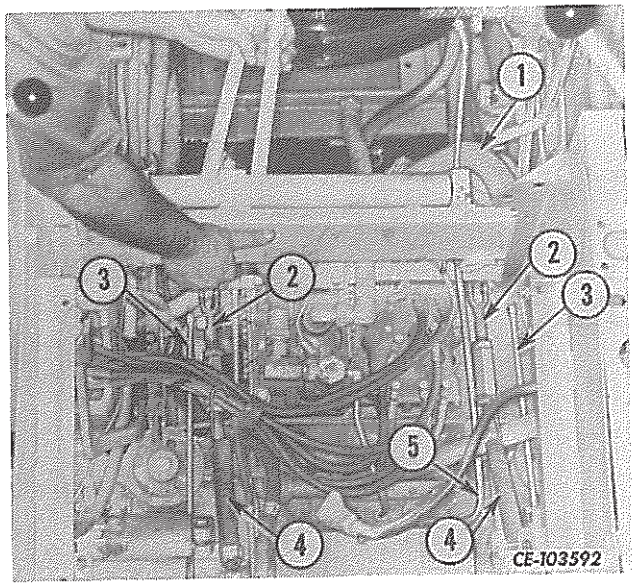


FIG. 6 — Removing the Platform Support Bar With Steering Levers

15. Disconnect the hydraulic equipment pump outlet hose (2, Fig. 10) at the pressure tube (1). Remove the hose.

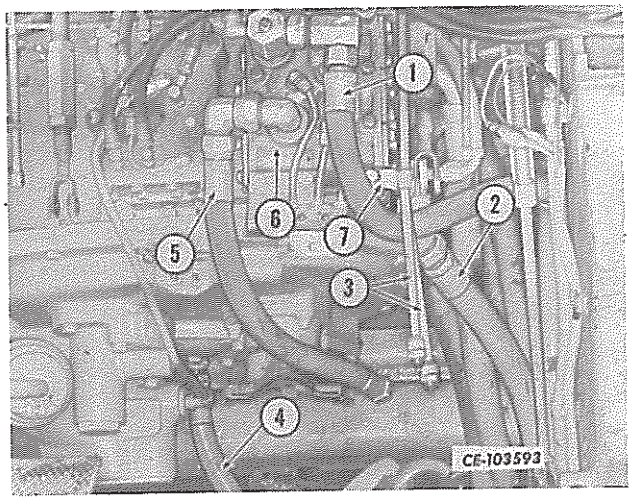


FIG. 7 — Transmission Disconnect Points

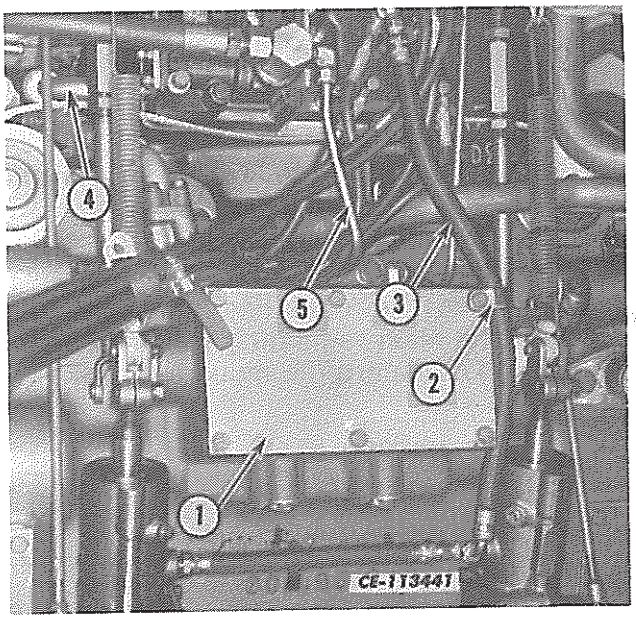


FIG. 8 — Disconnecting the Steering Booster Hose

16. Disconnect the hi-lo shifter tube (4, Fig. 10) at the shifter housing so it can be removed with the range selector valve (5). Disconnect the hose clamp (3) at the main regulating valve mounting bolt.

17. Remove the mounting hardware securing the range selector valve assembly to the transmission. Remove the range selector valve with hi-lo shifter tube, transmission hoses and the hose clamp, bolt and spacer assembly (1, Fig. 11) attached. Discard the valve mounting "O" rings.

TRANSMISSION

8A. REMOVAL — Continued

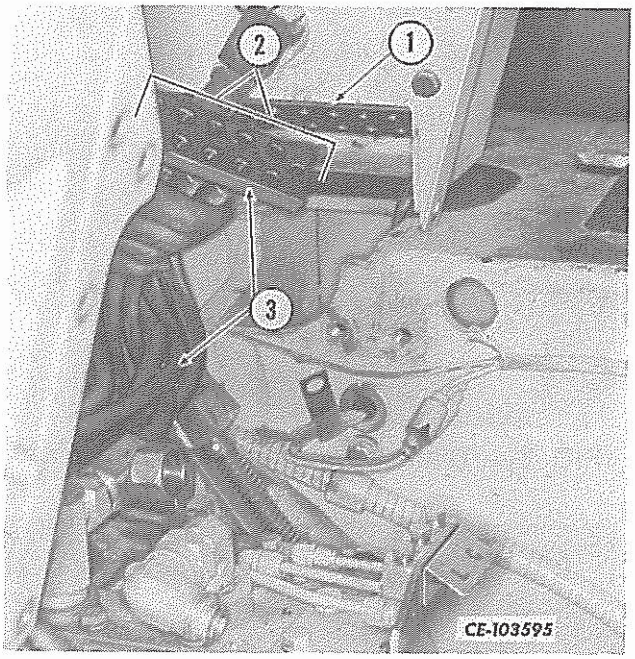


FIG. 9 — Removing the Transmission Hose and Manifold Assembly

18. Remove the mounting hardware and remove the main regulating valve assembly (2, Fig. 11). Discard the mounting gasket.

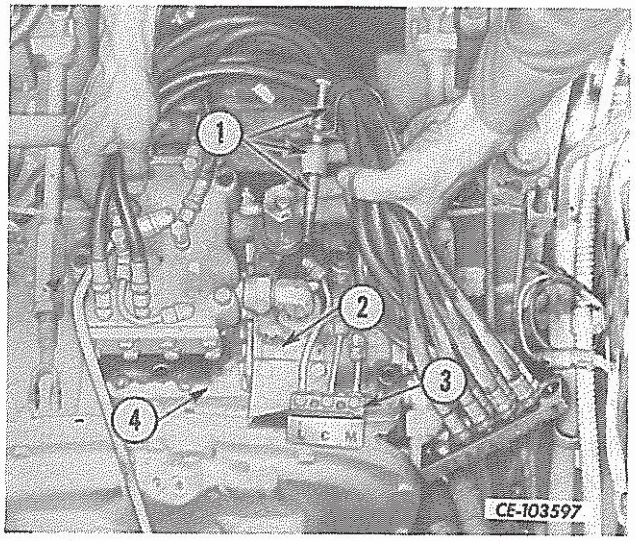


FIG. 11 — Removing the Range Selector Valve Assembly

19. Remove the mounting hardware and remove the valve spacer (4, Fig. 11) from the transmission case. Discard the mounting gasket.

20. Insert eyebolts into the top of the transmission case and attach a hoist as shown in Fig. 12. Remove the capscrews securing the transmission to the rear main frame and carefully lift the transmission out of the machine.

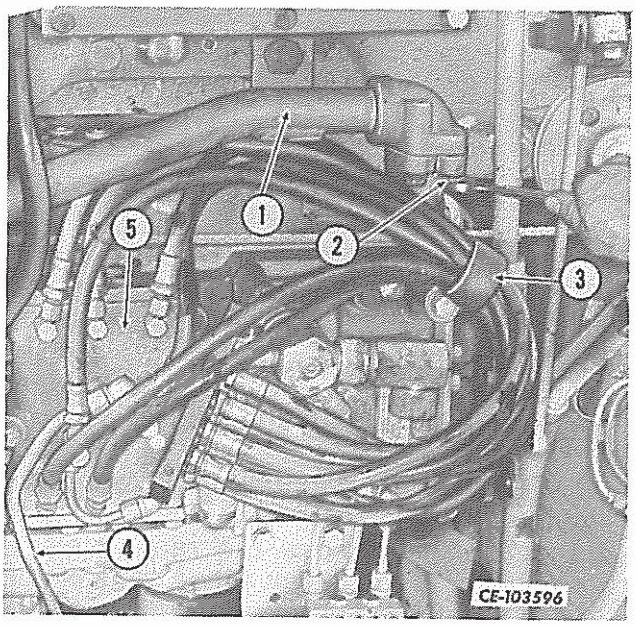


FIG. 10 — Disconnecting the Equipment Pump Outlet Hose

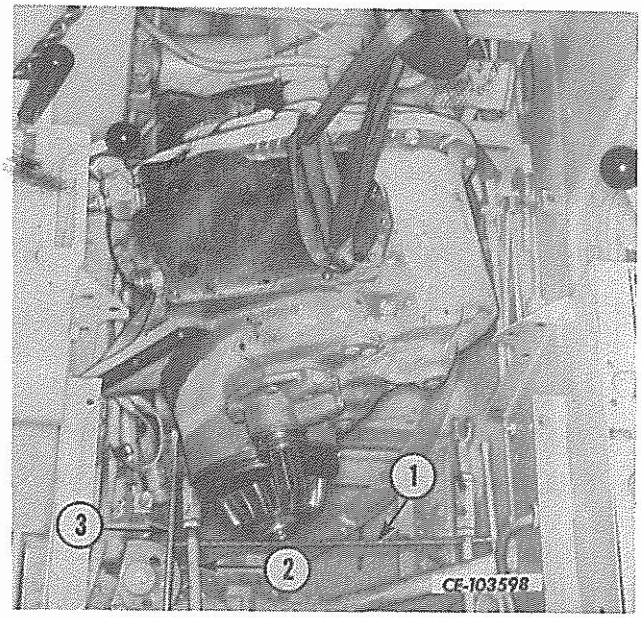


FIG. 12 — Removing the Transmission Assembly

TRANSMISSION

8A. REMOVAL — Continued

NOTE: As the transmission is lifted out it will have to be maneuvered to clear the pivot brake cable (1, Fig. 12) steering lever pull rod (2) and steering booster rod (3).

21. Cover the opening in the rear main frame to prevent dust and dirt from entering.

22. Place the transmission assembly on a bench with the shafts in a horizontal position. Block the case on each side.

9. DISASSEMBLY

Hi-Lo Shift Lever Assembly

1. Remove the ball from the end of the shift lever (1, Fig. 13). Remove the upper and lower boot clamps (2) and remove the boot (3) and clamps from the lever.

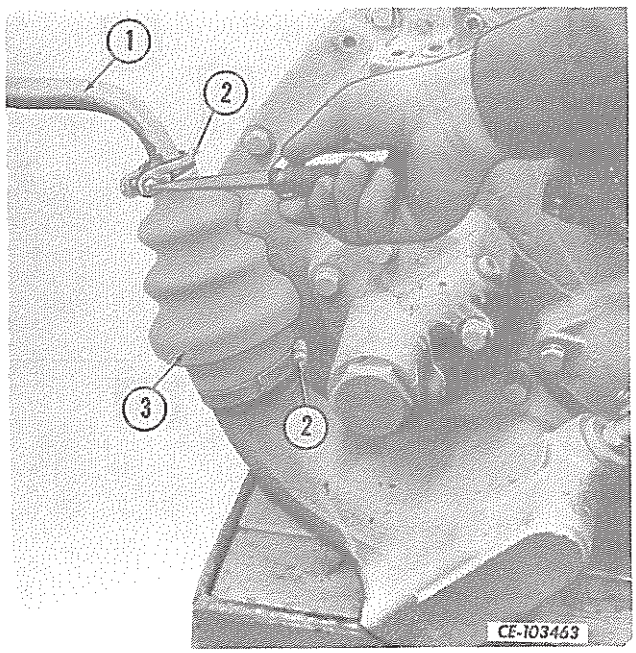


FIG. 13 — Removing the Shift Lever Boot Clamp

2. Remove the rivet (1, Fig. 14) securing the spring stop (2) to the shift lever. Remove the spring stop, spring (3), spring washer (4) and swivel cap (5) from the shift lever.

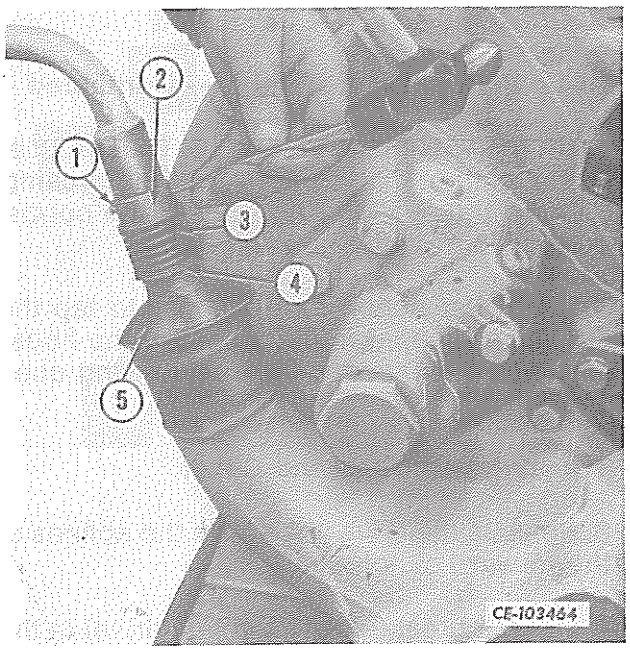


FIG. 14 — Removing the Spring Stop Rivet

3. Remove the swivel shaft (1, Fig. 15) securing the shift lever to the shifter housing (2). Pull the lever from the housing. Remove the hardware securing the shifter housing to the transmission cover and remove the housing. Discard the housing gasket.

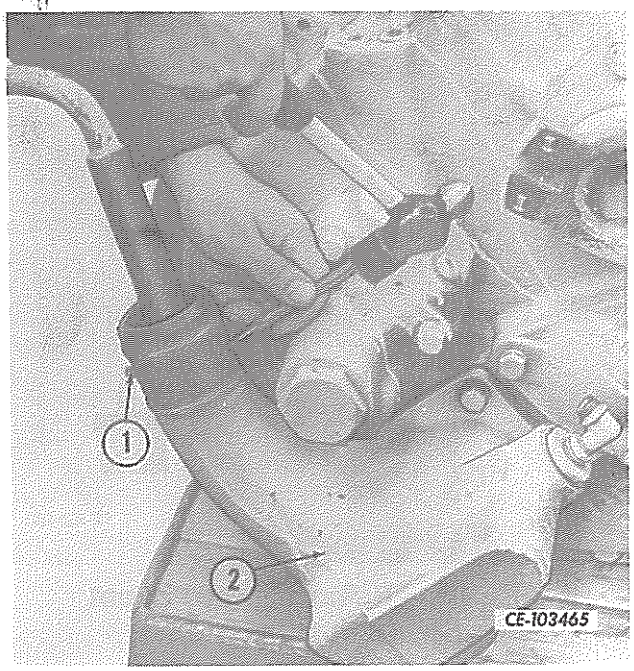


FIG. 15 — Removing the Shifter Housing Swivel Shaft

9. DISASSEMBLY — Continued

Hi-Lo Shift Lever Assembly — Continued

4. Unthread the plug (1, Fig. 16) with reducer bushing and fitting from the shifter housing. Discard the sealing ring (2). Lift the poppet spring (3) from the housing bore.

5. Use a flat punch and hammer to tap the shift lever poppet from its bore in the housing (Fig. 17). Discard the sealing ring used on the poppet.

Transmission Case and Cover

6. Remove the drive yoke from the splines of the forward clutch shaft.

7. Insert a breaker bar (3/4 inch drive) in the end of the pinion shaft and remove the pinion shaft rear nut with a box-end wrench and bar (Fig. 18). Remove and discard the transmission case sealing ring (1, Fig. 18).

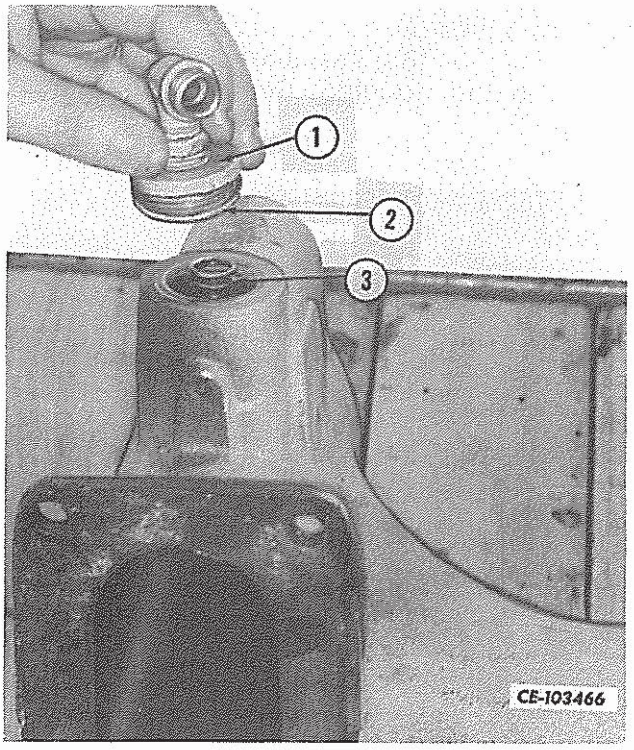


FIG. 16 — Removing the Poppet Spring Plug

8. With the aid of a puller, remove the bevel pinion from the shaft splines.

9. Remove the forward clutch shaft hydraulic manifold from the rear of the transmission case. Remove and discard the manifold "O" rings (1, Fig. 20) and sealing rings (2).

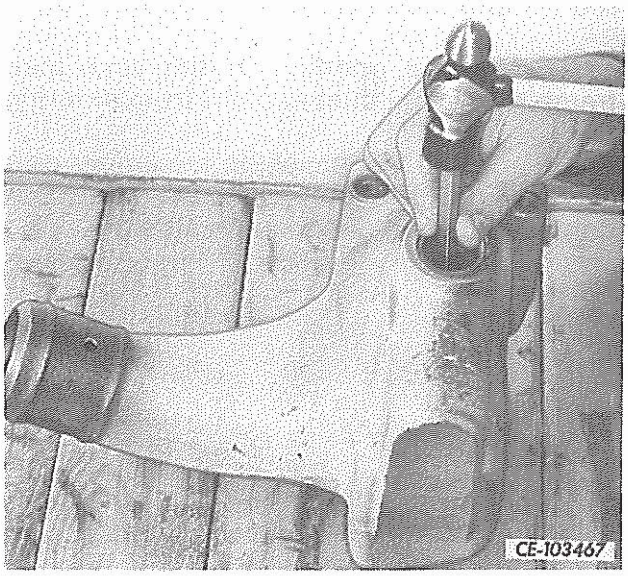


FIG. 17 — Removing the Shift Lever Poppet

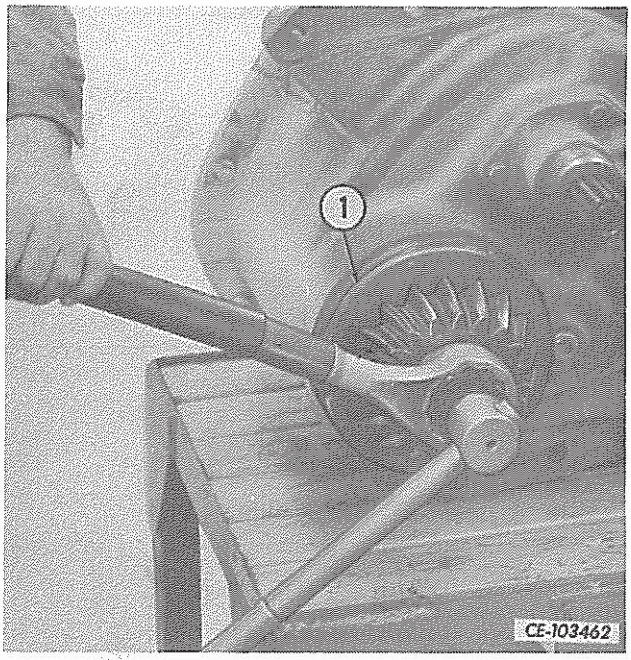


FIG. 18 — Removing the Pinion Shaft Rear Nut

NOTE: The four hook type seal rings (3, Fig. 20) should be left in the clutch shaft to protect the ring grooves in the shaft during further disassembly.

TRANSMISSION

9. DISASSEMBLY — Continued

Transmission Case and Cover — Continued

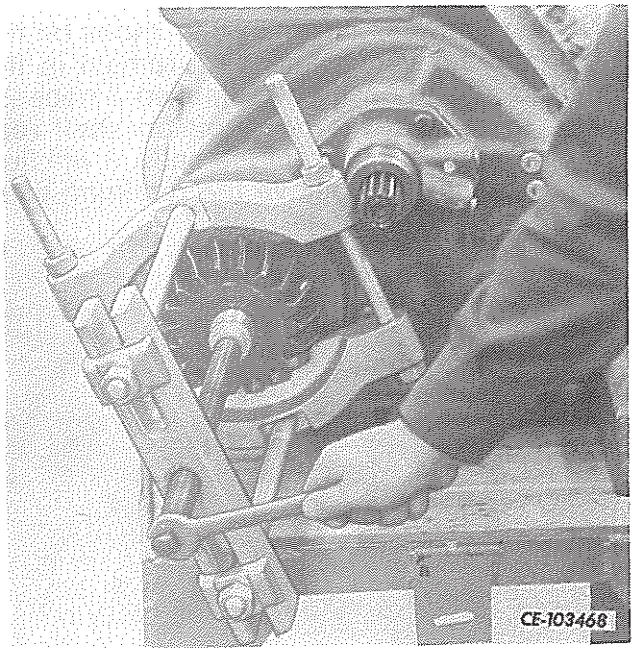


FIG. 19 — Removing the Bevel Pinion

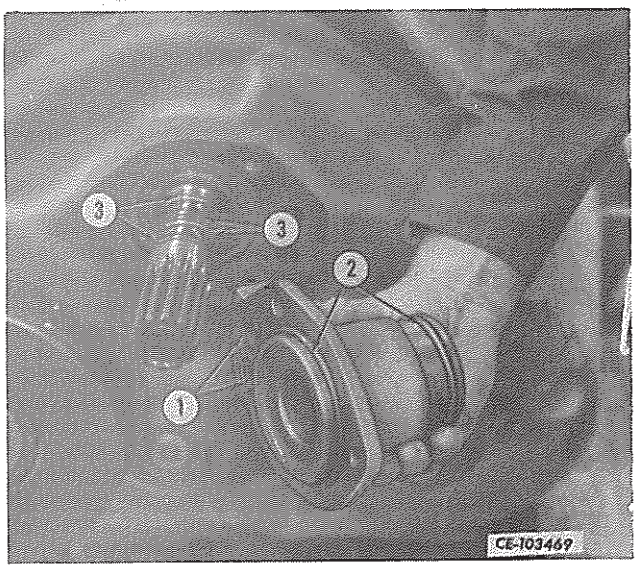


FIG. 20 — Removing the Forward Clutch Shaft Manifold

10. Remove the reverse clutch shaft hydraulic manifold from the transmission cover. Remove the shims (1, Fig. 21) and keep them with the manifold. Remove and discard the "O" rings (3) and sealing ring (2).

11. Remove the spline shaft cover (4, Fig. 21) from the transmission cover. Discard the cover sealing ring.

12. Remove the bearing retainer lock (5, Fig. 21). Remove the bearing retainer (6) using a 1-1/2 inch socket and a breaker bar. Remove the sealing ring from the bearing retainer and discard it.

13. Place a 3/4 inch square drive breaker bar in the rear of the pinion shaft. Place an extension bar (1, Fig. 22) over the breaker bar handle to hold the pinion shaft from turning while removing the pinion shaft front nut. Remove the front nut using an extension bar (2) for leverage.

To remove the spline shaft nut (3, Fig. 22), hold the bevel pinion shaft by placing the extension bar (1) on the opposite side of the transmission. Place the high and low gear in mesh with the low range driven gear on the bevel pinion shaft by pushing the hi-lo shifter shaft (4) in against the transmission front cover. This will keep the spline shaft from turning as the nut is loosened with a socket, breaker bar and extension bar.

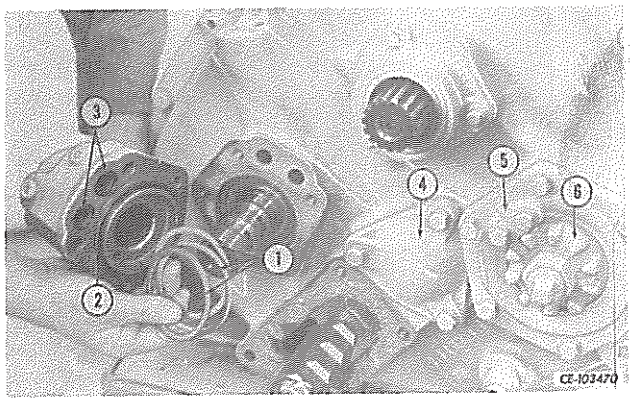


FIG. 21 — Removing the Reverse Clutch Shaft Manifold

14. Remove the spline shaft front bearing plate. This plate is part of the bearing and is not serviced separately (Fig. 23).

15. Re-install the bearing retainer (1, Fig. 24). It will be used later is disassembly to facilitate pinion shaft removal. Remove the plug (2) with gasket (3) from the retainer.

TRANSMISSION

9. DISASSEMBLY — Continued

Transmission Case and Cover — Continued

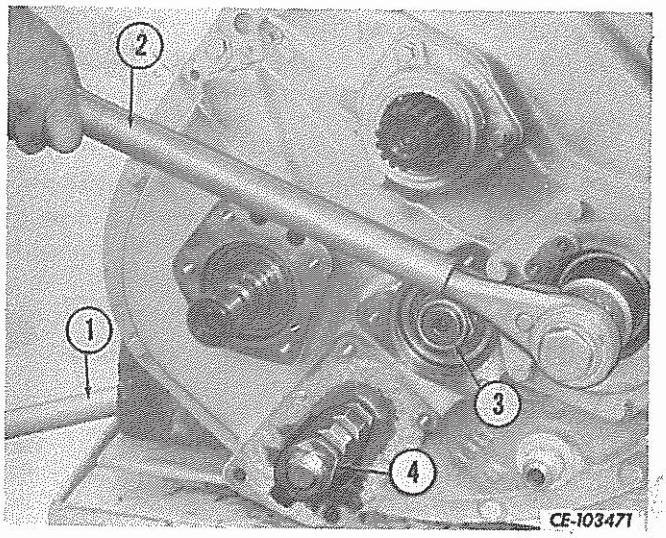


FIG. 22 — Removing the Bevel Pinion Shaft Front Nut

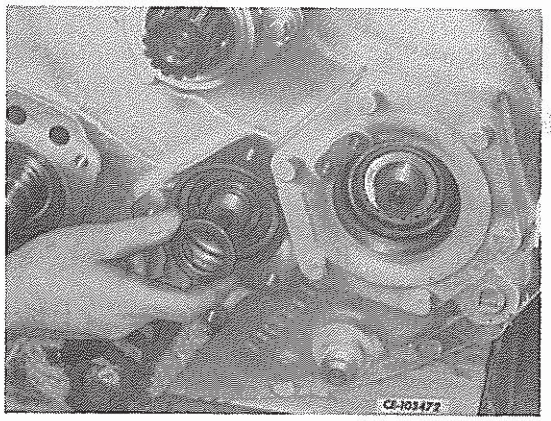


FIG. 23 — Removing the Spline Shaft Front Bearing Plate

16. Loosen the transmission cover-to-case mounting hardware, but do not remove at this time. Place the transmission assembly in a transmission stand or on a bench with the cover end down. Block under the cover to allow clearance for the shafts and removal of the cover bolts.

Attach a hoist to the transmission case as shown in Fig. 25 to obtain the correct balance. Remove the cover mounting bolts. Use the cover bolts as jackscrews (1, Fig. 25) in the holes provided in the cover to free the case from the dowels (2). Lift the case from the transmission shafts. Discard the cover gasket.

NOTE: The rear bearing outer races on the four transmission shafts will remain in the case and can easily be removed if necessary. To remove the bevel pinion shaft rear bearing outer race from the case, it will first be necessary to remove the retaining snap ring.

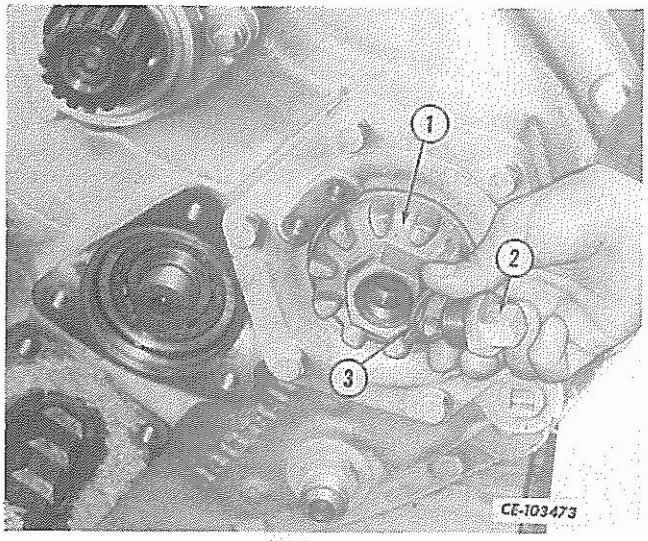


FIG. 24 — Removing the Bearing Retainer Plug

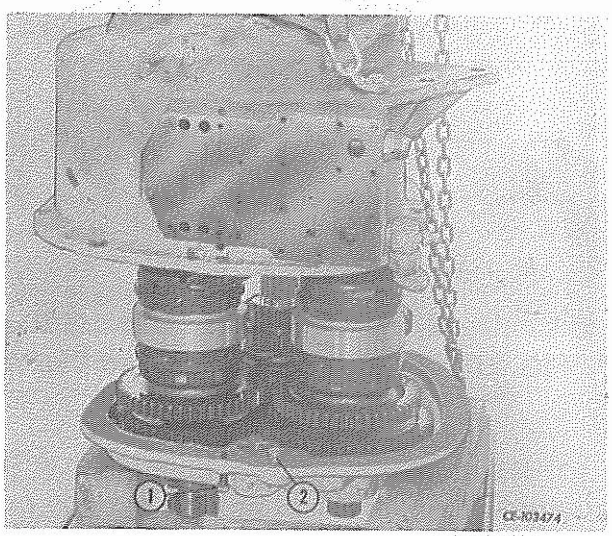


FIG. 25 — Removing the Transmission Case

TRANSMISSION

9. DISASSEMBLY — Continued

Transmission Case and Cover — Continued

17. Remove the locknut (1, Fig. 26) from the hi-lo shifter shaft locking bolt. Raise the shaft and fork assembly until the locking bolt (6) is clear of the clutch shaft assembly (5) and maintain this position using a socket (2) under the fork (4). Tap the locking bolt out of the fork until it is clear of the shifter shaft (3) and pull the shaft out the bottom of the cover. Remove the fork with the locking bolt from the spline shaft.

18. Lift the spline shaft from the front cover (Fig. 27). Lift the reverse clutch shaft from the front cover (Fig. 28). The front bearing outer races of these shafts will remain in the front cover.

If the shifter shaft binds in the bushing located in the transmission cover due to burrs or a possible bent shaft, it can be driven out using a brass drift and harness.

CAUTION! Be careful when performing the following step as the pinion shaft is only held in the cover by the press fit of the front bearing. It may be possible for the shaft to fall free of its bearing when the cover is turned over.

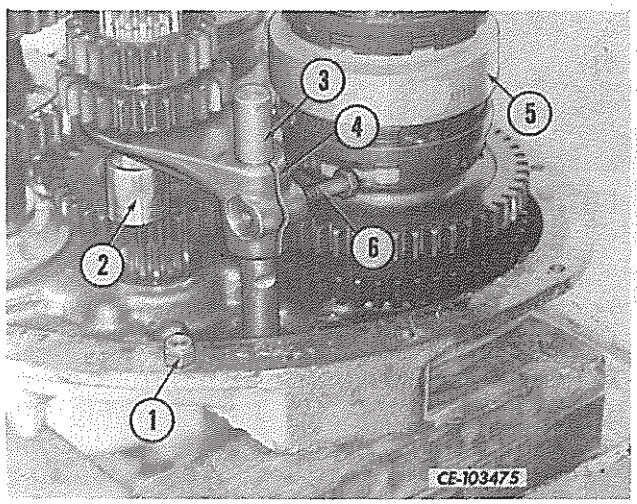


FIG. 26 — Removing the Hi-Lo Shifter Shaft

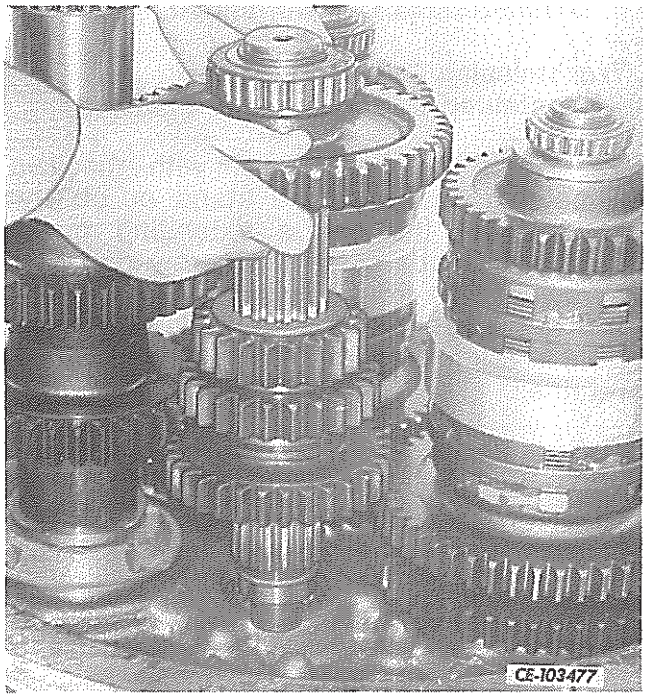


FIG. 27 — Removing the Spline Shaft Assembly

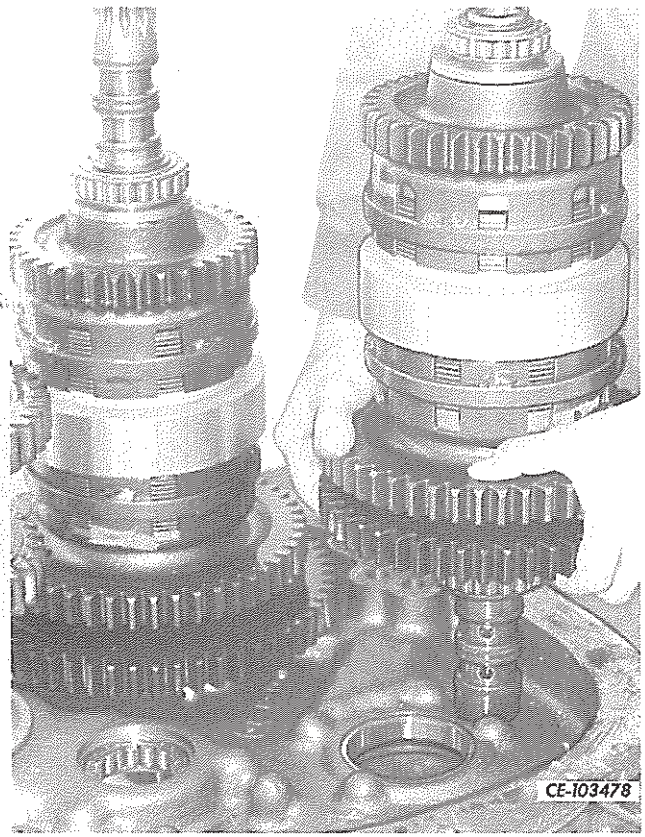


FIG. 28 — Removing the Reverse Clutch Shaft Assembly

TRANSMISSION

9. DISASSEMBLY — Continued

Transmission Case and Cover — Continued

19. Place the front cover with the two remaining shafts in the stand or on the bench with the shafts extending down. Screw a standard forcing screw or puller screw into the front bearing retainer (1, Fig. 29) to push the pinion shaft (2) out of the front bearing assembly. Remove the bearing retainer.

20. Remove the pinion shaft front bearing assembly from the bearing cage. Lift the bearing outer cup and cone from the bearing cage (2, Fig. 30). Remove the bearing inner cone (1, Fig. 30). Then remove the bearing cup spacer and bearing inner cup from the bearing cage (Fig. 31).

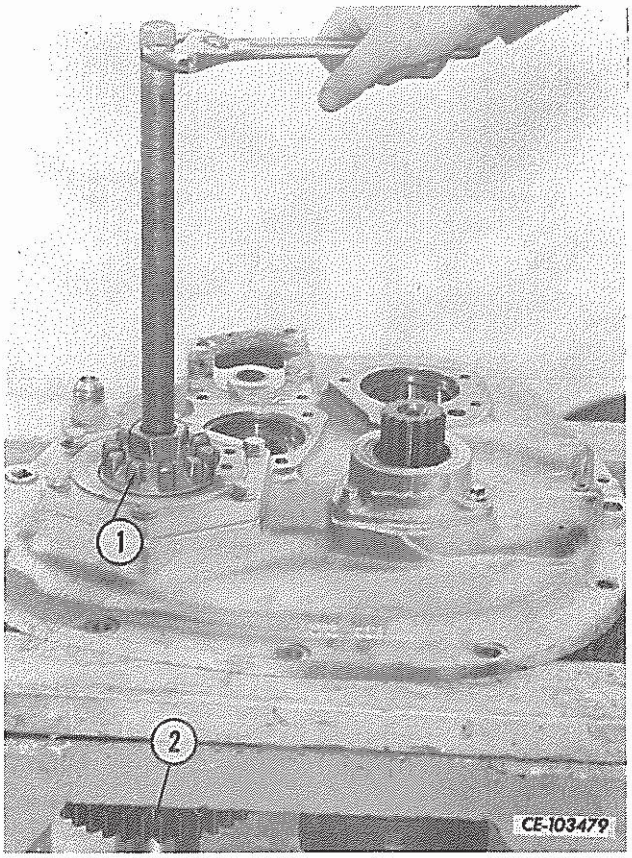


FIG. 29 — Removing the Bevel Pinion Shaft Assembly

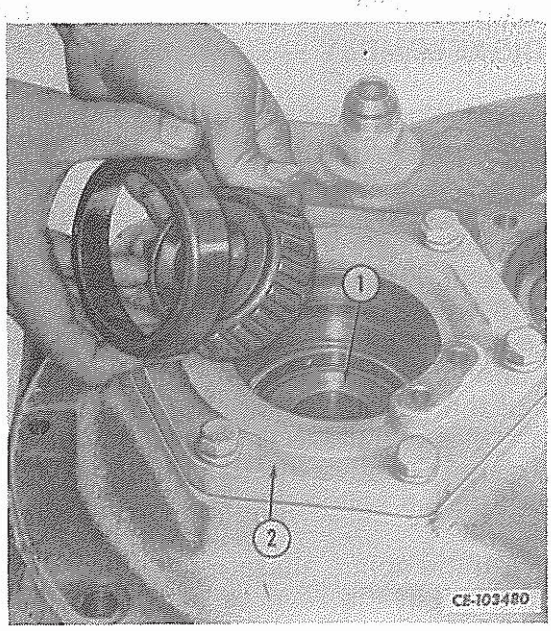


FIG. 30 — Removing the Pinion Shaft Front Bearing Outer Cup and Cone

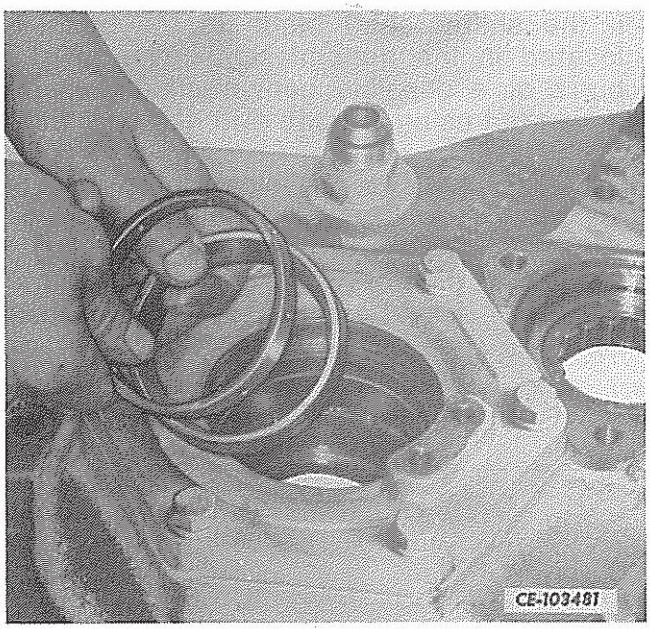


FIG. 31 — Removing the Pinion Shaft Front Bearing Cup Spacer and Inner Cup

21. Remove the capscrews and lockwasher securing the bearing cage to the front cover. The bearing cage is held in the front cover by the pressure of the "O" ring (1, Fig. 32) on its outside diameter and can be tapped out from the underside of the cover using a wooden block and hammer. Keep the shims (2) that fit between the bearing cage and

TRANSMISSION

9. DISASSEMBLY — Continued

Transmission Case and Cover — Continued

cover with the bearing cage to facilitate proper reassembly of the pinion shaft.

22. Remove the oil seat housing from the front cover. Remove and discard the sealing ring (1, Fig. 33) and oil seal (2).

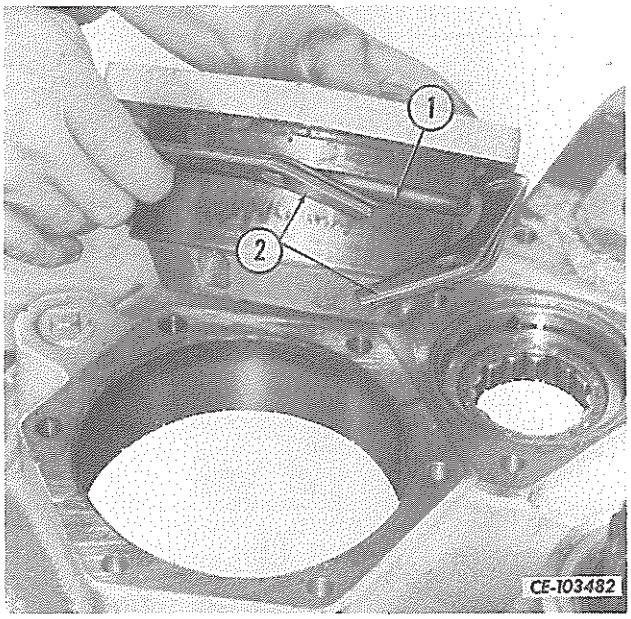


FIG. 32 — Removing the Pinion Shaft Front Bearing Cage

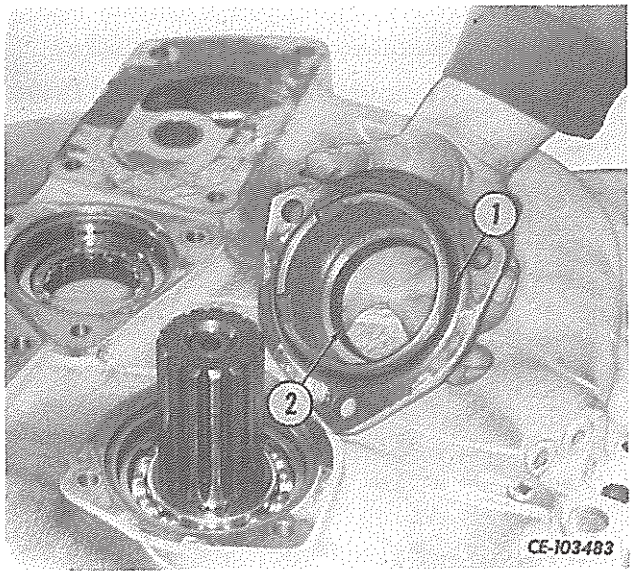


FIG. 33 — Removing the Oil Seal Housing

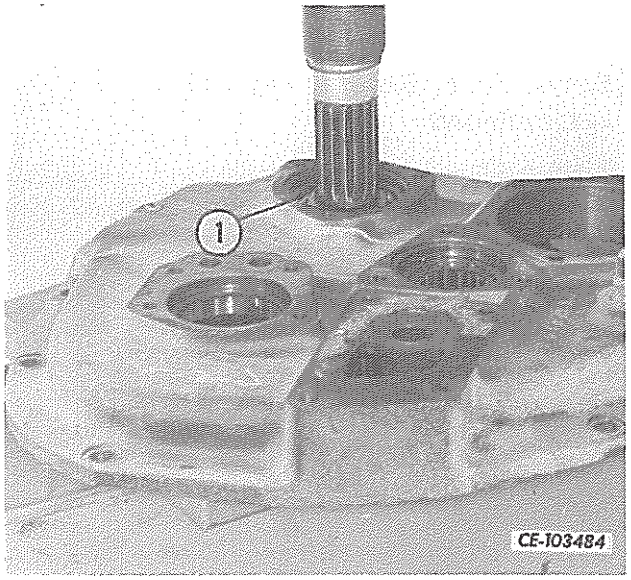


FIG. 34 — Removing the Forward Clutch Shaft Assembly

23. Support the forward clutch shaft and cover assembly in a press under the reverse drive gear (large gear on the end of the shaft). Remove the snap ring securing the shaft to the ball bearing (1, Fig. 34) and press the shaft from the bearing. The reverse drive gear will be partially pressed off as the shaft is freed from the bearing. If bearing replacement is necessary, reverse the cover in the press and press the bearing out the front of the cover.

Spline Shaft (Refer to Fig. 35)

24. Install a bearing split collar puller plate behind the front bearing inner race. Support the shaft assembly in a press on the puller plate and press the shaft from the bearing inner race.

25. Remove the second speed driven gear outer snap ring and the rear bearing inner race snap ring from the shaft.

26. Support the shaft in a press under the second speed driven gear and press the shaft from the gear (Fig. 36). Use a driver to protect the shaft.

27. Remove the second speed driven gear inner snap ring and slide the hi-lo range driving gear from the shaft (Fig. 27).

TRANSMISSION

9. DISASSEMBLY — Continued

Spline Shaft (Refer to Fig. 35) — Continued

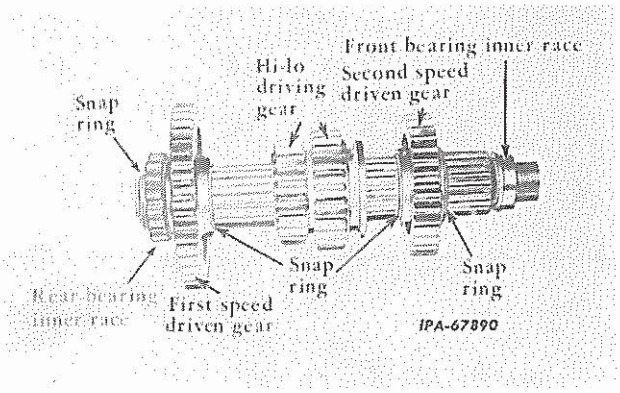


FIG. 35 — Spline Shaft Assembly

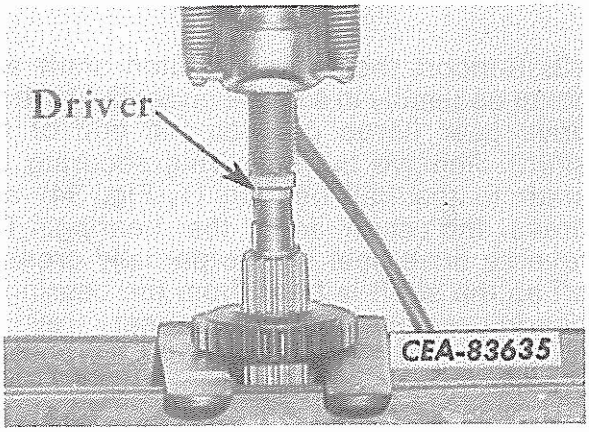


FIG. 36 — Removing the Second Speed Driven Gear

28. Position the shaft in a press supported by the first speed driven gear and press the shaft (using a driver) from the gear and bearing inner race (Fig. 38).

NOTE: If difficulty is encountered in removing the high or low range driven gears, use a torch on the gear hubs. Care must be taken that heat is uniform all around the hub and kept away from the gear bores or shaft. Do not heat to more than 400°F.

29. EARLIER MODELS: Slide the front and rear spacers from the shaft. Place the shaft in a press supported by the low range driven gear and press off both gears in one operation. Remove the woodruff keys (Fig. 40).

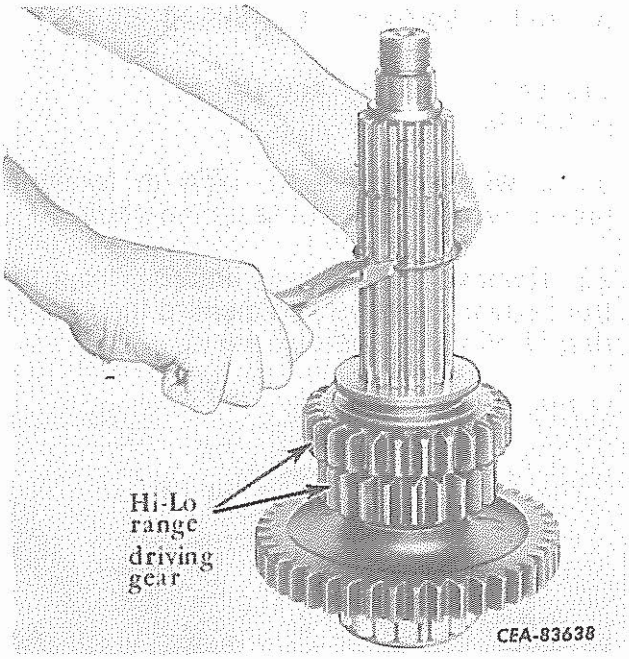


FIG. 37 — Removing the Second Speed Driven Gear Inner Snap Ring

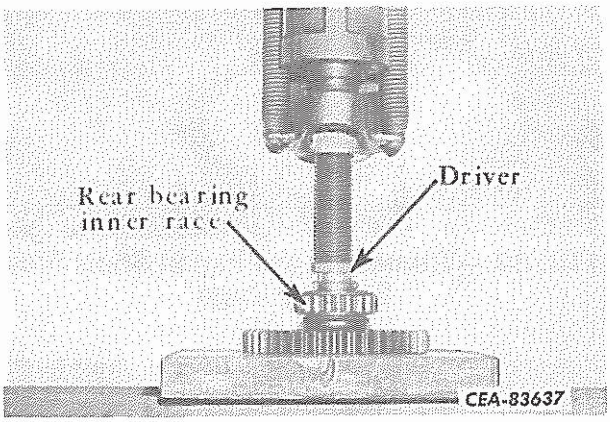


FIG. 38 — Removing the First Speed Driven Gear and Bearing Race

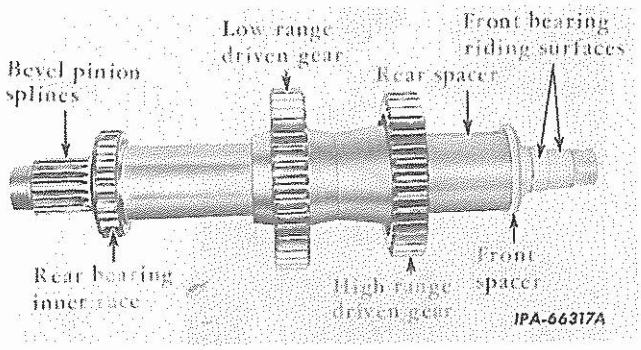


FIG. 39 — Bevel Pinion Shaft Assembly (EARLIER MODELS)

TRANSMISSION

9. DISASSEMBLY — Continued

Spline Shaft (Refer to Fig. 35) — Continued

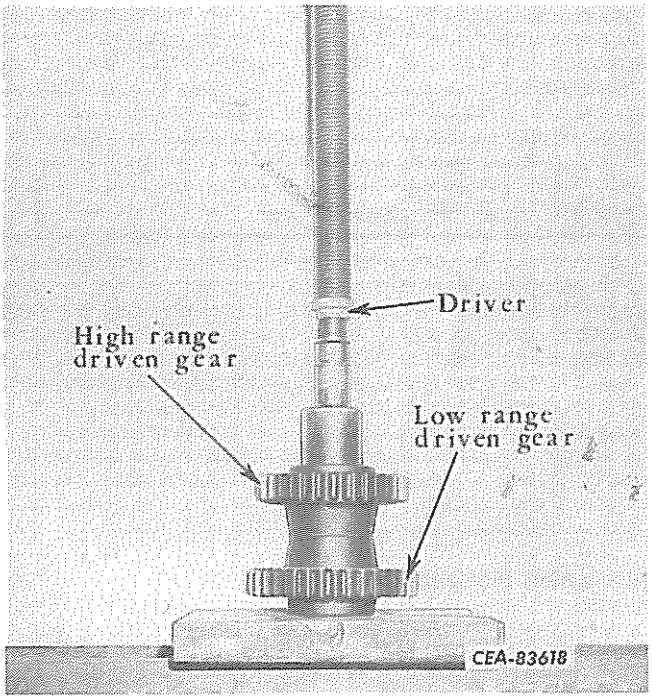


FIG. 40 — Removing the High and Low Range Driven Gears

LATER MODELS: Remove high gear retainer ring (it is not necessary to remove the bearing spacer unless it needs replacement). Place the shaft in a press supported by the low range driven gear and press off both gears in one operation. Remove the woodruff keys (Fig. 40).

30. Install a bearing split collar puller plate behind the rear bearing inner race. Support the shaft in a press on the puller plate and press the shaft from the bearing race.

NOTE: The following procedure covers the disassembling of either a forward or reverse clutch shaft. Whenever a difference in the disassembly of one clutch shaft from the other is required, both procedures are covered. Illustrations used to show disassembly are on the reverse clutch shaft; the forward clutch shaft would be similar.

Forward and Reverse Clutch Shaft

31. REVERSE CLUTCH SHAFT: Support the shaft assembly in a press under the reverse driven gear. Remove the snap ring (Fig. 41) securing the front bearing cone to the shaft and press the shaft from the bearing cone and gear (Fig. 43). Remove the gear key from the shaft.

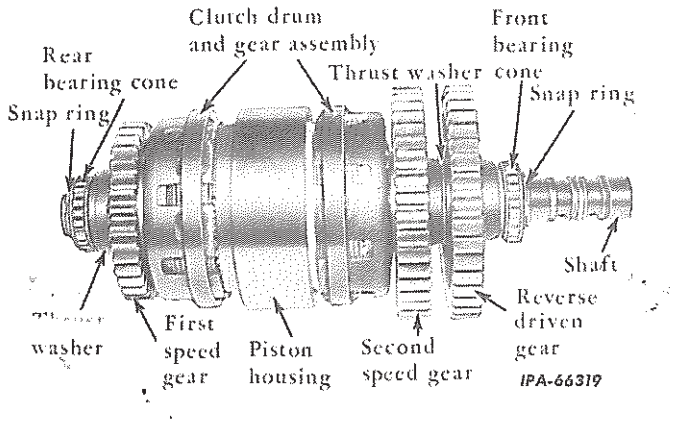


FIG. 41 — Reverse Clutch Shaft Assembly

FORWARD CLUTCH SHAFT: Support the shaft assembly in a press under the reverse drive gear and press the shaft from the gear (Fig. 42). Remove the gear key and the snap ring from the shaft.

32. Place the shaft assembly on a bench supported by the clutch gear so the end with the larger rear is up.

33. Remove the second speed drive gear thrust washer from the shaft (Fig. 44). Slip the clutch gear and drum assembly from the shaft (Fig. 45). Remove the two caged roller bearings (1, Fig. 45) and bearing spacer (2).

34. Remove the two bearing spacers and the thrust bearing from the shaft (Fig. 46).

35. Remove the internal snap ring from the groove in the clutch hub (1, Fig. 47) which secures the two clutch hub retainers (2). Remove the clutch hub retainers. To free the clutch hub retainers from the shaft, grasp

TRANSMISSION

9. DISASSEMBLY — Continued

Forward and Reverse Clutch Shaft — Continued

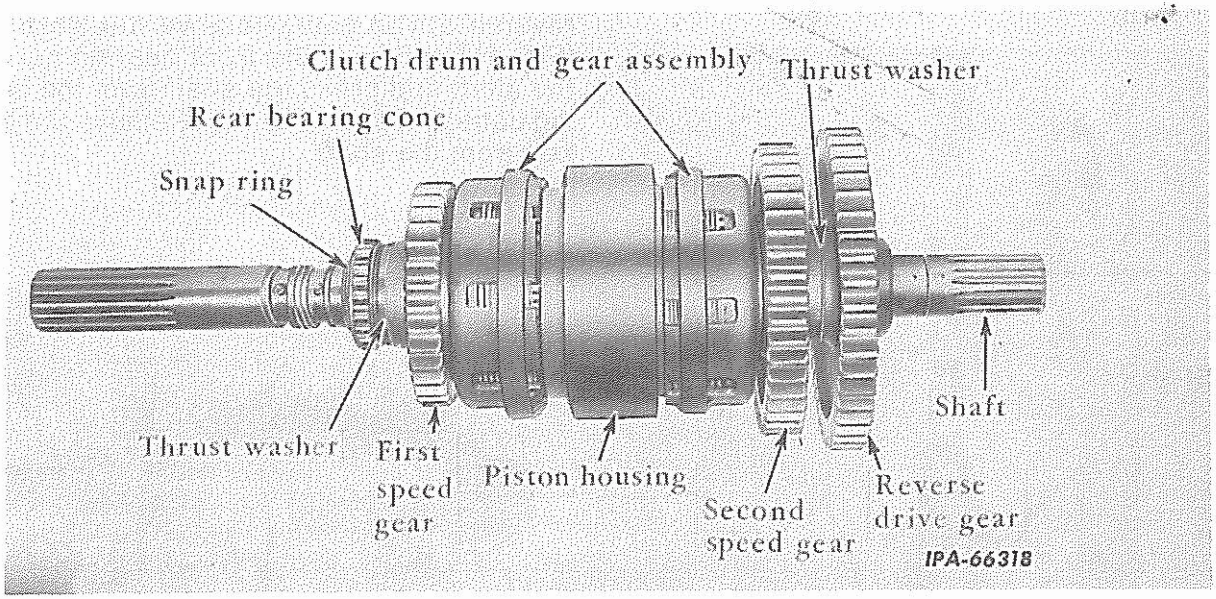


FIG. 42 — Forward Clutch Shaft Assembly

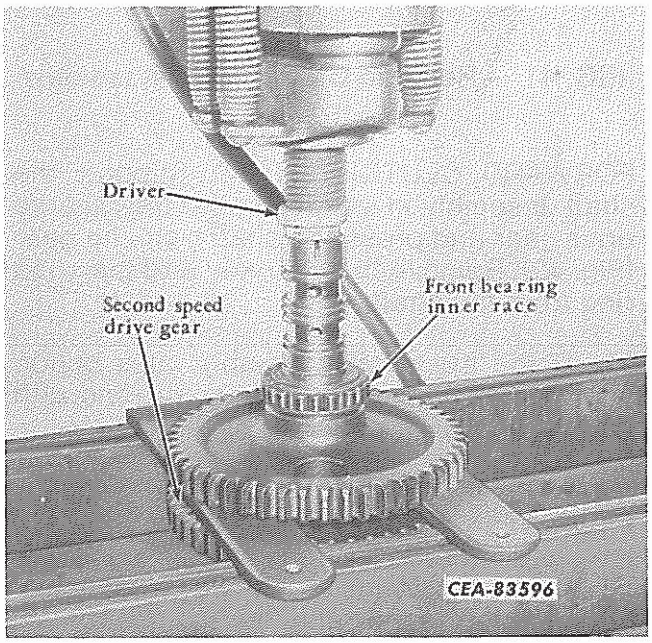


FIG. 43 — Removing the Reverse Driven Gear

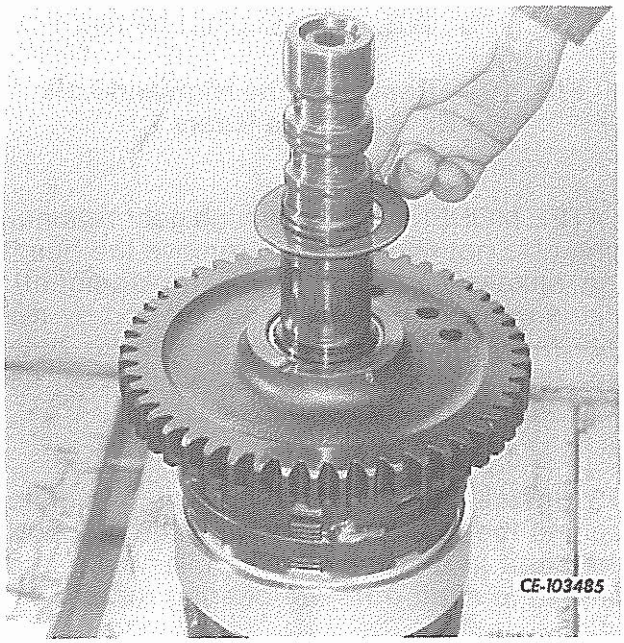


FIG. 44 — Removing the Second Speed Drive Gear Thrust Washer

TRANSMISSION

9. DISASSEMBLY — Continued

Forward and Reverse Clutch Shaft — Continued

the end of the piston housing (3) with the fingers and using the palms of the hands compress the hub assembly.

36. Grasp the outside diameter of the steel clutch plates (1, Fig. 48) and lift off the clutch hub assembly.

37. Reverse the shaft assembly on the bench so it is supported on the piston housing (4, Fig. 49). Remove the snap ring securing the rear bearing inner race (2) to the shaft. Install a three jaw gear puller to the clutch gear and drum assembly (5) as shown in Fig. 49. Use a spacer to protect the end of the shaft and pull the gear and drum assembly up until the bearing race is free of the shaft. Remove the bearing race and thrust washer (3) from the shaft.

NOTE: The hub assembly must be lifted straight off. Be careful not to cock the hub (2, fig. 48) on the shaft splines as the return springs in the hub may become twisted.

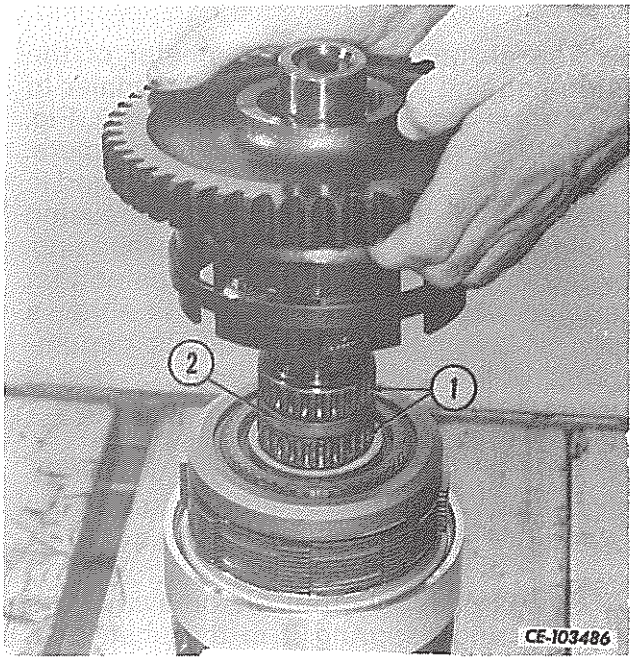


FIG. 45 — Removing the Clutch Gear and Drum Assembly

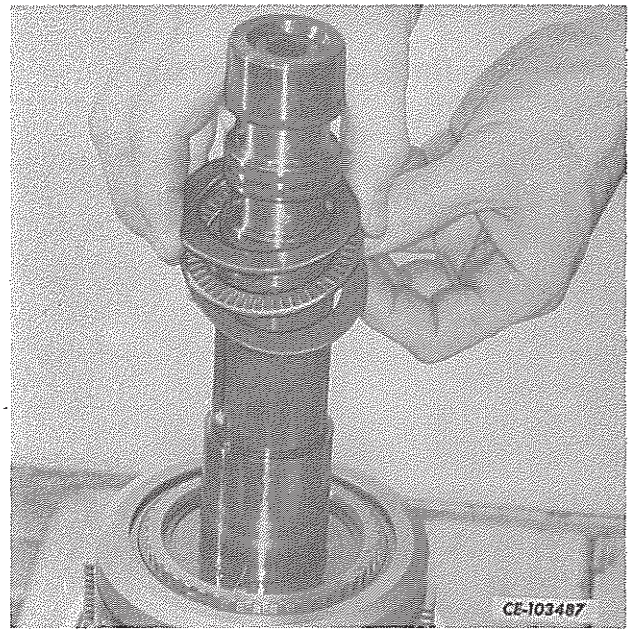


FIG. 46 — Removing the Thrust Washers and Thrust Bearing

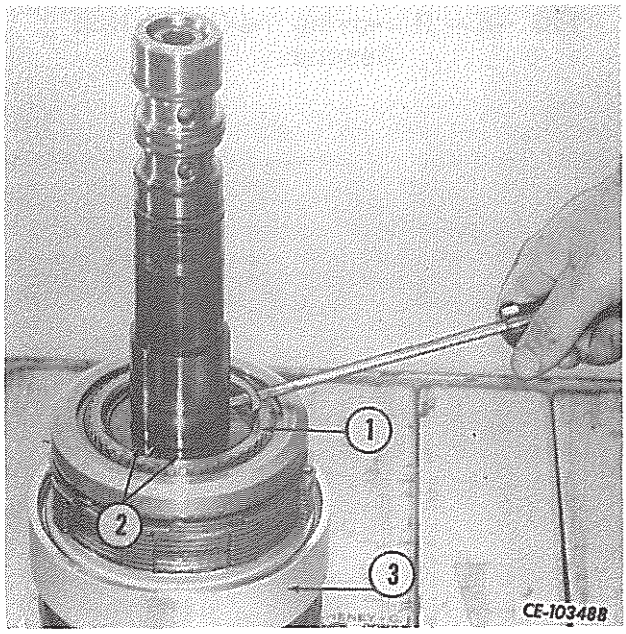


FIG. 47 — Removing the Clutch Hub Retainer Snap Ring

38. Lift the clutch gear and drum assembly from the shaft (Fig. 50). Remove the two caged roller bearings (1) and bearing spacer (2).

39. Remove the two thrust bearing spacers (1, Fig. 51) and the thrust bearing (2) from the shaft.

TRANSMISSION

9. DISASSEMBLY — Continued

Forward and Reverse Clutch Shaft — Continued

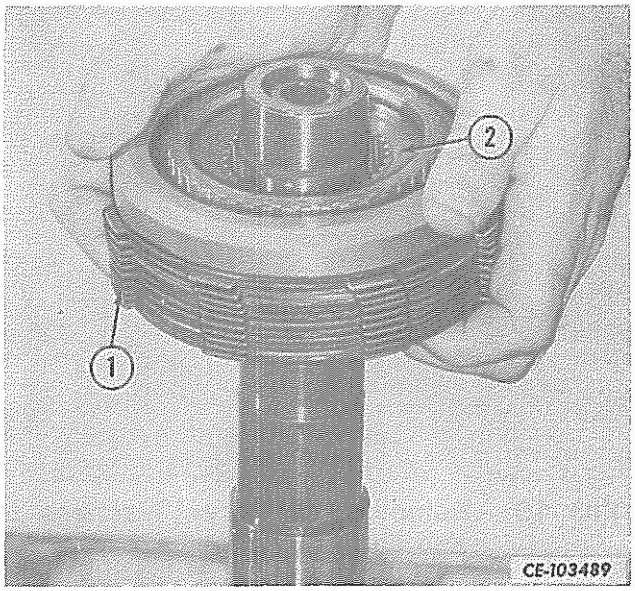


FIG. 48 — Removing the Clutch Hub Assembly

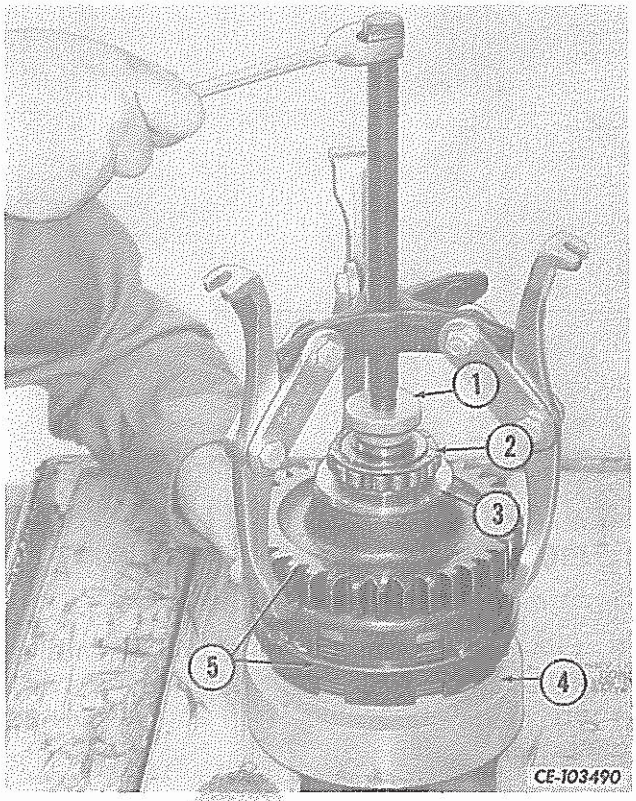


FIG. 49 — Removing the Clutch Gear and Drum Assembly

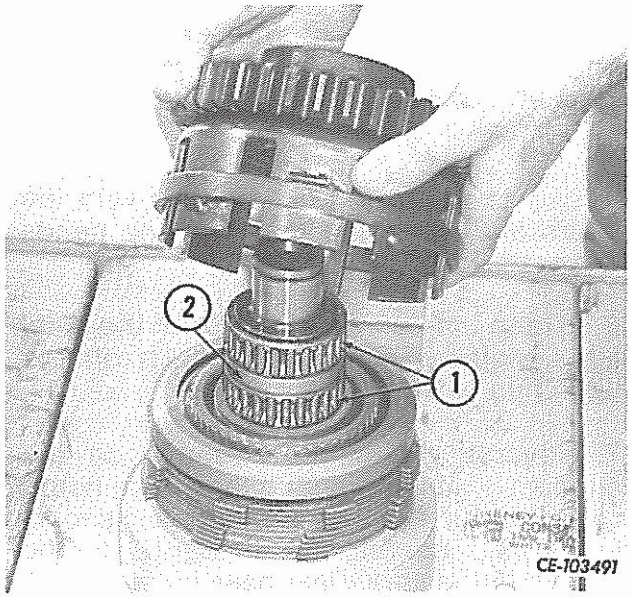


FIG. 50 — Removing the Clutch Gear and Drum Assembly

40. Stand the clutch shaft assembly on end with the remaining clutch hub assembly up. Repeat steps 35 and 36 for removing the hub assembly from the shaft.

41. Place the shaft on end so the force piston is up. Remove the internal snap ring from the groove in the piston housing using a screwdriver or other suitable tool (Fig. 52).

42. Tap around the outer diameter of the piston housing with a soft-faced hammer to free it from the sealing rings (1 and 2, Fig. 53) on the force piston and separator plate. In most cases these sealing rings will bind in the snap ring groove of the piston housing causing difficulty in removing the housing. For easier disassembly, it is suggested that the snap ring groove be filled with either a piece of brazing rod (approximate circumference of the force piston) or an "O" ring of the exact diamter of the snap ring groove.

43. Lift off the force piston (Fig. 53). Remove and discard the lathe cut seal ring (1) and the separator plate "O" ring (2).

44. Push the accelerator piston away from the snap ring securing it to the shaft and, using a pair of special snap ring pliers No. 1 020 441 R1, remove the snap ring (Fig. 54).

TRANSMISSION

9. DISASSEMBLY — Continued

Forward and Reverse Clutch Shaft — Continued

Remove the accelerator piston with seal ring from the shaft. Discard the piston seal ring.

45. Remove the reinforcing disc (1, Fig. 55) and disc valve (2) from the guide pins (4) in the separator plate. Remove the three guide pins and the three sets of inner and outer release springs (3) from their respective bores in the separator plate (5).

46. Reverse the shaft assembly on the bench and remove the remaining accelerator piston, reinforcing disc, disc valve and springs in the same manner as was done in steps 44 and 45. Then remove and discard the two hook-type seal rings (6, Fig. 55) from each side of the separator plate (5).

47. Disassemble the clutch hub assembly (the two hub assemblies removed from the shaft are identical). Remove the spiral snap ring from the groove in the backing plate (1, Fig. 56). Remove the external snap ring from the clutch hub (1, Fig. 57). Lift the backing plate from the hub splines and then remove the internally splined clutch plates (1, Fig. 58) and externally tanged clutch plates (2) from the hub.

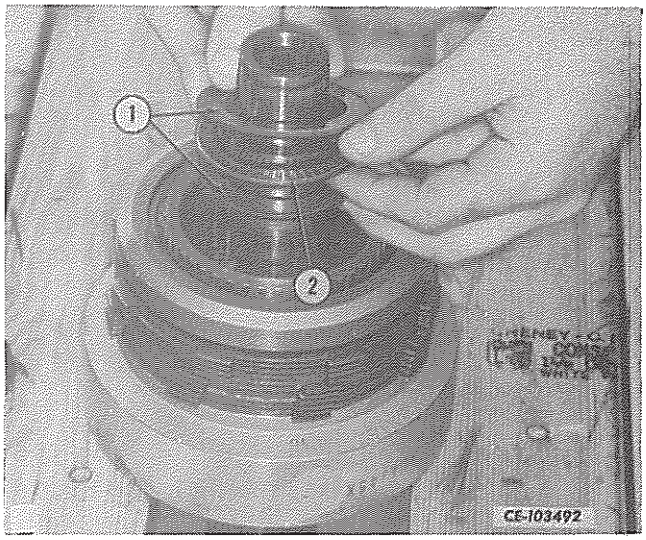


FIG. 51 — Removing the Thrust Bearing and Spacers

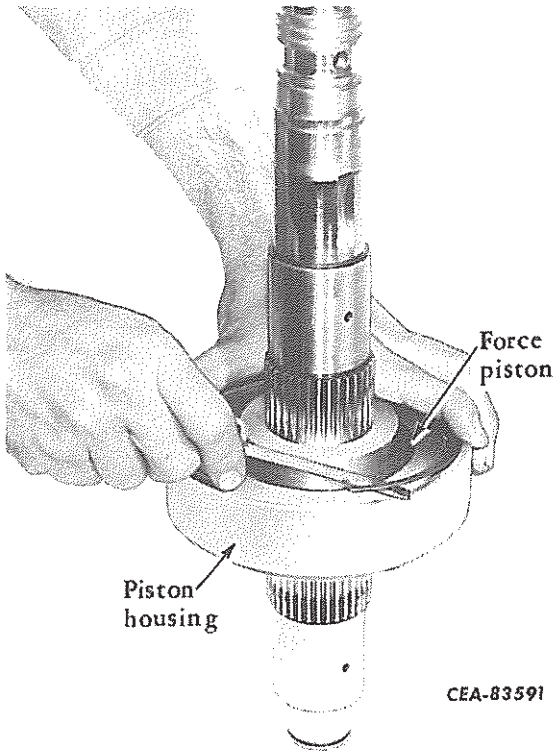


FIG. 52 — Removing the Force Piston Internal Snap Ring

NOTE: No attempt should be made to remove the sheet metal retainers (3, Fig. 58) and springs (4) contained on the inside of the clutch hub.

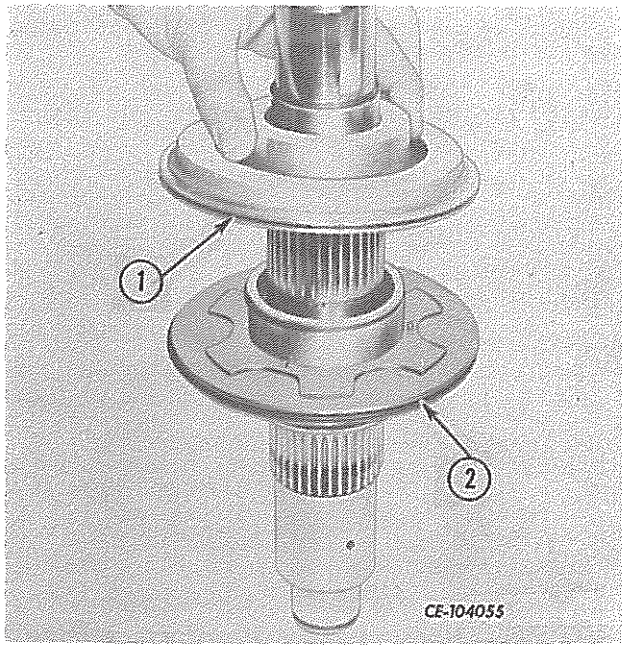


FIG. 53 — Removing the Force Piston

9. DISASSEMBLY — Continued

Forward and Reverse Clutch Shaft — Continued

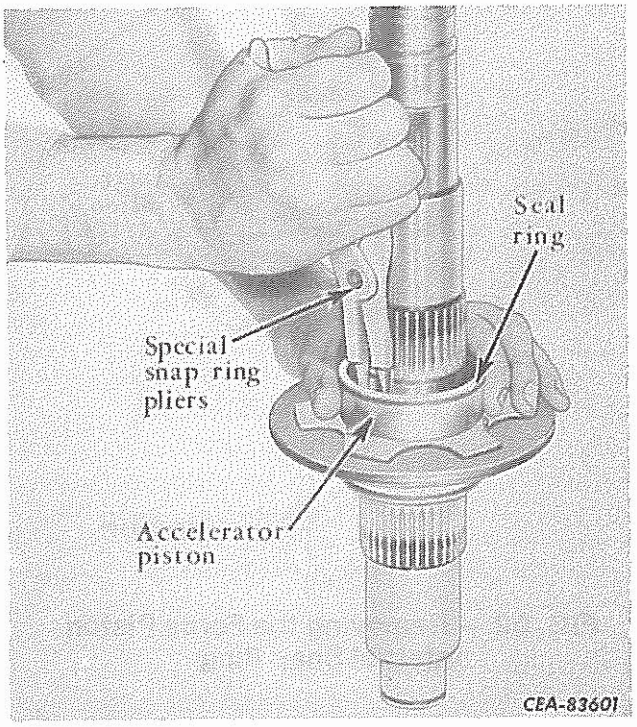


FIG. 54 — Removing the Accelerator Piston Snap Ring

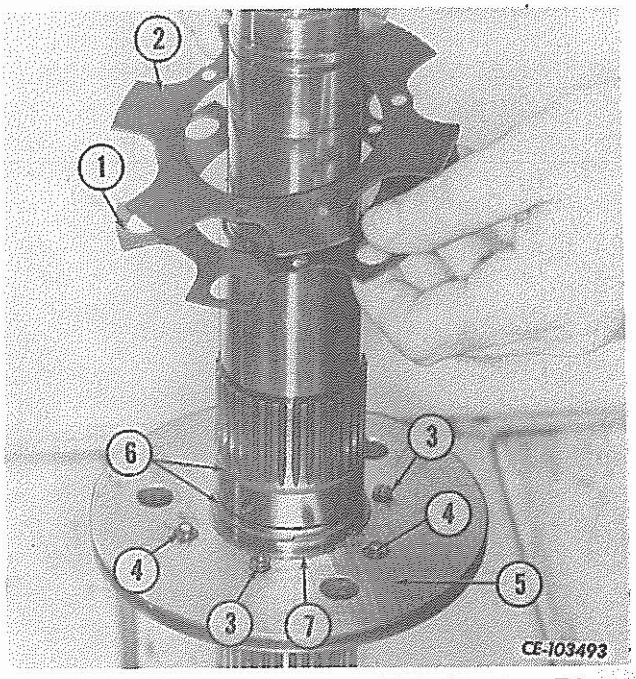


FIG. 55 — Removing the Reinforcing Disc and Disc Valve

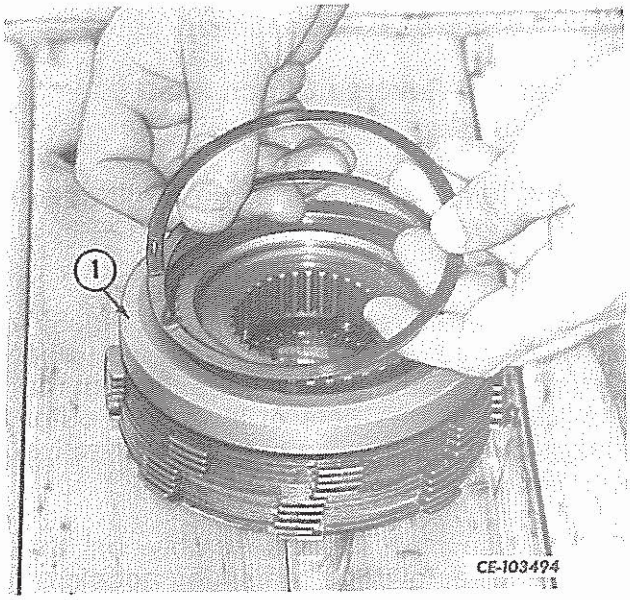


FIG. 56 — Removing the Clutch Hub Spiral Snap Ring

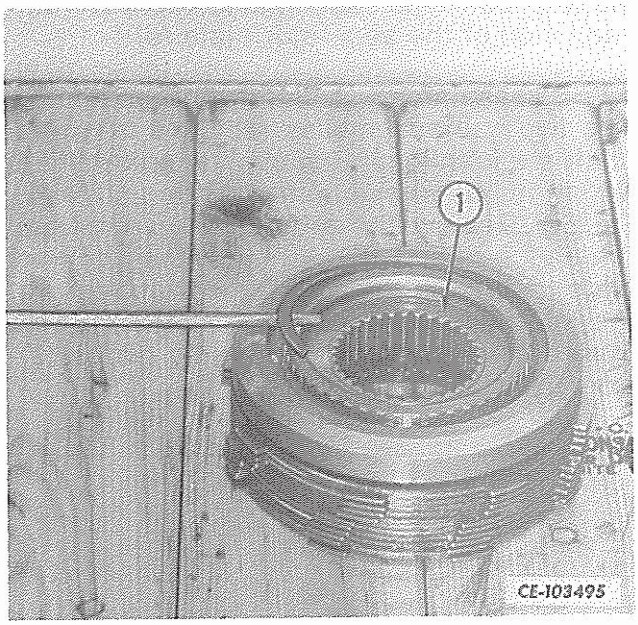


FIG. 57 — Removing the Clutch Hub External Snap Ring

48. Remove the four hook-type seal rings from the end of the shaft and discard them.

49. Do not remove the separator plate (5, Fig. 55) from the shaft unless it is damaged and a new plate is to be installed. The separator plate is thermally fitted on the shaft and must be removed by one of the following methods to prevent damaging the shaft.

9. DISASSEMBLY — Continued

Forward and Reverse Clutch Shaft — Continued

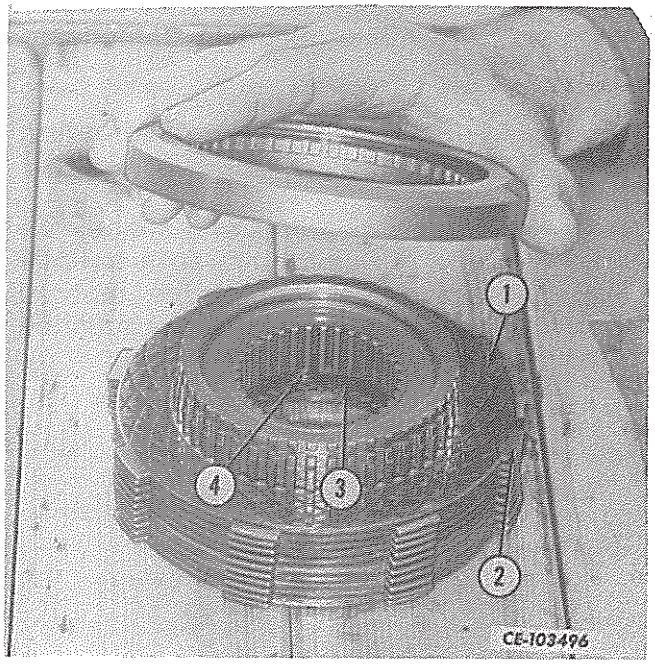


FIG. 58 — Removing the Clutch Hub Backing Plate

In either of the following methods one of the snap rings next to the separator plate must first be removed.

a. With a hack saw, saw through the separator plate from the outer diameter through one of the six holes and to within approximately 1.6mm (1/16 in.) of the inside diameter of the separator plate. Caution must be used to prevent the saw blade form marring the shaft. Place a chisel in the groove formed by the saw cut on the outer diameter of the separator plate. Using a hammer, drive the chisel down into the saw cut spreading and breaking the separator plate. This should spread the separator plate enough to be easily slipped off the shaft.

b. An alternate method of removing the separator plate is to heat the inside diameter with a torch until it expands enough to be slipped off of the shaft. The torch flame must never touch the shaft and no attempt should be made to cut the separator plate from the shaft by using the torch.

10. INSPECTION AND REPAIR

1. Inspect all bearings for cracks, scores and wear. Replace if necessary. Soak in oil, wrap and cover until ready for assembly.

2. Inspect the gears for wear or chipped or broken teeth. Replace if wear is excessive or teeth are damaged.

3. Inspect the hi-lo shifter fork fingers for misalignment or wear and the shifter fork slot in the driving gear for wear. (Refer to Par. 2, "SPECIFICATIONS.")

4. Inspect the condition of the hi-lo shifter poppet spring. If it is not within specification as described in Par. 2, "SPECIFICATIONS," it must be replaced.

5. Inspect the splines on the spline shaft and the power take-off and the universal joint coupling spline on the forward clutch shaft for wear. Replace shafts if wear is excessive. Slight burrs can be smoothed down with a stone.

6. Remove the plugs in the ends of the clutch shafts and flush all oil passages. Install the plugs until they are below the end of the shaft. Be sure all lube holes are clean and free of obstruction. All parts of the clutch packs should be thoroughly cleaned and reoiled before assembly.

7. Inspect the first and second speed drive gear thrust washers for excessive wear (refer to Par. 2, "SPECIFICATIONS" for minimum allowable thickness).

8. Inspect the clutch hub assembly. Lubrication holes in the hub should be checked for possible contamination by foreign particles that could interfere with lubrication. The return springs (4, Fig. 58) should be checked visually to see if they are properly seated and not damaged. Push the spring plate (3) down by hand and release to check spring fatigue and binding. Spring plate

10. INSPECTION AND REPAIR — Continued

must return immediately upon release. If any component of the hub assembly is not functioning properly, replace the complete hub assembly.

9. Inspect the reinforcing disc and disc valve of the forward and reverse clutch packs for wear or damage and replace parts as necessary.

10. Inspect the clutch plates for excessive wear or warpage and replace if necessary (refer to Par. 2, "SPECIFICATIONS" for wear tolerance to bronze clutch plates).

11. Using an oil stone, remove any burrs from the shaft that might damage sealing surfaces or increase wear to close tolerance parts (Fig. 59).

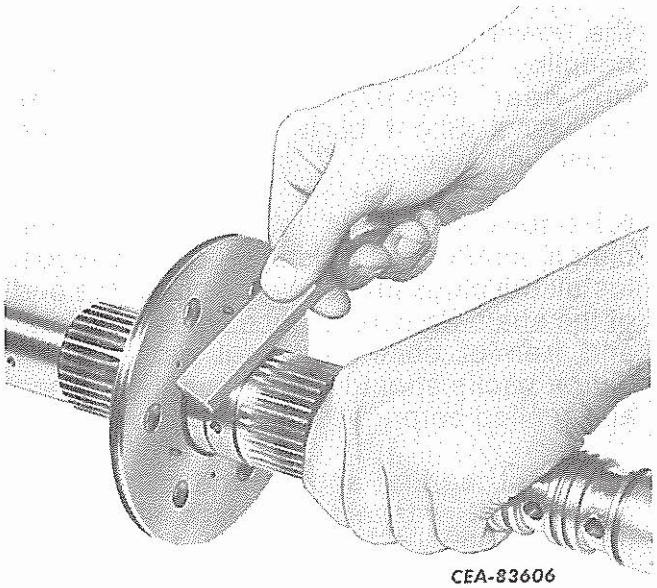


FIG. 59 — Removing Burrs from Clutch Shaft

12. It is suggested that all sealing rings, hook-type seal rings, gaskets and the oil seal used at the front of the forward clutch shaft assembly be replaced with new parts. The oil seal must be installed as described in the reassembly paragraph to assure correct installation.

13. Flush and clean all oil lines and the oil coolers to assure a clean hydraulic system. Replace or clean filter elements as necessary.

Procedure for Servicing and Adjusting Tapered Roller Bearings (Refer to Fig. 60)

The tapered roller bearings and spacer are furnished as a matched unit, so a definite procedure for adjustment of the tapered roller bearings, due to normal wear, must be followed.

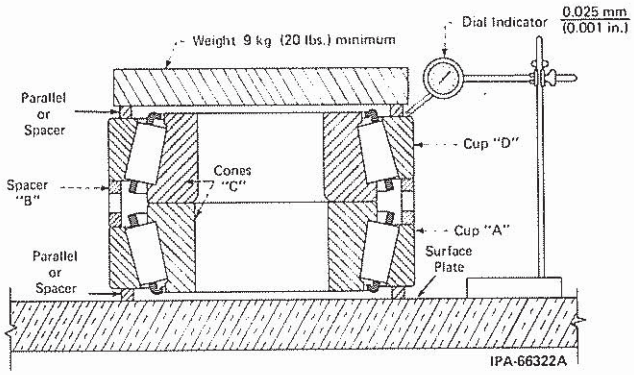


FIG. 60 — Adjustment of Tapered Roller Bearings

1. Assemble the complete bearing assembly on a flat surface (surface plate).

2. Place a weight (20 pounds minimum) on top of bearing assembly as shown in Fig. 60. This will keep the rollers in alignment.

NOTE: Be sure to place parallels or spacers on the bearing, and then rest the wright on top of the parallels or spacers. This is done so the weight is free from touching the bearing cone or rollers and the proper thrust is given. The same must be done between the bottom surface of the bearing cup and the surface plate (Fig. 60). Bottom parallels must be of equal thickness.

3. Rotate the cones (C) to a minimum of four revolutions in each direction.

TRANSMISSION

10. INSPECTION AND REPAIR — Continued

Procedure for Servicing and Adjusting Tapered Roller Bearings (Refer to Fig. 60) — Continued

4. With the spacer (B) in place, set the dial indicator at zero. Check at three different points.

5. Slide the dial indicator off the cup (D) carefully. (Do not disturb the indicator reading.)

6. Remove the weight, parallels, cup (D) and spacer (B). Replace the cup (D), parallels and weight. (Do not replace the spacer (B).)

7. Repeat the rotation of the cones (C) and slide the dial indicator on the cup (D). Be careful to get an accurate reading from the dial indicator. Check at three different points.

8. The factory end play specification in a new bearing assembly is 0.203 ± 0.025mm (0.008 ± 0.001 in.). If the reading on the dial indicator shows a greater drop than the maximum factory set end play 0.203 ± 0.025mm (0.008 ± 0.001 in.), grinding or lapping of the spacer (B) is necessary. The amount to be ground off of the spacer is the difference between the indicator reading and the factory set end play. A bearing assembly that is heavily pitted or scored must not be salvaged.

11. REASSEMBLY

Forward and Reverse Clutch Shaft

NOTE: The inner races for the reverse clutch shaft front and rear bearings or forward clutch shaft rear bearing must be heated to 275°F for approximately 45 minutes before assembling on the shaft.

1. If the separator plate (5, Fig. 55) was removed, install the new plate as follows:

Be sure one of the snap rings (7, Fig. 55) is installed on the shaft. Heat the separator plate in oil to 177°C to 204°C (350°F to 400°F) for approximately 15 to 20 minutes. This should allow the separator plate to drop onto the clutch shaft flush against the snap ring. Install the other plate snap ring and allow the plate to cool.

NOTE: Force must not be used at any time in attempting to install the separator plate. After the plate has cooled, it must be checked for warpage.

2. Install two hook type seal rings (2, Fig. 61) in the clutch shaft on each side of the separator plate (3).

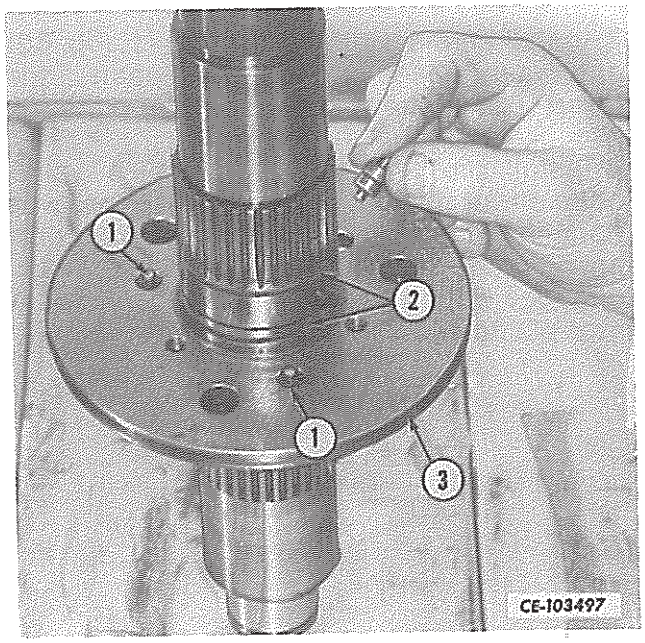


FIG 61 — Installing the Guide Pin

3. Place the shaft on end so the end with th woodruff key slot is down. Install an inner and outer release spring into each of the three spring bores in the separator plate (Fig. 62).

4. Install the reinforcing disc (1, Fig. 55) and disc valve (2) onto the release springs.

NOTE: The reinforcing disc is of heavier gauge metal and contains six oil passage holes. The reinforcing disc must be assembled next to the separator plate (Fig. 55).

5. Position the accelerator piston over the clutch shaft until it is past the snap ring

11. REASSEMBLY — Continued

Forward and Reverse Clutch Shaft — Continued

groove and install the snap ring. Install the hook type seal ring on the accelerator piston (Fig. 54).

6. Place the shaft assembly on the bench with the opposite end up. Install the three guide pins (1, Fig. 61) in the separator plate being sure they enter the holes in the reinforcing disc and disc valve installed on the underside of the separator plate.

7. Install an inner release spring (1, Fig. 62) and outer release spring (2) into each of the three spring bores in the separator plate (3).

8. Install the reinforcing disc, disc valve, accelerator piston and seal ring as was done in steps 4 and 5. Be sure the reinforcing disc and disc valve pin openings remain engaged with the guide pins as the accelerator piston is installed.

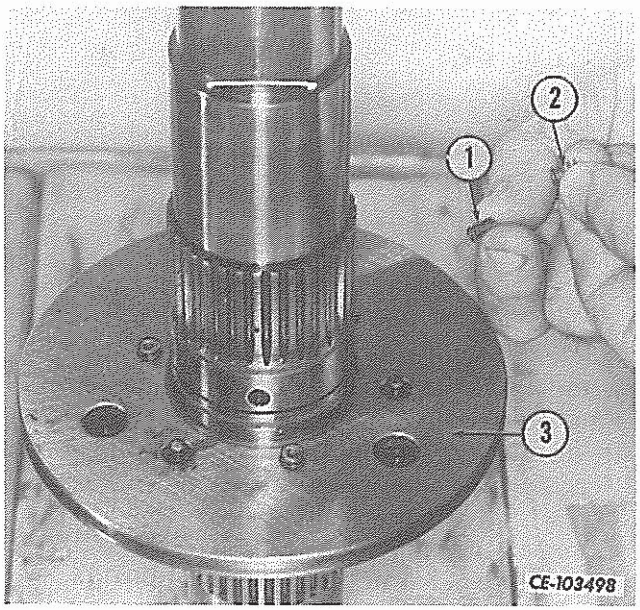


FIG. 62 — Installing the Release Springs

9. Apply a low melting, non-fibrous grease to the new separator plate "O" ring and position the "O" ring (1, Fig. 63) on the separator plate. Do not mistake the loose appearance of the "O" ring as being stretch or deformed. It is manufactured with a greater circumference than the separator plate.

10. Remove the brazing rod or "O" ring (if used in piston housing removal) from the snap ring groove in the piston housing. This groove does not have to be filled for installing the piston housing.

11. Place the shaft on end so the woodruff key slot in the shaft is down. Install the piston housing slowly onto the separator plate until it is on the sealing rings (1 and 2, Fig. 63).

NOTE: Do not force the piston housing into position. Allow the chamber of the housing to compress the seal rings and move the housing slowly over the separator plate "O" ring. Rough handling of the housing can result in a broken seal ring (2, Fig. 63) or cut "O" ring (1).

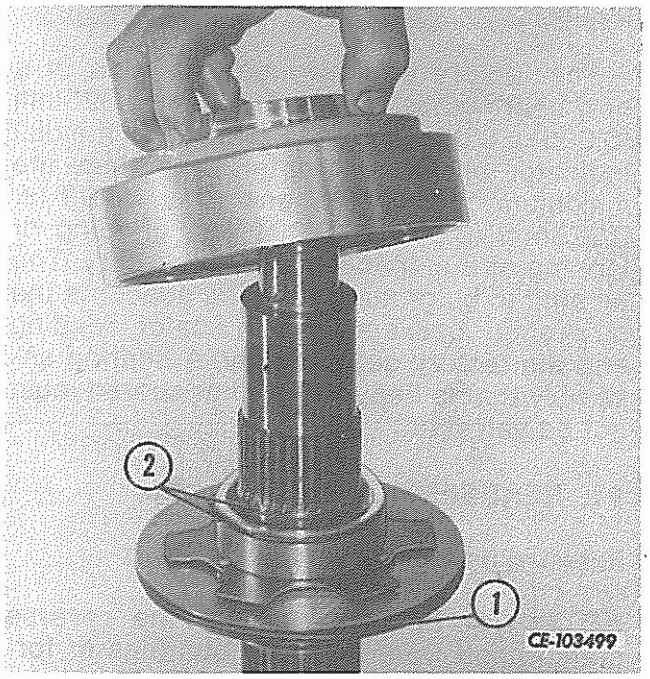


FIG. 63 — Installing the Piston Housing

12. Reverse the shaft assembly on the bench. Install the lathe cut "O" ring (1, Fig. 64) into the groove in the force position. Position the force piston on the clutch shaft and engage it into the piston housing (2). Care must be taken to prevent damage to the lathe cut "O" ring.

11. REASSEMBLY — Continued

Forward and Reverse Clutch Shaft — Continued

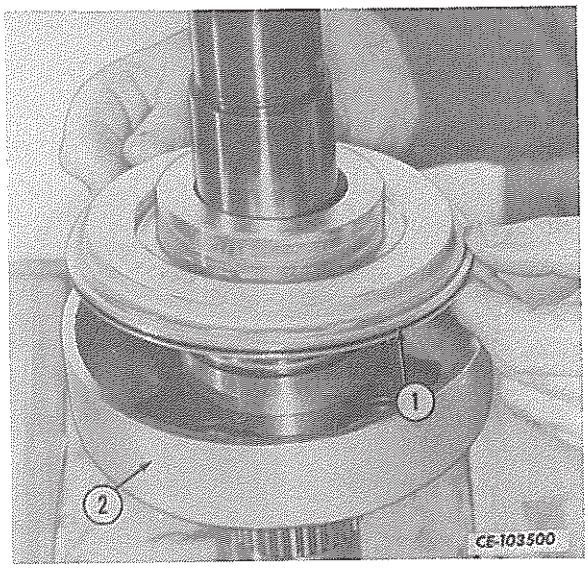


FIG. 64 — Installing the Force Piston

As the force piston contacts the hook type sealing ring on the clutch shaft and accelerator piston, rotate the piston and allow the chamber on the force piston to compress the sealing rings. Do not force the force pistons over the sealing rings.

13. After the force piston has cleared the snap ring groove in the piston housing, install the snap ring (Fig. 52).

14. Alternately install one internally splined bronze clutch plate (1, Fig. 58) and one externally tanged steel clutch plate (2) on the clutch hub.

NOTE: The bronze faced clutch plates must be thoroughly oiled (with same oil as used in the transmission) prior to assembling on the clutch hub. Because the sintered bronze facing is porous and absorbs oil, a light oiling with an oil can may not be sufficient. Whenever possible, the plates must be soaked, for at least two minutes, in a container of clean transmission oil. If facilities are not available for soaking, a heavy oiling on both surfaces may be sufficient.

15. Install the splined backing plate into position on the clutch hub (Fig. 58). Install the snap ring on the hub to secure the backing plate and install the internal spiral snap ring into the groove in the backing plate (Figs. 56 and 57).

16. Be sure the small hole in the sheet metal retainer is in line with the punch mark in the clutch hub (Fig. 65). Position the clutch hub assembly onto the shaft by properly aligning the sheet metal retainer and hub splines to the clutch shaft splines (Fig. 48).

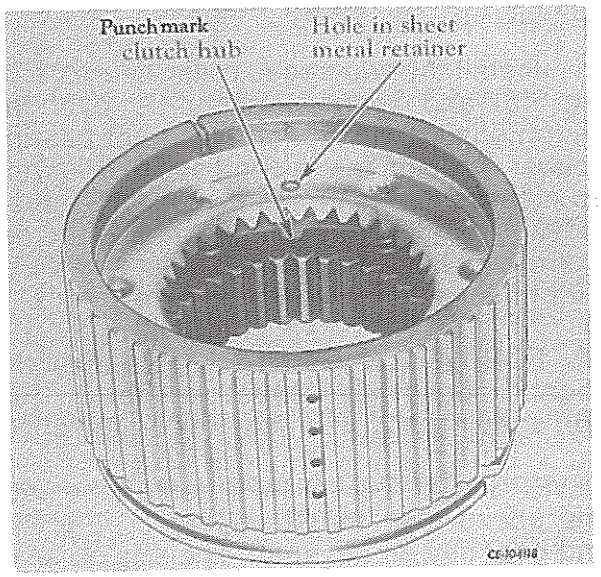


FIG. 65 — Clutch Hub Assembly

NOTE: When positioning the clutch hub assembly on the shaft, the splines of the retainer will engage the shaft splines first. The splines of the hub, which can be moved separately, may move slightly out of line with the shaft splines. If this happens, and the hub will not go down on the shaft, turn the hub very slightly in either direction until the splines engage. Do not turn the hub so the punch mark and hole (refer to Fig. 65) become misaligned. To do so will cock the springs, causing them to bind and even pop off their seats.

17. Compress the hub assembly to install the two clutch hub retainers (2, Fig. 47) into the shaft and secure them by installing the internal snap ring into the clutch hub (1).

11. REASSEMBLY — Continued

Forward and Reverse Clutch Shaft — Continued

18. Assemble and install the remaining clutch hub assembly as directed in steps 14 through 17.

19. Place the shaft on end so the woodruff key slot in the shaft is up.

20. Install the thrust bearing spacer, thrust bearing and then the other spacer, on the shaft (Fig. 46). Be sure the thin spacer is against the clutch hub retainers.

21. Install the two caged roller bearings (1, Fig. 45) and bearing spacer (2) over the clutch shaft and against the thrust bearing spacer. Position the second speed gear and drum assembly (48 teeth) over the shaft indexed on its outside diameter with the externally tanged clutch plates and flush with the spacer on its inside diameter.

22. FORWARD CLUTCH SHAFT: Install the second speed gear thrust washer (1, Fig. 66), snap ring (2) and gear key on the shaft.

REVERSE CLUTCH SHAFT: Install the second speed gear thrust washer (1, Fig. 66) and gear key on the shaft. There is no snap ring used on this shaft.

23. Place the clutch shaft in a press as shown in Fig. 67 and press the reverse drive gear (reverse driven gear on reverse clutch shaft) over the woodruff key so the long taper of the gear hub is up.

24. REVERSE CLUTCH SHAFT: Install the heated inner race of the bearing on the shaft (Fig. 68). Secure with the snap ring.

25. Place the shaft assembly on end so the clutch gear and drum assembly is down.

26. Install the thin bearing spacer over the end of the shaft until it is up against the clutch hub retainers. Install the thrust bearing next to the bearing spacer and install the thicker bearing spacer on the thrust bearing (Fig. 51).

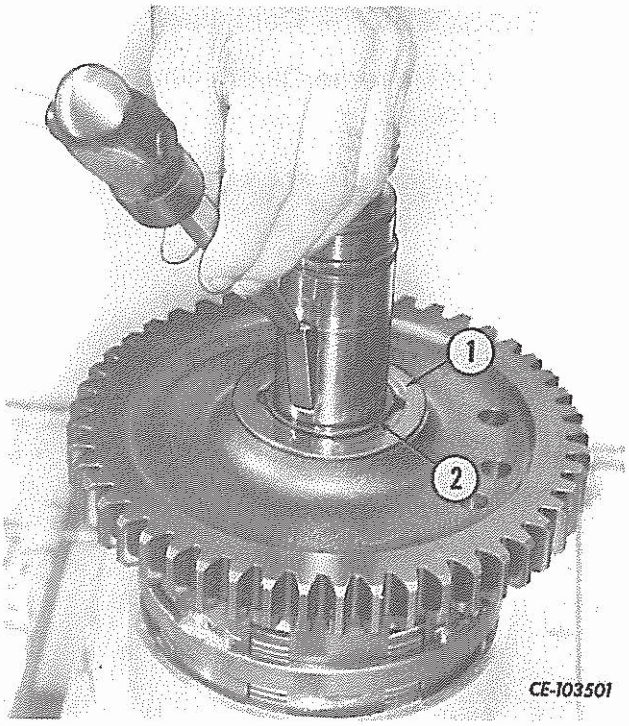


FIG. 66 — Installing the Gear Key (Forward Clutch Shaft Shown, Reverse Clutch Shaft Similar)

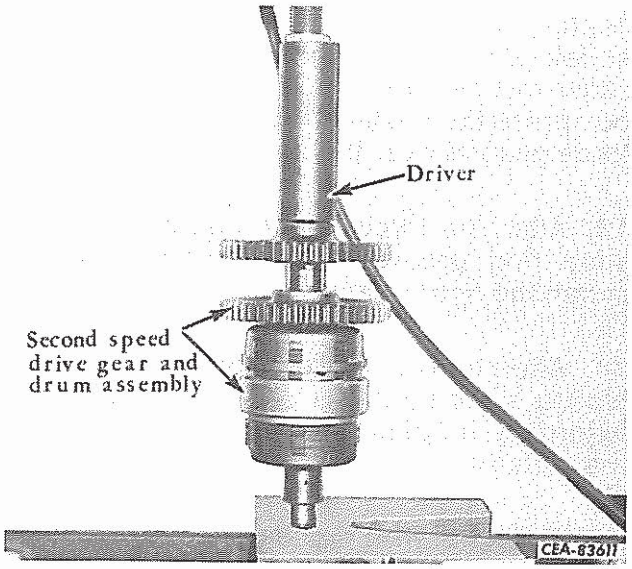


FIG. 67 — Installing the Reverse Driven Gear

27. Install the two caged roller bearings (1, Fig. 50) and bearing spacer (2) over the clutch shaft. Position the first speed gear and drum assembly over the shaft, indexed on its outside diameter with the externally tanged clutch plates and flush with the

11. REASSEMBLY — Continued

Forward and Reverse Clutch Shaft — Continued

thrust bearing spacer on its inside diameter (Fig. 50).

28. Install the thrust washer on the shaft so the slot engages the dowel pin (1, Fig. 69).

29. Install the heated inner race of the rear bearing on the shaft (Fig. 70). Secure with snap ring.

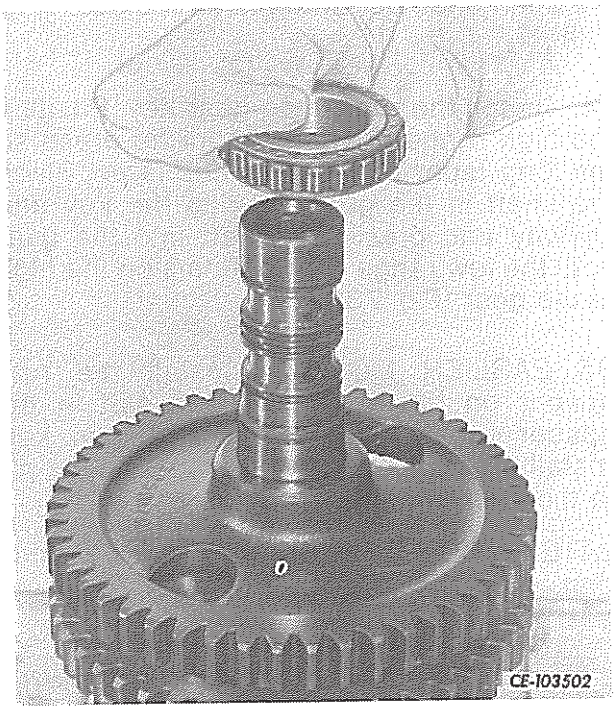


FIG. 68 — Installing the Front Bearing Inner Race

30. Check the gear and drum assembly end play. Move the gear and drum assembly away from the thrust washer as far as possible. Measure the clearance between the gear and thrust washer using a feeler gauge (Fig. 71). The clearance obtained must be within the limits shown in Par. 2, "SPECIFICATIONS." Check the gear and drum assembly end play on the opposite side of the clutch shaft in the same manner. If the clearance obtained on either of the assemblies is above or below the specified clearance, the clutch shaft must be disassembled and the thrust washer, gear and drum assembly and clutch shaft inspected. Replace the part or parts necessary to bring the end play within the limit specified.

31. Install the four hook type seal rings in the grooves in the end of the clutch shaft.

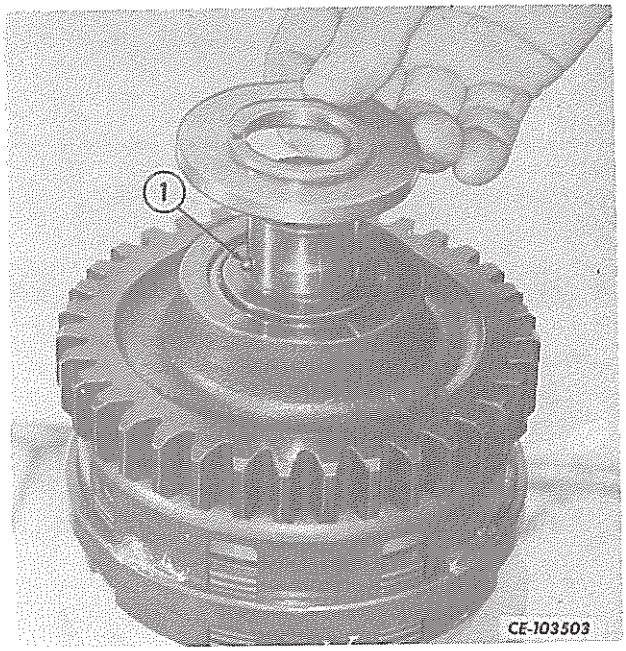


FIG. 69 — Installing the First Speed Gear Thrust Washer

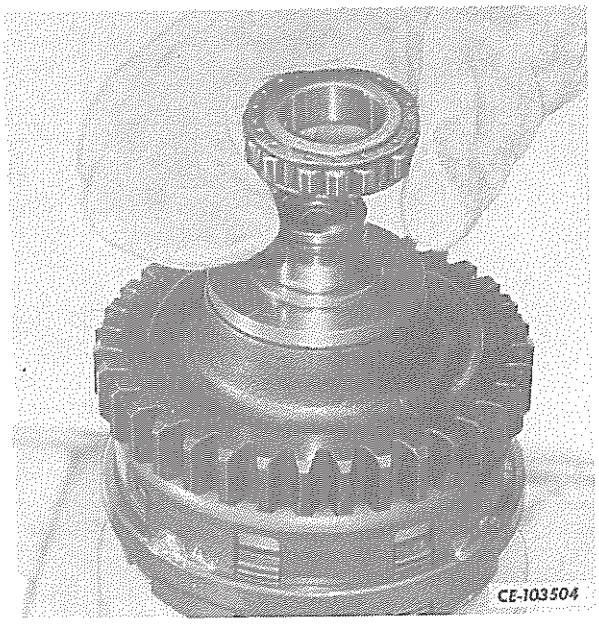


FIG. 70 — Installing the Rear Bearing Inner Race

11. REASSEMBLY — Continued

Forward and Reverse Clutch Shaft — Continued

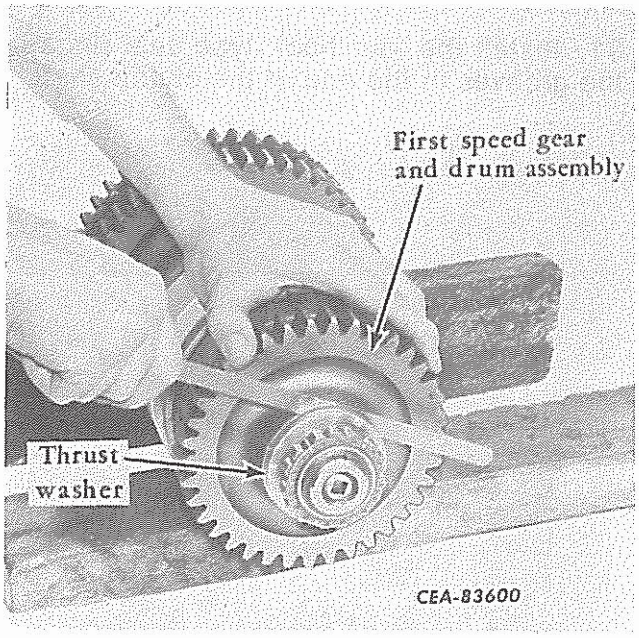


FIG. 71 — Checking Gear and Drum Assembly End Play

Pinion Shaft (Refer to Fig. 39)

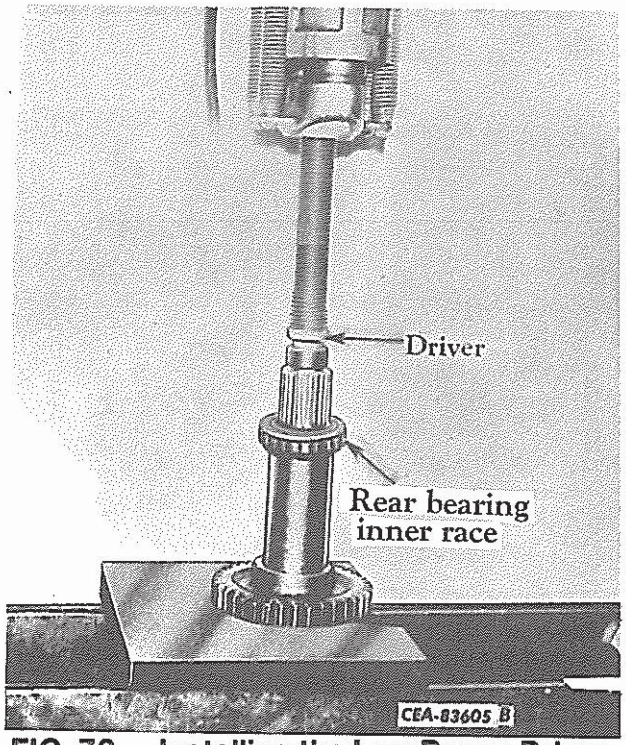


FIG. 72 — Installing the Low Range Driven Gear

NOTE: Heat the inner race of the rear bearing to not more than 149°C (300°F) and the driven gears to not more than 204°C (400°F) before installing on the shaft.

32. Install the heated rear bearing inner race on the shaft until it bottoms (Fig. 72).

33. Install the gear key in the keyway closest to the spline. Position the low range driven gear (gear with the larger outside diameter) in a press so the short taper of the gear hub is up. Place the shaft in the gear aligning the gear key with the keyway in the gear and press the shaft into the gear until the shaft shoulder bottoms on the gear (Fig. 72).

34. Install the remaining gear key. Position the high range driven gear in the press so the long taper of the gear hub is up. Place the shaft in the gear aligning the key and keyway and press the shaft into the gear until the low range gear bottoms on the high range gear (Fig. 73).

35. EARLIER MODELS: Install the rear spacer on the shaft until the slot in the spacer engages the high range gear key. Install the front spacer over the locating pin in the shaft (Fig. 39).

LATER MODELS: Install high gear retaining ring.

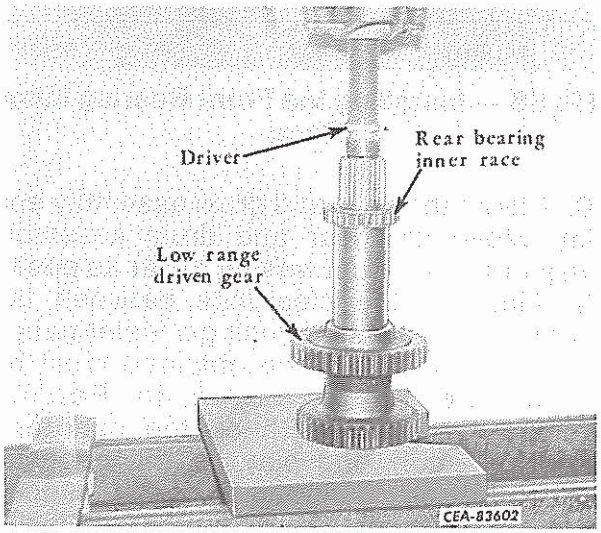


FIG. 73 — Installing the High Range Driven Gear

TRANSMISSION

11. REASSEMBLY — Continued

Spline Shaft (Refer to Fig. 35)

NOTE: Heat the front and rear bearing inner races to not more than 149°C (300°F) and the first and second speed driven gears to not more than 204°C (400°F) before installing on the shaft.

36. Install the snap ring in the groove farthest from the threaded end of the shaft. Place the first speed driven gear (gear with larger outside diameter) in a press. Press the shaft (threaded end up) into the gear until the snap ring bottoms on the gear (Fig. 74).

37. Install the hi-lo speed driving gear so the shift collar is up. Install the second speed driven gear inner snap ring (Fig. 74).

38. Place the second speed driven gear in a press and press the shaft into the gear until the inner snap ring (Fig. 74) bottoms on the gear (Fig. 75). Install the outer snap ring (Fig. 76).

39. Position the shaft in the press supported by the first speed driven gear. Press the front bearing inner race on the shaft (lip of race down) until it bottoms (Fig. 76).

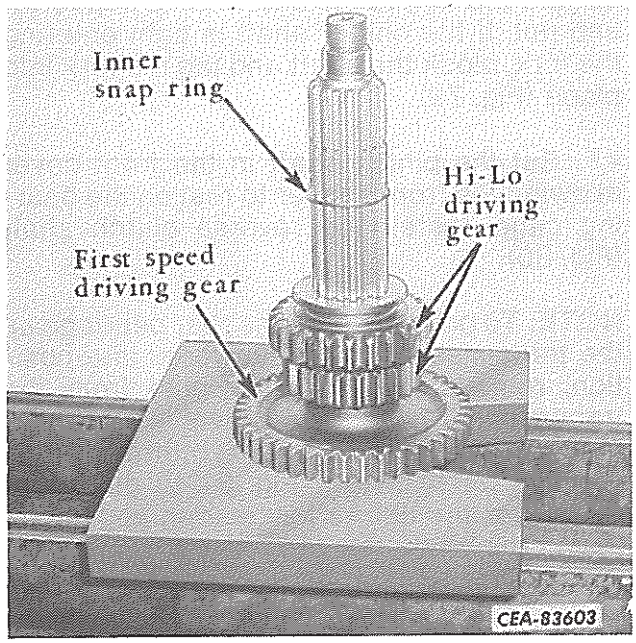


FIG. 74 — Hi-Lo Speed Driving Gear Installed

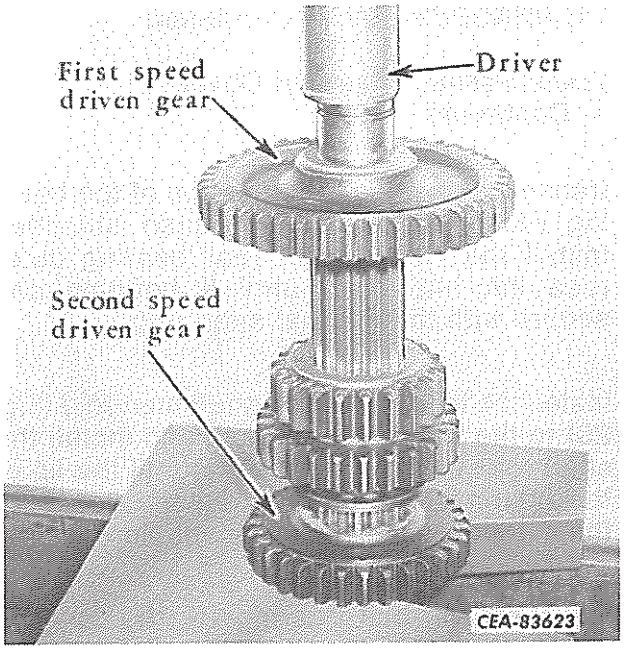


FIG. 75 — Installing the Second Speed Driven Gear

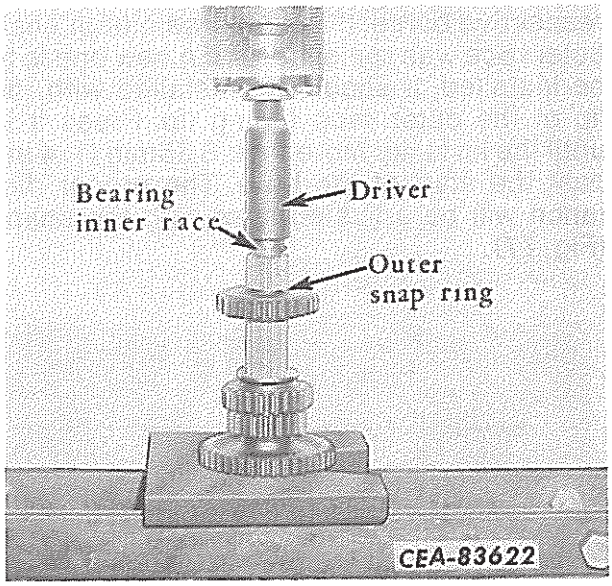


FIG. 76 — Installing Front Bearing Inner Race

40. Reverse the shaft in the press and repess on the rear bearing inner race until it bottoms on the first speed driven gear. Secure the bearing race with the snap ring.

Transmission Case and Cover

41. Install the reverse clutch shaft and the spline shaft rear bearing outer races into the

11. REASSEMBLY — Continued

Transmission Case and Cover — Continued

transmission case until the lips of the bearing races bottom on the case shoulder. Install the pinion shaft rear bearing outer race into the case until it bottoms and secure with the internal snap ring.

Install the forward clutch shaft manifold (Fig. 20) to the transmission case and install the shaft rear bearing outer race until the lip of the bearing race bottoms on the flange of the manifold. Remove the manifold.

42. Both the ball bearing for the forward clutch shaft and the straight roller bearing outer race for the spline shaft should be pressed in the transmission front cover until they bottom against a shoulder in their respective bores. If the reverse clutch shaft outer race was removed, or if a new one is to be installed, it should be installed with the lip of the outer race facing up. Press it in until the lip is not more than 6.35mm (1/4 in.) past the start of the bore. The proper distance will be adjusted later with the shims (Fig. 77).

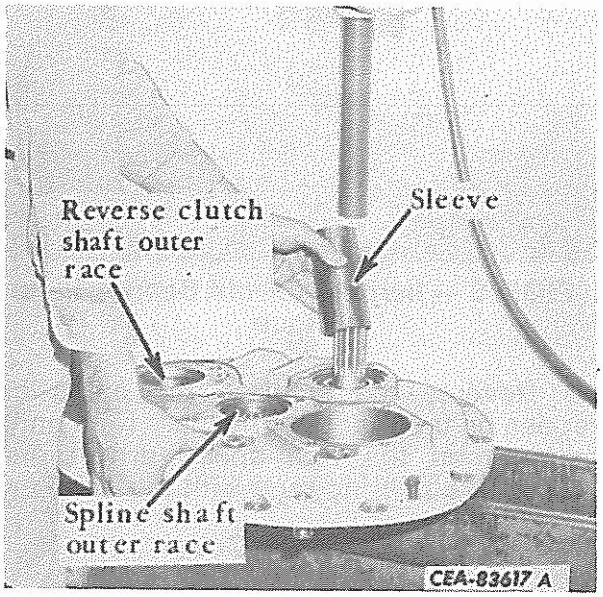


FIG. 77 — Installing the Forward Clutch Shaft

43. Place the forward clutch shaft in a press and let the lower end of the shaft rest on blocks. Do NOT rest the clutch shaft on the gears. Position the transmission front cover so the ball bearing is over the shaft. Then place a sleeve over the shaft that has an I.D. that will rest on the face of the inner race of the bearing. It should be deep enough to allow the bearing to be pressed all the way on the shaft before bottoming out. Support the transmission front cover by hand while the bearing is being pressed on the shaft. The bearing should bottom against the reverse drive gear. The install the snap ring (Fig. 77).

44. Place the "O" ring on the bevel pinion shaft front bearing cage. Install the bearing cage with the two tapped holes for the retainer lock at the bottom (Fig. 78).

45. Place the front cover in the stand or on blocks with the forward clutch shaft up. Set the spline shaft into the front cover (Fig. 79).

46. Install the hi-lo shifter fork on the sliding gear with the long part of the fork hub facing toward the front cover. Slide the shifter shaft through the bushing in the front cover and through the shift fork until the slot in the shaft is in the center of the fork. Secure the fork to the shaft with a capscrew and nut. If the shifter shaft is tight entering the fork, block the shaft and tap the fork into place (Fig. 79).

47. Set the pinion shaft in the front cover allowing the front spacer to rest on the bearing cage. Install the reverse clutch shaft (Fig. 80).

NOTE: To properly seat the rear bearings as the transmission case is lowered into position, remove the 3/4 inch plug from the transmission case that is over the reverse clutch shaft. Use a drift (1) through this opening as shown in Fig. 81 to guide the case over the shafts for bearing alignment. Install the plug after the case is secured to the cover.

48. Place a jack or blocks (3, Fig. 81) under the hi-lo shifter shaft (2) to raise the shaft to its highest position (Fig. 81). Then install a

TRANSMISSION

11. REASSEMBLY — Continued

Transmission Case and Cover — Continued

new transmission cover gasket. Begin to lower the transmission case over the four shafts. The case should be lowered so that the hi-lo shifter shaft starts into the hole provided for it in the transmission case. Then continue to lower the transmission case until it rests against the top of the shafts (Fig. 81). Secure the case to the cover with capscrews, washers and nuts.

49. Position the transmission in the stand or on blocks so the front cover is up.

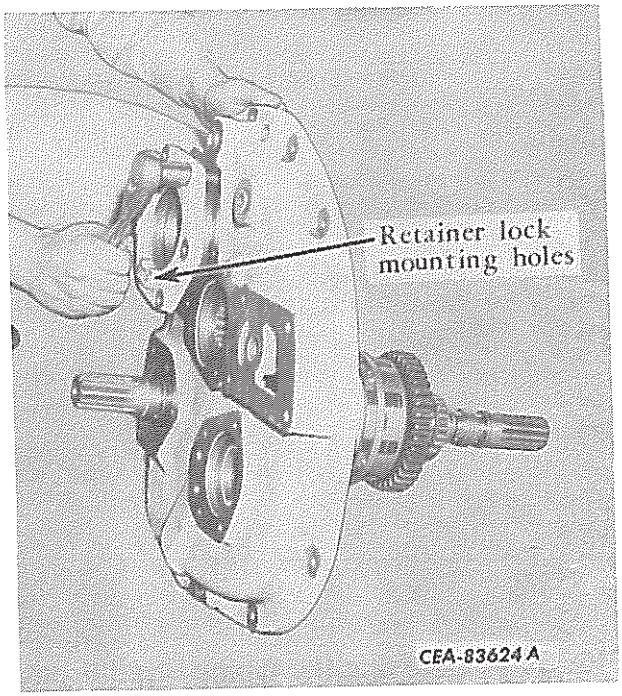


FIG. 78 — Installing the Pinion Shaft Front Bearing Cage

50. Install the oil seal (2, Fig. 33) into the rear of the oil seal housing until it is flush with the housing rear face and the seal part number is toward the inside of the housing. Install the "O" ring (1) on the housing.

51. Install the oil seal housing with the seal and "O" ring over the forward clutch shaft and secure to the front cover (Fig. 33).

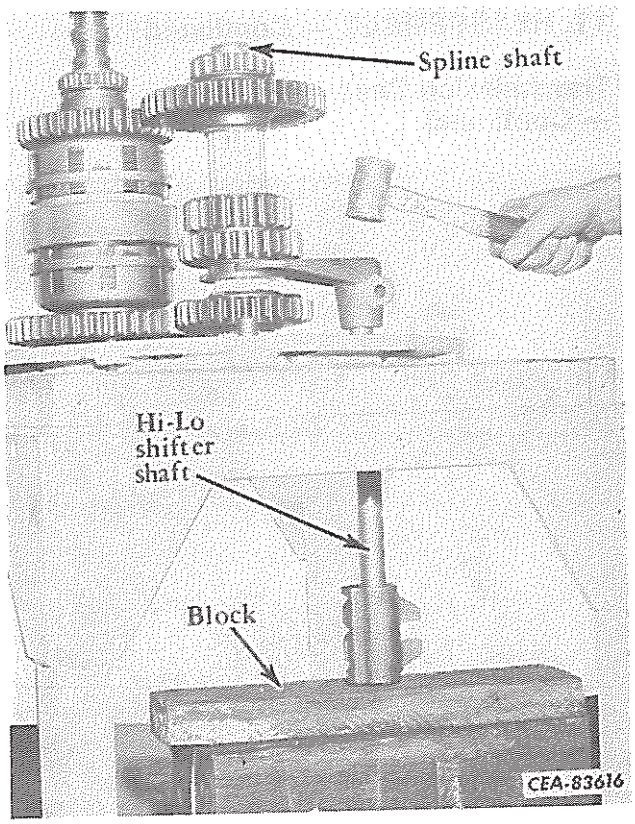


FIG. 79 — Installing the Hi-Lo Shifter Shaft and Fork

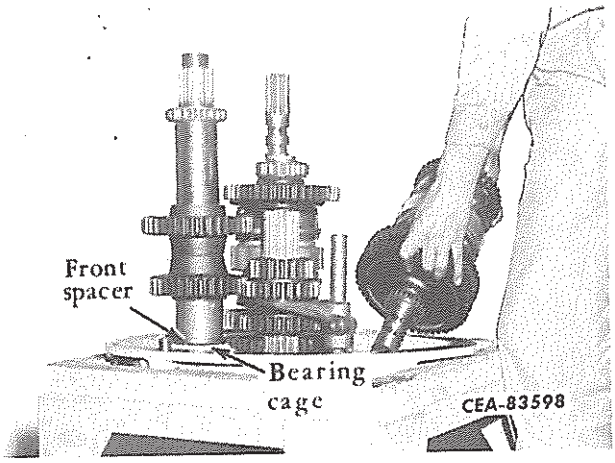


FIG. 80 — Installing the Reverse Clutch Shaft

52. Place a jack or some blocks under the pinion shaft and raise the shaft the full length of its travel.

53. Heat the pinion shaft front bearing cones to not more than 250°F for approximately 15 minutes before installing.

TRANSMISSION

11. REASSEMBLY — Continued

Transmission Case and Cover — Continued

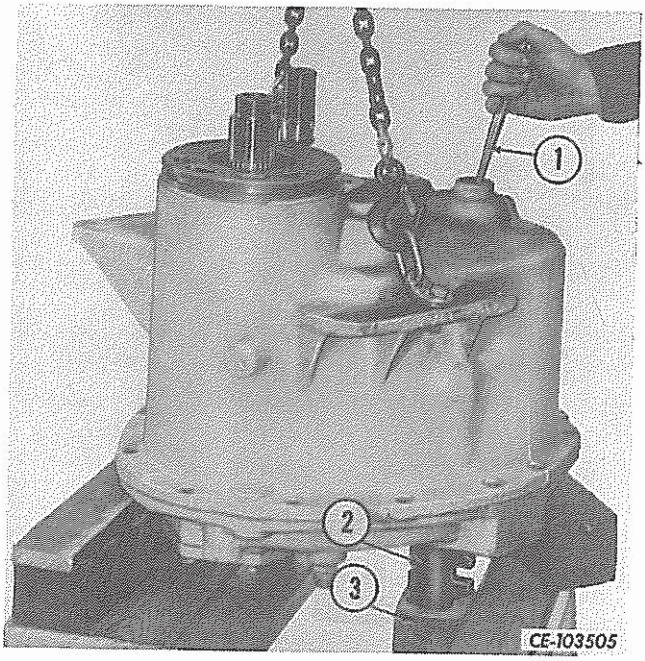


FIG. 81 — Installing the Transmission Case

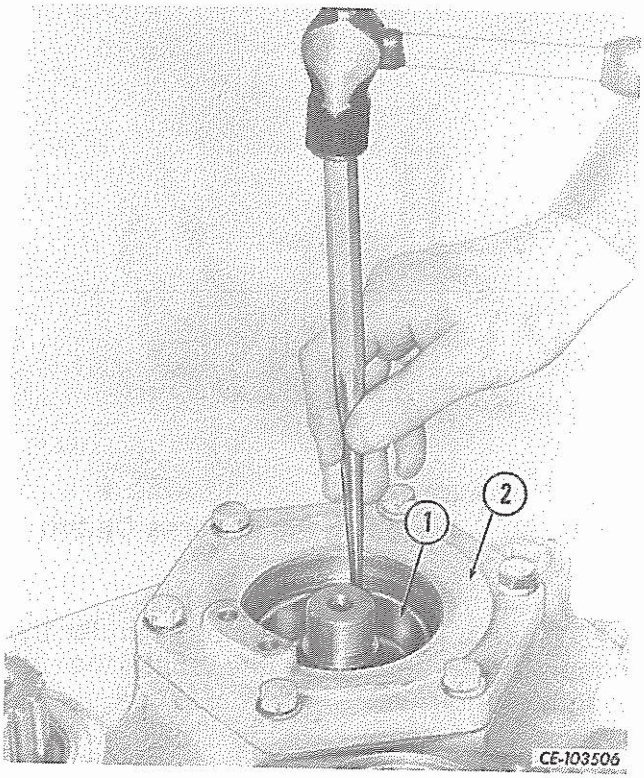


FIG. 82 — Installing Pinion Shaft Front Bearing Inner Cup

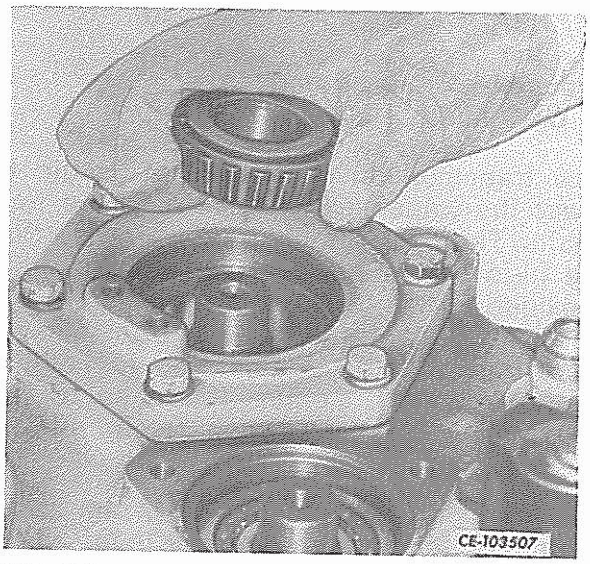


FIG. 83 — Installing the Pinion Shaft Front Bearing Inner Cone

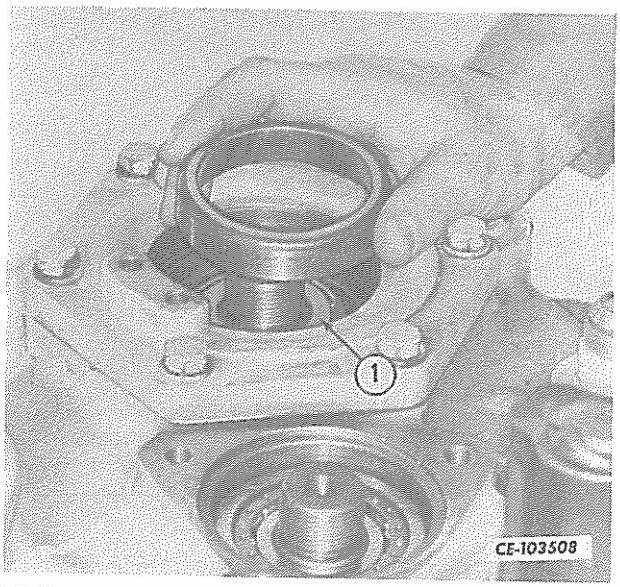


FIG. 84 — Installing the Pinion Shaft Front Bearing Outer Cutp

54. Install the inner bearing cup (1, Fig. 82) of the pinion shaft front bearing into the bearing cage (2) so the large diameter of the taper is up. Be sure the cup bottoms squarely in the cage.

55. Install the front bearing inner cone (cone with the larger I.D.) on the pinion shaft so the large diameter of the taper is up (Fig. 83). Place the bearing spacer (Fig. 31) on the inner cup.

TRANSMISSION

11. REASSEMBLY — Continued

Transmission Case and Cover — Continued

56. Install the outer cone (1, Fig. 84) on the shaft (small diameter of the taper up) until it bottoms on the inner cone. Install the outer cup until it bottoms on its cone (Fig. 84).

57. Install the front bearing plate (Fig. 85) and a new nut (1, Fig. 86) on the spline shaft. Install a new nut on the front of the bevel pinion shaft (Fig. 86).

58. Place the transmission assembly on the bench so the shafts are horizontal with the bench.

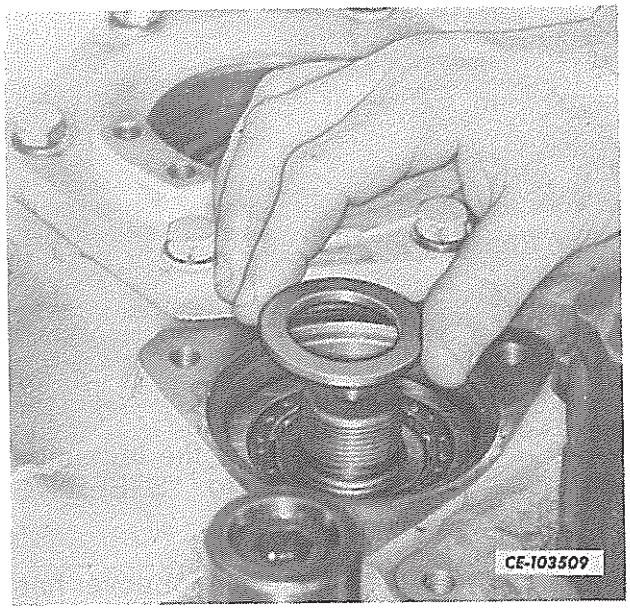


FIG. 85 — Installing the Spline Shaft Front Bearing Plate

59. Move the hi-lo shifter shaft (4, Fig. 87) into either high or low range. Position a box wrench (2) on the spline shaft nut and lay the wrench handle against the shifter shaft to prevent the spline shaft and pinion shaft from turning. Place the torque wrench (3) on the pinion shaft nut and, using a pry bar (1) to keep the case from rising, torque the nut from 678-745 N.m (500-550 lbf ft). Using this method will apply torque to both the spline shaft and pinion shaft front nuts simultaneously.

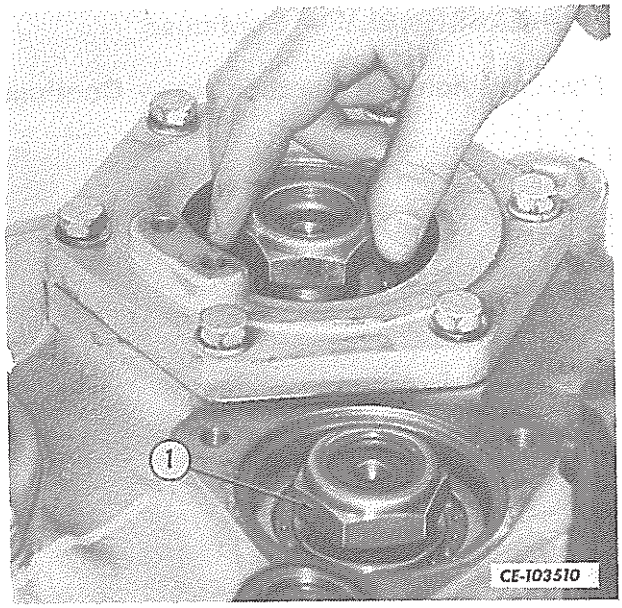


FIG. 86 — Installing the Pinion Shaft and Spline Shaft Front Nuts

60. Place the sealing ring on the spline shaft bearing cap and secure the cap (1, Fig. 88) to the front cover.

61. Place the sealing ring on the pinion shaft front bearing retainer (2, Fig. 88) against the first shoulder from the end of the retainer. Do not place the sealing ring against the second shoulder where the threads begin. Then screw the retainer into the bearing cage until it stops. Use a socket and torque wrench and tighten the retainer to 420-461 N.m (310-340 lbf ft) torque.

62. Install the retainer plug with gasket (3, Fig. 88) on the retainer.

63. Install the retainer lock. Then remove the capscrews securing the bearing cage and slide the split shims into place. The original shim thickness that was removed must be installed (Fig. 89).

NOTE: If the pinion shaft front bearing, pinion shaft, bevel pinion and the drive bevel gear in the steering planetary are to be reused, it will not be necessary to check the pinion shaft end clearance as long as the original shims are installed. However, if a new or reworked bearing, new shaft, pinion or bevel gear is installed, adjust for end

11. REASSEMBLY — Continued

Transmission Case and Cover — Continued

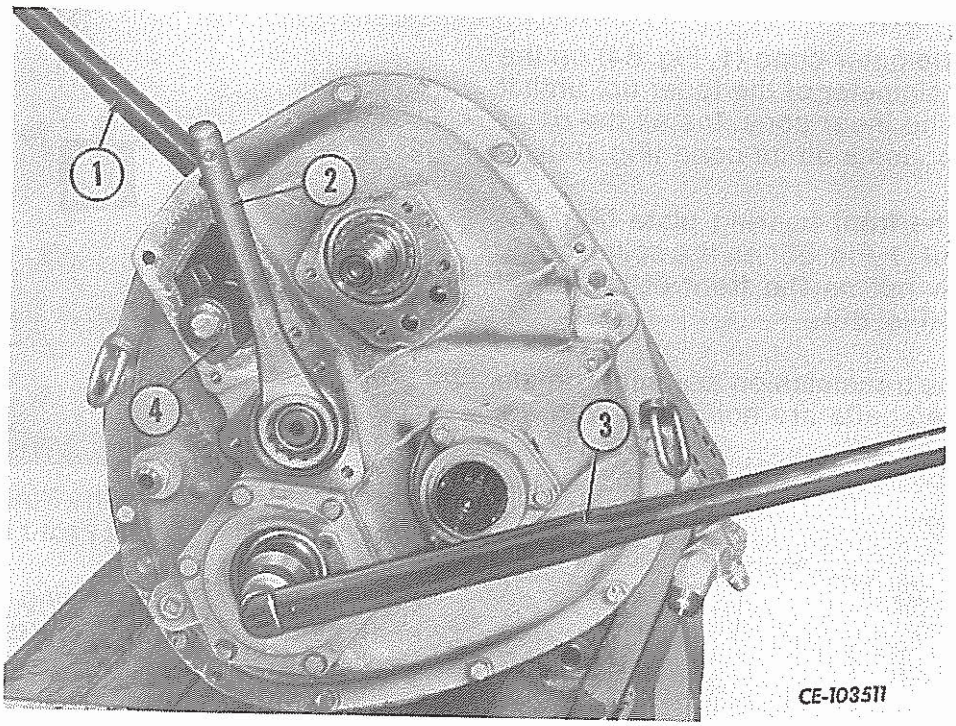


FIG. 87 — Tightening the Pinion Shaft Front Nut

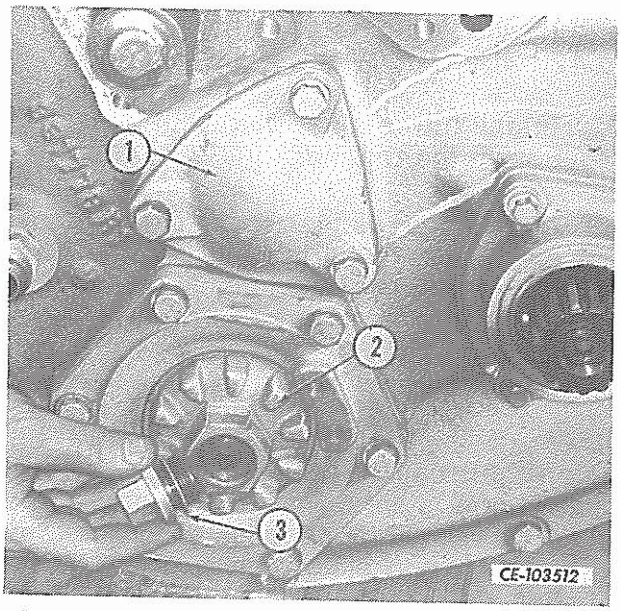


FIG. 88 — Installing the Bearing Retainer Plug

clearance and backlash after the transmission is installed. (Refer to "STEERING SYSTEM," Section 8.)

64. If a new transmission case or cover has been installed or any reverse clutch shaft bearings or gears replaced, it will be necessary to check the end play in the reverse clutch shaft. If it was not necessary to replace any of these parts, using the original shims will result in the proper end play.

65. Check the reverse clutch shaft end play. Push the clutch shaft in until the rear bearing cone bottoms in its cup. Secure the manifold (Fig. 21) to the front cover using standard torque.

Do NOT install shims (1, Fig. 21). Remove the manifold. Mount a dial indicator on the front cover, place the indicator pointer on

11. REASSEMBLY — Continued

Transmission Case and Cover — Continued

the end of the shaft and set the indicator at zero. Pull out on the shaft and take a reading (Fig. 90). The difference between the proper end play (refer to Par. 2, "SPECIFICATIONS") and the indicator reading is the amount of shims to be used to obtain the proper end play.

66. REVERSE CLUTCH SHAFT: Install the proper amount of shims (1, Fig. 21) against the front bearing cup. Be sure the "O" rings (3) and the sealing ring (2) are properly seated to the manifold. Secure the manifold to the front cover. Be careful not to damage the four sealing rings on the shaft as the manifold is passed over them.

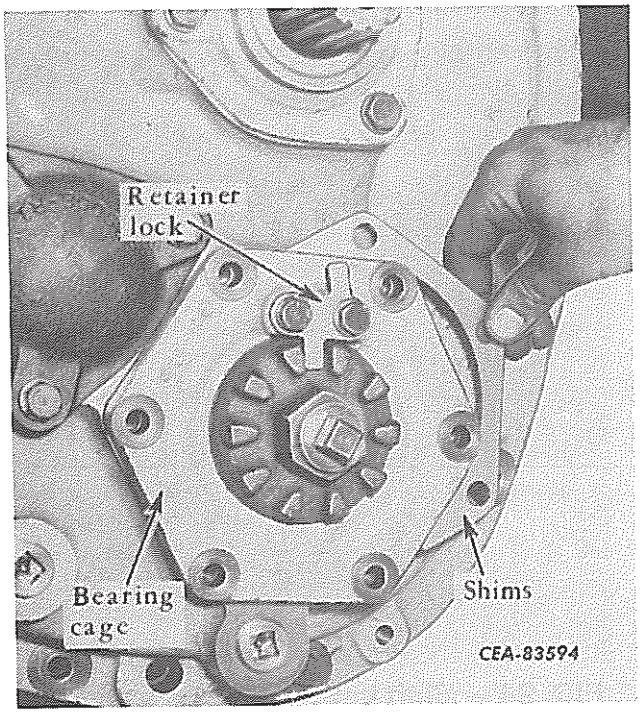


FIG. 89 — Installing the Pinion Shaft Front Bearing Cage Shims

67. Heat the bevel pinion gear to 204°C (400°F) for one hour and place it on the splines of the bevel pinion shaft. Make sure the gear is pushed back against the inner race of the rear bearing while it is cooling. Do NOT put the new retainer nut on the shaft for 15 to 20 minutes or the plastic portion of the elastic nut will melt. When the nut is installed, tighten it to 678-745 N.m (500-550 lbf ft) torque. To do this, the shaft should be turned with the torque wrench as the nut is held with a box wrench and extension bar (1, Fig. 91). Use a pry bar (2) to keep the case from rising.

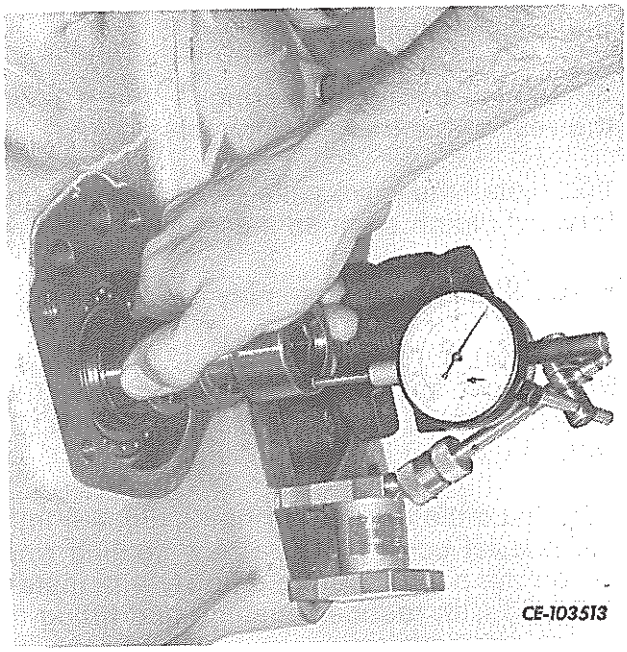


FIG. 90 — Checking Reverse Clutch Shaft End Play

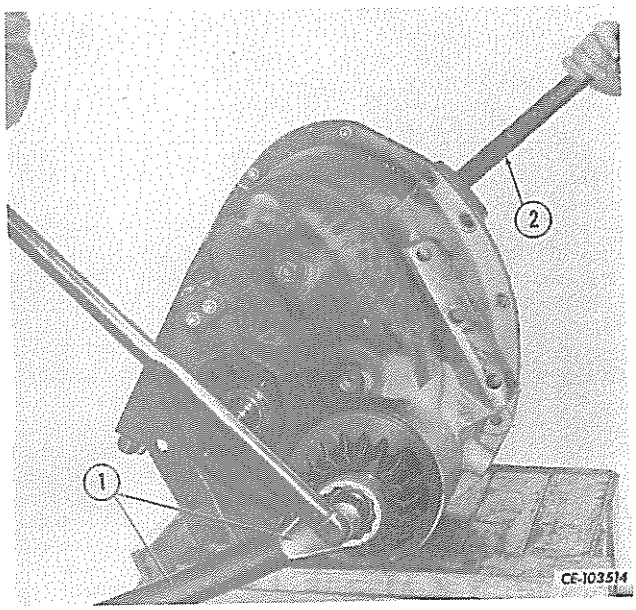


FIG. 91 — Installing the Pinion Shaft Rear Nut

11. REASSEMBLY — Continued

Transmission Case and Cover — Continued

68. Be sure the "O" ring (1, Fig. 20) and sealing rings (2) are properly seated in the forward clutch shaft manifold and carefully guide the manifold over the clutch shaft sealing rings (3). Secure the manifold the the transmission case.

69. Install the new "O" ring (1, Fig. 18) on the rear of the transmission case.

70. Install the drive yoke (1, Fig. 93) on the forward clutch shaft splines.

Hi-Lo Shift Lever Assembly

71. Install a new sealing ring (3, Fig. 92) on the poppet and insert the poppet into the shifter housing engaging the poppet slot (2) with the pin (1) in the housing.

72. Place the poppet spring (3, Fig. 16) into the poppet bore. Install a new sealing ring (2) on the poppet spring plug (1) and install the plug with reducer bushing and fitting to the shifter housing.

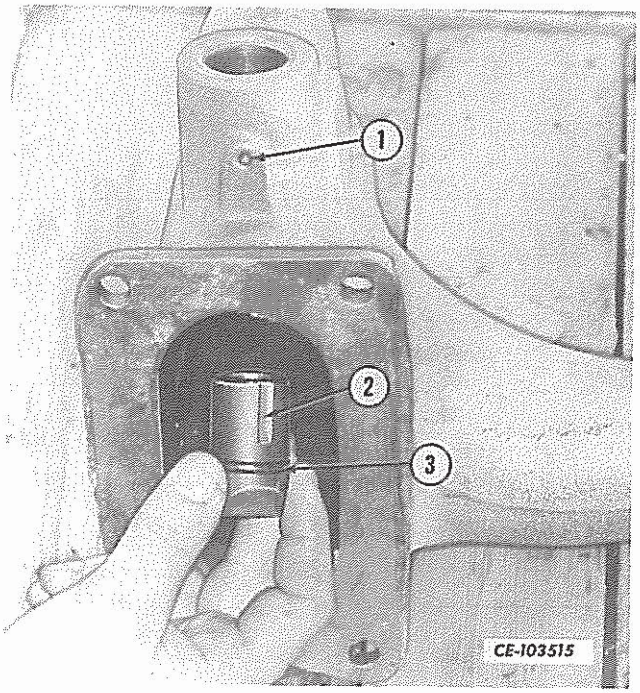


FIG. 92 — Installing the Shift Lever Poppet

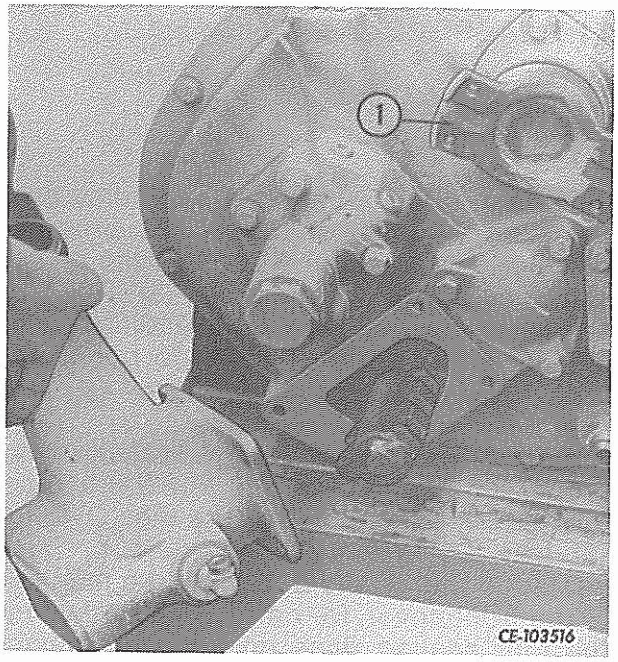


FIG. 93 — Installing the Hi-Lo Shifter Housing

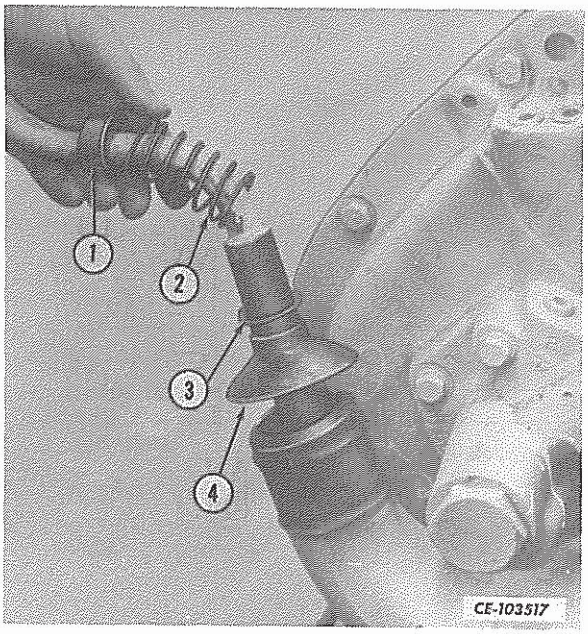


FIG. 94 — Shift Lever Spring Assembly

73. Install a new shifter housing gasket and secure the shifter housing to the front cover (Fig. 93).

74. Place the shift lever in the housing. Install the swivel cap (4, Fig. 94), spring washer (3), spring (2) and spring stop (1) on the shift lever. Secure this assembly by

TRANSMISSION

11. REASSEMBLY — Continued

Transmission Case and Cover — Continued

installing a rivet (1, Fig. 14) through the shift lever and spring stop. Next, maneuver the shift lever until it engages the notch in the shifter shaft located in the shifter housing and push down on the lever to compress the spring until the swivel shaft (1, Fig. 15) can be inserted through the lever and housing.

75. Place the shift lever boot (3, Fig. 13) in position and secure to the shift lever (1) and housing with the clamps (2).

12. INSTALLATION

1. Remove the cover from the opening in the rear main frame.

2. Be sure the two sealing rings at the rear of the transmission are properly seated. Apply 251H-EP grease to both ends of the forward clutch shaft. Attach a hoist to the transmission as was done in removal (Fig. 12) and lower the assembly into position being careful not to damage the brake cable (1, Fig. 12), steering lever pull rod (2) and steering booster rod (3). Secure the transmission case to the rear main frame and tighten the mounting bolts to 342-418 N.m (252-308 lbf ft).

3. Secure the valve spacer (4, Fig. 11) to the transmission case. Use a new mounting gasket.

4. Install the main regulating valve assembly (2, Fig. 11). Use a new mounting gasket.

5. Use new "O" rings between the range selector valve and the valve spacer. Position the valve assembly with the hose clamp, bolt and spacer assembly (1, Fig. 11) and the transmission hoses and the hi-lo shifter tube attached, on the valve spacer and secure with the mounting hardware.

6. Connect the hose clamp (3, Fig. 10) to the main regulating valve mounting bolt. Connect the hi-lo shifter tube (4, Fig. 10) to the shifter housing.

7. Connect the hydraulic equipment pump outlet hose (2, Fig. 10) to the pressure tube (1).

8. Install new "O" rings (2, Fig. 9) in the manifold counterbores and secure the transmission hose and manifold assembly (3) to the pilot control valve tube manifold (1).

9. Install the pivot brake oil cooling tube (5, Fig. 8) between the rear main frame and the main regulating valve.

10. Connect the main regulating valve drain hose (4, Fig. 8) to the transmission case.

11. Connect the steering booster hose (3, Fig. 8) to the range selector valve "M" port (Earlier models connect to the transmission.)

12. Place the diesel fuel tubes (3, Fig. 7) in position and connect to the fuel tank. Secure the fuel tube clamp to the rear mounting bolt of the rear main frame cover middle inspection cover and the clamp (7) to the main regulating valve.

12A. Connect steering booster hose (3, Fig. 8) at the steering booster. Fasten booster hose clamp (2) in position.

13. Connect the oil cooler outlet hose (1, Fig. 7) to the main regulating valve (6).

14. Connect the torque converter inlet hose (5, Fig. 7) to the main regulating valve (6).

15. Connect the pressure filter outlet hose (2, Fig. 7) and the flywheel-to-transmission hose (4) to the transmission.

16. Place the equipment pump suction tube (1, Fig. 6) in position on the machine but do not connect at this time. Then connect the torque converter vent tube (5) to the rear main frame cover.

17. Install the platform support bar with steering levers as an assembly (Fig. 6): Position the assembly in the machine and secure to the frame with the mounting hardware. The rear left hand and right hand

12. INSTALLATION — Continued

mounting bolts also hold a clamp to secure the cable harnesses. Connect the equipment pump suction tube (1) to the hydraulic tank. Secure the trnsmission hoses to the support bar using a strap in the opening used to connect the steering lever return spring. Connect the steering lever rods (2) and booster rods (3) to the hand levers. Install the booster springs (4), connecting the small spring loop at the booster lever.

18. Install the seat front support (7, Fig. 5).

19. Install the battery bottom support bracket (5, Fig. 5). The rear, LH mounting hardware also secures a clamp that holds the rear light wire (6).

20. Install the batteries (4, Fig. 5). Install the battery top support bracket (3) and connect the battery cables (2). Install the seat frame assembly (1) and seat bottom cushion.

21. Install the torque converter assembly as described in Section 6, including the filling and veting of the hydraulic systems.

CAUTION! Before starting the engine, be sure all the floor platforms are in place. As soon as the engine starts, observe the transmission clutch oil pressure gauge on the dash. If the needle moves rapidly to the extreme side of the "change filter" range, immediately turn off the engine and wait for pressure to subside before disconnecting any hoses or making any inspections.

22. Start the engine and operating until the torque converter oil temperature gauge is in the run area. Shut off the engine, remove the platforms and seat bottom cushion and check for leaks.

23. Perform the engine idle adjustments as described in Section 4, "ENGINE."

24. Check the oil pressures in the transmission as described in Par. 4, "CHECKING DRIVE TRAIN OIL PRESSURE."

25. Install the platforms.

26. After one hour of operation, disassemble and clean the suction and, if equipped, safety filters. Remove the pressure filter case and inspect the element. Replace the element if necessary.