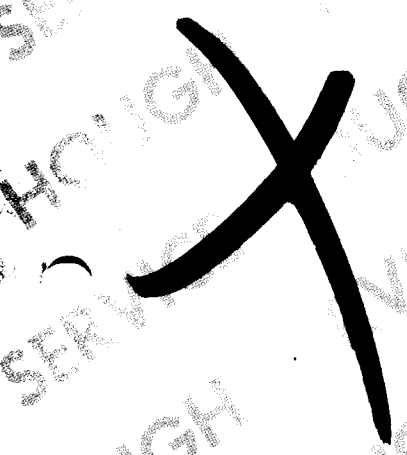
SERVICE MANUAL

TORQUE CONVERTER AND TRANSMISSION

P-1500 SERIES



PRICE $4.00

FORM

SM-P-1500

MARCH 1965

HOUGH®

THE FRANK G. HOUGH CO.
LIBERTYVILLE, ILLINOIS
SUBSIDIARY - INTERNATIONAL HARVESTER COMPANY.
IN CANADA - HOUGHCO PRODUCTS LTD., CANDIAC, QUE.

P-1500 SERVICE MANUAL

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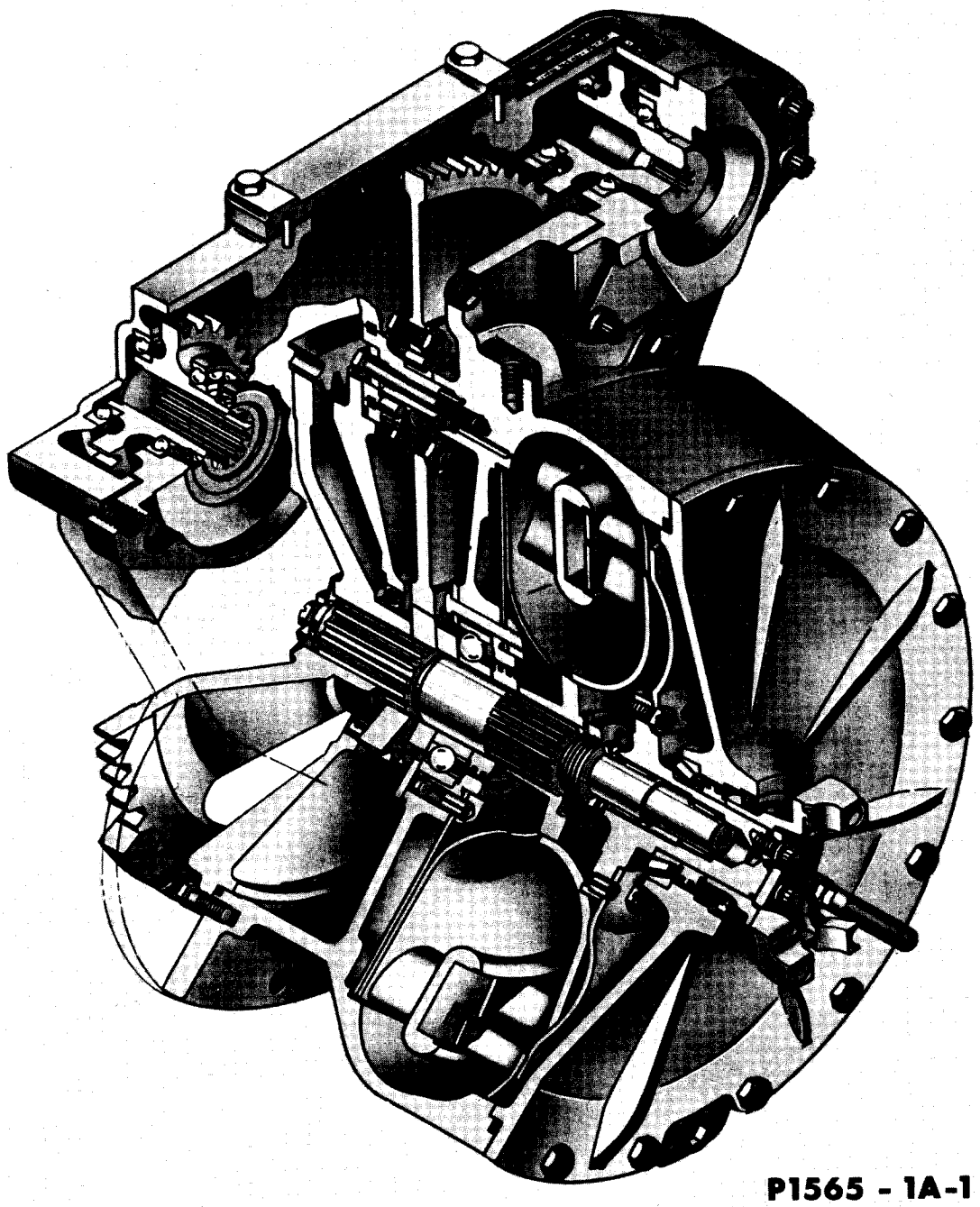


Figure IA-I P-1500 Series Torque Converter

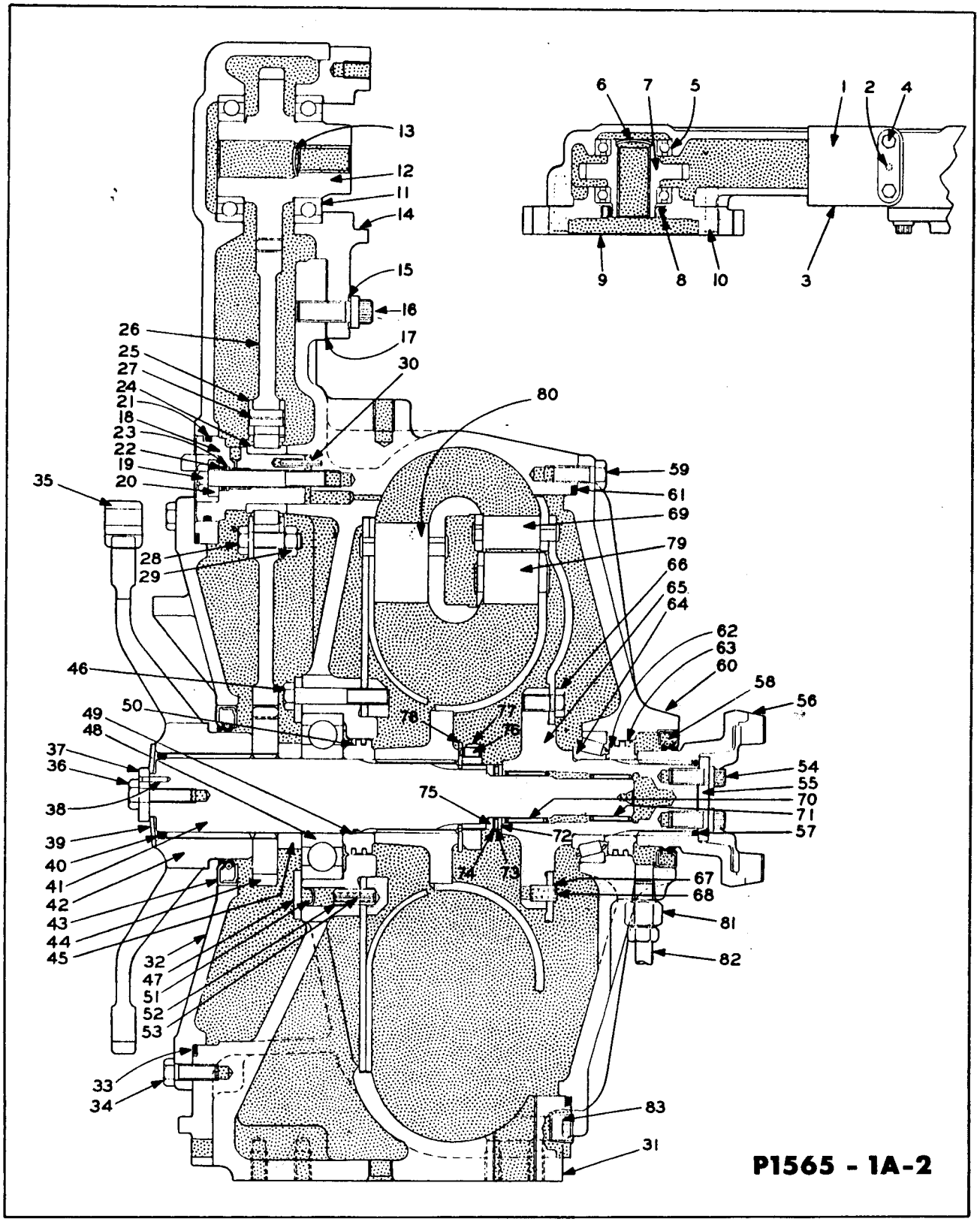


Figure IA-2 Cutaway View of P-1500 Series Torque Converter

P-1500 SERIES TORQUE CONVERTER

KEY TO FIGURE IA-2

1. Cover
2. Roll Pin
3. Gasket
4. Capscrew
5. Ball Bearing
6. Expansion Plug
7. PTO Driven Gear
8. Oil Seal
9. Plate
10. Capscrew
11. Ball Bearing
12. PTO Drive Gear
13. Expansion Plug
14. Cover Plate
15. Copper Washer
16. Capscrew
17. Cover Gasket
18. Idler Shaft
19. Capscrew
20. Washer
21. "O" Ring
22. "O" Ring
23. Washer
24. Roller Bearing
25. Bearing Retainer
26. Idler Gear
27. Roll Pin
28. Capscrew
29. Nut
30. Roll Pin
31. Assembly Housing
32. Cover Plate
33. Cover Gasket
34. Capscrew
35. Drive Ring
36. Special Screw
37. Retainer Washer
38. Roll Pin
39. Spring Washer
40. "O" Ring
41. Input Shaft
42. Drive Spider
43. Oil Seal
44. PTO Drive Gear
45. Spacer
46. Capscrew
47. Bearing Retainer
48. Ball Bearing
49. Oil Seal Carrier
50. Oil Seal Ring
51. Expansion Plug
52. Roll Pin
53. Roll Pin
54. Output Yoke Screw
55. Retainer Washer
56. Output Yoke
57. "O" Ring
58. Seal
59. Capscrew
60. End Plate
61. Ring Gasket
62. Oil Seal Carrier
63. Oil Seal Ring
64. Bearing
65. Output Flange
66. Capscrew
67. Roll Pin
68. Roll Pin
69. Turbine Wheel Assembly
70. Bearing
71. Bearing
72. Thrust Race
73. Bearing
74. Thrust Race
75. Backing Washer
76. Dog Point Set Screw
77. Lock Nut
78. Bearing Lock Washer
79. Impeller Wheel Assembly
80. Guide Wheel Assembly
81. Connector Fitting
82. Tubing
83. Pipe Plug

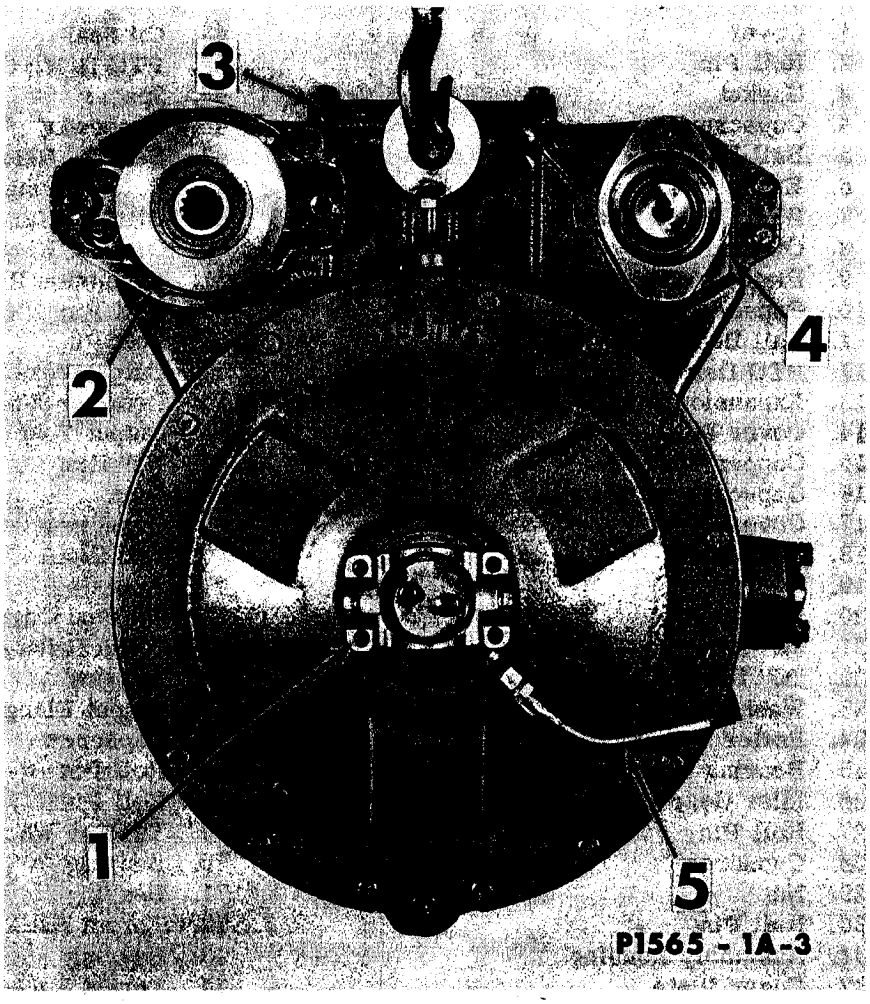


Figure 1A-3 Front View of Torque Converter

1. Output Yoke
2. Hydraulic Pump Mounting Plate
3. Cover
4. Charging Pump Mounting Pl
5. Bearing Lube Tube

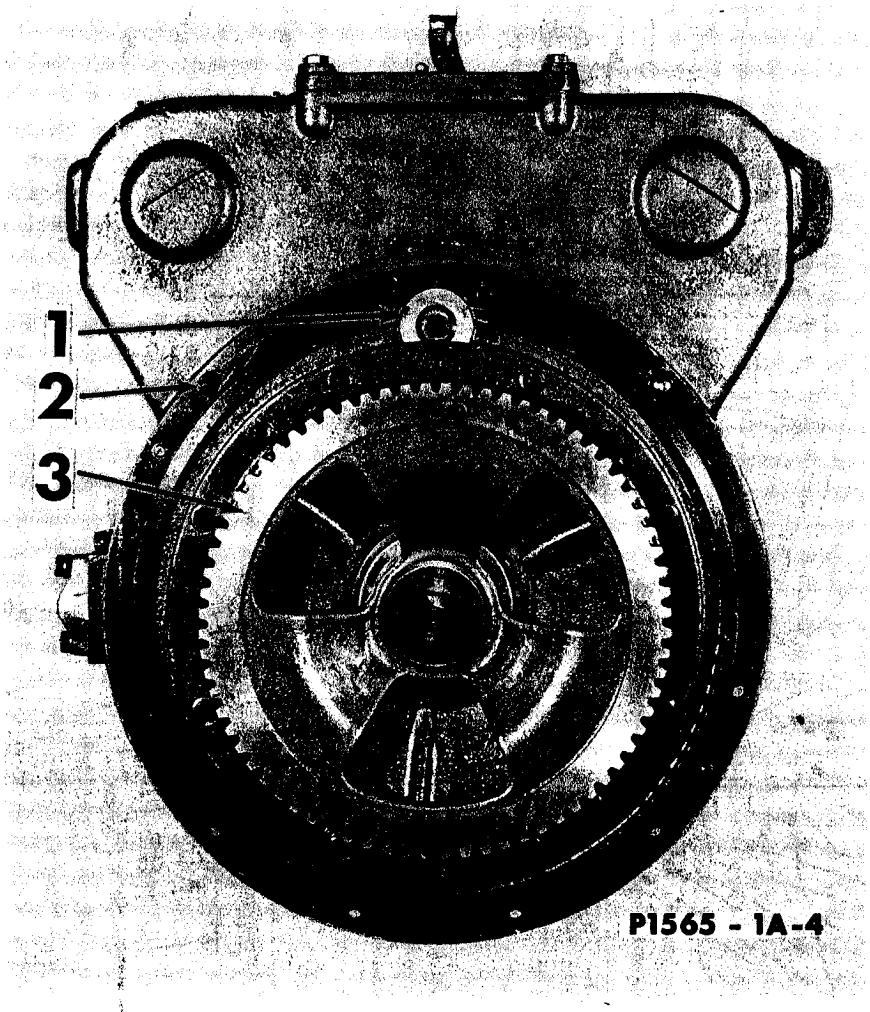


Figure IA-4 Rear View of Torque Converter

1. Idler Shaft
2. "O" Ring
3. Drive Spider

SPECIFICATIONS

CONVERTER TYPE:

Single stage, single phase converter.

TORQUE MULTIPLICATION AT STALL:

P-1500

Ratio - 6.43:1
Stall speed - 2250 R. P. M.
Input speed - 2300 R. P. M.

P-1501

Ratio - 5.66:1
Stall speed - 2230 R. P. M.
Input speed - 2300 R. P. M.

P-1502

Ratio - 4.63:1
Stall speed - 2220 R. P. M.
Input speed - 2300 R. P. M.

OIL SYSTEM:

Input pump; positive displacement, gear type.

OIL PRESSURE:

Converter "IN" at stall: 50 PSI Minimum
70 PSI Maximum

OIL TEMPERATURE:

250°F. maximum safe continuous duty.

OIL FILTER:

Full flow - remote mounted.

OIL COOLER:

Remote mounted.

WEIGHT:

317 lbs. (dry)

GENERAL INFORMATION

P-1500 Series Torque Converter

The converter is a single stage, single phase torque converter. The power takeoffs drive the tractor hydraulic system pump, steering pump, converter and transmission charging pump.

The converter is attached to the engine flywheel housing and is driven by a drive ring attached to the flywheel and is in motion anytime the engine is rotating.

The converter acts as a fluid coupling and torque multiplier between the engine and transmission. Torque multiplication in the converter is relative to the holding force applied to the converter output shaft. No torque multiplication takes place when the converter output holding force is just about the same as the engine input to the converter. But when the output holding force becomes greater than the engine input, a rerouting of fluid through the converter takes place and the converter output torque is proportionally increased.

The torque converter has three basic parts: The impeller or pump, which is directly driven by the drive ring bolted to the flywheel of the engine. The turbine wheel, which is connected through a flange to the output yoke; and the guide wheel, which is connected to the main housing and contains a row of stationary blades. The three parts are contained in the main housing which is filled with fluid. In operation the fluid is maintained at a constant pressure of a specified psi to suppress vacuum pockets which form at the blades under high fluid velocities. There is no direct mechanical connection between the impeller and turbine or guide wheel.

The torque converter also incorporates several accessory parts such as the charging pump, fluid filter, temperature gauge, lines, hoses and the fluid cooler.

The air in the converter system must be bled at the bleeder valve at the top of the fluid cooler or radiator until all air has escaped.

FLUID SYSTEM

Fluid under pressure is used to keep the converter charged and free of air. This fluid comes from the transmission pump and is diverted to the converter circuit through the converter port of the regulator valve assembly.

By-passed fluid from the transmission regulator valve passes through the converter valve to the converter. This valve is preset at the factory to regulate the amount of pressure for the converter system. A plug in the regulator valve is provided to check the converter pressure. Refer to Figure 1B-15.

COOLING SYSTEM

A separate radiator has been provided to cool the converter oil. This is also called an oil cooler. The hot fluid line extends from the outside diameter of the converter (where the fluid pressure is high) to the inlet of the oil cooler. After passing through the oil cooler the fluid returns to the converter (where the fluid pressure is low). The difference in fluid pressure at the converter outlet and inlet point is enough to circulate the fluid through the lines and oil cooler. The converter temperature gauge located on the instrument panel, indicates the temperature of the oil leaving the converter. The electric temperature sender is shown in figure 1B-14. The operating temperature should not exceed 250°F.

Should the temperature remain above 250°F. try to reduce the temperature by:

a. If the temperature rises above 250°F., with the engine throttle wide open and the output horsepower requirement is less then 70% of input horsepower, the cooling capacity of the radiator is exceeded. Decrease engine speed to 900-1000 R. P. M., shift into neutral and run engine to cool the torque converter fluid.

b. In the case of low output speed, shift into low range to reduce the torque requirements on the converter output shaft and allow its speed to build up.

c. If already in low range and converter temperature exceeds 250°F., as occurs with insufficient load, shift into high range to increase the torque requirement and decrease the speed on the output shaft. The converter will always overheat when the engine throttle is wide open and there is no load on the output shaft.

TROUBLE SHOOTING CHART

TROUBLE SHOOTING FOR THE P-1500 SERIES TORQUE CONVERTER

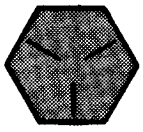
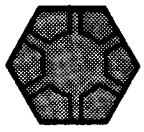
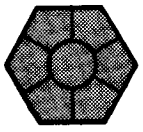
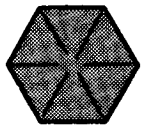
TROUBLE	POSSIBLE CAUSE	REMEDY
HIGH CONV. TEMP.	1. Improper vehicle operation.	1. Operate in correct range, downshift to lower range and up shift to high range. Idle, shift into neutral to cool torque converter fluid.
	2. Converter starving -	2.
	a. Restriction between transmission valve and converter.	a. Correct restriction
	b. Leakage between transmission valve and converter.	b. Repair leakage
	c. Converter pressure regulating valve stuck.	c. Check converter pressure for proper regulator valve opening. If found defective, overhaul.
	3. Mechanical failure -	3. Overhaul.
	a. Worn seals or seal rings.	
	4. Air in converter system.	4. Bleed air from converter cooler.
HIGH ENGINE SPEED AT CONVERTER STALL CHECK.	1. Stuck converter regulator valve.	1. Overhaul.
		a. Clean and inspect.
		b. Inspect spring.
		c. Inspect valve bore.
	2. Improper main regulator valve operation.	2. Overhaul.
	3. Worn pump gears.	3. Overhaul pump.

TROUBLE SHOOTING FOR THE P-1500 SERIES TORQUE CONVERTER (CONT'D)		
TROUBLE	**POSSIBLE CAUSE**	**REMEDY**
HIGH ENGINE SPEED AT CONVERTER STALL CHECK (CONT'D)	4. a. Internal converter leakage. b. External converter leakage. 5. Slipping direction or range clutch. 6. Air in converter.	4. a. Overhaul. b. Repair. 5. a. Cross check direction and range clutches by applying other clutches to verify slipping. b. Observe movement in drive line between converter and transmission. c. Correction will be to transmission. 6. Bleed converter at oil cooler.
LOW ENGINE SPEED AT CONVERTER STALL CHECK.	1. Plugged or restricted converter drain line. 2. Converter shaft hub seal worn. 3. Worn pump seal.	1. Clean or replace. 2. Overhaul. 3. Overhaul.
LOW CONVERTER "IN" PRESSURE.	1. Low transmission sump oil level. 2. External oil leak. 3. Converter regulator valve sticking	1. Add oil to proper level. 2. Check external lines for leaks. 3. a. Clean and inspect valve body bore. b. Inspect valve spring.
HIGH CONVERTER "IN" PRESSURE.	1. Stuck converter regulator valve.	1. a. Clean and inspect valve body bore. b. Inspect valve spring.
LOW LUBE PRESSURE.	1. Low oil level. 2. Worn input pump. 3. Internal leaks.	1. Correct oil level. 2. Overhaul input pump. 3. Overhaul transmission.
HIGH LUBE PRESSURE.	1. Stuck main pressure regulator valve	1. a. Clean and inspect valve body bore. b. Inspect valve spring.
LOSS OF POWER.	1. Low engine output. 2. Low converter "IN" pressure.	1. See low engine speed at converter stall. 2. See low converter "IN" pressure.

TORQUE CHART

FOR THE P-1500 SERIES

TORQUE CONVERTER AND TRANSMISSION

SIZE	THREADS PER INCH	TORQUE FT. LBS. FOR STD. HEAT TREATED SAE GRADE 5 ± 10 %	TORQUE FT. LBS. FOR SPECIAL HEAT TREATED SAE GRADE 8 ± 10 %
			  
1/4	20 28	9 10	12 14
5/16	18 24	18 20	25 29
3/8	16 24	32 37	45 50
7/16	14 20	52 58	70 80
1/2	13 20	80 90	110 125
9/16	12 18	115 125	160 180
5/8	11 18	160 165	225 230
3/4	10 16	280 315	400 440
7/8	9 14	420 460	650 700
1	8 14	625 700	950 1050

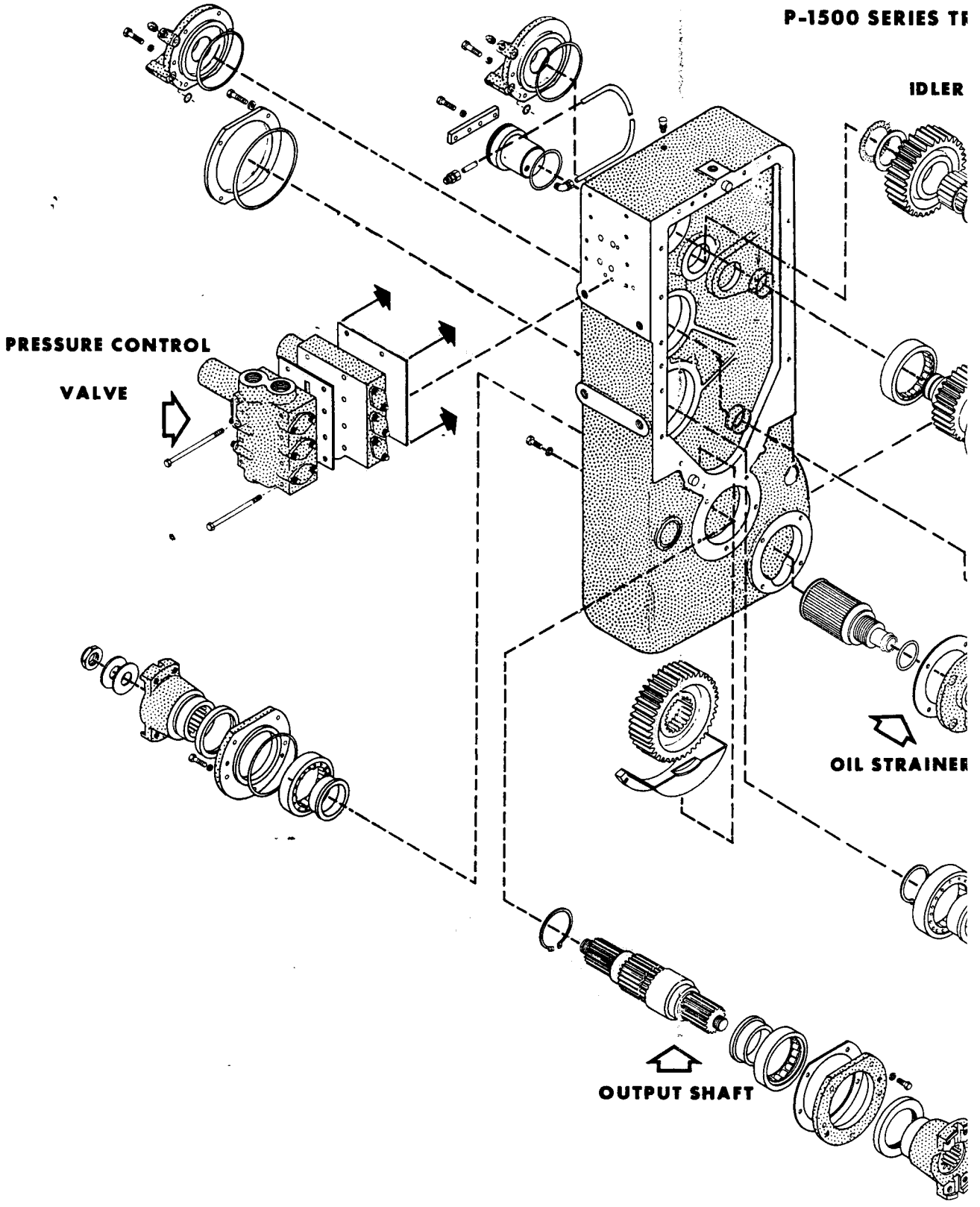
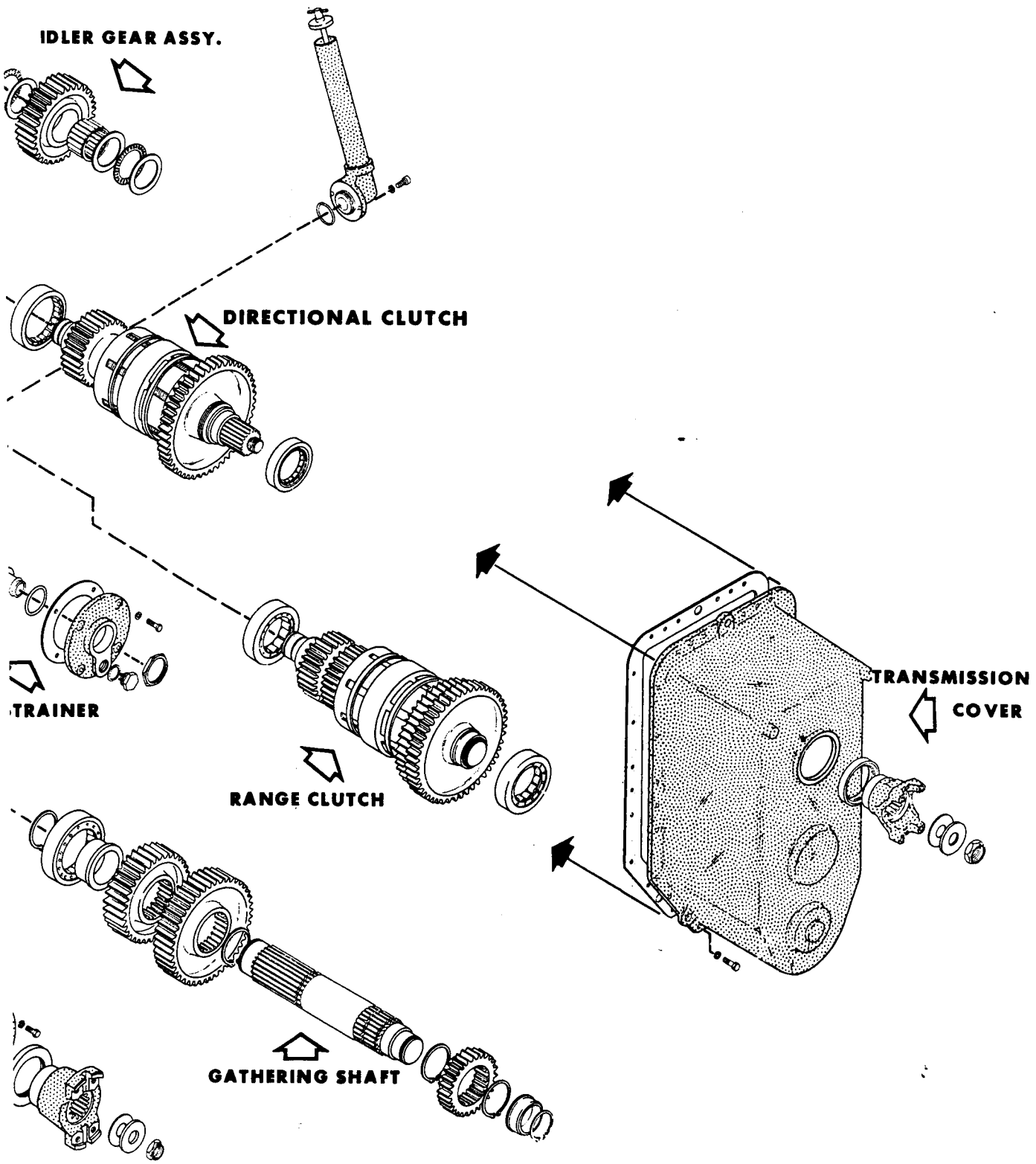


Figure IB-1 Exploded View of P

SERIES TRANSMISSION



ew of P-1500 Series Transmission

P1565 - 1B-1

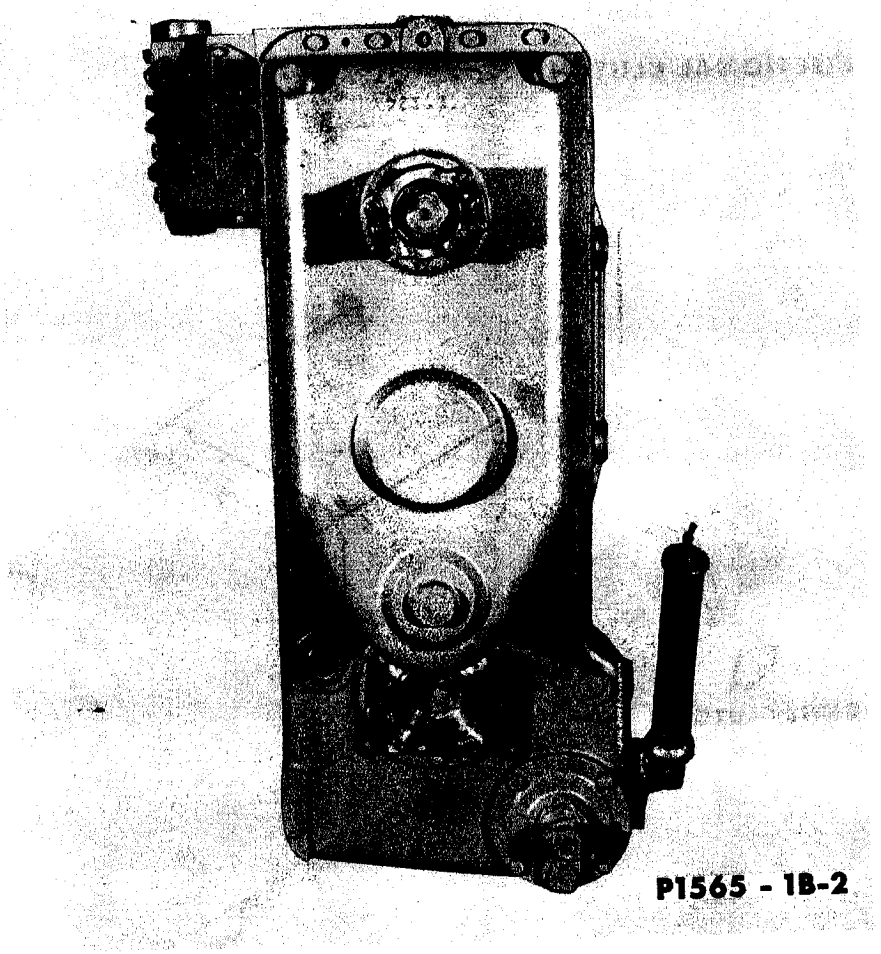


Figure 1B-2 Rear View of Transmission

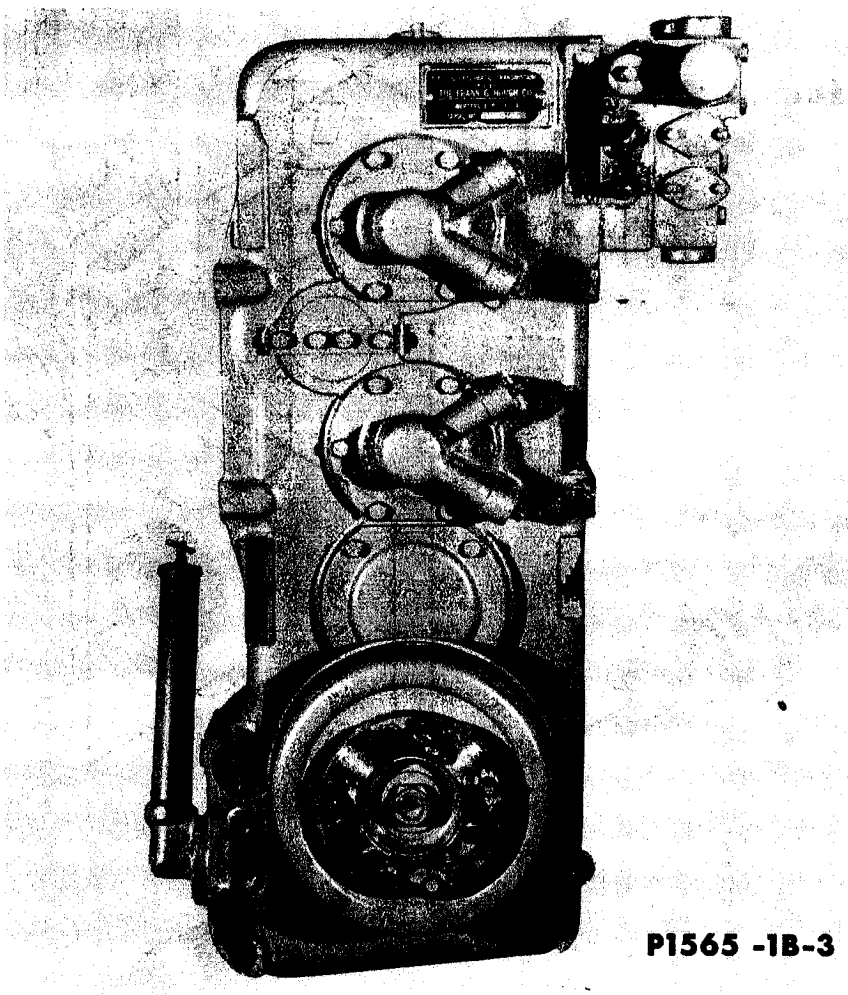


Figure 1B-3 Front View of Transmission

SPECIFICATIONS

ROAD SPEEDS (MPH) P-1500

Range	Forward	Reverse
1	6.75	7.1
2	20.00	21.3

ROAD SPEEDS (MPH) P-1501

Range	Forward	Reverse
1	6.45	6.77
2	19.25	20.4

ROAD SPEEDS (MPH) P-1502

Range	Forward	Reverse
1	5.75	6.09
2	17.20	18.25

RATING:

Maximum input speed - 2300 R. P. M.

CLUTCHES:

Multiple disc, oil cooled, and pressure balanced.

CLUTCH SIZE:

1st & 2nd range clutch - 5.25
Directional clutch - 5.25

GEARING:

Constant mesh - spur gear type.

HYDRAULIC SYSTEM:

Oil Sump - Integral
Capacity - 9 gal. 1 qt.
Type Oil - SAE Automatic Transmission Fluid Type "A"

OIL PRESSURE:

Clutch - 170-190 PSI
Lube - 5-15 PSI
Regulator Valve - Integral
Control Valve -
Directional - Integral
Range - Integral
Oil Strainer: Integral in sump
Oil Filter: Full flow, remote mounted
Oil Cooler: Remote mounted

OUTPUTS:

Front and rear output flange.
Rear disconnect and front and rear output flange.

WEIGHT:

620 lbs. (dry).

GENERAL INFORMATION

P-1500 SERIES TRANSMISSION

The P-1500 Series, full power shift transmission is designed to increase the useful range of the torque converter by using the constant mesh method of gearing with hydraulic actuated clutches. In low range the converter and transmission can deliver the most torque to the drive train. As the torque demand grows less on the converter, the transmission can be shifted into high range. The Frank G. Hough Co. has attained flexibility in gear ratio selection along with simplicity of construction and operation. The P-1500 Series transmission incorporates gearing ruggedly designed to "take it" in the types of work performed in the construction industry.

The P-1500 Series transmission has two speeds forward and two speeds reverse and has full power shift in all ranges.

The P-1500 Series transmission makes use of the countershaft type of design. This merely means that shafts are provided parallel to and driven by the input shaft for transfer of power to the output shaft. Gears mounted on the parallel shafts run free unless "clutched" to the shaft and thereby transmit power into the power-flow, developing a particular ratio or speed.

Two pair of self-adjusting multiple disc, oil cooled clutches, containing sintered bronze plates on steel backing.

DIRECTIONAL CLUTCH

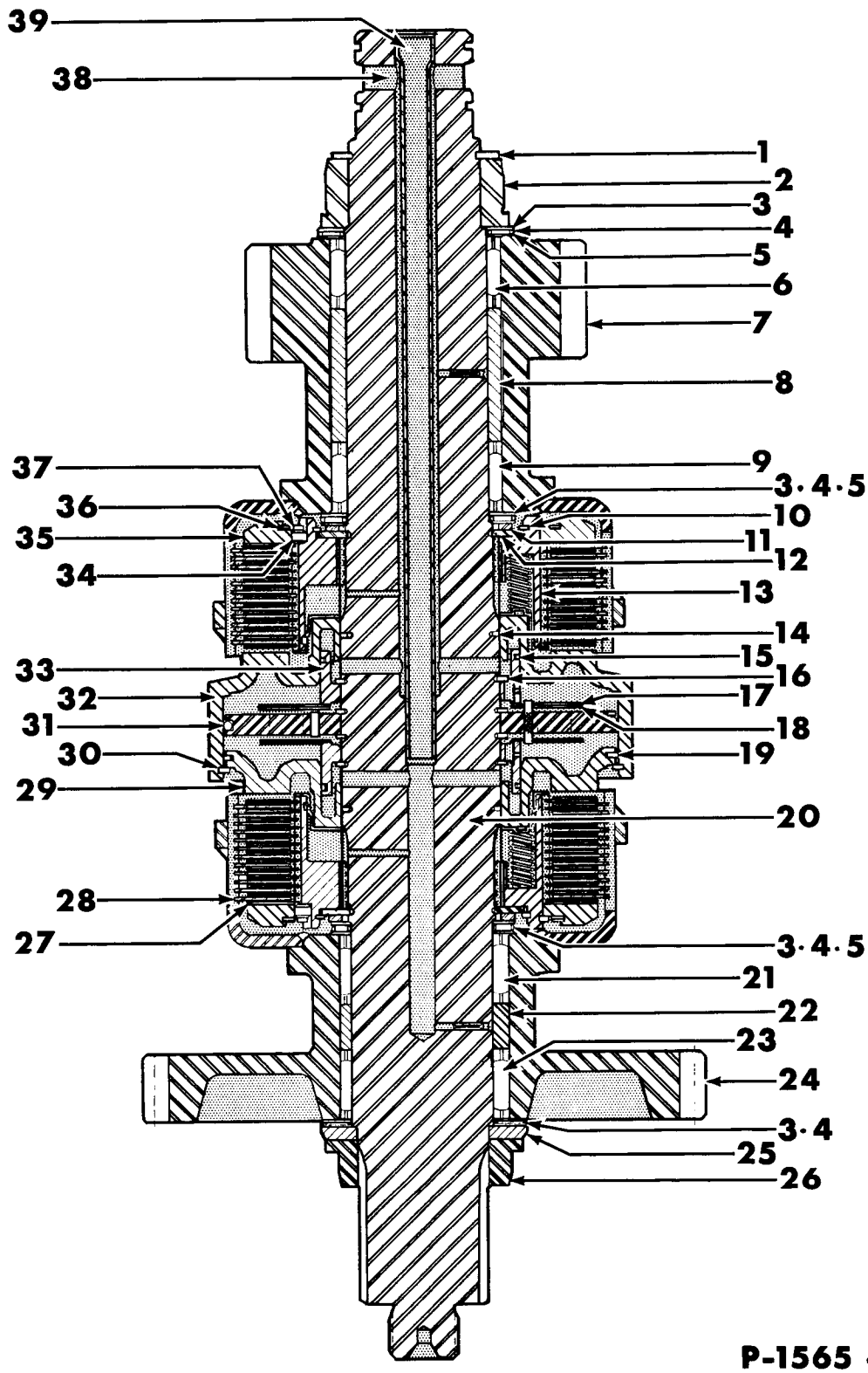


Figure IB-4 Cutaway View of the Directional Clutch

KEY TO FIGURE IB-4

1. Snap Ring	14. Seal Ring	27. Bronze Plate
2. Bearing Race	15. Seal Ring	28. Steel Plate
3. Thrust Race	16. Snap Ring	29. Clutch Piston
4. Thrust Bearing	17. Valve Disc	30. Snap Ring
5. Thrust Race	18. Disc	31. Seal Ring
6. Roller Bearing	19. Seal Ring	32. Piston Housing
7. Gear and Hub Assy.	20. Shaft Assembly	33. Accelerator Piston
8. Spacer	21. Roller Bearing	34. Dowel Pin
9. Roller Bearing	22. Spacer	35. Clutch Back Plate
10. Snap Ring	23. Roller Bearing	36. Snap Ring
11. Spacer	24. Gear and Hub Assy.	37. Snap Ring
12. Retainer	25. Thrust Race	38. Reverse Clutch Passage
13. Hub Assembly	26. Bearing Race	39. Forward Clutch Passage

CLUTCH OPERATION

In order that we may fully understand the operation of the P-1500 Series clutch packs, we must first know the component parts which make up a clutch pack and their functions.

Each clutch pack assembly is actually two clutches on one shaft (20). This shaft has two oil passages, one for Forward gear clutch (39), and one for the Reverse gear clutch (38). The lube oil is tapped off of the two passages. The lube oil lubricates the gears, bushings, and bearings. It also cools the component parts in the clutch packs and the transmission.

There are two sets of clutches in the transmission. Forward and Reverse directional clutches are on the top shaft. The first and second range clutches are in the center of the transmission. The two lower shafts are the gathering and output shaft. All the gears are in mesh all the time.

Each clutch shaft has a separator plate which is fastened to the shaft and therefore, we must consider it a part of the shaft.

In the separator plate there are six transfer ports which allow us to transfer oil from one side of the separator plate to the other.

On each side of the separator plate is a reinforcing disc (18) and a disc valve (17). The disc valve (17) is made of a thin, flexible material and functions as a one way valve. Three locating pins in the separating plate hold the reinforcing disc and disc valve in position. There are also three floating pins which pass through the separator plate. Their function are to hold the reinforcing disc (18) and disc valve (17) away from the separating plate when the opposite clutch is applied. On each side of the separator plate there is an accelerator piston (33) which is allowed to move laterally on the shaft when a clutch is being applied and isn't fixed to the shaft in any way.

In each accelerator piston there is a small drilled hole called an orifice.

Over the separator plate, reinforcing disc (18), disc valve (17) and the accelerator piston (33) is a large cylinder which is called the force piston housing. The force piston housing forms two cavities, the accelerator piston cavity and the force piston cavity. The oil supply passages (38-39) open directly in the accelerator piston cavity.

Splined to the shaft on each side of the force piston is a hub (13) which contains six centering springs. The centering springs help return the force piston (32) to the center of the shaft after a clutch has been released.

Splined to each hub are a number of sintered bronze discs (27) which are backed up by a backing plate (35). The hub (13), sintered bronze discs (27), and backing plate (35) turn with the shaft (20).

Alternating with the sintered bronze discs are steel discs (28) which are externally tanged to the drive gear and hub assembly. The drive gear and hub assembly is supported on the shaft by roller bearings and is completely independent of the shaft.

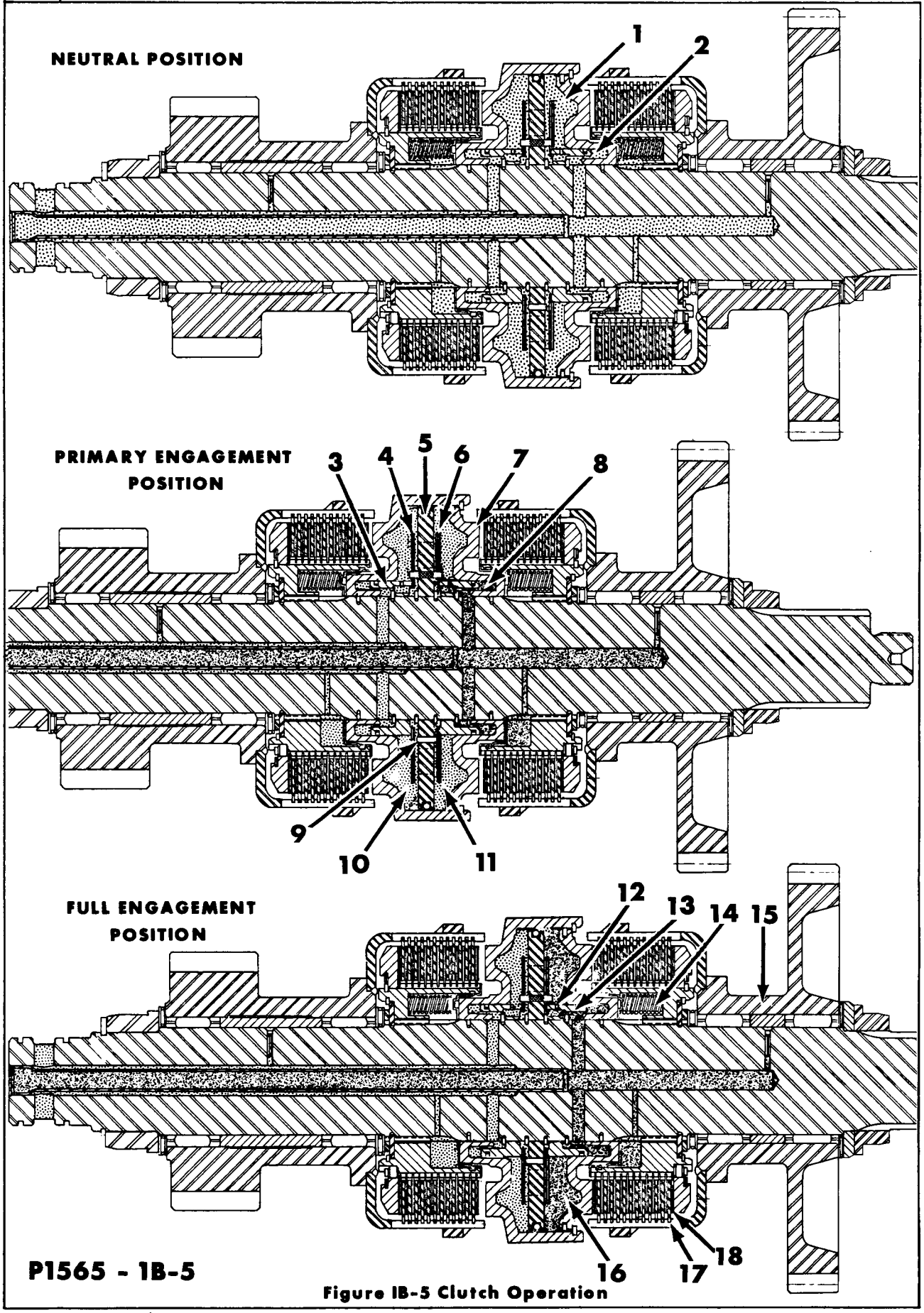


Figure IB-5 Clutch Operation

CLUTCH OPERATION

NEUTRAL POSITION

As soon as the engine begins to turn over, the pump, located on the torque converter housing, picks up the oil from the transmission sump and directs it to the main regulator valve. This in turn directs lube pressure to the selector valve which is in the neutral position. Lube oil is then sent through various passages to the oil supply covers and clutch packs through the oil supply passages in the shaft. Thus, filling the accelerator piston cavity (2) and force piston cavity (1) with lube pressure.

PRIMARY ENGAGEMENT POSITION

Upon application of a clutch, the range selector valve or the directional control valve, depending on which clutch is to be applied, directs high pressure through the oil supply passages in the clutch shaft to the accelerator piston cavity (8). The accelerator piston immediately moves toward the separator plate (5), thus pushing the disc valve and reinforcing disc (6) against the separator plate. The three floating pins (9) which float laterally in the separator plate hold the reinforcing disc, disc valve (4), and accelerator piston (3) on the opposite side away from the separator plate. At the same time the force piston (7) begins to move toward the clutch. The force piston cavity (11) enlarges and the corresponding force piston cavity (10) becomes smaller. The oil transfers through the transfer ports in the separator plate pushing the disc valve off its seat. Thus, completing the transfer of oil and the primary engagement.

FULL ENGAGEMENT POSITION

The force piston cavity (16) is completely pressurized by high pressure oil passing through the orifice (12) in the accelerator piston (13).

The sintered bronze (18) and steel discs (17) have been squeezed together, thus the drive gear and drive hub assembly (15) has become clutched to the shaft.

Each clutch is applied in the same manner as previously described.

To return the clutch to the neutral position, the high pressure oil is released through the directional control valve or the range selector valve, depending on which clutch was applied. The centering springs (14) in the hub, which have been compressed by the force piston, return the force piston to the center of the shaft. The accelerator piston, disc valve and reinforcing disc move away from the separator plate and the lube pressure remains in the accelerator and force piston cavities as shown in the neutral position.

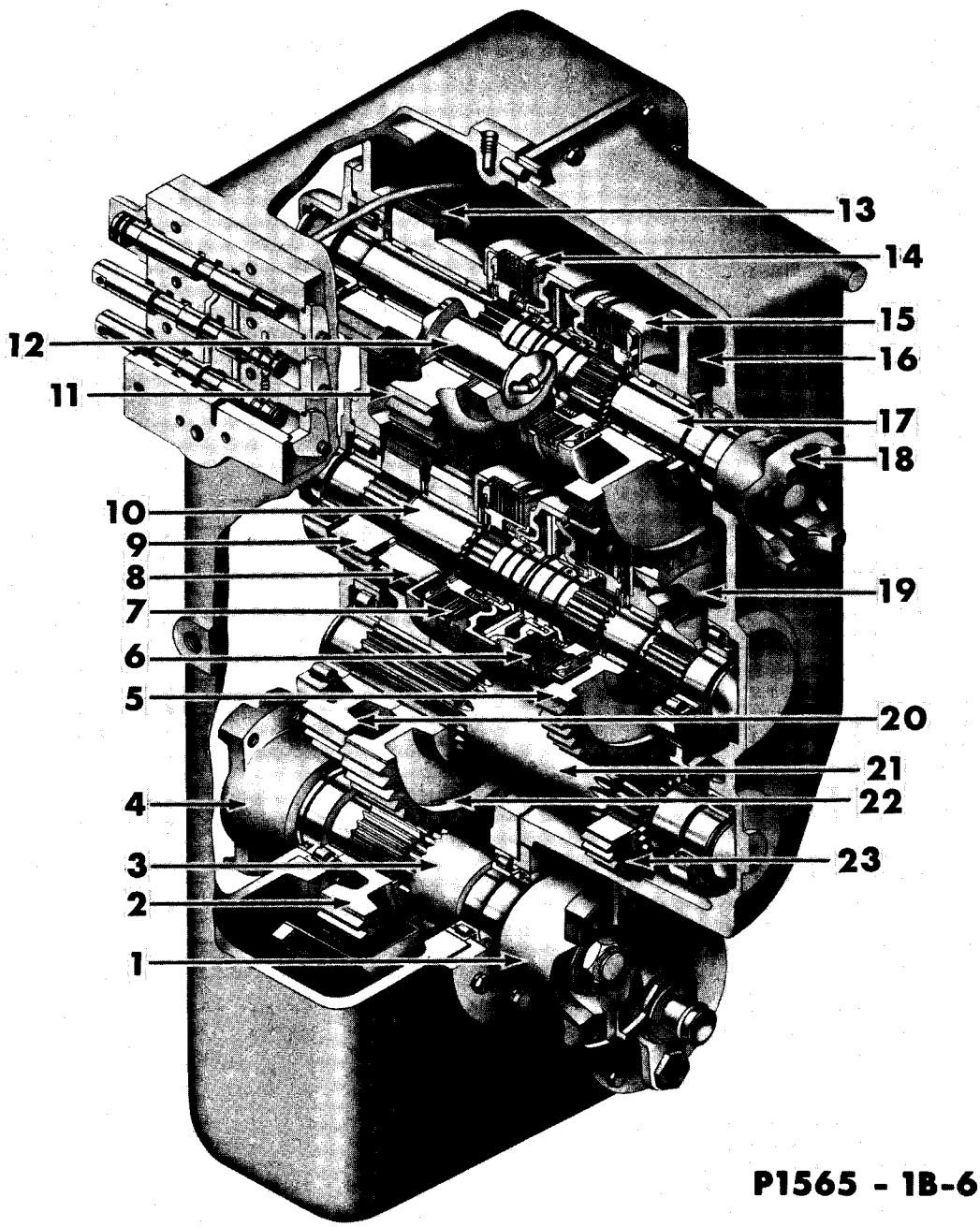


Figure 1B-6 Gear Train

1. Output Flange
2. Output Gear
3. Output Shaft
4. Output Flange
5. 2ND Range Clutch Gear
6. 2ND Range Clutch Pack
7. 1ST Range Clutch Pack
8. 1ST Range Clutch Gear
9. Range Clutch Input Gear
10. Range Clutch Shaft
11. Reverse Idler Gear
12. Reverse Idler Shaft
13. Reverse Clutch Gear
14. Reverse Clutch Pack
15. Forward Clutch Pack
16. Forward Clutch Gear
17. Directional Clutch Shaft
18. Input Flange
19. Range Clutch Input Gear
20. Gathering Shaft Input Gear
21. Gathering Shaft
22. Gathering Shaft Output Gear
23. Gathering Shaft Input Gear

TRANSMISSION OPERATION

The P-1500 series transmission utilizes two double clutches, one directional clutch assembly and one range clutch assembly, mounted between the necessary gears and shafts to produce two speeds forward and two speeds reverse. Engagement of two clutches, a direction clutch and a range clutch, is necessary to achieve a transfer of power through the transmission. Directional clutches impart either clockwise input rotation or counterclockwise input rotation to the range clutches. Range clutches, impart, through their respective gearing, rotation to the output shaft.

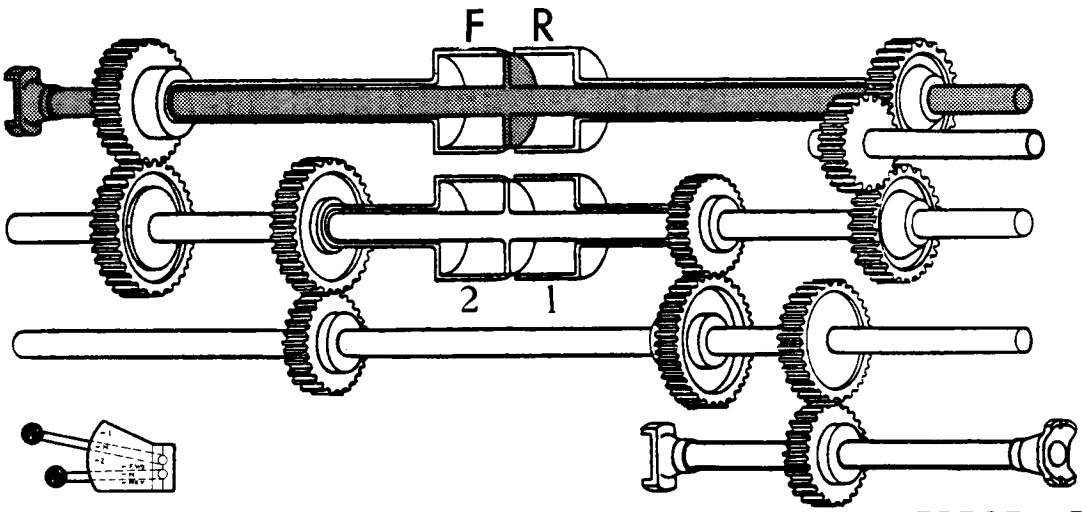
This is a full power shifting transmission and is designed to be shifted from range to range under power.

A. Forward to Reverse Shift. A directional shift should be made after the vehicle movement has stopped. Before making a shift change in direction, STOP!

B. Upshifting. As vehicle approaches its maximum speed in low range, momentarily release accelerator, shift into high range, and accelerate engine to complete upshifting procedure.

C. Downshifting. Downshifting under load is done under full power. Whenever vehicle speed is reduced below the maximum speed of the lower range, downshift to the lower range. If a down shift is required and the vehicle speed is above the maximum speed of the lower range, apply the vehicle service brake until the vehicle speed is less than the maximum speed of the range to which you are shifting. Never downshift to a range at a higher speed than that range can obtain.

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



P1565 - 1B-7

Figure 1B-7 Neutral

In NEUTRAL no power is imparted from the transmission input to the output. See Figure (1B-7). Engagement of a direction and a range clutch is necessary for a particular drive ratio. NEUTRAL does not allow main oil pressure to engage either a direction or range clutch. Therefore, a drive through the transmission does not exist in the neutral position.

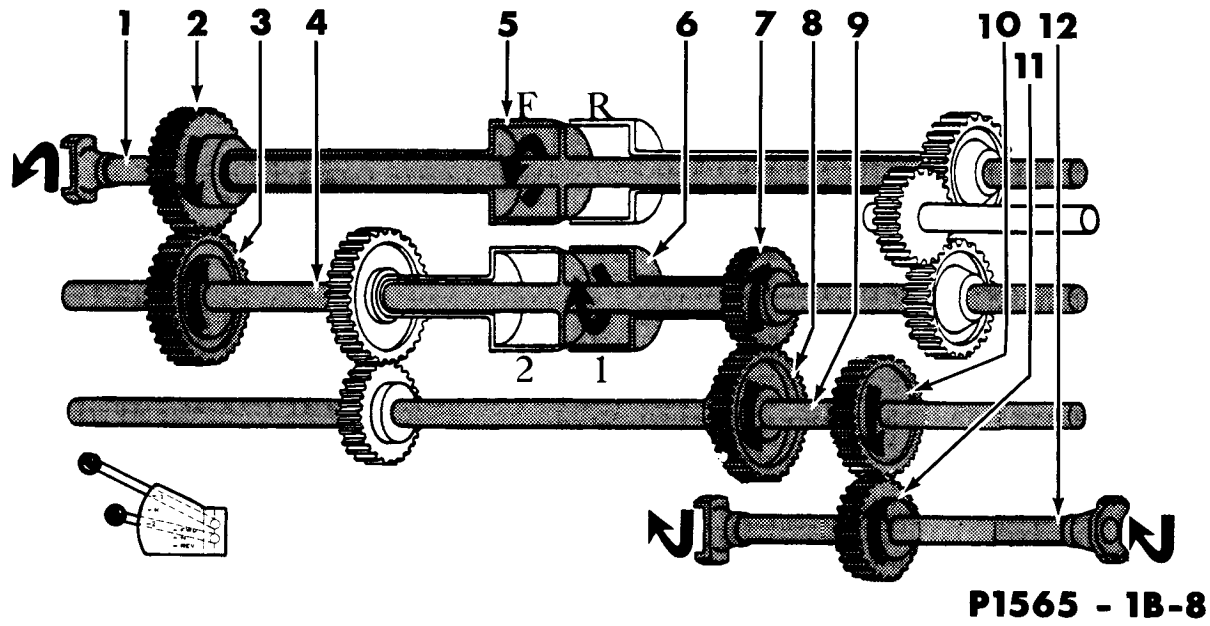


Figure IB-8 Forward, 1st Gear

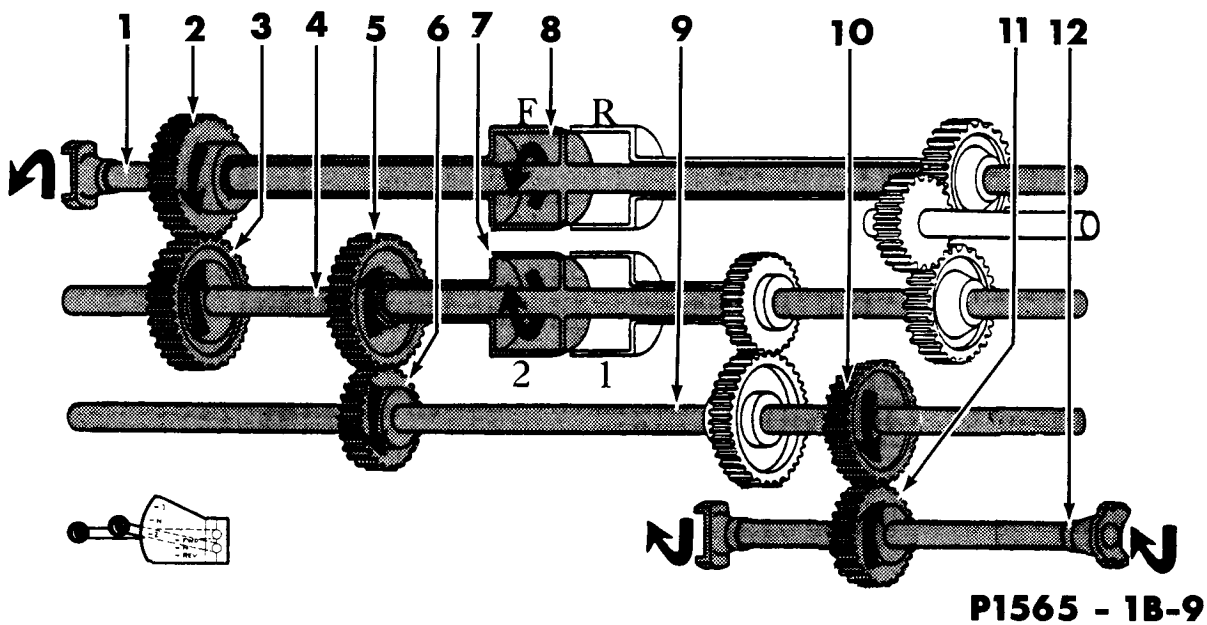


Figure IB-9 Forward, 2nd Gear

TRANSMISSION OPERATION

FORWARD, 1ST GEAR

Input rotation is received through the input shaft (1) by the forward clutch pack (5). Refer to Figure 1B-8.

When the forward clutch pack (5) is engaged it will impart rotation to the forward clutch gear (2), which drives the range input gear (3), range clutch shaft (4), and the first range clutch pack (6) into a counter input rotation.

When the first range clutch pack (6) is engaged, it will impart counter engine rotation to the first clutch gear (7). First clutch gear (7) drives the gathering shaft input gear (8) and thru the gathering shaft (9) drives the gathering shaft output gear (10) into engine rotation. The gathering shaft output gear (10) drives the output gear (11) and shaft (12) into a counter engine rotation.

FORWARD, 2ND GEAR

Input rotation is received through the input shaft (1) by the forward clutch pack (8). Refer to Figure 1B-9.

When the forward clutch pack (8) is engaged it will impart input rotation to the forward clutch gear (2) which drives the range input gear (3), range clutch shaft (4), and the second range clutch pack (7) into a counter input rotation.

When the second range clutch pack (7) is engaged it will impart counter engine rotation to the second clutch gear (5). Second clutch gear (5) drives the gathering shaft input gear (6) and thru the gathering shaft (9) drives the gathering shaft output gear (10) into engine rotation. The gathering shaft output gear (10) drives the output gear (11) and shaft (12) into a counter engine rotation.

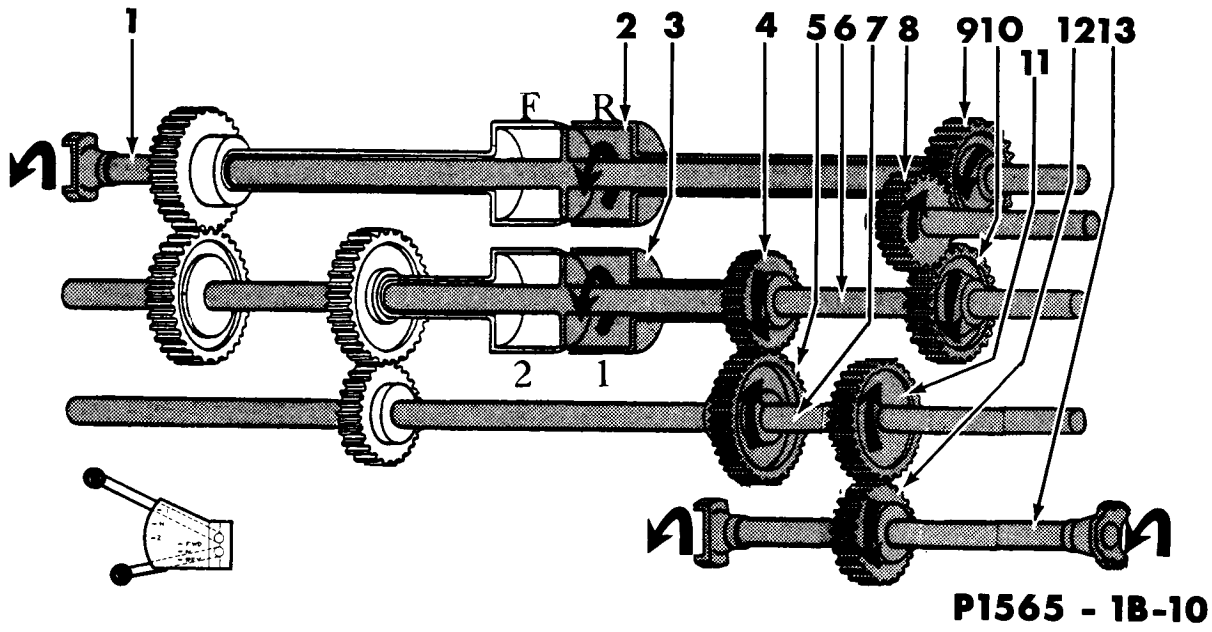


Figure IB-10 Reverse, 1st Gear

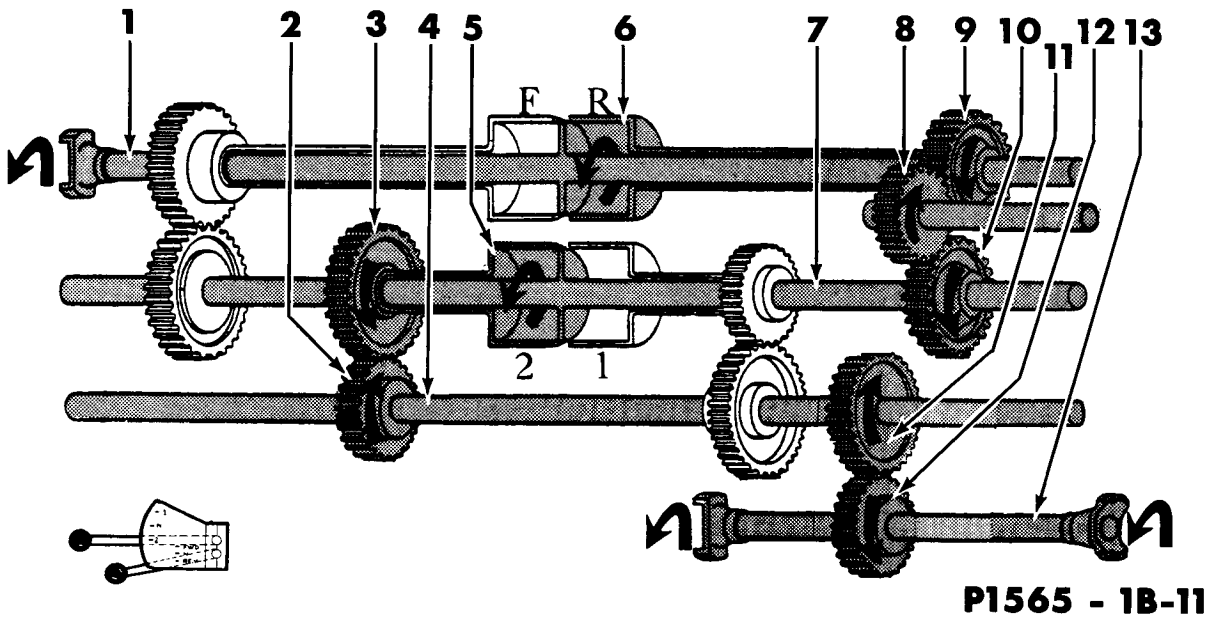


Figure IB-11 Reverse, 2nd Gear

TRANSMISSION OPERATION

REVERSE, 1ST GEAR

Input rotation is received through the input shaft (1) by the reverse clutch pack (2). Refer to Figure 1B-10.

When the reverse clutch pack (2) is engaged it will impart rotation to the reverse clutch gear (9) which drives the reverse idler gear (8) in a counter engine rotation. The reverse idler gear drives the range clutch input gear (10), range clutch shaft (6), and the first range clutch pack (3) into engine rotation.

When the first range clutch pack (3) is engaged, it will impart engine rotation to the first clutch gear (4). First clutch gear (4) drives the gathering shaft input gear (5) and through the gathering shaft (7) drives the gathering shaft output gear (11) into counter engine rotation. The gathering shaft output gear (11) drives the output gear (12) and shaft (13) into engine rotation.

REVERSE, 2ND GEAR

Input rotation is received through the input shaft (1) by the reverse clutch pack (6). Refer to Figure 1B-11.

When the reverse clutch pack (6) is engaged it will impart rotation to the reverse clutch gear (9) which drives the reverse idler gear (8) in a counter engine rotation. The reverse idler gear (8) drives the range clutch input gear (10), range clutch shaft (7), and the second range clutch pack (5) into engine rotation.

When the second range clutch pack (5) is engaged, it will impart engine rotation to the second clutch gear (3). Second clutch gear (3) drives the gathering shaft input gear (2) and through the gathering shaft (4) drives the gathering shaft output gear (11) into counter engine rotation. The gathering shaft output gear (11) drives the output gear (12) and shaft (13) into engine rotation.

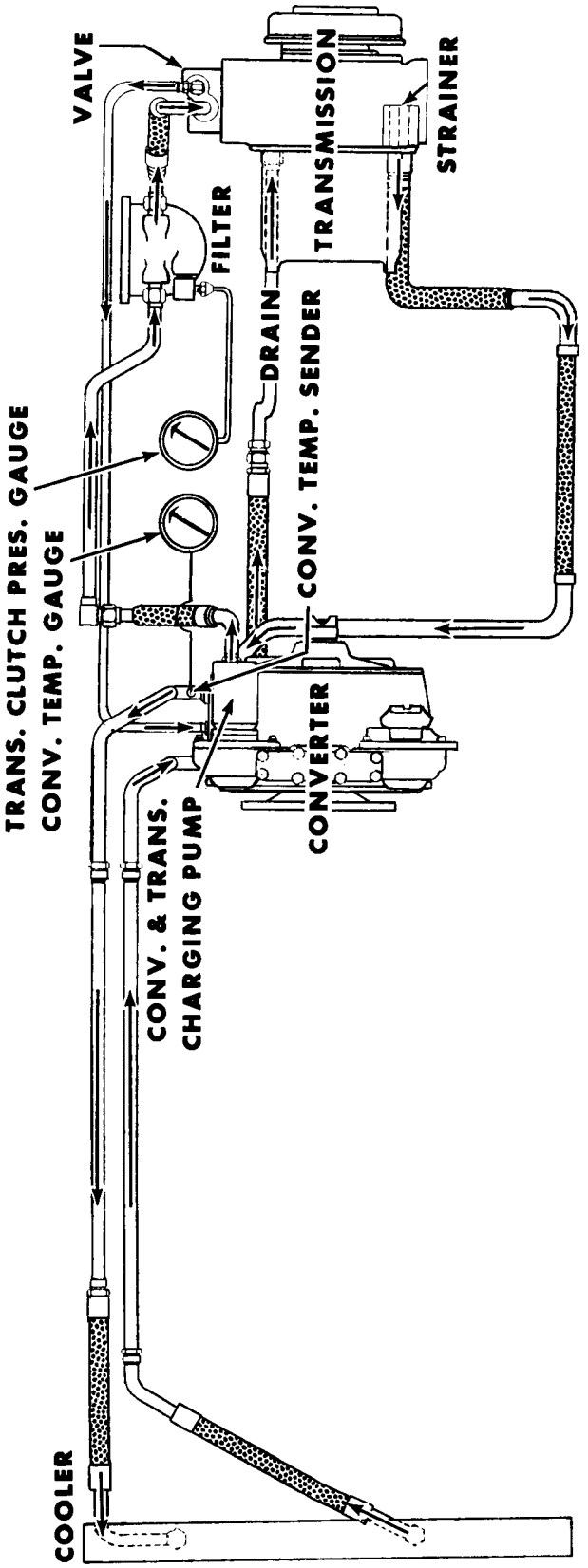


Figure 1B-12 Hydraulic Diagram

HYDRAULICS

External lines furnish the necessary connections to hydraulically integrate the separately mounted charging pump, filter, converter, cooler and the transmission unit. The sump of the transmission acts as a reservoir for the system oil supply. Hoses connect the transmission sump and strainer to the charging pump, filter and control valve. The charging pump is mounted on the converter power take off housing.

The control valve regulates the oil pressure for the directional and range clutch packs, converter and lube system. The oil cooler is connected to the converter with steel tubings, the electric temperature sender unit is mounted in the converter "out" tubing to the oil cooler.

Before the engine is started, all controls should be placed in the neutral position. As soon as the engine turns over, the transmission and converter charging pump picks up the oil from the transmission sump and pumps it through the full flow filter to the transmission pressure regulator valve.

The main pressure regulator valve then regulates transmission clutch pressure, that operates the clutches in the transmission when the controls are moved to operate the tractor.

The main pressure regulator valve then regulates converter "in" pressure. The converter "in" oil flow exits from the main pressure regulator valve body through a tube to the torque converter housing. Internally the oil is circulated through the converter and exits from the converter housing past the converter oil temperature unit thru a tube to the external oil cooler, and then from the cooler to the converter again.

Controlled leakage from the converter element lubricates the bearings and gears in the converter housing, then drains from the bottom of the housing through a hose to the transmission housing and sump.

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

a. A converter and transmission charging pump mounted on the converter power take off housing and driven by a gear train in the converter housing. The charging pump speed is the same as engine speed.

NOTE

Check your Operators Manual and Service Bulletins for specific charging pump GPM and RPM pump speed.

b. Two valve bodies:

1. Diverter valve assembly.
   a. Forward - Reverse spool.
   b. Range selector spool.
2. Regulator valve assembly.
   a. Clutch pressure regulator valve.
   b. Converter pressure regulator valve.
   c. Lube pressure regulator valve.

c. Accessories of the system consist of:

1. Sump screen contained in the transmission sump.
2. A full flow filter mounted externally.
   (1) Full flow filter contains by-pass valve set at 12 to 15 psi pressure differential
3. Oil cooler mounted externally.

PREVENTIVE MAINTENANCE

1. OIL

A. Basic Description:

Automatic Transmission Fluid Type "A"

B. Quantity for original fill - approximately 37 quarts.

C. CHANGE PERIODS.

1. Oil change - 1000 hours of operation.
2. Clean transmission filter oil screen - 1000 hours of operation.
3. Change external filter - 500 hours of operation.
4. Change the oil and filter and clean the oil screen whenever traces of dirt or the effects of high operating temperatures are present as evidenced by discoloration or strong odors.
5. After any internal failures, change oil and completely flush and clean the transmission including filter, lines, oil cooler and valve bodies. If it is not done, there is a danger of further contamination from foreign particles and more failures.
6. Metal particles in the oil indicate a failed or wearing part and the entire system and units should be drained, flushed and thoroughly cleaned.
7. To drain the system, remove the drain plug at the bottom of the transmission housing.

D. OIL LEVEL CHECK.

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

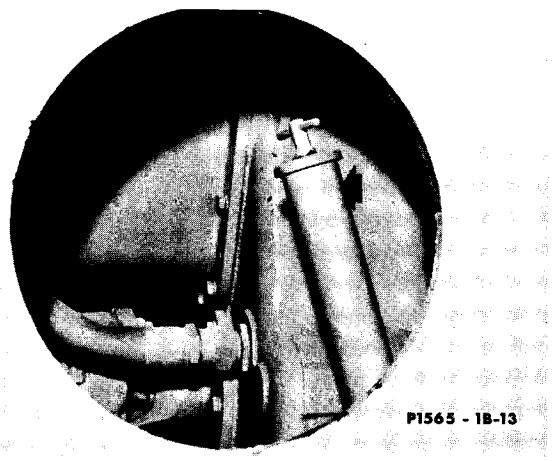


Figure 1B-13 Transmission Dipstick

2. Pre-start check - To insure sufficient oil in the system before starting the engine, loosen dipstick handle and remove dipstick from oil filler tube. The oil level must be at the "FULL" mark, before the tractor is worked. The dipstick is located on the right side of the transmission, and is accessible on the right side of the tractor.

3. Start the engine - Operate the transmission controls momentarily, then shift to neutral. Make a second oil level check with oil at operating temperature, and engine at a low idle speed. The oil level should be at the "FULL" mark on the dipstick. Add or remove oil to maintain level at "FULL" mark. Replace the dipstick and tighten the handle.

E. OPERATING TEMPERATURE.

1. The operating temperature of the oil is registered as the oil leaves the converter and is read on the vehicle dash. Converter "OUT" temperature sending unit is located on the converter outlet tube on the converter.

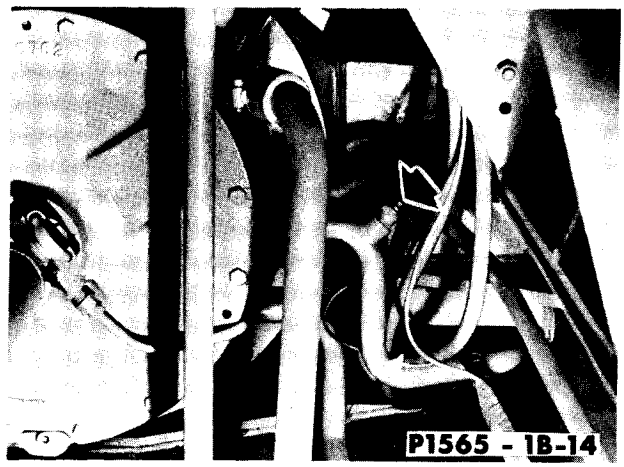
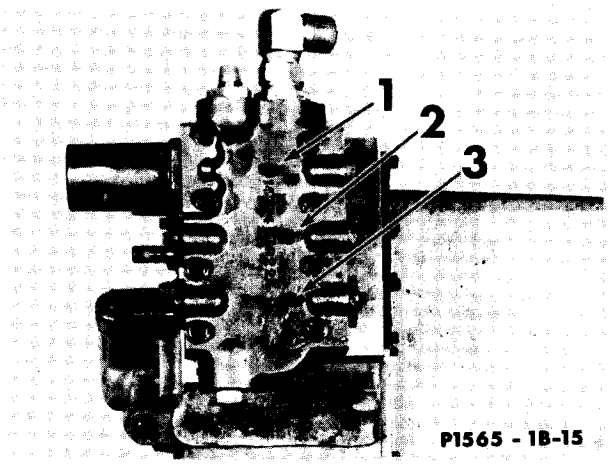


Figure 1B-14 Temperature Check Point

2. Maximum operating temperature - 250°F.
3. To cool the fluid in the converter, shift the transmission to low or "first" gear. If temperature remains high, shut the engine down. Correct conditions that cause continual high temperature reading before continuing to work machine.
4. a. Check oil level in transmission.
   b. Clean dirty oil cooler.
   c. Shift to low gear.
   d. Bleed air from converter at oil cooler.
   e. Clogged oil filter or sump screen.

F. OPERATING PRESSURE.

1. Pressure checks should be made with the engine and converter at a normal operating temperature.
2. Transmission pressure checks should be made at full power stall.
3. Clutch Pressure at stall:
   a. Is listed under Specifications.
   b. Is registered by gauge on vehicle dash.
   c. Can be checked by attaching a service gauge to pressure tap located on main regulator valve body on transmission.



1. Clutch Pressure 2. Converter Pressure 3. Lube Pressure

Figure IB-15 Main Regulator Valve

4. Converter "IN" pressure at stall. See Specifications. Service gauge can be attached to converter pressure tap located on main regulator valve body on transmission. Refer to figure IB-15.
5. Lube pressure at stall. See specifications. Service gauge can be attached to lube pressure tap on transmission.

G. STALL CHECK.

1. A full power stall check is made to determine that the engine has rated power and whether the converter and transmission are operating correctly.

CAUTION

Before making a stall check, accelerate the engine to 1000 rpm with transmission in neutral. At 1000 rpm clutch pressure should read the specified pressure found in your "Operators Manual." If it does not. DO NOT MAKE A STALL CHECK. If clutch pressure is below the minimum pressure the clutch will slip and burn at full stall.

2. A stall check is accomplished by -
   a. Engine, converter operating at proper temperature.
   b. Attach or use tachometer on engine.
3. Lower blade or bucket to the ground. Apply brakes.
4. Run the engine to see that it will operate at high idle. See specifications for high idle in tractor "Operators Manual". If this recording is lower than specified high idle, stall check cannot be taken. Correct engine trouble before proceeding.

NOTE

The given values have a plus or minus of 50 rpm.

5. Shift transmission to forward direction and second range.
6. Depress the accelerator to its maximum position and record the engine rpm. Converter stall speeds are found in the specifications in your "Operators Manual" for applicable engine used.
7. Observe converter temperature gauge and do not exceed 250°F. maximum converter temperature.
8. If the stall speed is less than the specified rpm in "Operators Manual," the engine and/or the converter may not be performing properly. Low stall speed may be caused by:
   a. Low engine output.
   b. Excessive converter input pump wear.
   c. Low transmission oil level.
9. Check the engine air cleaner and air intake system when the engine speed is low. It should be clean and free of all obstructions. Other causes contributing to low engine output are:
   a. Low quality fuel.
   b. Leaks in suction side of fuel system.
   c. Restricted fuel lines.
   d. Dirty injectors.
   e. Defective fuel pump.
   f. High-speed governor set too low.
   g. Injectors out of adjustment.
   h. Incorrect valve and injector timing.

H. LINKAGE ADJUSTMENTS.

1. Range selector valve.
2. Forward and reverse selector valve.
   a. The linkage should be adjusted to allow free movement and a definite "detent" feel as the lever is moved from one position to another. Linkage should not bind or hold valves or levers between "detent" position. "Never position between detents."

I. EXTERNAL LINES.

1. All external lines should be periodically inspected for:
   a. Loose fittings which allow oil leaks or air leaks.
   b. Damaged collapsed or worn hoses:

J. EXTERNAL WIRING.

1. All external wiring should be periodically inspected for loose connections and broken or damaged wires.

TROUBLE SHOOTING CHART

FOR THE P-1500 SERIES TRANSMISSION

TROUBLE	POSSIBLE CAUSE	REMEDY
Transmission clutch pressure below minimum (For minimum See Specifications)	1. Low oil level. 2. Restriction - a. Sump screen plugged. b. Oil filter plugged. 3. External leakage. 4. Stuck regulator valve. 5. Worn pump. 6. Internal oil leaks.	1. Add oil to proper level. 2. Clean. 3. Repair 4. Clean and inspect valve body bore and valve spring. 5. Overhaul. 6. a. Watch for an excessive pressure drop in a specific directional or range clutch. b. Overhaul transmission.
Transmission clutch pressure above maximum. (See Specifications for maximum).	1. Improper main pressure regulator valve operation. 2. Stuck converter regulator valve.	1. a. Clean and inspect. b. Inspect spring. c. Inspect valve bore. 2. a. Clean and inspect. b. Inspect spring. c. Inspect valve bore.
Slow or erratic clutch engagement.	1. Low transmission sump oil level. 2. Clogged oil strainer screen 3. Foamed oil. 4. Improper linkage adjustment. 5. Low clutch pressure. 6. Clutch pressure regulator valve stuck. 7. Internal oil leakage. Cross check clutches by applying other clutches. Damaged or worn seals.	1. Add specified oil to proper level. 2. Clean. 3. Eliminate air leak in pump suction line. 4. Free linkage and adjust. 5. See transmission clutch pressure below minimum. 6. a. Clean and inspect valve body bore. b. Inspect valve spring. 7. Overhaul transmission.

TROUBLE	POSSIBLE CAUSE	REMEDY
High engine speed at converter stall check.	1. Stuck converter regulator valve.	1. Overhaul. a. Clean and inspect. b. Inspect spring. c. Inspect valve bore.
	2. Improper main regulator valve operation.	2. Overhaul.
	3. Worn pump gears.	3. Overhaul pump.
	4. a. Internal converter leakage. b. External converter leakage.	4. a. Overhaul converter. b. Repair.
	5. Slipping directional or range clutch.	5. a. Cross check directional and range clutch by applying other clutches to verify slipping. b. Observe movement in drive line between converter and transmission. c. Correction will be to transmission.
	6. Foamed oil.	6. Bleed converter at cooler.
Vehicle drives in one direction and creeps in that direction in neutral but stalls when shifted to the opposite direction.	1. Failed directional clutches.	1. Overhaul transmission.
Vehicle drives in one range, but stalls when shifted to another range.	1. Failed range clutch.	1. Overhaul transmission.
All range pressures normal (See Specifications) in one direction but below normal in opposite direction.	1. Directional selector valve linkage out of adjustment. 2. Internal leakage in forward or reverse clutch pack.	1. Adjust or replace if worn. 2. Overhaul transmission.
Low clutch pressure in one range clutch in either direction.	1. Linkage out of adjustment. 2. Internal leakage in clutch pack.	1. Adjust or replace if worn. 2. Overhaul transmission.

P-1500 SERIES TORQUE CONVERTER

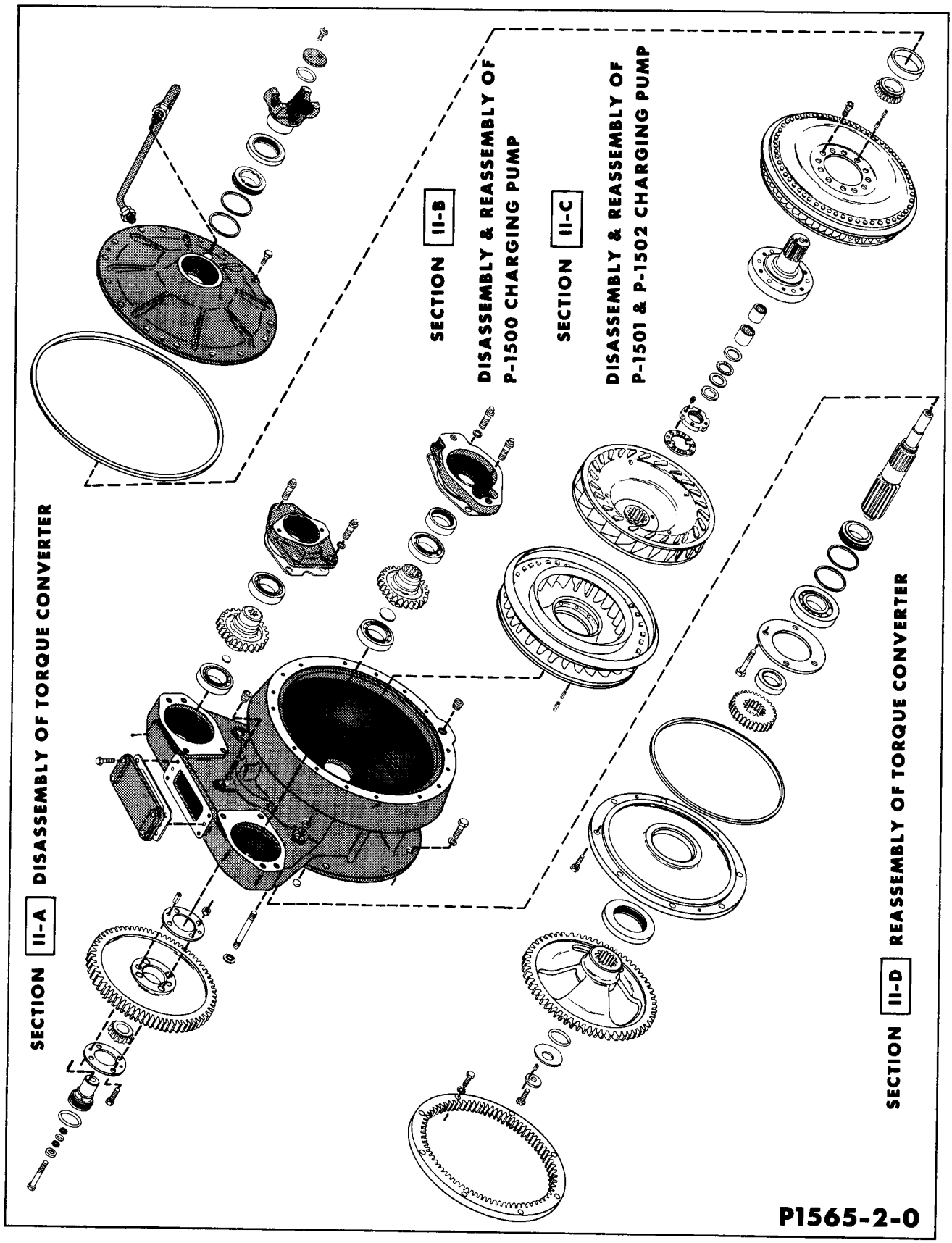


Figure 2-0 Pictorial Index

SECTION II

P-1500 SERIES TORQUE CONVERTER

TABLE OF CONTENTS

PREPARATIONS FOR DISASSEMBLY OF P-1500 SERIES TORQUE CONVERTER

In preparation for disassembly, the following should be done:

A. Disconnect all external lines from the housing.

B. Using plain steam (no caustic soda), clean the outside of the converter housing thoroughly.

C. Prepare a dirt-free work area at least 12 feet square.

D. A hoist should be available to aid in lifting.

E. Gather the following tools:

1. Low table or bench for disassembly use.
2. Shop press.
3. Solvent for cleaning parts.
4. Standard set of mechanic's hand tools including:
   a. Snap ring pliers
   b. 250 ft. lb. torque wrench
   c. Mallet, (preferably plastic)
   d. Locknut wrench (refer to Figure 2-tool-1, page II-3A).

F. Pans for holding small parts during disassembly.

LOCK NUT WRENCH

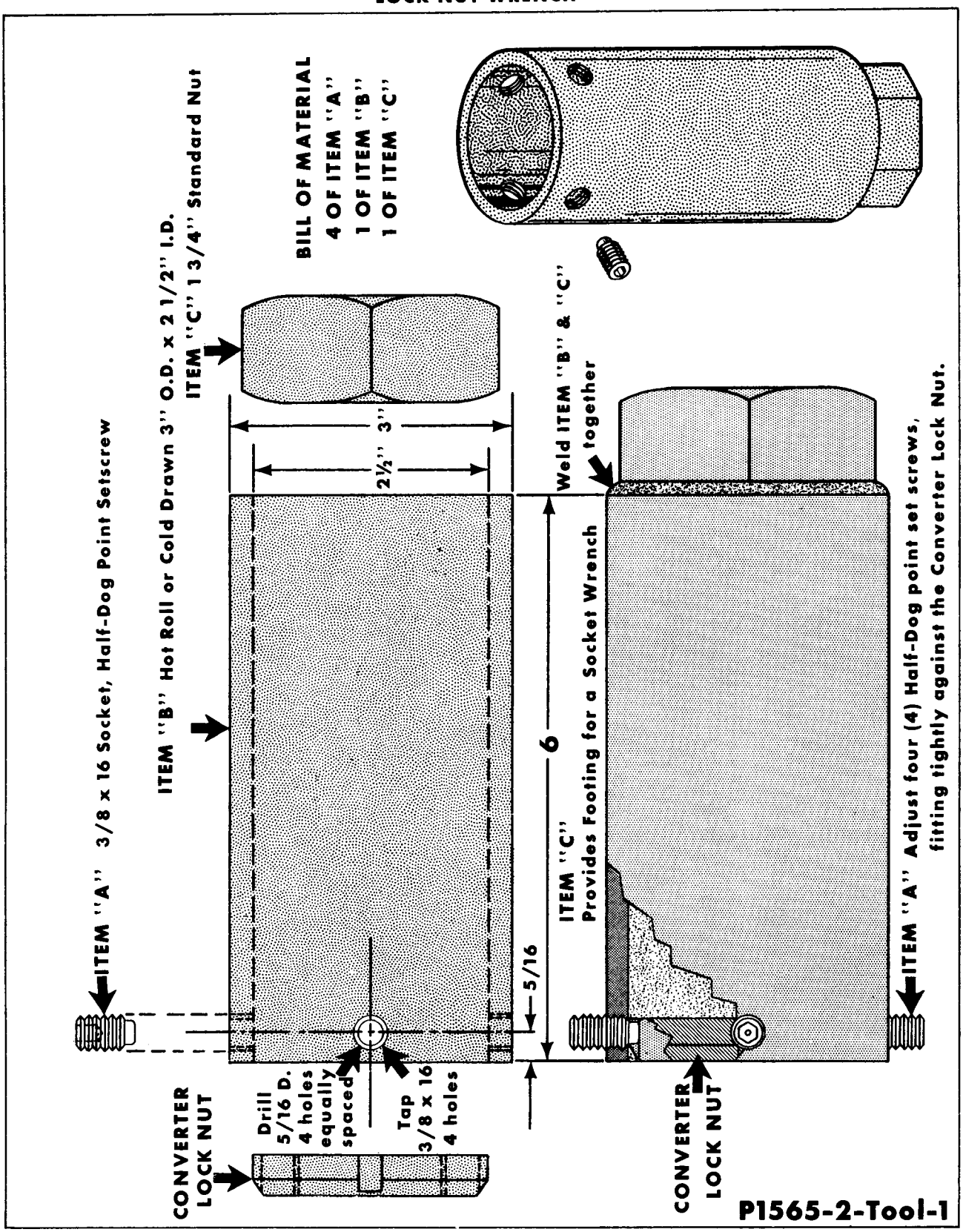


Figure 2-Tool-1 Lock Nut Wrench

DISASSEMBLY of P-1500 Series Torque Converter

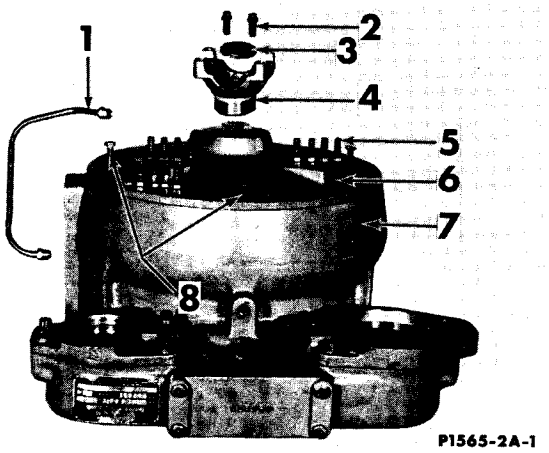


Figure 2A-1

Remove the tubing (1) from the outside of the converter housing. Remove the two output yoke counter-bore capscrews (2), plate (3) and output yoke (4). Remove sixteen capscrews (5) from the output housing cover (6). Remove the output housing cover from the converter housing (7), with the aid of three jack screws (8).

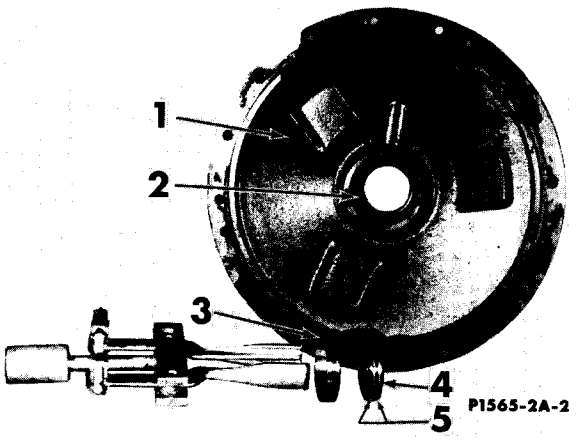


Figure 2A-2

Remove the bearing cup (3) from the output housing cover (1) with the aid of a suitable puller. Remove the seal ring carrier (4). Inspect the seal rings (5) for damage and wear. Remove oil seal (2) from the output housing cover.

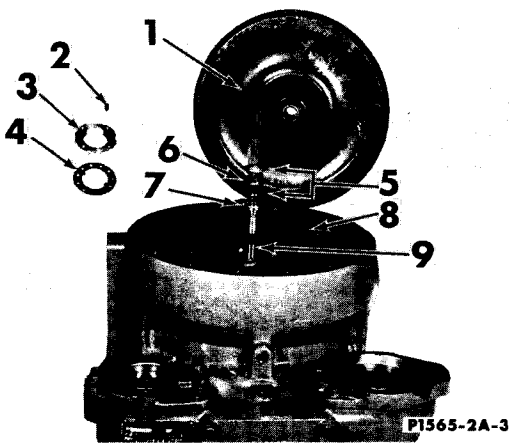


Figure 2A-3

Remove the turbine (1), two thrust races (5), bearing (6) and backing washer (7). Remove the socket head set screw (2) from the locknut (3). Using locknut wrench (refer to page II-3A), remove locknut (3). Remove lock plate (4) and impeller (8) from input shaft (9).

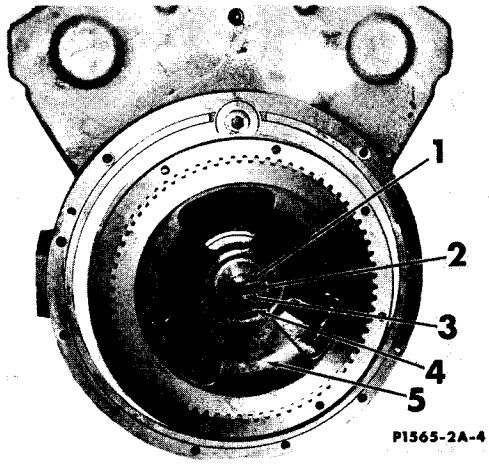


Figure 2A-4

Remove special capscrew (1), retainer washer (2), roll pin (3) and spring washer (4). Remove the drive ring (5).

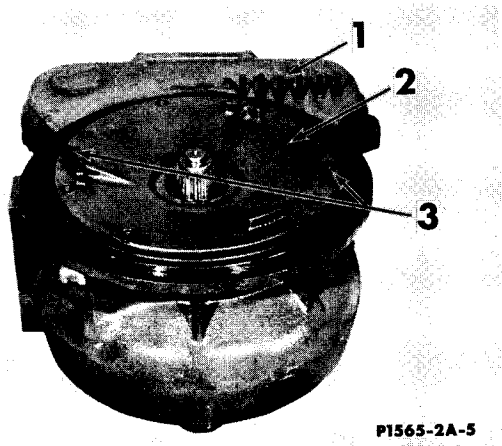


Figure 2A-5

Remove eight capscrews (1) from the cover plate (2). Insert two capscrews (3) in the jack screw holes to assist in the removal of the cover plate.

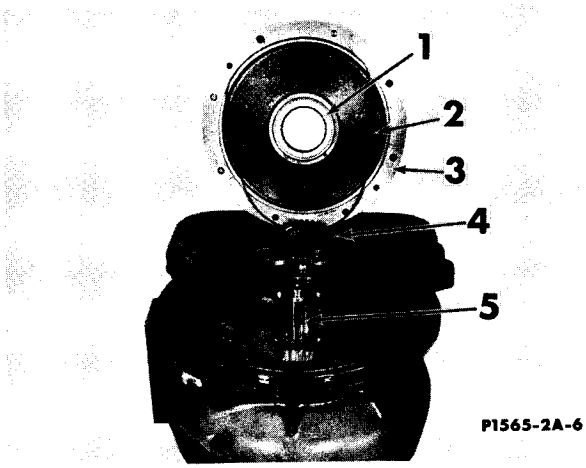


Figure 2A-6

Remove oil seal (1) and "O" ring (2) from the cover plate (3). Remove P.T.O. drive gear (4) from the input shaft (5).

DISASSEMBLY of P-1500 Series Torque Converter

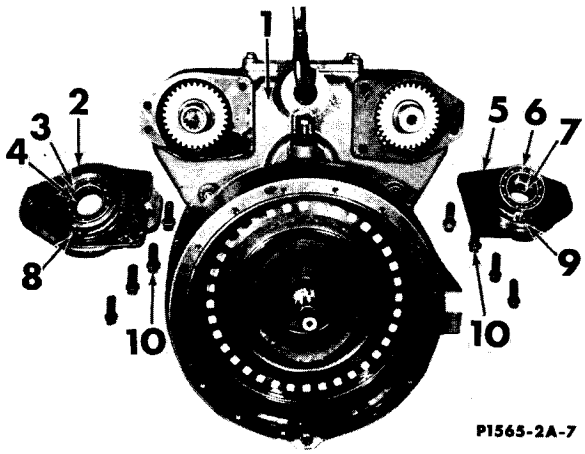


Figure 2A-7

Turn converter housing around to the output end. Punch mark each P. T. O. cap (2) & (5) and housing (1) for identification for reassembly. Remove eight counter-bore capscrews (10) for the removal of the P. T. O. caps. Remove P. T. O. cap bearings (3) & (6) and oil seals (4) & (7) from both P. T. O. caps.

CAUTION

Special attention should be given to the flow deflectors (8) & (9). Any damage to these deflectors will cause serious damage to the P. T. O. cover bearings.

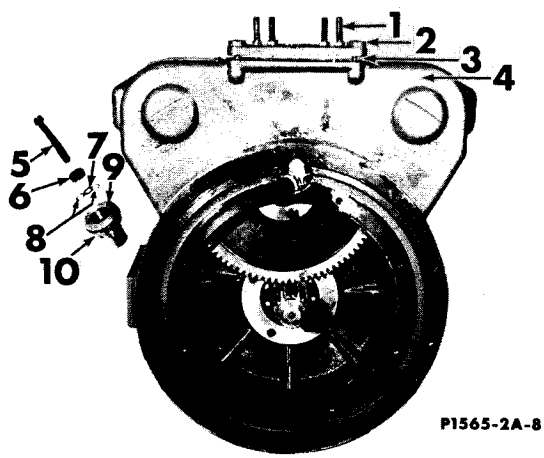


Figure 2A-8

Remove four capscrews (1), cover (2) and gasket (3) from the top of the converter housing (4). Removal of this cover (2) will enable you to pry off both P. T. O. gears. Before removing the idler gear shaft (9) punch mark the idler shaft and converter housing. This will enable you to re-match the dowel pin in the bottom of the idler gear shaft bore for reassembly. Remove the capscrew (5), thick washer (6) thin washers (8) and "O" ring (7). Remove idler gear shaft (9). Remove "O" ring (10) from idler shaft.

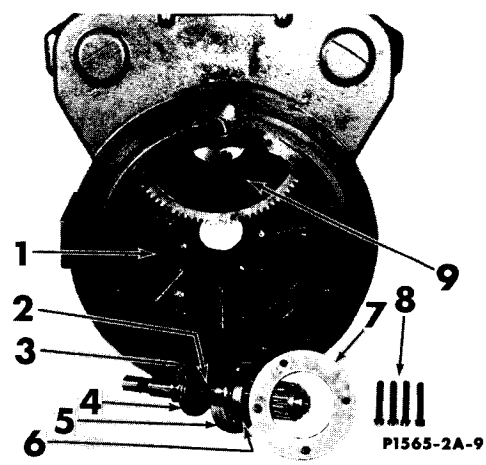


Figure 2A-9

To remove the input shaft (2), remove four capscrews (8) and bearing retainer (7). Apply force to back end of input shaft (2), forcing it out of the converter housing (1). Remove the idler gear (9). Remove the oil seal carrier (4), bearing (5), and spacer (6). Inspect the two oil seal rings (3) for damage or wear.

DISASSEMBLY of P-1500 Series Torque Converter

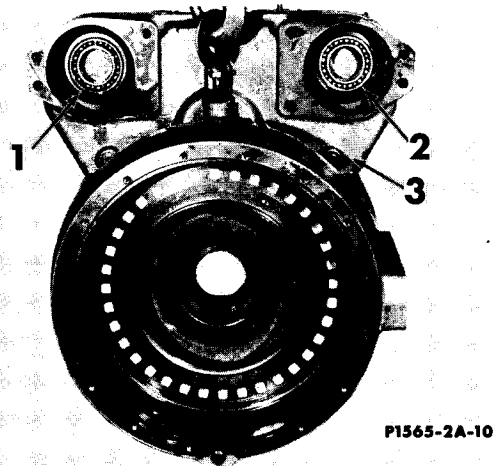
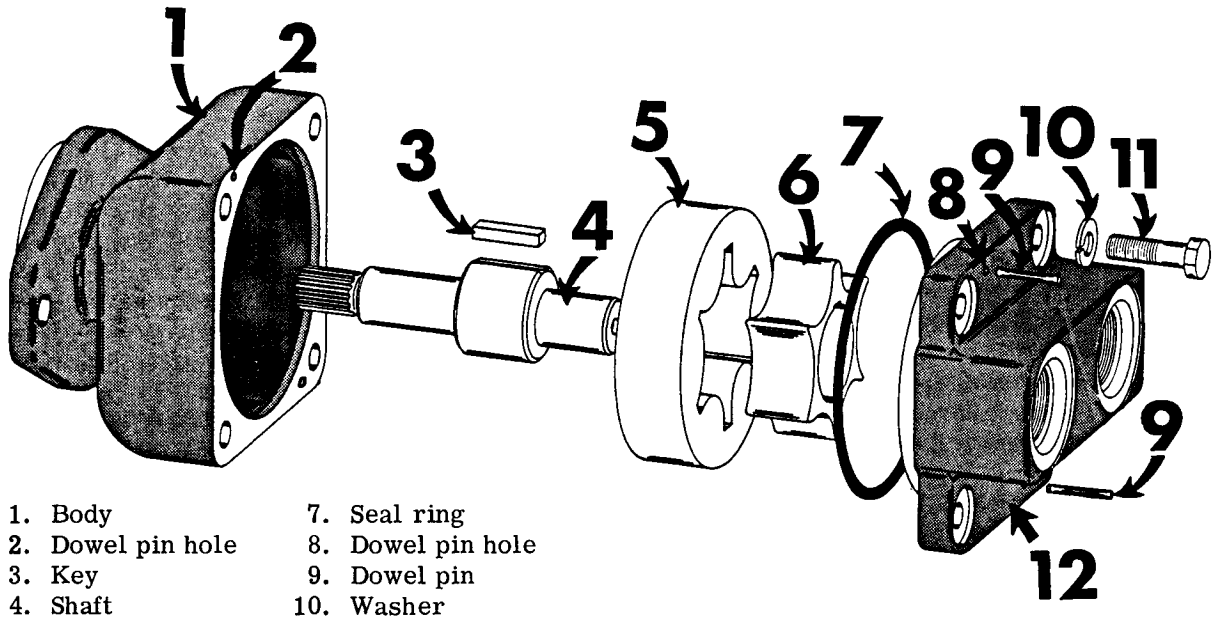


Figure 2A-10

Remove P. T. O. gear bearings (1 & 2) from the converter housing (3) if the bearings are worn, scarred, damaged, or to be cleaned. Use a suitable puller to remove P. T. O. gear bearings.

DISASSEMBLY & REASSEMBLY OF P-1500 CHARGING PUMP



1. Body
2. Dowel pin hole
3. Key
4. Shaft
5. Driven gear
6. Drive gear
7. Seal ring
8. Dowel pin hole
9. Dowel pin
10. Washer
11. Capscrew
12. Cover

P1565-2B-1

Figure 2B-1 P-1500 Charging Pump

DISASSEMBLY OF CHARGING PUMP

Punch mark the cover (12) and pump body (1). Remove the four capscrews (11) and washers (10) that secure the cover to the pump body. Remove the cover (12), dowels (9) and "O" ring (7). Check that the bleed hole in the cover bearing bore is open. Remove the rotor shaft (4) and key (3). Remove the drive gear (6) and driven gear (5) from the pump body.

Clean all parts thoroughly in mineral spirits. Inspect pump body, drive gear, driven gear, cover, bearings and shaft for excessive wear and scoring. Inspect needle bearings for wear and fatigue.

REASSEMBLY OF CHARGING PUMP

If the bearings are to be replaced, remove them with a suitable puller. Install new bearings in the cover (12) and body (1) bore so the bearing is below the gear face surface. Lubricate the needle bearings and gears with Type "A" oil while assembling. Install the shaft (4), key (3), driven gear (5), and drive gear (6) into body of pump. Install "O" ring (7) on flange of cover (12). Install cover on body of pump, making sure dowel holes (8) and (2) are aligned. Install dowels (9). Install capscrews (11) with washers (10), torque to 37 ft. lbs. Check that input shaft turns freely.

DISASSEMBLY & REASSEMBLY OF P-1501 & P-1502 CHARGING PUMP

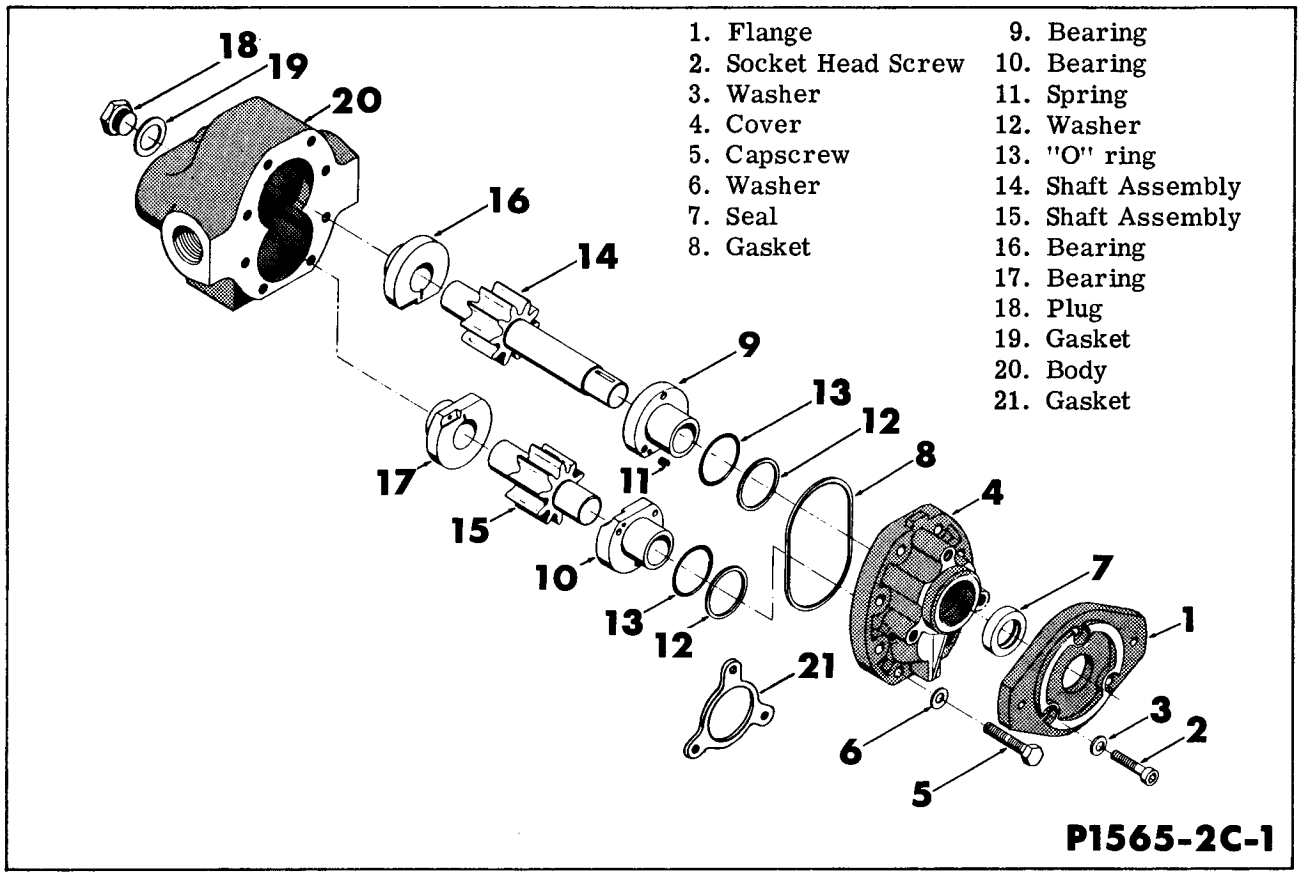


Figure 2C-1 P-1501 & P-1502 Charging Pump

DISASSEMBLY OF CHARGING PUMP

Center punch mark the pump cover and body. Remove three socket head screws (2) and washers (3) that hold the flange (1) to the cover (4). Remove eight capscrews (5) and washers (6) that hold the cover (4) to the body (20). Remove the cover with the gasket (8), bearings (9), (10), washers (12), "O" rings (13) and bearing springs (11). Note the location of the bearings (9), (10), (16), (17), they must go into the housing and cover in the same location they were removed. The cutaway on the bearing must be in the same location. Remove the two shafts assemblies (14) and (15). Remove the bearings (16), (17), from the pump body (20). Remove the plug (18) and gasket (19) from pump body.

Clean all parts thoroughly in mineral spirits. Inspect pump body, gear and shaft assembly, cover and bearings for excessive wear and scoring.

REASSEMBLY OF CHARGING PUMP

Install plug (18) and gasket (19) in pump body (20). Install bearings (16), (17) in pump body with the groove in the same location as they were removed. Install the two shaft and gear assemblies (14), (15) into the body bearings. Install the "O" ring (13) and washers (12) onto the bearings (10), (9), install bearings with the springs into the cover (4). Install the rubber gasket (8) into the cover. Replace the shaft seal (7). Install the cover (4) to body (20) with capscrews (5) and washers (6) torque to 37 ft. lbs. Install gasket (21), flange, (1) socket head screws (2) with flat washers (3). Torque to 20 ft. lbs.

Lubricate shafts and gears with light oil while assembling. Be sure the input drive shaft turns freely.

PREPARATION FOR REASSEMBLY

OF

P-1500 SERIES TORQUE CONVERTER

In preparation for reassembly of the converter, the following should be done:

A. Clean all parts thoroughly in solvent. Use compressed air to dry parts. Carefully inspect all parts for excessive wear, cracks and/or breakage.

B. Inspect all bearings for pits and spalled areas. Replace bearings which are pitted and/or spalled.

C. Inspect splines on all shafts for excessive wear.

D. Inspect all sealing surfaces for wear and/or grooving.

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

F. In assembly, use petroleum jelly.

REASSEMBLY of P-1500 Series Torque Converter

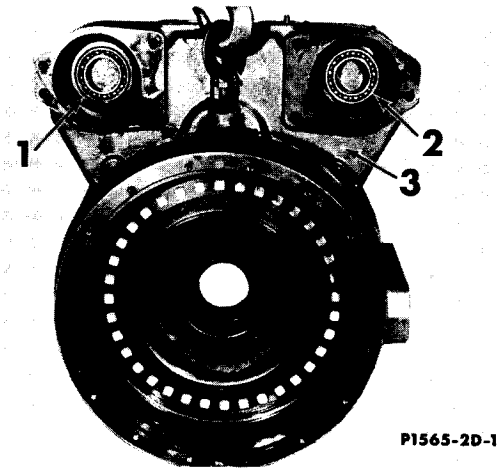


Figure 2D-1

Check the P.T.O. drive gear bearings (1 & 2). To check the bearings, spin the inner race of the bearings. If the bearings don't move freely, recheck.

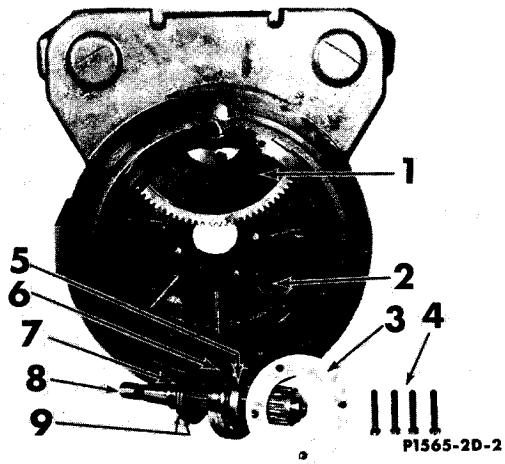


Figure 2D-2

Install two new oil seal rings (9) on the oil seal carrier (7). When installing the oil seal rings, make certain that the ring gaps are 180° apart.

Install oil seal carrier (7) into the converter housing (2). Press spacer (5) and bearing (6) on the input shaft (8). Make sure the spacer (5) butts up against the shaft splines. Install idler gear (1), holding it in place while inserting the input shaft assembly. Install bearing retainer (3) and four capscrews (4). Torque to 32 ft. lbs.

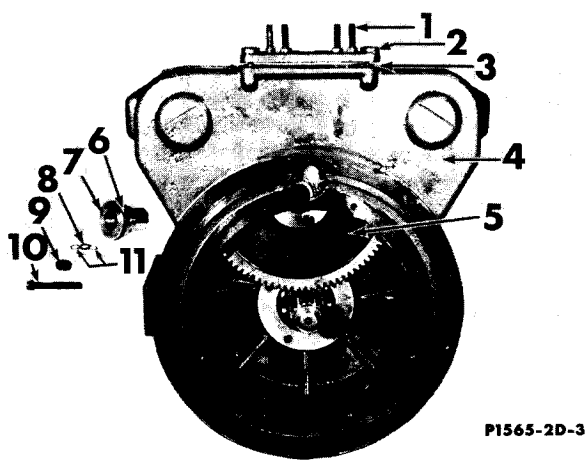


Figure 2D-3

Install new "O" ring (6) on the idler gear shaft (7). Position the idler gear (5) in place, while inserting the idler gear shaft (7). Match up the punch marks on the idler gear shaft (7) and the converter housing (4). This will correctly position the shaft so the dowel pin hole will index with the dowel pin in the bottom of the shaft bore. Install the thick washer (9), thin washers (11), and "O" ring (8) on the capscrew (10). Insert the capscrew assembly (10) into the idler gear shaft (7), and torque to 35 ft. lbs. Install gasket (3), cover (2) and four capscrews (1).

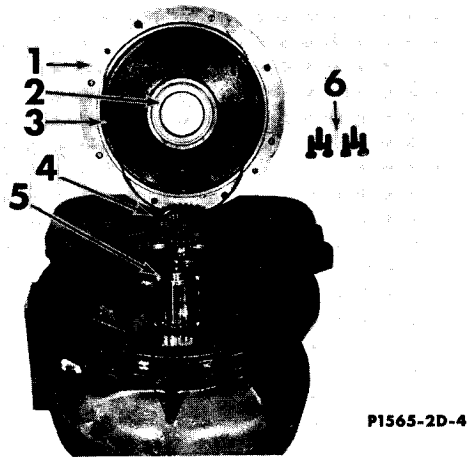


Figure 2D-4

Install P. T. O. drive gear (4) on the input shaft (5). Replace seal (2) in the input cover (1). Install a new seal ring (3) around the flange of the input cover (1). Install the input cover and insert eight capscrews (6). Torque to 32 ft. lbs.

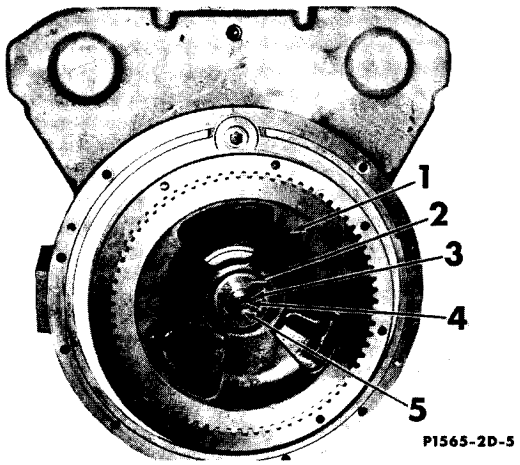


Figure 2D-5

Install drive ring (1) on input shaft. Install "O" ring into recess of drive ring. Install spring washer (2), with the convex side out. Install roll pin (5) retainer washer (3) and special capscrew (4).

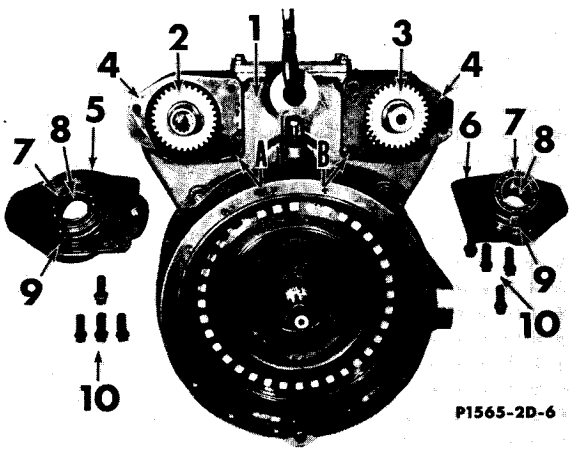


Figure 2D-6

Install the P. T. O. gears (2) & (3). The gear (3) with the small internal spline is installed on the right side of the housing (1). The gear (2) with the large internal spline is installed on the left side of the housing (1).

Install new oil seals (8) and bearings (7) in the cover plates (5) & (6). Inspect oil deflectors (9) on each cover plate, if damaged, replace.

Install new gaskets (4) on the cover plates. Install cover plates, (5) & (6) on housing (1), inserting eight counter-bore capscrews (10). Insert two flat copper washers, one on each cover plate, on the inner, bottom capscrews of the cover plates, refer to A & B. Torque the eight counter-bore capscrews (10) to 80 ft. lbs.

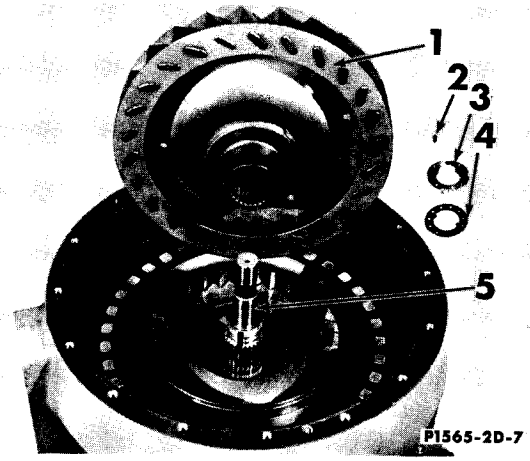


Figure 2D-7

Install impeller (1) onto the input shaft (5). Install lock plate (4) on the input shaft, with the tangs aligned with the shaft grooves. Install lock nut (3), and torque to 220 ft. lbs., using special locknut wrench, refer to Special Tool, Page 11-3A. Install socket head setscrew (2) through locknut and into lock plate.

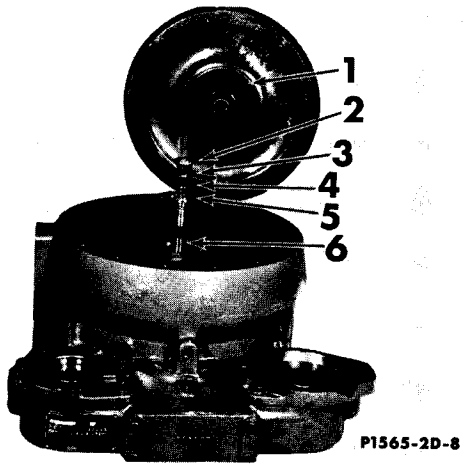


Figure 2D-8

Install backing washer (5) with bevel side down, .030" thrust race (4), needle roller bearing (3), and .090" thrust race (2) onto the input shaft (6). Install turbine (1) with output shaft facing up.

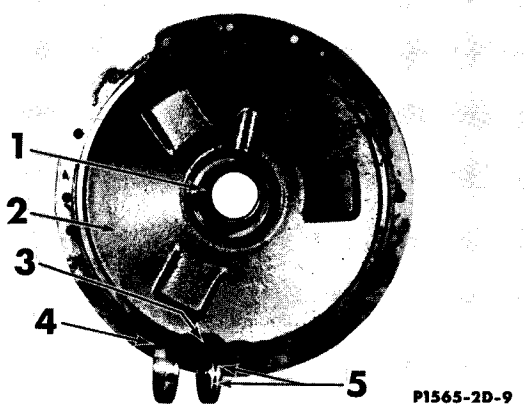


Figure 2D-9

Install two new oil seal rings (5) on the oil seal carrier (3). When installing the oil seal rings, make certain the ring gaps are 180° apart. Install new seal (1) in cover plate (2). Insert the oil seal carrier (3) and bearing cup (4) into position. Press on the tapered edge of the bearing cup till it bottoms in the cover plate.

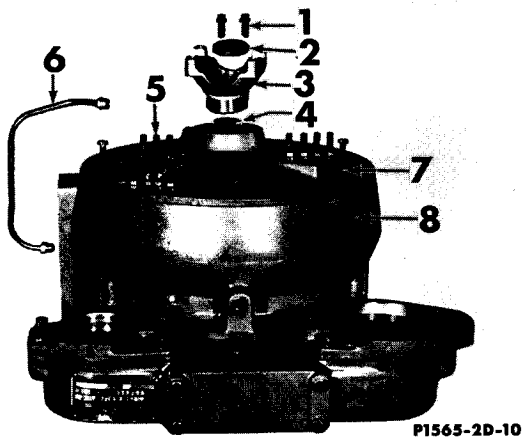


Figure 2D-10

Install the end cover (7) onto the main housing (8). Install 16 capscrews (5) into the end cover (7). Torque capscrews to 32 foot pounds. Install output shaft yoke (3) to the output shaft (4). Install retainer washer (2) and insert two counter-bore capscrews (1) thru the retainer washer (2) and into the output yoke (3). Torque the counter-bore capscrews to 32 foot pounds. Install external oil line (6), between the end plate (7) and the main housing (8).

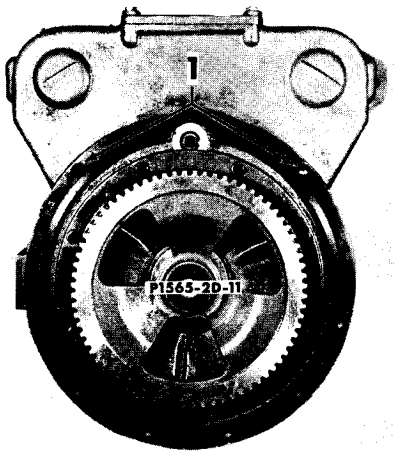


Figure 2D-11

Before installing torque converter and accessory drive to the engine flywheel housing, make certain that the 2 "O" rings (1) are in the main housing located just below the P. T. O. sections of the converter housing.

The matching holes in the flywheel housing are equipped with studs. Copper washers are used under the stud nuts when installing converter to flywheel housing.

NOTES

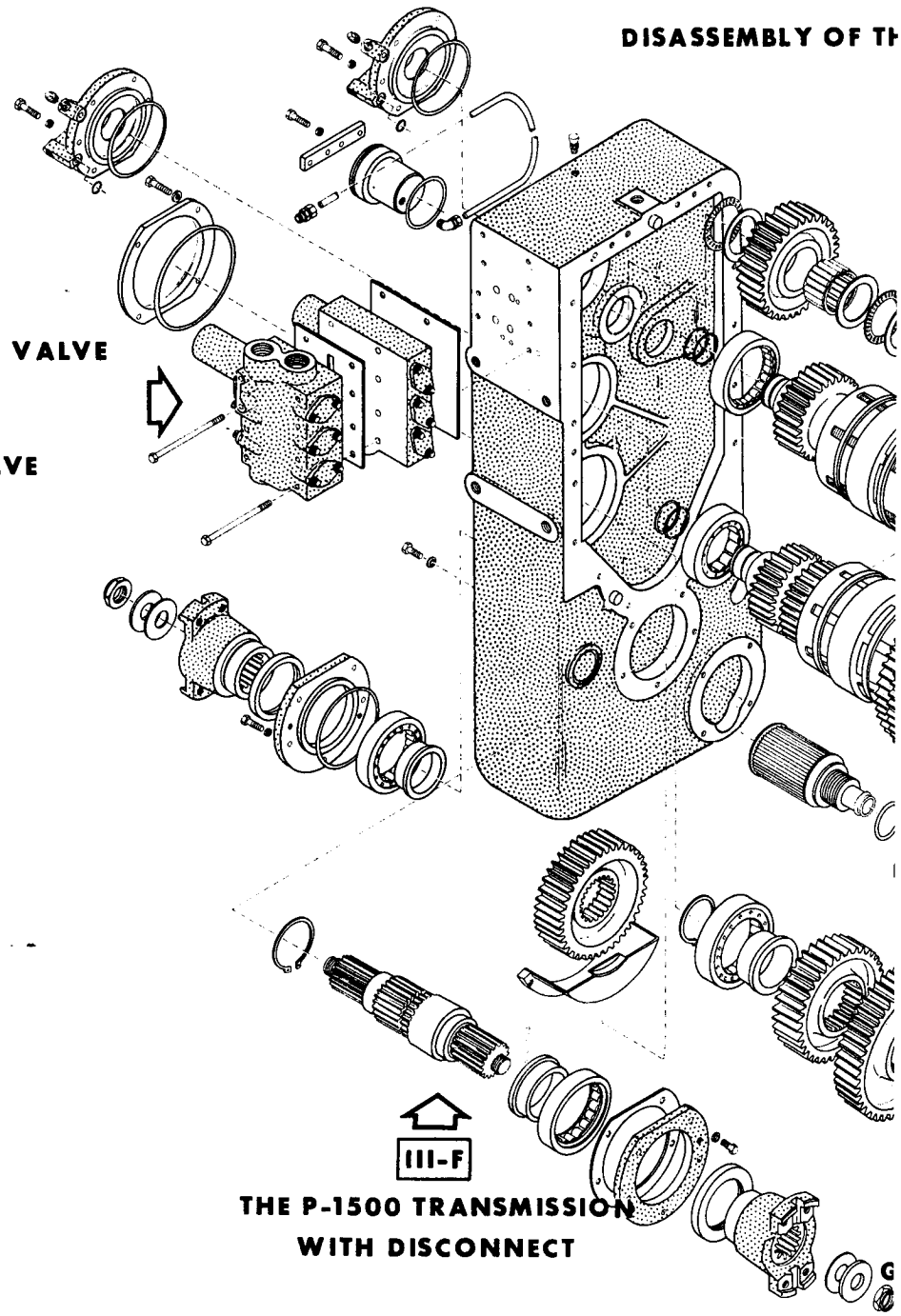
DISASSEMBLY OF TH

III-B

PRESSURE REGULATOR VALVE

III-C

DIRECTIONAL VALVE



III-F

THE P-1500 TRANSMISSION
WITH DISCONNECT

Figure 3-0 Pictori

SERIES TRANSMISSION

III-A

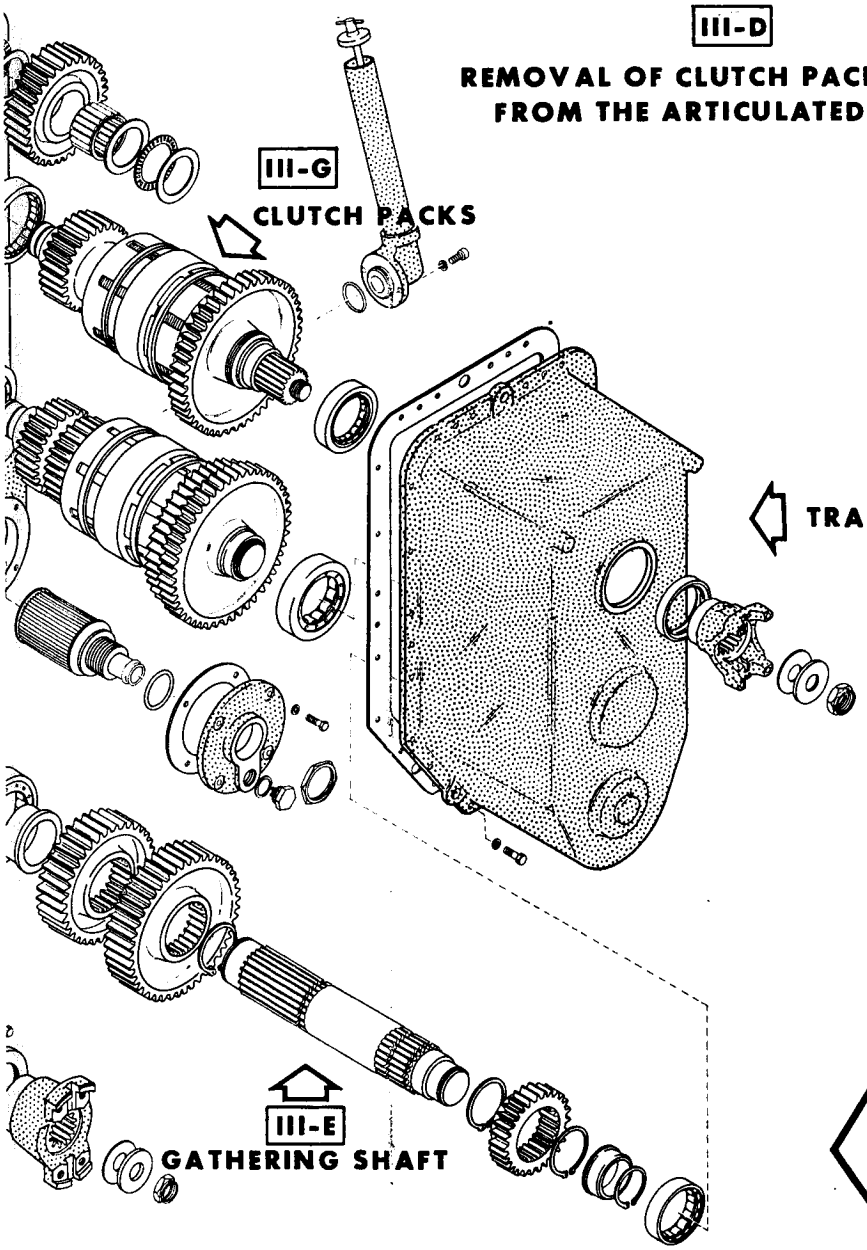
MBLY OF THE P-1500 SERIES TRANSMISSION

III-D

REMOVAL OF CLUTCH PACKS ONLY
FROM THE ARTICULATED UNITS

III-G

CLUTCH PACKS



III-H

TRANSMISSION COVER ASSEMBLY

III-E

GATHERING SHAFT

III-J

REASSEMBLY OF THE
P-1500 SERIES TRANSMISSION

SECTION III

P-1500 SERIES TRANSMISSION

TABLE OF CONTENTS

SECTION III

PREPARATION FOR DISASSEMBLY OF P-1500 SERIES TRANSMISSION

In preparation for disassembly of the P-1500 series transmission, the following should be done:

A. Disconnect all external lines from the transmission housing.

B. Using plain steam (no caustic soda), clean the outside of the transmission housing.

C. Prepare a dirt-free work area at least 12 ft. square.

D. A hoist should be available to aid in lifting.

E. Gather the following tools:

1. Low table or bench for disassembly use.
2. Shop press.
3. Hydraulic gear and bearing puller set, rated at 17 tons minimum.
4. Mechanical type gear and bearing puller set.
5. Solvent for cleaning parts.
6. Standard set of mechanic's hand tools including:
   a. Snap ring pliers
   b. Brake spring pliers
   c. 100 ft. lb. torque wrench
   d. Mallet (preferably plastic)
   e. Snap ring groove filler Refer to Section III-G, Figure 3G-6, page III- 31G.

F. Provisions for heating bearing inner race either in oil or an oven. (Used in reassembly).

G. Pans for holding small parts during disassembly.

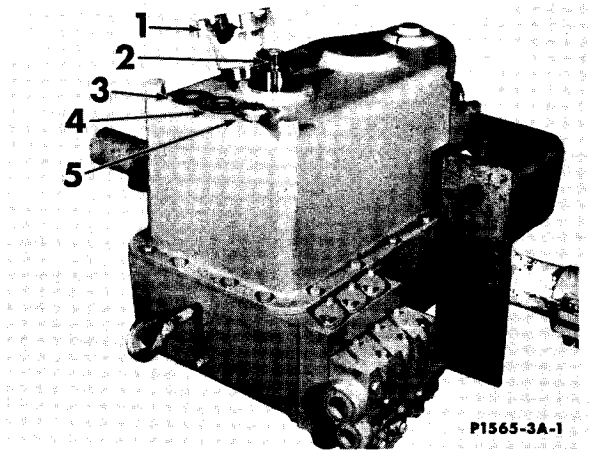


Figure 3A-1

To remove the input flange (1), remove the input flange nut (5), steel washer (4), and gasket (3) from the input shaft (2). Remove the input flange.

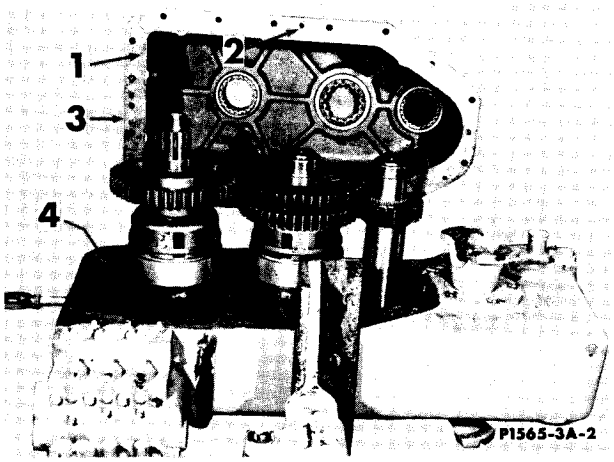


Figure 3A-2

To remove the transmission cover (1), remove nineteen capscrews from the transmission case (4). Insert four capscrews into the jackscrew holes (2) to aid in the removal. Remove the cover gasket (3).

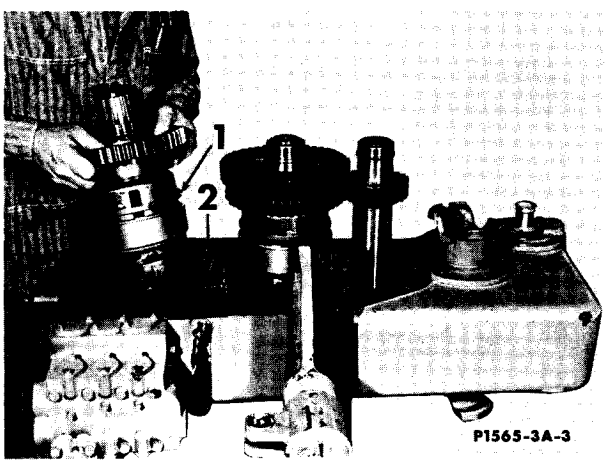


Figure 3A-3

For the removal of only the Directional and Range clutch from the Articulated "PAY" units with out removing the complete transmission from the unit, Refer to Section III-D, page III-10D.

Remove the directional clutch pack (1) from the transmission case (2). For further disassembly of the directional clutch pack, refer to Section III-G, page III-27G.

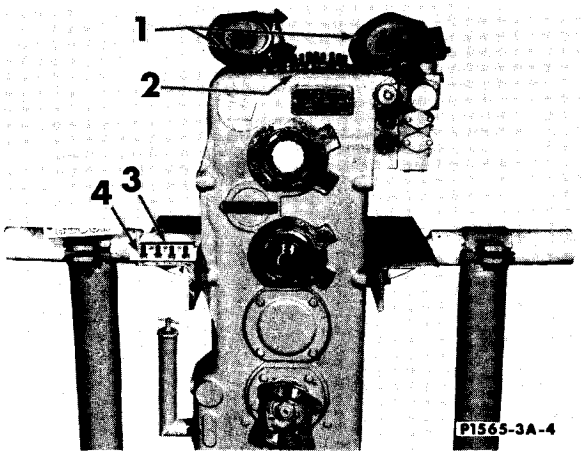


Figure 3A-4

Turn the transmission to a vertical position or completely over for the removal of the transmission caps.

Remove the two clutch pack caps (1) by removing the twelve capscrews (2) from the pack caps. The two clutch pack caps (1) are interchangable. Remove the idler shaft retainer (3) by removing the four capscrews (4).

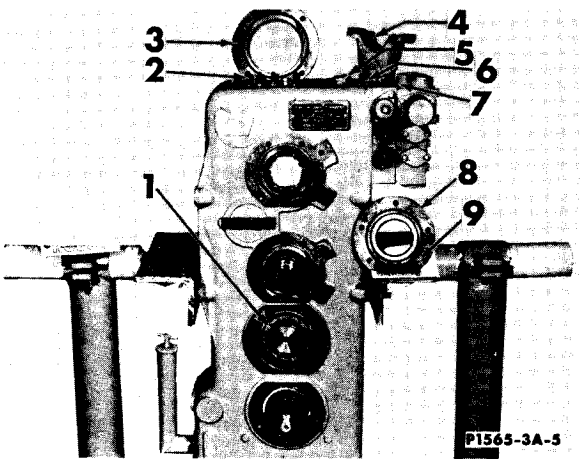


Figure 3A-5

Remove the gathering shaft cap (3) by removing four capscrews (2) from the cap. Also remove the snap ring (1) from the gathering shaft. Remove the output flange (4) by removing the flange nut (5), steel washer (6), and gasket (7). Remove the five capscrews (9) from the output flange cap (8). Remove the cap.

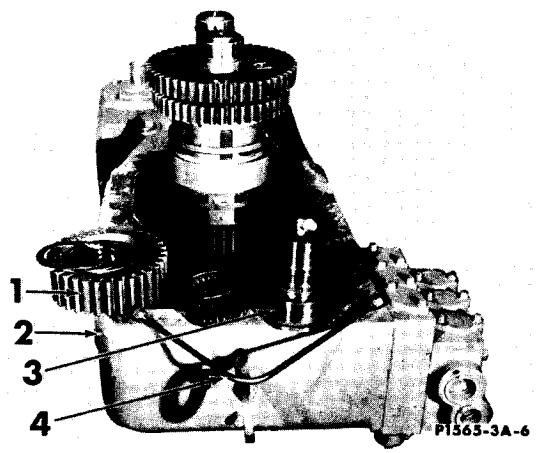


Figure 3A-6

Turn the transmission back to a horizontal position, exposing the inside of the transmission.

Remove the idler shaft oil-tube (4) from the idler shaft (3) and transmission case (2). Apply downward force on the idler shaft, holding the shaft from the bottom of the transmission case so it won't get damaged from falling on the floor. As the idler shaft is forced out of the housing, the idler gear (1) will become free for removal.

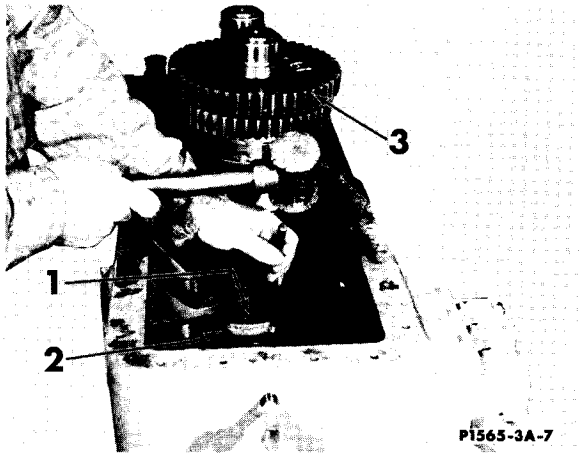


Figure 3A-7

Before removing the range clutch (3) the outer bearing race (1) must be driven half way out of the transmission case (2).

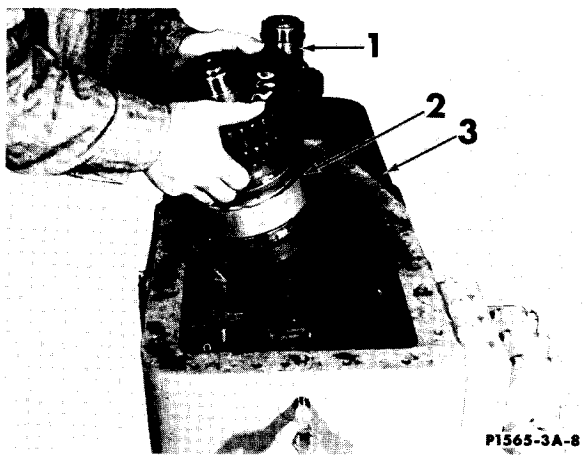


Figure 3A-8

Remove the range clutch pack (2) from the transmission case (3) by pulling the pack up and away from the gathering shaft (1). For further disassembly of the Range Clutch pack refer to Section III-G, page III-27G.

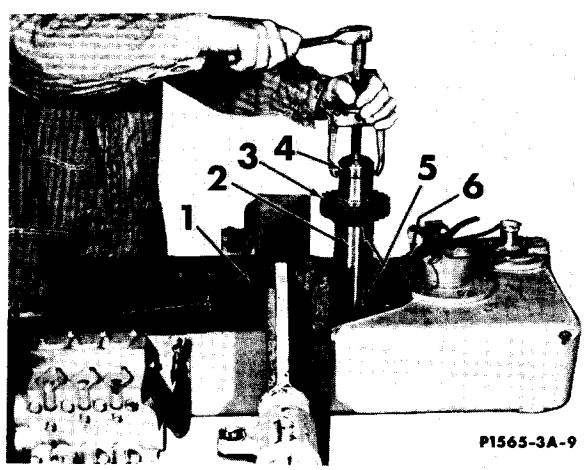


Figure 3A-9

To remove the gathering shaft (2) from the transmission case (1), remove the snap ring from the top of the bearing race (4). Remove the snap ring (6) from the top of the small gear (3). With a suitable puller, remove the top bearing race (4) from the gathering shaft. Remove small gear (3) and two remaining snap rings (5) from the bottom of the small gear, and the top of the large gears.

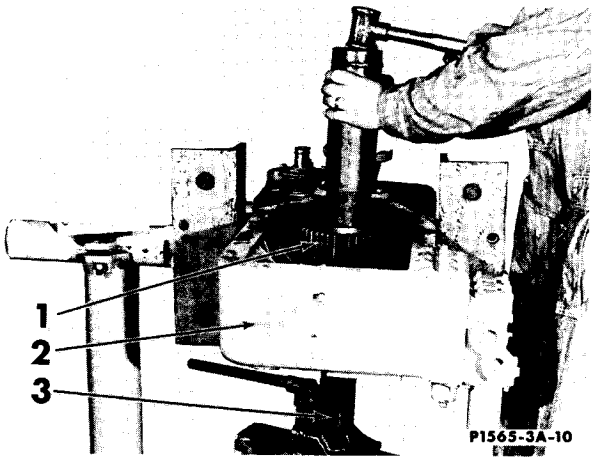


Figure 3A-10

To partially remove the remaining two gears (1) and bearing race from the gathering shaft enabling the removal of the gathering shaft from the transmission case. Apply a driving shell over the gathering shaft, driving down on the large gears (1). Place a hydraulic jack (3) under the transmission case (2) and apply an upward force on the gathering shaft, and at the same time driving down on the gears.

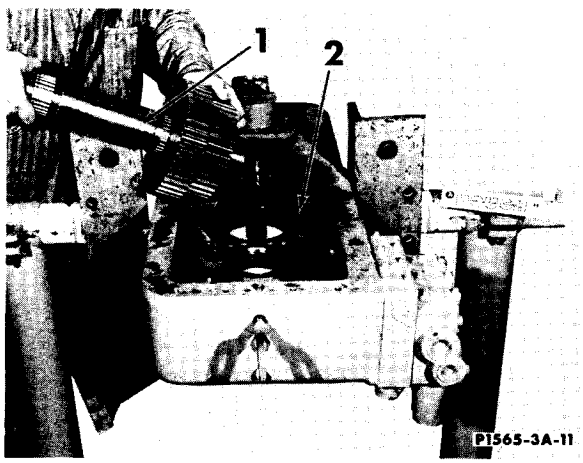


Figure 3A-11

Remove the gathering shaft assembly (1) from the transmission case (2).

For further disassembly of the gathering shaft refer to Section III-E, page III-15E.

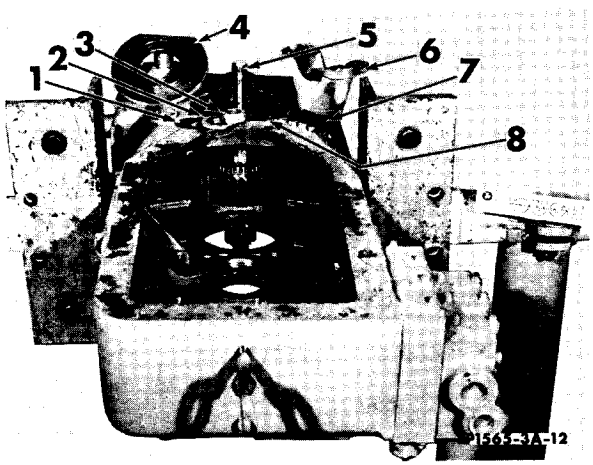


Figure 3A-12

For disassembly of the P-1500 Transmission with the disconnect output shaft assembly, refer to Section III-F, page III-16F.

To remove the output flange (6), remove the output flange nut (3), steel washer (2), and gasket (1) from the output shaft (5). Remove the output flange. Remove five capscrews (7) from the output shaft cap (4). Remove the cap (4) and cap gasket (8).

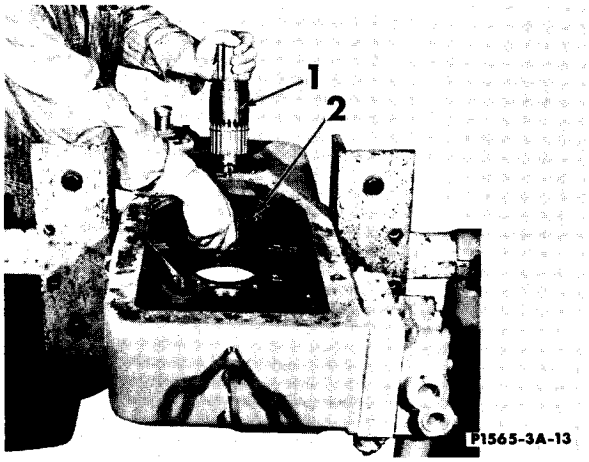


Figure 3A-13

To remove the output shaft (1) from the output gear (2), apply an upward force on the output shaft with the use of a hydraulic jack. Place the jack under the end of transmission shaft. As the upward force is applied, drive down on the output gear, forcing the gear and bearing race from the output shaft.

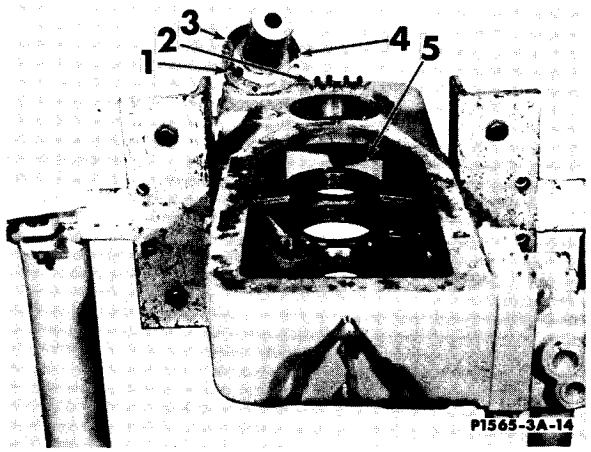


Figure 3A-14

Remove the oil strainer cap (3) by removing four capscrews (2) from the cap. Remove the cap gasket (4). Remove and clean the drain plug (1). To remove oil baffle (5) remove three capscrews from the bottom of the transmission case.

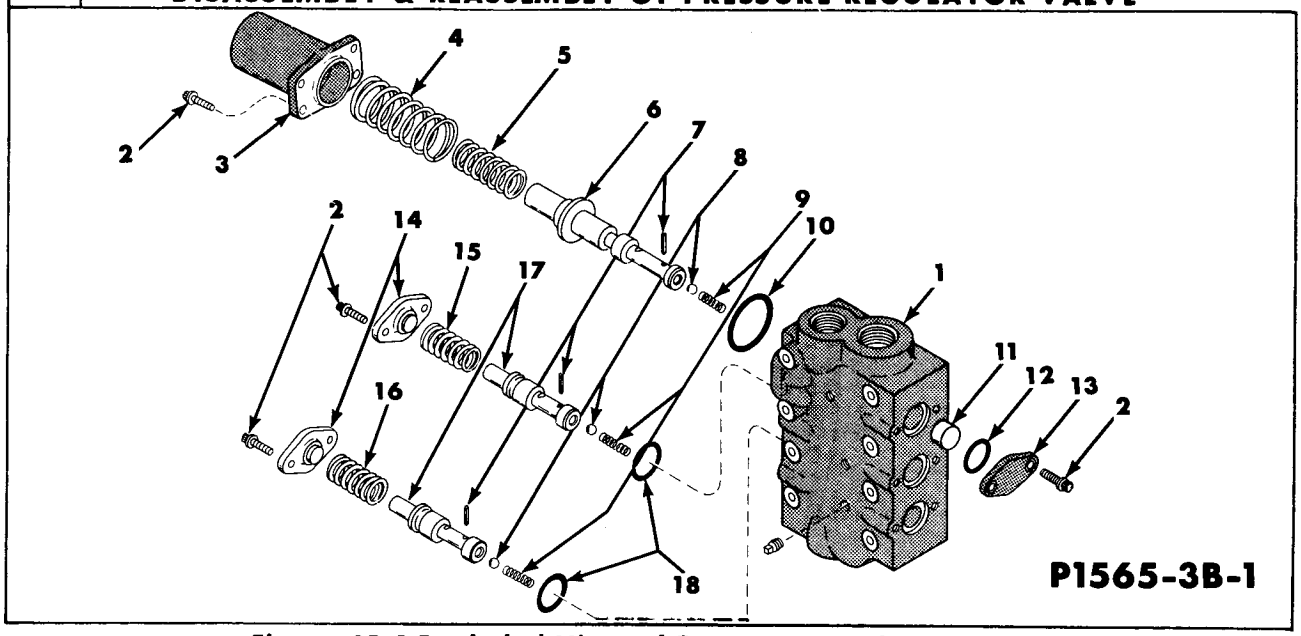


Figure 3B-1 Exploded View of Pressure Regulator Valve

DISASSEMBLY OF PRESSURE REGULATOR VALVE

Remove four capscrews (2) from the spring retainer cap (3).

CAUTION

Care must be taken when removing the capscrews, pressure of the springs are against the inside of the caps.

Remove the retainer cap (3), "O" ring (10), clutch pressure regulating springs (4 and 5), and clutch pressure spool (6). Remove six capscrews (2) from three spool caps (13). Remove caps and "O" rings (12) from the side of the valve body (1). Remove the slug (11) from bore when removing spool (6).

Remove four capscrews (2) from spring caps (14). Remove two caps (14) and "O" rings (18) from the valve body. Remove the torque converter regulator spring (15) and the lube regulator spring (16). Remove the two spools (17) from the valve body.

To clean and check the balls (8) and springs (9) in the spool the roll pins (7) must be driven out of the spool, the spring and ball removed, cleaned and inspected.

Clean all parts thoroughly in clean solvent and dry with compressed air. Inspect spools, valve body bores, springs and check valve balls in the spools. Flush valve body passages with solvent and dry with compressed air. Use a liberal amount of oil on the spools when assembling. Replace all "O" rings.

REASSEMBLY OF PRESSURE REGULATOR VALVE

Install ball (8) and springs (9) into the three spools (6) and (17). With the ball and spring in the correct position, drive roll pin (7) into the holes provided in the three spools (6) and (17).

Install the lube pressure spring (16) on the lower spool (17) and insert the spool (17) into the valve body. Install "O" ring (18) and cap (14), securing the cap to the valve body with two capscrews (2).

Install the converter pressure regulator spring (15) on the middle spool (17) and insert the spool (17) into the valve body. Install "O" ring (18) and cap (14) securing the cap to the valve body with two capscrews (2).

Install the clutch pressure regulating spring (4 and 5) on the clutch pressure spool (6) and insert spool (6) into the valve body. Install "O" ring (10) and spring retainer cap (3). Secure cap (3) to the valve with two capscrews (2).

Install slug (11) in the top bore of the valve body. The slug is designed to hold the main pressure spool in the open position. Install three new "O" rings (12) and caps (13), securing them to the valve body with capscrews (2). Torque capscrews to 18 ft. lbs.

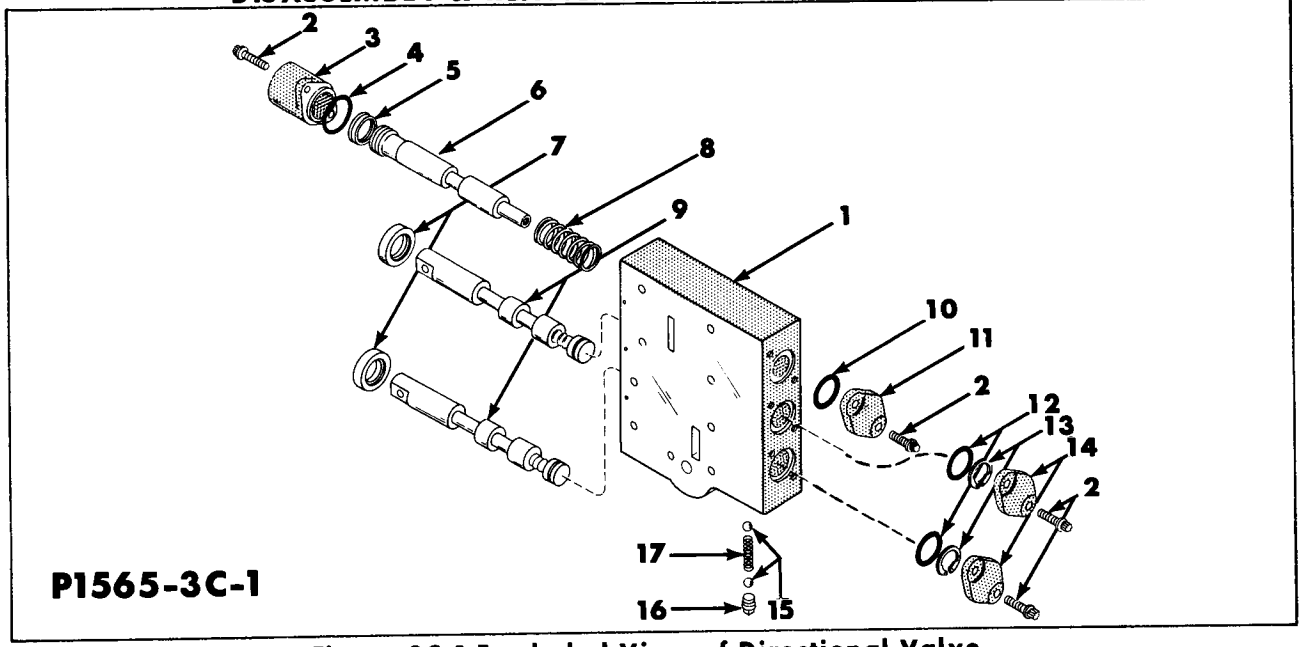


Figure 3C-1 Exploded View of Directional Valve

DISASSEMBLY OF DIRECTIONAL VALVE

Before disassembling the directional valve, remove all excessive dirt and oil from the valve body. The port holes must be plugged to keep the dirt from entering the valve ports.

Remove all eight capscrews (2) from the cylinder cap (3), disconnect (11) and the remaining two spool caps (14). Remove the four caps and "O" rings (4), (10), and the remaining two "O" rings (12). Remove plug (16) spring (17) and detent ball (15).

Push bottom spool (9) out far enough from the housing to remove spool snap ring (13). Push bottom spool (9) back thru the housing far enough to allow another ball (15), spring (17) and ball (15) to fall free thru the bore. Remove the spool from the valve body by pushing it out thru the cap end of the valve body. Use the same procedure as described in this paragraph for the remaining spool (9).

The disconnect spool (6) should be removed thru the cylinder cap end of the valve body.

Remove and replace all seals when assembling the directional valve.

Clean all parts thoroughly in mineral spirits. Inspect valve body, spools, springs, detent balls, and spool caps for excessive wear and scoring.

REASSEMBLY OF DIRECTIONAL VALVE

When reassembling the valve, the valve ports must be clean and lubricated. Install seal ring (5) with lip towards the end of the spool. Install "O" ring (4) on the end of the air cylinder cap (3). Slide cap (3) over end of spool (6), seal ring (5) and spring (8). Insert spool into the large opening in the valve body (1). Push the cylinder cap (3) tight against the valve body so spring (8) is compressed enough to start the capscrews (2) securing the cylinder cap to the valve body. Install "O" ring (10), cap (11) and capscrews (2) onto the valve body.

Install the middle spool (9) thru the cap end of the valve body, pushing it thru far enough to install spring (17) and detent ball (15) into the hole provided. Hold the spring (17) and detent ball (15) in position with a 5/16" dowel. Push the middle spool (9) back over the detent ball (15) and far enough to install snap ring (13) on the end of the spool (9).

Install the bottom spool (9) thru the cap end of the valve body, pushing it thru far enough to install detent ball (15), spring (17) and another detent ball (15) into the hole provided. Hold the spring and detent balls in position with a 5/16" dowel. Push the bottom spool (9) back over the detent ball (15) and far enough to install snap ring (13) on the end of the spool (9).

Install the remaining detent ball (15), spring (17) and pipe plug (16) into the valve body. Install "O" rings (12), caps (14) and capscrews (2) to the valve body. Torque capscrews to 18 ft. lbs. Press seals (7) into valve body over spool end with the wiper side of seal toward the outside of the valve body.

REMOVAL OF CLUTCH PACKS ONLY

FROM ARTICULATED UNITS

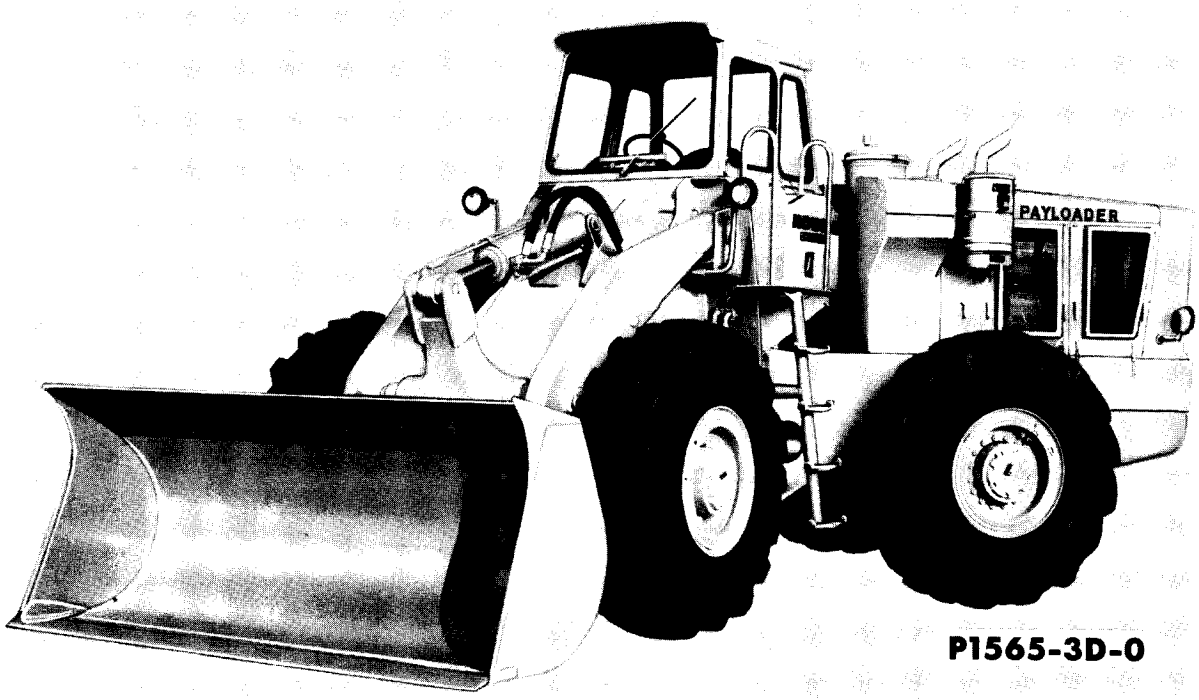


Figure 3D-0 Articulated "PAY" Units

Section III-D is directed only to the removal of the directional and range clutch from the articulated "PAY" Units. For complete overhaul of the P-1500 Series transmission the transmission should be removed from the unit.

PREPARATIONS FOR REMOVAL OF CLUTCH PACKS ONLY FROM ARTICULATED UNITS

A. Disconnect all external lines from the transmission housing.

B. Using plain steam (no caustic soda), clean the outside of the transmission housing and part of the main frame.

C. A hoist should be available to aid in lifting.

D. Provisions for heating bearing inner race either in oil or an oven. (Used in reassembly.)

E. Pans for holding small parts during disassembly and reassembly.

REMOVAL of Clutch Packs from Articulated Units

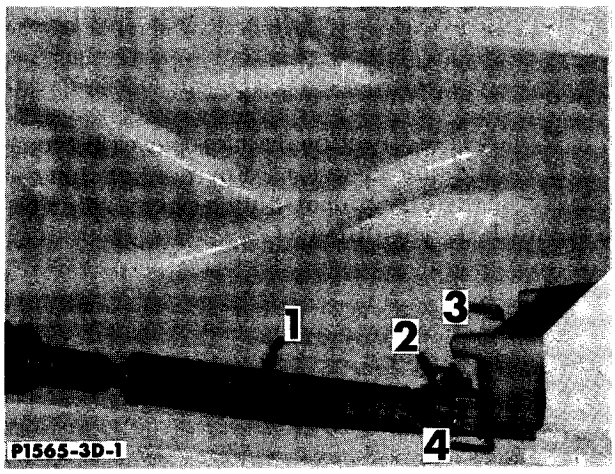


Figure 3D-1

Disconnect the input drive shaft (1) at the transmission end by removing the nuts (2) from the "U" bolts which hold the universal joint to the input yoke (4) of the transmission (3).

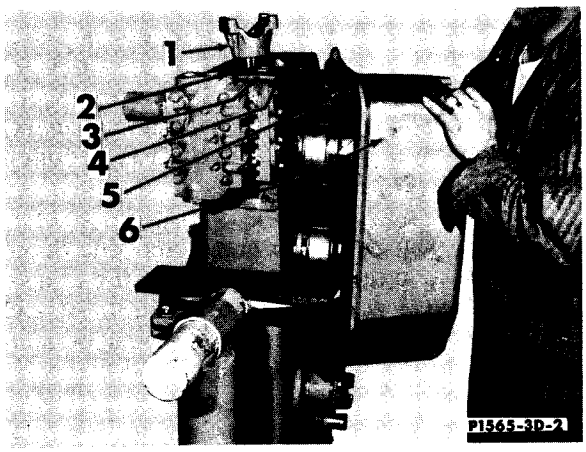


Figure 3D-2

Remove the input flange (1) by removing the flange nut (4), steel washer (3) and gasket (2). Remove flange (1). Remove nineteen capscrews from the transmission cover (6). Remove the transmission cover with the aid of the jackscrews. Remove the cover gasket (5).

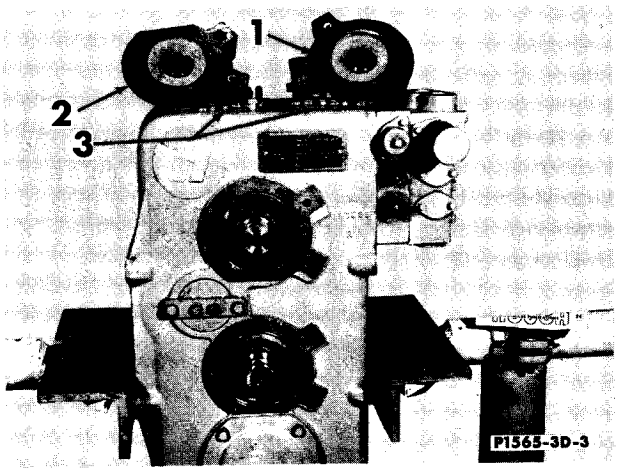


Figure 3D-3

Remove the directional (1) and range (2) clutch pack cap by removing six capscrews (3) on each cap. It is not necessary to remove the directional clutch cap (1) for the removal of the directional clutch pack ONLY.

REMOVAL of Clutch Packs from Articulated Units

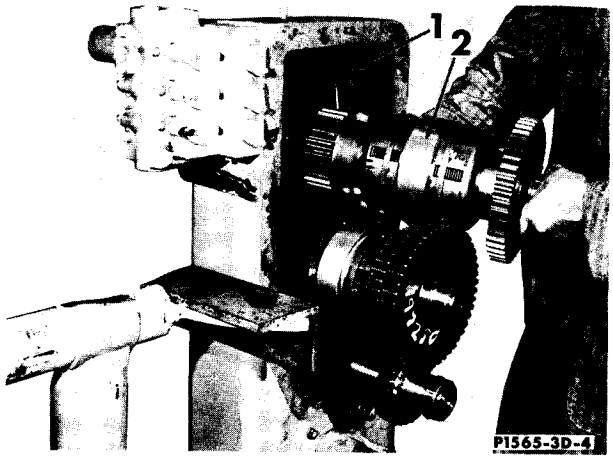


Figure 3D-4

Remove the directional clutch pack (2) from the transmission case (1). For further disassembly of the directional clutch pack, refer to Section III-G, page III-27G.

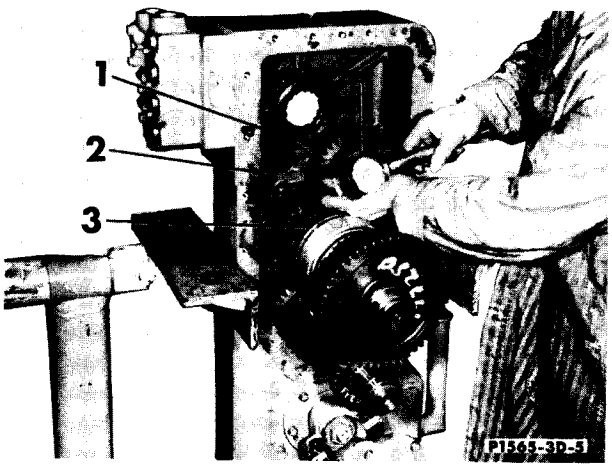


Figure 3D-5

The removal of the idler gear and shaft (1) can be eliminated by removing the range clutch as follows:

With the range clutch cap removed, drive the clutch bearing (3) half way out of the transmission case (2) with the use of a small, flat end punch and mallet. This will provide enough room to remove the range clutch pack.

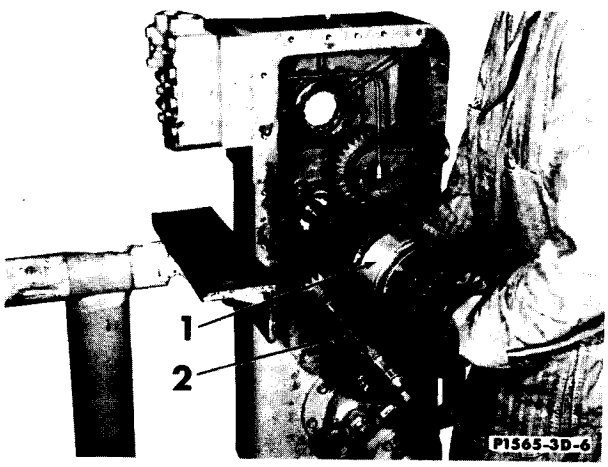


Figure 3D-6

Remove the range clutch pack (1) from the transmission case by lifting out and up away from the gathering shaft (2). For further disassembly of the range clutch pack refer to Section III-G, page III-27G.

INSTALLATION of Clutch Packs for Articulated Units

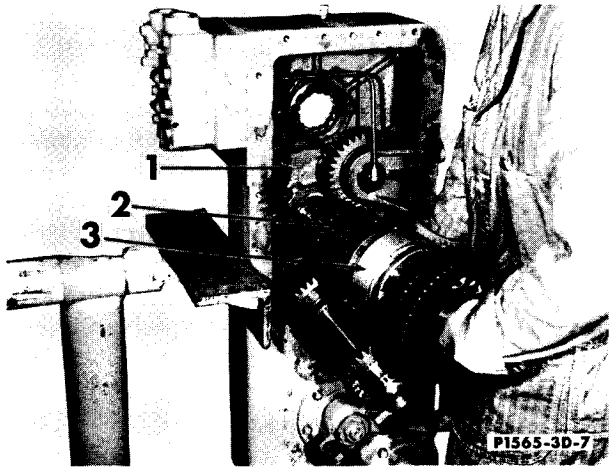


Figure 3D-7

Install a new clutch bearing or if the old one is still in good conditon, install the bearing (2), half way into the transmission case (1). This procedure must be done in order to install the clutch pack without removing the idler gear and shaft. Install the range clutch pack (3) into the transmission case.

NOTE

All capscrews should be accompanied by a lock washer unless otherwise stated. Torque all 3/8 NC capscrews to 32 ft. lbs.

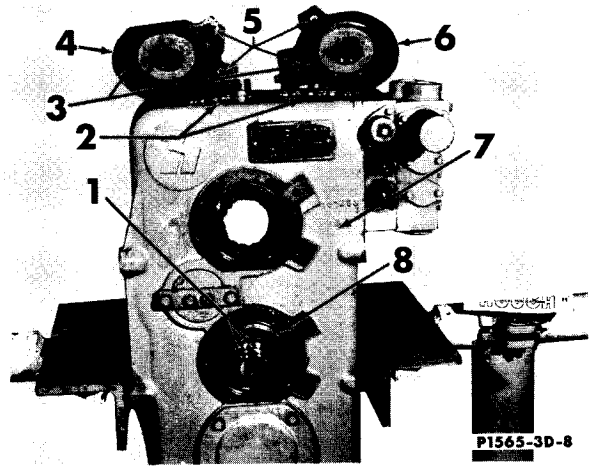


Figure 3D-8

Drive the range pack bearing (8) the rest of the way into the transmission case (7). Check the two oil rings (1) on the range clutch shaft. Be sure the rings are in excellent condition and connected. Install two "O" rings (5) on each clutch pack cap (4 and 6). These caps are interchangeable. Install a new "O" ring (3) on each cap. Install both caps (4 and 6) on the transmission case by inserting six capscrews (2) on each cap.

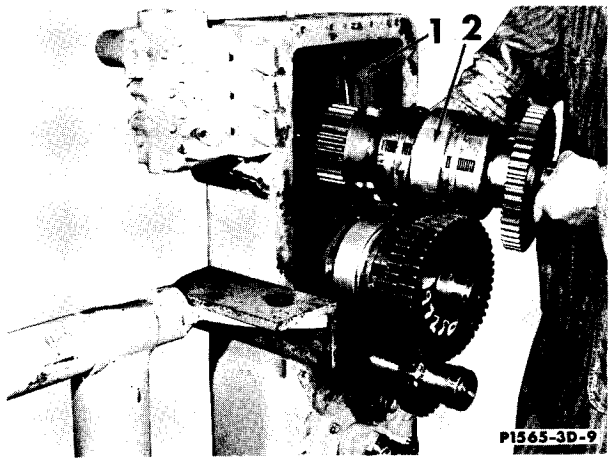


Figure 3D-9

Before installing the directional clutch pack (2), check the two oil rings on the clutch shaft. Be sure the oil rings are in excellent condition and connected. Install the directional clutch pack (2) into the transmission case (1).

INSTALLATION of Clutch Packs for Articulated Units

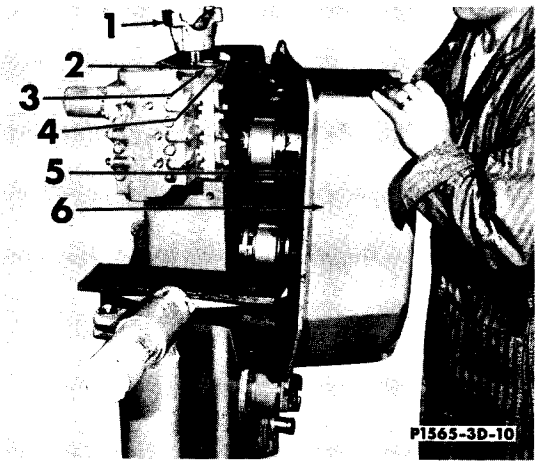


Figure 3D-10

Install a new gasket (5) on the transmission case. Check the bearings in the transmission cover for their condition and if they're in the cover correctly. Check the gathering shaft lock rings and clutch shaft lock rings. Install the transmission cover (6). Drive the transmission cover on to the shaft bearings. Insert nineteen capscrews to the transmission case. Install the input flange (1) new gasket (2), steel washer (3) and shaft nut (4) onto the input shaft.

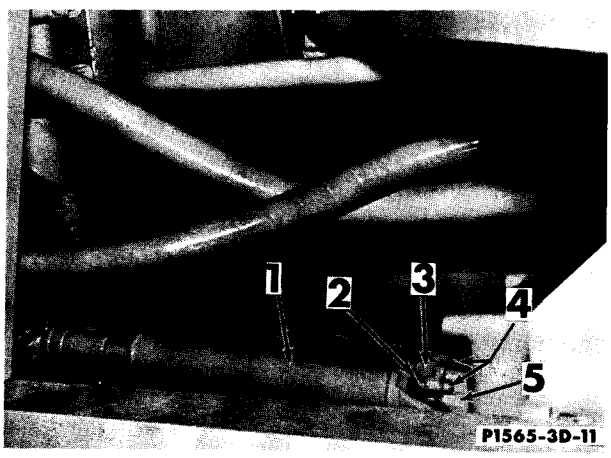


Figure 3D-11

Install the drive shaft (1) which connects the converter and transmission. Install a "U" bolt (2) to the output flange (5), securing the journal cross assembly (3). Install two lock washers and nuts (4) to the "U" bolt ends. Install the remaining "U" bolt the same procedure as above.

DISASSEMBLY & REASSEMBLY OF GATHERING SHAFT

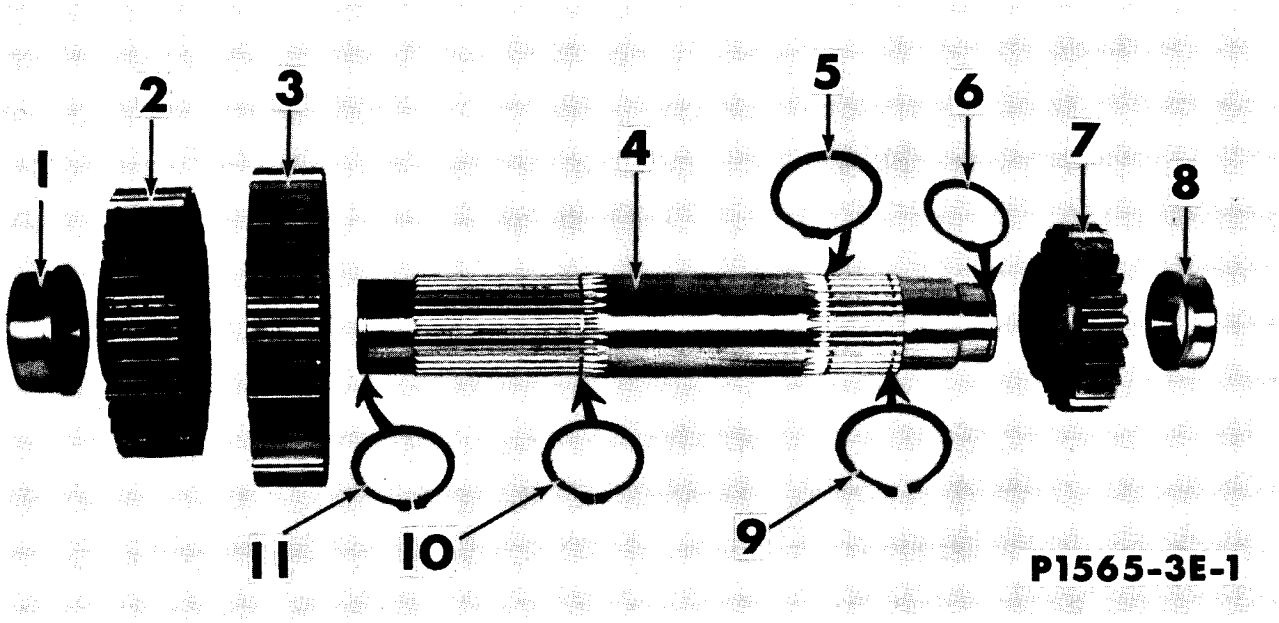


Figure 3E-1 Gathering Shaft Assembly

DISASSEMBLY OF GATHERING SHAFT

Remove snap ring (11) from the left end of the gathering shaft (4). With a suitable puller remove the bearing inner race (1) and the two large gears (2 & 3). Remove snap ring (10) from the gathering shaft (4).

Remove snap ring (6) from the right end of the gathering shaft (4). With a suitable puller remove the bearing inner race (8). Remove snap ring (9) and with a suitable puller remove the remaining gear (7). Remove the remaining snap ring (5).

REASSEMBLY OF GATHERING SHAFT

NOTE: Prior to reassembly, heat bearing inner races to 350°F. for 45 minutes in oil or an oven. This is only recommended if the heating equipment is available.

Install snap rings (5 & 10) on the gathering shaft (4). Install the largest gear (3) on the gathering shaft by driving the gear on the shaft. Install next largest gear (2) with long boss facing out against the bearing inner race. Install the bearing inner race (1). If race is not heated, drive the race down against the gear (2). Install snap ring (11) on top of the bearing inner race (1).

Install the smallest gear (7), with the long boss facing the other two gears, by driving the gear on the gathering shaft (4). Install snap ring (9) on top of the smallest gear (7). Install bearing inner race (8). If race is not heated, drive the race on. Install snap ring (6) on top of the bearing inner race.

DISASSEMBLY & REASSEMBLY OF

P-1500 TRANSMISSION WITH THE DISCONNECT

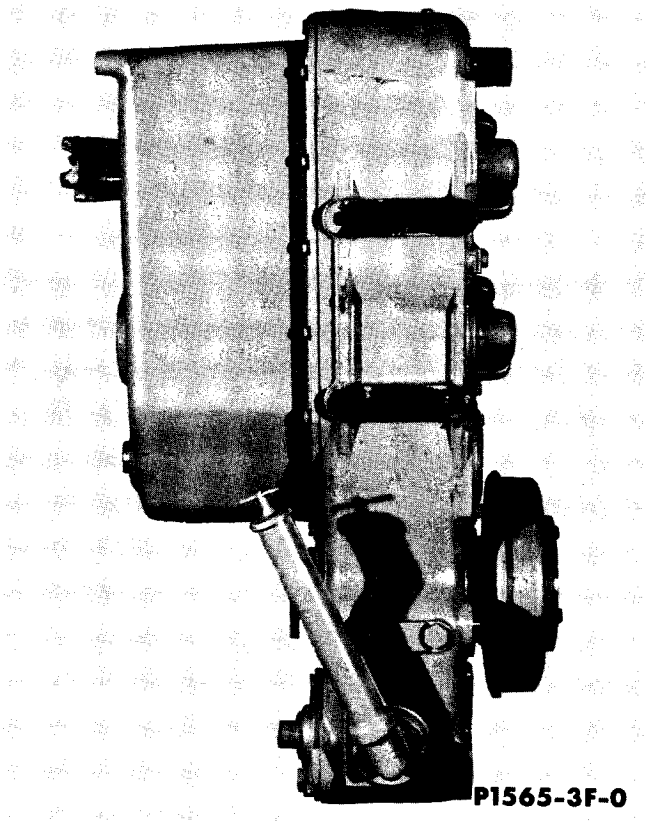


Figure 3F-0 P-1500 Transmission

Section III-F applys to the disassembly and reassembly of the P-1500 transmission. The P-1500 transmission is basically the same in construction as the P-1501 and P-1502 except it has an axle disconnect. This transmission is used in the Rigid frame "PAY" Units.

Disassembly and reassembly of the P-1500 transmission is identical as the P-1501 & P-1502 up to the gathering shaft.

This section will only disassemble and reassemble the axle disconnect. For disassembly procedure for this Section, refer to Section III-A, page III-1A - page III-7A. For reassembly procedure for this Section, refer to Section III-J, page III-45J thru page III-49J.

DISASSEMBLY of P-1500 Transmission W/Disconnect

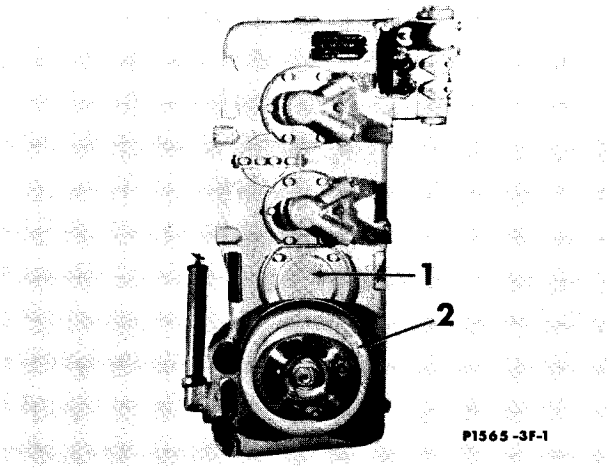


Figure 3F-1

The gathering shaft cap (1) can not be removed until the brake drum assembly (2) has been disassembled.

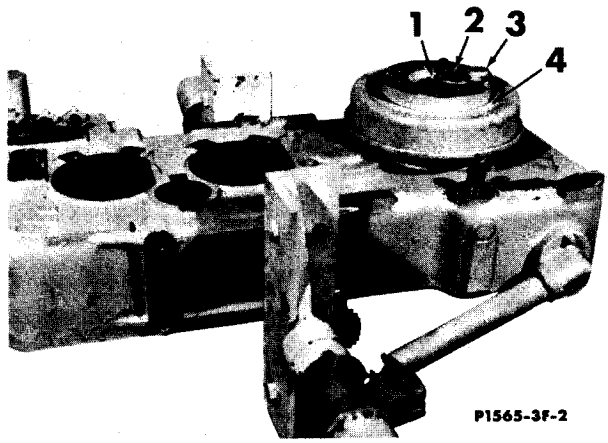


Figure 3F-2

To remove the brake drum (4), remove the nut (3) and steel washer (2) from the output shaft (1). Remove the brake drum.

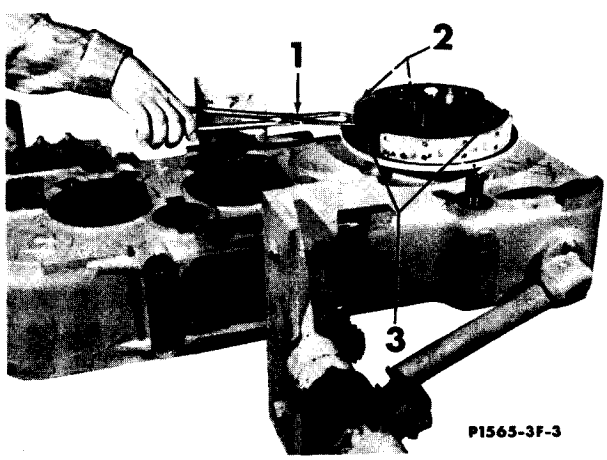


Figure 3F-3

Remove the brake shoe springs (3) from the brake shoes (2). Use a spring pliers (1) to aid in the removal of the brake shoe springs.

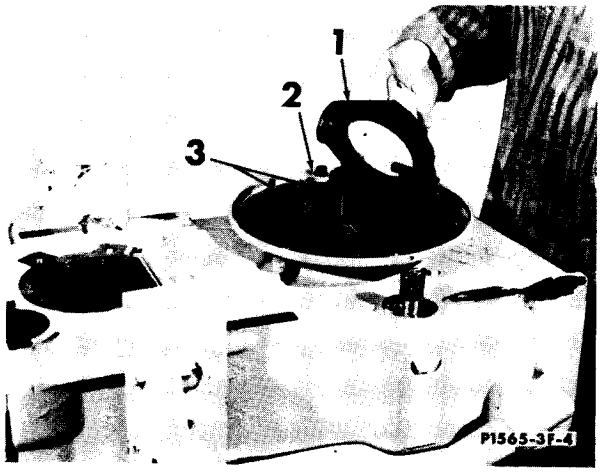


Figure 3F-4

Remove the brake lever (1) and the brake lever roller (2) from the lever pawl (3).

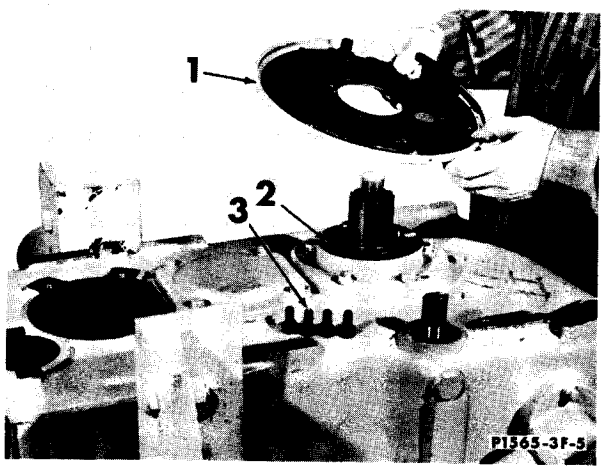


Figure 3F-5

Remove four capscrews (3) and remove the plate assembly (1) from the output shaft cap (2).

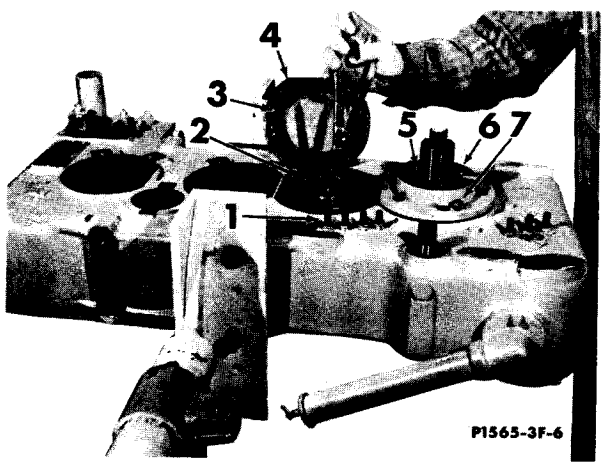


Figure 3F-6

Remove four capscrews (1) to remove the gathering shaft cap (4) and the "O" ring (3). Remove lock ring (2) from the gathering shaft.

Remove the five capscrews (7) from output shaft adapter (6). Insert two capscrews (7) into the jackscrew holes to aid in the removal of the adapter. Remove the adapter, "O" ring and spacer (5).

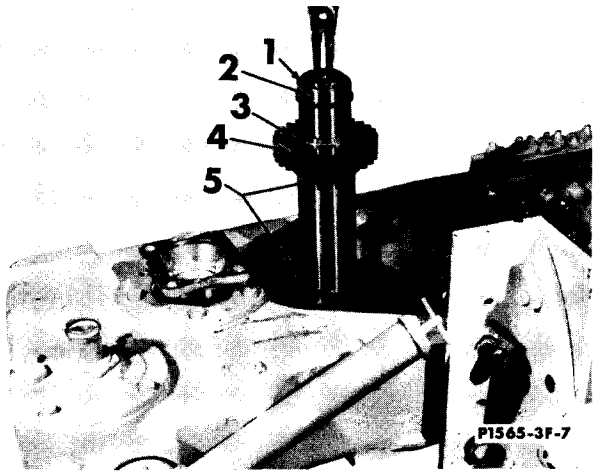


Figure 3F-7

Turn the transmission over and proceed to disassemble the gathering shaft. Remove snap rings (1) - (3) from the top of the bearing race (2) and from the top of the small gear (4). With a suitable puller remove the top bearing race (2) from the gathering shaft. Remove the gear (4) and two remaining snap rings (5).

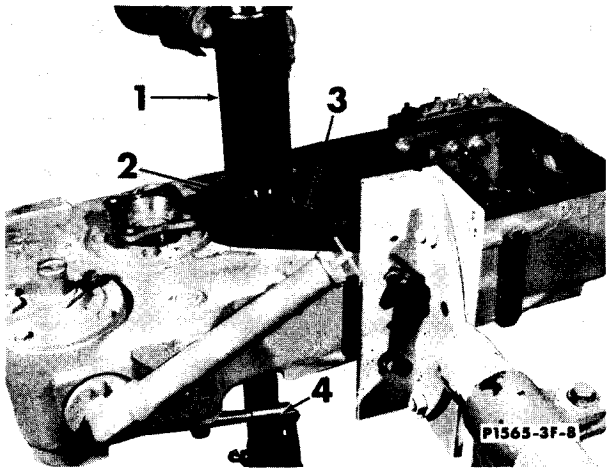


Figure 3F-8

To remove the gathering shaft from the transmission case, remove the remaining two gears (3) and bearing race from the gathering shaft (2).

Apply a driving shell (1) over the gathering shaft (2), driving down on the large gear (3). Place a hydraulic jack (4) under the transmission case and apply an upward force on the gathering shaft, and at the same time driving down on the driving shell. Remove the two gears and bearing race completely from the gathering shaft.

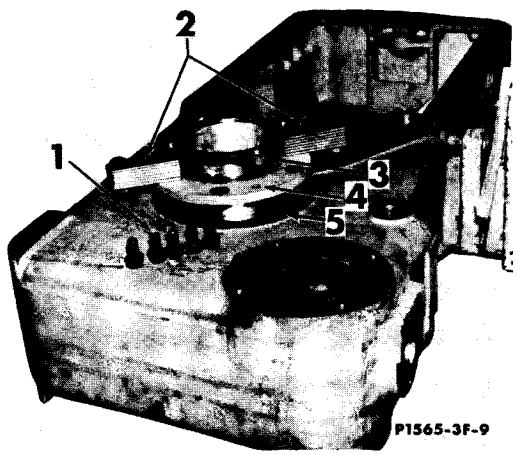


Figure 3F-9

When removing the output flange assembly (3), special attention should be given to the oil seal in the flange cap. Remove the five capscrews (1) from the flange cap. Insert two, three inch capscrews in the jackscrew holes (4). Insert two blocks (2) between the flange and cap to keep the flange from pushing the seal out of the cap. Remove the output flange assembly (3). Remove gasket (5).

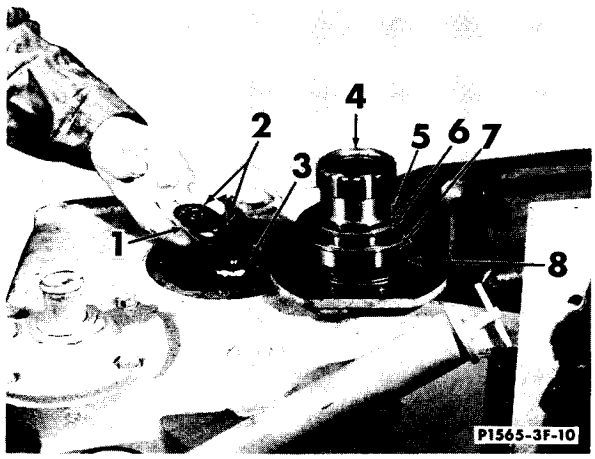


Figure 3F-10

Remove the two thrust races (2) and thrust bearing (1) from the top of the remaining output shaft (3).

For further disassembly of the removed output flange (4), remove the snap ring (5). With a suitable puller, remove bearing race (6) and bearing (7). Remove the oil seal (8).

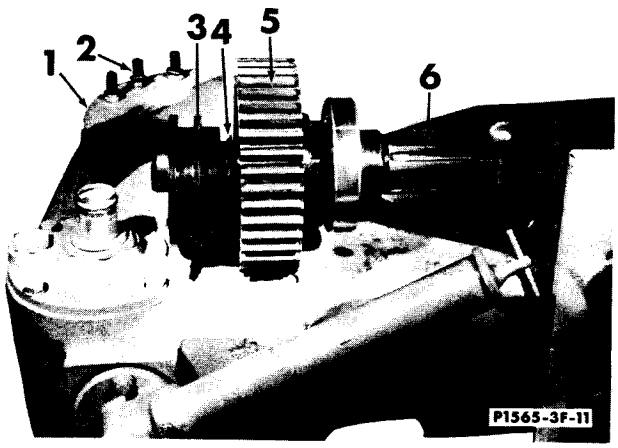


Figure 3F-11

To remove the remaining output shaft assembly (6) from the transmission case, remove the snap ring (4) from between the shifting collar (3) and the output gear (5). With the snap ring removed, drive down on the output shaft. Remove the shifting collar (3) and snap ring (4) from the transmission case. Remove three capscrews (2) from the oil baffle (1). Remove the output gear and oil baffle from the transmission case.

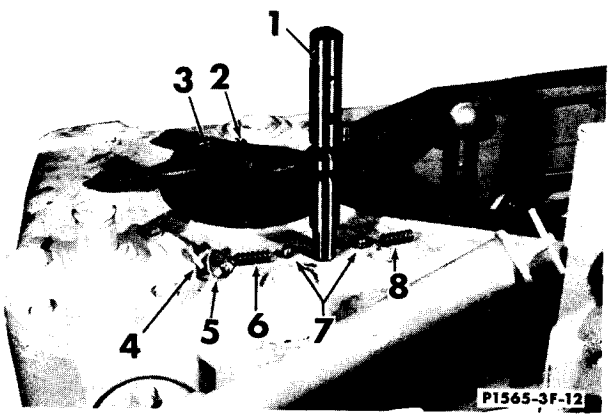


Figure 3F-12

Remove the spring retainer (4), washer (5), spring (6) and detent ball (7) from the side of the transmission case.

Remove the special capscrew (2) from the disconnect shaft (1) and shifting fork (3). Pull the disconnect shaft out of the shifting fork and transmission case. Remove the remaining ball (7) and spring (8) from the side hole of the transmission case.

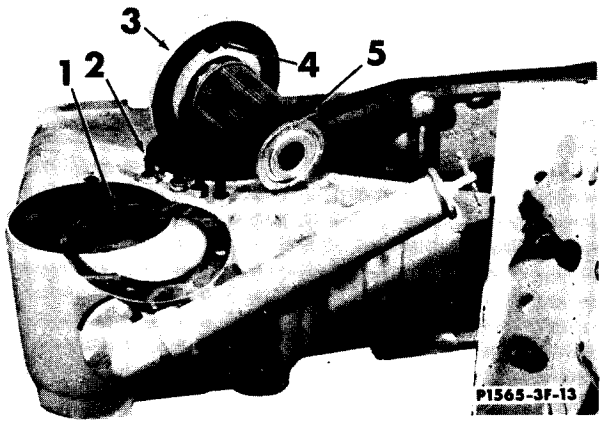


Figure 3F-13

Remove four capscrews (2), oil strainer cap (3), and gasket (1). Remove and clean the drain plug (4). Remove the oil strainer (5) by removing large nut from outside of cap.

PREPARATIONS FOR REASSEMBLY OF

P-1500 TRANSMISSION WITH THE DISCONNECT

In preparation for reassembly of the P-1500 transmission, the following should be done:

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

B. Inspect all bearings for pits and spalled areas. Replace bearings which are pitted and/or spalled.

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

D. Inspect all sealings surfaces for wear and/or grooving.

E. Inspect housing for dirt particles, and flush all passageways thoroughly.

F. Inspect splines on all shafts and drive gears for wear.

G. In assembly, use a heavy non-fibrous grease with a low melting point.

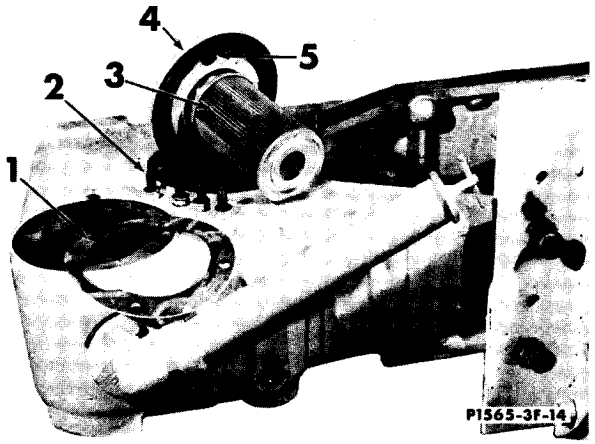


Figure 3F-14

Install oil strainer (3) on the oil strainer cap (4). Clean and install the drain plug (5). Install a new gasket (1) and oil strainer cap assembly (4) into the transmission case. Insert four capscrews (2) to secure the oil strainer cap.

NOTE

All capscrews should be accompanied by a lock washer unless otherwise stated. Torque all 3/8 NC capscrews to 32 ft. lbs.

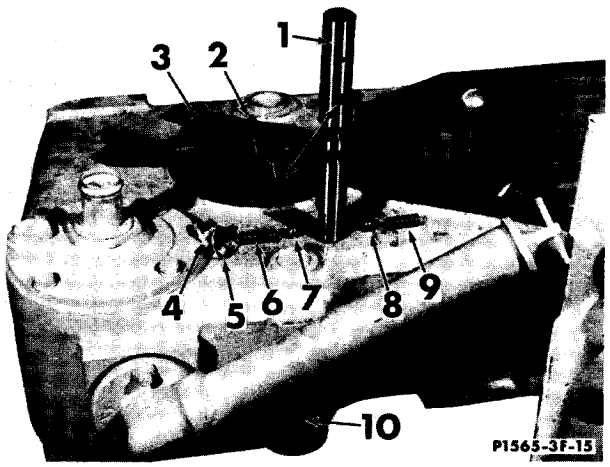


Figure 3F-15

Install the shifting fork (3) into the transmission case with the capscrew hole towards the bottom. Install detent spring (9) and ball (8) into the bottom of the bore (10). With the aid of a punch, hold the spring (9) and ball (8) into the bore and install the shifting rail (1). With the spring and ball properly assembled, continue to slide the shifting rail (1) up through the shifting fork (3). Install sleeve (10), the remaining ball (7) and spring (6). Install copper gasket (5) on spring retainer (4). Install spring retainer into the transmission case. Install special capscrew (2) in the proper position on the shifting rail (1) from inside the transmission case and tighten. (Follow the arrow pattern for proper position.)

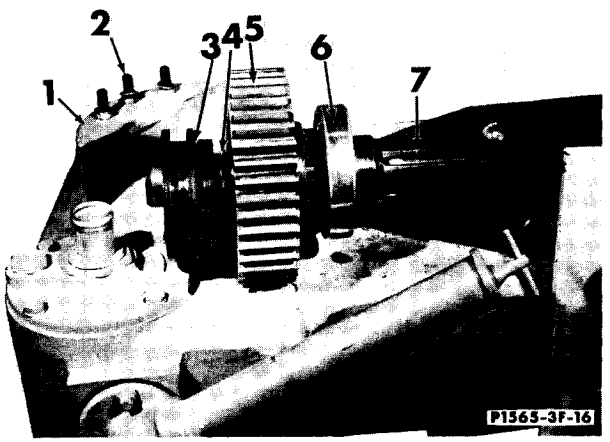


Figure 3F-16

Install the output gear (5), long boss facing down, into the transmission case. Install the oil baffle (1). Insert three capscrews (2) thru the bottom of the transmission case. Install the shifting collar (3), long boss facing down, into position on the shifting fork on top of the output gear (5). Insert snap ring (4) between the shifting collar and output gear.

Install bearing (6) on the output shaft (7), driving the bearing up to the splines. Install the output shaft, with bearing thru the bottom of the transmission case. Drive the output shaft thru the output gear, snap ring, and shifting collar. Install the snap ring (4), into groove on the output shaft.

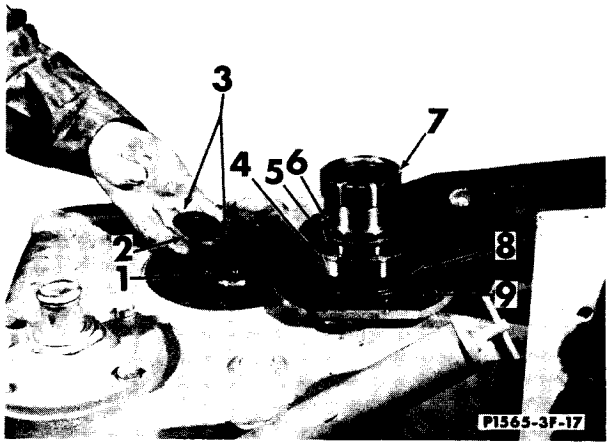


Figure 3F-17

Install a thrust washer (3), thrust bearing (2) and thrust washer (3) on top of the output shaft (1). Apply heavy grease to these parts causing the parts to stick together while assembling.

Install a new oil seal (8) in the retainer (9). Install the retainer (9) on the output flange (7). Install bearing (4) and press the bearing race (5) onto the output flange. Install snap ring (6).

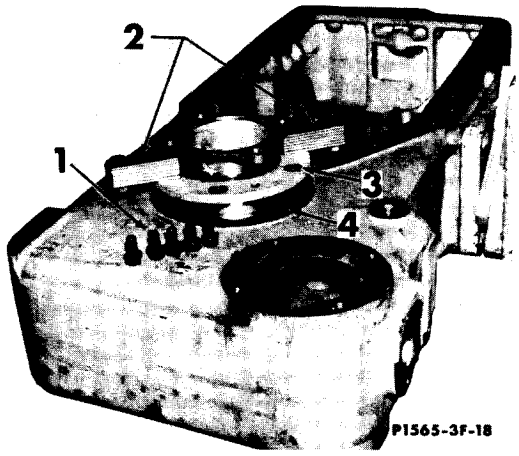


Figure 3F-18

Install a new gasket (4) on the transmission case. Install output flange assembly (3) into the transmission case. Insert spacers (2) between the output flange and retainer. Drive the output flange assembly (3) down. Insert five capscrews (1) to secure retainer.

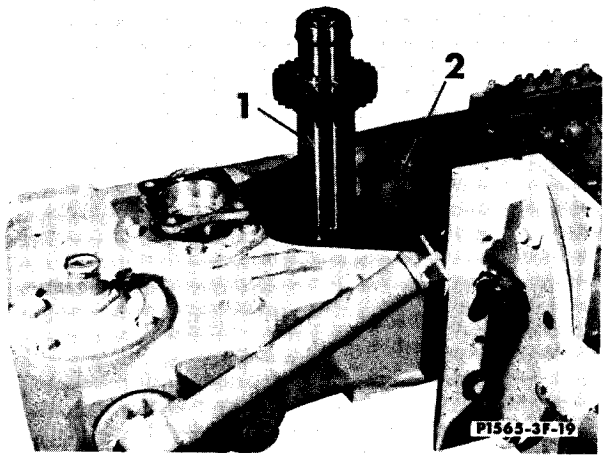


Figure 3F-19

Insert the gathering shaft assembly (1) into the transmission case (2). For disassembly and reassembly of the gathering shaft, refer to Section III-E, page III-15E. The gathering shaft must be installed into the transmission case without the bottom bearing installed.

With the gathering shaft installed in the transmission case, install the bottom bearing. The bearing must be installed thru the bottom of the transmission case. Drive the bearing even with the case.

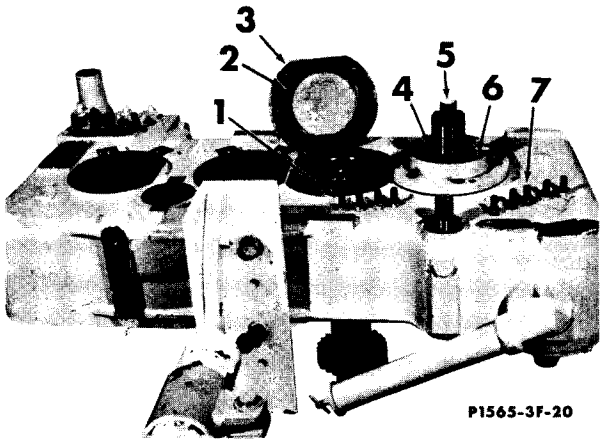


Figure 3F-20

Turn the transmission over. Install a new "O" ring (2) in the groove provided on the transmission. Install gathering shaft cap (3), by inserting four capscrews (1) into the cap.

Install a new seal and "O" ring into the output shaft adapter (6). Install adapter (6) by driving it into position. Insert spacer (4) on the output shaft (5). Insert five capscrews (7) to secure adapter to case.

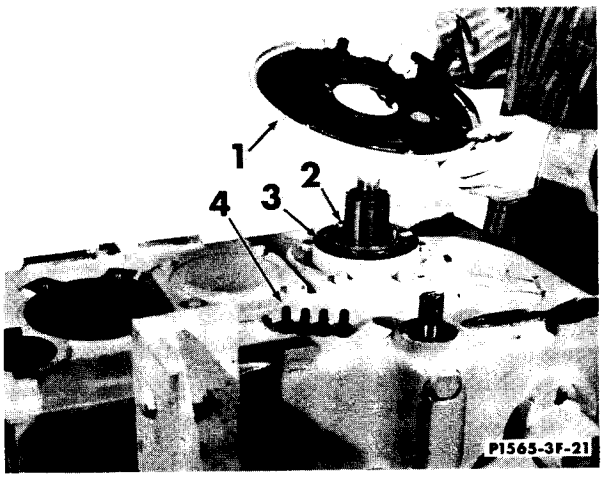


Figure 3F-21

Install the backing plate (1) onto the adapter (3). Position the backing plate (1) over the dowel pin (2) provided. Insert four capscrews (4) securing the backing plate.

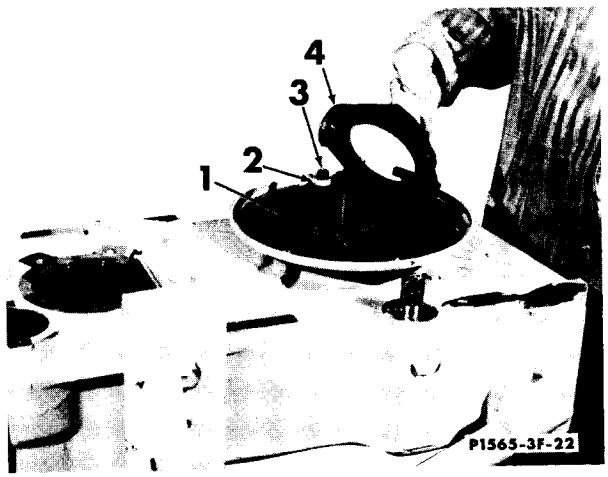


Figure 3F-22

Install brake lever (4) onto the brake lever pawl (1). Install the lever roller (2) onto the remaining lever pawl (3).

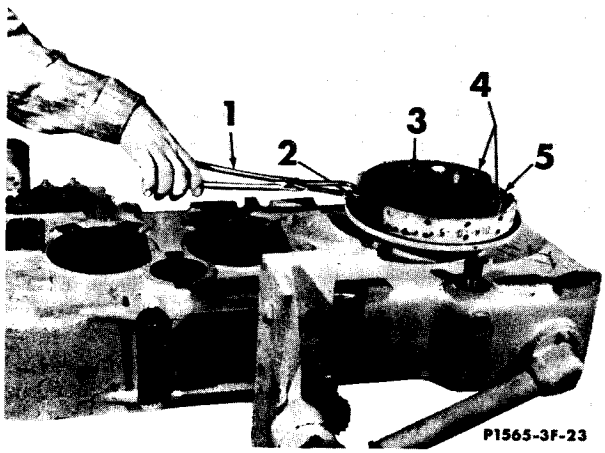


Figure 3F-23

Install the brake shoes (4) onto the backing plate, positioning them onto the pawls (3) and into the plate brackets. Install spring (5) on the lower brake shoe holes, nearest backing plate. With the aid of a spring pliers (1) install the remaining spring (2). Move the brake lever and check for free movement.

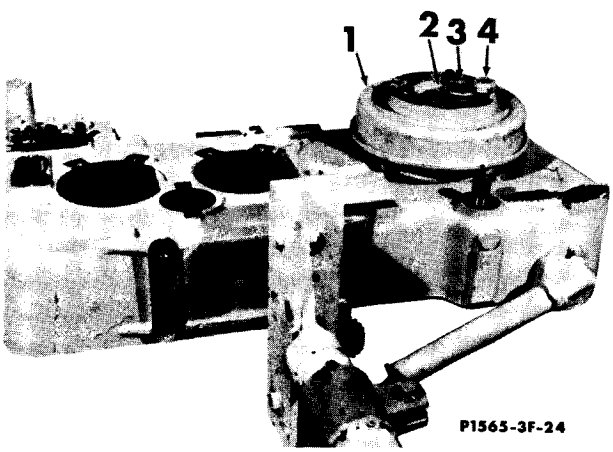


Figure 3F-24

Install the parking brake drum (1) onto the splined output shaft (2). Carefully position the drum over the brake shoes, avoiding any damage to the linings. Install steel washer (3), and nut (4) to the output shaft (2).

For further reassembly of the P-1500 transmission refer to Section III-J, page III-47J starting with Figure 3J-6.

DISASSEMBLY & REASSEMBLY OF CLUTCH PACKS

TABLE OF CONTENTS

DIRECTIONAL CLUTCH

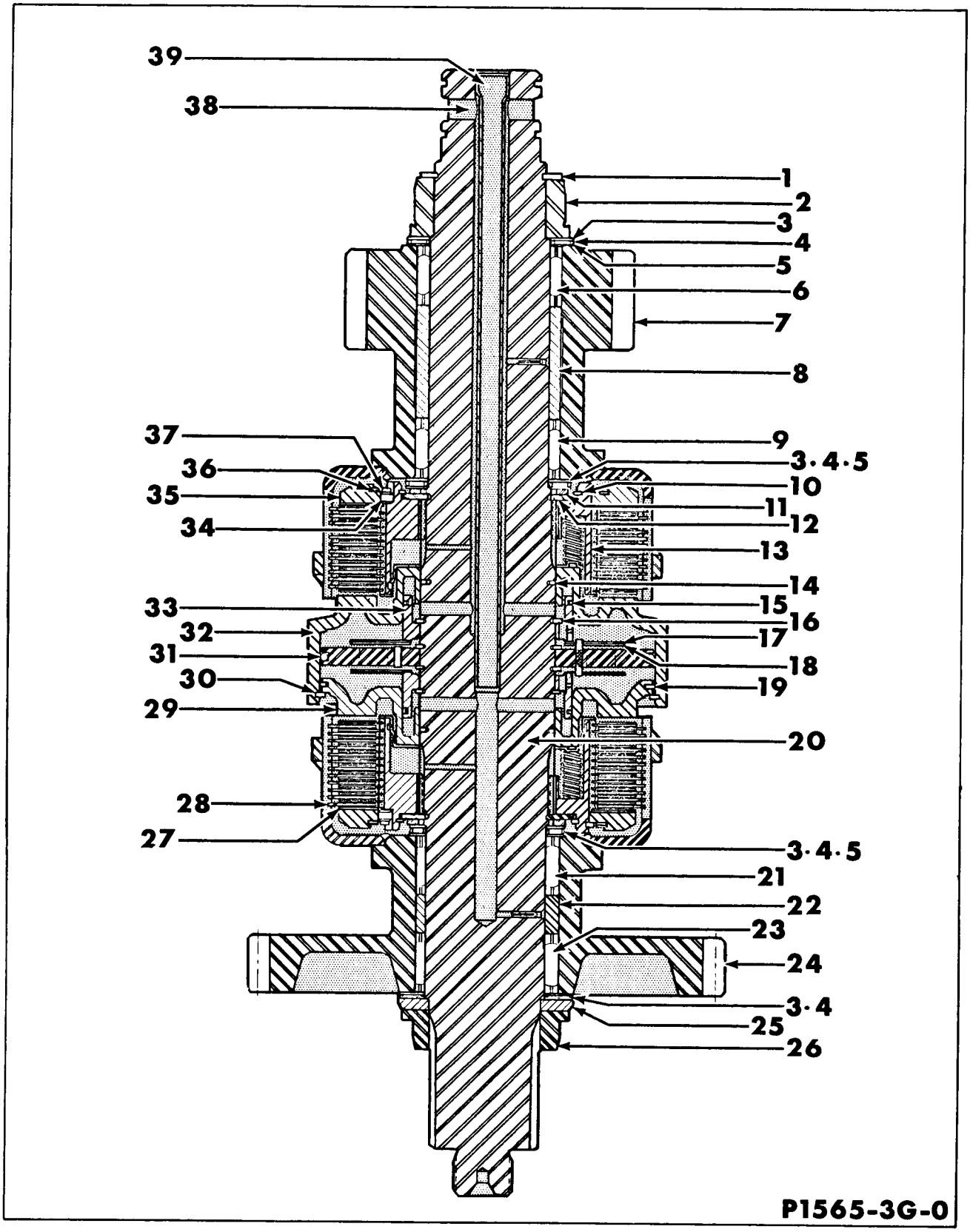


Figure 3G-0 Directional Clutch

KEY TO FIGURE 3G-0

1. Snap Ring
2. Bearing Race
3. Thrust Race
4. Thrust Bearing
5. Thrust Race
6. Roller Bearing
7. Gear and Hub Assy.
8. Spacer
9. Roller Bearing
10. Snap Ring
11. Spacer
12. Retainer
13. Hub Assembly
14. Seal Ring
15. Seal Ring
16. Snap Ring
17. Valve Disc
18. Disc
19. Seal Ring
20. Shaft Assembly
21. Roller Bearing
22. Spacer
23. Roller Bearing
24. Gear and Hub Assy.
25. Thrust Race
26. Bearing Race
27. Bronze Plate
28. Steel Plate
29. Clutch Piston
30. Snap Ring
31. Seal Ring
32. Piston Housing
33. Accelerator Piston
34. Dowel Pin
35. Clutch Back Plate
36. Snap Ring
37. Snap Ring
38. Reverse Clutch Passage
39. Forward Clutch Passage

DISASSEMBLY of Clutch Packs

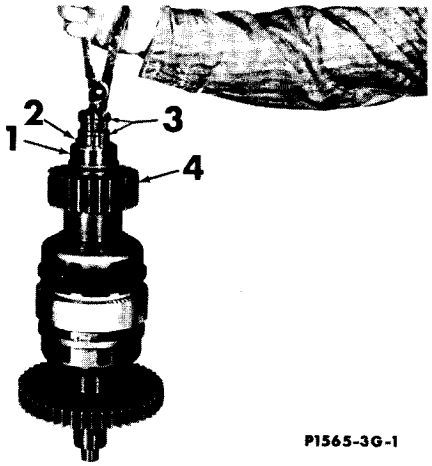


Figure 3G-1

Turn the clutch pack assembly on end with the smaller gear (4) facing up. Remove snap ring (2) from the top of the bearing race (1).

NOTE

Leave the two seal rings (3) in their proper location, protecting the ring grooves in the shaft from damage while disassembling and reassembling the clutch pack. Replace with new seal rings when reassembling.

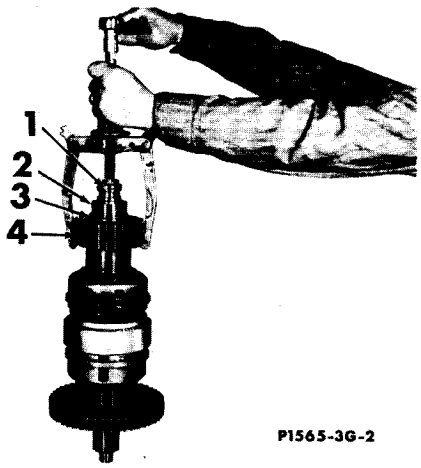


Figure 3G-2

With a suitable puller remove the bearing race (2), thrust washer, thrust bearing, and another thrust washer (3), and gear and hub assembly (4) from the shaft (1).

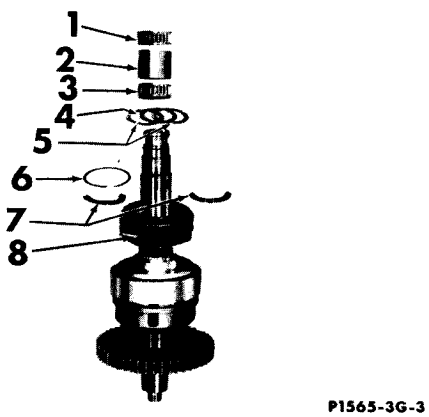


Figure 3G-3

Remove roller bearing (1), long spacer (2), and roller bearing (3). Remove thrust washer (5) thrust bearing (4), thrust washer (5), and spacer. Remove the snap ring (6). Push down on hub assembly to remove the two half retainers (7). Remove clutch hub final assembly (8) as a unit. Refer to Figure 3G-13 for disassembly procedure of the Hub Assembly.

DISASSEMBLY of Clutch Packs

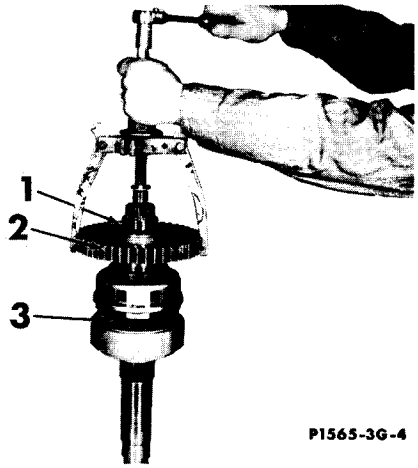


Figure 3G-4

Turn the clutch pack over so the large gear is facing up. With a suitable puller, remove the large gear assembly (2) from the shaft. As you remove the gear assembly (2) the bearing race (1) will also be forced off. Remove the clutch plates (3).

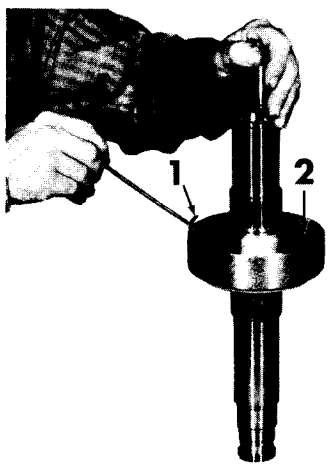


Figure 3G-5

Using a soft hammer, tap force piston (2) down making snap ring (1) accessible. Remove the snap ring.

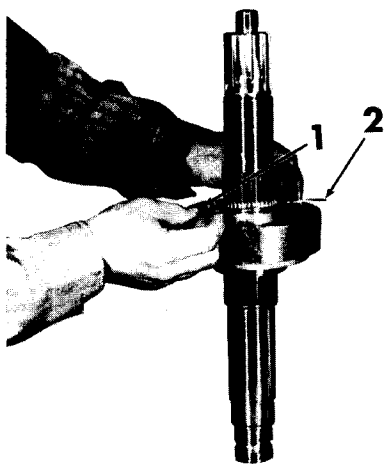
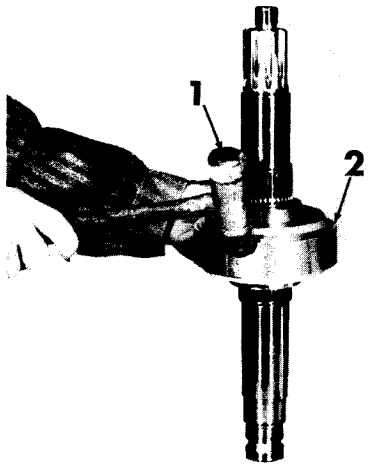


Figure 3G-6

Insert wire (2) as a * special tool to fill up the snap ring groove so the seal ring in the force piston does not drop in the snap ring groove (1).

* Special tool: Snap ring groove wire. This tool can be easily obtained. Measure a piece of 15 ga. .072 x 18-7/16 length of stock wire.



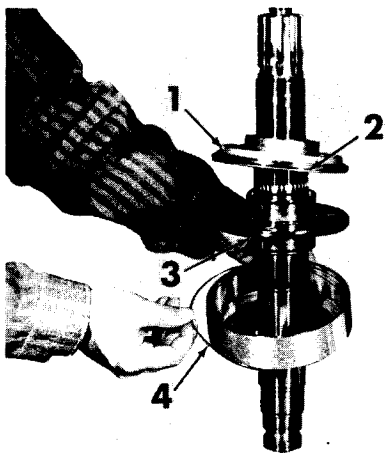
P1565-3G-7

Figure 3G-7

Use a soft hammer (1), tap around outer edge of cylinder force piston (2).

CAUTION

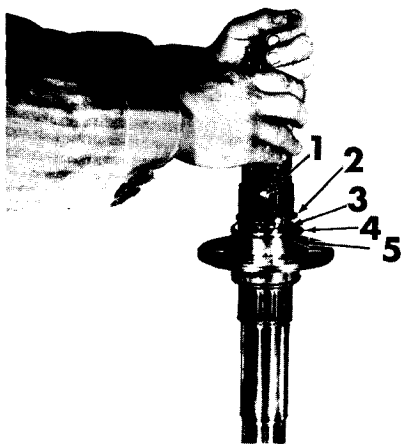
Do not allow cylinder force piston (2) to fall on bench. Handle with care.



P1565-3G-8

Figure 3G-8

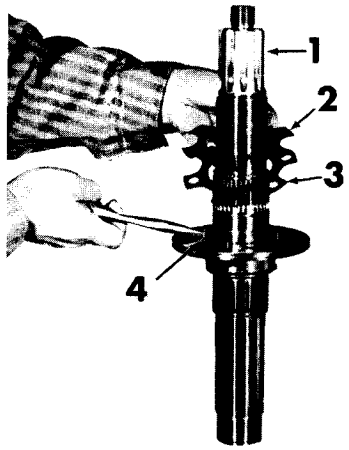
Remove force piston (1), rectangular seal ring (2), seal ring (3) wire (tool) (4) and the force piston.



P1565-3G-9

Figure 3G-9

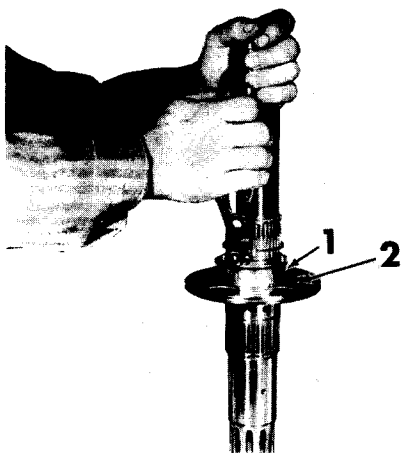
Remove the hook type seal ring (2) from the groove (3). Push the accelerator piston (5) down to remove the tru-arc snap ring with the aid of a snap ring pliers (1). Remove seal ring (4) from the accelerator piston. Remove accelerator piston (5).



P1565-3G-10

Figure 3G-10

Remove disc valve (2), reinforcing disc (3), the three pins (4) from shaft (1).



P1565-3G-11

Figure 3G-11

Turn shaft over and remove accelerator piston (1) and discs (2) by repeating steps Figure 3G-9 and Figure 3G-10.

CLUTCH STACKING PROCEDURE

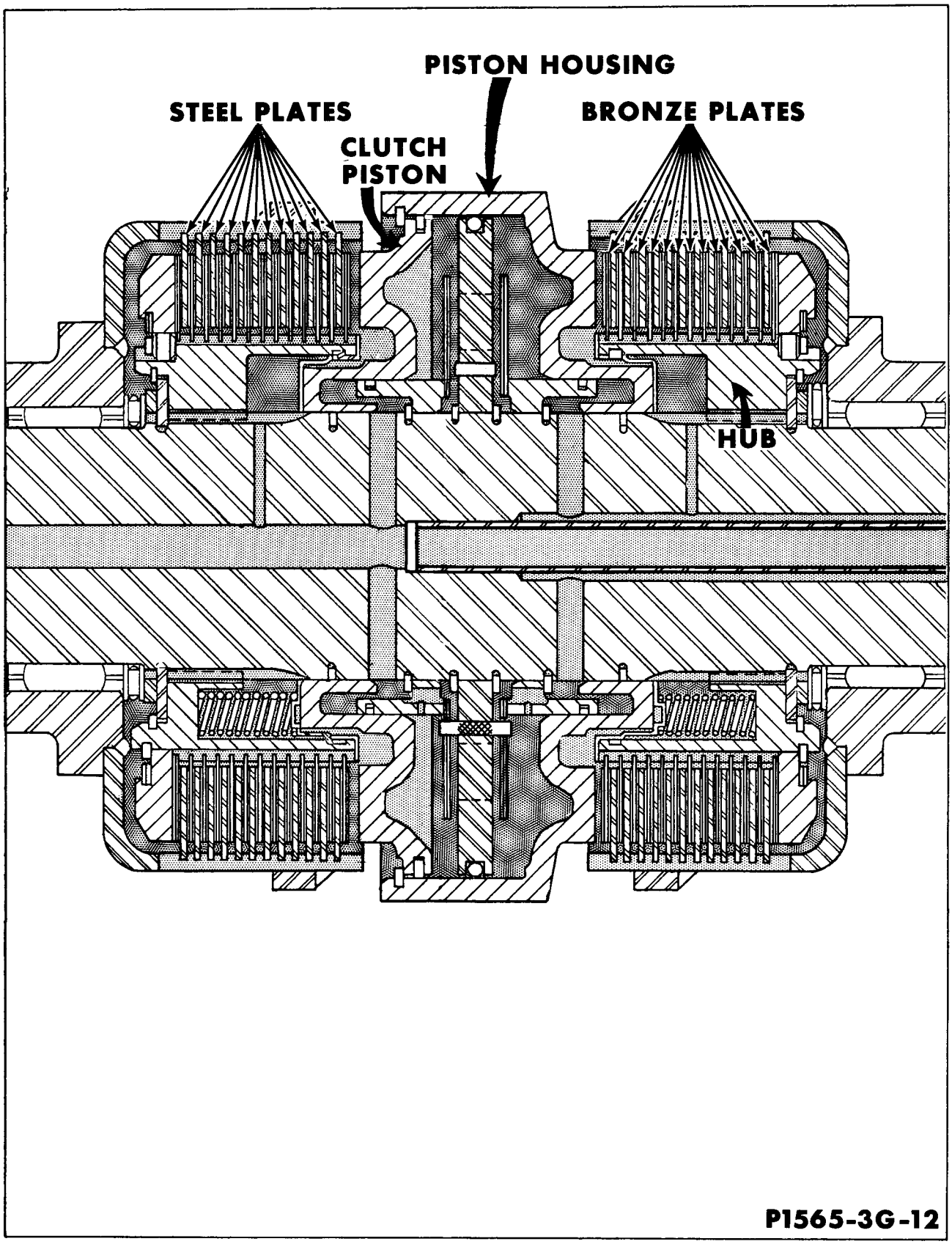


Figure 3G-12 Clutch Stacking Procedure

CLUTCH STACKING PROCEDURE

Opposite is the clutch plate stacking procedure for directional and range clutches in the P-1500 series transmissions. Starting with the hub end that assembles next to the piston assemble clutch plates as follows:

There are a total of 13 bronze and 12 steel plates in each final hub assembly. In assembling, starting at the piston end of the clutch hub, assemble one BRONZE, one STEEL, etc. the last plate will be one BRONZE plate.

NOTE

The bronze plates should be oiled prior to reassembly. Plates that are dry or only lightly oiled are subject to overheating the first time the clutch is applied.

Because the bronze clutch plate facings are porous and absorb oil, a light oiling with an oil can may not be sufficient. Bronze clutch plates should be pre-soaked for at least two minutes in a container of clean transmission oil before assembly into a clutch pack.

Different type oils are frequently incompatible. It is important that the oil used for pre-soaking is the same as the oil used in the transmission.

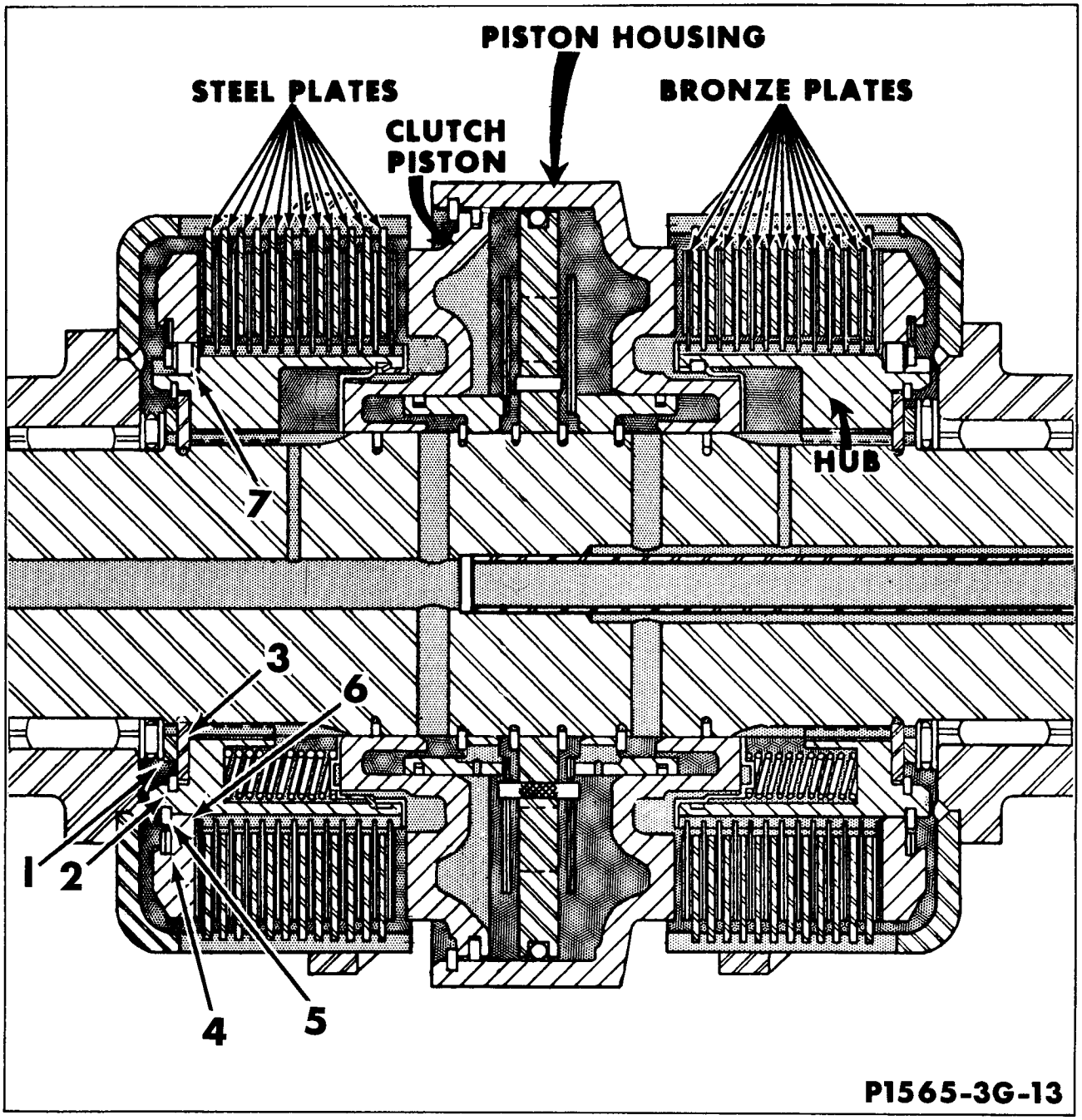


Figure 3G-13 Hub Assembly

1. Spacer
2. Internal Snap Ring
3. Retainer
4. Spir-o-lox Snap Ring
5. External Snap Ring
6. Backing Plate
7. Dowel

DISASSEMBLY & REASSEMBLY OF HUB ASSEMBLY

Refer to Section III-G, Figures 3G-1 thru Figures 3G-3, page III-30G, for disassembly to this point.

To remove clutch hub assembly, remove spacer (1) and internal snap ring (2). Stand clutch pack assembly on end, push down on hub assembly to remove the two retainers (3). Remove hub assembly from the shaft.

To remove clutch plates, remove Spir-o-lox snap ring (4), external snap ring (5), backing plate (6) and clutch plates.

CAUTION

Note location of dowel pin (7), used to prevent backing plate from turning.

To reassemble clutch hub assembly, reverse above procedure.

PREPARATIONS FOR REASSEMBLY OF CLUTCH PACKS

In preparation for reassembly of the clutch packs, the following should be done:

A. Clean all parts thoroughly in solvent. Use compressed air to dry parts. Carefully inspect all parts for excessive wear, cracks and breakage.

B. Inspect splines on all shafts and drive gears for excessive wear.

C. Inspect all sealing surfaces for wear and/or grooving.

D. Inspect bearing inner races and bushings for pits and spalled areas. Replace bearings and bushings which are pitted or spalled.

E. Inspect the sintered bronze and steel discs for wear or signs of being burnt and/or warped. Replace discs if any of these conditions exist.

F. Replace all seals, hook type seal rings, "O" rings and snap rings.

G. In assembly, use a heavy non-fibrous grease with a low melting point.

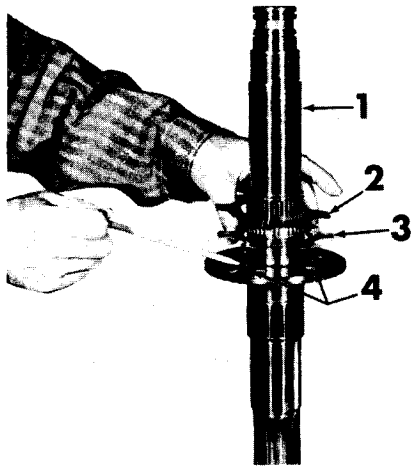


Figure 3G-14

Place clutch shaft (1) in a vertical position with the oil supply holes on top. Align the reinforcing disc (3) and disc valve (2) onto the three dowels (4). These three dowels are part of the separator plate assembly and need not be reassembled.

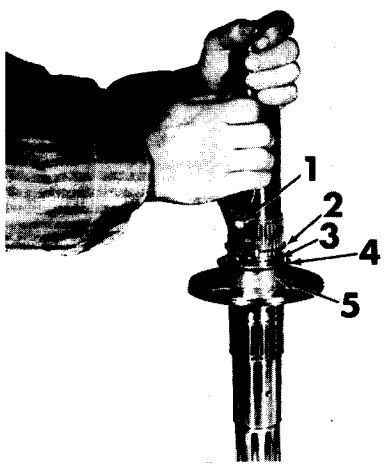


Figure 3G-15

Install accelerator piston (5), tru-arc snap ring with a snap ring pliers (1), seal ring (2) in seal ring groove (3) and seal ring (4) on the accelerator piston.

CAUTION

Care must be taken not to damage the hook rings on shaft (2) and on accelerator piston (4). The accelerator piston must be able to move up and down freely.

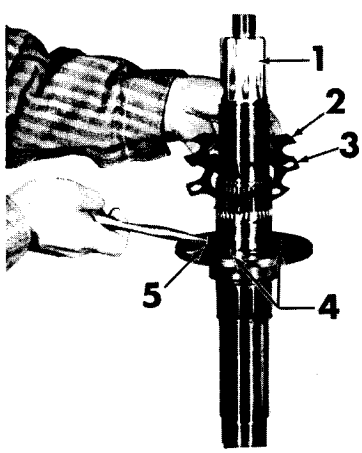
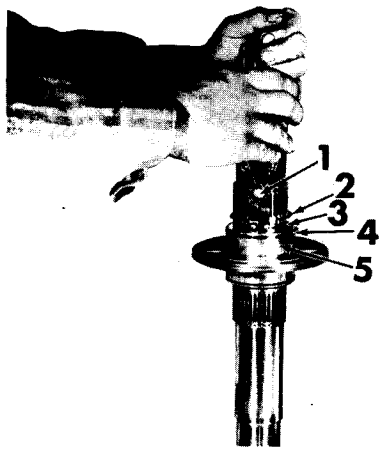


Figure 3G-16

Turn shaft over with oil supply holes facing down. Install the three pins (5). Install reinforcing disc (3) and disc valve (2) on dowel pins (4).



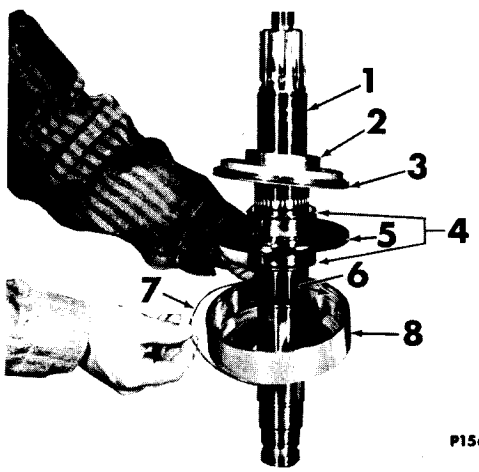
P1565-3G-17

Figure 3G-17

Install accelerator piston (5), tru-arc snap ring with a snap ring pliers (1), seal ring (2) in seal ring groove (3) and seal ring (4) on the accelerator piston.

CAUTION

Care must be taken not to damage the hook rings (2 and 4) on shaft and on accelerator piston (5). The accelerator piston must be able to move up and down freely.



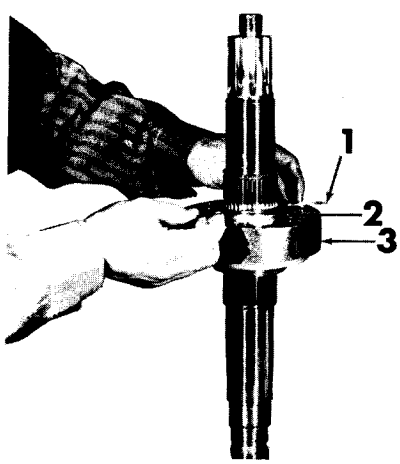
P1565-3G-18

Figure 3G-18

Install "O" ring seal (5) on separator plate and shaft assembly (1). Install rectangular seal ring (3) in force piston (2). Coat both seals with a petroleum jelly. Install wire (7) as a special tool in snap ring groove (6) of the force piston (8) to prevent rectangular seal ring (3) from falling into the snap ring groove (6). Coat both seal rings (4) with a petroleum jelly to prevent breakage of rings while installing force pistons.

NOTE

You will notice that the "O" ring seal is larger in diameter than the separator plate. The seal ring is so designed that the inside diameter of cylinder force piston compresses the seal ring circumferentially for the proper fit.



P1565-3G-19

Figure 3G-19

Lift the force piston half (3) over the "O" ring in the separator plate. Push the force piston (2) down into the lower force piston half (3) so the wire (tool) (1) can be removed.

NOTE

Special Care must be taken not to cut and damage the seal rings when assembling. If any indications show that a seal ring has been damaged, replace the seal ring.

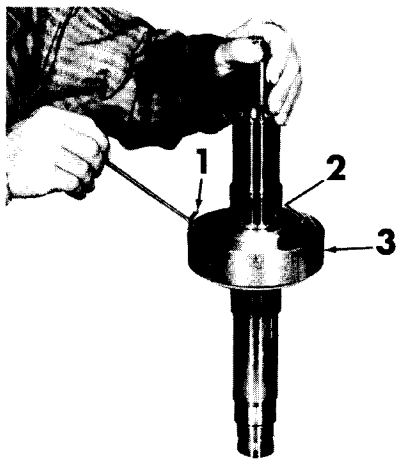


Figure 3G-20

Install snap ring (1) into groove (2) of the force piston (3).

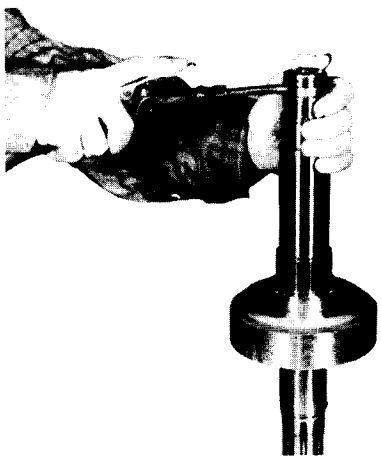


Figure 3G-21

By applying air pressure in the oil port hole, an air check of the clutch pack can be made. The force piston should move freely. Check for air leaks indicating damaged oil seal rings.

CAUTION

Do not exceed 100 PSI air pressure.

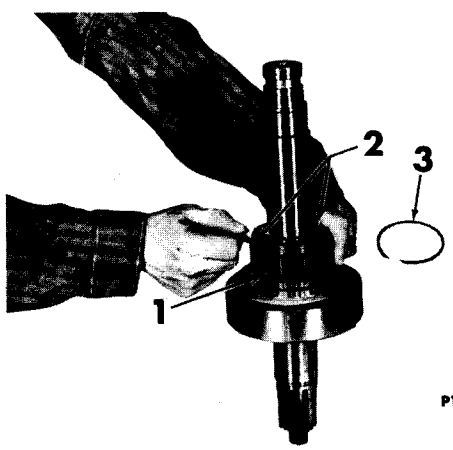


Figure 3G-22

Install hub (1). Push down on hub to install the two retainers (2). Install internal snap ring (3) in groove.

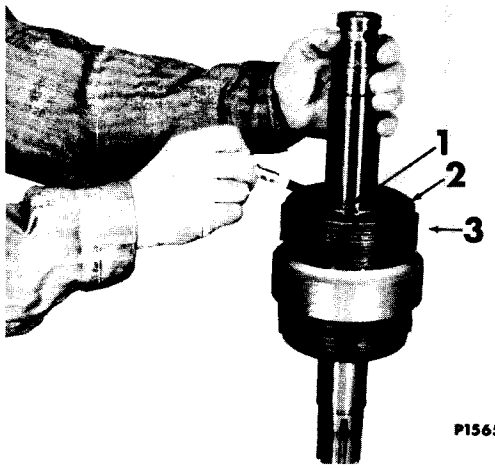


Figure 3G-23

Install the correct number of steel and bronze plates (3). Refer to Clutch Stacking procedure, Figure 3G-12, page III-34G. Install backing plate (2) and dowel pin (1).

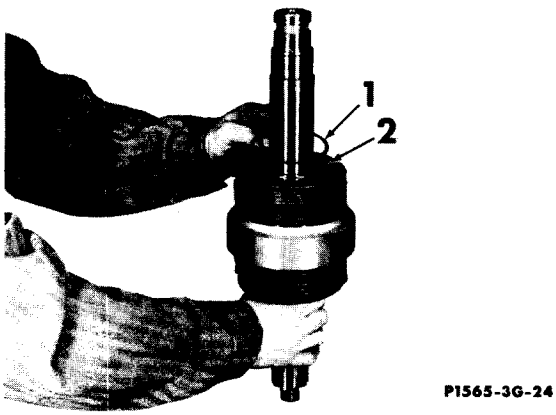


Figure 3G-24

Install external snap ring (1) on hub (2).

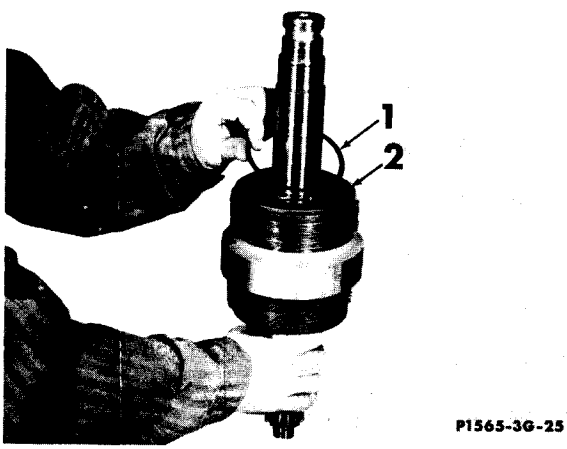


Figure 3G-25

Install Spir-o-lox retaining ring (1) in backing plate (2) to lock external snap ring.

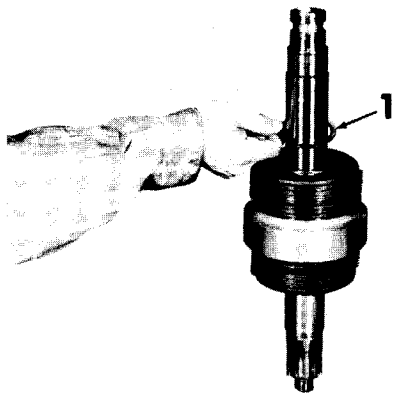


Figure 3G-26

Install a spacer (1) next to each backing plate retainer.

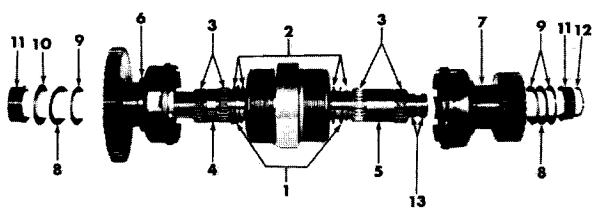


Figure 3G-27

Assemble each end of the clutch pack as illustrated. A thrust race (2), bearing (1), thrust race (2), a bearing (3) and a long or short spacer (4 or 5) on the proper ends. Assemble the remaining bearing (3), a gear and hub assembly (6 or 7), a thrust race (9) a bearing (8) and the remaining thrust race (10 or 9). Heat bearing races (11) to 275°F. in oil or an oven. It will assemble on shaft without pressure. A snap ring (12) is installed on the oil supply hole end of shaft.

With the clutch fully assembled, replace the two oil seal rings (13) and install new oil rings.

P-1500 SERIES TRANSMISSION COVER ASSEMBLY

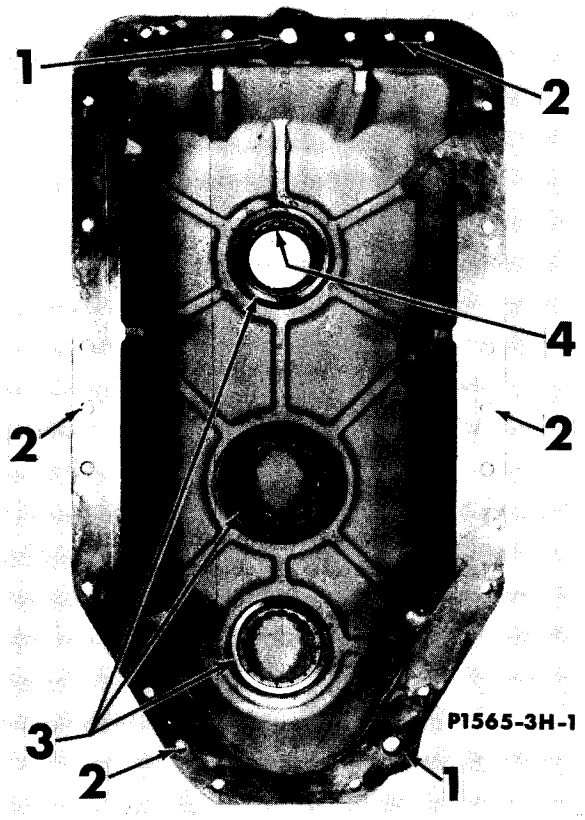


Figure 3H-1 Transmission Cover

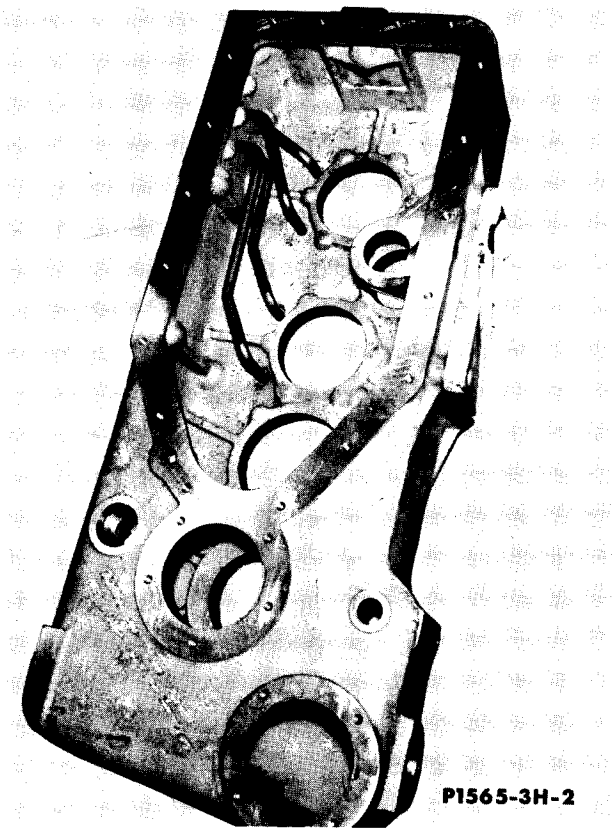


Figure 3H-2 Transmission Main Housing

TRANSMISSION COVER

Remove transmission cover as follows:

Remove attaching capscrews and insert four of the capscrews in the jackscrew holes (2) provided, to force cover off dowels (1).

If bearings (3) are to be removed, use a suitable puller, and pull on outer race only. Bearings are a light drive fit. To install bearings, use a soft drift, bearing driver, or mallet to drive bearing into bore.

Remove input shaft seal (4), using a suitable tool to drive seal out of cover. Install new seal by placing cover in press, coat O. D. of seal with Mar-Seal or comparable sealant. Place a plate with a larger diameter over the seal and press seal into cover with lip facing down or towards bearing.

TRANSMISSION MAIN HOUSING

Clean transmission housing and oil supply tubes with solvent and dry with compressed air. The oil supply tubes are not replaceable. Care must be taken not to damage these tubes.

PREPARATIONS FOR REASSEMBLY

OF

P-1500 SERIES TRANSMISSION

In preparation for reassembly of the P-1500 Series transmission, the following should be done:

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

B. Inspect all bearings for pits and spalled areas. Replace bearings which are pitted and/or spalled.

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

D. Inspect all sealing surfaces for wear and/or grooving.

E. Inspect housings for dirt particles, and flush all passageways thoroughly.

F. Inspect splines on all shafts and drive gears for wear.

G. In assembly, use a heavy non-fibrous grease with a low melting point.

REASSEMBLY of P-1500 Series Transmission

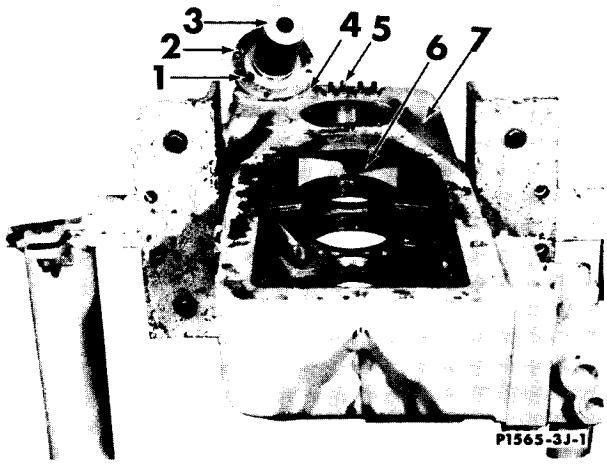


Figure 3J-1

Clean the inside of the transmission housing (7) with a suitable cleaning solvent. Blow dry. Install oil baffle (6) by inserting three capscrews thru the bottom of the transmission housing. Install a new oil strainer (3) to the oil strainer cap (2). Install clean drain plug (1). Install new oil strainer gasket (4) on the transmission case. Install oil strainer cap assembly by inserting four capscrews (5) to the strainer cap.

NOTE

All capscrews should be accompanied by a lock washer unless otherwise stated. Torque all 3/8 NC capscrews to 32 ft. lbs.

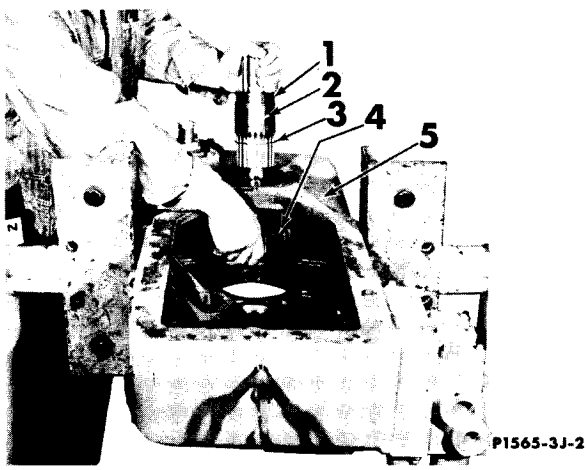


Figure 3J-2

Insert the output gear (4) into the transmission case (5), positioning the output gear (4) between the oil baffle and the bottom of the transmission case. Install the gear with the long neck facing down. Install lock ring (3) and bearing race (1) on to the output shaft (2). Insert the output shaft assembly (2) into the output gear and drive on.

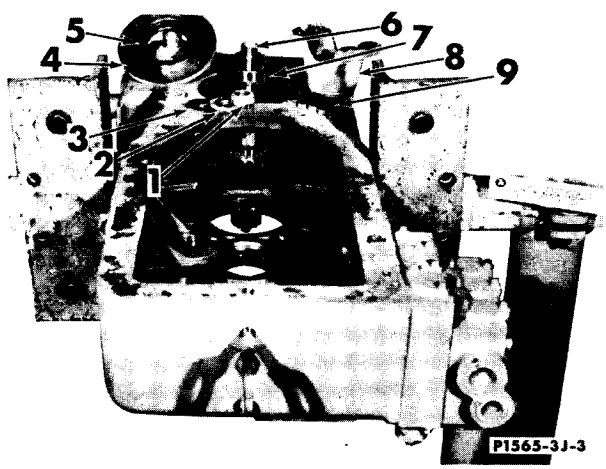


Figure 3J-3

Install output shaft bearing (7) onto the output shaft (6) and drive down flush with the transmission case. Install a new oil seal (5) in the output shaft cap (4). Install output shaft cap assembly (4) onto the transmission case by inserting five capscrews (9).

Install the bottom bearing on the output shaft from the bottom of the transmission case. Drive the bearing flush with the transmission case.

Install output flange (8) onto the output shaft. Install gasket (3), steel washer (2), and flange nut (1) on the output shaft. Torque nut to 100 ft. lbs.

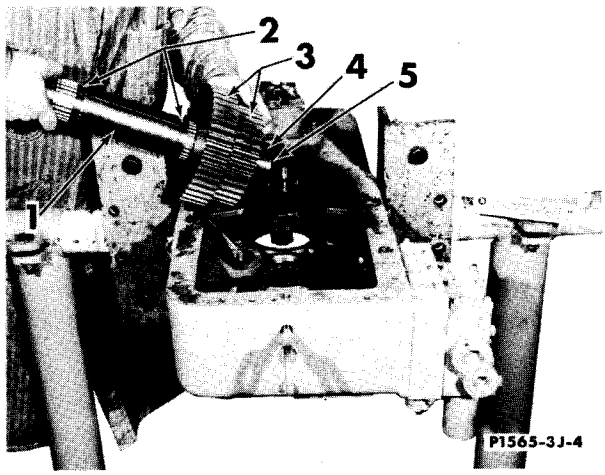


Figure 3J-4

Refer to Section III-E, page III-15E, for disassembly and reassembly of the gathering shaft.

Install the two inner snap rings (2) on the gathering shaft (1). Install the two large gears (3) on the end of the gathering shaft with the longest splines. Install the bearing race (4), driving it tight against the two large gears, and snap ring (5) on the gathering shaft.

Do not install the shaft bearing in the transmission case until the shaft assembly is installed.

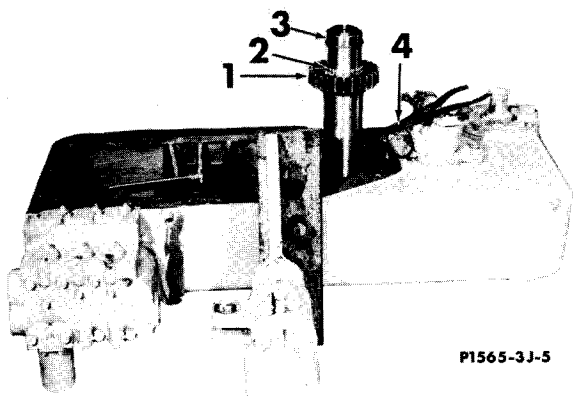


Figure 3J-5

Install the top small gear (1) with the long neck facing down on the gathering shaft. Install top snap ring (2). Install top bearing race (3) and drive down into position for the installation of the top snap ring (4).

Install the shaft bearing into the transmission case from the bottom. Drive the shaft bearing tight, even with the transmission case.

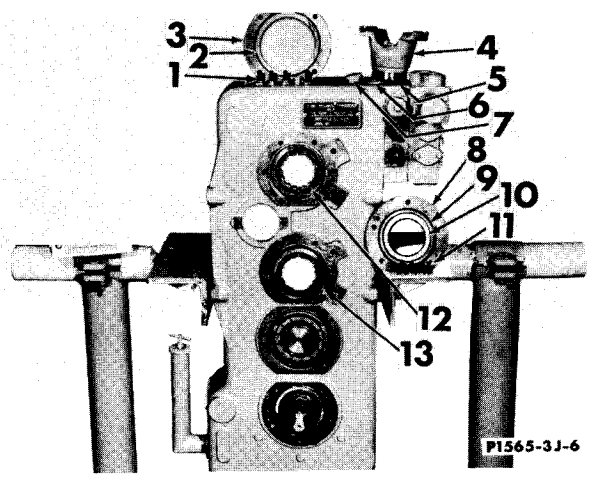


Figure 3J-6

Install the output shaft cap (8) with a new oil seal (10) and "O" ring (9) installed. Insert five capscrews (11) to the cap. Install output shaft flange (4). Install gasket (5), steel washer (6), and nut (7) to the output shaft. Torque nut to 100 ft. lbs.

Install gathering shaft cap (3) with a new "O" ring (2) installed. Insert four capscrews (1) to the gathering shaft cap (3).

Insert the directional range clutch bearing (12) and the range clutch bearing (13) in the transmission case. When inserting the range clutch bearing (13), insert the bearing half way, allowing installation of the range clutch pack.

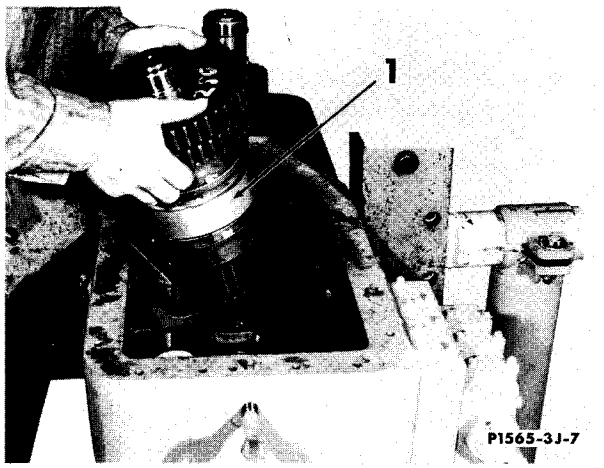


Figure 3J-7

Install the Range Clutch Pack (1) into the transmission case. With the clutch properly installed, drive the clutch bearing flush with the transmission case.

Refer to Section III-G, page III-27G, for disassembly and reassembly of the Range Clutch Pack.

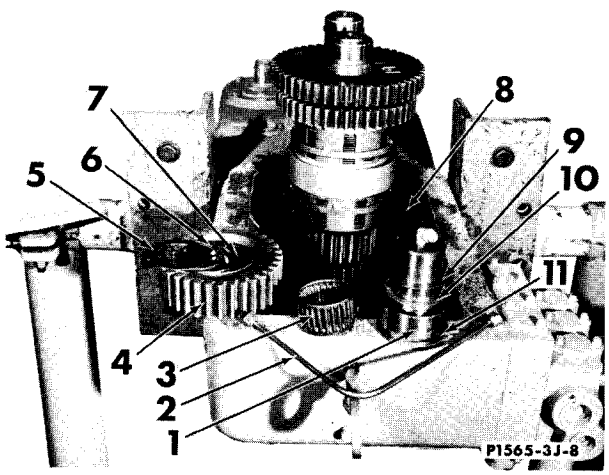


Figure 3J-8

Install the reverse idler gear (4) into the transmission case (8). Install the thrust washer (7), thrust bearing (6) and thrust washer (5) between the gear and the idler boss.

Install a new "O" ring (11) on the idler shaft (1). Position the needle bearing (3), thrust washer (9), and roller bearing (10) on the idler shaft. Install the shaft retainer by inserting two capscrews to the idler shaft. Insert the idler shaft assembly through the bottom of the transmission case, positioning the shaft retainer in line with the capscrew holes in the transmission case. Tighten the remaining two capscrews on the idler shaft retainer. Install the oil line (2) to the idler shaft and transmission case.

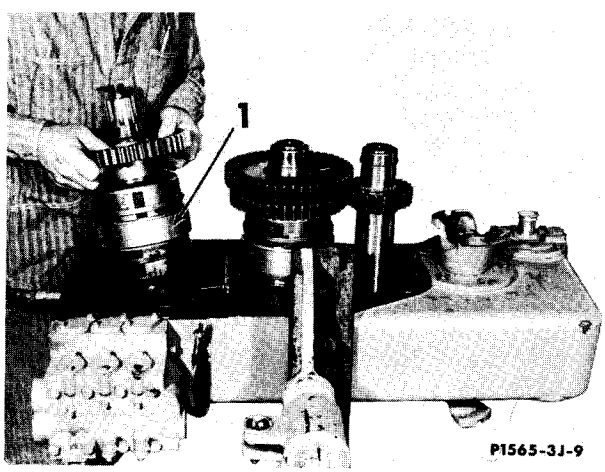


Figure 3J-9

Install directional clutch pack (1) being careful not to damage the oil supply tube.

For disassembly and reassembly of the Directional clutch refer to Section III-G, page III-27G.

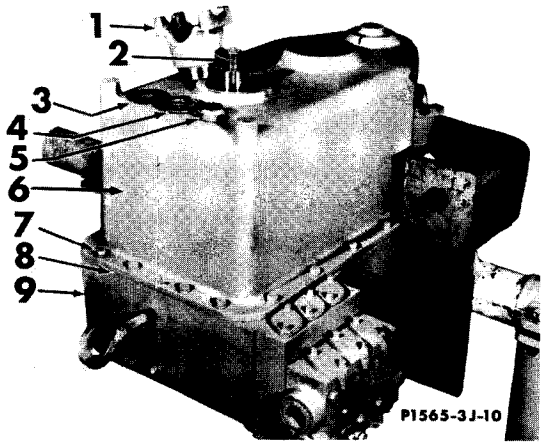


Figure 3J-10

Install a new cover gasket (8) on the transmission case (9). Install the transmission cover (6) by inserting nineteen capscrews (7). Install the input flange (1), gasket (3), steel washer (4) and nut (5) on the input shaft (2). Torque nut to 100 ft. lbs.

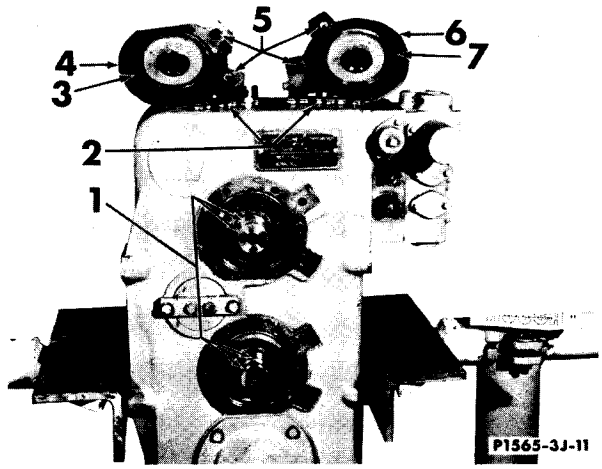


Figure 3J-11

Turn the transmission case over and install the two clutch pack caps (4) & (6). Both caps are interchangeable. Install four new small "O" rings (5) and two new large "O" rings (3) & (7) on the two caps. Before installing the caps on the transmission case, check the oil rings (1) on the clutch pack shafts. Check and see if the rings are hooked properly and in good condition. Install the clutch pack caps (4) and (6) by inserting the five capscrews (2) to each clutch pack cap.