Allied
WINCH

SERVICE MANUAL

FOR
POWER CONTROLLED
TRACTOR WINCH

W3C

OIL BRAKE

SCH

2300189W

A PRODUCT OF

Allied Systems COMPANY

SHERWOOD, OREGON USA

SAFETY PRECAUTIONS

Observe the following PRECAUTIONS to prevent injury to personnel and damage to equipment.

- Do not operate winch unless tractor is equipped with a rear screen for operator protection against cable breakage.
- Authorized operators only!
- Report damage or erratic operation of winch or pressure gauge immediately.
- Do not stand while operating the tractor or the winch.
- Make sure that instruments and controls are operative before working the unit.
- Do not use control levers or handles as machine mounting assists.
- Do not use control levers or handles as hangers for clothes, water bags, grease guns, lunch pails, etc.
- Do not permit personnel in the control area when working or making checks on the machine.
- Do not allow riders on the machine or load.
- Use extreme care when operating close to other machines.
- Avoid operating near anyone working or standing.
- Do not stand or permit others to stand in the bight (loop) of the cable.
- Do not stand or permit others to stand near the winch or cable when it is under tension.
- Do not work a damaged cable (broken wire or strands, or a decrease in the diameter of a cable, are warning signs).
- Do not leave the tractor while the winch line is under tension.
- Avoid pulling the hook over the drum and through the throat of the winch.
- Do not anchor a double or two-part line to the winch.
- When not operating the winch, always leave it in neutral with the brake on.
- Never attempt to clean, oil or adjust a machine while it is in motion.
- Use extreme care when removing cable and ferrule from the drum. When the ferrule is released, the cable may spring out with force.

Winch Serial Number _____

Date put into service _____

⚠ WARNING

FAILURE TO FOLLOW THESE INSTRUCTIONS CAN CAUSE SERIOUS INJURY OR DEATH.

AUTHORIZED, TRAINED OPERATOR ONLY.

KNOW THE EQUIPMENT: Know the operating, inspection, and maintenance instructions in the Operating Manual. Do not operate the winch unless the vehicle is equipped with a screen to protect the operator if the cable breaks.

INSPECT THE WINCH BEFORE USE: Make sure that the controls and instruments operate correctly. Report the need for repairs immediately. Do not work with a damaged or worn cable. Do not use a winch that needs repairs. If the ferrule and cable must be removed from the drum, make sure the end of the cable and ferrule are controlled when the cable is released. The end of the cable can suddenly move from the drum like a compressed spring when the ferrule is released, causing an injury.

PROTECT YOURSELF: Do not use the control levers for hand holds when entering or leaving the vehicle. Do not permit other people near the control area when you inspect or repair a machine. Never inspect, repair, or do maintenance on a machine that is in motion. Stay in the operator's seat. Do not stand on the vehicle when operating the winch.

KEEP A CLEAR WORK AREA: Avoid winch operation near people or other machines. Never stand or permit others to stand in the bight (loop) of a cable. Do not stand nor permit others to be near the winch or cable when there is tension on the cable. Observe jobsite rules. Be in complete control at all times.

USE COMMON SENSE: Do not use the control levers as hangers for clothes, water bags, grease guns, lunch pails, etc. Do not leave the vehicle when the winch cable is under tension. Do not permit riders on the vehicle or load. Do not use the winch as an anchor for a double or two-part line. Do not pull the hook through the throat or over the drum and cause damage. When the winch is not in use, make sure the control lever is in BRAKE ON position so that the winch brake is applied.

⚠ **WARNING**

Indicates a condition that can cause personal injury!

⚠ **CAUTION**

Indicates a condition that can cause property damage!

Notes

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(continued)

List of Illustrations

GENERAL

INTRODUCTION

This Service Manual is for the W3C Tractor Winch. The following information is included in this manual:

- **Section 1, GENERAL**, includes operational descriptions of systems and components as an aid in troubleshooting and repair.
- **Section 2, TROUBLESHOOTING**, lists common problems and the possible causes and corrections.
- **Section 3, SERVICE**, provides a guide for periodic maintenance, checks and adjustments.
- **Section 4, REPAIRS**, describes the removal, disassembly, assembly, and installation of the winch.
- **Section 5, WINCH INTERNAL OPTIONS**, Provides service information on the Power Forward/Reverse and Freespool Lock.

DESCRIPTION

The W3C winch has LINE IN, BRAKE OFF and FREESPOOL functions and is used on tractors with a uni-directional power take-off (PTO). The BRAKE OFF and FREESPOOL functions permit the cable to be pulled from the drum.

The **SCH** (Self Contained Hydraulics) indicates that the hydraulic system for winch operation is inside the winch case. A hydraulic pump is connected by a gear drive to the clutch housing on the input shaft. The design of the winch permits various configurations of PTO inputs to fit the different tractors that use this winch.

The W3C winch has a maximum line pull capacity of 183,250 N (41,200 lb.), rated at 133,447 N (30,000 lb.) when there is one layer or less of cable on the drum. When there is more than one layer of cable on the drum, the maximum line pull capacity is reduced.

1. Frame
2. Cover, Front
3. Cover, LH
4. Cover, Brake
5. Cover, RH
6. Freespool Drag Adjustment
7. Drum
8. Oil Filler / Breather
9. Oil Strainer Cover
10. Oil Drain Plug
11. Oil Level Check Plug
12. Handling Gear

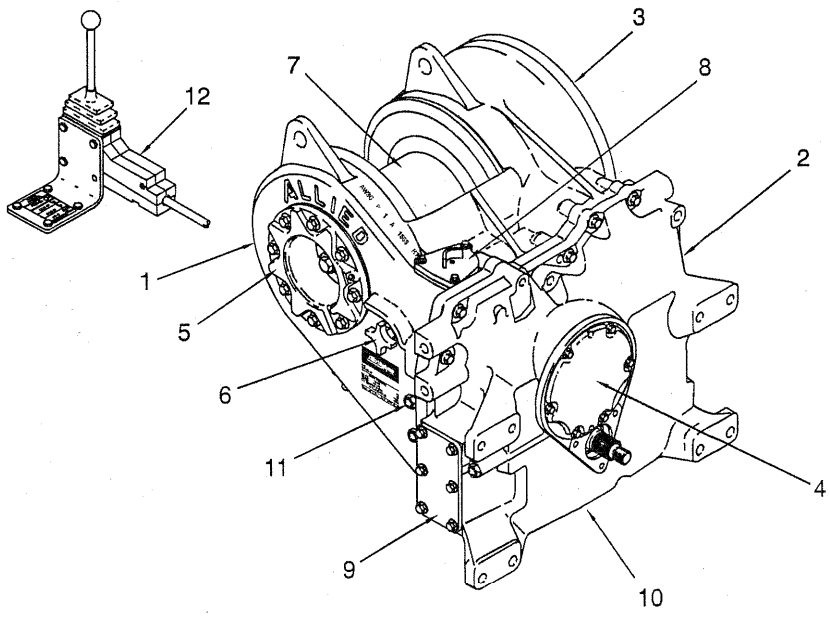


Fig. 1-1 W3C Tractor Winch

Unit Identification & Serial Number Code

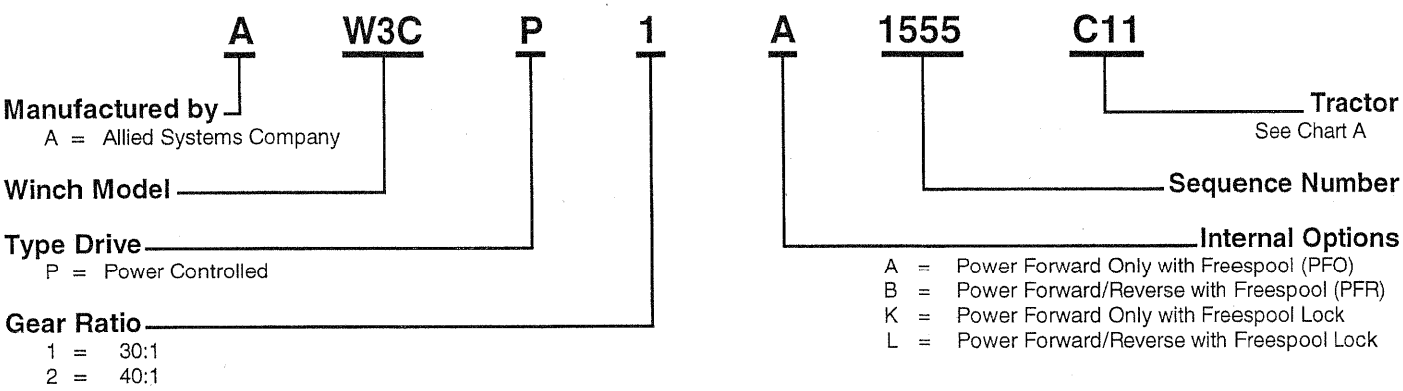


Chart A - Tractor Identification and Gear Ratio

CODE	Tractor Make Model and Starting Tractor Serial Number Where Applicable					
	A Fiat Allis	C Caterpillar	E John Deere	H Dresser	K Komatsu	R J I Case
11	FD & FL5 FD & FL7 (2)	D3B/C D4B/C D5C (2)			D31 D37 (2)	450 & 850 (2)
12			450G-650G (2)	TD7G/8G (2)		
13				TD7/8/9H (2)		
360		D4H-PS SERIES I & II (2)				
362		D4H-PS SERIES III (2)				

Notes:

1. In addition to the serial number plate, the serial number is stamped on the top of the winch frame near the oil filler/breather.

2. Circled numbers in Chart A indicate available gear ratios.

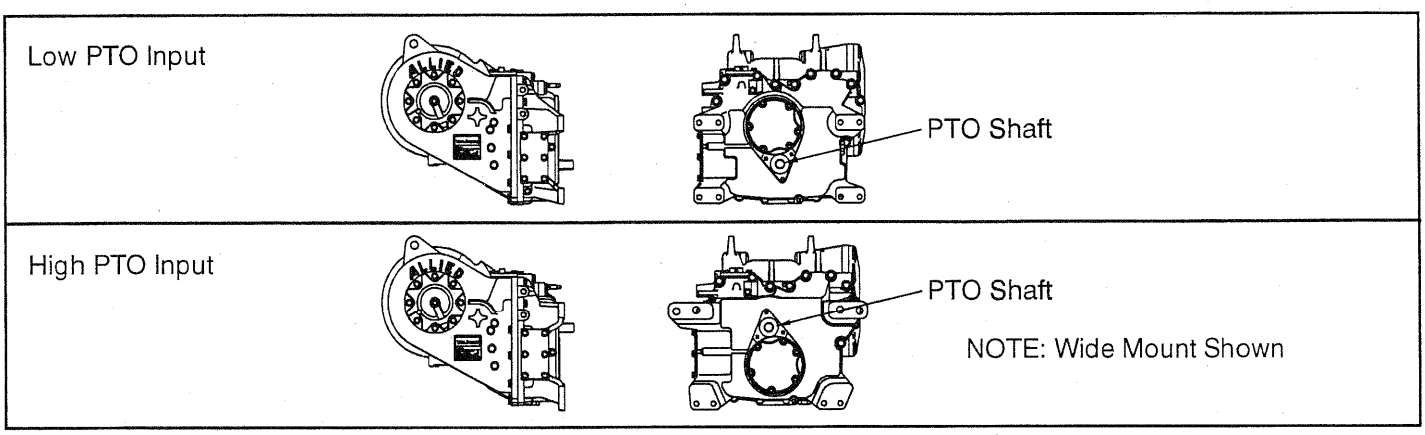


Table 1-1 Unit Identification

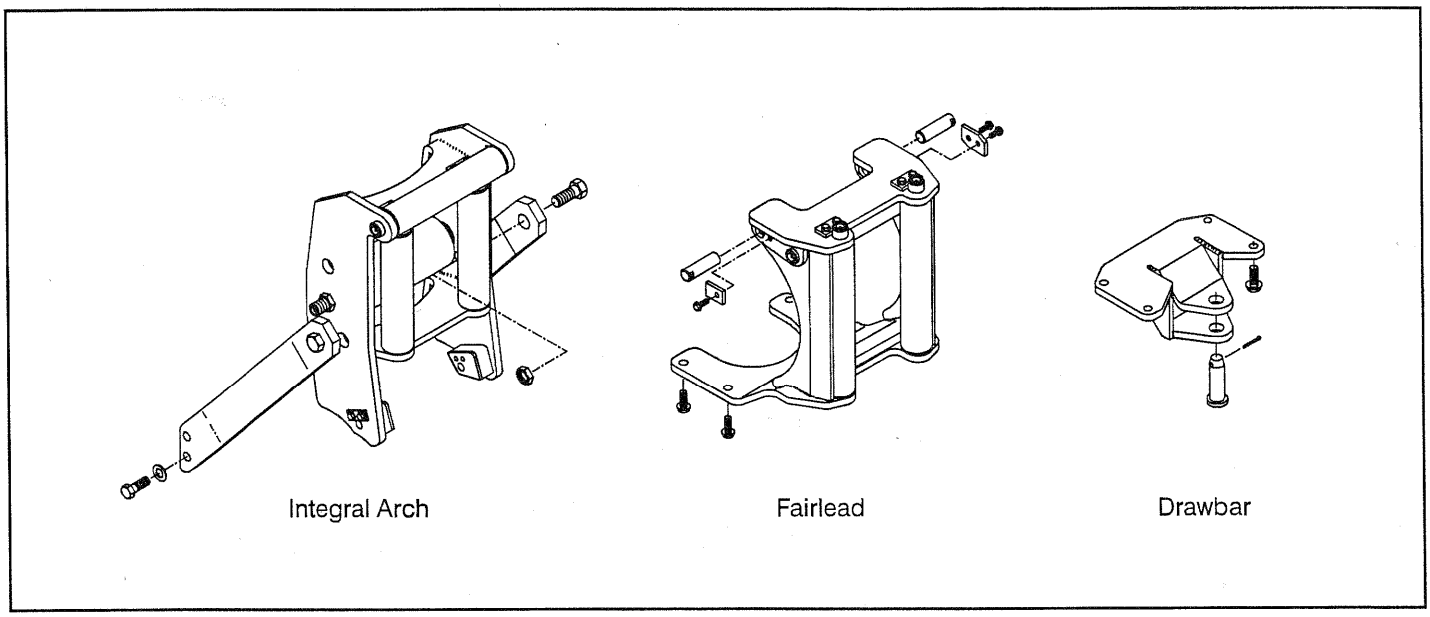


Fig. 1-2 W3C Winch, Optional Equipment

Optional Equipment (See Fig. 1-2)

The W3C winch may be equipped with options.

NOTE: Not all of the optional equipment listed is available for each model tractor.

- Integral Arch
- Fairlead Assembly
- Drawbar
- Power Forward/Reverse (PFR) - see section 5
- Freespool Lock - see section 5

Serial Number Codes

The nameplate with the serial number code is found below the drum shaft on the right side of the winch frame. The serial number code is also stamped on the top of the winch frame near the oil filler/breather. The serial number codes are described on Page 1-2 of this manual.

OPERATION AND CONTROL (See Section 5 for PFR winches)

A single control lever is used for winch control. See fig. 1-3. The control lever is used to select one of the following operations:

- FREESPOOL
- BRAKE OFF
- BRAKE ON
- LINE IN

From the LINE IN position the lever will return to the BRAKE ON position when the control lever is released. A spring arrangement on the spool of the control valve returns the spool and control lever to the BRAKE ON position. A ball and detent will hold the spool and control lever in the BRAKE OFF and FREESPOOL positions. The operator must pull the control lever from the BRAKE OFF and FREESPOOL positions.

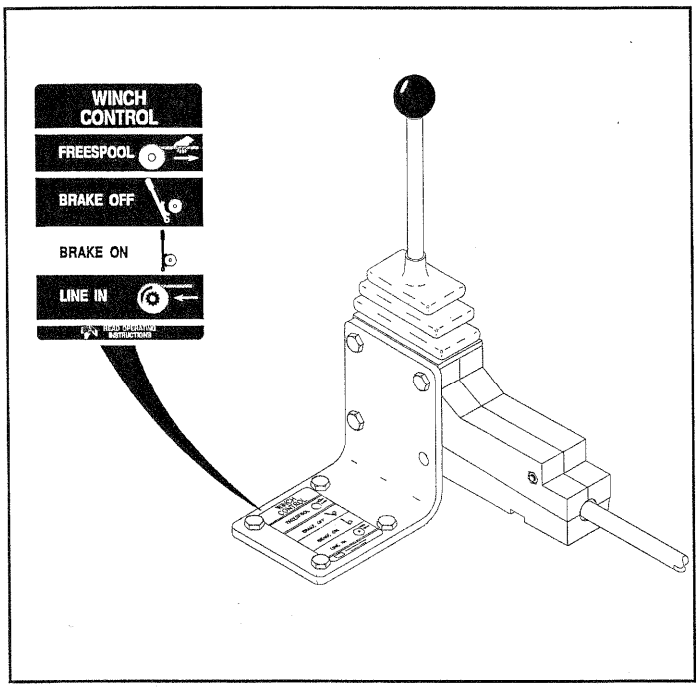


Fig. 1-3 Operator Controls

Power Operation

The BRAKE ON position is the neutral position. The clutch is not applied. The conical washer springs (also called belleville springs) in the brake fully apply the brake. The winch drum will not turn.

The LINE IN position engages the clutch and releases the brake. The winch will wind the cable at a speed controlled by the rpm of the engine or the output rpm of the torque converter of the tractor.

The BRAKE OFF position releases the brake as the control lever is moved toward the detented BRAKE OFF position (no hydraulic pressure is directed to the clutch). The brake friction is decreased as the operator pushes the control lever toward the BRAKE OFF position. The tractor engine must be at low idle for best control. If there is a load on the cable, this position will permit the cable to unwind from the drum against the friction of the clutch, brake, and gear train. The speed that the cable unwinds is not controlled by the operator, but by the movement of the load or the travel speed of the vehicle.

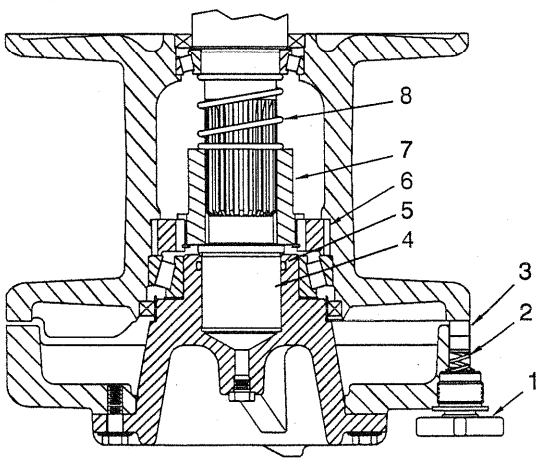
NOTE: Maintain sufficient engine rpm in order to ensure that the pump in the winch sends 11 liters/min (3 gpm) to the control valve for best control of BRAKE OFF. The engine speed of most tractors is approximately 700 to 1000 rpm.

Freespool Operation (See Fig. 1-4)

⚠ WARNING

When the control lever is moved to the FREESPOOL position, it always releases the gear train and any load that may be on the cable. An uncontrolled release of the load may result in personal injury and/or property damage.

When the control lever is moved to the FREESPOOL position, the winch drum is disengaged from the gear train. The FREESPOOL selection permits the cable to be pulled from the winch drum by hand. The amount



1. Knob
2. Adjusting Spring
3. Wear Pad
4. Piston
5. O-Ring
6. Torque Ring
7. Coupler
8. Engaging Spring

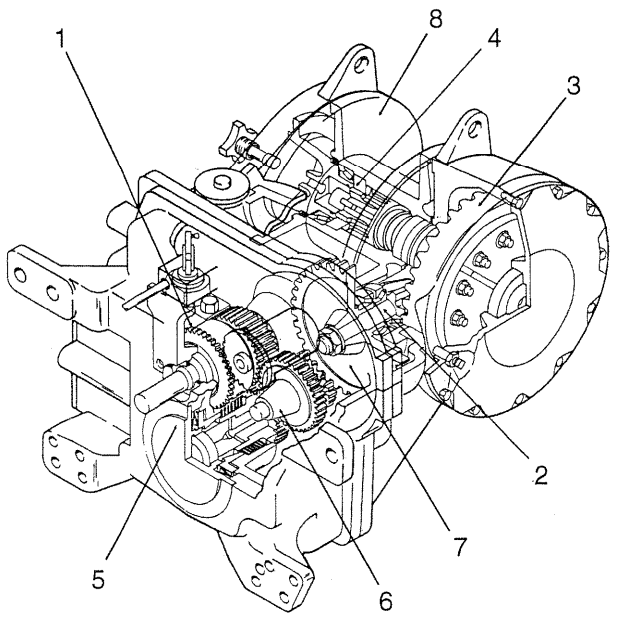
Fig. 1-4 Freespool Assembly

of drag when in FREESPOOL is manually adjustable. See Section 3, Service.

GEAR TRAIN (See Fig. 1-5)

Some tractors have a PTO that must connect at a lower position on the winch case than other tractors. A different front cover with appropriate gearing is used on the front of the winch for these models so that the PTO can be connected to the input shaft. See page 1-2.

The PTO is connected to the input shaft of the winch. The input shaft turns the clutch housing which has a gear attached to drive the hydraulic pump. See Figs. 1-5 and 1-7. When the clutch is engaged and the brake released, power is transmitted through the gears to the drum. As the drum rotates, cable is pulled onto the winch drum.



1. Clutch
2. Pinion
3. Ring Gear
4. Freespool Assembly
5. Oil Brake
6. Intermediate Gear
7. Pinion Drive Gear
8. Drum

Fig. 1-5 Gear Train

NOTE: Those winches that have a low PTO have the clutch and brake directly connected with each other. Winches with a high PTO have an intermediate shaft located between the clutch and brake.

The brake assembly is located on the forward end of the brake shaft. The intermediate gear is driven by the clutch and/or brake gear. The intermediate gear engages a large drive gear that is splined to the pinion gear. The pinion gear engages the ring gear, which is bolted to the drum shaft. Activating the FREESPOOL assembly disengages the drum from the gear as well as the brake and clutch so that cable can be pulled from the drum by hand.

HYDRAULIC CONTROL

The operation of the winch is controlled by a hydraulic circuit. A hydraulic gear pump is connected to the input shaft through a spur gear that is integral to the clutch housing. The bottom of the winch case is the sump for the hydraulic oil. Oil flows through the suction line to the strainer before entering the pump and hydraulic system. See Fig. 1-6. The strainer keeps dirt and other particles out of the hydraulic system. The output of the hydraulic pump flows to the hydraulic control valve. A control lever near the operator's seat is connected to the control valve by a push/pull cable so that the operator can control the valve. The control valve controls the flow and pressure of the hydraulic oil to the clutch, brake, and freespool when the hand lever is moved.

An accumulator is connected to the control valve. The purpose of the accumulator is to quickly send pressurized oil to the clutch and brake and reduce the release time of the brake. The accumulator also permits the release of the winch brake if the tractor engine or the hydraulic pump is not operating. The stored hydraulic pressure in the accumulator is released by a push rod that is moved by the control valve spool. The accumulator discharges oil into the system as the control valve spool is moved from the BRAKE ON (neutral) position. When the hydraulic pump is operating, a pressure of 1,310 kPA (190 psi) can be in the hydraulic system. The accumulator is charged to the hydraulic system

pressure when the hydraulic pump is operating. If the hydraulic pump is operating, the accumulator stays charged. If the hydraulic pump is not operating, discharge from the accumulator permits limited operation of the winch functions. The hydraulic flow of the various functions is depicted in Fig. 1-11 through Fig. 1-14.

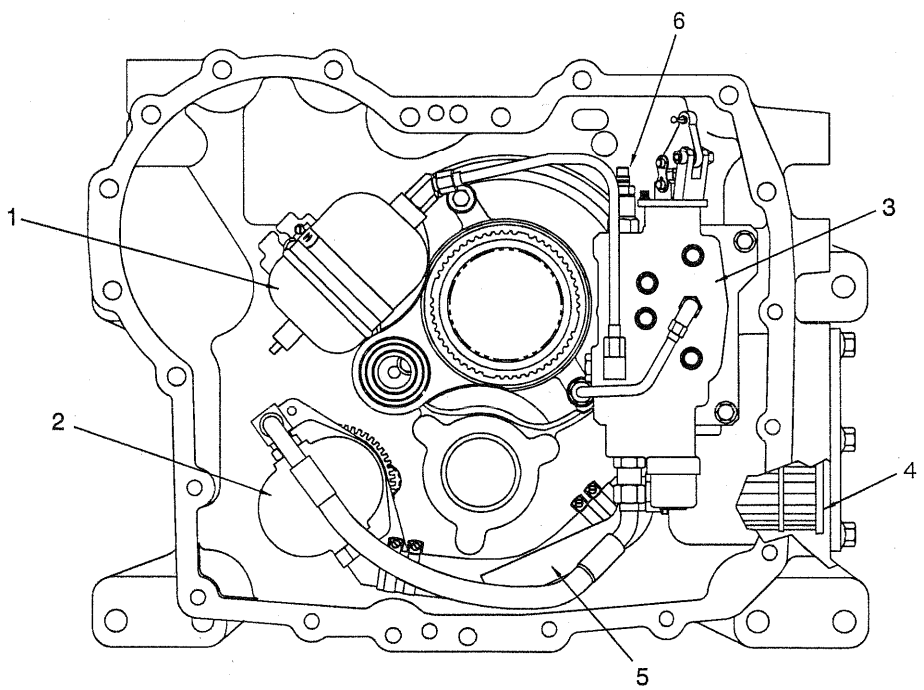
Oil Clutch (See Fig. 1-7)

The clutch assembly has seven friction discs, seven separator plates, a clutch housing, piston assembly, and hub. The friction discs of the clutch are internally splined to the clutch hub. The separator plates have large splines that fit the splines in the housing. The separator plates rotate with the housing. The piston and clutch housing rotate on the input shaft next to the hub. Oil passages in the clutch shaft supply the oil pressure from the control valve to the piston. Hydraulic oil also cools and lubricates the bearings and internal components of the clutch. When the oil pressure pushes the piston against the separator plates and friction discs, the clutch is applied. The torque from the input shaft is transferred through the clutch and causes the winch to operate.

Oil Brake (See Fig. 1-8)

The oil brake is a disc brake that has seven friction discs and seven separator plates. The gear on the brake hub or intermediate gear engages the gear on the clutch hub so that the clutch hub, intermediate gear, and brake hub rotate together. The seven separator plates have teeth that engage the splines inside the brake housing and are held stationary. Teeth in the seven friction discs engage the splines in the hub and rotate with the hub. The brake is applied by spring pressure from two conical washer springs in the brake housing.

The conical washer springs push against a piston and



1. Accumulator
2. Pump
3. Control Valve
4. Strainer
5. Suction Pickup Tube
6. Relief Valve

Fig. 1-6 Hydraulic System

the pressure is applied to the friction discs and the separator plates. When the brake is applied, the drum and gear train cannot rotate.

When the control valve sends hydraulic pressure to apply the clutch, the hydraulic pressure also releases the brake. The hydraulic pressure causes the piston to compress the conical washer springs and release the brake. The brake is released in the LINE IN, FREESPOOL, and BRAKE OFF positions of the control lever. The BRAKE OFF function applies hydraulic pressure to release the brake, but no hydraulic pressure is sent to apply the clutch. Low pressure oil flow gives a continuous flow of hydraulic oil for cooling the brake.

Control Valve (See Fig. 1-9)

The flow of hydraulic oil to and from the clutch, brake, and freespool is controlled by the control valve. The control valve is an open center type hydraulic valve. The valve is open center because the hydraulic oil flows through the valve with minimum restriction when the spool is in the BRAKE ON position. Passages inside the valve body connect the oil flow and pressure with the functions that control the winch. The control valve spool opens and closes passages to apply and release the clutch, brake, and freespool. All of the oil flow that is not used to apply the oil clutch and release the oil brake goes to the cooling circuit.

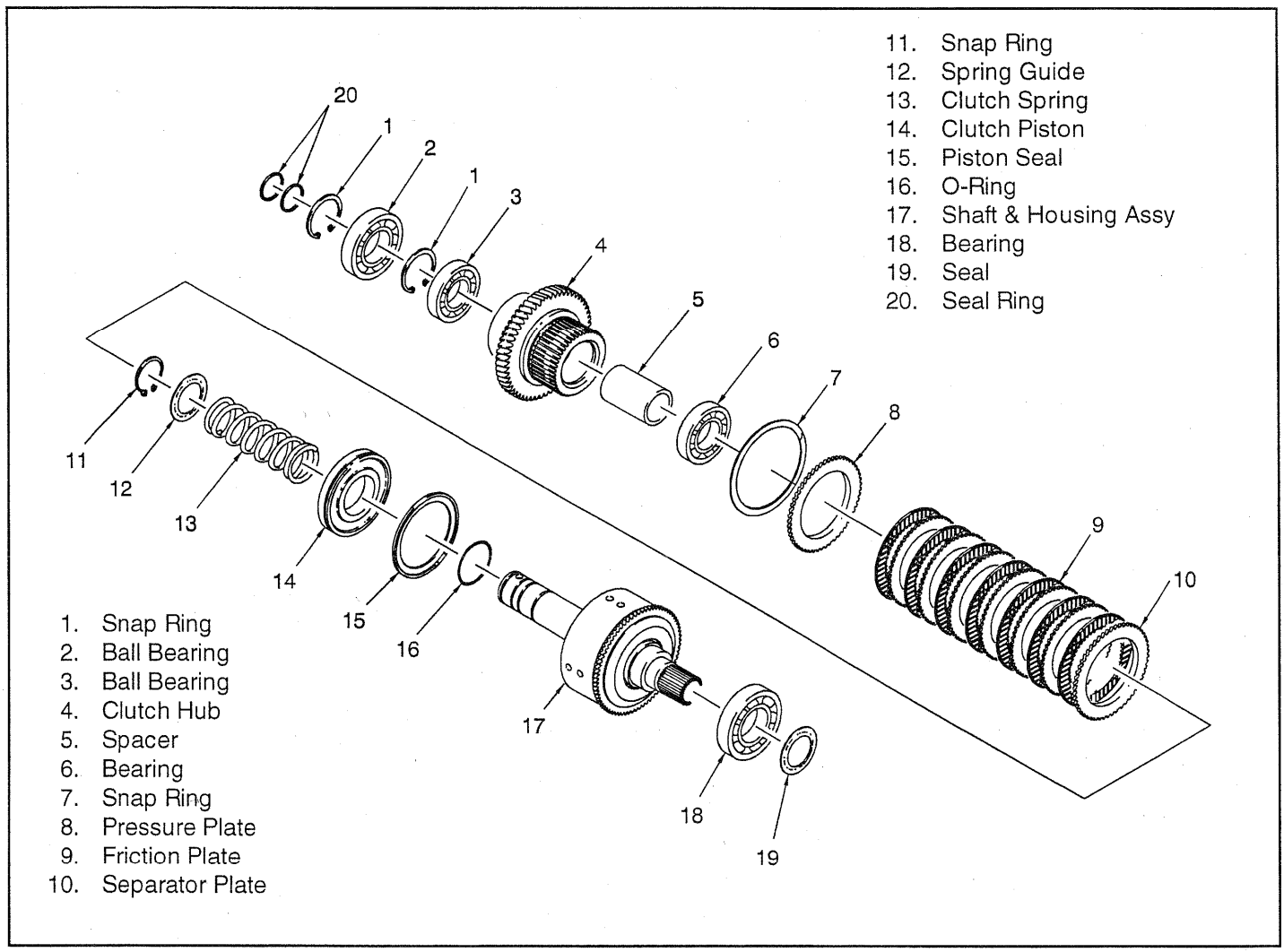


Fig. 1-7 PFO Oil Clutch Assembly

The LINE IN position of the control spool sends hydraulic oil to release the oil brake and apply the clutch. When the control spool is in the BRAKE ON position, the clutch is not applied, and conical washer springs apply the brake.

The FREESPOOL position of the control spool sends hydraulic oil to the FREESPOOL piston, which disengages the drum from the gear train.

The control valve spool is connected through a cable to the hand lever for operator control. A return spring moves the spool to the BRAKE ON position when the control lever is released. A detent will hold the control spool in the BRAKE OFF and FREESPOOL positions.

A system relief valve sets the limit for maximum pressure within the hydraulic system. When the pressure reaches 1,310 kPa (190 psi), the relief valve opens. This permits the oil flowing into the control valve to enter the cooling circuit and keeps the hydraulic pressure within limits. An adjustment increases or decreases the spring pressure on the relief valve spool.

The design of the hydraulic system permits a continuous flow of cooling oil through the clutch and brake. The hydraulic oil that is not used to apply the oil clutch and release the oil brake flows as cooling oil to the clutch and brake, and returns to the sump.

1. SnapRing
2. Ball Bearing
3. Snap Ring
4. Brake Hub
5. Snap Ring
6. Pressure Plate
7. Friction Plate
8. Separator Plate
9. Capscrew
10. Brake Housing
11. O-Ring
12. Brake Shaft
13. O-Ring
14. Brake Piston
15. Ball Bearing
16. Spring
17. Seal Ring
18. Pin
19. Fitting
20. O-Ring
21. Steel Ball
22. Spacer
23. O-Ring
24. Snap Ring
25. O-Ring

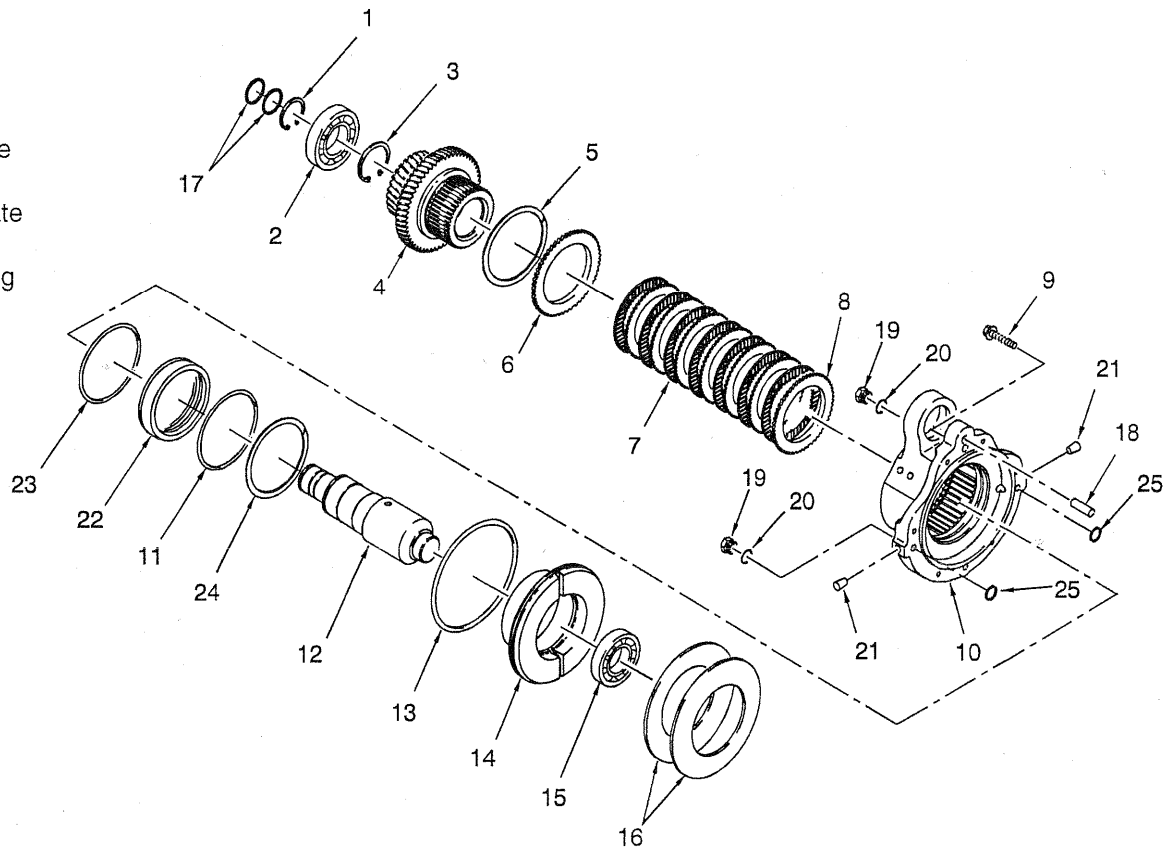


Fig. 1-8 Oil Brake Assembly

1. Valve Body
2. Relief Valve
3. Control Spool
4. Centering Spring
5. Check Valve
6. Accumulator Check Valve
7. Check Valve Actuating Rod
8. Freespool To Brake Check Valve
9. Inlet From Pump
10. Outlet Port To Tank*
11. Outlet Port To Accumulator*
12. Outlet Port To Brake*
13. Outlet Port To Clutch*
14. Outlet Port To Freespool*
15. Cooling Oil Port*

* Ports on opposite side

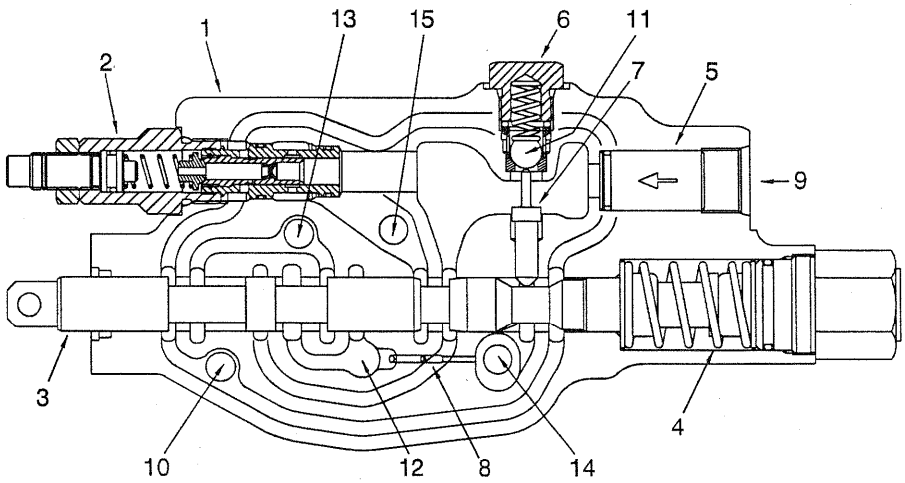


Fig. 1-9 Control Valve

Accumulator (See Fig. 1-10)

An accumulator is connected to the hydraulic system in the W3C tractor winch. The accumulator has an internal diaphragm made of rubber that holds nitrogen at a pressure of 800 kPa (115 psi). The purpose of the accumulator is to store a small volume of hydraulic oil at system pressure. If the operator momentarily permits the rotation of the PTO to decrease to a rate that decreases hydraulic pressure, the accumulator will discharge pressure to keep the clutch applied. The accumulator also sends additional pressurized oil to release the oil brake and apply the oil clutch more quickly. If the PTO stops, the hydraulic pump stops. The pressure in the accumulator also permits the operator to release the winch brake (and release a load).

The pressure from the hydraulic pump compresses the nitrogen and the accumulator stores the pressure. The accumulator valve is a ball check valve that can be mechanically opened. The accumulator valve permits the hydraulic pressure to charge the accumulator during operation. When the hydraulic pump is stopped and the operator moves the control valve spool to BRAKE OFF or FREESPOOL, a cam on the valve spool opens the ball check valve. This action permits the accumulator pressure to enter the control valve and supply pressure to release the brake. A check valve between the control valve and the hydraulic pump prevents the flow of oil and pressure from the accumulator to the hydraulic pump.

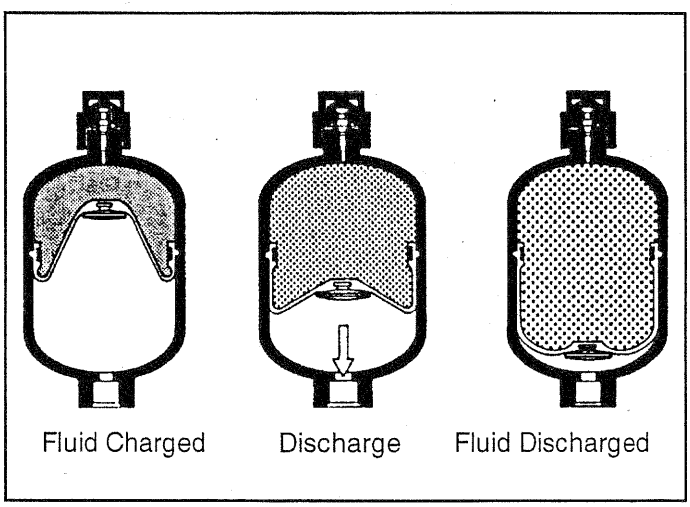


Fig. 1-10 Hydraulic Accumulator

Sequence of Operation - BRAKE ON

- The conical washer springs have applied the brake. The brake shaft cannot rotate.
- The clutch is not applied. The PTO shaft cannot power the gear train.
- If the winch has been operating, the accumulator will be charged.

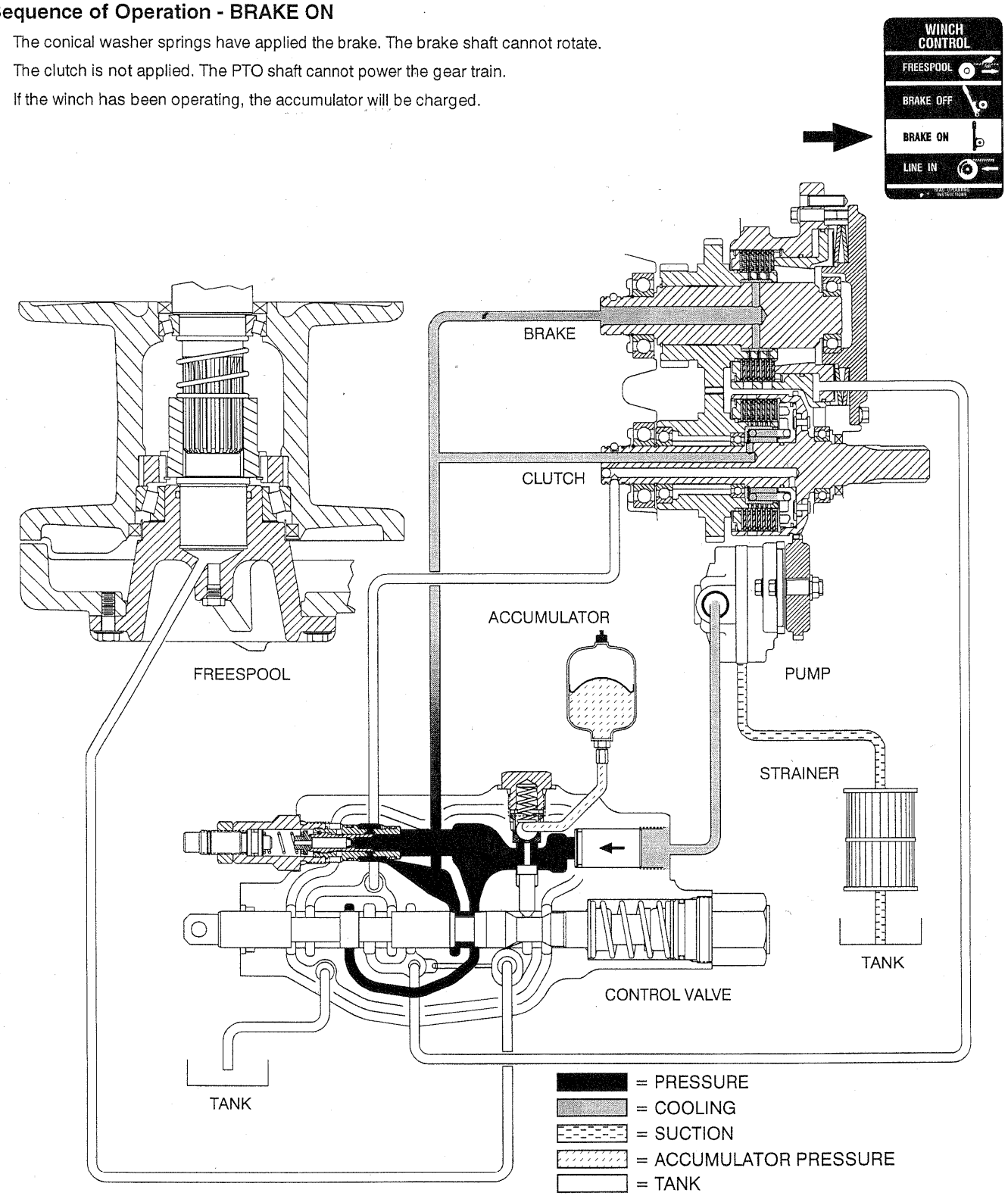


Fig. 1-11 Hydraulic System - BRAKE ON

Sequence of Operation - LINE IN

- When the control valve spool moves toward the LINE IN position, some of the oil flow goes to the clutch. The oil flow increases oil pressure to apply the clutch. The PTO shaft turns the gear train.
- Oil flow also goes to the brake, where it compresses the conical washer springs, releasing the brake. The brake shaft can now rotate.
- The valve spool has a ramp which pushes the accumulator actuator, which opens the accumulator valve. This allows the accumulator to pressurize the system.
- If the pressure increases to approximately (1310 kPa) 190 psi, the relief valve opens. The hydraulic oil flows to the cooling circuit.

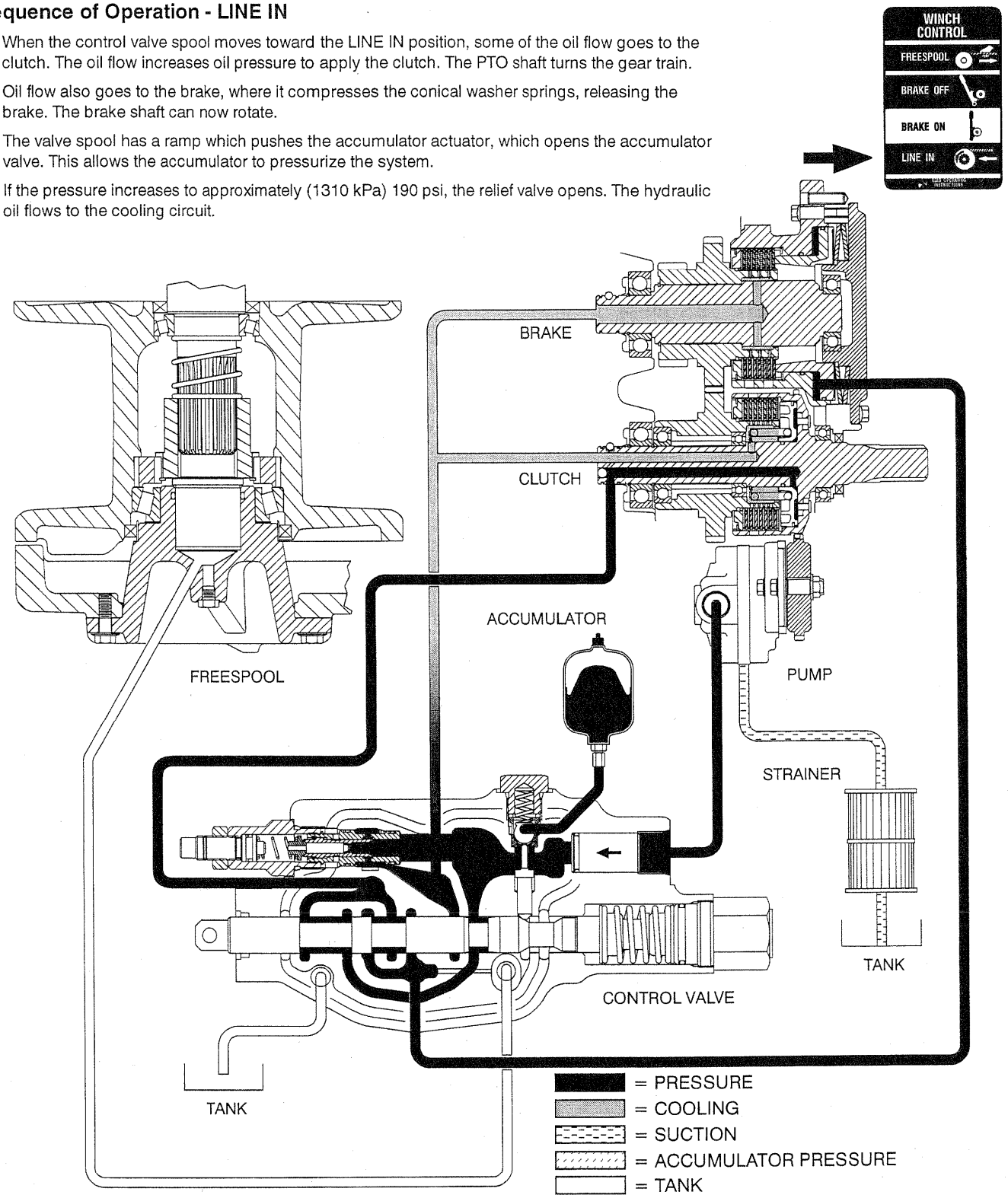


Fig. 1-12 Hydraulic System - LINE IN

Sequence of Operation - BRAKE OFF

- The control valve increases flow to the brake, where it compresses the conical washer springs, releasing the brake.
- The clutch is not applied. The PTO shaft cannot power the gear train.
- The valve spool has a ramp which pushes the accumulator actuator, which opens the accumulator valve. This allows the accumulator to pressurize the system.
- If the pressure increases to approximately (1310 kPa) 190 psi, the relief valve opens. The hydraulic oil flows to the cooling circuit.

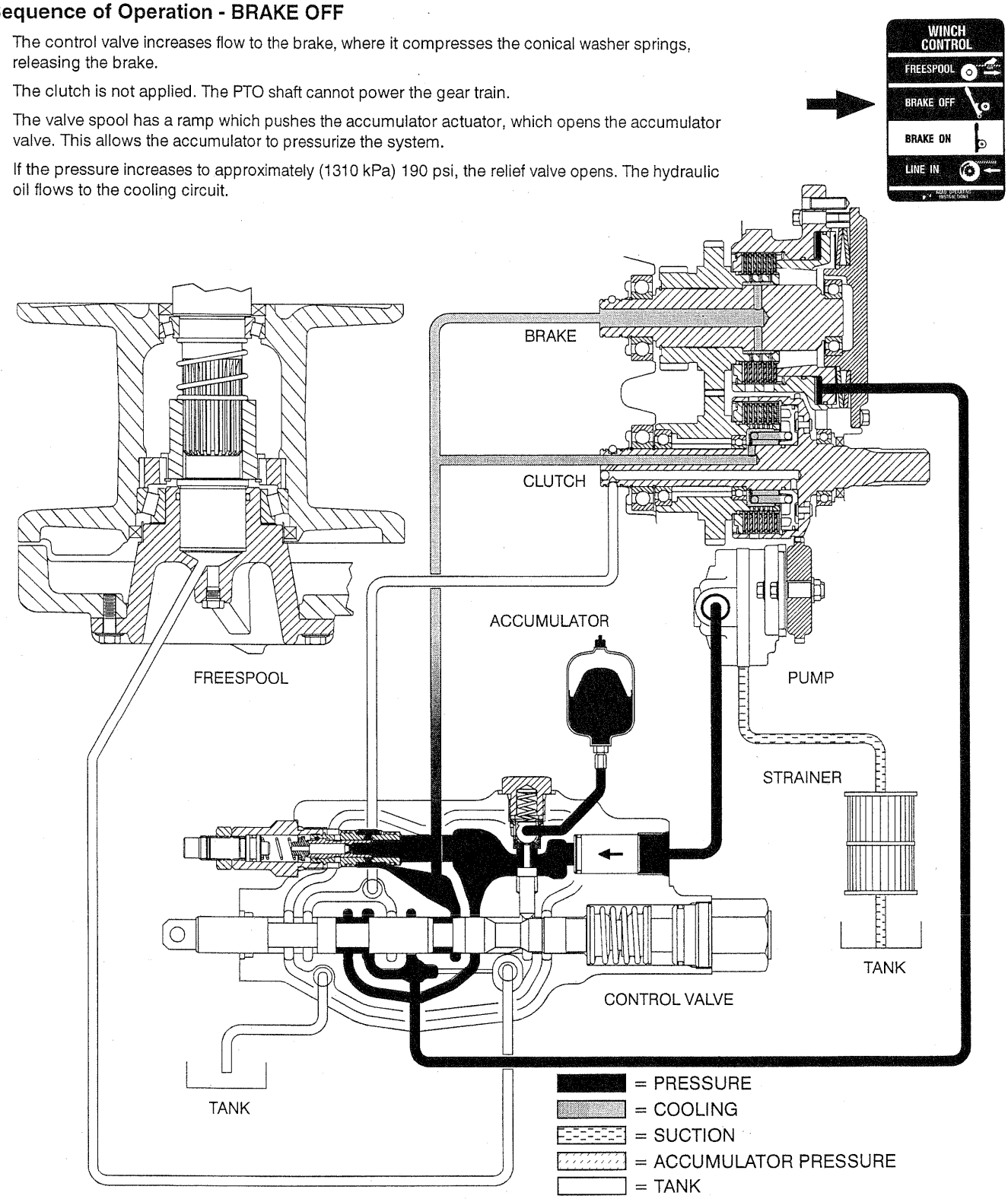


Fig. 1-13 Hydraulic System - BRAKE OFF

Sequence of Operation - FREESPOOL

- The control valve sends hydraulic oil to the FREESPOOL piston, which disengages the drum from the gear train.
- The brake is released.
- The clutch is not applied. The PTO shaft cannot power the gear train.
- The valve spool has a ramp which pushes the accumulator actuator, which opens the accumulator valve. This allows the accumulator to pressurize the system.
- If the pressure increases to approximately (1310 kPa) 190 psi, the relief valve opens. The hydraulic oil flows to the cooling circuit.

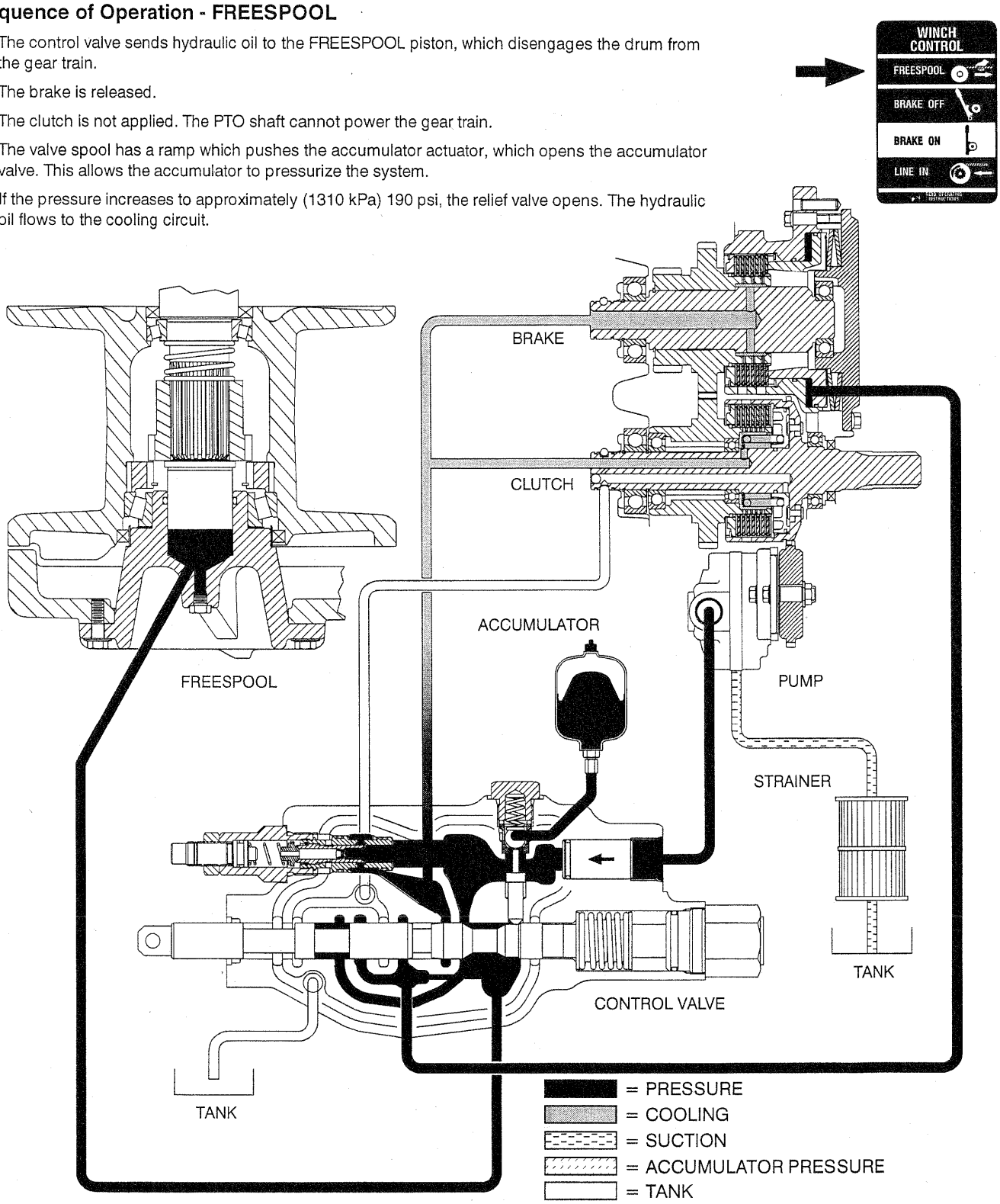


Fig. 1-14 Hydraulic System - FREESPOOL

Notes

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	CORRECTION
Operation is rough or irregular.	Hydraulic oil is too cold.	Put the control lever in FREESPOOL position. Run the engine at 1000 rpm to warm the oil before operating the winch.
	Low oil level.	Add hydraulic oil to the correct level.
	Low oil pressure.	See the Troubleshooting for "Low oil pressure".
	Wrong oil.	Drain oil and replace with correct grade.
	Control cable needs adjustment.	Adjust cable. See page 3-2.
	Tractor engine speed too slow.	Increase tractor engine speed.
Winch stops during shift when engine speed drops.	Tractor engine speed too slow.	Increase tractor engine speed.
	Defective valve seat in accumulator.	Repair or replace.
	Defective accumulator.	Repair or replace.
	Leak in brake or clutch.	Replace piston seals.
	Defective valve gasket.	Replace.
	Pump worn.	Repair or replace.
	Relief valve stuck.	Repair or Replace.
Low oil pressure.	Loose connections in the winch hydraulic system.	Tighten loose connections.
	Clogged suction screen.	Remove and clean screen.
	Defective relief valve.	Adjust, repair or replace.
	Defective valve gasket.	Replace.
	Oil brake leaking internally (indicated by low brake pressure and quick loss of pressure from the accumulator).	Repair as required.
	Pump worn.	Repair or replace.
Brake does not hold.	Worn friction discs in brake.	Repair or replace.
	Defective conical washers (belleville springs).	Repair or replace.
Brake does not release.	Low oil pressure.	See the Troubleshooting for "Low oil pressure".
	Defective accumulator.	Replace accumulator.
	Leaking piston seals.	Repair or replace.

Table 2-1 Troubleshooting

PROBLEM	POSSIBLE CAUSE	CORRECTION
Winch drum allowed to unwind before clutch is applied (brake begins to release before the clutch is applied).	Worn friction discs in brake.	Repair or replace.
	Clutch burned.	Repair or replace clutch.
	Defective accumulator.	Repair or replace.
Clutch slips or does not apply completely.	Low oil pressure.	See the Troubleshooting for "Low oil pressure".
	Worn friction discs in the clutch.	Repair or replace.
	Worn clutch piston seals.	Repair or replace.
	Defective Accumulator.	Replace.
Hydraulic oil becomes too hot during operation.	Winch is operated in the BRAKE OFF or FREESPOOL position for long periods. When the BRAKE OFF or FREESPOOL position is used, the hydraulic oil continuously flows through the relief valve.	Use the BRAKE OFF and FREESPOOL positions less.
	Restricted suction strainer.	Remove and clean strainer.
	Low oil level.	Add hydraulic oil to the correct level.
Lever is difficult to move.	Control Cable and/or linkage is dirty or corroded.	Clean and lubricate or replace cable and linkage.
FREESPOOL will not stay engaged.	Control cable or linkage need adjustment.	Adjust cable and linkage.
FREESPOOL will not disengage.	FREESPOOL coupler is stuck because of twisted drum shaft.	Replace.
	FREESPOOL coupler is stuck because of oversized or rough drum shaft splines.	Repair or replace.
PTO shaft is broken due to clutch/brake overlap.	Inadequate oil flow to brake.	Add orifice to clutch to decrease flow.
	Defective pump or accumulator.	Repair or replace.

Table 2-1 Troubleshooting (continued)

SERVICE

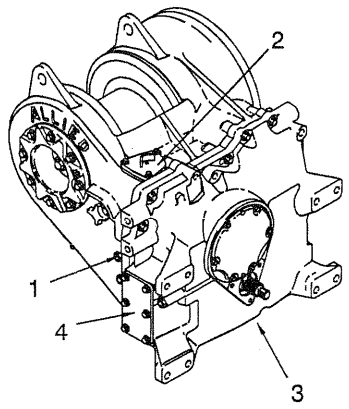
GENERAL

This section provides the instructions for performing maintenance and making checks and adjustments. Standard shop tools are used in doing the work described in this section.

MAINTENANCE (See Table 3-1 & Fig. 3-1)

The maintenance schedule is a program that includes periodic inspection and lubrication. Use the operating time on the tractor's hour meter to find the maintenance times for the winch.

Table 3-1 is outlined in two schedules: the HOURLY schedule and the PERIODIC schedule. If the unit is operated more than eight hours per day, the hourly schedule should be followed. If the unit is operated eight hours or less per day, the periodic schedule should be followed.



1. Oil Level Plug
2. Fill Cover & Breather
3. Drain Plug
4. Strainer Cover

Fig. 3-1 Maintenance Points

INTERVAL	PROCEDURE OR QUANTITY	SPECIFICATION
50 hours or weekly	Check oil level at Plug (1). Clean around filler/breather. Add oil as necessary at cover (2).	See Table 3-2.
	If equipped, lubricate fairlead or arch rollers through the lube fittings.	Use multi-purpose grease with 2-4% molybdenum disulfide.
500 hours or 3 months	Clean the oil strainer.* Remove any metal particles from the magnets. Use liquid gasket between the cover and strainer housing.	See Page 3-5. Replace the screen if it is torn or damaged.
	Check control lever linkage adjustment.	See page 3-2. Check that the lever mounting bracket and linkage are secure. Tighten the bolts as necessary.
	Check the accumulator charge.	See Page 3-3.
2000 hours or 12 months	Change the hydraulic oil. Drain from plug (3). Clean the strainer, add 19 liters (20 qt.) through fill plug (2). Check the oil level at plug (1) after operating.	See Table 3-2.
* **NOTE**: Clean the oil strainer after the first 50 hours on new and rebuilt winches.		

Table 3-1 Maintenance Schedule

The type of oil used in winches affects the line control. Use ONLY the following oils in the W3C winch:	
COMPANY	**BRAND NAME**
Amoco Oil Company	Amoco 1000 Fluid
Exxon Company	Torque Fluid 56
John Deere	Hy-Gard Transmission & Hydraulic Oil
Sun Oil Company	Sunfleet TH Universal Tractor Fluid

Table 3-2 Approved Oil List

NOTE: For operation in temperature below -23° C (-10° F), use John Deere J20D "Low Viscosity" Hy-Gard or equivalent.

CHECKS AND ADJUSTMENTS

The checks and adjustments for the winch have the following descriptions:

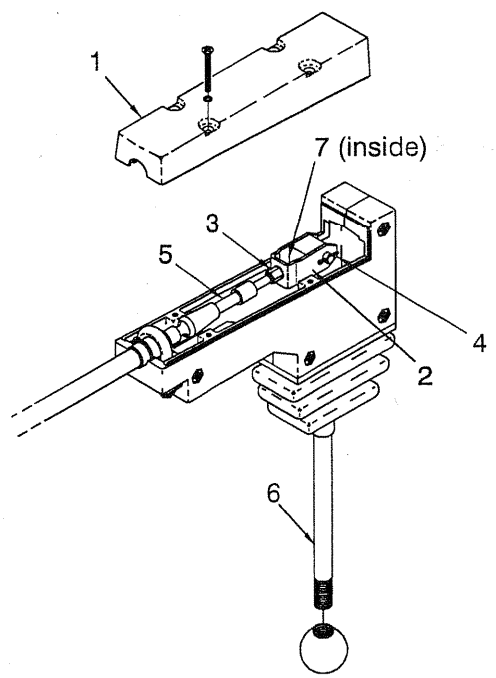
- Control Cable Adjustments
- Hydraulic System Checks
- FREESPOOL "drag" adjustment

Control Cable Adjustment (See Section 5 for PFR winches)

Check the operation of the control lever to make sure it moves smoothly and will return to the BRAKE ON position. Check that the BRAKE OFF and FREESPOOL positions have a detent to hold the lever in position. Make sure the control lever does not hit anything at the end of its travel. Check the lever control cable to make sure that the winch end of the cable is threaded completely into the ball joint and that the cable jacket is threaded completely into the cable mounting block. Check the lever end of the control cable to make sure the tall nut is threaded completely onto the cable.

Adjustment (See Fig. 3-2)

Remove the access cover on the control lever housing to make adjustments. Loosen the tall nut that keeps the clevis and adjustment nut from turning. Remove the cotter pin and link pin from the clevis. Turn the adjustment nut and clevis to adjust the effective length of the control cable. Use the link pin and cotter pin to connect the clevis to the control handle again and check the operation. When the adjustment is complete, tighten the tall nut and install the access cover.



1. Access Cover
2. Clevis
3. Tall Nut
4. Cotter Pin & Link
5. Control Cable
6. Control Lever
7. Adjustment Nut

Fig. 3-2 Control Cable Adjustment

HYDRAULIC SYSTEM

Preparation

A. These tests should be performed with a bare drum (no cable) since the drum will rotate during the tests.

B. The oil temperature in the winch must be at least 20° C (70° F). The oil can be heated by operating the winch in the FREESPOOL or BRAKE OFF position. When the oil is warm, stop the tractor engine.

C. Remove any dirt from the right side of the winch. Install the pressure gauges as described in the following section.

Pressure Gauges

The pressure checks can be performed with three 2000 kPa (300 psi) gauges.

⚠ WARNING

There is oil under pressure stored in the accumulator. Move the control lever from the BRAKE ON position to the LINE IN position with the engine stopped before connecting the pressure gauges. Except when performing pressure checks, stop the tractor engine when working on the winch.

Accumulator Pressure Test (BK Port, See Fig. 3-3)

A. Identify the BK Port and install a pressure gauge in the port. Run the tractor engine at 700 to 1000 rpm.

B. Move the winch control lever to the BRAKE OFF position for one minute. The pressure on the gauge at the BK Port must exceed 1,200 kPa (175 psi). Move the control lever to the BRAKE ON position and then stop the engine.

C. Move the control lever to the BRAKE OFF position with the engine stopped. The pressure on the gauge at the BK Port must increase to greater than 960 kPa (140 psi). The pressure must exceed 830 kPa (120 psi) for a minimum of 12 seconds.

D. If the test results are not within specifications, check for the following causes:

- Accumulator not charged to the correct pressure.
- Accumulator diaphragm is damaged.
- Leaking accumulator valve stem or seat.
- Leaking check valve or valve gasket.
- Worn clutch/brake seals.

The accumulator is charged with dry nitrogen to a pressure of 800 kPa (115 psi). Check the pressure. Charge or replace the accumulator as required.

The accumulator can be checked without removing it from the winch. The hydraulic oil must be drained to gain access to the charging valve on the accumulator.

After draining the oil from the winch, remove the access plug from the front cover. The location of the plug is different on the high input and low input winches. See Fig. 3-4.

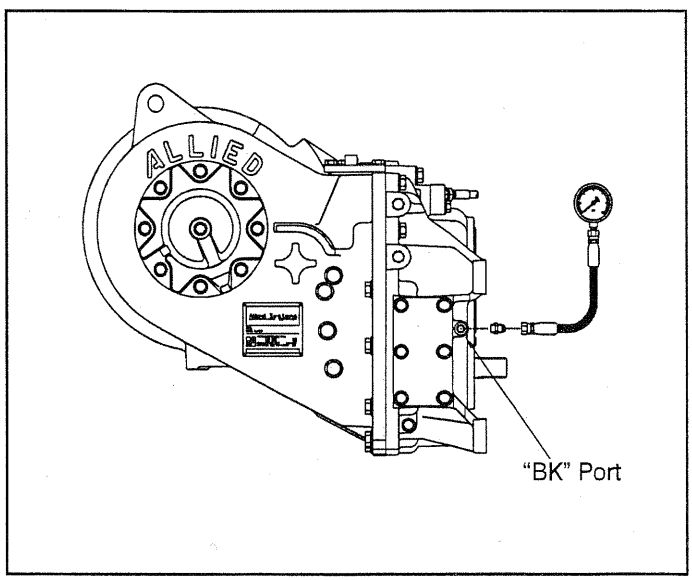


Fig. 3-3 Test Gauge at BK Port

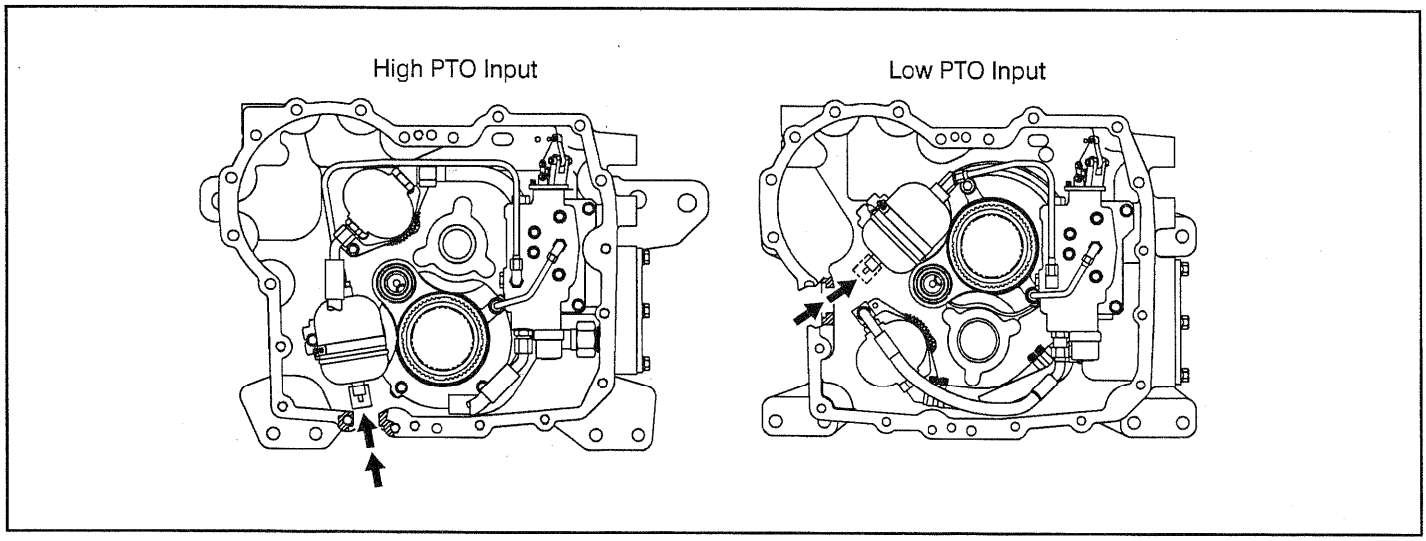


Fig. 3-4 Accumulator Access Ports

Push on the pin of the valve on the bottom of the accumulator. If the diaphragm is defective, oil will discharge from the valve. If the accumulator is good, make sure that it is charged to the correct pressure when the test is complete. Make sure that the valve stem is tight.

Pressure Check for the LINE IN Clutch (CL Port, See Fig. 3-5)

NOTE: To perform this test, it may be necessary to remove the cable from the drum, because the drum will be turning during the test.

A. Install a 2000 kPa (300 psi) gauge in the CL Port. Start and run the tractor engine at 1000 rpm.

B. Hold the control lever in the LINE IN position. Check that the pressure is 1,200 to 1,400 kPa (175 to 205 psi).

C. If the pressure is incorrect, check for the following causes:

- Relief valve poppet stuck.
- Valve spool not traveling full stroke.
- Leaking hydraulic fitting or hose, valve gasket.
- Damaged O-Rings in the clutch or brake.
- Damaged seal rings on clutch/brake shaft.
- Dirty strainer.
- Worn pump.

Make repairs as required to obtain the correct hydraulic pressure.

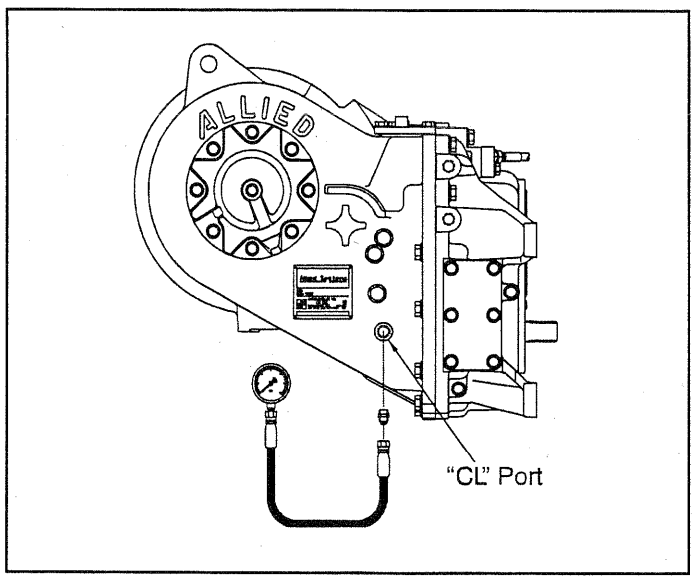


Fig. 3-5 Test Gauge at CL Port

Pressure Check of the Brake (BK Port, See Fig. 3-3)

There are no adjustments to the W3C winch brake. However, to be sure that the brake will hold a load correctly and release at the correct hydraulic pressure, perform the following checks:

A. Install a 2000 kPa (300 psi) gauge in Check Port BK (see Fig. 3-3). Run the tractor engine at low idle.

B. While watching the pressure gauge, slowly move the control lever toward the BRAKE OFF position.

C. When the drum begins to move, the brake is released. The correct brake release pressure with new discs for S/N 1302 and after (new piston design) is 620 to 800 kPa (90 to 115 psi). The correct brake release pressure with new discs for units before S/N 1302 (old piston design) is 800 to 930 kPa (115 to 135 psi). The pressure will continue to increase until system pressure is achieved.

Relief Valve Adjustment (See Fig. 3-6)

NOTE: Some units use a non-adjustable relief valve. On these winches no adjustment is necessary.

A. Remove the oil filler/breather cover.

B. Using a deep socket, loosen the relief valve lock nut.

C. Install a 0-2000 kPa (0-300 psi) gauge in the brake pressure test port (marked BK). See Fig. 3-3.

D. With the oil temperature between 25-50° C (80-120° F) and the engine rpm at 1000, place the control lever in the BRAKE OFF position.

E. Using suitable allen wrench, adjust the pressure to 1,310 kPa +/- 70 kPa (190 psi +/- 10 psi). Turning the screw clockwise will increase the pressure, while turning it counterclockwise will decrease the pressure.

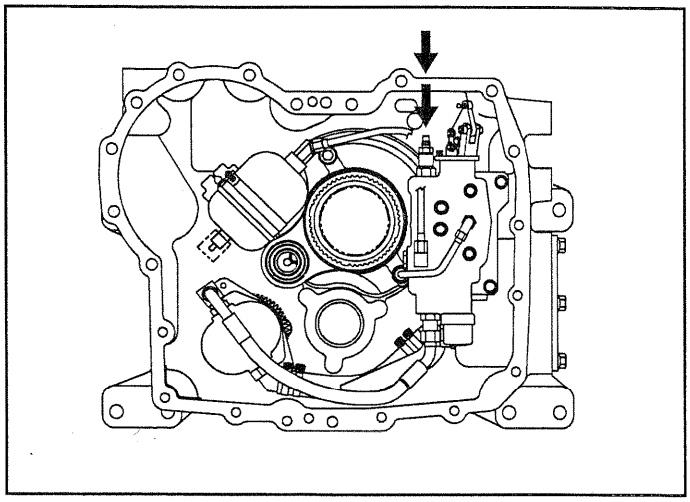


Fig. 3-6 Relief Valve Adjustment

Cleaning the Oil Strainer Screen

See Fig. 3-7. Remove the strainer access cover. Remove the strainer from its housing by pulling it from the fitting. Clean the strainer in solvent. Remove any metal particles from the magnets. Check the strainer O-Ring for damage. Slide the strainer onto its fitting in the housing and reinstall the cover, using liquid gasket on the cover mating surfaces.

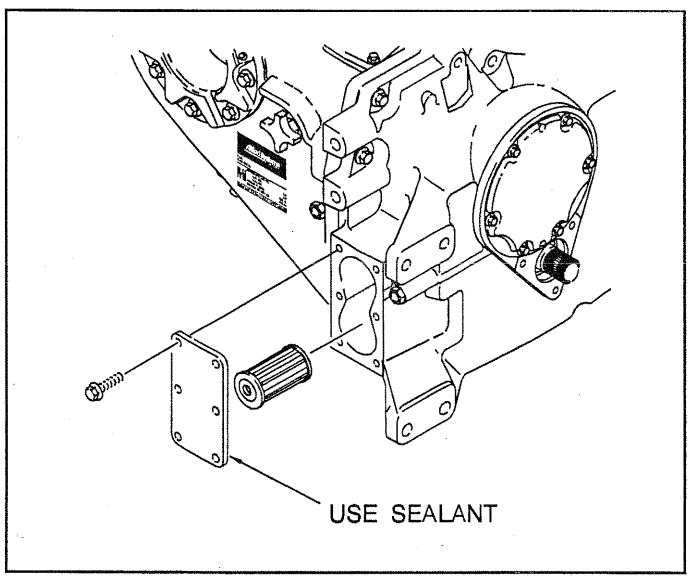


Fig. 3-7 Oil Strainer Access

FREESPOOL ADJUSTMENT

There are two adjustments for the drag that controls the resistance to rotation of the drum during FREESPOOL operation.

Coarse Adjustment (bearing preload)

The addition or removal of shims for the preload on the bearings for the drum adapter requires removal of the right side cover. This adjustment is normally only necessary if the "drag" shoe adjustment is not effective. This adjustment must be done by a trained service person. See Page 4-34.

Fine Adjustment ("drag" shoe adjustment)

See Fig. 3-8. Turn the knob to the right (clockwise) to increase the "drag" or turn the knob to the left (counter-clockwise) to decrease the "drag". Test the "drag" on the drum. Make additional adjustments as necessary.

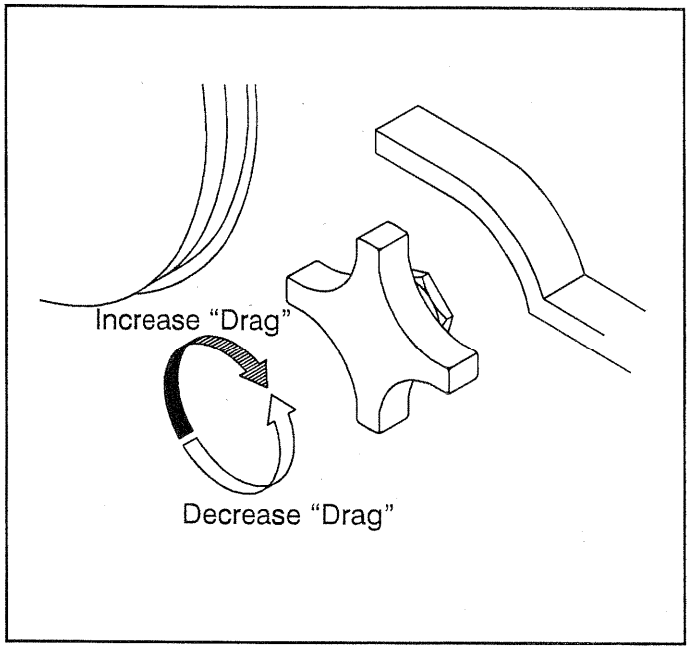


Fig. 3-8 "Drag" Shoe Adjustment

REPAIRS

GENERAL

This section provides the instructions for disassembly and assembly of the winch for repairs. For most major repair jobs the winch must be removed from the tractor prior to disassembly. The instructions for the removal and installation of the winch on the vehicle are also included in this section.

WINCH REMOVAL

⚠ WARNING

Be careful when you remove the cable from the drum. The end of the cable can move like a compressed spring, causing an injury when the ferrule is released from the drum.

⚠ WARNING

The slings and crane used to lift the winch must have a minimum lifting capacity of 1000 kg (2000 lb.).

A. Remove the arch or fairlead from the winch, if so equipped. If these accessories are left on the winch, the winch will not remain level when lifted from the tractor.

B. Remove the cable from the drum. Clean the outside of the winch and the area where the winch contacts the tractor.

C. Drain the oil from the winch.

D. Move the control lever to the LINE IN position at least three times to discharge the pressure in the accumulator.

E. Disconnect the control cable from the control lever. See Fig. 3-2.

F. Connect slings and a crane or lifting device to the winch. Install lifting eyes into the lifting holes provided in the front cover. Put a sling around the drum or attach a chain to the eyes as shown in Fig. 4-1. Use the crane to support the weight of the winch while removing the winch mounting nuts. Make a note of the arrangement to ease installation after repairs are completed.

NOTE: Keep the winch level during removal or installation. The PTO shaft must be in line with the winch input shaft in order to prevent damage to the PTO shaft.

G. Remove the bolts (or nuts) and washers that hold the winch to the tractor. Use the crane to move the winch away from the tractor. Put the winch in a clean work area so that you can make repairs.

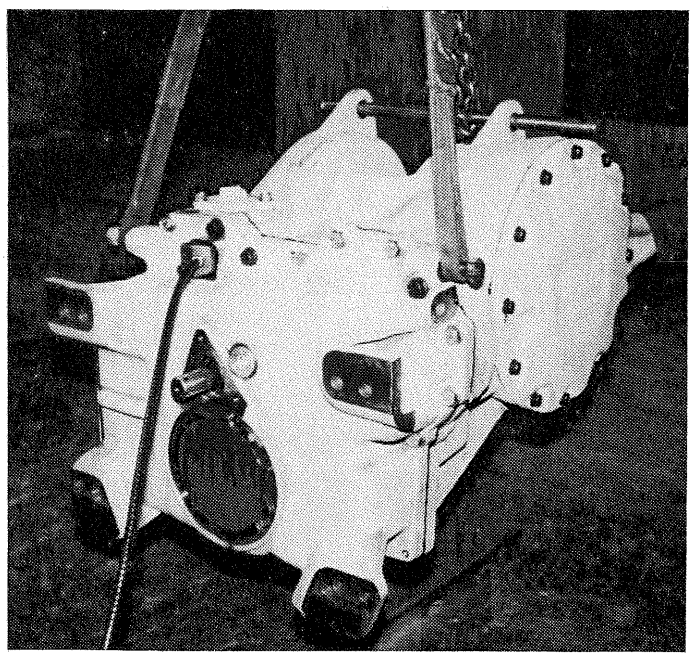


Fig. 4-1 Lifting Sling Arrangement

WINCH INSTALLATION

IMPORTANT: In order to protect the pump from aeration during initial operation, the hydraulic system MUST be primed BEFORE winch operation. Priming must be done BEFORE winch installation because the winch must be placed on its side during the procedure.

Hydraulic System Priming

A. Turn the winch onto its left side and block it securely.

B. Remove the strainer cover and pull the strainer from its fitting. Keep the strainer in a clean place.

C. Pour approximately 1.4 L (1.5 quarts) of 90W oil into the strainer fitting. Turn the clutch (PTO) shaft by hand (counterclockwise viewed from front on low input PTO or clockwise viewed from front on hi input PTO) while pouring the oil.

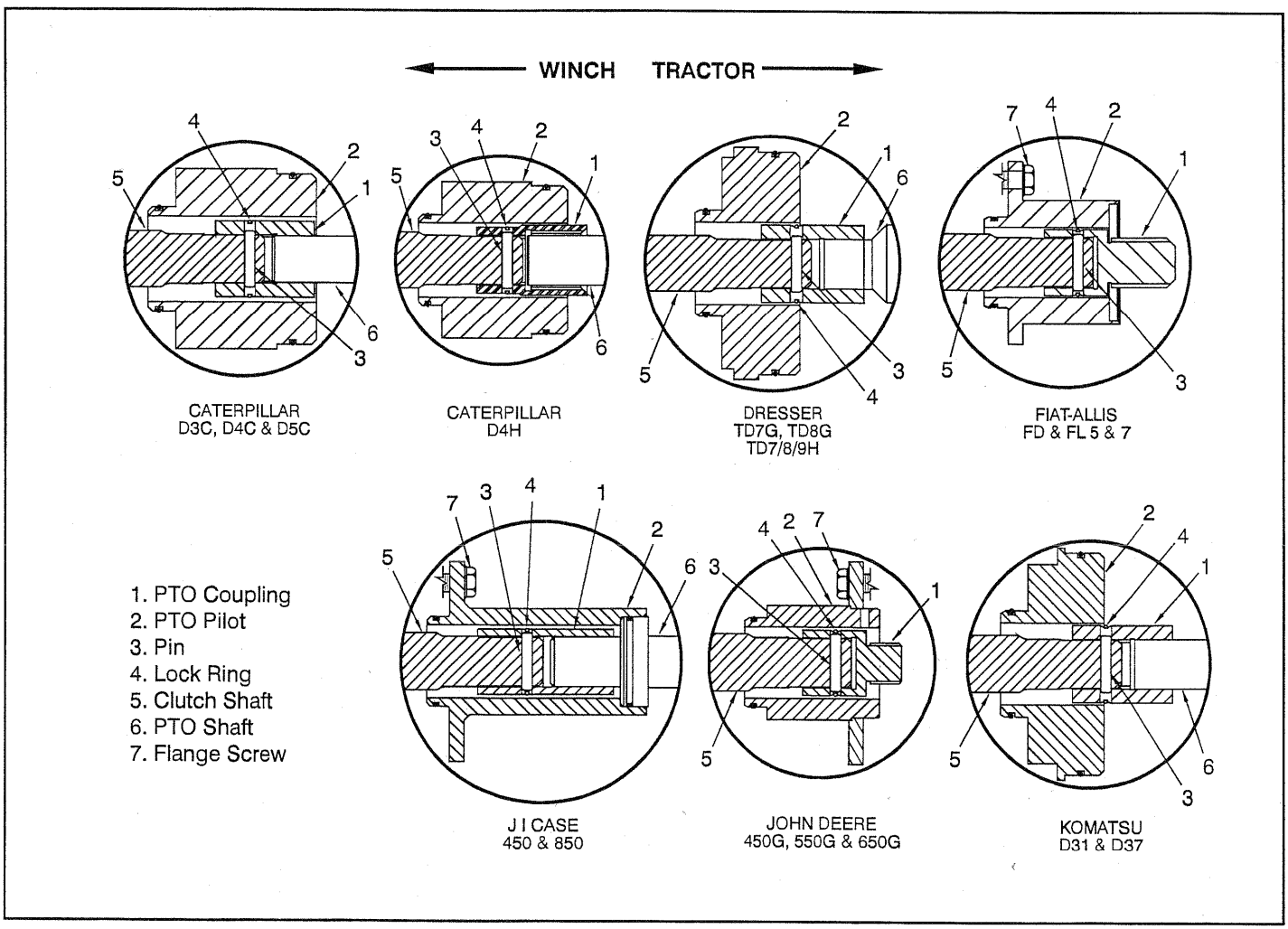


Fig. 4-2 PTO Arrangements

Installation

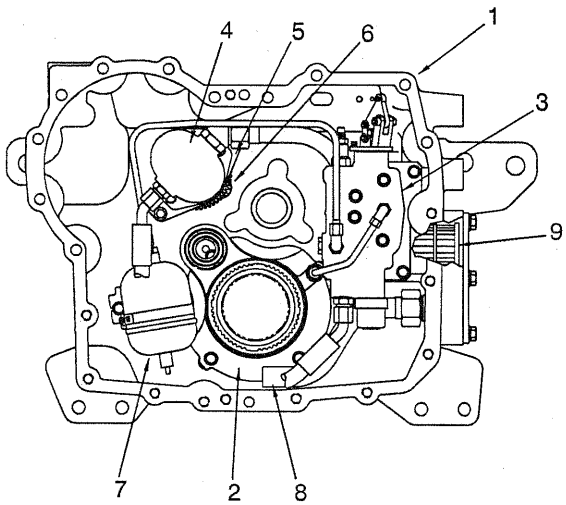
A. Thoroughly clean the mounting pads on the winch and the tractor. Clean the mounting holes and hardware of dirt, grit and oil.

B. Lubricate the PTO shaft splines and pilot shaft and bore with grease, where applicable. Lubricate and install new O-Rings on the PTO pilot where applicable.

Install the PTO attaching hardware required for your particular tractor. See Fig. 4-2.(Fig. 5-5 for PFR winches)

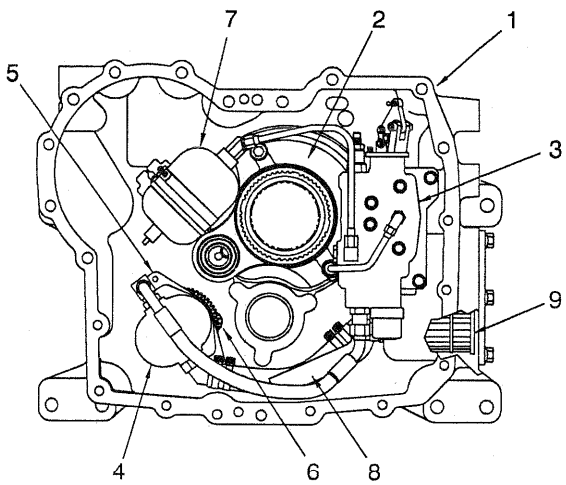
C. Connect the lifting slings in the same manner as for winch removal. It is critical that the winch mounting pads be parallel to the tractor's mounting surface. Misalignment can cause damage to the PTO shaft.

Front Cover, High Input PTO



1. Front Cover, High Input
2. Brake Housing
3. Control Valve
4. Pump
5. Pump Mounting Bracket
6. Pump Drive Gear
7. Accumulator
8. Pick up Tube
9. Suction Strainer

Front Cover, Low Input PTO



1. Front Cover, Low Input
2. Brake Housing
3. Control Valve
4. Pump
5. Pump Mounting Bracket
6. Pump Drive Gear
7. Accumulator
8. Pick up Tube
9. Suction Strainer

Fig. 4-3 Front Covers, High & Low Input PTO

D. Install the winch by aligning the PTO pilots and pushing the winch PTO into the tractor. The winch control cable should be routed to the hand lever at this time. If the PTO coupler or shaft splines do not align, the winch PTO shaft can be rotated by removing the filler cap, and using a long screwdriver or pry bar to rotate the clutch housing inside the winch.

E. Apply thread locking compound (P/N 318702) to the threads of the mounting bolts. Install the bolts or nuts and tighten to torque specified in Table 4-2 (Page 4-58).

F. Connect the control cable to the control lever. Adjust the cable length as described in Section 3.

G. Fill the winch to the proper level with the correct grade of oil. Add oil until the level is at the bottom of the port stamped "OIL" on the case.

H. Install the oil filler/breather cover and gasket and tighten the bolts.

I. Check the oil level again after operating the winch.

DISASSEMBLY OF THE WINCH

Most repairs require disassembly of the winch. The W3C must be removed from the tractor for disassembly. This procedure describes the complete disassembly of the winch with it removed from the tractor. Repair of the front cover, brake, and hydraulic parts are described in sections following the assembly instructions.

All components should be inspected for wear or damage as they are removed. Refer to Table 4-1(Page 4-21), Visual Inspection. All seals that were removed and any component that shows excessive wear or damage should be replaced during assembly.

Repair of Hydraulic System Components

To repair any of the hydraulic components, the winch must be removed from the tractor and the front cover removed from the winch.

Most of the parts of the control valve can be replaced. If the bore for the valve spool is damaged so that the winch's performance has changed, the entire valve must be replaced.

If the accumulator will not stay charged as described in Section 3, it must be replaced.

If the hydraulic pump flow is not as described in Section 3, the pump should be replaced.

Front Cover

There are two general arrangements of the PTO assemblies for the W3C winch, a High PTO Input for tractors with PTO shafts that enter the winch case towards the top and a Low PTO input for tractors with PTO shafts that enter the winch case towards the bottom. See Fig. 4-4. The front cover contains the hydraulics and some of the gear train. The two different front cover arrangements are shown in Fig. 4-3. Fig. 4-5 and Fig. 4-6 show the gears and components contained within the winch housing.

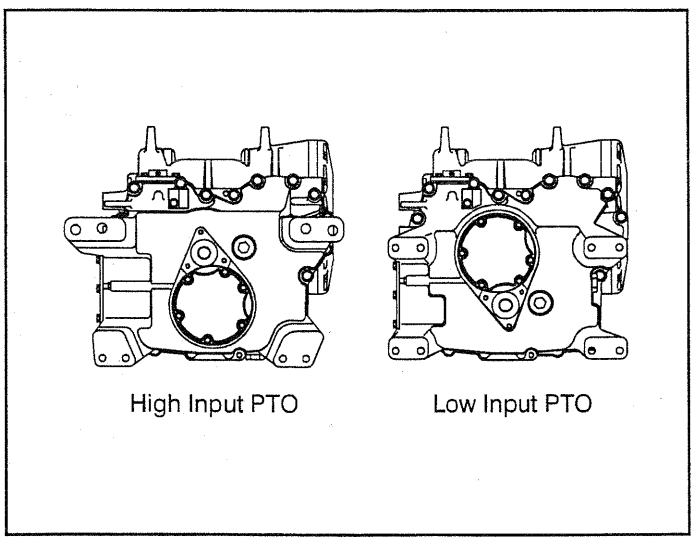
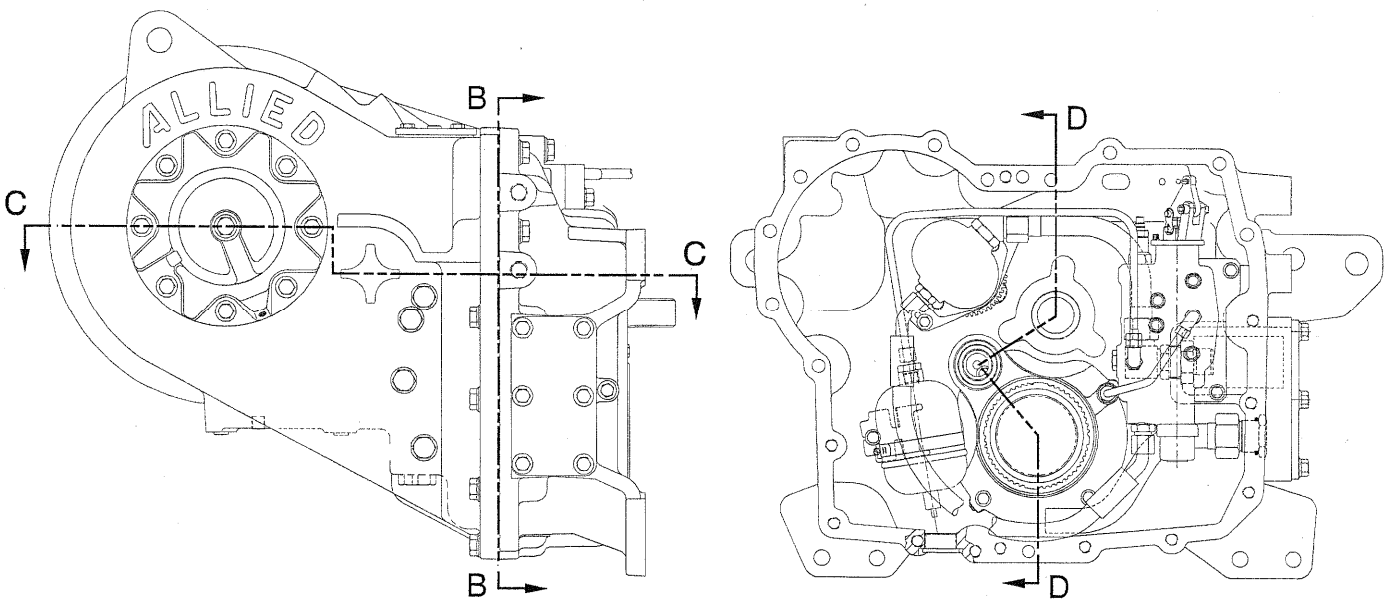
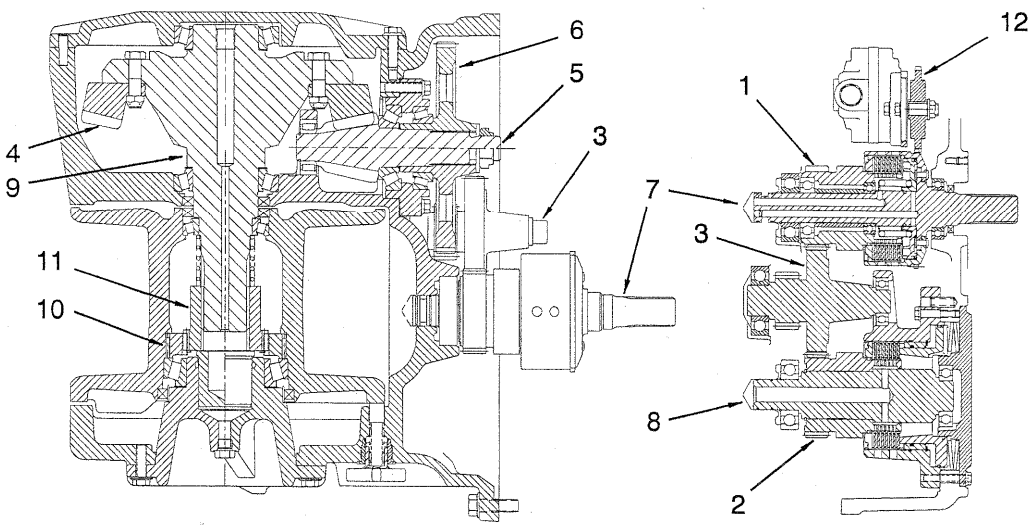


Fig. 4-4 PTO Input Identification



VIEW B - B

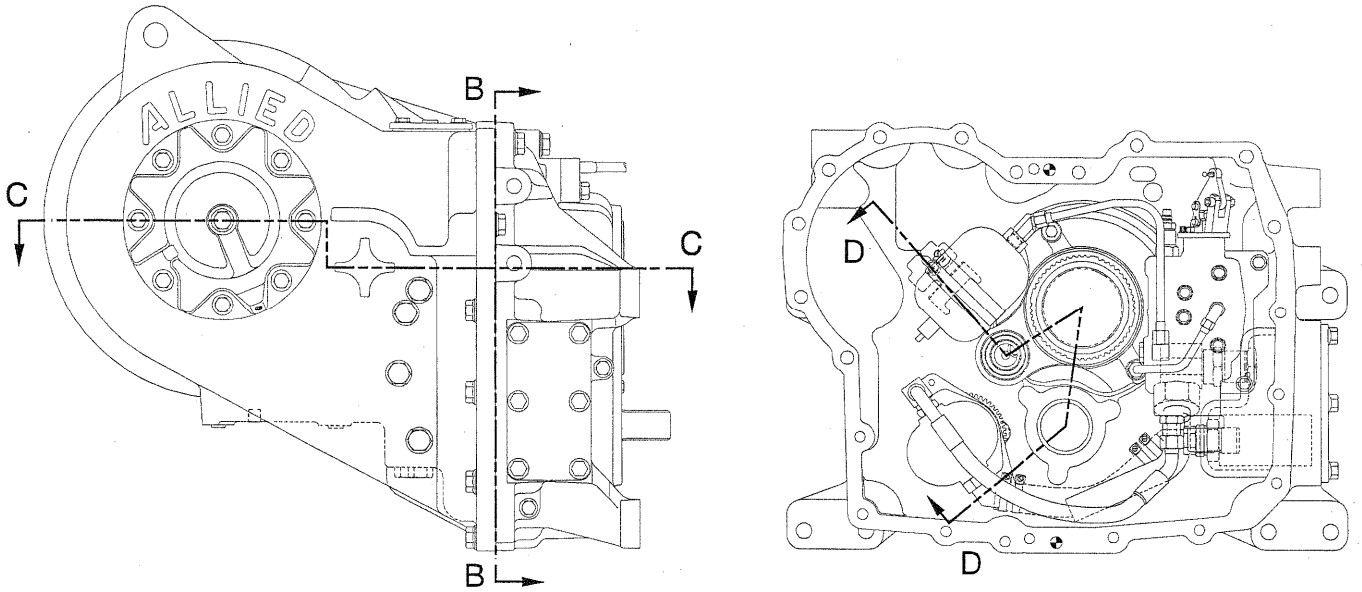


SECTION C - C
SHOWN W/O FRONT COVER ASSEMBLY

SECTION D - D

1. Clutch Hub
2. Brake Hub
3. Intermediate Shaft
4. Ring Gear
5. Pinion Gear
6. Pinion Drive Gear
7. Clutch Shaft
8. Brake Shaft
9. Drum Shaft
10. Torque Ring
11. Freespool Coupler
12. Pump Gear

Fig. 4-5 Gear Arrangement, High Input PTO



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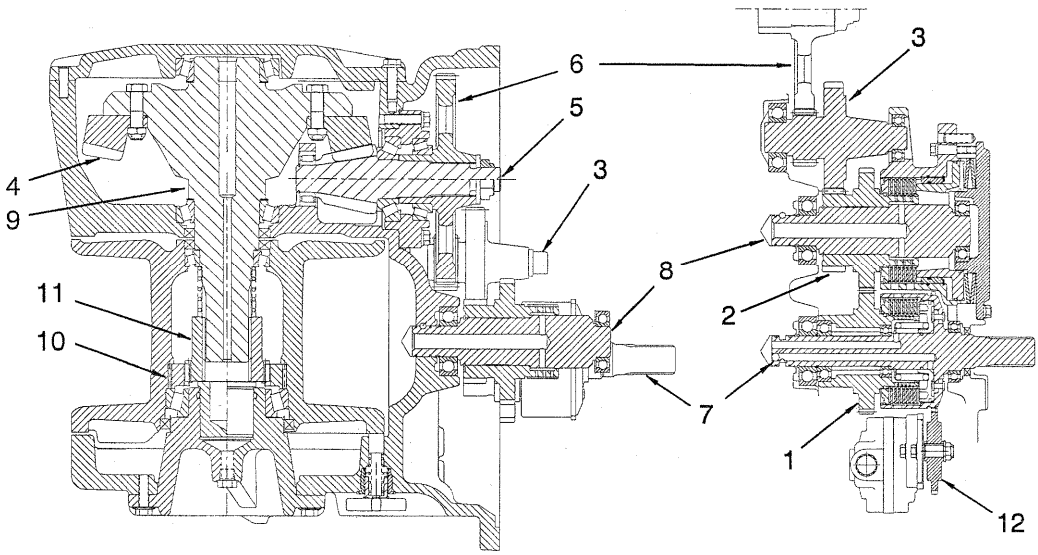


SECTION C - C
SHOWN W/O FRONT COVER ASSEMBLY

SECTION D - D

1. Clutch Hub
2. Brake Hub
3. Intermediate Shaft
4. Ring Gear
5. Pinion Gear
6. Pinion Drive Gear
7. Clutch Shaft
8. Brake Shaft
9. Drum Shaft
10. Torque Ring
11. FREESPOOL Coupler
12. Pump Gear

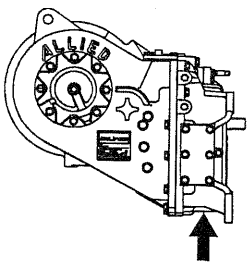
Fig. 4-6 Gear Arrangement, Low Input PTO

Front Cover Removal

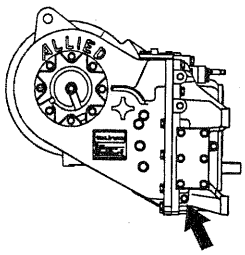
NOTE: The winch must be removed from the tractor for repairs.

Drain Plug Locations

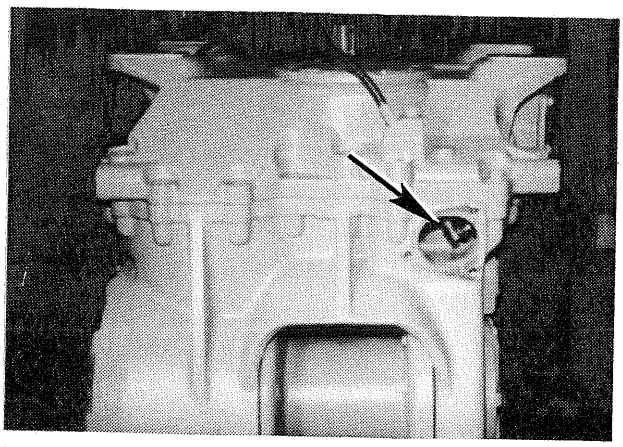
High PTO Input



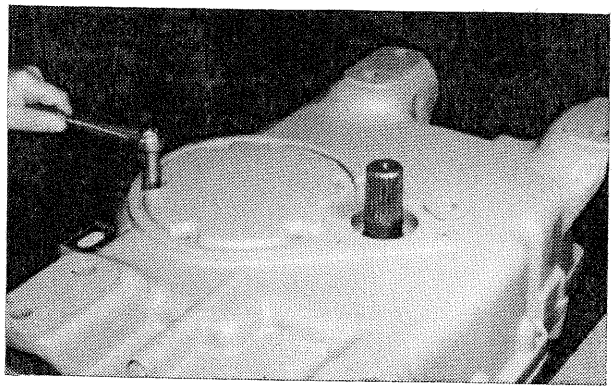
Low PTO Input



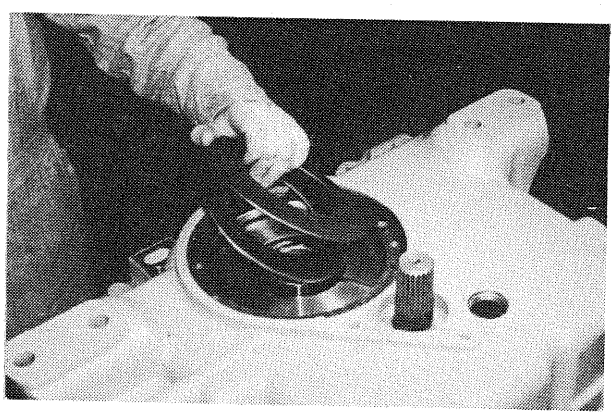
1. There may be additional hydraulic oil remaining after draining the winch in the normal manner. To drain this oil, remove the plugs shown above.



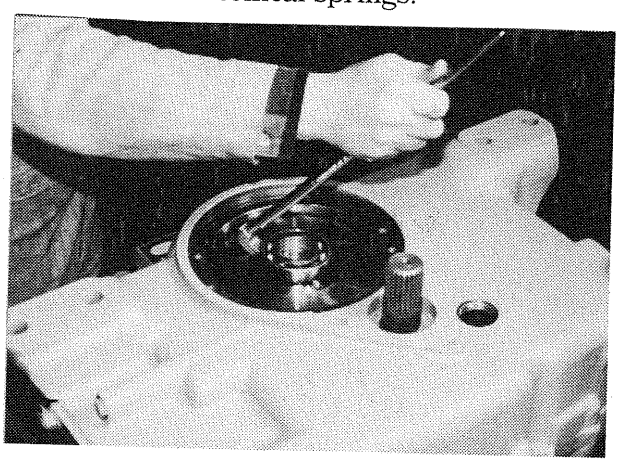
2. Move the handlever to the LINE IN position several times to remove any pressure in the accumulator. Remove the oil filler cover from the top of the winch to gain access to the control cable linkage. Disconnect the cable from the linkage. Remove the cable from the winch.



3. Position the winch with the clutch shaft (PTO) straight up. Block the winch securely. Remove the six capscrews holding the brake cover to the winch case and remove the cover.

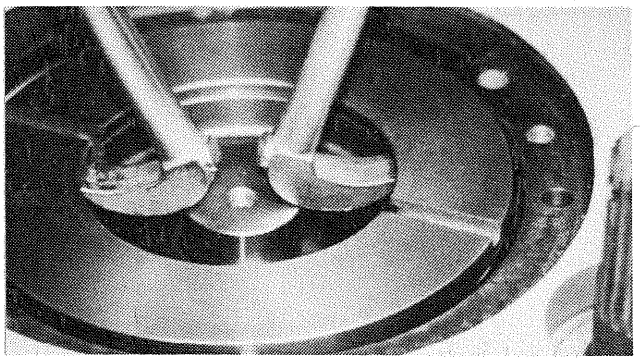


4. Remove the conical springs.

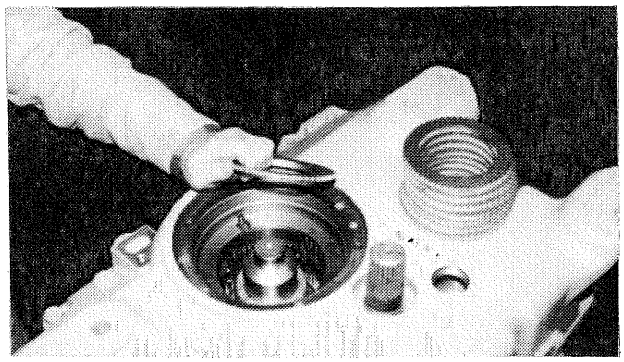


5. Remove the bearing from the brake shaft.

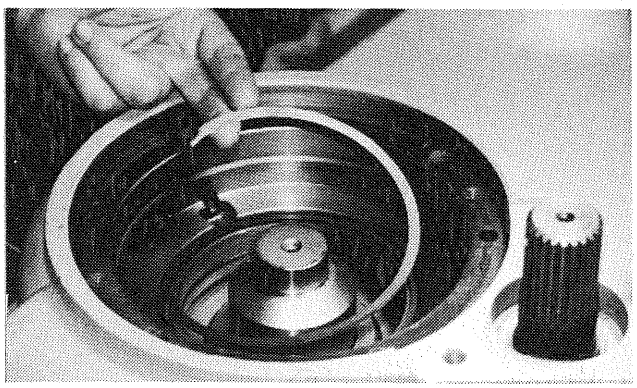
Fig. 4-7 Front Cover and Brake Removal (1 of 2)



6. Pull the brake piston from the housing. The brake pressure port plug may need to be loosened to prevent a vacuum from holding the piston in the housing.

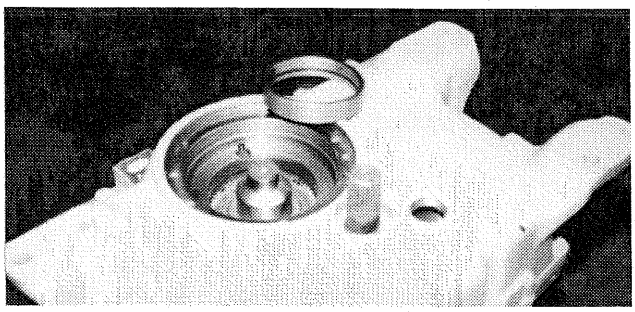


9. Remove the friction discs and separator plates from the brake housing.



7. Remove the snap ring from the bore of the brake housing.

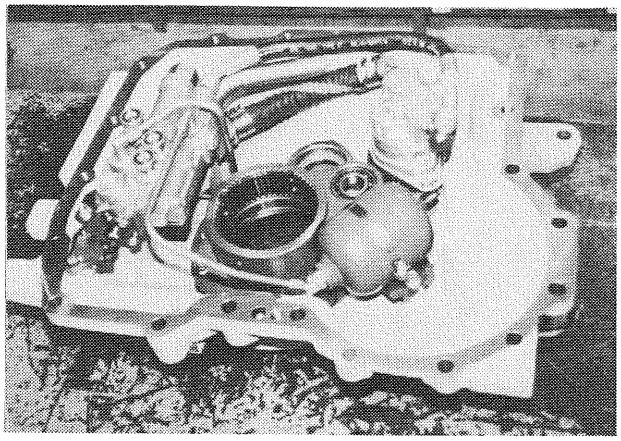
10. Remove the twenty capscrews securing the front cover to the gear housing. Attach two lifting eyes to the front cover, and using a suitable lifting device, remove the front cover. Be sure to lift vertically. During lifting, tap on the end of the clutch shaft to keep it seated in the frame. This will prevent seal ring bore scoring.



8. Remove the spacer from the bore.

Fig. 4-7 Front Cover and Brake Removal (2 of 2)

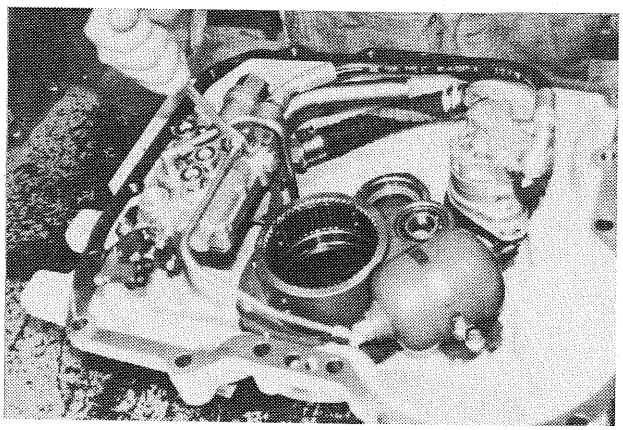
Removal of the Hydraulic Components and Brake Housing



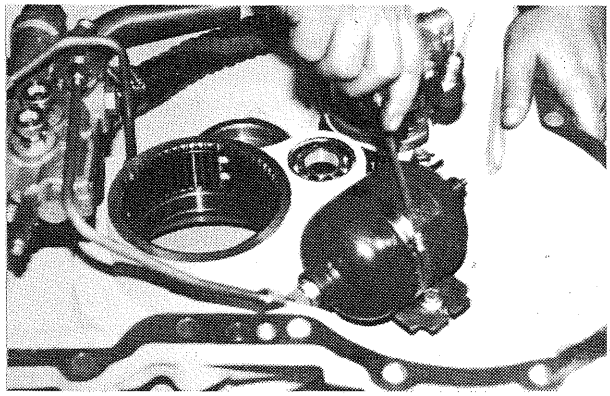
1. Place the front cover up side down on a flat surface.

⚠ WARNING

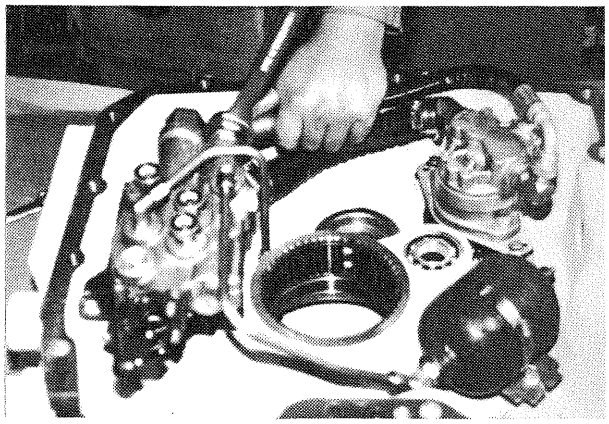
Make sure the accumulator is discharged before working on the hydraulic system. Use a screwdriver to actuate the control valve spool several times to lift the accumulator valve pin until the accumulator is discharged. Loosen any fittings slowly to relieve pressures.



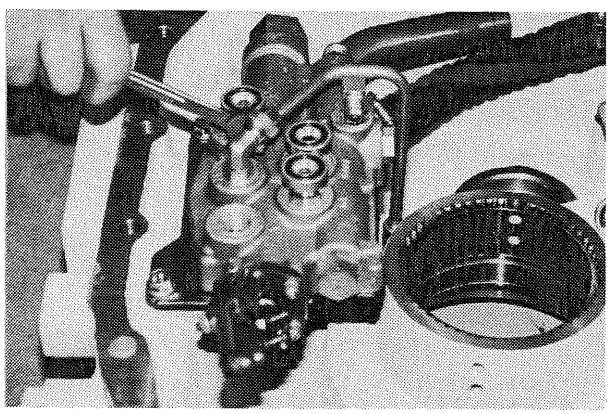
2. Disconnect the accumulator line from the control valve.



3. Remove the clamp holding the accumulator to the front cover and lift the accumulator assembly from the front cover.

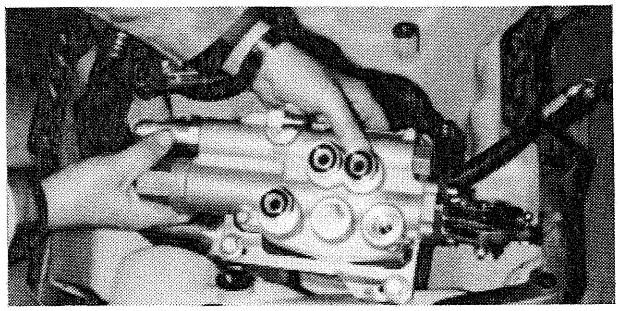


4. Disconnect and remove the hose going from the pump outlet to the control valve inlet.

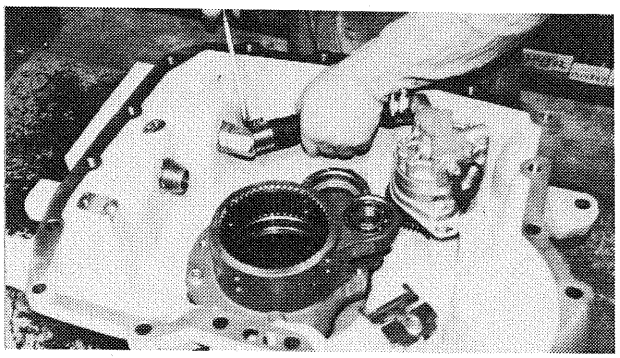


5. Remove the brake line.

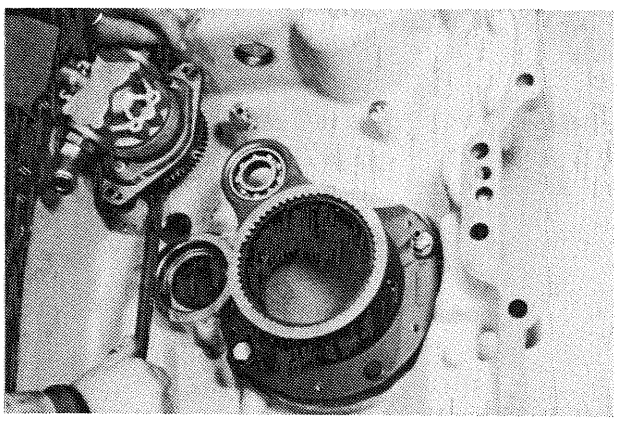
Fig. 4-8 Disassembly of the Front Cover (1 of 3)



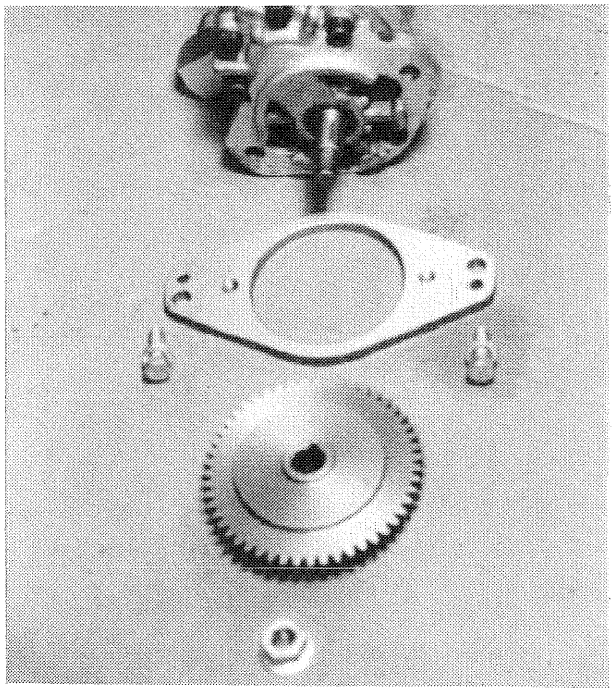
6. Remove the capscrews that hold the control valve to the front cover. Plug all open hydraulic ports. For valve service instructions, see page 4-53.



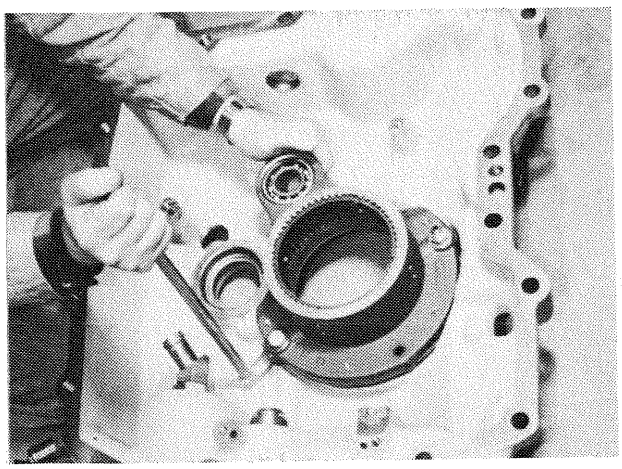
7. Disconnect and remove the suction lines and fittings from the strainer housing to the hydraulic pump.



8. Remove the two capscrews that hold the hydraulic pump to the front cover. Using a pry bar, remove the pump from the front cover.

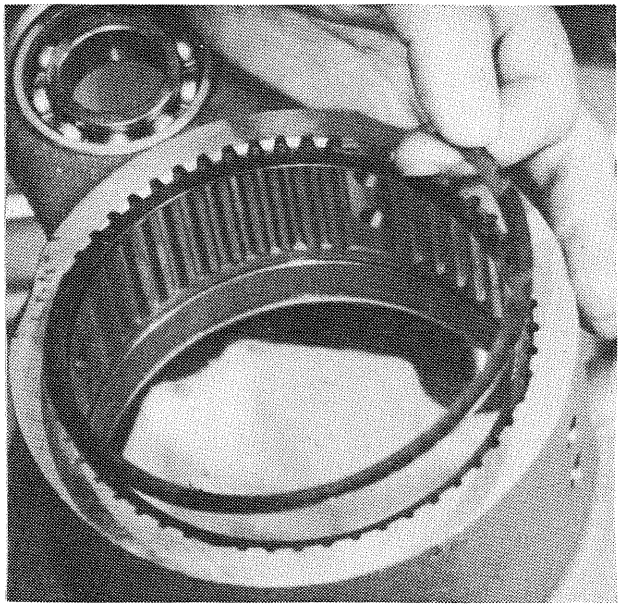


9. If the pump needs to be serviced, remove the drive gear and mounting plate. For pump service instructions, see page 4-55.

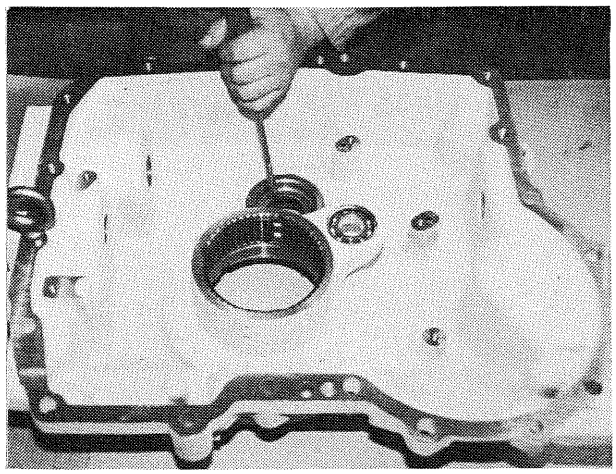


10. Remove the two flange screws securing the brake housing to the front cover. Install two of them in the lifting holes provided in the housing flange. Using a suitable pry bar, remove the brake housing.

Fig. 4-8 Disassembly of the Front Cover (2 of 3)



11. Remove the snap ring from inside the brake housing.



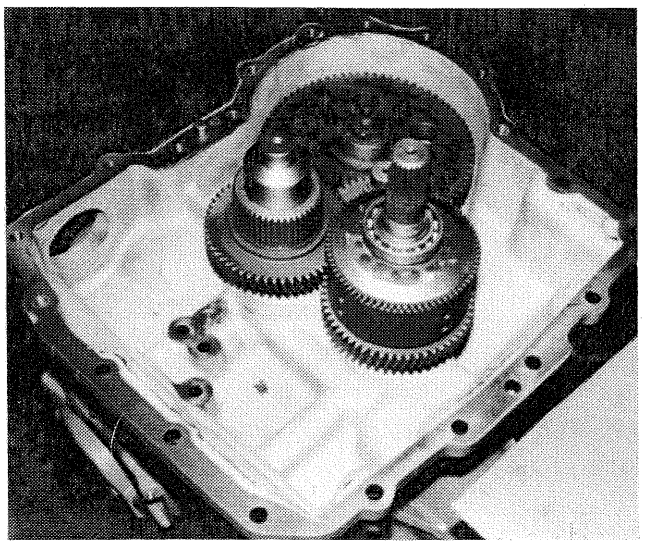
12. Remove the clutch shaft seal from the cover using a suitable driver.

NOTE: The seal should be replaced any time the front cover is removed.

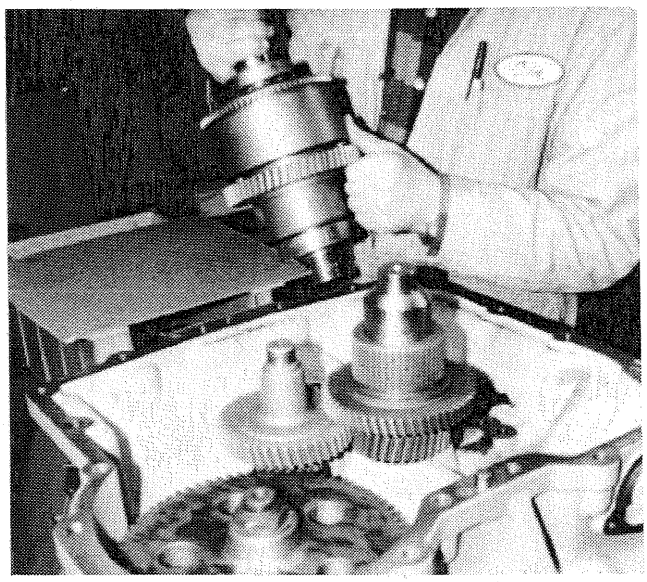
Fig. 4-8 Disassembly of the Front Cover (3 of 3)

Removal of Clutch Assembly, Intermediate Shaft, Pinion Shaft, and Pinion Drive Gear

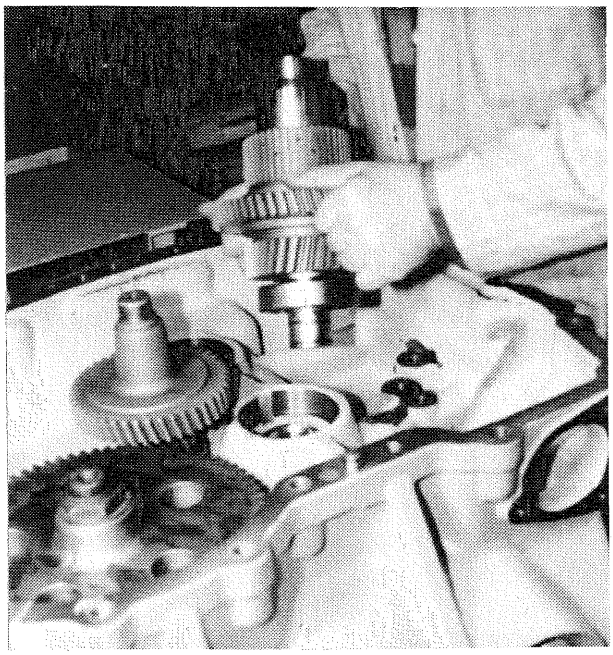
(See Figs. 4-5 and 4-6)



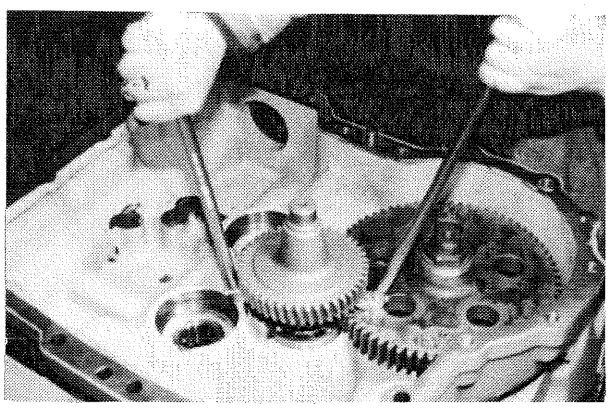
Arrangement of Low Mount PTO shown. On the High Mount PTO, the intermediate shaft is between the brake shaft and the clutch.



1. Lift the clutch assembly from the winch housing and set it aside for later disassembly.

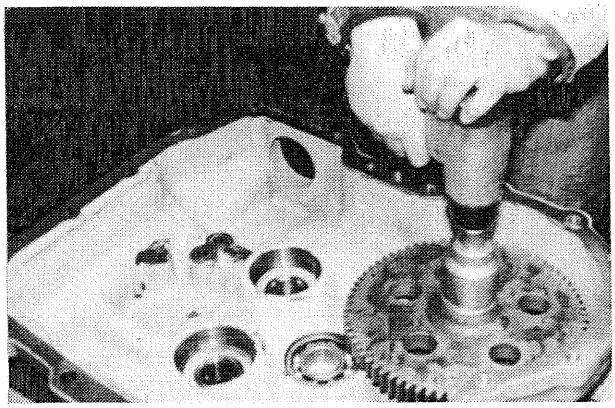


2. Lift the brake shaft assembly from the winch housing.

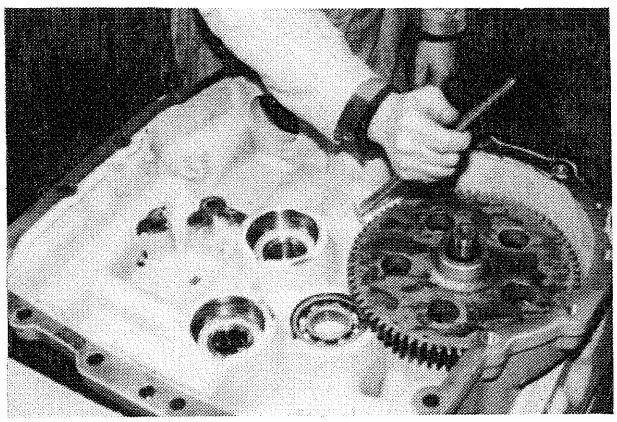


3. Using suitable pry bars, remove the intermediate shaft from the winch housing.

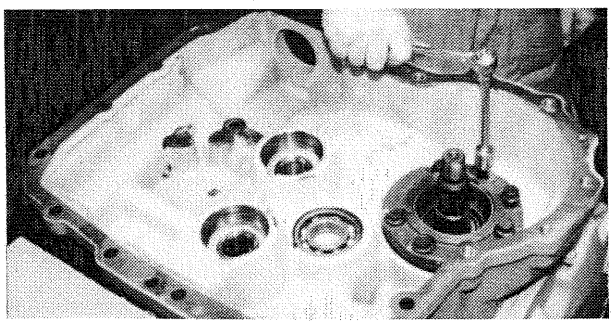
Fig. 4-9 Disassembly of the Gear Train (1 of 2)



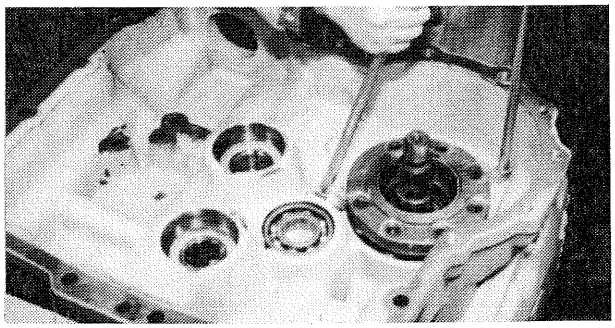
4. Remove the nut that secures the pinion drive gear to the pinion shaft. This nut is tightened to 675 N•m (500 lb-ft).



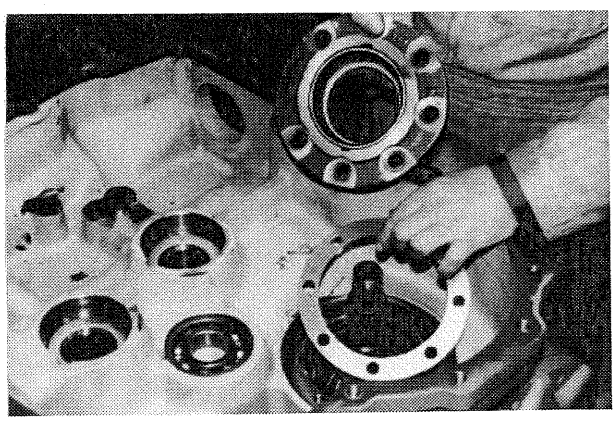
5. Use a suitable pry bar to remove the pinion drive gear from the pinion shaft.



6. Remove the seven capscrews securing the pinion carrier to the winch housing.



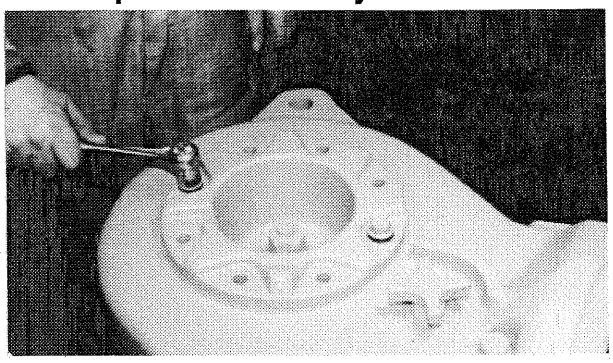
7. Use suitable pry bars to remove the pinion carrier from the winch housing.



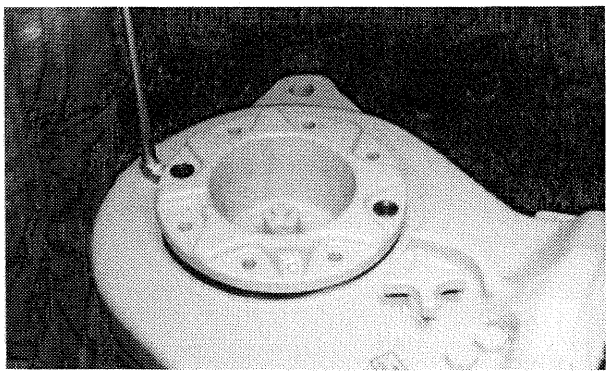
8. Remove the shim pack from beneath the pinion carrier.

Fig. 4-9 Disassembly of the Gear Train (2 of 2)

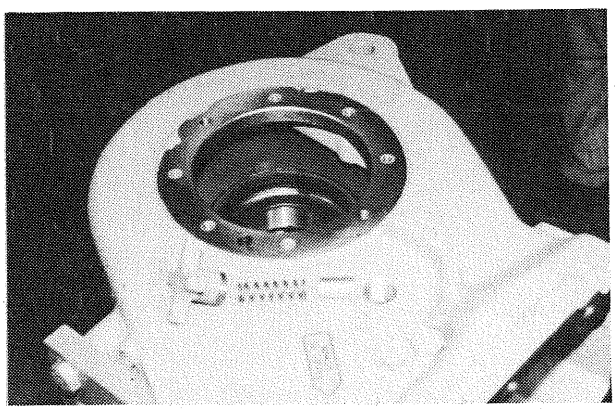
Removal of Pinion Gear, Ring Gear, Drum, Drum Shaft, and Freespool Assembly



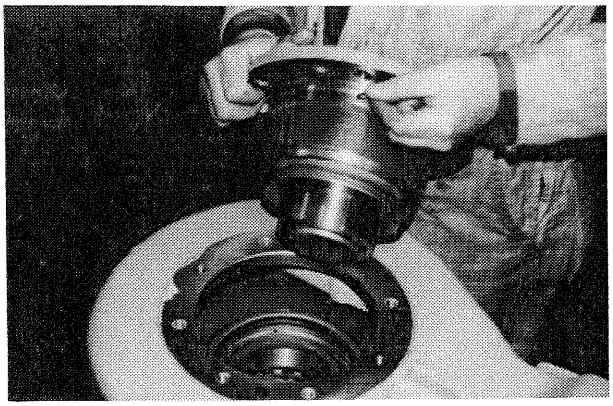
1. Remove the eight capscrews securing the right hand cover to the winch housing.



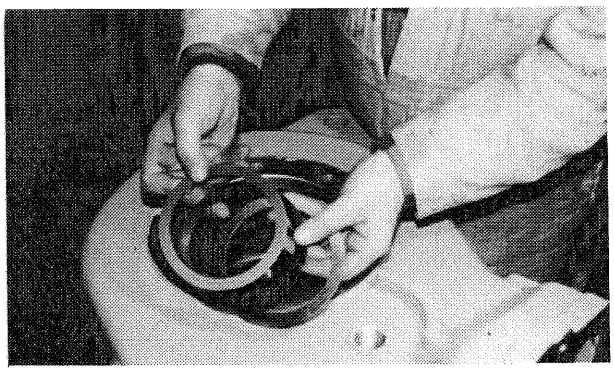
2. Use a pry bar under the cover to remove it from the winch housing.



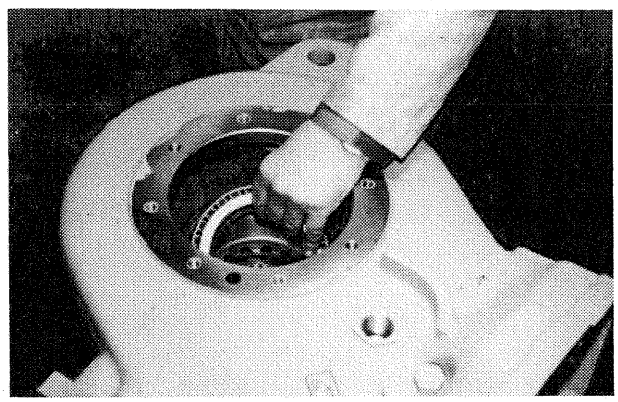
3. Remove FREESPOOL Drag adjustment Knob, Spring, and Pad.



4. Lift the cover from the housing. Do not lose the O-Ring.

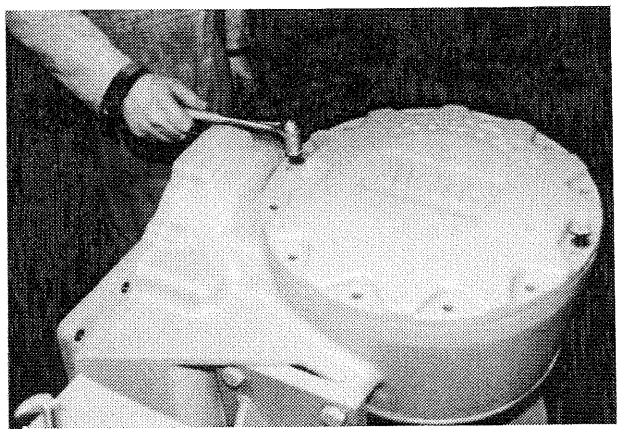


5. Remove the shim pack and save for later reuse.

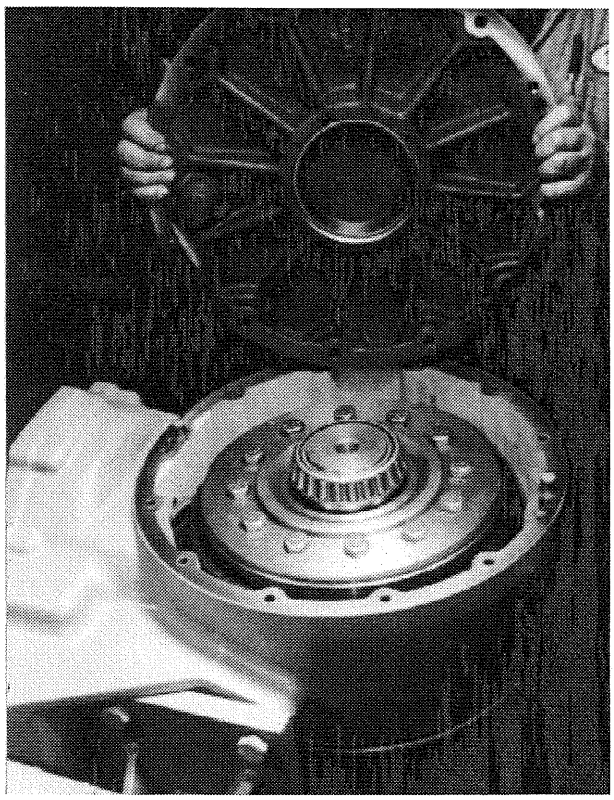


6. Remove the tapered roller bearing from the drum.

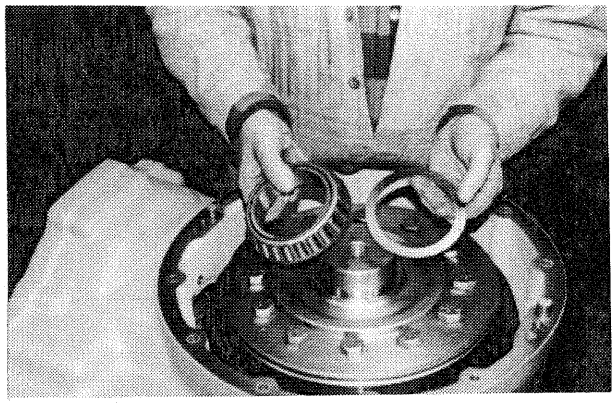
Fig. 4-10 Removal of Drum & Shaft, and Ring Gear (1of 4)



7. Turn the winch on the other side and remove the twelve capscrews securing the left hand cover to the winch housing.



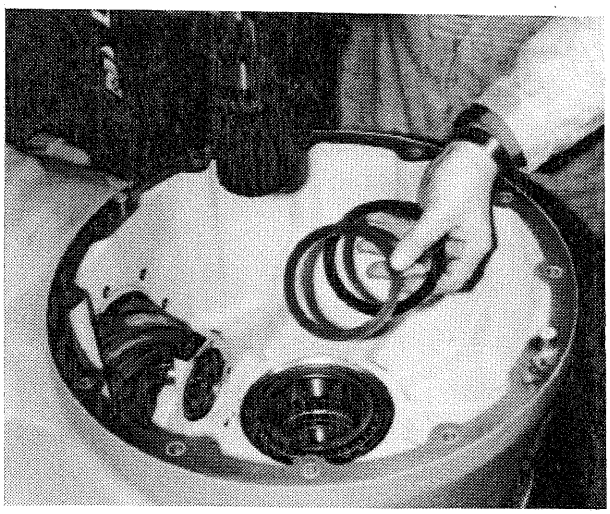
8. Lift the cover from the housing. Use the jacking bolt locations.



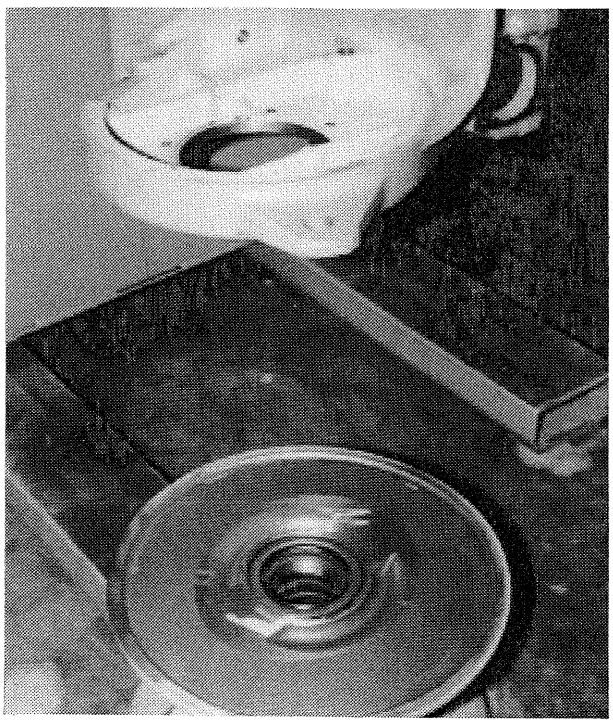
9. Remove the tapered roller bearing and shim pack from the drum shaft.

10. Attach a lifting eye in the end of the drum shaft and use a suitable lifting device to pull the drum shaft from the housing.

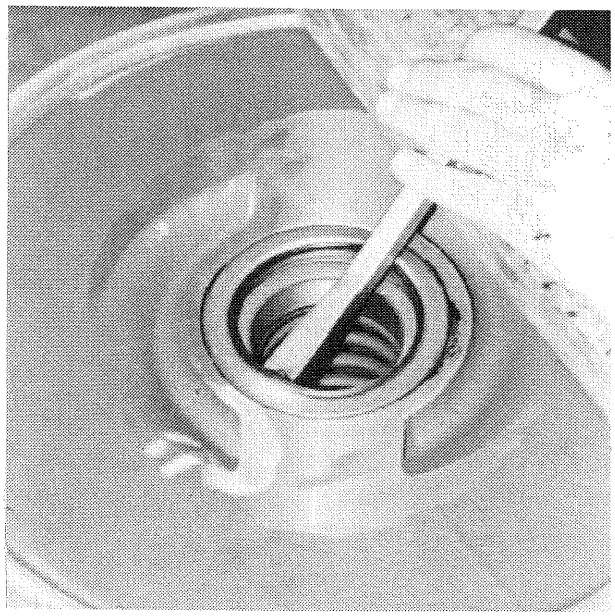
Fig. 4-10 Removal of Drum & Shaft, and Ring Gear (2 of 4)



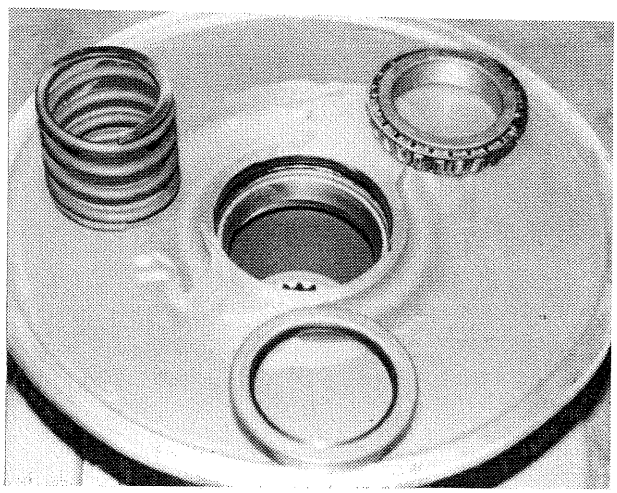
11. Remove the shim pack from under the drum shaft as it is withdrawn. Be aware that the bearing on the bottom of the drum shaft can fall off.



12. Remove the Drum from the Winch Housing by lining up the slot in the frame with the ferrule pocket in the drum.

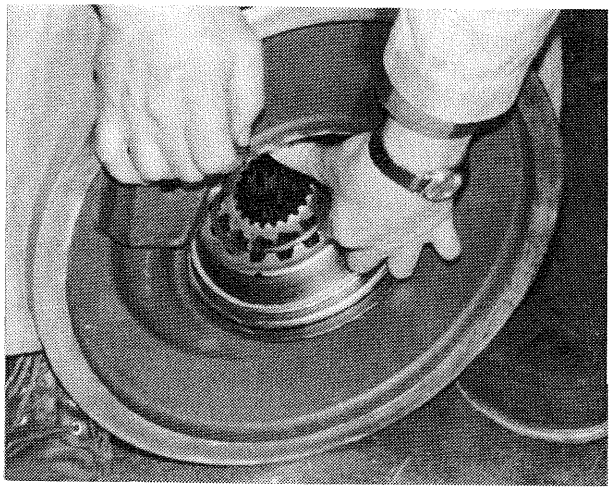


13. Use a pry bar to remove the oil seal from the inside of the drum.

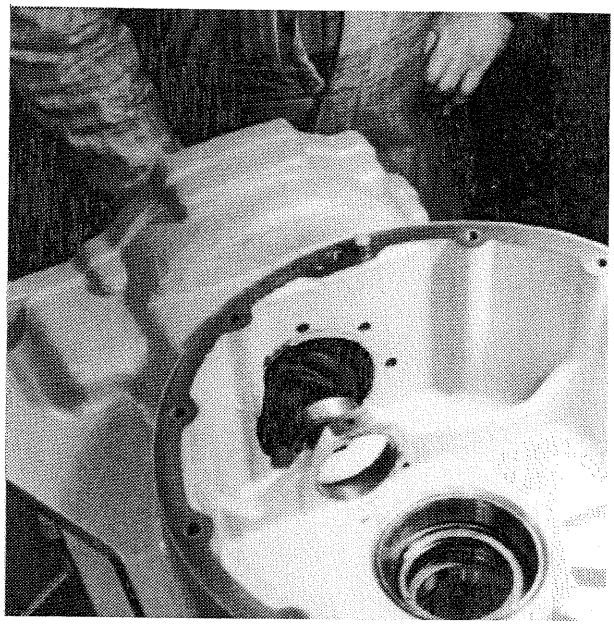


14. Remove the bearing and freespool return spring from the inside bore of the drum.

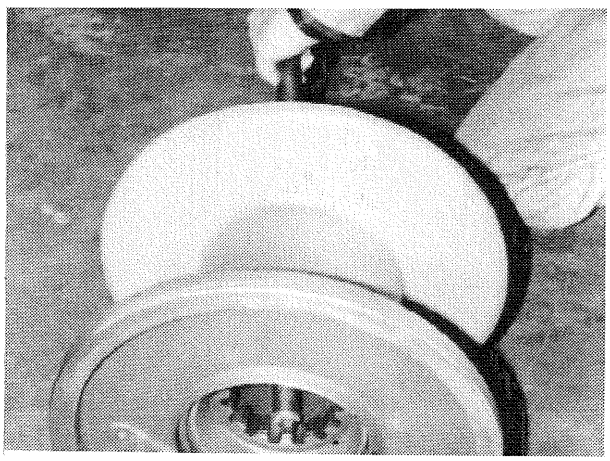
Fig. 4-10 Removal of Drum & Shaft, and Ring Gear (3 of 4)



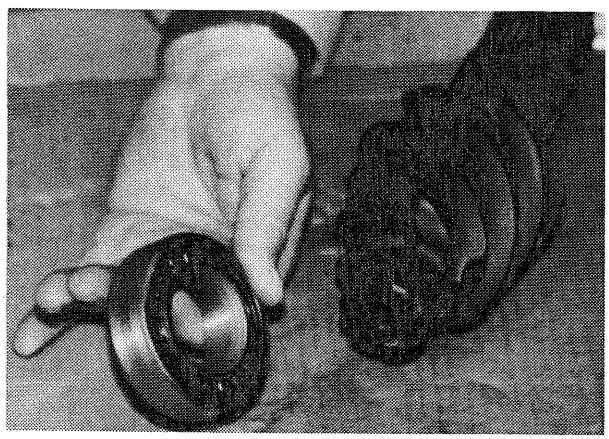
15. Turn the drum over and remove the internal snap ring and the freespool coupler.



17. Remove the pinion gear shaft and nose bearing from the winch housing.



16. If necessary, use suitable drivers to remove the drum shaft bearing cup and the torque ring from the drum.

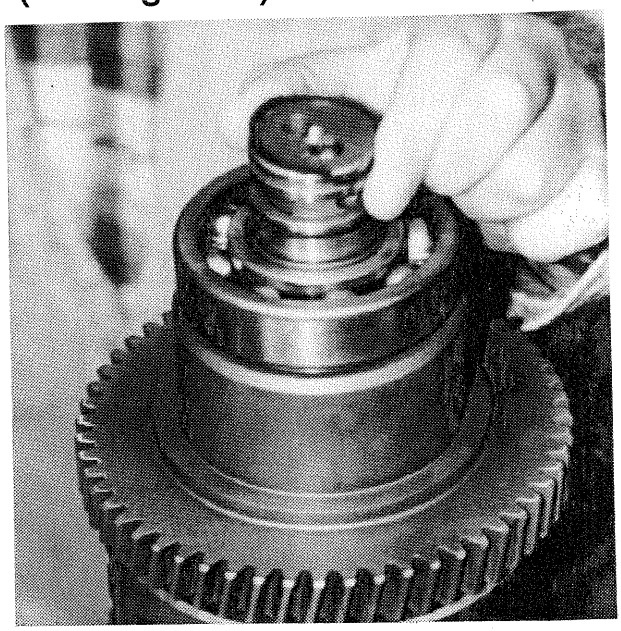


18. Remove the nose bearing from the pinion gear shaft. A press is required for this operation.

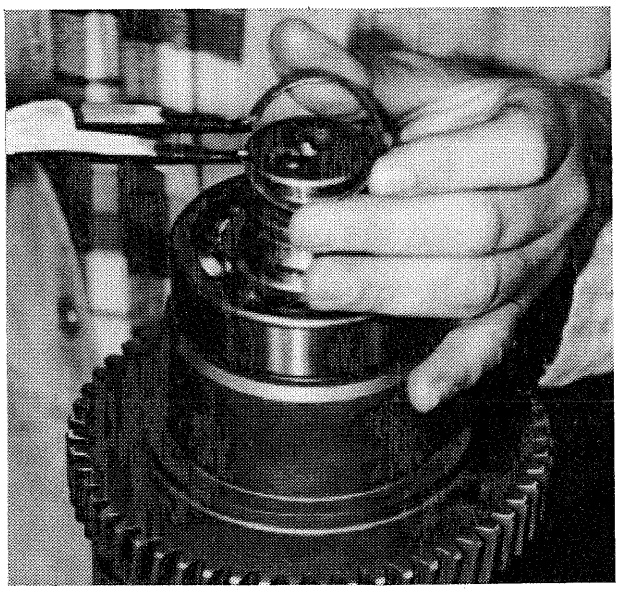
NOTE:
Inspect all gears and bearings for excessive wear, pitting, or other damage.

Fig. 4-10 Removal of Drum & Shaft, and Ring Gear (4 of 4)

Disassembly of the Clutch (See Fig. 4-12)

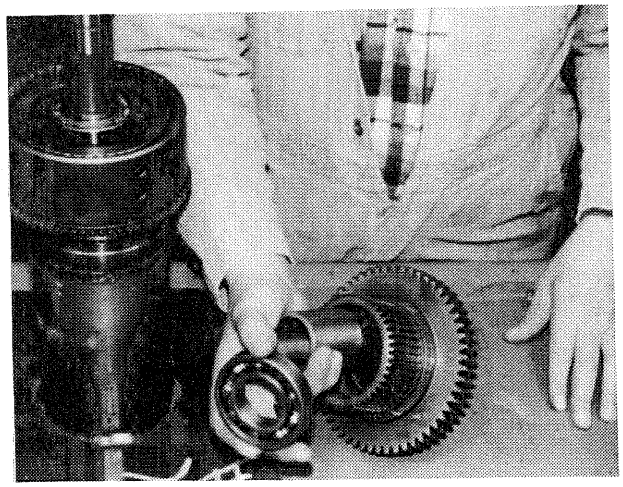


1. Remove the two seal rings from the end of the clutch shaft.

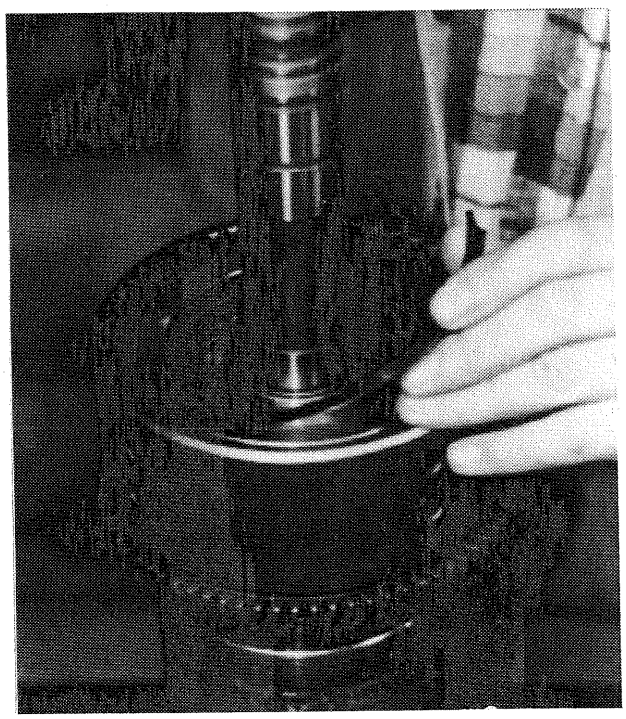


2. Remove the snap ring that secures the roller bearing to the clutch shaft. Remove the bearing and the second snap ring.

(See Fig. 5-7 for PFR winches)

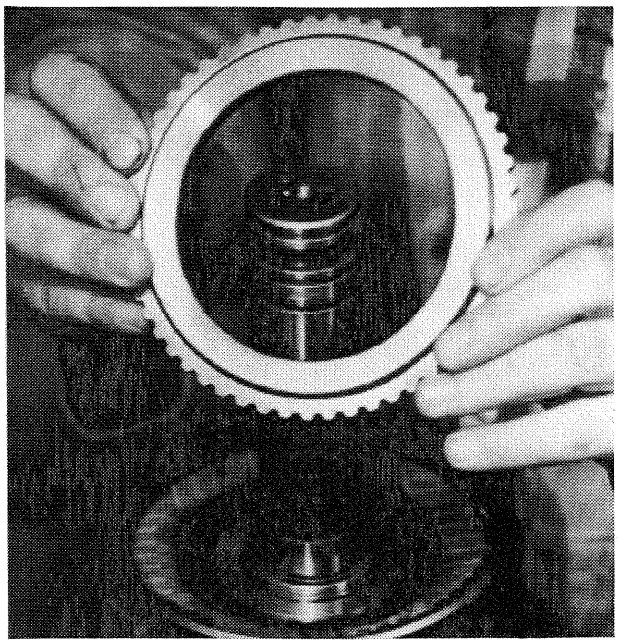


3. Withdraw the clutch hub. Remove the spacer and roller bearing that are located inside the clutch hub.

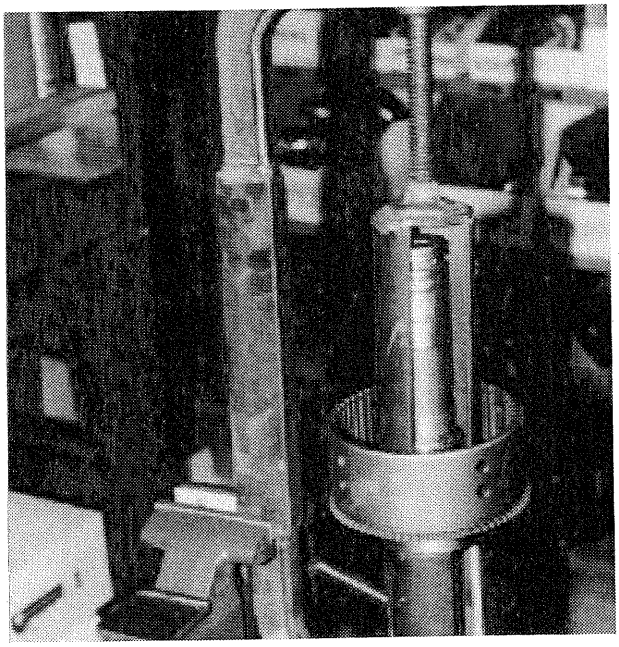


4. Remove the snap ring from the inside of the clutch housing.

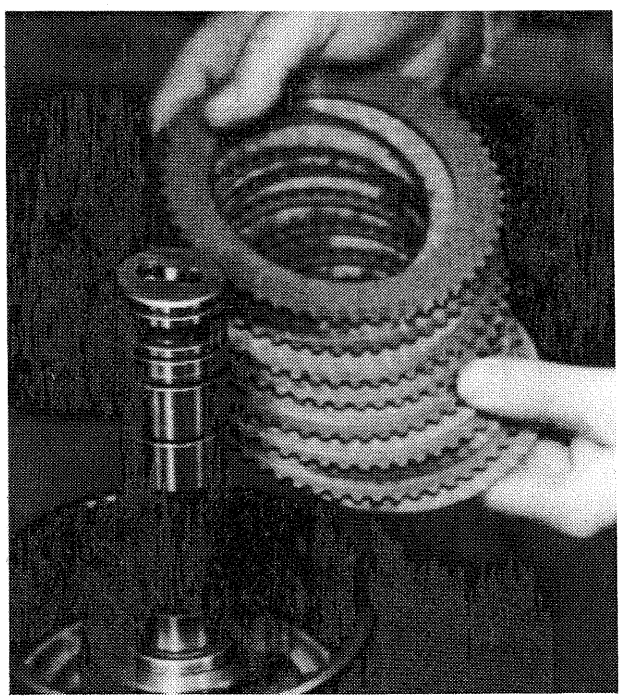
Fig. 4-11 Disassembly of the Clutch (1 of 3)



5. Remove the pressure plate.



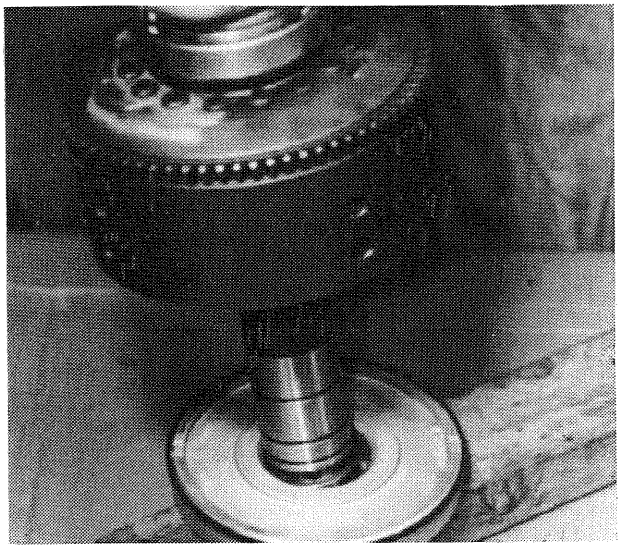
7. Use a spring compressor as shown to compress the clutch spring and guide.



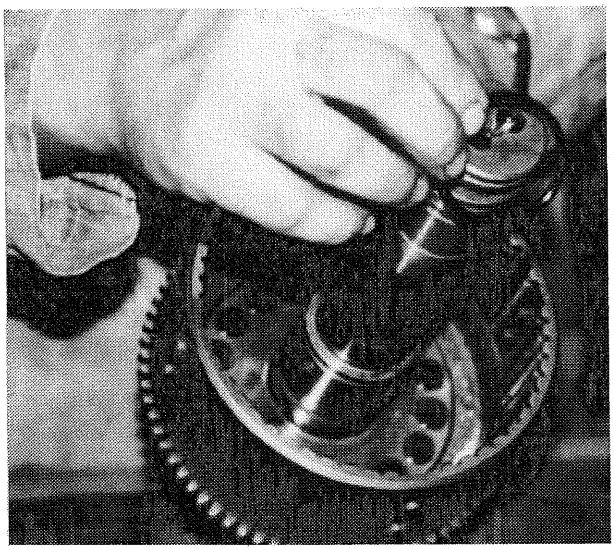
6. Remove the separator plates and friction discs from the clutch housing.

8. Remove the snap ring from the clutch shaft and withdraw the spring guide and spring.

Fig. 4-11 Disassembly of the Clutch (2 of 3)



9. Invert the clutch housing and shaft assembly and gently tap the end of the shaft on a soft board to remove the clutch piston.



10. Remove the O-Ring that is located on the clutch shaft at the bottom of the housing.

Fig. 4-11 Disassembly of the Clutch (3 of 3)

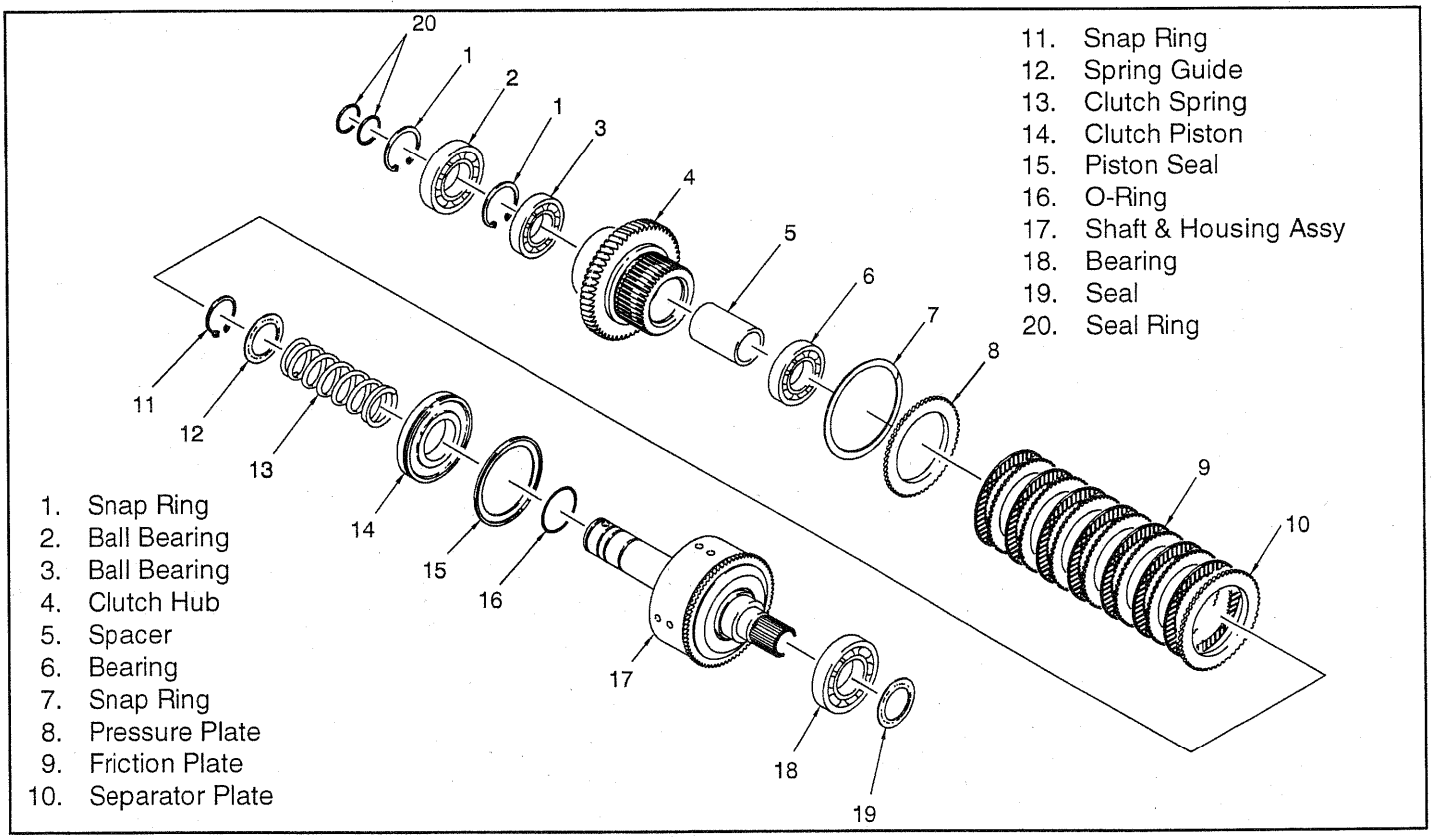


Fig. 4-12 Clutch Assembly

ASSEMBLY OF THE WINCH

All components should be inspected for wear or damage as they are removed. Refer to Table 4-1, Visual Inspection. All seals that were removed should be replaced during assembly. Any component that indicates excessive wear or damage should be replaced.

The following procedures are in a sequence that assumes a complete overhaul.

Repair of Hydraulic System Components

To repair any of the hydraulic components, the winch must be removed from the tractor and the front cover removed from the winch.

Most of the parts of the control valve can be replaced. If the valve spool bore is worn or damaged so that the winch performance has changed, the entire valve should be replaced.

If the accumulator will not stay charged as described in Section 3, it must be replaced.

If the hydraulic pump flow is not as described in Section 3, the pump should be repaired or replaced.

Visual Inspection

ITEM	INSPECTION	ACTION
Ring & Pinion Gear	Check for an uneven wear pattern.	Check clearance between the pinion gear and the bevel gear. These gears are matched and must be replaced as a unit.
Pinion Shaft Bearings	Inspect bearings for wear or damage.	Replace defective bearings.
Pump Drive	Check both gears for wear.	Replace a worn or damaged gear.
PTO Shaft	Check for grooves or other damage on the machined surfaces.	Repair the surface or replace the shaft.
	Check the snap rings.	Replace any snap ring that will not hold a bearing in position on the shaft.
Clutch Assembly	Make sure that the oil passages are clean.	Clean oil passages with a small brush. Blow passages clear with compressed air.
	Check the friction discs for wear, distortion, or damage. Minimum thickness of wear surface per side: 0.5 mm (.020 in). Maximum thickness of friction disc: 3.28 mm (.129 in).	Replace the friction discs if the oil grooves are worn away, or the discs are burned, damaged, or warped. If the discs are being replaced due to overheating, the clutch return spring should also be replaced.
	Check that the separator plates are flat, free of large blue areas (caused by overheating) or damaged surfaces.	Replace damaged separator plates.
	Inspect the piston housing and piston for cracks and damage. Make sure that the O-Ring grooves and sealing surfaces are in good condition.	Replace a damaged piston or piston housing.
	Inspect clutch shaft bearings for wear or damage.	Replace worn or damaged bearings.

Table 4-1 Visual Inspection (1 of 2)

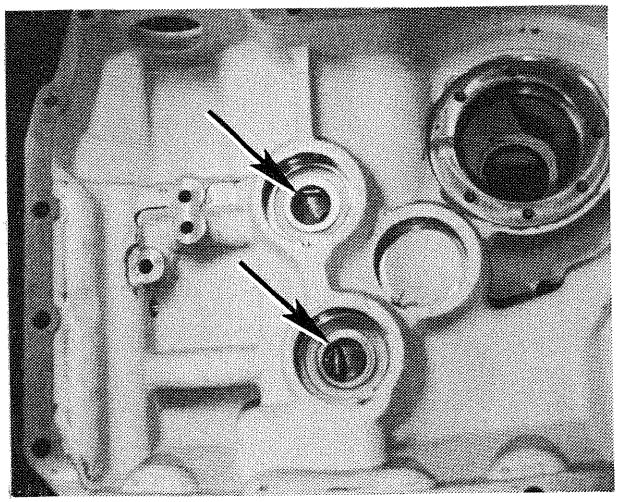
Visual Inspection (continued)

ITEM	INSPECTION	ACTION
Control Valve	Check for damaged or worn parts if the performance of the valve is not correct.	Repair or replace control valve.
Oil Brake Assembly	Check for a cracked or broken conical washer spring.	Replace a damaged spring.
	Inspect the oil brake cover for leakage or damage.	Repair or replace the cover if the sealing surfaces are damaged.
	Check the friction discs for wear, distortion, or damage. Minimum thickness of wear surface per side: 0.5 mm (.020 in). Maximum thickness of friction disc: 3.28 mm (.129 in).	Replace the friction discs if the oil grooves are worn away, or the discs are burned, damaged, or warped. If the discs are being replaced due to overheating, the clutch return spring should also be replaced.
	Check that the separator plates are flat, free of large blue areas (caused by overheating) or damaged surfaces.	Replace damaged separator plates.
	Inspect the piston housing and piston for cracks and damage. Make sure that the O-Ring grooves and sealing surfaces are in good condition.	Replace a damaged piston or piston housing.
	Inspect the brake hub and shaft for wear or damage.	Replace a damaged hub or shaft.
	Inspect brake shaft bearings for wear or damage.	Replace worn or damaged bearings.
Intermediate Gear and Shaft	Check shaft for damaged bearing surfaces. Check bearings for wear or damage.	Repair a surface with minor damage. Replace if shaft is badly worn or damaged. Replace worn or damaged bearings.
	Check for damaged teeth. Inspect the leading edge of the teeth for wear.	Replace if gear is worn or damaged.
Drum Shaft	Check for worn or damaged sealing surfaces.	Polish a lightly scored shaft. replace the shaft if damage is serious.
Freespool Assembly	Inspect parts for freedom of movement. Inspect splines for wear or damage. Inspect freespool piston for scoring.	Replace any worn or damaged parts. Remove light scoring on freespool piston with abrasive paper.
Drum	Inspect for cracks and excessive cable wear. Inspect inner surfaces of drum for scoring or damage. Inspect bearing races for damage or wear.	Replace a damaged drum. Light scoring on inner drum surfaces may be polished. Replace worn or damaged bearings.
Frame	Inspect the frame for cracks distortion and other damage. Inspect the clutch and brake shaft bores for excessive wear.	Replace a distorted or cracked frame. Remove sealing surface blemishes. A kit is available to repair worn clutch and brake shaft bores.

Table 4-1 Visual Inspection (2 of 2)

Assembly of the Frame

1. Clean the winch frame thoroughly. Blow any dirt or contamination from the frame and oil passages.



2. Inspect the clutch and brake shaft bores in the case. If you can see or feel grooves or scratches in the bores, they should be repaired.

3. To repair a case shaft bore, obtain a repair kit for each bore. See Parts Book.

4. The frame must be machined to accept the repair sleeve. The machining must meet the tolerances shown in the drawings to the right. De-burr all intersecting holes.

5. After machining the case, clean the area thoroughly, making sure to remove all metal chips. Clean the bores with solvent and blow them dry.

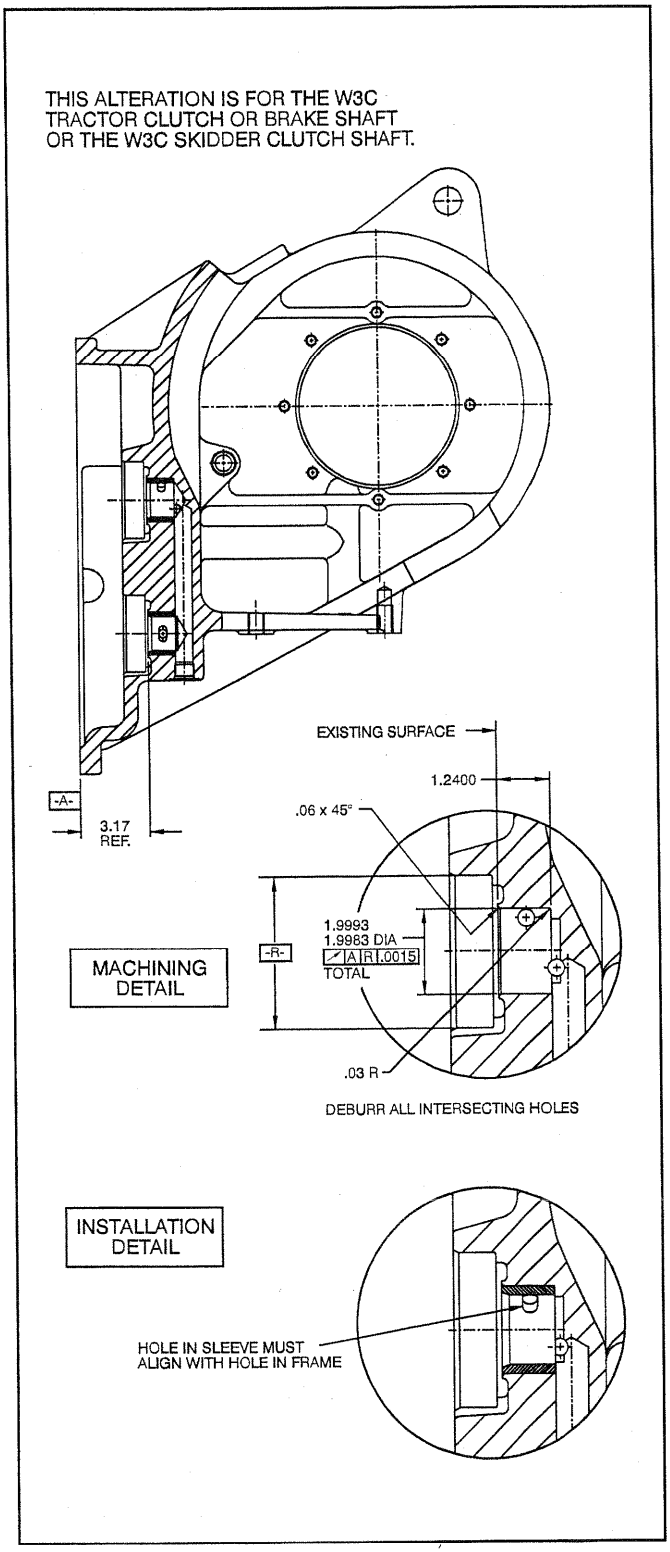
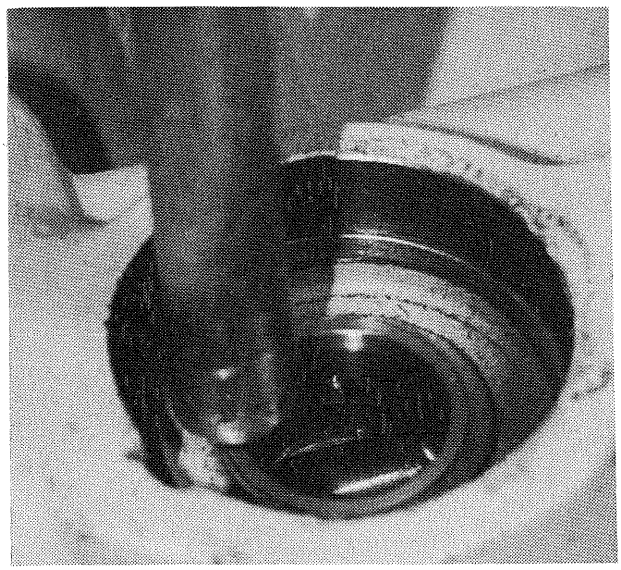
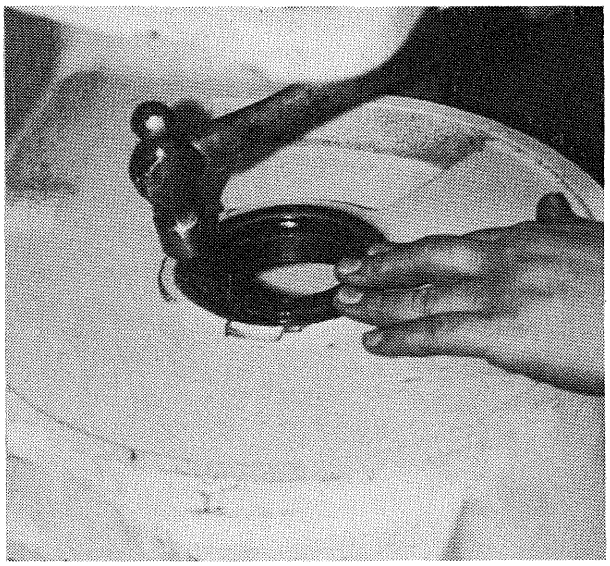


Fig. 4-13 Assembly of the Frame (1 of 2)



6. Using a suitable driver, install the sleeve into its bore in the frame. Before driving, put a bead of bearing lock compound (included with kit) in the sleeve bore in the case, below the hole that enters the bore from the side. Also, put a bead of bearing lock compound around the outer diameter of the sleeve on the end without the external chamfer. It is very important that the hole in the sleeve aligns with the oil passage in the case.

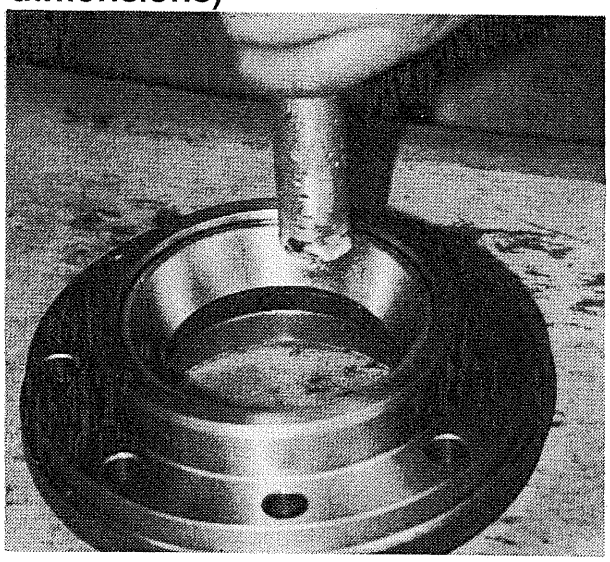


7. Install any pipe plugs that were removed from the case during disassembly. Use "PST" sealant (HCE 83) on the plug threads. Replace any O-Ring fittings that were removed from drilling passages.

8. Install a new drum shaft seal. Coat the outer surface of the seal with liquid gasket and install in the frame using an appropriate size seal driver.

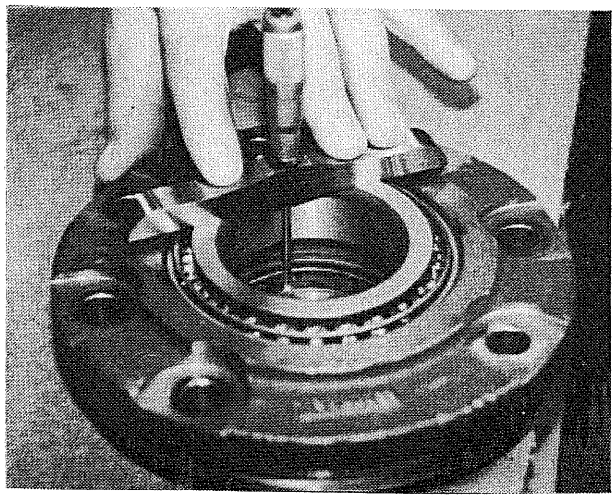
Fig. 4-13 Assembly of the Frame (2 of 2)

Ring Gear, Pinion & Drum Shaft (See Fig. 4-23 for set up dimensions)

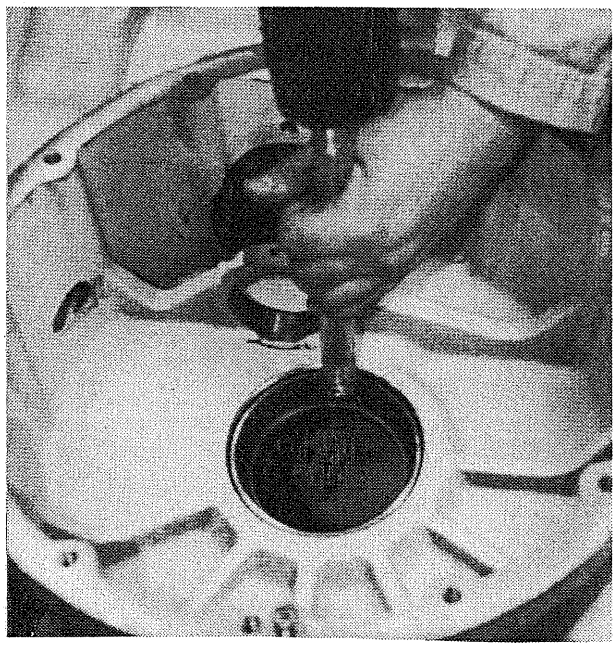


1. If required, install the roller bearing cups into the pinion carrier, using an appropriate driver.

2. Place the matching roller bearing cones into the cups and place the assembly on the workbench. Measure the distance from the outer face of the larger bearing cone to the mounting face of the bearing carrier. Record this measurement as dimension "K".

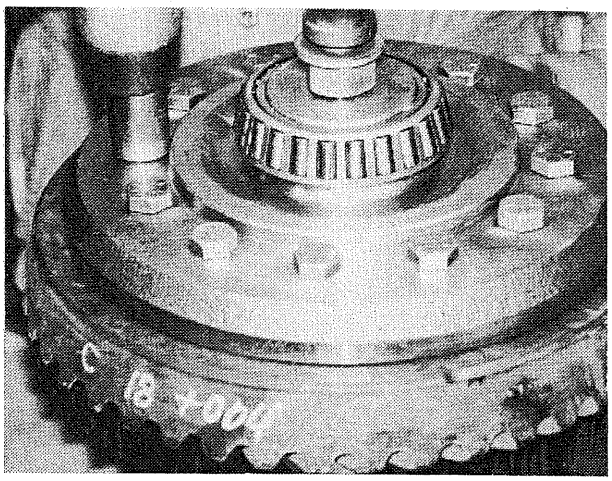


3. Turn the assembly over. Measure the distance from the outer face of the smaller bearing cone to the inner face of the larger bearing cone. Record this measurement as dimension "R".



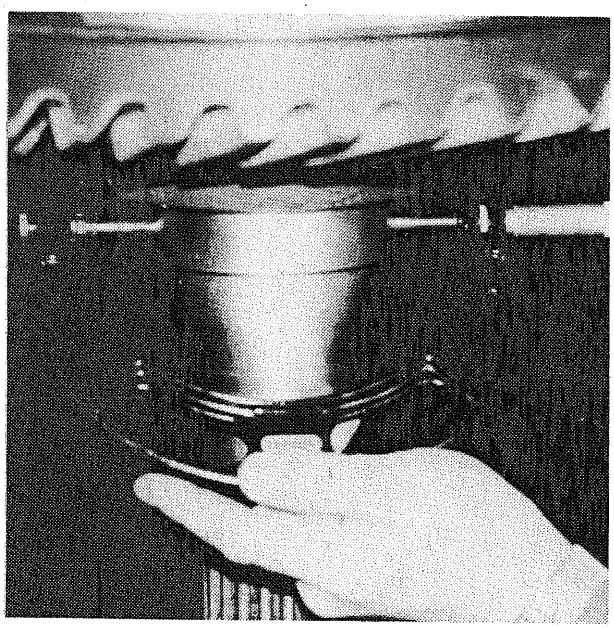
4. Install the larger of the two drum shaft bearing cups in the frame, using an appropriate bearing driver. Place the matching bearing cone into the cup.

Fig. 4-14 Ring Gear, Pinion & Drum Shaft (1 of 5)

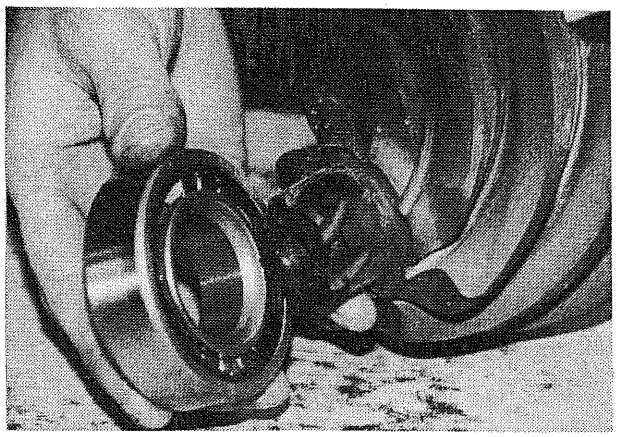


5. Attach the ring gear to the drum shaft using 12 capscrews and nuts. Tighten the nuts to 220 N•m (165 lb-ft).

NOTE: The ring gear must be heated to 82° C (180° F) to allow for assembly.

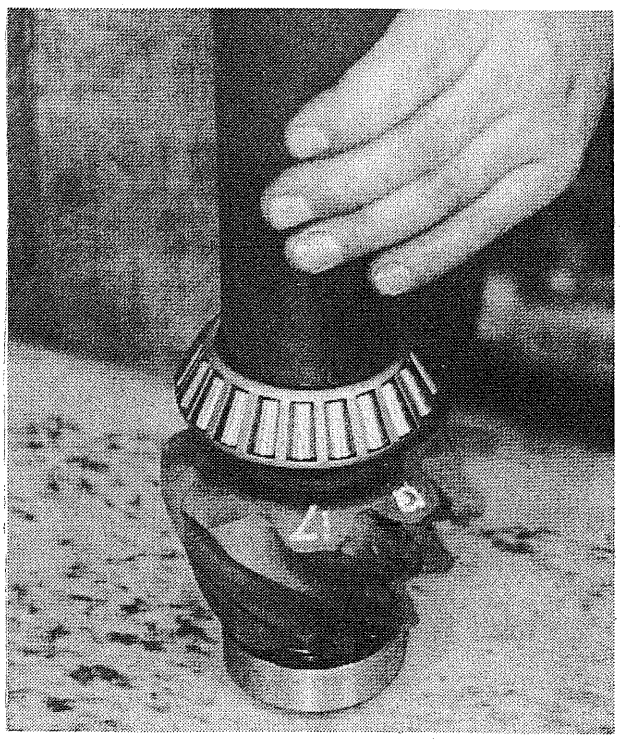


6. After the ring gear has cooled, measure the diameter of the drum shaft at the surface above the bearing shoulder. Record this measurement as dimension "M".



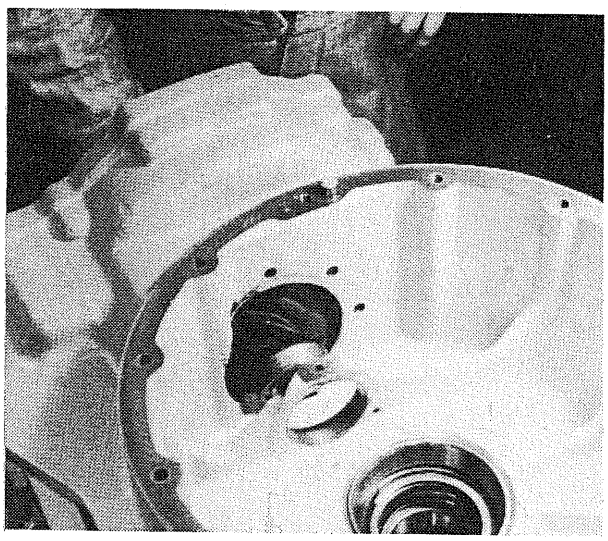
7. Fit the roller bearing onto the end of the pinion shaft, and secure with the snap ring.

NOTE: The tapered end of the inner race must face toward the gear.

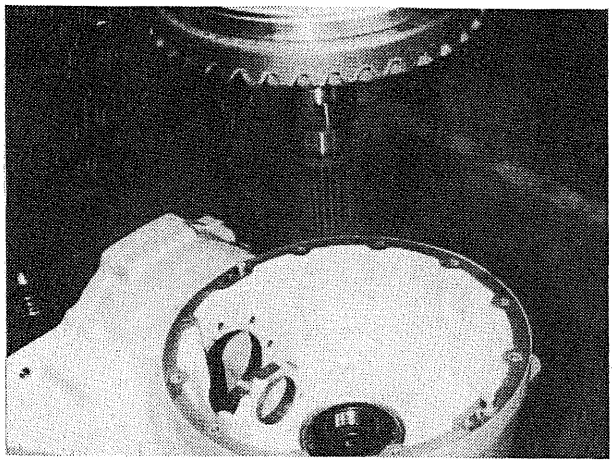


8. Install the pinion shaft bearing cone onto the other end of the shaft, using an appropriate driver.

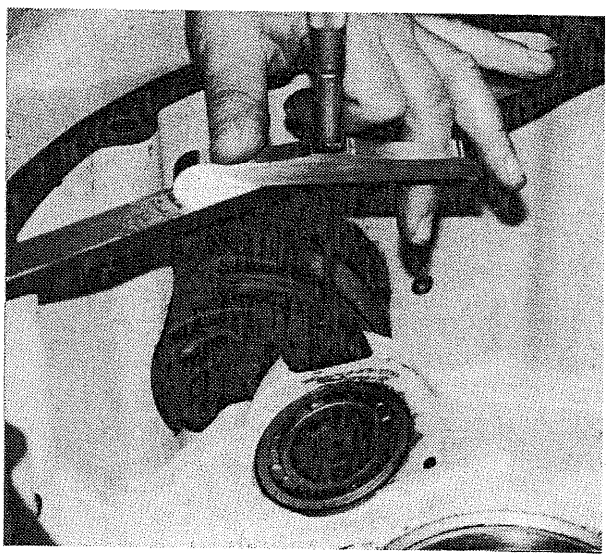
Fig. 4-14 Ring Gear, Pinion and Drum Shaft (2 of 5)



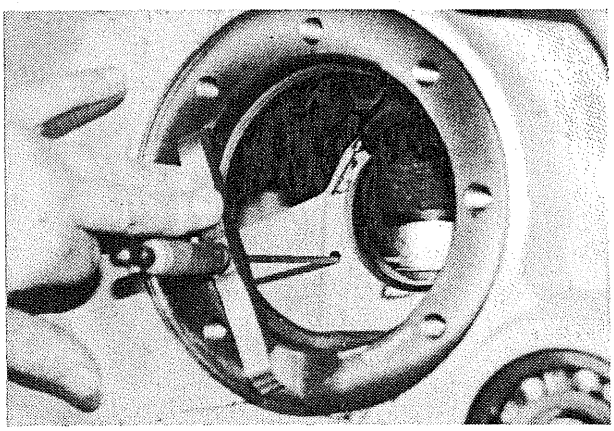
9. Fit the pinion into the case. Install so that the nose bearing fits into its bore in the case.



11. Remove the pinion shaft and bearing assembly. Fit the drum shaft and gear assembly into the frame, and seat it into its bearing.

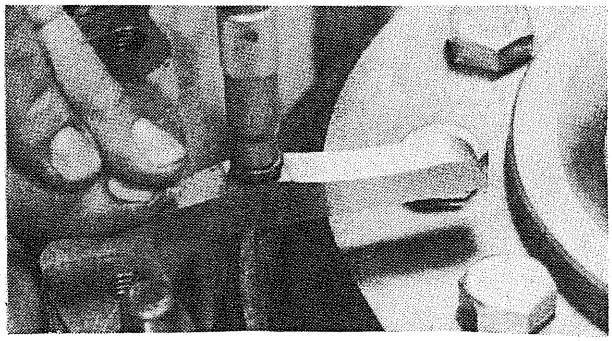


10. Using the access hole in the nose bearing housing, measure the distance from the LH side cover mounting surface to the outer race of the nose bearing. Record this measurement as dimension "W". Add 35.92 mm (1.414") to dimension "W" and record as dimension "X".

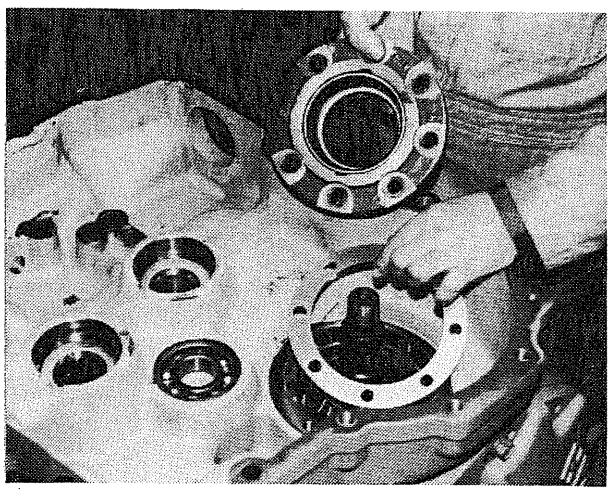


12. Using the access hole in the housing, measure the distance from the pinion carrier mounting surface to the shoulder on the drum shaft. Record this as dimension "L". Divide dimension "M" by 2 and add to dimension "L". Record this as dimension "P". Subtract dimension "K" from dimension "P". Record this as dimension "N". Subtract dimension "N" from 195.28 mm (7.688"). This is the correct shim pack thickness between the pinion carrier and the frame. Use shims to create the correct thickness.

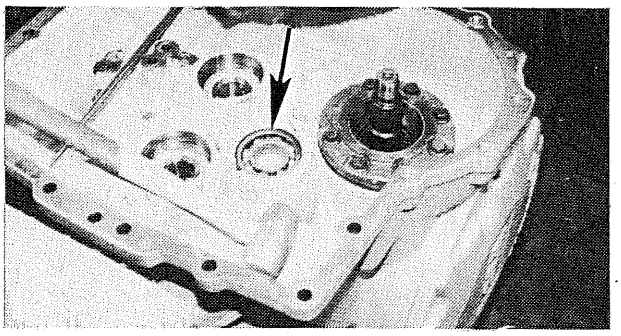
Fig. 4-14 Ring Gear, Pinion and Drum Shaft (3 of 5)



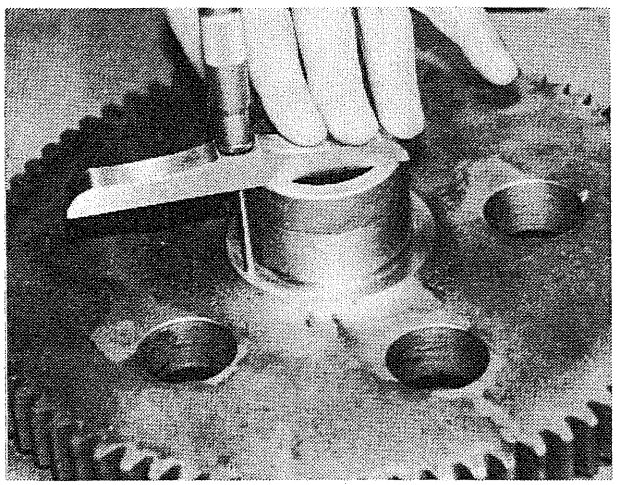
13. In three equidistant places, measure the distance from the LH cover mounting surface to the flat surface of the ring gear. Record these dimensions as "Y1", "Y2" and "Y3". Add "Y1", "Y2" and "Y3" together and divide the total by 3. Record this as dimension "Y". Subtract dimension "Y" from dimension "X". Record this as dimension "Z". Subtract dimension "Z" from 81.99 mm (3.228"). This is the correct shim pack thickness between the drum shaft shoulder and the drum shaft frame bearing. Use shims to create the correct shim pack thickness.



14. Install shim packs as measured. Fit the pinion shaft and secure with 7 flange screws. Tighten the flange screws to 110 N•m (80 lb-ft).



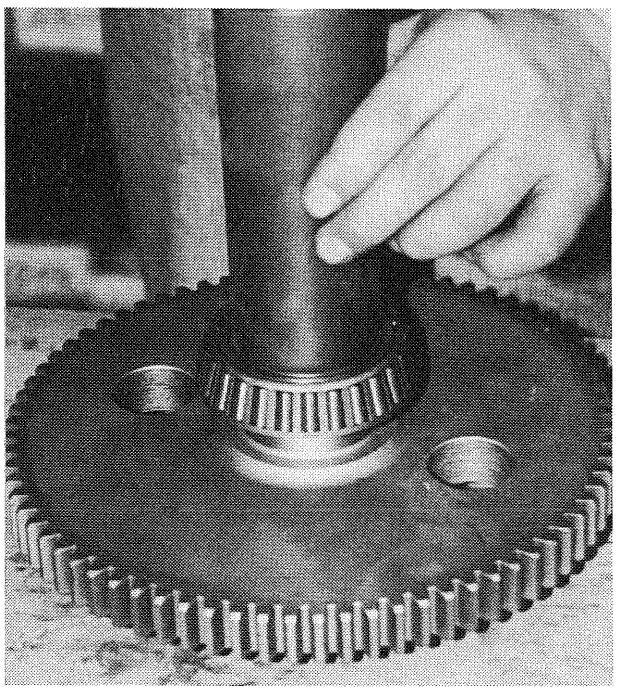
15. Fit the intermediate shaft bearing into its bore in the case.



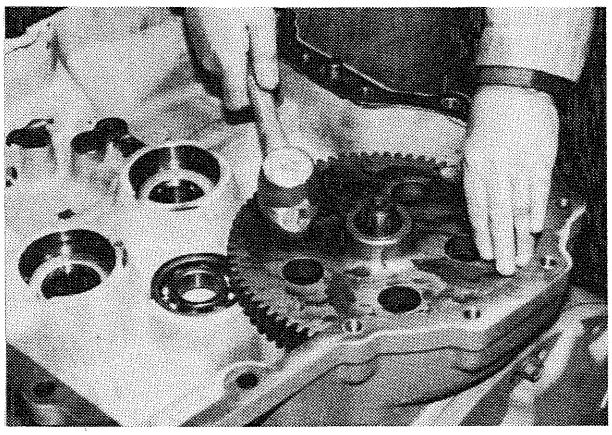
16. Place the pinion shaft driver gear on the workbench with its hub facing up. Measure the distance from the face of the hub to the bearing seat shoulder on the gear. Record this as dimension "S". Subtract dimension "S" from dimension "R". This is the correct shim pack thickness between the inner pinion bearing and the face of the gear hub. Use shims to create the correct thickness.

Fig. 4-14 Ring Gear, Pinion and Drum Shaft (4 of 5)

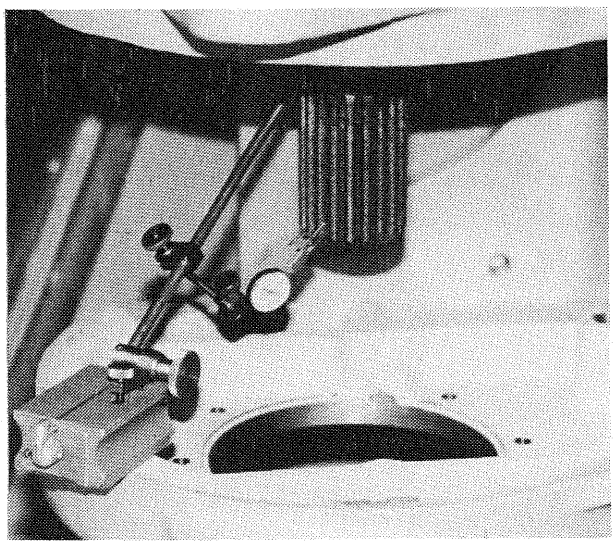
17. Install the shim pack as measured.



18. Press the outer bearing cone onto the gear hub using an appropriate driver.



19. Fit the pinion drive gear onto the pinion shaft and secure with the nut and washer. Tighten the nut to 675 N•m (500 lb-ft).

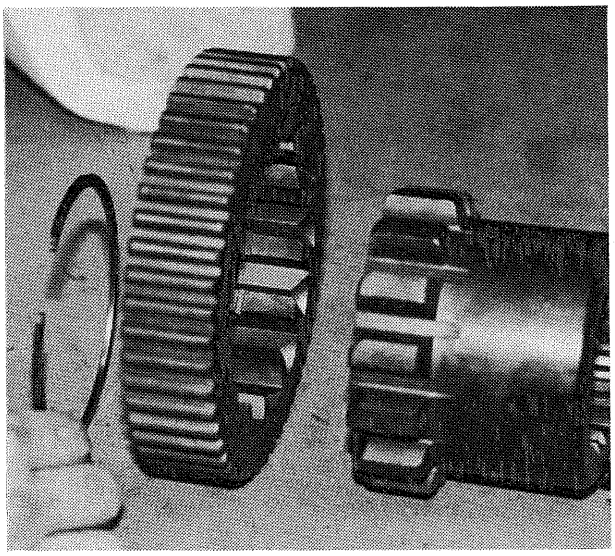


20. Using a dial indicator, measure the backlash at the splined end of the drum shaft. Adjust the drum shaft shim pack to achieve .051-.076 mm (.002 - .003") at this point.

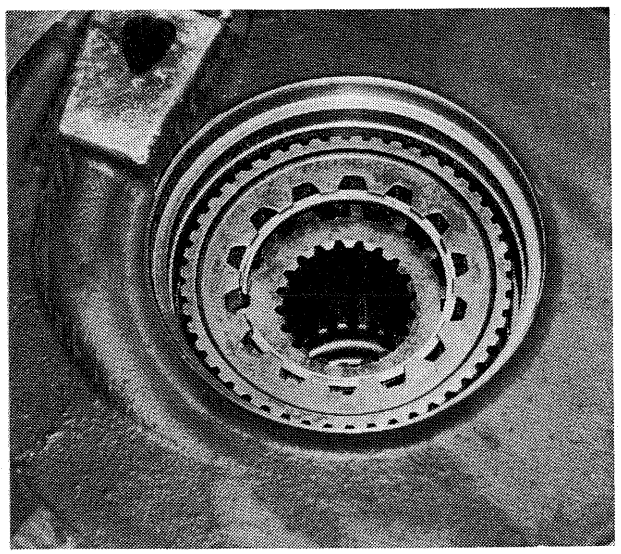
NOTE: This translates to 0.457 mm (.018") at the gear mesh point.

Fig. 4-14 Ring Gear, Pinion and Drum Shaft (5 of 5)

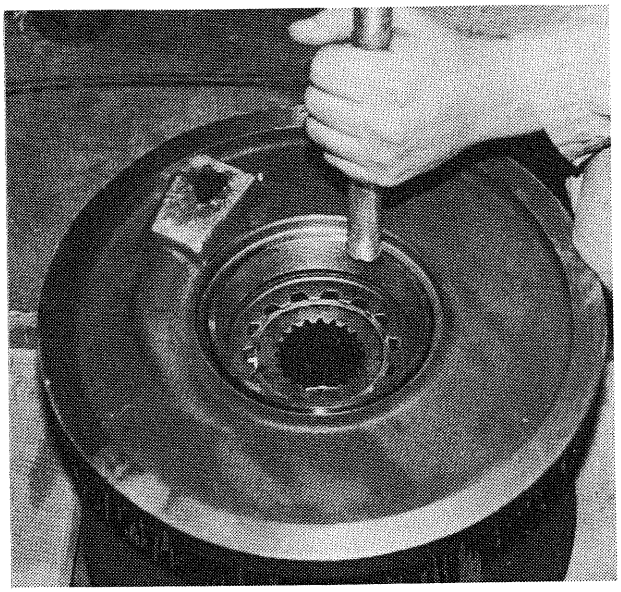
Drum Assembly



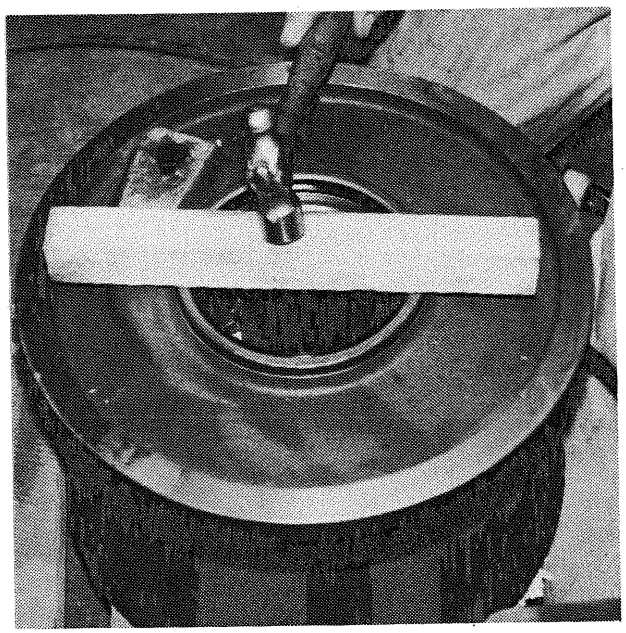
1. Fit the coupler and snap ring into the torque ring.



2. Fit the torque ring assembly into the drum with the snap ring facing outward.

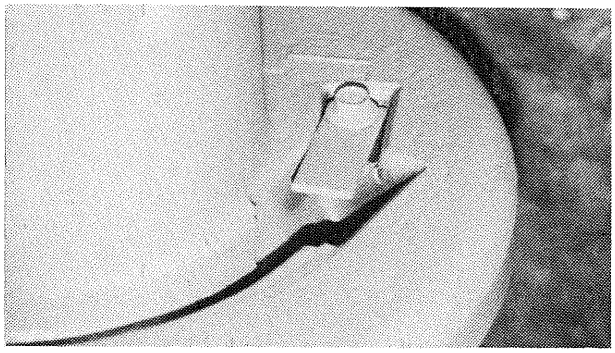


3. Install the bearing cup using an appropriate driver.

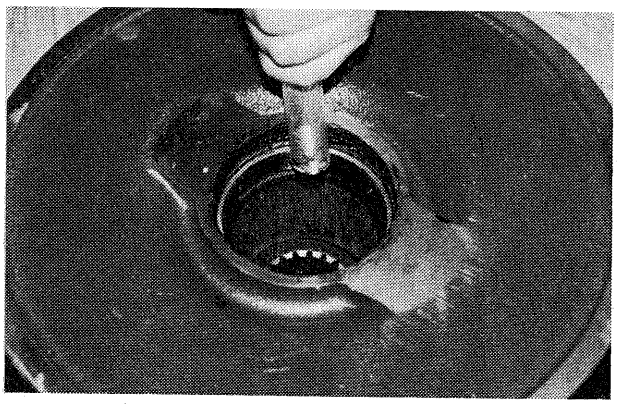


4. Coat the oil seal bore with liquid gasket. Install the seal with an appropriate seal driver. The seal lip must face inward.

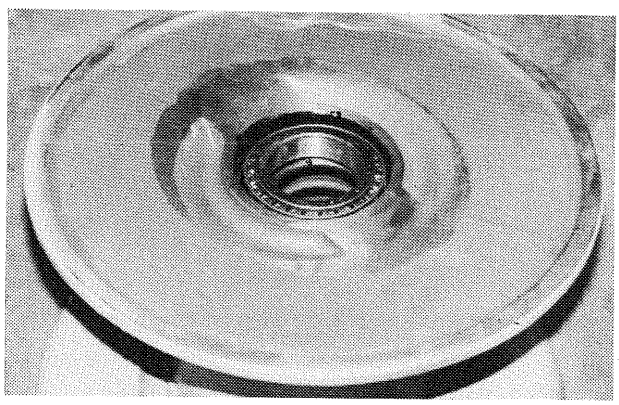
Fig. 4-15 Drum & Freespool Assembly (1 of 7)



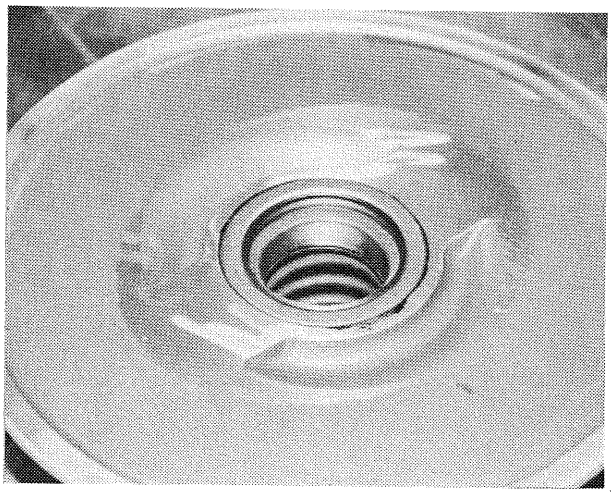
5. Turn the drum over (small end up). Fit the ferrule keeper and install the retaining cap screw finger tight.



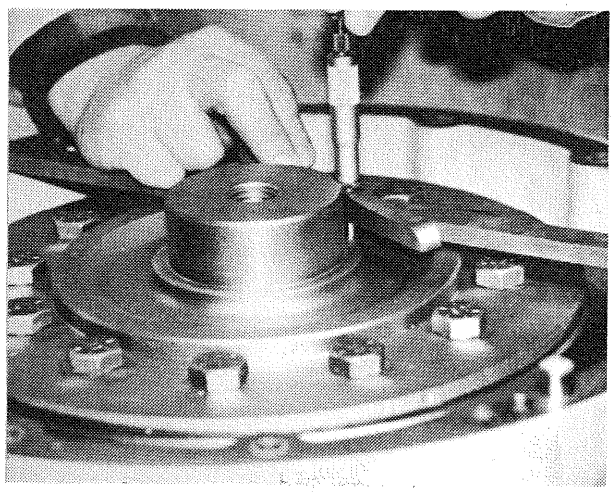
6. Press the bearing cup into its bore using an appropriate driver.



7. Fit the spring and bearing cone. Coat the seal bore with liquid gasket.

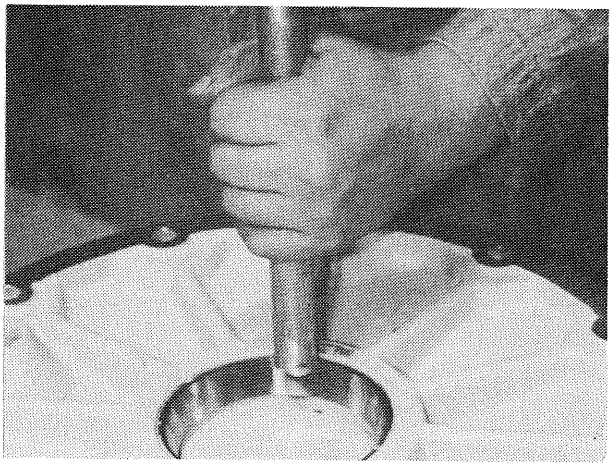


8. Press the seal into its bore using an appropriate driver. The dirt exclusion lip must face outward.

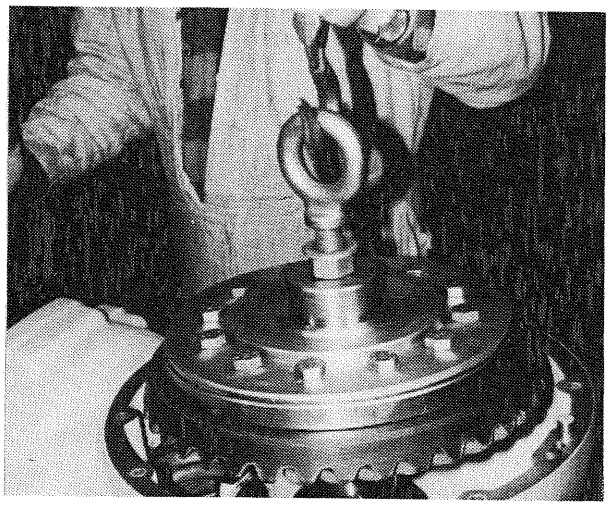


9. With the drum shaft in place and the ring and pinion gears properly shimmed, measure the distance from the LH cover mounting face on the frame to the bearing seat shoulder on the drum shaft. Record this measurement as dimension "B".

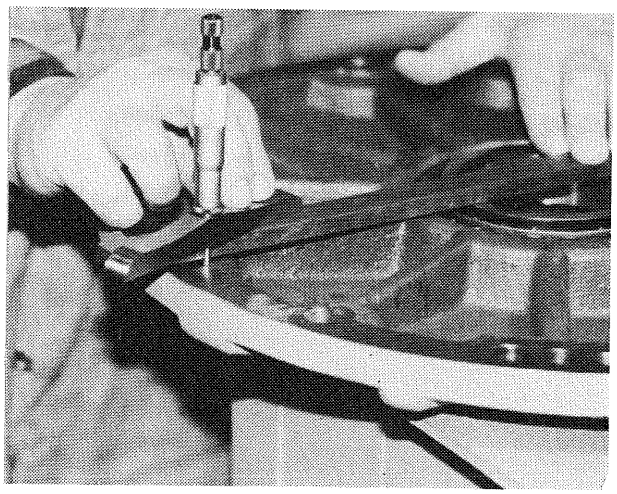
Fig. 4-15 Drum & Freespool Assembly (2 of 7)



10. Place the LH cover on the workbench with the mounting face up. Install the bearing cup with an appropriate driver.

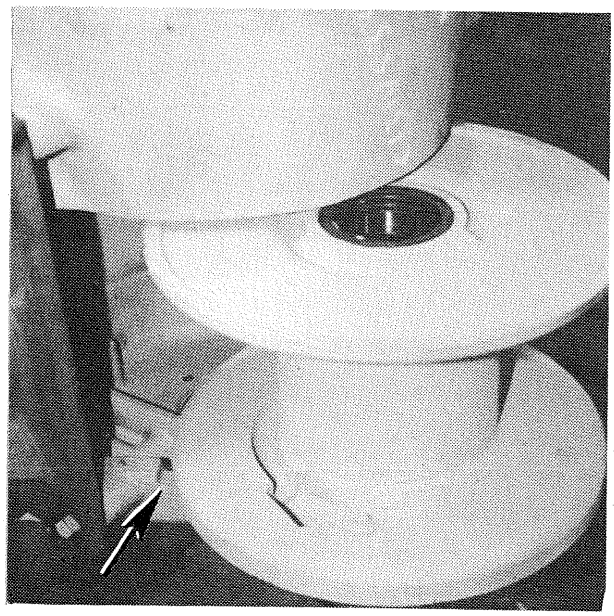


12. Remove drum shaft assembly, using care not to dislodge the shim pack.



11. Place the drum shaft bearing cone into its cup in the bearing carrier. Measure the distance from the face of the bearing cone to the mounting face of the LH cover. Record this measurement as dimension "C".

NOTE: "B" - "C" + 0.051 mm (.002") = Shim Pack. Use shims to create required thickness.

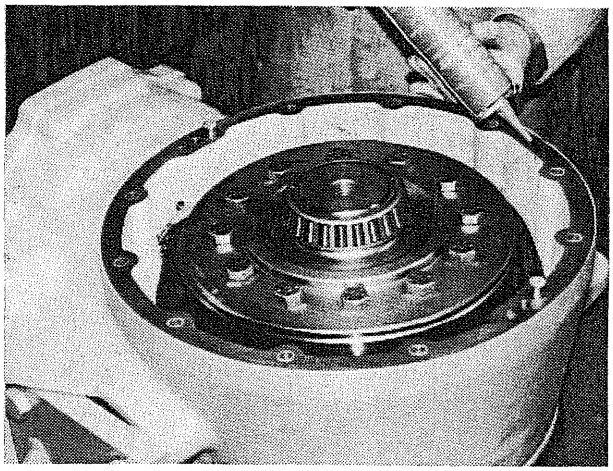


13. Fit the drum assembly into the frame. When installing the drum, align the ferrule pocket with the cut-out in the frame

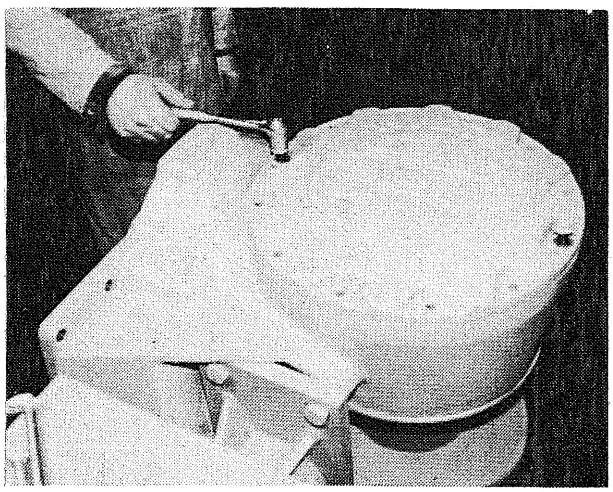
Fig. 4-15 Drum & Freespool Assembly (3 of 7)

14. Re-install the drum shaft assembly, aligning the splines on the drum shaft with the splines inside of the freespool coupler in the drum.

15. Use shims to produce the required shim pack. Place the shim pack and bearing cone on the drum shaft.

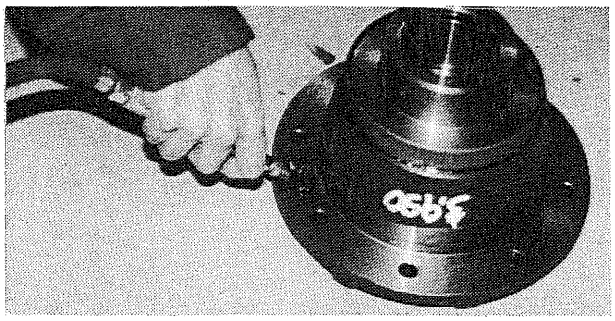


16. Apply Loctite 515 sealant (HCE-98) to the sealing surface of the housing.



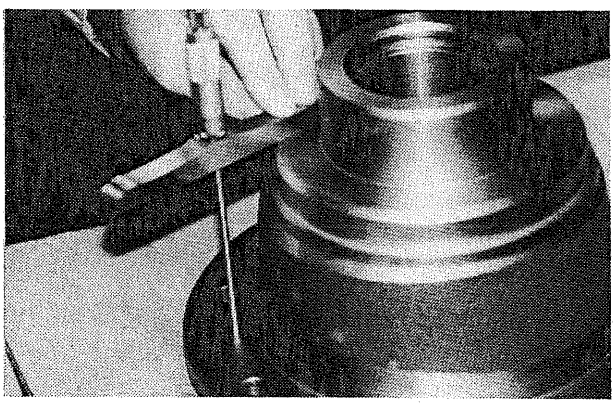
17. Place the LH cover onto the housing, taking care to align the dowel pins with their holes. Install and tighten the 12 retaining capscrews to 110 N•m (80 lb-ft).

Fig. 4-15 Drum & Freespool Assembly (4 of 7)



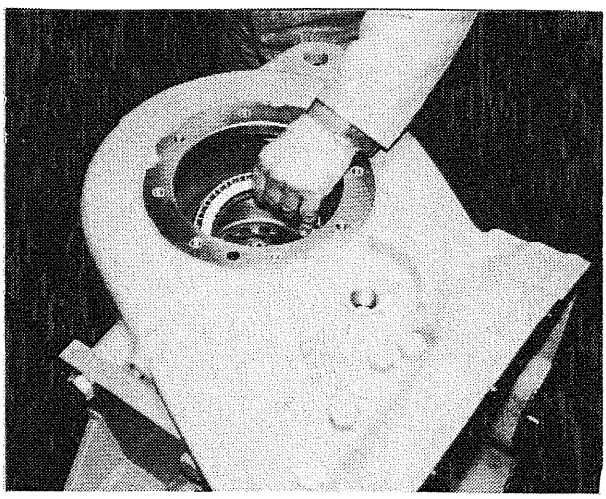
18. Blow any contamination from the oil ports in the RH cover.

19. Fit the O-Ring into the internal groove in the freespool piston bore.



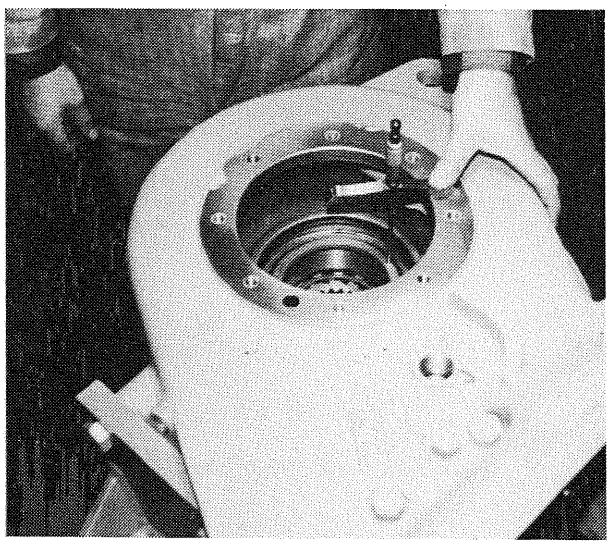
20. Place the RH cover on the workbench with the mounting flange facing down. Measure the distance from the bearing seat shoulder to the mounting face. Record this measurement as dimension "E".

21. Lubricate and install the freespool piston into the cover.

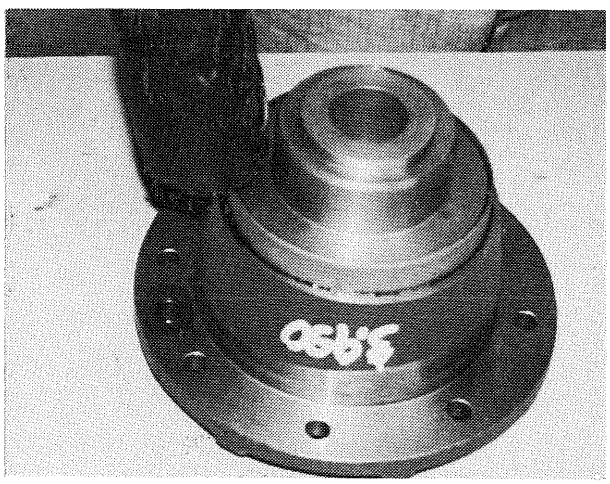


22. With the drum and shaft installed and properly pre-loaded, and the ring and pinion gears properly shimmed, turn the winch housing so that the RH side is facing up. Fit the bearing cone into the drum assembly.

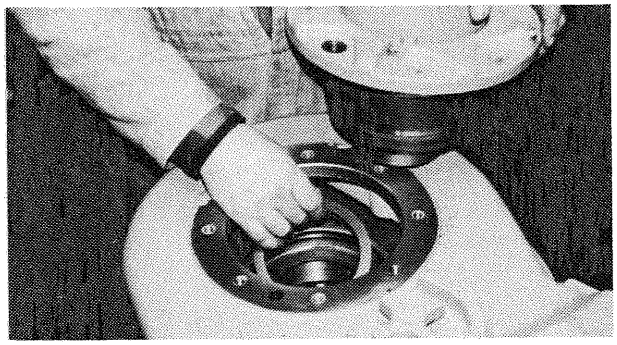
Fig. 4-15 Drum & Freespool Assembly (5 of 7)



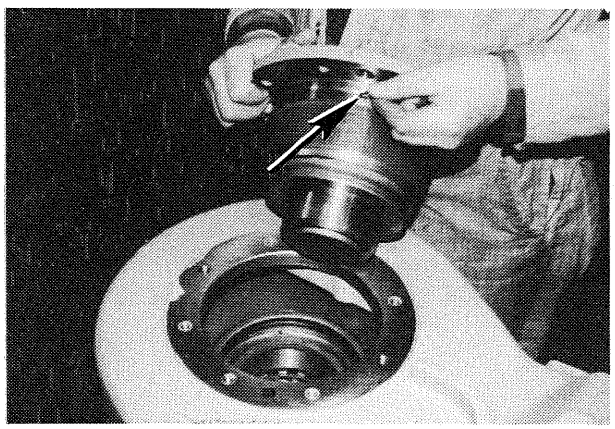
23. Measure the distance from the RH cover mounting face to the outer face of the drum bearing cone. Record this measurement as dimension "F". Subtract "E" from "F", and then add enough shims to obtain +/- .051 mm (.002"). This will be the correct shim pack thickness beneath the RH cover.



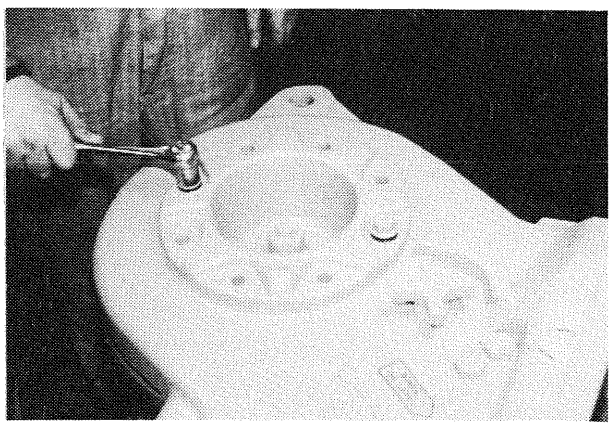
24. Install the seal sleeve into the RH cover using an appropriate driver and Loctite 515.



25. Install the shim pack on the cover.

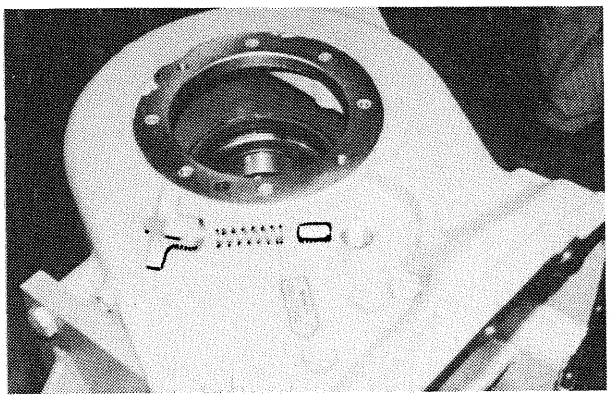


26. Install the O-Ring in the recess in the RH housing mounting flange. Be sure that it stays in place.

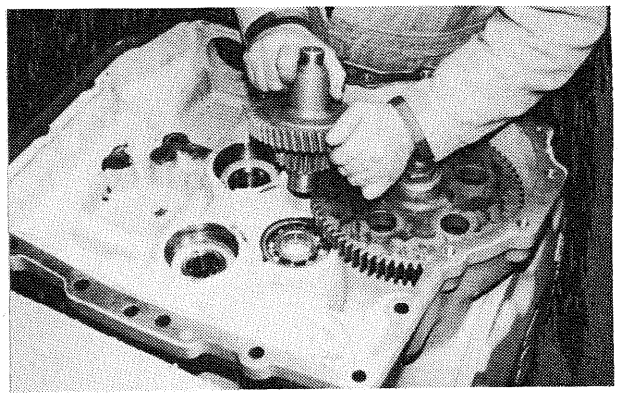


27. Install the RH cover and secure with 8 flange screws. Tighten to 110 N•m (80 lb-ft).

Fig. 4-15 Drum & Freespool Assembly (6 of 7)



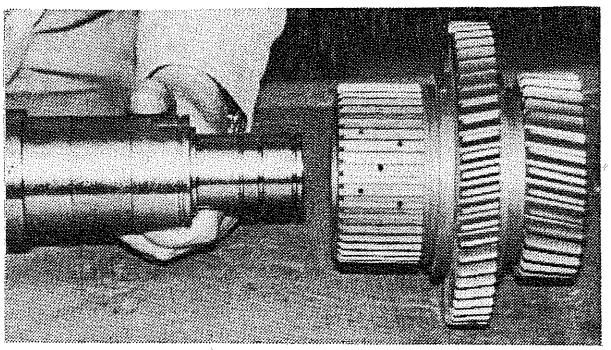
28. Install the drag shoe and spring. Screw the knob in "hand" tight.



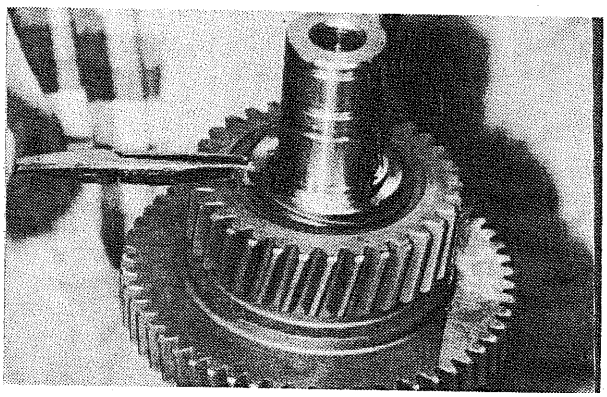
29. Install the intermediate gear into the bearing in the frame.

Fig. 4-15 Drum & Freespool Assembly (7 of 7)

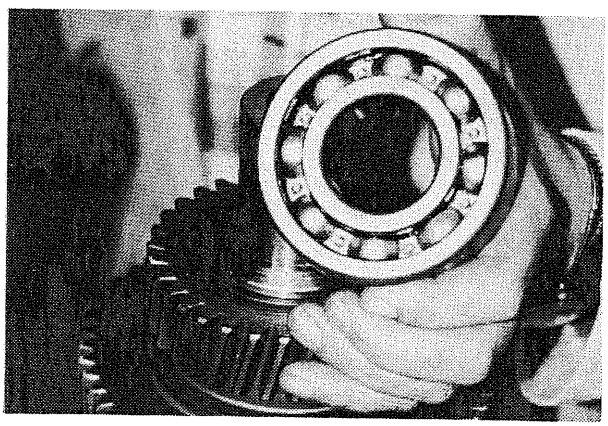
Brake Shaft & Hub Assembly



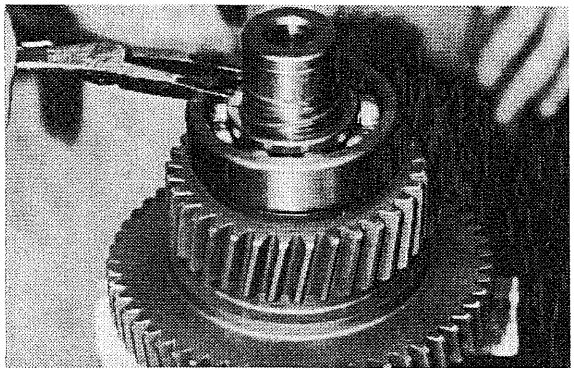
1. Press the brake hub onto the brake shaft using a suitable driver.



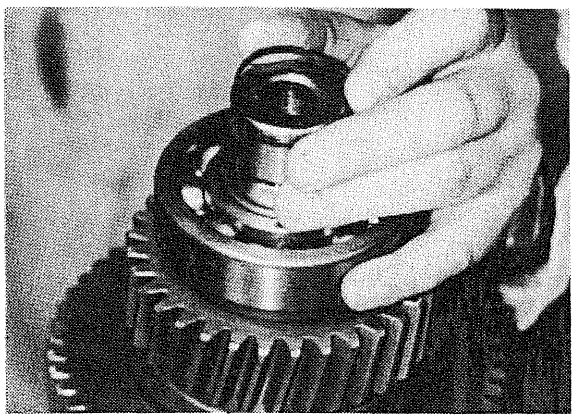
2. Install hub retaining snap ring.



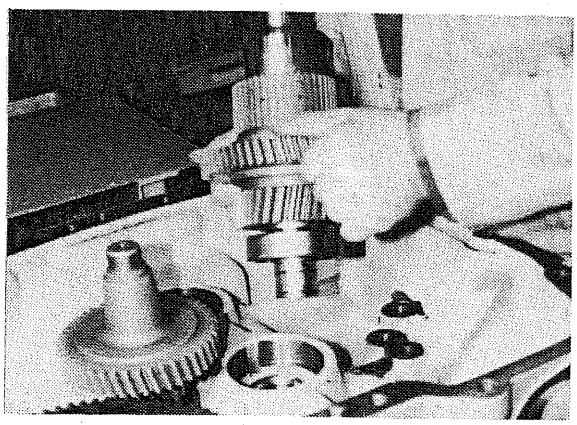
3. Press the bearing onto the brake shaft using an appropriate driver.



4. Install the bearing retaining snap ring.



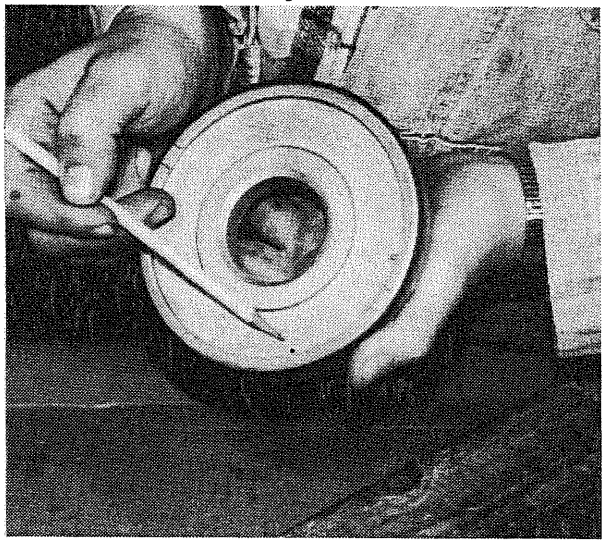
5. Fit the seal rings into the grooves in the brake shaft.



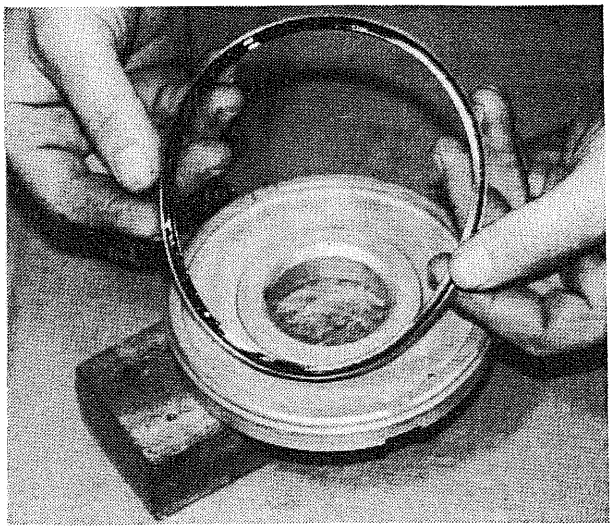
6. Install the brake shaft assembly into its bore in the frame.

Fig. 4-16 Brake Shaft & Hub Assembly (1 of 1)

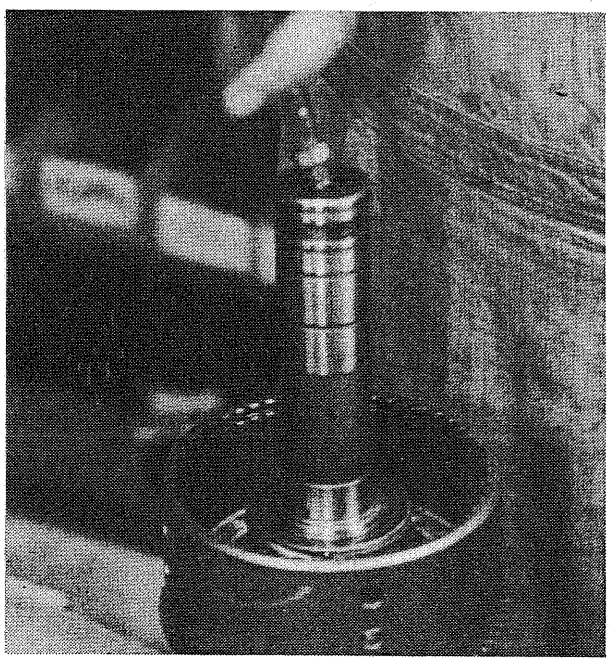
Clutch Assembly



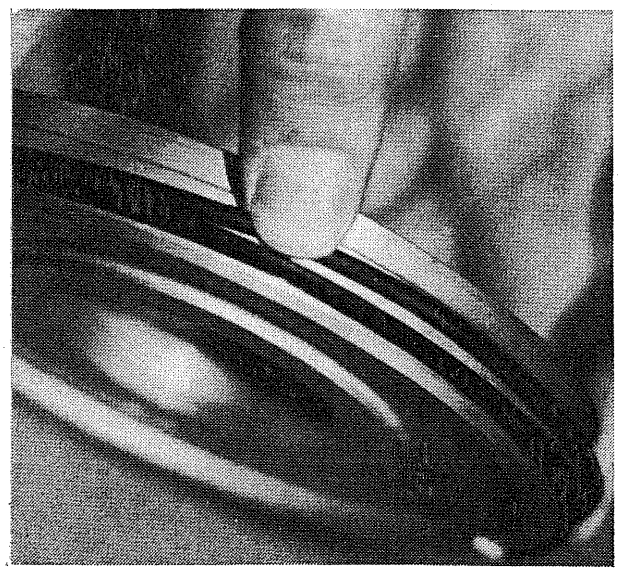
1. Inspect the piston to ensure that the oil bleed hole is clear. Use 1.17 mm (0.046") ream if required.



3. Fit the piston seal onto the piston so that the seal lip will be facing away from the clutch plates when installed.

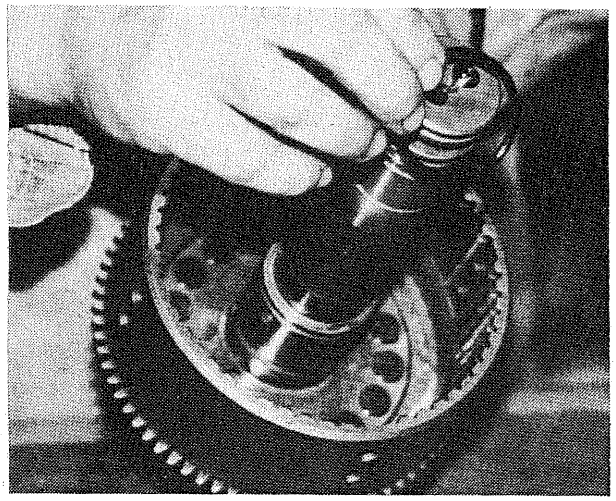


2. Place the clutch shaft and housing in a suitable assembly stand. Blow any contaminants from housing and shaft oil passages.

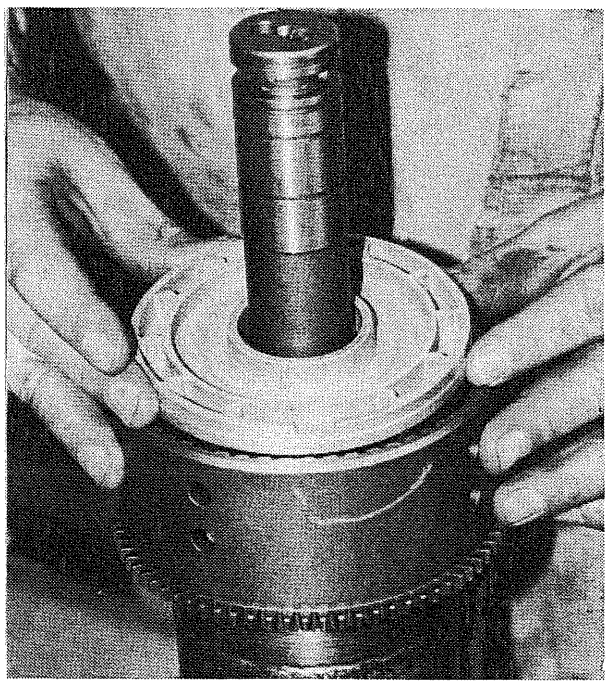


4. Stretch a rubber band or O-Ring over the installed seal, compressing the seal flat. Leave it in place for at least five minutes to allow the seal to set to size. This is to make the seal lip lie flat long enough to allow you to insert the piston into its bore in the clutch.

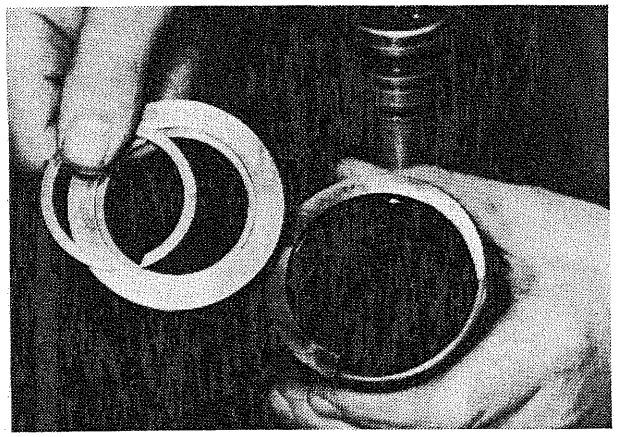
Fig. 4-17 Clutch Assembly (1 of 6)



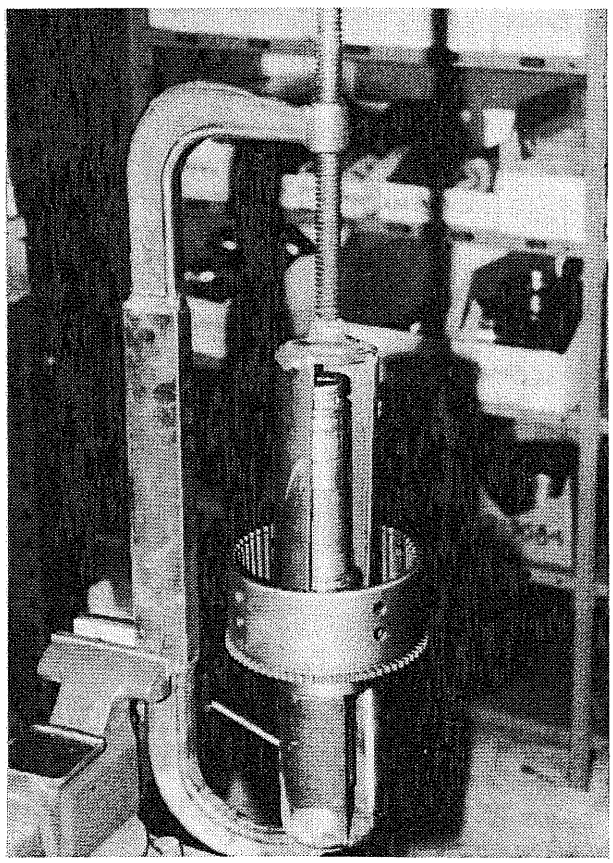
5. Fit the O-Ring onto the shaft. Lubricate the O-Ring and the piston seal surface in the clutch housing.



6. Remove the rubber band from the piston and IMMEDIATELY insert it into the clutch housing, seal end first.

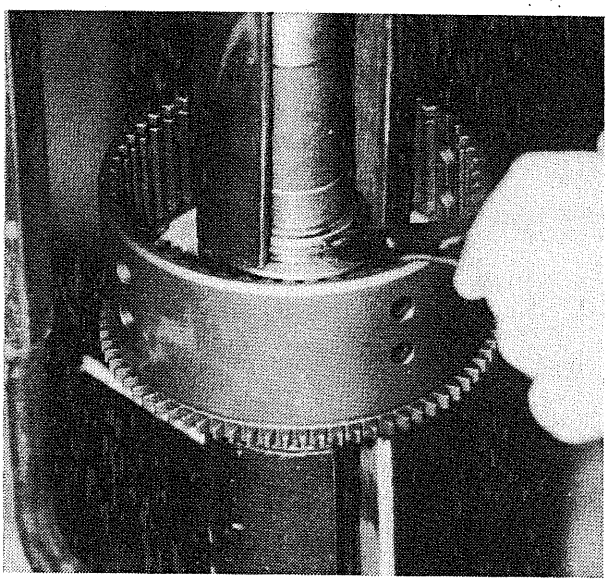


7. Install the spring, spring guide, and snap ring loosely onto the clutch shaft.

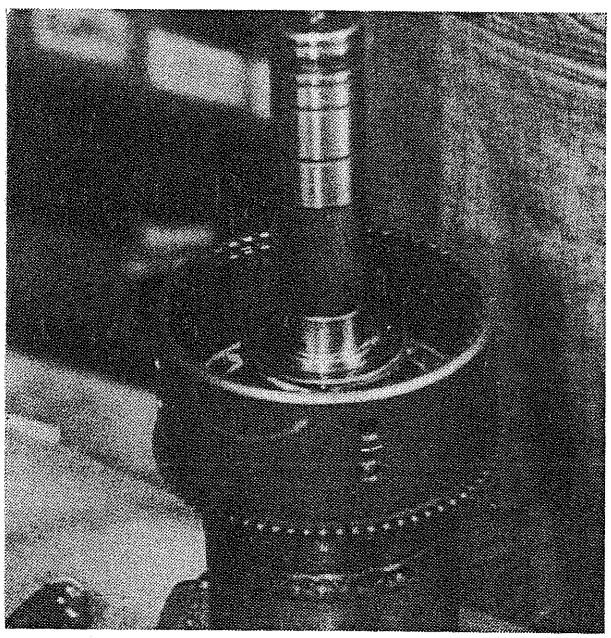


8. Place the entire assembly into a suitable spring compressor.

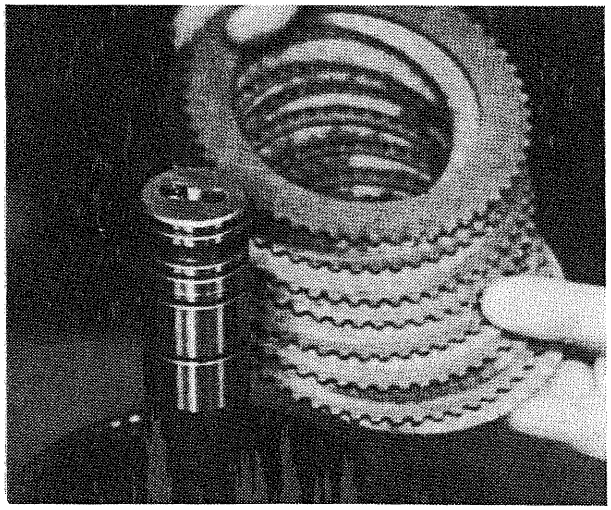
Fig. 4-17 Clutch Assembly (2 of 6)



9. Compress the spring and spring guide, and install the snap ring in its groove on the shaft.

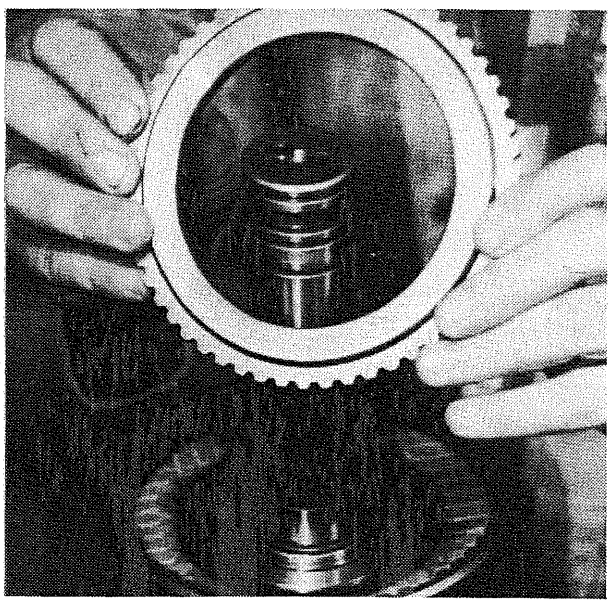


10. Return the clutch assembly to the assembly stand, and press the bearing onto the shaft using a suitable driver. The position of the shield on the bearing is not important.



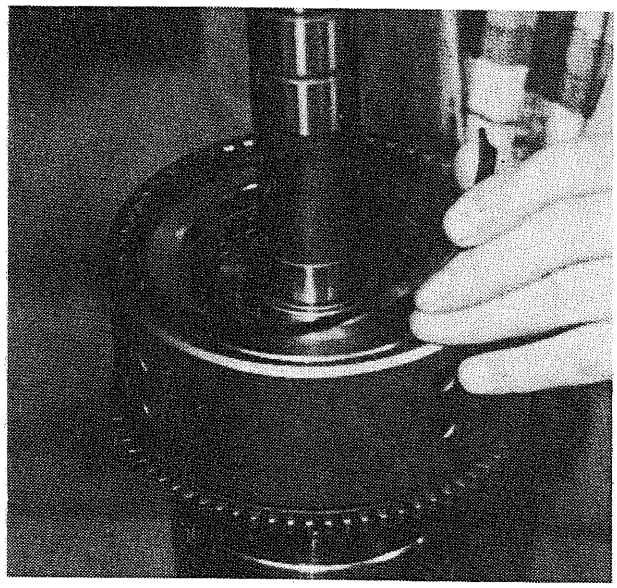
11. Beginning with a separator plate, fit 7 separator plates and 7 friction discs alternately into the clutch housing.

NOTE: The position of the missing teeth in the friction discs is not important.

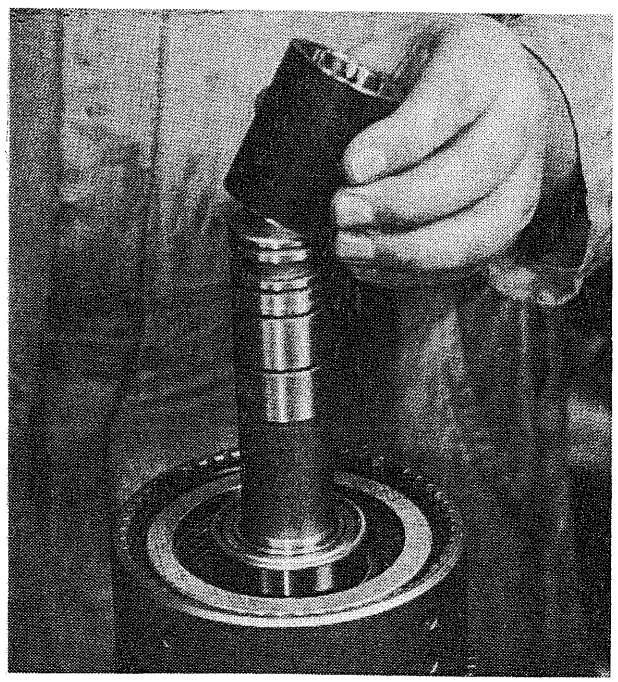


12. Fit the pressure plate. The step faces up.

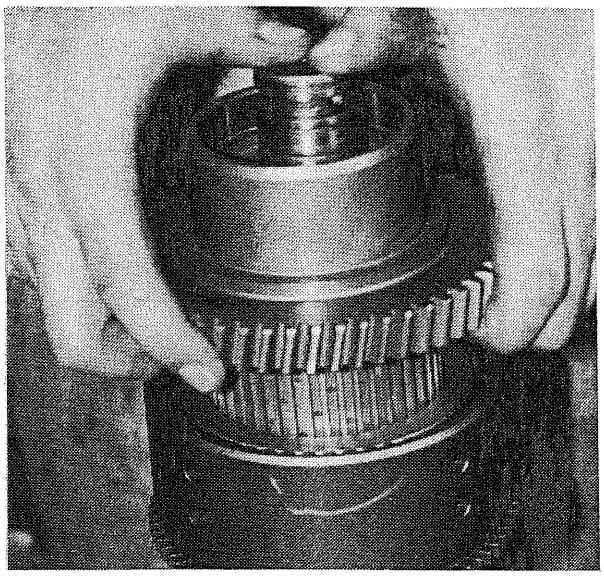
Fig. 4-17 Clutch Assembly (3 of 6)



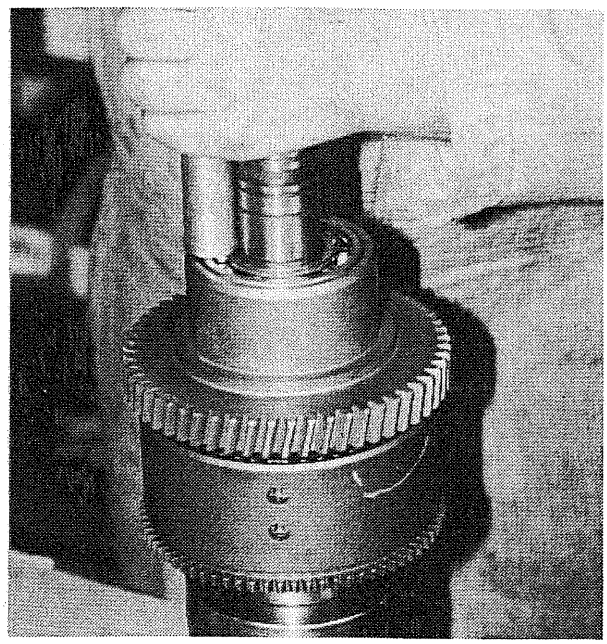
13. Install the snap ring in its groove.



14. Fit the spacer onto the clutch shaft.

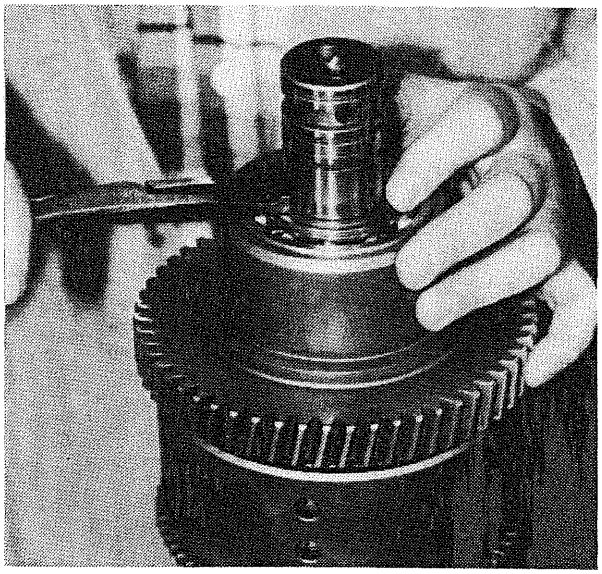


15. Insert the clutch hub into the clutch housing, using care not to damage the internal teeth on the friction discs. Wiggle the hub gently to help the teeth engage the splines.



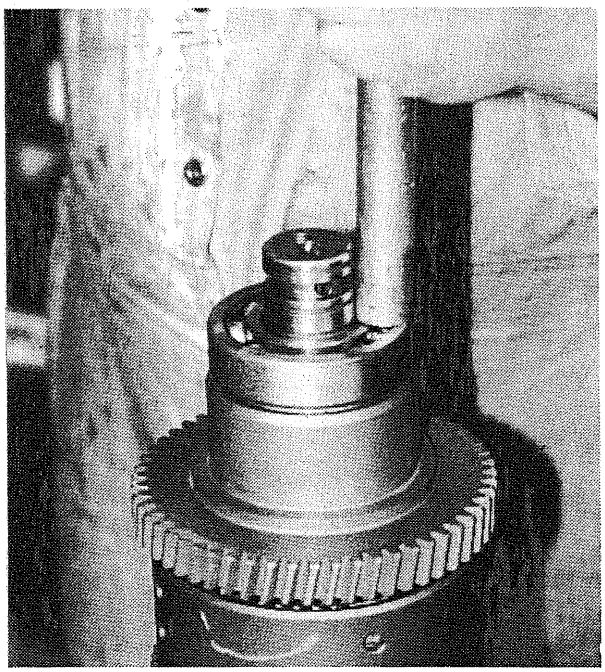
16. Press the bearing into the clutch hub, using a suitable driver.
(See Fig. 5-8 for PFR winches)

Fig. 4-17 Clutch Assembly (4 of 6)

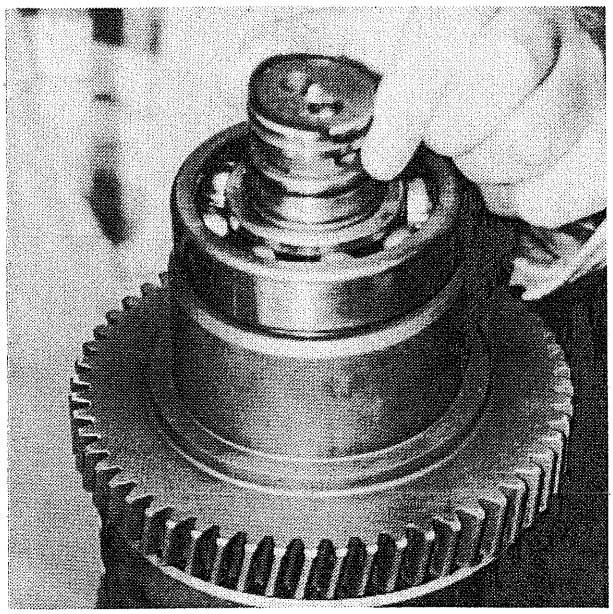


17. Install the snap ring.

19. Install the snap ring.

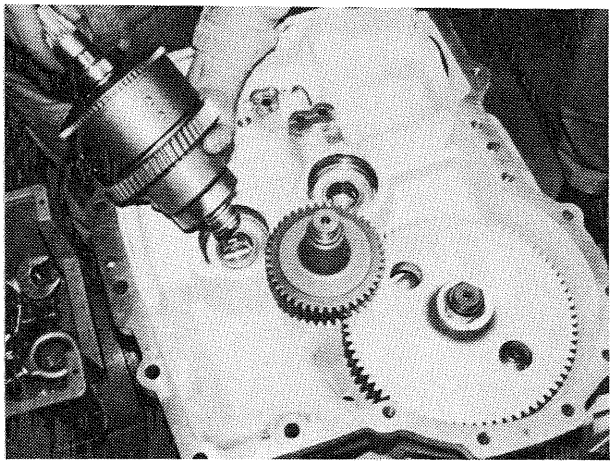


18. Press the bearing onto the clutch shaft using a suitable driver.

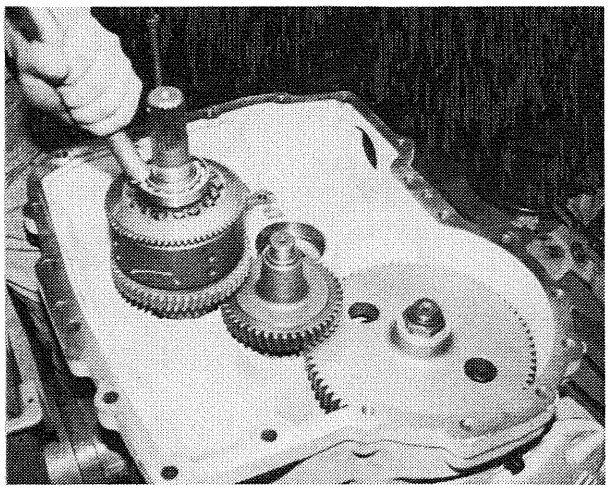


20. Install the seal rings into the grooves in the clutch shaft.

Fig. 4-17 Clutch Assembly (5 of 6)



21. Install the clutch assembly into its bore in the frame. Use care to avoid damaging the sealing rings.

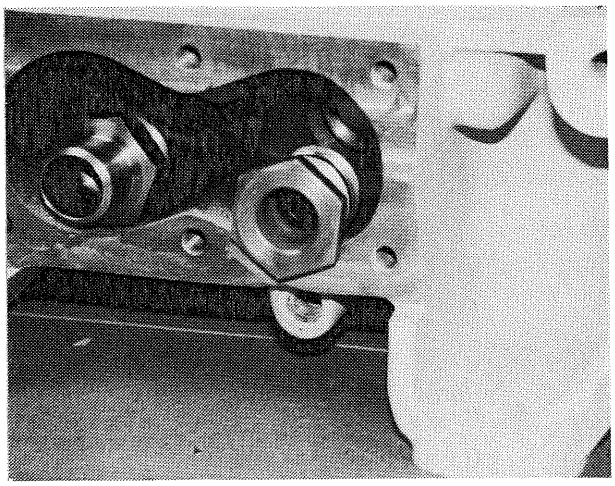


22. Press the bearing onto the clutch shaft using a suitable driver.

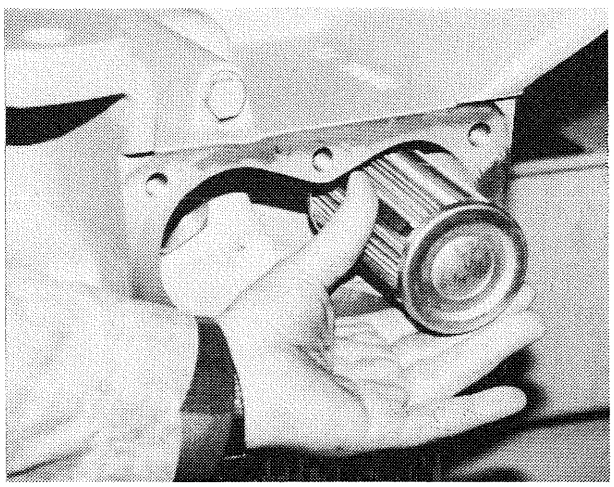
Fig. 4-17 Clutch Assembly (6 of 6)

Front Cover Assembly

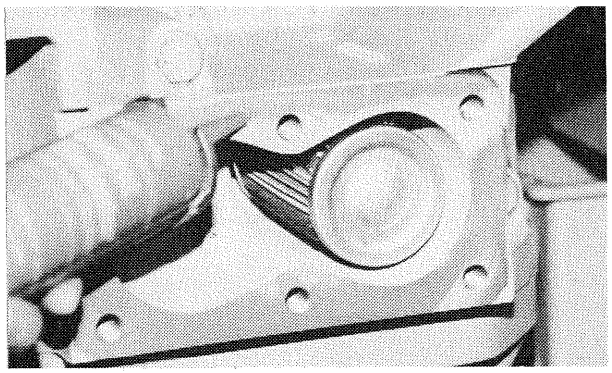
NOTE: The Low Mount installation is shown in the following sequence. The High Mount installation is essentially the same. Any important differences will be noted.



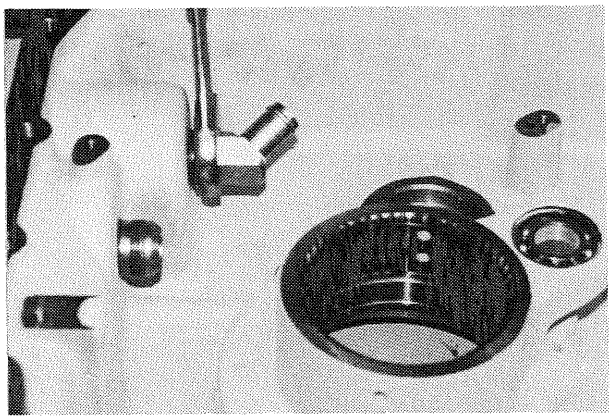
1. Install the 2 fittings and O-Rings in the oil strainer housing.



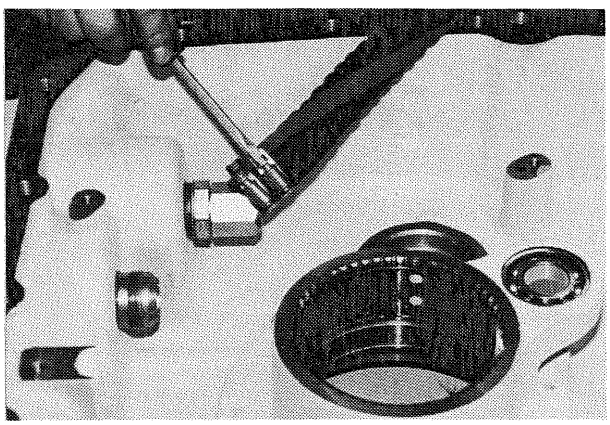
2. Install a clean or new strainer onto the suction fitting.



3. Apply liquid sealing compound and install the cover. Secure with 6 flange screws.

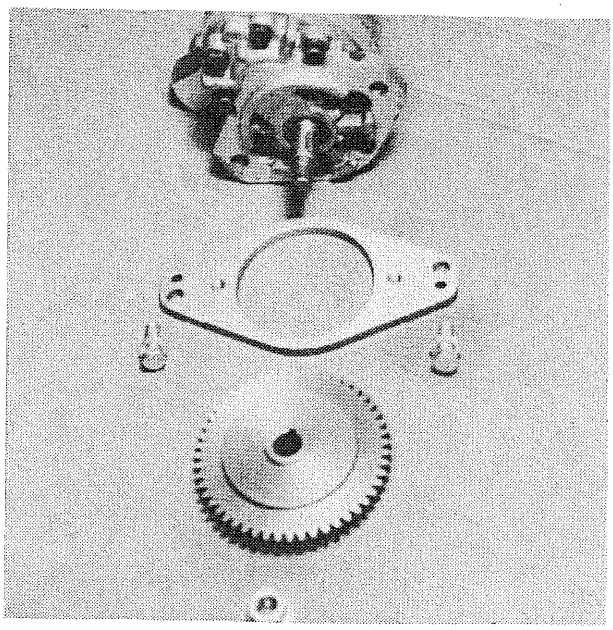


4. Install fitting to suction strainer outlet port inside the cover.

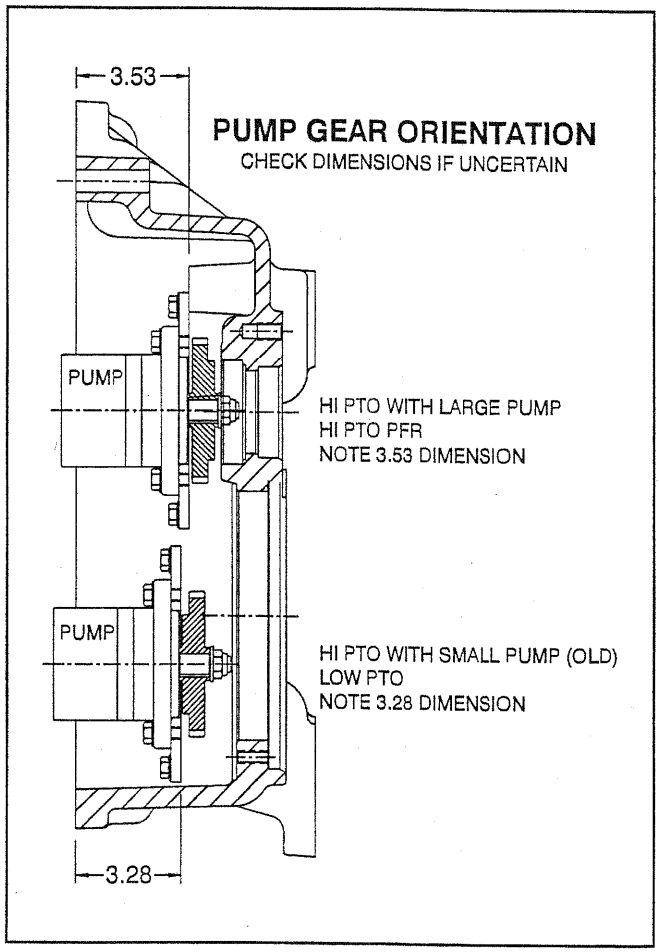


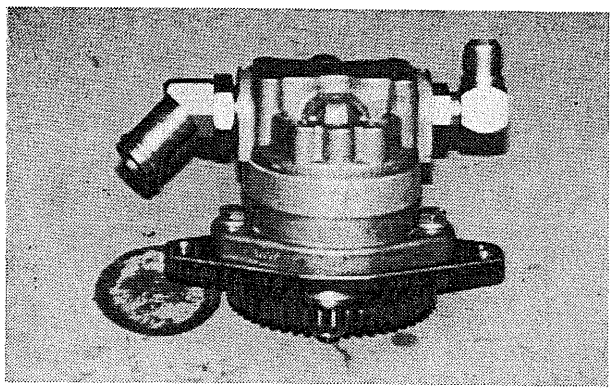
5. Fit the suction hose and secure with two hose clamps. The high PTO model uses a tube.

Fig. 4-18 Front Cover Assembly (1 of 6)

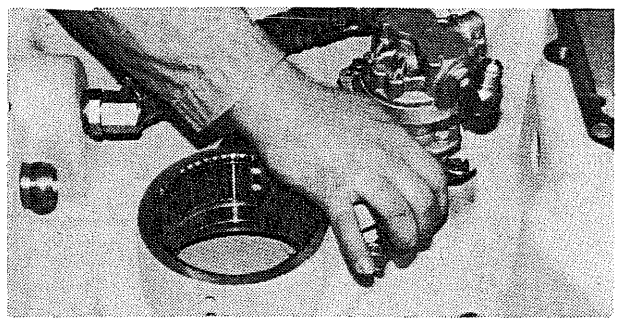


6. Fit the pump mounting bracket to the pump and secure with two capscrews and lock washers. Install the pump drive gear onto the pump shaft. See illustration on right for orientation of pump gear. Make sure that the woodruff key engages the gear and shaft correctly. Secure the gear with the flange nut and tighten to 85 N•m (64 lb-ft).



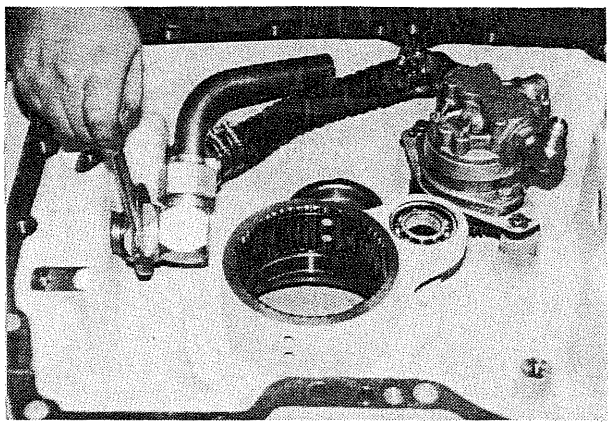


7. Install the inlet and outlet port fittings on the pump. Fit the suction hose from the strainer housing onto the inlet fitting on the pump and secure with two hose clamps.

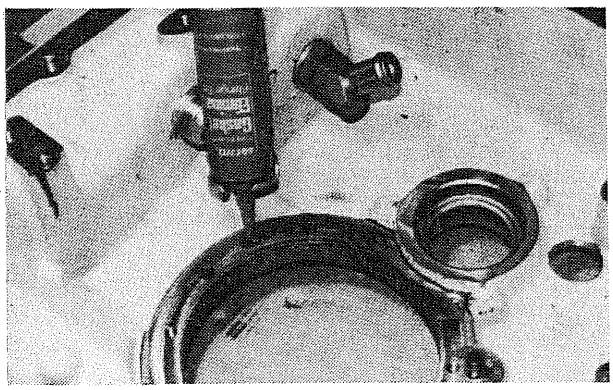


8. Fit the pump assembly onto the locating pins in the front cover. Install the two capscrews and lock washers and tighten to 30 N•m (23 lb-ft).

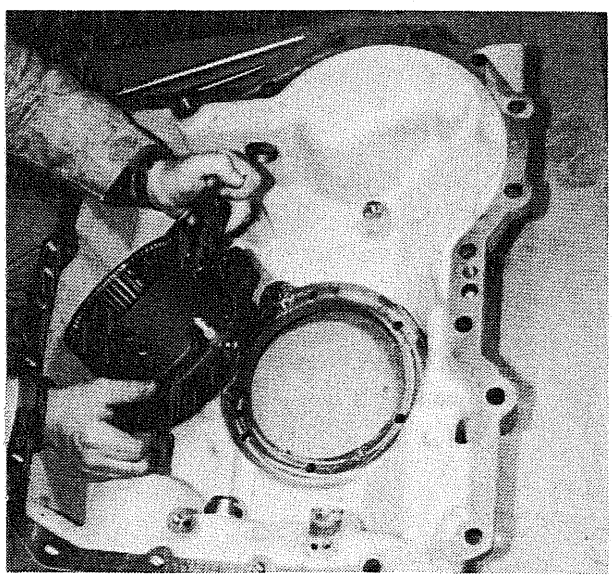
Fig. 4-18 Front Cover Assembly (2 of 6)

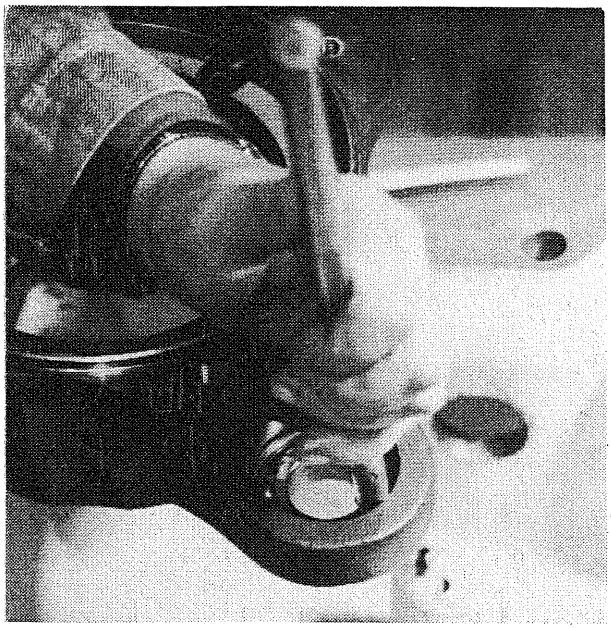


9. Install the fitting at the suction housing inlet port, and install the suction pick-up tube.

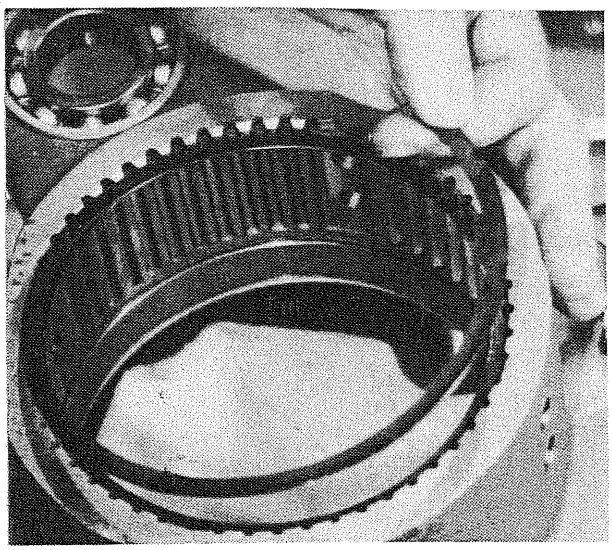


10. Apply liquid gasket sealant to the brake housing mounting surface of the front cover. Or install O-Rings.





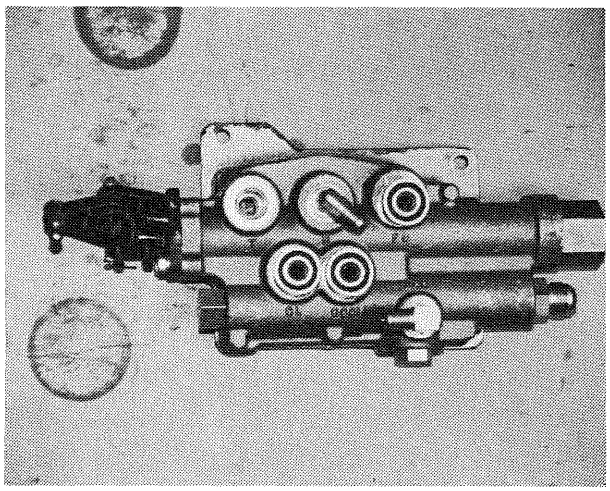
12. If necessary, drive the intermediate shaft bearing into its bore in the brake housing using an appropriate driver.



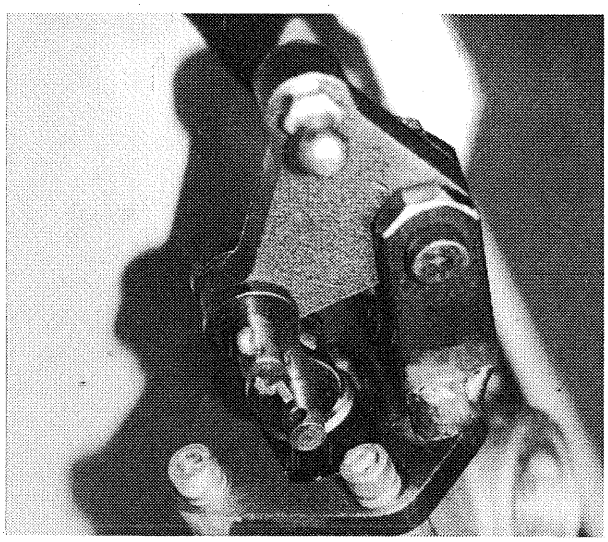
13. Install the snap ring in the groove in the brake housing.

◀ 11. (see photo on left) Fit the brake housing over the locating pin in the front cover, secure with two flange screws and tighten to 30 N•m (23 lb-ft).

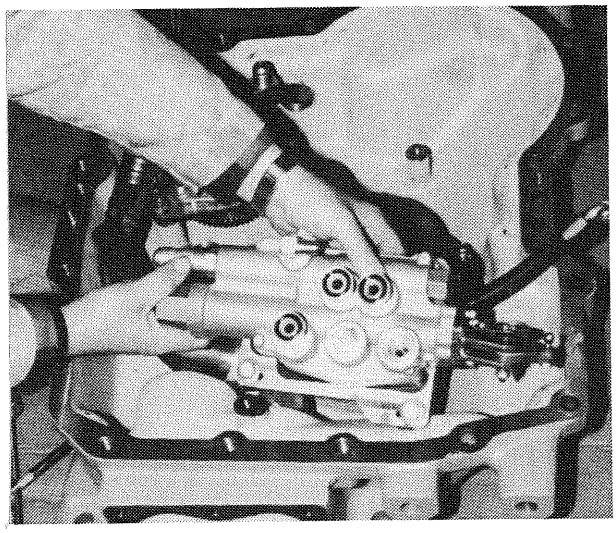
Fig. 4-18 Front Cover Assembly (3 of 6)



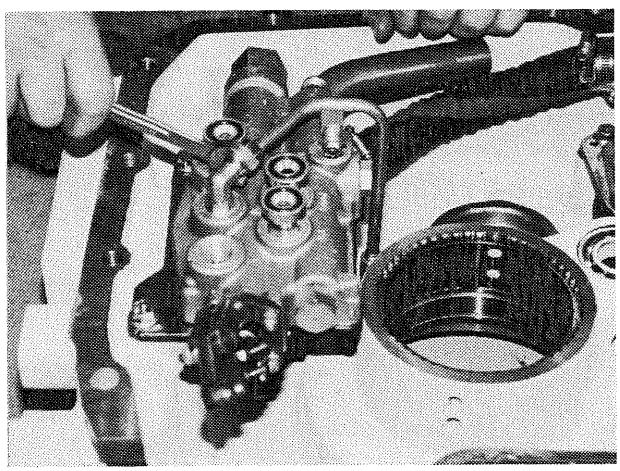
14. Install the hydraulic fittings in the control valve as required. Install new O-Rings on the fittings. Note that the port marked "T" is left open.



15. Fit the control crank mounting bracket to the control valve using three capscrews and lock washers. Fit the crank to the control crank mounting bracket using the shoulder bolt and locknut. Install the ball stud on the crank and secure it with the locknut. Connect the crank to the valve spool with the master link assembly.

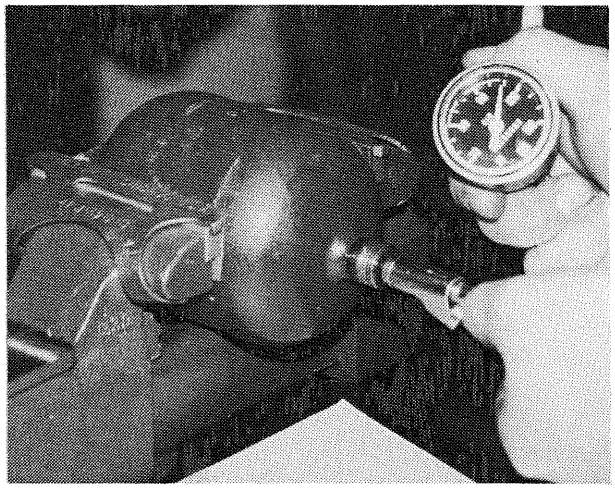


16. Install the control valve assembly in the front cover. Secure it with two flange screws tightened to 30 N•m (23 lb-ft).

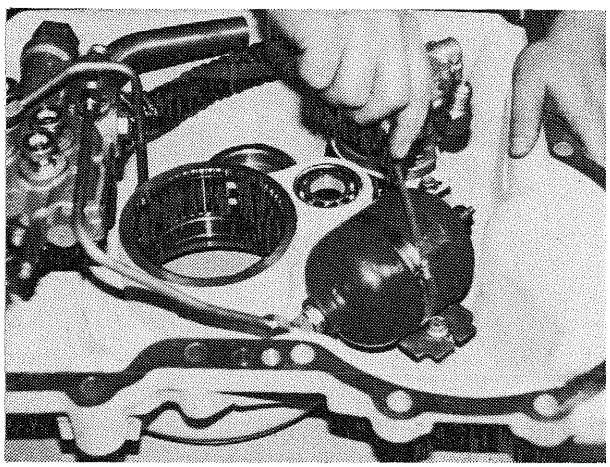


17. Install the brake pressure line from the control valve to the inlet port on the brake housing.

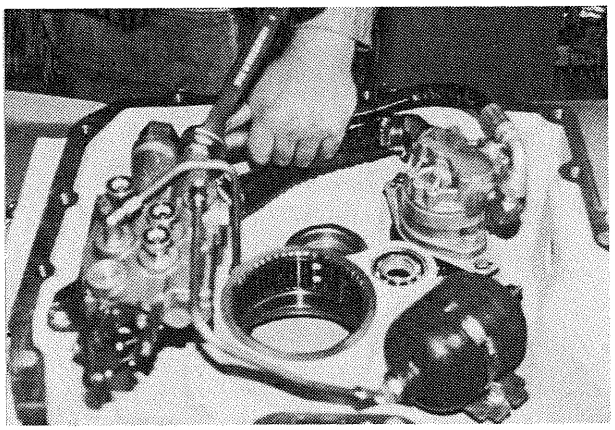
Fig. 4-18 Front Cover Assembly (4 of 6)



18. Install a pressure gauge on the gas side of the accumulator. The gauge should read 800 kPa (115 psi). Recharge the accumulator if necessary. If the accumulator will not hold a charge, it must be replaced.

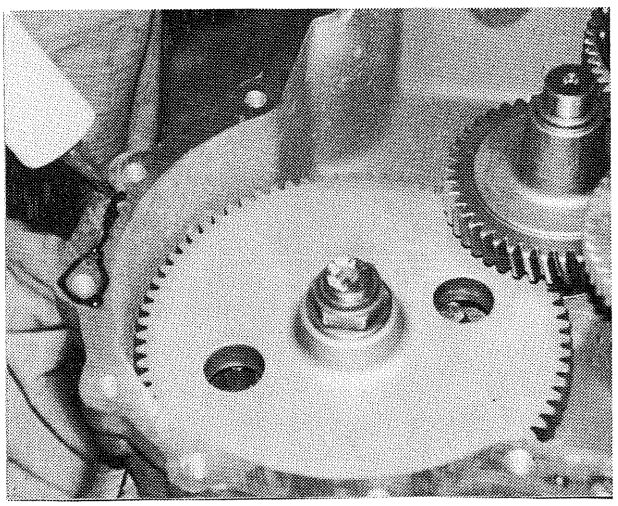


19. Install the accumulator mounting bracket in the front cover and secure with a flange screw. Install the accumulator and secure to the mounting bracket with the clamp and flange screw. The charging valve end of the accumulator should point towards the access hole in the cover.



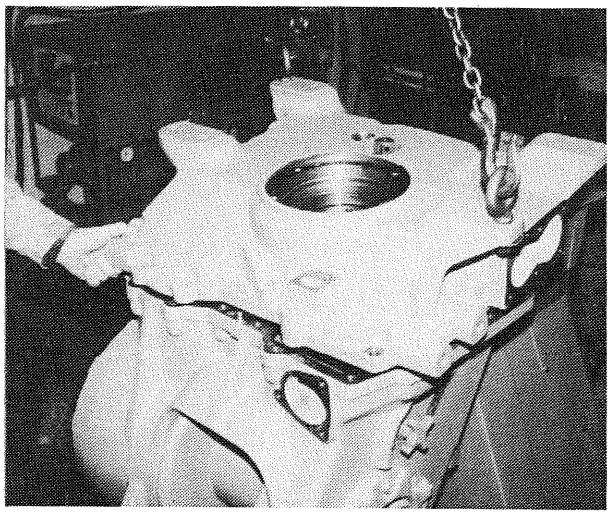
20. Install the tube assembly between the accumulator hydraulic port and the control valve. Install the hose assembly between the pump outlet fitting and the control valve. Check all hydraulic connections for tightness.

(See Fig. 5-9 for PFR winches)

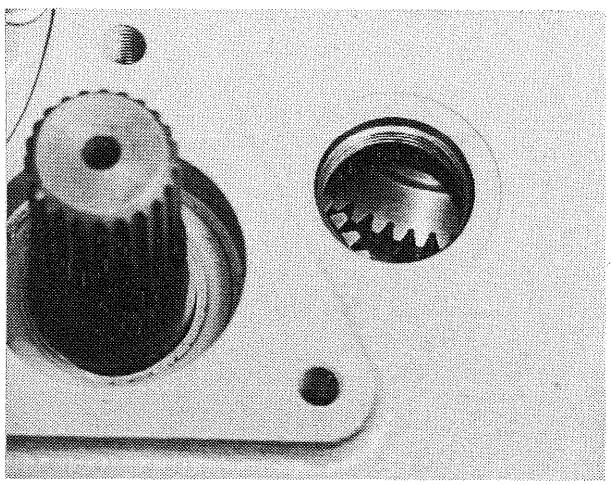


21. Coat the front sealing surface of the frame with Loctite 515 sealant.

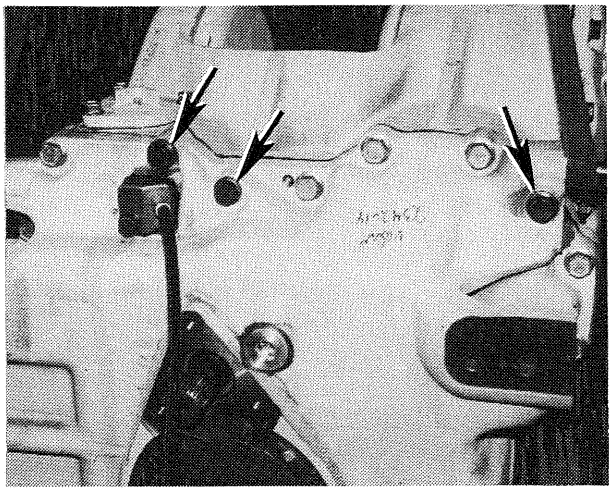
Fig. 4-18 Front Cover Assembly (5 of 6)



22. Lower the front cover onto the frame, using caution not to dislodge the O-Rings on the control valve fittings. Guide the cover onto the alignment pins, and fit it flush with the main housing.

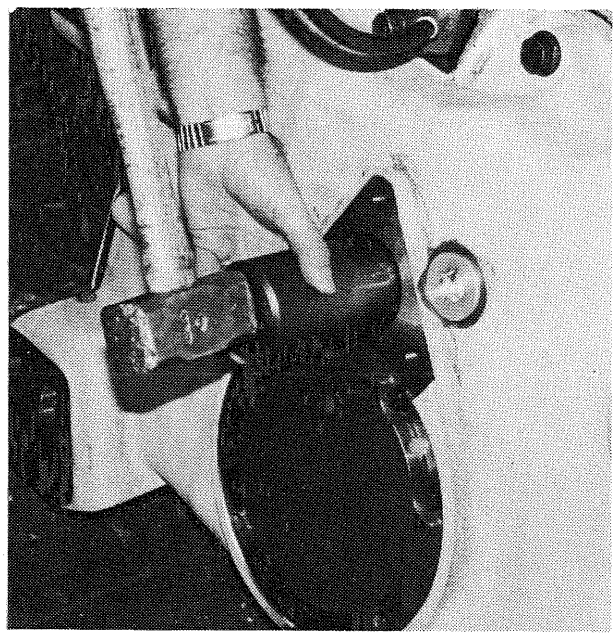


23. Align the pump gear with the pump drive gear on the clutch housing. A viewing port is provided in the front cover for this purpose. (See fig. 4-4.)



24. Secure the cover to the frame with seventeen 50 mm (2") long flange screws, and three 90 mm (3.5") long flange screws. Tighten to 215 N•m (160 lb-ft).

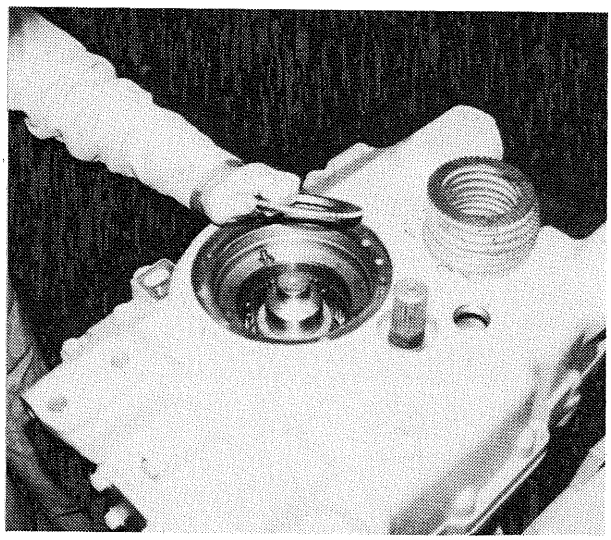
NOTE: The three longer screws go into specific holes in the frame and cover. See arrows in photo.



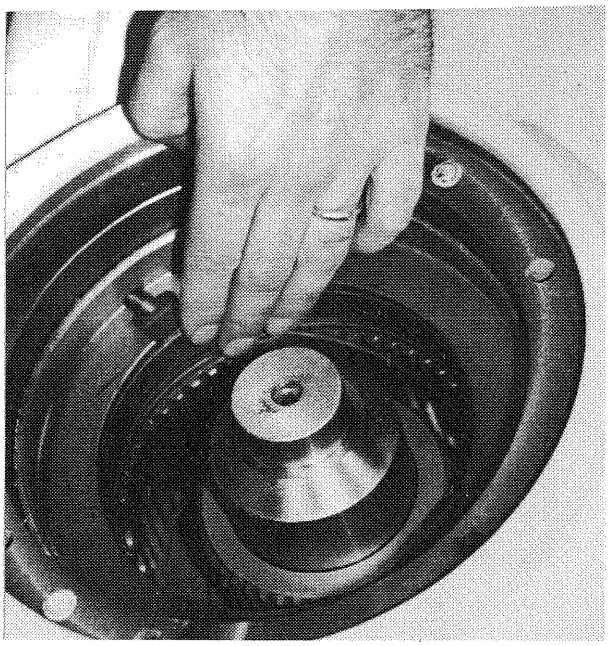
25. Install the PTO shaft seal into the front cover using a suitable driver. Coat the seal outer diameter with liquid gasket before installation.

Fig. 4-18 Front Cover Assembly (6 of 6)

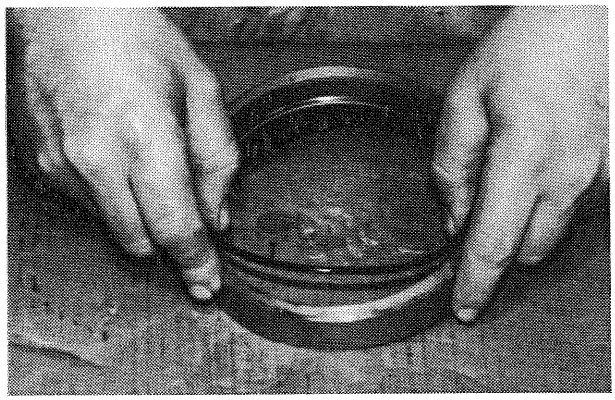
Brake Assembly



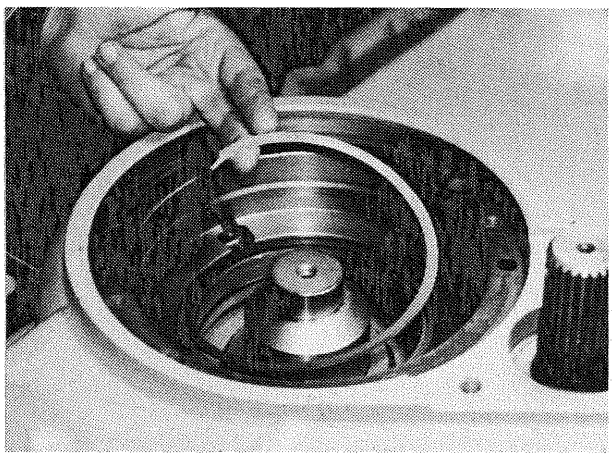
1. Fit the brake pressure plate into the brake housing in the front cover. The step on the plate must face in. Beginning with a friction disc, fit seven separator plates and seven friction discs alternately into the brake housing.



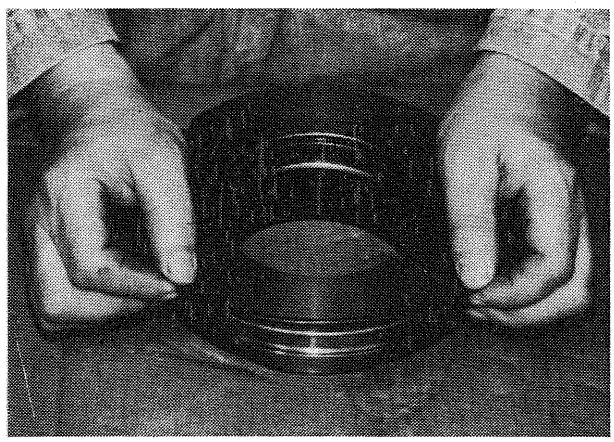
2. Fit a new O-Ring into the brake housing.



3. Fit a new O-Ring into the the spacer. And install spacer.

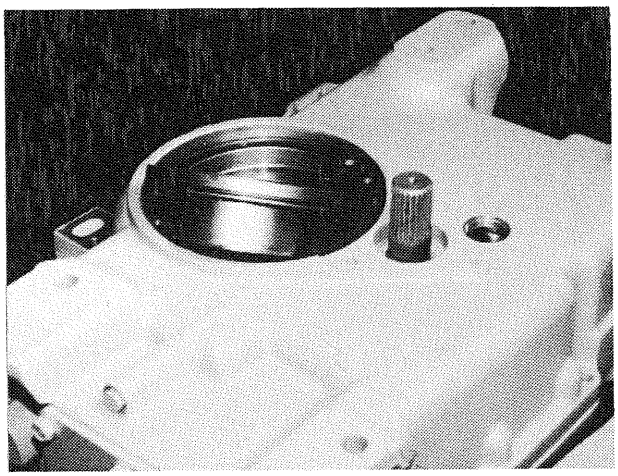


4. Fit the snap ring into the brake housing.

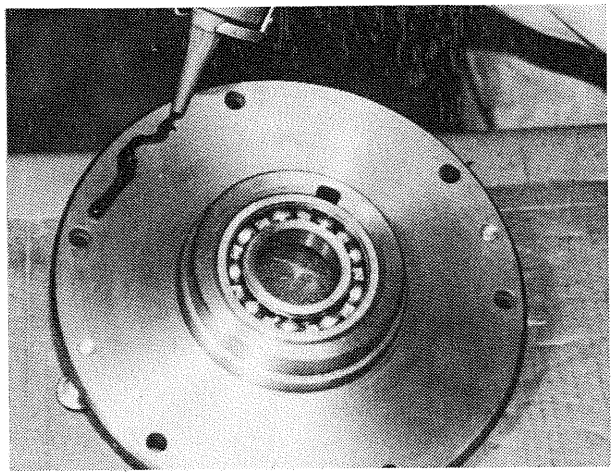


5. Fit a new O-Ring to the brake piston.

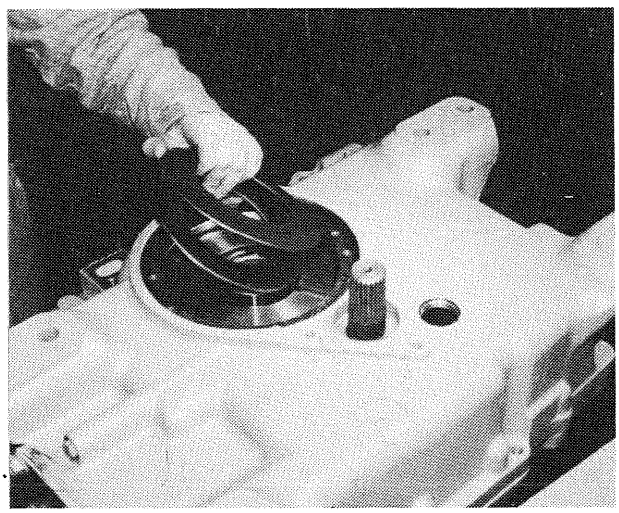
Fig. 4-19 Brake Assembly (1 of 2)



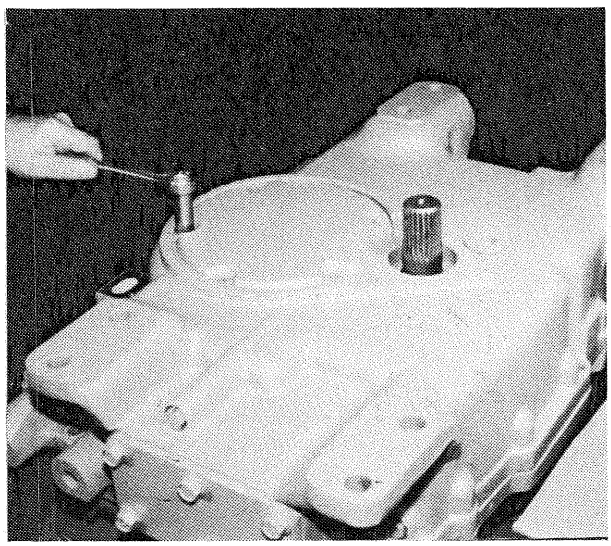
6. Install the piston into the brake housing.



8. Using a suitable driver, press the shaft bearing into the brake cover. Coat the brake cover sealing surface with Loctite 515 sealant.



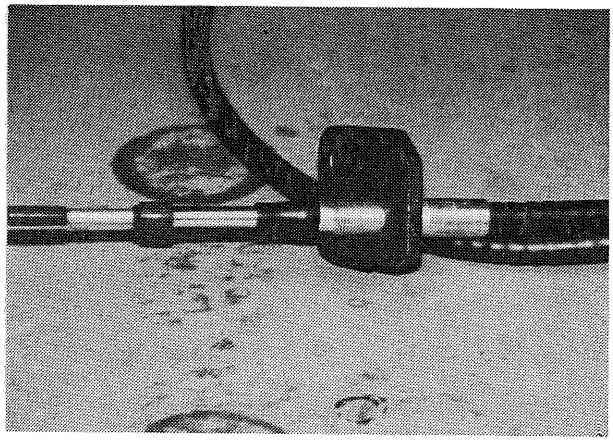
7. Install the two spring washers in the brake housing. Note orientation of springs.



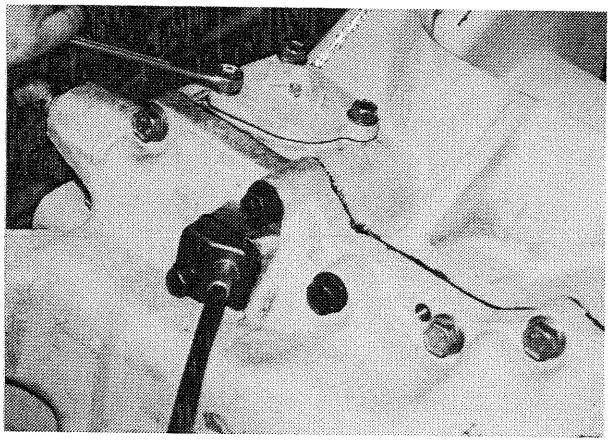
9. Fit the brake cover to the front cover and secure with six flange screws. Tighten to 45 N•m (33 lb-ft).

Fig. 4-19 Brake Assembly (2 of 2)

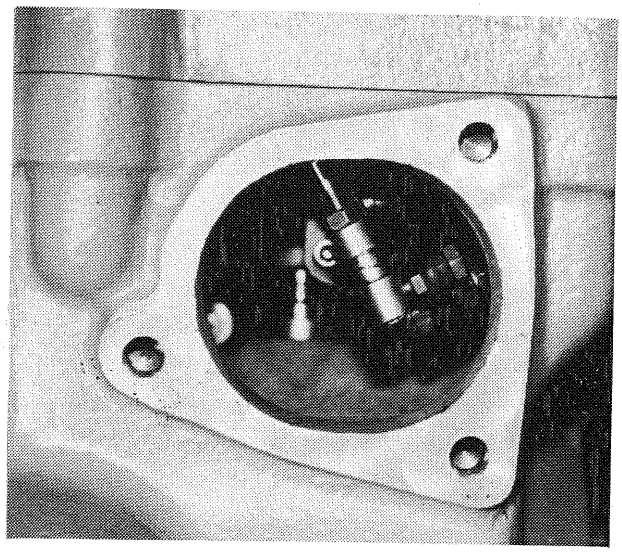
Final Assembly



1. Apply Loctite 242 thread locker to the threads on the control cable. Screw the cable fully into the cable mounting block.



3. Fit the filler/breather cover and gasket, and secure with three flange screws.



2. Assemble the control cable swivel end to the valve linkage. Coat the base of the cable anchor block with Loctite 515 and secure with a flange screw. Tighten to 110 N•m (80 lb-ft).

(See Fig. 5-9, step 5 for PFR winches)

Fig. 4-20 Final Assembly (1 of 1)

CONTROL VALVE (See Fig. 4-21)

Removal

1. To remove the control valve, the winch must be removed from the tractor, and the front cover must be removed. Follow the winch removal instructions, and the disassembly instructions up through step 6 of Fig. 4-8.

Disassembly

1. Place the valve in a clean work area.

2. Remove the relief valve cartridge (2). Carefully remove the external O-Rings and backup-rings (3) from the cartridge body. A seal kit is available for external seals only. Internal parts are not available. If the relief valve has been malfunctioning, it should be replaced as an assembly.

3. Unscrew the accumulator check valve plug (4) and remove the check valve components. Do not remove the seat (10) and plunger (11) unless the check valve has been leaking, or if the seat is damaged. If replacement is required, use a small hooked tool to pull the seat from the valve body.

1. Valve Body
2. Relief Cartridge
3. O-Rings & Backup-Rings
4. Retaining Plug
5. O-Ring
6. O-Ring
7. Spring
8. Retainer
9. Ball
10. Seat
11. Plunger
12. Cover Plate
13. Capscrew & Lockwasher (Qty 8)
14. Gasket
15. Inlet Check Valve
16. O-Ring
17. Spool
18. Centering Spacer (Qty 2)
19. Spacer
20. Spring
21. Spool End
22. Ball (Qty 4)
23. Spring
24. Ball
25. End Cap
26. O-Ring
27. Fitting

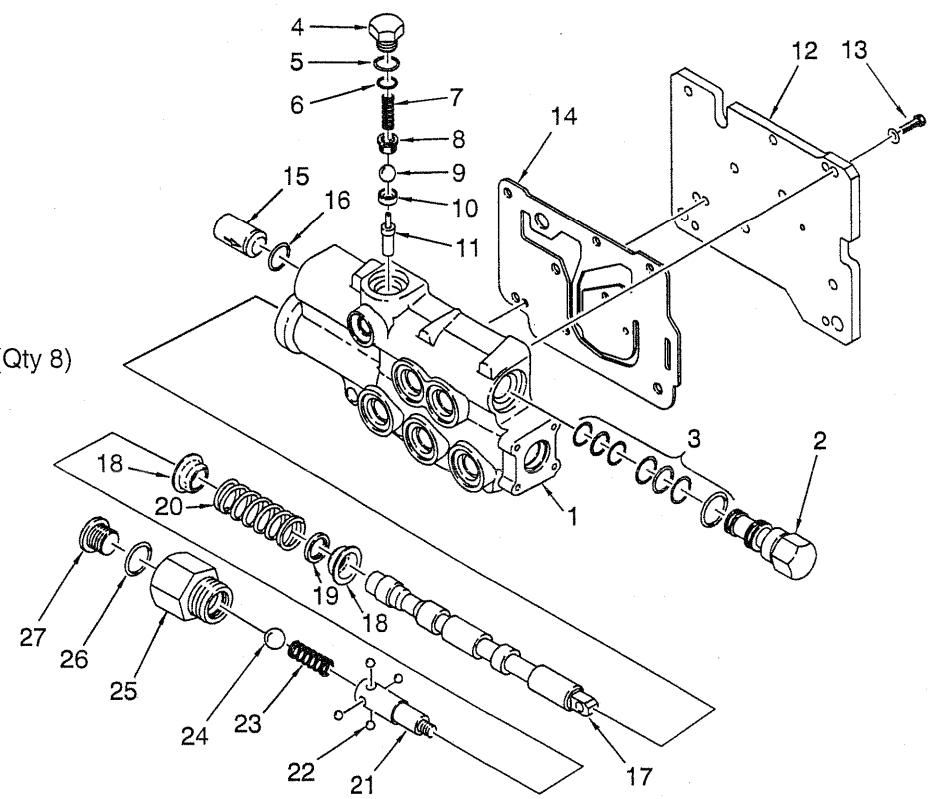


Fig. 4-21 Hydraulic Control Valve

4. With the steel cover plate (12) held in a vise, unscrew the spool detent assembly and carefully pull the spool assembly from the valve body. Use care not to damage the spool surfaces. Do not disassemble the spool assembly (items 17 through 25) unless required for repairs.

5. Unscrew the valve cover plate capscrews (13) and remove the cover plate (12). Carefully remove the gasket (14) from the valve body or plate. Remove all traces of gasket, but use care not to scratch the sealing surfaces.

6. Use a soft metal rod or hardwood stick to push the inlet check valve (15) from the valve body. Use care not to damage the valve body or check valve. Remove the O-Ring (16) from the check valve.

Inspection

1. Clean all metal parts in a suitable cleaning solvent or kerosene. Dry carefully with a lint-free cloth.

2. Blow all passages clear with compressed air. Lubricate parts with clean hydraulic oil during assembly.

3. Inspect all parts for wear damage. Replace any defective parts.

4. Replace all O-Rings, backup-rings and gaskets.

Assembly

1. If it was removed, insert the accumulator actuator spool (11) into its bore in the valve body. This part must be installed before installing the seat (10).

2. Carefully drive a new accumulator check valve seat into its bore in the valve body. Use an appropriate driving tool, using care not to damage the seat. Make sure it is fully bottomed in its bore.

3. Lubricate the spool assembly and carefully insert it into the valve body. Use care not to damage the spool. Screw the spool assembly into the valve body and tighten.

4. Insert the accumulator check ball (9), retainer (8), O-Ring (6), spring (7), and retaining plug (4). Tighten the plug.

5. Install a new O-Ring (16) on the inlet check valve (15). Lubricate the valve and install into its bore in the valve body. The grooved end goes in first. Use care not to cut the O-Ring on the threads in the bore.

6. Install O-Rings and backup-rings (3) into the grooves in the relief valve cartridge (2). There must be a backup-ring on either side of each O-Ring. Lubricate the cartridge and screw it into its bore. Tighten the cartridge.

NOTE: If a new relief cartridge is being installed, its pressure setting must be adjusted after winch installation.

7. Install the cover plate gasket (14) and the cover plate (12) onto the valve body. Clean any oil from the capscrew (13) threads and coat them with Loctite 262. Install the capscrews and lockwashers and tighten to 8 N•m (70 lb-in).

HYDRAULIC PUMP (See Fig. 4-22)

Removal

1. To remove the hydraulic pump, the winch must be removed from the tractor, and the front cover must be removed. Follow the winch removal instructions, and the disassembly instructions up through step 8 of Fig. 4-8.

Disassembly

1. Clean the pump thoroughly with solvent, kerosene, or other non-corrosive cleaning fluid, which will not affect rubber components.

2. Scribe a line across the three sections of the pump to act as a guide in re-assembly.

3. Remove the six hex screws (3), and two capscrews (2). Remove the key (15) from the drive shaft.

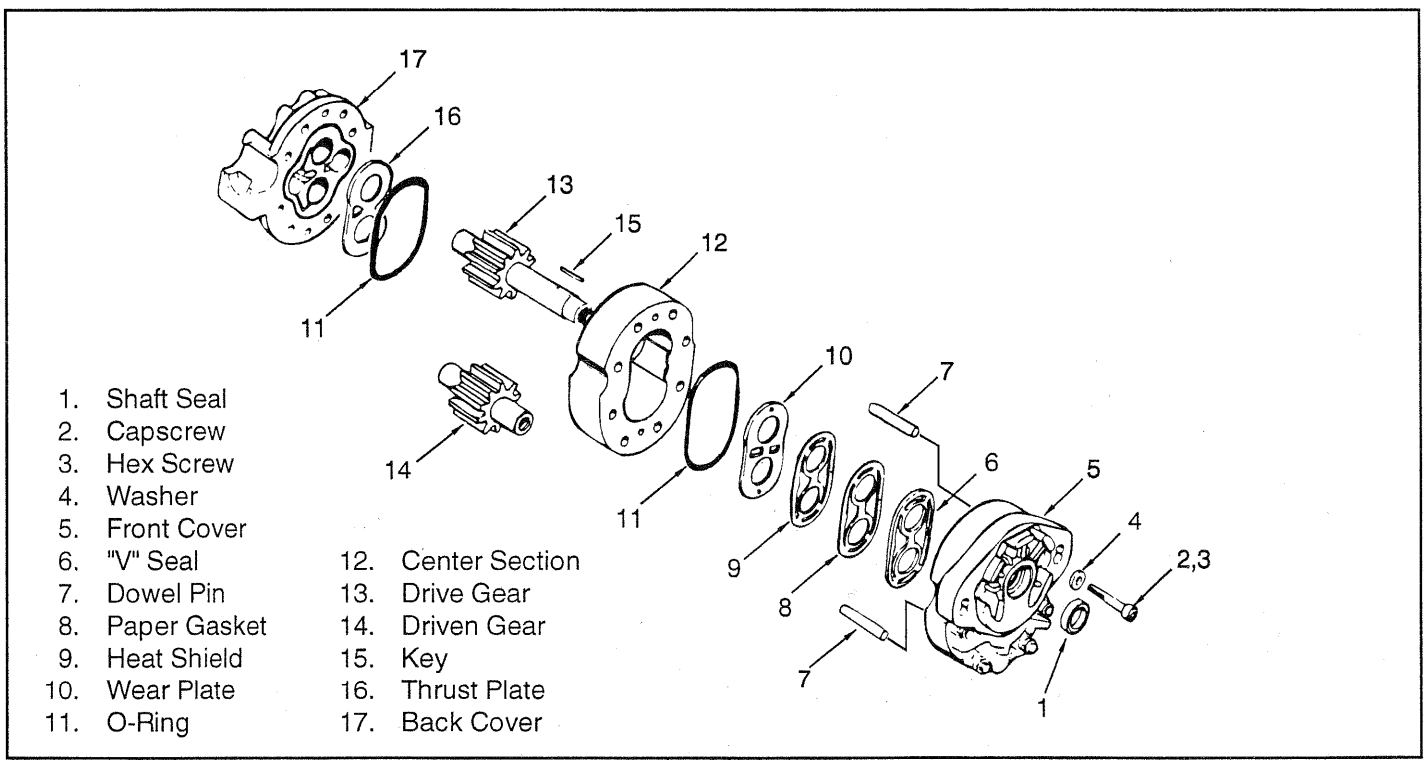
4. Remove the front cover (5) by lightly tapping the flange with a soft metal hammer.

5. The center section (12) will remain to either the front cover (5) or the back cover (17). Place the drive gear (13) into the unseparated sections, and while holding the center section (12), tap lightly to separate. Be careful to avoid cocking on the dowel pins (7).

6. Remove the wear plate (10) and thrust plate (16).

7. Mark the front cover island next to the pressure vent hole in the heat shield (9), gasket (8), and V-seal (6) to act as a guide during re-assembly. The location of this vent hole determines pump rotation.

8. Use a small diameter wire (a paper clip will do) to remove the phenolic heat shield (9), the paper compound gasket (8), and the rubber V-seal (6). Discard these parts and replace when the pump is re-assembled.



1. Shaft Seal
2. Capscrew
3. Hex Screw
4. Washer
5. Front Cover
6. "V" Seal
7. Dowel Pin
8. Paper Gasket
9. Heat Shield
10. Wear Plate
11. O-Ring
12. Center Section
13. Drive Gear
14. Driven Gear
15. Key
16. Thrust Plate
17. Back Cover

Fig. 4- 22 Hydraulic Pump

9. Remove both O-Rings (11) and discard. They too should be replaced.

10. Do not remove the shaft seal (1) in the front cover unless it is damaged or leaking. If the seal is to be replaced, use great care not to damage the seal recess or bearing. Heating the cover in an oven to 121° C (250° F) will reduce the press fit.

Inspection

Pump Gears (13 & 14):

Inspect shafts for roughness in the bearing and sealing areas. Measure shaft diameter for wear. Minimum size is 19.03 mm (.7492").

Inspect the key way, and key for wear or damage.

Inspect the gear end faces, outside diameter, and teeth for roughness and score marks. The O.D. of the gears must be 43.54 mm (1.7140") minimum. The minimum gear widths are to be:

low input cover and hi w/ large pump	17.98 mm (.7079")
hi input cover	11.51 mm (.4531")

Be sure snap rings are secure. Break any sharp edges on the sides of the gears.

Front and Back Cover Assemblies (5 & 17):

If any bearing bore diameter exceeds 19.10 mm (.7518"), the cover should be discarded. Bearings are not available separately.

Replace the shaft seal (1) only if it shows excessive wear or cracking. Check all internal threads for damage.

Bearings must be below the cover faces and show no signs of contact with snap rings on gear shafts. If bearings are scored, rough, or show signs of heat discoloration, the cover assemblies should be replaced.

Center Section (2)

Inspect the wall of the gear bore diameters for excessive wear or score marks. The center section gear bores will show signs of wear on the inlet side of the pump. A wear ridge will develop at the end of the gear bore where the thrust plate is located. This wear ridge should not exceed 0.79 mm (0.031").

Lightly tap the faces to remove any nicks or burrs. Do not break inside edges.

Wear Plate (10) & Thrust Plate (16)

Inspect bronze wear surfaces for excessive roughness or heat discoloration. If wear ridges exceed 0.0127 mm (.0005"), discard and replace.

General

The following parts should be replaced at every major overhaul: Wear Plate (10), Thrust Plate (16), Fiber Heat Shield (9), Paper Gasket (8), "V" Seal (6), and O-Rings (11). The Shaft Seal (1) should be replaced only when necessary.

Assembly

1. All parts must be thoroughly cleaned prior to re-assembly by dipping in solvent and brushing to remove all traces of contamination. The pump should be reassembled in a dirt-free area.

2. Install the shaft seal (1), if it was removed, in the front cover with the spring loaded lip facing inward. Force the seal into place using a flat steel rod slightly smaller in diameter than the O.D. of the seal. This will permit the tool to enter the seal recess and bottom the rotary seal on the stop. (The front cover (5) must be backed-up on a smooth, clean surface to prevent damaging its face.) The load used to force the seal into place

should be applied exactly in line with the housing seal bore to prevent bending the seal steel retainer, and/or scoring the seal housing bore.

3. Install the "V" seal (6), the gasket (8), and heat shield (9) into the front cover cavity as follows:

The small vent hole through all of these parts must be in line and positioned next to the scribe mark on the island previously made during disassembly. This position locates the vent holes on the outlet side of the pump.

The lips on the "V" seal must face toward the cavity and be tucked into the groove with the aid of a dull tool to prevent damage to the rubber surface. A small screwdriver can be used.

The gasket should be pressed firmly toward the bottom of the cavity with the thumbs so as to ensure all of its perimeter is completely within the groove to avoid interference with subsequent assembly.

The heat shield should be firmly pressed toward the bottom of the cavity with the thumbs to provide sufficient space for the wear plate.

4. Install an O-Ring (11) into the groove provided in the front cover face. Oil the O-Ring and stretch it slightly, if necessary, so that it will remain in its groove.

5. Install the wear plate (10) with the bronze surface against the gears and the small vent hole in line with the hole in the heat shield (9). Press the wear plate into the oval cavity sufficiently so that it is axially retained.

6. Install the pump gears (13 & 14) into the front cover. Apply oil to the shaft at the drive end to prevent damage to the shaft seal caused by sharp edges on the drive shaft passing through the shaft seal. An oil-coated shaft, rotated slowly, will usually cause no damage to the seal. Check to see that the shaft seal lip and spring is not pushed out by the shaft.

7. Check the wear plate (10) to ensure that it is still seated into its oval cavity and install the center section (12) over the gears until it engages the wear plate (10). The center section (12) must be positioned so that the previously scribed lines on the housing exteriors are in line with those scribed on the front cover (5). The small slot located midway between the bores should align with the small vent hole in the wear plate (10).

Then, install the dowel pins (7) and add a generous amount of clean oil into the gear cavities. Rotate the gears to distribute the oil.

8. Position the thrust plate (16) on top of the gears in the center section, with the bronze face toward the gears. The open side should be toward the inlet.

9. Install an O-Ring (11) into its back cover face groove. Oil the O-Ring, the cover face, and the bearings. Install the back cover (17) so that the scribe marks are in line with the marks on the center section (12) and front cover (5).

10. The housing retaining screws (2 & 3) should be alternately tightened to 21-24 N•m (190-210 lb-in).

Add a generous portion of clean oil to both ports to ensure that the pump is adequately lubricated. Rotate the drive shaft to distribute the oil and check for freedom of shaft rotation. The shaft must be free to rotate with the help of a short wrench (11 N•m (100 lb-in) maximum).

To prime the pump, fill it with a heavy oil such as 90W prior to installation. This is important to protect the pump from aeration during initial operation.

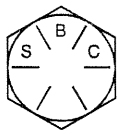
11. Replace the key (15) in the drive shaft.

SPECIFICATIONS

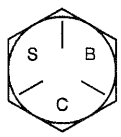
Torques listed are suggested values on parts carrying residual oil of manufacture.

These values apply to CADMIUM PLATED AND LUBRICATED parts.

SAE & SBC IDENTIFICATION



S.A.E. GRADE 8 (Used for load carrying bolts only)



S.A.E. GRADE 5 (General purpose bolts)

AWC001

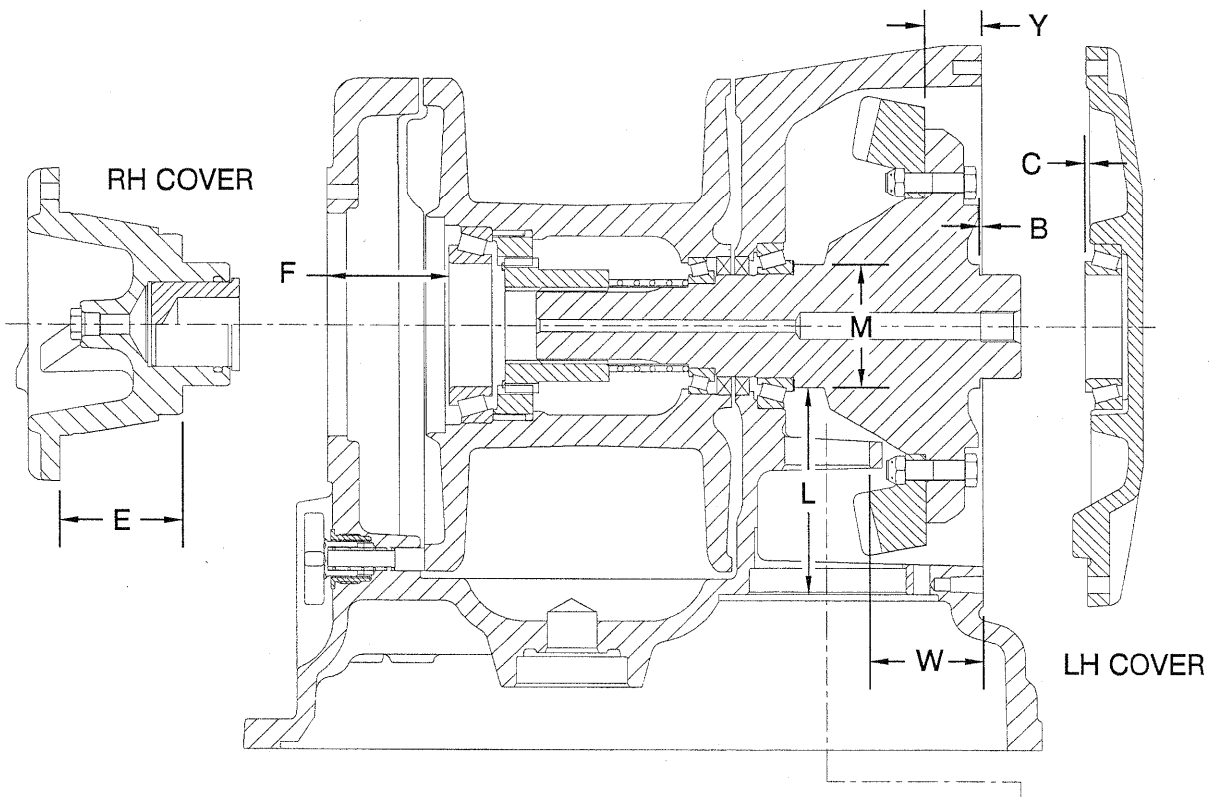
BOLT SIZE	TORQUE	
	S.A.E. GRADE 5	S.A.E. GRADE 8
1/4-20	7 lb-ft	10 lb-ft
1/4-28	8 lb-ft	12 lb-ft
5/16-18	14 lb-ft	21 lb-ft
5/16-24	15 lb-ft	24 lb-ft
3/8-16	24 lb-ft	36 lb-ft
3/8-24	28 lb-ft	40 lb-ft
7/16-14	40 lb-ft	60 lb-ft
7/16-20	44 lb-ft	63 lb-ft
1/2-13	60 lb-ft	84 lb-ft
1/2-20	82 lb-ft	96 lb-ft
9/16-12	88 lb-ft	124 lb-ft
9/16-18	96 lb-ft	136 lb-ft
5/8-11	120 lb-ft	168 lb-ft
5/8-18	144 lb-ft	192 lb-ft
3/4-10	216 lb-ft	310 lb-ft
3/4-16	240 lb-ft	338 lb-ft
7/8-9	315 lb-ft	490 lb-ft
7/8-14	370 lb-ft	550 lb-ft
1-8	475 lb-ft	768 lb-ft
1-12	520 lb-ft	800 lb-ft
1-14	525 lb-ft	813 lb-ft
1 1/4	1005 lb-ft	1680 lb-ft
1 1/2	1740 lb-ft	2920 lb-ft
2		3600 lb-ft

Table 4-2 Torque Specifications

Hydraulic Pressure Specifications, kPa (psi)				
FUNCTION	CLUTCH	BRAKE	FREESPOOL	COOLING
Line In	1,310 (190)	1,310 (190)	0	0-350 (0-50)
Brake On	0	0	0	0-350 (0-50)
Brake Off	0	1,310 (190)	0	0-350 (0-50)
Freespool	0	1,310 (190)	1,310 (190)	0-350 (0-50)

Table 4-3 Hydraulic Pressure Specifications

Setup Dimensions



Dim.	Description
B	LH Cover Mounting Surface to Bearing Seat Shoulder on Drum Shaft
C	Face of Bearing Cone to Mounting Face of LH Cover
E	Bearing Seat Shoulder to Mounting Face of RH Cover
F	RH Cover Mounting Face on Frame to Outer Face of Drum Bearing Cone
K	Inner Bearing Face to Pinion Carrier Mounting Surface
L	Pinion Carrier Mounting Surface to Drum Shaft Shoulder
M	Drum Shaft Diameter above Bearing Shoulder
N	*Dim. P - Dim. K*
P	$\frac{Dim.M}{2} + L$
R	Outer Bearing Face to Inner Bearing Cone
S	Face of Hub to Bearing Shoulder of Pinion Drive Gear
W	LH Cover Mounting Surface to O.D. of Nose Bearing
X	*Dim. W + 35.92 mm (1.414")*
Y	LH Cover Mounting Surface to Flat Surface of Ring Gear (average of three places)
Z	*Dim. X - Dim. Y*

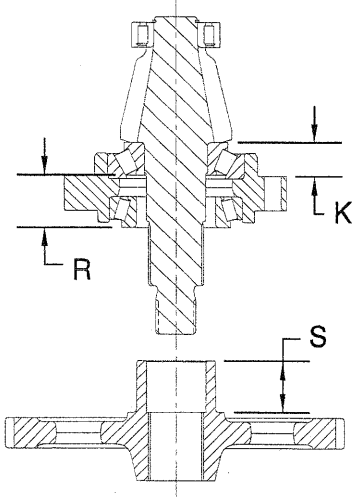


Fig. 4-23 Setup Dimensions

Notes

WINCH INTERNAL OPTIONS

1. POWER FORWARD/REVERSE (PFR)

W3C winches equipped for power forward and reverse operation are called PFR winches.

DESCRIPTION

On PFR winches a sliding gear is used to engage two different sets of gears rotating in opposite directions. Moving the right hand lever to either the forward or reverse position will determine which set of gears are engaged.

OPERATION AND CONTROL

A dual control lever is used for winch control. See fig. 5-1. The right control lever is used to set winch direction (forward or reverse). The left control lever must be in the neutral (Brake On) position before moving the right control lever. The left control lever is used to select one of the following operations:

- FREESPOOL
- BRAKE OFF
- BRAKE ON
- POWER

From the LINE IN position, the lever will return to the BRAKE ON position when the control lever is released. A spring arrangement on the spool of the control valve returns the spool and control lever to the BRAKE ON position. A ball and detent will hold the spool and control lever in the BRAKE OFF and FREESPOOL positions. The operator must pull the control lever from the BRAKE OFF and FREESPOOL positions.
The FREESPOOL position disengages the gear train so that the cable can be pulled from the winch by hand.

Power Operation

The BRAKE ON position is the neutral position. The clutch is not applied. The conical washer springs (also called belleville springs) in the brake fully apply the brake. The winch drum will not turn.

The POWER position engages the clutch and releases the brake. The winch will wind the cable, in the direction selected by the right control lever, at a speed controlled by the rpm of the engine or the output rpm of the torque converter of the tractor.

The BRAKE OFF position releases the brake as the control lever is moved toward the detented BRAKE OFF position (no hydraulic pressure is directed to the clutch). The brake friction is decreased as the operator pushes the control lever toward the BRAKE OFF position. The tractor engine must be at low idle for best control. If there is a load on the cable, this position will permit the cable to unwind from the drum against the friction of the clutch, brake, and gear train. The speed that the cable unwinds is not controlled by the operator, but by the movement of the load or the travel speed of the vehicle.

NOTE: Maintain sufficient engine rpm in order to ensure that the pump in the winch sends 11 liters/min (3 gpm) to the control valve for best control of BRAKE OFF. The engine speed of most tractors is approximately 700 to 1000 rpm.

Freespool Operation (See Fig. 5-1)

⚠ WARNING

When the control lever is moved to the FREESPOOL position, it always releases the gear train and any load that may be on the cable. An uncontrolled release of the load may result in personal injury and/or property damage.

When the control lever is moved to the FREESPOOL position, the winch drum is disengaged from the gear train. The FREESPOOL operation permits the cable to be pulled from the winch drum by hand. The amount of drag when in FREESPOOL is manually adjustable. See Section 3, Service.

2. MECHANICAL FREESPOOL LOCK (See Fig. 5-2)

Some W3C winches are equipped with an optional manually operated mechanical FREESPOOL lock.

DESCRIPTION

The FREESPOOL is hydraulically activated. If the tractor engine is shut off while the winch is in FREESPOOL, hydraulic pressure will gradually bleed off allowing the gears to engage.

The optional FREESPOOL lock is a mechanical stop that prevents the gears from engaging. This will keep the winch in FREESPOOL continuously, even if the tractor engine is off.

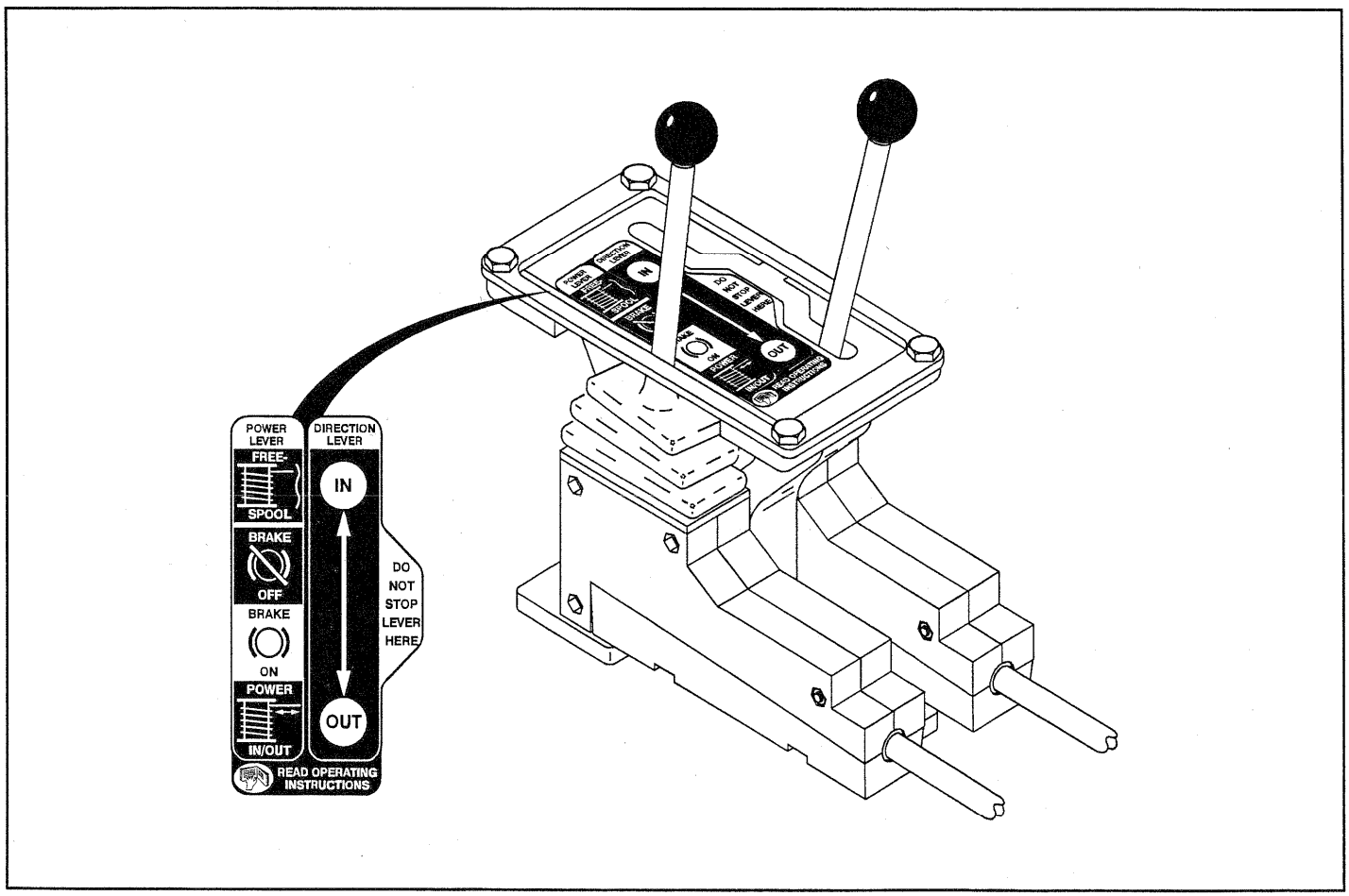


Fig. 5-1 PFR Operator Controls

OPERATION

The optional FREESPOOL lock is controlled from the operator's seat using a push-pull cable. Pulling up on the handle, after the winch control lever has been shifted into FREESPOOL will mechanically lock the winch in FREESPOOL. The engine may then be shut off and the winch will stay in FREESPOOL.

To Lock Freespool

- Shift winch control lever into FREESPOOL.
- Pull the handle up to engage FREESPOOL lock.
- Engine may be shut off.
- The winch drum is now disengaged from the gear train.

To Unlock Freespool

- Start engine, if previously shut off.
- Make sure winch control lever is in FREESPOOL.
- Push the handle down to unlock FREESPOOL.
- The winch can now be operated in the normal manner.

1. Cover RH
2. Shaft
3. Detent
4. O-Ring
5. O-Ring
6. Lever
7. Key
8. Nut
9. Ball joint
10. Nut
11. Cable
12. Bracket
13. Cover
14. Flange Screw
15. Washer
16. Washer

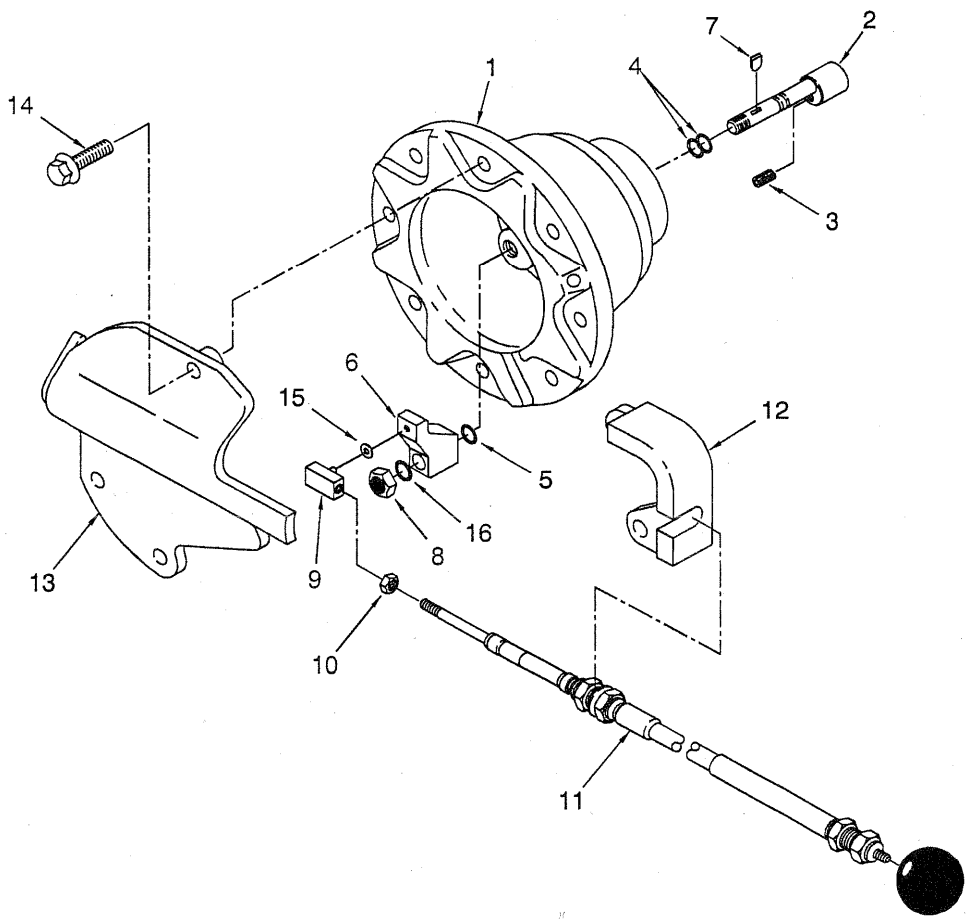


Fig. 5-2 Freespool Lock

CONTROL CABLE ADJUSTMENT

Check the operation of the control lever to make sure it moves smoothly and will return to the BRAKE ON position. Check that the BRAKE OFF and FREESPOOL positions have a detent to hold the lever in position. Make sure the control lever does not hit anything at the end of its travel. Check the POWER lever control cable to make sure that the winch end of the cable is threaded completely into the ball joint. Check the DIRECTION lever control cable to make sure that the winch end of the cable is threaded completely into the shifter fork. Check that the cable jackets are threaded completely into the cable mounting block. Check the tall nut to make sure it is threaded completely onto the cable.

Power Lever Adjustment (See Fig. 5-3 & 5-4)

Pull the POWER lever back and release. The lever should spring forward to the BRAKE ON position. Remove the access cover on the control lever housing to make adjustments. Loosen the Jam nut that keeps the clevis and adjustment nut from turning. Remove the cotter pin and link pin from the clevis. Align the lever with the BRAKE ON slot by moving the clevis with the adjustment nut. Install the clevis pin, tighten the jam nut and check for complete lever travel. Pull the lever back to the POWER IN/OUT position. Push the lever forward to the BRAKE OFF and FREESPOOL positions. Both the BRAKE OFF and FREESPOOL positions have a detent to hold the lever in position. Install the cotter pin and access cover when the adjustment is complete.

Direction Lever Adjustment (See Fig. 5-3 & 5-4)

Move the POWER lever to the BRAKE ON position. Move the DIRECTION lever back and forth. The DIRECTION lever should travel equally into the IN and OUT positions. The sliding plate should retain the POWER lever at the BRAKE ON position when the DIRECTION lever

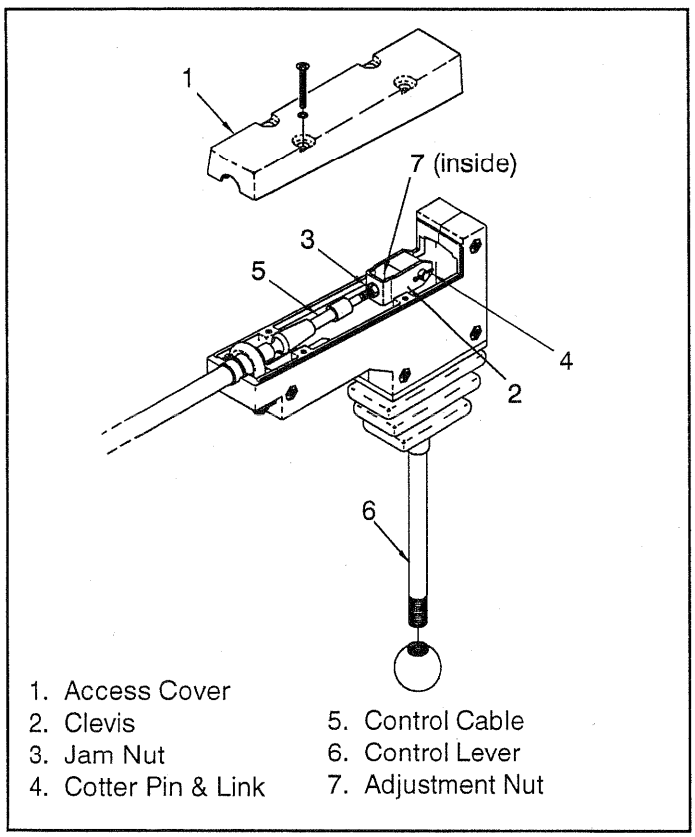


Fig. 5-3 PFR Control Cable Adjustment

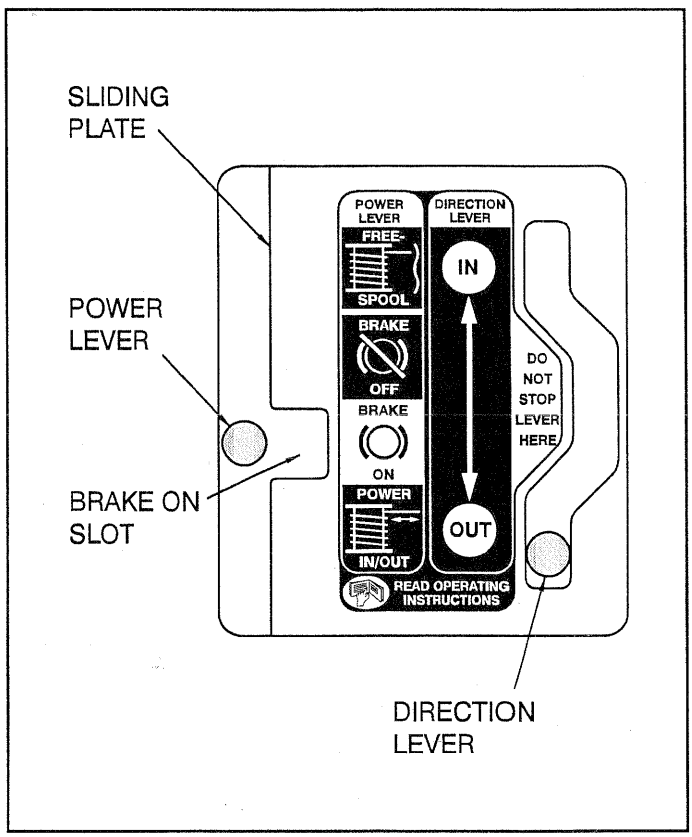


Fig. 5-4 PFR Operator Controls

is not at the IN or OUT position. Remove the access cover on the control lever housing to make adjustments. Loosen the Jam nut that keeps the clevis and adjustment nut from turning. Remove the cotter pin and link pin from the clevis. Adjust the DIRECTION lever by moving the clevis with the adjustment nut. Install the clevis pin, tighten the jam nut and check for complete lever travel. Install the cotter pin and access cover when the adjustment is complete.

WINCH INSTALLATION (See Fig. 5-5)

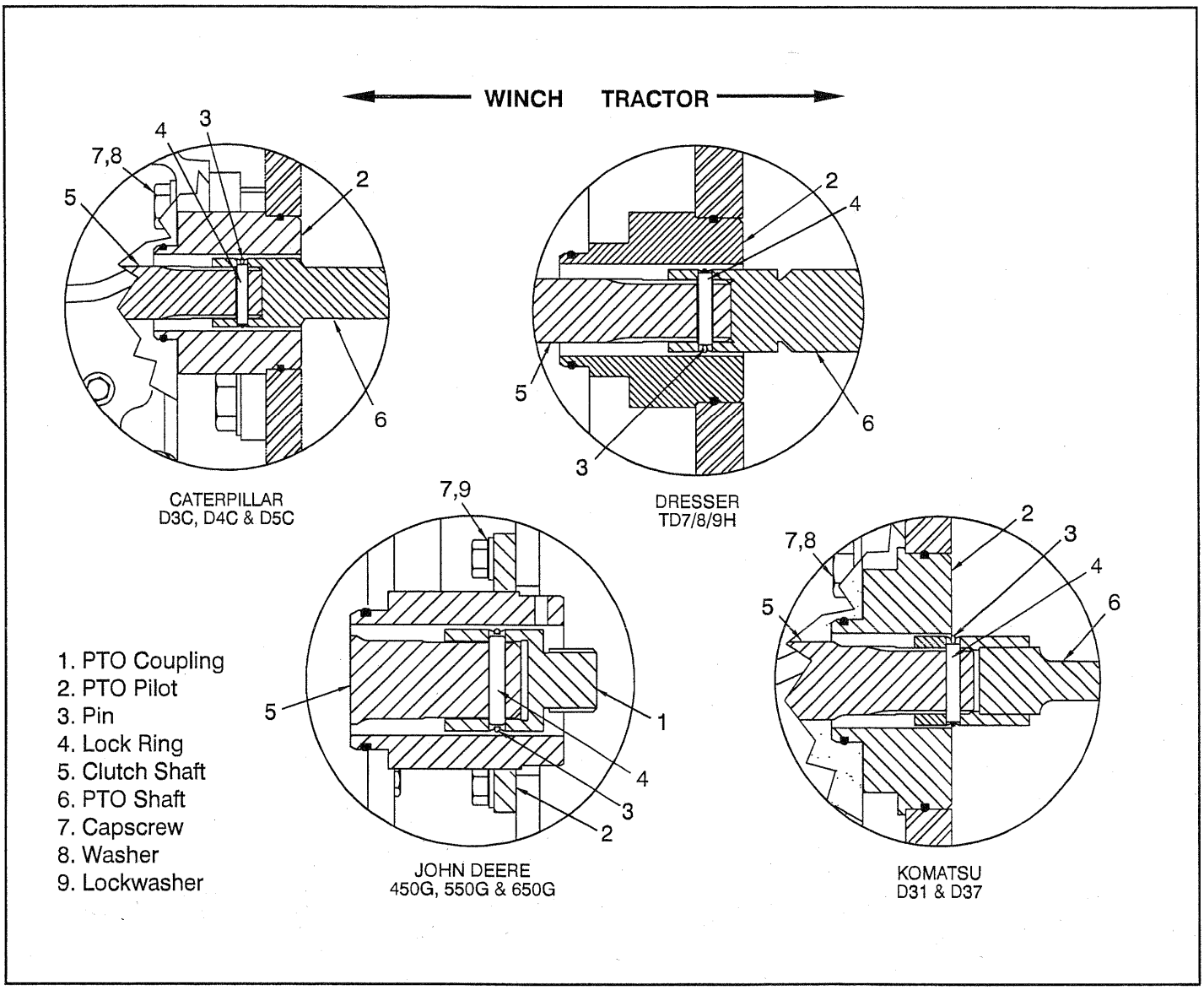


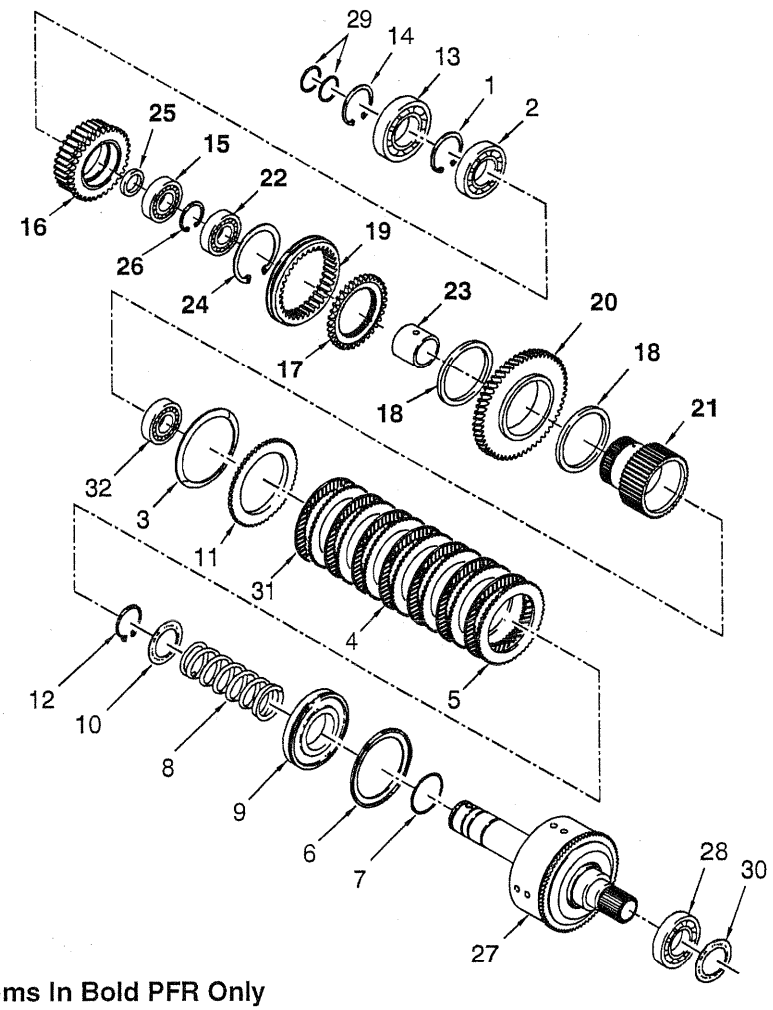
Fig. 5-5 PTO Arrangements

HYDRAULIC CONTROL

Oil Clutch For PFR Winches (See Fig. 5-6)

The clutch assembly has seven friction discs, seven separator plates, a clutch housing, piston assembly, and hub. See Fig. 5-3. The friction discs of the clutch are internally splined to the clutch hub. The separator plates have large splines that fit the splines in the housing. The separator plates rotate with the housing. The piston and clutch housing rotate on the input shaft next to the hub. Oil passages in the clutch shaft supply the oil pressure from the control valve to the piston. Hydraulic oil also cools and lubricates the bearings and internal components of the clutch. When the oil pressure pushes the piston against the separator plates and friction discs, the clutch is applied. The torque from the input shaft is transferred through the clutch and causes the winch to operate.

1. Snap Ring
2. Ball Bearing
3. Snap Ring
4. Friction Plate
5. Separator Plate
6. Clutch Pack Seal
7. O-Ring
8. Clutch Spring
9. Clutch Piston
10. Spring Guide
11. Pressure Plate
12. Ext. Snap Ring
13. Ball Bearing
14. Snap Ring
15. **BEARING**
16. **GEAR**
17. **GEAR**
18. **THRUST WASHER**
19. **COLLAR**
20. **GEAR ASSEMBLY**
21. **CLUTCH HUB**
22. **BALL BEARING**
23. **SPACER**
24. **SNAP RING**
25. **SPACER**
26. **SNAP RING**
27. Shaft & Housing Assembly
28. Bearing
29. Seal Ring
30. Seal
31. Separator Plate
32. Ball Bearing



NOTE: Items In Bold PFR Only

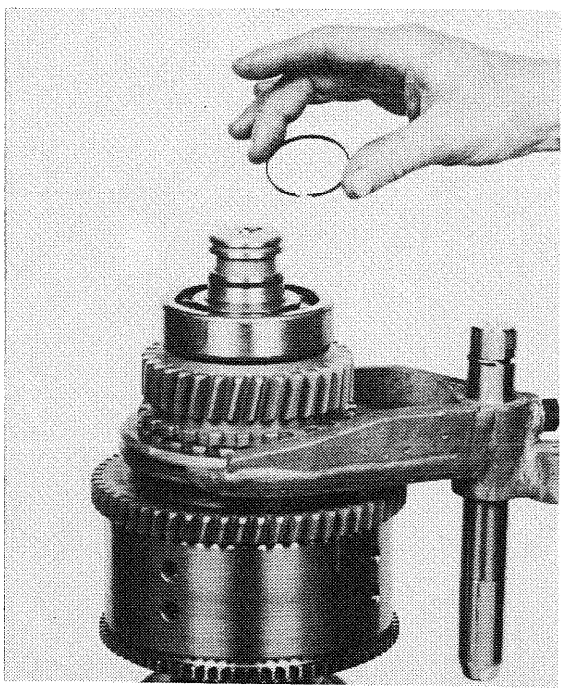
Fig. 5-6 PFR Oil Clutch Assembly

SERVICE

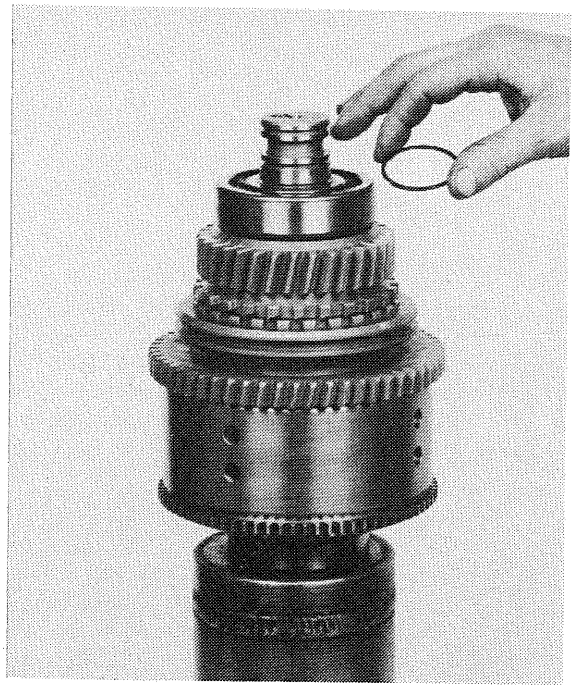
NOTE: This section provides the additional instructions for disassembly of the clutch for winches with Power Forward/Reverse. The instructions for the removal and installation of the winch and for other repairs are in Section 4.

NOTE: Disconnect the Direction Lever control cable from the shifter fork before removing the front cover.

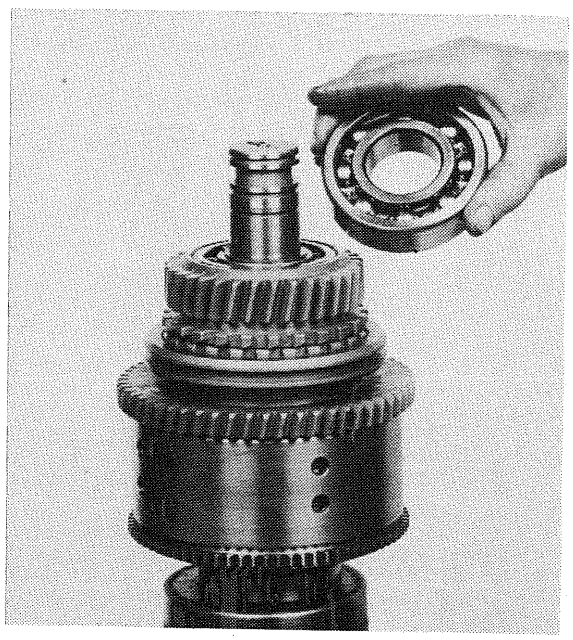
Disassembly of the PFR Clutch (See Fig. 5-6)



1. Remove the two seal rings from the end of the clutch shaft. Remove the shifter fork from the PFR clutch assembly.



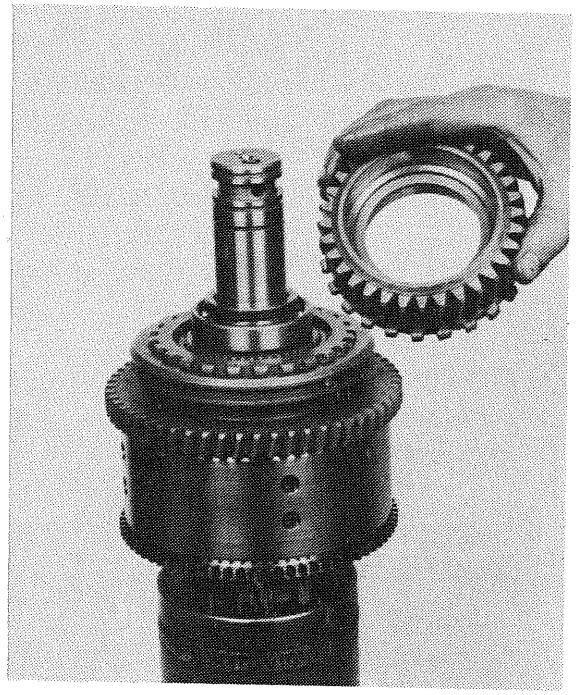
2. Remove the snap ring that secures the roller bearing to the clutch shaft.



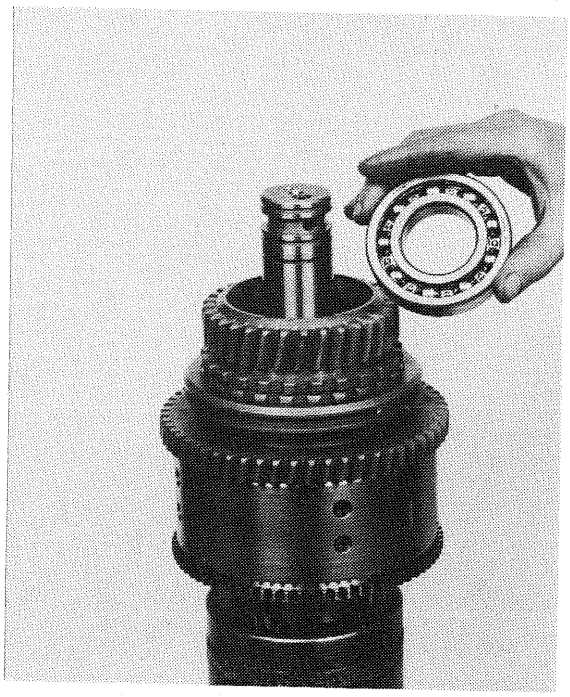
3. Remove the roller bearing from the end of the clutch shaft.

Fig. 5-7 Disassembly of the PFR Clutch (1 of 4)

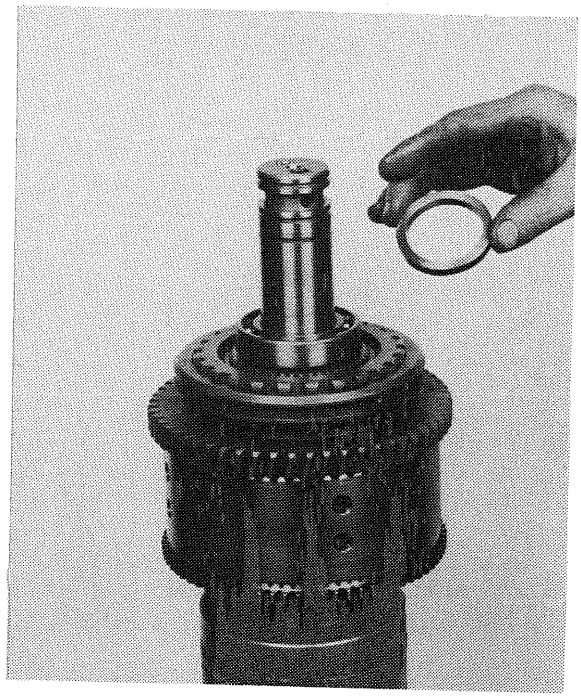
4. Remove the snap ring that secures the roller bearing to the clutch shaft.



6. Remove the gear from the end of the clutch shaft.

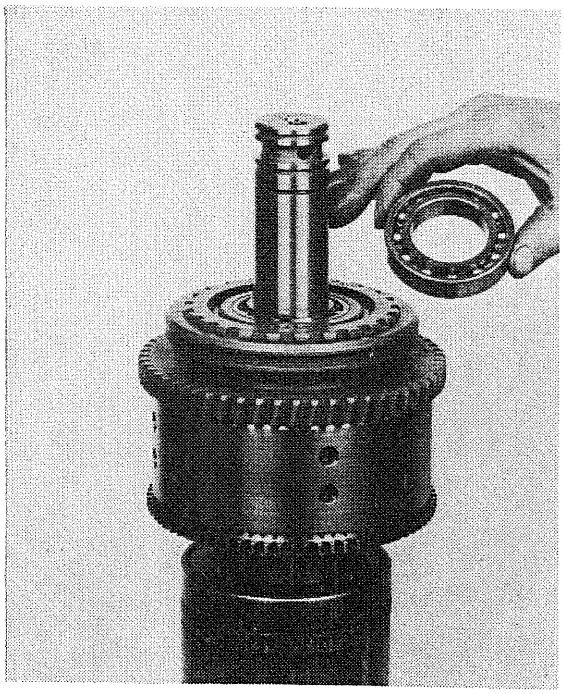


5. Remove the roller bearing from the end of the clutch shaft.

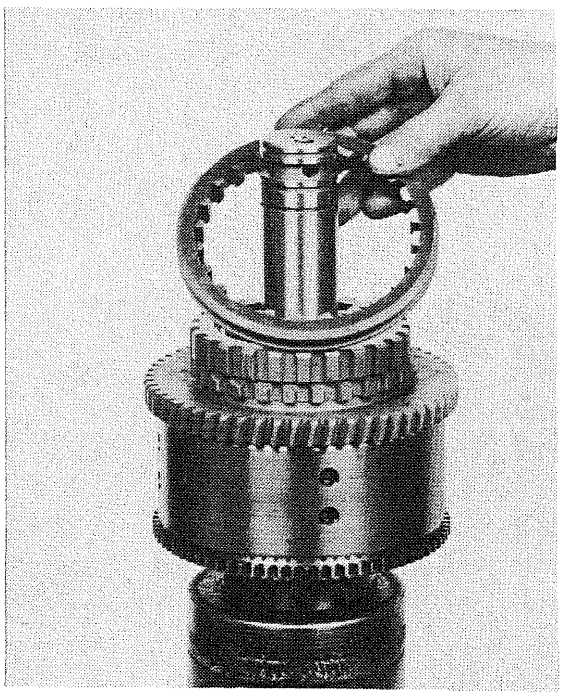


7. Remove the spacer.

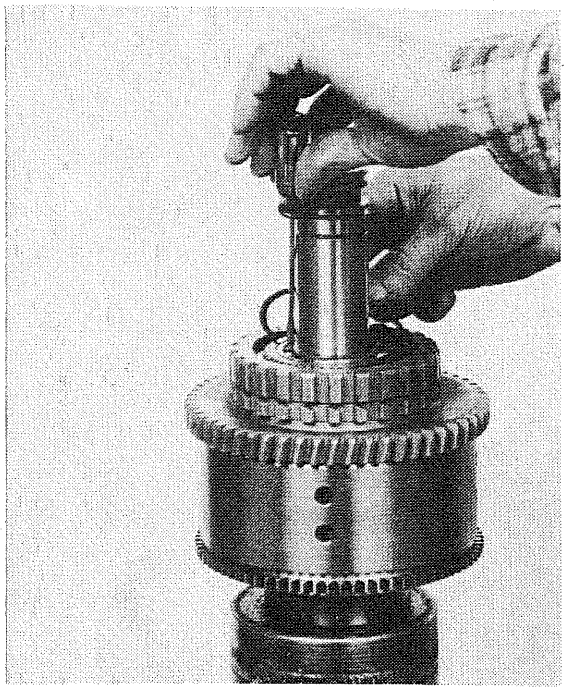
Fig. 5-7 Disassembly of the PFR Clutch (2 of 4)



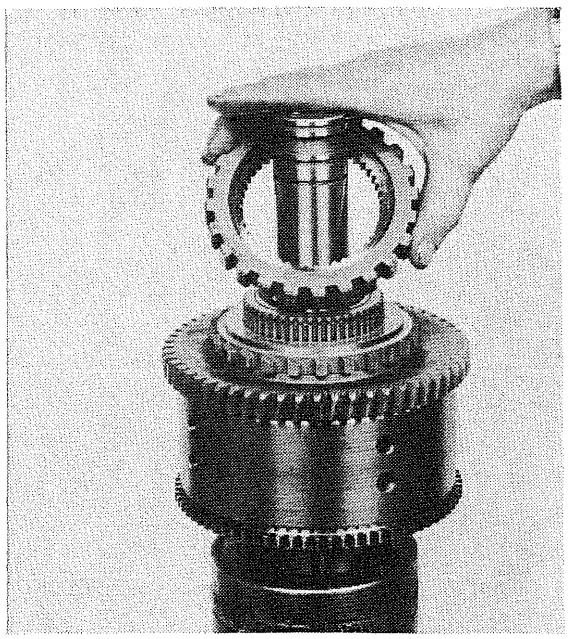
8. Remove the roller bearing.



9. Remove the collar from the gear. Note the orientation of the bevel on the collar for assembly.

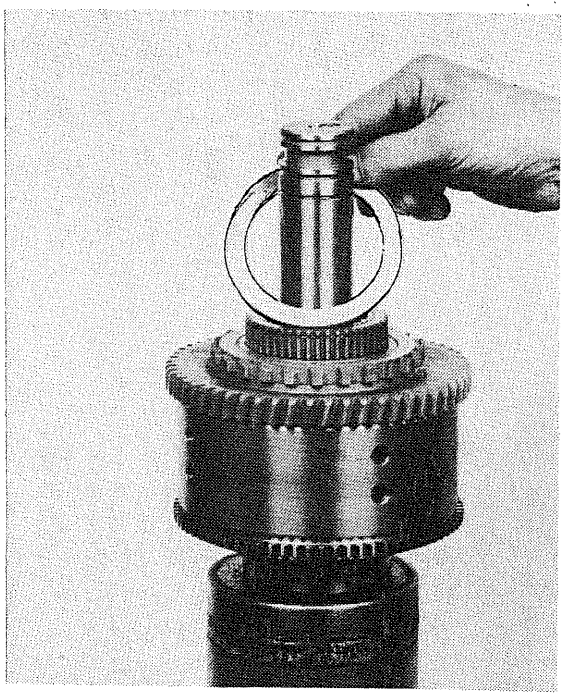


10. Remove the snap ring from the inside of the gear.

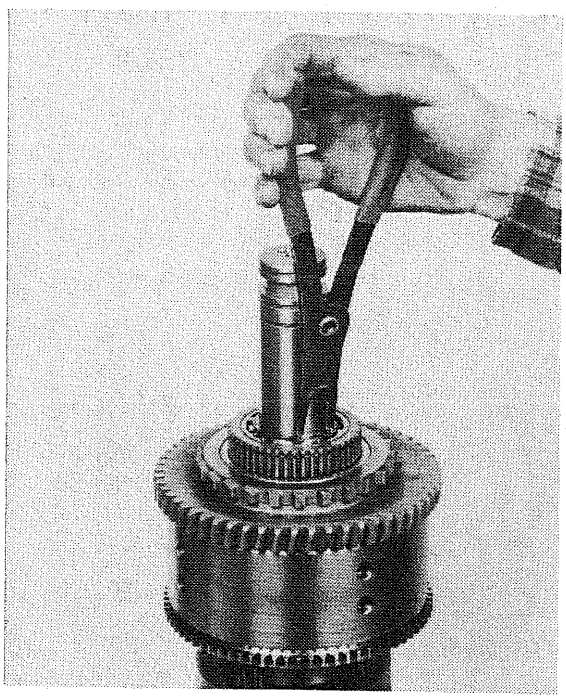


11. Remove the gear from the clutch hub.

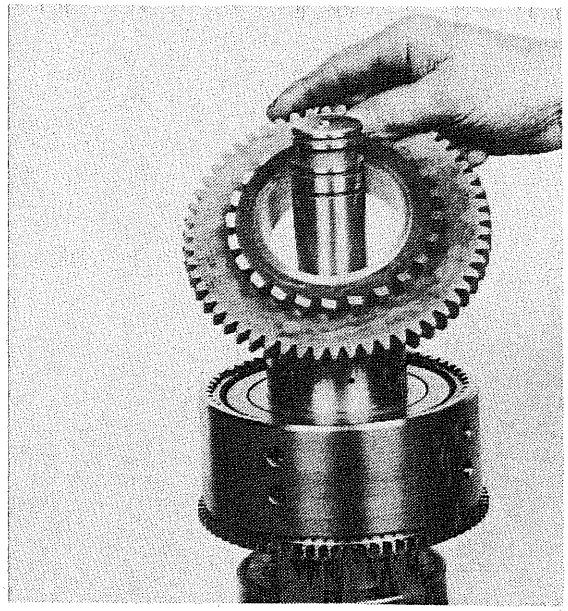
Fig. 5-7 Disassembly of the PFR Clutch (3 of 4)



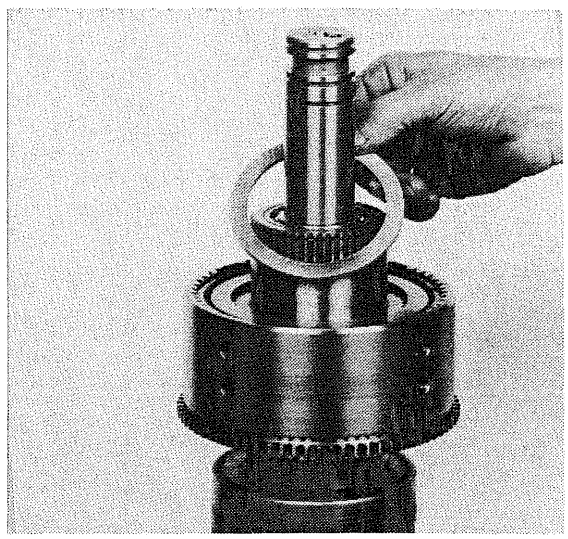
12. Remove the thrust washer from the gear assembly.



13. Remove the snap ring from the gear assembly.



14. Remove the gear assembly from the clutch shaft.



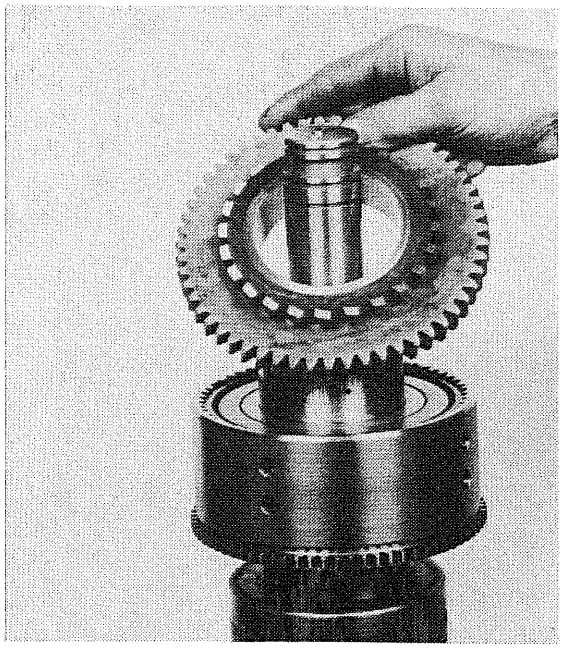
15. Remove the thrust washer from the clutch hub.

NOTE: For the rest of the disassembly instructions, see page 4-18, step 3.

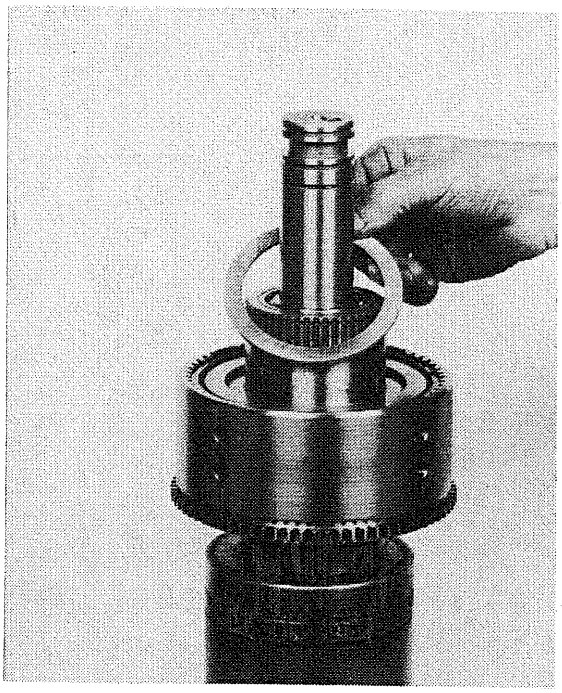
Fig. 5-7 Disassembly of the PFR Clutch (4 of 4)

Assembly of the PFR Clutch (See Fig. 5-6)

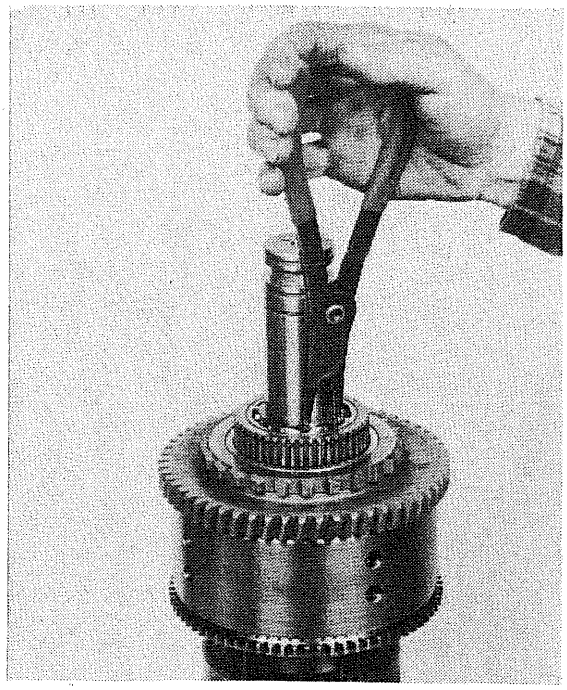
NOTE: This section provides the additional instructions for assembly of the clutch for winches with Power Forward/Reverse. The instructions for the removal and installation of the winch and for other repairs are in Section 4.



2. Install the gear assembly onto the clutch shaft.

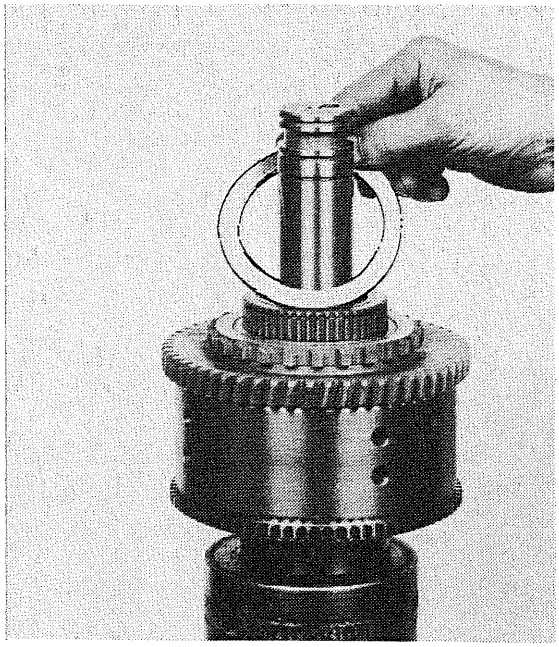


1. Install the thrust washer into the clutch hub.

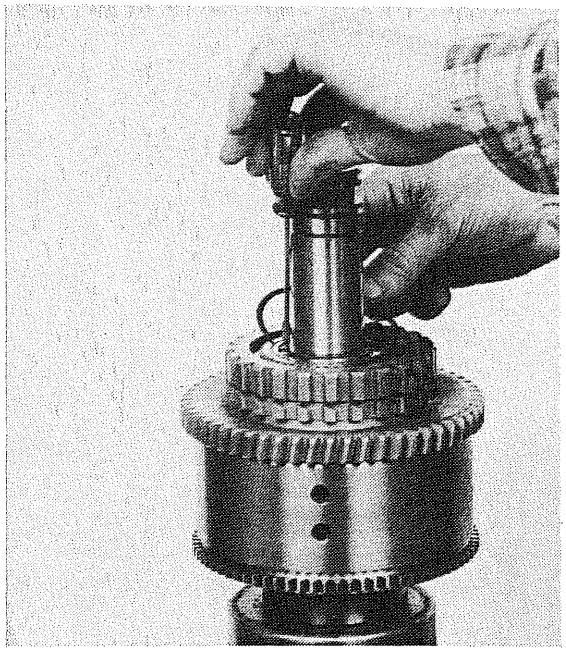


3. Install the snap ring into the gear assembly.

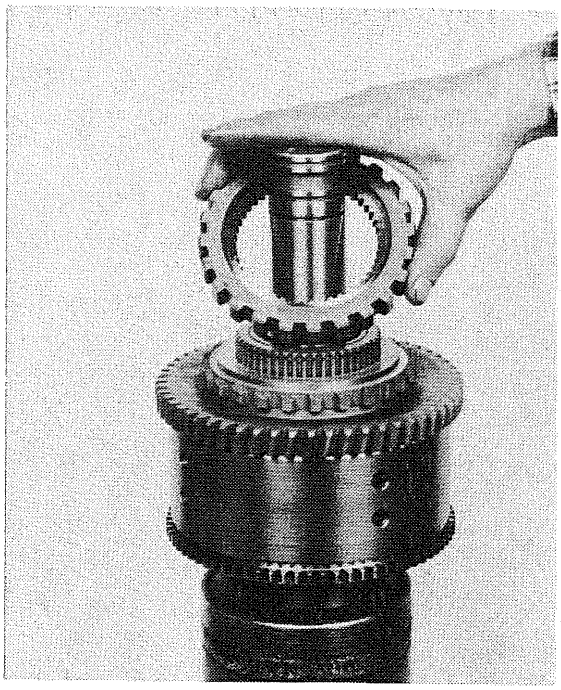
Fig. 5-8 Assembly of the PFR Clutch (1 of 5)



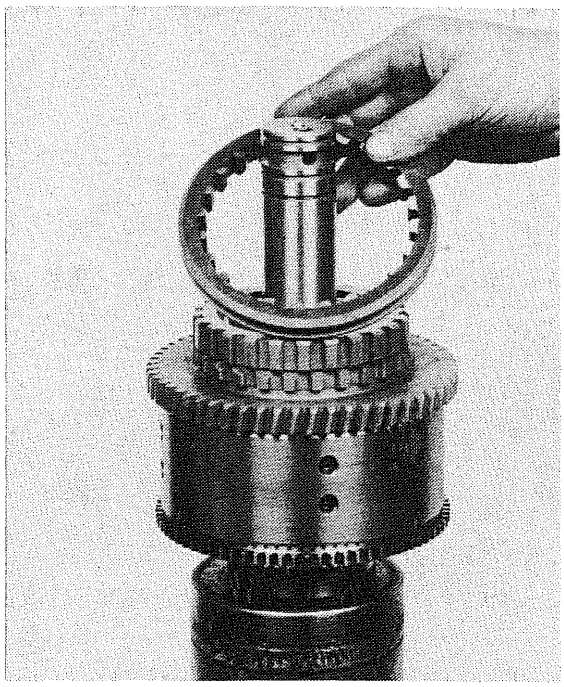
4. Install the thrust washer into the gear assembly.



6. Install the snap ring into the inside of the gear.

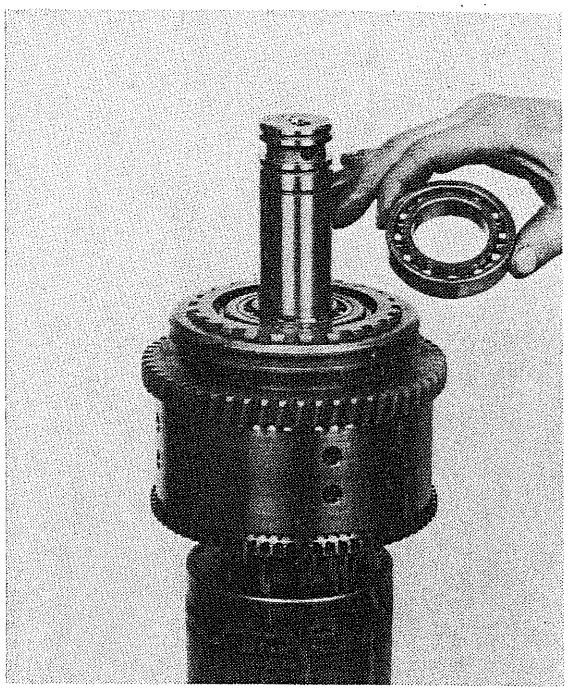


5. Install the gear onto the clutch hub.

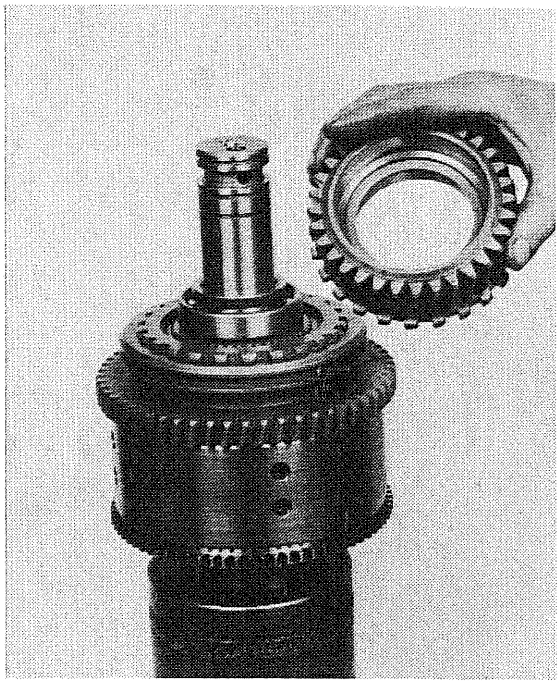


7. Install the collar onto the gear. Note the orientation of the bevel on the collar.

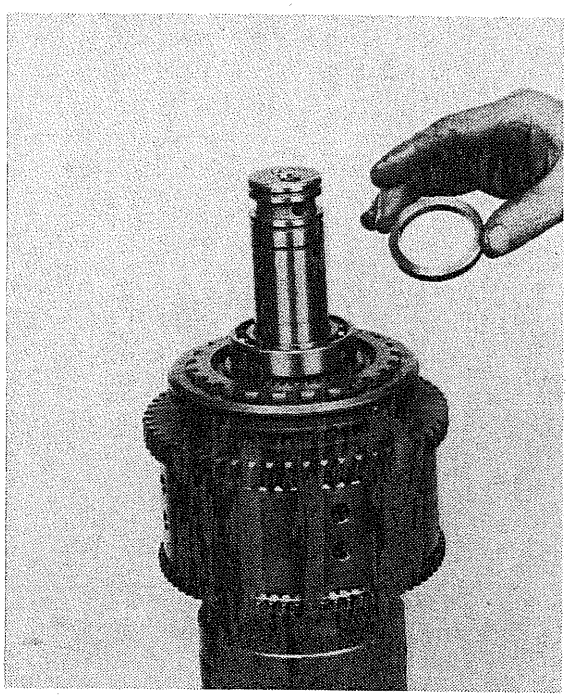
Fig. 5- Assembly of the PFR Clutch (2 of 5)



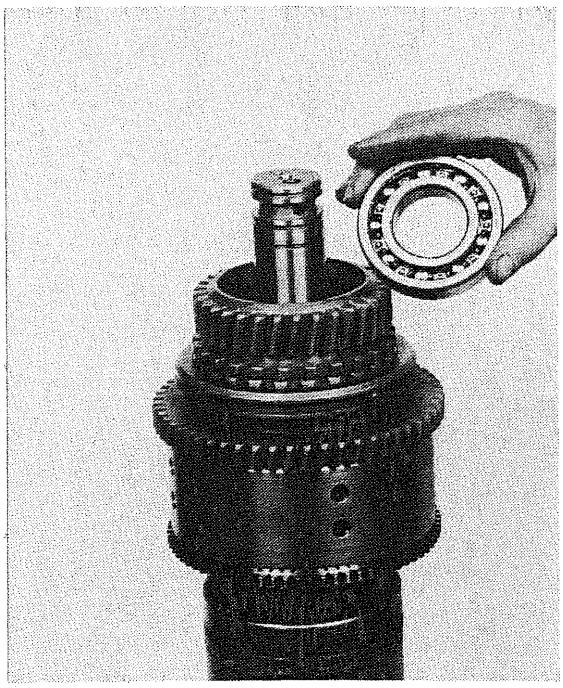
8. Press the roller bearing onto the clutch shaft, using a suitable driver.



10. Install the gear onto the end of the clutch shaft.

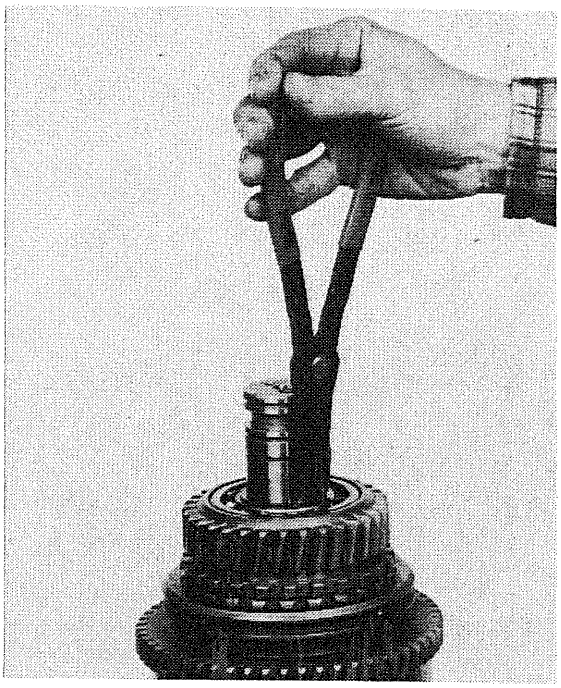


9. Install the spacer.

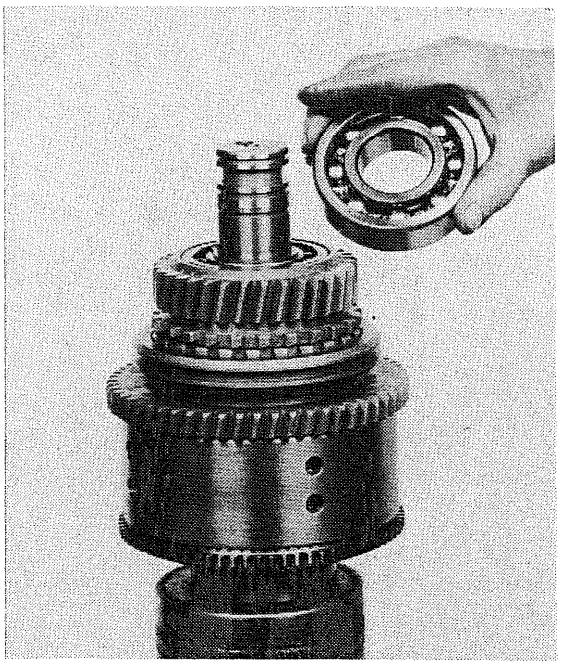


11. Press the roller bearing into the gear, using a suitable driver.

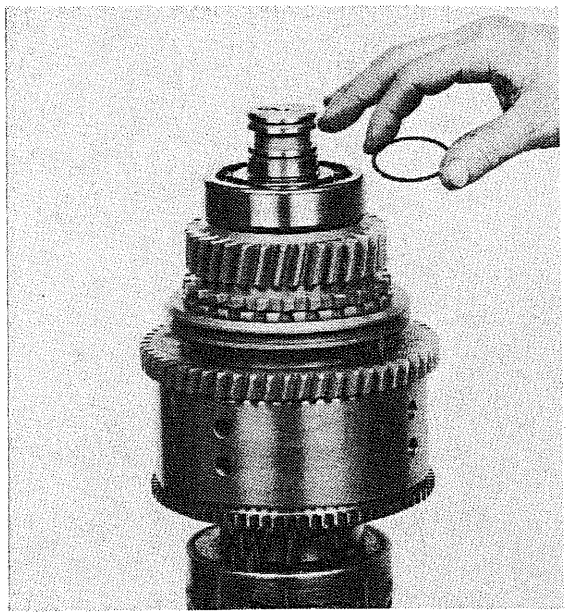
Fig. 5-8 Assembly of the PFR Clutch (3 of 5)



12. Install the snap ring that secures the roller bearing to the clutch shaft.

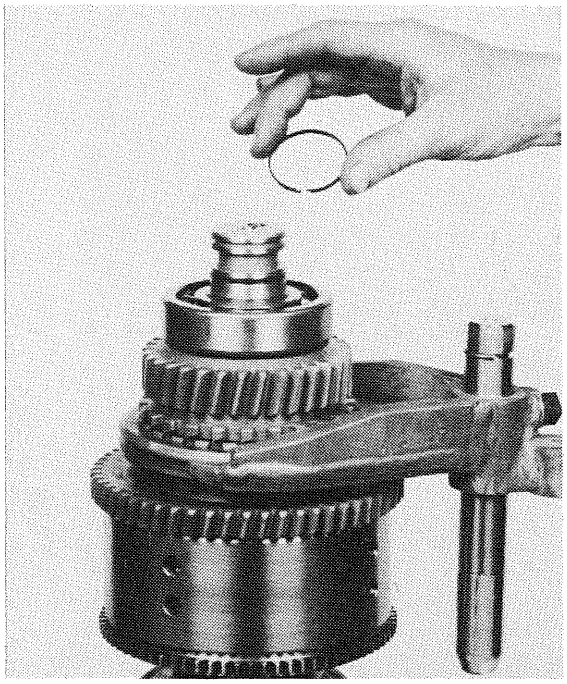


13. Press the roller bearing onto the clutch shaft, using a suitable driver.



14. Install the snap ring that secures the roller bearing to the clutch shaft.

Fig. 5-8 Assembly of the PFR Clutch (4 of 5)



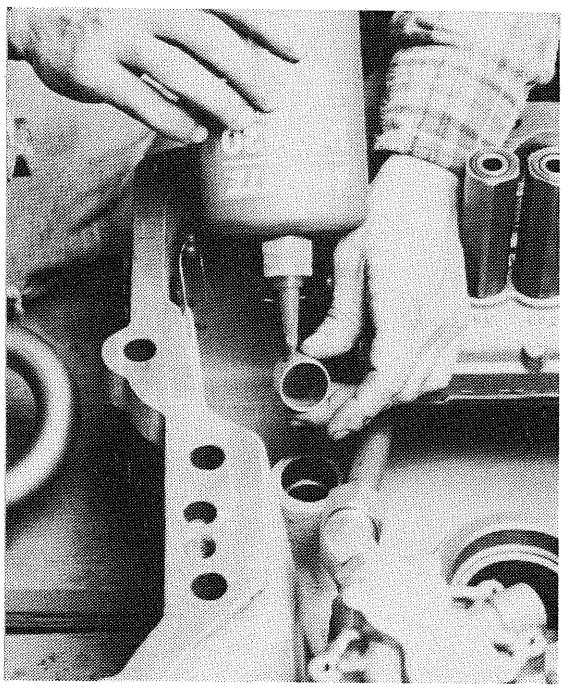
15. Install the two seal rings onto the end of the clutch shaft. Install the shifter fork onto the PFR clutch assembly.

NOTE: For the rest of the assembly instructions, see page 4-43, steps 21 and 22.

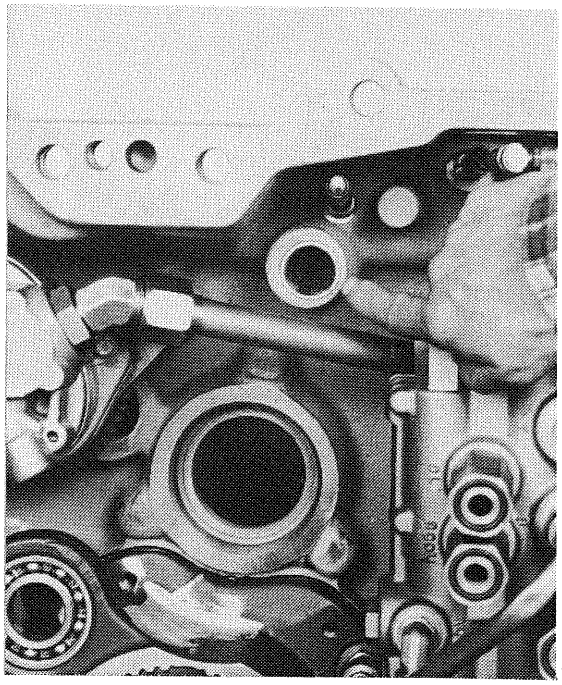
Fig. 5-8 Assembly of the PFR Clutch (5 of 5)

Final Assembly PFR

NOTE: This section provides the additional instructions for final assembly of winches with Power Forward/Reverse. The instructions for the removal and installation of the winch and for other repairs are in Section 4.



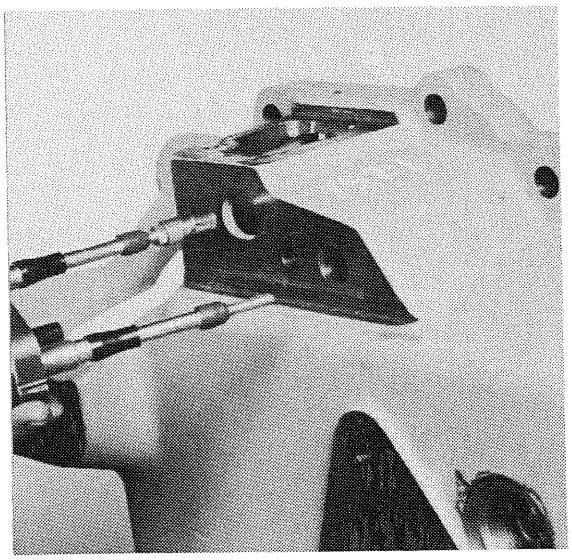
1. Apply Loctite 242 thread lock to the shifter fork bushing.



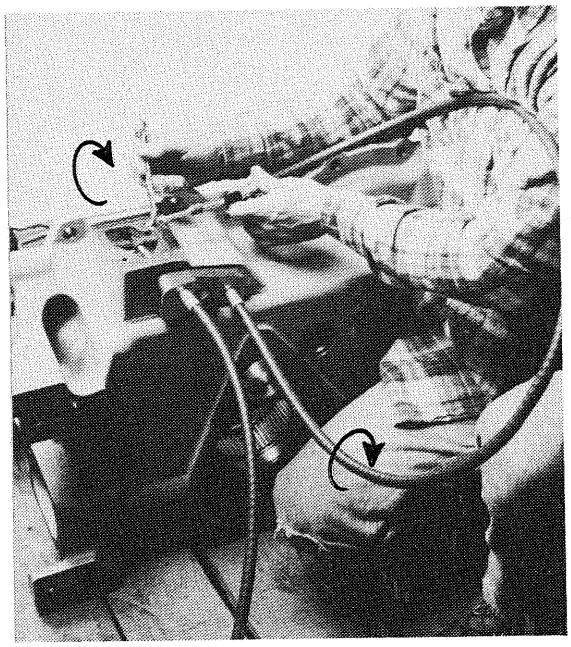
2. If necessary, drive the shifter fork bushing into its bore in the front cover assembly using an appropriate driver. Install PFR clutch assembly with shifter fork into its bore in the frame. Use care to avoid damaging the sealing rings.

NOTE: For the assembly of the front cover to the frame, see page 4-48, step 21.

Fig. 5-9 Final Assembly PFR (1 of 2)

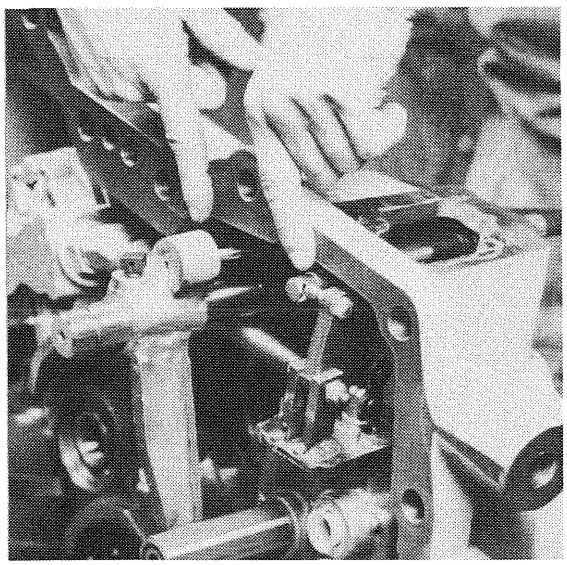


3. Insert the cable anchor block assembly into the appropriate holes in the front cover assembly.



5. Use a nut and wrench to screw the direction lever control cable completely into the shifter fork.

NOTE: For the rest of the final assembly instructions, see page 4-52.



4. Connect the direction lever control cable to the shifter fork. Connect the power lever cable to the ball joint on the control valve.

Fig. 5-8 Final Assembly PFR (2 of 2)

Notes

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