

FOREWORD

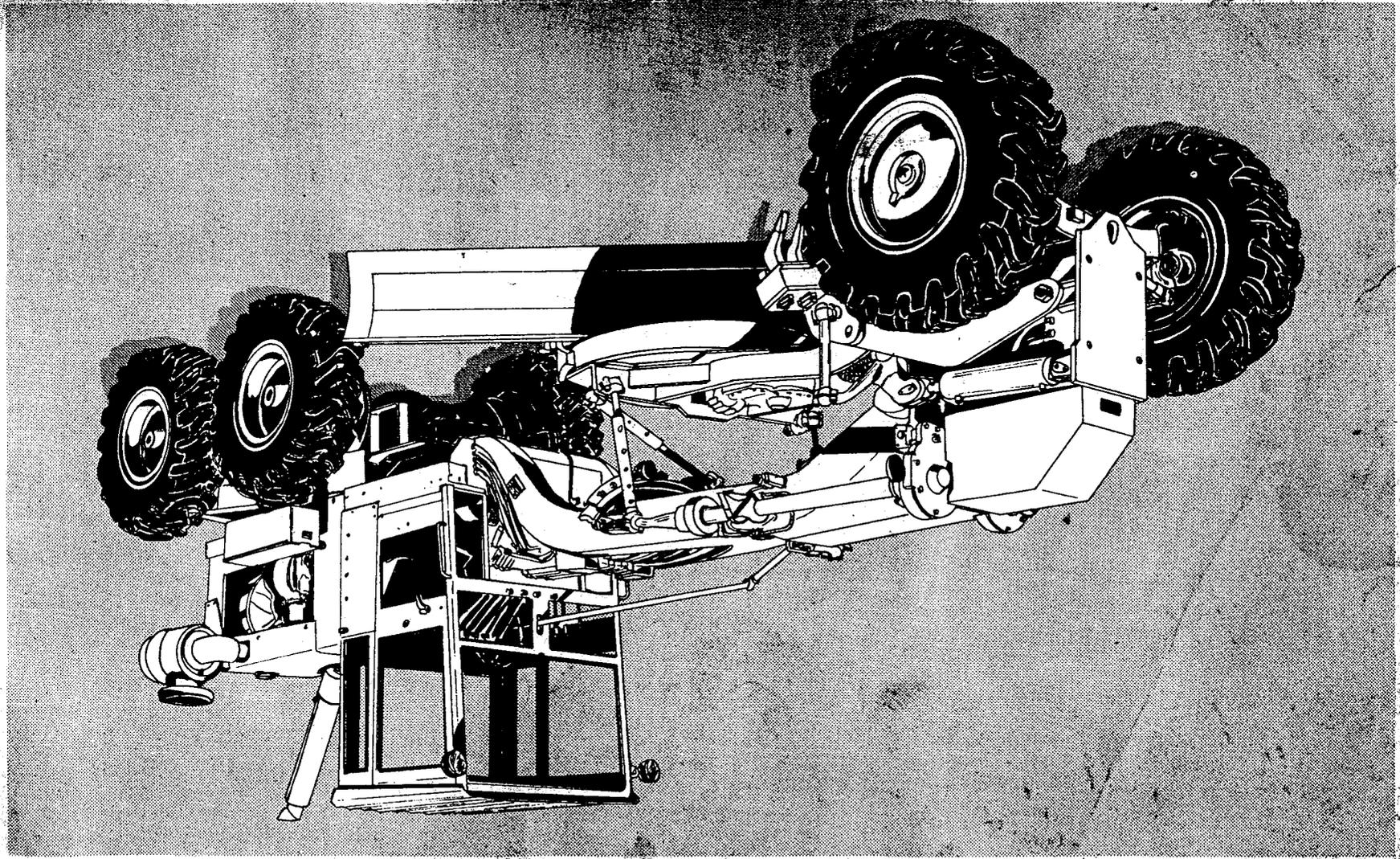
The Service Manual is especially designed for use by mechanics. The material is arranged for easy reference and logical sequence of detail.

The greater portion of the manual pertains to disassembly, reassembly and adjustments. Each major mechanical division is dealt with individually. For example: The disassembly and reassembly of the final drives is discussed as a unit and so on through the engine mechanical detail of the machine. Thus, if you have a repair problem on your machine, all material pertaining to that part or parts will be grouped together in one section, ready for your quick reference and use.

The illustrations used in this manual are typical of the component shown and do not necessarily refer to any one particular machine.

All reference to locations "right" or "left" is made from the operator's normal seated position.

MODEL 2775 MOTOR GRADER



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GENERAL INFORMATION

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GENERAL INFORMATION

PRE-OPERATING CHECKS

BRAKES

1. Check brake master cylinder for proper fluid level.
2. Operate brakes before moving machine to determine if they are operating properly. Check lines for leaks.

CONTROLS

1. With engine running, operate blade lifts to lower moldboard until front wheels are clear of floor or ground. Operate leaning wheel control and steering control. Check for looseness and interference. Lower front wheels and check toe-in. It should be $1/8''$ to $1/4''$.
2. With engine running, operate lateral shift controls and move lateral shift rack through its complete range of travel. Check for binding or looseness.
3. Before and after starting engine, observe all instruments and controls for correct readings and operation.

COOLING SYSTEM

1. Check level of coolant in radiator. For cold weather operation, a sufficient amount of permanent type anti-freeze must be in system to protect engine.
2. Check tightness of radiator hose connections and clamps.

ELECTRICAL SYSTEM

1. Visually check generator belt for alignment. Check belt for proper tension.

2. Check to make certain cranking motor will not operate unless power-flow clutch pedal is in neutral position. (Power-Flow models only)
3. Check level of electrolyte in batteries. Test specific gravity of electrolyte to determine if batteries are sufficiently charged.
4. Operate all lights and accessories.
5. Check electrical connections for tightness.

ENGINE

1. Check engine RPM to assure the engine is operating at specified speed at full throttle as listed below.

<u>MODEL</u>	<u>GM</u>	<u>CUMMINS</u>
777B Power-Flow	2,000	2,000
777B Standard	1,800	2,000
666B Power-Flow	2,100	2,100
666B Standard	2,000	2,100

2. On Power-Flow models check operation of tailshaft governor. Start engine, shift lower transmission into fourth gear, shift clutch to forward. Set throttle at $1/4$ engine RPM. Apply brakes. Tailshaft governor should open up and operate smoothly.
3. Check radiator, hoses and oil lines for leaks.
4. Check crankcase oil level. Oil must be up to "FULL" mark on dipstick.

GENERAL

1. Check drawbar draft ball for looseness.

2. Check all nuts and bolts for looseness.
3. Make a visual check of entire machine cleanliness.
4. Check all belts for proper tension. (Includes tailshaft governor drive belt on Power-Flow models.)
5. Check clutch pedal free travel. Check action of clutch brake. (Standard models)
6. Check parking brake.
6. Check torque converter oil level with bayonet gauge under seat. (Power-Flow models)
7. Check hydraulic reservoir oil level at sight gauge on L.H. side of reservoir.
8. Make a visual check of all hydraulic piping and fittings for leaks.

HYDRAULIC SYSTEM

1. Attach a pressure gauge with a capacity of 3000 psi to Sundstrand relief valve. With engine running, operate hydraulic motor to stall position and check pressure gauge reading. Maximum reading with engine at high idle should be 2750 psi.

Operate Hydreco valve to move one of the hydraulic cylinders to stop. Gauge should read 2000 psi at high idle.

When operating any of the controls with no load, the gauge should show a maximum of 900 psi.

2. Check blade limit valves to make sure they relieve the flow of oil to motor just before lift arms reach stop.
3. Check torque converter pressure. Should be 35-50 psi. (Power-Flow models)
4. Check power-flow clutch pressure. Should be 130-145 psi. (Power-Flow models)
5. Check all hydraulic lines for tightness and crimping.

LUBRICATION

1. Lubricate entire machine in accordance with lubrication instructions in Section J of this manual.
2. Check all components for proper lubrication and oil level.
 - (a) Type "A" oil for hydraulic components, torque converter on Power-Flow models and oil clutch on Standard models.
 - (b) 90 weight gear oil for upper and lower transmission on Standard models, also for lower transmission on 777B Power-Flow model.
 - (c) 10 weight engine oil for tandems.
 - (d) Special lubricant for gear housings.
3. Check all breathers.

WHEELS AND TIRES

1. Check pressure on all tires. Refer to specification page in this section for correct pressures.
2. Check front wheels while steering. They should turn same distance in both directions. If correction is required, make adjustment as outlined in Section F.
3. Check wheel lug nuts for tightness. Check each day for first few days of operation and intermittently thereafter.

INSTRUMENTS AND CONTROLS

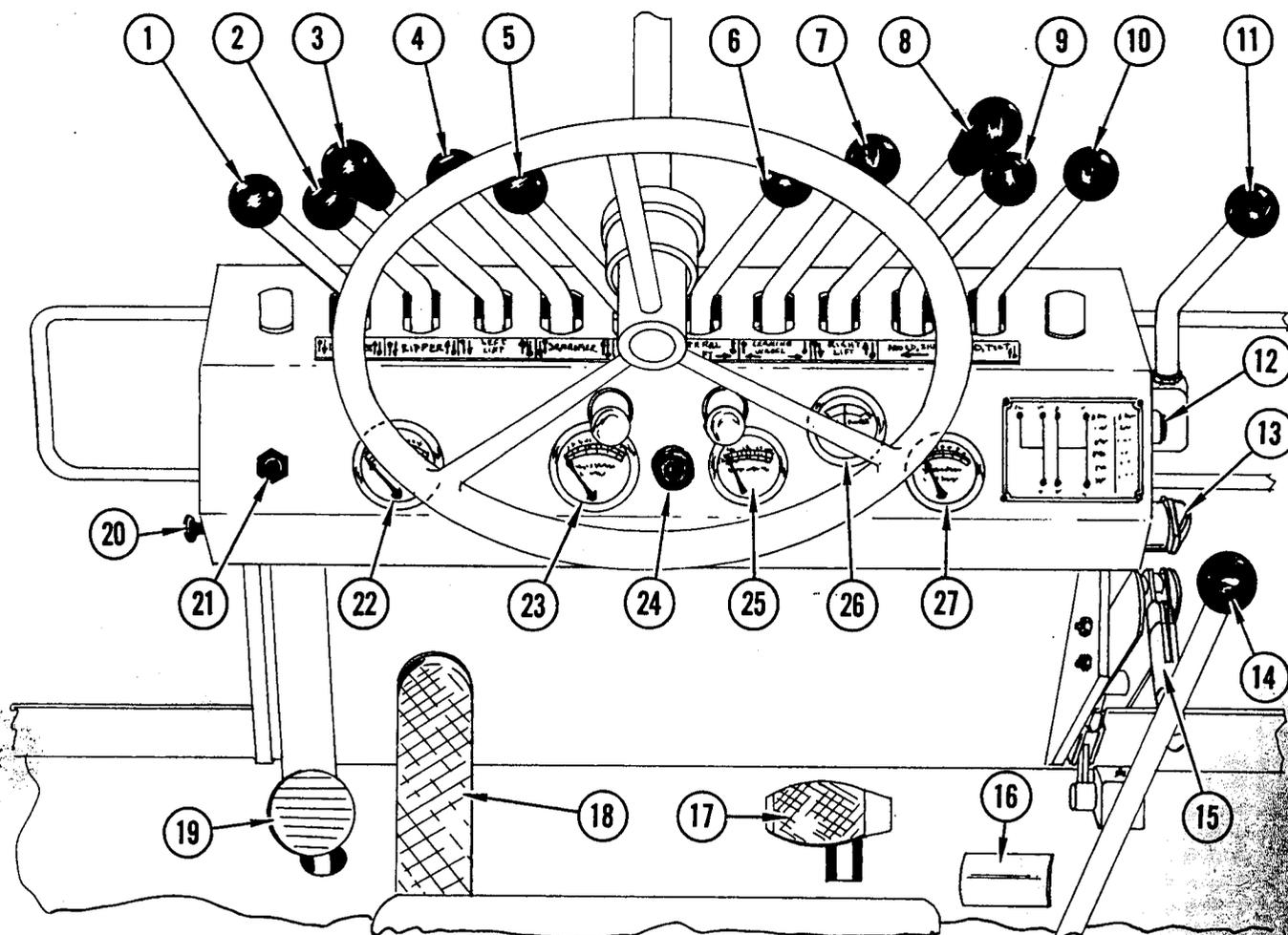


FIG. 1. INSTRUMENTS AND CONTROLS

- | | | |
|--------------------------|---------------------------------------|---|
| 1. Ripper Tilt | 11. Ground Speed Selector | 20. Light Switch |
| 2. Ripper Block | 12. Horn Button | 21. Engine Shut Down Button (GM) |
| 3. L. H. Blade Lift | 13. Key Switch | 22. Engine Oil Pressure |
| 4. Scarifier Control | 14. Gear Shift Lever (1 Std) (2 PF) | 23. Engine Temperature |
| 5. Circle Reverse | 15. Parking Brake | 24. Clutch Warning Light |
| 6. Lateral Shift | 16. Accelerator-Decelerator | 25. T/Converter Oil Temperature (PF only) |
| 7. Leaning Wheel | 17. Wheel Brake | 26. Ammeter |
| 8. R. H. Blade Lift | 18. Clutch Pedal (PF shown) | 27. Power Shift Clutch Oil Pressure (PF only) |
| 9. Moldboard Power Shift | 19. Transmission Gear Brake (PF only) | |
| 10. Moldboard Tilt | | |

Figure 1 shows view of operating controls as seen from the operator's seat. Plates are attached to instrument panel to identify the control levers. Arrows on plate designate directional movement of controls.

Ripper Tilt Lever, Item 1. Use for tilting ripper teeth to proper angle for types of

material being worked.

Ripper Block Lever, Item 2. Use for raising or lowering ripper block to get proper tooth penetration.

Left Hand Blade Lift Lever, Item 3. Use for raising and lowering left hand end of moldboard.

Scarifier Control Lever, Item 4. Used to raise and lower scarifier.

Circle Reverse Lever, Item 5. Use for rotating moldboard clockwise or counterclockwise for correct positioning of moldboard for type of work being done.

Lateral Shift Lever, Item 6. Use for moving moldboard and circle right or left to desired position for type of work being done.

Leaning Wheel Lever, Item 7. Use for leaning front wheels to offset side thrust caused by position of moldboard. For most operations the top of the front wheels are leaned away from the leading edge of moldboard.

Right Hand Blade Lift Lever, Item 8. Use for raising or lowering the right hand end of moldboard.

Moldboard Power Shift Lever, Item 9. Use for shifting moldboard right or left for extended reach or to clear obstructions such as bridge abutments, etc.

Moldboard Tilt Lever, Item 10. Use for tilting moldboard to correct position for type of work and material.

Ground Speed Selector Lever, Item 11. Use for hand control of engine RPM.

Horn Button, Item 12.

Key Switch, Item 13, turns on the electrical system. When turned clockwise to its extreme position, it acts as starter switch.

Gear Shift Lever, Item 14. Use to shift lower transmission gears through the four gear ranges.

Parking Brake Lever, Item 15. Use to set parking brake when machine is parked. The parking brake is located on front end of lower shaft of lower transmission.

Accelerator-Decelerator Pedal, Item 16. Use as a foot throttle by pressing down on forward pad to increase engine RPM. Or use to decelerate engine RPM when working with ground speed selector lever in a set position. By pressing down on the rear pad, engine RPM will be reduced. Remove foot from pad and engine RPM will increase to that as preset with ground speed selector lever.

Wheel Brake Foot Pedal, Item 17. Use to apply wheel brakes for bringing grader to a halt. Each of the four tandem wheels are equipped with a hydraulic actuated, shoe-type brake.

Power Shift Clutch Pedal, Item 18. Use to engage Power-Shift transmission clutches (upper transmission). Depress toe of pedal for forward motion. Depress heel of pedal for reverse motion. Clutch pedal must be in neutral position before starting motor circuit will work.

Transmission Gear Brake Pedal, Item 19. To be used only when shifting transmission gears while grader is at halt. Do not use when grader is moving. The gear brake stops transmission gears from rotating while shift is being made. Permits easier shifting without clashing of gears.

Light Switch, Item 20. Controls light circuits.

Engine Shut Down Button (GM Engine), Item 21. Pressing button actuates solenoid at engine governor to shut down engine. Hold button in until engine stops. If grader is equipped with lever instead of solenoid, the pull knob will be located just under R.H. side of the operator's seat. Pull lever and hold until engine stops. NOTE: Do not use the emergency engine shut down to stop engine except in case of an emergency.

Engine Oil Pressure Gauge, Item 22. Registers engine oil pressure. Gauge should read 40 to 60 psi at high idle, 30 to 60 psi at

1200 RPM and a minimum of 18 psi at low idle.

Engine Temperature Gauge, Item 23. The engine temperature gauge indicates the temperature of the coolant in the engine's cooling system.

Oil Clutch Warning Light, Item 24. Do not engage clutch if light is on.

Torque Converter Oil Temperature Gauge, Item 25. The torque converter temperature gauge indicates the temperature of the converter oil. Do not operate the grader when gauge needle is in the red section of the gauge. Should converter oil start to heat

up, shift transmission to next lower gear to permit cooling of oil.

Ammeter, Item 26. The ammeter indicates the condition of the electrical system. It should not show discharge when engine is operating. If ammeter does show discharge, see your WABCO distributor for service.

Power-Shift Clutch Oil Pressure Gauge, Item 27. This gauge shows the oil pressure at the power-shift clutches. Pressure at normal engine RPM should be 130 to 145 psi. If pressure drops to 60 psi at any time, an investigation should be made to determine the cause. Serious damage to clutch discs will occur, due to slippage, if grader is operated with low oil pressure.

OPERATING INSTRUCTIONS (POWER-FLOW MODELS)

SETTING MACHINE INTO MOTION

The Power-Flow clutch pedal must be in neutral position before the cranking motor will operate.

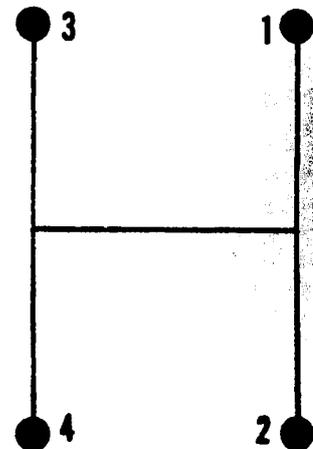
Set ground speed selector (Hand Throttle) to approximately 1/4 open. Turn key switch clockwise until engine starts.

Allow engine to warm up before starting operation. Be sure instrument panel gauges show pressure.

Do not spin tires when setting motor grader into motion. Spinning the tires causes a digging action which not only damages road surfaces but causes excessive wear on the tires.

Set ground speed selector to idle position. With Power-Flow clutch pedal in neutral position, press down on gear brake pedal, Item 17, Figure 1. This will prevent upper shaft of lower transmission from rotating until proper gears can be engaged. Shift the shifter lever, Item 13, into a gear suitable for the type of work to be done.

LOWER
TRANSMISSION
SHIFTER
LEVER



Forward Motion: Press down on toe end of Power-Flow clutch pedal.

Reverse Motion: Press down on heel end of Power-Flow clutch pedal.

When movement of grader occurs, gradually increase speed by pulling back on ground selector lever. After correct working speed has been obtained, the tail shaft governor will maintain this speed until the ground speed selector lever position has been changed.

TAILSHAFT GOVERNOR

The tailshaft governor is an engine governing device which maintains, within limits, a constant output shaft speed as load placed on torque converter varies.

This governing device is driven by a belt from the output shaft, thereby sensing any variation in output shaft speed.

ACCELERATOR-DECELERATOR PEDAL

The accelerator-decelerator pedal is an aid to the operator in controlling engine RPM. Continuous use of the ground speed selector lever is practically eliminated.

After the ground speed selector lever is once adjusted for proper working speed, the engine RPM can be decreased by pressing down on the rear pad of accelerator-decelerator pedal. To bring the engine RPM back up to RPM set by ground speed selector lever, remove foot from pad of accelerator-decelerator pedal.

To increase engine RPM above that set

by ground speed selector lever, press down on front pad of lever. To return engine to the pre-set speed, remove foot from front pad.

ENGINE SHUT-DOWN (GM)

To shut down the GM engine, push the ground speed selector forward to idle position. Allow engine to run at idle a few minutes. Pull out engine shut-down lever (located under R.H. side of seat). Hold lever out until engine has stopped. Return lever to "run" position. Turn off key switch. **IMPORTANT:** Do not use the emergency engine shut-down for normal engine shut-down. To do so can cause damage to the blower seals.

ENGINE SHUT-DOWN (CUMMINS ENGINE)

To shut down the Cummins engine, push forward on the ground speed selector lever to idle speed position. Allow engine to run at idle for a few minutes. Turn key switch to off position. This will deactivate the PT fuel pump solenoid, thus stopping flow of fuel oil to the injectors.

OPERATING INSTRUCTIONS (STANDARD MODEL)

GOVERNOR CONTROL LEVER

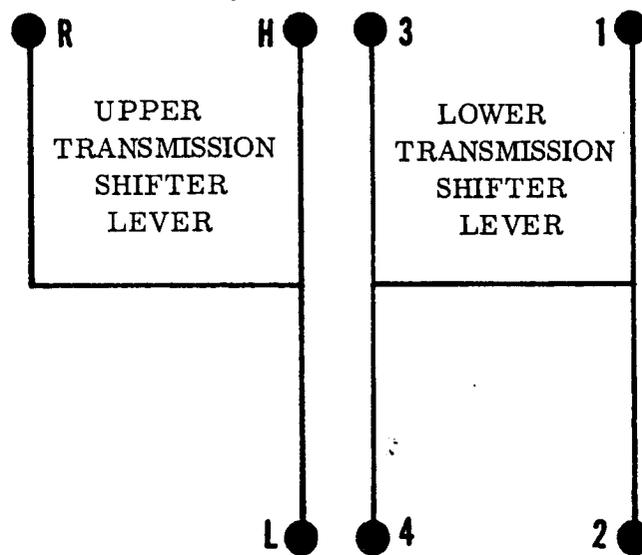
The engine governor control lever is located on R.H. end of power control panel. This lever is used to obtain various engine speeds. To increase engine speed, pull back on lever. To decrease engine speed, push forward on lever.

STARTING GM AND CUMMINS ENGINES

Make certain that the upper and lower transmissions are in neutral position before starting engine.

Set governor control lever to approximately 1/4 open throttle. Turn ignition key clockwise in ignition switch until engine starts.

Allow engine to warm up before starting operation.



SETTING MACHINE INTO MOTION

Do not spin tires when setting motor grader into motion. Spinning the tires caus-

es a digging action which not only damages road surfaces but causes excessive wear on the tires.

Set governor control lever to approximately 1/4 open throttle. Depress clutch pedal all the way to floor board. NOTE: Do not depress clutch pedal all the way to floor board when motor grader is in motion.

Shift upper transmission and lower transmission into gears suitable for the work required. See shifter chart. The outside shifter lever is used to engage gears in lower transmission. The inside shifter lever is used to engage gears in upper transmission.

Slowly raise clutch pedal until movement of motor grader has started, then permit clutch pedal to reach its extreme position.

At the same time pull down on the governor control lever until the desired working speed has been obtained. Use the accelerator-decelerator pedals as explained previously to reduce or increase the engine RPM without changing the pre-set position of the governor control lever.

ENGINE SHUT-DOWN

Move governor control lever to idle position. Shift both upper and lower transmissions into neutral.

Turn key switch to off position. This will stop Cummins Engine. For stopping GM Engine, pull out on engine shut-down lever and hold until engine stops. Return shut-down lever to its normal position. IMPORTANT: Do not use the emergency engine shut-down for normal engine shut-down.

Anti-Freeze Recommendations

Anti-Freeze: Alcohol is not recommended for protecting of cooling system in cold weather.

Permanent type anti-freeze (Ethelene-Glycol) with rust inhibitor is recommended for the cooling system. Refer to chart for recommended quantities.

<u>PROTECT TO</u>	<u>MODEL 666B GM ENGINE 15 Gal. Cap.</u>	<u>MODEL 666BPF GM ENGINE 17 Gal. Cap.</u>	<u>MODEL 666B WITH CUMMINS 20 Gal. Cap.</u>	<u>MODELS 777B AND 777BPF 20 Gal. Cap.</u>
+25° F.	2	2-1/4	2-1/2	2-1/2
+20° F.	2-3/4	3	3-1/2	3-1/2
+10° F.	3-3/4	4-1/4	5	5
0° F.	5	5-3/4	6-1/2	6-1/2
-10° F.	6	6-3/4	8	8
-20° F.	6-3/4	7-1/2	9	9
-30° F.	7-1/2	8-1/2	10	10
-40° F.	8	9	10-1/2	10-1/2

TORQUE CHART

BOLT AND CAPSCREW TORQUES

CONVERTER (Power-Flow Models)

Output Shaft Bearing Retainer Nut #725409 (Stake)	200-250 ft. lbs.
Pump Cover Bearing Retainer Nut #725417 (Stake)	125-150 ft. lbs.
Reactor Sleeve Retainer Nut #725414 (Stake)	250-300 ft. lbs.
Sleeve Flange Stud Nut #C 1522	10-15 ft. lbs.
PTO Gear to Pump Housing Capscrew #C 7569	10-15 ft. lbs.
Turbine Hub to Turbine Capscrew #725421	20-25 ft. lbs.
Pump Cover to Pump Capscrew #C 1604	20-25 ft. lbs.
Pump Cover Cap to Pump Cover Capscrew #727290	55-60 ft. lbs.

POWER-SHIFT CLUTCH (Power-Flow Models)

Upper Shaft Locknut #725146 (Stake)	550-575 ft. lbs.
Lower Shaft Locknut #722073 (Stake)	550-575 ft. lbs.
Reverse Idler Shaft Locknut #722088 (Stake)	450-475 ft. lbs.

NOTE: The above three locknuts and torques also apply to the standard upper transmission.

LOWER TRANSMISSION AND FINAL DRIVE

Upper Shaft Locknut #722073 (Stake)	550-575 ft. lbs.
Lower Shaft Locknut #722115 (Stake)	550-575 ft. lbs.
Bull Gear Bolts #722169	250-265 ft. lbs.
Bull Pinion Shaft Bearing Cage Capscrews #920135	175-190 ft. lbs.
Transmission Housing to Final Drive Housing Capscrews #92013	250-275 ft. lbs.
Outer Axle Carrier Capscrews #920136	250-275 ft. lbs.
Tandem Wheel Axle Locknut #5P 1258	600 ft. lbs.

ENGINE

Injector Clamp Bolt (GM)	25-30 ft. lbs.
Fuel Line Connectors (GM)	20-28 ft. lbs.
Rocker Arm Bracket Bolt (GM)	90-100 ft. lbs.
Injector Filter Cap (GM)	65-75 ft. lbs.
Injector Adjustment Screw Locknut (Cummins)	70-80 ft. lbs.

OIL CLUTCH (Standard Models)

Clutch Shaft Universal Coupling Capscrews	70-80 ft. lbs.
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GEAR HOUSINGS

Worm Thrust Bearing Cap Studs #728431	25 ft. lbs.
Thrust Adjusting Screw Locknut #921580	250 ft. lbs.

STEERING

Pitman Arm Retaining Nut	600-700 ft. lbs.
Steering Arm Ball Nut	420 ft. lbs.

WHEELS

Wheel Lug Nuts #4P 1462	120 ft. lbs.
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SPECIFICATIONS
MODELS 666B AND 777B STANDARD

	<u>MODEL 666B</u>	<u>MODEL 777B</u>
WEIGHTS, STANDARD EQUIPMENT (Approximate)		
Equipped With GM Engine	27,100	32,100
Equipped With Cummins Engine	28,100	32,300
OVERALL MEASUREMENTS		
Length	27' 0"	27' 1"
Width	7' 8"	8' 0"
Height, With Cab	10' 6"	10' 7"
Height, Without Cab (Top of Muffler)	10' 4"	10' 5-1/2"
SPEEDS IN MPH (Variable by Governor Control)		
Forward - 1st	2.2	2.2
2nd	3.2	3.2
3rd	4.4	4.4
4th	6.3	6.2
5th	10.0	9.9
6th	14.1	14.0
7th	16.2	16.0
8th	23.0	22.8
Reverse - 1st	1.8	1.8
2nd	3.6	3.6
3rd	8.1	8.1
4th	13.2	13.1
Creeper - 1st28	.26
2nd55	.51
3rd	1.27	1.2
SERVICE CAPACITIES (U. S. Standard Measurement)		
Fuel Tank	62 Gals.	82 Gals.
Cooling System (GM Engine)	15 Gals.	20 Gals.
Cooling System (Cummins Engine)	20 Gals.	20 Gals.
Crankcase (Without Filter) GM Engine	3.5 Gals.	3.5 Gals.
Crankcase (Without Filter) Cummins Engine	5 Gals.	5 Gals.
Transmission (Upper And Lower) and Final Drive	17.25 Gals.	25 Gals.
Oil Clutch	8.5 Gals.	8.5 Gals.
TIRE INFLATION		
13.00 x 24 (12 Ply) Lug Tread	35 Lbs.	
16.00 x 24 (12 Ply) Lug Tread		30 Lbs.

NOTE: For maintenance work on established highways, inflation pressure may be increased 25% if desired.

MODELS 666B AND 777B POWER-FLOW

	<u>MODEL 666B</u>	<u>MODEL 777B</u>
WEIGHTS, STANDARD EQUIPMENT (Approximate)		
Equipped With GM Engine	27,400	32,250
Equipped With Cummins Engine	--	32,450
OVERALL MEASUREMENT		
Length	27' 0"	27' 1"
Width	7' 8"	8' 0"
Height, With Cab.	10' 6"	10' 7"
Height, Without Cab (Top of Muffler)	10' 4"	10' 5-1/2"
SPEEDS IN MPH (Variable by Governor Control)		
Forward - 1st	3.6	3.5
2nd	7.0	7.0
3rd	16.0	15.6
4th	25.3	25.1
Reverse - 1st	3.2	3.1
2nd	6.2	6.2
3rd	14.0	13.9
4th	22.8	22.3
SERVICE CAPACITIES (U.S. Standard Measurement)		
Fuel Tank	62 Gals.	82 Gals.
Cooling System.	17 Gals.	20 Gals.
Crankcase (Without Filter) GM Engine	3.5 Gals.	3.5 Gals.
Crankcase (Without Filter) Cummins Engine	--	5 Gals.
Torque Converter and Power Shift Transmission.	--	10 Gals.
Torque Converter, Lower Transmission and Final Drive	20 Gals.	--
Lower Transmission and Final Drive	--	13 Gals.
TIRE INFLATION		
13.00 x 24 (12 Ply) Lug Tread.	35 Lbs.	
16.00 x 24 (12 Ply) Lug Tread.		30 Lbs.

NOTE: For maintenance work on established highways, inflation pressure may be increased 25% if desired.

STORING AND SHIPPING

STORING

When a motor grader is not to be used for a period of time, it should be stored in a dry and protected place. To leave a unit standing in an open field or yard exposed to rain and snow will result in materially shortening its life.

When the machine is to be out of service for an extended period of time, the following steps should be taken.

Clean all dirt and mud off the machine. Paint the moldboard and all other surfaces which should be kept bright with a heavy coat of grease. Touch up all painted surfaces where the paint has been scraped off.

Lubricate the engine as described under "Engine Storage Instructions" of the Engine Manufacturers Operators and Maintenance Manual.

Cover the exhaust pipe. Raise all wheels clear of the ground and place blocks under the front axle and the tandem housings so that no weight is supported by the tires. Drain the cooling system and leave the drain plugs open. Remove the battery and store it in a place where it will not be damaged. The battery should be periodically charged (once every month or six weeks) to insure its not going "dead".

SHIPPING

When the motor grader is to be shipped to a new location, certain precautions should be observed. The climate conditions during transit and at destination, method of transportation and time in transit should determine the precautions to be taken. If the motor grader is to be in transit for a long period of time or will not be used immediately

upon its arrival, the same precautions should be taken for shipping as outlined previously for storing. The only exception to this is the battery. It should not be removed from the machine but should be disconnected. However, if the motor grader is to be in transit for only a few days, the following precautions should be sufficient.

The air pressure in the tires should always be checked and brought up to recommended pressure in order to prevent any danger or excessive bouncing of the machine in transit. The radiator and fuel tank should be drained. The battery should be disconnected.

Cover the exhaust pipe. Paint the moldboard and all other surfaces which should be kept bright with a heavy coat of grease. This will prevent rusting of the polished surfaces.

Place blocks at front and rear sides of each wheel. The blocks should be about 12" high and sawed to fit the tires. Also place blocks at least 6" high against outside of each tire. Nail all blocks down securely.

Use heavy-gauge wire, steel straps, cables or chains to tie the grader down to the car or truck bed. Tie the front end down on both sides and tie the rear end down by passing the ties or straps over the rear axle housing between the tandem housings and the final drive.

If the moldboard is to be left attached to the circle, it should be turned so that it does not extend out past the width of the car or truck bed. In such cases, it is also advisable to lower the moldboard to the bed of the car as this will materially lessen the vibration of the machine during transit.

SECTION B
POWER TRAIN

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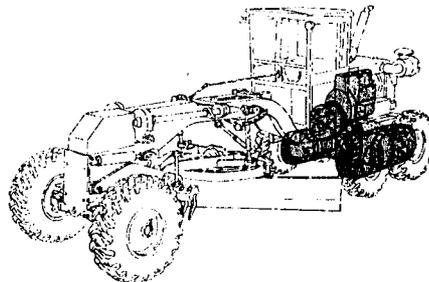
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ENGINE

General

The engine can be removed from the grader without first removing the radiator. Likewise, the entire power train can be removed from the main frame without first re-

moving the engine. For convenience and logical order in disassembly and reassembly, the various sub-assemblies will be treated as separate items.

Removal

The following procedure for engine removal covers the points to be disconnected before engine can be removed. This procedure can be used as a check list to assure all disconnects have been made prior to lifting engine from grader. Also use it as a check list to assure all points have been connected after installing engine.

RADIATOR

Remove drain plug from lower radiator tank and drain coolant from radiator. NOTE: Protect regulator to prevent coolant from splashing on it.

To remove air cleaner from side of radiator, see Figure 1. Loosen hose clamps and remove elbow (1). Remove air cleaner mounting bands (2) and remove air cleaner (3). Remove air cleaner indicator (4).

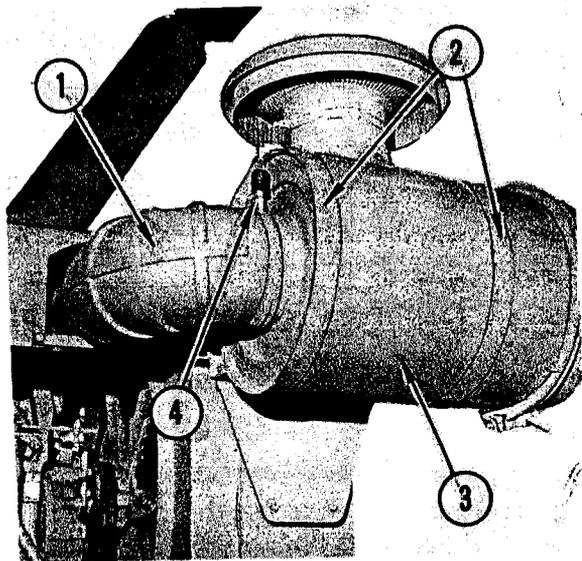


FIGURE 1. AIR CLEANER REMOVAL

- | | |
|--------------------|----------------|
| 1. Elbow | 3. Air Cleaner |
| 2. Mounting Clamps | 4. Indicator |

Remove four capscrews and lockwashers attaching hood to top of radiator. Remove two capscrews and lockwashers attaching sides of hood to sides of radiator. Remove four capscrews and lockwashers attaching side plates to radiator and battery box and remove side plates.

Disconnect tail light and stop light wires at quick disconnects located at lower left hand side of radiator.

Loosen clamps and pull radiator hoses free of engine inlet and outlet fittings. Inspect hoses for damage or deterioration.

Attach sling and hoist to radiator and take up slack.

Remove six capscrews and lockwashers (3 on each side) attaching lower radiator support to engine mount support and move radiator away from machine. Lower to floor taking care not to damage hose connections.

Radiator installation will be the reverse sequence of removal.

HOOD AND LINKAGE

Loosen clamping bolt securing exhaust stack to muffler and remove stack.

Refer to Figure 2. Loosen nuts on hook bolts (1) at front corners of hood sufficiently to permit releasing hooks from hood. Lower hood to ground.

Remove positive wire from back of hour-meter (2).

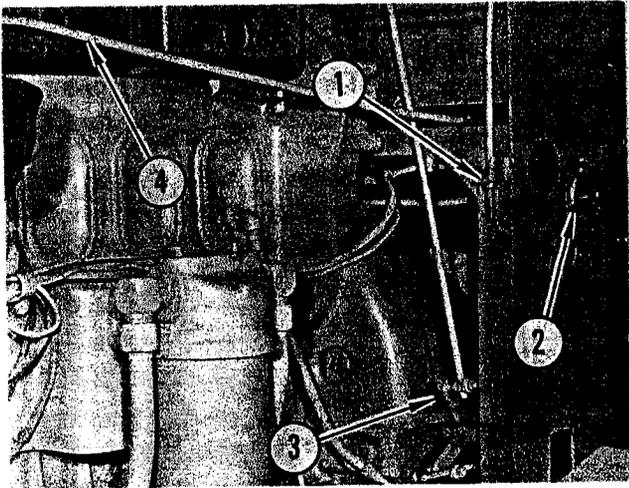


FIGURE 2. HOOD & LINKAGE REMOVAL
 1. Hook Bolt 3. Throttle Linkage
 2. Hourmeter 4. Shut-Down Linkage

Disconnect throttle linkage (3) at right hand side of engine flywheel housing. Move linkage clear of engine.

Disconnect emergency shut-down linkage (4) at lever immediately above generator.

BATTERIES

Remove battery box cover. Loosen bolts in battery terminal cable clamps (1). Refer to Figure 3. Expand terminals slightly and lift clamp from positive and negative posts. Do not exert force to free clamps as this may damage batteries.

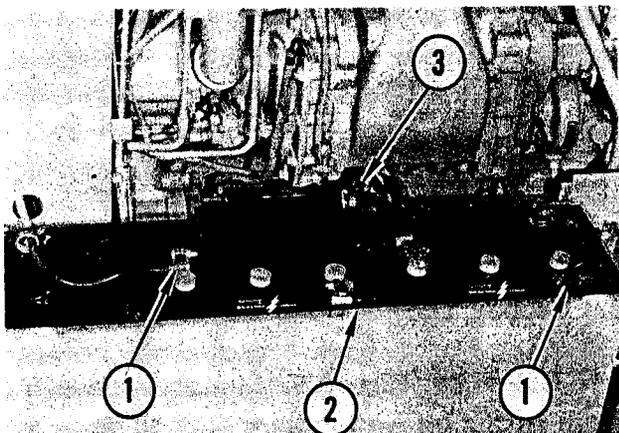


FIGURE 3. BATTERY REMOVAL
 1. Cable Clamps 3. Starter Solenoid
 2. Connecting Cable

If batteries are to be removed from box, disconnect cable joining them together (2). Remove U-bolt securing batteries in place and lift batteries from box. CAUTION: Take care not to spill electrolyte. Battery box may be removed by removal of capscrews securing it to mounting brackets.

Disconnect cable at starter solenoid terminals (3).

ELECTRICAL

Refer to Figure 4. Disconnect the three leads at voltage regulator terminals (1). Identify wires for easy identification at time of reassembly. Disconnect wires at pressure switch (2) and free from clamps securing it to side of engine. Mark wires for easy identification.

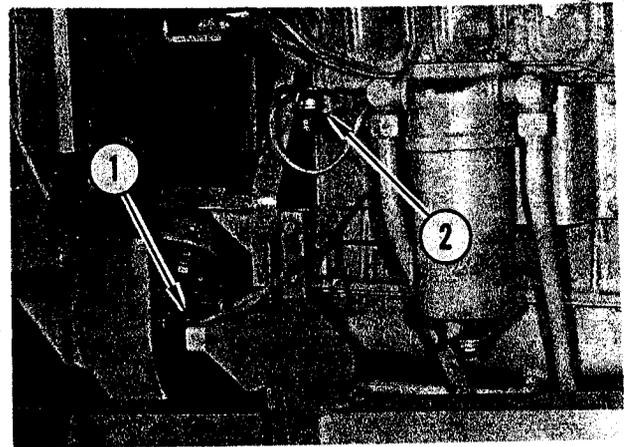


FIGURE 4. ELECTRICAL DISCONNECTS
 1. Voltage Regulator 2. Pressure Switch

Disconnect wire at engine shut-down solenoid terminal. Disconnect pull cable from emergency engine shut-down. Remove capscrew from cable clamp and remove cable from top of engine. CAUTION: As engine is removed, be sure cable is free of all parts and linkage to prevent damage.

Refer to Figure 5. Disconnect wires at generator terminals (1) and free from clamps on side of engine. Disconnect air hose (2) leading to engine air box and cover ends to prevent entrance of dirt.

Disconnect ground cable, converter

housing to fuel tank, at converter housing.

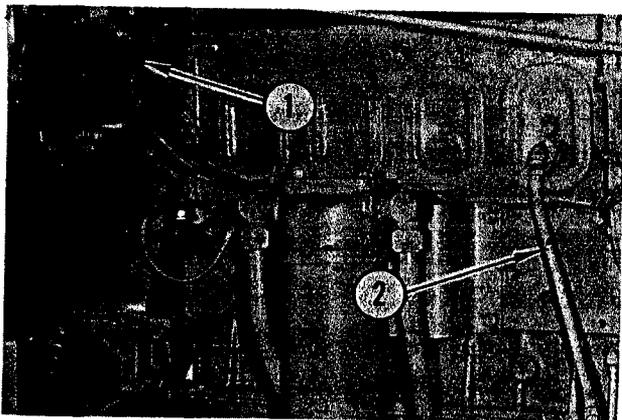


FIGURE 5. GENERATOR DISCONNECT
 1. Generator Terminals 2. Air Hose

FUEL AND OIL LINES

Refer to Figure 6. Close fuel shut off valve (1). Remove fuel line (2) from valve fitting. Remove fuel return line (3) from fuel tank fitting. Remove converter oil line (4) at converter relief valve fitting. Disconnect drain back hose (5) at converter housing.

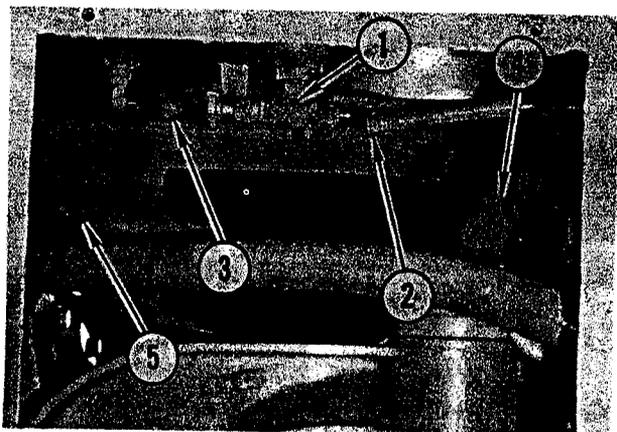


FIGURE 6. FUEL LINES
 1. Shut-Off Valve 4. Converter Oil Line
 2. Fuel Line 5. Drain-Back Hose
 3. Fuel Tank Fitting

Refer to Figure 7. Disconnect fuel line (1) at top of primary filter (2). Remove temperature sending unit from water jacket. Carefully roll sending unit tube into a coil and lay to one side of frame. If radiator was not removed, disconnect tail light and stop

light wires. Disconnect fuel return line. If grader is equipped with a cab heater, disconnect hose. Fasten ends of fuel lines and water hose up to prevent run-off of fuel and water.

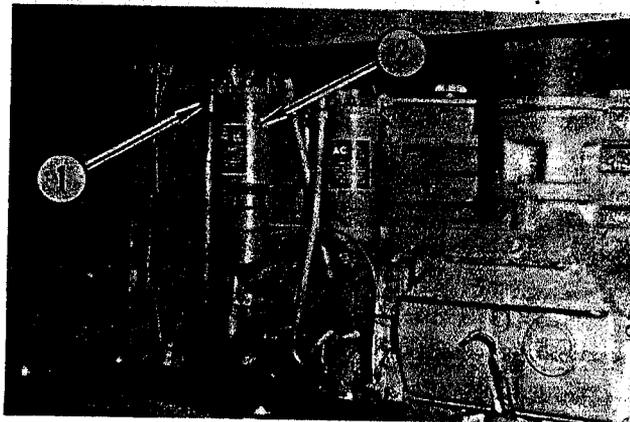


FIGURE 7. FUEL FILTER
 1. Fuel Line 2. Primary Fuel Filter

Refer to Figure 8. Remove hose connecting oil gallery fitting (1) and copper tube (2). This copper tube goes to oil pressure gauge on instrument panel. Remove water hose from front and rear of converter oil cooler (3).

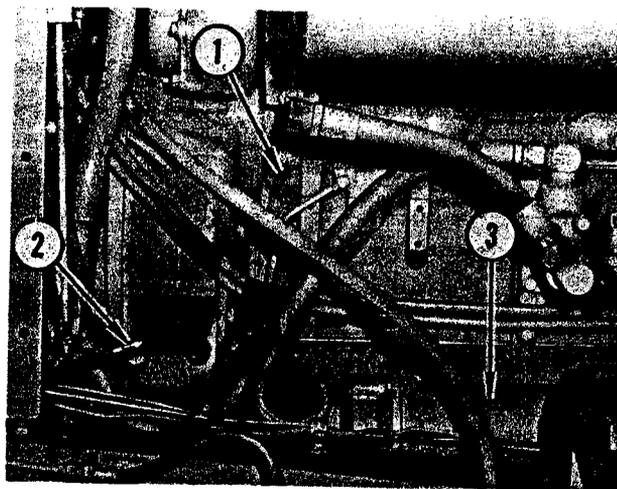


FIGURE 8. OIL LINE DISCONNECTS
 1. Oil Gallery Fitting 3. Converter
 2. Copper Tube Oil Cooler

Refer to Figure 9. Remove hose (1) from fitting on relief valve (2). Remove tail shaft governor flexible shaft (3) from tail shaft governor drive pulley (4). Loosen cap-screws (5) and remove "V" belt (6). Remove

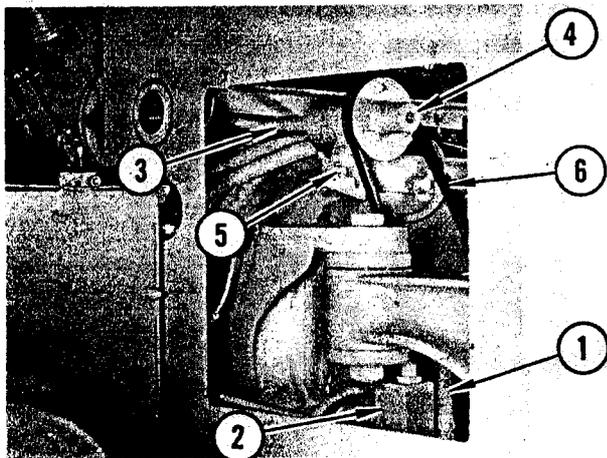


FIGURE 9. GOVERNOR DRIVE PULLEY REMOVAL (GM ENGINE)

- | | |
|----------------------|----------------------|
| 1. Relief Valve Hose | 4. Drive Pulley |
| 2. Relief Valve | 5. Mounting Capscrew |
| 3. Flexible Shaft | 6. "V" Belt |

the two capscrews and remove governor drive pulley from bracket.

Remove the two drain back hoses from the formed tube at bottom of converter housing.

ENGINE MOUNTS AND SUPPORTS

Attach engine lifting bar to engine lifting eyebolts. Attach chain hoist to lifting bar and take up slack.

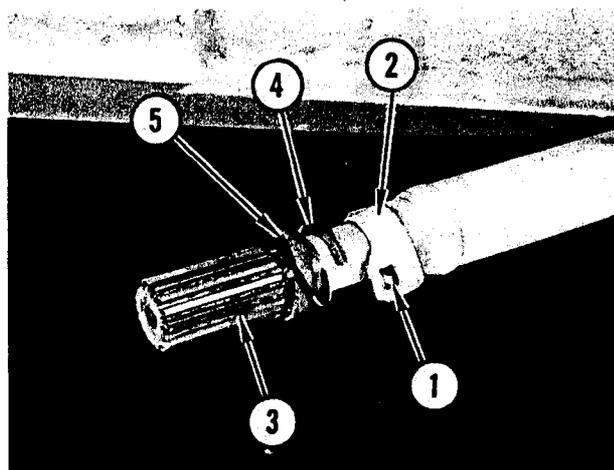


FIGURE 10. POWER TAKE-OFF SHAFT (Power-Flow Models)

- | | |
|-------------------------|-------------------|
| 1. Locking Clip | 4. Retaining Ring |
| 2. Collar | 5. Oil Seal |
| 3. Power Take-Off Shaft | |

Using a prick punch, make aligning marks on converter output shaft universal coupling hub and drive shaft. These marks will be required to help align universal couplings during reassembly.

Reaching through L.H. opening of fuel tank support, use a small screwdriver to raise locking clips (1) on coupling collar (2) of PTO shaft (3). Slide collar forward away from coupling, Figure 10.

Refer to Figure 11. Remove nut (1) and lower washer (2) from front engine mount bolt. There will be shims on the washer. Wire these shims to washer and identify as being lower washer. These shims will be required during reassembly.

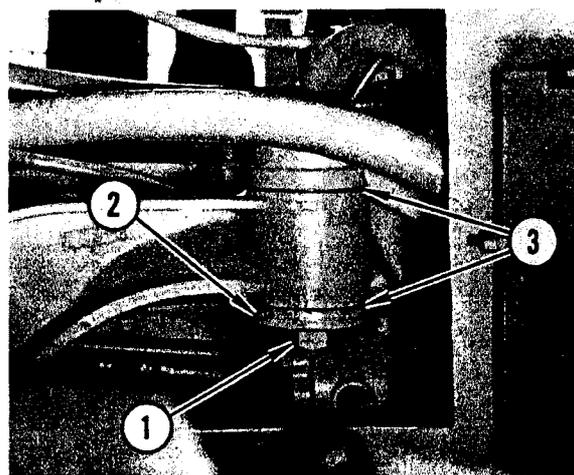


FIGURE 11. ENGINE MOUNT
1. Mounting Nut 2. Washer 3. Shims

Remove capscrews and lockwashers attaching rear engine mounts to engine support.

Take up on hoist and raise engine assembly just enough to remove weight from main frame. Slide engine to rear far enough for universal coupling splines to clear end of drive shaft and PTO shaft.

Check to make sure all disconnects have been completed. Raise engine and remove from grader.

Engine can be set on floor with fan end resting on rear engine support and block under flywheel end.

Remove upper washers and shims from top of front engine supports. Wire the wash-

ers and shims to engine brackets to prevent their getting lost.

POWER TRAIN

Removal

Install chain around both tandem housings and under lower transmission and tighten securely with a binder, Figure 12. Loosen, but do not remove at this time, front transmission support bolts.

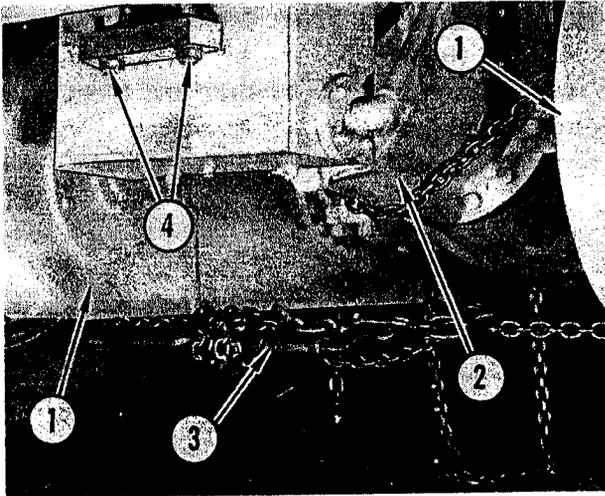


FIGURE 12. UNIT REMOVAL

- | | |
|-----------------------|------------------|
| 1. Tandems | 3. Chain Binder |
| 2. Lower Transmission | 4. Support Bolts |

Start engine. Using the circle reverse control lever, rotate circle until moldboard is at right angles to main frame. Using the lateral shift control lever, shift the circle and drawbar until they are centered with main frame.

Remove locking pin from lateral shift adjustable link. Using both blade lift control levers, lower the moldboard until front wheels have been raised above floor for a distance of 10 to 12 inches. Replace locking pin in lateral shift adjustable link. Shut down engine.

Refer to "Engine Removal" for information on hood removal, wiring harness disconnects, fuel and oil lines disconnects and PTO shaft coupling disconnect.

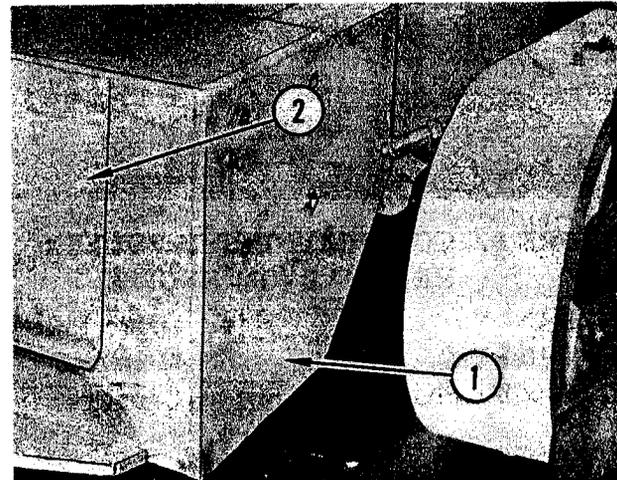


FIGURE 13. CLOSURE PLATE - TOOL BOX
1. Closure Plate 2. Tool Box

For unit removal additional disconnects as outlined below will be required.

Refer to Figure 13. Remove 6 capscrews and lockwashers from each side of closure plate. Attach sling and hoist. Slide closure plate and tool box to rear until free of main frame.

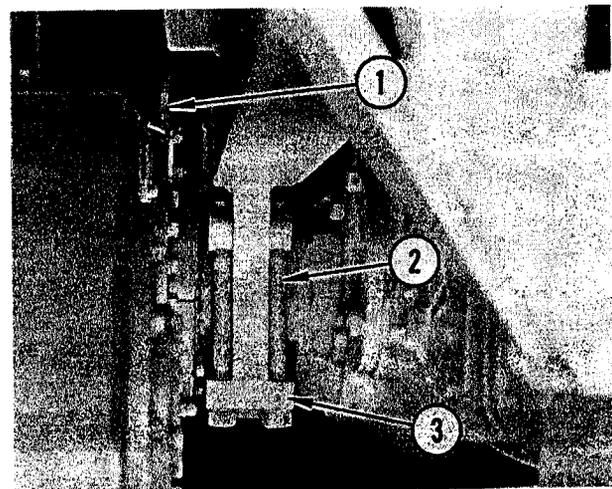


FIGURE 14. SADDLE BOLT

- | | |
|-------------------|-----------------|
| 1. Brake Hose | 3. Saddle Mount |
| 2. Mounting Bolts | |

Refer to Figure 14. Disconnect hydraulic brake hose (1) from top of each tandem. Remove four bolts (2) from each saddle mount and remove saddle mounts (3).

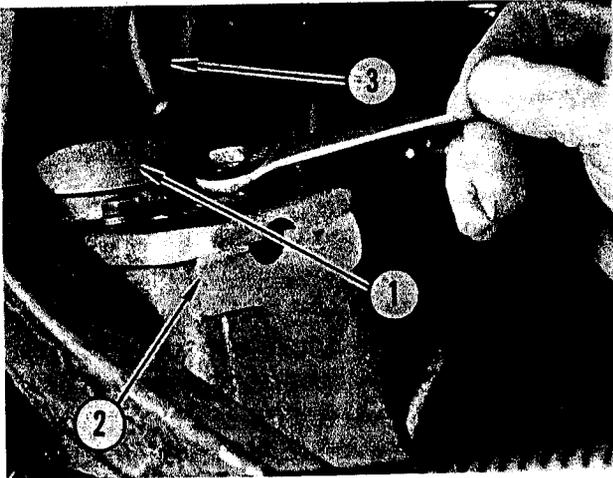


FIGURE 15. SHIFTER ASSEMBLY

- | | |
|-------------|-----------------|
| 1. Ball Cap | 3. Rubber Cover |
| 2. Housing | |

Remove four carriage bolts retaining shifter housing cover plate to cab floor. Remove band retaining rubber cover to shifter housing. Remove four capscrews retaining shifter lever ball cap (1) to shifter housing (2) and lift assembly from housing. Figure 15.

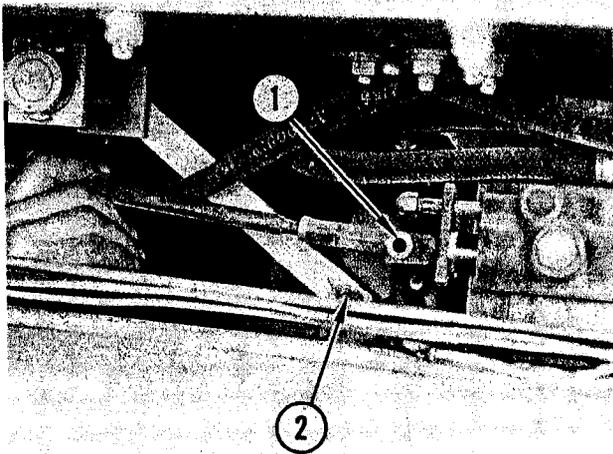


FIGURE 16. CONTROL VALVE LINKAGE
1. Connecting Bolt 2. Drilled Pin

Refer to Figure 16. Remove connecting bolt (1) from power-shift clutch control valve

linkage. Remove cotter pin from drilled pin (2) and remove drilled pin from gear brake lever (Power-Flow models only).

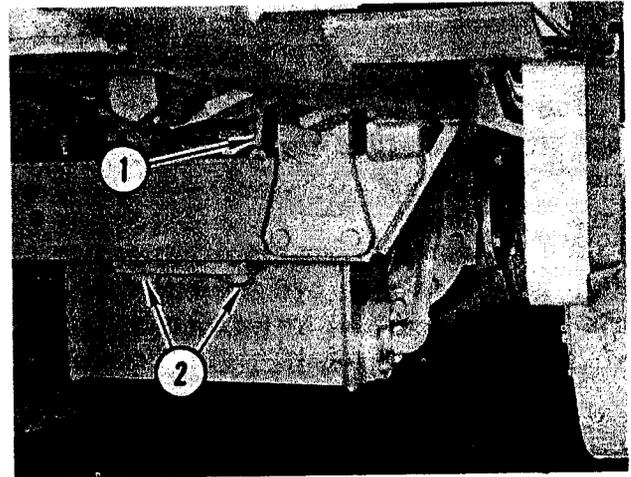


FIGURE 17. TRANSMISSION SUPPORT

- | | |
|------------------|------------------|
| 1. Return Spring | 2. Support Bolts |
|------------------|------------------|

Refer to Figure 17. Unhook gear brake lever return spring (1) from eye on cross member. Remove the two front transmission support bolts (2).

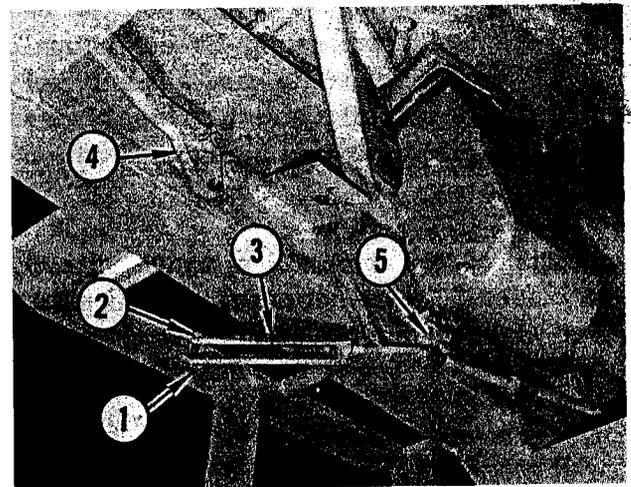


FIGURE 18. LINKAGE DISCONNECTS

- | | |
|----------------|----------------|
| 1. Cotter Pin | 4. Bell Crank |
| 2. Drilled Pin | 5. Cable Clamp |
| 3. Turnbuckle | |

Refer to Figure 18. Remove cotter pin (1) from drilled pin (2). Remove drilled pin to disconnect parking brake cable turn buckle (3) from brake lever bell crank (4). Remove capscrews from cable clamp (5).

Force front end of grader down so as to raise rear end of main frame until saddle mounts will clear final drive outer axle carrier. At same time, roll unit to rear a few

inches, then make inspection to see if all disconnects have been made. Continue to roll unit to rear until clear of main frame.

TORQUE CONVERTER

General

The torque converter is a 16" single stage converter with a torque multiplication ratio of 2.78 to 1.

The converter consists of three main parts; pump, reactor and turbine. These parts have blades cast at an angle between their inner and outer shell.

The converter pump is attached to and driven by the engine. The turbine is attached (through a gear train) to and drives the tandem wheels. The reactor is supported between pump and turbine by a stationary sleeve attached to converter housing. There is no mechanical connection between these parts.

Starting the engine causes oil to be thrown outward from pump by centrifugal force. Curvature of pump case and angle of pump blades throws oil against turbine blades causing the turbine to turn in same direction of pump.

Angle of turbine blades cause oil to leave blades in a direction almost opposite to that which turbine is turning. Curvature

of turbine case throws oil toward center of unit.

Oil now enters the reactor. This unit rotates freely with pump and turbine when their speeds are approximately the same. If turbine speed drops below that of pump speed, oil pressure on reactor blades causes the reactor to lag and become stationary. In this position the reactor blades change direction of the oil causing it to strike the back of pump blades increasing the torque output of this unit.

When engine RPM is increased, a greater flow of oil causes turbine to turn faster. When there is a maximum flow of oil through all three members, there is maximum torque output.

As speed of turbine reaches that of pump, several changes take place. Centrifugal force throws oil toward outer rim of turbine. This reduces amount of oil which can enter from pump. The smaller amount of oil entering turbine relieves pressure on reactor blades allowing reactor to rotate freely. Oil turbulence through and around the reactor is reduced and heating of oil is greatly reduced.

Removal

Attach sling around converter housing and attach hoist to sling. Remove the twelve capscrews and lockwashers attaching converter housing to engine flywheel housing. Swing converter outward until externally splined ring gear on converter pump cover

is free of internally splined ring gear on engine flywheel.

Place converter assembly on work bench for disassembly.

Disassembly

Refer to Figure 19. Using hammer and chisel, or other blunt tool, flatten corners of locking plates (1). Remove the eight cap-

screws (2) and the four locking plates. Install two puller bolts in the two tapped holes in cap and remove cap (3). Shims will be be-

tween cap and converter cover; keep these shims with cap as they will be required during reassembly.

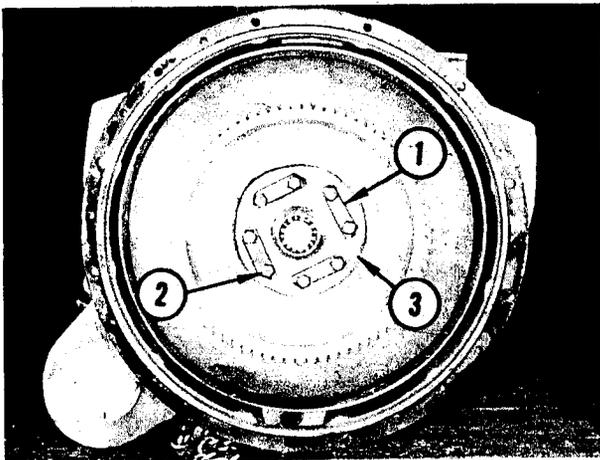


FIGURE 19. CONVERTER CAP REMOVAL

- | | |
|--------------------|--------|
| 1. Locking Plates | 3. Cap |
| 2. Plate Capscrews | |

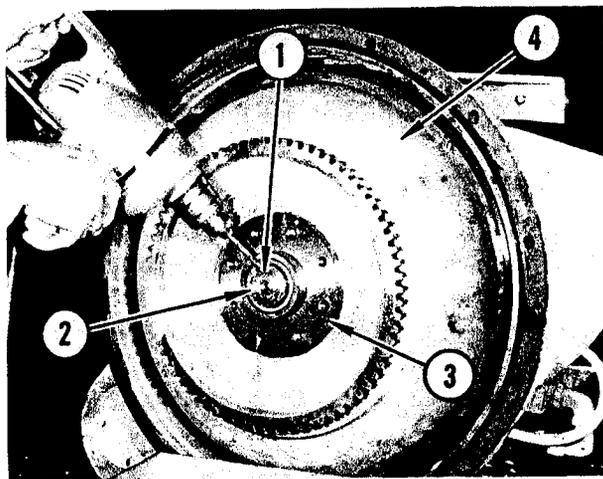


FIGURE 20. CONVERTER BEARING REMOVAL

- | | |
|-------------------|------------|
| 1. Drilling Stake | 3. Bearing |
| 2. Locknut | 4. Cover |

Refer to Figure 20. Drill stake from bearing retaining locknut. After all of stake portion has been cleaned out, remove locknut and bearing.

Remove the four capscrews and lockwashers from converter housing coverplate. Remove cover plate and gasket.

Working through opening in the top of

converter housing, remove the thirty-two capscrews and shakeproof washers retaining pump cover to pump. Remove pump cover, Figure 21.

Remove turbine from output shaft.

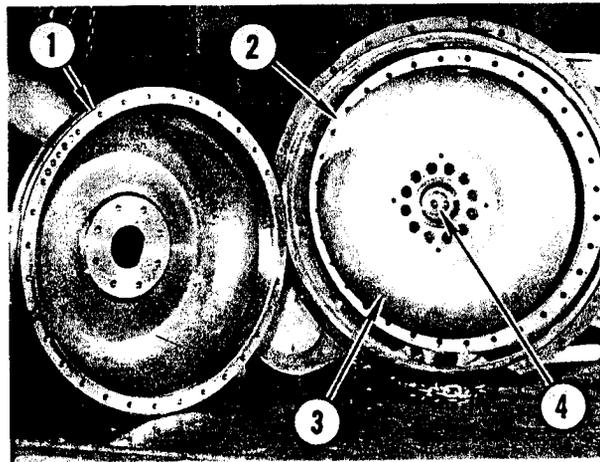


FIGURE 21. PUMP COVER REMOVAL

- | | |
|---------------|-----------------|
| 1. Pump Cover | 3. Turbine |
| 2. Pump | 4. Output Shaft |

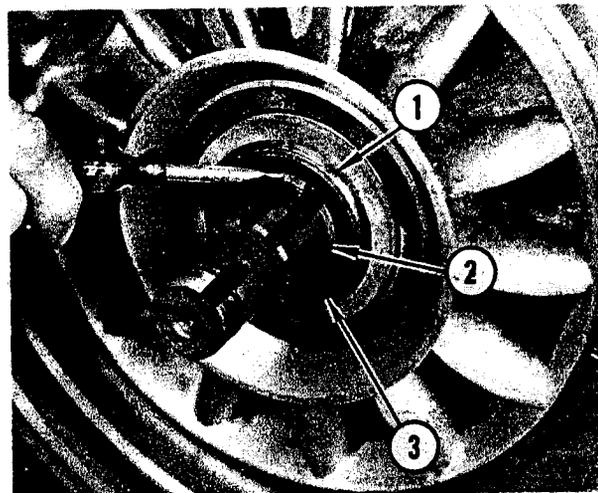


FIGURE 22. REACTOR REMOVAL

- | | |
|-------------------|-----------------|
| 1. Reactor Sleeve | 2. Output Shaft |
| Snap Ring | Snap Ring |
| 3. Reactor Sleeve | |

REACTOR ASSEMBLY

Refer to Figure 22. Remove snap ring (1) from groove in reactor sleeve. Remove snap ring (2) from groove in output shaft. The reactor blades have a thick side and a thin side. Note that thick sides of blades are out or toward engine. During reassem-

bly they must be in this position. Rotate the reactor assembly clockwise and pull outward

at same time until assembly is off of reactor sleeve.

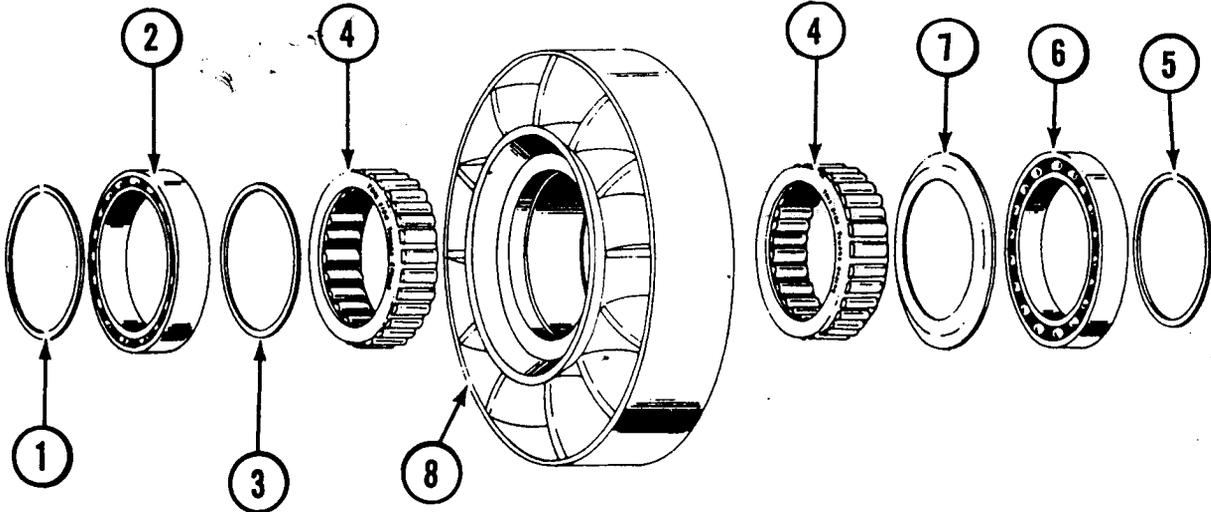


FIGURE 23. EXPLODED VIEW OF REACTION GROUP

- | | | | |
|--------------|---------------|--------------|-------------------|
| 1. Snap Ring | 3. Washer | 5. Snap Ring | 7. Special Washer |
| 2. Bearing | 4. Sprag Cams | 6. Bearing | 8. Reactor |

Refer to Figure 23 and disassemble the reactor assembly in the numerical order as shown. Item (1) snap ring was previously removed from reactor sleeve.

Remove the twelve capscrews and shake-proof washers securing gear to pump. Remove gear and press roller bearing from pump hub.

CONVERTER PUMP

Remove converter pump as illustrated in Figure 24.

OUTPUT SHAFT

Refer to Figure 25. Remove five nuts and lockwashers from bearing retainer studs (1). Remove output shaft assembly (2). Remove shims (3) and attach to bearing retainer (4) to assure using the same quantity at time of reassembly.

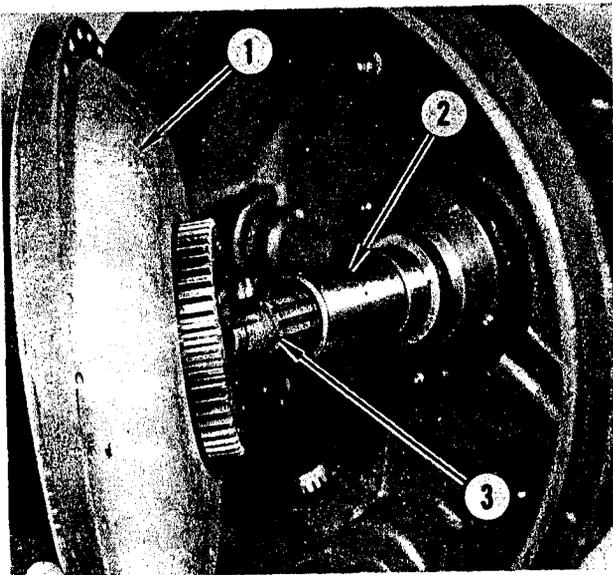


FIGURE 24. PUMP REMOVAL

- | | |
|-------------------|-----------------|
| 1. Pump | 3. Output Shaft |
| 2. Reactor Sleeve | |

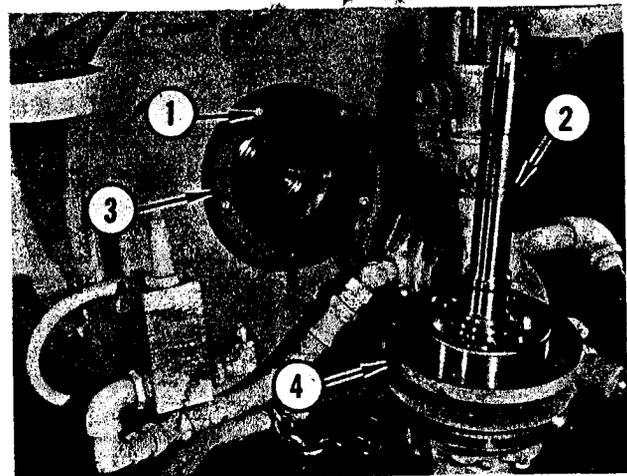


FIGURE 25. OUTPUT SHAFT REMOVAL

- | | |
|--------------------------|-------------|
| 1. Retainer Studs | 3. Shims |
| 2. Output Shaft Assembly | 4. Retainer |

OUTPUT SHAFT

Refer to Figure 26. Disassemble output shaft assembly in the numerical order as shown. Carefully remove piston ring (1). Drill stake from locknut (2) and remove locknut. Remove bearing retainer (3) with bearing (4) and oil seal (5). Press bearing and seal from bearing retainer. Item (6) is output shaft.

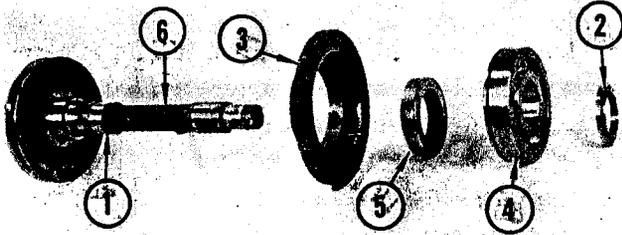


FIGURE 26. OUTPUT SHAFT

- | | |
|---------------------|-----------------|
| 1. Piston Ring | 4. Bearing |
| 2. Locknut | 5. Oil Seal |
| 3. Bearing Retainer | 6. Output Shaft |

OIL PUMP AND RELIEF VALVES

Refer to Figure 27. Remove oil lines from pump and relief valve fittings. Remove nuts and lockwashers from pump retaining

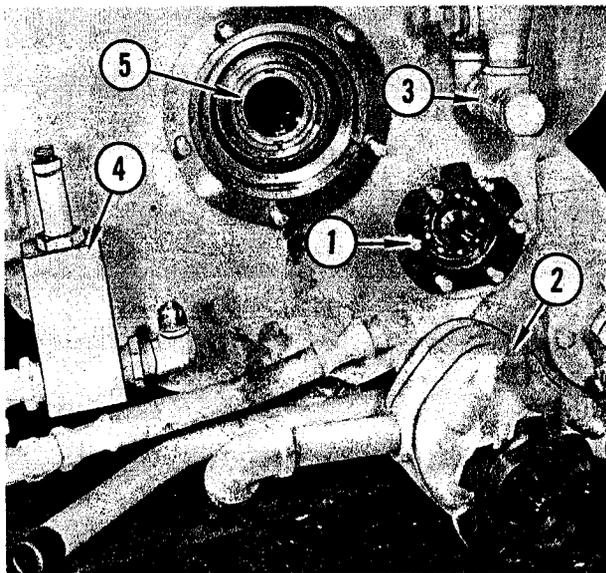


FIGURE 27. PUMP AND REACTOR SLEEVE REMOVAL

- | | |
|---------------------------|-----------------------------|
| 1. Mounting Studs | 4. Power-Shift Relief Valve |
| 2. Oil Pump | 5. Sleeve Locknut Valve |
| 3. Converter Relief Valve | |

studs (1) and remove pump (2). Remove converter relief valve and fittings (3). Remove power-shift relief valve and fittings (4).

REACTOR SLEEVE

Refer to Figure 27. Drill stake from sleeve retaining locknut (5). Remove locknut with special wrench. If special wrench is not available, use a spanner wrench. Remove sleeve and hub from open side of converter.

Refer to Figure 28. Place assembly in arbor press and remove sleeve (1) from hub (2). Remove short key (3) from sleeve. Remove ring retainer (4) from sleeve. Remove piston ring (5) from ring retainer. Remove long key (6) from sleeve. Note the two milled surfaces on sleeve. One has three holes; the other is blank. During assembly install ring retainer so that crescent shape cut on inside diameter of ring retainer is over the blank milled surface. This is important for proper flow of oil through converter.

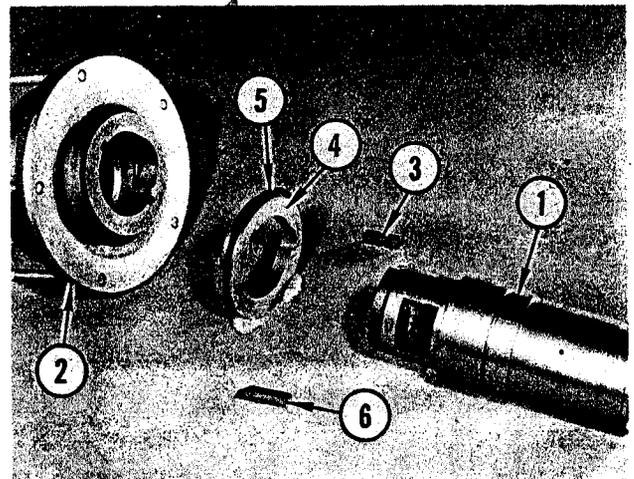


FIGURE 28. REACTOR SLEEVE DISASSEMBLY

- | | |
|----------------|------------------|
| 1. Sleeve | 4. Ring Retainer |
| 2. Hub | 5. Piston Ring |
| 3. Key (short) | 6. Key (long) |

OIL PUMP DRIVE

Refer to Figure 29 and follow the numerical sequence for removal of pump drive. Remove retaining ring (1) from hub of pump

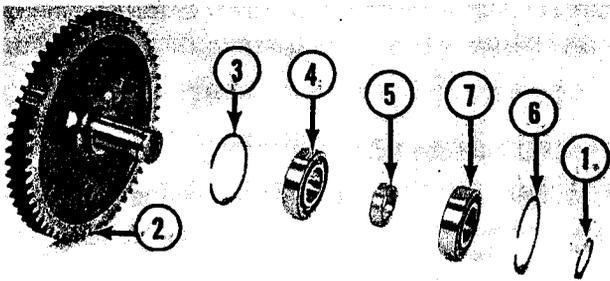


FIGURE 29. OIL PUMP DRIVE

- | | |
|-------------------|-------------------|
| 1. Snap Ring | 5. Spacer |
| 2. Drive Gear | 6. Retaining Ring |
| 3. Retaining Ring | 7. Bearing |
| 4. Bearing | |

drive gear (2). Remove pump drive gear from open side of converter housing. Remove retaining ring (3) from inner groove in bore of converter housing. Remove bearing (4) and spacer (5) from bore. Remove the retaining ring (6) from outer groove in bore and remove bearing (7).

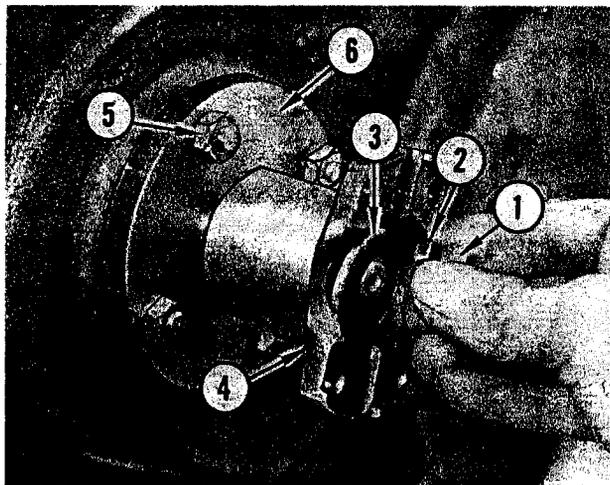


FIGURE 30. YOKE REMOVAL

- | | |
|---------------|----------------------------|
| 1. Nut | 4. Yoke |
| 2. Washer | 5. Capscrews & Lockwashers |
| 3. Flatwasher | 6. Cap |

PTO DRIVE

Remove universal coupling from PTO yoke.

Refer to Figure 30. Remove nut (1), lockwasher (2) and flatwasher (3) retaining yoke to PTO shaft and remove yoke (4) from shaft. Remove Woodruff key from shaft. Remove four capscrews and lockwashers (5) and remove seal cap (6).

Refer to Figure 31. Remove four capscrews and lockwashers and remove cover plate (1). Remove spacer (2). Remove retainer ring (3). Remove spacer (4). Remove bearing cup (5) and bearing cone (6). Drive or press shaft (7) from gear (8); remove gear from converter through the open side. Bearing cone (9) and bearing cup (10) will come out with shaft. Remove bearing cone from shaft. Remove Woodruff key (11) from shaft.

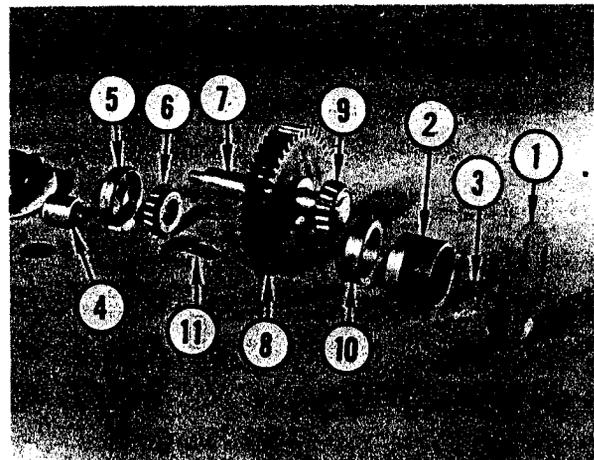


FIGURE 31. PTO DRIVE REMOVAL

- | | |
|------------------|-----------------|
| 1. Cover Plate | 7. Shaft |
| 2. Spacer | 8. Gear |
| 3. Retainer Ring | 9. Bearing Cone |
| 4. Spacer | 10. Bearing Cup |
| 5. Bearing Cup | 11. Key |
| 6. Bearing Cone | |

Reassembly

Reassembly of all converter components will be the reverse of the disassembly sequence and the following information.

PTO DRIVE

Reverse the numerical order as shown in Figure 30 and 31 and the following:

1. Install oil seal in seal cap with lip of seal away from cap flange.
2. Install seal cap, without shims, onto retaining studs. Install stud nuts without lockwashers. Tighten nuts evenly while turning shaft with a torque wrench until a reading of 4 to 8 inch pounds is obtained. Measure clearance between cap and housing.
3. Remove the seal cap; add proper amount of shims and reinstall cap. Install stud nuts and lockwashers. Tighten securely. Recheck torque reading.

OIL PUMP DRIVE

For reassembly reverse the numerical sequence of disassembly as shown in Figure 29.

REACTOR SLEEVE

Reverse the numerical sequence of disassembly as shown in Figures 27 and 28 and the following information:

1. Install longest key into keyway in sleeve.
2. Install ring retainer onto sleeve and key with piston ring groove toward shoulder of sleeve. Make certain the crescent shape cut in ring retainer is over the blank milled section of sleeve. Install short key.
3. Install sleeve assembly into housing bore. Align oil ports in hub with oil ports in converter housing. Install locknut, tighten to a torque reading of 250 to 300 ft. lbs. Stake locknut.

OUTPUT SHAFT

Reverse the numerical sequence of disassembly as shown in Figures 25 and 26 and the following information:

1. Install oil seal in bearing retainer with lip of seal towards inner side of retainer.
2. Press bearing into retainer until bearing is against shoulder in retainer.
3. Install bearing retainer assembly onto output shaft. Install locknut. Tighten locknut to torque reading of 200 to 250 ft. lbs. Stake locknut.
4. Install output shaft, without piston ring and without shims. Tighten bearing retainer stud nuts snug and evenly. Measure clearance between bearing retainer flange and converter housing. Remove output shaft. Install shims to equal the clearance plus one shim. Install piston ring. Reinstall output shaft assembly using care not to damage the piston ring. Tighten stud nuts to a torque reading of 10 to 15 ft. lbs.

CONVERTER PUMP

1. Tighten gear and bearing retaining capscrews to a torque reading of 14 ft. lbs.
2. Install pump onto reactor sleeve until gear hub is against piston ring. Strike pump assembly sharply with hands to compress piston ring. Push pump onto sleeve as far as it will go.

REACTOR

Reverse the numerical sequence of disassembly as shown in Figure 22 and 23 and the following information:

1. Install the special washer with the concave or extruded side toward sprag cams.
2. Install assembly on reactor sleeve and rotate reactor clockwise while

pushing onto sleeve. Do not force. Should reactor fail to turn clockwise, it indicates sprag assemblies are installed wrong. The spray assemblies are marked with an electric pencil "This Side Toward Engine". This side must be toward side of reactor with thick sides of blades.

TURBINE

Install turbine onto output shaft until hub of turbine is against snap ring on output shaft.

PUMP COVER

Install pump cover and bearing onto output shaft. Install retaining locknut and torque to a reading of 125 to 150 ft. lbs.

Install cover cap without shims. Install three capscrews evenly spaced. Tighten capscrews evenly and snug. Measure clearance between cap flange and cover. Remove cap and install shims to equal clearance. Reinstall cap. Tighten capscrews to a torque reading of 60 ft. lbs. Bend corner of locks over flat side of capscrews.

When installing the thirty-two capscrews and shakeproof washers retaining cover to pump, use a spring loaded clothes pin to hold capscrews until they are started. To drop one of them means converter disassembly to retrieve it. Tighten capscrews to a torque reading of 25 ft. lbs.

To install converter onto engine, reverse the removal instructions.

CONVERTER SUPPLY PUMP

Disassembly

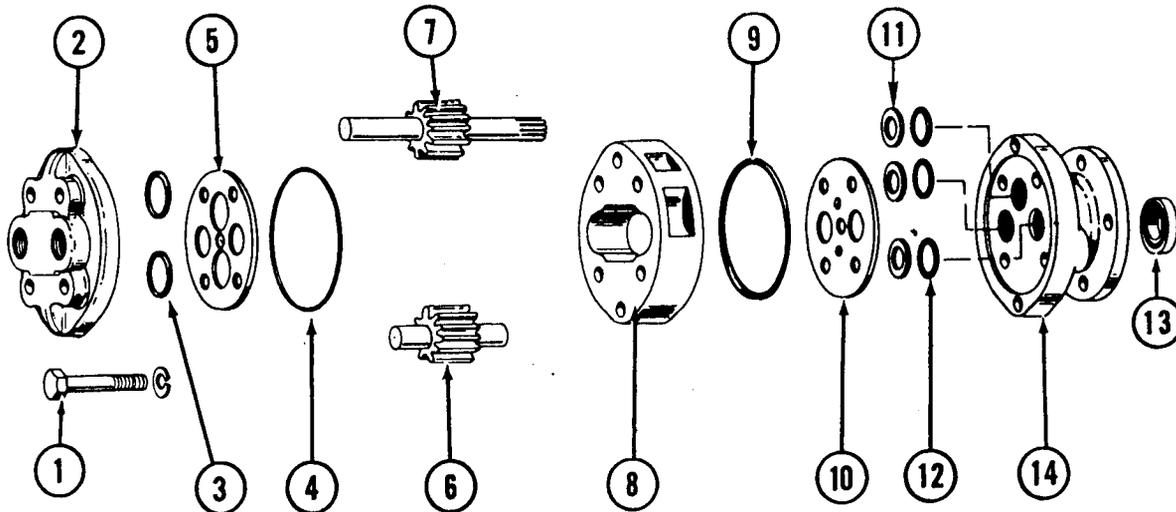


FIGURE 32. CONVERTER PUMP DISASSEMBLY

- | | | |
|--------------------------|---------------------|-----------------------|
| 1. Capscrew & Lockwasher | 6. Driven Gear | 11. Spacers |
| 2. Pump Cover | 7. Drive Gear | 12. "O" Rings (Small) |
| 3. "O" Ring (Small) | 8. Housing | 13. Oil Seal |
| 4. "O" Ring (Large) | 9. "O" Ring (Large) | 14. Adapter |
| 5. Wear Plate | 10. Wear Plate | |

Refer to Figure 32 and follow the numerical sequence for disassembly.

Remove the four capscrews and lock-

washers (1) from pump cover and remove pump cover (2). Remove two "O" rings (3) from bores in cover. Remove large "O" ring (4) from outside diameter of wear plate (5).

Remove driven gear (6). Remove drive gear (7). Remove pump housing (8). Remove large "O" ring (9) from outside diameter of wear plate (10). Remove the three spacers (11). Remove three "O" rings (12). Remove oil seal (13) from bore of adapter (14).

All "O" rings and seals should be replaced with new ones. Check wear plates for wear and cracks around ports and reliefs. Replace with new wear plates if badly worn.

Reassembly

Reverse the numerical sequence of disassembly as shown in Figure 32 and the following information:

1. Install wear plates with bronze side toward gears.

2. Install head retaining capscrews and locknut. Tighten capscrews to a torque reading of 60 ft. lbs.

Install pump on converter housing. Connect hydraulic hose to the inlet and outlet ports.

TORQUE CONVERTER RELIEF VALVE

Disassembly

Refer to Figure 33 and follow the numerical sequence as shown for disassembly. Remove valve cap (1). Remove locknut (2)

and gasket (3). Remove adjusting screw (4). Remove spring (5) and ball seat (6) from valve body (7).

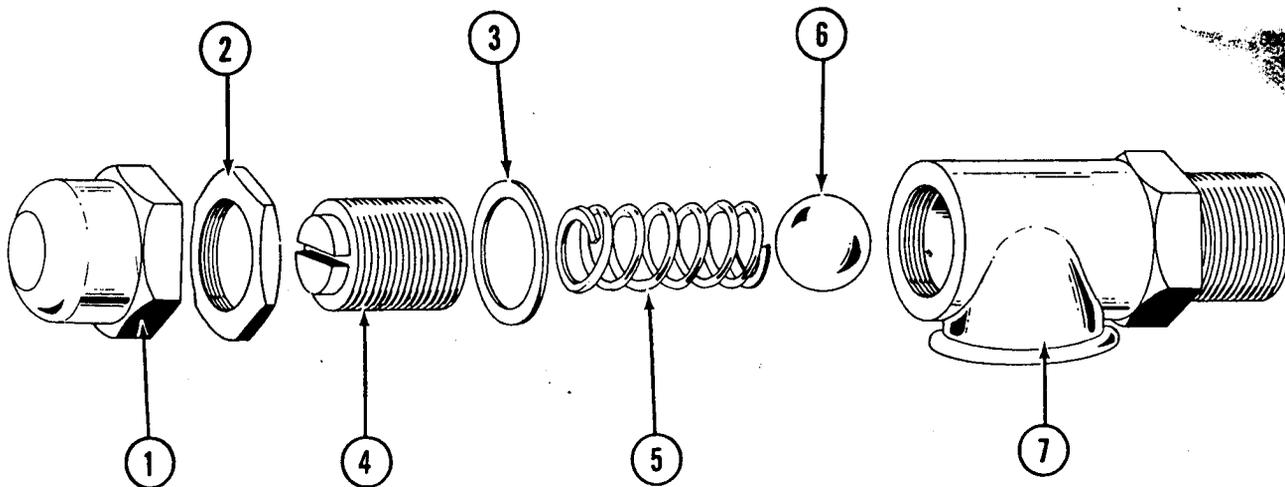


FIGURE 33. CONVERTER RELIEF VALVE DISASSEMBLY

- | | | | |
|--------------|--------------------|--------------|---------------|
| 1. Valve Cap | 3. Gasket | 5. Spring | 7. Valve Body |
| 2. Locknut | 4. Adjusting Screw | 6. Ball Seat | |

Reassembly

To reassemble relief valve, reverse the numerical sequence as shown in Figure 33.

For relief valve adjustment, see "Adjustments" in this section.

Install valve and fittings into converter housing. Connect hydraulic hose leading to oil cooler and copper tube leading to tail shaft governor.

POWER SHIFT CLUTCH RELIEF VALVE

The power shift clutch relief valve is not serviceable except for replacement of "O" rings.

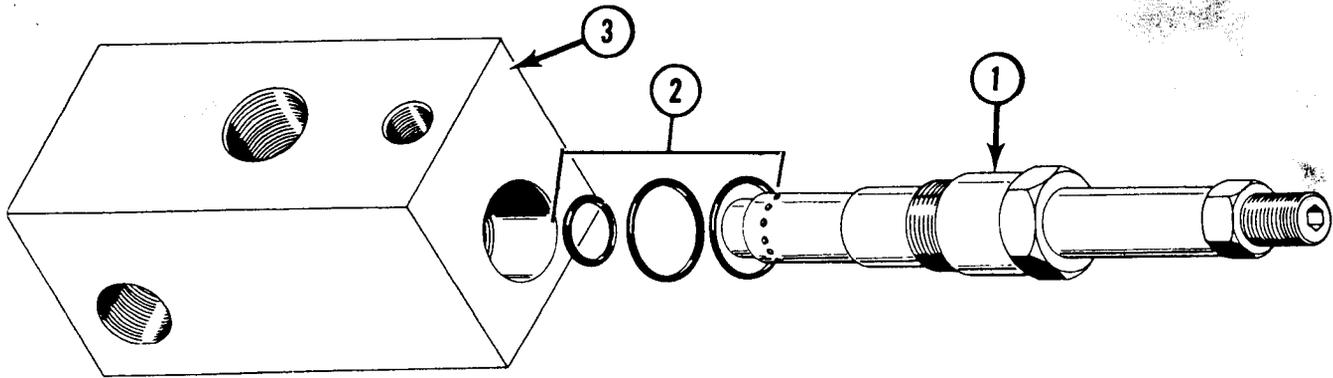


FIGURE 34. RELIEF VALVE REMOVAL

1. Valve Assembly 2. "O" Rings 3. Body

Refer to Figure 34. Remove valve assembly (1) from valve body (3). Remove the three "O" rings (2). Install new "O" rings on valve assembly and reinstall valve assembly into valve body. Removal of relief

valve body from converter housing is not required to replace "O" rings.

For adjusting the power shift clutch relief valve, see "Adjustment Section".

TAILSHAFT GOVERNOR

Disassembly

Remove tailshaft governor from mounting bracket on engine. Remove tailshaft flexible drive from governor.

Refer to Figure 35. Follow the numerical sequence as shown for disassembly. Remove four capscrews and lockwashers retaining governor flange (1) to governor housing. Remove flange and gasket (2). Lift spider assembly (3) from housing. Remove snap ring (4) from spider shaft. Remove thrust bearing (5). Remove sleeve (6). Remove bearing (7). Remove two slotted capscrews retaining yoke (8) to housing and remove yoke. Remove bushing (9) from bore in end of housing (10).

Inspect bearings and bushing for wear. Replace if worn. Inspect fingers of yoke for wear or cracks. Replace if damaged. Inspect sleeve for wear and binding. Replace if worn.

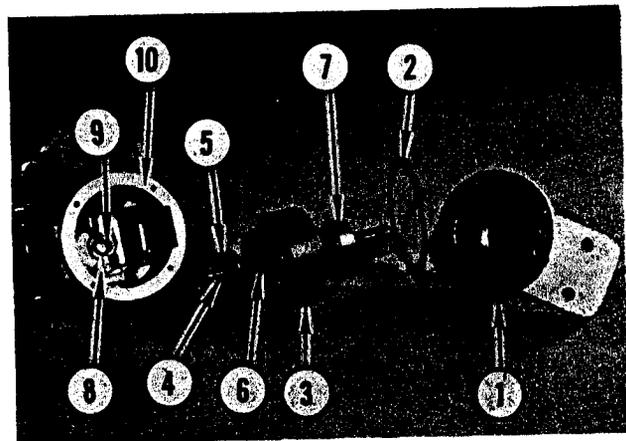


FIGURE 35. TAILSHAFT GOVERNOR DISASSEMBLY (PF ONLY)

- | | |
|--------------------|-------------|
| 1. Flange | 6. Sleeve |
| 2. Gasket | 7. Bearing |
| 3. Spider Assembly | 8. Yoke |
| 4. Snap Ring | 9. Bushing |
| 5. Thrust Bearing | 10. Housing |

Reassembly

Reverse the numerical sequence as shown for disassembly. After tightening flange re-

taining capscrews, the spider shaft should rotate freely and without binding.

Adjustments

GOVERNOR

Place governor in vise with vise jaws clamping governor flange mounting bracket.

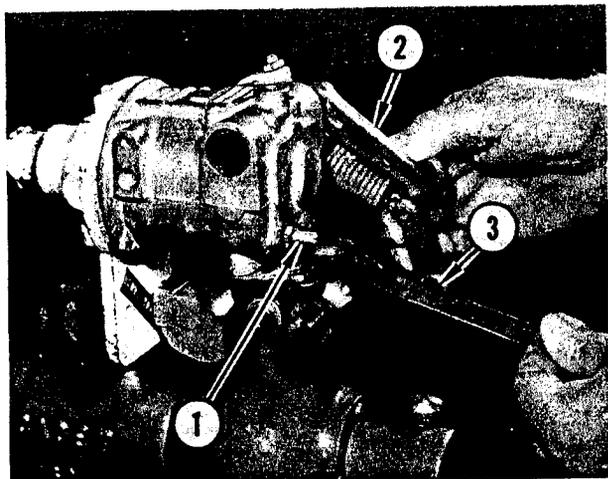


FIGURE 36. GOVERNOR ADJUSTMENT

- | | |
|--------------------|---------------|
| 1. Adjusting Screw | 3. Lever Hole |
| 2. Lever | |

Refer to Figure 36. Loosen locknut on adjusting screw (1). Back adjusting screw out until only 2 or 3 threads remain in housing. Pull back on governor lever (2) as far as it will go. Holding governor lever in this position, turn adjusting screw in until hole (3) in governor lever moves toward governor $1/16$ ". Tighten adjusting screw locknut. If this adjustment is not properly made, the

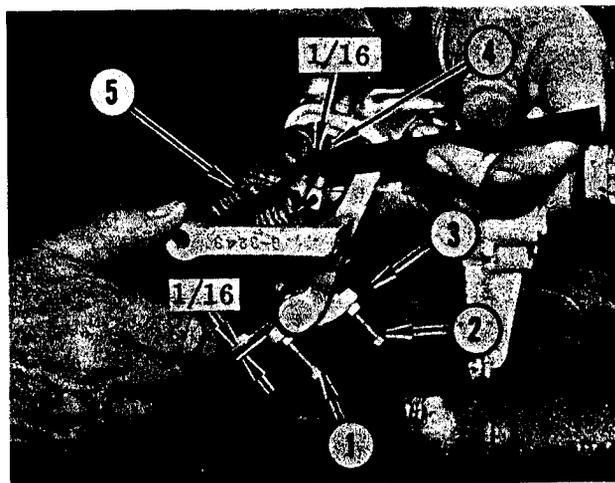


FIGURE 37. GOVERNOR ADJUSTMENT

- | | |
|--------------|-------------------|
| 1. Stop Bolt | 4. Eyebolt |
| 2. Stop Bolt | 5. Governor Lever |
| 3. Stop | |

weights on spider can expand enough to cut housing. If setscrew is run in too far, it will be impossible to get full engine RPM.

Refer to Figure 37. Loosen locknut on stop bolt (1) and adjust stop bolt until $1/16$ " of threaded end of bolt extends through bracket. Tighten locknut.

Loosen locknut on stop bolt (2). Run stop bolt against stop (3) until there is a clearance of $1/16$ " between spring eyebolt (4) and governor lever (5) (arrow and scale).

Refer to Figure 38. Hook fish scale onto throttle lever (1) and adjust spring eyebolt (2) until it takes a pull of 9 lbs. to pull lever in a horizontal line. Do not pull against stop.

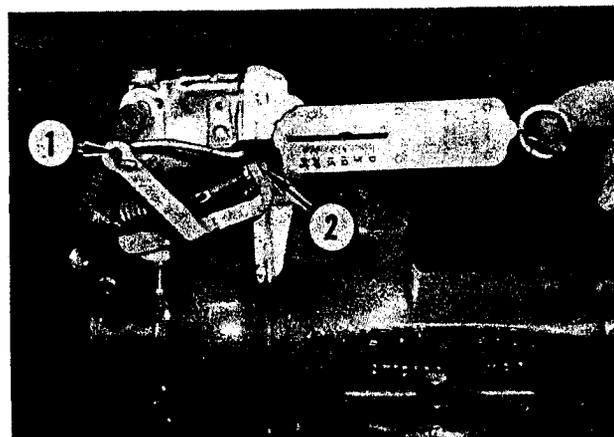


FIGURE 38. THROTTLE LEVER ADJUSTMENT

- | | |
|----------|------------|
| 1. Lever | 2. Eyebolt |
|----------|------------|

Install tailshaft governor onto engine bracket. For adjustment of linkage, see "Engine Controls" in adjustment section.

Attach tailshaft governor flexible drive to governor flange. One end of the flexible drive can be adjusted; this end attaches to the tailshaft governor. Refer to Figure 39. Adjust knurled adjustment nut (1) until flexible shaft (2) will depress slightly when pressed with thumb. NOTE: Make this adjustment with opposite end of flexible drive connected to the drive pulley. CAUTION: The

adjustable end must always be attached to the tailshaft governor.

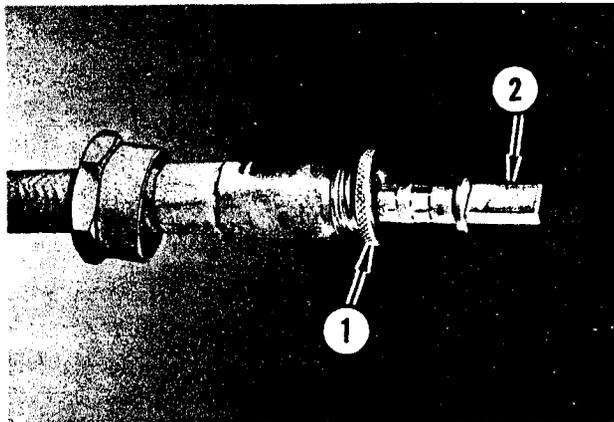


FIGURE 39. GOVERNOR FLEXIBLE DRIVE
1. Adjustment Nut 2. Shaft

TORQUE CONVERTER RELIEF VALVE

Remove pipe plug located in the fitting between relief valve and converter housing. Install pressure gauge line into this fitting.

Start engine and run at idle for a period of 5 minutes to warm converter oil. Increase engine RPM to approximately 900. Adjust relief valve until a pressure of 25 to 35 psi registers on test gauge.

Set brakes, shift lower transmission into 4th gear. Shift power shift clutch into forward position. Increase engine speed to full RPM. Test gauge must register 35 to 45 psi.

Shift transmission to neutral. Shut down engine. Remove test gauge from fitting and replace pipe plug.

OIL CIRCULATION TEST

Remove drain cock and pipe bushing from oil cooler tee fitting. Install a nipple with short piece of hose. Place a container beneath hose. Start engine and operate at approximately 600 RPM in neutral until a steady flow of oil flows into container. There should be a flow of 2-1/2 gallons per minute or 1 gallon in 24 seconds.

POWER SHIFT CLUTCH RELIEF VALVE

Loosen locknut on relief valve adjusting screw.

Start engine and run at idle RPM for 5 minutes to permit oil to warm up.

With engine speed at about 600 RPM, turn relief valve adjusting screw in or out until the oil pressure gauge on instrument panel shows a reading of 90 to 100 psi. Tighten locknut.

Shift lower transmission into fourth gear. Set wheel brakes. Shift power-shift clutch pedal to forward position. Increase engine RPM to full throttle. Pressure gauge reading should show a minimum reading of 100 to 125 psi.

Move clutch pedal to neutral and shift transmission lever to neutral. Release brakes. Shut down engine.

ENGINE CONTROLS

With ground speed control lever (Hand Throttle) set at approximately one-half throttle, adjust all rods and clevis so that vertical operating rods are approximately vertical and all horizontally operating rods are approximately horizontal. Adjust front ver-

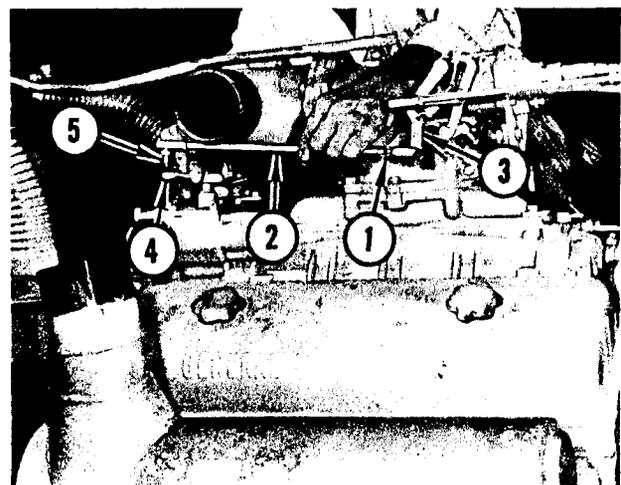


FIGURE 40. THROTTLE ADJUSTMENT
1. Locknut 4. Full Fuel Position
2. Push Rod 5. Ball Joint
3. Governor Lever

tical pull rod, through floor board, until accelerator-decelerator rod is pulled out of its housing 1/2" to 3/4" when ground speed selector lever is moved to full throttle position.

Full Throttle Adjustment (GM Engine)

Refer to Figure 40. Loosen locknut (1)

on governor push rod (2). Hold tailshaft governor lever (3) and engine governor lever (4) in full fuel position. Adjust governor push rod until ball joint (5) will engage engine governor lever freely. Install nut on ball joint and tighten. Tighten locknut on push rod. (For Cummins Engine Adjustment, see Page B-25.)

POWER SHIFT TRANSMISSION

The power shift transmission consists of an upper shaft with two clutch packs, one for forward movement and one for reverse movement. A lower shaft with two gears;

one forward and one reverse. A reverse idler gear assembly mounted on front cover and a gear brake mounted on lower shaft.

Disassembly

Disconnect all oil hose from oil cap. Remove two capscrews and lockwashers and remove control valve from left side of upper transmission housing.

move rocker arm (4). NOTE: To remove locknut (1) shift lower transmission into gear.

Remove nuts and washers from bolts supporting converter oil reservoir and remove reservoir (Model 777BT only).

Refer to Figure 42. Remove six capscrews and lockwashers (1). Remove gear brake backing plate assembly (2). Remove three stud nuts and lockwashers (3) retaining shifter housing (4) to transmission cover.

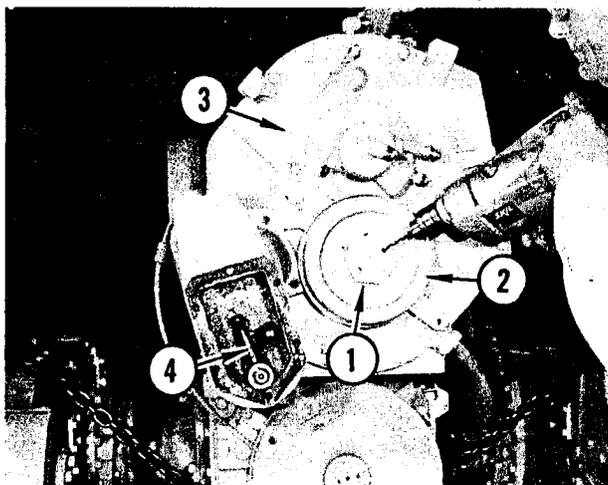


FIGURE 41. TRANSMISSION LOWER SHAFT

- 1. Locknut
- 2. Brake Drum
- 3. Oil Line
- 4. Rocker Arm

Refer to Figure 41. Drill stake from locknut (1) on lower shaft. Remove locknut and gear brake drum (2) and brake shoes. Remove copper tube oil line (3). Remove nut and lockwasher from rocker shaft and re-

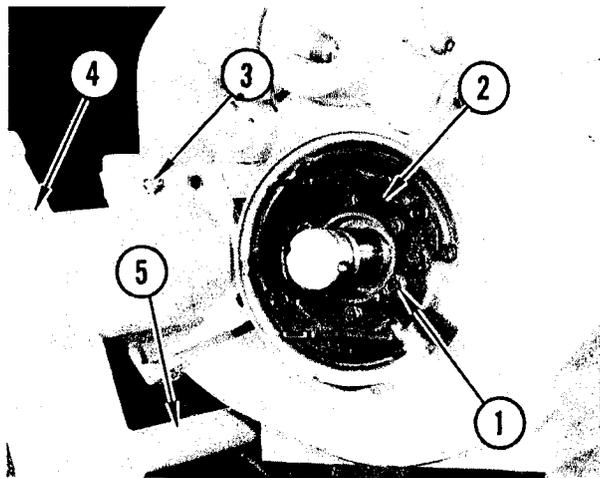


FIGURE 42. BRAKE BACKING PLATE REMOVAL

- 1. Capscrew & Lockwashers
- 2. Backing Plate
- 3. Nuts & Lockwashers
- 4. Shifter Housing
- 5. Rocker Shaft Tube

Remove two capscrews and lockwashers retaining rocker shaft tube end (5) to intermediate plate. Remove shifter housing.

Refer to Figure 43. Remove five capscrews and lockwashers (1). Remove oil cap (2) and gasket. Remove five hexhead capscrews (3) and one countersunk Allenhead setscrew. Remove oil seal retainer (4). Remove snap ring from upper shaft bearing. Lower shaft bearing will come off with cover.

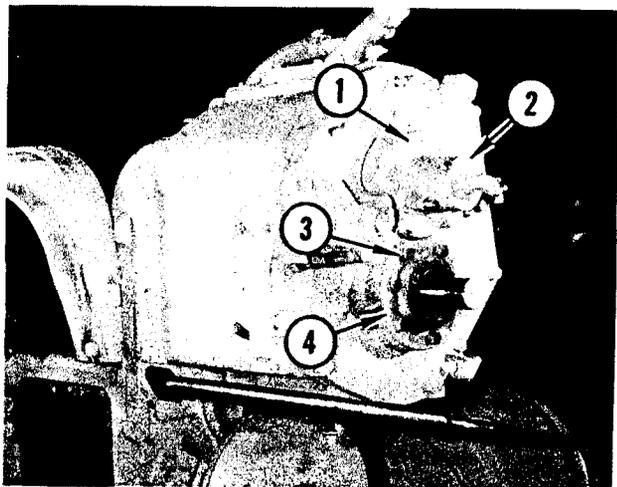


FIGURE 43. OIL CAP & BEARING COVER REMOVAL

- | | |
|------------------------|-----------------------|
| 1. Capscrews & Washers | 3. Hex Head Capscrews |
| 2. Oil Cap | 4. Retainer |

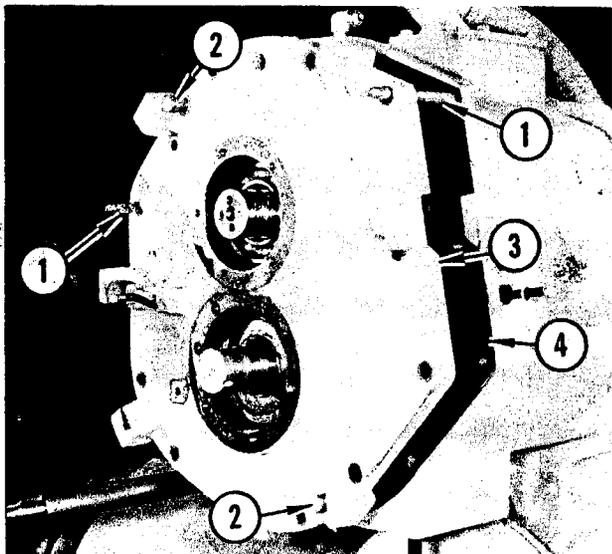


FIGURE 44. TRANSMISSION HOUSING COVER

- | | |
|---------------|-----------|
| 1. Guide Pins | 3. Cover |
| 2. Dowel Pins | 4. Gasket |

Refer to Figure 44. Remove thirteen capscrews and lockwashers retaining cover to transmission housing. Install guide pins (1) as shown. Install nuts on the threaded portion of the two dowel pins (2). Tighten nuts until dowel pins are removed. Tap out on cover (3) until cover is loose, then remove. NOTE: Force upper and lower shafts back as cover is removed. Remove gasket (4).

Refer to Figure 45. Remove spacer (1) and reverse gear (2) from lower shaft. Remove spacer (3) from upper shaft.

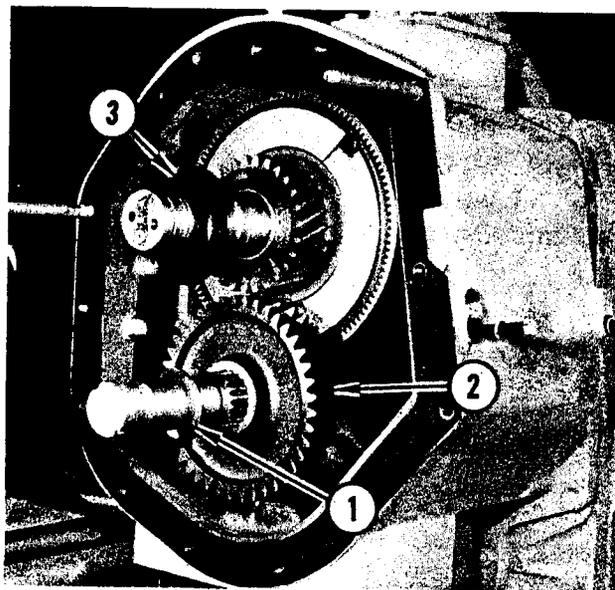


FIGURE 45. REVERSE GEAR REMOVAL
1. Spacer 2. Reverse Gear 3. Spacer

Refer to Figure 46. Install lifting tool (1) onto chain hoist and place prongs of tool under upper shaft assembly (2). Take up on chain hoist. Move front end of upper shaft back and forth and at same time pull forward until assembly is free of bearing bore in housing. Remove assembly from housing. Remove long spacer (3) from lower shaft.

Move end of lower shaft back and forth and at same time pull forward until assembly is free of bearing bore in housing. Remove shaft assembly from housing.

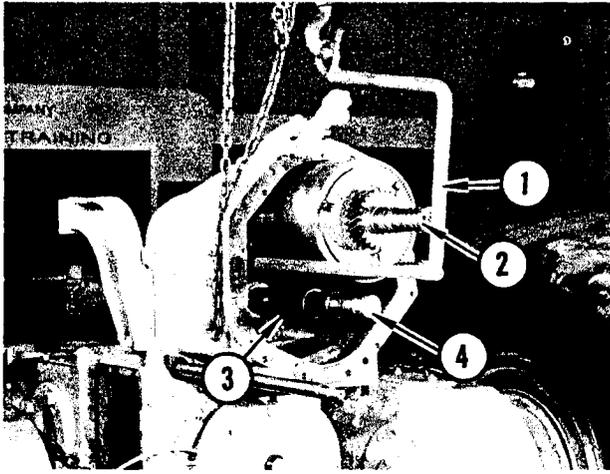


FIGURE 46. UPPER SHAFT ASSEMBLY
 1. Lifting Tool 3. Spacer
 2. Upper Shaft Assembly 4. Lower Shaft

Remove short spacer and forward gear from shaft. Remove allspeed gear assembly. Remove "O" ring retainer and "O" ring from groove in splined end of shaft.

Refer to Figure 47 and disassemble allspeed gear assembly. Press or pull bearing (1) from gear hub. Remove seal retainer (2) from allspeed gear (3). Remove "O" ring (4) from groove in seal retainer. Press or drive oil seal (5) from seal retainer.

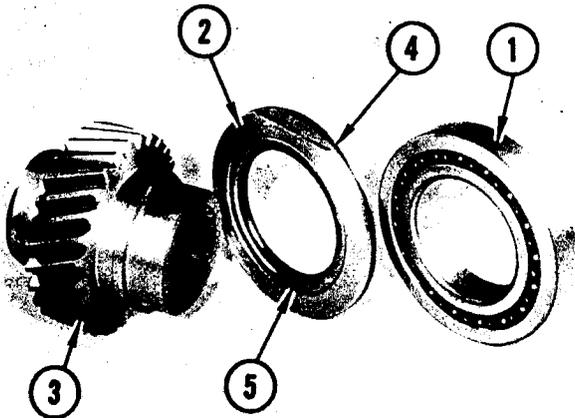


FIGURE 47. ALL SPEED GEAR ASSEMBLY
 1. Bearing 4. "O" Ring
 2. Seal Retainer 5. Oil Seal
 3. Gear
 NOTE: Items 2, 4 and 5 are for 777BT only.

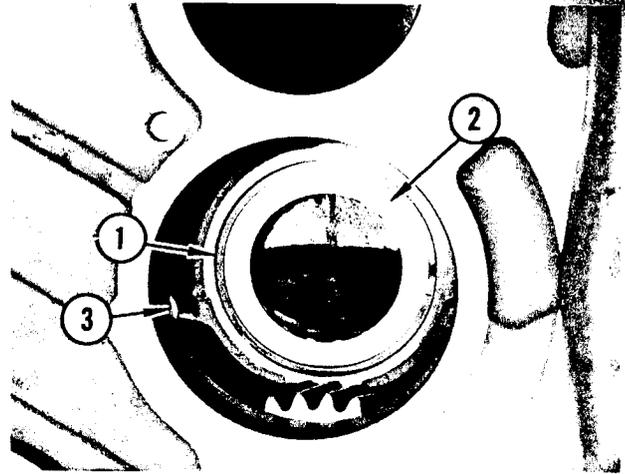


FIGURE 48. HOUSING BEARING REMOVAL
 1. Retainer Ring 3. Seal Retainer
 2. Bearing

Refer to Figure 48. Remove retainer ring (1). Remove outboard bearing (2) from bore in housing. Item (3) is seal retainer lock.

LOWER SHAFT REASSEMBLY

Reassembly will be the reverse of disassembly and the following information:

1. Press oil seal into seal retainer with lip of seal away from side of retainer having the milled surface. Install retainer on hub with milled surface side toward gear.
2. Press bearing onto gear hub with chamfer on bearing bore toward gear. Press bearing until it is against shoulder on gear hub.
3. When installing lower shaft into housing, the milled surface on retainer must align with retainer lock on intermediate plate.

REMOVE REVERSE IDLER GEAR

Drill stake from locknut and idler shaft. Remove locknut.

Remove idler gear assembly from cover. Remove idler shaft from idler gear bore.

Remove retaining ring from groove in idler gear and remove tapered roller bearings.

Reassembly of reverse idler will be the reverse of the disassembly procedure and the following information:

1. Install locknut and tighten to a torque reading of 450 to 475 ft. lbs.

POWER SHIFT CLUTCH DISASSEMBLY

The disassembly and reassembly of both clutch packs are identical so only one will be shown. Carefully unlock and remove the four piston rings from ring grooves in shaft.

Drill stake from locknut and upper shaft. Remove locknut. Using a puller, remove ball bearing.

Refer to Figure 49. Remove the three capscrews and lockplates (1). Remove retaining ring (2). Remove backing disc (3).

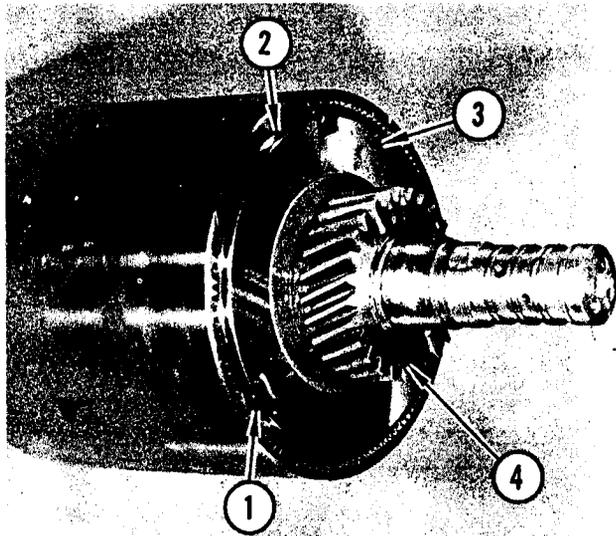


FIGURE 49. UPPER SHAFT DISASSEMBLY

- | | |
|--------------------------|-----------------|
| 1. Capscrews & Lockplate | 3. Backing Disc |
| 2. Retaining Ring | 4. Clutch Gear |

Remove clutch gear (4). Remove clutch discs. There will be ten externally splined discs and nine internally splined discs in each clutch pack.

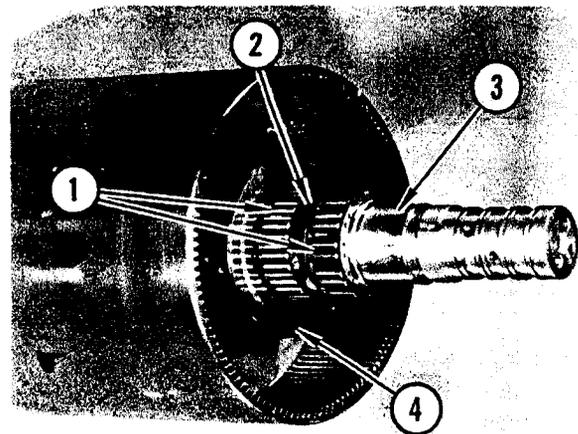


FIGURE 50. BEARING REMOVAL

- | | |
|------------------------|-------------------|
| 1. Clutch Gear Bearing | 3. Bearing Sleeve |
| 2. Spacer | 4. Piston Cup |

Refer to Figure 50. Remove bearings (1) and spacer (2).

Remove bearing sleeve (3), and piston cup (4). Remove spacer and "O" ring from inside piston cup.

Press or drive the shaft assembly from piston housing.

NOTE: The forward clutch cannot be completely disassembled until shaft has been

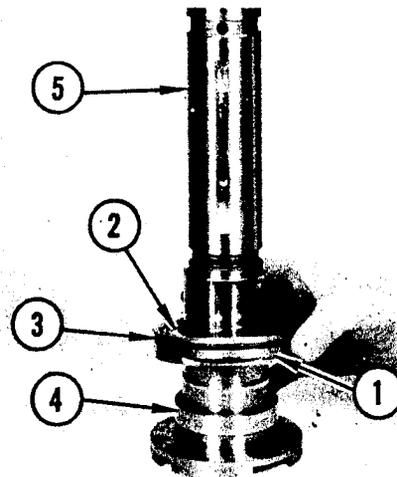


FIGURE 51. CLUTCH SHAFT DISASSEMBLY

- | | |
|------------------|-----------|
| 1. Seal Retainer | 4. Collar |
| 2. Oil Seal | 5. Shaft |
| 3. "O" Ring | |

removed from piston housing. The clutch discs can be removed without removal of shaft.

Complete forward clutch disassembly by removing spacer, "O" ring, clutch gear, roller bearings, bearing sleeve, spacer and ball bearing from shaft. These parts to be removed in the order outlined.

Refer to Figure 51. Remove seal retainer (1). Remove oil seal (2) and "O" ring (3) from seal retainer. Remove collar (4) from shaft (5).

Refer to Figure 52. Install two long bolts into tapped holes in piston. Remove piston (1) from piston housing. Remove piston ring (2) from groove in hub of piston. Remove seal ring (3) and ring expander from groove in piston. When installing piston, make certain that oil port in piston is aligned with hole in housing. See arrows.

Remove dowels from piston housing. Remove ball check from piston.

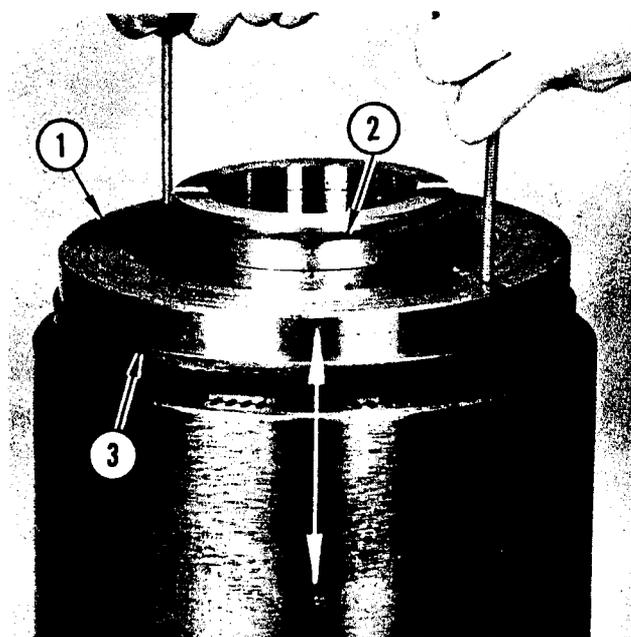


FIGURE 52. CLUTCH PISTON
DISASSEMBLY

1. Piston 2. Ring 3. Seal Ring

CLUTCH REASSEMBLY

The reassembly of the power shift clutch will be the reverse of the disassembly procedure as outlined and the following information:

1. Heat collar in hot oil and install on upper shaft with chamfer in collar toward flanged end of shaft.
2. Press or drive oil seal into seal retainer with lip of seal away from side of retainer with milled surface.
3. Heat ball bearing in hot oil and press onto shaft until tight against collar.
4. Install spacer on shaft with shoulder of spacer against ball bearing.
5. Heat bearing sleeve in oil and install on shaft.
6. Assemble the following parts for forward clutch onto shaft before installing piston housing on shaft, two roller bearings with spacer, clutch gear, piston cup, spacer and "O" ring. Install piston into piston housing.

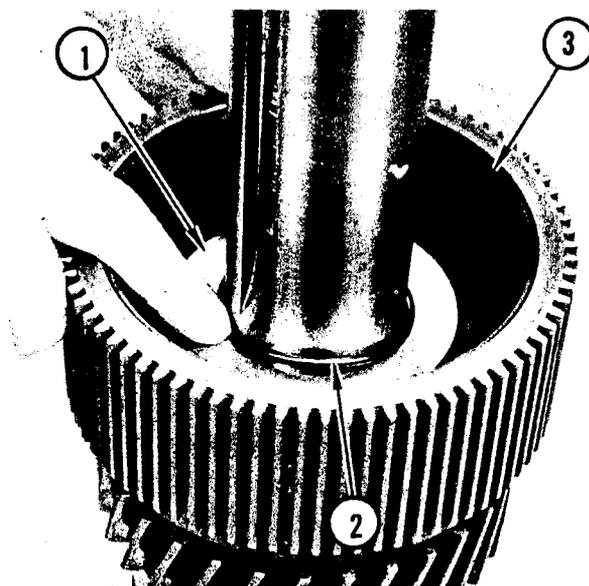


FIGURE 53. PISTON REASSEMBLY

1. Spacer 2. "O" Ring 3. Piston Cup

7. When installing spacer (1) and "O" ring (2) into piston cup (3), make certain "O" ring is inside of spacer and between shaft and spacer bore. See Figure 53.
8. Install flanged spacer in reverse clutch assembly with flange of spacer toward clutch gear.

9. Install locknut and tighten to torque of 550 to 575 ft. lbs.
10. When installing clutch discs, start with an externally splined disc, then alternate with internally splined and externally splined discs, completing the assembly with an externally splined disc.

CONTROL VALVE

Disassembly

Clamp valve housing in vise and remove all hydraulic fittings. See Figure 54.

Remove slotted capscrews and flatwashers. Remove the two brush holder assemblies.

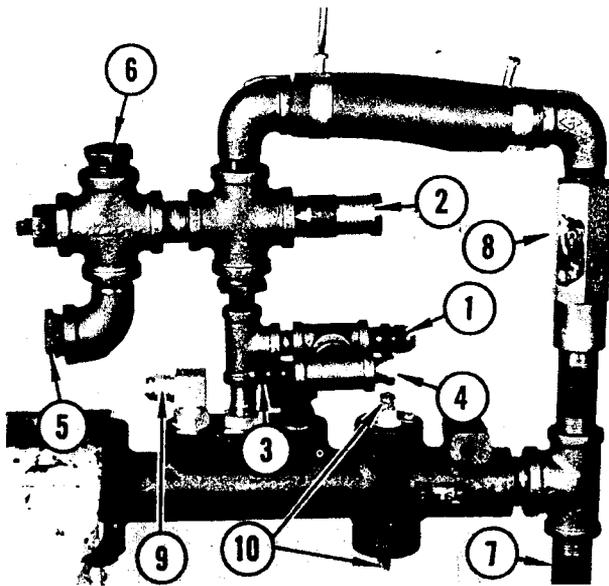


FIGURE 54. CONTROL VALVE
DISASSEMBLY

1. From Relief Valve
2. From Oil Cooler
3. To Clutch Release
4. To Pressure Gauge
5. To Clutch Lubrication
6. To Clutch Cooling
7. To Oil Cooling
8. #15 Check Valve
9. To Reverse Clutch
10. Brush Holder

Refer to Figure 55. Remove nut from stud (1). Remove pull rod bolt (2) from piston (3). Remove bar (4).

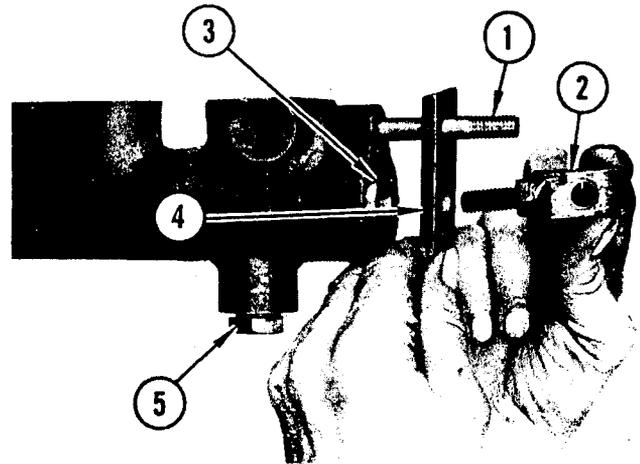


FIGURE 55. CONTROL VALVE

- | | |
|------------------|---------------|
| 1. Stud | 4. Bar |
| 2. Pull Rod Bolt | 5. Poppet Cap |
| 3. Piston | |

Remove poppet cap (5), copper washer, flatwasher and roll pin. Remove poppet spring, and poppet ball from housing.

Refer to Figure 56. Remove retaining ring and wiper ring from end of piston. Remove piston assembly (1) from valve body. Remove locknut (2). Remove the two nylon spacers (3) and brass collar (4). Remove "O" ring (5).

Reassembly

Reassembly will be the reverse of disassembly and the following information:

1. Install new "O" ring on piston.
2. Inspect nylon spacers and brass collar. If excessively worn or cracked, replace with new ones.
3. Inspect lands on piston, if badly scored or worn excessively, replace the piston.
4. Install locknut on stud so that when detent ball is in the third detent groove from end of piston, the valve bar will be against locknut.

Full Throttle Adjustment (Cummins Engine)

Install throttle lever ball joint into lower hole in fuel pump lever. Install and tighten nut and lockwasher.

With fuel pump lever and tailshaft governor lever in full fuel position, adjust length of governor rod until ball joint is in

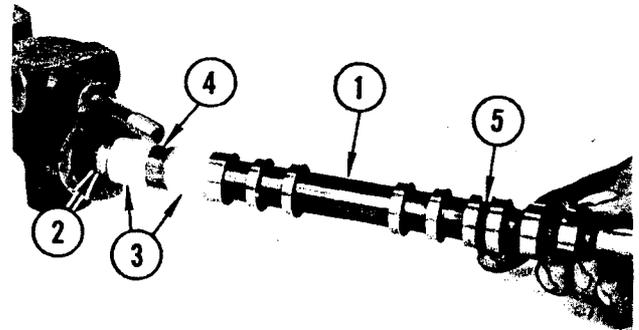


FIGURE 56. CONTROL VALVE PISTON REMOVAL

- | | |
|----------------------|-------------------|
| 1. Piston | 4. Collar, Copper |
| 2. Locknut | 5. "O" Ring |
| 3. Bushings, Plastic | |

line with hole in governor lever. Install ball joint into lever; install and tighten nut and lockwasher.

Tighten both jam nuts on throttle rod ball joints.

ENGINE CLUTCH (OIL)

General

The mechanical function of the WABCO Motor Grader oil clutch is basically the same as the rugged and dependable dry disc clutch.

The oil clutch incorporates either two or three Raybestos discs, depending on the size and horsepower of the grader. The Model 777B will have three Raybestos discs and two steel discs. The Model 666B will have two Raybestos discs and one steel disc except when equipped with a Cummins engine; then it will have same number of discs as the Model 777B.

The oil supply for lubricating and cool-

ing the clutch is independent of the engine crankcase lubricating oil and the grader hydraulic system. The positive displacement gear type pump which supplies oil to the clutch is externally mounted on the clutch housing and is driven at engine speed through a gear train which originates in the clutch cover. Anytime the engine is running, the pump is being driven and oil is supplied to the clutch. Oil is routed from the pump through an oil passage to the clutch shaft where it flows between the power take-off shaft and the inside diameter of the clutch shaft and the power take-off coupling. Oil is sprayed from two perforated tubes attached to the power take-off coupling onto the clutch

discs and steel discs. The oil is slung towards the outside edges of the discs, creating an oil mist which lubricates the rear clutch passages and the pump bearings.

The oil spray accumulates in the lower part of the clutch housing where it drains into the reservoir which is mounted at the rear of the final drive housing. Oil from the reservoir is routed to the oil cooler which is located in the lower tank of the radiator to the pump. Oil from the pump (12 GPM) is filtered by an oil filter located on R. H. side of fuel tank support. From the filter it goes through a non-adjustable relief valve which is set at 15 psi where it enters the clutch

housing, completing the oil flow cycle.

Located on the instrument panel of the grader is a red indicator light. Insufficient oil pressure in the system will cause the light to come on. The grader should never be operated when the warning light is on. On graders equipped with GM engines, the key switch must be turned off at shutdown to prevent the warning light from staying on. The capacity of the WABCO oil clutch system is eight gallons of type A, automatic transmission oil. Check your oil for the clutch with engine running and with oil warm. The dipstick is located between L. H. side of engine and L. H. side of main frame.

Removal

Engine must be removed from motor grader before clutch can be disassembled. Refer to "Engine Removal" for instructions.

Attach sling to clutch housing. Attach hoist to sling and take up slack.

Remove the twelve capscrews and lockwashers retaining clutch housing to flywheel housing. Pull housing assembly away from flywheel housing until clutch shaft clears clutch assembly.

Lower assembly to ground for disassembly after completing removal of clutch.

Install and tighten three hold-down capscrews with flat washer through backing plate and into pressure plate. Tighten capscrews enough to compress pressure springs, Figure 57.

Remove twelve capscrews and lockwashers retaining clutch assembly to the flywheel adaptor (13). NOTE: There will be shims (2) between the backing plate (1) flange and the flywheel adaptor. Wire these shims to the backing plate flange. When reassembling, make certain these shims are replaced in same position as removed, Figure 58.

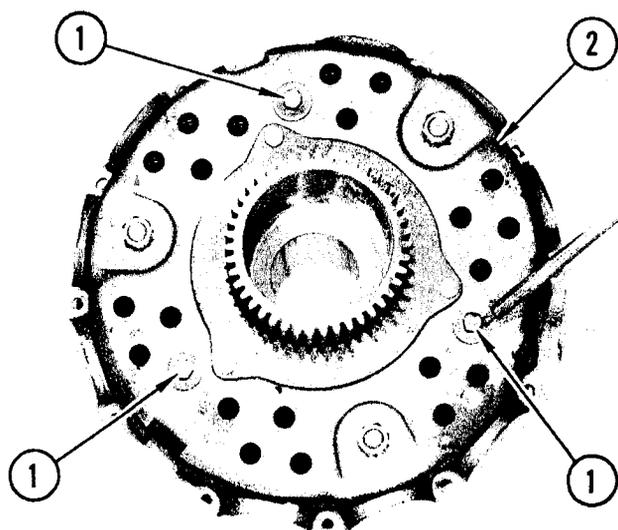


FIGURE 57. CLUTCH ASSEMBLY

- | | |
|---------------------------|---------------------|
| 1. Hold-Down
Capscrews | 2. Backing
Plate |
|---------------------------|---------------------|

Remove clutch backing plate (1) and pressure plate (4) as an assembly.

Remove lined clutch disc (5) from driven hub. Remove outer disc (steel) (6) from flywheel adaptor. Remove second lined clutch disc (7). Remove driven hub (8), spacer (9) and snap ring (10) as an assembly.

Remove six capscrews (GM) retaining PTO adaptor (11) to flywheel and remove PTO adaptor.

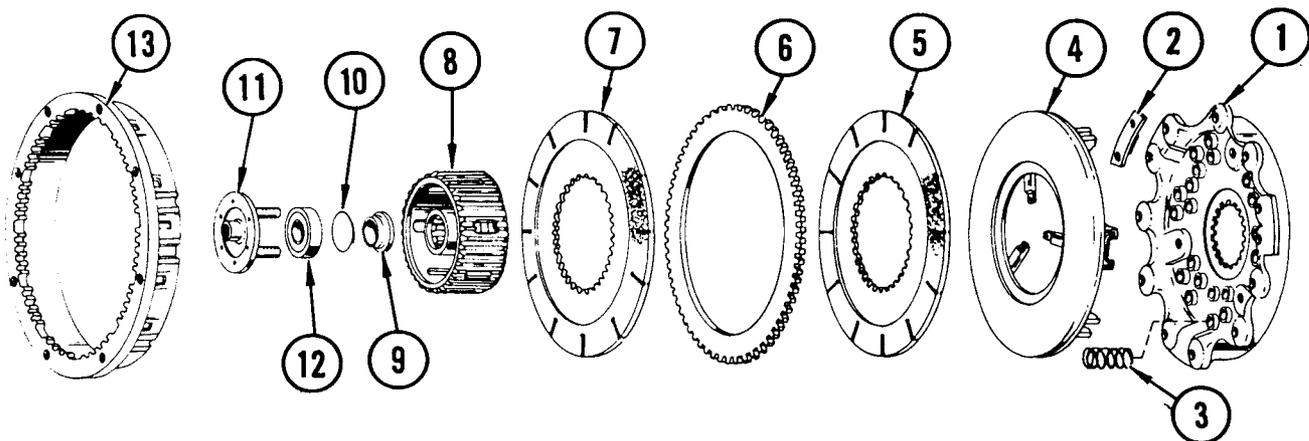


FIGURE 58. EXPLODED VIEW OF CLUTCH ASSEMBLY (2 DISC)

- | | | | |
|--------------------|-------------------|--------------------|----------------------|
| 1. Backing Plate | 4. Pressure Plate | 7. 2nd Clutch Disc | 10. Retainer Ring |
| 2. Shim | 5. Clutch Disc | 8. Driven Hub | 11. PTO Adapter |
| 3. Pressure Spring | 6. Steel Disc | 9. Spacer | 12. Bearing |
| | | | 13. Flywheel Adapter |

Disassembly

CLUTCH ASSEMBLY

Place clutch backing plate and pressure plate assembly in an arbor press and force backing plate down until hold-down bolts can be removed. Remove hold-down bolts. Remove nuts and shakeproof washers from eye bolts.

Remove clutch assembly from press.

Remove backing plate. Note position of the eighteen pressure springs (3). When re-assembling clutch, replace springs in same position. Remove the eighteen pressure springs.

Remove the anti-rattle springs from the three lever assemblies.

Remove cotter pin from lever pin. Remove washer from lever pin and remove lever pin. Remove lever assembly from pressure plate (4). Remove pivot pin from lever. Remove eye bolt.

CLUTCH HOUSING ASSEMBLY

Figure 59 shows an exploded view of clutch housing assembly.

Remove capscrew from cross shaft keeper (1) and remove keeper from groove in cross shaft.

Pull cross shaft assembly (2) from housing. When end of shaft clears shifter fork (3), remove fork.

Remove thrust gear assembly (4) from release bearing support (7). The thrust gear assembly consists of a thrust gear, small retaining ring, two ball bearings, spacer, large retaining ring and bearing release sleeve, Figure 60.

To disassemble thrust gear assembly, first remove large retaining ring from groove in thrust bear. Remove release bearing sleeve assembly from gear.

Remove small retaining ring from groove in release bearing sleeve. Remove the ball bearings and spacer from sleeve.

Remove compression spring (5) by expanding spring enough to slip over splines of clutch shaft. Remove retaining ring (6), Figure 59.

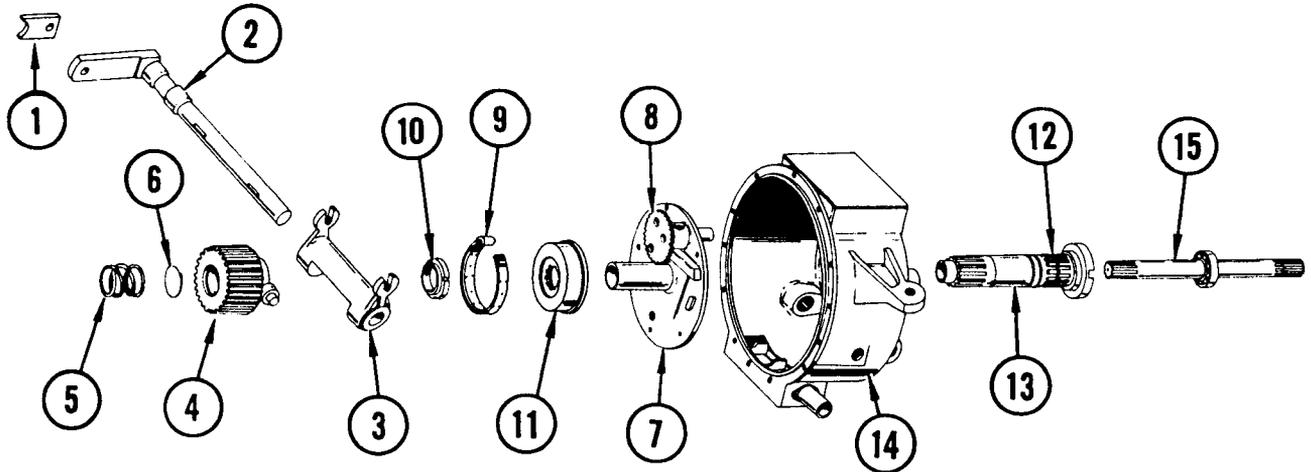


FIGURE 59. EXPLODED VIEW OF CLUTCH HOUSING ASSEMBLY

- | | | |
|-------------------------|----------------------------|-----------------------|
| 1. Cross Shaft Keeper | 6. Retainer Ring | 11. Clutch Brake Drum |
| 2. Cross Shaft | 7. Release Bearing Support | 12. Piston Rings |
| 3. Release Shifter Fork | 8. Pump Drive Assembly | 13. Clutch Shaft |
| 4. Thrust Gear | 9. Clutch Brake Band | 14. Clutch Housing |
| 5. Compression Spring | 10. Locknut | 15. PTO Shaft |

Remove the five capscrews and lockwashers retaining release bearing support (7) to housing. Pump drive assembly (8) will come off with release bearing support.

Remove cotter pin from yoke pin and remove yoke pin from yoke. This will release clutch brake band (9) from yoke. Remove clutch brake band.

Raise the piston rings (12) in their grooves until they can be unlocked and removed from shaft.

Using a spanner wrench, remove locknut (10). Remove clutch brake drum (11) from shaft. Bump end of clutch shaft (13) with a soft hammer to remove it from housing.

Remove oil seal from bore in housing. Remove retaining ring and remove ball bearing from bore.

Remove two pipe plugs from front of housing. Using a small punch, drive the two roll pins from the clutch brake shaft. Pull

brake shaft from housing. As the shaft is being removed, slide the bell crank and a spacer from the end of shaft inside housing.

Remove oil seal from brake shaft bore on L.H. side of housing. Remove oil seal

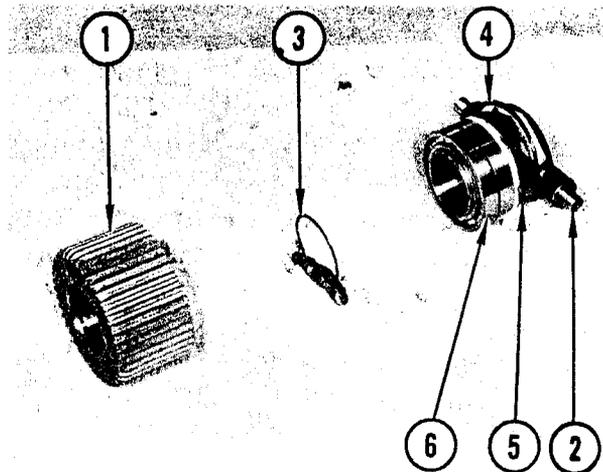


FIGURE 60. EXPLODED VIEW OF THRUST GEAR

- | | |
|------------------------------------|--------------|
| 1. Thrust Gear | 4. Snap Ring |
| 2. Release Bearing Sleeve Assembly | 5. Spacer |
| 3. Retaining Ring | 6. Bearing |

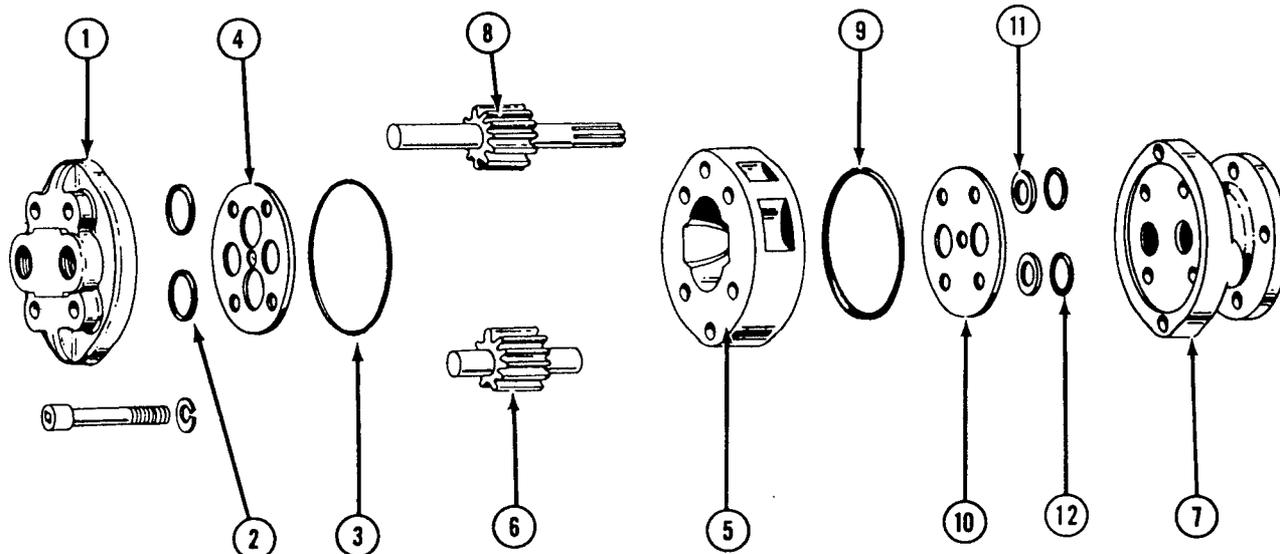


FIGURE 61. EXPLODED VIEW OF OIL PUMP

- | | | |
|--------------------|-------------------------|---------------------|
| 1. Pump Cover | 5. Pump Housing | 9. Large "O" Ring |
| 2. Small "O" Rings | 6. Driven Gear Assembly | 10. Wear Plate |
| 3. Large "O" Ring | 7. Adapter | 11. Back-Up Washers |
| 4. Wear Plate | 8. Drive Gear Assembly | 12. Small "O" Rings |

from L.H. clutch cross shaft bore. Remove needle bearings from both L.H. and R.H. clutch shaft bores.

OIL PUMP

Clean outside of pump thoroughly. Remove inlet hose and outlet tubing. Plug hose to prevent foreign matter front entering system.

Remove pump from clutch housing by removing four capscrews and lockwashers.

Make a punch mark, in a line, on each of the following; adaptor, housing and cover. These marks will aid in reassembling these parts in their same positions in relation to each other.

Figure 61 shows an exploded view of the pump assembly.

Remove four capscrews and lockwashers retaining cover (1) to body and adaptor. Remove cover.

Remove small "O" rings (2) from face of cover assembly. Remove large "O" ring (3) from wear plate (4). Remove wear plate. Remove housing (5).

Remove driven gear assembly (6) from adaptor (7). Remove drive gear assembly (8) from adaptor.

Remove large "O" ring (9) from wear plate (10). Remove wear plate from adaptor.

Remove washers (11) and small "O" rings (12) from face of adaptor.

RELIEF VALVE

The relief valve is non-adjustable and under normal conditions should not require any maintenance other than replacing "O" ring.

Figure 62 shows an exploded view of the relief valve.

Remove the four capscrews and lock-

washers retaining the relief valve to the clutch housing. Remove the relief valve. Remove the "O" ring from relief valve body.

Remove small Allen head setscrew which locks the spring retaining nut in valve body.

Remove the spring retaining nut. Note depth of nut in housing. Replace it to same position during reassembly. Remove spring and ball.

If required, the pressure switch may be removed by unscrewing it from valve body.

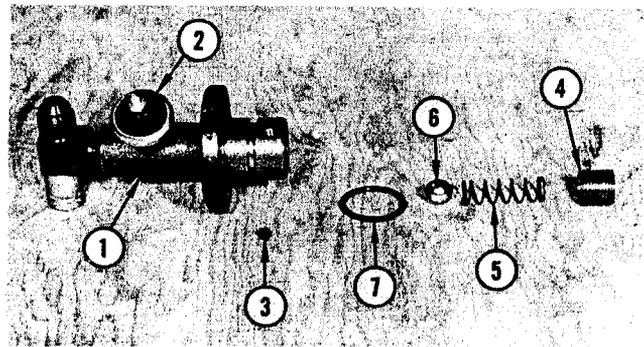


FIGURE 62. EXPLODED VIEW OF RELIEF VALVE

- | | |
|-----------------------|-------------|
| 1. Valve Body | 5. Spring |
| 2. Pressure Switch | 6. Ball |
| 3. Retaining Setscrew | 7. "O" Ring |
| 4. Retaining Nut | |

Reassembly

RELIEF VALVE

Reverse the disassembly procedure. Install "O" ring on valve body. Put white lead on the "O" ring and install the assembly into clutch housing.

OIL PUMP

Thoroughly clean all reusable parts and

dry with air. Do not use waste or soft cloth to clean parts.

Inspect all parts for wear, scoring or damage. Replace wear plates when erosion paths appear at relief pockets. Replace all seals and "O" rings.

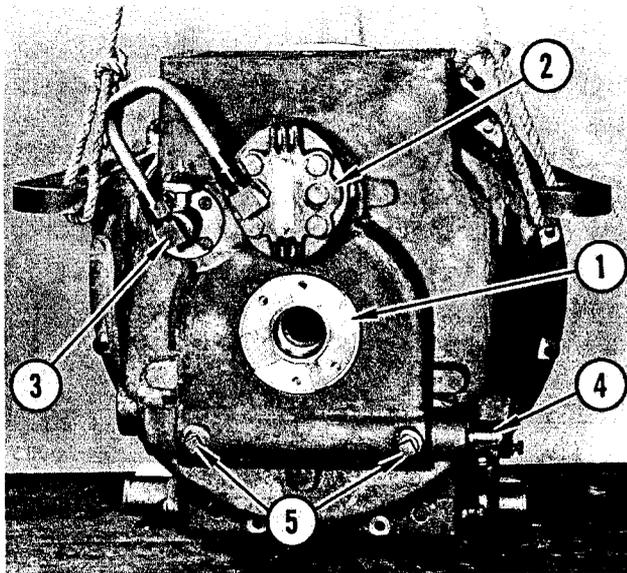


FIGURE 63. FRONT VIEW OF HOUSING ASSEMBLY

- | | |
|-----------------|-----------------------|
| 1. Clutch Shaft | 4. Clutch Brake Lever |
| 2. Oil Pump | 5. Pipe Plugs |
| 3. Relief Valve | |

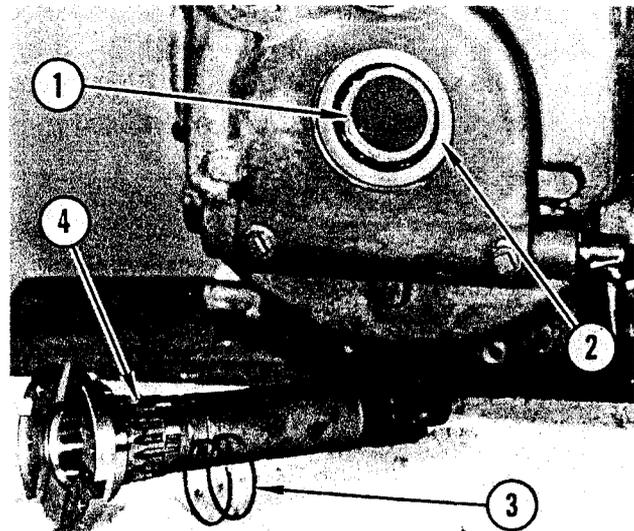


FIGURE 64. CLUTCH SHAFT ASSEMBLY

- | | |
|-------------|-----------------|
| 1. Bearing | 3. Piston Rings |
| 2. Oil Seal | 4. Clutch Shaft |

Replace pump assembly on clutch housing. Connect inlet hose and outlet tubing, Figure 63.

HOUSING ASSEMBLY

Install ball bearing into clutch shaft bore. Press bearing up against shoulder in bore, Figure 64.

Install snap ring. NOTE: Install opening in snap ring to align with grease fitting hole in housing. This will allow grease to enter housing.

Install oil seal; lip of seal to outside.

Install clutch shaft into housing bore. Do not install piston rings on shaft at this time.

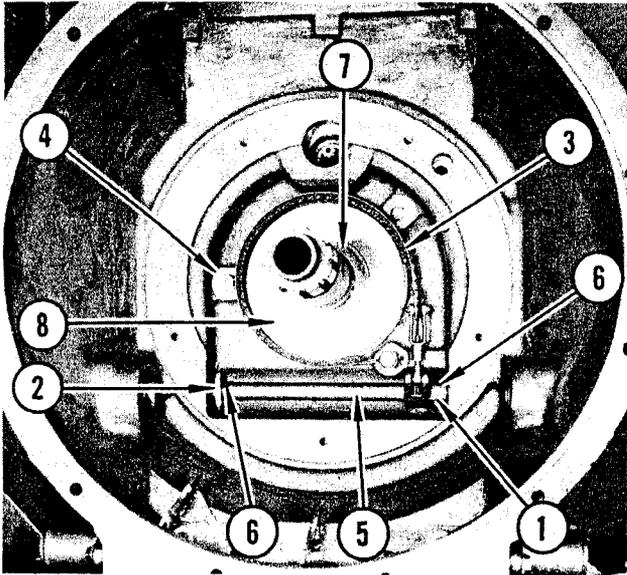


FIGURE 65. CLUTCH BRAKE ASSEMBLY

- | | |
|---------------|----------------------|
| 1. Bellcrank | 5. Brake Cross Shaft |
| 2. Spacer | 6. Roll Pins |
| 3. Brake Band | 7. Locknut |
| 4. Dowel Stop | 8. Brake Drum |

Refer to Figure 65. Install clutch brake drum on clutch shaft. Install locknut and tighten securely. Stake locknut. To remove locknut, the stake must first be drilled out.

Install oil seal in brake shaft bore (L.H. side of housing).

Lubricate the bearing surfaces of the clutch brakeshaft and insert shaft into housing bore (from L.H. side). Install spacer and bell crank on shaft inside housing. Continue to push shaft until it enters bore on R.H. side of housing.

If Welch plug was removed from R.H. bore, install a new Welch plug.

Align roll pin hole in shaft with pin hole in bell crank. Install roll pin.

Install second roll pin in shaft just inside L.H. side of housing. NOTE: Spacer must be between roll pin and housing.

Install the two pipe plugs in front of housing. These plugs were removed to permit roll pins to be driven out.

Place eye on end of brake band over end of dowel in housing and install brake band over brake drum. Attach other end of brake band to bell crank yoke with yoke pin. Install cotter pin in yoke pin. With brake lever in released position, brake band should just contact dowel stop or stops, whichever the case may be. Should adjustment be required, remove cotter and pin from bell crank yoke and turn yoke in direction necessary to obtain correct adjustment. Reinstall pin and cotter.

Install piston rings in piston ring grooves of clutch shaft.

PUMP DRIVE ASSEMBLY

Install bearing onto pump drive gear shaft; shielded side of bearing toward gear. Press bearing against shoulder and install retainer ring.

Install pump drive gear shaft assembly into bearing support. Install ball bearing with snap ring onto shaft; snap ring side of bearing toward gear. Install bearing retainer ring.

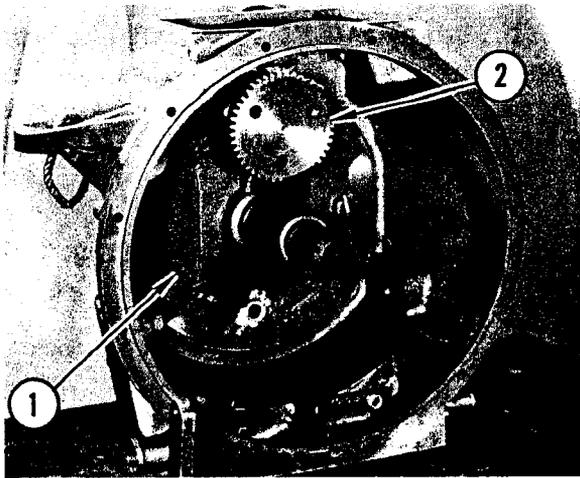


FIGURE 66. RELEASE BEARING SUPPORT INSTALLED

- | | |
|-------------------------------------|-----------------------------|
| 1. Release Bearing Support Assembly | 2. Pump Drive Gear Assembly |
|-------------------------------------|-----------------------------|

Align piston ring splits so that they are on the bottom side of clutch shaft. (This will put splits opposite oil port in bearing support.)

Install release bearing support assembly onto clutch shaft and into clutch housing. Align splines on pump drive gear shaft with splines in pump drive coupling. Push release bearing support into place in clutch housing, Figure 66.

Install capscrews with lockwashers and tighten securely.

Install compression spring retaining ring into groove in clutch shaft. Install compression spring by expanding enough to slip over splines in clutch shaft and up against retaining ring, Figure 67.

Install needle bearings into cross shaft bores in housing. Large bearing on L.H. side, small bearing on R.H. side.

Install oil seal in L.H. bore; lip of seal toward outside.

Lay shifter fork in housing with angle of fork toward front of housing.

Install keys into keyways of cross shaft. Install cross shaft assembly into housing from L.H. side. Use caution not to damage oil seal. Align keyways of shifter fork with keys in cross shaft and install shifter fork on shaft, Figure 67.

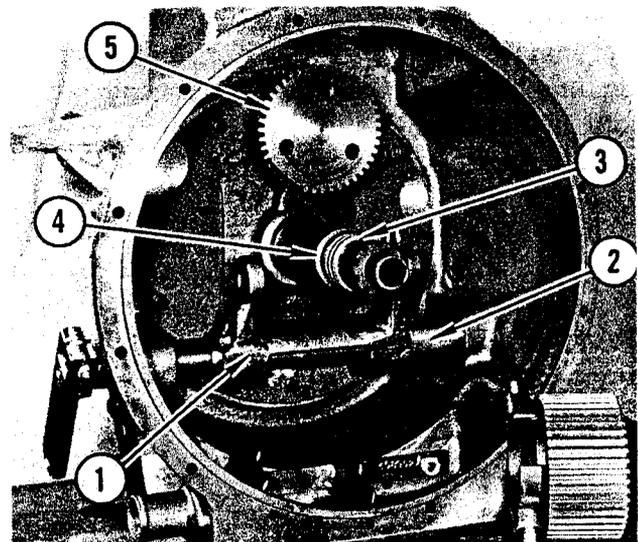


FIGURE 67. SHIFTER FORK ASSEMBLY INSTALLED

- | | |
|-----------------------|------------------------|
| 1. Shifter Fork | 4. Retainer Ring |
| 2. Cross Shaft | 5. Pump Drive Assembly |
| 3. Compression Spring | |

Insert shaft into housing until keeper groove in shaft is flush with housing. Install keeper and retaining capscrews with lockwasher, Figure 68.

Place the large snap ring and the spacer on release bearing sleeve. Heat the two ball bearings in hot oil and press bearings onto retainer ring.

Install release bearing sleeve into thrust gear. Insert spacer against bearing and install snap ring in groove of thrust gear.

Install thrust gear assembly onto release bearing support hub. As the thrust gear assembly is moved onto support hub, align grooves in shifter fork with lugs on release bearing sleeve, Figure 69.

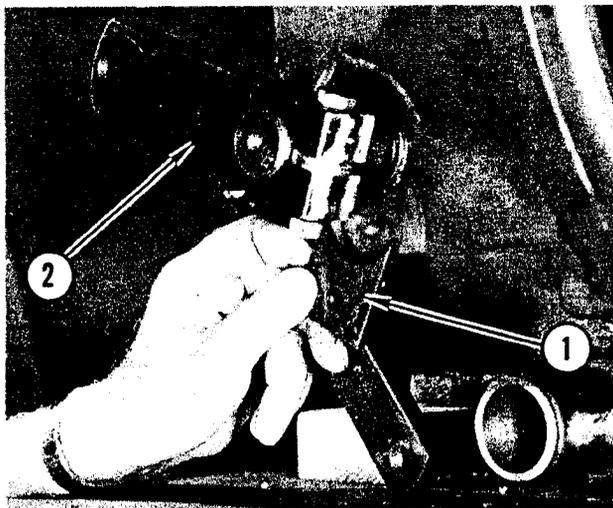


FIGURE 68. INSTALL CROSS SHAFT
KEEPER

1. Keeper 2. Clutch Lever

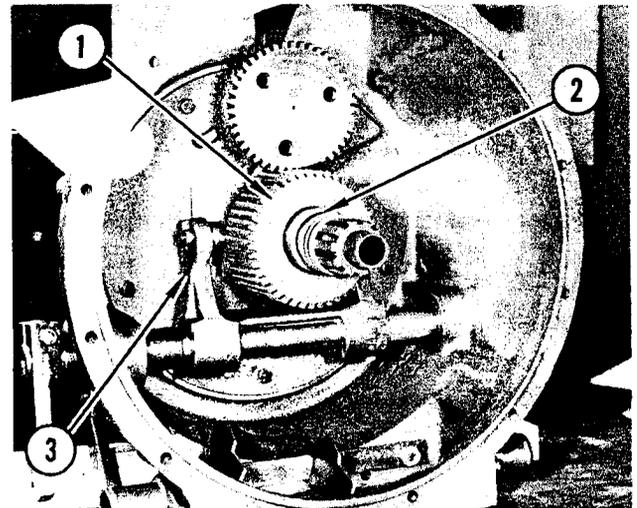


FIGURE 69. INSTALL THRUST GEAR

1. Thrust Gear 3. Shifter Fork
2. Release Bearing Support Hub

CLUTCH ASSEMBLY (Figure 70)

Insert eye bolt into throwout lever and secure in place with pivot pin.

Position lever between mounting ears on pressure plate. Insert anti-rattle spring into lever with eyes of spring aligned with lever pin holes.

Install lever pin; head of lever pin toward rotation of clutch. Install washer on lever pin. Install and spread cotter pin.

Repeat above for the two other lever assemblies.

Place the eighteen pressure springs in their proper places on pressure plate. Place backing plate onto springs; square holes in backing plate to be aligned with eye bolts.

Put assembly into an arbor press. Press down on backing plate to compress the pressure springs. As the backing plate is pressed down, guide the three eye bolts into the three eye bolt holes in backing plate. Continue to press on backing plate until eye bolt nuts and shakeproof washers can be installed.

Tighten eye bolt nuts until shoulder of eye bolt is solid against backing plate.

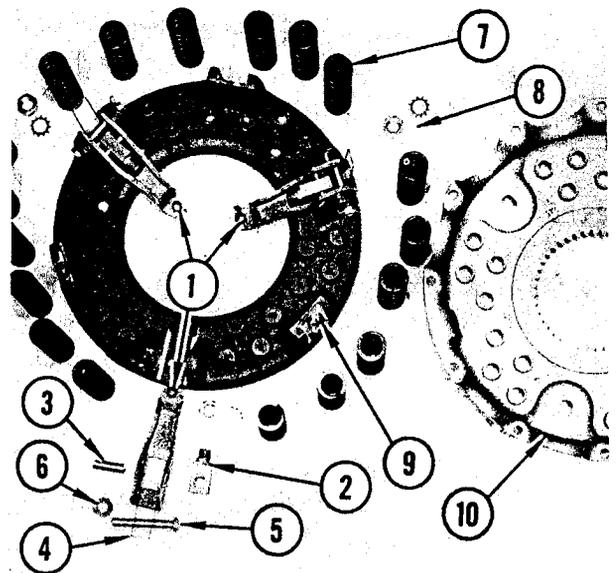


FIGURE 70. EXPLODED VIEW OF
CLUTCH ASSEMBLY

1. Throwout Levers 7. Pressure Springs
2. Eyebolt 8. Eyebolt Nuts &
3. Pivot Pin Shake-Proof
4. Anti-Rattle Spring Washer
5. Lever Pin 9. Pressure Plate
6. Washer 10. Backing Plate

Install the three hold-down capscrews with flat washers and tighten securely. Remove clutch assembly from press.

If the same discs are being reinstalled in clutch, it may not be necessary to change setting of adjustment screws of throwout lever. If new discs are installed, adjust the setscrews with approximately the same amount of threads on each side of lever. In any case, all three screws must be in the same length on the head end.

Install pilot bearing into PTO adaptor. Mount adaptor to flywheel. Hub of adaptor goes into flywheel. Install capscrews and tighten securely.

Install spacer into bore of driven hub; shoulder of spacer toward outside of driven hub. Install spacer retaining ring.

Insert a short (at least 6" long) pilot shaft into driven hub. Install pilot shaft with driven hub into pilot bearing in PTO adaptor. Push shaft into bearing until shoulder of driven hub spacer is against bearing.

If flywheel adaptor has been removed, reinstall the adaptor to flywheel.

Install a lined clutch disc onto driven hub.

Install outer disc (steel) into flywheel adaptor.

Install second lined clutch disc onto driven hub.

Install guide bolts into flywheel adaptor to guide the pressure plate assembly into place.

Place pressure plate assembly onto guides. Install shims in the six locations from which they were removed.

Install capscrews retaining pressure plate assembly to flywheel housing and tighten securely.

Remove the three hold-down capscrews. Remove the pilot shaft.

Adjustment

CLUTCH

The clutch throwout levers should be adjusted so the distance from face of the driven hub to the head of adjustment screws on lever is 1.844", Figure 71.

A tool, similar to that shown in Figure 71, can be made of light weight steel plate and will be of great help in making adjustments.

With the driven hub as far toward flywheel as it will go, insert the tool into splines of driven hub. Turn the adjustment screws in or out until they will just touch the shoulder of tool. There should be not less than three threads of the adjustment screw extending through the lever after proper adjustment.

If unable to obtain above adjustment, it will be necessary to add or take away shims between flywheel adaptor and clutch backing plate. One shim will change the distance approximately 1/8". There must be an equal amount of shims at each of the six points.

CLUTCH LINKAGE (Model 777B)

Remove inspection door on left side of fuel tank to expose the clutch lever and pull-type clutch valve.

Using a small bar, push clutch lever toward front of grader. Measure the free travel of the lever. Free travel should be 1/8". Figure 72.

If adjustment is required, loosen lock-

nuts at each end of turnbuckle. Rotate turnbuckle until the 1/8" free travel of clutch lever has been obtained. Tighten both locknuts.

Readjustment is necessary when free travel is 1/16" or less.

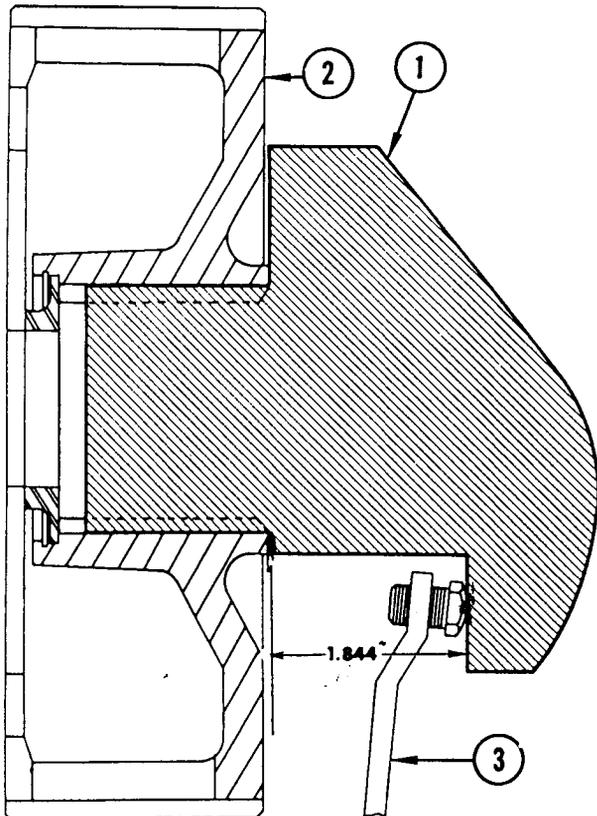


FIGURE 71. SPECIAL GAUGE FOR ADJUSTING CLUTCH

- 1. Adjusting Gauge
- 2. Driven Hub
- 3. Throwout Lever

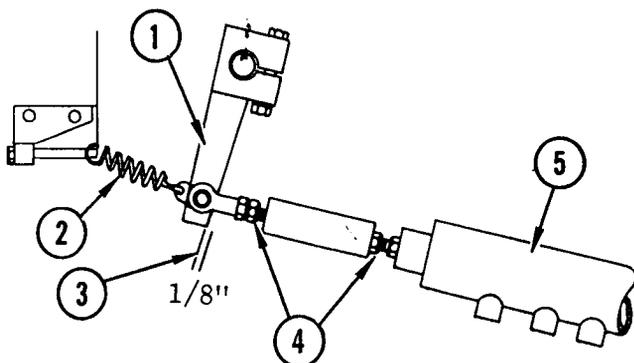


FIGURE 72. CLUTCH LINKAGE (777B)

- 1. Clutch Lever
- 2. Spring
- 3. Free Movement
- 4. Locknuts
- 5. Pull-Type Clutch Valve

CLUTCH LINKAGE (Model 666B)

Remove inspection door on left hand side of fuel tank to expose clutch lever and slave cylinder. Using a small pry bar, press down on clutch lever. Measure the free movement of the clutch pedal. It should be 1/8". Figure 72A.

If adjustment is required, loosen locknut on connector link and rotate piston nut until free play of 1/8" is obtained. Tighten locknut.

Adjustment must be made when free play is 1/16" or less.

CLUTCH BRAKE LINKAGE

Remove inspection door on left side of fuel tank to expose clutch brake pull rod and adjusting nuts.

Loosen locknuts on brake pull rod end. Adjust nuts against spring until spring will be compressed 1/16" to 3/32" when clutch foot pedal pad is pressed all the way to the cab floor.

Adjust nut on opposite side of swivel just enough so that spring will not rattle when foot pedal is not depressed.

CAUTION: DO NOT RIDE CLUTCH PEDAL. DO NOT OPERATE CLUTCH PEDAL WHILE RED WARNING LIGHT IS ON.

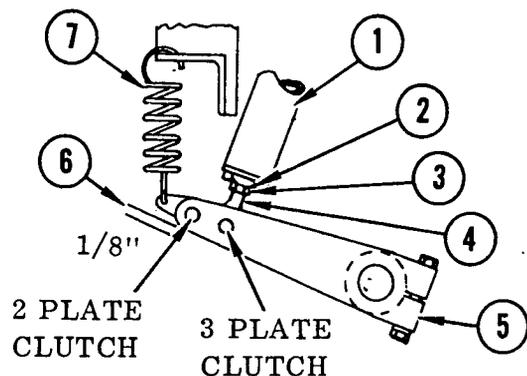


FIGURE 72A. CLUTCH LINKAGE (666B)

- 1. Slave Cylinder
- 2. Piston Nut
- 3. Locknut
- 4. Connector Link
- 5. Throwout Lever
- 6. Free Movement
- 7. Spring

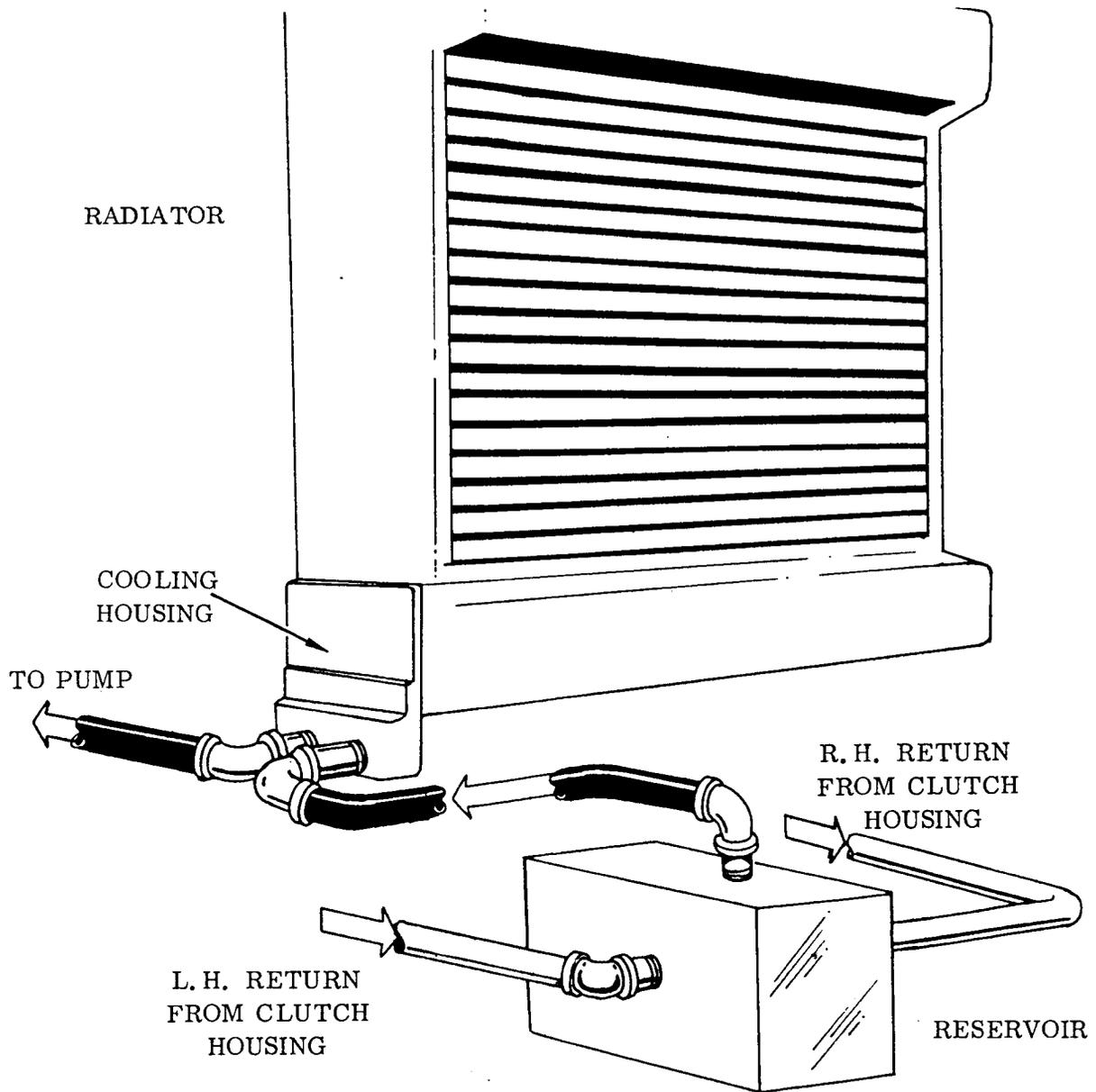


FIGURE 73. SCHEMATIC OF OIL CLUTCH PIPING

POWER TAKE-OFF SHAFT

To remove PTO shaft from clutch shaft, first remove snap ring in bore of clutch shaft hub. By pulling on end of PTO shaft, it can be removed from clutch shaft. See Item 15, Figure 59.

On the PTO shaft will be a ball bearing retainer on shaft with two retainer rings, a spacer and a grease seal. The spacer will be between the grease seal and the bearing.

If necessary to replace bearing, remove one of the retaining rings from groove in shaft and remove bearing.

Replace bearing and retaining ring on shaft. Install spacer; then grease seal on shaft (short end) and against bearing.

Insert PTO shaft (long end first) into clutch shaft. Rotate PTO shaft to align splines on end of shaft with splines in PTO adaptor

on flywheel. Force shaft in until bearing is against shoulder in bore of clutch shaft. Install snap ring in groove in bore of clutch shaft.

Figure 73 shows schematic of oil clutch piping. The cooling housing is shown 180° out of position in order to illustrate connection.

UPPER TRANSMISSION (STANDARD MODELS)

General

The upper transmission for standard model graders is a constant mesh transmission consisting of an upper shaft which is connected to the clutch shaft and a lower shaft which is connected to the lower transmission through a gear train. The upper shaft has three helical gears. One gear for high range, one gear for low range and one gear for reverse. If the transmission is equipped with optional creeper gears, there will be two extra shafts for the creeper gear assembly. The creeper gear assembly is driven by the upper shaft reverse gear.

The lower shaft has three helical gears

which rotate on roller bearings. One gear is in mesh with high range gear on upper shaft; one gear is in mesh with low range gear on upper shaft. One gear, the reverse, is in mesh with an idler gear which in turn is in mesh with the reverse gear on upper shaft. If the transmission is equipped with optional creeper gears, there will be a fourth helical gear in mesh with the creeper gears.

Also on the lower shaft there are two shifter gears which are splined to the lower shaft. Shifter collars on the shifter gears can be shifted to make contact with shifter teeth on sides of the helical gears.

Disassembly

Remove pipe plug from bottom of upper transmission housing and drain lubricant (approximately 2-1/2 gallons if to level plug).

Remove shifter levers. Refer to Page B-7 for instructions.

SHIFTER HOUSING

Remove eight capscrews and lockwashers and remove shifter housing cover and gasket.

Remove sixteen stud nuts and lockwashers and remove shifter housing cover and R.H. side of housing.

Cut and remove lockwires from the drilled head capscrews on front and rear shifter forks; loosen capscrews. Loosen setscrews on both shifter forks, Figure 74.

Shift upper transmission gears into neutral position. From inside of shifter housing pull out the upper shifter rail. As shifter

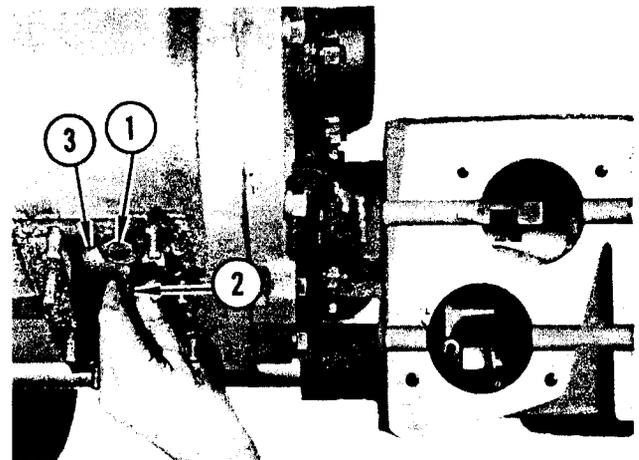


FIGURE 74. REMOVE SHIFTER RAILS

- | | |
|-------------|-----------------|
| 1. Capscrew | 3. Shifter Fork |
| 2. Setscrew | |

rail clears front fork, reach through opening on side of transmission housing and prevent front shifter fork from falling. Follow the same procedure for removal of the lower shifter rail and rear fork. Remove pipe plug from hub of shifter housing to remove the interlock steel ball. This interlock ball will prevent the removal of the shifter rails unless upper transmission gears are in the neutral position. Figure 75 shows an exploded view of upper shifter assembly.

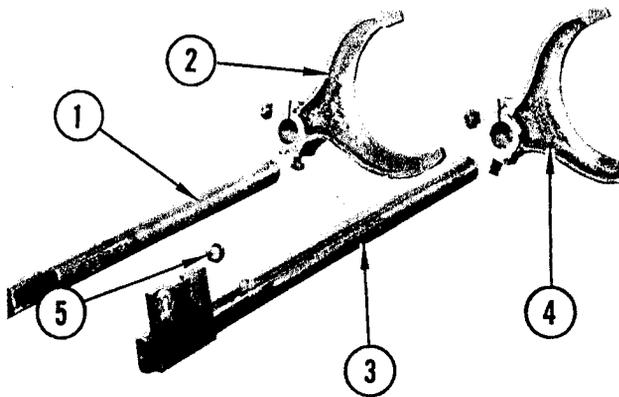


FIGURE 75. EXPLODED VIEW OF SHIFTER RAILS

- | | |
|-----------------------|-----------------------|
| 1. Upper Shifter Rail | 4. Lower Shifter Fork |
| 2. Front Shifter Fork | |
| 3. Lower Shifter Rail | 5. Interlock Ball |

Remove cotter pin from slotted nut and remove nut from rocker arm shaft. Remove rocker arm from shaft, Figure 76.

Remove four stud nuts and lockwashers retaining shifter housing to upper transmission housing cover. Remove shifter housing.

Refer to hydraulic section for instructions on removal of the hydraulic pumps and PTO shaft. Remove pumps and PTO shaft from upper shaft of transmission.

Drill the stake from upper shaft locknut and lower shaft locknut. Make certain that all of the stake portion has been removed before attempting to remove nuts.

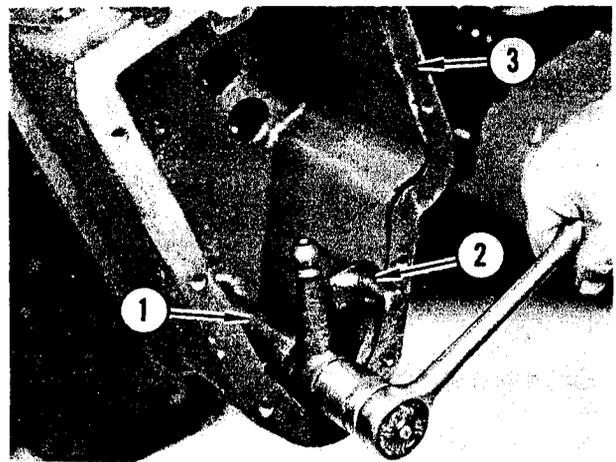


FIGURE 76. REMOVE FRONT ROCKER ARM

- | | |
|---------------------|--------------------|
| 1. Rocker Shaft | 3. Shifter Housing |
| 2. Front Rocker Arm | |

Refer to Figure 77 and follow the numerical sequence for removing the following parts; upper shaft locknut (1), lower shaft locknut (2), seal retainer (3) with spacer (4) and oil seal (5), and spacer (6) from lower shaft. Remove two flat head capscrews (7), four stud nuts and lockwashers (8) and remove cover plate (9) with gasket. NOTE: If transmission is equipped with creeper

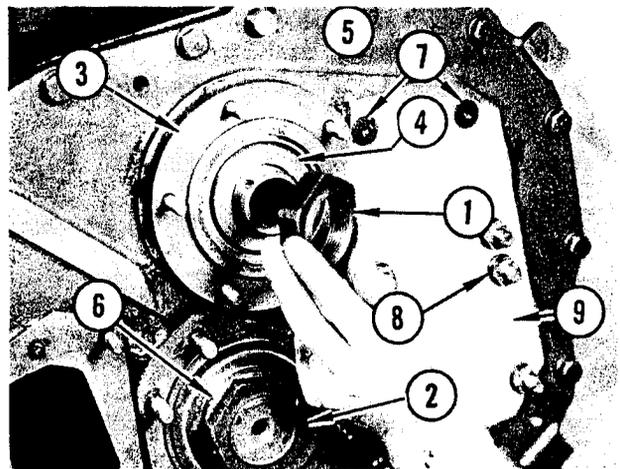


FIGURE 77. COVER REMOVAL

- | | |
|------------------------|---------------------|
| 1. Upper Shaft Locknut | 6. Spacer |
| 2. Lower Shaft Locknut | 7. Flat Head Screws |
| 3. Seal Retainer | 8. Stud Nuts |
| 4. Spacer | 9. Cover Plate |
| 5. Oil Seal | |

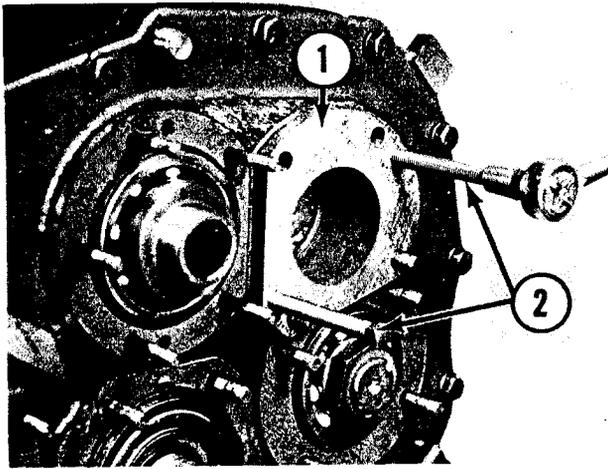


FIGURE 78. BEARING RETAINER REMOVAL

1. Bearing Retainer 2. Pusher Bolts

gears, there will be two covers in place of the cover plate (9) but will have the same capscrews and stud nuts.

If transmission is equipped with creeper gears, drill stake from locknut on upper creeper gear shaft and remove locknut. Install pusher bolts into the two tapped holes of bearing retainer and remove bearing retainer, Figure 78. NOTE: As bearing retainer is being removed, tap the end of upper creeper gear shaft to prevent shaft from coming out with retainer.

Install nuts on threaded portion of the two dowels. Turn nuts onto dowel to pull dowels from transmission housing cover. Remove the fourteen capscrews and lockwashers retaining cover to transmission housing. Tap outward on the four cover lugs and at same time tap the shafts back into case. Bearings on upper and lower shafts will come off with cover. After cover has been removed, press or drive the bearings out. NOTE: If equipped with creeper gears, it will be necessary to remove snap ring from roller bearing on lower creeper gear shaft, but it will not be necessary to remove the locknut in order to remove transmission housing cover.

After cover has been removed, the upper and lower shaft assemblies can be removed, Figure 79.

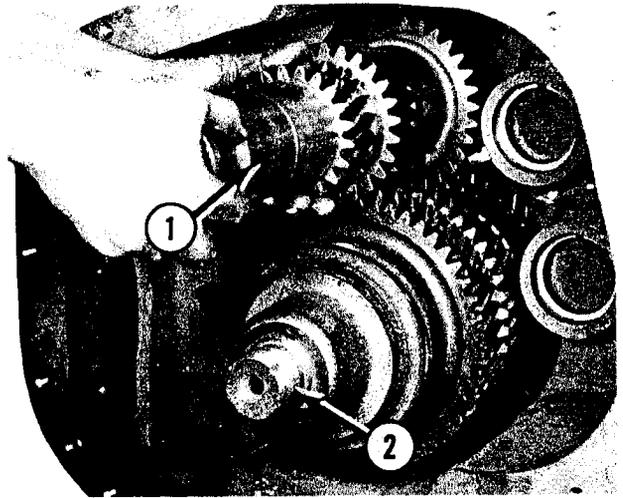


FIGURE 79. REMOVE UPPER SHAFT ASSEMBLY

1. Upper Shaft Assembly 2. Lower Shaft Assembly

If equipped with creeper gears, it will be necessary to remove the thin spacer and 53 tooth gear from lower shaft. Remove both upper and lower creeper gear shaft assemblies as shown in Figure 80.

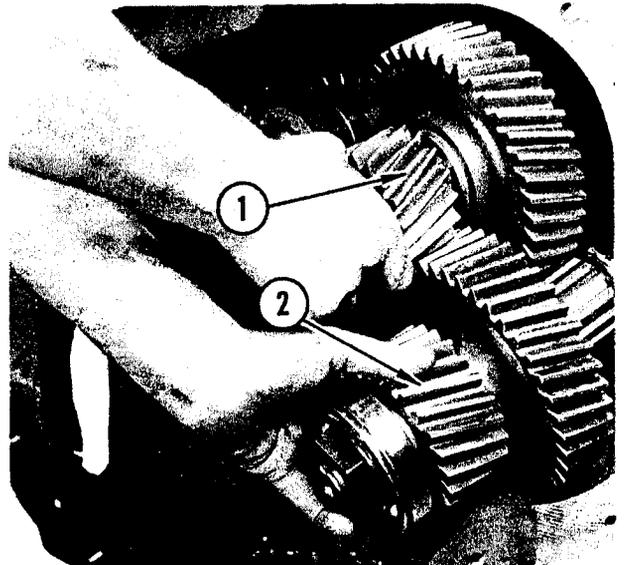


FIGURE 80. REMOVE CREEPER GEAR ASSEMBLY

1. Upper Creeper Gears 2. Lower Creeper Gears

Drill stake from locknut on idler shaft. Make certain all of the stake portion has been removed; then remove the locknut.

Refer to Figure 81. Remove bearing cone (1) and reverse idler gear (2). Remove idler gear shaft from boss in housing. If necessary to replace bearing cup in idler gear, remove retainer ring and then press bearing cup from gear.

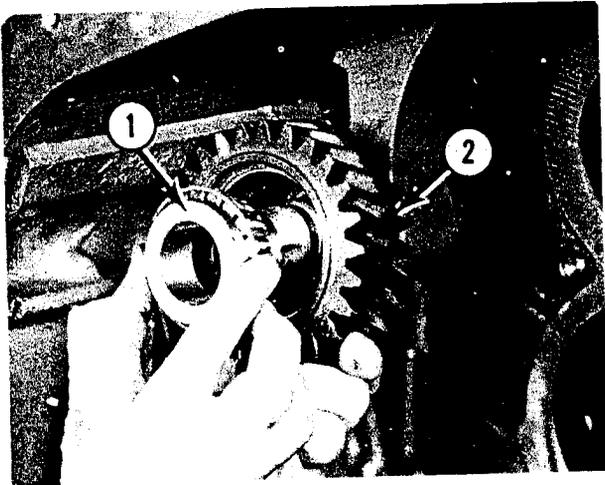


FIGURE 81. REMOVE REVERSE IDLER GEAR

- 1. Bearing Cone
- 2. Reverse Idler Gear

UPPER SHAFT

Refer to Figure 82. Remove the two spacers (1), cluster gear (2), spacer (3) and high range gear (4). Using a puller, remove bearing (5). Remove seal retainer (6). Remove "O" ring from groove in outside diameter of retainer. Drive or press oil seal from retainer. Using a puller, remove seal collar from shaft (7).

LOWER SHAFT

Refer to Figure 83. Remove shifter gear assembly (1). When removing this assembly, note that one side of the shifter gear is marked "Engine Side". When reinstalling the assembly, make certain this marked side is away from the threaded end of lower shaft.

Remove the 47 tooth reverse gear. Remove the two roller bearings on which the

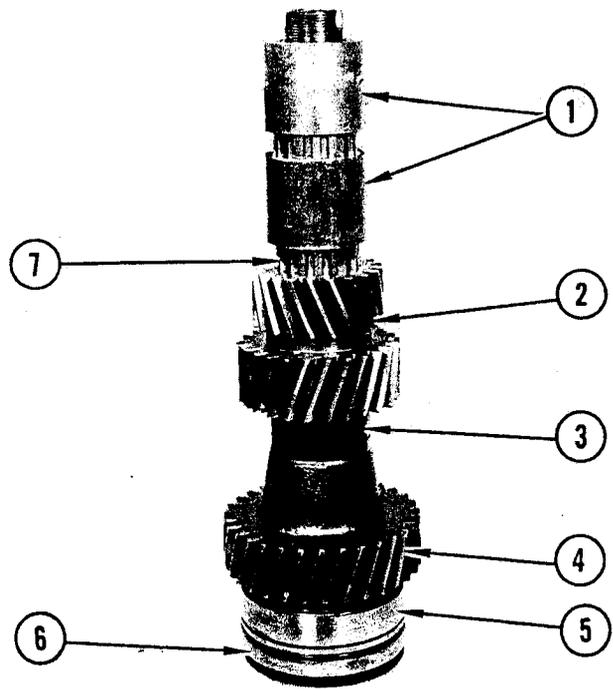


FIGURE 82. UPPER SHAFT DISASSEMBLY

- 1. Spacers (2)
- 2. Cluster Gear
- 3. Spacer
- 4. High Range Gear
- 5. Bearing
- 6. Seal Retainer
- 7. Upper Shaft

gear rotates. Attach puller behind the 48 tooth low range gear and remove reverse gear bearing inner race, spacer (3) and low range gear (4). Remove the two roller bearings on which the low range gear rotates. Attach puller back of high range gear and remove the low range gear bearing inner race, shifter assembly (5) and high range gear (6). Remove the two roller bearings on which the high range gear rotates.

Attach puller back of seal retainer and remove high range gear bearing inner race, spacer (7), bearing (8) and seal retainer (9). Remove "O" ring from groove of seal retainer. Press or drive oil seal from retainer. Remove all speed gear (10). Remove snap ring, back-up ring and "O" ring from groove in lower shaft (11).

CREEPER GEAR

Refer to Figure 84 and disassemble the

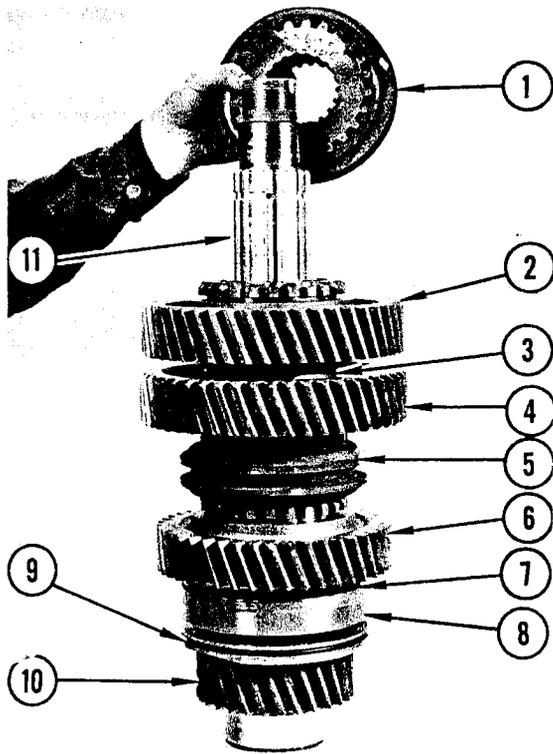


FIGURE 83. LOWERSHAFT DISASSEMBLY

- | | |
|--------------------------|--------------------|
| 1. Shifter Gear Assembly | 6. 42 Tooth Gear |
| 2. 47 Tooth Gear | 7. Spacer |
| 3. Spacer | 8. Bearing |
| 4. 48 Tooth Gear | 9. Seal Retainer |
| 5. Shifter Gear Assembly | 10. All Speed Gear |
| | 11. Lower Shaft |

upper creeper gear assembly. Remove the 16 tooth gear (1) and the 38 tooth gear (2). Press or drive bearing (3) from end of shaft. Remove retainer ring (4) and spacer (5) from upper shaft (6).

Refer to Figure 85 and disassemble the lower creeper gear assembly. Drill stake from locknut (1) and remove locknut. Retainer ring (2) was previously removed while

Reassembly

CREEPER GEARS

Refer to Figure 85 and reverse the numerical sequence as shown and the following information.

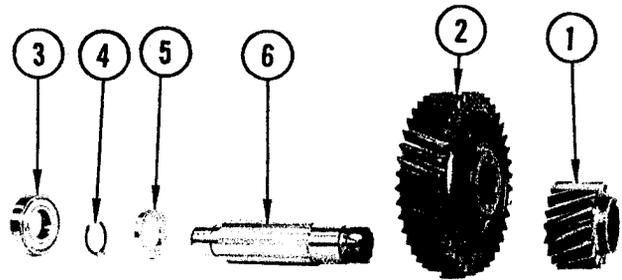


FIGURE 84. EXPLODED VIEW OF UPPER CREEPER GEAR ASSEMBLY

- | | |
|------------------|--------------------------|
| 1. 16 Tooth Gear | 4. Retaining Ring |
| 2. 38 Tooth Gear | 5. Spacer |
| 3. Bearing | 6. Upper Shaft (Creeper) |

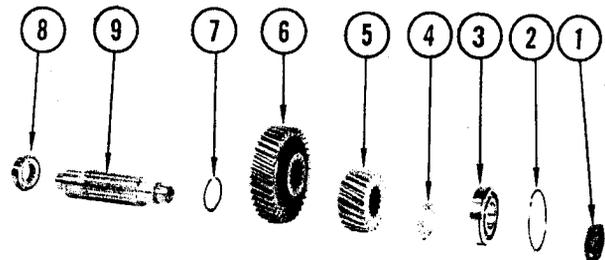


FIGURE 85. EXPLODED VIEW OF LOWER CREEPER GEAR ASSEMBLY

- | | |
|-------------------|--------------------------|
| 1. Locknut | 6. 38 Tooth Gear |
| 2. Retaining Ring | 7. Retaining Ring |
| 3. Bearing | 8. Bearing |
| 4. Spacer | 9. Lower Shaft (Creeper) |
| 5. 22 Tooth Gear | |

removing transmission housing cover. Press or drive bearing (3) from shaft. Remove spacer (4), 22 tooth gear (5) and 38 tooth gear (6). Remove retainer ring (7). Press or drive bearing (8) from lower shaft (9).

1. Heat bearing (8) in hot oil and press or drive bearing onto lower shaft with the shielded side of bearing toward the threaded end of shaft.

2. Install retainer ring (7) into groove in lower shaft and install the 38 tooth gear on shaft with long hub of gear away from retainer ring.
3. Install the 22 tooth gear onto shaft with flat side of gear toward threaded end of shaft.
4. Install spacer (4) onto shaft with chamfer of bore next to gear. Heat the bearing (3) in hot oil and press or drive bearing onto shaft until tight against spacer. Retainer ring (2) is not installed on bearing until after transmission cover has been installed.
5. Place lower shaft assembly in vise, protecting gear teeth against damage. Install locknut (1) and tighten to a torque of 450 to 475 ft. lbs. Stake nut.

Refer to Figure 84 and reverse the numerical sequence as shown and the following information.

1. Install spacer (5) onto upper shaft with counterbore of spacer away from shoulder of shaft. Install retaining ring in groove next to spacer.
2. Heat bearing (3) in hot oil and press or drive bearing onto shaft with shielded side of bearing toward snap ring.
3. Install 38 tooth gear on shaft and against spacer with long hub of gear away from spacer. Install 16 tooth gear against 38 tooth gear and with the long hub of gear toward threaded end of shaft. Install locknut on shaft but do not tighten.

UPPER TRANSMISSION LOWER SHAFT

Refer to Figure 83 and reverse the nu-

merical sequence as shown and the following information.

1. Install oil seal into seal retainer (9) with lip of oil seal away from side of retainer having the milled surface. Install "O" ring onto seal retainer and install seal retainer onto hub of all speed gear (10). Lip of oil seal to be away from gear.
2. All bearing inner races must be heated in hot oil before installing them on shaft.
3. If shifter collars were removed from the shifter gears, align the tapered teeth of the collar with the poppets in shifter gear and install collar on gear.
4. When installing the reverse shifter gear (1), make certain the side of gear marked "This side toward engine" is away from threaded end of shaft.
5. Install lower shaft assembly into housing. Align the milled surface of the seal retainer with the stop on intermediate plate. Work assembly up and down and at same time push so that bearing will be forced into bearing bore in intermediate plate.

UPPER TRANSMISSION UPPER SHAFT

Refer to Figure 82 and reverse the numerical sequence shown and the following information.

1. Heat seal collar in hot oil and press or drive collar onto hub of flange end of upper shaft.
2. Press or drive oil seal into seal retainer with lip of seal away from side of retainer having the milled surface. Install "O" ring into groove of seal retainer. Install retainer

onto upper shaft and seal collar with lip of seal toward threaded end of shaft.

3. Heat bearing (51) in hot oil and press or drive onto upper shaft with the shielded side of bearing toward threaded end of shaft.
4. Install high range gear (4) with long hub of gear toward threaded end of shaft. Install cluster gear with smaller gear toward threaded end of shaft. Install upper shaft into housing.

IDLER GEAR ASSEMBLY

Refer to Figure 81 and reverse the numerical sequence as shown and the following information.

1. Install locknut and torque to 450 to 475 ft. lbs. Stake locknut.

Creeper Gear Installation

Refer to Figure 80 and install the creeper assemblies in the same manner as they were removed; that is, both upper and lower assemblies must be installed at same time as shown in illustration.

Upper Transmission Cover

Refer to Figures 77 and 78 and reverse the numerical sequence as shown and the following information.

1. When installing the lower shaft bearing in cover, align open space in

retainer ring with oil port in cover.

2. Tighten locknuts on shafts to a torque of 550 to 575 ft. lbs. Stake nuts.

Shifter Housing

Refer to "Shifter Housing Removal", reverse the procedure outlined and the following information.

1. Install the front and rear shifter forks over shifter collars on lower shaft of upper transmission. Install lower shifter rail through lower hole in shifter housing; raise front shifter fork so that the shifter rail can pass under it and into the rear shifter fork.
2. Insert the interlocking ball in drilled hole between the upper and lower shifter rail holes in shifter housing. Align the detent in lower rail so that ball will drop into it. Insert upper shifter rail through upper hole and into front shifter fork.
3. Align setscrew detents in shifter rails with setscrew holes in shifter forks. Install and tighten setscrews.
4. Tighten setscrews securely; then loosen 1/4 of a turn. Tighten capscrews securely. Retighten setscrews to a torque of 65 ft. lbs. Wire heads of capscrew and setscrew together.

LOWER TRANSMISSION

Disassembly

Remove cover plate from R.H. side of transmission bearing.

Drill stake from locknut on lower shaft. Remove locknut and parking brake drum.

Refer to Figure 86. Use a screwdriver to expand brake shoes and remove strut (1) and strut spring (2).

Remove eight capscrews and lockwash-

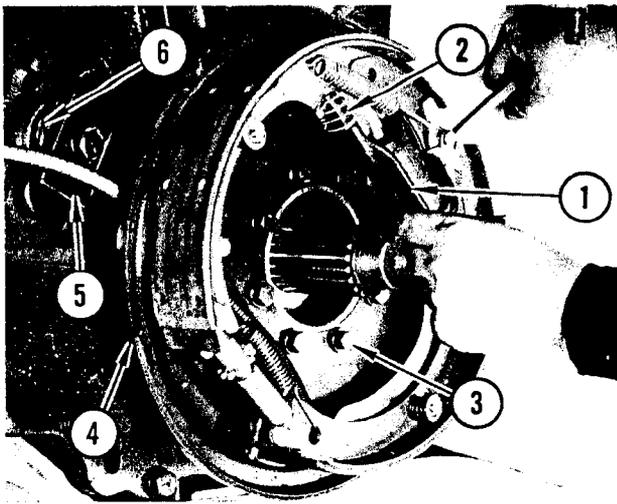


FIGURE 86. BRAKE REMOVAL

- | | |
|----------------------------|---------------------------|
| 1. Strut | 4. Backing Plate Assembly |
| 2. Strut Spring | 5. Bar |
| 3. Capscrews & Lockwashers | 6. Locking Disc |

ers (3). Remove backing plate assembly (4).

Remove capscrew, lockwasher, bar (5), and locking disc (6) from transmission plate.

Refer to Figure 87 and remove shifter mechanism. Pull lower shifter rail (1) and remove rear shifter fork (2), interference

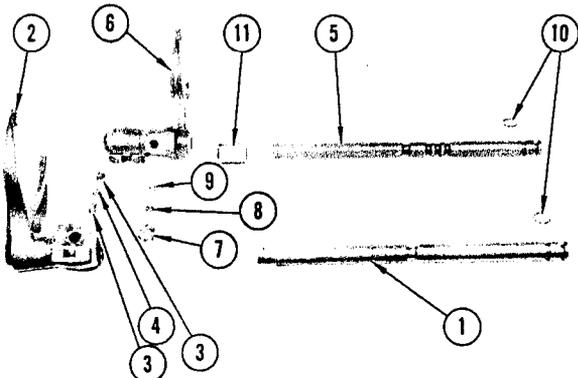


FIGURE 87. EXPLODED VIEW OF SHIFTER MECHANISM

- | | |
|-------------------------|---------------------|
| 1. Shifter Rail (Lower) | 7. Poppet Cap-screw |
| 2. Shifter Fork (Rear) | 8. Poppet Spring |
| 3. Interference Pins | 9. Poppet Ball |
| 4. Biscuit | 10. "O" Rings |
| 5. Shifter Rail (Upper) | 11. Spacer |
| 6. Shifter Fork (Front) | |

pins (3) and biscuit (4). Pull upper shifter rail (5) and remove front shifter fork (6). Remove poppet capscrew (7), poppet spring (8) and poppet ball (9) from front shifter fork. Remove "O" rings (10) from upper end lower shifter rails.

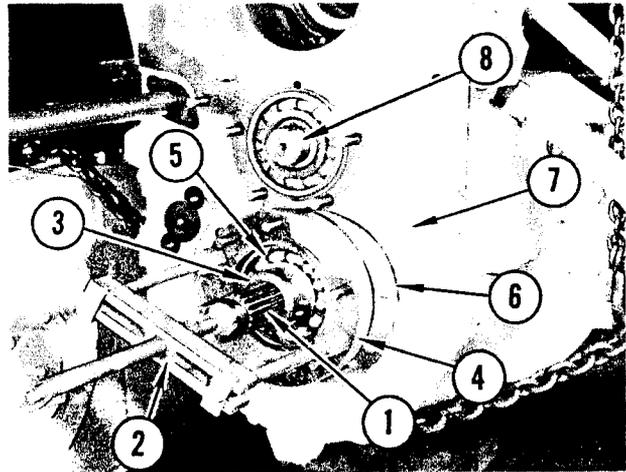


FIGURE 88. LOWER SHAFT ADAPTER REMOVAL

- | | |
|-----------------|-----------------------|
| 1. Lower Shaft | 5. Bearing |
| 2. Puller | 6. Shims |
| 3. Collar | 7. Intermediate Plate |
| 4. Bearing Cage | 8. Upper Shaft |

Remove stud nuts and lockwashers. Remove adapter and gasket from lower shaft (1).

Refer to Figure 88. Install puller bolts into tapped holes in bearing cage flange. Attach puller (2) and remove the following parts in this order. Collar (3), remove "O" ring from inside of collar, bearing cage (4), press or drive bearing (5) from cage. Remove shims (6). Remove five capscrews and lockwashers retaining intermediate plate (7) to housing.

Drill stake from locknut on upper shaft (8) and remove nut. NOTE: Using a bar, shift transmission into two gears in order to lock transmission for locknut removal.

Attach puller to studs on each side of upper shaft bearing and pull intermediate

plate from housing. Upper shaft bearing will come with intermediate plate. Press or drive bearing from intermediate plate.

Remove oil slinger from lower shaft.

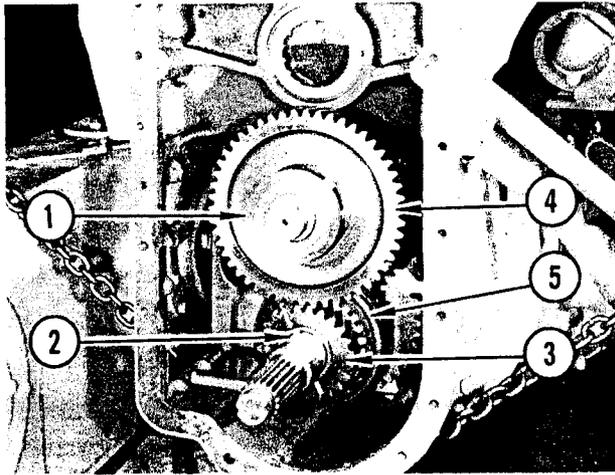


FIGURE 89. LOWER TRANSMISSION

- | | |
|-------------|---------------------------------|
| 1. Spacer | 4. All Speed Gear
(59 Tooth) |
| 2. Lockpin | 5. Shifter Collar |
| 3. 4th Gear | |

Refer to Figure 89. Remove spacer (1) from upper shaft. Remove lockpin (2) and fourth gear (3) from lower shaft. Remove all speed gear (4) from upper shaft.

Remove shifter collar (5) from shifter gear in order to clear 50 tooth gear on upper shaft. Move front end of upper shaft side-

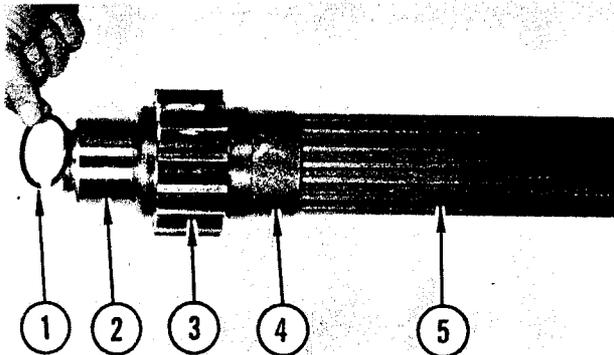


FIGURE 90. REMOVE 15 TOOTH GEAR

- | | |
|-----------------------|----------------|
| 1. Retainer Ring | 4. Spacer |
| 2. Bearing Inner Race | 5. Upper Shaft |
| 3. 15 Tooth Gear | |

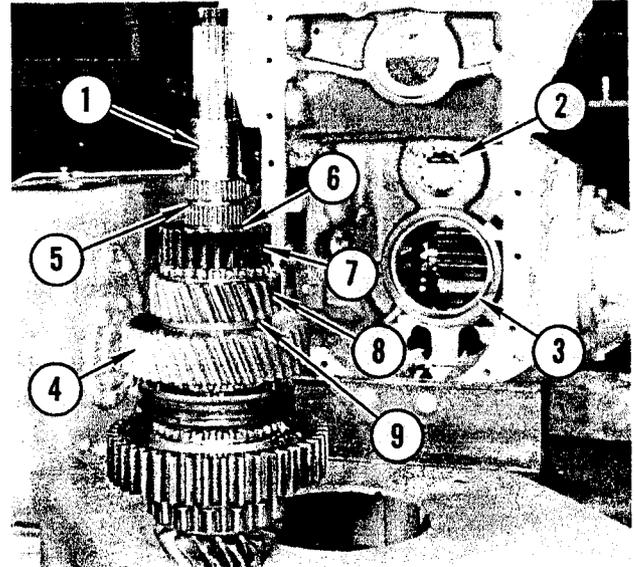


FIGURE 91. LOWER SHAFT ASSEMBLY

- | | |
|---------------------|-----------------|
| 1. Shaft Assembly | 6. Spacer |
| 2. Bearing | 7. Shifter Gear |
| 3. Outer Race | 8. 3rd Gear |
| 4. 2nd Gear | 9. Spacer |
| 5. 4th Gear Bearing | |

ways and at same time pull assembly from housing.

Remove 50 tooth gear and 34 tooth gear from upper shaft. Refer to Figure 90 and remove the following in the numerical sequence as shown. Retainer ring (1), bear-

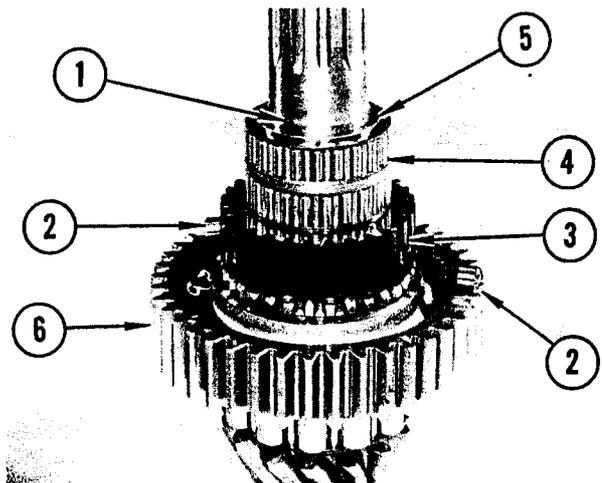


FIGURE 92. 1ST GEAR REMOVAL

- | | |
|--------------------|---------------|
| 1. Lockpin | 4. Bearing |
| 2. Poppet & Spring | 5. Inner Race |
| 3. Shifter Gear | 6. 1st Gear |

ing inner race (2), 15 tooth gear (3), spacer (4) and upper shaft (5).

Refer to Figure 91. Move end of lower shaft up and down; at same time pull out until bearing is free of bore in housing. Remove lower shaft assembly (1) from housing. Remove roller bearing (2) from housing. Remove bearing outer race (3) from housing.

Install puller on second gear (4) and remove the following parts in the numerical order as illustrated; fourth gear bearing (5), spacer (6), shifter gear (7), third gear (8),

spacer (9) and second gear (4).

Refer to Figure 92. Lift shifter collar from shifter gear (3). Remove lockpin (1) from shaft. Remove poppets and springs (2) from shifter gear (3). Remove bearing (4). Install puller on first gear and remove the following parts; bearing inner race (5), shifter gear (4) and first gear (6).

Using a puller, remove bearing inner race and spacer from shaft. Remove lockpin from shaft. Pull roller bearing from shaft.

Reassembly

Reassembly of the lower transmission will be the reverse of disassembly and the following information.

1. Replace all oil seals, gaskets and "O" rings.
2. Heat all bearings, except needle bearings for floating gears, and bearing inner races in hot oil (Temperature 275° to 300°) before installing.
3. Install roller bearing next to output pinion with chamfer on inner race next to pinion.
4. When installing shifter collar on shifter gear between first and second gear, make sure the slanted teeth on collar are located over poppets in shifter gear.
5. When installing spacer in shifter gear located between third and fourth gears, the beveled edges of spacer must be toward shifter gear.
6. To install the two gears on upper shaft, first heat gears in hot oil — 300° to 325° . Apply white lead to shaft. Press gears on shaft.

7. When installing ball bearing on upper shaft into bore of intermediate plate, the open space of retainer ring must be aligned with oil port in intermediate plate.
8. Install bearing cage on lower shaft without shims. Do not tighten stud nuts. With parking brake installed, tighten locknut to a torque of 550 to 575 ft. lbs. Refer to Figure 93. In-

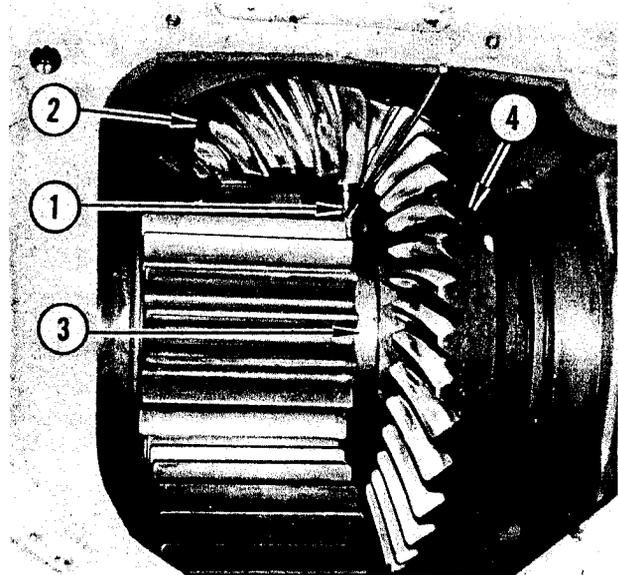


FIGURE 93. OUTPUT PINION
ADJUSTMENT

- | | |
|------------------|--------------|
| 1. Gauge | 3. Spacer |
| 2. Output Pinion | 4. Ring Gear |

stall gauge (1) between end of output pinion (2) and spacer (3). Item (4) is beveled ring gear. Tap on front end of lower shaft to move pinion against gauge. Tighten bearing cage stud nuts snug. With a feeler gauge, measure clearance between bearing cage flange and intermediate plate. Loosen stud nuts. Add shims equal

to the clearance checked with feeler gauge. Re-tighten stud nuts. Remove gauge from between pinion and spacer. Part number for this gauge is 723017. If gauge is not available, the clearance between pinion and spacer should be 1.325" to 1.330". This setting will give correct toe depth for pinion and bevel gear.

FINAL DRIVE

Disassembly

Attach sling and hoist to engine support. Remove eighteen stud nuts and lockwashers retaining engine support to final drive case. Remove support (1) and gasket (2), Figure 94. NOTE: The engine support also forms rear cover for final drive case.

Place blocks under final drive case for support.

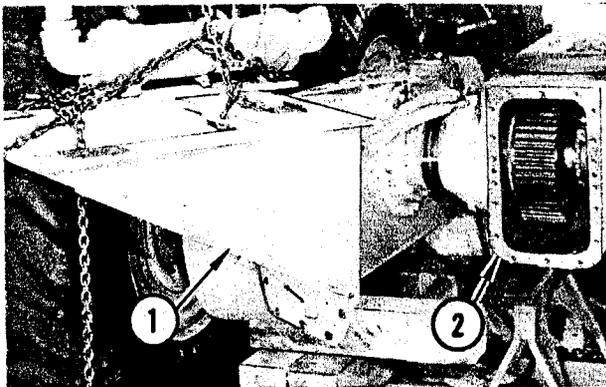


FIGURE 94. ENGINE SUPPORT REMOVAL
1. Support 2. Gasket

Refer to Figure 95. Remove seven capscrews and lockwashers (1) from both R. H. and L. H. outer axle carriers. Cut locking wire from the two drilled head capscrews (2). Remove capscrews and lockplate (3). Cut locking wire from clamp bolt (4). Loosen clamp bolt. Using a spanner wrench, back up adjusting nut (5) until it is against bull gear hub.

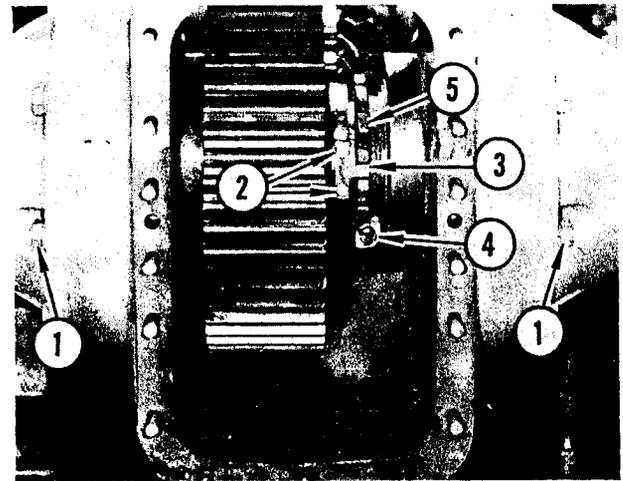


FIGURE 95. AXLE CARRIER REMOVAL
1. Carrier Capscrews 4. Clamp Bolt
2. Lockplate Capscrews 5. Adjusting Nut
3. Lockplate

Place blocks between bull gear and bottom of final drive case; refer to Figure 96. Install sling and hoist to R. H. tandem. Take up hoist just enough to relieve weight. Pull tandem away from final drive case until outer axle carrier hub is clear of bull gear bearing and R. H. drive axle is clear of bull gear hub. Repeat procedure for L. H. side. Inspect "O" rings on axle carrier. If they are cracked or broken, replace with new ones.

Roll bull gear assembly from final drive case.

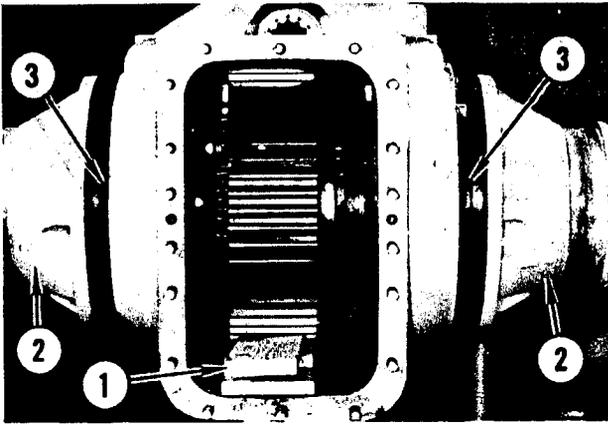


FIGURE 96. AXLE CARRIER REMOVAL

- | | |
|-----------------|-------------|
| 1. Blocking | 3. "O" Ring |
| 2. Axle Carrier | |

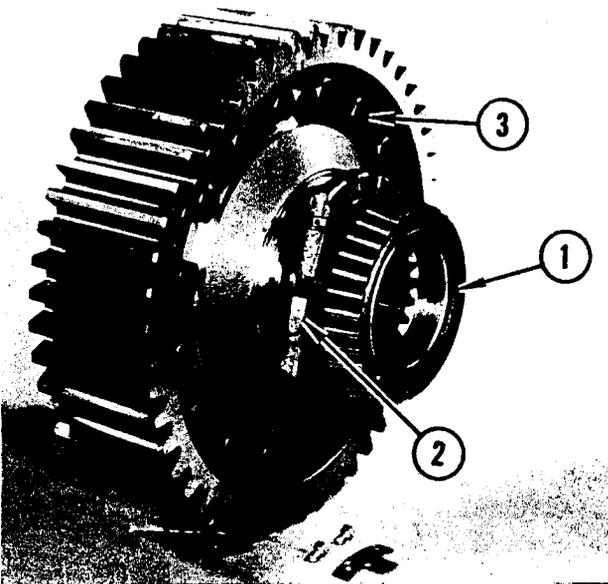


FIGURE 97. BULL GEAR DISASSEMBLY

- | | |
|------------------|--------------|
| 1. Bearing | 3. Bull Gear |
| 2. Adjusting Nut | Capscrews |

Refer to Figure 97. Remove bearing (1) from R.H. bull gear hub. Repeat for bearing on L.H. hub. Remove adjusting nut (2) from R.H. hub. Inspect bull gear teeth. If any are broken, cracked or show signs of excessive

wear, remove the self-locking nuts from the sixteen bolts (3) and replace the bull gear. When installing the sixteen bolts, note they should be installed from the R.H. side.

Attach sling and hoist to bull pinion assembly. Refer to Figure 98. Remove four capscrews and lockwashers from R.H. bearing cage (1). Remove bearing cage and shims (3) from final drive housing. Remove "O" ring from bearing cage. Keep shims with bearing cage. Remove four capscrews and lockwashers from L.H. bearing cage (2). Remove bearing cage and shims from housing. Keep shims with bearing cage. Remove "O" ring from bearing cage. Remove bearing cups from both bearing cages. Remove bearing cones (4) and (5) from shaft. Press spiral bevel ring gear (6) from shaft. NOTE: It will require a force of approximately 75 tons to remove ring gear. Remove square key and spacer from bull pinion shaft (7).

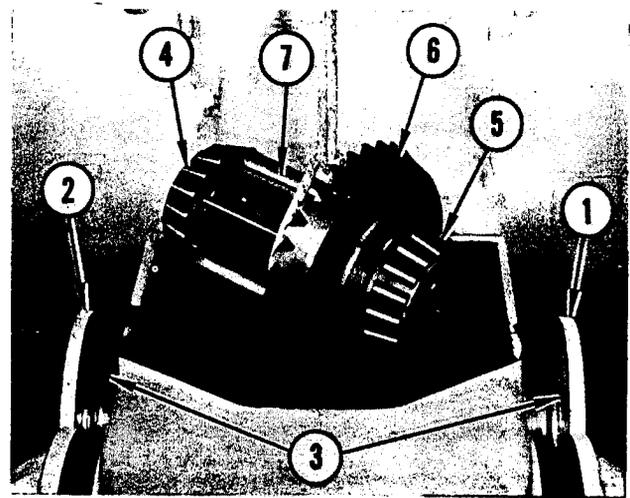


FIGURE 98. RING GEAR DISASSEMBLY

- | | |
|----------------------|-----------------|
| 1. R.H. Bearing Cage | 5. Bearing Cone |
| 2. L.H. Bearing | 6. Ring Gear |
| 3. Shims | 7. Pinion |
| 4. Bearing Cone | |

Reassembly

Reassembly of the final drive will be the reverse of disassembly procedure and the following information.

1. Install spacer on bull pinion shaft with chamfered side of bore toward bull pinion.

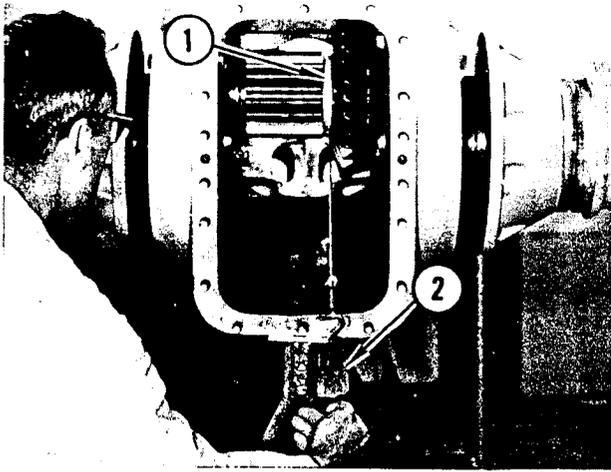


FIGURE 99. CHECKING ROLLING TORQUE

1. Spacer
2. Scale
2. Heat spiral bevel gear in hot oil (350°). Press gear onto bull pinion shaft until gear is tight against spacer. Hold under pressure until gear cools.
3. Heat bearing cones in hot oil and press onto shaft. Hold under pressure until bearings have cooled.
4. Install bearing cages with all the shims from both cages on the R. H. bearing cage. Tighten bearing cage capscrews to 190 ft. lbs. of torque. Refer to Figure 99. Wrap sash cord

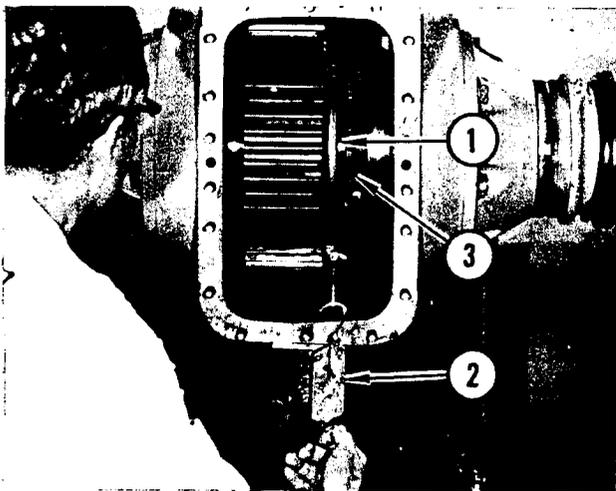


FIGURE 100. CHECKING BULL GEAR ROLLING TORQUE

1. Gear Hub
2. Scale
3. Adjusting Nut

around spacer (1) and pull with a fish scale (2). Rolling torque must be 12 to 15 lbs. pull. Add or remove shims to obtain this rolling torque.

5. Heat bull gear bearing cones in hot oil (350°) and press cones onto bull gear hubs. Hold under pressure until bearings have cooled.
6. Install axle carrier capscrews and lockwashers. Tighten to 275 ft. lbs. of torque. Refer to Figure 100. Wrap sash cord around bull gear hub (1) and pull on fish scale (2). Tighten or loosen adjusting nut (3) until a rolling torque of 18 to 25 lbs. pull is obtained. NOTE: Loosen bull pinion shaft bearing cage capscrews before adjusting bull gear bearing preload.

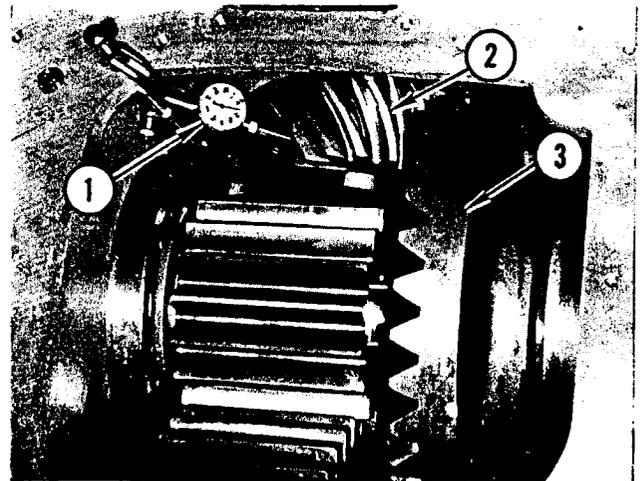


FIGURE 101. ADJUSTING PINION AND GEAR BACKLASH

1. Dial Indicator
2. Output Pinion
3. Bevel Gear

ADJUST PINION AND SPIRAL GEAR BACKLASH

Refer to Figure 101. Install a dial indicator (1) in such a way as to get a reading from either the output pinion (2) or spiral bevel gear (3). The backlash should be .010" to .014". Make adjustment by moving shims from R.H. bearing cage to L.H. bearing cage.

TANDEMS

Disassembly

Block up tandems until tires are clear of ground or floor. Install rope sling around tire (do not use chain or wire cable) and attach hoist to sling. Remove cotter pin from slotted nut and axle. Remove slotted nut from axle. Install puller bolts in the two tapered holes in wheel. Install puller and remove wheel and tire from axle, Figure 102. NOTE: It will require 20 to 25 tons pressure to remove wheel from axle.

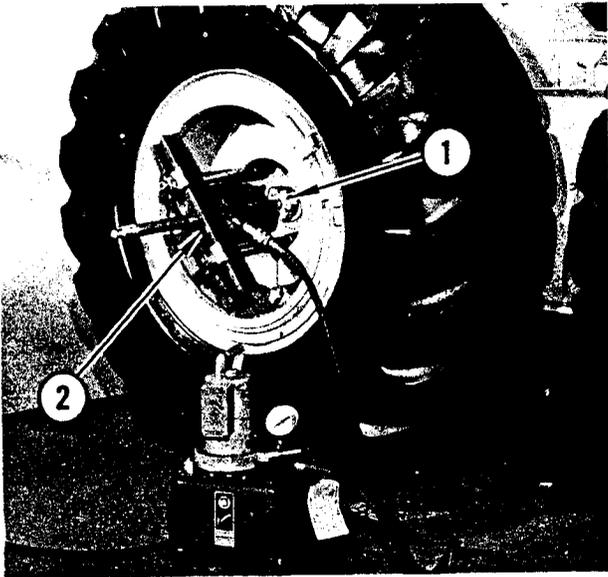


FIGURE 102. WHEEL AND TIRE REMOVAL
1. Axle Nut 2. Puller Tool

Repeat above procedure for the other wheel.

Remove twelve capscrews and lockwashers and remove side cover and gasket from tandem housing.

Remove top hand hole plates and side inspection plates.

Refer to Figure 103. Remove lockplate (1) from final drive axle.

Drive retainer pins (2) from chain coupler link. Remove coupler link plate (3).

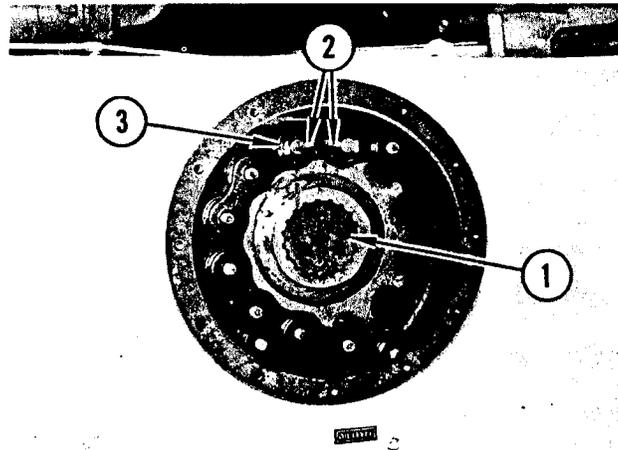


FIGURE 103. TANDEM CHAIN REMOVAL
1. Lockplate 3. Coupler Link Plate
2. Retainer Pins

Disconnect chain by removing coupler link. Remove chain from tandem housing through top hand hold opening. Repeat procedure for removal of the other chain.

Remove drive sprocket from final drive axle, Figure 104.

Remove snap ring (1), Figure 105.

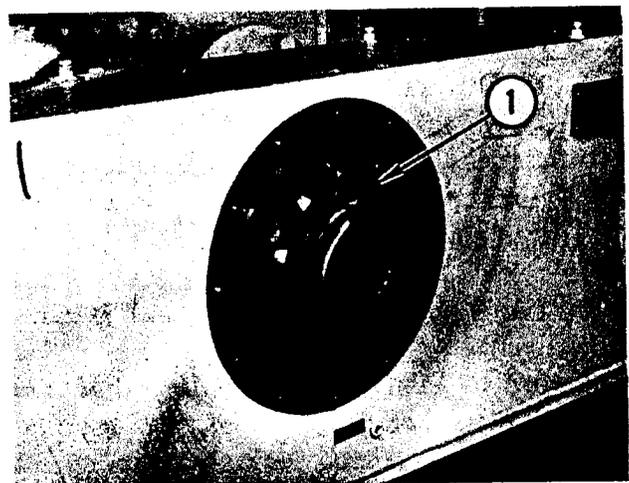


FIGURE 104. DRIVE SPROCKET REMOVAL
1. Sprocket

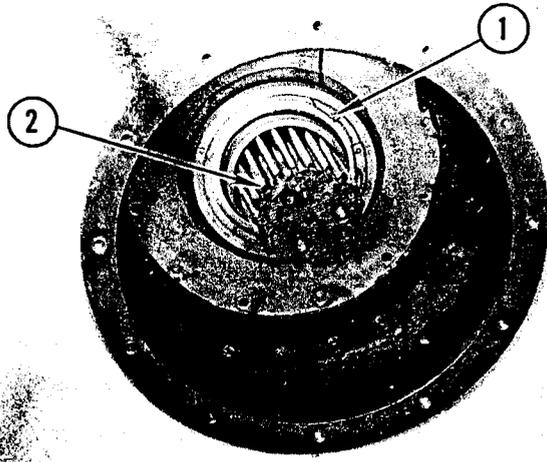


FIGURE 105. BEARING RETAINER SNAP RING

1. Snap Ring 2. Final Drive Axle

Attach lockplate to end of final drive axle. Using a pry bar, Figure 106, remove final drive axle (1), spacer (2), grease seal (3), retainer (4) and bearing (5).

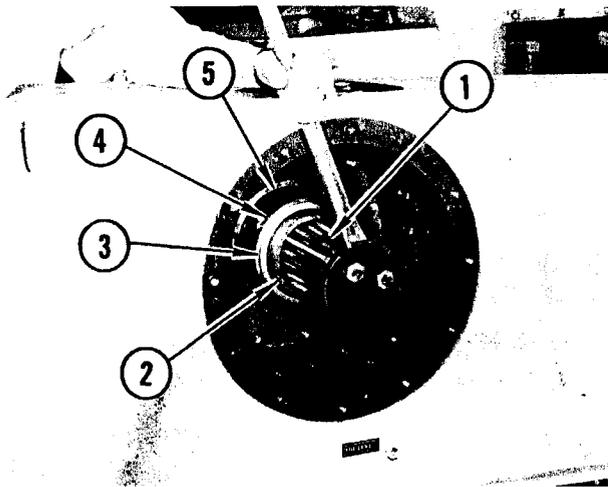


FIGURE 106. AXLE REMOVAL

1. Axle 3. Seal 5. Bearing
2. Spacer 4. Retainer

Attach sling and hoist to tandem housing (1). Remove twenty-two capscrews and lockwashers retaining tandem housing to inner axle carrier (2). Remove tandem housing, Figure 107. Remove brake assemblies from eccentric housing hubs. See Section C for brake removal and repair.

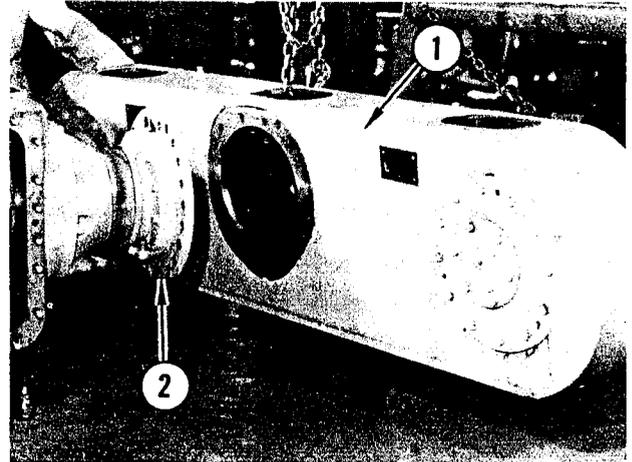


FIGURE 107. TANDEM HOUSING REMOVAL

1. Tandem Housing 2. Inner Axle Carrier

Remove twelve capscrews and lockwashers retaining outer eccentric housing (1) to tandem case (2). Install two guide pins (3). Work outer eccentric housing out far enough so that sling can be attached as shown in Figure 108.

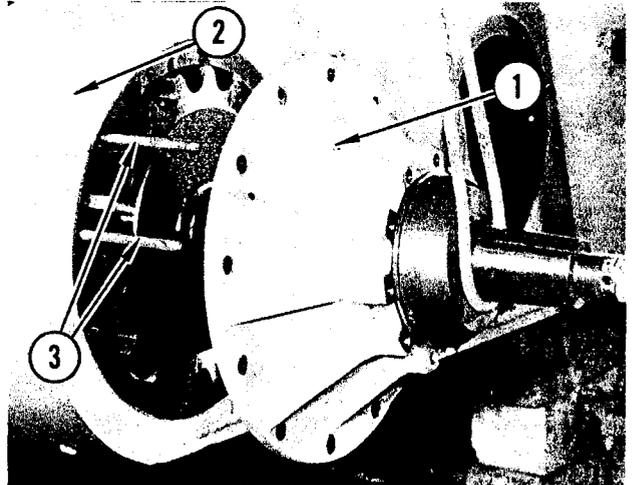


FIGURE 108. HOUSING REMOVAL

1. Eccentric Housing 3. Guide Pins
2. Tandem Case

Place assembly on work bench with sprocket side down. Remove square key from axle. Lift outer eccentric housing from axle.

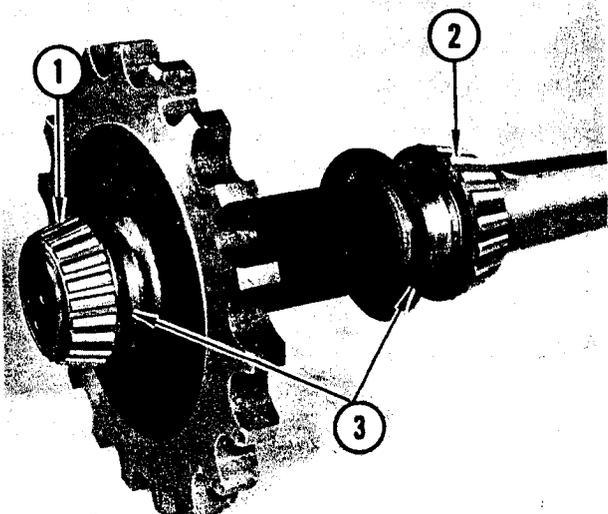


FIGURE 109. AXLE ASSEMBLY

- | | |
|--------------------|-----------------|
| 1. Bearing (Outer) | 3. Grease Seals |
| 2. Bearing (Inner) | |

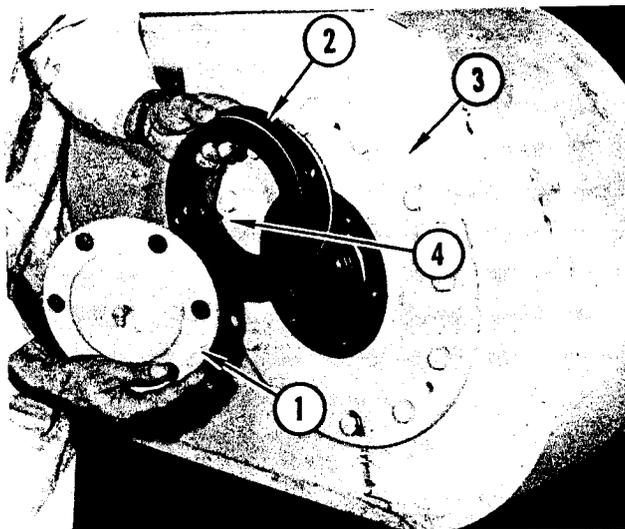


FIGURE 111. INNER ECCENTRIC HOUSING

- | | |
|------------|------------------|
| 1. Hub Cap | 3. Inner Housing |
| 2. Shims | 4. Notch |

(1) and (2) from axle with bearing puller. Remove grease seals (3).

Refer to Figure 110. Remove oil seal (1) and bearing cup (2) from outer eccentric housing. NOTE: To drive bearing cup from housing, first remove three slotted pipe plugs from hub of eccentric housing. Insert a small punch through these openings to drive against bearing cup.

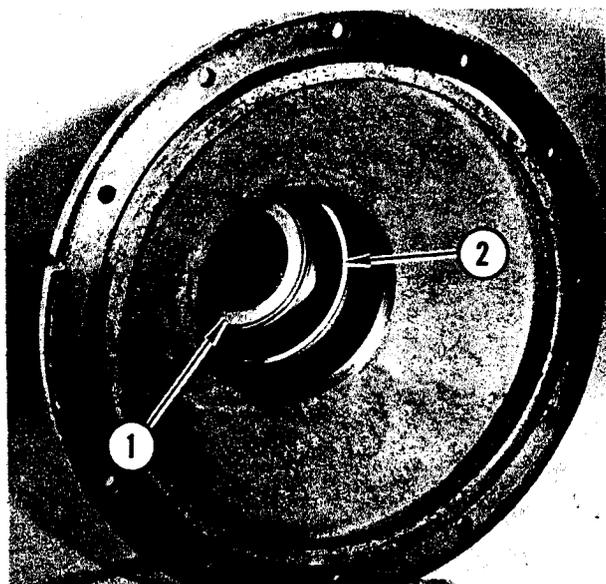


FIGURE 110. HOUSING SEAL REMOVAL

- | | |
|-------------|----------------|
| 1. Oil Seal | 2. Bearing Cup |
|-------------|----------------|

Refer to Figure 109. Remove bearings

Refer to Figure 111. Remove six capscrews and lockwashers retaining hub cap (1) to inner eccentric housing (3). Remove hub cap and shims (2). Remove twelve capscrews and lockwashers retaining inner axle carrier to tandem housing and remove inner eccentric housing and gasket. Remove bearing cup from eccentric housing.

Reassembly

Reassembly of the tandem will be the reverse of the disassembly procedure and the following information.

1. When installing inner and outer eccentric housing, make certain the

notch in flange, Figure 111, is toward center of tandem housing.

2. To pre-load wheel axle bearings, install hub cap without shims, tighten the six capscrews evenly until a

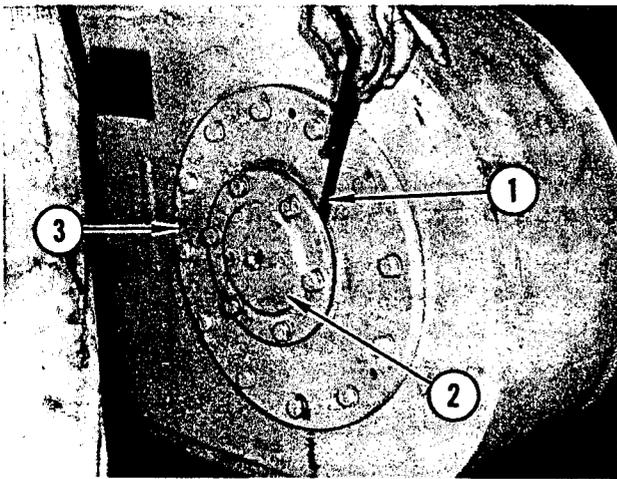


FIGURE 112. PRE-LOADING AXLE BEARINGS

- | | |
|-----------------|----------------------|
| 1. Feeler Gauge | 3. Eccentric Housing |
| 2. Hub Cap | |

slight drag is felt when axle is rotated by hand. With a feeler gauge, check the clearance between hub cap and inner eccentric housing, Figure 112. Remove hub cap. Install shims to equal clearance shown by feeler gauge.

- To install chain, start end of chain through center hand hold opening in top of tandem housing. Insert wire

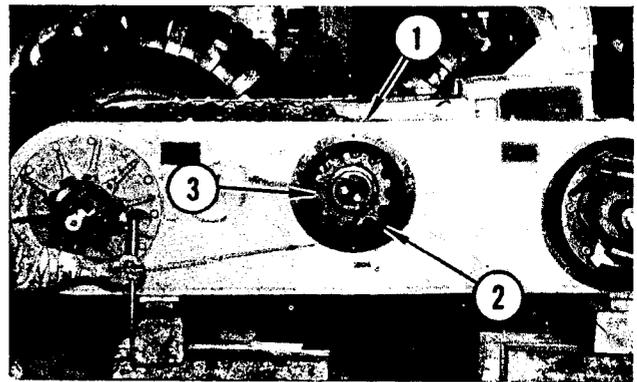


FIGURE 113. CHAIN INSTALLATION

- | | |
|---------------------------|-------------|
| 1. Hand Hold Opening | 3. Sprocket |
| 2. Wire Attached To Chain | |

or rope through side opening, around wheel axle and attach to end of chain, Figure 113. Pull chain around sprocket on wheel axle and connect ends of chain with connector link. Chain can be pulled tight for installation of connector link with two bars. A special tool is also available for this purpose. Install coupler link on outside chain so that retainer pins are toward outside wall of tandem case. Install coupler link on inside chain so that retainer pins are toward inside wall of tandem case.

AXLE CARRIERS

Disassembly

Remove oil seal from inner axle carrier.

Refer to Figure 114. Remove four cap-screws and lockwashers from each of the three seal retainers (1). Remove seal retainers. Remove upper and lower halves of axle carrier flange (2).

Remove grease seals (3). Remove inner axle carrier (4) from outer axle carrier. Remove red fiber gaskets (5). Remove thrust rings (6). Remove grease seal (7).

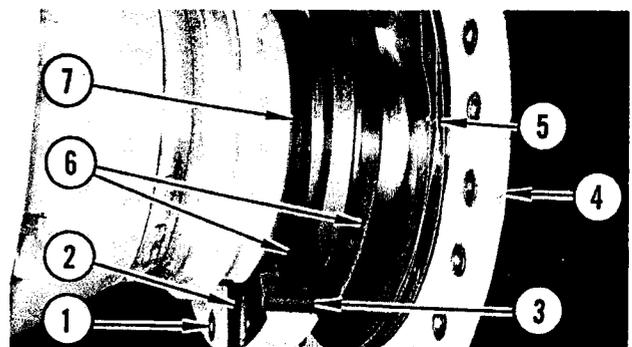


FIGURE 114. AXLE CARRIER REMOVAL

- | | |
|-------------------|-----------------|
| 1. Seal Retainer | 5. Gaskets |
| 2. Carrier Flange | 6. Thrust Rings |
| 3. Grease Seal | 7. Grease Seal |
| 4. Axle Carrier | |

Inspect the two synthane bushings in outer axle carrier bore. If they are crack-

ed or show signs of excessive wear, remove bushings and install new ones.

Reassembly

1. Pack the cavity between the synthane bushings in outer axle carrier with general purpose grease.
2. Inspect thrust rings for cracks or excessive wear. Replace if damaged.

3. After axle carriers are completely reassembled, the inner axle carrier should require a slight effort to rotate by hand. If too tight, add red fiber gasket. If too loose, remove red fiber gasket.

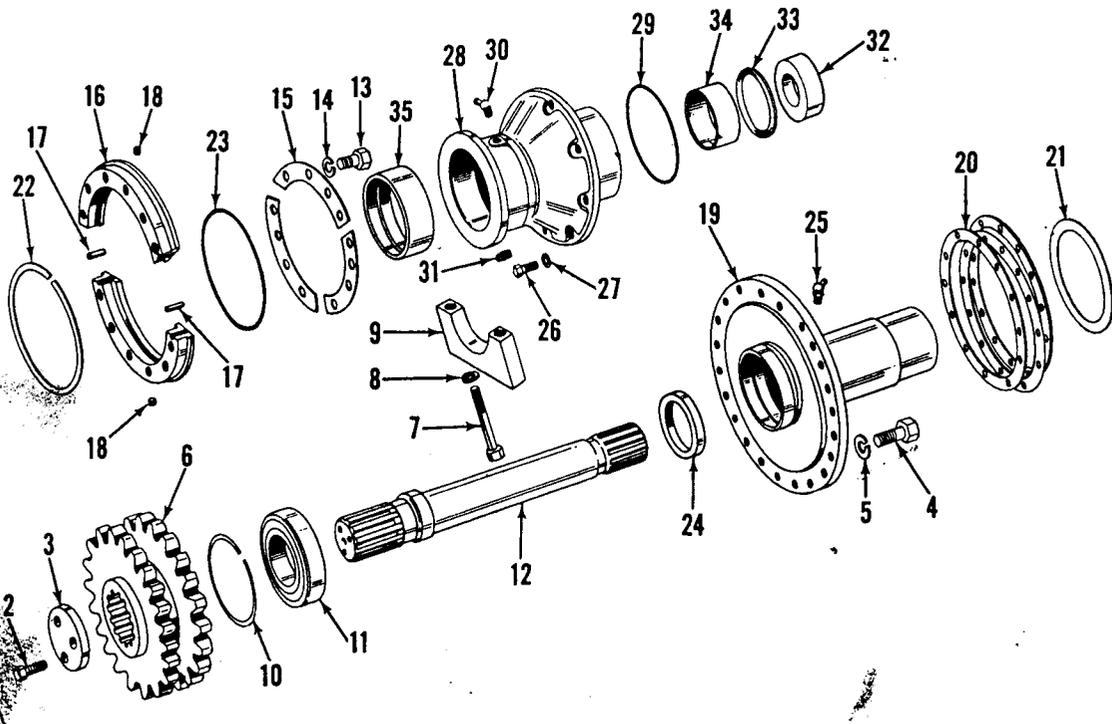


FIGURE 115. DRIVE AXLE AND CARRIERS

- | | | |
|-----------------------|-------------------------|-------------------------|
| 1. Locking Wire | 13. Capscrew, Hex-Head | 25. Lubrication Fitting |
| 2. Capscrew, Drilled | 14. Lockwasher | 26. Capscrew, Hex-Head |
| 3. Bolting Plate | 15. Seal Retainer | 27. Lockwasher |
| 4. Capscrew, Hex-Head | 16. Axle Carrier Flange | 28. Axle Outer Carrier |
| 5. Lockwasher | 17. Grease Seal | 29. Preformed Packing |
| 6. Drive Sprocket | 18. Pipe Plug | 30. Lubrication Fitting |
| 7. Bolt | 19. Axle Inner Carrier | 31. Pipe Plug |
| 8. Lockwasher | 20. Gasket | 32. Bearing Cup |
| 9. Axle Cap | 21. Thrust Ring | 33. Grease Seal |
| 10. Retaining Ring | 22. Split Thrust Ring | 34. Bushing |
| 11. Bearing | 23. Grease Seal | 35. Bushing |
| 12. Drive Axle | 24. Grease Seal | |

POWER TRAIN

Unit Installation

Unit installation will be the reverse of unit removal, Page B-6, and the following information.

1. Carefully roll unit into main frame. Check frequently to make certain all hydraulic hoses are clear and not being crushed.
2. When unit is within six or eight inches of being in position, guide PTO shaft into universal coupling.
3. Tighten front transmission support bolts (1), Figure 116, until support

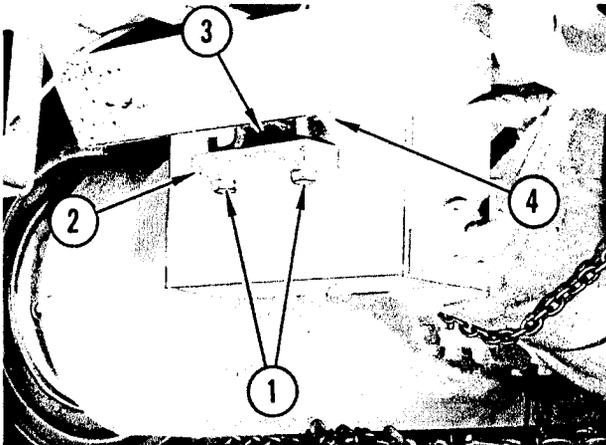


FIGURE 116. TRANSMISSION FRONT SUPPORT

1. Bolts
2. Support Bar
3. Rubber Biscuit
4. Support

bar (2) has compressed rubber biscuit (3) to a clearance of 1/16" between support bar and front transmission support (4).

4. Install saddle mounts and tighten bolts until front side of mounts are pulled together tight. Any gap between the mounts must be at rear side of mounts.

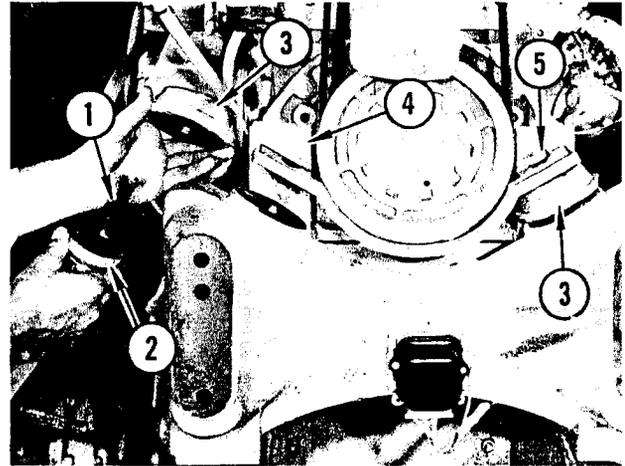


FIGURE 117. ENGINE INSTALLATION

1. Capscrew
2. Rubber Biscuit
3. Rubber Mount
4. Engine Bracket
5. Locknut

ENGINE INSTALLATION

Engine installation will be the reverse of engine removal, Page B-2, and the following information.

1. Align punch marks made on converter output shaft universal coupling and drive shaft.
2. Refer to Figure 117 to install rear engine mounts (radiator end). Install capscrew (1) with rubber biscuit (2), up through engine support and rubber mount (3) and thread into engine bracket (4). Tighten capscrew until rubber biscuit (2) can be rotated by hand with effort. Install and tighten locknut (5).
3. Refer to Figure 118 to install and adjust front engine mounts (flywheel end). Install top rubber bonded washers and shims (1) between engine support (2) and engine mount-

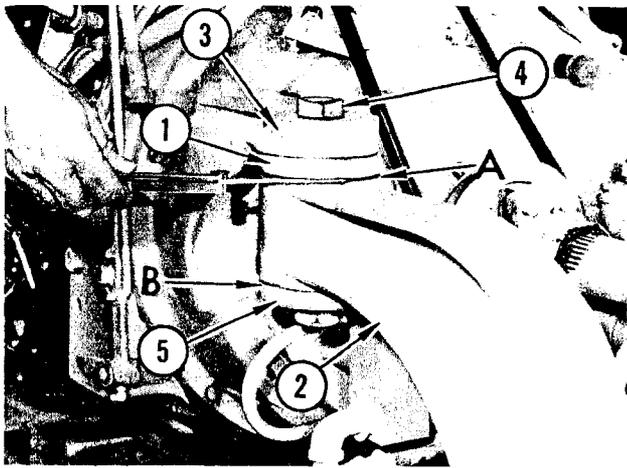


FIGURE 118. ENGINE MOUNTS
(Flywheel End)

- | | |
|-------------------|-------------------|
| 1. Washer & Shims | 4. Bolt |
| 2. Engine Support | 5. Washer & Shims |
| 3. Engine Bracket | |

ing bracket (3). Install bolt (4) down through brackets, washer and shims. Install lower bonded washer and shim (5) over end of capscrew and secure with nut. Check clearance at "A" and "B". With used tubular mount, the clearance should be:

"A" — .060 Min.
"B" — .1875 Max.

In case the clearance at "A" is below the minimum allowance, move shims from lower washer to upper washer. If unable to obtain the minimum at "A" it will be necessary to install new tubular mounts. Refer to Figure 119. Install snap ring (1) and tubular mount (2) into engine support (3). With new tubular mounts, the clearance should be:

"A" — .120" to .140"
"B" — .002" to .030"

LIMITING SPEED GOVERNOR

If the engine limiting speed governor has been reconditioned or replaced, it will be necessary to make adjustment for maximum no-load engine speed and the idle speed. Refer to the GM Diesel Operator Manual, 71 series engine for instructions.

ADJUST ENGINE LOAD LIMITING DEVICE

Remove rocker arm covers. Hold injector control racks in full fuel position and check load limiting arm to see that it is parallel to the cylinder head. If arm is not parallel to cylinder head, adjust by loosening the two clamp bolts on the injector control tube and rotate arm to proper position. Tighten the two clamp bolts to a torque of 7 to 9 ft. lbs.

Turn the adjusting screw down until it just touches the arm, then turn the adjusting screw down another 4-1/4 turns.

Replace rocker arm covers.

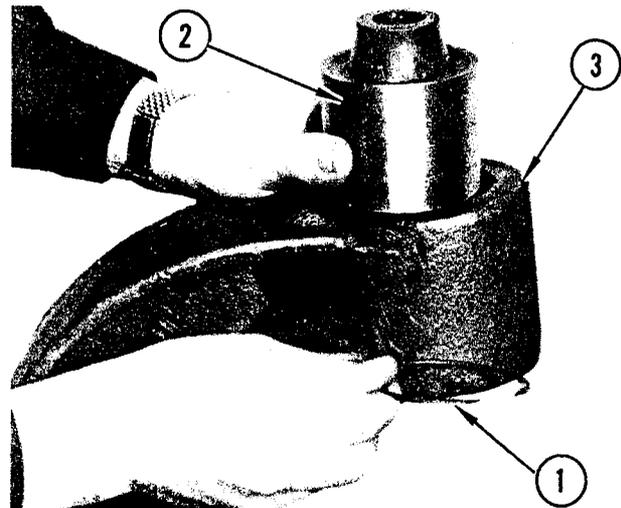


FIGURE 119. TUBULAR MOUNT
INSTALLATION

- | | |
|------------------|-------------------|
| 1. Snap Ring | 3. Engine Support |
| 2. Tubular Mount | |

TROUBLE SHOOTING

TORQUE CONVERTER

TROUBLE: Torque converter overheating.

CAUSE: Torque converter reactor stuck. To check this, drive machine with no load on it in any gear with engine operating at top RPM. If torque converter oil temperature raises excessively, this will indicate that sprag cams in the hub of the reactor are stuck, preventing reactor from free wheeling.

REMEDY: Repair torque converter as necessary.

CAUSE: Insufficient oil. Check by first removing hose from oil outlet end of heat exchanger and putting it in a large container. Start engine and run at 600 RPM. Oil should flow at the rate of 2-1/2 gals. per minute or 1 gal. in 24 seconds. If oil does not flow at this rate, check for:

A. Plugged oil line or oil screen.

REMEDY: Clean line or unplug oil screen.

B. Control valve not functioning properly.

REMEDY: Clean, repair or replace valve.

C. Internal leakage in torque converter.

REMEDY: Check torque converter and make necessary repairs or replacements.

D. Internal leakage in power shift clutch assembly.

REMEDY: Check for worn or broken rings on clutch assembly pistons and upper shaft rotary seal.

E. Low oil level.

REMEDY: Add oil to bring oil in hydraulic tank up to proper level.

F. Oil pump malfunction.

REMEDY: Repair or replace oil pump.

G. Power shift clutches dragging and heating oil.

REMEDY: Refer to "Clutches Overheating" further along in Trouble Shooting.

CAUSE: Overloading machine.

REMEDY: Drop down to lower gear.

TROUBLE: Lack of power to drive wheels.

CAUSE: Powershift clutches slipping. To check, start engine and shift lower transmission into 3rd or 4th gear. Set the wheel brakes and rev engine up. If the output shaft from the torque converter turns, the clutches are slipping. Check this in both forward and reverse to check both clutches.

REMEDY: Check the power shift clutch for:

A. Low oil pressure at clutches.

B. Excessively worn or broken discs or other components.

C. Restricted or broken lines to clutches.

D. Relief or control valve

- not functioning properly.
- E. Oil pump not functioning properly.

REMEDY: Repair or replace parts not functioning properly.

CAUSE: Torque converter not working properly. To check, follow same test procedure as stated under "power shift clutches slipping". If the torque converter output shaft does not turn and the engine does not labor, torque converter is not delivering power to power shift clutches.

REMEDY: Check the torque converter assembly for:

- A. Internal leakage in

torque converter assembly.

- B. Restricted or broken oil lines to torque converter.
- C. Relief valve not functioning properly.
- D. Oil pump not functioning properly.
- E. Reactor sprag cams not holding. This could be caused by worn or damaged sprag cams or parts they work in conjunction with.

CAUSE: Tail shaft governor not functioning properly.

REMEDY: Refer to "tail shaft governor not functioning properly" further along in Trouble Shooting.

TRANSMISSION

TROUBLE: Clutches fail to release.

CAUSE: Broken seal rings.

REMEDY: Replace seal rings.

CAUSE: Oil return line to valve restricted.

REMEDY: Free return line.

TROUBLE: Only one clutch works satisfactorily.

CAUSE: Oil leaking past clutch piston.

REMEDY: Repair clutch assembly to correct leakage.

CAUSE: Low oil pressure to clutch.

REMEDY: First, check individual oil lines to both clutches to determine that oil pressure is normal to clutch that is operating satisfactorily. Check

oil lines, fittings and passages to clutch. Replace or repair broken lines or fittings and remove any restrictions present.

CAUSE: Ball check valve in piston not holding pressure.

REMEDY: Inspect ball and ball seat. Replace ball or make any other corrections required to permit ball to seal correctly.

CAUSE: Other possible internal damage.

REMEDY: Remove power clutch assembly and make necessary corrections.

TROUBLE: Power shift clutch assembly overheating. NOTE: An indication of clutch overheating is high

torque converter oil temperature. Before removing clutches, check to determine if torque converter is causing overheating of oil.

CAUSE: Clutch discs or other parts binding. To check, set rear of grader on chocks with all four wheels off floor. Set engine at 600 RPM and run with machine in neutral for 5 minutes to warm up torque converter oil. Put lower transmission in gear and engage forward clutch, then disengage it and halt wheels in neutral. Repeat this five times for both forward and reverse, then place both transmission and power shift clutch in neutral and shut off engine. Measure the inch pounds required to turn the clutch assembly lower shaft, which in turn will rotate the upper shaft and clutch assemblies. To do this, turn

the nut on the end of the small brake which is located under the cam with a torque wrench. It should not require over 80 inch pounds to turn the shaft. (If clutch assembly has been removed, rotate each side by the gears on each end. Both sides should rotate easily by hand.)

REMEDY: Replace damaged or broken parts.

TROUBLE: Hard shifting of lower transmission.

CAUSE: Power shift clutch assembly clutches dragging.

REMEDY: Remedy dragging of clutches.

CAUSE: Improper use of gear brake.

REMEDY: Coordinate use of brake with shifting.

CAUSE: Gear brake out of adjustment.

REMEDY: Adjust brake so that it functions properly.

TAILSHAFT GOVERNOR

TROUBLE: Tailshaft governor not functioning properly.

CAUSE: Tailshaft governor linkage out of adjustment.

REMEDY: Adjust governor linkage.

CAUSE: Governor weights stuck.

REMEDY: Free governor weights.

CAUSE: Broken "V" belt.

REMEDY: Replace "V" belt.

CAUSE: Flex shaft that runs from the tailshaft governor drive to the tailshaft governor broken or damaged.

REMEDY: Replace flex shaft.

CAUSE: Linkage from tailshaft governor to engine governor binding at Tourek joints.

REMEDY: Adjust Tourek joints so there is no friction or drag present. Do not replace Tourek joints with the spring loaded type as they will cause drag on linkage and consequently poor engine response and performance.

TROUBLE: Tailshaft governor overheating.

CAUSE: Too much lubricating oil.

REMEDY: Check to see that restricted fitting is in output shaft gov-

ernor lubricating oil line. It is located on the engine block where the output shaft governor lubricating oil line attaches. If missing, install restricted fitting.

CAUSE: Too little lubricating oil.
REMEDY: Check tailshaft governor lubricating oil line and fittings for restrictions, breaks or leaks. Repair or replace line or fittings as necessary.

TANDEMS

TROUBLE: Tandem chains breaking.

CAUSE: Chains or sprockets badly worn.
REMEDY: Install new chains and/or sprockets.

TROUBLE: Tandems bouncing.

CAUSE: Flat spots on tires due to sliding wheels when stopping.
REMEDY: Can be corrected or improved by increasing tire pressure.

ENGINE

TROUBLE: Engine low oil pressure.

CAUSE: Faulty pump.
REMEDY: Repair or replace pump.

CAUSE: Faulty relief valve.
REMEDY: Repair or replace relief valve.

CAUSE: Intake screen partially clogged.
REMEDY: Remove and clean intake screen.

TROUBLE: Cooling system over heating.

CAUSE: Coolant low in radiator.
REMEDY: Fill radiator with coolant to proper level.

CAUSE: Plugged air passages in radiator core.
REMEDY: Thoroughly clean radiator core of all foreign matter.

CAUSE: Loose fan belts.
REMEDY: Adjust fan belts to proper tension.

CAUSE: Collapsed or disintegrated hose.
REMEDY: Remove faulty hose and replace with new hose.

CAUSE: Loose impeller in water pump.
REMEDY: Repair water pump.

CAUSE: Faulty cylinder head gasket.
REMEDY: Replace cylinder head gasket.

CAUSE: Cracked cylinder head.
REMEDY: Remove and replace cylinder head.

TROUBLE: Loss of power or uneven running of engine.

CAUSE: Insufficient air supply.
REMEDY: A. Clean air filter.
B. Clean screen between blower and air inlet horn.
C. Make certain emergency engine shut-down valve is completely open.

CAUSE: Faulty injector or injectors.
REMEDY: Remove and replace injectors.

CAUSE: Low compression.
REMEDY: Remove and replace broken or stuck piston rings.

EXHAUST SMOKE ANALYSIS

Black or Gray Smoke

Probable causes:

- A. Insufficient air.
- B. Improper grade of fuel.
- C. Lugging engine.

Blue Smoke

Probable Cause: Fuel or lubricating oil not burned in cylinder.

White Smoke

Probable Cause: Misfiring cylinders.

SECTION C

WHEEL AND PARKING BRAKES

INDEX

WHEEL BRAKES C- 2

WHEEL CYLINDER C- 4

 Bleeding Brakes C- 5

 Adjusting Brakes C- 5

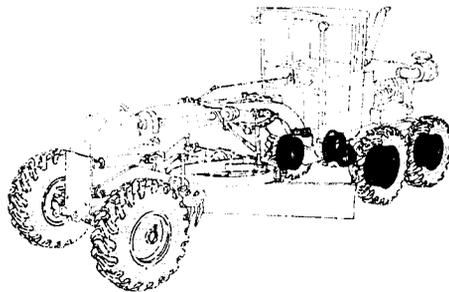
BRAKE MASTER CYLINDER C- 5

POWER BRAKES (OPTIONAL) C- 6

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TROUBLE SHOOTING C-12

WHEELS AND TIRES C-13



WHEEL BRAKES

Removal

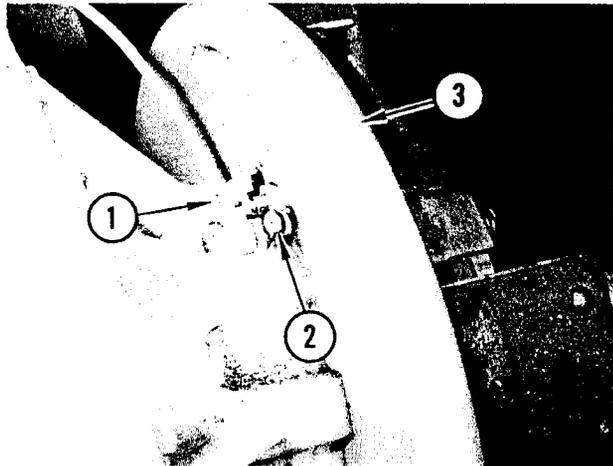


FIGURE 1. WHEEL CYLINDER REMOVAL
1. Wheel Cylinder 3. Backing Plate
2. Capscrew & Lockwashers

Block under tandem until tire is clear of ground. Remove wheel and tire. Refer to Page E-2, Section E for wheel removal instructions.

Refer to Figure 1. Disconnect hydraulic line (1) at wheel cylinder. Remove two cap screws and lockwashers (2) retaining

wheel cylinder to backing plate (3).

Refer to Figure 2. Expand upper ends of brake shoes and remove wheel cylinder (1). Remove the ten cap screws and lockwashers (2) retaining brake assembly to eccentric housing and remove brake assembly. Illustration shows brake assembly for R. H. Note adjusting cable is on rear brake shoe.

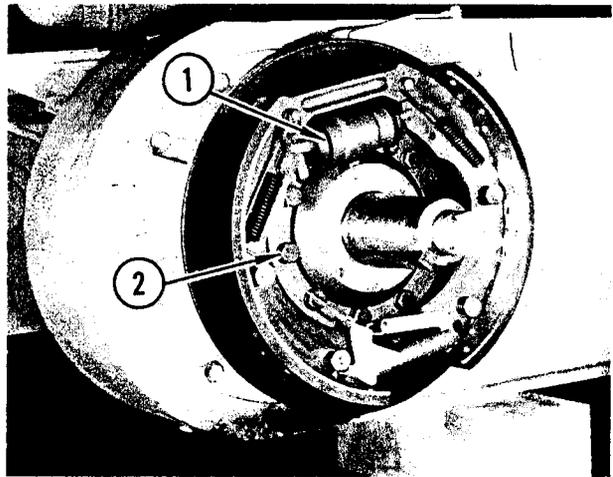


FIGURE 2. BACKING PLATE REMOVAL
1. Wheel Cylinder 2. Cap screws
& Lockwashers

Disassembly

Refer to Figure 3 and disassemble brake assembly by following the numerical sequence. Remove the two shoe return springs (1). Remove automatic adjusting cable (2). Remove cable guide (3) from brake shoe. Remove automatic adjusting lever spring (4). Remove automatic adjusting lever (5). Expand lower ends of brake shoes and remove

adjusting screw assembly (6). Remove the four shoe hold down pins (7) by turning pin until the flat end aligns with slot in spring cup. Remove shoe hold down springs and spring cups (8). Remove brake shoes (9). Remove two cap screws (10) retaining anchor block (11) to backing plate (12).

Reassembly

For reassembly of the brake assembly, reverse the numerical sequence for disassembly as shown in Figure 3 and the following information.

1. Illustration shows disassembly of a L.H. brake assembly, that is, it goes on left hand side of grader. The disassembly and reassembly of

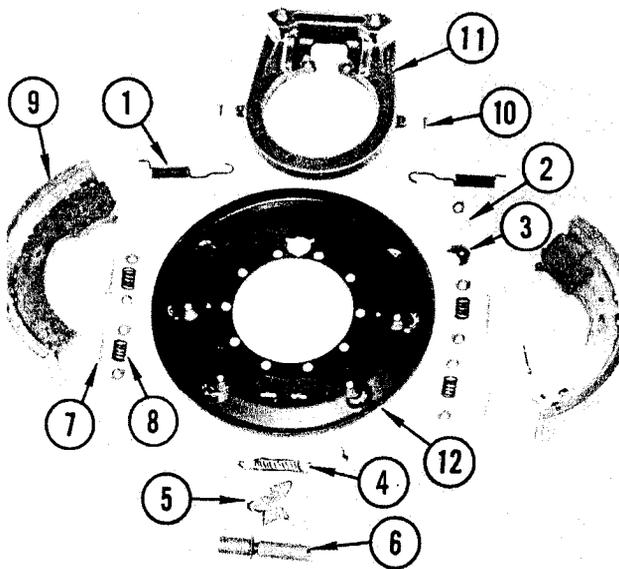


FIGURE 3. BACKING PLATE ASSEMBLY

- | | |
|--------------------|-------------------|
| 1. Spring | 7. Pins |
| 2. Adjusting Cable | 8. Springs |
| 3. Cable Guide | 9. Cups |
| 4. Spring | 10. Brake Shoes |
| 5. Adjusting Lever | 11. Capscrews |
| 6. Adjusting Screw | 12. Backing Plate |

a R. H. brake will be the same as for L. H. except for automatic adjusting parts. These parts will be assembled on the opposite shoe. The automatic adjusting parts must always be assembled on the rear shoe.

2. When installing the hook end of the automatic adjusting cable (1) to the automatic adjusting lever (2), the hook must be inserted from the top of lever, Figure 4. CAUTION: Do not twist cable.
3. When installing automatic adjusting cable around cable guide, make certain cable does not get between guide and brake shoe flange.
4. If new linings were installed on brake shoes, there are several precautions necessary:

- (a) Snug fit between liners and shoes.
- (b) Selection of proper rivets.
- (c) Removal of high spots on lining.

Snug fit is absolutely necessary between lining and shoes. Loosely applied linings contact only part of their area due to lumps between rivets.

There are several liner stretchers that pull linings tightly to shoes before riveting. Stretchers are not necessary if care is used and center rivets are set first. The installer then works toward both ends.

Proper selection of rivets is necessary to insure close fit between rivet shank and drilled hole in lining and shoe. Rivets with small shank permit lining to shift on shoe under pressure. Such shifting gradually loosens lining and sometimes shears rivets. If rivet shank is too long, upset end will split, weakening the assembly. Aluminum rivets must not be used.

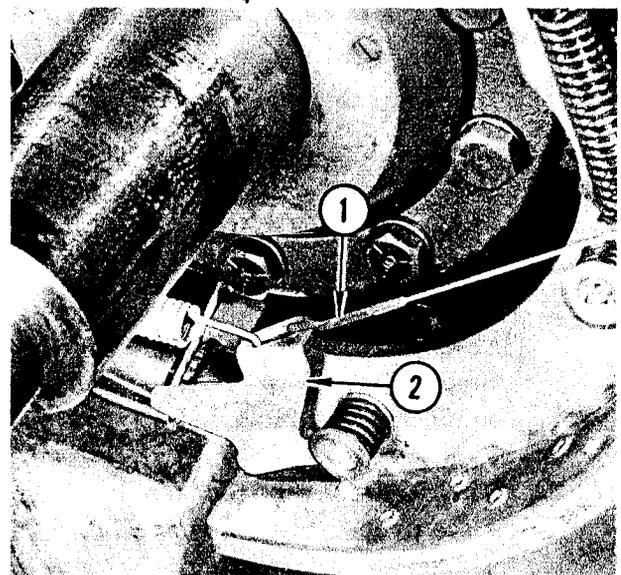


FIGURE 4. INSTALLING CABLE

- | | |
|--------------------|--------------------|
| 1. Adjusting Cable | 2. Adjusting Lever |
|--------------------|--------------------|

If brake drum is heavily scored or out of round, it must be turned on

lathe. Do not remove more metal than necessary to true it.

Installation

To install brake assembly onto eccentric housing, reverse the procedure for removal. Do not install wheel cylinder into

brake assembly until after assembly is installed on eccentric housing.

WHEEL CYLINDER

Disassembly

The wheel cylinder is located between the top ends of the brake shoes. The wheel cylinder connecting links are in contact with the wheel cylinder pistons and the upper ends of the brake shoes. When hydraulic pressure is applied to the two pistons, they move outward pushing the connecting links against the upper ends of the brake shoes, thus forcing the brake shoes against the brake drum.

Refer to Figure 5 and follow the numerical sequence for disassembly. Remove connecting links (1). Remove boots (2). Remove pistons (3), piston cups (4) and piston spring (5). Remove hydraulic line fitting (6) and bleeder valve (7) from the valve body (8).

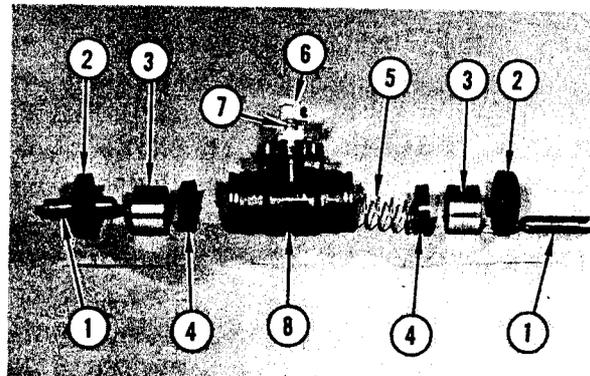


FIGURE 5. WHEEL CYLINDER ASSEMBLY

- | | |
|--------------------|------------------|
| 1. Connecting Link | 5. Spring |
| 2. Boot | 6. Fitting |
| 3. Valve | 7. Bleeder Valve |
| 4. Valve Cup | 8. Valve Body |

Reassembly

Reverse the numerical sequence as shown in Figure 5 to reassemble the wheel cylinder along with the following information.

1. Anytime the wheel cylinder is disassembled, new piston cups and boots must be installed.
2. Worn cylinder bores can be honed if the proper tools are available. If

the tools are not available, the cylinders should be serviced by an authorized dealer.

3. Wash parts in denatured alcohol. Do not use gasoline or kerosene. Do not permit brake fluid to remain on brake shoes. Use carbon-tet to remove fluid or oil from shoe linings.

Installation

Remove shoe return springs from groove-

ed pins on anchor plate. Expand top ends of

brake shoes and install wheel cylinder. Make certain slots in connecting links fit notch on brake shoes. Install shoe return springs on ground pins.

Install wheel cylinder capscrews and locknuts. Tighten capscrews to 180-200 inch pounds of torque.

Connect hydraulic line to fitting on wheel cylinder.

Rotate adjusting wheel assembly to expand brake shoes until outside diameter of shoes are slightly less than the inside diameter of brake drum. Install wheel. Install washer and slotted nut on end of axle. Tighten nut to a torque of 600-650 ft. lbs. If slot in nut does not align with cotter pin hole in axle, tighten nut until cotter pin can be inserted and spread.

Bleeding Brakes

Install a rubber hose on bleeder valve. Insert end of hose into container. Fill container with enough hydraulic fluid to cover end of hose. Figure 6.

Open bleeder valve and depress foot brake pedal until all air has been expelled from lines. Close bleeder valve. Remove

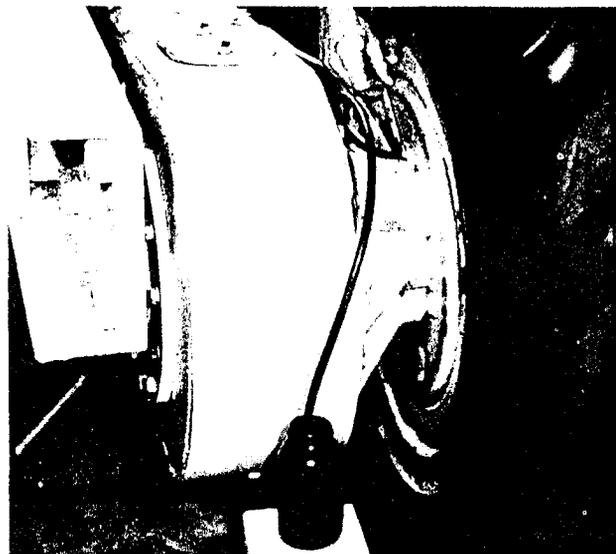


FIGURE 6. BLEEDING BRAKES

bleeder hose. Repeat bleeding procedure on the rest of brakes. As the parking brake is equipped with a wheel cylinder, it will be necessary to bleed parking brake also.

Adjusting Brakes

After bleeding brakes, shift transmission into gear, shift power shift clutch pedal into reverse. Run grader in reverse several feet and apply brakes. Repeat several times until automatic adjuster brings brake shoes to proper adjustment.

BRAKE MASTER CYLINDER

General

Hydraulic pressure to apply the brakes is supplied by the master cylinder. Movement of the brake linkage forces a piston in the cylinder against a return spring in the cylinder. As the piston moves in the cylinder, it closes an oil return port. Fluid trapped in the cylinder is forced out through the

brake hydraulic lines under pressure. The fluid enters the center of the wheel cylinder, moving the two wheel cylinder pistons outward forcing the brake shoe linings against the brake drums. The filler cap is also a breather to insure atmospheric pressure on the fluid in reservoir.

Removal

Refer to Figure 7. Pull stop light plug (1) from socket. Disconnect all hydraulic

lines (2). Plug ends of lines to prevent foreign material from entering the hydraulic

system. Remove cotter pin from drilled pin and remove the drilled pin from clevis. Remove connecting linkage (3). Remove the

nuts and lockwashers from the three cap-screws and remove the master cylinder

Disassembly

Remove the boot straps and remove the boot and connecting link.

Remove snap ring from bore in housing

and remove the piston stop, piston, secondary cup, primary cup and return spring. Remove check valve.

Reassembly

To reassemble the master cylinder, reverse the disassembly sequence as outlined above and the following information.

1. Clean all metal parts in a good cleaning solvent and dry thoroughly with compressed air. **WARNING:** Do not use solvent near an open flame.
2. Inspect boot for deterioration and damage, particularly in the creases. Extend and retract boot by hand to check flexibility. Replace boot if not in serviceable condition.
3. Inspect piston and cylinder bore for scoring, scratches and wear. Replace all worn or damaged parts.
4. After installation, move connecting link into master cylinder by hand. Connecting link should move approximately $1/32$ " before contacting piston. This distance is required

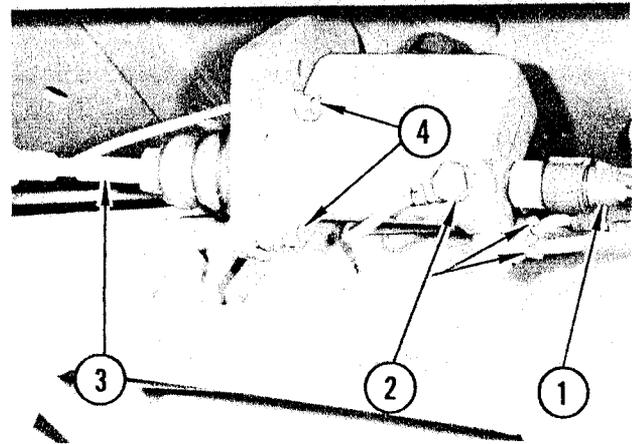


FIGURE 7. REMOVE MASTER CYLINDER

- | | |
|-----------------------|--------------------|
| 1. Stop Light Plug | 4. Nuts With Lock- |
| 2. Hydraulic Fittings | Washers |
| 3. Connecting Linkage | |

to prevent blocking of the by-pass port in the cylinder. To adjust travel of the connecting link, lengthen or shorten the brake linkage at the clevis.

POWER BRAKE (OPTIONAL)

General

The power brake valve gives a braking assist with oil flow and pressure furnished by the steering pump. This valve reduces

the braking effort considerably. Regular braking is also available when the hydraulic pump is not operating.

The brake valve does not interfere with the operation of the power steering system, nor does the power steering system affect the operation of the brake valve. Full pres-

sure is available at all times to operate the steering system. The brake valve requires a very small amount of hydraulic oil for its operation.

Removal

Disconnect all hydraulic lines. Plug ends of lines and fittings to prevent foreign material from entering the hydraulic system.

Remove cotter pin from drilled pin and remove drilled pin from clevis and bell crank. Remove threaded rod and clevis from valve push rod.

Remove three capscrews retaining valve assembly to main frame bracket and remove valve assembly.

NOTE: The master cylinder can be removed from the power cylinder without removing the power cylinder from grader. For the purpose of this manual, the assembly is removed as a complete unit.

Disassembly

Remove three capscrews and lockwashers and remove master cylinder from power cylinder.

Refer to Figure 8 for disassembly of the master cylinder.

Remove snap ring (1). Remove secondary cup (2) from piston (3). Remove "V" block packing (4) and "O" ring (5) from reaction piston (6).

cup (11), "U" cup retainer (12), piston return spring (13) and valve and seat (14) from cylinder bore of master cylinder body (15).

Refer to Figure 9 for disassembly of the power cylinder.

Remove push rod (1) and boot (2). Remove retaining ring (3) end cover (4) and remove "O" ring (5) from groove in end cover.

Remove retaining ring (10) from inside the reaction piston and remove check valve (7), spring (8) and retainer (9). Remove "U"

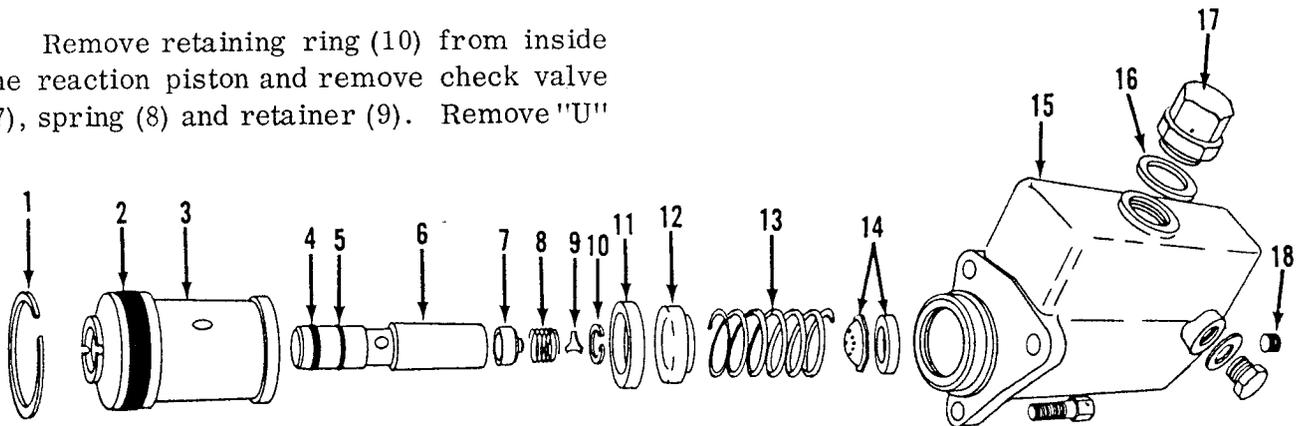


FIGURE 8. EXPLODED VIEW OF MASTER CYLINDER (POWER BRAKES)

- | | | | |
|----------------------|-----------------------------|--------------------------|------------------|
| 1. Retaining Ring | 6. Reaction Piston Assembly | 10. Retaining Ring | 14. Valve & Seat |
| 2. Secondary Cup | 7. Check Valve | 11. "U" Cup | 15. Cylinder |
| 3. Piston | 8. Spring | 12. "U" Cup Retainer | 16. Cap Gasket |
| 4. "V" Block Packing | 9. Retainer | 13. Piston Return Spring | 17. Cap |
| 5. "O" Ring | | | 18. Pipe Plug |

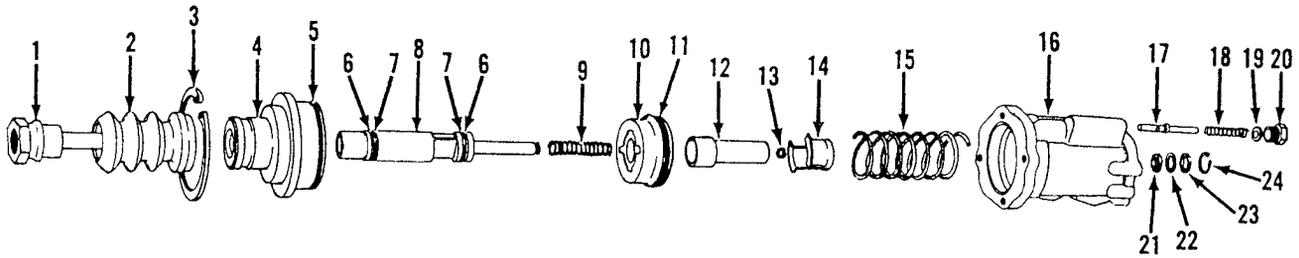


FIGURE 9. EXPLODED VIEW OF POWER CYLINDER

- | | | | |
|-------------------|---------------|---------------------|--------------------|
| 1. Push Rod | 7. "U" Cup | 13. Retaining Ring | 19. Gasket |
| 2. Boot | 8. Valve | 14. Spring Retainer | 20. Cap |
| 3. Retaining Ring | 9. Spring | 15. Return Spring | 21. "U" Cup |
| 4. End Cover | 10. Piston | 16. Cylinder Body | 22. Back-Up Washer |
| 5. "O" Ring | 11. "O" Ring | 17. By-Pass Valve | 23. Back-Up Ring |
| 6. Back-Up Washer | 12. Connector | 18. Valve Spring | 24. Snap Ring |

Remove back-up washers (6) and "U" cups (7) from valve (8). Remove spring (9). Remove piston (10) and remove "O" ring (11) from piston.

Remove connector (12), retaining ring (13), spring retainer (14) and return spring (15) from cylinder body (16).

Remove by-pass valve assembly consisting of valve (17), valve spring (18), gasket (19) and cap (20).

From bore of cylinder, remove snap ring (24); then remove "U" cup (21), back-up washer (22) and back-up ring (23).

Reassembly

To reassemble the power cylinder, refer to Figure 9 and reverse the sequence shown for disassembly, also the following information.

1. Clean all parts in a good solvent and dry with compressed air. Never use waste or soft cloths to clean internal parts. Lint from these will clog the small ports in the hydraulic circuit.
2. Replace all worn parts and all seals and gaskets. Apply hydraulic fluid to all parts at time of assembly.
3. Install "U" cup (21) with the "U" in cup toward inside of cylinder.
4. Install by-pass valve assembly in same order as shown in illustration.
5. Install piston return spring and spring retainer with taper of retainer inside spring.
6. Install "U" cup (7) and back-up washer (6) on valve (8) in groove near small end of valve. "U" in cup toward large end of valve. Back-up washer towards small end of valve.
7. Install spring (9) on small end of valve and install connector (12) over spring and retain with retainer ring (13).
8. Install piston (10) on valve with "O" ring (11) toward connector.
9. Install second "U" cup (7) and back-up washer (6) into groove on large end of valve with "U" in cup toward piston and back-up washer toward

push rod end of valve.

10. Insert valve and piston assembly into body. Connector end of valve to fit through hole in return spring retainer. Insert end cover over valve. Place assembly in arbor press and carefully press end cover down until retainer ring (3) can be installed.

To reassemble the master cylinder, refer to Figure 8 and reverse the sequence as shown for disassembly; also the following information.

1. Install valve and valve seat (14) into cylinder with seat going in first and point of valve away from seat.
2. Insert piston return spring (13) and

"U" cup retainer (12) into cylinder with hub of "U" cup retainer inside end of spring. Install "U" cup (11) over retainer.

3. Insert check valve (7), spring (8) and retainer (9) into reaction piston (6) and secure with retaining ring (10). Install "O" ring (5) and block "V" packing onto reaction piston with lip of "V" packing away from "O" ring.
4. Install secondary cup (2) onto piston (3) with lip of cup toward open end of piston.
5. Insert reaction piston assembly into piston (3) and insert the assembly into housing. Secure with retaining ring (1).

Installation

Install master cylinder onto power cylinder by reversing the removal instructions.

Install assembly onto grader by reversing the removal instructions.

When connecting threaded rod and clevis to the bell crank, thread the clevis onto

threaded rod until pin hole in clevis is short of alignment with pin hole in bell crank by 1/32" to 1/16". Install drilled pin and secure with cotter pin. Lock jam nuts on threaded rod.

Bleed brakes. Refer to instructions for bleeding brakes in this section.

PARKING BRAKE

Removal

To remove the parking brake from the lower shaft of lower transmission, it will be necessary to first remove the torque converter oil reservoir.

Remove eight capscrews and lockwashers retaining brake assembly adaptor and remove brake assembly. NOTE: It will be necessary to remove strut and strut spring in order to remove the two top capscrews.

Disassembly

Refer to Figure 10 and follow the numerical sequence for disassembly.

Remove strut (1) and strut spring (2). Remove the two brake shoe return springs

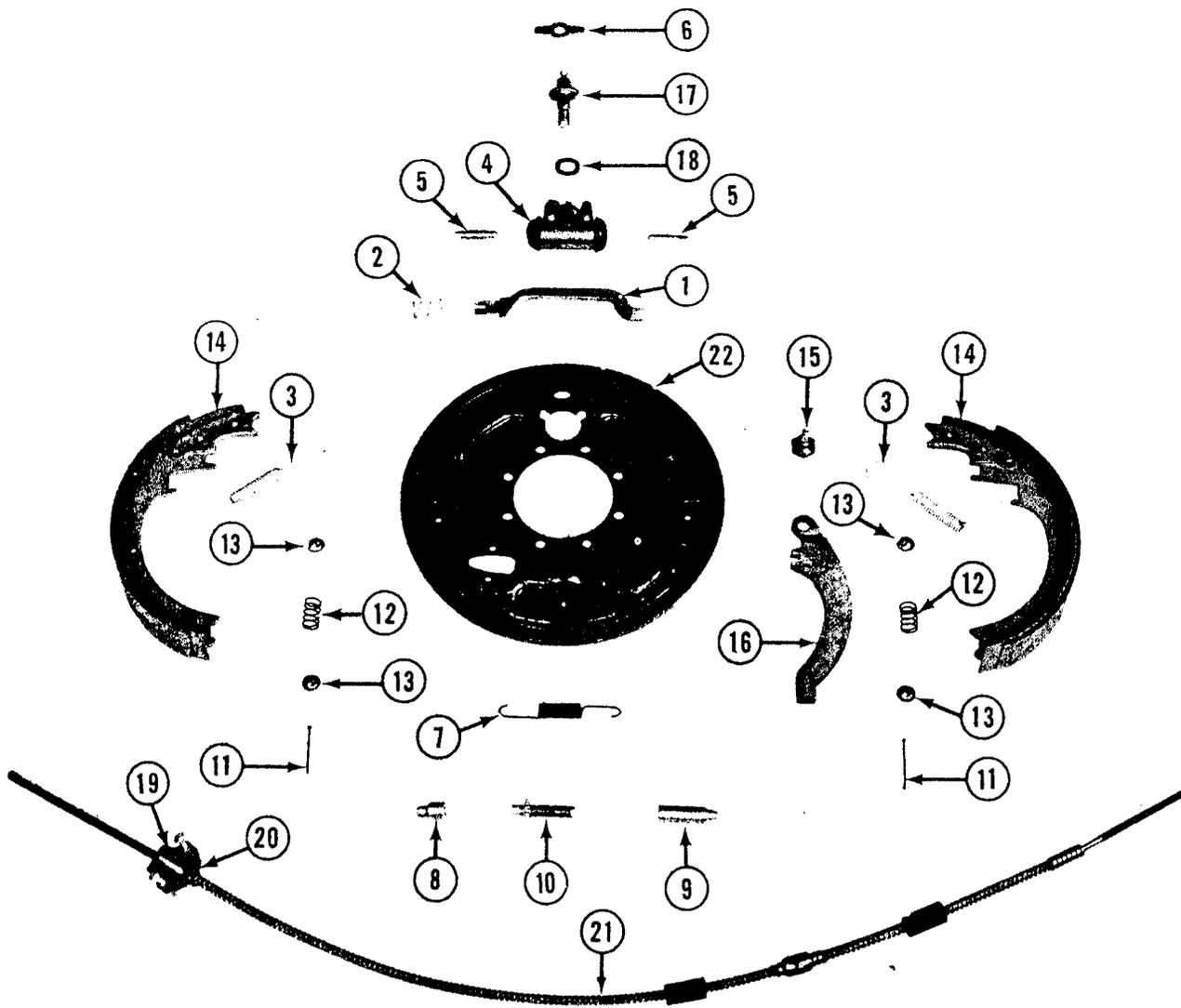


FIGURE 10. PARKING BRAKE ASSEMBLY

- | | | |
|-----------------------------|--------------------------------|-------------------------|
| 1. Strut | 9. Nut (Adjusting Screw Pivot) | 16. Brake Lever |
| 2. Spring (Strut to Shoe) | 10. Adjusting Screw | 17. Anchor Pin |
| 3. Springs (Anchor to Shoe) | 11. Pins (Hold Down) | 18. Washer (Anchor Pin) |
| 4. Cylinder | 12. Springs (Hold Down) | 19. Abutment Cap |
| 5. Connecting Links | 13. Cups (Hold Down Spring) | 20. Felt Seal |
| 6. Shoe Guide Plate | 14. Shoes | 21. Cable |
| 7. Spring (Adjusting Screw) | 15. Brake Lever Pin | 22. Backing Plate |
| 8. Socket (Adjusting Screw) | | |

(3). Remove two capscrews and washers retaining wheel cylinder (4) to backing plate and remove wheel cylinder. Refer to Page C-4 of this section for disassembly of wheel cylinder. Remove connecting links (5) from wheel cylinder (4). Remove shoe guide plate (6) from anchor pin (17). Remove adjusting screw

spring (7). Remove adjusting screw assembly, socket (8), nut (9) and adjusting screw (10). Remove shoe hold-down pins (11), spring cups (13) and springs (12). Remove brake shoes (14). Remove lever pin (15) from L.H. brake shoe (with reference to left side of grader) and remove brake lever (16). In

removing brake lever, unhook end of cable from slot in end of lever. Remove nut from anchor pin (17) and remove anchor pin and washer (18). Remove two capscrews retain-

ing abutment cap (19) to backing plate. Remove abutment cap and felt seal (20). Remove cable (21) from backing plate (22).

Reassembly

Reassembly will be the reverse of the numerical sequence as outlined in Figure 10.

Figure 11 shows the parking brake as-

sembly ready to be installed. The strut and strut spring will have to be removed to install the two top backing plate capscrews.

Adjustment

Loosen locknut on anchor bolt. Remove cover plate from slot in backing plate. Insert adjusting tool through slot and contact toothed wheel of adjusting screw.

Turn adjusting screw until brake shoes move out against drum. Tap around outside of drum to center brake shoes. Tighten locknut on anchor bolt. Back off adjusting screw six or eight notches of adjusting screw.

Install cover plate in slot in backing plate.

Attach cable turnbuckle to bell crank. Adjust turnbuckle so that parking brake is fully applied when hand lever moves less than 1/2 its length of travel.

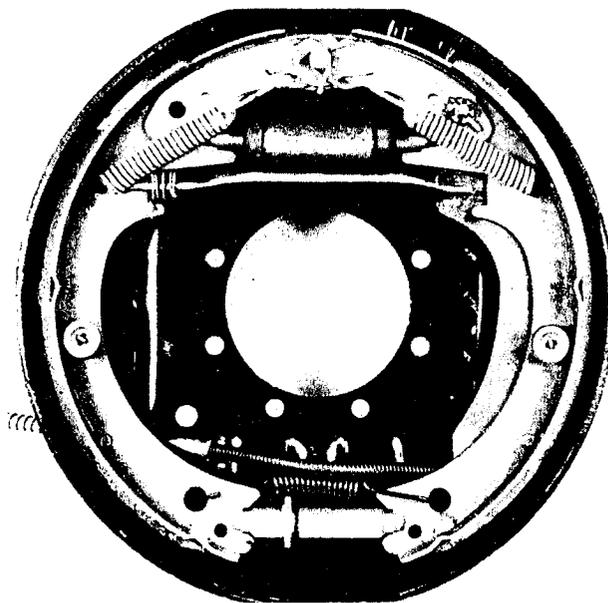


FIGURE 11. PARKING BRAKE ASSEMBLED

TROUBLE SHOOTING

TROUBLE: Brake pedal goes all the way to floor.

CAUSE: Normal wear of brake linings.

REMEDY: Replace brake lining.

CAUSE: Insufficient hydraulic fluid.

REMEDY: A. Repair master cylinder.

B. Replace or repair flow control valve.

C. Replace or repair steering pump. NOTE: If steering circuit operates satisfactorily, the trouble is not likely to be in pump or flow control valve.

TROUBLE: Springy or spongy pedal.

CAUSE: Brake shoes improperly adjusted.

REMEDY: Operate grader in reverse and apply brakes several times to adjust brakes.

CAUSE: Air in hydraulic system.

REMEDY: Bleed air from system.

TROUBLE: Poor brakes.

CAUSE: Brake shoes improperly adjusted.

REMEDY: Adjust brakes as outlined above.

CAUSE: Partial contact between linings and drum.

REMEDY: Requires grinding of linings or turning of drums on lathe.

CAUSE: Oil or hydraulic fluid on linings.

REMEDY: Repair wheel cylinders and wash linings thoroughly with carbon-tet.

CAUSE: Glazing of lining.

REMEDY: Run grader at maximum speed. Apply brakes as hard as possible several times.

REMEDY: Apply brakes several times while grader is moving. This will generate enough heat to remove water.

TIRES

TIRE HANDLING

Proper handling and correct procedure in mounting, servicing and maintenance are essential to obtain all the advantages of tubeless tires. The following information has been prepared for this purpose.

Tires should be stored and transported in a vertical position. Horizontal storing may make initial inflation difficult.

Do not lift tires by the beads with hooks or forks unless forks are saddle type construction. Sharp hooks or forks may tear, cut or snag the tubeless tire beads and result in leaks at these points. The beads should be protected and the tire should be handled with a rope around the outside.

Any foreign material or moisture should be removed from inside the tire.

RIMS

Tubeless tire rims perform an important function as part of the assembly air seal. Proper care must be taken not to distort or damage the rim parts as they must mate properly to form part of the basic air chamber.

Never lift the rim by using the valve hole.



FIG. 12. LOCKING RING

Never drop, tumble, or roll rim parts.

If rim parts are to be stored outside exposed to the weather, it is recommended they be given a protective coating of good commercial primer paint.

Babbitt or lead hammers should be used in assembling rim parts.

"O" ring seals for tubeless tires should be carefully stored in a cool, dry place and where they will not become damaged.

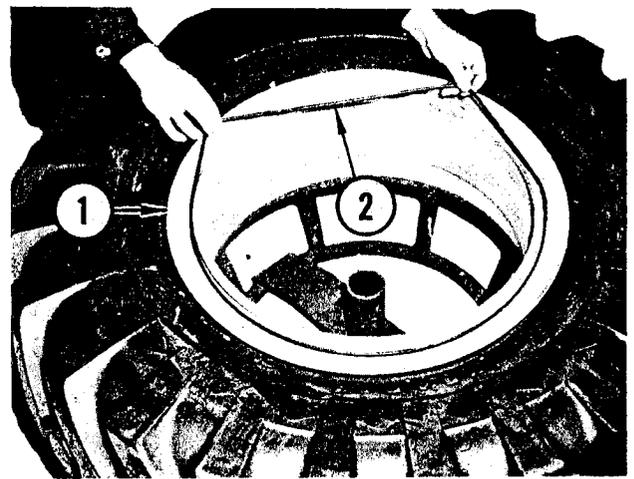


FIG. 13. "O" RING REMOVAL

1. Flange Ring 2. "O" Ring

TIRE REMOVAL

Remove the valve core and exhaust off all air before starting to remove the tire.

After complete deflation, place the assembly on the floor with loose ring side up. Starting opposite the valve, break the tire bead loose from the flange ring by tapping the flat ends of two tire tools between the tire and the flange about 5 inches apart.

Pry both tools outward. Leave one tool in position, place second tool about 5 inches beyond and pry outward again. Repeat this operation in successive steps until the bead is completely broken loose.

After the bead is broken loose, stand on the flange ring and tire side wall to depress the flange ring down along rim base. Using the straight end of tire tool pry loose the locking ring.

Pry around locking ring until it is free of groove in wheel.

Figure 12 shows locking ring being removed.

Force flange ring down far enough to permit removal of "O" ring, Figure 13.

Remove flange ring, Figure 14.

Turn the tire and rim base over. Break the tire bead from the rim flange in same



FIG. 14. FLANGE REMOVAL

1. Base 2. Flange Ring

manner as described previously for flange ring. After bead is completely broken loose, remove tire from rim base.

Remove valve from rim base.

TIRE MOUNTING

Clean rim base thoroughly of all dirt and rust. Wire brush the "O" ring groove and locking groove until there is absolutely no foreign matter in these grooves. Take

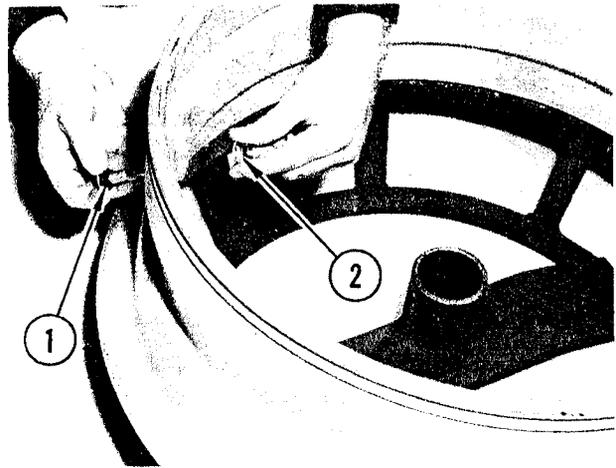


FIG. 15. INSTALLING VALVE

1. Valve & Grommet 2. Nut & Washer

particular precaution around valve opening in rim base.

Install valve in rim base and lock in place with nut.

Place the rim base on the floor with the rim side down. Place the tire over the rim base.

Place the side flange ring over the rim base and push down as far as possible, making sure the flange ring does not bind on rim base.

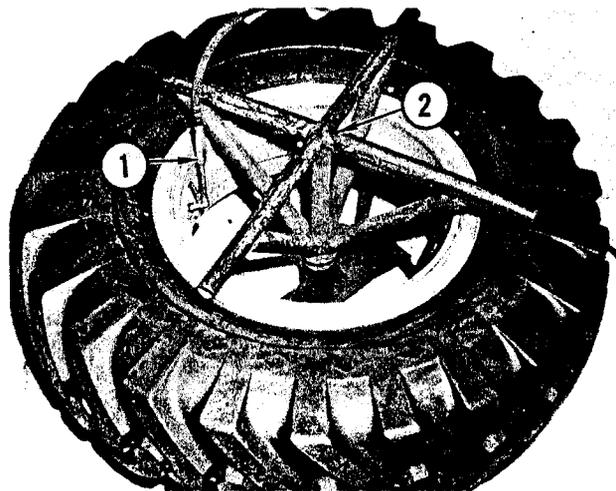


FIG. 16. INFLATING TIRE

1. Air Hose 2. Safety Device



FRONT TIRE

REAR TIRE

FIG. 17. TREAD ROTATION

Stand on flange ring to position it below the two grooves in the rim base. Lubricate the "O" ring thoroughly and install in groove.

Snap the lock ring into position in the outside groove. Make certain lock ring is entirely in groove.

Pull flange ring up until it is over "O" ring.

Inflate the tire to 50 - 75 psi to seat the beads against the flange; then reduce to the recommended pressure. If necessary, lift the tire upwards by the tread to effect a seal between the flange and "O" ring.

CAUTION: It is recommended that a protective device of some type be used when inflating the tire in case locking ring should blow off due to improper seating. Never stand in front of or over tire and wheel when inflating. Figure 16.

TIRE INFLATION CHART

Model 666B (Standard & Power Flow)

STANDARD SIZE

13.00 x 24, 12 PR, Traction (G-2) Front & Rear 35 lbs.

OPTIONAL SIZES

14.00 x 24, 10 PR, Traction (G-2) Front & Rear 30 lbs.

14.00 x 24, 12 PR, Traction (G-2) Front & Rear 35 lbs.

17.5 x 25, 12 PR, Traction (L-2) Front & Rear. 25 lbs.

Model 777B (Standard & Power Flow)

STANDARD SIZE

14.00 x 24, 12 PR, Traction (G-2) Front & Rear 35 lbs.

OPTIONAL SIZES

16.00 x 24, 12 PR, Traction (G-2) Front & Rear 30 lbs.

17.5 x 25, 12 PR, Traction (L-2) Front & Rear. 25 lbs.

NOTE: For maintenance work on established highways, inflation pressures may be increased 25% if desired.

SECTION D

MOLDBOARD AND CONTROLS

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BLADE LIFT GEAR HOUSING ASSEMBLIESD- 2

CIRCLE REVERSE GEAR HOUSING ASSEMBLYD- 6

MOLDBOARD, CIRCLE AND DRAWBAR

 Moldboard CylindersD- 9

 Slide Shift CylinderD-10

 Tilt PlateD-11

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ROTARY VALVE.D-12

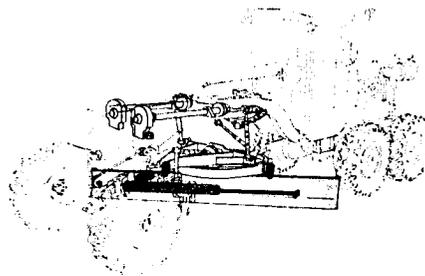
CIRCLED-13

DRAWBARD-14

LATERAL SHIFTD-15

RACKD-18

TROUBLE SHOOTINGD-20



BLADE LIFT GEAR HOUSING ASSEMBLIES

The blade lifts are operated by hydraulic motors controlled by the operator using valve control levers. The motors are powered by a hydraulic pump which is driven by the PTO shaft which is turning anytime engine is operating. The hydraulic pump turns approximately 2600 RPM with an engine speed of 2000 RPM. The hydraulic motors turn on a one to one ratio with the pump, which would mean that the motors are turn-

ing at pump speed with the exception of minor leakage which would exist in either the motor or the pump.

As all the hydraulic motors used in controlling blade movements are identical, the disassembly and reassembly of them will be covered completely in the hydraulic section of this manual.

Removal

Remove two capscrews and lockwashers from front cover. Raise cover to full height to permit removal of hydraulic hose and motors. Make certain safety latch is in position over lower end of support.

Remove hydraulic hose and copper tube from pump fittings. Plug all hydraulic lines to prevent foreign matter getting into system.

Refer to Figure 1. Remove two capscrews and lockwashers retaining motor to adapter. Remove motor assembly (1) and gasket (2) by pulling straight forward on motor until splines on motor shaft have cleared

splines in splined coupling (3). Remove splined coupling.

Refer to Figure 2. Loosen nuts (1) on clamping bolts. Drive chisel (2) into slot of lift arm (3) hub to open bore of hub. Remove lift arm by sliding it off end of shaft. Remove clamping bolts from blade lift limit valve actuator arms (4) and remove actuator arms (4) from lift shaft.

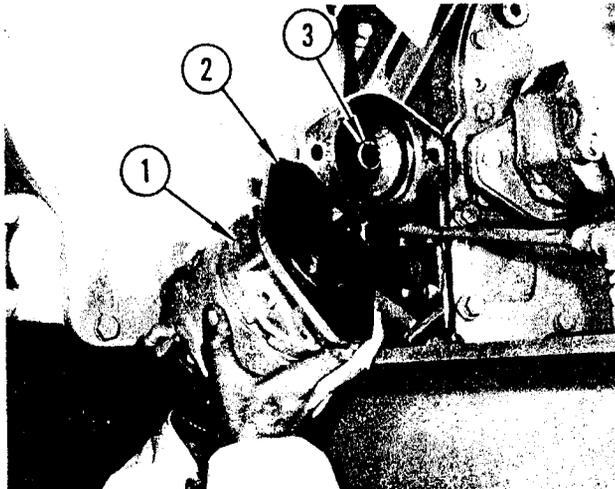


FIGURE 1. BLADE LIFT HYDRAULIC MOTOR

- | | |
|--------------------------|--------------------------|
| 1. R.H. Blade Lift Motor | 3. Coupling |
| 2. Gasket | 4. L.H. Blade Lift Motor |

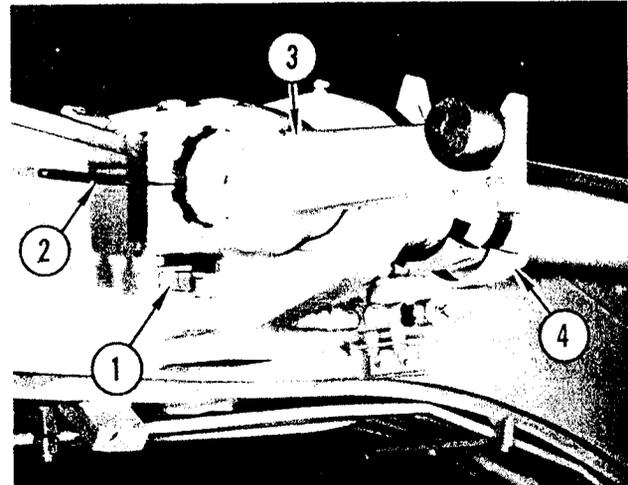


FIGURE 2. LIFT ARM REMOVAL

- | | |
|-----------|-----------------|
| 1. Nuts | 3. Lift Arm |
| 2. Chisel | 4. Actuator Arm |

Attach chain sling and hoist to blade lift shaft at point about 14 inches to the rear of blade lift housing hub. Refer to Figure 3. Remove two capscrews and lockwashers (1) and remove bearing cap (2). Remove nut (3)

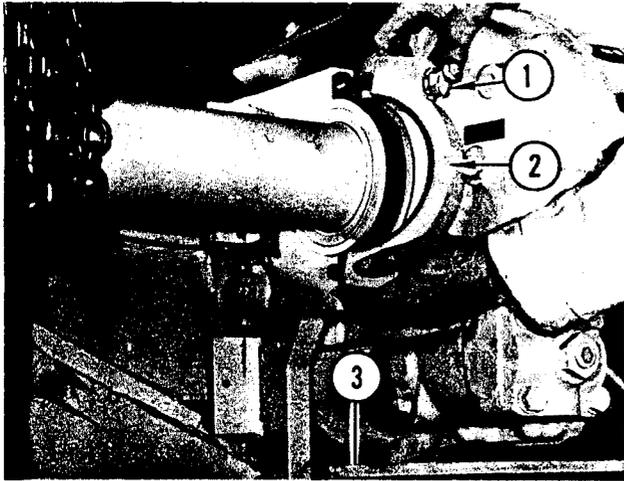


FIGURE 3. BLADE LIFT SHAFT

- | | | |
|-------------------------------|----------------|--------------------|
| 1. Capscrews &
Lockwashers | 2. Bearing Cap | 3. Torque Bolt Nut |
|-------------------------------|----------------|--------------------|

from torque bolt and remove torque bolt and spacer.

Take up slack on chain hoist. Rotate lift gear housing counterclockwise and at same time, swing gear housing end of shaft away from main frame until torque bolt boss

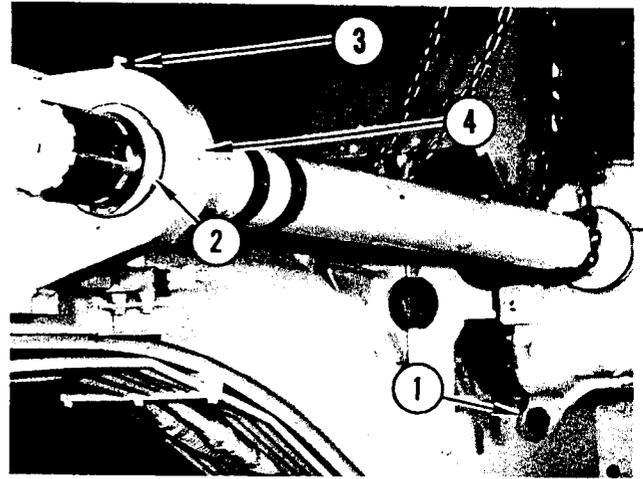


FIGURE 4. BLADE LIFT ASSEMBLY

- | | |
|---------------------|--------------------|
| 1. Torque Bolt Boss | 3. Grease Fitting |
| 2. Bearing | 4. Bearing Housing |

(1), Figure 4, will clear main frame. Pull forward on assembly until end of lift shaft clears bearing (2).

Remove lubrication fittings (3) from lift shaft bearing housing (4). Rotate the bronze bearing (2) to a horizontal position and remove from housing.

Disassembly

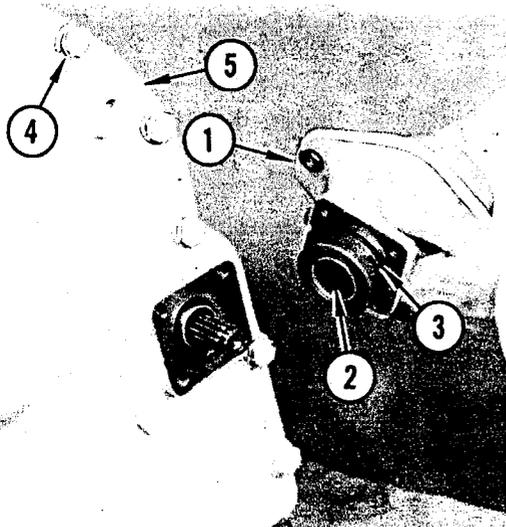


FIGURE 5. REMOVE MOTOR ADAPTER

- | | |
|----------------|--------------|
| 1. Adapter | 4. Capscrews |
| 2. Bearing Cup | 5. Housing |
| 3. "O" Ring | |

Refer to Figure 5. Remove four capscrews and lockwashers retaining hydraulic motor adapter (1) to gear housing cover. Remove adapter. Remove bearing cup (2) from bore of adapter. Remove "O" ring (3) from hub of adapter. Remove fifteen capscrews and lockwashers (4) retaining cover (5) to gear housing. Remove cover and gasket.

Refer to Figure 6 and follow the numerical sequence for disassembly of the first reduction group. Items (1) and (2) were previously removed under Figure 5.

Rotate the splined end of first reduction worm shaft so that the assembly will be forced out of gear housing through the cover opening.

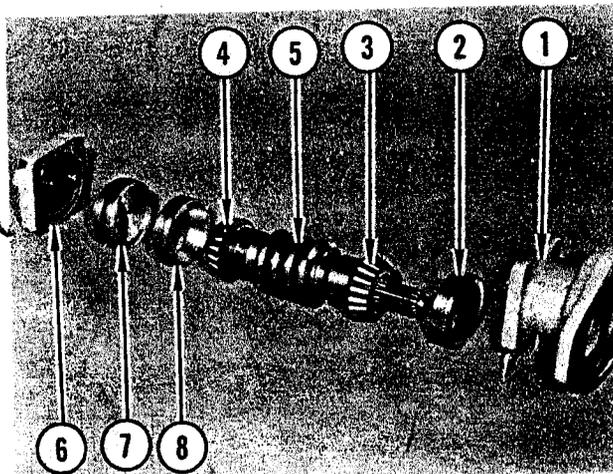


FIGURE 6. BLADE LIFT FIRST REDUCTION GROUP

- | | |
|-----------------------------|--------------------------|
| 1. Adapter | 6. Bearing Adjusting Cap |
| 2. Bearing Cup | 7. Bearing Retainer |
| 3. Bearing Cone | 8. Bearing Cup |
| 4. Bearing Cone | |
| 5. 1st Reduction Worm Shaft | |

Press or pull the two bearing cones (3) and (4) from the ends of the worm shaft (5).

Loosen jam nut on thrust adjusting screw and remove the adjusting screw from bearing adjusting cap (6). Remove dowel pin from cap.

Remove bearing retainer (7) from bore in gear housing and remove "O" ring from retainer. Remove bearing cup (8) from bore in gear housing.

Refer to Figure 7 for numerical sequence disassembly of second reduction group. Remove four capscrews and lockwashers (1). Remove thrust bearing adjusting cap (2) and remove adjusting setscrew from cap. Remove bearing retainer (3) and remove "O" ring from retainer. Remove four stud nuts and lockwashers from worm thrust cap (4). Remove thrust cap and remove "O" ring from thrust cap. Place a block of wood between spiral gear (5) and inner wall of housing. Using a brass drift, drive worm shaft from hub of spiral gear and remove gear

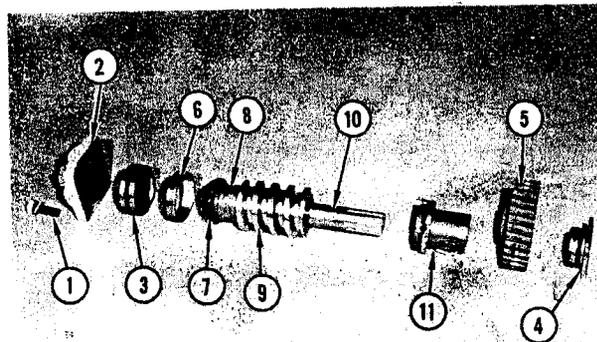


FIGURE 7. 2ND REDUCTION GROUP

- | | |
|----------------------------------|-------------------------|
| 1. Capscrews & Lockwashers | 7. Roller Bearing Cone |
| 2. Adjusting Cap | 8. Spacer |
| 3. Bearing Retainer Without Ring | 9. Worm |
| 4. Worm Thrust Cap | 10. Worm Gear Shaft |
| 5. Spiral Gear | 11. Worm Thrust Bearing |
| 6. Roller Bearing Cup | |

from housing. Remove roller bearing cup (6), roller bearing cone (7), spacer (8). Place worm (9) and shaft (10) in arbor press and press worm from shaft. Remove two

Woodruff keys from shaft. Remove worm thrust bearing from bore in inner wall of gear housing.

Refer to Figure 8. Move gear housing (1) back on lift shaft far enough to permit in-

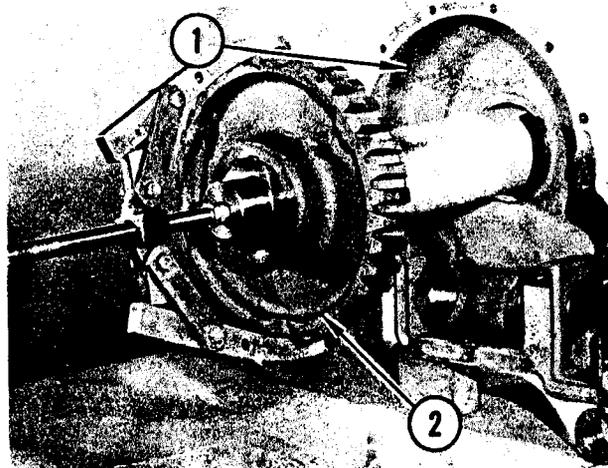


FIGURE 8. LIFT GEAR REMOVAL

- | | |
|------------|--------------|
| 1. Housing | 2. Lift Gear |
|------------|--------------|

stalling puller on blade lift gear (2). Remove gear. Remove housing from lift shaft.

Remove oil seal from lift gear housing. Press or drive bushing from bore of housing.

Reassembly

Reassembly will be the reverse of the disassembly sequence and the following information.

1. Thoroughly clean splines on blade lift shaft and in blade lift gear hub. Heat gear in hot oil, 350° to 375°, and drive or press gear onto shaft until splines on shaft are slightly under flush with bull gear hub. Short hub of gear goes on shaft first.
2. When installing gear housing onto lift shaft, use extreme care not to damage oil seal in housing bore.
3. Press worm shaft (machined end) into worm until shaft extends 2-9/32" from face of worm.
4. Refer to Figure 9. Insert torque bolt (1) through torque boss on main frame just far enough to install spacer (2). Swing blade lift assem-

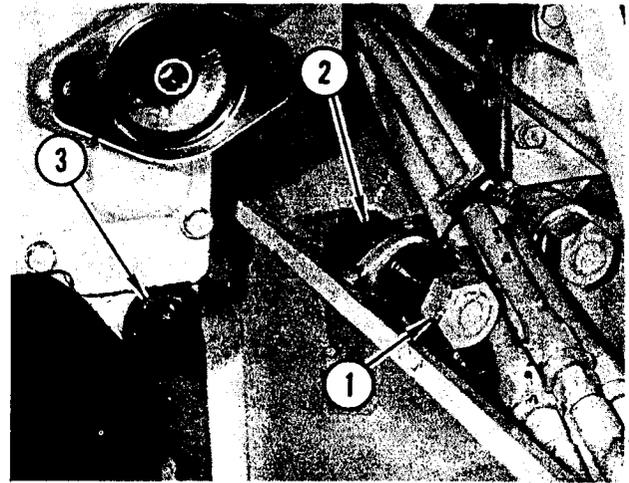


FIGURE 9. TORQUE BOLT INSTALLATION
1. Torque Bolt 2. Spacer 3. Boss

bly into position. Rotate gear housing until torque bolt boss (3) on gear housing will swing into alignment with torque bolt. Install nut on torque bolt and tighten. No adjustment will be necessary to turn torque bolt in order to tighten nut.

Adjustments

THRUST BEARING

Loosen locknut on adjustment screw in first reduction bearing adjusting cap. With Allen wrench, tighten adjusting screw as tight as possible, using only the Allen wrench, then back off adjusting screw 1/16 of a turn. Tighten locknut to a torque of 130 ft. lbs.

Loosen locknut on adjustment screw in second reduction bearing adjusting cap.

Using an Allen wrench, tighten the adjusting screw as tight as possible using only the Allen wrench. Back off adjusting screw 1/16 of a turn and tighten locknut to a torque of 250 ft. lbs.

LIFT LIMIT VALVE

Limit valves are installed in the hydraulic circuits controlling the blade lifts. Two valves for each blade lift; one for each direction of travel.

As the blade lift arm nears the extreme end of its travel, an actuator arm on the blade lift shaft contacts adjusting screw on limit valve spool causing valve to open and permit the hydraulic oil to bypass the hydraulic motor on the blade lift gear housing.

Disconnect adjustable lift link from the blade lift arm. Loosen clamp bolts on both actuator arms.

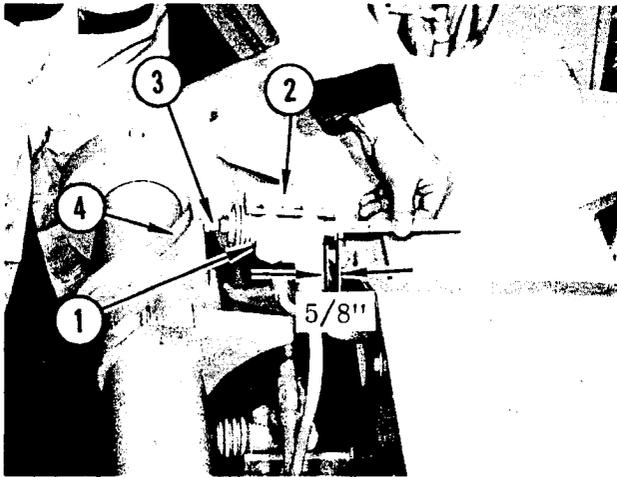


FIGURE 10. LIMIT VALVE ADJUSTMENT
 1. Valve 3. Adjusting Screw
 2. Angle Clip 4. Actuator Arm

Refer to Figure 10. Start engine and, using blade lift controls, rotate blade lift until lift arm is against stop on main frame. Mount limit valve (1) on angle clip (2) with valve retaining capscrews located in center position of slots in angle. Loosen locknut on adjusting screw (3). Turn adjusting screw until 1/2" or 3/4" of threads on adjusting screw have been turned into valve spool. Tighten locknut. Rotate actuator arm (4) against adjusting screw until valve spool extends 5/8" past end of housing. Tighten clamp bolts on actuator arm.

Start engine and operate blade lift to move lift arm around to opposite stop on main frame. Adjust the second limit valve in same manner as outlined above.

CIRCLE REVERSE GEAR HOUSING ASSEMBLY

Removal

Disconnect all hydraulic lines to hydraulic motor. Plug all hydraulic fittings to prevent foreign matter from entering the hydraulic system.

Remove two capscrews and lockwashers retaining hydraulic motor to circle reverse gear housing (1) and remove hydraulic motor (2), Figure 11. Servicing the motor will be covered in the hydraulic section of this manual.

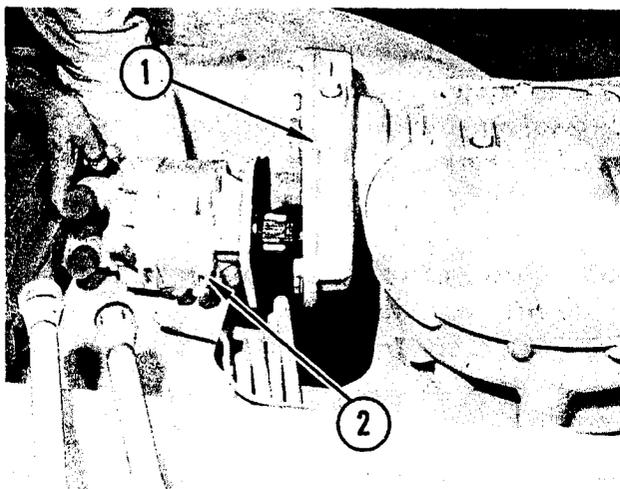


FIGURE 11. CIRCLE REVERSE HYDRAULIC MOTOR
 1. Housing 2. Motor

Remove nuts and lockwashers from five studs on under side of drawbar, see arrows, Figure 12. Remove the five studs from the gear housing. If a stud remover is not available, use double nuts to remove studs.

Attach sling and hoist to gear housing (1) and lift assembly from drawbar, Figure 13. As housing is lifted, tilt top of housing toward front of grader to get pinion (2) clear of circle gear.

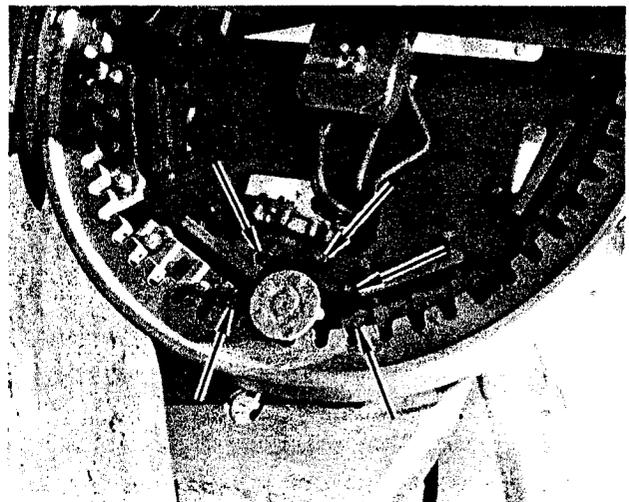


FIGURE 12. GEAR HOUSING MOUNTING CAPSCREWS

Disassembly

Drain all lubricant from reduction housing and circle reverse housing.

Thoroughly clean exterior of assembly and place on work bench for disassembly.

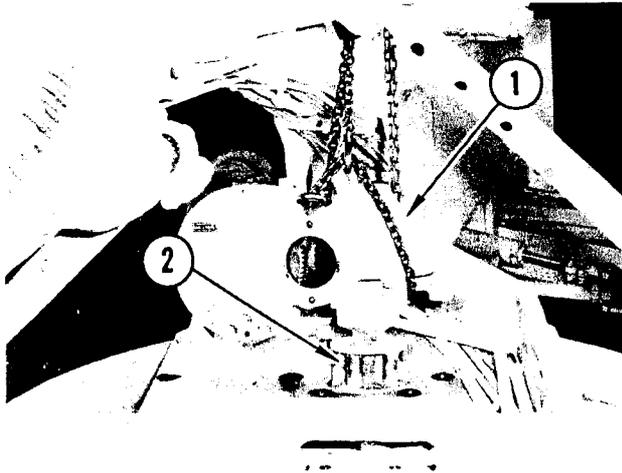


FIGURE 13. GEAR HOUSING REMOVAL

1. Housing 2. Pinion

Refer to Figure 14 and follow the numerical sequence for disassembly.

Remove thirteen capscrews and lockwashers (1) from cover (2) and remove cover and gasket. It will be necessary to drive out the two cover dowels before cover can be removed. Remove bushing from bore in cover.

Remove eleven capscrews and lockwashers from reduction housing cover (3). Remove cover and gasket (4). Remove 72 tooth gear (5).

Remove four setscrews and lockwashers from thrust bearing adjusting cap (6). Remove cap. Remove adjusting capscrew and jam nut from cap.

Remove worm thrust bearing (7) from bore in housing. Remove "O" ring (8) from bearing. If bushing in bearing is worn or damaged, remove bushing from bearing.

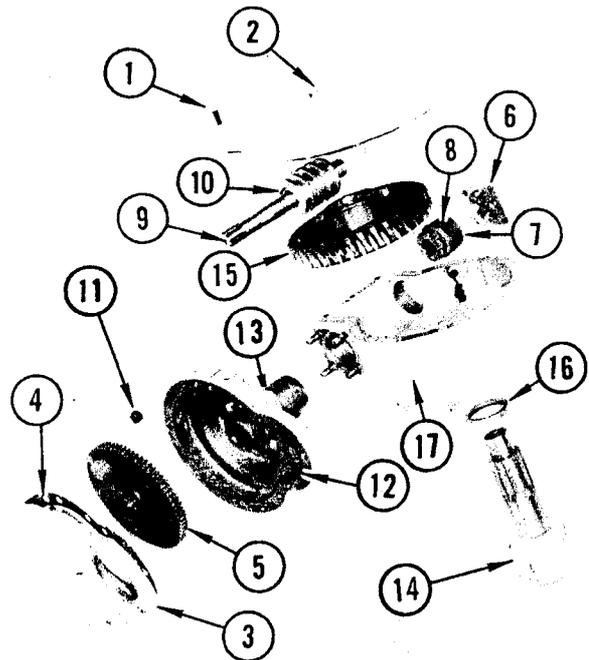


FIGURE 14. CIRCLE REVERSE HOUSING

- | | |
|--------------|---------------|
| 1. Capscrews | 10. Worm |
| 2. Cover | 11. Stud Nuts |
| 3. Cover | 12. Housing |
| 4. Gasket | 13. "O" Ring |
| 5. Gear | 14. Shaft |
| 6. Cap | 15. Worm Gear |
| 7. Bearing | 16. Oil Seal |
| 8. "O" Ring | 17. Housing |
| 9. Shaft | |

Remove worm shaft assembly (9) from housing through thrust bearing bore. Press worm (10) from shaft. Remove two Woodruff keys from shaft.

Remove four tapered stud nuts (11) from inside reduction housing (12). Remove reduction housing. Remove "O" ring (13) from reduction housing hub. Inspect the two bushings in hub of reduction housing. If bushings are worn or damaged, remove them and remove spacer located between the two bushings.

Place blocks under hub of gear housing and press or drive pinion shaft (14) from worm gear (15).

Press or drive oil seal (16) from hub of gear housing (17). Inspect bushing in gear

housing hub. If worn or damaged, press or drive bushing from hub.

Reassembly and Installation

Reassembly will be the reverse of the numerical sequence for disassembly and the following information.

1. Heat worm gear in hot oil, 350° to 375°, and press or drive on pinion shaft after shaft has been installed in gear housing. Short hub of worm gear goes on shaft first. Press or drive gear until face of long hub is flush with machined shoulder of shaft.
2. If the two bushings were removed from reduction housing hub, press new bushing into hub from one end of hub until bushing is flush with face of hub. From opposite end of hub install spacer and press the other new bushing into hub until flush with face of hub.
3. Press worm shaft into worm until machined end of shaft extends through worm a distance of 2-1/32".

4. If bushing was removed from gear housing cover, press new bushing into cover bore until flush or slightly under flush.

Installation of the circle reverse will be the reverse of the removal procedure.

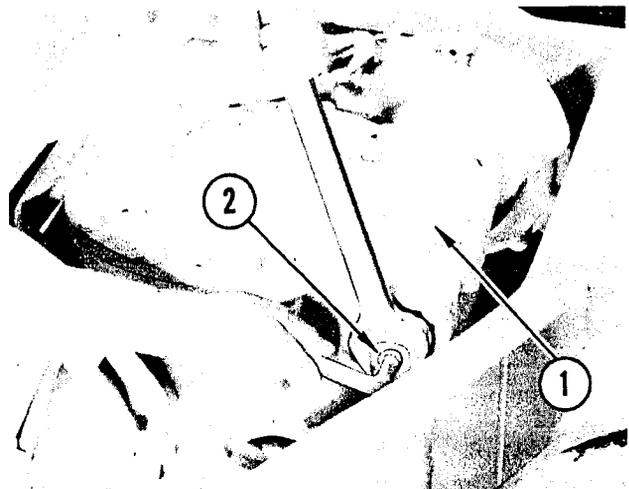


FIGURE 15. THRUST BEARING
ADJUSTMENT

1. Circle Reverse Housing
2. Adjusting Screw

Adjustment

To make thrust bearing adjustment, loosen jam nut on adjusting screw. Using an Allen wrench, tighten adjusting screw as much as possible using only the Allen wrench.

Back off adjusting screw 1/16 of a turn. Tighten jam nut to a torque of 250 ft. lbs., Figure 15.

MOLDBOARD, CIRCLE AND DRAWBAR

MOLDBOARD CYLINDERS

Removal

TILT CYLINDER

Disconnect both hydraulic hose. Plug hydraulic fittings to prevent foreign matter from entering hydraulic system.

Refer to Figure 16. Remove nuts and lockwashers (1) from link cap retaining capscrews. Remove capscrews. Remove link

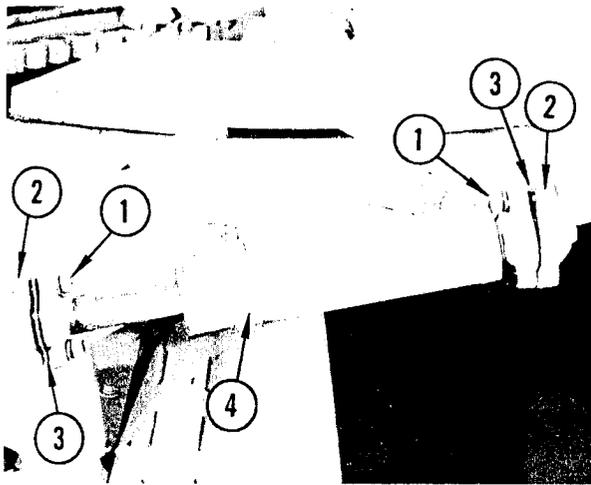


FIGURE 16. TILT CYLINDER REMOVAL

- | | |
|-----------------------|-------------|
| 1. Nuts & Lockwashers | 3. Shims |
| 2. Caps | 4. Cylinder |

caps (2) and shims (3). Remove cylinder assembly (4) from circle. Repeat procedure for removal of opposite cylinder.

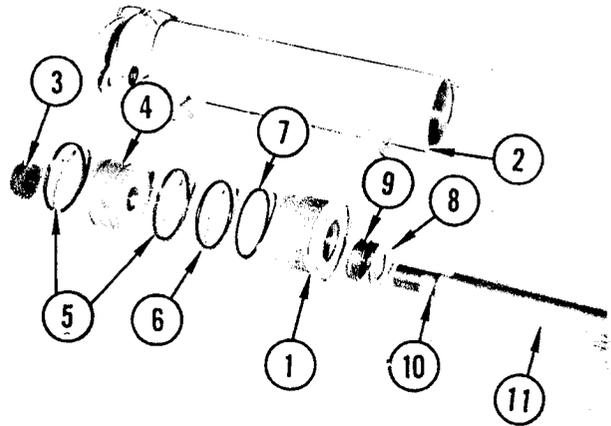


FIGURE 17. TILT CYLINDER DISASSEMBLY

- | | |
|------------------|-----------------|
| 1. Packing Gland | 7. Back-Up Ring |
| 2. Cylinder | 8. Wiper |
| 3. Nut | 9. Packing |
| 4. Piston | 10. "O" Ring |
| 5. Rings | 11. Piston Rod |
| 6. "O" Rings | |

Disassembly

Refer to Figure 17. Unscrew packing gland (1) from cylinder (2). Pull piston rod assembly from cylinder. Remove nut (3) from piston rod. Remove piston (4) from piston rod and remove piston rings (5) from

piston. Remove packing gland (1) from piston rod. Remove "O" ring (6) and back-up ring (7) from gland. Remove wiper (8) and packing (9) from bore of gland. Remove "O" ring (10) from groove in piston rod (11).

Reassembly

Reassembly of moldboard tilt cylinder will be the reverse of disassembly and the following information.

1. Check inside of cylinder for wear, grooves or burrs. Clean thoroughly. Coat walls with light coat of oil.

2. Install new "O" rings and packing. Lubricate packing and "O" rings before installing. Use industrial vasoline or a vegetable shortening if available.
3. Remove any nicks or burrs from piston rod.

Installation

Installation of moldboard tilt cylinder will be the reverse of removal and the following information.

1. Ball caps are provided with laminated shims to take care of wear.

After tightening nuts of ball cap capscrews, there should be no free play between cap and ball. Peel off shims until all free play is eliminated. Do not peel off more shims than required.

Removal

SLIDE SHIFT CYLINDER

Disconnect hydraulic lines from each end of slide shift cylinder. Plug hydraulic fittings to prevent foreign material from entering hydraulic system.

Refer to Figure 18. Remove hex nut (1) and tilt washer (2). Remove shim (3) and tilt roller (4). Remove cotter pin and slotted nut (5). Remove cylinder ball cap (6). Remove capscrews and lockwashers from each upper corner of cylinder shield (7) and remove shield.

Remove hex nut and lockwasher from threaded bolt and pry R.H. tilt plate away from circle leg. Move tilt plate to right until it can be removed from slide bar and angle slide.

Remove piston rod ball cap from ball on left end of moldboard. Move slide shift cylinder

out from between circle legs and moldboard.

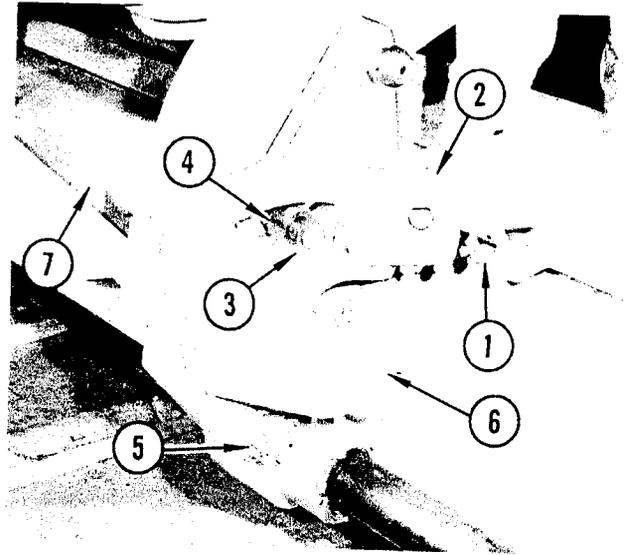


FIGURE 18. TILT PLATE REMOVAL

- | | |
|----------------|----------------|
| 1. Hex Nut | 5. Slotted Nut |
| 2. Tilt Washer | 6. Cap |
| 3. Shim | 7. Shield |
| 4. Roller | |

Disassembly

Using a spanner wrench unscrew stuffing box assembly from cylinder. Pull piston rod assembly, consisting of piston rod, piston assembly and stuffing box assembly, from cylinder. If compressed air is available, hold air hose to hydraulic fitting at closed end of cylinder. Admit air into cylinder slowly. Piston assembly will be forced from cylinder.

Refer to Figure 19. Remove cotter pin (1) from drilled nut (2) and remove nut from piston rod. Remove piston half (3), packing set (4), center section (5), packing set (6)

and piston half (7). Remove two "O" rings (8) from piston rod (9).

Remove stuffing box assembly from piston rod. Follow the numerical sequence of Figure 20 to disassemble stuffing box.

Remove locking setscrew (1). Using a spanner wrench, remove packing gland (2). Remove wiper ring (3) from bore of packing gland. Remove packing set (4) from bore of stuffing box. Remove bushing (5). Remove "O" ring (6) from groove in stuffing box (7).

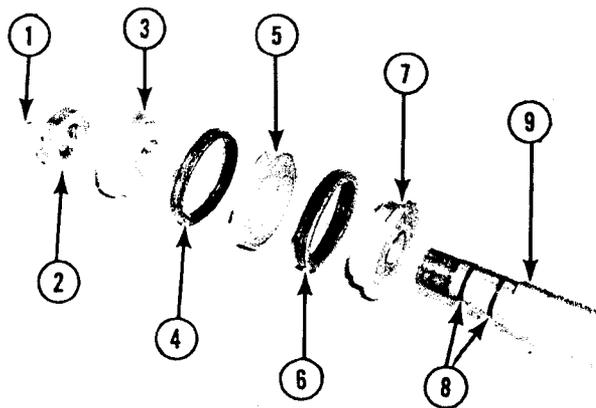


FIGURE 19. SLIDE SHIFT CYLINDER

- | | |
|-------------------|----------------|
| 1. Cotter Pin | 6. Packing Set |
| 2. Nut | 7. Piston Half |
| 3. Piston Half | 8. "O" Rings |
| 4. Packing Set | 9. Piston Rod |
| 5. Center Section | |

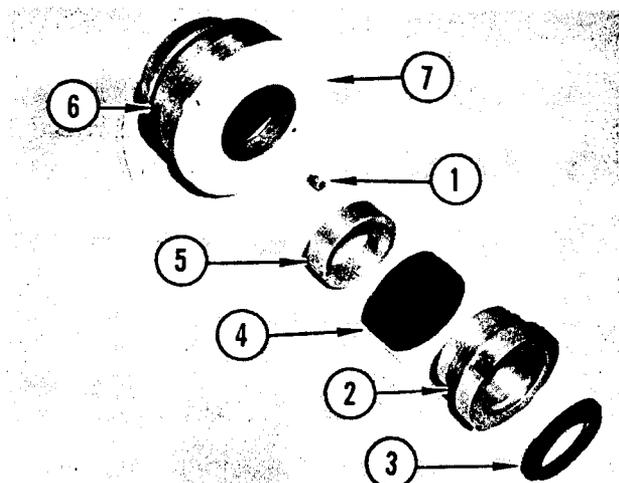


FIGURE 20. STUFFING BOX

- | | |
|---------------------|-----------------|
| 1. Locking Setscrew | 5. Bushing |
| 2. Packing Gland | 6. "O" Ring |
| 3. Wiper Ring | 7. Stuffing Box |
| 4. Packing Set | |

Reassembly

Reassembly of the slide shift cylinder will be the reverse of the disassembly sequence and the following information.

1. Assemble packing gland, packing set, bushing and stuffing box on piston rod separately until piston rod and piston have been installed in cylinder. The packing set consists of cup shaped rings. The lip of the cups must be away from the packing gland when installed.

2. Install piston packing sets with lip of cups in first half section away from threaded end of piston rod. The lip of second half section toward threaded end of piston rod.
3. Wrap thin shim stock around piston set, to facilitate installing piston into cylinder. Remove shim stock when piston is all the way in cylinder.

Installation

To install slide shift cylinder onto moldboard, reverse the sequence for removal.

Disassembly

TILT PLATE

Remove four capscrews and lockwashers and remove retainer plate from tilt plate.

Press or drive bushing from tilt plate.

Remove square key from bushing. Remove zerk fitting from hub of tilt plate. Press or drive bushing from tilt plate. Disassembly procedure for L.H. and R.H. tilt plates is identical.

Reassembly

The reassembly of tilt plate will be the reverse of disassembly sequence.

MOLDBOARD

Removal

Refer to previous instruction on removal of R. H. tilt plate and slide shift cylinder and remove these items.

Remove moldboard tilt cylinder ball cap from L. H. tilt plate.

Remove cotter pin and slotted nut from L. H. tilt bolt. Remove hex nut and lockwasher from threaded bolt. Remove threaded bolt and pipe spacer.

Remove hex nut and tilt washer from

L. H. tilt plate. Remove roller.

Pry L. H. tilt plate to left far enough to clear tilt bolts.

Remove moldboard from under grader.

Slide L. H. tilt plate from slide bar and slide angle. Remove and replace bushings in L. H. tilt plate in same manner as described for R. H. tilt plate.

Remove both L. H. and R. H. end boots. Remove cutting blades.

Installation

The installation of moldboard will be the reverse of removal instructions.

ROTARY VALVE

Removal

Refer to Figure 21. Remove four capscrews and lockwashers from bottom of support (1) and remove support.

Disconnect hydraulic hose (2), (3) and (4).

#2 — Slide shift cylinder hoses

#3 — R. H. tilt cylinder hoses

#4 — L. H. tilt cylinder hoses

Disconnect hydraulic tubes (5). Plug all hydraulic fittings to prevent foreign material from entering hydraulic system.

Remove the two capscrews and lockwashers (6) and remove rotary valve from drawbar.

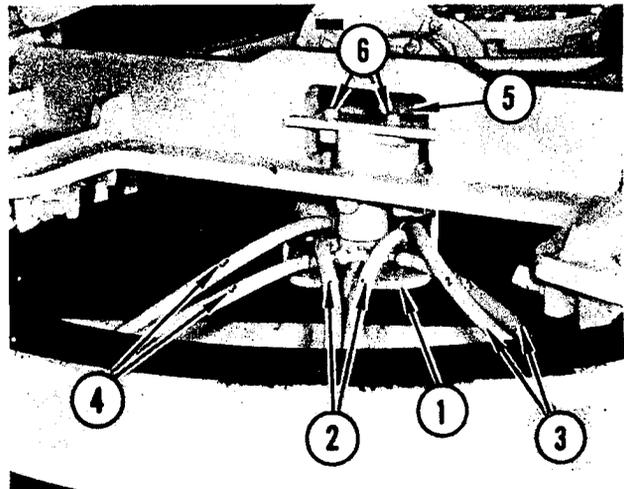


FIGURE 21. ROTARY VALVE HOSE DISCONNECTIONS

Disassembly

The rotary valve is practically trouble-free. Most repairs consist of replacing the five "O" rings in valve body and the felt washer. When disassembled, check the lands on rotor for cuts and scratches due to abrasives getting into hydraulic system.

Refer to Figure 22. Remove the two taperhead capscrews (1) and remove bolting plate (2). Remove rotor (3) and remove felt washer (4) from rotor. Remove the five "O" rings (5) from grooves in bore of valve body (6).

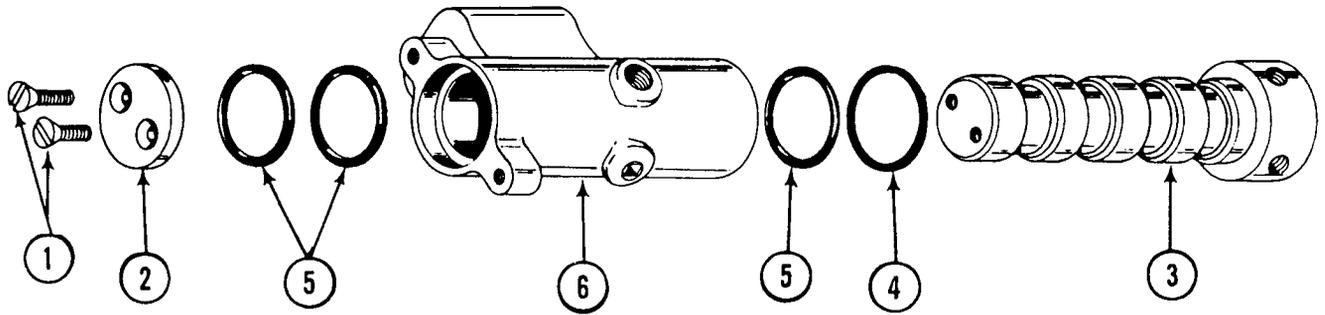


FIGURE 22. ROTARY VALVE (Exploded View)

- | | | |
|--------------|----------------|--------------|
| 1. Capscrews | 3. Rotor | 5. "O" Rings |
| 2. Plate | 4. Felt Washer | 6. Body |

Reassembly

Discard "O" rings and felt washer. Replace with new ones. Felt washer should be soaked in oil before installing.

Reassembly will be the reverse of disassembly procedure.

Installation

Installation will be the reverse of removal procedure.

CIRCLE

Removal

Using blade lifts and lateral shift, swing circle and drawbar to right until a sling and hoist can be attached to circle.

Refer to moldboard removal and remove moldboard.

Refer to rotary valve removal and remove rotary valve.

Lower drawbar and circle until circle legs rest on floor.

Refer to Figure 23. Remove stud nuts and flat washers from the two studs (1). Back off circle pusher adjusting screws (2) at all four suspension points. Remove hex nuts and flat washers from capscrews (3) retaining

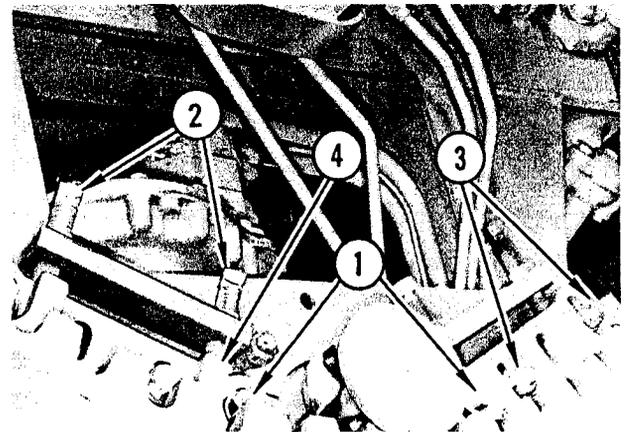


FIGURE 23. CIRCLE PUSHER REMOVAL

- | | |
|---------------------|------------------|
| 1. Studs | 3. Capscrews |
| 2. Adjusting Screws | 4. Circle Pusher |

circle pushers (4) to drawbar. Remove circle pushers, wear plates and shims.

Installation

Installation of the circle will be the reverse of the removal procedure.

Refer to Figure 24. Remove R.H. lift link (1) from R.H. drawbar ball. Remove L.H. lift link (2) from L.H. drawbar ball. Remove lateral shift link (3) from drawbar ball.

Refer to Figure 25. Remove bands (1). Disconnect hydraulic lines (2) and remove

lines from drawbar. Remove locking wire from the four drilled head capscrews (3) and remove capscrews. Remove drawbar from main frame.

Remove cotter pin and slotted nut (4) and remove drawbar ball (5) from drawbar. Remove ball cap and shims (6) from drawbar ball.

Installation

To install drawbar, reverse the removal instructions and the following information.

1. Before assembling drawbar ball and ball cap on drawbar, install ball and ball cap to ball socket on main frame without shims. Install the four drilled head capscrews and tighten until drawbar ball will re-

main in any position without dropping of its own weight, but can still be moved by hand. Measure clearance between ball cap and ball socket housing. Make note of this measurement. When drawbar is installed, add shims between ball cap and ball socket housing to equal clearance.

LATERAL SHIFT

Removal

Disconnect hydraulic lines at hydraulic motor. Plug all hydraulic fittings to prevent foreign materials from entering hydraulic system.

Drain lubricant from gear housing and reduction housing.

Remove two gear housing cover capscrews opposite each other. Install eye bolts where these capscrews were located. Attach sling and hoist to these eye bolts.

Refer to Figure 26. Remove two cap-

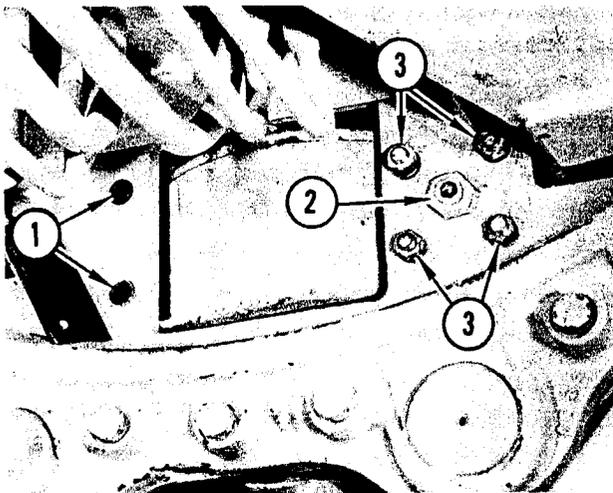


FIGURE 26. GEAR HOUSING MOUNTING
 1. R.H. Support
 2. Adjusting Screw
 3. Stud Nuts

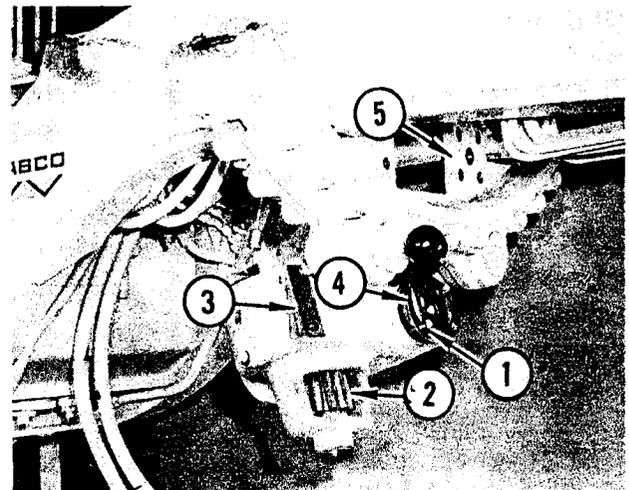


FIGURE 27. GEAR HOUSING REMOVAL
 1. Studs
 2. Pinion
 3. Shims
 4. Shims
 5. Support

screws and lockwashers from R.H. support (1). Remove thrust bearing adjusting screw and locknut (2) from L.H. support. Remove four stud nuts and lockwashers (3).

Refer to Figure 27. Move gear housing to rear until studs (1) have cleared L.H.

Disassembly

Refer to Figure 28. Remove the nine capscrews and lockwashers from reduction housing cover (1) and remove cover and gasket.

Remove 50 tooth gear (2) from splined worm shaft.

Remove eight capscrews and lockwashers from gear housing cover (3) and remove cover from housing. Remove large "O" ring from groove in cover. Remove bushing from bore of cover.

Remove bearing retainer (4) from bore in gear housing. Remove "O" ring from groove in bearing retainer.

Block worm gear to prevent it from turning. Rotate splined worm shaft clockwise to force worm shaft assembly out of gear housing through bearing bore. Remove roller bearing cup (5), tapered roller bearing (6), and spacer (7). Place shaft assembly in arbor press and press shaft (9) from worm (8). Remove the two Woodruff keys from shaft.

Remove the four tapered stud nuts (10) and remove reduction housing (11). Remove gasket from reduction housing. Press or drive the two bushings and spacer from bore of reduction housing hub.

Lift worm gear (12) and pinion-shaft

support and pinion (2) has cleared rack. Lower assembly to ground or floor. Remove shims (3) from R.H. mounting plate and shims (4) from L.H. mounting surface. Attach shims to support (5) to prevent loss. They will be required during reassembly.

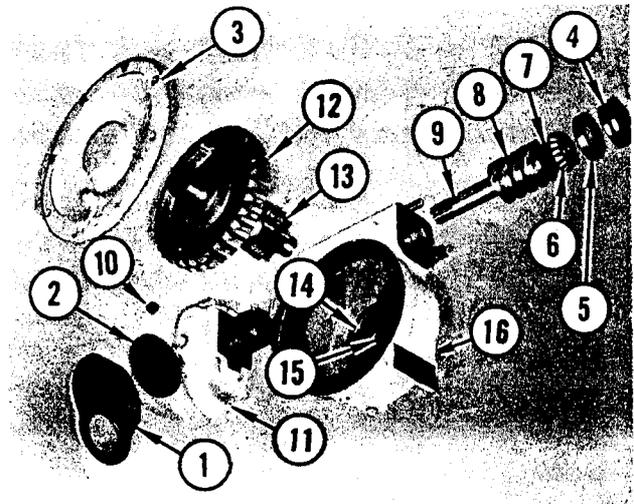


FIGURE 28. LATERAL SHIFT HOUSING

- | | |
|-----------------------|-----------------------|
| 1. Cover | 8. Worm |
| 2. 50 Tooth Gear | 9. Worm Shaft |
| 3. Gear Housing Cover | 10. Stud Nuts |
| 4. Bearing Retainer | 11. Reduction Housing |
| 5. Bearing Cup | 12. Worm Gear |
| 6. Bearing Cone | 13. Pinion Shaft |
| 7. Spacer | 14. Bushing (Upper) |
| | 15. Oil Seal |
| | 16. Bushing (Lower) |

(13) assembly from gear housing. Place assembly in press and remove worm gear from shaft. Remove "O" from groove in shaft.

Remove upper bushing (14) from bore in housing. Remove oil seal (15) from bore in housing. Remove lower bushing (16) from housing.

Reassembly

Reassembly of the lateral shift housing will be the reverse of the disassembly pro-

cedure and the following information.

1. When installing worm gear and pinion-shaft assembly into housing, use caution to prevent damage to oil seal.
2. Press splined worm shaft into worm until 2" of machined end of shaft extends past face of worm.
3. Heat tapered roller bearing cone in hot oil, 275° to 300°, install on worm shaft, and hold bearing against spacer until bearing has cooled.
4. Press one of reduction housing bushings into hub until flush with face of hub. From opposite end of hub, install spacer and press second bushing into hub until against spacer.
5. Press bushing into gear housing cover until bushing is flush or slightly under flush with face of cover hub.
6. Install 50 tooth gear on splined worm shaft with long hub of gear going on shaft first.

Installation

Installation of the lateral shift gear housing will be the reverse of the removal instructions and the following information.

1. Install all the original shims at R.H. and L.H. support points. Tighten securely the two capscrews at R.H. point and four stud nuts at L.H. point. Do not install thrust adjusting setscrew and locknut at this time.

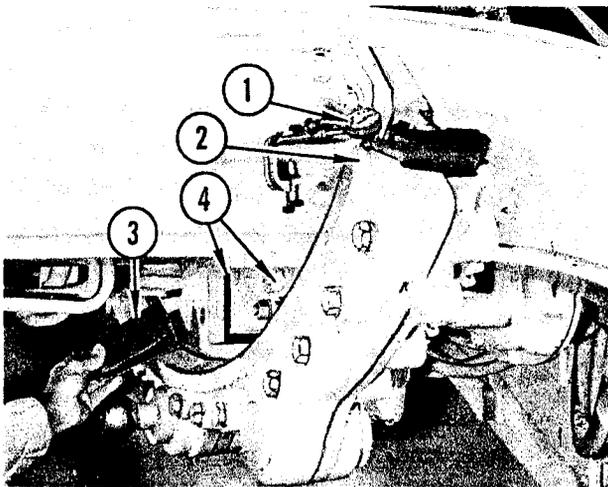


FIGURE 29. LATERAL SHIFT GEAR ADJUSTMENT

- | | |
|-------------------|-------------------|
| 1. Dial Indicator | 3. Shims |
| 2. Shift Rack | 4. Support Points |

2. Refer to Figure 29. Attach a dial indicator (1) to support bracket in such a position that the contact point of dial indicator rests on end

of lateral shift rack (2). Manually move the rack right and left and observe amount of movement as registered on the dial indicator. This movement should be between .008" and .010". Remove or add shims (3) at support points (4) if required. NOTE: These shims come in three thicknesses; 1/16", 1/32" and .010".

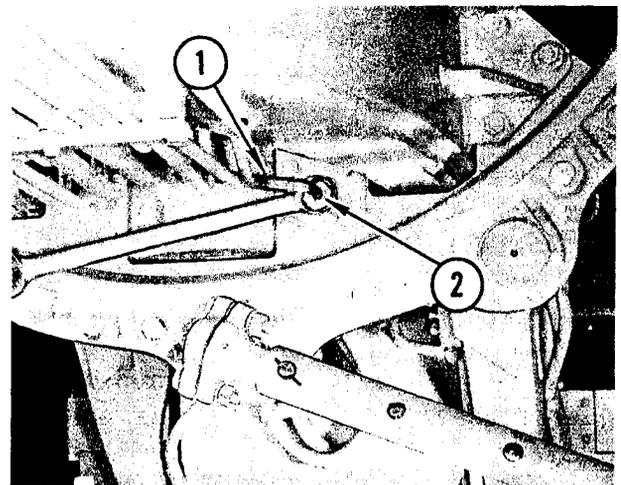


FIGURE 30. SETTING THRUST SETSCREW
1. Allen Wrench 2. Adjusting Screw

3. Install thrust adjusting setscrew. Using an Allen wrench (1), tighten adjusting screw (2) as tight as possible using only the Allen wrench, then back off 1/16 of a turn. Tighten locknut to a torque of 250 ft. lbs. See Figure 30.

RACK

Removal

Refer to Figure 31. Remove ball cap at rack end of lateral shift link (1) and remove lateral shift link from rack ball stud. Remove two capscrews, lockwashers and large washer (2) from ball stud and plug. Remove ball stud and plug from rack assembly (3).

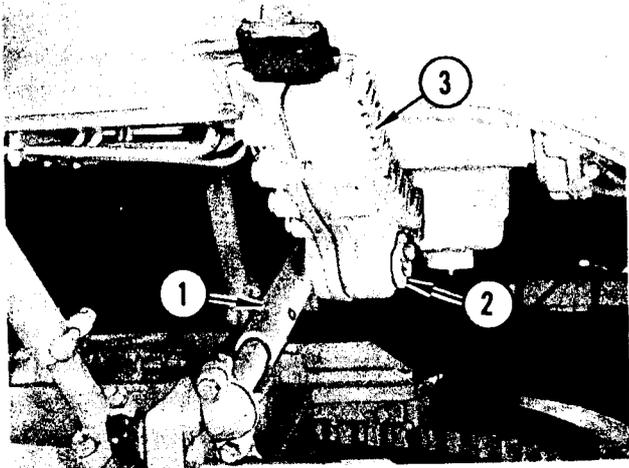


FIGURE 31. RACK REMOVAL

1. Shift Link
2. Capscrews & Washers
3. Ball Stud

Start engine. Using lateral shift control lever shift rack (1) to either right or left until a sling can be installed in ball stud bore of rack. Attach hoist to sling. Continue operating lateral shift and also take up on hoist until rack is free of pinion. See Figure 32. Slide rack off of rail (2) and lower to work bench for disassembly.

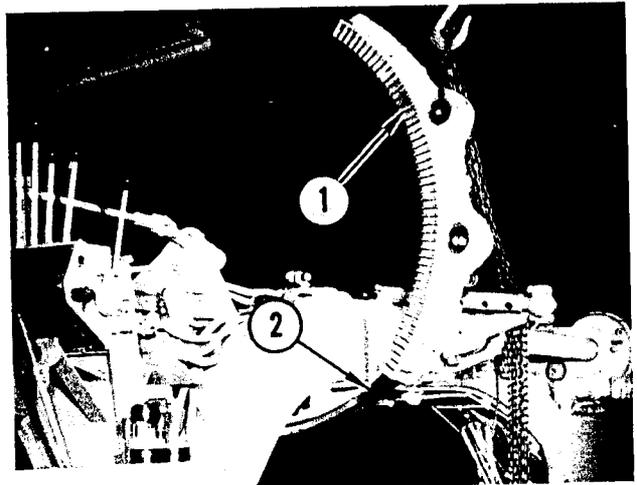


FIGURE 32. RACK REMOVAL

1. Rack
2. Rail

Disassembly

Remove the eleven capscrews and lockwashers connecting the two sections of the rack. There will be four sets of shims; one set at each end of rack, one set at each bore

for plug and stud ball. Attach these shims to the rack at the location where they were to prevent their loss. They will be required during reassembly.

Reassembly and Installation

Reassembly and installation of the rack will be the reverse of removal and disassembly procedure and the following instructions.

1. Install all the shims in the same location from which they were removed. Install and tighten all capscrews and lockwashers.

2. Move rack through its full range of travel. Check to make sure there is no binding at any point between rail and rack. The rack should fit on the rail tight enough so as to have no lateral movement but still allow the rack to slide along the rail smoothly.

Adjustment

Position the rack near the center of its travel so that approximately 1" of rail extends past end of rack.

Refer to Figure 33. Pry rack (1) away from pinion (2) and against rail (3). Measure the clearance between bevel of rail and

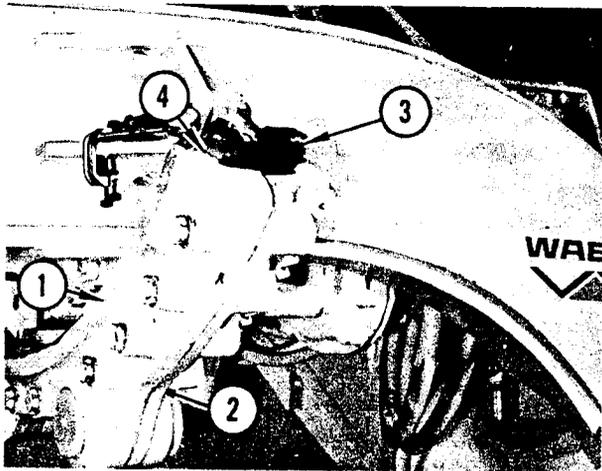


FIGURE 33. RACK ADJUSTMENT

- 1. Rack
- 2. Pinion
- 3. Rail
- 4. Clearance

level of rack at point (4). This clearance should be between .0" and .010". Repeat procedure at opposite end of rail. Make check at four points along rail.

The following chart will help determine the number of shims to be removed to obtain the desired sliding fit. Using the smallest of the four measured clearances in the left hand column, the thickness of shims to be removed will be found directly opposite in the right hand column.

<u>Measured Clearance</u>	<u>Thickness of Shims To Be Removed</u>
.0" to .010"	None
.011" to .014"	.010
.015" to .022"	.020
.023" to .029"	.030
.030" to .036"	.040
.037" to .043"	.050
.044" to .050"	.060
.051" to .057"	.070
.058" to .064"	.080
.065" to .072"	.090

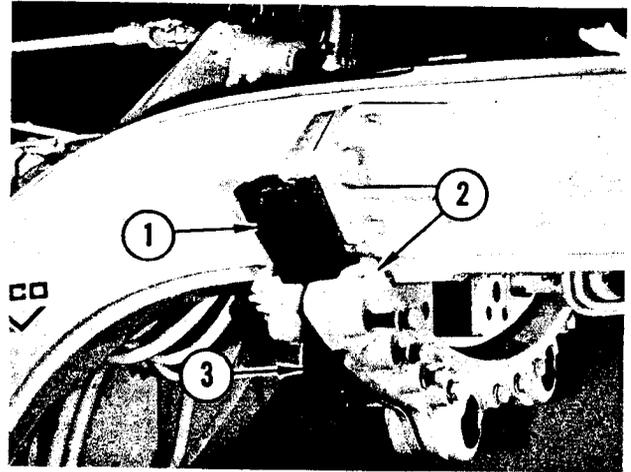


FIGURE 34. RACK END SHIMS

- 1. Rail
- 2. Rack
- 3. Shims

The shim packs in the rack assembly consists of 1/16", 1/32" and .010".

Figure 34 shows changing the end shim packs.

Figure 35 shows changing the shim pack at ball stud locations.

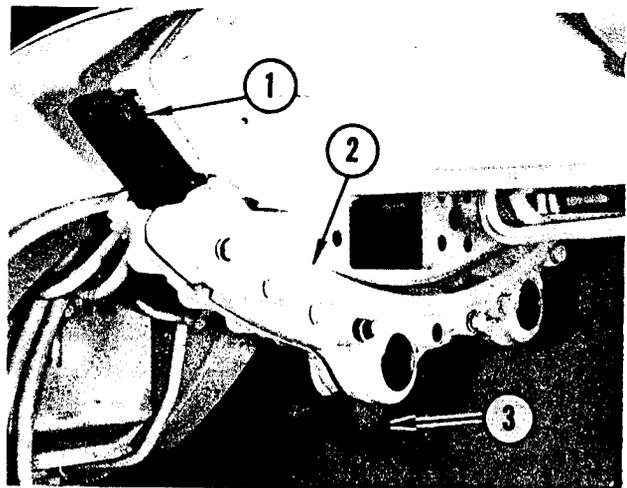


FIGURE 35. BALL STUD SHIMS

- 1. Rail
- 2. Rack
- 3. Shims

TROUBLE SHOOTING

TROUBLE: Excessive free play in ball and sockets.

CAUSE: Ball and socket worn.

REMEDY: Adjust by removing enough shims to compensate for wear.

TROUBLE: Moldboard coasting.

CAUSE: Wear in gear box worm.

REMEDY: Adjust gear housing thrust bearing as instructed on page D-17.

CAUSE: Restriction in 15 psi circuit to hydraulic motors (circle reverse and lateral shift).

REMEDY: Clear circuit of restriction.

TROUBLE: Moldboard chatter.

CAUSE: Looseness of circle wear plates.

REMEDY: Adjust circle clearance as described on Page D-14.

CAUSE: Worn ball and sockets on lift links and lateral shift link.

REMEDY: Adjust ball and sockets for wear by removing shims.

CAUSE: Looseness in lateral shift rack.

REMEDY: Remove shims to compensate for wear.

SECTION E

FRONT AXLE ASSEMBLY

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AXLE ASSEMBLY

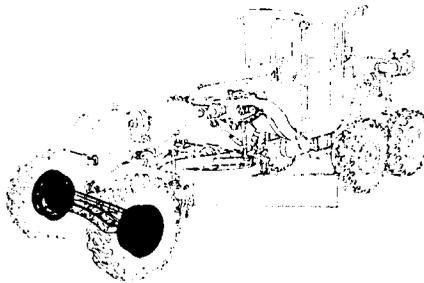
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FRONT AXLE ASSEMBLY

Removal

WHEEL

Start engine and use blade lift control levers to lower blade until front wheels are clear of ground. For safety, place blocks under front axle. Stop engine.

Remove the three capscrews and lockwashers. Remove hub cap and gasket.

Refer to Figure 1. Remove capscrew and nut (1). Remove drilled nut (2) from spindle (3). Remove outer bearing cone (4).

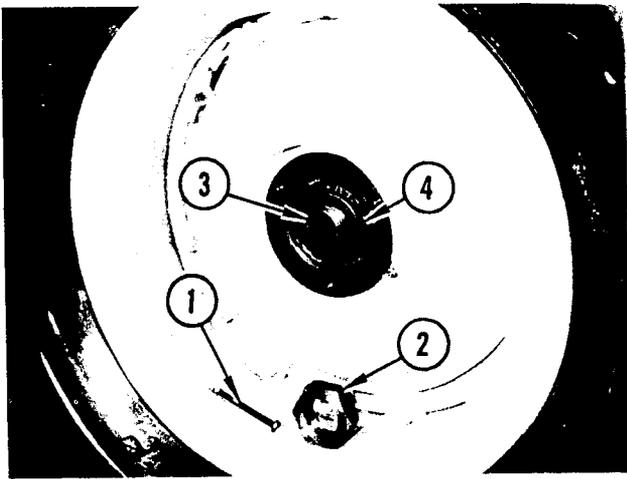


FIGURE 1. WHEEL NUT REMOVAL

- | | |
|-------------------|-----------------|
| 1. Nut & Capscrew | 3. Spindle |
| 2. Drilled Nut | 4. Bearing Cone |

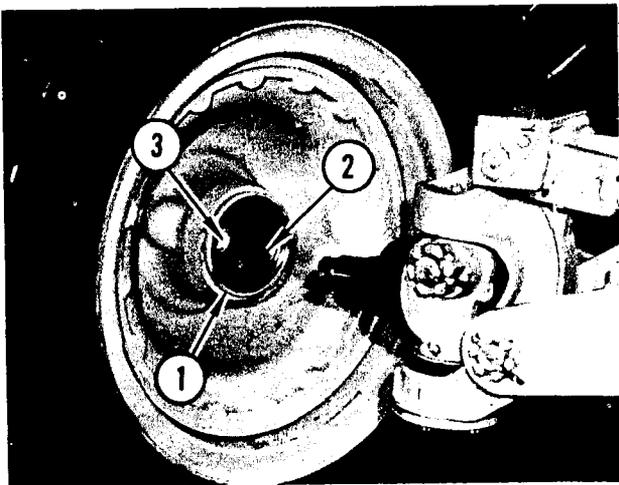


FIGURE 2. WHEEL REMOVAL

- | | |
|------------------------|------------------------|
| 1. Seal Retainer | 3. Bearing Cup (Outer) |
| 2. Bearing Cup (Inner) | |

Refer to Figure 2. Remove wheel from spindle. Remove felt seal retainer (1) from wheel hub. Remove inner bearing cup (2) and outer bearing cup (3) from hub. If required, remove outer bearing retainer snapping from hub.

SPINDLE

Refer to Figure 3. Using a bearing puller, remove inner bearing cone (1). Remove cotter pin from slotted nut (2). Remove slotted nut and washer (2) from steering arm (3). Remove tie rod (4) from steering arm.

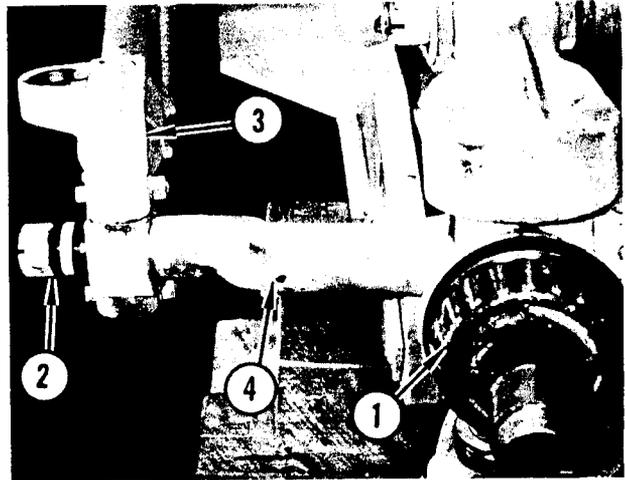


FIGURE 3. STEERING ARM DISCONNECT

- | | |
|-----------------|-----------------|
| 1. Bearing Cone | 3. Steering Arm |
| 2. Slotted Nut | 4. Tie Rod |

Refer to Figure 4. Remove spacer and felt seal (2) from spindle. NOTE: When installing spacer on spindle, make certain that drilled hole (3) in spacer fits over dowel (4) in spindle hub.

Refer to Figure 5. Remove six capscrews and lockwashers and remove lower spindle bearing (1). Remove shims (2) from bearing. Permit the spindle to drop down as far as it will go. Tilt top of spindle outward and remove from fork. Remove closure washer (3) and seal washer (4) from fork.

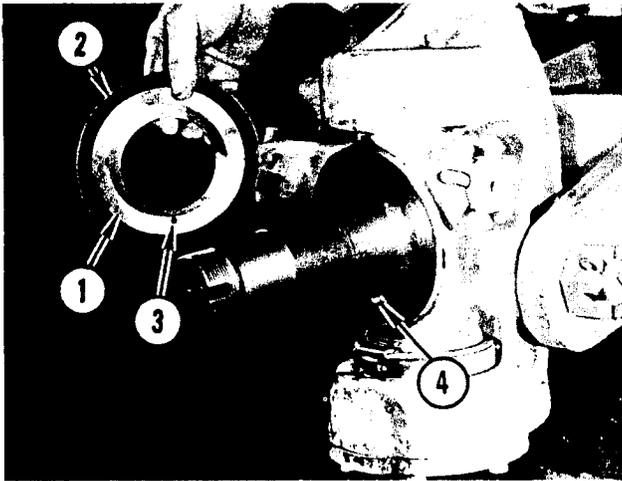


FIGURE 4. SPINDLE DISASSEMBLY

- | | |
|--------------|-----------------|
| 1. Spacer | 3. Drilled Hole |
| 2. Felt Seal | 4. Dowel |

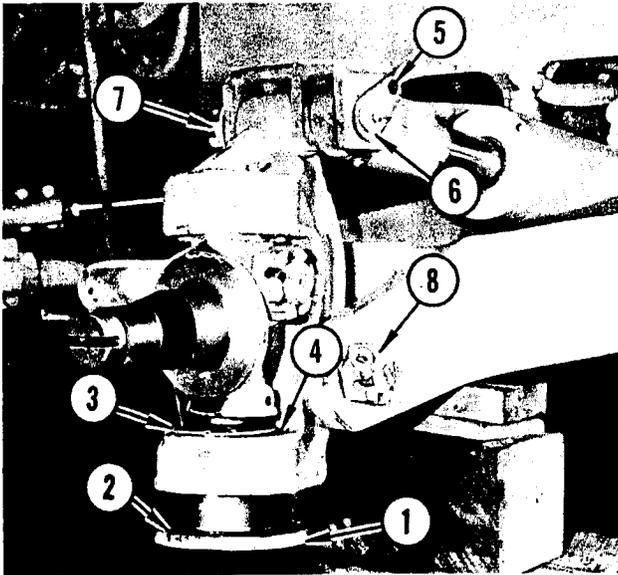


FIGURE 5. SPINDLE REMOVAL

- | | |
|--------------------|----------------|
| 1. Spindle Bearing | 5. Capscrew |
| 2. Shims | 6. Weldment |
| 3. Washer | 7. Slotted Nut |
| 4. Seal Washer | 8. Slotted Nut |

FORK

To install spindle fork, reverse the instructions for removal and the following information.

1. Press bearing cup into top bore of fork until it is against bottom of bore.

Using a bearing puller, remove bearing cone from top of spindle. After bearing has been removed, the closure washer and felt seal, in that order, can be removed from top of spindle.

FORK

Remove locking capscrew (5) from vibrator bar pin weldment (6). Remove cotter pin from slotted nut (7) and remove nut. Remove cotter pin from slotted nut (8) and remove nut.

Refer to Figure 6. Remove pivot pin from vibrator bar and top of fork. Remove locking capscrew from pin weldment and remove pivot pin (1). Remove fork (2). Remove bushing (3) from fork. Remove bushing (4) from fork. Remove bearing cup (5) from inside top bore of fork.

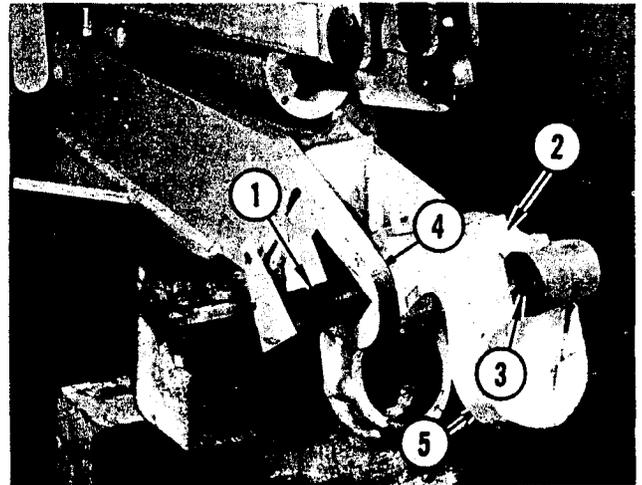


FIGURE 6. SPINDLE FORK REMOVAL

- | | |
|--------------|----------------|
| 1. Pivot Pin | 4. Bushing |
| 2. Fork | 5. Bearing Cup |
| 3. Bushing | |

Installation

2. Upper and lower fork pivot pins must be free of any clamping action. Tighten the slotted nuts snug, back nut off 1/16 of a turn or more if necessary to align cotter pin hole. Install cotter pin.

SPINDLE

To install spindle, reverse the instructions for removal and the following information.

1. Install felt seal, then closure washer on top of spindle. Heat bearing cone in hot oil, 275° to 300° , and press on spindle until bearing is against closure washer.
2. Install lower spindle bearing, less shims. Install bearing retaining capscrews without lockwashers. Tighten capscrews and at same time pull on fish scale, hooked onto end of steering arm, until it takes a pull of 4 to 8 lbs. to keep the arm moving. Using a feeler gauge or shims, measure the clearance between bearing flange and bottom of fork. Remove bearing and install correct amount of shims. See Figure 7.
3. Install spacer on spindle with beveled side going on spindle first. Heat bearing cone in hot oil, 275° to 300° and press on spindle until tight against spacer. Hold in position until bearing has cooled.
4. Press large bearing cup into bore of wheel hub until it is tight against shoulder in hub.
5. Press felt seal retainer into wheel hub until retainer is flush with face of hub. Use extreme care not to damage retainer.

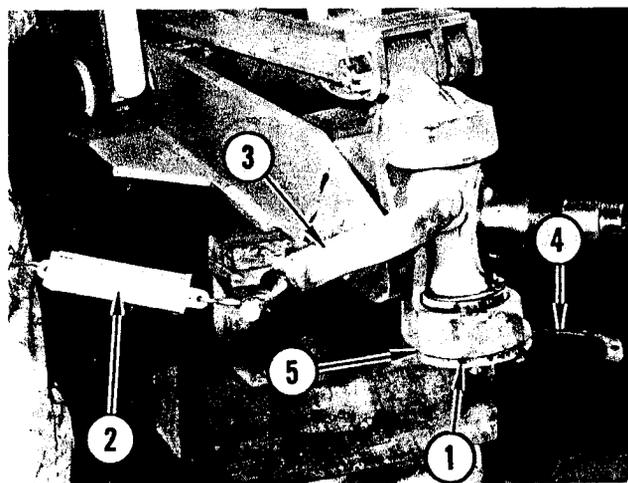


FIGURE 7. SPINDLE ADJUSTMENT

- | | |
|--------------------|------------|
| 1. Spindle Bearing | 4. Shims |
| 2. Fish Scale | 5. Measure |
| 3. Steering Arm | |
6. Press small bearing cup into wheel hub until it is against snap ring.
 7. When installing wheel onto spindle, make certain the felt seal retainer goes over felt seal without damaging seal.
 8. Install spindle bearing retaining nut. Hook fish scale on rim lug bolt. Pull scale in horizontal direction and at same time tighten spindle nut until it takes a pull of 10 to 20 lbs. to keep wheel turning. If lock bolt holes do not align, back off nut until lock bolt can be installed.
 9. Pack bearings with a fibrous type of wheel bearing grease. Fill hub cap with grease and install hub cap and gasket. Wipe off excess grease.

LEANING WHEEL CYLINDER

Removal

Install locking bolt in vibrator bar to prevent front wheels from leaning.

Remove hydraulic lines from tilt cylinder.

Plug all fittings to prevent foreign material from getting into hydraulic system.

Refer to Figure 8. Remove cotter pin

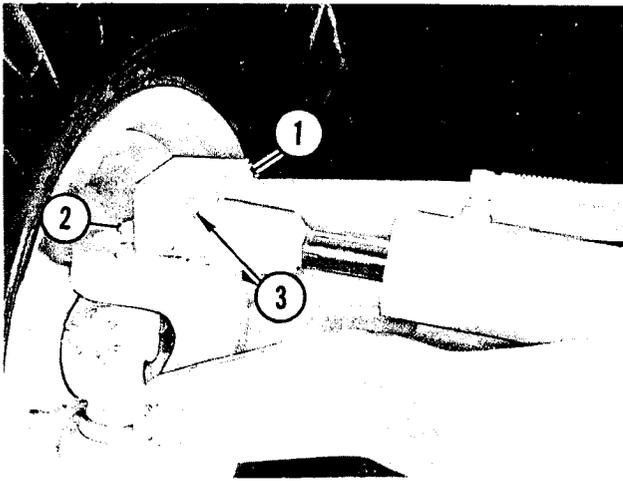


FIGURE 8. CYLINDER REMOVAL

1. Cotter & Nut 3. Capscrew & Washer
2. Tilt Pin

and slotted nut (1) from tilt pin (2). Remove locking capscrew and lockwasher (3). Remove tilt pin.

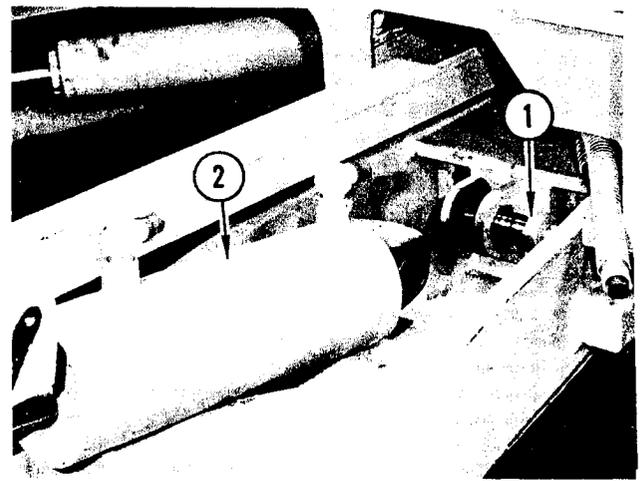


FIGURE 9. TILT CYLINDER REMOVAL

1. Anchor Pin 2. Tilt Cylinder

Refer to Figure 9. Remove hex nut and lockwasher from anchor pin (1). Remove anchor pin. Remove tilt cylinder (2) from front axle.

Disassembly

Remove self aligning bushing from cylinder anchor and from piston rod anchor. Unscrew packing gland from cylinder and remove piston rod with piston and packing gland assembly from cylinder.

Remove self locking nut from end of piston rod. Remove piston assembly and packing gland assembly from piston rod. Remove "O" ring from groove in threaded end of piston rod.

Refer to Figure 10 for disassembly of the piston and packing gland assemblies. Item (1) self locking nut was previously removed from end of piston rod.

Remove piston rings (3) and Teflon seal (4) from piston (2).

Remove "O" ring (6) and back-up ring (7) from groove in packing gland (5). Re-

move wiper seal (8), "U" cup seal (9) and "O" ring (10) from bore of packing gland.

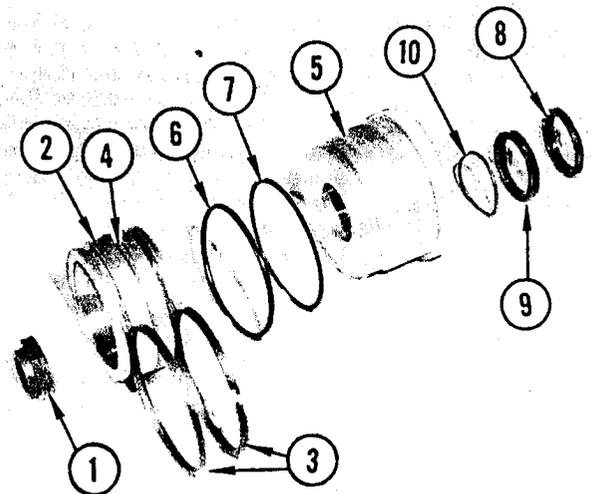


FIGURE 10. LEANING WHEEL

1. Nut 6. "O" Ring
2. Piston 7. Back-Up Ring
3. Piston Rings 8. Wiper Seal
4. Seal 9. "U" Seal
5. Packing Gland 10. "O" Ring

Reassembly

The reassembly of tilt cylinder will be the reverse of disassembly instructions and the following information.

1. Discard all seals and "O" rings and replace with new ones.
2. Install wiper seal (8), "U" cup seal (9) and "O" ring (10) onto piston rod before inserting them into bore of packing gland. NOTE: The "O" ring goes inside the "U" cup seal, the

"O" ring side of seal must be toward threaded end of piston rod.

3. Use piston ring compressor to facilitate installing piston assembly into cylinder.
4. After packing gland has been tightened into cylinder, install "U" cup seal with "O" ring into packing gland, then install wiper seal into packing gland.

Installation

Installation of tilt cylinder will be the reverse of cylinder removal instructions and the following information.

1. Snug up the slotted nut on tilt pin, then back off 1/16 of a turn or

more if necessary to install cotter pin.

2. The hex nut on anchor pin should be snugged up tight but should be free of any clamping action.

STEERING LINKAGE

Removal

Loosen the jam nuts on both tie rod ends. Remove cotter pin from slotted nut on end of steering arm and remove nuts (both R.H. and L.H. steering arm). Swing yoke ends of tie rods to clear ends of steering arms. Remove tie rods by unscrewing them from tie rod ends.

Refer to Figure 11 and follow the sequence as shown to remove the pitman arm assembly. Item (1) tie rods were previously removed.

Remove cotter pin from slotted nut (2) and remove nut and flat washer.

Remove the four capscrews (3) and remove the two retaining caps. Remove ball shaft with tie rod ends from pitman arm.

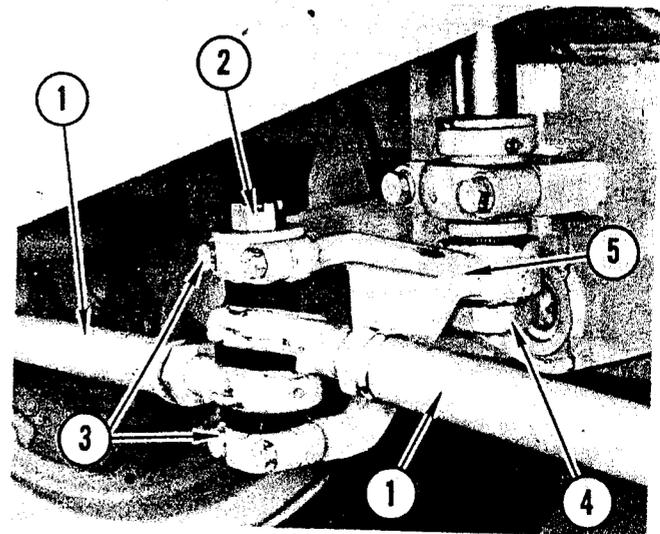


FIGURE 11. STEERING LINKAGE REMOVAL

- | | |
|----------------|---------------|
| 1. Tie Rods | 4. Locknut |
| 2. Slotted Nut | 5. Pitman Arm |
| 3. Capscrews | |

Remove locknut (4) and lockwasher from lower end of the steering gear vertical shaft. Attach puller to pitman arm (5) and remove arm from vertical shaft. NOTE: Before removing pitman arm, make a prick punch mark on one serration of vertical shaft and on the pitman arm. These marks will be used during reassembly for aligning the pitman arm with steering gear assembly.

Figure 12 shows an exploded view of the ball shaft and tie rod end assembly. Follow the numerical sequence as shown to disassemble. Items (1) slotted nut and (2) flat washer were previously removed.

Remove upper seal pad (3) from shaft. Remove spiral retaining ring (4) from upper tie rod end (5). (If center seal pad is to be replaced, it can be cut out in order to simplify removal of the retaining ring.) Place assembly in arbor press and press upper tie rod end from shaft. NOTE: Both tie rod ends must come off the threaded end of ball shaft. The spherical bushing (6) is in two

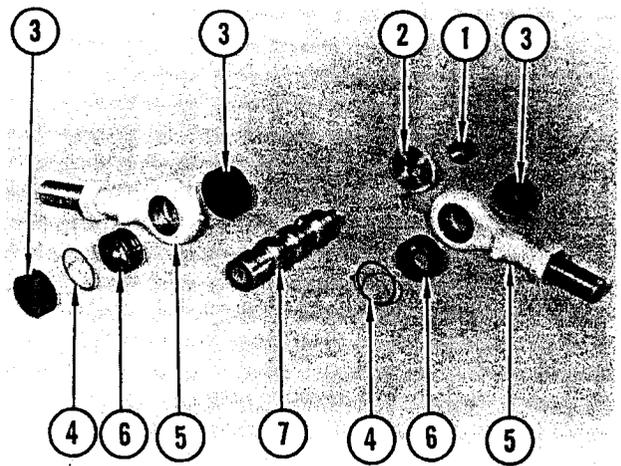


FIGURE 12. EXPLODED VIEW OF BALL SHAFT

- | | |
|--------------------|----------------------|
| 1. Slotted Nut | 5. Tie Rod Ends |
| 2. Flatwasher | 6. Spherical Bushing |
| 3. Seal Pads | 7. Double Ball Shaft |
| 4. Retaining Rings | |

halves and can be removed as soon as it clears the tie rod end. Repeat the above procedure for removing the lower tie rod end from ball shaft (6).

Reassembly

To reassemble the steering linkage, reverse the sequence shown for disassembly; and the following information.

1. The new spherical bushings sections will be held together with a retaining ring. Leave this ring on the bushings until they have started into the tie rod end, then remove

the bushing retaining ring.

2. After the lower tie rod end has been installed, assemble the upper tie rod end retaining ring onto ball shaft before starting to install upper tie rod end.
3. Tighten the slotted nut (1) snug to a torque of not more than 25 ft. lbs.

Adjustment

TOE-IN

Toe-in adjustment is made in the following manner: Raise both front wheels clear of ground (install locking bolt in vibrator

bar to hold front wheels in vertical position). Revolve wheels by hand while holding a piece of chalk at the approximate center of tire. Lower wheels to ground.

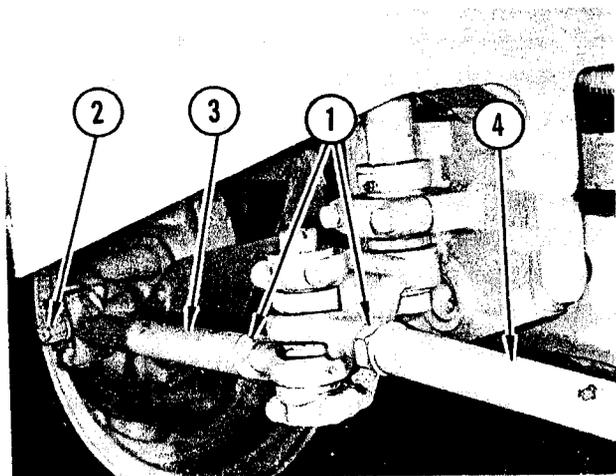


FIGURE 13. LINKAGE ADJUSTMENT
 1. Jam Nuts 3. L.H. Tie Rod
 2. Slotted Nut 4. R.H. Tie Rod

Refer to Figure 13. Loosen jam nuts (1) on both tie rod ends. Remove cotter pin from slotted nuts (2) and remove slotted nut from both L.H. and R.H. steering arms. Slide yoke ends of tie rods off end of steering arm. Turn tie rods in or out on tie rod ends until a toe-in of 1/8" to 1/4" has been obtained.

Reinstall yoke ends of tie rods to the steering arms and tighten jam nuts.

There is no adjustment of castor or camber for the front wheels as correct castor and camber are built into the assembly. Correction can be made by replacement of worn or bent spindles, bent axle, wheel bearings or spindle fork bearings.

AXLE

Removal

Start engine and, using blade lift controls, lower moldboard until front of grader is raised just enough to relieve weight of grader from the bolster pin.

Install locking bolt in vibrator bar to keep front wheels in a vertical position.

Disconnect hydraulic lines from leaning wheel cylinder. Plug ends of lines and hydraulic fittings to prevent foreign material from entering the hydraulic system.

Remove pitman arm from lower end of steering gear vertical shaft (refer to steering linkage).

Refer to Figure 14 for removal of bolster pin.

Remove locking setscrew and lockwasher (1). From rear side of axle, drive the bolster pin (2) from axle and bolster plate (3). Should there be any binding of the bolster pin, raise or lower front of grader

frame to relieve the binding. As the bolster pin is driven out, reach beneath axle and remove spacers located between bolster plate and flange of axle. Also remove pipe spacer from inside the axle flanges.

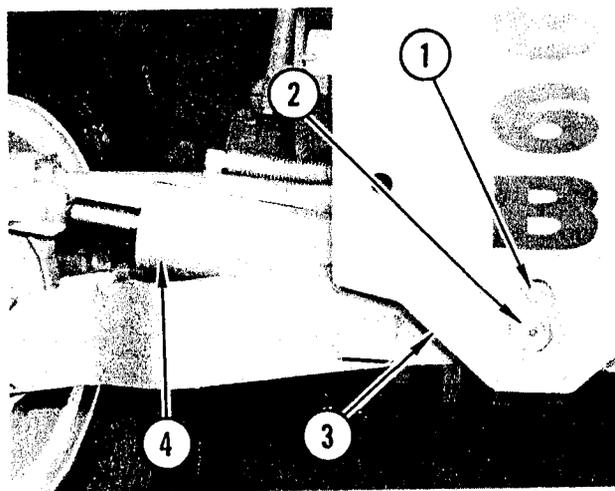


FIGURE 14. BOLSTER PIN REMOVAL
 1. Setscrew & Lockwasher 3. Bolster Plate
 2. Bolster Pin 4. Leaning Wheel Cylinder

After the bolster pin has been removed, continue to raise front end of grader frame until axle can be rolled from grader.

Drive bushings from front and rear axle flanges using a piece of shaft or pipe slightly smaller than outside diameter of bushing.

Installation

To install axle into grader, reverse the instructions for removal and the following information.

1. Roll axle assembly into position under front end of grader frame. Using blade controls, slowly lower front end of frame into position on axle. Continue to lower frame until

bolster pin bores in bolster plates and axle are in alignment. Install bolster pin.

2. Install the same spacer or spacers which were removed from bolster pin between bolster plate and axle flange.

TROUBLE SHOOTING

TROUBLE: Front wheels shimmy.

CAUSE: Loose connections in linkage.

REMEDY: Tighten all connections after checking for excessive wear.

CAUSE: Worn spindle thrust bearing.

REMEDY: Adjust for wear by removing shims.

TROUBLE: Excessive front tire wear.

CAUSE: Toe-in and/or camber out of adjustment.

REMEDY: Adjust toe-in and replace worn parts to correct camber.

CAUSE: Lug nuts not tight.

REMEDY: Tighten lug nuts to a torque of 130-140 ft. lbs.

TROUBLE: Hard steering.

CAUSE: Front axle does not have proper toe-in, castor or camber.

REMEDY: Replace worn parts to adjust castor and camber. Adjust toe-in of front wheels 1/8" to 1/4".

CAUSE: Failure to use leaning wheel feature.

REMEDY: When making a turn, lean front wheels in direction of turn.

CAUSE: Defects in power steering circuit.

REMEDY: Refer to Section F for component information.

SECTION F

HYDRAULIC SYSTEM

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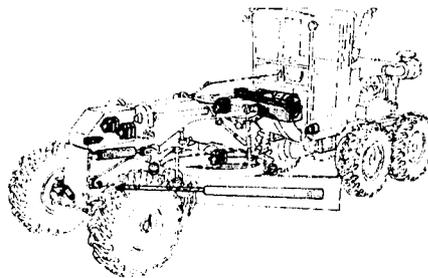
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HYDRAULIC SYSTEM

General

The hydraulic system of the Model 666B and 777B Motor Grader consists of two pumps, four hydraulic motors, power shift moldboard, moldboard tilt cylinders, steering cylinder, leaning wheel cylinder, valves

for control of cylinders, valves for control of hydraulic motors, steering valve, master brake valve, reservoir, various hydraulic lines and fittings with necessary check valves, flow valves and relief valves.

HYDRAULIC PUMPS

One pump (main) has a capacity of 30 gallons per minute, one pump (Brakes & Steering) has a capacity of 12 gallons per minute. Small pump is mounted "piggy back" to the large pump. A splined coupling between the two pumps drives the smaller

pump. Both are mounted beneath cab floor along L.H. side of main frame and driven by PTO shaft from torque converter drive. Pumps turn approximately 2600 RPM with an engine speed of 2000 RPM.

HYDRAULIC MOTORS

The four hydraulic motors are identical. They will rotate at approximately a 1 to 1 ratio with the pump. One motor powers the lateral shift and is located between main frame sides just forward of cab. One powers

the circle reverse and is located on drawbar. The other two motors power the R.H. and L.H. blade lifts and are located under front cover plate at front of grader.

HYDRAULIC CYLINDERS

Power Shift Moldboard Cylinder. Supplies power to slide moldboard out for extended reach. Located on back of moldboard.

Moldboard Tilt Cylinders. Supplies power to tilt moldboard to different angles for various types of work. One on each side of circle gear.

Front Wheel Tilt Cylinder. Supplies power to tilt front wheels. Located inside front axle on R.H. side.

Steering Cylinder. Supplies power to steer front wheels. Located at rear of front axle. Anchored to front axle and tie rod.

Cylinder Control Valves. Located in front of cab and between main frame sides.

Hydraulic Motor Control Valves. Located between main frame sides and just above moldboard circle.

Steering Valve. Attached to end of steering control shaft and located just forward of cab.

Brake Valve. Located beneath cab floor and attached to outside of R.H. main frame.

Reservoir. Located between main frame sides and just in front of cab. Front of reservoir can be removed for easy cleaning. Two filter cylinders are located inside reservoir. There are two filter elements in each cylinder making a total of four elements. Filter elements can be changed without draining the reservoir. The reservoir

is pressurized by air from the engine air box. A filter in the air line prevents foreign material from entering the hydraulic reservoir.

See schematic diagrams of the various circuits for locations of check valves, limit valves, flow valves, etc.

HYDRAULIC PUMPS

Removal

Disconnect the hydraulic oil lines from pump assembly. Plug all hose ends and all hydraulic fittings to prevent foreign material from entering the hydraulic system.

Refer to Figure 1. Remove two capscrews and lockwashers (1) retaining pump assembly (2) to pump drive housing (3). Pull forward on pump assembly until splined end of pump shaft has cleared the internally splined shaft in pump drive housing. Remove pump from grader for disassembly.

Clean the exterior of the pump assembly thoroughly with a good cleaning solvent. Dry with compressed air if available. Scribe a mark across the adapter, pump housing and cover. This mark will assist in reassembling these parts in their same relative position.

To separate the two pumps, remove the

four capscrews from the highest bosses on the steering pump cover. Pry steering pump away from main pump cover until free of dowel pins and splined coupling.

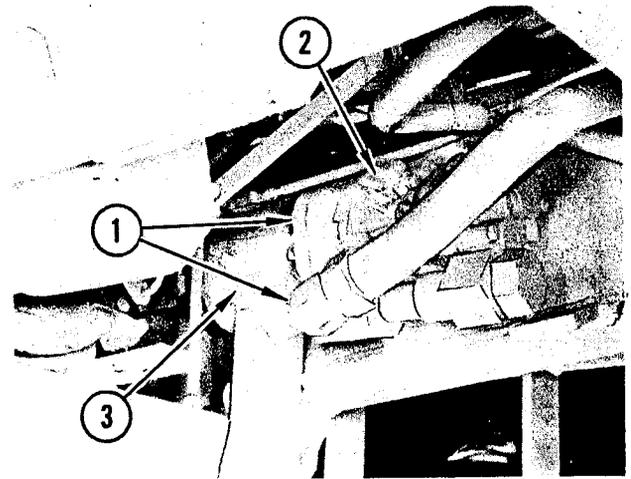


FIGURE 1. PUMP REMOVAL

- | | |
|------------------------|------------------|
| 1. Capscrews & Washers | 2. Pump |
| | 3. Drive Housing |

MAIN PUMP

Disassembly

Remove the eight capscrews and lockwashers from cover end of pump. These capscrews extend through cover, housing and threads into adapter.

Figure 2 shows an exploded view of the main pump. When disassembling, make note of how the seals and wear plates are installed.

Item (1) capscrews have been removed previously. Remove cover assembly (2). Remove wear plate (3) and "O" ring (4). "O"

ring will be around the outside circumference of the wear plate. Note that the copper coated side of wear plate is toward gears. Remove three small "O" rings and back-up rings from bores in cover. Remove splined coupling from cover. Remove two bushings from cover.

Remove driven gear (5) and drive gear (6), lift housing (7) from adapter. Remove the two dowels from housing. Remove wear plate (8), and "O" ring (9). Remove seal assembly (10) consisting of one seal, two small

"O" rings and two back-up rings.

Press or drive oil seal from bore of

Reassembly

Inspect wear plates for excessive wear, cracks or grooves. Replace if damage is found. Discard seals and "O" rings. Replace with new.

Reassembly of pump will be the reverse of disassembly and the following information.

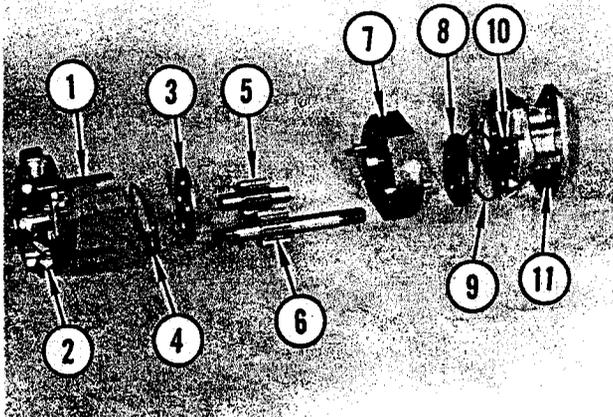


FIGURE 2. MAIN PUMP DISASSEMBLY

- | | |
|----------------|-------------------|
| 1. Capscrews | 7. Housing |
| 2. Cover | 8. Wear Plate |
| 3. Wear Plate | 9. "O" Ring |
| 4. "O" Ring | 10. Seal Assembly |
| 5. Driven Gear | 11. Adapter |
| 6. Drive Gear | |

1. Install oil seal in pump adapter with lip of seal toward interior of pump. NOTE: Install oil seal after drive shaft has been installed. Place thin shim stock over splines on shaft to prevent damage to seal.
2. Refer to Figure 3. Press bushings (1) into adapter until bushing is against shoulder in bore. Install seal assembly (2) as follows:
 - (a) Install two small "O" rings over bushings.
 - (b) Install two back-up rings on "O" rings.
 - (c) Install seal. It will be noted

adapter (11). Remove two bushings from bores in adapter.

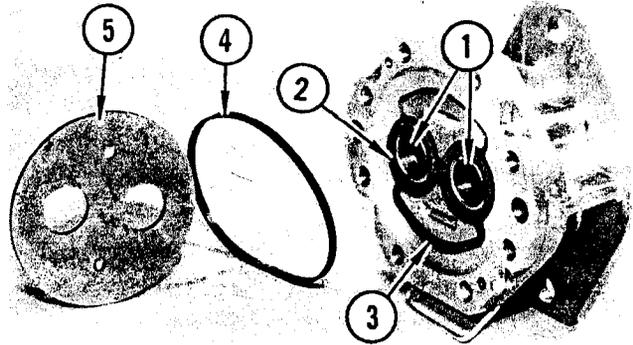


FIGURE 3. MAIN PUMP REASSEMBLY

- | | |
|------------------|---------------|
| 1. Bushings | 4. "O" Ring |
| 2. Seal Assembly | 5. Wear Plate |
| 3. Seal | |

that the seal can be installed in two ways. Always install so that extended part of seal (3) is on low pressure side of pump. Install "O" ring (4) in face of adapter and install wear plate (5) inside "O" ring.

3. Install wear plates so that copper coated side is toward gears.

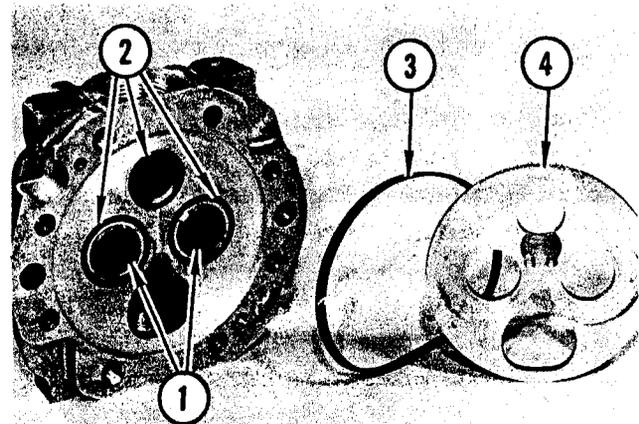


FIGURE 4. PUMP COVER REASSEMBLY

- | | |
|-------------|---------------|
| 1. Bushings | 3. "O" Ring |
| 2. Rings | 4. Wear Plate |

4. Refer to Figure 4. Press bushings (1) into pump cover until they are against shoulder in bore. Install small "O" rings and back-up rings (2) in that order. Install large "O" ring (3) in face of pump cover and

install wear plate (4) inside "O" ring.

5. After pump has been completely assembled, torque all capscrews to 35-40 ft. lbs.

STEERING PUMP

Disassembly

Disassembly and reassembly of the steering pump will be similar to the main pump except for the following.

1. The seal assembly will be located in pump cover instead of in the adapter.

2. There will be only one wear plate. It will be located on cover side of gears.

3. An "O" ring groove is located on each side of steering pump adapter.

Installation

Installation of the pump assembly will be the reverse of removal instructions.

HYDRAULIC PUMP DRIVE

Removal

Refer to hydraulic pump removal instructions and remove pump assembly.

Remove capscrews and lockwashers retaining spider bearings to PTO universal coupling. NOTE: Twist a piece of wire around bearings before removing capscrews. This will prevent bearing dropping off spider.

Support end of PTO shaft to prevent it from dropping.

Remove three capscrews retaining pump drive assembly to main frame cross support. Remove assembly from grader for disassembly. NOTE: These instructions are for Power-Flow Models only.

Disassembly

Thoroughly clean the assembly of all dirt, grease, etc.

Figure 5 shows an exploded view of the pump drive assembly. To disassemble, follow the numerical sequence as shown.

Using a screwdriver or similar tool, lift tang of lockwasher from slot in locknut (2) and using a spanner wrench, remove locknut. Remove lockwasher (3). Using a soft drift, drive or press yoke assembly (4) from housing.

Remove "O" ring (1) from housing.

Remove ball bearing (5) from yoke as-

assembly. Remove oil seal (6). Remove seal sleeve (7).

Press or drive ball bearing (8) from

housing (9). CAUTION: Do not attempt removal of snap ring from bearing as it may be broken and replacement of complete bearing assembly will be necessary.

Reassembly

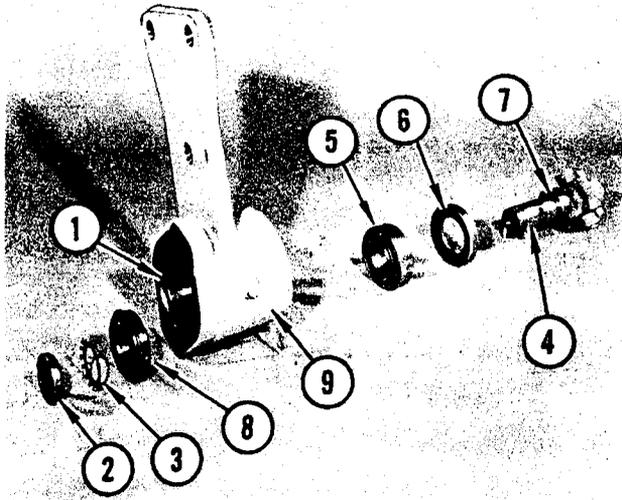


FIGURE 5. PUMP DRIVE ASSEMBLY
(Power-Flow Machines)

- | | |
|---------------|----------------|
| 1. "O" Ring | 6. Oil Seal |
| 2. Locknut | 7. Seal Sleeve |
| 3. Lockwasher | 8. Bearing |
| 4. Yoke | 9. Housing |
| 5. Bearing | |

1. Examine oil seal, "O" ring and bearings for wear or damage and replace if necessary.
2. Heat seal sleeve in hot oil and press

- onto yoke hub until sleeve is flush with shoulder on yoke.
3. Install oil seal onto sleeve with lip of seal away from universal coupling flange.
4. Heat large ball bearing in hot oil, 275° to 300°, and press onto yoke until bearing is against shoulder.
5. Install bearing and snap ring assembly into bore of housing.
6. Place yoke assembly into housing and guide shaft through bearing. Install lockwasher and nut. Tighten locknut until a definite drag is felt when yoke assembly is rotated. Back locknut off until drag is eliminated.
7. Lock nut in place by bending washer tang into slot of nut.
8. Fill housing with approximately one pint of multi-purpose lubricant #90.

Installation

Installation of the pump drive assembly will be the reverse of removal.

HYDRAULIC MOTORS

Removal

Disconnect hydraulic lines from motor. Plug all hose ends and hydraulic fittings to prevent foreign material from entering the hydraulic system.

Remove two capscrews and lockwashers retaining the motor to gear housing.

On blade lift gear housings, work motor

out until end of motor shaft has cleared splined coupling. Remove motor from gear housing.

On lateral shift and circle reverse gear housings, work motor out until pinion on motor shaft clears gear in first reduction housing. Remove motor.

Disassembly

On lateral shift or circle reverse motors, remove retaining ring and pinion from motor shaft.

Figure 6 shows an exploded view of the hydraulic motor. To disassemble the motor, follow the numerical sequence as shown.

Remove the eight capscrews and lock-washers (1). Carefully pry motor cover (2) away from dowels in housing. Remove roller bearings from shaft bores in cover. Remove small "O" rings from oil ports in cover.

Remove wear plate (3). Remove "O" rings (4) from each side of wear plate. Push the two seal assemblies from shaft bores in wear plate.

Remove motor housing (5). Press or drive dowels from housing.

Remove driven gear (6) and drive gear (7).

Remove wear plate (8); remove "O" rings from each side of wear plate. Push the two seal assemblies (9) from shaft bores in wear plate.

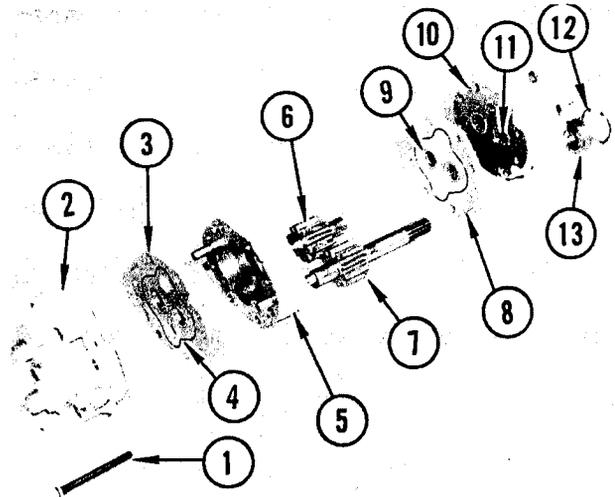


FIGURE 6. HYDRAULIC MOTOR

- | | |
|------------------------|--------------------|
| 1. Capscrews & Washers | 7. Drive Gear |
| 2. Cover | 8. Wear Plate |
| 3. Wear Plate | 9. Seal Assembly |
| 4. "O" Rings | 10. Adapter |
| 5. Housing | 11. Bearings |
| 6. Driven Gear | 12. Retaining Ring |
| | 13. Bearing |

Remove roller bearings (11) from adapter (10). Remove retaining ring (12) and remove ball bearing (13). Remove oil seal from same bore as ball bearing.

Reassembly

Replace all "O" rings and seals. Inspect wear plates for excessive wear, grooves, cracks, etc. If damaged, the wear plates should be replaced.

Inspect bearings for wear. If there is any damage or excessive looseness, they should be replaced.

Reassembly of the hydraulic motor will be the reverse of the disassembly sequence and the following information.

1. Press or drive oil seal into motor

adapter with lip of seal toward inside of motor.

2. Press or drive roller bearing into adapter just far enough to clear retaining ring groove.
3. Press or drive roller bearings into adapter and cover until they are against shoulder in bore.
4. When installing seal assemblies in wear plates, make certain that tang on seal seats in machined surface

on face of wear plate. This prevents seal assembly from rotating with shaft. When installing wear plates

make sure milled reliefs are not adjacent to each other. Tighten cap-screws to a torque of 35 to 50 ft. lbs.

CONTROL VALVES (HYDRECO)

Removal

Refer to Figure 7. Disconnect control linkage for each valve by removing hex nuts (1) from connect pins. Remove connect pins from valve plungers.

Disconnect all hydraulic lines (2). Plug ends of all hose and plug all hydraulic fittings to prevent foreign material from entering the hydraulic system.

Remove capscrews and lockwashers (3) from mounting brackets. There are three capscrews at each end of valve group assembly.

Remove valve group assembly by sliding group out R. H. side of machine.

Thoroughly clean the exterior of the valve group assembly before starting disassembly.

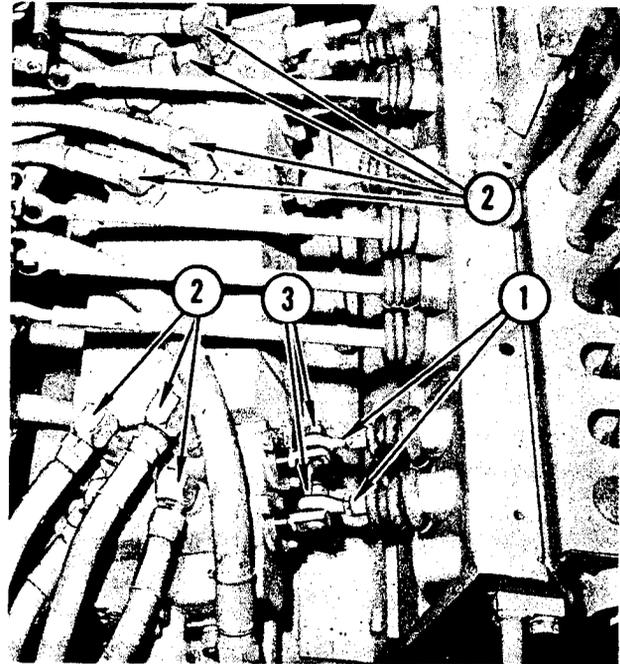


FIGURE 7. VALVE CONTROL LINKAGE
1. Control Linkage 3. Capscrews
2. Hydraulic Lines

Disassembly

VALVE GROUP

Refer to Figure 8 and follow the numerical sequence for disassembly of the valve group.

Remove hex nuts and lockwashers (1) and remove mounting brackets (2) from studs (3). There will be three studs. One stud, (not shown), goes through center hole of valve group. Remove all three studs.

Remove end section (4). This is the inlet section and contains the relief valve. Remove valve sections (5) and (6). Valve (5)

controls moldboard power shift. Valve (6) controls moldboard tilt cylinders. Remove spacer section (7). Remove valve section (8). This valve controls the leaning wheel cylinder. Remove the four spacer sections (9). Remove valve sections (10) and (11). These two valves control the ripper cylinders. Remove end section (12). This is the outlet section.

There will be three "O" rings between sections; this applies also to the spacer sections.

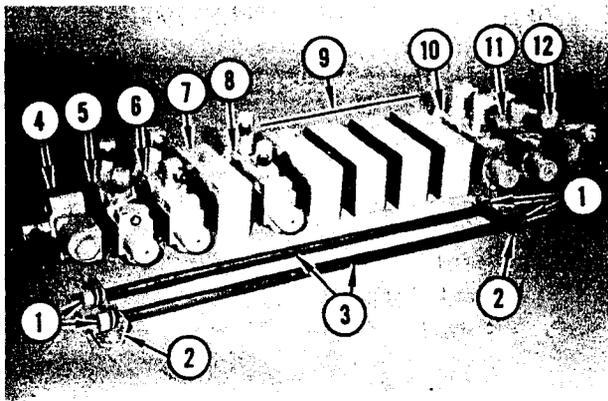


FIGURE 8. VALVE GROUP

- | | |
|-------------------|-------------------|
| 1. Nuts & Washers | 7. Spacer |
| 2. Brackets | 8. Valve Section |
| 3. Studs | 9. Spacers |
| 4. End Section | 10. Valve Section |
| 5. Valve Section | 11. Valve Section |
| 6. Valve Section | 12. End Section |

CONTROL VALVE

As all the valves are identical, only one will be covered in disassembly and also re-assembly.

Figure 9 shows an exploded view of the control valve. For disassembly, follow the numerical sequence as shown.

Remove two capscrews and lockwashers (1) and remove spring cover (2).

Using an Allen wrench, remove spring cap (3). Remove "O" ring (4).

Remove spring guide (5), plunger spring (6), and spring guide (7).

Remove plunger check spring (8), plunger check (9) and "O" ring (10).

Remove two capscrews and lockwashers (11). Remove retaining plate (12) and wiper (13).

Remove plunger assembly (14). Remove plunger eye (15). Remove "O" ring from eye.

Remove plunger check spring (16), plunger check (17) and "O" ring (18).

Remove three "O" rings (19) from oil ports in valve housing (21).

Remove hydraulic fittings (20). Remove "O" rings and locknuts from fittings.

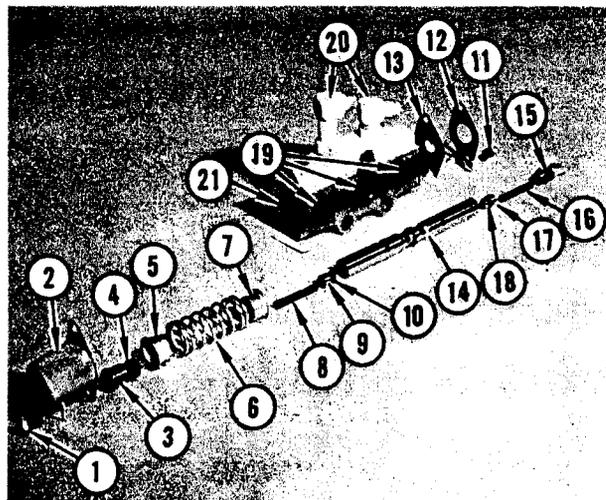


FIGURE 9. CONTROL VALVE

- | | |
|-------------------|----------------------|
| 1. Capscrews | 11. Capscrews |
| 2. Spring Cover | 12. Retaining Plate |
| 3. Spring Cap | 13. Wiper |
| 4. "O" Ring | 14. Plunger Assembly |
| 5. Spring Guide | 15. Plunger Eye |
| 6. Plunger Spring | 16. Check Spring |
| 7. Spring Guide | 17. Plunger Check |
| 8. Check Spring | 18. "O" Ring |
| 9. Plunger Check | 19. "O" Rings |
| 10. "O" Ring | 20. Fittings |

RELIEF VALVE

Figure 10 shows an exploded view of the relief valve. The relief valve is located in the inlet end section.

For disassembly of the relief valve, follow the numerical sequence as shown in Figure 10.

Remove bottom cap (1) and "O" ring (2).

Remove acorn nut (3), adjusting screw and locknut (4).

Remove valve cap (5) and "O" ring (6).

Remove spring guide (7), valve spring (8), valve plunger (9) and valve seat (10).

Remove hydraulic fitting (11) from inlet and housing (13). Remove "O" ring (12) from hydraulic fitting.

Reassembly

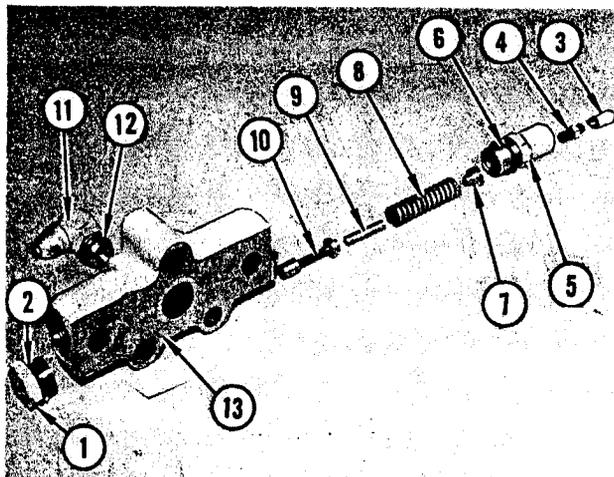


FIGURE 10. RELIEF VALVE

- | | |
|--------------------|------------------|
| 1. Cap | 8. Valve Spring |
| 2. "O" Ring | 9. Valve Plunger |
| 3. Acorn Nut | 10. Valve Seat |
| 4. Adjusting Screw | 11. Fittings |
| 5. Valve Cap | 12. "O" Ring |
| 6. "O" Ring | 13. Housing |
| 7. Spring Guide | |

RELIEF VALVE

To reassemble the relief valve, reverse the numerical sequence shown in Figure 10 and the following information.

1. Inspect all seals for nicks, cuts and cracks. Replace if damaged.

Installation

To install valve group in grader, reverse the removal instructions.

Adjustment

Install a 3000 psi gauge at fitting on L.H. end of Sundstrand valve bank.

Remove acorn nut from top of Hydreco relief valve. Loosen locknut on adjusting screw.

2. Install hydraulic fitting in housing, hand tight, to correct position; then tighten locknut.
3. Inspect housing bore for wear or scoring.
4. Check springs for serviceable condition.

CONTROL VALVE

Reassembly of the control valve will be the reverse of the disassembly sequence and the following information.

1. Install hydraulic fittings in valve housing, hand tight, until in proper position; then tighten locknut.
2. Insert new "O" rings in oil ports, making certain they fit in grooves securely.
3. Inspect plunger for scoring, nicks and scratches.

VALVE GROUP

To reassemble the valve group, reverse the disassembly instructions.

Start engine and operate at high idle. Operate any one of the hydraulic cylinder control levers. Take the ram all the way to its limit and hold. Check pressure reading on gauge. Turn adjustment screw in or out until a reading of 2000 psi is obtained on the gauge.

Remove test gauge and replace plug in the hydraulic fitting.

Tighten locknut on adjusting screw and install acorn nut.

CONTROL VALVES (SUNDSTRAND)

General

Multiple section valves are made to provide direction control of hydraulic motors. They are constructed so that a number of motors may be operated at the same time in a positive sequence from one pump regardless of load on the moving parts as long as the total load does not exceed the relief valve setting. Working pressures do not have to be the same. Return oil from each section is used as pressure oil for the next section. Any number of operating section up to ten may be used.

Individual valves may be disassembled and reassembled without removing the valve body from the section or group. It is not necessary to remove the valve group from grader and separate the group unless there is leaking between sections or it is desired to remove or add a valve section.

For the purpose of this manual, complete removal and disassembly will be covered.

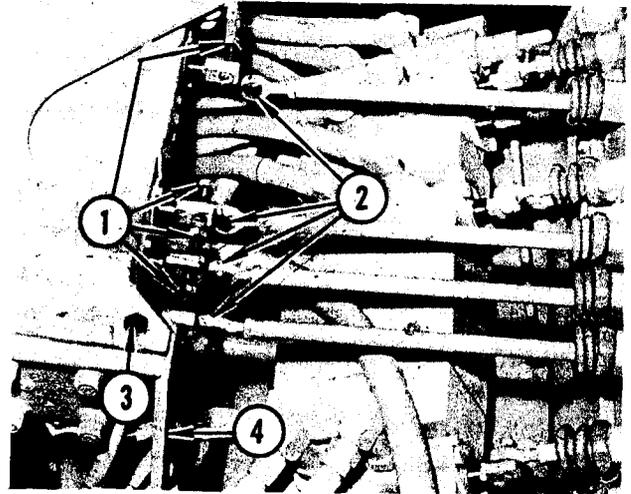


FIGURE 11. CONTROL VALVE REMOVAL

- | | |
|-----------------|--------------|
| 1. Connect Pins | 3. Capscrews |
| 2. Bearings | 4. Bracket |

Removal

Disconnect all hydraulic lines at valve fittings. Plug all hose ends and hydraulic fittings to prevent foreign material from entering the hydraulic system.

Attach sling to valve group and attach hoist to sling.

Refer to Figure 11. Remove hex nuts

from connect pins (1) and remove connect pins from self-aligning bearings (2).

Remove capscrews and lockwashers (3) from mounting lugs on each corner of valve group and the mounting bracket (4).

Take up on hoist and remove valve group from grader for disassembly.

Disassembly

VALVE GROUP

Thoroughly clean the exterior of the valve group of all grease, dirt, etc.

Refer to Figure 12. Remove the six hex

nuts and lockwasher (1) from tie rods and remove tie rods.

Remove end section (2). This section contains the relief valve. Remove separator

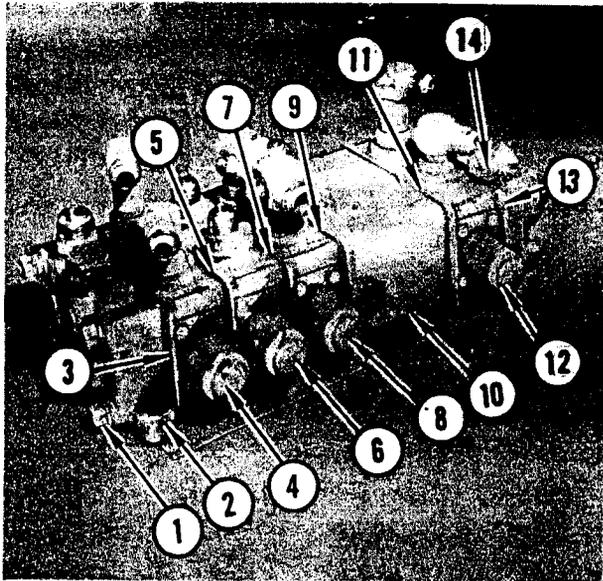


FIGURE 12. VALVE GROUP DISASSEMBLY

- | | |
|-------------------|-------------------|
| 1. Nuts & Washers | 8. Valve Section |
| 2. End Section | 9. Separator |
| 3. Separator | 10. Spacer |
| 4. Valve Section | 11. Separator |
| 5. Separator | 12. Valve Section |
| 6. Valve Section | 13. Separator |
| 7. Separator | 14. End Section |

(3). Remove the two lathe cut washers and retainer from separator. All separators will have these washers.

Remove valve section (4) and separator (5). This valve controls L.H. blade lift motor.

Remove valve section (6) and separator (7). This valve controls the lateral shift motor.

Remove valve section (8) and separator (9). This valve controls the reverse circle motor.

Remove spacer section (10) and separator (11).

Remove valve section (12) and separator (13). This valve controls the R.H. blade lift.

Remove end section (14). This section

contains the flow control valve.

RELIEF VALVE

Figure 13 shows an exploded view of the Sundstrand relief valve. For disassembly of the valve, follow the numerical sequence as shown.

Remove relief valve adjusting plug (1). Remove "O" ring (2) and locknut (3) from adjusting plug.

Remove valve spring (4) and valve stem (5).

Remove hydraulic fitting (6) from housing (8). Remove "O" ring (7) from fitting.

Reassembly

Closely inspect valve stem and valve seat for nicks and scratches.

Install new "O" rings.

Reverse the numerical sequence as shown for disassembly.

For adjustment of relief valve, see "Adjustments" at end of installation.

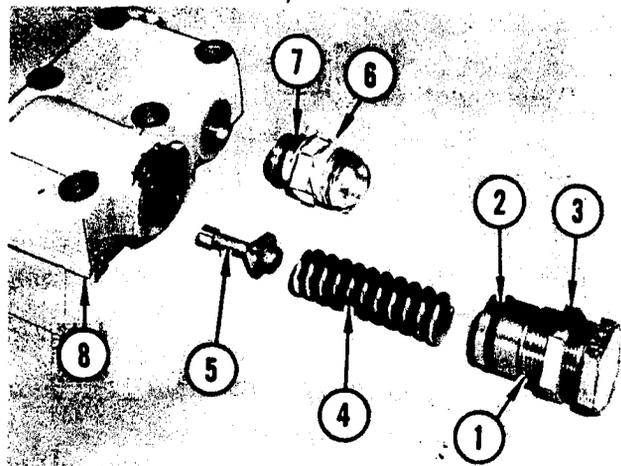


FIGURE 13. RELIEF VALVE DISASSEMBLY

- | | |
|-------------------|-------------|
| 1. Adjusting Plug | 5. Fitting |
| 2. "O" Ring | 6. Fitting |
| 3. Locknut | 7. "O" Ring |
| 4. Valve Spring | 8. Housing |

CONTROL VALVE

As all the motor control valves are identical, only one will be covered in disassembly.

Figure 14 shows an exploded view of the motor control valve. To disassemble the valve, follow the numerical sequence as shown.

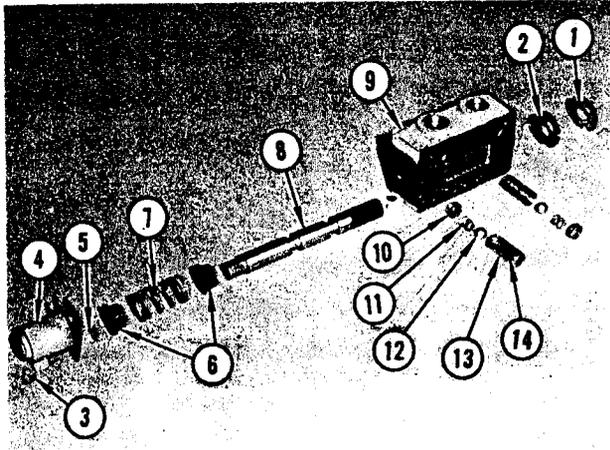


FIGURE 14. CONTROL VALVE
DISASSEMBLY

- | | |
|---------------------|---------------------|
| 1. Retainer Ring | 8. Valve Stem |
| 2. Wiper Ring | 9. Valve Body |
| 3. Capscrews | 10. Spring Retainer |
| 4. End Cap | 11. Spring |
| 5. Retaining Ring | 12. Ball |
| 6. Spring Retainers | 13. Sleeve |
| 7. Centering Spring | 14. "O" Ring |

Remove the two capscrews that retain the retainer ring (1) and wiper ring (2) to valve body. Remove retainer ring and wiper ring.

Remove four capscrews and lockwashers (3) retaining end cap (4) to housing and remove the end cap.

The valve stem assembly can now be removed from valve body. It should be pulled out from end of housing where cap was removed. NOTE: Clean exposed end of stem of paint, etc., before trying to remove stem. The stem should come out easily but can be tapped lightly on clevis end of stem.

Remove the spirolox retaining ring (5) and remove spring retainers (6) and centering spring (7) from valve stem (8).

Remove the two check valve assemblies from valve body (9). To remove the check assemblies, first remove spring retainer (10), spring (11) and ball (12). Remove "O" ring from groove in spring retainer.

Remove sleeve (13) and remove "O" ring (14) from groove in sleeve. Both check assemblies will be removed in the same sequence as shown above, but note that their relative positions in the valve body are reversed. Looking at the valve body from the cap end, the sleeve nearest the cap end goes into body from the right side. The other sleeve goes into valve body from the left side.

FLOW DIVIDER VALVE

The flow divider valve, located in the outlet end section, should be practically trouble-free except for replacing of "O" ring seals.

Figure 15 shows an exploded view of the end section and flow divider valve. To disassemble, follow the numerical sequence as shown.

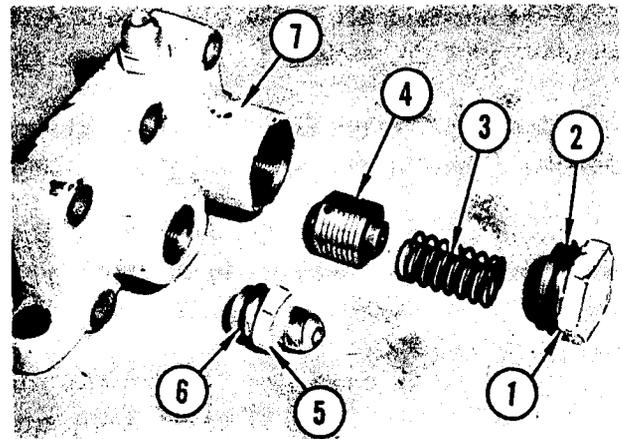


FIGURE 15. FLOW DIVIDER VALVE

- | | |
|-----------------|----------------|
| 1. Valve Plug | 5. Fitting |
| 2. "O" Ring | 6. "O" Ring |
| 3. Valve Spring | 7. End Section |
| 4. Valve | |

Remove valve plug (1) and remove "O" ring (2) from the plug.

Remove valve spring (3) and valve (4).

Remove hydraulic fitting (5) and "O" ring (6) from end section (7).

Reassembly

VALVE GROUP

Regrouping of the valves will be the reverse of disassembly sequence and the following information.

1. Replace all lathe cut washers with new ones.
2. Install lathe cut washers in separator plate as shown in Figure 16. Install the large lathe cut washer (1) in separator plate (4). Install washer retainer (2). Install small lathe cut washer (3). Make certain washers fit flat and snug against separator plate surface. Assemble separator plate to valve body (5) as shown.
3. Install tie rods and tighten tie rod nuts to a maximum torque of 30 ft. lbs.

RELIEF VALVE

Make certain all parts are free of dirt and other foreign matter.

Inspect "O" rings for scratches, nicks, wear and cleanliness. Replace if damaged.

Reassembly will be the reverse of the disassembly numerical sequence.

CONTROL VALVE

Check valve stem for indications of scoring or burring. Should valve stem appear to be tight in valve body, check the bore size of body and stem size. Bore size is indicated on body beneath the wiper. The stem size is indicated on the stem near the clevis hole. Clearance should be .0005". If

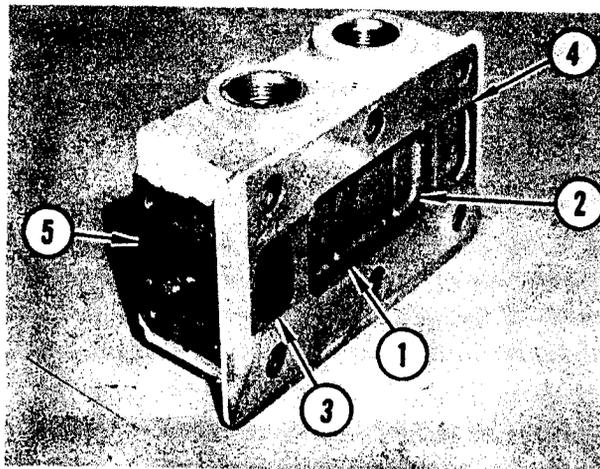


FIGURE 16. VALVE GROUP

- | | |
|-------------|--------------------|
| 1. Washer | 4. Separator Plate |
| 2. Retainer | 5. Valve Body |
| 3. Washer | |

the bore marking on body is 0, the stem marking should be -5; if the body marking is 1, the stem marking should be -6, etc.

Check "O" rings for scratches, nicks, wear and cleanliness. Replace if damaged.

The reassembly of the control valve will be the reverse of the numerical sequence shown for disassembly and the following information.

1. Make sure all parts and the valve bore are free of any dirt or foreign matter. A slight film of oil on the stem will aid in reassembly.
2. After centering spring has been installed on valve stem, test it in the end cap to make sure there is no binding.

Installation

To install the valve group on grader, reverse the instructions for removal.

Adjustment

RELIEF VALVE

Refer to Figure 17. Remove pipe plug from end of inlet section. Install hydraulic fitting (1) and install a pressure gauge (2) up to 3000 psi.

Remove adjustable lift link from either the R.H. or L.H. blade lift arm. Loosen clamping bolt of limit valve cam on blade lift shaft and rotate cam to position where it will not contact limit valve.

Start engine and operate at full RPM.

Operate control valve of blade lift from which lift link was removed. Rotate blade lift until lift arm engages stop on main frame. Observe the pressure gauge; if valve is correctly adjusted, the gauge should show a maximum reading of 2750 psi.

If adjustment is necessary, loosen the locknut on relief valve adjusting plug (3) and turn plug in to increase pressure or turn plug out to decrease pressure.

Care should be taken when adjusting the

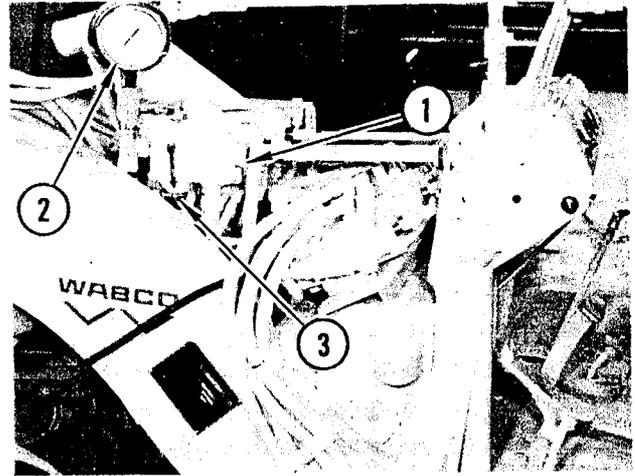


FIGURE 17. RELIEF VALVE
ADJUSTMENT

1. Hydraulic Fitting
2. Gauge
3. Adjusting Plug

relief valve since a very slight movement of adjustment plug will vary the pressure considerably.

After the relief valve has been correctly adjusted, shut off engine. Readjust limit valve cam and install lift link to lift arm.

STEERING GEAR (ROSS HYDRAPOWER)

General

The Ross "Hydrapower" unit is a fully integral steering gear incorporating a hydraulic control valve, a power cylinder, and a mechanical means of steering control. The power of the cylinder is transmitted to the steering gear output shaft by means of gear teeth on the piston mating with teeth of

sector gear on shaft. The flow of oil from the steering pump, which is driven by the engine, is directed to the power cylinder by means of the control valve. The valve is concentric with the input shaft and located on the steering shaft end of the input shaft.

Operation

The action of the steering gear is both manual and hydraulic. When the input shaft is turned, by the operator's effort on the steering wheel, the piston is caused to move by the interaction of recirculating balls spaced between a groove in the shaft (worm) and a groove in the ball nut. The ball nut in turn is rigidly fastened to the piston. Whenever the operator's effort at the steering wheel exceeds the force of the centering springs and the "hydraulic reaction" provided by the control valve, the valve is actuated permitting oil to flow against the piston in the cylinder and thus provides power steering.

Power steering control valves generally utilize the hydraulic pressure in the steering system to urge the valve spool to its neutral position. This is called "hydraulic reaction". As the pressure in the hydraulic cylinder builds up, the hydraulic centering force increases. Because the hydraulic pressure is low in straight ahead driving, it is necessary to add centering springs to assist the valves hydraulic reaction in giving the steering system "road feel".

When the valve is in the center position, the oil pressure at its two cylinder ports is low and equal and produces no effective force in the cylinder. This results in no movement of the piston and no circula-

tion of oil in the cylinder; however, oil is circulating from the pump through the control valve and back to the reservoir with only enough pressure to overcome friction of lines and fittings.

Whenever the operator's effort at the steering wheel overcomes the valve centering spring and the hydraulic reaction, the valve spool is moved axially restricting one of the return passages to the outlet port, thus causing an immediate increase in pressure at one of the cylinder ports and in one end of the cylinder. At the same time, the other return passage is enlarged, permitting the oil from the discharging end of the cylinder free passage to the outlet port and return to the reservoir. The immediate effect is increased pressure in one end of the cylinder to actuate the piston, thereby applying hydraulic force directly to the steering gear Pitman arm. Full pressure is obtained with a valve spool travel of approximately .035".

If the steered wheels are subjected to a shock load, the Pitman arm, acting through the various parts of the steering gear, shifts the input shaft worm and control valve spool axially in the opposite direction, thus directing the fluid to the proper side of the piston to resist the shock force. This "blocking" action prevents kickback at the steering wheel.

Removal

Disconnect all hydraulic lines. Cap or plug all lines and fittings to prevent foreign material from entering the hydraulic system.

Refer to Figure 18 to remove pitman arm. Remove capscrews from the two ball shaft caps and remove caps. Swing double ball shaft and tie rods to rear until clear of pitman arm.

Remove locknut and lockwasher (2). Attach puller to pitman arm (3) and remove arm from vertical shaft. NOTE: Before removing pitman arm, make a prick punch mark on one serration of vertical shaft and on pitman arm. These marks are to be used when installing pitman arm.

Remove bearing retaining cap (4) by removing the two capscrews and lockwashers.

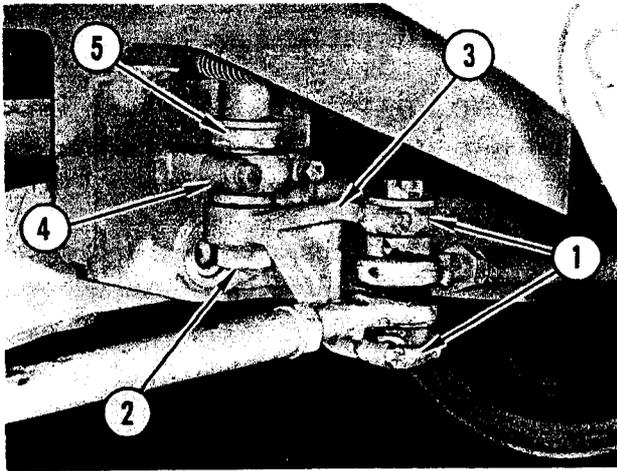


FIGURE 18. REMOVE PITMAN ARM

- | | |
|-------------------------|--------------------------|
| 1. Ball Shaft Caps | 4. Bearing Retaining Cap |
| 2. Locknut & Lockwasher | 5. Self Aligning Bearing |
| 3. Pitman Arm | |

Remove self aligning bearing (5) from vertical shaft.

Remove one capscrew and lockwasher from output shaft cover on steering gear housing. Install eyebolt, then attach sling and hoist to the eyebolt.

Remove two capscrews and lockwashers retaining triangle cap to support weldment. Remove cap.

Remove one capscrew and lockwasher

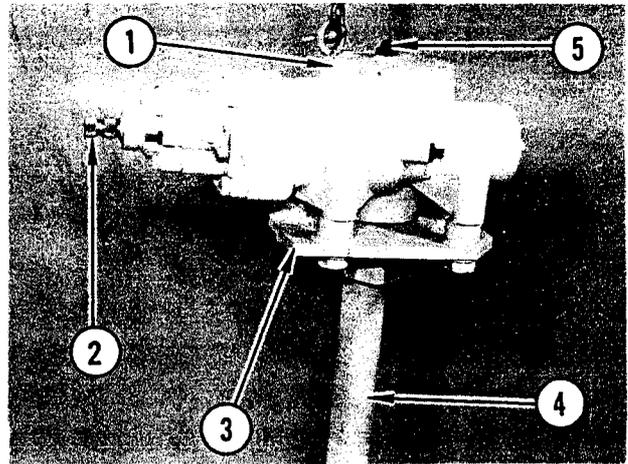


FIGURE 19. REMOVE STEERING GEAR ASSEMBLY

- | | |
|-----------------------|----------------------------|
| 1. Output Shaft Cover | 4. Output (Vertical) Shaft |
| 2. Input Shaft | 5. Adjusting Screw |
| 3. Mounting Plate | |

retaining mounting plate to the support weldment.

Loosen clamp bolt on universal coupling of steering column and push column to rear until coupling is clear of splined end of input shaft.

Take up on hoist and remove steering assembly from grader. Refer to Figure 19.

Remove four capscrews and lockwashers retaining the mounting plate to the housing. Remove mounting plate.

Disassembly

Thoroughly clean the exterior of the steering gear assembly before starting disassembly.

Remove the eyebolt used to lift the assembly from the grader. Remove the remaining five capscrews and lockwashers from cover.

Loosen the jam nut on the adjusting

screw located in cover. Using a screwdriver, turn the adjusting screw into cover (clockwise). Cover will be forced away from housing due to the adjusting screw being anchored to the output shaft. The adjusting screw must be turned all the way out of cover.

Refer to Figure 20 for numerical sequence of cover disassembly.

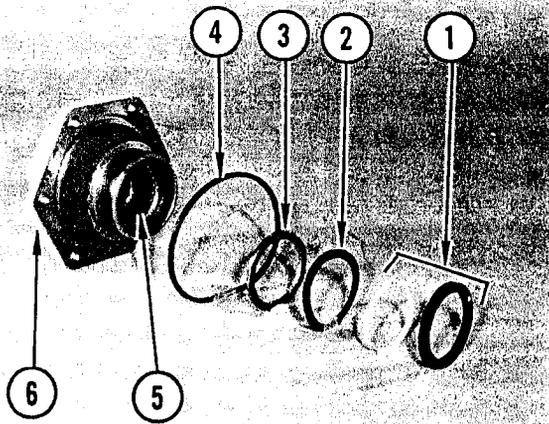


FIGURE 20. EXPLODED VIEW OF COVER ASSEMBLY

- | | |
|------------------------|-------------|
| 1. Seal Set | 4. "O" Ring |
| 2. Leather Washer | 5. Bearing |
| 3. Seal Back-Up Washer | 6. Cover |

Remove seal set (1), set consists of an oil seal and a teflon ring. Note the white dot on seal. When installing seal, the white dot must be facing out after seal is installed.

Remove leather washer (2), seal back-up washer (3) and "O" ring (4).

Remove bearing (5) from bore of cover (6).

OUTPUT SHAFT

From lower side of gear housing, remove dirt seal boot from housing hub and output shaft.

In the following sequence, remove four socket head capscrews, seal retainer, oil seal, teflon ring, leather back-up ring, "O" ring and bearing.

Rotate, by hand, the input shaft until sector gear on output shaft is positioned so that it will clear opening in housing. Lift output shaft from housing.

Using a spanner wrench, remove adjusting screw retainer from end of output

shaft. Remove adjusting screw, two thrust washers and a thrust bearing.

VALVE AND ADAPTOR

Remove seal boot from valve cover and input shaft.

Remove four capscrews and lockwashers retaining hydraulic control valve cover to adaptor and remove cover assembly.

To disassemble the cover assembly, refer to Figure 21 and follow the numerical sequence as shown.

Remove "O" ring (1) from groove in face of valve cover.

Remove retaining ring (2), seal back-up washer (3), input shaft seal (4) and bearing (5).

Loosen jam nut on pressure unloader valve adjusting screw (6) and turn the adjusting screw out of cover (7). Remove the small "O" ring from groove at machined end of adjusting screw.

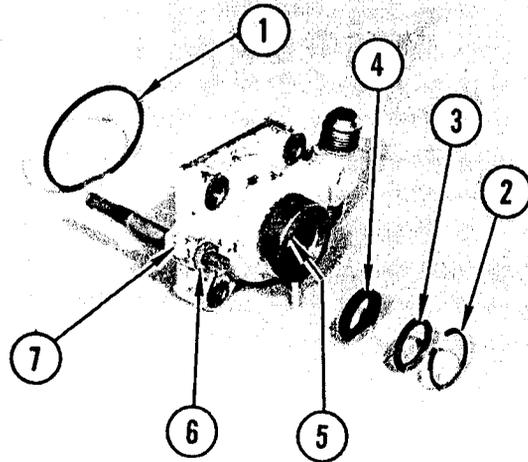


FIGURE 21. CONTROL VALVE COVER

- | | |
|---------------------|---|
| 1. "O" Ring | 6. Pressure Unloading Valve Adjusting Screw |
| 2. Retaining Ring | 7. Control Valve Cover |
| 3. Back-Up Washer | |
| 4. Input Shaft Seal | |
| 5. Bearing | |

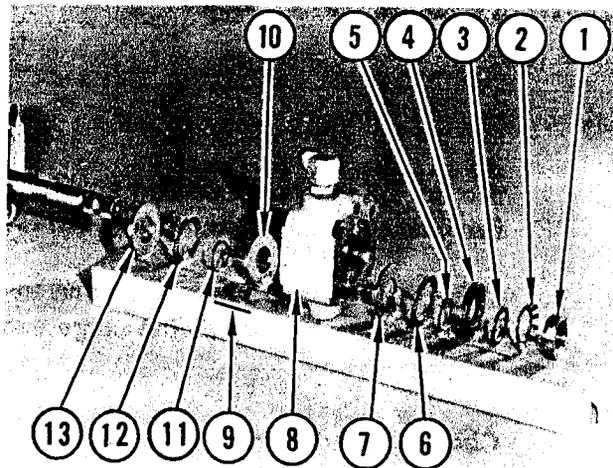


FIGURE 22. EXPLODED VIEW OF CONTROL VALVE

- | | |
|------------------------------|------------------------------|
| 1. Locknut | 8. Control Valve Assembly |
| 2. Lockwasher | |
| 3. Internal Tanged Washer | 9. Cylinder Port "O" Rings |
| 4. Thick Thrust Bearing Race | 10. Thin Thrust Bearing Race |
| 5. Thrust Bearing | 11. Bearing Spacer |
| 6. Bearing Spacer | 12. Thrust Bearing |
| 7. Thin Thrust Bearing Race | 13. Thick Bearing Race |

Refer to Figure 22 and follow the numerical sequence for disassembly of the control valve.

Pry locking tang from groove in locknut (1) and, using a spanner wrench, remove the locknut. Remove lockwasher (2), internal tanged washer (3), thick thrust bearing race (4), thrust bearing (5) with bearing spacer (6) and thin thrust bearing race (7).

Remove control valve assembly (8) from input shaft. The valve is the control center of the steering hydraulic system. The major parts, which are the body and spool, are machined to very close tolerances and with precision machined edges. The spool and valve body are selectively fitted at the factory and, therefore, these two parts are not serviced separately. The sealing edges of the valve bore and the spool should never be broken. This will result in excessive leak-

age and reduced hydraulic power.

Remove two cylinder port "O" rings (9). Remove thin thrust bearing race (10), thrust bearing spacer (11), thrust bearing (12) and thick thrust bearing race (13)

Refer to Figure 23 and follow the numerical sequence outlined for disassembly of the adapter and piston rack.

Remove "O" ring seal (1) from groove in adapter. Remove four capscrews and lockwashers (2) retaining adapter to housing. Rotate input shaft and adapter 60° and remove assembly from housing.

Remove spiral lockring (3), adapter seal (4), seal back-up washer (5), adapter (6), cylinder port seal (7) and "O" ring (8).

Remove follower locking screw (9). Pull input shaft and ball follower assembly from piston rack until approximately 1" of ball follower has been exposed. Wipe dry the surface of ball follower and place tape around follower to cover the ball cross over tubes. This will prevent loss of the balls from follower. Continue removal of input shaft and follower from piston rack.

Remove retaining ring (10) from end of input shaft, then remove seal set consisting of the following: retaining ring washer (11), seal back-up washer (12), seal cup (13), seal (14) and back-up washer (15).

Place a mandrel (WABCO Part #SS-0076) in hole at end of input shaft, unscrew follower (16) off of shaft (17) and onto mandrel. Carefully remove mandrel with follower and set aside with ball follower up. Use extra care in order that the tape around follower does not become disengaged.

Remove piston ring (18), unloader valve seat (19) and unloader valve (20) from piston rack (21).

Loosen jam nut (22) and unscrew unloader valve adjusting screw (23) and "O" ring

(24) from housing (25).

Reassembly

Before assembly, all parts should be cleaned in a good solvent, then blown dry with clean compressed air. Do not wipe parts with a cloth since lint from the cloth could cause binding and sticking of the closely fitting parts.

the bores and outer ground surfaces for damage and stone off any burrs.

Discard all used seals and "O" rings.

2. Carefully expand piston ring and install in ring groove at the large end of piston rack.
3. Check threaded hole in face of large

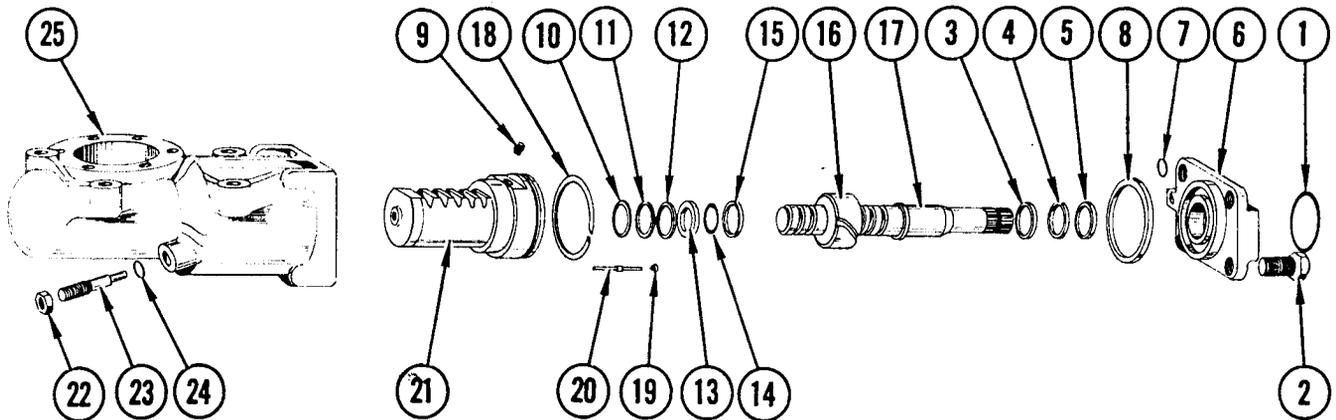


FIGURE 23. EXPLODED VIEW OF PISTON RACK AND BALL FOLLOWER ASSEMBLY

- | | | |
|-----------------------|---------------------------|-------------------------|
| 1. "O" Ring | 9. Follower Locking Screw | 18. Piston Ring |
| 2. Capscrew (4) | 10. Retaining Ring | 19. Unloader Valve Seat |
| 3. Spiral Lockring | 11. Washer | 20. Unloader Valve |
| 4. Seal | 12. Back-Up Washer | 21. Piston Rack |
| 5. Back-Up Washer | 13. Seal Cup | 22. Jam Nut |
| 6. Adapter | 14. Seal | 23. Adjusting Screw |
| 7. Cylinder Port Seal | 15. Back-Up Washer | 24. "O" Ring |
| 8. Seal | 16. Ball Follower | 25. Housing |
| | 17. Input Shaft | |

Replace with new ones.

ADAPTOR AND PISTON RACK

To reassemble the adaptor and piston rack, refer to Figure 23 and reverse the numerical sequence as shown plus the following information.

end of piston rack for dirt and oil. Clean with solvent and blow dry. Insert pressure unloader valve in the threaded hole. Clean all oil from threads of valve seat, apply one drop of Loctite - Type "A" to threads, insert valve seat and torque to 20 ft. lbs.

1. Using a soft faced vise, clamp the piston rack in a horizontal position with the teeth up. Carefully inspect

4. After ball follower, seal sets and adaptor have been assembled onto

input shaft, coat seal at end of shaft with good clean grease and enter shaft into bore of piston rack. As the ball follower approaches the piston bore, align the conical hole in the ball follower with the locking screw hole in piston. Move the assembly into bore until about 1" of the ball follower remains outside of piston. Remove tape from ball follower; then complete moving assembly into piston. Assemble a new locking setscrew into threaded hole, torque to 35 ft. lbs. and stake securely. NOTE: If the steel balls should become disengaged from the ball follower, replace them as follows: install ball follower onto input shaft with the large chamfer on outer diameter away from the serrated end of shaft. Load six steel balls, alternating a dark and light ball, into the ball return guides. Retain them with grease. Load the remaining twenty-two balls, again alternating a dark and light ball, into the ball follower groove. Use care to assure all balls enter the groove. Place the ball return guides in the slot provided and secure temporarily with tape. Carefully rotate ball follower for its full length of travel to assure that all balls are in the correct recirculating path.

5. Coat the pressure unloading valve adjusting screw "O" ring with clean grease and carefully install it over the plain end of adjusting screw and into groove provided for it. Insert the adjusting screw into the threaded hole provided for it until 7/8" of threaded end is left exposed. Assemble the jam nut and tighten securely.
6. Install large "O" ring in face of adapter and the small "O" rings in

recesses provided in face of adapter. Retain them with grease. Insert piston rack into the housing bore; position piston rack so that teeth are visible through output shaft cover opening. As the piston enters the housing bore, compress the piston ring until it is in position. Before moving adapter into contact with housing, check position of the two small "O" rings.

7. Install the four capscrews and washers to retain adapter to housing and torque to 70 ft. lbs.

CONTROL VALVE

To reassemble the control valve, reverse the numerical sequence as shown in Figure 22 plus the following information.

1. After all parts shown in Figure 22 have been assembled on input shaft, carefully tighten locknut, noting that the thrust bearings are located over the spacers, until snug tight, then back off the nut approximately 20° and bend one tang of lockwasher into a matching slot of nut. Check for free rotation on shaft. Valve should have no perceptible end play.

CONTROL VALVE COVER

To reassemble the control valve cover, reverse the numerical sequence as shown in Figure 21 plus the following information.

1. If input shaft needle bearing has been removed from the valve cover, a suitable pressing mandrel which will pilot on the inner diameter of the bearing and just have clearance in the bearing bore must be used. The bearing must be pressed on the numbered end and positioned 1-1/8" from face of valve cover. After bearing has been installed, check for freedom of needles in bearing.

2. Coat small "O" ring with clean grease and carefully install it over plain end of pressure unloader valve adjusting screw and into groove provided for it. Thread the adjusting screw through the valve cover until 13/16" of threaded end is exposed beyond boss. Install jam nut and tighten securely.
3. Carefully install valve cover noting that the adjusting screw passes through the valve and adapter. Install four capscrews and washers. Tighten to a torque of 25 ft. lbs.

OUTPUT SHAFT

Assemble the two thrust washers and the thrust bearing onto the output shaft adjustment screw. Using a good grade of wheel bearing grease, thoroughly coat the expanded end of adjustment screw and the thrust bearing.

Insert expanded end of the adjustment screw into threaded hole in top end of output shaft. Thread the adjustment screw retainer into the threaded hole and adjust to permit free rotation of the adjustment screw without perceptible end play.

Stake the retainer into the two slots provided. After staking, check freedom of adjusting screw movement.

Carefully press output shaft bearing into housing bore until 3/16" of the bearing remains exposed. Install bearing retaining ring into groove in bearing. NOTE: The bearing must be installed so that it is pressed on the groove end. After bearing is installed, check freedom of the rollers in bearing.

Rotate by hand the input shaft and, by observation through output shaft cover opening, position the piston rack centering mark in the approximate center of opening. Install output shaft into housing, aligning center

tooth of output shaft with centering line of piston rack. Refer to Figure 24.

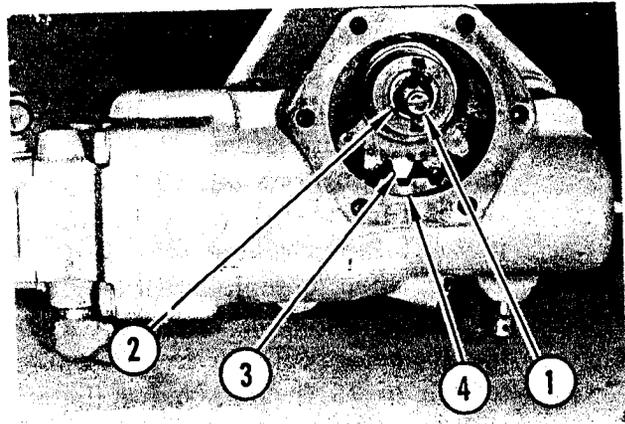


FIGURE 24. OUTPUT SHAFT INSTALLED

- | | |
|--------------------|----------------|
| 1. Adjusting Screw | 4. Piston Rack |
| 2. Screw Retainer | Centering Mark |
| 3. Output Shaft | |
| Center Tooth | |

For reassembly of the output shaft cover, refer to Figure 20 and reverse the numerical sequence as shown plus the following information.

1. After pressing bearing into cover bore, work a good grade of EP grease into the bearing.
2. Assemble back-up washer, leather washer and two piece seal into cover bore. The white dot on seal must be visible after seal has been installed.
3. Coat the upper end of output shaft with clean grease. Install cover onto output shaft until end of adjusting screw makes contact with threaded hole in cover. Using a screwdriver, turn the adjusting screw counter-clockwise until the cover flange is against housing.
4. Assemble the six cover retaining capscrews and washers. Tighten to a torque of 45 ft. lbs.

5. Cover the serrations on lower end of output shaft with one layer of transparent Scotch tape. Assemble the oil seal, teflon ring, leather back-up washer and "O" ring into seal retainer. Install seal assembly over lower end of output shaft

and onto housing. Care must be taken to assure that the "O" ring in retainer is properly positioned over bearing retaining ring. Assemble the four socket head capscrews and torque to 20 ft. lbs.

Installation

To install steering gear assembly into grader frame, reverse the instructions for removal.

Adjustments

PRESSURE UNLOADER VALVE

Install a suitable pressure gage in the hydraulic line between pump and steering gear pressure port.

With engine running at idle, actuate steering until steering arm is against stop. Adjust pressure unloader valve adjustment screw to provide between 400 and 600 psi on gage.

Repeat procedure in the opposite direction.

NOTE: Care must be exercised to not hold pressure for more than 15 seconds at a time while this adjustment is being made.

OUTPUT SHAFT ADJUSTMENT SCREW

Using a torque wrench reading in inch pounds, rotate input shaft 90° each side of

center; at same time adjust the adjustment screw until a torque of 15 to 20 in. lbs. is provided.

Back out the adjustment screw one turn and check the torque required to move 90° each side of center. Turn adjustment screw in to provide a rise in torque of 2 to 4 in. lbs. at a point within 45° each side of center.

After adjustment is completed, tighten jam nut to a torque of 20-25 lbs.

NOTE: Before making the above adjustments, the pressure setting of the steering system hydraulic relief valve should be checked. At full engine RPM, the relief valve should open at 1600 psi. Adjustments to the relief valve can be made by adding or removing shims.

FLOW CONTROL VALVE (On Models Having Power Brakes)

General

The flow control valve used in the brake and steering circuit incorporates an integral relief valve. This relief valve consists basically of a poppet, spring, shims and an orifice plug. Shims are used for adjusting the pressure.

The relief is adjusted for 1500 psi at

full engine RPM when the grader leaves the factory. Under normal operating conditions, it should not be required to change this adjustment.

Should an adjustment be required, it will be necessary to remove the valve from grader.

Removal and Disassembly

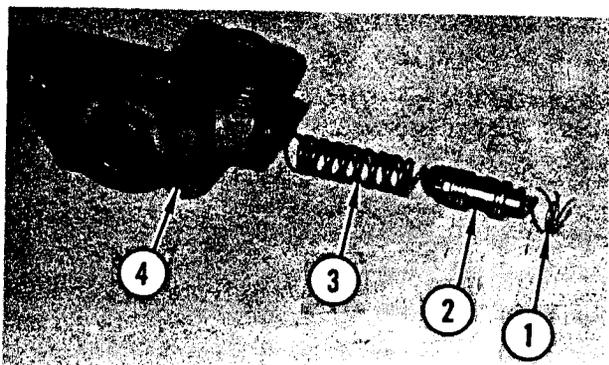


FIGURE 25. FLOW CONTROL VALVE

- | | |
|-------------------|-----------|
| 1. Retaining Ring | 3. Spring |
| 2. Valve Assembly | 4. Body |

Remove the three hydraulic lines at the valve body. Plug ends of hose and each hydraulic fitting to prevent dirt or foreign material from entering the hydraulic system.

Remove the two capscrews retaining flow control valve to main frame cross member (beneath cab floor) and remove valve. Thoroughly clean exterior of valve of all dirt and contamination before starting disassembly.

Refer to Figure 25. Using a pair of snap ring pliers, reach inside the inlet port and remove the retaining ring (1). Turn valve body on end to remove valve assembly (2) and spring (3) from valve body (4).

Refer to Figure 26. Place shop cloth around valve assembly and clamp a pair of pliers around valve body between lands. Remove orifice plug (1) and remove shims (2) from plug. Remove poppet (3) and poppet spring (4) from valve (5).

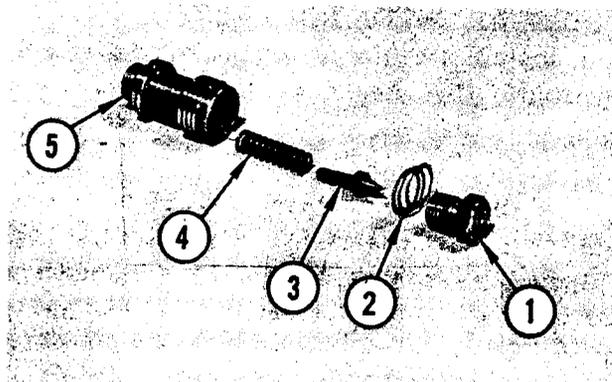


FIGURE 26. VALVE DISASSEMBLY

- | | |
|-----------------|------------------|
| 1. Orifice Plug | 4. Poppet Spring |
| 2. Shims | 5. Valve |
| 3. Poppet | |

Reassembly

Reassembly will be the reverse of disassembly and the following information.

Check parts for scoring or burring. Replace if damaged. Make certain springs are not broken or have become set.

Clean all parts thoroughly with a good solvent and blow dry with compressed air.

Replace same shims as were removed during disassembly.

Adjustment

Install pressure gauge, reading to 2000 psi, at outlet port of steering pump.

Start engine and operate at full RPM. Gauge should show a pressure reading of 1500 psi.

If pressure is lower than 1500 psi, re-

move a shim from valve plug. If pressure is higher than 1500 psi, add a shim to valve plug.

Turn steering wheel in both directions and observe steering action of front wheels. Front wheels should turn from stop to stop in 8 to 10 seconds with engine operating at full RPM.

HYDRAULIC RESERVOIR

General

The hydraulic reservoir is located between the main frame sides and just in front of cab. It has a capacity of 16 gallons although this does not represent the capacity of the complete hydraulic system. If the entire hydraulic system is drained, it will require about 22 to 24 gallons. Fill with type "A" hydraulic oil.

The reservoir has a filler cap which is sealed for pressure. Reservoir is pressurized with air from engine air box. A relief valve, adjusted at 15 psi, relieves ex-

cess air pressure. An air filter in the line between engine air box and reservoir prevents impurities from engine air box getting into the hydraulic reservoir.

The reservoir is made in two sections so that it can be separated for easy cleaning. The filter elements are located inside the reservoir and can be changed without draining the reservoir. A relief valve adjusted at 5 psi returns the oil directly to reservoir in case filters become clogged.

Removal and Disassembly

Remove the twenty-four stud nuts and lockwashers. Remove front section of reservoir.

Refer to Figure 27. Remove the four capscrews and lockwashers (1) and remove the baffle (2). Remove 5 psi relief valve (3). The two filter housings (4) cannot be removed from reservoir. Filter elements are

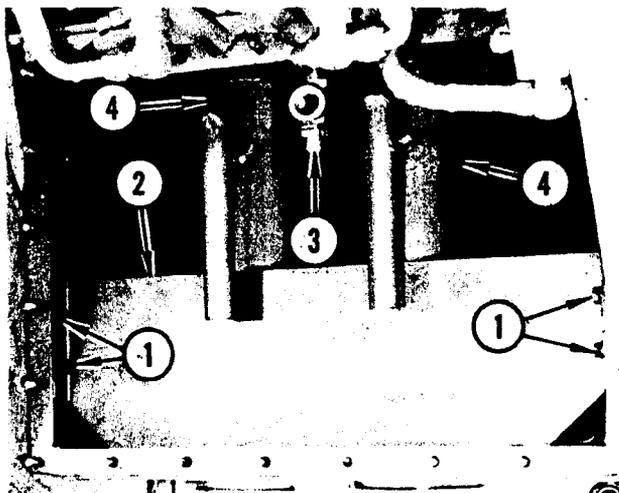


FIGURE 27. RESERVOIR REMOVAL

- | | |
|--------------|-----------------|
| 1. Capscrews | 3. Relief Valve |
| 2. Baffle | 4. Filters |

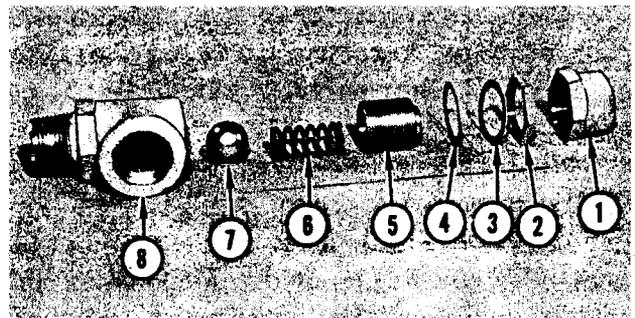


FIGURE 28. RELIEF VALVE

- | | |
|------------|--------------------|
| 1. Cap | 5. Adjusting Plug |
| 2. Locknut | 6. Pressure Spring |
| 3. Gasket | 7. Ball Seat |
| 4. Gasket | 8. Valve Body |

removed by removing caps located on bottom of reservoir.

RELIEF VALVE

The 5 psi and the 15 psi relief valves are identical so only one will be shown in disassembly and reassembly.

Refer to Figure 28. Remove cap (1). Remove locknut (2) and gaskets (3) and (4). Remove adjusting plug (5). Tilt valve body (8) to remove pressure spring (6) and ball seat (7).

Reassembly

Reassembly of the reservoir will be the reverse of disassembly instructions and the following information.

1. Thoroughly clean old gasket from

front section and install new gasket.

2. Make certain insides of reservoir are clean of all foreign material.

AIR LINE FILTER

General

The air line filter is located on R.H. side of hydraulic reservoir. It consists of a filter element for removing impurities and a bowl for trapping condensation.

The bowl should be drained regularly; never allow moisture to fill bowl above the baffle. NOTE: This filter used only with GM engine.

Disassembly

It is not necessary to remove the filter assembly from the grader to service or clean.

Refer to Figure 29. Unscrew clamping ring (1) to remove bowl (2). Unscrew and remove baffle (3) to remove filter element (4) from body (5). Remove drain cock (6) from bowl by unscrewing it from insert. Item (7) is check valve located in line between filter and reservoir. This check valve prevents oil or air in reservoir from bleeding back into engine air box.

Use soap and water or a petroleum solvent such as kerosene to clean the filter element and other parts. WARNING: Do not use toluene, carbon tetrachloride or any strong alkaline solution for cleaning the filter parts.

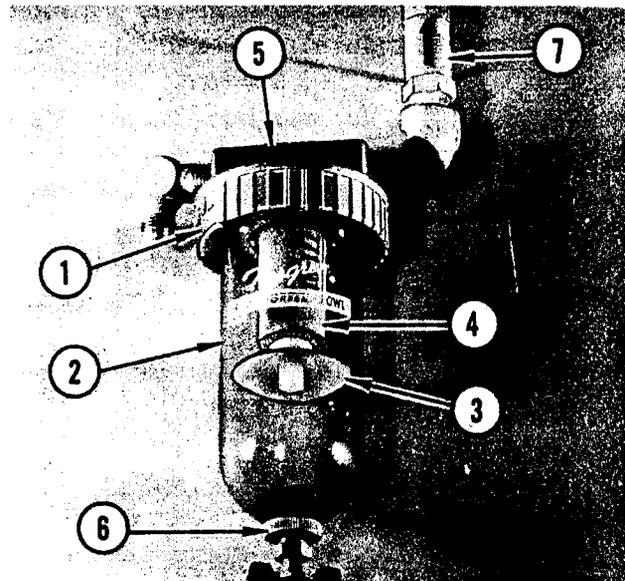


FIGURE 29. AIR LINE FILTER

- | | |
|-------------------|----------------|
| 1. Clamping Ring | 5. Body |
| 2. Bowl | 6. Drain Cock |
| 3. Baffle | 7. Check Valve |
| 4. Filter Element | |

Reassembly

Reassembly will be the reverse of disassembly procedure.

HYDRAULIC CIRCUITS

The following schematic drawings show the various circuits of the hydraulic system. A study of these schematics will acquaint the mechanic with all the components of each circuit making the job of trouble shooting the hydraulic system alot easier.

Figure 30 shows one of the two blade lift circuits. The two circuits are identical, hence, only one is shown.

Oil from the 30 GPM pump passes through the relief valve inlet section of the Sundstrand valve bank. It continues through the cluster of valves and out the flow control outlet end. The flow control valve permits 15 GPM to flow to the Hydreco, or cylinder control, valves and the balance of the oil is returned to the reservoir.

When one of the blade lift control valves is activated, oil passes through the valve ports to the blade lift hydraulic motor causing the blade lift motor to rotate; thus raising or lowering the moldboard, depending upon which way the control valve was moved.

As the blade lift arm nears its maximum travel, and just prior to the lift arm contacting the stop on the main frame, an acuator arm attached to the blade lift shaft contacts the limit valve in the circuit, opening the valve permitting the oil to bypass the hydraulic motor. Operating the motor in the opposite direction will move the actuator arm away from the limit valve permitting a spring action to close the valve.

Figure 31 shows the hydraulic circuits for the lateral shift and the circuit reverse motors. As these two circuits are identical, only one will be discussed.

When the lateral shift, or circle reverse, control valve is activated, oil is permitted to flow through the valve ports to the hydraulic motor, causing the motor to ro-

tate either clockwise or counter-clockwise, depending upon which direction control valve was moved. As the motor rotates, it drives a gear box and pinion which in turn shifts the moldboard circle and drawbar sideways (Lateral Shift).

An oil manifold in this circuit supplies make up oil under a pressure of 15 psi to prevent voids or a vacuum from forming in the circuits and to aid in preventing "coasting" by forming a hydrostatic lock.

Figure 32 is in two parts. The top half shows a schematic of the steering circuit without power brakes; the lower half shows a schematic of the steering circuit with power brakes.

The steering pump furnishes approximately 12 GPM at full engine RPM. On graders not equipped with power brakes, the oil flow is from pump to steering gear, through steering gear control valve and back to reservoir. When steering wheel is turned, the control valve spool is moved axially restricting one of the return passages to the outlet port, thus causing an immediate pressure at one of the cylinder ports and against one end of the piston rack. When, and if pressure builds up to the relief valve setting, the relief valve opens and returns the unused oil to the hydraulic reservoir. The relief valve setting should be 1600 psi at full engine RPM.

On graders equipped with power brakes, the oil flow is from the steering pump to a flow control valve. The flow control valve varies the flow of oil to the brakes and steering to approximately 5 to 6 GPM. The oil not used is returned to the hydraulic reservoir. The flow valve has a built-in relief valve to regulate the pressure to 1600 psi at full engine RPM; therefore, the pressure relief valve mentioned above is not used on graders with power brakes.

From the flow control valve, oil flows through the brake master cylinder to supply oil pressure for brake operation, then to steering gear and steering control valve. From the steering control valve back to reservoir when not steering.

Figure 33 shows schematic of the leaning wheel circuit. The scarifier circuit is also similar to this circuit.

Oil flows from the flow control valve at the outlet end of Sundstrand valve bank into the inlet end and relief valve of the Hydreco valve bank. The oil continues through the Hydreco valves and out the outlet end and returns to reservoir.

When the leaning wheel control valve is actuated, oil flows to one end of the leaning wheel cylinder causing the piston to move towards the opposite end of cylinder, thus leaning the front wheels in the desired direction.

A double pilot check valve is located in the circuit between the control valve and the cylinder. With no oil flowing, both checks are closed to prevent the front wheels from leaning over should the valve be opened while grader is parked. It also prevents the piston from "wandering" or coasting while

grader is operating.

When the control lever is activated, the oil flow causes the pilot to move both checks off the valve seats. This permits oil flow into one end of the cylinder and out the other. When oil flow stops, a spring action returns both checks to closed position.

Two orifice checks, one .070", one .086", are located in the circuit between the double pilot check valve and the cylinder. These checks prevent the front wheels from leaning faster than the flow of oil can move the piston, thus causing a vacuum in the cylinder.

Figure 34 shows schematic of the power shift moldboard hydraulic circuit. The moldboard hydraulic tilt circuit is the same as the moldboard shift.

This is a very simple circuit. When the control valve is actuated, the oil flows through the valve ports to the power shift cylinder. The cylinder is anchored to the R.H. tilt plate. The piston rod is anchored to the moldboard. When oil flows into one end of cylinder, the moldboard is shifted either to the right or to the left, depending upon which way the control is moved.

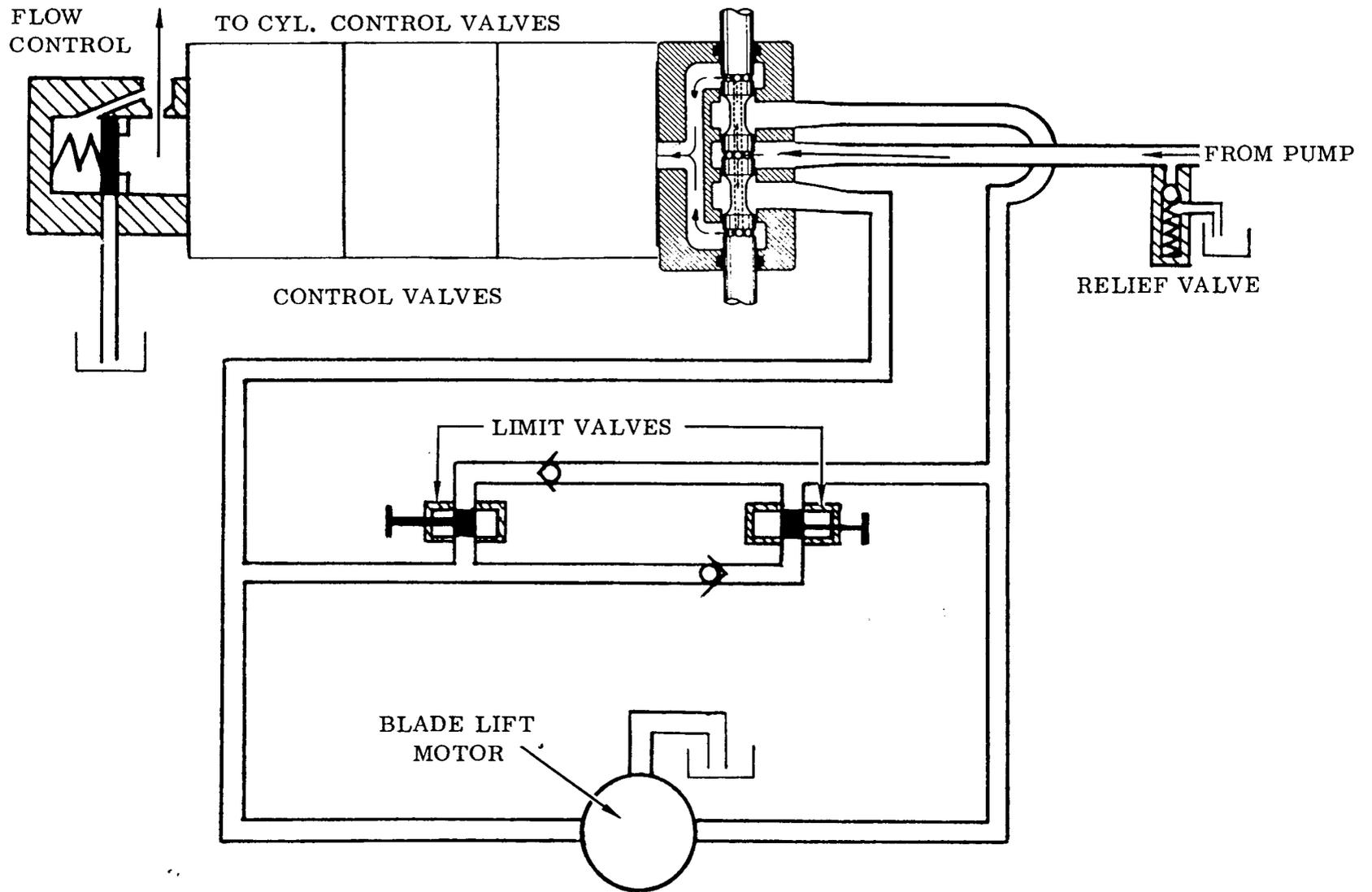


FIGURE 30. BLADE LIFT CIRCUIT

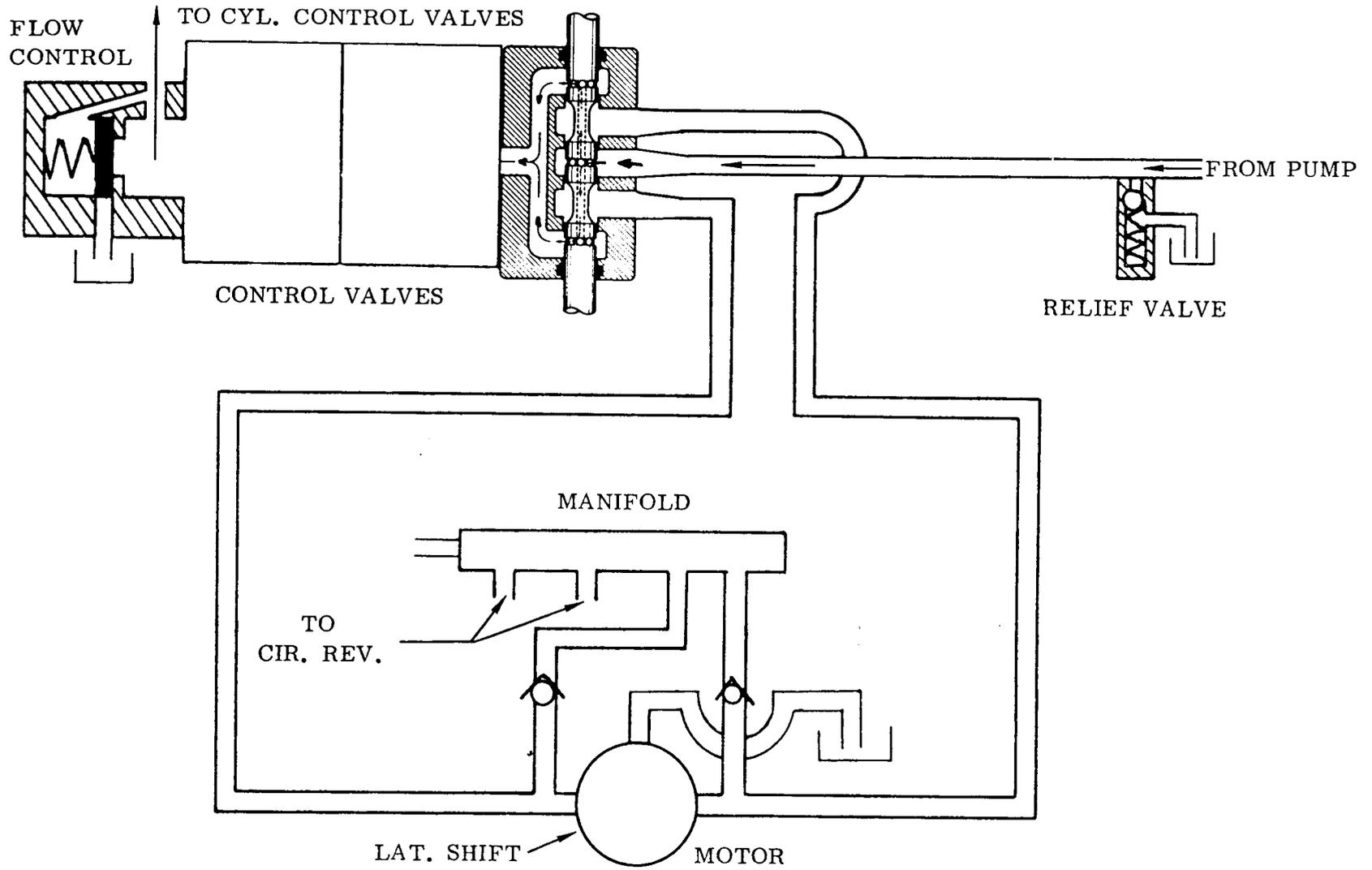


FIGURE 31. LATERAL SHIFT AND CIRCLE REVERSE CIRCUIT

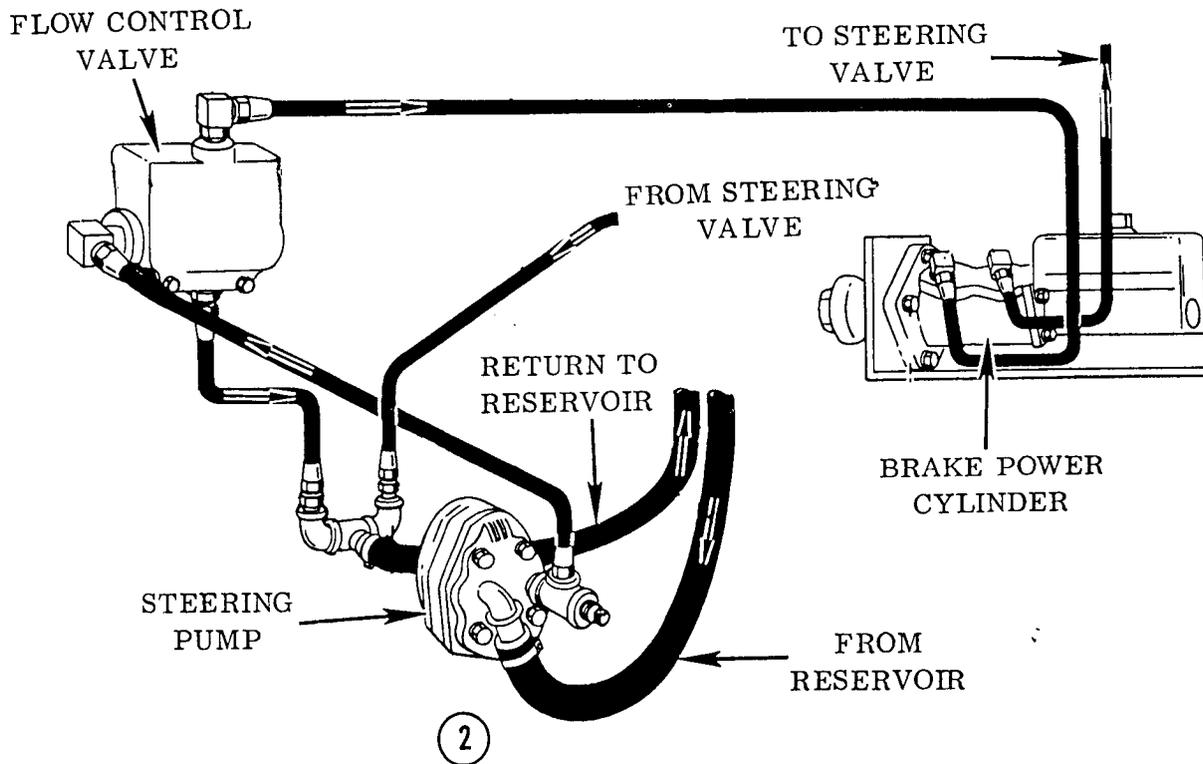
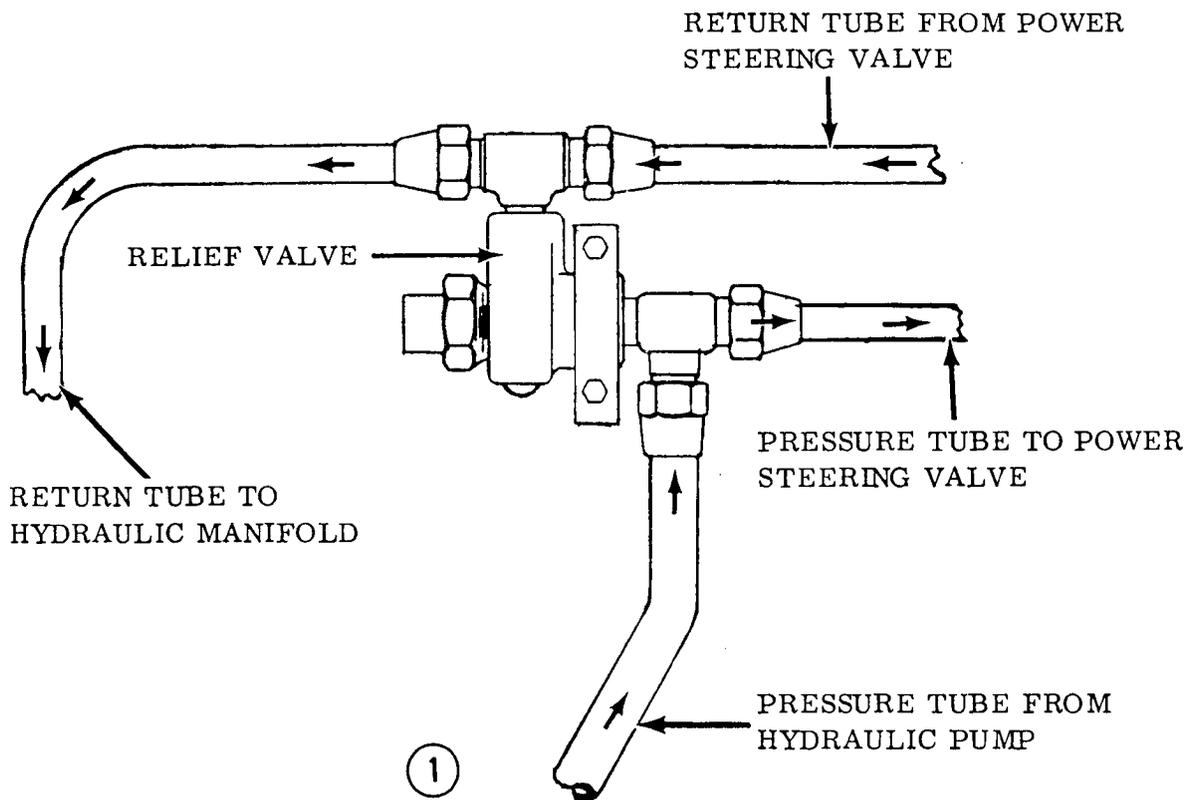


FIGURE 32. STEERING HYDRAULIC CIRCUITS
 1. Without Power Brakes 2. With Power Brakes

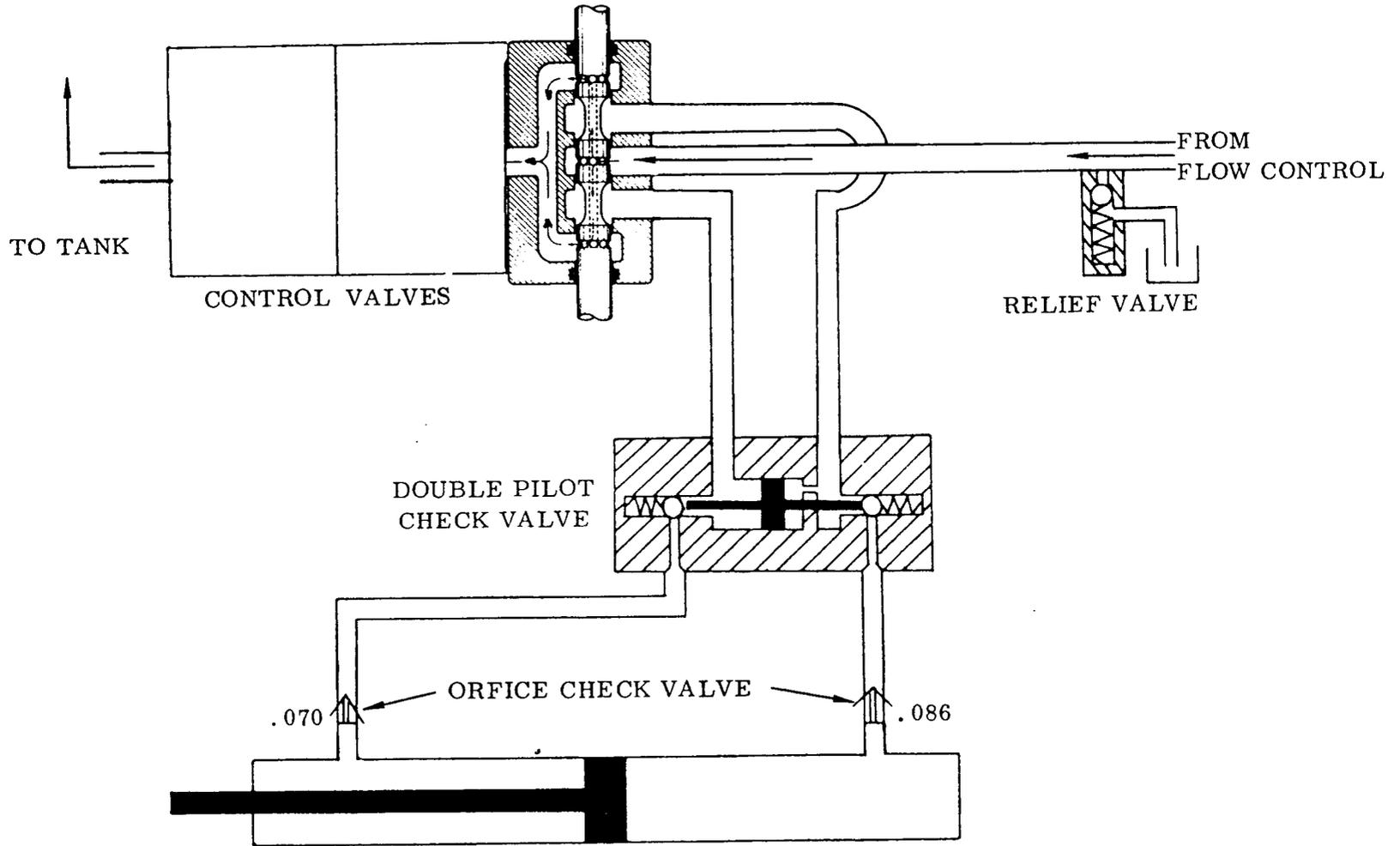


FIGURE 33. LEANING WHEEL CIRCUIT

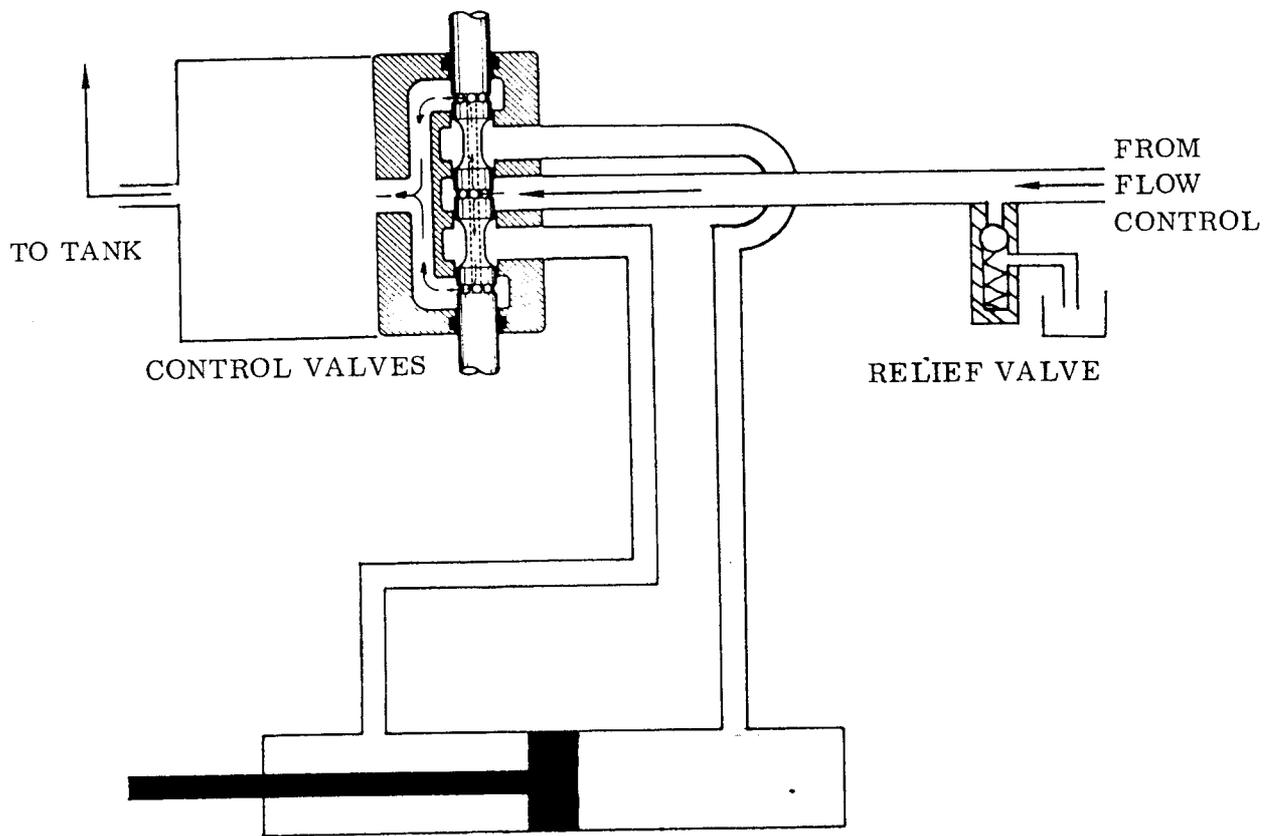


FIGURE 34. POWER SHIFT MOLDBOARD CIRCUIT

HYDRAULIC SYSTEM

General

No oil flow within the system indicates the pump is at fault. In most cases this will not be so. The pump can usually be assumed to be all right. Tracing actual flow of oil in the circuits by disconnecting lines, if necessary, discloses the trouble. If cylinders or motors will not operate, finding out where the oil is going usually solves the problem.

The ability to recognize trouble indications can save considerable time in locating the trouble. Some trouble indications are as follows:

1. Excessive heat means trouble. A warmer than normal reservoir return line from a relief valve indicates relief valve is set for too low a pressure. Cavitation and slippage in a pump will also generate heat.

2. Excessive noise means wear, misalignment, cavitation or air in the fluid. These noises may be the result of dirty filters or oil, low reservoir level or loose intake lines.

Three simple maintenance procedures have the greatest effect on the hydraulic system performance, efficiency, and life. They are:

1. Changing filters and strainers.
2. Maintaining a clean, sufficient quantity of hydraulic fluid of the proper type and viscosity.
3. Keeping all connections tight but not to the point of distortion, so that air is excluded from the system.

TROUBLE SHOOTING

TROUBLE: Noisy pump.

CAUSE: Cavitation.

REMEDY: Change filters. Change oil to proper viscosity.

CAUSE: Air in system.

REMEDY: Tighten inlet connections. Fill reservoir to proper level. Replace pump shaft seal.

CAUSE: Pump worn or damaged.

REMEDY: Repair or replace pump.

CAUSE: Worn or damaged system relief valve.

REMEDY: Repair or replace valve.

CAUSE: Fluid dirty or low supply.

REMEDY: Change filters and system fluid. Fill reservoir to proper level.

CAUSE: Worn pump, control valve, hydraulic motor or other component.

REMEDY: Repair or replace.

TROUBLE: Noisy hydraulic motor.

CAUSE: Coupling mis-aligned.

REMEDY: Re-align coupling and check condition of seals and bearings.

CAUSE: Motor worn or damaged.

REMEDY: Repair or replace motor.

TROUBLE: No flow.

CAUSE: Pump not receiving fluid.

REMEDY: Clean air line filter (GM Engine). Clean hydraulic reservoir pressuring valve (Cummins Engine).

CAUSE: Hydraulic lines connected to wrong fittings.

REMEDY: Change lines to proper fittings.

CAUSE: Entire flow passing over system relief valve.

REMEDY: Install test pressure gauge and adjust relief valve to proper setting.

CAUSE: Worn or damaged pump.

REMEDY: Repair or replace pump.

TROUBLE: Noisy relief valve.

CAUSE: Setting too close to operating pressure.

REMEDY: Install pressure gauge and adjust to correct pressure.

CAUSE: Worn poppet and seat.

REMEDY: Repair or replace relief valve.

TROUBLE: Excessive heat.

CAUSE: Cavitation.

REMEDY: Replace dirty filters. Change hydraulic oil. Clean, adjust or repair hydraulic reservoir relief valve.

CAUSE: System relief valve setting incorrect.

REMEDY: Install pressure gauge and adjust system relief valve.

TROUBLE: Blade lift does not raise or lower moldboard. NOTE: Operate the other blade lift control; if it operates properly, then the trouble is localized to the one circuit.

CAUSE: Worn or damaged hydraulic motor.

REMEDY: Repair or replace motor.

CAUSE: Defective or not properly adjusted limit valve.

REMEDY: Repair or replace limit valve. Properly adjust limit valve.

CAUSE: Wear in control valve permitting excessive internal leakage.

REMEDY: Repair or replace limit valve.

TROUBLE: Leaning wheel cylinder piston drifting or floating.

CAUSE: Check valve stuck open.

REMEDY: Repair or replace check valve.

CAUSE: Excessive wear in piston and piston rings.

REMEDY: Repair or replace hydraulic cylinder.

TROUBLE: Hard steering.

CAUSE: Defective relief valve.

REMEDY: Repair or replace relief valve.

CAUSE: Defective flow control valve (when equipped with power brakes).

REMEDY: Repair or replace flow valve.

CAUSE: Worn or damaged steering pump.

REMEDY: Repair or replace steering pump.

CAUSE: Spool in control valve sticking.

REMEDY: Remove valve and clean thoroughly. Replace valve if worn excessively. NOTE: Valve body and spool are not serviced separately. Must be replaced as an assembly.

CAUSE: Input shaft bent or sprung.

REMEDY: Replace bent parts.

CAUSE: Output shaft adjustment too tight.

REMEDY: Refer to adjustment section and readjust output shaft adjustment screw.

CAUSE: Broken piston ring on piston rack.

REMEDY: Replace piston ring. Check cylinder walls for signs of scoring.

CAUSE: Low tire pressure.

REMEDY: Inflate tires to proper pressure.

TROUBLE: No recovery from turn.

CAUSE: Bind in input shaft worm and ball follower.

REMEDY: Repair or replace shaft and follower.

CAUSE: Spool in control valve sticking.

REMEDY: Remove valve and clean thoroughly. Replace valve if worn excessively. NOTE: Valve body and spool are not serviced separately. Must be replaced as an assembly.

TROUBLE: Front wheels will turn all the way to stop in one direction but not in the opposite direction.

CAUSE: Pressure unloader valve improperly adjusted.

REMEDY: Refer to adjustment section and properly adjust unloading valve.

CAUSE: Output shaft gear and piston rack not properly centered.

REMEDY: Refer to steering gear assembly section and center output shaft with piston rack as shown.

SECTION G
ELECTRICAL SYSTEM
INDEX

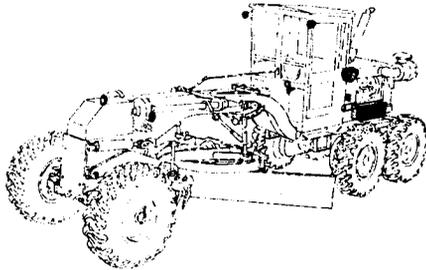
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ELECTRICAL SYSTEM

The WABCO Motor Graders are equipped with an A.C./D.C. system consisting of a "Delcotron" generator, regulator, batter-

ies and wiring. Figure 1 shows the basic A.C./D.C. system.

GENERATOR

The "Delcotron" generator is a continuous-output, diode-rectified A.C. generator.

At low speeds, the A.C. generator supplies adequate electrical power. However, if the electrical requirement increases, the battery assists the A.C. generator in supplying the necessary power. When the electrical load is low, the generator supplies the necessary current for the electrical load and some power for charging the battery.

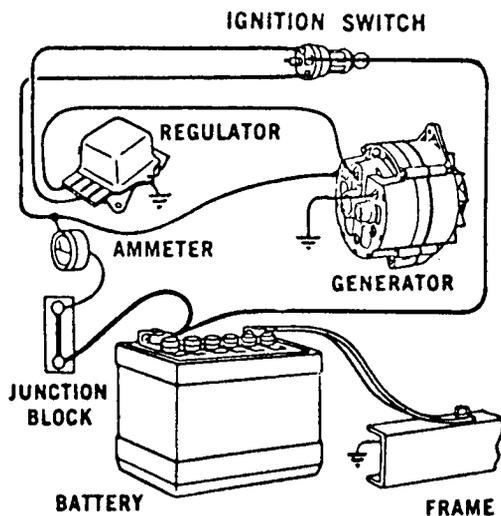


FIGURE 1. A. C. /D. C. SYSTEM

The generator rotor is supported by a ball bearing at the drive end and a roller bearing at the slip ring end. See Figure 2. Each bearing is factory packed with lubricant which eliminates the need for periodic lubrication. However, after periods of ex-

tended operation or at engine overhaul time, the bearings should be checked to see if they are in a satisfactory condition.

Remove the generator belt. Hold the generator pulley with your fingers and rotate to see if bearings feel rough or worn. Also, note if there is excessive side play. Should bearings seem to be rough or have excessive side play, remove the generator for repairs or replacement.

Never attempt to repair the generator in the field. Remove the complete assembly and send it to your WABCO Distributor for service.

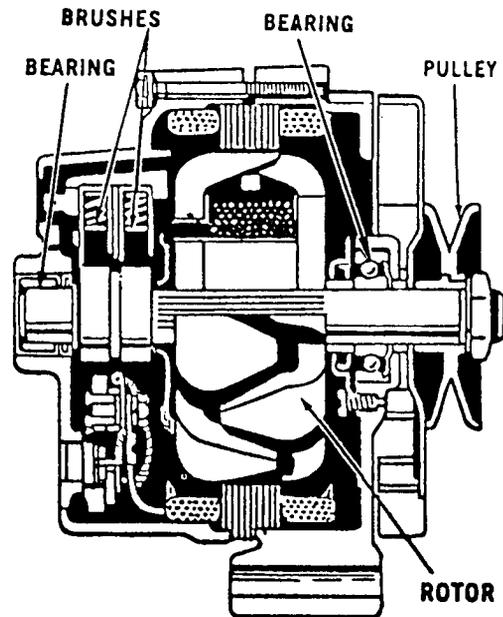


FIGURE 2. CROSS SECTION OF GENERATOR

Removal

Disconnect wiring from terminals on slip ring end of generator, see Figure 3.

Remove locking capscrew from belt tension adjusting bracket and adjusting lug of

generator. Remove belt from pulley.

Remove capscrew from mounting brack-

et and mounting lug of generator. Remove generator.

Disassembly

The generator consists of four main components; the two end frames, the stator and the rotor.

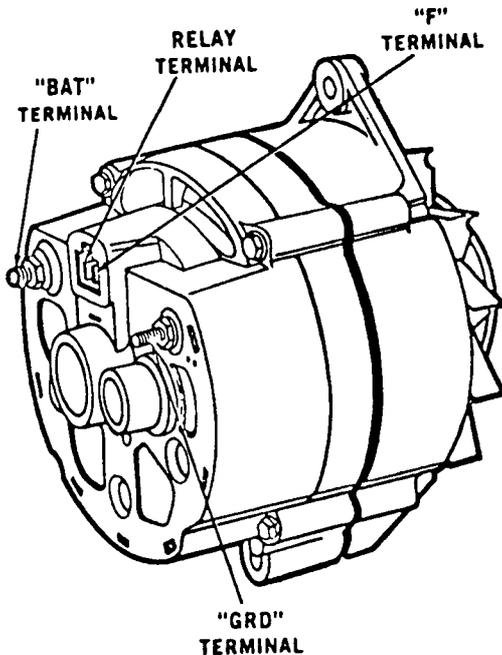


FIGURE 3. A. C. GENERATOR

Remove the four bolts securing the two end frames together. Remove the drive end frame and rotor assembly by prying the end frames apart with a screw driver at the slot between end frames. NOTE: Before separating the end frames, make a scribe mark across the end frames to help locate the parts in the same position during reassembly.

After removing the drive end frame and rotor assembly, place a piece of tape over the bearing in slip ring end frame to prevent dirt entering the bearing. Also, place a piece of tape over end of shaft. (Slip ring end.)

To remove the end frame from rotor, place the rotor in a vise. Tighten vise only tight enough to hold rotor while shaft nut is

being removed. Avoid excessive tightening of vise as this could cause distortion of rotor. Remove the shaft nut, pulley, fan and collar. Remove end frame from rotor shaft.

ROTOR CHECK

The rotor may be checked for grounded, open, or short circuited field coils.

1. Ground Check — Connect a 110 volt test lamp between either slip ring and the end of shaft. If the lamp lights, the field winding is grounded.
2. Open Check — Attach a test lamp lead to each of the slip rings. If lamp fails to light, the winding is open.
3. Short Circuits — Connect a 12 volt battery and ammeter in series with the two slip rings. Note the ammeter reading. If the reading is higher than the specified value, the rotor is short circuited. The specified value for the 630 watt generator used on the Model 666B and 777B Grader is 1.9 to 2.3 amps at 12 volt.

If the rotor checks out as not being defective and the generator fails to supply rated output, the trouble is in the stator or diodes.

STATOR CHECK

To check the stator windings, remove all three nuts attaching stator leads to heat sink. Separate the stator from end frame. The fit between stator and end frame is not tight and the two can be easily separated.

The stator can be checked for a ground

or an open with a 110 volt test lamp.

1. Ground Test — Attach one lead of test lamp to any of the stator leads and the other test lamp lead to stator frame. If the test lamp lights, the windings are grounded.
2. Open Test — Connect test lamp between each pair of stator leads. If test lamp fails to light, the windings are open.

A short circuit in the stator windings is difficult to locate without laboratory test equipment due to the low resistance of the windings. However, if all other checks are normal and the generator still fails to supply the rated output, a short in the stator windings is indicated.

DIODE CHECKS

Each diode can be checked for a short or open condition.

Use a test lamp of not more than 12 volts. CAUTION: Do not use a 110 volt test lamp to check diodes.

With the stator disconnected, connect one test lamp lead to the head sink and the other test lamp lead to a diode lead. Now reverse the position of the leads. If the diode is good, the test lamp will light in only one of the above tests.

If test lamp lights in both tests, the diode is shorted. If test lamp fails to light in either test, the diode is open.

To replace a diode, use a suitable tool to support the end frame or heat sink, and use an arbor press to push the diode out. To press diode in, use a suitable tool which will fit over the outer edge of the diode. CAUTION: Do not strike the diode as the shock may damage the other diodes.

SLIP RINGS

If the slip rings are dirty, they may be cleaned and finished with 400 grain or finer polishing cloth. Spin the rotor in a lathe and hold the polishing cloth against slip rings until they are clean. The rotor MUST be rotated in order for the slip rings to be cleaned easily. Cleaning slip rings without rotating could cause flat spots on the slip rings. This would cause a brush noise.

BRUSHES

When the slip ring end frame assembly is separated from the rotor and drive end frame assembly, the brushes may fall into the lubricant. If they are to be reused, they must be thoroughly cleaned with a soft cloth. Also, the shaft must be thoroughly cleaned before reassembly.

The brush springs should be inspected for any damage or corrosion. If there is any doubt as to the condition of the springs, they should be replaced.

To install new brushes, remove the brush holder assembly from the end frame by removing two Phillips head capscrews. While removing brush holder, note carefully the stack-up of the parts and reassemble them in the same order.

Insert the brushes and springs into brush holder. Insert a piece of straight wire or a pin into the small hole at bottom of brush holder to retain the brushes. Attach the brush holder to the end frame. Permit the straight wire or pin to protrude through the hole in end frame.

The heat sink may be replaced by removing the "BAT" and ground terminal from the end frame. When removing heat sink, note stack-up of parts and reassemble them in same order during reassembly.

BEARING

The bearing in the drive end frame can be removed by detaching the retainer plate capscrews and pressing the bearing from the end frame. If the bearing is in good condition, it may be reused. It should be filled to one-quarter full with a good grade high temperature lubricant before installing in end frame. Do not overfill as this may cause bearing to overheat.

Press the bearing into end frame with a tube or collar that just fits over the outer race. Install retainer plate. If the felt seal in the retainer plate is hardened or excessively worn, the retainer plate should be replaced.

The bearing in the slip ring end frame should be replaced if its grease supply is exhausted. No attempt should be made to re-lubricate the bearing. Press bearing out of end frame with a tube or collar that just fits inside bearing bore in the end frame. Press from the outside of the end frame toward the inside.

Install new bearing by placing a flat plate over the bearing and pressing into end frame from the outside toward the inside until the bearing is flush with the outside of the end frame. Support the inside of the end frame with a hollow cylinder to prevent breakage of the end frame. Saturate the felt seal with SAE 20 oil and install the seals and metal retainer.

Reassembly

The reassembly of the generator will be the reverse of disassembly and the following information.

1. When assembling the drive pulley to the rotor shaft, clamp the rotor in a vise only tight enough to permit tightening the nut to a torque of 50-60 ft. lbs.
2. Remove tape from end of shaft and

slip ring end frame bearing. Make certain end of shaft is clean after tape is removed.

3. After generator is completely reassembled, withdraw the wire or pin which was inserted to retain the brushes. Removing the wire permits the brushes to drop onto slip rings.

REGULATOR

The regulator on the WABCO Motor Grader is a double-contact type, Figure 4. Normally, no periodic servicing is required for the regulator. However, contact points of the voltage regulator that have an excessive resistance or a sticking tendency can cause erratic operation. When this condition exists, the contacts should be cleaned. A sooty or discolored condition is normal after a relatively short period of operation. This is not an indication that the contacts need cleaning.

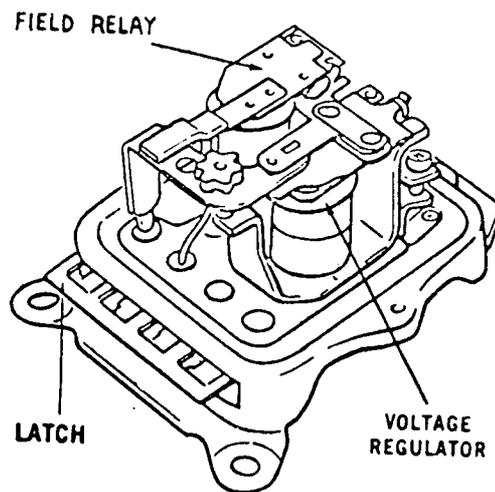


FIGURE 4. REGULATOR

The contacts on the voltage regulator unit are of a soft material and must not be cleaned with a file. A strip of #400 silicon carbide paper, or equal, should be used. Fold the paper over and then pull back and forth between the contacts. After cleaning, the contacts should be washed with trichloroethylene or alcohol to remove the residue.

To clean the field relay contacts, use a thin, fine-cut, flat file. Remove only enough material to clean the points.

Never use emery cloth or sand paper to clean contact points. CAUTION: Never polarize the regulator or generator.

STARTER

The starter, or cranking motor, is a solenoid operated, 24 volt, overrunning-sprag clutch type with a fully enclosed shift lever and plunger.

Periodic checking of the starter will go far toward eliminating failures due to neglect or lack of attention.

Every 500 hours the following checks should be made.

All cables should be inspected for breaks in insulation. Keep all cables clean. Check all connections for tightness and make sure they are clean.

Remove commutator end plate and brush holder. Check condition of commutator and

brushes. If the commutator is dirty, it may be cleaned with #00 sandpaper.

The brushes should have good, clean contact with the commutator and should have the proper spring tension. If brushes are worn so that they will not last until the next inspection periods, they should be replaced.

If the commutator is rough, worn, out-of-round, or if it has high mica, the starter should be removed and sent to your WABCO Distributor for service.

The overrunning clutch type drive must never be cleaned by any high temperature or grease dissolving method since this would remove the grease originally packed in the overrunning clutch, causing the clutch to fail quickly.

BATTERIES

When experiencing electrical troubles, the source could be in the batteries. Therefore, they should be checked first when trouble shooting the electrical system.

Batteries with an internal short will cause a high charge rate and use excessive amounts of water. This condition is caused by overcharging.

An undercharged battery can be noted by failure to crank engine.

Batteries should be checked every two weeks, whether grader is operating or not, using a hydrometer. A specific gravity reading of 1275 indicates full charge. Specific gravity reading of 1150 indicates complete discharge.

If batteries consistently show low charge, check the generator belt. Check physical condition and tension of belt. A slipping belt may not drive the generator at sufficient speed to keep batteries charged.

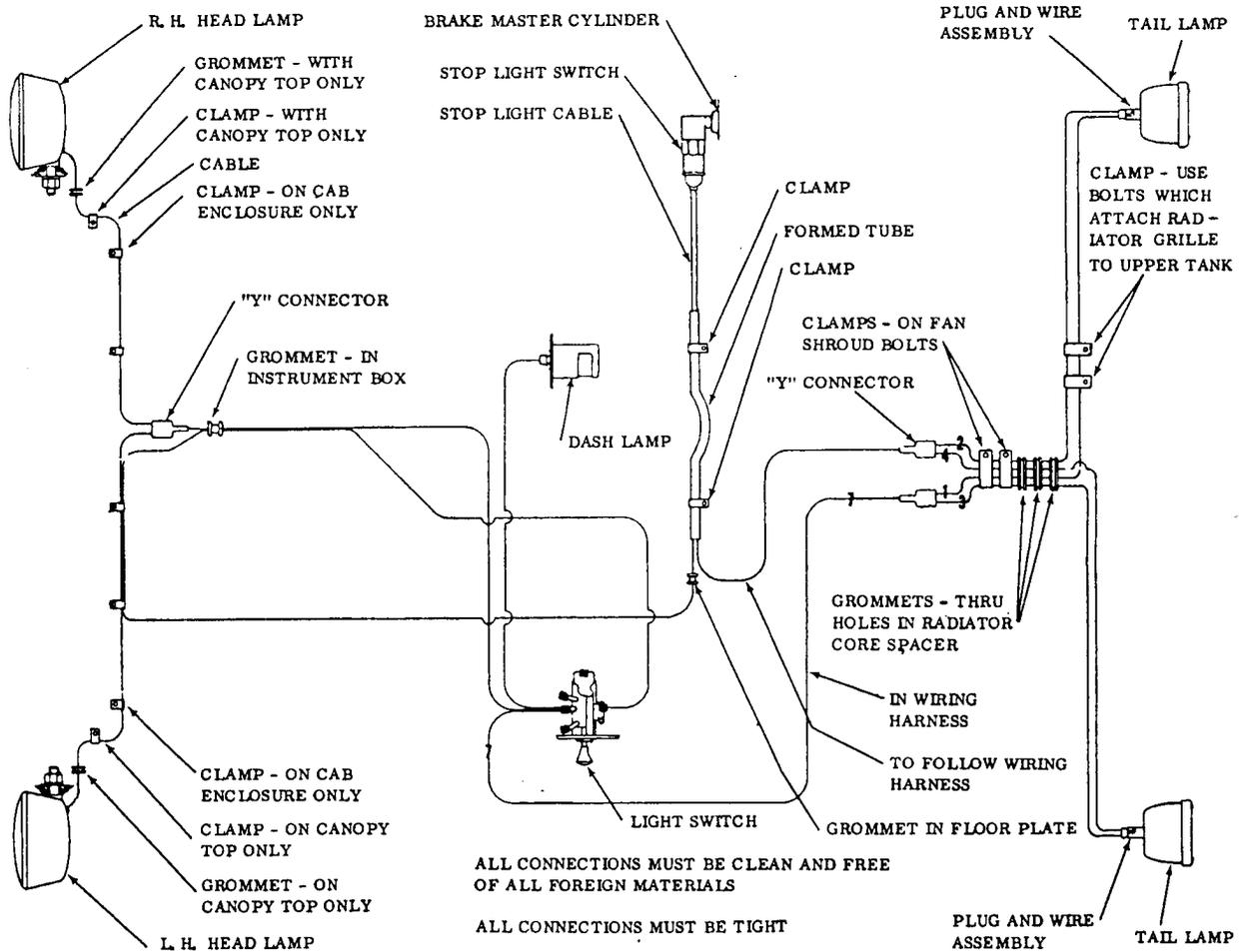
WIRING CIRCUITS

The wiring circuit is just as important a part of the electrical system as the electrical units themselves.

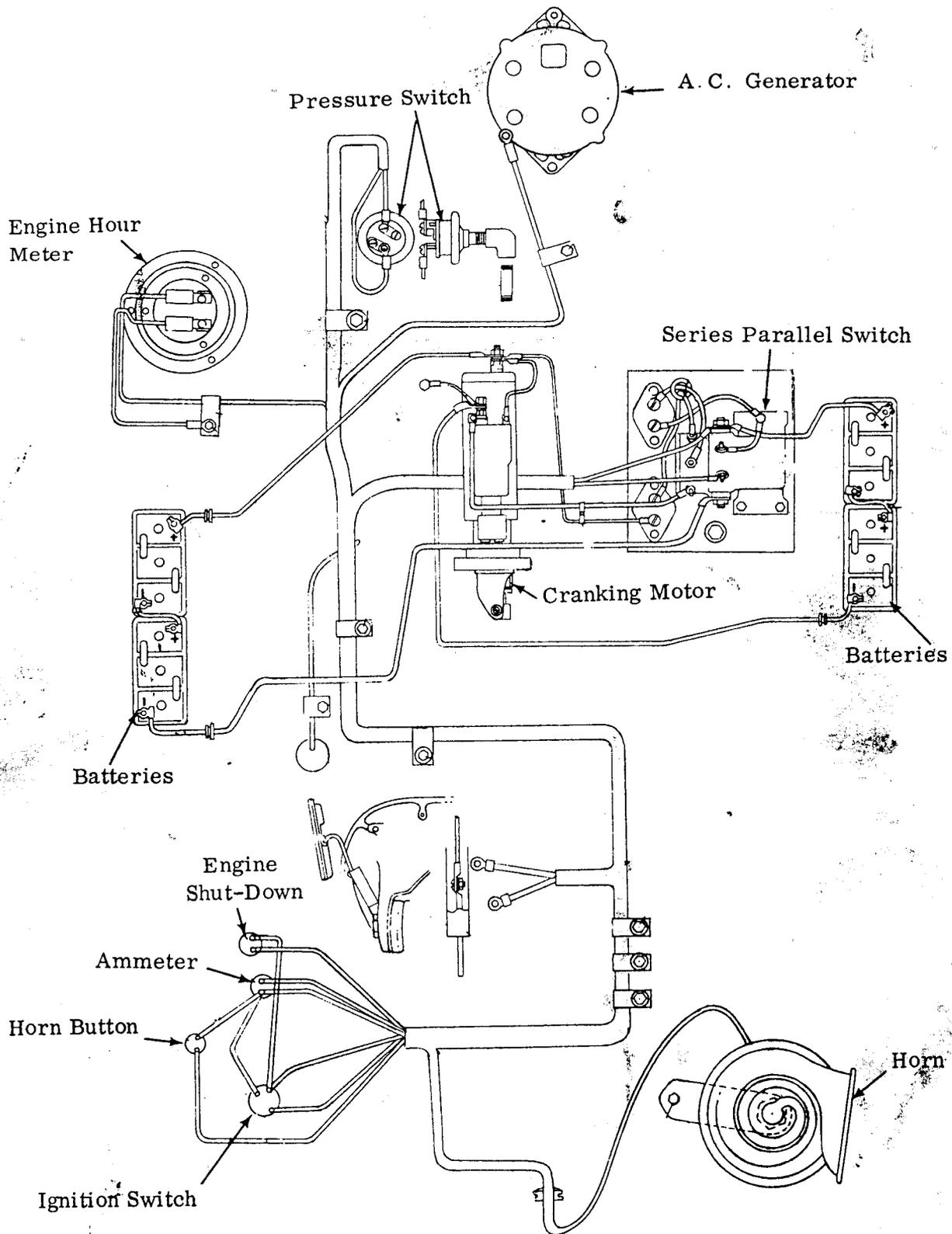
A visual inspection will often reveal much useful information relative to the condition of the electrical system. Faulty wir-

ing should be replaced. All terminals should be checked for loose or corroded connections.

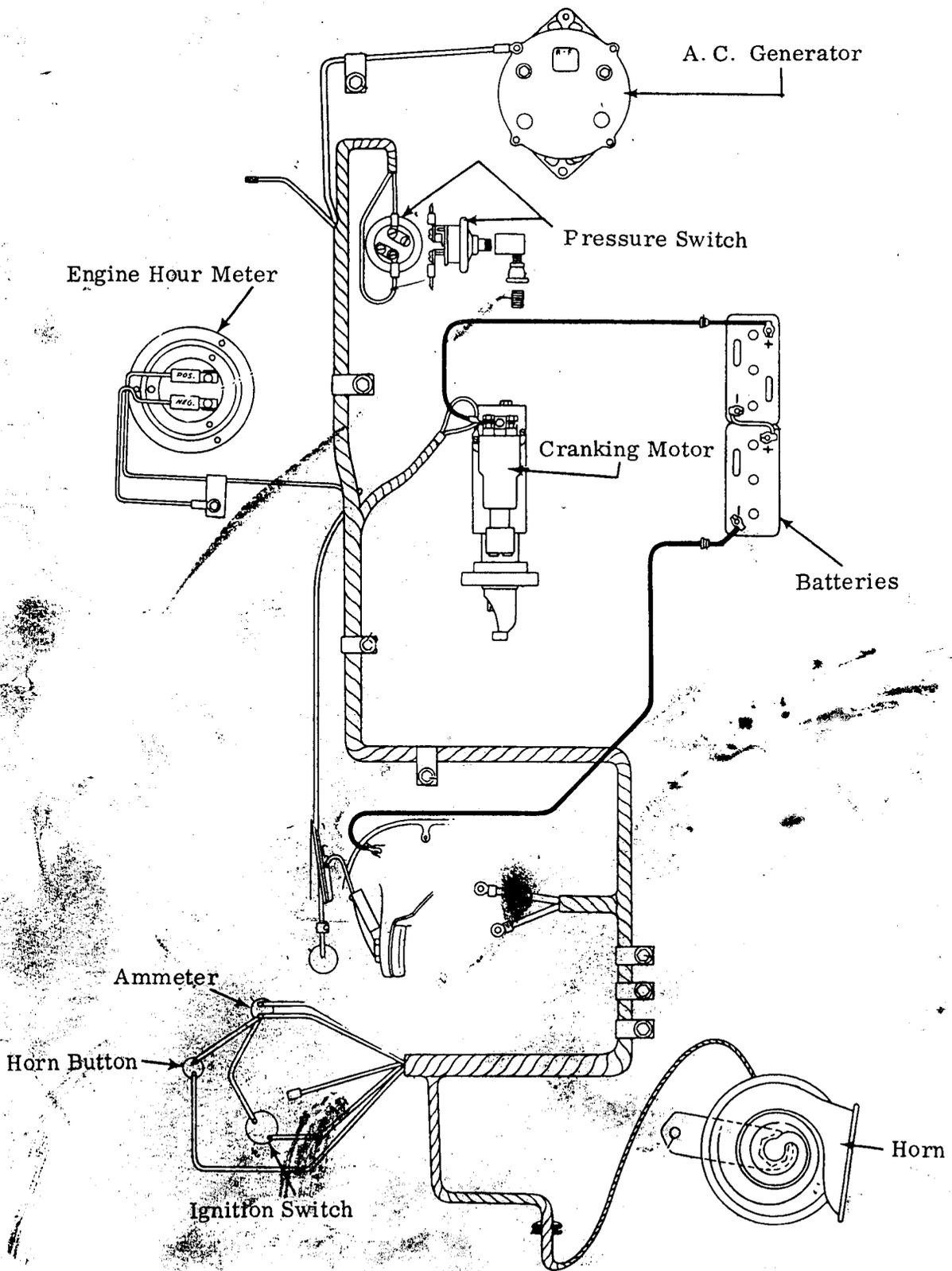
The following wiring diagrams show the basic schematic arrangement of the electrical system.



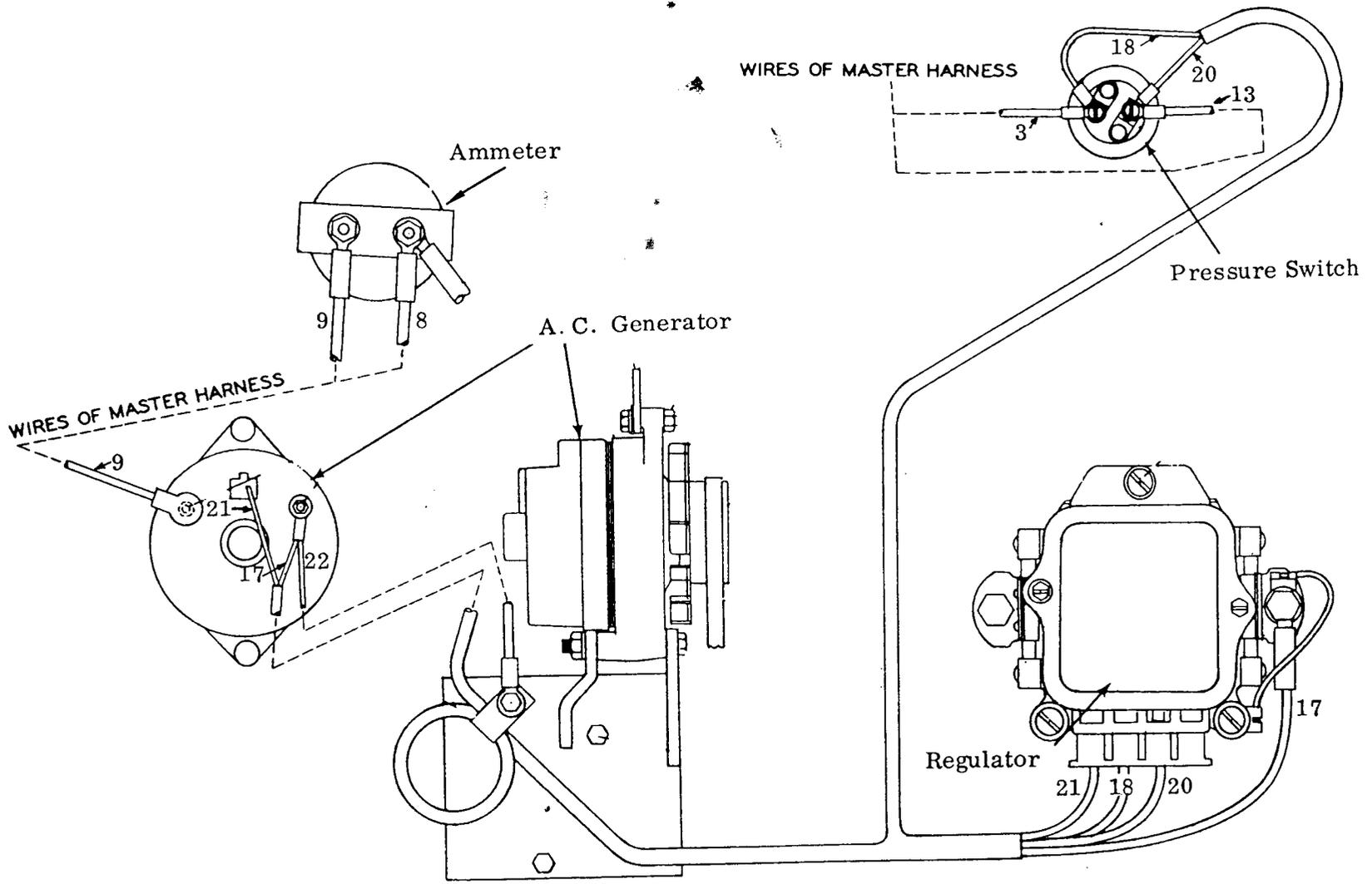
WIRING DIAGRAM, LIGHTING



ELECTRICAL-GENERAL (CUMMINS ENGINE)



ELECTRICAL - GENERAL (GM ENGINE)

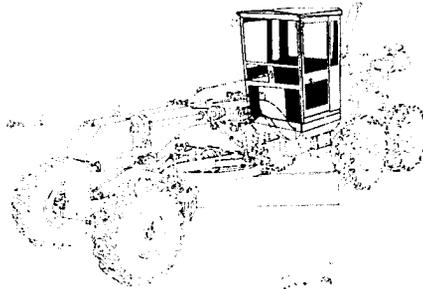


GENERATOR AND REGULATOR CIRCUIT

SECTION H
CAB AND ENCLOSURE

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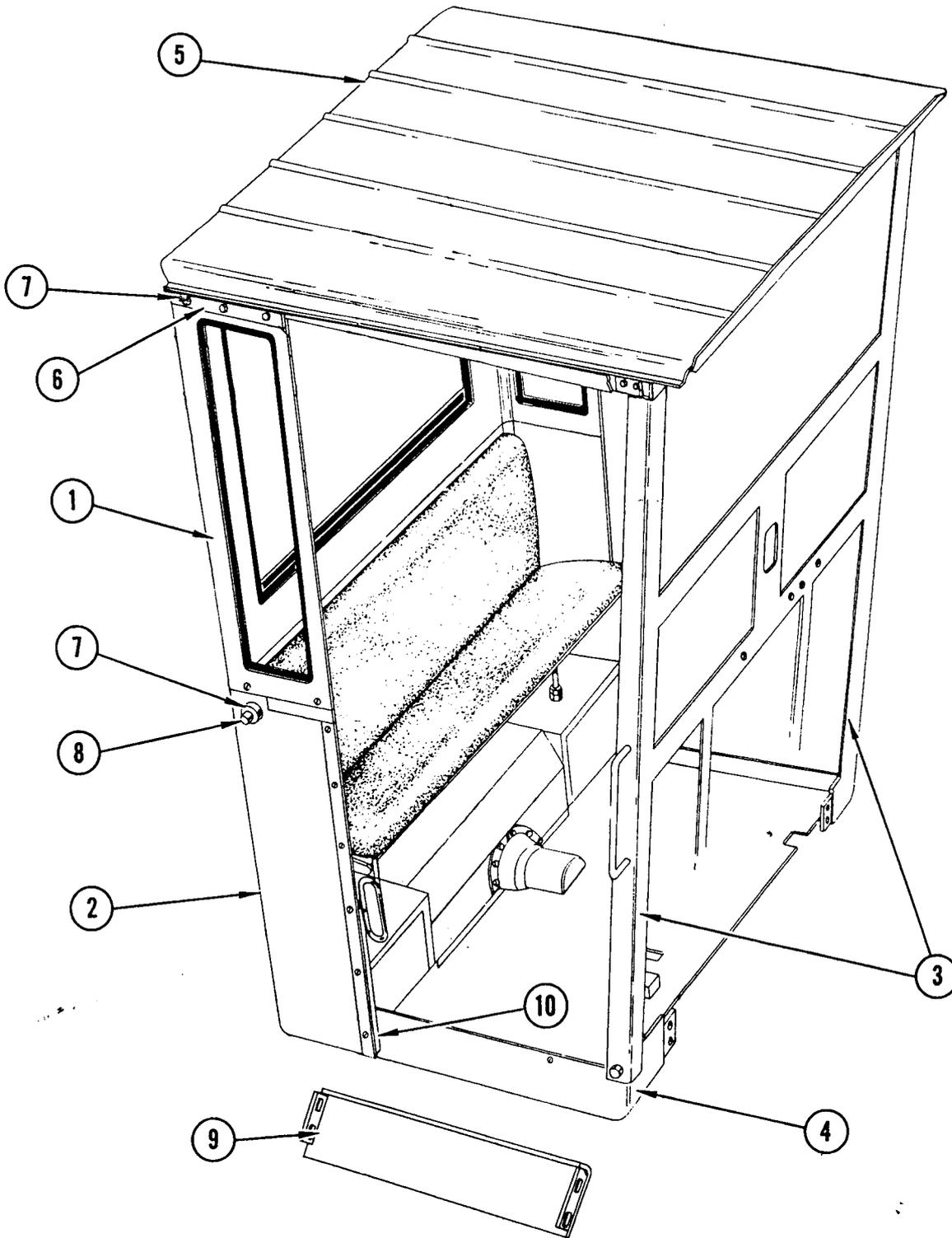


FIGURE 1. CAB AND ENCLOSURE

- | | | | | |
|---------------|-------------------------|-----------|----------------|----------|
| 1. Rear Panel | 3. L.H. & R.H. Uprights | 5. Roof | 7. Door Bumper | 9. Sill |
| 2. Cab Back | 4. Base | 6. Filler | 8. Striker | 10. Caps |

CAB & ENCLOSURE

Cab enclosure can be removed from roadster cab without removing cab from grader.

Glass can be removed from cab by pressing on glass from outside and prying outer rubber channel over edge of metal at one corner. Continue to work channel off of metal edge until remaining portion slides off easily. Use care to prevent cracking of glass or damage to channel.

Install rear panel, Figure 1. Install and tighten all bolts with lockwashers and nuts securing bottom edge of panel (1) to cab back (2).

Install left hand and right hand uprights (3) and secure to cab base (4) with carriage bolts, lockwashers and nuts.

Install cab roof (5) and fasten to uprights and rear panel with capscrews, lockwashers and nuts. Install filler (6).

Install door bumpers (7) and strikers (8). Secure with capscrews, machine screws, lockwashers and nuts.

Install left hand and right hand sills (9) at bottom of door openings and secure with nuts and lockwashers.

Install left hand and right hand door caps (10). Install left hand and right hand doors and hinges. Install and tighten machine screws with lockwashers and nuts.

Install latch plates. Install flat head machine screws with lockwashers, cutwashers and nuts. Do not tighten at this time.

Install windshield frame, carriage bolts, capscrews, lockwashers and nuts.

Install steering shaft through windshield frame and bearing and install bearing cap

and steering wheel. Install and tighten capscrews and nut with lockwashers.

Install glass and felt seal in rear window frame. Install frame in rear cab opening.

Install weather seal and seal retainer around outside edge of rear window and secure with capscrews and lockwashers.

Install weather stripping and bar across top of windshield opening inside enclosure. Install and tighten machine screws with lockwashers and nuts.

DOOR LOCKS

Assembly instructions are identical for R.H. and L.H. cab door locks. Apply a coating of grease to all parts before assembly.

Figure 2 is an exploded view of the door latch body.

Install spring (1) into latch body (2), Figure 3. Insert lock pawl (3) through open-

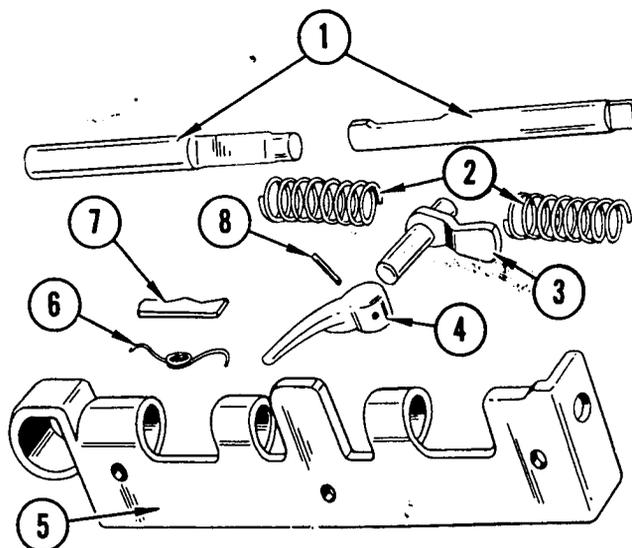


FIGURE 2. DOOR LOCK ASSEMBLY, R. H.

- | | |
|---------------|---------------|
| 1. Lock Pawls | 5. Body |
| 2. Springs | 6. Spring |
| 3. Lock Cam | 7. Latch Pawl |
| 4. Handle | 8. Roll Pin |

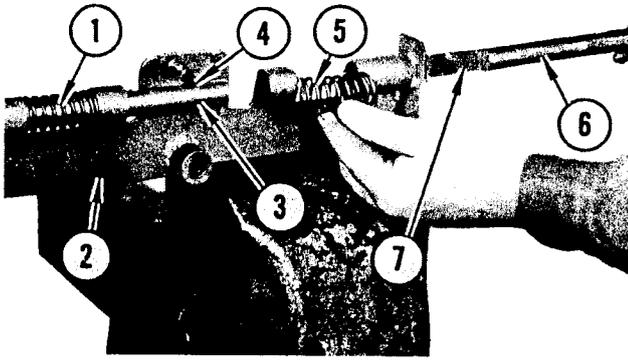


FIGURE 3. SPRING AND PAWL
INSTALLATION

- | | |
|----------------|----------------|
| 1. Spring | 5. Spring |
| 2. Latch Body | 6. Lock Pawl |
| 3. Lock Pawl | 7. Cam Opening |
| 4. Cam Opening | |

ing sin body and through spring. Position lock pawl so door lock cam openings (4) are toward inside of body.

Place second spring (5) in latch body. Insert second lock pawl (6) through opening in body and through spring. Position lock pawl so cam openings (7) in pawl are toward outside of body.

Carefully pry first lock pawl (1) away from body, Figure 4, with screwdriver (2) to allow clearance for locating second pawl (3) between first pawl and body.

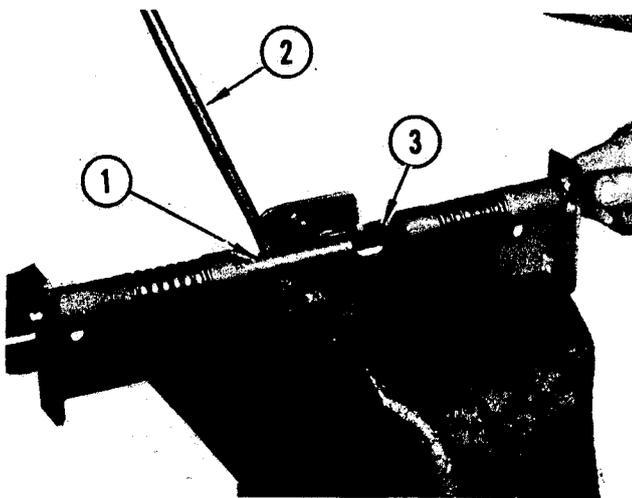


FIGURE 4. LOCK PAWL INSTALLATION

- | | |
|----------------|--------------|
| 1. Lock Pawl | 3. Lock Pawl |
| 2. Screwdriver | |

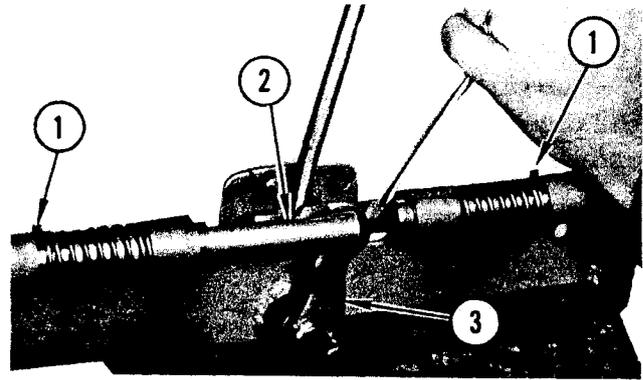


FIGURE 5. CAM INSTALLATION

- | | |
|-----------------------|--------|
| 1. Roll Pins | 3. Cam |
| 2. Insert Screwdriver | |

Compress springs with screwdriver and drive rolled pins (1) into lock pawls. Figure 5.

Spread lock pawls with screwdriver at point shown (2) and insert long end of cam shaft through body positioning cam (3) between pawls.

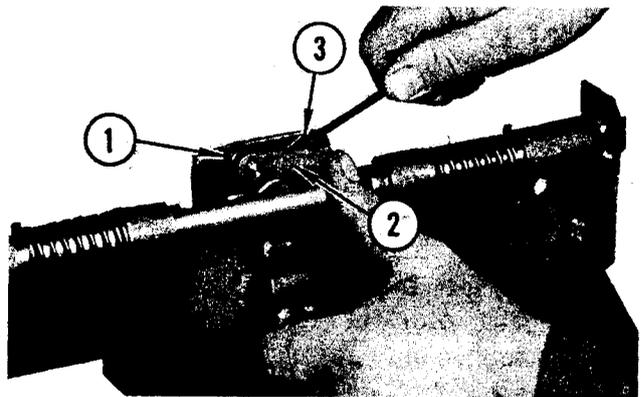


FIGURE 6. LATCH PAWL INSTALLATION

- | | |
|-----------------|----------------------|
| 1. Latch Spring | 3. Spring (Long End) |
| 2. Latch Pawl | |

Place latch spring (1) on pin. Short end of spring will hook over top edge of body. Install latch pawl (2) into body. Hook long end of spring (3) over pawl. Install two cut-washers over end of pin and against spring. Secure with cotter pin. Figure 6.

Assemble door lock assembly (1) to door frame. Insert machine screws (2) from outer side of door through lock. Install spa-

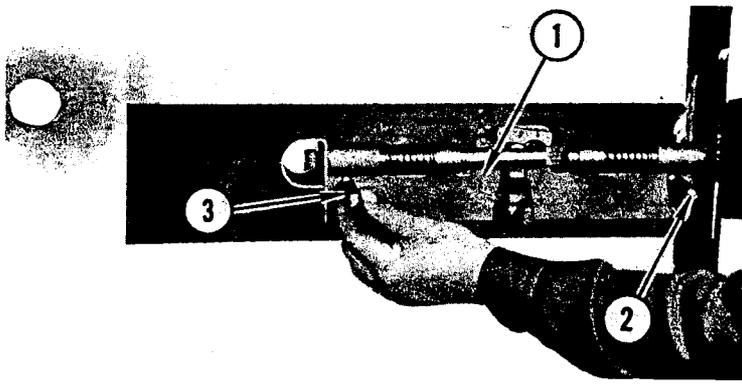


FIGURE 7. INSTALLING DOOR LOCK

- | | |
|-----------------------|-------------------|
| 1. Door Lock Assembly | 2. Machine Screws |
| | 3. Spacers |

cers (3) on screws, Figure 7.

Install mid-cover on machine screws and against spacers and secure with lock-washers and nuts.

Install outer door handle onto cam shaft. Outer handle can be identified by padlock lug. Install inner door handle.

DOOR LATCH ADJUSTMENT

With door closed, move latch plate (1) toward door until lock pawl (2) extends 1/4" to 3/8" over plate, Figure 8. Tighten nuts.

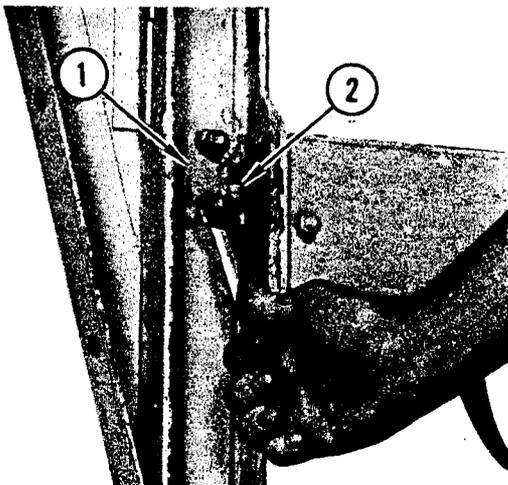


FIGURE 8. DOOR LATCH ADJUSTMENT

- | | |
|----------------|--------------|
| 1. Latch Plate | 2. Lock Pawl |
|----------------|--------------|

GLASS INSTALLATION

Each piece of glass in enclosure is pro-

vided with its own rubber channel made to fit one certain opening. Type of channel used is shown in Figure 9.

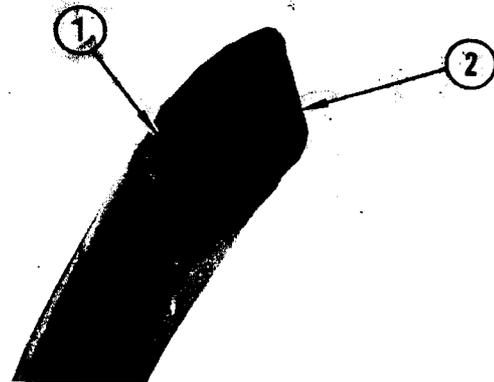


FIGURE 9. GLASS CHANNEL TYPE

1. Rounded side over edge of opening.
2. Straight edge over glass.

Installation of all glass is identical so only one will be explained.

Install straight sided channel over glass so that all edges of glass are encased in rubber, Figure 10.

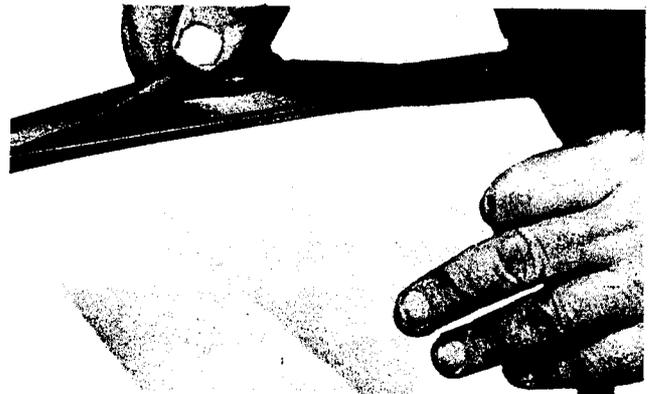


FIGURE 10. PLACING CHANNEL OVER GLASS

Install a 3/16" diameter cord into outer channel, Figure 11. Start cord at one corner. Use a screwdriver or similar tool and work cord into bottom of channel. Cord must extend completely around glass. Allow cord to overlap at its starting point.

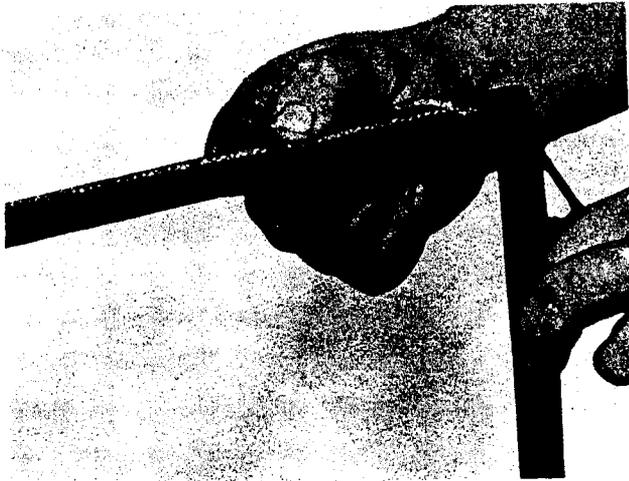


FIGURE 11. POSITIONING CORD

Place glass against inside surface of cab opening with ends of cord hanging outside of cab. Pull one end of cord until corner of channel starts over edge of cab opening. Pull other end of cord until cord of channel is in place on cab opening, Figure 12. Continue to pull each end of cord, gradually lapping channel over cab opening, Figure 13. Use care at corners to prevent tearing channel.

Installation of the lower front windshield glass to cab is the same as installation of the door glass.



FIGURE 12. USING CORD TO POSITION CHANNEL

NOTE: Above instructions for installing glass does not apply to the rear glass.

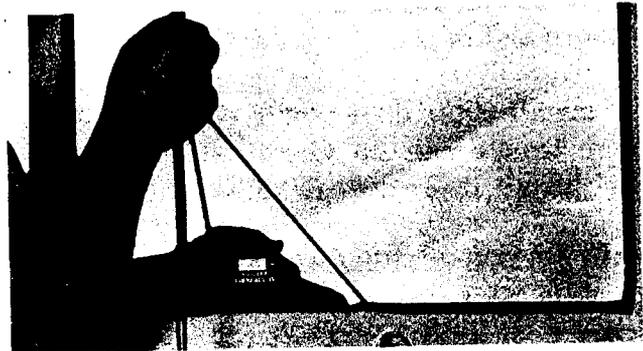


FIGURE 13. LAPPING RUBBER CHANNEL

SECTION I

RIPPER-SCARIFIER AND SCARIFIER

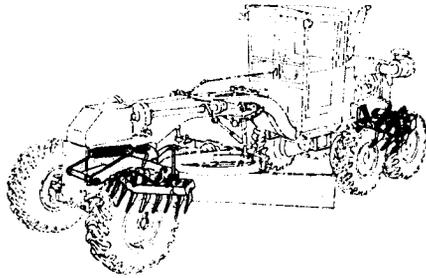
INDEX

RIPPER-SCARIFIER

General I-2
Removal and Disassembly I-2
Reassembly and Installation I-3

SCARIFIER

General I-4
Removal I-4
Disassembly I-5
Reassembly and Installation I-5



RIPPER-SCARIFIER

General

The ripper-scarifier is mounted on the rear end of main frame. It is hydraulically operated and controlled by the operator with control levers in the cab. The control valves, one for raising and lowering the block and one for tilting the block, are located at L. H. end of Hydreco valve bank.

The hydraulic rams can be removed for servicing without removing the entire assembly from the grader. For the purpose of this manual, removal of the complete assembly will be shown.

Removal

Remove all shanks (1) from the block (2). NOTE: To remove shank, raise point end of shank and remove lock wedge (3) from top of shank and block; then remove shank. Figure 1.

Start engine and, using ripper control levers, lower block to ground as shown in illustration.

Disconnect hydraulic lines at points 4 and 5. Plug or cap ends of lines and fittings to prevent foreign matter from entering the hydraulic system.

Place blocks under mounting plates (6) for support when mounting bolts are removed.

Remove the nuts and lockwashers from the twelve mounting bolts (six on each side) and remove the bolts.

Start engine and move the grader forward until rear end of frame is clear of rip-

per mounting plates. CAUTION: Do not operate ripper control levers while moving grader forward.

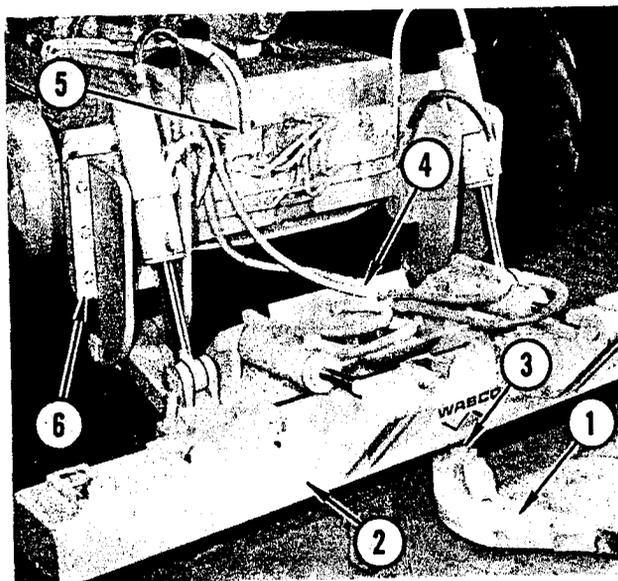


FIGURE 1. RIPPER-SCARIFIER REMOVAL
1. Shanks
2. Block
3. Wedge
4. Hydraulic Line
5. Hydraulic Line
6. Mounting Plate

Disassembly

HOIST CYLINDER

The disassembly and stack-up of parts are the same for both the hoist cylinder and the tilt cylinder. Only the hoist cylinder will be covered.

Refer to Figure 2. Disconnect the two

hydraulic lines at (1). Plug or cap ends of hose and fittings. Drive roll pin from pin structure (2) and remove pin structure. Remove nuts and lockwashers from the six capscrews (3) retaining inside cylinder support (4) to mounting plate. NOTE: Three of the capscrews are located under the cylinder.

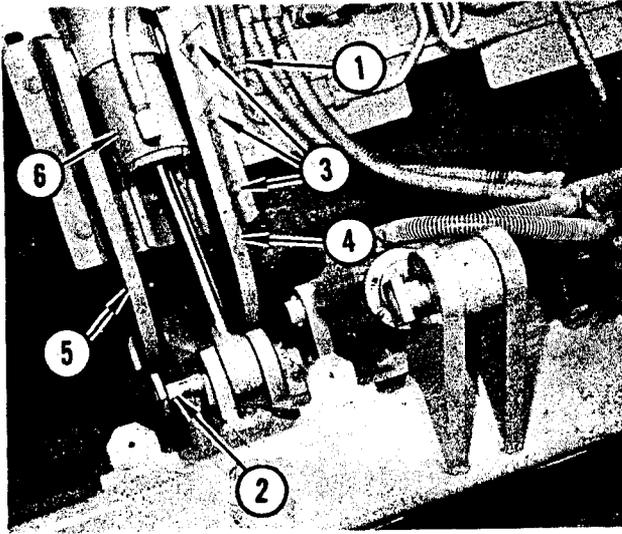


FIGURE 2. HOIST CYLINDER REMOVAL

1. Hydraulic Lines	5. Cylinder Support
2. Roll Pin	(Outside)
3. Capscrews	6. Cylinder
4. Cylinder Support (Inside)	

Slide the inside cylinder support toward center of ripper until support clears cylinder bearing stud. Slide cylinder toward center until cylinder bearing stud clears outside cylinder support (5). Remove cylinder (6).

Refer to Figure 3 and follow the numerical sequence for disassembly of cylinder.

Remove hydraulic fitting (1) from cylinder. This fitting threads into the stuffing

Reassembly

To reassemble the cylinder, reverse the numerical sequence shown for disassembly and the following information.

1. Discard and replace all seals and

Installation

To install the ripper-scarifier on grader, reverse the instructions for removal.

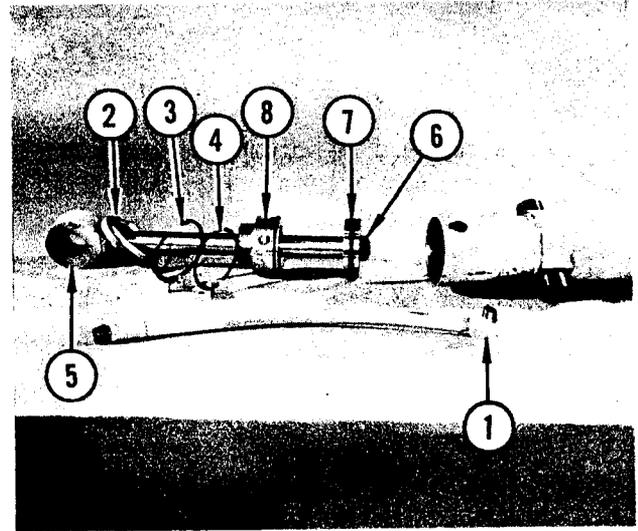


FIGURE 3. CYLINDER DISASSEMBLY

1. Hydraulic Cylinder	5. Piston Rod Assy.
2. Packing Gland	6. Hex Nut
3. Retainer Ring	7. Piston
4. Back-Up Ring	8. Stuffing Box

box.

Using a spanner wrench, remove packing gland (2). Remove retainer ring (3) and back-up ring (4). Piston rod assembly (5) can now be removed from the cylinder. Remove hex nut (6) and remove piston (7). Remove piston rings from piston. Remove "O" ring from groove in piston rod. Remove stuffing box (8). Remove Teflon seal from stuffing box.

"O" rings.

2. When installing small "O" ring onto piston rod, wrap a piece of thin shim stock around threads to prevent damage to the "O" ring.

SCARIFIER

General

The scarifier is mounted beneath the front of the main frame. The drawbar is anchored to the bolster end of main frame with pivot pin. It is hydraulically operated and controlled by the operator with levers located in the cab.

Before performing any service on the scarifier, remove all the scarifier shanks. Start engine and, using scarifier control lever, lower scarifier block until it rests on the floor or ground.

Removal

Refer to Figure 4. Disconnect hydraulic lines at fittings (1) on cylinder. Cap or plug the ends of lines and the fittings.

Remove the two locking capscrews and lockwashers (2). Remove pivot pin (3) from bolster anchor. Remove pivot pin (4) from bell crank (5) and remove cylinder.

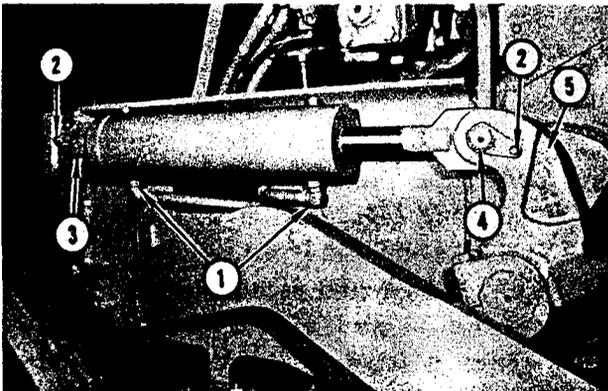


FIGURE 4. SCARIFIER CYLINDER REMOVAL

- | | |
|-----------------------|---------------|
| 1. Hydraulic Fittings | 4. Pivot Pin |
| 2. Locking Setscrew | 5. Bell Crank |
| 3. Pivot Pin | |

Refer to Figure 5. Remove lift link caps (1) from both lift links and remove links.

Fasten a sling about scarifier drawbars (3) and take up slack. Remove cotter pins, pivot pin nuts (2), and nuts from pivot pin. Remove pin from ends of drawbars. Start engine and move grader forward until scarifier block (4) and drawbars can be removed

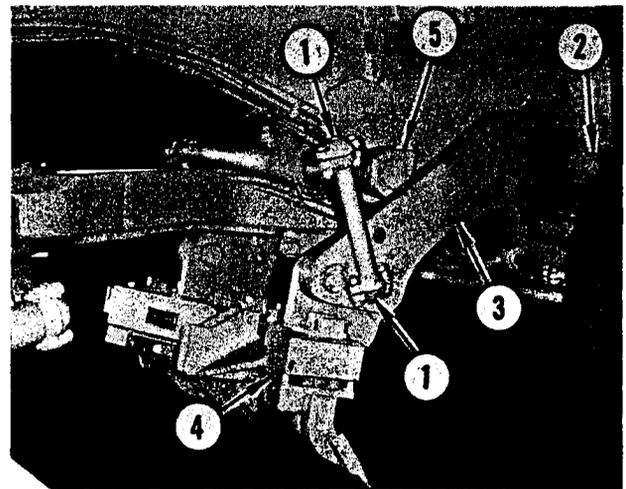


FIGURE 5. SCARIFIER REMOVAL

- | | |
|------------|-------------------|
| 1. Caps | 4. Block |
| 2. Nuts | 5. Clamping Bolts |
| 3. Drawbar | |

from beneath grader frame.

Loosen clamping bolts from lift arms (5) and remove lift arms from cross shaft. It may be necessary to drive chisel into slot of lift arm in order to loosen for removal.

Remove collars from R.H. and L.H. end of cross shaft. Remove cross shaft from spherical bearings.

Remove lubrication fitting and pipe nipple from both bearing brackets. Rotate bearings in brackets until bearing is at right angle to bracket. Align bearing with notch cut in bracket. Bearing can now be removed from bracket.

Disassembly

HYDRAULIC CYLINDER

Thoroughly clean exterior of cylinder and piston rod of all dirt and other foreign matter.

Remove the three hollow head capscrews from retainer ring (8) and, using a spanner wrench, remove the retainer ring from cylinder. Pull packing gland and piston assembly from cylinder.

Figure 6 shows an exploded view of piston and packing gland assembly.

Remove nut (1) from end of piston rod and remove piston assembly and packing gland assembly from piston rod. Remove small "O" ring from groove in piston rod.

Remove piston rings (3) from piston (2); then remove Teflon seal and "O" ring (4). The "O" ring will be in groove beneath Teflon seal.

Remove the large "O" ring (5) and back-up ring (6) from groove in outside diameter of packing gland (7).

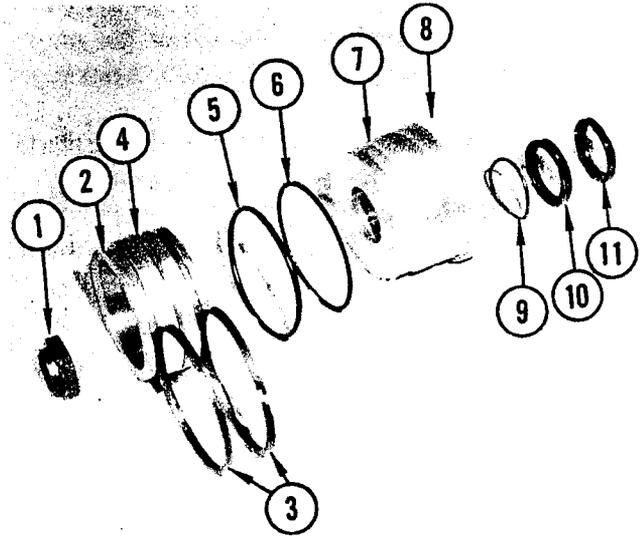


FIGURE 6. CYLINDER DISASSEMBLY

- | | |
|------------------------------|---------------------|
| 1. Nut | 6. Back-Up Ring |
| 2. Piston | 7. Packing Gland |
| 3. Piston Rings | 8. Retaining Ring |
| 4. Teflon Seal &
"O" Ring | 9. "O" Ring (Small) |
| 5. "O" Ring (Large) | 10. "U" Cup Seal |
| | 11. Wiper |

Remove "O" ring (9), "U" cup seal (10) and wiper seal (11)

Reassembly

Reassembly of the hydraulic cylinder will be the reverse of disassembly and the following information.

1. Discard and replace all seals and "O" rings.
2. When installing the small "O" ring onto the piston rod, prevent damage to "O" ring by wrapping thin shim stock around threads at end of piston rod.

3. Attach retainer ring to packing gland using only two of the hollow head capscrews. Do not install the capscrew in the threaded hole at the split in ring at this time. Install gland and ring into cylinder until face of ring is flush with end of cylinder. Install the third hollow head capscrew and tighten securely. This capscrew will spread the ring and thus lock it in position.

Installation

To install the cylinder, reverse the removal instructions.

Installation of the scarifier will be the reverse of removal instructions and the fol-

lowing information.

1. Install cross shaft through spherical bearings and equalize the shaft protrusions through each bearing.
2. Assemble lift arms on cross shaft until they are against collars. After tightening clamping bolts, the shaft must be rotated for a complete circle. If there is any bind-

ing, the lift arms are too tight against collars.

3. After drawbars have been attached to pivot pin, install slotted nuts and tighten until drawbars are pulled to within $1/32$ " of bosses. Install cotter pin.
4. Install lift link caps and shim until it takes a slight effort to rotate lift link by hand.

SECTION J

LUBRICATION AND SERVICE

INDEX

LUBRICATION INSTRUCTIONS. J-2
GREASE GUN LUBRICATION POINTS. J-6
TABLE OF HOUSING CAPACITIES. J-8

LUBRICATION INSTRUCTIONS

Correct lubrication is of prime importance in prolonging the life of a motor grader. Fuels, oils and greases must be of good quality. Select only those of recognized manufacturers.

It is recommended that proper SAE weights of oils be stocked and available for the prevailing temperatures. Lubricants must be kept free of dirt, water or other foreign matter.

Oil companies have adapted an oil SAE viscosity numbering system which classifies the viscosity of fluidity only. Higher numbers denote a thicker, heavier oil. Lower numbers denote a lighter oil.

When draining of oil from gear housings become necessary, drain them when the gear housings are warm. Oil will be thinner and will drain more completely carrying with it any dirt that might be in suspension before it has a chance to settle.

ENGINE CRANKCASE OIL: The crankcase is filled with an oil approved by the engine manufacturer and meeting MIL-L-2104B specifications. It is recommended that oil be changed every 100 hours of operation. Change intervals may be lengthened or shortened dependent on used oil analysis.

HYDRAULIC SYSTEM RESERVOIR

The capacity of the hydraulic reservoir does not represent the quantity of oil required to operate the hydraulic system. Oil requirements vary according to grader's hy-

draulic equipment.

Never start engine before checking oil level in hydraulic reservoir. Add oil if necessary. Start engine, operate hydraulic equipment one time and recheck oil level. Add additional oil if necessary.

Fill reservoir with Type "A" automatic transmission oil. Ambient temperature range for this type of oil is +130° F. to -25° F.

OIL CAN POINTS

Lubricating points on grader that do not have grease gun fittings, such as clevis pins, yoke joints, etc., must be lubricated occasionally with a light grade of engine oil applied with a hand oil can.

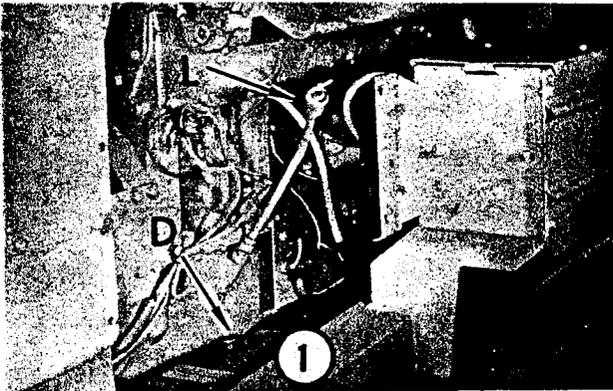
LUBRICATING FITTINGS

Use pressure gun grease (Multi-Purpose Grease #2) to lubricate all points equipped with grease gun fittings.

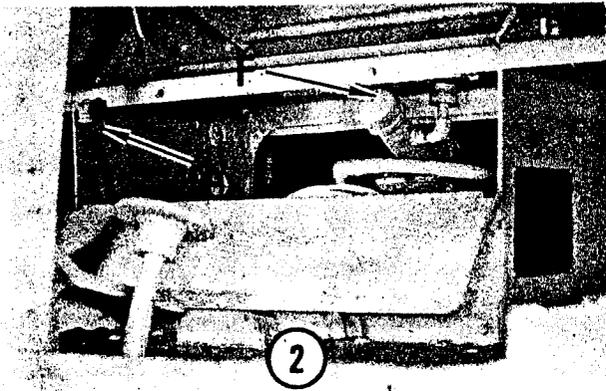
Familiarize yourself as soon as possible with all points on grader which must be lubricated. The reference chart on Page J-6 will aid you. Numbers on chart indicate general location of lubrication points.

In the following illustrations, the letter "D" indicates drain plug. The letter "L" indicates level plug. The letter "F" indicates fill plug.

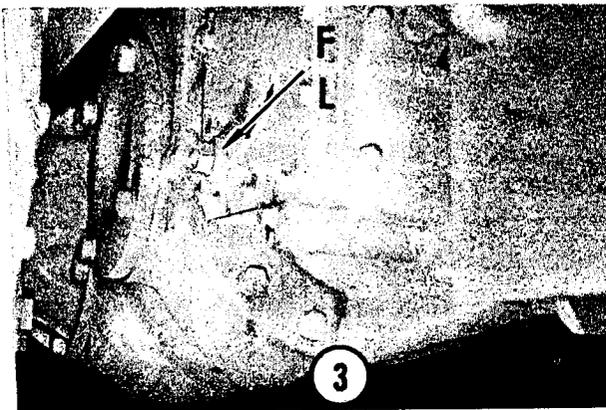
Refer to "Table of Housing Capacity" for recommended lubricants and capacities of housing.



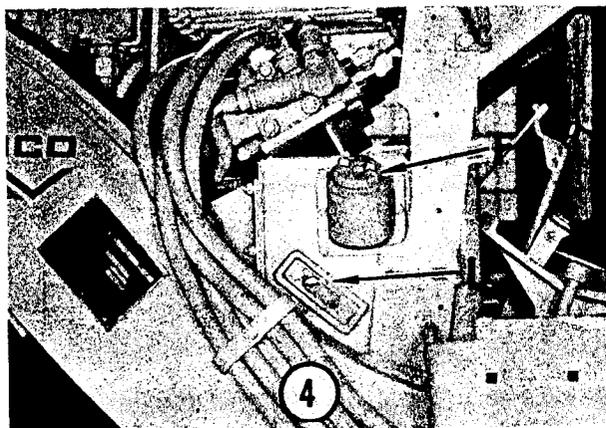
1. **ENGINE CRANKCASE.** Fill to full mark on dipstick. Change oil every 100 hours. The interval may be extended or reduced according to used engine oil analysis. Oil must meet MIL-L-2104B specifications. Check level daily. (GM engine shown.)



2. **POWER-SHIFT TRANSMISSION AND TORQUE CONVERTER.** Check oil level with engine running at idle and transmission in neutral. Add oil to bring to full mark on dipstick. Check oil level every 60 hours of operation. Change oil after first 50 to 75 hours of operation. Change oil after every 500 hours of operation thereafter. At any time the converter or power-shift clutches have been disassembled for repairs, the oil should be changed. (For Standard Machines, refer to NOTE on Page J-6.)

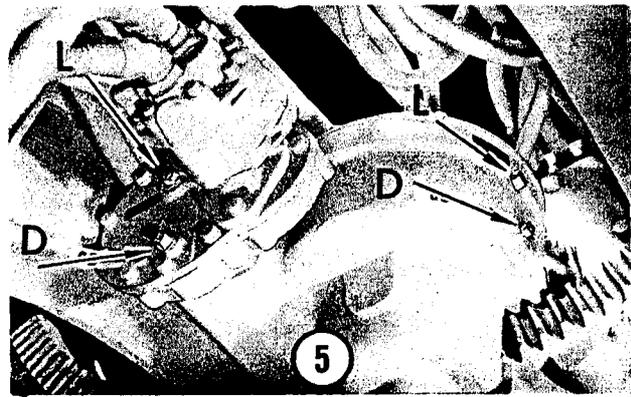


3. **LOWER TRANSMISSION AND FINAL DRIVE.** Check oil level every 60 hours of operation. Check level by removing level plug on right hand cover plate of transmission housing. Fill or add oil at same plug. Change oil after every 5000 hours of operation or once a year. NOTE: For Model 666BT, follow instructions outlined in Step 2, above.

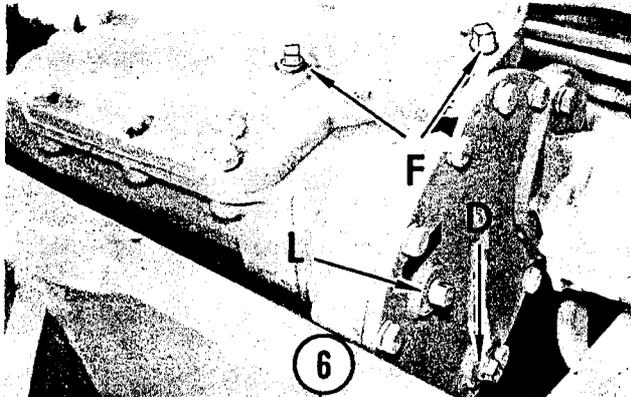


4. **HYDRAULIC SYSTEM.** Check oil level daily. Before removing filler cap, clean all dirt and foreign matter from around filler tube. Change oil after every 1000 hours of operation.

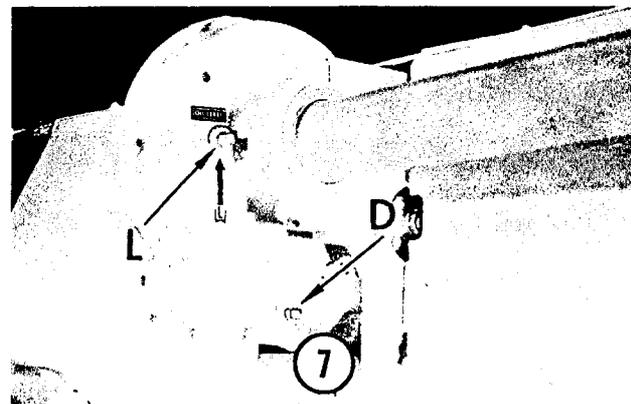
5. LATERAL SHIFT GEAR HOUSING. Check oil level every 60 hours of operation. Check level on the gear housing and the first reduction housing. Add oil if required. It is not necessary to change oil unless housings have been disassembled for repairs.



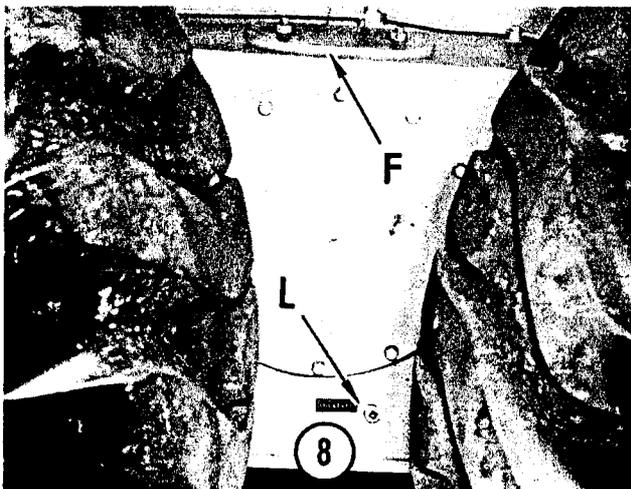
6. CIRCLE REVERSE GEAR HOUSING. Check oil level every 60 hours of operation. Check level of the gear housing and the first reduction housing. Add oil if required. It is not necessary to change oil unless the housings have been disassembled for repairs.

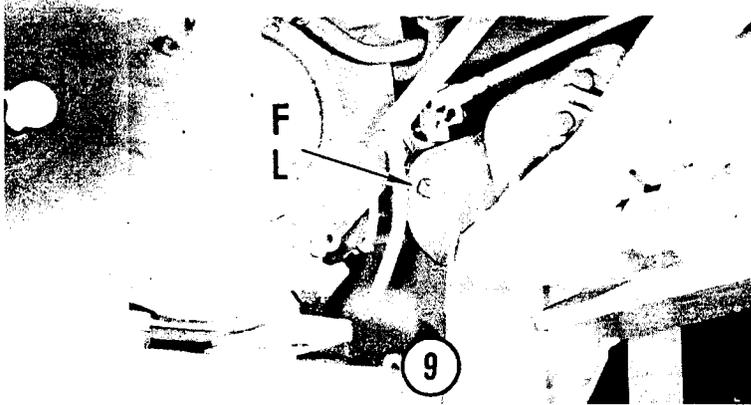


7. BLADE LIFT HOUSINGS. Check oil level every 60 hours of operation. Add oil if required. It is not necessary to change oil unless housing has been disassembled for repairs.

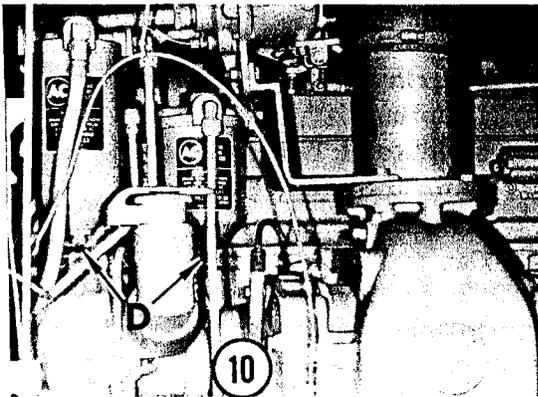


8. TANDEMS. Check oil level every 60 hours of operation. Check at level plug on side of tandem housing, between tires. Fill or add oil by removing inspection cover on top of tandem housing. Grader must be parked on level area when checking oil level in tandems. Drain housing by removing plug in bottom of housing. Change oil after 5000 hours of operation or once a year.

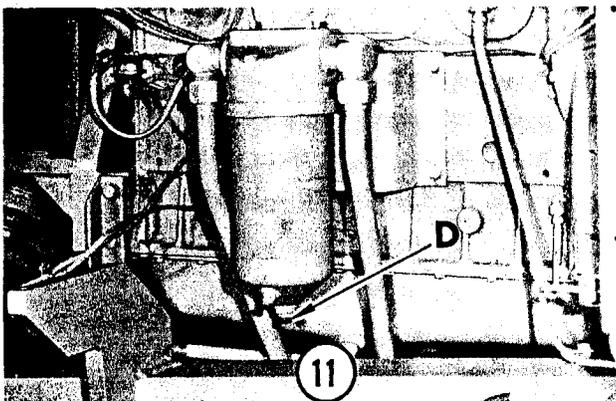




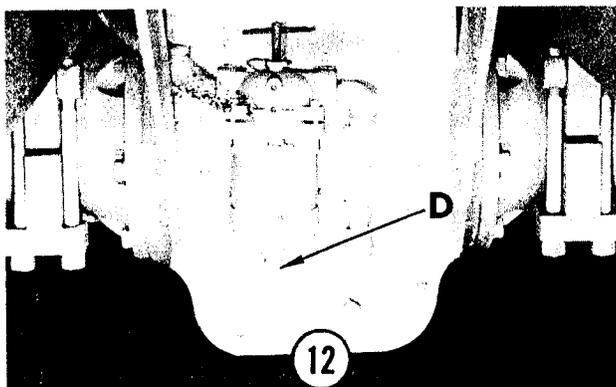
9. HYDRAULIC PUMP DRIVE BEARING HOUSING. Check oil level every 60 hours of operation. Check oil level and add oil or fill at plug on side of housing.



10. FUEL FILTERS (GM). Drain sediment and water every 10 hours. Change elements every 250 hours or more often under adverse conditions. Drain moisture from fuel tank every 10 hours.



11. FUEL FILTER (Cummins). Drain sediment and water every 10 hours. Change elements every 250 hours or more often under adverse conditions. Drain moisture from fuel tank every 10 hours.



12. AUTO - KLEAN FILTER. Rotate handle and drain sediment daily for first 100 hours of operation. Rotate and drain sediment every 50 hours of operation thereafter. Should handle turn hard, rotate back and forth until cleaner blades free themselves. IMPORTANT: Never use a wrench or other tool to turn handle. (666BT only)

Grease Gun Lubrication Points

<u>No.</u>	<u>Location</u>	<u>Total No. of Fittings</u>	<u>No.</u>	<u>Location</u>	<u>Total No. of Fittings</u>
1	Front Wheel Bearings	2	15.	Accelerator-Decelerator	3
2.	L.H. Fork and Spindle	4	16.	Governor Control Linkage	3
3.	Bolster Pin	2	17.	Tandem Wheel Axle Bearings (inner)	4
4.	Leaning Wheel Cylinder	2			
5.	R.H. Fork and Spindle	4	18.	Tandem Wheel Axle Bearings (outer)	4
6.	Pitman Arm Bearings	2			
7.	R.H. & L.H. Steering Arm Block	2	19.	Final Drive Axle Bearing	2
			20.	Inner Axle Carrier Bushing	2
8.	Blade Lift Shaft Bearing	2			
9.	Power Shift Moldboard	2	21.	Power-Shift Clutch Pedal	2
10.	Blade Lift Link Ball and Cap	4	22.	Steering Shaft Bearing and Coupling	2
11.	Slide Bar Bearings	2	23.	Moldboard Tilt Cylinders	4
12.	Lateral Shift Pinion Bearing	1	24.	Lateral Shift Rack	6
			25.	Lateral Shift Link Ball Cap	2
13.	Ground Speed Control Floor Block	1			
			26.	Circle Reverse	1
14.	Brake Pedal Linkage	1	27.	Drawbar Ball and Socket	1

Lubricate daily with 1 or 2 strokes with hand gun.

NOTE: UPPER TRANSMISSION (STANDARD MACHINES)
 Check oil level at petcock on front of upper transmission cover.
 Add oil at filler tube under operator's seat. Check level every 60 hours of operation. Change oil after 5000 hours or once a year.

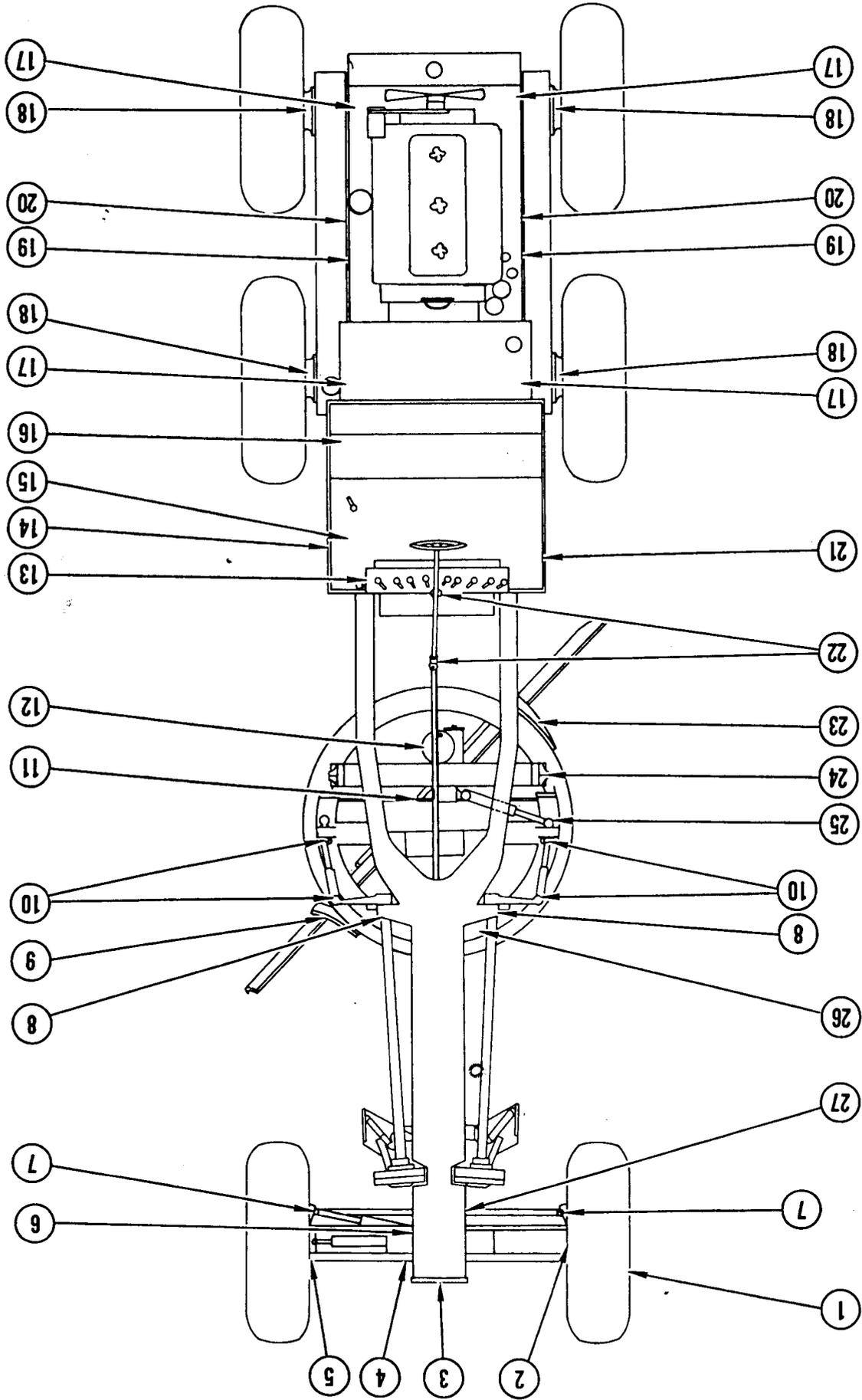
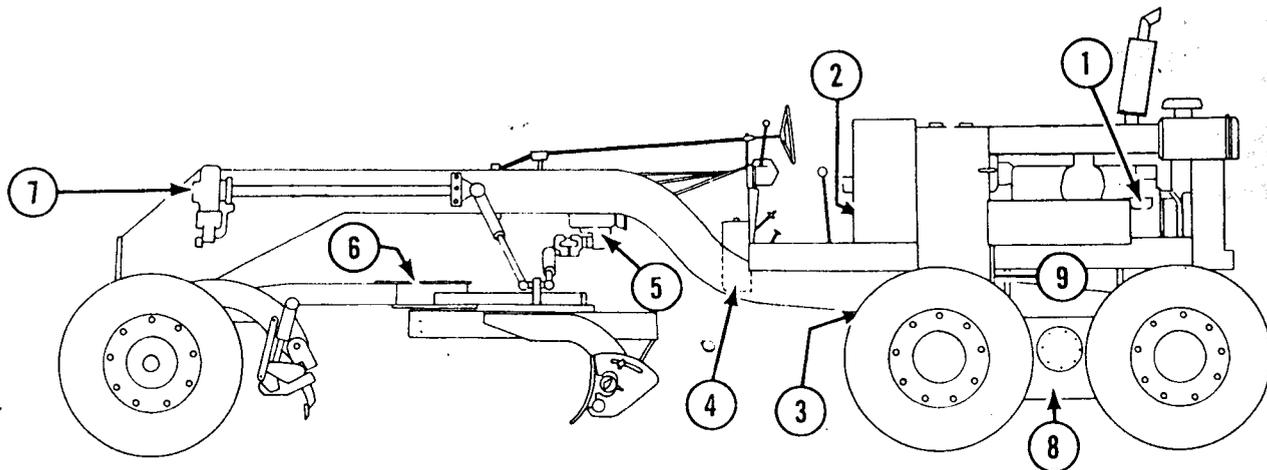


TABLE OF HOUSING CAPACITIES



Picture Number	Housing	Capacity U.S. Measure	Recommended Lubricant SAE Weights
1	Engine Crankcase	See Specifications Page A-10	See below.
2	Power-Shift Transmission and Torque Converter (Model 777BT)	12 Gals.	Automatic Transmission Fluid Type "A"
2	Power-Shift Transmission, Torque Converter, Lower Trans- mission and Final Drive (Model 666BT)	20 Gals.	Automatic Transmission Fluid Type "A"
3	Lower Transmission and Final Drive (Model 777BT)	13 Gals.	Multi-Purpose Type Gear Lubricant 90
4	Hydraulic System Reservoir	16 Gals.	Automatic Transmission Fluid Type "A"
5	Lateral Shift Housing	5 Qts.	Special Lubricant
	Lateral Shift Reduction Housing	1 Qt.	Special Lubricant
6	Circle Reverse Housing	4-1/2 Qts.	Special Lubricant
	Circle Reverse Reduction Housing	1 Qt.	Special Lubricant
7	Blade Lift Housing (each)	5 Qts.	Special Lubricant
8	Tandems (each)	5 Gals.	Engine Crankcase Oil SAE 10
9	Hydraulic Pump Drive Bearing	1 Pt.	Multi-Purpose Type Gear Lubricant 90

GM Engines - Crankcase Oil - Must meet MIL-L-2104B specifications. Ambient temperatures 32° F. and above, use SAE 30. For temperatures below 32° F., consult nearest GM engine dealer for cold weather starting aids.

Cummins Engines - Crankcase Oil - Must meet MIL-L-2104B specifications. Ambient temperatures -10° F. to 32° F., use SAE 10. For temperatures 32° F. to 90° F., use SAE 20; above 90° F., use SAE 30.

Multi-Purpose Type Gear Lubricant - Must meet MIL-L-2105B specifications.

Special Lubricant - Gallon Size - Part Number 722324.

Grease Gun Lubricant - Multi-Purpose #2.