FOREWORD

This manual contains the Fiat-Allis approved procedures for overhaul of hydraulic pump, hydraulic control valves, hydraulic cylinders, and dozer and ripper mounting.

Assure best results and maintain original quality by always using Fiat-Allis parts.

Always furnish Dealer with machine Serial Number when ordering parts.

Many equipment owners employ Dealer's Service Department for all work other than routine lubrication, adjustments, and minor service. This practice is encouraged, as our Dealers are well informed and equipped to render factory approved service.

NOTICE

CONSULT FIAT-ALLIS DEALER FOR OTHER SERVICE MANUALS AVAILABLE FOR YOUR UNIT. SEE TECHNICAL PUBLICATIONS INDEX 70658800 FOR ALL AVAILABLE PUBLICATIONS.

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TOPIC 1 GENERAL DESCRIPTION

1.1 DOZER

1.1.1
Two hydraulically-operated dozers are available for the HD-11 Series B Tractor They are the 11-HS dozer, which has a straight moldboard and push beams and the 11-HA dozer which has an angling moldboard and a C-frame.

1.1.2
A hydraulically-operated tilt cylinder is available for the 11-HS dozer as special equipment.

1.2 RIPPER

The rear mounted ripper is hydraulically controlled. The tool bar has three slots to accomodate one, two, or three ripper shanks. Adjustment holes in the mounting frame and in the ripper shanks provide a means for adjusting the ripper depth and the angle of penetration.

TOPIC 2 HYDRAULIC SYSTEM SPECIFICATIONS, CAPACITY AND SERVICE

2.1 OIL SPECIFICATIONS

2.1.1
Hydraulic system oil performs the dual function of lubrication and transmission of power. Therefore, it must be selected with care, and if necessary, with the assistance of a reputable supplier.

2.1.2
Hydraulic oil used in our hydraulic systems should be "Service SD"(formerly MS). The oil should also meet or exceed the "Five Engine Test Sequences" or conform to "Mil-L-2104B". These engine sequence tests were adopted by The Society of Automotive Engineers, The American Society for Testing Materials, and Automotive Engine Builders. The "SD" classification is the key to selection of oils containing the type of compounding that will extend the operating life of the hydraulic system by providing additional resistance to wear, scuffing, corrosion, and rusting.

2.1.3
When atmospheric temperature is below 100°F (37°C) use SAE 10W; above 100°F, use SAE 20-20W. When atmospheric temperature is below -10°F (-23°C), oil meeting Military Specifications "Mil-L-10295B OES" may be used.

CAUTION

Do not use "MIL-L-10295B OES" if atmospheric temperature remains consistently above -10°F (-23°C).

2.2 CAPACITY

2.2.1
The hydraulic system refill capacity is as follows:

32 gallons (121.1 lit) with dozer only.

An additional 3 gallons (11.3 lit) when equipped with a ripper.

An additional .5 gallons (1.8 lit) when equipped with a tilt cylinder.

2.3 SERVICE

2.3.1
Hydraulic mechanisms are precision units and their continued trouble-free operation is dependent on proper care. Dirt and particles of metal or packing can cause considerable trouble; every precaution should be taken to keep the system clean. Always change filters as a set to insure a clean system. Drain, flush and refill system each 1200 hours. Check oil level frequently and add oil if necessary. Use only clean oil that meets specifications.

2.3.2
Refer to Operator's Manual for detailed periodic service instructions.

2.4 HYDRAULIC SYSTEM SPECIFICATIONS

IMPORTANT: Athough engine rpm does not affect hydraulic pressure, rpm does affect hydraulic pump output(flow); therefore, always adjust engine rpm at high idle and at converter stall before attempting to check pump output. The high idle check determines only the maximum engine speed; the converter stall check determines if the engine is turning fast enough (under load)to turn the pump at sufficient speed for it to supply the specified flow.

Engine rpm

Direct drive:
- low idle - - - - - - - - - - - - - - 600 -- 650
- high idle - - - - - - - - - - - - - 1950 -- 2000
- governed speed - - - - - - - - 1800

Hydraulic System Specifications, Capacity and Service

Power shift:
low idle - - - - - - - - - - - - - 600 -- 650
high idle- - - - - - - - - - - - 2135 -- 2185
converter stall- - - - - - - - 1965 -- 1985
governed speed- - - - - - - - -2050

Pump flow
Direct drive:
no load at high idle- - - - - - 91 gpm (344.4 lit/min)
1400 psi (98.4 kg/cm^2) at governed speed - 70 gpm (264.9 lit/min)

Power shift:
no load at high idle- - - - - - 93 gpm (352.0 lit/min)
1400 psi (98.4 kg/cm^2) at governed speed - 75gpm (283.9 lit/min)

Main relief valve(s) opening pressure- - 1550 psi (109.0 kg/cm^2)
Safety valves (if so equipped)opening pressure- - 2300 psi (161.7 kg/cm^2)

Normal hydraulic oil operating temperature- - - - - -190 °F.(88°C)
Maximum intermittent temperature- - - - - -250°F.(121°C)

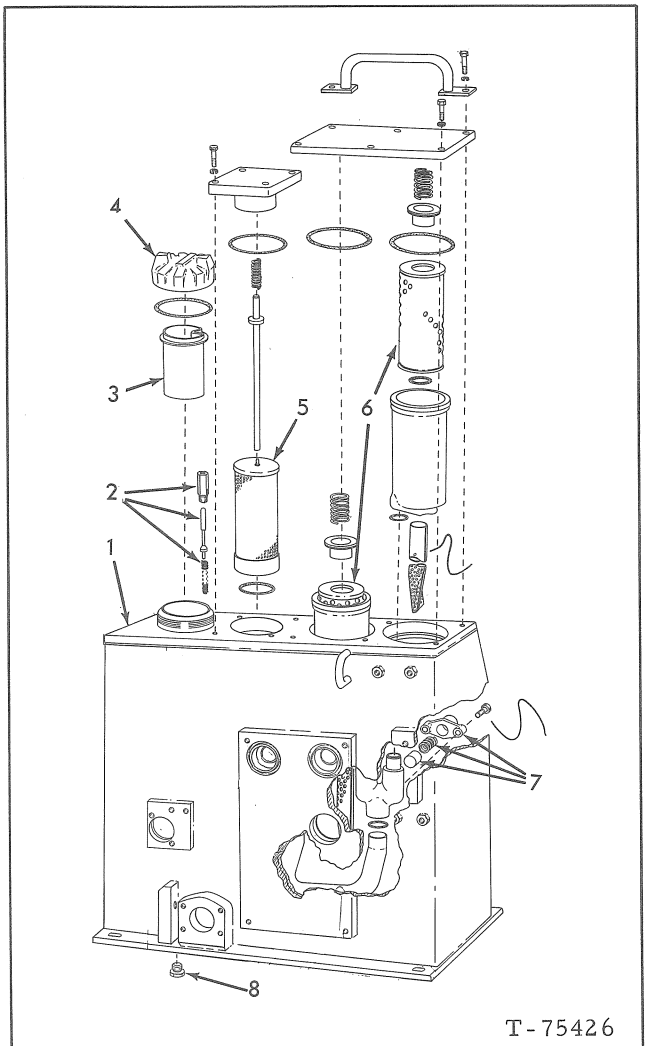

FIG. 1 HYDRAULIC TANK

1. Hydraulic tank
2. Air relief valve
3. Strainer
4. Filler cap
5. Contaminant separator
6. Filters
7. By-pass valve
8. Oil drain plug

TOPIC 3 HYDRAULIC COMPONENT FUNCTIONS AND CIRCUIT OIL FLOWS

CAUTION

Oil flow illustrations are NOT to be used for assembly purposes.

3.1 INTRODUCTION TO HYDRAULICS

3.1.1
The fundamental principle of all hydraulic systems is known as Pascal's Law, which is as follows:

"Pressure applied to any part of a confined liquid is transmitted undiminished in all directions, and acts with equal force on all equal areas of the surfaces confining the liquid and at right angles to them."

This principle applied to the hydraulic system causes a multiplication of force. If oil is introduced at any pressure to the piston, this same pressure is transmitted undiminished to each area of the piston.

EXAMPLE

If piston is 6 inches in diameter, piston area is 28.27 square inches -- 28.27 x 1000 psi= 28,270 lbs. force being applied to piston.

(6 inches = 152 mm)
(28.27 square inches = 182.38 cm^2)
(1000 psi = 70.3 kg/cm^2)
(28,270 lbs. = 12,823.0 kg)

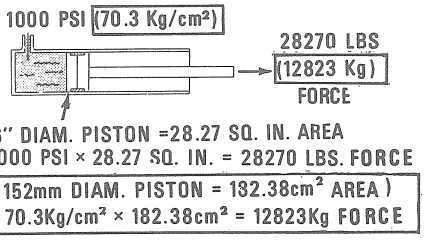

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FIG. 2 SINGLE ACTING HYDRAULIC CYLINDER

3.2 DESCRIPTION OF HYDRAULIC SYSTEM

3.2.1
The dozer hydraulic system consists of a hydraulic tank, Fig. 1 (1), containing two full flow filters (6), a by-pass valve (7) to protect the filters, a strainer (3) to prevent dirt from entering system while filling it, an air relief valve (2) to prevent oil from splashing when filler cap (4) is removed, and a contaminant separator (5) to prevent metal and other particles from entering the pump suction line; a hydraulic pump to create oil flow; and a hydraulic control valve to direct the oil to the hydraulic cylinders. The components of the control valve will vary depending upon what hydraulic equipment is mounted on the tractor; refer to Fig. 19.

3.3 HYDRAULIC PUMP FUNCTION AND OIL FLOW

3.3.1 HYDRAULIC PUMP FUNCTION

3.3.1.1
On direct drive tractors the pump is mounted on the left rear of the clutch housing. On power shift tractors the pump is mounted on the right rear of the torque converter. The pump contains two sets of gears and the flow of oil is illustrated in the circuit oil flow diagrams, Figs. 6 thru 13. Rotation of the pump is counterclockwise.

3.3.2 HYDRAULIC PUMP OIL FLOW

3.3.2.1
The hydraulic pump draws oil from the hydraulic tank and forces it through two pressure lines to the control valve.

3.4 MAIN RELIEF VALVES FUNCTION AND OIL FLOW

NOTE: If tractor is equipped with only a dozer, only one main relief valve is provided. If other hydraulic equipment is used, two main relief valves are provided; refer to Fig. 19.

3.4.1 MAIN RELIEF VALVES FUNCTION

3.4.1.1
The function of the main relief valves is to protect the system (pump, cylinders, and linkage) from overload when the control lever is in a work position and the cylinder piston rods cannot move (rods have reached an extreme in or out position, or imposed load prevents rod movement)

IMPORTANT: Main relief valve (s) have no function when the control lever is in HOLD position.

3.4.2 MAIN RELIEF VALVES OIL FLOW

3.4.2.1
Oil flow through main relief valves is as follows; when oil flow is not restricted pump oil flows around the valve and returns to tank. When oil flow is restricted (cylinder piston rods cannot move) pressure build-up in cavity, Fig. 3 (C) momentarily opens valve (D) dumping oil from cavity (C). Due to the small orifice in

valve (B), oil pressure at (A) is greater than at (C), therefore, valve (B) opens and allows a large dump off to (E). When pressure at (C) and (A) equalize, the light spring closes valve (B) and cycle iscompleted.

3.5 HYDRAULIC CYLINDER FUNCTION

3.5.1
The function of hydraulic cylinders is to convert hydraulic power into mechanical power; however, additional functions of safety and speed are performed by the limit travel valves and quick-drop valves within the dozer cylinders.

3.5.2
The limit travel valves protect the dozer components from damage when the moldboard is fully raised or fully lowered while tilted, Fig. 4. The valve function is as follows: as the moldboard reaches its full height, one piston will reach the end of its travel, the valve pins in that piston push the valve open allowing the pressurized oil to flow through the piston and escape to sump; this stops the moldboard movement. Without limit travel valves, the pressure behind the opposite piston (piston not bottomed) would tend to twist the dozer components.

3.5.3
The quick-drop valves maximize moldboard drop speed. Refer to Fig. 5 -- VALVES IN QUICK-DROP POSITION: When control lever is placed in down pressure or float position, oil from pump passes through valve (1) -- which is closed and pushes on cylinder piston and rod. Oil from opposite side of piston reenters rear of cylinder from tube, pushes valve (2) back -- which restricts return port and directs main flow of oil up to valve (1); valve (1) opens and this "return oil" lends itself to pump flow to help fill area at rear of piston. When demand for oil diminishes, valves reseat.

NOTE: Valve (3) is adjustable so you may regulate quick-drop speed to your particular application.

Refer to Fig. 5 -- VALVES IN RAISE OR HOLD POSITION: When control lever is placed in raise position, oil from pump flows around valve (3), and flows through valve (2); return oil flows through valve (1) and returns to reservoir.

3.6 SAFETY VALVE AND ANTI-CAVITATION VALVE FUNCTIONS

3.6.1
If the dozer is equipped with a tilt cylinder, there are two safety valves incorporated in the control valve to prevent overloading the outer extremes of the moldboard. If the tractor is equipped with a ripper, there are two safety valves incorporated in the ripper valve to help prevent ripper breakage when an obstacle tends to pull the ripper down or push it up.

3.6.2
The anti-cavitation valve, located in the dozer control section, directs return oil into top of dozer cylinder Fig . 8. This action takes place when moldboard is powered down or floated down because it drops with such speed that the return oil has more pressure than the work oil; therefore, anti-cavitation in this case, means preventing a void (lack of oil) in top of dozer cylinder.

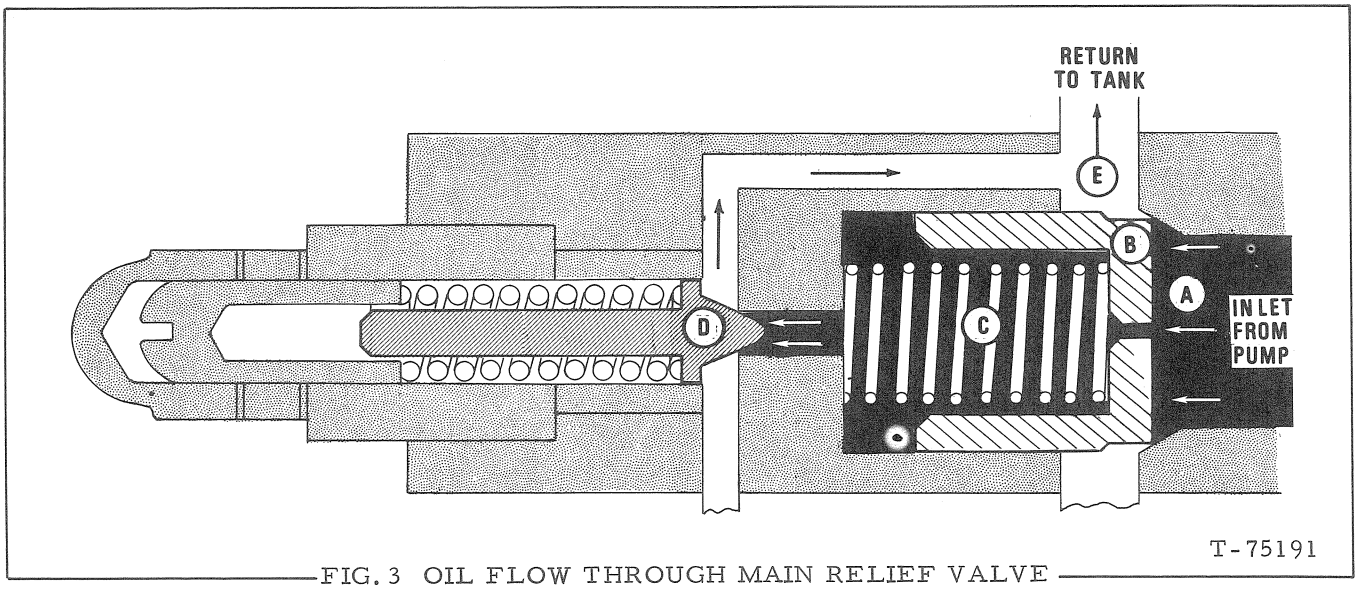

FIG. 3 OIL FLOW THROUGH MAIN RELIEF VALVE

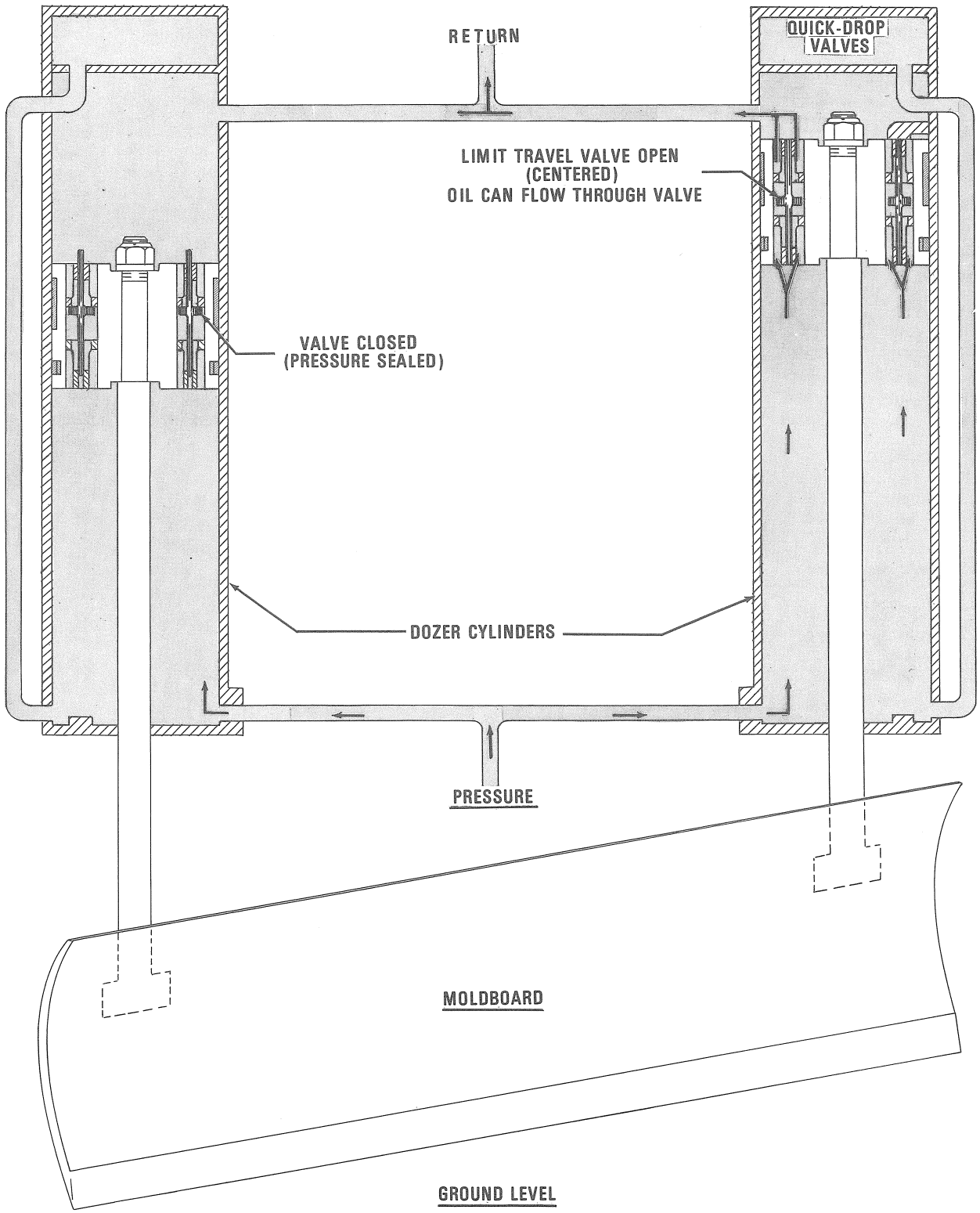

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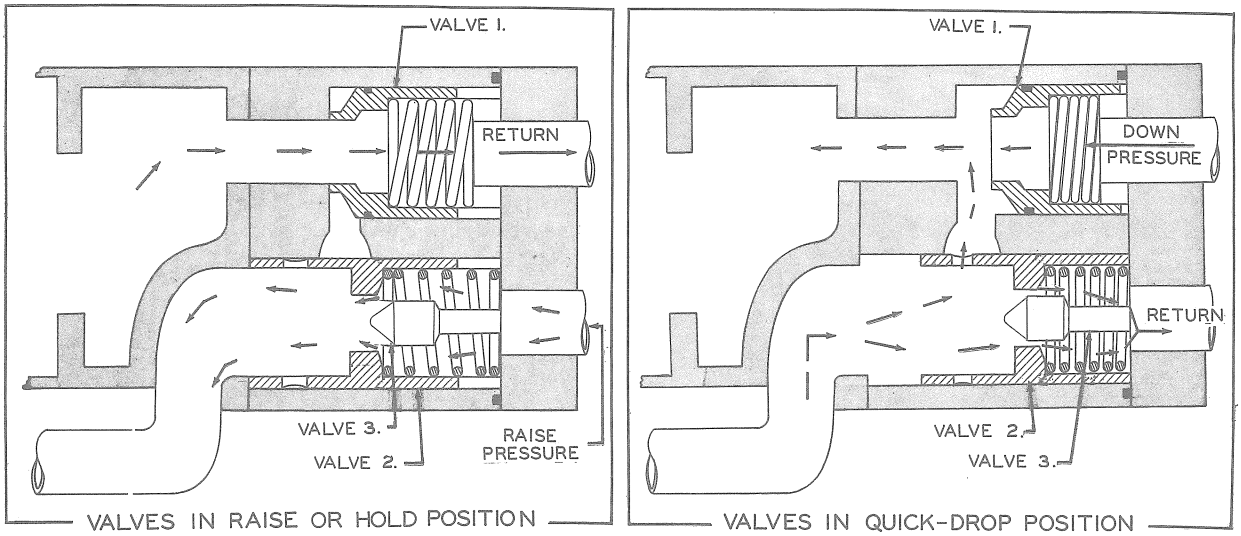
FIG. 4 LIMIT TRAVEL VALVE FUNCTION (MOLDBOARD RAISING WHILE TILTED)



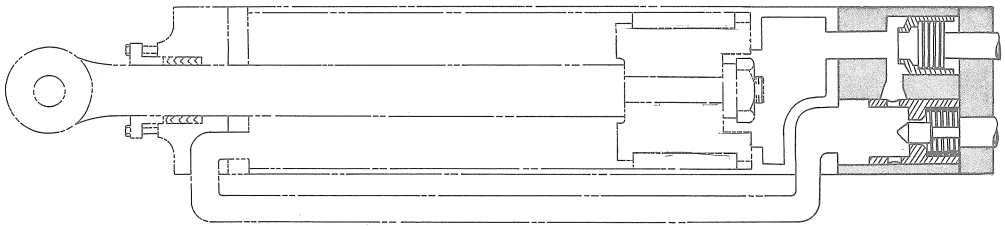


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FIG. 5 QUICK — DROP VALVES FUNCTION

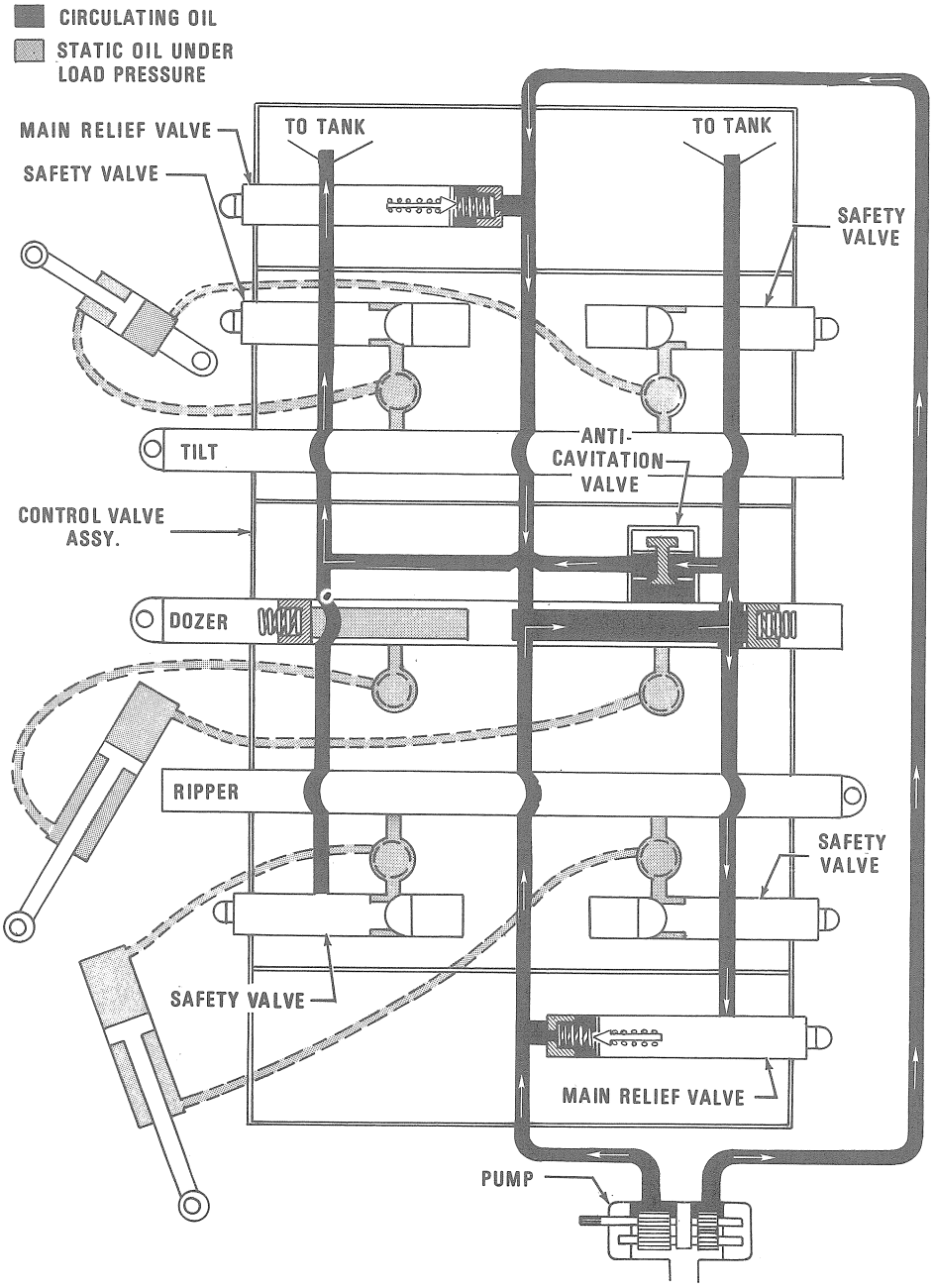

FIG. 6 DOZER, TILT AND RIPPER OIL FLOW--HOLD POSITION

3.7 DOZER, TILT AND RIPPER, OIL FLOW–HOLD POSITION

3.7.1
Pump oil from both sets of pump gears merely circulates; anti-cavitation valve has no function. The control valve spools prevent oil circulation to or from the hydraulic cylinders. If an excessive load is imposed on either end of tilt or ripper cylinders, the safety valves will prevent damage to the system by allowing oil to escape from the end of cylinder that is over loaded (this allows the ripper or dozer to give and prevents shock damage). The dozer cylinder limit travel valves and quick-drop valves, Figs. 4,5, main relief valves, and control spool check valves, have no function in HOLD.

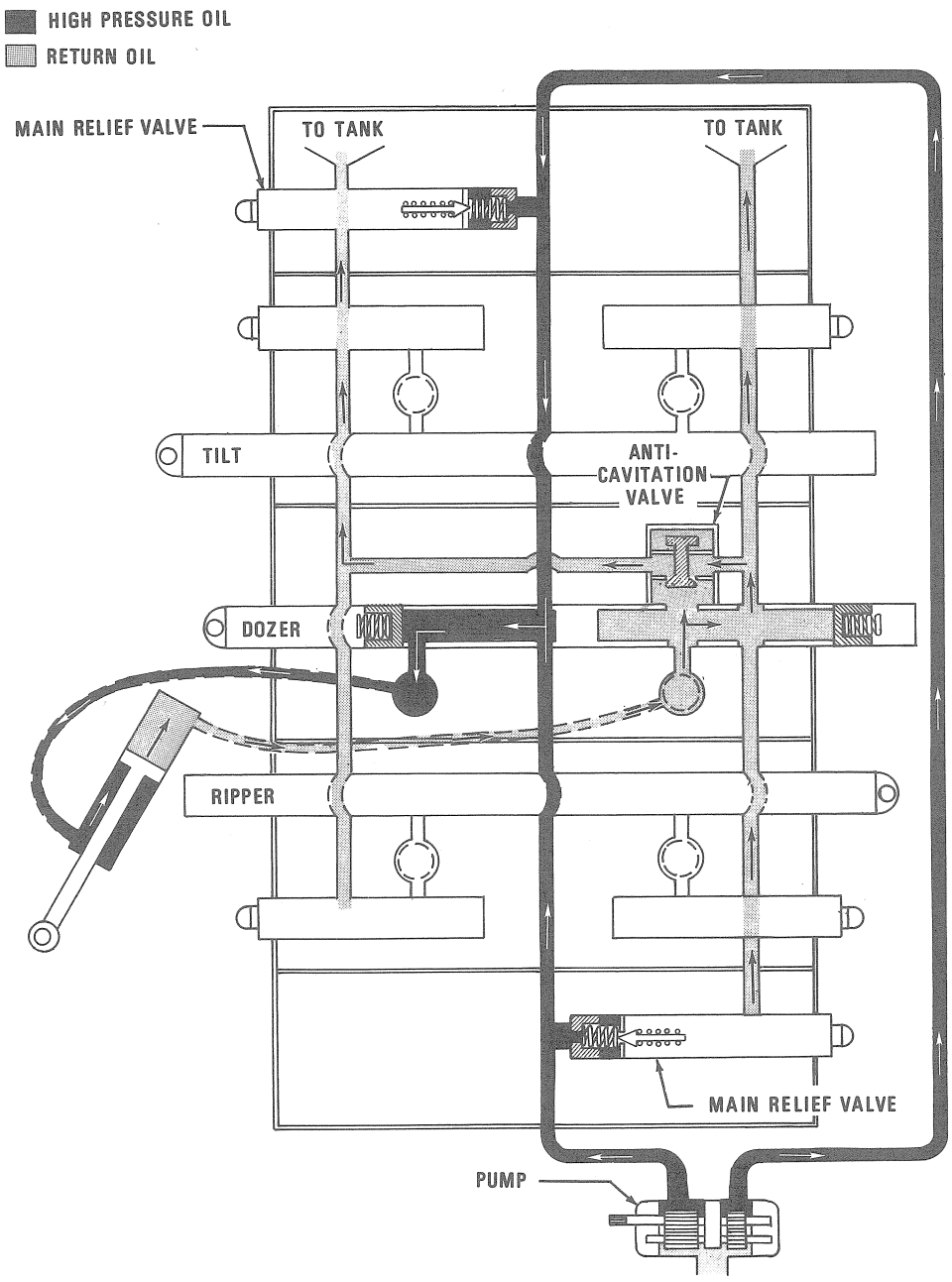

FIG. 7 DOZER OIL FLOW--RAISE POSITION

3.8 DOZER OIL FLOW–RAISE POSITION

3.8.1
Pump oil from both sets of pump gears flow past the main relief valves, around the ripper and tilt spools and into the dozer spool. Pushing the check valve to the left, the oil flows to the cylinders and pushes the piston rod in. Oil from opposite end of cylinder flows to tank.

3.8.2
If the piston rods cannot move due to excessive load, the flow of work oil is restricted, pressure builds until it reaches main relief valve adjustment, and valves (one or both) open to relieve pressure.

3.8.3
Safety valves, and anti-cavitation valve, regardless of their condition, cannot affect dozer raise.

3.8.4
The purpose of check valve in control spool is to prevent a reverse flow of oil when changing spool positions. If valve fails, moldboard will drop slightly before raising.

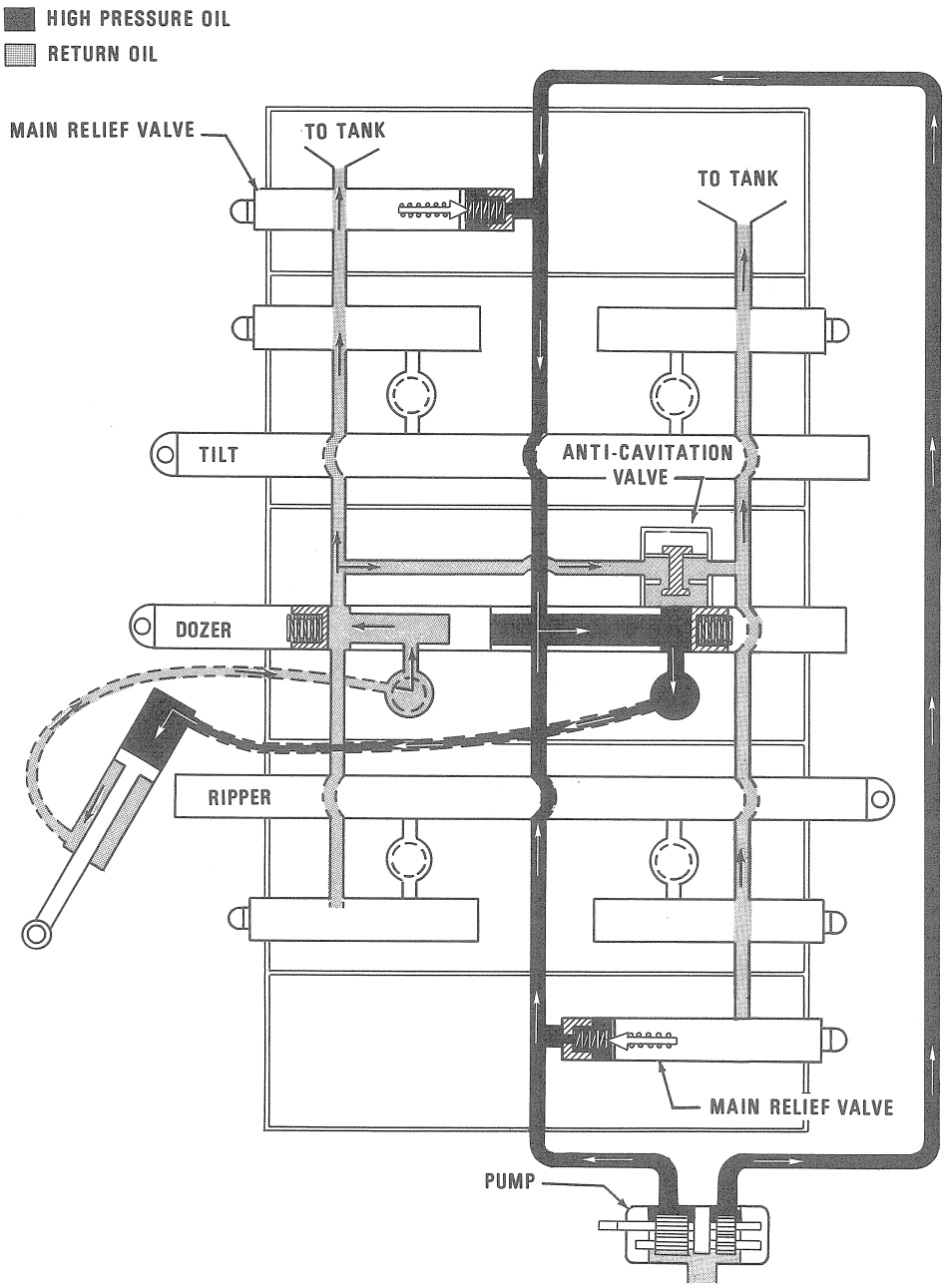

FIG. 8 DOZER OIL FLOW -- POWER-DOWN POSITION

3.9 DOZER OIL FLOW—POWER-DOWN POSITION

3.9.1
Pump oil from both sets of pump gears flow past the main relief valves, around the ripper and tilt spools into dozer spool. Pushing the check valve to the right, the oil flows to the top of cylinder to push the piston rod out. If the moldboard is in such a position that it can drop rapidly, oil from the opposite end of cylinders (oil returning to tank) will have more pressure than work oil; return pressure opens anti-cavitation valve and adds return flow to work flow (to help pump fill cylinder) until work pressure is greater than return pressure.

3.9.2
If the piston rods cannot move due to excessive load, the flow of work oil is restricted, pressure builds until it reaches main relief valve adjustment and valves (one or both) open to relieve pressure.

3.9.3
Safety valves, and check valve in control spool, regardless of their condition, cannot affect dozer power down.

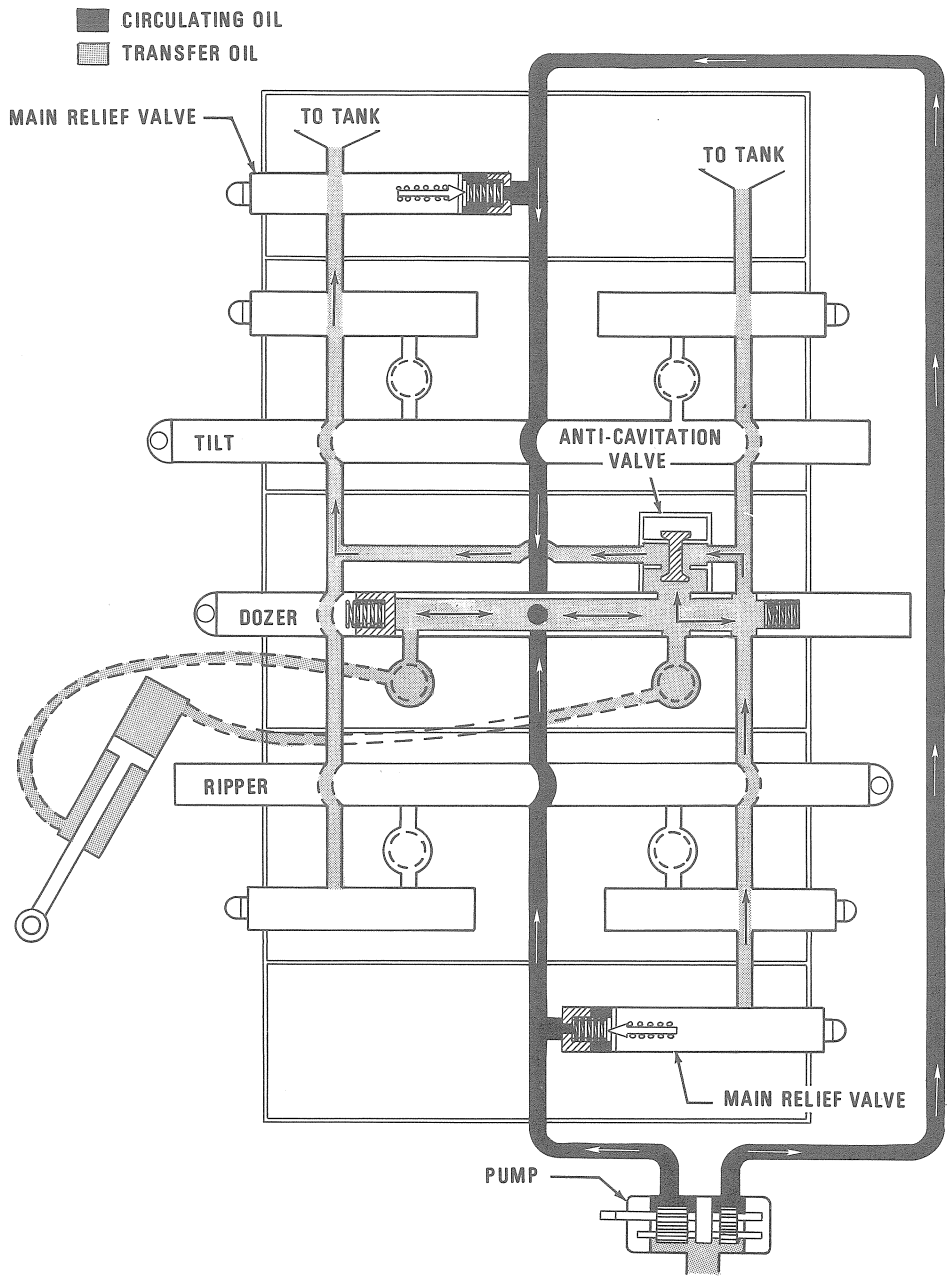

FIG. 9 DOZER OIL FLOW--FLOAT POSITION

3.10 DOZER OIL FLOW–FLOAT POSITION

3.10.1
Pump oil from both sets of pump gears circulates from pump to tank; it flows around the ripper and tilt spools but flows through a series of holes in the dozer spool

3.10.2
As the moldboard lowers or raises, oil from one end of the cylinders transfers through the hollow spool to the other end of the cylinders. If more oil is required to fill the cylinders it is supplied by the pump and/or the anti-cavitation valve.

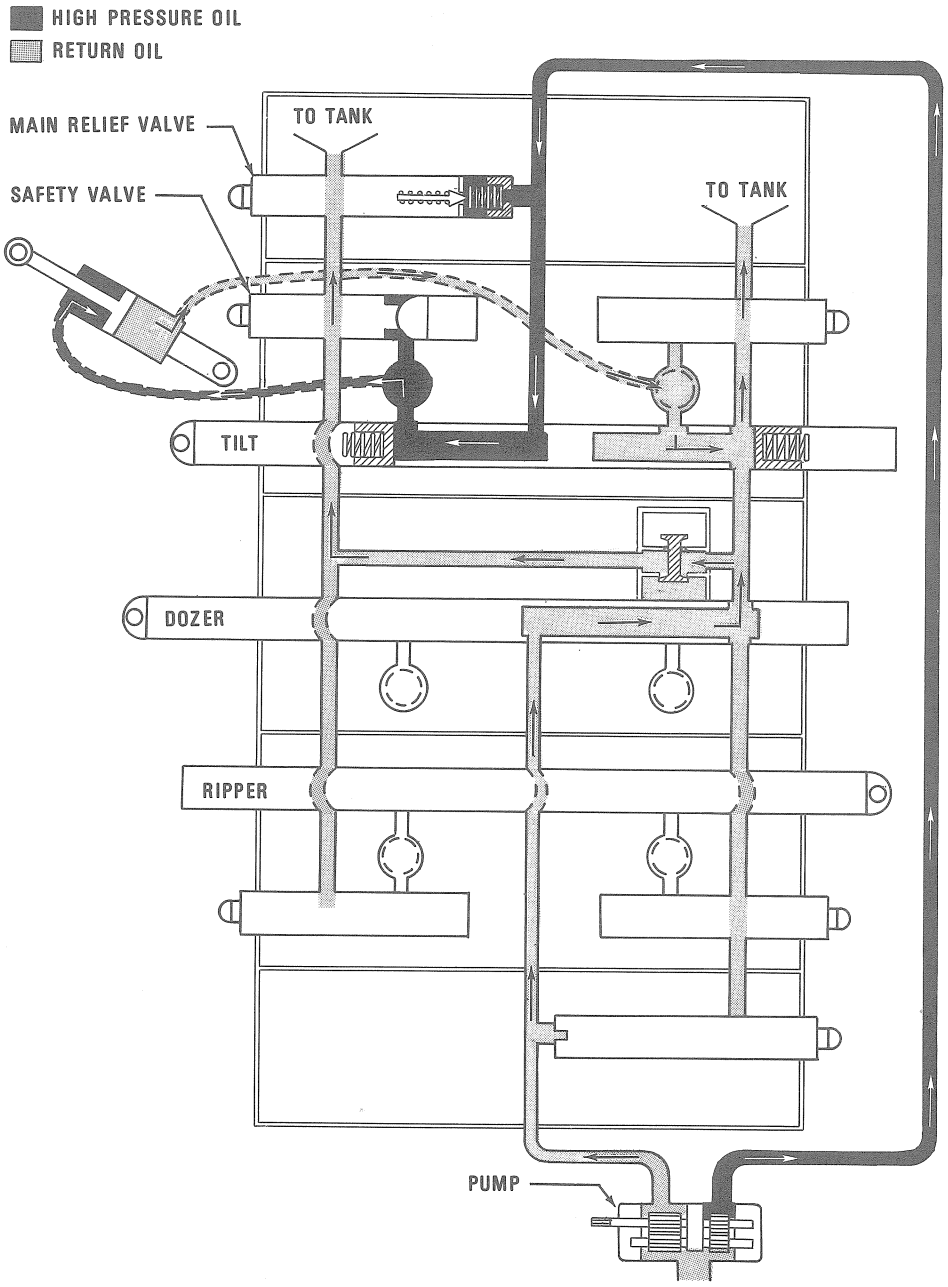

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FIG. 10 DOZER OIL FLOW--TILT LEFT POSITION

3.11 DOZER OIL FLOW–TILT LEFT POSITION

3.11.1
Pump oil from front set of gears circulates and returns to tank; oil from rear gears flows past the main relief valve and into the tilt control spool. Pushing the check valve to the left, the oil flows to the tilt cylinder and pushes the piston rod in--this tilts the moldboard to the left. Oil from opposite end of cylinder is forced back to tank.

3.11.2
If piston rod reaches the end of its travel or cannot move due to excessive load, pressure builds in the work circuit until the main relief valve adjustment is reached, and the valve opens. Of course, if the safety valve is malfunctioning, or is adjusted wrong (set lower than main), the tilting power will be affected--in fact, moldboard may not move.

3.11.3
The purpose of the check valves in control spool is to prevent a reverse flow of oil when changing control positions. If valve(on pressure side) fails, moldboard may tend to tilt in the opposite direction (or hesitate) until work oil pressure equalizes load back-up pressure.

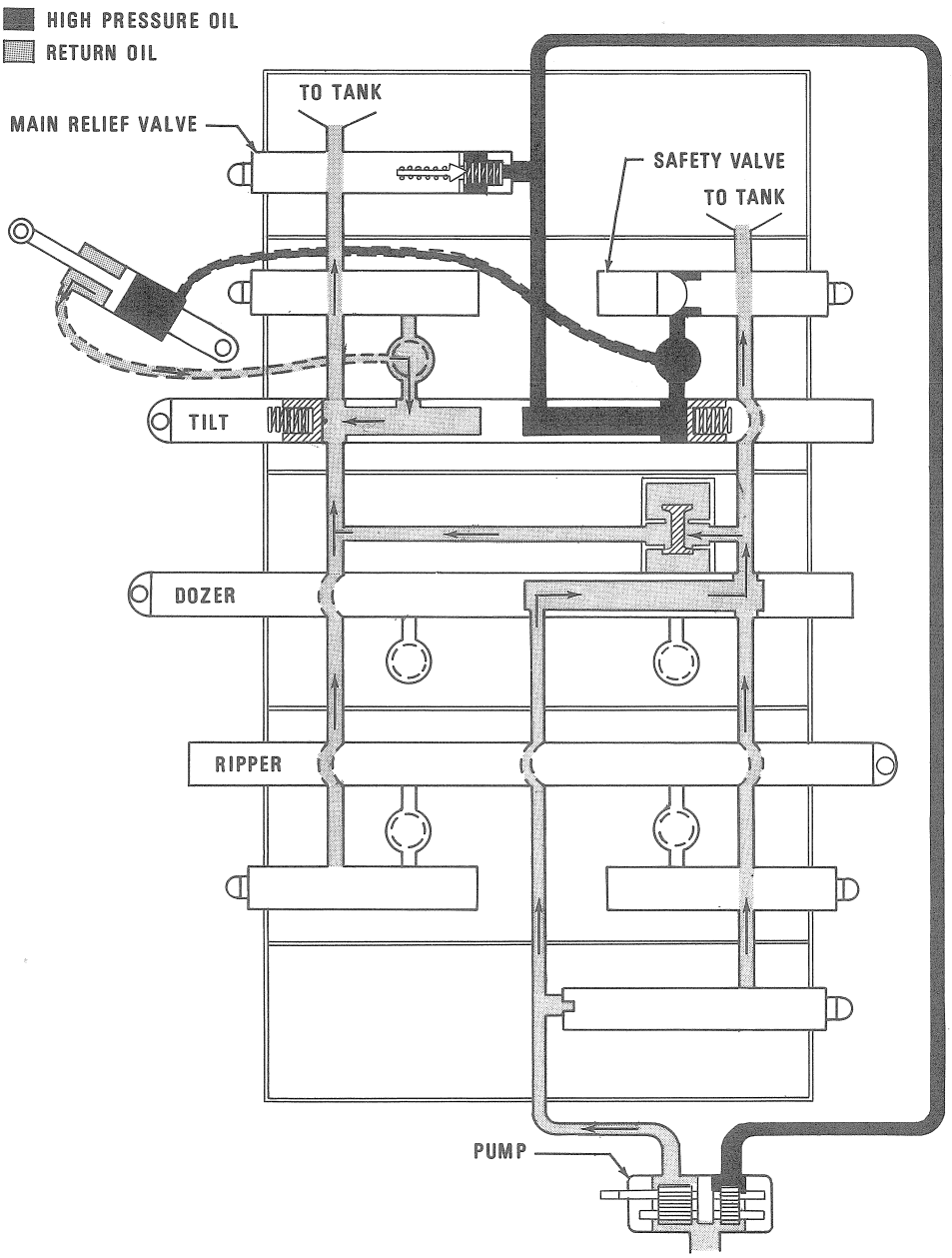

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FIG. 11 DOZER OIL FLOW--TILT RIGHT POSITION

3.12 DOZER OIL FLOW–TILT RIGHT POSITION

3.12.1
Pump oil from front set of gears circulates and returns to tank; oil from rear gears flows past the main relief valve and into the tilt control spool. Pushing the check valve to the right, the oil flows to the tilt cylinder and pushes the piston rod out--this tilts the moldboard to the right. Oil from opposite end of cylinder is forced back to tank.

3.12.2
If piston rod reaches the end of its travel, or cannot move due to excessive load, pressure builds in the work circuit until the main relief valve adjustment is reached, and the valve opens. Of course, if the safety valve is malfunctioning, or is adjusted wrong (set lower than main), the tilting power will be affected--in fact, moldboard may not move.

3.12.3
Control spool check valves prevent a reverse flow of oil when changing control positions. If valve (on pressure side) fails, moldboard may tend to tilt in the opposite direction (or hesitate) until work pressure equalizes load back-up pressure.

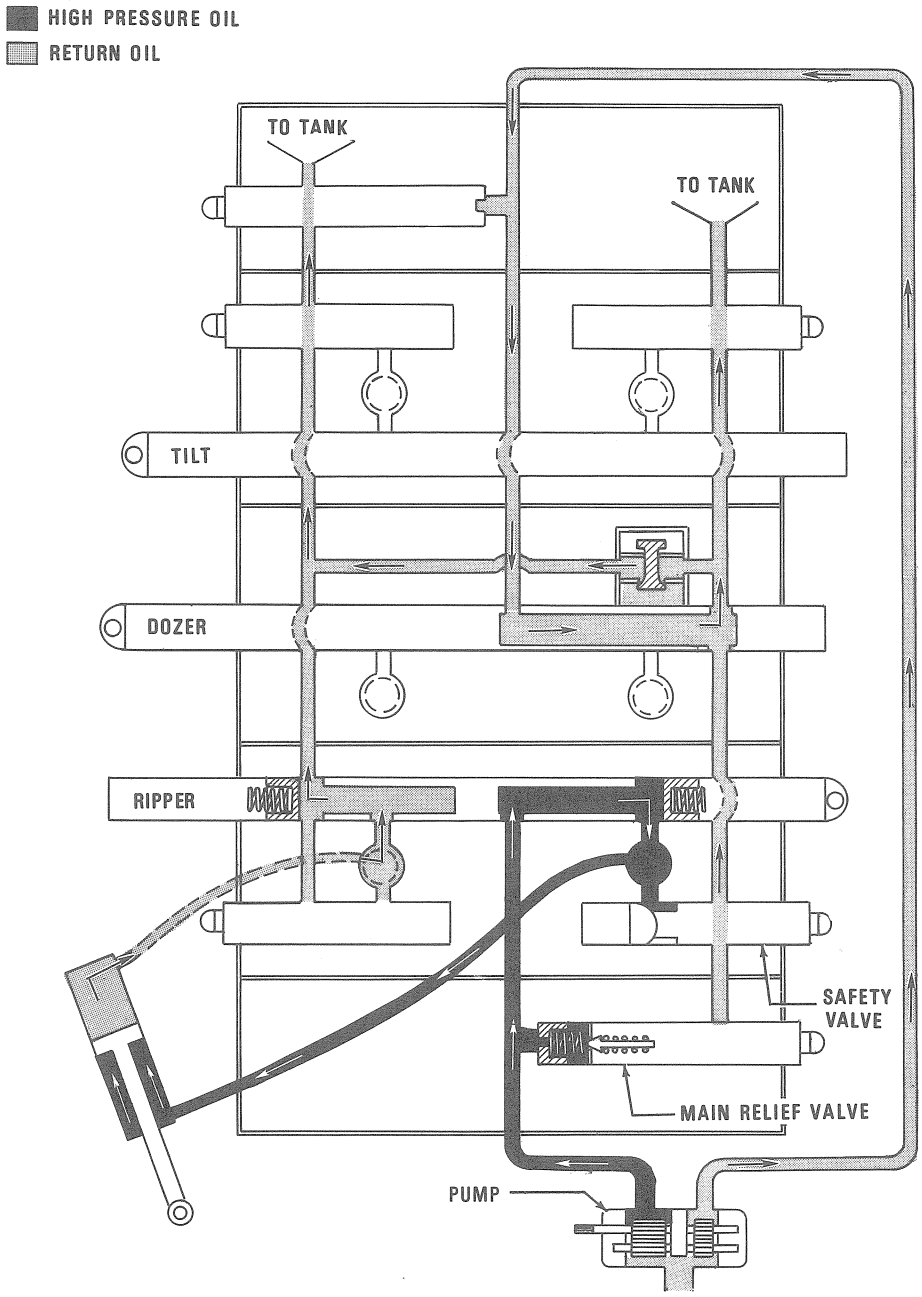

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FIG. 12 RIPPER OIL FLOW--RAISE POSITION

3.13 RIPPER OIL FLOW–RAISE POSITION

3.13.1
Pump oil from rear set of gears circulates and returns to tank; oil from front gears flows past the main relief valve and into the ripper control spool. Pushing the check valve to the right., the oil flows to the ripper cylinder and pushes the piston rod in to raise the ripper. Oil from opposite end of cylinder is forced back to tank.

3.13.2
If piston rod reaches the end of its travel, or cannot move due to excessive load, pressure builds in the work circuit until the main relief valve adjustment is reached, and the valve opens. Of course, if safety valve malfunctions, or is adjusted wrong (set lower than main) the raise power will be affected--in fact, ripper may not move.

3.13.3
The purpose of the check valves in control spool is to prevent a reverse flow of oil when changing control positions. If valve on pressure side fails, ripper may tend to drop (or hesitate) before raising.

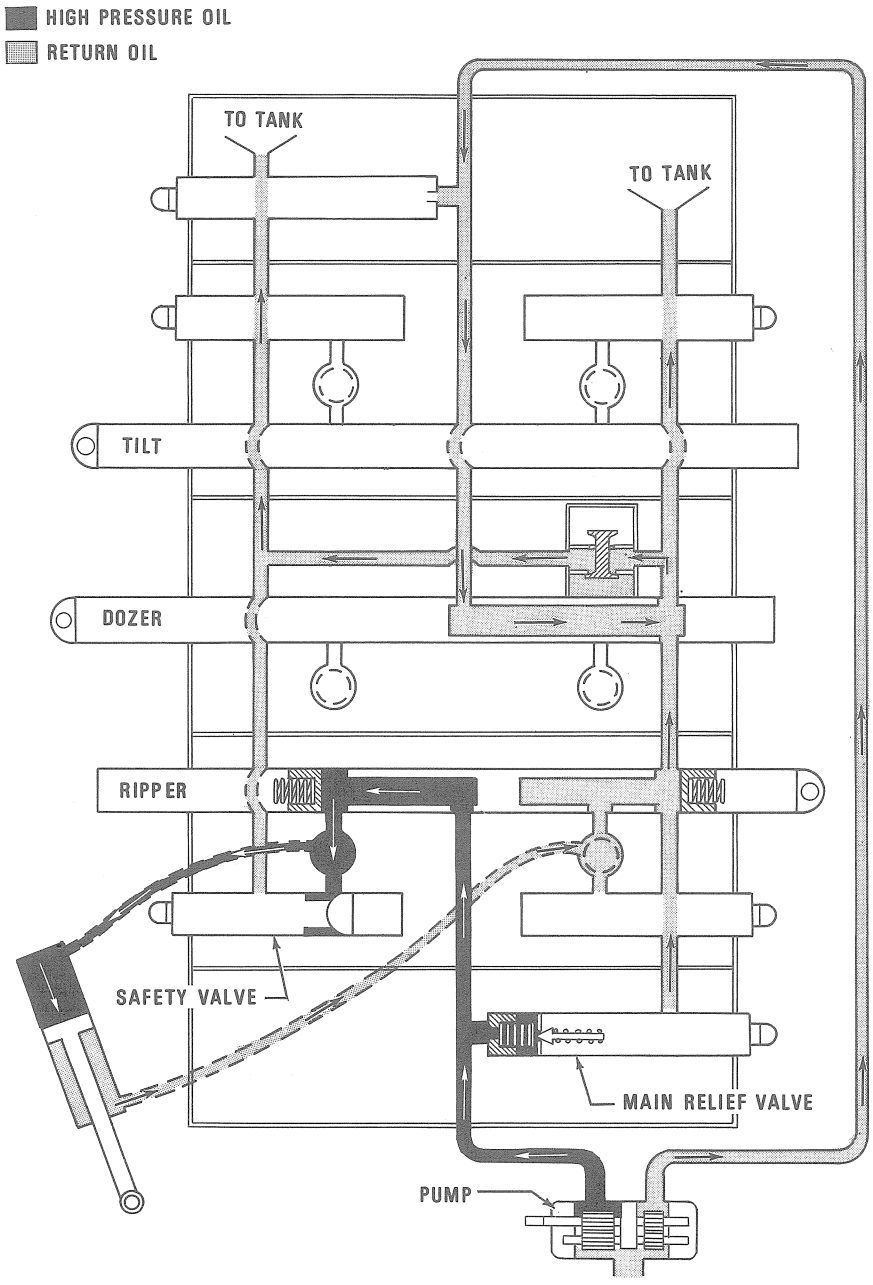

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FIG. 13 RIPPER OIL FLOW--POWER-DOWN POSITION

3.14 RIPPER OIL FLOW–POWER-DOWN POSITION

3.14.1
Pump oil from rear set of gears circulates and returns to tank; oil from front gears flows past the main relief valve and into the ripper control spool. Pushing the check valve to the left, the oil flows to the ripper cylinder and pushes the piston rod out to lower the ripper. Oil from opposite end of cylinder is forced back to tank.

3.14.2
If piston rod reaches the end of its travel, or cannot move due to excessive load, pressure builds in the work circuit until the main relief valve adjustment is reached, and the valve opens. Of course, if safety valve malfunctions, or is adjusted wrong (set lower than main) down-pressure will be affected--in fact, ripper may not move.

3.14.3
The purpose of the check valves in the control spool is to prevent a reverse flow of oil when changing control positions. If valve on pressure side fails, ripper may hesitate when down-pressure is applied.

TOPIC 4 TROUBLE-SHOOTING

4.1 GENERAL

4. 1. 1
When using the trouble-shooting list, 4. 2. 1, it is not advisable to remove and disassemble major hydraulic components such as the pump cylinders, or control valves without first checking hydraulic system with a pressure gauge, 4. 7, or a flow meter, 4. 6, to make sure that component may be the cause of the trouble.

4. 1. 2
Before checking hydraulic system pressure and/ or flow, engine speed and power should be checked see 4. 5, to make sure engine is supplying sufficient speed and power to the hydraulic pump.

4.2 TROUBLE–SHOOTING DOZER HYDRAULIC SYSTEM

The following chart is designed as a quick reference tool for finding the less complex troubles and isolating difficult troubles. If your trouble is not listed, a study of the oil flow schematics should help. Above all, do not immediately diagnose your trouble as pump or control valve spool failures. Always check engine rpm at high idle and under load when moldboard speed, not power, is questionable (see 4. 5)

4.2.1 DOZER COMPLAINTS AND REMEDY SEQUENCE

COMPLAINTS	REMEDY SEQUENCE
Moldboard will not move at engine high idle(complete power loss)	1, 16, 8, 23
Moldboard drifts down quickly(not just occasionally cracking down) but no other trouble is apparent (lever in hold).	11, 24, 25, 20
Moldboard is slow but has good power.	26, 1, 2, 3, 4, 7, 9, 27,
Moldboard is jerky may not fully raise.	1, 2, 3, 4, 15, 10, 20
Power-down will not raise front of tractor but raise power and speed is good.	1, 16, 15, 17, 18, 19, 20 or 6
Moldboard will not raise, but power-down is good.	1, 21, 18, 20
Moldboard slow raising and lacks power.	1, 2, 3, 4, 22, 20,
Power-down applied but will not hold with lever in hold position.	11, 28, 20
Moldboard lacks power in raise and power-down but appears fast enough.	8, 9, 20
Moldboard drops before raising when lever is pulled into raise position.	12
Moldboard drifts down after several hours.	Normal
Oil heating.	1, 2, 3, 15, 20
Control valves seals leaking.	13, 5
Oil leaks from hole in housing where hydraulic pump is connected.	14

4.2.2. DOZER COMPLAINT REMEDIES

This is a list of numbered remedies. Perform only those remedies that are in numbered sequence opposite your complaint in 4.2.1, and perform them only in the sequence indicated.

1. Make certain the hydraulic system oil level is visible about midway in the tank sight gauge.
2. Clean contaminant separator, Fig. 1 (5), screens and magnets; refer to Operator's Manual for cleaning instructions.
3. Replace filters located in hydraulic tank.
4. Check oil for foaming; if oil is foaming, replace with a "non-foaming" oil that meets specifications. (Perform remedy #10).
5. Replace control valve seals.
6. Repair or replace valve section (refer to 6.2).
7. Make certain engine is running properly and rpm meets specifications. The out (gpm) of hydraulic pump is in proportion to how fast it is turning; therefore, a slow engine will create a slow hydraulic system (see 4.5).
8. Adjust main pressure relief valves (see 4.7).
9. Check engine rpm while stalling torque converter; the purpose of this procedure is to determine if the trouble lies in power-train or loader hydraulic system (see 4.5).
10. Check hydraulic tank-to-pump suction line for leaks -- tighten all clamps.
11. Check control linkage to be sure control spool is fully positioned in hold.
12. The check valve, located in front end of control spool, Fig. 21, stuck open or has a weak or or broken spring.
13. Check filter by-pass valve, Fig. 1, to determine if it is sticking (if valve is sticking excessive back pressure may cause seals to leak).
14. Replace seal in hydraulic pump.
15. Be certain main relief valve pressure is correct (see 4.7).
16. Check control linkage to be sure control spool is fully positioned for power-down.
17. Interchange the raise and power-down lines (both sides) and again check power-down function. If down-pressure is now good (control lever in raise position), the anti-cavitation valve is faulty. If down-pressure has not improved (control lever in raise position), the limit travel valves, Fig. 4, are malfunctioning in one or both cylinders.
18. Remove piston rod assemblies from each cylinder for inspection (refer to 7.1.4).
19. Be sure to reposition hoses after repair is complete.

20. Check the entire hydraulic system.

21. Discounting the possibility that quick-drop valve, Fig. 5 (2), has stuck open (very improbable), the limit travel valves, Fig. 4, are malfunctioning in one or both cylinders.

22. One of the main relief valves is faulty (if set too low, speed would still be good) -- see 4.7 to determine which valve is faulty.

IMPORTANT: Just because the hydraulics are slow, do not assume pump trouble; usually, the pump should be considered as the last source of trouble.

23. With moldboard on ground, engine running and control lever in down-pressure position, loosen (do not remove) one line leading to rod end of a dozer cylinder. Normally oil should flow from the loosened connection but if oil squirts out, inspect internal parts of both cylinders.

24. If moldboard drifts down quickly when oil is hot but not when it's cold, quick-drop valve, Fig. 5 (2), has stuck partially open. Remove valve (see 7.1.7) and repair or replace it.

25. If moldboard drifts down quickly when oil is hot or cold, perform remedy 24; if valve is good, trouble lies in cylinder piston packing or limit travel valves (see 7.1 for repair).

26. Check control linkage to be sure control spool is fully positioned for raise.

27. Check pump output to determine if one or both sets of gears are worn (see 4.6).

28. Remove and inspect quick-drop valves, Fig. 5 (1) and (2), in each cylinder. Valve (2), on one or both sides, must be stuck open, and valve (1), on one or both sides must not be seating. If valves or seats are scored, lapping is recommended (refer to 7.1.7).

4.3 TROUBLE-SHOOTING TILT CYLINDER HYDRAULIC SYSTEM

IMPORTANT: if dozer moldboard raise or power-down is lacking power, refer to 4.2 before proceeding.

4.3.1
Assuming that no trouble exists in the moldboard raise and power-down circuits, we may also assume the pump and suction line, and the main relief valves are good; therefore, trouble lies in safety valves or cylinder piston packing.

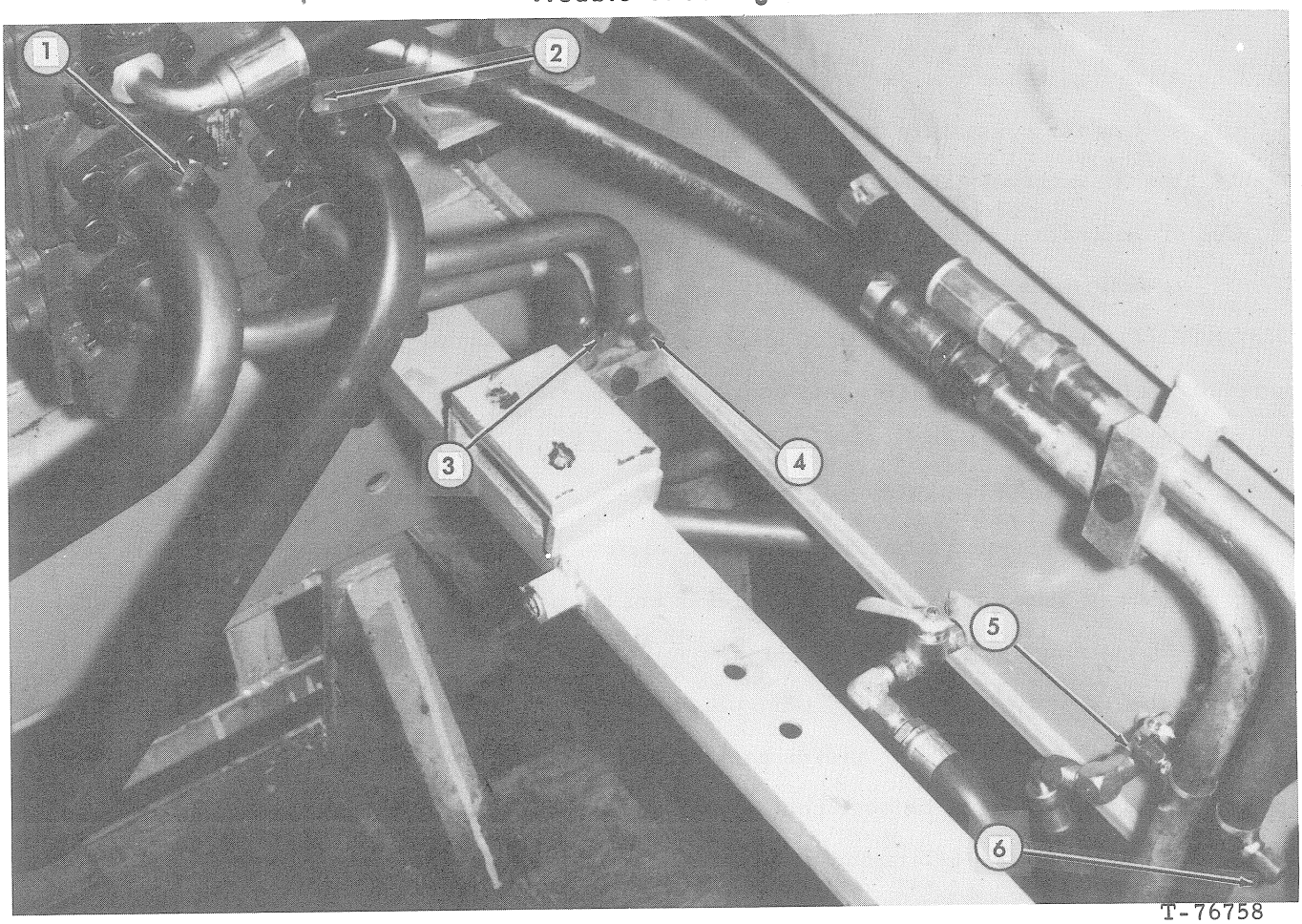

FIG. 14 PRESSURE CHECK POINTS FOR DOZER, TILT, AND RIPPER HYDRAULIC SYSTEMS

1. Dozer raise
2. Dozer lower
3. Ripper lower
4. Ripper raise
5. Dozer tilt right
6. Dozer tilt left

4.3.2
Remove cap, Fig. 14 (5), from tube in piping connected to rear port of tilt cylinder control valve and connect a pressure gauge, of at least 3000 psi (210.9 kg/cm^2) capacity, to the spud. Tilt moldboard right and record pressure while lever is in tilt position. Connect pressure gauge to spud (6) in piping connected to front port of tilt cylinder control valve. Tilt moldboard left and record pressure. Both pressures should approximate main relief valve adjustment of 1550 psi (109.0 kg/cm^2). If pressures differ (only one side is low) safety valve on low pressure side may be faulty or need adjustment. Adjust valve as follows:

4.3.2.1
The specified opening pressure of the safety valves is 2300 psi (161.7 kg/cm^2). Remove acorn nut, Fig. 20 (4), from upper main relief valve, Fig. 16 (3). Loosen jam nut, Fig. 20 (7), and turn adjusting screw (6) in one full turn; this should raise relief valve opening pressure to more than 2300 psi (161.7 kg/cm^2).

Attach pressure gauge to spud in tubing. Remove cap, Fig. 22 (7), from safety valve on low pressure side. Add shimming washers (9) (10) one at a time and check pressure after each addition. If pressure is too high, remove shimming washers. When the specified opening pressure of 2300 psi (161.7 kg/cm^2) has been reached, install and tighten cap (7). Return to main relief valve and turn adjusting screw, Fig. 20 (6), out until the specified relief valve opening pressure of 1550 psi (109.0 kg/cm^2) is attained. Tighten jam nut (7); install copper washer (5) and acorn nut (4). Tighten nut securely. Both the main pressure relief valve and the safety valve are now properly adjusted.

4.3.2.2
If adjustment of the other safety valve is required, proceed as in 4.3.2.1 using the same main pressure relief valve.

4.3.2.3
If adding shimming washers to safety valve does not raise the opening pressure, the valve should be removed, disassembled, and inspected; refer to 6.5.1.4.

4.3.2.4
If pressure at tilt left and tilt right are the same and both are low, tilt cylinder piston packing may be considered at fault. Refer to 7.2.4 for repair procedure.

4.4 TROUBLE-SHOOTING RIPPER HYDRAULIC SYSTEM

IMPORTANT: If dozer moldboard raise or power-down is lacking power, refer to 4.2 before proceeding.

4.4.1
Assuming that no trouble exists in the moldboard raise and power-down circuits, we may also assume the pump and suction line, and the main relief valves are good; therefore, trouble lies in safety valves or cylinder piston packing.

4.4.2
Remove cap, Fig. 14 (4), from tube in piping connected to rear port of ripper cylinder control valve and connect a pressure gauge, of at least 3000 psi (210.9 kg/cm^2) capacity, to the spud. Raise ripper and record pressure while lever is in raise position. Connect pressure gauge to spud (3) in piping connected to front port of ripper cylinder control valve. Lower ripper and record pressure. Both pressures should approximate main relief valve adjustment of 1550 psi (109.0 kg/cm^2). If pressure differs(only one side) is low) safety valve on low pressure side may be faulty or need adjustment. Adjust valve as follows:

4.4.2.1
The specified opening pressure of the safety valves is 2300 psi (161.7 kg/cm^2). Remove acorn nut, Fig. 20 (4), from lower main relief valve. Loosen jam nut,Fig. 20 (7), and turn adjusting screw (6) in one full turn; this should raise relief valve opening pressure to more than 2300 psi (161.7 kg/cm^2). Attach pressure gauge to spud in tubing. Remove cap, Fig. 22 (7), from safety valve on low pressure side. Add shimming washers (9) (10) one at a time and check pressure after each addition. If the pressure is too high,remove shimming washers. When the specified opening pressure of 2300 psi (161.7 kg/cm^2) has been reached, install and tighten cap (7). Return to main relief valve and turn adjusting screw, Fig.20 (7), out until the specified relief valve opening pressure of 1550 psi (109.0 kg/cm^2) is attained. Tighten jam nut (7); install copper washer (s) and acorn nut (4). Tighten nut securely. Both the main pressure relief valve and the safety valve are now properly adjusted.

4.4.2.2
If adjustment of the other safety valve is required, proceed as in 4.4.2.1 using the same main pressure relief valve.

4.4.2.3
If adding shimming washers to the safety valve does not raise the opening pressure, the valve should be removed, disassembled and inspected, refer to 6.5.1.4.

4.4.2.4
If pressure at ripper raise and ripper lower are the same and both are low, ripper cylinder packing may be considered at fault. Refer to 7.3.4 for repair procedures.

4.5 CHECKING ENGINE SPEED AND POWER

IMPORTANT: The following check can be made only on tractors equipped with a power shift transmission. It is advisable, however, to check the high idle speed on tractors equipped with a direct drive transmission; specified high idle for direct drive tractors is 1950 -- 2000 rpm. If necessary, adjust throttle control to bring it within this range.

4.5.1
This check will determine if the engine, under load, will turn the hydraulic pump fast enough so that it can supply the specified flow. Hydraulic pump output and efficiency rise as engine rpm rises, therefore, if the moldboard action is slow or seems to lack power, the engine may be a very real problem area.

4.5.2
Check the torque converter/transmission oil level. Start engine and observe pressure gauges; if gauges do not register within operating range stop engine and determine cause. If pressures are within operating range, run machine long enough to heat oil to operating temperature. Stop engine and immediately check oil level. Oil level must be within operating range on gauge rod.

4.5.3
Check engine rpm at high idle; specified high idle with transmission in neutral is 2135 -- 2185 rpm. If necessary, adjust throttle control to bring it within this range.

4.5.4
With engine at normal operating temperature and both brakes fully applied, place transmission speed shift lever in second forward. Gradually increase engine speed to full throttle; quickly check engine rpm and return speed shift lever to neutral. This rpm reading is known as converter stall. Specified converter stall speed is 1965 -- 1985 rpm. If specified converter stall speed cannot be attained, trouble shoot engine and/or torque converter and transmission before proceeding.

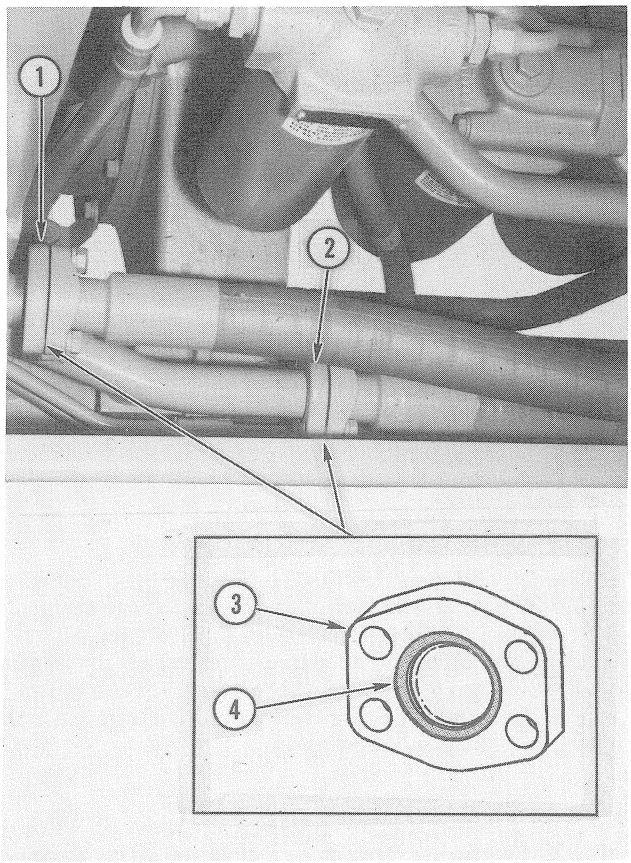

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FIG. 15 BLOCKING OFF DOZER CYLINDERS FOR FLOW OR PRESSURE CHECKING

1. Dozer hydraulic raise line flange
2. Dozer hydraulic lower line flange
3. Cover (Part No. 0184602-1)
4. O-ring (Part No. 0924192-8)

4.6 CHECKING HYDRAULIC PUMP OUTPUT

4.6.1
Disconnect dozer hydraulic lines at location shown in Fig. 15 and install a cover (3) and O-ring (4) on each flange using capscrews and lockwashers that were removed with split flanges. Make sure that oil level is at center of sight gauge on hydraulic tank;add oil if necessary.

4.6.2
Remove housing plug, Fig. 16 (1), from top of hydraulic valve and connect the inlet side of flow meter to this opening. Flow meter must have capacity of at least 100 gpm (378.5 lit/min). Remove filler cap (2) and strainer, Fig. 1 (3), from hydraulic tank and insert return line from meter into this opening. Make certain return line is clean inside and out. Return line should extend into tank far enough to be well submerged.

WARNING

The line leading to tank will tend to "jump out" and must be held firmly while testing. As pressures is applied with meter load valve, this tendency will increase but should be manageable. Be certain all test hoses will withstand a minimum of 3000 psi (210.9 kg/cm^2).

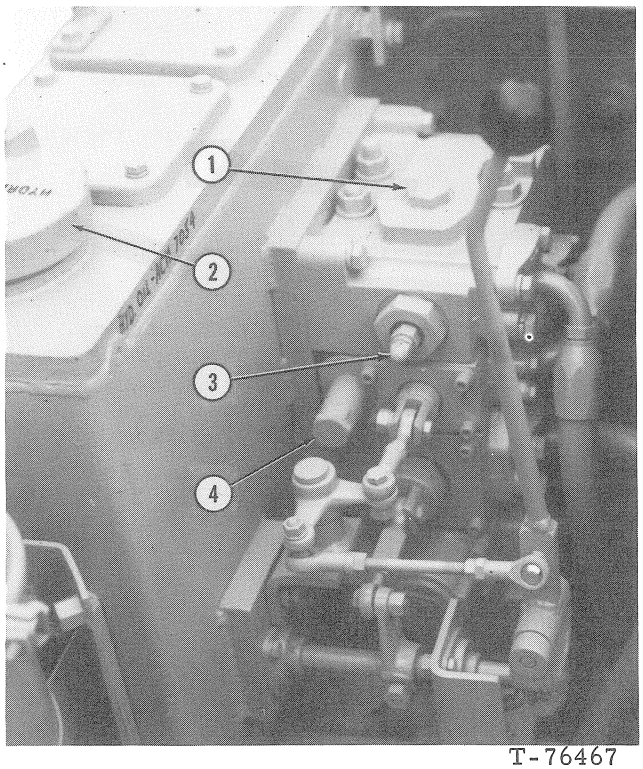

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FIG. 16 HYDRAULIC CONTROL VALVE

1. Housing plug
2. Hydraulic tank filler cap
3. Upper main relief valve
4. Tilt left safety valve

4.6.3
Start engine allow hydraulic oil to reach normal operating temperature; then increase engine speed to full throttle. Place the dozer control in raise position and, using the flow meter load lever, gradually apply load until a pressure of 1400 psi (98.4 kg/cm^2) is reached. At this point read and record flow; flow should read at least:

Tractors with direct drive transmission:
70 gpm (264.9 lit/min)

Tractors with power shift transmission:
75 gpm (283.9 lit/min)

If readings are lower than this, pump gears are probably worn and pump should be removed and repaired; refer to 5.2.

4.7 CHECKING AND ADJUSTING MAIN RELIEF VALVES

IMPORTANT: When performing the following checks and adjustments, never hold the operating control lever in engaged position more than 10 seconds after piston rod reaches end of its travel. In this position the hydraulic system is working against relief valve pressure; oil will heat and may cause binding of the control valve spool.

4.7.1 TRACTORS EQUIPPED WITH DOZER ONLY

NOTE: Refer to Fig. 19 and notice that only one main relief valve (16) and no safety valves are incorporated in the hydraulic system when tractor is equipped with a dozer only.

4.7.1.1
Disconnect dozer hydraulic lines at location shown in Fig. 15, and install a cover (3) and O-ring (4) on each flange using capscrews and lockwashers that were removed with split flanges. Make sure that oil level is at center of sight gauges on hydraulic tank; add oil if necessary.

4.7.1.2
Remove cap from dozer raise line, Fig. 14 (1), and attach a pressure gauge of at least 3000 psi (210.9 kg/cm^2) capacity to the flare fitting. Start engine and allow hydraulic oil to reach normal operating temperature; then with engine running at high idle slowly move the dozer control lever to raise position. Reading on pressure gauge should be 1450 -- 1650 psi (101.9 -- 116.0 kg/cm^2). If reading on gauge is higher or lower than this range adjust upper main relief valve as follows:

4.7.1.2.1
Remove acorn nut Fig. 20 (4); loosen jam nut (7) and, if pressure is too low, screw adjusting screw in until the specified pressure of 1550 psi (109.0 kg/cm^2) is attained; if pressure is too high, screw adjusting screw out until a pressure of 1550 psi (109.0 kg/cm^2) is attained.

4.7.1.2.2
Tighten jam nut and install acorn nut.

4.7.1.3
If specified pressure cannot be reached, a particle of dirt may be holding the relief valve partly open. This condition can usually be corrected by washing the valve as follows:

4.7.1.3.1
Remove acorn nut, loosen jam nut, and screw adjusting screw almost all the way out.

4.7.1.3.2
Start engine and move dozer control lever to raise position several times. Dirt should now be washed out. Screw in adjusting screw until the specified opening pressure of 1550 psi (109.0 kg/cm^2) is attained. Tighten jam nut and install acorn nut.

4.7.1.3.3
If washing does not correct the condition, main relief valve may have failed; refer to 6.3. If inspection of main relief valve shows it to be in good condition, hydraulic pump may have failed. Check pump; refer to 4.6.

4.7.1.4
Disconnect pressure gauge from fitting on dozer line and install cap on fitting.

4.7.1.5
Remove covers installed in 4.7.1.1 and connect hydraulic lines. Check hydraulic oil level and add oil if necessary.

4.7.2 TRACTORS EQUIPPED WITH DOZER AND RIPPER

NOTE: Refer to Fig. 19 and notice that the upper main relief valve (16) protects the dozer hydraulic system and the lower main relief valve (15) protects the ripper system. Two safety valves are incorporated in the ripper control valve.

4.7.2.1
Block off dozer hydraulic lines, refer to 4.7.1.1.

4.7.2.2
Check and adjust upper main relief valve following the procedure described in 4.7.1.2 and 4.7.1.3.

4.7.2.3
Disconnect pressure gauge from fitting on dozer raise line and install cap on fitting.

4.7.2.4
Remove cap Fig. 14 (4), from ripper raise line and attach the pressure gauge to the flare fitting. Run engine at high idle and move ripper control lever to raise position. When piston rod reaches end of its travel, read gauge and record reading. Disconnect pressure gauge from fitting in ripper raise line and connect it to fitting (3) in ripper lower line. Run engine at high idle and move ripper control lever to lower position. When piston rod reaches end of its travel, read gauge and record reading. Both readings should be 1450 -- 1650 psi (101.9 -- 116.0 kg/cm^2).

4.7.2.5
If pressure on only one side is low, the safety valve on that side may have failed or need adjustment. Refer to 4.4.2 for adjustment procedure.

4.7.2.6
If both pressures are less than 1450 psi (109.9 kg/cm^2), adjust lower main relief valve as follows:

4.7.2.6.1
Attach pressure gauge to fitting, Fig. 14 (4) in ripper raise line.

4.7.2.6.2
Remove acorn nut, Fig. 20 (4), and loosen jam nut, (7). Run engine at high idle, move ripper control lever to raise position and, when piston rod reaches end of its travel, read gauge. If pressure is too low, screw adjusting screw in, or if pressure is too high, screw adjusting screw out until a pressure of 1550 psi (109.0 kg/cm^2) is attained. Tighten jam nut and install acorn nut.

4.7.2.6.3
If specified pressure cannot be reached, proceed as in 4.7.1.3 using ripper control lever instead of dozer control lever.

4.7.2.7
Disconnect pressure gauge from fitting on ripper raise line and install cap on fitting.

4.7.3 TRACTORS EQUIPPED WITH DOZER AND TILT CYLINDER

NOTE: Refer to Fig. 19 and notice that the upper main relief valve (16) protects the tilt cylinder and dozer hydraulic systems. The lower main relief valve (15) is provided to protect the dozer system when tilt and dozer are operated simultaneously. Two safety valves are incorporated in the tilt cylinder control valve.

4.7.3.1
Block off dozer hydraulic lines; refer to 4.7.1.1.

4.7.3.2
Remove cap, Fig. 14 (5), from tilt right hydraulic line and install a pressure gauge of at least 3000 psi (210.9 kg/cm^2) capacity. Start engine and allow hydraulic oil to reach normal operating temperature, then tilt moldboard to the right. When piston rod reaches end of its travel, read gauge and record reading. Disconnect pressure gauge from fitting in tilt right line and connect it to the fitting (4) in tilt left line. Run engine at high idle and tilt moldboard to the left. When piston rod reaches end of its travel, read gauge and record reading. Both readings should be 1450 -- 1650 psi(109.9 -- 116.0kg/cm^2).

4.7.3.3
If pressure on only one side is low, the safety valve on that side may have failed or need adjustment. Refer to 4.4.2 for adjustment procedure.

4.7.3.4
If both pressures are less than 1450 psi (101.9 kg/cm^2), adjust upper main relief valve as follows:

4.7.3.4.1
Attach pressure gauge to fitting, Fig. 14 (5), in tilt right hydraulic line.

4.7.3.4.2
Remove acorn nut, Fig. 20 (4), and loosen jam nut (7). Run engine at high idle and tilt moldboard to the right. When piston rod reaches end of its travel, read gauge. If pressure is too low, screw adjusting screw in, or if pressure is too high screw adjusting screw out until a pressure of 1550 psi (109.0 kg/cm^2) is attained. Tighten jam nut and install acorn nut.

4.7.3.4.3
If specified pressure cannot be reached, proceed as in 4.7.1.3 using tilt control lever instead of dozer control lever.

4.7.3.5
Disconnect pressure gauge from fitting on tilt right line and install cap on fitting.

4.7.3.6
After upper main relief valve has been adjusted, adjust lower main relief valve as follows:

4.7.3.6.1
Connect pressure gauge to fitting, Fig. 14 (1) in dozer raise line.

4.7.3.6.2
Remove acorn nut from lower main relief valve and loosen jam nut. With engine running at high idle move dozer control lever to raise position and screw adjusting screw out until pressure is well below 1550 psi (109.0 kg/cm^2) then gradually screw adjusting screw in until pressure gauge reads 1550 psi (109.0 kg/cm^2). Tighten jam nut and install acorn nut.

IMPORTANT: As soon as gauge registers 1550 psi (109.0 kg/cm^2) stop turning adjusting screw immediately. Turning screw in farther will raise the opening pressure above 1550 psi (109.0 kg/cm^2) but it will not register on the gauge because the upper main relief valve (which is set at this pressure) will open first.

4.7.3.7
If specified pressure connot be reached, proceed as in 4.7.1.3.

4.7.3.8
Disconnect pressure gauge from fitting in dozer raise line and install cap.

4.7.3.9
Remove covers installed in. 4.7.1.1 and connect hydraulic lines. Check hydraulic oil level and add oil if necessary.

4.7.4 TRACTORS EQUIPPED WITH DOZER, RIPPER, AND TILT CYLINDER

NOTE:Refer to Fig. 19 and notice that the upper main relief valve (16) protects the tilt and the lower main relief valve (15) protects the ripper hydraulic systems. Both relief valves protect the dozer system. Two safety valves are incorporated in both the tilt and ripper control valves.

4.7.4.1
Check and adjust upper main relief valve following procedure described in 4.7.3.2 thru 4.7.3.5.

4.7.4.2
Check and adjust lower main relief valve following procedure described in 4.7.2.4 thru 4.7.2.7.

TOPIC 5 HYDRAULIC PUMP

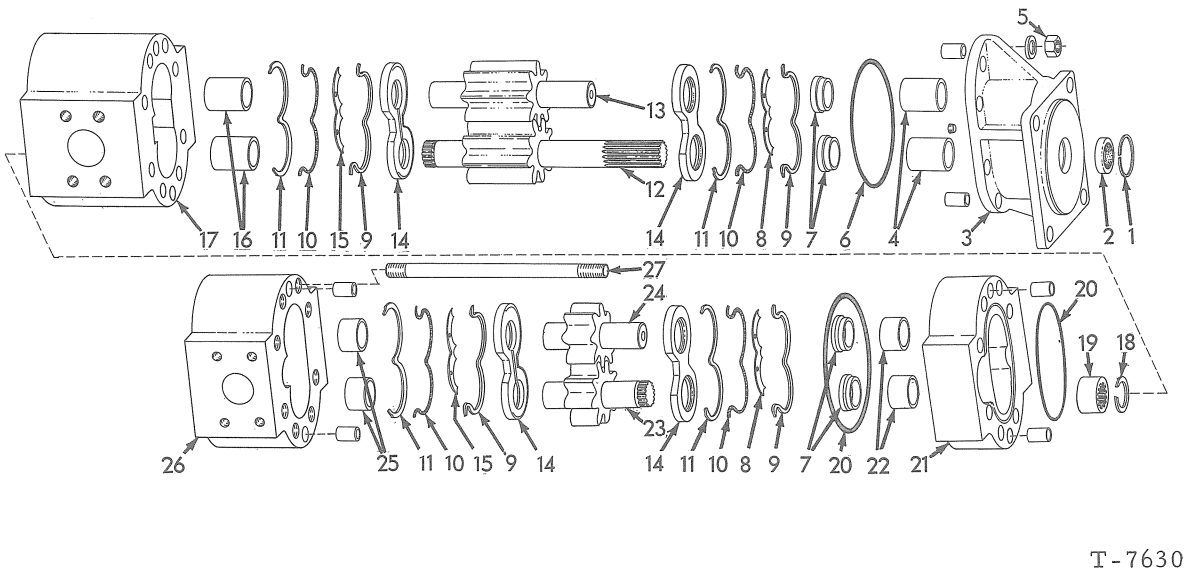

FIG. 17 HYDRAULIC PUMP

1. Snap ring
2. Oil seal
3. Flange
4. Bushings
5. Nut
6. O-ring
7. Steel rings
8. Isolation plate
9. Back-up ring (teflon)
10. Sealing ring (rubber)
11. Seal retainer (nylon)
12. Gear shaft (large drive)
13. Gear shaft (large driven)
14. Wear plate
15. Isolation plate
16. Bushings
17. Pump body (large)
18. Snap ring
19. Coupling
20. O-ring
21. Plate
22. Bushings
23. Gear and shaft (small drive)
24. Gear and shaft (small driven)
25. Bushings
26. Pump body (small)
27. Studs

5.1 DESCRIPTION

5.1.1
On direct drive tractors the pump is mounted on the left rear of the clutch housing. On power shift tractors the pump is mounted on the right rear of the torque converter. The pump contains two sets of gears and the flow of oil is illustrated in the circuit oil flow diagrams, Fig. 6 thru 13. Rotation of the pump is counterclockwise.

5.1.2
Although the hydraulic pumps are mounted differently, their internal components are the same and the following overhaul procedures apply to both.

5.2 REMOVAL

5.2.1
Position moldboard and ripper on ground; shut off engine and move control levers to each position several times to relieve trapped pressures.

5.2.2
Remove filler cap, Fig. 1(4), from hydraulic tank. Remove drain plug (8) and allow oil to drain.

5.2.3
Remove floor plates. Clean exterior of hydraulic pump and surrounding area. Disconnect inlet tube and outlet hoses from pump.

5.2.4
Remove stud nuts and lockwashers attaching pump to housing; slide pump to the rear and remove pump. Cover all openings to prevent entrance of dirt.

5.3 DISASSEMBLY

5.3.1.
Clean exterior of pump thoroughly and mark the pump sections so that they can be reassembled as they originally were. Remove any sharp edge or burrs from drive shaft splines.

5.3.2
Place pump on a smooth clean surface. Remove nuts, Fig. 17 (5), and plain washers from flange end of pump.

CAUTION

Do not pry sections apart as machined sealing surfaces may get damaged.

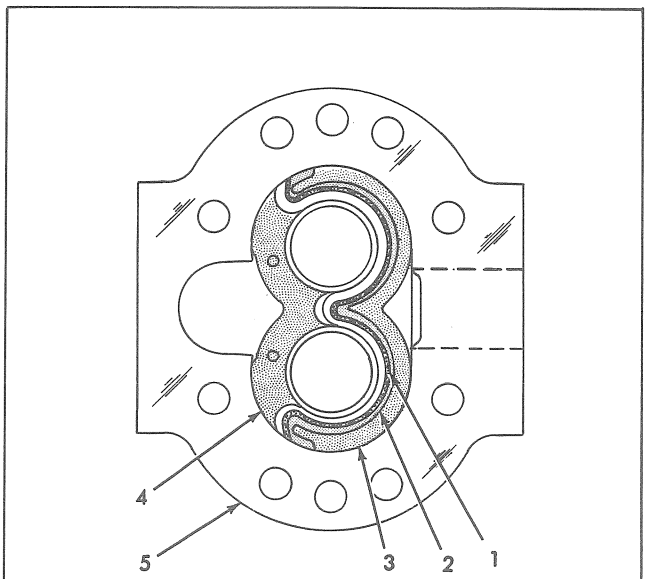

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FIG. 18 PRESSURE SEALING PARTS INSTALLED

1. Rubber seal ring
2. Teflon back-up ring
3. Nylon seal retainer
4. Isolation plate
5. Pump body (small)

5.3.3
Carefully remove flange (3) by tapping with a soft hammer. Remove snap ring (1), oil seal (2) and O-ring (6) from flange.

5.3.4
Remove isolation plate (8), seal retainer (11), sealing ring (10), back-up ring (9), and steel rings (7).

5.3.5
Lift up on drive shaft (12) to dislodge front wear plate (14). Lift wear plate off of shaft and remove drive shaft and gear (12) and driven shaft and gear (13).

5.3.6
Lift rear wear plate (14), from the pump body. Use extreme care in removing this plate as it will bind in the bores of the body if not held straight during removal. Do not pry or force it out. Remove remaining seal parts from bottom of the bore.

5.3.7
Tap pump body (17) with a soft hammer to loosen it, then remove pump body from studs. Remove spacer (21) and O-rings (20).

5.3.8
Remove seal parts, wear plates, and shafts and gears in the same manner as described in 5.3.4 thru 5.3.6.

5.4 INSPECTION

IMPORTANT: Discard all rubber and Teflon seals and O-rings and the drive shaft oil seal. Use new parts when the pump is assembled.

5.4.1
Wash pump parts thoroughly and visually inspect all parts. There will be a gear track on inside of each pump body. Measure the depth of this track. If it is more than .015"(.381mm) the pump body must be replaced.

5.4.2
Inspect the wear plates. If there are deep score marks on the bronze side, replace the wear plates. Make certain the isolation plates are perfectly flat and not cracked.

5.4.3
Inspect shafts and gears. If excessive wear is visible on the journals, sides, or face of the gears, or if gear teeth are cracked or broken replace the shafts and gears as a set.

5.5 ASSEMBLY

5.5.1
Wash pump parts thoroughly, air dry, and lubricate freely with clean oil.

5.5.2.
Position pump body, Fig. 17 (26), on a clean work bench, machined face up and outlet port to your right as shown in Fig. 18.

5.5.3
Examine the isolation plates, Fig. 17(8, 15); note that two of them have rounded edges. Install one of these plates, rounded edge down into pump body bore as shown in Fig. 18 (4). Install rubber seal ring (1), Teflon back-up ring (2) and nylon seal retainer (3).

5.5.4
Install wear plate, Fig. 17 (14), over seal, bronze side up and relief pocket to your right (outlet side of pump body). If plate binds on way down, do not force it into place. Work back and forth gently until it slides into position.

5.5.5
Install splined drive shaft and gear, Fig. 17 (23), in lower pump body bore when pump body is viewed as shown in Fig. 18. Install driven shaft and gear, Fig. 17 (24), in opposite bore.

5.5.6
Install the other wear plate over the gears with bronze side towards gears and relief pocket to your right (outlet side of pump body).

5.5.7
Slide a steel ring, smaller O.D. down, over each shaft and seat them in the counter bores in the wear plate.

5.5.8
Position the other isolation plate (plate with square edges) on the wear plate to your right (outlet side of pump body) as shown in Fig. 18 (4). Install rubber seal ring (1), Teflon back-up ring (2) and nylon seal retainer (3).

5.5.9
Place a new O-ring, Fig. 17 (20), in groove in plate (21) and install plate in position on pump body (26) making sure marks put on at disassembly are aligned. Press or tap plate down until seated.

5.5.10
Make certain snap ring (18) is in coupling (19). Install coupling (19) and O-ring (20). Install pump body (17) making sure marks put on at disassembly are aligned. Tap pump body down until seated.

5.5.11
Install isolation plates, rubber seal rings, Teflon back-up rings, nylon seal retainers, wear plates, and shafts and gears in exactly the same manner and in the same relative positions as those in the smaller pump body. Refer to 5.5.2 thru 5.5.8.

5.5.12
Install a new oil seal (2) in flange (3) with sealing lip of seal facing toward pump. Install snap ring (1). Protect seal by covering splines on drive shaft with shim stock or tape. Install O-ring (6) in flange (3). Lubricate oil seal and carefully install flange (3) on pump body(17).

5.5.13
Install nuts (5) and plain washers. Tighten two opposite nuts to a torque of 115 lbs. ft. (15.89 kg-m). Using a wrench, check to see if the drive shaft will turn. Shaft will be tight but should turn freely with a maximum of 20 lbs. ft. (2.76 kg-m) torque. If shaft will not turn as described, disassemble pump and examine for foreign material, interference, and proper assembly.

5.5.14
After trouble has been corrected and shaft turns properly, tighten the remaining nuts to a torque of 115 lbs. ft. (15.89 kg-m).

5.6 INSTALLATION

5.6.1
Align pump shaft splines with internal splines in pump drive and install pump on housing. Install nuts and lockwashers; snug up, but do not tighten them.

5.6.2
Using new O-rings, connect the inlet tube and outlet hoses to the pump. Tighten flange retaining capscrews securely. Tighten pump attaching nuts to a torque of 90 lbs. ft.

TOPIC 6 HYDRAULIC CONTROL VALVES

6.1 DESCRIPTION

6.1.1
The number and type of valve sections in the hydraulic control valve depends upon what hydraulic equipment is mounted on the tractor; refer to Fig. 19.

6.1.2
The upper main relief valve, Fig. 19 (1), has two holes on the tank side to return oil to the hydraulic tank and a main relief valve, Fig. 20, to regulate pressure in the hydraulic system.

6.1.3
The lower valves, Fig. 19 (2 and 3), do not have holes to return oil to tank, and valve (2) has a plug, Fig. 20 (19), instead of a relief valve.

6.1.4
If tractor is equipped with a hydraulic tilt cylinder, valve Fig. 19 (14) is used; otherwise a spacer (5) is used.

6.1.5
A dozer control valve (4) is used in all hydraulic control valves.

6.1.6
If tractor is equipped with ripper, valve (13) is used; otherwise valve (3) is moved up.

6.2 REMOVAL AND INSTALLATION

NOTE: If removal of only the main relief valve assembly, Fig. 20(3), is required, it may be removed by unscrewing it from its housing as an assembly without disturbing any other hydraulic control valve components.

6.2.1
Disconnect control linkage from control valves. Disconnect all hydraulic tubes and lines from hydraulic control valve. Cover all openings to prevent entrance of dirt.

6.2.2
Remove nuts, Fig. 19 (9), and washers (10) from top of valve (1). Remove two capscrews securing valve (1) to hydraulic tank. Remove valve (1) and spacer (5) or valve (14).

6.2.3
Remove nuts (9) and washer (10) from bottom of valve (2 or 3). Remove dozer control valve (4) and, if so equipped, remove ripper control valve, (13).

6.2.4
Remove two capscrews securing lower valve (2 or 3) to hydraulic tank and remove valve.

6.2.5
Install hydraulic control valves by reversing removal procedure. Refer to Fig. 19 for length and location of studs. Use new sealing rings and O-rings. Tighten all stud nuts (9) to a torque of 80 -- 85 lbs. ft. (11.0 -- 11.7 kg-m).

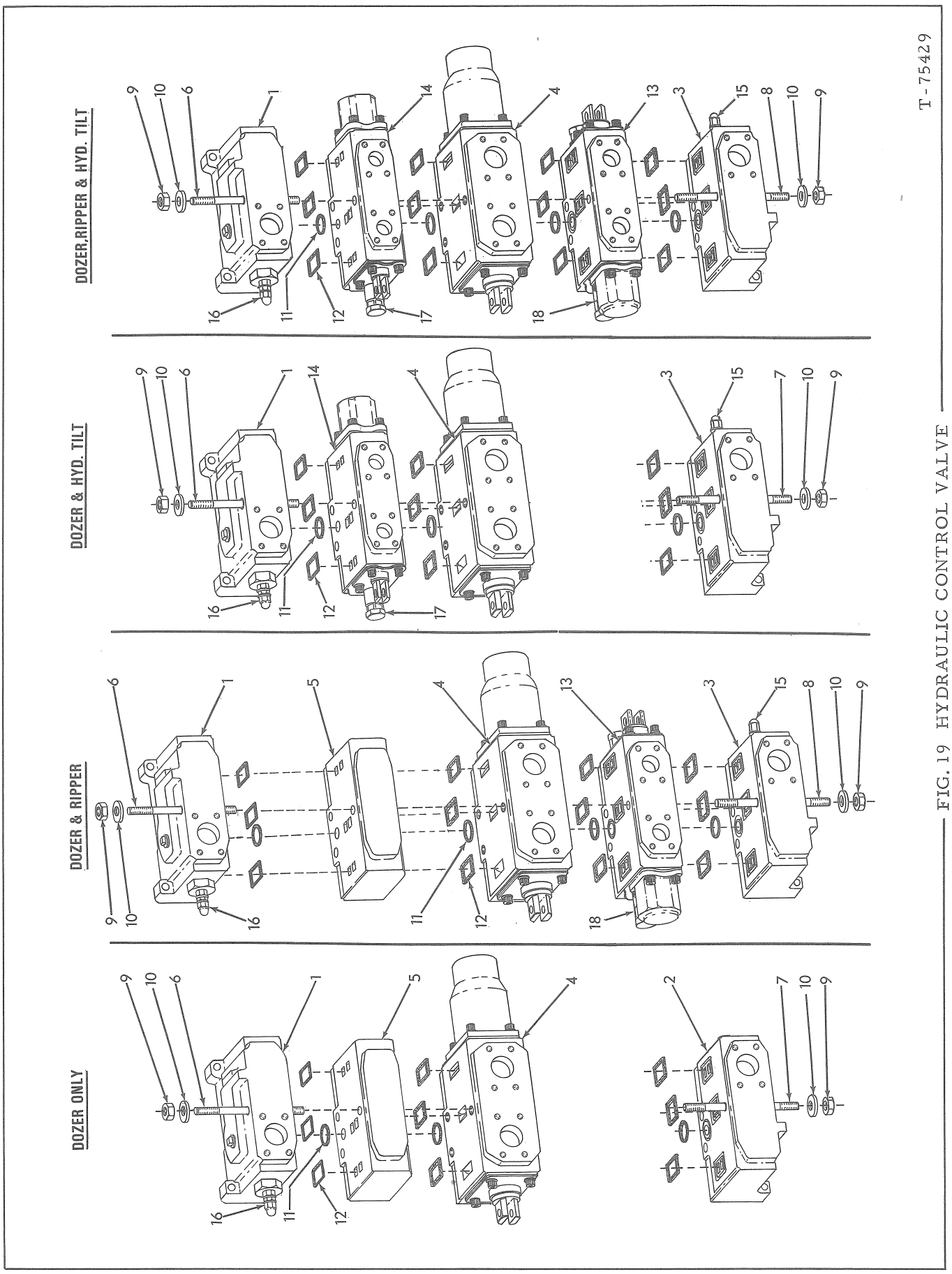

FIG. 19 HYDRAULIC CONTROL VALVE

LEGEND FOR FIG. 19

1. Upper main relief valve housing
2. Valve assembly
3. Lower main relief valve housing
4. Dozer control valve
5. Spacer
6. Upper stud 7-1/2" (190.5 mm)
7. Lower stud
8. Lower stud 7-7/8" (200.1 mm)
9. Nut
10. Washer
11. Sealing ring
12. Sealing ring
13. Ripper control valve
14. Tilt cylinder control valve
15. Lower main relief valve
16. Upper main relief valve
17. Tilt cylinder safety valve
18. Ripper safety valve

6.3 MAIN RELIEF VALVES

NOTE: On tractors equipped with a dozer only, a plug, Fig. 20 (19) is used in place of a relief valve in the lower section.

6.3.1 DISASSEMBLY

6.3.1.1
Refer to Fig. 20 and unscrew cartridge assembly (3) from housing (1).

6.3.1.2
Secure cartridge assembly in a vise, and remove acorn nut, Fig. 20 (4), washer, jam nut, and washer from the adjusting screw. Loosen the screw, and then remove the spring retainer, screw, spring and poppet, as an assembly. The seat (13), with O-ring, may be removed with a small hook. The balance of the assembly is serviced only as a unit; therefore, it should not be taken apart.

6.3.2 ASSEMBLY

6.3.2.1
Secure the cartridge, Fig. 20 (16), in a vise (at the nut). Install a new O-ring (14) on the floating seat; lubricate and push seal into cartridge.

6.3.2.2
Screw the adjusting screw a short way into the spring retainer (8); position the spring, and poppet (12) into the retainer, and a new copper back-up ring (9) and O-ring (10) on the retainer. Screw retainer into cartridge. Tighten retainer securely.

IMPORTANT: The adjusting screw should not be tightened until after the pressure can be measured so that excessive pressure is not present when the unit is first started.

6.3.2.3
Position a new back-up ring, Fig. 20 (17), and O-rings (15 and 18) on cartridge as shown. Install valve assembly into housing section, and tighten securely. After pressure is adjusted install washer (5) jam nut (7) washer (5) and acorn nut (4).

6.4 DOZER CONTROL VALVE

6.4.1 DISASSEMBLY

6.4.1.1
Clean exterior of valve housing thoroughly. Remove anti-cavitation valve, Fig. 21 (27), by unscrewing cap (22) and then unscrewing seat assembly (24) from housing.

6.4.1.2
Remove plates (4) and end cap (21). Pull spool out of housing and clamp it in a soft-jawed vise. Do not mar finish and do not hold spool by inserting a tool in holes. Remove back-up ring (3) and O-ring (2) from front of valve housing.

6.4.1.3
Remove clevis (11). Clevis may be staked. If not, and clevis is hard to remove, apply about 300°F. (149°C) heat to breakdown thread sealant. Remove O-ring (9) and back-up ring from clevis. Remove spring (7) and check valve. Remove bolt (20) and slide balance of parts from spool. Apply heat, about 300°F (149°C), to breakdown thread sealant, and remove detent (12). Remove O-ring (9) and back-up ring from detent. Remove spacer (8), spring, and check valve. Remove back-up ring and O-ring from rear of valve housing.

6.4.2 INSPECTION

6.4.2.1
Inspect springs for cracks and worn spots.

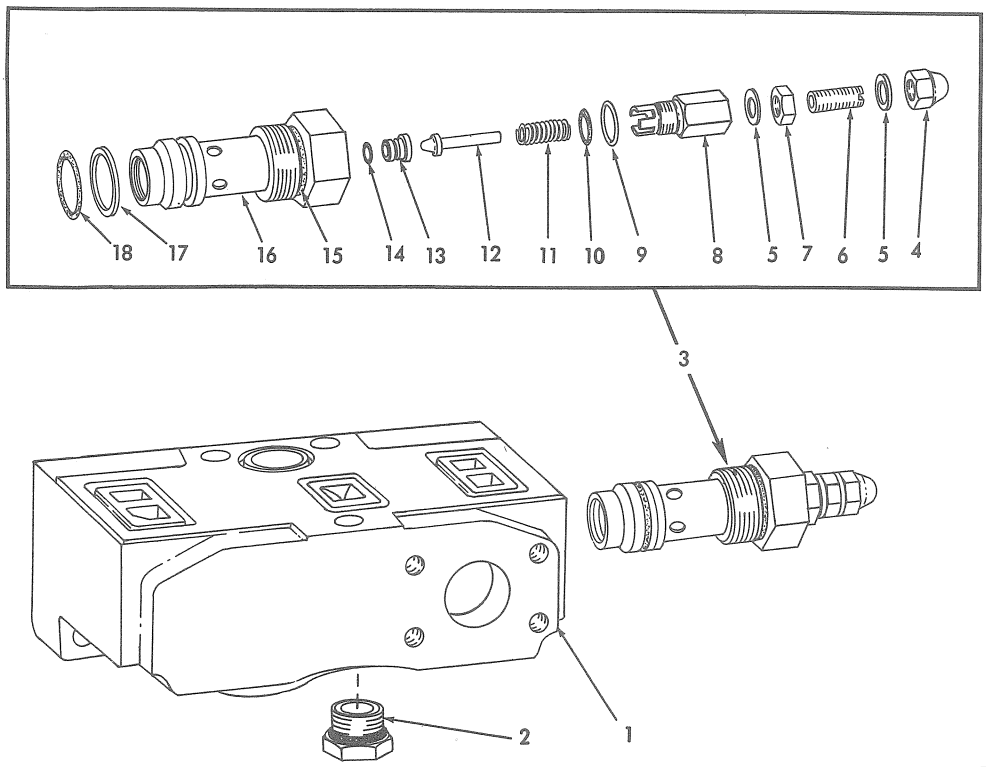

FIG. 20 MAIN RELIEF VALVE

1. Valve housing
2. Plug (includes O-ring)
3. Cartridge assembly
4. Acorn nut
5. Copper washers
6. Adjusting screw
7. Jam nut
8. Spring retainer
9. Back-up ring
10. O-ring
11. Spring
12. Poppet valve
13. Floating valve seat
14. O-ring
15. O-ring
16. Cartridge
17. Back-up ring
18. O-ring
19. Plug(used in valve Fig. 19(2)in place of relief valve)

6.4.2.2
Inspect plungers, spool, ball seat, and check valves for grooving and scoring.

6.4.2.3
Replace all seals, seal rings and back-up rings.

6.4.3 ASSEMBLY

6.4.3.1
Clamp spool, Fig. 21 (5), in a soft jawed vise. Do not mar finish and do not hold spool by inserting a tool in holes. Install back-up ring and O-ring on detent (12). Refer to Fig. 21, and insert check valve (6), spring (7), and spacer (8) into spool, Coat threads on detent with Loctite B7-2 (yellow), or equivalent, and screw into spool; tighten securely. Install back up ring and O-ring on clevis (11). Install check valve and spring in spool. Screw clevis into spool and tighten securely.

NOTE: If clevis was previously staked in place, restake after tightening. If clevis was not staked, apply a light coat of Loctite B7-2 (yellow), or equivalent, to threads before installing.

6.4.3.2
Install an O-ring, Fig. 21 (2), and then a Teflon back-up ring (3) into each end of housing (1). Install one retaining plate (4) over spool (5). Lubricate the spool assembly and insert it into the housing.

6.4.3.3
Install two retaining plates (4) over clevis end of spool. Install capscrews and lockwashers and tighten securely. Position ball retainer(13), detent sleeve (15), spring (16), washer (17), spring (18), and guide (19) over spool. Apply a light coat of Loctite B7-2 (yellow), or equivalent, to threads of bolt (20). Install bolt and tighten securely. Wedge ball retainer (13) and sleeve (15) apart and install detent balls (14). Install end cap (21) and tighten attaching capscrews securely.

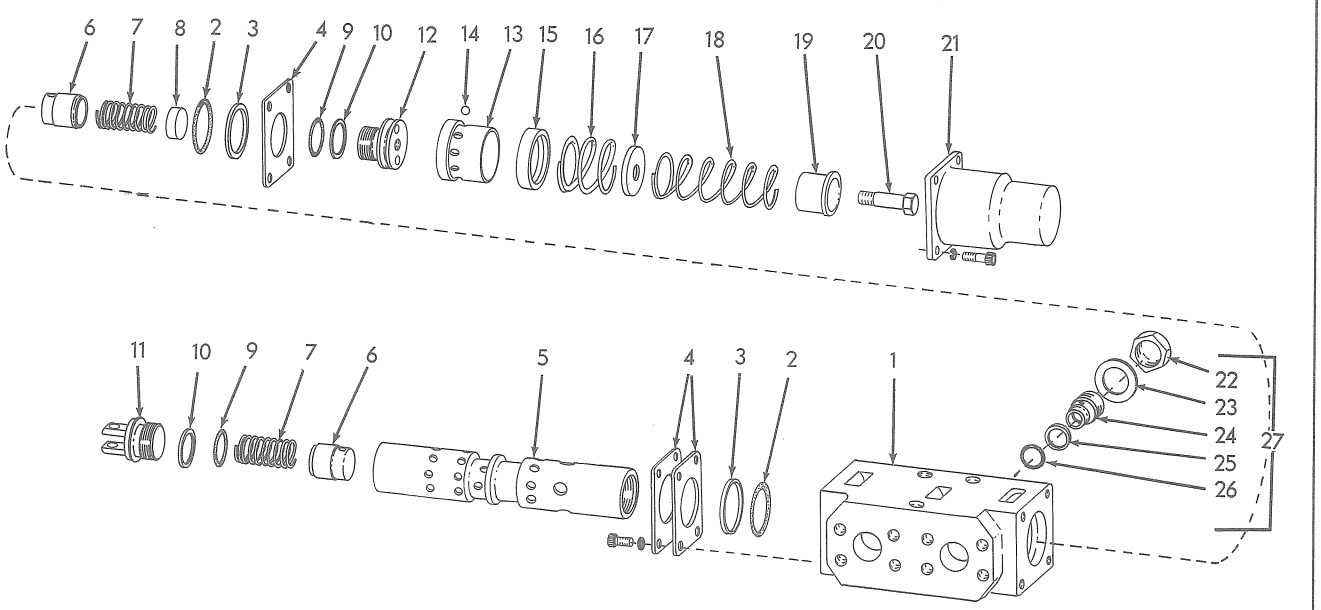

FIG. 21 DOZER CONTROL VALVE

1. Housing
2. O-ring
3. Teflon back-up ring
4. Retaining plates
5. Spool
6. Check valve
7. Spring
8. Spacer
9. O-ring
10. Back-up ring
11. Clevis
12. Detent
13. Detent ball retainer
14. Detent ball
15. Detent sleeve
16. Detent spring
17. Washer
18. Spool return spring
19. Return spring guide
20. Bolt
21. End cap
22. Cap
23. Cap gasket
24. Seat assembly
25. Back-up ring
26. O-ring
27. Anti-cavitation valve

6.4.3.4
Install back-up ring (25) and O-ring (26) on seat assembly (24). Screw seat assembly into housing (1). Install gasket (23) and cap (22). Tighten cap to 50 lbs. ft. (6.91 kg-m).

6.5 TILT CYLINDER AND/OR RIPPER CONTROL VALVES

NOTE: Except for a difference in the size of some of the parts, the tilt cylinder and ripper control valves are the same; therefore, the following procedures apply to both.

6.5.1 DISASSEMBLY

6.5.1.1
Remove retaining plates, Fig. 22 (4) and cap (5). Pull spool from housing, and clamp it in a soft-jawed vise (do not mar finish, and do not hold spool by inserting a tool in holes).

6.5.1.2
Remove clevis (30 or 31)(clevis may be staked; if not and clevis is difficult to remove, apply about 300°F.(149°C)heat to break-down thread sealant). Remove spring and check valve. Unscrew bolt, Fig. 22 (22) (heat may be applied here also for easier removal). Remove spring guides, springs, and check valve.

6.5.1.3
Remove and discard all seal rings and back-up rings.

6.5.1.4
Remove the safety valves; disassemble and assemble them as follows:

6.5.1.4.1
Remove cap, Fig. 22 (7), adjustment shimming washers, spring, and plunger. Press cap (21) off of cartridge (13), and remove spring and ball seat. Use a small hook to remove O-ring and back-up ring from inside of cartridge.

6.5.1.4.2
Inspect parts per paragraph 6.4.2.

6.5.1.4.3
Install back-up ring, Fig. 22(15)then O-ring(16) in groove inside of cartridge. Install ball seat(19)and spring(20)into cartridge;refer to illustration for correct installation. Install cap(21),cap may appear to be too loose but tolerances after installation will not permit it to come free.

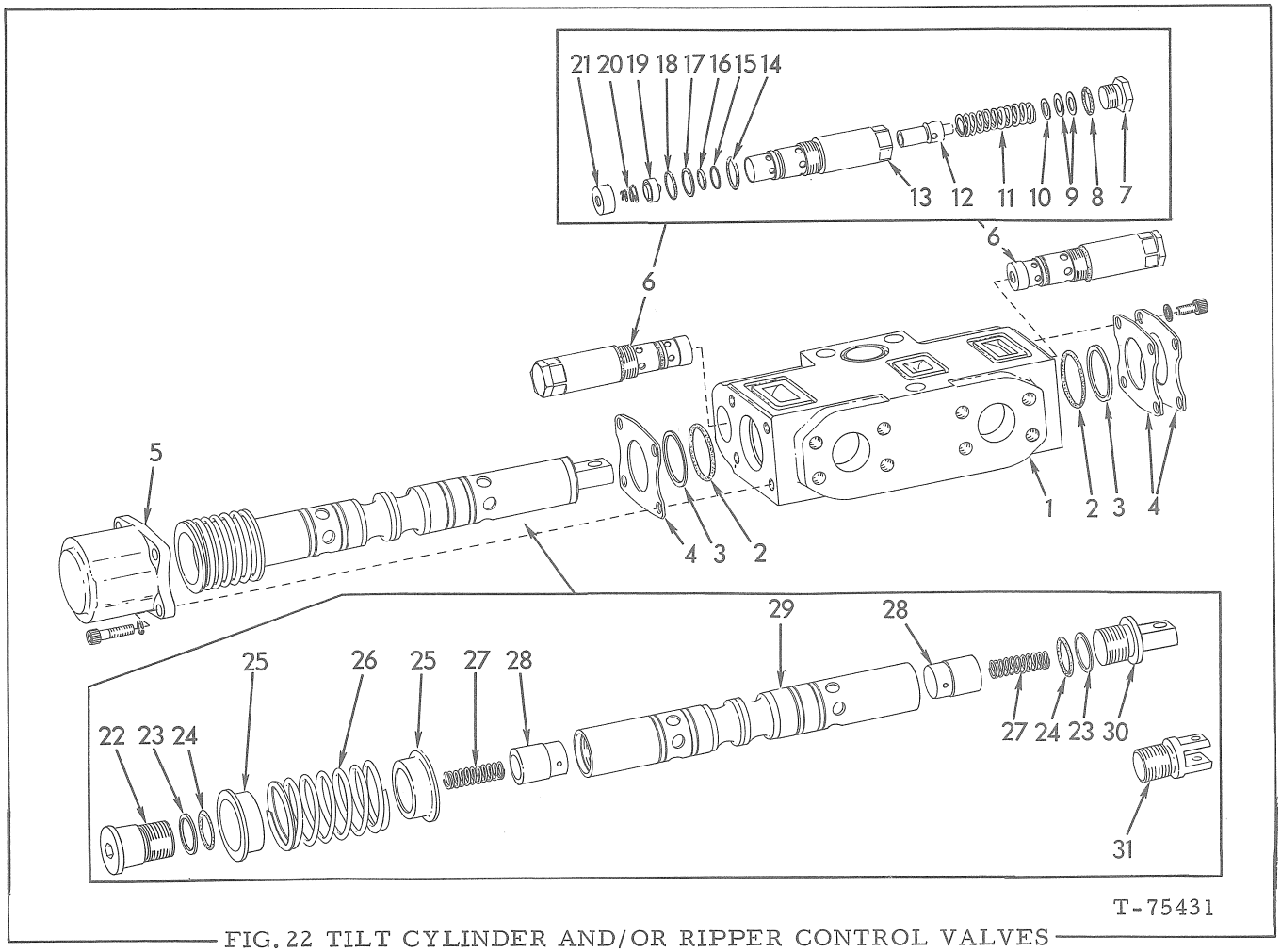

FIG. 22 TILT CYLINDER AND/OR RIPPER CONTROL VALVES

1. Housing
2. Seal ring
3. Back-up ring
4. Retainer plates
5. Cap
6. Safety valve
7. Cap
8. O-ring
9. Shimming washers
10. Shimming washer
11. Spring
12. Plunger
13. Cartridge
14. O-ring
15. Back-up ring
16. O-ring
17. Back-up ring
18. O-ring
19. Ball seat
20. Spring
21. Cap
22. Spool return bolt
23. Back-up ring
24. O-ring
25. Spring guides
26. Spring
27. Spring
28. Check valves
29. Spool
30. Clevis (ripper)
31. Clevis (tilt)

6.5.1.4.4
Install large O-ring (14) behind threads on O.D. of cartridge and install back-up ring (17) and O-ring(18)in this order in smaller diameter groove.

6.5.1.4.5
Install plunger, Fig. 22(12)spring(11)and original amount of shimming washers(9)(10)into cartridge. Position O-ring(8)on cap(7) and screw the cap into cartridge; tighten it securely.Install the safety valve assembly into either position in housing section and tighten it securely.

6.5.2 ASSEMBLY

6.5.2.1
Assemble and install safety valves, Fig. 22(6), in housing(refer to 6.5.1.4).

6.5.2.2
Clamp spool (29) in a soft-jawed vise (do not mar finish, and do not hold spool by inserting a tool in holes). Install front check valve (28) and spring into spool. Position a back-up ring and O-ring on clevis (30 or 31).

NOTE: If clevis was previously staked in place, restake it after installation. If clevis was not staked, apply a light coat of Loctite B7-2 (yellow), or equivalent, to the threads before installing. Tighten clevis securely.

6.5.2.3
Install rear check valve and spring into spool, Install a back-up ring, then an O-ring onto spool return bolt, Fig. 22 (22). Lightly coat bolt threads with Loctite B7 -- 2 (yellow) or equivalent. Position spring guides and spring (26) onto bolt and screw bolt into spool. Tighten bolt securely.

6.5.2.4
Install seal rings (2) then back-up rings (3) into housing. Lubricate rings and bore of housing freely. Install two plates (4) on front of housing but do not tighten. Position the other plate (4) over spool and install assembly in housing from rear. Install cap (5) and tighten securely; tighten front plates (4).

TOPIC 7 HYDRAULIC CYLINDERS

7.1 DOZER CYLINDERS

7.1.1
The dozer hydraulic cylinders are double acting and equipped with limit travel valves and adjustable quick-drop valves. The piston packing is a Teflon seal ring with rubber inner ring; the piston also is equipped with a wear ring. The piston rod packing is a multi-lip type, spring loaded and shim adjusted.

7.1.2 REMOVAL AND INSTALLATION

7.1.2.1
Level the dozer moldboard on ground; shut off engine, and move controls to all positions several times (relieves trapped pressures). Disconnect piston rod (s) from moldboard; start engine and move control lever to raise position to force rod into cylinder. Shut off engine, and again relieve trapped pressures.

NOTE: If the purpose of cylinder removal is cylinder disassembly, loosen the cylinder head before removing cylinder from tractor. Before removing cylinder, it is advisable to tie piston rod in the retracted position.

7.1.2.2
Disconnect hydraulic lines, and plug both ends. Attach a hoist to cylinder, Drive out roll pins, Fig. 23 (1), and remove shafts (2). The end of each shaft is provided with a 1/2"NC tapped hole so that a puller may be used to remove the shaft. Remove cylinder and trunnion (3) as an assembly.

7.1.2.3
Installation of cylinder may be accomplished by reversing the removel procedure. Be sure to check hydraulic oil level and add oil as necessary.

7.1.3 PISTON ROD PACKING ADJUSTMENT

7.1.3.1
The rod packing set, contained in the cylinder head, Fig. 24, consists of a set of multi-lip packing rings, a wave spring, and a back-up washer. The packing is properly adjusted when a light film of oil is evident on the piston rod (a dry rod causes rapid wear of packing). Shims (5) between the end plate (4) and cylinder head provide the means of adjustment.

7.1.3.2
Remove capscrews securing end plate; slide the plate down the rod, and remove one shim. Reassemble end plate to head. If leakage persists remove one more shim; after all shims are removed, the packing set must be replaced. When a new packing set is installed four shims must also be installed.

IMPORTANT: The cylinder must be disassembled to replace the rod packing (do not cut new packing to make installation easier).

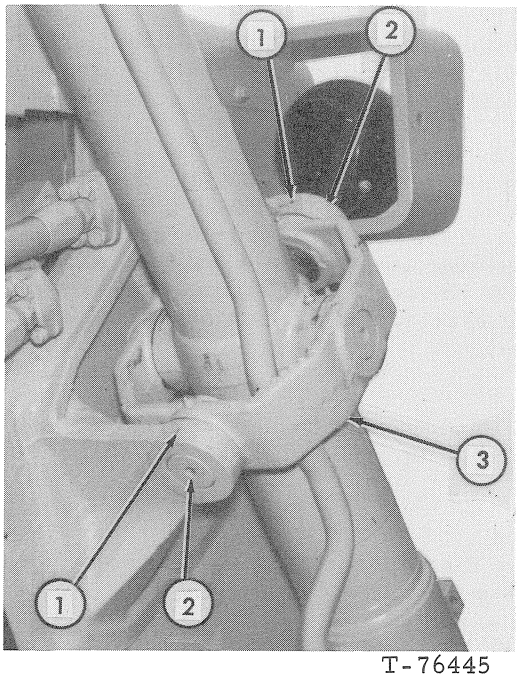

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FIG. 23 DOZER CYLINDER MOUNTING

1. Roll pin 2. Shaft 3. Trunnion

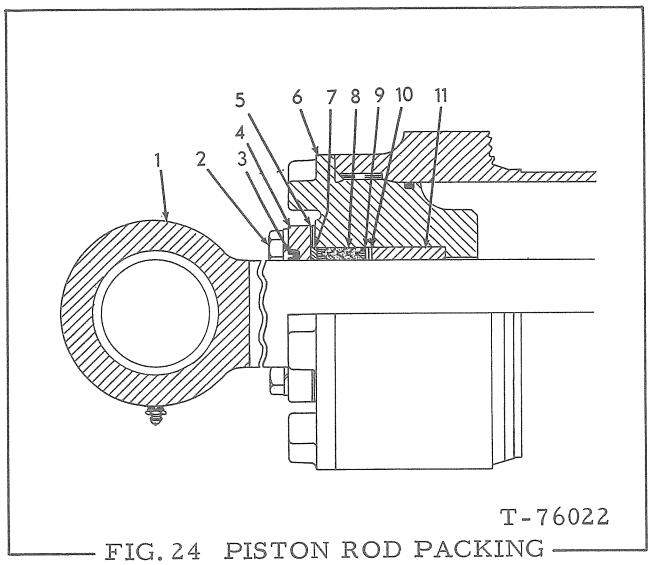

FIG. 24 PISTON ROD PACKING

1. Piston rod
2. Capscrew
3. Wiper seal
4. End plate
5. Shims
6. Cylinder head
7. Washer (aluminum)
8. Packing
9. Washer (steel)
10. Wave spring
11. Bushing

7.1.4 WIPER SEAL, PISTON ROD PACKING AND PISTON PACKING REMOVAL

NOTE: The piston rod assembly must be removed from the cylinder, however, it is not necessary to remove the cylinder from the tractor unless cylinder removal is desired; see 7.1.2.

7.1.4.1
Level moldboard on ground; shut off engine and relieve trapped pressures by moving control lever to each position several times.

7.1.4.2
Loosen end plate, Fig. 25 (34), then loosen (do not remove) cylinder head (29). Disconnect piston rod from moldboard (be sure to block the cylinder, or secure it with the shipping bracket). Unscrew cylinder head and remove the rod assembly(a large amount of oil will be present).

7.1.4.3
Clamp the eye end of rod securely in a vise, and remove the rod nut; slide the parts from rod.

7.1.4.4
Remove the wiper seal, Fig. 25 (35), from end plate and clean the bore.

7.1.4.5
Remove rod packing (31), washer, wave spring, and bushing from cylinder head. Clean the bore in head and inspect the bushing and packing for wear.

7.1.4.6
Remove and discard the seal rings, Fig. 25, (25 and 26) and wear ring (24) from piston.

IMPORTANT: Limit travel valve guides, Fig. 4, are pressed into piston. If valves leak, replace piston assembly which includes new valves.

7.1.5 INSPECTION

7.1.5.1
Visually inspect piston for wear, scoring, and nicks.

7.1.5.2
Check rods for nicks, burrs, and wear. If there are minor imperfections, remove with crocus cloth. Check for a bent rod by rolling rod on flat surface. Replace rod if chrome is worn or if there are any rust spots.

7.1.5.3
Measure I. D. of bushing, Fig. 25 (30); if I. D. is 2.516"(63.9 mm) or more, replace bushing.

7.1.5.4
Inspect interior of cylinder tube. Minor imperfections may be removed with crocus cloth. If tube is scored or worn it should be replaced.

7.1.5.5
Inspect weld at end of piston rod and weld at cap end of cylinder tube. If welds are cracked they may be repaired by welding. Use a low hydrogen weld rod #E70 18, .12"(3.0 mm) and set generator at 180 -- 195 amps. Do not weld on any portion of tube that piston travels across.

7.1.6 WIPER SEAL, PISTON ROD PACKING AND PISTON PACKING INSTALLATION

7.1.6.1
Press a new wiper seal, Fig. 24 (3), into end plate (4); sealing lip facing out.

7.1.6.2
Place bronze bushing, Fig. 24 (11), in cylinder head (6), then install wave spring (10), steel washer (9), packing (8), and aluminum washer (7) as shown.

7.1.6.3
Place four shims, Fig. 24 (5), and end plate (4) in position on cylinder head. Install capscrews (2) and lockwashers. Tighten capscrews hand tight only; do not apply pressure.

7.1.6.4
Lightly coat end of piston rod with grease and carefully install cylinder head assembly on piston rod as shown in Fig. 26. Use care to prevent damaging the wiper seal and the packing on the shoulder on the piston rod.

(Continued)

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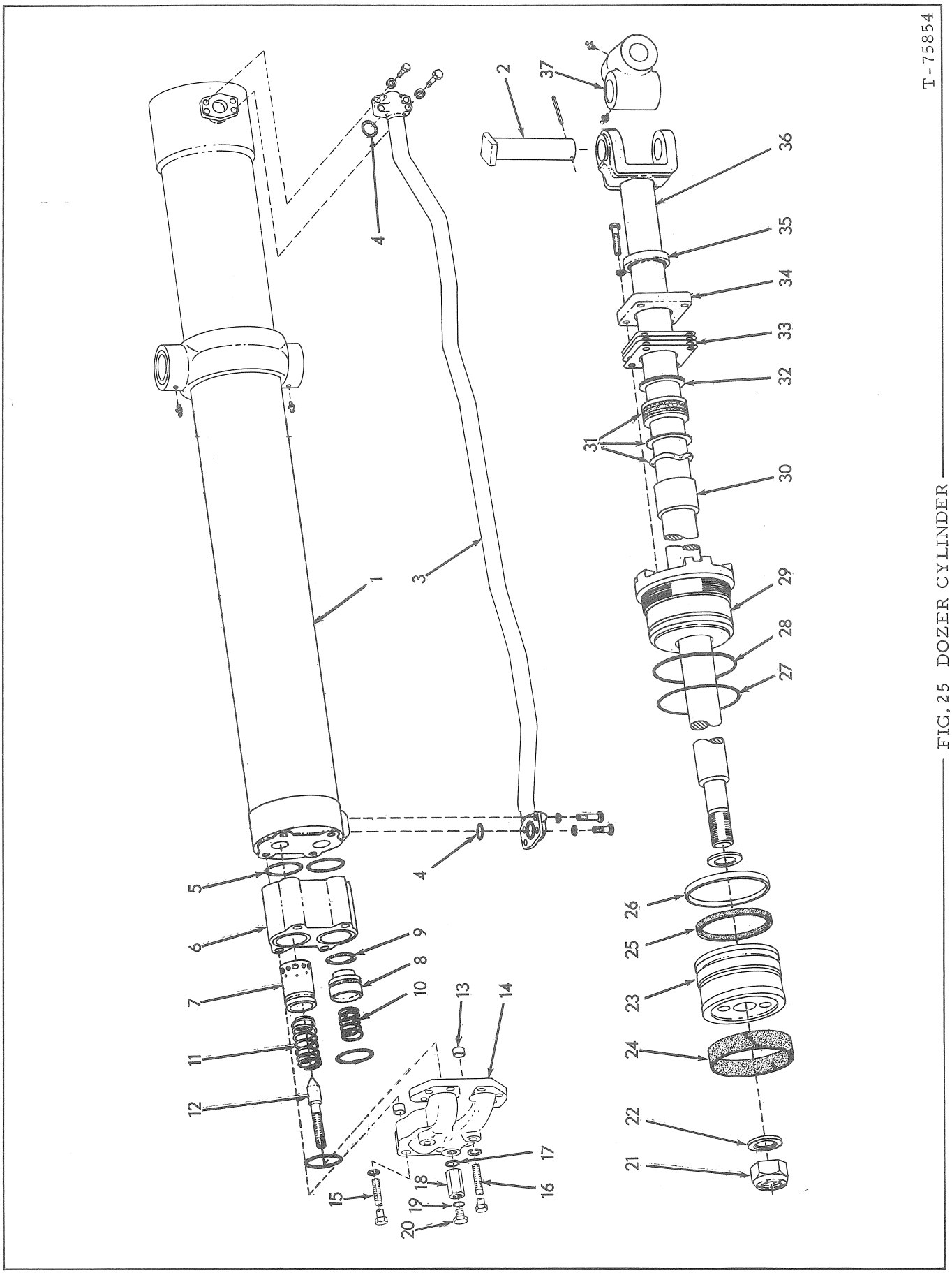

FIG. 25 DOZER CYLINDER

LEGEND FOR FIG. 25

1. Cylinder tube
2. Pin
3. Tube
4. O-ring
5. O-ring
6. Valve housing
7. By-pass valve
8. By-pass valve
9. O-ring
10. Spring
11. Spring
12. Adjustment Valve
13. Dowel bushing
14. Valve head
15. Capscrew
16. Capscrew
17. Seal
18. Adjustment screw locking nut
19. O-ring
20. Valve access plug
21. Piston rod nut
22. Spacer
23. Piston
24. Wear ring
25. Inner seal ring(rubber)
26. Outer seal ring(Teflon)
27. Cylinder head O-ring
28. Back-up ring
29. Cylinder head
30. Bushing
31. Piston rod packing
32. Packing washer
33. Shims
34. End plate
35. Piston rod wiper seal
36. Piston rod
37. Piston rod universal

7.1.6.5
Install O-ring, Fig. 25 (27), and back-up ring (28) on cylinder head.

7.1.6.6
Install rubber seal ring, Fig. 28 (2), in narrow groove in position. The Teflon ring may be difficult to install. To make it more plyable, twist ring with hands as shown in Fig. 27, then install Teflon ring over rubber ring as shown in Fig. 28; in a few minutes Teflon ring will be back to its original shape. Install wear ring. Fig. 25 (24) in groove in position.

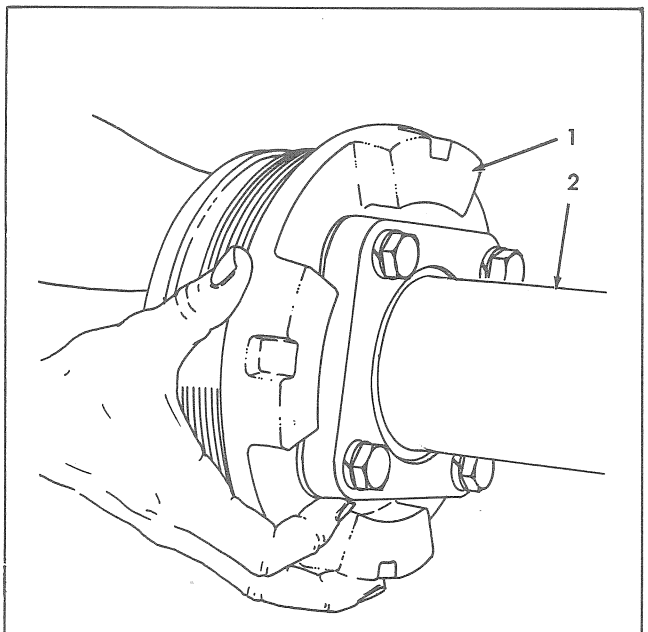

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FIG. 26 INSTALLING CYLINDER HEAD ON PISTON ROD

1. Cylinder head assembly
2. Piston rod

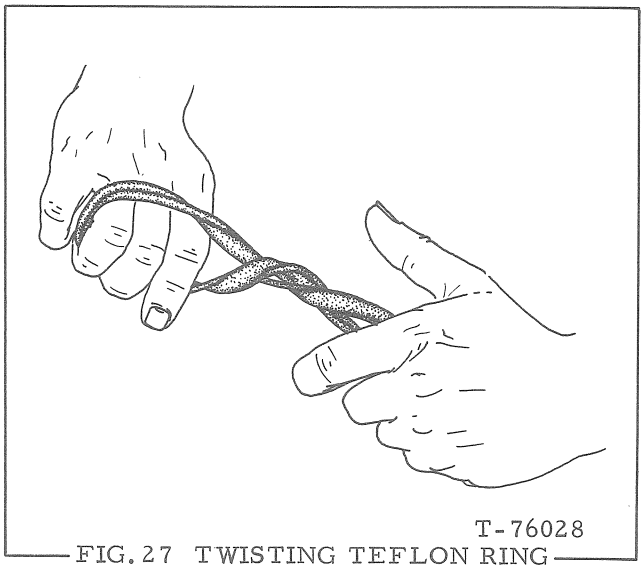

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FIG. 27 TWISTING TEFLON RING

7.1.6.7
Install piston assembly on piston rod. Install spacer, Fig. 25 (22), and nut (21). Tighten nut to a torque of 1100 -- 1200 lbs. ft. (152.1 -- 165.9 kg-m).

7.1.6.8
Make sure the cylinder tube is clean and lubricated. Carefully install the piston rod assembly.

IMPORTANT: Use shim stock around piston to prevent cutting seal rings on cylinder tube threads when installing piston.

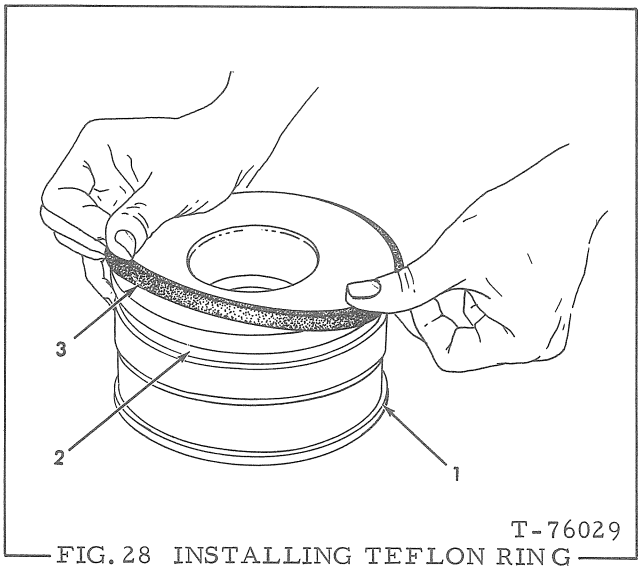

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FIG. 28 INSTALLING TEFLON RING

1. Piston
2. Rubber seal ring
3. Teflon seal ring

7.1.6.9
Lubricate threads on cylinder head and screw into cylinder tube. Tighten cylinder head to a torque of 1300 -- 1500 lbs. ft. (179.7 -- 207.4 kg-m).

7.1.6.10
Tighten capscrews in end plate to 40 lbs.ft. (5.53 kg-m).

7.1.7 QUICK-DROP VALVES INSTALLATION AND ADJUSTMENT

7.1.7.1
The quick-drop valves are located in the upper end of each dozer cylinder. Refer to Fig. 25 for correct valve placement.

IMPORTANT: Before installing by-pass valve (8) -- even though valve is new -- lap the flat sealing end of valve to its seat in housing (6). Be sure to thoroughly wash the lapping compound from valve and housing.

7.1.7.2
Position adjustment valve, Fig. 29 (6), in each valve head (5) to dimension "A" with nut (3) removed. This adjustment is an initial adjustment only; screwing valves in farther will decrease the distance operator must move control lever to make the moldboard drop; if the operator does not want a "touchy" control, the valves may be screwed out slightly.

CAUTION

Valve head securing capscrews, Fig. 25 (15 and 16), must be tightened to a torque of 75 lbs. ft. (10.4 kg-m) and the adjustment valve in each dozer cylinder must be adjusted to the same dimension so that each cylinder will react at the same time.

7.2 TILT CYLINDER

7.2.1 DESCRIPTION

The tilt hydraulic cylinder is double acting. The piston packing is a Teflon seal ring with a rubber inner ring; the piston also is equipped with a wear ring. The piston rod packing is multi-lip type, spring loaded and shim adjusted.

7.2.2 REMOVAL, INSTALLATION, AND ADJUSTMENT

NOTE: If the purpose of cylinder removal is cylinder disassembly, loosen the cylinder head before removing cylinder from tractor.

7.2.2.1
Level the dozer moldboard on ground; shut off engine and move controls to all positions several times (relieves trapped pressures). Disconnect piston rod from moldboard; start engine and move control lever to force rod to cylinder. Shut off engine and again relieve trapped pressures. Before removing cylinder it is advisable to tie piston rod in retracted position.

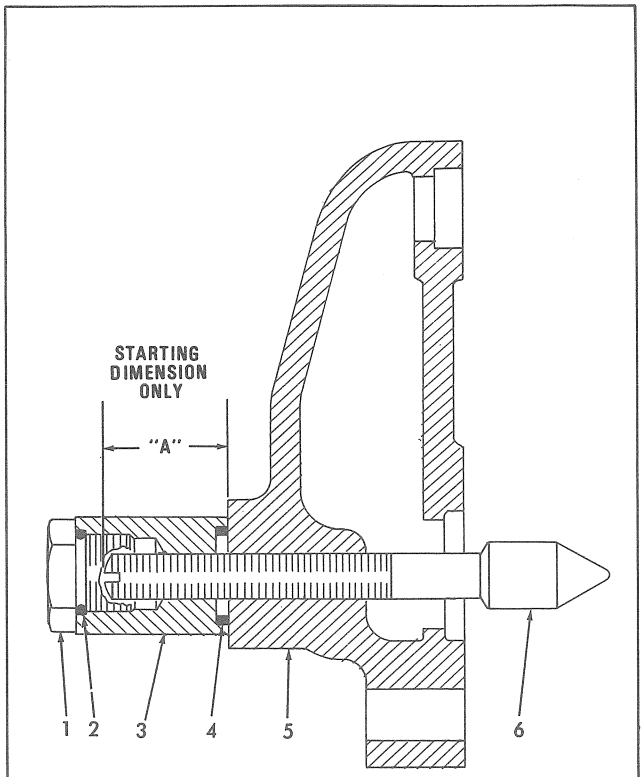

FIG. 29 QUICK -- DROP VALVE ADJUSTMENT

1. Valve access plug
2. O-ring
3. Adjusting screw locking nut
4. Seal
5. Valve head
6. Adjustment valve

DIM. "A" 1.07" -- 1.13" (27.2 -- 28.7 mm)

7.2.2.2
Disconnect hydraulic lines, and plug both ends. Attach a hoist to cylinder; remove pin from lower end of cylinder and remove cylinder.

7.2.2.3
Installation of cylinder may be accomplished by reversing the removal procedure. Be sure to check hydraulic oil level and add oil as necessary.

7.2.2.4
Moldboard adjustment, after tilt cylinder installation, may be accomplished as follows:

7.2.2.4.1
With power, raise blade and operate controls to expel air from cylinders. Set tilt cylinder to approximately mid-stroke, then lower blade to ground level.

7.2.2.4.2
Adjust opposite tilt brace (screw type) until moldboard is level on ground.

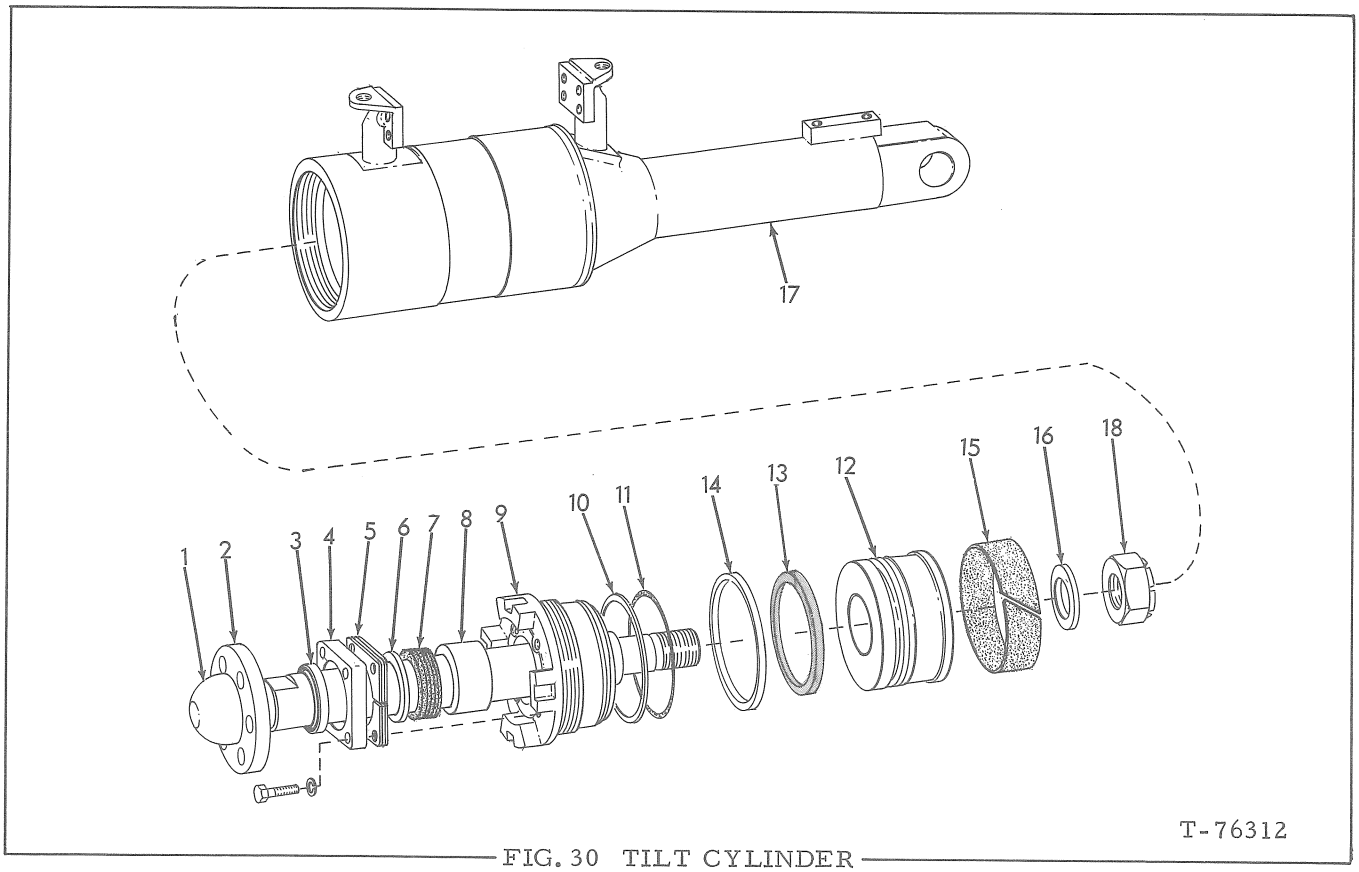

FIG. 30 TILT CYLINDER

1. Piston rod
2. Collar
3. Wiper seal
4. End plate
5. Shims
6. Packing washer
7. Piston rod packing
8. Bushing
9. Cylinder head
10. Back-up ring
11. O-ring
12. Piston
13. Inner seal ring (rubber)
14. Outer seal ring (Teflon)
15. Wear ring
16. Spacer
17. Cylinder tube
18. Piston rod nut

7.2.3 PISTON ROD PACKING ADJUSTMENT

Packing adjustment for the tilt cylinder is the same as for the dozer cylinders. Refer to 7.1.3

7.2.4 WIPER SEAL, PISTON ROD PACKING AND PISTON PACKING REMOVAL

NOTE: The piston rod assembly must be removed from the cylinder, however, it is not necessary to remove the cylinder from the tractor unless cylinder removal is desired ; see 7.2.2.

7.2.4.1
Level moldboard on ground, shut off engine and relieve trapped pressures by moving control lever to each position several times.

7.2.4.2
Loosen end plate, Fig. 30 (4); then loosen (do not remove) cylinder head (9) Disconnect piston rod from moldboard (be sure to block the cylinder). Unscrew cylinder head and remove rod assembly (a large amount of oil will be present).

7.2.4.3
Clamp flat of rod securely in a vise, and remove the rod nut; slide the parts from rod.

7.2.4.4
Remove the wiper seal, Fig. 30 (3), from end plate and clean the bore.

7.2.4.5
Remove rod packing (7), washer, wave spring and bushing, from cylinder head. Clean the bore in head, and inspect the bushing and packing for wear.

7.2.4.6
Remove and discard the seal rings, Fig. 30 (13 and 14), and wear ring (15).

7.2.5 INSPECTION

Refer to 7.1.5 except 7.1.5.3. Measure I. D. of bushing Fig. 30 (8); if I.D. is 2.516" (63.9 mm) or more, replace bushing.

7.2.6 WIPER SEAL, PISTON ROD PACKING AND PISTON PACKING INSTALLATION

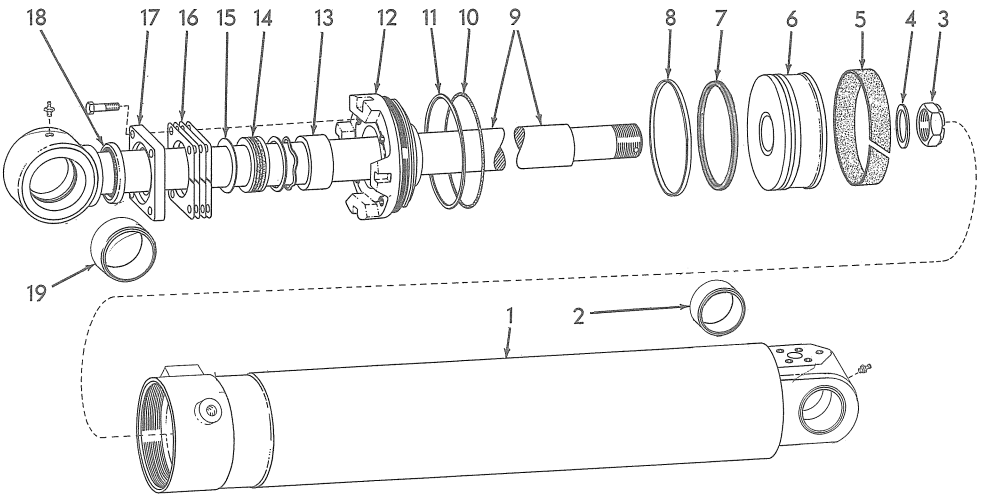

FIG. 31 RIPPER CYLINDER

1. Cylinder tube
2. Bushing
3. Piston rod nut
4. Spacer
5. Wear ring
6. Piston
7. Inner seal ring (rubber)
8. Outer seal ring (Teflon)
9. Piston rod
10. Cylinder head O-ring
11. Back-up ring
12. Cylinder head
13. Bushing
14. Piston rod packing
15. Packing washer
16. Shims
17. End plate
18. Piston rod wiper seal
19. Bushing

7.2.6.1
Press a new wiper seal, Fig. 30(3) into end plate (4); sealing lip facing out.

7.2.6.2
Place a bronze bushing (8) in cylinder head (9), then install wave spring, Fig. 24(10), steel washer (9), packing (8), and aluminum washer (7), as shown.

7.2.6.3
Place four shims, Fig. 24 (5), and end plate (4) in position on cylinder head. Install capscrews (2) and lockwashers. Tighten capscrews hand tight only; do not apply pressure.

7.2.6.4
Lightly coat end of piston rod with grease and carefully install cylinder head assembly on piston rod as shown in Fig. 26. Use care to prevent damaging the wiper seal and packing on the shoulder on the piston rod.

7.2.6.5
Install O-ring, Fig. 30 (11), and back-up ring (10) on cylinder head.

7.2.6.6
Install rubber seal ring, Fig. 30 (13), in narrow groove in piston. The Teflon ring (14) may be difficult to install. To make it more plyable, twist ring with hands as shown in Fig. 27, then install Teflon ring over rubber ring s shown in Fig. 28. In a few minutes Teflon ring will be back to its original shape. Install wear ringFig. 30(15), in groove in piston.

7.2.6.7
Install piston assembly on piston rod. Install spacer, Fig. 30 (16), and nut (18). Tighten nut to a torque of 2000 -- 2100 lbs. ft. (276.5 -- 290.3 kg-m).

7.2.6.8
Make sure the cylinder tube is clean and lubricated. Carefully install the piston rod assembly.

IMPORTANT: Use shim stock around piston to prevent cutting seal rings on cylinder tube threads when installing piston.

7.2.6.9
Lubricate threads on cylinder head and screw into cylinder tube. Tighten cylinder head to a torque of 1400 -- 1500 lbs. ft. (193.5 -- 207.4 kg-m).

7.2.6.10
Tighten capscrews in end plate to 40 lbs. ft. (5.53 kg-m).

7.3 RIPPER CYLINDERS

7.3.1 DESCRIPTION

The ripper hydraulic cylinder is double acting. The piston packing is a Teflon seal ring with rubber inner ring; the piston is also equipped with a wear ring. The piston rod packing is a multi-lip type, spring loaded and shim adjusted.

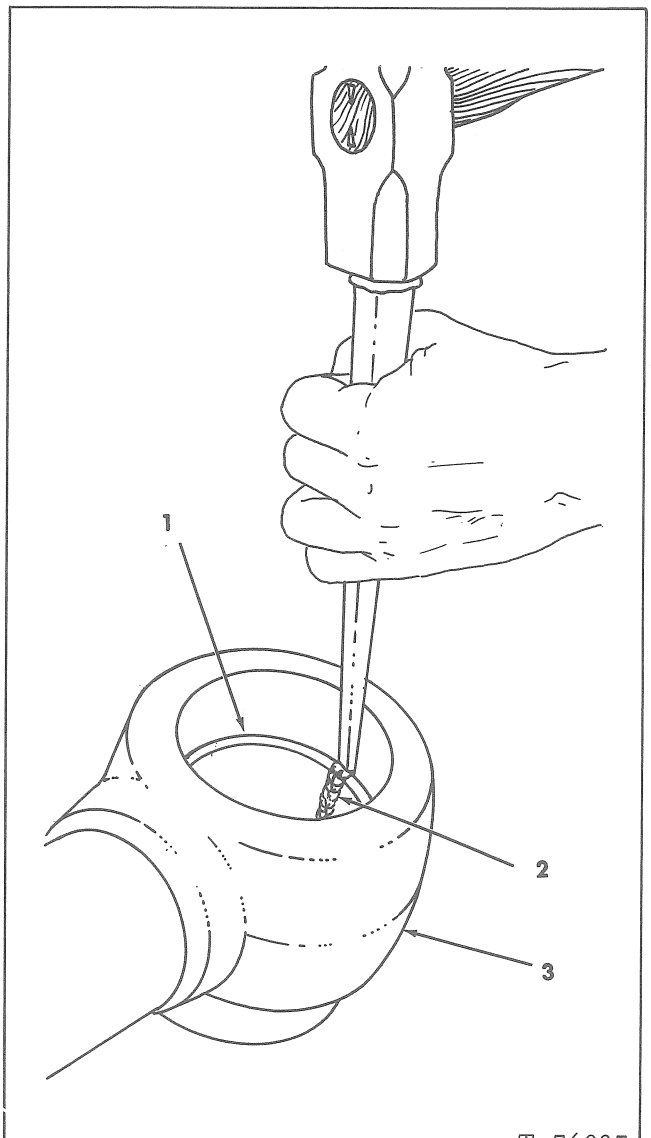

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FIG. 32 DRIVING OUT RIPPER PISTON ROD EYE BUSHING

1. Bushing
2. Weld bead
3. Ripper cylinder piston rod

7.3.2 REMOVAL AND INSTALLATION

7.3.2.1
Lower ripper to ground; shut off engine and move controls to all positions several times to relieve trapped pressures. Disconnect piston rod from ripper lower beam. Start engine and move control lever to raise position to retract rod into cylinder. Shut off engine and again relieve trapped pressures.

NOTE: If the purpose of cylinder removal is cylinder disassembly, loosen the cylinder head before removing cylinder from tractor. Before removing cylinder, it is advisable to tie piston rod in the retracted position.

7.3.2.2
Disconnect hydraulic lines and plug both ends. Attach a hoist to cylinder; remove pins from upper end of cylinder and remove cylinder.

7.3.2.3
Installation of cylinder may be accomplished by reversing the removal procedure. Be sure to check hydraulic oil level and add oil as necessary.

7.3.3 PISTON ROD PACKING ADJUSTMENT

Packing adjustment for the ripper cylinder is the same as for the dozer cylinders. Refer to 7.1.3.

7.3.4 WIPER SEAL, PISTON ROD PACKING AND PISTON PACKING REMOVAL

NOTE: The piston rod assembly must be removed from the cylinder, however, it is not necessary to remove the cylinder from the tractor unless cylinder removal is desired; see 7.3.2.

7.3.4.1
Lower ripper to ground; shut off engine and relieve trapped pressures by moving control lever to each position several times.

7.3.4.2
Loosen the end plate, Fig. 31(17), then loosen (do not remove) cylinder head (12). Disconnect piston rod from moldboard (be sure to block the cylinder). Unscrew cylinder head and remove rod assembly (a large amount of oil will be present).

7.3.4.3
Clamp the eye end of rod securely in a vise and remove the rod nut; slide the parts from rod.

7.3.4.4
Remove the wiper seal, Fig. 31(18), from end plate and clean the bore.

7.3.4.5
Remove rod packing (14), washer, wave spring and bushing from cylinder head. Clean the bore in head and inspect the bushing and packing for wear.

7.3.4.6
Remove and discard the seal rings, Fig. 31 (7 and 8) and wear ring (5).

7.3.5 INSPECTION

7.3.5.1
Refer to 7.1.5 except 7.1.5.3.

7.3.5.2
Measure I. D. of bushing, Fig. 31(13); if I. D. is 3.016" (76.3 mm) or more, replace bushing.

7.3.5.3
Measure I. D. of bushings, Fig. 31 (19); if I. D. is 3.023" (76.8 mm) or more, replace bushings. These are hardened steel bushings which may be removed as follows:

7.3.5.3.1
Weld two or three beads across the inner surface of each bushing. Be careful not to weld too close to space between bushings. These welds will shrink the bushings so they may be driven out as shown in Fig. 32.

7.3.5.3.2
Press new bushings into piston rod eye so that ends of bushings are flush with faces of rod eye.

7.3.6 WIPER SEAL, PISTON ROD PACKING AND PISTON PACKING INSTALLATION

7.3.6.1
Press a new wiper seal, Fig. 31 (18), into end plate (17), sealing lip facing out.

7.3.6.2
Place a bronze bushing (13) in cylinder head (12). Refer to Fig. 24 and install wave spring (10), steel washer (9), packing (8) and aluminum washer (7) as shown.

7.3.6.3
Place four shims, Fig. 24 (5), and end plate (4) in position on cylinder head. Install capscrews (2) and lockwashers. Tighten capscrews hand tight only; do not apply pressure.

7.3.6.4
Lightly coat end of piston rod with grease and carefully install cylinder head assembly on piston rod as shown in Fig. 26. Use care to prevent damaging the wiper seal and packing on the shoulder on the piston rod.

7.3.6.5
Install O-ring, Fig. 31 (10), and back-up ring (11) on cylinder head.

7.3.6.6
Install rubber seal ring, Fig. 31 (7), in narrow groove in piston. The Teflon ring (8) may be difficult to install. To make it more plyable, twist ring with hands as shown in Fig. 27, then install Teflon ring over rubber ring as shown in Fig. 28. In a few minutes Teflon ring will be back to its original shape. Install wear ring Fig. 31 (5), in groove in piston.

7.3.6.7
Install piston assembly on piston rod. Install spacer, Fig. 31 (4), and nut (3). Tighten nut to a torque of 3100 -- 3200 lbs. ft. (428.5 -- 442.4 kg-m).

7.3.6.8
Make sure the cylinder tube is clean and lubricated. Carefully install the piston rod assembly.

IMPORTANT: Use shim stock around piston to prevent cutting seal rings on cylinder tube threads when installing piston.

7.3.6.9
Lubricate threads on cylinder head and screw into cylinder tube. Tighten cylinder head to a torque of 1500 -- 1700 lbs. ft. (207.4 -- 435.0 kg-m).

7.3.6.10
Tighten capscrews in end plate to 40 lbs. ft. (5.53 kg-m).

TOPIC 8 DOZER AND RIPPER REMOVAL AND INSTALLATION

8.1 HA C-FRAME AND MOLDBOARD REMOVAL

8.1.1 C-FRAME REMOVAL

8.1.1.1
Level dozer moldboard on ground and block up the C-frame, Fig. 33 (7), so that tension on C-frame trunnions (5) is minimized. Shut off engine and relieve trapped hydraulic pressure by moving control lever to each position several times.

8.1.1.2
Disconnect piston rods (2) from C-frame. Start engine and retract piston rods into hydraulic cylinders; stop engine. Disconnect trunnions (5) and back tractor away.

NOTE: Tie each individual shim pack together to prevent loss or mix-up.

8.1.2 MOLDBOARD REMOVAL

8.1.2.1
The moldboard may be removed whether or not the C-frame is attached to the tractor. To remove moldboard from C-frame, block up moldboard and C-frame, and remove moldboard pivot pin located at rear center of moldboard.

8.1.2.2
Disconnect moldboard struts from C-frame at swivel pin location, Fig. 33 (6), and remove moldboard.

8.2 HA C-FRAME AND MOLDBOARD INSTALLATION

8.2.1 C-FRAME INSTALLATION

8.2.1.1
Raise and block the C-frame until trunnion sockets are level with trunnion on tractor. Position tractor in C-frame so that trunnions are snug in C-frame sockets.

8.2.1.2
Install pivot cap, Fig. 35 (5); do not install shims (4) at this time. Tighten capscrews and locate cap so that gap is equal at each end. Make up two equal shim packs, each equal to the width of the gap, and add one more shim to each pack. Remove pivot cap; grease the ball and socket freely, and install shim packs and pivot cap. Lubricate capscrews and nuts and tighten to a torque of 310 --330 lbs. ft (41.5 -- 45.6 kg-m).

8.2.1.3
Connect piston rods, Fig. 33 (2), to C-frame.

8.2.2 MOLDBOARD INSTALLATION

8.2.2.1
Place moldboard in position on C-frame with strut brackets snug against swivel pins, Fig. 33 (6). Install pivot pin and collar connecting moldboard to C-frame.

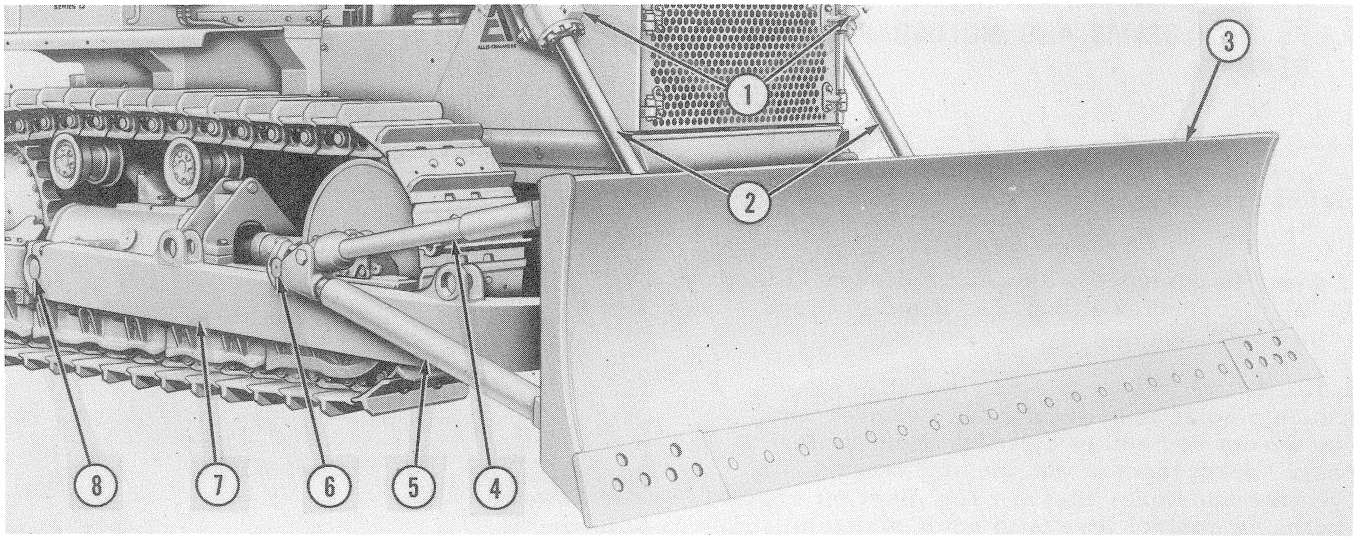

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FIG. 33 11HA DOZER (HYDRAULICALLY — OPERATED, ANGLING MOLDBOARD)

1. Hydraulic cylinder
2. Piston rod
3. Moldboard
4. Upper strut
5. Lower strut
6. Swivel pin
7. C-frame
8. Trunnion

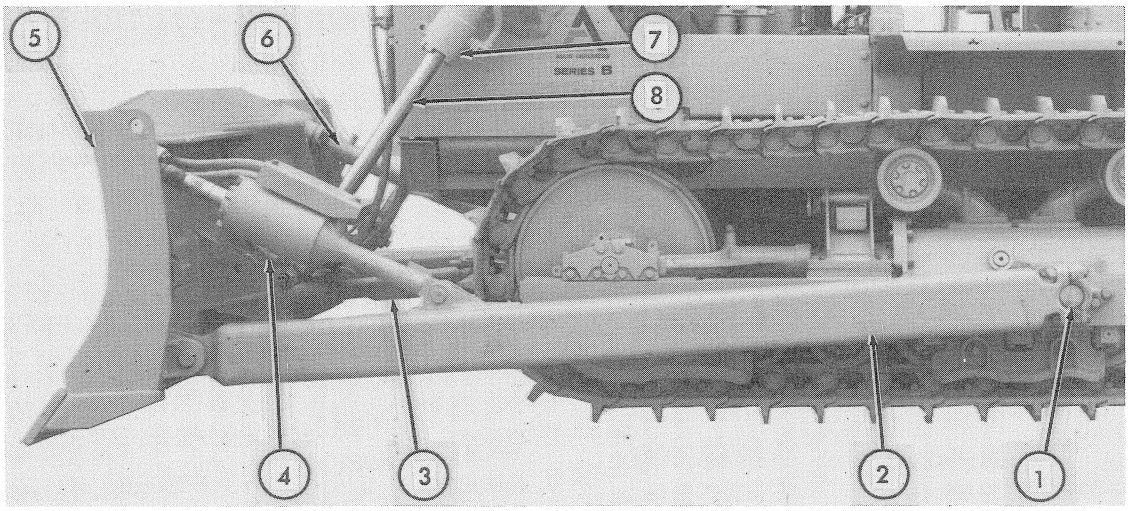

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FIG. 34 11HS DOZER (HYDRAULICALLY — OPERATED, STRAIGHT MOLDBOARD)

1. Trunnion
2. Push beam
3. Diagonal brace
4. Tilt cylinder (special equipment)
5. Moldboard
6. Tilt brace
7. Hydraulic cylinder
8. Piston rod

8.2.2.2
Install swivel pin cap but do not install shims at this time. Tighten capscrews securely and locate cap so that gap is equal at each end. Make up two equal shim packs , each equal to the width of the gap, and add one more shim to each pack. Remove pivot pin cap; grease the ball and socket freely, and install shim packs and swivel pin cap. Lubricate capscrews and nuts and tighten to a torque of 480 -- 520 lbs. ft. (66.3 -- 71.9 kg-m).

8.3 HS PUSH BEAMS AND MOLDBOARD REMOVAL

8.3.1
Level dozer moldboard on ground and block it to prevent tipping. Disconnect dozer cylinder piston rods, Fig. 34 (8), from moldboard (5).

8.3.2
If dozer is equipped with a tilt cylinder, Fig. 34 (4), proceed as in 8.3.2.1; if not proceed as in 8.3.2.2.

8.3.2.1
Attach a hoist to hydraulic tilt cylinder and disconnect rod end of cylinder from moldboard. Start tractor engine and retract tilt cylinder and dozer piston rods. Shut off engine and move control levers to each position several times to relieve trapped pressures. Disconnect tilt cylinder hydraulic lines from tubes on rear of moldboard and plug all openings. Disconnect tilt cylinder from push beam and remove tilt cylinder. Disconnect tilt brace, Fig. 36 (4), from moldboard.

NOTE: Tie each individual shim pack together to prevent loss or mix-up.

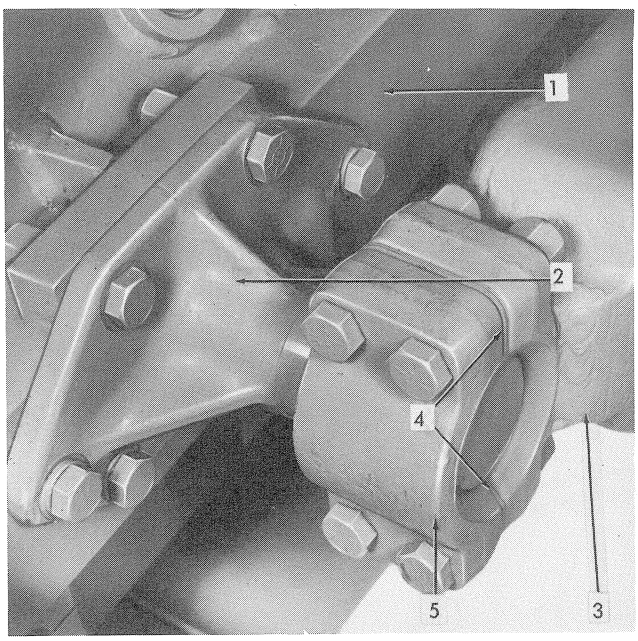

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FIG. 35 HA OR HS DOZER TRUNNION

1. Track frame
2. Trunnion
3. C-frame or push beam
4. Shims
5. Pivot cap

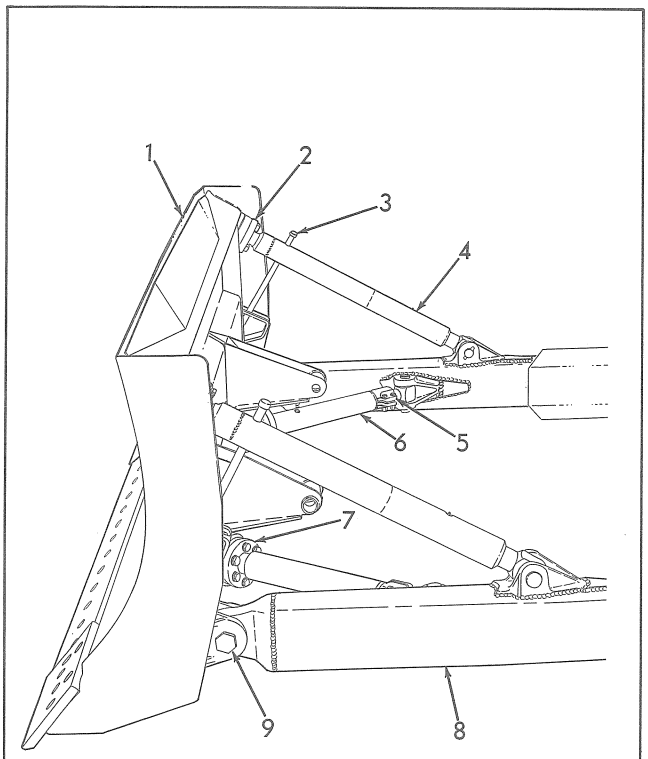

FIG. 36 11HS DOZER MOUNTING

1. Moldboard
2. Shims
3. Adjusting bar
4. Tilt brace
5. Diagonal brace clamp
6. Diagonal brace
7. Shims
8. Push beam
9. Hinge bolt

8.3.2.2
Disconnect both tilt braces, Fig. 36 (4), from moldboard; refer to preceding NOTE.

8.3.3
Loosen diagonal braces, Fig. 36 (6), by loosening clamp (5) and turning brace with a bar inserted through holes provided in brace. After brace is loose, disconnect it from moldboard and push beam, and remove the brace. Refer to NOTE following 8.3.2.1.

8.3.4
Block up push beams; remove hinge bolts, Fig. 36 (9), and remove moldboard.

8.3.5
Remove caps, Fig. 35 (5), from ends of push beams and back tractor away from beams.

8.4 HS PUSH BEAMS AND MOLDBOARD INSTALLATION

8.4.1
Position each push beam, Fig. 35 (3), on its trunnion (2) and install cap (5); do not install shims (4) at this time. Tighten capscrews securely and locate cap so that gap is equal at each end. Make up two equal shim packs, each equal to the width of the gap, and add one more shim to each pack. Remove pivot cap; grease the ball and socket freely, and install shim packs and pivot cap. Lubricate capscrews and nuts and tighten to a torque of 310 -- 330 lbs. ft. (41.5 --45.6 kg-m).

8.4.2
Move moldboard into position at front end of push beams. Install hinge bolt, Fig. 36 (9), nut, and cotter pin to attach each side of moldboard to the push beams.

8.4.3
If dozer is equipped with a tilt cylinder, Fig. 34 (4), proceed as in 8.4.3.1; if not proceed as in 8.4.3.2.

8.4.3.1
Coat ball end of tilt brace, Fig. 34 (6), with grease and install brace. Use shims to obtain a .000" -- .032"(.000 -- .813 mm) loose fit on ball. Position tilt cylinder (4) on push beam and install pin and spring pin. Block up tilt cylinder and connect hydraulic lines. Start tractor engine; extend dozer cylinder piston rods and connect them to moldboard. Coat tilt cylinder ball with grease and use hydraulic power to position ball in socket in moldboard. Use shims to obtain a .000" -- .032"(.000 -- .813 mm) loose fit on ball.

8.4.3.2
Adjust tilt braces, Fig. 36 (4), so that they are approximately equal in length. Coat ball end of braces with grease and install braces. Use shims (2) to obtain a .000" -- .032" (.000 -- .813 mm) loose fit on ball. Start tractor engine; extend dozer cylinder piston rods and connect them to moldboard.

8.4.4
Coat ball end of diagonal braces, Fig. 36 (6), with grease and install braces. Use shims (7) to obtain a .000" -- .032" (.000 -- .813 mm) loose fit on ball.

8.4.5
Adjust length of diagonal braces as necessary to position push beams (8) equidistant from track frames. After push beams are aligned, shorten both diagonal braces equally until all looseness is removed and moldboard is tight. Lubricate capscrews and nuts in clamps (5) and tighten to a torque of 86 -- 94 lbs. ft. (11.9 -- 12.9 kg-m).

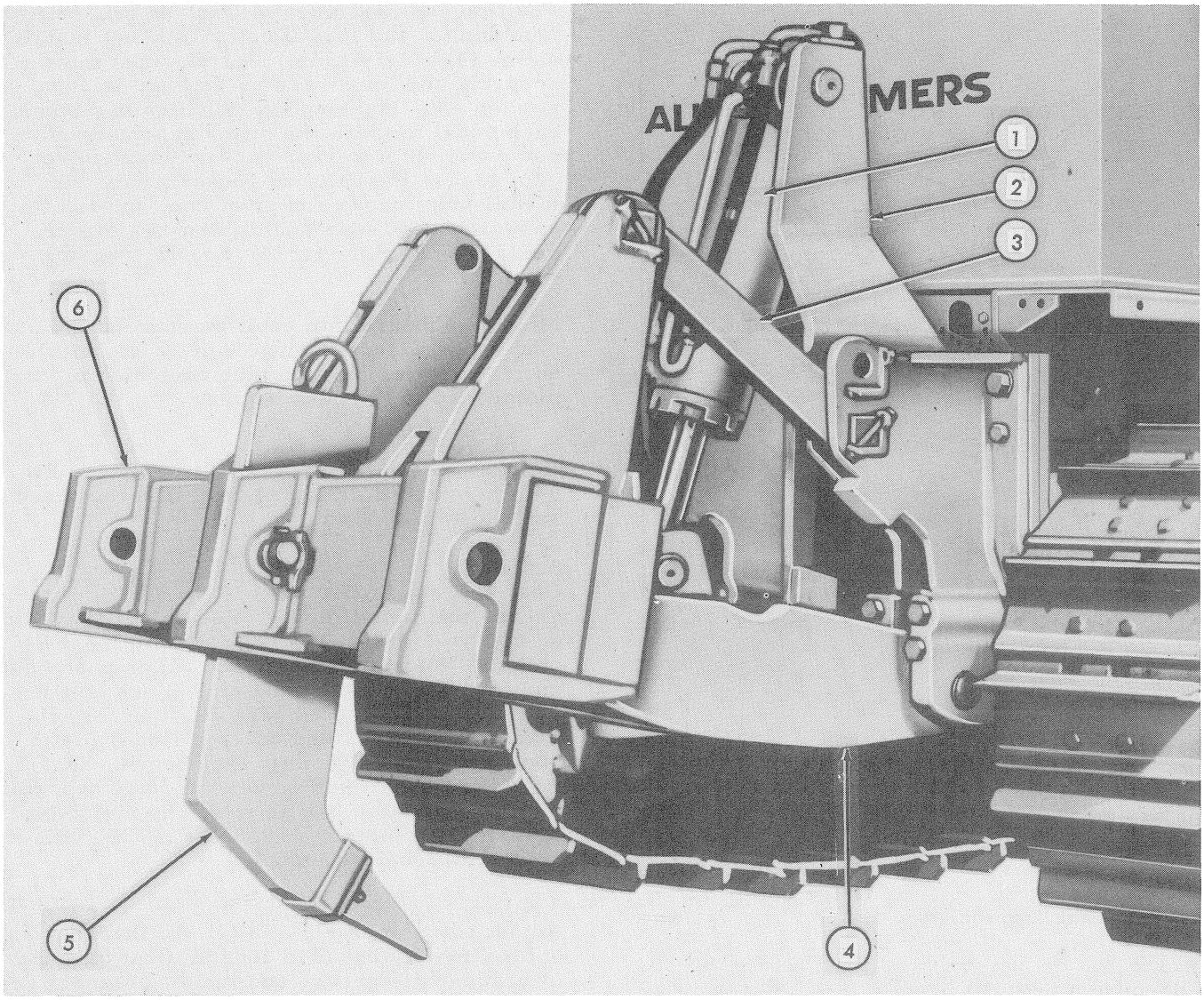

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FIG. 37 11R RIPPER

1. Hydraulic cylinder
2. Mounting frame
3. Upper strut
4. Lower beam
5. Ripper tooth shank
6. Tool bar

8.4.6
Adjust tilt braces. If dozer is equipped with a tilt cylinder, Fig. 34 (4), proceed as in 8.4.6.1; if not proceed as in 8.4.6.2.

8.4.6.1
With tractor on level ground, set tilt cylinder at midstroke. Position lower edge of moldboard an inch or two (25.4 -- 50.8 mm) above the ground and adjust tilt brace, Fig. 34 (6), until lower edge of moldboard is parallel to ground. After adjusting, lock tilt brace by inserting adjusting bar, Fig. 36 (3), into its lock on rear of moldboard.

8.4.6.2
With tractor on level ground, position lower edge of moldboard an inch or two (25.4 -- 50.8 mm) above the ground and adjust tilt braces, Fig. 36 (4), until lower edge of moldboard is parallel to ground.

NOTE: For normal dozing conditions, recommended position of moldboard is : back of board perpendicular to ground, and/or cutting edge at an angle of 52 — 1/2° to ground. After adjusting, lock tilt braces by inserting adjusting bars into their locks located on rear of moldboard.

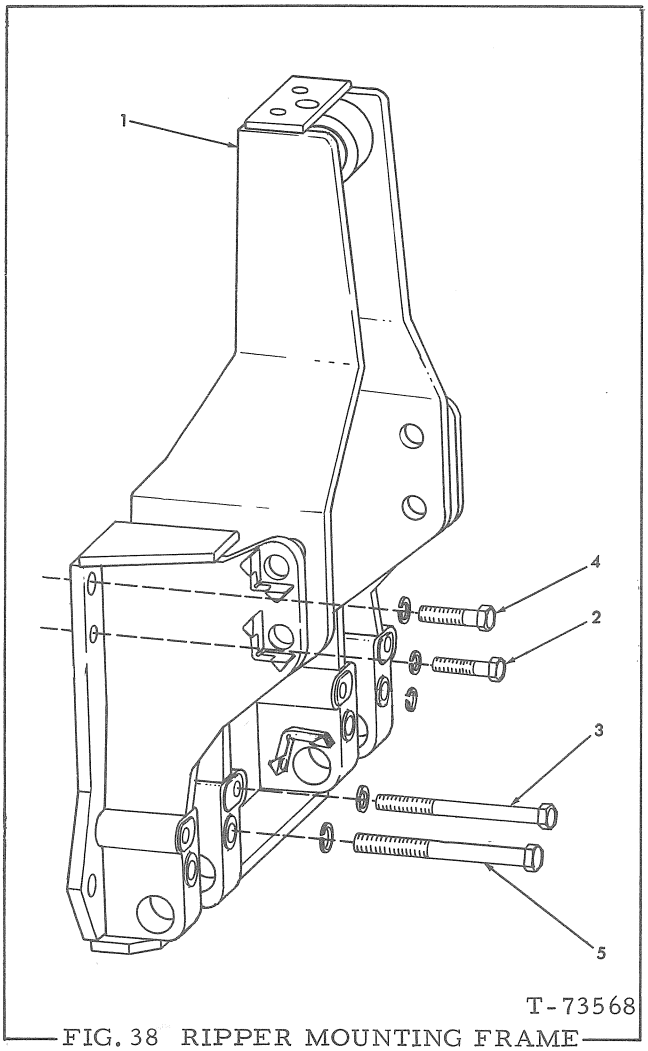

FIG. 38 RIPPER MOUNTING FRAME

1. Mounting frame
2. Capscrew, 1"NF (25.4 mm)
3. Capscrew, 1"NF (25.4 mm)
4. Capscrew, 1.25"NF (31.7 mm)
5. Capscrew, 1.25"NF (31.7 mm)

8.5 RIPPER TOOL BAR AND MOUNTING FRAME REMOVAL

8.5.1
The ripper shanks, Fig. 37 (5), are held in place by pins and may be removed from the tool bar (6) after the pin is removed.

8.5.2
If only the ripper tool bar and linkage are to be removed, the ripper hydraulic cylinder piston rod must be disconnected from the lower beam (4) but the cylinder need not be disconnected from the mounting frame (2).

8.5.3
The ripper tool bar and linkage are connected to the ripper mounting frame and to each other by pins. The linkage may be removed a piece at a time or as an assembly. Refer to Fig. 37 for location of the pins.

8.5.4
The ripper mounting frame, Fig. 38, may be removed, after the tool bar and linkage, and the ripper hydraulic cylinders have been removed, by removing capscrews attaching the mounting frame to the main housing.

8.6 RIPPER TOOL BAR AND MOUNTING FRAME INSTALLATION

8.6.1
Use new capscrews and lockwashers to secure mounting frame, Fig. 38, to main housing. Clean all paint from mounting faces of frame and main housing. Lubricate all threads with white lead before installing.

8.6.2
Position mounting frame on main frame and install capscrews. Tighten all 1 inch (25.4mm) capscrews to a torque of 700 lbs. ft. (96.7kg-m) and all 1.25 inch(31.7mm)capscrews to a torque of 1200 lbs. ft. (165.9 kg-m).

8.6.3
Install ripper tool bar and linkage and ripper hydraulic cylinders by reversing removal procedure.

TOPIC 9 TORQUE VALUES

IMPORTANT: The following values are for lubricated threads unless stated otherwise.

HYDRAULIC CYLINDERS

Dozer cylinder rod nut	1100--1200 lbs.ft. (152.1--165.9 kg-m)
Dozer cylinder head	1300--1500 lbs.ft. (179.7--207.4 kg-m)
Tilt cylinder rod nut	2000--2100 lbs.ft. (276.5--290.3 kg-m)
Tilt cylinder head	1400--1500 lbs.ft. (193.5--207.4 kg-m)
Ripper cylinder rod nut	3100--3200 lbs.ft. (428.5--442.4 kg-m)
Ripper cylinder head	1500--1700 lbs.ft. (207.4--235.0 kg-m)

HYDRAULIC PUMP

Shaft rotating torque after rebuild	20 lbs.ft. (2.76 kg-m)
Stud nuts	115 lbs.ft. (15.89 kg-m)

HYDRAULIC CONTROL VALVE

Studs nuts	80 -- 85 lbs.ft. (11.0 -- 11.7 kg-m)

DOZER

Cutting edge plow bolts (Seat bolts with heavy hammer and then retorque).	312 -- 338 lbs.ft. (43.1 -- 46.7 kg-m)

RIPPER

Mounting frame capscrews:	
1" diam (25.4 mm)	700 lbs. ft. (96.7 kg-m)
1.25" diam (31.7 mm)	1200 lbs. ft. (165.9 kg-m)

TOPIC 10 SERVICE TOOLS

All tools required to perform the repair operations described in this manual are considered to be standard service tools; these tools can be ordered from local tool suppliers.

ALPHABETICAL INDEX

ALPHABETICAL INDEX