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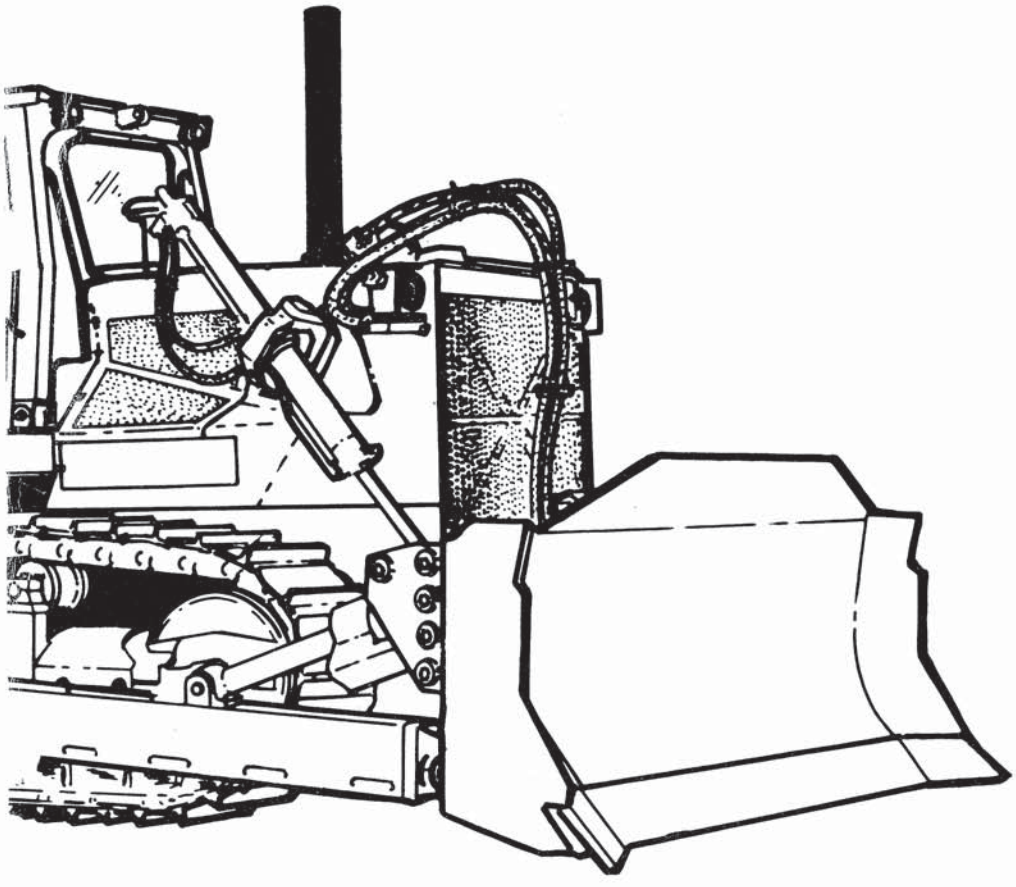

Service manual

TRANSMISSION

Form 73108460 English

TOPIC 1 GENERAL DESCRIPTION AND OIL FLOW SCHEMATICS

1.1 MECHANICAL OPERATION

1.1.1
Input clutch and torque converter transmit engine power through drive shaft universal joint to transmission. Multiple plate clutch, located in front part of torque converter housing, is hydraulically controlled. Engine power is transmitted through input clutch to the torque converter rotating housing. Rotating housing drives impeller wheel; impeller wheel pumps oil through turbine wheel; turbine wheel drives torque converter output shaft to transmit power to transmission.

1.1.2
Between the torque converter housing and engine flywheel housing is a gear train to drive the dozer pump, transmission pump, and steering pump. Gear train is driven directly from engine through torque converter accessory drive gear.

1.1.3
Transmission is constant mesh type, with three speeds in both forward and reverse. Transmission has three clutch shafts, plus a countershaft and a bevel pinion (output) shaft; the three clutch shafts carry five clutches. Viewing transmission from front, the top (input) shaft carries forward and reverse clutches, lower right shaft carries the first and second range clutches, and the lower left shaft carries third range clutch. In center is the bevel pinion shaft; upper right shaft is the countershaft.

1.1.4
Transmission clutches are multiple plate, oil cooled and lubricated. The clutches are hydraulically engaged and spring released -- they require no adjustment. The clutches are all indentical in design and operation; size of clutch drum gears vary to obtain different speed and power ratios.

1.1.5
A direction clutch and range clutch must both engage to move the tractor. Engagement of all the clutches is controlled by a single lever -- the transmission shift lever, Fig. 6-7. Front - to-rear movement of the transmission shift lever engages the range clutches; side-to-side movement engages the direction clutches. Engagement of the input clutch takes place automatically after engagement of the transmission direction clutch.

1.2 FUNCTION OF HYDRAULIC SYSTEM

1.2.1 TRANSMISSION OIL PUMP

1.2.1.1
Mounted on rear of gear housing just above the torque converter housing and driven from engine flywheel through gear train within gear housing. Pump contains a single set of gears to draw oil from sump in transmission housing and charge the hydraulic system. Pump rotation is clockwise (viewed from drive shaft end); pump speed is .86 time engine speed. Refer to 5.1 for specified flow.

1.2.2 SHIFT INHIBITING PUMP

1.2.2.1
Attached to transmission bevel pinion shaft front bearing retainer, pump contains a single set of gears. Pump is driven by bevel pinion shaft -- therefore the tractor must be moving for pump to operate. Purpose of the pump is to create a pressure differential on ends of shift inhibiting valve shift inhibit piston which is controlled by travel speed of the tractor; this allows full speed directional shifts to be made (see oil flow description in 1.5). When tractor is moving, pump transfers main circuit oil from one end of shift inhibit piston to the other end; suction and pressure sides of the pump depend on direction of travel. Pump volume is limited by restriction on inlet side; relief valve on output side of pump prevent cavitation at high speeds.

1.2.3 PRESSURE REGULATING VALVE

1.2.3.1
Mounted on lower rear side of torque converter, valve contains components to regulate main pressure and torque converter/transmission lube pressure, and regulate oil flow to the input clutch.

1.2.3.2
Main pressure is regulated in the center section of pressure regulating valve. Oil in main circuit flows through a small passage in the regulator piston to both ends of the piston. Oil flow to the poppet end of the regulator piston flows through a small orifice in the poppet and is deadheaded at the end of the regulator piston. Pressure build up in the pocket forces the regulator piston open allowing oil in main circuit to bypass into torque converter circuit. Regulator piston is shown in its normal bypass position in Fig. 1-2. If oil is extremely cold or thick and will not flow through the orifice in the poppet, the poppet will be forced off its seat allowing a larger flow of oil to react on the end of the regulator piston. Regulator piston is forced all the way open, Fig. 1-1, to allow a portion of the bypass oil to return to sump. After oil warms to normal operating temperature, the poppet will close and the regulator piston will return to the position shown in Fig. 1-2. Oil flow to the spring end of the regulator piston flows through a small orifice, then through a passage to a pilot valve located at the opposite end of the regulator piston. Pressure reacting

Troubleshooting

TROUBLE	POSSIBLE CAUSE	REMEDY
Tractor seems low on power in all ranges (Continued)	Low engine rpm	Set engine to specified high idle speed then check engine speed at torque converter stall. With engine running and both brakes applied, engage 3rd forward clutch. Accelerate engine to full throttle and check engine rpm. Converter oil temperature must be in normal operating range; engine stall speed is 2000-2060 rpm. Low rpm indicates engine trouble; refer to Engine Service Manual for further troubleshooting. If stall speed is high, check transmission pump flow (5.2) and converter pressure (4.8)
	Oil build-up in engine flywheel housing	Disconnect the drain line between flywheel housing and front of transmission housing and front of transmission; make sure it is not clogged.
Tractor operates OK in one direction; will not move in opposite direction	Transmission direction clutch not engaging	Check clutch apply pressure in direction which tractor will not move (4.7); make necessary repairs.
	Shift inhibit pistons not centered in their bore in shift inhibiting valve. This will allow one direction clutch to stay engaged at all times -- thus the other direction clutch cannot be engaged	Check shift inhibit system pressure (4.9) to determine the cause
	Shift inhibit relief valve(s) stuck open	Refer to 9.3.7 and make necessary repairs
Tractor coasts excessively before changing directions when directional shift is made	Brakes are too loose or not applying	Refer to Steering Clutches and Brakes service manual for remedy
	Input clutch not disengaging	If the brakes are operating properly when shift is made, the cause for the clutch remaining engaged has to be a mechanical failure in the clutch itself -- refer to INPUT CLUTCH and TORQUE CONVERTER for repair procedure.
Brakes will not release	No brake signal pressure	Refer to 4.5 and check main pressure
	For all other causes refer to Steering Clutches and Brakes service manual	

TOPIC 5 FLOW CHECKING

5.1 SPECIFICATIONS AND GENERAL INFORMATION

SHIFT LEVER POSITION / FLOW (GPM)**	RPM	NEUT.	1ST	2ND	3RD	* 1ST FWD	* 2ND FWD	* 3RD FWD	* 1ST REV	* 2ND REV	* 3RD REV
TRANSMISSION PUMP	1450	43-47									
	High Idle	62-68									
TRANSMISSION CLUTCH APPLY	High Idle	1.5-2	4-6	4-6	4-6			5-7			5-7
INPUT CLUTCH APPLY	High Idle							1.5-2			1.5-2
TORQUE CONVERTER IN	1450							32-37			32-37
	High Idle							52-57			52-57
TRANSMISSION LUBE	1450					20-25	20-25	20-25	20-25	20-25	20-25
	High Idle					36-40	36-40	36-40	36-40	36-40	36-40

*See text **See text

5.2 TRANSMISSION PUMP

WARNING

- Do not start the engine of this machine in closed areas without proper ventilation to remove deadly exhaust gases.
- Warn all people who may be servicing or working around your machine before starting engine.
- Never leave machine unattended with engine running.

IMPORTANT: The pump flow cannot be checked at high idle if the test kit shown in Fig. 4-2 is used because the pump output at high idle is greater than the capacity of the flow meter. Set engine speed at 1450 rpm before checking the pump flow. Pump output at this speed can be checked with no danger of damaging the flow meter, and will give an accurate indication of the pump condition.

5.2.1
Install flow block in line between pressure regulating valve and filter; Fig. 5-1 illustrates one method of hookup. If hose assembly can not be made using components shown in Fig. 5-1, hose assembly 70664615 can be used. Check flow with transmission in neutral; refer to 5.1 for specified flow.

5.2.2
Flow check results:

5.2.2.1
No flow. Pump drive shaft broken; remove and repair pump (6.5).

5.2.2.2
Low flow, flow meter needle fluctuates during check, suction line screen clogged and/or leak in suction line. Remove and clean screen and/or tighten suction line fittings.

NOTE: If suction line screen is clogged replace the filter elements. Cut the old elements open and inspect them for foreign material indicating a failure in its early stage.

5.2.2.3
Low flow. Repair or replace pump if flow is less than 53 gpm at 180 psi (200.6 lit/min at 12.65 kg/cm^2) at high idle or 36 gpm at 180 psi (136.2 lit/min at 12.65 kg/cm^2) at 1450 rpm.

5.3 TRANSMISSION CLUTCH APPLY

5.3.1
Install flow meter flow block in line coming out left rear side of pressure regulating valve. Fig. 5-2 illustrates one method of hookup; other hookups can be used if different fittings are available.

5.3.2
Engage each range clutch separately by pulling transmission shift lever down center of shift guide, then engage all three ranges in both directions; move lever to neutral. Leave shift lever in each position long enough to get an accurate flow reading. Refer to 5.1 for specified flow.

5.3.3
Flow check results:

5.3.3.1
High flow in neutral. Blown gasket between one of the clutch shaft shuttle valve bodies and its front cover.

NOTE: This trouble will be accompanied by a noticeable increase in oil temperature and high lube pressure.

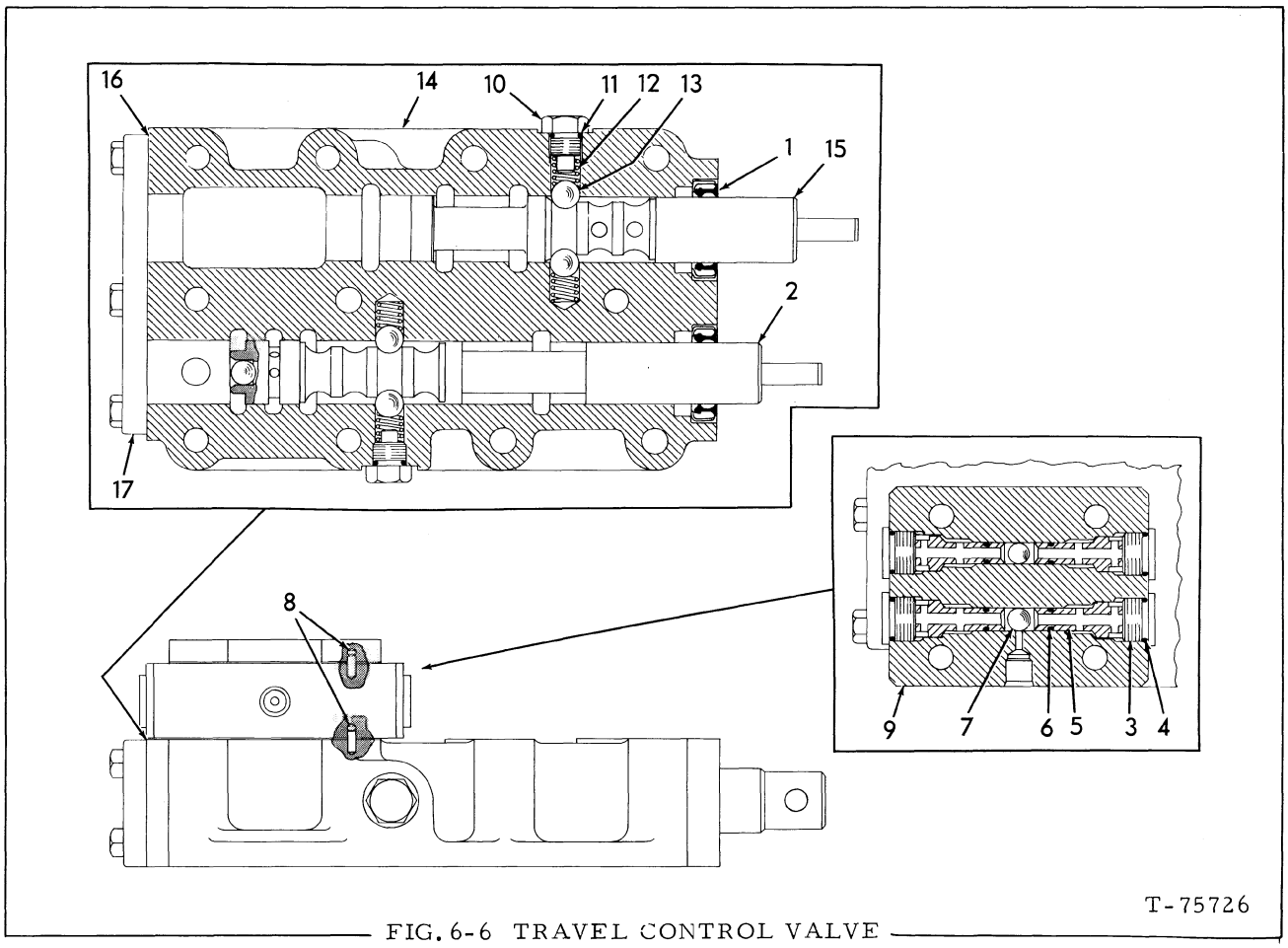

FIG. 6-6 TRAVEL CONTROL VALVE

1. Oil seal
2. Range control plunger
3. Plug
4. O-ring
5. Check ball seat
6. O-ring
7. Check ball
8. Roll pin
9. Check valve body
10. Plug
11. O-ring
12. Detent spring
13. Detent ball
14. Body
15. Direction control plunger
16. Gasket
17. Cover

6.2.3.2
Install new O-ring, Fig. 6-5 (22) (24) on pilot body (23); lubricate O-ring and install pilot body -- small end first -- in large bore in end cover (37). Coat washer (34) and check valve (35) with petroleum jelly and install in end cover (37).

6.2.3.3
Stand valve body, Fig. 6-5 (3) on end with large end of bores up. Install piston stop (28) in valve body; install spring (29) and piston (32) (piston (31) on early models) in piston stop (28). Install new O-ring (33) on end of piston stop (28) and new gasket (36) on end of valve body (3); install end cover (37) on valve body.

NOTE: Use caution while installing end cover to avoid damage to O-rings (22) and (33). Make certain washer (34) and check valve (35) do not fall from their bore while installing end cover.

6.2.3.4
Install new O-ring on plug, Fig. 6-5 (6); install and tighten plug. Turn valve body (3) end for end and stand on end cover (37); make certain spring (29) and piston (32) do not fall from their bore.

6.2.3.5
On early models only, install piston stop, Fig. 6-5 (30) in spring (29). Install piston (27) -- solid end first -- in bore against

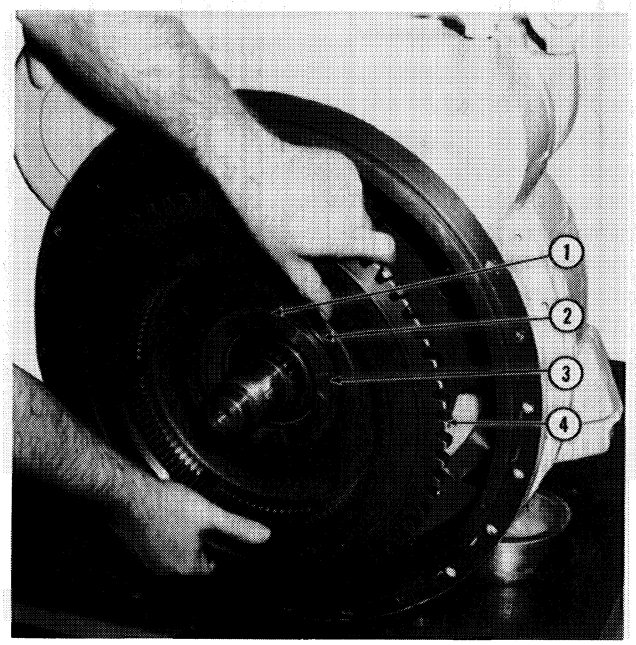

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FIG. 7-8 REMOVING SPIDER AND ACCESSORY DRIVE GEAR

1. Washer (split)
2. Snap ring
3. Accessory drive gear
4. Spider (back plate)

7.2.4
Remove piston, Fig. 7-5 (2) from carrier (3); remove sealing rings from piston and carrier. Remove dump piston cap (4) and dump piston from carrier.

7.2.5
Remove all friction plates from spider and clutch hub. Install puller as shown in Fig. 7-7 and pull clutch hub from driving flange.

7.2.6
Remove spider and accessory drive gear as an assembly, Fig. 7-8. Lay spider down with clutch splines up; remove snap ring, Fig. 7-8 (2), push spider down, remove washer (1), remove accessory drive gear (3) from spider.

7.3 GEAR HOUSING DISASSEMBLY

7.3.1
Turn converter on table so rear yoke is extended into hole in table; block converter in level position as shown in Fig. 7-10. If this type table is not available, block converter high enough that rear yoke clears the top of table.

7.3.2
Remove capscrews attaching gear housing to torque converter housing; pry gear housing away from torque converter housing.

NOTE: Pump driving shafts must be removed with gear housing. However it is possible for

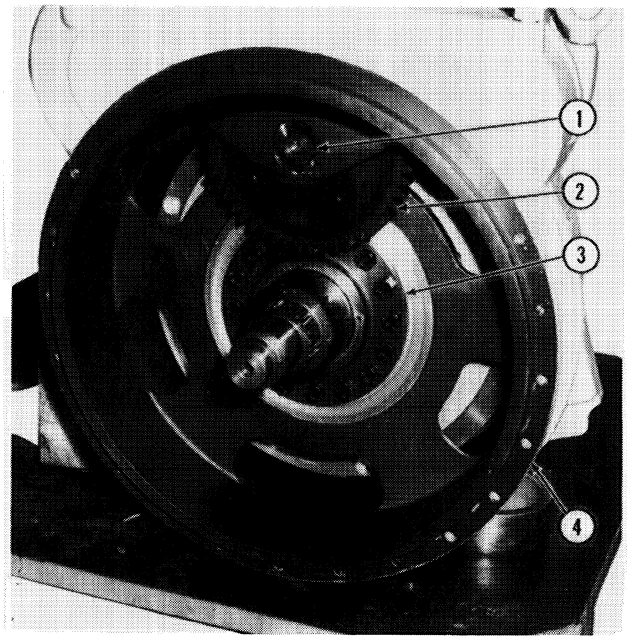

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FIG. 7-9 GEAR HOUSING -- INPUT CLUTCH REMOVED

1. Idler gear shaft
2. Idler gear
3. Clutch driving flange
4. Gear housing

the shafts to fall free after they have cleared the torque converter housing. One method of preventing the shafts from falling is shown in Fig. 7-10 and 7-26.

7.3.3
Attach lifting eyes and hoist to gear housing as shown in Fig. 7-10 and lift it from the converter.

7.3.4
Remove all shafts and gears from gear housing; use a suitable puller to remove any bearings which must be replaced.

7.4 TORQUE CONVERTER DISASSEMBLY

7.4.1
Remove clutch driving flange, Fig. 7-10 (3) from rotating housing.

IMPORTANT: Do not pry driving flange from rotating housing; gauges made in rotating housing while prying will affect its balance. If driving flange is difficult to remove, tap it in one direction enough to open a small gap between the flange and rotating housing; place a wedge in the gap and tap the flange in the opposite direction. Repeat tapping and wedging procedure until driving flange is removed. Do not cock flange too much while removing or sealing rings in I. D. of the flange may be damaged.

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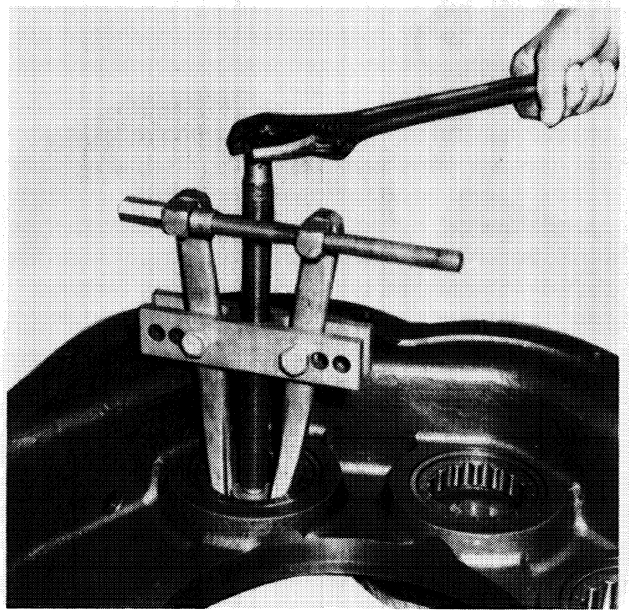

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FIG. 8-17 REMOVING FORWARD/ REVERSE SHAFT REAR BEARING

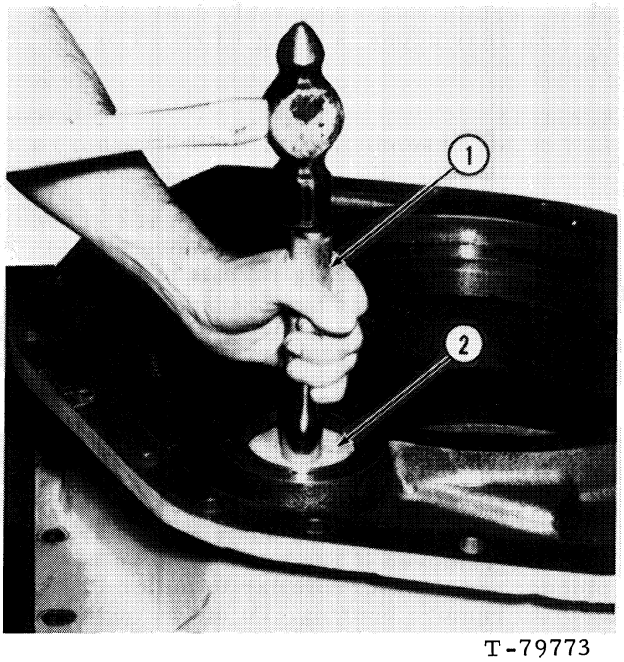

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FIG. 8-18 REMOVING FORWARD/ REVERSE SHAFT REAR SEAL

1. Driver handle
2. Driver disc (3.12"(79.2 mm)dia.)

8.2.1.16
Turn rear cover over; use a bushing driver similar to the one shown in Fig. 8-18 to drive rear seal and pilot washer from bore.

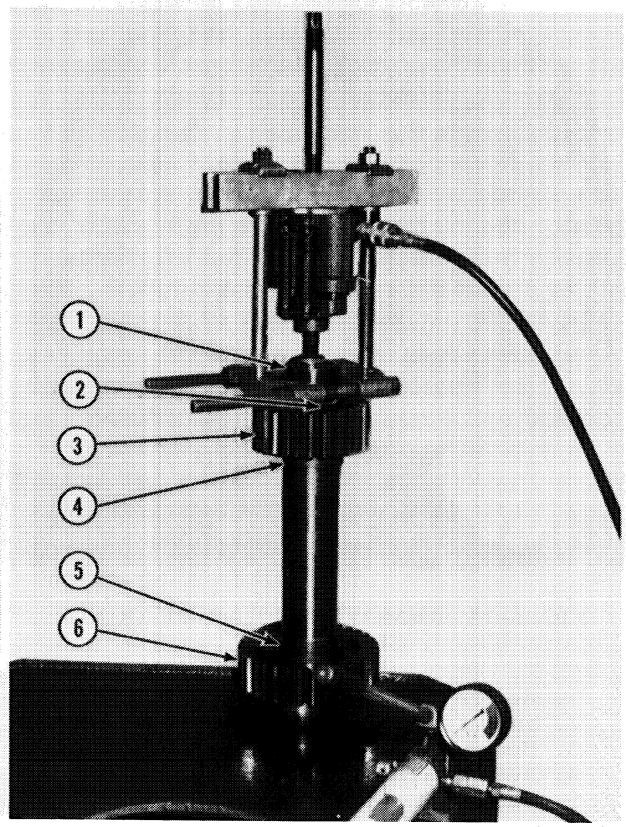

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FIG. 8-19 REMOVING BEARING RACE FROM COUNTERSHAFT

1. Bearing race
2. Snap ring
3. Gear
4. Spacer
5. Spacer
6. Gear

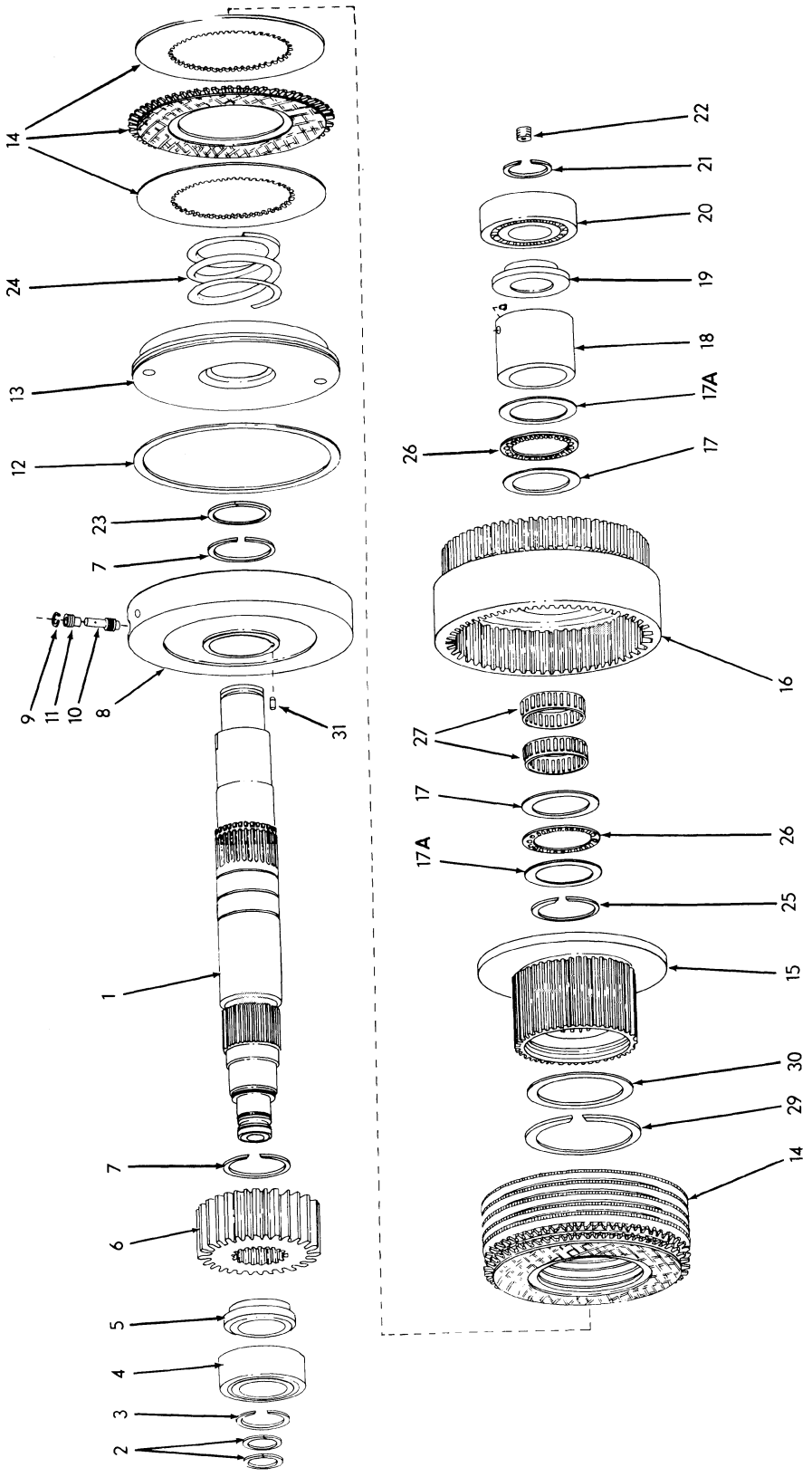
8.2.2 BEVEL PINION SHAFT DISASSEMBLY

8.2.2.1
Only two pieces remain on bevel pinion shaft after shaft has been removed, the rear bearing inner race and first speed gear spacer. Race and spacer may be removed together by using a press and suitable bearing puller attachment.

8.2.3 COUNTERSHAFT DISASSEMBLY

8.2.3.1
Use a puller similar to that shown in Fig. 8-19 to remove front and rear bearing races from shaft.

8.2.3.2
Remove snap ring, Fig. 8-19 (2) from shaft; slide gear (3) and spacer (4) from shaft. Turn shaft end for end and repeat this procedure to remove parts from opposite end.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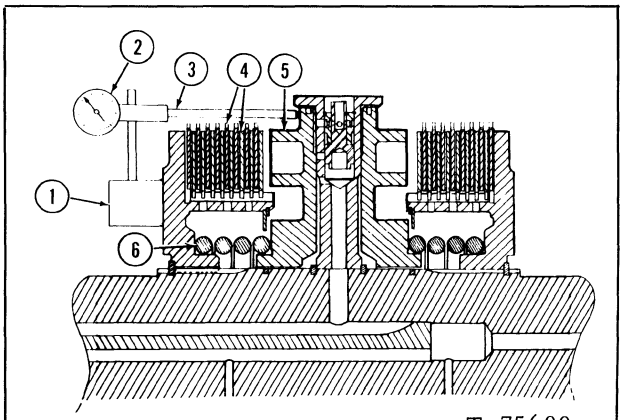

FIG. 8-49A DETERMING TRAVEL OF APPLY PISTON

1. Magnetic base
2. Dial indicator
3. Indicator rod
4. Clutch plates
5. Apply piston
6. Return spring

8.5.1.16
Install magnetic base on clutch hub as shown in Fig. 8-49A. Mount dial indicator with indicator rod as shown. Be certain that indicator rod is resting on piston and not on snap ring or piston housing.

8.5.1.17
Apply pressure to piston as described in 8.5.1.15 and set gauge to zero. Release piston and check travel. Piston travel should be .080 -- .165" (2.03 -- 4.19 mm).

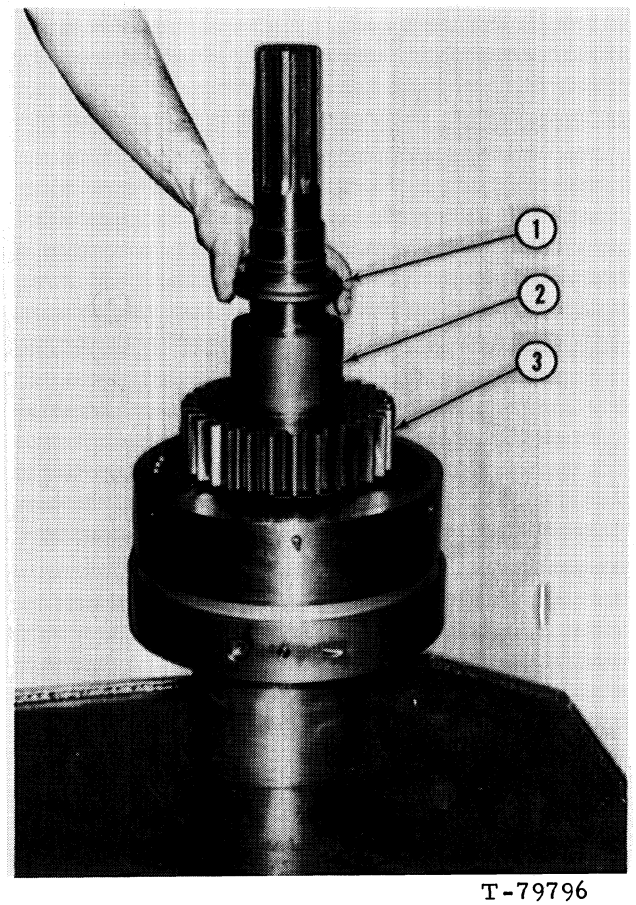

FIG. 8-50 INSTALLING REAR BEARING SPACER

1. Rear bearing spacer
2. Drum and gear spacer
3. Drum and gear

8.5.2 COUNTERSHAFT ASSEMBLY

8.5.2.1
Install spacer, Fig. 8-21 (7), gear (9) and snap ring (10) from rear end of shaft. Install spacer (7), gear (6) and snap ring (5) from front end of shaft.

NOTE: Both gears can be installed either direction on shaft.

8.5.2.2
Use a bearing heater similar to the one in Fig. 8-51 and heat bearing races to 250°F. (121°C). Use a temperature indicating crayon to control temperature. Install races on shaft; make certain they are properly seated on shaft.

8.5.3 BEVEL PINION SHAFT ASSEMBLY

8.5.3.1
Use a suitable press to install rear bearing inner race and spacer. Some bearings have the letter "B" or "pinion side" etched on one side of the race; this side must be against the pinion.

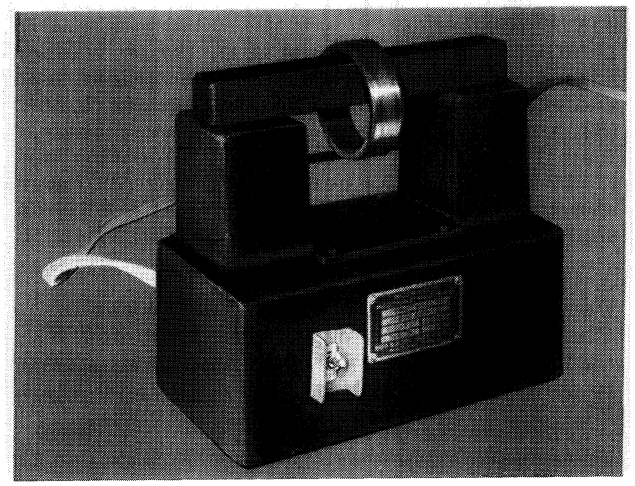

FIG. 8-51 HEATING BEARING RACE (Typical)

8.5.3.2
Remainder of the shaft parts are installed after shaft is in transmission case.

leaks and correct any found. Observe oil pressure gauges for normal readings; if normal readings are not indicated within a few minutes, stop engine and determine cause.

Run engine long enough to heat oil in system to normal operating temperature; lock transmission shift lever in neutral during warm-up period. Check oil level (check procedure is stamped on oil level gauge rod); oil level must be within operating range marks on gauge rod.

8.6.10
Make any pressure and/or flow checks to be certain all parts are working properly (refer to TOPIC 4 and/or 5). Shift inhibit system pressures (4.9) must be checked so a final adjustment can be made.

8.6.11
Install floor plate on tractors not equipped with a cab; if tractor is equipped with a cab refer to Cab Service Manual for proper procedures and lower cab.

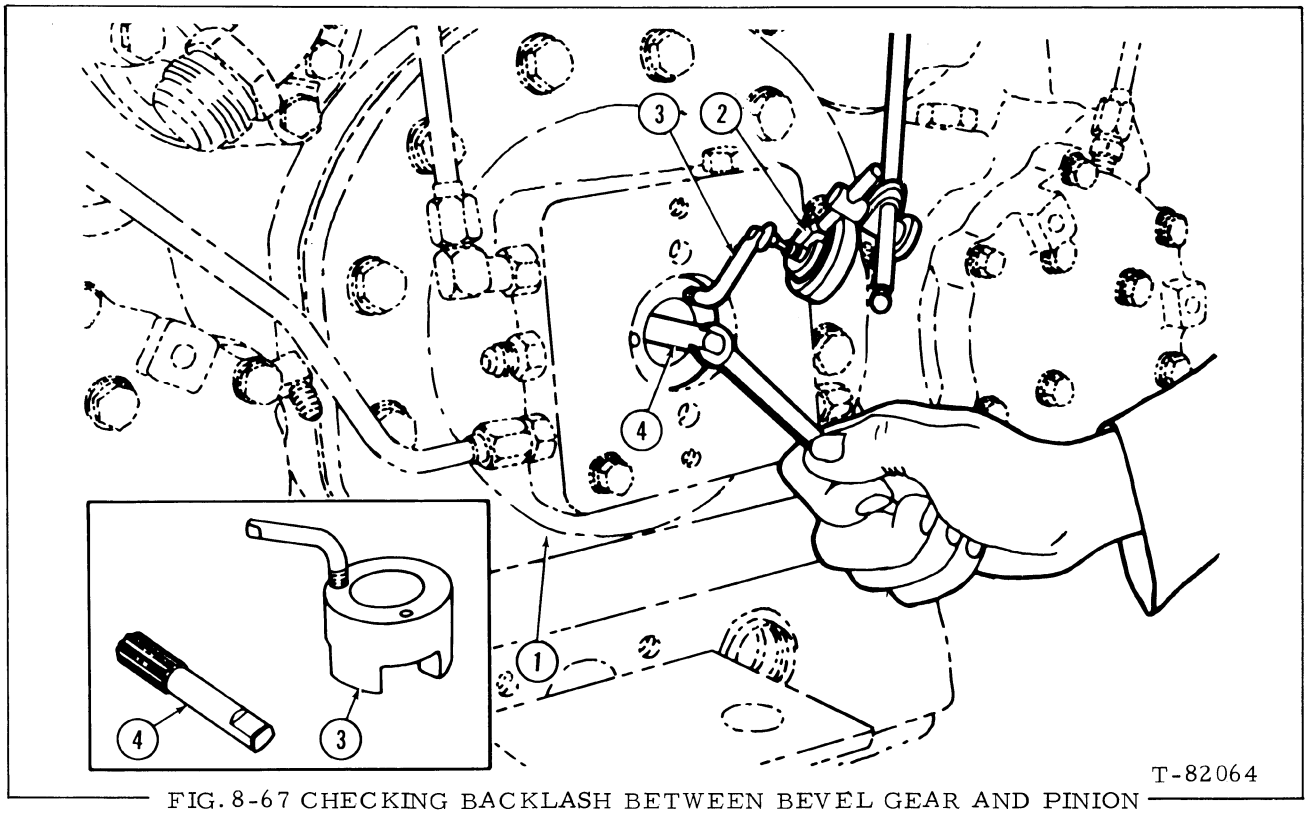

FIG. 8-67 CHECKING BACKLASH BETWEEN BEVEL GEAR AND PINION

1. Transmission
*2. Dial indicator
*3. Shaft indicator
*4. Adapter

*See Service Tools

bearing caps turn freely and smoothly on the cross journal, and if there is no evidence of rust or a failed grease seal around the base of the bearing cap, the spider can be re-packed and re-used.

10.2 ASSEMBLY AND INSTALLATION

10.2.1
Attach front and rear spider assemblies to connecting plate with lube access plugs aligned. Lubricate threads and underside of head of spider attaching capscrews; torque them to 110 -- 135 lbs. ft. (15.2 -- 18.7 m-kg).

10.2.2
Slide rear yoke all the way back on transmission input shaft. Install front yoke (if removed) and torque retaining capscrew to 90-100 lbs.ft. (12.4-13.8 kgm); secure with lockwire.

10.2.3
Place universal joint assembly on front yoke and install attaching capscrews; torque capscrews to 110 -- 135 lbs. ft. (15.2 -- 18.7 m-kg).

10.2.4
Align universal joint with rear yoke; move rear yoke forward and install attaching capscrews; torque capscrews to 110 -- 135 lbs. ft. (15.2 -- 18.7 m-kg).

31

crawler tractor

STEERING CLUTCHES and BRAKES

service manual

S/N 84M 01001 - UP

Form 73108461 English

⚠ WARNING

STUDY THE OPERATION AND MAINTENANCE INSTRUCTION MANUAL THROUGH BEFORE STARTING, OPERATING, MAINTAINING, FUELING OR SERVICING THIS MACHINE.

⚠ The Operation and Maintenance Instruction Manual provides the instructions and procedures for starting, operating, maintaining, fueling, shutdown and servicing that are necessary for properly conducting the procedures for overhaul of the related components outlined in this Service Manual.

⚠ This symbol is your safety alert sign. It MEANS ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED.

⚠ Read and heed all safety instructions carrying the signal words WARNING and DANGER.

⚠ Machine mounted safety signs have been color coded yellow with black borders and lettering for warning and red with white borders and lettering for danger points.

FOREWORD

Always furnish serial number if making an inquiry to dealer or factory about this machine.

Many equipment owners employ the Dealer Service Department for all work other than routine lubrication and minor service. This practice is encouraged, as our Dealers are well informed and equipped to render efficient service by factory trained mechanics.

Illustrations show standard and optional items.

IMPORTANT

The information in this manual was current at the time of publication. It is our policy to constantly improve our product and to make available additional items. These changes may affect procedures outlined in this manual. If variances are observed, verify the information through your Dealer.

Fiatallis is not responsible for any liability arising from any damage resulting from defects caused by parts and/or components not approved by Fiatallis for use in maintaining and/or repairing products manufactured or merchandized by Fiatallis.

In any case, no warranty of any kind is made or shall be imposed with respect to products manufactured or merchandized by Fiatallis when failures are caused by the use of parts and/or components not approved by Fiatallis.

1.1 MECHANICAL OPERATION

1.1.1
Steering clutches and brakes are used to steer and stop tractor. Both are located in steering clutch compartments in main housing. Multiple plate steering clutches are held in engaged (driving) position by heavy springs; clutches are hydraulically disengaged.

1.1.2
Brake is a three section brake band with bonded linings; sections are hinged together around brake drums which enclose steering clutches. Brakes are applied through foot operated, hydraulically assisted linkage and are used in conjunction with steering clutches to steer tractor. Brakes are automatically applied when transmission shift lever is in neutral and between speed and direction shifts.

1.1.3
In the event of power failure, brakes are spring applied automatically. If tractor is coasting, move transmission shift lever to neutral. They can also be assisted mechanically; however, considerable foot pressure will be required.

1.1.4
Steering clutches and brakes operate in oil to provide cooler operating temperature and longer component life.

1.2 FUNCTION OF HYDRAULIC SYSTEM COMPONENTS

1.2.1 HYDRAULIC PUMP

1.2.1.1

The dual-type hydraulic pump contains two sets of gears. The front set of pump gears supply oil to right steering clutch and left brake; rear pump gears supply oil to left steering clutch and right brake. The drive end of pump is considered front regardless of position on tractor.

1.2.1.2
The hydraulic pump is mounted on the torque convertor (Fig. 4). Pump is driven at 1.27 x engine speed. Pump output at engine high idle is 12 -- 13 gpm (45-49 lit/min) from each set of gears.

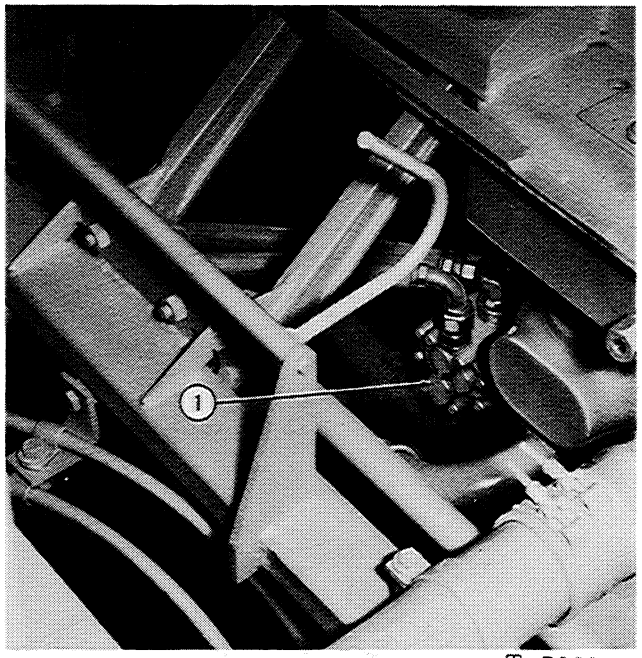

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FIG. 4 HYDRAULIC PUMP LOCATION

1. Hydraulic pump.

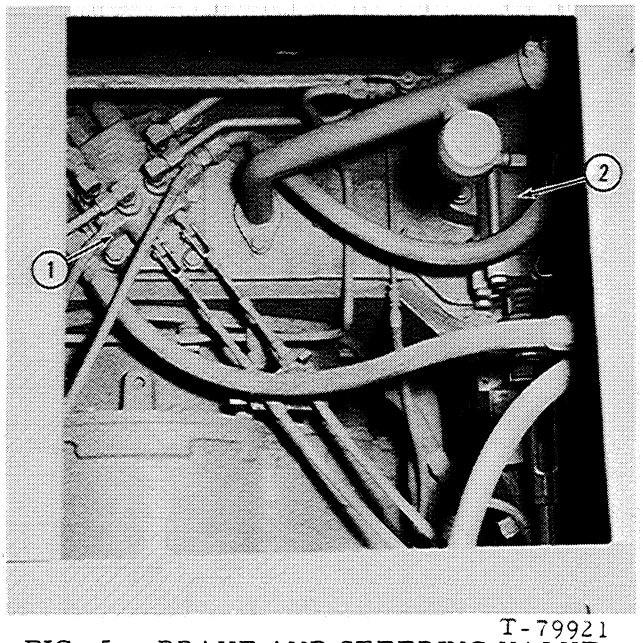

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FIG. 5 BRAKE AND STEERING VALVE LOCATION
(Prior to Tractor S/N 84M01821)

1. Steering valve
2. Brake valve

WARNING

⚠ Never use gasoline, solvent or other flammable fluids to clean parts. Use authorized commercial, non-flammable, non-toxic solvents.

⚠ Wear safety glasses with side shields or goggles when using compressed air for cleaning to reduce the danger of personal injury from flying particles. Limit the pressure to 30 psi (2.1 kg/cm^2) according to local or national requirements.

3.7.2
Low inlet pressure may be caused by a worn steering pump, plugged strainer or loose suction line. Check pump, strainer and line, and clean or repair as necessary.

3.7.3
Low inlet pressure may also be caused by valve, Fig. 6B (8) being stuck in the open position. Valve (8) may remain in the open position if it is not free in the bore, if spring (7) is broken, or if orifice in valve is plugged.

3.7.4
Low inlet pressure may also be caused by spring (which applies pressure to poppet (9)) being broken. This would allow poppet to open before pressure could come within specifications.

3.8 BRAKES APPLY WITH FOOT PEDAL BUT NOT WITH HAND LEVERS

3.8.1
Refer to Fig. 6B. Check linkage adjustment to spool (14). At the second position of the steering levers (clutch release, brake apply) plunger should travel 42mm(1.2 in.) out of body.

3.8.2
Screw, Fig. 6B (11) may be broken allowing guide (15) to remain in position. This would prevent a decrease in tension on spring (10) and brake release pressure would remain high.

3.8.3
Spool (1) or (4) not free in bore.

3.9 BRAKES APPLY WITH HAND LEVER BUT NOT FOOT PEDAL

3.9.1
Brake spool, Fig. 6B (16) not traveling far enough into valve (12). Adjust linkage.

3.10 NEITHER HAND LEVER NOR FOOT PEDAL APPLIES BRAKE

Refer to para. 4.2.3, Tests 4 and 5. If brake release pressure (P2) is below 3.2 kg/cm^2(45 psi) in Test 4, and brake apply pressure is above 46.6kg/cm^2(225 psi) in Test 5, problem is either in brake valve, Fig.6B (12) such as broken spring, or in brake band area.

each adjustment to properly locate operating plunger in valve body.

4.5.2 COMBINED STEERING-BRAKE VALVE PRESSURE(Effective S/N 84M01821)

4.5.2.1 Pressure regulating valves may be adjusted externally; remove nuts Fig. 11A (1) and (3) to make pressure adjustment. Adjustment is made by turning screw (4) clockwise to increase pressure, and counterclockwise to decrease pressure. Right screw affects right inlet pressure; left screw affects left inlet pressure. Turn in small increments so the pressure increase will not be too great.

4.5.3 BRAKE PRESSURE

Brake pressure is regulated by the brake regulator valve. The brake regulator valve is controlled by pressure (sensing) from the shift inhibitor valve. Therefore,if the brake pressure is too low, refer to Transmission and Torque Converter Service Manual to adjust the pressure from inhibitor valve. If the pressure is correct at shift inhibitor valve,then the brake regulator valve springs should be checked. See Topic 8. Also check for leakage in brake valve.

NOTE: Combined Steering-brake valves can be shimmed in the area of Spring, Fig. 11A (22) to change required pressure to open regulator valve. One shim, .030"(.762mm) will change opening pressure 13psi(.914kg/cm^2).

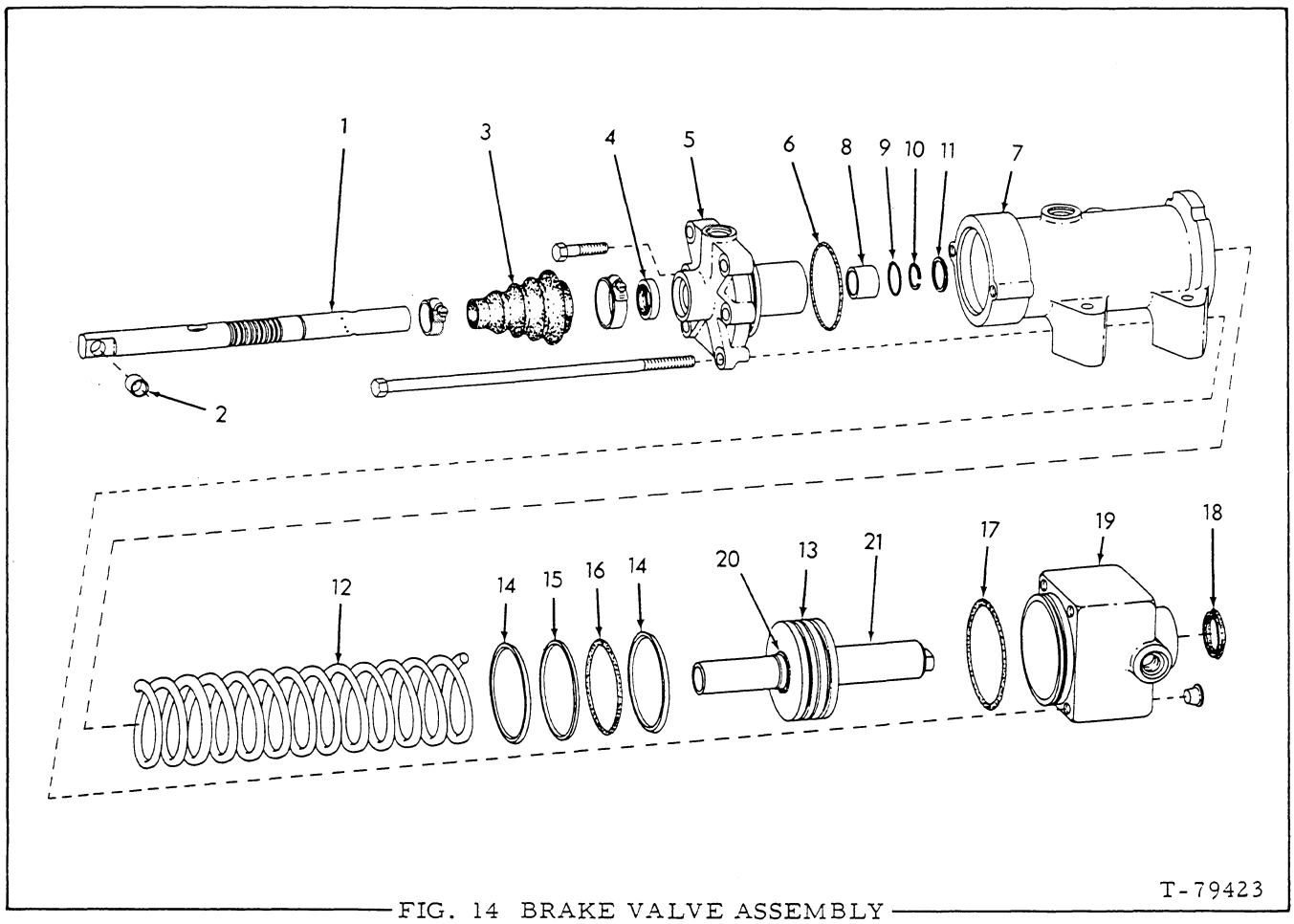

FIG. 14 BRAKE VALVE ASSEMBLY

1. Rod assembly
2. Bushing
3. Boot
4. Seal
5. Cover (front)
6. O-ring
7. Housing
8. Wear ring
9. O-ring
10. Ring
11. Ring
12. Spring
13. Piston assembly
14. Ring guide
15. Seal ring
16. O-ring
17. O-ring
18. Seal
19. Cover (rear)
20. Piston retaining ring
21. Spool

5.3.2.4
The clearance between the rod (O.D.) and the piston spool bore should not exceed .006" (.15 mm). The O.D. of rod at piston spool bore location should be no less than 1.1235 " (28.537 mm).

5.3.2.5 Piston and Rear Cover
The normal clearance between the piston and rear cover is .006" to .014" (0.15 to 0.36 mm). If the O.D. of piston or rear cover bore is pitted or scuffed it should be replaced.

5.3.2.6 Piston Spool to Rear Cover Shaft Bore Clearance
The normal clearance between piston spool (O.D.) and the rear cover bore is .001" to .007" (0.025 to 0.18 mm). If the clearance exceeds .009" (0.23 mm) or the spool or cover is scored or pitted, it should be replaced. The spool O.D. at bore location should be no less than 1.749" (44.42 mm).

5.3.2.7 Wear Ring
The I.D. of wear ring should be no greater than 1.131" (28.73 mm).

5.3.3 ASSEMBLY AND INSTALLATION

5.3.3.1
Position new O-ring, Fig. 15 (2) in groove of cover (3). Install a new seal (24) in cover bore.

NOTE: Make certain all components are clean and lubricated before assembling.

5.3.3.2
Install O-ring (11) and wear ring (10) in the front cover bore and secure with snap ring (12), make certain ring is seated properly.

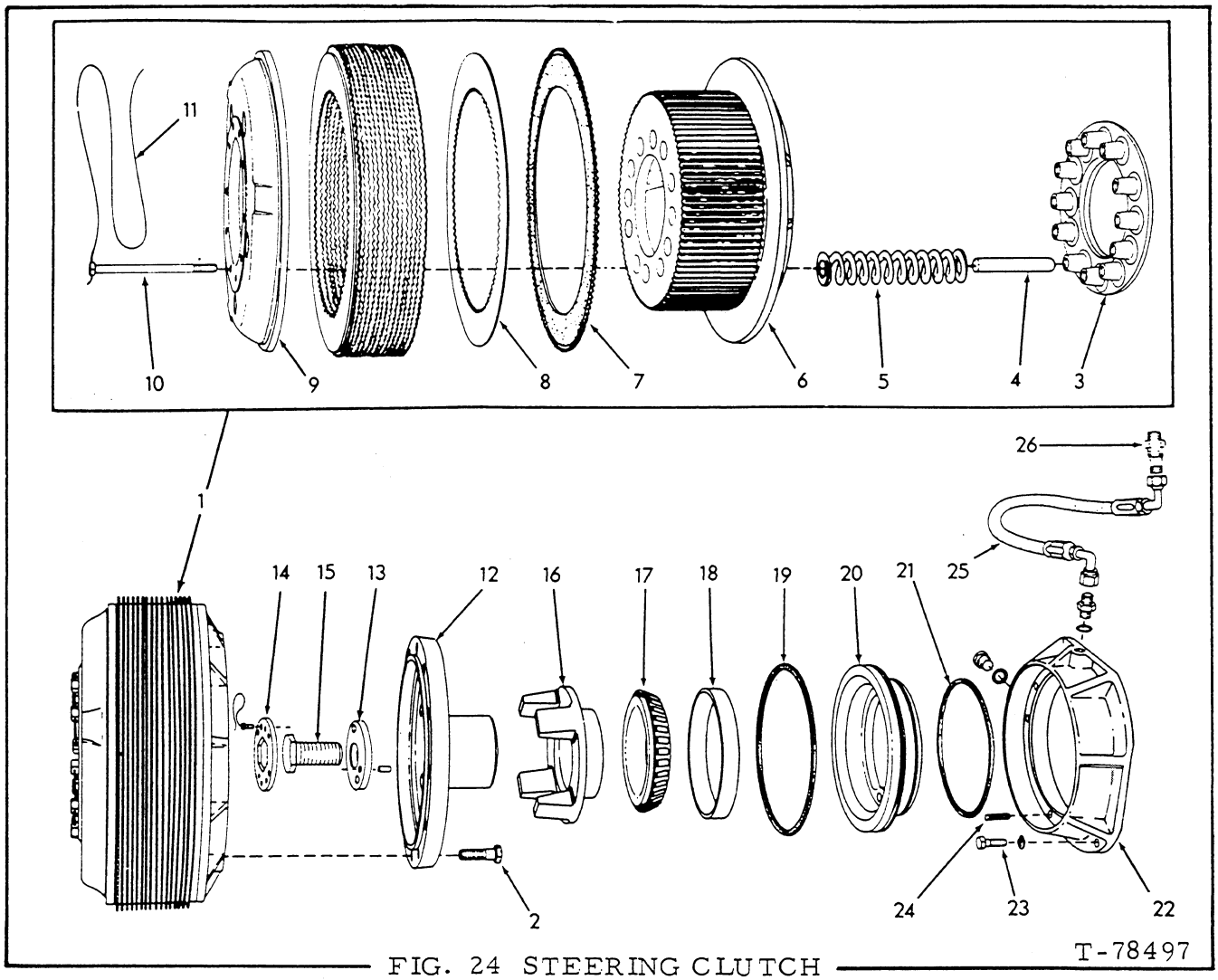

FIG. 24 STEERING CLUTCH

1. Clutch assembly
2. Clutch attaching capscrew
3. Throwout plate
4. Spacer
5. Pressure spring
6. Clutch hub
7. Bi-metallic friction disc
8. Steel disc
9. Pressure plate
10. Throwout plate capscrew
11. Locking wire
12. Clutch driving hub
13. Hub retaining washer w/pins
14. Capscrew lock
15. Hub retaining capscrew
16. Throwout sleeve
17. Throwout bearing cone
18. Throwout bearing cup
19. Piston outer ring
20. Actuating piston
21. Piston inner ring
22. Collector ring
23. Capscrew
24. Piston spring
25. Oil supply line
26. Connector

6.1.15
If throwout bearing is to be replaced, use suitable tools to remove bearing cup from actuating piston, Fig. 24 (20) and pull bearing cone from throwout sleeve (16).

NOTE: Use same procedure and tool to remove brake drum hub if necessary.

NOTE: Several repositionings may be necessary before band assembly will rotate around drum and slide into position.

7.3.3
Assemble the adjusting screw (5), upper pins (6), spring (7), and nut (8). Assemble lower pin (9) and turn pin on screw (5) about 2 turns. Attach adjusting screw (5) to universal drive assembly (10) with pin.

7.3.4
Install top band section (1), hook lower pin (9) in bottom band section bracket (2) and hook upper pin (6) in position on top band section bracket (1). Start upper adjuster into sleeve of lower portion, if adjuster had been removed see step below.

7.3.5
The brake band adjustment assembly does not require removal from compartment cover to remove the steering clutch and brakes; however, if the assembly had been removed, insert the upper portion of universal drive (10) in the sleeve of lower portion. Install spring (11) and washer (11A) on adjuster (drive). Push adjuster through bushing in top of main housing. Compress the spring by raising the adjuster in compartment to permit the installation of roll pin in adjuster. Make certain the pin is centered in adjuster. Install O-ring (12) and guide (13).

7.3.6
Position pivot yoke, Fig. 33 (1) and actuating lever (4) in bracket (3) and insert yoke pin (2).

7.3.7
Install lower yoke, Fig. 34 (2) on actuating lever (3) and insert yoke pin (1).

7.3.8
Install bracket assembly, Fig. 31 (20). Position pivot yoke (17) in rear band section (3) and connect upper yoke (15) to top band section (1) with pin (14) and cotter pins.

⚠ WARNING

Never use gasoline, solvent, or other flammable fluids to clean parts.

7.3.9
Thoroughly clean the mating surfaces of main housing and brake compartment cover plate to remove foreign matter and old gasket material. Clean with commercial, non-flammable, non-toxic solvent.

7.3.10
Position cover plate with a new gasket on main housing. Install capscrews and lockwashers to attach band lever bracket Fig. 31

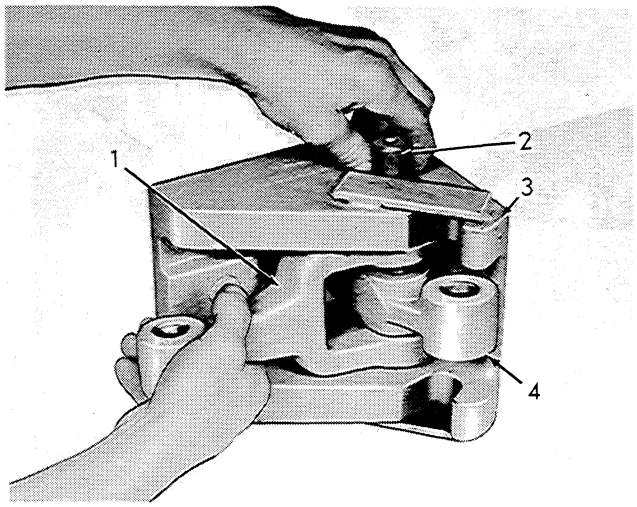

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FIG. 33 INSTALLING BAND ACTUATING LEVER AND UPPER YOKE IN LEVER BRACKET

1. Pivot yoke
2. Yoke pin
3. Band lever bracket
4. Band actuating lever

(20) to compartment cover plate but do not tighten. Make certain locating pin, Fig. 31 (21) in band lever bracket (20) is started into holes in compartment cover.

7.3.11
Be certain compartment cover plate is positioned over dowel pin in main housing. Install but DO NOT tighten, all cover plate capscrews, spacers and lockwashers.

7.3.12
Torque band lever bracket capscrews to 220-280 lbs. ft. (30.4--39 m-kg).

7.3.13
Refer to Fig. 31 and install brake valve (28) (if removed) on compartment cover and secure with capscrews to a torque of 110 -- 135 lbs. ft. (15.2 -- 18.6 m-kg); also torque cover attaching capscrews to 110 -- 135 lbs. ft. (15.2 -- 18.6 m-kg).

7.3.14
If removed, install boot, (24) on linkage cover or valve. Connect link (26) to brake lever (18) with yoke pin (25) and cotter pin. Secure the boot with clamps.

GENERAL SUPPLEMENT
to

FORM 70698975 - 21-C Undercarriage Manual
73108463 - 31 Undercarriage Manual
70695529 - 41-B Undercarriage Manual
73127702 - FD30 Undercarriage Manual
73127736 - FD40 Service Specifications Manual
73127739 - FD50 Service Specifications Manual

for

TOPIC I. REBUILDING AND LUBRICATING SEALED AND LUBRICATED TRACK
TOPIC II. LUBRICATING USED SEALED AND LUBRICATED TRACK
TOPIC III. FIELD REPLACEMENT OF A TRACK SEAL

(4/83)

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Insert a copy of this supplement under the front cover of each of the above manuals.

==========

WARNING - If engine is to be started indoors, insure proper ventilation to remove deadly exhaust gases.

==========

WARNING - Before moving machine, or attachments, be sure exposed personnel in the area are clear of the unit. WALK COMPLETELY AROUND machine before mounting. Sound horn.

==========

WARNING - Brakes are inoperative when manually released for servicing. Provision must be made to maintain control of machine by blocking or other means.

==========

WARNING - Do not work under or near unblocked or unsupported linkage, parts or machine.

==========

WARNING - Wear safety glasses with side shields or goggles when using compressed air for cleaning to reduce the danger of personal injury from flying particles. Limit the pressure to 2.1 bar (30 psi) according to local and national requirements.

==========

WARNING - The attachments or tools can be lowered in response to attachment control lever movement with or without engine power.

==========

WARNING - Never use gasoline, solvent or other flammable fluids to clean parts. Use authorized commercial, non-flammable, non-toxic solvents.

8. Fig.14. After the track links are realigned, remove the ram.

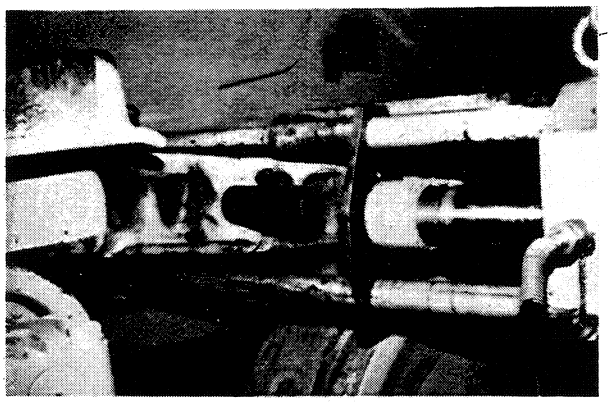

FIG.14 INSTALL GUIDE PIN

9. Clean the pin bore thoroughly. Clean and buff the track pin. Be sure the taper on end of pin is sufficient, and, very smooth (so it will enter the seal without damage to seal). Apply #75000780 Locking Sealant (Loctite 290) to the inner link pin bore, and to the pin (only on the area of the pin which will contact the outer link pin bore). Lubricate the remainder of the pin O.D. with SAE 90EP (extreme pressure) gear oil.

10. Fig.15. Install the guide pin, and remove the chain and hoist securing the track. Use the pin pusher to force the track pin into position within the track. The track pin forces the guide pin out as the pin is installed. Once the pin is installed, use the Lubricating Pump and Nozzle to fill the pin with oil (refer to Topic II). Install the track shoes and tighten the capscrews to specified torque (refer to Topic I.G).

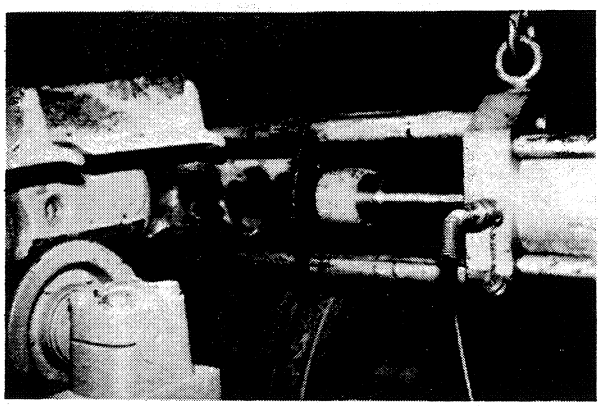

FIG.15 INSTALL TRACK PIN

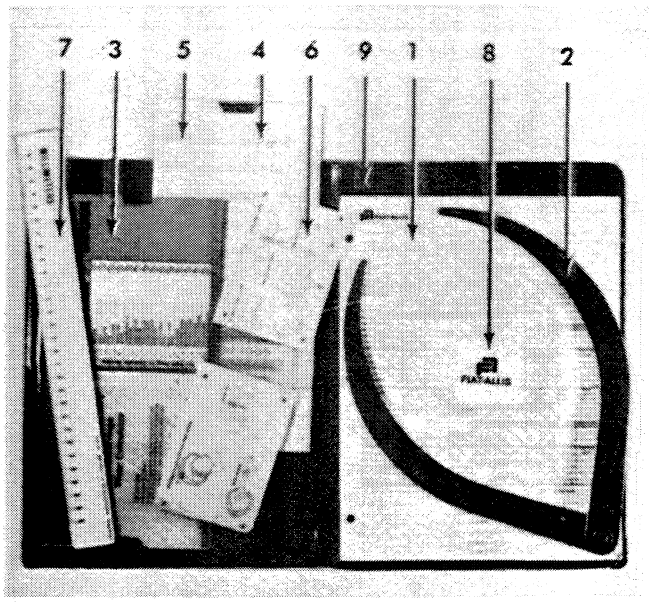

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FIG. 5 UNDERCARRIAGE MEASUREMENT KIT

1. Undercarriage survey form (75120274)
2. Calipers (75000522)
3. Wear calculator (75000523)
4. Calculator slide (HD-41 S/N 1001 to 3000 and 31)(75000567)
5. Calculator slide (21C and MMT units (75000694)
6. Depth gauge case (75000525)
7. Depth gauge scale (75000526)
8. Steel tape, U.S. and Metric (75000527)
9. New binder (75000696)

life can be prolonged by switching track assemblies and idlers. If wear on one side of sprocket teeth is pronounced, sprocket segments can also be switched to obtain new wear surface.

3.2.5 Using Tractor To Back-Fill

3.2.5.1
Back-fill operation causes higher loads on idlers and front track rollers when tractor is brought to edge of fill. Proper operating technique, Fig. 4 will reduce this load, but track rollers should be inspected regularly; at first indication of abnormal wear, front track roller(s) can be switched (moved to another position) to prolong life.

3.3 TRACK ALIGNMENT

3.3.1
Wear on undercarriage components cannot be prevented, but a systematic inspection program can lead to longer component life with resulting less down time. Proper track alignment can be determined by regular visual inspection, as any misalignment will cause visible wear to all undercarriage components. A complete inspection program is given in Topic 4.

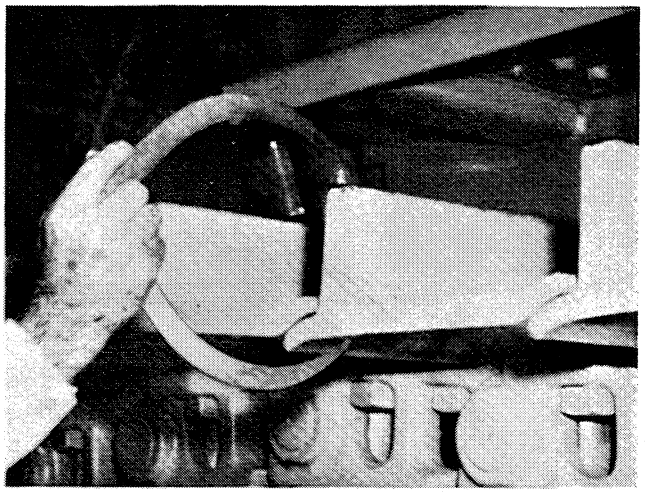

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FIG. 6 MEASURING TRACK SHOE GROUSER

3.4 TRACK

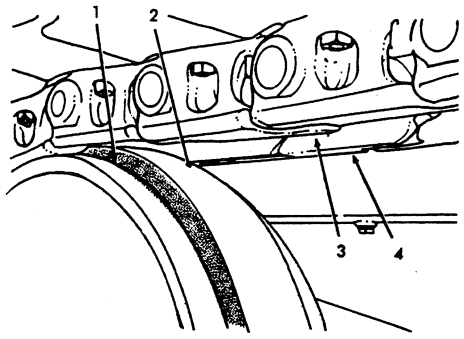
3.4.1 Track Shoes

3.4.1.1
A variety of shoes (28" -- 711.2 mm standard) are available to meet requirements of operating conditions and terrain. It is a good practice to always use the narrowest shoes suitable for the job in order to obtain maximum track life. When working in rock use narrow shoes. Use of extra wide shoes should be avoided unless a definite requirement exists for improved flotation (lower ground pressure). Such shoes will materially decrease life of undercarriage components.

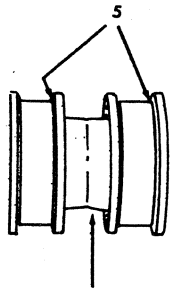
3.4.1.2
Wear of grouser, Fig. 6 can be determined by use of measuring kit, Fig. 5, and calculating its useful life.

3.4.2 Track Link

3.4.2.1
The track links are forged, machined, and heat treated. The bushings interlock in counterbore of links (Fig. 6) with the exception of master link which uses a link to bushing clearance spacer. The master pin can be identified by the large counterbore in the end of track pin.



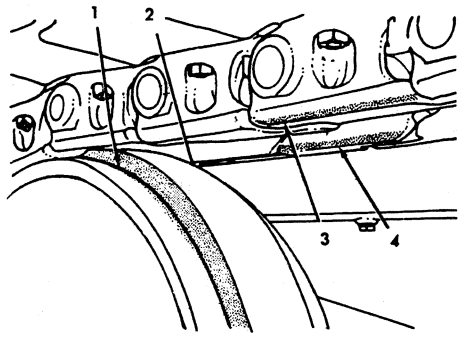
1. HEAVY CONTACT (CUTTING IF TOE-IN IS 1/4" OR MORE) ON IDLER OUTER FLANGE
2. MODERATE CONTACT ON IDLER INNER FLANGE
3. HEAVY CONTACT (CUTTING IF TOE - IN IS 1/4" OR MORE) ON INNER SIDE OF OUTER SIDE LINKS
4. HEAVY CONTACT ON OUTER SIDE OF INNER SIDE LINKS
5. HEAVY CONTACT ON INNER FLANGES.



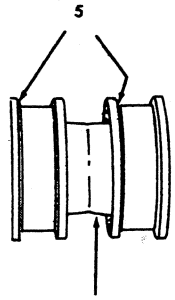
FRONT TRACK ROLLER

T-72954

FIG. 21 WEAR PATTERN - IDLER "TOED-IN"



1. MODERATE CONTACT ON IDLER OUTER FLANGE
2. HEAVY CONTACT (CUTTING IF TOE-OUT IS 1/4"OR MORE) ON IDLER INNER FLANGE
3. HEAVY CONTACT ON OUTER SIDE OF OUTER SIDE LINKS
4. HEAVY CONTACT (CUTTING IF TOE-OUT IS 1/4" OR MORE) ON INNER SIDE OF INNER SIDE LINKS
5. HEAVY CONTACT ON OUTER FLANGES.



FRONT TRACK ROLLER

T-72954

FIG. 22 WEAR PATTERN - IDLER "TOED-OUT"

TOPIC 5 TRACK

WARNING

- If engine is to be started indoors, insure proper ventilation to remove deadly gases.
- Warn all people who may be servicing or working around machine before starting engine.
- Sound horn before starting.
- Never leave machine unattended with engine running.
- Do not work under or near unblocked or unsupported linkage, parts or machine.
- It is unsafe to strike hardened steel parts with anything other than a soft iron or nonferous hammer. When installing or removing such parts wear safety glasses with side shields and heavy gloves, etc., to reduce the possibility of injury.
- Use only grounded auxiliary power source for heaters, chargers, pumps and similar equipment to reduce the hazard of electrical shock.
- Never use gasoline, solvent or other, flammable fluids to clean element.
- Wear safety glasses with side shields or goggles when using compressed air for cleaning to reduce the danger of personal injury from flying particles. Limit the pressure to 30 psi according to OSHA requirements.

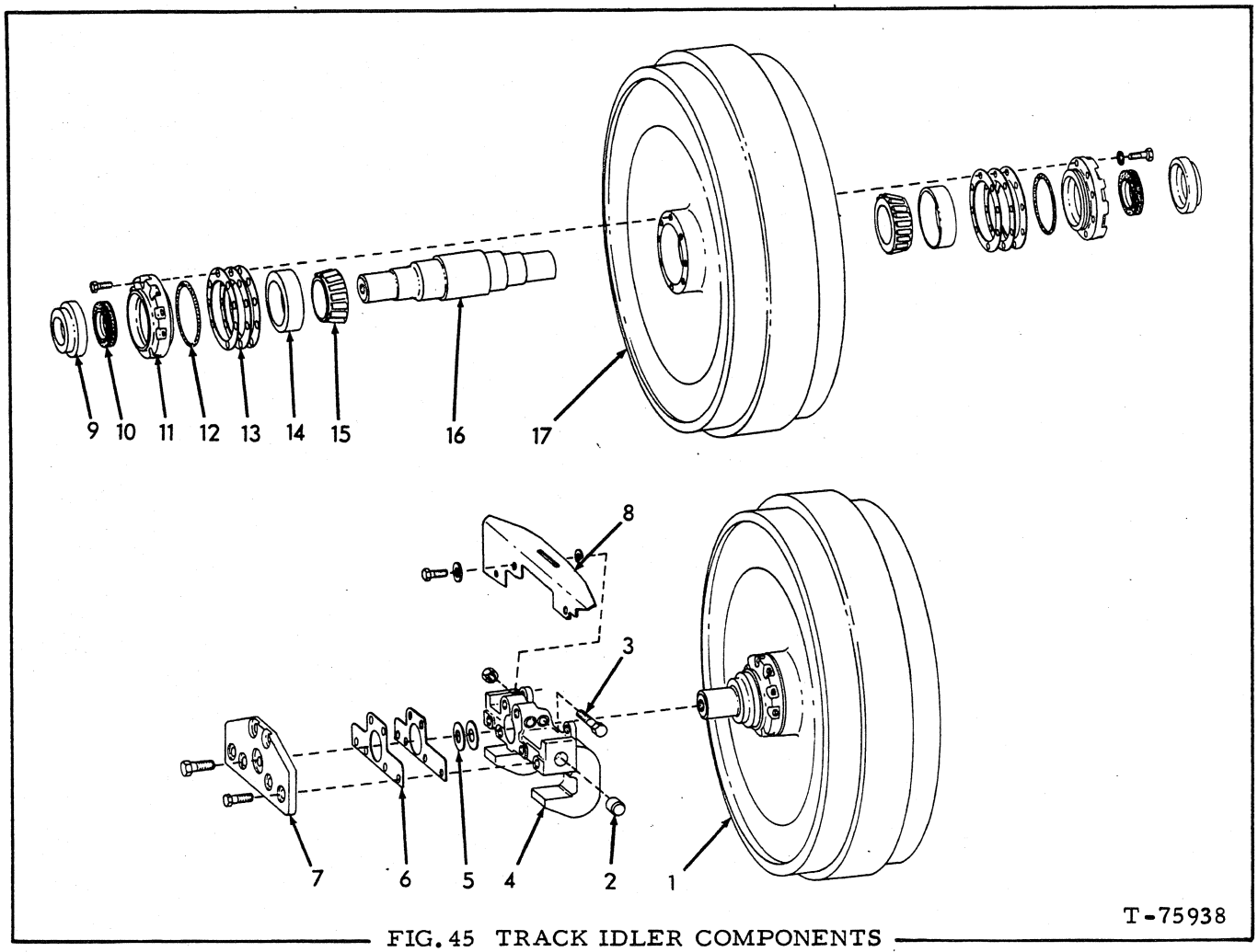


FIG. 45 TRACK IDLER COMPONENTS

1. Idler assembly
2. Dowel (yoke)
3. Clamping capscrew
4. Left bracket
5. Shaft adjusting shims
6. Guide plate shims
7. Guide plate
8. Guard
9. Seal retainer
10. Seal assembly
11. Bearing retainer
12. O-ring
13. Bearing adjusting shims
14. Bearing cup
15. Bearing cone
16. Idler shaft
17. Idler

6.2 MAINTENANCE

6.2.1
Maintenance of track idler consists of a periodic check for bearing adjustment, idler bracket shim adjustment, slide bar wear, lubricant leakage and track alignment. Using undercarriage measuring kit, check the remaining amount of useful life of idler wear surfaces and repair or replace if necessary. See Figs. 41 and 42.

6.2.2
Release all track tension as outlined in 5.2.2.

6.2.3
Place a block of wood in front of track and move tractor forward until block is directly under front track roller to remove any tractor weight or load on idler.

6.2.4
Using a long bar, pry against track idler bearing retainer and idler bracket and check for end play in bearings. If any end play is found, idler assembly must be removed and repaired.

NOTE: Lubricant leakage at seals is a possible indication of loose bearing adjustment or seal damage.

6.3 REMOVAL

6.3.1
Loosen all tension from track assembly described in 5.2.2 Fig. 36, and remove idler yoke guards.

7.5.9.2
Do not remove the plastic band from seal assembly. Carefully insert the seal assembly in bearing retainer bore, making certain that the rubber ring with the barb is installed in bearing retainer bore.

NOTE: If plastic band is broken, the seals may be installed by putting one half in seal retainer and the other half in bearing retainer. However the steel seal ring faces must not be contaminated or damaged.

IMPORTANT: If seal faces are touched or contaminated they must be wiped clean with dry tissue paper, then oiled lightly with a tissue paper dipped in clean lubricant. Do not use a shop towel for this purpose.

7.5.9.3
Apply a light coat of grease on I. D. of seal retainer, making certain that no grease gets into the seal counterbore; then place seal retainer on roller shaft. Using a suitable press, install the seal retainer to the dimension of .514" -- .519" (13.05 -- 13.18 mm) as shown in Fig. 50.

7.5.10
Install the carrier roller in the roller bracket and align the roller to the center line of track idler and track sprocket. Install and tighten capscrew to a torque of 900-1100 lbs. ft. (124.4 - 152 kgm).

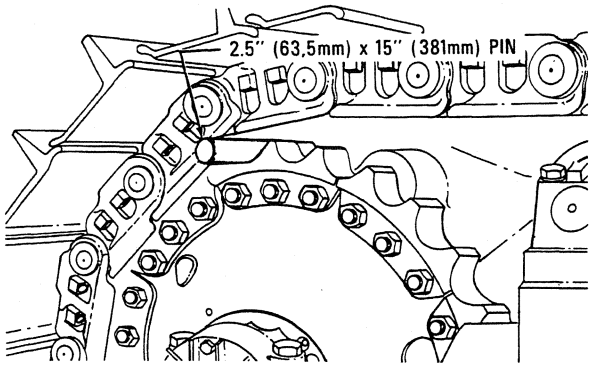


FIG. 58 CHECKING TRACK RELEASE - Typical

9.1 PERIODIC CHECKS

9.1.1
Periodic check should be made to assure a free moving track idler and proper function of release mechanism. Remove rocks, dirt or debris that may have accumulated around track idler, idler yoke and track adjuster.

9.1.2
Check track mechanism by inserting a 2.5" (63.5 mm) diameter steel pin approximately 15" (381 mm) long in sprocket tooth, Fig. 58, at top front of sprocket beneath track. Move tractor rearward until pin is wedged between track and sprocket and the idler is moved to the rear approximately 2" (50.8 mm). Move tractor forward until pin is free and observe if track idler returns to its original position. If idler does not return properly, the track release is not functioning, the idler bracket adjustment is incorrect or the hydraulic track adjuster piston seal is leaking grease.

9.2 REMOVAL AND INSTALLATION OF TRACK ADJUSTER PISTON AND CYLINDER

9.2.1
Refer to 5.2 and Fig. 59, loosen the track.

⚠ DANGER

Fluid under pressure. Do not loosen track tension by unscrewing overload relief valve, Fig. 59 (11).

9.2.2
Remove the front carrier roller/saddle bracket capscrews, Fig. 59 (9) and all guards from above track release and idler yoke.

9.2.3
Using a 50 ton (45390 kg) jack or hoist, raise the tractor and oscillating beam approximately 6" (150 mm) and block beneath the beam. Remove bracket, push bar, and idler yoke,

9.2.4
Install a 1/2"N.C. capscrew in piston puller hole, Fig. 59, and remove the track adjuster piston (3). If piston and cylinder come out of housing to gether, remove fitting (13) to permit removal of piston from cylinder.

NOTE: If piston is difficult to remove from cylinder, reinstall fitting (13) and using a grease gun, force piston from cylinder.

9.2.5
Thoroughly clean the cylinder and piston with non-toxic and non-flammable solvent, wipe dry with a clean cloth.

9.2.6
Remove seals, (14) and (15) from cylinder (16) and wiper seal (17) from front counterbore of cylinder housing (19). Discard seals.

9.2.7
Inspect piston (3) for scoring. If scored, piston should be replaced. Check I.D. of cylinder (16). If scoring or heavy wear pattern is apparent, measure the bore of cylinder. The cylinder I.D. should be no larger than 6.019" (152.88 mm) at any location. The O.D. of cylinder should be no less than 8.002" (203.23 mm).

9.2.8
Clean interior of housing, Fig. 59 (19) and check housing for scoring and wear. Check the rear seal in housing bore making certain it is intact and seated in the bore. If seal is damaged, requiring replacement, refer to 9.3.

9.2.9
Make certain counterbore in housing, Fig. 59 (19) is clean and dry. Apply a coating of Loctite 290 on outside diameter of seal (17). Install metal clad seal in counterbore with wiper lip outward. Make certain that no Loctite is on the sealing surfaces of seal and that the seal is seated.

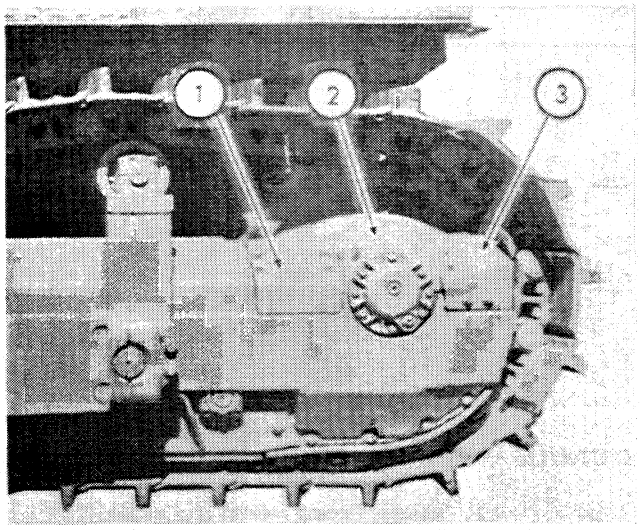


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FIG. 67 SPROCKET GUARDS

1. Front guard
2. Outboard bearing cap
3. Rear guard

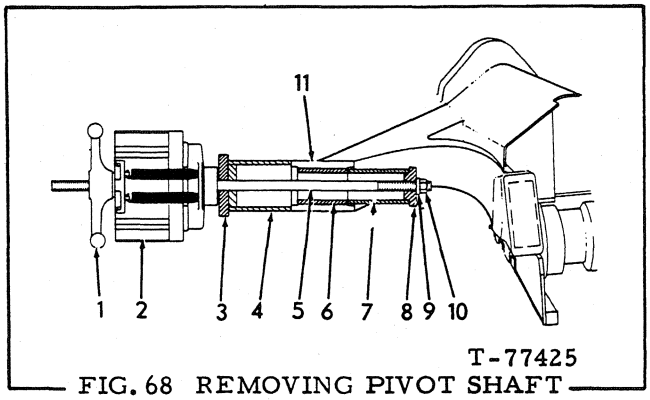

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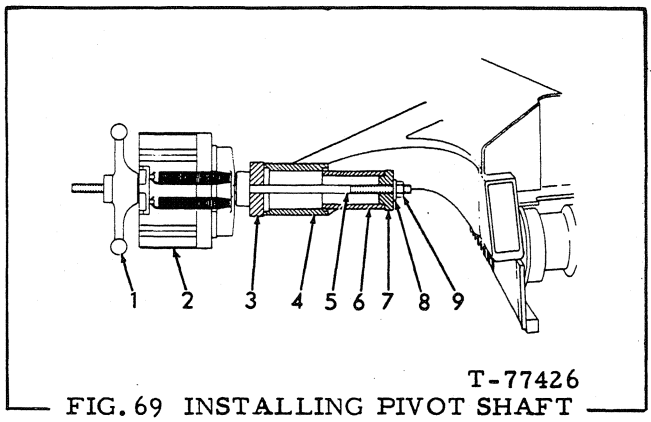
FIG. 68 REMOVING PIVOT SHAFT BUSHING - Typical

1. Speed nut
2. Hydraulic ram
3. Step plate
4. Sleeve
5. Threaded bar
6. Pivot bushing
7. Sleeve
8. Step plate
9. Washer
10. Nut
11. Track frame

10.4.4
Lubricate the outer diameter of bushing and the bore of track frame. Start bushing in bore of frame; then install tools similar to those in Fig. 69. Press bushing into bore so that bushing is centered in bore (ends equidistant in bore) so that seals may be installed against bushing without protruding from frame bore face.

10.4.5
Install seals, Fig. 66 (5) in bore at each end of bushing making certain seal is fully seated against bushing and with the lip of each seal outward.



T-77426

FIG. 69 INSTALLING PIVOT SHAFT BUSHING - Typical

1. Speed nut
2. Hydraulic ram
3. Plate
4. Track frame
5. Threaded bar
6. Pivot bushing
7. Step plate
8. Washer
9. Nut

10.5 INSPECTION

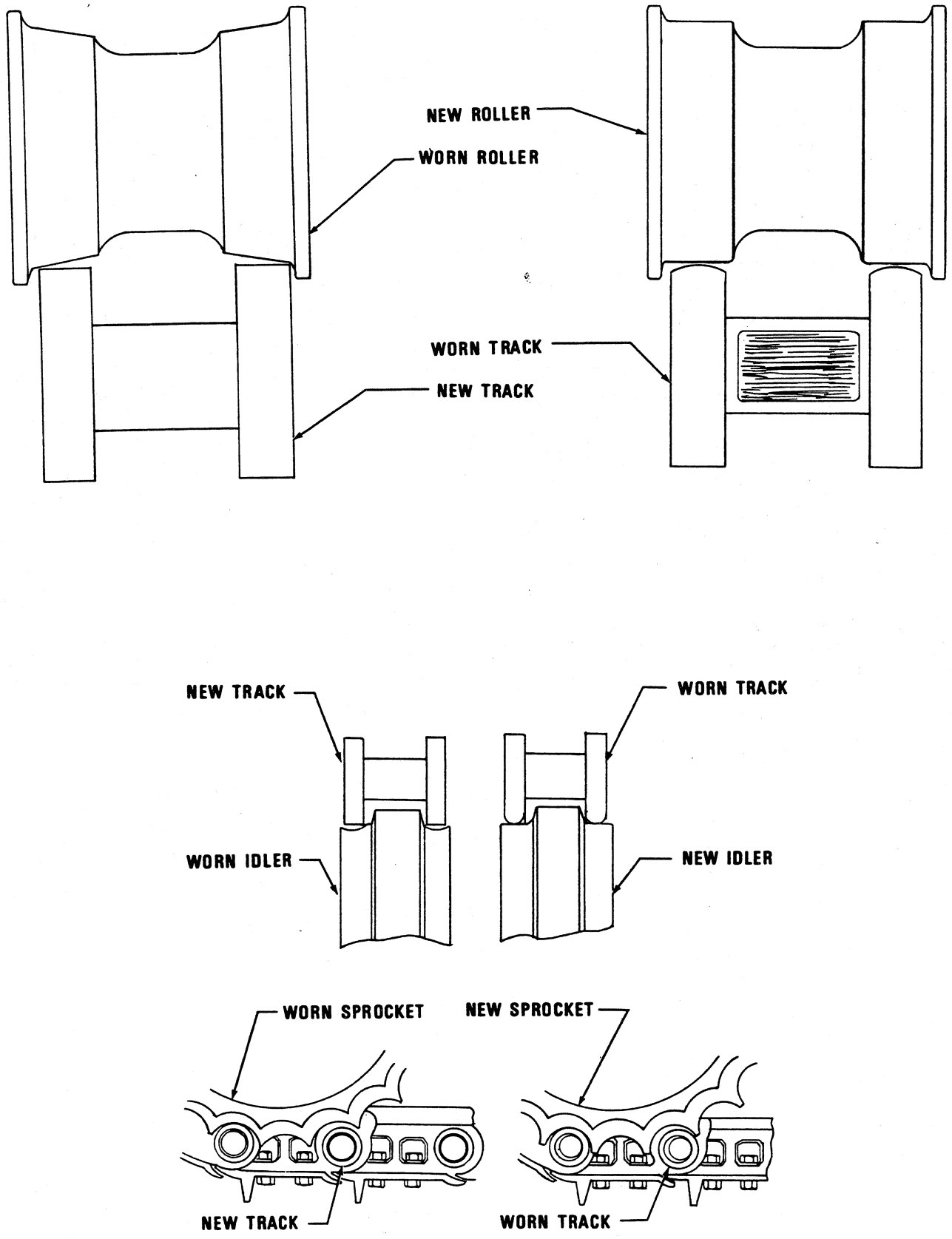
10.5.1
Before installing track frame on tractor a thorough inspection of track rollers, guards, carrier rollers, track release mechanism and idler slide bars should be made and necessary repairs or replacement made. Refer to Topics 13 and 14, for dimensions.

10.5.2
Inspect the slide bars (upper and lower). If slide bars are worn more than .03" (.762 mm) the slide bars should be replaced. If slide bars are removed or replaced, torque dowel bolts to a torque of 110 -- 135 lbs. ft. (15.2 -- 18.5 m-kg).

10.6 INSTALLATION

10.6.1
Make certain all components such as track rollers, and track roller guards are installed on track frame. Then position the track frame beneath tractor so that pivot shafts are aligned to their brackets and the track frame adjusting shims, Fig. 64 (13), will seat against frame without damage.

10.6.2
Position the carrier roller/oscillating beam saddle on beam; then lower the tractor until pivot shafts are seated in brackets and the outboard bearing cage is in place. Make certain shims, Fig. 64 (13) are properly seated.



T-75515

FIG. 75 MATING WORN COMPONENTS WITH NEW OR REBUILT COMPONENTS

MEMO

FIAT-ALLIS

SUPPLEMENT NO. 1
SERVICE MANUAL FORM 73110068
CAB
21–C, 31 CRAWLER TRACTORS

(6-77)

ATTENTION: Insert this sheet in the front of publication as record of receipt. Replace or add pages in the publication according to instructions below.

Additional copies of this supplement are available. Please direct your request to *Fiat-Allis Construction Machinery, Inc., Technical Publications Dept., 3000 South 6th Street, Springfield, Illinois, 62710 U.S.A.*

Write in the following changes:

Page 26	8.5.6	Delete instructions to use a halide torch to check for leaks.
Page 27	8.6.3	Delete instructions to use a halide torch to check for leaks.

Replace the following like pages:

1 (Revised)	11D (Added)	17 (No Change)	33 (Revised)
2 (Revised)	11E (Added)	18 (Revised)	34 (Revised)
3 (Revised)	11F (Added)	19 (No change)	35 (Revised)
4 (Revised)	11G (Added)	20 (Revised)	
11 (No Change)	11H (Added)	23 (Revised)	
11A (Added)	12 (No Change)	24 (Revised)	
11B (Added)	15 (No Change)	31 (Revised)	
11C (Added)	16 (Revised)	32 (Revised)	

Reason: To extend service manual usage to include 31 Crawler Tractor.

NOTICE
THESE CHANGES ARE
INCLUDED IN THIS COPY

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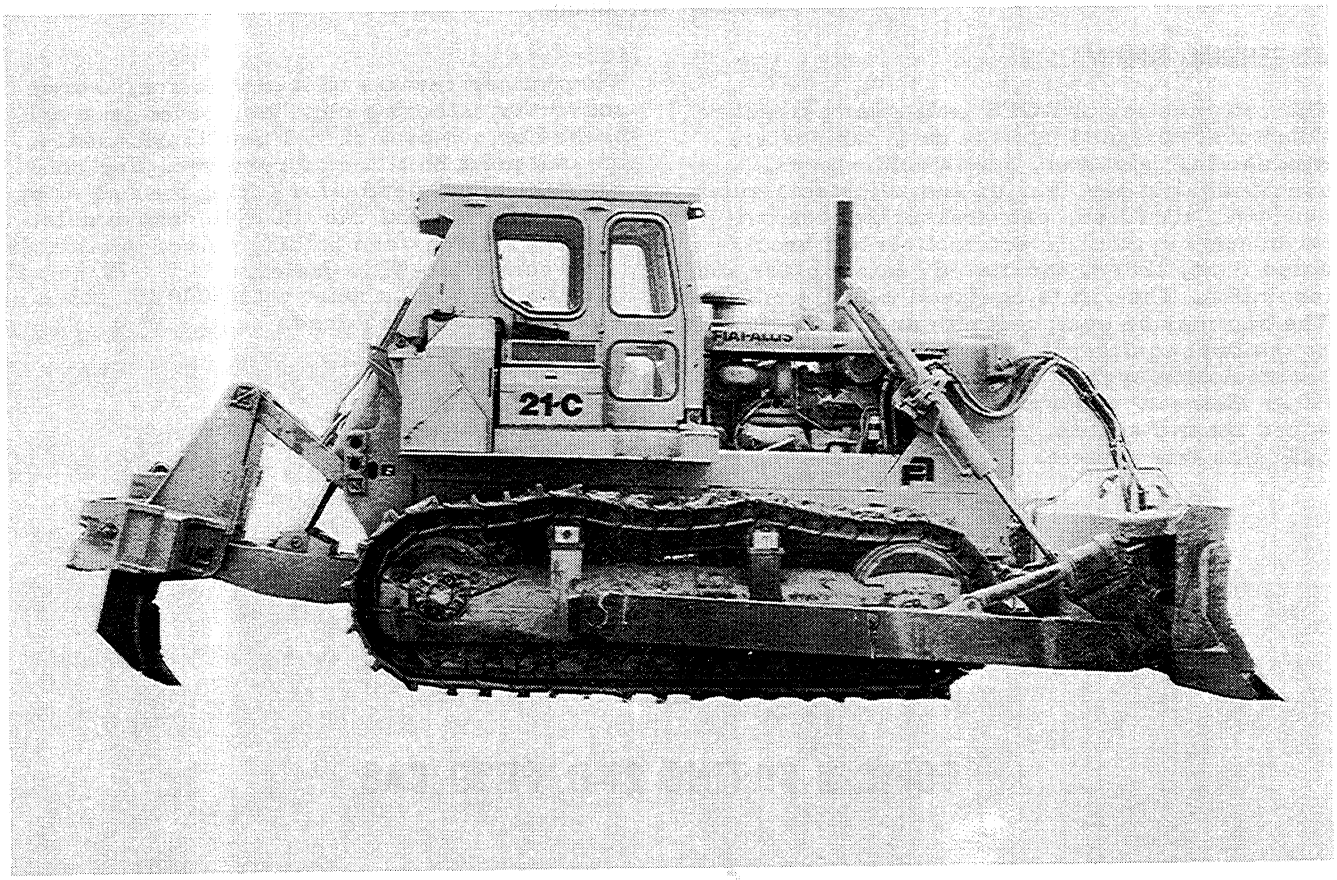
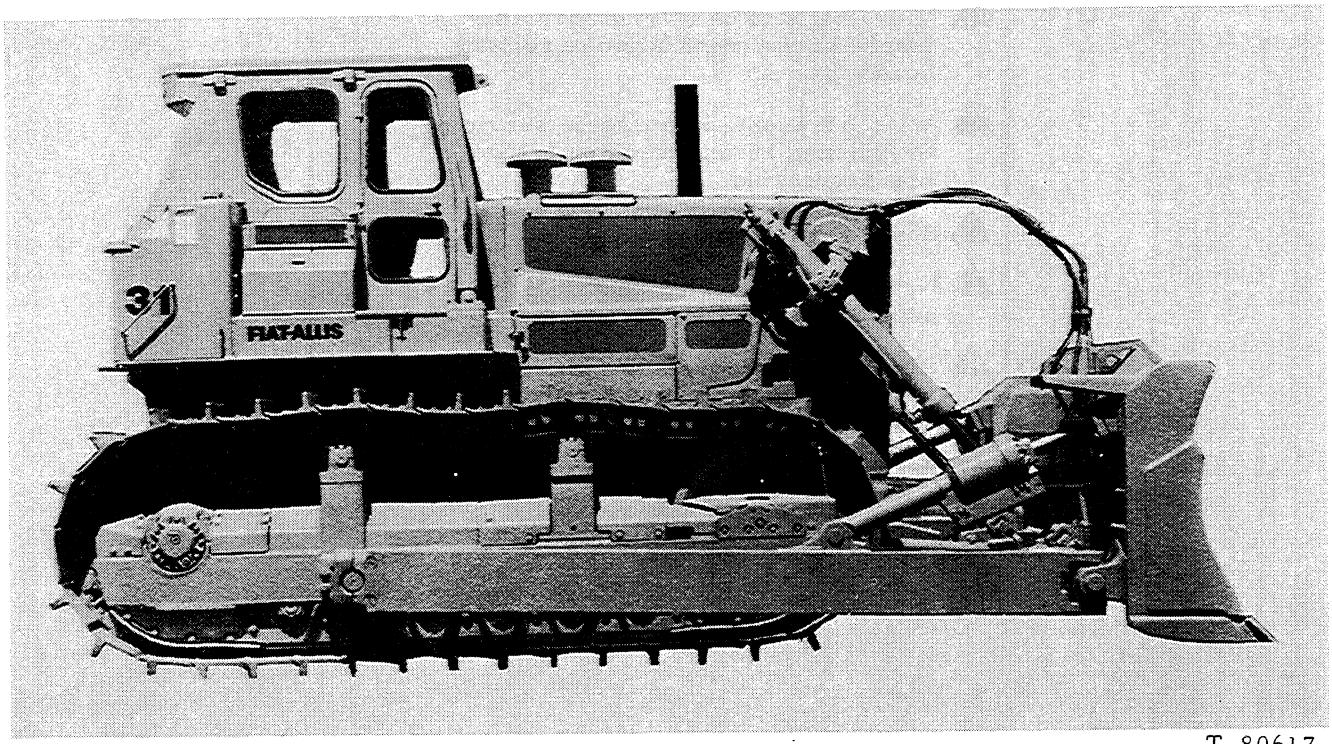
TOPIC 1 GENERAL DESCRIPTION



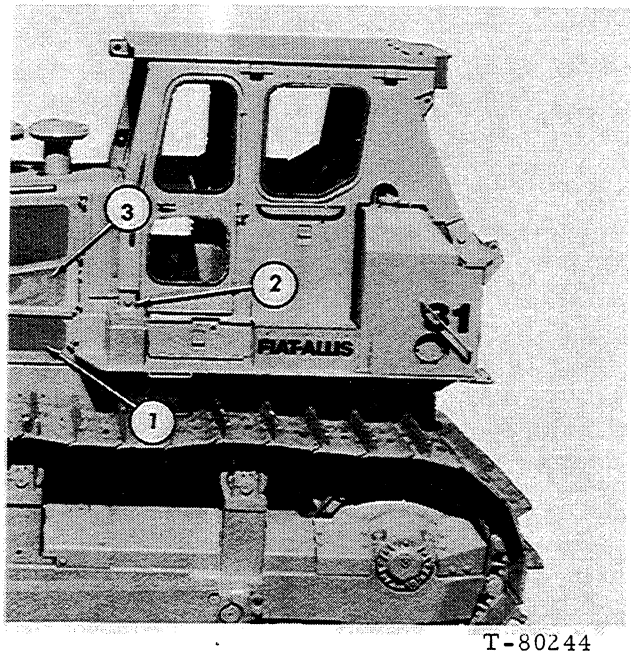
21-C TRACTOR T-79617



31 TRACTOR T-80617

FIG. 1 CAB MOUNTED ON TRACTOR

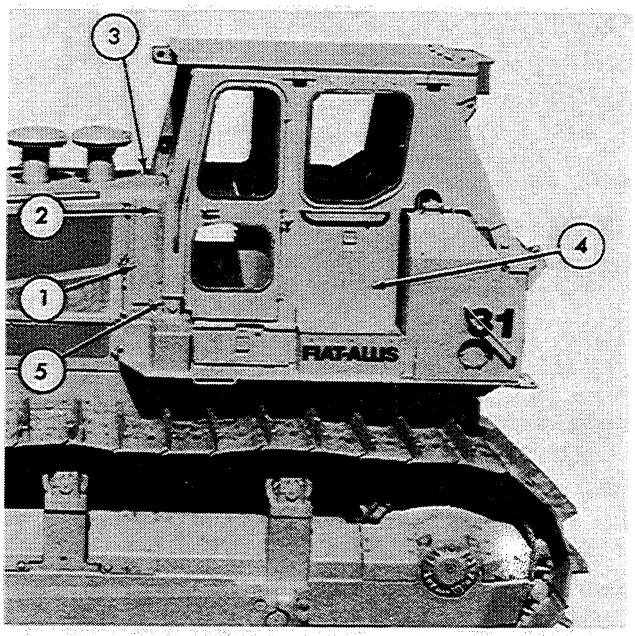
Study SAFETY RULES, pages I thru III, thoroughly for the protection of personal and machine safety.



T-80244

FIG. 15D ENGINE COMPARTMENT LEFT SIDE PLATES AND CAB MOUNTING BRACKET

1. Lower side plate
2. Cab mounting bracket
3. Upper side plate



T-80244

FIG. 15E HOOD SUPPORT AND FILLER STRIP

1. Filler strip
2. Rubber seal
3. Windshield washer reservoir access plate
4. Left compartment access cover
5. Filler plates

2A.2.6
Refer to Fig. 15E and remove the support to cab filler strip (1)(including the rubber seal(2).

2A.2.7
Refer to Fig. 15G and close the two heater hose (inlet and outlet) shut off valves (3) at hose connector at lower right front of cab. Refer to Fig. 15F, and close heater hose valves below the water pump inlet elbow and at the engine water manifold (top right front).

2A.2.8
Refer to Fig. 15G (4) and disconnect the main electrical cable (orange) air conditioner magnetic clutch cable (light blue) and rear flood light cable (dark blue) at lower left front side of cab.

2A.2.9
Disconnect windshield washer hose from front of cab.

2A.2.10
Refer to Fig. 15G and disconnect the two air conditioner to compressor hoses (5) making certain hose connectors are covered and protected against dirt or damage.

2A.2.11
Refer to Fig. 15G and remove the heater hose (hoses to engine) clamps and remove the two heater hoses from the cab valve assemblies.

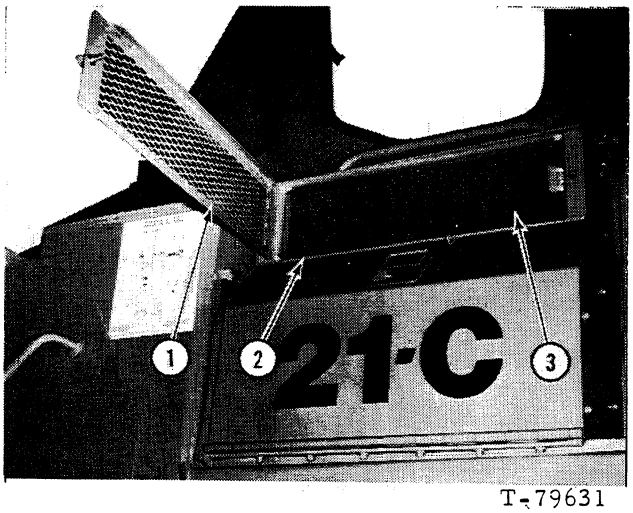
2A.2.12
Refer to Fig. 15C; open right access cover (1). Remove cover plate from front side of right valve compartment.

2A.2.13
Remove decelerator rod pin beneath pedal and remove decelerator pedal and foot rest bracket from floor plate (Fig. 15H).

2A.2.14
Remove brake pedal foot pads from brake levers.

2A.2.15
Remove small vertical floor mat retaining plate below dozer control console.

2A.2.16
Remove the floor mat. Remove the center and left floor plates (Fig. 15 I).



T-79631

FIG. 19 AIR FILTER COMPARTMENT

1. Access door
2. Screen (late units)
3. Filter element

4.1 GENERAL

The specification and capacities will be included in the service steps as they are preformed.

4.2 DAILY SERVICES

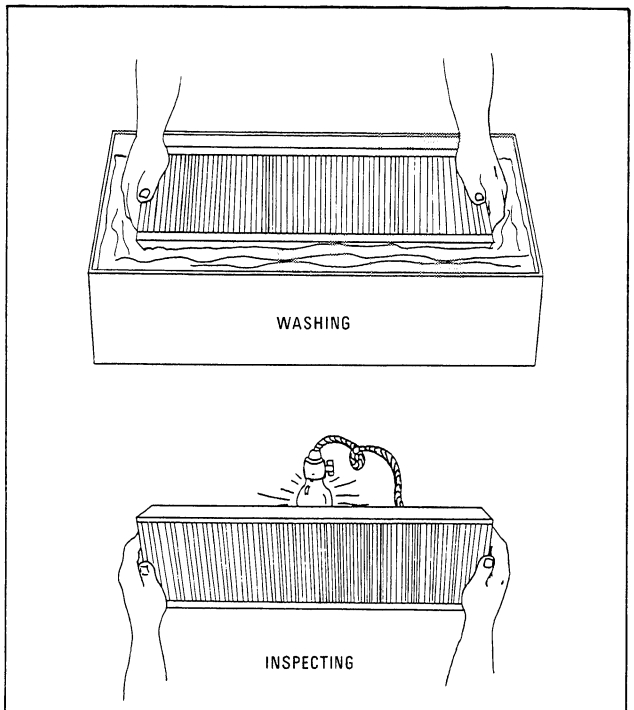
4.2.1 PRESSURIZER AIR FILTER (FIG. 19)

4.2.1.1
Refer to Fig. 19, and open access door. Using the tab on filter, remove filter from compartment. Filter may be temporarily cleaned (mid-shift) by tapping filter on flat surface (dirty side down), however, for daily service clean filter with compressed air (step 4.2.1.2) or by washing (steps 4.2.1.3 thru 4.2.1.7). If contaminant on element is mostly dry dust, either method is satisfactory; if element is caked, washing method is recommended.

NOTE: Keep clean spare elements on hand to reduce downtime.

4.2.1.2
To clean element with compressed air, direct dry, clean air up and down the pleats from reverse side (opposite of screen) of element until all dust is removed.

4.2.1.3
Wash element in a solution of two ounces (57 grams) low detergent soap or filter cleaner in one gallon (3.78 liters) of water. For best mixing results, dissolve detergent or cleaner in a small amount of cool water, then add warm water (approximately 100°F. (37°C) to obtain proper proportion.



T-79632

FIG. 20 WASHING AND INSPECTING FILTER

4.2.1.4
Soak element in the solution for at least fifteen minutes, then agitate element for about two minutes to loosen dirt. Rinse element with water from hose or faucet until clean; water pressure must not exceed 40 psi (2.81 kg/cm^2).

4.2.1.5
Air dry element for 24 hours before using. Mechanized drying methods may be used but heated air (180°F. (82°C) maximum) must be circulated. Do not use light bulbs to dry element.

4.2.1.6
After element has been cleaned and dried, it must be inspected (Fig. 20), for rupture or holes. Place bright light on backside (opposite arrows) of element and inspect element; light will shine through any holes or tears making them plainly visible. If any holes are evident, new element must be installed.

4.2.1.7
Clean the inside of filter compartment. Replace seals if necessary.

4.2.1.8
Install filter element in filter compartment making certain arrows on filters are directed inward; install screen (if used) then close access door and secure with thumb screw.

TOPIC 8 AIR CONDITIONER

WARNING

- If engine is to be started indoors, insure proper ventilation to remove deadly gases.
- Warn all people who may be servicing or working around machine before starting engine.
- Sound horn before starting.
- Never leave machine unattended with engine running.
- Do not use hands to search for pressure leaks.
- Refrigerant is extremely cold and will freeze flesh on contact. Use care to prevent contact with skin, eyes or other parts of the body to avoid personal injury.
- Wear goggles to protect your eyes when handling refrigerant or when checking refrigerant lines for leaks. Liquid refrigerant in the eyes can cause blindness.

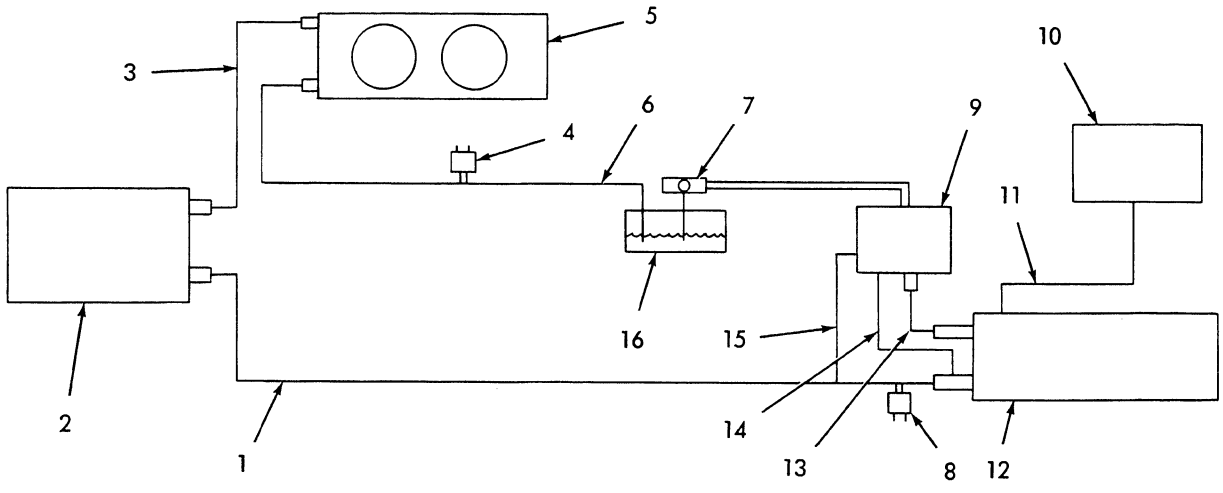


FIG. 27A REFRIGERATION SYSTEM SCHEMATIC

1. Suction hose (low pressure)
2. Refrigerant compressor
3. Discharge hose (high pressure)
4. Clutch cutout control (high pressure, 350 psi (24.6 kg/cm^2)
5. Condenser
6. High pressure (liquid)
7. Sight glass (refrigerant)
8. Clutch cutout control (low pressure, 17 psi (1.2 kg/cm^2)
9. Expansion valve
10. Temperature control switch
11. Temperature sensing tube
12. Evaporator
13. Refrigerant line
14. Equalizing line
15. Sensing tube
16. Receiver/drier

9.3.2.1
If pressure is incorrect, remove plug (2). Adjust pressure by turning valve (3) in to increase pressure or out to decrease pressure. Install plug (2).

9.3.3
Activate pump to position piston rod in full extend position (piston rod out). When piston rod bottoms, read pressure gauge. Correct pressure is 2000 -- 2400 psi (141 -- 169 kg/cm^2).

9.3.3.1
If pressure is incorrect, remove plug (5). Adjust pressure by turning valve (6) in to increase pressure or out to decrease pressure. Install plug (5).

9.3.4
Operate the tilt cylinder to the full extend and retract limits several times to recheck pressure settings. If pressure readings are inconsistent, do not attempt to tilt cab until malfunction is corrected. Remove hydraulic pump.

SAFETY RULES

GENERAL

Study the Operation and Maintenance Instruction Manual before starting, operating, maintaining, fueling, or servicing machine.

Read and heed all machine-mounted safety signs before starting, operating, maintaining, fueling or servicing machine.

Machine-mounted safety signs have been color coded yellow with black border and lettering for ***WARNING*** and red with white border and lettering for ***DANGER*** points.

Never attempt to operate the machine or its tools from any position other than seated in the operator's seat. Keep head, body, limbs, hands and feet inside operator's compartment at all times to reduce exposure to hazards outside the operator's compartment.

Do not allow unauthorized personnel to operate service or maintain this machine.

Always check work area for dangerous features. The following are examples of dangerous work areas: slopes, over hangs, timber, demolitions, fire, high walls, drop off, back fills, rough terrain, ditches, ridges, excavations, heavy traffic, crowded parking, crowded maintenance and closed areas. Use extreme care when in areas such as these.

An operator must know the machine's capabilities. When working on slopes or near drop offs be alert to avoid loose or soft conditions that could cause sudden tipping or loss of control.

Do not jump on or off machine. Keep two hands and one foot, or two feet and one hand, in contact with steps grab rails and handles at all times.

Do not use controls or hoses as hand holds when climbing on or off machine. Hoses and controls are movable and do not provide a solid support. Controls also may be inadvertently moved causing accidental machine or equipment movement.

Keep operator's compartment, stepping points, grab-rails and handles clear of foreign objects, oil, grease, mud or snow accumulation to minimize the danger of slipping or stumbling. Clean mud or grease from shoes before attempting to mount or operate the machine.

Be careful of slippery conditions on stepping points, hand rails, and on the ground. Wear safety boots or shoes that have a high slip resistant sole material.

For your personal protection. Do not attempt to climb on or off machine while machine is in motion.

Never leave the machine unattended with the engine running.

Always lock up machine when leaving it unattended. Return keys to authorized security. Heed all shut down procedures of the Operation and Maintenance Instruction Manual. Always set the parking brake when leaving the machine for any reason.

Do not wear rings, wrist watches, jewelry, loose or hanging apparel, such as ties, torn clothing, scarves, unbuttoned or unzipped jackets that can catch on moving parts. Wear proper safety equipment as authorized for the job. Examples: hard hats, safety shoes, heavy gloves, ear protectors, safety glasses or goggles, reflector vests, or respirators. Consult your employer for specific safety equipment requirements.

Do not carry loose objects in pockets that might fall unnoticed into open compartments. Do not use machine to carry loose objects by means other than attachments for carrying such objects.

DO NOT CARRY RIDERS unless the machine is equipped for carrying people to reduce personal exposure to being thrown off.

Do not operate machinery in a condition of extreme fatigue or illness. Be especially careful towards the end of the shift.

Roll Over Protective Structures are required on wheel loaders, dozer tractors, track type loaders, graders and scrapers by local or national requirements. *DO NOT* operate this machine without a Roll Over Protective Structure.

Do not operate a machine without a falling object protective structure (FOPS).

Do not operate this machine without a rear canopy screen when machine is equipped with rear mounted towing winch.

Seat belts are required to be provided with roll over protective structures or roll protection cabs by local or national regulations. Keep the safety belt fastened around you during operation.

Where noise exposure exceeds 90 dBA for 8 hours, wear authorized ear protective equipment per local or national requirements that apply.

Keep clutches and brakes on machine and attachments such as power control units, winches and master clutches adjusted according to Operation and Maintenance Instruction Manuals of the manufacturers at all times. *DO NOT* adjust machine with engine running except as specified.

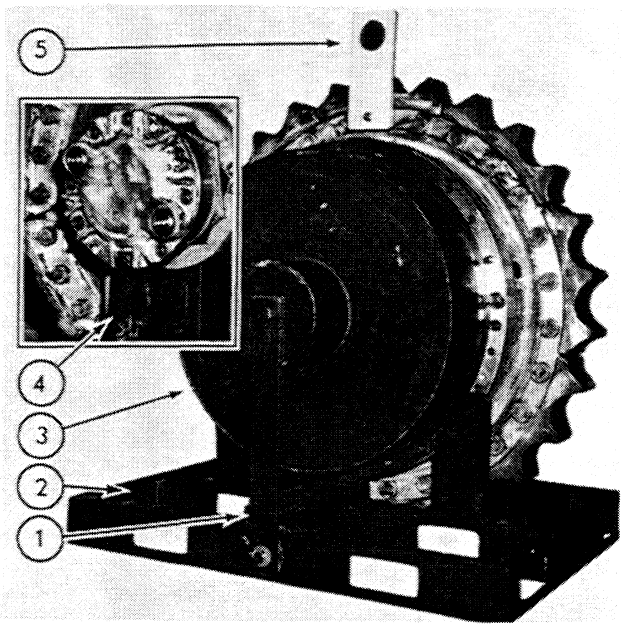
Do not operate a machine with brakes out of adjustment. See the Operation and Maintenance Instruction Manual.

Move carefully when under, in or near machine or implements. Wear required protective equipment, such as hard hat, safety glasses, safety shoes, ear protectors.

To move a disabled machine, use a trailer or low boy truck if available. If towing is necessary, provide warning signals as required by local rules and regulations and follow Operation and Maintenance Instruction Manual recommendations. Load and unload on a level area that gives full support to the trailer wheels. Use ramps of adequate strength, low angle and proper height. Keep trailer bed clean of clay, oil and all materials that become slippery. Tie machine down securely to truck or trailer bed and block tracks (or wheels) as required by the carrier.

TOPIC 3 TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	REMEDY
Seal rings leak	Bearings out of adjustment	Adjust bearings
	Seal boots (on early units)	Replace boot
	Seal rings worn or damaged	Replace seal rings
	Seal rings not contacting	Replace rubber rings. Check sprocket hub installation.
	Planet carrier loose on carrier shaft.	Replace shaft and carrier assembly.
	Sprocket hub nut loose.	Tighten nut.
Noise in final drive assembly	Bearing failure	Replace bearings
	Pinion worn or broken.	Replace pinion
	Brake drum loose on pinion	Tighten retaining capscrew
	Carrier assembly worn or damaged	Replace carrier assembly
Outboard bearing failure	Carrier assembly inner and intermediate bearings loose	Adjust bearings
	Track release mechanism not functioning properly	Refer to Undercarriage Service Manual
	Worn or loose track frame pivot shafts and/or bushings	Refer to Undercarriage Service Manual



T-80729

FIG. 4-11 FINAL DRIVE CARRIER ASSEMBLY MOUNTED IN SHIPPING STAND

1. Holding strap w/bolt
2. Shipping stand
3. Protection cover
4. Holding plate w/ bolt and eyebolt
5. Lifting bracket

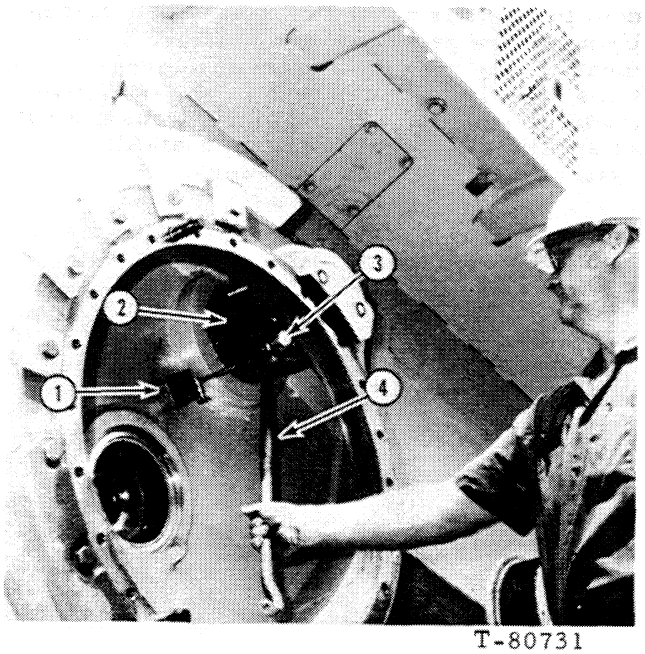


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FIG. 4-13 CHECKING PINION BEARINGS WITH DIAL INDICATOR

1. Magnetic base
2. Pinion
3. Dial indicator
4. Pry bar

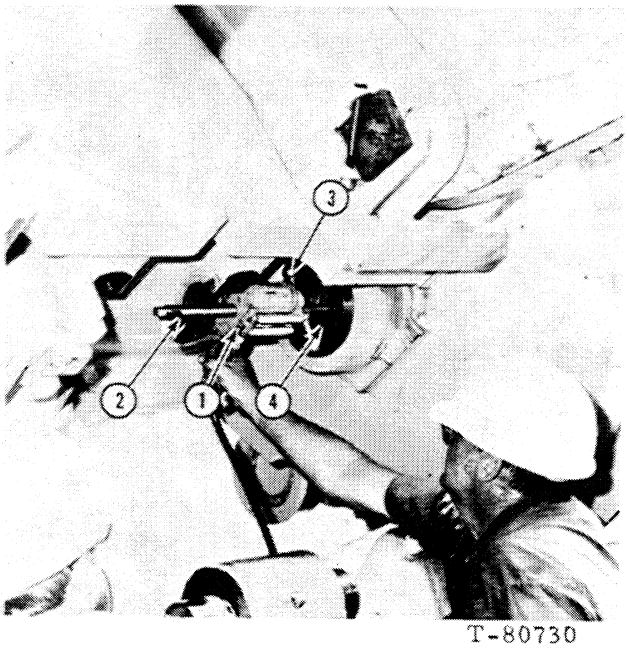

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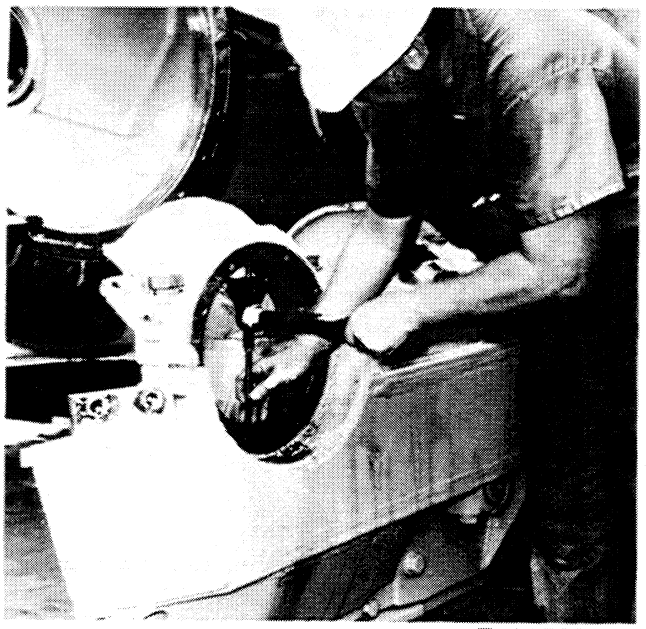
FIG. 4-12 REMOVING INNER BEARING CAGE

1. Ram (17 ton)
2. Forcing screw
3. Speed nut
4. Threaded push plate



T-80732

FIG. 4-14 CHECKING OUTBOARD BEARING BORE WITH BORE GAUGE

The reading should be 0.010" -- 0.050" (0.25 -- 1.27 mm). If necessary refer to pertinent Topic 8 in this manual.

4.2.7

Make certain the contact surfaces of outboard bearing cage cap and track frame are clean, then install cap and torque the two capscrews

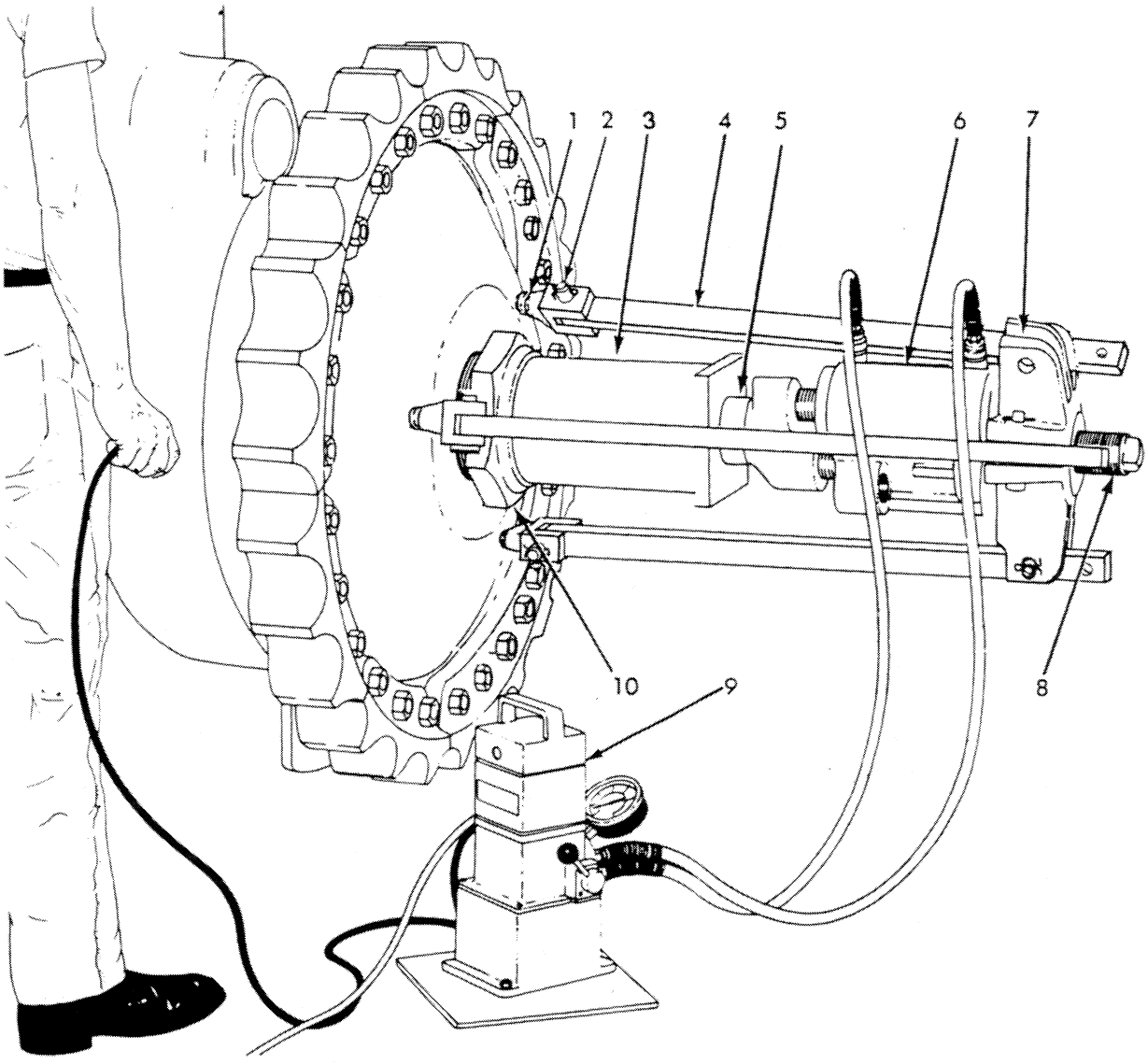


FIG. 5-4 PULLING SPROCKET HUB

*1. Adapter
*2. Pin
*3. Spacer tube
*4. Puller leg
*5. Insert
*6. Hydraulic ram (100 ton)
*7. Puller head
*8. Ram screw
9. Power unit
10. Sprocket hub retaining nut
*See SERVICE TOOLS

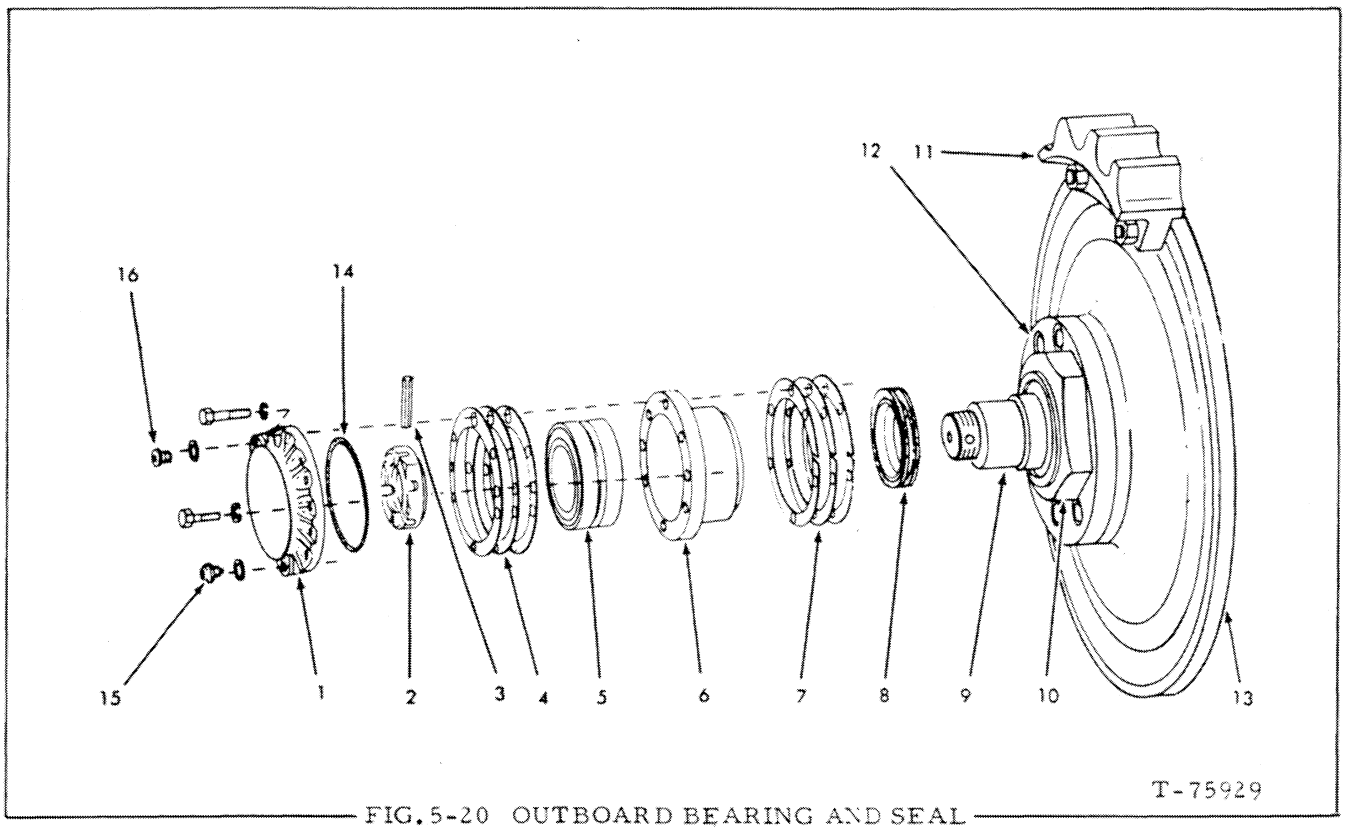


FIG. 5-20 OUTBOARD BEARING AND SEAL

1. Outboard bearing retainer
2. Outboard bearing nut
3. Roll pin
4. Bearing adjusting shims
5. Outboard bearing
6. Cage
7. Track frame locating shims - approximately .165" (4.19 mm)
8. Seal
9. Carrier
10. Sprocket hub retaining nut
11. Sprocket segment
12. Nut lock
13. Sprocket hub
14. O-ring
15. Magnetic drain plug w/gasket
16. Fill plug w/gasket

NOTE: If the seal faces are touched or contaminated they should be wiped clean with dry tissue paper, and oiled lightly with a tissue paper dipped in clean final drive lubricant. Do not use a shop towel for this purpose.

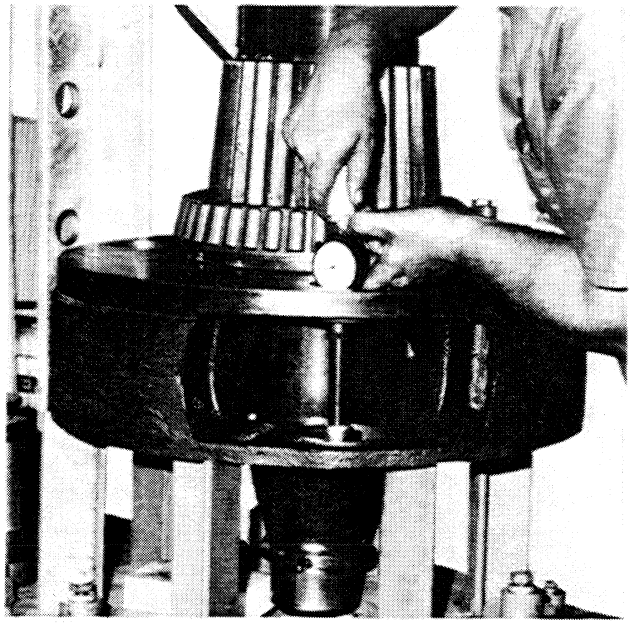
5.13 INSTALLATION AND ADJUSTMENT OF OUTBOARD BEARING

5.13.1
Lubricate outboard bearing, Fig. 5-20(5) with clean final drive oil and install it in cage (6). Be sure the bearing parts remain matched.

5.13.2
The bearing shim pack, Fig. 5-20 (4) can be determined before or after the bearing is installed on shaft - the procedure is the same in either case. Make certain bearing is seated in cage.

5.13.3
Hold retainer, Fig. 5-20 (1) firmly on bearing cage without any shims. Be certain the retainer flange is butted solidly against outboard bearing cup. This is VERY important to assure proper adjustment.

5.13.4
Use a feeler gauge to measure the gap between retainer and cage in three places, Fig. 5-19. The required shim pack must equal the average of the three measurements MINUS .004" -- .006" (0.10 -- 0.15 mm). This step must be performed accurately in order to have the correct adjustment. (An example follows).



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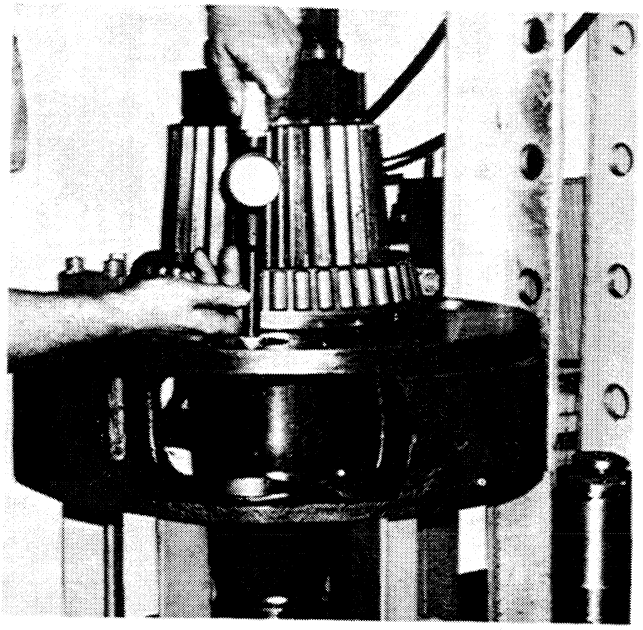

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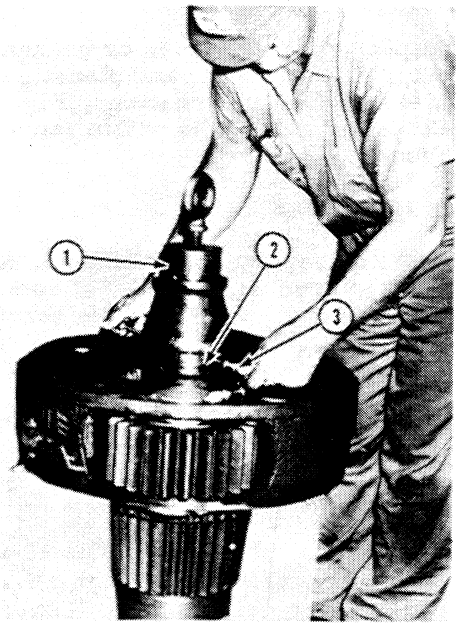
FIG. 6-19 MEASURING BORES FOR PLANET GEAR PINS



T-80771

FIG. 6-20 MEASURING BEARING LOCATIONS

1. Inboard bearing location
2. Sun gear bearing location
3. Micrometer

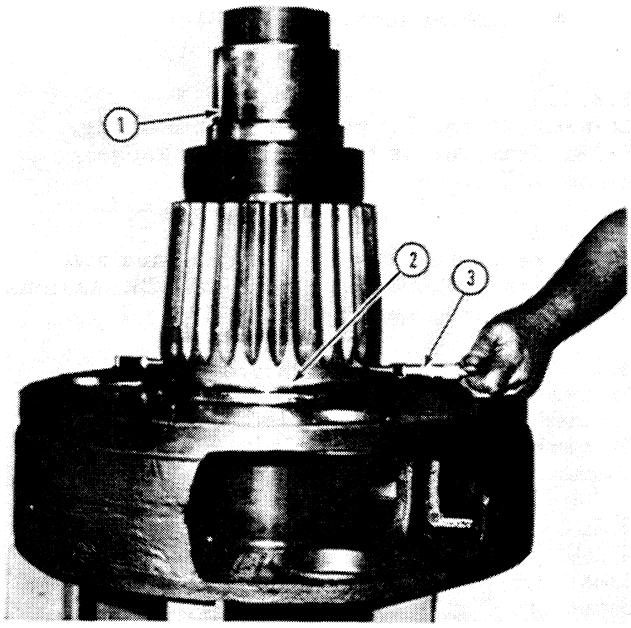


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FIG. 6-21 MEASURING INTERMEDIATE BEARING LOCATION

1. Outboard bearing location
2. Intermediate bearing location
3. Micrometer

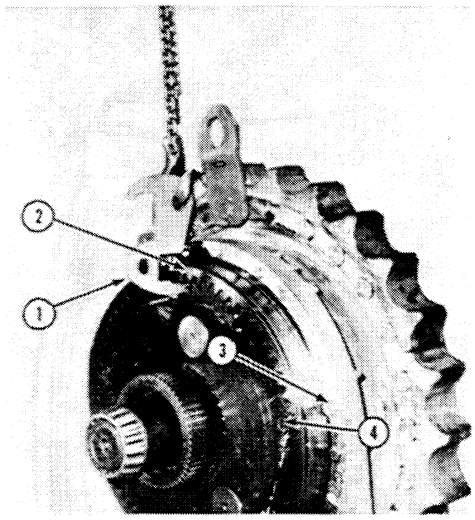

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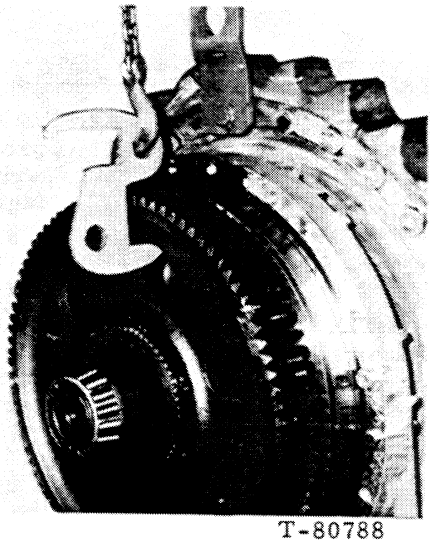
FIG. 6-42 INSTALLING RING GEAR

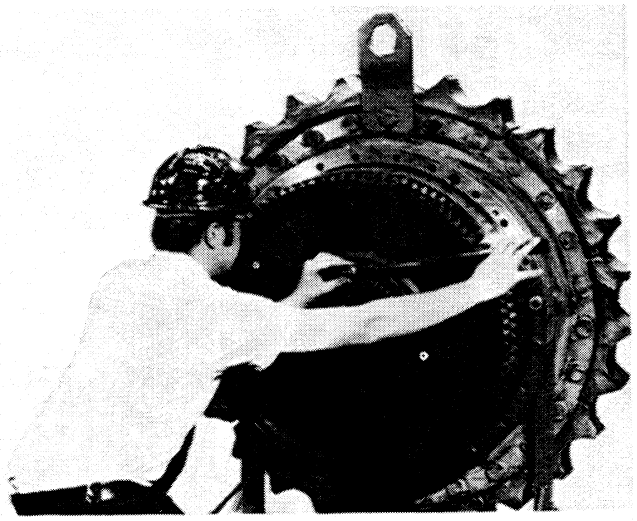
1. Lifting tool
2. Ring gear
3. Snap ring holding capscrew
4. Planet gear



T-80788

FIG. 6-43 INSTALLING GEAR ON CARRIER HUB

6.5.7
Install the three stabilizer bolts (#75300047) in sprocket puller holes and against cover (flat surface). Tighten bolts only slightly.



T-80789

FIG. 6-44 INSTALLING LOCKING PLATES

6.6 INSTALLATION OF RING GEAR AND DRIVEN GEAR

6.6.1
Install snap ring and the two O-rings in outer diameter of ring gear. Make certain O-rings are not twisted. Using lifting tool install the ring gear (Fig. 6-42) in cover making certain snap ring is against cover. Secure with two retaining bolts and nuts to prevent ring gear from coming out.

6.6.2
Refer to Fig. 6-43, install gear on carrier hub with locking capscrew holes outward. Refer to Fig. 6-44, install locking plates and secure with capscrews to a torque of 45 lbs. ft. (6.22 m-kg) and secure with tie wire.

6.6.3
Make certain that carrier and bearing cage counterbores are absolutely clean and dry. The presence of oil, grease or other lubricant on either side of these surfaces will cause failure of seal in service.

6.7 INSTALLATION OF OUTBOARD BEARING SEALS AND BEARING CAGE

6.7.1
Remove the plastic band from the seal assembly, Fig. 6-45 (8) and discard. Carefully slide the two steel halves apart. Make certain that the rubber ring is seated against shoulder of metal seal ring.

6.7.2
Carefully install one half of the seal assembly in the carrier. (The other half of seal will go in the outboard bearing cage counterbore after bearing is installed). Use care to avoid touching the sealing surface of the metal seal. Fully seat the rubber ring in the counterbore.

Pinion Removal and Installation

7.5.3
Install washer, Fig. 7-1 (5) and capscrew (4) torqued to 500 -- 550 lbs. ft. (69 -- 76 m-kg). Install capscrew lock (6) and retaining capscrews torqued to 43 -- 47 lbs. ft. (6 -- 6.5 m-kg). Install lockwire in retaining capscrews.

7.5.4
Refer to Steering Clutches and Brakes Service Manual for installation of steering clutches.

Never use gasoline or solvent or other flammable fluid to clean parts. Use authorized commercial, non-flammable, non-toxic solvents.

Never place gasoline or diesel fuel in an open pan.

Shut off engine and be sure all pressure in system has been relieved before removing panels, housings, covers, and caps. See Operation and Maintenance Instruction Manual.

Do not remove hoses or check valves in the hydraulic system without first removing load and relieving pressure on the supporting cylinders. Turn radiator cap slowly to relieve pressure before removing. Add coolant only with engine stopped or idling if hot. See Operation and Maintenance Instruction Manual.

Fluid escaping under pressure from a very small hole can almost be invisible and can have sufficient force to penetrate the skin. Use a piece of card board or wood to search for suspected pressure leaks. *DO NOT USE HANDS.* If injured by escaping fluid, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

Never use any gas other than dry nitrogen to charge accumulators. See Operation and Maintenance Instruction Manual.

When making pressure checks, use the correct gauge for expected pressure. See the Operation and Maintenance Instruction Manual or Service Manual for guidance.

For field service, move machine to level ground if possible and block machine. If work is absolutely necessary on an incline, block machine and its attachments securely. Move the machine to level ground as soon as possible.

Brakes are inoperative when manually released for servicing. Provision must be made to maintain control of the machine by blocking or other means.

Block all wheels before bleeding or disconnecting any brake system lines and cylinders.

Never use make shift jacks when adjusting track tension. Follow the Undercarriage Service Manual.

Know your jacking equipment and its capacity. Be sure the jacking point used on the machine is appropriate for the load to be applied. Be sure the support of the jack at the machine and under the jack is appropriate and stable. Any equipment up on a jack is dangerous. Transfer load to appropriate blocking as a safety measure before proceeding with service or maintenance work according to local or national requirements.

Always block with external support any linkage or part on machine that requires work under the raised linkage, parts, or machine per local or national requirements. Never allow anyone to walk under or be near unblocked raised equipment. Avoid working or walking under raised blocked equipment unless you are assured of your safety.

When servicing or maintenance requires access to areas that cannot be reached from the ground, use a ladder or step platform that meets local or national requirements to reach the service point. If such ladders or platforms are not available, use the machine hand holds and steps as provided. Perform all service or maintenance carefully.

Shop or field service platforms and ladders used to maintain or service machinery should be constructed and maintained according to local or national requirements.

Lift and handle all heavy parts with a lifting device of proper capacity. Be sure parts are supported by proper slings and hooks. Use lifting eyes if provided. Watch out for people in the vicinity.

In lifting and handling heavy parts, slings must be of adequate strength for the purpose intended and must be in good condition.

Handle all parts with extreme care. Keep hands and fingers from between parts. Wear authorized protective equipment such as safety glasses, heavy gloves, safety shoes.

When using compressed air for cleaning parts use safety glasses with side shields or goggles. Limit the pressure to 207 kPa (30 psi) according to local or national requirements.

Wear welders protective equipment such as dark safety glasses, helmets, protective clothing, gloves and safety shoes when welding or burning. Wear dark safety glasses near welding. *DO NOT LOOK AT ARC WITHOUT PROPER EYE PROTECTION.*

Replace seat belts every two years on open canopy units and every three years on machines with cabs or at change of ownership.

Wear proper protective equipment such as safety goggles or safety glasses with side shields, hard hat, safety shoes, heavy gloves when metal or other particles are apt to fly or fall.

Use only grounded auxiliary power source for heaters, chargers, pumps and similar equipment to reduce the hazards of electrical shock.

Keep maintenance area *CLEAN* and *DRY.* Remove water or oil slicks immediately.

Remove sharp edges and burrs from reworked parts.

Be sure all mechanics tools are in good condition. *DO NOT* use tools with mushroomed heads. Always wear safety glasses with side shields.

Do not strike hardened steel parts with anything other than a soft iron or non-ferrous hammer.

Do not rush. Walk, do not run.

Know and use the hand signals used on particular jobs and know who has the responsibility for signaling.

TOPIC 3 MUFFLER AND AIR CLEANER

3.1 MUFFLER REMOVAL

3.1.1
Refer to 2.1 and remove the engine hood, exhaust pipe, and rain cap. Refer to 2.3 and remove the engine upper right hand side plate.

3.1.2
Loosen clamp Fig. 5 (2) securing muffler (3) to engine exhaust manifold. Remove mounting capscrews. Use a suitable sling and hoist and lift muffler from engine.

3.2 MUFFLER INSTALLATION

3.2.1
Slide clamp on lower muffler extension. Lift muffler into place on engine with muffler extension mating with exhaust manifold. Align holes in bracket with muffler mounting holes. Secure muffler to engine with mounting capscrews. Tighten lower clamp to secure muffler to exhaust manifold.

3.2.2
Refer to 2.3 and install engine upper right hand side plate. Refer to 2.1 and install hood, exhaust pipe, and rain cap.

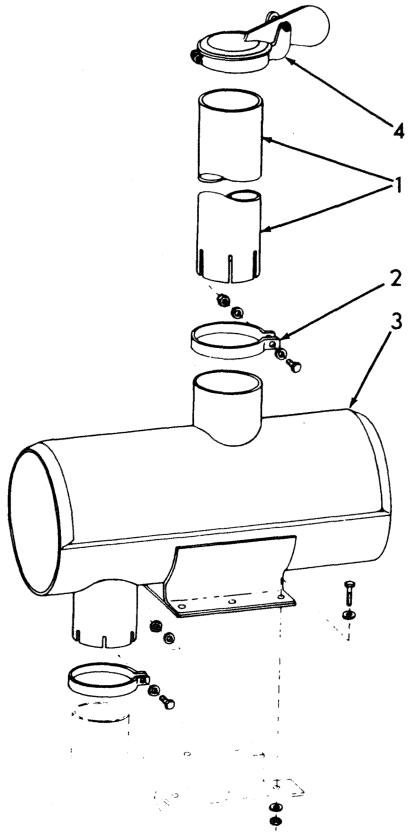


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FIG. 5 MUFFLER

1. Exhaust pipe
2. Clamp assembly
3. Muffler
4. Cap (Special equipment)

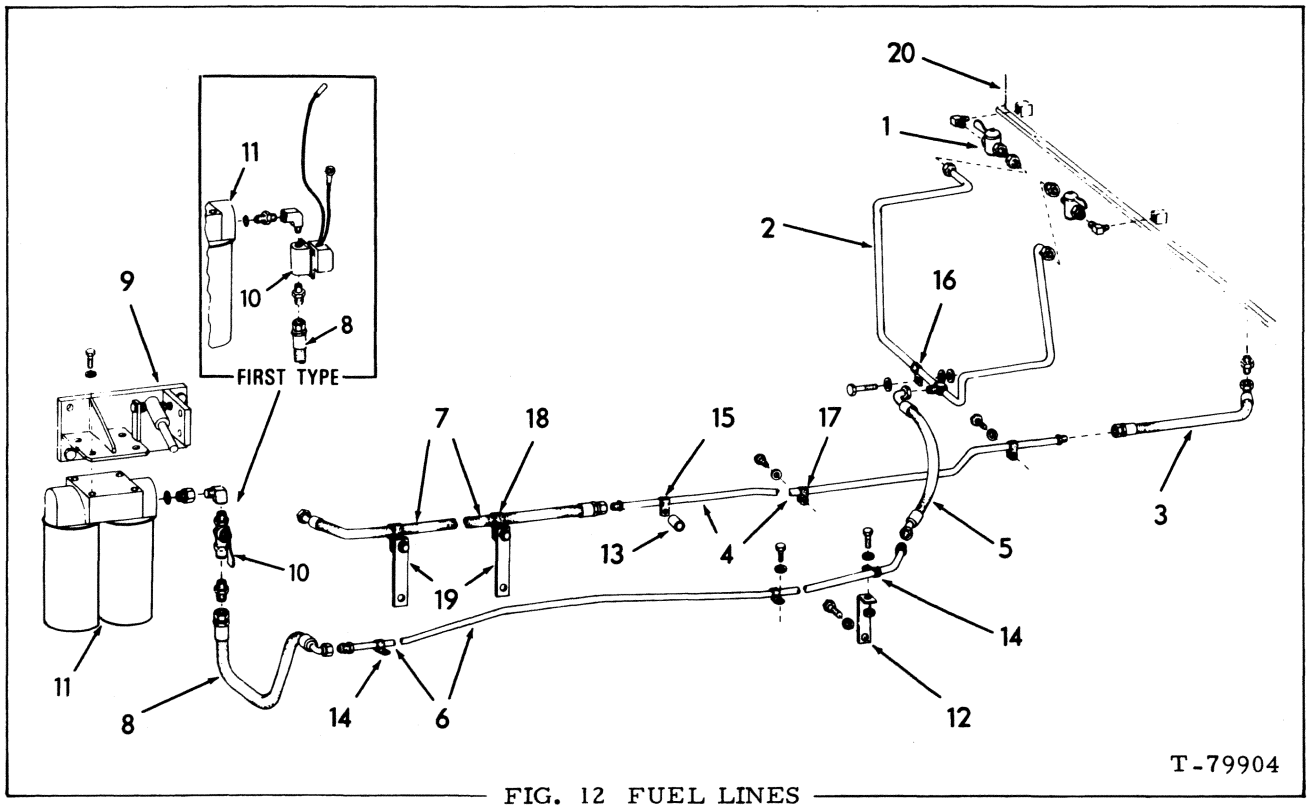

FIG. 12 FUEL LINES

1. Shut-off cock
2. Tube
3. Hose
4. Tube
5. Hose
6. Tube
7. Hose
8. Hose
9. Bracket
10. Electric valve (first type)
10. Manual valve (second type)
11. Fuel filter
12. Angle
13. Block
14. Clamp
15. Clamp
16. Clamp
17. Clamp
18. Clamp
19. Strip
20. Fuel tank

4.3.1.3
Disconnect tube (9) from engine intake manifold. Remove tie (12). Remove capscrews and remove valve (10) and bracket (8) from plate (5).

4.3.2 INSTALLATION

4.3.2.1
Install jet Fig. 13 (10) and bracket (8) on plate (5). Secure with capscrews.

4.3.2.2
Install cable (1) through grommet (2). Install clips (4) to support cable. Aline cable with bracket (8) and secure with screw. Attach stop (11) at end of cable and secure to valve arm with setscrew. Operate cable and adjust position of stop to be sure valve is opened when cable is actuated. Connect tube (9) to fitting at intake manifold and secure with tie (12).

4.3.2.3
Install tank (6) in position and connect to valve. Secure tank and remaining clip (4) with clamps (7) and wing nuts. Close engine side plates.

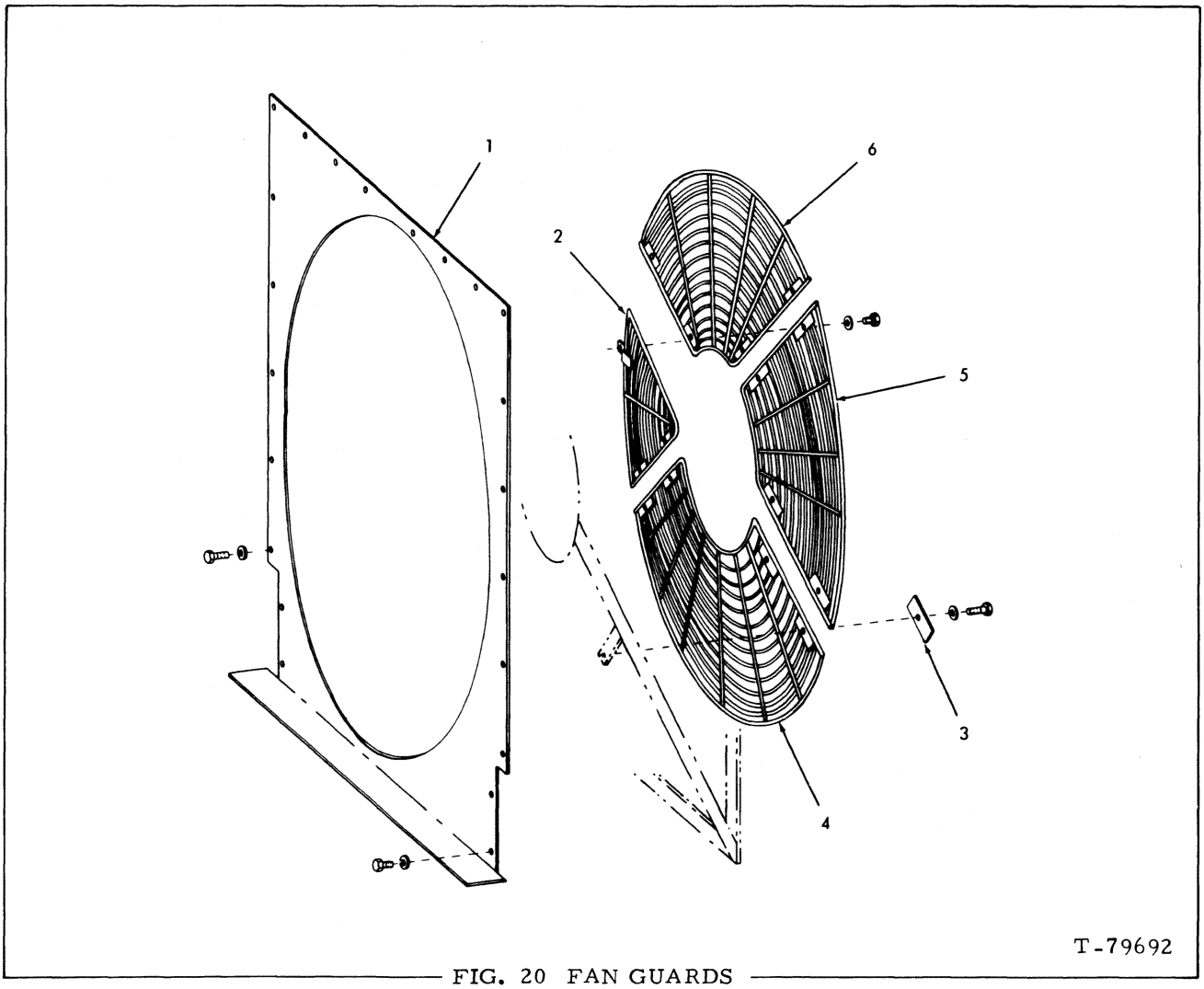

FIG. 20 FAN GUARDS

1. Shroud
2. Guard
3. Plate
4. Guard
5. Guard
6. Guard

6.2.1.4
Remove capscrews and plates Fig. 20 (3) and remove fan guards (2, 4, 5 and 6) from fan shroud.

6.2.2 INSTALLATION

6.2.2.1
Install fan guards Fig. 20 (2, 4, 5 and 6) on shroud and secure with plates and capscrews.

6.2.2.2
Install fan shroud through front of tractor. Secure fan shroud with capscrews. Install fan guard sections on back side of guard; secure with capscrews and plates.

6.2.2.3
Attach a sling to the fan and lift fan into position through front of tractor. Secure fan to hub with capscrews. Tighten capscrews to a torque of 43--55 lbs. ft. (5.93--7.59 m-kg).

6.2.2.4
Install overflow tube and secure with clips and capscrews. Refer to 6.1.2 and install radiator.

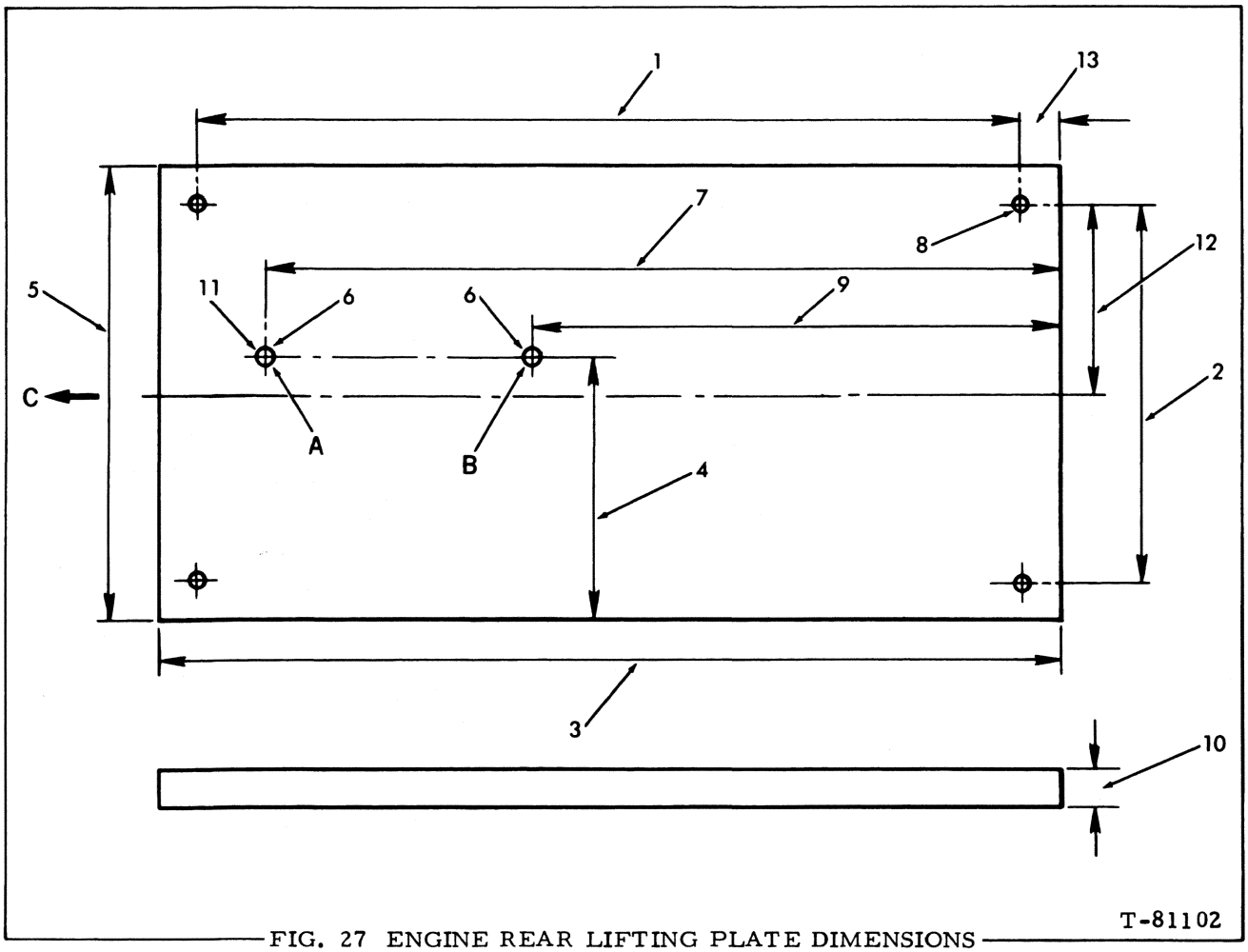

FIG. 27 ENGINE REAR LIFTING PLATE DIMENSIONS

1. 15.5" (393.7 mm)
2. 12.0" (304.8 mm)
3. 17.75" (450.8 mm)
4. 7.5" (190.5 mm)
5. 14.0" (355.6 mm)
6. Two hole .78125 (19.8 mm) drill
7. 14.5" (368.3 mm)
8. Four holes .5625" (14.2 mm) drill
9. 8.875" (225.4 mm)
10. Plate .5" (12.7 mm) thick
11. Nut - .75" -10NC. Two required. Weld in position on underside of plate
12. 6.0" (152.4 mm)
13. .75" (19.0 mm)

A. Position of lifting eye for lifting engine without converter.
B. Position of lifting eye for lifting engine with converter.
C. To front of engine when installed.

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21-C
31
41-B

crawler tractors

service manual

HYDRAULICS

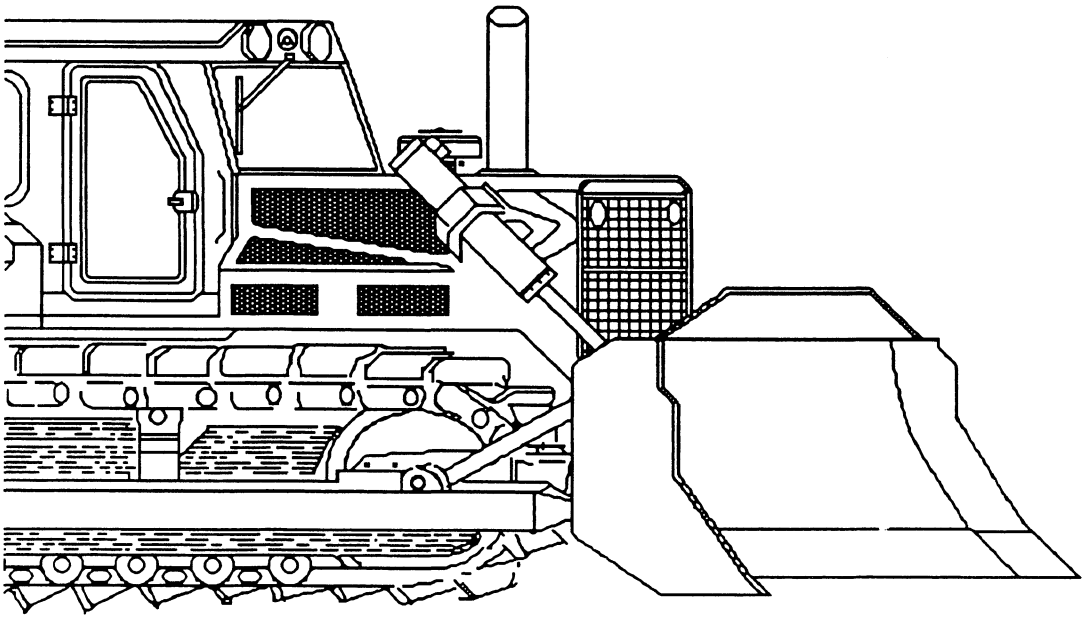

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TABLE OF CONTENTS

TOPIC 1 HYDRAULIC SYSTEM SPECIFICATIONS

1.1 HYDRAULIC OIl

Oils used in the hydraulic system perform a dual function of lubrication and transmission of power. Oil must be selected with care. Whenever possible, use the assistance of a reputable supplier in purchasing hydraulic system oil.

Use oils meeting one of the following specifications:

1. Type C-3 Transmission Fluid (oil)
2. Engine Oil TO-2 Qualified API Service CD
3. MIL-L-2104C, API Service CD/SC (supersedes the requirements of -- also meets the requirements of -- both MIL-L-2104B and MIL-L-45199B).

VISCOSITY: SAE 10W year around.

OPERATING TEMPERATURE

Normal - 88°C (190°F)
Intermittent - 121°C (250°F)

1.2 SYSTEM REFILL CAPACITY

(Reservoir and cylinders completely drained)

	L	gal.
Dozer only w/tilt		
21-C	131	34.5
31	212	56
41-B	219	58
Ripper (std.) add	28	7.5
21-C	28	7.5
31	57	15
41-B	49	13
Ripper w/pitch, add		
21-C	-	-
31	78	20.5
41-B	-	-

1.3 SERVICE

Hydraulic mechanisms are precision units and their continued trouble free operation is dependent on proper care. Dirt, particles of metal and packing can cause considerable trouble. Every precaution must be taken to keep the system clean. Always change filters as a set to insure a clean system. Drain and refill system each 2000 hours. Check oil level frequently and if necessary, add oil. Use only clean oil that meets specifications. Refer to Operation and Maintenance Instruction Manual for detailed service instructions.

1.4 RELIEF VALVE PRESSURES

1.4.1 MAIN RELIEF VALVES

	21-C	31	41-B	Allowable Variation
Top(ripper) Section				
bar	138	138	159	± 3.4
kg/cm²	140.6	140.6	163	± 3.5
psi	2000	2000	2300	± 50
Bottom(tilt) Section				
bar	159	159	159	± 3.4
kg/cm²	162	162	162	± 3.5
psi	2300	2300	2300	± 50

1.4.2 POWER ASSIST RELIEF VALVE

ALL -- 17.2 bar (17.58 kg/cm²)(250 psi)

1.4.3 OVERLOAD RELIEF VALVES

ALL -- 179.3gpm (183 kg/cm²)(2600 psi)

1.5 PUMP VOLUME, DOZER

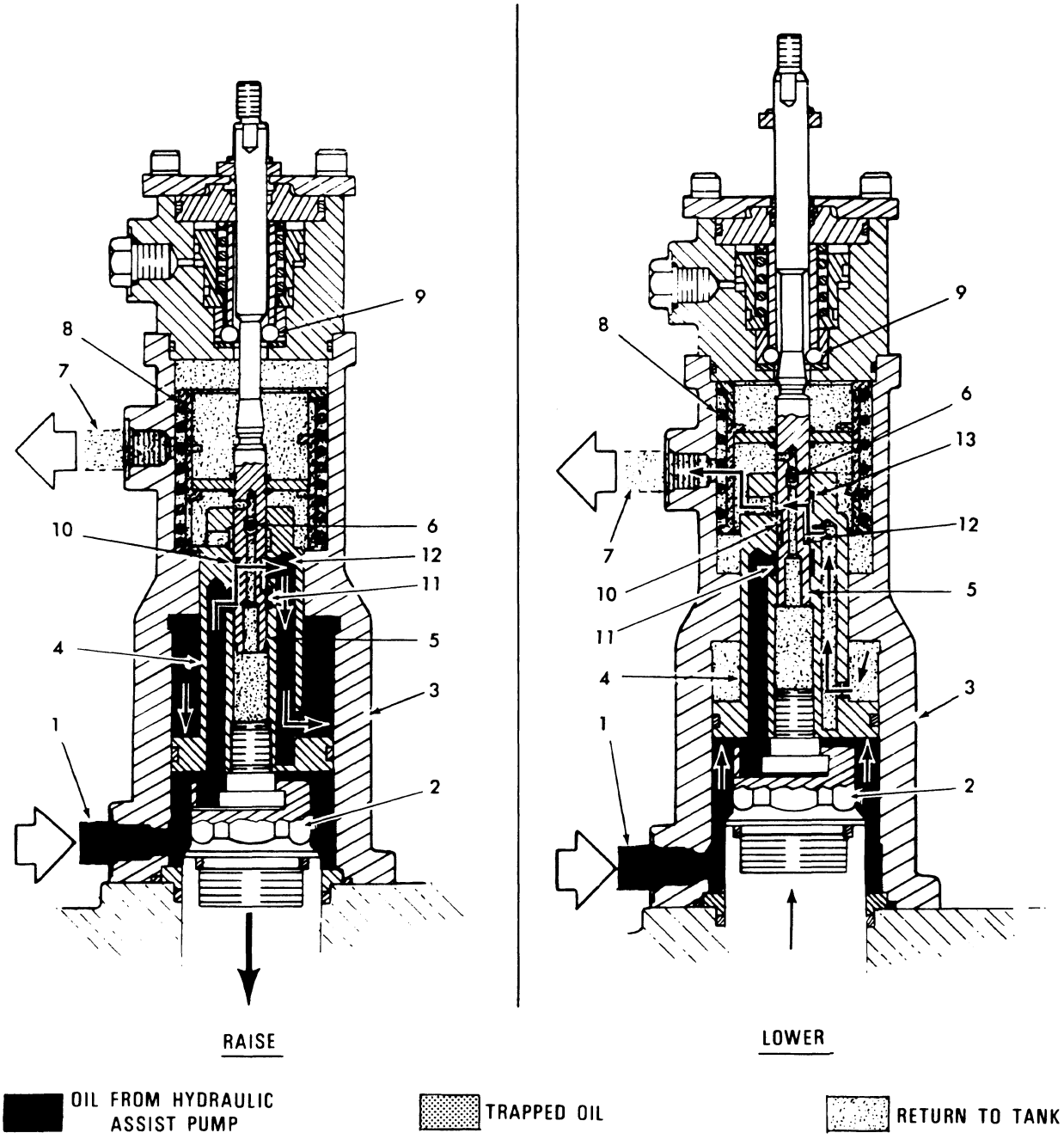
at Governed engine speed 21-C -- 2035 rpm, 31, 41-B -- 2100rpm.

at 75% of main relief valve pressure (tilt or ripper) - see above -

at Oil temperature of 71-82°C (160-180°F).

IMPORTANT: Do not attempt to check pump volume unless engine speed and main relief valve pressure meet specifications.

Hydraulic Component Functions and Circuit Oil Flows



6. Pin
7. Oil return to tank
8. Spool centering spring
9. Detent balls
10. Master spool transfer port
11. Piston inlet port
12. Piston inlet/return port
13. Piston return port

T-82131

LEGEND FOR FIG. 2-10

1. Main hydraulic pump
2. Power assist pump
*3. Transmission pump
4. Upper main relief valve
5. Power assist relief valve
6. Overload relief valve
7. Oil return to tank
8. Ripper pitch or pin puller control section
9. Ripper lift control section
10. Dozer control section
11. Moldboard tilt control section
12. Lower main relief valve

* On the Model 31 tractor, power assist pump (2) is driven from transmission pump (3). On the Model 21-C and 41-B tractors, power assist pump (2) is driven from main hydraulic pump (1).

2.3.2 DOZER, TILT AND RIPPER - HOLD POSITION

2.3.2.1
Refer to Fig. 2-10. While the control lever is moving to the "hold" position, a portion of the oil from the power assist pump (2) is used within the respective power assist valve. When the "hold" position is reached, the power assist valve is held stationary by a self-centering spring. Oil flow within the valve ceases and all power assist oil flows to the tank through relief valve (5).

2.3.2.2
Pump oil from both sets of pump gears of main hydraulic pump (1) circulates. All control valve spools prevent oil circulation to and from the hydraulic cylinders. If an excessive load is imposed on either end of the tilt or ripper cylinders, overload relief valve (6) will prevent damage to the system by allowing oil to escape from the end of the cylinder that is overloaded (this allows the ripper or dozer to give and prevent shock damage). The dozer cylinder limit travel valves and quick-drop valves (Fig. 2-7 and 2-8), main relief valves (4 and 12) and the control spool check valves have no function in the "hold" position.

LEGEND FOR FIG. 2-15

1. Main hydraulic pump
2. Power assist pump
*3. Transmission pump
4. Upper main relief valve
5. Power assist relief valve
6. Overload relief valve
7. Oil return to tank
8. Ripper pitch or pin puller control section
9. Ripper lift control section
10. Dozer control section
11. Moldboard tilt control section
12. Lower main relief valve
13. Check valve

* On the Model 31 tractor, power assist pump (2) is driven from transmission pump (3). On the Model 21-C and 41-B tractors, power assist pump (2) is driven from main hydraulic pump (1).

2.3.7 RIPPER-RAISE POSITION

2.3.7.1
Refer to Fig. 2-15. While the ripper lift control lever is moving to the "raise" position, a portion of the oil from power assist pump (2) is used within the ripper lift power assist valve. When movement of the control lever stops, the power assist valve becomes stationary and all power assist oil flows through relief valve (5) to the tank.

2.3.7.2
Pump oil from the rear set of gears of main hydraulic pump (1) circulates and returns to the tank. Oil from the front set of gears flows past main relief valve (4) and into ripper lift control spool (9). Pushing check valve (13) off its seat, the oil flows to the ripper lift cylinder and forces the piston rod in to raise the ripper. Oil from the opposite end of the ripper cylinder flows through the control spool and back to the tank.

2.3.7.3
If the piston rod reaches the end of its travel, or the ripper cannot move due to an excessive load, pressure builds in the work circuit until the main relief valve opening pressure is reached and the valve opens. If overload relief valve (6) jams in the open position or is adjusted incorrectly (set lower than the main relief valve), the raise power will be affected.

2.3.7.4
The purpose of check valve (13) in the control spool is to prevent a momentary reverse flow of oil when changing control positions. If the valve on the pressure side fails, the ripper may hesitate or tend to drop before raising.

3.2.3 (Continued)

25. NOTE: This remedy applies only to the dozer cylinders. Remove and inspect the quick-drop valves (Fig. 2-8) 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 the valves or their seats are scored, lapping is recommended (refer to paragraph 7.1.8.9).
26. Refer to Topic 6, paragraph 6-3 or 6-4, and check for defects in the inoperative power assist valve.
27. Check adjustment and operation of the power assist relief valve, paragraph 3.7.5.
28. Check power assist suction line, pressure lines and pump.

3.3 METHODS OF TESTING THE HYDRAULIC SYSTEM

3.3.1 INTRODUCTION

3.3.1.1
The two methods of testing the hydraulic system, covered in this topic, are by use of a flow meter and by use of a pressure gauge. Flow testing the system is the most advantageous in that more information is presented to the user. This decreases the time and effort involved in the troubleshooting process by eliminating much of the costly guess work.

3.3.2 FLOW METER

3.3.2.1
A flow meter is an instrument that measures the output volume of the pump, pressure created in the system, and the temperature of the oil. When tests are run at various pressures, the meter will indicate the amount of system leakage and/or the amount of pump slippage by showing decreasing volume as pressure is raised with the flow meter's load valve.

3.3.2.2
The flow meter used in the following tests must have a capacity of at least 567.7 L/min (150 gpm) and 207 bar (211 kg/cm^2)(3000 psi). All test hoses must be of the high pressure type, capable of withstanding pressures to the capacity of the flow meter.

3.3.3 PRESSURE GAUGE

3.3.3.1
A pressure gauge is an instrument that measures pressure only. A decrease in pressure will provide an indication of system leakage. The pressure gauge used in the following tests must have a capacity of 207 bar (211 kg/cm^2) (3000 psi).

3.3.4 HYDRAULIC CHECK POINTS

3.3.4.1
Hydraulic check points are provided on each model of tractor, see Fig. 3-1, 3-2 or 3-3. These check points are in the high pressure line, leading from the front and rear sections of the main hydraulic pump. The check points are used with both the flow meter or the pressure gauge. By placing the check points in the output lines of the pump, the flow meter is connected in parallel with all circuits of the hydraulic system. This allows several circuits to be tested with one hook up and eliminates the time consuming job of disconnecting hydraulic lines and inserting the flow meter in series each time a test is made.

3.4 ISOLATION OF PROBLEMS

3.4.1 INTRODUCTION

3.4.1.1
Some of the more common complaints about a faulty hydraulic circuit are

the following pressure readings. Repeat this procedure with the ripper control lever in the "raise" position and record the results. Make sure that engine speed remains constant for each test.

bar	kg/cm^2	psi	Ripper Lower	Ripper Raise
34.5	35.1	500	- - -	- - -
68.9	70.3	1000	- - -	- - -
103.4	105.4	1500	- - -	- - -
*117.2	*119.5	*1700	- - -	- - -

*41-B only

3.6.4.5
Analysis of the results of paragraph 3.6.4.4 is as follows:

IMPORTANT: If a trouble is located and corrected, this entire procedure should be repeated to make sure that all components in the circuit are functioning properly.

1. If everything is normal up to this point the flow readings should drop off slightly, from that recorded in paragraph 3.6.4.3, as pressure (load) is increased. There should be NO noticeable difference between the flow readings("ripper-lower" or "ripper-raise") at each pressure point.

2. If any or all pressure(s) cannot be reached in EITHER direction ("ripper-lower" or "ripper-raise"), the main relief valve is probably stuck open, defective or mis-adjusted. This can be checked by shutting off the engine, relieving hydraulic pressure and interchanging the main relief valves. Start the engine and repeat paragraph 3.6.4.4. If the tests are now normal, shut off the engine, relieve hydraulic pressure and replace the valves in their normal position. Refer to paragraph 3.6.4.6 for adjustment of the main relief valve.

3. If the flow readings drop off in ONLY ONE direction ("ripper-lower" or "ripper-raise") the overload relief valve associated with that direction is probably stuck open, defective, or mis-adjusted. This can be checked by shutting off the engine, relieving hydraulic pressure and interchanging the overload relief valves. Start the engine and repeat paragraph 3.6.4.4. If the results are reversed from what they were ("lower" readings are now "raise" readings and visa versa) the valve is at fault. Refer to paragraph 3-8 for overload relief valve adjustment.

4. If the flow readings dropped off (as pressure was raised) more than 20% of that recorded in paragraph 3.6.4.3 and there is NO noticeable difference between the readings ("ripper-lower" or "ripper-raise") at each pressure point, the ripper lift cylinder(s) piston packing or the front section of the pump is probably at fault. Since the front section of the pump is also used in the dozer circuit, further isolation can be accomplished by flow testing the dozer circuit, paragraph 3.6.5. If the pump operates satisfactorily in the dozer circuit, one or both ripper lift cylinders are at fault. To determine which cylinder is at fault, apply down pressure on the ripper until the lift cylinder piston rods are fully extended. Securely block under the tractor and shut off the engine. Relieve hydraulic pressure and remove the "raise" line (the lower hydraulic line) from one of the ripper lift cylinders. Start the engine and again apply down-pressure on the ripper. If oil pumps from the cylinder opening, that cylinder is at fault. If oil pumps from the disconnected "raise" line,

engine, relieve hydraulic pressure, remove the flow block plates, and tighten the hydraulic connections. Start the engine and apply down pressure on the ripper until the lift cylinder piston rods are fully extended, Securely block under the tractor and shut off the engine. Relieve hydraulic pressure and remove the raise line (at the piston rod end) from one of the ripper lift cylinders. Start the engine and again apply down-pressure on the ripper. If oil pumps from the cylinder opening, that cylinder is at fault. If oil pumps from the disconnected raise line. the other cylinder is at fault. If oil pumps from both the cylinder opening and the disconnected line, both cylinders are at fault. See Topic 7, paragraph 7.3, for cylinder repair procedures.

3.7.4.8
Start the engine and set speed to about 1/2 throttle. Slowly engage the ripper pitch lever and note the pressure gauge reading after the ripper pitch cylinder piston rods reach the end of their stroke. Operate the ripper in the opposite direction and again note the pressure gauge reading after the piston rods reach the end of their stroke. Both pressure readings must be as follows:

MODEL	PRESSURE
	bar
21-C or 31	134.4 -- 141.3
41-B	155.1 -- 162
	kg/cm^2
21-C or 31	137 -- 144.1
41-B	158.2 -- 165.2
	psi
21-C or 31	1950 -- 2050
41-B	2250 -- 2350

3.7.4.9
If only one pressure reading is low, the overload relief valve associated with that pitch position may have failed or needs adjustment. Refer to paragraph 3.8 for the adjustment procedure.

3.7.4.10
If both pressure readings are low, the ripper pitch cylinder(s) piston packing is probably at fault. To determine which cylinder is at fault, raise the ripper, fully extend the pitch cylinder piston rods, and lower the ripper to the ground. Shut off the engine, relieve hydraulic pressure, and remove the "pitch-out" line (on piston rod end of cylinder) from one of the ripper pitch cylinders. Start the engine and again apply "pitch-in" pressure to the ripper. If oil pumps from the cylinder opening, that cylinder is at fault. If oil pumps from the disconnected "pitch-out" line, the other cylinder is at fault. If oil pumps from both the cylinder opening and the disconnected line, both cylinders are at fault. See Topic 7, paragraph 7.4, for cylinder repair procedures.

3.7.5 PRESSURE TESTING THE POWER ASSIST CIRCUIT

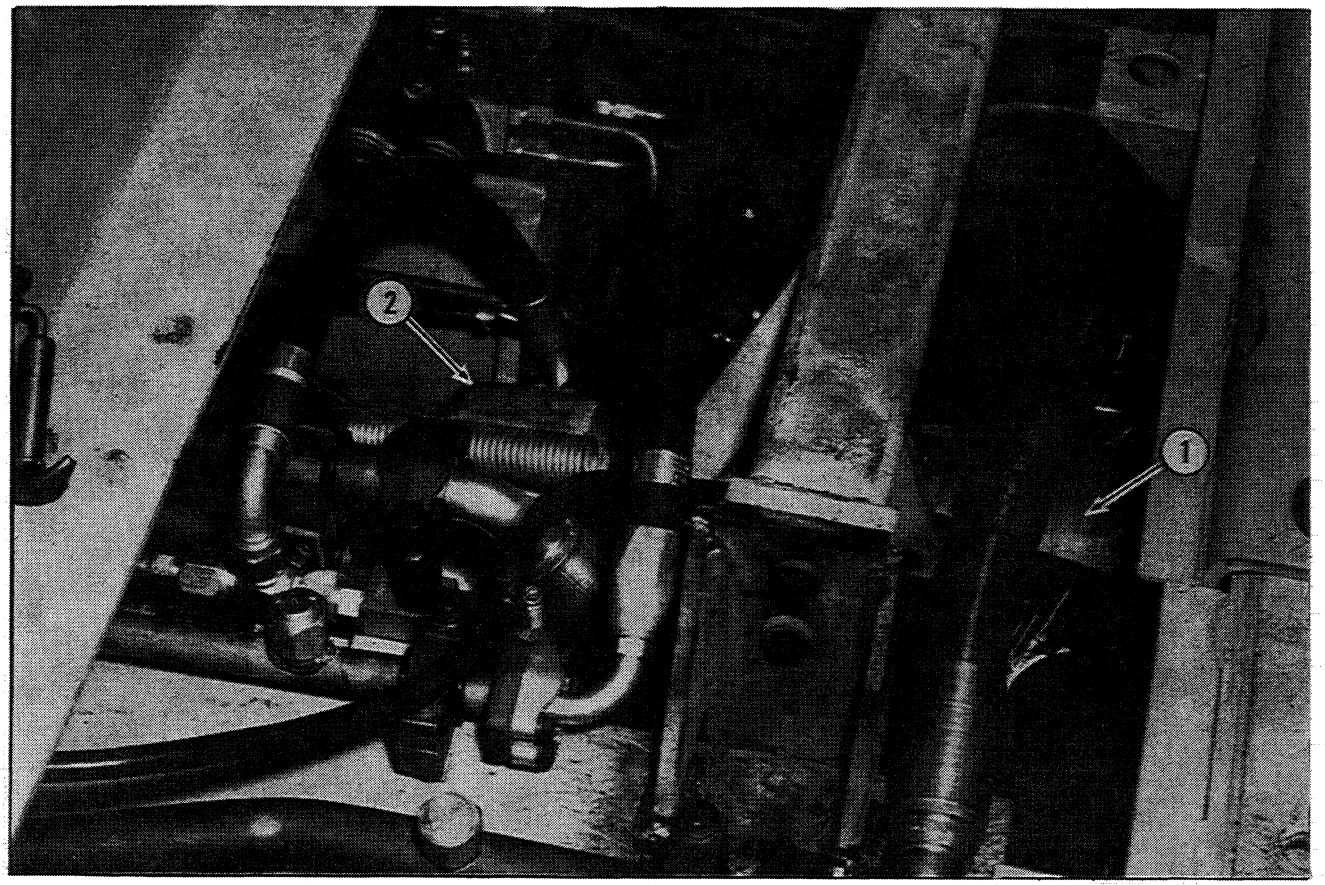
⚠ DANGER

Fluid under pressure. Always lower hydraulic equipment to ground. Shut off engine, move control levers to each position several times and loosen and retighten hydraulic tank filler cap to relieve trapped pressure before loosening hydraulic connections.

3.7.5.1
Relieve hydraulic pressure. Refer to Topic 5, Fig. 5-17, 5-18 or 5-19 and locate the power assist relief valve. Insert a pressure gauge in the line on the pump side of the valve.

NOTE: It may be easier to remove the cap on manifold tubing, Fig. 5-24 (20), 5-25 (20) or 5-26 (14) and connect the pressure gauge at this point.

TOPIC 5 HYDRAULIC PUMPS



T-82132

FIG. 5-1 MODEL 21-C; HYDRAULIC PUMP LOCATIONS

1. Main hydraulic pump
2. Power assist pump

5.1 MAIN HYDRAULIC PUMP (All Tractors)

5.1.1 GENERAL DESCRIPTION

5.1.1.1
Refer to Fig. 5-1, 5-2, or 5-3. The main hydraulic pump is located at the upper right rear of the torque converter. It is bolted to the gear housing and driven by the gear train. Rotation of the pump (21-C, 31) is clockwise (41-B counterclockwise) viewed from the front. The pump is accessible when the right front floor plate is removed.

5.1.2 MAIN HYDRAULIC PUMP; REMOVAL

⚠ DANGER

Fluid under pressure. Always lower hydraulic equipment to ground. Shut off engine, move control levers to each position several times and loosen and retighten hydraulic tank filler cap to relieve trapped pressure before loosening hydraulic connections.

5.1.2.1
Relieve hydraulic pressure and drain all the oil from the hydraulic tank.

front body assembly. Grasp both shafts of front gear assembly (12) and with a quick motion, lift both gears and top wear plate (13) from the front body assembly. This will usually break the suction holding bottom wear plate (13) and will make it easier to remove.

IMPORTANT: Use extreme care when removing the bottom wear plate. DO NOT pry or force it out.

5.3.1.5
Remove isolation plate (14) nylon retainer (11) rubber seal ring (10) and Teflon back-up ring (9). Note that this isolation plate differs from plate (8) in that it has two short rounded edges.

5.3.1.6
Lift off front body assembly (15); remove O-ring (19) and gear coupling (18). Remove studs (23) from center plate assembly (20).

5.3.1.7
Remove the eight capscrews (32) and washers from the rear of rear body assembly (30). Lift off center plate assembly (20) and remove O-ring (22).

5.3.1.8
Remove isolation plate (24) nylon retainer (27) rubber sealing ring (26) and Teflon back-up ring (25) from the rear body assembly. Grasp both shafts of rear gear assembly (33) and, with a quick motion, lift both gears and top wear plate (28) from the rear body assembly. This will usually break the suction holding bottom wear plate (28) and will make it easier to remove.

IMPORTANT: Use extreme care when removing the bottom wear plate. DO NOT pry or force it out.

5.3.1.9
Remove isolation plate (29) nylon retainer (27) rubber sealing ring (26) and Teflon back-up ring (25). Note that this isolation plate differs from plate (24) in that it has two short rounded edges.

5.3.2 MODEL 31; PUMP INSPECTION

⚠ WARNING

Never use gasoline, solvent or other flammable fluids to clean parts. See Operation and Maintenance Instruction Manual.

5.3.2.1
Wash all pump parts with a non-toxic, non-flammable, cleaning solution and let dry. Inspect the front and rear body assemblies. If the gear track on the suction side is more than 0.38 mm (0.015") deep, discard the body. Minor scoring can be smoothed out with a fine emery cloth. Also smooth the machined body faces with a fine flat stone.

5.3.2.2
Refer to Figs. 5-7 and 5-8. Make certain that isolation plates (8) (14) (24) and (29) are perfectly flat and are not cracked.

5.3.2.3
Inspect the gear shafts. If wear is evident, replace the gears and shafts. If the shafts and gears are to be reused, remove all burrs on the gear teeth with a fine flat stone. Break the sharp edges off the ends of the gear teeth with a fine stone.

5.3.2.4
Wear plates (13) and (28) must not show excessive wear on the bronze side. If deep curved wear marks are visible, discard them.

5.3.2.5
Front and rear pump kits and a seal kit are available for complete pump rebuilding.

5.4.3.8
Install the top wear plate (29) over the gears with the bronze side down and the relief pocket on the left (outlet) side of the pump).

IMPORTANT: The top surface of this wear plate must be flush with or below the machined surface of the rear pump body. If not, the seal rings may not seat properly.

5.4.3.9
Install top isolation plate (25) on the right (inlet) side of the pump as shown in Fig. 5-13 (4). Install Teflon back-up ring (2) rubber seal ring (1) and nylon seal retainer (3) as shown.

5.4.3.10
Refer to Figs. 5-11 and 5-12. Install O-ring (20A) in the groove in the bottom side of the center plate. Place the center plate over studs (34) and seat it securely against the rear body assembly. Make sure that the marks on the housings, made at the time of disassembly, are aligned. Lubricate the threads on studs (34) and install the eight socket nuts (35) and lockwashers. Tighten the socket nuts to a torque of 10.8 -- 12.2 daNm (11 -- 12.4 kgm) (80 -- 90 lbs. ft.).

5.4.3.11
Place O-ring (20) in the groove in the top surface of the center plate. Place gear coupling (19) over the splined shaft of rear drive gear (30). Make sure the shaft seats up against snap ring (18) which is inside the coupling.

5.4.3.12
Place front body assembly (17) on the center plate. Make sure that the marks on the housings, made at the time of disassembly, are aligned. Lubricate the threads on studs (22). Install hex nuts (23) and lockwashers and torque to 10.8 -- 12.2 daNm (11 -- 12.4 kgm) (80 -- 90 lbs. ft.).

5.4.3.13
Install bottom isolation plate in the bore of the center body assembly, with the rounded edges on the bottom, see Fig. 5-13 (4). Install Teflon back-up ring (2) rubber seal ring (1) and nylon seal retainer (3) as shown.

5.4,3.14
Refer to Fig. 5-11. Install bottom wear plate (12) over the seal rings, with the bronze side up and the relief pocket to the left (outlet side of pump body). If the plate binds on the way down, DO NOT force it into place. Work it back and forth gently until it slides into position.

5.4.3.15
Install front drive gear (13) into the top bore (6) of the pump body as viewed in Fig. 5-13. The splined shaft should seat in coupling (19) and the gear should seat against the bottom wear plate. Install front idler gear into the opposite bore.

5.4.3.16
Install top wear plate (12) over the gears with the bronze side down and the relief pocket on the left (outlet) side of the pump).

IMPORTANT: The top surface of this wear plate must be flush with or below the machined surface of the pump body. If not, the seal rings may not seat properly.

5.4.3.17
Install top isolation plate (8) on the right (inlet) side of the pump as shown in Fig. 5-13 (4). Install Teflon back-up ring (2) rubber seal ring (1) and nylon seal retainer (3) as shown.

5.4.3.18
Refer to Figs. 5-11 and 5-12. Place O-ring (7) in the groove in mounting flange (4) and seat the mounting flange against front body assembly (17).

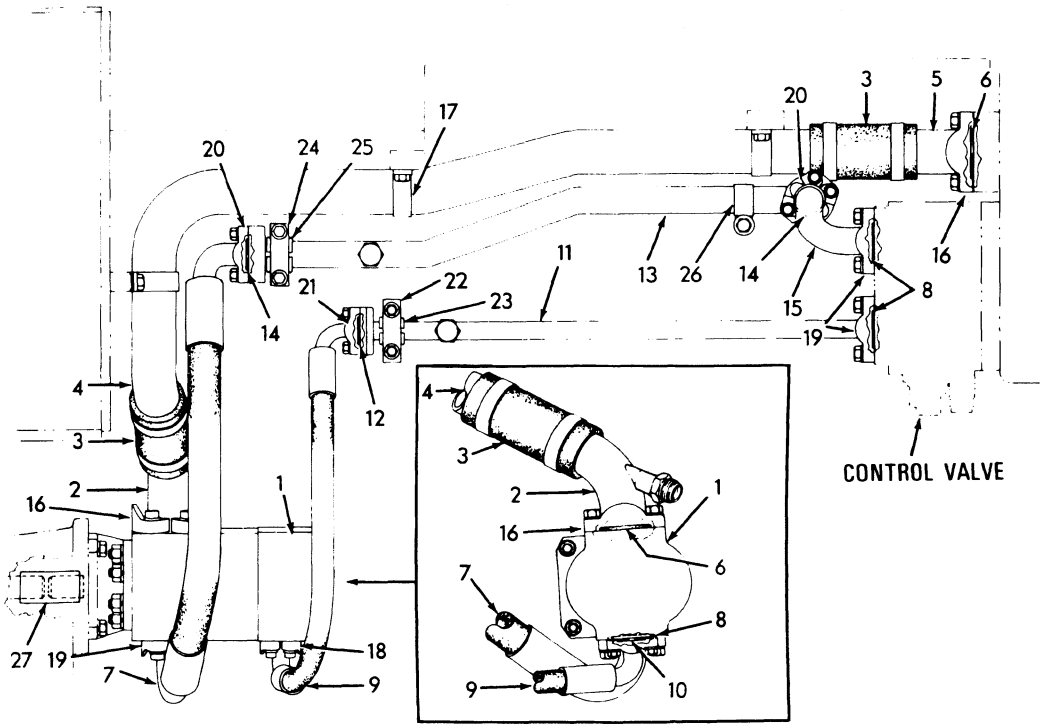


FIG. 5-21 MODEL 21-C; MAIN HYDRAULIC PUMP, PIPING

1. Pump assembly
2. Tube
3. Hose
4. Tube
5. Tube
6. O-ring
7. Hose
8. O-ring
9. Hose
10. O-ring
11. Tube
12. O-ring
13. Tube
14. O-ring
15. Tube
16. Flange
17. Clip
18. Flange
19. Flange
20. Flange
21. Flange
22. Clamp
23. Bushing
24. Clamp
25. Bushing
26. Clamp
27. Splined coupling

6.2 MAIN RELIEF VALVE SECTIONS

6.2.1 DESCRIPTION

The main relief valve sections are very similar and the service instructions apply to both. These valves are pilot operated which means they operate on an unbalanced principle, (See paragraph 2.7). Valve construction permits removal of the complete valve from either the tilt or ripper pitch sections.

6.2.2 MAIN RELIEF VALVE; REMOVAL AND DISASSEMBLY

⚠ DANGER

Fluid under pressure. Always lower hydraulic equipment to ground. Shut off engine, move control levers to each position several times and loosen and retighten hydraulic tank filler cap to relieve trapped pressure before loosening hydraulic connections.

6.2.2.1
The valves are located on either end of the hydraulic control valve assembly (1 and 12) Fig. 6-4. Remove either of the valves by unscrewing the valve cartridge and pulling the complete valve from the housing.

6.2.2.2
Refer to Fig. 6-5 and 6-6. Secure the valve in a vise and remove acorn nut (4) washer (5) jam nut (7) and washer (5) from adjusting screw (6). Loosen the screw and then remove spring retainer (8) screw (6) spring (11) and poppet (12) as an assembly. Seat (13) with O-ring (14) and back-up ring (15) may be removed with a small hook.

6.2.2.3
On the other end of the relief valve cartridge there are two set screws (30) that must be removed. Once these have been removed, pull out seat retainer (29) and relief valve seat (28). Remove O-ring (26) and back-up ring (27). Remove poppet assembly (21) and spring (20) which is directly behind it. Located inside the poppet assembly is a snap ring (25) which must be removed to gain access to spacer (24) and screens (22 and 23).

6.2.2.4
If it becomes necessary to remove the housing section, remove the two corner capscrews securing the total valve to its mounting plate. Remove the nuts from the stud holding the section. Disconnect the applicable lines and linkage and lift each section off individually (note the seal ring placements between sections). The bottom of left section also has two corner capscrews. When re-installing the sections, use new seal rings and tighten the stud-nuts to 13.5 daNm (13.8 kgm)(100 lbs. ft.) lubricated. Reinstall the two corner capscrews and tighten to 14.9 -- 18.3 daNm (15.2 -- 18.6 kgm)(110 -- 135 lbs. ft.).

6.2.3 MAIN RELIEF VALVE; ASSEMBLY AND INSTALLATION

6.2.3.1
Refer to Figs. 6-5 and 6-6. Secure cartridge (17) in a vise (at the hex). Install a new O-ring (14) and back-up ring (15) on floating seat (13). Lubricate and push the seat into the cartridge.

6.2.3.2
Screw adjusting screw (6) a short way into spring retainer (8). Position spring (11) and poppet (12) into the retainer, and a new copper gasket (9) and O-ring (10) on the retainer. Screw the retainer into the cartridge. Tighten retainer securely.

IMPORTANT: To avoid excessive pressure when the unit is first started, the adjusting screw must NOT be tightened until the mechanic is ready to measure the pressure.

6.4.3 TILT, RIPPER OR RIPPER PITCH CONTROL VALVE; ASSEMBLY

6.4.3.1
Refer to Figs. 6-9 and 6-10. It is recommended that all seals, back-up rings, O-rings and snap rings be replaced with new parts during assembly.

6.4.3.2
Lubricate all internal parts with clean hydraulic oil before beginning assembly.

6.4.3.3
At the smaller end of the cartridge of overload relief valve (6) install O-ring (14) in the outside groove behind the threads. Refer to Fig. 6-10. Install back-up ring (17) and O-ring (18) in the smaller diameter outside groove. Insert back-up ring (15) and O-ring (16) into the groove on the inside of the cartridge. Insert poppet (19) and spring (20) into the cartridge. Position cap (21) over the end of the cartridge. The cap may appear to be too loose, but tolerances after installation will not permit it to come free.

6.4.3.4
At the other end of the cartridge, insert seat (12) spring (11) and washers (9) and (10). Install O-ring (8) over the threads of cap (7) and screw the cap into the cartridge. Tighten the cap securely. Install the relief valve assembly into either position in the control valve housing and tighten it securely. Repeat paragraphs 6.4.3.4 for assembly of the other overload relief valve.

6.4.3.5
Install O-ring (2) back-up ring (3) plate (4) and end cap (5) to the end of control valve housing (1) using the four capscrews and lockwashers removed in paragraph 6.4.2.10.

6.4.3.6
Clamp valve spool (27) in a soft jawed vise. DO NOT mar the finish and DO NOT hold the spool by inserting a tool into the holes. Place check valve (26) and spring (25) into the proper end of the spool, see paragraph 6.4.2.9. Place back-up ring (23) and O-ring (24) over the threaded end of bolt (22). Apply a light coat of Loctite B7-2 -- yellow (or equivalent) to the threads on the bolt. Insert the bolt into the end of the spool and tighten securely.

6.4.3.7
Place check valve (26) and spring (25) into the other end of valve spool (27). Place back-up ring (23) and O-ring (24) over the threaded end of spool lug (31). Apply a light coat of Loctite B7-2 -- yellow (or equivalent) to the threads on the spool lug. Insert the spool lug into the end of the valve spool and tighten securely.

6.4.3.8
Insert valve spool (27) into control valve housing (1) with the spool lug protruding from the open end of the housing. The valve spool may have to be turned as it is inserted into the housing due to the close tolerances. Insert O-ring (2) and pilot sleeve (30) into the open end of the control valve housing.

6.4.3.9
Assemble piston (32) and spool (37) using pin (33). Place O-ring (34) into the groove on the piston. Place the piston and spool assembly into power assist housing (28). With a soft hammer lightly tap on the piston lug until the piston O-ring is just seated into the housing.

6.4.3.10
Insert O-ring (29) into the groove in the end of the power assist housing. Place the piston lug into the slot in the end of spool lug (31). With the soft hammer, lightly tap on the other end of the power assist housing until it seats against the control valve housing. Secure the power assist housing to the control valve housing using the four capscrews and lockwashers removed in paragraph 6.4.2.5.

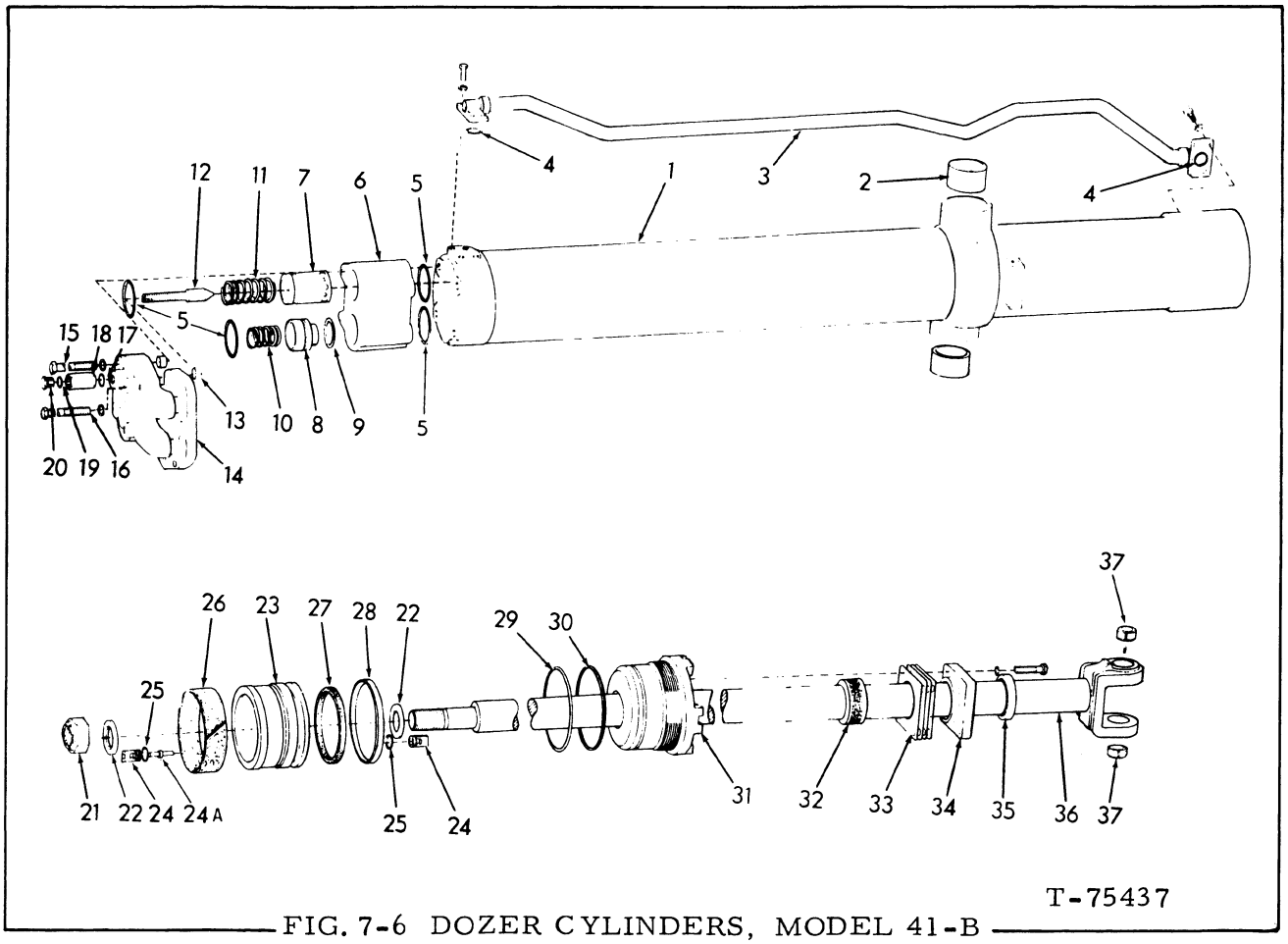


FIG. 7-6 DOZER CYLINDERS, MODEL 41-B

LEGEND FOR FIGS. 7-4, 7-5 and 7-6

1. Cylinder assembly
2. Bushing
3. Tube
4. O-ring
5. O-ring
6. Valve and housing assy.
7. By-pass valve (raise line)
8. By-pass valve (drop line)
9. O-ring
10. Spring
11. Spring
12. Adjusting screw
13. Bushing
14. Head
15. Capscrew
16. Capscrew
17. Seal
18. Nut
19. O-ring
20. Plug (includes item 19)
21. Locknut
22. Spacer
23. Piston assy.
24. Limit travel guides
24A. Limit travel plunger
25. O-ring
26. Wear ring
27. Seal ring (rubber)
28. Seal ring (Teflon)
29. O-ring
30. Ring
31. Head
32. Rod packing assembly
33. Shim
34. Plate
35. Wiper
36. Rod
37. Bushing

(.12") and set the generator at 180 -- 195 amps. DO NOT weld over any portion of the tube that the piston travels across.

7.2.4.2
Lower the moldboard to the ground. Shut off the engine and relieve trapped pressure. If oil is leaking from the packing, remove the capscrews and lockwashers that secure end plate (3) to cylinder head (7). Slide the end plate away from the cylinder head and remove one shim (5). Reassemble the end plate to the cylinder head. If leakage persists, remove one more shim. If leakage still persists after all shims have been removed, replace the packing assembly and install four new shims.

IMPORTANT: DO NOT remove more than one shim at a time. If the piston rod packing is too tight it will sieze against the rod causing excessive wear and improper operation of the cylinder. When installing new piston rod packing the cylinder MUST be disassembled. DO NOT cut the new packing to make the installation easier.

7.2.5 DOZER TILT CYLINDER WIPER SEAL, PISTON ROD PACKING AND PISTON REMOVAL

NOTE: The piston rod assembly must be removed from the cylinder for this operation.

7.2.5.1
Refer to paragraph 7.2.2, and remove the cylinder from the tractor. Refer to Fig. 7-15, and remove the cylinder head capscrews and lockwashers. Pull the rod and piston assembly from the cylinder.

7.2.5.2
Refer to Figs. 7-3 and 7-15. Install the rod assembly in the torquing fixture. Remove locknut (17) and slide all parts from the piston rod.

7.2.5.3
Remove the capscrews and lockwashers that secure end plate (3) to cylinder head (7). Remove rod wiper (4) from the end plate, and clean the bore in the end plate.

7.2.5.4
Remove rod packing assembly (6) O-ring (9) and back-up ring (8) from the cylinder head. Clean the bore in the cylinder head, and inspect the packing for wear.

7.2.5.5
Remove and discard Teflon seal ring (11) rubber seal ring (10) and wear ring (12) from piston (13).

7.2.6 DOZER TILT CYLINDER INSPECTION

7.2.6.1
Visually inspect the piston for wear, scoring and nicks.

7.2.6.2
Check the piston rod for such minor imperfections as nicks, burrs and wear. If present, remove these imperfections with crocus cloth. Check for a bent rod by using a straight edge or by rolling the rod on a flat surface. Replace the rod if the chrome is worn or if there are any rust spots.

7.2.6.3
Inspect the interior of cylinder tube. Minor imperfections may be removed with crocus cloth. If the tube is scored or worn it must be replaced.

7.2.6.4
Inspect the weld at end of piston rod and the weld at the cap end of the cylinder tube. If the welds are cracked they may be repaired by welding. Use a low hydrogen weld rod #E7018, 3.0 mm (.12") and set the generator at 180 -- 195 amps. DO NOT weld on any portion of the tube that the piston travels across.

7.2.7 DOZER TILT CYLINDER WIPER SEAL, PISTON ROD PACKING AND PISTON PACKING INSTALLATION

NOTE: Refer to Fig. 7-15. A repair kit is available to supply items 4 thru 6 and 8 thru 12. Each of these items may also be ordered separately.

Replace the rod if the chrome is worn or if there are any rust spots.

7.3.9.3
Measure the inside diameter of bushing (17). If the I.D. is 76.96 mm (3.03") or more, replace the bushing. This is a hardened steel bushing which may be removed as follows:

⚠ WARNING

Wear welders protective equipment such as dark safety glasses, helmets, protective clothing, gloves and safety shoes when welding or burning. Wear dark safety glasses near welding. DO NOT LOOK AT THE ARC WITHOUT PROPER EYE PROTECTION.

7.3.9.4
Weld two or three beads across the inner surface of the piston rod bushing. This will shrink the bushing so that it may be driven out of the piston rod eye as shown in Fig. 7-18.

7.3.9.5
Press a new bushing into the piston rod eye so that the ends of the bushing are flush with the faces of the rod eye.

7.3.9.6
Inspect the interior of the cylinder tube. Minor imperfections may be removed with crocus cloth. If the tube is scored or worn it must be replaced.

7.3.9.7
Inspect the welds at the end of the piston rod and the cap end of the cylinder tube. If the welds are cracked, they may be repaired by welding. Use a low hydrogen weld rod #E7018, 3.0 mm (0.12") and set the generator at 180 -- 195 amps. DO NOT weld on any portion of the tube that the piston travels across.

7.3.10 MODEL 31 RIPPER LIFT CYLINDER -- WIPER SEAL, PISTON ROD PACKING AND PISTON PACKING INSTALLATION

NOTE: Refer to Fig. 7-19.

1. A repair kit is available to supply items 5, 7, 8, 10, 11, 13, 14 and 16. Each of these items may also be ordered separately.

7.3.10.1
Press a new rod wiper (16) into end plate (15) with the sealing lip facing out.

7.3.10.2
Install packing assembly (13) into cylinder head (12). Place the four shims (14) and end plate (15) into position on the cylinder head. Lubricate the threads of the end plate capscrews. Install the end plate capscrews and lockwashers and tighten hand tight only; DO NOT apply pressure.

7.3.10.3
Refer to Fig. 7-7, and install pilot sleeve (1) on the piston rod. This sleeve protects the rod wiper and packing from damage when the cylinder head is being installed on the piston rod. Lightly coat the end of the piston rod with grease, and carefully install the cylinder head assembly onto the piston rod as shown in Fig. 7-8. Use care to prevent damaging the wiper seal and packing on the shoulder of the piston rod. Remove the pilot sleeve.

7.3.10.4
Refer to Fig. 7-19, and install backup ring (11) and O-ring (10) on the cylinder head.

7.3.10.5
Install the rubber seal ring (7) in the narrow groove in piston (6). The Teflon seal ring (8) may be difficult to install. To make it more pliable, twist the ring, as shown in Fig. 7-9, and then install the Teflon ring over the rubber ring as shown in Fig. 7-10. In a few minutes the Teflon ring will be back to its original shape. Refer to Fig. 7-19, and install wear ring (5) into the wide groove in the piston.

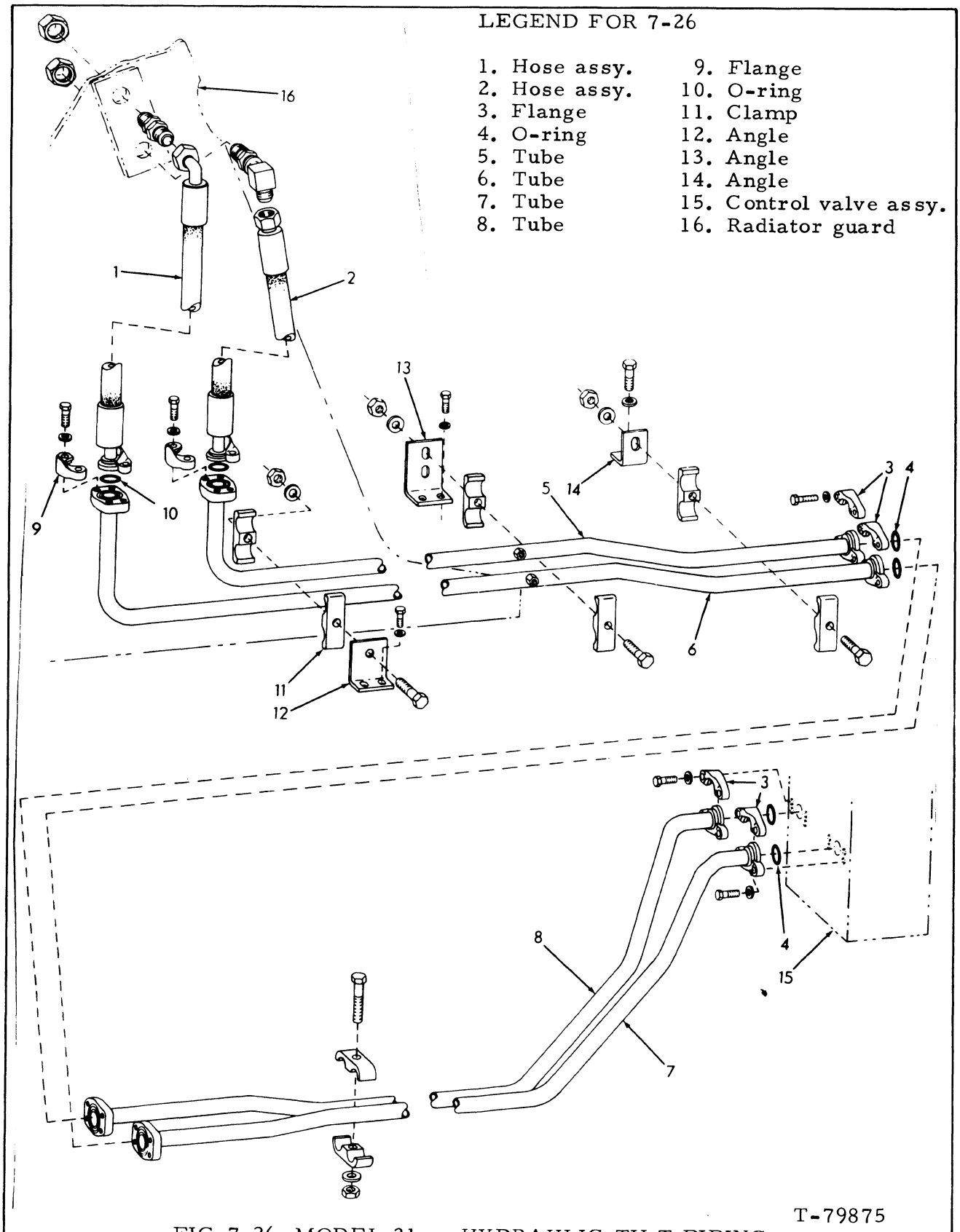


FIG. 7-26 MODEL 31 -- HYDRAULIC TILT PIPING

TOPIC 8 DOZER

⚠ WARNING

⚠ Before moving machine or attachments be sure exposed people in the area are clear of the machine. Walk completely around machine before mounting. Sound horn.

⚠ Never attempt to operate machine or attachment except when seated in the operator's seat. Keep head, body, limbs, hands and feet inside the operator's compartment to reduce exposure to hazards outside the operator's compartment.

⚠ Warn all people who may be servicing or working around machine before starting engine.

⚠ Do not run the engine of this machine in closed areas without proper ventilation to remove deadly exhaust gases.

⚠ Keep people clear of attachments and tools while in raised position, to prevent possible injury.

⚠ Observe all start up and shut down procedures and ⚠ WARNINGS listed in the Operation and Maintenance Instruction Manual.

⚠ Do not work under or near unblocked or unsupported linkage, parts or machine.

⚠ When servicing or maintenance requires access to areas that cannot be reached from the ground, use a ladder or step platform that meets local or national requirements to reach the service point. Perform all service maintenance carefully.

8.1 MODEL 21HA C-FRAME AND MOLDBOARD

8.1.1 DOZER REMOVAL

8.1.1.1
Refer to Fig. 8-1. Level the moldboard on the ground and shut off the engine. Block up C-frame (1) to minimize tension on moldboard pivot pin (15) and track frame trunnions (13). Approximate weight of the C-frame is 1587 kg (3500 lbs.).

8.1.1.2
Disconnect the C-frame from the trunnions by removing capscrews (10) and pivot caps (9).

NOTE: Individual shim packs will be found between both ends of pivot cap (9) and pivot socket (8). Wire each shim pack together and attach to cap (9) to prevent loss or mixup.

⚠ DANGER

Fluid under pressure. Always lower hydraulic equipment to ground. Shut off engine, move control levers to each position several times and loosen and retighten hydraulic tank filler cap to relieve trapped pressure before loosening hydraulic connections.

8.1.1.3
Relieve hydraulic pressure and disconnect both lift cylinder piston rods from lifting lugs (6) (7) on the C-frame. Start the engine. Move the dozer control lever to the "raise" position to force the piston rods into the lift cylinders. Tie each piston rod to its cylinder in the retracted position and secure the cylinders by attaching the shipping bracket to each cylinder.

8.1.1.4
Back the tractor away from the C-frame.

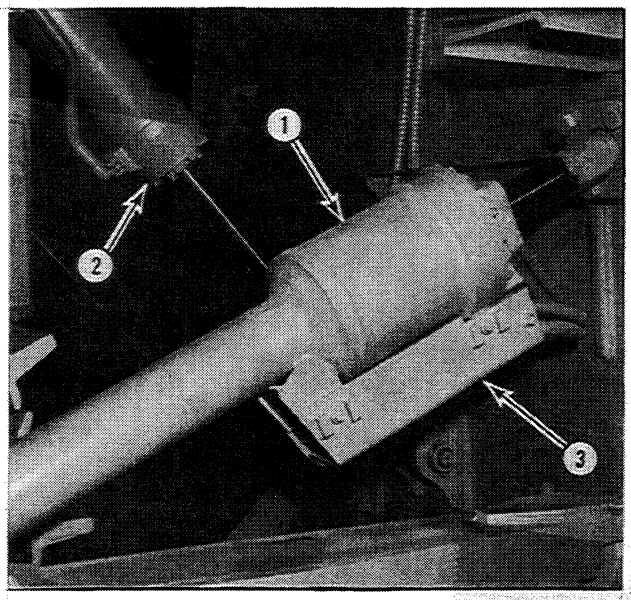


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FIG. 8-3 TYPICAL TILT CYLINDER INSTALLED

1. Tilt cylinder
2. Dozer cylinder
3. Hose guard

8.2.4.6
Clean the ball sockets on the moldboard, the balls on the ends of the braces, and the ball on the tilt cylinder piston rod. Coat each ball with grease, and place the attached shim packs over each ball.

8.2.4.7
Disconnect the shipping bracket from each lift cylinder. Start the engine, and move the dozer control lever to force the piston rods out of the lift cylinders. When in position attach the piston rods to the moldboard.

8.2.4.8
Move the dozer tilt control to force the piston rod out of the tilt cylinder. Position the cylinder with the hoist so that the ball is in place and collar (15) may be secured to the moldboard. Shut off the engine. Lubricate and install collar capscrews (17) and torque to the following values.

NOTE: The ball and socket should be a 0.0 -- 0.812 mm (0.0 -- 0.32") loose fit on the ball, Add or remove shims (14) as required.

MODEL	TORQUE
	daNm
21-C 31 or 41-B	81.3 -- 100.3 244 -- 271.2
	kgm
21-C 31 or 41-B	83 -- 102.3 248.9 -- 276.6
	lbs. ft.
21-C 31 or 41-B	600 -- 740 1800 -- 2000

8.2.4.9
Install the brackets holding the hydraulic support cable and tilt cylinder hydraulic hoses to the moldboard.

8.2.4.10
Attach both diagonal braces (11) and tilt brace (19) to the moldboard. The ball and socket fit and collar capscrews torque of each is the same as that required for the tilt cylinder in paragraph 8.2.4.8.

IMPORTANT: Recheck all the ball fits after the first 50 hours of operation.

8.2.4.11
Using an adjusting bar, center the dozer with the tractor by adjusting the length of each diagonal brace (11) until the left and right push beams are at an equal distance from the track frame.

8.2.4.12
Once the push beams are aligned, lengthen each diagonal brace equally until all looseness is removed and the moldboard is tight. Lock each brace by installing flex pin (13) see Fig. 8-2.

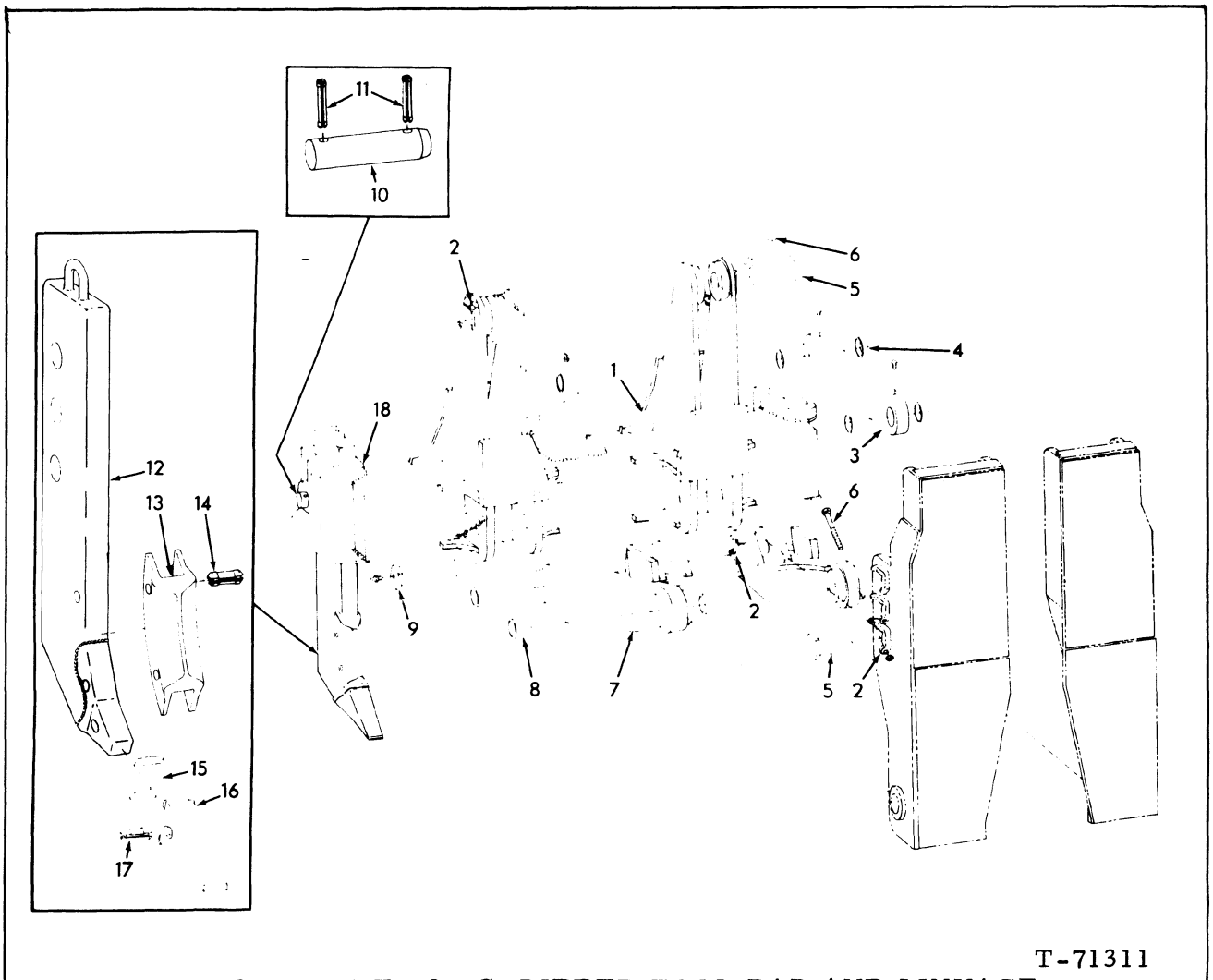

FIG. 9-1 MODEL 21-C; RIPPER TOOL BAR AND LINKAGE

1. Tool bar assembly
2. Pin stop
3. Upper strut
4. Bushing
5. Upper strut pin
6. Capscrew
7. Lower beam
8. Bushing
9. Lower beam pin
10. Shank retaining pin
11. Pin
12. Ripper shank and tooth assembly
13. Plate
14. Flex pin
15. Collar
16. Tooth
17. Flex pin
18. Bracket
19. Plate
20. Rib

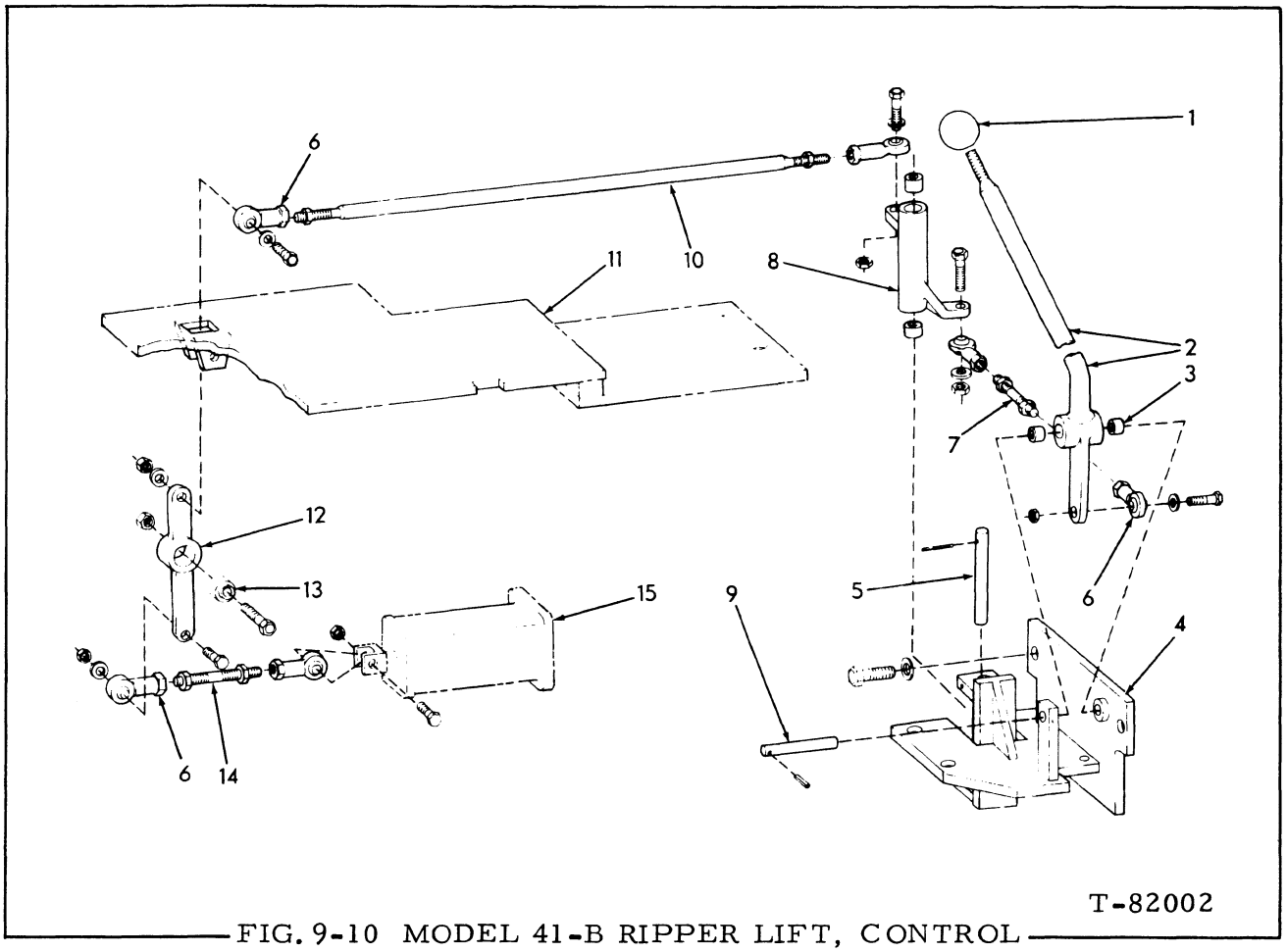

FIG. 9-10 MODEL 41-B RIPPER LIFT, CONTROL

1. Knob
2. Lever assembly
3. Bearing
4. Bracket
5. Shaft
6. Rod end
7. Rod
8. Bellcrank assembly
9. Shaft
10. Rod
11. Plate
12. Lever assembly
13. Bearing
14. Rod
15. Control valve assembly