WABCO

C TRACTOR DOZER

service manual

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CONSTRUCTION EQUIPMENT DIVISION
Peoria, Illinois, U.S.A. 61601

FOREWORD

The Maintenance and Repair Manual is especially designed for use by mechanics. The material is arranged for easy reference and logical sequence of detail. The first section contains brief instructions on how to operate the machine, it's specifications, and instructions on lubrication. (For a more complete explanation, refer to the Operator's Manual.)

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

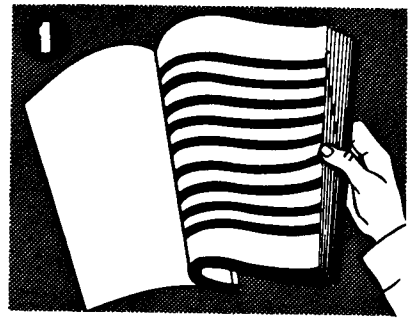
The instruction manual contained herein pertains to machines with serial number suffix SCT and up.

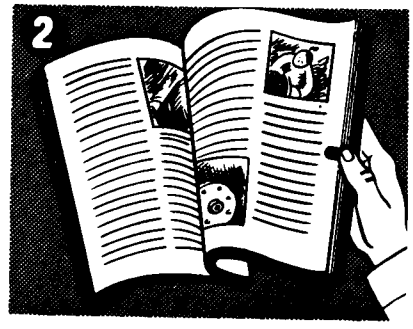
How to use Table of Contents

To save you time and also make it easy for you to find the information needed, each section in this manual has been indicated with a tab.

To quickly find each section, follow these two steps:

1. Hold manual in your right hand . . . flex book (as illustrated in figure 1) so you can see corresponding black tabs printed down right hand edges of inside pages.
2. Slide thumb down edge of manual to section desired . . . and open (see figure 2.)





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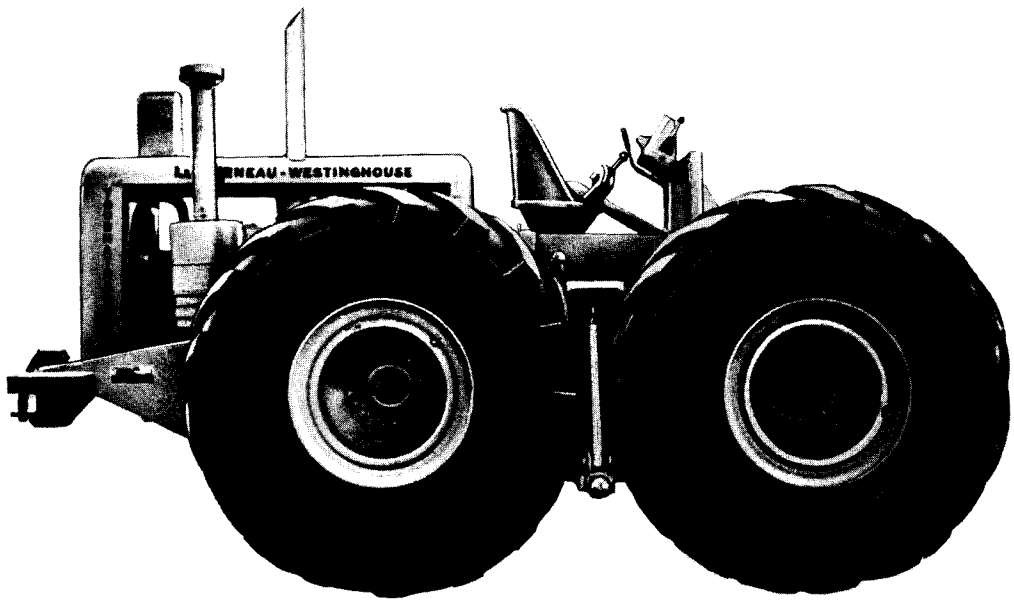


Figure A-1. Model C Tournatractor, Steering Levers

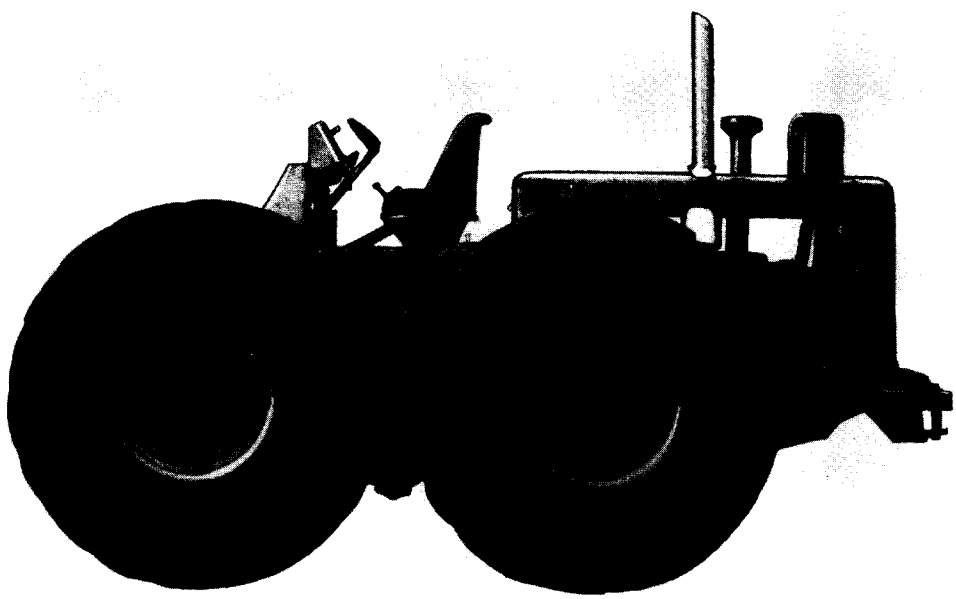


Figure A-2. Model C Tournatractor, Steering Wheel

GENERAL INFORMATION

MODEL C TOURNATRACTOR

The Model C Tournatractor is powered by a solid injection type, full diesel engine located at the rear of the machine.

The fuel tank is located to the rear of the cockpit. The fuel tank filler is on the right hand side of the fuel tank.

The Tournatractor has 4 speeds forward and 2 in reverse, ranging from 1.61 m.p.h. to 19.23 m.p.h. in forward, and from 3.52 m.p.h. to 8.09 m.p.h. in reverse.

The Tournatractor has a self contained electrical system consisting of an A.C. generator, transformers and rectifiers, batteries, control switches, A.C. motors, and connecting cables. The A.C. generator is located directly in front of the engine. The generator rotor is connected to the engine flywheel by means of a flexible drive plate. The generator is a 3 phase, 300 volt alternating current, 120 cycle type. The A.C. electric motors which operate the attachments are 3 phase, 120 cycle, high slip induction type motors.

The torque converter is connected directly to the generator rotor by an adaptor. The torque converter output shaft is connected to the transmission by means of a splined drive shaft extended through the ring gear compartment.

The torque converter oil pump is bolted either to the left hand accessory drive of the engine, or to a mounting bracket located on the right side of the engine compartment floor. This pump maintains the required volume of oil in the torque converter under pressure.

The transmission is of the constant mesh type. Different gear ratios are affected by air actuated clutches located on the front of the transmission case.

The ring gear compartment is directly under the cockpit floor plate. This compartment contains the spiral bevel ring gear and pinion, carrier shaft and drive shaft. These are splash lubricated.

To the right and to the left of the ring gear compartment are the steering clutch compartments, one on each side, which contain the right and left steering clutches. The steering clutches are connected to the final drive pinions and the final drive pinions are meshed with the idler gears which in turn are meshed with the final drive bull gears.

These gears are supported on anti-friction bearings and are splash lubricated.

Remove the cover plates on the front and rear of each side of the main case to gain access to the final drive gears.

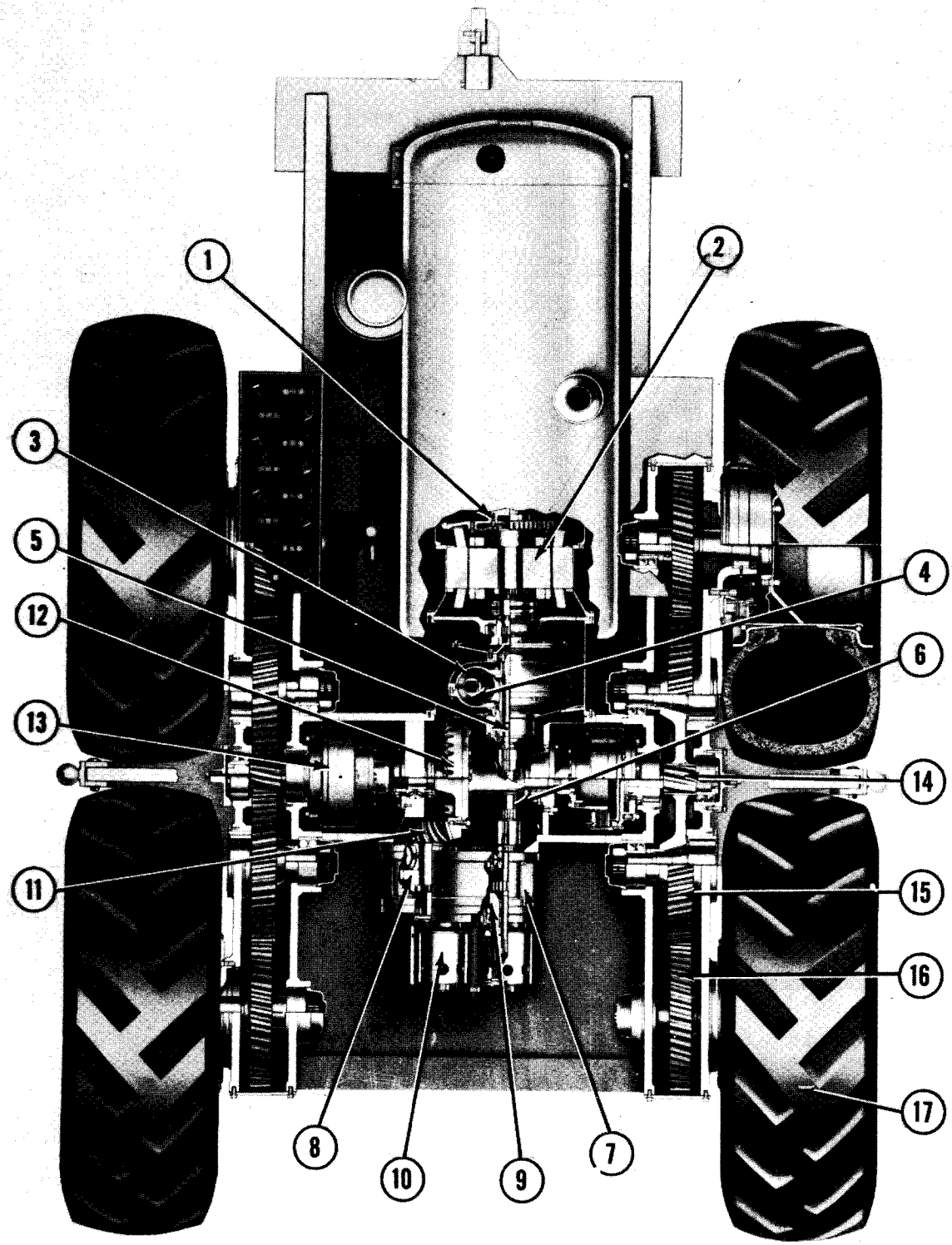
All four wheels are equipped with multiple disc air actuated and spring released brakes, operated by foot application valves, located on the cockpit floor.

The Tournatractor has 4 tapered bead, low pressure, pneumatic tires with directional tread for added flotation and traction.

The instrument panel is in the cockpit, in front of the foam rubber operator's seat. All switches and gauges necessary for operation of the Tournatractor are conveniently located on the instrument panel.

The name plate for the Tournatractor is attached to the right rear of the main case. This plate lists the name and serial number of the machine. This number is important when ordering replacement parts.

Figure A-3. Tournatractor Nameplate



1. ENGINE FLYWHEEL
2. GENERATOR ROTOR
3. TORQUE CONVERTER TURBINE
4. TORQUE CONVERTER PUMP
5. TURBINE OUTPUT SHAFT
6. ENGINE SHAFT
7. TRANSMISSION
8. INNER GEAR TRAIN
9. OUTER GEAR TRAIN
10. CLUTCHES
11. OUTPUT PINION
12. RING GEAR AND CARRIER SHAFT
13. STEERING CLUTCH
14. FINAL DRIVE PINION
15. IDLER GEAR
16. FINAL DRIVE GEAR
17. WHEEL

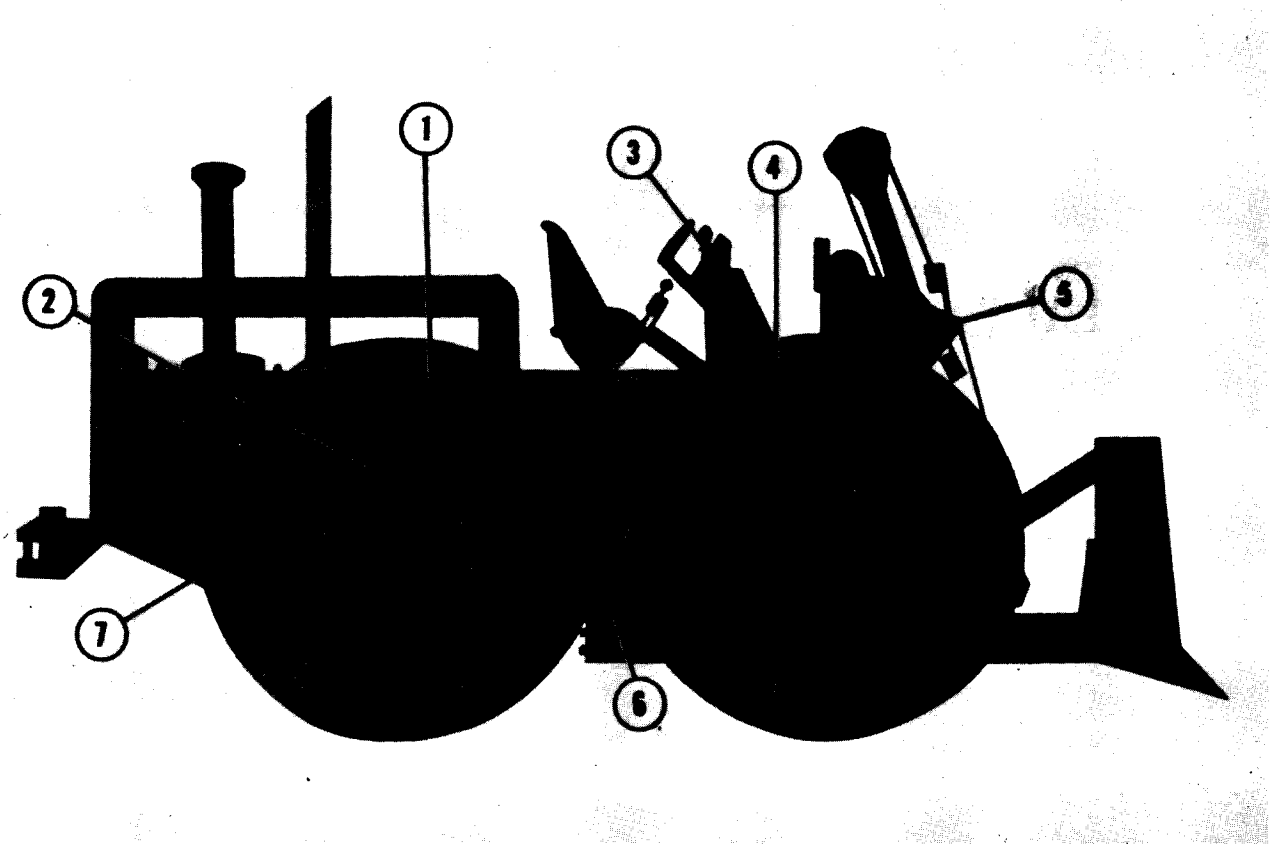
Figure A-4. Cut-Away of Model C Tournatractor

DRIVE SYSTEM

The rotation of the engine flywheel goes through the generator rotor to the torque converter pump. Here the rotation is transferred to the oil in the torque converter which drives the torque converter turbine. The turbine output shaft carries the rotation through the engine shaft to the transmission. Here the combined inner and outer gear trains plus the air actuated disc clutches linking the desired gear ratios for the various speeds carry the rotation from the engine shaft through the transmission to the output pinion. From the output pinion the rotation is carried through the ring gear and carrier shaft to the steering clutches. The engaged steering clutches rotate the final drive pinion. When the final drive pinion rotates, the idler and final drive gear rotate giving the driving rotation to the wheels.

ELECTRICAL SYSTEM

When a control switch on the instrument panel is closed the power from the generator is conducted to the motor controlled by the closed switch. While the motor is operating the brakes are automatically released. As soon as operation ceases the brakes are automatically engaged, thereby holding the load. Electric current is always available when the engine is running and the generator is excited.



1. BATTERIES
2. TRANSFORMER
3. INSTRUMENT PANEL
4. CONTROL BOX
5. ELECTRIC MOTOR
6. A.C. GENERATOR
7. RECTIFIERS

Figure A-5. Electrical System

PREPARING NEW UNIT FOR OPERATION

General

Inspect machine thoroughly for external appearance and possible damage or theft in shipment. Report any damage or shortage to railroad or carrier.

Remove all processing, protective material or packing used to condition the machine for shipment. Detach tools or bundles wired to the machine.

Check lubrication points.

Check for water, oil, fuel or air leaks before start-

ing and during operation of engine.

Check level of fuel oil in tank.

Engine and Accessories

Check fuel pump and governor oil level.

Fill radiator, check coolant. (Anti-freeze in winter.)

Check fan belt adjustment.

Grease water pump and fan.

Drain off small amount of fuel from fuel filters to remove water or sludge.

See the engine manufacturer manual for complete instructions of preparing engine for initial operation.

Start engine. Observe operation. Check for any unusual noise or abnormal engine performance.

Check engine oil pressure at pressure gauge.

Check engine temperature at temperature gauge.

Check torque converter tank oil level.

Check unloader valve clearance.

Transmission

Check oil level.

Check clutch clearance. Lock screws tight.

Back off adjustment on Hi-forward clutch if driving long distances at high speed.

Grease bearings in inlet fittings.

Drain water from air tank.

Check for air leaks in air lines or at shifter valves.

Check transmission for correct operation at all speeds. Inspect clutches for slippage or overheating.

Steering Clutches

Check for proper operation. Examine for overheating or slippage.

Check for air leaks at control valves.

Final Drives

Check oil level in final drive housing on both left and right sides of machine.

Check operation and adjustment of parking brake.

Wheel Brakes

Check for air leaks in brake air line.

Check brakes for correct operation.

Wheels and Tires

Check tire pressure. Inflate or deflate to correct pressure.

Check wheel bolts for tightness. Check bolts each shift for first few days of operation and then intermittently thereafter.

Electrical System

Check all electrical connections for tightness.

Check level of electrolyte in batteries.

Check lights.

Check oil level in rectifier pot.

Check ammeter on instrument panel. The ammeter should show a charge of 20 amperes with lights off and engine at full speed.

Check for open breather hole in rectifier oil tank fill pipe cap.

Check operation of limit switches.

Miscellaneous

Check air pressure gauge on dash panel. For proper operation, it should be 90 to 120 pounds per square inch before moving the machine.

Drain air line filter.

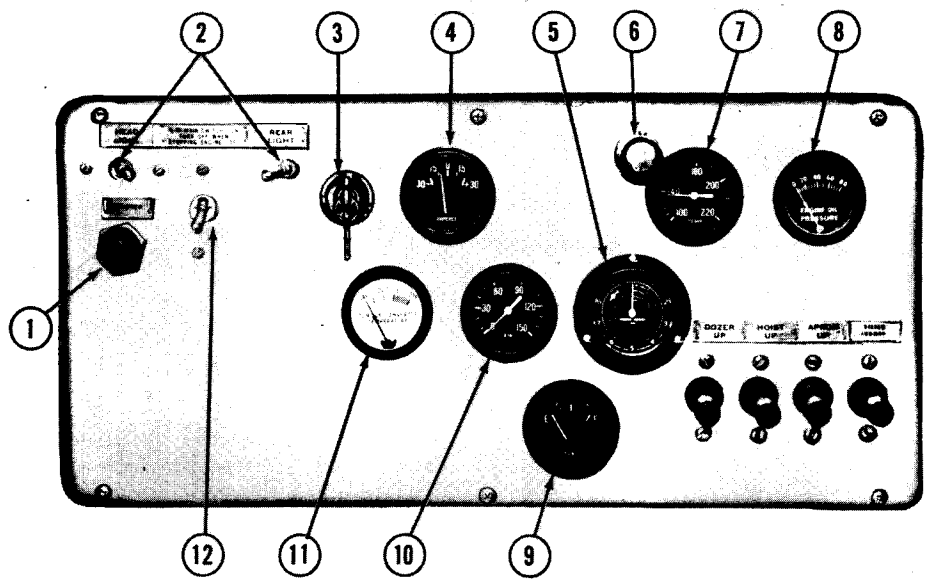
OPERATING INSTRUCTIONS

The instructions which follow are intended to acquaint the mechanic with the instruments and controls and their proper use in operating the Tournatractor.

These instructions will serve as a guide or reference to the new Tournatractor operator or mechanic. Practice and operating experience alone will make him skilled in Tournatractor operation.

It is imperative that the mechanic understands the function of each of the instruments and control switches on the dash panel. This knowledge is essential for the proper maintenance and safe operation of the machine.

Instruments



1. CRANKING MOTOR SWITCH
2. LIGHT SWITCH
3. KEY SWITCH
4. AMMETER
5. HOURMETER
6. PANEL LIGHT
7. TEMPERATURE GAUGE
8. ENGINE OIL PRESSURE GAUGE
9. FUEL GAUGE
10. AIR PRESSURE GAUGE
11. TORQUE CONVERTER TEMPERATURE GAUGE
12. D.C. MAIN SWITCH

Figure A-6. Instrument Panel

CRANKING MOTOR SWITCH

The cranking motor switch (1) is a push button type switch that opens and closes the 24 volt D.C. circuit to the cranking motor solenoid. On engines equipped with PT fuel system, the cranking motor switch also opens and closes the 24 volt D.C. circuit to the fuel shut-off valve solenoid which controls the flow of fuel to the injectors. Press in on the cranking motor switch to engage the starter and open the fuel shut-off valve. Release pressure on switch to cease operation of the cranking motor. As the engine is being cranked and the engine lubricating oil pressure reaches 8 p.s.i. the oil pressure switch closes and completes a circuit to the fuel shut-off valve solenoid, by-passing the cranking motor switch, holding the shut-off valve open as long as the oil pressure is above 8 p.s.i.

LIGHT SWITCH

The light switches (2) are toggle type switches that control the front and rear lights. Pushing the toggle up turns on the lights controlled by the switch. Push the toggle down to turn off the lights.

KEY SWITCH

The key switch (3) opens and closes the 24 volt D.C. circuit to the D.C. main switch and cranking motor switch. On machines equipped with PT fuel system the key switch also closes the circuit to the engine oil pressure switch. Turning the key to the "off" position opens the circuit to the PT shut-off valve solenoid, closing the valve and stopping the flow of fuel to the engine.

AMMETER

The ammeter (4) indicates the rate of charge or discharge of the batteries. Normal rate of charge at governed engine R.P.M. with no load on the electrical system is approximately 15 to 20 amperes.

HOURMETER

The hourmeter (5) indicates the number of hours of engine operation. Instructions on how to use are as follows:

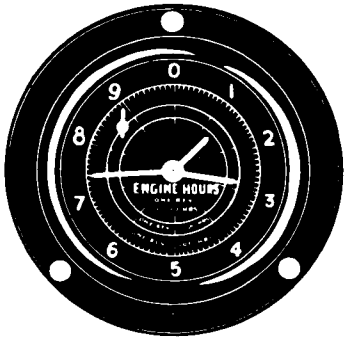


Figure A-7. Hourmeter

Example:

1st digit, 10,000-hour track.

Short hand is pointing between 1 and 2. The first digit will then be 1.

2nd digit, 1,000-hour track.

The next longer hand is pointing between 2 and 3. The second digit will then be 2.

3rd digit, 100-hour track.

The longest hand is pointing between 7 and 8. The third digit will then be 7.

4th digit, 100-hour track.

In order to get the last digit the outer track has ten graduations between any two numbers. Each graduation is equal to one hour. Again reading the longest hand, it will be noted that it is 4 graduations past the number 7. Then the last digit will be 4.

The total then recorded on the instrument will be 1,274 hours.

The hourmeter is attached to an oil pressure switch on the reverse side of the instrument panel. This switch allows the hourmeter to register engine hours only after sufficient oil pressure has been built up to trip the switch and close the circuit to the hourmeter.

NOTE: On later machines equipped with GM engines, the hourmeter on the instrument panel has been replaced by a revolution counter attached to the right balancer shaft on the engine. The numbers appearing on the counter are to be read as hours of engine operation.

PANEL LIGHT

The panel light (6) contains a built in switch. To turn the light on, push the switch lever in a clockwise direction. To turn the light off, push the switch lever in a counter-clockwise direction.

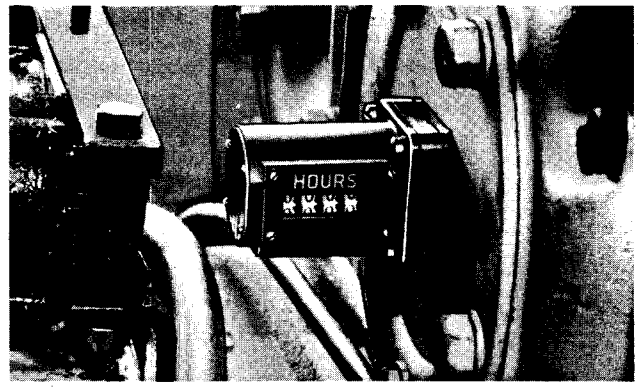


Figure A-8. Revolution Counter

TEMPERATURE GAUGE

The temperature gauge (7) registers the temperature of the coolant in the engine. Under normal operating conditions, the temperature should range from approximately 165 to 180° F.

ENGINE OIL PRESSURE GAUGE

The engine oil pressure gauge (8) indicates the oil pressure in pounds per square inch of the engine's lubricating system. The normal idling pressure should be at least 25 p.s.i.

FUEL GAUGE

The fuel gauge (9) indicates the amount of fuel oil in the supply tank. Before the gauge will operate sufficient oil pressure must first be built up to trip the engine oil pressure switch and close the circuit to the gauge.

NOTE: On later machines the fuel gauge has been replaced with a bayonet type dip stick on the fuel tank filler cap.

AIR PRESSURE GAUGE

The air pressure gauge (10) indicates pressure in pounds per square inch of compressed air in the air supply tank. Normal operating pressure for the operation of the air system is from 90 to 120 pounds.

TORQUE CONVERTER TEMPERATURE GAUGE

The torque converter temperature gauge (11) indicates the temperature of the oil as it leaves the torque converter. During operation, the oil temperature should be between 150 to 250° F., with a maximum of 275° F.

D.C. MAIN SWITCH

The D.C. main switch (12) opens and closes the 24 volt D.C. basic excitation circuit to the A.C. generator. When the switch toggle is up, the circuit is closed (on), when the toggle is down the circuit is open (off). (On machines equipped with PT fuel system, the engine may be started without use of the D.C. main switch. This switch must be on before operating any of the A.C. electric motors. Open the switch when idling engine for long periods to prevent unnecessary drain on the storage batteries.)

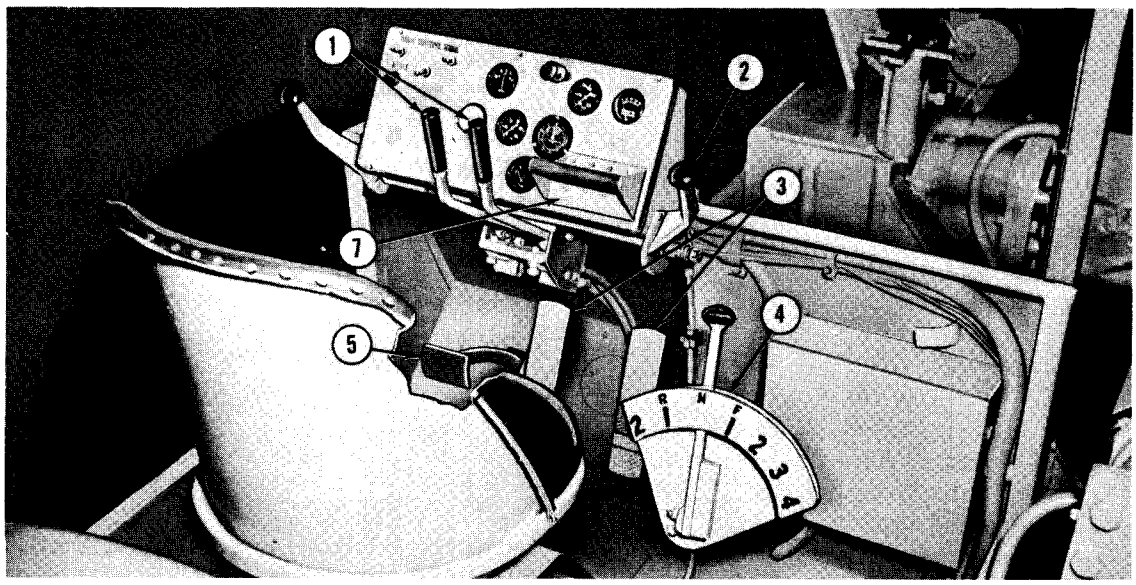


Figure A-9. Cockpit Controls, Steering Levers

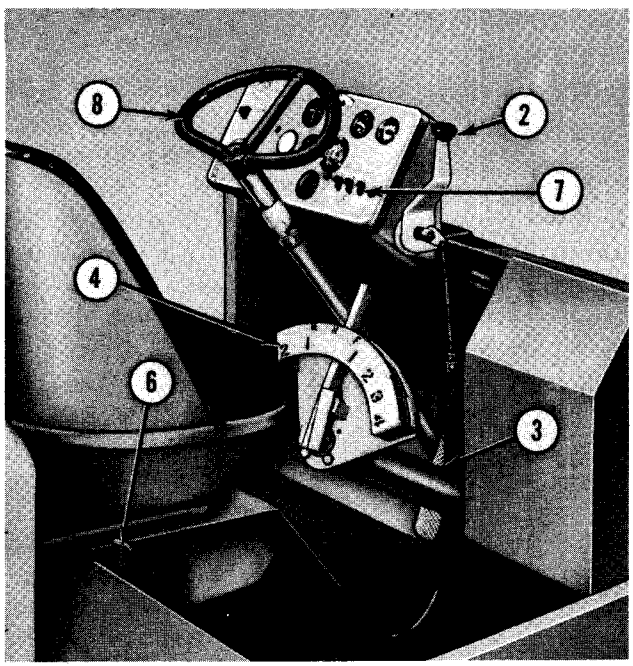


Figure A-10. Cockpit Controls, Steering Wheel

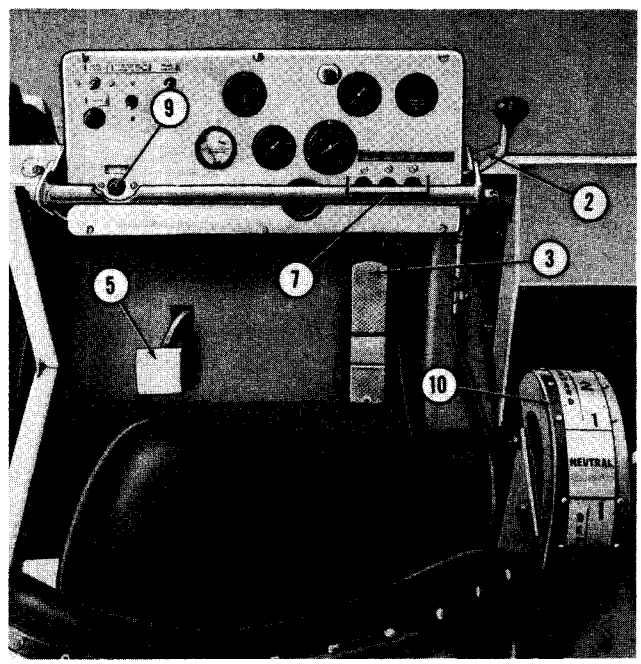


Figure A-11. Cockpit Controls, Steering Switch

1. STEERING LEVERS
2. THROTTLE CONTROL
3. BRAKE PEDAL
4. AIR SHIFT QUADRANT
5. PARKING BRAKE PEDAL
6. EMERGENCY ENGINE SHUT-OFF
7. ATTACHMENT CONTROL SWITCHES
8. STEERING WHEEL
9. STEERING SWITCH
10. ELECTRIC SHIFT QUADRANT

STEERING LEVERS

The steering levers (1) operate the air valves that control the flow of air to the steering clutches. To make a right turn, pull back on the right steering lever and press on the right brake pedal. When the steering lever is pulled back it actuates an air valve which releases the air pressure at the right steering clutch, disengaging it. Pressing the right brake pedal applies brakes only on the right side of the machine. With no pressure on the steering clutch and the brakes applied on the right side, the Tournatractor will turn to the right. The amount of pressure on the brake pedal determines the sharpness of the turn. Light pressure — slow turn, heavy pres-

sure — fast turn. The steering levers are spring loaded and will return to the neutral position when released. For a left turn, pull back on the left steering lever and press on the left brake pedal, the same procedure is repeated on the left side.

THROTTLE CONTROL

The throttle control lever (2) controls the rate of flow of fuel oil to the diesel engine. To increase engine R.P.M. the lever should be pulled toward the operator. To decrease, push throttle control lever forward.

BRAKE PEDAL

The brake pedals (3) each operate a double acting type air brake valve which controls the air flow to the brakes for steering and stopping. The right pedal controls the wheel brakes on the right side of the machine and the left pedal the left side of the machine. Pressure on a brake pedal opens the valve and allows air to flow to the diaphragm in the wheel brakes controlled by the pedal. The diaphragm forces the pressure plate against the brake discs which in turn retard the motion of the wheels by friction against each other. Releasing the pressure on the brake pedal lets the air bleed from the wheel brakes thereby releasing them. To stop the machine the operator should remember to press on both brake pedals. If the machine has only one brake pedal, it controls all four wheel brakes. If the machine with one brake pedal must be stopped during a turn, only the brakes on the inside of the turn will be applied. Allow the steering wheel or switch to return to the neutral position so that the braking force will be applied to all four wheels.

AIR SHIFT QUADRANT

The air shift quadrant (4) used for speed selection, operates a rotary type air valve which distributes compressed air to the two transmission clutches necessary for the speed selected by moving the lever to one of the seven positions on the shift quadrant.

PARKING BRAKE PEDAL

The parking brake pedal (5) is the foot pedal for a mechanically operated brake. When downward pressure is applied on the foot pedal it moves down applying equal pull on two parallel actuator arms which in turn pull the brake bands tight around the steering clutch housing. The steering clutch housing is splined to the final drive pinion, this prevents the wheels from turning. The parking brake pedal is equipped with a ratchet to hold it in the locked position. To set the ratchet press in on the bottom edge of the pedal until the ratchet is against the cockpit floor plate, then release foot pressure. To release press in on the top edge of the pedal until the ratchet releases.

A similar type brake arrangement, less the locking ratchet is available for the right steering clutch as optional equipment.

ENGINE EMERGENCY SHUT-OFF

The emergency engine shut-off (6) stops the engine when pulled up, by shutting off the air supply to the engine. USE THIS CONTROL IN CASE OF EMERGENCY ONLY.

ATTACHMENT CONTROL SWITCHES

The attachment control switches (7) control the operation of the electric motors which control the attachment. Moving a control switch lever up results in an up, forward or right movement of the assembly controlled by the switch. Moving a control switch lever down results in a down, backward or left movement of the assembly controlled by the switch. These switches are spring loaded and will return to the neutral position when released.

STEERING WHEEL

The steering wheel (8) operates metering type air valves controlling the flow of air to the wheel brakes, and a rotary type air valve controlling the flow of air to the steering clutch simultaneously. To make a right turn, turn the steering wheel to the right. The actuator arm which is fastened to the lower part of the steering post makes contact with a forked cam. This cam, being pinned to the air valve mounting plate structure, pivots against the plunger of the right hand metering air valve. As the valve opens air flows through it to the two wheel brakes on the right hand side of the machine. At the same time, the steering clutch valve located at the extreme end of the steering post, shuts off the flow of air to the right hand steering clutch and allows the air in the clutch to bleed out. The further the steering wheel is turned the sharper the turn obtained. Center the steering wheel to resume forward motion. For a left turn, the steering wheel is turned to the left and the same procedure is followed on the left side.

STEERING SWITCH

The steering switch (9) operates electric valves which control the distribution of air to the steering clutches. To make a right turn push the steering switch to the right. This completes a circuit that closes the electric control valve that controls the flow of compressed air to the right hand steering clutch. When the valve closes and the supply of air to the steering clutch stops, the clutch disengages and the wheels on the right side are free-wheeling.

Next apply the foot brake. Another electric control valve, operated by the same switch, directs air only to the wheels on the side with the disengaged clutch. With no pressure on the steering clutch and the brakes applied on the right side, the Tournatractor will turn to the right. The amount of pressure on the brake pedal determines the sharpness of the turn. Light pressure — slow turn, heavy pressure — fast turn. The switch is spring loaded and returns to neutral position when pressure is released.

For a left turn, the steering switch is moved to the left and the same procedure is repeated on the left side.

ELECTRIC SHIFT QUADRANT

The electric shift quadrant (10) used for speed selection, operates electric control valves which distribute compressed air to the two transmission clutches necessary for the speed selected by moving the lever to one of the seven positions on the shift quadrant.

Starting the Engine

Before initial operation of the engine, read the instructions given in the engine manual on preparing the unit for operation and follow each step carefully.

Make certain the transmission is in the "neutral" position. Turn on the key switch. Push up on the D.C. main switch. Open the throttle about half way. Be sure the engine shut-off control is all the way in. Press the cranking motor switch, engaging the cranking motor. When the engine starts, set the throttle for idle speed until a definite temperature rise is noted on the temperature gauge.

NOTE: Do not operate the cranking motor more than 30 seconds at one time.

Pushing up on the D.C. main switch to the "on" position is not necessary for the starting of the engines equipped with the PT fuel system. However, if the machine is to be moved immediately after starting it is advisable to turn the D.C. main switch on before starting. The D.C. main switch controls the basic excitation circuit to the generator, without which the A.C. motors would not operate. When idling the engine for long periods it is advisable to turn the D.C. switch off to prevent unnecessary battery drain.

Stopping the Engine

Throttle the engine down to idling speed for a few moments to cool it before stopping. Push the throttle control lever as far forward as it will go and hold until the engine stops running. Turn the D.C. main switch and the key switch to their "off" positions.

NOTE: On engine with PT fuel system, turn key switch to the "off" position, then turn the D.C. main switch off.

Use engine emergency shut-off control in case of emergency only.

It is necessary to use emergency shut-off control to stop Buda engines. Be sure control is in before attempting to start engine.

MAINTENANCE SCHEDULE

Whenever Needed

Adjust transmission clutches.

Adjust steering clutches.

Check wheel bolts for looseness.

During Operation

Water temperature should be from 165° to 185° F.

Ammeter should show a charge reading when the engine is not idling.

The torque converter oil temperature should be between 150° and 250° F. with a maximum of 275° F.

Once Each Shift

Check engine and torque converter oil levels (Bayonet gauges.)

Check oil level and condition of the oil in the air cleaner oil cup.

Check water level in radiator. (Use only clean, soft water; if water is hard, use a commercial water softener.)

Check water level in batteries.

Lubricate A.C. generator rear bearing.

Lubricate ball and sockets, sheave bearings.

Look for leaks of lubricating oil, air, fuel oil and water.

Bleed moisture from air storage tank.

Check tire pressure.

Check cables for excessive wear, kinks, etc.

Lubricate A.C. electric motor bearing. (If motor is equipped with grease fitting).

Drain Purolator fuel filter (Cummins engine).

Drain Ful-Flo fuel filter and strainer (G.M. engine).

Turn handle of Cuno lube oil filter one complete turn twice daily (Buda engine).

Every 5 Shifts

Change oil in air cleaner.

Change oil in air compressor air cleaner, if so equipped.

Every 7 Shifts

Replace DeLuxe oil filter element (Cum.engine)

Every 10 Shifts

Clean air passages in radiator.

Clean engine thoroughly on outside.

Drain, flush, and refill engine crankcase.

Check oil level in the transmission (bayonet gauge) and in final drives and electric motor gear boxes (level plugs).

Drain condensate and sediment from fuel tank.

Lubricate engine throttle and control linkage.

Remove and clean breather caps.

Check the specific gravity of each battery cell.

Check the tension on fan and compressor belts.

Add 2 or 3 drops of oil to the cranking motor bearings.

Check oil level in rectifier pot on machines equipped with oil bath rectifiers.

Drain shell and replace elements of Cuno lube oil filter (G.M. engine).

Drain Cuno fuel filter shell (Buda engine).

Drain Cuno lube oil filter shell (Buda engine).

Drain Nugent fuel filter shell (Cummins engine).

Every 50 Shifts

Clean air cleaner filter body and element.

Check contactor switch points for dirt, pitting and burning.

Replace Cuno fuel filter element (Buda engine).

Replace Ful-Flo fuel filter and strainer elements (G.M. engine).

Replace Purolator fuel filter element (Cummins engine).

Every 100 Shifts

Drain and flush transmission, final drive compartments and electric motor gear boxes.

Replace Nugent fuel filter element (Cummins engine).

LUBRICATION

Proper lubrication and lubricants are essential to successful operation and a minimum of down time.

Use care in lubricating the machine. Use only the recommended lubricants obtained from a reputable supplier.

Clean all grease fitting and filler plugs before lubricating. Any foreign material on the fittings or plugs may be forced into the machine and cause faster wearing of the moving parts.

Do not over lubricate. Too much lubricant may rupture the oil seals.

Lubrication instructions for the individual assemblies are to be found in the individual sections of this manual. Refer to Operators' Manual for Lubrication Diagram.

The lubricating intervals specified by shifts of operation are based on an average work period of approximately 10 hours per shift.

TORQUE CHART

Wrench Combination	Used on	Torque in Foot Lbs.	Reference
1-7	Pinion Hub Nut	3500	Page H-7
7-6	Final Drive Pinion Bearing Locknut	3500	Page H-8
31	Idler Shaft and Axle Bearing Retainer Caps	2000	Page H-3, H-5
6	Axle Shaft and Idler Gear Shaft Locknuts	8000	Page H-3, H-5
7-6	Carrier Shaft Hub Nut	2750	Page H-12
28-26-27	Clutch Hub Nut	1200	Page G-4
28-26	Clutch Housing Nut	600	Page G-4, G-11
26	Cluster Gear Locknut	1350	Page G-9
6-2	Transmission Shaft Bearing Retainer Nuts	600	Page G-7
5	Carrier Shaft Outer Bearing Adjusting Nut	1000	Page H-12
5	Carrier Shaft Inner Bearing Adjusting Nut	—	Page H-12
2-6	Generator Hub Locknut	1200	Page E-8
27-26	Transmission Shaft Spline	—	Section G
8-7-6	A.C. Motor Brake Hub Nut	1200	Page K-5
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4	Trunnion Eyebolt Nut	—	Page H-7
36	Torque Converter Bearing Retainer Nut	300	Page F-8
15-14-13-26-28	Install Clutch Housing Structure	1200	Page G-11
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21	Bumper and "A" Frame Capscrews	600	Page O-2
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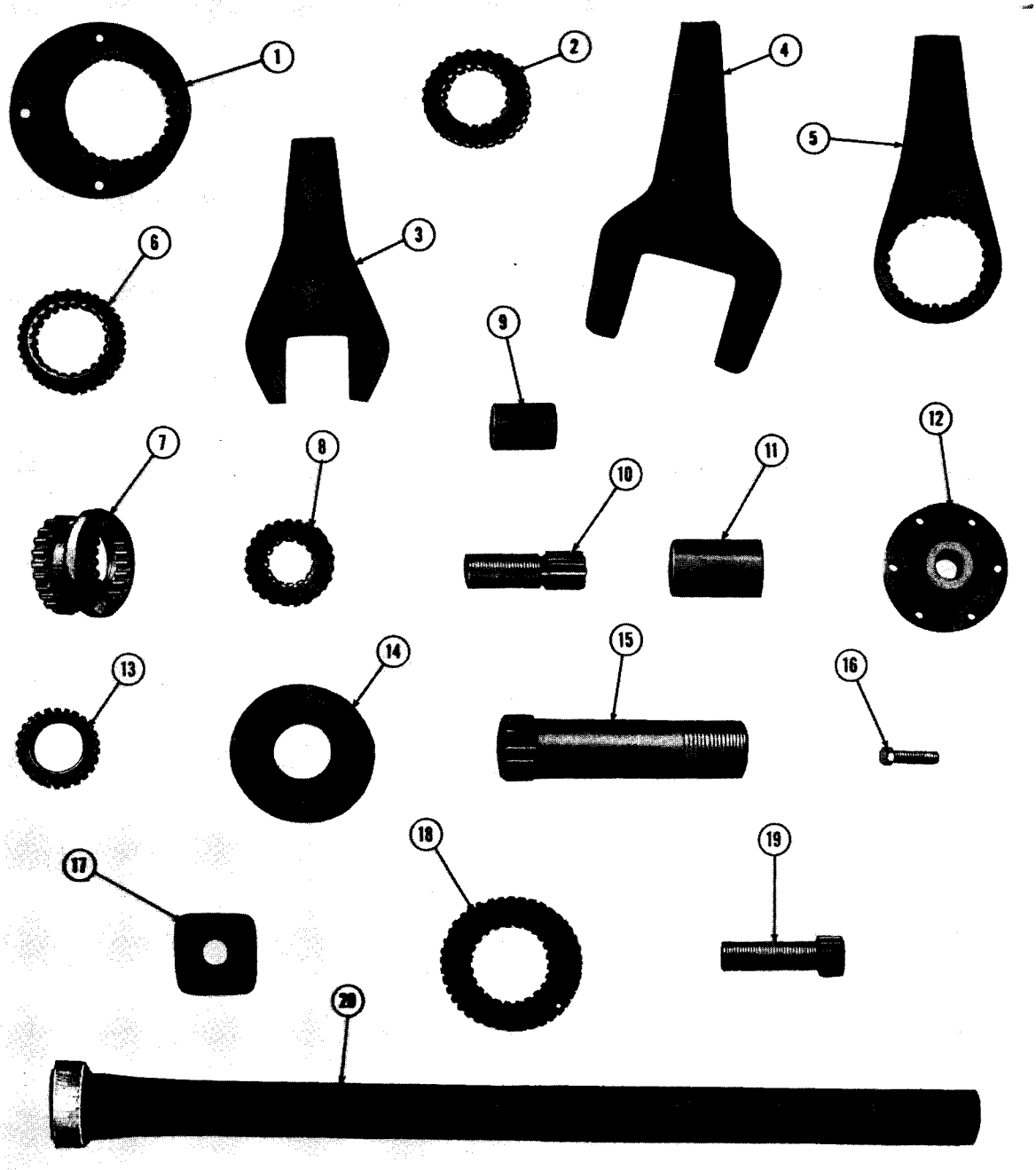
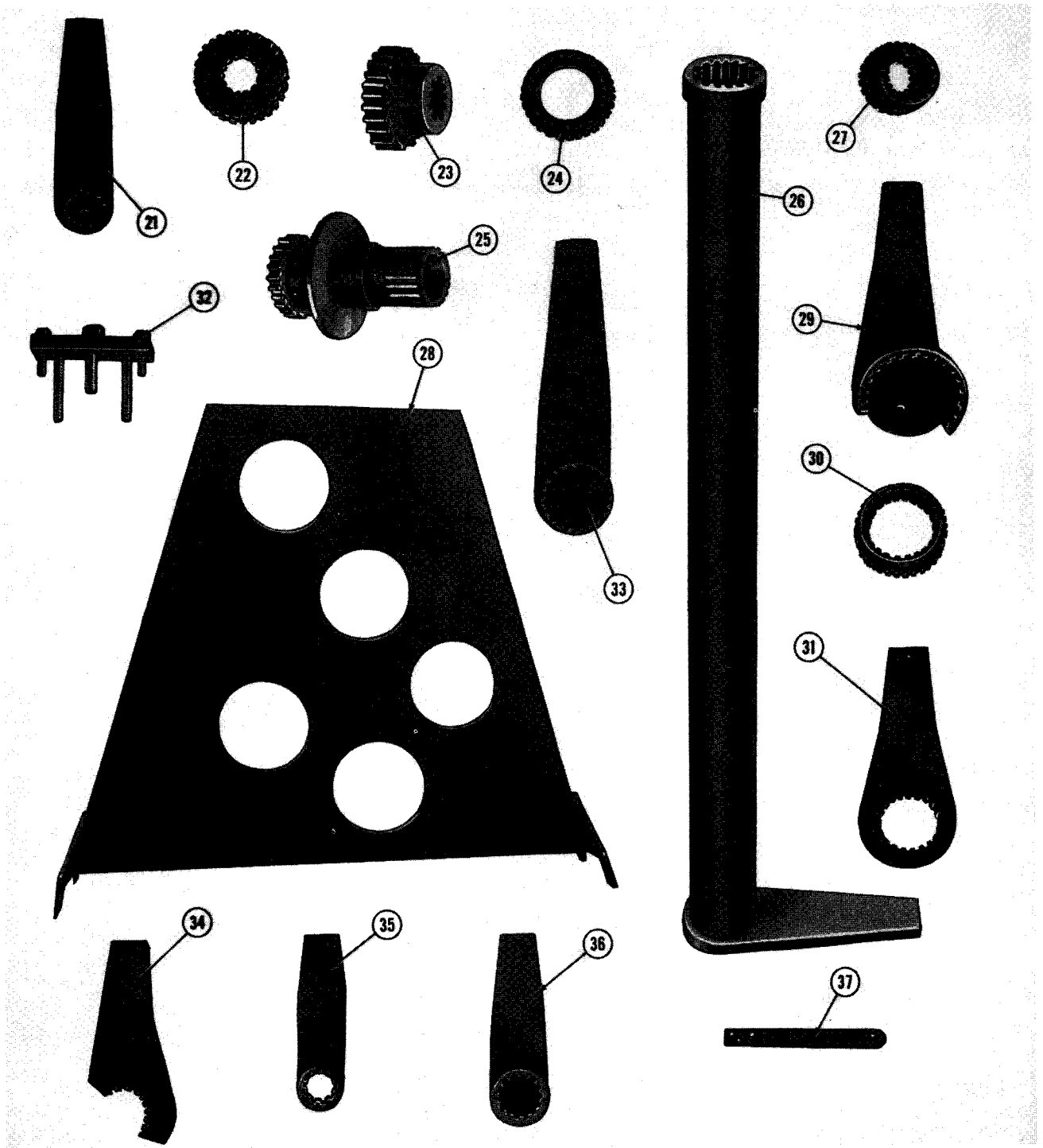
32	Torque Converter Hub Puller	—	Page F-8
6-30	Output Gear Locknut (#2 Gear Box)	2000	Page K-10
35	1st Reduction Gear Locknut (#2 Gear Box)	100	Page K-10
36	2nd Reduction Gear Locknut (#2 Gear Box)	200	Page K-10



1. CARRIER SHAFT SPLINED HUB WRENCH
2. ADAPTOR 3⅜" TO 5¼"
3. WRENCH HANDLE
4. TRUNNION EYEBOLT NUT WRENCH
5. CARRIER SHAFT ADJUSTING NUT WRENCH
6. ADAPTOR 3 13/16" TO 5¼"
7. ADAPTOR 4 5/16" TO 5¼"
8. ADAPTOR 2 9/16" TO 4 5/16"
9. PUSHER SLEEVE
10. HUB PUSHER
11. CLUTCH HOUSING PULLER PLUG
12. HUB TO PINION PULLER
13. CLUTCH HOUSING PULLER NUT
14. CLUTCH HOUSING PULLER DISC
15. CLUTCH HOUSING PULLER
16. CAPSCREW
17. CLUTCH HUB PULLER NUT
18. CLUTCH LOCKING DISC
19. CLUTCH PULLER BOLT AND BALL
20. WRENCH EXTENSION

Figure A-12. Standard Tools



Optional with Bumper
21. CAPSCREW WRENCH
22. ADAPTOR 1 31/32" TO 4 5/16"
23. ADAPTOR 30 TEETH TO 12 TEETH
24. CLUTCH HUB AND HOUSING ADAPTOR
25. CLUTCH HUB AND HOUSING WRENCH

Optional with "A" Frame
26. CLUTCH HOUSING NUT WRENCH
27. ADAPTOR 2 3/16" TO 4 5/16"
28. WRENCH GUIDE PLATE
29. CABLE DRUM LOCKNUT WRENCH

Optional with Torque Converter
30. ADAPTOR 25 TEETH TO 30 TEETH
31. BEARING RETAINER NUT WRENCH
32. HUB PULLER

Optional with Tilt Mechanism
33. MOUNTING NUT WRENCH
34. PINION GEAR NUT WRENCH

Optional with Gear Box
35. 1ST REDUCTION GEAR LOCKNUT WRENCH
36. 2ND REDUCTION GEAR LOCKNUT WRENCH
37. BEARING CAP WRENCH

Figure A-13. Optional Tools

SPECIFICATIONS

(Tournatractor)

ENGINE (DIESEL)

GM 6-71—Horsepower at 2000 R.P.M.	208
Maximum Governed R.P.M.	Approx. 2000
Displacement	425 Cu. In.
Bore and Stroke	4½" x 5"
Cummins HBIS 600—Horsepower at 1800 R.P.M.	200
Maximum Governed R.P.M.	Approx. 2000
Displacement	627 Cu. In.
Bore and Stroke	4⅞" x 6"
Buda 6DA-844—Horsepower at 1800 R.P.M.	200
Maximum Governed R.P.M.	Approx. 2000
Displacement	844 Cu. In.
Bore and Stroke	5¼" x 6½"

TRANSMISSION

Type	Constant Mesh, Clutch Operated w/Torque Converter
Transmission Clutches	Multiple Disc — Air Actuated
Clutch Friction Material	Bimetallic
Type of Gears	Forged, Helical
Forward Speeds	4
Reverse Speeds	2
Type of Selector	Shifting Quadrant

STEERING

Method	Steering Clutches
Type of Clutches	Multiple Disc — Air Actuated
Clutch Frictional Material	Bimetallic

FINAL DRIVES

Types of Gears	Forged, Helical

BRAKES

Type	Multiple Disc — Air Actuated
Control	Metering Valve

AIR SYSTEM

Type of Compressor	Piston
Compressor Capacity	12 Cu. ft. @ 1250 Compressor R.P.M.
Operating Pressure	90 to 120 lbs. per sq. in.

TIRES

Size	4 (18.00 x 25) 12 ply GG
Type	Road Builder, Heavy Duty, Tapered Bead

ELECTRIC CONTROL

Type of System	Alternating Current — 3 phase
Maximum Voltage	Approx. 300 (120 cycles) varies with engine speed
A.C. Generator	Tournatorque #2

PERFORMANCE (2000 Engine R.P.M. — 21.00 x 25 Tires)

Speed — 1st Gear Forward	1.61 M.P.H.
Speed — 2nd Gear Forward	3.69 M.P.H.
Speed — 3rd Gear Forward	8.38 M.P.H.
Speed — 4th Gear Forward	19.23 M.P.H.
Speed — Low Reverse	3.53 M.P.H.
Speed — High Reverse	8.09 M.P.H.

OVERALL DIMENSIONS — w/Bumper and Push Block

Length	17'
Width	10' 1"
Height (Top of Muffler) (@ full rated tire deflection)	8' 10"
Height (Top of Cab) (@ full rated tire deflection)	9' 4¼"
Wheelbase	5' 11½"
Gauge	8' 4½"
Ground Clearance	13' ¾"

CAPACITIES (U.S. Standard Gals.)

Fuel Tank	80 gals.
Transmission	14 gals.
Effective with Serial Suffix CW-C & up	42 gals.
Cooling System	
GM 6-71	12½ gals.
Cummins HBIS 600	22 gals.
Buda 6DA-844	12½ gals.
Crankcase (Including Filters)	
GM 6-71	6 gals.
With Optional Luber-Finer Filter	8½ gals.
Cummins HBIS 600	10½ gals.
With Optional Luber-Finer Filter	13 gals.
Buda 6DA-844	7 gals.
With Optional Luber-Finer Filter	10½ gals.
Final Drive Case (Each Side)	17 gals.
Air Cleaner	5 qts.
Rectifier Tank	7 gals.
Torque Converter	13 gals.

GENERAL SPECIFICATIONS

Type of Frame Used	Welded Steel — Box Construction
Bearings	Anti-friction

WEIGHT (Approx.)

Total Weight (Less Bumper and Pushplate)	28,000 lbs.

Model C Bulldozer

BULLDOZER SPECIFICATIONS

Type of Cutting Edge	Reversible
Dimensions of Cutting Blade without tip	¾" x 10" x 8'
Dimensions of Each Replaceable Tip	1" x 10" x 20"
Height of Blade and Bowl	43"
Height Blade Can Be Raised Above Ground	54"
Depth Blade Can Be Lowered Below Ground	18"
Width of Blade	11' 4"

ELECTRIC MOTOR

A.C. Motor	Tournatorque #2
Motor Brake	Multiple Disc — 3 Phase — Magnetic
Capacity of Electric Motor Gear Box	4½ qts.

CABLE REQUIREMENTS (6 x 19 FW, Preformed Tournarope, IPS, Right Lang Lay, IWRC)

WEIGHT (Approx.) (Bulldozer Only) 3,695 lbs.

OVERALL MEASUREMENTS and WEIGHTS — w/Tournatractor

Length	18' 5"
Width	11' 4"
Weight (Approx.)	31,700 lbs.

Model C Snow Plow

MOLDBOARD

Width at Cutting Edges	12' 4"
Size of Cutting Edges (two)	½" x 10" x 9' 3"
Width at Top of Moldboard	13' 7"
Height at Front of "V"	4' 7½"
Height at Top of Moldboard	6' 5½"
Thickness	3/16"
Shoe	12" x 20"
Height Moldboard Can Be Raised: (Distance from Cutting Edge to Ground)	5' 6"

CABLE REQUIREMENTS (6 x 19 FW, Preformed Tournarope, IPS, Right Lang Lay, IWRC)

WEIGHT (Approx.) (Snow Plow Only) 4,390 lbs.

OVERALL MEASUREMENTS and WEIGHTS — w/Tournatractor

Length	25' 6½"
Width	13' 7"
Weight (Approx.)	32,390 lbs.

SNOW PLOW WING

Moldboard Length — Bottom	8' 10"
Moldboard Length — Top	9' 3½"
Moldboard Length — Inner End	2' 5½"
Moldboard Length — Outer End	2' 8½"
Moldboard Construction — Steel Plates	3/16"
Rear Brace — Telescoping 4" Pipe — Maximum Length	9'
Upright Brace — (2) 6" Channels: Length	11' 4"
Height above Ground	12' 4"
Cutting Edges — Renewable	½" x 9' 6" x 4"

CABLE REQUIREMENTS (6 x 19 Preformed Filler IWRC)

CONTROL

Finger Tip Electric — Wing Lifted By Two Tournatorque Electric Motors. Either End of Wing Can Be Raised or Lowered as Desired.

MAXIMUM REACH OUTSIDE PLOW ON GROUND	7' 6"
MAXIMUM LIFT INSIDE END (Clearance)	4' 10"
MAXIMUM LIFT OUTSIDE — END WING EXTENDED	9' 5"
MAXIMUM LIFT OUTSIDE — END WING FOLDED AGAINST SIDE	12' 3"
CUTTING WIDTH WING SPREAD	7' 6"
OVERALL WIDTH WING FOLDED AGAINST SIDE	12' 7"
OVER WIDTH WING EXTENDED	19' 6"
WEIGHT (Approx.) (Wing Only)	1,440 lbs.

Model CE and CLE Scrapers

		CE	CLE
CAPACITY			
Tons		19	16
Cubic Yards	(Struck)	12.2	19.6
	(Heaped)	16	24
OVERALL MEASUREMENTS (Scraper Only)			
Length		29' 10"	33' 8"
Width		10' 8"	12' 6½"
Height		10' 3"	11' 2"
Wheelbase		17' 4"	20' 0"
TIRES			4 (21.00 x 25) 16 Ply or
Front	2 (16.00 x 20) 16 Ply	2 (16.00 x 20) 16 Ply	
Rear	2 (21.00 x 25) 24 Ply	2 (21.00 x 25) 16 Ply	
GAUGE			
Front		5' 6"	7' 11"
Rear		8' 2½"	8' 1"
MAXIMUM GROUND CLEARANCE			
At Rear of Bowl		15"	18"
At Front Axle		21½"	30"
WIDTH REQUIRED FOR NON-STOP TURN (Approx.)		23'	25'
TYPE OF EJECTION		Forward — Positive	
APRON OPENING — Maximum		7'	7'

CONTROL

Finger Tip Electric — Tailgate, Apron and Bowl Operated by Tournatorque Electric Motors.

BOWL

Height of Sides — Maximum	4' 5"	6' 0"
Dimensions at Bottom — Approx.	5' x 8' 6"	4' 11" x 10'

BRAKES	Multiple Disc Air Brakes	
CUTTING EDGE LENGTH	18"	21"
MAXIMUM DEPTH OF SPREAD	8' 6"	10'

CABLE SPECIFICATIONS (6 x 19 FW, Preformed Tournarope, IPS, Right Lang Lay, IWRC)

WEIGHT (Approx.) (Scraper Only) ..... 19,760 lbs. 25,500 lbs.

Model C Angledozer

WIDTH OF BLADE ..... 13'

HEIGHT OF BOWL ..... 41½"

MAXIMUM BLADE ANGLE (Right or Left) ..... 20°

BLADE TILT ADJUSTMENT (For Digging With Point) ..... 10" Up or Down

HEIGHT BLADE CAN BE RAISED (Low Corner of Blade in Angled Position) ..... 36"

DEPTH BLADE CAN BE LOWERED ..... 36"

CABLE REQUIREMENTS (6 x 19 FW, Preformed Tournarope, IPS, Right Lang Lay, IWRC)

WEIGHT (Approx.) (Angledozer Only) ..... 5,980 lbs.

OVERALL MEASUREMENTS AND WEIGHT — w/Tournatractor

- Length:
  - Blade Straight ..... 20' 1"
  - Blade Angled ..... 22' 3"
- Width:
  - Blade Straight ..... 13'
  - Blade Angled ..... 12' ½"

WEIGHT (Approx.) (Angledozer and Tournatractor Only) ..... 33,980 lbs.
(Without Rear PCU'S and Electric Blade Tilt Adjuster)

Model C Root Rake

WIDTH ..... 11' 4"

HEIGHT (Including Teeth) ..... 4' 6"

NUMBER OF TEETH 10

LENGTH OF TEETH BELOW BOX BEAM ..... 12"

TOOTH WIDTH ..... 4"

SPACING OF TEETH (Center to Center) ..... 14½"

LIFTING HEIGHT (Approx.) (Bottom of Teeth to Ground Line) ..... 46"

DISTANCE RAKE CAN BE LOWERED ..... Unlimited

CABLE REQUIREMENTS (6 x 19 FW, Preformed Tournarope, IPS, Right Lang Lay, IWRC)

WEIGHT (Approx.) (Root Rake Only) ..... 6,600 lbs.

OVERALL MEASUREMENTS AND WEIGHT — w/Tournatractor

- Length ..... 18' 7¼"
- Width ..... 11' 4"
- Weight (Approx.) (Combined Unit) ..... 34,600 lbs.

Tree Stinger

LENGTH ..... 32' 7¼"

WIDTH ..... 11' 2"

HEIGHT STRINGER CAN BE RAISED ABOVE GROUND ..... Approx. 25'

CABLE REQUIREMENTS (6 x 19 FW, Preformed Tournarope, IPS, Right Lang Lay, IWRC)

WEIGHT (Approx.) (Stringer Only) ..... 3,400 lbs.

OVERALL MEASUREMENTS AND WEIGHT — w/Tournatractor

- Length ..... 48' 10¾"
- Width ..... 11' 8½"
- Weight (Approx.) (Combined Unit) ..... 31,400 lbs.

Model C Winch

WINCH DRUM SIZE
- Barrel Diameter ..... 18"
- Flange Diameter ..... 32"
- Barrel Length ..... 12"
- Flange Depth ..... 7"

APPROX. CABLE CAPACITY TYPE RECOMMENDED
- 6 x 19 FW, Preformed, IPS, Left Regular Lay, IWRC

AVAILABLE LINE PULL ..... 43,000 to 80,000 lbs.

AVAILABLE LINE SPEED (Based on 2000 Engine R.P.M.)
- Spooling ..... 36'/Min.
- Unspooling (w/o Quick Release) ..... Approx. 63'/Min.
- (with Quick Release) ..... Unlimited

WEIGHT (Approx.) (Tournaskidder Only) ..... 5,780 lbs.

OVERALL MEASUREMENTS AND WEIGHTS — w/Tournatractor and Bulldozer
- Length ..... 23' 3"
- Width ..... 13'
- Weight (Approx.) ..... 39,760 lbs.

Bumper and Push Block

BUMPER
- Width of Bumper ..... 10' ½"
- Height of Bumper ..... 16"
- Depth of Bumper ..... 3"

PUSHBLOCK ..... 3' 4" wide x 3' 4" high

WEIGHT (Approx.) (Bumper and Pushblock Only) ..... 4,200 lbs.

OVERALL MEASUREMENTS AND WEIGHT — w/Bumper & Push block
- Length ..... 17'
- Width ..... 10' 1"
- Height (Top of Muffler) (@ full rated tire deflection) ..... 8' 10"
- Height (Top of Cab) (@ full rated tire deflection) ..... 9' 4½"
- Weight (Approx.) (Bumper and Pushplate Included) ..... 30,000 lbs.

Optional Accessories Available (On Order)

Torque Converter, Blade Tilt Mechanism, Down Pressure, Quick Release Clutch, Double Emergency Brake, Bumper Bar, Push Block, Side Arm Extension, Pintle Hook, Electrotarder, Extra Motors and Drum Assemblies for 2-line Rear Operation, Cab, Cab Heater and Defroster, Windshield Wiper and Horns.

▼

TROUBLE SHOOTER'S GUIDE

INDEX

TROUBLE SHOOTER'S GUIDE

MECHANICAL

AIR BRAKE VALVE

TROUBLE	CAUSE	REMEDY
Brakes gradually apply themselves with no foot pressure on the pedal.	Incorrect exhaust valve adjustment preventing the valve from opening and the inlet valve from closing.	Adjust the exhaust valve.
Brakes release slowly when foot pressure is removed.	Incorrect pedal linkage adjustment preventing the valve from returning to full release position.	Correct pedal linkage adjustment.
	Insufficient clearance between the exhaust valve and its seat.	Adjust the exhaust valve.
	Piston sticking in the valve body.	Clean and lubricate the valve.
The valve will not balance or hold the pressure constant.	Weak inlet valve return spring.	Replace spring.
	Inlet valve pilot is sticking in its guide in the valve cap.	Remove cap and clean the guide and valve pilot.
	Broken metering spring.	Replace spring.
Air brake not functioning properly.	Leaks in air system.	Check entire system and all connections for leaks.

AIR COMPRESSOR

Compressor fails to maintain adequate pressure in air system.	Dirty air strainer. (If compressor is so equipped.)	Remove and wash all parts in cleaning solvent. Refill cup with clean engine oil.
	Dirty air cleaner.	Remove cup and disc. Clean all parts in cleaning solvent. Refill cup and reassemble air cleaner.
	Excessive carbon in compressor cylinder head or discharge line.	Clean head and line of carbon and replace if necessary.
	Discharge valves leaking.	Repair or replace compressor cylinder head if excessive leakage is found.
	Excessive wear.	Disassemble compressor and replace worn parts.
	Drive belt slipping.	Replace pulley if worn. Tighten or replace belt.

TROUBLE	CAUSE	REMEDY
Compressor fails to maintain adequate pressure in air system *(continued)*.	No clearance at compressor unloading valves.	Adjust clearance to 0.010" minimum to 0.015" maximum. Clearance can be checked only when compressor is loaded.
	Unloading valve stuck open.	Check condition of unloading valves. If slot at end of stem or stem is worn, replace valve. If there is excessive clearance between the unloading valve stems and the unloading valve bushings, both may have to be replaced.
	Excessive leakage of unloading valves.	Unloading valves pitted or worn must be ground to their seats. If valve seats are too badly pitted or worn, unloading valve and valve bushing must be replaced.
Compressor passes excessive oil.	Excessive wear.	Replace compressor or worn parts.
	Dirty air strainer.	See above.
	Oil return line to engine crankcase plugged.	Remove line and clean.
	Compressor crankcase flooded.	Remove oil return line and clean.
	Oil rings improperly installed.	Remove pistons and re-install or replace rings.
Noisy operation.	Loose drive pulley.	Tighten pulley.
	Excessive carbon in cylinder head or discharge line.	Clean head and line of carbon. Replace if necessary.
	Worn or burned out bearings.	Replace bearings.
	Excessive wear.	Replace compressor or worn parts.

TROUBLE	CAUSE	REMEDY
Compressor does not unload.	Defective unloading diaphragms.	Replace worn diaphragms.
	Excessive clearance at unloading valves.	Adjust clearance from 0.010" minimum to 0.015" maximum.
	Unloading cavity plugged with carbon.	Remove piston head, disassemble and clean.
	Unloading mechanism binding or stuck.	Disassemble and clean all parts with a cleaning solvent. Replace all worn parts.

BEARING FAILURES

Excessive wear of bearings.	Bearings improperly lubricated.	Lubricate at specified intervals and with recommended lubricants as shown on lubrication chart.
	Bearings improperly seated.	Seat bearings correctly and replace if worn or damaged.
	Dirt or other foreign matter in oil or grease.	Correct cause of dirt, etc., entering lubricant and replace with new oil or lubricant.

ENGINE AND ACCESSORIES

For trouble shooting information on engine and accessories, refer to the engine manufacturer's manual.

FINAL DRIVE

Noisy gears.	Chipped, broken, pitted or galled gear teeth.	Replace gears.
End play in axle.	Bearing failure.	Replace bearing.
	Loose axle nut.	Tighten nut. Replace if threads are damaged.
	Loose retainer ring.	Tighten retainer.
Axle oil seal leakage.	Lubricants may not be those which are recommended. Oils lighter than recommended may seep out under seals. Incorrect type of grease may break down and become fluid from heat of operation.	Remove lubricants and replace with recommended oils and grease.
	Oil seal incorrectly installed with leathers cupped outward away from oil or grease chamber.	Remove oil seals and install with leathers cupped inward toward oil or grease chamber.

TROUBLE	CAUSE	REMEDY
Axle oil seal leakage. ***(continued).***	Gear case filled with oil above the oil level plug.	Lower oil level to level plug.
	Oil seals becoming burned and hardened as a result of overheating.	Correct cause of overheating and install new seals.
	Axle bearings loose or worn thereby whipping out seals.	Replace bearings and seals.
	AIR SYSTEM	
No pressure in air system.	Leak in tank or valves.	Repair leaks and clean and repair valves.
	Loss of air through steering clutches.	Check for loss of air by disengaging both clutches. If air pressure builds up with both clutches disengaged, engage each clutch separately and check for leaks at each clutch. Repair leaks.
	Defective diaphragm.	If air escapes through holes in clutch drums, replace diaphragm.
	Air escaping through backing plate of steering clutch.	Tighten backing plate capscrews.
	TRANSMISSION CLUTCHES	
Slipping clutches.	No air pressure.	Check air pressure system.
	Improper clutch adjustment.	Adjust clutch.
	Leak in diaphragm.	Replace diaphragm.
	Restricted air line.	Clean or replace air line.
	Worn discs.	Replace discs and readjust.
	Discs won't release.	Check for damaged discs or damaged splines.
	Clogged opening in pressure plate.	Clean.
	Leak in oil seal.	Replace oil seal.
Clutches overheating. (Make same checks as suggested for slipping clutches.)	Clutch fails to release.	Check air control valve for proper operation and exhaust.
	Bearing failures.	Replace defective bearings.

TORQUE CONVERTER

TROUBLE	CAUSE	REMEDY
Over-heating.	Improper gear selection causing excess slippage in torque converter.	Shift to lower gear range.
	Accumulation of grease, dirt in bottom of case.	Clean bottom of case.
Insufficient oil pressure.	Oil level low.	Add oil to full mark on bayonet gauge.
	Oil leaks.	Check for loose capscrews. If loose—tighten.
		If leaks are at piston ring seals, replace worn or damaged seals.
Abnormal variations in oil pressures and oil leaks. (See above.)	Oil in tank above full mark on bayonet gauge.	Lower oil to full mark.
	Clogged oil suction screen filter.	Clean screen.
	Improper oil weights.	Change to proper oil weight.
	Pressure relief valve on pump sticking.	Clean valve. Replace worn parts.
Output shaft bearing failure.	Improper amount of shims between flywheel and coupling plate or between torque converter housing and generator stator.	Check shimming. Refer to Section "F," Torque Converter Reassembly.
Broken drive shaft or excessive vibration of torque converter.	Torque converter out of alignment.	Realign. Refer to "Engine Installation," Section "D" for method.

D.C. ELECTRIC CONTROL VALVE

Valve fails to operate.	Loose connections or broken conductors leading to or at valve.	Tighten all terminal screws and knife connectors. Replace broken leads.
	Faulty control switch.	Replace switch.
	Open or partially grounded coil.	Replace coil.
Air leakage past valve.	Plunger sticking in sleeve.	See below.
	Damaged inserts in plunger.	Replace plunger.
	Weak or broken springs.	Replace.
Plunger sticking in sleeve.	Corrosion or dirt in sleeve.	Disassemble and clean plunger and sleeve.

ELECTRICAL

A.C. GENERATOR

TROUBLE	CAUSE	REMEDY
Generator produces no A.C. voltage or low A.C. voltage.	No excitation current or excitation current below normal.	1. Worn brushes and weakened brush springs: Friction between brush and slip ring may eventually wear away brush, increasing distance between brush rings and reducing spring pressure against brushes. This condition may increase resistance in excitation circuit reducing excitation current. If brush springs are exposed to high heat springs lose their tension, with same result as above. See section on generator brushes, page E-9 for proper preventive maintenance instructions. 2. If brush rings are kept from sliding freely on their studs or if the studs become misaligned and brush rings bind, the resulting poor contact may reduce or cut off the excitation current completely. This condition may result in no A.C. voltage at all, or in A.C. voltage which rapidly varies from normal to zero reading depending upon whether or not the brush is making contact with the slip ring at the time the reading is taken. 3. If there is an open in the excitation circuit or in units which are a part of the circuit itself this will result in no A.C. voltage at the generator.
	Open, ground or short circuit in rotor.	1. If D.C. amperage (no load) to the generator field is above normal, grounded or partially grounded generator rotor windings are indicated.

TROUBLE	CAUSE	REMEDY
Generator produces no A.C. voltage or low A.C. voltage *(continued)*.		2. If the ground or open results from centrifugal force developed by the rotating generator rotor the condition may not be apparent at lower engine R.P.M.'s. Yet as the engine throttle is opened the A.C. voltage may drop off as the open or ground occurs. In this instance amperage to field will be affected only at high engine speeds as described in paragraph "1" above. 3. In some cases a ground and open may be combined, that is, a break in a winding may occur and one end may ground at the break. This condition can be detected with the feeler gauge test described in paragraph "4." 4. To check pole windings on generator rotor, insert a long feeler gauge between generator rotor and stator with excitation current flowing in the field windings (D.C. main switch and key switch on, but WITHOUT diesel engine operating). In a rotor in normal condition each rotor pole will exert a definite pull on the gauge. No pull above a pole indicates that no current is flowing in the windings of the pole under test and that there must be an open in the excitation circuit between the pole winding and the source of the excitation current. If only one or two poles fail to exert a pull there may be a combined open and ground in the rotor. If all poles fail to exert a pull there may be an open in either the rotor or in the excitation circuit outside the rotor. 5. To check condition of rotor windings, place a jumper wire directly from the batteries to the generator field and check the amperage flowing in the circuit. If batteries are in good condition the following readings should be obtained if rotor is in normal condition. #2 Generator .....14 to 16 D.C.A. (18 amps if cold)

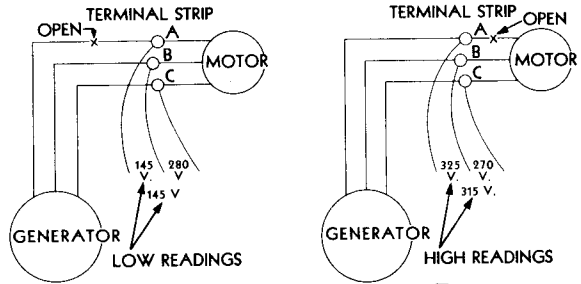
TROUBLE	CAUSE	REMEDY
Generator produces no A.C. voltage or low A.C. voltage *(continued)*.		6. Should one or more windings short out of the field circuit both excitation current and A.C. voltage output will be effected. Amperage to field will increase, yet due to loss of field windings, A.C. voltage will be reduced. A feeler gauge check as described in paragraph "4" will verify this condition in the rotor windings.
	Improperly operating voltage boost system.	1. If "no load" D.C. voltage excitation to the field is normal and yet no increase in voltage occurs when generator is tested under a "locked rotor" load, the voltage boost system is not operating properly. The constant voltage transformer supplements the excitation current at all times, slightly under no load condition, more when a load is placed on the generator.
		2. The performance of the voltage boost system on a unit equipped with the constant voltage transformer (NOTE: Check to see whether the reactor coils are interconnected or direct connected between the A.C. and D.C. systems) can be affected by a ground in the A.C. system at a point away from the transformer and rectifier as well as by conditions developing in the transformer itself, the transformer rectifier, and the conductors.
		3. Therefore when no boost is evident with a constant voltage transformer, check for grounds in the A.C. circuits or in the constant voltage transformer circuits first. Disconnect the lead from negative terminal of rectifier which carries excitation current to generator field. Make ground test on three A.C. leads to rectifier. If no

TROUBLE	CAUSE	REMEDY
Generator produces no A.C. voltage or low A.C. voltage *(continued)*.		ground is indicated close fingertip control switches and repeat the test. No ground isolates trouble in constant voltage transformer or in the rectifier.
		4. It is good policy to make a continuity check on the leads from transformers to rectifiers and in the rectifier case itself. Refer to the wiring diagram for proper connection.
	Mechanical troubles.	Rear generator bearing failure may cause brushes to skip (make and break contact with the slip rings) giving erratic A.C. voltage. Mis-alignment of generator rotor or stator may result in scrubbing between the two units and a reduction in A.C. voltage. This condition normally does not affect the readings on a rotor test unless rotor windings have been damaged and shorts or opens are evident. If the "scrubbing" is very severe the stator and/or rotor may become permanently damaged. As a precautionary measure check the air gap with a feeler gauge all around the rotor to make certain there is clearance between the rotor and the stator.
	Opens or grounds in stator windings.	Usually, if the stator is at fault, it will have smoked or burned out because of the high current involved. However, unbalanced readings (variations in readings between phases) may occur when part of the coils in one phase are shorted out in the stator windings, and this condition may or may not have a visible effect on the stator windings. With all other units in a normal condition, it can be assumed that the cause of a variation in voltage readings lies in the generator stator windings if the variation occurs in a "no load" voltage test.

TROUBLE	CAUSE	REMEDY
Generator produces no A.C. voltage or low A.C. voltage *(continued)*.	Booster and constant voltage transformer primary windings.	1. An open in the primary winding of the booster transformer can be located with a continuity test. Disconnect the three A.C. leads from the booster transformer terminal strip. Test the transformer for continuity from input to output leads on each primary winding (3 tests, A to A, B to B, C to C). 2. Opens in any of the A.C. circuits or parts of the circuit will result in no voltage readings on two out of three of the voltage tests made across three A.C. terminals providing the circuits are not interconnected in such a way as to provide another path for the current to flow. A unit in this condition is said to be "single phased."
	Rectifiers.	If the difference in readings (voltage drop) is as follows the rectifier is at fault and should be replaced. As Low As — As High As 12 plate rectifier ...2 Volts D.C. — 5 Volts D.C. 18 plate rectifier ...3 Volts D.C. — 6 Volts D.C. 24 plate rectifier ...6 Volts D.C. — 9 Volts D.C. Voltage drop below normal indicates the rectifier plates are partially shorted. A voltage drop above normal indicates that the rectifier plates have become overheated or have aged to the point at which they are no longer serviceable. Should the voltage drop be within the tolerance given, yet tests indicate an improperly operating rectifier, continue testing the rectifier for opens or grounds.

A.C. MOTOR

TROUBLE	CAUSE	REMEDY
Motor doesn't operate (stalled) — single motor only.	No A.C. voltage to the motor at all.	First check the main switch, the circuit to the motor and the control circuit. No voltage to one motor only indicates an open in the power circuit somewhere between the input to the main switch controlling the motor and the motor itself or in the motor control circuit.
	Low A.C. voltage to the motor.	1. If all other motors operate, this condition may show up when a motor is operated under heavy load. The A.C. generating system may not be functioning properly and will not produce enough to operate the heavily loaded motor. Check the A.C. voltage at the main switch panel with the motor engaged. If it drops below 200 volts A.C. as the motor is operated check the generating system. 2. If the engine is operated at a low R.P.M., generated voltage may not be enough to operate the motor. Keep the engine R.P.M.s' up.
	Open circuit — internally or externally.	1. A variation in the voltage readings between phases at the motor indicates an open circuit either in the motor or in the conductor between the motor and the main switch. 2. Following are typical examples of the variation in the voltage readings showing the unbalanced readings obtained with an open in the motor circuit. 3. Drawing (A) gives readings on the A.C. voltmeter taken with the point of test between the generator and the open in the circuit. Tests are made on two of the three leads (A, B, and C) at one time. One lead will be present in both tests which will have high voltage readings, and the open can be isolated in this lead.

TROUBLE	CAUSE	REMEDY
Motor doesn't operate (stalled) — single motor only *(continued)*.		4. Drawing (B) gives readings on the A.C. voltmeter when the open in the circuit is between the point of test and the generator. The readings AC and AB are below normal. Note also that the same lead is present in both low readings (as in the case of lead A in c above). The open can be isolated in this lead.
		
		5. An open or ground in the stator can be located by a continuity test after the leads to the brake coils are removed.
		6. An open in the leads to the motor can be located by a continuity test.
	Open brake coils or loose leads.	Can be detected if, as fingertip switch on the instrument panel is engaged, the brake does not open and normal A.C. voltage is present at the motor terminal. Check the brake coils and circuits between brake coils and between brake and motor terminal strips.
	Brake out of adjustment.	Check brake for proper air gap between the floating plate and the motor endbell. Make certain that the brake discs are not warped, or stuck in engaged position.
	Faulty main switch.	Check the main switch for mechanical action, for burned points, and for open holding coils.

TROUBLE	CAUSE	REMEDY
Sluggish and overheating motor.	Low A.C. voltage to the motor.	Even though the motor may operate under a low voltage condition, operating temperature will rise, in some cases high enough to cause the heat control switch to cut out the motor. If this occurs make a voltage check at the motor terminals while the motor is in operation.
	Single phase in brakes.	1. If power leads to brakes become broken or disconnected, brakes may be only partially releasing, resulting in a drag on the motor. 2. Burned out brake coils may have the same effect as described in section (1) above.
	Open coils in the stator.	Open coils in the stator are indicated by unequal voltages noted during A.C. voltage tests with the motor under load.
	Open rotor bars.	If sunflower or ring has separated from rotor bars or bars have burned out, fast and intense heat development, signs of arcing, and loss of power are indications of this condition.
	Mechanical.	1. The rotor may be dragging on the stator because of the following; stator and end bell hold-down bolts loose or tightened unevenly, boss filled with dirt, foreign material between stator and rotor. 2. The motor may be filled with dirt causing improper ventilation between coils, improper ventilation in the rotor because of the holes in the rotor stack being plugged up. 3. Overloading on the assembly operated, failure of the gear box, or binding assemblies may cause additional drag on the motor.

MAIN SWITCHES

TROUBLE	CAUSE	REMEDY
Switch inoperative.	Faulty control circuit.	1. Holding coil, control switch, heat control switch, or limit switch inoperative. 2. Loose connections. 3. Mechanical failure — loose bolts and screws associated with mechanical movement. 4. Defects which can be located by visual inspection.
Switch operates mechanically but supplies no power or single phase power output.	No output or single phase output.	1. Mechanical bind, no contact. 2. Bad contactor points. 3. Loose or broken connections. 4. Visual inspection for mechanical failures.

COOLING, AIR, FUEL, AND LUBRICATION SYSTEMS

INDEX

COOLING, AIR, FUEL, AND LUBRICATION SYSTEMS

COOLING SYSTEM

The cooling system includes the fan and fan belts, radiator, thermostats and water pump. Water is circulated by a centrifugal pump which pumps the water out of the radiator into the water inlet manifold, where it circulates around an oil cooler and passes into the engine water jackets and then into the water inlet manifold at the top of the cylinder head. There is a set of thermostats in the water outlet manifold which controls the flow of water. Before the temperature of the water reaches 165° F., the thermostats stay closed and the water by-passes the radiator. When the temperature of the circulating water is approximately 165° F., the thermostats allow the water to flow through the water by-pass line into the inlet side of the water pump. When the temperature of the circulating water exceeds approximately 165° F., the thermostats open and permit the flow of water into the radiator. Under normal operating conditions, the water temperature should range from approximately 165 to 185° F.

Water from the engine cooling system is also circulated through the air compressor head and block. Water hoses are connected to the compressor on the end opposite the drive pulley.

The spring type radiator cap permits any overflow caused by water expansion within the radiator to flow out through the overflow pipe.

RADIATOR

Removal

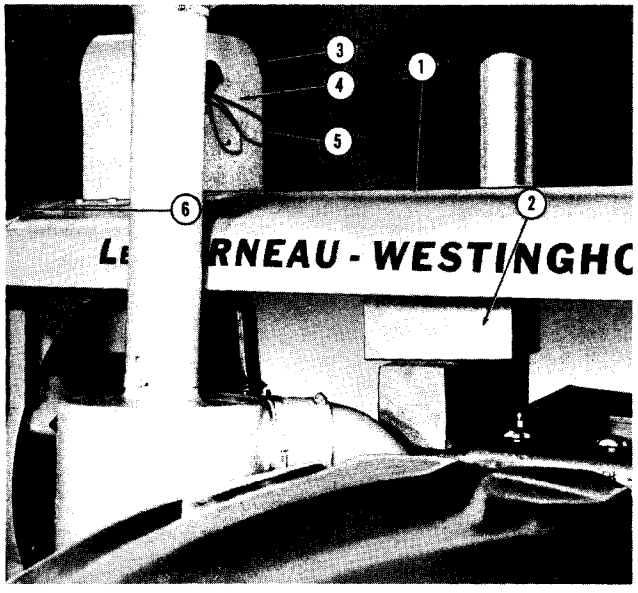
Drain the water and disconnect the water hoses at the radiator.

Remove the capscrews fastening the hood to the radiator shell. Prop up the hood, using blocks of wood between the underside of the hood and the top of the engine (Fig. C-1).

If the machine is equipped with rear driving lights, these must be disconnected before the radiator assembly can be removed. Disconnect the wire by removing the cover on the light housing and disconnecting the knife connector (Fig. C-1).

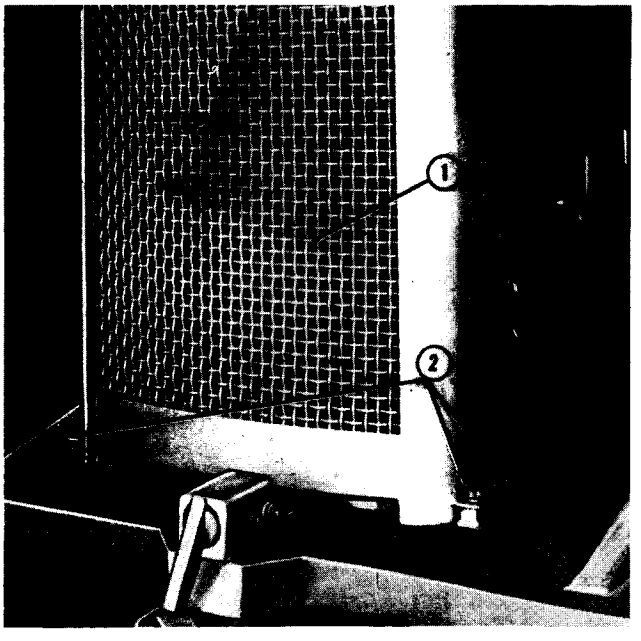
Remove the four radiator mounting capscrews (Fig. C-2).

Attach hoist to the top of the radiator and lift off.



1. HOOD
2. BLOCKS
3. LIGHT HOUSING
4. COVER
5. KNIFE CONNECTOR
6. CAPSCREWS

Figure C-1. Blocking Hood



1. RADIATOR
2. MOUNTING CAPSCREWS

Figure C-2. Radiator Mounting Capscrews

Disassembly

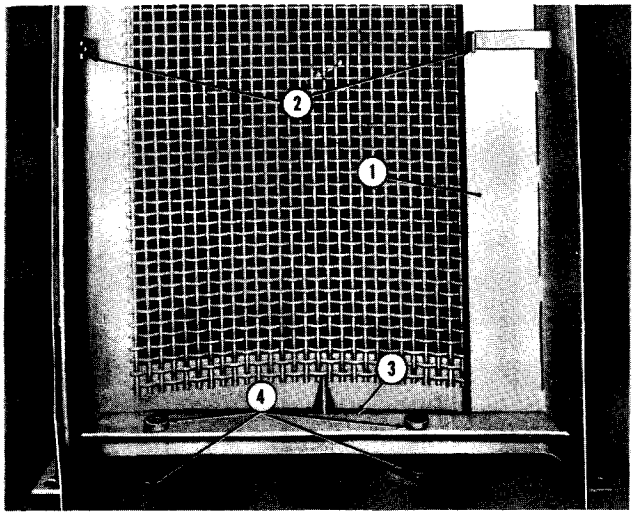
ONE PIECE RADIATOR:

The radiator is held in the shell by two capscrews, one on each side. One fastens into a slotted bracket on one side of the radiator shell. The other

fastens into a drilled bracket on the other side. Two studs fasten to the bottom of the radiator. The bottom studs go through holes in a mounting bracket welded to the inside of the radiator shell.

Spacers are placed between the radiator and the slotted brackets on the radiator shell. These spacers are to align the holes in the radiator and the bracket for the side mounting capscrews.

Spacers are also placed between the bottom of the radiator and the mounting bracket on the shell. These spacers fit onto the bottom mounting studs.



1. RADIATOR SHELL
2. SIDE BRACKETS
3. BOTTOM BRACKET
4. SPACERS

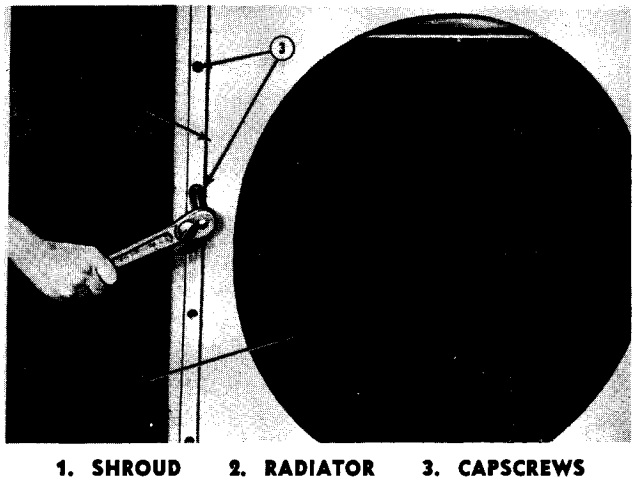
Figure C-3. Radiator Shell and Bottom Spacers

To disassemble the radiator, first loosen the two capscrews which fasten into the side mounting brackets on the inside of the radiator shell.

Remove spacers from bottom studs and keep together for reassembly.

THREE PIECE RADIATOR:

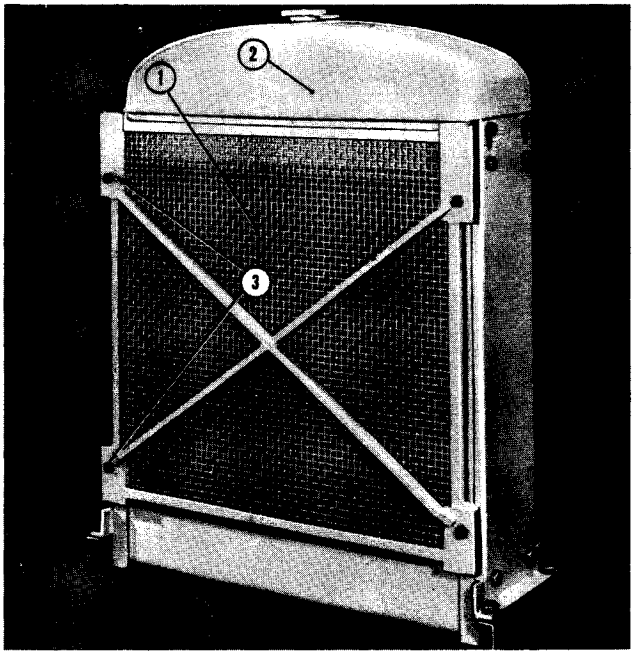
Remove capscrews securing shroud structure to radiator (Fig. C-4).



1. SHROUD
2. RADIATOR
3. CAPSCREWS

Figure C-4. Removing Shroud Structure

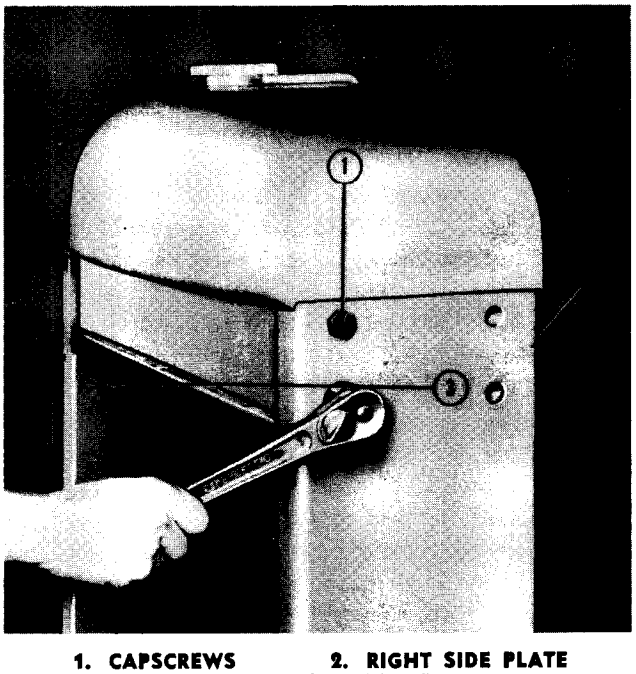
Remove grille structure by removing the four capscrews securing it to the radiator shell (C-5).



1. GRILLE
2. RADIATOR SHELL
3. CAPSCREWS

Figure C-5. Removing Grille Structure

Remove the left and right side plates by removing the four capscrews securing each to the top tank and the four capscrews securing each to the bottom tank (Fig. C-6).



1. CAPSCREWS
2. RIGHT SIDE PLATE
3. LEFT SIDE PLATE

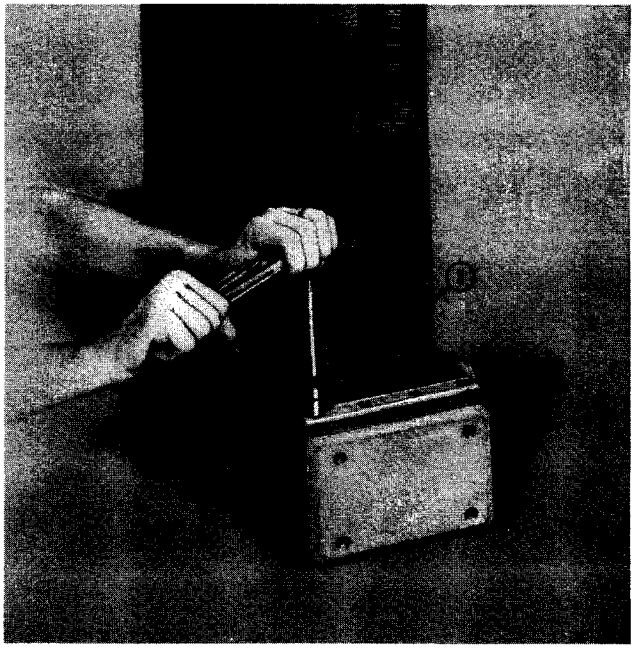
Figure C-6. Removing Side Plates

To separate the core from the top and bottom tanks, remove the capscrews securing the tanks to

their respective headers (Fig. C-7).

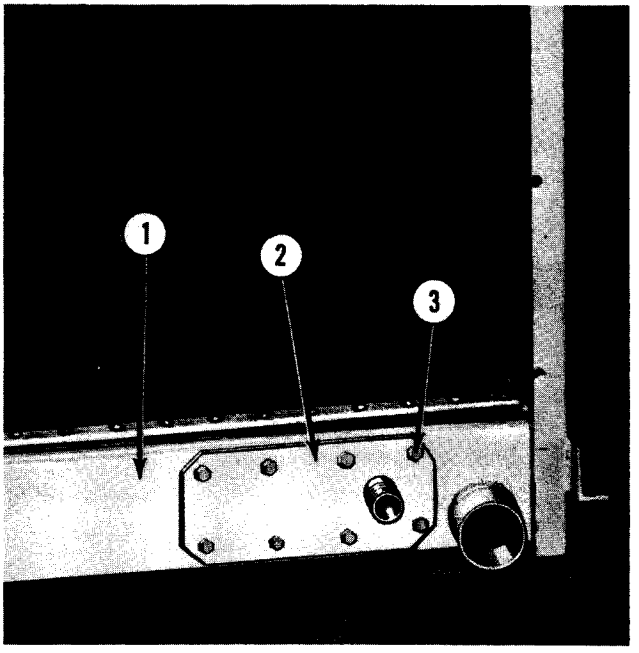
To remove the oil cooler core, remove the capscrews holding the oil cooler cover plate to the radiator bottom tank.

Remove cover plate and pull out core, taking care not to damage the gaskets.



1. BOTTOM TANK 2. CAPSCREWS 3. HEADER

Figure C-7. Removing Bottom Tank



1. BOTTOM TANK 2. OIL COOLER COVER PLATE 3. CAPSCREWS

Figure C-8. Oil Cooler

Reassembly

To reassemble the radiators, reverse the procedures outlined for disassembly. Replace the spacers in the same position as they were removed.

Service

Drain and flush the radiator every three to six months depending upon the condition of the coolant and the amount and type of service required of the engine. Flush the radiator and engine block separately. Flushing water should enter the radiator at the bottom connections, the reverse of the regular flow of water. Thermostats must be removed before flushing the engine.

A badly clogged radiator may have to be cleaned with the aid of a commercial cleaner. Follow the manufacturer's recommendation when using the cleaning solvent. With caution, a solution of washing soda may be used to remove the grease and oil. These solutions should be lukewarm before use, and allowed to stand in the radiator and water jackets for three to four hours. The effectiveness of the solution will be increased if the engine is warm. Drain and thoroughly rinse the engine and radiator so that no trace of the cleaning solution remains.

A leaking water pump should be repaired immediately and defective parts replaced. Be sure that all hose connections are tight and that the hoses themselves are in good condition. Even a slight leak will be sufficient to pass large quantities of air, causing a greatly accelerated corrosion attack.

On machines equipped with a greasable type water pump care should be taken not to force excess grease into it. The excess will work through the pump bearing into the water system. Collected grease on the tube walls and the top of the core prevents proper heat transfer and partially or completely plugs the water channels.

The use of rust preventatives and inhibitors materially reduce corrosion within the radiator.

Thermostats should be checked from time to time and tested in hot water to determine the operating temperature. The opening temperature specified by the engine manufacturer is approximately 165°F.

Use clean, soft water in the cooling system. Where hard water cannot be avoided, use a commercial water softener. As an alternate, use fresh water taken from large quiet bodies of water.

Keep radiator grille and core tubes clean and free from foreign material which may restrict the

flow of air through the radiator. Use compressed air and blow from the engine side out on machines equipped with suction type fans. On machines equipped with pusher type fans, blow in the opposite direction. Occasionally wash with a cleaning solution.

ANTI-FREEZE MIXTURES

Temperature Degrees Fahrenheit	Amount of ALCOHOL
(General Motors Engine)	
20	8 qts.
0	16 qts.
−12	21 qts.
−20	24 qts.
−29	28 qts.
−40	32 qts.
(Cummins Engine)	
20	15 qts.
0	29 qts.
−12	38 qts.
−20	43 qts.
−29	48 qts.
−40	56 qts.
(Buda Engine)	
20	15 qts.
0	29 qts.
−12	38 qts.
−20	44 qts.
−29	49 qts.
−40	58 qts.

Temperature Degrees Fahrenheit	Amount of PERMANENT ANTI-FREEZE
(General Motors Engine)	
16	10 qts.
1	16 qts.
−12	20 qts.
−20	22 qts.
−29	24 qts.
−40	26 qts.
(Cummins Engine)	
16	17 qts.
1	28 qts.
−12	36 qts.
−20	39 qts.
−29	42 qts.
−40	46 qts.
(Buda Engine)	
16	18 qts.
1	29 qts.
−12	37 qts.
−20	39 qts.
−29	43 qts.
−40	47 qts.

FAN ASSEMBLY

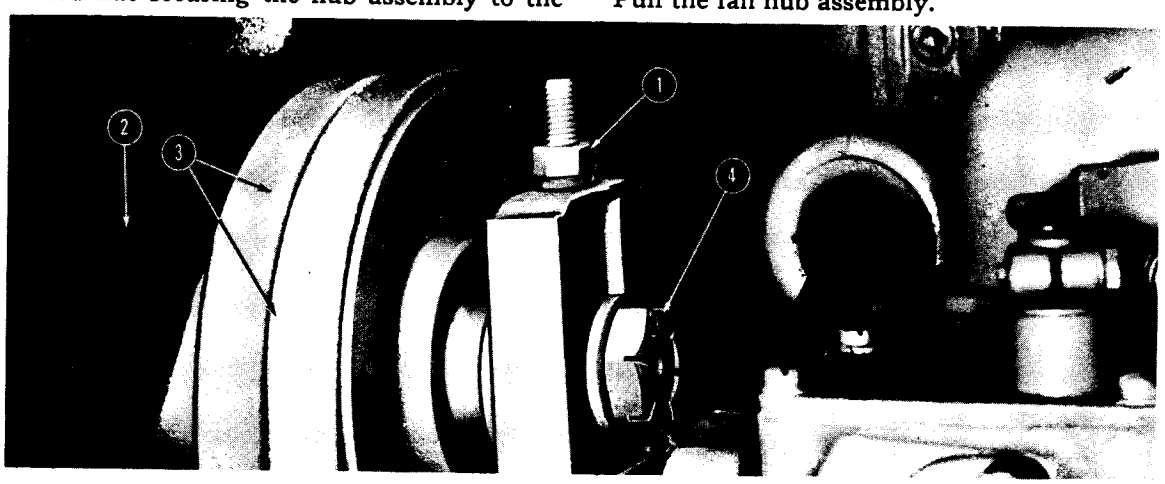
Removal

Remove capscrews and lockwashers securing fan blade assembly to the hub and withdraw the blade assembly from the radiator shroud.

Release tension on the fan belts by loosening the large slotted nut securing the hub assembly to the mounting bracket and turning the adjusting nut in a counter-clockwise direction.

Remove the fan belts.

Remove the large slotted nut and lockwasher. Pull the fan hub assembly.



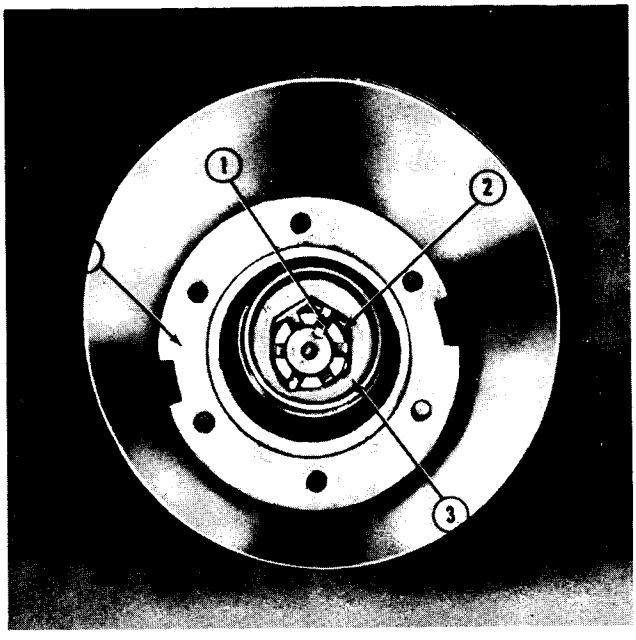
1. ADJUSTING NUT
2. FAN HUB
3. FAN BELTS
4. NUT

Figure C-9. Fan Adjusting Nut

Disassembly

Remove the cotter, spindle nut and washer from the fan end of the hub.

Press the spindle out of the fan hub (Fig. C-11).

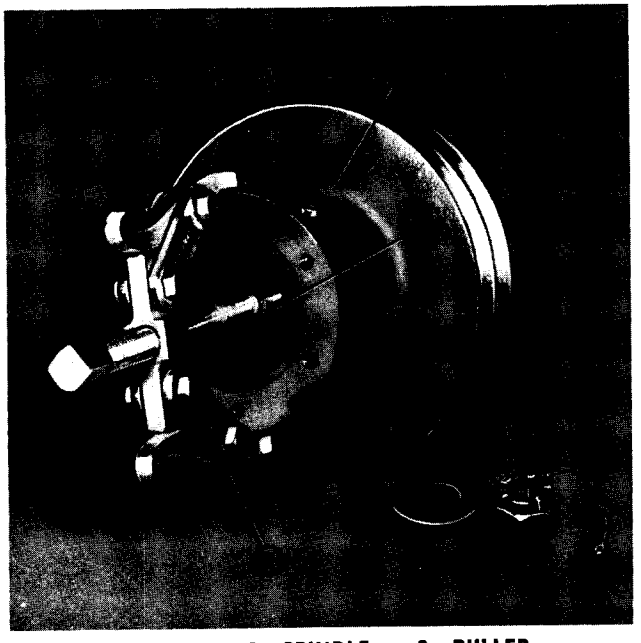


1. COTTER
2. SPINDLE NUT
3. WASHER
4. HUB

Figure C-10. Fan Hub

Pull rear bearing cone and oil seal from the spindle. Remove front bearing cone and bearing spacer from the hub.

Pull bearing cup from fan hub.



1. HUB 2. SPINDLE 3. PULLER

Figure C-11. Removing Spindle

1. SPINDLE 2. OIL SEAL 3. REAR BEARING CONE

Figure C-12. Rear Bearing and Spindle Removed

Service

Clean all parts in a cleaning solution.

Examine the bearings for pitting or irregularities in the rollers, and for wear or unevenness on the bearing surfaces. Replace worn or damaged bearing cones. If the bearing cup is pitted or worn it should be replaced.

Examine the spindle shaft for damaged threads and any evidence of bearing inner races turning on the shaft. If necessary, replace the shaft.

Check the fan pulley for cracked flanges; the hub for damaged threads in the tapped holes and looseness of the outer bearing cups. If the outer bearing cups are turning in the hub, replace the hub.

Clean and refill with fresh grease.

Lubricate every 100 shifts with high grade short fiber grease.

To lubricate, remove the pipe plug on the fan hub and fill the hub with grease. Two or three strokes of a hand gun should be sufficient.

Care should be taken not to force so much grease into the hub that the seal is ruptured, allowing the grease to leak out.

Reassembly

To reassemble the fan, reverse the procedure outlined for disassembly.

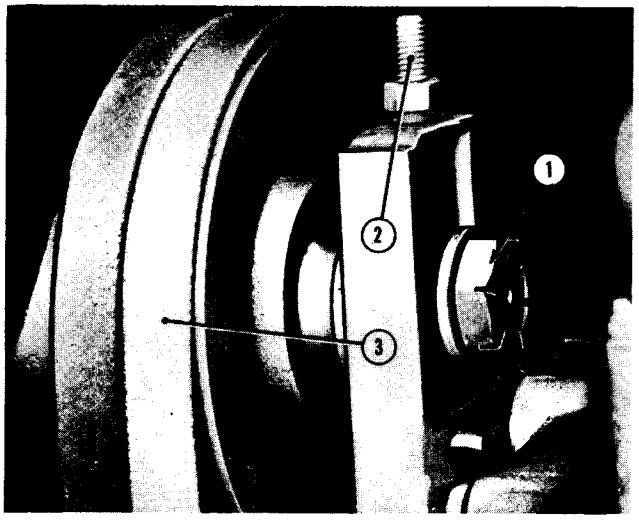
Adjust the fan belts as follows:

On machines equipped with fan adjusting nut, to tighten first, loosen the large slotted nut at the rear of the fan hub. Turn the adjusting nut in a clockwise direction to tighten the belts. After properly adjusted, tighten the slotted nut on the fan hub.

On machines without the adjusting nut, first loosen the capscrews holding the water pump and fan assembly to the engine. Insert a large screw driver in the hole provided in the water pump and turn the water pump on its eccentric counter-clockwise to tighten the belt.

Replace both belts as a unit when either one or both have been stretched beyond the adjusting limits.

The recommended fan belt tension allows ¾" movement downward with normal thumb pressure.



1. SLOTTED NUT 2. ADJUSTING SCREW
3. FAN BELTS

Figure C-13. Fan Belt Adjustment

THERMOSTATS

For information pertaining to thermostats, refer to the engine manufacturer's manual.

TEMPERATURE GAUGE

The temperature gauge is located on the instrument panel. It indicates the temperature of the coolant in the cooling system. Temperature should remain between 160° F., and 185° F. If the temperature registers at a level in excess of 185° F., checks should be made to determine the trouble. Should the gauge become inoperative, remove the nuts on the back of the instrument panel holding the gauge to its mounting bracket. Also loosen the nut holding the temperature gauge bulb in position in the engine block. Remove the gauge. A broken gauge should be replaced with a new unit.

AIR SUPPLY SYSTEM

AIR CLEANER OPERATION

The air intake line to the engine's manifold is connected to the discharge side of the air cleaner. Dust laden air is drawn into the inlet cap through the openings around the outside of the bottom of the cap.

On some engines the air compressor intake line is attached to an air box cover on the side of the engine block, permitting air to enter the compressor from the engine air box.

The inlet cap keeps fibrous materials such as chaff or lint from entering the main body of the air cleaner assembly where it is combined with the oil spray and drawn upward through the filter element in the cleaner body. Oil and dust particles are sepa-

rated from the air in the filter element and drain back into the oil cup. Cleaned air is drawn into the engine's intake manifold.

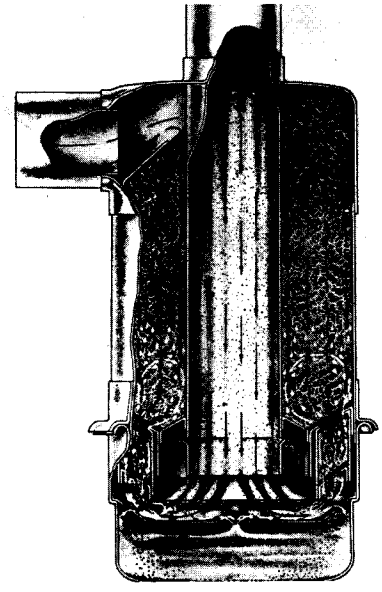


Figure C-14. Flow of Air Through Air Cleaner

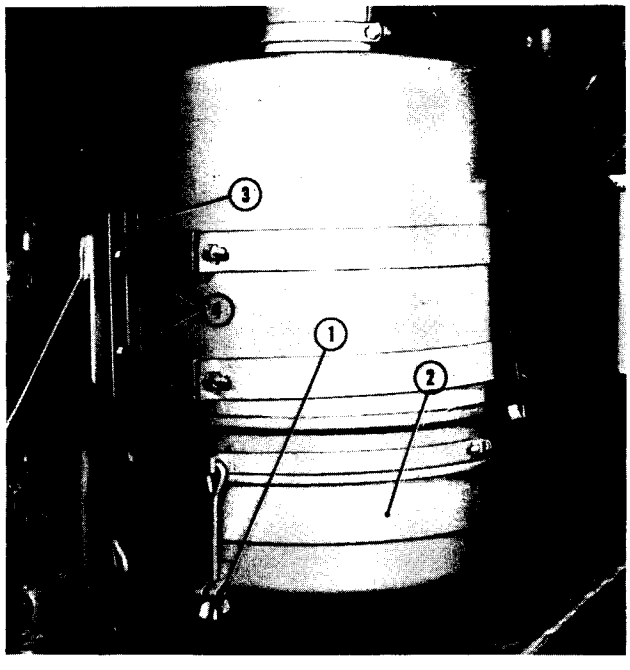
Removal

Loosen the wing nuts at the bottom of the air cleaner assembly and remove the oil cup and disc.

Remove the hose from the air cleaner discharge pipe.

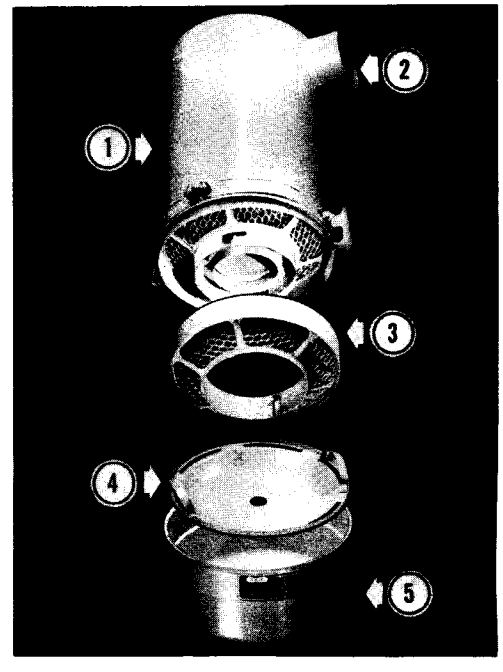
Remove the four capscrews securing the air cleaner to the mounting bracket and lift off air cleaner as a unit.

Place the air cleaner assembly on a bench for further disassembly. Remove the prefilter by a slight turn and a downward pull. Loosen the clamp on the neck of the inlet cap and remove the cap.



1. WING NUT
2. OIL CUP
3. MOUNTING BRACKET
4. CAPSCREW

Figure C-15. Air Cleaner



1. BODY ASSEMBLY
2. DISCHARGE PIPE
3. PRE-FILTER
4. DISC
5. CUP

Figure C-16. Air Cleaner, Exploded

Service and Reassembly

After the unit has been disassembled, all parts can be cleaned and defective parts replaced. Empty the oil cup and refill when the oil becomes too thick to spray readily or when one-fourth of the oil has been displaced by sediment.

Daily inspection is necessary to determine when any of these conditions have been reached.

The wire screen condensing element will need very little attention if the correct oil level is maintained, using the proper oil. However, the bottom of the screen element should be inspected whenever the cleaner is serviced. Any accumulation of dirt or straw should be removed. The heavy-duty oil bath air cleaner is provided with a removable section in the lower portion of the element. When service of the element is required, this removable piece can be taken out, washed in a cleaning solvent, dried and replaced. A slight turn and a pull will remove the prefilter element.

The inlet tube requires periodic attention, since an accumulation of dirt will restrict the air flow to the engine. Cleaning is best accomplished by pushing a rag on a stick through the inlet tube.

The entire air cleaner should be removed from its mounting and the wire screen condensing element washed thoroughly in cleaning solvent at least once each season — more often if dust conditions are severe.

Loose connections between the air cleaner and engine will allow dust to enter the cylinders. Vibration may loosen these connections. Check them frequently and keep them air tight.

The oil cup should be kept filled with fresh oil (the same weight as is used in the engine crankcase) as near as possible to the level indicated by the level bead. Never use oil heavier than that used in the engine crankcase. The best performance of the air cleaner is obtained by keeping the oil level up to the bead on the cup. Raising the oil level above this point does not increase the efficiency and this practice should be avoided.

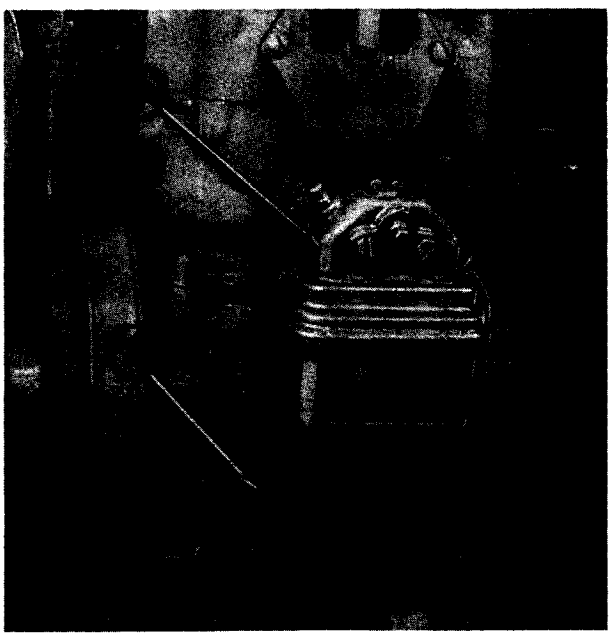
Check the oil level at the beginning of each shift. Change oil every 5 shifts. (Oftener if necessary in extreme dusty conditions.) Use the same lubricant as used in the engine crankcase.

Fill to full mark on the oil cup — 5 qts. CLEAN FILTER BODY AND ELEMENT WITH CLEANING FLUID, BLOW DRY WITH COMPRESSED AIR every 50 shifts.

COMPRESSOR AIR CLEANER

The compressor air cleaner is mounted on the outboard side of the compressor, covering the intake opening. This oil-bath type cleaner filters the air as it is drawn into the compressor.

This compressor air cleaner is found on the machines that do not have the compressor intake connected to the diesel engine air box.



1. AIR CLEANER 2. AIR COMPRESSOR

Figure C-17. Air Compressor Air Cleaner

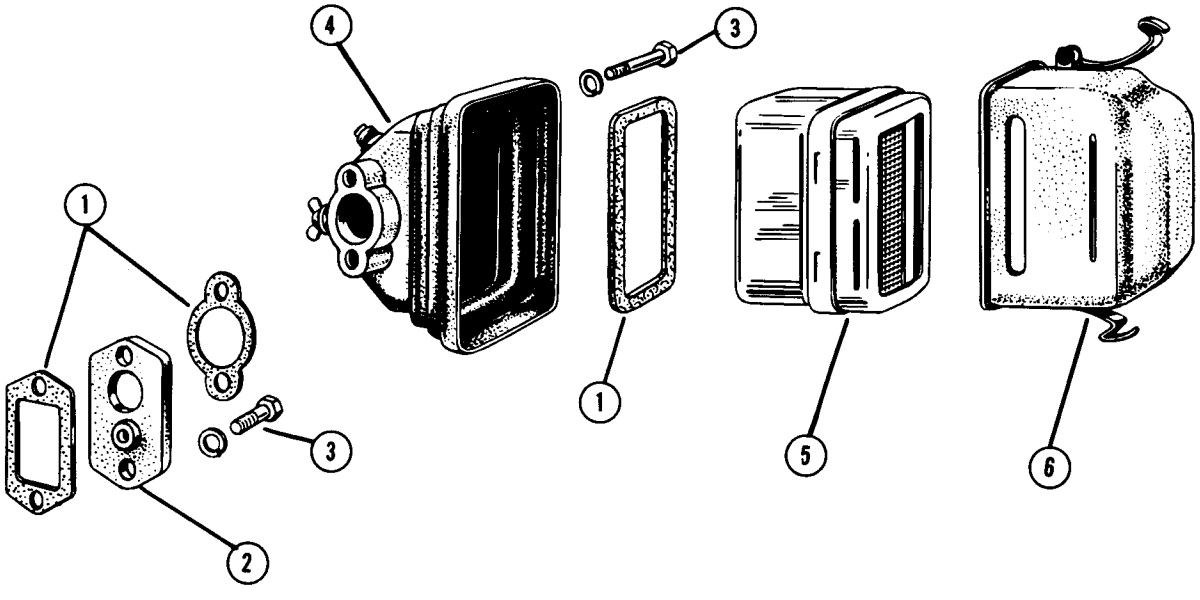
Removal and Disassembly

Release the two spring clips holding the oil cup to the cover.

Next remove the oil cup, filter element and gasket from the cover.

Remove the two slot head capscrews securing the cover to the adaptor and remove cover and gasket.

Remove the slot head capscrew that goes through the adaptor and gasket into the compressor cylinder head, then remove the adaptor and gasket.



1. GASKET
2. ADAPTOR PLATE
3. CAPSCREW
4. BODY
5. FILTER ELEMENT
6. OIL CUP

Figure C-18. Air Cleaner, Exploded

Service

Remove and clean the filter every time the engine crankcase oil is changed.

Check the oil level at the beginning of each shift. Change oil every 5 shifts. (Oftener if necessary in extremely dusty conditions.)

Refill the oil cup with the same weight oil as is used in the engine crankcase. Keep the oil as near the oil level mark on the oil cup as possible.

Replace any damaged gaskets.

Reassembly

To reassemble the air compressor air cleaner reverse the procedure outlined for disassembly.

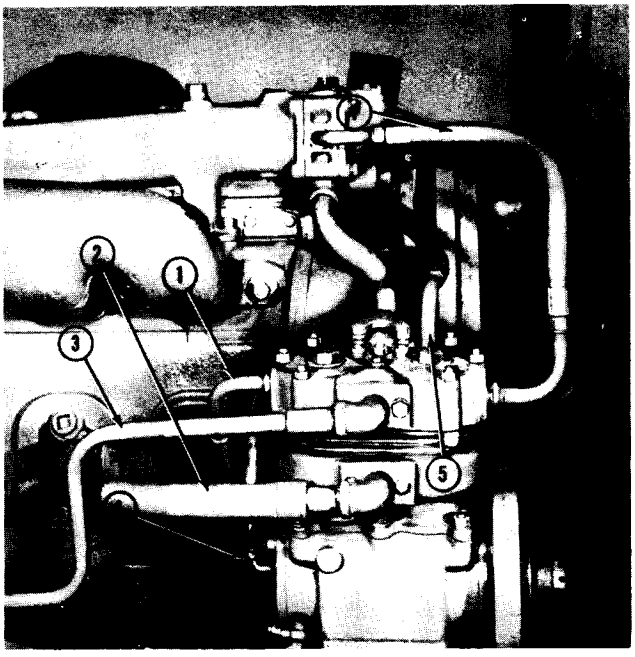
AIR COMPRESSOR

Description

The compressor is of the two cylinder single acting reciprocating type. The rated capacity of 12 cubic feet per minute is based on piston displacement when running at a speed of 1250 R.P.M.

The air compressor cylinder head and cylinder block are water cooled from the diesel engine's cooling system.

Oil under pressure from the engine enters the compressor through a passage in the compressor crankcase and is fed to the connecting rod bearings through drilled holes in the crankshaft and to the wrist pin bearings through drilled holes in the connecting rods. The main bearings are ball bearings and are splash lubricated. Surplus oil returns to the



1. WATER LINE
2. AIR INTAKE LINE
3. AIR LINE TO AIR TANK
4. OIL LINE
5. AIR LINE TO AIR COMPRESSOR GOVERNOR

Figure C-19. Air Compressor Piping

engine crankcase through a line from the open compressor base.

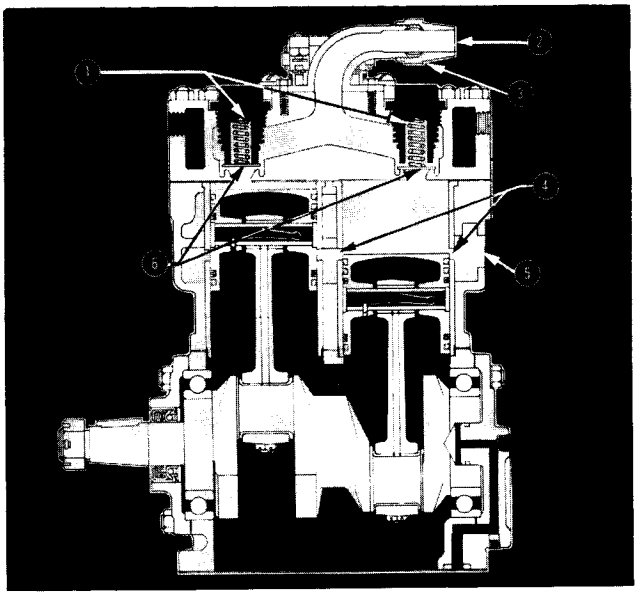
The air compressor furnishes the compressed air needed to operate the brakes and clutches.

The compressor nameplate is attached to the crankcase and includes the serial number, piece number and type of compressor.

Figure C-20. Air Compressor Nameplate

Operation

The compressor runs continually while the engine is operating. However, the actual compression of air is controlled by a governor which, acting in conjunction with the unloading mechanism in the compression cylinder head, starts or stops the compression of air by loading or unloading the compressor when the air pressure in the system reaches the desired minimum (90 pounds) or maximum (120 pounds) respectively.



1. DISCHARGE VALVE SPRINGS
2. DISCHARGE LINE
3. DISCHARGE FITTING
4. INTAKE PORTS
5. INTAKE MANIFOLD
6. DISCHARGE VALVE

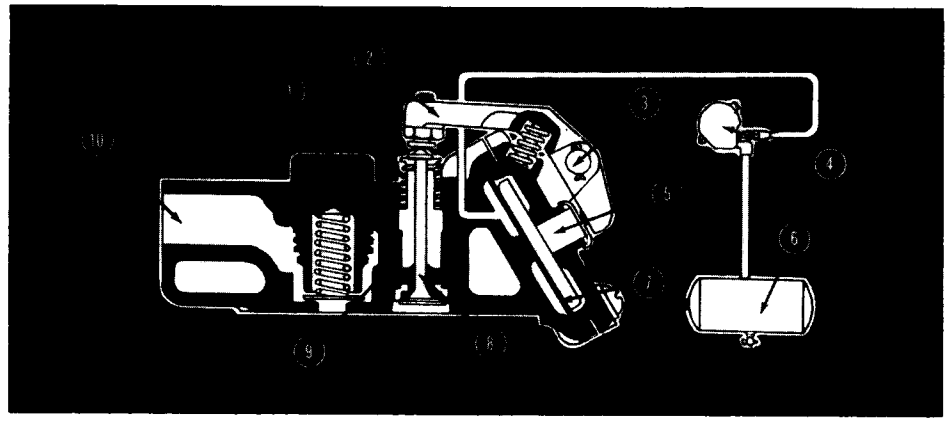
Figure C-21. Compressor Cut-Away

COMPRESSING AIR (Loaded): (Fig. C-22). During the downstroke of each piston, a partial vacuum is created above the piston and as the piston nears the bottom of its stroke, it uncovers the intake ports in the cylinder wall. Air then enters the cylinder above the piston after passing through the air cleaner, the intake manifold and the intake ports in the cylinder wall.

As each piston begins its upstroke, it covers the intake ports in the cylinder wall and the air which has entered the cylinder is trapped above the piston. As the piston continues its upstroke, the air above the piston is compressed until the pressure lifts the discharge valve and the compressed air is discharged through the discharge line into the air supply tank.

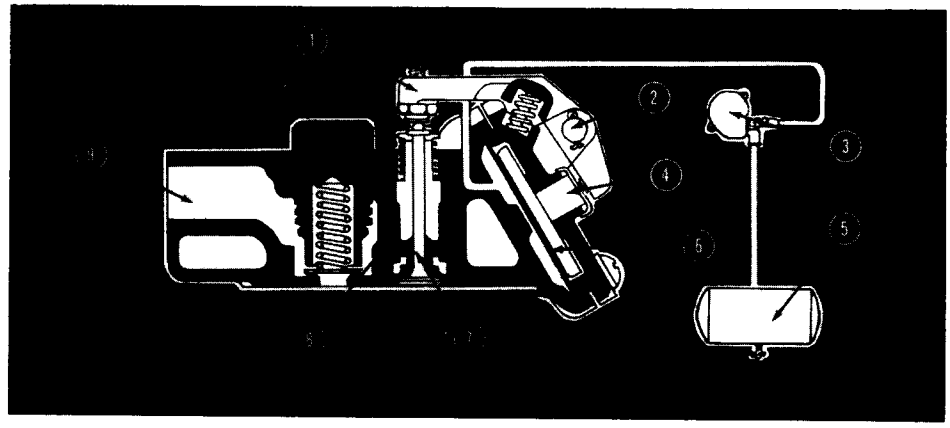
As each piston starts its downstroke, the discharge valve above it returns to its seat preventing the compressed air from returning to the cylinder, and the same cycle is repeated.

NOT COMPRESSING AIR (Unloaded): (Fig. C-23). When the air pressure in the air tank reaches the maximum setting of the governor (120 pounds), compressed air from the air tank passes through the governor into the cavity under the unloading dia-



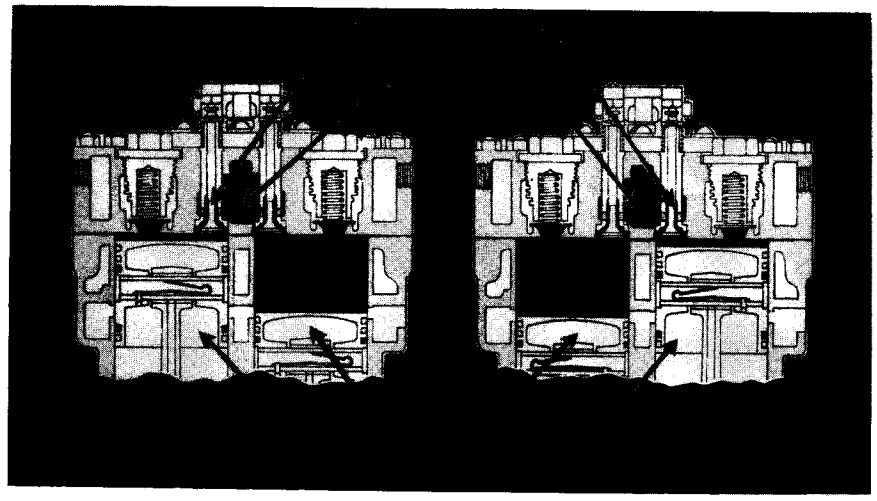
1. UNLOADING VALVE SPRING
2. UNLOADING LEVER
3. UNLOADING LEVER PIN
4. GOVERNOR
5. DIAPHRAGM FOLLOWER
6. RESERVOIR
7. UNLOADING DIAPHRAGM
8. UNLOADING VALVE
9. UNLOADING VALVE CAVITY
10. DISCHARGE PORT

Figure C-22. Compressing Position, Governor Cut-In, Compressor Loaded



1. UNLOADING LEVER
2. UNLOADING LEVER PIN
3. GOVERNOR
4. DIAPHRAGM FOLLOWER
5. RESERVOIR
6. UNLOADING DIAPHRAGM
7. UNLOADING VALVE
8. UNLOADING VALVE CAVITY
9. DISCHARGE PORT

Figure C-23. Non Compressing Position, Governor Cut-Out, Compressor Unloaded



1. UNLOADING VALVE
2. UNLOADING VALVE CAVITY
3. PISTONS

Figure C-24. Unloading Cavity

phragms in the compressor cylinder head. This air pressure lifts the unloading diaphragms in the compressor cylinder head and one end of the unloading lever. The unloading lever then pivots on the unloading pin and the other end pushes the unloading valves off their seats (Fig. C-23).

With the unloading valves off their seats, the unloading cavity forms a passage between the cylinders above the pistons (Fig. C-24). Thus during the upstroke of each piston air merely passes back and forth through this passage and compression is stopped. When the air pressure in the reservoir drops to the minimum setting of the governor (90 pounds), the governor releases the air pressure from beneath the unloading diaphragms. The unloading valve springs then return the unloading valves to their seats and compression is resumed.

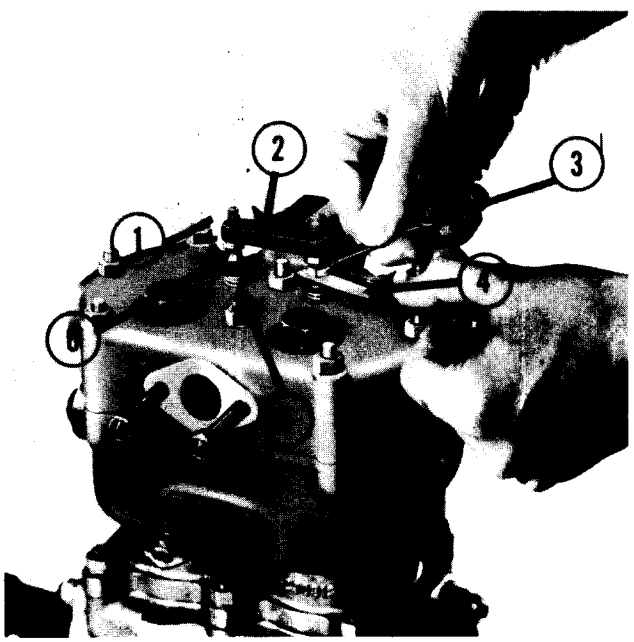
Service

Water lines connect the water-cooled section of the compressor to the water circulating system of the engine. Check the connections for leaks and tighten periodically. During cold weather, the water-cooled section should be drained whenever the engine is drained. Anti-Freeze will protect the compressor to the same extent as the engine.

Keep the air inlet line fittings tight. Check the blanking cover and gasket covering the air inlet opening or the intake manifold not in use for leaks and improper installation.

With the compressor running, check for noisy operation and oil or water leaks.

Check the unloading valve clearance. Clearance must be 0.010" minimum to 0.015" maximum. To adjust the clearance loosen the lock nuts and turn the adjusting screws until the proper clearance is obtained (Fig. C-25). Then tighten the lock nuts.



1. ADJUSTING SCREW
2. UNLOADING LEVER
3. WRENCH
4. FEELER GAUGE
5. UNLOADING VALVE SPRING
6. LOCKNUT

Figure C-25. Adjusting Unloading Valve Clearance

Clearance can be checked only when the compressor is loaded. Check the unloading lever for binding at the same time.

Keep the oil lines clean and tight. One line connects the compressor end cover with the lubricating oil distributing cavity on the engine. The oil in this line is under pressure. Oil which has circulated through the compressor lubricating system drains back into the engine crankcase through a line from the opening in the compressor base (Fig. C-19).

The compressor drive belt should be regularly checked for wear and kept under firm tension. A slipping compressor belt wears both the belt and the pulleys and will prevent the compressor from delivering its rated amount of air. A properly adjusted belt can be pushed down 3/4" with normal thumb pressure.

To tighten the belt, loosen the clamp and the capscrew securing the compressor mounting bracket to the engine or the main case, whichever the case may be. Pull the compressor unit away from the engine until the proper belt tension has been obtained. Then tighten the capscrew and clamp locking the compressor in the new position.

Failure of the compressor to maintain normal air pressure usually denotes loss in efficiency due to wear, provided loss is not excessive in the remainder of the system. Another sign of wear is excessive oil passing. If either of these conditions develop and inspection shows the remainder of the system to be in good condition, the compressor must be repaired or replaced.

Excessive leakage past the discharge valves can be detected by fully charging the system with air and then (with the engine stopped) carefully listening at the compressor for the sound of escaping air.

With the air system fully charged (compressor unloaded) coat the unloading box cover with soap suds to check for leakage past the unloading diaphragms. Leakage of a one inch soap bubble in three seconds is permissible.

If excessive leakage is found the compressor should be replaced.

Removal

Drain the air system.

Drain engine cooling system, compressor cylinder head and compressor block.

Disconnect all air, water, and oil lines connected to the compressor block.

Relieve tension of the compressor drive belt.

Remove compressor mounting bolts and remove compressor from machine.

Use a gear puller to remove the pulley from the compressor crankshaft after removing crankshaft nut.

Installation

Clean oil supply line to compressor and, if possible, run engine a few seconds to be sure oil supply to compressor is flowing freely.

Clean oil return line and passage to be sure oil can return from the compressor to the engine crankcase.

Lubricate compressor cylinder walls and bearings with lubricating oil before placing compressor in position.

Inspect bore and keyway of pulley for wear or damage. Pulley must be a neat fit on the compressor crankshaft. Replace pulley if bore or keyway is damaged or worn.

Install pulley on compressor crankshaft being sure it properly contacts the shaft and does not ride the key. Tighten crankshaft nut securely and install cotter.

Clean or replace any dirty air or water lines before connecting them to the compressor. Always use a new discharge fitting gasket.

Align compressor drive if necessary and tighten mounting bolts securely and evenly. Adjust belt tension. Then, with compressor running, check for noisy operation and coil, water, or air leaks. Check the unloading valve for clearance. Test air system for serviceability.

NOTE: When connecting air inlet line to compressor care should be taken not to crush fiber washer. Damage to washer may result in compressor pumping oil into the air tank.

Disassembly

CLEANING BEFORE DISASSEMBLY: Remove all grease or dirt from the exterior of the compressor by scraping. If necessary use cleaning solvent and a brush.

MARKING BEFORE DISASSEMBLY: The cylinder head, cylinder block, and crankshaft of many compressors are designed so that the compressor can be assembled in several different ways to meet the installation requirements. In order to insure correct assembly, such parts should be marked before disassembly where necessary to show their correct position in relation to each other. This can be done best by making center punch marks in the related parts to act as guides during assembly.

The following parts should be marked:

Position of cylinder head in relation to cylinder block.

Position of air intake fitting in relation to cylinder block.

Position of cylinder block in relation to crankcase.

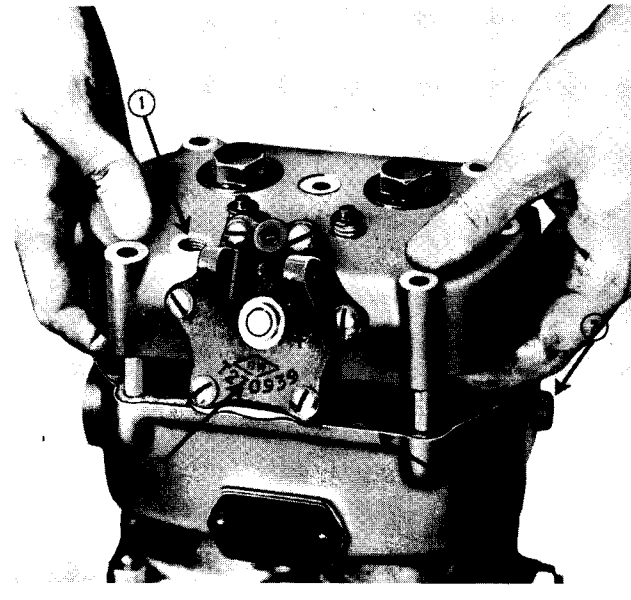
Position of front end cover (drive end of crankcase) in relation to the crankcase. (Make one punch mark on each.)

Position of rear end cover in relation to the crankcase. (Make two punch marks on each.)

All crankshafts are marked already with one punch mark on the throw nearest the drive end. Marking the crankcase with one punch mark at the drive end will permit the crankshaft to be positioned properly in the crankcase during assembly.

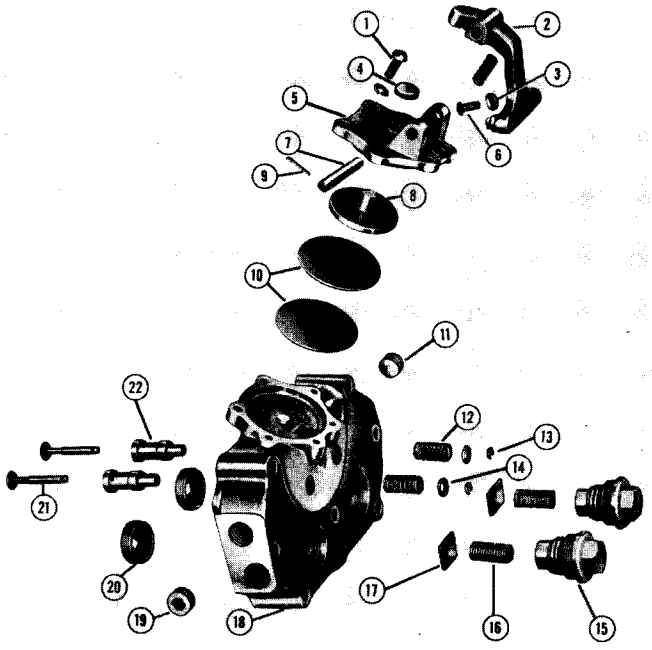
Disassembly: Remove unloading lever, unloading lever spring and dust cover.

Remove nuts from all cylinder head studs and lift off cylinder head (Fig. C-26). The cylinder head may have to be tapped lightly with a rawhide hammer to break the gasket joints.



1. TO GOVERNOR
2. DRAIN PLUG
3. GASKET
4. UNLOADING BOX COVER

Figure C-26. Removing Cylinder Head



1. CAPSCREW
2. UNLOADING LEVER
3. LOCKNUT
4. DUST COVER
5. BOX COVER
6. ADJUSTING SCREW
7. LEVER PIN
8. DIAPHRAGM FOLLOWER
9. COTTER
10. DIAPHRAGMS
11. PLUG
12. UNLOADING VALVE SPRING
13. STOP
14. RETAINING RING
15. CAP NUT
16. SPRING
17. DISCHARGE VALVE
18. BODY
19. PLUG
20. DISCHARGE VALVE SEAT
21. UNLOADING VALVE
22. UNLOADING VALVE BUSHING

Figure C-27. Cylinder Head, Exploded

Scrape cylinder head gasket off cylinder head and block.

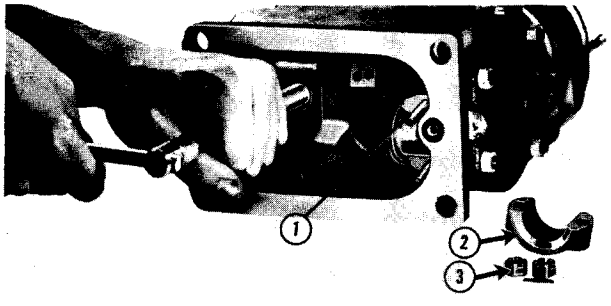
Remove machine screw attaching unloading box cover to cylinder head. Lift off unloading box cover and remove diaphragm follower and the tow diaphragms.

Remove discharge valve cap nuts and lift out discharge valve springs and discharge valves.

Compress unloading valve springs by hand and remove spring retaining rings. Then remove unloading valve stops and unloading valve springs. Remove unloading valves by pushing them out the bottom of the cylinder head body.

Remove cotter pins and slotted nuts from bolts securing connecting rod bearing caps to connecting rods (Fig. C-28). Lift out connecting rod bearing caps. Then push pistons, with connecting rods attached, out the top of the cylinder block. Replace caps on each connecting rod to avoid damage to the bearings. The connecting rod caps and connecting rods are already marked with center punch marks to show the proper position of the caps.

Remove piston rings from each piston. If pistons are to be removed from connecting rods, remove wrist pin lock wires from each wrist pin and press



1. CONNECTING ROD 2. BEARING CAP
3. SLOTTED NUT

Figure C-28. Removing Rod Bearing Caps

wrist pins from pistons and connecting rods.

Remove nuts from studs securing front or drive end cover to crankcase. Remove end cover with oil seal and gasket. If oil seal needs replacing, remove it from end cover.

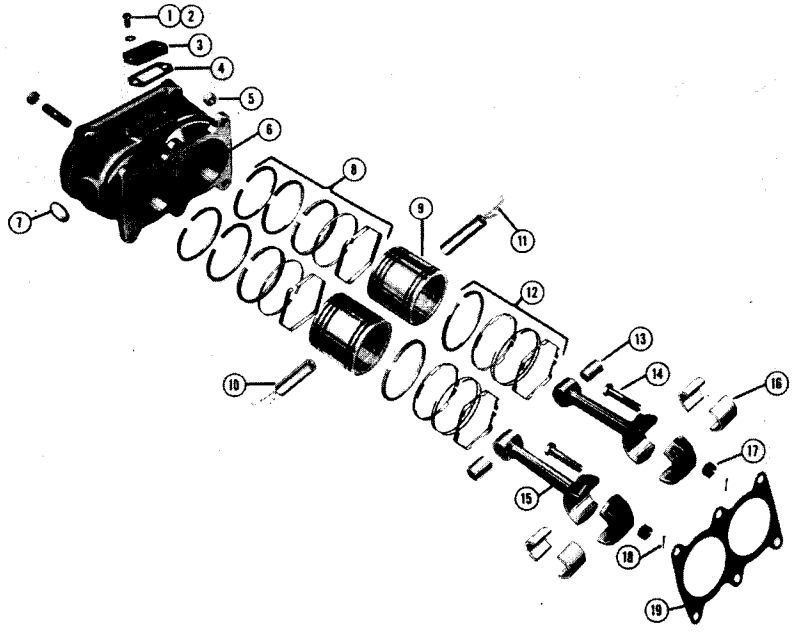
Remove nuts from studs securing rear end cover to crankcase. Remove end cover and gasket.

Some crankcases are fitted with a shoulder. This positions the crankshaft in the crankcase. In such cases the crankshaft may be removed only through one end of the crankcase. Press crankshaft and ball bearings out of crankcase, then press ball bearings

off crankshaft.

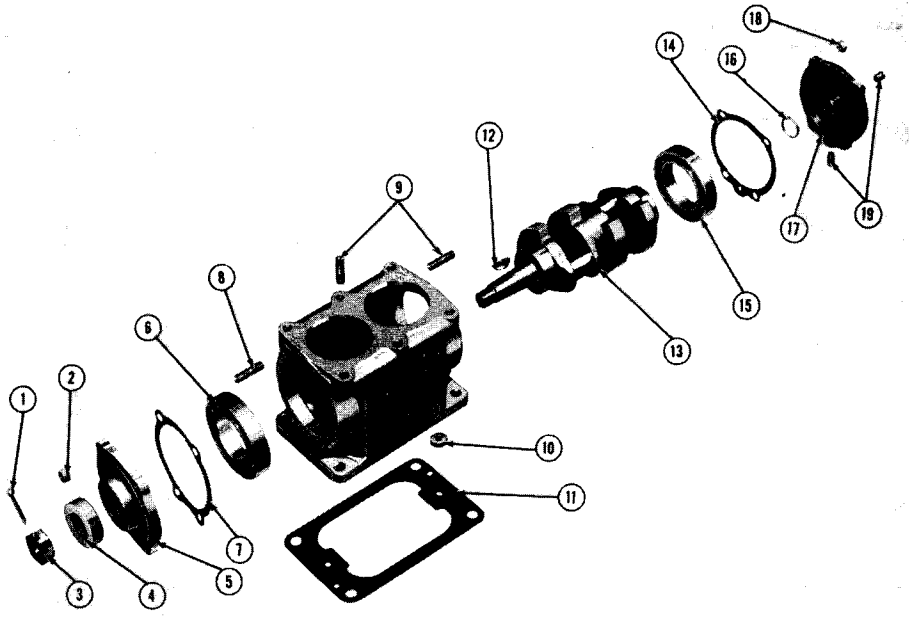
Remove intake manifold cover and gasket.

Remove nuts securing cylinder block to crankcase and remove cylinder block and gasket.



1. CAPSCREW
2. LOCKWASHER
3. COVER PLATE
4. GASKET
5. NUT
6. SLEEVE
7. PLUG
8. RINGS
9. PISTON
10. WRIST PIN
11. LOCKWIRE
12. RINGS
13. WRIST PIN BUSHING
14. BOLT
15. CONNECTING ROD
16. BEARING
17. SLOTTED NUT
18. COTTER
19. GASKET

Figure C-29. Cylinder Block, Exploded



1. COTTER PIN
2. NUT
3. NUT
4. OIL SEAL
5. END COVER
6. BALL BEARING
7. GASKET
8. STUD
9. STUD
10. OIL SEAL GASKET
11. BASE GASKET
12. WOODRUFF KEY
13. CRANKSHAFT
14. GASKET
15. BALL BEARING
16. OIL SEAL RING
17. END COVER
18. NUT
19. PLUGS

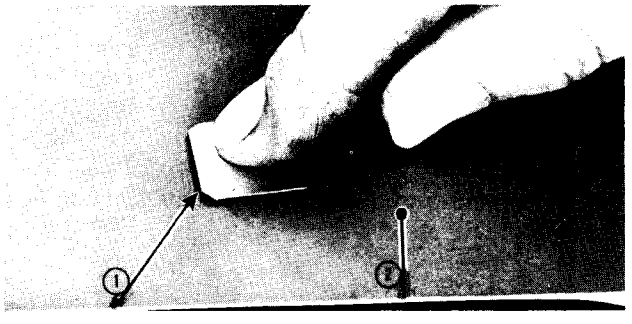
Figure C-30. Crankcase, Exploded

Cleaning and Inspecting of Parts

Clean all parts using cleaning solvent to remove all traces of dirt, oil and grease before inspection.

Put cylinder head body through a cleaning solution to remove all carbon from discharge valve cavities and unloading valve cavity and to remove all rust and scale from water cavity. Use air pressure to blow dirt out of all cavities. Scrape carbon, dirt, and particles of old gaskets from all surfaces.

Clean discharge valves (not worn excessively or damaged) by lapping them on a piece of crocus cloth on a flat surface (Fig. C-31).



1. DISCHARGE VALVE 2. LAPPING PLATE

Figure C-31. Lapping Discharge Valve

Clean thoroughly all oil passages through crankshaft, connecting rods, crankcase, base plate, and end covers. If necessary, probe oil passages with a piece of wire and flush with cleaning solvent.

Put cylinder block through a cleaning solution to remove all carbon and dirt from intake manifold and intake ports and to remove all rust and scale from water cavity.

All ball bearings must be washed thoroughly in cleaning solvent.

Inspect cylinder head body for cracks or breaks. Replace if any are found. Check condition of unloading diaphragm cavity in cylinder head. Replace cylinder head body if seat is pitted or damaged in any way.

Test water jacket after cleaning for leakage, using air pressure. This must be done by assembling the cylinder head body to the cylinder block. The water jackets in both parts are checked at the same time. Replace cylinder head body or the cylinder block if any leakage is found.

Check fit of unloading lever pin in unloading lever for excessive play. If pin or lever show signs of wear, either or both should be replaced.

Check unloading diaphragms and replace if any signs of wear or cracking are present. Check diaphragm seat on bottom of unloading box cover. Lap seat or replace cover if necessary.

Check condition of slot in unloading valve stems where the retaining washers contact the valve stems. Replace unloading valves if any evidence of wear is present. Check fit of unloading valve stems in unloading valve bushings. If excessive clearance is found, check unloading valve stems. Wear of the unloading valve stems must not exceed 0.002". This may be checked by comparing the diameter of the unloading valve stem and the unloading valve bushings, with the diameter of the stem where it does not engage the bushing. If there is excessive clearance between the unloading valves and unloading valve bushings, the unloading valves, the unloading valve bushings, or both must be replaced. If the unloading valve bushings are to be replaced they may be removed by pressing them out through the bottom of the cylinder head. Heat the head to at least 300° F. before removing or installing unloading valve bushings.

Discard all used discharge valve springs and replace with new springs.

Inspect condition of discharge valves and discharge valve seats. If discharge valves are grooved deeper than 0.003" where they contact the seats, they should be replaced. If the discharge valve seats are worn excessively so there is no longer sufficient metal left to reclaim the seat by using a lapping stone, the seats should be replaced. The head must be heated to at least 300° F. before removing or installing discharge valve seats.

Check crankcase and end covers for cracks and broken lugs. Replace if any are found.

Check fit of oil seal ring in the ring groove. Ring must be a neat fit in the ring groove and have 0.008" to 0.015" clearance at the gap when placed in the end bore of the crankshaft. Check lip of oil seal for wear. If worn thin or damaged the oil seal must be replaced.

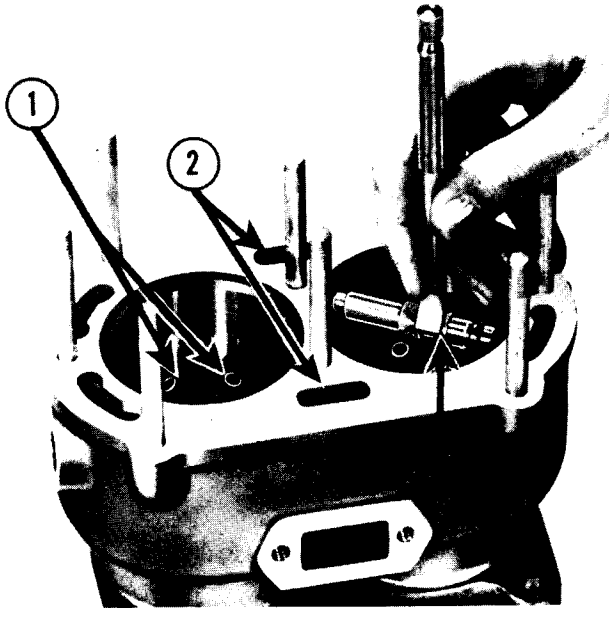
Check fit of ball bearings in crankcase. Bearings must be a light press fit. If the crankcase bearing bores are worn or damaged, the crankcase should be replaced.

A cylinder block with broken lugs or with cracks of any kind must be replaced.

Check cylinder bores for evidence of excessive wear, out-of-round or scoring. Cylinder bores which are scored or out of round more than 0.003" or tapered more than 0.003" should be rebored or honed oversize (Fig. C-32). Cylinder bores must be smooth, straight, and round and must be finished with a 500 grit hone, or finer. Clearance between pistons and cylinder blocks must be 0.002" minimum and 0.004" maximum.

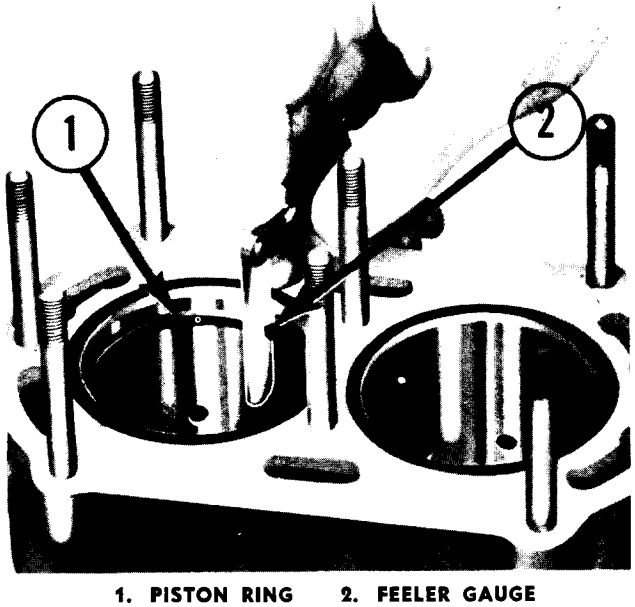
Inspect pistons for scores, cracks or damage of any kind. If scores or cracks are found, replace the

piston. Check each piston with a micrometer in relation to the cylinder bore diameter to be sure the clearance is between 0.002" minimum and 0.004" maximum.



1. INTAKE PORTS 2. WATER PASSAGE
3. INSIDE MICROMETER

Figure C-32. Checking Cylinder Bore



1. PISTON RING 2. FEELER GAUGE

Figure C-33. Checking Ring Gap

Check fit of piston rings in ring grooves. Check piston ring gap with rings installed in cylinder. With earlier pistons having all ring grooves the same width, the piston ring groove clearance for compression and ventilated oil rings should be 0.0015" to 0.0030". Scraper oil ring and groove clearance should be 0.0035" to 0.0050". Replace rings if gap is more than 0.020". Gap of new rings should be 0.010" to 0.015". With later pistons having the scraper ring grooves wider than the oil ring grooves, the ring groove clearance should be 0.002" to 0.004" for compression rings and 0.0035" to 0.0055" for scraper rings. Ring gap should be 0.005" to 0.015", replace rings if more than 0.020" (Fig. C-33). Installation of expander type rings on later type pistons is recommended during compressor repairs. With these the compression ring groove clearance should be 0.0015" to 0.0025" and the gap should be 0.008" to 0.0010".

Check fit of wrist pins in pistons and connecting rods. Wrist pins must be a light press fit in the pistons. If wrist pin is a loose fit in the piston, the wrist pin, piston, or both must be replaced. Check fit of wrist pin in connceting rod bushing by rocking the piston. If excessive clearance is apparent, replace wrist pin bushings in connecting rod. Wrist pin bushings should be reamed after being pressed in place. Discard all used wrist pin lock wires.

Inspect connecting rod bearings for proper fit on crankshaft journals. Also check babbitt bearing for wear . . . If worn, cracked, or broken, the connecting rods must be re-babbitted or replaced. Clearance between the connecting rod journal and the connecting rod bearing must not be less than 0.001" and not more than 0.002".

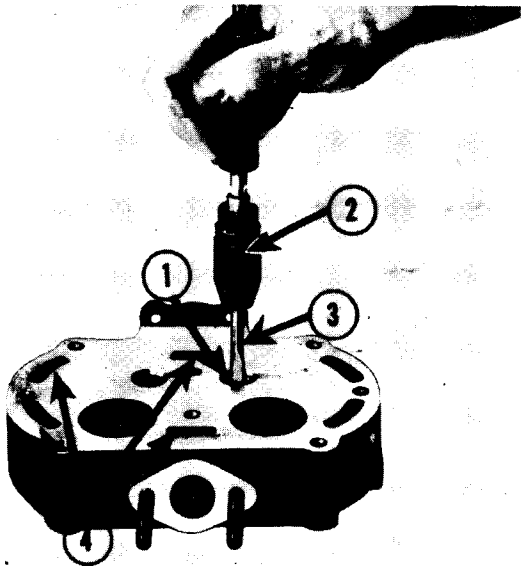
Crankshaft journals which are more than 0.001" out-of-round or bruised must be reground. When regrinding, the fillets at the ends of the journals must be maintained. Connecting rods 0.010", 0.020" and 0.030" undersize are made for reground crankshafts. Screw threads, keyways, tapered ends and all ground and machined surfaces of the crankshaft must not be mutilated or excessively worn. Main bearing journals must not be worn too much to prevent the ball bearings being a light press fit. The oil seal ring groove in the crankshaft must not be worn to prevent a good fit of the oil seal ring. Walls of the oil seal ring grooves must be square and have a good finish.

Check the ball bearings for wear or flat spots. If found, the bearings must be replaced.

Repairs

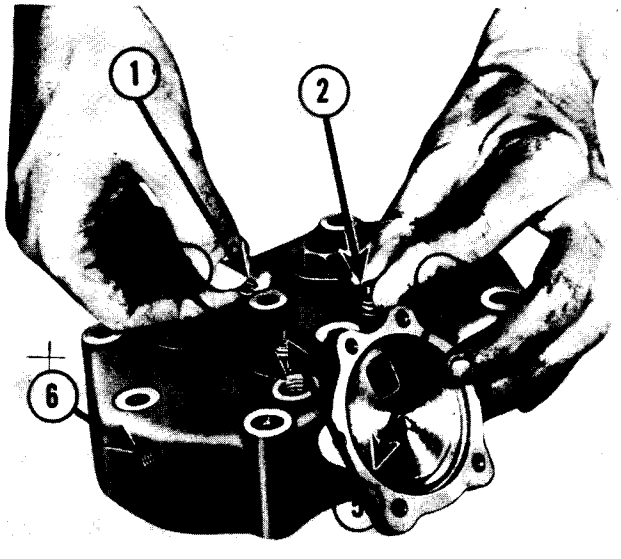
UNLOADING VALVES: Reseat unloading valves which are not too badly worn or pitted using grinding compound (grade 1000), reciprocating valve grinding tool, and driver (Fig. C-34). If the valve seats are badly pitted or worn, both the unloading valve and the unloading valve bushing

should be replaced. The head must be heated to at least 300° F. to remove and install new unloading valve bushings. Valves must be ground to their seats and cleaned after grinding. After cleaning, install the unloading valves, unloading valve springs, unloading valve stops and spring retaining rings in the cylinder head (Fig. C-35), and test the unloading valves for leakage (Fig. C-36).



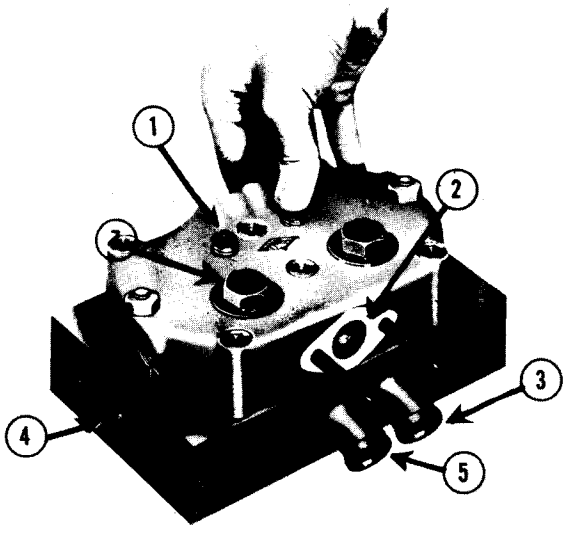
1. UNLOADING VALVE
2. VALVE GRINDING TOOL
3. DRIVE TOOL
4. WATER PASSAGES

Figure C-34. Reseating Unloading Valve



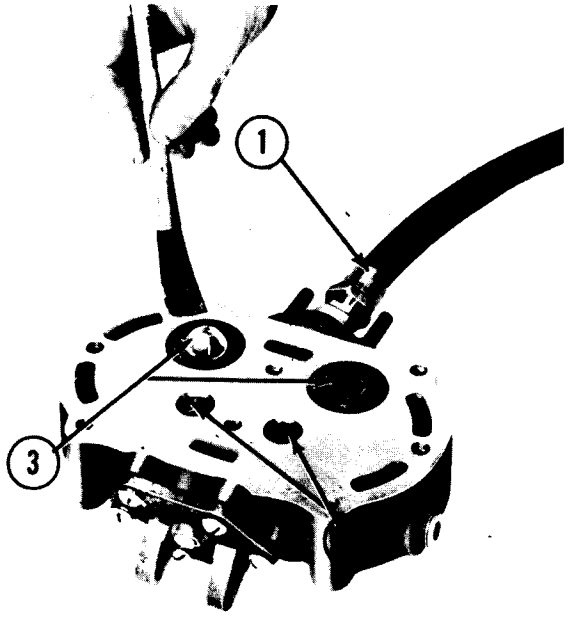
1. RETAINING RING
2. UNLOADING VALVE, STOP AND SPRING
3. TO GOVERNOR
4. UNLOADING DIAPHRAGM SEAT — CAVITY
5. RETAINING RING INSTALLED
6. WATER CONNECTION

Figure C-35. Installing Unloading Valves



1. UNLOADING VALVE STEM
2. DISCHARGE PORT
3. TEST FOR LEAKAGE HERE
4. TEST FIXTURE
5. CONNECT AIR SUPPLY HERE
6. WATER CONNECTION
7. DISCHARGE VALVE CAP NUT

Figure C-36. Testing Unloading Valve for Leakage



1. AIR LINE CONNECTED TO DISCHARGE PORT
2. UNLOADING VALVES
3. DISCHARGE VALVES

Figure C-37. Checking Discharge Valves for Leakage

Test the unloading valves for leakage by clamping the cylinder head in a special fixture. Test with 100 pounds air pressure using soap suds.

Each unloading valve must be tested by applying soap suds to the exhaust port of the fixture while

holding the other unloading valve down off its seat. Leakage in excess of one inch soap bubble in three seconds for any one unloading valve is not permissible. If excessive leakage is found, again grind the leaking unloading valve to its seat.

DISCHARGE VALVES: If the discharge valve seats merely show signs of slight scratches or are pitted, they can be reclaimed by using lapping stone, driver, and grinding tool. The valve seats must be cleaned after grinding.

After the discharge valves, discharge valve springs, and cap nuts are installed, the discharge valves must be tested for leakage.

To test for leakage, apply 100 pounds air pressure through the discharge port of the cylinder head and apply soap suds to the discharge valve openings (Fig. C-37). Leakage in excess of a one inch soap bubble in one second is not permissible.

If excessive leakage is found, leave the air pressure applied and, using a fiber or hardwood dowel and light hammer, tap the discharge valves off their seats several times to improve the seal between the valves and their seats. If the valves and valve seats have been reconditioned correctly, this will reduce the leakage.

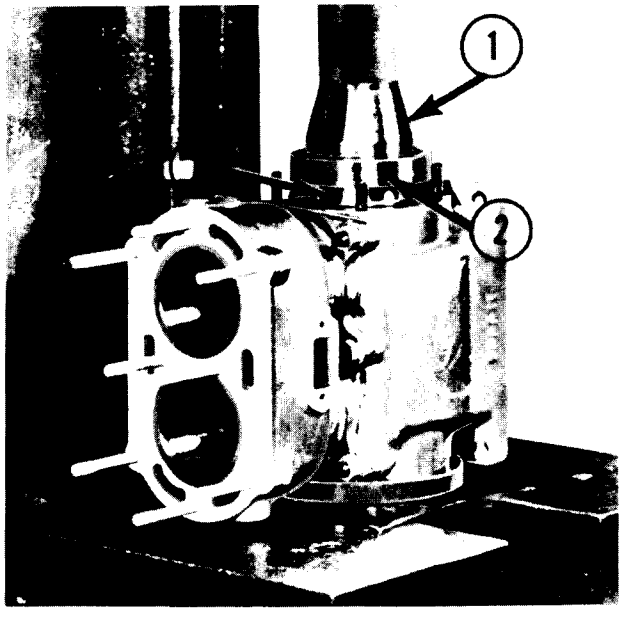
Leakage tests must also be made by applying soap suds around the top of the discharge valve cap nuts. Leakage here must not exceed a one inch soap bubble in five seconds.

Assembly

INSTALLING CYLINDER BLOCK: Place new cylinder block gasket in position over crankcase studs. Position cylinder block on crankcase in accordance with markings made before disassembly. Install nuts securing block to crankcase.

INSTALLING CRANKCASE: If the crankshaft is fitted with oil seal rings, install rings.

Position ball bearings and crankshaft in crankcase. Be sure the drive end of the crankshaft is positioned at the end of the crankcase which was marked with one punch mark before disassembly. If one end of the crankcase is counterbored for holding bearing, be sure the crankshaft is entered through the correct end of the crankcase. Carefully press crankshaft and bearings into crankcase (Fig. C-38).



1. COLLAR 2. BEARING 3. CRANKSHAFT

Figure C-38. Installing Crankshaft into Crankcase

Place a new rear end cover gasket in position over studs on rear end of crankcase BEING SURE the oil hole in the gasket lines up with the oil hole in the crankcase.

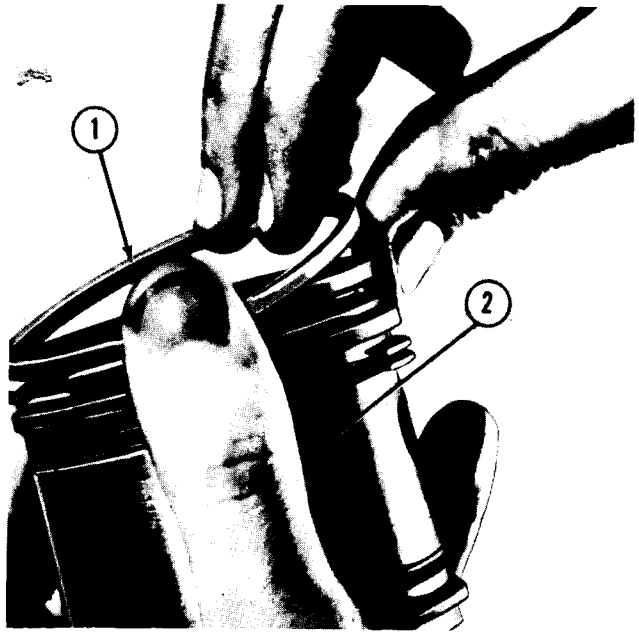
Install oil seal ring. Then position rear end cover over studs in crankcase being sure that the oil hole in the rear end cover lines up with the oil hole in the gasket and crankcase. Install nuts securing the end cover in place. Install pipe plugs in end cover oil openings which are not in use.

If front end cover oil seal has been removed from the end cover, press a new oil seal into the end cover. Install a new gasket. Carefully position the front end cover so as not to damage the oil seal and install nuts securing end cover in place.

ASSEMBLING PISTONS AND CONNECTING RODS: If wrist pin bushings have been removed from connecting rods, press new bushings into place making sure that the oil holes in the bushings line up with the oil holes in the connecting rods. Bushings must then be reamed, honed, or bored to provide between 0.0005" and 0.001" clearance on the wrist pin. Position connecting rod in piston and press wrist pin into piston. Keep lock wire hole in pin aligned with lock wire hole in piston. Install new wrist pin lock wire in wrist pin so that the end of the wire engages the hole in the piston. Do not use pistons in which the wrist pin is loose.

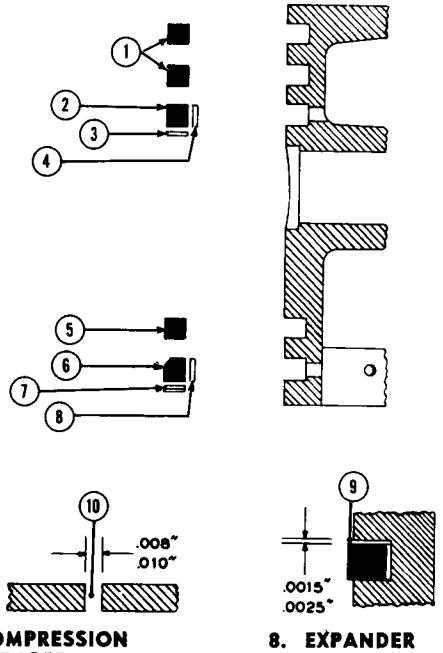
Install piston rings by hand (Fig. C-39). Five rings are used in each piston and they must be installed in their proper location. These rings are easily identified by their shaft so that the compression rings and oil scraper rings may be installed with the proper side uppermost. Ventilated oil rings are installed with either side uppermost. The loca-

tion and correct positioning of all piston rings as shown in Fig. C-40 is very important. Stagger the position of the ring gaps.



1. PISTON RING 2. PISTON

Figure C-39. Installing Piston Rings



1. COMPRESSION
2. SCRAPER
3. SEGMENT
4. EXPANDER
5. COMPRESSION
6. OIL
7. SPIRO-SEAL
8. EXPANDER
9. CORRECT GROOVE CLEARANCE — COMPRESSION RING
10. CORRECT GAP CLEARANCE WITH RING IN CYLINDER

Figure C-40. Piston Ring Positions

Before installing pistons and connecting rods, thoroughly lubricate pistons, piston rings, wrist pin bearings, and connecting rod bearings with clean engine oil.

Turn crankshaft until No. 1 crankshaft journal is down. Remove bearing cap from No. 1 connecting rod leaving connecting rod bolts in the rod. Connecting rods face the same side of the compressor as when disassembled.

Insert No. 1 connecting rod and piston through top of No. 1 cylinder making sure the connecting rod bearing engages the connecting rod journal in the same position as that in which it was fitted.

Position and attach lower bearing cap to connecting rod and install two slotted nuts and cotter pins.

Install other piston and connecting rod in the same manner.

ASSEMBLING AND INSTALLING CYLINDER HEAD: If the unloading valve bushings have been removed, press new bushings into place, from the bottom of the cylinder head. Heat the head to at least 300° F. before installing new bushings.

Insert each unloading valve into cylinder head body from bottom side and grind into place by using grinding compound (grade 1000). Install unloading valve spring over each unloading valve and place unloading valve stop over each spring. Then compress each unloading valve spring by hand until spring retaining ring can be inserted over stop (Fig. C-35).

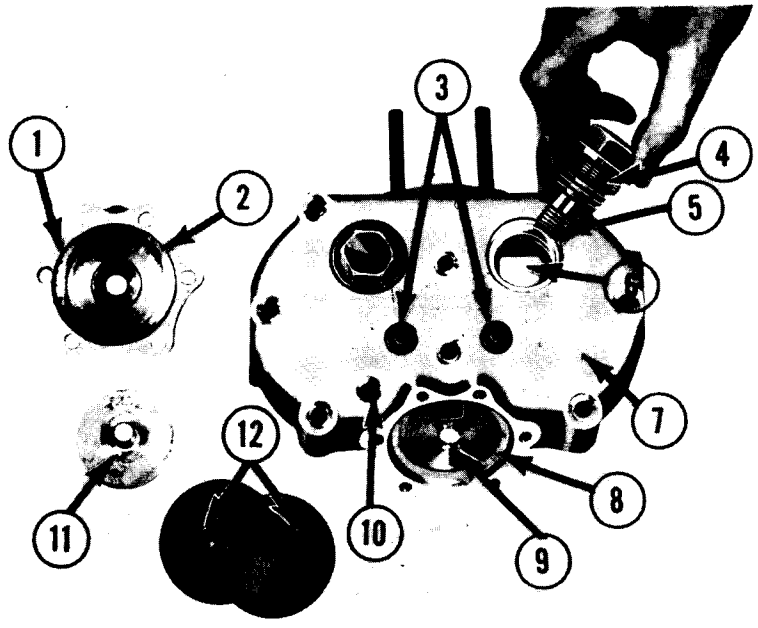
Position each discharge valve on its seat through the opening in the top of the cylinder head as illustrated in Fig. C-41. Then position discharge valve spring and discharge valve cap nut by inserting them into cylinder head body over discharge valve. Tighten each discharge valve nut cap.

Position two unloading diaphragms in unloading diaphragm cavity in top of cylinder head body after lubricating the diaphragms with a thin coating of light engine oil. Place diaphragm follower in position on diaphragms with post upward. Place unloading box cover in position over diaphragm follower post. Attach unloading box cover to cylinder head body with machine screws and lockwashers. Tighten all machine screws gradually and evenly.

Check for leakage past the unloading diaphragms by applying 100 pounds of air pressure through the unloading diaphragm cavity port and applying soap suds all over the unloading box cover. Leakage in excess of a one inch soap bubble in three seconds is not permissible.

Install a new cylinder head gasket. Position cylinder head on cylinder block in accordance with markings made before disassembly and install and tighten nuts on cylinder head studs. Place dust cover in position on unloading box covers.

Place unloading lever spring in position on un-



1. UNLOADING BOX COVER
2. DIAPHRAGM SEAT
3. UNLOADING VALVES
4. DISCHARGE VALVE CAP NUT
5. SPRING
6. DISCHARGE VALVE
7. CYLINDER HEAD
8. DIAPHRAGM SEAT
9. UNLOADING DIAPHRAGM CAVITY
10. UNLOADING DIAPHRAGM CAVITY PORT
11. FOLLOWER
12. UNLOADING DIAPHRAGMS

Figure C-41. Positioning Discharge Valves

loading box cover and position unloading lever over spring. Insert unloading lever pin through unloading box cover and unloading lever. Install cotter pin in the ends of unloading lever pin.

Turn adjusting screws in unloading lever until clearance between the head of the adjusting screws and the end of the unloading valves is 0.010" minimum and 0.015" maximum. Tighten locknut when desired clearance is obtained. If there is too much clearance at this point, the unloading valves may not be opened sufficiently to unload the compressor. If there is no clearance, the unloading valves may be held open continuously and the compressor will not compress air.

INSPECTION OF REBUILT UNIT: Check to be sure all threaded openings to oil passages, such as may be found in the end covers or base plate, are properly plugged.

If the compressor is not to be installed immediately on a machine, plug the air connection to the unloading mechanism and the water connection to the cylinder head and cylinder block. Protect the discharge port against the entrance of dirt by fitting it with a temporary blanking cover.

Fit the ends of all crankshafts with cotter pins, nuts and keys when such parts are required and then protect against damage during handling by wrapping with friction tape or some other similar material.

The unloading lever and valve mechanism must be well lubricated with lubricating oil.

Protect the open bottom against the entrance of dirt during handling or storage by installing a temporary cover.

AIR COMPRESSOR GOVERNOR

The air compressor governor has been inserted into the air supply system to control the amount of air contained in the reservoir tank.

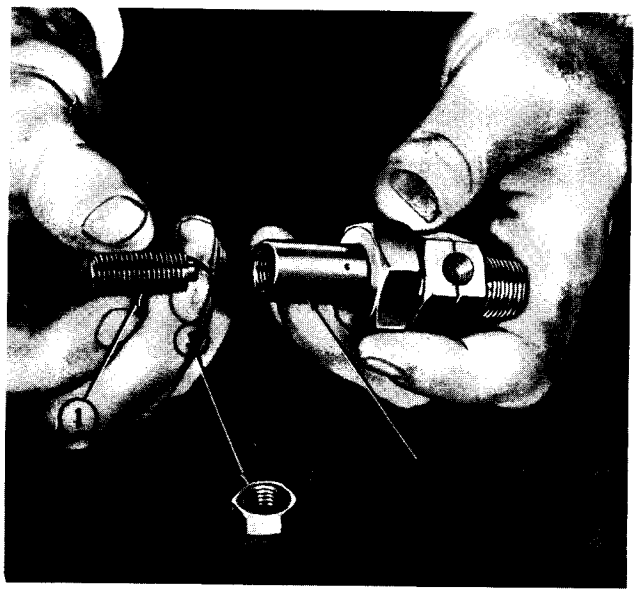
Although the compressor runs continuously during engine operation, actual compression of air takes place only at time air tank pressure falls below minimum requirements (90 lbs.). After pressure has again been built up to maximum amount (120 lbs.), the governor acting in conjunction with the compressor unloading mechanism, halts further compression of air.

Removal

Bleed the air from the air supply tank. Disconnect line at side of governor. Unscrew governor from the air filter.

Disassembly

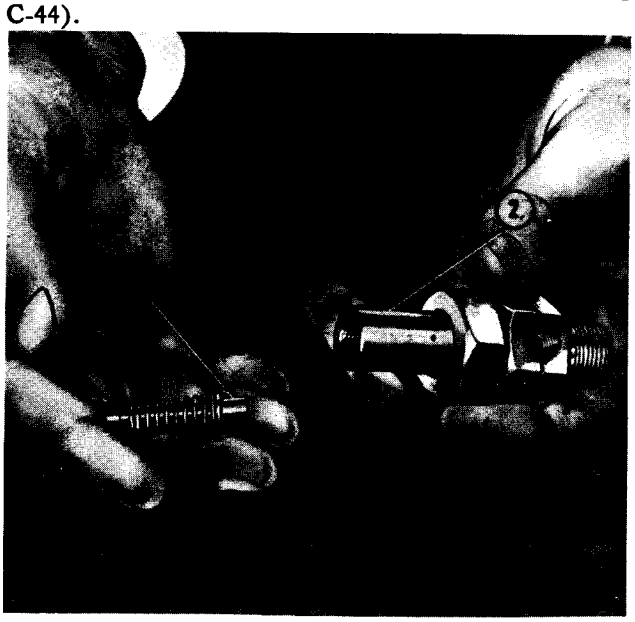
Release the nut which locks the adjusting screw in place and then back out screw from sleeve (Fig. C-42).



1. ADJUSTING SCREW 2. SLEEVE 3. LOCKNUT

Figure C-42. Removing Adjusting Screw

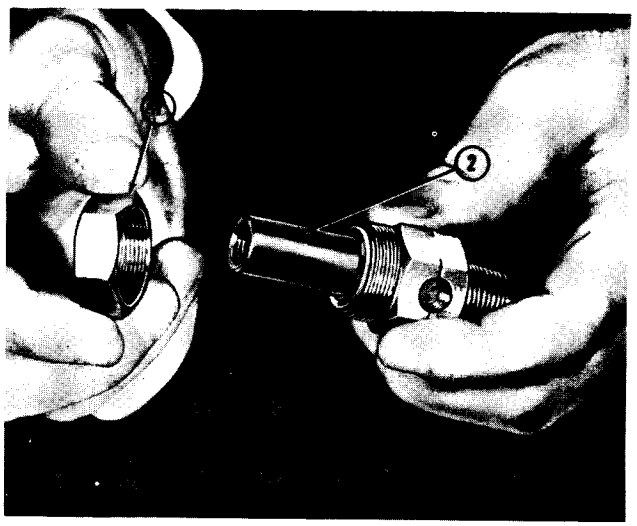
Lift spring and plunger from sleeve (Fig. C-43). Loosen the sleeve collar until it is entirely free of governor body, permitting removal of sleeve (Fig. C-44).



1. SPRING AND PLUNGER 2. SLEEVE

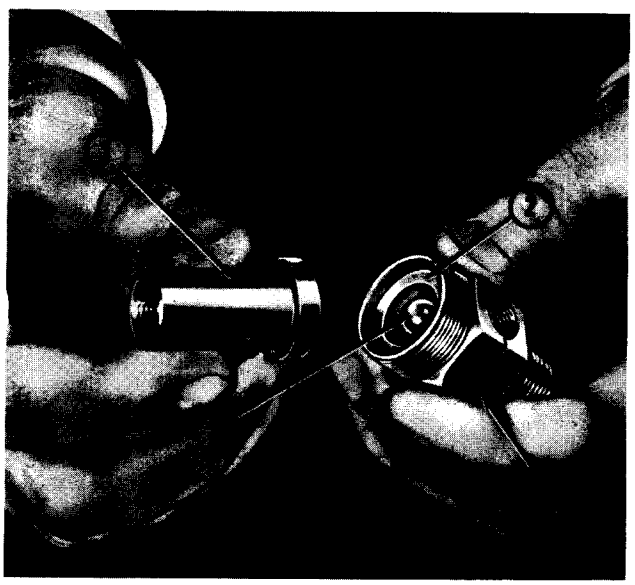
Figure C-43. Removing Spring and Plunger

The end of the sleeve is a snug fit in the governor body but can be removed by hand. Sleeve must not be pried or forced to free it of its seat. After sleeve has been removed, exposed ball check and shim may then be removed (Fig. C-45).



1. COLLAR 2. SLEEVE

Figure C-44. Removing Collar



1. SLEEVE
2. SHIM
3. BALL CHECK
4. GOVERNOR BODY

Figure C-45. Sleeve Removed

The two screens and the filter material may be removed from the end of the governor body by pushing a rod through the body from the adjusting screw end, if the governor is so equipped.

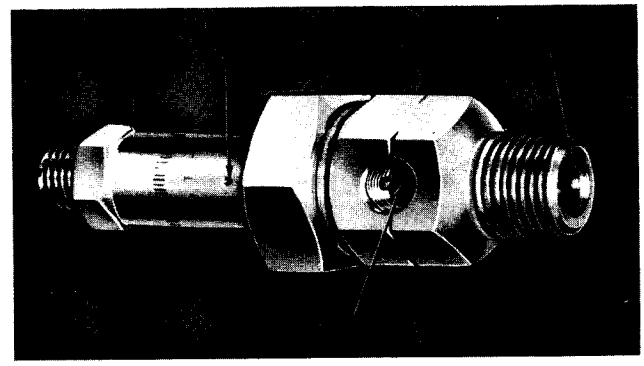
Reassembly

To reassemble the governor, reverse the procedure outlined for disassembly.

Adjustment

Re-install the governor on the machine. Do not connect the line to the compressor unloader. Operate the engine until the air pressure in the supply tank reaches 120 pounds per square inch (refer to air gauge on instrument panel). The valve should open at this point and exhaust air through the port in the side of the governor body.

If air should exhaust before the limit is reached, loosen locknut and screw in the adjusting screw. If air exhausts after the proper pressure is reached, screw the adjusting screw out, releasing some of the spring pressure against the piston. When the proper adjustment has been obtained, lock the adjusting screw into place with the lock nut.



1. EXHAUST PORT 2. INLET — FROM AIR TANK
3. OUTLET — TO COMPRESSOR UNLOADER

Figure C-46. Air Compressor Governor

AIR TANK AND SAFETY VALVE

The air supply tank is mounted in a horizontal position at the rear of the cockpit beneath the engine hood.

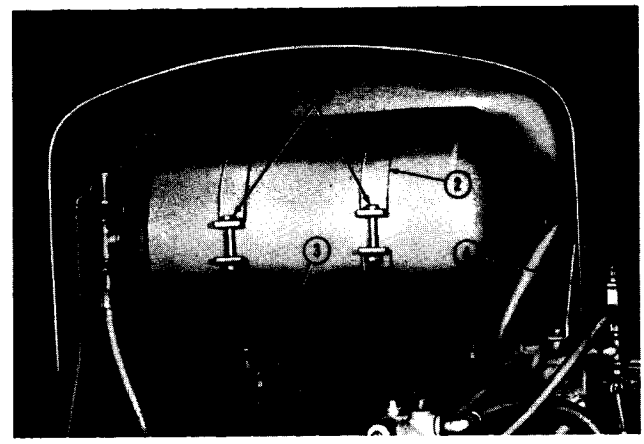
An air line filter is inserted in the air line from the air compressor to the tank. Drain the filter before each day's operation.

The bleeder valve is located at the bottom of the tank. The tank should be drained of all collected moisture as part of the daily preventive maintenance schedule.

The tank itself requires little attention because of the all welded, sheet steel construction. Care should be exercised, however, to prevent bending or breaking the inlet and outlet lines and fittings.

The safety valve is installed on the air supply tank and set to open at 150 p.s.i.

Should the air pressure in the supply tank rise to a point above the setting of the safety valve, the pressure will force the ball, against the spring, from its seat and allow the air to flow around the ball and out through the exhaust port. As soon as the pressure is reduced to the setting of the valve, the spring forces the ball back on its seat, stopping the exhaust.



1. CAPSCREWS
2. STEEL BAND
3. BLEEDER VALVE
4. GOVERNOR
5. AIR TANK
6. SAFETY VALVE
7. AIR FILTER

Figure C-47. Air Supply Tank

Air Tank Removal

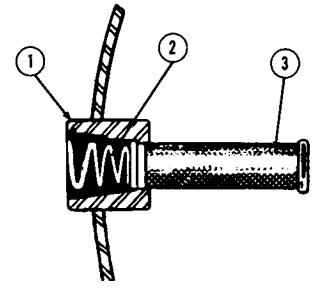
First disconnect all tubing to the air tank.

Remove capscrews holding the two ends of the steel bands together and slide the air tank from between the bands.

The bands may be removed from the firewall by removing the two capscrews securing each to the firewall.

Remove the pipe tee, nipple and bushing from end of the air tank.

Remove the spring and screen from the bore in the tank.



1. BUSHING 2. SPRING 3. SCREEN

Figure C-48. Air Tank Screen

Clean the screen in cleaning solvent and blow dry with compressed air.

The screen should be cleaned every 50 shifts, or more often if operating conditions warrant.

Safety Valve Removal and Disassembly

To remove the safety valve, unscrew the complete unit from the air supply tank. See Figure C-47.

Unscrew the spring cage from the body of the safety valve. Lift ball valve from body and remove spring, spring seat, and release pin from spring cage.

Inspection and Reassembly

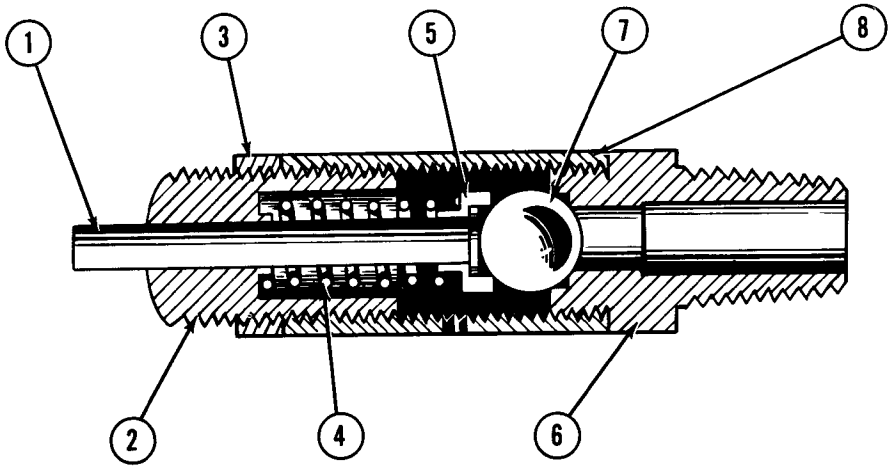
Clean all parts in cleaning solvent. Examine ball valve for signs of pitting or scratches. If the ball cannot be reconditioned, it should be replaced.

Check the body and spring cage for cracks. Be sure the exhaust port in the spring cage is not plugged.

To reassemble the safety valve, place the ball valve in the body of the safety valve.

Place spring pin and spring seat in spring cage with the adjusting screw assembly.

Position the spring seat over the ball valve and screw the spring cage to the body.



1. RELEASE PIN
2. ADJUSTING NUT
3. LOCK NUT
4. SPRING
5. SPRING SEAT
6. BODY
7. BALL
8. SPRING CAGE

Figure C-49. Safety Valve

Testing and Adjusting

The safety valve may be tested to be sure it is operative by pulling the exposed end of the valve stem. This removes the spring load from the ball and permits the valve to exhaust. If the valve does not exhaust when this is done, the ball must be stuck on its seat. The complete valve should be removed and dismantled for cleaning.

Leakage at the exhaust port should not exceed a three inch soap bubble in three seconds with the air system fully loaded.

The safety valve should be set to exhaust at approximately 150 p.s.i. The pressure setting may be adjusted by loosening the lock nut and turning the adjusting screw.

Turning the adjusting screw clockwise raises the pressure setting. Turning the adjusting screw counterclockwise lowers the pressure setting. The setting of the adjusting screw should be locked by tightening the adjusting screw lock nut after each adjustment. An accurate test gauge should be used when adjusting pressure setting of safety valve.

STEERING LEVERS

The steering levers are mounted to the underside of the instrument panel housing. The levers operate the air valves which control the air supply to the steering clutches.

When the left steering lever is pulled back it actuates an air valve that stops the flow of air to the left steering clutch and at the same time exhausts the air pressure present in the steering clutch.

This removes all driving force from the left side. When the steering lever is released a spring forces the valve open allowing air pressure to again go to the steering clutch.

The same process is repeated on the right side when the right steering lever is pulled to the rear.

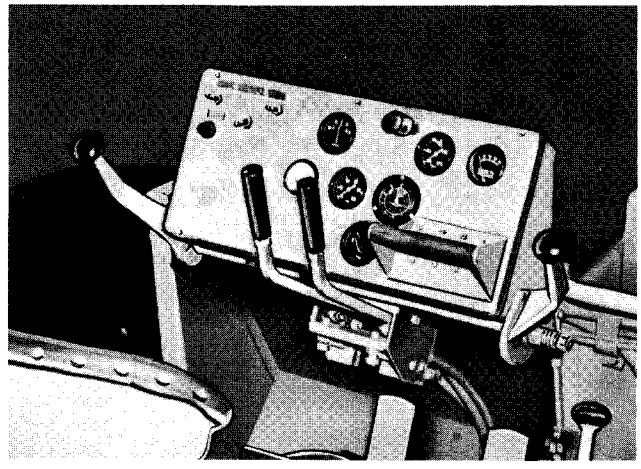
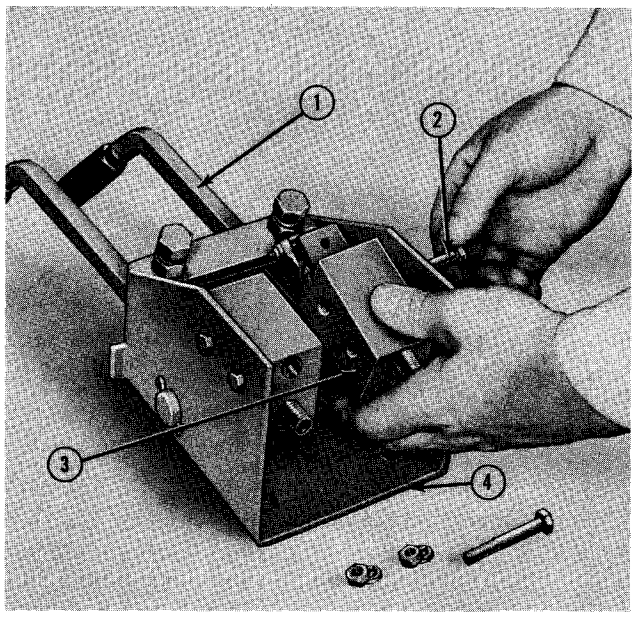


Figure C-50. Steering Levers

Removal and Disassembly

Bleed the air system and disconnect the air lines to the air valves. Mark air lines and fittings to facilitate reassembly.

Remove the capscrews and lockwashers securing the steering lever assembly to the cockpit.

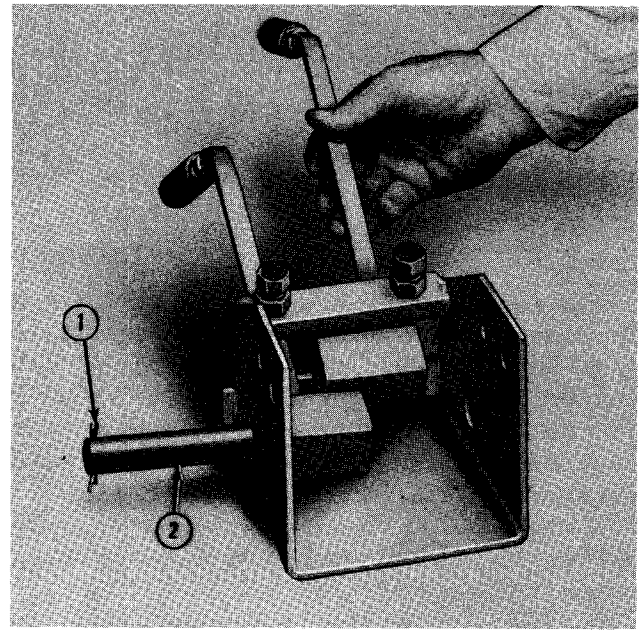


1. STEERING LEVER
2. CAPSCREW
3. VALVE
4. BRACKET

Figure C-51. Removing Air Valve

Remove the two nuts and lockwashers from the capscrews securing each valve to the brackets. Remove capscrews and valves (Fig. C-51).

Remove cotter from one end of the lever pivot pin and pull pivot pin from levers and bracket. Remove levers (Fig. C-52).



1. COTTER
2. PIVOT PIN

Figure C-52. Removing Lever

Reassembly

Place levers in bracket, insert pivot pin and secure with cotter.

Secure air valves, with roller to the front and against the steering lever, to side of bracket with

capscrews, lockwashers, and nuts.

Fasten assembly to under side of instrument panel housing with capscrews and lockwashers.

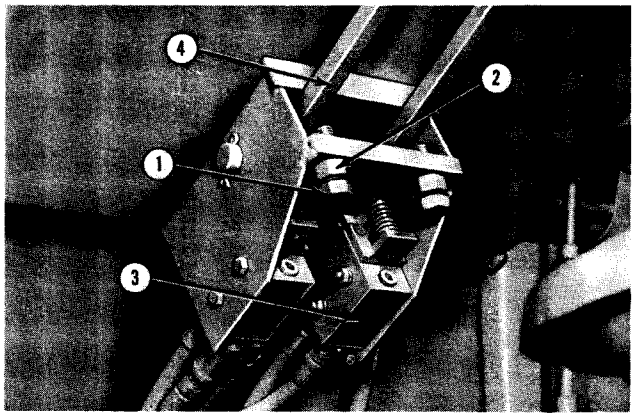
Loosen jam nuts and back out adjusting screws. Pull back on steering lever lightly until valve arm bottoms.

Turn adjusting screw until it moves the steering lever up slightly. Tighten jam nuts. Repeat the same process for the other steering lever.

Re-connect air lines to valves. Make sure air tank bleeder valve is closed. Re-charge air system before moving machine.

Coat connections with soap suds and check for air leaks.

Lubricate steering lever pivot pin at regular intervals to prevent rust. Use light weight engine oil.



1. ADJUSTING SCREWS
2. JAM NUT
3. VALVE
4. STEERING LEVER

Figure C-53. Steering Lever Adjustment

AIR PRESSURE GAUGE

The air pressure gauge is mounted on the instrument panel and indicates the pressure in pounds per square inch of compressed air in the storage tank.

Should the gauge become inoperative and checks of the air supply system indicate that the gauge is faulty, remove the unit by removing the two mounting bolts from the back of the instrument panel and replace with a new unit.

STEERING WHEEL ASSEMBLY

To steer the Tournatractor equipped with steering wheel, turn the wheel in the direction of turn desired. The further the steering wheel is turned the sharper the turn obtained.

When turning the Tournatractor in either direction, the following action takes place:

The actuator arm which is fastened to the lower part of the steering post, makes contact with a forked cam. This cam, being pinned to the air valve mounting plate structure, pivots against one of the two air metering valves forcing in the plunger. (The direction of turn determines which of these two valve plungers is depressed.) As the metering valve opens, air flows through it to the two wheel brakes on the side of the machine toward the direction of turn.

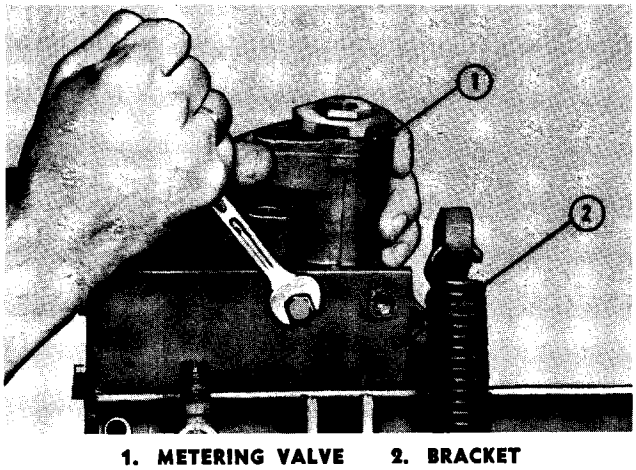
At the same time, the steering clutch valve located at the extreme end of the steering post, is operated by the action of the turning steering wheel. Air is bled from the steering clutch driving the two wheels on the side of the machine toward the direction of turn.

Removal and Disassembly

From valve end of the steering post, disconnect the hoses from air brake metering valve and steering clutch air valve assembly. Now remove the steering wheel by prying hole plug from center of wheel and backing nut from steering shaft structure. To remove the wheel, first jar it free of the Woodruff key on the shaft and then pull it straight up.

Remove the two capscrews from the steering post mounting bracket at the bottom of the instrument panel and remove the clamp. Remove the capscrews from the mounting plate in cockpit floor and then pull steering assembly down through cockpit floor until it has cleared machine.

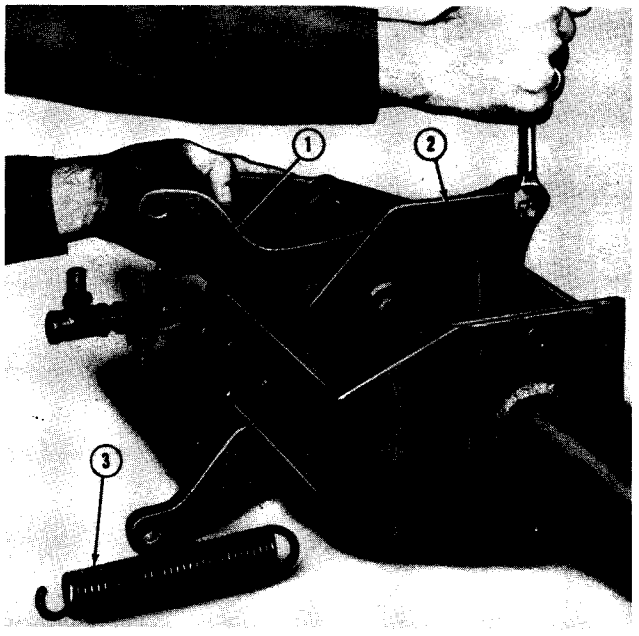
Turn bottom side of steering assembly up and remove the two air brake metering valves from the mounting brackets (Fig. C-54).



1. METERING VALVE
2. BRACKET

Figure C-54. Removing Air Brake Metering Valve

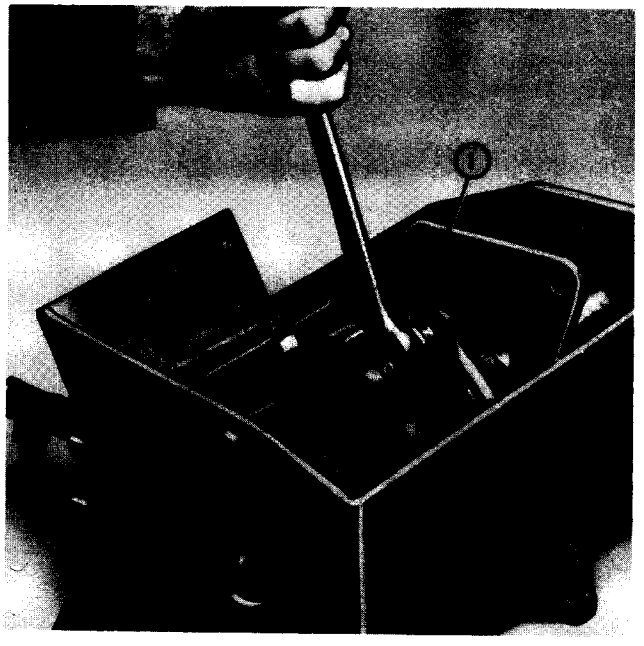
Release the large spring from the cam arms and then remove nuts and shoulder bolts fastening arms to mounting bracket (Fig. C-55).



1. CAM ARM 2. MOUNTING BRACKET
3. CAM SPRING

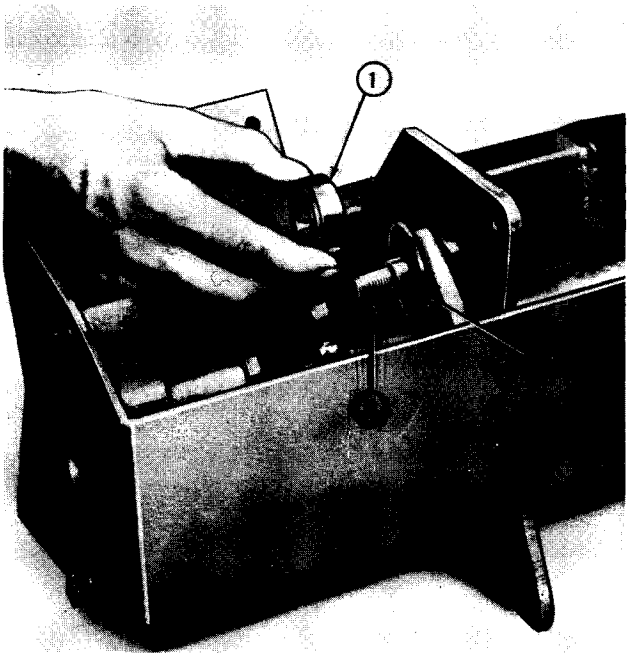
Figure C-55. Removing Cam Arm

Remove the centering cam actuator by first removing cotter from castellated nut, and then back off nut (Fig. C-56). Remove the large washers and the bearing and withdraw shoulder bolt from mounting bracket (Fig. C-57).



1. ACTUATOR ASSEMBLY

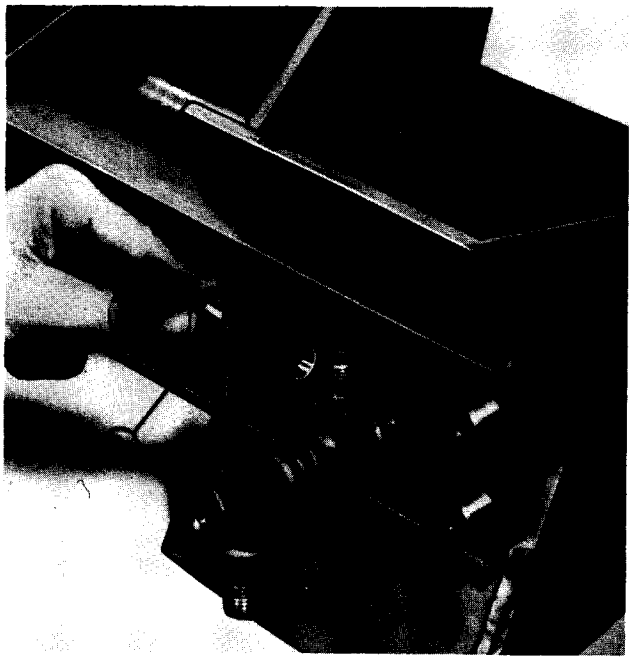
Figure C-56. Removing Actuator



1. BEARING 2. WASHER 3. BOLT

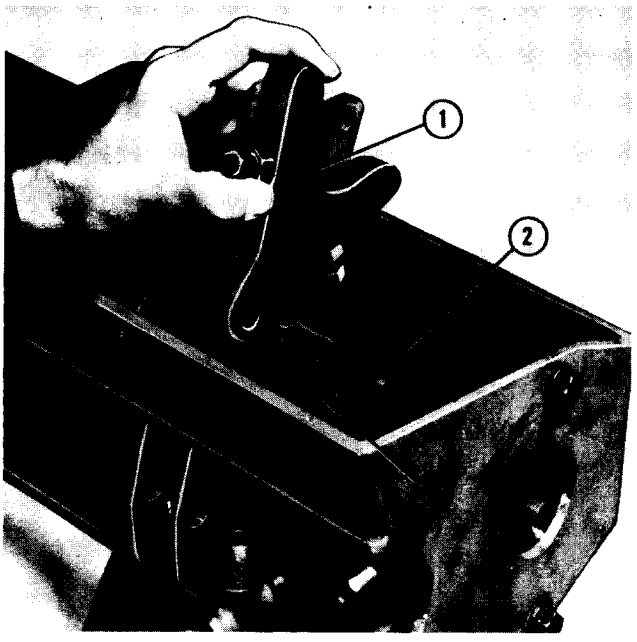
Figure C-57. Removing Shoulder Bolt and Bearing

From bottom side of steering assembly, remove cotter and pin securing air brake valve cam to steering assembly structure (Fig. C-58). To remove cam from inside structure, it will first be necessary to pull steering wheel shaft structure from assembly until sufficient clearance has been obtained between end of shaft structure and valve shaft to permit withdrawal of the cam. (Fig. C-59).



1. CAM PIN

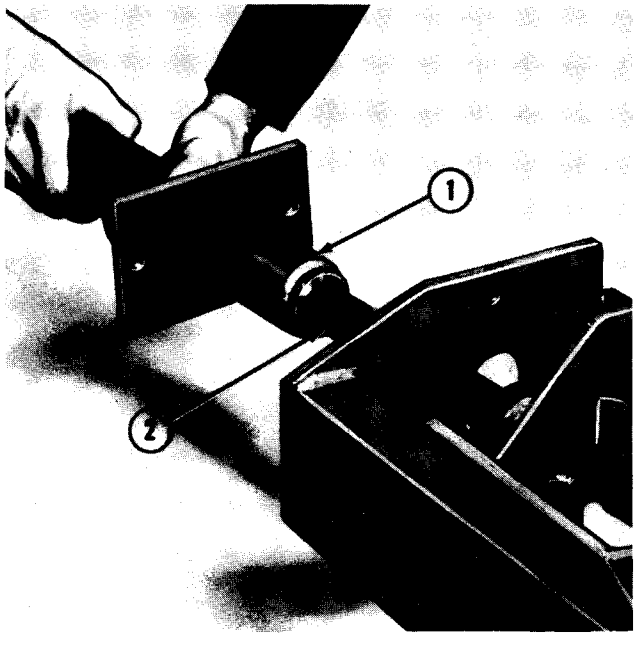
Figure C-58. Removing Cam Pin



1. CAM 2. VALVE SHAFT 3. SHAFT STRUCTURE

Figure C-59. Removing Cam

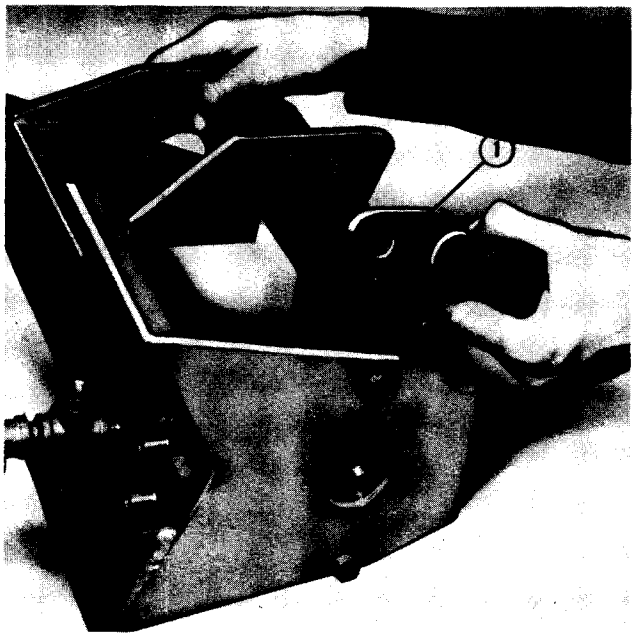
Slide steering post structure from shaft (Fig. C-60). Grasping the actuator end of the shaft, pull towards valve and then slant shaft up and sideways until valve can be cleared, permitting the complete removal of the shaft. (Fig. C-61).



1. STEERING POST STRUCTURE 2. SHAFT

Figure C-60. Removing Steering Post Structure

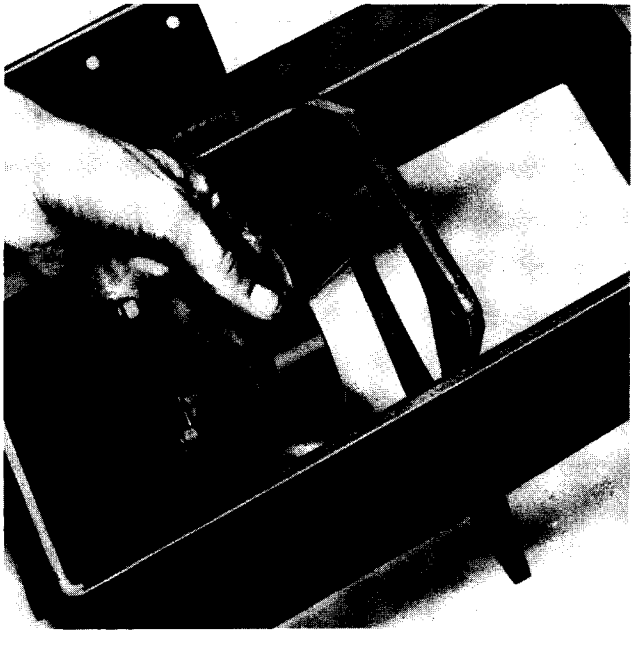
Slide coupling sleeve from valve shaft (Fig. C-62). Unscrew the short lengths of pipe from the inlet and outlet ports of the valve.



1. SHAFT STRUCTURE

Figure C-61. Removing Shaft Structure

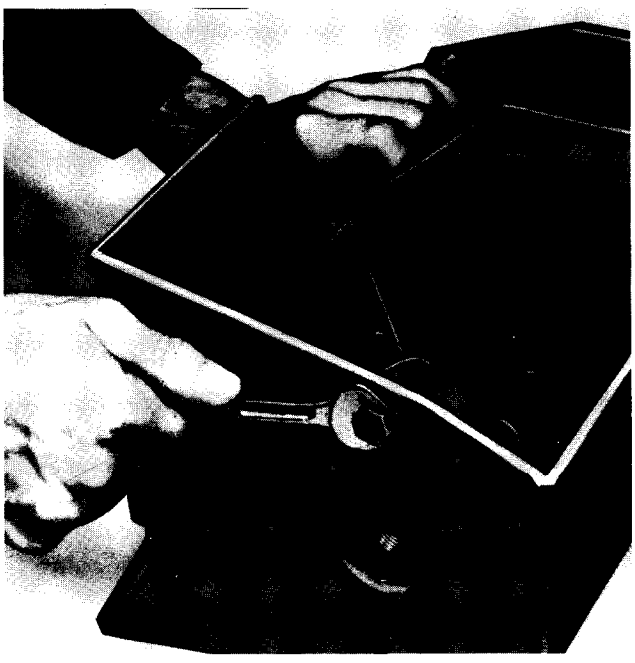
Remove the four capscrews securing the housing structure and base together and separate the two (Fig. C-64). Push valve shaft up and out of housing structure (Fig. C-65).



1. COUPLING SLEEVE

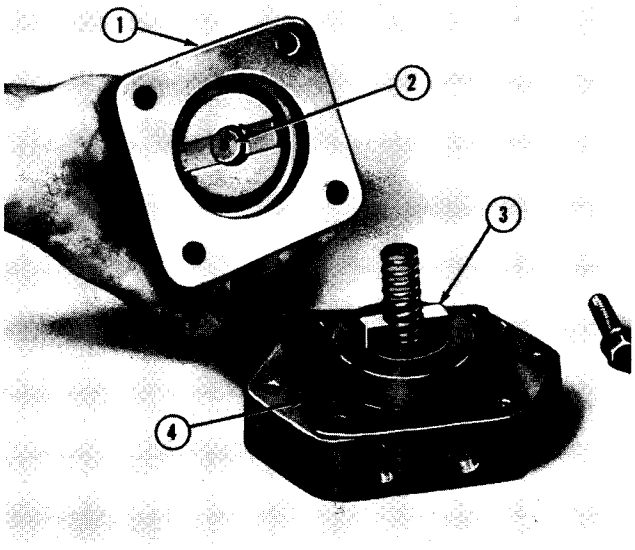
Figure C-62. Removing Coupling Sleeve

From bottom of steering assembly, remove the two capscrews securing valve to mounting bracket (Fig. C-63). Remove valve and proceed to disassemble as follows:



1. VALVE

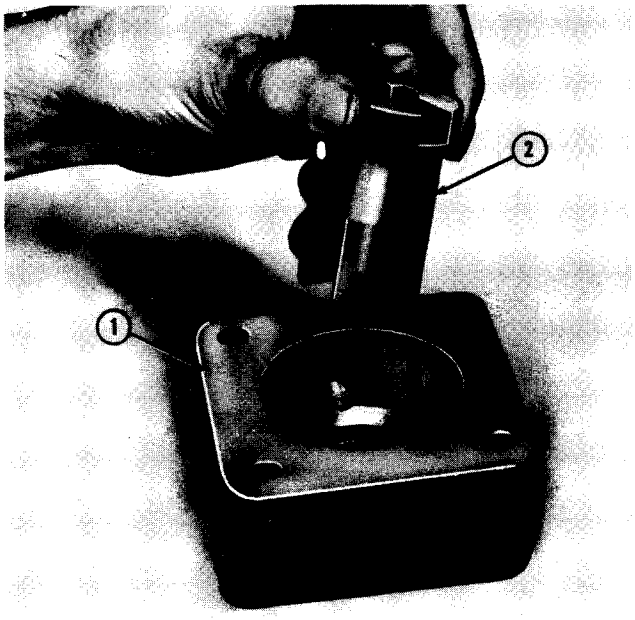
Figure C-63. Removing Valve



1. HOUSING
2. SHAFT
3. ROTATING DISC
4. GASKET

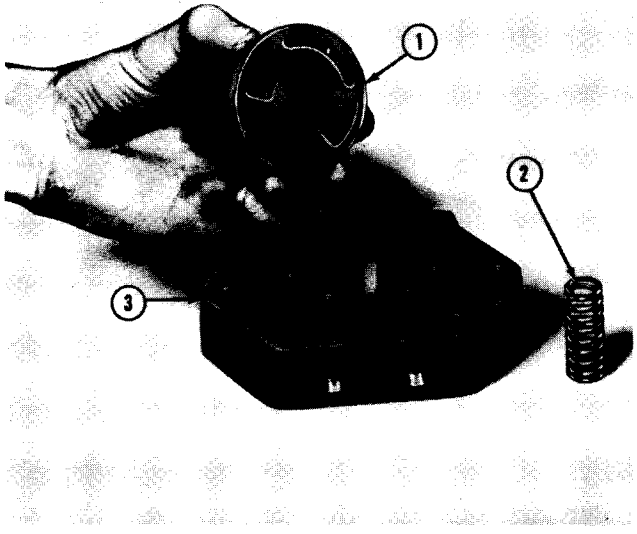
Figure C-64. Housing and Base Separated

From the base of air valve, lift spring, rotating disc, and gasket (Fig. C-66). Should difficulty be encountered in separating disc from the base, do not use screwdriver or similar tools to pry disc free. Merely slide the rotating disc to one side until free of valve base facing.



1. HOUSING 2. SHAFT

Figure C-65. Removing Shaft from Housing



1. ROTATING DISC 2. SPRING 3. BASE

Figure C-66. Removing Rotating Disc

Reassembly

To reassemble the steering and air valve assemblies, reverse the procedure outlined for disassembly.

Inspect the gasket between the base and the housing structure for wear or damage and replace if necessary.

Absolute cleanliness is essential for proper valve

function.

Powdered graphite must be sprinkled between the facings of the base and rotating disc and also between seating surface of shaft in the housing structure and shoulder of the shaft.

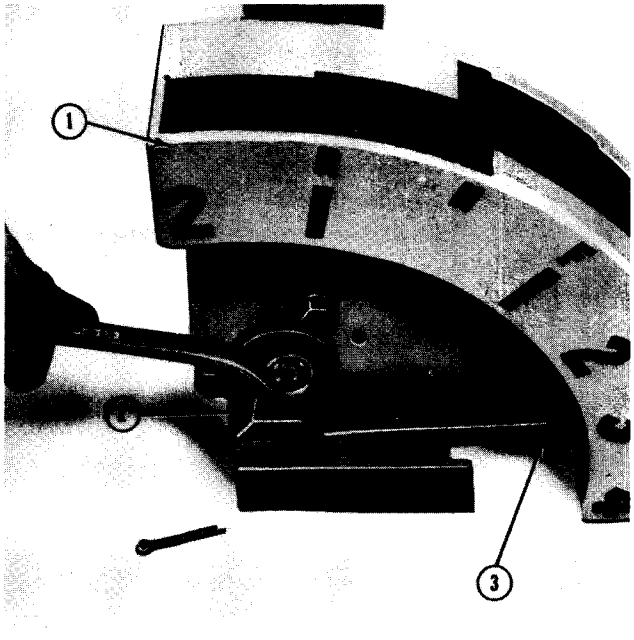
SHIFTING QUADRANT

The air shift quadrant, located to the right of the operator's seat provides instant gear ratio changes with a minimum of effort.

To shift into speed desired from the neutral position, first move selector handle out from "stop" and then into either the forward or reverse speed notch. As handle is moved into position desired, air is automatically metered to the air operated transmission clutches necessary to obtain this speed.

Removal and Disassembly

Remove the cotter and nut from the lever pivot bolt which secures lever to the end of the shaft structure and then withdraw the capscrew (Fig. C-67). As the plunger reactor structure is released this will permit removal of the lever plunger and spring (Fig. C-68).



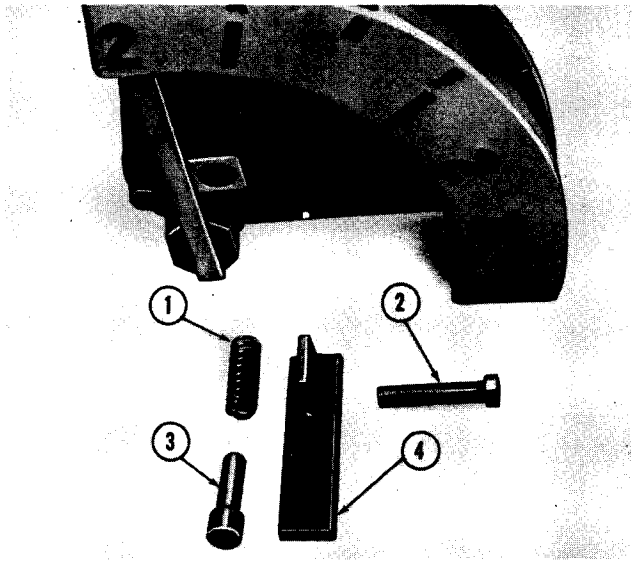
1. QUADRANT 2. SHAFT 3. LEVER

Figure C-67. Removing Cotter and Nut

Raise lever straight up until it is free of the shaft and quadrant.

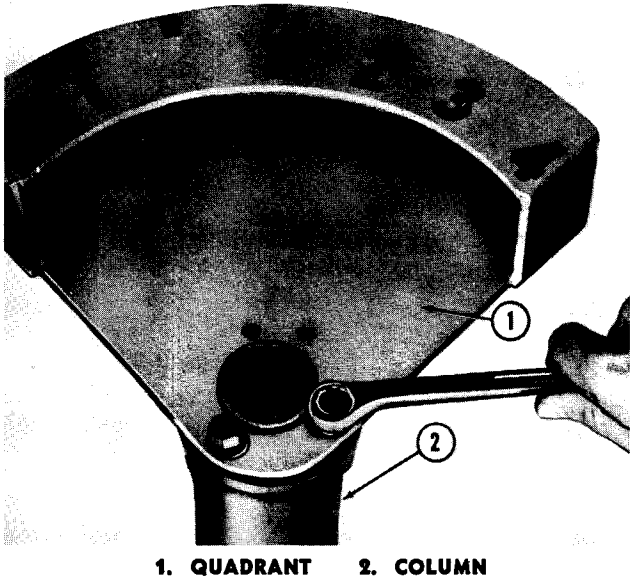
Remove the three capscrews securing quadrant to column and separate the two (Fig. C-69). Remove the bushing from end of column (Fig. C-70).

From opposite end of column structure, disconnect air hoses from the transmission clutches. Back out the four capscrews securing the column support to the side wall of the cockpit. From inside cockpit, remove the column structure backing plate capscrews and then withdraw selector valve assembly and column down through cockpit until clear of ma-



1. SPRING
2. CAPSCREW
3. LEVER PLUNGER
4. PLUNGER REACTOR

Figure C-68. Plunger Reactor Removed

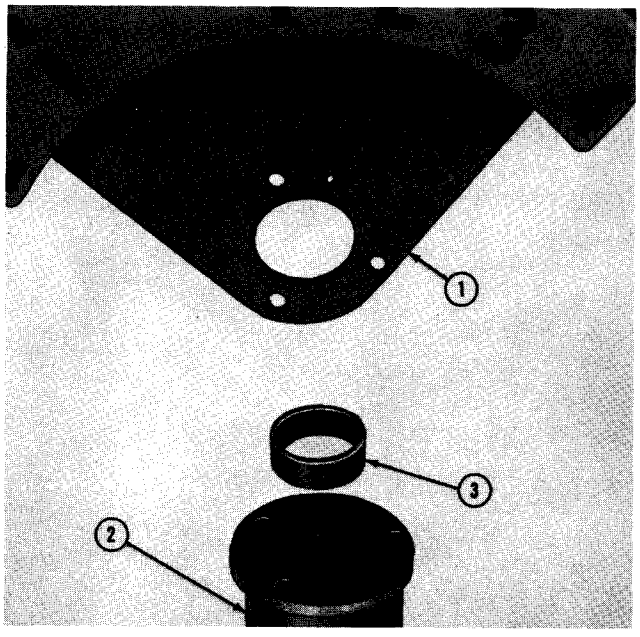


1. QUADRANT 2. COLUMN

Figure C-69. Separating Quadrant and Column

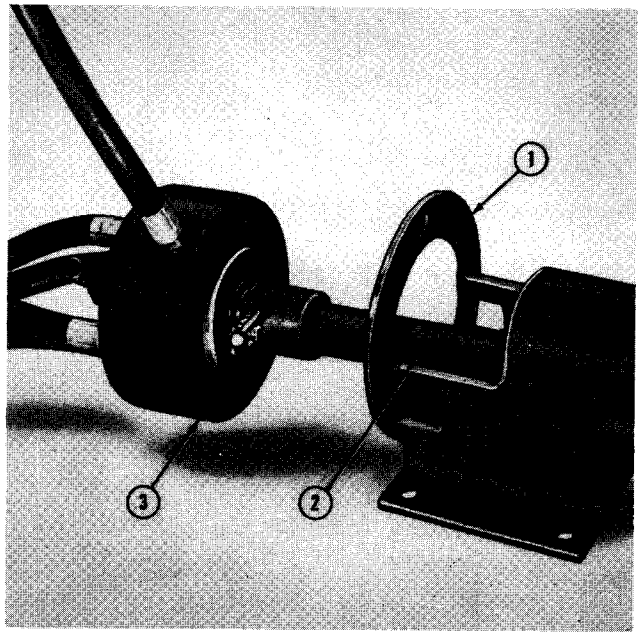
chine.

Remove the three long capscrews, bolts, and lockwashers securing the selector valve to the mounting ring at the base of column. Withdraw valve and shaft from column (Fig. C-71).



1. QUADRANT 2. COLUMN 3. BUSHING

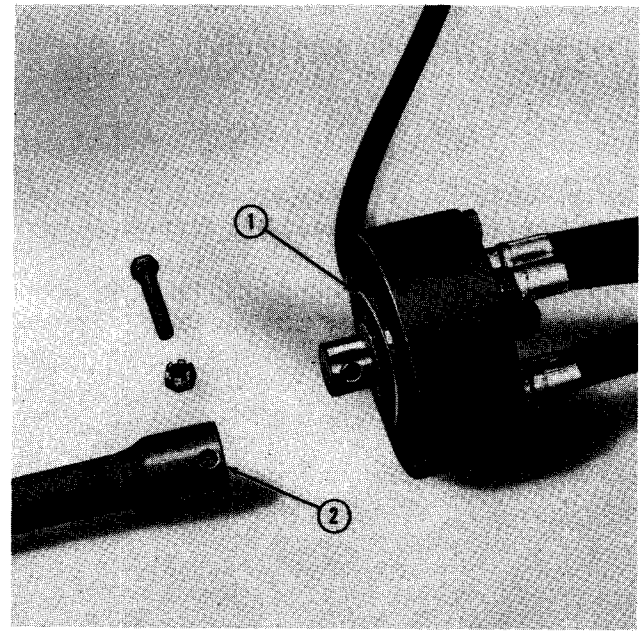
Figure C-70. Bushing Removed.



1. MOUNTING RING 2. VALVE SHAFT
3. SELECTOR VALVE

Figure C-71. Separating Valve and Shaft from Column

Drive cotter from bolt which secures shaft to the selector valve hub and then back off nut. Remove bolt and separate the shaft and valve (Fig. C-72).

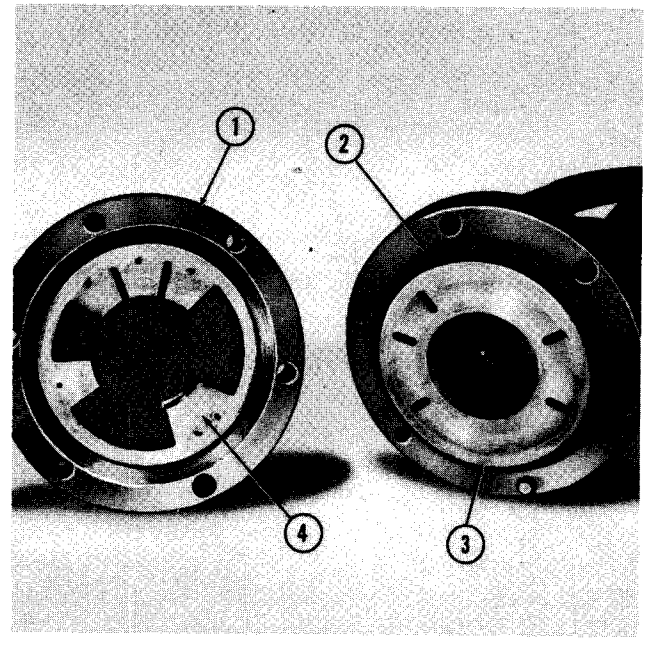


1. HUB 2. SHAFT

Figure C-72. Shaft and Valve Separated

Remove the remaining three capscrews which secure the front and back plates of the valve together and separate the two (Fig. C-73). As these plates are separated care must be taken to prevent marring the valve facings. Excessive contact with the hands on facings should be avoided as much as possible. Remove the "O" ring from around facing of back plate.

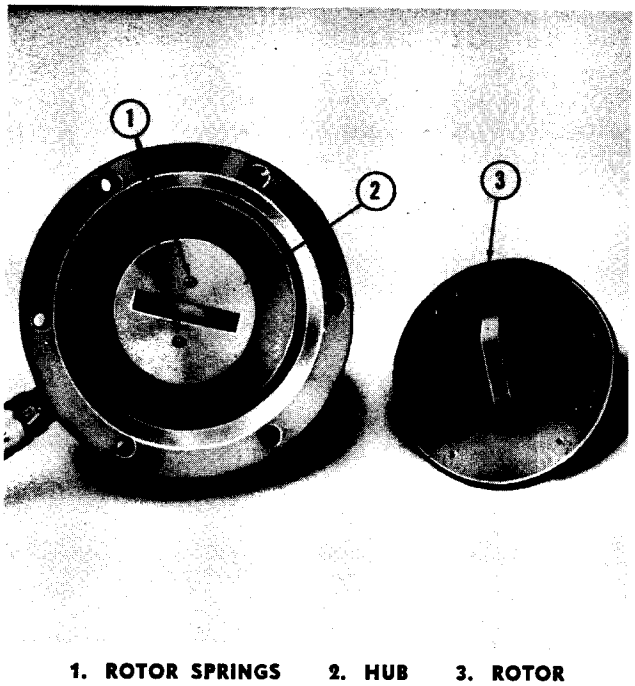
Lift the rotor from front plate using extreme care as the two small springs located in recesses of the



1. FRONT PLATE 3. BACK PLATE
2. "O" RING 4. ROTOR

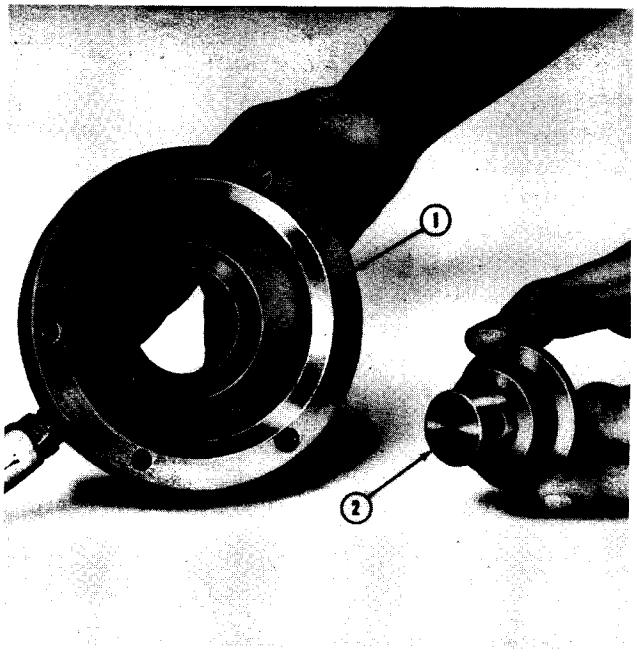
Figure C-73. Front and Rear Plates, Separated

hub may fly out (Fig. C-74). Remove the springs and then lift hub from front plate (Fig. C-75).



1. ROTOR SPRINGS 2. HUB 3. ROTOR

Figure C-74. Rotor Springs



1. FRONT PLATE 2. HUB

Figure C-75. Hub Removed from Front Plate

Reassembly

To reassemble the selector valve assembly, reverse the procedure outlined for disassembly.

Before proceeding with the reassembly of the valve, apply a coating of grease to all parts. Stanolith #42 or equivalent is recommended.

As front plate, hub, and rotor are reassembled, it will be noted that there are positioning marks on each of the parts. These marks must line up with each other with shifting quadrant in the neutral position.

Replace "O" ring on the back plate first making sure ring is not damaged.

Secure the front and back plates together with the three shorter capscrews. Place shaft structure end over the hub and align the bolt holes. Replace bolts, nut and tighten. Align castellations of nut with cotter hole in bolt and insert cotter, locking into place.

Slide shaft structure up into the column structure and secure the valve assembly to the mounting ring by inserting the three long capscrews through valve and ring. Replace lockwashers and nuts and tighten securely.

Insert quadrant end of column up through hole in the cockpit and bolt into place.

At the quadrant end of the column structure, place bushing into end of column until it bottoms on ridge inside column. Position quadrant over bushing and against column. Be certain aligning plug and hole are mating. Secure into place with the capscrews and lockwashers.

Slide shifting lever down between the two halves of the quadrant and into forked end of the shaft. Place spring and plunger into shifting lever block. Position plunger reactor structure against plunger and force in until bolt can be inserted through reactor, shaft, and shifting lever. Fasten into place with nut and lockwasher.

QUICK RELEASE VALVE

The purpose of the quick release valve is to reduce the time required to release the brakes by hastening the exhaust of air pressure from the brake chambers.

The valve consists of a body containing a spring loaded diaphragm so arranged as to permit air pressure to flow through the valve in one direction but when the supply pressure is reduced, the air which has passed through the valve is permitted to escape through the exhaust port.

The quick release valve assumes three positions during normal operation. These three positions are the applying position, when air pressure is passing through the valve into the brake; the holding posi-

tion, when pressure is being held in the brake; and the releasing position, when the brake is being exhausted.

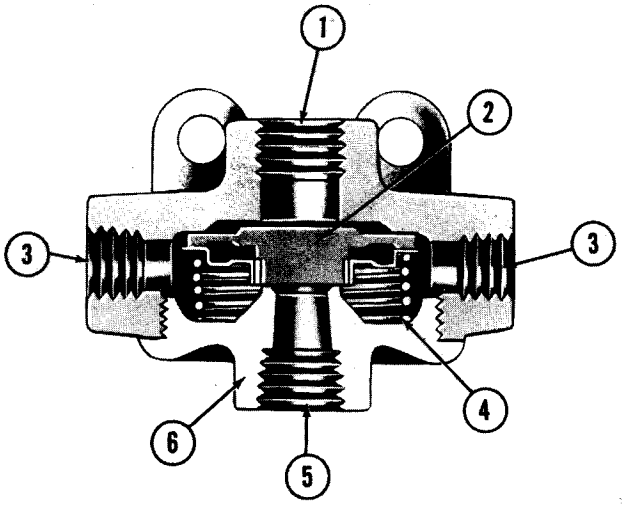
When air pressure from the brake valve enters the top connection of the valve, the diaphragm moves down and closes the exhaust port. Air pressure then deflects the outer edges of the diaphragm downward and flows out the side connections to the brakes.

As soon as the brake chamber pressure below the diaphragm equals the brake valve pressure above the diaphragm, the force of the spring below the diaphragm forces the outer edge of the diaphragm back up against the body, although the center of the diaphragm keeps the exhaust port closed. This is the holding position.

If the brake valve pressure on top of the diaphragm is released, the brake chamber pressure below the center of the diaphragm raises it then opens the exhaust port and permits the brake air pressure to be released through the exhaust port.

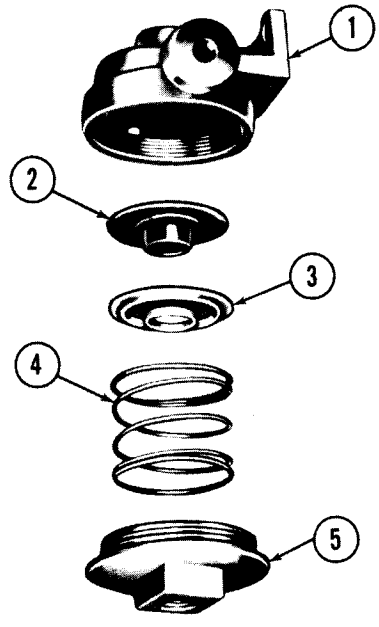
If the brake valve pressure on top of the diaphragm is only partially released, the diaphragm assumes its holding position as soon as the pressures above and below it are equalized.

In this manner the quick release valve reacts to pass any increased brake valve pressure through it to the brakes, or quickly releases the brake air pressure when the brake valve pressure is reduced and thus maintains the same pressure in the brakes as the brake valve is delivering.



1. INLET PORT
2. DIAPHRAGM
3. OUTLET
4. SPRING
5. EXHAUST
6. COVER

Figure C-76. Sectional View of Quick Release Valve



1. BODY
2. DIAPHRAGM
3. SPRING SEAT
4. SPRING
5. COVER

Figure C-77. Quick Release Valve, Exploded

Removal and Disassembly

The Tournatractor is equipped with two quick release valves, one for the wheel brakes on each side of the machine.

The valves are mounted to the cockpit side panels under the deck, one on each side. Each valve is held in place by two capscrews.

Disconnect the tubing, remove the two capscrews and remove the valve from the machine.

Unscrew the cover, lift out diaphragm spring, diaphragm spring seat and diaphragm.

Service

Remove all dirt and grease from exterior of valve using cleaning solvent and a brush.

Inspect exterior of valve for broken or damaged parts. All broken or damaged parts must be replaced.

Examine all metal parts and wash in cleaning solvent.

Examine diaphragm for signs of cracking, wear or damage. Carefully examine the lower face of the diaphragm which contact the exhaust port seat in the cover for signs of pitting or grooving. Replace diaphragm if any of these conditions are found.

Reassembly

To reassemble the quick release valve, reverse the procedure outlined for disassembly.

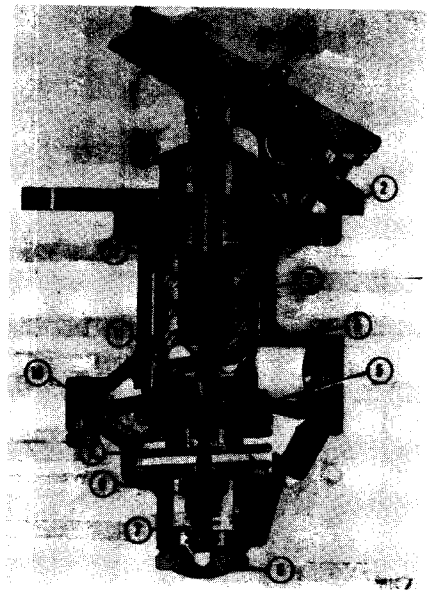
Install valve on machine, reconnect air lines.

With brake applied, coat the exhaust port with soap suds to detect leakage. Leakage in excess of a one inch soap bubble in one second is not permissible.

AIR BRAKE APPLICATION VALVE

The air brake application operates as follows: As the actuating treadle is pushed downward, the push rod moves downward carrying with it the piston, thereby seating the metering piston assembly on the exhaust valve insert and closing the exhaust to the atmosphere.

As further movement takes place, the valve stem moves downward, unseats the inlet valve insert and allows air pressure to enter the application side of the brake system through the port. When the desired braking has been accomplished and the movement of the foot pedal is stopped, balance occurs in the valve mechanism. That is, the applied air pressure below the metering piston assembly forces the assembly upward, compresses the metering spring and allows the intake valve to close. Thus, both inlet and exhaust valves are closed and applied air pressure is held constant until further application or release of the foot pedal.



1. TREADLE
2. METERING SPRING
3. PLUNGER
4. PISTON
5. DIAPHRAGM
6. CAP VALVE
7. RETURN SPRING
8. VALVE INLET
9. LOWER VALVE BODY
10. DIAPHRAGM RETURN SPRING
11. EXHAUST VALVE
12. UPPER VALVE BODY
13. PUSH ROD

Figure C-78. Application Valve

Disassembly

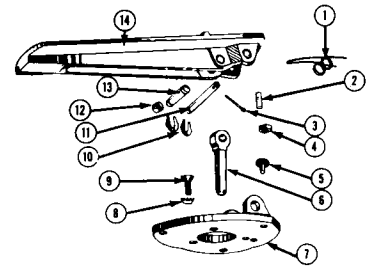
To disassemble the application valve, it is necessary to remove it from the cockpit. Since location of ports varies with different valves, it is advisable to punch mating marks on flanges of upper and lower valve bodies for assembly in the proper position.

After the assembly has been removed from the cockpit, remove the "C" washer and fulcrum pin, treadle, and treadle return spring. Lift off treadle with push rod attached. Remove "C" washer, hinge pin, bushing, push rod and bolt. Three capscrews and lockwashers attaching valve body to mounting plate are to be removed before body can be separated from the plate. Extreme care should be used in removing the actuating treadle.

Remove the valve cap, cap gasket, and valve return spring so that inlet valve assembly will have side play, thereby preventing binding of the valve

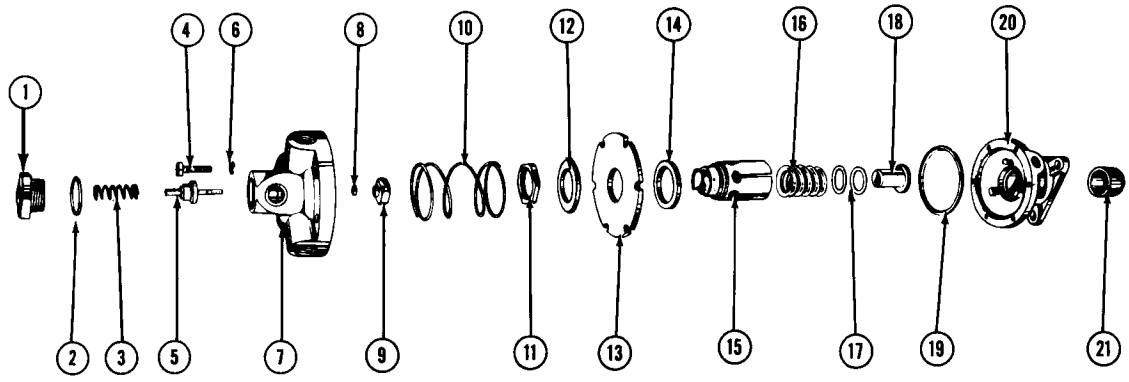
stem when separating the upper and lower valve bodies. To separate the upper valve body from the lower valve body, remove the six attaching capscrews and lockwashers.

The diaphragm outer support ring, diaphragm and piston will slide out of the upper valve body. The metering spring, adjusting washers and plunger can be removed from the piston. Remove the diaphragm return spring from the lower valve body. Insert a suitable drift through the exhaust holes in the piston and unscrew diaphragm retainer nut. Remove diaphragm lower washer, diaphragm, and diaphragm upper washer from the piston. To remove the exhaust valve and the inlet valve, loosen the locknut holding the exhaust valve to the inlet valve and unscrew the exhaust valve from the stem.



1. TREADLE RETURN SPRING
2. ADJUSTING SCREW
3. COTTER
4. JAM NUT
5. ADJUSTING SCREW STOP
6. PUSH ROD
7. MOUNTING BRACKET
8. LOCKWASHER
9. CAPSCREW
10. "C" WASHER
11. FULCRUM PIN
12. PIN BUSHING
13. HINGE PIN
14. ACTUATING TREADLE

Figure C-79. Actuating Treadle, Exploded



1. VALVE CAP
2. GASKET
3. INLET VALVE RETURN SPRING
4. CAPSCREW
5. INLET VALVE
6. LOCKWASHER
7. VALVE BODY (LOWER)
8. LOCKNUT
9. EXHAUST VALVE
10. DIAPHRAGM RETURN SPRING
11. DIAPHRAGM RETAINER NUT
12. DIAPHRAGM WASHER (LOWER)
13. DIAPHRAGM
14. DIAPHRAGM WASHER (UPPER)
15. PISTON
16. METERING SPRING
17. ADJUSTING WASHER
18. PLUNGER
19. DIAPHRAGM SUPPORT RING
20. VALVE BODY (UPPER)
21. BOOT

Figure C-80. Application Valve, Exploded

Adjusting and Testing

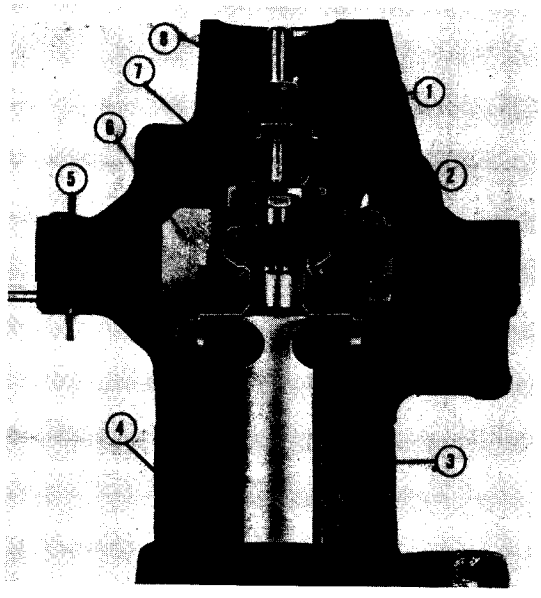
Adjustment is necessary whenever the exhaust valve locknut is loosened. A clearance of .060" to .070" is necessary between the exhaust valve and the exhaust valve seat when the valve is in released position.

To make the adjustment refer to cutaway illustration and proceed as follows.

Insert piston in upper valve body so that the face of the tool rests on stops of upper valve body. Invert upper body as shown in illustration and clamp lightly in a vise. Insert inlet valve assembly in lower valve body. Screw on exhaust valve two or three turns. Place lower valve body on inverted upper valve body. Inlet valve should be off its seat at this time. Screw inlet valve on its seat, or by checking the flanges of the upper and lower valve bodies to see that there is a minimum of play between them when the exhaust valve is pressed on its seat. Tighten inlet valve locknut and re-check. If correct,

remove tool.

When adjusting the treadle type valve, adjust the treadle adjusting screw so that the back lash can just be detected. Lock the jam nut securely.



1. INLET VALVE
2. EXHAUST VALVE
3. PISTON
4. UPPER VALVE BODY
5. CLEARANCE .060" TO .070"
6. TOOL
7. LOCKNUT
8. LOWER VALVE BODY

Figure C-81. Exhaust Valve Clearance

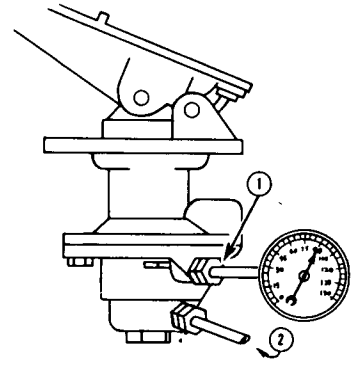
Test Procedure

With the valve in released position, cover the exhaust port with soap suds. If bubbles appear, the inlet valve is not properly seated. This condition may be caused by a damaged or worn valve, or valve seat, the presence of dirt or other foreign substances, or by a bent inlet valve stem.

With the valve in fully applied position, cover the exhaust port with soap suds. If bubbles appear, a leak is indicated either at the exhaust seat or past the diaphragm at the piston.

Install an air gauge on the application side of the system. With the brakes fully applied, the instrument panel pressure gauge and the gauge in the application side of the system should have approximately the same reading.

Use the test gauge on the application side of the system to check the valve for reaction or balance. Partially open the valve and hold it in this position. (See Fig. C-82). Observe the two air gauges which should show different unchanging air pressures. The pressure differential should remain constant until further application or release movement of the brake pedal occurs.



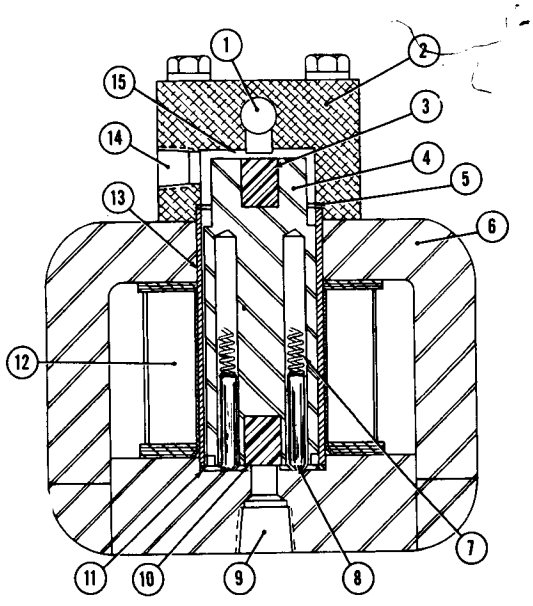
1. APPLICATION 2. INTAKE

Figure C-82. Application Valve Test

CONTROL VALVES

D.C. Electric Control Valves control the distribution of compressed air to the transmission clutches, steering clutches and brakes as the Tournatractor is operated. These valves are solenoid type valves operated by electromagnets. The 24 volt electromagnets are connected to the batteries

through switches on the instrument panel and the electric shift quadrant.



1. AIR INPUT
2. MANIFOLD
3. NYLON INSERT
4. PLUNGER
5. RUBBER GASKET
6. SOLENOID BRACKET STRUCTURE
7. SPRING
8. SPRING PIN
9. AIR EXHAUST
10. SEAT
11. RUBBER GASKET
12. WINDING
13. BRASS SLEEVE
14. AIR OUTPUT
15. SEAT

Figure C-83. Control Valve Cross Section

The electric control valve assembly includes a solenoid bracket structure with an electromagnet winding positioned in the center opening in the bracket. The exhaust valve seat is located at the bottom of the blind bore in the bracket. A brass sleeve extends through one side of the bracket, through the center of the electromagnet winding, and seats against a rubber gasket at the bottom of the blind bore in the other side of the bracket, making an air tight joint at this point. The piston is placed in the sleeve (spring pins and springs in place in the piston) with the large diameter nearest the exhaust valve seat. The spring pins and springs in the piston hold the piston away from the exhaust seat and against the input seat when the magnet is not energized. The manifold contains the input valve seat. Another rubber gasket at the point of contact between the brass sleeve and the bottom of the manifold bore makes an air tight connection between the two (Fig. C-83).

NOTE: The input opening becomes the exhaust opening and the exhaust opening becomes the input opening when the D.C. control valve assembly is used to control the steering clutches and brakes. There is no change in the construction of the valve. However the springs must be changed (see page C-41).

It is necessary to connect the air input line to the opening normally used for exhausting the air.

When the D.C. control valve assembly is used to distribute the air to the transmission clutches, the valve functions as follows:

The air input line is connected to the valve manifold, and air pressure is present at the input seat at all times. When a control switch is closed, the valve coil is energized. The piston is pulled away from the inlet seat and pressed against the exhaust seat and air is released through the output opening to the clutch, engaging the clutch. When the switch on the instrument panel is opened, the electromagnet becomes de-energized and the springs and spring pins reseat the piston over the inlet valve, cutting off the air supply to the clutch and opening the exhaust valve. Air is then exhausted through the exhaust opening and the clutch is released.

When the D.C. control valve assembly is used to control the steering clutches, the valve functions as follows:

The air input line is connected to the exhaust opening in the valve solenoid bracket and air pressure is present at the exhaust opening at all times. The air passes through the two slots in the piston, out the output opening, and through the lines to the clutches, engaging the clutches. When the control switch on the instrument panel is closed, the electromagnet is energized and the piston is pulled away from the inlet seat and pressed against the exhaust seat, cutting off the supply of air to the clutch. The air engaging the steering clutch is then exhausted out through the input opening and the steering clutch is released.

When used to distribute the air to the brakes when turning, the D.C. control valve functions exactly the same as the valve used to control the steering clutches. However, no air pressure is present at the valve until the brake pedal is depressed, and the amount the pedal is depressed determines the amount of air applied through the valve to the brake.

For detailed information of speed selection, steering and braking, refer to the Operator's Manual for the Model C Tournatractor.

Removal

First bleed the air system and then disconnect the air line from rear of control valve manifold block.

Remove the air lines leading to the valves at the manifold block.

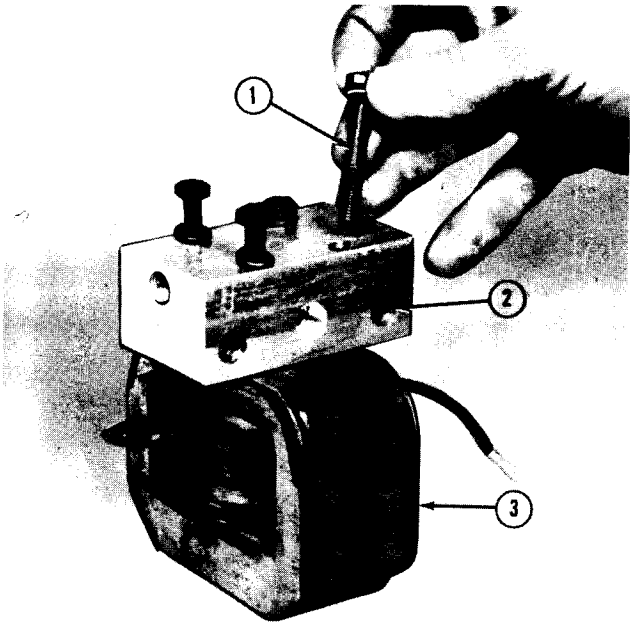
Disconnect the coil wires leading to the control

switches at knife connectors.

Remove the four mounting capscrews from the manifold block which fasten the valves to the mounting plate and remove the valves.

Disassembly

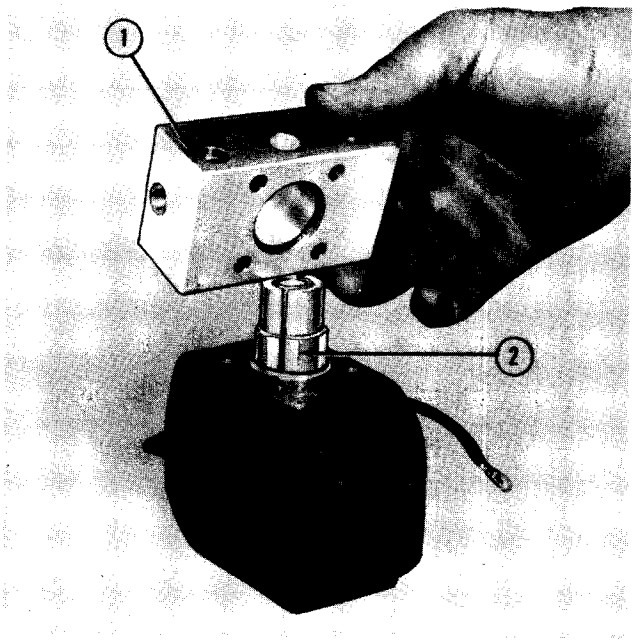
Remove the four capscrews securing the manifold to the solenoid bracket structure (Fig. C-84).



1. CAPSCREW 2. MANIFOLD
3. SOLENOID BRACKET STRUCTURE

Figure C-84. Removing Manifold Capscrews

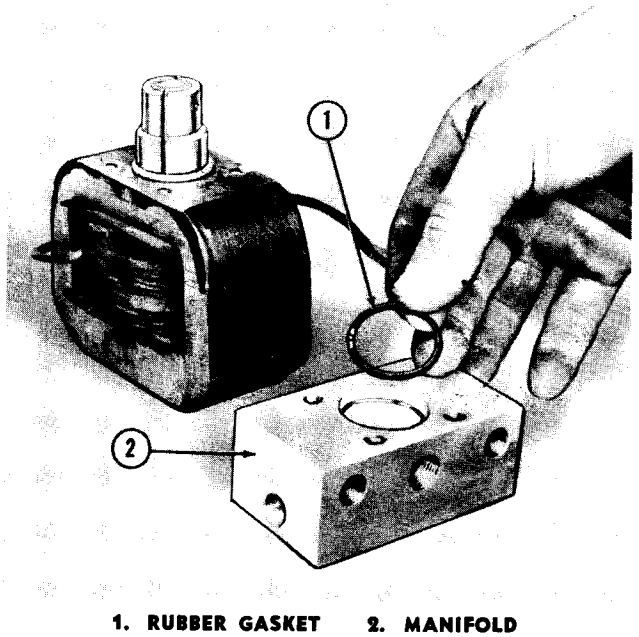
Lift off the manifold exposing the valve piston (Fig. C-85).



1. MANIFOLD 2. PISTON

Figure C-85. Manifold Removed

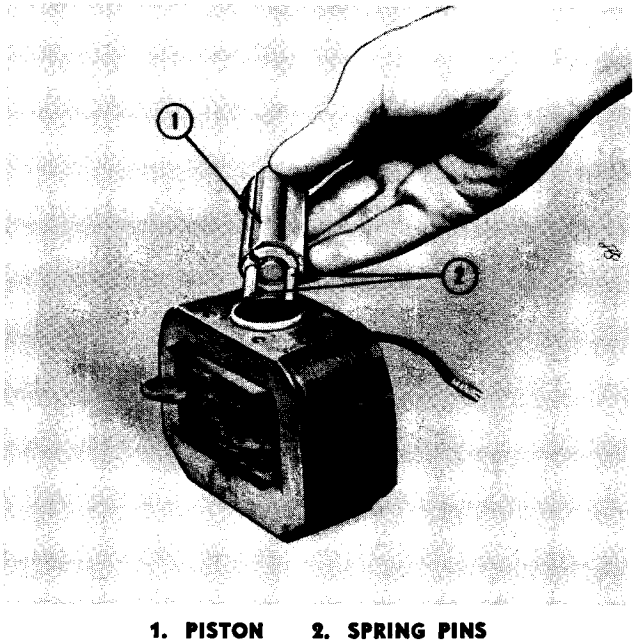
Remove the rubber gasket from the manifold (Fig. C-86).



1. RUBBER GASKET 2. MANIFOLD

Figure C-86. Removing Gasket from Manifold

Lift out the piston (Fig. C-87). Springs and spring pins may be removed with the piston or they may fall free in the brass sleeve as the piston is removed. In either case remove the springs and spring pins (Fig. C-87).

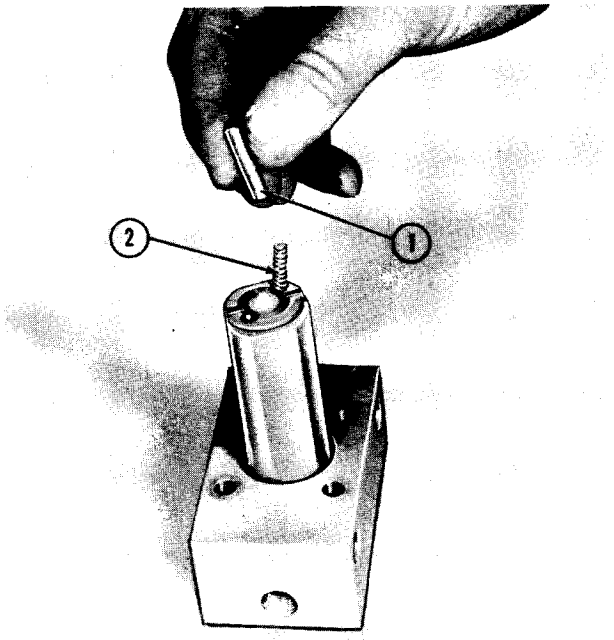


1. PISTON 2. SPRING PINS

Figure C-87. Removing Piston

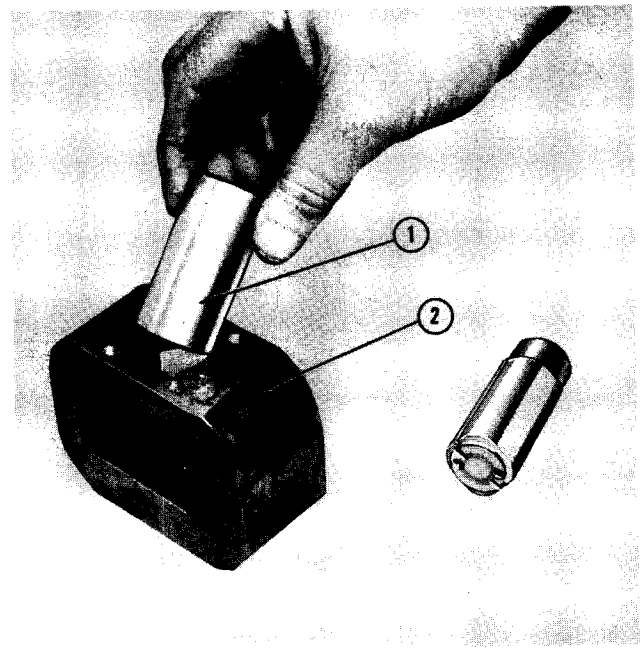
Remove the brass sleeve and slide the magnet winding out of the solenoid bracket structure after disconnecting the ground wire at the solenoid bracket (Fig. C-89).

Remove the rubber gasket from the bottom of the blind bore in the bracket structure.



1. SPRING PIN 2. SPRING

Figure C-88. Removing Springs and Spring Pins



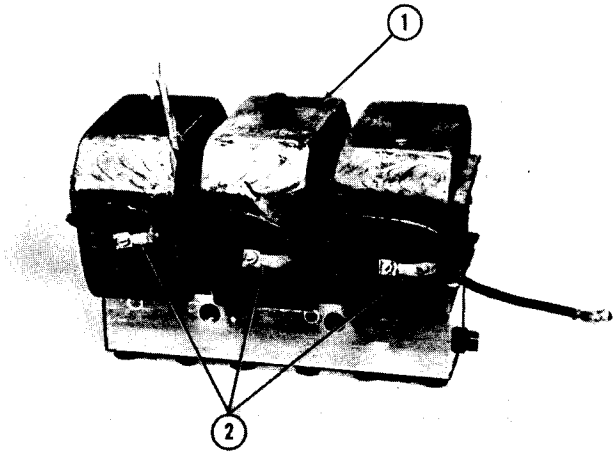
1. BRASS SLEEVE 2. SOLENOID BRACKET STRUCTURE

Figure C-89. Removing Brass Sleeve

Reassembly

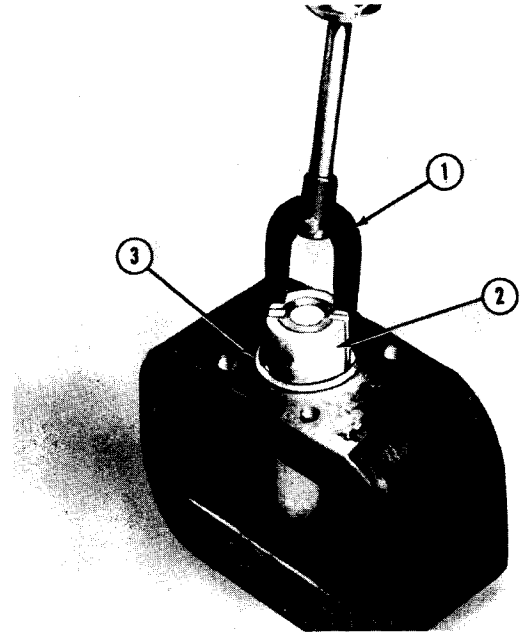
To reassemble, reverse the disassembly procedure outlined above.

NOTE: Install the winding in the bracket so the ground lead, identified by a clip type connector, comes out of the coil toward the left side of the bracket on the side nearest the ground connecting screw. Left side is determined with the bracket positioned so the ground screw is toward the observer and the hole



1. BRACKETS AND WINDINGS 2. GROUND LEADS

Figure C-90. Installing Windings



1. LAPPING TOOL 2. PISTON 3. BRASS SLEEVE

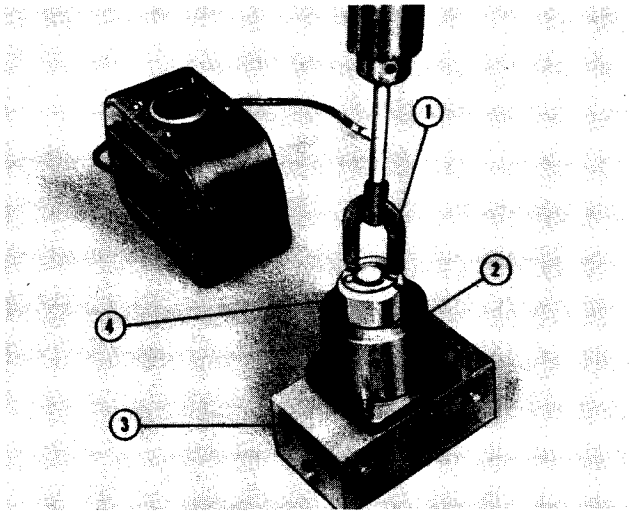
Figure C-91. Lapping Nylon Inserts

bored through the bracket structure is up (Fig. C-90).

If a new piston is to be installed, the nylon inserts must be lapped so they will seat properly on the valve seats in the solenoid bracket and the manifold block.

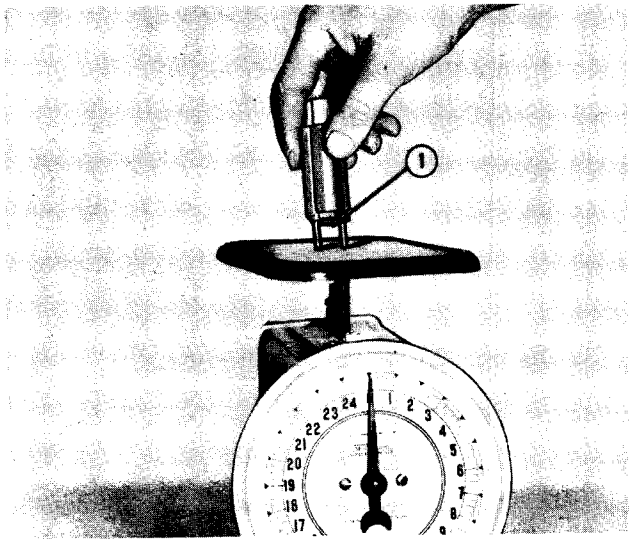
Construct a lapping tool similar to the one shown in the illustration (Fig. C-91).

Insert the brass sleeve in the bores in the solenoid bracket to act as a guide for the piston. Insert the new piston, place the lapping tool in position, and lap the piston insert. The tool is driven by an electric drill. Apply as much pressure as possible by hand against the seat during the lapping process without stopping the electric drill. Repeat the above procedure on the seat in the manifold using a lapping similar to the one illustrated after reversing the piston (Fig. C-92).



1. LAPPING TOOL
2. LAPPING GUIDE
3. MANIFOLD
4. PISTON

Figure C-92. Lapping Nylon Inserts



1. SPRINGS AND PINS

Figure C-93. Measuring Spring Compression

When installing new springs in the piston, check the springs for proper compression before assembling the unit. A common household scale can be used for checking. Insert both springs and spring pins in the piston and press down on the scale platform until the tip of the nylon insert is flush with the surface of the scale platform.

At this instant the scale should read between 18 and 19 lbs. for the transmission control valves and between 8 and 9 lbs. for the steering clutch and brake control valves. If less than 18 or 8 lbs. is indicated, cut off enough of the springs to bring the reading down to between 18 and 19 lbs. or 8 and 9 lbs., whichever is required. See Fig. C-93, C-94.

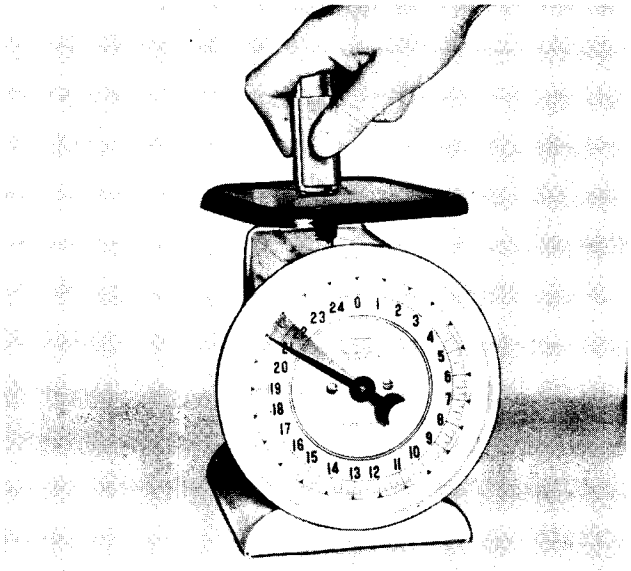
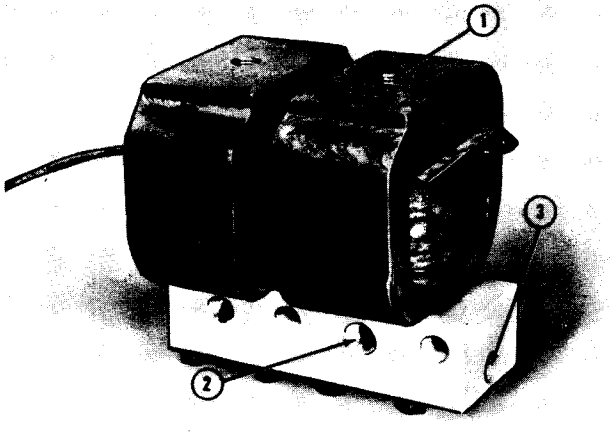


Figure C-94. Correct Compression for Transmission Control Valves



1. EXHAUST
2. OUTLET
3. INLET

Figure C-95. Control Valve Unit, Assembled

After the unit is assembled, apply air to the air inlet port on the manifold. No air should escape from either the outlet or exhaust ports. Then close the outlet port and energize the electromagnet. No air should escape from the exhaust port. Operate the valve rapidly several times and recheck. See Fig. C-95.

FUEL SUPPLY SYSTEM

The fuel supply system cleans, contains, prepares and controls the flow of fuel to the engine. The use of a good grade of fuel oil and proper care of the fuel filters are one of the important factors of engine care and maintenance. Dirty fuel may contain solid material which may be abrasive. If some of this material reaches the fuel injection equipment, the finely finished surfaces will become damaged and the fuel injection equipment will no longer function properly.

Under such circumstances, the engine will begin to show symptoms of loss of power, incomplete combustion, hard starting, missing and other forms of erratic operation.

Keep all fuel lines tight and free from leaks. Replace fuel oil filters periodically.

FUEL TANK

Removal

Remove seat, exhaust muffler and engine hood.

Disconnect all tubing and wiring to the air tank, compressor governor, fuel tank and lubricating oil filters.

Remove two capscrews, one on each side of the machine, between the battery box and the fuel tank.

Attach sling to fuel tank and lift off. Air tank and lubricating oil filters will come with the fuel tank.

Service

The filter unit included in the tank filler assembly removes any large foreign particles which may be present in the fuel used to fill the tank. Inspect the filter screen and clean with a solvent periodically. Any enlarged openings reduce the efficiency of the unit and should be corrected. If the filter unit cannot be repaired, it should be replaced.

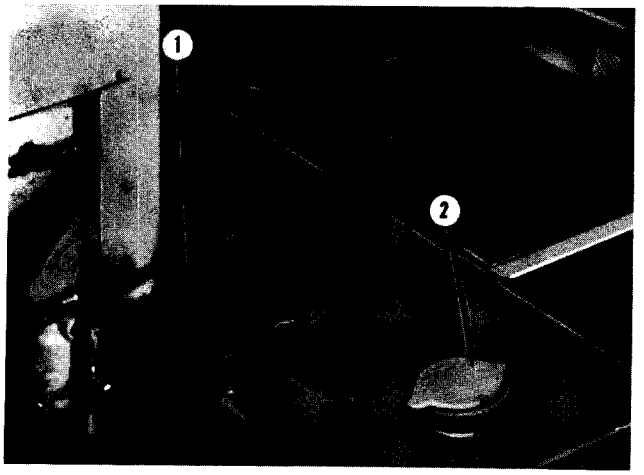
The fuel tank should be drained periodically to remove any sediment and condensate which may be present.

Be sure that the drain tubing for the fuel tank has been properly reconnected if the tank is removed for repairs.

BUY CLEAN FUEL. KEEP IT STORED IN A CLEAN PLACE.

The fuel level tank unit is held in position by five screws. A float is used to register the fuel level. If the unit is in good mechanical condition and fails to function properly, check the electrical circuit and gauge.

NOTE: Later machines have a fuel tank dip stick fastened to the under side of the filler cap, replacing the fuel gauge on the instrument panel.



1. FUEL LEVEL UNIT 2. FILLER CAP

Figure C-96. Fuel Tank Level Unit and Cap

FILTERS

To insure satisfactory operation of the diesel engine, primary and secondary fuel filters have been installed in the fuel system between the supply tank and the engine. Fuel oil is drawn from the tank by the fuel pump and forced through the filters — through the inlet manifold — and then by means of the inlet pipe, through the injector filters — and finally to the fuel chamber within the injectors. Any

surplus fuel which may be present at the injectors flows through the outlet pipe to the return manifold and then through the return pipe to the supply tank.

The sediment should be drained from the filter bowls, and the filter elements replaced at regular intervals.

See "Maintenance Schedule" page A-11 for correct intervals.

Optional Filter (Luber-Finer)

This filter may be inserted into the fuel system as a supplementary filter to the primary and secondary filters already on the machine.

Drain sediment from strainer and filter every shift. Replace the element every 50 shifts.

Refer to the following instructions for replacement of filter pack.

1. Remove the drain plug from bottom of the housing and drain the fuel.
2. Extract the capscrews from the lid and remove it from the housing, taking care to avoid damaging the gasket.
3. Unscrew the T-handle pack hold-down assembly and lift out the pack.
4. Clean housing thoroughly and replace the drain plug.
5. Install new pack, making sure first that the pack seal bushings are clean and in good condition.
6. Replace the lid and lid capscrews and tighten.

LUBRICATION SYSTEM

Proper lubrication is one of the most important parts of the preventative maintenance program. The importance of lubricating with the correct weights and types of lubricants at the specified intervals cannot be over emphasized. More engines, for example have been ruined by the use of inferior oil than any other cause.

ENGINE: Lubricating oil is carried in the oil pan. Oil is circulated by a gear type oil pump.

The pump draws the oil from the sump and forces it through a short drilled vertical path through the crankcase, then to the oil cooler where it is cooled by the circulating water of the cooling system.

From the cooler the oil is delivered to an oil header drilled the full length of the engine block. From this header lines lead to the main bearing caps where oil enters the crankshaft, lubricating the main and connecting rod bearings, and goes through drilled holes in the connecting rods to lubricate the piston pins. Cylinder walls are lubricated by the splashing action of the moving connecting rods.

A line also leads from the header to the oil filter. Pressure in the system is regulated by an oil pressure regulator valve. Excess oil passes through this valve back into the pan.

The bayonet type oil gauge is located on the manifold (left) side of the engine. The oil level should be checked regularly and be maintained as near the high mark as possible at all times.

TOURNATRACTOR: The transmission and final drive are lubricated by a splash system.

The compressor is lubricated by the engine lubricating system.

A bayonet type oil level gauge is located in the center floor plate of the cockpit which indicates the oil level in the ring gear and pinion compartment and in the transmission.

A level plug is located on the front of each final drive compartment.

A torque converter gets its supply of oil from a tank located directly beneath the converter unit.

The oil screen filter in the converter's suction line should be inspected and cleaned every day for the first week of operation, thereafter, once every week.

Engine Lube Oil Filter

Engine lube oil filters should be serviced at regular intervals.

See "Maintenance Schedule" page A-11 for correct intervals.

Optional Filter (Luber-Finer)

This type of oil filter may be obtained as an optional piece of equipment. It will replace the present filter supplied with the engine as standard equipment.

When a filter is used in the lubricating system a controlled rate of oil flow is necessary. This is accomplished by an orifice fitting located in the T-handle assembly. This orifice size has been predetermined at the factory and will therefore require no further adjustment.

Change the filter element every 10 shifts and every time the engine lubricating oil is changed.

For replacement of filter pack follow the instructions below.

1. Remove the drain plug from bottom of the housing and drain the oil.

2. Extract the capscrews from the lid and remove it from the housing, taking care to avoid damaging the gasket.

3. Unscrew the T-handle pack hold-down assembly and lift out the pack.

4. Clean housing thoroughly and replace the drain plug.

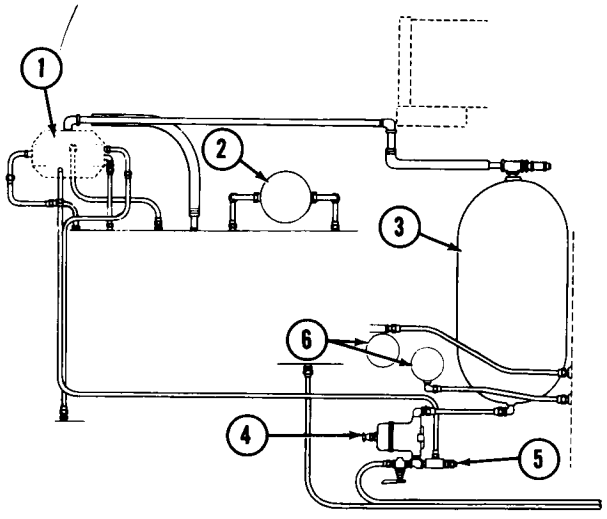
5. Install new pack, making sure first that the pack seal bushings are clean and in good condition.

6. Inspect the T-handle pack hold-down assembly to see that the metered hole in the orifice fitting is open, then replace the T-handle assembly in the unit and tighten firmly. If the lid gasket in the unit has been damaged replace it with a new one.

7. Replace the lid and lid capscrews and tighten.

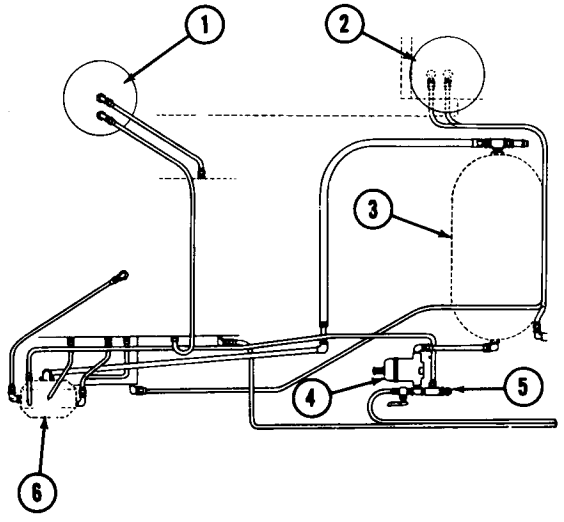
8. An additional amount of oil must be added to the crankcase to fill the filter unit (3½ gals.).

9. Remove the air vent plug in the lid and then start the engine. When oil reaches the vent replace the plug. The filter becoming warm is an indication of proper circulation of oil through the unit. Check all lines and fittings for leaks.



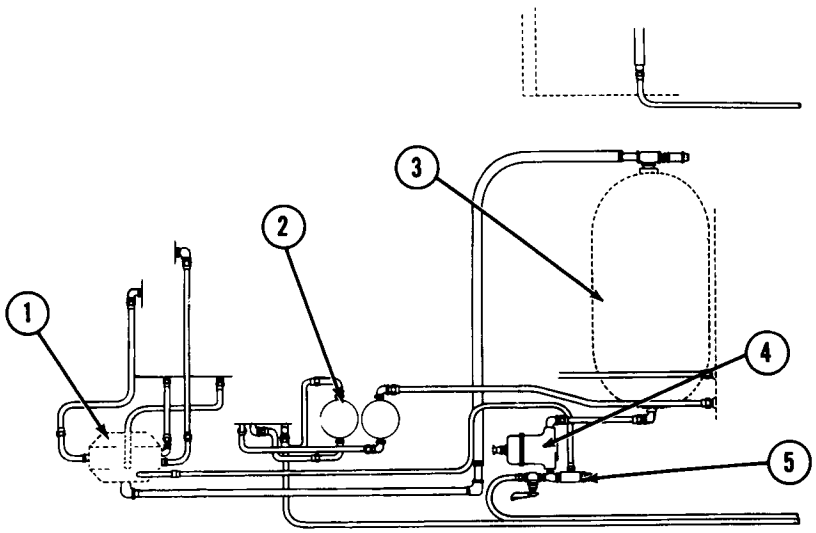
1. AIR COMPRESSOR
2. LUBE OIL FILTER
3. AIR TANK
4. AIR FILTER
5. GOVERNOR
6. FUEL FILTERS

Figure C-97. Engine Piping (G.M.)



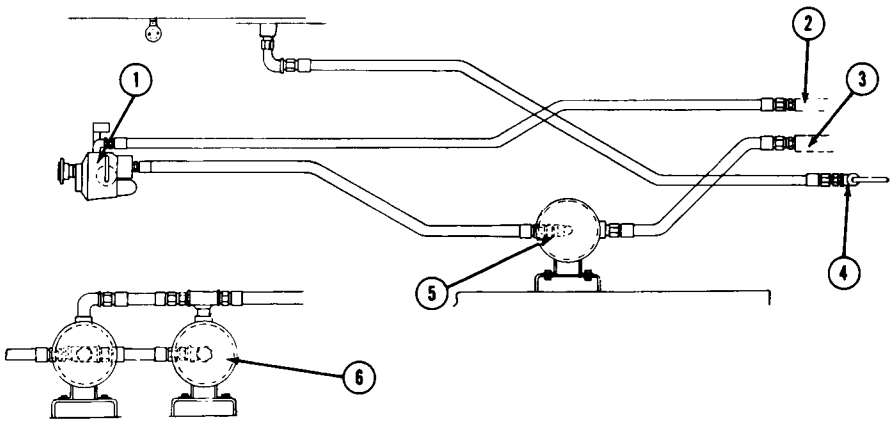
1. LUBE OIL FILTER
2. FUEL FILTER (OPTIONAL)
3. AIR TANK
4. AIR FILTER
5. GOVERNOR
6. AIR COMPRESSOR

Figure C-98. Engine Piping (Cummins)



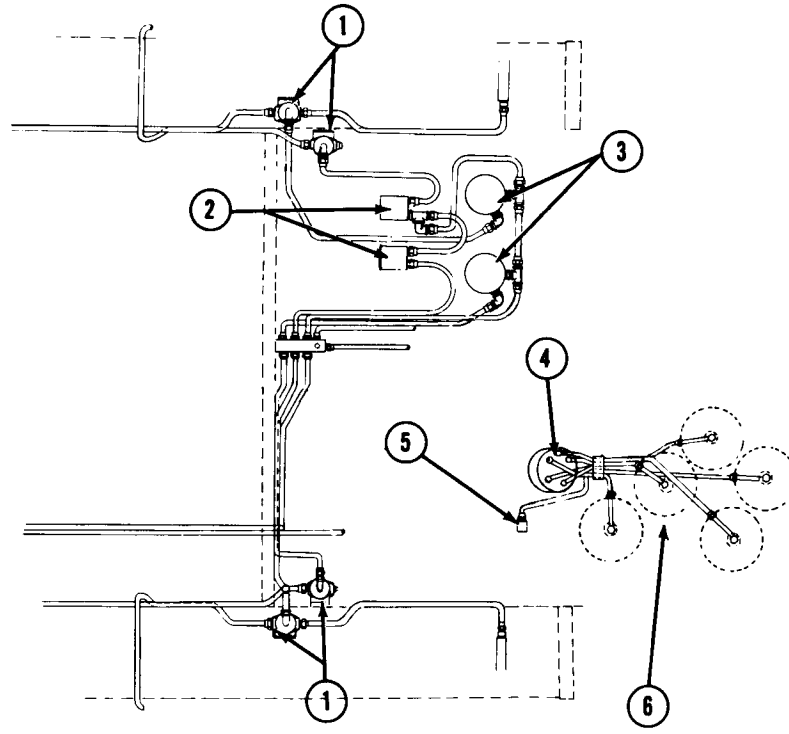
1. AIR COMPRESSOR
2. LUBE OIL FILTER
3. AIR TANK
4. AIR FILTER
5. GOgovernor

Figure C-99. Engine Piping (Buda)



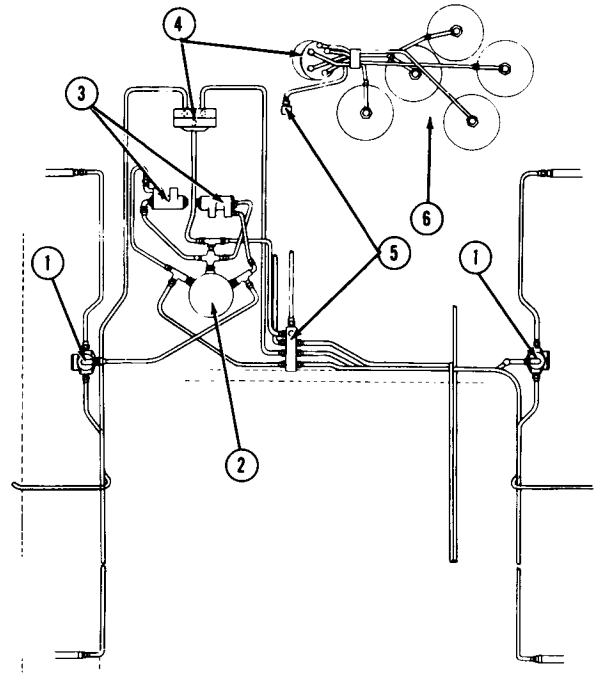
1. FUEL PUMP
2. FUEL RETURN LINE
3. FUEL LINE
4. INJECTOR DRAINBACK LINE
5. FUEL FILTER
6. OPTIONAL FUEL FILTER

Figure C-100. Piping for PT Fuel System (Cummins only)



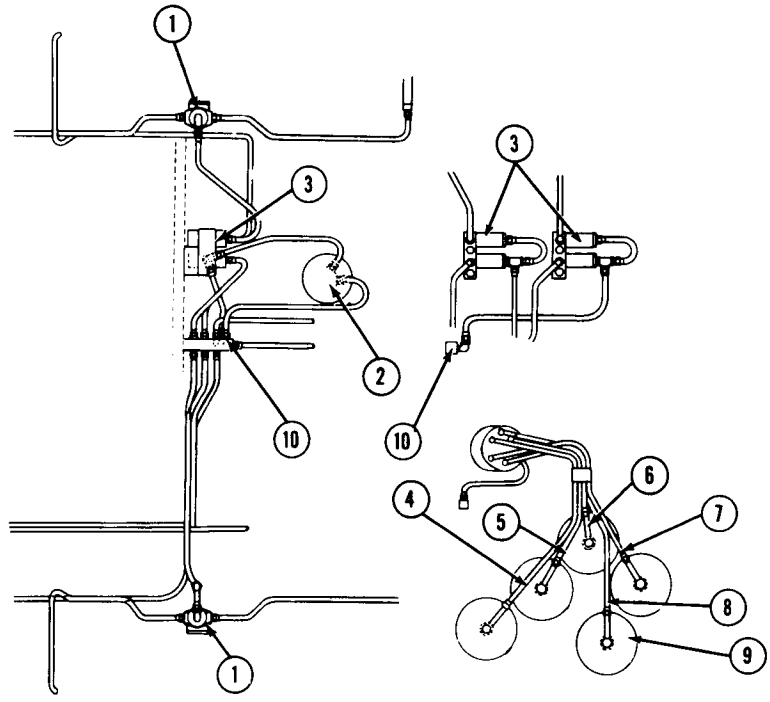
1. QUICK RELEASE VALVE
2. STEERING VALVE
3. TREADLE VALVE
4. SELECTION VALVE
5. SUPPLY VALVE
6. TRANSMISSION CLUTCHES

Figure C-101. Control Piping (Steering Levers and Air Shift)



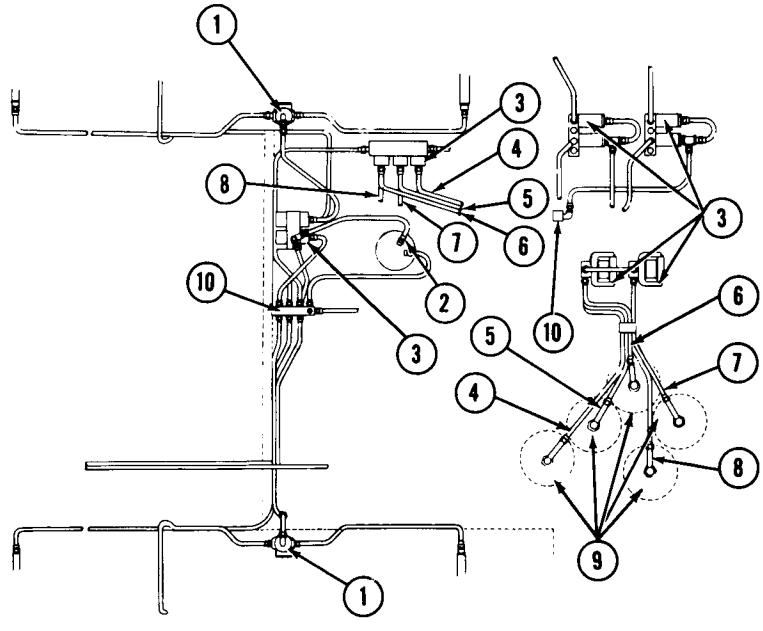
1. QUICK RELEASE VALVE
2. TREADLE VALVE
3. METERING AIR VALVE
4. SELECTOR VALVE
5. SUPPLY BLOCK
6. TRANSMISSION CLUTCHES

Figure C-102. Control Piping (Steering Wheel and Air Shift)



1. QUICK RELEASE VALVE
2. TREADLE VALVE
3. D.C. CONTROL VALVE
4. TO HIGH FORWARD CLUTCH
5. TO REVERSE CLUTCH
6. TO ENGINE CLUTCH
7. TO COMPOUND CLUTCH
8. TO LOW FORWARD CLUTCH
9. TRANSMISSION CLUTCHES
10. SUPPLY BLOCK

Figure C-103. Control Piping (Steering Switch and Air Shift)



1. QUICK RELEASE VALVE
2. TREADLE VALVE
3. D.C. CONTROL VALVE
4. TO HIGH FORWARD CLUTCH
5. TO REVERSE CLUTCH
6. TO ENGINE CLUTCH
7. TO COMPOUND CLUTCH
8. TO LOW FORWARD CLUTCH
9. TRANSMISSION CLUTCHES
10. SUPPLY BLOCK

Figure C-104. Control Piping (Steering Switch and Electric Shift)

ENGINE

D

INDEX

ENGINE

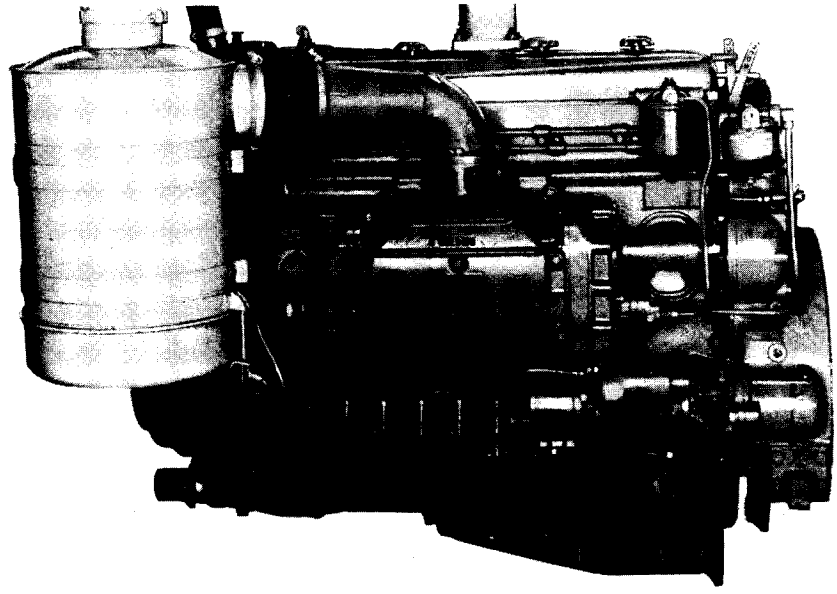


Figure D-1. Engine

REMOVAL

Remove hood and radiator assemblies.

Disconnect all wiring, tubing, hoses and control cables to the engine and accessories and A.C. generator. (If torque converter is to be removed with engine, disconnect the suction and drainback hoses from the torque converter oil tank. Cover or plug all hose and tank connections. Remove fuel tank and seat assemblies.)

Attach sling hoist to the engine and take up slack in chain. Remove the top cover plate to the access opening in the torque converter housing. Cut the lockwires and remove the capscrews holding the converter drive plate and the generator drive plate together.

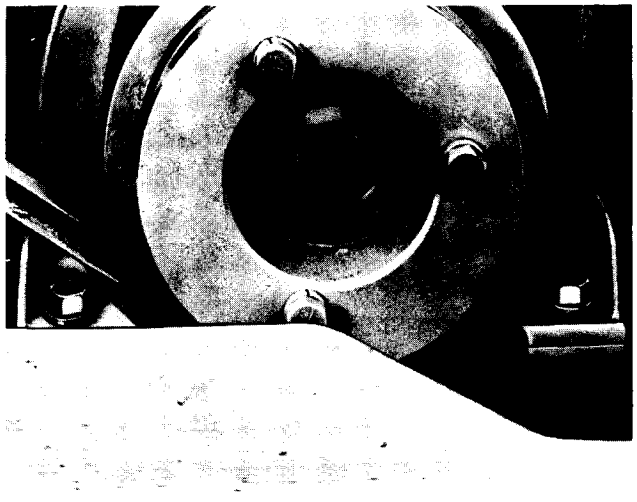


Figure D-2. Engine Front Mounting Capscrews

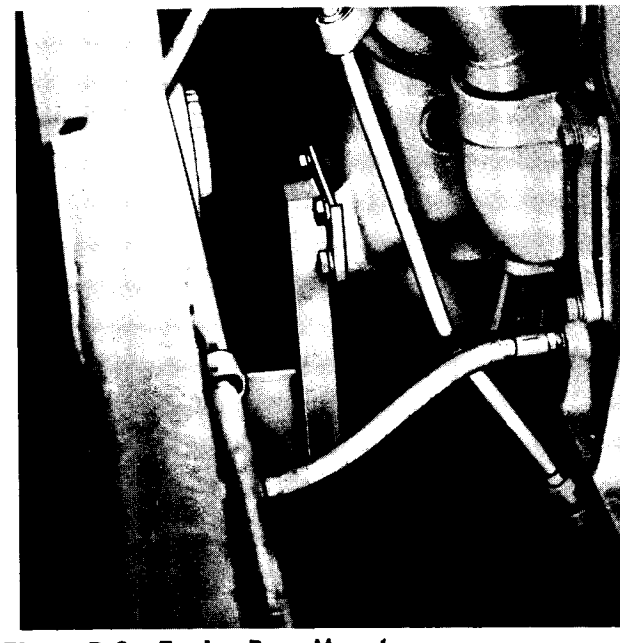


Figure D-3. Engine Rear Mount

Remove the front and rear engine mounting capscrews and the capscrews securing the torque converter housing to the generator stator. Remove shims from between torque converter and generator stator, or from between converter flywheel and generator drive plate and keep separate.

(Remove drive belts from torque converter oil pump pulley and air compressor pulley on Cummins and Buda engines.)

Lift engine slightly. Remove the shims from

front engine mount. Mark these shims for re-installation in the same place.

Check for any wiring, tubing or controls which may have been overlooked and left connected before removing the engine and A.C. generator.

Remove engine and generator from case. Refer to Section "E" for A.C. generator removal and disassembly.

To remove engine, generator and torque converter as one unit, remove seat and fuel tank with air tank and lubricating oil filter attached.

Drain lubricant from transmission and ring gear compartment.

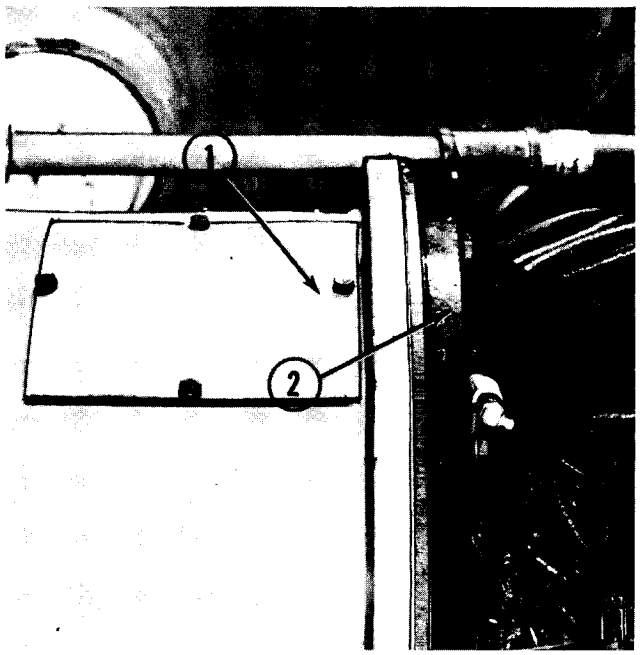
Disconnect all wiring, tubing, hoses and control cables to engine, generator and torque converter.

Attach sling hoist to engine and take up slack.

Remove capscrews securing the torque converter housing to the main case wall.

Remove front and rear mounting capscrews and follow the procedure described above for removing the unit from case.

Refer to Section "F" for removal and disassembly of the torque converter.



1. TORQUE CONVERTER 2. A.C. GENERATOR

Figure D-4. Torque Converter and Generator

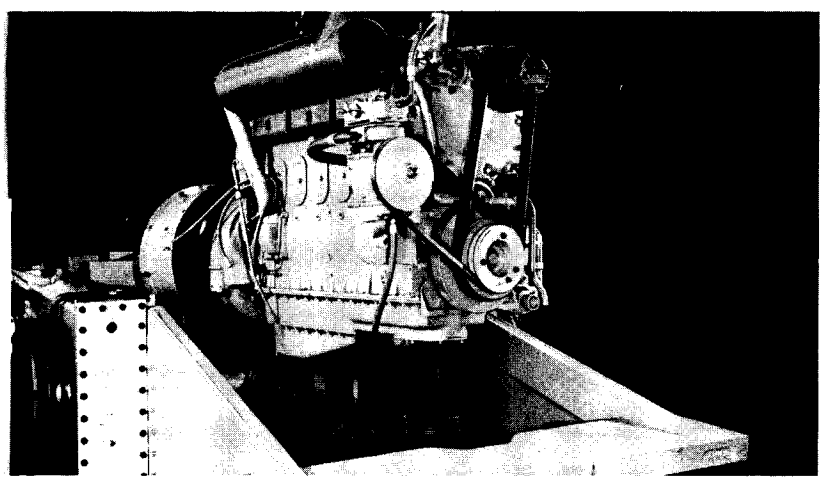


Figure D-5. Removing Engine

SERVICE

See the engine manufacturer's manual for complete instructions on engine maintenance and repair.

Check the crankcase oil level once each shift.

For the G.M. engine, the nameplate is included on the "Options and Accessories" plate on the valve rocker cover. Earlier engines have a separate nameplate located on the flywheel housing on the cranking motor side of the engine. Change crankcase oil every 10 shifts. Use SAE #30 Heavy Duty for temperatures above 32° F., and SAE #20 Heavy Duty for temperatures below 32° F.

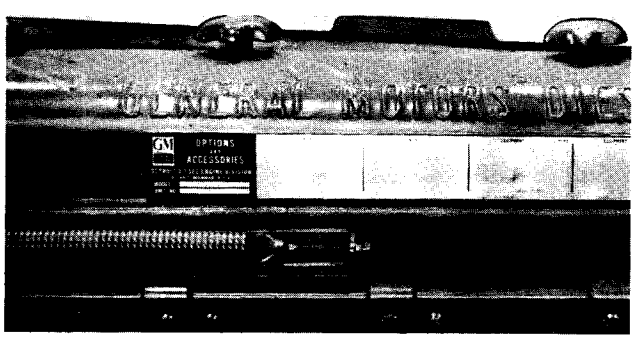


Figure D-6. Options and Accessories Plate

The name plate for Buda engines is above and forward of the fuel pump and governor on the right side. Change crankcase oil every 10 shifts. Use SAE #40 for temperatures above 90° F., SAE #30 for temperatures from 32 to 90° F., and SAE #20 for temperatures below 32° F.

For the Cummins engine the nameplate is located below the air compressor on the cylinder block. Change crankcase oil every 7 shifts. Use SAE #30 for temperatures above 90° F., SAE #20 for temperatures from 32 to 90° F., and SAE #10W for temperatures below 32° F.

If cranking motor front bearing is equipped with oil cup lubricate every 10 shifts. Use SAE #30 engine oil for temperatures above 32° F., and SAE #10 engine oil for temperatures below 32° F. Three to five drops from an oil can should be sufficient. DO NOT OVER LUBRICATE.

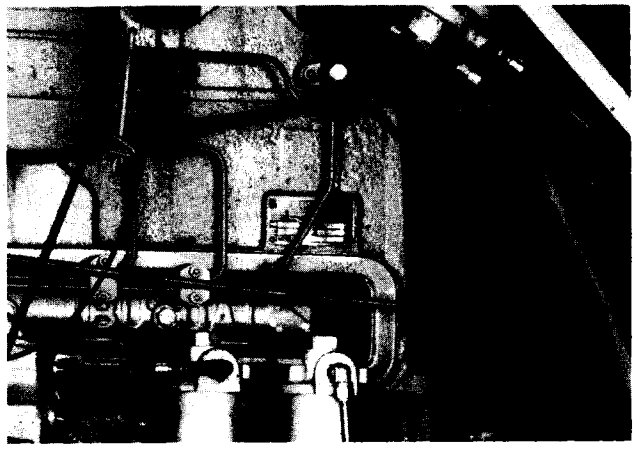


Figure D-7. Buda Nameplate

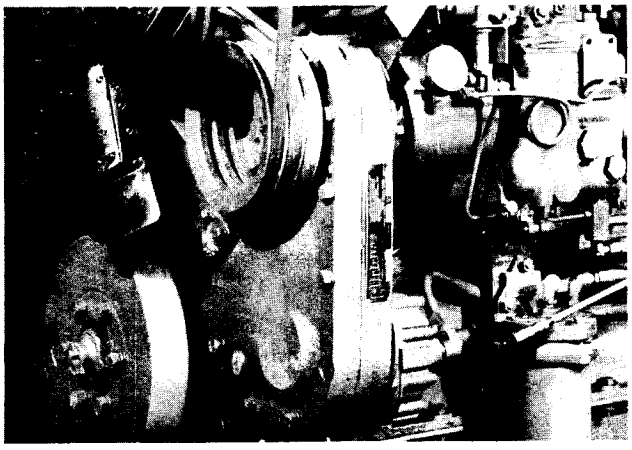


Figure D-8. Cummins Nameplate

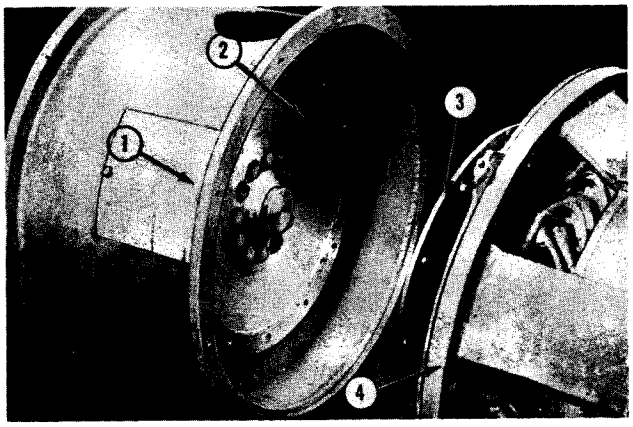
INSTALLATION

Thoroughly clean the boss and face of the generator stator or torque converter housing and the bore and face of the main case wall. Remove any burrs with a bearing scraper.

Sling engine and generator and lift into engine compartment.

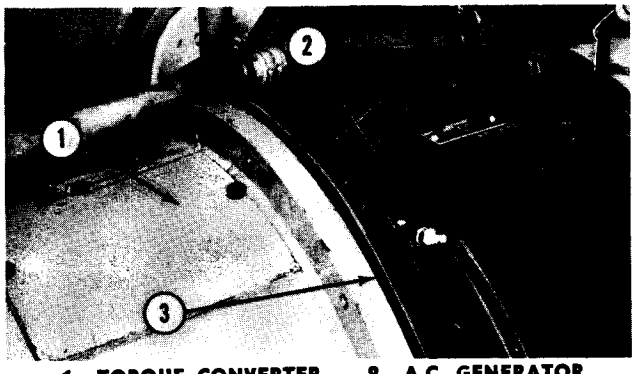
Check engine crankshaft endplay.

Swing engine and generator toward the torque converter. Note which comes into contact first, the converter housing and generator stator or the adaptor structure and converter flywheel. If housing and stator touch first shims will be used between adaptor structure and converter flywheel. If adaptor and flywheel touch first shims will be used between the converter housing and generator stator (Fig. D-10).



1. TORQUE CONVERTER
2. TORQUE CONVERTER FLYWHEEL
3. GENERATOR ADAPTOR
4. GENERATOR

Figure D-9. Torque Converter and Generator

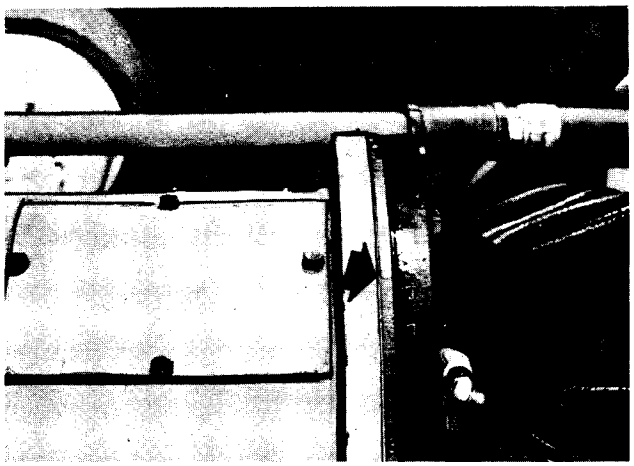


1. TORQUE CONVERTER
2. A.C. GENERATOR
3. CHECK HERE WITH FEELER GAUGE

Figure D-10. Checking Space

If adaptor plate and flywheel touch first, check space remaining between housing and stator. Check four places 90° apart — average readings, insert necessary shims.

Follow the same procedure for shimming if converter housing and generator stator touch first, inserting the shims between the adaptor plate and flywheel.



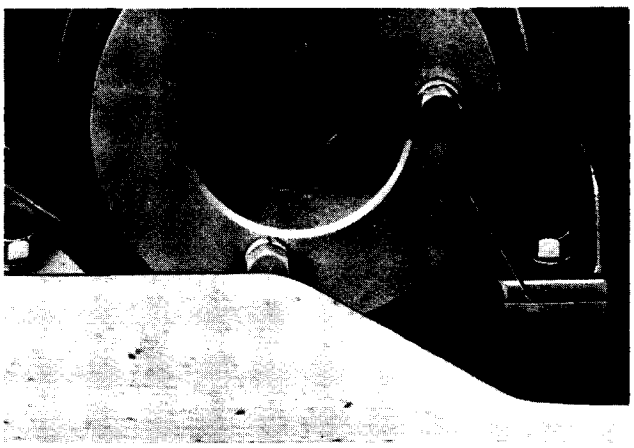
1. PLACE 0.010" SHIM HERE

Figure D-11. Inserting Shim

If converter housing and stator touched first place 0.010" shims between the two assemblies in two positions 180° from each other. Secure with capscrews.

Check the space all around the circumference of the generator stator and torque converter housing. Move engine and generator up or down which ever is necessary to obtain the same reading (0.010") at all points around the stator circumference.

If adaptor and flywheel touched first insert necessary shims between the stator and housing and secure with capscrews. Check space between the housing and stator around their circumference. Move engine and generator to obtain the same reading at all points.



1. CHECK HERE WITH FEELER GAUGE

Figure D-12. Front Engine Mount

Now check the space between the front engine mount and the mounting block with a feeler gauge (Fig.D-12). Be sure to get the same reading at both ends of the mounting bracket. This distance equals the amount of shim stock to be inserted between the mounting bracket and the mounting block.

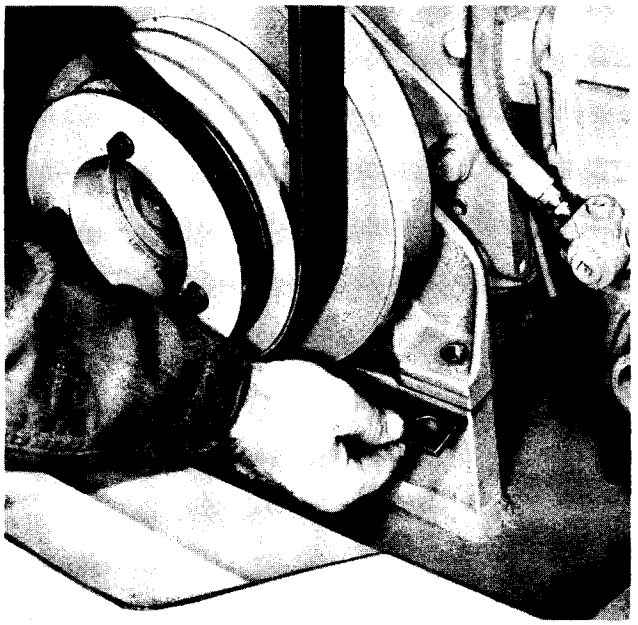
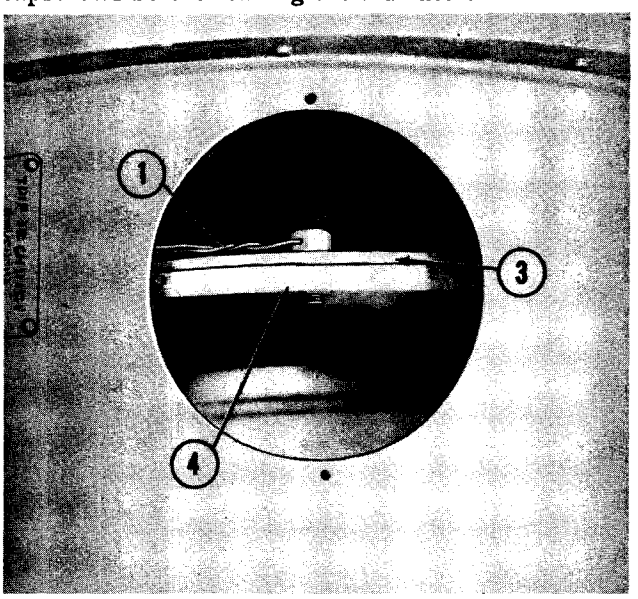


Figure D-13. Inserting Shims

Install or replace shims if needed, as described above or remove the 0.010" shims (if used) and bolt the generator stator to the torque converter housing. Replace and wire the capscrews fastening the converter flywheel and generator drive plate together (Fig. D-14).

Before tightening the front engine mounting capscrews, place a dial indicator on the top of crankshaft pulley and set at "O". Insert shims and tighten capscrews. If the indicator moves from "O", add enough shims to bring the reading back. Tighten capscrews before reading the indicator.

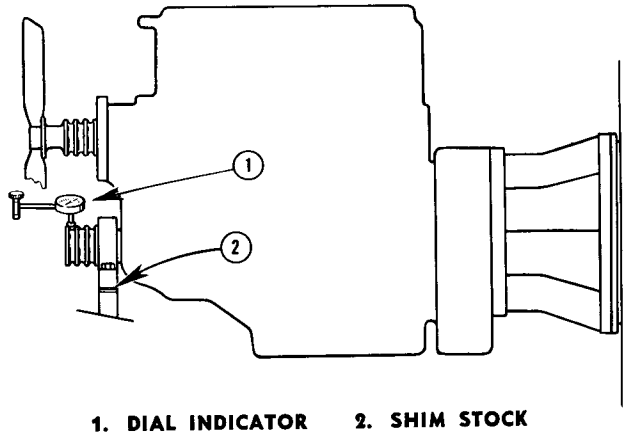


1. LOCKWIRE
2. CAPSCREW
3. ADAPTOR
4. FLYWHEEL

Figure D-14. Torque Converter Flywheel and Generator Adaptor

Complete the installation of tubing, wiring, control cables and other assemblies removed.

If torque converter was removed from machine, position converter in case and secure to main case wall. Proceed as described above.



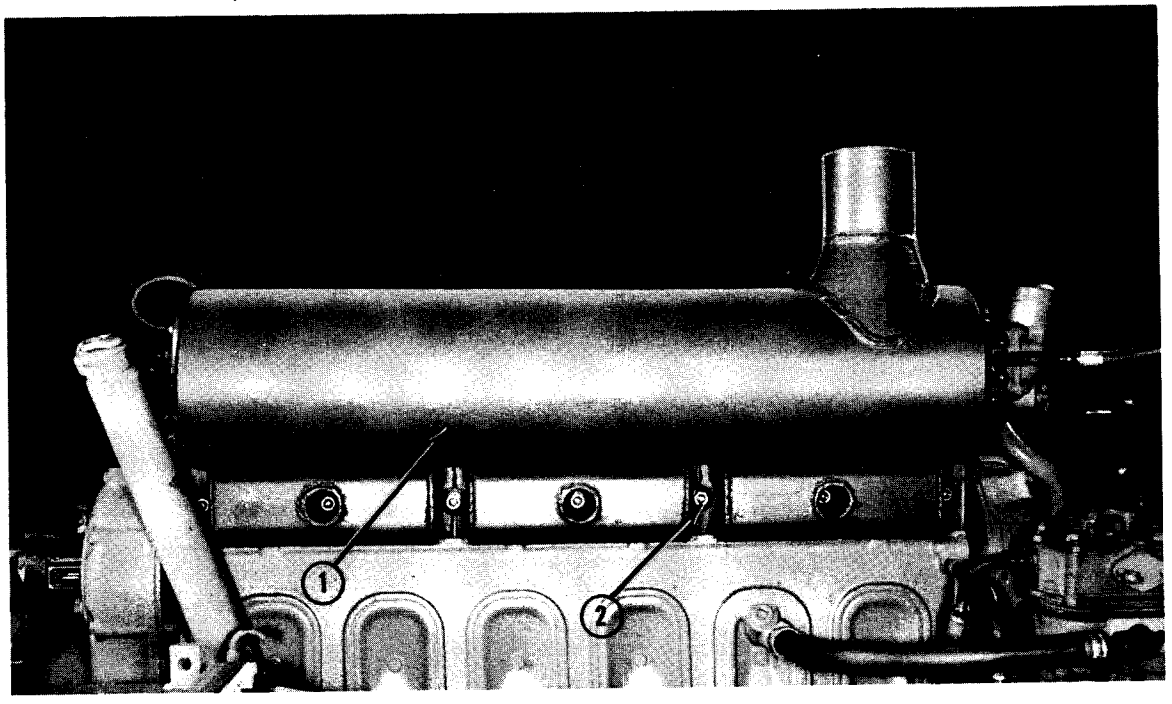
1. DIAL INDICATOR 2. SHIM STOCK

Figure D-15. Position of Dial Indicator

EXHAUST MUFFLER

On later machines with G.M. engines an exhaust muffler replaces the exhaust manifold.

To remove the muffler, remove the exhaust stack by loosening the clamp and pulling the stack from the muffler. Remove the nuts securing the muffler to the manifold studs. Lift muffler from engine.



1. MUFFLER 2. NUTS

Figure D-16. Exhaust Muffler

▼

A.C. GENERATOR

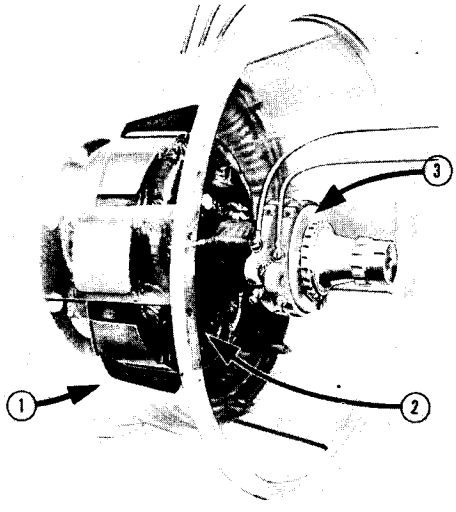
INDEX

A.C. GENERATOR

The A.C. generator is mounted in line with the engine. This three-phase generator is designed and constructed to produce current without the fluctuation and the power loss of the ordinary generator, and to handle the loads required by the various operations peculiar to the equipment.

The Tournatorque generator is a three-wire, three-phase, 300 volt, 120 cycle, rotating field type, rated on the basis of an engine speed of 1800 R.P.M.

The three major assemblies that make up the A.C. generator are:



1. STATOR 2. ROTOR
3. BRUSH HOLDER ASSEMBLY

Figure E-1. A.C. Generator Main Assemblies

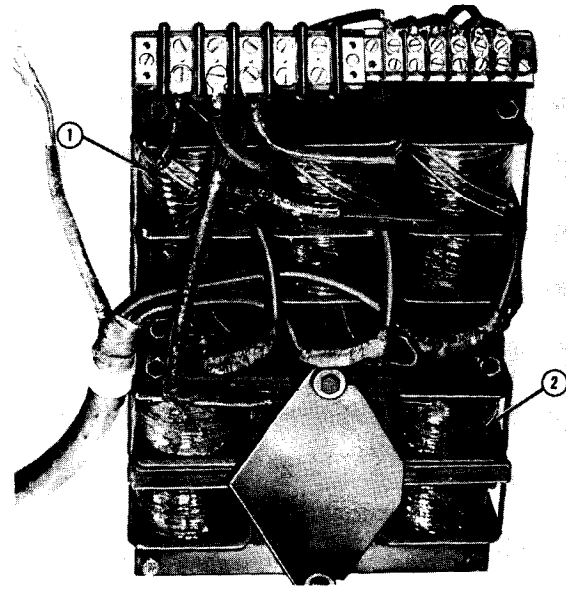
1. Stator — the outside or stationary member which bolts to the engine flywheel housing at the rear and to the end bell and torque converter housing at the front.

2. Rotor — the rotating member which is attached to the engine flywheel by a drive disc and to the torque converter flywheel by the driving adaptor structure.

3. Brush Holder Assembly — two aluminum brush holders which hold the segments of the generator brushes. Each holder is composed of two half rings, held together by capscrews.

A two unit transformer group, mounted on the right side of engine against case wall in engine compartment, provides excitation current for the A.C. generator field and charges the batteries. Rectifiers convert the alternating current from the transformers' secondary winding into the direct current required for excitation and battery charging.

1. A constant voltage transformer is interconnected in the generator excitation circuit to maintain



1. CONSTANT VOLTAGE TRANSFORMER
2. MAIN TRANSFORMER

Figure E-2. Transformer Unit

constant voltage at the A.C. generator output terminals regardless of the varying loads experienced during the operation cycle. This transformer is of the current transformer type with reactor windings in addition to the primary and secondary windings.

2. Main transformer unit provides the "no load" excitation current and also the current used to keep the batteries in a charged condition. This transformer is designed to provide adjustment of the charging rate without changing the electrical connection. To accomplish this the magnetic circuit between the primary and secondary windings includes an adjustable "flux-bridge", which can be moved in or out to change the reluctance of the magnetic circuit and consequently the transformer output.

1. STATOR 2. NAMEPLATE

Figure E-3. Generator Nameplate

The selenium plate rectifiers, mounted in a bath of oil or in the engine air stream, receive alternating current from the transformers' secondary windings and deliver direct current to the generating system. The selenium coated plates allow curent to pass in only one direction.

The name plate for the A.C. generator is attached to the outside of the generator stator and includes the size, name, voltage, cycles, R.P.M., serial number and part number.

THEORY OF OPERATION

Basic Excitation Circuit

Before any usable amount of alternating current can be generated in the generator and delivered to the electrical system, an exciting current must be flowing through the generator's field winding, and the field itself must be rotating. The engine, directly connected to the generator rotor, drives the rotating field. The basic excitation circuit provides the current flow in the field windings. When the key switch and the D.C. main switch on the instrument panel are closed, current from the batteries flows through the two switches and through the booster rectifier to the field windings. From this connection, current flows through the field windings to a ground on the frame of the machine, and back to the grounded terminal on the batteries, completing the circuit.

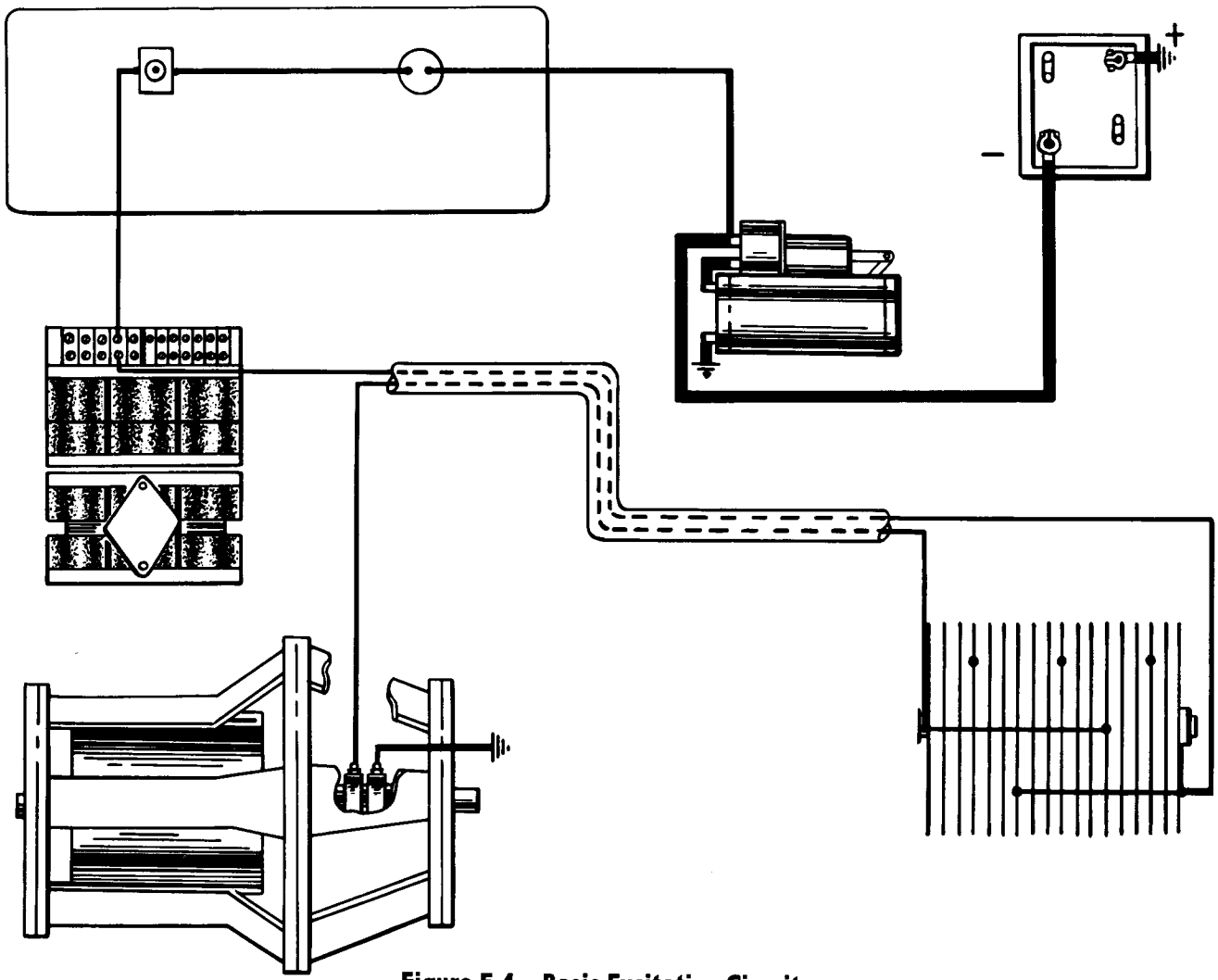


Figure E-4. Basic Excitation Circuit

Three Phase Power Circuit

When driven at 1800 revolutions per minute by the engine and excited by the basic excitation circuit the generator will deliver three phase, 300 volt, alternating current to an electric motor when the power circuit to this motor is closed. With the main switch between the generator and the A.C. motor closed, current flows from the generator stator windings, through the constant voltage transformer and the main switch, to the A.C. motor stator windings and to the brake coils on the motor, rotating the motor rotor and releasing the motor brakes simultaneously.

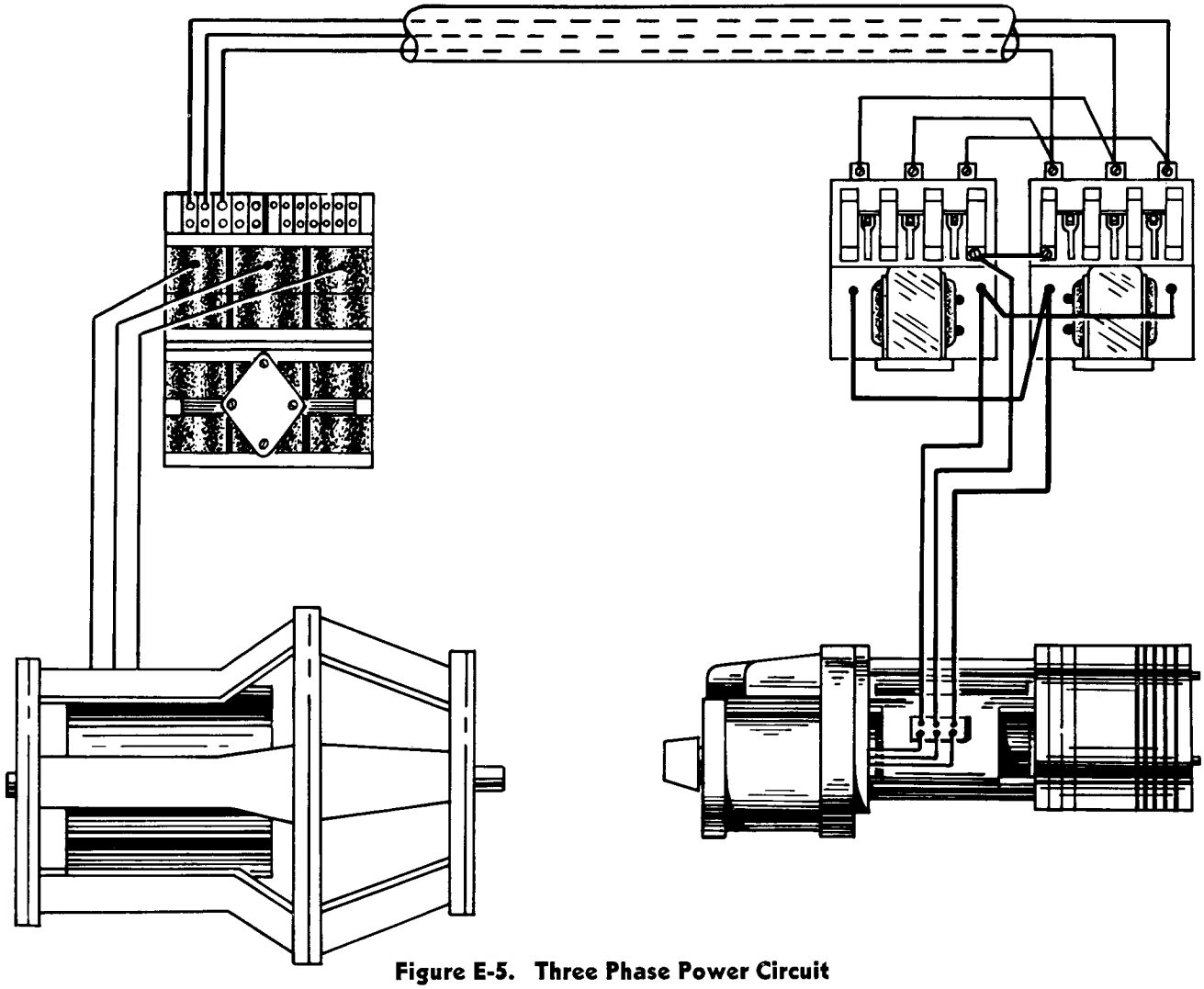


Figure E-5. Three Phase Power Circuit

Battery Charging Circuit

As the generator's output voltage approaches 300 volts, the main transformer and rectifier begins to supply enough current to the excitation circuit to assume the normal excitation load from the batteries and to supply the charging current to the batteries. The primary windings of the main transformer are connected across the output terminals of the generator. As voltage builds up in the generator, voltage is conducted to the main transformer primary and current flows in the primary windings. The main transformer is a voltage type transformer which reduces the voltage in proportion to the ratio between the number of turns in the primary and the secondary windings. Induced current at the reduced voltage flows from the main transformer secondary windings to the main rectifier. Here the alternating current is converted to pulsating direct current and led into the excitation circuit at the D.C. main

switch. From the D.C. main switch, part of the current flows to the generator rotor to excite the field, through the field to the ground on the frame of the machine, through the frame of the machine back to the grounded terminal on the main rectifier. The remainder of the current flows through the battery (charging the cells), to the battery's grounded terminal connected to the frame of the machine, and back through the frame of the machine to the grounded terminal on the main rectifier. The amount of current from the secondary of the main transformer is controlled by spacing a movable flux-bridge nearer or further from the core of the transformer. Spacing is accomplished by the removal or addition of micarta shims beneath the bridge. Adding shims increases the output of the transformer's secondary windings, removing shims reduces the output.

NOTE: Should D.C. main switch be turned off while engine is running, current from the generator may cause arcing and burning of the main switch contact points. To prevent this, a capacitor has been connected across the D.C. main switch.

This is a non-polarized type capacitor (neither post is negative or positive until connected). However make sure that the lead from the capacitor to the cold side of the D.C. main switch is connected to the same terminal as the wire from the booster rectifier.

The remaining lead from the capacitor is connected to the hot side of the main switch, to the terminal directly opposite the one previously connected.

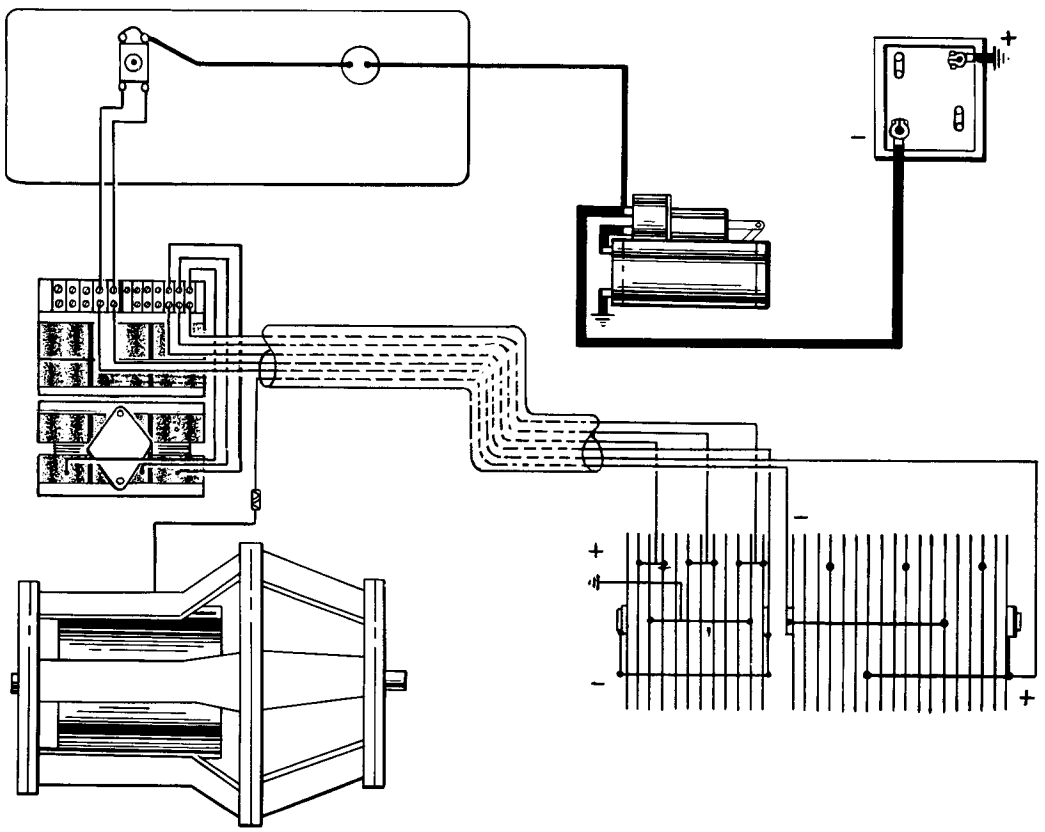


Figure E-6. Battery Charging Circuit

Voltage Boost Circuit

When the main switch between one of the motors and the generator is closed, current flows from the generator to the motor through the primary windings of the constant voltage transformer and through the main switch. If the load on the motor increases or if additional motors are operated the current flow from the generator through the primary windings of the constant voltage transformer increases to handle the additional load. The constant voltage transformer is a current type transformer and the secondary output is directly proportional to the amount of current flowing through the primary windings. When current flows through the primary windings, induced current at reduced voltage flows from the secondary windings, the amount dependent upon the amount of the current flowing in the primary. Cur-

rent flows from the secondary windings to the booster rectifier. The booster rectifier, which is connected in the excitation circuit, adds pulsating direct current to the excitation current supplied by the main transformer (see battery charging circuit above) increasing the generator output to take care of the increased load without a drop in terminal voltage at the generator output terminals.

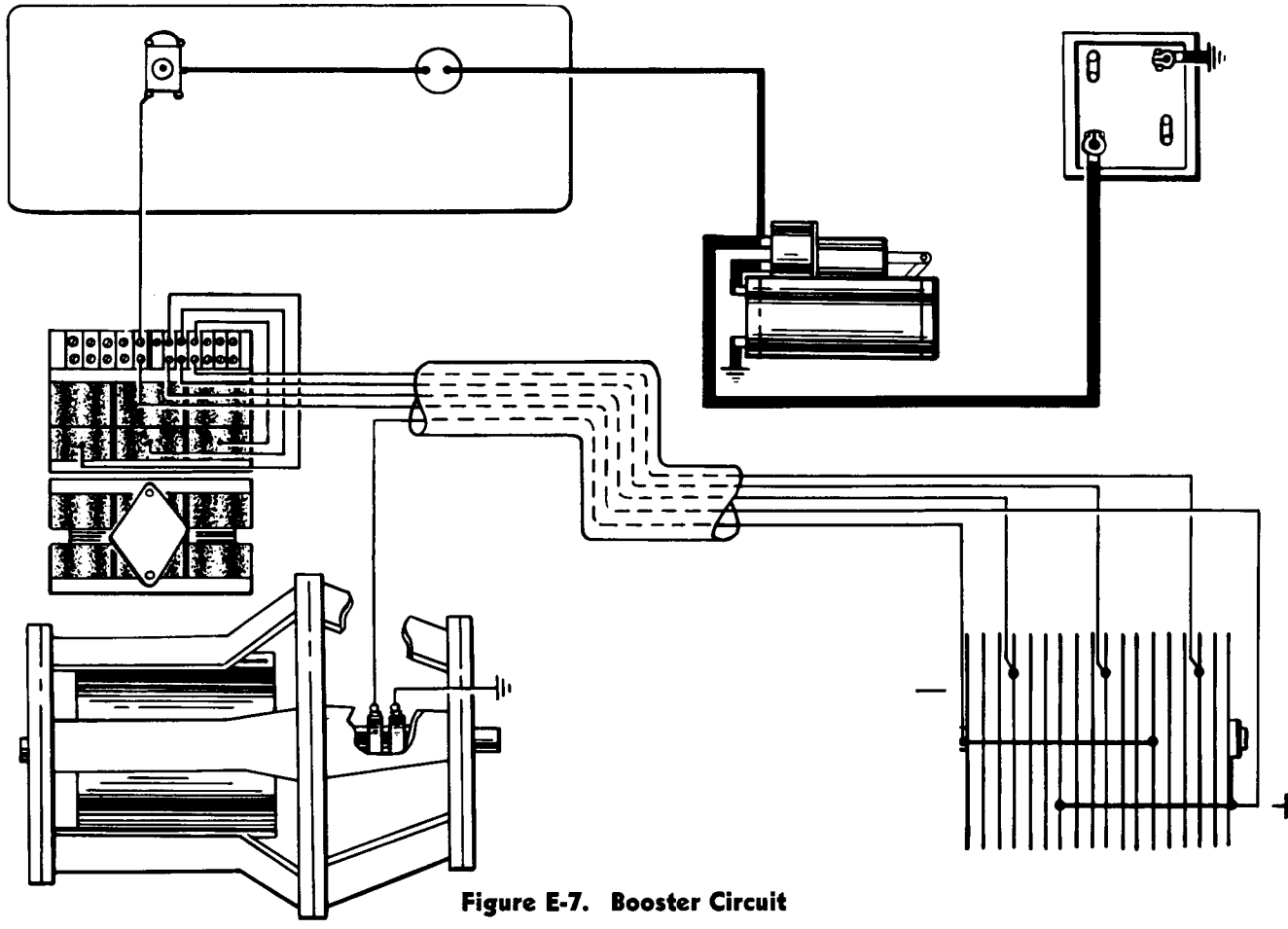


Figure E-7. Booster Circuit

Removal

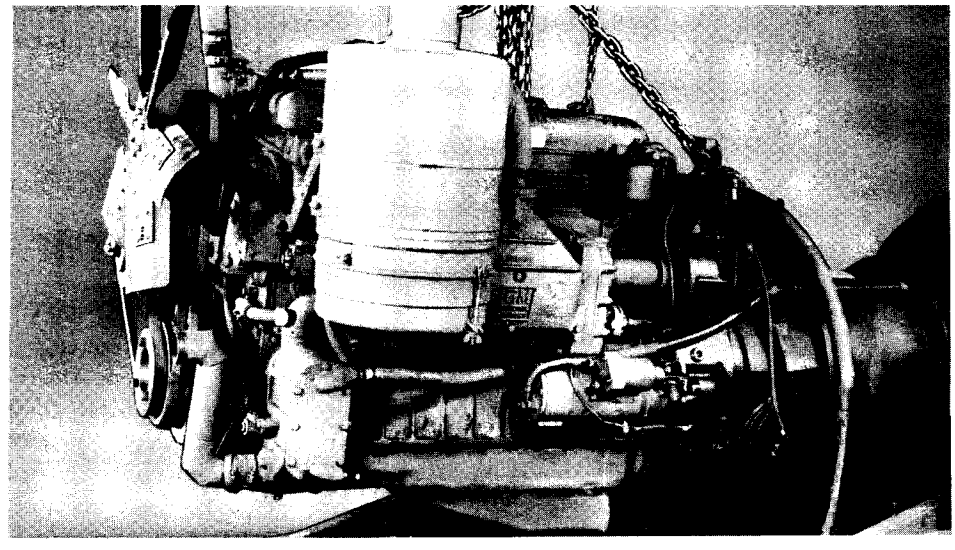
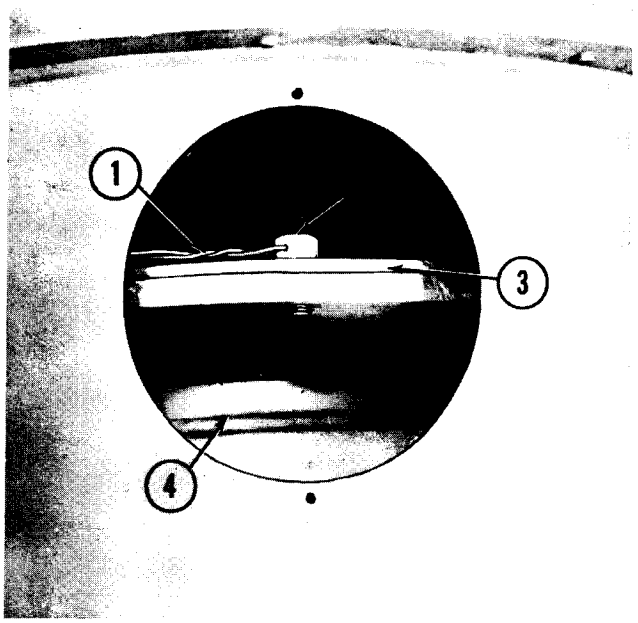


Figure E-8. A.C. Generator and Engine

Remove engine, generator and torque converter. (See Section D).

Remove the top cover plate to the access opening in the torque converter housing. (Fig. E-9). Cut the wire and remove capscrews which hold the converter drive plate and the generator coupling plate together.

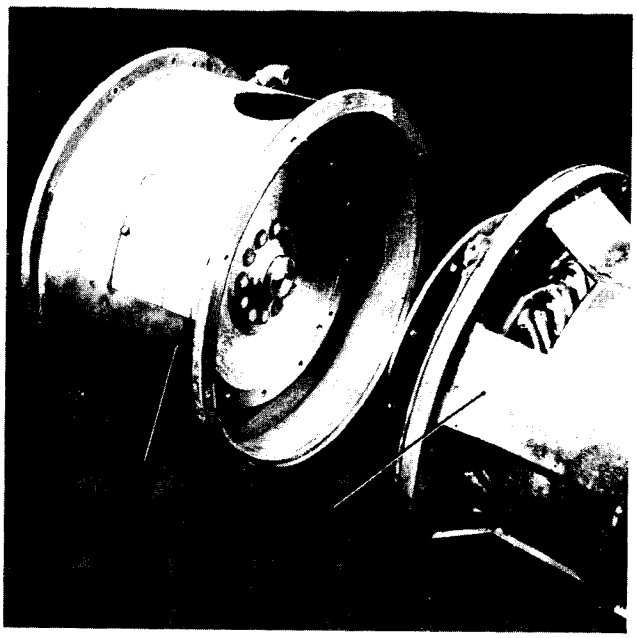


1. LOCKWIRE
2. CAPSCREW
3. ADAPTOR STRUCTURE
4. TORQUE CONVERTER FLYWHEEL

Figure E-9. Generator Coupling Plate and Torque Converter Adaptor

Remove the capscrews which connect the converter housing and generator end bell to the generator stator (Fig. E-9). Remove shims and tie together so they may be replaced when the generator and converter are reassembled.

Separate the torque converter and generator. (Fig. E-10).

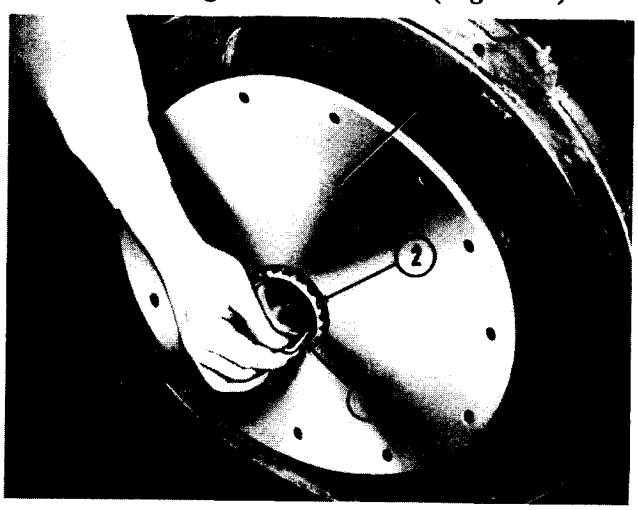


1. TORQUE CONVERTER
2. GENERATOR

Figure E-10. Torque Converter and Generator, Separated

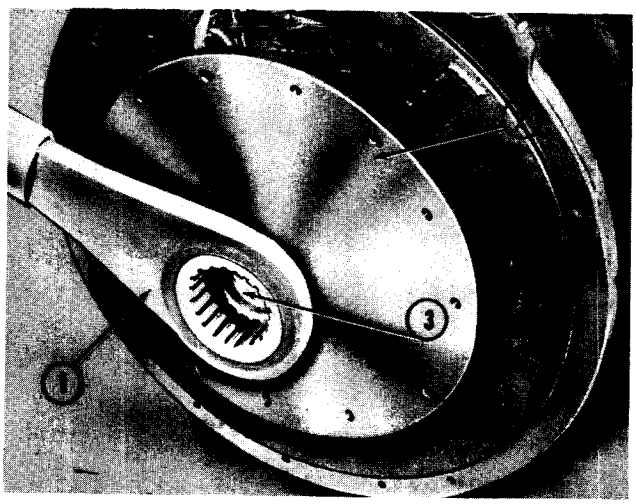
Disassembly

With an Allen wrench, remove the locking setscrew from the generator locknut (Fig. E-11). Now remove the generator locknut with a special wrench and extension handle (Fig. E-12).



1. ADAPTOR STRUCTURE
2. SETSCREW
3. WRENCH

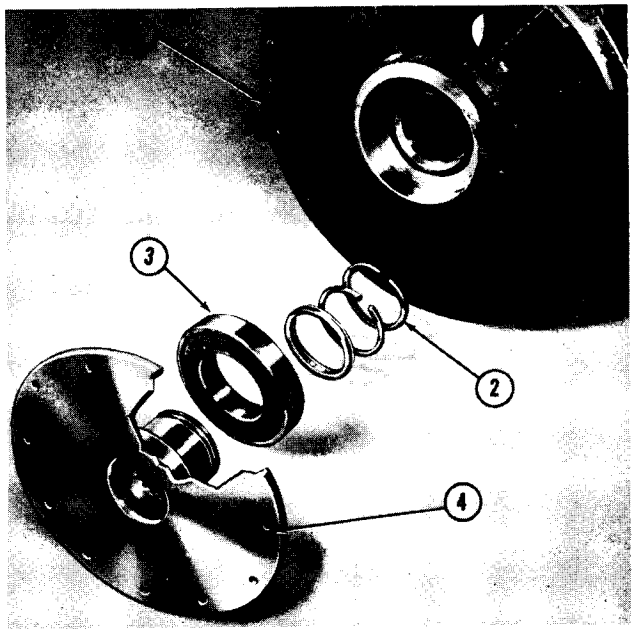
Figure E-11. Removing Locking Setscrew



1. WRENCH
2. ADAPTOR STRUCTURE
3. LOCKNUT

Figure E-12. Removing Locknut

The generator adaptor plate structure, bearing and piston rings may now be removed from the end bell (Fig. E-13).



1. END BELL
2. PISTON RINGS
3. BEARING
4. ADAPTOR STRUCTURE

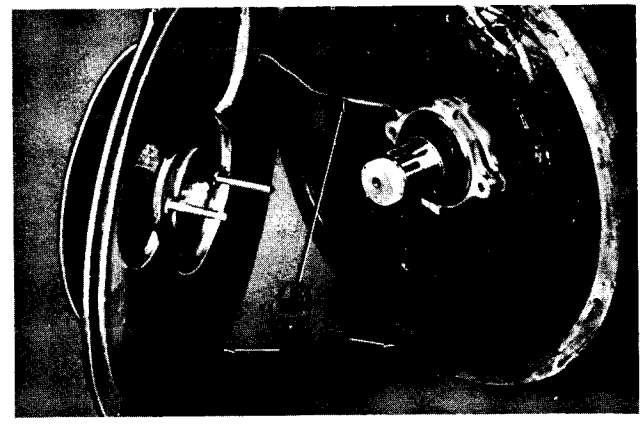
Figure E-13. Bearing, Piston Rings and Adaptor Removed

Now remove the end bell carefully from the generator taking care not to break the brush holder ground wire (Fig. E-14).

Disconnect the ground wire on the end bell from the brush holder (Fig. E-14).

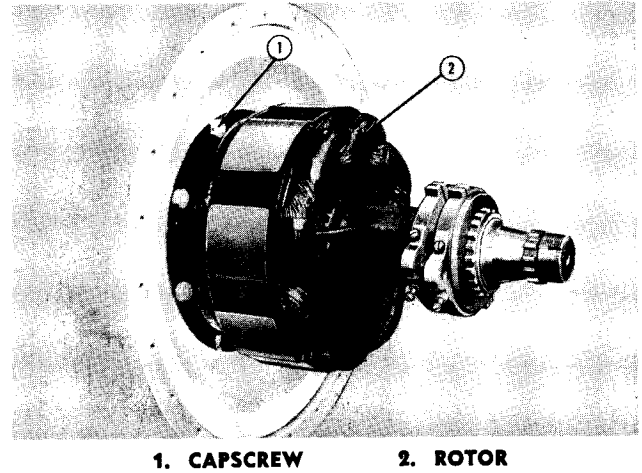
Remove capscrews holding stator to engine. Pull stator away from rotor taking care not to damage windings.

Remove rotor by backing out capscrews after cutting lockwires. To prevent damage to rotor windings, sling rotor to keep it from dropping to the floor when capscrews are removed. Take capscrews only half way out, pull on rotor, then take the remainder of the way out (Fig. E-15). CAUTION: Tape threads on end of rotor shaft to prevent damage to threads.



1. STATOR
2. END BELL
3. GROUND WIRE

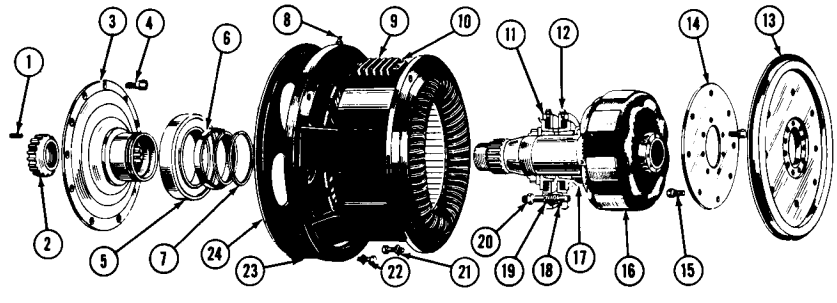
Figure E-14. End Bell Removed



1. CAPSCREW
2. ROTOR

Figure E-15. Removing Rotor

(Generators which are returned to the plant should not be shipped in with the end bell attached.)



1. SETSCREW
2. LOCKNUT
3. HUB
4. CAPSCREWS
5. BEARING
6. SLEEVE
7. PISTON RING
8. GREASE FITTING
9. TERMINAL
10. SCREW
11. BRUSH AND REAR HOLDER
12. SCREW AND WASHER
13. FLYWHEEL
14. COUPLING PLATE
15. CAPSCREW
16. ROTOR
17. FRONT BRUSH HOLDER
18. INSULATOR
19. SPRING
20. STUD
21. CAPSCREW AND LOCKWASHER
22. CAPSCREW AND LOCKWASHER
23. STATOR AND WINDING
24. END BELL

Figure E-16. A.C. Generator, Exploded

Reassembly

To reassemble the A.C. generator reverse the procedure outlined for disassembly. Assemble the adapter by first sliding the retainer ring onto the hub until it has passed the piston ring grooves. (Beveled edge of ring away from adaptor.) Place the two piston rings in the grooves of the hub. Compress the rings and position the retainer ring over them thus holding them in the compressed position. Now start the adaptor hub into the bore of the end bell. This will force the retainer ring back, freeing the piston rings in the bore of the end bell.

Reassemble the adaptor and torque the locknut to 1200 ft. lbs. Replace socket head setscrew.

Maintenance

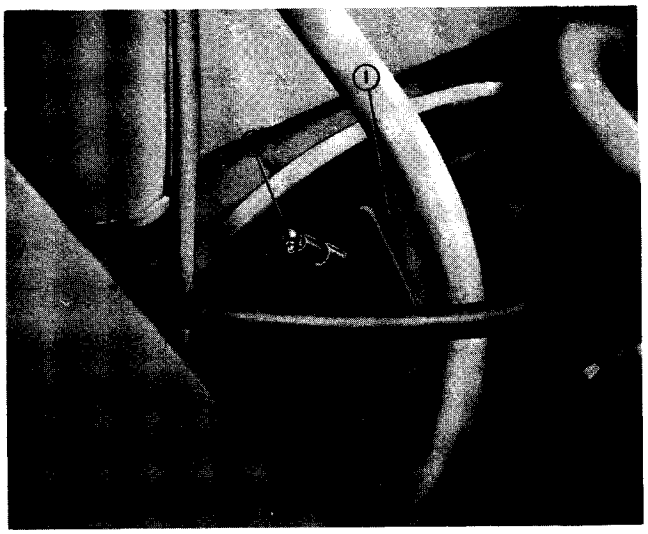
Inspect the Tournatractor generator at 50 shift intervals for any large accumulation of oil and dirt on the stator. An excessive amount of waste material at the point will prevent proper cooling of the generator. Make sure that the drains in the bottom of the engine compartment are open and the waste materials are draining away, since the drains sometimes plug up with mud and allow the dirt and water to build up to the level of the generator stator.

Inspect the stator windings. Remove any accumulation of grease and dirt with a low pressure siphon hose and a hose and a cleaning fluid, such as carbon tetrachloride. After the windings have been washed down with the cleaning fluid, blow off the surplus fluid with air.

Make sure that the leads that are connected to the transformer and generator terminal strips are tight.

Remove any excess accumulation of grease and dirt found on the terminal strip with cleaning fluid.

Lubricate the generator rear bearing every shift. Use high temperature ball bearing grease. Do not over lubricate.



1. GENERATOR STATOR 2. GREASE FITTING

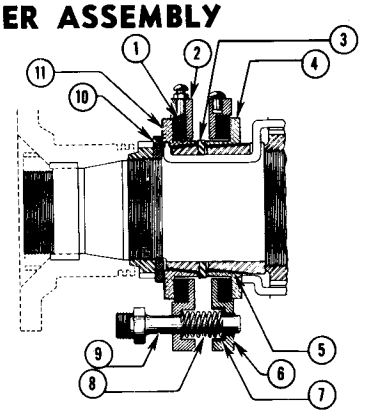
Figure E-17. A.C. Generator Lubrication Point

A.C. GENERATOR BRUSH HOLDER ASSEMBLY

Two aluminum brush holders hold the segments of the generator brushes. The holder farthest from the engine is grounded to the holding studs and to the generator end bell. The remaining holder is insulated from the holding studs by insulating bushings. This insulated holder is connected to the terminal strip on the generator stator.

Each split type holder is composed of two half rings, held together by capscrews. Two clips are inserted between the two halves, extending slightly into the counterbore which holds the brush segments. These clips fit between the brush segments, preventing them from turning in the holder.

The brushes are made of graphite carbon. Non-adjustable springs between the brush holders give the required brush pressure as the brush makes side contact with the rotor slip rings.



1. GRAPHITE RING BRUSHES
2. BRUSH HOLDER (REAR)
3. CENTER WASHER
4. SLIP RING (FRONT)
5. MICA SHIM
6. BRUSH HOLDER (FRONT)
7. INSULATOR
8. SPRING
9. STUD
10. MICARTA WASHER
11. SLIP RING (REAR)

Figure E-18. Brush Holder Assembly

Maintenance

The generator brushes should be inspected for wear whenever the generator is disassembled. The brushes are 3/8" thick when new and should be discarded when one-half of the brush has worn away.

Be sure the insulated bushings are not crushed.

Check for grounds or shorts between the brush holders or between brush holders and the frame of the machine.

Disassembly

Remove the two socket head capscrews holding the two pairs of brush holder half-rings together.

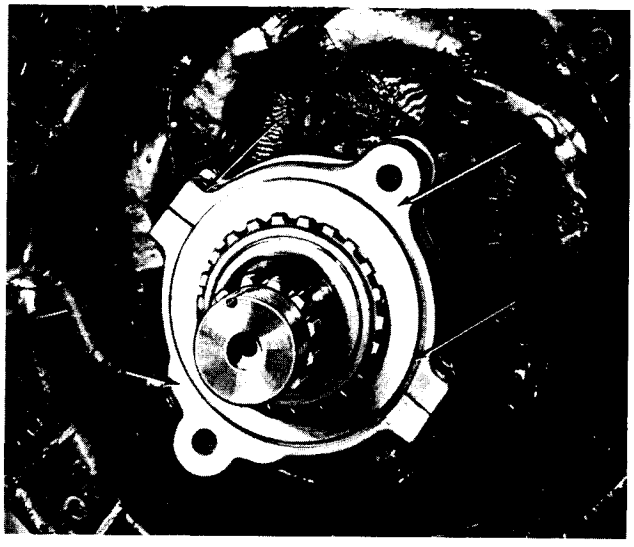
Remove the half-rings, brush segments and springs from around the rotor shaft.

The brush segments, tension springs, half-rings, clips and bushings may now be separated.

To replace the brush holder assembly, assemble the two top half-rings, brush segments and tension spring. Compress spring by squeezing half-rings together and place over rotor shaft between the rotor slip rings.

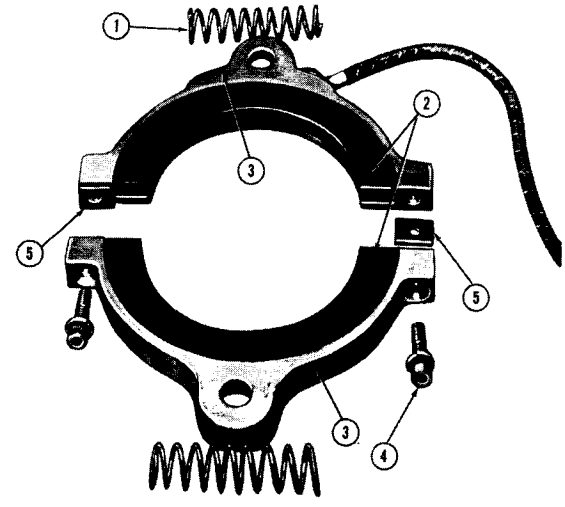
Assemble bottom half-rings in the same manner. Place clips on bottom half-rings, compress spring and place over bottom of rotor shaft.

Replace socket head capscrews and lockwashers.



1. CAPSCREW
2. BRUSH HOLDER
3. BRUSH
4. ROTOR SHAFT

Figure E-19. Removing Brush Holders



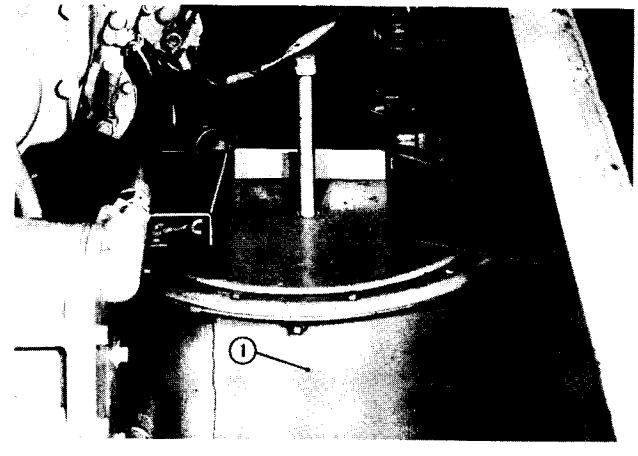
1. SPRINGS
2. BRUSH SEGMENTS
3. HALF-RINGS
4. CAPSCREWS
5. CLIPS

Figure E-20. Brush Holder

RECTIFIERS

The rectifier assemblies on later type machines are located in the engine intake air stream. One side of the rectifier housing is connected to the air cleaner discharge pipe while the other side is connected to the engine air intake.

The rectifier tank for machines with the rectifiers mounted in oil is located in the lower right hand side of the engine compartment, against the final drive case. The rectifier assembly consists of two rectifiers, a constant voltage rectifier and a main rectifier. The basic function of the rectifiers is to change the alternating current from the transformer secondary windings to direct current. Each rectifier is connected to a different circuit, the 18-plate stack into the voltage boost circuit, and the 12-plate stack into the battery charging circuit.



1. RECTIFIER TANK
2. MAIN CASE

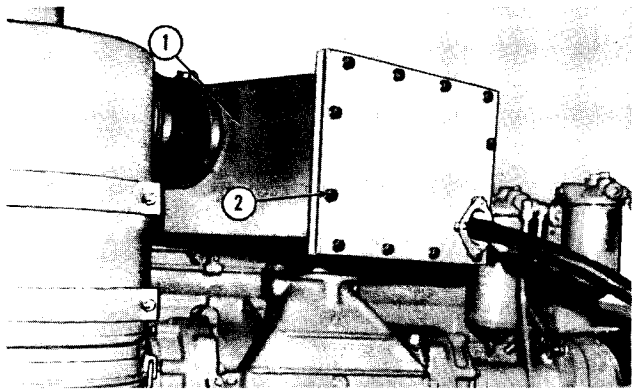
Figure E-21. Rectifier Tank

Removal

To remove the rectifiers from the air stream, first remove the capscrews and lockwashers securing the lid to the housing. (Fig. E-22.)

Remove lid and gasket with rectifiers attached from the housing.

Loosen the hose clamp on the housing intake

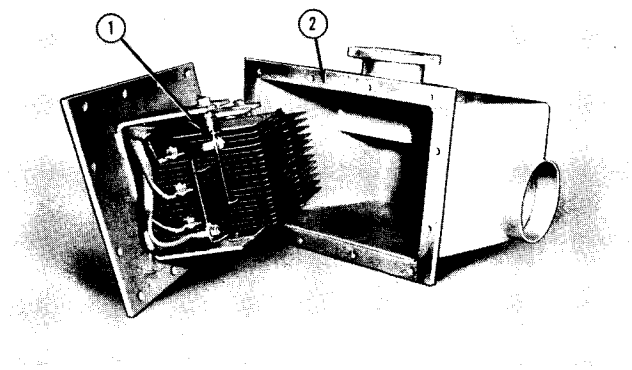


1. RECTIFIER HOUSING 2. CAPSCREW

Figure E-22. Rectifier Housing

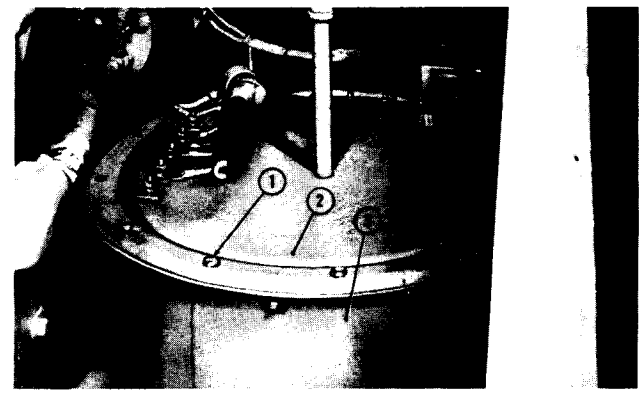
hose and remove the capscrews securing the rectifier housing to the engine air intake, remove rectifiers.

For rectifiers in oil, first remove terminal covers on rectifier tank lid.



1. RECTIFIERS 2. HOUSING

Figure E-23. Removing Rectifiers



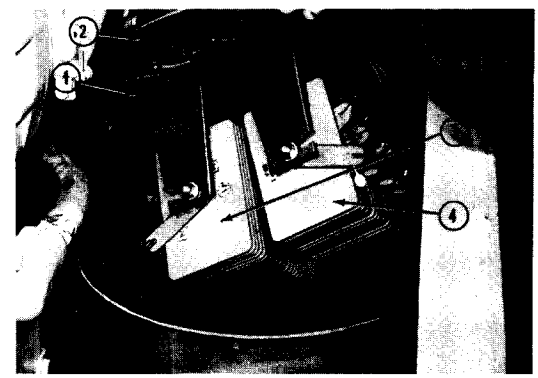
1. CAPSCREWS 2. LID 3. TANK

Figure E-24. Removing Capscrews

Disconnect all wires at terminals on rectifier tank lid.

Remove capscrews securing the rectifier tank lid to the rectifier tank.

Remove lid, gasket and rectifier assemblies.



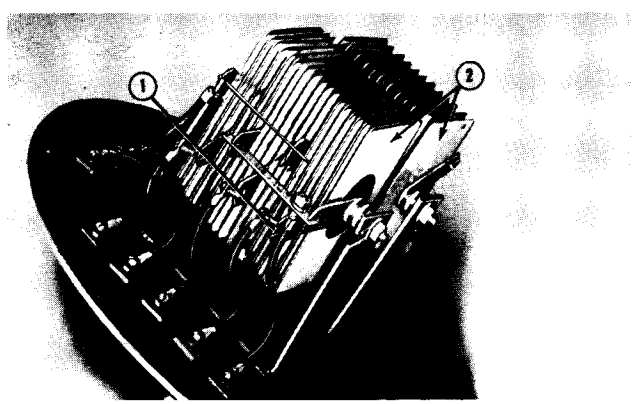
1. LID
2. GASKET
3. CONSTANT VOLTAGE RECTIFIER
4. MAIN RECTIFIER

Figure E-25. Removing Rectifiers from Tank

Disassembly

The disassembly for both units is similiar.

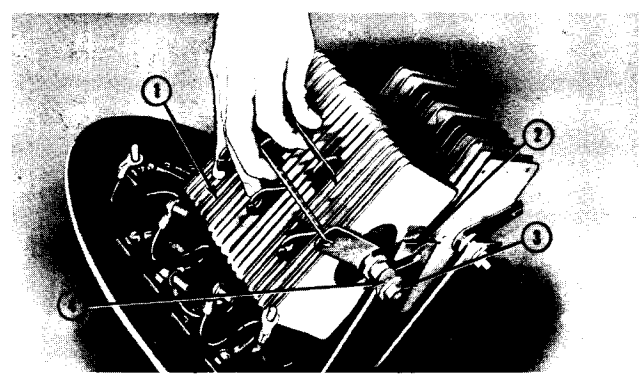
Disconnect the wires to the rectifier terminals. (Mark to facilitate reassembly.)



1. TERMINALS 2. RECTIFIERS

Figure E-26. Disconnecting Rectifier Leads

Loosen nuts on each end of rectifier mounting bolt and slide rectifier from between mounting bracket.



1. RECTIFIER
2. MOUNTING BRACKETS
3. NUTS
4. MOUNTING BOLT

Figure E-27. Removing Rectifier from Brackets

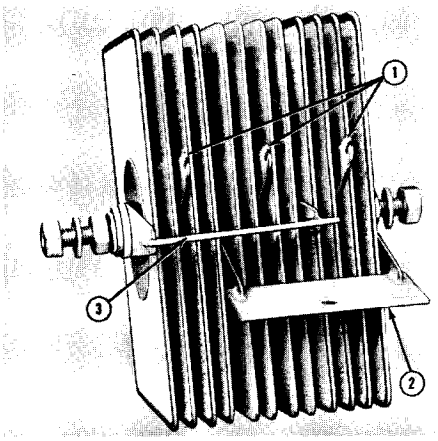
Reassembly

The constant voltage rectifier and the main rectifier should never be interchanged. Replacement must always be made with a rectifier with the same number of plates and stacked in the same way as the one being replaced.

The three A.C. terminals are color coded yellow and are not connected by a terminal bar. NOTE: A.C. terminals on 18-plate rectifier are double terminals and each pair is connected by a short terminal bar.

The D.C. positive terminal is color coded red and is always connected to the brass collector ring on one end of the rectifier. It is in between the three A.C. terminals and the D.C. negative terminals.

The D.C. negative terminal is color coded black and is on the opposite side of the A.C. terminals, across the D.C. positive terminals.



1. A.C. TERMINALS 2. D.C. NEGATIVE TERMINAL
3. D.C. POSITIVE TERMINAL

Figure E-28. Rectifier

Service

Check the oil level in the rectifier tank every 10 shifts. Change the oil whenever water and dirt are present in any quantity. Use a good grade transformer oil. Keep the level at least 1" above the rectifier plates. The capacity of the rectifier tank is 7 gals.

Check the selenium coating on the plates for flaking or purple discoloration. If large areas of these conditions exist the rectifier should be tested as outlined in Section "L" and replaced if necessary

CONSTANT VOLTAGE SYSTEM

The constant voltage system maintains the generator output at 300 V.A.C. at 1800 engine R.P.M. under normal operating loads.

The constant voltage system is made up of the following two units plus connecting conductor cables.

1. Constant Voltage Transformer — delivers alternating current at a reduced voltage to the rectifier in proportion to the current flowing through the electric motor windings.

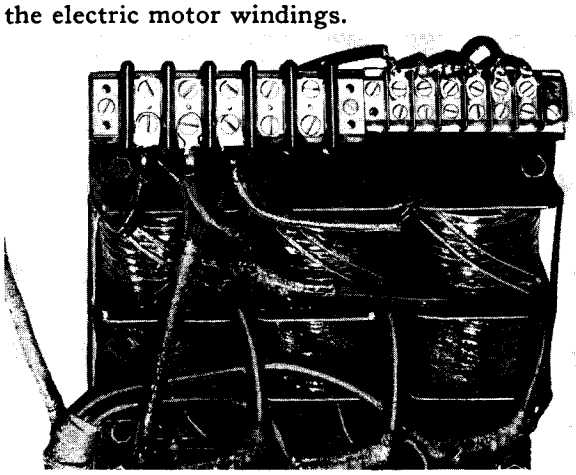


Figure E-29. Constant Voltage Transformer

2. Rectifier — receives alternating current from the constant voltage transformer and delivers direct current to the excitation current.

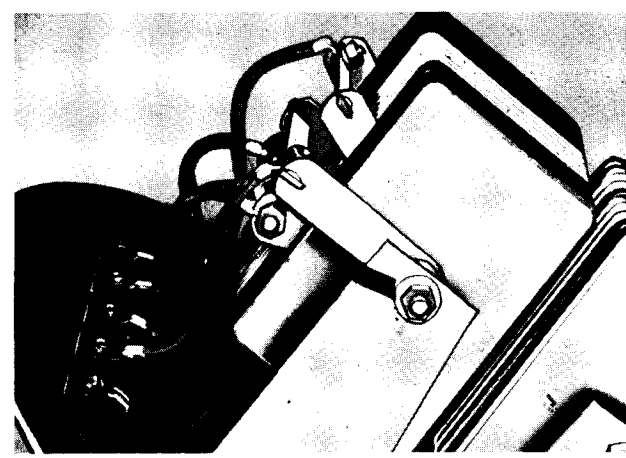


Figure E-30. Constant Voltage Rectifier

The 18 selenium coated rectifier plates allow current to pass in only one direction and the alternating current is transformed by the rectifier into direct current.

Maintenance

Since the constant voltage system has no moving parts, it presents none of the maintenance problems common with mechanically operated unit.

The most important single item of maintenance is one of cleanliness.

Keep all connectors and terminal screws tight and clean.

MAIN TRANSFORMER AND BATTERY CHARGING RECTIFIER

The battery charging circuit has no moving parts. The circuit includes the main transformer, rectifier and connecting cable.

The transformer delivers alternating current at a reduced voltage to the rectifier.

The positive (+) side of the rectifier (marked with red paint on the rectifier) is grounded to the frame of the machine. The negative (—) side (marked with black paint on rectifier) is connected to the D.C. main switch on the instrument panel.

The ammeter indicates the charge rate.

The ammeter is connected to the battery through a lead to the cranking motor solenoid switch.

The normal rate of charge at governed engine R.P.M. with no load on the electrical system is approximately 15 to 20 amperes.

The unique feature of the main transformer is the flux bridge. This bridge is an iron core which is movable. The flux bridge is adjusted by removing or adding fiber shims beneath the bridge. A 1/16" shim increases the ampere output by approximately 10 amperes.

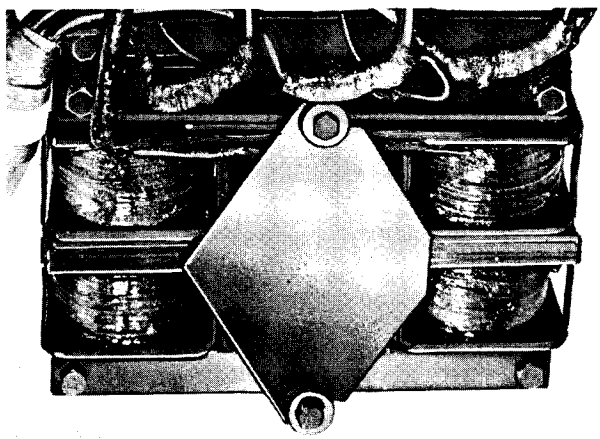
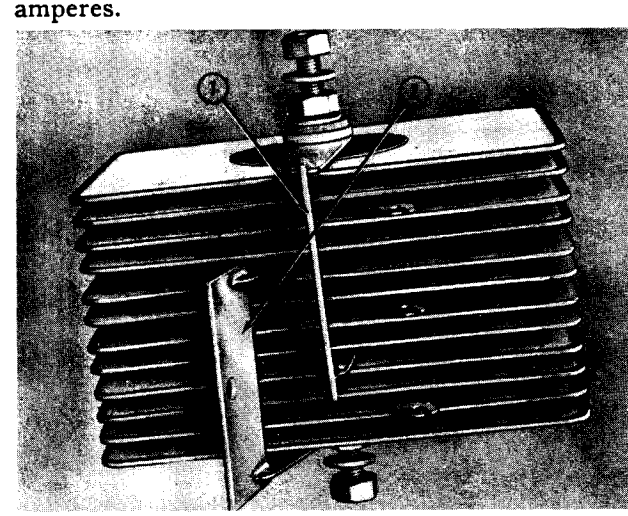
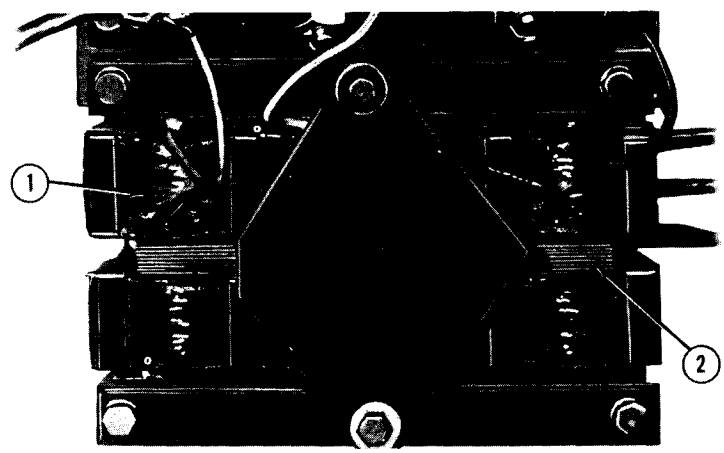


Figure E-31. Main Transformer



1. POSITIVE TERMINAL **2. NEGATIVE TERMINAL**

Figure E-32. Main Rectifier



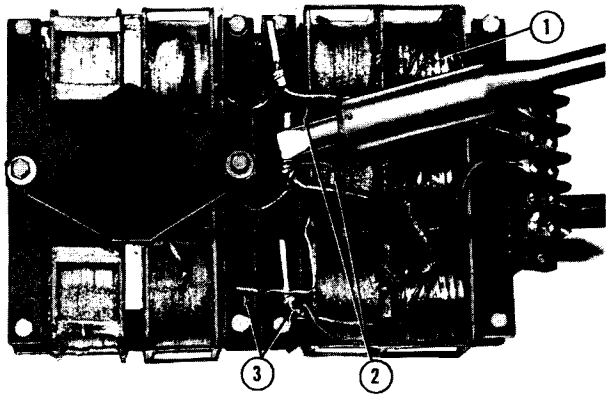
1. MAIN TRANSFORMER **2. FLUX BRIDGE**

Figure E-33. Flux Bridge

Replacement of Transformers

CONSTANT VOLTAGE TRANSFORMER — first remove the entire transformer unit from the machine.

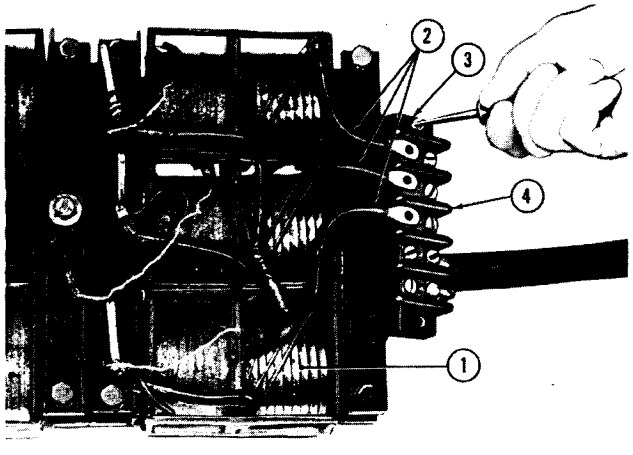
Separate generator leads and main and constant voltage transformer primary winding leads by heating the splices (Fig. E-34).



1. CONSTANT VOLTAGE TRANSFORMER
2. REACTOR LEADS 3. PRIMARY COIL LEADS

Figure E-34. Disconnecting Primary Coil Leads (Generator Leads Removed.)

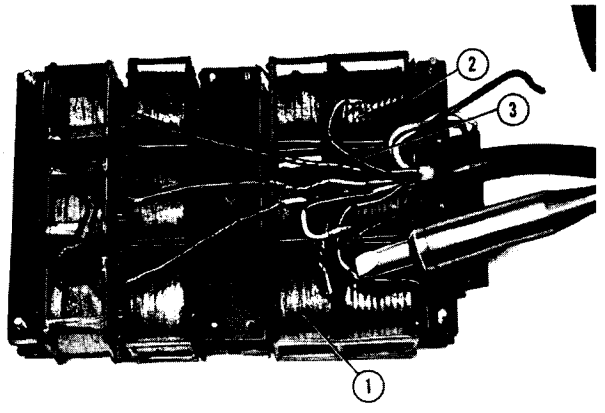
Disconnect the three primary leads at the transformer terminal strip. Remove the terminal strip mounting screws and remove strip from the transformer frame (Fig. E-35).



1. CONSTANT VOLTAGE TRANSFORMER
2. PRIMARY LEADS 3. TERMINAL STRIP 4. SCREWS

Figure E-35. Removing Terminal Strip

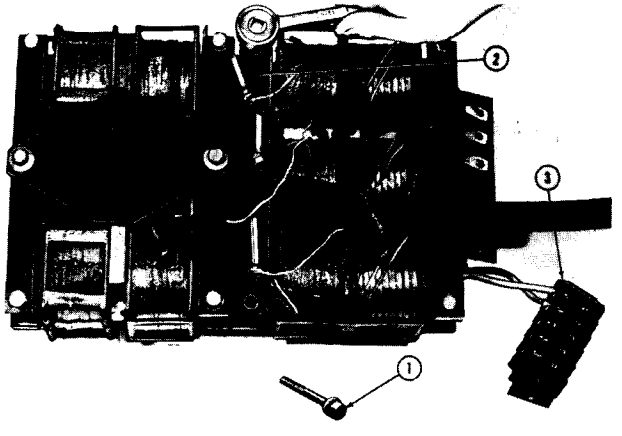
Turn transformers over and strip insulation at point where the three secondary winding leads join multiple cable leads. Slide insulation sleeves along wire until splices are exposed. Heat connections with soldering iron until wires can be separated (Fig. E-36).



1. INSULATION SLEEVES 2. SECONDARY WINDINGS
3. CONSTANT VOLTAGE TRANSFORMER

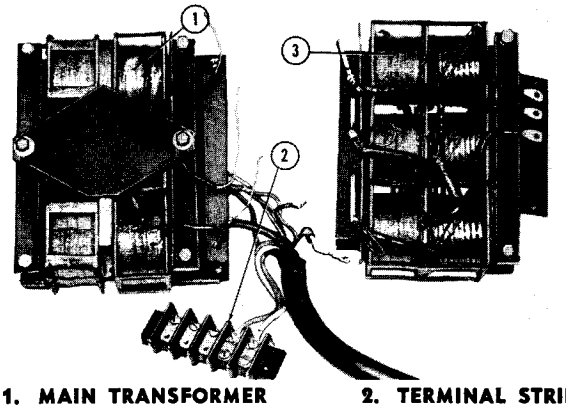
Figure E-36. Disconnecting Secondary Winding Leads

Remove the two capscrews from the connecting bar (Fig. E-37), remove bar and separate the transformer (Fig. E-38).



1. CAPSCREWS 2. CONNECTING BAR
3. TERMINAL STRIP

Figure E-37. Removing Capscrews from Connecting Bar



1. MAIN TRANSFORMER 2. TERMINAL STRIP
3. CONSTANT VOLTAGE TRANSFORMER

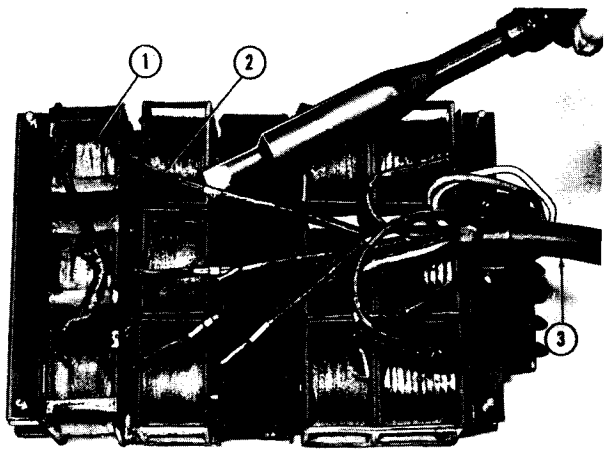
Figure E-38. Transformers Separated

MAIN TRANSFORMER — first remove the entire transformer unit from the machine.

Disconnect the main transformer primary coil leads from the primary windings of the constant voltage transformer as shown in Fig. E-34.

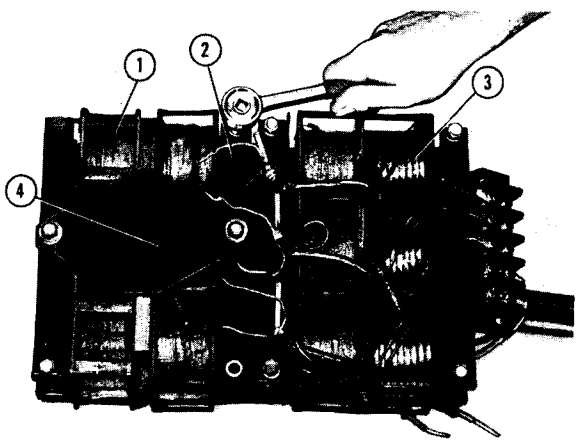
Turn transformers over and strip insulation from the three spliced connections of the main transformer secondary windings at the point where they join the three leads from the multiple lead cable. Slide insulation sleeves from connections and heat splices with a soldering iron until wires can be separated (Fig. E-39).

Remove the capscrews from each end of the connecting bar (Fig. E-40). Remove the capscrew securing the adjusting plate to connecting bar between the transformers.



1. MAIN TRANSFORMER
2. SECONDARY WINDING LEADS
3. MULTIPLE LEAD CABLES

Figure E-39. Disconnecting Secondary Coil Leads



1. MAIN TRANSFORMER
2. CONNECTING BAR
3. CONSTANT VOLTAGE TRANSFORMER
4. ADJUSTING PLATE

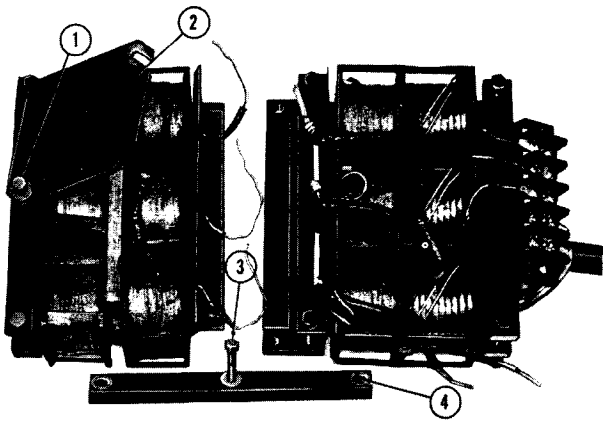
Figure E-40. Separating Transformers

Loosen other capscrew until plate can be moved aside. Remove bar and separate the transformers (Fig. E-41).

When returning main transformer to the factory for replacement, be certain adjusting plate and magnetic bridge are included.

REASSEMBLY — to reassemble transformers, reverse the disassembly procedures described above.

When re-connecting leads, be certain all wires have been scraped clean. After splicing leads together, solder each connection to insure a good contact.



1. CAPSCREWS
2. ADJUSTING PLATE
3. CAPSCREW
4. CONNECTING BAR

Figure E-41. Transformers Separated

Slide insulation sleeves over splices and secure each sleeve into place with glass fiber tape. Paint all insulated connections with glyptol solution or its equivalent.

Later machines may be equipped with transformers that have two terminal strips. These transformers do not require unsoldering of connections to separate the transformer units from each other.

To replace the transformers follow the instructions below.

MAIN TRANSFORMER — first disconnect leads to terminal strip. Remove mounting capscrews and remove entire unit from machine.

Disconnect the three leads from the main transformer secondary windings at the six-terminal strip (right terminal strip when transformer is mounted on machine).

Disconnect the three leads from the main transformer primary windings at the five-terminal strip (left terminal strip when transformer is mounted on machine).

Remove the two capscrews from the connecting bar and separate the two units.

CONSTANT VOLTAGE TRANSFORMER — first

disconnect the leads from the constant voltage transformer secondary windings at the six-terminal strip.

Disconnect the leads from the constant voltage transformer primary windings at the five-terminal strip.

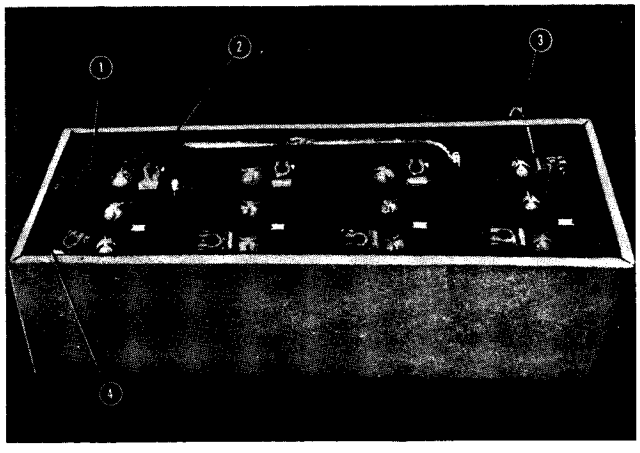
Remove machine screws securing the terminal strips to the transformer unit and remove the terminal strips.

Remove insulation from the soldered connection of the generator to transformer cable at the constant voltage transformer leads. Heat connections with soldering iron until wires can be separated.

BATTERIES

The 8 six volt batteries, mounted in two battery boxes with four batteries on the left hand side of the engine and four on the right, provide direct current for the cranking motor, initial excitation for the A.C. generator, instruments and lights. The four batteries in each case are connected in series to provide 24 volts D.C. The two sets of four batteries are connected in parallel to provide ample current for the system's operation.

The 6 volt current needed for the operation of the instruments and panel light is obtained by placing resistors in the 24 volt circuit to the instrument panel. Earlier machines have a 6 volt tap from the first battery from the ground in the right hand battery box.



1. BATTERY
2. 6 VOLT TAP
3. 24 VOLT LEAD
4. GROUND

Figure E-42. Right Hand Battery Box

Operate the batteries at or near full charge and keep the electrolyte at the proper level. A battery half charged or less cannot be depended upon for starting and wears out rapidly. A low battery indicates that the charging system is out of adjustment.

The following specific gravity readings indicate the different charge values: 1.280 — Full Charge, 1.225 — Half Charge, 1.150 — Discharged. (In tropical climates, full charge should read between 1.200 and 1.215. The battery charging circuit should maintain the battery above 1.155.)

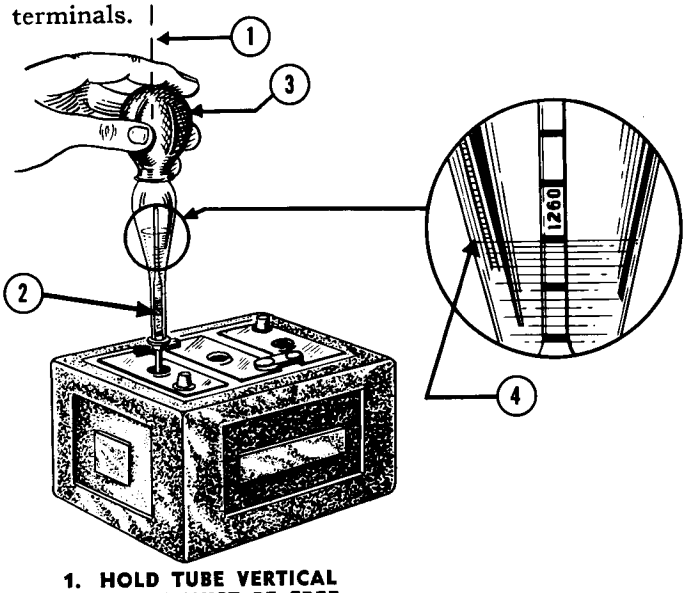
The voltage reading across each cell of the fully charged battery should be approximately 2 volts.

Keep the electrolyte above the plates so that the battery can produce its full capacity and not be damaged by over-heating. Maintain battery water level from the top of the plates to $\frac{3}{8}$" above the plates. Distilled water (never boiled or filtered) or water from local sources approved by the battery manufacturer should be used for filling storage batteries. The best time to add water is just prior to operation. This insures a good mixture between water and electrolyte. The water will stay on top in cold weather and freeze at about 32 degrees F., unless it is mixed.

The batteries should be kept clean and dry. Dirt and dampness furnish a path for electricity to leak away. Connections must be clean and tight to reduce resistance to the flow of current.

Dirt should be brushed off with a stiff bristle (non-metallic) brush. Wipe with a cloth wet with ammonia or bicarbonate of soda (one pound of soda to a gallon of water). Wash off with water. Examine vent plugs to see if the gas escape holes are clean afterwards.

Corrosion should be removed by scraping or with a stiff brush. Wash with ammonia or soda solution. After rinsing in water and drying, a thin coating of terminal grease or vaseline should be applied to the terminals.



1. HOLD TUBE VERTICAL
2. FLOAT MUST BE FREE
3. DO NOT DRAW IN TOO MUCH ELECTROLYTE
4. TAKE READING AT EYE LEVEL

Figure E-43. Checking Specific Gravity of Battery

TORQUE CONVERTER

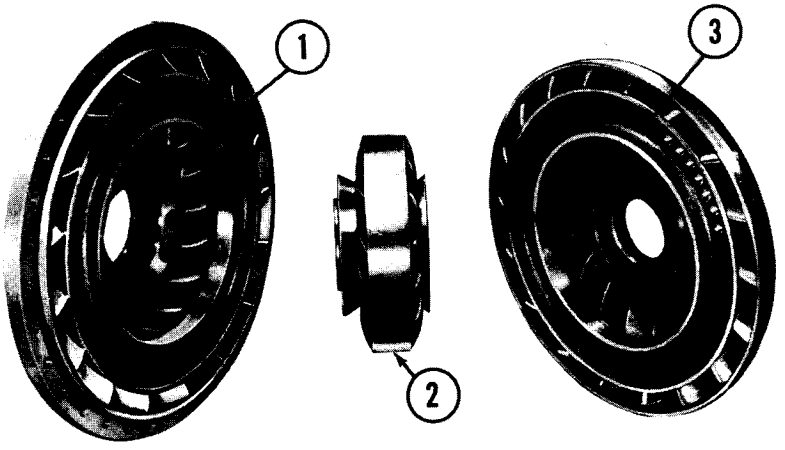
INDEX

F

TORQUE CONVERTER

PRINCIPAL OF OPERATION

The main parts of the converter are the pump, the turbine, and the reaction member. These three parts are single piece aluminum castings and each of them has a number of blades between the outer and inner shells (Fig. F-1).



1. PUMP 2. REACTION MEMBER 3. TURBINE

Figure F-1. Principal Parts of Torque Converter

Power Flow

The converter pump is driven by the engine.

The turbine is attached to the converter output shaft by a splined steel hub. The output shaft is supported by high capacity, deep groove ball bearings to withstand the thrust loads created between the pump and the turbine of the converter.

The reaction member is supported (between the pump and the turbine) and held from rotating by a splined sleeve attached to the converter housing.

Thus we have the pump, connected to the generator rotor which is driven by the engine (Fig. F-2); the turbine, connected to the output shaft and transmission but rotating free (no mechanical connection with the pump or the engine) (Fig. F-3); and the reaction member, non-rotating, positioned between the pump and the turbine (Fig. F-4).

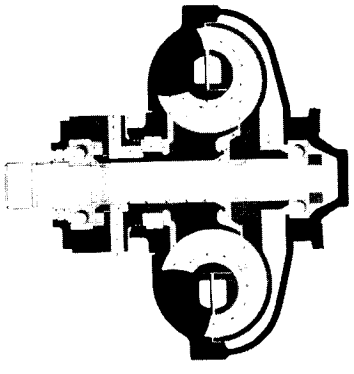


Figure F-2. Pump to Rotor

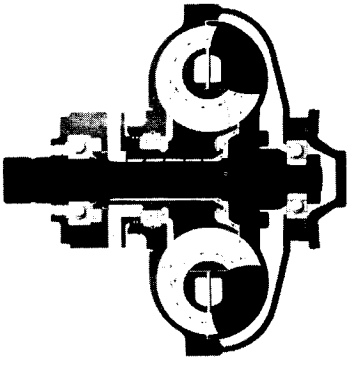


Figure F-3. Turbine to Output Shaft

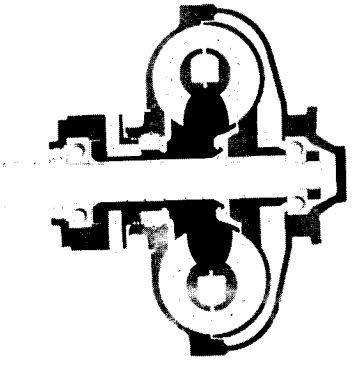


Figure F-4. Reaction Member to Converter Housing

Action of the Fluid Coupling

The blades in the pump are curved in one direction, whereas the blades in the turbine are much more sharply curved in the opposite direction. The curvature of these blades is of greatest importance for they are scientifically designed to develop high torque efficiently.

In visualizing the operation of the torque converter, it is important to remember that the fluid flows essentially in two directions; around the converter in the same direction of rotation as the converter pump and the input shaft; and around the torus shaped ring formed by the pump, turbine, and reaction member (Fig. F-5).

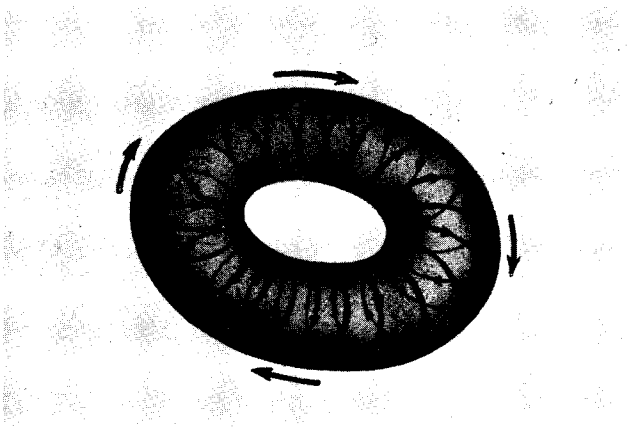


Figure F-5. Torus Ring

When the pump is spun by the engine, centrifugal force tries to throw the oil in pump outward. However, the oil can't be thrown outward in a straight line because of the curvature of the pump case and its blades. Therefore, the oil is thrown against the blades of the turbine (Fig. F-6). The force with which oil is thrown against the blades of the turbine causes the turbine to turn in the same direction as the pump is traveling.

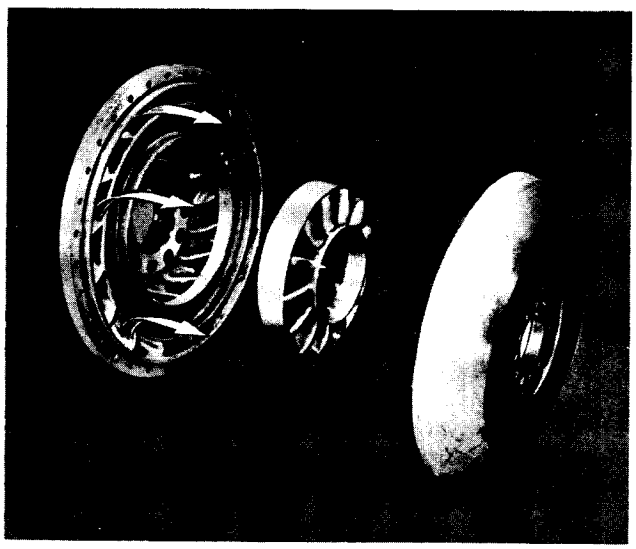


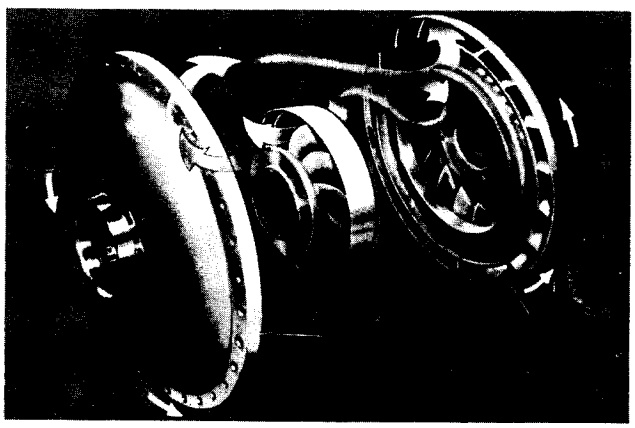
Figure F-6. Oil From Pump to Turbine.

After the oil passes over the turbine blades, it leaves the inner edge of these blades, traveling in a direction almost opposite to that in which the turbine is traveling (Fig. F-7).

If nothing were done to change the direction of the oil flowing from the turbine, it would strike the blades of the pump on their leading surfaces and tend to stop the pump . . . thus causing the engine to work much harder to keep the pump turning.

This is where the reaction member comes in. The reaction member has no mechanical connection to either the pump or the turbine. The reaction member fits in between the outlet of the turbine and the inlet of the pump — so all oil has to pass through it when returning from the turbine to the pump.

The reaction member changes the direction of the oil flowing from the turbine so it is going in the same direction as the pump. Also, the openings between the reaction member blades speed up the flow of the oil so that it re-enters the pump in such a manner that less engine torque is required to drive the pump at a given speed (Fig. F-7).



1. PUMP
2. REACTION MEMBER
3. TURBINE
4. DIRECTION OF ROTATION

Figure F-7. Flow of Oil Through Vanes

When the oil leaving the turbine strikes the blades of the reaction member, it tries to turn the reaction member in the opposite direction to which the pump is turning. But that is impossible because the reaction member is stationary, so the oil is deflected into the pump, traveling in the same direction as the pump.

Thus you see there is a continuous circulation of oil through the three units of the torque converter . . . from the pump through the turbine, through the reaction member, and back into the pump.

It is the speed with which the oil is circulated through the units of the torque converter that determines the degree of torque multiplication. For example, with the transmission engaged and the engine operating at idle speed, the turbine is standing still while the pump is turning. Accelerating the engine then causes the pump to force oil through the turbine and reaction member at the maximum rate. As a result a great volume of oil is forced through the turbine, causing the turbine to turn very slowly but with enormous twisting force as the machine begins to move. Thus engine power is fed to the drive wheels of the machine very smoothly and slowly but with great torque . . . to provide high pulling ability with low machine speed.

Since the wheels are driven by the turbine, the speed of the machine is dependent upon the speed of the turbine. As the speed of the machine picks up, the speed of the turbine begins to approach the speed at which the pump is turning. As the turbine turns faster and faster more and more centrifugal force is created within the turbine. The centrifugal force thus generated tries to throw the oil in the turbine towards the outer edge of the turbine, opposing the flow of oil from the pump into the turbine. Thus the rate at which oil circulates from pump to turbine to reaction member and back into pump decreases as turbine speed approaches pump speed. The amount by which torque is multiplied also decreases gradually as turbine speeds up and thus rate of circulation decreases.

When the speed of the turbine is almost as fast as the speed of the pump, the torque converter stops multiplying torque and acts as a fluid coupling between the engine and the driving mechanism of the machine. At no time is there a mechanical connection between the engine and transmission. Power always flows through the cushion of oil that assures smoothest performance.

Every variation between the speed of the pump and the speed of the turbine causes a proportionate variation in the rate (or ratio) at which engine power is fed to the drive wheels of the machine. So it is easy to see that the torque converter can send engine power to the drive wheels at countless number of different ratios, within its operating range. And that's equivalent of having an ordinary transmission with thousands of different gear-shifting positions . . . except that the torque converter automatically and scientifically selects exactly the right ratio to maintain a perfect power balance between the engine and the drive wheels of the machine at all times.

Efficient Operation of the Converter

The torque converter is efficient in a range from no slip to a 2 to 1 slip. In the Tournamatic transmission in the Tournatractor, 2nd speed is 2¼ times faster than 1st speed, 3rd speed is 2¼ times faster than 2nd speed, and 4th speed is 2¼ times faster than 3rd speed. So, whenever the torque converter slippage gets down below the 2 to 1 ratio a lower gear should be picked up to maintain efficiency. A greater slippage only means a loss of power and heating of the oil. There is no need for inefficient operation with the Tournamatic transmission and torque converter combination because the multiple for the ratios of the various speed in the transmission is so closely matched with the efficiency range of the torque converter. By selecting the proper speed the converter can be kept operating in its efficient range (from no slip to a 2 to 1 slip) continuously. However, no harm will be done if the torque converter is operated at a greater slippage for short periods of time.

One advantage of the torque converter is that regardless of the gear you use, if the load becomes too heavy to be handled without a lower ratio the torque converter automatically begins to lower the ratio in order to handle the load. Then, whenever the load gets lighter the torque converter automatically picks up speed back to the gear you are in.

Judge the performance of the machine by the speed at which it is traveling, not by the r.p.m.'s of the engine, since with the torque converter in the power train the engine speed will remain almost constant.

In low gear under normal operating conditions the torque converter drive will slip the drive wheels under the load.

In higher gear ranges, the load may stop the drive wheels, indicating that the speed selected is too high for the load. In this case the converter is slipping and will develop excessive heat unless lower speed range is selected.

In most cases, unless a noticeable increase in road speed is noticed after shifting to higher speed range, the lower range is the best.

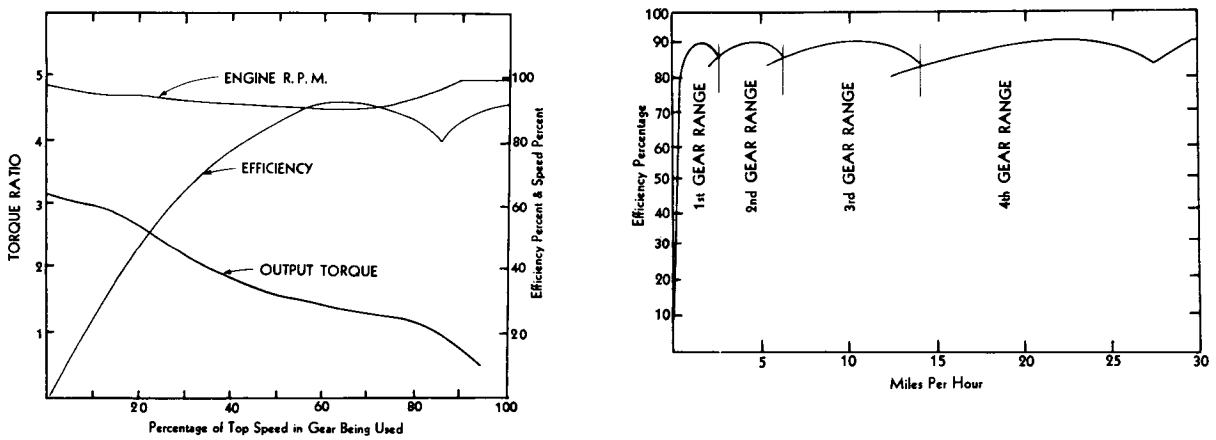


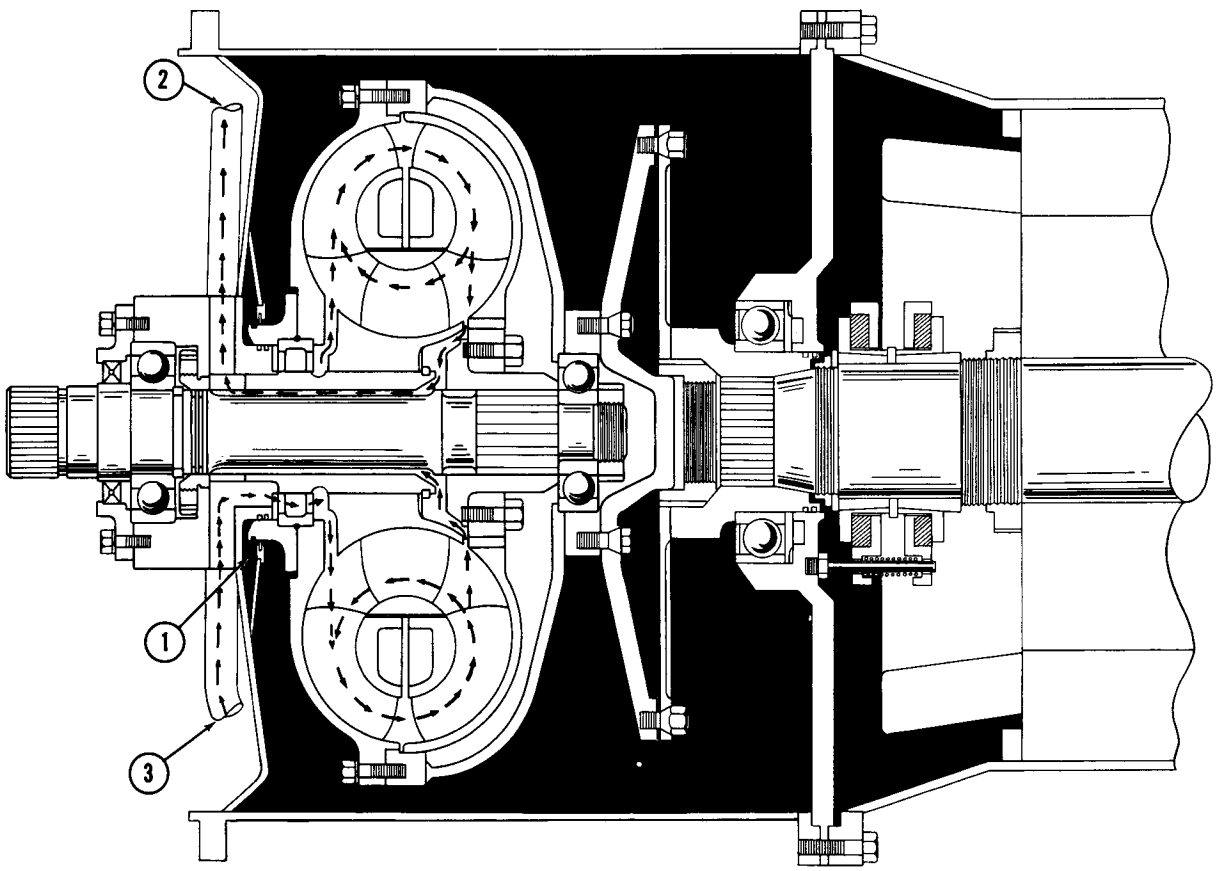
Figure F-8. Efficiency Charts

Oil Flow

The oil pump is driven by the left accessory shaft on the G.M. engine, or by a belt on the right side of the Cummins engine. The pump draws the oil from the oil tank through a 1¼" neoprene hose and delivers it to the torque converter, keeping the converter filled with oil and under pressure at all times.

Oil circulates through the torque converter as shown in Fig. F-9.

The oil enters the lower fitting on the converter



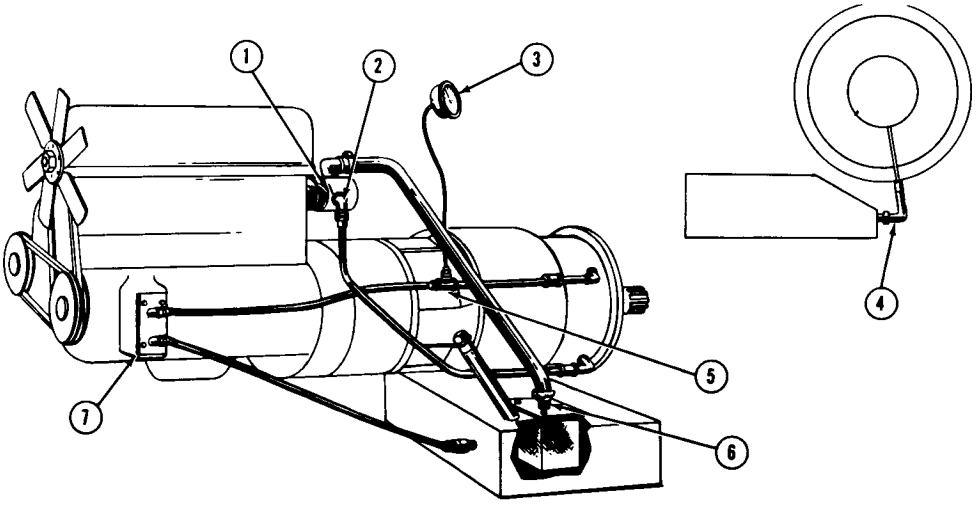
1. LEAKAGE CAVITY 2. OUT 3. IN

Figure F-9. Flow of Oil in Torque Converter

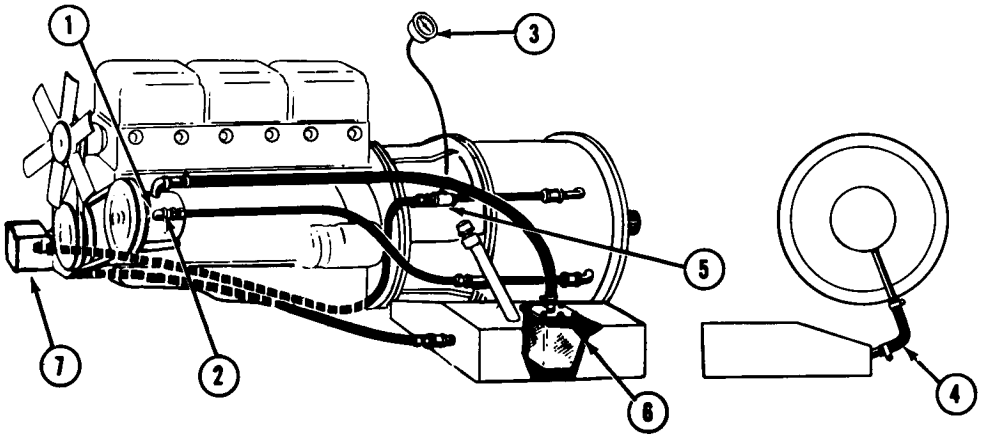
and is carried up to the converter housing's hub. The oil then flows through a passage between the reaction member sleeve and the hub into the converter pump bearing compartment. The oil spreads throughout the bearing compartment, then flows out into the converter chamber from between the reaction member and the pump. The oil flows out of the converter chamber between the reaction member sleeve and the turbine shaft back to the hub, then, finally, out through a hole drilled in the reaction member sleeve into the upper pipe and up to the outlet fitting on the converter. After the oil circulates through the converter, it is delivered to the oil cooler. The oil is delivered from the lower connection on the cooler back to the supply tank. The drain back line works as a scavanger and carries the leakage oil from the converter back to the oil tank.

All the rotating parts are surrounded by the stationary converter housing. There are no complicated oil seals holding oil pressure in this converter. Piston ring seals are used, not to keep it oil tight but to keep the converter filled with oil and under pressure. The leakage past these oil rings collects in a cavity and is returned to the oil tank. An oil screen is placed over the oil suction pipe to prevent foreign matter from entering the oil system. By removing the cover this screen can be easily cleaned.

The oil tank is placed beneath the converter and contains a breather and filler cap, and also an oil level bayonet gauge.



WITH G.M. ENGINE



WITH CUMMINS OR BUDA ENGINES

1. OIL PUMP ASSEMBLY
2. TEST HERE (50 P.S.I.)
3. TEMPERATURE GAUGE
4. DRAINBACK HOSE
5. TEST HERE (35 P.S.I.)
6. SUCTION PIPE
7. COOLER

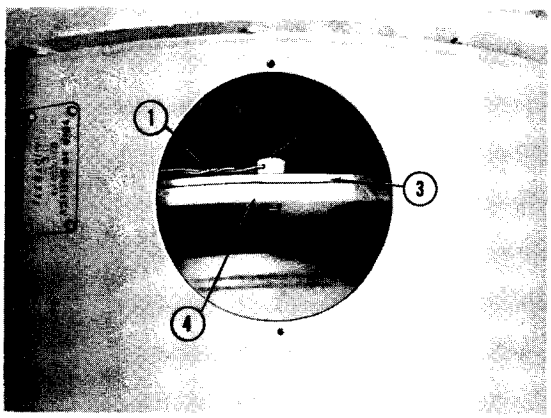
Figure F-10. Torque Converter Piping

REMOVAL AND DISASSEMBLY

Remove the engine, A.C. generator and torque converter from the Tournatractor. For further details, refer to Sections "D" and "E".

To remove the torque converter from the A.C. generator, first remove large cover plate from top of the converter housing. Reaching through the opening thus exposed, remove the capscrews fastening flywheel to adaptor structure. Shims are located between the adaptor structure and the flywheel, or between the generator end bell and the converter housing for alignment purposes. Remove the shims and keep together for use when unit is reassembled (Fig. F-11).

Attach a sling to the converter—remove the capscrews securing torque converter housing to generator housing and lift converter away from the generator.



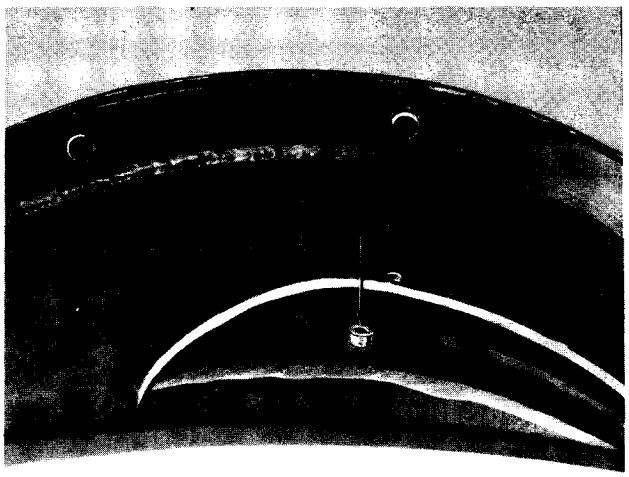
1. LOCKWIRE
2. CAPSCREW
3. ADAPTOR STRUCTURE
4. TORQUE CONVERTER FLYWHEEL

Figure F-11. Flywheel and Adaptor Structure, Assembled

Drain the oil from the converter unit by rotating unit until the drain plug is visible through the inspection port in top of housing. Remove plug and then rotate converter until the drain hole is on the bottom (Fig. F-12). Replace plug after unit is drained.

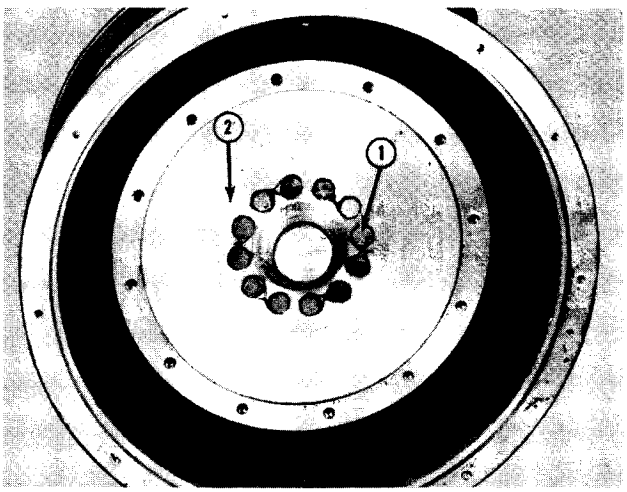
Remove the capscrews securing flywheel to the pump cover (Fig. F-13). Remove flywheel by tapping lightly around outside diameter of flywheel.

Remove the locking pipe plug and the locknut securing the pump cover bearing to the output shaft (Fig. F-14). Turn converter with flywheel side down and remove four capscrews which hold the cover plate to the housing wall (Fig. F-15) and remove cover plate. Reaching through the opening left by the cover plate, unlock metal locks and remove the capscrews securing the pump cover to the pump (Fig. F-16).



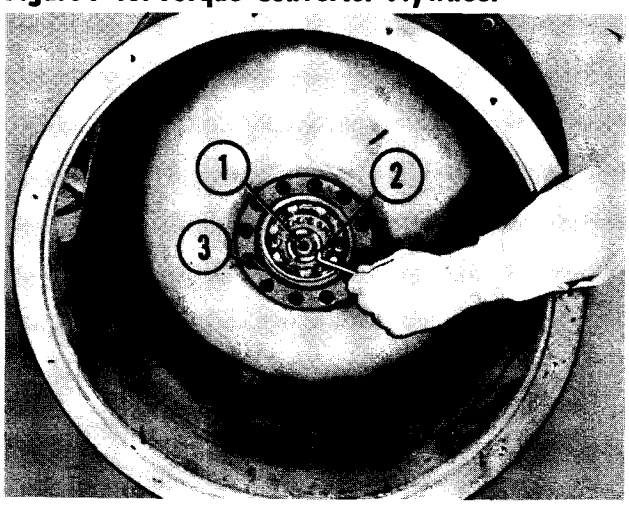
1. DRAIN PLUG

Figure F-12. Torque Converter Drain Plug



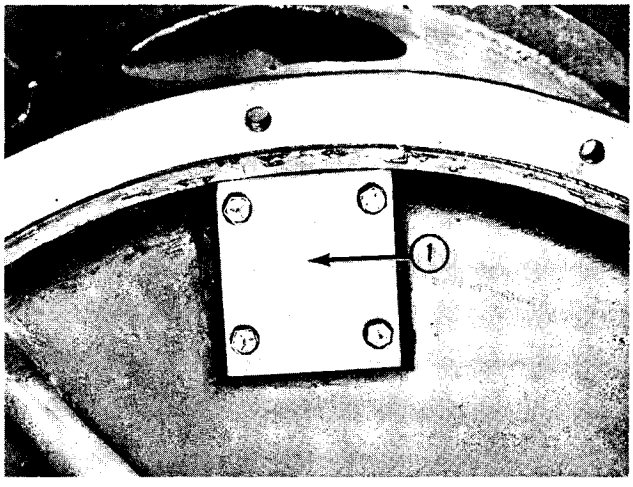
1. CAPSCREWS
2. FLYWHEEL

Figure F-13. Torque Converter Flywheel



1. OUTPUT SHAFT
2. PIPE PLUG
3. PUMP COVER BEARING

Figure F-14. Removing Locking Setscrew



1. COVER PLATE

Figure F-15. Torque Converter Cover Plate

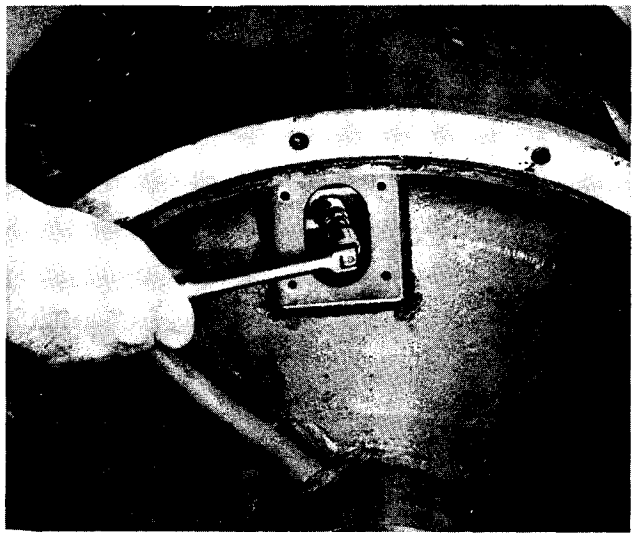
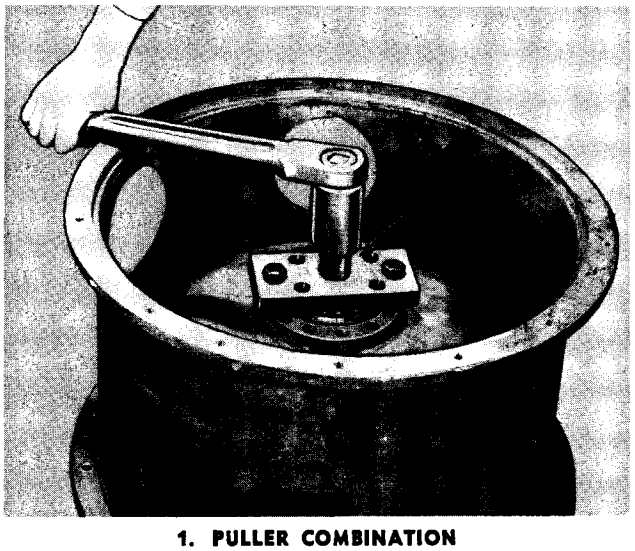
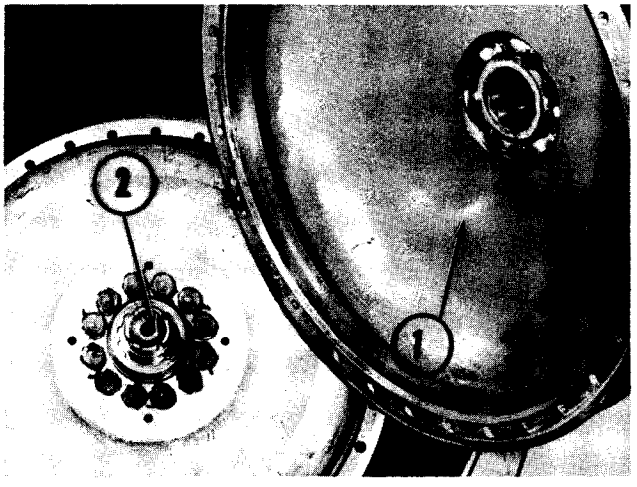


Figure F-16. Removing Capscrews Securing Pump Cover to Pump



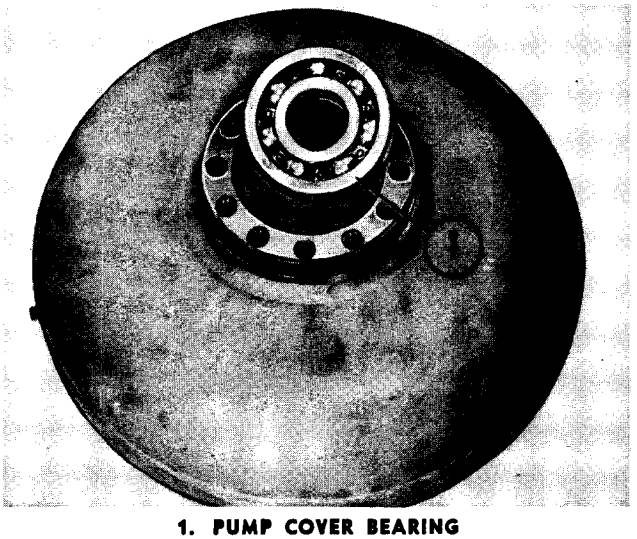
1. PULLER COMBINATION

Figure F-17. Pulling Pump Cover and Bearing



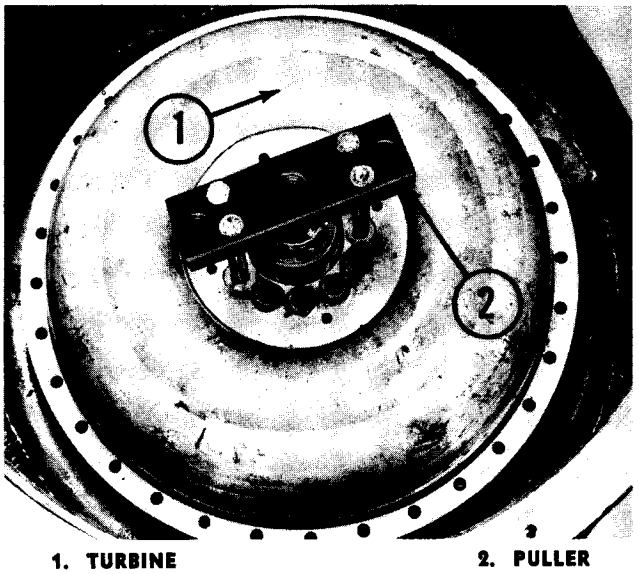
1. PUMP COVER 2. OUTPUT SHAFT

Figure F-18. Pump Cover and Bearing Removed



1. PUMP COVER BEARING

Figure F-19. Removing Bearing From Pump Cover



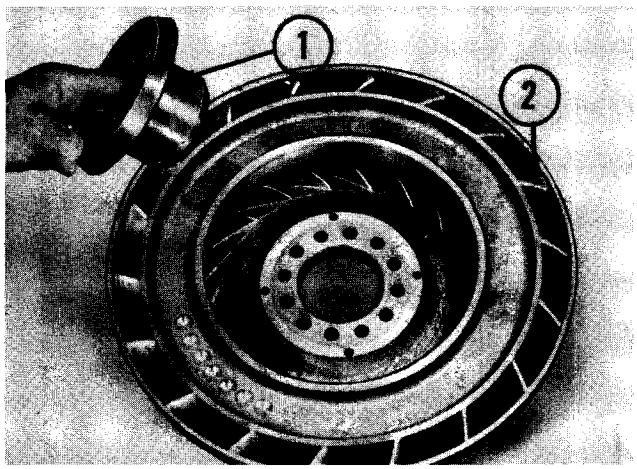
1. TURBINE 2. PULLER

Figure F-20. Pulling Turbine and Hub

Turn converter over, flywheel side up. Pump cover and bearing can then be pulled from the output shaft using puller combination 12, 16, and 19. See page A-14. See Figs. F-17 and F-18.

Remove bearing from pump cover (Fig. F-19).

Remove four capscrews from the group attaching the turbine to the splined hub and attach special puller, 32, page A-15, to the hub. Pull the hub and turbine together. CAUTION: DO NOT ALLOW PULLER CAPSCREWS TO EXTEND BEYOND THE INSIDE FACES OF THE STEEL HUB OR THEY MAY PRESS AGAINST AND DAMAGE THE REACTION MEMBER, MAXIMUM $1\frac{5}{16}$". (Fig. F-20).



1. HUB 2. TURBINE

Figure F-21. Torque Converter Hub and Turbine

Remove remaining capscrews securing the hub to the turbine and separate the two parts (Fig. F-21). Remove front snap ring from reactor sleeve. Heat the reactor hub slightly and remove reactor by hand. Do not use hammer.

Remove hub from turbine (Fig. F-21). Turbine is cast aluminum, take care not to damage.

Remove back reactor snap ring from reactor sleeve. Lift pump and pump bearing from converter housing.

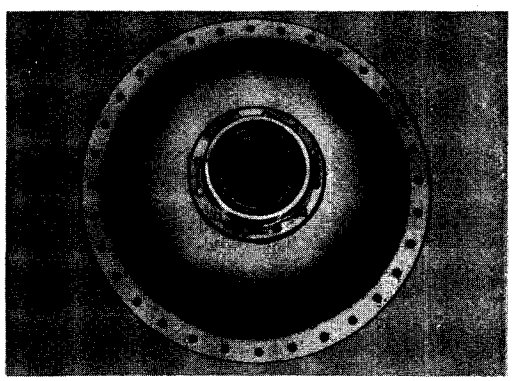
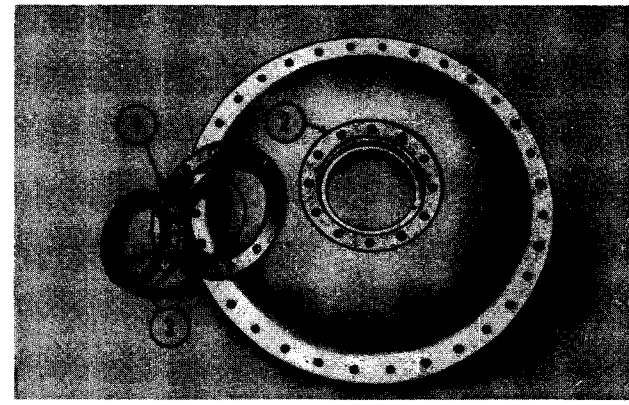
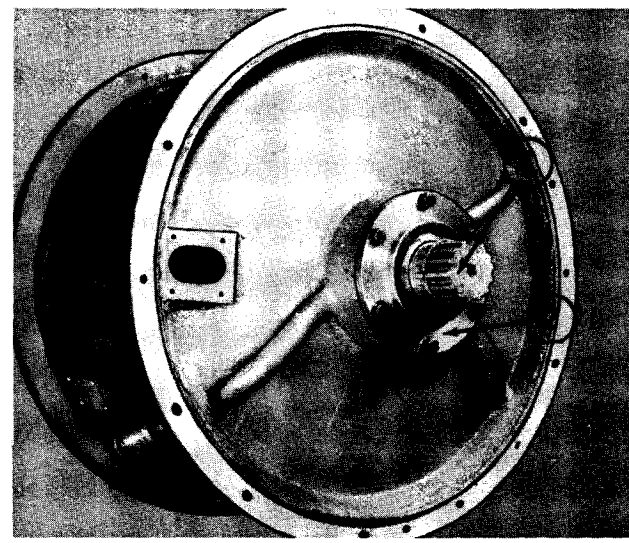


Figure F-22. Torque Converter Pump



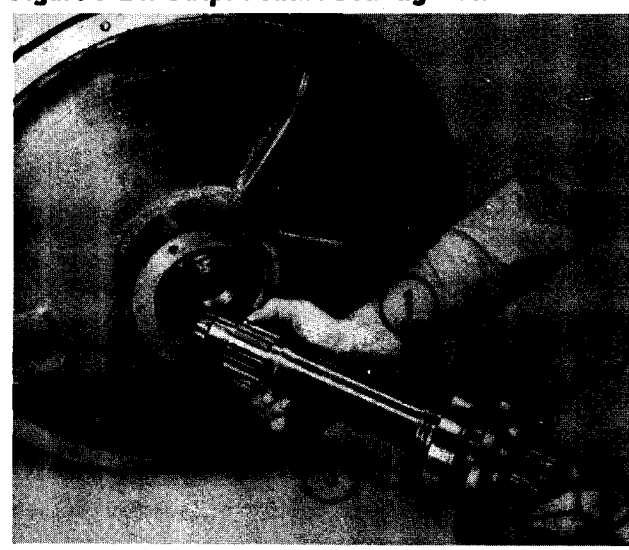
1. "O" RING 2. RETAINER 3. BEARING

Figure F-23. "O" Ring, Retainer and Bearing Removed



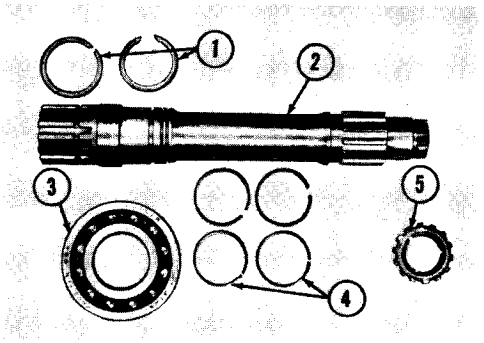
1. OUTPUT SHAFT 2. BEARING RETAINER

Figure F-24. Output Shaft Bearing Retainer



1. PISTON RINGS
2. BEARING
3. SNAP RINGS
4. RETAINER AND SEAL

Figure F-25. Output Shaft Removed



1. SNAP RINGS
2. OUTPUT SHAFT
3. BEARING
4. PISTON RINGS
5. LOCKNUT

Figure F-26. Output Shaft Group, Exploded

Turn converter with flywheel side down.

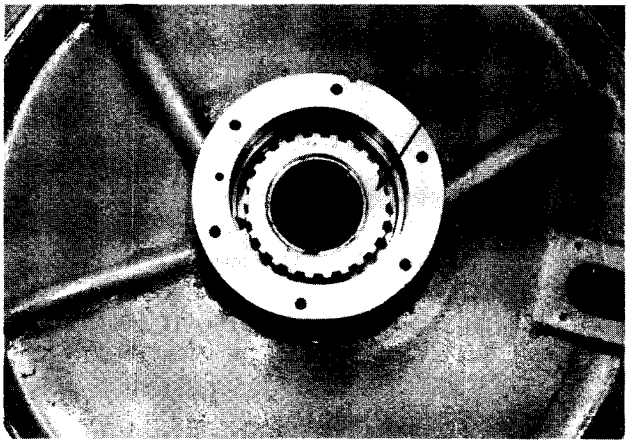
Remove capscrews, bearing retainer, roller bearing, and "O" ring seal from the pump (Fig. F-22 and F-23).

Move to the opposite side of the converter housing and remove the output shaft bearing retainer capscrews. Remove the output shaft with retainer and seal, bearing, snap rings, and piston rings in place by tapping with a brass drift. Keep shaft centered in reactor sleeve while removing.

Then remove parts from the output shaft. See Fig. F-24, F-25 and F-26.

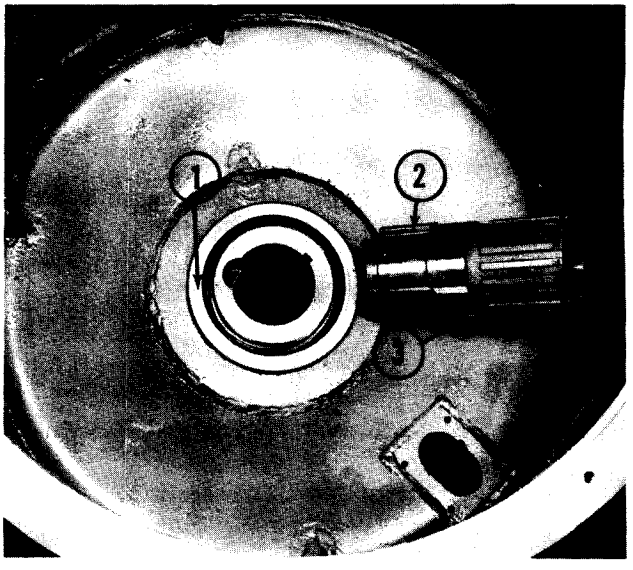
Remove the reaction member sleeve locknut (Fig. F-27) and press out the reaction member sleeve toward inside of converter housing. Remove the key which keeps the sleeve from turning in the torque converter housing hub (Fig. F-28).

Remove felt oil seal and retainer from housing by prying with a screw driver or small chisel. Take care not to damage ring lands or retainer bore. Remove piston rings from inside torque converter housing (Fig. F-28).



1. LOCKNUT

Figure F-27. Reaction Member Sleeve Locknut



1. OIL SEAL AND PISTON RINGS
2. KEY
3. REACTION MEMBER SLEEVE

Figure F-28. Reaction Member Sleeve Removed

SERVICE

Wash and clean all parts thoroughly in cleaning solvent.

Inspect all parts for worn ring grooves, damaged threads in tapped holes, burrs on bearing surfaces, key ways and threads, worn bearings or races, damaged or rough splines.

The oil screen filter in the suction line should be inspected and cleaned every day for the first week of operation, and thereafter once every week.

If the pressure gauges show abnormal pressures the first thing to do is check the suction screen filter and clean if necessary.

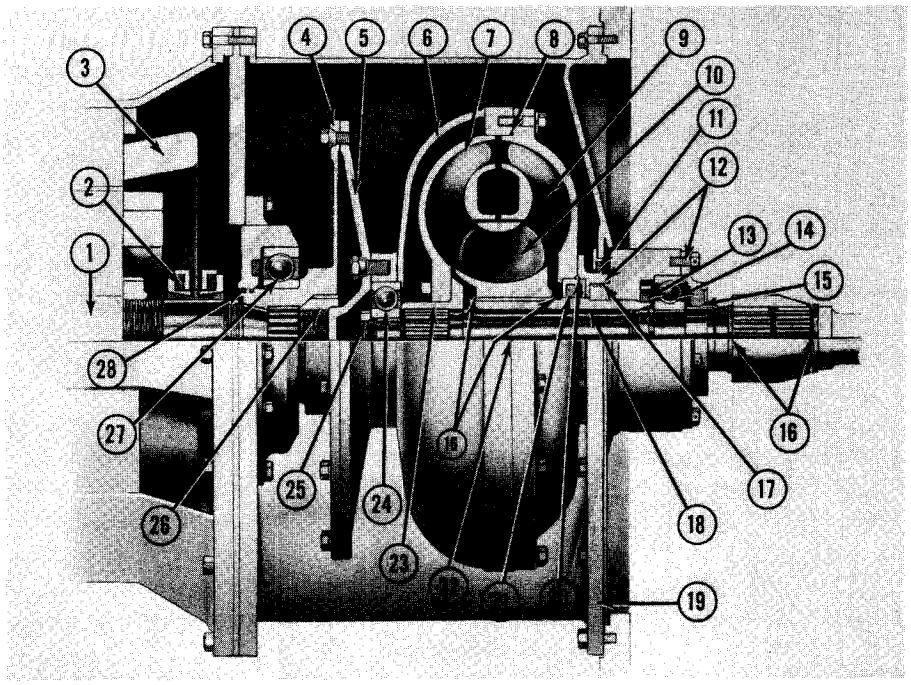
Operating temperature of the oil should be between 150 and 250° F. with a maximum of 275° F. Should the oil temperature for any reason exceed 325° F. there is danger of burning the oil. Burned oil should be replaced. This may occur when the converter is operated too long in the stalling position.

To refill the torque converter tank, first fill tank to full mark on bayonet gauge. Start engine and operate at approximately 1000 R.P.M. until converter is filled with oil. Stop engine and immediately check the oil level in the tank. Add enough oil to the tank to bring the level up to 2 gallons low. This is the correct amount to be maintained. When the engine is idle part of the oil in the converter drains back into the tank. The oil gauge will then show the tank to be full. The drain back time for the oil is from 10 to 30 minutes.

Check the oil level once each shift. Change the

oil seasonally, or when dirt or foreign material is present in quantity, or when oil temperature has exceeded 275° F. and the oil has become burned. Use a good grade mineral base oil with non-foaming characteristics. SAE #10 (summer), SAE #5 (winter).

REASSEMBLY



1. ROTOR
2. BRUSH ASSEMBLY
3. GENERATOR STATOR
4. ADAPTOR STRUCTURE
5. TORQUE CONVERTER FLYWHEEL
6. PUMP COVER
7. TURBINE
8. "O" RING
9. PUMP
10. REACTION MEMBER
11. WIPER
12. RETAINER
13. LOCKNUT
14. BEARING
15. SEAL
16. SNAP RINGS
17. PISTON RINGS
18. SLEEVE
19. HOUSING
20. "O" RING
21. BEARING
22. OUTPUT SHAFT
23. SPLINED HUB
24. BEARING
25. LOCKNUT
26. LOCKNUT
27. BEARING
28. PISTON RINGS

Figure F-29. Torque Converter Section

It is recommended that the following parts be replaced regardless of amount of wear:

Felt oil seal.

All piston ring seals.

Turbine shaft oil seal.

Pump cover to pump neoprene seal.

Pump to pump bearing retainer neoprene oil seal.

NOTE: Never rotate converter in housing during assembly in any other than a vertical position. To do so will damage the inside of reactor sleeve and felt oil seal race and other close fitting parts.

Install roller bearing, neoprene oil seal and bearing retainer in pump. Replace copper washers and capscrews. Lock capscrews with lockwires.

Install the piston rings in their sleeves and check the ring gaps prior to further assembly. Rings should have a gap of 0.003" or less when installed.

Install piston rings in grooves in converter housing, with one cast ring and one steel ring in each groove, steel rings toward the flywheel side of cast rings. Care should be exercised when installing piston rings to prevent damage. Position rings so that the ring gaps are staggered. Put oil on rings and make sure they rotate freely in grooves.

Pack felt seal in retainer, pack seal as tight as possible and using as much of the seal as possible by using hands and screw driver. Cut off remainder of seal. Do not wet seal. Use torch to singe off any hair or fuzz that is not flush with retainer.

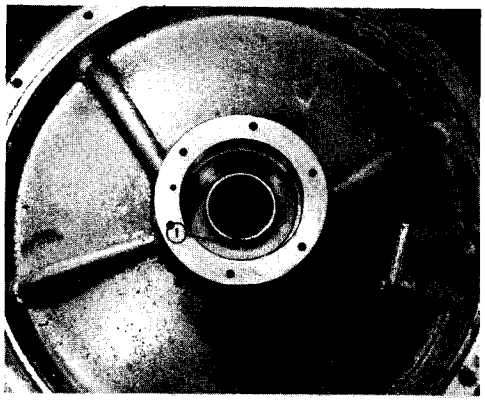
Install retainer in housing by tapping. Exercise caution so as not to damage retainer or piston rings.

Press reactor sleeve into converter housing with key in place.

Puddle lead or solder into the recess left by the keyway and the reactor sleeve to act as a seal (Fig. F-30).

Install reactor sleeve locknut and torque to 500 ft. lbs.

Peen reactor sleeve locknut in key way of sleeve to lock it in place.



1. KEYWAY

Figure F-30. Reaction Member Sleeve Keyway

Install bearing and snap ring on turbine shaft with groove side of bearing toward splines.

Put small piston ring seals on turbine shaft with one cast ring and one steel ring in each groove, with cast ring toward the bearing.

Put oil on rings and check for free rotation.

Stagger all ring gaps.

Install turbine shaft and bearing by starting bearing evenly in bore. Then tap lightly on shaft while rotating shaft. Before bearing is seated in bore, install bearing retainer with oil seal and gasket. Use capscrews to finish pressing bearing in bore.

Install bearing retainer and oil seal with oil seal lip facing converter. Make sure bearing retainer and gasket line up with oil passages in converter hub.

Position converter with flywheel side up.

Center piston rings in grooves and oil rings with lubricating oil. Check to see that they rotate freely.

Install pump, bearing and retainer assembly on reactor sleeve. When roller bearing starts on bearing surface on reactor sleeve, don't use force but rotate pump till bearing goes in place, then press firmly on pump and rotate slowly until piston ring seals slip into bearing retainer. Do not press too hard when installing pump because piston rings may break.

Install snap rings in front of pump bearing on reactor sleeve.

Install reactor member and front snap ring.

Install turbine and turbine hub on shaft.

Position $\frac{1}{8}$" neoprene seal on converter pump flange. Lay length of neoprene seal stock around flange and stick with cement. Cut seal so that the ends of it lack about $\frac{1}{16}$" of coming together. Let cement dry a few minutes so it will stay in place while installing pump cover.

Install pump cover and bearing on shaft.

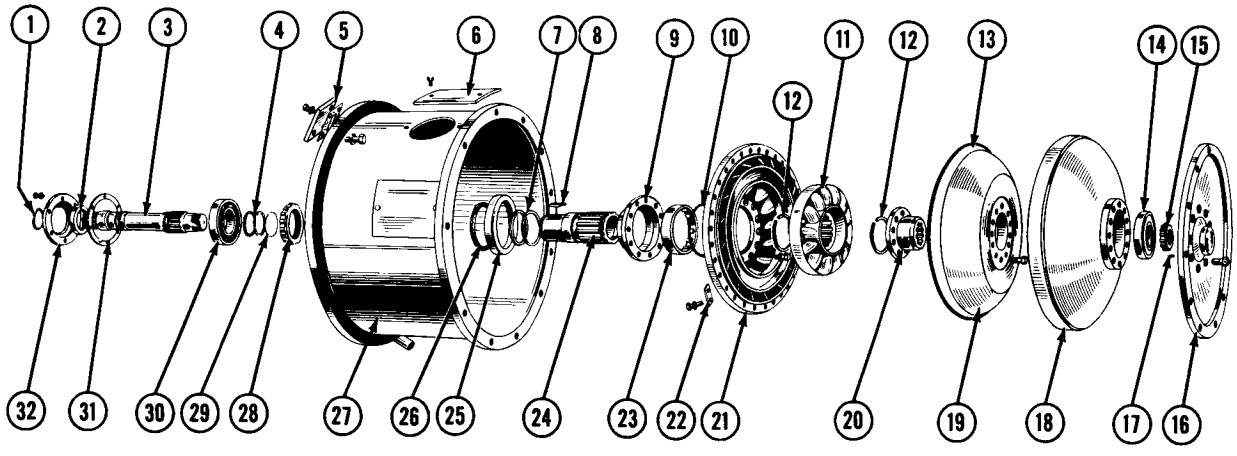
Press bearing on shaft with bearing locknut.

Insert capscrews and metal locks around pump cover and pump and tighten evenly all around. Lock capscrews.

Tighten pump cover bearing nut to 300 ft. lbs. torque and lock with setscrew.

Put thin coat of permatex on converter flywheel. Position flywheel in place, secure with capscrews and lockwire.

Position converter with flywheel side up and rotate converter to see that it turns freely with no dragging.



1. SNAP RING
2. OIL SEAL
3. SHAFT
4. COVER
5. SNAP RING
6. COVER
7. OIL RINGS
8. KEY
9. RETAINER
10. NEOPRENE SEAL
11. REACTOR
12. SNAP RING
13. SEAL
14. BEARING
15. LOCKNUT
16. DRIVE PLATE
17. PIPE PLUG
18. PUMP COVER
19. TURBINE
20. HUB
21. PUMP
22. LOCK PLATE
23. BEARING
24. SLEEVE
25. SEAL RING
26. FELT SEAL
27. HOUSING
28. LOCKNUT
29. OIL RINGS
30. BEARING
31. GASKET
32. RETAINER

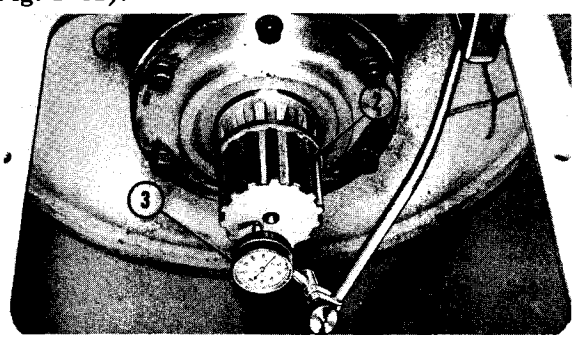
Figure F-31. Torque Converter, Exploded

INSTALLATION

Place a dial indicator at the front of the engine to determine the amount of engine crankshaft endplay present. When this figure has been obtained, move crankshaft back until it has reached midpoint, as shown on the indicator. For example: should endplay of crankshaft read .004", move crankshaft back until a reading of .002" is shown on dial indicator. Now, with indicator still in position, turn indicator dial until it reads as "O". Do not remove indicator from engine.

Swing converter into place and check which comes together first, the converter housing and generator end bell or the adaptor structure and converter flywheel.

Loosen the capscrews on the torque converter output shaft bearing retainer and mount another dial indicator against the end of the output shaft (Fig. F-32).



1. BEARING RETAINER 2. OUTPUT SHAFT
3. DIAL INDICATOR

Figure F-32. Indicating Output Shaft Movement

If converter housing and generator end bell come together first, add shims between generator and converter drive plates until indicator shows output shaft moving out. Then remove the amount of shims it takes to move the indicator back to zero.

Once again refer to the indicator at front of the engine. The reading of "O" should still be present, indicating that crankshaft has not been forced either forward or backward during installation of torque converter. If reading has been changed, shimming procedure must be repeated.

If generator and converter drive plates come together first, shims will be added between housing and generator end bell.

When bearing cap is loosened indicator will show output shaft moving out and shims must be added until output shaft is back to normal position or indicator on zero. Check crankshaft for endplay as described above.

Replace engine, A.C. generator and torque converter in main case.

Reconnect all wiring, tubing and control cables.

Complete re-installation of all assemblies removed from the machine.

Arrange two temporary oil pressure gauges so that one is connected to the oil inlet side of the converter and the other is connected to the oil outlet side of the converter. See Fig. F-10.

Fill the oil tank with SAE #10 oil to proper level. (In cold weather use SAE #5 oil.)

Making sure the transmission is in neutral position, start the engine and bring the engine speed up to about 1000 RPM.

The oil pump for the converter will draw oil from the tank and fill the converter. When both gauges show pressure the converter is full and oil has to be added in the tank to bring the oil up to the proper level again. Now increase the engine speed slowly to a maximum governed speed watching the oil pressure gauges. At this speed the inlet pressure should be 50 pounds per square inch and the outlet pressure at about 35 pounds per square inch.

A relief valve in the pump is factory set at 50 pounds per square inch inlet pressure. This setting does not affect the inlet and outlet pressures, serving rather as a safety device to protect the system should excess pressure develop. The special restricted nipple and the oil cooler itself, holds enough back pressure on the converter to maintain 35 pounds per square inch of pressure without the use of a special relief valve.

The torque converter is now ready for operation.

During the working cycle the gauge at the converter outlet should read approximately 30 pounds per square inch minimum to 40 pounds maximum, while the gauge at the inlet should read approximately 23 pounds per square inch pressure to 50 pounds. Under lugging load the lowest inlet pressure should pull down no lower than 18 or 20 pounds per square inch.

NOTE: All pressures indicated above are with oil temperatures at 180 degrees or more.

TORQUE CONVERTER OIL PUMP

The torque converter oil pump, located at the rear of the G.M. engine directly above the A.C. generator is driven by the engine left balance shaft. On machines equipped with Cummins or Buda engines the pump is mounted on a bracket secured to the bottom of the main case, on the right side of

the engine beneath the air compressor. This pump is used to circulate oil through the torque converter.

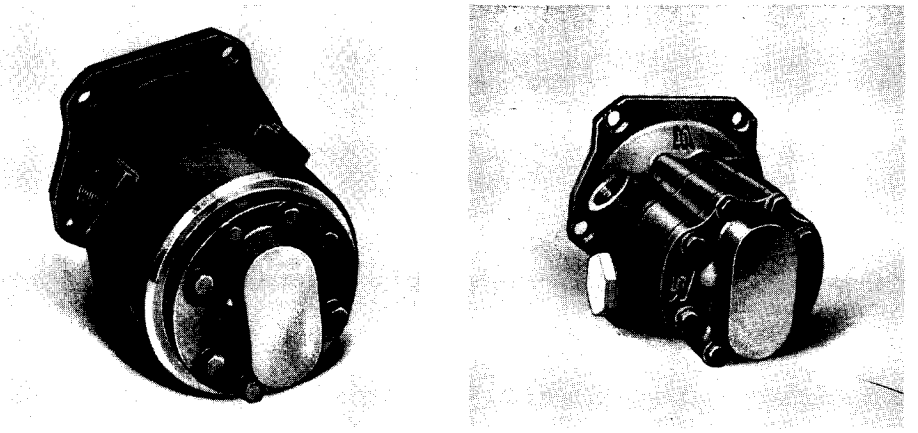


Figure F-33. Torque Converter Oil Pump

Removal

First remove the suction and pressure hoses at the oil pump.

Remove the capscrews securing the pump to the adaptor on the rear of engine. As pump is removed the splined adaptor hub will remain on pump drive shaft. With the pump removed the adaptor is now exposed and may be removed from engine by extracting capscrews securing it to the engine left balance shaft. Pull splined hub from shaft.

To remove pump from machine where it is mounted to main case, first remove suction and pressure hoses at pump.

Remove capscrew holding mounting plate to mounting bracket (Fig. F-34).

Remove belt from pulley and lift pump assembly and mounting plate from main case.

Remove socket head capscrew securing pulley to drive shaft. Pull pulley from shaft.

Remove capscrews securing pump to mounting plate and remove pump.

Pull bearing and oil seal from mounting plate.

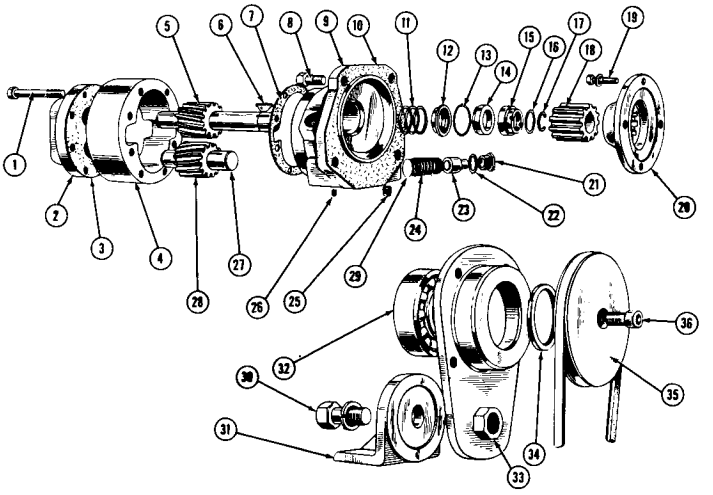


Figure F-34. Torque Converter Oil Pump, Exploded

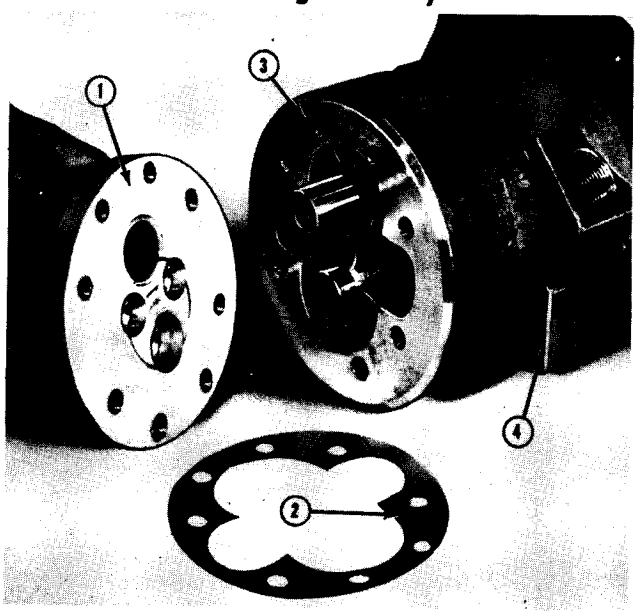
1. CAPSCREW
2. BACK PLATE AND BUSHING ASSEMBLY
3. GASKET
4. GEAR CASE
5. DRIVE GEAR
6. KEY
7. GASKET
8. CAPSCREW
9. MAIN HOUSING AND BUSHING ASSEMBLY
10. GASKET
11. SEAL SPRING
12. SEAL PLATE
13. SEAL RING
14. BRASS RING
15. STOP RING
16. SEAL RING
17. SNAP RING
18. ADAPTOR
19. CAPSCREW
20. ADAPTOR
21. BY-PASS CAP
22. BY-PASS GASKET
23. PISTON
24. SPRING
25. PIPE PLUG
26. PIPE PLUG
27. DRIVEN GEAR SHAFT
28. DRIVEN GEAR
29. BRASS RING
30. CAPSCREW AND LOCKWASHER
31. BRACKET
32. BEARING
33. MOUNTING PLATE
34. OIL SEAL
35. PULLEY
36. CAPSCREW

Disassembly

Remove the eight capscrews and washers securing the back plate and bushing assembly, gear case, and main housing and bushing assembly together (Fig. F-35). Remove back plate and bushing assembly (Fig. F-36) taking care not to damage gasket. Remove gear case and gasket (Fig. F-37).

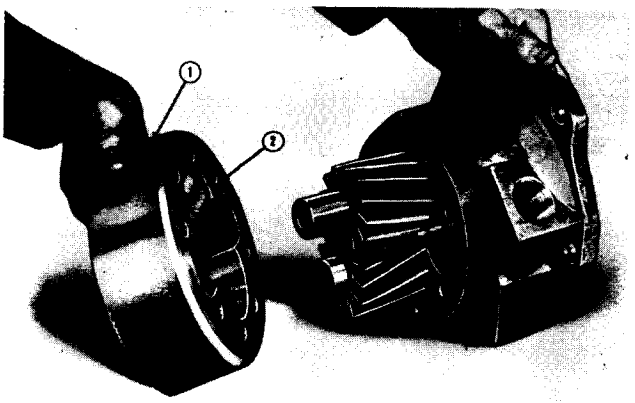
1. CAPSCREWS AND WASHERS
2. BACK PLATE AND BUSHING ASSEMBLY
3. GEAR CASE
4. MAIN HOUSING AND BUSHING ASSEMBLY

Figure F-35. Removing Capscrews From Back Plate and Bushing Assembly



1. BACK PLATE AND BUSHING ASSEMBLY
2. GASKET
3. GEAR CASE
4. MAIN HOUSING AND BUSHING ASSEMBLY

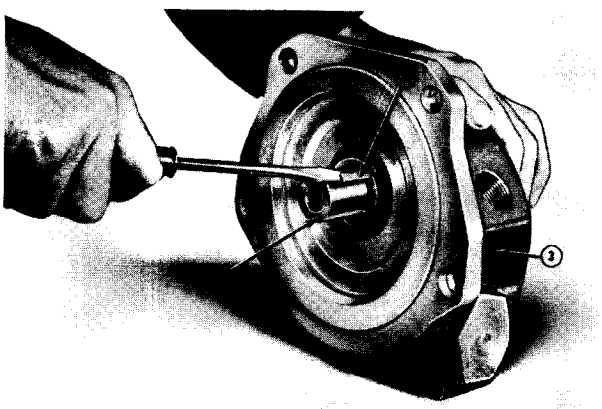
Figure F-36. Removing Back Plate and Bushing Assembly



1. GEAR CASE
2. GASKET

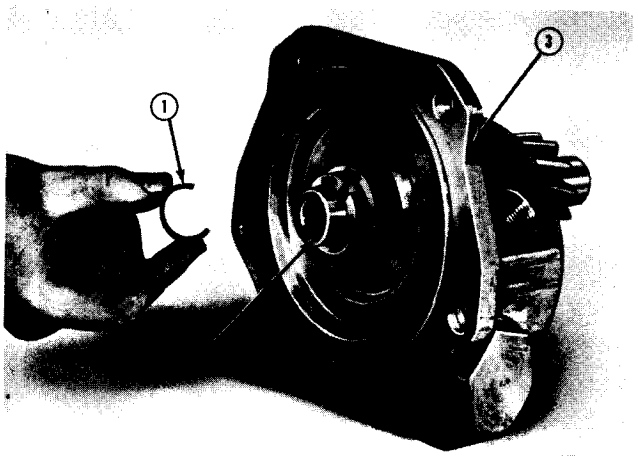
Figure F-37. Removing Gear Case and Gasket

The drive gear, driven gear, driven gear shaft (Fig. F-38), bore and bushings (Fig. F-36) may now be inspected for wear or damage.



1. HIGH-PROFILE KEY
2. DRIVE SHAFT
3. MAIN HOUSING AND BUSHING ASSEMBLY

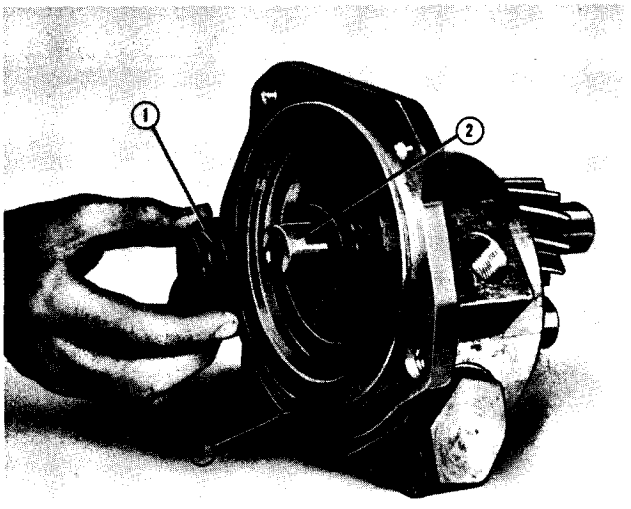
Figure F-38. Removing High-Profile Key



1. SNAP RING
2. DRIVE SHAFT
3. MAIN HOUSING AND BUSHING ASSEMBLY

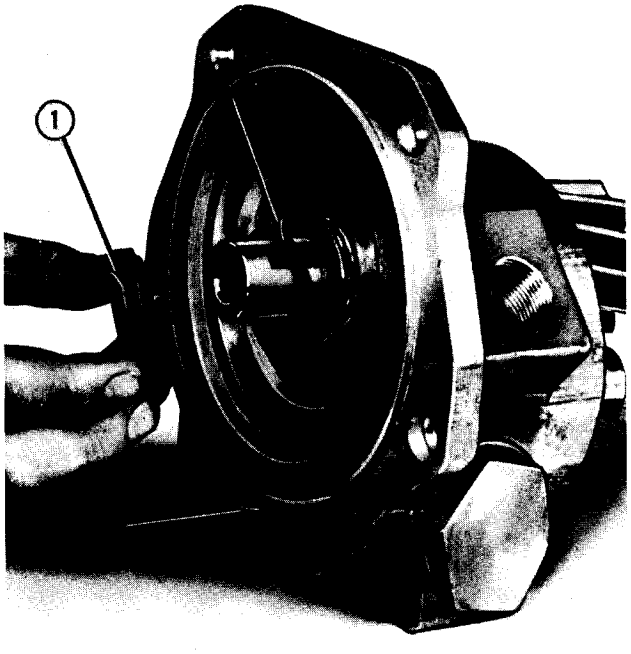
Figure F-39. Snap Ring Removed

Remove the high-profile key from end of drive shaft (Fig. F-38) and remove snap ring (Fig. F-39), shaft seal ring and stop ring (Fig. F-40), seal boss ring and housing seal ring (Fig. F-41), seal plate and seal spring from drive shaft (Fig. F-42). Shaft seal ring is inside stop ring. Inspect seal faces and seal rings for damage or excessive wear.



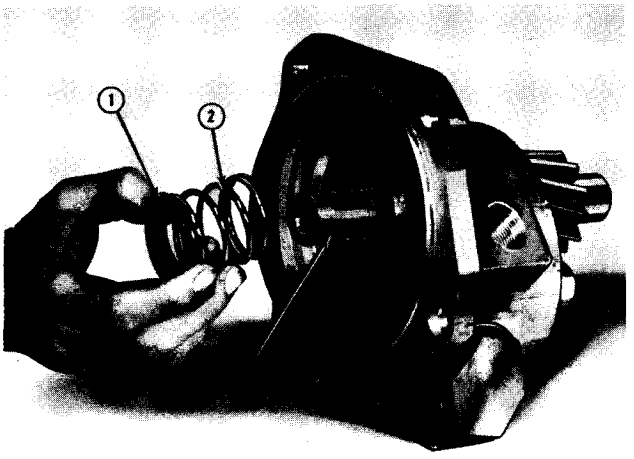
1. SHAFT SEAL RING AND STOP RING 2. DRIVE SHAFT
3. MAIN HOUSING AND BUSHING ASSEMBLY

Figure F-40. Shaft Seal Ring and Stop Ring Removed



1. SEAL BOSS RING 2. HOUSING SEAL RING
3. MAIN HOUSING AND BUSHING ASSEMBLY

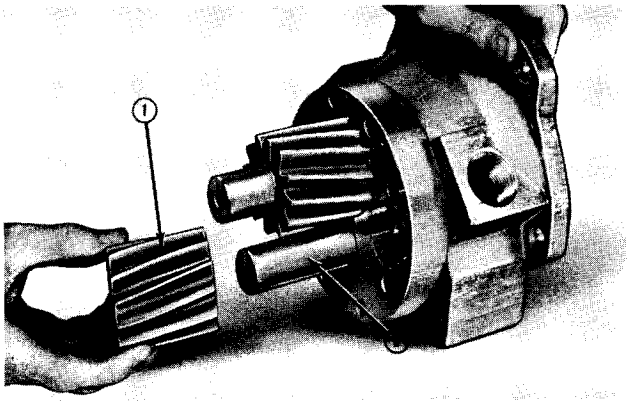
Figure F-41. Removing Seal Boss Ring and Housing Seal Ring



1. SEAL PLATE 2. SEAL SPRING
3. DRIVE SHAFT

Figure F-42. Removing Seal Plate and Seal Spring

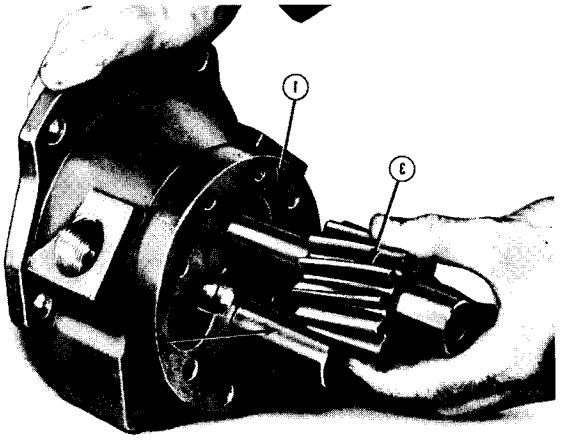
Pull driven gear from shaft (Fig. F-43).



1. DRIVEN GEAR 2. DRIVEN GEAR SHAFT

Figure F-43. Removing Driven Gear

Pull drive shaft and gear (one piece) from bore in main housing and bushing assembly (Fig. F-44). Check drive shaft gear for chipped teeth or wear.



1. MAIN HOUSING AND BUSHING 2. DRIVE SHAFT
3. DRIVEN GEAR SHAFT

Figure F-44. Removing Drive Shaft and Gear

Reassembly

Before reassembling pump, clean all parts thoroughly. Remove all burrs and replace any damaged or worn parts or gaskets.

Insert drive shaft and gear into the back plate and bushing assembly. Slide the driven gear onto the driven gear shaft. Install gasket on the back plate making sure it is smooth and free of wrinkles.

Place gasket on gear case making sure the notches in the gasket are in line with the machined out portions of the gear case.

Now place gear case over shafts and onto back plate facing.

Install main housing and bushing assembly onto top of gear case. Install the eight capscrews and washers through back plate, gear case and into main housing and bushing assembly. Tighten capscrews evenly (Fig. F-35).

Install the seal assembly onto the drive shaft in the following order:

a. Seal spring. Note that one end of the spring is bent to fit into a hole in the main housing and bushing assembly.
b. Seal plate.
c. Seal boss ring with housing seal ring in place.
d. Stop ring with shaft seal ring in place.

Compress the seal assembly and install the snap ring onto the drive shaft. Install the key in the slot provided on the shaft, and then place splined adaptor over end of shaft.

Mount pump on engine. Reconnect pressure hose to right hand port while facing rear of engine. Reconnect suction hose to left hand port while facing rear of engine. See Fig. F-10.

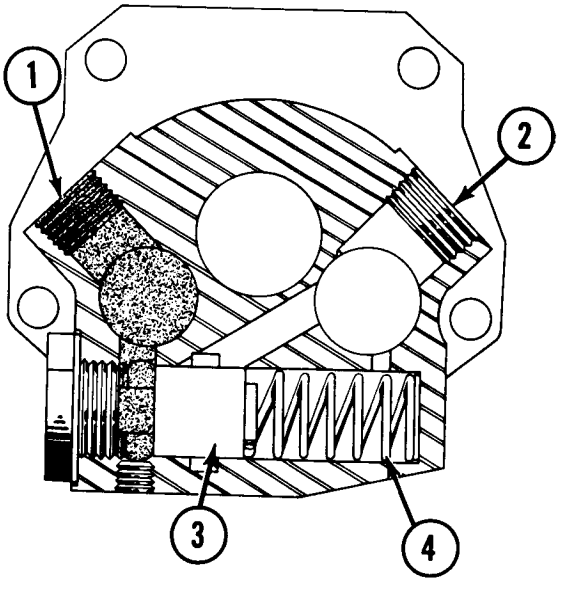
Relief Valve

The relief valve on the bottom of the torque converter oil pump is a safety valve to prevent the building up of excess oil pressure in the torque converter. The valve is spring loaded to open at 50 p.s.i. oil pressure.

When the oil pressure in the torque converter builds up to 50 p.s.i. the pressure backs up in the discharge line of the oil pump.

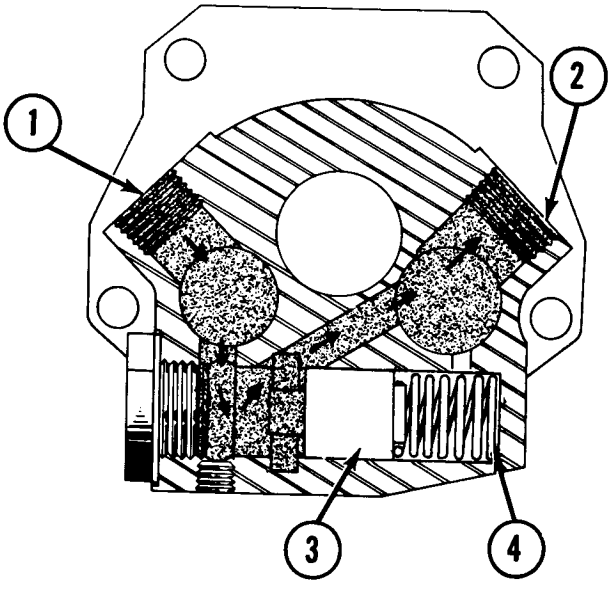
The back pressure forces back the relief valve piston compressing the spring and allowing the oil to circulate in the pump without increasing the pressure in the torque converter (Fig. F-45).

When the pressure has receded the spring forces the piston to close the valve causing the oil to resume its normal flow to the torque converter (Fig. F-46).



1. DISCHARGE
2. SUCTION
3. PISTON
4. SPRING

Figure F-45. Relief Valve, Closed

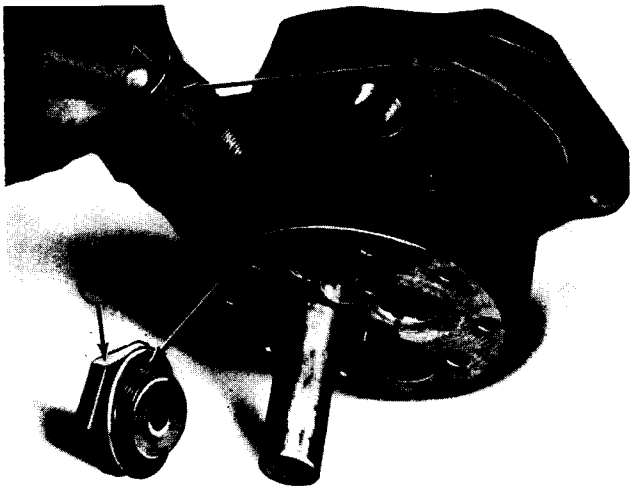


1. DISCHARGE
2. SUCTION
3. PISTON
4. SPRING

Figure F-46. Relief Valve, Open

Disassembly

Remove relief valve cap and gasket from side of main housing and bushing assembly. Remove valve piston (Fig. F-47).

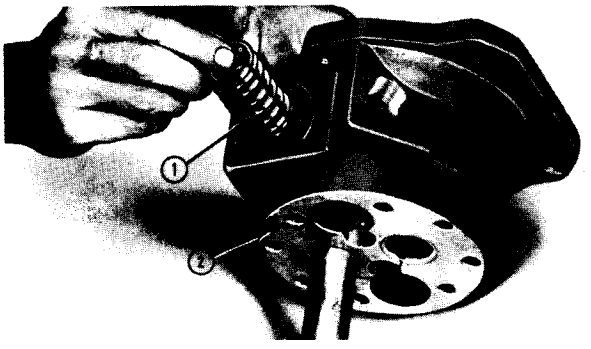


1. VALVE CAP 2. GASKET 3. PISTON

Figure F-47. Removing Relief Valve Cap and Piston

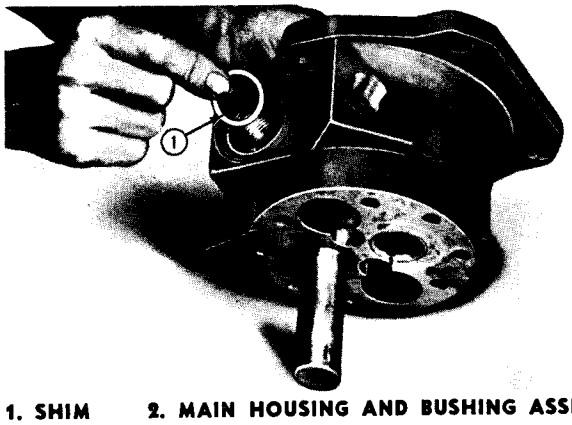
Spring may now be removed (Fig. F-48).

Shims (Fig. F-49) may be placed at the bottom of the relief valve bore to adjust the pressure at which the valve opens. The valve is factory set and the shims are to be replaced when reassembling the valve.



1. SPRING 2. MAIN HOUSING AND BUSHING ASSEMBLY

Figure F-48. Removing Relief Valve Spring



1. SHIM 2. MAIN HOUSING AND BUSHING ASSEMBLY

Figure F-49. Relief Valve Spring Shim

Reassembly

To reassemble the valve reverse the procedure outlined for disassembly.

TRANSMISSION

INDEX

TRANSMISSION

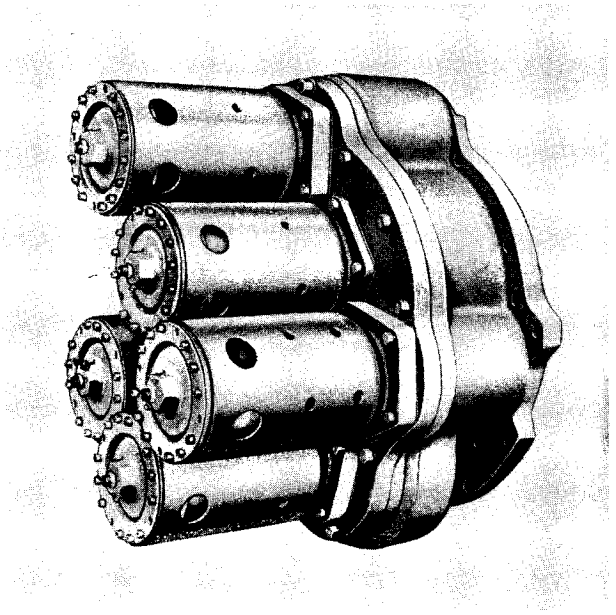


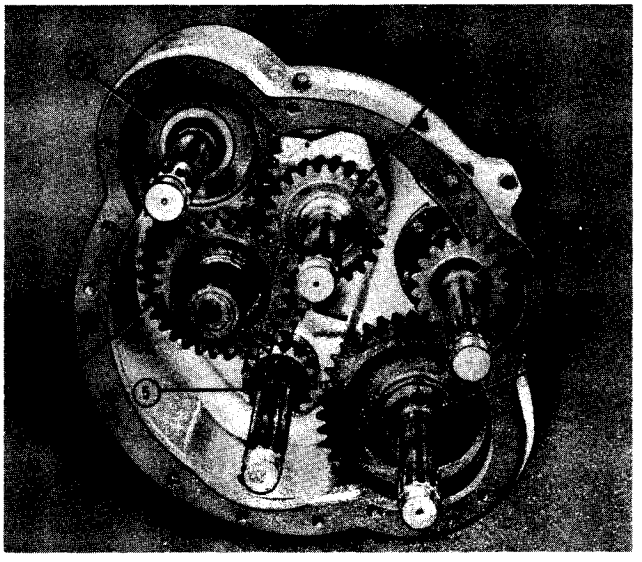
Figure G-1. Transmission Assembly

FUNCTION

The engine gear (inner train) rotates with the engine crankshaft. The compound gear is in mesh with the engine gear and rotates with it. The remaining gears in the inner train (reverse, low forward, and high forward) all mesh with the output gear cluster (Fig. G-2).

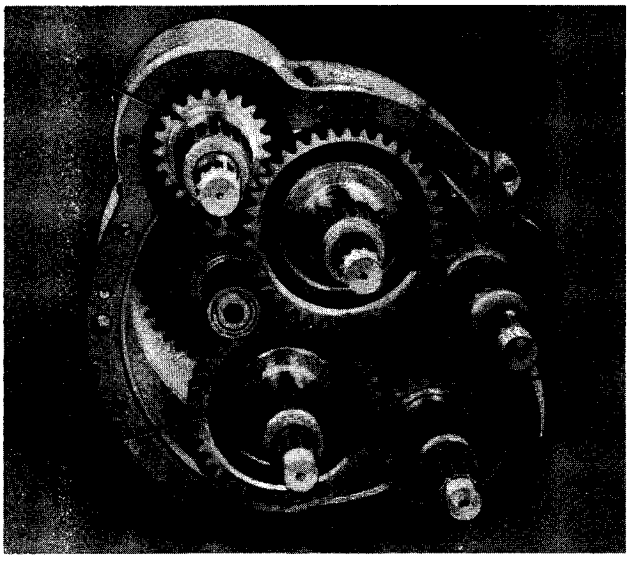
The inner gear and shaft structures extend through the case cover to the outside of the transmission case. Here the clutch hubs are attached to the ends of the shafts by splines and are secured by locknuts.

The outer gear train is made up of five sleeve gears mounted on the inner gear train shafts but rotating independently of these shafts (Fig. G-3). The hubs of the sleeve gears extend through the cover plate to the outside of the transmission case where the clutch housings are locked in position on these sleeve gear hubs by splines and locknuts.



1. HIGH FORWARD
2. REVERSE
3. ENGINE
4. COMPOUND
5. LOW FORWARD
6. OUTPUT GEAR CLUSTER

Figure G-2. Inner Gear Train

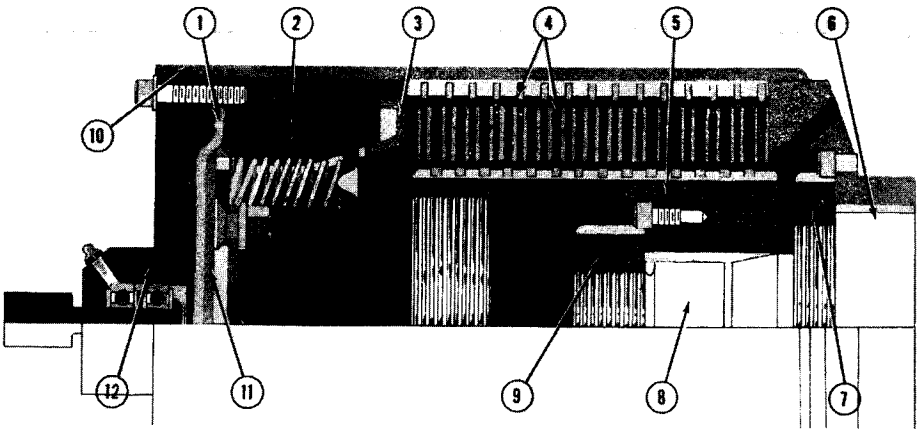


1. HIGH FORWARD
2. REVERSE
3. ENGINE
4. COMPOUND
5. LOW FORWARD

Figure G-3. Outer Gear Train

TRANSMISSION CLUTCH

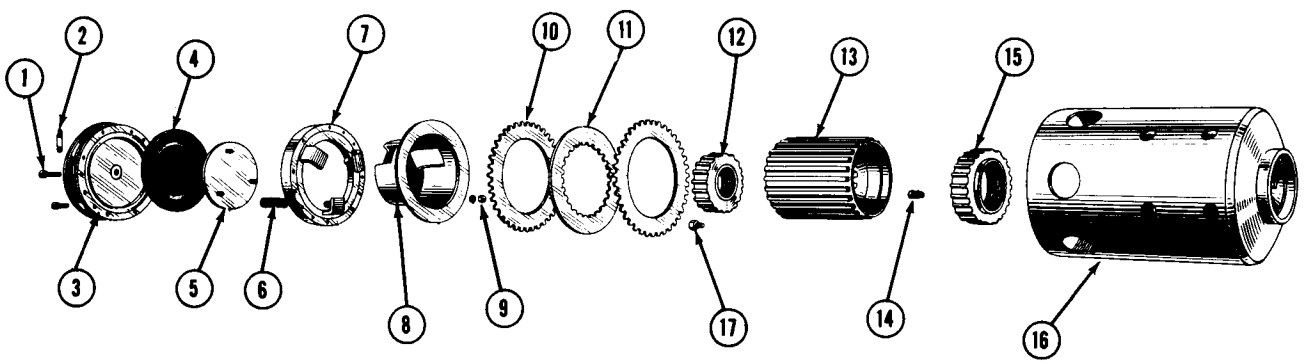
When the clutch is actuated by the speed selector control valve, compressed air from the tank is admitted to the clutch diaphragm. This air pressure against the diaphragm moves the pressure plate against the clutch discs. The lined discs are splined to the clutch housing and the steel discs to the clutch hub. Pressure exerted against these discs locks the housing and the hub together. Since the housing and hub are splined respectively to the sleeve gear hub and to the inner gear shaft, the sleeve gear and the inner shaft and gear must rotate together. The power is transferred in this manner from the outer train to the inner gear train which meshes with the output gear cluster, and from the inner train to the outer in the case of the engine and compound shafts.



1. DIAPHRAGM
2. RETAINER
3. PRESSURE PLATE
4. LINED & UNLINED DISCS
5. HUB
6. SLEEVE GEAR
7. NUT
8. SHAFT
9. NUT
10. HOUSING
11. THRUST PLATE
12. CLUTCH HEAD

Figure G-4. Transmission Clutch Cut-Away

Disassembly



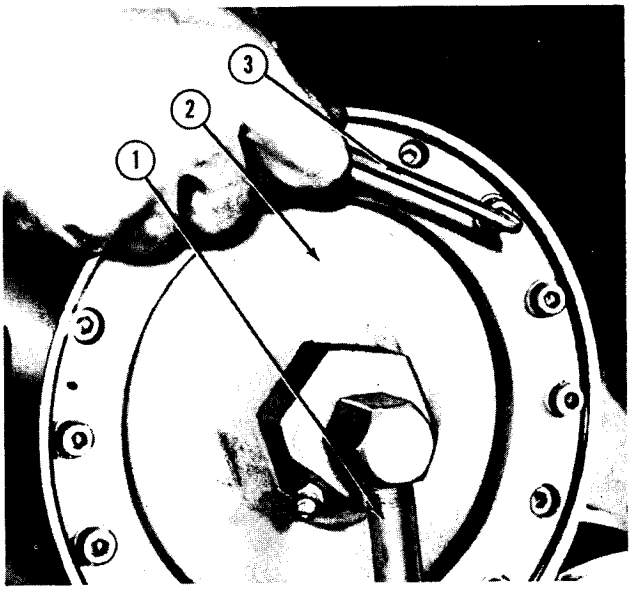
1. CAPSCREW
2. NIPPLE
3. LOCK PLATE & ADJUSTING PLATE
4. DIAPHRAGM
5. THRUST PLATE
6. SPRING
7. RETAINER
8. PRESSURE PLATE
9. NUT & LOCKWASHER
10. LINED DISCS
11. UNLINED DISCS
12. NUT
13. HUB
14. SETSCREW
15. NUT
16. HOUSING
17. CAPSCREW

Figure G-5. Transmission Clutch, Exploded

Each transmission clutch is disassembled in the following manner:

1. Remove the air line between the clutch head and the control valve.

2. Loosen the 12 capscrews which are not countersunk. These capscrews lock the clutch head in position (Fig. G-6).



1. AIRLINE 2. CLUTCH HEAD 3. WRENCH

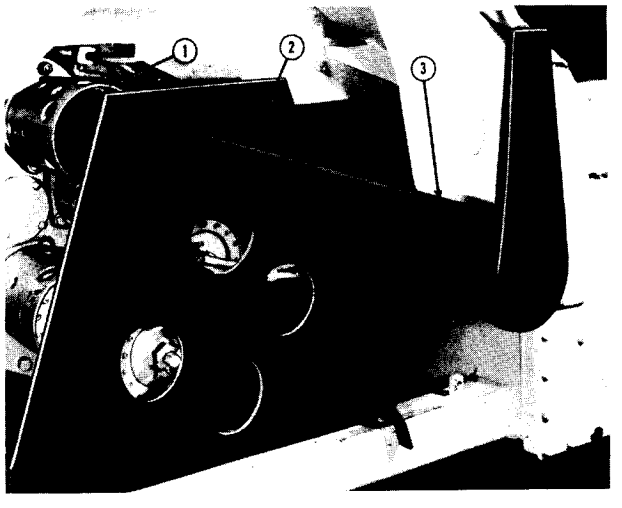
Figure G-6. Releasing Clutch Head Lock

3. Unscrew the clutch head from the clutch housings and remove.

4. Remove clutch discs.

5. Remove setscrew locking the hub nut.

6. Remove splined nut holding the clutch hub to the shaft. Use the special wrench and support plate shown in Fig. G-7.

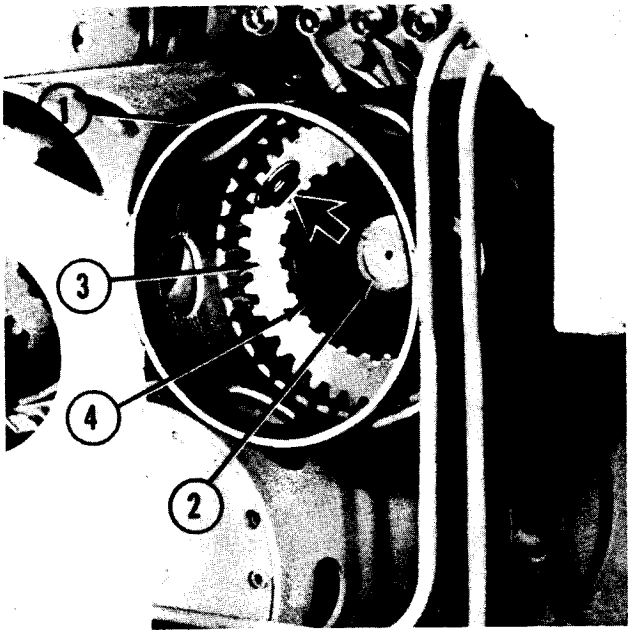


1. CLUTCH HOUSING 2. SUPPORT PLATE
3. WRENCH

Figure G-7. Clutch Hub Wrench and Support Plate

NOTE: Special wrenches are provided with the tool kit to facilitate the removal of clutch hub and clutch housing locking nuts.

These wrenches are made up of round plates with teeth cut on the outside diameter and with a splined bore. The O.D. (outside diameter) fits into the splines in the clutch housing. The I.D. (inside diameter) fits over the splines on the clutch hub (Fig. G-8). When the wrench is positioned in the clutch housing over the splines on the clutch hub the housing and hub are locked together and the clutch is, in effect, engaged, since the shaft and hub cannot rotate without turning the housing.



1. CLUTCH HOUSING 3. CLUTCH LOCKING DISC
2. CLUTCH HUB LOCKNUT 4. CLUTCH HUB

Figure G-8. Clutch Locking Disc

The clutch hub nut can be removed with the special wrench in position over the clutch hub. The clutch housing nut cannot be removed with the wrench in position in the clutch.

The wrenches can be inserted in the clutch and over the clutch hub after two or three of the clutch discs are removed.

The following combinations can be used to lock the transmission when removing clutch assemblies:

a. To remove engine clutch hub nut — lock engine and any two of low forward, reverse, and high forward.

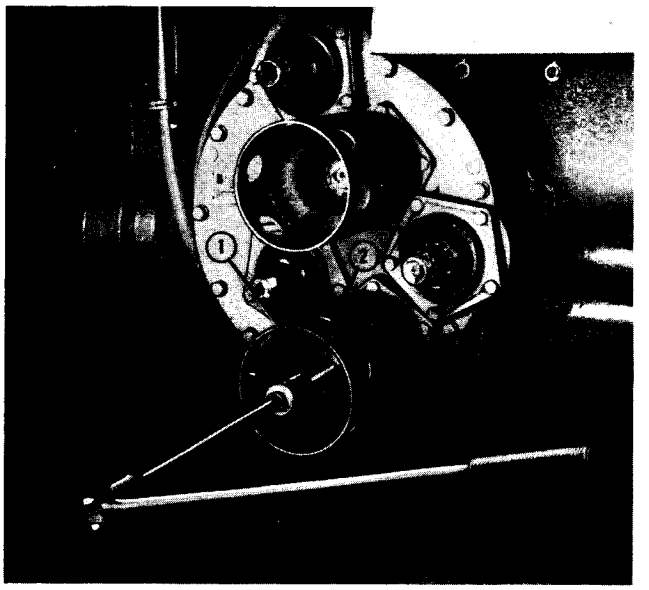
b. To remove compound clutch hub nut — lock compound and any two of low forward, reverse, and high forward.

c. To remove engine and compound clutch housing nuts — lock any two of the following three clutches: high forward, reverse, and low forward.

d. To remove high forward, reverse, low forward clutch hub nuts — lock the clutch being removed and any one other except the engine and compound.

e. To remove high forward, reverse, low forward clutch housing nuts — lock any two of the remaining clutches except the engine and compound clutches.

f. An alternate method can be used to lock the transmission when working on a single clutch. Turn the clutch heads clockwise until tight against the discs instead of removing the clutch heads and several discs and inserting the special wrenches. Tighten the same clutch heads that are locked with the special wrenches provided.



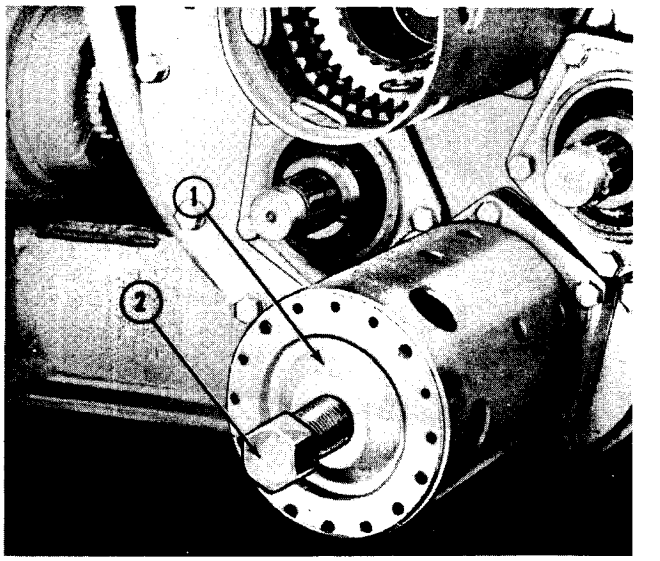
1. CLUTCH HUB 2. SPECIAL PULLER

Figure G-9. Puller Installed on Clutch Hub

7. Remove splined clutch hub with special puller (Fig. G-9). See page A-13 for puller combination.

8. Remove setscrew locking the clutch housing nut to the sleeve gear hub and remove splined nut holding the clutch housing to the sleeve gear.

9. Remove clutch housing with special puller (Fig. G-10). See page A-13 for puller combination.



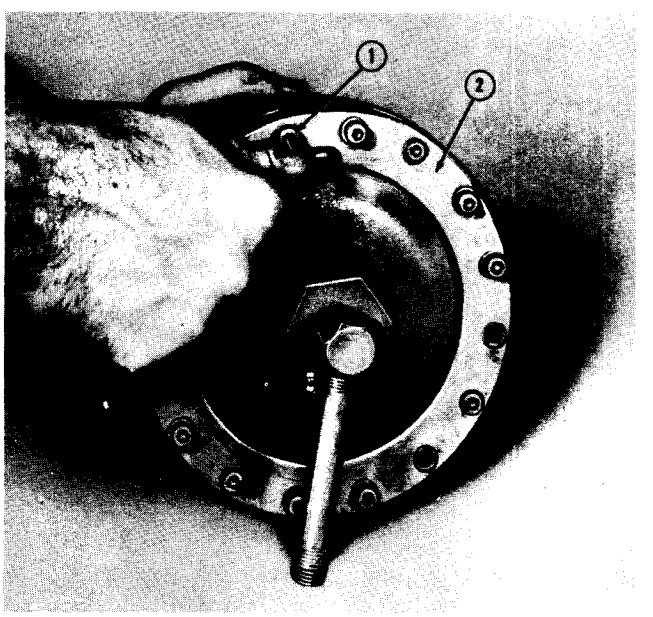
1. PINION HUB PULLER 2. CAPSCREW

Figure G-10. Removing Clutch Housing

Clutch Head Disassembly

Remove socket head capscrews from adjusting plate (Fig. G-11) and separate adjusting and locking plates.

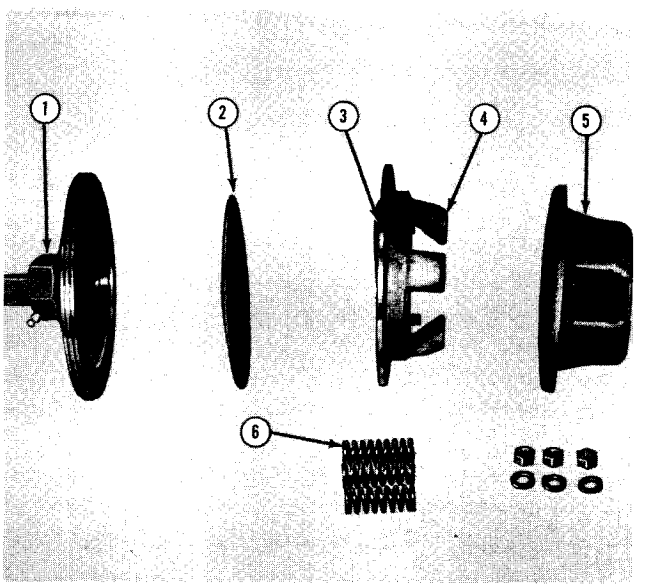
Separate retainer, adjusting plate and diaphragm.



1. CAPSCREWS 2. ADJUSTING PLATE

Figure G-11. Removing Capscrews

Remove 3/8" nuts and lockwashers from the inside of the pressure plate, thereby releasing the three compressed springs and completing disassembly (Fig. G-12).

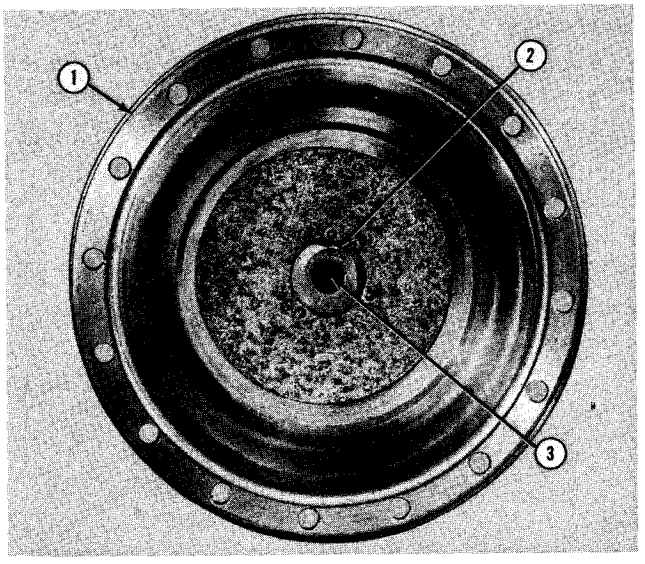


1. ADJUSTING PLATE
2. DIAPHRAGM
3. THRUST PLATE
4. RETAINER
5. PRESSURE PLATE
6. SPRINGS

Figure G-12. Clutch Head Disassembled

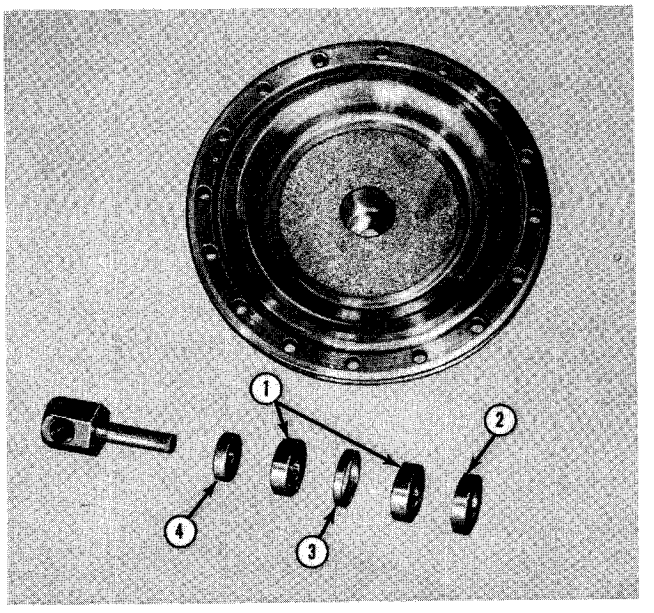
To disassemble the air inlet group first remove bearing retainer. Insert driver tool into the air inlet tube from the inside of the adjusting plate and drive out tube. See Fig. G-13.

Pull bearings and spacer. Remove oil seal (Fig. G-14).



1. ADJUSTING PLATE 2. RETAINER
3. INSERT DRIVER TOOL HERE

Figure G-13. Air Inlet Tube



1. BEARINGS 3. SPACER
2. RETAINER 4. OIL SEAL

Figure G-14. Bearings, Oil Seal and Spacer Removed

Reassembly

To reassemble air inlet group, install new seal and bearings. Insert new air inlet tube into bearings. Peen tube over.

Reassemble clutch by reversing disassembly reversing the above procedure outlined for disassembly.

When reassembling clutch assemblies on transmission torque clutch housing nuts to 600 ft. lbs. minimum, 800 ft. lbs. maximum. Torque splined hub nuts to 1200 ft. lbs. plus to nearest lock.

TRANSMISSION

Removal

Remove all air lines between the transmission clutches and the manifold block on the cockpit.

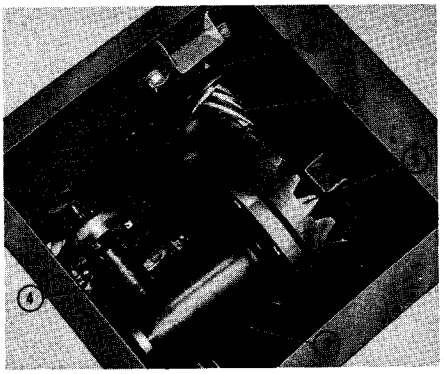
Remove the cockpit and A-frame assemblies and drain the lubricating oil from the transmission case. The drain plug can be reached after removing the small plate directly beneath the transmission.

Remove the five transmission clutch assemblies. See the instructions on page G-4.

Remove the floor plate over the ring gear and pinion compartment. Remove the lockwire and the two capscrews in the upper right hand corner of the compartment (Fig. G-15).

Attach a chain hoist or some similar lifting device to the transmission assembly and remove the remaining capscrews securing the transmission to the main case.

Remove the transmission assembly (Fig. G-16). Support the weight of the transmission with the lifting device as the boss on the transmission case and the two dowel pins are freed from the main case. Weight resting on the engine shaft may result in a bind at the shaft splines and hinder removal as well as place undesirable strain on the engine shaft.



1. SPIRAL BEVEL PINION 5. CARRIER SHAFT
3. CAPSCREWS 6. DRIVE SHAFT
4. SPIRAL BEVEL RING GEAR

Figure G-15. Ring Gear and Pinion Compartment

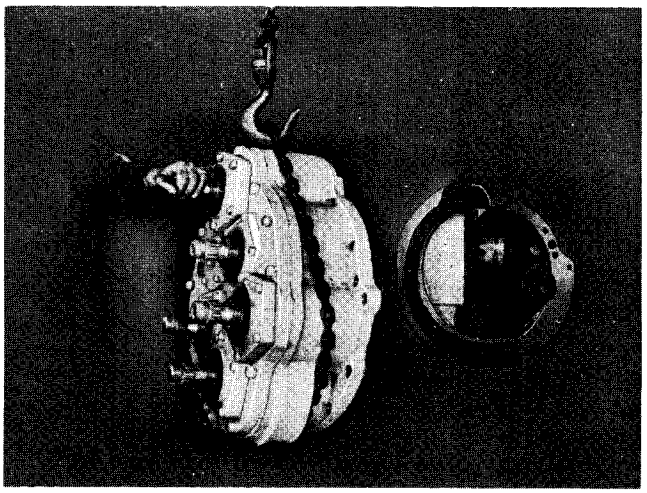
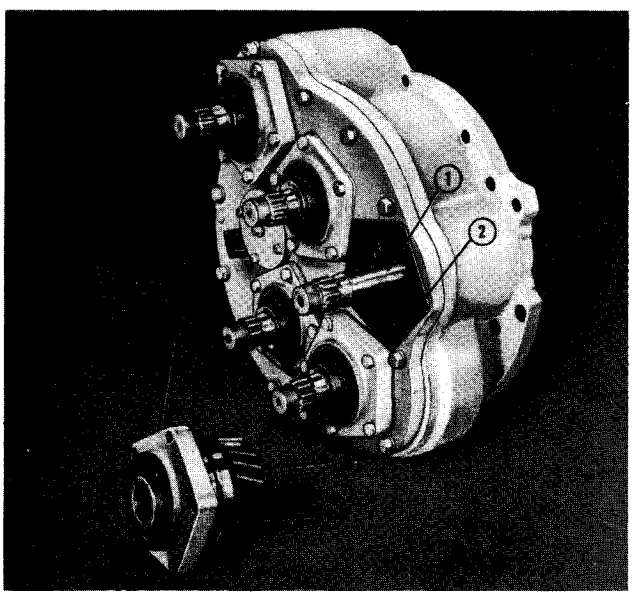


Figure G-16. Removing Transmission from Tournatractor Case

Disassembly

NOTE: Wrenches and adaptors are provided in the tool kit which can be used to remove the splined nuts from the transmission shafts, etc.

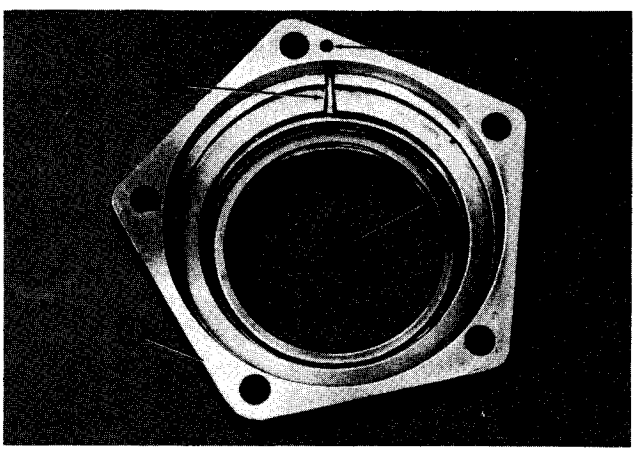
Remove the lockwire and capscrews securing the bearing retainers to the transmission case cover plate. Remove the engine, compound, and high forward retainers, the cork gaskets between the retainers and the cover plate, and the sleeve gears (Fig. G-17). Bearing assemblies will come with the sleeve gears because of the press fit between the two units.



1. SHAFT GEAR
2. CORK GASKET
3. SLEEVE GEAR
4. BEARING
5. RETAINER

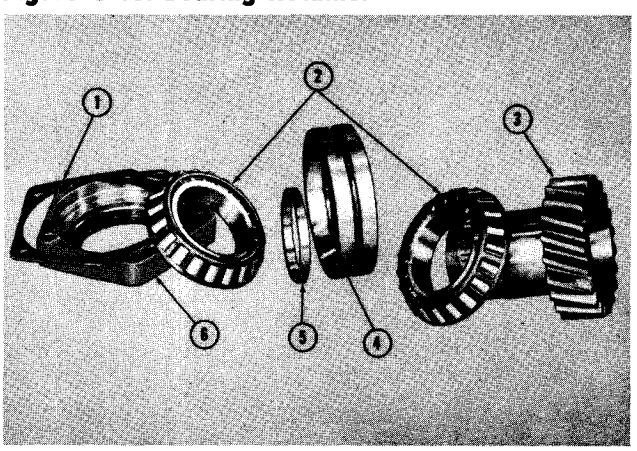
Figure G-17. Sleeve Gear and Retainer, Removed

Remove the oil seals from the bearing retainers (Fig. G-18).



1. OIL RETURN
2. OIL RETURN GROOVE
3. SEAL
4. RETAINER

Figure G-18. Bearing Retainer



1. CORK GASKET
2. BEARING CONES
3. SLEEVE GEAR
4. BEARING CUP
5. SPACER
6. RETAINER

Figure G-19. Bearing Set Removed from Sleeve Gear and Retainer

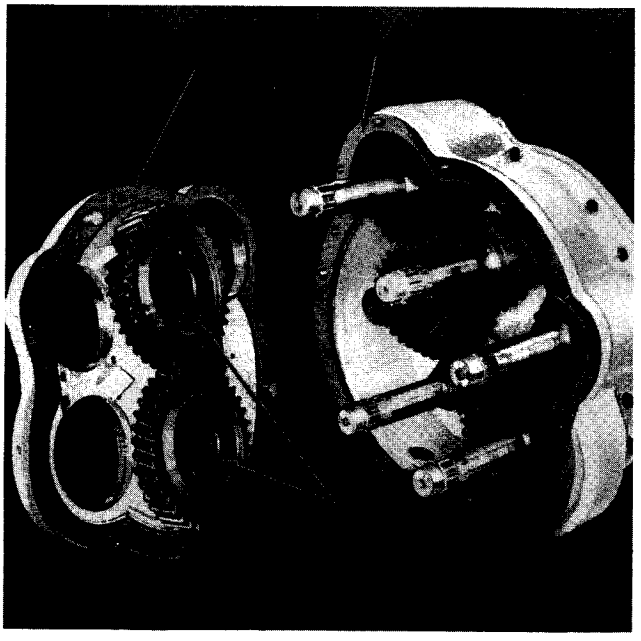
Pull the bearings from the sleeve gear hubs (Fig. G-19). Keep the bearing cones, cup, and spacer together since the four parts make up a matched bearing set. (All tapered roller bearings used in this transmission are used in matched sets. See "Transmission Service" on page G-10 for more detailed information.)

Remove the snap rings, bearings, spacers, and seals from the bores in the sleeve gears.

Low forward and low reverse sleeve gears cannot be removed through the bores in the transmission cover plate. First remove the capscrews which secure the transmission cover plate to the case and remove the cover plate (Fig. G-20). Then press low forward and low reverse sleeve gears out of their respective bearing assemblies.

Remove the bearings from the bores in the transmission case cover plate.

Remove the output pinion roller bearing from its bore in the cover plate. Note that this bearing can be removed from either side of the transmission cover plate after the bearing cap is removed from the outer side of the plate.



1. COVER PLATE
2. CASE
3. LOW FORWARD AND REVERSE SLEEVE GEARS

Figure G-20. Cover Plate Removed

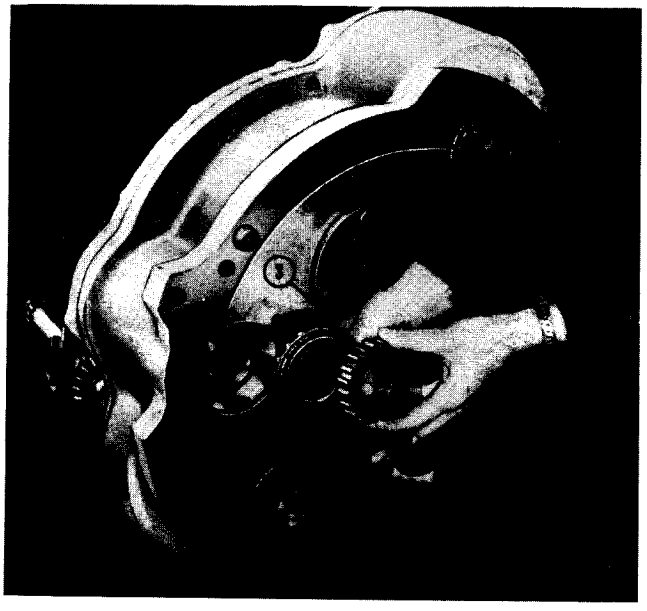
Engine Shaft Gear

Remove the setscrew which locks the bearing locknut in position, then remove the nut. Press the shaft out of the rear cone of the double row bearing assembly and remove the cone. Next remove the shaft with the front cone still in position on the shaft (Fig. G-21), then pull the front cone from the shaft.

Remove the retainer and U-shaped cork gasket from the transmission.

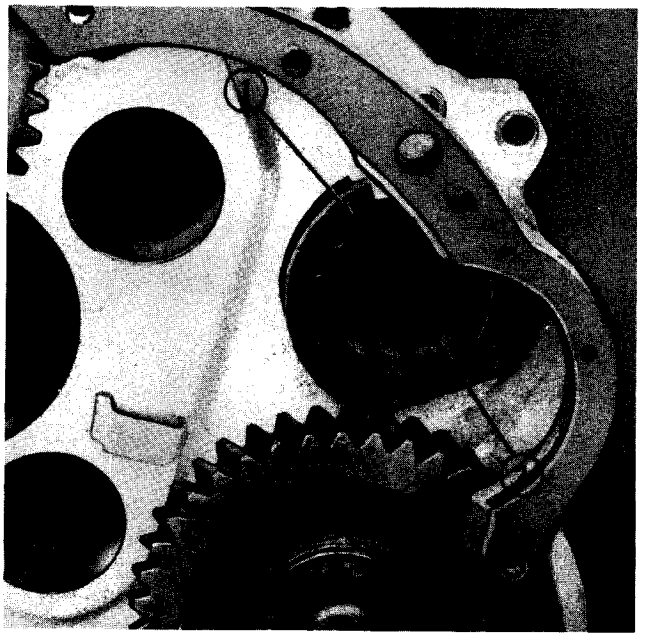
Remove the bearing cup from the bore in the case wall.

Remove the lockwire and capscrews which secure the inner bearing retainer to the rear wall of the transmission case and remove the retainer (Fig. G-22).



1. SHAFT GEAR
2. BEARING CONE
3. LOCKNUT
4. BEARING CONE

Figure G-21. Locknut and Bearing Cone, Removed



1. INNER BEARING RETAINER
2. BEARING CUP

Figure G-22. Bearing Retainer and Cup

Spiral Bevel Pinion Gear

Remove locknut from pinion shaft. This nut secures the output gears to the spiral bevel pinion gear shaft.

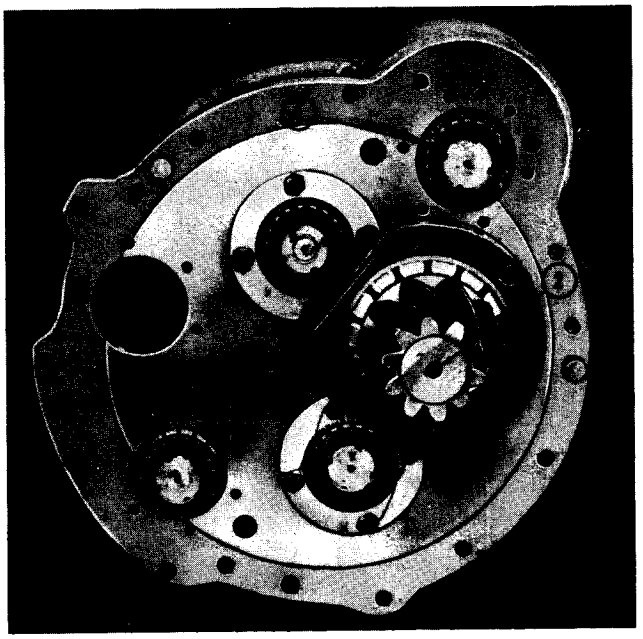
Cut the lockwire and remove the capscrews from the spiral bevel pinion retainer (Fig. G-23). (This retainer is located on the outside of the rear wall of the transmission case.)

Remove the spiral bevel pinion with bearing attached (Fig. G-24).

Remove the shims placed between the bearing cup and the bottom of the pinion bore. NOTE: Shims also between the retainer and bearing cup.

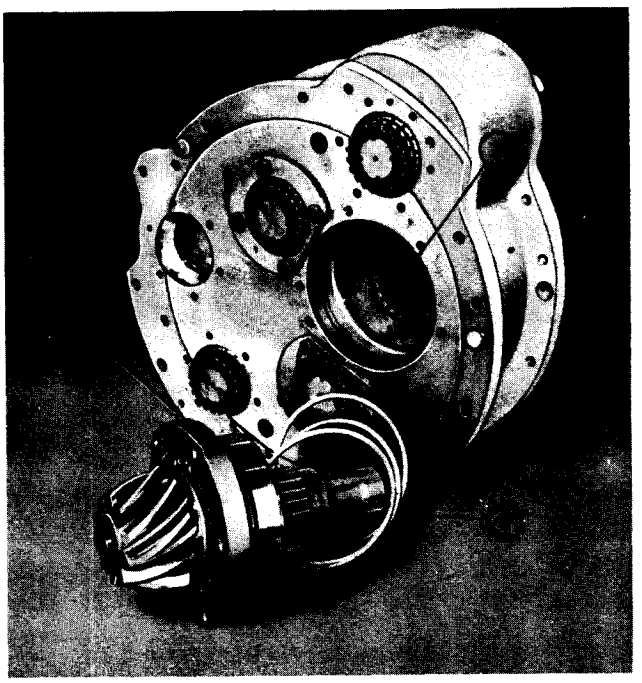
Remove the retainer and the shims between the retainer and the bearing cup. Keep the retainer and the shims together. Make certain these shims are not mixed with shims which will be removed from between the bearing cup and the bottom of the pinion bore.

Press the bearing from the pinion shaft.



1. CAPSCREW
2. PINION
3. RETAINER

Figure G-23. Spiral Bevel Pinion



1. CLUSTER GEAR
2. RETAINER
3. SHIMS

Figure G-24. Spiral Bevel Gear and Bearings

Reverse Gear

Remove the setscrew which locks the bearing retainer nut in position and remove the nut.

Move the output (cluster) gear to the left (when facing the inside of the transmission case with the high forward shaft gear at the top) as far as possible. This will prevent any interference with the inner roller bearing cone as the bearing and shaft are removed.

Press the shaft out of the rear cone of the double row bearing assembly and remove the cone. Then remove shaft and inner (front) cone together. Press the cone from the shaft.

Remove the lockwires and capscrews which secure the retainer to the case wall. Remove retainer and spacer.

Remove the bearing cup from the bore in the transmission.

Low Forward Shaft Gear

Repeat the steps described under "Reverse Shaft Gear" with the following exception.

a. Remove the output (cluster) gear as the shaft and the front cone are removed.

High Forward and Compound Shaft Gears

Remove the locknuts from the shafts (Fig. G-25).

Press the shafts out of the rear bearing cones and remove the cones.

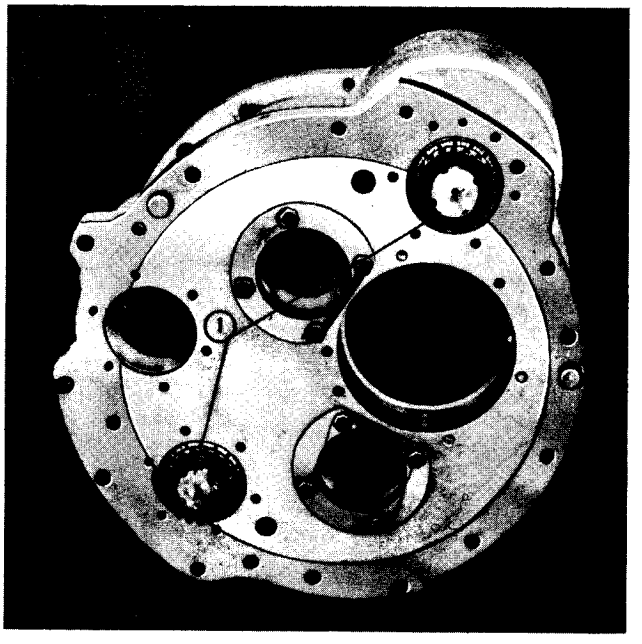
Remove the gear and front bearing cone from the case.

Press the shaft from the front bearing cone.

Remove the lockwires and capscrews which secure the inner bearing retainer to the rear wall of the transmission case and remove the retainer (Fig. G-26).

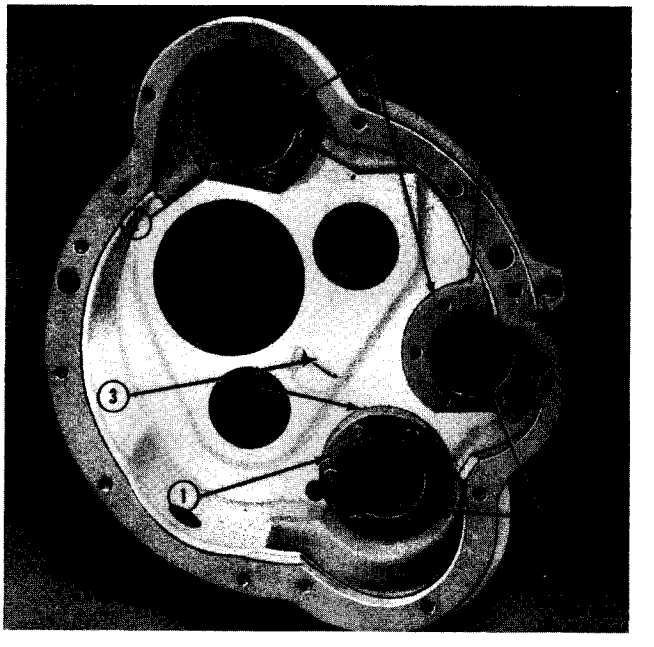
Remove the U-shaped cork gasket from beneath the retainer.

Remove the bearing cup from the bore in the case wall.



1. LOCKNUT

Figure G-25. High Forward and Compound Shafts Locknuts



1. RETAINER
2. BEARING CUP
3. OIL CUPS

Figure G-26. Inner Bearing Retainers

Service

The double row, tapered roller bearings used in the transmission have the required amount of lateral (end play) built in during the assembly process by the bearing manufacturer. These bearings are made up in matched sets. Each set includes two bearing cones, a cup, and a ground spacer located between the two cones. See Fig. G-19.

NOTE: The bearings must be kept in matched sets and parts of one set ARE NOT interchangeable with any other set. Keep the parts of each set together and install in the same bore from which they were removed.

Each bearing set is identified by a code number. The same code number is etched on the faces of the cones and the cup and also on the spacer. All parts having the same code number are parts of the same bearing set.

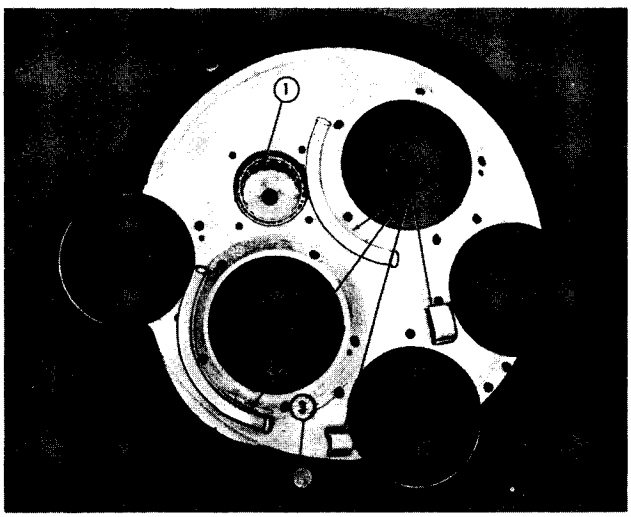
Some bearings will have identifying letters in addition to the set numbers. Bearings which have etched letters in addition to the code numbers must be installed with the "A" cone in the "A" side of the cup and the "C" cone in the "C" side of the cup.

Those bearings without letters have been manufactured so that the cones can be used in either side of the cup without affecting the accuracy of the end play setting.

Examine the bearings as they are removed and replace those that may have become Brinelled, pitted, or excessively worn. Wash good bearings in cleaning solvent and store in oil.

The transmission bearings are splash lubricated. Catch cups are located on the inner walls of the transmission cover, case, and the ring gear and pinion compartment to assure an adequate flow of lubricant to the bearings. See Fig. G-27. The oil passages must be kept free from obstructions. Oil cups must be checked to make certain they have not become flattened during disassembly so the opening into the cup is restricted. Oil return passages are also provided from the bearing retainers through the

cover plate into the transmission case. These must be kept open. Be sure the cork gaskets beneath the retainers are installed so the oil holes in the gaskets match the oil holes in the retainers and the transmission cover plate. Check gaskets placed between the case cover and the case and between transmission case and main case for any conditions which might restrict the flow of lubricant in the oil passages.



1. PINION SHAFT BEARING 2. OIL CUPS
3. DOWEL PIN

Figure G-27. Oil Cups

Inspect all oil seals for signs of wear, damage from excessive heat, or nicks. Place all seals in oil, ready for installation.

Inspect gears and shaft structures for excessive gear tooth wear, pitting, cracking, or checking of the teeth. Check the bearing surface in the bore of the sleeve gear for wear or irregularities.

Check the splines in the clutch housings and on the clutch hubs for worn or rough spots which might interfere with free movement of the discs.

Check all bi-metallic linings for excessive surface wear and steel discs for warpage by placing them on a flat surface.

Diaphragm surface on thrust plate, retainer and adjusting nut should be freed from all nicks and burrs by polishing with emery cloth.

Check air inlet assembly for drag on bearings, excessive end play, and air leaks.

Lubricate transmission clutch bearings every 10 shifts. Use only high temperature ball bearing grease. One shot with a hand gun is sufficient. DO NOT OVER LUBRICATE.

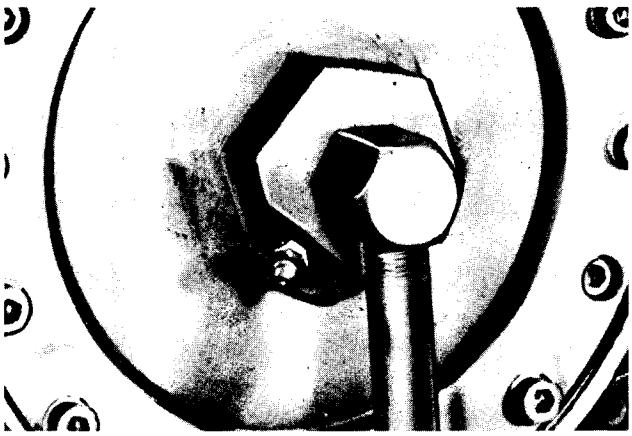


Figure G-28. Clutch Lubrication Point

Figure G-29. Ring Gear Compartment Bayonet Gauge

NOTE: Be sure to allow enough time for the lubricant to rise to the same level in both the transmission and the ring gear and pinion compartment before operating the machine.

Check the oil level in the transmission every 10 shifts. Change the oil once every 100 shifts. Use extreme pressure gear oil meeting U.S. Army Specification MIL-2105-L or be of equal quality. Use SAE 140 E.P. (above 90° F.), SAE 90 E.P. (from 32° to 90° F.), SAE 80 E.P. (below 32° F.). Capacity 14 gallons, fill to full mark on bayonet gauge.

Assembly

TORQUE CHART FOR TRANSMISSION CAPSCREWS

Location	Torque
Shaft Bearing Retainer Capscrews Inside Case for Engine, Compound and High Forward Shafts	40 ft. lbs.
Shaft Bearing Retainer Capscrews on Back of Case for Low Forward and Reverse Shafts	50 ft. lbs.
Output Pinion Bearing Retainer Socket Head Capscrews	60 ft. lbs.
Output Pinion Bearing Cover Capscrews on Cover Plate	30 ft. lbs.
Bearing Retainer Capscrews on Cover Plate for Engine, Compound and High Forward Shafts	70 ft. lbs.
Bearing Retainer Capscrews on Cover Plate for Low Forward and Reverse Shafts	50 ft. lbs.
Cover Plate Capscrews	150 ft. lbs.

Install bearing cups in the bores in the transmission case and in the case cover plate. It is advisable to place the "A" side of all cups installed in the case in the same direction, and the "A" side of all cups installed in the cover plate in the same direction. There will be less chance of installing cones in the wrong side of the cup if all cups are installed in this manner. In addition, mark the bearing set number alongside each cup as it is installed, since the retainers will cover markings on the cups when the retainers are installed. Install the bearing retainers and gaskets or spacers and secure with capscrews and lockwires.

Expand the bearing cones by heating to 275°—300° F., before installing on shafts or sleeve gear hubs. The heating will not damage the bearings. The parts heated merely expand sufficiently to make installation easy.

Place transmission case, with cover side up, on blocks. Position inner bearing cone (high forward shaft) in cup. Insert shaft from the gear end. Strike light blows with the hammer to eliminate the possibility of Brinelling the bearing. Next install the outer cone on the shaft, the splined locknut, and torque to 600 ft. lbs. or to nearest lock (maximum 800 ft. lbs.). (Fig. G-32.)

Repeat the same procedure for the compound shaft. (Fig. G-32.)

Install heated inner bearing cone on low forward shaft. Install low forward shaft and the output gear cluster together. Install the heated outer bearing cone on the low forward shaft, then the splined locknut. Torque the locknut to 600 ft. lbs. or to nearest lock. (Fig. G-33.)

Roll the output (cluster) gear to the left and install the inner cone on the low reverse shaft. Next install the shaft and cone into the transmission case, then install the outer bearing cone and locknut, and torque the nut to 600 ft. lbs. or to nearest lock. (Fig. G-33.)

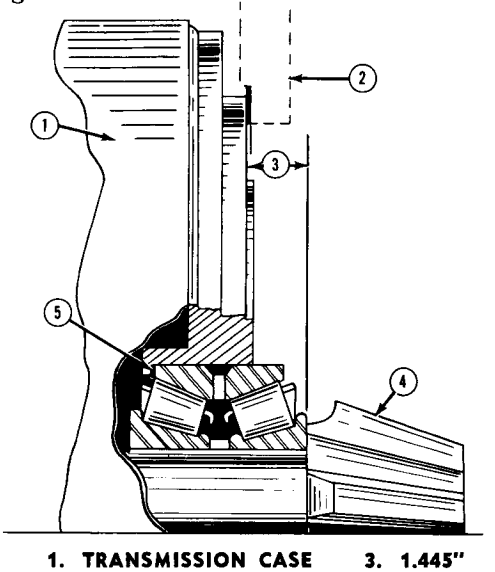
Install the inner cone on the engine shaft, the shaft and cone into the transmission case, the outer cone and splined nut on the shaft and torque the nut to 600 ft. lbs. or to nearest lock. (Fig. G-34.)

Install the heated bearing cones and cup on the output pinion shaft. Install shims, pinion, and pinion bearings in the bore in the transmission case. At the same time, align the splines in the bore of the cluster gear with the splines on the pinion shaft and insert the shaft in the gear. (Fig. G-35.) Install shims and retainer and socket head capscrews. Be sure to install the shims between the retainer and the bearing cup as well as the shims between the bearing cup and the bore in the transmission case wall.

The spiral bevel pinion may have an M.D. marking on it which must be taken into account to accurately determine the amount of shims required to position the pinion. The main case of the Tournatractor may also have a reference marking on it which must also be considered when positioning the pinion.

The position of the pinion is checked by measuring between the gasket surface of the transmission case to the face of the outer pinion bearing cone, when the pinion and pinion bearing are installed in the transmission case. (The gasket surface of the transmission is to be considered that surface of the case, under the gasket, which bolts up against the main case when the transmission is in the mounted position.)

The shims between the pinion bearing cup and the bottom of the bearing bore are shown in Fig. G-30. If the pinion is marked M.D. Std., or does not have an M.D. marking and if the main case of the machine does not have a reference marking, the pinion is correctly positioned when the distance from the gasket surface of the transmission case to the face of the outer bearing cone is 1.445", as shown in Fig. G-30.



1. TRANSMISSION CASE
2. MAIN CASE
3. 1.445"
4. PINION
5. SHIMS

Figure G-30. Measured Distance

If there is an M.D. minus (—) marking on the end of the pinion, it indicates that the pinion must be set farther out of the bearing bore by shimming between the bottom of the bearing bore and the bearing cup, the distance of the M.D. marking. For example, if the pinion is marked M.D. —.005" it indicates that the pinion must be set out an additional .005" from the bearing bore. The measurement between the gasket surface of the transmission case

and the face of the pinion outer bearing cone would change from 1.445" to 1.450".

If the pinion is marked on the end with an M.D. plus (+) marking, it indicates that the pinion must be set deeper in the bearing bore by removing shims from beneath the bearing cup. For example, if the pinion is marked M.D. +.005" the pinion must be set .005" deeper in the bearing bore and the measurement between the gasket surface and the face of the outer bearing cone will be 1.440".

The pinion mounting reference number marked on the main case of the Tournatractor, if any, will be steel stamped on the main case, above the transmission, on the gasket surface under the ring gear compartment cover plate.

If the case is marked with a plus (+) number, it indicates that the pinion must be set out of the bearing bore by adding shims, in the manner described above. For instance, if the case is marked +.005" the pinion must be set out of the bearing bore .005".

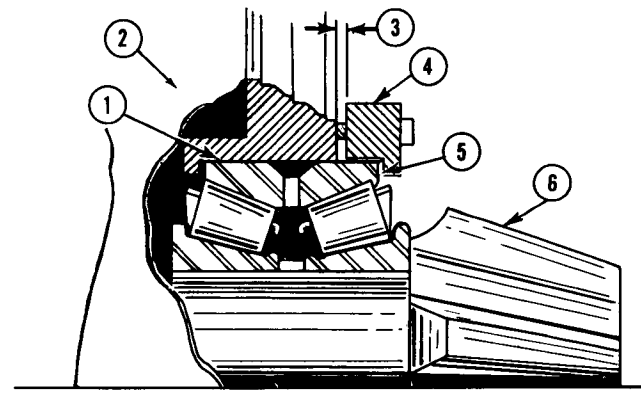
If the case is marked with a minus (−) number, it indicates that the pinion must be set deeper in the bore the same distance as the case is marked.

From the above mentioned markings on the pinion and case, determine the amount that the pinion mounting in the transmission case will deviate from 1.445" measurement. Add or remove shims between the pinion bearing bore and the bearing cup to properly position the pinion.

Install the pinion bearing retainer and torque the mounting capscrews to 60 ft. lbs. In order to insure that the retainer is properly securing the bearing there must be at least .002" clearance between the bearing retainer and the transmission case, as shown in Fig. G-30, when the capscrews are tightened to correct torque.

If a .002" feeler gauge cannot be inserted between the bearing retainer and transmission case, remove the retainer and add shims between the bearing retainer and the bearing cup until this clearance is obtained.

Install the splined locknut on the gear end of the pinion shaft and torque to 1350 ft. lbs.



1. BEARING CUP
2. TRANSMISSION CASE
3. .002"
4. BEARING RETAINER
5. SHIMS
6. PINION

Figure G-31. Bearing Retainer Clearance

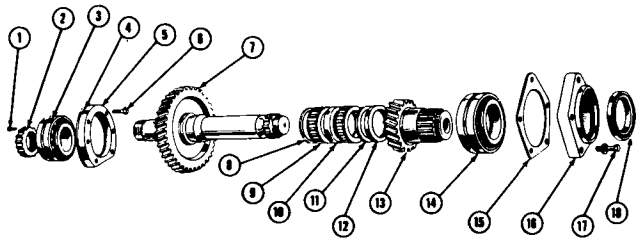
Install the bearings, spacers, seals, and snap rings in the sleeve gears. Next, install the inner bearing cones on the sleeve gears. Place the gears in position on the rear side of the case cover plate with gear hubs extending through their respective bores and install the outer bearing cones.

Install the output pinion roller bearing in the bore in the cover plate and bolt on the bearing cap.

Place the seals in the retainers and mount the retainers on the cover plate. The two thin retainers cover the low forward and the low reverse gear bearings. Check the position of the cork gaskets and make certain the oil holes are aligned. Torque the retainer capscrews to 50 ft. lbs. and install lockwires.

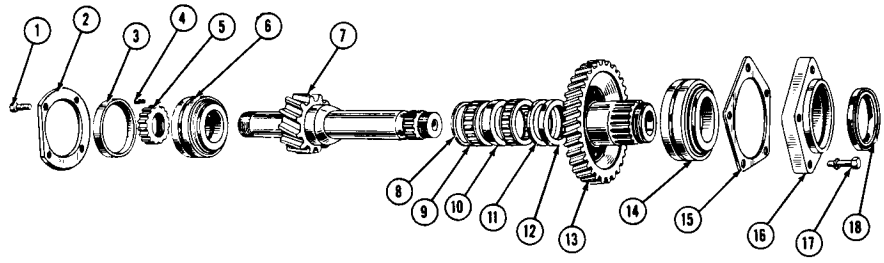
Mount the cover plate on the transmission case. Install the unit in the main case. Next, add the clutch assemblies, reconnect the air lines, and fill the transmission and ring gear and pinion compartment to the proper level with lubricating oil as prescribed.

Mount the cover plate on the transmission case. Install the unit on the main case. Most ring gear and pinion sets will have an "X" etched on one tooth of the pinion and an "X" etched on two adjoining teeth of the mating ring gear. Make certain that the pinion tooth marked with the "X" is placed between the two teeth of the ring gear with the "X's". See page H-15 for back-lash adjustment.



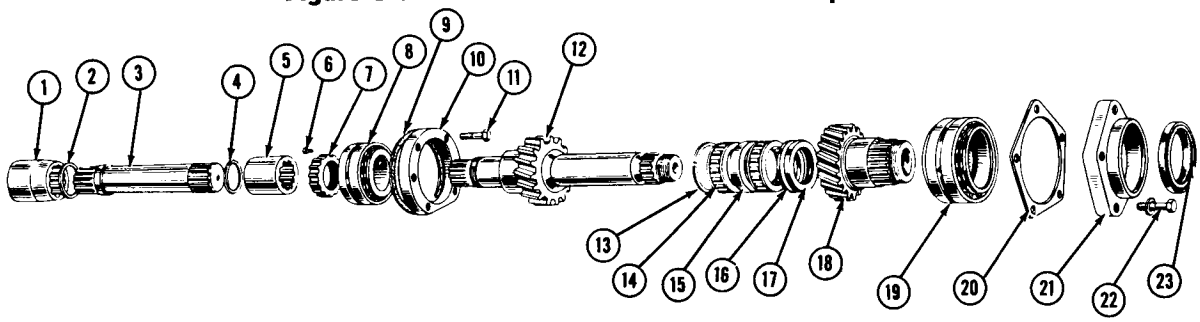
1. SETSCREW
2. LOCKNUT
3. BEARING
4. GASKET
5. RETAINER
6. CAPSCREW
7. SHAFT
8. SNAP RING
9. BEARING
10. SPACER
11. SPACER
12. OIL SEAL
13. SLEEVE GEAR
14. BEARING
15. GASKET
16. RETAINER
17. CAPSCREW
18. OIL SEAL

Figure G-32. Transmission Compound Shaft, Exploded



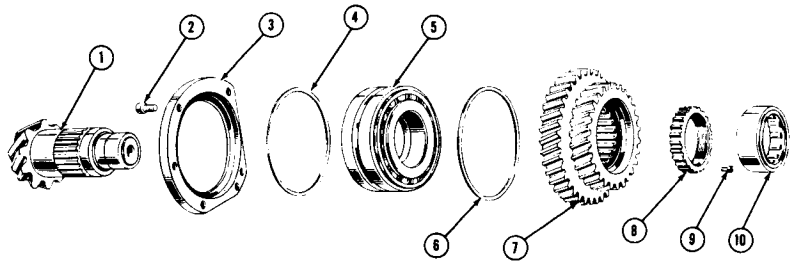
1. CAPSCREW
2. RETAINER
3. SPACER
4. SETSCREW
5. LOCKNUT
6. BEARING
7. SHAFT
8. SNAP RING
9. BEARING
10. SPACER
11. SPACER
12. OIL SEAL
13. SLEEVE GEAR
14. BEARING
15. GASKET
16. RETAINER
17. CAPSCREW
18. OIL SEAL

Figure G-33. Transmission Reverse Shaft, Exploded



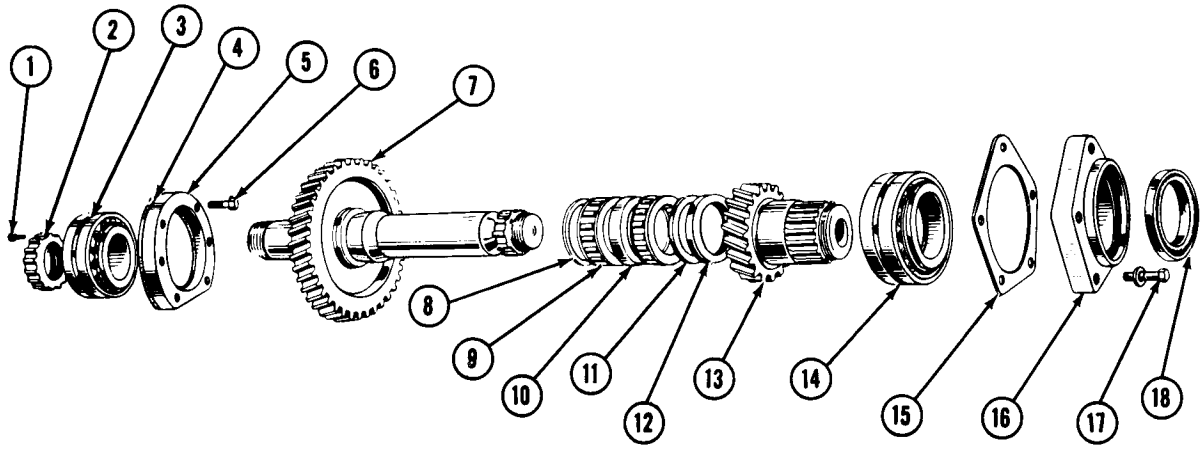
1. SPLINED SLEEVE
2. SNAP RING
3. DRIVE SHAFT
4. SNAP RING
5. SPLINED SLEEVE
6. SETSCREW
7. LOCKNUT
8. BEARING
9. GASKET
10. RETAINER
11. CAPSCREW
12. SHAFT
13. SNAP RING
14. BEARING
15. SPACER
16. SPACER
17. OIL SEAL
18. SLEEVE GEAR
19. BEARING
20. GASKET
21. RETAINER
22. CAPSCREW
23. OIL SEAL

Figure G-34. Transmission Engine Shaft, Exploded



1. RING GEAR AND PINION
2. CAPSCREW
3. RETAINER
4. SHIM
5. BEARING
6. SHIM
7. GEAR
8. LOCKNUT
9. SETSCREW
10. BEARING

Figure G-35. Transmission Output Pinion, Exploded



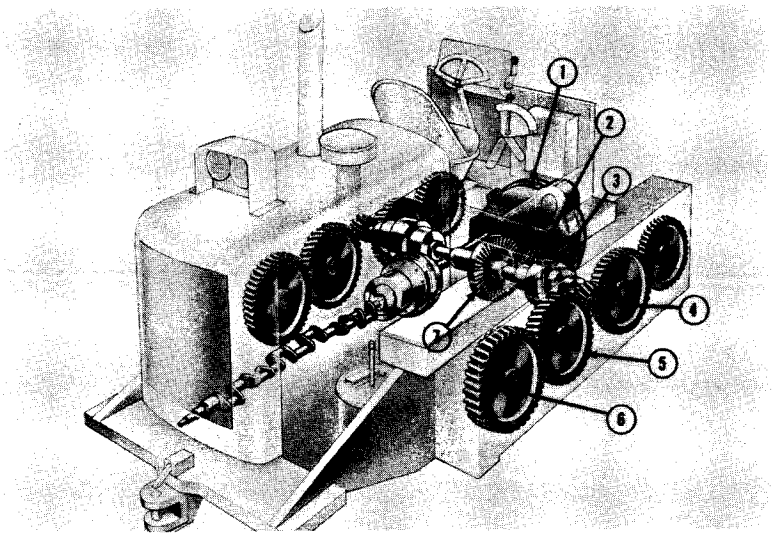
1. SETSCREW
2. LOCKNUT
3. BEARING
4. GASKET
5. RETAINER
6. CAPSCREW
7. SHAFT
8. SNAP RING
9. BEARING
10. SPACER
11. SPACER
12. OIL SEAL
13. SLEEVE GEAR
14. BEARING
15. GASKET
16. RETAINER
17. CAPSCREW
18. OIL SEAL

Figure G-36. Transmission High Forward Shaft, Exploded

FINAL DRIVE

INDEX

FINAL DRIVE



1. TRANSMISSION
2. PINION
3. STEERING CLUTCH
4. IDLER GEARS
5. FINAL DRIVE GEARS
6. FINAL DRIVE PINION
7. RING GEAR

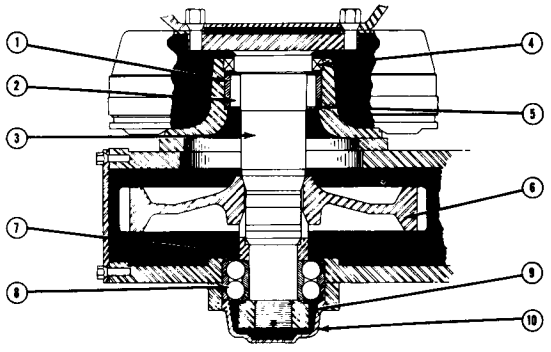
Figure H-1. Final Drive Gear Train

The transmission output pinion delivers power to the spiral bevel ring gear. The spiral bevel ring gear and pinion reduce the transmission speed so that engine power can be used to best advantage, transfer power from the transmission to the steering clutches and change the direction of power flow through 90 degrees.

The steering clutches function in the same manner as the transmission clutches. Air pressure applied to the clutch diaphragm forces the pressure plate against discs. This pressure against the discs locks the hub and drum together so they rotate as one unit and power is transferred from the ring gear carrier through the steering clutch to the final drive pinion. From the final drive pinion, power is carried on through the idler gears and the final drive gears to the wheel.

There is a left and right steering clutch controlling the power flow to corresponding wheels. These two clutches can function together, with both clutches engaged and carrying power to the wheels. They can also function independently, with one clutch engaged and the other disengaged. The engaging and disengaging action is controlled by the steering control arrangement. Both clutches are engaged when the steering arrangement is in the neutral postion.

FINAL DRIVE GEAR AND AXLE



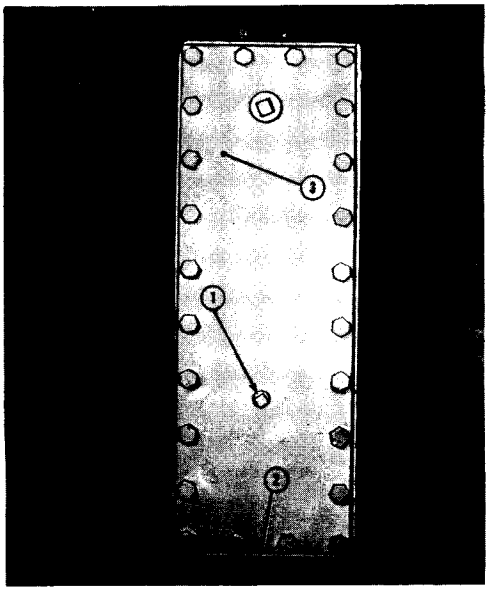
1. RACE
2. BEARING
3. AXLE
4. SEAL
5. RETAINER
6. GEAR
7. SLEEVE
8. BEARING
9. LOCKNUT
10. CAP

Figure H-2. Final Drive Gear and Axle

Disassembly

Block up the Tournatractor and remove wheels and tires on side to be repaired.

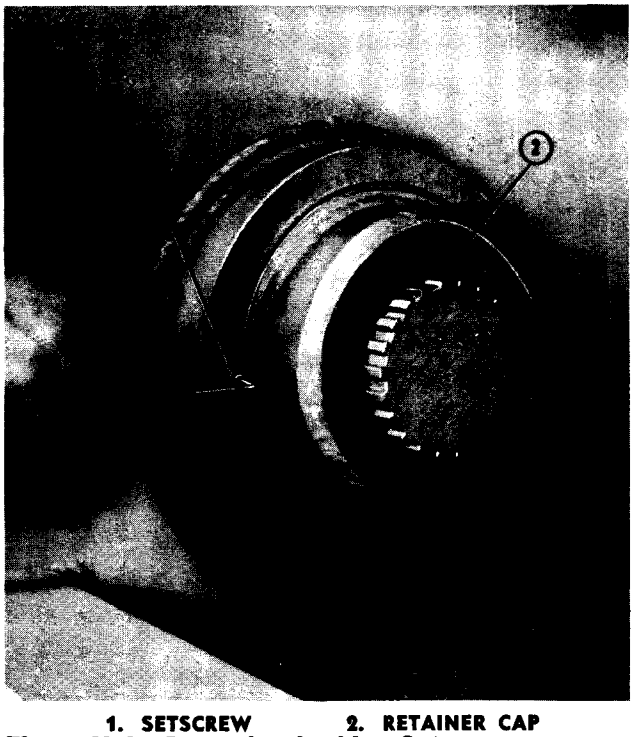
Drain the final drive case and remove the cover plate on the end of the case nearest the final drive gear to be removed.



1. LEVEL PLUG 2. DRAIN 3. COVER PLATE

Figure H-3. Final Drive Case Cover Plate

Remove the setscrew locking the retainer cap in position. The retainer cap is located on the inside wall of the final drive housing (Fig. H-4).



1. SETSCREW 2. RETAINER CAP

Figure H-4. Removing Locking Setscrew

Using the special wrench, adaptor and extension handle provided, remove the retainer cap (Fig. H-5).

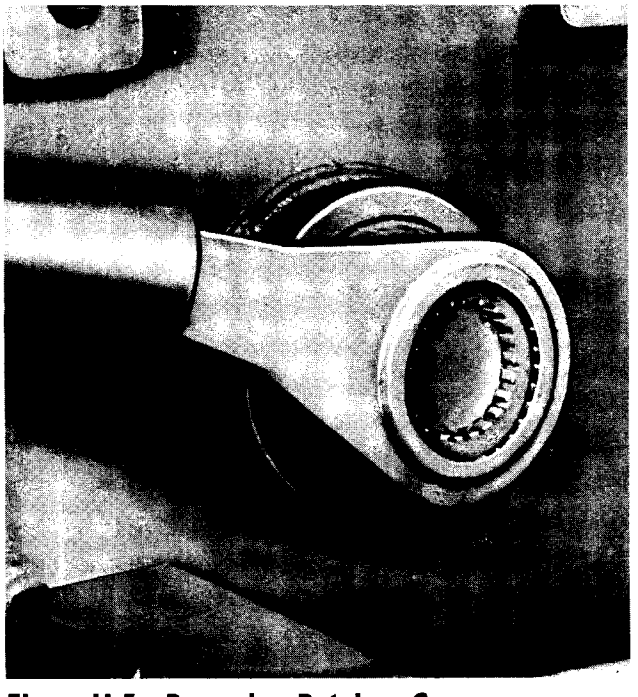
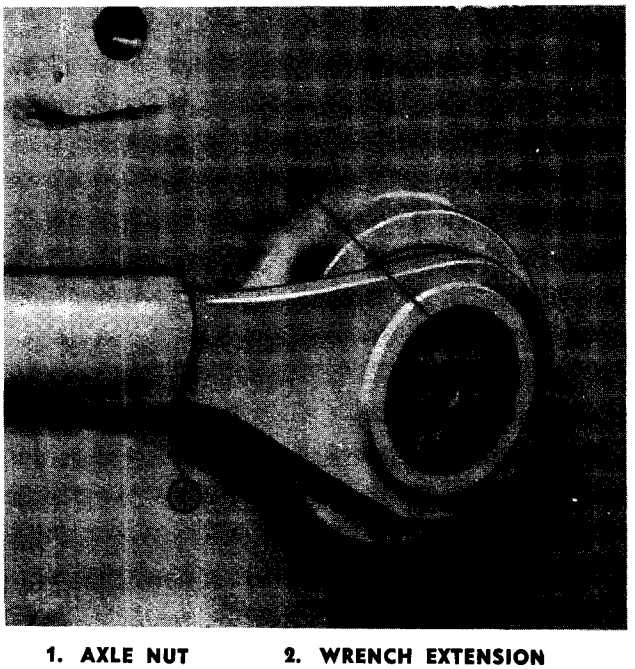


Figure H-5. Removing Retainer Cap

Remove the large cotter from the axle nut. Block final drive gear inside the case to prevent turning and remove the nut using wrench and extension handle (Fig. H-6).



1. AXLE NUT 2. WRENCH EXTENSION

Figure H-6. Removing Axle Nut

To remove the axle from the gear, place tight fitting blocks between the final drive gear and the

case inner wall. Unseat the tapered sleeve by hitting the flange end of the axle sharply with a heavy maul. Drive the axle toward the center of the machine. Be sure to hit the axle flange squarely so as not to damage the flange or shoulders of the axle.

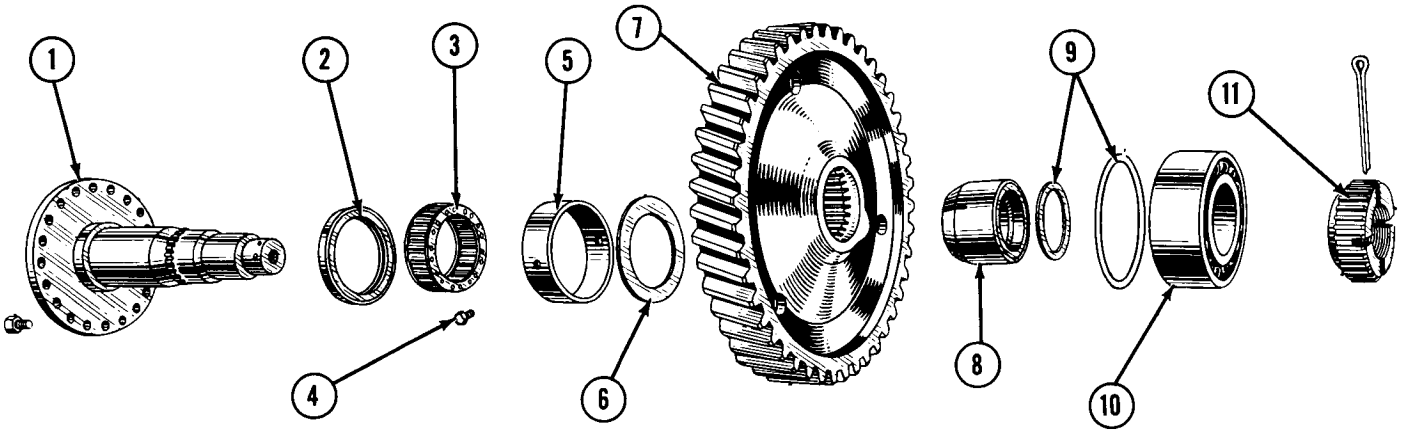
Next remove the axle from the final drive case. Use wood block or some other soft material which will not damage the axle. Drive from the inner wall of the final drive case toward the wheel flange side of the axle. Keep the tapered sleeve from wedging into the final drive gear again as the axle is removed. Block under the final drive gear to keep it from dropping to the bottom of the case as the axle is removed.

Remove the oil seal, outer roller bearing, outer bearing race, and bearing retainer.

NOTE: A special capscrew and jam nut hold the bearing race in position in the bore.

Remove the inner ball bearing, shims and the tapered sleeve.

Roll the final drive gear from the opening in the end of the final drive housing.



1. AXLE
2. OIL SEAL
3. BEARING
4. LOCKING SETSCREW
5. OUTER RACE
6. RETAINER
7. GEAR
8. SLEEVE
9. SHIM
10. BEARING
11. LOCKNUT

Figure H-7. Final Drive Gear and Axle, Exploded

Service

Clean all parts thoroughly. Check bearings for damage or excessive wear and put good bearings in oil until reassembly. Check oil seals for stiffness, nicks or damage and put good seals in oil. Check general condition of the final drive gear for chipped or broken teeth, checks, or cracks. Replace all damaged parts.

Reassembly

To reassemble the final drive gear and axle, reverse the procedure outlined for disassembly. For proper torque recommendations, refer to torque chart on page A-13.

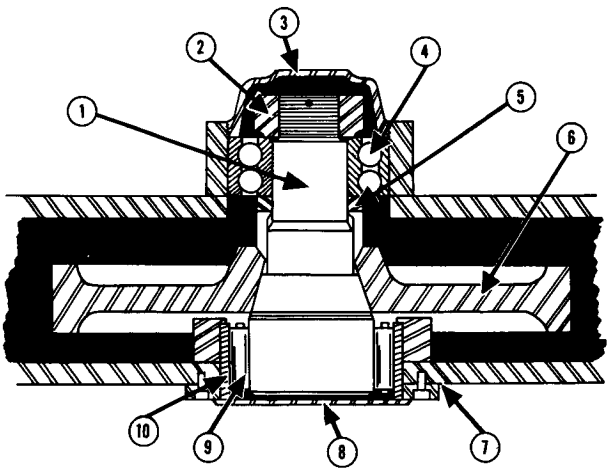
Reassemble the axle and final drive gear in the final drive housing but do not replace retainer cap. Replace shims, force inner ball bearing into bore until it seats against the shoulder in the bore. Do this by prying out on the axle flange with a pry bar. Now measure the distance between the axle flange and some stationary point on the brake, such as the brake backing plate. Push the axle as far toward the center of the Tournatractor as possible and measure the distance from the axle flange to the same point of the brake. The difference between the two measurements is the end clearance on axle roller bearing. This clearance should be maintained between 1/16" and 3/16". If the distance is less than 1/16" add shims between inner race of the inner axle bearing and the sliding sleeve on the axle.

If the distance is more than 3/16" add shims between the outer race of the inner axle bearing and the bottom of the bearing bore in the axle housing.

Replace locknut and torque to 8000 ft. lbs.

Install cotter and replace retainer cap and locking setscrew.

IDLER GEAR



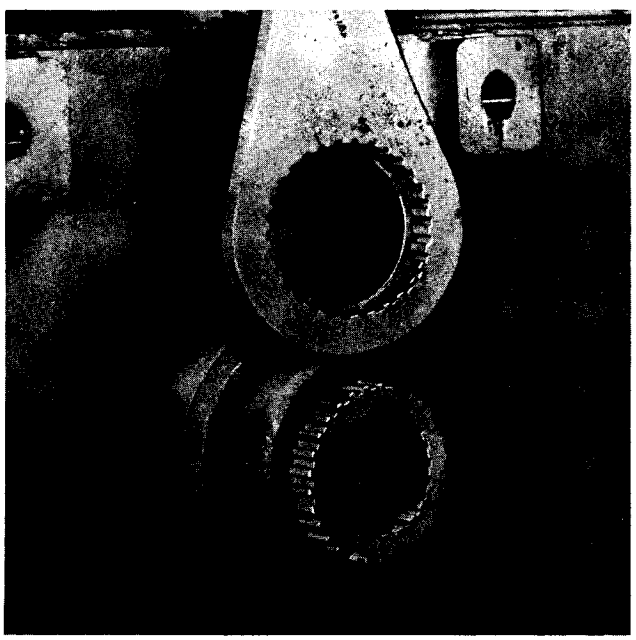
1. SHAFT
2. LOCKNUT
3. CAP
4. BEARING
5. SLEEVE
6. GEAR
7. GASKET
8. CAP
9. BEARING
10. OUTER RACE

Figure H-8. Idler Gear, Cross Section

Disassembly

Remove the final drive gear. See page H-3.

Remove the setscrew locking the idler gear inner bearing retainer cap in position. (The retainer cap is located on the inside wall of the final drive housing.) (Fig. H-9).

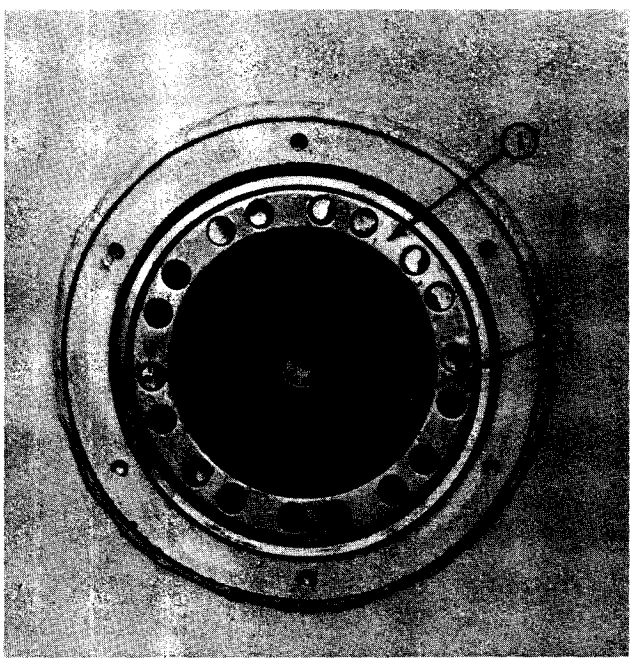


1. WRENCH
2. RETAINER CAP
3. SETSCREW

Figure H-9. Retainer Cap Setscrew

Remove the retainer cap. Use wrench, adaptor and pipe extension handle (Fig. H-9).

Remove six socket head capscrews and the outer bearing cap, exposing the end of the idler shaft and the roller bearing (Fig. H-10).



1. ROLLER BEARING
2. IDLER SHAFT

Figure H-10. Bearing Cap Removed

Now remove the large cotter from the idler shaft locknut and remove the locknut.

Place a brass plug into the bore of the idler gear shaft. The plug must be large enough to protrude from the bore in the shaft. With a heavy sledge drive against the plug, toward the center of the

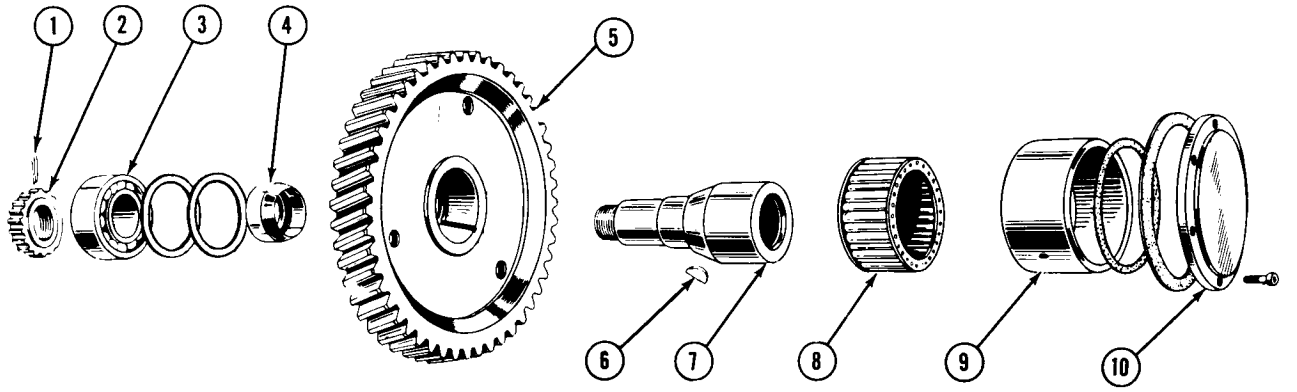
machine, to unseat the tapered sleeve. If idler gear shaft has 1¼" drilled and tapped hole in the outer end use puller to remove shaft.

Place a block of wood under the idler gear to prevent its dropping to the bottom of the final drive housing and remove the idler shaft and Woodruff key. Drive shaft toward the outside of the final drive housing.

Remove the inner ball bearing, shims and the tapered sleeve.

Roll the idler gear out of the open end of the final drive housing.

Remove the outer roller bearing and bearing race.



1. COTTER
2. LOCKNUT
3. BEARING
4. SLEEVE
5. GEAR
6. KEY
7. SHAFT
8. BEARING
9. OUTER RACE
10. CAP

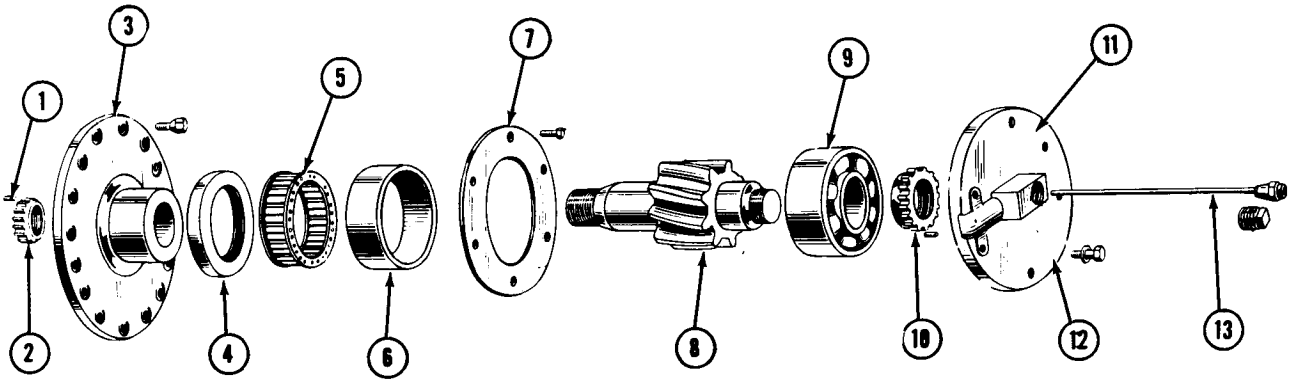
Figure H-11. Idler Gear and Shaft, Exploded

Service and Reassembly

Inspect the idler gear for excessive wear, and pitted or cracked teeth. Check threads for damage. Check bearings and bearing races for wear or damage. Place good bearing in oil until reassembled.

Reverse the disassembly procedure outlined above to reassemble the idler gear in the final drive case.

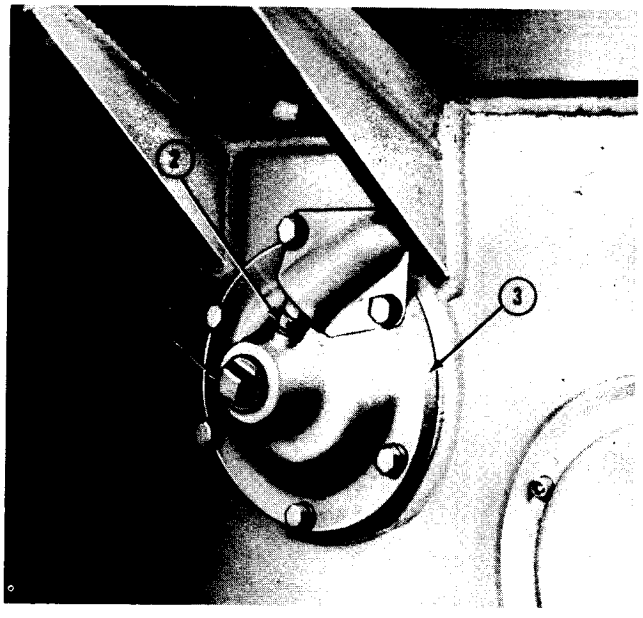
FINAL DRIVE PINION



1. SETSCREW
2. LOCKNUT
3. HUB
4. OIL SEAL
5. BEARING
6. OUTER RACE
7. RETAINER
8. PINION
9. BEARING
10. LOCKNUT
11. CAP AND GASKET
12. HOSE GUARD
13. INLET FITTING AND SLEEVE

Figure H-12. Final Drive Pinion, Exploded

Remove the pipe plug in the pinion cap. Loosen the hex nut on the inlet tube until the inlet tube is loose. Remove the tube. Disconnect the air line to the air pipe (part of the bearing cap), remove the six capscrews, and lift off the cap exposing the outer final drive bearing locknut.



1. AIR PIPE 2. INLET TUBE
3. BEARING CAP

Figure H-13. Removing Inlet Tube and Bearing Cap

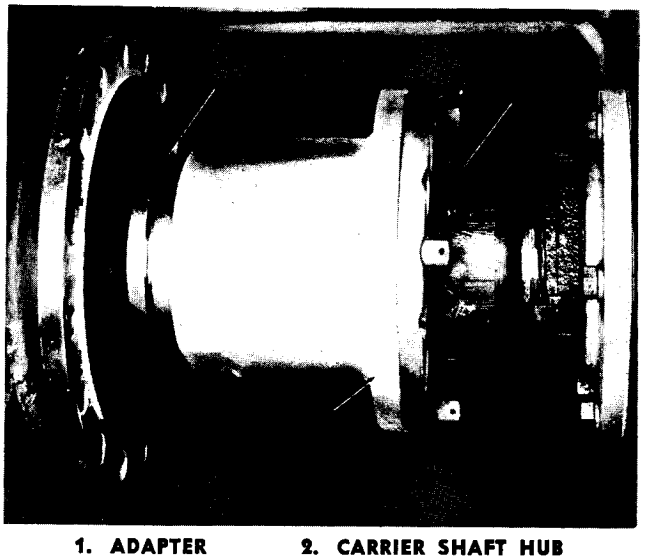
Remove cover plate over steering clutch housing and remove the steering clutch. See page H-9 for more detailed instructions on steering clutch removal.

Remove the locking setscrew and attach the wrench and adaptor to the pinion hub locknut. Note that part of the wrench is bolted to the carrier shaft hub after it is positioned over the splined wrench adaptor (Fig. H-14).

Secure the steering lever controlling the clutch that has been removed to the rear or released position. (For machines with steering switch secure the switch toggle in the position that released the clutch.) Be sure the transmission speed selector lever is in the neutral position. Start the engine and operate until full pressure has been built up in the air tank (120 lbs.). Shut off the engine and apply the wheel brakes. The brakes will keep the final drive gears from turning while locknuts are being removed. The air cannot escape through the open line to the steering clutch as long as the steering lever or switch is kept in the released position.

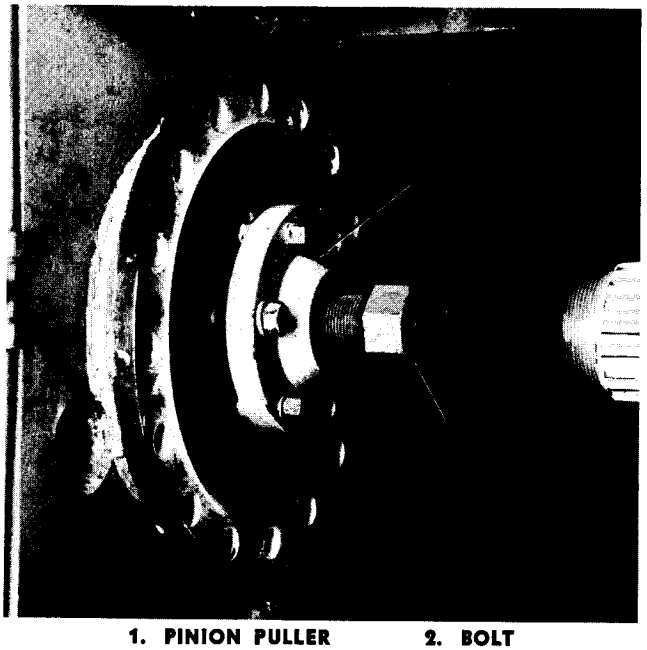
Now remove the transmission clutch adjusting head from the low forward clutch, and using wrench and support plate with pipe extension handle, turn the low forward shaft. This method utilizes the gear reductions through the transmission and ring gear to the pinion hub locknut. By this method approximately 350 ft. lbs. applied pressure is necessary to loosen the nut which was torqued to 3500 ft lbs.

Bolt the pinion puller to the face of the pinion hub flange and insert the large puller bolt (Fig. H-15). Tighten the bolt until pressure is applied to the end of the pinion. Strike the puller with a brass drift or some similar material and continue to turn the puller bolt until the pinion is separated from the pinion hub. Remove the pinion with the outer ball bearing attached.



1. ADAPTER 2. CARRIER SHAFT HUB
3. WRENCH STRUCTURE

Figure H-14. Carrier Shaft Hub Wrench



1. PINION PULLER 2. BOLT

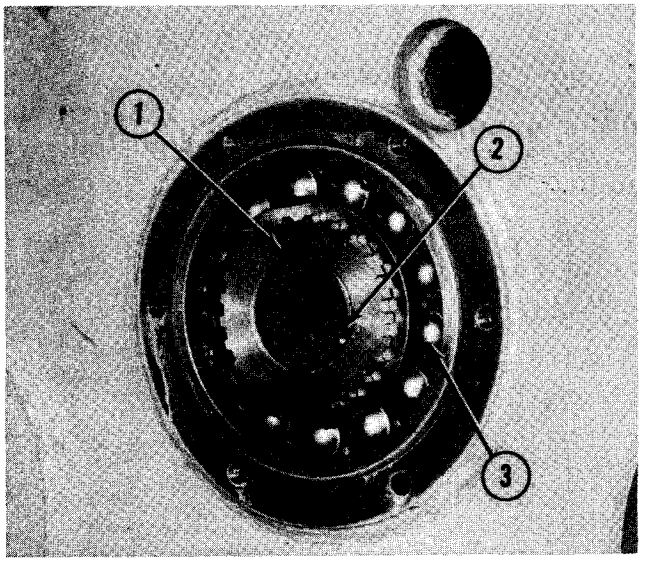
Figure H-15. Pinion Puller Attached

When the tapered surfaces between the pinion and the hub separate the pinion may fly out through

the bore in the outer wall of the final drive housing. Take any precautions necessary to keep the pinion from dropping to the ground.

Remove the locking setscrew, the pinion outer bearing locknut, and the pinion outer ball bearing (Fig. H-16).

Remove the pinion hub, seal, and roller bearing. Remove these parts through the steering clutch compartment.



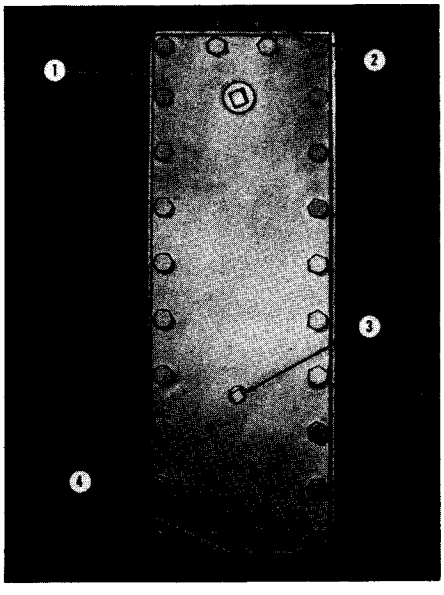
1. LOCKNUT 2. SETSCREW
3. BEARING

Figure H-16. Pinion Outer Bearing Locknut

Service

Check the inlet tube seal. Inspect the pinion for excessive wear, pitting, or cracking of teeth. Check threads and splines for damage. Check bearings and oil seals for damage and place good bearings and seals in oil until reassembled.

Check the oil level every 10 shifts. Change oil ever 100 shifts. Use only extreme pressure gear oil meeting U.S. Army Specification MIL-L-2105 or of equal quality. Use SAE 140 E.P. (above 90° F.), SAE 90 E.P. (from 32° to 90° F.), SAE 80 E.P. (below 32° F.) 17 gallon capacity on each side. Fill to level plug.



1. MAIN CASE
2. FILLER CAP
3. LEVEL PLUG
4. DRAIN PLUG

Figure H-17. Lubrication Point

Reassembly

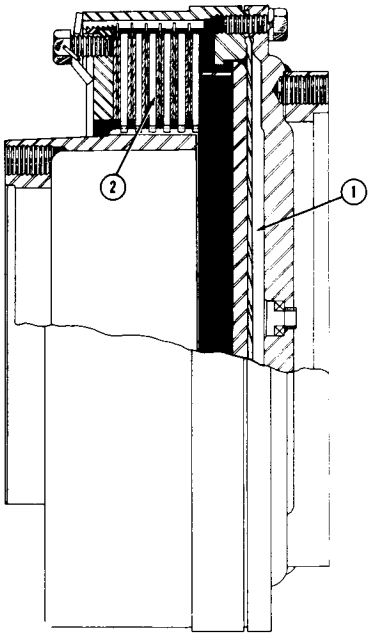
Reverse the procedure outlined for disassembly to reassemble the final drive pinion.

When reassembling the air inlet tube into the final drive pinion cap, push the tube in until it touches the steering clutch diaphragm. Back out the tube ¼" and tighten the hex nut. This clearance is necessary to keep the end of the air inlet tube from cutting the diaphragm.

STEERING CLUTCH

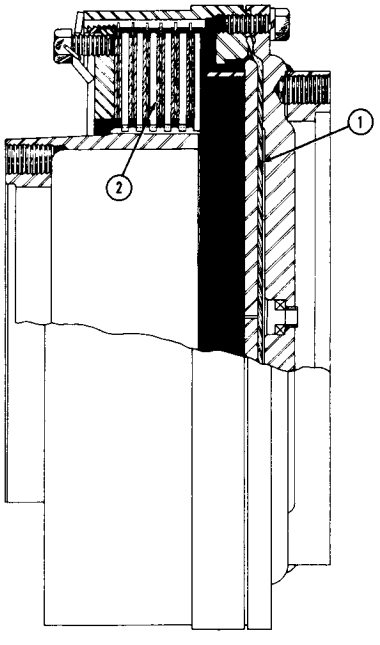
There is a left and a right steering clutch controlling the power flow to the left and right wheels. These clutches can function together with both engaged and carrying power to the wheels, or they can function separately with one clutch engaged and the other disengaged.

The engaging action of the steering clutch is similar to that of the transmission clutch (see page G-3). The disengaging action takes place as the air is exhausted through the steering control valve. Steering clutch operation is illustrated under two conditions: engaged and disengaged.



1. AIR PRESSURE 2. DISCS ENGAGED

Figure H-18. Steering Clutch, Engaged



1. AIR PRESSURE RELIEVED 2. DISCS DISENGAGED

Figure H-19. Steering Clutch, Disengaged

Removal

NOTE: Before removing the left steering clutch assembly refer to Section "I" for parking brake disassembly.

Remove the cover plate over the steering clutch compartment.

Remove the air inlet tube. (Refer to "Final Drive Pinion Removal", page H-6.)

Remove the lock wires and the capscrews which fasten the clutch assembly to the final drive pinion hub flange and to the carrier shaft hub flange (Fig. H-20).

A tube has been built into the final drive housing to facilitate removal of the capscrews in the final drive hub flange. Use a standard socket and a long

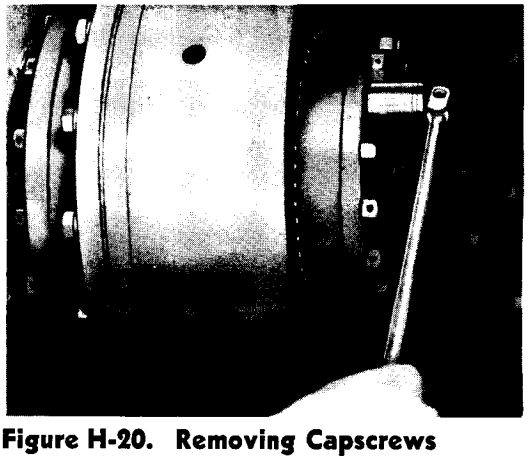
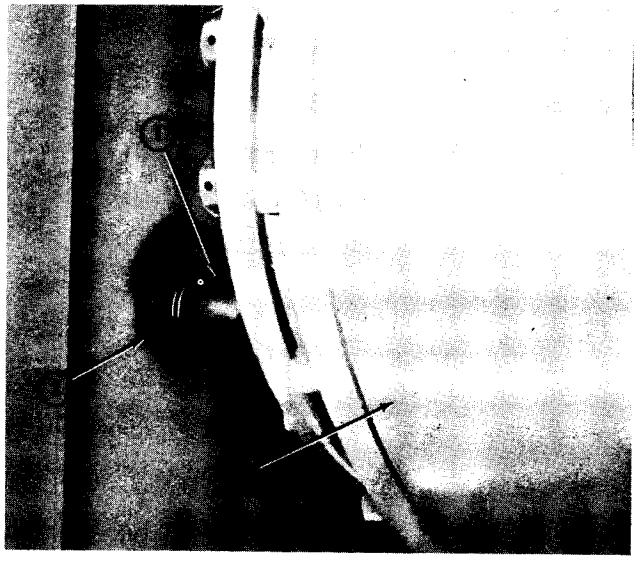


Figure H-20. Removing Capscrews

extension and remove the capscrews by reaching through the tube from the outside of the case. Rotate the clutch and hub to line up the capscrew heads with the hole in the final drive housing (Fig. H-21).



1. SOCKET WRENCH 2. CLUTCH HOUSING
3. ACCESS OPENING

Figure H-21. Access Opening to Hub Flange

Attach a sling to the clutch assembly, before the last capscrews are removed, remove the capscrews and lift out the clutch (Fig. H-22).

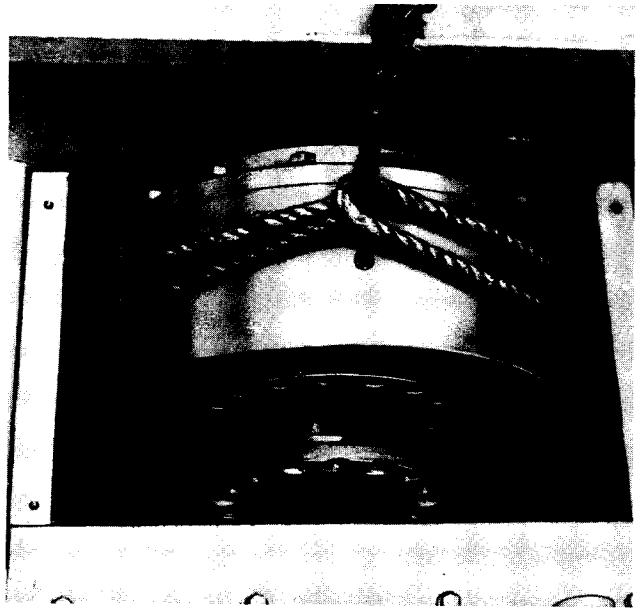


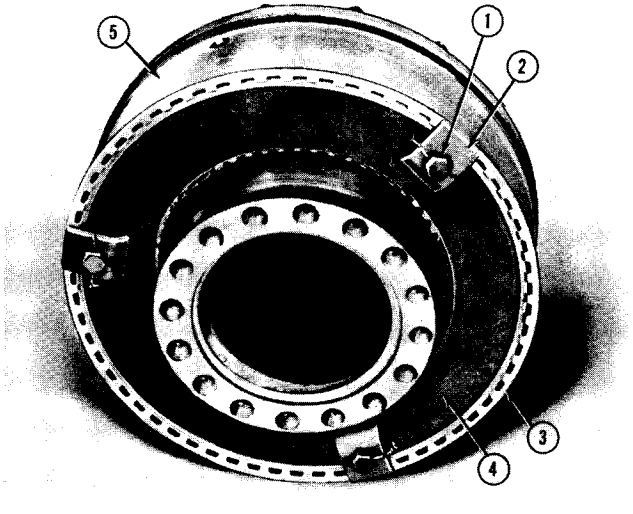
Figure H-22. Removing Clutch from Case

Disassembly

The clutch hub can be pulled from the clutch assembly after it has been removed from the machine.

Cut the wires and remove the three capscrews and bolt lugs from the adjusting disc (Fig. H-23).

Remove the adjusting ring.



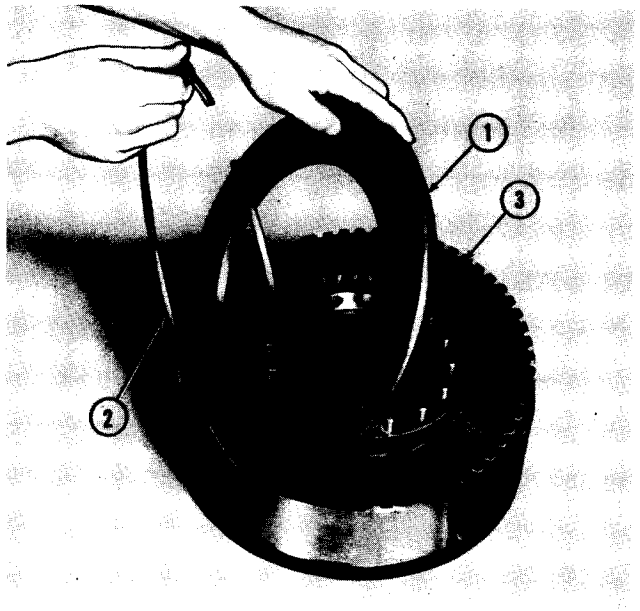
1. CAPSCREWS 3. ADJUSTING RING
2. BOLT LUGS 4. ADJUSTING DISC
5. HOUSING

Figure H-23. Steering Clutch, Removed

Remove the adjusting disc, the lined and unlined (steel) disc and the thrust plate (Fig. H-24).

Remove the capscrews holding the diaphragm backing plate to the clutch housing.

Remove diaphragm backing plate, oil seal, diaphragm and pressure plate.



1. ADJUSTING DISC 2. ADJUSTING RING
3. DISCS

Figure H-24. Removing Adjusting Ring and Disc

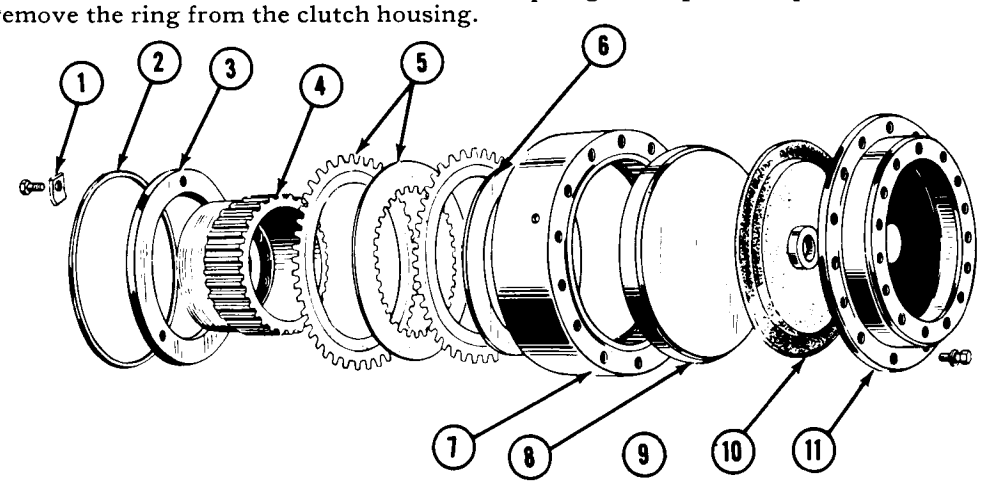
For machines with steering clutches that have a notched adjusting ring, tap the adjusting disc away from the adjusting ring. Tap on at least four equally spaced points around the circumference of the disc.

Turn the adjusting ring in a counter-clockwise direction to remove the ring from the clutch housing.

Remove adjusting disc, lined and unlined discs and the thrust plate.

Remove the capscrews holding the diaphragm backing plate to the clutch housing.

Remove diaphragm backing plate, oil seal, diaphragm and pressure plate.



1. BOLT LUG
2. ADJUSTING RING
3. ADJUSTING DISC
4. HUB
5. DISC
6. THRUST PLATE
7. HOUSING
8. PRESSURE PLATE
9. OIL SEAL
10. DIAPHRAGM
11. BACKING PLATE

Figure H-25. Steering Clutch, Exploded

Service and Reassembly

Check all parts for excessive wear or damage and clean thoroughly. Check backing plate and pressure plate for burrs and remove any found with emery cloth. Check the clutch discs in the same manner as was outlined in the transmission section.

Reassemble the unit by reversing the procedure outlined for disassembly.

NOTE: Be sure that the diaphragm is properly seated when the clutch is reassembled.

Adjustment (After Installation)

Insert the ½" square end of a flex socket handle in one of the notches cut in the adjusting ring and rotate the adjusting ring in a clockwise direction until tight. Then rotate the ring in a counter-clockwise direction ⅓ to ½ turn (to allow approximately ⅛" movement of the clutch pressure plate as the clutch is engaged and disengaged). Apply air pressure to the clutch. The air pressure will lock the adjusting ring in position.

To adjust clutches with snap ring type adjusting ring, first loosen the three capscrews holding bolt lugs to adjusting disc.

Insert gauge, through inspection port in clutch housing, between any two clutch discs and force snap ring in until the clearance between discs is ⅛".

Replace and rewire capscrews and bolt lugs. Apply air pressure to the clutch. The air pressure will lock the adjusting ring in position.

SPIRAL BEVEL RING GEAR

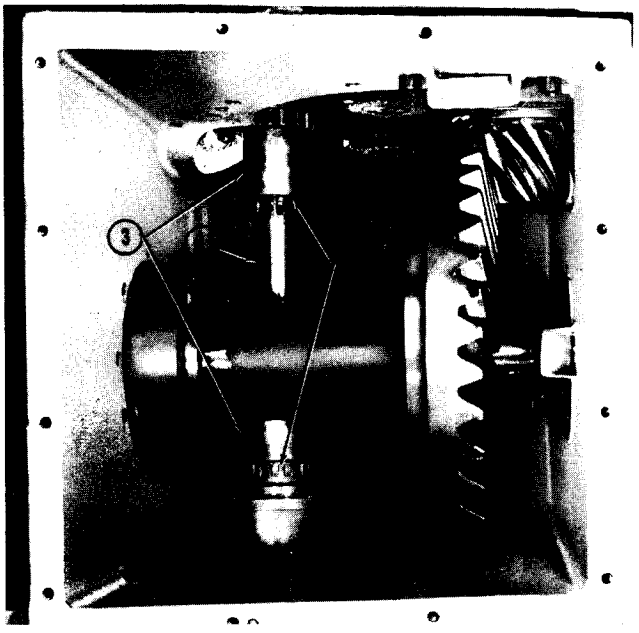
Removal

Remove the parking brake, steering clutches and transmission.

Remove ring gear compartment cover plate.

Remove drive shaft from ring gear compartment.

For machines with torque converter, pull drive shaft and snap ring from splined sleeve on torque converter shaft. If machine is not equipped with torque converter pull drive shaft from splined hub.

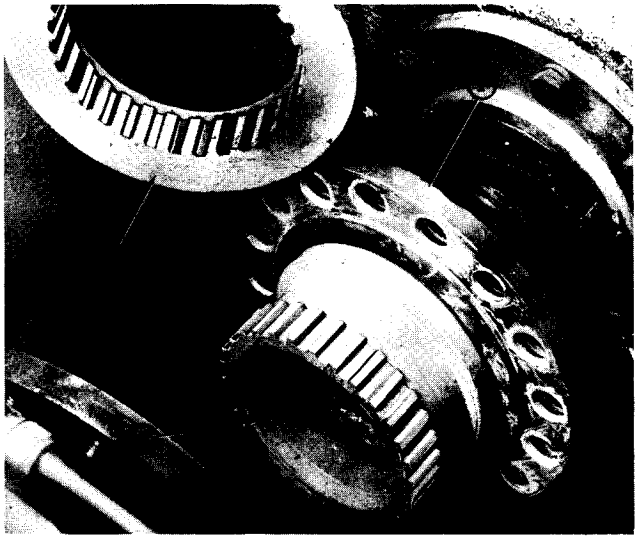


1. DRIVE SHAFT 2. SNAP RINGS
3. SPLINED SLEEVES

Figure H-26. Ring Gear Compartment

Remove the right hand carrier shaft hub locknut and pull the hub (Fig. H-27).

Cut lockwires and remove capscrews securing the ring gear to the carrier shaft. With soft hammer drive gear from it's seat on carrier shaft. Attach sling to carrier shaft.



1. WRENCH 2. HUB 3. ADAPTER

Figure H-27. Pulling Hub

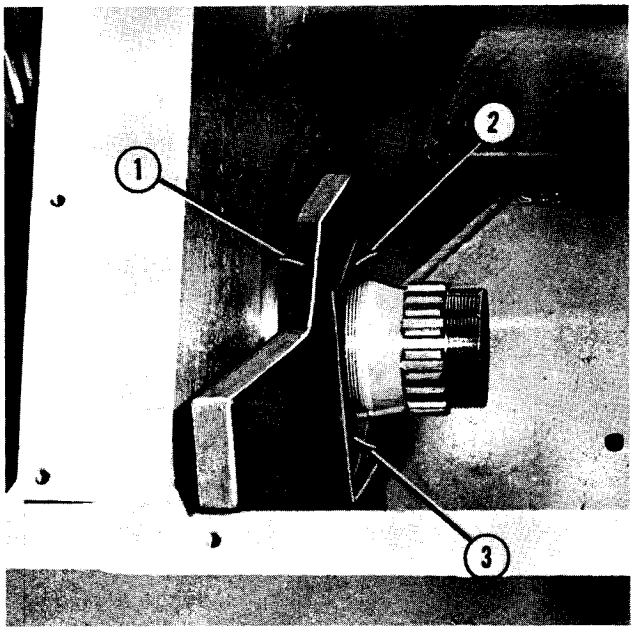
Cut lockwire, loosen locking capscrews, and back off the adjusting nut in the right hand steering clutch compartment. Remove bearing retainer with oil seal in right compartment (Figs. H-28, H-29).

Remove the bearing.

Remove steering clutch hub locknut in left steering clutch compartment and pull hub.

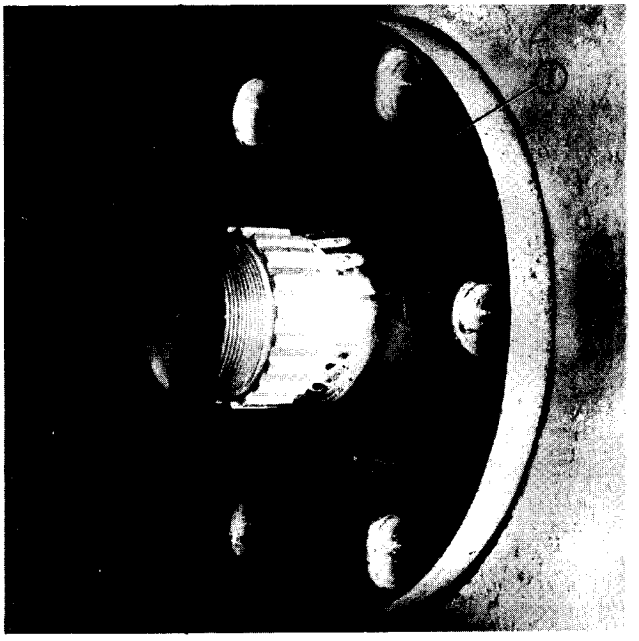
Support the ring gear carrier with a sling and remove the bearing cage in the left compartment.

Further disassemble the cage by removing the oil seal and the outer bearing race. (Bearing race is held in position by a setscrew through the cage just behind the flange.)



1. WRENCH 2. NUT 3. LOCKING CAPSCREWS

Figure H-28. Removing Adjusting Nut



1. BEARING RETAINER

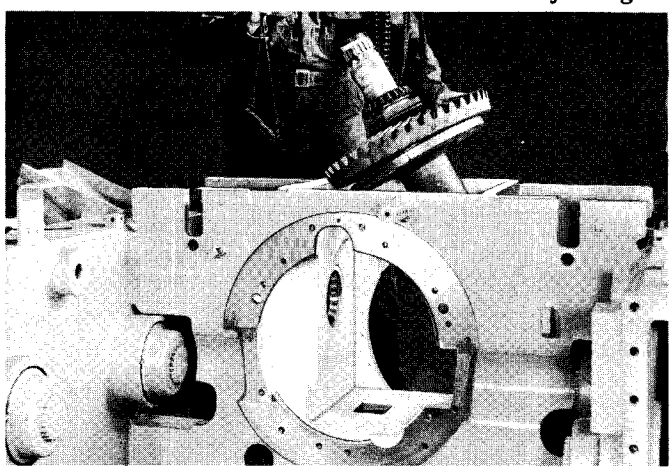
Figure H-29. Pulling Bearing Retainer with Capscrews

Remove bearing and keeper ring from carrier shaft.

Slide ring gear carrier to the left until right end of shaft clears bore in case wall. Lift ring gear and carrier from case.

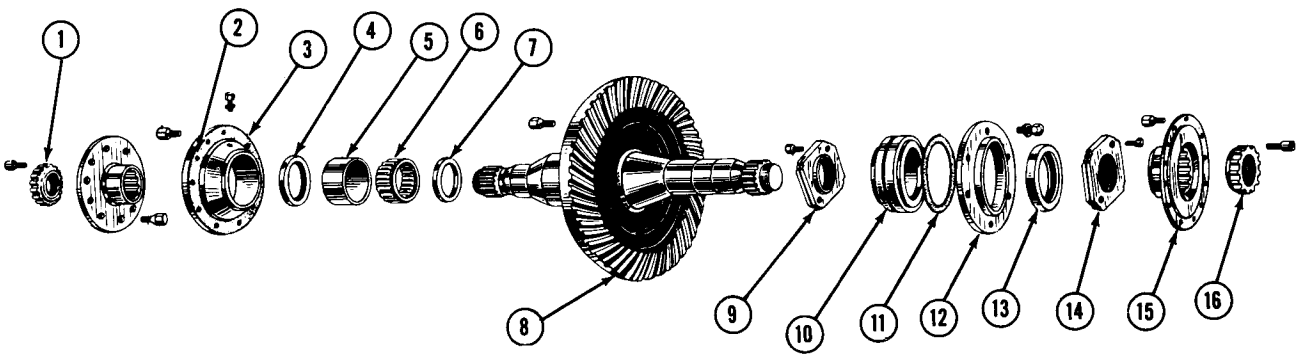
Separate gear and shaft.

Remove locking wire, locking capscrew, and inner carrier adjusting nut.



1. CARRIER SHAFT

Figure H-30. Removing Carrier Shaft



1. NUT
2. GASKET
3. CAGE
4. OIL SEAL
5. OUTER RACE
6. BEARING
7. KEEPER RING
8. PINION AND RING GEAR
9. ADJUSTING NUT
10. BEARING
11. GASKET
12. RETAINER
13. OIL SEAL
14. ADJUSTING NUT
15. SPLINED HUB
16. LOCK NUT

Figure H-31. Ring Gear Carrier, Exploded

Reassembly

Inspect the mating surfaces of the ring gear and carrier flange for burrs which may cause misalignment of the gear on the flange.

Place ring gear on carrier shaft.

Seat ring gear on carrier shaft and install capscrews and lockwires.

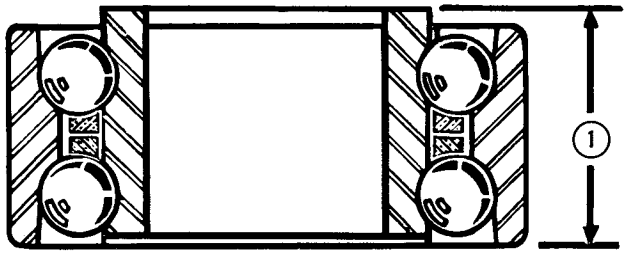
Install the inner adjusting nut with the flange side of the nut facing the bearing. Move the carrier shaft and ring gear into the case with the left end of the shaft going through the left bore. Level and slide the carrier shaft into the right bore. Then install bearings, seals, keeper ring and cages.

NOTE: Make sure bearings and cages pull up straight. Install the outer adjusting nut.

Install the drive shaft and transmission.

NOTE: The toe of the pinion tooth must be flush with the toe of the spiral bevel ring gear at the index point. This is obtained by adding to or taking out shims between the outer bearing race of the rear spiral bevel pinion shaft bearing and the bore in the transmission case. If a new bearing is installed, measure the width of the new bearing and then measure the width of the replaced bearing. See Fig. H-32. If the new bearing is wider take out shims equal to the difference in width between the replaced and the new bearing. If new bearing width is less than replaced bearing add shims equal to the difference.

Now move the ring gear carrier endwise in the direction needed, until the backlash between the ring gear and pinion, as checked with a dial indicator, is equal to the dimensions stamped or burned on the outer edge of the ring gear (Fig. H-33). This is done by loosening or tightening the two adjusting nuts on the right end of the carrier shaft (Figs. H-34, H-35).



1. WIDTH

Figure H-32. Width of Bearing Measured from Surface of Inner Race to Surface of Outer Race

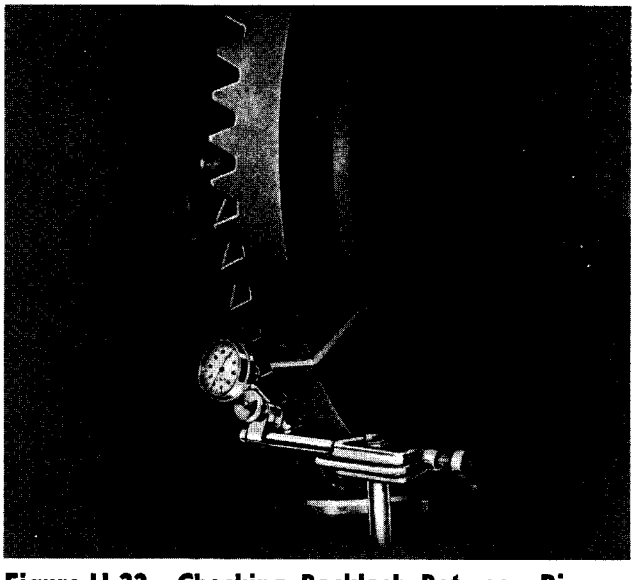
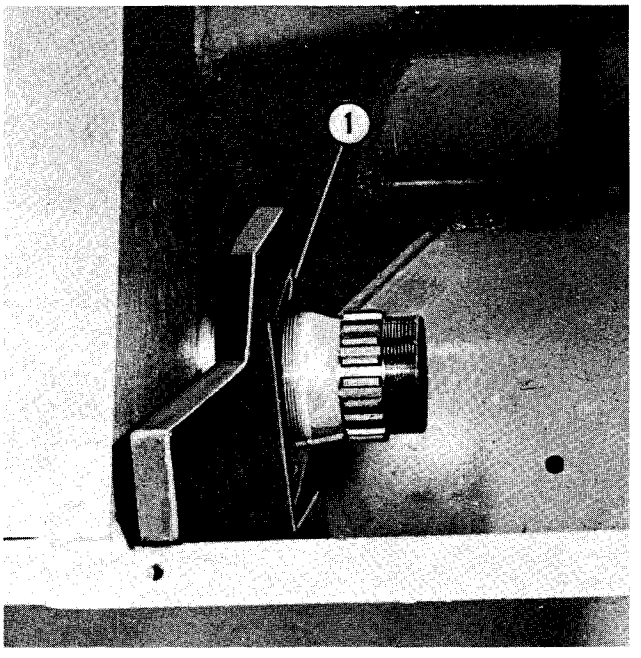


Figure H-33. Checking Backlash Between Ring Gear and Pinion

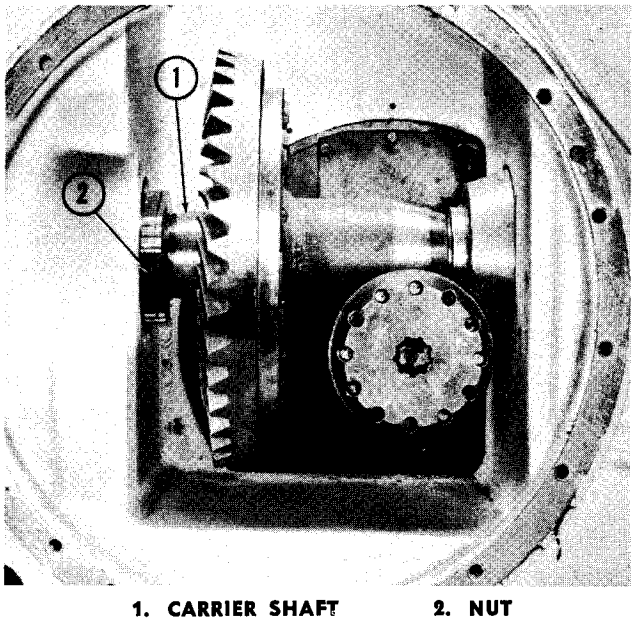
Both adjusting nuts should be drawn up tight in checking the lash. Before locking, check at four points on the ring gear. After the proper adjustment is obtained, lock both adjusting nuts with capscrews and safety wires.

NOTE: The back lash adjustment between the pinion and spiral bevel ring gear is required whenever either or both of these units are installed in the machine, or if the adjustment is disturbed for other reasons. It must be remembered that the PINION AND SPIRAL BEVEL RING GEAR ARE REPLACEABLE IN MATCHED SETS ONLY.



1. ADJUSTING NUT

Figure H-34. Steering Clutch Compartment



1. CARRIER SHAFT 2. NUT

Figure H-35. Ring Gear Compartment

None of the ring gears and pinions leave the factory with more than .005" run-out. If more than .005" run-out is found after installing the set, the cause should be determined and the condition corrected. Several possible causes may be found, such as the carrier shaft flange being sprung shavings or trash between the ring gear and carrier flange or capscrews unevenly tightened.

If the back lash setting is stamped at .008", it

should be no more than .013" at any other point on the gear.

The heel and toe adjustment of the output pinion using the double row, tapered roller bearing is made by inserting or removing shims from between the bearing cup and the bottom of the transmission case bore similar to the method described above.

When the bearing is in the proper position, the distance from the face of the transmission case to face of the outer bearing cone should be 1.445". The face of the transmission case is to be considered that portion of the case which rests against the main case when the transmission is in the mounted position. (See page G-12.)

An alternate method for checking the position of the pinion is as follows:

1. Install only the output pinion group in the transmission case.

2. Mount the transmission case on the machine. Make certain that the pinion tooth marked with an "X" is placed between the two ring gear teeth marked with "X's".

3. Note that the "X's" are etched on ground surfaces on the gears. With the gears in the position described in Step 2, the ground surfaces will be aligned, and these surfaces should be flush. Remove or add shims between the bearing cup and the bottom of the case bore until the surfaces are flush.

BRAKES AND TIRES

INDEX

BRAKES AND TIRES

WHEEL BRAKES

Principle of Operation

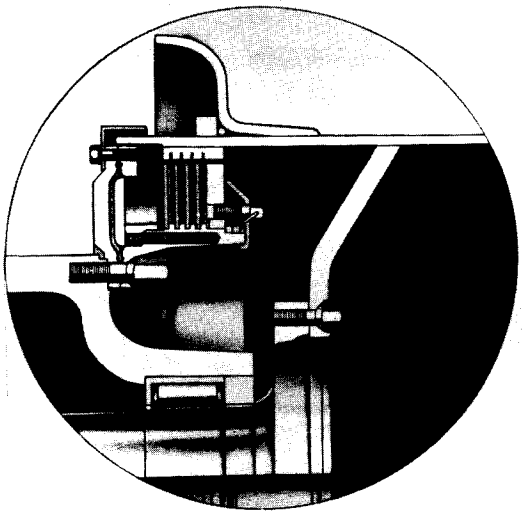
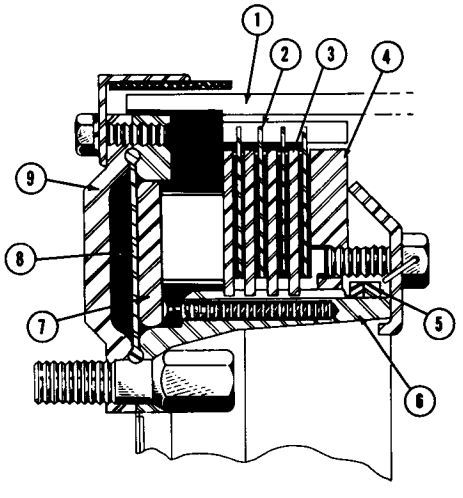


Figure I-1. Wheel Brake

Each wheel is equipped with an air actuated and spring released multiple disc brake. The principle parts of the brake are: brake drum which is bolted to the wheel; brake hub which is bolted to the main case structure; discs of two types, steel discs splined to the brake hub and fabricated discs splined to the brake drum; and pressure plate with diaphragm.

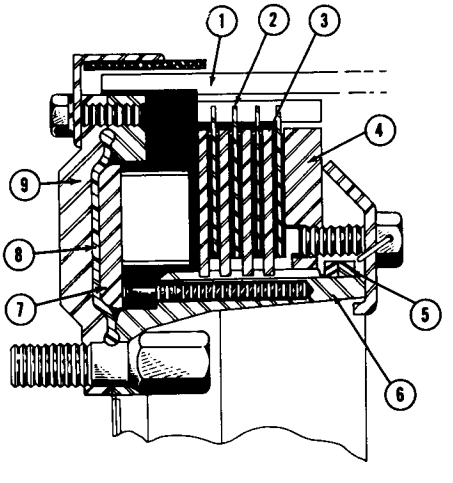
When the brake is actuated by foot pressure on the metering type air valve on the floor of the cockpit, compressed air from the supply tank is admitted to the brake. The air exerts pressure through the diaphragm against the pressure plate. The pressure plate pressed against the discs forcing them together. Since part of the discs are splined to the revolving brake drum and part to the stationary brake hub, the wheel is braked when the discs are forced together (Fig. I-2).

When air to the brake is cut off (brake pedal released), the return springs force the pressure plate back to its original or released position. These springs are compressed when the brake is engaged (Fig. I-3).



1. BRAKE DRUM
2. REVOLVING DISCS
3. STATIONARY DISCS
4. BACKING PLATE
5. SNAP RINGS
6. BRAKE HUB
7. PRESSURE PLATE
8. DIAPHRAGM
9. DIAPHRAGM BACKING PLATE

Figure I-2. Wheel Brake, Applied



1. BRAKE DRUM
2. REVOLVING DISCS
3. STATIONARY DISCS
4. BACKING PLATE
5. SNAP RINGS
6. BRAKE HUB
7. PRESSURE PLATE
8. DIAPHRAGM
9. DIAPHRAGM BACKING PLATE

Figure I-3. Wheel Brake, Released

Removal

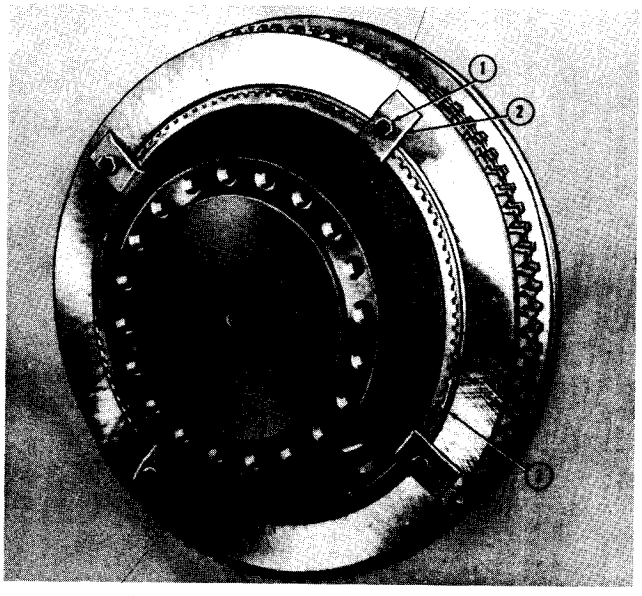
Block up the Tournatractor so the wheel and tire will roll free. Place a sling around the tire and wheel and remove capscrews securing the wheel to the hub.

Disconnect the air lines at each brake unit. Remove the wheel and tire and the brake drum.

Disassembly

Remove the four capscrews and snap ring guards around the circumference of the brake hub. Be sure the brake is completely released (no air applied).

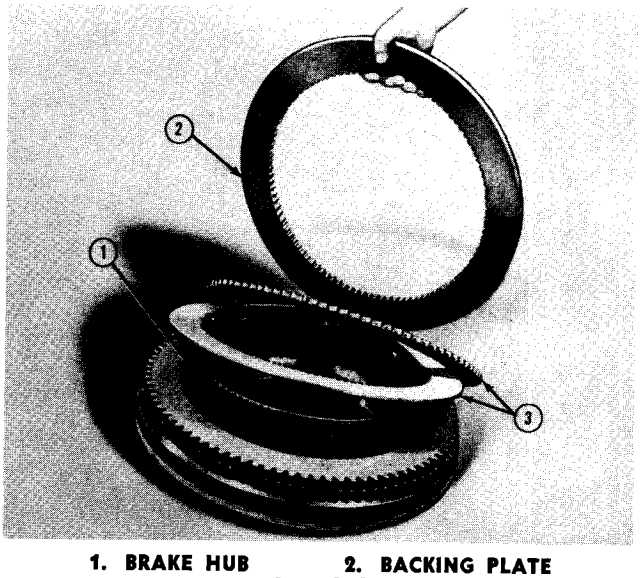
Pry out the snap rings (Fig. I-4).



1. CAPSCREWS 2. SNAP RING GUARDS
3. SNAP RINGS

Figure I-4. Snap Ring Guards and Snap Rings

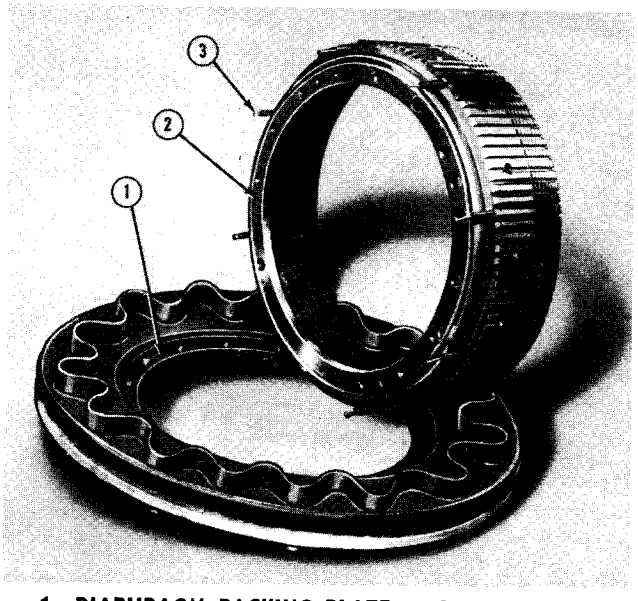
Remove the backing plate and lined and unlined discs (Fig. I-5).



1. BRAKE HUB 2. BACKING PLATE
3. DISCS

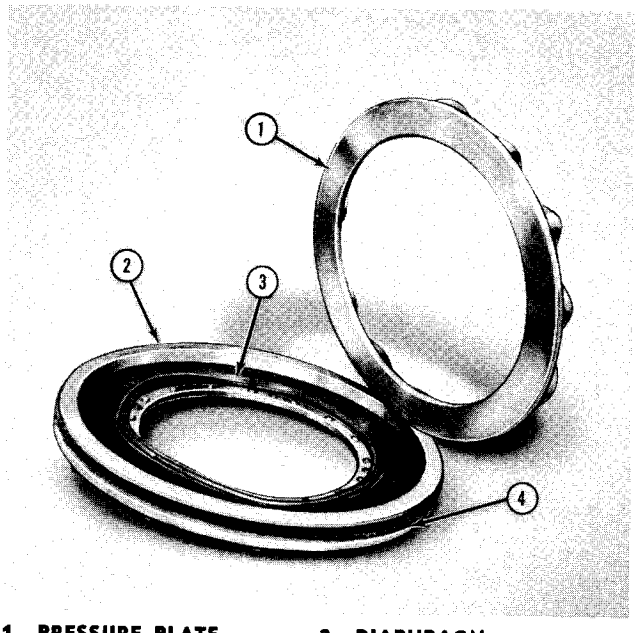
Figure I-5. Removing Backing Plate and Discs

Remove the tapered capscrews securing hub and diaphragm backing plate together. Note the position of the brake release springs and guides as the hub and plate are separated (Fig. I-6).



1. DIAPHRAGM BACKING PLATE 2. BRAKE HUB
3. SPRINGS AND SPRING GUIDES

Figure I-6. Removing Brake Hub



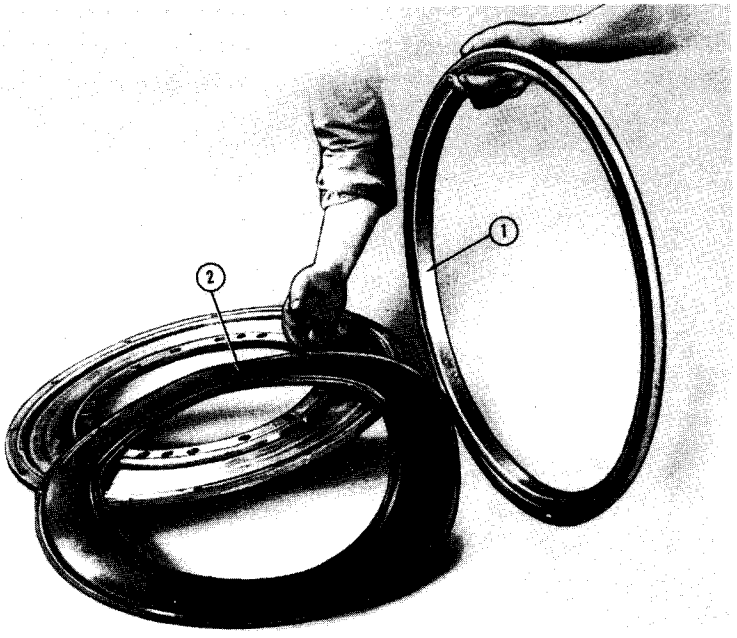
1. PRESSURE PLATE 3. DIAPHRAGM
2. RETAINER 4. BACK PLATE

Figure I-7. Removing Pressure Plate

NOTE: The brake can be disassembled while still mounted on the machine as described in the above paragraphs. However, the same capscrews which secure the brake assembly to the main case fasten the brake hub to the plate with the exception of four short capscrews. These four, the middle capscrews in the groups of three, do not extend through to the brake plate on the main case. If tapered capscrews are all removed the drum will be separated from the plate and the plate from the main case in one operation. However, the brake assembly can be removed as a unit if all capscrews except the four short capscrews are removed. It is then necessary to remove only these four capscrews to separate the hub and the plate.

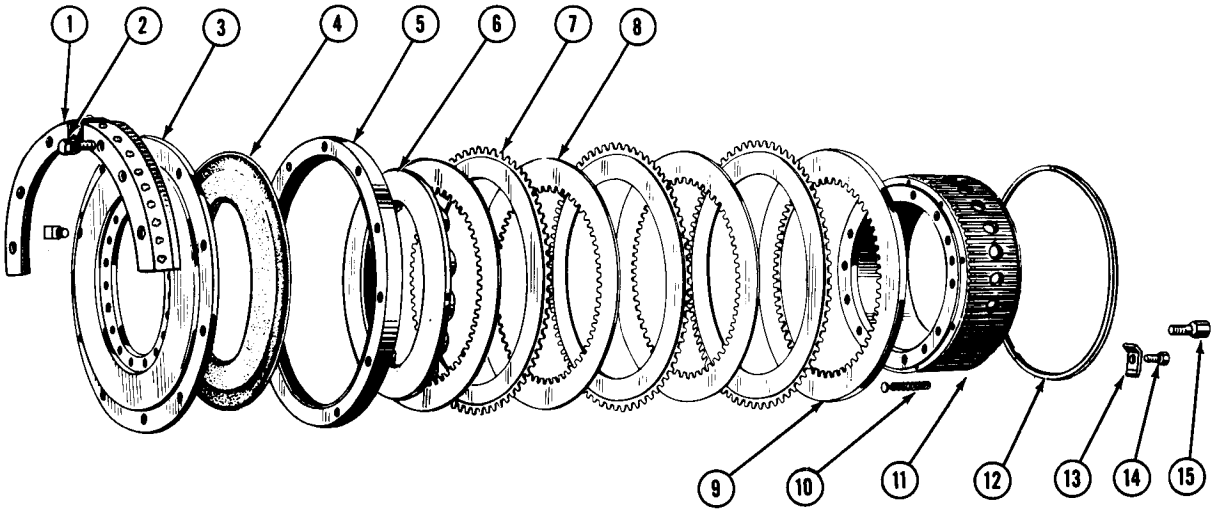
Separate the pressure plate from the diaphragm backing plate (Fig. I-7).

Remove the retainer ring (Fig. I-8).



1. RETAINER RING 2. DIAPHRAGM

Figure I-8. Removing Retainer Ring and Diaphragm



1. DIRT GUARD
2. CAPSCREW
3. PLATE
4. DIAPHRAGM
5. RETAINER
6. PRESSURE PLATE
7. REVOLVING DISC
8. STATIONARY DISC
9. BACKING PLATE
10. SPRING AND GUIDE
11. HUB
12. SNAP RING
13. BOLT LUG
14. CAPSCREW
15. CAPSCREW

Figure I-9. Air Brake, Exploded

Service

Check the diaphragm. A leaky diaphragm causes slippage and excessive wear, and must be replaced with a new unit.

Keep the brake hub splines clean. Any obstructions in the splines is apt to cause uneven movement and sluggish brake action.

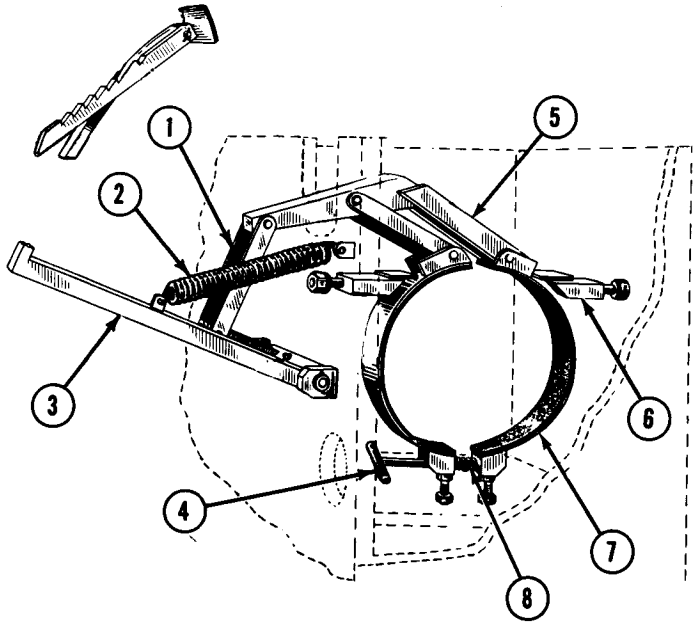
Correct any defect in the air lines which may retard the flow of air to the brake such as compressed, broken, or clogged lines. In extremely cold weather, condensate in the air lines may freeze and impede the flow of air. Add alcohol to the air system to help eliminate this condition (1 pt. each day to the air tank).

Reassembly

To reassemble, reverse the procedure outlined under "Removal" and "Disassembly". Lubricate the diaphragm when installing with a good grade cup grease. Be sure the brake diaphragm is properly seated so that it will not be pinched. Silicon diaphragms are not to be lubricated.

If replacement steel discs are installed in the brake the variation in thickness of the discs may result in a tight brake. Should this occur and the counterbore in the backing plate faces the disc, reverse the position of the backing plate so that the counterbore faces the ring guards and snap rings.

PARKING BRAKE



1. LINK
2. SPRING
3. LEVER
4. ADJUSTING "T" HANDLE
5. ACTUATOR
6. STOP BLOCK
7. BRAKE BAND
8. SPRING

Figure I-10. Parking Brake Schematic

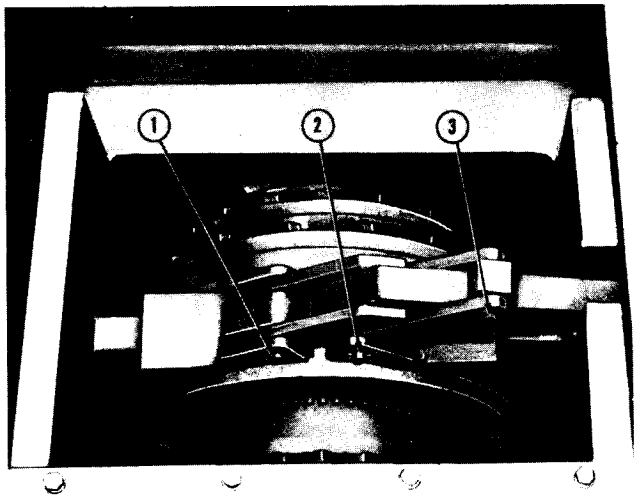
Removal

Remove the link pins and linkage at 1, 2 and 3 in Fig. I-11.

Loosen the jam nuts at 2 in Fig. I-12 and tighten down capscrew 4 until there is as much clearance as possible between the top of the capscrew and the bottom of the band.

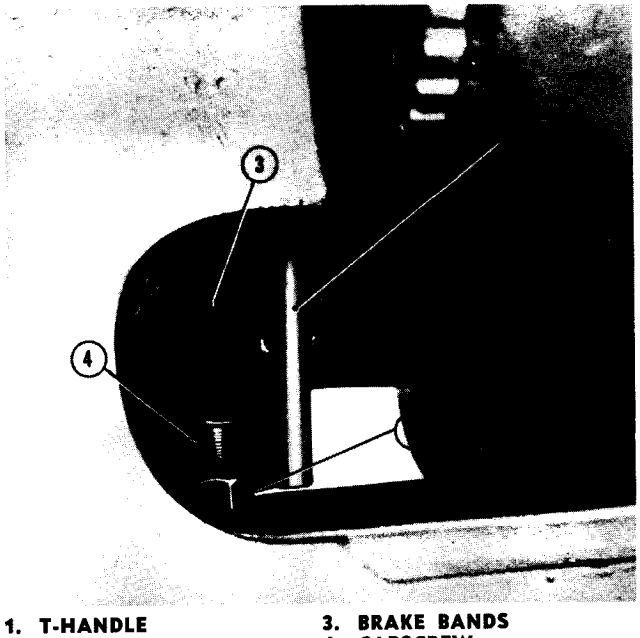
Rotate the adjusting handle 1, Fig. I-12 in a counterclockwise direction until it is free of the nut on the rear half of the band.

Now slide the rear half of the band to the left of the compartment clearing the stop block, rotate 90 degrees and lift out of the compartment (Fig. I-13). Repeat the above procedure for the front half of the band.



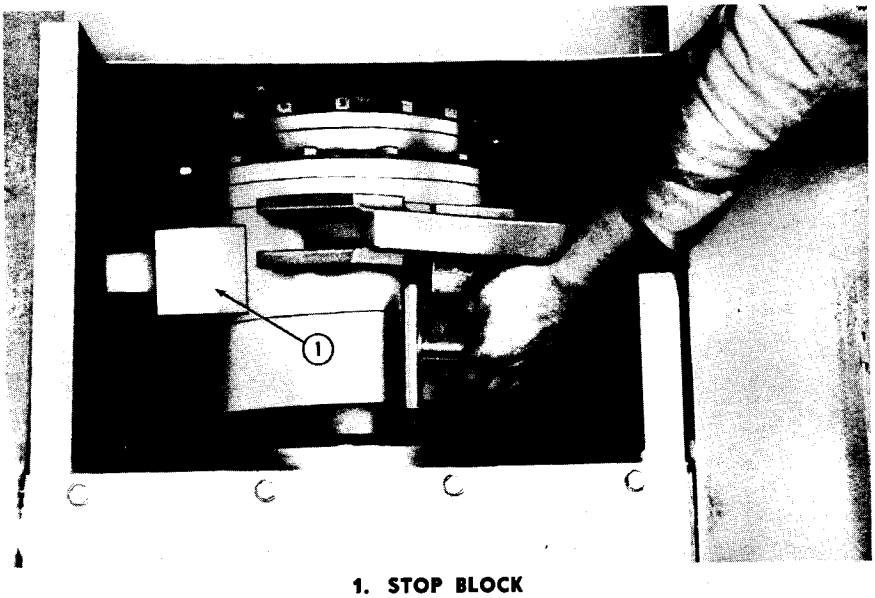
1. LINK PIN, ACTUATOR TO REAR BAND
2. LINK PIN, ACTUATOR TO FRONT BAND
3. LINK PIN, ACTUATOR TO LINKAGE

Figure I-11. Parking Brake Linkage



1. T-HANDLE
2. JAM NUTS
3. BRAKE BANDS
4. CAPSCREW

Figure I-12. Parking Brake Adjustment



1. STOP BLOCK

Figure I-13. Removing Brake Bands

Service

Check link pins for excessive wear. Replace brake bands when worn excessively by cutting off the old lining and welding a new lining to the band.

Reassembly

Reverse the above procedure given for disassembly.

Adjustment

Release the parking brake pedal and turn T-handle 1, in a clockwise direction to tighten the brake. The T-handle is located under the left steering clutch and can be reached from the transmission compartment through a hole cut in the clutch compartment's forward wall (Fig. I-12).

The foot pedal cannot be depressed further than the second notch from the end of the row of locking notches when the parking brake is properly adjusted (Fig. I-10).

After adjusting the brake depress foot pedal as far as possible and lock pedal in position. Then check the space between the top of capscrews 4, and bottom of brake bands 3. This space should be approximately .020". To change the space loosen jam nuts 2, and turn the capscrews in counterclockwise direction to decrease the space, clockwise to increase the space. Then tighten jam nuts against bottom of case. *NOTE: After making the above adjustment, recheck to make sure there is proper clearance.*

TIRES

Care and Maintenance

Tires should be checked for inflation with an accurate gauge once each week. The proper inflation for tires (check when cold) is as follows:

INFLATION AT ATMOSPHERIC TEMPERATURE

Normal Operation	Very Loose Soils Only
25 lbs.	20 lbs.

NOTE: In mounting, tires should be inflated to 75 pounds to properly seat the beads, then reduced to the above operating pressure.

Do not depend upon the valve cores being air tight; always keep valve caps securely applied to valve stems. Caps also protect the valves from damage and deterioration.

Do not bleed air from tubes which are hot due to operating. Under such conditions it is normal for the pressure in the tube to increase.

While a weekly inflation check with a gauge is recommended, the operator must watch the tires as punctures or slow leaks may develop at any time.

Rims

A bent or damaged rim which does not support the bead properly may cause abnormal strain on the tire and result in a tire failure.

Repairs

Should a tire become cut exposing the cords of the body plys of fabric, it should be removed and repaired. Neglected cuts cause many tire failures. Water, sand, dirt, grit, and other foreign materials work their way into a tire through a cut, eventually causing tread or ply separation and failure.

A tire may be retreaded if it is removed in time.

Storage

Store tires and tubes indoors if possible. If not practicable to store inside, be certain to cover them with tarpaulin to keep out dirt, water and other foreign materials. Storage should be in a dark, cool, dry and free-from-draft location. Avoid contact with petroleum products such as oil, grease, fuel oil, etc.

Before storing used tires, clean them thoroughly, and inspect carefully for damage, and repair where necessary. When a rubber tired vehicle is placed in storage, it should be blocked up to take its weight off the tires, and the tires then deflated. If the vehicle cannot be blocked up, check air and tires twice a month and keep properly inflated.

Tire Changing

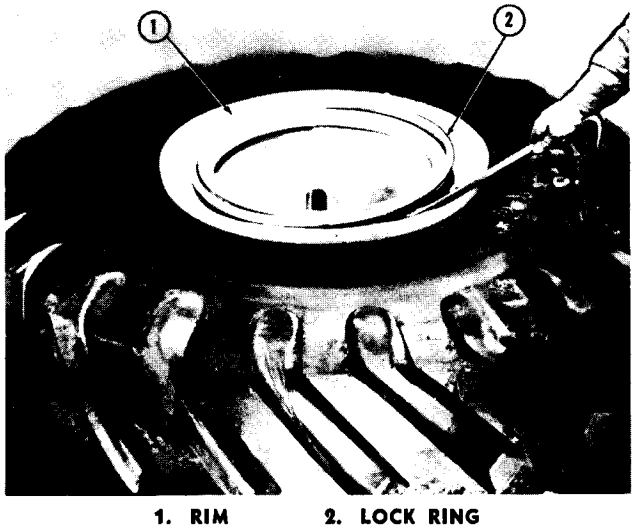
Remove the tire and wheel from machine and lay on ground with outside of wheel up.

Remove the core from the tube stem and deflate tire. Do not attempt to remove the lockring from the wheel rim until the tire is completely deflated. Pry lockring from the rim of the wheel (Fig. I-14). Now turn wheel and tire over so opposite side of wheel is up.

Remove the cork from the tapped holes around the wheel rim and insert six $\frac{3}{4}$" x $3\frac{1}{2}$" NC capscrews furnished with the machine, into the holes. Turn the capscrews down evenly until the tire bead has been forced from the wheel (Fig. I-15). Remove the capscrews and also the lugs which the capscrews forced from their recesses in the underside of the rim. Turn the wheel and tire over again and fasten a sling or similar lifting device about the tire. Raise tire, with sliding ring still in place, until they are free of wheel (Fig. I-16). Lower tire to ground and remove ring, flap, and tube.

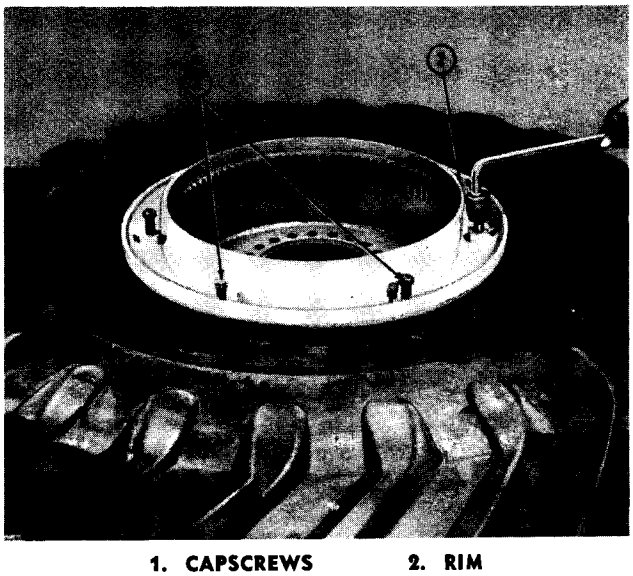
Should difficulty be encountered in removing the sliding ring due to the seizure of tire's tapered bead on ring, remove as follows:

Using a torch, apply heat around inside of the sliding ring opposite the tapered bead on the tire. In applying this caution should be exercised to prevent damage to the sliding ring or tire due to overheating. DO NOT apply heat directly to tire. After heat has been applied progressively about the ring, use a pry bar to remove it from tire (Fig. I-17).



1. RIM 2. LOCK RING

Figure I-14. Removing Lock Ring

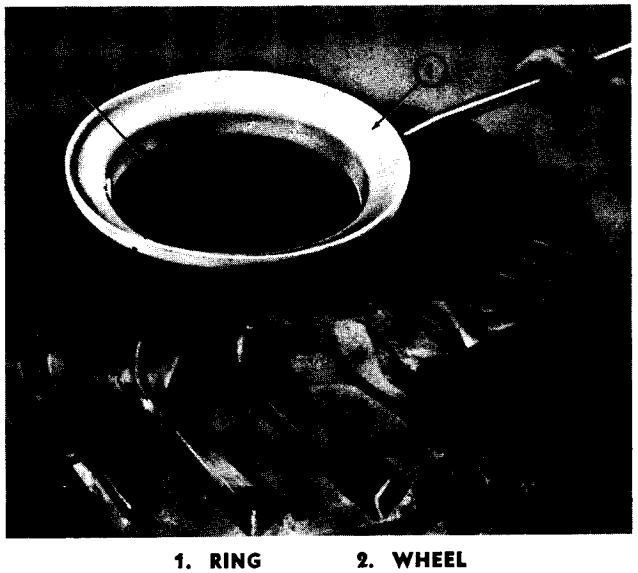


1. CAPSCREWS 2. RIM

Figure I-15. Forcing Bead from Wheel

1. WHEEL 2. TIRE

Figure I-16. Removing Tire from Wheel



1. RING 2. WHEEL

Figure I-17. Removing Ring

To reassemble the tire and tube on the wheel, place tube inside the tire and then position wheel on the ground with the outside of the wheel up. Replace the lugs in their recesses at the underside of each capscrew hole in the wheel rim. The use of masking tape to hold lugs in place during the reassembly procedure is recommended. Lower the tire and tube into place over the wheel and then place the sliding ring (with the lugs in position) onto the wheel. Seat the lock ring between the sliding ring and wheel. It is very important that the lock-ring is seated properly before inflating tire.

Stand to one side of tire and wheel and inflate to 75 lbs. to seat the tire beads — then lower to the recommended pressure.

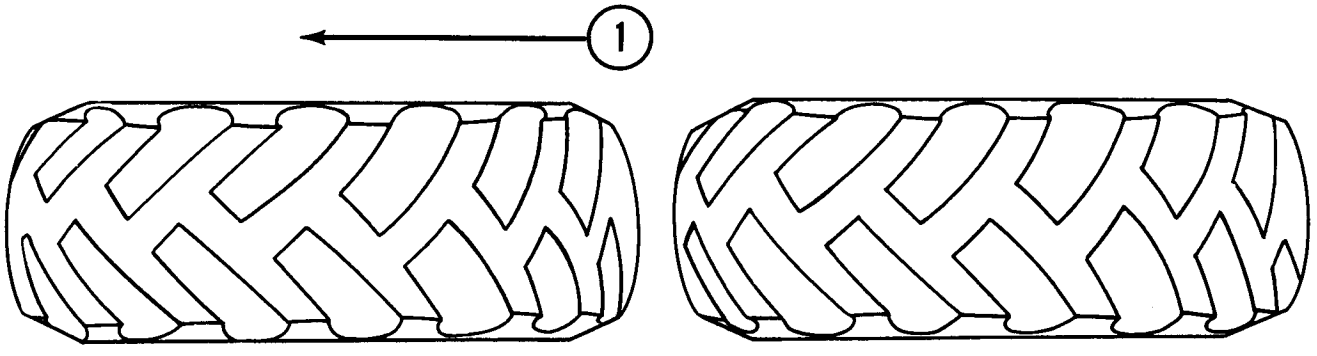
To remove tires from 65" wheels, first deflate the tire and remove the locking ring from around the wheel rim.

Now slide the tire and inner and outer sliding rings off wheel.

To separate the tire and rings loosen the rings by driving wedges between the rings and the tire beads. Remove sliding rings from the tires.

To mount tires, first seat sliding rings inside the tire beads and place tire over wheel. Place locking ring in its correct position.

Next, stand to one side of the tire and inflate to 75 lbs. pressure to seat the tire beads, then lower to the recommended pressure.



1. FRONT OF MACHINE

Figure I-18. Correct Position for Mounted Tires Note Direction of Tread

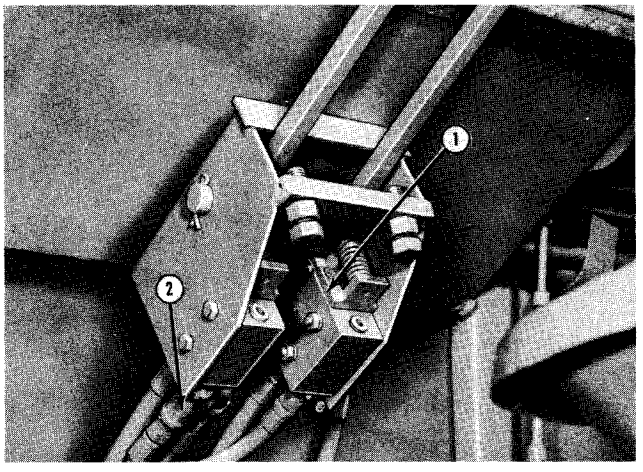
COCKPIT AND ACCESSORIES

INDEX

COCKPIT AND ACCESSORIES
COCKPIT

Removal

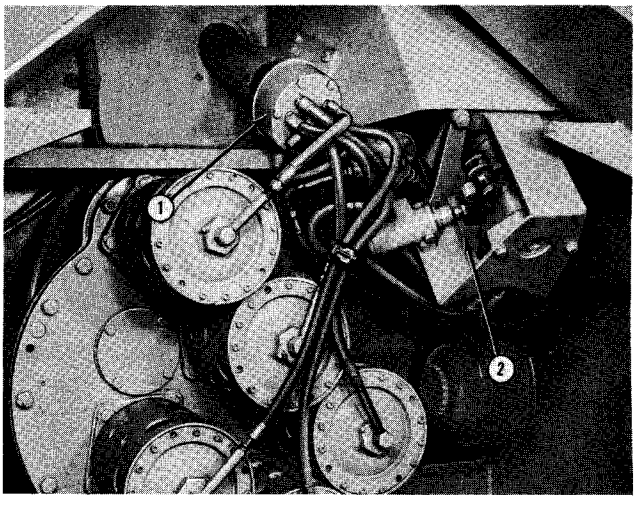
Disconnect the air lines to the steering lever valves (Fig. J-1) and air shift quadrant (Fig. J-2). If machine is equipped with steering wheel, disconnect air lines to air valves at bottom of steering column (Fig. J-2).



1. VALVES 2. AIR LINES

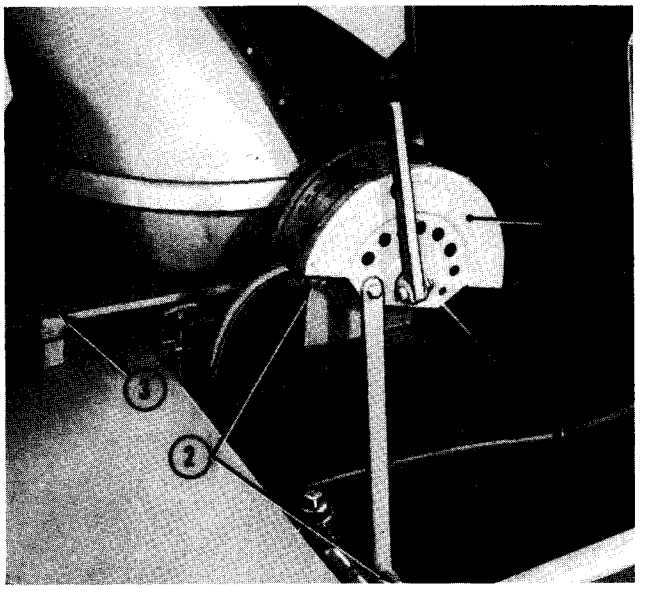
Figure J-1. Steering Lever Valves

If Tournatractor is equipped with electric shift quadrant, remove the two capscrews and lockwashers fastening the quadrant to the mounting bracket and the capscrew and lockwasher holding the brace to the steering clutch compartment cover (Fig. J-3). Do not disconnect the cable leading to the quadrant. Place the quadrant on the ring gear compartment cover or the fuel tank. It is not necessary to remove the electric shift quadrant when removing the cockpit.



1. AIR SHIFT VALVE 2. AIR STEERING VALVES

Figure J-2. Air Shift and Steering Valves



1. SHIFT QUADRANT
2. QUADRANT MOUNTING CAPSCREWS
3. SEAT MOUNTING CAPSCREWS

Figure J-3. Electric Shift Quadrant

Remove the two capscrews and lockwashers fastening the seat assembly to the fuel tank (Fig. J-3) and the two fastening the seat to the cockpit deck plate and remove the seat assembly from the cockpit.

Disconnect main leads to instrument panel at transformer strip and control leads at knife connectors between main cable and transformer terminal strip.

Disconnect torque converter heat indicator bulb at pipe tee on the hose from torque converter to oil cooler.

Remove coolant heat indicator bulb from engine at water manifold on engine.

Disconnect throttle control cable from control linkage at engine and pull through passage in fuel tank.

Remove parking brake pedal by removing the cotter and pin holding ratchet, pedal and lever together.

Disconnect air lines to air brake treadle valve or valves, and air pressure gauge tubing at junction block under left front of cockpit.

Remove air lines to quick release valves.

Remove ring gear compartment breather pipe. Filter cap may have to be removed before pipe can be turned sufficiently to allow removal.

Attach sling to cockpit.

Remove the four mounting capscrews holding the cockpit in position (two secure the cockpit to the main case and two secure the cockpit to the fuel tank), raise the cockpit two or three inches. Double check to make sure all leads, cables, tubing, etc. have been disconnected.

Remove the cockpit assembly and set on blocks to protect air lines and fittings on the bottom of the assembly.

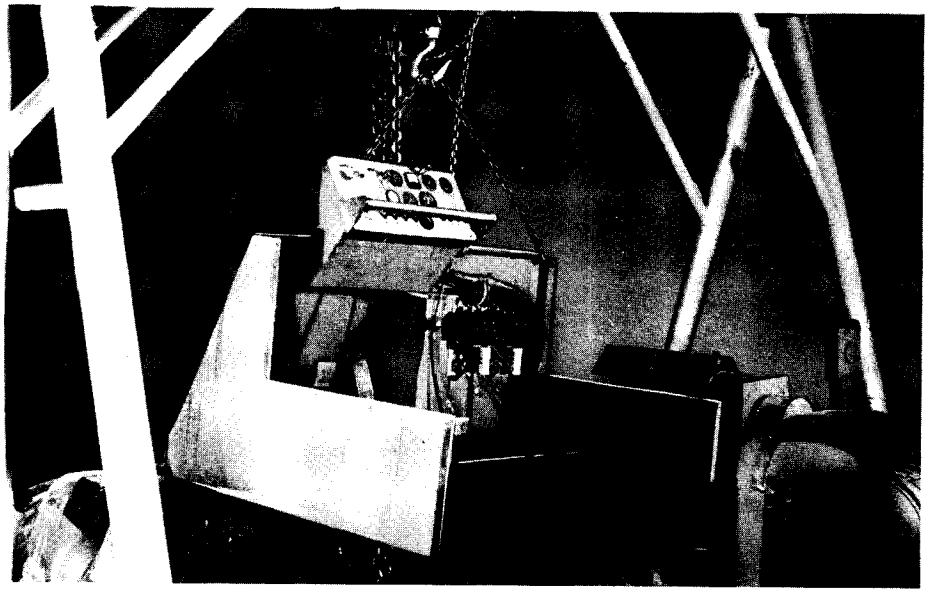


Figure J-4. Removing Cockpit

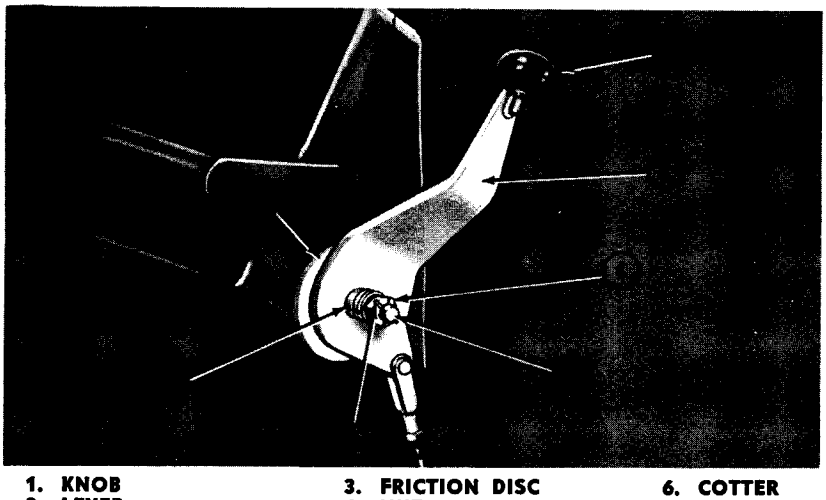
THROTTLE CONTROL

Disassembly

Remove cotter and pin and disconnect throttle lever from throttle control cable. Remove cotter, castellated nut, washers and spring. Remove throttle lever and friction disc.

Later machines are equipped with dual throttle control levers (one on each side of the instrument panel). To remove the left control lever, proceed to dismantle the right lever as described above. Remove the key from the key way in the connecting bolt. Pull left control lever and bolt from bracket under the instrument panel.

The friction can be increased or decreased by tightening or loosening the castellated nut which increases or decreases the spring tension against the friction disc.



1. KNOB
2. LEVER
3. FRICTION DISC
4. NUT
5. BOLT
6. COTTER
7. SPRING

Figure J-5. Throttle Control Lever

SERVICE

Keep the control linkage clean. Every 10 shifts lubricate all moving connections with two or three drops of engine oil (SAE #30 for above 32° F., and SAE #10 for below 32° F.).

SHIFT QUADRANT

Removal

See "Air Shift Quadrant", Section "C" for removal and disassembly of air shift quadrant.

To remove electric shift quadrant from Tournatractor, first remove the capscrews securing the quadrant to the mounting bracket and brace. See Fig. J-3.

Disconnect leads to switches on the inside of shift quadrant. Mark each wire as it is removed to hasten reassembly.

Disassembly

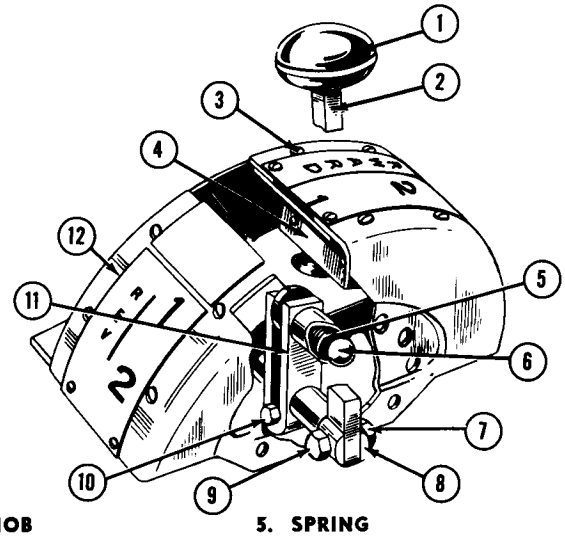
Remove nut, capscrew and handle.

Remove capscrew allowing pin to slide out of roller fork.

Roller fork is now free. Take care not to lose spring or ball as they are free and will drop out.

Remove nut from pin on roller fork, remove pin and wheel from roller fork.

The six individual Tournaticker switches are held in place by two machine screws each. These switches may be replaced separately.



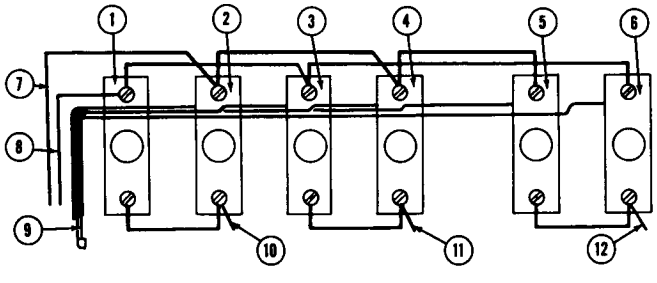
1. KNOB
2. HANDLE
3. MACHINE SCREW
4. TOURNATICKER
5. SPRING
6. BALL
7. NUT
8. PIN
9. CAPSCREW
10. CAPSCREW
11. ROLLER FORK
12. HOUSING

Figure J-6. Electric Shift Quadrant

Reassembly

To reassemble the electric shift quadrant, reverse the procedure outlined for disassembly.

The leads from the Tournaticker switches are to be connected to the coil on the D.C. control valve for that particular transmission clutch.



1. 4TH SPEED SWITCH
2. 3RD SPEED SWITCH
3. 2ND SPEED SWITCH
4. 1ST SPEED SWITCH
5. LOW REVERSE SPEED SWITCH
6. HIGH REVERSE SPEED SWITCH
7. TO ENGINE CLUTCH CONTROL VALVE
8. TO COMPOUND CLUTCH CONTROL VALVE
9. 24 VOLT D.C. CABLE
10. TO HIGH CLUTCH CONTROL VALVE
11. TO LOW CLUTCH CONTROL VALVE
12. TO REVERSE CLUTCH CONTROL VALVE

Figure J-7. Wiring Hook-up for Electric Shift Quadrant

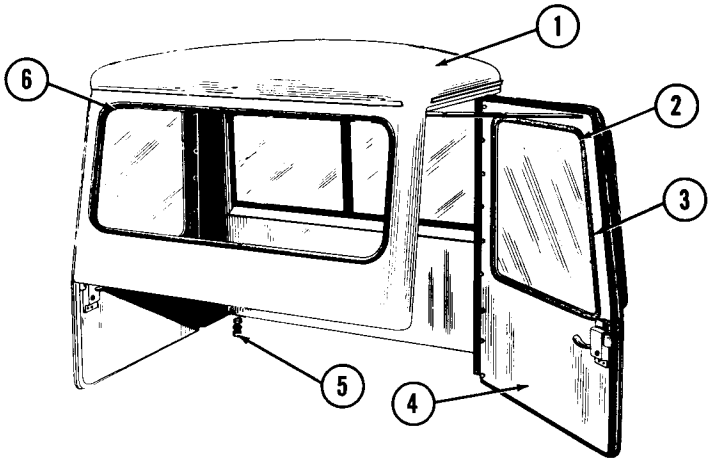
CAB

Removal

Four capscrews secure the cab to the Tournatractor, one on each side at the bottom of the rear panel fastening cab to fuel tank and one on each side of the front panel fastening the cab to the front panel of the cockpit.

Disconnect leads to windshield wiper and defroster fan, if cab is so equipped.

Remove the four mounting capscrews and lift the cab from the machine.



1. CAB
2. RUBBER STRIP
3. FILLER STRIP
4. DOOR
5. MOUNTING CAPSCREWS
6. WEATHER STRIP

Figure J-8. Cab Assembly

Service

Except for the sliding glass panel in the rear of the cab, the glass is mounted in special rubber stripping. This stripping holds the glass in position in the window opening.

The rear sliding glass is mounted in felt lined channels screwed in position.

To install new glass, lay glass on a flat surface and press rubber onto the glass. The rubber must be cut and mitered for 90° turns. It can be pressed around the rounded corners of the glass without cutting.

After rubber is in place press glass and rubber into position in the window opening. Be sure the thin metal edge around the window opening is seated in the narrow groove in the glass rubber after glass has been positioned.

CAB HEATER

Removal

Disconnect the 6 volt lead from the fuel gauge to the heater at the rear of the instrument panel.

The wire leading from the heater to the heater control switch is to be disconnected at the instrument panel or at the front of heater, whichever the case may be.

Disconnect two water hoses at rear of heater from inside engine compartment and opposite ends at the engine. To remove heater from cockpit panel, remove capscrews from heater studs or fastening nuts at hose connections, whichever the case may be.

Remove heater from inside the cockpit.

If heater is not to be re-installed be certain pipe plugs are placed in engine at openings where hoses were connected. Drain all water from heater to prevent rusting.

Installation

If installation of heater is the initial mounting, follow instructions accompanying heater.

WINDSHIELD WIPER

Removal

Disconnect 6 volt lead wire from windshield wiper motor.

From outside cab, release lock screw in head of wiper arm permitting removal of arm and blade from motor shaft.

Using a screwdriver, back nut from shaft and remove drum. Remove nut and washer from shaft.

Moving to inside of cab, remove two capscrews from wiper motor mounting bracket and remove motor.

If conductor wire only is to be replaced, disconnect the lead at windshield wiper motor and also lead at defroster fan.

Disconnect opposite ends of wires at instrument panel control switches for both the fan and wiper.

Installation

For initial installation see instructions accompanying wiper assembly. For re-installation of wiper, reverse removal procedure.

DEFROSTER FAN

Removal

Disconnect lead at fan motor.

Remove capscrews from mounting bracket and remove fan.

If wire is to be replaced, disconnect wires leading to fan motor and windshield wiper motor. Disconnect opposite ends at windshield wiper and defroster fan switches on instrument panel. Pull wires from conduit.

Installation

For initial installation see instructions accompanying defroster fan assembly.

For re-installation of fan, reverse removal procedure.

TWIN AIR HORN

Removal

Bleed air from system.

Disconnect pull chain from hand bar on instrument panel.

Disconnect copper tubing to air horn at junction block on main case. Put plug in opening in junction block if air horns are to be left off.

Remove capscrews from mounting bracket securing horn assembly to front of cockpit and remove coupling from control valve.

Remove horns and control valve from the cockpit.

Installation

For initial installation see instructions accompanying twin air horns.

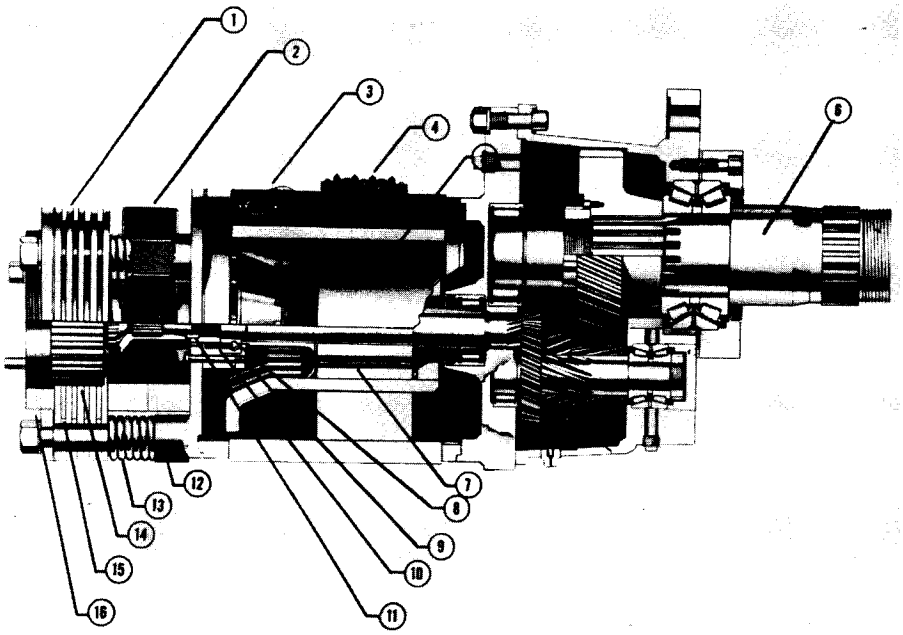
For re-installation of air horns reverse removal procedure.

A.C. ELECTRIC MOTOR, GEAR BOX, AND CONTROL CIRCUIT

INDEX

A.C. ELECTRIC MOTOR, GEAR BOX, AND CONTROL CIRCUIT

A.C. ELECTRIC MOTOR



1. STATIONARY PLATE
2. BRAKE COIL
3. HEAT CONTROL SWITCH
4. TERMINAL STRIP
5. STATOR
6. OUTPUT SHAFT
7. ROTOR
8. REAR MOTOR BEARING
9. RETAINER CAPSCREWS
10. RETAINER NUT
11. LOCKING NUT
12. STUD
13. SPRING
14. HUB
15. ROTATING DISC
16. ADJUSTING RING

Figure K-1. A.C. Electric Motor, Cut-Away

The A.C. electric motors are induction motors, all of the three phase, 120 cycle, high slip type. These motors have been designed especially to handle the various operations peculiar to the equipment.

The electric motors are made up of the three major assemblies following:

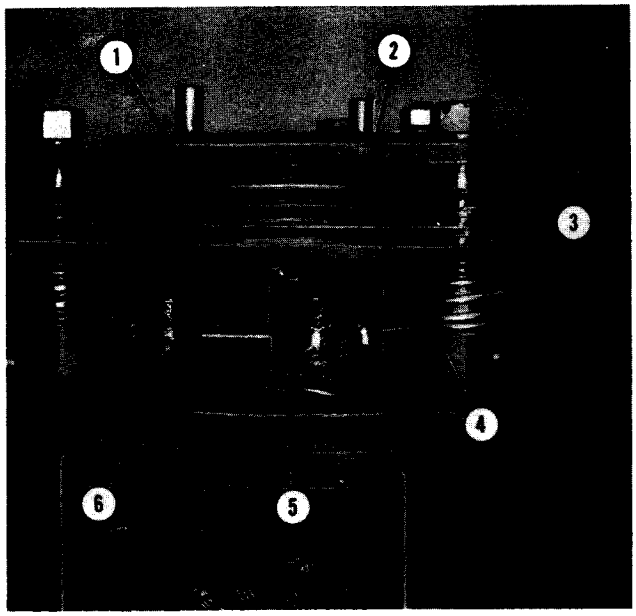
1. Stator — the outside or stationary member which is bolted to the gear reduction box.

2. Rotor — the inner or rotating member, attached to the pinion shaft which drives the gears in the gear box.

3. Brake — a spring loaded, disc type, electromagnetic unit which is automatically released when the electric motor is operated.

These motors are instantly reversible in operation. Each direction of rotation is controlled by a separate main switch. Motors are reversed by reversing two of the three main leads to the motor. This reversal is made in the wiring of the main switches.

Each A.C. electric motor is equipped with an electrically operated disc brake. This brake is held in the engaged position by strong coil springs and is disengaged automatically by the electromagnets as the electric motor is operated. The instant the flow of current to the motor is shut off, the brake springs re-engage the brake.



1. ADJUSTING PLATE
2. STATIONARY PLATE
3. BRAKE PLATE
4. DISC
5. FLOATING PLATE
6. COIL

Figure K-2. Electric Motor Brake

The electric motor brake is simple in construction, consisting of the following:

1. Adjusting Ring—an externally threaded ring which regulates the motor brake air gap. A clockwise turn decreases the air gap and a counterclockwise turn increases it.

2. Brake Discs (two types) — (1) steel discs, or a stationary plate held in position by three brake studs, and (2), internally splined friction discs. Spring pressure forces the discs together until released by action of the electromagnets.

3. Coils — six electromagnetic coils pull the brake into the released position when energized by the current which at the same time flows to the motor. These coils give the brake quick and positive release providing the brake is properly adjusted.

4. Spring — powerful coil springs which force the brake discs together braking the rotor. The brake springs are manufactured with several different compression ratings. Springs with higher compression ratings are used on brakes supporting the heavier loads.

The name plate for the A.C. electric motor is attached to the motor stator and includes size, number of teeth on pinion, voltage, cycles, R.P.M., motor number and part number of the motor.

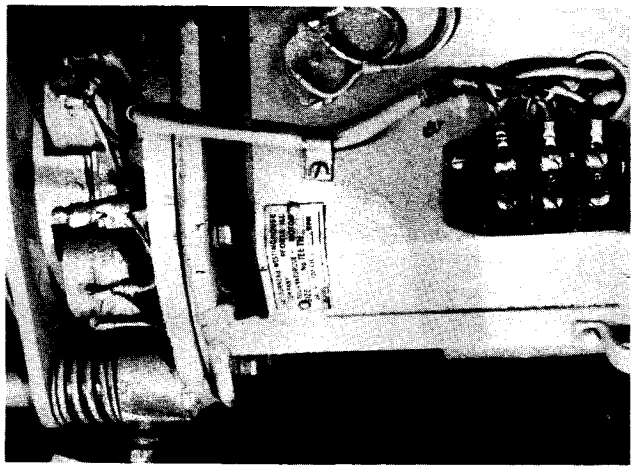


Figure K-3. A.C. Electric Motor Nameplate

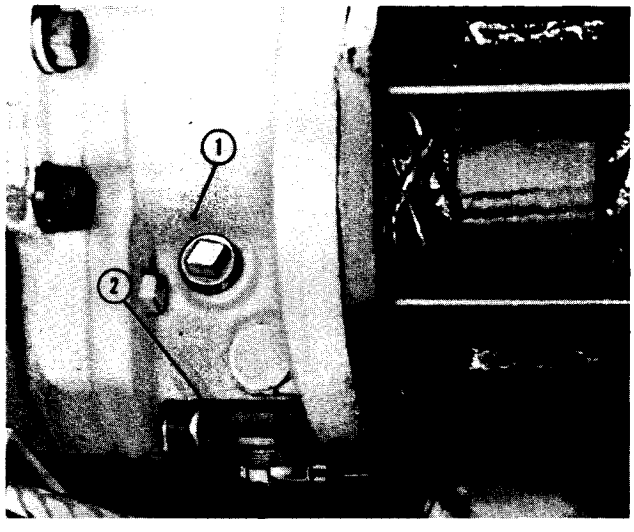
Removal

To remove the A.C. electric motor from the machine first remove the plug on the bottom of the gear box and drain the lubricant from the gear box (Fig. K-4).

Remove the capscrews securing the cover to the stator frame of the motor (Fig. K-5). Remove cover.

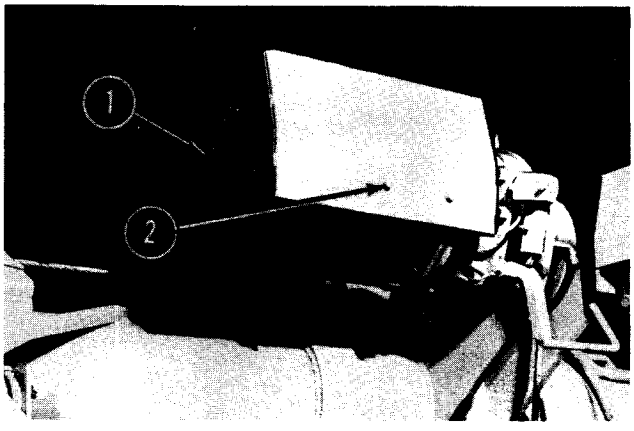
Disconnect all wires leading to the motor and mark for easy re-connection.

Place sling around electric motor. Enough tension must be maintained to prevent mounting capscrews from binding as they are removed. Remove the mounting capscrews (Fig. K-6).



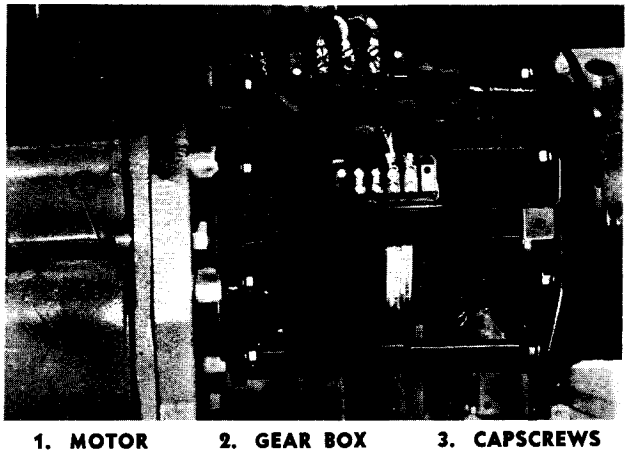
1. GEAR BOX 2. DRAIN PLUG

Figure K-4. Gear Box Drain Plug



1. COVER 2. CAPSCREWS

Figure K-5. Electric Motor Cover



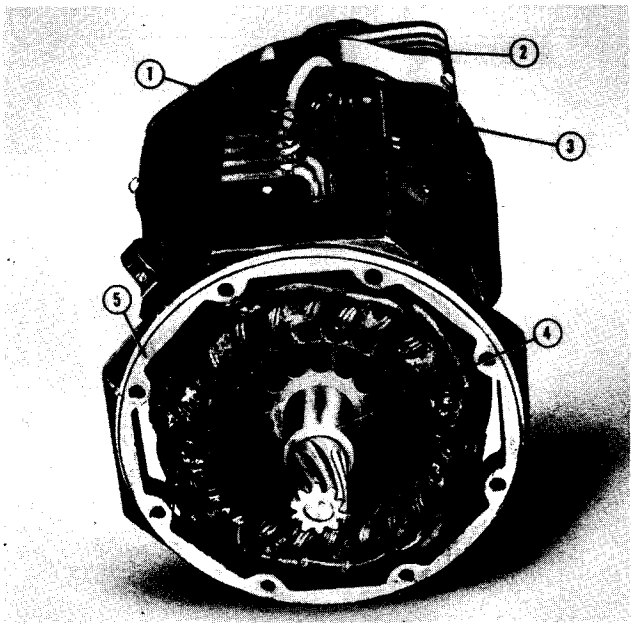
1. MOTOR 2. GEAR BOX 3. CAPSCREWS

Figure K-6. Motor Mounting Capscrews

Pull motor straight away from gear box until motor pinion clears the bore in the gear box. Take care not to damage the oil seal in the gear box.

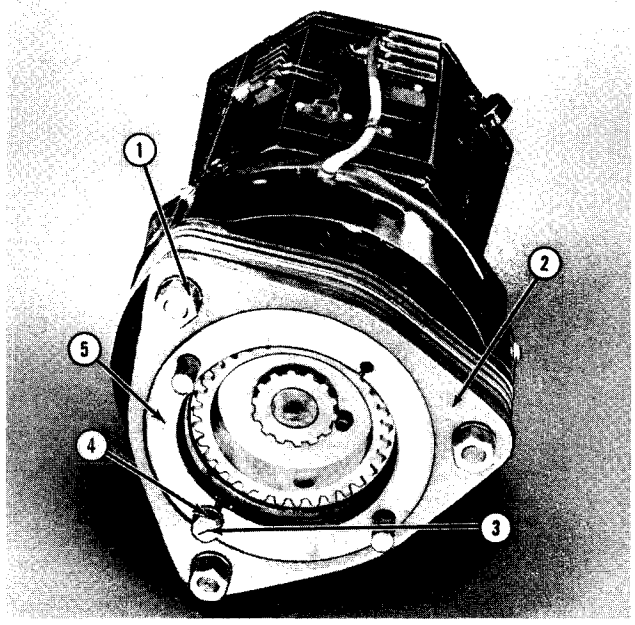
Disassembly

Remove the endbell capscrews, disconnect brake coil leads at the terminal strip, and using slings or chain hoist, lift off brake assembly, endbell and rotor as one unit.



1. TERMINAL STRIPS
2. BRAKE ASSEMBLY
3. HEAT CONTROL SWITCH
4. ROTOR AND SHAFT
5. STATOR ASSEMBLY

Figure K-7. A.C. Electric Motor and Brake

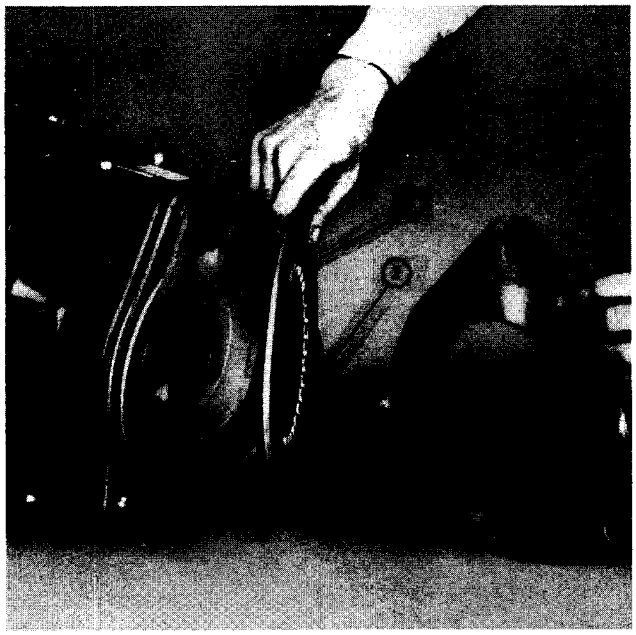


1. STUD NUT
2. BRAKE PLATE
3. LOCKBOLT
4. LOCKNUT
5. ADJUSTING PLATE

Figure K-8. Electric Motor Brake

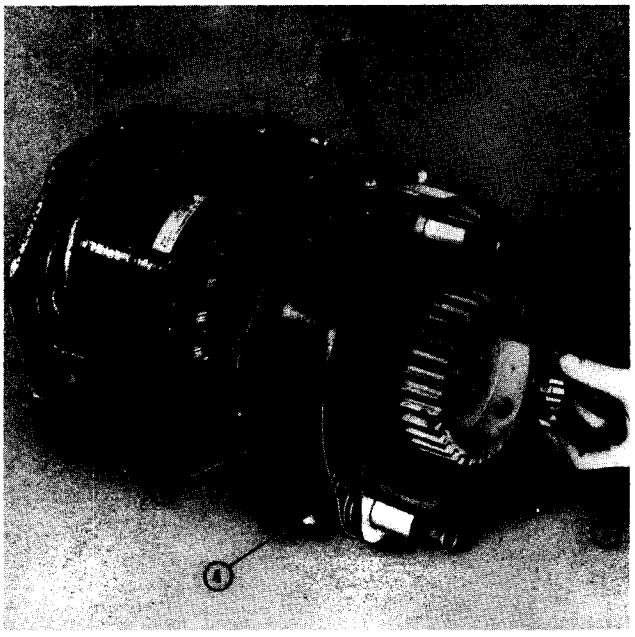
Loosen the nut on the lockbolt which locks the adjusting plate in position.

Remove the three stud nuts and lockwashers, then the top plate, floating plate and the brake discs (Figs. K-8 and K-9).



1. DISC
2. STUD
3. BRAKE PLATE

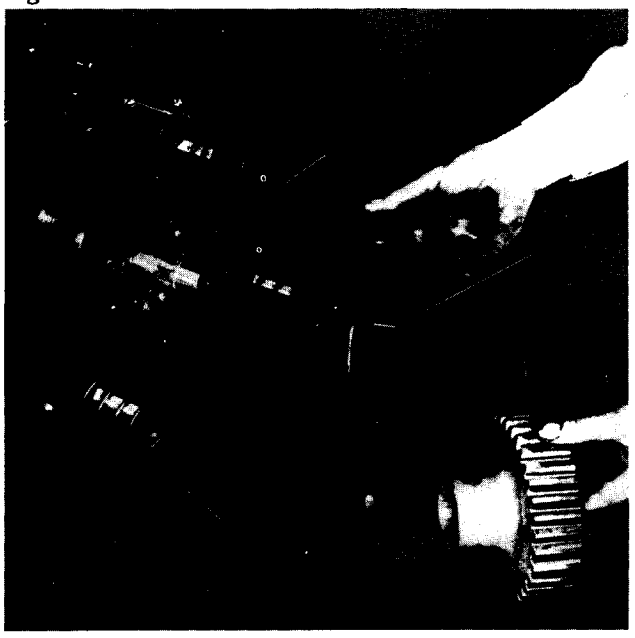
Figure K-9. Removing Brake Plate and Discs



1. FLOATING PLATE
2. BRAKE HUB
3. LOCKING NUT
4. SPRING
5. COVER BAND

Figure K-10. Removing Brake Hub Lock Nut

Remove the locking setscrew, brake hub locking nut, brake hub, floating plate and coil springs. See Figs. K-10 and K-11.



1. ROTOR SHAFT
2. FLOATING PLATE
3. HUB
4. SPRING
5. COIL

Figure K-11. Removing Brake Hub and Floating Plate

If coils are damaged, or should for some reason need to be removed, remove the hold down screws clamping the coils to the top endbell and remove the brake coils. It is not necessary to remove the coils to further disassemble the motor.

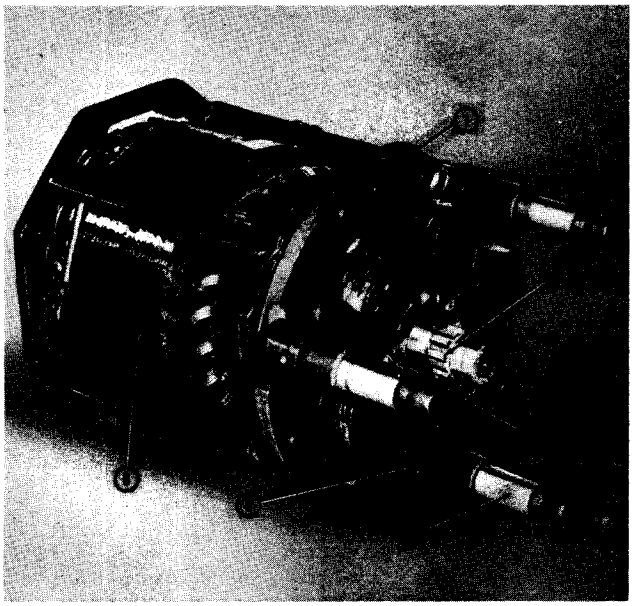
Remove the cover band from around brake coils.

To disassemble the motor, first remove the bearing retainer capscrews and lift off the endbell.

Remove the bearing retainer locknut. The bearing retainer nut is locked in position by a pin inserted in a hole drilled parallel to the rotor shaft, half in the nut and the other half in the rotor shaft.

Using the special wrench provided with the machine, remove the retainer nut.

Pull bearing with bearing retainer.

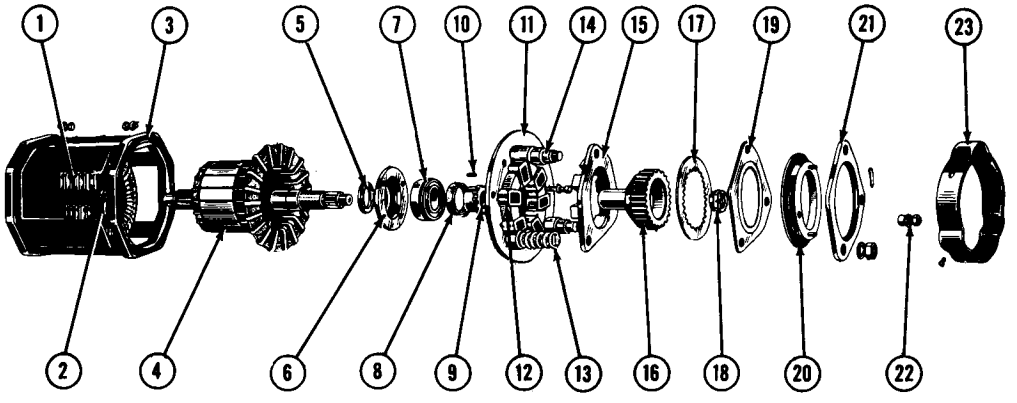


1. TOP END BELL
2. ROTOR SHAFT
3. BEARING RETAINER CAPSCREWS
4. STUD
5. COIL
6. STATOR

Figure K-12. A.C. Electric Motor

Reassembly

Reverse the above procedure in assembling the electric motor and brake. Torque the bearing retainer nut to 150 ft. lbs. Connect the wires that were marked during disassembly.



1. TERMINAL STRIP
2. HEAT CONTROL SWITCH
3. STATOR
4. ROTOR AND SHAFT
5. OIL SEAL
6. RETAINER
7. BEARING
8. OIL SEAL
9. LOCK NUT
10. LOCKPIN
11. END BELL
12. COIL
13. SPRING
14. STUD
15. FLOATING PLATE
16. HUB
17. DISC AND LINING
18. LOCKNUT
19. STATIONARY PLATE
20. ADJUSTING PLATE
21. BRAKE PLATE
22. LOCKBOLT
23. COVER BAND

Figure K-13. A.C. Motor and Brake, Exploded

Service

Every 100 shifts remove the motor cover and blow the dust and dirt from around the windings, rotor and brake assembly with an air hose.

Check the brake clearance every 10 shifts. Excessive clearance at the brake magnets will cause improper brake release, over-heating the motor, warping of the plates thus causing them to wear out prematurely. Insufficient brake clearance will also prevent proper brake release.

Inspect all electrical connections every 10 shifts, making sure they are tight and free from grease and dirt.

Adjustment

Loosen the nut on the tapered bolt locking the adjusting plate in position.

Insert a bar between the adjusting lugs on the adjusting ring and turn either clockwise or counter-clockwise until the space between the floating plate and the end bell is 1/32" for single disc brakes or 1/16" for double disc brakes. Clockwise rotation decreases the space and counter-clockwise rotation increases the space.

After the proper adjustment is obtained, tighten the nut on the end of the tapered bolt, locking the ring in position.

No. 1 GEAR BOX

Removal

For details on removing the A.C. electric motor from the gear box see electric motor removal instructions.

The nameplates for the A.C. motor gear boxes are attached to the outside surface of the gear boxes, and includes the size, gear reduction, model number and part number of the gear box.

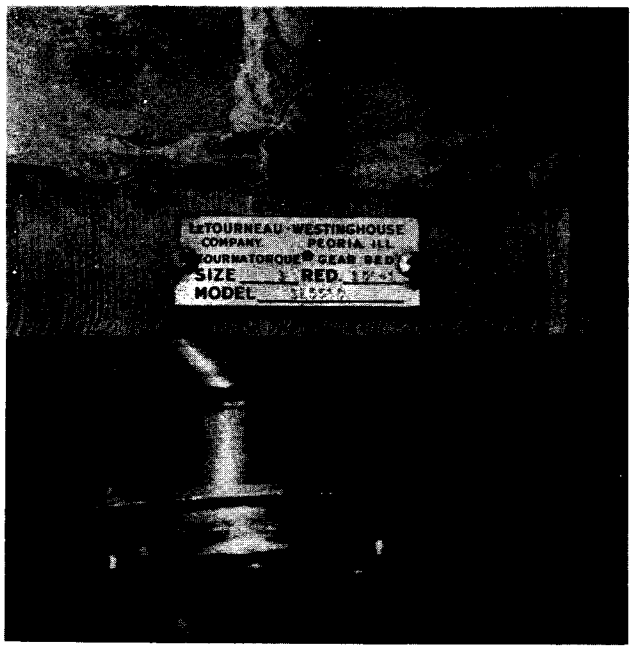
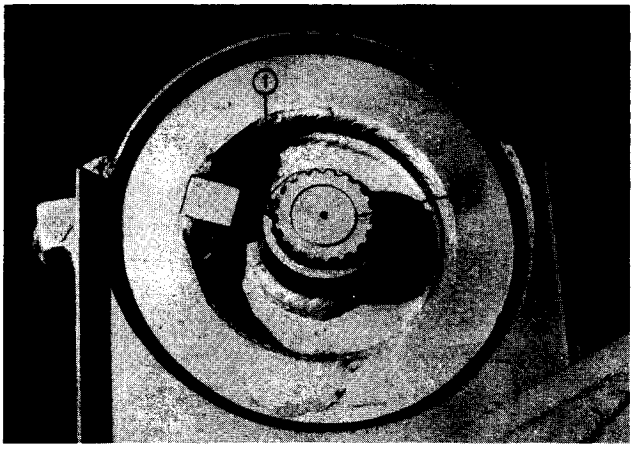


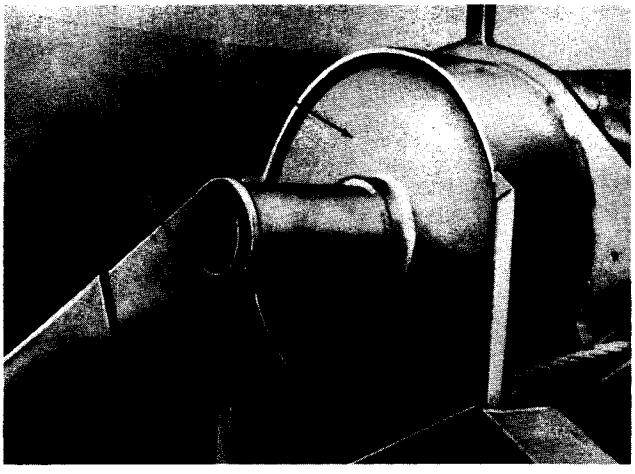
Figure K-14. Gear Box Nameplate

To remove the gear box from the machine, first remove the setscrew from the cable drum locknut. With special wrench and extension handle remove the splined locknut (Figs. K-15 and K-16).



1. SETSCREW 2. LOCKNUT

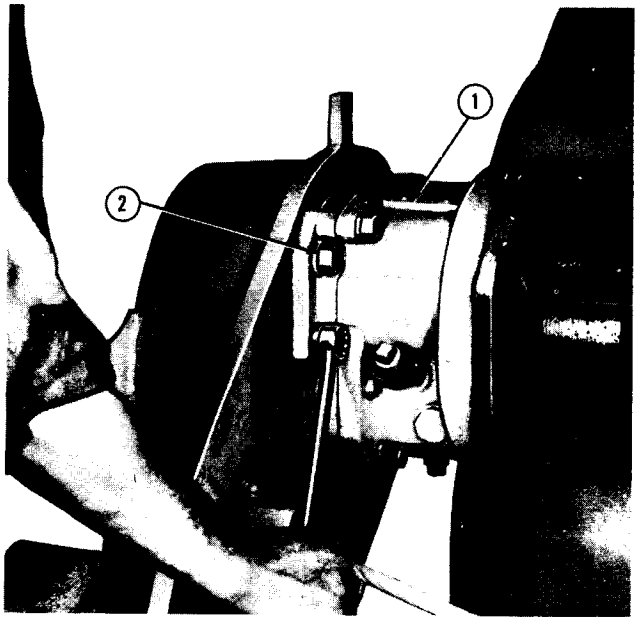
Figure K-15. Cable Drum Locknut



1. WRENCH 2. CABLE DRUM

Figure K-16. Removing Cable Drum Locknut

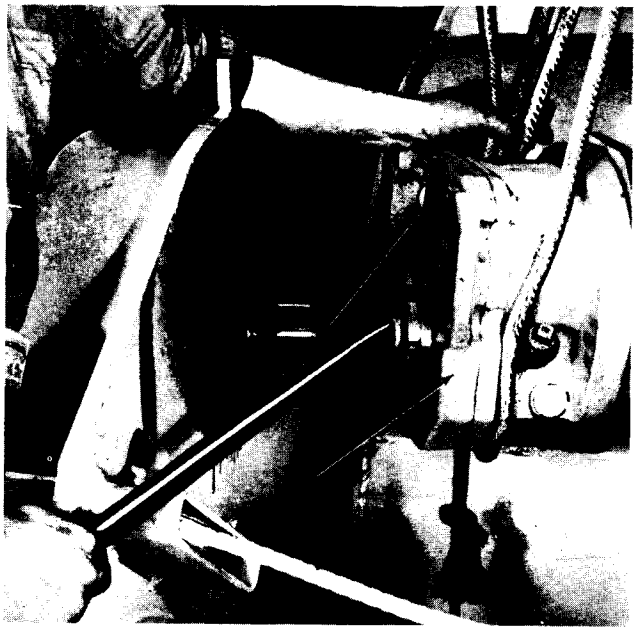
Place a sling around the gear box to relieve tension of the capscrews and to prevent the gear box from being damaged by a sudden drop. Remove the capscrews (Fig. K-17).



1. GEAR BOX 2. CAPSCREWS

Figure K-17. Removing Mounting Capscrews

Insert a pry bar between the gear box and mounting bracket and pry back and forth to loosen the drive shaft from the cable drum (Fig. K-18).



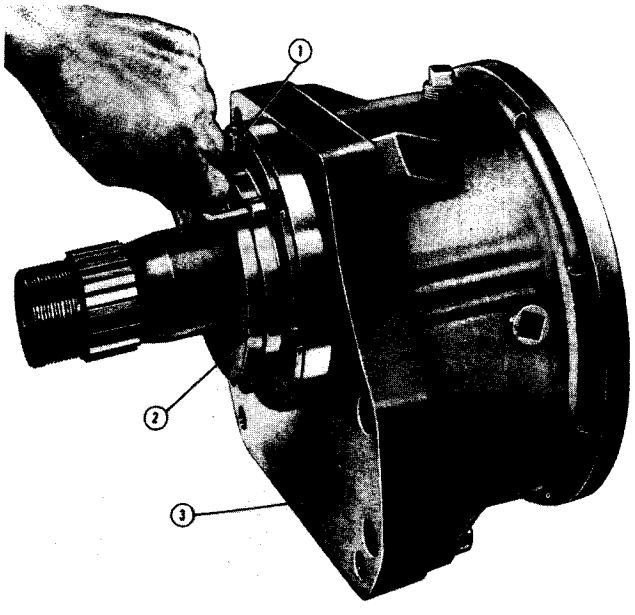
1. DRIVE SHAFT 2. GEAR BOX

Figure K-18. Removing Gear Box

Disassembly

Place the gear box on its side so that the output shaft parallels the work bench.

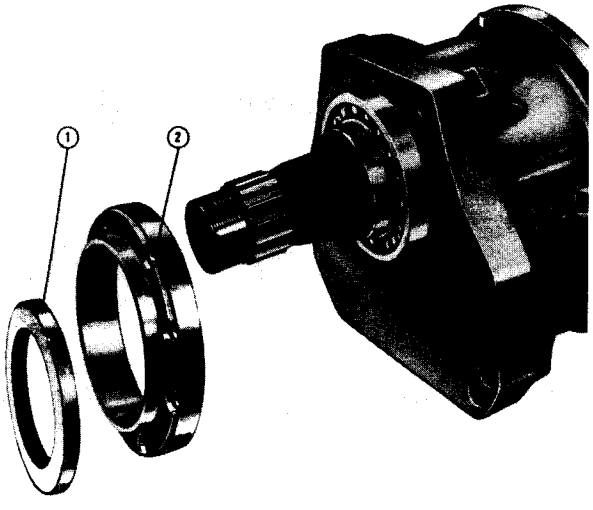
Remove the socket heat capscrews securing the retainer to the gear box (Fig. K-19). Remove the retainer and oil seal.



1. CAPSCREWS 2. RETAINER 3. GEAR BOX

Figure K-19. Removing Capscrews

Take a soft hammer and tap the oil seal out of the retainer (Fig. K-20).

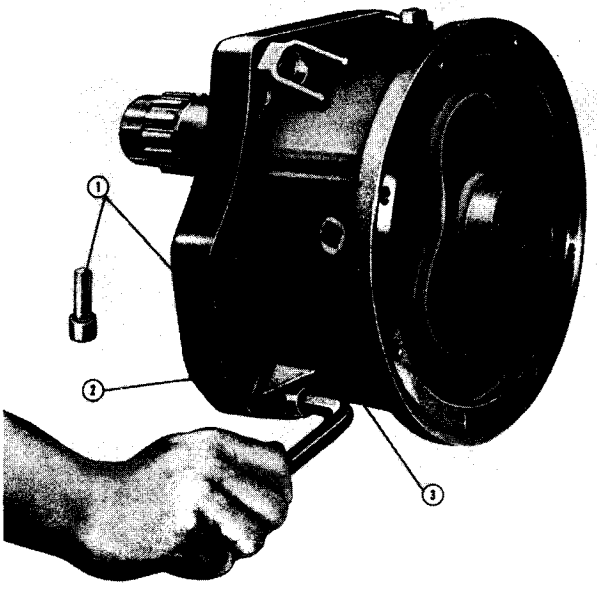


1. OIL SEAL 2. RETAINER

Figure K-20. Oil Seal and Retainer Removed

Remove two dowel bolts used to keep backing plate and case in alignment.

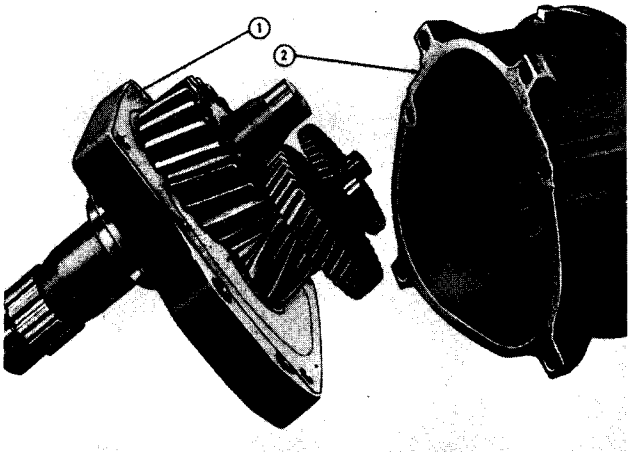
Remove two socket head capscrews securing backing plate to the case (Fig. K-21).



1. CAPSCREW 2. BACKING PLATE 3. CASE

Figure K-21. Removing Capscrews

Separate backing plate and case. The gears will remain with the backing plate assembly (Fig. K-22).

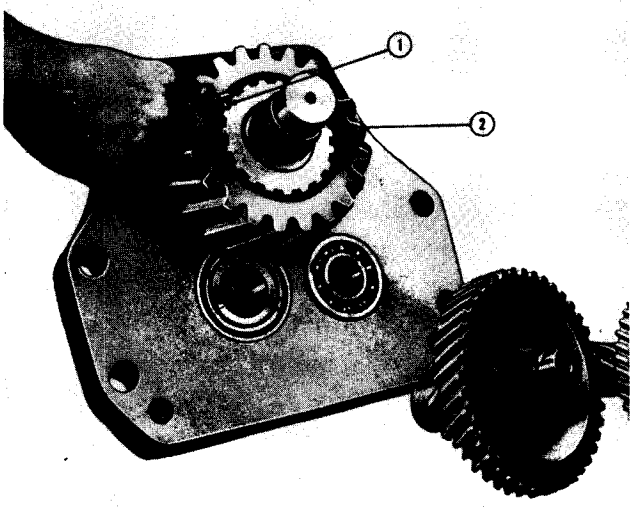


1. BACKING PLATE 2. CASE

Figure K-22. Backing Plate Removed

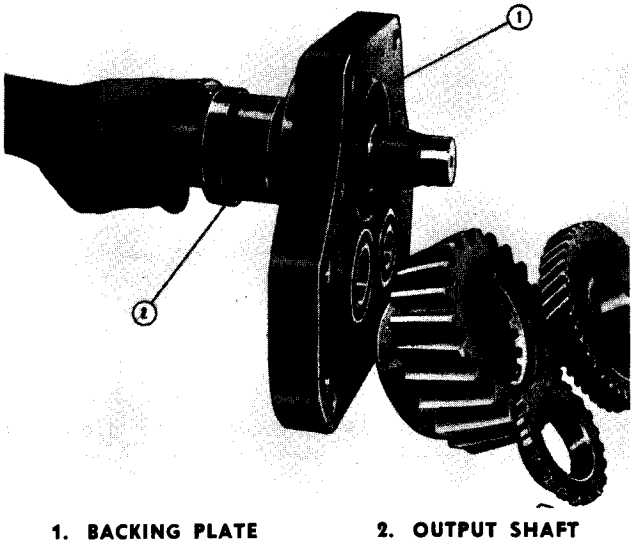
Using an expansion type bearing puller, remove the four bearings in the case and the two bearings in the backing plate.

Remove the first reduction gear and the second reduction gear. These gears may be removed by tapping lightly with soft hammer.



1. SETSCREW 2. LOCKING NUT

Figure K-23. Removing Setscrew



1. BACKING PLATE 2. OUTPUT SHAFT

Figure K-24. Removing Output Shaft

Remove locking setscrew from splined locknut (Fig. K-23).

Place a special wrench and extension bar on splined locknut and remove locknut. (This locknut has 1400 ft. lbs. of torque applied.)

Pull the output shaft. Tap out output shaft bearing with soft hammer (Fig. K-24).

Reassembly

Carefully check all gear teeth for damage. Wash and check all bearings and replace those damaged. Clean gear box and all parts before reassembly.

To reassemble the gear box, reverse the disas-

sembly procedure. When replacing the oil seal in the retainer, use special care in the installation of the oil seal as it is important to prevent damage to the seal which will result in leakage.

NOTE: When reassembling the reduction gears, check carefully to be sure that there is clearance between the second reduction gear and the main output shaft. Also, when replacing the bearing retainer, be sure to tighten the socket head capscrews evenly to keep bearing from binding.

Service

Check the oil level every 10 shifts. Change the oil every 100 shifts. Use only SAE 90 Extreme Pressure gear oil for above 32° F., and SAE 80 Extreme Pressure gear oil for below 32° F. Fill to the level plug. Capacity is approximately 2½ quarts.

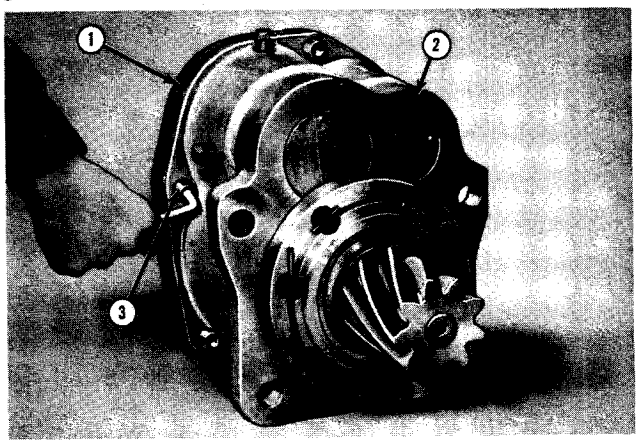
No. 2 GEAR BOX

Removal

See page K-6 for instructions for gear box removal.

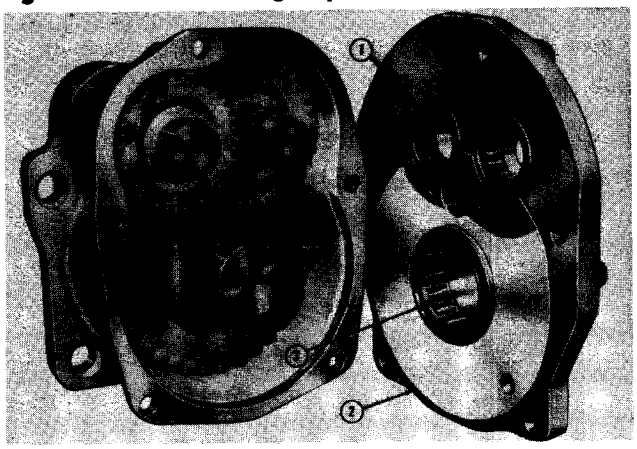
Disassembly

Remove the five socket head capscrews, lockwashers and nuts securing the face plate to the gear box case (Fig. K-25).



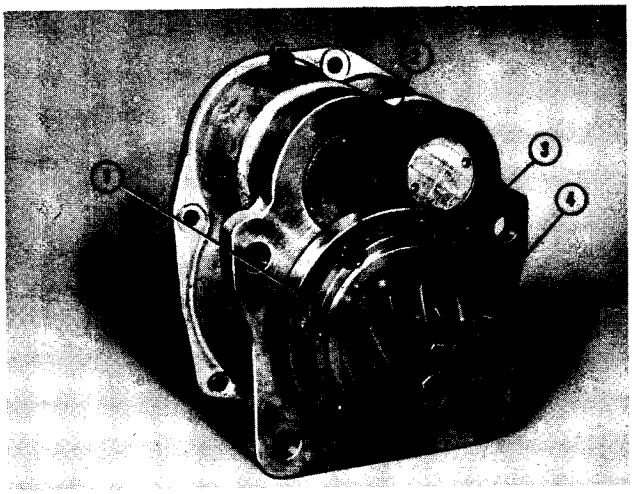
1. FACE PLATE 2. CASE 3. CAPSCREW

Figure K-25. Removing Capscrews



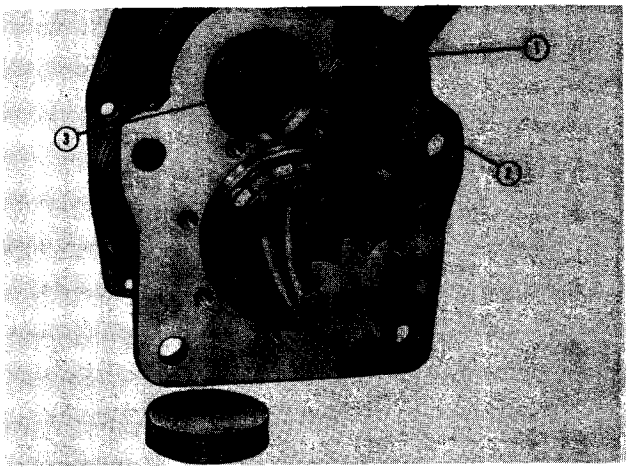
1. BEARINGS
2. FACE PLATE
3. OUTPUT SHAFT BEARING AND SEAL

Figure K-26. Face Plate Removed



1. ROLL PIN
2. CAPSCREW
3. RETAINER
4. CASE

Figure K-27. Bearing Retainer and Capscrews



1. WRENCH 2. BEARING CAP 3. LOCKNUT

Figure K-28. Removing Bearing Cap

Remove the face plate. Note the bearings in face plate (Fig. K-26). Use puller to remove bearings. Remove rotor shaft oil seal and bearing at the same time.

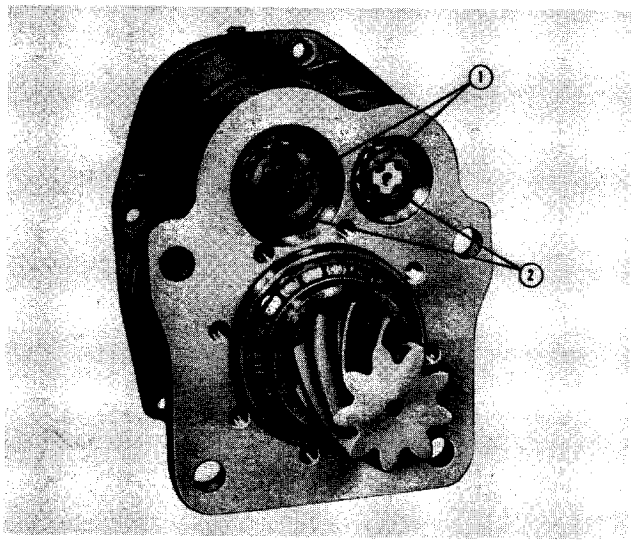
Drive out roll pins and remove the eight Tournahead capscrews securing the bearing retainer to the gear box (Fig. K-27) and remove retainer.

Using special wrench remove the bearing caps from the first and second reduction gears (Fig. K-28). Remove locking setscrews from locknuts and remove locknuts (Fig. K-29).

Pull first and second reduction gears from the gear box case. Remove locking setscrew from output shaft locknut and remove locknut. See Fig. K-30. Remove outer bearing cones and bearing cups from the bores in the case and press bearing cones from shafts.

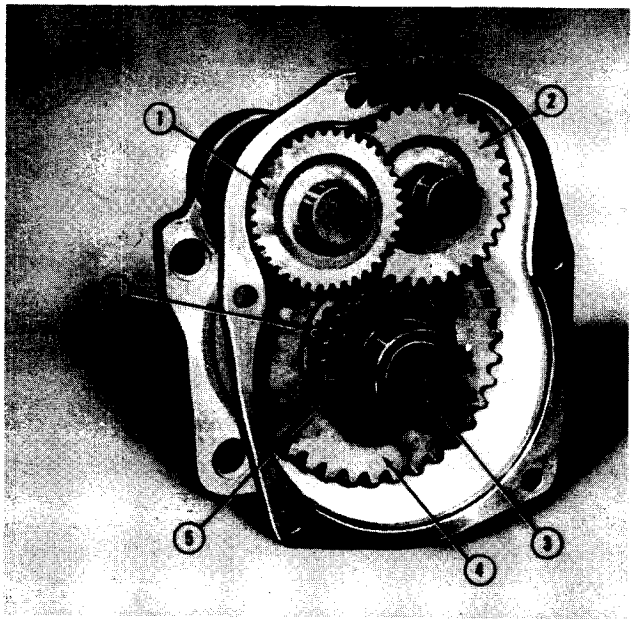
Drive out the output shaft, using a soft hammer. Outer roller bearing will come out with the shaft. Press bearing and seal ring from output shaft and remove locking ring. Remove output gear from case.

NOTE: The tapered roller bearings used in this gear box are made up in matched sets and parts of each set should be kept together. See page G-10 for detailed instructions on assembling this type bearing.



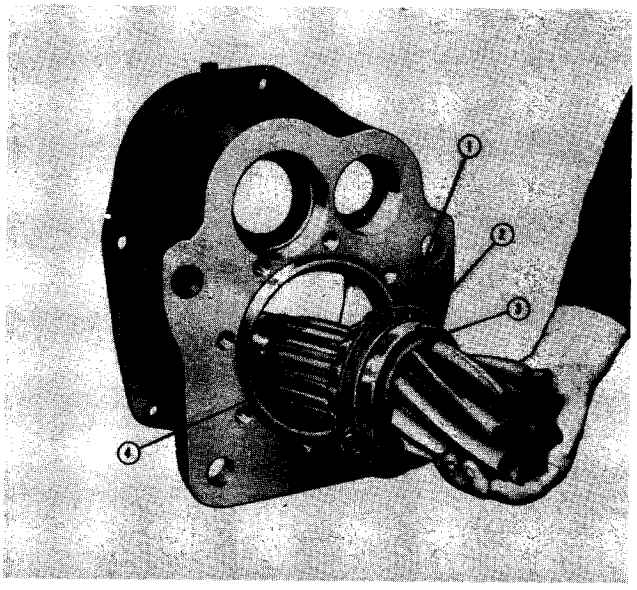
1. SETSCREW
2. LOCKNUT

Figure K-29. Locknuts and Setscrews in Position



1. FIRST REDUCTION GEAR
2. SECOND REDUCTION GEAR
3. OUTPUT SHAFT
4. OUTPUT GEAR
5. LOCKNUT
6. SETSCREW

Figure K-30. Gear Box Reduction Gears



1. BEARING
2. SEAL RING
3. LOCK RING
4. OUTPUT SHAFT

Figure K-31. Output Shaft, Removed

Service

See page K-9 for service instructions.

Capacity for No. 2 gear box is approximately 4½ quarts.

Reassembly

Carefully check all gear teeth for damage. Wash and check all bearings and replace those damaged. Clean gear box and all parts before reassembling.

To reassemble the gear box, reverse the disassembly procedure.

Note the following during assembly:

1. The first and second reduction gear bearing locknuts must be torqued to 100 and 200 ft. lbs. re-

spectively. The output gear locking nut must be torqued to 2000 ft. lbs.

2. Fill the gear box with the correct lubricant after mounting.

No. 5 GEAR UNIT

Removal

Disconnect leads from electric motor terminal strip.

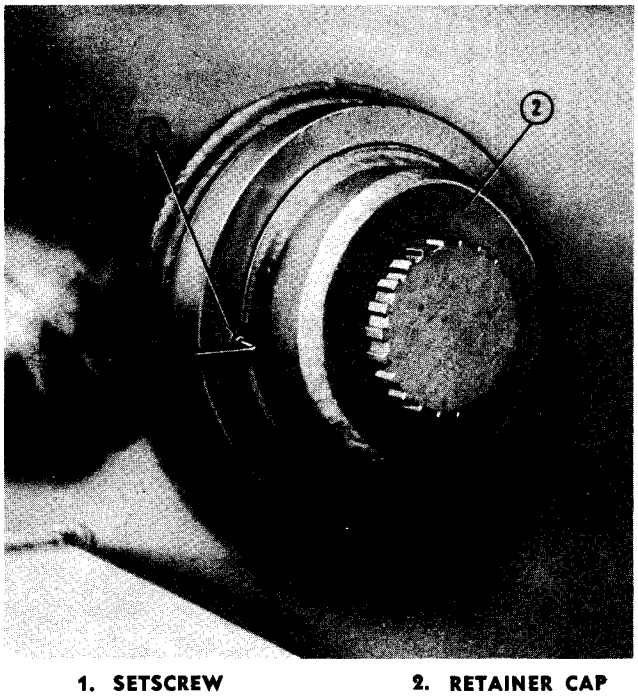
Fasten a chain hoist around the gear unit and remove the mounting bolts fastening the gear unit to the machine. Lower the assembly to the ground for further disassembly.

Remove the gear box mounting capscrews and pull gear box and motor away from the No. 5 gear unit until output shaft clears the bore.

Disassembly

Remove the cover plate from back of gear unit case.

Remove the setscrew locking the gear unit axle bearing retainer cap in position (Fig. K-32).



1. SETSCREW 2. RETAINER CAP

Figure K-32. Removing Locking Setscrew

Using the special wrench, adaptor, and extension handle provided with the machine, remove the retainer cap.

Remove the cotter from axle nut. Block the drive gear inside the case to prevent its turning, and remove the axle nut (Fig. K-33). Use same wrench and extension handle used for retainer cap removal.

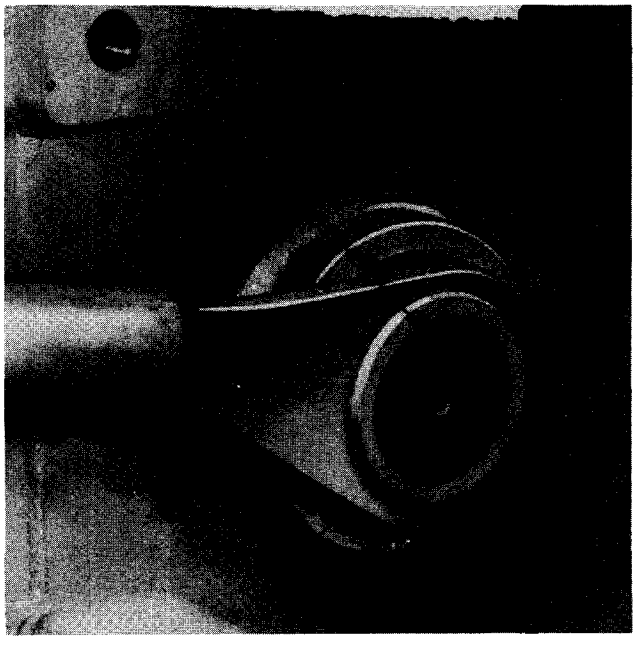
Insert a pry bar between the drive gear and the case wall and work the gear back and forth on the axle. Rotate the gear and repeat until the tapered sleeve has been loosened and forced from its seat on axle.

Using a block of wood or some other soft material which will not damage the axle, drive against the axle from the motor side of the gear unit until cable drum and axle have been freed of gear case. Keep the tapered sleeve from wedging into the gear again as the axle is removed. Block under the drive gear to prevent it dropping to the bottom of the case as axle and cable drum are withdrawn.

Loosen the capscrew which locks the bearing race into place in the bore and remove the oil seal, outer roller bearing, bearing race, and bearing retainer.

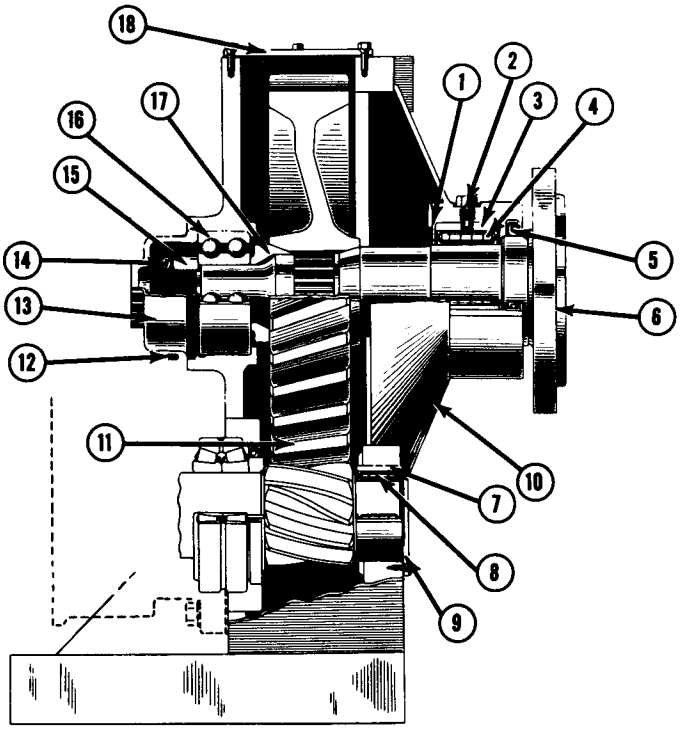
Remove the inner ball bearing and the tapered sleeve. Roll the drive gear from the opening at the rear of gear unit case.

Remove the pinion bearing cap and gasket from side of case and remove roller bearing and outer bearing race.



1. AXLE NUT 2. WRENCH AND EXTENSION

Figure K-33. Removing Axle Nut



1. RETAINER	7. OUTER RACE	13. RETAINER
2. LOCKBOLT	8. BEARING	14. COTTER
3. OUTER RACE	9. CAP	15. NUT
4. BEARING	10. CASE	16. BEARING
5. OIL SEAL	11. GEAR	17. COLLAR
6. AXLE	12. SETSCREW	18. COVER

Figure K-34. No. 5 Gear Unit, Cut-Away

Reassembly

Clean all parts thoroughly. Check bearings for damage or excessive wear. Check oil seals for stiffness, nicks or damage. Check drive gear for chipped or broken teeth, check or cracks. Replace all worn or damaged parts.

To reassemble the gear unit, reverse the disassembly procedure.

Torque axle nut to 8000 ft. lbs., and the bearing retainer cap to 2000 ft. lbs.

Service

See page K-9 for service instructions.

CONTROL CIRCUIT

The control circuit includes the fingertip control switches, limit switches, heat control switches, and main switches. When a fingertip switch is closed, current from one phase of the three phase system (phase A) flows through the fingertip switch, through the main switch holding coil, through the limit switch or switches, through the heat control switch and back to one of the remaining two phases (phase C) in the three phase system. The holding coil closes the main switch and current flows to the motor, (see Three Phase Power Circuit, page E-4). When the component operated by the motor has reached its safe limit of travel, the limit switch open the control circuit, the main switch opens, and the motor stops. If at any time the heat of the motor exceeds safe operating temperature, the heat control switch automatically opens the control circuit and stops the motor. When the motor has cooled the switch closes the circuit again and the motor will operate.

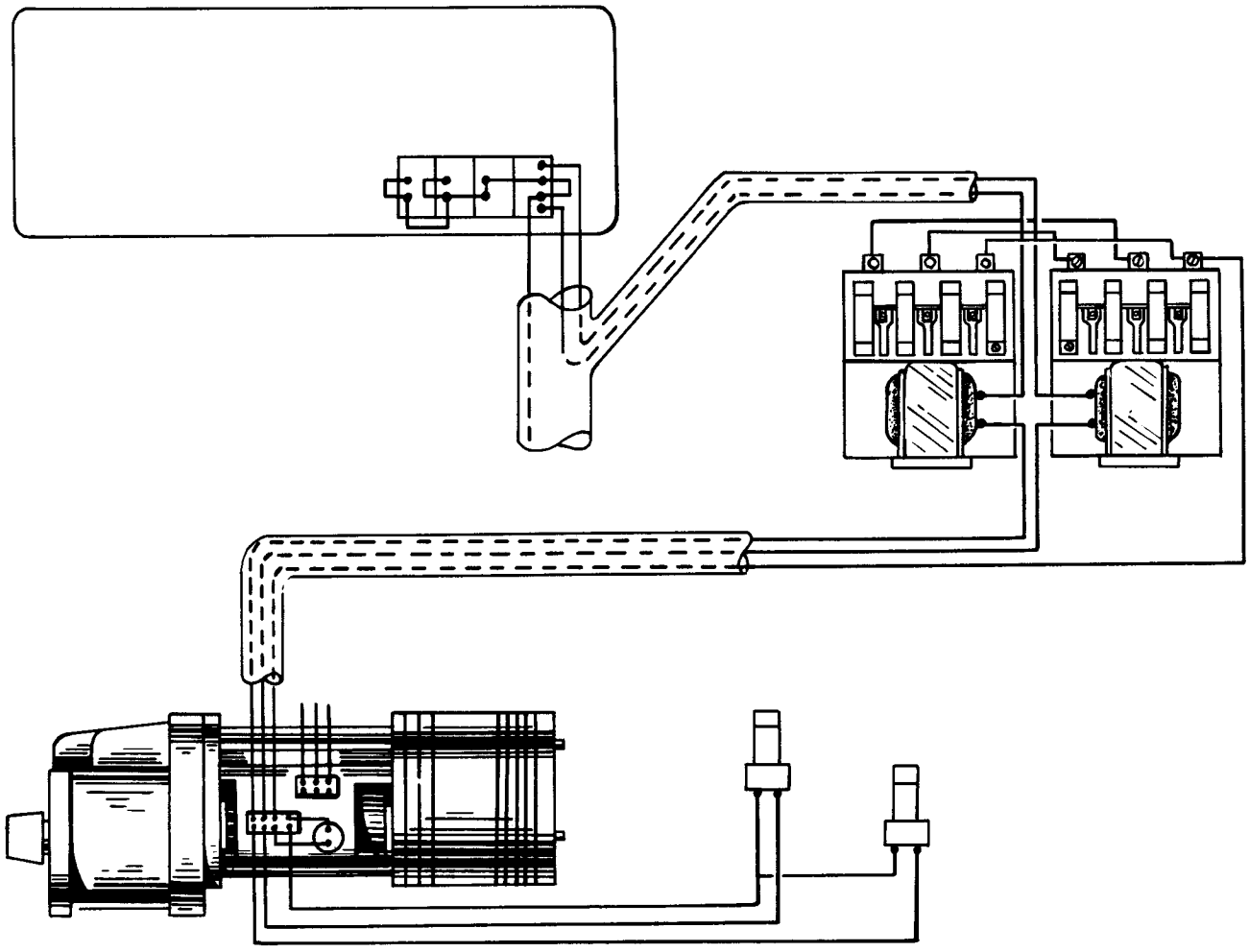


Figure K-35. A.C. Control Circuit

CONTROL, LIMIT AND HEAT CONTROL SWITCHES

The main switches which operate the A.C. motors are remote controlled by fingertip switches on the instrument or control panel.

Each fingertip control has two individual switches mounted to its frame (Fig. K-36). The switches are operated by the lever arm which protrudes through the dash panel.

A fingertip switch in the released position does not have current flowing through it. When a switch is closed, the control circuit energizing the holding coil of the corresponding main switch is closed. The contactors then close and the A.C. motor operates.

The control circuit also includes limit switches and heat control switches. Both are safety devices which prevent damage to the machine from improper operation.

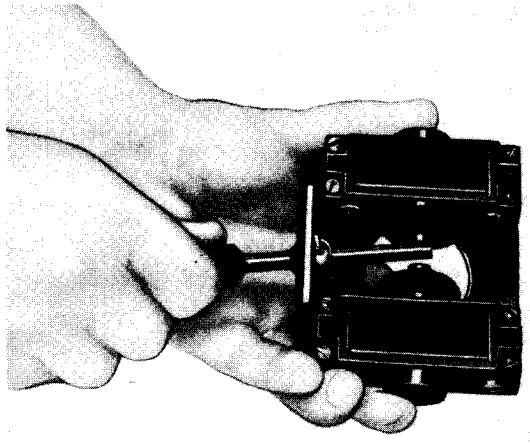


Figure K-36. Fingertip Switch Unit

The limit switches (Fig. K-37) are operated by the action of the stop plate against an actuator arm. The action of the actuator movement will cut off the flow of current to the motor, thus preventing any damage to the equipment.

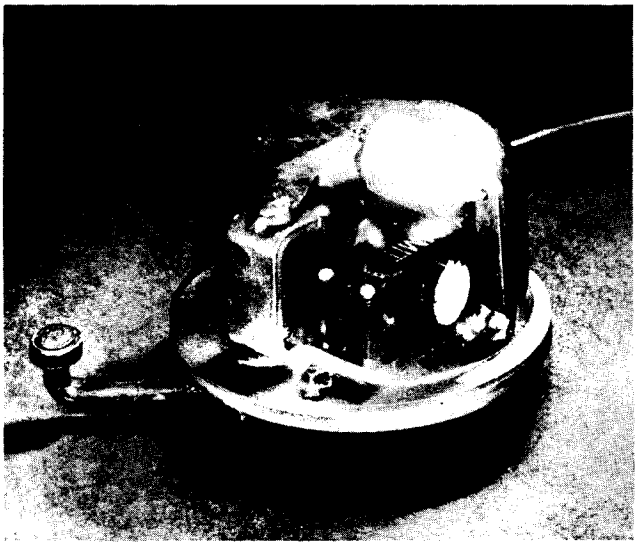


Figure K-37. Limit Switch

The heat control switch is operated by temperature changes. This safety switch has an element constructed of two metals having different rates of expansion and contraction. When subjected to an increased temperature, the metals expand and "bow up" away from the contact points, opening the motor control circuit and stopping the A.C. motor (Fig. K-38).

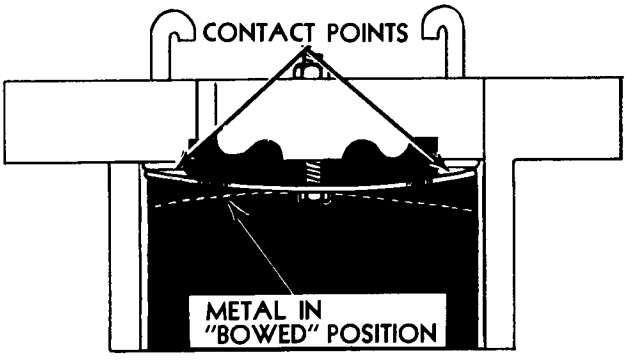


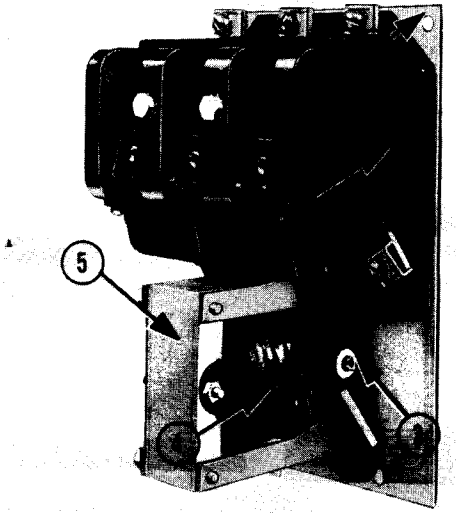
Figure K-38. Heat Control Switch

MAIN SWITCHES

Main switches inserted in the circuit between the generator and the motor, control the flow of current to the motors. When the contacts within the switches are closed, the A.C. electric motors will operate.

Heavy currents flow through these switches when the A.C. motor is in operation and large contact points of special material are used to carry the load.

Main switches are operated by electromagnets which are called holding coils. These coils are energized by a separate circuit known as the control circuit.

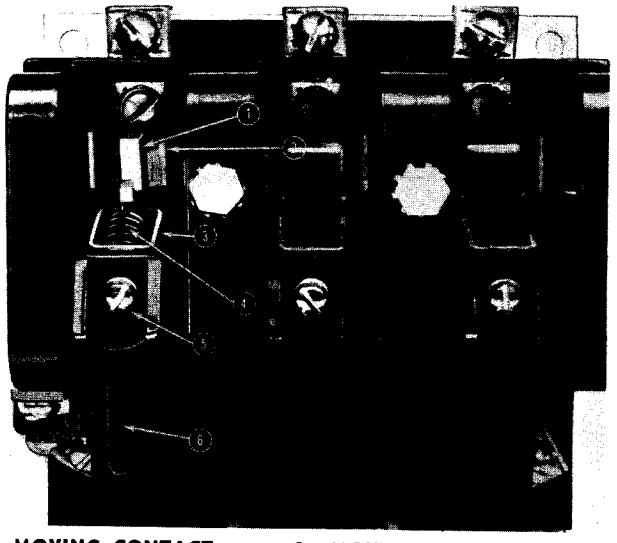


1. BASE PLATE STRUCTURE
2. CONTACTOR BASE
3. MAGNET AND ARM STRUCTURE
4. COIL STRUCTURE
5. MAGNET STRUCTURE

Figure K-39. Main Switch

REMOVING CONTACT POINTS

Moving Points — Compress spring by lifting up on moving contact point structure, rotate structure 90 degrees and remove. Spring will remain in position in the movable contact holder (Fig. K-40).



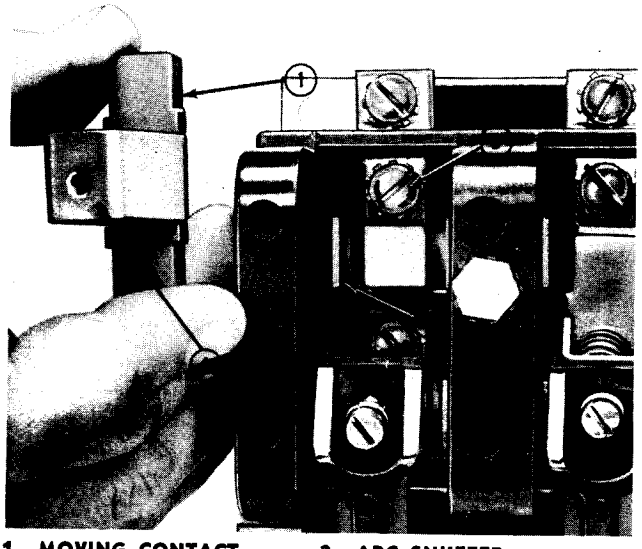
1. MOVING CONTACT POINT
2. STATIONARY CONTACT POINT
3. MOVING CONTACT HOLDER
4. SPRING
5. MACHINE SCREW
6. ARM STRUCTURE

Figure K-40. Contact Points

Stationary Points — Remove screws securing stationary contactor point structure to the contactor base and lift out the structures (Fig. K-40).

UNIT DISASSEMBLY

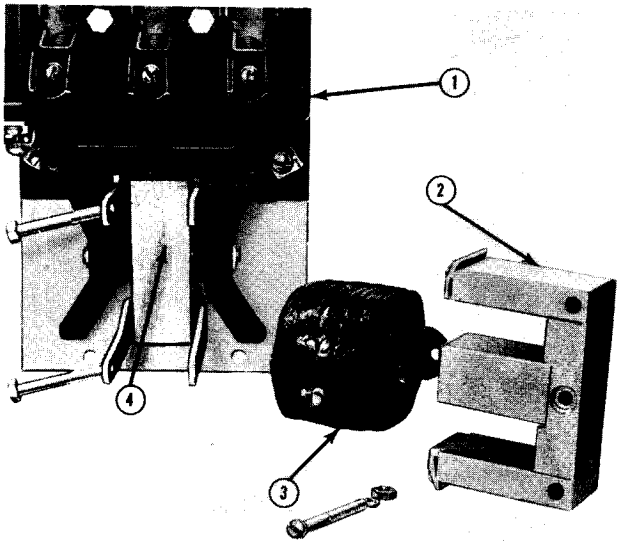
Remove machine screw securing moving contact point to arm structure and lift out the point, holder, and spring. Remove point and spring from holder (Fig. K-41). Remove remaining moving contacts in same manner.



1. MOVING CONTACT POINT
2. MACHINE SCREW
3. ARC SNUFFER
4. MOVING CONTACT HOLDER

Figure K-41. Moving Contact Point, Removed

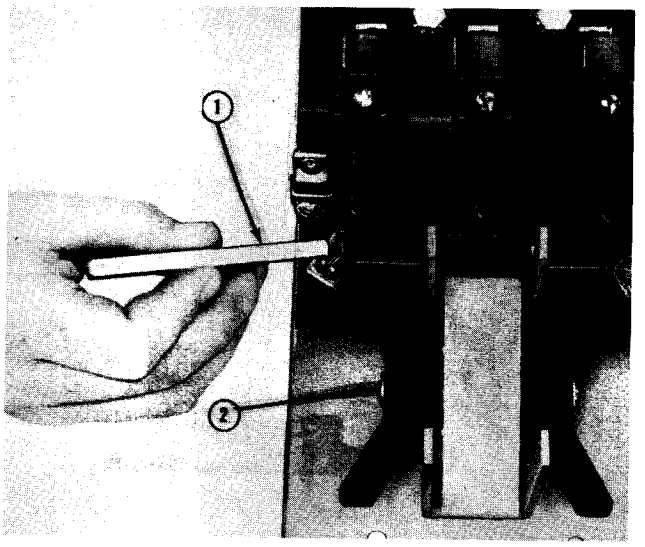
Disconnect leads to holding coil then removing capscrews securing coil and magnet structure to contactor base structure and lift magnet and coil out of mounting brackets. Remove capscrews, nut and lockwasher securing coil to magnet structure and separate the two units (Fig. K-42).



1. CONTACTOR BASE
2. MAGNET STRUCTURE
3. COIL STRUCTURE
4. BAR MAGNET AND ARM STRUCTURE

Figure K-42. Coil and Magnet, Separated

Press down on the magnet and arm structure and remove the key (Fig. K-43). Lift out the arm structure and remove the arm support spring (Fig. K-44).

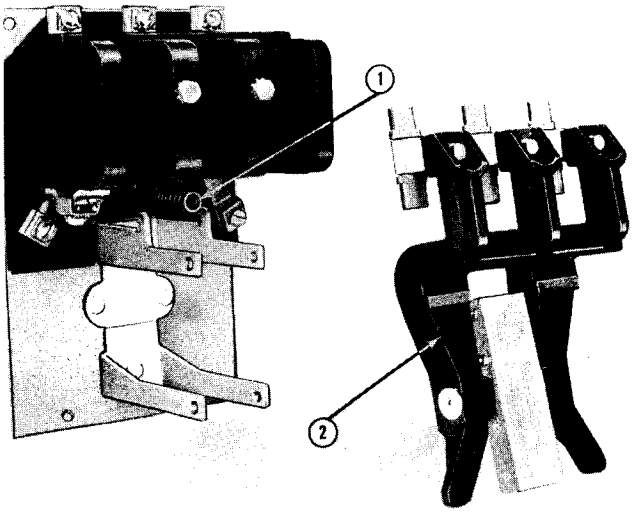


1. KEY
2. BAR MAGNET AND ARM STRUCTURE

Figure K-43. Removing Key

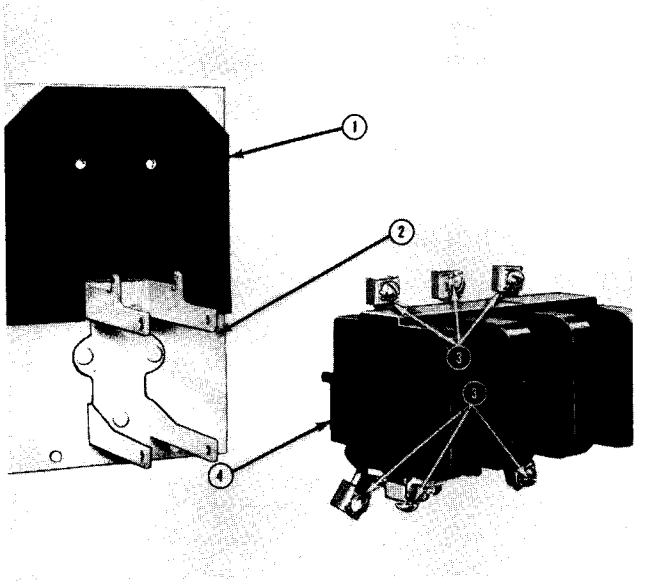
Remove the two capscrews securing the contactor base to the base plate structure and lift off the base (Fig. K-45).

Remove stationary contactor point structures, arc snuffers, and terminal strips from top and bottom of contactor base.



1. ARM SUPPORT SPRING
2. BAR MAGNET AND ARM STRUCTURE

Figure K-44. Removing Bar Magnet and Arm Structure



1. INSULATING SHEET
2. CONTACTOR BASE PLATE STRUCTURE
3. TERMINAL MOUNTS AND CLIPS
4. CONTACTOR BASE

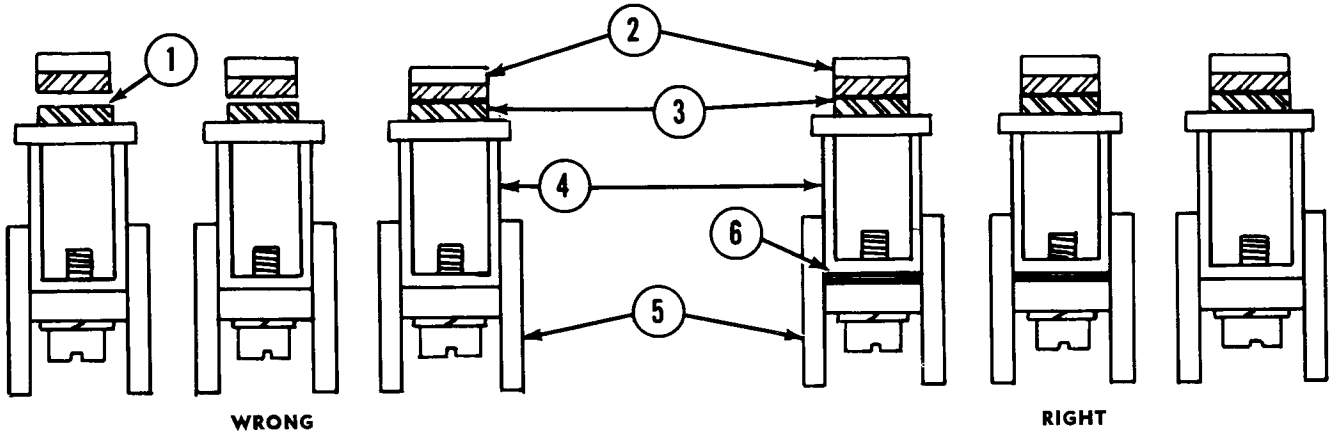
Figure K-45. Removing Base

Adjustment

To avoid excessive wear and arcing of the main switch points, all three points must make contact at the same time with a maximum of .015" variation between any two points. This also means that the top and bottom portions of each individual moving contact point must contact the mating stationary points at the same time, within the .015" limit.

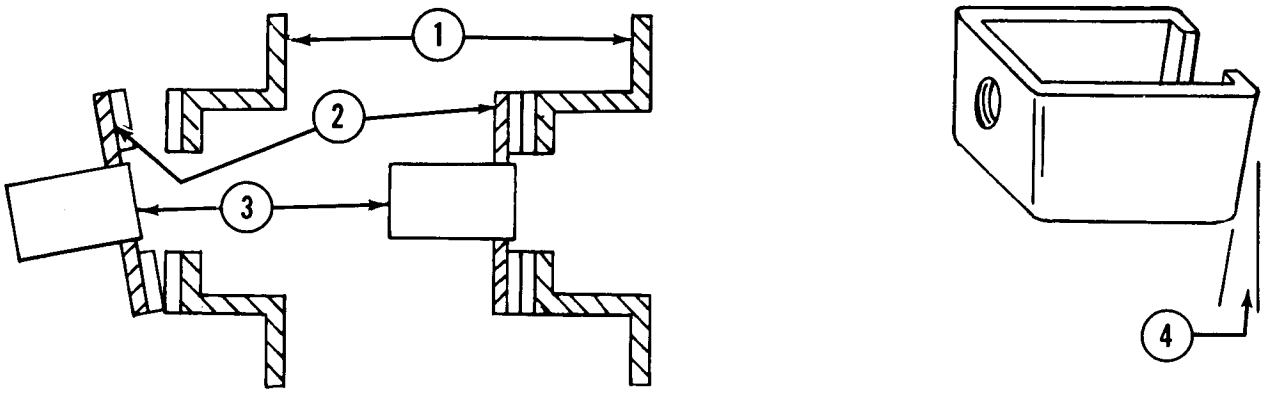
When installing a new magnet and arm assembly, moving or stationary contact points, or replacing a complete main switch assembly, shimming between the arm and moving contact holders may be necessary to keep within the specified limits.

Incorrect angle of the lips on the moving contact holder will cause the top or bottom of the contact point to engage first. If such is the case, replacement of the holder will be necessary.



1. GAP
2. STATIONARY POINTS
3. MOVING POINTS
4. POINT HOLDERS
5. MAGNET AND ARMS
6. SHIMS

Figure K-46. Shimming Between Arm and Moving Contact Holder



WRONG RIGHT

1. STATIONARY POINTS
2. MOVING POINTS
3. HOLDER
4. POINT HOLDER ANGLE

Figure K-47. Moving Contact Holder Angle

Reassembly

To reassemble the main switches, reverse the disassembly procedure.

Service

Check the condition of the contactor points for wear or pitting every 50 shifts. Pitted or burned contactor points tend to reduce or restrict the flow of current to the electric motors. To avoid rapid burning or pitting of points, the engine speed should be kept as high as possible while operating the motors, never below 1200 R.P.M. Check tightness of screws that hold power leads to switches, also main power leads coming in on the multiple conductor cable every 50 shifts.

Check the hinge bolts and other hardware on contactor armature group. These must not be loose or binding. Keep excessive dust blown off. If grease or oil has worked into the assembly, wash with a solvent such as carbon tetrachloride. Keep the control panel cover securely fastened and in place at all times.

Check the collector cups and blow out any accumulation of dust, dirt, and other foreign materials every 100 shifts.

▼

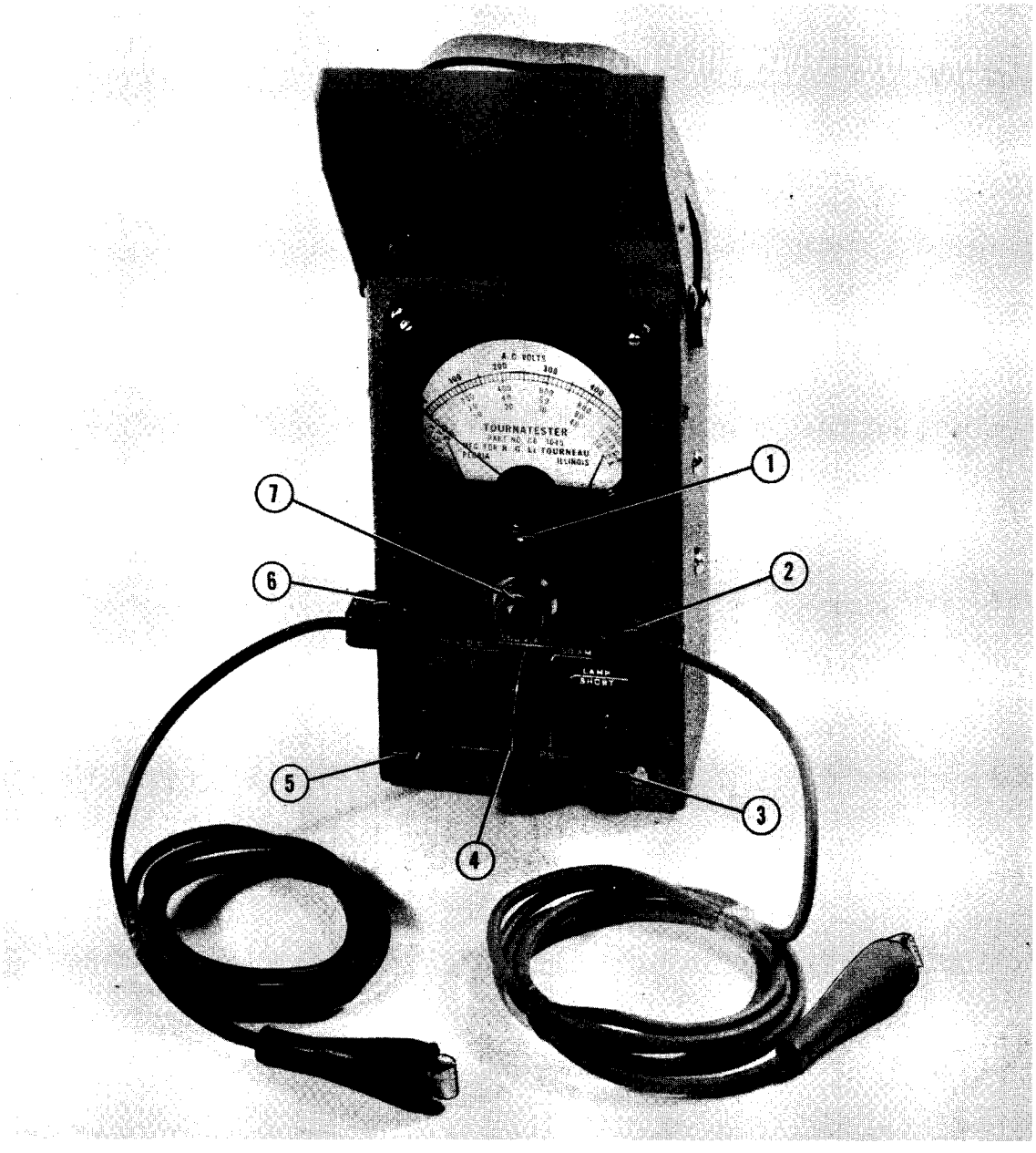
TESTING THE ELECTRICAL SYSTEM

INDEX

TESTING THE ELECTRICAL SYSTEM

THE TOURNATESTER

The Tournatester has been designed specifically for LeTourneau-Westinghouse equipment testing. Encased in a steel box with a leather carrying handle, it is small enough to be carried in a jumper pocket while on the job.



1. ADJUSTING SCREW
2. POSITIVE PIN JACK
3. POSITIVE BINDING POST
4. SELECTOR SWITCH
5. NEGATIVE BINDING POST
6. NEGATIVE PIN JACK
7. TEST LAMP

Figure L-1. Tournatester

Although the Tournatester is a very accurate instrument, it is not a delicate piece of laboratory equipment. However, the owner of this tester should exercise reasonable caution in its use. It should not be dropped or roughly handled.

The meter has four scales with the following

ranges: Alternating current (A.C.) volts from 0 to 500 volts, direct current (D.C.) volts from 0 to 1000 volts or from 0 to 100 volts; D.C. amps from 0 to 50 amps. These ranges are sufficient to cover all tests on the LeTourneau-Westinghouse equipment.

In addition to the above, the Tournatester includes built-in batteries and a test lamp. This test lamp is used for ground tests and for checking the continuity of wires. See (7) on Figure L-1.

Directly below the meter are two pin jacks (2 and 6, Fig. L-1) labeled (+) and (−). These pin jacks are used for all voltage tests and for ground and continuity tests with the test lamp. Use the test leads supplied with the Tournatester.

The large binding posts at the bottom of the meter case (3 and 5) are used for D.C. amperage tests only. Use two lengths of #8 insulated wire for test leads.

The selector switch (4) is a five position switch which can be set to the scale desired. Positions are marked clearly and identified.

CAUTION: Tester must not be placed in lamp short position while connected to 24 volt D.C. current as this will burn out bulb.

Testing With the Tournatester

Before making any voltage test determine whether the test is going to be in alternating current or direct current voltages. Position the selector knob accordingly. If this precaution is not observed the meter may be seriously damaged.

Proceed with the test, reading the scale calibration corresponding to the selector switch setting.

A voltage test, whether it be alternating current, or direct current, is always an "across-the-line" test and no wires need be disconnected (Fig. L-2).

For direct current amperage tests on the 0 to 50 amp scale it is necessary to disconnect the wire under test and connect the tester in series with this wire since amperage tests are series tests (Fig. L-3).

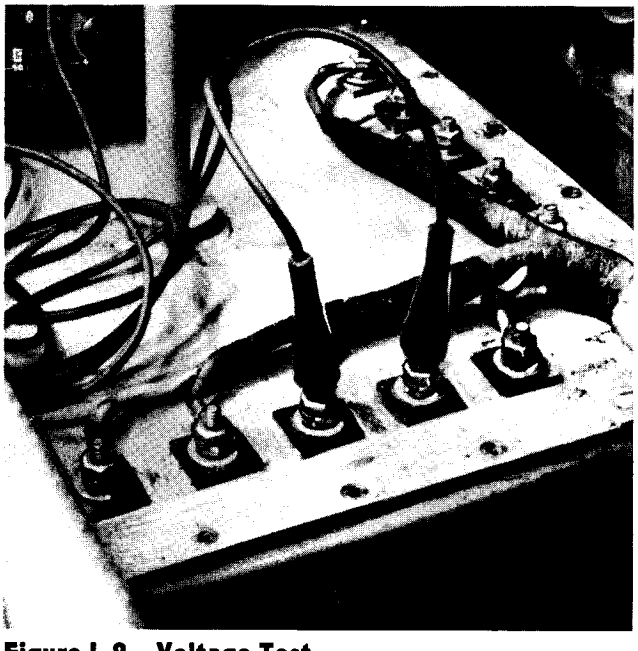


Figure L-2. Voltage Test

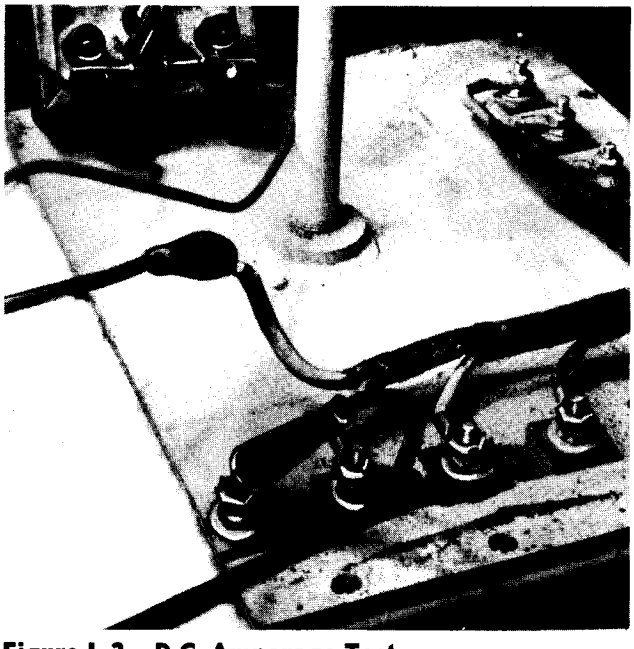


Figure L-3. D.C. Amperage Test

D.C. Amperage Tests

Secure the two lengths of #8 wire in the large binding posts (3 and 5, Fig. L-1).

Turn the selector switch to the point marked 0 to 50 amps direct current.

Disconnect the wire under test and fasten this wire to one of the leads in the meter.

Before making the test, touch the second lead from the meter to the connector and remove it with a rapid motion. Watch the meter carefully. Make certain that the meter is not swinging off the scale to the right. Under this condition a short circuit is indicated and if the meter is left in the circuit for an appreciable length of time it will sustain damage resulting from the heavy current flow.

After checking for short circuits as described above, fasten the lead to the connector.

While making direct current checks, should the meter swing to the left rather than the right, polarity of the meter is reversed and the test leads must be reversed. The left swing is then changed to right.

After the meter has been connected testing is a matter of comparing the reading on the correct printed scale on the meter with the known value obtained under normal operation.

Voltage Tests

Insert the two leads supplied with the meter into the pin jacks, 2 and 6, Fig. L-1.

Turn the selector switch to the scale setting required by the test.

Using the clip ends of the test leads, connect the meter across (in parallel with) the circuit or equipment under test.

After the meter has been connected as described above, testing again is a matter of comparing the reading on the correct printed scale on the meter with known value obtained under normal operation.

In testing D.C. volts it may be necessary to reverse the clip positions to obtain the correct direction of swing on the meter needle. This condition will not arise during A.C. voltage tests.

Maintenance

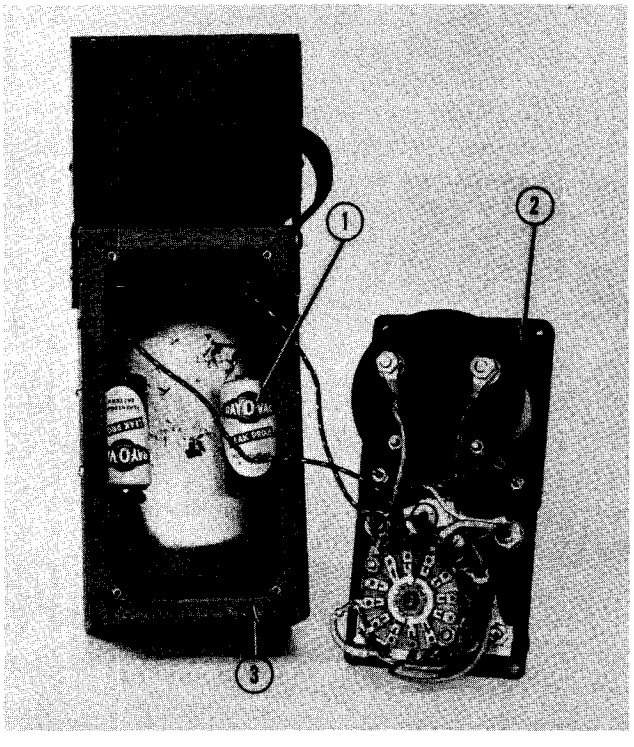
The meter should be checked for accuracy from 2 to 3 times each year. This accuracy test can be a comparative test using another new Tournatester or the meters in any good electrical shop as standard.

Because temperature variations will have a slight effect on the hairspring in the meter, the indicating hand on this meter may need adjusting to the "O" position from time to time. Zero the meter by turning the small screw (1, Fig. L-1) at the bottom of the meter face before making any test.

Whenever possible use the meter in the horizontal position. If this is not practical, zero the meter hand with the meter in the position to be maintained during test and try to make all tests with the meter in the same position, either vertical or horizontal.

Should the meter require repair send it to the factory from which it was purchased. Flashlight batteries from the test lamp are standard #1 batteries and can be purchased from most retail stores. The test lamp itself is a 2 volt pintle type lamp, No. GE 1490, which can be secured in most radio or electrical supply shops.

Batteries can be replaced after panel (with meter and switch) is removed from case. The panel is held in position by four screws, two at the top (through meter) and two at the bottom (Fig. L-4).



1. BATTERIES 2. PANEL
3. CASE

Figure L-4. Tournatester with Panel Removed

Continuity Testing

A continuity test is a test to determine whether or not an individual wire has a broken section which prevents it from conducting current and to localize the break.

If the lead from the Tournatester will reach from one end of the wire to be tested to the other, it is only necessary to disconnect one end of the wire under test, turn the Tournatester to the test lamp position, and apply the test leads to both ends of the wire. If the lamp glows the wire is not broken. If the lamp fails to glow the wire has a break somewhere along its length causing an open circuit. Either locate the break and repair it or replace the wire.

If the Tournatester leads will not reach from one end of the wire to the other, one of the two following steps can be followed:

(A) Add extensions to the leads of the Tournatester or (B) disconnect the wire to be tested from each piece of electrical equipment at the opposite ends.

Ground one end of this wire to good ground and touch the other end with one of the Tournatester leads. Hold the other Tournatester lead to a good ground. Thus the ground acts as the return wire which will complete the circuit and light the test lamp if the wire in question is in good condition. Should the test lamp fail to glow there is a break in the wire.

Often the break can be localized if as the test meter is applied to the wire in question, the wire is flexed at points which are apt to be flexed during the operation of the machine. Should the light glow as the wire is flexed a break at point of flex is indicated. Although in some cases breaks in the multi-wire conductors can be repaired, it is advisable, whenever possible to replace the entire cable with a new unit.

Ground Test

The LeTourneau 3 phase A.C. electrical system is an ungrounded system. Therefore, whenever occasion arises for testing the system, always make a ground test in conjunction with any test.

Make a ground test as a preventive maintenance measure at least 3 times yearly.

Ground tests are made with the Tournatester in the test lamp position.

Place one test prod on a connector in the circuit to be tested and place the other test prod on a good ground on the machine frame. (A lighted lamp during the test indicates a ground.)

REMEMBER: The system, since it is an ungrounded system, must have two grounds to completely ground a circuit and short. An indication of arcing and burning at one point due to ground means that the circuit is grounded at one other point too. Locate this and correct before operating the machine.

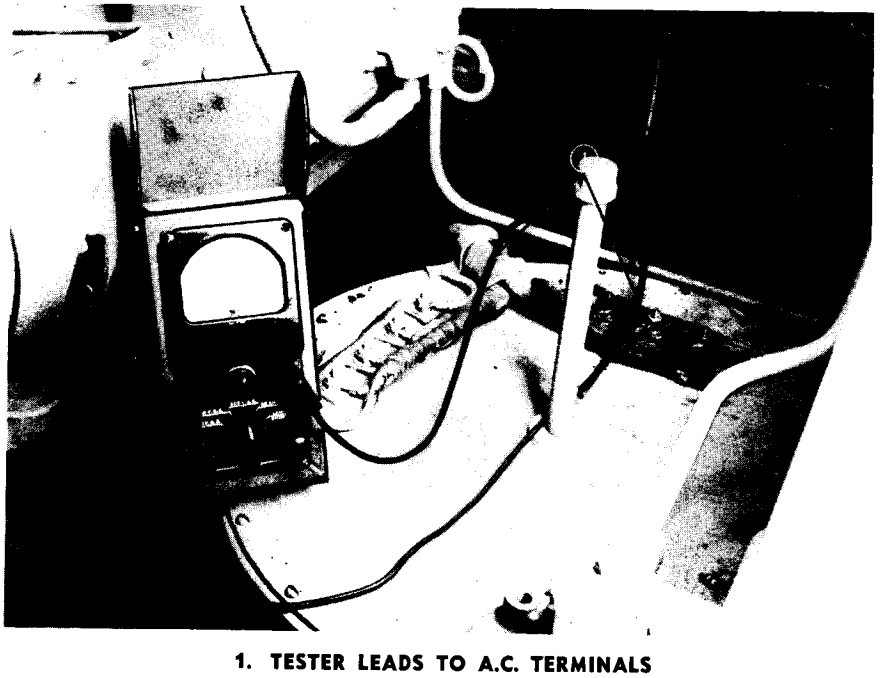
If the second ground is not located failure may result at this point during future operations.

TEST PROCEDURES

Before making these tests, refer to the "Tournatester" section for detailed instructions on making amperage and voltage tests. Follow these instructions closely. Make certain any leads removed to make a test are reconnected before proceeding to the next test.

A.C. GENERATOR

1. Output Voltage (No Load)



1. TESTER LEADS TO A.C. TERMINALS

Figure L-5. Output Voltage Test

TEST PROCEDURE:

1. Attach the test leads to the upper terminals on the Tournatester and set the selector switch at 500 V.A.C. READ THE TOP SCALE ON THE METER.

2. Turn on the key switch and the main D.C. switch. Start the engine, and after warm-up, operate the engine at 1800 R.P.M. DO NOT OPERATE ANY ELECTRIC MOTORS DURING THE TEST.

3. Make A.C. voltage tests across the 3 A.C. terminals (3 tests, A to B, A to C, and B to C) on the transformer terminal strip.

NORMAL READINGS

#2 GENERATOR.....300 Volts A.C.

NOTE: Normal readings are based on 1800 engine R.P.M. with batteries and component parts of the electrical system in good condition.

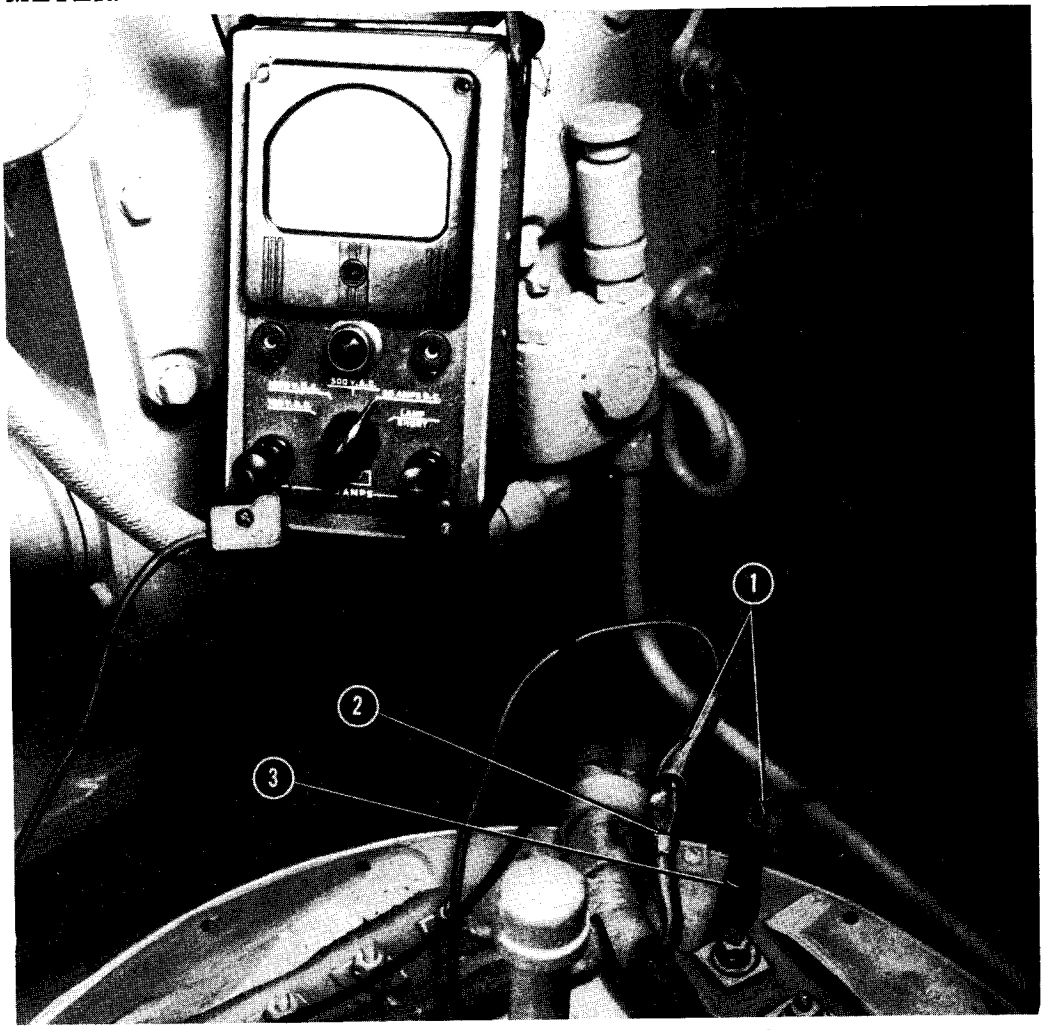
The voltage readings taken may vary slightly from normal due to the temperature at which the generator is operating. A higher temperature will result in a lower voltage reading. However, temperature will not cause a variation between any two phases during the same test.

2. Amperage to the A.C. Generator Field

TEST PROCEDURE:

1. Attach two #8 wire leads to the lower terminals on the Tournatester and set the selector switch at 50 amps D.C. READ THE BOTTOM SCALE ON THE METER.

2. Remove the negative (field lead) at the rectifier terminal strip on the rectifier case. Connect the Tournatester in series between this detached lead and the terminal from which the lead was removed on the rectifier case.



1. TESTER LEADS 2. FIELD LEAD
3. (—) NEGATIVE TERMINAL

Figure L-6. Amperage Test

3. Turn on the key switch and the D.C. main switch. Operate the engine at 1800 R.P.M.

4. Read the D.C. amps to the generator field on the Tournatester meter.

NOTE: To make this test on machines with rectifiers in the air stream, find knife connector between generator field lead and negative lead of booster rectifier. Make test at this point by disconnecting knife connector and inserting tester in line.

NORMAL READINGS

#2 GENERATOR.....16 D.C. Amps.

NOTE: Normal readings are based on 1800 engine R.P.M. with batteries and component parts of the electrical system in good condition.

3. D.C. Voltage to the A.C. Generator Field

TEST PROCEDURE:

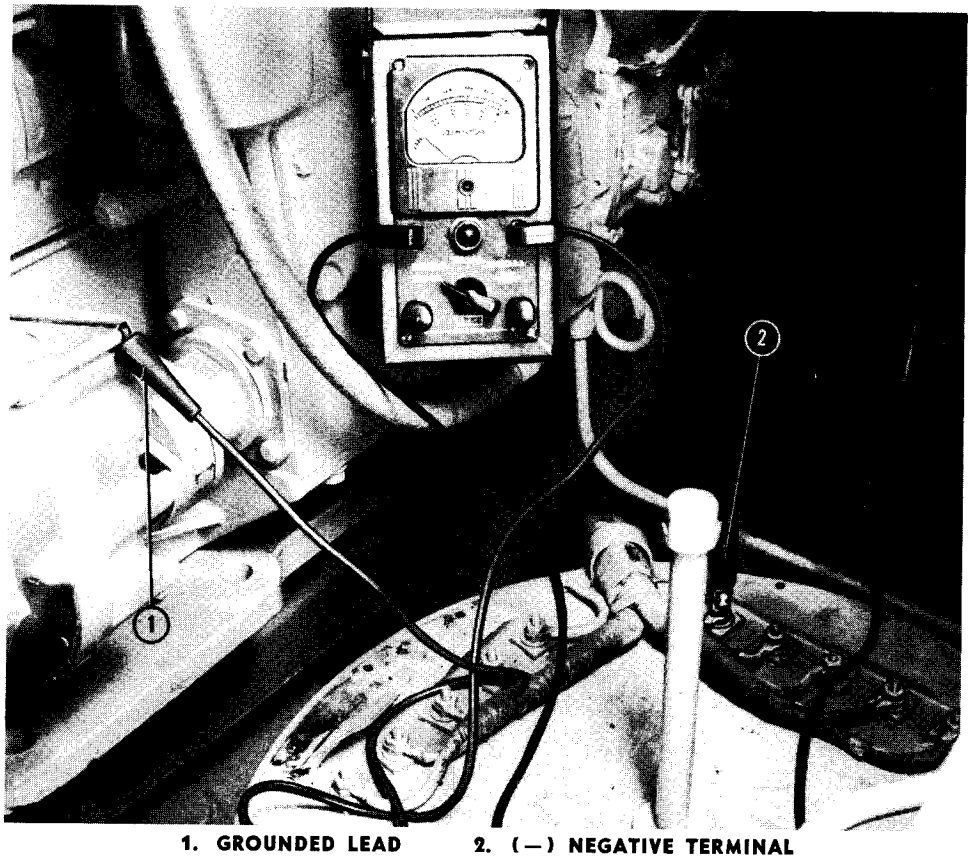
1. Attach the test leads to the upper terminals on the Tournatester and set the selector switch at 0 - 100 V.D.C. READ THE SECOND SCALE FROM THE BOTTOM ON THE METER.

2. Attach one test lead to the negative terminal on the booster rectifier terminal strip on the rectifier case and attach the other test lead to a good ground.

3. Turn on the key switch and the main D.C. switch. Start the engine and operate at 1800 R.P.M. DO NOT OPERATE ANY A.C. ELECTRIC MOTORS DURING THIS TEST.

4. Read the D.C. volts to the generator field on the Tournatester meter.

NOTE: To make this test on machines with rectifier in air stream: slide back insulator on knife connector on lead going to generator field and read from this point to good ground — no wires to be disconnected.



1. GROUNDED LEAD 2. (—) NEGATIVE TERMINAL

Figure L-7. D.C. Voltage Test

NORMAL READINGS

#2 GENERATOR.....26 D.C. Volts

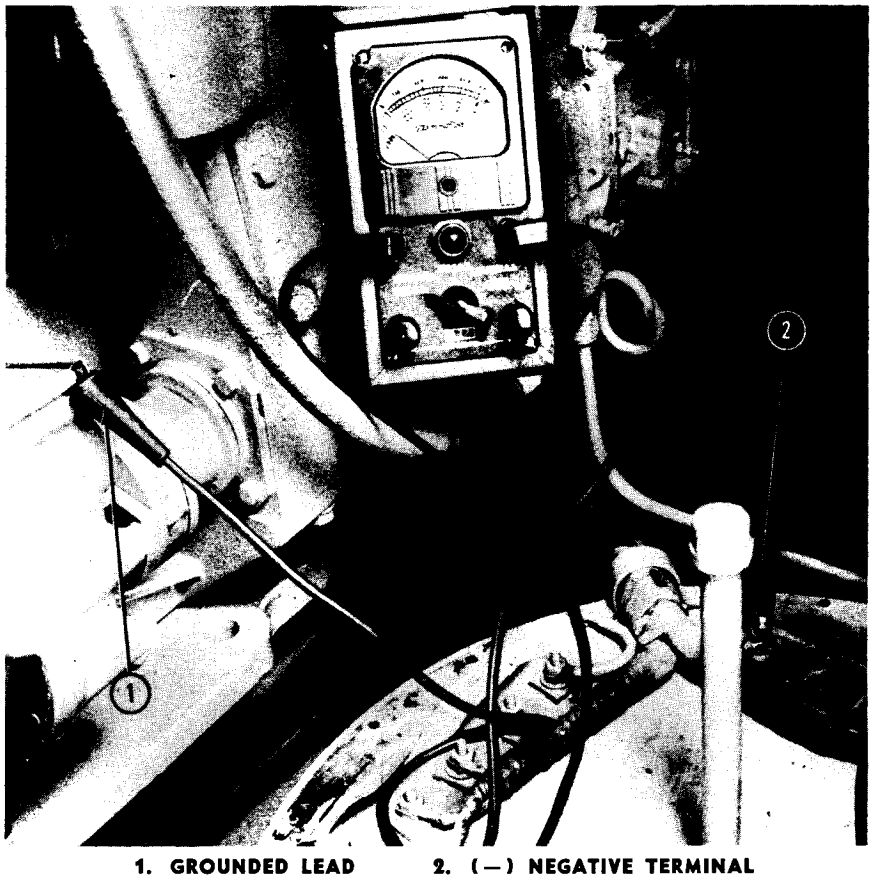
NOTE: Normal readings are based on 1800 engine R.P.M. with batteries and component parts of the electrical system in good condition.

4. Voltage Boost to the A.C. Generator Field

TEST PROCEDURE:

1. Attach the test leads to the upper terminals on the Tournatester and set the selector switch at 0-100 V.D.C. READ THE SECOND SCALE FROM THE BOTTOM ON THE METER.
2. Attach one test lead to the negative terminal on the booster rectifier terminal strip on the rectifier case and attach the other test lead to a good ground.
3. Remove leads to the motor brake at the motor terminal strip on the electric motor.
4. Turn on the key switch and the main D.C. switch. Start the engine and operate at 1800 R.P.M.
5. Operate the fingertip switch on the instrument panel controlling the motor with the brake disconnected.
6. Read the D.C. voltage to the A.C. generator field on the Tournatester meter. Since the test is made with a locked rotor, make tests as rapidly as possible to keep the motor from heating.

NOTE: To make this test on machines with rectifiers in air stream: slide back insulator on knife connector on lead going to generator field and read from this point to good ground.



1. GROUNDED LEAD 2. (—) NEGATIVE TERMINAL

Figure 8. Voltage Boost Test

NORMAL READINGS

#1, #2 and #3 GENERATORS:

Voltage to Field With Boost..... .....45 to 60 D.C. Volts

5. Rectifiers

TEST PROCEDURE:

1. Attach the test leads to the upper terminals on the Tournatester and set the selector switch at 0-100 V.D.C. READ THE SECOND SCALE FROM THE BOTTOM ON THE METER.
2. Attach one Tournatester lead to the positive terminal on the rectifier and the other lead to a good ground.
3.. Turn on the key switch and the main D.C. switch.
4. Make a record of the voltage reading taken.
5. Attach one Tournatester lead to the negative

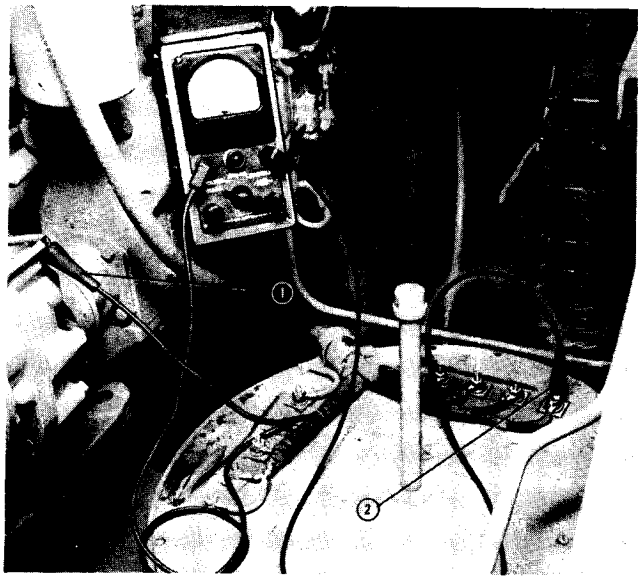
terminal on the rectifier and the other lead to a good ground.

6. Make a record of the voltage reading taken.

7. Subtract the reading taken in #4 from the reading taken in #6.

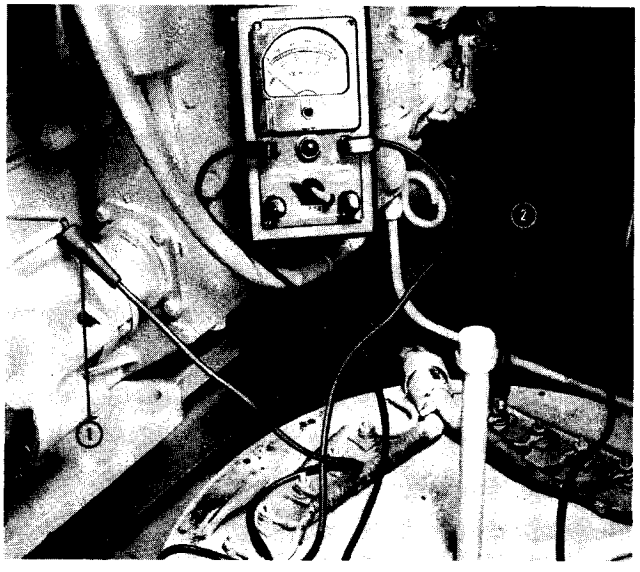
8. The difference between the two readings is considered the voltage drop of the rectifier under test.

NOTE: On machines with air cooled rectifiers the (−) negative reading must be taken at the knife disconnector leading to the generator field and the (+) positive reading may be taken at either of the two D.C. leads found on the 5 connector terminal strip mounted on top of the transformers. Readings taken on either one will be the battery voltage.



1. GROUNDED LEAD 2. (+) POSITIVE TERMINAL

Figure L-9. Test to Positive Terminal



1. GROUNDED LEAD 2. (−) NEGATIVE TERMINAL

Figure L-10. Test to Negative Terminal

OPEN AND GROUNDED RECTIFIER — TEST PROCEDURE

1. This test is made with the key switch, main D.C. switch off, and engine stopped.

2. Remove rectifier tank cover exposing the rectifiers. Disconnect all leads from the rectifier under test.

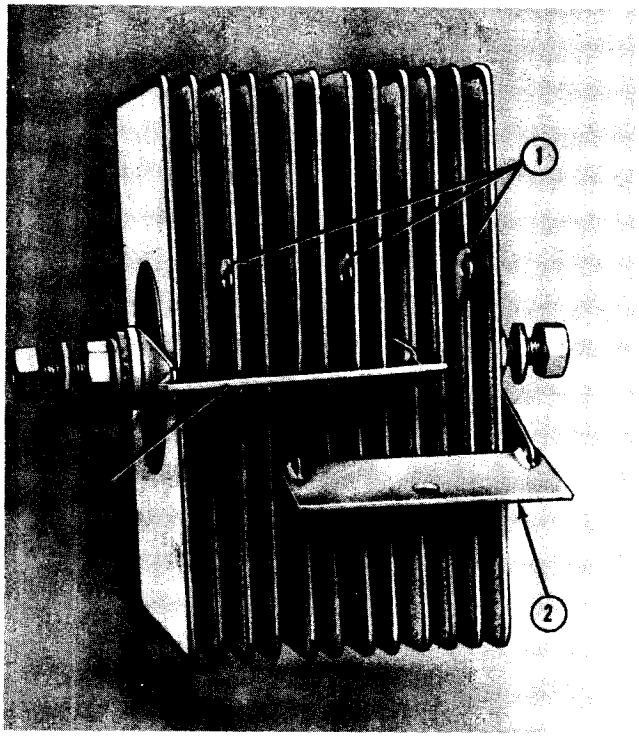
3. Place the Tournatester in the "Lamp Short" position. Place the test leads in the upper terminals of the Tournatester. Connect the lead from the positive terminal on the Tournatester to the positive terminal on the rectifier. Make a continuity test on each of the three A.C. terminals with the remaining test lead attached to the negative terminal on the Tournatester. The lamp should glow.

4. Reverse the leads and repeat the test. The lamp should glow.

5. If the lamp glows on only one of the above tests the rectifier is probably in good condition. If the lamp glows on both tests the rectifier is faulty and should be replaced.

NOTE: In the event the polarity of the test meter is not the same as the polarity of the rectifier the lamp will not glow during the first test, but will glow during the second. The important point to remember in this case is that the lamp should glow on only ONE of the two tests. Otherwise the rectifier is faulty.

6. Repeat the above test with the negative terminal of the Tournatester to the negative terminal of the rectifier. Make a continuity test on each of



1. A.C. TERMINALS 2. (−) NEGATIVE TERMINAL
3. (+) POSITIVE TERMINALS

Figure L-11. 12 Plate Rectifier

the three A.C. terminals with the remaining test lead attached to the positive terminal on the Tournatester. In this case also, the test lamp should glow on only one of the two tests, otherwise the rectifier is faulty and should be replaced.

7. Faulty rectifiers result from selenium breakdown, burning, etc., which allows current to flow in both directions through the plates. Rectifiers no longer function efficiently as rectifiers when their "back resistance" is gone.

8. Place the Tournatester selector switch in the "Lamp Short" position. Place the test leads in the upper terminals on the Tournatester. Fasten one Tournatester lead to the end of the rectifier mounting bolt. This bolt extends through the centers of all the rectifier plates. Make continuity tests on all terminals (both A.C. and D.C.) on the rectifier. If the test lamp glows the rectifier is defective and should be replaced.

9. A light indicates a short between the rectifier plates and the mounting bolt. This results in an inoperative system. Check connections at rectifier terminals and make sure that connectors are not touching any of the plates, only the proper connecting terminals.

NORMAL READINGS

VOLTAGE DROP ACROSS RECTIFIER

12 plate rectifier.....3 to 4 V.D.C.
18 plate rectifier.....4 to 5 V.D.C.
24 plate rectifier.....7 to 8 V.D.C.

6. Constant Voltage Transformer

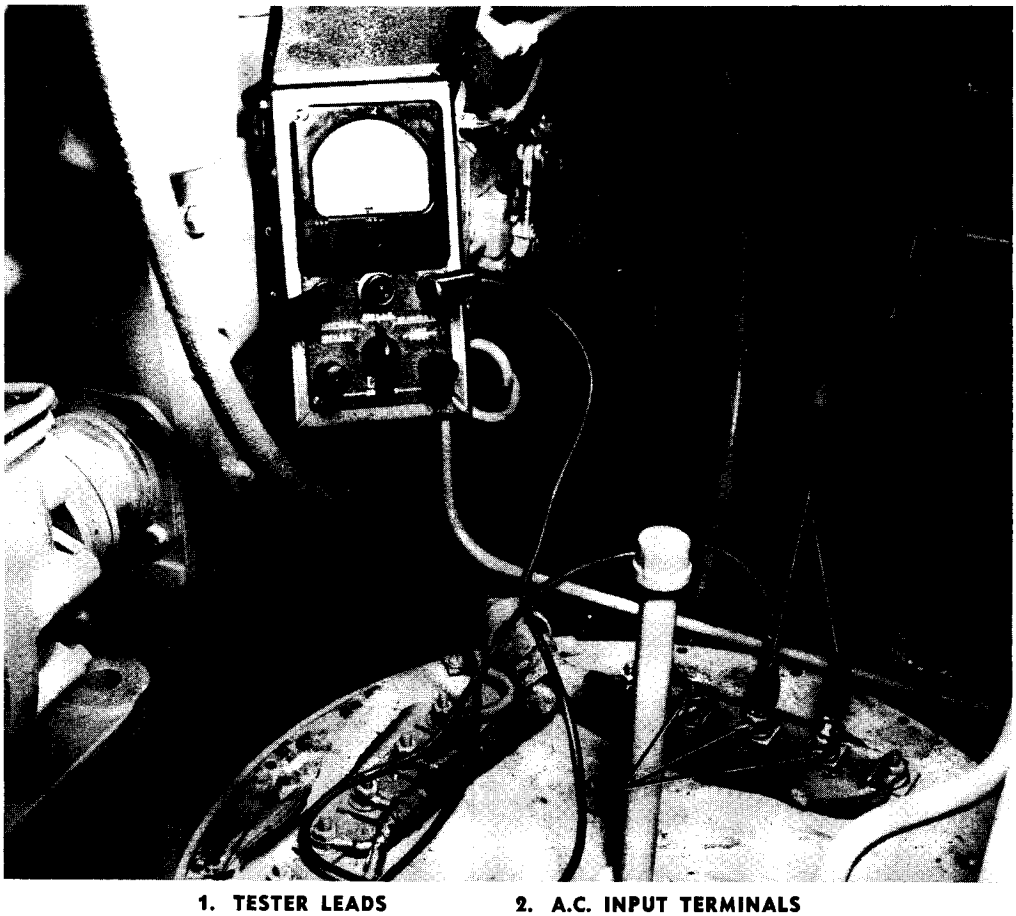
TEST PROCEDURE:

1. Attach the test leads to the upper terminals on the Tournatester and set the selector switch to 0 - 500 V.A.C. READ THE TOP SCALE ON THE METER.

2. Connect the test lead to two of the three A.C. terminals on the rectifier terminal strip.

3. Start the engine, and, after warm-up, operate the engine at 1800 R.P.M.

4. Read the "no load" output of the transformer secondary directly from the Tournatester meter.



1. TESTER LEADS 2. A.C. INPUT TERMINALS

Figure L-12. Transformer Voltage Test

5. Remove leads to the motor brake at the motor terminal strip on the electric motor. Operate the fingertip switch on the instrument panel controlling the motor with the brake disconnected.

6. Read the volts (A.C.) from the secondary of the transformer directly from the Tournatester meter.

NOTE: On machines with air cooled rectifiers make this test by reading across the three proper A.C. connections on the 6 connector transformer terminal strip on top of the transformer. With the operator facing machine this would be the strip on his left; the first three connections on the left being the output of the main transformer; the next three from the constant voltage transformer.

NORMAL READINGS

#2 GENERATORS

Constant Voltage Transformer

.....Approx. 7 V.A.C.

A.C. Volts to Rectifier.....Approx. 30 V.A.C.

NOTE: Repeat above test for each of the combinations of A.C. terminals on the booster rectifier terminal strip. Voltage readings should not vary over 5% between any two tests.

7. Main Transformer

TEST PROCEDURE:

1. Turn on key switch and main D.C. switch. Then, before the engine is started, make a test (with the Tournatester set to the 0 - 100 V.D.C. position) from the negative side of the main transformer rectifier to a good ground.

2. If no voltage is indicated on the meter, make a continuity check on the leads to the battery and check the condition of the battery.

NOTE: To make this test on machines with air cooled rectifiers, the two D.C. leads on top of the transformer terminal strip (5 connector strip) are to be used. One of these leads is the (+) positive of the booster rectifier and the other the (—) of the main rectifier.

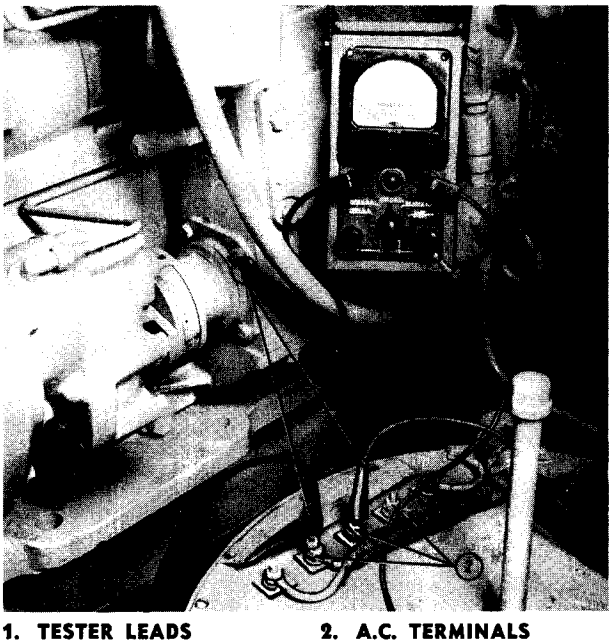
They may be identified in this manner:

1. *Turn on key switch and D.C. main switch until ammeter shows normal discharge.*
2. *Remove either one of the two D.C. leads on the 5 connector transformer terminal strip.*
3. *If the ammeter still shows discharge the (—) negative of the main rectifier has been removed.*
4. *If ammeter goes to zero the (+) positive of the booster rectifier has been removed.*

After this has been determined then proceed with the test as described with the (—) negative of the main rectifier.

NORMAL READINGS

D.C. Voltage (Neg. to Gnd.).....Approx. 24 V.D.C.



1. TESTER LEADS **2. A.C. TERMINALS**

Figure L-13. Transformer Output Voltage Test

NORMAL CHARGE — TEST PROCEDURE:

The normal charge rate, with the flux bridge in place and shims beneath it is from 15 to 20 amps. The charge rate is indicated by the ammeter on the panel.

The engine should be operating at full governed speed. *NOTE: It may be that due to severe operating conditions 20 amps charging rate will not maintain the batteries at the proper level. In this case, add fiber shims, 1/32" at a time, until the charge rate is high enough to maintain proper charge level in the batteries.*

LOW CHARGE — TEST PROCEDURE:

Low charge or complete lack of charge registered on the ammeter is an indication of trouble in the battery charging circuit.

Remove the bridge completely before making the following tests:

With the engine operating at full governed speed the following charge rate should be registered on the ammeter:

#2 Generator .....Approx. 50 D.C. Amps

If the readings are below the normal listed in the table above and are above 28 amps, D.C.., an aging rectifier is indicated. In this case, replace the flux bridge with enough shims to bring the charging rate up to normal (20 amps with bridge in place). The rectifier still has considerable useful life remaining at this point.

If no amperes or low amperes (below 28 amps) are observed on this test, make a visual inspection of the rectifier and transformer. Check all connections for tightness. Check rectifier plates for blown or burned spots. Should these be observed. Replace the rectifier.

If no plates are found to be burned or any other irregularities found to be present, test the A.C. input voltage at phases A, B, and C on the input side (primary) of the transformer. Insulation will have to be slit, or sharp prods used to make contact with the leaks to the main transformer. Be sure to reinsulate the leads after the test is concluded. The normal reading should be the same as the normal reading under no load voltages tests on page L-7.

TRANSFORMER SECONDARY —
TEST PROCEDURE:

To test the main transformer secondary output operate the engine at full governed speed and make a three phase voltage test at the output (secondary) side of the transformer. USE THE 0 - 500 V.A.C. SCALE ON THE TOURNATESTER.

NOTE: Make this test at the A.C. terminals at the rectifier tank. These terminals are connected directly to the transformer secondary.

For air cooled rectifiers make this test using the first three connectors on the left of the 6 terminal transformer terminal strip.

NORMAL READINGS

The normal reading should be between 26 and 30 volts. The batteries must be in fully charged condition or the accuracy of the test may be affected.

A.C. ELECTRIC MOTORS

1. Motor

TEST PROCEDURE

1. Attach the test leads to the upper terminals on the Tournatester and set the selector switch at 500 V.A.C. READ THE TOP SCALE ON THE METER.

2. Check the motor brake for proper clearance, binding, warping, and other mechanical troubles, and make certain there are no loose wires or visible defects.

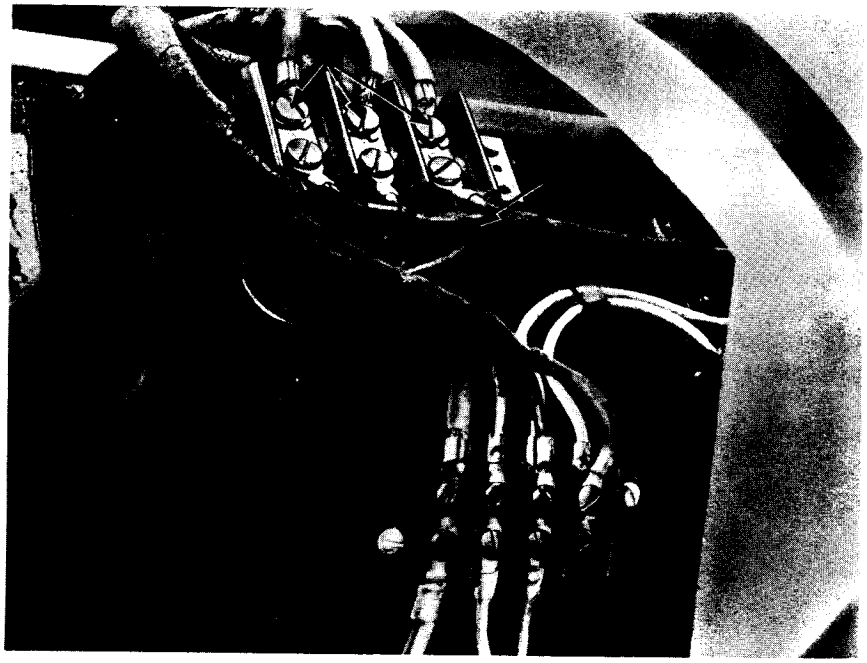
3. Turn on the key switch and the main D.C. switch. Start the engine, and after warm-up, operate the engine at 1800 R.P.M.

4. Test the A.C. voltage across the 3 A.C. terminals (3 tests, A to B, A to C, and C to B) on the motor terminal strip. Connect the test leads to the terminals under test, close the fingertip switch controlling the motor under test. Approximately 2 seconds for each reading eliminates tester overheating.

NORMAL READINGS

Single Motor, No Load....Never Under 250 V.A.C.

Single Motor, Locked Rotor.....300 V.A.C.



1. A.C. TERMINALS 2. MOTOR BRAKE LEADS

Figure L-14. A.C. Electric Motor Terminals

2. Electric Motor Brake

TEST PROCEDURE:

1. Attach test leads to the top terminals on the Tournatester. Set the selector at the "Lamp Short" position.

2. Disconnect the leads to the brake at the motor terminal strip.

3. Make a ground test from each of the brake leads to a good ground on the motor frame.

NORMAL READINGS

If the test lamp glows a ground is indicated. Proceed to "Grounded Brake Coil" test. If no ground is indicated proceed to "Open Brake Coil" test.

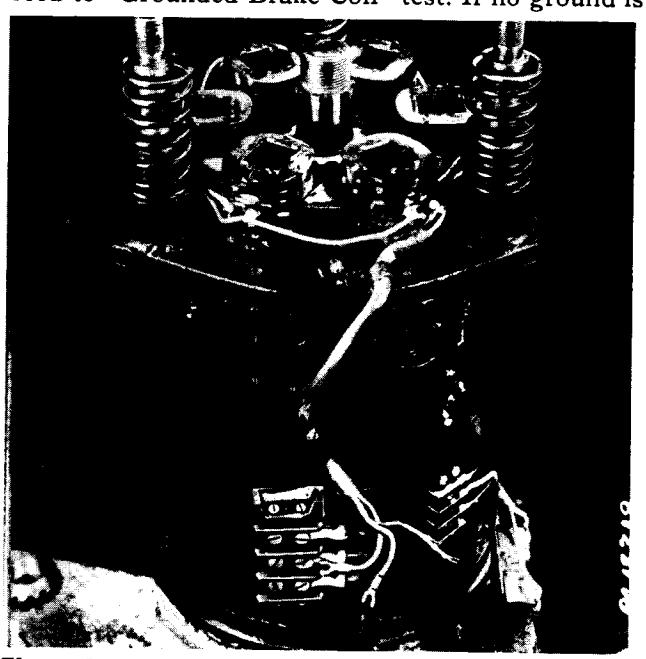


Figure L-15. Brake Coil Leads

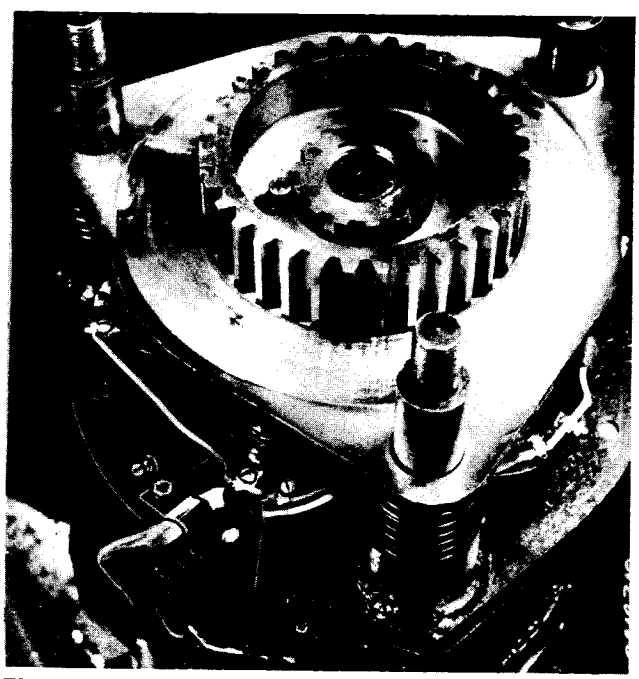


Figure L-16. Brake Coil Terminals

GROUNDED BRAKE COIL —

TEST PROCEDURE:

1. Disconnect both leads to the brake coil under test. *NOTE: Because of the manner in which the coils are interconnected it would be difficult to localize the trouble should these leads be left connected.*

2. Attach test leads to the upper terminals on the Tournatester. Set the selector switch to the "Lamp Short" position.

3. Touch one test lead to a good ground and touch each of the terminals on the coil with the other lead. If the test lamp glows, a grounded brake coil is indicated. Replace the coil.

OPEN BRAKE COIL — TEST PROCEDURE:

1. Disconnect one lead to the coil under test.

2. Attach test leads to the top terminals on the Tournatester and set the selector at the "Lamp Short" position.

3. Touch one coil terminal with a test lead and the other coil terminal with the remaining test lead. If the coil is in good condition the test lamp will glow. If the lamp fails to glow the coil is open and should be replaced.

CONTROL CIRCUIT

1. Main Switch Panel

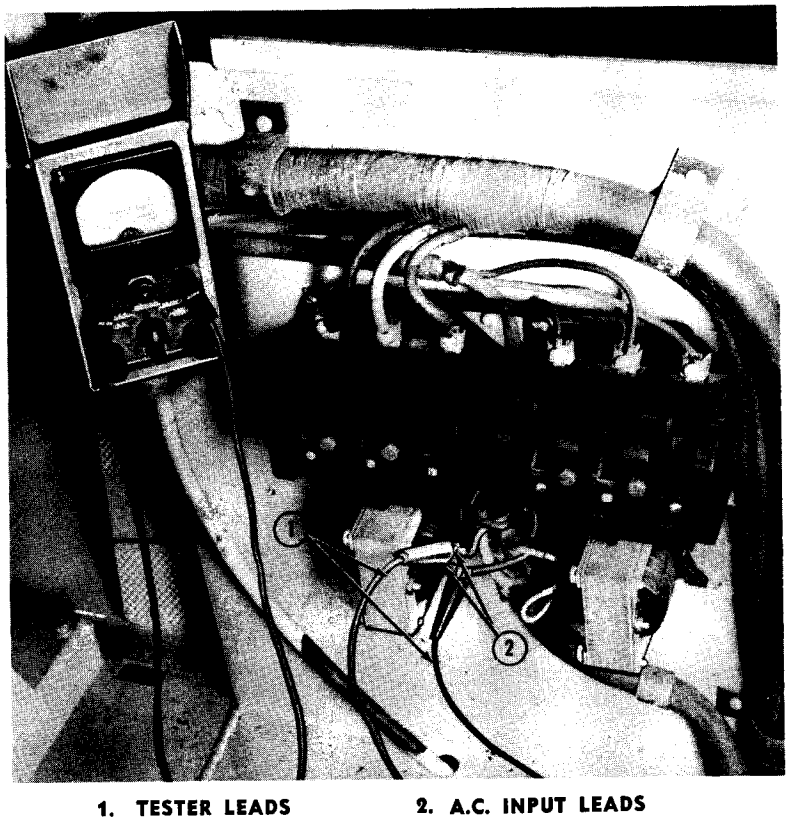
A.C. VOLTAGE TO SWITCH PANEL —

TEST PROCEDURE:

1. Attach the test leads to the upper terminals on the Tournatester and set the selector switch to 0 - 500 V.A.C. READ THE TOP SCALE ON THE METER.

2. Turn on the key switch and the main D.C. switch. Start the engine, and, after warm-up, operate the engine at 1800 R.P.M.

3. Test the A.C. voltage across the 3 A.C. input leads at the point of connection with the first main switch. The A.C. input leads are part of the multiple wire conductor which connects the instrument panel, generator, and main switch panel.



1. TESTER LEADS 2. A.C. INPUT LEADS

Figure L-17. Switch Panel Voltage Test

NORMAL READINGS

#2 GENERATOR.....300 Volts A.C. each test phases tested.
No more than 10 volts variation between any two

MAIN SWITCH — TEST PROCEDURE:

1. If the motor does not operate when the main switch is engaged, make the following tests. Make a voltage test (0 - 500 V.A.C.) from input to output side of the main switch as the fingertip control switch on the instrument panel is engaged and disengaged rapidly. Make three tests, one for each of the three leads. This test is made to determine whether or not the contactor switches are functioning. A voltage reading on all of the tests when the fingertip switch is closed indicated that the contact points are not operating properly if the motor does not operate.

OPEN HOLDING COIL — TEST PROCEDURE:

1. If the main switch does not pull in when the fingertip switch on the instrument panel is engaged there may be two sources of trouble, either an open holding coil or an open control circuit. First, make a voltage test with the Tournatester set at the 0 - 500 V.A.C. scale across the two leads of the main switch holding coil as the fingertip switch is engaged. A voltage reading on this test indicates an open holding coil. Replace the coil. If, however, no voltage is recorded, proceed to test for an open control circuit.

1. COIL TERMINALS 2. TESTER LEADS

Figure L-18. Open Holding Coil Test

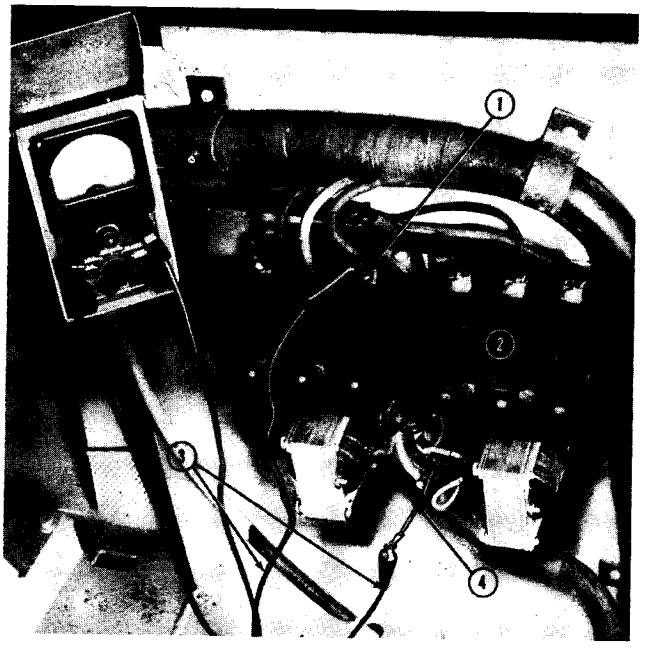
ISOLATING OPENS IN THE CONTROL CIRCUIT — TEST PROCEDURE:

1. Attach test leads to the upper terminals on the Tournatester. Set the selector switch to the "Lamp Short" position.

2. Disconnect lead from the upper terminal on the holding coil.

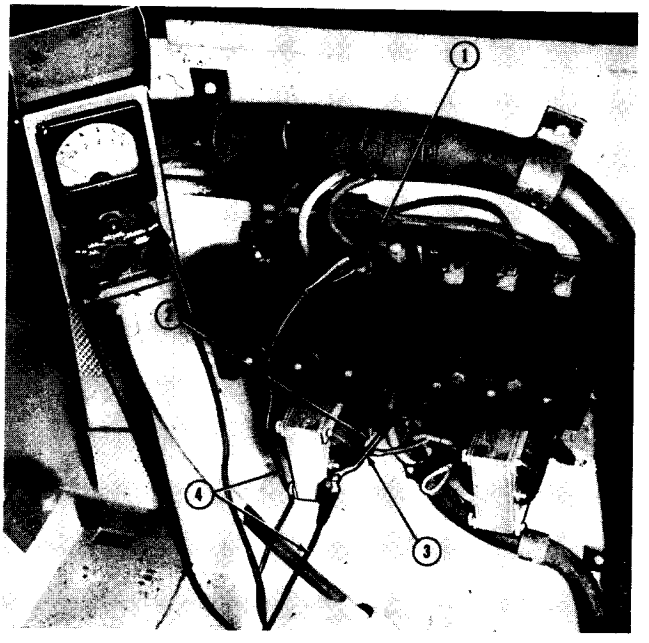
3. Place one test lead on the lower terminal of the holding coil and the other lead on the "C" phase terminal (input side) on the main switch.

4. Attach one test lead to the lead disconnected from the upper terminal of the holding coil and place the other lead on the "C" phase terminal (input terminal) of the main switch. Close the fingertip switch for the main switch and motor circuit under test.



1. "C" PHASE 3. TESTER LEADS
2. COIL TERMINALS 4. BOTTOM LEAD

Figure L-19. Test Lead Connected to Bottom Lead



1. "C" PHASE 3. TOP LEAD
2. COIL TERMINALS 4. TESTER LEADS

Figure L-20. Test Lead Connected to Top Lead

NORMAL READINGS

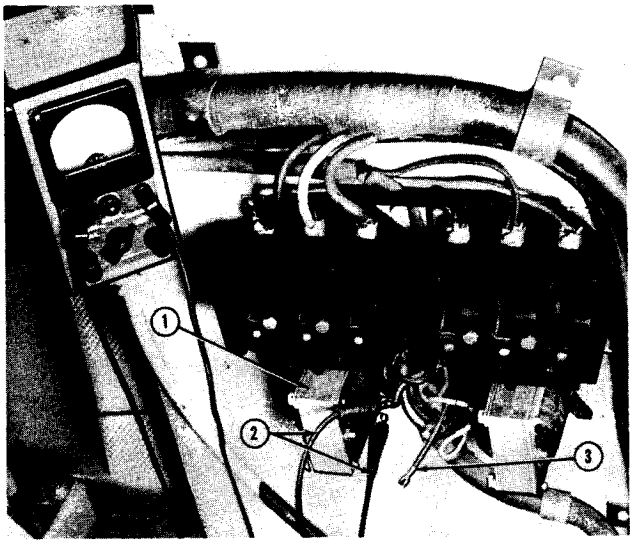
If the lamp glows with the test leads connected to the bottom terminal of the holding coil and "C" phase, the motor control circuit between the holding coil and the motor is functioning properly. If the lamp does not glow the circuit is open.

If the lamp glows with the test leads connected to the lead disconnected from the top terminal on the holding coil and "C" phase, the motor control circuit between the holding coil and the instrument panel is functioning properly. If the lamp does not glow the circuit is open.

ALTERNATE HOLDING COIL TEST —

TEST PROCEDURE:

1. Place test leads across holding coil terminals with Tournatester in the test lamp position after disconnecting one of the leads to the holding coil. If the coil is in good condition the test lamp will glow. A faulty coil will give no glow. Replace coil.



1. HOLDING COIL 2. TESTER LEADS
3. BOTTOM LEAD

Figure L-21. Alternate Holding Coil Test

LIMIT SWITCH — TEST PROCEDURE:

1. Check the limit switch for mechanical operation. If the limit switch is not defective mechanically, proceed with the following.

2. Place Tournatester in the test lamp position. Do not operate the engine during this test. Keep the key switch and the main D.C. switch in the "off" position.

3. Make a test directly across the two connections of the limit switch controlling the movement which is not operating. For example: If the hoist motor on the dozer will go down but will not go up, make a test across the up limit switch. If the light does not glow the limit switch is faulty and should be replaced. *NOTE: Actuating cam should not touch the switch button unless moving part has reached its limit of travel.*

HEAT CONTROL SWITCH —

TEST PROCEDURE:

1. The following test is made to determine the condition of the heat control switch. Before making this test make certain that the heat switch is not open due to an overheated motor. If the switch is not too hot to touch for one second with a finger, the heat control switch should be closed.

2. Put the two test lamp leads directly across the two terminals of the heat switch. If the test lamp glows the heat control switch is operating properly. If the lamp does not glow the heat switch has failed and should be replaced.

CONDUCTOR CABLES —

TEST PROCEDURE:

1. Make a visual inspection of all connections at both the main switch panel and the motor terminal strip.

2. If these are in good order, look for a pinched cable or a spot where the cable might be flexing. If a break is found, it can be repaired. In most cases, however, it is advisable to replace the entire cable. See "Continuity Testing" for the correct procedure when a break is suspected in a conductor.

INSTRUMENT PANEL —

TEST PROCEDURE:

1. Remove the capscrews securing the instrument panel and pull the panel down, exposing the rear of the switch panel.

2. If the open circuit has been isolated (by the preceding tests) forward of the main switch the first thing to establish is whether or not the fingertip control switch is functioning properly, as this is the most likely point of trouble.

3. Disconnect the top holding coil lead at the main switch that is controlled by the inoperative switch. Make certain this lead does not touch any other leads or terminals in the main switch panel.

4. Test across the terminals of the fingertip switch controlling the movement that is inoperative. Make tests on switches across terminals marked "B" to which leads are connected. If the test lamp glows when the switch is depressed, the switch is operating properly. If the lamp does not glow the switch is defective and should be replaced.

CONTINUITY OF COCKPIT CONTROL CIRCUIT — TEST PROCEDURE:

1. Make continuity test on the conductor between the fingertip switch and the top of the holding coil. Make continuity test between the bus or common lead terminal for fingertip switches and the center A.C. main lead of the terminal strip on the Constant Voltage Transformer.

WIRING DIAGRAM

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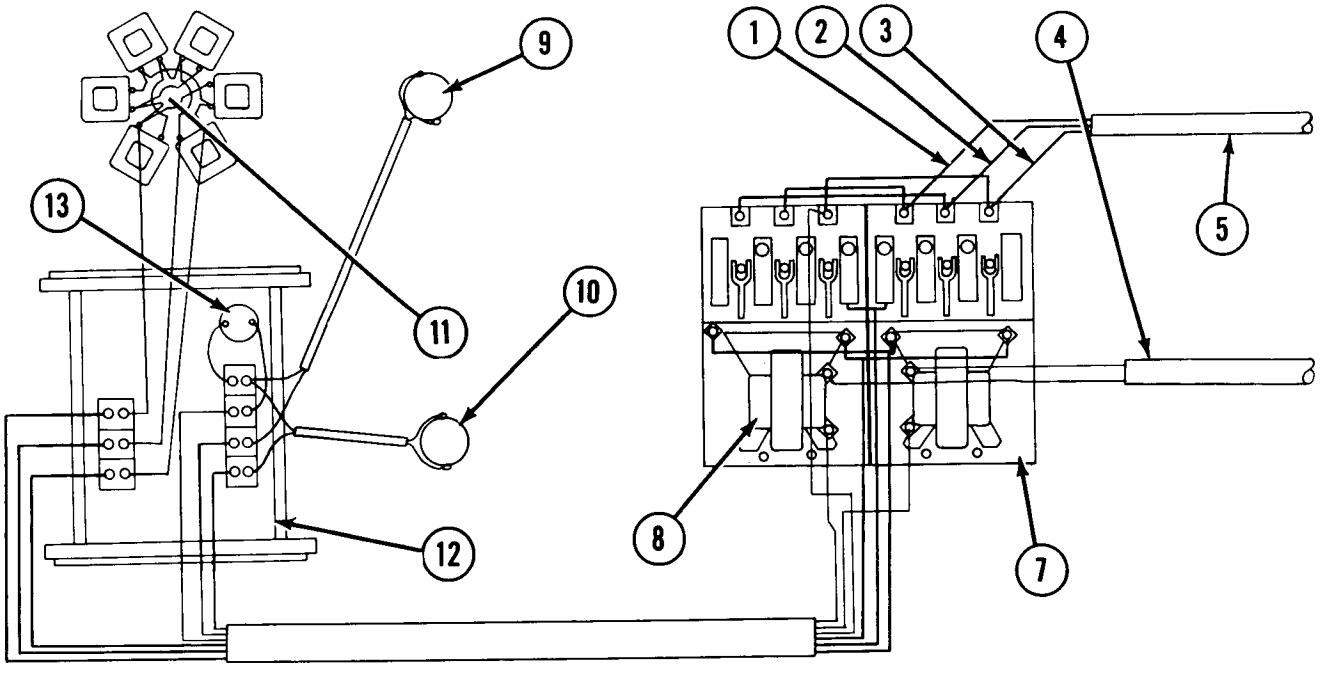
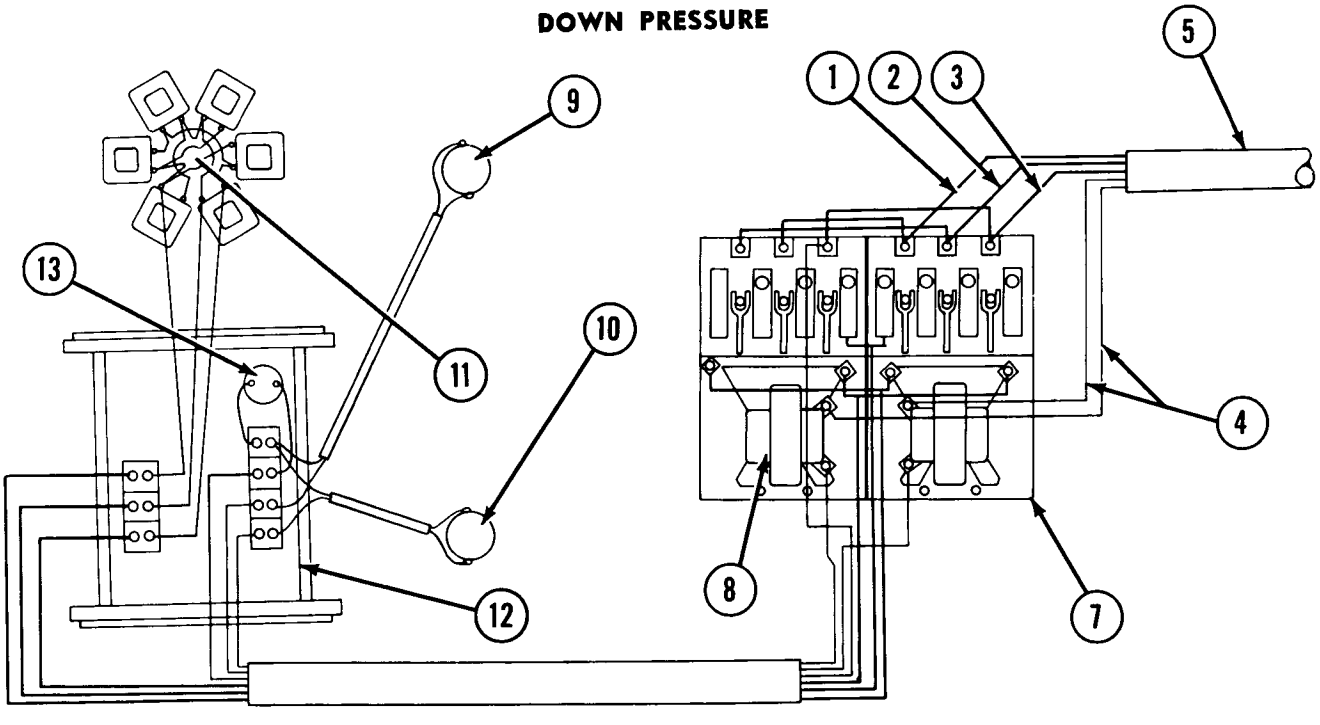


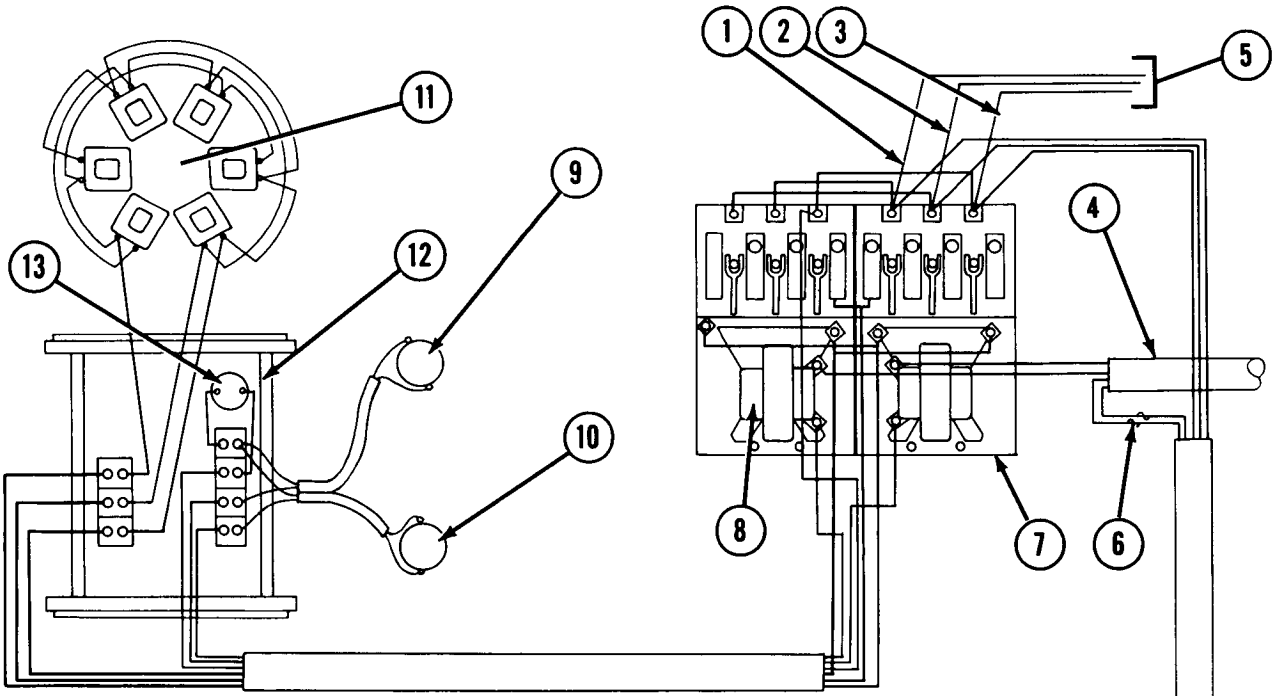
DOWN PRESSURE



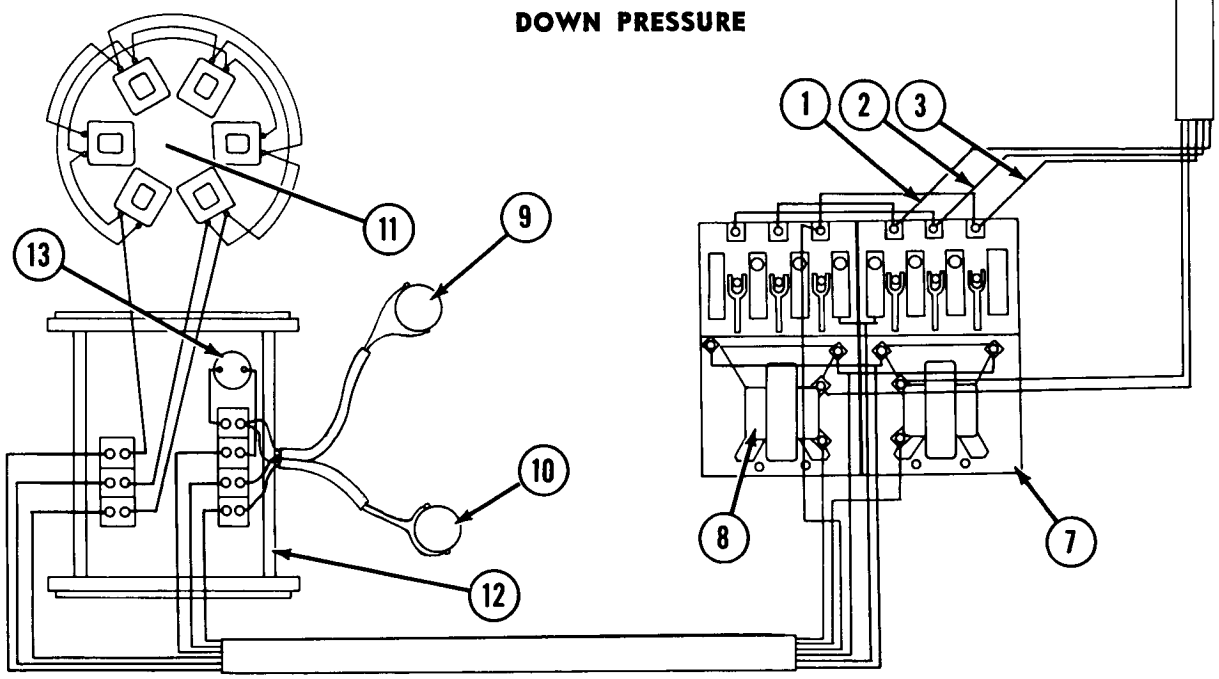
TILT

1. PHASE "A"
2. PHASE "B"
3. PHASE "C"
4. TO FINGERTIP CONTROL SWITCH
5. TO TRANSFORMER TERMINAL STRIP
7. TOURNATACKER MAIN SWITCH
8. HOLDING COIL
9. "UP" LIMIT SWITCH
10. "DOWN" LIMIT SWITCH
11. A.C. MOTOR BRAKE
12. A.C. MOTOR
13. HEAT CONTROL SWITCH

Figure M-1. Wiring for Down Pressure and Side Tilt Attachments



DOWN PRESSURE

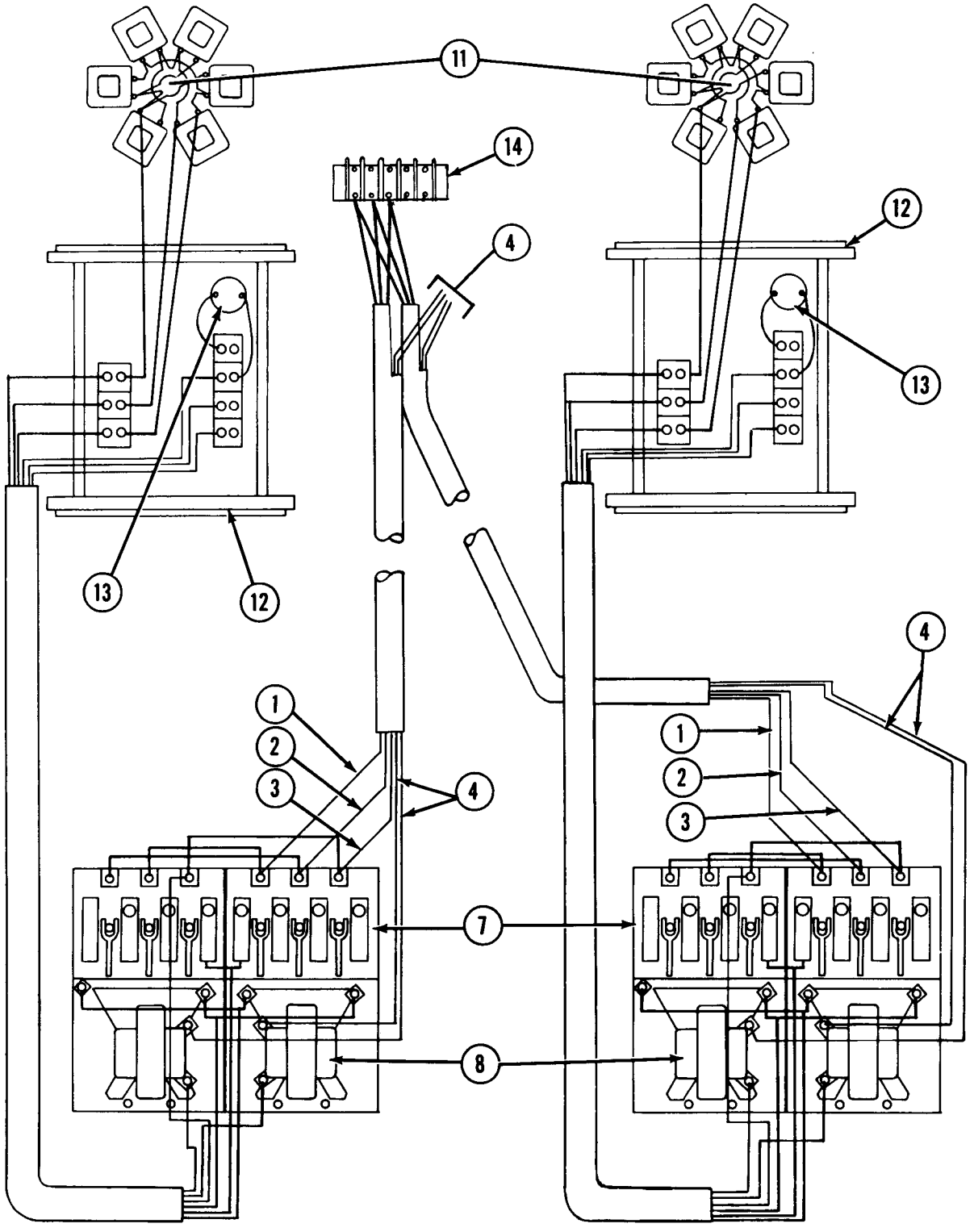


TILT

Effective with Serial Suffix SCT-F and Up

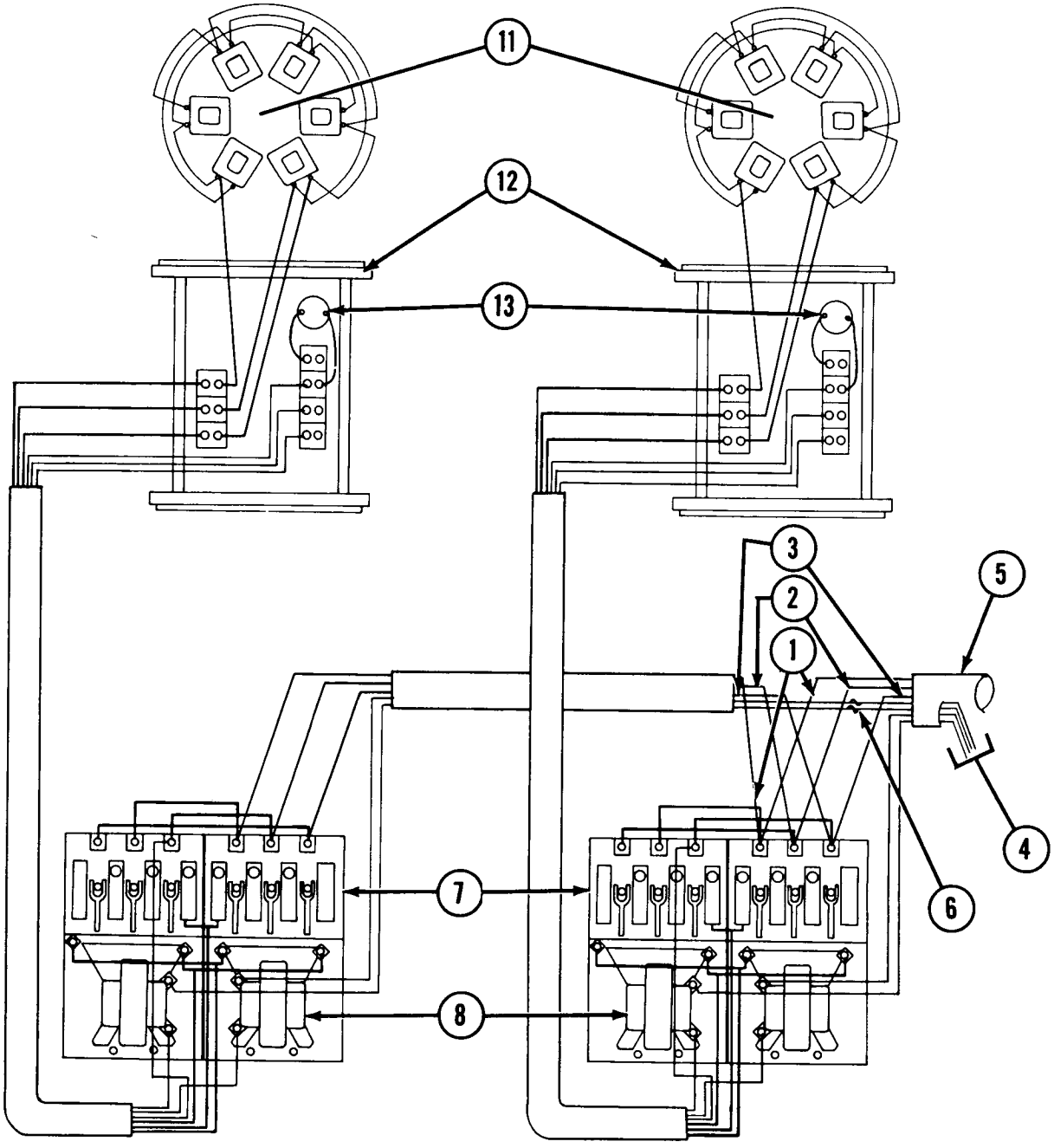
1. PHASE "A"
2. PHASE "B"
3. PHASE "C"
4. TO FINGERTIP CONTROL SWITCH
5. TO TRANSFORMER TERMINAL STRIP
6. KNIFE CONNECTOR
7. TOURNATACKER MAIN SWITCH
8. HOLDING COIL
9. "UP" LIMIT SWITCH
10. "DOWN" LIMIT SWITCH
11. A.C. MOTOR BRAKE
12. A.C. MOTOR
13. HEAT CONTROL SWITCH

Figure M-2. Wiring for Down Pressure and Side Tilt Attachments



1. PHASE "A"
2. PHASE "B"
3. PHASE "C"
4. TO FINGERTIP CONTROL SWITCH
7. TOURNATACKER MAIN SWITCH
8. HOLDING COIL
11. A.C. MOTOR BRAKE
12. A.C. MOTOR
13. HEAT CONTROL SWITCH
14. TRANSFORMER TERMINAL STRIP

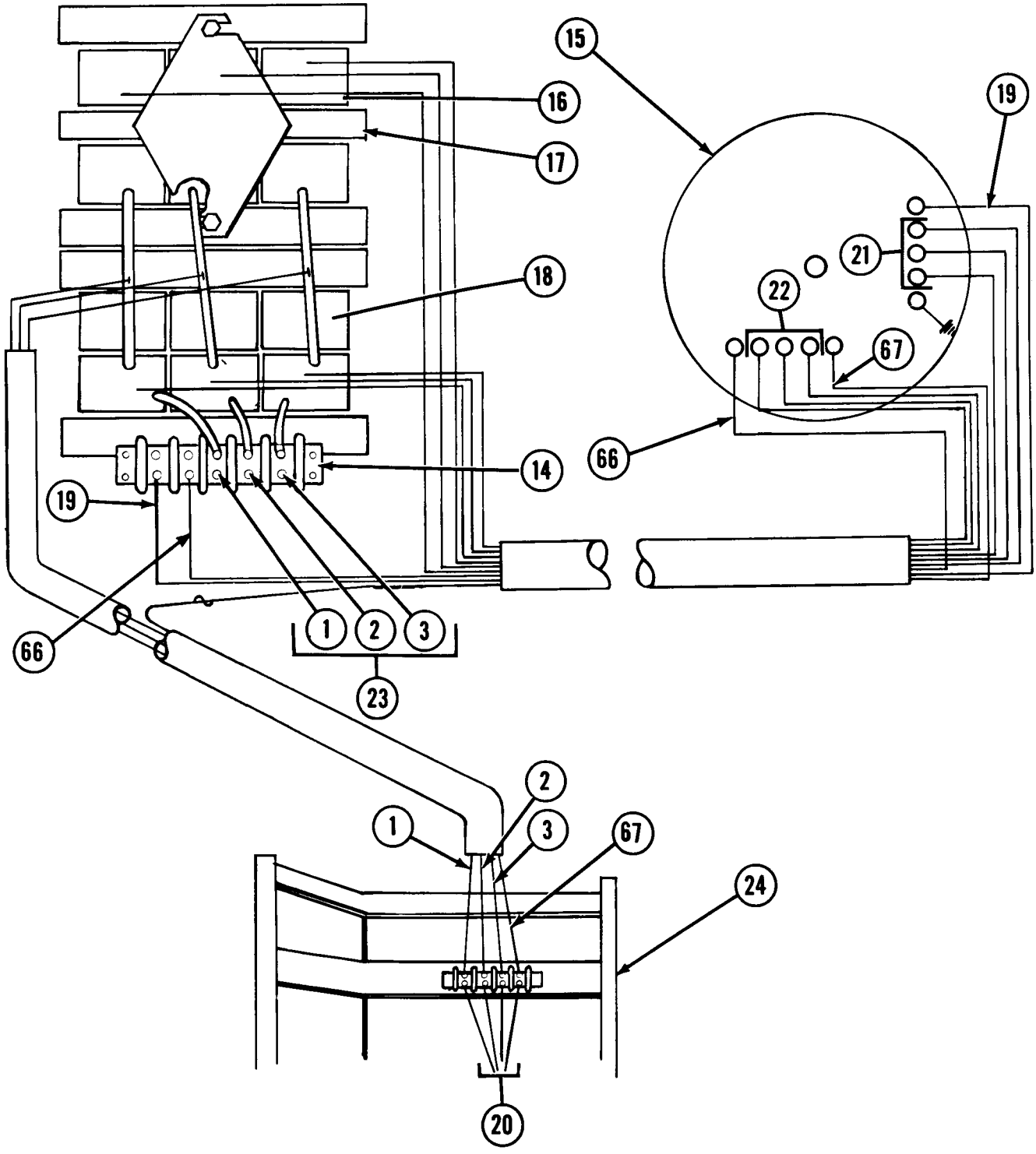
Figure M-3. Wiring for Rear Power Control Unit



Effective with Serial Suffix SCT-F and Up

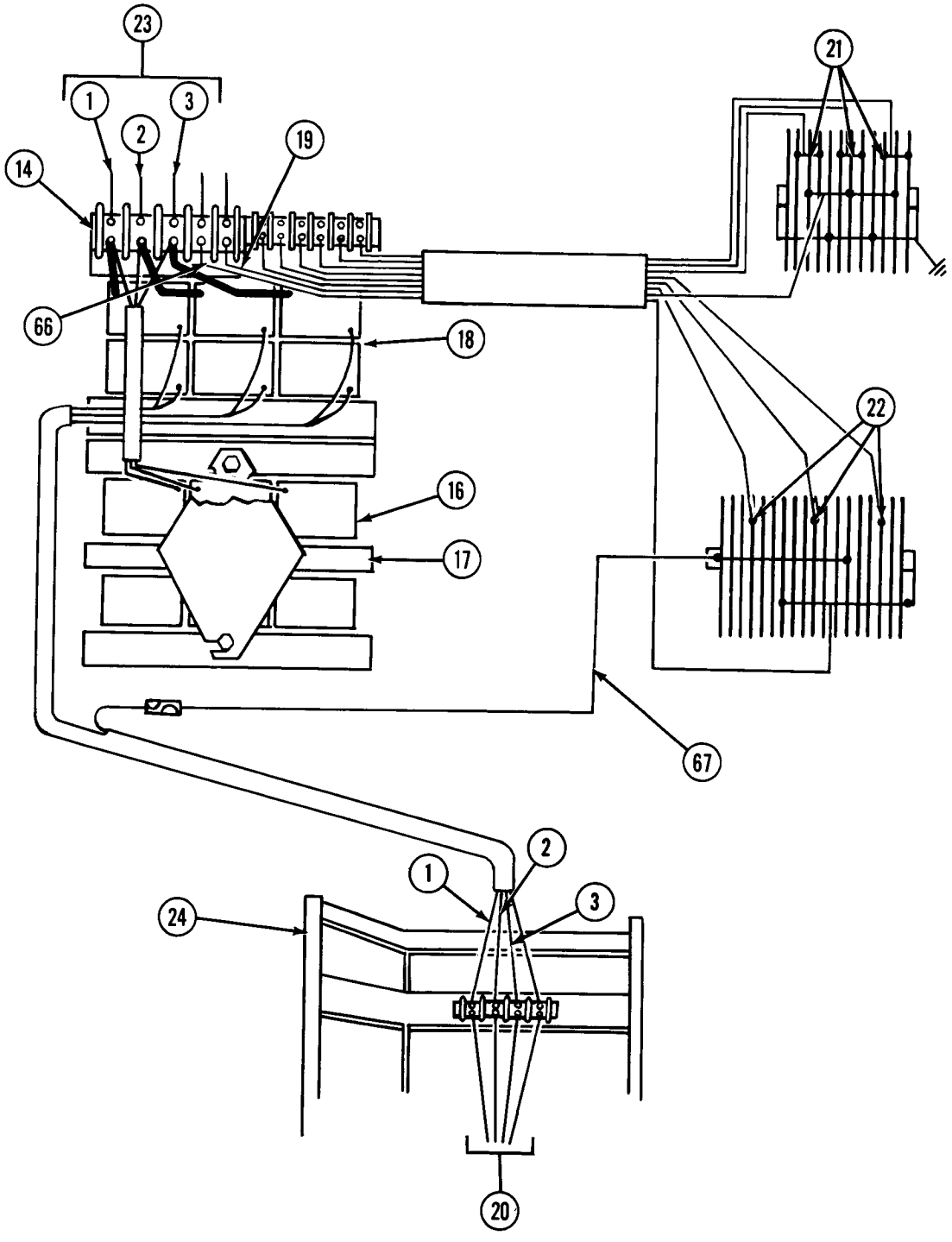
1. PHASE "A"
2. PHASE "B"
3. PHASE "C"
4. TO FINGERTIP CONTROL SWITCH
5. TO TRANSFORMER TERMINAL STRIP
6. KNIFE CONNECTOR
7. TOURNATACKER MAIN SWITCH
8. HOLDING COIL
11. A.C. MOTOR BRAKE
12. A.C. MOTOR
13. HEAT CONTROL SWITCH

Figure M-4. Wiring for Rear Power Control Unit



1. PHASE "A"
2. PHASE "B"
3. PHASE "C"
14. TRANSFORMER TERMINAL STRIP
15. RECTIFIER TANK UNIT
16. MAIN TRANSFORMER
17. FLUX BRIDGE
18. CONSTANT VOLTAGE TRANSFORMER
19. FROM MAIN TRANSFORMER RECTIFIER (NEG.)
20. TO GENERATOR STATOR AND SLIP RINGS
21. MAIN RECTIFIER TERMINALS (A.C.)
22. BOOSTER RECTIFIER TERMINALS (A.C.)
23. A.C. POWER TO SWITCH BOXES
24. A.C. GENERATOR
66. FROM CONSTANT VOLTAGE TRANSFORMER RECTIFIER (POS.)
67. TO GENERATOR FIELD

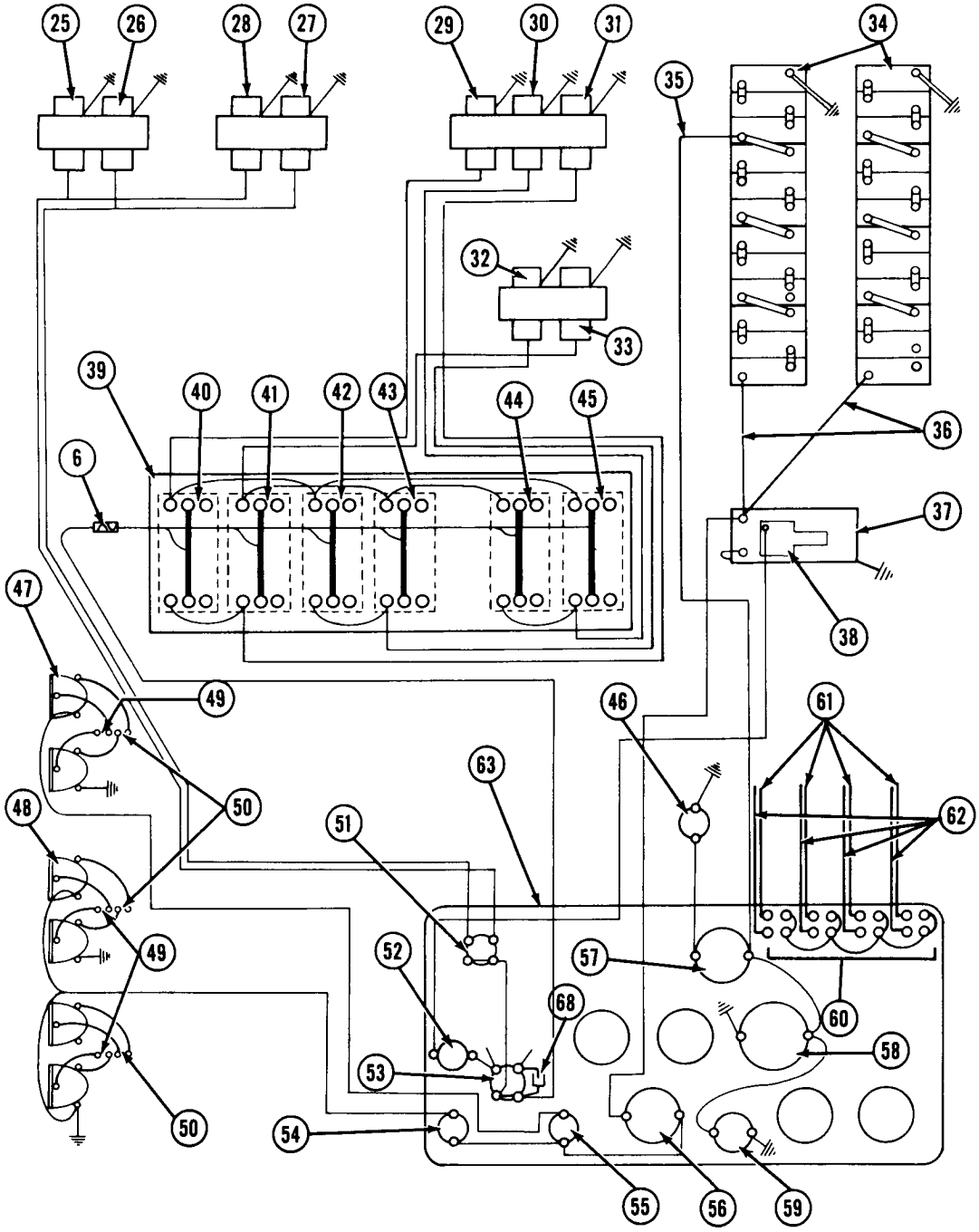
Figure M-5. Wiring for Generator, Transformer and Rectifiers



Effective with Serial Suffix SCT-L and Up

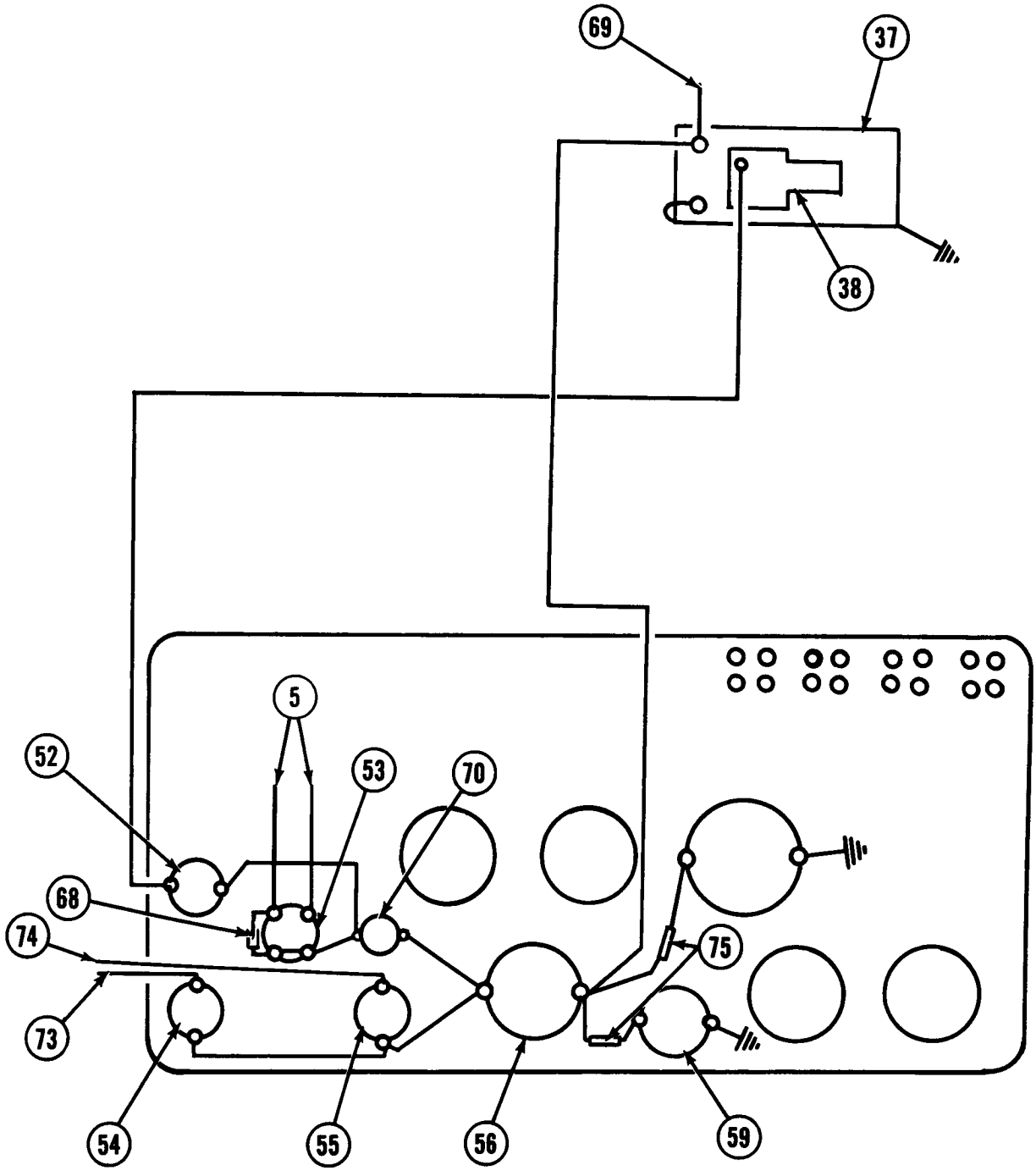
1. PHASE "A"
2. PHASE "B"
3. PHASE "C"
14. TRANSFORMER TERMINAL STRIP
16. MAIN TRANSFORMER
17. FLUX BRIDGE
18. CONSTANT VOLTAGE TRANSFORMER
19. FROM MAIN RECTIFIER (NEG.)
20. TO GENERATOR STATOR AND SLIP RINGS
21. MAIN RECTIFIER TERMINALS (A.C.)
22. CONSTANT VOLTAGE RECTIFIER TERMINALS (A.C.)
23. A.C. POWER TO SWITCH BOX
24. A.C. GENERATOR
66. FROM CONSTANT VOLTAGE RECTIFIER (Pos.)
67. TO GENERATOR FIELD

Figure M-6. Wiring for Generator, Transformer and Rectifiers



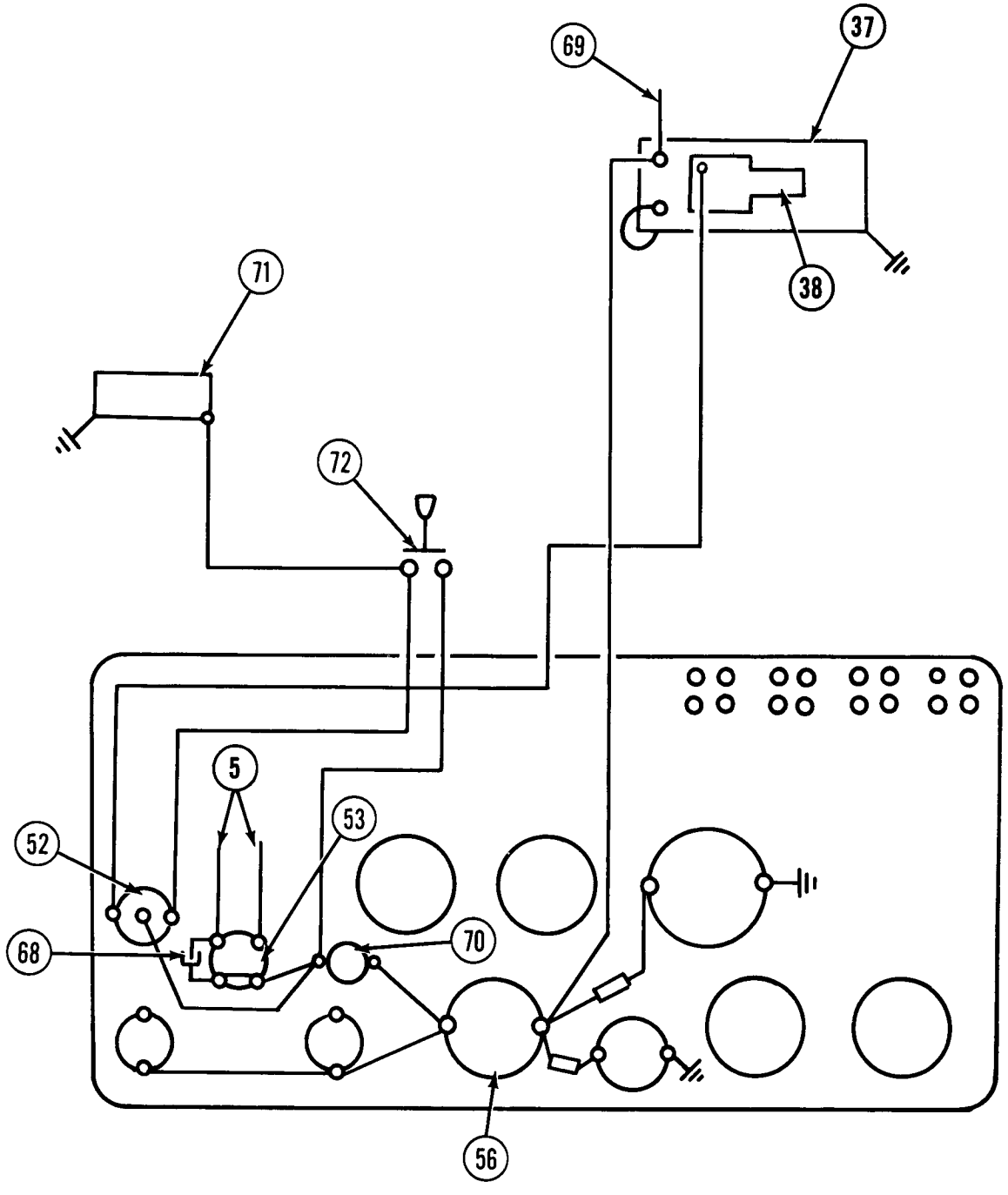
6. KNIFE CONNECTOR
25. RIGHT BRAKE CONTROL VALVE
26. LEFT BRAKE CONTROL VALVE
27. RIGHT STEERING CLUTCH CONTROL VALVE
28. LEFT STEERING CLUTCH CONTROL VALVE
29. ENGINE CLUTCH SHIFT VALVE
30. REVERSE CLUTCH SHIFT VALVE
31. HIGH CLUTCH SHIFT VALVE
32. LOW CLUTCH SHIFT VALVE
33. COMPOUND CLUTCH SHIFT VALVE
34. BATTERIES
35. 6 VOLT TAP
36. 24 VOLT LEAD
37. CRANKING MOTOR
38. SOLENOID
39. SHIFT QUADRANT (ELECTRIC)
40. 4TH SPEED FORWARD SWITCH
41. 3RD SPEED FORWARD SWITCH
42. 2ND SPEED FORWARD SWITCH
43. 1ST SPEED FORWARD SWITCH
44. 1ST SPEED REVERSE SWITCH
45. 2ND SPEED REVERSE SWITCH
46. FUEL GAUGE LEVEL UNIT
47. REAR LIGHTS
48. FRONT LIGHTS
49. PLUG IN FOR "LOW" FILAMENT
50. PLUG IN FOR "HIGH" FILAMENT
51. STEERING SWITCH
52. STARTER SWITCH
53. D.C. MAIN SWITCH
54. HEADLIGHT SWITCH
55. REARLIGHT SWITCH
56. AMMETER
57. FUEL GAUGE
58. HOURMETER
59. PANEL LIGHT
60. FINGERTIP CONTROL SWITCHES
61. TO "UP" MOTOR CONTROLS
62. TO "DOWN" MOTOR CONTROLS
63. INSTRUMENT PANEL
68. CAPACITOR

Figure M-7. Wiring for Instrument Panel



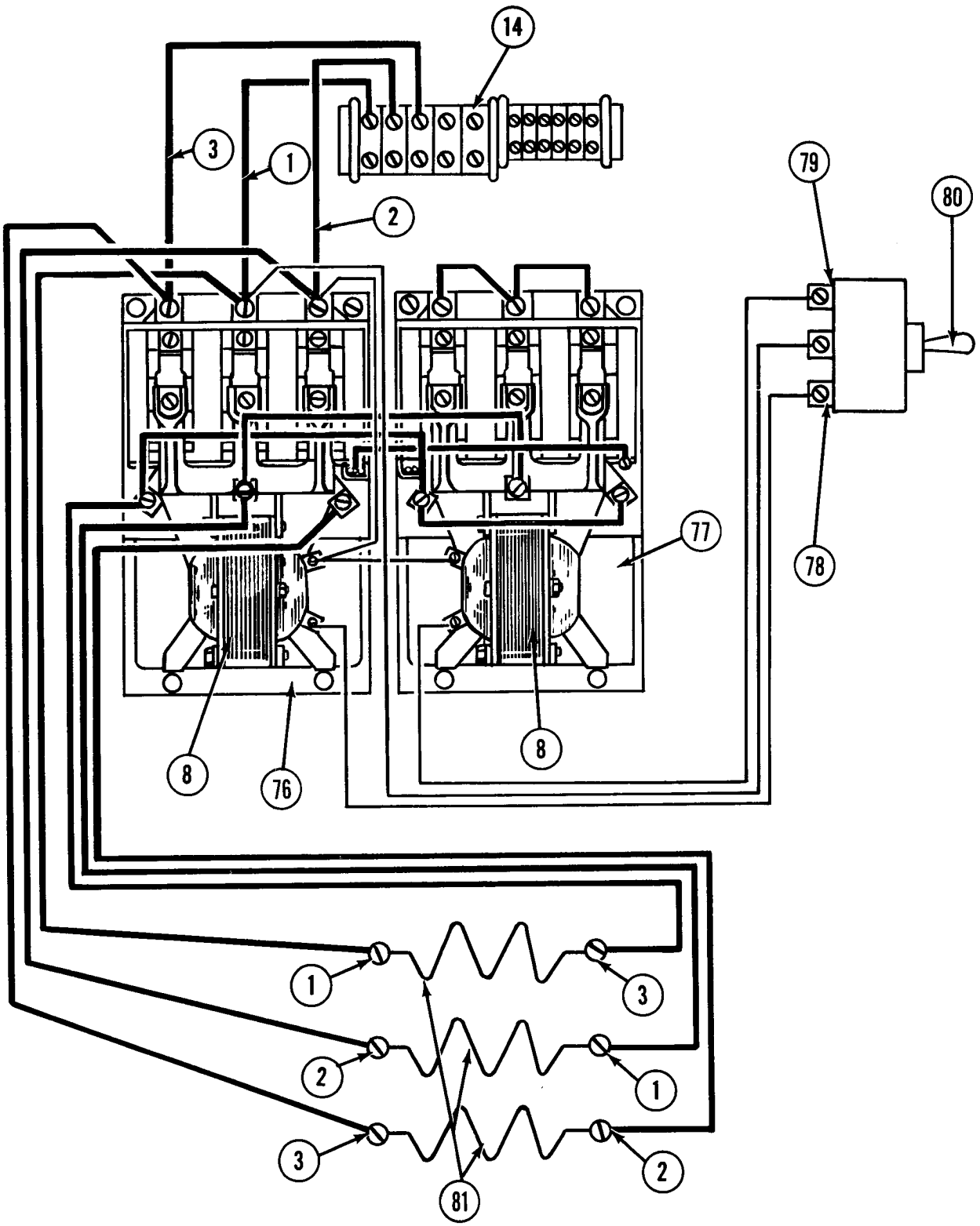
5. TO TRANSFORMER TERMINAL STRIP
37. CRANKING MOTOR
38. SOLENOID
52. STARTER SWITCH
53. D.C. MAIN SWITCH
54. HEADLIGHT SWITCH
55. REARLIGHT SWITCH
56. AMMETER
59. PANEL LIGHT
68. CAPACITOR
69. TO BATTERIES
70. KEY SWITCH
73. TO FRONT LIGHTS
74. TO REAR LIGHTS
75. RESISTOR

Figure M-8. Wiring for Instrument Panel with 24 Volt Circuit



5. TO TRANSFORMER TERMINAL STRIP
37. CRANKING MOTOR
38. SOLENOID
52. STARTER SWITCH
53. D.C. MAIN SWITCH
56. AMMETER
69. TO BATTERIES
68. CAPACITOR
70. KEY SWITCH
71. P.T. SOLENOID
72. OIL PRESSURE SWITCH

Figure M-9. Wiring for P.T. Fuel System



1. PHASE "A"
2. PHASE "B"
3. PHASE "C"
8. HOLDING COIL
14. TRANSFORMER TERMINAL STRIP
76. HIGH SWITCH
77. LOW SWITCH
78. HIGH POSITION
79. LOW POSITION
80. CONTROL SWITCH
81. ELECTROTARDER GRID

Figure M-10. Wiring for Electrotarder

TRAIL UNIT

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TRAIL UNIT

ELECTRICALLY CONTROLLED SCRAPER

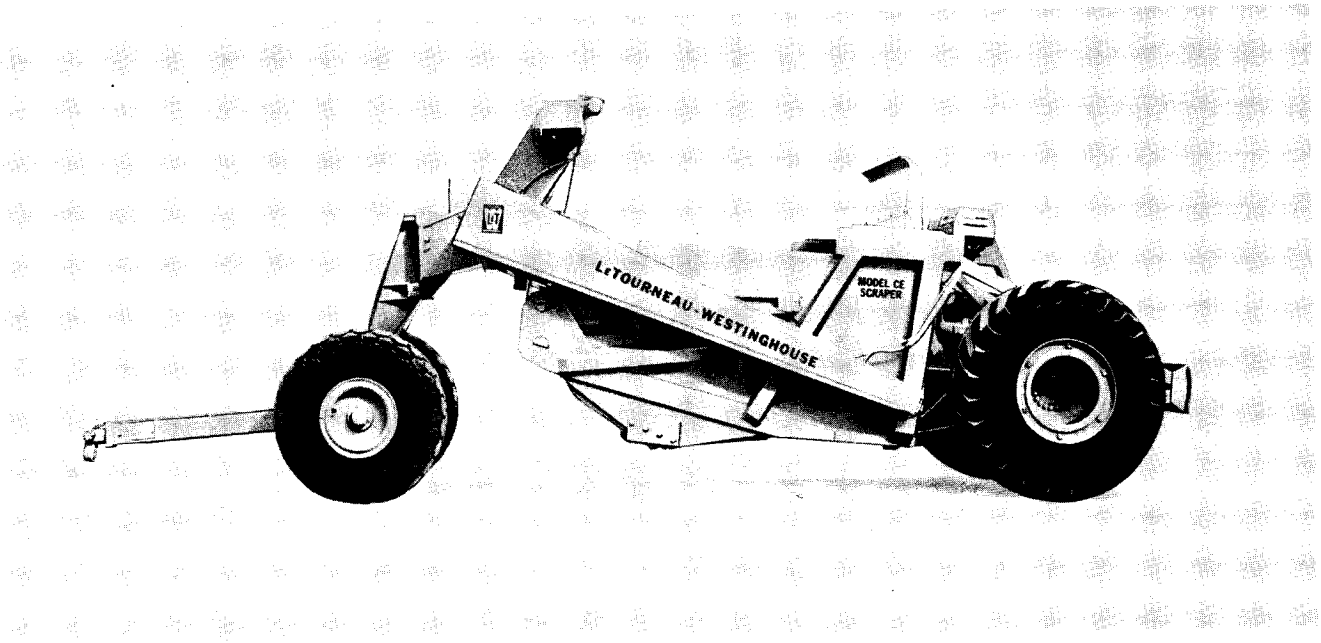
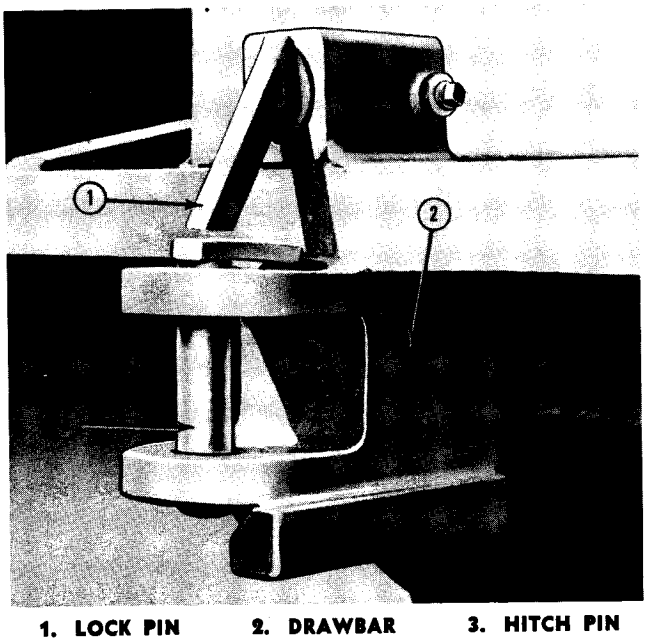


Figure N-1. Model CE Scraper

Model CLE or Model CE Scrapers may be used with the Tournatractor to make up a tractor-scraper combination.

To connect the scraper to the Tournatractor, position the tractor directly in front of and in line with the scraper. Turn the lock pin in its mounting to a horizontal position.

Lift out hitch pin.

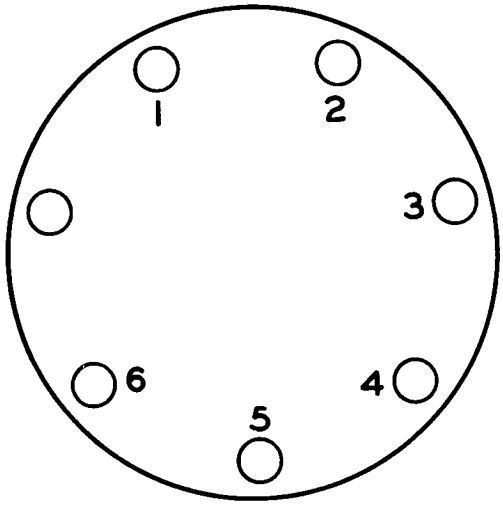


1. LOCK PIN 2. DRAWBAR 3. HITCH PIN

Figure N-2. Drawbar Group

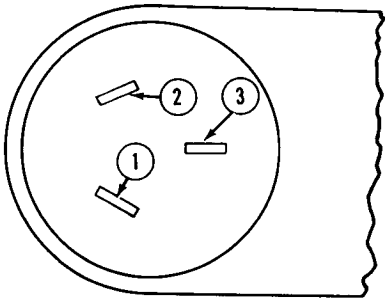
Raise tongue of scraper until it is the same level as the drawbar. Back the Tournatractor slowly until the hole in the scraper hitch block is in line with the hole in the drawbar. Insert hitch pin through hole. Turn lock pin back to a vertical position to lock the hitch pin in position.

Connect the electric cables from the scraper into the receptacles on the Tournatractor.



1. HOIST UP
2. HOIST DOWN
3. APRON UP
4. APRON DOWN
5. TAILGATE FORWARD
6. TAILGATE BACK

Figure N-3. Wiring Sequence for 7-Lead Receptacle

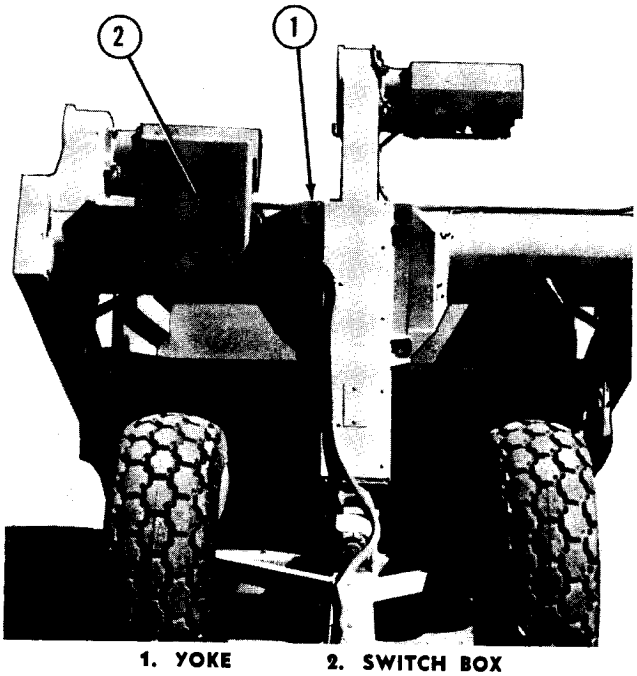


1. PHASE "A" 2. PHASE "B" 3. PHASE "C"

Figure N-4. A.C. Power Hook-up

The electric control motors on the scraper are operated by switches on the Tournatractor's instrument panel. Electrical connections between the scraper and Tournatractor are made through the use of receptacles — one three-prong plug and receptacle for A.C. power and one seven-prong plug and receptacle for the control switches.

Six main switches which control the operation of the scraper motors are mounted in a switch box on the scraper yoke.



1. YOKE 2. SWITCH BOX

Figure N-5. Control Switch Box

CABLE CONTROLLED SCRAPER

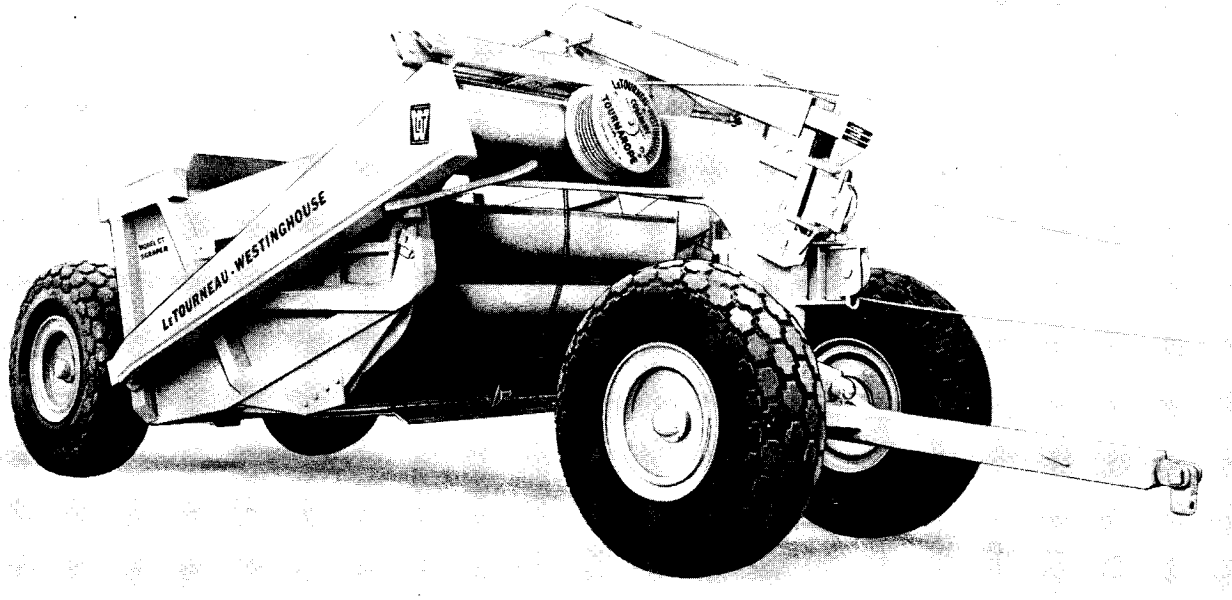


Figure N-6. Model CT Scraper

Cable controlled scrapers may be used with the Tournatractor which is equipped with a double drum rear power control unit.

To connect the scraper to the Tournatractor, it is usually not necessary to thread the cable through the scraper, because when uncoupled from the Tournatractor, the cable is usually disconnected from the PCU on the rear of the tractor and left threaded through the scraper.

With the cable threaded through the scraper, back the tractor up to the scraper tongue and thread the hoist cable through the bottom of the right hand fairlead sheave, up through the guide hole and over the top of the upper right hand sheave and down to

the dead end on the right hand cable drum. In the same manner the apron and tailgate cable should be threaded through the left hand fairlead sheave and upper left hand sheave to the left hand cable drum.

A cable socket is welded to the side of the tongue so that it can be raised mechanically by the PCU.

To raise the tongue, pull a few feet of slack in the right hand cable and loop it through the bottom side. Tap the wedge into place. Start the diesel engine and open throttle to maximum governed speed. Then raise the tongue so that the hitch block is even with the tractor drawbar by closing the fingertip control switch that operated the hoist motor.

After the tongue is raised up even with the tractor drawbar, back the tractor up, positioning the scraper hitch block between the jaws of the tractor drawbar and insert the hitch pin.

Remove the cable wedge from the cable socket on the side of the tongue and take up the slack.

ROOTER

The rooter may be used with the Tournatractor by connecting the rooter tongue to the Tournatractor drawbar and connecting the rooter operating cable to the right hand cable drum.

This cable should be connected in the same way as the hoist cable for the cable operated scraper.

SHEEP'S FOOT ROLLER

The Sheep's Foot Roller may be used with the Tournatractor by connecting the Roller tongue to the Tournatractor drawbar.

ATTACHMENTS

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ATTACHMENTS

When removing the attachments from the Tournatractor keep all the component parts together to insure proper installation.

BUMPER AND PUSH BLOCK

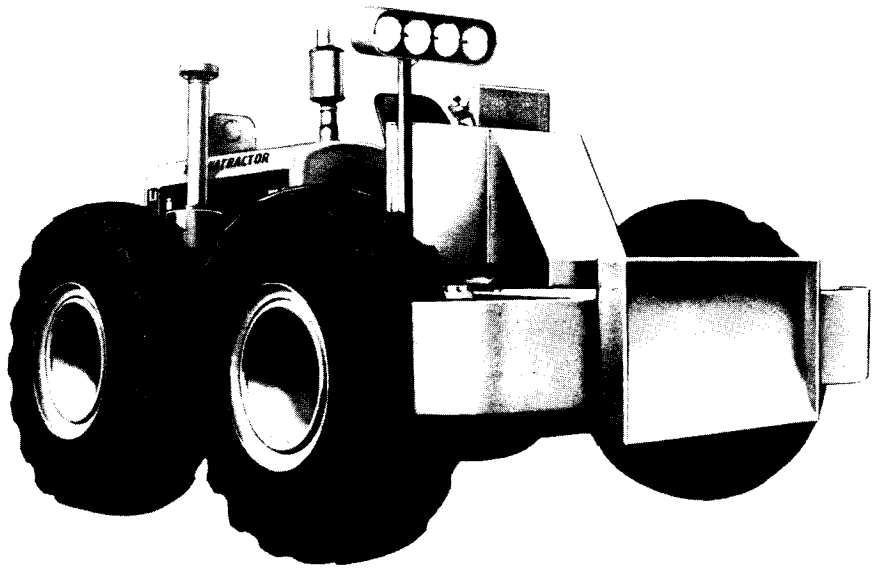


Figure O-1. Tournatractor with Bumper and Push Block

Installation

Attach chain hoist to bumper group and raise into position on front of Tournatractor.

Place enough shims between bumper arms and the blocks welded to the final drive case wall to insure a snug fit without pulling the final drive case out of line.

Put capscrews through the holes in the bumper arms into the tapped holes in the blocks. Torque capscrews to 600 foot pounds.

MODEL C BULLDOZER

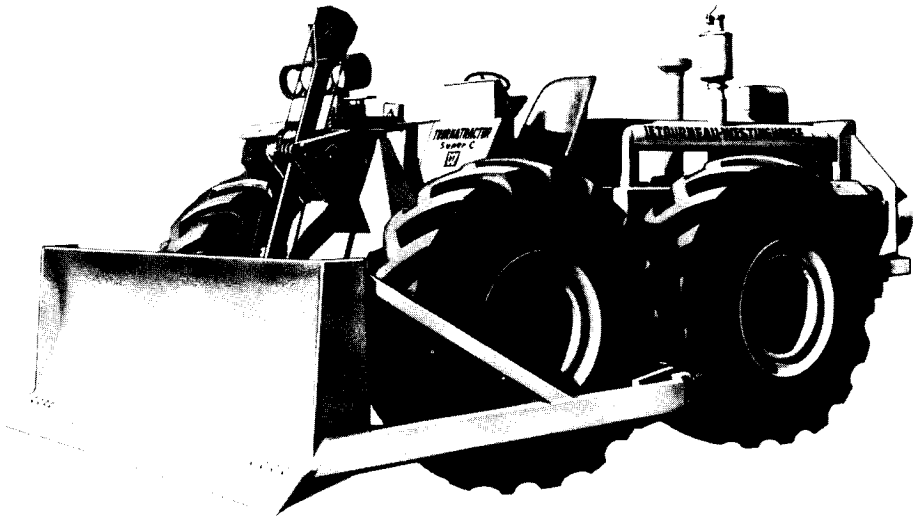


Figure O-2. Tournatractor with Bulldozer

Installation

With bulldozer on floor, place blocks of wood next to the side arms at the trunnion end.

Drive the Tournatractor forward over the blocks, between the sidearms, until the trunnion balls are in line with the sidearm sockets (on each side) (Fig. O-3).

Raise the sidearms until the trunnion balls fit into the sockets.

Place the trunnion cap over the exposed side of the trunnion ball on one side and install the capscrews and lockwashers.

Repeat the process for the other side.

Thread the cable as shown in Fig. O-6. Thread according to Fig. O-7 if machine is equipped with down pressure A-frame.

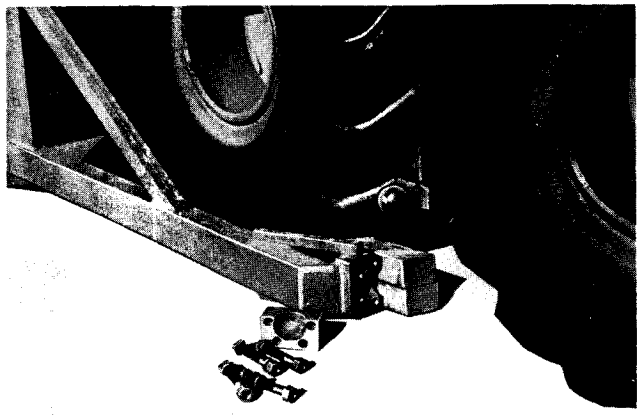


Figure O-3. Tournatractor in Position Between Sidearms

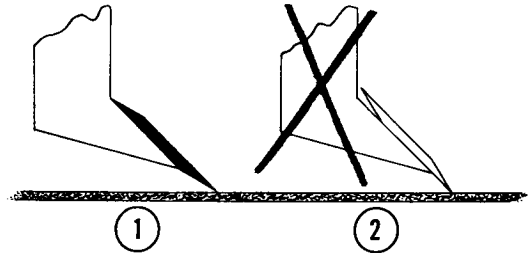
Changing Blades

The blades may be changed while the bowl is attached to the machine. CAUTION: Remember that the bowl is heavy and should be blocked up before any work is done on the blade or blade tips.

To change the blade or blade tips remove the nuts from the plow bolts and remove blades.

Place new blades on bowl and replace plow bolts and nuts.

Be sure that the bevel faces of the blades are in the correct position. See Fig. O-4 for proper mounting position.



1. CORRECT — BEVEL FACES DOWN **2. INCORRECT**

Figure O-4. Position of Blade Bevel Faces

A-FRAME

Installation

Fasten chain hoist to the A-frame and raise into position on the front of the Tournatractor.

Place the two splined head mounting capscrews into the two front mounting holes on the A-frame. Place the two hex head capscrews into the rear mounting holes. Torque the capscrews to 600 foot pounds.

Thread the cable according to the cable threading instructions.

Connect the electric wiring to the A.C. electric motor on the A-frame.

Down Pressure Attachment

The bulldozer may be equipped with a down pressure arrangement which provides a steady down pressure on the attachment bowl while operating. A cable operated push-beam is attached to the Tournatractor A-frame and the center of the attachment. It is raised and lowered by an electric motor, gear box and cable drum unit.

The electric motor is controlled by a finger tip switch which is located on the lower right hand corner of the instrument panel. An upward push releases the pressure and raises the bowl while a downward push lowers the bowl and applies a downward pressure to it.

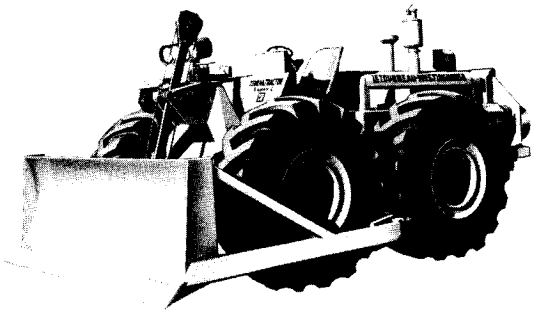
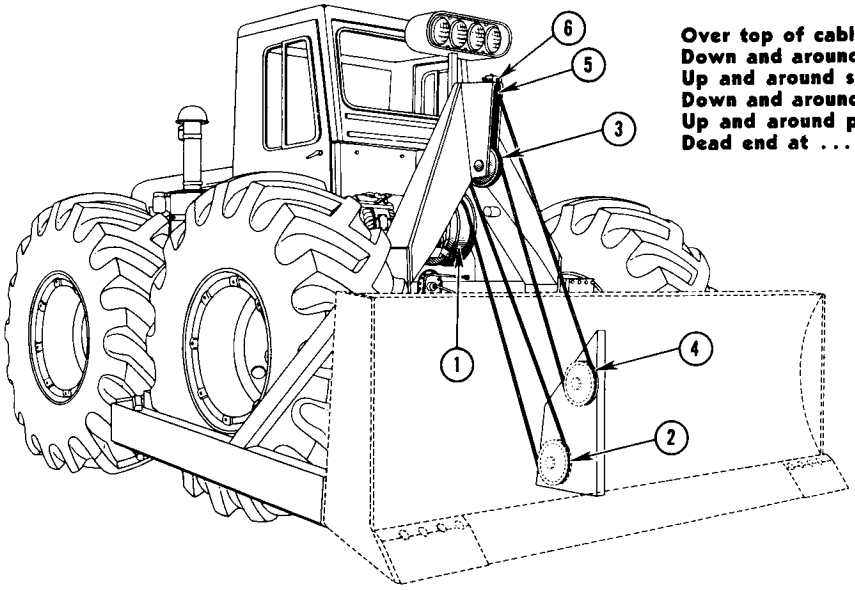


Figure O-5. Tournatractor with Down Pressure A-Frame

Cable Threading

The following cable threading diagram and instructions show the proper method for threading the cable on a Tournatractor with a standard A-frame.



Over top of cable drum 1
Down and around sheave 2
Up and around sheave 3
Down and around sheave 4
Up and around pipe 5
Dead end at 6

Figure O-6. Cable Threading

The following cable threading diagram and instructions show the proper method for threading the cable on a Tournatractor equipped with the down pressure A-frame.

Dead end cable on left side of cable drum 1
(Wrap Approx. 3 turns around drum)
Then down front side of cable drum to sheave 2
Then up through loop 3
Then up through loop 4
Then back and dead end to cable tightener 5
Dead end other cable on right side of cable drum 1
(Wrap Approx. 3 turns around drum)
Then bring around bottom and up front side of cable drum . 1
Then up and enter back of sheave 6
Then over and down and through loop 3
Then down and Approx. 2 turns around anchor bar and dead end at 7

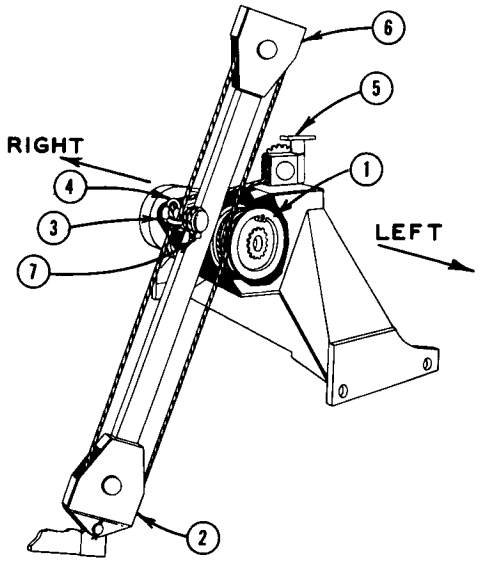


Figure O-7. Cable Threading For Down Pressure A-Frame

SIDE TILT ADJUSTMENT

The bulldozer may be adjusted to a side tilt position with one corner lower than the other by operating the tilt mechanism attached to the right side of the Tournatractor between the front and rear wheels. A cable operated push-beam is attached to the Tournatractor sidearm and is raised and lowered by an electric motor, gear box and cable drum unit.

The electric motor is operated by a fingertip switch on the lower right hand corner of the instrument panel. An upward push on the switch raises

the sidearm and a downward push lowers it.

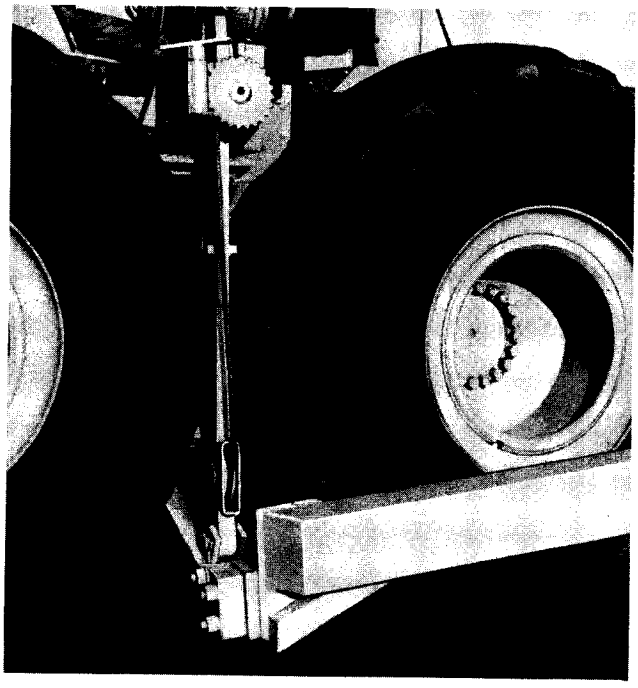


Figure O-8. Bulldozer in Tilted Position

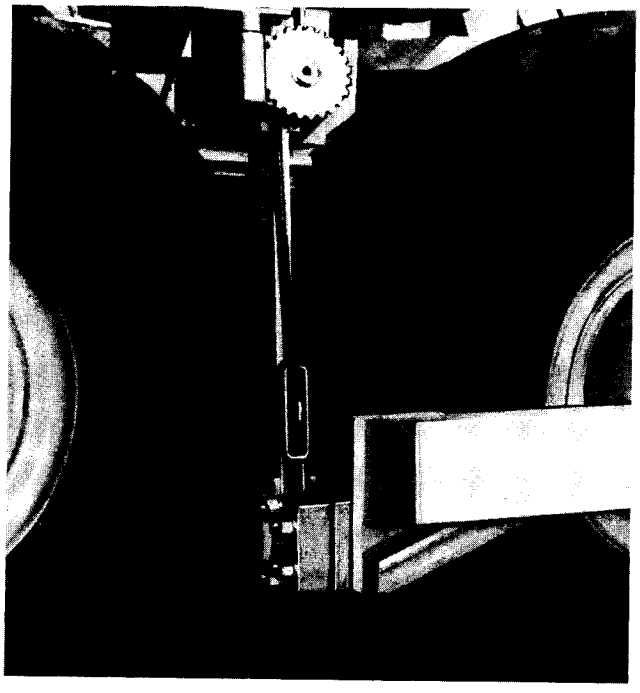


Figure O-9. Bulldozer in Level Position

Installation

Remove the nut from the right hand trunnion bolt and lower trunnion arm to the floor.

Remove cotter and pin from bracket on trunnion arm and remove trunnion bolt.

Fasten hoist to tilt mechanism and raise up and over the trunnion bolt bracket on the main case.

Lower tilt mechanism onto bracket, guiding the stud on the bottom of tilt mechanism into hole in bracket.

Place nut on stud and tighten.

Raise trunnion arm until hole in bottom of push beam is aligned with holes in bracket on the trunnion arm.

Insert pin through holes and install cotter.

Thread cable as shown in Fig. O-10.

Connect electric wiring to the A.C. motor.

Cable Threading

The following cable threading diagram and instructions show the proper method for threading the cable.

Dead end cable on rear side of cable drum 1
Wrap Approx. 3 turns around drum)
Bring up and over top of drum 1
Then down and enter bottom of sheave 2
Then up and around sheave 3
Then down to cable tightener 4
Then through hole in shaft of tightener and down and around sheave 5
Then up and over top of sheave 6
Then up and around bottom of cable drum 1
(Wrap Approx. 3 turns around drum)
end cable on front side.)

HOW TO TIGHTEN —

If the cable on one side of tightener, tightens before the other side, proceed as follows:

Slack off on the tight side slightly with the A.C. motor and take up with the tightener.

Repeat the above procedure until all slack is out of both sides of the cable.

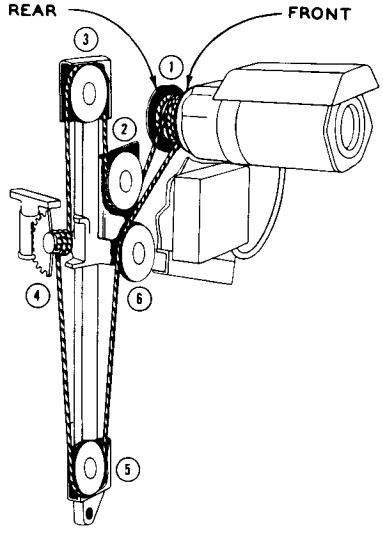


Figure O-10. Cable Threading

POWER CONTROL UNIT

Attach a chain hoist to the power control unit. Position the power control unit over the four holes drilled in the rear of the Tournatractor case structure.

Install the four bolts and tighten.

Connect electric wiring to the A.C. motors.

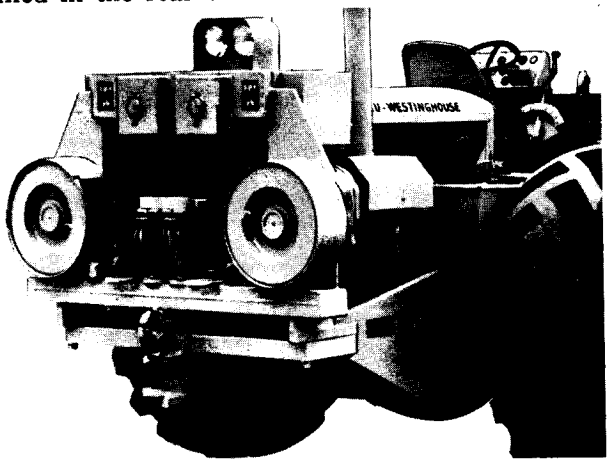


Figure O-11. Power Control Unit

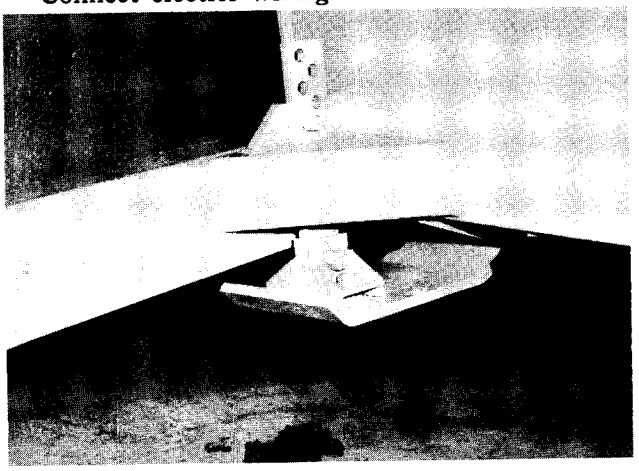


Figure O-12. Depth Shoes

DEPTH SHOES

Depth shoes are available for use on the Model C Bulldozer. The shoes are mounted on each side of the dozer bowl, directly behind the blade.

They are used to regulate the depth of cut or spread. They are adjustable and can be removed when desired.

To remove the depth shoes, remove the adjusting bolt and nut from the adjusting arm and bracket. Remove the two capscrews fastening the forward part of the depth shoe to the underside of the dozer bowl.

ANGLEDOZER, SNOWPLOW, ROOT RAKE AND TREE STINGER

For installation and cable threading of Angledozer, Snowplow, Tree Stinger, and Root Rake see instructions for installation and cable threading of Bulldozer in this section.

The instructions for changing the blade and blade tips of the angledozer are the same as described for the bulldozer on page O-3.

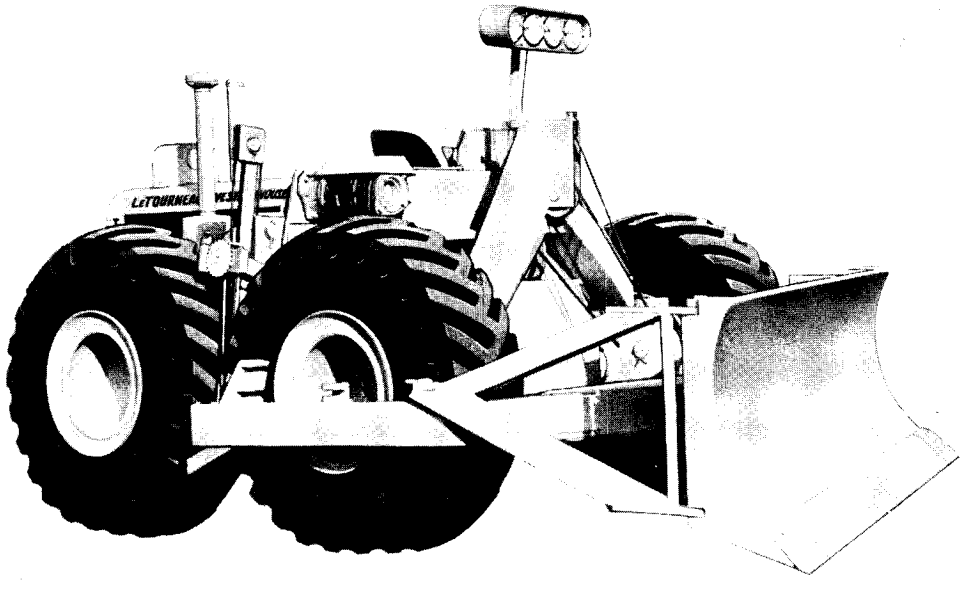


Figure O-13. Tournatractor with Angledozer

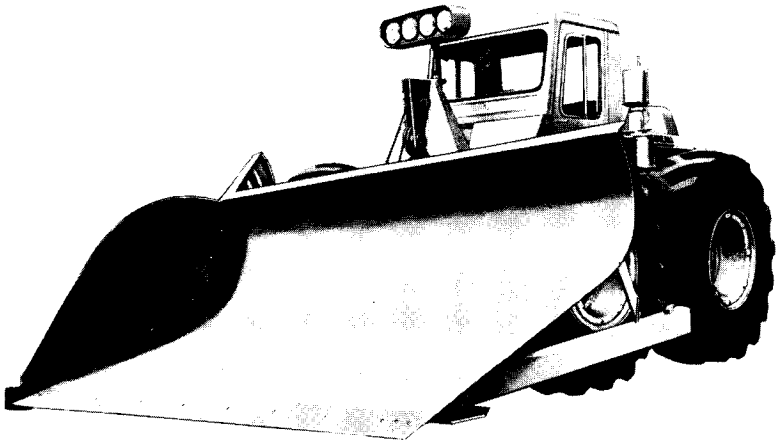


Figure O-14. Tournatractor with Snowplow

Figure O-15. Tournatractor with Root Rake

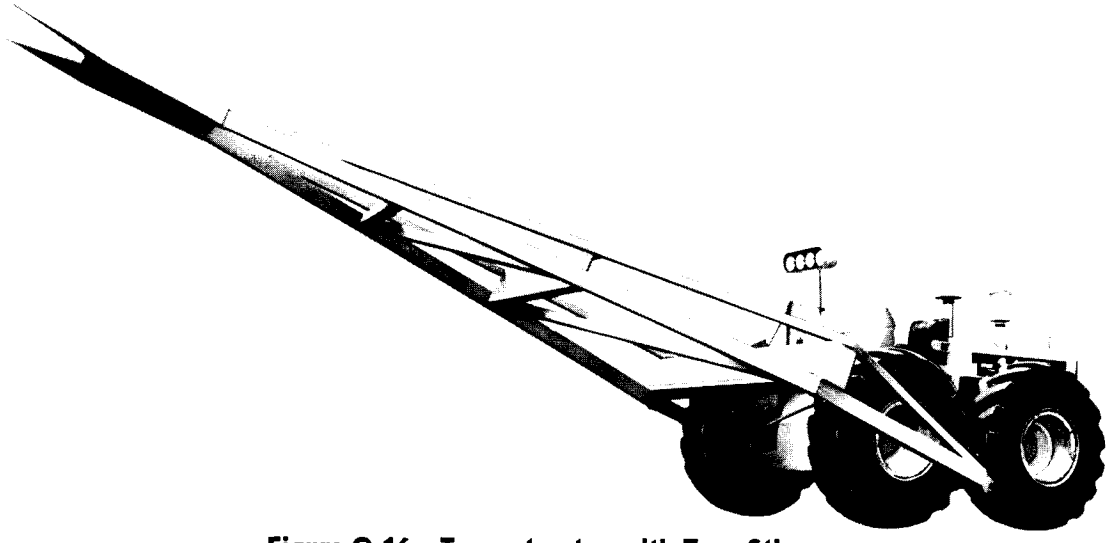


Figure O-16. Tournatractor with Tree Stinger

MODEL C WINCH

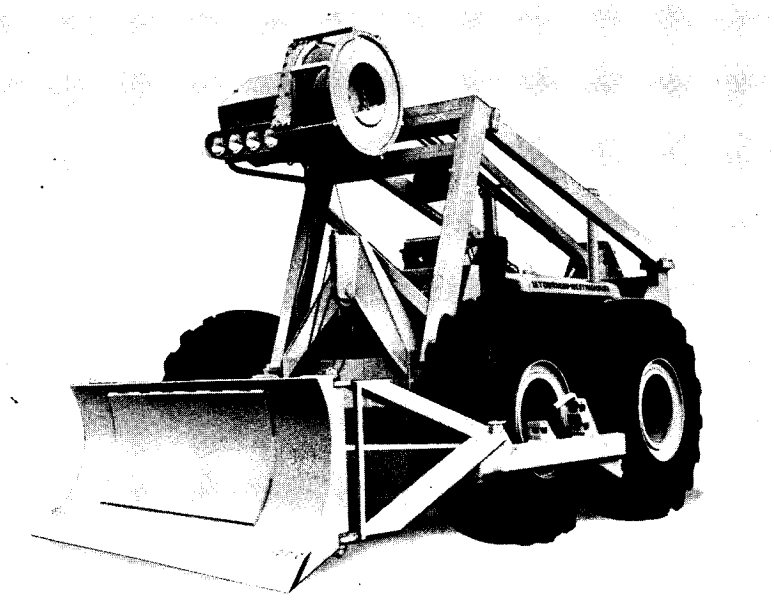


Figure O-17. Tournatractor with Model C Winch

The Model C Winch is equipped with a large winch unit which includes two A.C. electric motors, gear reduction boxes, #5 gear unit and a cable drum. (See page K-11 for #5 gear unit.)

The motors operating the winch are controlled by fingertip switches on the Tournatractors instrument panel. Power for each of the winch motors is supplied by the Tournatractor's engine driven A.C. generator. An upward push on the control switch reels in the cable and a downward push pays out the cable.

The Model C Winch may be equipped with a quick release cable drum that allows the cable to be payed out at unlimited line speed.

Removal

Disconnect the multiple wire conductor cable connecting the winch motor to the main switches at the main switch box. (If the machine is to be operated with the cable disconnected, plug the opening left after the cable is removed, the keep dirt out of the switch box.)

Loosen the cable clamp on the right top beam and free the cable from the clamp.

Remove the capscrews from each end of the right top beam, left top beam and the cable trough and remove members from the top of the machine.

Attach a sling or some similar lifting device to the rear frame member.

Remove the mounting capscrews from the rear frame mounting pads and from the side anchor plates and lift off the rear frame with motor and gear box attached.

Disconnect leads to No. 5 gear unit motors at the main switch box.

Attach sling to the front frame.

Remove capscrews from the frame mounting pads and lift off the frame.

Remove the cotter pin, sheave wheel and bearing from the sheave housing on the cable trough.

Installation

To install the Model C Winch reverse the procedure outlined for removal.

QUICK RELEASE CABLE DRUM

Disassembly

Remove air line from air inlet fitting.

Remove air inlet assembly and washer from adjusting plate and remove piston from bore in adjusting plate.

Loosen capscrews securing lock ring to adjusting plate enough to permit their being turned in the

outer hub.

Turn the lock ring into a counter-clockwise direction and remove lock ring, adjusting plate, diaphragm, pressure plate and backing plate from the outer hub.

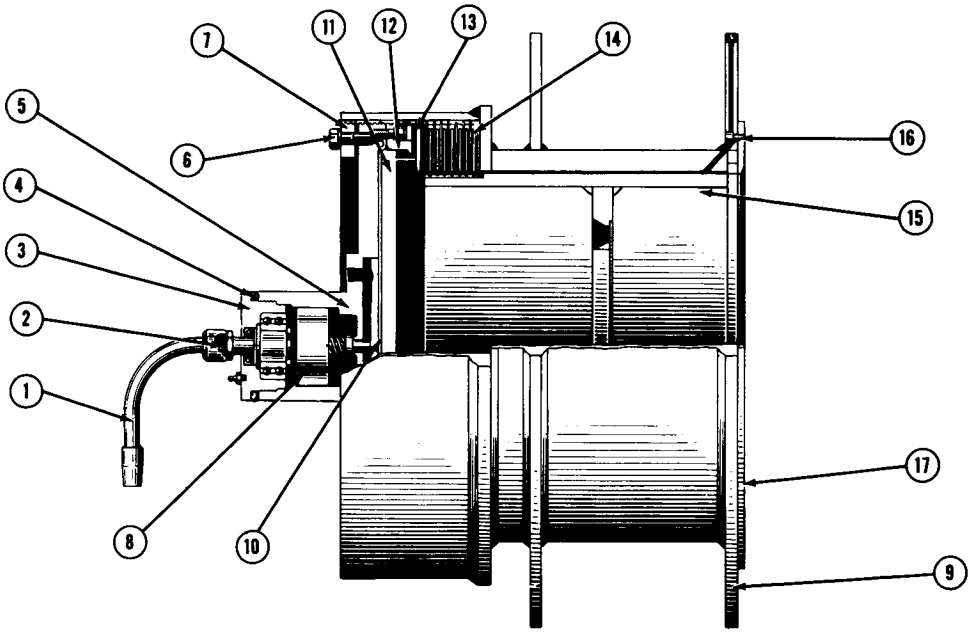
Remove the capscrews from the backing plate and separate backing plate, pressure plate and diaphragm.

The thrust plate, lined and unlined discs may now be removed from the outer hub.

Remove the capscrews securing the outer hub to the retainer.

Outer hub may now be removed from inner hub.

To further disassemble air inlet assembly use driver tool to remove air inlet tube. Pull bearing and oil seal.



1. AIR LINE
2. AIR INLET FITTING
3. AIR INLET ASSEMBLY
4. WASHER
5. ADJUSTING PLATE
6. CAPSCREW
7. LOCK RING
8. PISTON
9. OUTER HUB
10. DIAPHRAGM
11. PRESSURE PLATE
12. BACKING PLATE
13. THRUST PLATE
14. DISCS
15. INNER HUB
16. CAPSCREWS
17. RETAINER

Figure O-18. Quick Release Cable Drum, Cross Section

Reassembly

To reassemble the quick release cable drum reverse the procedure outlined for disassembly.

Install new bearing, oil seal and air inlet tube.

LUBRICATION

Lubricate sheave bearings and trunnion ball and socket joints once each shift. Use chassis grease (heavy) for temperatures above 32° F., and chassis grease (medium) for temperatures below 32° F.

Check cable frequently for worn or frayed spots and lubricate at intervals determined by the operating conditions with crater compound and petrolatum or its equivalent.

ELECTROTARDER

The electrotarder group is made up of three grid assemblies mounted in a case. Each grid assembly consists of 58 resistance grid plates which are connected in series. The electrotarder is connected to the three phase output terminals on the transformer strip by means of two Tournatacker switches. The Tournatacker switches are operated by a toggle type switch on the instrument panel.

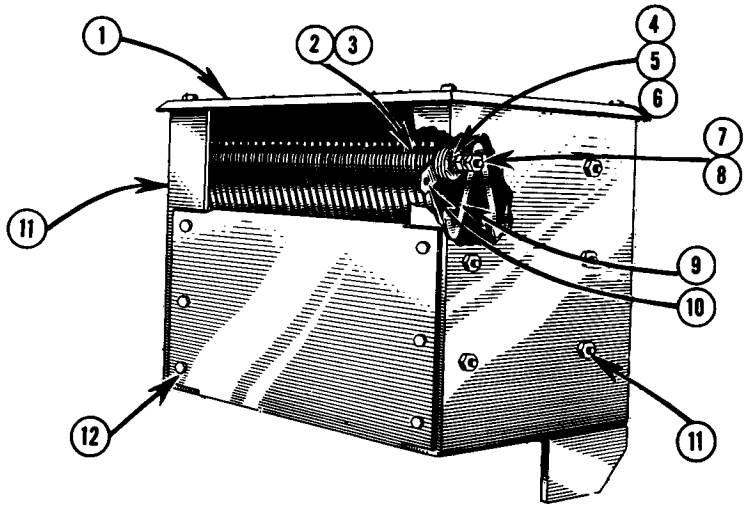
When loaded machines are operating down grades, the load has a tendency to push the machine. This will cause the engine to overspeed, thus causing the machine to go beyond safe operating speeds unless the wheel brakes are applied to hold the load.

The electrotarder is placed on the Tournaskidder as an additional means of slowing down the machine. Operated by the switch on the instrument

panel, the electrotarder is a resistance which if added to the generator circuit, places a load on the generator, thereby slowing down the rotor. Since the generator rotor is part of the power train, this will cause the machine to slow down.

The electrotarder is mounted in a case on the side of the front section of the Tournatractor. The case can be removed after disconnecting the leads to the grids and removing the mounting capscrews.

Disassembly



1. COVER
2. STEEL SPACER
3. MICA SPACER
4. WASHER
5. INSULATING WASHER
6. NUT
7. SUPPORT ROD
8. MICA TUBE
9. GRID PLATE
10. TERMINAL LUG
11. SUPPORT PLATE
12. COVER PLATE

Figure O-19. Electrotarder

Remove the top and front cover plates.

Remove the six nuts from the support rods which secure the front support plate in position on the rear plate depending upon whichever is closer to the point of repair.

Remove nuts, steel spacers and insulation washers from support rods. Slide spacers and resistance grid plates off support rod. Slide mica tube from support rod.

Be sure to note the relative position of spacers, both mica and steel, and grids so they can be replaced in the same order as removed.

Repeat the same procedure for each grid assembly.

Reassembly

To reassemble the electrotarder, reverse the procedure outlined for disassembly.

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CONSTRUCTION EQUIPMENT DIVISION
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