

MICHIGAN

OPERATORS MANUAL

No. 1371

MODEL 175A TRACTOR SHOVEL

Information Contained Herein Pertains Only to Machine
Serial Numbers Listed Below:

175A Waukesha Diesel — 19128 and thereafter
175A G.M. — 25541 and thereafter
175A Cummins — 26366 and thereafter

Record Your Machine Serial Number and Engine
Model Specification and Serial Number Here

Machine Serial.....

Engine Model.....

Engine Serial.....

**CLARK
EQUIPMENT**

CLARK EQUIPMENT COMPANY
Construction Machinery Division
BENTON HARBOR, MICHIGAN, U.S.A.

MICHIGAN

In Canada: Canadian Clark, Ltd., St. Thomas, Ontario



CONSTRUCTION MACHINERY DIVISION

MICHIGAN

TO OWNERS

The purpose of this manual is to serve as a guide to the proper operation, lubrication and minor adjustment of the Michigan Tractor Shovel. Study this manual carefully before starting or operating the machine the first time. Become familiar with all controls and procedures, and keep the manual on the machine for handy reference.

You have purchased this Michigan Tractor Shovel with the expectation that it would give you long and faithful service. In its construction we have taken every precaution to see that you get an efficient, long lived, satisfactory machine. It is our sincere hope that you derive from its operation the full measure of value and utility which you looked forward to when purchasing it.

For these reasons, we take the liberty of suggesting that your Michigan Tractor Shovel will always respond at its best with considerate treatment and care. The slight outlay in personal attention and cost required to give it regular and proper lubrication, inspection at stated intervals, and such adjustments as may be indicated, will repay you many times in low cost operation and trouble-free service.

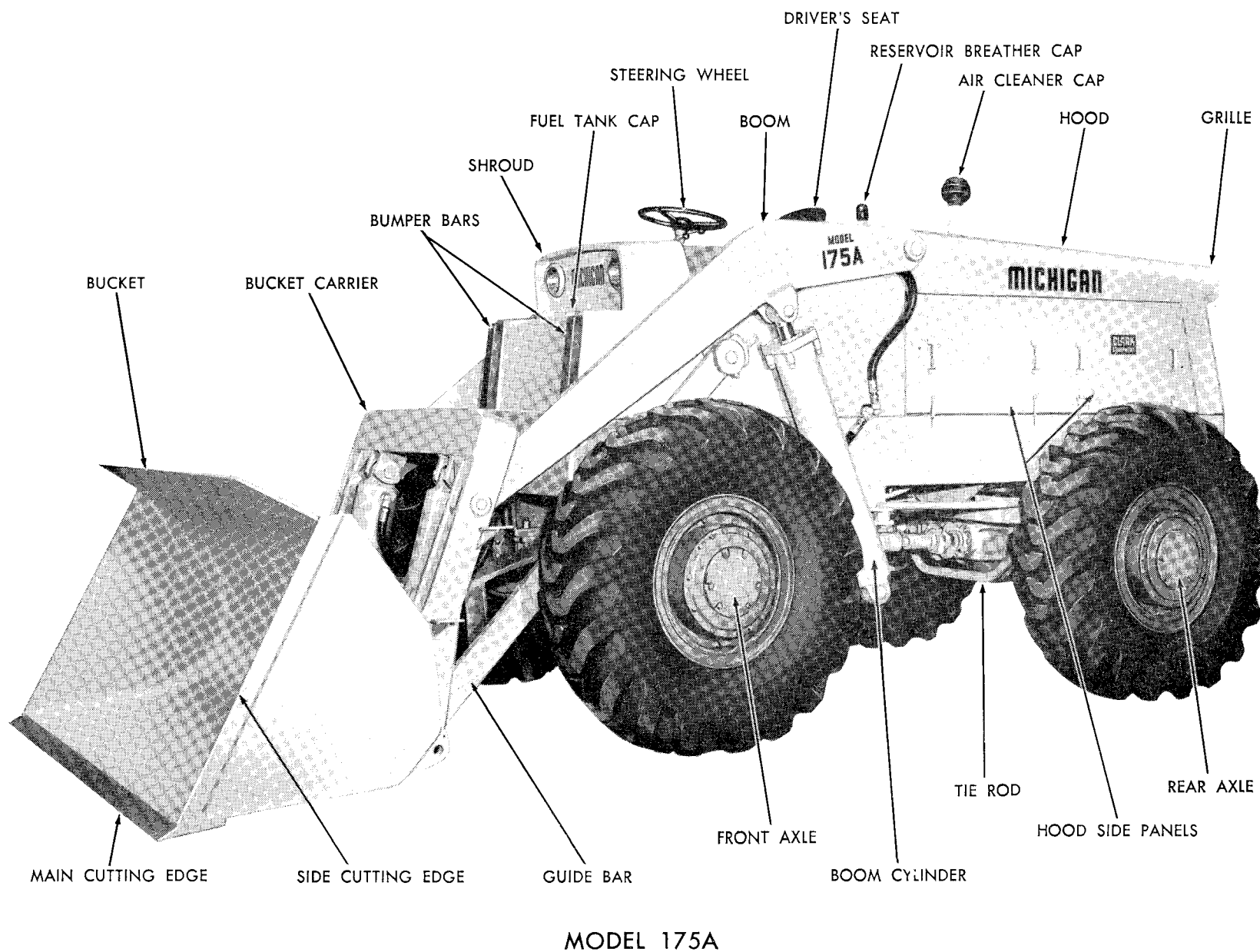
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Construction Machinery Division

BENTON HARBOR, MICHIGAN, U. S. A.

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GENERAL DESCRIPTION

MICHIGAN Tractor Shovels are constructed for rugged, heavy-duty industrial and commercial applications. They are specifically engineered for maximum ease of operation to move the greatest amount of material in the shortest possible time.

Drive power is from the engine thru a torque converter having a 3.0-1 torque multiplication factor, to a power shifted, four speed, full reversing type transmission, to the axle assemblies. Universal slip-joint drive shaft assemblies are used between power transfer units.

Axle assemblies are all wheel drive, rear wheel steer, full floating, spiral bevel ring gear and pinion, with further reduction provided by planetary gear sets within the wheel hubs.

The tractor shovel has four shift ranges in both forward and reverse. Provision is also made for the selection of two or four-wheel drive. Effortless hydraulic power steering is provided, utilizing two double acting steering cylinders, one at each rear wheel. Service brakes at each wheel are air actuated, with a mechanical parking brake on the propeller shaft.

Numerous quick-change attachments are available as optional accessory equipment, enabling one to increase the usefulness and productivity of the machine for a variety of different operations.

For more complete specifications refer to Specifications and Service Data on Page 34 of this manual.

DATA PLATES

Data plates and decals are used throughout the machine to aid in its safe and efficient operation; others give service instructions. Read all instruction plates before starting and operating the machine.

MACHINE SERIAL NUMBER PLATE

The machine serial number plate is mounted on inside of right-hand side plate of operator's compartment, giving model number and serial number of machine. See Figure 1. Serial number of machine also is stamped in one-half inch numerals on right-hand side of frame at the rear.

MICHIGAN <small>TRADE MARK OF CLARK EQUIPMENT CO.</small> TRACTOR SHOVEL	
MODEL <div style="border: 1px solid black; width: 100px; height: 20px; margin: 5px 0;"></div>	SERIAL NO. <div style="border: 1px solid black; width: 100px; height: 20px; margin: 5px 0;"></div>
<small>PATENTS PENDING</small>	
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: left;"> CLARK <small>EQUIPMENT</small> </div> <div style="text-align: right;"> CONSTRUCTION MACHINERY DIVISION </div> </div> CLARK EQUIPMENT COMPANY <small>BENTON HARBOR, MICHIGAN, U.S.A. TS-1648</small>	

Fig. 1. Machine Serial Number Plate

IMPORTANT: ALWAYS GIVE SERIAL NUMBER OF MACHINE WHEN ORDERING PARTS

TRANSMISSION OR TORQUE CONVERTER SERIAL NUMBER PLATE

The transmission serial number plate is located on right front side of transmission. The torque converter serial number plate is located on left front side of converter. Both plates are identical except for model number and serial number which are stamped on each plate to properly identify the units. Plate is shown in Figure 2.

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BENTON HARBOR, MICHIGAN

MODEL
SERIAL

TS-1008

Fig. 2. Transmission or Torque Converter Serial Number Plate

PREPARATION FOR OPERATION

It is essential that the following points be checked with machine in level position before operating this MICHIGAN Tractor Shovel.

Refer to the Lubrication Charts to locate items referred to below.

1. Check entire machine for damages in transit or storage.
2. Check oil level in the following to specifications outlined in Lubrication Section:
 - (a) Engine Crankcase
 - (b) Engine Air Cleaner
 - (c) Transmission Case (With Engine Shut Down)
 - (d) Front Drive Axle Differential
 - (e) Front Drive Axle Planetary Hubs
 - (f) Rear Drive Steer Axle Differential
 - (g) Rear Drive Steer Axle Planetary Hubs
 - (h) Hydraulic System Reservoir
 - (i) Steering Gear
3. Check cooling system to be sure radiator is filled and that radiator drain cock and engine block drain cock are closed. When air temperature is 32° F or below, or there is danger of water freezing in the cooling system, use a known reliable brand of permanent anti-freeze solution and add it to radiator according to manufacturer's instructions. For further information refer to engine manufacturer's Operation and Maintenance Manual.
4. Check batteries to be sure that plates are covered with water. If necessary to add, use only clean distilled water.
5. Check fuel level in tank. Handle fuel in clean containers. Use No. 2 Diesel fuel oil, Cetane, 40 minimum for Cummins and G.M. Diesels, Cetane 45 minimum for Waukesha Diesels.
6. Check to determine that all drain plugs, drain cocks, filler openings, fuel lines, oil lines, hydraulic lines, cooling system and air cleaner connections are tight, and do not leak.
7. Check tire pressures. See Specifications Section for proper air pressure. Be sure valve caps are in place to prevent dirt, moisture and foreign material from damaging valve core.

8. Grease all lubrication points of the entire unit. Refer to Lubrication Section as a guide for location, type and quantity of lubricant.

SAFETY PRECAUTIONS

A careful and efficient operator of heavy equipment must be guided by simple and fundamental rules of safety. He must take the necessary precautions to insure the safety of others as well as himself, and must avoid careless operating habits which cause damaging accidents to machinery and equipment. The use of this machine is subject to certain hazards that cannot be met by mechanical means, but only by the exercise of intelligence, care, and common sense.

The following are a few of the primary sources of injury to operators and other workmen.

1. Repairing and servicing equipment in dangerous positions.
2. Striking other persons or vehicles with the machine or with the bucket.
3. Unexpected violent tipping of the equipment.
4. Unexpected violent shocks or jars to the machine.
5. Uncontrolled traffic involving other vehicles.
6. Hazards from limbs of trees or overhead obstructions.
7. Leaving earth-moving or other equipment in dangerous positions, unattended.

In order to help prevent accidents the following safety rules should be observed at all times.

Do Not Leave Machine Unattended: Do not leave machine unattended with engine running. Always place directional and speed range shift levers in neutral, lower bucket, set parking brake, and shut down engine before leaving operator's seat.

Never Leave Machine with Bucket in Air: Never leave machine without first lowering bucket so that it rests on the ground. Make sure all control levers are in neutral position and engine shut down.

Be Careful of Hands and Arms. Never reach between boom and frame to lower bucket. Even though engine has been shut off, bucket can be lowered and cause possible injury.

Watch Bucket and Direction at All Times: Keep your eye on the load and always face or look in direction machine is traveling.

Avoid Greasy Hands and Floors: Keep hands, floors, and controls free from water, grease, and mud to insure non-slip control.

Never Waste Air by Pumping Brakes: Brake firmly in one application. Frequent and repeated light applications may exhaust air from reservoirs faster than it can be replaced by compressor. Never operate machine with less than 60 psi pressure on gauge.

Enter and Leave Operator's Compartment from Left Side: Always enter and leave operator's compartment from left-hand side of machine using steps provided. Accidental movement of control levers on right-hand side may occur by entering or leaving from that side, resulting in possible serious injury.

Never Get On or Off a Machine in Motion: Never get off or on a machine that is in motion. Positively in no case should anyone ride in the bucket, or on the outside of the machine, or hitch a ride in any manner.

Stop Machine to Lubricate or Adjust: Stop all operation and shut down engine when cleaning, adjusting, or lubricating the machine.

Never Lift Bucket Over Ground Crew: Watch for ground crew and other workers on foot while machine is in motion. Never swing bucket over a truck cab. Sound horn as a warning when approaching ground crew, and before setting machine into motion.

Keep Brakes Properly Adjusted: At first signs of brake slippage, stop machine and adjust them promptly.

Never Transport Load with Bucket Fully Raised: The nearer the ground that the bucket is held, the better the stability, especially on slopes or when turning machine. Approximately 15 inches from the ground is best.

Disengage Rear Drive Axle for Traveling: When working machine, engage rear axle to gain additional tractive effort. When traveling machine for long distances or operating on hard surfaced roads, disengage rear axle to prevent excessive tire wear.

Bucket Position for Travel: Raise bucket approximately 15 inches off the ground and tip back to afford maximum visibility.

Always Set Brake to Hold Machine When Parked: Set parking brake lever when parking machine. If on a grade, block wheels.

Maintain Proper Tire Inflation: Check tire inflation pressure weekly to provide best operation and longest tire life. If tires are hydro-inflated, they should be checked at more frequent intervals, as there is less volume of air to provide cushioning.

Select Proper Speed Range: Operate machines at speeds consistent with conditions on the particular job. Extra caution should be used if roads are wet or icy.

Maintain Shovel Balance: Keep bucket close to the ground for balance when tractor shovel is traveling up a steep grade.

Do Not Use Bucket as a Brake: When going down a steep slope, do not use bucket as a brake.

Check Before Moving Shovel: Walk around machine to make certain that no one is in "danger area" before entering operator's compartment. Sound horn before moving machine.

Portions of above safety precautions taken from Data Sheet D-256 by permission of
National Safety Council.

INSTRUMENTS AND OPERATING CONTROLS

Before operating a machine of this type it is essential that the operator become thoroughly familiar with the location and function of the various controls and instruments. Reference to, and study of the illustrations of the operator's compartment, controls, and instruments, together with the following paragraphs will aid in acquiring this end.

The operator should work slowly and carefully until he has become thoroughly accustomed to the machine. Speed and skill will be attained much easier if the necessary time is spent to acquire complete familiarity with the machine and its operation.

The terms "right-hand" and "left-hand" referred to below are determined by sitting in the operator's seat and facing toward front of machine.

INSTRUMENTS AND SWITCHES

All instruments and switches are conveniently located in the instrument panel directly in front of the operator. It is good practice to glance at gauges frequently while working the machine, as they indicate operating conditions of the torque converter and transmission, and of the engine and accessories.

Figure 3 shows illustration of instrument panel, giving identification of instruments and switches.

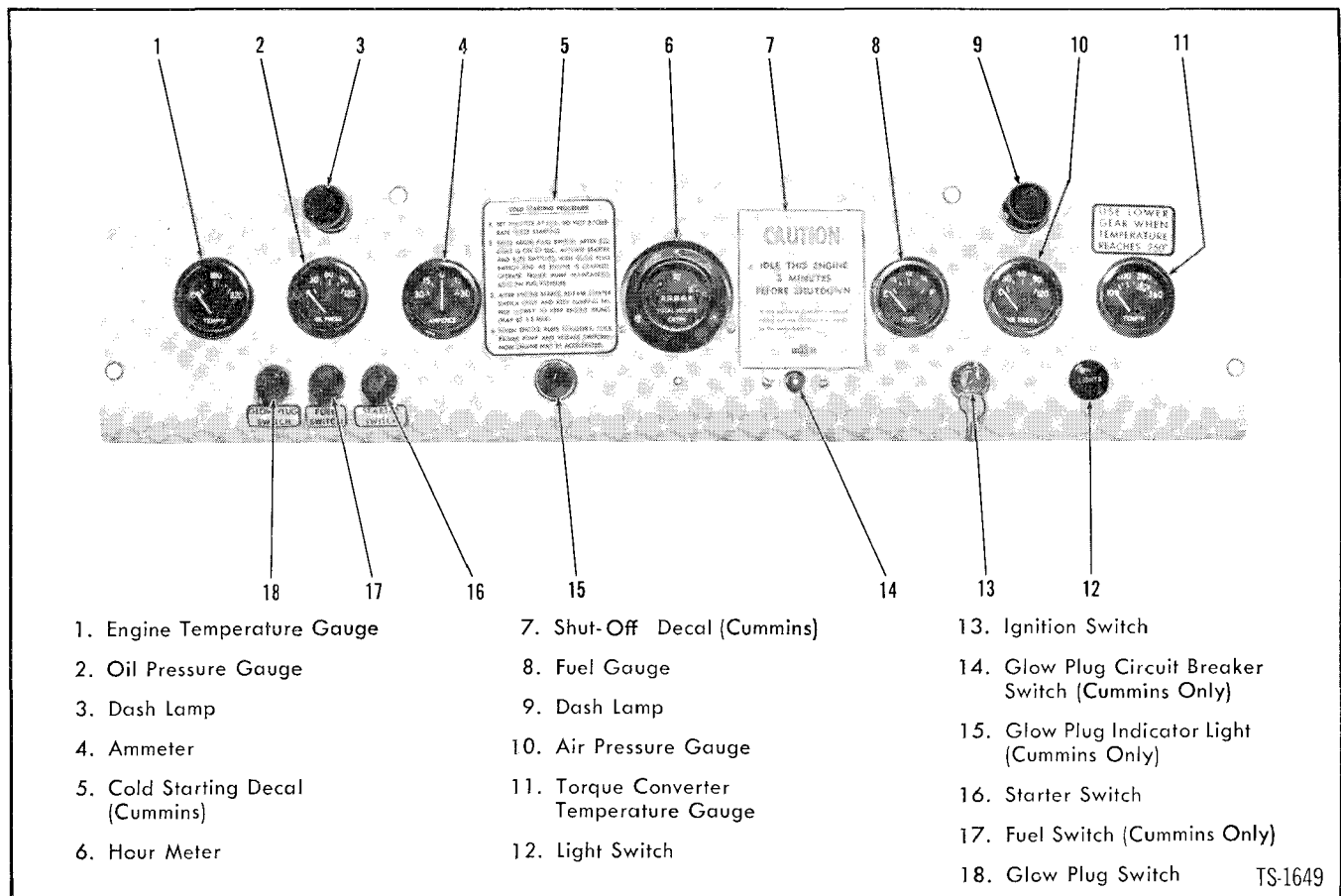


Fig. 3. Instrument Panel

Engine Temperature Gauge indicates temperature of engine coolant. Gauge should register in vicinity of 180°F for normal operation. If gauge indicates temperature to be at boiling point, idle engine, remove radiator cap and add water. When temperature lowers, shut off engine and trouble shoot cooling system for cause of overheating.

Oil Pressure Gauge indicates pressure in engine lubrication system. Under normal operation, gauge pressure is as follows for the respective engines:

Cummins	30-50 psi
G.M.	approx. 45 psi
Waukesha	25-30 psi

Dash Lamps light when light switch is pulled out to first position.

Ammeter shows current flow to and from batteries. Electrical current going from generator to batteries registers on the charge (+) side. Gauge will show discharge (—) when more electrical energy is being consumed than received from generator.

Hour Meter indicates working time of machine in hours and tenths of an hour.

Fuel Gauge indicates quantity of fuel in tank only when ignition switch is ON. When ignition switch is off, pointer drops back beyond "E" (Empty) mark.

Air Pressure Gauge indicates pressure in air reservoir for operating brakes. Gauge should read between 80 and 105 psi. Never operate machine with less than 60 psi pressure.

Torque Converter Temperature Gauge indicates temperature of fluid in torque converter and transmission lubricating system. When temperature approaches 250°F, or red portion of gauge, shift to a lower operating speed range.

Light Switch operates dash lights, head lights, and tail lights in first position, with addition of back-up lights in second position. Pull switch to operate.

Ignition Switch energizes all gauges and switches on instrument panel, and starting motor circuit. Turn key to right for ON position.

Glow Plug Circuit Breaker Switch (Cummins Diesel Only) should be pushed to close glow plug circuit if circuit has been opened due to overheating.

Glow Plug Indicator Light (Cummins Diesel Only) lights when glow plug switch is pushed. If light does not go on, push circuit breaker switch.

Starter Switch energizes cranking motor to start engine. Press to operate; release when engine starts. Do not crank engine continuously for more than 20 seconds to avoid damage to cranking motor. Pause a few moments between cranking cycles, if difficulty is encountered, to let windings cool. See Starting Procedure on Page 9.

Fuel Switch (Cummins Diesel Only) energizes shut-down valve on fuel pump to permit initial flow of fuel to start engine. See Starting Procedure on Page 9.

Glow Plug Switch (Cummins and Waukesha Diesels Only) closes circuit to heat single glow plug in intake manifold on Cummins Diesel, and individual glow plugs in each cylinder on Waukesha Diesel. Glow plugs should be used to aid in starting engine, especially during cold weather. When switch is pushed, dash indicator red light (Cummins Diesel Only) is ON. See Starting Procedure on Page 9.

OPERATING CONTROLS

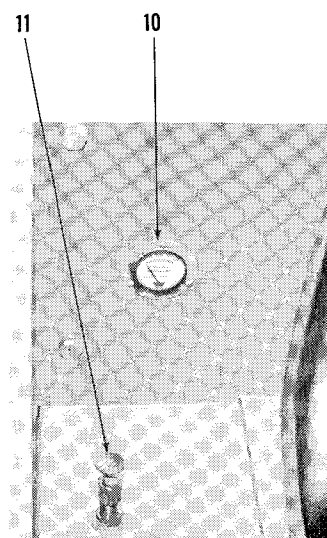
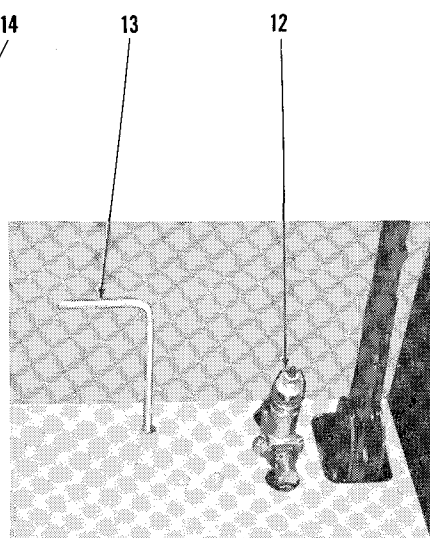
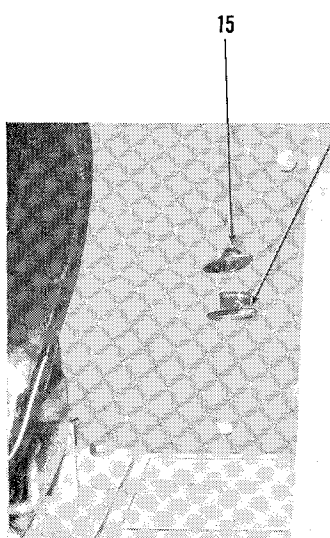
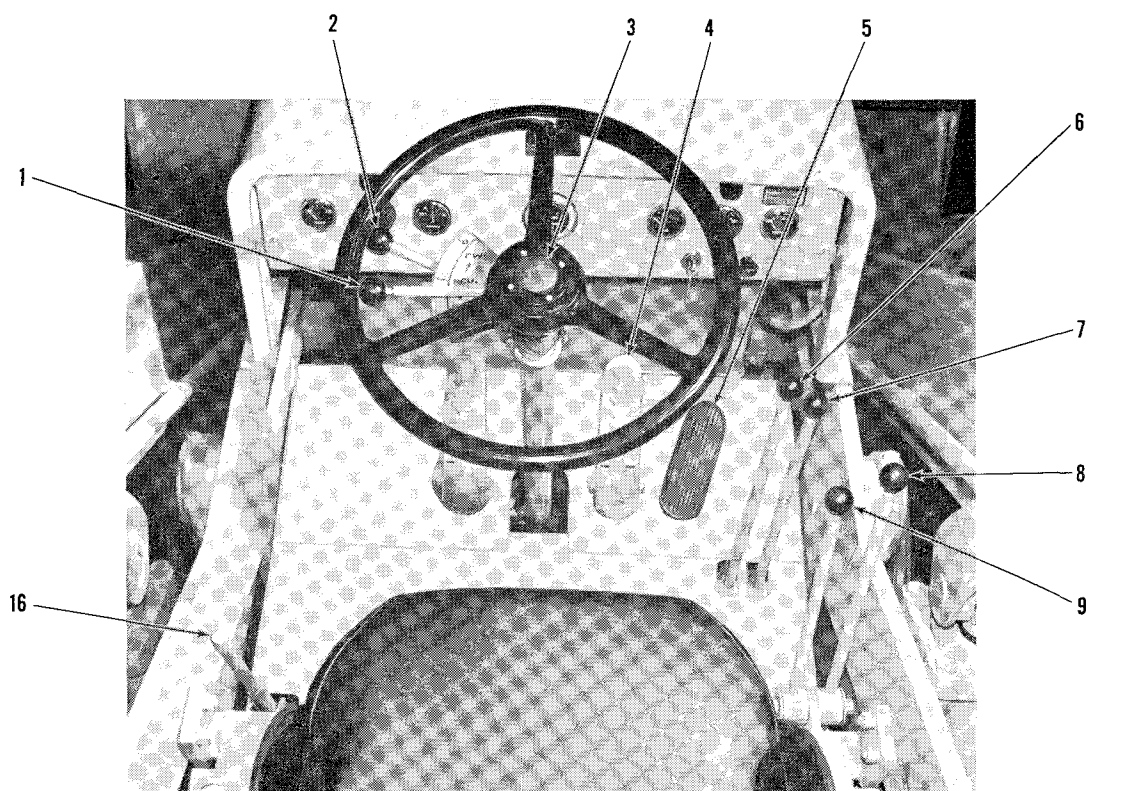
All controls are conveniently located to provide maximum ease of operation of the machine.

The operator's seat can be shifted forward or rearward to suit the individual. Move lever on left-hand side of seat forward, and shift seat to desired position. To provide access for servicing batteries, seat can be tilted toward front of machine.

If enclosed parking is not available when shutting down machine at end of shift, tilt seat forward over steering wheel, or spread tarpaulin over operator's compartment to give protection from inclement weather. A cab is available as accessory equipment.

Refer to Figure 4 for location and identification of operating controls.

Directional Shift Lever is the top lever on steering column. This lever is in neutral when in its central position. Forward direction is obtained by pushing forward on lever. Reverse direction is obtained by pulling back on lever.



1. Directional Shift Lever
2. Speed Range Lever
3. Horn Button
4. Brake Pedal
5. Accelerator Pedal
6. Range Shift Lever
7. Drive Selection Lever

8. Boom Control Lever
9. Bucket Control Lever
10. Fuel Pressure Gauge (Cummins Diesel)
11. Preheater Priming Pump (Cummins Diesel)
12. Priming Pump (Waukesha Diesel)

13. Shut-Off Control (Waukesha Diesel)
14. Emergency Shut-Down Control (G. M. Diesel)
15. Shut-Down Control (G. M. Diesel)
16. Parking Brake Lever

TS-1650

Fig. 4. Operating Controls

When shifting from forward into reverse or vice versa, always decrease engine rpm and stop machine momentarily while making the shift.

Speed Range Lever is the bottom lever on steering column. Low or High speed range may be selected. Pushing lever forward engages Low speed range; pulling lever to the rear engages High speed range. Lever is in neutral when in its central position.

Speed range lever and range shift lever make available to the operator a choice of four speed ranges, providing selective power requirements for any operating condition.

Speed range and directional shift levers are so arranged that it is convenient to load in low range forward, and back away from pile in high range reverse by gripping both levers at the same time. High range always should be used when traveling machine for comparatively long distances without a load.

Glance at torque converter temperature gauge when working machine. If gauge approaches 250°F shift to a lower operating speed range.

Shifting from one speed range to another can be made at any time during the working cycle. Momentarily let up on accelerator when shifting into High and accelerate slightly when shifting into Low.

Horn Button is in center of steering wheel.

Brake Pedal is so designed as to permit brake application with either left or right foot of operator. Pedal operates an air valve for applying brakes at all wheels. As pedal pressure increases, air valve opens wider, and brake application becomes more severe. Brake pedal also operates a shut-off valve in transmission control cover which shuts off hydraulic oil pressure to the forward and reverse clutches thus disengaging the transmission.

Accelerator Pedal increases fuel supply to engine thus increasing its rpm.

Range Shift Lever is inner lever at right front of floorboard. Working or travel range may be selected. Pushing lever forward engages working range. Pulling lever to the rear engages travel range. Lever is in neutral when in its central position.

Range shift lever and speed range lever make available to the operator a choice of four speed ranges, providing selective power requirements for any operating condition.

Working range always should be used when loading and dumping bucket. Travel range always should be used when traveling machine for comparatively long distances without a load.

Shifting from working range to travel range or vice versa should be performed when machine is stationary, and with speed range and directional levers in neutral.

Drive Selection Lever is outer lever at right front of floorboard. When lever is in forward position, both front and rear axles are engaged. When lever is pulled backward, power is transmitted to the front axle only. This lever does not have a neutral position.

Four wheel drive is generally used when working machine. Always use 2-wheel drive when traveling machine.

When shifting into 2 or 4-wheel drive, place speed range lever in low speed range, and set machine into motion at a slow, creeping rate of speed. Turn steer wheels to give relative motion between clutch hubs in transmission thru differential action, and apply pressure to drive selection lever until it drops into engagement. **CAUTION: Do not attempt to clash shift.**

Boom Control Lever is the outer lever on right hand side of the seat. This lever has four positions. Each position can be distinctly felt by the operator when poppet falls into position as lever is moved.

To raise boom and bucket, pull boom lever backward to last poppet position. Boom and bucket will raise in direct proportion to engine speed.

Push lever forward, one notch ahead of raise position, to "Hold" position. Placing boom lever in "Hold" position will stop and hold bucket at any height desired.

To lower boom and bucket, push lever all the way forward into "Float" position. In this poppet position, hydraulic oil will pass from bottom of boom cylinders, thru the control valve and into the top of the cylinders, keeping them free of air. "Float" position also is used for back-dragging, allowing the bucket to move freely following variations in grade level.

The poppet position directly forward of "Hold" is "Down Pressure", and is used to provide penetration to dig underground.

Always place boom control lever in "Hold" or neutral position before starting or shutting down engine. This lever will lower boom and bucket even though the engine has been shut down.

Bucket Control Lever is inner lever on right-hand side of the seat. This lever controls "Dumping", "Holding", and "Closing" of the bucket. There are no poppet positions or notches, since it is connected to a spring loaded plunger in the control valve. Control lever returns to its central or neutral position automatically when released.

To "Dump" bucket, push lever forward. Release lever and it will return to neutral position, allowing bucket to remain in "Dump" position.

To "Close" bucket, pull lever backward. Release lever and it will return to neutral position, allowing bucket to remain in closed position.

Bucket may be stopped and held in any position of its dumping arc by releasing lever for return to its neutral position.

Preheater Priming Pump Gauge (Cummins Diesel Only) registers fuel pressure created by priming pump. Pressure should be maintained between 40-60 psi. See Starting Procedure on Page 9.

Preheater Priming Pump (Cummins Diesel Only) is a hand priming pump to force fuel into intake manifold. Pump should be used only as a cold starting aid. See Starting Procedure on Page 9.

Priming Pump (Waukesha Diesel Only) is to left of operator on floorboard. Unscrew bail nut and flip bail to one side. Operate pump 6 or 8 strokes to prime fuel lines each time engine is started. See Starting Procedure on Page 9.

Shut-Off Control (Waukesha Diesel Only) is located on floorboard directly below operator's seat. Turn ignition switch off, and pull up on handle to shut down engine. Pulling handle cuts off fuel supply at injection pump.

Emergency Shut-Off Control (G.M. Diesel Only) is bottom T-handle on seat support plate at left and behind operator. This control is for emergency shut-down of the engine.

Shut-Off Control (G.M. Diesel Only) is top T-handle on seat support plate at left and behind operator. Turn ignition switch off and pull T-handle to shut down engine. Pulling handle cuts off fuel supply through the injectors.

Parking Brake Lever applies brake on forward drive line. To set brake pull up and back on lever. To release brake push lever forward and down.

OPERATING INSTRUCTIONS

After the machine has been properly checked, and the operator has familiarized himself with location and function of the various controls, the machine should be operated according to instructions in the following paragraphs.

STARTING PROCEDURE

PRE-STARTING CHECKS

Before starting engine at beginning of the work shift, or at anytime machine has been shut down for adjustment or time-off period, perform the following checks.

1. Engine oil level
2. Engine air cleaner
3. Hydraulic system oil level
4. Cooling system
5. Fuel supply
6. Transmission fluid level
7. Tire pressures

Service units at this time if inspection indicates the necessity.

NORMAL STARTING

CAUTION: *Walk around machine to make certain that no one is in "danger area" before entering operator's compartment.*

In warm weather, or with a warm or hot engine, start engine as follows:

1. Set all control levers in neutral. Prime fuel lines on Waukesha Diesel.
2. Turn ignition switch ON. Press glow plug switch 30 to 60 seconds on Waukesha Diesel.
3. Press starter switch. At same time press fuel switch on Cummins Diesel. If Waukesha Diesel, continue to hold glow plug switch.
4. Watch oil gauge on instrument panel when engine starts to be sure of oil pressure.
5. Allow engine a few minutes to warm up before driving or operating machine.

COLD WEATHER STARTING

MICHIGAN machines do not require extensive preparation for cold weather operation beyond addition of a permanent type anti-freeze to the cooling system, and a change of engine oil to a viscosity suitable for anticipated temperatures in which the machine is to operate. At temperatures below 32°F a change of oil in hydraulic system to Type "A" Automatic Transmission Fluid will aid starting by reduction of resistance in the main hydraulic pump. Probably the most important item to insure prompt starting is proper maintenance of the electrical system, especially the batteries.

Batteries must be kept fully charged at all times, since in cold weather the capacity of a battery to deliver full power is greatly reduced. A fully charged battery at 15°F is capable of delivering only 70% of its rated amperage, and at lower temperatures becomes even more inefficient. Service batteries weekly as follows:

1. Add distilled water to cover plates and separators, but do not overfill. Overfilling causes dilution of the electrolyte, and sputtering during the charging cycle. This may result in battery freezing and corroded terminals.
2. Keep terminals clean and tight. Dirty or loose connections offer high resistance.
3. Keep vent plugs in place, and tight, to prevent entrance of foreign material into cells.
4. Check specific gravity regularly with a hydrometer, and recharge or replace batteries that continually show low reading.

Glow plug circuits used on Waukesha and Cummins Diesels also should be checked to be sure they are in proper working order.

1. Check wiring that insulation is not cracked, and that terminals are clean and tight.
2. Remove glow plugs and check that they are clean. Test glow plug heating by connecting to electrical source as follows:

Waukesha	24 Volts
Cummins	6 Volts

3. On Cummins Diesels only, remove and clean fuel nozzle in intake manifold, and check that fuel connections are tight.

To avoid unnecessary cranking because of air locks in cold fuel oil, change fuel filters only when engine is hot; then start and run engine after filter change, and check that there is no fuel restriction nor leakage.

When not in use, machine should be parked or stored in a closed garage or building during cold weather to reduce cranking effort when starting a cold engine. It is particularly important in starting the engine, that it is not accelerated to governed speed, or a load applied until the oil has become warm enough to circulate to all bearing surfaces.

Cold starting procedure for the various makes of Diesel engines is as follows, after first placing all control levers in their neutral position.

Cummins Diesel (When Colder Than 50° F)

Cummins Diesels are equipped with an air preheater arrangement consisting of a single glow plug mounted in the intake manifold, and a hand priming pump to force atomized fuel into the manifold. Depressing glow plug switch heats glow plug, igniting the fuel in the manifold and heating the intake air entering the combustion chamber. *Since primary ignition takes place within the manifold, serious damage may result if starting fluid (pressurized can type) is used with glow plugs hot. Do not use starting fluid in any form.*

1. Set throttle in idle position. **Do not accelerate during the starting procedure.**
2. Turn ignition switch ON, and press glow plug switch. When indicator light has been on 20 seconds, press starter, and fuel switches.
3. As engine rotates, operate preheater priming pump to maintain 40 to 60 psi fuel pressure as shown in Figure 5. Use of primer before 20 second interval will wet glow plug and prevent heating. **Do not use starting fluid in any form.**
4. If engine does not start within 20 seconds, stop cranking and repeat steps 2 and 3. This will aid in battery conservation, and provide maximum cranking time. If no start is obtained after two trials, check intake manifold for heat.

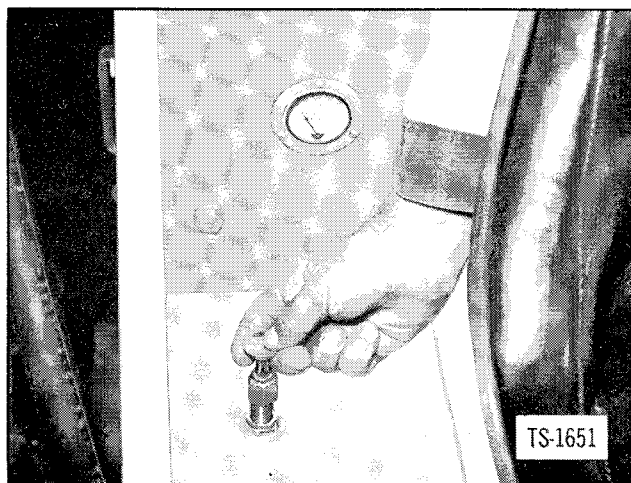


Fig. 5. Preheater Priming Pump (Cummins Diesel)

5. After engine starts, release starter switch, but hold glow plug and fuel switches. When engine oil pressure is 7 to 10 psi, release fuel switch. Pump primer slowly to keep engine idling smoothly. In cold weather this may require 4 to 5 minutes or longer. Do not accelerate engine.
6. When engine does not falter between primer strokes, stop pumping, close primer and lock; then release glow plug switch.
7. Allow engine a few minutes to warm up before driving or operating machine.

G. M. Diesel

On G. M. Diesels no starting aid is provided for cold weather. Starting fluid (pressurized can type) sprayed into air cleaner intake is recommended as engine is being cranked.

Two types of starting aids: (1) air heater, and (2) fluid starting (capsule form) can be installed by any authorized G. M. Diesel Distributor.

1. Turn ignition switch ON.
2. Depress accelerator to full throttle position.
3. Press starter switch and use starting fluid (pressurized can type) directed into air cleaner intake.
4. Check engine oil pressure, and allow engine a few minutes to warm up before driving or operating machine.

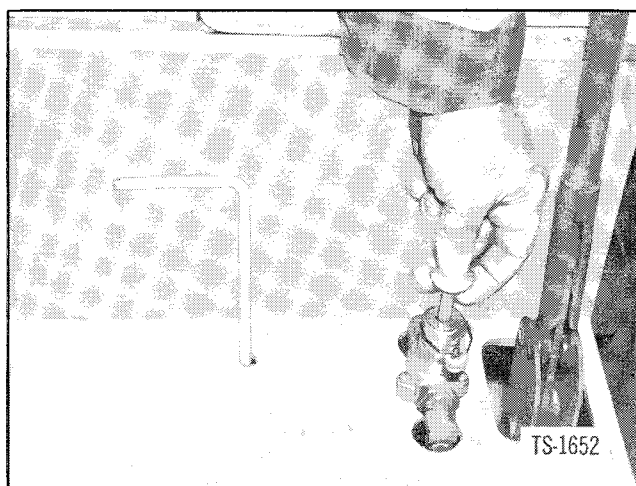


Fig. 6. Priming Pump (Waukesha Diesel)

Waukesha Diesel (When Colder Than 40° F)

Waukesha Diesels are equipped with glow plugs individually mounted in each combustion chamber. Depressing glow plug switch heats the glow plugs to ignite the fuel, and warm the cold engine parts and the intake air entering each combustion chamber. *Since ignition takes place within the combustion chamber, starting fluid (pressurized can type), can be safely used with glow plugs hot, and is recommended for easier starting during cold weather.*

1. Prime fuel lines as shown in Figure 6.
2. Turn ignition switch ON, and press glow plug switch 30 to 60 seconds.
3. Depress accelerator to full throttle position.
4. Press starter switch while continuing to hold glow plug switch. *When colder than 40°F, use glow plugs and starting fluid (pressurized can type) directed into air cleaner intake.*
5. Check engine oil pressure, and allow engine a few minutes to warm up before driving or operating machine.

If difficulty is experienced in starting engines, please refer to Operator's Manual of respective engine manufacturer for further trouble shooting procedures.

WARM-UP CHECKS

Hold engine at idle speed for approximately two minutes after starting; then while engine continues to warm up for the next few minutes perform the following checks.

1. Oil pressure gauge
2. Ammeter
3. Engine temperature gauge
4. Air pressure gauge
5. Fuel gauge
6. Torque converter temperature gauge
7. Horn
8. Lights
9. Hydraulic system-boom and bucket control levers

Visually check for leaks at drain and fill plugs in axle assemblies, torque converter and transmission, and at hose couplings and fittings in hydraulic and cooling systems. Correct all leaking conditions, and repair or replace gauges that are not functioning before continuing the operation of the machine.

PARKING AREA CHECKS

As a final check before leaving the parking area, set machine into motion and test the following.

1. Steering gear
2. Service brakes
3. Parking brake

Remember, the safety of the operator and other workmen, and the efficient operation of the machine depend upon the performance of all items in the check lists above.

SHUTTING DOWN ENGINE

It is important to idle an engine 3 to 5 minutes before shutting it down. This will allow lubricating oil and water to carry heat away from combustion chambers, cylinder head, bearings, shafts, and turbocharger.

Residual heat can damage many parts, ranging from valves to fuel and injection pumps. The latter suffer from gums and deposits remaining after evaporation of the lighter ends. In addition, the physical stresses from expansion and contraction can cause distortion, permanent warping, and gasket failures. In some cases, oil seals and cylinder sleeve seals suffer badly, although the results may not appear until much later.

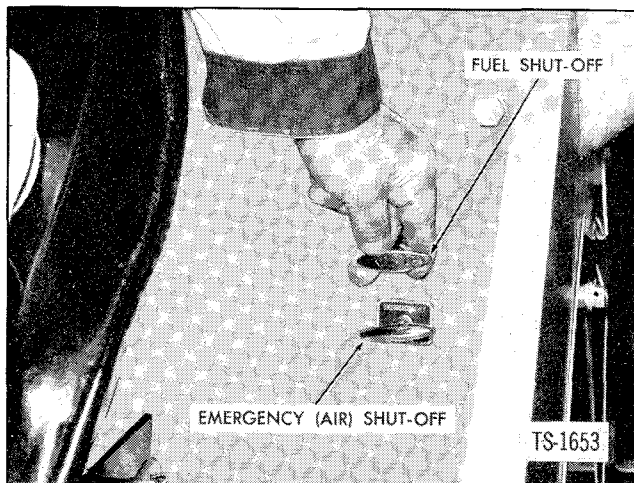


Fig. 7. Shut-Off Controls (G.M. Diesel)

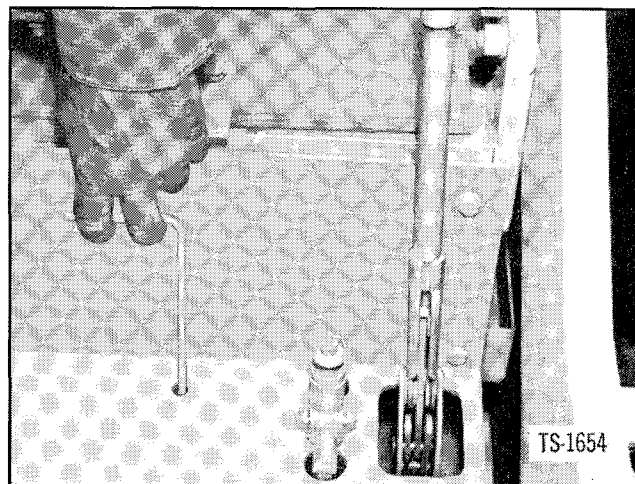


Fig. 8. Shut-Off Control (Waukesha Diesel)

IT IS GOOD PRACTICE TO IDLE ANY ENGINE LONG ENOUGH TO REDUCE EXTREME TEMPERATURES.

A Cummins Diesel can be shut down completely by turning ignition switch OFF. To shut down a G. M. or Waukesha Diesel, turn ignition switch OFF, and pull shut-off control. On G. M. Diesels be sure to pull top T-handle; the bottom T-handle is for emergency shut-down only. It should be used only in the event that regular shut-off control fails to shut down the engine. Refer to Figures 7 and 8.

TOWING TRACTOR SHOVEL

If at any time, it is found necessary to tow a tractor shovel any appreciable distance, the transmission to front drive axle and rear drive steer axle propeller shaft assemblies should be removed from the machine. This is necessary, since the engine must be running to actuate the torque converter charging pump to provide pressure and oil flow for actuating speed and directional clutches, and to provide lubrication for converter and transmission gears and bearings.

When replacing propeller shaft assemblies, care should be exercised to use only the special heat treated bolts and nuts provided. Attaching bolts should be tightened to 75 ft.-lbs. torque.

OPERATING TRACTOR SHOVEL

The steps below give proper procedure for setting machine into motion. Refer to Operating Controls Diagram, Figure 9.

1. Raise boom and bucket approximately 15" above ground by pulling backward on boom control lever.
2. Place directional shift lever in position for direction of travel desired. When shifting from forward into reverse, or vice versa, always decrease engine rpm, and stop machine momentarily while making the shift.
3. Select high or low speed range for operating machine. Speed range and directional shift levers are so positioned that it is convenient to load in low range forward, and back away from pile in high range reverse by gripping both levers at the same time.

High range should be used when traveling machine for comparatively long distances without a load.

A shift from low range to high range can be made when machine is in motion, by momentarily letting up on accelerator, making the shift, and again depressing accelerator.

When making a downshift, accelerate engine to synchronize engine and drive shaft speeds when transmission clutch re-engages.

4. Select by use of range shift lever the speed range desired — working range for all normal work operations; travel range for moving relatively long distances without load.

The range shift lever should be shifted only when machine is stationary, and with speed range and directional levers in neutral.

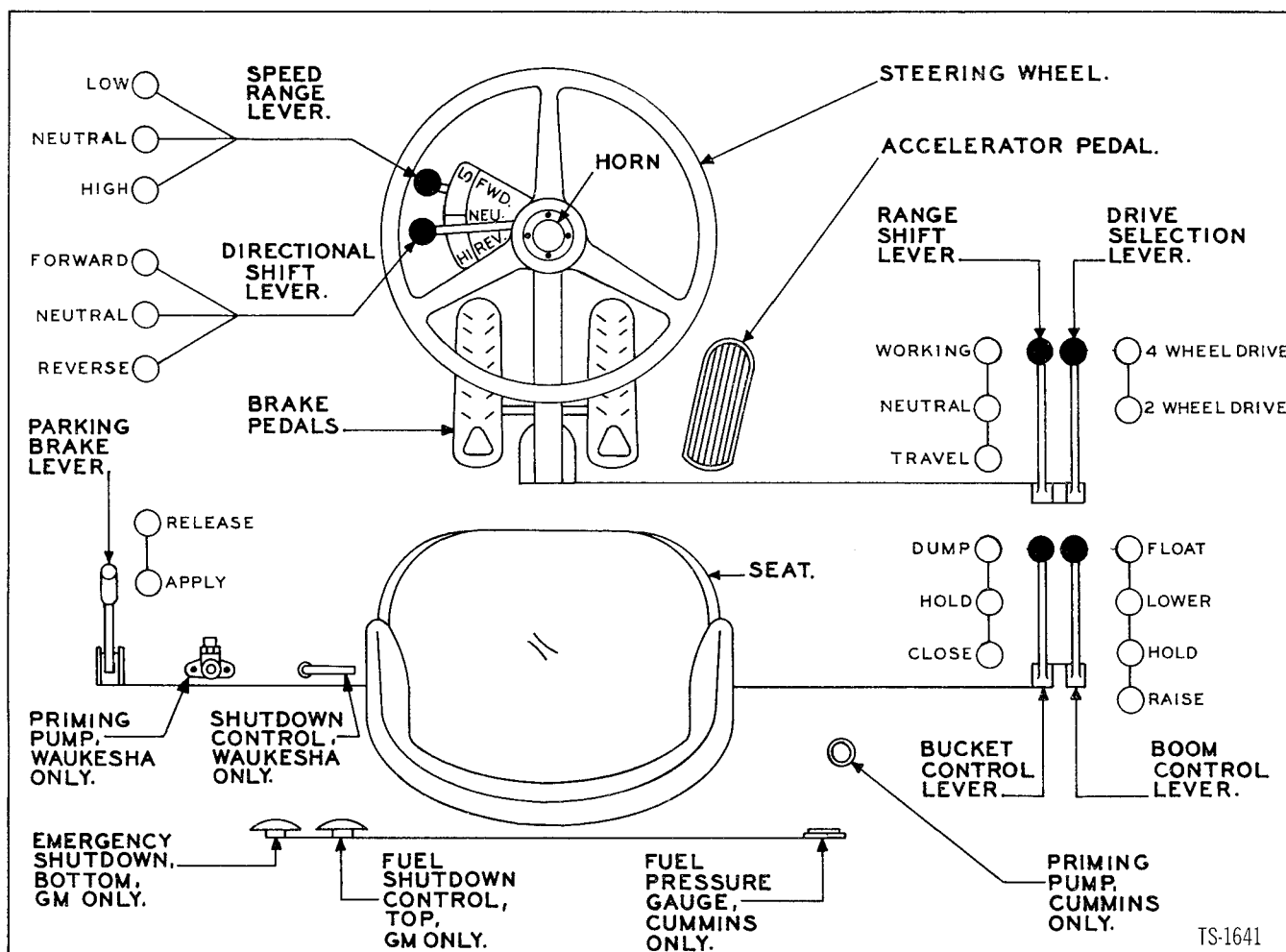


Fig. 9. Operating Controls Diagram

There are available to the operator a selection of four speeds in both forward and reverse directions. This is accomplished by use of range shift lever and speed range lever. In other words a choice of low or high speed is possible in both working range and in travel range.

5. Select two or four wheel drive by use of drive selection lever. Use 4-wheel drive for working conditions, and 2-wheel drive when traveling machine, especially on hard surfaces.
6. Release parking brake.
7. Gradually apply pressure on accelerator pedal until desired travel speed is reached.

LOADING THE BUCKET

Place speed range lever in low and directional lever in forward position. Engage 4-wheel drive

and place range shift lever in working range. With bucket control lever, adjust bucket until pointer on right-hand side of bucket indicates it is in level position.

When loading from a stockpile, drive into pile with cutting edge parallel to the ground, and push cutting edge into pile until bucket is nearly full. Then pull boom control lever back to raise bucket. As bucket raises, pull bucket lever back to tip bucket back against stops. Continue to raise bucket with boom lever until it breaks out of pile. Back out of pile, keeping load low, and deliver load to desired dumping position.

When grading or excavating, bucket should also be adjusted so that pointer indicates it is in level position. Place boom control lever in "Lower" position to force bucket cutting edge down against the ground as machine moves forward.

If cutting edge does not penetrate the ground immediately, use bucket control lever to incline the angle of the cutting edge slightly to give better penetration. When cutting edge penetrates, use bucket control lever to adjust bucket to level position to prevent excessive penetration. The operator may manipulate boom and bucket control levers slightly to maintain a good grade as machine moves forward.

When maintaining a grade, machine should be driven in low gear at about half throttle to make an accurate cut. When bucket is full, or the end of the cut is reached, pull backward on bucket control lever to tip bucket back against the stops, then raise boom so that bucket is approximately 15" off the ground for carrying to dumping position.

TRANSPORTING THE LOAD

When transporting the load, travel speed of machine will depend upon the length of haul, and the kind of surface over which the machine must pass. Rough terrain calls for a fairly slow speed. When bucket is full, it should be carried approximately 15" off the ground. Never transport load with bucket fully raised. The nearer the ground that bucket is held, the better the stability, especially on slopes or when turning machine.

DUMPING THE BUCKET

When dumping into a truck or bin, raise bucket so that it clears the top edge safely. Move machine up so that bucket is inside the dumping area. With boom control lever in the neutral or "Hold" position push forward slowly on bucket control lever, thus causing bucket to tip forward

and spill its load. The load may be dumped entirely or a part at a time by manipulating bucket lever.

Dumping load slowly will ease the shock of suddenly added weight to the truck body. Releasing pressure on bucket control lever will allow it to return to neutral, holding bucket in the dumped position. Pull backward on bucket control lever to return bucket to "level" position before backing machine away from truck or bin, and lower bucket to carrying position (approximately 15" above the ground) before returning machine for another load.

BACKFILLING AND BULLDOZING

The bucket can be removed and replaced with a dozer blade for bulldozing operations. Use the dozer blade to spread material, strip, level, or to backfill ditches and foundations. Again, one of the slower speed ranges is best when working with a dozer blade, since dozing requires more power and slow speed.

The dozer blade pivots at the same points as the bucket, and may be dumped and retracted similarly. This feature will be helpful when working wet clay or other sticky material.

TRAVELING WITHOUT A LOAD IN BUCKET

When driving machine from job to job, shift into two wheel drive and travel range. Shift the speed range lever into high speed range. Use of two wheel drive will minimize tire wear. The bucket should be raised approximately 15" off the ground and tipped back to afford maximum visibility.

LUBRICATION

The importance of proper lubrication cannot be overemphasized. It is the most essential single factor in a well planned preventive maintenance program. Refer to lubrication diagrams to locate the various points to be serviced. Before servicing machine, always wipe dirt and foreign material from grease fittings, clips, plugs, or covers to prevent dirt, grit or foreign material from entering.

The lubrication diagrams are divided into two groups covering: (1) General Chassis Layout and (2) Drive Line—Torque Converter, Transmission, Axles, and connecting Propeller Shafts.

Frequency of servicing chassis is indicated as required every 8 hours, 50 hours, and 500 hours of operation. Frequency of servicing drive line is indicated as required every 8 hours, 50 hours, 500 hours, and 1000 hours of operation.

Be sure machine is setting level when checking various lubricant levels.

SERVICE DAILY (EVERY 8 OPERATING HOURS)

Grease Fittings: Use a good grade chassis grease and lubricate all points indicated on General Chassis Layout lubrication chart.

Engine and Accessories: Refer to Operation and Maintenance Manual of engine manufacturer for lubrication and maintenance instructions of engine and accessories.

Air Cleaner: Service daily or oftener as required. This is important. Under some operating conditions this unit may require cleaning several times each day. To clean, remove cup, scrape out sediment and wash cup in clean kerosene. Refill cup with clean oil to height of oil level mark using same grade oil used in engine crankcase.

Capacity: Cummins Diesel5 qt.

G. M. Diesel5 qt.

Waukesha Diesel2 qt.

Also, see "Service Every 50 Operating Hours."

Hydraulic System Reservoir: Reservoir is located back of operator's seat. With bucket resting on ground and engine shut down, check and maintain oil level to indicated mark on sight glass. Add

oil when necessary using premium quality hydraulic oil with following characteristics.

Viscosity Index90-100

SSU Viscosity at 100°F.....190-210

Pour Point-25°F

With Rust and Oxidation Inhibitors

Oil must Not Foam in Service

See "Service Periodically" for Drain and Refill.

Radiator: Check daily and refill as required with clean, soft water. See "Service Periodically" for Drain and Refill.

Air Reservoir: Each day open drain cock on bottom of reservoir and bleed accumulated condensation.

Torque Converter and Transmission: Check fluid level in transmission daily, when fluid is hot (180°F-200°F) by removing level plug on lower front face of transmission. This check is to be performed with engine shut down.

Refill as necessary to level plug opening in transmission, by adding Type "A" Automatic Transmission Fluid at filler plug in torque converter. See "Service Periodically" for Drain and Refill.

Fuel Tank: Fill tank with clean fuel handled in clean containers. Use a good brand procured from a reliable company. Cummins and G. M. Diesels require fuel with Cetane 40 minimum. Waukesha Diesels use fuel with Cetane 45 minimum. Also see "Service Every 50 Operating Hours."

Batteries: Keep terminals clean and tight, and be sure that distilled water is added to cover plates and separators in each cell.

SERVICE WEEKLY (EVERY 50 OPERATING HOURS)

Grease Fittings: Use a good grade chassis grease and lubricate all points indicated on General Chassis Layout lubrication chart requiring lubrication at 50 hour period.

CLARK[®] EQUIPMENT

LUBRICATION CHART

GENERAL CHASSIS LAYOUT

MICHIGAN

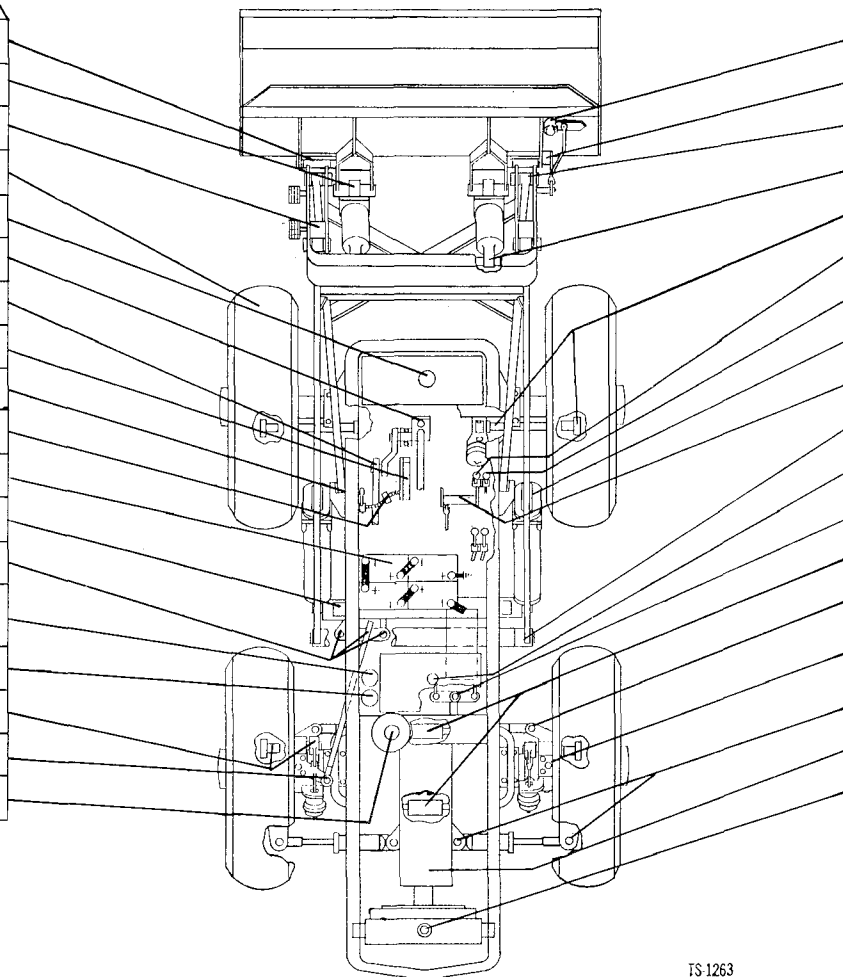
CLARK
EQUIPMENT

CONSTRUCTION MACHINERY DIVISION

MICHIGAN

DESCRIPTION	500 HOURS	8 HOURS	KEY
BUCKET PIVOT SHAFT 1 Fitting Each Side		X	CG
CYLINDER TO BUCKET 1 Fitting Each Side		X	CG
BOOM TO CARRIER 1 Fitting Each Side		X	CG
TIRES — FRONT AND REAR (See Text)	X		
FUEL TANK (See Text)	X	X	
STEERING GEAR (See Text)	X		GL
STEERING DRAG LINK — FRONT 1 Fitting		X	CG
PARKING BRAKE BELL CRANK 1 Fitting		X	CG
GUIDE BAR TO FRAME 1 Fitting Each Side		X	CG
PARKING BRAKE CABLE 1 Fitting		X	CG
BATTERIES (See Text)		X	
CYLINDER TO FRAME 1 Fitting Each Side		X	CG
STEERING BELL CRANK 3 Fittings		X	CG
TRANSMISSION AND TORQUE CONVERTER FILTER (See Text)	X		TA
HYDRAULIC SYSTEM FILTER (See Text)			HO
BRAKE CAMSHAFT 2 Fittings Each Side		X	CG
STEERING DRAG LINK — REAR 1 Fitting		X	CG
AIR CLEANER (See Text)		X	OE

KEY	
CG	CHASSIS GREASE
GL	SAE-90 STRAIGHT MINERAL OIL
TA	TYPE "A" AUTOMATIC TRANSMISSION FLUID
HO	HYDRAULIC OIL
OE	ENGINE OIL



KEY	8 HOURS	50 HOURS	500 HOURS	DESCRIPTION
CG	X			BUCKET INDICATOR 1 Fitting
CG	X			BUCKET INDICATOR CAM 1 Fitting
CG	X			GUIDE BAR TO CARRIER 1 Fitting Each Side
CG	X			CYLINDER TO CARRIER 1 Fitting Each Side
CG	X			BRAKE CAM SHAFT 2 Fittings Each Side
CG	X			RANGE SHIFT LEVER 1 Fitting
CG	X			DRIVE SELECTION LEVER 1 Fitting
CG	X			CYLINDER TO BOOM 1 Fitting Each Side
CG	X			RANGE SHIFT BELL CRANK 1 Fitting
CG	X			BOOM TO FRAME 1 Fitting Each Side
HO	X			HYDRAULIC SYSTEM RESERVOIR (See Text)
CG	X			DRIVE SELECTION LEVER BELL CRANK 1 Fitting
CG	X			AXLE CRADLE BEARINGS 2 Fittings
CG	X			TIE ROD ENDS 1 Fitting Each Side
CG		X		STEERING TRUNNION 1 Fitting Each Side Sparingly with Hand Gun
CG		X		STEERING CYLINDERS 2 Fittings Each Side
	X			ENGINE AND ACCESSORIES (See Text)
	X			RADIATOR (See Text)

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LUBRICATION CHART

DRIVE LINE

FRONT OF MACHINE →

17

	1000 HOURS	500 HOURS	50 HOURS	8 HOURS	KEY							DESCRIPTION
TRANSMISSION AND TORQUE CONVERTER FILL PLUG (See Text)				X	TA							PROPELLER SHAFTS (See Text)
TORQUE CONVERTER HOUSING DRAIN PLUG (See Text)				X	TA							PLANETARY FILL AND DRAIN PLUG (See Text)
PLANETARY FILL AND DRAIN PLUG (See Text)		X		X	EPGL							DIFFERENTIAL FILL AND LEVEL PLUG (See Text)
DIFFERENTIAL FILL AND LEVEL PLUG (See Text)		X		X	EPGL							DIFFERENTIAL DRAIN PLUG (See Text)
PLANETARY LEVEL PLUG (See Text)		X		X	EPGL							TRANSMISSION LEVEL PLUG (See Text)
DIFFERENTIAL DRAIN PLUG (See Text)		X			EPGL							TRANSMISSION DRAIN PLUG (See Text)

KEY	
CG	CHASSIS GREASE
EPGL	SAE-90 EXTREME PRESSURE GEAR LUBE (*SCL TYPE)
TA	TYPE "A" AUTOMATIC TRANSMISSION FLUID

*"SCL" signifies Sulfo-Chloro-Lead Type.
Factory fill is made with SCL type lube and it is recommended that same type be used when adding or refilling.

TS-1197

Engine and Accessories: Refer to Operation and Maintenance Manual of engine manufacturer for lubrication and maintenance instructions of engine and accessories.

Air Cleaner: All air cleaners have removable inner tray screens. On Cummins and G. M. powered machines the tray screens generally will drop with the oil cup. If not, they can be removed by tapping with the heel of the hand. On Waukesha powered machines the tray screen is held in place with wing nuts.

Remove inner tray screens, wash in solvent, dry, and reinstall. Also, see "Service Periodically."

Axle Differentials: Check lubricant level in front and rear axle differentials each 50 hours of operation. Add SAE 90 Extreme Pressure Gear Lube (*SCL Type) until level with filler plug openings. See "Service Periodically" for Drain and Refill.

Rear Drive Steer Axle Planetary Hubs: Filler plug is located on external diameter of hub and drum assembly, and level plug is located slightly off center of thrust cap. Rotate wheel until filler plug is at top center; this will position level plug slightly below center of wheel.

Remove plug and check lubricant level each 50 operating hours. Refill to level of plug opening with SAE 90 Extreme Pressure Gear Lube (*SCL Type). See "Service Periodically" for Drain and Refill.

Steering Gear: Check oil level each 50 operating hours. Keep reservoir filled with SAE 90 Straight Mineral Oil. When adding lubricant, use of hand pump or gun is recommended to force lubricant into housing and up thru bearing, since weight of lubricant alone in filler extension is insufficient to raise level above bearing.

Tires: Check air pressure in all tires each 50 operating hours. See Specifications Section for inflation pressure. Hydro-inflated tires should be checked at more frequent intervals as there is less volume of air to provide cushioning. Be sure valve caps are in place to prevent dirt, moisture, and foreign material from damaging valve core. Keep tires free from oil and grease, and repair cuts immediately to prolong tire life.

Fuel Tank: Each 50 operating hours open drain cock to remove accumulated water and sediment.

**"SCL" signifies Sulfo-Chloro-Lead Type. Factory fill is made with SCL Type lube and it is recommended that same type be used when adding or refilling.*

SERVICE PERIODICALLY

Check and service the following items at intervals as specified.

(EVERY 500 OPERATING HOURS)

Engine and Accessories: Refer to Operation and Maintenance Manual of engine manufacturer for lubrication and maintenance instructions of engine and accessories.

Air Cleaner: Each 500 operating hours while servicing air cleaner, remove rain cap and wash in solvent. Ram a clean cloth thru center tube to remove dirt and oil accumulation.

Propeller Shafts and Universal Joints: There are three propeller shafts — one from torque converter to transmission, one from transmission to front drive axle, and one from transmission to rear drive axle. Each shaft has 3 points of lubrication — one on each spider assembly, and one on slip yoke assembly. Total 9 points. Remove pipe plugs and install grease fittings. Use a hand gun and apply a good grade chassis grease sparingly every 500 hours of operation. Remove grease fittings and reinstall pipe plugs.

Torque Converter and Transmission: Drain and refill torque converter and transmission every 500 operating hours.

Fluid should be drained only when it is hot (180°F- 200°F)

1. Remove drain plugs from both torque converter and transmission housings, and drain thoroughly.
2. Remove transmission sump and screen, clean in solvent, dry, and reinstall, using new gaskets.
3. Replace element in transmission and torque converter filter assembly (filter at front of bracket on left-hand frame side rail). Thoroughly clean filter case and base casting before inserting new element. Using new gasket in base casting, tighten center bolt to 50 ft.-lbs. torque.

4. Remove breather cap and element from top of transmission. Clean parts in solvent, blow dry with compressed air, and reassemble.
5. Refill torque converter and transmission with Type "A" Automatic Transmission Fluid thru filler opening on converter housing until it reaches level plug opening in transmission case. Capacity — approximately 7 gals.
6. Reinstall filler and level plugs, and run engine 2 minutes at idle speed (500-600 rpm) to prime torque converter.
7. At the end of 2 minutes, operate speed range and directional levers in sequence as follows to insure that transmission clutches will be filled; then shut down engine.
 - (a) Forward in High
 - (b) Reverse in High
 - (c) Reverse in Low
 - (d) Forward in Low
 - (e) Both Levers in Neutral
8. Recheck level of fluid in transmission with engine shut down, and add quantity necessary to reach level plug opening in transmission case.
9. Recheck bolts, drain and level plugs, hoses, and filter assembly for leaks, and tighten if necessary. NEVER UNDER ANY CIRCUMSTANCES USE ANY FLUSHING OIL OR COMPOUNDS FOR CLEANING THE SYSTEM.

(EVERY 1000 OPERATING HOURS)

Radiator: Twice a year, drain, flush and refill cooling system. Add permanent type anti-freeze according to manufacturer's instructions when air temperature is 32°F or lower, or when there is danger of water freezing in the system. Always use a hydrometer to check freezing point of solution. Capacity — approximately 40 qt.

Front Drive Axle: Drain differential and wheel hubs every 1000 operating hours. Refill with SAE 90 Extreme Pressure Gear Lube (*SCL Type) until it is level with filler plug openings. Refill thru wheel hub and differential filler openings. Capacity — differential, 12 qts; planetary hubs, 8 qts. each; total 28 qts.

Rear Drive Steer Axle Differential: Drain and refill differential every 1000 operating hours. Refill with SAE 90 Extreme Pressure Gear Lube (*SCL Type) until it is level with filler plug opening. Capacity — 11 qts.

Rear Drive Steer Axle Planetary Hubs: Drain and refill planetary hubs every 1000 operating hours. Position wheel so that filler plug in outer diameter of hub and drum assembly is at top center, and refill with SAE 90 Extreme Pressure Gear Lube (*SCL Type) until level with plug opening in sun gear thrust cap. Capacity — 8 qts. each hub.

**"SCL" signifies Sulfo-Chloro-Lead Type. Factory fill is made with SCL Type lube and it is recommended that same type be used when adding or refilling.*

(EVERY 2000 OPERATING HOURS)

Hydraulic System Reservoir: Drain, clean, and refill hydraulic oil system every 2000 hours of operation, or oftener if required. When operating under severe dusty and dirty conditions, the system should be cleaned and refilled more often to prevent excessive wear or premature failure of valve, pump, or cylinder parts.

Drain and refill system as follows:

1. Always drain system after working machine, and while oil is still warm. Warm oil flows more freely, and carries more dirt and sludge with it.
2. To thoroughly drain cylinders and hoses, raise boom and bucket to full height with bucket dumped. Securely block or chain booms and bucket in raised position; then shut off engine.
3. Remove cover and breather from top of reservoir. Clean breather to permit passage of air.
4. Disconnect control valve to pump hose and drain reservoir.
5. Disconnect boom and bucket cylinder hoses at lowest points to drain cylinders.
6. Remove sight glass and clean all dirt and sludge from bottom of reservoir, being careful not to force dirt into lines, and valve. Remove magnet from bottom of reservoir, clean thoroughly and reinstall.

7. After oil has stopped draining, and dirt and sludge removed, reconnect all hoses and unions.
8. Replace element in steering hydraulic system filter assembly (filter at rear of bracket on left-hand frame side rail). Thoroughly clean filter case and base casting before inserting new element. Using new gasket in base casting, tighten center bolt to 50 ft.-lbs. torque.
9. Refill reservoir nearly to top with clean hydraulic oil. Capacity — approximately 40 gals.
10. Be sure all control levers are in neutral position. Then start engine and let it run at idle speed for a few minutes.
11. Place boom lever in raise position to pump oil into boom hoists. Then remove blocks or chains holding boom and bucket. Do not stand or work under boom or bucket after removing block or chains.
12. Operate unit by raising, lowering, dumping, and closing the bucket until oil ceases to foam.
This will "bleed" the system, forcing trapped air to escape through reservoir breather.
13. After oil has ceased to aerate, add oil to reservoir to bring it to level mark in sight glass. This is necessary to replace oil drawn into cylinders and hoses.
14. Check all connections for leaks. Be sure reservoir cap is in place. **NEVER UNDER ANY CIRCUMSTANCES USE ANY FLUSHING OIL OR COMPOUNDS FOR CLEANSING HYDRAULIC SYSTEM.**

NOTES

ADJUSTMENTS

The information that follows is limited only to those items that fall within the daily duties of the operator to keep his machine in good operating condition.

Quick attention to minor irregularities will prevent progressive damage that could possibly lead to malfunction and shut down of the machine for major repair.

Inspection, lubrication, attention to service points, and minor adjustments should be practiced regularly. They will maintain efficient operating characteristics, and insure safe and profitable operation of the machine.

Adjustments must be performed with engine shut down, boom and bucket on the ground, and all levers in their neutral position.

BOOM AND BUCKET CONTROL LEVERS

The control levers are properly set at the factory. An adjustment is provided by a clevis connected to levers behind floorboard to permit changing angle of levers if desired and to insure that spools shift into all positions.

With engine shut down, and bucket on the ground, place lever in "HOLD" or neutral position. The adjustment can be made as follows. See Figure 10.

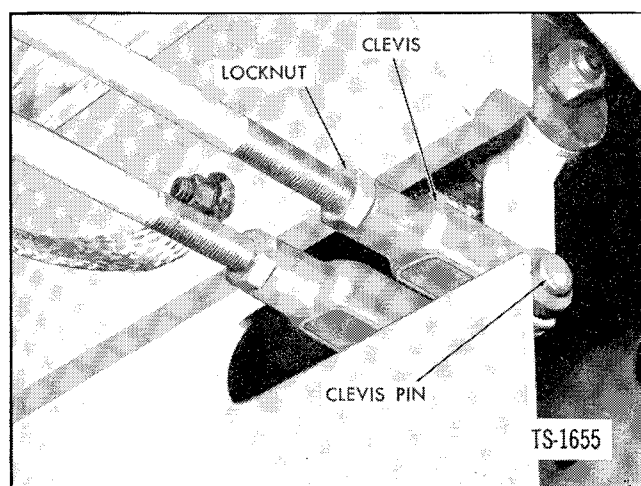


Fig. 10. Adjust Boom and Bucket Control Levers

1. Loosen locknut on control rod.
2. Remove cotter and clevis pin.
3. Turn clevis clockwise to move lever away from operator; counter-clockwise to move lever toward operator.
4. When lever is set where desired, attach clevis with pin and cotter and tighten locknut securely.
5. Check that levers shift into all positions without interference.

BUCKET INDICATOR

An adjustment is provided on indicator rod to maintain alignment between pointer and arrow point on bucket. Pointer should be horizontal when bucket is level.

Remove cotter and clevis pin. Loosen locknut and turn clevis so that pointer is properly aligned when viewed from operator's seat. See Figure 11. Set locknut, and install clevis pin and cotter.

BRAKE SLACK ADJUSTER

Slack adjusters are used between brake chambers and brake camshafts at all wheels. Slack adjusters permit a rotation of the camshaft from its original position sufficient to compensate for wear of brake linings. See Figure 12. The adjustment is as follows:

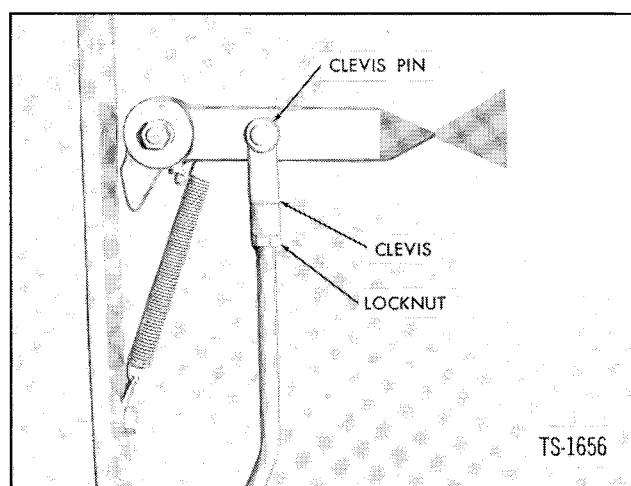


Fig. 11. Adjust Bucket Indicator

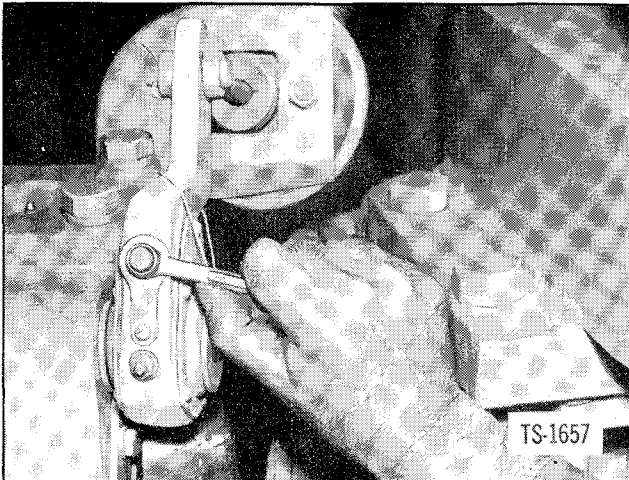


Fig. 12. Adjust Brake Slack Adjuster

1. Turn adjusting screw to change position of lever in relation to brake camshaft. Turning screw clockwise will decrease clearance between brake and shoe and drum. If adjusting screw is difficult to turn, remove Allen head pipe plug, insert grease fitting, and lubricate adjuster with chassis grease.
2. With maximum air pressure and with brakes fully activated and applied, adjust at slack adjuster to obtain 1" of travel on brake chamber push rod when brakes are released. Refer to Figure 13.

DIRECTIONAL AND SPEED RANGE SHIFT LEVERS

Check and adjust directional and speed range shift levers to insure full engagement into all detent positions without interference.

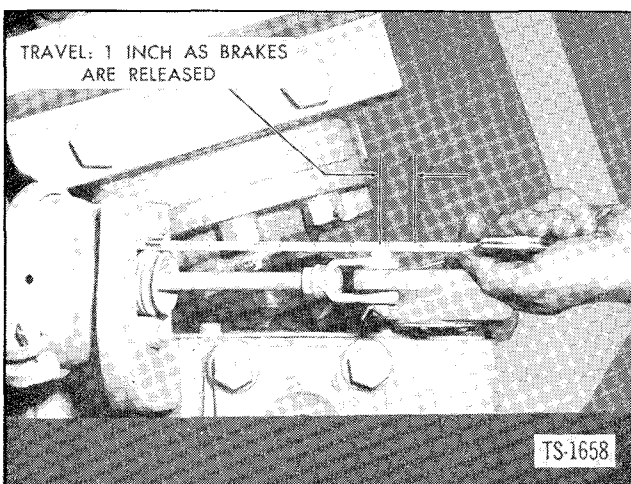


Fig. 13. Measure Brake Chamber Push Rod Travel

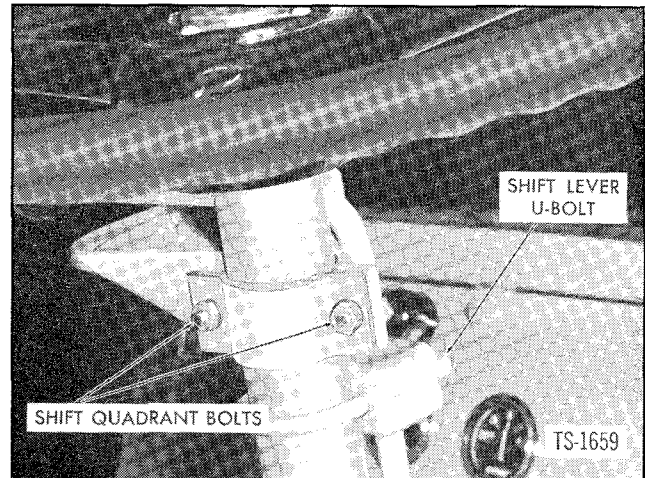


Fig. 14. Tighten Shift Quadrant and Shift Lever Mounting Bolts

Levers should be positioned at approximately right angles to steering column, and in line with one another so that it is convenient to shift by gripping both levers at the same time. Levers line up with markings on shift quadrant only when in neutral position.

1. Check and tighten shift quadrant mounting bolts.
2. Check and tighten U-bolts holding shift lever support plates to steering column. See Figure 14. These bolts should be snug. If too tight, levers will bind in support plate grommets. Support plates are keyed into steering column which prevents their rotation.
3. Place speed range and directional levers in neutral.

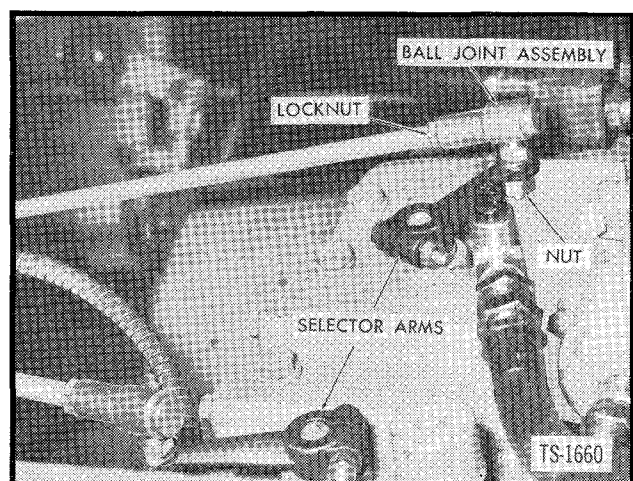
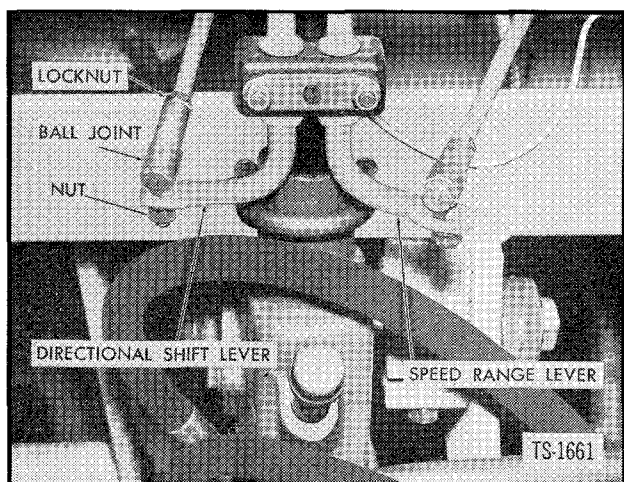


Fig. 15. Adjust Directional or Speed Range Levers (Transmission)



**Fig. 16. Adjust Directional or Speed Range Levers
(Steering Column)**

4. Loosen locknut on shift rod, and remove nut and lockwasher securing ball joint assembly to selector arm. See Figure 15.
5. Turn ball joint assembly, then check alignment in operator's compartment. If sufficient adjustment is not available, turn ball joint at opposite end of shift rod as shown in Figure 16.
6. Reassemble and tighten locknuts.
7. Check that levers will shift into all detent positions without interference from steering column and transmission control cover.

DRIVE SELECTION LEVER

Drive selection lever shifts machine into two or four wheel drive. If lever strikes opening in floor-board in either front or rear positions before engagement, make following adjustment at shift box assembly on rear of transmission to properly center lever. See Figure 17.

1. Loosen locknut on shift rod at clevis.
2. Remove cotter and clevis pin.
3. Turn clevis on rod to correct condition.
4. Reassemble and tighten locknut securely.
5. Recheck adjustment by shifting into both two and four wheel drive, being sure full engagement is secured.

ENGINE AND ACCESSORIES

Refer to Operation and Maintenance Manual of engine manufacturer for maintenance instructions of engine and accessories.

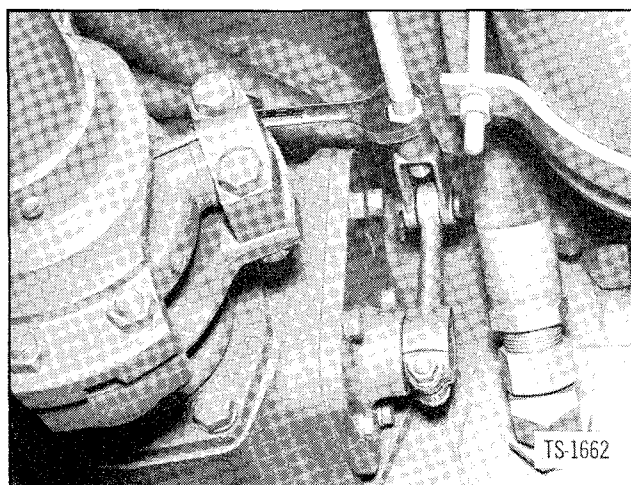


Fig. 17. Adjust Drive Selection Lever

FUSES AND RESET BUTTON

Two fuses provide protection for the electrical system, one in gauge circuit, the other in light circuit.

Fuses are contained in plastic connectors behind instrument panel at right-hand end as shown in Figure 18. Remove four bolts holding panel to front shroud, and pull panel back toward operator. Push and twist to open and lock connectors.

The circuits and fuse protection are:

GAUGE CIRCUIT — SFE 4 AMP

LIGHT CIRCUIT — SFE 14 AMP

A red reset button (Cummins Diesel Only) on the front of the instrument panel controls the glow plug circuit. Push switch to close circuit if glow plug indicator light or glow plug fails to operate.

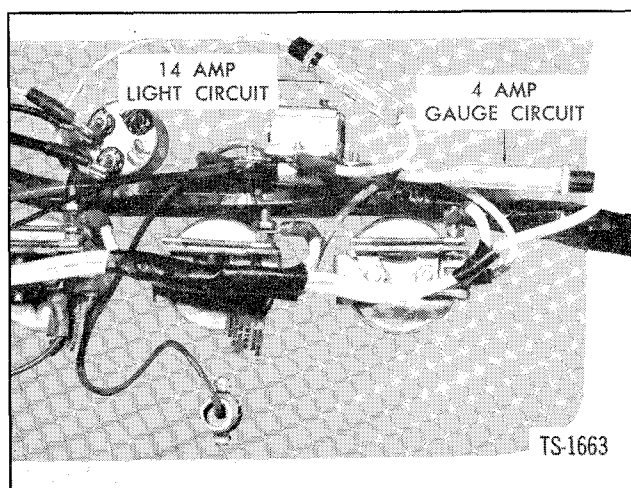


Fig. 18. Replace Fuses

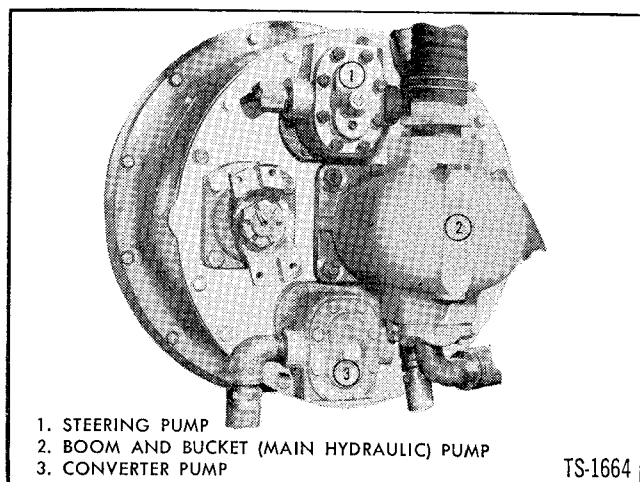


Fig. 19. Hydraulic Pumps on Torque Converter

HYDRAULIC SYSTEM PRESSURES

Three separate hydraulic systems: (1) main hydraulic, (2) steering, (3) transmission and torque converter, control the operation of this machine. Each of these three systems has its own pump and pressure relief valve, and two of the systems (1) main hydraulic, (2) steering, draw oil from a common reservoir.

All pumps are mounted on the rear of the torque converter housing. They are identified in Figure 19.

The pumps are coupled to the drive line, and operate as soon as the engine is started. They draw oil or fluid from the reservoirs, and force it under pressure into the bucket and boom control valve (main hydraulic), steering pressure relief valve, and pressure regulator valve assembly.

Maintenance consists of periodic checking of pressures in all three systems.

Bucket and Boom Control Valve (Main Hydraulic)

1. Use a hydraulic pressure gauge of at least 3000 psi capacity. With engine shut down, move boom control lever into raise position to prevent hydraulic oil draining while attaching gauge.
2. Remove pipe plug at bottom of control valve, and attach gauge as shown in Figure 20.
3. Start engine, and raise boom to its extreme height. When cylinder reaches the end of its stroke, take a pressure gauge reading which

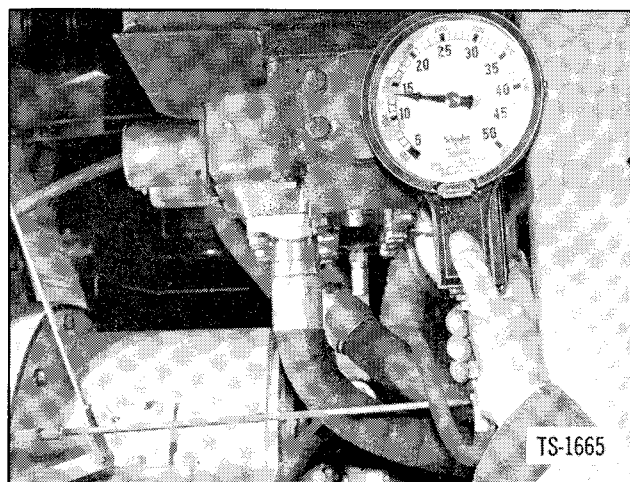


Fig. 20. Pressure Reading — Boom and Bucket (Main Hydraulic) Valve

should be 1350 psi at 1200 rpm. If reading is not as specified, shut down engine and adjust valve.

4. Remove acorn nut on end of adjusting screw, and loosen locknut. Insert screwdriver and turn screw clockwise to increase pressure, counterclockwise to decrease pressure. See Figure 21. Turn screw in increments of approximately one revolution or less, set locknut, and retake reading. Repeat until gauge reads 1350 psi.
5. Shut down engine, set locknut, and replace acorn nut. Lower boom and bucket, remove gauge line from valve, and reinstall plug.

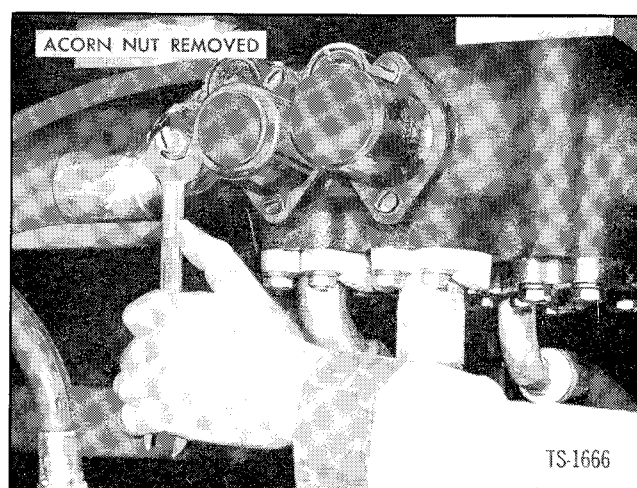


Fig. 21. Adjust Pressure — Boom and Bucket (Main Hydraulic) Valve

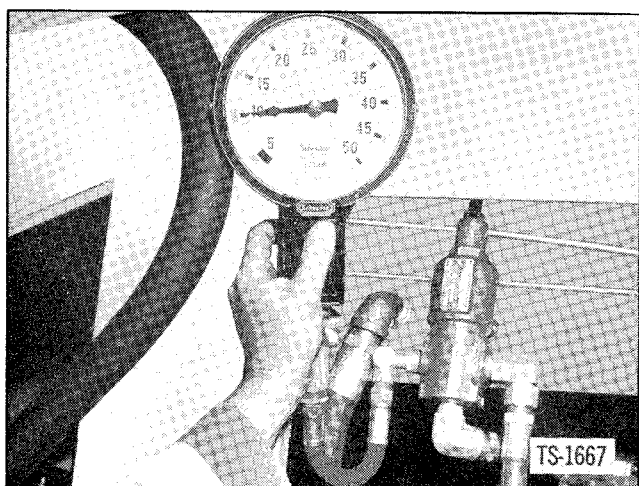


Fig. 22. Pressure Reading — Steering Relief Valve

Steering Pressure Relief Valve

The steering relief valve is mounted on side of hydraulic reservoir at left-hand side of machine.

1. Use a pressure gauge of at least 3000 psi capacity. Shut down engine, and remove plug on relief valve. Connect gauge line as shown in Figure 22.
2. Start engine and accelerate to 1200 rpm.
3. Turn wheels right or left and hold against STOP position. Take reading on gauge, which should be 1000 psi.
4. Remove acorn nut on top of valve, and loosen locknut. Insert screwdriver and turn screw clockwise to increase pressure, counterclockwise to decrease pressure. See Figure 23. Turn screw in increments of approximately one revolution or less, set locknut, and retake reading. Repeat until gauge reads 1000 psi.
5. Shut down engine, set locknut, and replace acorn nut. Remove gauge line from valve, and replace plug.

Transmission and Torque Converter

Periodically or whenever machine evidences improper operation in any one of the four speed ranges in Forward or Reverse direction, a check of the clutch operating pressures should be made.

Using a gauge of at least 350 lbs. capacity, check should be made on transmission control cover by removing $\frac{1}{4}$ " pipe plug and inserting gauge as shown in Figure 24.

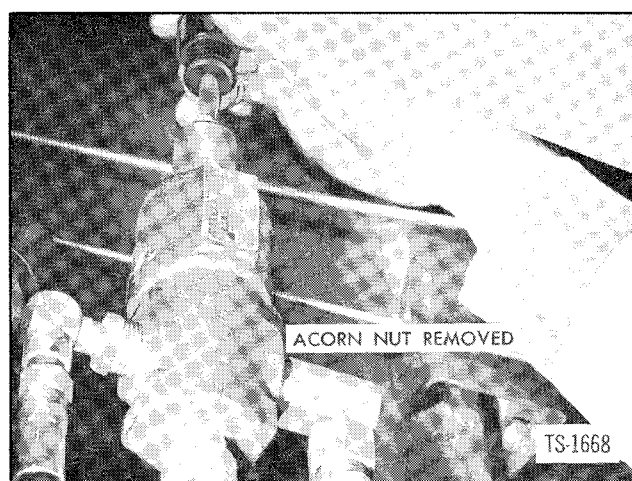


Fig. 23. Adjust Pressure — Steering Relief Valve

Pressure check should be taken with oil temperature of at least 180°F to 200°F. Wheels of machine should be securely blocked and parking brake applied. Pressure check should be made in high and low speed ranges in both forward and reverse direction. With engine operating at 500 rpm, pressure reading should be 160 to 200 psi. If pressure is not as specified, further trouble shooting of torque converter and transmission by a qualified mechanic will be required.

MISCELLANEOUS CHECKS AND ADJUSTMENTS

Periodically check for evidence of external leakage of engine oil, fuel, water, transmission fluid, hydraulic oil, and axle lubricant. Also check for looseness of sheet metal, hanger straps, brackets, mounting bolts, bell cranks, and clevises.

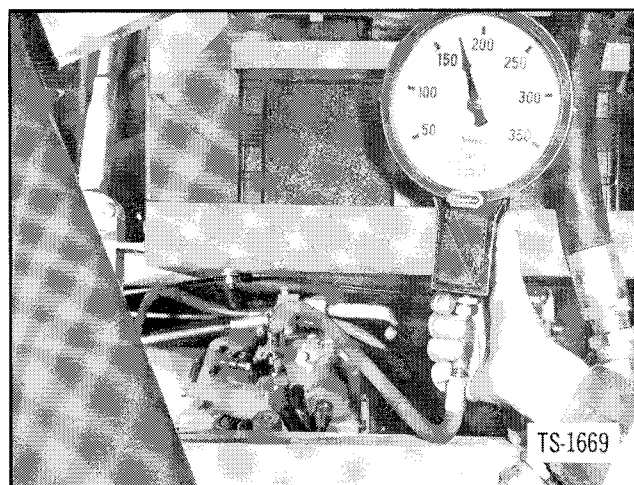


Fig. 24. Pressure Reading — Oil to Transmission

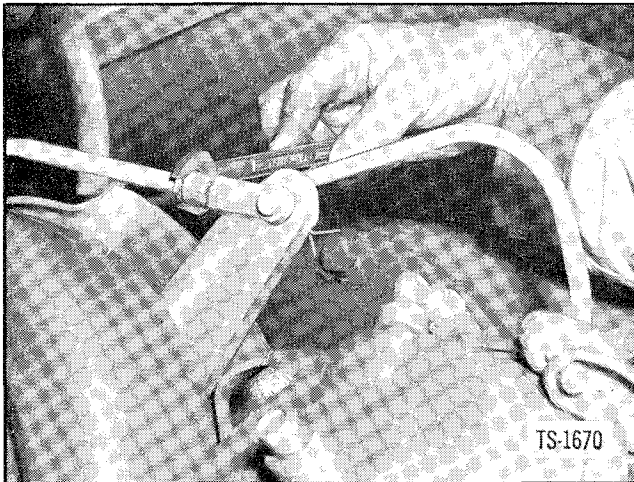


Fig. 25. Adjust Parking Brake Rod

Tighten hose clamps, fittings, fill plugs, drain plugs, loose nuts, bolts or screws, with particular attention to axle mounting bolts, transmission mounting bolts, and tie rod and linkage ball stud nuts.

PARKING BRAKE

When slack develops in the parking brake linkage, perform the following adjustments.

1. With lever in released position turn acorn on end of handle clockwise.
2. Test for good resistance over center as handle is pulled up to applied position.

Further adjustment is provided by clevises at the bell crank and brake arm. See Figures 25 and 26. First be sure that acorn on lever is backed off, so that all slack can be taken up at the clevises. Brake lever should be in released position.

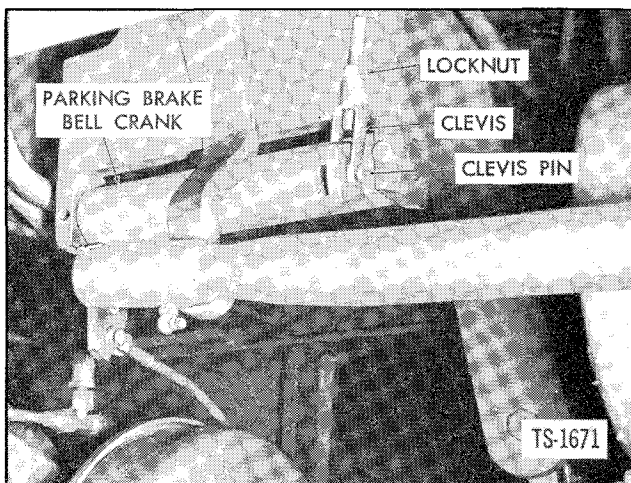


Fig. 26. Adjust Parking Brake Cable

1. Loosen locknut on brake rod.
2. Remove cotter and clevis pin.
3. Turn clevis clockwise to tighten brake.
4. Reassemble and tighten locknut.
5. Test brake for proper application.
6. If sufficient adjustment is not available at brake rod clevis, take up additional slack on brake cable clevis at bell crank.

RANGE SHIFT LEVER

Range shift lever engages transmission working range or travel range. If lever strikes opening in floorboard before engagement, or if it is desired to change angle of lever to provide additional space between lever knobs for greater ease in shifting, perform following adjustment:

1. Loosen locknut on shift shaft at bell crank assembly just forward of transmission on right-hand side of machine. See Figure 27.
2. Remove cotter and clevis pin.
3. Turn clevis on shaft to desired position.
4. Reassemble and tighten locknut securely.
5. Recheck adjustment by shifting into both working and travel ranges, being sure full engagement is secured.

SEAT ADJUSTMENT

The operator's seat can be shifted forward or rearward to suit the individual. Move lever forward on left-hand side of seat, and shift seat to desired position. See Figure 28.

Tilt seat over steering wheel when shutting down machine at end of work shift.

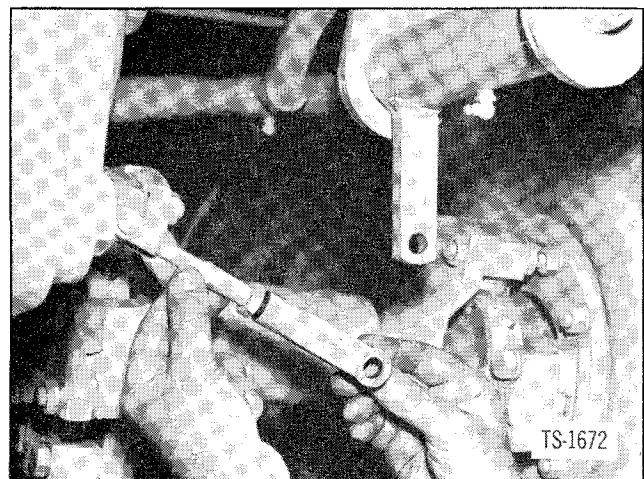


Fig. 27. Adjust Range Shift Lever

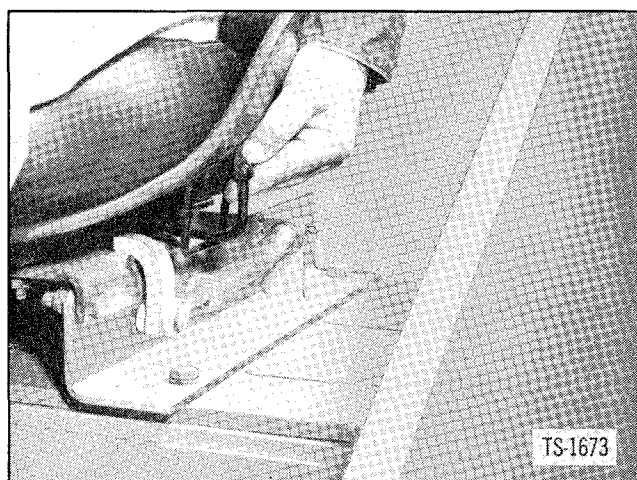


Fig. 28. Adjust Seat

SHUT-OFF CONTROLS

A Cummins Diesel can be shut down completely by turning ignition switch OFF which de-energizes electric solenoid valve. When valve closes, it cuts off fuel supply leaving the pump.

G. M. and Waukesha Diesels have manual controls which must be operated in addition to turning ignition switch. These controls also close off fuel supply to shut down engine. On G. M. Diesels, an emergency control shuts off air supply to the blower assembly.

All controls must operate freely to shut down engine.

G. M. Diesel (Fuel Shut-Off)

1. Start engine; then pull top T-handle to shut down engine.

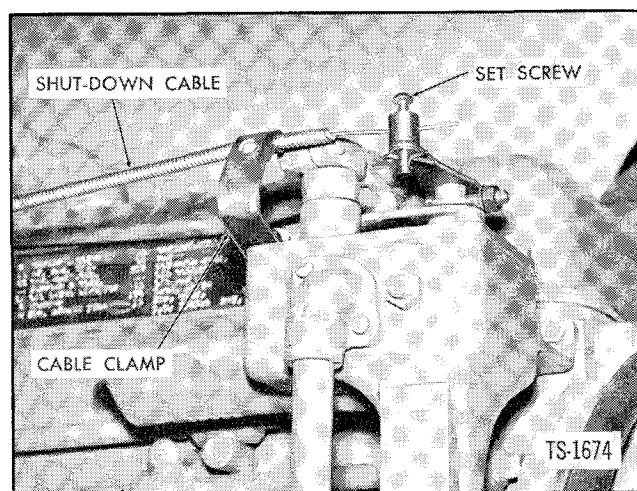


Fig. 29. Adjust Fuel Shut-Off Control (G.M. Diesel)

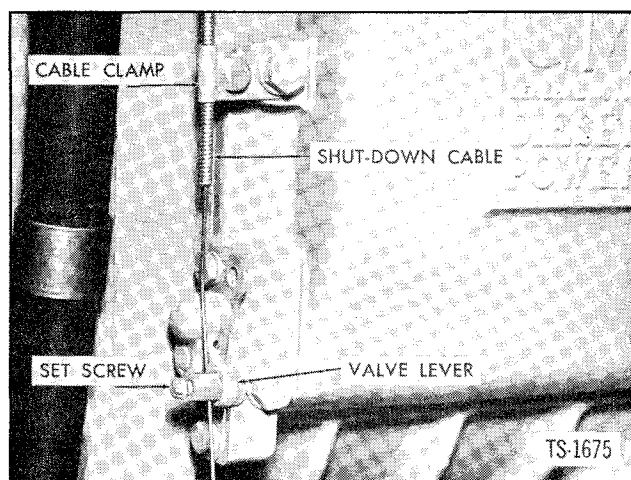


Fig. 30. Adjust Emergency Shut-Off Control (G.M. Diesel)

2. If cable binds, eliminate kinks or free with penetrating oil. Remove excess oil to prevent dirt accumulation.
3. Check that cable rotates governor cover cam sufficiently to allow pin on throttle lever to slide back beyond idle notch into the fuel shut-off area.
4. Adjust cable length if necessary at clamp or at lever. See Figure 29.
5. Recheck operation of shut-off control.

G. M. Diesel (Emergency Shut-Off)

1. Start engine; then pull bottom T-handle to shut down engine.
2. If cable binds, eliminate kinks or free with penetrating oil. Remove excess oil to prevent dirt accumulation.
3. Check that cable completely closes valve in blower assembly.
4. Adjust cable length if necessary at clamp or at lever. See Figure 30.
5. Recheck operation of emergency shut-off control.

Waukesha Diesel

Shut-off lever on side of pump rotates metering valve from no-fuel to full-fuel positions. The amount of fuel passing through the metering valve determines the torque characteristic of the engine, and when this has been properly adjusted, the screws are lock-wired. The fuel then becomes subject to control by operation of throttle valve

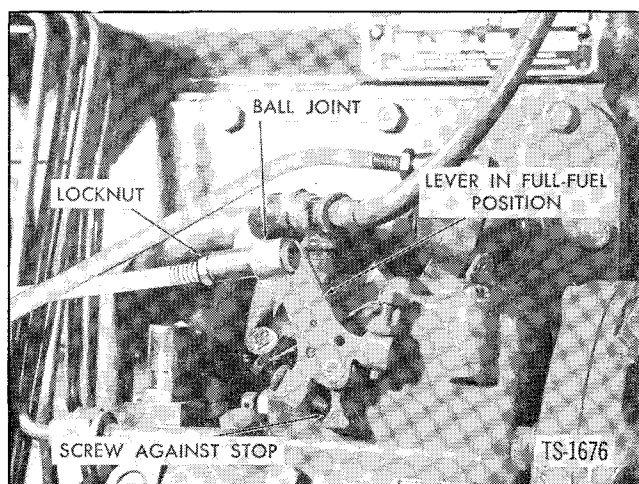


Fig. 31. Adjust Fuel Shut-Off Control (Waukesha Diesel)

from idle to no-load governed speed. **DO NOT CLIP LOCKWIRES AND ADJUST FUEL RATE EXCEPT WHEN ON FUEL PUMP TEST STAND.**

Adjust fuel shut-off control as follows:

1. Disconnect ball joint from shut-off lever.
2. Rotate lever to full-fuel position (screw against stop) as shown in Figure 31.
3. Adjust ball joint so that screw contacts stop just before control lever in operator's compartment returns to normal position.
4. Start engine; then check that engine shuts down.

STEERING DRAG LINK

Adjust front and rear ball joints on both drag links whenever excess looseness develops. This condition will be indicated by an increase of free play at steering wheel before wheels respond to turning action.

Remove cotter and turn slotted adjusting plug to remove all slack in ball joints at each end of drag links as shown in Figure 32.

THROTTLE LINKAGE

Linkage should be checked to insure wide open throttle when accelerator is fully depressed, also closed throttle when accelerator is fully released. Accelerator should operate freely in all positions.

Occasionally control rods, control levers, or bell cranks become loose or damaged and impair the operating efficiency of the engine. Low power fre-

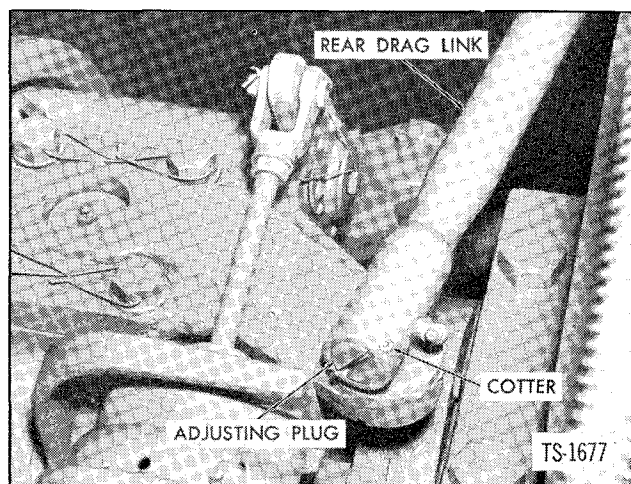


Fig. 32. Adjust Steering Drag Link

quently is caused by throttle linkage not being in proper adjustment.

Perform check at fuel pump on Cummins and Waukesha Diesels, at governor control on G. M. Diesels.

Fuel controls are accurately calibrated at the factory to insure correct idle and no-load governed speeds. **DO NOT ADJUST CUMMINS OR ROOSA MASTER (WAUKESHA DIESEL) FUEL PUMPS, OR GOVERNOR ASSEMBLY ON G. M. DIESELS WITHOUT CONSULTING OPERATION AND MAINTENANCE MANUAL OF ENGINE MANUFACTURER.**

The adjustments that follow are for linkage between accelerator and throttle lever on Cummins and Waukesha Diesels, and between accelerator and throttle cross-shaft on G. M. Diesels.

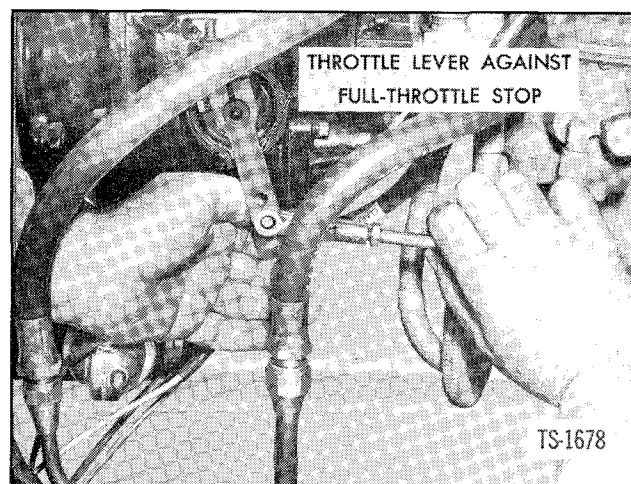


Fig. 33. Adjust Throttle Linkage (Cummins Diesel)

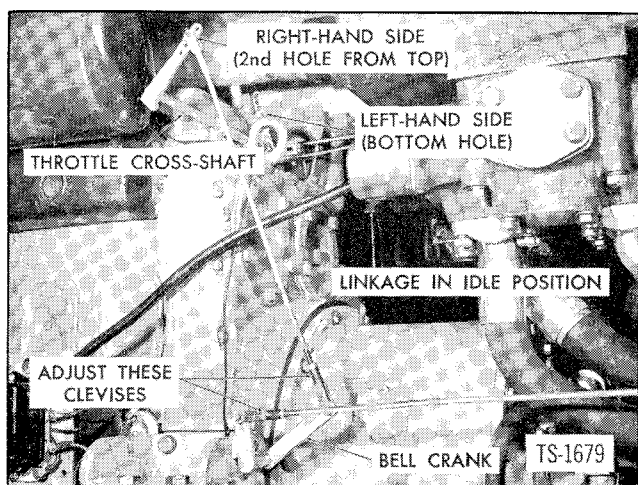


Fig. 34. Throttle Linkage and Cross-Shaft (G.M. Diesel)

Cummins Diesel

1. Disconnect clevis from throttle lever on fuel pump, and rotate lever to full throttle position as shown in Figure 33.
2. Depress accelerator until it contacts stop on floorboard.
3. Adjust clevis so that throttle lever is against stop just before accelerator bottoms.
4. Release accelerator, and check that linkage will return throttle lever to idle position.
5. If sufficient adjustment is not available at rear clevis, turn clevis beneath accelerator pedal.

G. M. Diesel

First check that linkage is connected to proper holes in throttle cross-shaft levers as shown in Figure 34. On left-hand side of the machine, this is the bottom hole, and on right-hand side of machine, it is the second hole from the top.

Linkage adjustment must be performed at bell crank clevises on right-hand side of machine.

1. Disconnect outside clevis from bell crank on right-hand side of machine.
2. Advance cross-shaft to full fuel position. Check that pin on throttle lever is at nose section of governor cover cam. See Figure 35.
3. Depress accelerator until it contacts stop on floorboard.

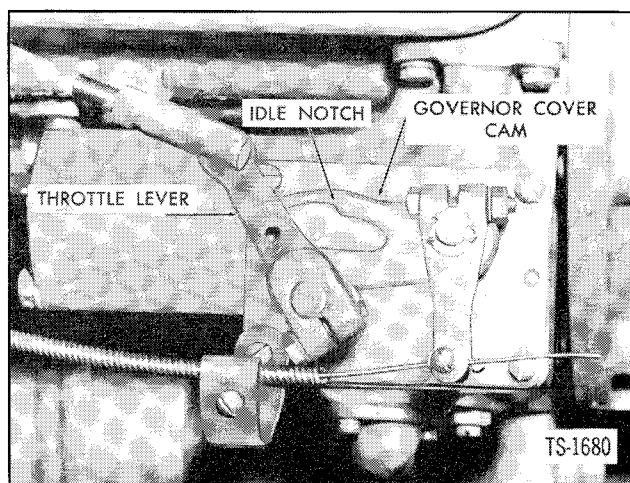


Fig. 35. Full Fuel Position (G.M. Diesel)

4. Adjust clevis so that pin on throttle lever contacts nose of cam just before accelerator bottoms.
5. Release accelerator, and check that linkage returns throttle lever to idle notch in governor cover cam as shown in Figure 36.
6. If sufficient adjustment is not available, adjust inside clevis at bell crank.

Waukesha Diesel

1. Disconnect control rod ball joint from throttle lever. Refer to Figure 37.
2. Rotate lever to full throttle position.
3. Depress accelerator until it contacts stop on floorboard.

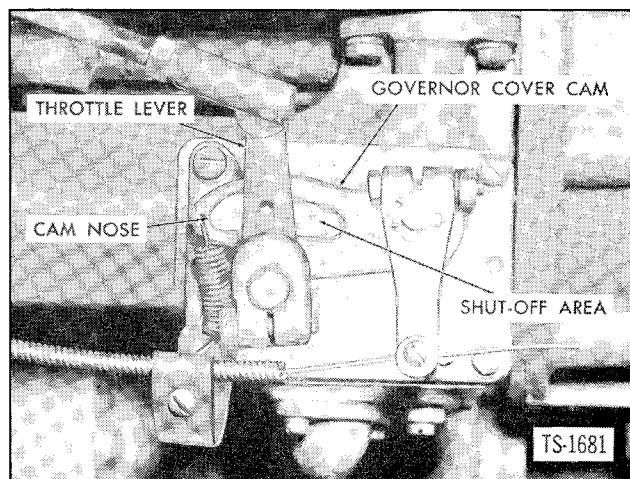


Fig. 36. Idle Position (G.M. Diesel)

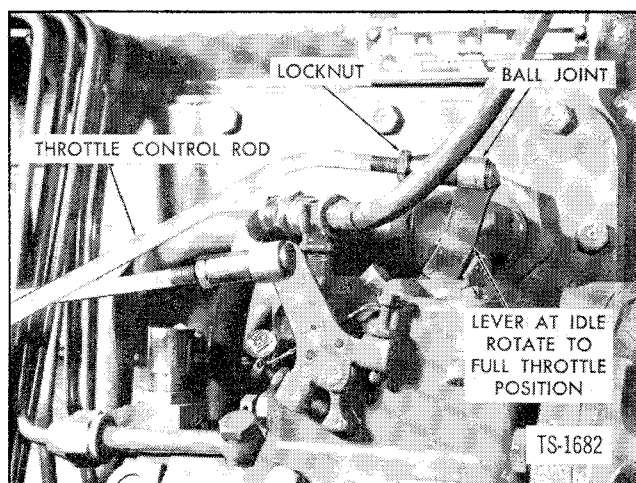


Fig. 37. Adjust Throttle Linkage (Waukesha Diesel)

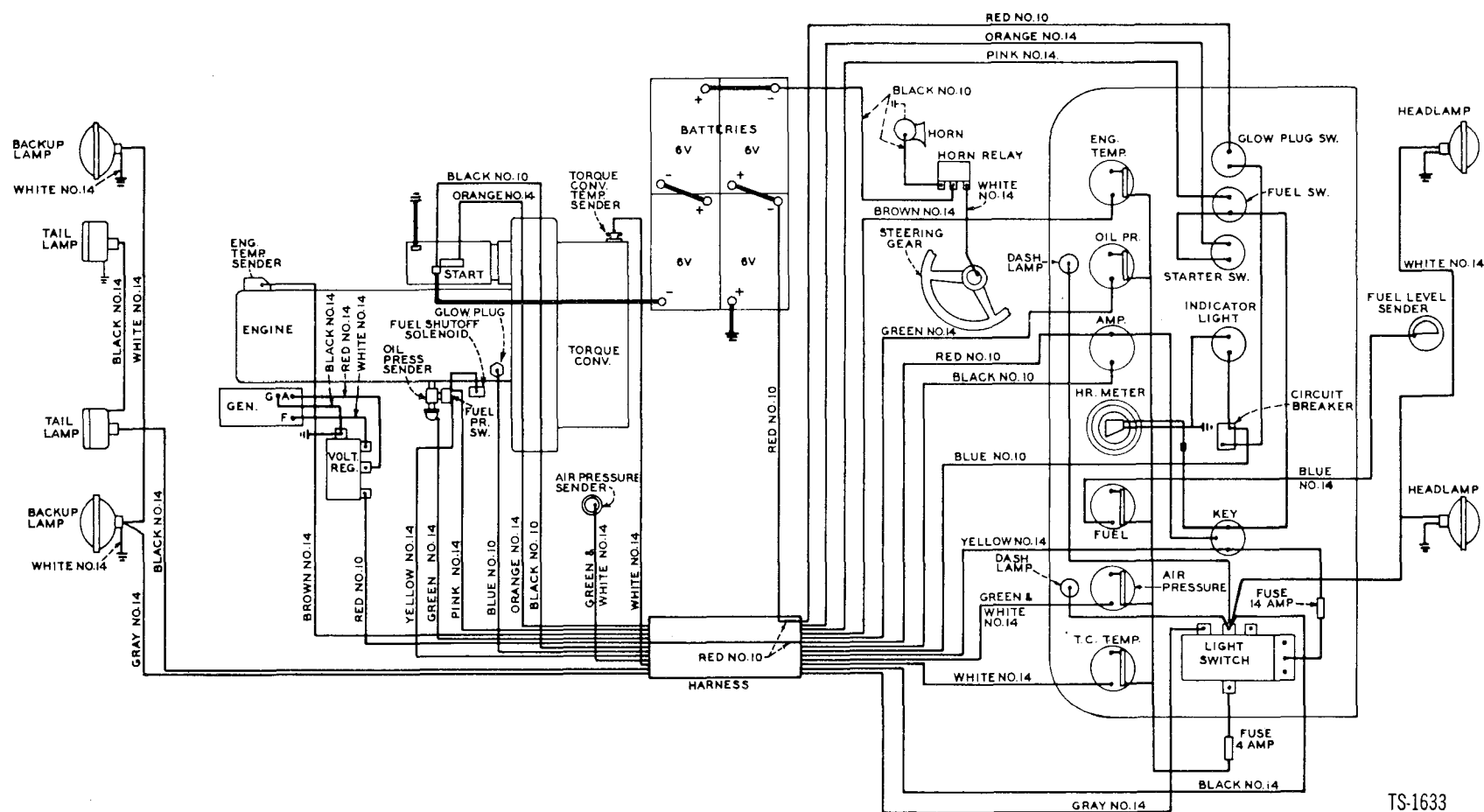
4. Adjust ball joint so that throttle lever is against stop just before accelerator bottoms.
5. Release accelerator, and check that linkage returns throttle lever to idle position.
6. If sufficient adjustment is not available at rear clevis, turn clevis beneath accelerator.

WHEEL NUTS

Wheel nuts should be checked regularly and kept tight. Loose wheel nuts will cause undue tire wear, strain axle assemblies, and affect steering and load distribution. Tighten to 450 to 475 ft.-lbs. torque dry thread.

NOTES

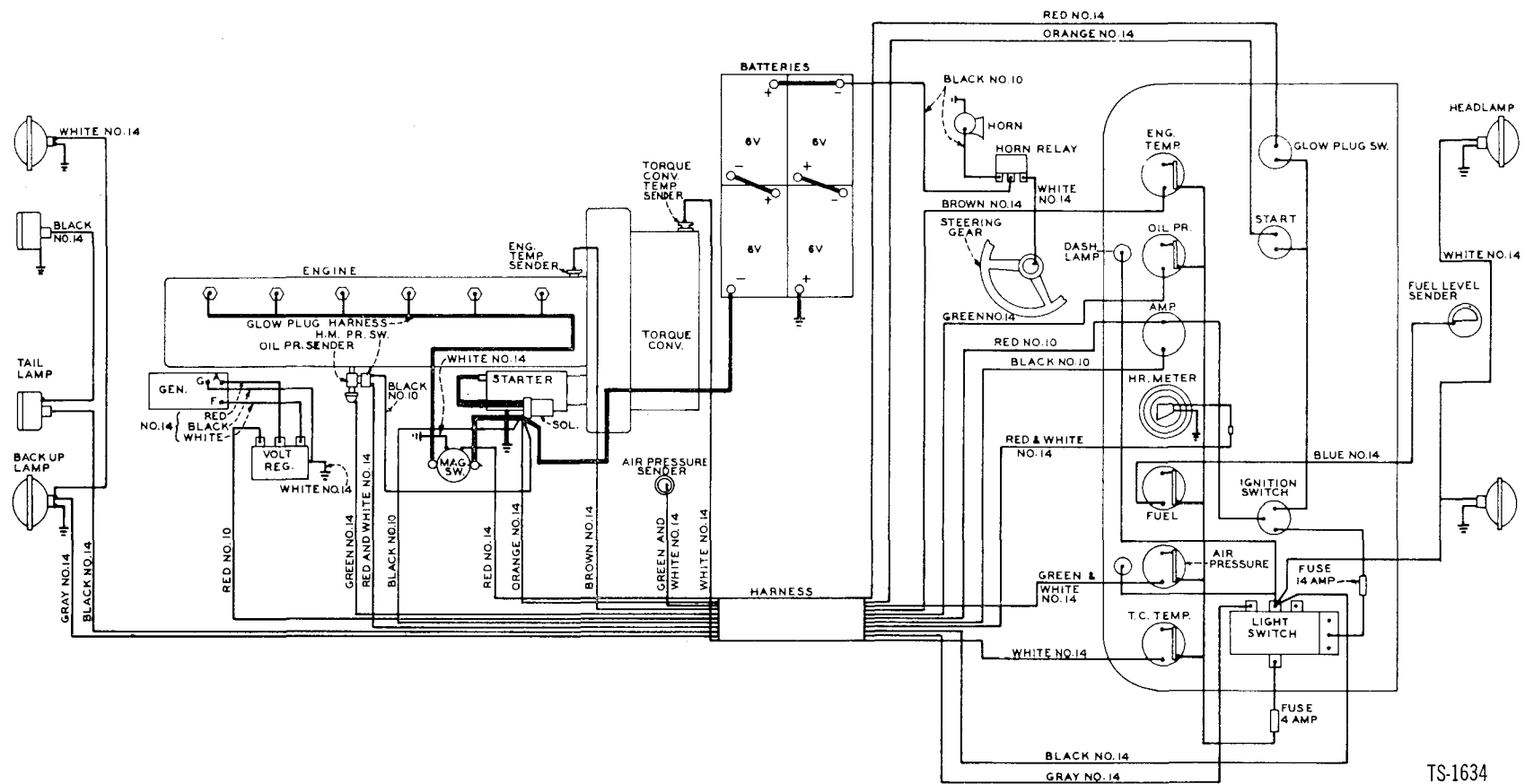
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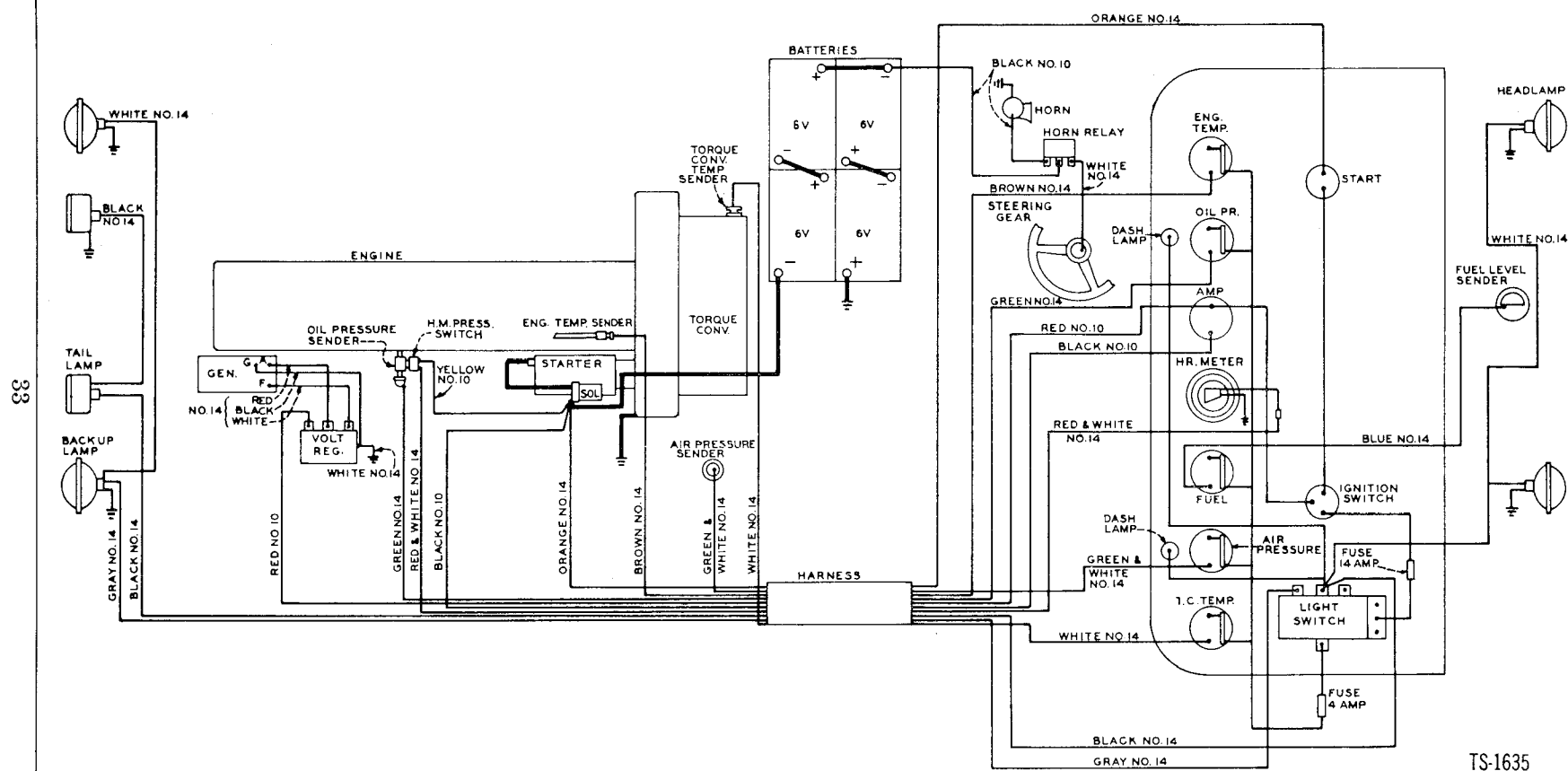
Wiring Diagram (Cummins Diesel)

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TS-1634

Wiring Diagram (Waukesha Diesel)



Wiring Diagram (G.M. Diesel)

SPECIFICATIONS AND SERVICE DATA

ENGINE

	DIESEL	DIESEL	DIESEL TURBOCHARGED
Make	Waukesha	GM	Cummins
Model	135-DKB	4-71	JT
Max. horsepower	133	147	162
Governed RPM	2200	2200	2200
Maximum torque	326 @ 1700	366 @ 1600	407 @ 1750
Bore and stroke	4 1/4" x 5"	4 1/4" x 5"	4 1/8" x 5"
No. of cylinders	6	4	6
Disp., cu inches	426	283.7	401

POWER TRAIN

TORQUE CONVERTER: Clark Industrial type 3.0 to 1 multiplication factor.

TRANSMISSION: Clark Power-shifted, four speed, full reversing type with selector for two or four wheel drive.

AXLES: Clark all wheel drive, rear wheel steer. Spiral bevel ring gear and pinion with planetary reduction in wheels.

TRAVEL SPEEDS:	1st	2nd	3rd	4th
Forward, MPH	0-4	0-8	0-13.5	0-27
Reverse, MPH	0-4	0-8	0-13.5	0-27

HYDRAULIC SYSTEM

BOOM CYLINDERS: Two, double acting, 7" dia. Chromium plated piston rods. Chevron ring packing.

BUCKET CYLINDERS: Two, double acting, 7" dia. Chromium plated piston rods. Chevron ring packing.

BOOM AND BUCKET (MAIN HYDRAULIC) PUMP: Gear type-driven from flywheel by splined P.T.O. shaft thru the torque converter. Flange mounted on converter. Capacity — 84 GPM at governed engine speed.

BOOM AND BUCKET (MAIN HYDRAULIC) CONTROL VALVE: Two spool type with built-in adjustable relief valve. Pressure — 1350 psi @ 1200 rpm.

STEERING PUMP: Gear type-driven from flywheel by splined P.T.O. shaft thru the torque converter. Flange mounted on converter. Capacity — 17 GPM at governed engine speed.

STEERING RELIEF VALVE: Single spool type, adjustable. Pressure — 1000 psi @ 1200 rpm.

CONVERTER CHARGING PUMP: Gear type-driven from flywheel by splined P.T.O. shaft thru the torque converter. Flange mounted on converter. Capacity — 17 GPM at governed engine speed.

PRESSURE REGULATOR VALVE ASSEMBLY: Single spool type, non-adjustable, mounted on back cover of converter. Regulates transmission clutch pressure. Pressure — 160-200 psi @ 500 rpm, oil temperature 180°F-200°F.

RESERVOIR: Electric welded with baffles and hand hole for cleaning.

BRAKES

SERVICE: Four wheel air.

PARKING: Mechanical on prop shaft.

WEIGHT

	WAUKESHA DIESEL	GM DIESEL	CUMMINS DIESEL
Total	28,608 lbs.	28,972 lbs.	28,827 lbs.

BUCKET

Capacity, S.A.E. Rated	2 3/4 cu. yd.
Capacity, S.A.E. Struck	2 1/4 cu. yd.
Lifting capacity	17,000 lbs.
Carry capacity	13,000 lbs.
Width outside	8' 5"
Maximum dumping height	8' 9"
Clearance under bucket hinge, maximum height	11' 3"

Materials and Specifications Subject to Change Without Notice or Obligation

Angle of dump, maximum height.....	56°
Angle of tip-back at carrying height of 3' 9" measured from ground to cutting edge	40°
Raising time	10 sec.
Lowering time	7 sec.
Dumping time	3 sec.
Reach from front of tire, dumping clearance 7' 0", dumping angle 50°	3' 8"
Reach from front of frame, dumping clearance 7' 0", dumping angle 50°	4' 10"
Digging depth (16° angle).....	16"

OVERALL MEASUREMENTS

Height (over air cleaner cap).....	8' 1"
Height (to seat cushion).....	6' 6"
Width (over tires).....	8' 9"
Width (over hubs).....	8' 5 ⁵ / ₈ "
Length (bucket on ground).....	20' 8"
Length (bucket at carry).....	21' 2"
Wheelbase	8' 4"
Ground clearance	1' 7"
Height of drawbar.....	3' 1"
Tread	7' 0"

TURNING RADIUS

Outside corner bucket.....	23' 6"
Outside front hub.....	21' 5"
Outside rear hub.....	23' 6"
Inside front hub.....	13' 4"

CAPACITIES

Air Cleaner:	
Cummins	5 qt.
G. M.	5 qt.
Waukesha	2 qt.
Cooling System	40 qt.
Engine Crankcase:	
Cummins	20 qt.
G. M.	24 qt.

Waukesha	18 qt.
Front Drive Axle Differential.....	12 qt.
Front Drive Axle Planetary Hubs (each)	8 qt.
Rear Drive Steer Axle Differential.....	11 qt.
Rear Drive Steer Axle Planetary Hubs (each)	8 qt.
Torque Converter and Transmission (approx.)	7 gal.
Fuel Tank	55 gal.
Hydraulic System (approx.).....	40 gal.

BATTERIES

Make and Part No.....	Exide XF-25
Number	4-6 volt in series
Electrical System	24 volt
Grounded Terminal	Positive
Specific Gravity	1.230-1.260
(Not over .025 variance between adjacent cells)	

ELECTRICAL SYSTEM

All Sender Units.....	12 volt
All Gauges	12 volt
Back-up Lamps.....	24 volt, parallel, 40 watt
Dash Lamps	24 volt
Gauge Circuit Fuse.....	SFE 4 amp
Generator	24 volt
Glow Plugs:	
Cummins Diesel	6 volt, 30 amp
Waukesha Diesel	24 volt, 5 amp
Glow Plug Circuit Breaker (Cummins Only)	25 amp
Glow Plug Indicator Lamp (Cummins Only)	6 volt, 3 C. P.
Headlamps.....	24 volt, parallel, 60 watt
Horn	12 volt
Light Circuit Fuse.....	SFE 14 amp
Starting Motor	24 volt
Tail Lamps.....	12 volt, series, 4 C. P.
Voltage Regulator	24 volt

TIRES AND TIRE PRESSURES (All Tires Tubeless Construction)

	SIZE	PLY RATING	INFLATION PSI	RIM SIZE	LUG
Standard (Hi-Flotation)	18.00-25	12	30	13.00-25 5ST	Earthmover Sure Grip
Optional (Hi-Flotation)	16.00-24	12	45	10.00 VATG	Sure Grip Grader
Optional (Rock Service)	16.00-24	16	45	10.00 VATG	Rock Grader
Optional (Rock Service)	18.00-25	20	30	13.00-25 5ST	Hard Rock Lug
Optional (Hi-Flotation)	23.5-25	12	20	19.00-25	Sure Grip Lug

Materials and Specifications Subject to Change Without Notice or Obligation

