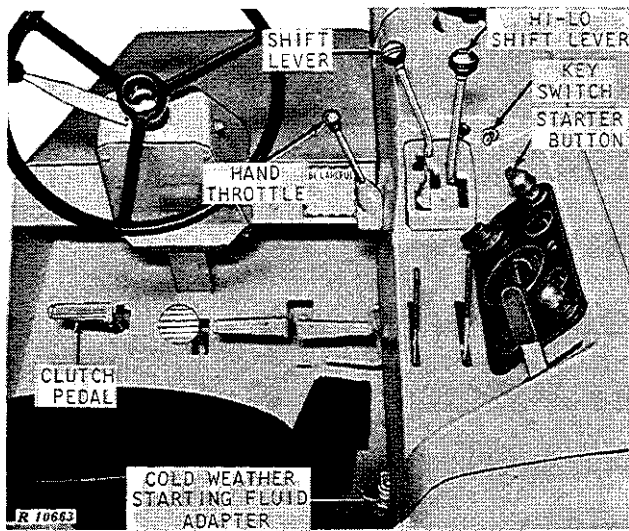
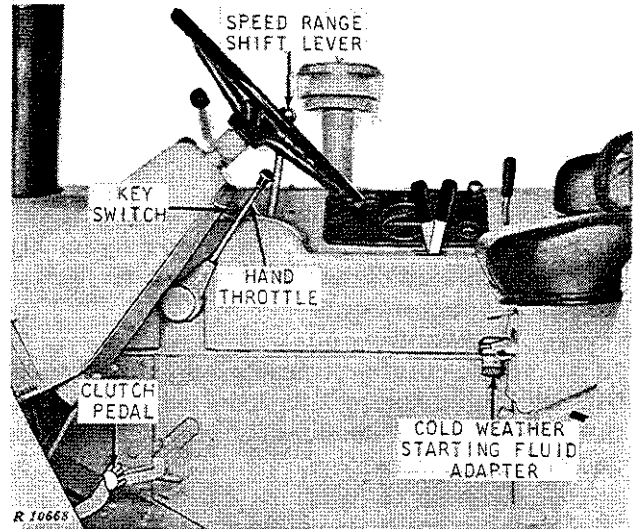


## Group 10

# OPERATION



Serial No. 8000 and After



Prior to Serial No. 8000

Fig. 10-10-1—Engine Starting Controls

### STARTING CONTROLS

Figure 10-10-1 illustrates the starting controls for the engine.

#### PRE-STARTING INSPECTION

1. Check the engine crankcase oil level.
2. Check the radiator coolant level.
3. Check radiator hose and connections for leaks.
4. Make sure the fuel shut-off valve on the bottom of the fuel tank is open.
5. Visually inspect tractor and tires for any irregularities which might affect operation.

### STARTING THE ENGINE

1. Place the Hi-Lo (right-hand) gearshift lever in neutral (N) position.
2. Move hand throttle lever to a position midway between the slow idle and 1900 rpm positions.
3. Turn the key switch to the first position. The oil pressure indicator lamp should light. If it does not, turn the key switch off and determine the cause. See Section 150.
4. At temperatures below 32° F, use the cold-weather starting fluid adapter (page 10-10-2) and other cold weather starting aids as required.

5. Tractors, Serial No. 8000 and after: Press the starter button to crank the engine.

Tractors prior to Serial No. 8000: Turn the key switch all the way to the right to crank the engine.

*NOTE: Do not hold switch in "crank" position for more than 30 seconds at a time. To do so may overheat the starter.*

If the engine does not start the first time, wait a minute or two before trying again. If it does not start after four attempts, refer to Section 250 of this manual.

6. As the engine begins to run, check to see that the oil pressure light goes out. If not, stop the engine and determine the cause. See Section 150 of this manual.

Check ammeter for alternator charging rate. If no charge is shown, refer to Section 150 of this manual.

#### AFTER-STARTING INSPECTION

1. Make sure that oil pressure light goes out.
2. Be sure ammeter shows charge.
3. Check for water, oil, or hydraulic leaks.

#### COLD WEATHER STARTING

##### COLD WEATHER STARTING FLUID ADAPTER

The tractor is equipped with an adapter (Fig. 10-10-1) to inject atomized starting fluid into the engine air intake system. The starting fluid, which aids fuel combustion, is furnished in pressurized cans.

To install a can of starting fluid, remove cap from the adapter, position outlet tube of can on adapter pilot, and push up gently on bottom of can until it snaps into place.

To inject starting fluid, push the can up 1/16 inch farther while turning the engine with the starter. Relax pressure on can between "shots" of starting fluid. Stop injecting fluid after the engine starts. If engine starts to die during the first few moments of operation, inject starting

fluid to smooth out engine operation. Remove can from the adapter when the engine is operating satisfactorily.

*NOTE: Install cap on adapter when not in use. This prevents dust being drawn into engine air intake system.*

#### ADDITIONAL BATTERIES

Starting the engine in cold weather can be facilitated by connecting an additional 24 volts of booster batteries in parallel with the tractor batteries.

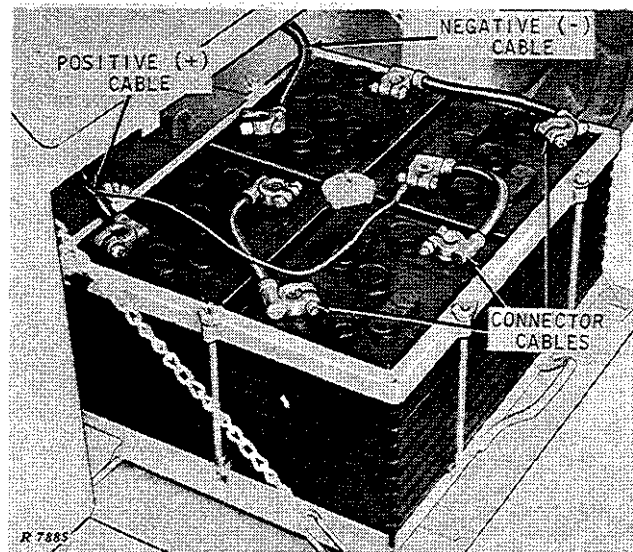


Fig. 10-10-2—Battery Connections

Use jumper cables to connect the positive (+) terminal of the booster battery assembly to the positive terminal of the tractor battery assembly (Fig. 10-10-2) and the negative (-) terminal of the booster battery to the negative terminal of the tractor battery assembly.

**CAUTION: Use care, when connecting auxiliary batteries, to avoid generating a spark which could cause an explosion.**

#### CRANKCASE OIL HEATER

The tractor is designed to permit use of a 240-watt electrical crankcase oil heater. The heater warms the oil in the crankcase to facilitate engine starting.

To install the crankcase oil heater, drain crankcase oil and remove plug (Fig. 10-10-3)

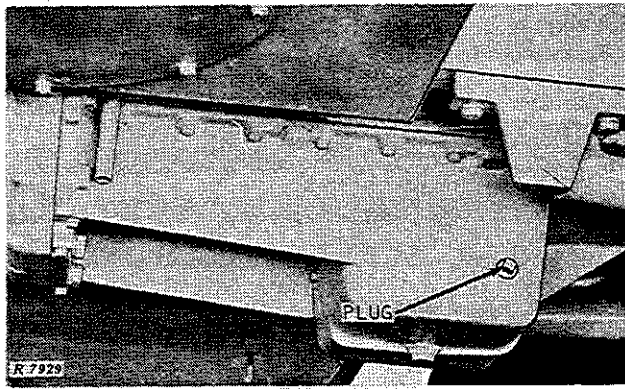


Fig. 10-10-3—Plug for Crankcase Oil Heater Installation

from right front side of case. Apply thread paste to threads of heater, install heater and refill crankcase. When heater is to be put to use, remove protective cap, attach cord, and plug into any convenient 115-volt electrical source with suitable ground.

The connector at the heater has a release lever to lock the connector to the heater. Press the lever when connecting or disconnecting the cord.

#### HYDRAULIC PUMP

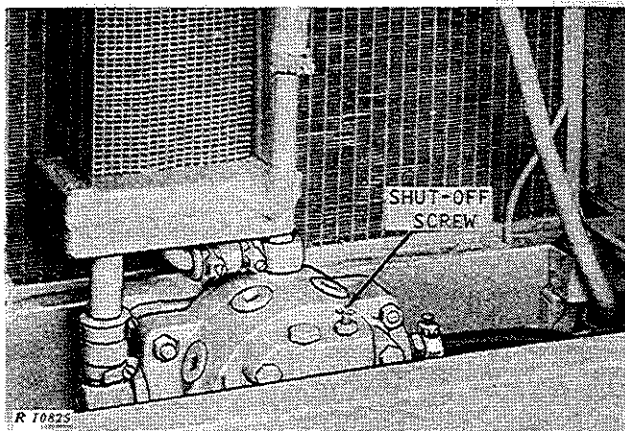


Fig. 10-10-4—Hydraulic Pump Shut-Off Screw

On tractors prior to Serial No. 4500 the hydraulic pump can be taken "out-of-stroke" (shut off) as an aid to cold weather starting.

Tractors, Serial No. 4500 and after do not have this feature unless it has been installed as a field installation.

To shut off the pump, remove tractor radiator grille and turn shut-off screw (Fig. 10-10-4) in (clockwise) one turn with a screwdriver. Then

turn screw in by hand until resistance is felt, then one more turn. The hydraulic pump is now out-of-stroke (shut off). After the engine has started, use a screwdriver to back the shut-off screw (counter-clockwise) all the way out. The pump will now build up pressure.

*NOTE: Oil will leak past the shut-off screw if it is not backed all the way out against the internal stop.*

#### POWER SHAFT CLUTCH DRIVE

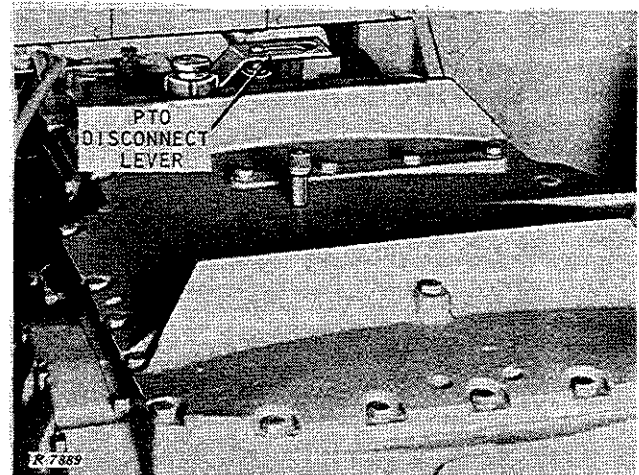


Fig. 10-10-5—PTO Drive Disconnect Lever

An additional method of removing drag from the engine to assist in cold weather starting is to disconnect the power shaft clutch drive. The drive is disconnected when the straight edge of the disconnect lever (Fig. 10-10-5) is up. Drive is disconnected by lifting up lever and rotating it 180 degrees, then returning it to the slot.

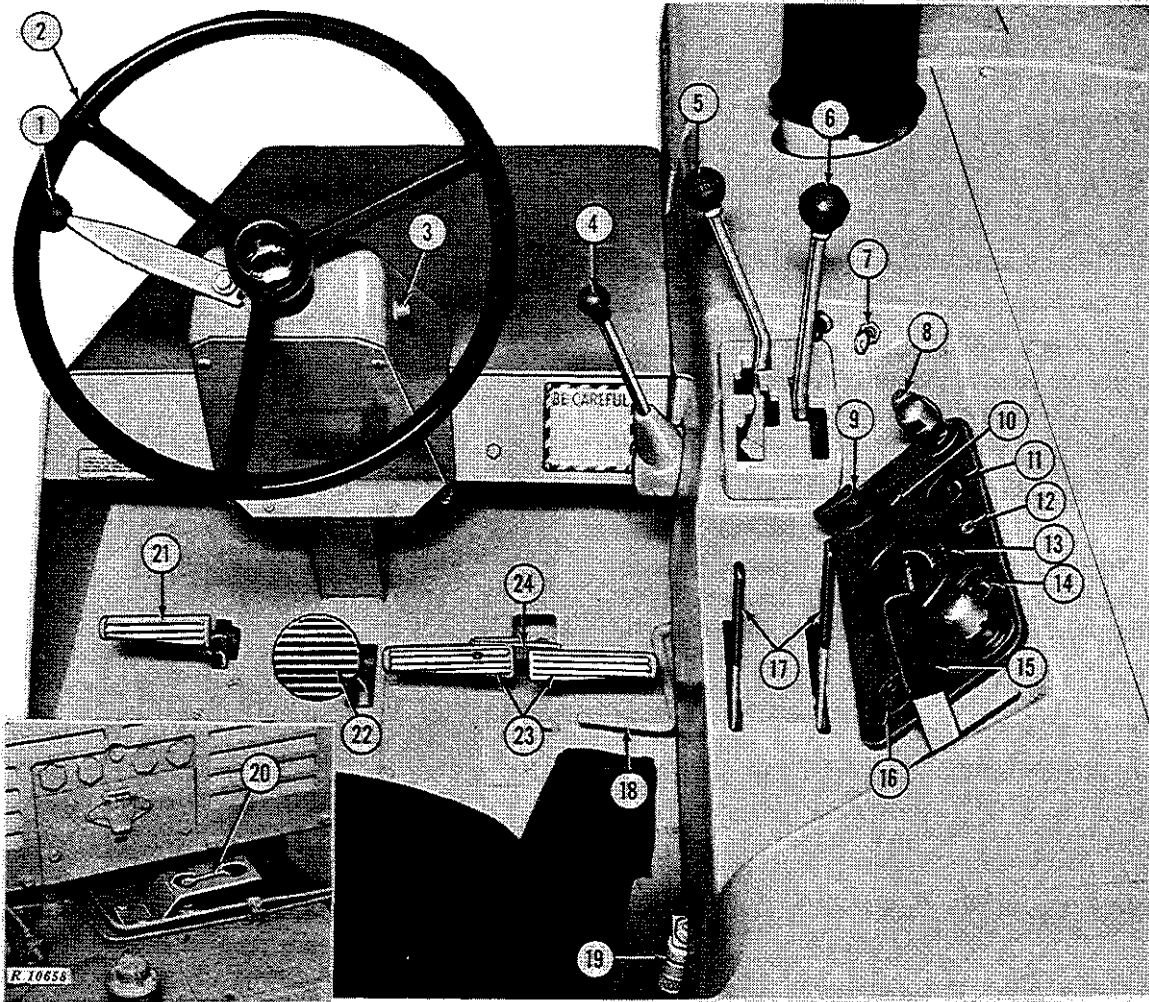
#### STOPPING THE ENGINE

After operating the engine under load, run the engine at slow idle (600 rpm) for at least one or two minutes before stopping. This will allow the engine to cool gradually, preventing uneven contraction of parts and coking of lubricating oil on piston rings, valve guide, etc.

Turn the key switch off. After a few revolutions the engine will stop.

*NOTE: Never drain coolant immediately after the engine is stopped.*

## OPERATING CONTROLS



- |                                   |  |
|-----------------------------------|--|
| 1 - Scraper Brake Operating Lever | 13 - Speed Meter                         |
| 2 - Steering Wheel                | 14 - Ammeter                             |
| 3 - Horn Button                   | 15 - PTO Clutch Operating Lever          |
| 4 - Hand Throttle Lever           | 16 - Fuel Gauge                          |
| 5 - Range Selector Lever          | 17 - Selective Control Operating Levers  |
| 6 - Hi-Lo Shift Lever             | 18 - Foot Throttle Lever                 |
| 7 - Key Switch                    | 19 - Cold Weather Starting Fluid Adapter |
| 8 - Starter Button                | 20 - PTO Drive Disconnect Lever          |
| 9 - Light Switch                  | 21 - Clutch Operating Pedal              |
| 10 - Speed Meter Knob             | 22 - Differential Lock Operating Pedal   |
| 11 - Water Temperature Gauge      | 23 - Brake Operating Pedals              |
| 12 - Oil Pressure Indicator Lamp  | 24 - Brake Pedal Bar                     |

Fig. 10-10-6—Operating Controls  
(Serial No. 8000 and After)

## OPERATING THE TRACTOR

Operating controls are illustrated in Figure 10-10-6.

### ENGINE WARM-UP

Always be sure that the engine is at operating temperature before subjecting it to a full load.

A practical way to do this is to idle the engine at about 1500 rpm a few minutes, then operate at a very light load (such as driving to the job) for the next five or ten minutes.

It is good practice, when the tractor is first put to work, to operate in the next lower speed than normally used for the load, for about 30 minutes. This gives the oil a chance to circulate freely and prevents undue wear on engine or transmission parts.

### ENGINE BREAK-IN

With the following exceptions, the diesel engine is ready for normal operation. To facilitate break-in, avoid prolonged periods of engine idling, particularly for the first 100 hours of service.

When the sulphur content of the diesel fuel used does not exceed 0.5%, drain the oil from the crankcase after the first 100 hours of service and replace the engine oil filter. Fill the crankcase with the proper oil.

*NOTE: When the sulphur content of the diesel fuel exceeds 0.5%, change the engine oil and oil filter after the first 20 hours of operation.*

*NOTE: Observe engine coolant carefully during break-in period. If temperature rises above normal operating range, shift to a lower gear to reduce load on the engine.*

### ENGINE SPEEDS

The engine is designed to operate at working speeds ranging from 1500 to 2200 rpm. These are variable governed speeds, and the engine

can be operated at any speed between the two extremes to meet various working conditions.

Slow idle speed of the engine is 600 rpm.

### Foot Throttle

Since engine speed most used when operating industrial tractors is 2200 rpm, and since engine speed must be varied quickly when shifting the transmission up or down, the foot throttle (Fig. 10-10-7) is usually used to control engine speed.

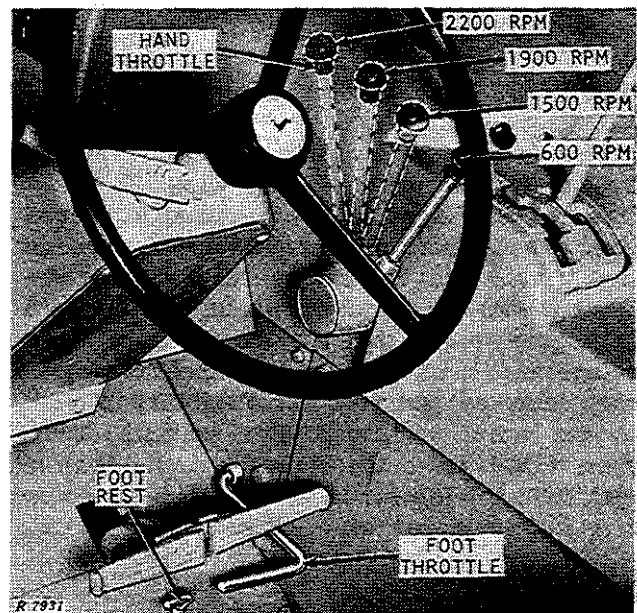


Fig. 10-10-7--Range of Hand Throttle Positions

The foot throttle can be used to obtain any engine speed between 600 and 2200 rpm. However, it cannot be used to obtain any speed below that established by the hand throttle.

### Hand Throttle

The hand throttle (Fig. 10-10-7) is normally used to control engine speeds when the tractor is operated without the scraper.

Move hand throttle (knob in) all the way to the rear to obtain slow idle (600 rpm) speed.

To obtain 1900 rpm speed (for PTO operation at rated speed) move lever forward to first stop. Placing lever midway between slow idle and 1900 positions gives 1500 rpm engine speed. Engine

speeds between 1500 and 1900 rpm can be obtained by moving lever between these two positions.

To obtain working speeds above 1900 rpm, pull up on knob at end of the hand throttle lever and move lever all the way forward. This is the 2200 rpm position. Engine speeds between 1900 and 2200 rpm can be selected by moving the lever between these two positions.

*NOTE: Avoid overloading tractor engine. Overloading causes undue strain on parts, eventually resulting in poor operation and unnecessary repair expense.*

**SELECTING GROUND SPEEDS**

The transmission has four speed ranges, grouped in four shift stations (Fig. 10-10-9). Three of the ranges have low, high and reverse gears. The fourth range has low and high speeds only. Thus, eight forward speeds and three reverse speeds are provided, which, together with the engine speeds that may be selected, allow the operator to balance, load and speed for maximum economy and give him flexibility to meet varying work conditions. For example, for a given travel speed the operator may choose to work in a low speed at a high engine speed or in a higher speed at a lower engine speed.

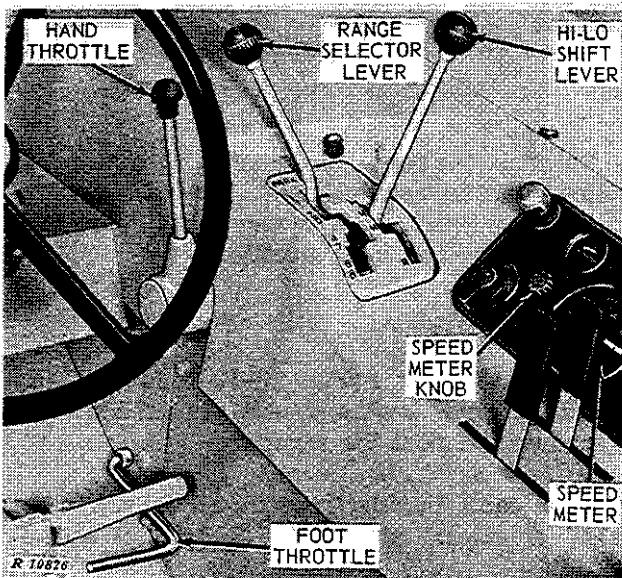


Fig. 10-10-8—Shift Levers and Quadrant

Shifting is accomplished by means of two levers located to the left and forward of the

instrument panel (Fig. 10-10-8). The range selector lever is used to shift between stations. By moving the lever from one station to another, a new range of speeds is available. Normally, this shift is made when the tractor is stopped, but by using the proper "double-clutching" technique it may be made while the tractor is moving. This technique is explained on page 10-10-7. The desired speed within a range is selected by means of the Hi-Lo shift lever, located at the right of the range selector lever. The Hi-Lo shift lever has four positions: "L" (Low), "N" (Neutral), "H" (High), and "R" (Reverse). When the Hi-Lo shift lever is in the "L" position the transmission is in the lower speed of the range. When the lever is in the "H" position, the transmission is in the higher speed of the range. When the lever is in the "R" position, the transmission is in reverse.

Examples of ground speeds at which the tractor will travel are given in Group 15 of this Section. Engine working speeds can be varied between 1500 and 2200 rpm.

*Gear Shifting*

Figure 10-10-9 illustrates details of the gear-shift quadrant.

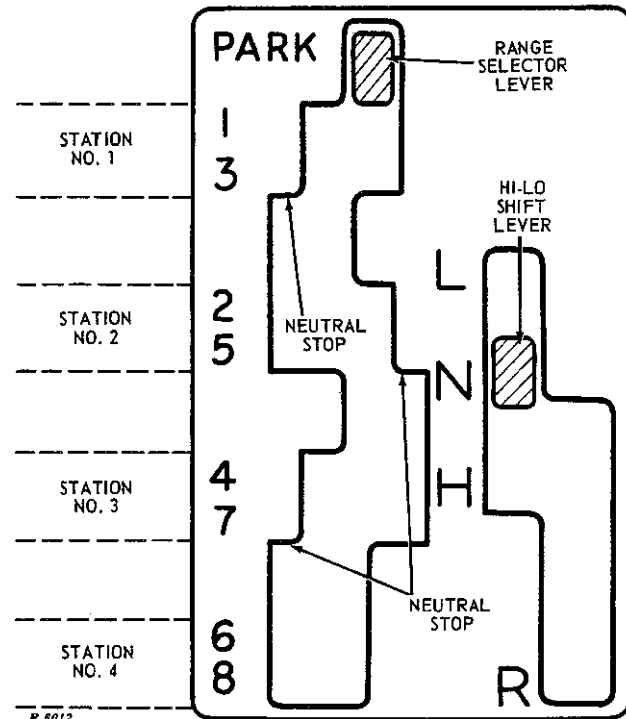


Fig. 10-10-9—Details of Shift Quadrant

Depress the clutch pedal and move the range selector lever into the desired station (Fig. 10-10-9). Move the Hi-Lo shift lever from neutral to "H," "L," or "R" to obtain the desired speed within the range. Gradually release the clutch to take up the load smoothly. With the clutch pedal depressed, the Hi-Lo shift lever can be shifted from the low to the high or the high to the low range of speeds in any station while the tractor is moving. The lever can also be shifted from forward to reverse (except in Station No. 4) without stopping the tractor. To avoid injury or damage, reverse direction only at very slow speeds.

Although shifting between stations usually is done with the tractor stopped, this shift can be made while the tractor is in motion by "double clutching." Basically this is a matter of engaging the clutch momentarily while the range selector lever is in neutral, and bringing the engine speed up or down to match the speed of the next desired station.

For example: Suppose the transmission is in 5th speed while the engine is operating at 2200 rpm. For higher ground speed it is desired to shift into 7th speed. Leave the Hi-Lo shift lever in "H," depress the clutch pedal, release the foot throttle, and move the range selector lever to neutral. (This lever is in neutral when it is located in any space in the quadrant between stations.)

Momentarily engage the clutch until engine speed has decreased to about 1100-1200 rpm. Disengage the clutch, move the range selector lever to 7th speed, and engage the clutch. This shift requires a little time (2 to 5 seconds) and cannot be rushed or clash will result. Note that engine speed is reduced about 50 percent.

Down shifting must be done rapidly. To down shift from 7th to 5th speed, for example, reduce engine speed to 1300-1500 rpm, disengage the clutch (but do not let up on the foot throttle), and move the range selector lever against the upper neutral stop illustrated in Figure 10-10-9. (The three neutral stops are provided for down shifting.) Rapidly engage and disengage the clutch, move the selector lever to 5th speed, and engage the clutch. The entire shift requires only 1 to 2 seconds.

**CAUTION:** Do not down shift from high to low speed without reducing engine speed. If engine speed is not reduced it may become excessive when the clutch is engaged, causing damage to engine.

The above procedures with minor variations to meet operating conditions, will result in "no clash" shifts between range stations but require practice. Avoid forcing the shift lever when a mismatch occurs due to improper timing during the shifting process. Unnecessary clash may cause damage. In general, double clutching is necessary for any shift of the range selector lever while the tractor is in motion.

#### DIFFERENTIAL LOCK

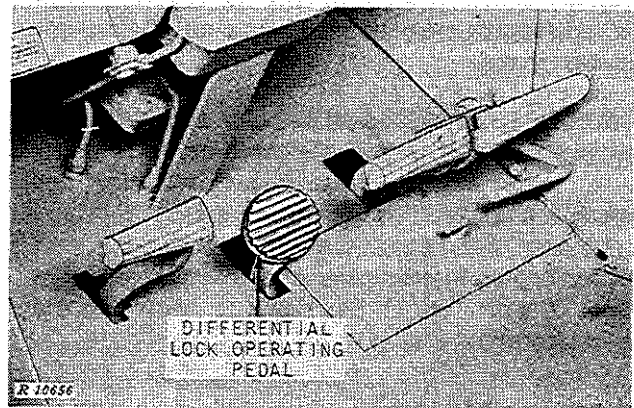


Fig. 10-10-10—Differential Lock Operating Pedal

When conditions are encountered where one drive wheel has lost traction, tractor movement can often be maintained by using the differential lock.

To engage the lock, depress the operating pedal (Fig. 10-10-10) and hold until conditions improve. Releasing the pedal pressure disengages the lock.

*NOTE:* So long as the differential lock is applied any attempt to turn the tractor will be resisted by the action of the locked differential. Under some conditions it may be necessary to engage the lock intermittently to maintain tractor motion in the direction desired.

## PARKING THE TRACTOR

When the tractor is stopped for parking, move the Hi-Lo shift lever to the "N" (neutral) position and move the range selector lever as far as it will go forward into the "PARK" position. The lever, once in "PARK," must be moved from this position before the Hi-Lo shift lever can be moved from neutral.

**CAUTION:** Be sure tractor is stopped before placing shift lever in "PARK" position.

## TOWING THE TRACTOR

Place the range selector lever in any neutral position and the Hi-Lo shift lever in the "N" (neutral) position when towing the tractor. This will eliminate unnecessary wear of the transmission parts.

*NOTE: If at all possible, the engine should be run at idle speed while the tractor is being towed. This will provide power steering and brakes.*

**CAUTION:** Never tow the tractor at high speed. Always attach tow bars or chains to the tow hooks provided.

## HYDRAULIC SYSTEM

The hydraulic system is a constant pressure, closed center, variable displacement type that provides a quick, easy means of supplying oil under pressure to operate power steering, power brakes, power take-off clutch, transmission clutch, two remote hydraulic cylinders (if so equipped) or, on scraper units, scraper brakes and scraper cylinders.

Pressure and flow of the oil are maintained by a variable displacement, constant pressure pump driven by the engine crankshaft. The reservoir for the system is the transmission case, and oil is carried through external pipes and hoses to each hydraulic function. All oil in the system is filtered through full-flow filters.

## POWER BRAKES

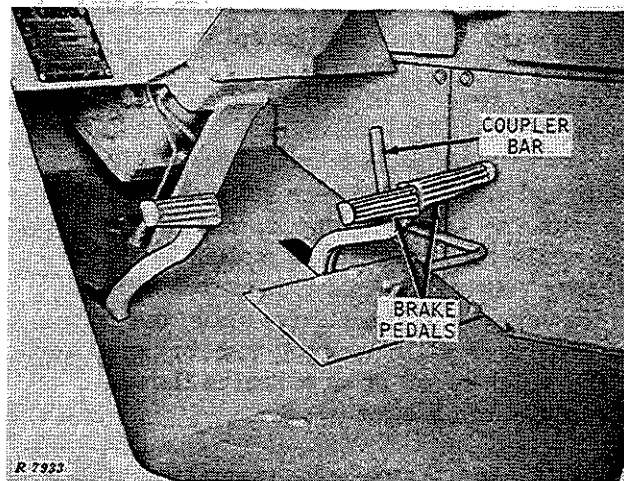


Fig. 10-10-11—Brake Pedals and Coupler Bar

The tractor is equipped with hydraulically actuated power brakes. Each brake pedal (Fig. 10-10-11) can be applied individually to assist in making short turns or simultaneously for slowing or stopping the tractor. The pedals can be locked together for simultaneous operation.

On scraper units, power brakes are operated by a lever located under the left side of the steering wheel. Pulling down on the lever applies the brakes.





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