

# **MAINTENANCE MANUAL**

## **4x4 TRACTOR FWD MODEL HAR**

### **CONTRACT NUMBERS**

**CANADA 200**

**CANADA 203**

**CANADA 214**

# **FWD**

**THE FOUR WHEEL DRIVE AUTO CO.**

**Clintonville, Wis., U. S. A.**

**Kitchener, Ontario, Canada**

November 15, 1943

Printed in U. S. A.

60

# MAINTENANCE MANUAL

## 4x4 TRACTOR FWD MODEL HAR

Contract No.	U.S.P.-No.	Sply./Mech.	Serial No.
CANADA 200	18311	3858	110446 - 111645 (Inc.)
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# FWD

Prepared By  
**The Four Wheel Drive Auto Co.**  
 Service Department  
 Clintonville, Wis., U. S. A.

Printed in U. S. A.

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# INTRODUCTION

This manual is published for the information and guidance of the driver and mechanic. It is grouped in a convenient and understandable manner in sections, which are numbered and tabbed to correspond with tabs on the index page.

The scope of this manual contains the description of the major units, group assemblies, and functional systems, including instructions with reference to their operation, inspection, adjustments, repair, and unit replacement, for two types of vehicles with and without winches.

<b>FOUR WHEEL DRIVE AUTO CO.</b>	
CLINTONVILLE, WIS., KITCHENER, ONTARIO	
CHASSIS MODEL	
CAB MODEL	
CHASSIS SERIAL	
ENGINE SERIAL	
ORDER NO.	
DATE OF MFG.	

PUBLICATIONS APPLYING TO THIS VEHICLE	
<input checked="" type="radio"/> MAINTENANCE MANUAL	<b>HAR-FWD-3</b>
SPARE PARTS LIST	<b>FWD-HAR-03</b>

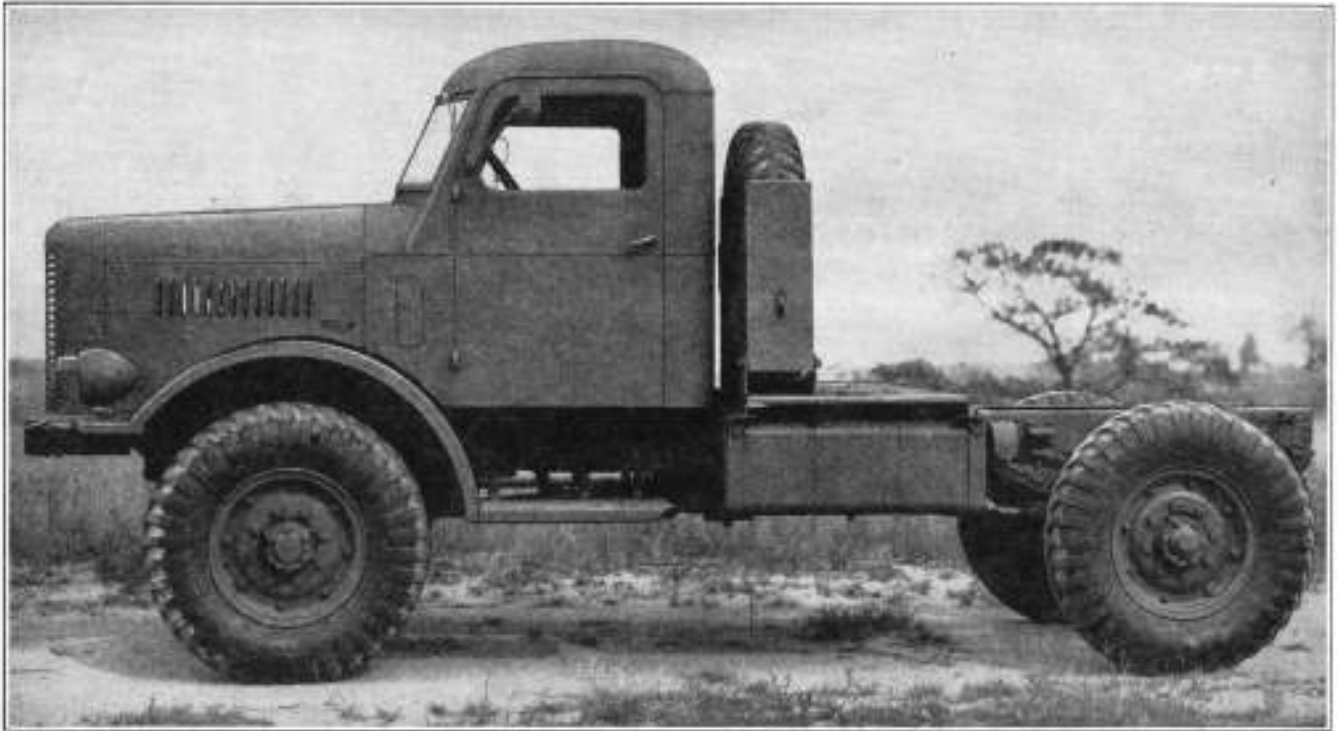


Fig. 1, Side View of Truck

## GENERAL DATA

## Engine:

Type .....	Waukesha BZ
H. P. at 2800 R.P.M. ....	95
Bore .....	4"
Stroke .....	4 $\frac{1}{4}$ "
Cylinders .....	6

## Capacities:

Fuel tank (trucks with winch)	
Tank on frame.....	42 U.S. gals.—35 Imp.
Tank under seat.....	25 U.S. gals.—20 $\frac{3}{4}$ Imp.
Fuel tank (trucks without winch)	
L. H. frame tank.....	45 U.S. gals.—37 $\frac{1}{3}$ Imp.
R. H. frame tank.....	45 U.S. gals.—37 $\frac{1}{3}$ Imp.
Engine crankcase (refill) .....	10 U. S. Qts.
.....	8 $\frac{1}{2}$ Imp. Qts.
Cooling system (complete) .....	23 U. S. Qts.
.....	19 Imp. Qts.
Radiator (only).....	12 U. S. Qts.—10 Imp. Qts.
Transmission .....	6 U. S. Qts.—5 Imp. Qts.
Transfer .....	4 U. S. Qts.—3 $\frac{1}{3}$ Imp. Qts.
Front axle differential .....	2 $\frac{1}{2}$ U. S. Qts.
.....	2 Imp. Qts.
Rear axle differential.....	2 $\frac{1}{2}$ U. S. Qts.
.....	2 Imp. Qts.
Oil bath air cleaner.....	1 U. S. Qt.—5/6 Imp. Qt.
Winch .....	2 U. S. Qts.—1 $\frac{3}{4}$ Imp. Qts.
Hydraulic brake assembly capacity.....	2 U. S. Qts.
.....	1 $\frac{3}{4}$ Imp. Qts.
Steering gear capacity.....	3 U. S. Qts.
.....	2 $\frac{1}{2}$ Imp. Qts.

Speeds (all wheels driving)—Ratio 9.02  
with 10.50x20 Tires:

In first gear .....	5 M. P. H.
In second gear .....	9 M. P. H.
In third gear .....	15 M. P. H.
In fourth gear .....	26 M. P. H.
In fifth gear .....	37 M. P. H.
Maximum allowable speed .....	37 M. P. H.

## Dimensions and Weights:

Wheelbase .....	136 in.
Length, over all .....	212 in.
Width, over all .....	85 in.
Height, over all .....	95 in.
Wheel size .....	20 in.

## Tire size:

Split type wheel .....	10.50x20
Steel spoke wheel .....	9.00x20
Tread (front) .....	67.5 in.
Tread (rear) .....	69 in.
Weight of vehicle empty.....	8090 lbs.
Approach angle .....	45
Departure angle .....	72
Minimum turning radius.....	31 ft.
Ground clearance .....	11 $\frac{3}{4}$ in.

## Towing facilities:

Front .....	Tow hooks
Rear .....	Pintle hook
Pintle height .....	36 in.

## DRIVER'S INSTRUCTIONS

TRUCK NO.	FWD	MODEL
		HAR
CAPACITY		
BODY WEIGHT ALLOWANCE		
CHASSIS, BODY & PAY LOAD NOT TO EXCEED		
SPEED LIMIT - M. P. H.		

**CENTER DIFFERENTIAL LOCK** - THIS TRUCK DRIVES ON ALL WHEELS AT ALL TIMES. THE CENTER DIFFERENTIAL LOCK IS PROVIDED TO OVERCOME WHEEL SLIPPAGE ON EITHER AXLE AND SHOULD BE ENGAGED BEFORE SLIPPAGE OCCURS. UNDER NO CONDITIONS SHOULD THIS LOCK BE KEPT ENGAGED WHEN THE POSSIBILITY OF SLIPPAGE NO LONGER EXISTS. SEE YOUR MANUAL FOR DETAILS.

**LUBRICATION** - FOR COMPLETE SPECIFICATIONS & CHART SEE THE OWNERS MANUAL.

**CAUTION** - TO OBTAIN MAXIMUM EFFICIENCY ALWAYS KEEP TEMPERATURE BETWEEN 160° & 180° FAHRENHEIT.

**WARNING** - KEEP ALL EXHAUST LINE CONNECTIONS TIGHT TO PREVENT DANGEROUS CARBON MONOXIDE GASES FROM ENTERING CAB.




DIAGRAM OF  
SPEED POSITIONS

**THE FOUR WHEEL DRIVE AUTO CO.**  
CLINTONVILLE, WIS., U. S. A. - KITCHENER, ONTARIO, CANADA

Fig. 2, FWD Chassis Plate

## 1. CONTROLS.

a. **General** (figs. 3 to 7). It is essential that the driver be thoroughly familiar with the

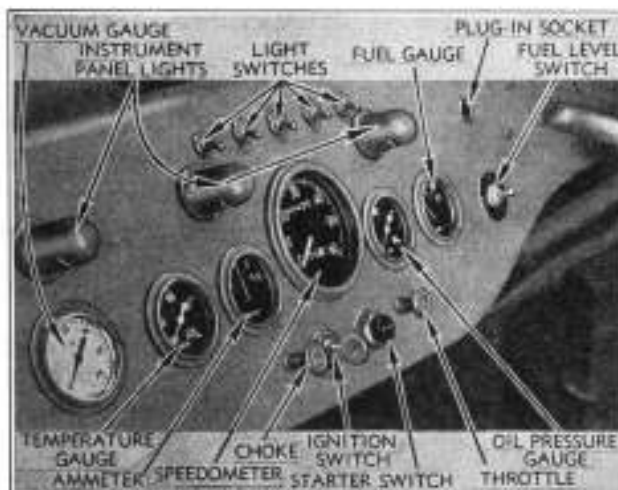


Fig. 3, Instrument Panel

controls and their location before attempting to operate the vehicle. The driver should study the controls (figs. 3 to 7), as there are some controls which are not found on standard vehicles.

(1) **Ignition Switch** (fig. 3). The ignition switch is located directly below the speedometer. This switch requires a separate key for its operation. It must be turned to the right to complete the electrical circuit necessary to start the engine.

(2) **Lighting Switches** (Fig. 3 and 4). The lights are controlled by a series of five switches located on the upper part of the instrument panel. Reading from the left side to the right side of the dash the switches are as follows: 1. Instrument panel light. 2. Stop light isolating. 3. Tail light only. 4. Side lights only. 5. Head lights only.

(3) **Headlight Beam Control Switch**. This switch commonly known as the dimmer switch, is located just to the left of the steering column, and is a button operated by


**Fig. 4, Light Switch Location**

the left foot. It controls the high and low beam of the service headlights and operates only when the main lighting switch is pulled on. To operate, press the button with the left foot to raise or lower the headlight beam; the high and low beams alternate each time the switch is operated. It is not necessary to keep pressure on the button after the desired beam is obtained as the switch locks itself each time the button is pressed.

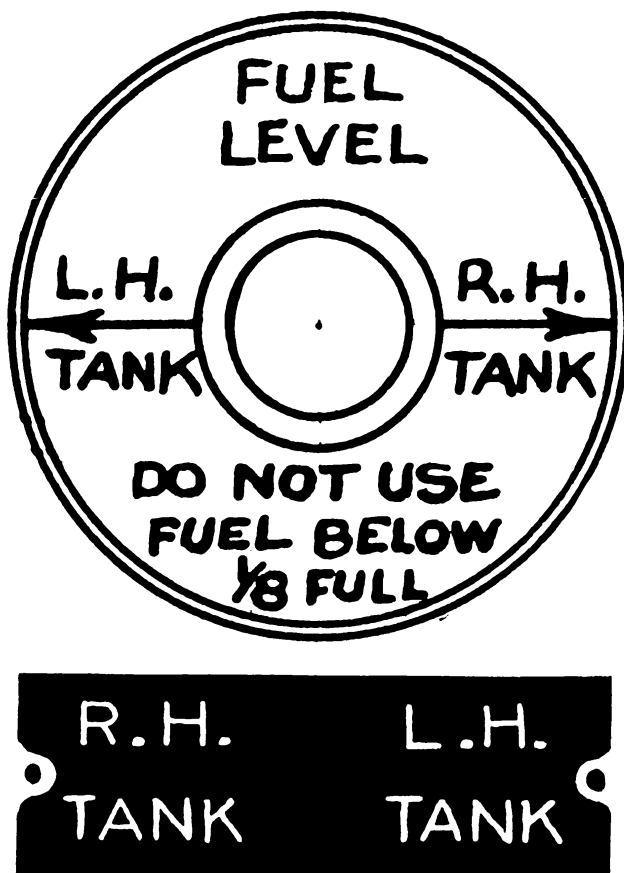
(4) **Fuel Gauge Switch and Two-way Valve (Fig. 3 and 5).** The fuel gauge switch is located to the left of the steering column and its purpose is to check the amount of fuel in the fuel tanks. The two-way valve is located in front of the driver's seat and controls the flow of fuel from only one tank. When the valve handle is turned to either left or right as shown on the plate it indicates which tank fuel is drawn from.

(5) **Choke Control (fig. 3).** The choke con-

trol consists of a button attached to a wire and housing assembly which is secured to the carburetor mixture control valve. The button—located on the dash below the ammeter—is identified by a letter "C" on its face. It closes the valve in the throat of the carburetor when it is pulled out. This prevents the carburetor from drawing air and consequently it feeds a richer gasoline mixture to the engine. Pull the choke control out when starting a cold engine and gradually push it in as the engine becomes warm. **NOTE:** Always be sure that the choke button is pushed in when the engine has reached normal operating temperature. To neglect this will cause a flooding condition in the engine. This results in too much raw fuel in the cylinders, which takes the oil film from the cylinder walls and dilutes the crankcase oil. Excessive choking also wastes fuel. The use of the choke control is unnecessary in starting a warm engine.

(6) **Throttle Control (fig. 3).** The throttle consists of a button—attached to a wire and housing assembly—which is secured to the carburetor throttle arm at its opposite end. The button is located on the instrument panel below the oil gauge to the right of the ignition switch and is identified by a letter "T" on its face. Its purpose is to provide increased engine speed beyond that provided by the idling adjustment on the carburetor. It is used chiefly in starting the engine when not convenient or practical to use the foot accelerator. Pulling the button outward opens the throttle. After the engine has been started, the button should be pushed in and acceleration or deceleration controlled by the foot accelerator pedal.

(7) **Center Differential Lock Lever (fig. 6).** The center differential lock lever is located on the instrument panel just to the right of the steering column. It provides a means of locking and unlocking the center differential. (This should not be confused with declutching devices and other transfer case levers used on other vehicles.) When it is necessary to lock the differential, pull the lever out and then turn the handle to the left. If the locking clutch and sleeve in the center differential do not mesh immediately, the spring tension will automatically engage them when the proper position is reached while the truck is in motion. For further information refer to page 7 of this section. For the simplicity of construction and operation refer to Section 08 Page 2 and 3.


**Fig. 5, Views of Fuel Gauge Switch and Two-way Valve Plates**



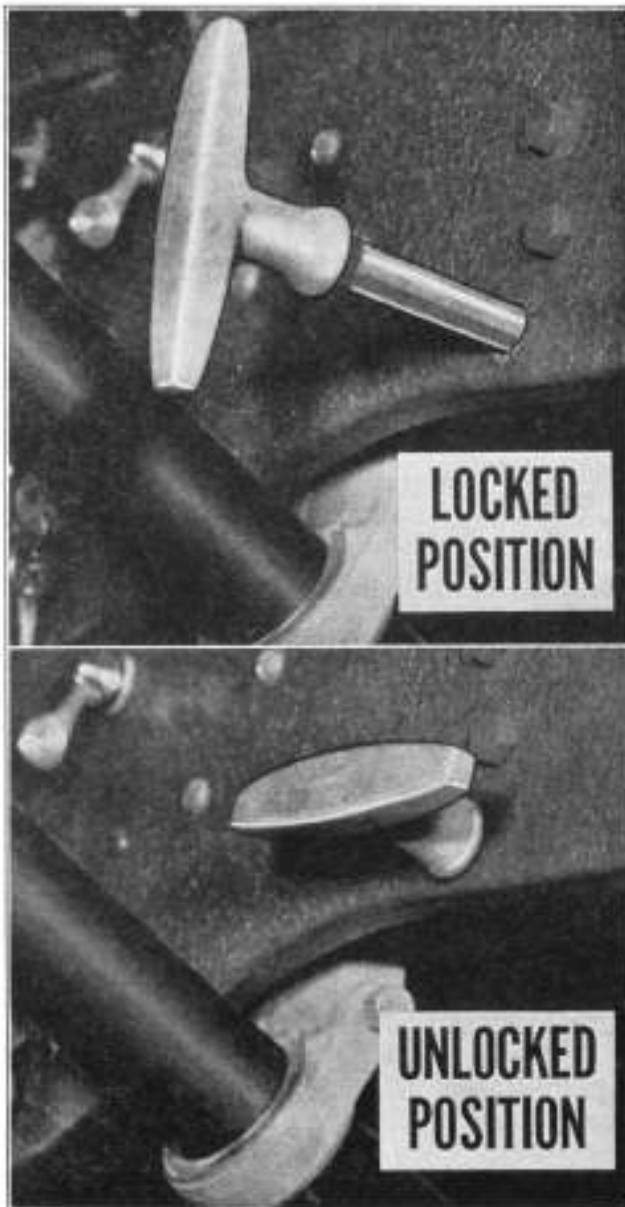


Figure 6, Center Differential Lock Lever

(8) **Starter Motor Button** (fig. 3). The starter motor button is located on the instrument panel between the ignition switch and throttle lever and is easily accessible for operation with the left hand. Its purpose is to complete the electrical circuit to the starter motor, so that it can crank the engine. To operate, press the button with the left hand and hold it in the depressed position until the engine starts. **CAUTION:** Do not press the starter button while the engine is running or while the shifting lever is in gear.

(9) **Windshield Wiper.** This vehicle is equipped with two windshield wipers. The control is a small individual switch located on each wiper and is pushed up or down to operate the windshield wiper blades.

(10) **Accelerator Pedal** (fig. 7). The accelerator pedal located on the floor board to the right of the steering gear, is used to control engine speed with the right foot while driving the truck.

(11) **Clutch Pedal** (fig. 7). The clutch pedal, located on the floor boards directly in front of the operator, is to be operated with the left foot. Depressing the pedal to the floor boards disengages the clutch so that the transmission gears may be shifted.

(12) **Brake Pedal** (fig. 7). The foot brake pedal, also located on the floor boards and directly in front of the operator, is operated by the right foot and is depressed to slow down or stop the vehicle.

(13) **Winch Power Take-off Lever** (fig. 7). The hand lever, third from the left side and protruding from the floor boards, controls the winch. Extreme rear position is the high speed for winding the cable and extreme forward position is low speed for winding. Center position is the reverse gear for unwinding. There are two neutral positions, one between high and reverse and one between low and reverse.

(14) **Winch Clutch Lever.** (Fig. 7). The lever next to the power take-off lever is the winch clutch lever. With the clutch disengaged, it allows the winch drum to become free. The forward position is engaged position and to the rear is disengaged position.

(15) **Winch Brake Lever** (Fig. 7). The lever to the left of the winch clutch lever controls the winch drum. It is used principally for holding a load. The brake is released when the lever is in the forward position and applied when pulled back toward the seat.

(16) **Transmission Gearshift Lever** (fig. 7). This lever is located to the right of the power take-off lever. Its purpose is to control the shifting of all gears in the transmission. The diagram (fig. 2) shows the different positions of the lever for various gear selections in the transmission. **CAUTION:** Always be sure that the gearshift lever is in the neutral position before starting the engine.

(17) **Hand Brake Lever (Parking)** (fig. 7). This lever is the one to the left of the driver. It is used principally for holding the truck while parked. The hand brake is released when the lever is in the extreme forward position, and applied when pulled back toward the seat. When pulled back, the lever will lock in position. In order to move it forward the grip latch must be released by squeezing it to the lever handle.

(18) **Horn Button.** The horn button, located in the center of the steering wheel, is for the purpose of sounding the horn. It is operated by pressing downward.

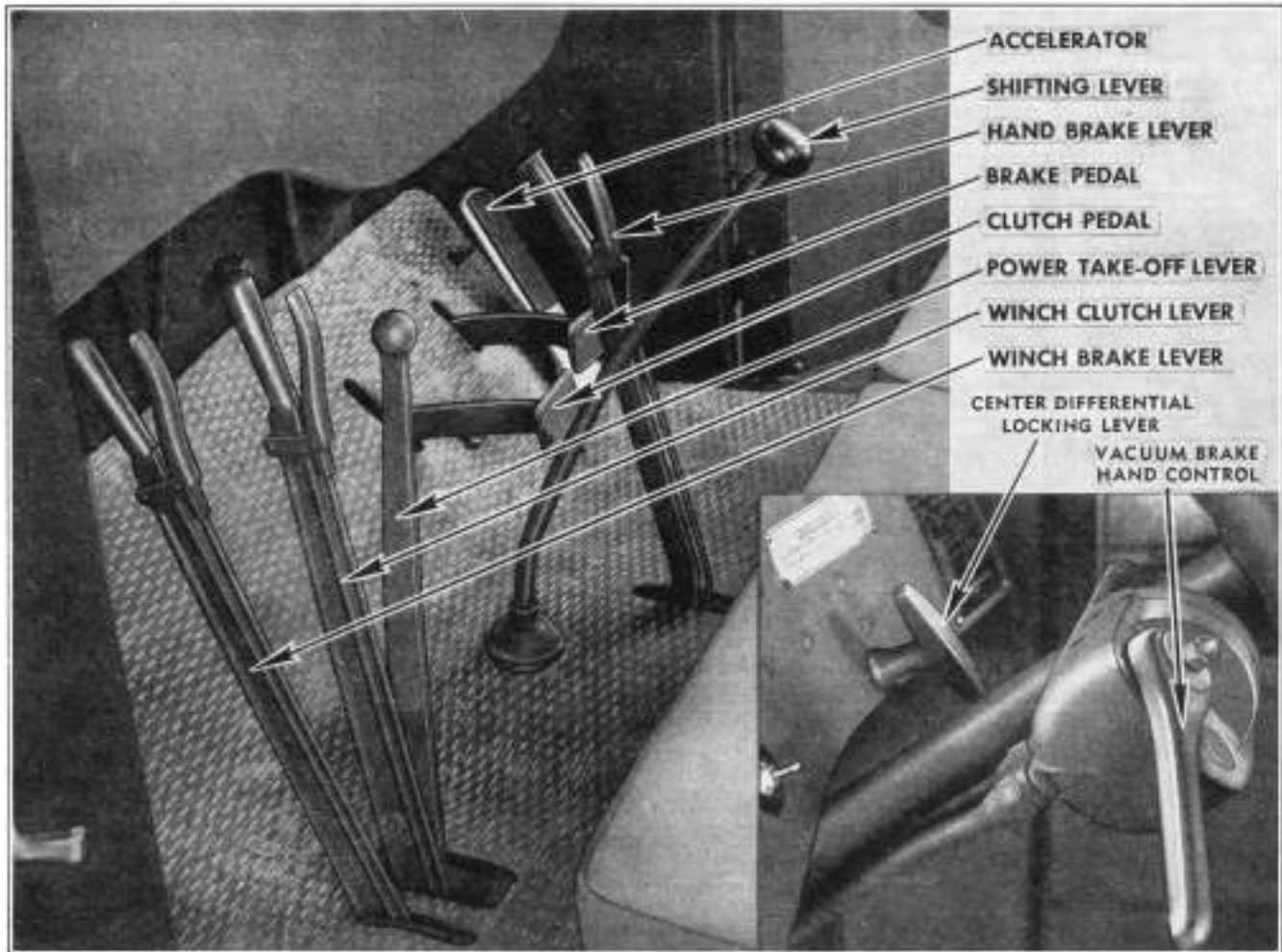


Fig. 7, View of Controls

## 2. SPECIAL PRECAUTIONS WITH NEW ENGINES.

a. Special precautions should be taken with new engines to avoid unnecessary repairs. Put lubricating oil in the fuel tank. Use about one pint of light engine oil to every three to five gallons of fuel during the first fifty hours of service.

b. Remove the spark plugs and inject a teaspoonful of light cylinder oil in each cylinder to insure lubrication of the pistons and cylinders when the engine first starts.

c. Before starting a new engine, inspect it thoroughly and see that it is complete and in proper working order.

d. Both engine and accessories must have proper lubrication at all times.

e. See that the crankcase is filled with the proper grade of oil.

f. See that the water pump and fan have proper lubrication. All other accessories — electrical equipment, etc.—should be lubricated in accordance with instructions in lubrication chart.

g. Next to proper lubrication, proper cooling of the engine is the most important precaution.

Be sure that the cooling system is full, that it does not leak, and that none of the hose connections have collapsed or become obstructed. Whenever possible, use soft or distilled water in the cooling system; avoid hard or alkaline waters.

h. This engine has been designed to operate most smoothly and economically on gasoline of 65 to 68 octane or better, with the automatic advance distributor set at 2 degrees before "T.D.C." Always use the cleanest fuel obtainable and keep the fuel line free from sand, lime, and water. NOTE: Always keep the fuel tank full to prevent condensation.

i. This engine is equipped with a governor which will maintain the speed within the proper limits. Under no conditions should maximum permissible speeds be exceeded.

j. The oil bath air cleaner should be serviced before the truck is put in service.

## 3. STARTING THE ENGINE.

a. The following duties must be performed before starting the engine.

- (1) Fill the cooling system.
- (2) Set the hand brake lever.
- (3) Place transmission shift lever in neu-



tral position.

(4) Check fuel supply.

(5) Pull out hand throttle part way.

(6) Pull out choke control. NOTE: It is not necessary to choke a warm engine.

(7) Turn the ignition switch and push the starter button. NOTE: At freezing temperatures, depress clutch pedal to ease the starting load.

(8) Release the clutch pedal and adjust the hand throttle to a position to prevent the engine from racing. If the choke was used, push in after engine runs smoothly.

(9) Idle the engine for about 15 minutes to fill all the bearings with oil. The oil pressure may not build up at once, especially in cold weather, so a short period of idling will be necessary to fill the lines and build up the pressure before the engine is ready to be put under load. Oil pressure should be up to 10 pounds minimum at idling and 40 pounds maximum at governed speed.

#### b. Starting Hints.

(1) If the starter is not functioning, engage the starting hand crank and pull up. Do not grasp the starting crank with the thumb on the same side as the fingers, as this may result in a broken wrist if the engine should back-fire. In cold weather the engine should start easily with the third or fourth attempt. Close the choke, leave the ignition "OFF", crank four or five times to fill the cylinders full of mixture, open the choke, turn "ON" the ignition, and crank.

(2) If the starter will not turn the engine over, first check the battery to see if it is charged. Continued attempts to start with a low battery will result in a worn starter commutator.

(3) Easier starting may be secured in cold weather if the clutch is released while cranking. This disconnects the engine from the transmission, making it unnecessary for the starter to turn the engine and transmission gears at the same time.

(4) If the starter gear engages in the flywheel and locks, release the starter push button, turn off the ignition switch, release the parking brake, and place the transmission in high gear. Rock the vehicle backward and forward. If the gear will not release from the flywheel, loosen the starting motor until the gear releases. Be sure to tighten the cap screws before attempting to use the starter motor.

c. Cooling System Hints. The engine utilizes a pressure cooling system in which water from the bottom of the radiator is drawn into a vane-type pump which forces it through the engine water jackets, out the top of the engine, and back to the radiator for cooling.

(1) Draining the Cooling System (fig. 8). Drain cocks are located at the lowest points of

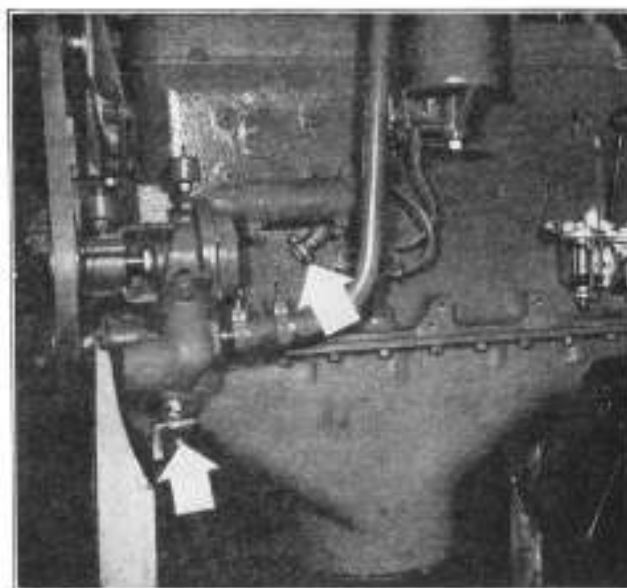


Figure 8, Cooling System Drain Cocks

the cooling system. There is a drain cock on the left side of the cylinder block, and one at the bottom of the lower radiator inlet pipe. Make sure that none of these cocks is overlooked.

(2) Cold Weather Suggestion. Cover the radiator partly or completely for efficient winter operation. To avoid cooling system freeze-ups, a solution of antifreeze is recommended.

(3) Carburetor. The carburetor choke should never be left closed or partially closed when an engine is running. The closing of the choke increases the richness of the mixture. Rich mixtures always heat up the engine, waste fuel, and burn the exhaust valves. Always make certain that the choke valve is wide open when the engine is running.

#### 4. OPERATING THE VEHICLE.

a. Starting the Truck on Level Road. After the engine is thoroughly warmed up at approximately 140° F, the vehicle may be moved as follows:

(1) Release the parking brake.

(2) Disengage the clutch by pushing the clutch pedal fully down.

(3) Shift the transmission in first or second speed gear, depending on the load.

(4) Release the clutch pedal slowly and at the same time accelerate the engine by pressing down on the accelerator pedal.

(5) With the clutch engaged, increase the truck's speed. NOTE: Do not overspeed engine.

(6) After the truck gains momentum, remove foot from accelerator and immediately disengage clutch. Shift the transmission into the next higher gear. Continue these steps until the transmission is placed in high gear.

**b. Starting on a Hill.** Apply the parking brake. Disengage the clutch and shift to low gear. Engage the clutch slowly and at the same time accelerate the engine and gradually release the parking brake as the clutch takes hold.

**c. Double Clutching.** It may be necessary to shift to a lower gear on a grade. This can be accomplished by double-clutching to assure a smooth engagement of transmission gears. Disengage clutch and shift the transmission into neutral position. Release the clutch pedal and momentarily step on the accelerator to increase the speed of the countershaft gears in the transmission. This tends to synchronize the mating gears. The shift is then completed by disengaging the clutch pedal and shifting the transmission into the next lower gear. The operator must remember that an even speed between the countershaft and main shaft gears to be engaged must be maintained, otherwise a smooth shift cannot be made.

**d. Shifting into Reverse Gear.** Before attempting to shift into reverse gear, stop the truck. Remove foot from accelerator and disengage clutch. Move the transmission shift lever into the position (R) (fig. 2). Release the clutch pedal gradually and at the same time accelerate the engine by pressing down on the accelerator pedal.

**e. Permissible Road Speed (Maximum.)** This truck is equipped with a governor which limits the maximum permissible road speeds. The truck speed depends on the position in which the transmission shift lever is placed. **CAUTION:** When driving down a hill, do not permit the truck to exceed the maximum road speed, for first, second, third, fourth, or fifth gear. Excessive engine speed under such conditions may develop into bearing, piston, and valve failures.

**f. Driving in Sand and Gravel.** When approaching loose sand and gravel, slow down. The truck will be moving too fast for good control on the soft road. Although the engine may propel the truck at a higher speed, it is dangerous in loose sand or gravel on account of hard steering and slipping wheels. Do not overspeed engine as spinning the wheels will cause them to work their way into the soft surface and difficulty may be encountered if the truck is stalled.

**g. Driving Through Soft Terrain.** When a truck is being driven through soft terrain, good judgment should be observed. The engine speed should be reduced, as spinning wheels will cause a "jumping" effect. This will usually result in the wheel digging deeper in the soft surface and may lead to destruction of component parts of the truck.

**h. Reason for the Center Differential Lock Lever.** The center differential lock lever is operated from the driver's seat. A connecting

link, or rod, is attached to the lever and leads to the transfer case where the center differential and lock are located. Under ordinary driving conditions, this differential is left unlocked. Some drivers have the opinion that this truck does not drive on the four wheels unless the center differential is locked. This is not true; the truck always drives on four wheels, but locking the center differential provides for additional traction under adverse conditions. However, this mechanism should not be locked continuously, since it is designed only for emergency use under the following conditions: Going through sand or gravel pits; climbing hills which have ice, snow, mud, or sand on some parts of the grade; plowing through snow drifts; going through ditches, streams, plowed fields, and over unusually rough terrain.

**i. When to Lock the Center Differential.** (Refer to Fig. 2. Chassis plate located on the right hand door of each vehicle.) The driver of the truck should engage the lock before reaching what appears to be a bad spot. It is satisfactory to engage the lock while the truck is traveling at any speed, so long as all wheels have equal traction, but the lock must not be engaged while the truck is traveling unless equal traction does exist. Most center differential trouble is caused by drivers engaging the lock when equal traction condition does not exist. If the truck has begun to enter a pit, and the two rear wheels have traction while the front wheels do not, the truck must then be brought to a stop before the differential lock is engaged. To engage the lock while one wheel is spinning and the others are not is comparable to running a pleasure car in high gear and suddenly throwing it into reverse. When the truck is moving through difficult places, there is no strain on any particular part, since the locking of the center differential makes the entire truck a single driving mechanism.

**j. Driving a Disabled Vehicle.** In the event that either the front or rear axle is damaged, disconnect the propeller shaft—leading to the damaged axle—at the universal joints, and remove the driving flanges from the dead axle. Disconnecting the propeller shaft and removing the driving flanges will prevent further damage to the disabled axle assembly. Lock the center differential and proceed.

## 5. STOPPING THE VEHICLE.

**a. Remove foot from accelerator.** Apply the brakes gradually by pressing down on the brake pedal. When the truck has been slowed down to engine idling speed, disengage the clutch by pressing down on clutch pedal. Move the transmission shift lever into neutral position. When the truck has come to a complete stop, release the clutch pedal and apply the parking brake.

**b. Stopping the Engine.** To stop the engine, turn off the ignition switch. In cold weather, the engine should be stopped with the throttle