TM 9-815

WAR DEPARTMENT

TECHNICAL MANUAL

of

4-TON TRUCK, 4 x 4

(FOUR WHEEL DRIVE MODEL HAR-1)

JUNE 10, 1943

TECHNICAL MANUAL
No. 9-815

WAR DEPARTMENT
Washington, June 10, 1943

4-TON TRUCK, 4 x 4
(FOUR WHEEL DRIVE MODEL HAR-1)

Prepared under the direction of the
Chief of Ordnance
(with the cooperation of the Four Wheel Drive Auto Co.)

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4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

PART I—OPERATING INSTRUCTIONS

Section I

INTRODUCTION

1. SCOPE.

a. This manual is published for the information and guidance of the using arms and services.

b. In addition to a description of the FWD 4 x 4 Model HAR-1 General Service Cargo Truck, this manual contains descriptions of the major units, group assemblies, and functional systems, including instructions with reference to their operation, inspection, adjustments, minor repair, and unit replacement. Specific information for the guidance of operating personnel (crew) is contained in Part I, sections I to IX, inclusive. Information for the guidance of organizational maintenance (using arms unit mechanics) is contained in Part II, sections X to XXXI, inclusive.

c. In all cases where the nature of the repair, modification, or adjustment is beyond the scope or facilities of the unit, the responsible ordnance service should be informed, so that trained personnel with suitable tools and equipment may be provided, or proper instructions issued.

2. DESCRIPTION (figs. 1 through 5).

a. This General Service Cargo Truck is a four-wheel drive chassis and is powered with a six-cylinder L-head type of engine. It has a conventional type of transfer case assembly, with a center differential similar to the differential in the front and rear axles. A military type of cargo body is mounted to the chassis with seating capacity for the using arms.

b. A single plate dry disk clutch and constant mesh clash type transmission is used.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

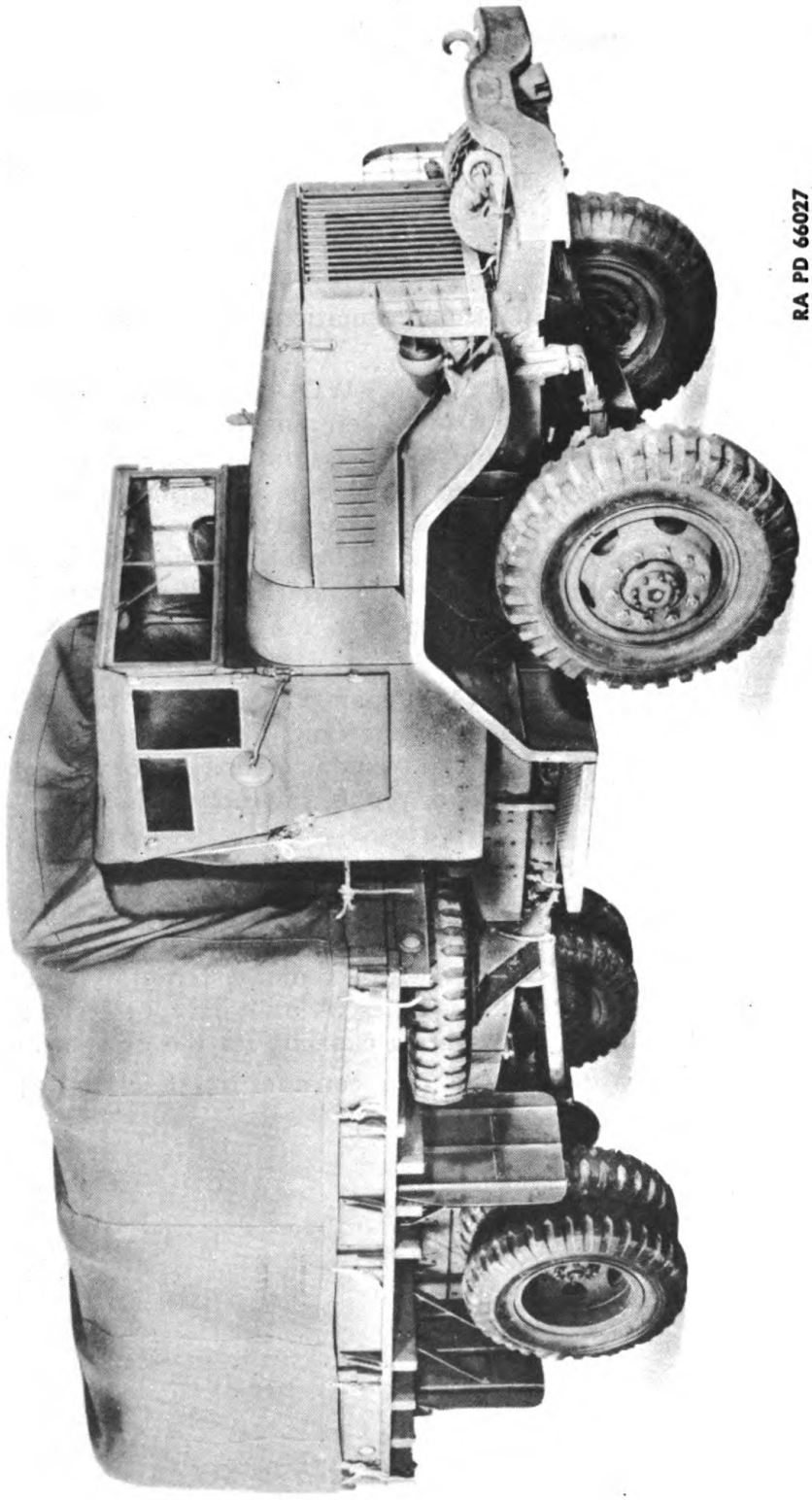

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Figure 1—Cargo Truck HAR-1—Three-quarter Right Front

INTRODUCTION

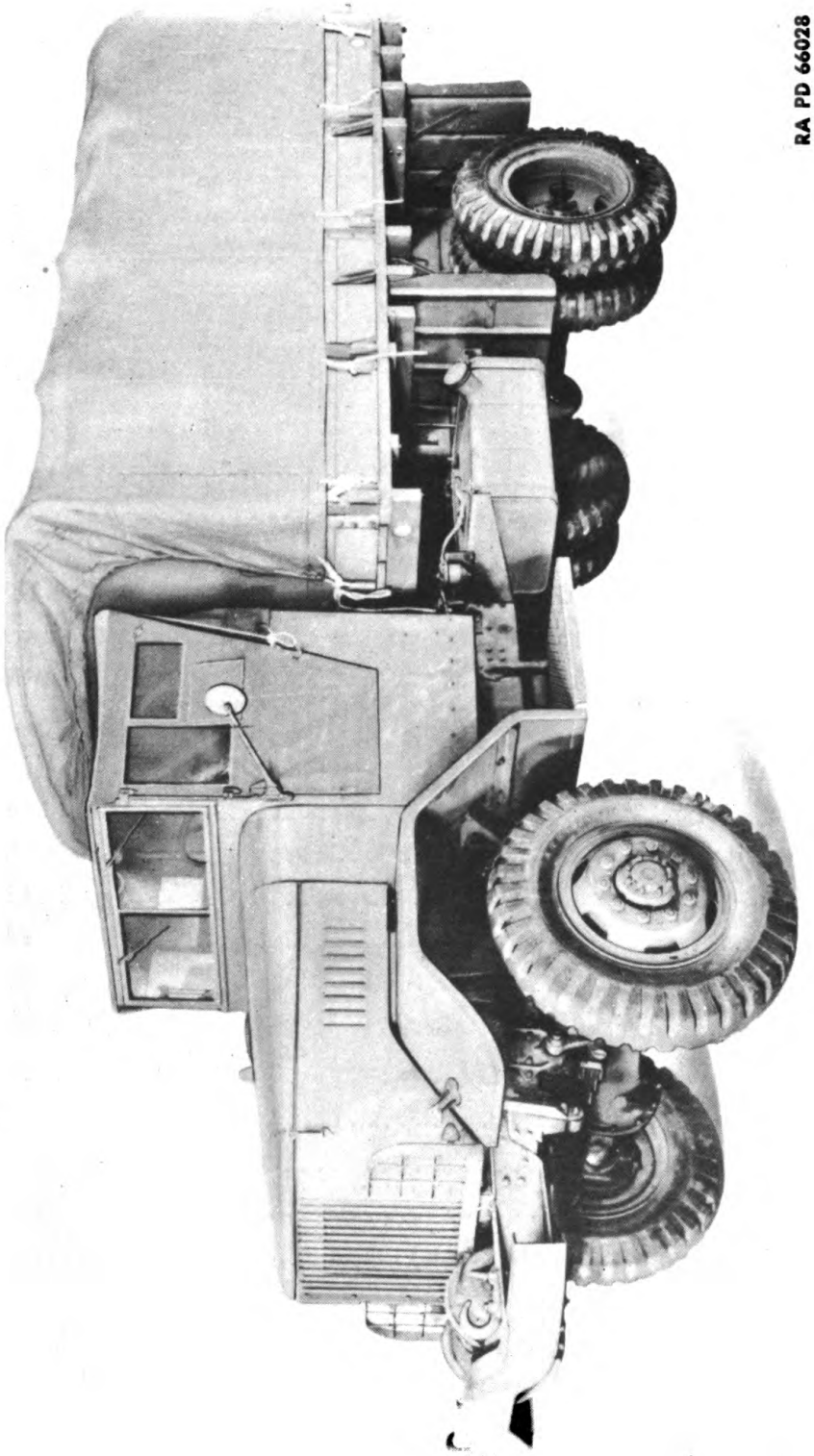

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Figure 2—Cargo Truck HAR-1—Three-quarter Left Front

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

3. TABULATED DATA.

Wheelbase	156 in.
Length, over-all	266.75 in.
Width, over-all	96 in.
Height, over-all	111 in.
Wheel size	20 in.
Tire size	9:00 x 20
Tread (front)	67.5 in.
Tread (rear)	69 in.
Weight of vehicle—empty	11,425 lb
Weight of vehicle—loaded	19,425 lb
Approach angle	35°
Departure angle	30°
Minimum turning radius	38½ ft
Ground clearance	11 in.
Fording depth (bottom of transfer case)	18½ in.
Towing facilities (front)	Tow hooks
(rear)	Pintle hook
Pintle height	36 in.
Speeds (all wheels driving)	
In first gear	4 mph
In second gear	8 mph
In third gear	13 mph
In fourth gear	24 mph
In fifth gear	25 mph
Maximum allowable speed	35 mph
Transmission capacity	6 qt
Transfer case capacity	4 qt
Front axle capacity	6 pt
Rear axle capacity	6 pt
Gasoline tank capacity (one tank)	40 gal
Cooling system capacity	23 qt
Crankcase capacity	10 qt
Air cleaner capacity	1.5 pt
Hydraulic brake assembly capacity	2 qt
Steering gear capacity	4.75 pt
Winch capacity	1¾ qt

INTRODUCTION

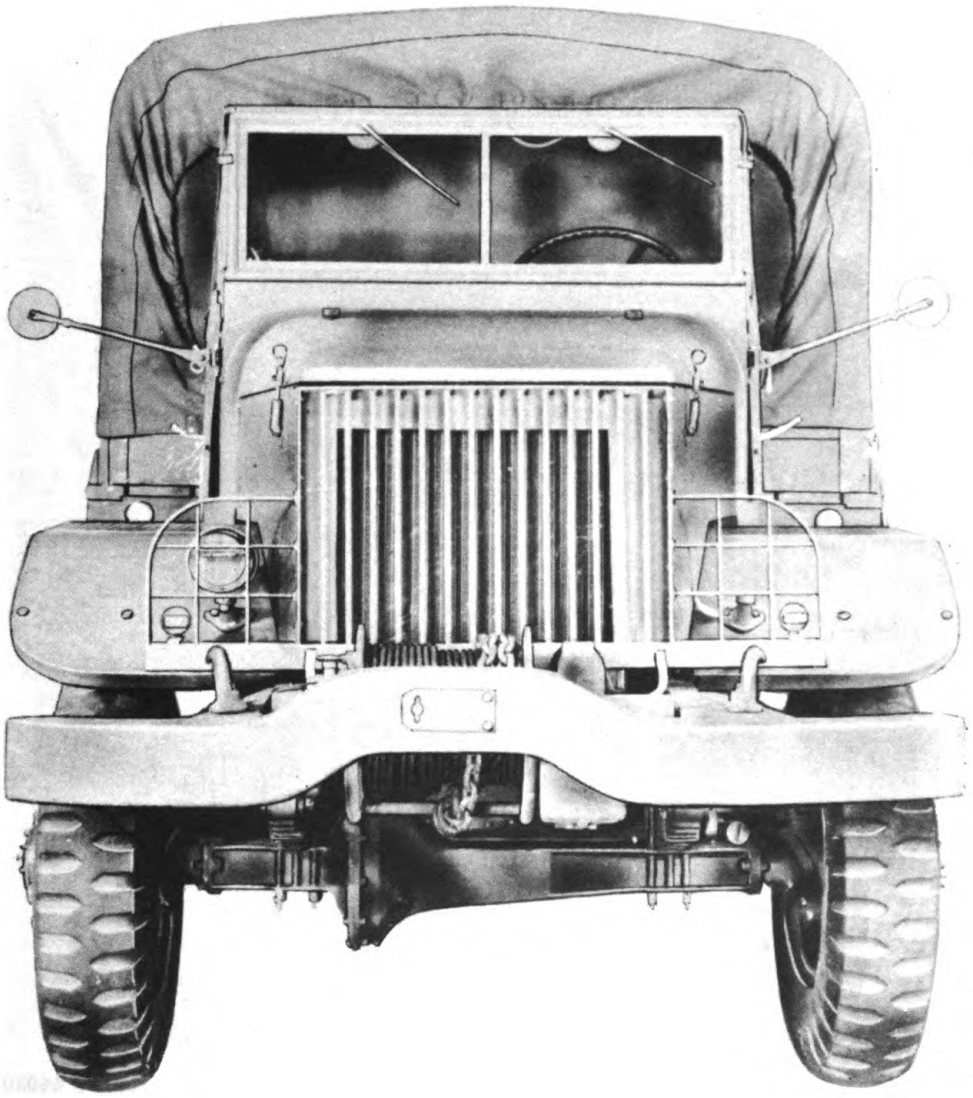

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Figure 3—Cargo Truck HAR-1—Front

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

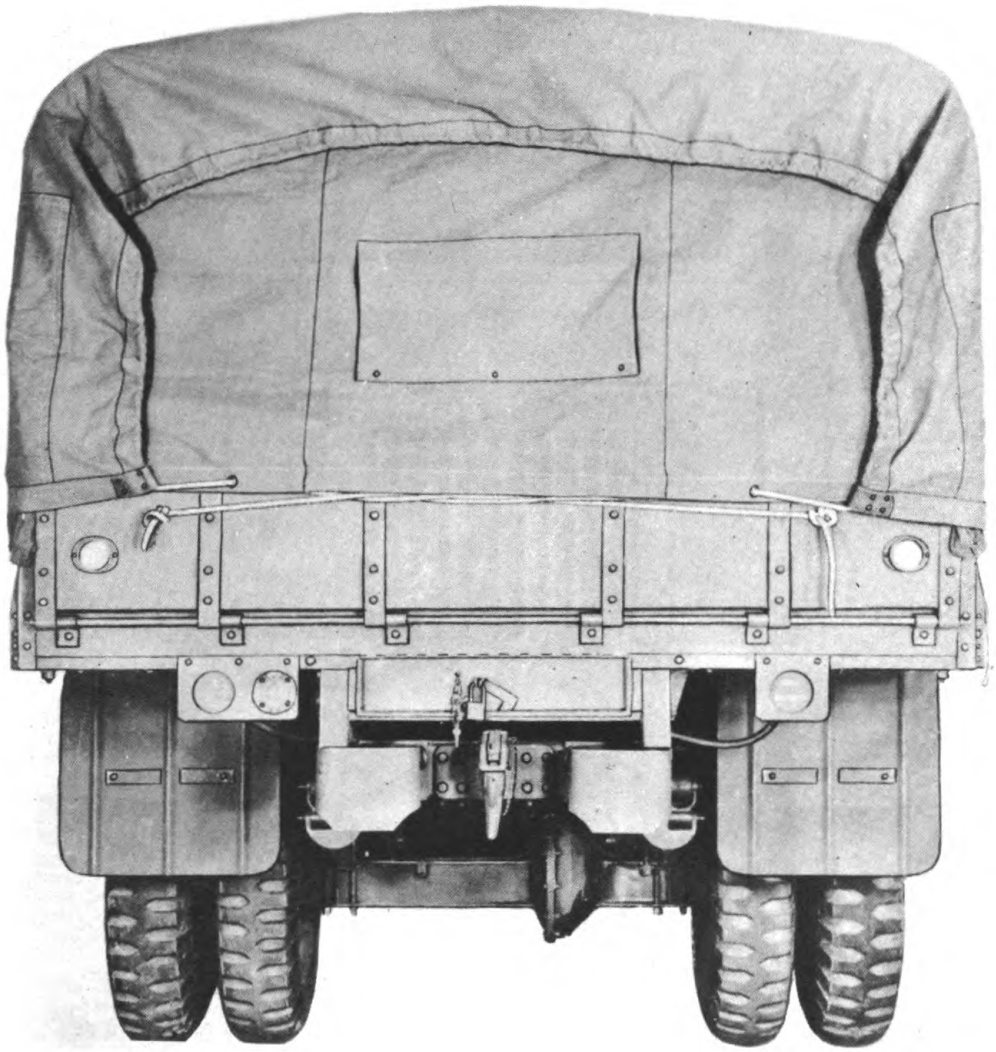

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Figure 4—Cargo Truck HAR-1—Rear

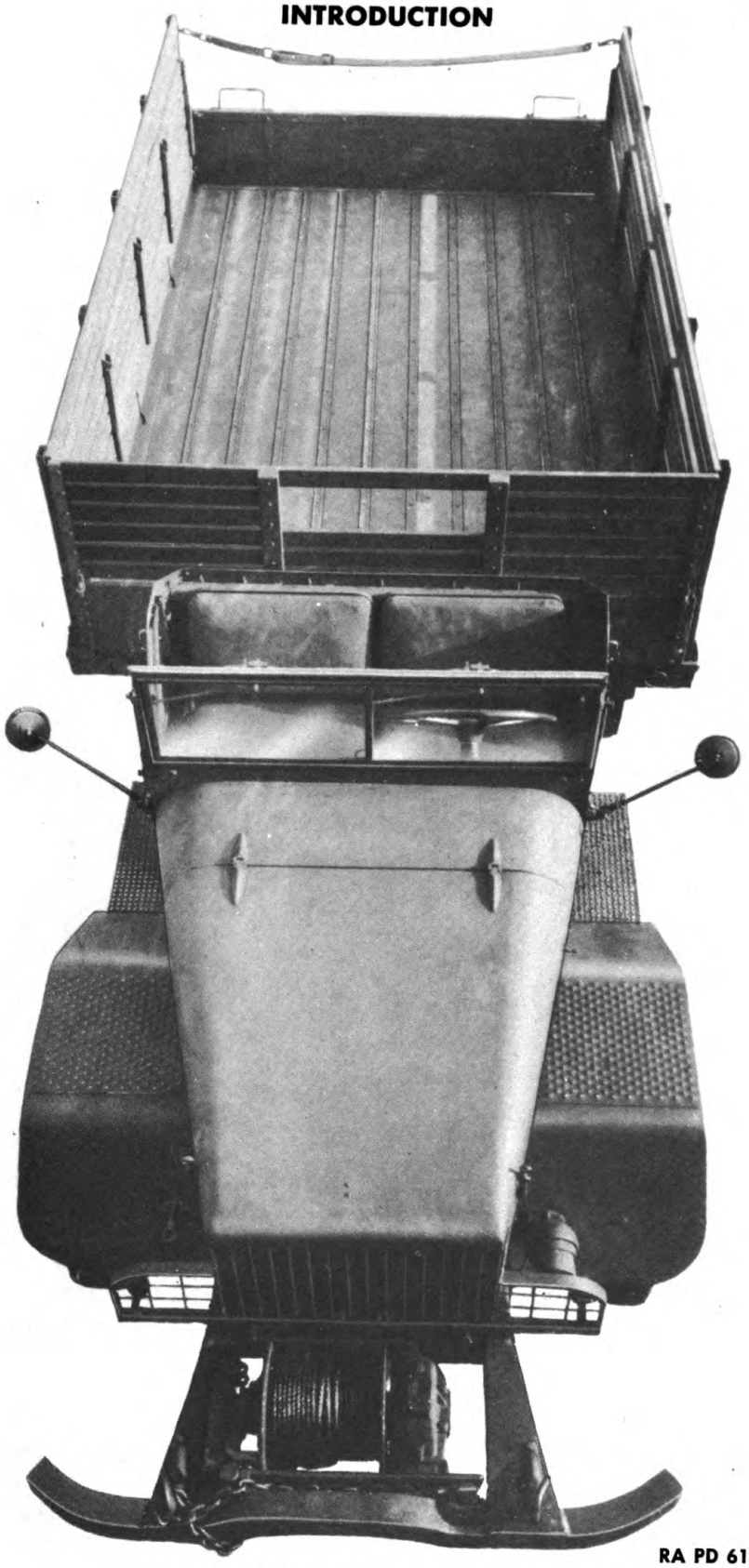

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Figure 5—Cargo Truck HAR-1—Top

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Section II

CONTROLS AND OPERATION

4. CONTROLS.

a. General (figs. 6 to 12). It is essential that the driver be thoroughly familiar with the controls and their location before attempting to operate the vehicle. The driver should study the controls (figs. 6 to 12), as there are some controls which are not found on standard vehicles.

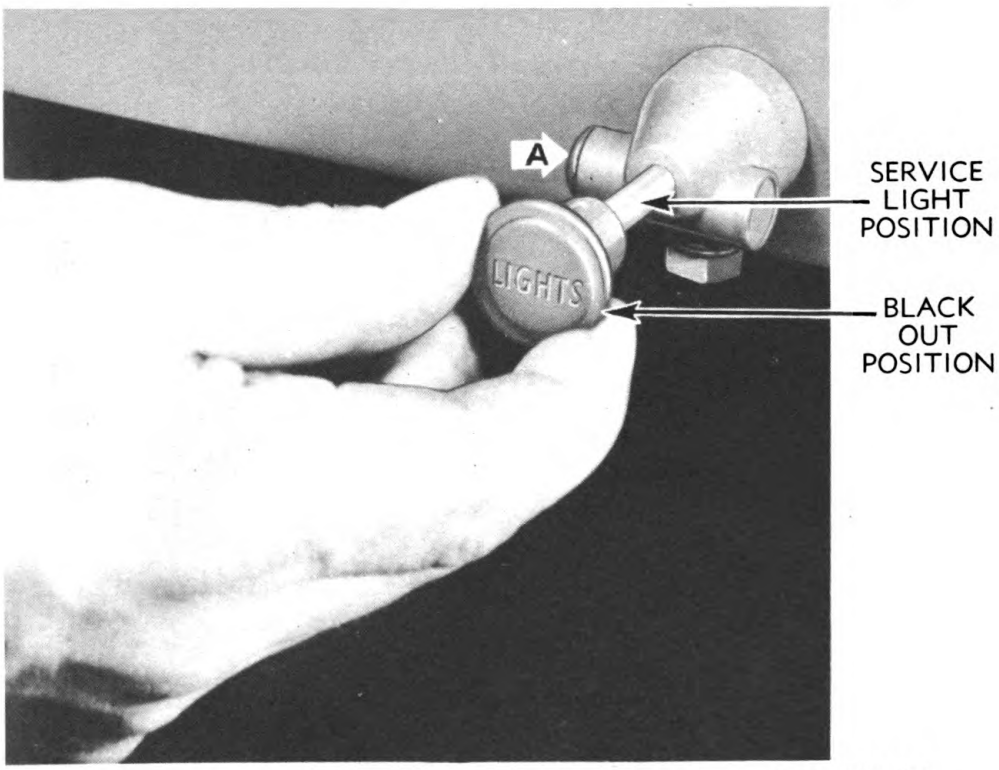


Figure 6—Light Switch

(1) IGNITION SWITCH (fig. 7). The ignition switch is located directly below the speedometer. This switch is self-contained and does not require a separate key for its operation. It is constructed with a thumb piece which must be turned to the left to complete the electrical circuit necessary to start the engine.

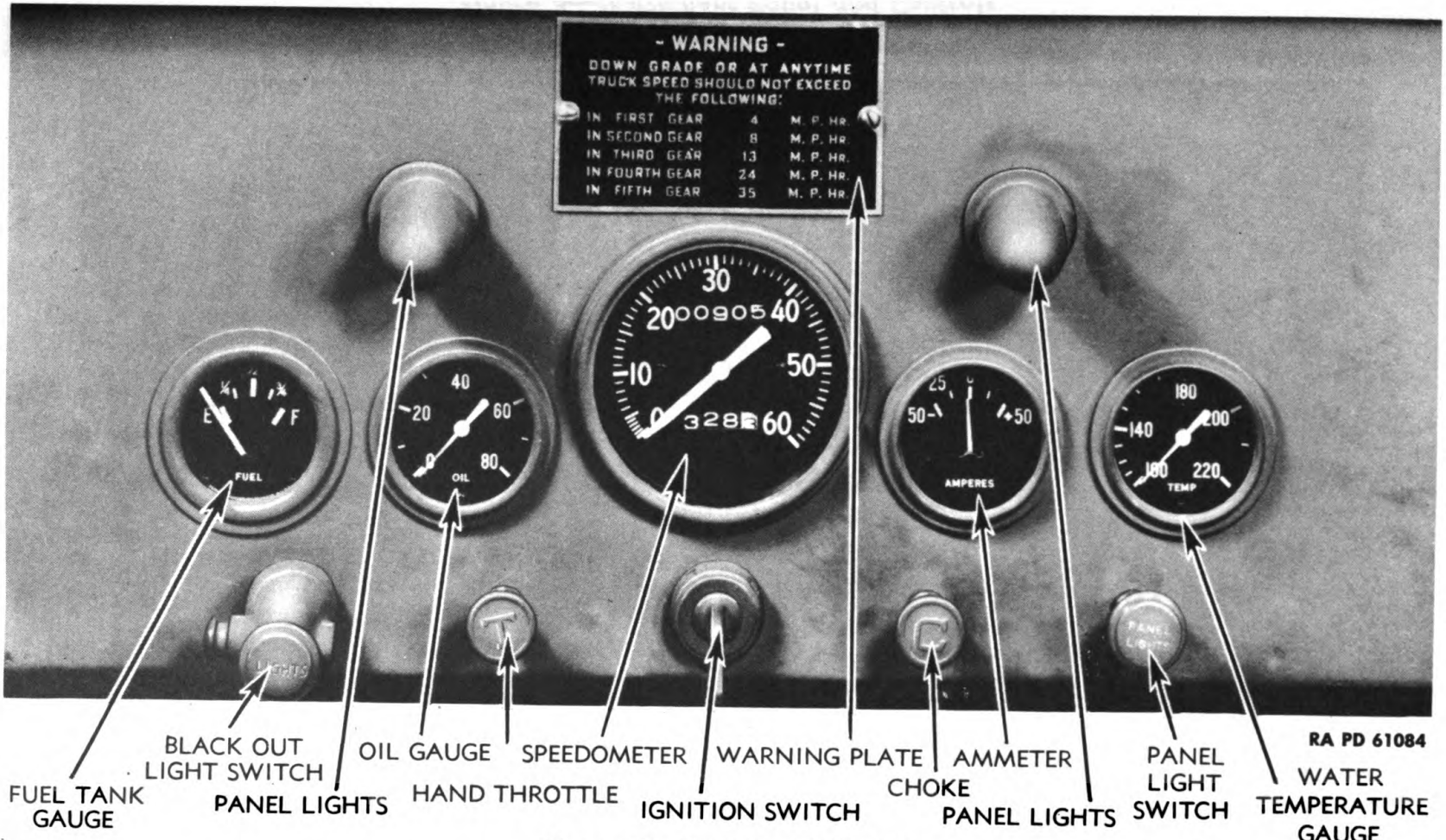


Figure 7—Instrument Panel

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

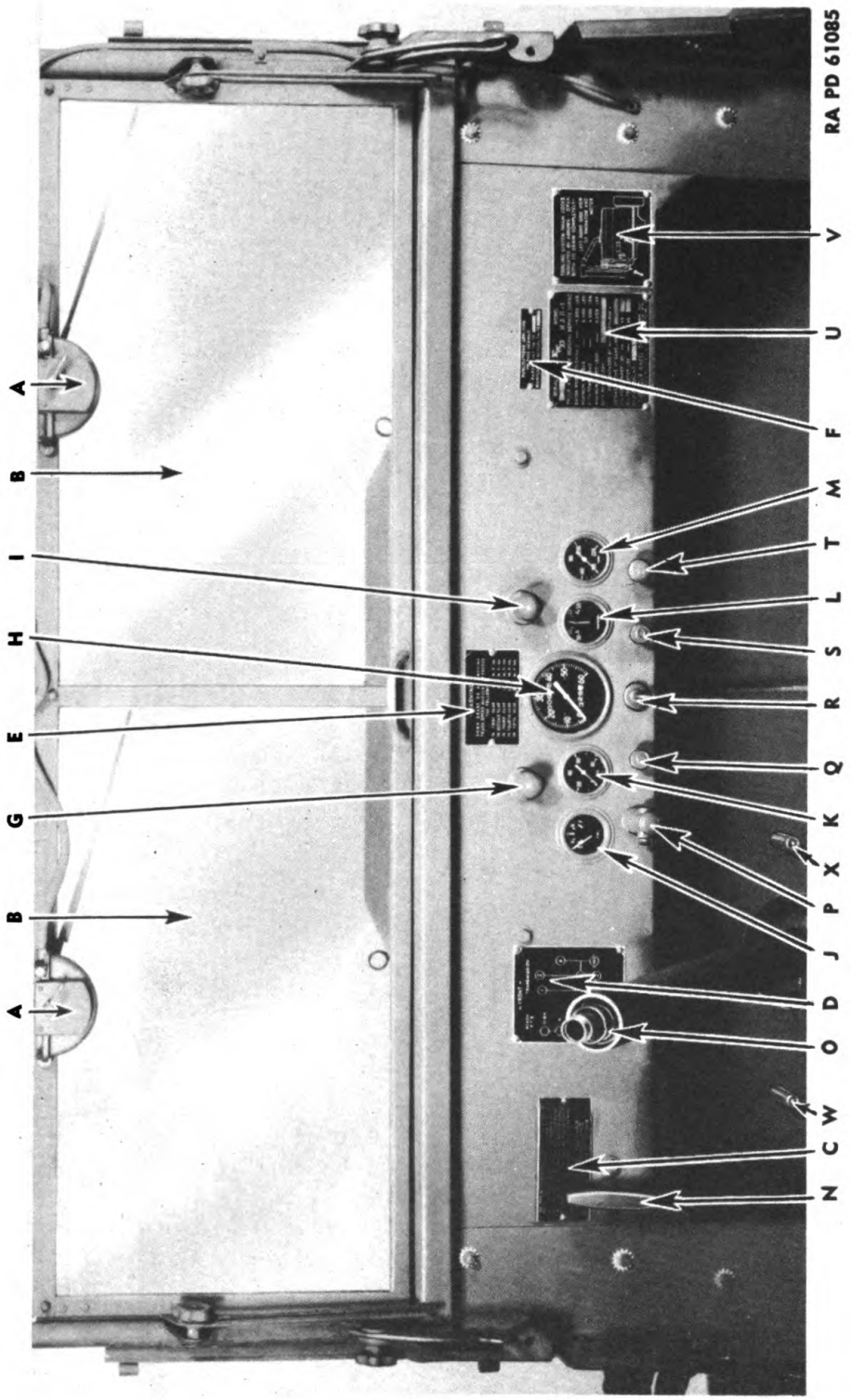


Figure 8—Instrument Panel and Controls

A—WINDSHIELD WIPERS
B—WINDSHIELD
C—CENTER DIFFERENTIAL LOCKING LEVER INSTRUCTION PLATE
D—SHIFTING PLATE
E—WARNING PLATE
F—PUBLICATIONS PLATE
G—PANEL LIGHT
H—SPEEDOMETER
I—PANEL LIGHT
J—FUEL GAGE
K—OIL GAGE
L—AMMETER
M—WATER TEMPERATURE GAGE
N—CENTER DIFFERENTIAL LOCKING LEVER
O—STEERING POST
P—BLACKOUT LIGHT SWITCH
Q—HAND THROTTLE
R—IGNITION SWITCH
S—CHOKE
T—PANEL LIGHT SWITCH
U—NAME PLATE
V—COOLING SYSTEM PLATE
W—HEADLIGHT BEAM CONTROL SWITCH
X—STARTER SWITCH

RA PD 61085A

Legend for Figure 8—Instrument Panel and Controls

(2) LIGHTING SWITCH (figs. 6 and 7). The lighting switch controls all service and blackout lights. By pulling the switch out to the first position, the blackout lights are turned on. These lights consist of blackout headlights, taillights, and blackout signal light. By depressing the lock button (A, fig. 6) and pulling the switch to the second position, the service lights are turned on. This includes the service headlights and taillights. The circuit is also completed, so that the service stop light will operate, as well as the lights on and within the dash panel. The service stop light is turned on by depressing the brake pedal. By pulling the light switch all the way out, or to the third position, the service stop light only is made operative for daytime operation. The dash lights are operated by a separate switch on the dash panel (step (4) below).

(3) HEADLIGHT BEAM CONTROL SWITCH (fig. 8). This switch, commonly known as the dimmer switch, is located just to the left of the steering column, and is a button operated by the left foot. It controls the high and low beam of the service headlights and operates only when the main lighting switch is pulled out to its second position. 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) PANEL SWITCH (figs. 7 and 8). The panel lights are controlled by a push and pull switch. This switch is operating only when the main light switch is pulled out to second position (service lights on). The panel lights are on when the switch is pulled out.

(5) CHOKE CONTROL (figs. 7 and 8). The choke control 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 (figs. 7 and 8). The throttle control 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 dash below the oil gage to the left 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 con-

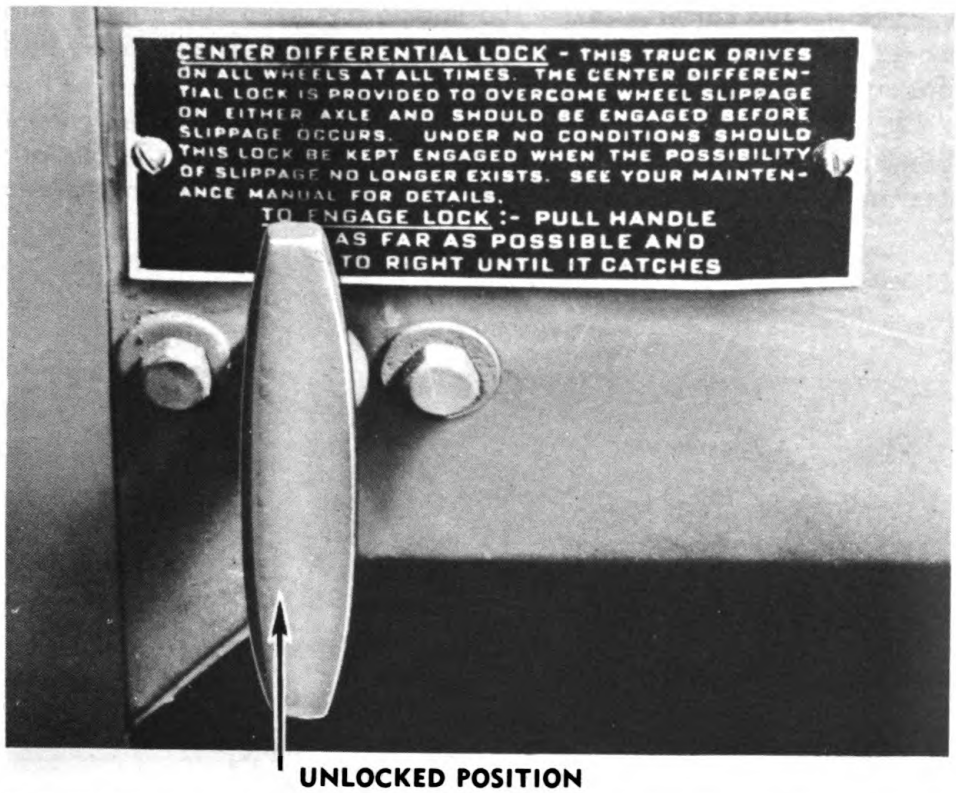
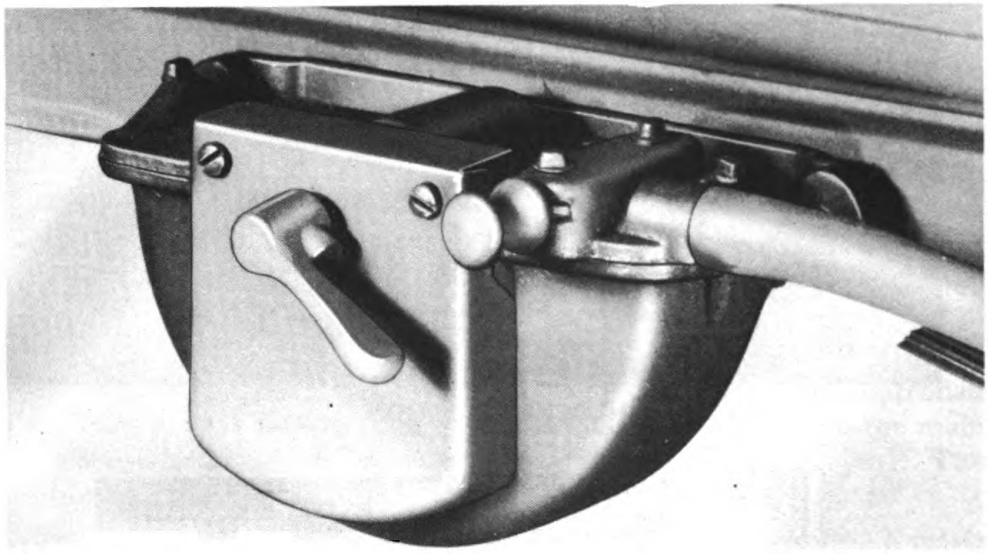


Figure 9—Center Differential Lock Lever

venient 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. 8). The center differential lock lever is located on the dash panel just to the left of the steering column. It provides a means of locking and unlocking the center



RA PD 61087

Figure 10—Windshield Wiper

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 additional information, refer to paragraph 6 **h** and **i**.

(8) STARTER MOTOR BUTTON (fig. 9). The starter motor button, located on the cowl right of steering column and above the accelerator pedal, is easily accessible for operation with the right foot. 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 right foot and hold it in the depressed position until the engine starts. **CAUTION:** Do not

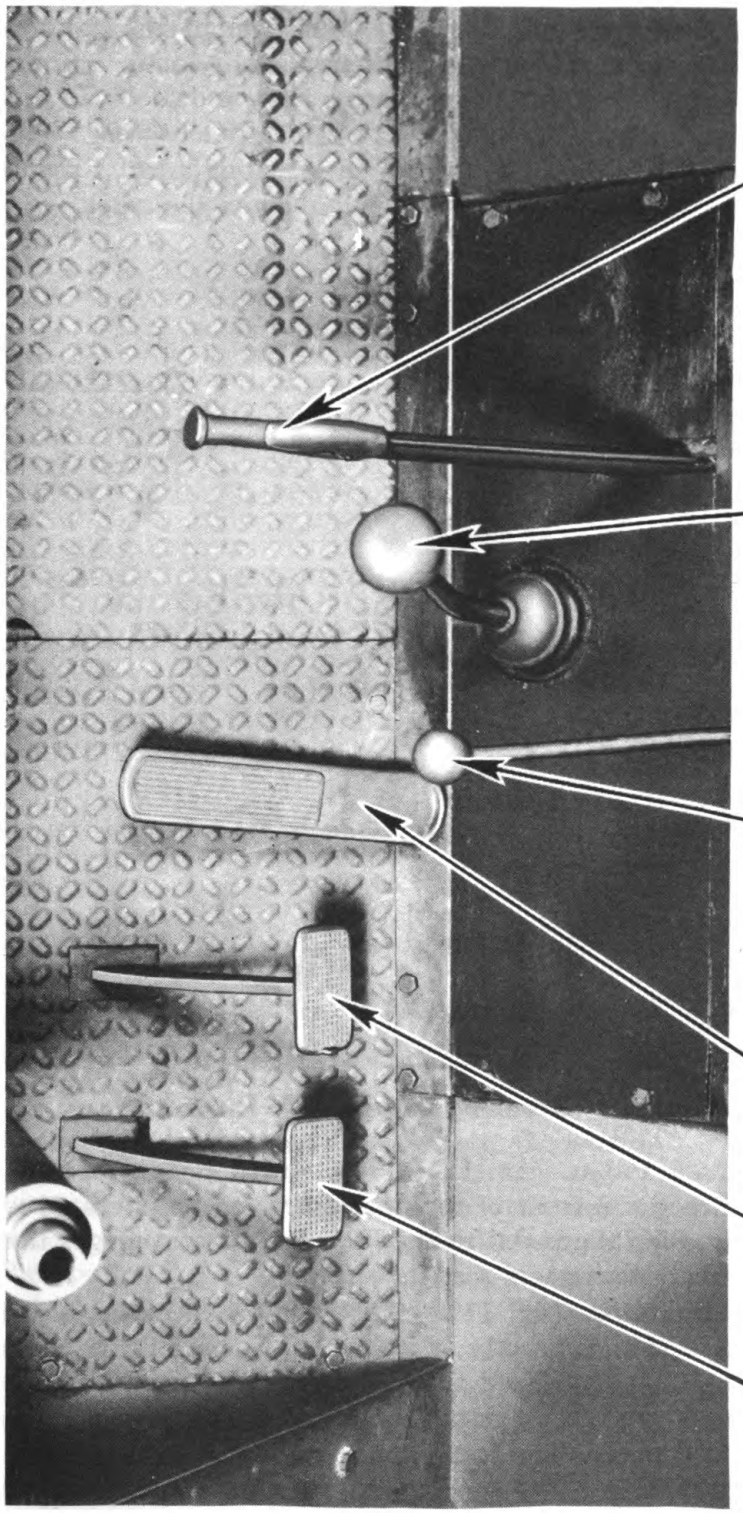


Figure 11—Controls

press the starter button while the engine is running or while the shifting lever is in gear.

(9) WINDSHIELD WIPER (fig. 10). This vehicle is equipped with two windshield wipers. The control is a small individual button located on each wiper and is pulled out to operate the windshield wiper blades.

(10) ACCELERATOR PEDAL (fig. 11). 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.

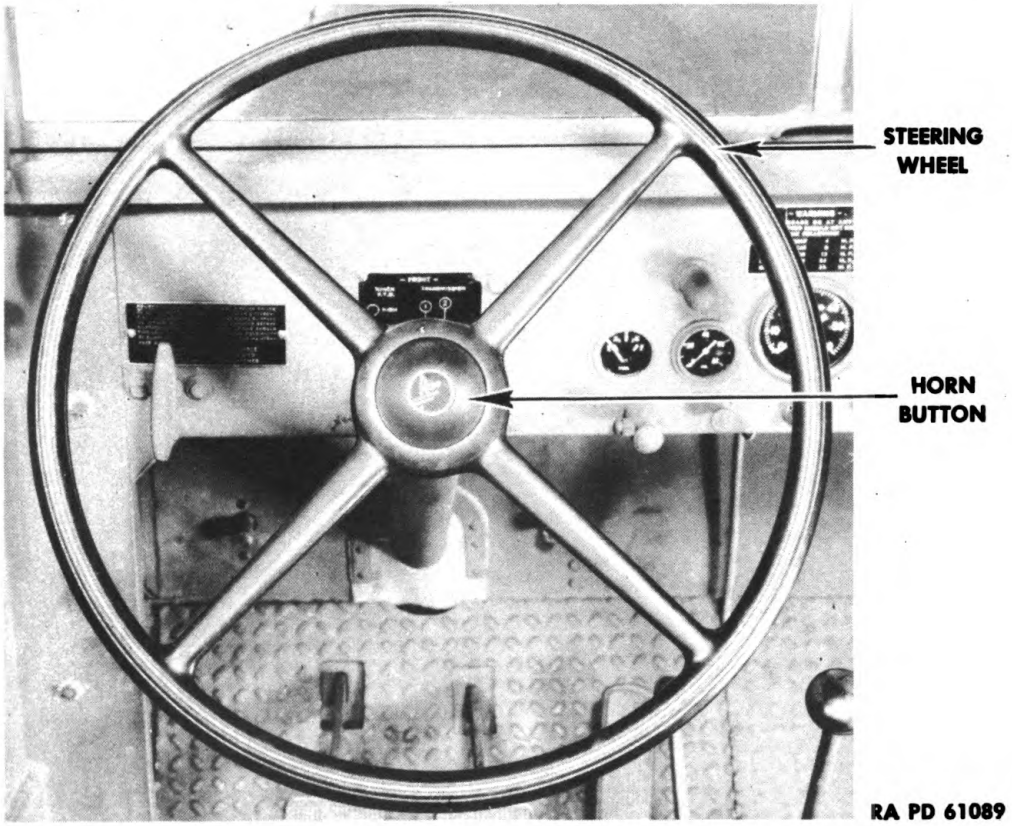


Figure 12—Steering Wheel and Horn Button

(11) CLUTCH PEDAL (fig. 11). 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.

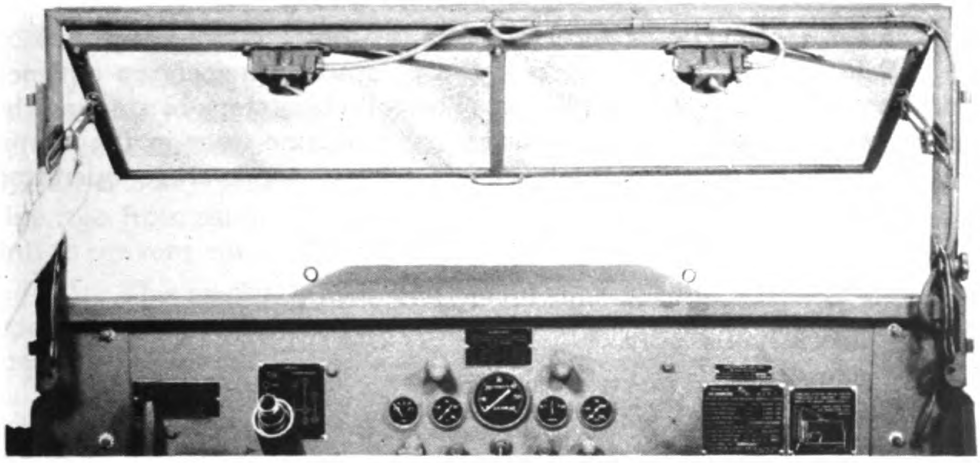
(12) BRAKE PEDAL (fig. 11). The foot brake pedal, also located on the floor boards and directly in front of the operator, is operated by the right foot and is depressed to slow down or stop the vehicle.

(13) WINCH POWER TAKE-OFF (fig. 11). The hand lever, nearest the operator 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.

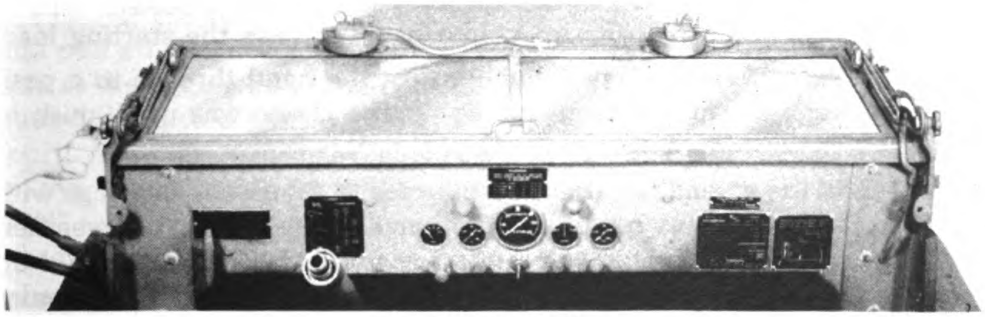
CONTROLS AND OPERATION

(14) TRANSMISSION GEARSHIFT LEVER (fig. 11). This lever is located to the right of the winch control lever. Its purpose is to control the shifting of all gears in the transmission. The diagram (fig. 15) 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.

(15) HAND BRAKE LEVER (PARKING) (fig. 11). This lever is the one farthermost to the right of the driver. It is used principally for holding



OPEN POSITION



DOWN POSITION RA PD 61090

Figure 13—Windshield Operation

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.

(16) HORN BUTTON (fig. 12). 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.

(17) WINDSHIELD ADJUSTMENTS (fig. 13).

(a) Each side of the windshield is fitted with adjustable throw-out arms. These arms permit the windshield to be moved out at the bottom.

It is necessary only to loosen the thumb nuts on each throw-out arm, move the windshield to the desired position, and tighten the thumb nuts.

(b) The windshield is also designed with a hinge arrangement at the bottom so that the entire windshield and framework may be tipped forward and made to lie flat over the hood. This arrangement may be used only when the canvas top is not used. To place the windshield in this position, loosen the thumb nuts, tilt the windshield forward as far as the adjusting arms will allow, and tighten the thumb nuts.

5. STARTING THE ENGINE.

a. Before the engine is started, the prestarting inspection outlined in section IV must be accomplished. The following steps in starting the engine should be taken to avoid unnecessary engine wear in the warm-up period. The steps below are satisfactory under average operating conditions:

(1) Set the hand brake lever.

(2) Place transmission shift lever in neutral position.

(3) Check fuel supply.

(4) Pull out hand throttle part way.

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

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

(7) 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.

(8) 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. Special Precautions with New Engines.

(1) 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.

(2) Remove the spark plugs and inject a teaspoonful of light cylinder oil in each cylinder to ensure lubrication of the pistons and cylinders when the engine first starts.

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

(4) Both engine and accessories must have proper lubrication at all times. (See section VI.)

(5) See that the crankcase is filled with the proper grade of oil (par. 19).

(6) See that the water pump and fan have proper lubrication. All other accessories—electrical equipment, etc.—should be lubricated in accordance with instructions in section VI.

(7) 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. Wherever possible, use soft or distilled water in the cooling system; avoid hard or alkaline waters.

(8) 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." (Refer to section XIX, par 85 f). 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.

(9) This engine is equipped with a governor which will maintain the speed within the proper limits, as listed in paragraph 3. Under no conditions should maximum permissible speeds be exceeded.

(10) The oil bath air cleaner should be serviced before the truck is put in service (par. 19).

c. 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 (par. 11). 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 (par. 84).

d. 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.

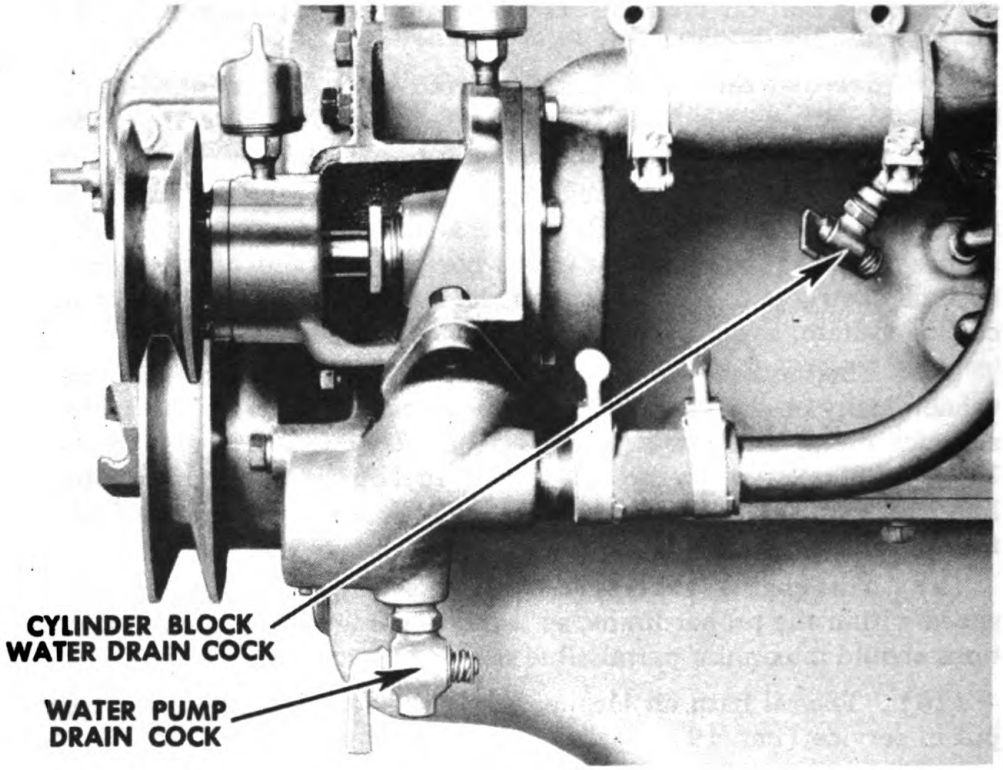


Figure 14—Cooling System Drain Cocks

(1) DRAINING THE COOLING SYSTEM (fig. 14). Drain cocks are located at the lowest points of the cooling system. There is a drain cock on the left side of the cylinder block, one on the water pump, 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 (par. 10).

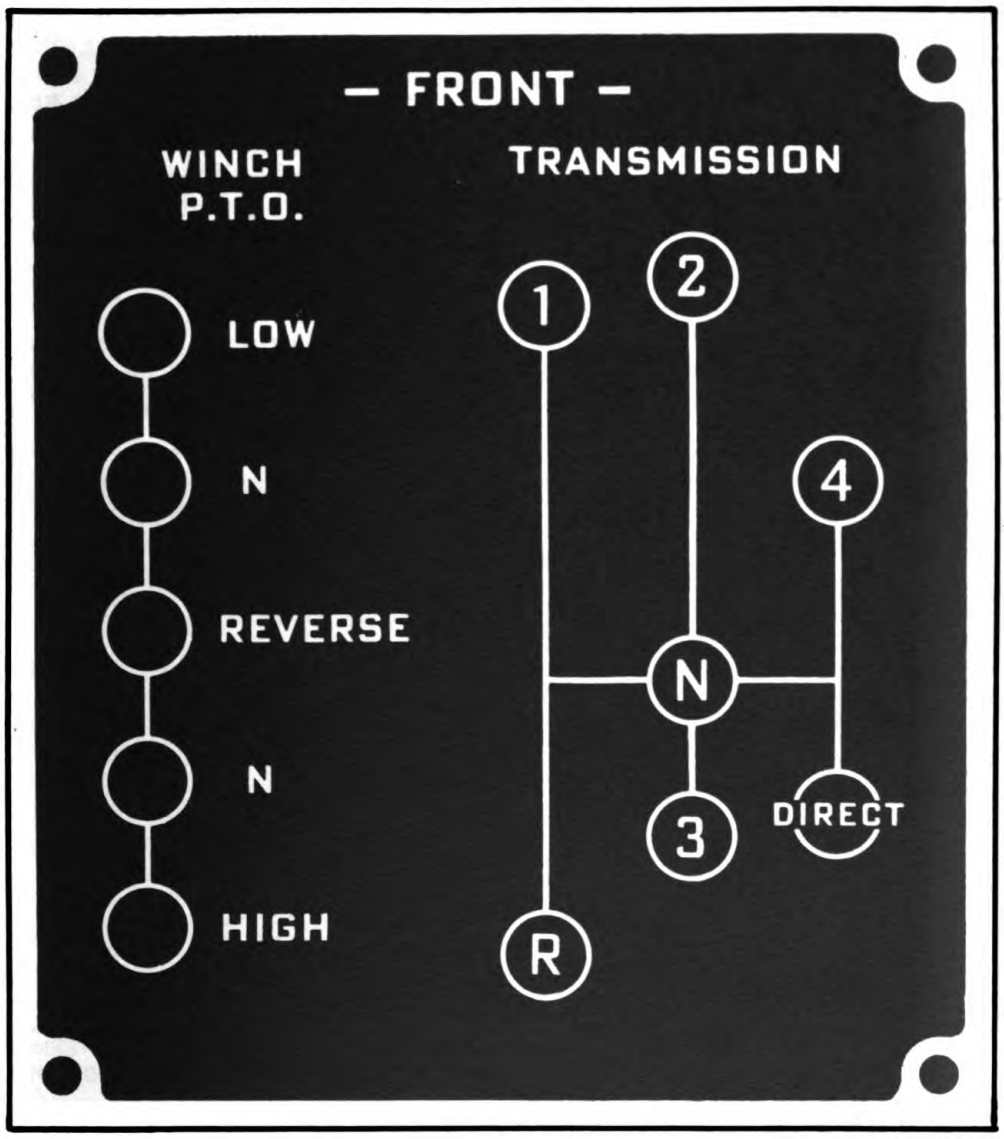
(3) CARBURETOR. The carburetor choke should never be left closed or partially closed when an engine is running. The closing of the choke increases the richness of the mixture. Rich mixtures always heat up the engine, waste fuel, and burn the exhaust valves. Always make certain that the choke valve is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

6. 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.



RA PD 61092

Figure 15—Shifting Plate

(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.

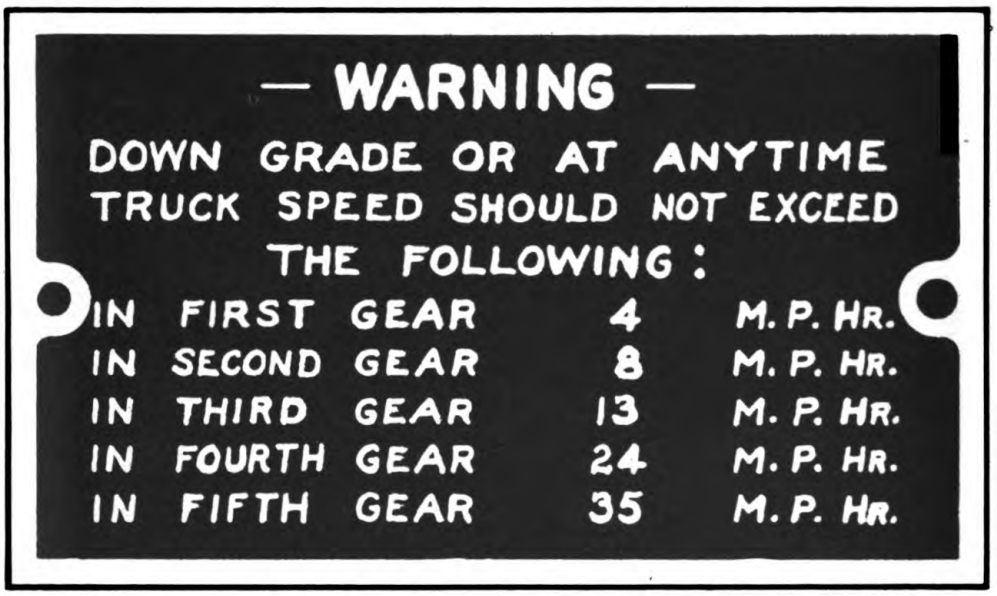


Figure 16—Warning Plate RA PD 61093

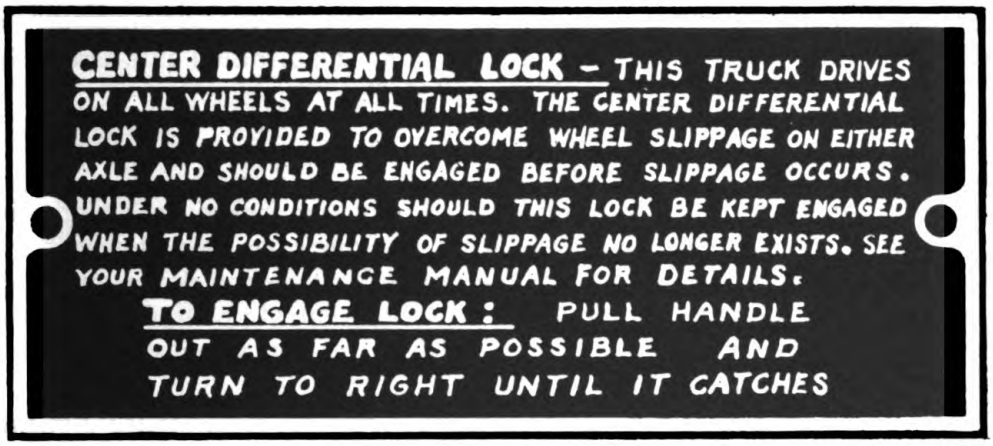
d. Shifting into Reverse Gear. Before attempting to shift into reverse gear, stop the truck. Remove foot from accelerator and disengage clutch. Move the transmission shift lever into the position (R) (fig. 15). Release the clutch pedal gradually and at the same time accelerate the engine by pressing 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 (fig. 16). **CAUTION**: When driving down a hill, do not permit the truck to exceed the maximum road speed specified in paragraph 3 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. Refer to paragraph 6 **h** and **i** for additional information when approaching loose sand and gravel.

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. Refer to steps **h** and **i** below for additional information when approaching soft terrain.



RA PD 61094

Figure 17—Center Differential Warning Plate

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. 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 spiders from the dead axle. Disconnecting the propeller shaft and removing the driving spiders will prevent further damage to the disabled axle assembly. Lock the center differential (par. 4 a (7)).

7. 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 partly open and the engine speed increased before turning off the ignition. As the engine coasts to a stop, it will blow out all vapors and residual matter, and leave air and gasoline vapor in the combustion chambers. Make certain all lights are turned off.

Section III

AUXILIARY EQUIPMENT CONTROLS AND OPERATION

8. WINCH DESCRIPTION (figs. 18 to 20).

a. The winch used on this vehicle has a 10,000-pound capacity. It is mounted at the front end of the truck and is supported between the two side frame rails.

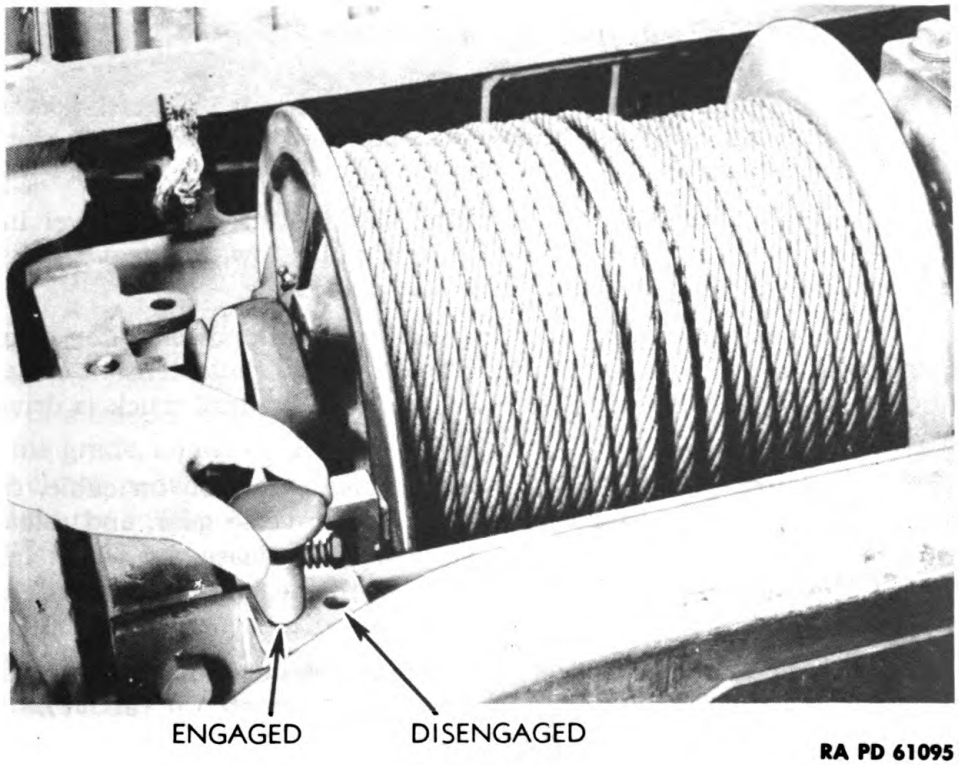


Figure 18—Winch Jaw Clutch Operation

9. WINCH OPERATION.

a. Power for operating the winch is transmitted from the main transmission through the power take-off unit, mounted to the left side of the transmission, through the drive shaft to the worm shaft of the winch.

b. The winch is controlled by the power take-off shift lever in the cab which operates the power take-off in either the two forward or one reverse speeds (fig. 15). Neutral points are between each of the gear speeds, and the lock for the control lever will secure the take-off in one of the neutral points. Lever operation is explained in paragraph 4 a (13).

Figure 19—Winch Caution Plate RA PD 61096

c. Hooking onto Load. Pull out jaw clutch to released position (fig. 18). Pull out cable and hook onto load; then engage the jaw clutch with the poppet locked.

d. Pulling. Disengage clutch pedal, shift power take-off lever into high or low forward speeds (high, for light pulls; low, for heavy pulls). Release clutch pedal gradually; winch will wind cable.

e. Stopping. Disengage clutch pedal and shift power take-off into neutral position. Worm shaft automatic brake will hold tension on line until power take-off is shifted into reverse gear, or until truck is driven forward.

f. Releasing Tension. To lower or release tension on cable, disengage clutch pedal, shift power take-off into reverse gear, and release pedal. Winch will now operate in reverse and release the winch line. CAUTION: Never try to release a load with the jaw clutch "out"; always use reverse.

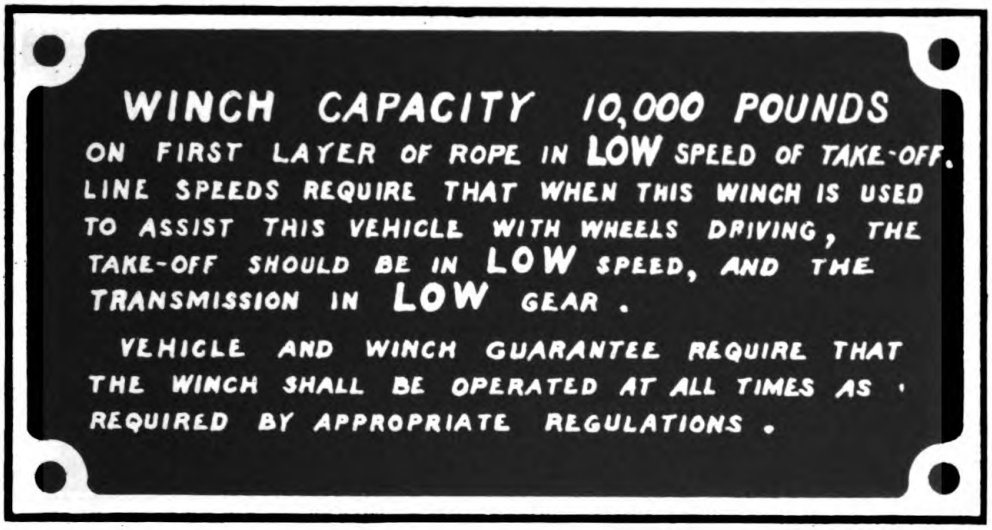
g. Pulling Truck. Pull out winch line and secure to a tree with the jaw clutch released. Engage jaw clutch and follow step d (above).

h. Winding Cable. Winding-on the first layer is most important. The coils of the rope must be tight against each other so the coils on the next layer cannot jam down between the first layer. As the cable is wound on, it should be tapped every few inches with a wooden block to prevent flattening the wires. NOTE: Winch-pulling speeds are based on a maximum engine speed of 800 revolutions per minute, which should not be exceeded when using winch.

i. Winch Hints.

(1) When the winch is not in use, and the line properly coiled in place, keep the jaw clutch engaged and lock the power take-off shift lever in neutral.

(2) When the winch is being used to assist the vehicle, with the wheels driving, always have the power take-off in low gear. The transmission should also be in low gear.



RA PD 61097

Figure 20—Winch Capacity Plate

j. Automatic Brake. The automatic brake is a band type consisting of a brake band around a disk keyed to the worm shaft. It prevents the load from releasing when the power take-off is in neutral position, or after the shear pin has failed. To test the brake, place the truck at the top of a steep grade, fasten the winch line to another truck at the bottom of the grade, and start pulling it up the grade. After a short haul, release the clutch pedal. The winch will stop pulling, and the truck being pulled should not roll backward if the brake is correctly adjusted.

k. Shear Pin. The forward universal joint is connected to the winch worm shaft by a shear pin, to prevent overloading of power take-off and chassis frame.

l. Lubrication. Refer to Lubrication Guide (section VI).

Section IV

OPERATION UNDER UNUSUAL CONDITIONS

10. COLD WEATHER OPERATION.

a. The operation and maintenance of automotive vehicles at low temperatures involve factors which do not exist at normal temperatures. Operators and maintenance personnel must spend more time in protective maintenance. Failure to give this extra service will result in actual damage, unnecessary and untold expenses, and also failure to start.

b. "Low temperatures" have been divided into 2 ranges: –10 F to –30 F, and below –30 F. Engine and lubricants undergo changes in physical properties below –30 F. In many cases accessories and equipment for supplying heat to engine, fuel, and intake air are required.

c. The following is information that the operator should be familiar with before operating a vehicle in cold weather:

(1) GASOLINE. The formation of ice crystals from small quantities of water in the fuel sometimes causes considerable trouble. The following precautions should be followed to keep water out of the fuel tank:

(a) Strain gasoline through a suitable strainer. CAUTION: A positive metallic contact must be maintained between the fuel container and gasoline tank unless fuel tank and container are independently grounded.

(b) Keep fuel tank as full as possible.

(c) Add ½ pint of denatured alcohol to a tank of gasoline to absorb moisture that might condense.

(d) Store gasoline in clean drums.

(e) Never pump gasoline drums dry; allow about 4 inches of fuel to remain.

(2) CRANKCASE. Engine lubrication at temperatures above –10 F is covered in section VI of this manual and in the Lubrication Guide. For temperatures below –10 F, one of the following measures must be taken according to facilities available:

(a) Keep vehicle in heated enclosure, if possible, when it is not being operated.

(b) When the engine is stopped, drain the crankcase oil while it is still warm, and store it in a warm place until vehicle is to be operated again. If a warm place is not available, heat the oil before putting it in the crankcase. (Do not get the oil too hot. Heat only to a point where the bare hand can be inserted without burning.) CAUTION: *Place a tag in*

OPERATION UNDER UNUSUAL CONDITIONS

a conspicuous place in the cab to warn personnel that the crankcase is empty.

(c) Cover the engine with a tarpaulin. About three hours before the engine is to be started, place fire pots under the tarpaulin. A Van Prag, Primus type, or any other type of blow torch or kerosene lantern may be used. With due consideration for fire hazards involved, the flame may be applied direct to the oil pan.

(d) Dilute crankcase oil with gasoline. The table below shows the quantities of diluent to be added to the oil prescribed on the Lubrication Guides for use at – 10 F. The quantities of diluents will form mixtures for satisfactory starting at temperatures indicated.

	—10 F to —30 F	Below —30 F
Gasoline	½ qt to each 4½ qt of engine oil	1 qt to each 5 qt of engine oil

1. When the crankcase oil is first diluted, turn the engine over several times to mix oil and diluent thoroughly.

2. Check oil level frequently.

(3) COOLING WATER. Ethylene glycol (Prestone) is prescribed for use as antifreeze solution. If ethylene glycol is not available, other materials may be used. The following table gives three permissible materials and the quantity to be added to prevent freezing at indicated temperatures:

Freezing Point	Pints Ethylene Glycol (Prestone) per gallon of system capacity	Pints Glycerine Grade A, U.S.P. per gallon of system capacity	Pints Denatured Alcohol per gallon of system capacity
10 F	2	3	2½
0 F	2½	3½	3
– 10 F	3	3½	3½
– 20 F	3½	4	4
– 30 F	4	5	5
– 40 F	4½	–	5½
– 50 F	4½	–	6
– 60 F	5	–	6½
– 70 F	5	–	–

(a) Precautions:

1. Do not use alcohol if other materials are available.

2. Flush out the radiator and cylinder head separately before adding antifreeze material.

3. Do not mix antifreeze solutions.

4. Check cooling system for leaks.

5. If hot water heater is added to cooling system, add about one gallon to the original quantity of the cooling system liquid.

6. Check thermostat.

7. Use radiator cover to accelerate and maintain engine operating temperatures.

8. Check adjustment and strength of fan belt. Replace rubber fan belt with fiber, leather, or synthetic belts below – 20 F.

9. Make sure that water pump is in good operating condition.

(4) BATTERY AND ELECTRICAL PARTS.

(a) Keep battery fully charged, with hydrometer reading between 1.275 and 1.300. A fully discharged battery will freeze and rupture at 5 F.

(b) Clean and repair all electrical wiring accessories (spark plugs, ignition coil, and distributor) to prevent undue resistance. Make sure all connections are tight.

(c) Set spark plug gap at 0.005-in. less than that recommended for operation under normal conditions.

(d) Check generator, starter brushes, commutators, and bearings. See that the commutators and brushes are clean.

(e) Be sure that no heavy grease or dirt is on the starter throw-out mechanism.

(5) GEAR LUBRICANTS. Below – 15 F dilute lubricants prescribed for use at – 10 F with 10 per cent gasoline. If circumstances preclude dilution of lubricants, heat gear cases with a blow-torch. Play the torch lightly under the entire gear case; do not concentrate the heat in one spot.

(6) CHASSIS AND OTHER LUBRICANTS.

(a) Chassis, wheel-bearing, and other lubricants prescribed for use at – 10 F will furnish satisfactory lubrication as low as – 30 F. For sustained temperatures below – 30 F, use grease comparable to GREASE, lubricating, special, or GREASE, O. D., No. 00. Use OIL, engine, crankcase grade, in steering gear housing.

(b) Commercial brake, and shock absorber fluids remain fluid at temperatures encountered.

(7) SPECIAL OPERATING PRECAUTIONS.

(a) Full choke is necessary to secure the air to fuel ratio required for cold-weather starting. Check the butterfly valve to see that it closes all the way and otherwise functions properly.

(b) Check fuel pump.

(c) Below +10 F remove oil from the air cleaners. Below –30 F remove the air cleaner.

(d) Inspect vehicle frequently.

(e) Remove or bypass oil filters at temperatures below – 30 F.

(f) Disconnect oil-lubricated speedometer cables at the drive end for operating vehicles at temperatures of below – 30 F.

(g) Remove and clean sediment bulb, strainer, etc., in the fuel system at frequent intervals.

(h) Re-tune engine frequently.

(i) Before starting the engine, pull the choke all the way out and leave it partially pulled out until the engine has warmed up. Turn the engine as rapidly as possible with the starter and release starting pedal as soon as the engine fires. After the engine has started, idle it until it has warmed up sufficiently to run smoothly. Do not race the engine immediately after starting.

(j) To stop the engine, first increase the engine speed and then turn off the ignition and release the throttle at the same time.

d. Cold Weather Accessories. The following list of cold weather accessories may be employed at the discretion of officers in charge of the materiel:

(1) Tarpaulins, tents, or collapsible sheds are useful for covering vehicles, particularly the engines.

(2) Fire pots, Primus type, or Van Prag blow-torches, ordinary blow-torches, oil stoves, or kerosene lanterns can be used for heating vehicles.

(3) Extra batteries and facilities for changing batteries quickly are aids in starting.

(4) Steel drum and suitable metal stands are useful for heating crankcase oil.

(5) Insulation of the fuel line will help prevent ice formation inside the line.

(6) Small quantities of denatured alcohol, about one-half pint to a tank of fuel, will reduce difficulties from water in gasoline.

(7) Radiator covers can be improvised locally and help to keep the engine running at normal temperatures.

11. HIGH TEMPERATURE OPERATION.

a. To prevent overheating, the following units should be checked:

(1) The cooling system should be kept clean and full.

(2) The fins in the radiator should be kept free from bugs and foreign material that might affect free circulation of air.

(3) The fan belt should be properly adjusted.

(4) A gear reduction which requires the engine to labor at low engine speeds should not be used, if practical, as this will cause overheating due to lack of sufficient water and air circulation.

(5) Under severe conditions it may be advisable to remove the hood side panels, providing less restriction to the flow of air.

(6) Watch the temperature indicator, and if the needle goes in the red band, stop the engine and investigate the cause. The vehicle should be headed into the wind, if possible, and permitted to cool.

b. Vapor Locks. Vapor locks are frequent. The fuel lines and fuel pump should be located away from areas of great heat and should not be screened from the air from the fan. If vapor locks occur, it may be necessary to insulate fuel lines and fuel pumps which cannot be relocated.

12. SANDY AND DESERT TERRAIN.

a. Air Filters and Protective Covers.

(1) There is always some sand in the air in the desert, more is stirred up by the passage of vehicles, and during a sandstorm the amount may be such as to prohibit movement. Without adequate protective measures the sand will choke carburetors, plug feed lines, score the cylinders, damage the distributor, and increase the wear on all bearings. The oil bath air filter will protect the engine if it is kept clean. Constant, close supervision and daily inspection of air filters are the only ways of insuring that sand will not get into the engine. The crankcase breather opening should be equipped with an effective air cleaner. Air cleaners should be also provided for any other device using an air intake, such as a vacuum booster or engine-driven compressor. Air cleaners should be located where the air stream will have the least dirt pollution.

(2) Sand will enter the crankcase and fuel lines when replenishing the oil or refueling unless great care is used during these operations. The driver should wipe all sand off the caps before removing and off the spouts of oil and gasoline containers before they are used. It may be necessary to make canvas boots to protect front wheel joints and distributors. Sand and dust will cause failure of instruments in panel if these are not carefully sealed. Scotch tape may be used for this purpose.

b. Tires.

(1) Operations in the desert will require movement over all types of terrain. Tires must be suitable for every type of surface which will be encountered. Most difficulty will be met in sand. Air pressure must be varied to suit the type of ground surface. Over sand or soft-powdered clay, the ground pressure per square inch should be reduced to the minimum. By deflating the tires the area in contact with the ground is increased and the tire fits itself to the irregularities of the sand without breaking through the crust. The minimum pressure must be determined by test for each type of vehicle. Tires on flat-base rims will spin on the rims if pressure is too low.

(2) In rocky or boulder-strewn ground, tires must be as fully inflated as the age and condition of the vehicle permit. At low pressure the innermost layers of canvas will be broken by the violent inward bending when a sharp rock is struck. The resulting chafing will wear out the inner tube even though no danger is apparent from the outside of the tire. Since a normal day's march will take a vehicle over different kinds of ground, strict tire discipline is necessary.

c. Electrical Difficulties. The constant shock and vibration which accompanies passage over rough ground frequently causes cable clips to shake loose, and cables are broken or shorted. Frequent inspection of cable clips should be made and spring washers inserted under the nuts if possible. Voltage control units may cause trouble because of breaking of wire in shunt winding or sticking of regulator points. Drivers should watch the ammeter as carefully as any other instrument, since overcharging, even when not sufficient to buckle the plates, always results

in loss of battery water, most difficult to obtain in the desert. The high salinity of water issued for drinking and for radiators forbids its use in batteries.

d. Loading. The vehicle must be carefully loaded. Excessive breaking of springs has been a constant source of trouble in the vehicles used in the desert. The rough going is very hard on springs and they are quickly broken by overloading, improper distribution of load, or shifting of load while moving.

e. Special Equipment.

(1) To extricate the vehicle from soft sand the driving wheels must be given a firm surface. For vehicles with single tires on driving wheels an excellent solution is the provision of a pair of steel channels four or five feet long. In cross section the channels should have a curved bottom wide enough to take the whole width of the tire at low pressure. It should be bent up sharply at the sides to prevent the tires running off, and then down again to form a rounded flange on each side to strengthen the channel. Two angle irons projecting from the underside and holes punched in the bottom will prevent the channel from slipping under driving thrust. Mats should be used to form a roadway for front wheels. Canvas strips, stiffened by lateral rungs of steel sewn between two thicknesses of canvas, are excellent for this purpose. Such mats can be rolled up for transport and rolled out in front of each front wheel when needed.

(2) If dual wheels are used on the vehicle, a single round wooden spar may be used instead of channels. The spar should be placed between the tires and used as a rail.

f. Driving.

(1) The driver should not attempt to get out of the sand by means of his engine, the instant the vehicle has broken through the crust and ceased to move. Otherwise, the driving wheels will merely sink deeper into the sand and extrication will be made more difficult.

(2) If the vehicle breaks through the crust and becomes stuck, adequate excavations must be made in front (or, if backing out, in rear) of the wheels so that the near ends of the channels or mats are on a level with the bottom of the tire tread, and so that the slope of the channels is not too steep. If this is not done the engine will be unable to set the vehicle in motion up the initial slope to enable the wheels to begin to drive against the firm surface of the extricating equipment. Once in motion, the vehicle should be driven to firm ground or stopped headed down a slope to avoid getting stuck again after the channels have been loaded on.

(3) To avoid breaking through the crust when starting, vehicles should always halt, when possible, on hard ground or headed down a slope.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Section V

INSPECTION AND PREVENTIVE MAINTENANCE SERVICE

13. PURPOSE.

a. To insure mechanical efficiency it is necessary that the vehicle be systematically inspected at intervals during the day, and each week, in order that scheduled maintenance services be performed, and that defects may be discovered and corrected before they result in serious damage or failure. The services set forth in this section are those performed by driver or crew before operation, during operation, at halt, and after operation (and weekly).

b. Driver preventive maintenance services are outlined for all vehicles in general on the back of Drivers Trip Ticket and P. M. Service Record, W. D. Form No. 48. However, in this manual, certain procedures that do not apply to this vehicle are deleted, and in some cases there is deviation from the numerical sequence of the item numbers in order to best conserve driver's time and effort in the performance of the services.

c. The general inspection of each item applies also to any supporting member or connection, and usually includes a check to see whether the item is in good condition, correctly assembled, secure, or excessively worn.

d. The inspection for "good condition" is usually an external visual inspection to determine whether the unit is damaged beyond safe or serviceable limits. The term, "good condition," is explained further by the following terms: Not bent or twisted, not chafed or burned, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut.

e. The inspection of a unit to see that it is correctly assembled is usually an external visual inspection to see whether it is in its "normal assembled" position in the vehicle.

f. The check of a unit to determine if it is "secure" is usually an external visual inspection, a hand-feel, or a pry-bar check for looseness in the unit. Such an inspection should include any brackets, lock washers, lock nuts, locking wires, or cotter pins used in the assembly.

g. Excessively worn, which is a frequently used term, will be understood to mean worn close to, or beyond, serviceable limits, and likely to result in a failure if not replaced before the next scheduled inspection.

h. Any defects or unsatisfactory operating characteristics beyond the scope of first echelon to correct must be reported at the earliest opportunity to the designated individual in authority.

INSPECTION AND PREVENTIVE MAINTENANCE SERVICE

14. BEFORE-OPERATION SERVICE.

a. This service will not be entirely omitted, even in extreme tactical situations. When thoroughly trained, driver will be able to quickly determine the condition of the vehicle.

b. Procedures. Before-operation service consists of inspecting items listed below according to the procedure described, and correcting or reporting any deficiencies. Upon completion of the service, results should be reported promptly to the chief of section or other designated individual.

(1) ITEM 1, TAMPERING AND DAMAGE. Look for any injury to vehicle in general, its accessories or equipment, caused by tampering or sabotage, collision, falling debris, or shell-fire since parking vehicle. Look under hood for signs of tampering or sabotage, such as loosened or damaged accessories, loose fuel, oil or water lines, or disconnected linkage.

(2) ITEM 2, FIRE EXTINGUISHER. Inspect for corrosion, full charge, clogged nozzle, and secure mounting.

(3) ITEM 3, FUEL, OIL AND WATER.

(a) Fuel—Check for amount in tank and spare cans.

(b) Oil—Read crankcase level. Maintain level to full mark. Add oil if necessary.

(c) Water—Check level, condition of coolant, and value of antifreeze if used. Add if necessary. NOTE: Any appreciable change in level since performing after-operation service should be investigated and reported.

(4) ITEM 4, ACCESSORIES AND DRIVES. Examine all accessories such as carburetor, generator, regulator, starting motor, fuel pump, fuel strainer, fan, water pump for loose connections or mountings, and leaks.

(5) ITEM 6, LEAKS, GENERAL. Examine ground under vehicle for indications of fuel, oil, water, gear oil or brake fluid leaks.

(6) ITEM 7, ENGINE WARM-UP. Start engine and note any tendency toward hard starting, low cranking speed, improper or noisy engaging and disengaging when starter control is operated. Set hand throttle to fast idle speed and during the warm-up period proceed with the following before-operation services. NOTE: During engine warm-up period listen for unusual noises; watch instrument indications and engine performance such as misfiring and rapid temperature rise.

(7) ITEM 8, CHOKE. While starting engine, test operation of choke and examine linkage and connections for looseness. As engine warms up, reset choke as required to prevent over-choking and diluted engine oil.

(8) ITEM 9, INSTRUMENTS.

(a) Oil Pressure Gage. Normal reading 40 to 45 pounds at 1000 rpm or fast idle speed. Slow idle, 15 pounds. NOTE: If gage does not indicate normal pressure, stop engine immediately and investigate cause.

(b) Ammeter. After engine starts and is running at fast idle, ammeter should show a high positive (+) charge rate for a short period until generator restores to battery the current used in starting. After this period

ammeter should register a zero or slight positive (+) charge with lights and accessories turned off.

(c) Fuel Gage. Must register approximate amount of fuel in tank. Normally fuel tanks would have been filled during the after-operation services and the gage should register full.

(d) Temperature Gage. Normal operating engine temperature 150 F to 190 F. Engine temperature should increase gradually during warm-up period. Extremely low temperature after reasonable warm-up period may indicate thermostat is stuck open.

(9) ITEM 10, HORN AND WINDSHIELD WIPERS.

(a) Horn. Tactical situation permitting, test horn.

(b) Windshield Wipers. Inspect for missing or damaged blades or arms and note whether blades contact glass properly. Start wiper motors to see that they operate properly through their full stroke.

(10) ITEM 11, GLASS AND REAR-VIEW MIRRORS. Inspect for damaged frames, and brackets, or discolored glass. Clean windshield glass. Clean mirror and aim properly.

(11) ITEM 12, LAMPS AND REFLECTORS. Tactical situation permitting, turn on switches and see that all lamps light. See that lamps are secure and that lenses are clean and not broken.

(12) ITEM 13, WHEEL AND FLANGE NUTS. See that they are all present and secure.

(13) ITEM 14, TIRES. Pressure 60 pounds (maximum) cool. Look for damage and see that there are no embedded objects in treads or carcass.

(14) ITEM 15, SPRINGS AND SUSPENSION. See that they are secure and not damaged or shifted.

(15) ITEM 16, STEERING LINKAGE. Steering gear case and all connecting linkage must be secure, not damaged and no excessive lubricant leaks in evidence.

(16) ITEM 17, FENDERS AND BUMPERS. Inspect for looseness or damage.

(17) ITEM 18, TOWING CONNECTIONS. See that they are secure, and not damaged.

(18) ITEM 19, BODY, LOAD, AND TARPAULINS. Inspect to see that they are in good condition and secure.

(19) ITEM 20, DECONTAMINATOR. Must be secure and fully charged.

(20) ITEM 21, TOOLS AND EQUIPMENT. Present (see tool list in manual), serviceable, properly mounted and stowed.

(21) ITEM 22, ENGINE OPERATION. Should idle smoothly. Accelerate and decelerate and listen for any unusual noise that may indicate compression or exhaust leaks, worn, damaged, loose or inadequately lubricated engine parts or accessories. Note any unusual smoke from exhaust.

(22) ITEM 23, DRIVER'S PERMIT AND FORM NO. 26. Must be present in vehicle, legible, and safely stowed.

(23) ITEM 25, DURING OPERATION SERVICE. The during-operation services should start immediately vehicle is put in motion, in the nature of a road test.

15. DURING-OPERATION SERVICE.

a. While vehicle is in motion, listen for any sounds such as rattles, knocks, squeals, or hums that may indicate trouble. Look for steam from radiator and smoke from any part of vehicle. Know and watch for *odor* of an overheated generator, brakes or clutch, boiling antifreeze, fuel vapor from a leak in fuel system, exhaust gas or other such signs of trouble. Any time the brakes are used, gears shifted, or vehicle turned, consider this a test and notice any unsatisfactory or unusual performance. Watch the instruments constantly. Notice promptly abnormal instrument indication that may signify possible trouble in system to which the instrument applies.

b. Procedures. During-operation services consist of observing items listed below according to the procedures, following each item and stopping vehicle when serious trouble develops. Notice minor deficiencies to be corrected or reported at earliest opportunity, usually next scheduled halt.

(1) ITEM 27, FOOT AND HAND BRAKES. The foot brake should operate smoothly and effectively without pulling vehicle to one side, leaving reserve pedal travel of one-half inch. When vehicle is stopped, hand brake should hold vehicle satisfactorily when on a reasonable incline, reserve of one-quarter to one-third of lever travel available.

(2) ITEM 28, CLUTCH. Clutch pedal should have ½ inch free pedal travel before clutch starts to disengage. Should not chatter, squeal, or slip.

(3) ITEM 29, TRANSMISSION. Gears should shift smoothly, operate quietly, and not creep out of mesh during operation.

(4) ITEM 31, ENGINE AND CONTROLS. Be on the alert for deficiencies in engine performance such as lack of usual power, misfiring, unusual noise or stalling, indications of engine overheating or unusual exhaust smoke. Notice whether engine responds to controls satisfactorily and whether controls appear to be in proper adjustment, and not loose.

(5) ITEM 32, INSTRUMENTS. Observe readings of all instruments for proper and normal indication of functioning of system to which they apply.

(a) Temperature Gage. Should read normal 150 F to 190 F (except under unusual conditions).

(b) Oil Pressure Gage. Should read normal at idle 15 pounds, fast idle or higher speed, 40 to 45 pounds. Any unusual drop or no oil pressure, engine should immediately be stopped.

(c) Ammeter. During operation, ammeter should indicate a zero or positive (+) reading. A discharge, negative (−) reading may indicate faulty generator, regulator or other serious electrical trouble.

(d) Fuel Gage. Should continue to indicate approximate amount of fuel in tank.

(e) Speedometer. Speedometer should indicate vehicle speed correctly at all times (except reverse) without noise or fluctuation.

(6) ITEM 33, STEERING GEAR. Inspect for looseness, binding, pulling to one side, wandering, shimmy, or unusual noise.

(7) ITEM 34, RUNNING GEAR. Listen for any unusual noises from wheels, axles, or suspension parts, that may indicate looseness or damage.

(8) ITEM 35, BODY. Be on alert for noise that would indicate shifting load, loose top, tarpaulin or curtains, loose or damaged panels, hardware, body attachments or gun mounts.

16. AT-HALT SERVICE.

a. At-halt services may be regarded as minimum battle maintenance, and should be performed under all tactical conditions even though more extensive maintenance services must be slighted or omitted altogether.

b. Procedures. At-halt services consist of investigating any deficiencies noted during operation, inspecting items listed below according to the procedures following the items, and correcting any deficiencies found. Deficiencies not corrected should be reported promptly to chief of section or other designated individual.

(1) ITEM 38, FUEL, OIL, AND WATER. Replenish as required.

(2) ITEM 39, TEMPERATURES: HUBS, BRAKE DRUMS, TRANSFER, TRANSMISSION, AND AXLES. Feel for overheating. Transfer case temperatures will run higher than other gear cases.

(3) ITEM 40, AXLE AND TRANSFER VENTS. Wipe clean and examine for damage or clogged condition. Remove and clean if necessary.

(4) ITEM 41, PROPELLER SHAFTS. Examine for looseness, damage, or oil leaks.

(5) ITEM 42, SPRINGS AND SUSPENSION. Inspect for broken or shifted spring leaves, damaged or loose clips, U-bolts, eye-bolts, shackles, and shock-absorber linkage.

(6) ITEM 43, STEERING LINKAGE. Examine steering control mechanism, arms, and linkage for damage or looseness.

(7) ITEM 44, WHEEL AND FLANGE NUTS. All must be present and secure.

(8) ITEM 45, TIRES. 60 pounds (maximum) pressure when cool. Examine for flats or damage. Remove stones from treads and between duals.

(9) ITEM 46, LEAKS, GENERAL. Look under hood, and under vehicle for indications of fuel, oil, water, or brake fluid leaks.

(10) ITEM 47, ACCESSORIES AND BELTS. Examine for looseness, damage, and incorrect alinement. Generator belt tension ½ inch deflection and fan belt 1 inch deflection.

(11) ITEM 48, AIR CLEANERS. Must be secure and air passages clean. When operating under extremely dusty or sandy conditions, inspect air cleaners and breather caps frequently for condition to deliver clean air properly. Service as required.

(12) ITEM 49, FENDERS AND BUMPERS. Inspect for looseness or damage.

(13) ITEM 50, TOWING CONNECTIONS. All towing connections must be securely fastened and locked.

(14) ITEM 51, BODY, LOAD AND TARPAULIN. Inspect vehicle load for shifting, tarpaulin properly secured, and not damaged.

(15) ITEM 52, APPEARANCE AND GLASS. Clean windshield, door, and window glass, rear-view mirror, and lamp lenses, and inspect for damage.

17. AFTER-OPERATION SERVICE AND WEEKLY SERVICE.

a. After-operation servicing is particularly important because at this time the driver inspects his vehicle to detect any deficiencies that may have developed and corrects those he is permitted to handle. He should report the results of his inspection promptly to his chief of section or other designated individual. If this schedule is performed thoroughly, the vehicle should be ready to roll again on a moment's notice. The before-operation service, with a few exceptions, is then necessary only to ascertain whether the vehicle is in the same condition in which it was left upon completion of the after-operation service. The after-operation service should never be entirely omitted even in extreme tactical situations, but may be reduced to the bare fundamental services outlined for the at-halt service if necessary.

b. Procedures. When performing the after-operation service the driver must remember and consider any irregularities noticed during the day in the before-operation, during-operation, and at-halt services. The after-operation service consists of inspecting or testing the following units and correcting or reporting any deficiencies. Those items of the after-operation that are marked by an asterisk (*) require additional weekly services, the procedures for which are indicated in sub-step *(b)* of each applicable item.

(1) ITEM 54, FUEL, OIL AND WATER. Fill fuel tanks and spare cans. Read crankcase level on dip stick and fill to proper level with specified oil. Note level of coolant and observe for contamination. Add water if needed.

(2) ITEM 55, ENGINE OPERATION. Test for satisfactory engine idle without stalling. Accelerate and decelerate engine, noting any tendency to miss or backfire, unusual noises or vibration that may indicate worn parts, loose mountings, incorrect fuel mixture, or faulty ignition. Investigate any unsatisfactory engine-operating characteristics noted during operation.

(3) ITEM 56, INSTRUMENTS. Before stopping engine inspect following instruments for secure mounting, proper connections, damage and proper readings:

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

(a) Oil Pressure, 40 to 45 pounds, at fast idle.

(b) Water Temperature, 160 F.

(c) Ammeter, zero or slight charge at idle speed, with lights and accessories off.

(d) Fuel Gage, approximate fuel in tank.

(4) ITEM 57, HORN AND WINDSHIELD WIPERS. Inspect horn for secure mounting and proper connections, and wiper arms and blades for security, good condition, and wiper motors for smooth operation and full stroke.

(5) ITEM 58, GLASS AND REAR VIEW MIRROR. Clean rear view mirror, windshield and other glass. Examine for secure mounting and damage.

(6) ITEM 59, LAMPS AND REFLECTORS. Observe whether lamps light with switches at ON positions and go out when switched OFF. Inspect all lenses and warning reflectors for dirt or damage; clean if necessary.

(7) ITEM 60, FIRE EXTINGUISHERS. Inspect for tight mountings, damage and leakage at valves. If extinguisher has been used, report it for refill or replacement.

(8) ITEM 61, DECONTAMINATOR. Inspect for good condition and security of mounting.

(9) ITEM 62, *BATTERY.

(a) Inspect battery for cleanliness, good condition, secure mountings and connections, proper electrolyte level and leaks. See that vent caps are clean and secure.

(b) Weekly: Clean dirt from top of battery and remove battery caps; level electrolyte with clean water (distilled if available) if necessary. NOTE: When terminals or posts are corroded, clean thoroughly and apply fresh coating of grease. Tighten terminal bolts if loose. When mountings are loose, tighten them cautiously to avoid damage to battery case. Clean and paint battery carrier if corroded.

(10) ITEM 63, *ACCESSORIES AND BELTS.

(a) Inspect carburetor, generator and regulator, starting motor, fan, and water pump for loose connections or mountings and leaks. Examine adjustment of generator and fan drive belt. Generator belt should deflect ½ inch at half-way between pulleys. Fan belt 1 inch.

(b) Weekly: Tighten all accessories such as carburetor, generator and regulator, starting motor, fan and water pump, loose connections and leaks. Adjust belt if necessary to a deflection of one inch for fan, ½ inch for generator.

(11) ITEM 64, *ELECTRICAL WIRING. Inspect ignition wiring for secure connections, cleanliness and damage. Make an inspection of all accessible low voltage wiring for damage and security.

INSPECTION AND PREVENTIVE MAINTENANCE SERVICE

(12) ITEM 65, AIR CLEANERS AND BREATHER CAPS.

(a) Check oil in air cleaner for correct level and excessive dirt. When oil in cleaner is excessively dirty, clean and refill with fresh oil. When operating in sandy or dusty territory, remove breather caps at least once daily and serve.

(b) Weekly: Remove, disassemble, and clean carburetor air cleaner, breather pipe air cleaner and crankcase ventilator air cleaner. Fill reservoir to correct level with clean engine oil.

(13) ITEM 66, *FUEL FILTERS.

(a) Inspect for good condition, security of mountings and leaks.

(b) Weekly: Remove drain plug bottom side edge (not the top center nut); allow any water and sediment to drain out of the bowl; replace drain plug, and tighten securely.

(14) ITEM 67, ENGINE CONTROLS. Examine for wear, damage, or disconnected linkage and proper lubrication.

(15) ITEM 68, *TIRES.

(a) Remove all foreign matter such as nails, glass or stones from tires or from between duals. Inspect tires for signs of low pressure, abnormal tread wear, cuts and position of valve stem. Replace missing valve caps. Inflate to 60 pounds pressure when cool.

(b) Weekly: Replace badly worn or otherwise unserviceable tires.

(16) ITEM 69, *SPRINGS AND SUSPENSIONS.

(a) Inspect springs for abnormal sag, broken or shifted leaves, loose or missing rebound clips, eye-bolts, U-bolts or shackles.

(b) Weekly: Tighten securely and aline as necessary.

(17) ITEM 70, STEERING LINKAGE. Inspect steering linkage for good condition, loose or inadequately lubricated parts. Examine steering joints and steering gear case for leaks.

(18) ITEM 71, PROPELLER SHAFTS. Remove dirt and excess grease from around shafts and U-joints and inspect for loose connections, lubricant leaks and damage. Remove any foreign material wrapped around shafts.

(19) ITEM 72, AXLE AND TRANSFER VENTS. Examine all axle housing and transfer vents for presence, good condition and security. Free all breather vents of obstructions.

(20) ITEM 73, LEAKS, GENERAL. Look under hood and beneath vehicle for indications of fuel, oil and water leaks. Check around brake drums for brake fluid leaks or lubricant leaks. Examine axle flanges, transmission, transfer case, and differentials for gear oil leaks. Trace all leaks to their source and correct or report them.

(21) ITEM 74, GEAR OIL LEVELS. Check differentials, transmission, transfer case units for correct lubricant level, from ½ inch below, to filler hole when cool.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

(22) ITEM 76, FENDERS AND BUMPERS. Inspect for security and good condition.

(23) ITEM 77, TOWING CONNECTIONS. Inspect towing hooks and pintle hook for looseness or damage. Be sure any towed load is secure and safety latches lock properly.

(24) ITEM 78, BODY, LOAD AND TARPAULIN. Inspect cargo body carefully for damage, loose or missing parts. See that load is evenly distributed and secure. Tarpaulin should be secure and not damaged.

(25) ITEM 82, *TIGHTEN.

(a) Tighten all wheel mounting, rim, axle flange and spring U-bolt nuts securely.

(b) Weekly: Tighten all vehicle assembly or mounting nuts or screws which inspection indicates is necessary.

(26) ITEM 83, LUBRICATION.

(a) Lubricate all parts where inspection reveals need for lubrication. Wipe all dirt from fittings before applying lubricant. Report any missing fittings.

(b) Weekly: Lubricate all points indicated on vehicle lubrication chart as requiring attention on a weekly or mileage basis, or any points that conditions and experience indicate additional lubrication is necessary.

(27) ITEM 84, *CLEAN ENGINE AND VEHICLE.

(a) Clean dirt and trash from inside cab and body. Remove excessive dirt and grease from exterior of vehicle and engine.

(b) Weekly: Wash vehicle and remove all dirt and excess grease. If washing is impractical, wipe as clean as possible, using care not to create bright spots to cause glare. Clean engine and accessories thoroughly.

(28) ITEM 85, *TOOLS AND EQUIPMENT. Check all tools and equipment assigned to vehicle against stowage lists to be sure they are present, in good condition, and properly stowed and mounted.

Section VI

LUBRICATION

18. INTRODUCTION

a. Lubrication is an essential part of preventive maintenance determining to a great extent the serviceability of parts and assemblies.

19. LUBRICATION GUIDE

a. General. Lubrication instructions for this materiel are consolidated in a Lubrication Guide (fig. 21). These specify the points to be lubricated, the periods of lubrication, and the lubricant to be used. In addition to the items on the guide, other small moving parts, such as hinges and latches, must be lubricated at frequent intervals.

b. Supplies. In the field, it may not be possible to supply a complete assortment of lubricants called for by the Lubrication Guide to meet the recommendations. It will be necessary to make the best use of those available, subject to inspection by the officer concerned, in consultation with responsible ordnance personnel.

c. Lubrication Notes. The following notes apply to the Lubrication Guide. All note references in the guide itself are to the subparagraph below having the corresponding number.

(1) FITTINGS. Clean before applying lubricant. Lubricate until new lubricant is forced from the bearing, unless otherwise specified. CAUTION: Lubricate chassis points after washing vehicle.

(2) INTERVALS. Intervals indicated are for normal service. For extreme conditions of speed, heat, water, sand, mud, snow, rough roads, dust, etc., reduce interval by ⅓ or ½, or more if conditions warrant.

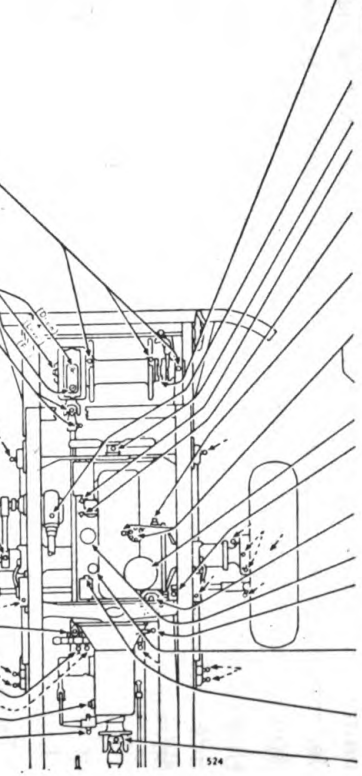
(3) AIR CLEANERS. Daily, check engine air cleaner level and refill oil reservoir to bead level with used crankcase oil or OIL, engine, crankcase grade. Every 2,000 miles, daily under extreme dust conditions, remove cleaner and wash all parts. Daily, check level and refill oil reservoir of crankcase breather pipe air cleaner to oil level stamped on inside of reservoir, with used crankcase oil or OIL, engine, crankcase grade. Every 1,000 miles, daily under extreme dust conditions, remove cleaner and wash all parts. Every 3,000 miles, remove hydrovac cylinder air cleaner, located in rear end of hydrovac cylinder, wash curled hair and reoil with used crankcase oil or OIL, engine, crankcase grade.

Proper maintenance of air cleaners is essential to prolonged engine life.

CAUTION—Lubricate Dotted Arrow Points on *Both Sides*. Points on *Opposite Side* are indicated by Dotted Short-Shaft Arrows.

Lubricant • Interval

- WINCH DRUM AND SHAFT BEARINGS **CG 1**
- WINCH GEAR HOUSING (See Table) (Note 6) **GO 6**
- WINCH UNIVERSAL AND SLIP JOINT **CG 1**
- SPRING BOLT **CG 1**
- DRAG LINK **CG 1**
- FRONT AXLE UNIVERSAL JOINT (Sparingly) (Note 7) **CG 1**
- FRONT AXLE BALL AND SOCKET (Sparingly) (Note 8) **CG 1**
- FRONT WHEEL BEARINGS (remove) (Note 9) **WB 6**
- TIE ROD **CG 1**
- SHOCK ABSORBER (Fill to filler plug hole) **SA 6**
- WINCH UNIVERSAL JOINT **CG 1**
- SPRING SHACKLE **CG 1**
- BRAKE PEDAL SHAFT **CG 1**
- CLUTCH RELEASE SHAFT (Sparingly) **CG 1**
- TRANSMISSION (See Table) (Note 6) **GO 6**
- POWER TAKE-OFF LEVER SHAFT **CG 1**



Interval • Lubricant

- **OE** WINCH JAW CLUTCH (Clean and oil when necessary to avoid sticking)

Serviced From Under Hood

- **1 GO** STEERING GEAR (fitting) (Fill to vent level)
- **1 CG** FAN (fitting)
- **D CG** WATER PUMP SHAFT BRG. (Refill cup when necessary, turn 1 full turn daily)
- **D WP** WATER PUMP BUSHING (Refill cup when necessary, turn 1 full turn daily)
- **6 GO** FRONT AXLE DIFFERENTIAL (See Table) (Note 6) (Reached from under truck)
- **1 OE** DISTRIBUTOR (6 to 8 drops) (Slide top oiler)
- **2 OE** WICK UNDER ROTOR (Note 13)
- **OE** AIR CLEANER (Note 3)
- **1 CG** CENTER DIFFERENTIAL LOCK BELL CRANK (Reached from under truck)
- **1 CG** UNIVERSAL JOINT (Note 12) (Reached from under truck)
- *Oil Filter* (Note 5)
- **1 CG** CLUTCH RELEASE BEARING (Sparingly) (Reached from under truck)
- **1 OE** CRANKCASE (See Table) Drain, refill (Note 4) Check level daily
- **1 OE** STARTER (6 to 8 drops) (covered oil hole)
- **1 CG** UNIVERSAL JOINT (Note 12)

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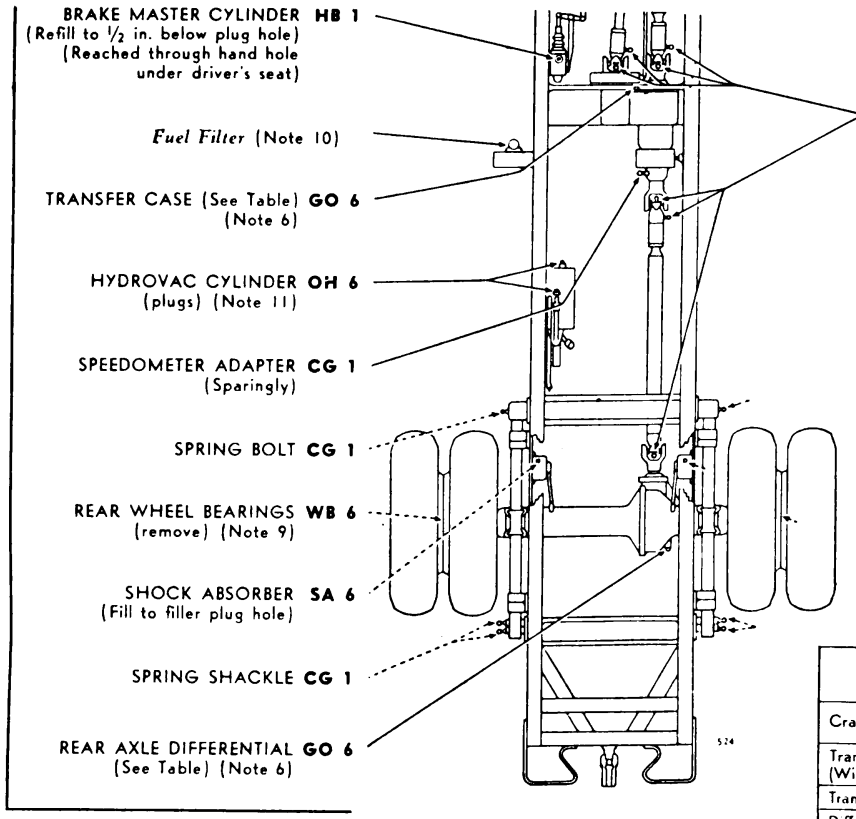

KEY

LUBRICANTS
OE—OIL, engine Crankcase grade
CG—GREASE, general purpose No. 1 (above +32° F.) No. 0 (+32° F. to 0° F.)
GO—LUBRICANT, gear, universal
WB—GREASE, general purpose, No. 2
WP—GREASE, water pump
HB—FLUID, brake, hydraulic
SA—FLUID, shock-absorber, heavy
OH—OIL, hydraulic

INTERVALS
D—DAILY
1—1,000 MILES
2—2,000 MILES
6—6,000 MILES
CHECK DAILY
Crankcase
Air cleaner

TABLE OF CAPACITIES AND LUBRICANTS TO BE USED

UNIT	CAPACITY (Approx.)	LOWEST EXPECTED AIR TEMPERATURE		
		+32° F. and above	+32° F. to 0° F.	Below 0° F.
Crankcase	10 qt.	**OE** SAE 30	**OE** SAE 10	Refer to OFSB 6-11
Transmission (With Power Take-off)	6 qt. 6½ qt.	**GO** SAE 90	**GO** SAE 80	
Transfer Case	4 qt.			
Differentials (each)	3 qt.			
Winch Worm Housing	¾ qt.			

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Figure 21—Lubrication Chart

(4) CRANKCASE. Drain only when engine is hot. Refill to FULL mark on gage. Run engine a few minutes and recheck oil level. Be sure pressure gage indicates oil is circulating. See Table.

(5) OIL FILTER. Every 1,000 miles, drain filter through drain plug. Every 6,000 miles or more often if filter becomes clogged, drain filter, clean inside of filter body and renew filter element. After renewing element, refill crankcase to FULL mark on gage. Run engine a few minutes, recheck level and add oil to FULL mark.

(6) GEAR CASES. Weekly, check level with truck on level ground and, if necessary, add lubricant to within ½ inch of plug level when cold, or to plug level when hot. Drain, flush and refill at intervals indicated on guide. When draining, drain immediately after operation. Keep vents clean. To flush, fill cases to about ½ capacity with OIL, engine SAE 10. Operate mechanism within cases slowly for several minutes and redrain. Replace drain plugs and refill cases to correct level with lubricant specified on guide.

(7) FRONT AXLE UNIVERSAL JOINT. Every 1,000 miles, apply GREASE, general purpose, seasonal grade, sparingly through fitting located on each front axle ball member. Every 6,000 miles, repack front axle universal joint and ball member. This operation requires the removal of the front wheels and axle skeins. Clean out all old grease from the ball member and axle shaft and repack with 1½ lb of GREASE, general purpose, seasonal grade.

(8) FRONT AXLE BALL AND SOCKET. Every 1,000 miles, lubricate front axle ball and upper and lower socket bearings through fittings located at top and bottom on each socket with GREASE, general purpose, seasonal grade, sparingly.

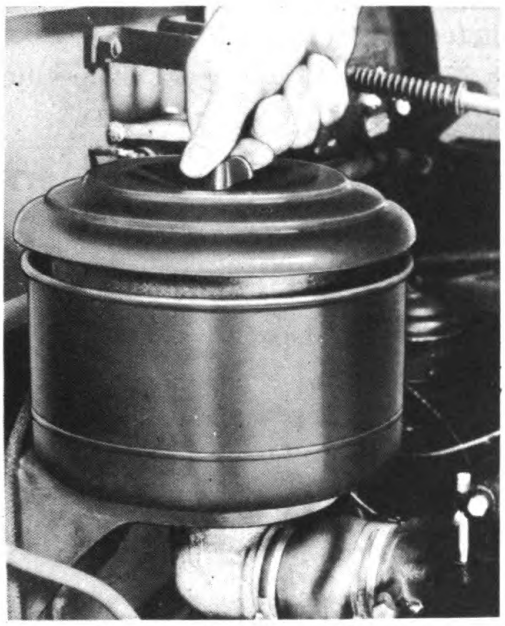
(9) WHEEL BEARINGS (front and rear). To clean and pack bearings properly, they must be removed from the hub. Follow the procedure below:

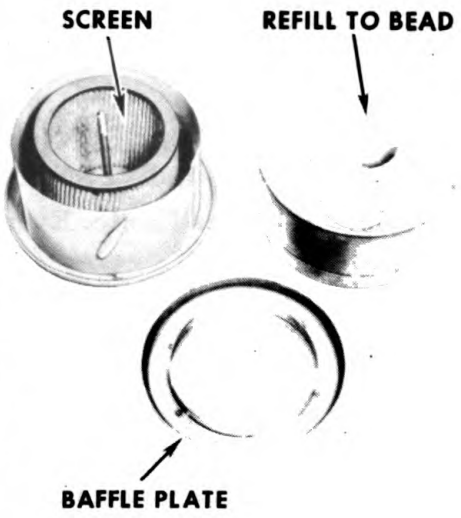
(a) Remove bearings from hub and wash in SOLVENT, dry-cleaning, until all the old lubricant is removed from both inside and outside of cage.

(b) Lay bearings aside to dry and wash inside of hub and spindle with SOLVENT, dry-cleaning.

(c) When bearings are thoroughly dry, pack races with GREASE, general purpose No. 2, and reassemble in hub. To satisfactorily pack a bearing it is necessary to knead lubricant by hand into space between the cage and inner race. Coat inside of hub and spindle with a thin coat of grease to prevent rusting. Do not fill hub. The lubricant packed in bearing races is sufficient to provide lubrication until the next service period. An excess may result in leakage of lubricant into the brake drum.

(d) Replace wheel and adjust bearings according to instructions in Technical Manual.





B — REMOVING SCREEN

A — AIR CLEANER DISASSEMBLED

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Figure 22—Air Cleaner

(10) FUEL FILTER. Every 100 to 1,000 miles, or more often if necessary, depending on operating conditions, remove plug and drain sediment. Every 1,000 miles, remove filter bowl and wash element.

(11) HYDROVAC CYLINDER. Every 6,000 miles, remove plug in front end of cylinder, also plug from atmospheric connection of center plate, and lubricate with about ½ oz. of OIL, hydraulic, through each plug hole. Replace plugs.

(12) UNIVERSAL AND SLIP JOINTS. Apply GREASE, general purpose, seasonal grade, to universal joint until it overflows at relief valve and to slip joint until lubricant is forced from end of slip joint.

(13) DISTRIBUTOR. Every 2,000 miles, wipe distributor breaker cam lightly with GREASE, general purpose, seasonal grade, and lubricate breaker arm pivot and camshaft wick under rotor with 1 or 2 drops of OIL, engine, crankcase grade.

(14) OIL CAN POINTS. Every 1,000 miles, lubricate accelerator control rod joints, winch brake handle, center differential lock linkage, foot brake linkage, power take-off shift linkage, emergency brake linkage, hinges, latches and pintle hook with OIL, engine, crankcase grade.

(15) RUBBER BUSHINGS. Every 1,000 miles, apply FLUID, brake, hydraulic to shock absorber link bushings. CAUTION: Do not use oil.

(16) POINTS REQUIRING NO LUBRICATION SERVICE. Clutch pilot bearing, generator, springs.

(17) POINTS TO BE SERVICED AND/OR LUBRICATED BY ORDNANCE MAINTENANCE PERSONNEL. Speedometer cable (par. 20).

(18) NOTE: Figures 22 through 27 show localized views of specific lubrication points.

20. POINTS TO BE SERVICED AND/OR LUBRICATED BY ORDNANCE MAINTENANCE PERSONNEL.

a. Speedometer Cable. Every 6,000 miles lubricate cable. Follow procedure below:

(1) Disconnect flexible shaft at speedometer head.

(2) Pull out inner core.

(3) Place about 1 tablespoonful of GREASE, general purpose No. 0, in one hand and feed the core through the grease and back into the casing.

(4) Engage the core at both ends and reconnect the conduits.

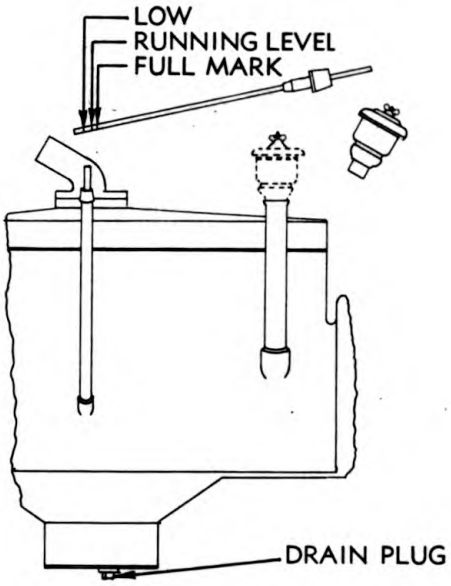
(5) CAUTION: Under no circumstances should the casing be filled with grease.

21. REPORTS AND RECORDS

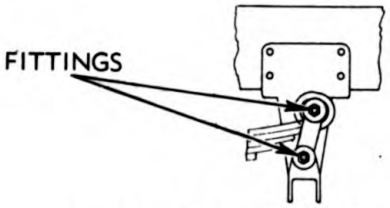
a. Reports. If lubrication instructions are closely followed, proper lubricants used, and satisfactory results are not obtained, a report will be made to the ordnance officer responsible for the maintenance of the materiel.

b. Records. A complete record of lubrication servicing will be kept.

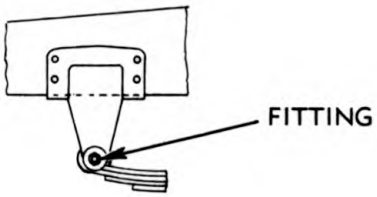
LUBRICATION



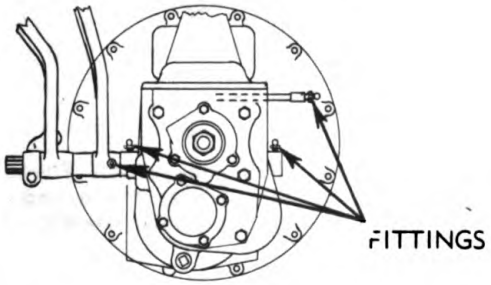
A — Crankcase. Drain only when engine is warm. Refill to full mark on gage. Run engine a few minutes and recheck oil level. CAUTION: Be sure pressure gage on instrument panel indicates oil is circulating in engine.



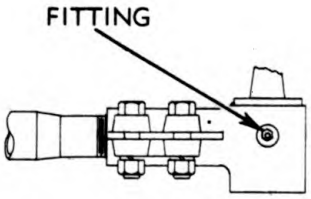
B — Spring Shackle. Lubricate from under chassis, until grease shows at each side.



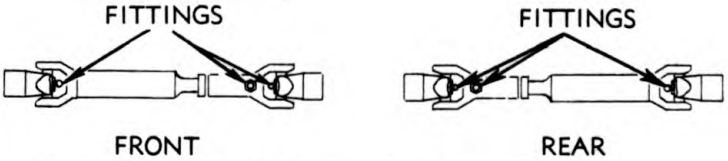
C — Spring Bolt. Lubricate from under chassis, until grease shows at each side.



D — Clutch Release Bearing and Shafts. Lubricate sparingly from under chassis.



E — Tie Rod Ends. Lubricate from under chassis until grease shows around tie rod end.



F — Propeller Shaft Universal Joints. Lubricate from under chassis, until oil shows through safety valve.

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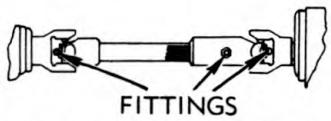
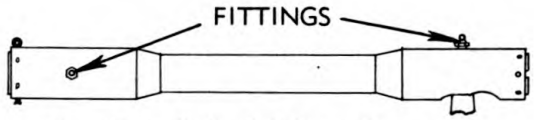
Figure 23—Points of Lubrication

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

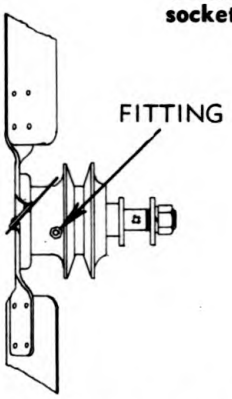
A — Short-Coupled Propeller Shaft Universal Joints. Lubricate, from under chassis, until oil shows through safety valve.



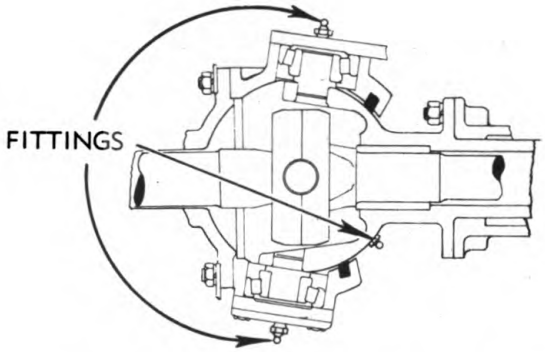
B — Winch Drive Propeller Shaft Universal Joints. Lubricate, from under chassis, until grease shows around bearings.



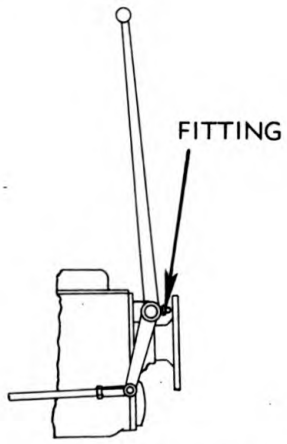
C — Drag Link. Lubricate from under chassis until grease shows at ball sockets.



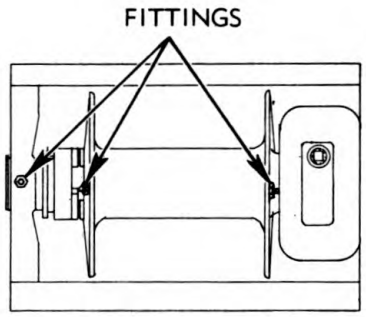
D — Fan. Lubricate from under hood.



E — Front Axle Ball and Socket. Four fittings (2 on each socket at top and bottom). Lubricate from under chassis.



F — Power Take-off Lever. Lubricate from under chassis until grease shows around bearing.



G — Winch Drum. Lubricate daily in regular service.

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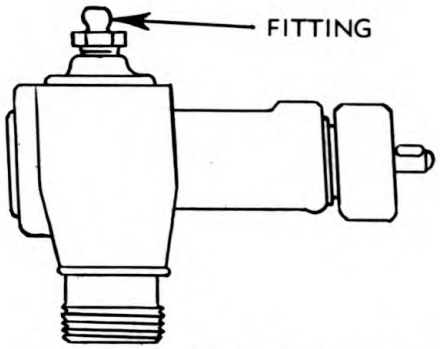
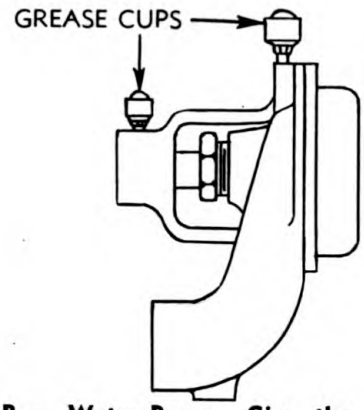
Figure 24—Points of Lubrication

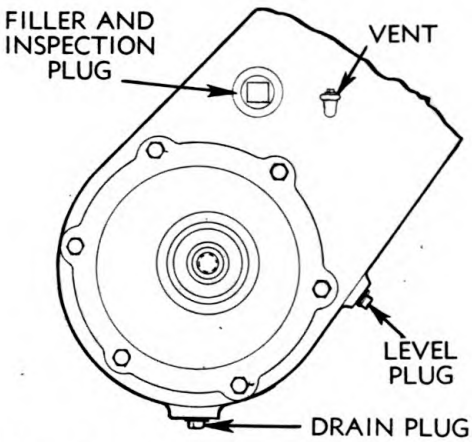
LUBRICATION



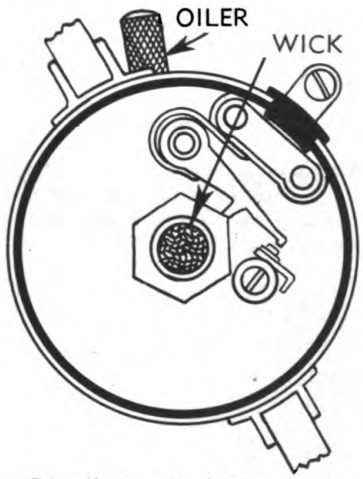
A — Speedometer Adapter. Lubricate from under chassis.



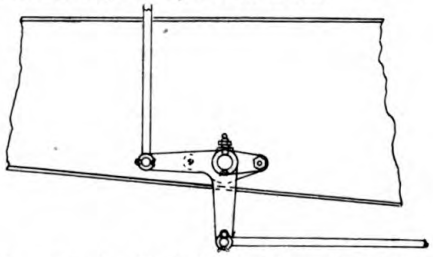
B — Water Pump. Give the grease cups a turn each day when the engine is in regular service.



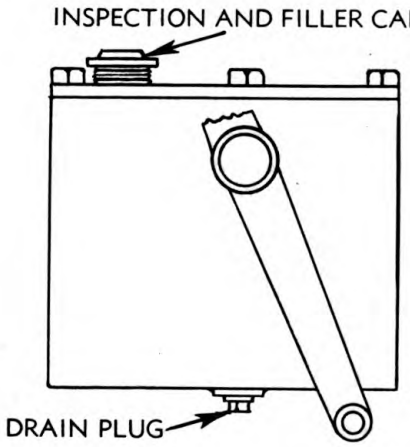
C — Transfer Case. Check every 1000 miles. Drain, flush, and refill at 6000 miles. Clean vent at side of case.



D — Distributor. Lubricate wick beneath rotor with two to three drops. Fill oil cup every 1000 miles.



E — Fly Lock Bell Crank. Lubricate From Under Chassis Until Grease Shows at Each Side

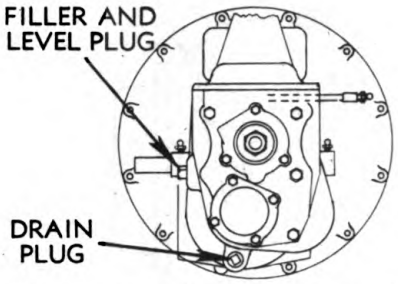


F — Brake Master Cylinder. Inspect fluid level monthly. Fill reservoir to ½ inch below plug hole.

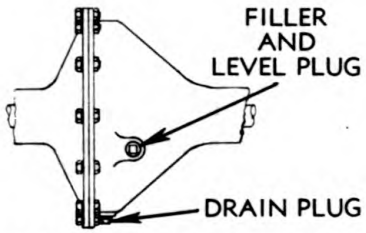
RA PD 61102

Figure 25—Points of Lubrication

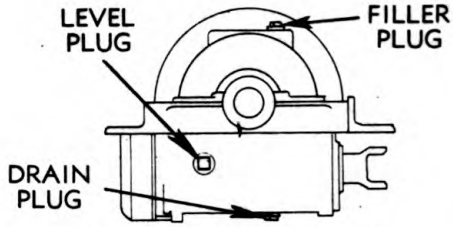
4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)



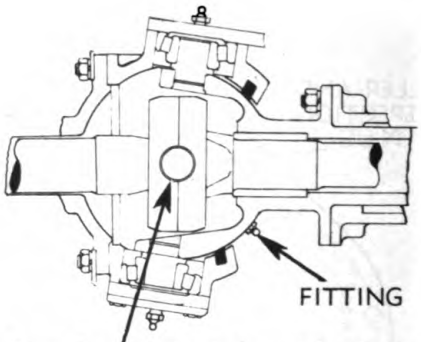
A — Transmission. Check every 1000 miles. Drain, flush, and refill at 6000 miles.



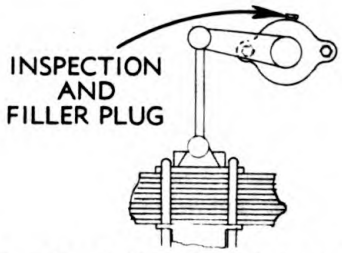
B — Axle Housing (Front and Rear) Check every 1000 miles; drain, flush, and refill at 6000 miles. Clean vent at top of axle housing.



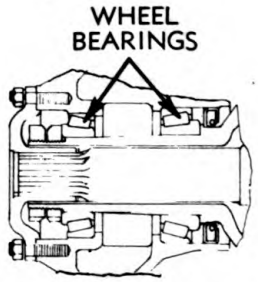
C — Winch Gear Housing. All plugs located at left side of winch. Check weekly in regular service. Drain, flush, and refill in Spring and Fall.



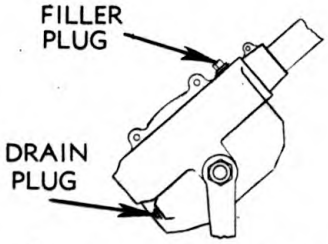
D — Front Axle Universal Joint. Repack front axle universal joint and ball member every 6000 miles.



E — Shock Absorbers. Inspect fluid level, Spring and Fall, or at intervals of 6000 miles whichever occurs first. Fill reservoir to bottom of filler plug hole.



F — Wheel Bearings. Repack wheel bearings every 6000 miles.



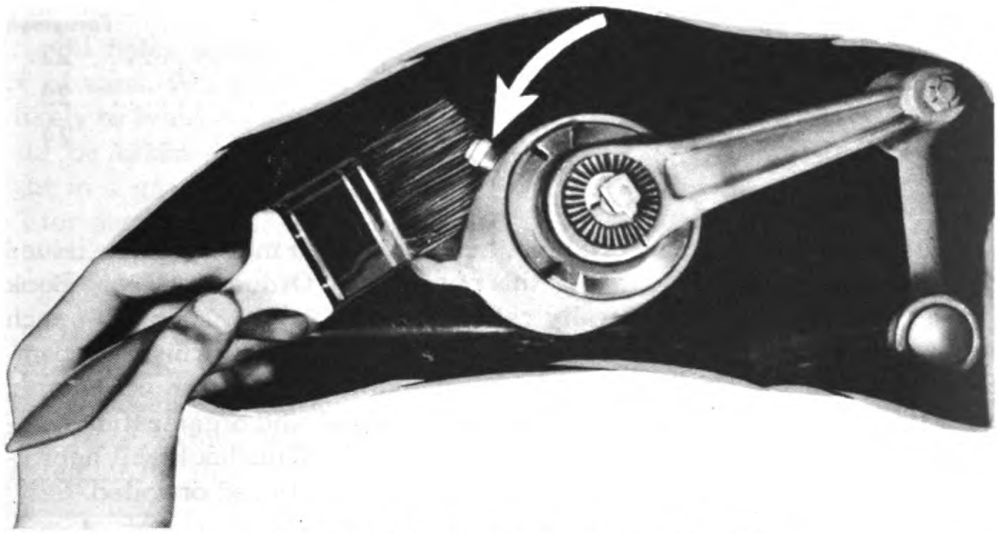
G — STEERING GEAR

G — Steering Gear. Lubricate from under hood, until grease flows through vent. Drain and refill every 6000 miles.

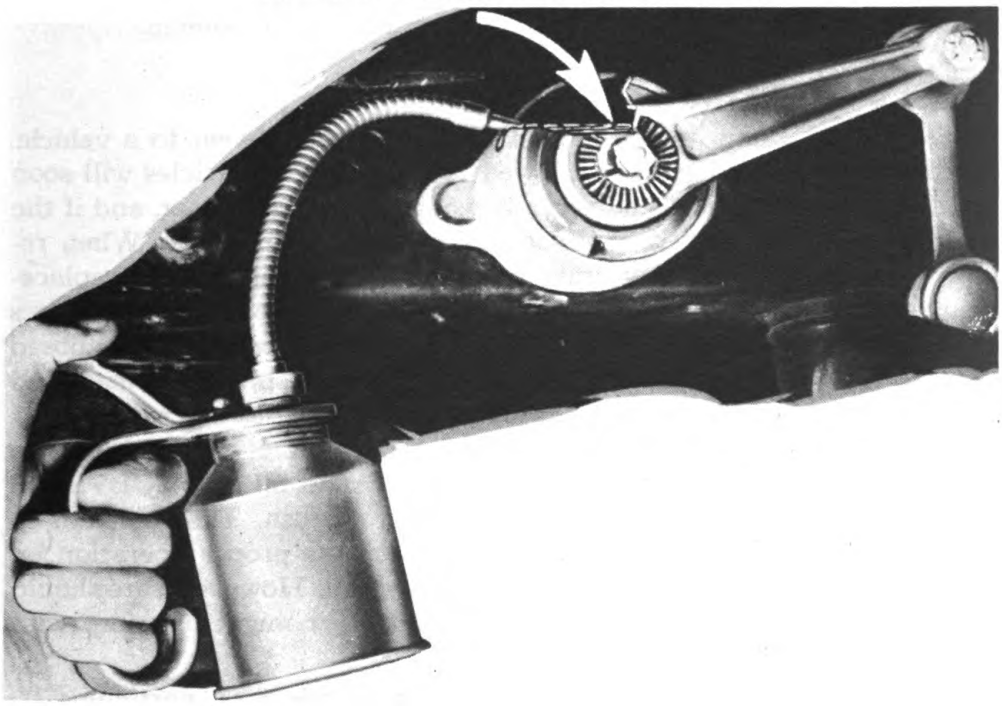
RA PD 61103

Figure 26—Points of Lubrication

LUBRICATION



A.—REMOVE DIRT BEFORE REFILLING



B.—REPLENISHING FLUID

RA PD 61104

Figure 27—Servicing Shock Absorbers

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Section VII

GENERAL CARE AND PRESERVATION

22. RECORDS.

a. Use. An accurate record must be kept of each motor vehicle issued by the ordnance department. For this purpose the Ordnance Motor Book (O.O. Form No. 7255), generally called "Log Book," is issued with each vehicle and must accompany it at all times. This book furnishes a complete record of the vehicle, from which valuable information concerning operation and maintenance costs, etc., are obtained, and organization commanders must insist that correct entries are made. This book will habitually be kept in a canvas cover to prevent its being injured or soiled.

b. The page bearing a record of assignment must be destroyed prior to entering the combat zone. All other references which may be posted regarding the identity of the organization must also be deleted.

23. CLEANING.

a. Grit, dirt, and mud are the sources of greatest wear to a vehicle. If deposits of dirt and grit are allowed to accumulate, particles will soon find their way into bearing surfaces, causing unnecessary wear, and if the condition is not remedied, will soon cause serious difficulty. When removing engine parts or any other units, in making repairs and replacements, or if in the course of inspection working joints or bearing surfaces are to be exposed, all dirt and grit that might find its way to the exposed surfaces must first be carefully removed. The tools must be clean, and care must always be taken to eliminate the possibilities of brushing dirt or grit into the opening with the sleeve or other part of the clothing. To cut oil-soaked dirt and grit, hardened grit, or road oil, use SOLVENT, dry-cleaning, applied with rags (not waste) or a brush. The vehicle is so designed that the possibility of interfering with its proper operation by careless application of cleaning water is very small. However, care should be taken to keep water from the power unit, as it might interfere with proper ignition and carburetion.

b. When using vapor and/or steam-cleaning devices, particular attention should be directed to the proper protection of all electrical equipment used on the engines, chassis, and bodies of the vehicles being cleaned. The jet of vapor from the cleaning nozzle must not be applied directly to electrical accessories. Steam or moisture forced into the equipment is sufficient to cause short circuits and corrosion of the internal parts. Generator regulators, generators, starters, distributors, etc., should be cleaned with SOLVENT, dry-cleaning. These electrical accessories

should either be removed prior to cleaning the vehicle with any type of high-pressure steam- or vapor-cleaning machine, or have adequate protection provided to preclude the entrance of moisture during the operation of cleaning.

c. Oil holes which have become clogged should be opened with a piece of wire. Wood should never be used for this purpose, as splinters are likely to break off and permanently clog the passages. Particular care should be taken to clean and decontaminate vehicles that have been caught in a gas attack. (See section IX, "Materiel Affected by Chemicals", for details of this operation.)

24. PAINTING.

a. The painted portions of the vehicle should be kept painted according to the original color scheme. Exposed metal parts that have previously been painted will be kept in a well-painted condition; however, surfaces which were unpainted when the materiel was received must remain in that condition.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Section VIII

TOOLS AND EQUIPMENT ON THE VEHICLE

25. INTRODUCTION.

a. The materiel listed herein includes tools and equipment for general care and maintenance of the vehicle; an Ordnance Motor Book to record the vehicle history, a manual pertinent to vehicle operation, and a parts list. Tools and equipment should not be used for purposes other than described and when not in use should be placed in their proper location in the vehicle.

26. EQUIPMENT.

	Quantity	Where Carried
Book, Ordnance Motor	1	Inside of cab
Book, Standard Nomenclature List	1	Inside of cab
Chains, single tire	1 pr	Inside of cab
Chains, dual tire	1 pr	Inside of cab
Crank, starting	1	Tool compartment
Extinguisher, fire	1	Inside of cab
Gun, alemite grease	1	Tool compartment
Label, underwriters	1	Tool compartment
Oiler, straight spout	1	Under hood
Pump, tire	1	Tool compartment
Rivets, silent chain	1 set	Tool compartment

27. TOOLS.

a. Tools issued with vehicle are reviewed in Standard Nomenclature List No. G-531.

b. Tools included in kit are as follows:

	Quantity	Where Carried
Bag, tool	1	Tool compartment
Hammer, ball peen	1	Tool compartment
Handle, wheel wrench	1	Tool compartment
Jack, hydraulic	1	Tool compartment
Pliers, combination, 6-in.	1	Tool compartment
Screwdriver, 6-in. blade	1	Tool compartment
Screwdriver, 8-in. blade Phillips	1	Tool compartment

TOOLS AND EQUIPMENT ON THE VEHICLE

	Quantity	Where Carried
Tool, ring	1	Tool compartment
Wrench, adjustable, 12-in.	1	Tool compartment
Wrench, adjustable, 15-in.	1	Tool compartment
Wrench, open-end, 15° angle, double head	1	Tool compartment
Wrench, open-end, 3/8-in. x 7/16-in.	1	Tool compartment
Wrench, open-end, 1/2-in. x 19/32-in.	1	Tool compartment
Wrench, open-end, 9/16-in. x 11/16-in.	1	Tool compartment
Wrench, open-end, 5/8-in. x 25/32-in.	1	Tool compartment
Wrench, open-end, 3/4-in. x 7/8-in.	1	Tool compartment
Wrench, skein nut (wheel brg. nut)	1	Tool compartment
Wrench, spark plug	1	Tool compartment
Wrench, wheel (and handle)	1	Tool compartment

Section IX

MATERIEL AFFECTED BY CHEMICALS

28. PROTECTIVE MEASURES.

a. When materiel is in constant danger of gas attack, unpainted metal parts will be lightly coated with engine oil. Instruments are included among the items to be protected by oil from chemical clouds or chemical shells. Care will be taken that the oil does not touch leather or canvas fittings. Materiel not in use will be protected with covers as far as possible.

b. Ordinary fabrics offer practically no protection against mustard gas or lewisite. Rubber and oilcloth, for example, will be penetrated within a short time. The longer the period during which they are exposed, the greater the danger of wearing these articles. Rubber boots worn in an area contaminated with mustard gas may offer a grave danger to men who wear them several days after the bombardment. Impermeable clothing will resist penetration more than an hour, but should not be worn longer than this.

29. CLEANING.

a. All unpainted metal parts of materiel that have been exposed to any gas except mustard and lewisite must be cleaned as soon as possible with SOLVENT, dry-cleaning, or ALCOHOL, denatured, and wiped dry. All parts should then be coated with OIL, engine.

30. DECONTAMINATION.

a. For the removal of liquid chemicals (mustard, lewisite, etc.) from materiel, the following steps should be taken:

(1) PROTECTIVE MEASURES.

(a) For all of these operations a complete suit of impermeable clothing and a service gas mask will be worn. Immediately after removal of the suit, a thorough bath with soap and water (preferably hot) must be taken. If any skin areas have come in contact with mustard, if even a very small drop of mustard gets into the eye, or if the vapor of mustard has been inhaled, it is imperative that complete first-aid measures be given within 20 to 30 minutes after exposure. First-aid instructions are given in TM 9-850 and FM 21-40.

(b) Garments exposed to mustard gas must be decontaminated. If the impermeable clothing has been exposed to vapor only, it may be decontaminated by hanging in the open air, preferably in sunlight, for several days. It may also be cleaned by steaming for two hours. If the impermeable clothing has been contaminated with liquid mustard, steaming for six to eight hours will be required. Various kinds of steaming devices can be improvised from materials available in the field.

(2) PROCEDURE.

(a) Commence by freeing materiel of dirt through the use of sticks, and rags, etc., which must be burned or buried immediately after this operation.

(b) If the surface of the materiel is coated with grease or heavy oil, this grease or oil should be removed before decontamination is begun; SOLVENT, dry-cleaning, or other available solvents for oil should be used with rags attached to ends of sticks.

(c) Decontaminate the painted surfaces of the materiel with bleaching solution made by mixing one part AGENT, decontaminating (chloride of lime), with one part water. This solution should be swabbed over all surfaces. Wash off thoroughly with water, then dry and oil all surfaces.

(d) All unpainted metal parts and instruments exposed to mustard gas or lewisite must be decontaminated with AGENT, decontaminating, non-corrosive, mixed one part solid to fifteen parts solvent (ACETYLENE TETRACHLORIDE). If this is not available, use warm water and soap. Bleaching solution must not be used, because of its corrosive action. Coat all metal surfaces lightly with OIL, engine.

(e) In the event AGENT, decontaminating (chloride of lime), is not available, materiel may be temporarily cleaned with plenty of hot water. However, mustard lying in joints or in leather or canvas webbing is not removed by this procedure, and will remain a constant source of danger until the materiel can be properly decontaminated. All mustard washed from materiel in this manner lies unchanged on the ground, necessitating that the contaminated area be plainly marked with warning signs before abandonment.

(f) The cleaning or decontaminating of materiel contaminated with lewisite will wash arsenic compounds into the soil, poisoning many water supplies in the locality for both men and animals.

(g) Leather or canvas webbing that has been contaminated should be scrubbed thoroughly with bleaching solution. In the event this treatment is insufficient; it may be necessary to burn or bury such materiel.

(h) Detailed information on decontamination is contained in FM 21-40, TM 9-850, and TC 38, 1941 (Decontamination).

31. SPECIAL PRECAUTIONS FOR AUTOMOTIVE MATERIEL.

a. When vehicles have been subjected to gas attack with the engine running, the air cleaner should be serviced by removing the oil, flushing with SOLVENT, dry-cleaning, and refilling with the proper grade of oil.

b. Instrument panels should be cleaned in the same manner as outlined for instruments.

c. Contaminated seat cushions will be discarded.

d. Washing the compartments thoroughly with bleaching solution is the most that can be done in the field. Operators should constantly be on the alert, when running under conditions of high temperatures, for slow vaporization of the mustard or lewisite.

e. Exterior surfaces of vehicles will be decontaminated with bleaching solution. Repainting may be necessary after this operation.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

PART II—VEHICLE MAINTENANCE INSTRUCTIONS

Section X

MAINTENANCE ALLOCATION

32. SCOPE.

a. The scope of maintenance and repair by the crew and other units of the using arms is determined by the availability of suitable tools, availability of necessary parts, capabilities of the mechanics, time available, and the tactical situation. All of these are variable and no exact system of procedure can be prescribed.

33. ALLOCATION OF MAINTENANCE.

a. Indicated below are the maintenance duties for which tools and parts have been provided for the using arm personnel. Other replacements and repairs are the responsibility of ordnance maintenance personnel but may be performed by using arm personnel when circumstances permit, within the discretion of the commander concerned. Echelons and words as used in this list of maintenance allocations are defined as follows:

SECOND ECHELON:	Line organization regiments, battalions, companies, detachments, and separate companies.
THIRD ECHELON:	Ordnance light maintenance companies, ordnance medium maintenance companies, ordnance divisional maintenance battalions, and post ordnance shops.
FOURTH ECHELON:	Ordnance heavy maintenance companies, and service command shops.
FIFTH ECHELON:	Ordnance base regiments, ordnance bases, arsenals, and manufacturers' plants.
SERVICE: (Including preventive maintenance. Refer to AR 850-15, paragraph 23 a (1) and (2)).	Consists of servicing, cleaning, lubricating, tightening bolts and nuts, and making external adjustments of subassemblies or assemblies and controls.
REPLACE: Refer to AR 850-15, paragraph 23 a (4).	Consists of removing the part, subassembly or assembly from the vehicles and replacing it with a new or reconditioned or rebuilt part, subassembly or assembly, whichever the case may be.

MAINTENANCE ALLOCATION

REPAIR: Refer to AR 850-15, paragraph 23 a (3) and (5), in part.	Consists of making repairs to, or replacement of the part, subassembly or assembly that can be accomplished without completely disassembling the subassembly or assemblies, and does not require heavy welding, or riveting, machining, fitting and/or alining or balancing.
REBUILT: Refer to AR 850-15, paragraph 23 a (5) in part, and (6).	Consists of completely reconditioning and replacing in serviceable condition any unserviceable part, subassembly or assembly of the vehicle, including welding, riveting, machining, fitting, alining, balancing, assembling, and testing.

The following are the maintenance duties for which tools and parts have been provided for the using arms personnel.

	ECHELONS			
	2nd	3rd	4th	5th
ABSORBERS, SHOCK AND LINKAGE				
Absorber, shock and linkage, assembly—replace	X			
Absorber, shock and linkage, assembly—repair		X		
Absorber, shock and linkage, assembly—rebuild			E	X
AXLE, FRONT				
Arm, steering knuckle—replace	E	X		
*Axle, front, assembly—replace	*	X		
Axle, front, assembly—repair		X		
Axle, front, assembly—rebuild			E	X
Bearings, wheel—service (adjust) and replace	X			
Drums, brake—replace	X			
Gear, bevel and pinion—service (adjust)		X		
Retainers, grease, wheel—replace	X			
Rod, tie, assembly—replace	X			
Rod, tie, assembly—repair		X		
Shaft, axle—replace		X		

NOTE: Operations allocated will normally be performed in the echelon indicated by "X."

Operations allocated to the echelons as indicated by "E" may be accomplished by the respective echelons in emergencies only.

*The second echelon is authorized to remove and reinstall engine and transmission assemblies, transfer unit, controlled differential assembly and other items marked by an asterisk. However, when it is necessary to replace an item marked by an asterisk with a new or rebuilt part, subassembly or unit assembly, the assembly marked by an asterisk will not be removed from the vehicle by the second echelon until authorization is received from a higher echelon.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

	Echelons			
	2nd	3rd	4th	5th
AXLE, FRONT (Cont'd)				
Shoes, brake—service (adjust) and replace	X			
Shoes, brake—repair (reline)		X		
Wheel, alinement, toe-in—service (adjust)	X			
Wheel, alinement, camber and caster—service (check)		X		
Wheel, alinement, camber and caster—aline			E	X
AXLE, REAR				
*Axle assembly—replace	*	X		
Axle assembly—repair		X		
Axle assembly—rebuild			E	X
Bearings, wheel—service (adjust) and replace	X			
Drums, brake—replace	X			
Gear, bevel and pinion—service (adjust)		X		
Retainers, grease, wheel—replace	X			
Shaft, axle—replace	X			
Shoes, brake—service (adjust) and replace	X			
Shoes, brake—repair (reline)		X		
BODY				
Body assembly—replace		X		
Body assembly—repair		X		
Body assembly—rebuild			E	X
Shields, mud—replace	X			
Shields, mud—repair		X		
Tarpaulin—replace	X			
Tarpaulin—repair		X		
BRAKES, HYDRAULIC				
Connections and lines—replace	X			
Connections and lines—repair	E	X		
Controls and linkage—service (adjust) and replace	X			
Controls and linkage—repair		X		
Cylinder, master, assembly—replace	X			
Cylinder, master, assembly—repair		X		
Cylinder, master, assembly—rebuild			X	
Cylinder, power (hydrovac)—replace	X			
Cylinder, power (hydrovac)—repair		X		
Cylinder, power (hydrovac)—rebuild			X	
Cylinder, wheel—replace	X			
Cylinder, wheel—repair		X		
Cylinder, wheel—rebuild			X	
Hose—replace	X			

*See Notes on Page 63.

MAINTENANCE ALLOCATION

	Echelons			
	2nd	3rd	4th	5th
BRAKE, PARKING				
Band assembly—service (adjust) and replace	X			
Band assembly—repair (reline)		X		
Controls and linkage—replace	X			
Controls and linkage—repair		X		
CAB				
Cab assembly—replace or repair		X		
Cab assembly—rebuild			E	X
Top and curtains—replace	X			
Top and curtains—repair		X		
Wipers, windshield, assembly—replace	X			
Wipers, windshield, assembly—repair	E	X		
Wipers, windshield, assembly—rebuild			X	
CASE, POWER TAKE-OFF				
Case, power take-off, assembly—replace	X			
Case, power take-off, assembly—repair		X		
Case, power take-off, assembly—rebuild			E	X
Controls and linkage—replace	X			
Controls and linkage—repair		X		
CASE, TRANSFER				
*Case, transfer, assembly—replace	*	X		
Case, transfer, assembly—repair		X		
Case, transfer, assembly—rebuild			E	X
Controls and linkage—replace	X			
Controls and linkage—repair		X		
Drum, brake, parking—replace	X			
CLUTCH AND HOUSING				
Clutch assembly—service (adjust) and replace	E	X		
Clutch assembly—repair (reline)		X		
Clutch assembly—rebuild			E	X
Controls and linkage—replace	X			
Controls and linkage—repair		X		
Housing, clutch—replace		X		
Housing, clutch—rebuild			X	
Pedal, clutch (free travel)—service (adjust)	X			
COOLING SYSTEM				
Cooling system—service (flush)	X			
Hose and connections—replace	X			
Radiator assembly—replace	X			
Radiator assembly—repair		X		
Radiator assembly—rebuild			E	X

*See notes on page 63.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

	Echelons			
	2nd	3rd	4th	5th
ELECTRICAL SYSTEM				
Battery—service, recharge or replace	X			
Battery—repair		X		
Battery—rebuild			E	X
Blocks, junction—replace	X			
Box, apparatus, assembly (generator control)—replace	X			
Box, apparatus, assembly (generator control)—service (adjust) and repair		X		
Box, apparatus, assembly (generator control)—rebuild			X	
Breaker, circuit—replace	X			
Cables, battery—replace	X			
Cables, battery—repair	E	X		
Compartment, battery and stowage—replace	X			
Compartment, battery and stowage—repair		X		
Filters (all)—replace	X			
Harness, wiring (all)—replace	X			
Harness, wiring (all)—repair		X		
Harness, wiring (all)—rebuild			X	
Horns—replace	X			
Horns—repair		X		
Lamps (all)—service (adjust) and replace	X			
Lamps (all)—repair		X		
Switches (all)—replace	X			
Switches (all)—repair		X		
Wiring—replace	X			
ENGINE (Powered by Waukesha Engine Model 6BZ)				
Bearings, connecting rod (inserts)—replace		E	E	X
Bearings, crankshaft (inserts)—replace		E	E	X
Belts—service (adjust) and replace	X			
Block, cylinder—rebuild (recondition)			E	X
Carburetor assembly—service (adjust) and replace	X			
Carburetor assembly—repair		X		
Carburetor assembly—rebuild			X	
Cleaner, air—service (clean) and replace	X			
Cleaner, air—repair		X		
Coil, ignition—replace	X			
Condenser, distributor—replace	X			
Controls and linkage—replace	X			
Controls and linkage—repair		X		
Crankshaft—rebuild (recondition)			E	X
Distributor assembly—replace	X			

See notes on page 63.

MAINTENANCE ALLOCATION

	Echelons			
	2nd	3rd	4th	5th
ENGINE (Cont'd)				
Distributor assembly—repair		X		
Distributor assembly—rebuild			X	
*Engine assembly—replace	*	X		
Engine assembly—repair		X		
Engine assembly—rebuild			E	X
Fan assembly—replace	X			
Fan assembly—repair		X		
Fan assembly—rebuild			X	
Filter, oil—service or replace	X			
Flywheel—replace		X		
Flywheel—rebuild (recondition)			E	X
Gaskets, cylinder head and manifold—replace	X			
Gears, timing, train—replace		X		
Generator assembly—replace	X			
Generator assembly—repair		X		
Generator assembly—rebuild			X	
Governor assembly—service (adjust) and replace		X		
Governor assembly—rebuild			E	X
Head, cylinder—replace		X		
Head, cylinder—rebuild (recondition)			E	X
Lines, oil (external)—replace	X			
Lines, oil (external)—repair	E	X		
Lines, oil (internal)—replace and repair		X		
Manifolds—replace	X			
Manifolds—repair		X		
Motor, starting—replace	X			
Motor, starting—repair		X		
Motor, starting—rebuild			X	
Pan, oil, assembly—service (clean) and replace gaskets	X			
Pan, oil, assembly—replace or repair		X		
Pistons and rings—replace		E	E	X
Plugs, spark—replace	X			
Plugs, spark (two-piece)—repair		X		
Points, breaker, distributor—replace	X			
Pump, fuel, assembly—replace	X			
Pump, fuel, assembly—repair	E	X		
Pump, fuel, assembly—rebuild		E	X	
Pump, oil, assembly—replace or repair		X		
Pump, oil, assembly—rebuild			X	
Pump, water, assembly—replace	X			
Pump, water, assembly—repair		X		
Pump, water, assembly—rebuild			X	
Rod, connecting—replace		E	E	X

*See notes on page 63.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

	Echelons			
	2nd	3rd	4th	5th
ENGINE (Cont'd)				
Support, rear, engine—replace			X	
Thermostat—replace	X			
Valve clearance—service (adjust)	X			
Valve—replace or repair		X		
EXHAUST SYSTEM				
Muffler and exhaust pipes—replace	X			
EXTINGUISHERS, FIRE				
Extinguisher, fire (carbon tetrachloride—$CC1_4$)—service (refill) and replace	X			
Extinguisher, fire (carbon tetrachloride—$CC1_4$)—repair		X		
Extinguisher, fire (carbon tetrachloride—$CC1_4$)—rebuild			E	X
FRAME				
Bumpers, front and rear—replace	X			
Bumpers, front and rear—repair		X		
Frame—repair		E	X	
Frame—rebuild			E	X
Hooks, towing—replace	X			
Pintle assembly—replace	X			
Pintle assembly—repair		X		
Pintle assembly—rebuild			E	X
FUEL SYSTEM				
Filter, fuel—service (clean) and replace	X			
Filter, fuel—repair		X		
Fittings, lines and valves—replace	X			
Fittings, lines and valves—repair	E	X		
Tank, fuel—replace	X			
Tank, fuel—repair		X		
INSTRUMENTS AND GAGES				
Instruments and gages—replace	X			
Instruments and gages—repair		X		
Instruments and gages—rebuild			E	X
METAL, SHEET				
Boards, runnning—replace	X			
Boards, running—repair		X		
Fenders—replace	X			
Fenders—repair		X		
Hood assembly—replace	X			
Hood assembly—repair		X		

See notes on page 63.

MAINTENANCE ALLOCATION

	Echelons			
	2nd	3rd	4th	5th
SHAFTS, PROPELLER				
Shaft assemblies, w/universal joints (all)—replace	X			
Shaft assemblies, w/universal joints (all)—repair		X		
Shaft assemblies, w/universal joints (all)—rebuild			E	X
STEERING SYSTEM				
Arm (Pitman)—replace	X			
Gear, steering, assembly—replace	E	X		
Gear, steering, assembly—repair		X		
Gear, steering, assembly—rebuild			E	X
Link, drag, assembly—replace	X			
Link, drag, assembly—repair		X		
SUSPENSION SYSTEM				
Bushings, spring, front (rubber)—replace	X			
Spring assemblies—replace	X			
Spring assemblies—repair		X		
Spring assemblies—rebuild			E	X
TIRES				
Casings and tubes—replace	X			
Casings—repair			E	X
Tubes, inner—repair	E	E	X	
TRANSMISSION				
Adapter, speedometer—replace or repair	X			
*Transmission assembly—replace	*	X		
Transmission assembly—repair		X		
Transmission assembly—rebuild			E	X
VEHICLE ASSEMBLY				
G531, cargo carrier, assembly—service	X			
G531, cargo carrier, assembly—rebuild (with serviceable assemblies)			X	E
WHEELS				
Wheel assembly—replace	X			
Wheel assembly—rebuild			E	X
WINCH, FRONT				
Band, brake, assembly—service (adjust) and replace	X			
Band, brake, assembly—repair (reline)		X		
Bearings, drive shaft—replace	X			

*See notes on page 63.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

	Echelons			
	2nd	3rd	4th	5th
WINCH, FRONT (Cont'd)				
Cable and hook assembly—replace	X			
Cable and hook assembly—repair		X		
Controls and linkage—replace	X			
Controls and linkage—repair		X		
Drum, brake—replace	X			
Shaft assemblies, drive—replace	X			
Shaft assemblies, drive—repair		X		
Shaft assemblies, drive—rebuild			E	X
Winch assembly—replace	X			
Winch assembly—repair		X		
Winch assembly—rebuild			E	X

See notes on page 63.

Section XI

ORGANIZATION PREVENTIVE MAINTENANCE SERVICE

34. SECOND ECHELON PREVENTIVE MAINTENANCE SERVICE.

a. Regular scheduled maintenance inspections and services are a preventive maintenance function of the using arm, and are the responsibility of commanders of operating organizations.

(1) FREQUENCY. The frequencies of the preventive maintenance services outlined herein are considered a minimum requirement for normal operation of vehicles. Under unusual operating conditions it may be necessary to perform certain maintenance services more frequently.

(2) FIRST-ECHELON PARTICIPATION. The drivers should accompany their vehicles and assist the mechanics while periodic second-echelon preventive maintenance services are performed. Ordinarily the driver should present the vehicle for a scheduled preventive maintenance service in a reasonably clean condition; that is, it should be dry and not caked with mud or grease to such an extent that inspection and servicing will be seriously hampered. However, the vehicle should not be washed or wiped thoroughly clean, since certain types of defects, such as cracks, leaks and loose or shifted parts or assemblies are more evident if the surfaces are slightly soiled or dusty.

(3) If instructions other than those contained in the general procedures to follow, or the specific procedure in subparagraph (5) are required for the correct performance of a preventive maintenance service or for correction of a deficiency, the motor sergeant or the vehicle operator's manual should be consulted.

(4) GENERAL PROCEDURES. These general procedures are basic instructions which are to be followed when performing the services on the vehicle items listed in the specific procedures of paragraph (5). NOTE: The second echelon personnel must be so thoroughly trained in these procedures that they will apply them automatically.

(a) When new or overhauled subassemblies are installed to correct deficiencies, care should be taken to see that they are clean and properly lubricated and adjusted.

(b) When installing new lubricant retainer seals, a coating of the lubricant should be wiped over the sealing surface of the lip of the seal. When the new seal is a leather seal, it should be soaked in SAE 10 engine oil (warm if practicable) for at least 30 minutes. Then the leather lip should be worked carefully by hand before installing the seal. The lip must not be scratched or marred.

(c) The general inspection of each item applies also to any supporting member or connection, and usually includes a check to see whether the item is in good condition, correctly assembled, secure, or excessively

worn. The mechanics must be thoroughly trained in the following explanations of these terms:

1. The inspection for good condition is usually an external visual inspection to determine whether the unit is damaged beyond safe or satisfactory limits. The term, good condition, is explained further by such terms as the following: Not bent or twisted, not chafed or burned, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut, not deteriorated.

2. The inspection of a unit to see that it is correctly assembled is usually an external visual inspection to determine whether it is in its normal assembled position in the vehicle.

3. The check of a unit to determine if it is secure is usually an external visual inspection, a hand-feel, or a pry-bar check for looseness in the unit. Such an inspection should include any brackets, and all lock washers, lock nuts, locking wires, or cotter pins used to secure the tightening.

4. Excessively worn, which is a frequently used term, will be understood to mean worn close-to or beyond satisfactory limits, and likely to result in a failure if not replaced before the next scheduled inspection.

(d) Special Services. These are indicated by added item numbers in the 1000 or 6000 miles column or both, and indicate that the part or assembly is to receive certain mandatory services. For example, an item number in one or both columns opposite a TIGHTEN procedure, means that the actual tightening of the object must be performed. The special services include:

1. Adjust. Make all necessary adjustments in accordance with the vehicle operator's manual, special bulletins, or other current directives.

2. Clean. Clean units of the vehicle to remove excess lubricant, dirt, etc., using SOLVENT, dry-cleaning. After the parts are cleaned, rinse them in clean fluid and dry them well. Take care to keep the parts clean until reassembled, and to keep cleaning fluid away from rubber or other material which it will damage. Clean the protective grease coating from new parts. This material is usually not a good lubricant. Clean hydraulic brake cylinder parts in clean brake fluid. Do not use solvent cleaning fluids on such parts.

3. Special lubrication. This applies either to lubrication operations that do not usually appear on the vehicle lubrication chart, or to items that do appear on such charts but which should be performed in connection with the maintenance operations if parts have to be disassembled for inspection.

4. Serve. Serving a part usually consists of performing special operations, such as replenishing battery water, brake fluid, and shock absorber fluid; draining and refilling units with oil, and changing the oil filter cartridge.

5. Tighten. All tightening operations should be performed with sufficient wrench torque (force on the wrench handle) to tighten the unit

according to good mechanical practice. Use torque-indicating wrench where specified. Do not overtighten, as this may strip threads or cause distortion. Tightening will always be understood to include the correct installation of lock washers, lock nuts, and cotter pins provided to secure the tightening.

(e) When conditions make it difficult to perform the complete preventive maintenance service at one time, it can sometimes be handled in sections, planning to complete all operations within the week if possible. All available time at halts, rest periods, and in bivouac areas must be utilized if necessary to assure that maintenance operations are completed. When limited by the tactical situation, items with Special Services in the columns should be given first consideration.

(f) The numbers of the Preventive Maintenance Procedures that follow are identical with those outlined on WD AGO Form No. 461, which is the Preventive Maintenance Service Work Sheet for Wheeled and Half-track Vehicles. Certain procedures that do not apply to this vehicle are deleted. The numerical sequence in general is followed, but in some cases there is deviation for conservation of the mechanic's time and effort.

(5) SPECIFIC PROCEDURES. These procedures for performing each item in the 1000 miles (monthly) and 6000 miles (six-month) preventive maintenance inspections and services are described on the following chart. Each page of the chart has two columns at its left edge corresponding to the 6000 miles and the 1000 miles service, respectively. Very often it will be found that a particular procedure does not apply to both services. In order to determine which procedure to follow, look down the column corresponding to the service due, and wherever an item number appears, perform the inspection and/or service indicated opposite the number.

ROAD TEST

6000 Mile	1000 Mile	
		NOTE: When the tactical situation does not permit a full road test, perform those items which require little or no movement of the vehicle. When a road test is possible, it should be for preferably 5 and not over 10 miles.
1	1	**Before Operation Service.** Perform the before-operation service as described in paragraph 14, as a check to determine whether the vehicle is in a satisfactory condition to safely make the road test.
3	3	**Instruments and Gages.** *Oil Pressure.* Oil pressure range is 40 to 45 pounds with engine at fast idle. CAUTION: When gage indicates zero or excessively low pressure, stop engine immediately and investigate. *Ammeter.* Reading should show high charge for a short time after starting and then return to slightly above zero with all lights and electrical accessories switched off. When battery is low, a higher charge may be indicated, and for a longer period of time. *Speedometer.* Speedometer must operate without excessive fluctuation, or unusual noises. *Temperature.* Should not exceed 190 F. Danger temperature is at 200 F or over. *Fuel.* With the ignition switch on, see that fuel gage registers approximate amount of fuel.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

6000 Mile	1000 Mile	
4	4	**Horn, Mirrors, and Windshield Wipers.** When tactical situation permits, test horn. Aim, clean, and secure rear-vision mirrors. Operate windshield wipers. Tighten, adjust arms and replace blades if faulty.
5	5	**Brakes (Foot and Hand).** Make first brake check from low speed when starting road test. Continue tests as other stops are made. *Foot Brakes.* Foot brakes must stop the vehicle safely at a fast rate, within a reasonable distance; operate with good effectiveness; brake pedal must have moderate but not "hard" or "spongy" feel. Front brakes must not pull the vehicle to one side. Listen for any objectionable noise or chatter. Reserve pedal travel at the end of the stop should be ½ inch minimum. *Hand Brake.* When hand brake is set, it must hold vehicle effectively on grade. Half the ratchet travel should be reserve.
6	6	**Clutch.** Test for grabbing, dragging, chatter or noise that might indicate faulty adjustment, defective clutch parts, or dry release bearing. Pedal should have free travel of ½ to 1½ inches before meeting resistance. While running at low speed in high gear depress accelerator fully, at same time apply brakes slightly, and observe if clutch appears to slip.
7	7	**Transmission and Transfer.** With vehicle in motion, shift through the entire gear range of transmission and see that shifter mechanism operates freely without clashing or jumping out of gear, that the locking mechanism in transfer operates freely, whether there are any unusual vibrations that might indicate loose mountings, and whether there is any unusual noise.
8	8	**Steering.** With the vehicle in motion move steering wheel fully in both directions and observe whether there is any indication of looseness or binding. Test for any tendency to wander, shimmy, or pull to one side while vehicle is operated at normal speeds. Steering column and steering wheel must be in good condition and secure.
9	9	**Engine.** *Idle.* During the road test note any tendency of the engine to stall while decelerating to shift gears. With the vehicle stopped, observe whether engine will run smoothly at normal idling speed. *Acceleration, Power and Noise.* Observe if engine has normal acceleration, pulling power and operating characteristics in each speed when shifting through the gear range from first to high. Make a similar observation in high gear from low speed with wide-open throttle. During this operation, note any unusual engine noise such as excessive "ping," which may indicate early timing or too low octane fuel. Listen for other noises that might indicate damaged, excessively worn or inadequately lubricated engine parts or accessories or loose drive belts. *Governed Speed.* With vehicle in second gear, slowly depress the accelerator to toe-board and by observing speedometer reading, see if vehicle reaches, but does not exceed, the governed speed specified on the caution plate.
10	10	**Unusual Noises.** Be alert for any unusual noise that may indicate looseness, damage, excessive wear in body, wheels, suspension assemblies, attachments, and equipment.
11	11	**Brake Booster Operation—Hydrovac.** Test brakes to learn whether vacuum power unit assists in application. A quick test is to stop vehicle, with engine running and listen for air movement in the hydrovac unit air cleaner, while the brake pedal is being operated.
13	13	**Temperatures.** (After completing road test run.) *Brake Drums and Hubs.* Feel all brake drums and wheel hubs cautiously for abnormal temperatures. An overheated brake drum or

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6000 Mile	1000 Mile	
		wheel hub is an indication of a dragging brake, or a defective, dry, or improperly adjusted wheel bearing; an abnormally cool brake drum is an indication of an inoperative brake. *Axles, Transmission, and Transfer.* Cautiously feel axle differentials and carriers, transmission, and transfer case for overheating. If any gear case is excessively hot, for the distance traveled, an abnormal condition in the unit is indicated.
14	14	**Leaks.** Look within engine compartment and under vehicle for indications of fuel, oil, water, and brake fluid leaks. Trace them to their source, and correct or report them.
16	16	**Gear Oil Level and Leaks.** Examine driving axles, transmission and transfer for lubricant level and leaks. NOTE: The safe range level is from the lower edge of the filler hole when hot, to ½ inch below when cold. When organization lubrication records indicate a change of oil in these units is due, drain and refill transmission, transfer case, and front and rear axle housings, and refill with specified lubricant.

MAINTENANCE OPERATIONS
(Raise Vehicle—Block Safely)

17	17	**Unusual Noises.** With the engine running: *Engine, Belts and Accessories.* Accelerate and decelerate engine momentarily and listen for unusual noise that might indicate damaged, loose, or excessively worn engine parts, drive belts or accessories. Locate and correct or report any unusual engine noise heard during road test. *Transmission, Transfer, Propeller Shafts and U-Joints, Axles and Wheel Bearings.* With transmission in intermediate gear, operate these units at constant, moderate speed by use of the hand throttle, and test for any unusual noise that might indicate damaged, loose or excessively worn unit parts. Also observe all propeller shafts for vibrations or run-out, and vibrations in the other units which may indicate looseness or unbalance. Locate, correct or report any noise noted during road test.

ENGINE AND ACCESSORIES

18	18	**Cylinder Head and Gasket.** Check for cracks or indications of oil, water, or compression leaks around studs, cap screws, and gaskets. CAUTION: Cylinder heads should not ordinarily be tightened unless there is definite indication of looseness or leaks.
..	19	**Valve Mechanism.** Adjust valve stem clearance if valves are noisy. Intake 0.010 inch to 0.012 inch and exhaust 0.014 inch to 0.016 inch (room temperature). Leaking cover gasket must be replaced.
19	..	See that valves, springs, and locks are in good condition, correctly assembled, and secure. *Adjust.* Set valve stem clearances intake 0.010 inch to 0.012 inch and exhaust 0.014 inch to 0.016 inch (room temperature), making sure lock nuts are secure when clearances are last checked during adjustment.
20	20	**Spark Plugs.** Clean and examine insulators to see if they are cracked. Reset electrodes to 0.025 inch. Test compression before reinstalling plugs.
21	..	**Compression Test.** Test compression. Compression of 85 pounds at normal cranking speed; not varying more than 10 pounds between cylinders, the compression pressure may be considered normal.
22	22	**Battery (Cables, Hold-downs, Carrier, Specific Gravity).** Examine for leaks. Clean and dry exterior, cables, and terminals. Grease terminals. Tighten hold-down bolts. Test specific gravity, normal 1.275 —report reading of 1.225 or less. Bring electrolyte level to ½ inch above plates.

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6000 Mile	1000 Mile	
22	..	*Test.* Make a high-rate discharge test of the battery. Report if difference in reading between cells is more than 30 percent.
23	23	**Crankcase.** Inspect the crankcase, valve covers, timing gear cover, and clutch housing for oil leaks, and check oil level.
23	23	NOTE: When organization lubrication records indicate an oil change is due, drain crankcase and refill to proper level with specified oil. Do not start engine again until item number 24 is completed.
24	24	**Oil Filters and Lines.** Inspect for leakage, loose connections or loose mountings.
24	..	*Serve.* Remove the filter. Clean oil filter case, install new filter cartridge.
25	25	**Radiator (Core, Mountings, Hose, Cap and Gasket).** Observe for looseness, damage, or leakage. Check coolant for contamination.
		Anti-Freeze. If anti-freeze is used, check protective value for temperature encountered. Clean the dirt, insects and trash from the exterior of the core.
25	..	*Tighten* all radiator mountings and hose.
26	26	**Water Pump, Fan, and Shroud.** Observe water pump for leaks. Test shaft for end-play and loose bearings. Inspect fan blades and shroud for damage.
27	27	**Generator, Starter, and Switch.** Examine mountings and wiring connections for good condition and security.
27	..	*Serve.* Remove inspection covers and inspect to see that commutators and brushes are in good condition and not excessively worn; that brushes are free in holders, and brush-connecting wires are secure and not chafing. Dirty commutator must be cleaned with 00 flint paper according to instructions in this manual, Par. 82 b. Blow out the dust with compressed air. Tighten starting motor mounting nuts securely.
29	29	**Drive Belts and Pulleys.** Check fan and generator drive belts for good condition, and drive pulleys and hubs for good condition and security. Adjust generator drive belts to ½-inch deflection and fan belt to 1-inch deflection.
31	31	**Distributor.** Wipe off distributor and external attachments and examine for good condition, correct assembly, security and serviceability. Inspect for cracks in cap and rotor arm, corrosion of terminals and connections, and burning of the outer ends of conductor strap. Breaker points must be in good condition, alined, and adjusted to 0.020-inch gap. Replace if burned, pitted or excessively worn.
31	..	*Serve.* If breaker-plate assembly is excessively worn, dirty, remove distributor, clean in solvent, dry with compressed air, lubricate as specified below, and reinstall in position for timing. When cleaning remove the wick and lubrication cup. Clean while removed and reinstall only after distributor assembly is cleaned and dried. Lubricate cam surface, movable breaker arm pin, wick and camshaft with light oil. Adjust breaker point gap to 0.020 inch.
31	31	*Shaft.* Inspect for looseness. Test centrifugal advance to see whether the camshaft can be rotated by finger force through normal range of movement permitted by centrifugal advance mechanism, and returns when released without binding or sticking.
32	32	**Coil and Wiring.** Inspect coil for good condition, cleanliness and security, and all high-voltage ignition wiring, including shielding or conduits; see that they are in good condition and securely fastened at all support mountings and terminals. See that insulation and connections are clean. Inspect all low voltage wiring in the engine compartment in the same manner.

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6000 Mile	1000 Mile	
33	33	**Manifolds.** Inspect intake and exhaust manifold for good condition, security and manifold gaskets for leaks.
34	34	**Air Cleaner.** Inspect carburetor air cleaner for good condition, security, and oil leaks. Observe condition of the cleaning element, baffles and seals. Clean element, and fill reservoir to correct level with specified oil.
35	35	**Breather Caps and Ventilators.** Inspect to see that they are in good condition, correctly assembled, secure, and that ventilator tubes are open. Remove the elements, clean both element and body in solvent, and dip element in engine oil. Clean and service oil bath cylinder-head breather in the same manner as for item 34.
36	36	**Carburetor (Choke, Throttle, Linkage, and Governor).** Inspect to see that they are in good condition, correctly assembled, secure, that carburetor does not leak, and that governor is properly sealed.
37	37	**Fuel Filter and Lines.** Inspect fuel filter, sediment bowl, fuel lines and connections to see that they are in good condition, secure, and not leaking. Remove filter bowl and element, and clean in solvent. Include screen or filter element at carburetor fuel line connection or fuel pump. Reinstall, using new gaskets. After assembling, recheck for leaks.
38	38	**Fuel Pump.** Inspect fuel and vacuum pump for good condition, security and leaks. Attach test gage and with the engine idling, note whether the pump pressure and vacuum are satisfactory.
39	39	**Starter.** Start engine, observing whether general action of starting motor is satisfactory, particularly whether it engages and disengages properly without excessive noise and has adequate cranking speed, and whether engine starts readily.
40	40	**Leaks.** Check engine compartment and under the vehicle for engine oil, fuel, brake fluid, and water leaks.
41	41	**Ignition Timing.** Check and set according to instructions in par. 85 f (1).
42	42	**Engine Idle and Vacuum Test.** Connect a vacuum gage to intake manifold, adjust engine to its normal idle speed by means of throttle stop screw, then adjust the idle-mixture adjusting needle until vacuum gage indicates maximum reading. If this latter adjustment changes idle speed appreciably, reset idle speed and mixture until both are satisfactory.
43	43	**Regulator Unit.** Observe if it is in good condition and if connections and mountings are secure. Connect low-voltage circuit tester and test voltage regulator, current regulator and cut-out for proper generator output control. Follow the instructions which accompany the test instrument.

CHASSIS, BODY AND ATTACHMENTS

47	47	**Tires and Rims.** Inspect as follows: *Valve Stems and Caps.* Inspect valve stems for good condition, correct position, and that all valve caps are present and secure. *Condition and Tread Wear.* Inspect tires for cuts, bruises, breaks, and blisters and irregular tread wear, watching for any sign of flat spots, cupping, feather edges, and one-sided wear. Any mechanical deficiencies causing such conditions should be determined and corrected or reported. Remove embedded glass, nails and stones. The wheel positions of tires with irregular wear should be changed—front tires to rear wheel positions and vice versa. *Direction.* Directional and non-directional tires should not be installed on same vehicle. All tires should be mounted so that "V" of chevron points down, looking from front of vehicle.

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6000 Mile	1000 Mile	
		Matching. With the tires properly inflated, inspect for matching according to over-all circumference, ¾-inch variation permissible.
		Spare Tire Carriers. Inspect spare tire carriers for good condition and security.
		Rims. Check to see that all rims and their lock rings or flanges are in good condition and secure. Tighten securely.
48	48	**Brakes, Rear.** Inspect and service as follows:
48	..	*Drums and Supports*. Remove dirt and grease and inspect to see if they are in good condition, securely mounted, and not excessively worn or scored.
..	48	*Wheel Cylinders*. Observe if they are in good condition, securely mounted, and not leaking. Tighten the brake support and drum mounting bolts securely.
49	49	**Brake Shoes, Rear (Linings, Links, Guides, and Anchors).** Inspect and service as follows:
..	49	Inspect the linings through inspection holes or openings in brake drums or supports to see whether they are so worn that rivet heads may score drums within next 1000 miles of operation. If linings are not visible, remove right rear hub and drum for inspection of brake linings by motor sergeant to determine whether they should be replaced. If linings on this wheel brake must be replaced, remove all wheels and service their brakes similarly, being sure to clean, lubricate and adjust all removed bearings, and to adjust brakes. A similar inspection of brake linings should be made if vehicle has recently been operated in deep water, mud, loose sand, or dirt which may have entered brake drum.
49	..	Inspect to see that linings are in good condition, secure, in good wearing contact with drums, free of lubricant or brake fluid, and not excessively worn. Also to see that brake shoes are in good condition; properly secured and guided by anchor bolts, connecting links, guides and springs; and properly returned against their cam or stops by the retracting springs. Clean dust from the linings with a wire brush, clean cloth, or compressed air. After completion, adjust brake shoes by minor adjustment methods, so linings have proper clearances from brake drums. Where new linings have been installed, adjust shoes by the major adjustment method.
52	52	**Rear Wheels (Bearings, Seals, Drive Flanges, and Nuts).** Inspect and service these items as follows:
		Wheels. Inspect to see that wheels are in good condition; revolve them, and observe if they have excessive run-out.
		Bearings and Seals. Without removing rear wheels, examine for evidences of looseness in wheel bearing or adjustment. Revolve rear wheels and listen for indications of dry or damaged wheel bearings. Inspect drive flanges and around brake supports and drums for lubricant or brake fluid leaks.
		Drive Flanges and Nuts. Check to see that they are in good condition and secure.
..	52	*Lubrication*. On the 1000-mile service, if vehicle has recently been operated in deep water which may have entered wheel bearings, remove one wheel to see whether bearing lubricant appears to be contaminated. Clean and lubricate bearings of the one removed wheel before it is reinstalled. When such inspections of wheel bearing lubricant are made, also inspect the brake linings to see whether they are excessively worn.
52	..	*Clean*. Disassemble the bearings and oil seals. Clean thoroughly and inspect the rollers, balls, races, and cages to see that they are in good condition, and that the cups are secure. Also examine to see if the

ORGANIZATION PREVENTIVE MAINTENANCE SERVICE

6000 Mile	1000 Mile	
		machined surfaces upon which the bearings are assembled are in good condition. When bearings are reinstalled, lubricate the wheel bearings and adjust until drag is felt, then back off $\frac{1}{6}$ turn.
53	..	**Front Brakes (Drums, Supports, and Cylinders).** Inspect and service as follows: *Drums and Supports.* Remove dirt and grease and examine drums and supports for good condition, secure mounting, excessive wear or scoring. *Wheel Cylinders.* Examine for good condition and secure mounting and fluid leaks. Tighten brake support and drum mounting bolts securely. Examine backing plate for alinement and distortion.
54	54	**Front Brake Shoes (Linings, Links, Guides, and Anchors).** Inspect and service as follows:
..	54	Examine linings through inspection holes or openings in brake drums or supports to see whether they are so worn that rivet heads may score drums within next 1000 miles of operation. If linings on this wheel brake must be replaced, remove all wheels and service their brakes similarly, being sure to clean, lubricate and adjust all removed bearings, and to adjust brakes. A similar inspection of the brake linings should be made if vehicle has recently been operated in deep water, mud, loose sand, or dirt which may have entered brake drum.
54	..	Check to see that linings are in good condition, tightly screwed to brake shoes, in good wearing contact with the drums, free of lubricant or brake fluid, and not excessively worn. Also to see that brake shoes are in good condition; properly secured and guided by anchor bolts, connecting links, guides and springs; and properly returned against cams or stops by retracting springs. Clean all dust from linings with a wire brush, clean cloth, or compressed air.
54	54	*Adjust.* After services and inspections of all following items to and including item 60, are completed, adjust brake shoes by minor adjustment method, so linings have proper clearances from brake drums. Where new linings have been installed, adjust shoes by major adjustment method.
55	55	**Steering Knuckles (Joints, Bearings, Seals, and Boots).** Inspect and service as follows: Examine knuckle housings and steering arms for good condition. Observe whether outside seal is in good condition and secure. Obtain a sample of the lubricant from each knuckle; inspect it for contamination.
55	..	*Clean.* Disassemble and clean the steering knuckle and axle U-joint assembly parts. Observe whether disassembled knuckle and joint parts are in good condition. As the knuckle pivot bearings and drive joints are reassembled, lubricate and adjust the pivot bearing. When reassembling the units, be sure to install any required new lubricant retainer seals and gaskets.
56	56	**Front Springs (Clips, Leaves, U-Bolts, Hangers, and Shackles).** Examine to see that they are in good condition, correctly assembled, and secure, and whether springs have excessive sag. Tighten U-bolts securely.
57	57	**Steering (Arms, Tie Rod, Drag Link, Seals, Pitman Arms, Gear, Column, and Wheel).** Examine to see that these items are in good condition, correctly and securely assembled and mounted, and whether steering gear case lubricant is at the proper level and not leaking. Note if steering gear is in satisfactory adjustment.
57	..	*Tighten* Pitman arm shaft nut and steering gear case assembly and mounting nuts or screws securely. CAUTION: Loosen the steering column bracket when tightening the steering case mounting nuts, so as not to distort the column.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

6000 Mile	1000 Mile	
58	58	**Front Shock Absorbers and Links.** Examine shock absorber bodies and links for good condition, security and fluid leaks.
58	..	*Serve.* Fill shock absorber bodies with specified fluid. Work the arm several times and add fluid. Repeat this operation until all air is expelled and the reservoir is full. Disconnect the link and check to see that the action is normal. A double-acting shock absorber should have resistance in both directions.
60	60	**Front Wheels (Bearings, Seals, Flange, Axle End Play, and Nuts).** Inspect and service these items as follows: *Wheels.* Inspect to see that wheels are in good condition, revolve them, and observe if they have excessive run-out. *Bearings and Seals.* Without removing front wheels, examine for evidences of looseness in wheel bearing or adjustment. Revolve front wheels and listen for indications of dry or damaged wheel bearings. Inspect drive flanges and around brake supports and drums for lubricant or brake fluid leaks. *Drive Flanges and Nuts.* Check to see that they are in good condition and secure.
..	60	On the 1000-mile service, if vehicle has recently been operated in deep water which may have entered wheel bearings, remove one wheel to see whether bearing lubricant appears to be contaminated. Clean and lubricate bearings of the one removed wheel before it is reinstalled. When such inspections of wheel bearing lubricant are made, also inspect the brake linings to see whether they are excessively worn.
60	..	*Clean.* Disassemble the bearings and oil seals. Clean thoroughly and inspect the rollers, balls, races, and cages to see that they are in good condition, and that the cups are secure. Also examine to see if the machined surfaces upon which the bearings are assembled are in good condition. When bearings are reinstalled, lubricate the wheel bearings and adjust until drag is felt, then back off $\frac{1}{6}$ turn.
61	61	**Front Axle (Pinion End Play, Seal, Vent, and Alinement).** If front axle appears to be out of line, measure the distance from front spring eye-bolt to center of axle spring pad on each side. This distance should be about the same on each side. Inspect to see that the axle housing is in good condition and not leaking: Examine pinion shaft for excessive end play and seal for leaks. *Clean* the axle housing vent thoroughly.
62	62	**Front Propeller Shaft (Joints and Alinement, Seals and Flanges).** Inspect for good condition, correct and secure assembly and mountings; U-joints for proper alinement and excessive wear; slip joint should be free, not excessively worn, and well lubricated; and seals of U-joints and slip joint should not leak excessively.
62	..	*Tighten* all U-joint assembly and companion flange bolts securely.
63	63	**Engine Mountings.** Inspect to see that they are in good condition and securely mounted and connected. If the mounting bolts are loose, tighten them properly. Remove all oil or grease from rubber mountings. Apply brake fluid if rubber is hard or cracked.
64	64	**Hand Brake (Ratchet and Pawl, Linkage, Drum and Lining).** Examine to see that hand brake ratchet and pawl and linkage are in good condition and secure; that brake drum is not scored or oily; and that brake lining is not oil soaked, nor worn thin.
64	..	*Adjust* the clearance between the brake drum and lining to 0.060 inch.
65	65	**Clutch Pedal (Free Travel, Linkage, and Return Spring).** Examine to see that the pedal free travel is satisfactory, 1 to $1\frac{1}{2}$ inch, that

ORGANIZATION PREVENTIVE MAINTENANCE SERVICE

6000 Mile	1000 Mile	
		the pedal is securely mounted and that clutch operating linkage is in good condition, secure, and not excessively worn. See that return spring is intact and has sufficient tension.
65	..	*Adjust* clutch pedal "free travel" according to specifications, 1 to 1½ inch.
66	66	**Brake Pedal.** Reserve pedal travel at the end of the stop should be ½ inch minimum. Inspect the brake linkage for damage and excessive wear. See that return spring is intact and has sufficient tension.
67	67	**Brake Master Cylinder (Vent, Fluid Level, Leaks, and Switch).** Examine to see that they are in good condition and secure; that the boot is properly installed and whether there are any indications of fluid leaks. *Serve.* Fill the master cylinder reservoir to the correct level. Allow approximately ¼ inch for expansion. Clean vent.
68	68	**Brake Booster—Hydrovac (Linkage, Air Cleaner Hose, and Slave Cylinder).** Inspect to see that they are in good condition, securely assembled and mounted; and that the operating and control linkage does not bind, and whether brake fluid is leaking from the slave cylinder. Clean and oil the air cleaner element.
68	..	*Special Lubrication.* Insert a few drops of light oil into power cylinder.
71	71	**Transmission (Mounting, Seals, Power Take-Off, and Linkage).** Inspect transmission case for good condition, oil leaks from seals and gaskets, and that control linkage is in good condition, properly connected, and secure.
71	..	*Tighten* all transmission and power take-off mounting and external assembly bolts and cap screws securely.
72	72	**Transfer (Mountings, Linkage, Seals and Vent).** Inspect transfer case for good condition and security of mountings, and seals for leaks. Be sure transfer case vent is clean, and tighten mountings and external assembly nuts or screws securely.
72	..	Inspect silent chain for proper adjustment (should have ½ inch perceptible slack).
73	73	**Rear Propeller Shafts.** Inspect in the same manner as item 62.
73	..	*Tighten* the U-joint and companion flange bolts securely.
75	75	**Rear Axles (Pinion End Play, Seals, Vents, and Alinement).** Inspect items and clean vent items in the same manner as for item 61.
77	77	**Rear Springs (Clips, Leaves, U-Bolts, Hangers, and Shackles).** Examine to see that they are in good condition, correctly assembled, and secure, and whether springs have excessive sag. Tighten U-bolts securely.
78	78	**Rear Shock Absorbers and Links.** Examine shock absorber bodies and links for good condition, security and fluid leaks.
78	..	*Serve.* Fill shock absorber bodies with specified fluid. Work the arm several times and add fluid. Repeat this operation until all air is expelled and the reservoir is full. Disconnect the link and check to see that the action is normal. A double-acting shock absorber should have resistance in both directions.
79	79	**Cab and Body Mountings.** Check to see that all mounting brackets and bolts are present and tighten securely. The cab mounting bracket with spring should be tightened cautiously.
80	80	**Frame (Rails and Cross Members).** Inspect to see that they are in good condition, secure, and correctly alined.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

6000 Mile	1000 Mile	
81	81	**Wiring, Conduits and Grommets.** Examine these items underneath the vehicle to see that they are in good condition, properly supported, connected, and secure.
82	82	**Fuel Tanks, Fittings, and Lines.** Examine fuel tanks for good condition and security. Inspect caps for defective gaskets or plugged vents. See that filler necks and caps fit securely. Inspect fuel lines and fittings for good condition, security and leaks.
83	83	**Brake Lines (Fittings and Hose).** Look underneath vehicle and on rear axle housing to see that they are in good condition, and secure, and whether they leak.
84	84	**Exhaust Pipes and Muffler.** Examine exhaust pipes to see that they are securely attached to the exhaust manifold and muffler, whether gasket or packing leaks, that muffler is in good condition and securely mounted. Examine tail pipe to see that it is securely clamped to the muffler, properly supported and unobstructed at its outer end.
85	85	**Vehicle Lubrication.** Check the lubrication of the entire vehicle. On any unit where disassembly was necessary for inspection purposes, lubrication must be performed unless the vehicle is to be deadlined for repair of that unit. Lubricate all points of vehicle and gun mounts in accordance with instructions in vehicle maintenance manual, lubrication guide, and current lubrication bulletins or directive, and following instructions: Use only clean lubricant and keep all lubricant containers covered. Clean the lubrication fitting or plug before applying lubricant. Replace missing or damaged lubrication fittings, flexible lines, vent or plugs. On all unsealed bushings or joints the lubricant should be applied until it appears at the openings. On units provided with lubricant-retainer seals, do not force the lubricant beyond the seals. Drain oil from engine, transmission, transfer case, or axle housings while warm. Refill units to the correct level as soon as the draining is completed, so there will be little hazard that they may be operated without lubricant. The correct COLD oil level in the axles, transfer case, and transmission is ½ inch below the lower side of the filler-plug hole. Do not apply more than specified amount of lubricant to generators, starters, distributors, or water pump. To do so may cause a failure. Wipe off excess lubricant that may drip onto brakes or rubber parts, soil clothes, or detract from the vehicle's appearance. Parts or assemblies that have already been lubricated while disassembled for inspection, gear cases that have been drained and refilled as mandatory items in the procedures, and those parts that have been indicated in the procedures for "special lubrication" may be omitted from the general lubrication of the vehicle.
86	86	**Toe-In and Turning Stops.** Lower vehicle to ground. With the front wheels on the ground in straight ahead position, and using a proper toe-in gage, see if the front wheel toe-in is within specified limits, 1/16 to 1/8 inch; and that the wheel turning stops are present and secure, tight, and weld not broken. Turn the front wheels in both directions to see that they engage the stops and if the tires clear all parts of the vehicle in this position. If there is any indication that turning angle exceeds the specified limits, causing scuffing of tires against vehicle, or abnormal front-drive U-joint wear, report for a check of turning angle by higher echelon.

ORGANIZATION PREVENTIVE MAINTENANCE SERVICE

6000 Mile	1000 Mile	
87	87	**Winch (Clutch, Brake, Drive, Shear Pin, Cable, and Guides).** Inspect for good condition, correct assembly and security. See that clutch moves freely and latches securely, that the drag brake lining is in good condition, secure, and correctly adjusted. Inspect automatic brake to see that lining is secure, and not excessively worn. Check the propeller shaft in the same manner as in item 62, see that the proper shear pin is installed and in good condition. Check cable guides for good condition and security. Also see that the oil level in the worm gear case is correct. If level is high remove the drain plug and drain off the water or excess lubricant to proper level. Lubricate the winch clutch, shaft, and operating arm with engine oil. Move the clutch back and forth several times during application of lubricant, to be sure it is free. Unwind cable and inspect it for broken or frayed strands and for flat or rusty spots.
87	..	**Clean and Serve.** Clean entire length of the cable with a cloth saturated with mixture of one part engine oil and four parts kerosene. Dry off excess, and as cable is properly rewound on drum, coat it with a thin film of grease or gear oil. Suggest used engine oil. Drain the worm gear case and refill to correct level.
91	91	**Lamps (Head, Tail, Stop, and Blackout).** Test to see that switches and lamps operate properly; be sure to include the stop light, and to see that foot switch controls head lamp beams and that they are correctly adjusted. Inspect all lamps for good condition and security, and check for dirty and broken lenses or discolored reflectors.
91	..	*Adjust* head lamp beams.
93	93	**Front Bumpers, Tow Hooks and Brush Guards.** Inspect to see that they are in good condition; correctly assembled to brackets.
94	94	**Hood (Hinges and Fasteners).** See that the hood, hinges, fasteners, and props are in good condition, secure, and properly lubricated.
95	95	**Front Fenders and Running Boards.** See that they are in good condition and secure.
98	98	**Circuit Breaker.** Inspect breaker joints for cleanliness.
99	99	**Splash Guards.** See that they are in good condition and secure.
100	100	**Body (Floor, Bows, Tops, Troop Seats and Stowage Compartments).** Inspect these items to see that they are in good condition and secure; that the tarpaulin and end curtains, fasteners or ropes, grommets, and metal hooks or loops on the body are all present, and secure; and whether all door, troop seats and stowage compartment door hinges and latches are adequately lubricated.
101	101	**Rear Bumpers and Pintle Hook (Latch, Lock Pin, and Drawbar).** See that they are in good condition and secure, that the pintle and latch operate properly, are adequately lubricated, and whether lock pin is secured with a chain.
103	103	**Paint and Markings.** Examine paint of entire vehicle for good condition. Repaint shiny spots in finish. See that identification plates and vehicle markings are legible.
104	104	**Radio Bonding (Suppressors, Filters, Condensers, and Shielding).** Examine these items to see if their bonding connections are in good condition, clean and secure, and whether all items are securely mounted. NOTE: Any irregularities, except cleaning and tightening, should be reported through channels to Signal Corps personnel.
105	105	**Armament (Guns, Mounts, Rails, Spare Parts, and Covers).** Examine gun mountings and rails for good condition, clean lines, security and lubrication. NOTE: Refer all mounted guns, spare gun parts and covers through channels to the armorer or gun commander for all inspections and service.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

6000 Mile	1000 Mile	
		TOOLS AND EQUIPMENT
131	131	**Tools (Vehicle and Pioneer).** Check all the standard vehicle and pioneer tools against the stowage lists to see that they are all present, in good condition, clean, and properly stowed or securely mounted. Any tools mounted on the outside of vehicle which have bright or polished surfaces, should be painted or otherwise treated so as not to cause glare or reflection.
132	132	**Fire Extinguisher.** Inspect to see that it is fully charged, in good condition, securely mounted, and the nozzle clean. The CO_2 extinguisher must be checked for full charge by weight.
133	133	**Decontaminator.** Inspect for good condition, security, and full charge. NOTE: Contents of decontaminator must be renewed every 90 days, as it deteriorates. Refer to tag for date of last recharge.
134	134	**First-Aid Kit.** Inspect for good condition, and presence of all items. Report deficiencies immediately.
135	135	**Publications and Form No. 26.** The vehicle and equipment operators' manuals and parts lists, chek-chart, Lubrication Guide and Standard Accident Form No. 26 should be present, legible and properly stowed.
136	136	**Traction Devices (Chains).** Inspect chains, connector links for good condition, cleanliness, excessive wear, protection against rust and proper stowage.
137	137	**Tow (Chain, Cables).** See that provided towing devices are in good condition, clean and properly stowed. Tow chain should be properly protected against rust when not in use.
138	138	**Spare Shear Pins and Bulbs.** See that prescribed number and sizes are present, in good condition and properly stowed.
139	139	**Fuel and Water Cans and Brackets.** See that they are in good condition, secure; that caps fit tightly and are secured to can with a chain; examine cans for leaks.
141	...	**Modification (F.S.M.W.O.'S Completed).** The organizational vehicle records should be checked by the chief of section or other designated individual to be sure that all Field Service Modification Work Orders pertaining to the vehicle have been completed.
142	142	**Final Road Test.** Make final road test rechecking items 2 to 15 inclusive. Be sure to recheck the transmission, transfer case and all driving axles to see that lubricant is at the correct level and not leaking. Confine road test to minimum distance necessary to make satisfactory observations. Correct or report all deficiencies found during final road test.

Section XII

ORGANIZATION SPARE PARTS AND ACCESSORIES

35. ORGANIZATION SPARE PARTS.

a. A set of organization spare parts is supplied to the using arms for field replacement of those parts most likely to become broken, worn, or otherwise unserviceable. The set is kept complete by requisitioning new parts for those used. Organization spare parts are listed in pertinent Standard Nomenclature Lists.

b. Care of organization spare parts is covered in the section of this manual entitled, "General Care and Preservation" (section VII).

36. ACCESSORIES.

a. Accessories include tools and equipment required for such disassembling and assembling as the using arm is authorized to perform, and for the cleaning and preservation of the gun carriage, ammunition, etc. They also include chests, covers, tool rolls, and other items necessary to protect the material when it is not in use or when traveling. Accessories should not be used for purposes other than those prescribed, and when not in use, should be properly stored.

b. Accessories provided are listed in pertinent Standard Nomenclature Lists, or see section VIII of this manual.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Section XIII

ORGANIZATION TOOLS AND EQUIPMENT

37. INTRODUCTION.

a. The tools and equipment included in this section, together with the vehicle tools listed in section VI, provide the using arms with necessary tools and equipment for servicing the vehicle.

38. SPECIAL TOOLS AND EQUIPMENT.

a. Organization maintenance tools, standard sets:

Standard Tool Sets	Federal Stock Numbers
Tool set, motor vehicle mechanics'	41-T-3538
Tool set, welders	41-T-3555
Tool set, unit equipment, second echelon No. 1	41-T-3545-10
Tool set, unit equipment, second echelon No. 2	41-T-3545-11
Tool set, unit equipment, second echelon No. 3	41-T-3545-12
Tool set, unit equipment, second echelon No. 4	41-T-3545-13
Tool set, unit equipment, second echelon No. 5	41-T-3545-14
Tool set, unit equipment, second echelon No. 6	41-T-3545-15
Tool set, unit equipment, second echelon No. 7	41-T-3545-16
Tool set, unit equipment, second echelon No. 9	41-T-3545-18

b. Special Tools.

Description	Part Number	Quantity
Wrench, skein nut	FWD 68869	1
Puller, flange and brake wheel	FWD 7167	1
Wrench, head tension	FWD 43A-49975	1
Lifter valve	FWD 1A-K.D.-380	1
Puller, clutch pilot bearing	Ordnance 41-P-2906-15	1
Tool, flaring	FWD 6C-FL-335	1
Puller, pitman arm	FWD 43DD-CG-250	1
Adjuster, drag link	FWD 7168	1
Puller, universal joint	FWD 7166	1
Sleeve, oil seal installing	FWD 7128	1
Puller, brake wheel	FWD 7167	1
Driver, jackshaft oil seal	FWD 7129	1
Sleeve, oil seal installing	FWD 7144	1
Driver, upper oil seal	FWD 7130	1
Puller, bearing cup	Snap-on BR-16	1
Driver, wheel bearing cup	FWD 7157	1
Puller, gear, 6-in. jaw	FWD 438S-1012	1

ORGANIZATION TOOLS AND EQUIPMENT

c. Equipment.

Description	Part Number	Quantity
Hose, bleeder		1
Lifter, engine	FWD 7126	1
Hoist, chain	Ordnance 41-H-2122	1
Chain, 1-in.		1
Lifter, transfer case	FWD 7172	1

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Section XIV

FRONT AXLE

39. FRONT AXLE DESCRIPTION.

a. The front axle is the full floating, single reduction, spiral bevel gear driven type. The assembly is composed of a two-piece cast steel housing, which is provided with special ball and sockets on the outer ends of the housing to insure free movement of the wheels for steering and permits rotation of the axle shaft and universal joint.

40. FRONT AXLE TROUBLE SHOOTING.

a. Noise in Axle.

Possible Cause	Possible Remedy
(1) Broken teeth in ring gear or pinion (snapping noise).	Replace axle assembly (pars. 44 and 45) or report to higher authority.
(2) Wheel bearings out of adjustment (continuous hum).	Adjust wheel bearings (par. 157).
(3) Lack of grease, or poor ring gear and pinion adjustment (hum when pulling).	Check lubricant. See Lubrication (section VI) or report to higher authority.
(4) Lack of grease, or poor ring gear and pinion adjustment (hum when coasting).	Check lubricant. See Lubrication (section VI) or report to higher authority.
(5) Worn or broken differential or pinion bearings.	Replace axle assembly (pars. 44 and 45) or report to higher authority.

b. Backlash.

(1) Poor ring gear and pinion adjustment.	Report to higher authority.
(2) Worn differential or pinion bearings.	Report to higher authority.
(3) Worn axle shaft cage ring bushings.	Replace worn axle shaft assembly (par. 41 **b** and **c**).

FRONT AXLE

Possible Cause	Possible Remedy
(4) Worn splines on either end of axle shaft assembly.	Replace worn axle shaft assembly (par. 41 **b** and **c**).
(5) Loose nuts on wheel driving flange.	Tighten flange nuts (par. 158).
(6) Worn splines on pinion shaft or propeller shaft yoke.	Report to higher authority.
c. Grease Leakage.	
(1) Loose bolts in axle housings.	Tighten bolts.
(2) Poor pinion oil seal.	Report to higher authority.
(3) Poor wheel grease retainers (grease on brake linings).	Replace wheel grease retainers (par. 160).
(4) Loose driving flange nuts or poor gasket (grease leakage at wheel driving flange).	Tighten nuts or replace driving flange gasket (par. 160).
d. Hard Steering.	
(1) Incorrect toe-in.	Adjust (par. 41 **e**).
(2) Incorrect ball and socket adjustment.	Adjust (par. 41 **d**).
(3) Axle loose on springs.	Tighten spring clips.
(4) Lack of lubricant.	Lubricate as necessary. (See Lubrication, section VI.)
(5) Bent frame.	Report to higher authority.
(6) Caster or camber angle wrong.	Report to higher authority.
(7) Loose wheel bearings.	Adjust wheel bearings (par. 157).
(8) Improper tire inflation.	Inflate tires to 65 lb.
(9) Loose steering gear to axle linkage.	Adjust linkage (par. 144).
e. Shimmy.	
(1) Loose wheel bearings.	Adjust wheel bearings (par. 157 **c**).
(2) Loose ball and socket steering knuckle.	Adjust (par. 41 **d**).
(3) Wheel alinement wrong.	Check wheel alinement (par. 41).
(4) Loose steering gear linkage.	Adjust linkage (par. 144).
f. Wandering.	
(1) Loose wheel bearings.	Adjust wheel bearings (par. 157 **c**).
(2) Axle loose on springs.	Tighten spring clips.

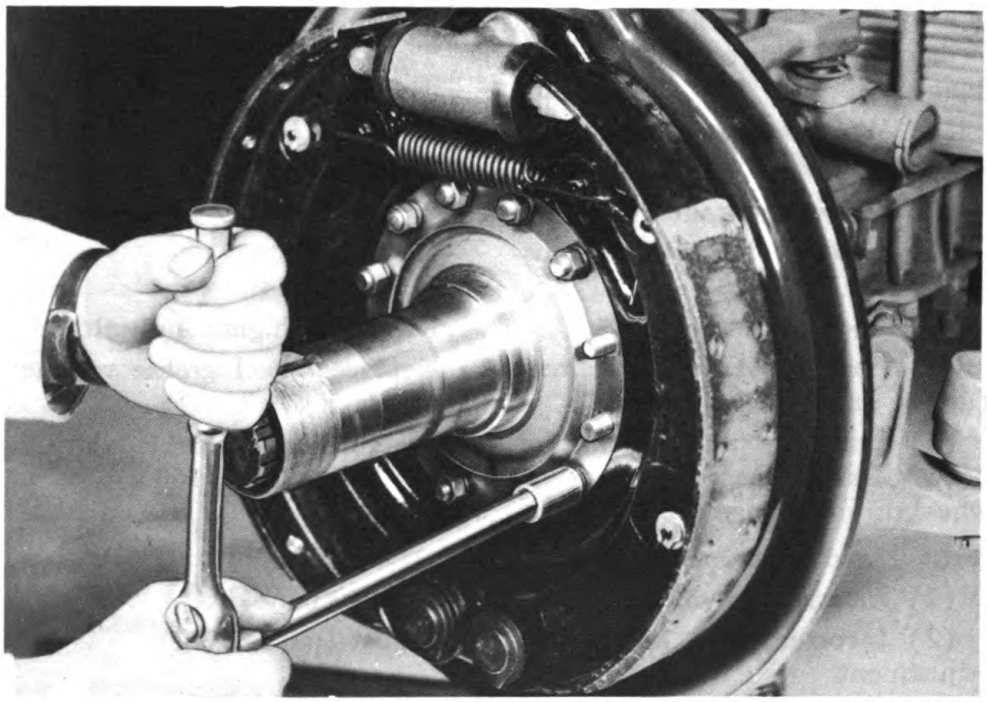

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Figure 28—Removing Nuts From Skein

Possible Cause	Possible Remedy
(3) Broken springs or spring tie bolt.	Replace spring (par. 138).
(4) Bent frame.	Report to higher authority.
(5) Improper tire inflation.	Inflate tires to 65 lb.
(6) Loose steering gear linkage.	Tighten linkage (par. 144).
(7) Broken spring bolts or shackle.	Replace broken part (par. 138).
(8) Caster or camber angle wrong.	Report to higher authority.
(9) Wrong toe-in adjustment.	Correct adjustment (par. 41 f).

41. FRONT AXLE MAINTENANCE AND ADJUSTMENTS.

a. Front Axle Shaft Maintenance. The front axle shaft universal joints are lubricated from an outside source, either from a pressure or hand grease gun. The lubricant is picked up by the revolving action of the joint and self-lubricates all working parts. The front axle shaft should be removed at 6000 miles of service and repacked. Clean the ball member and axle shaft with a dry-cleaning solvent. (See par. 20 c.) For removal of front axle shaft, refer to paragraph 41 b.

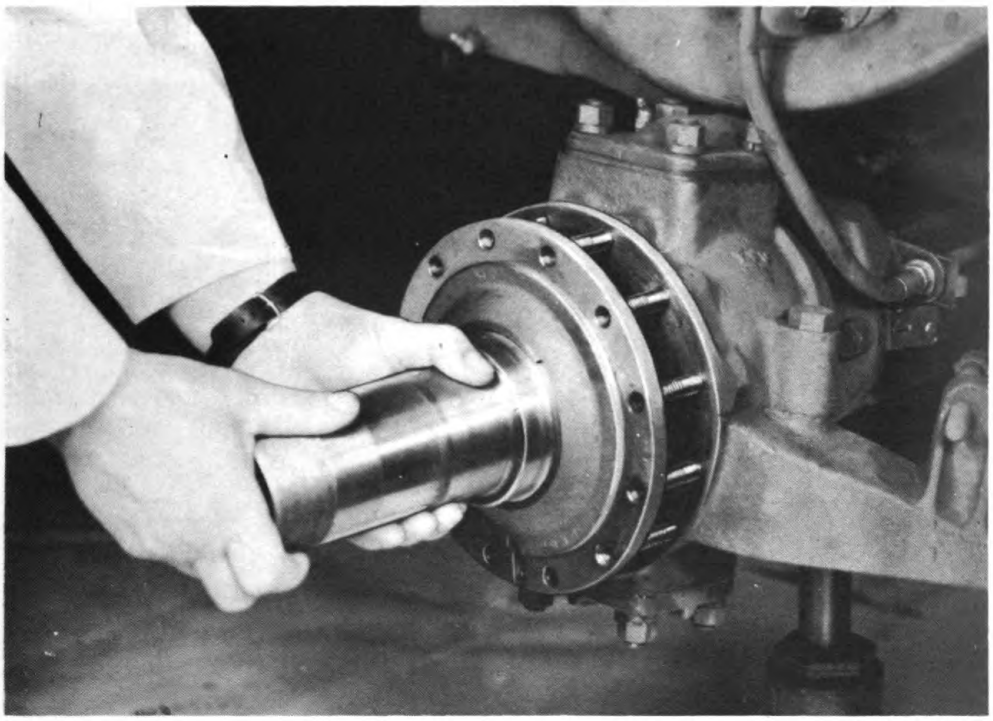

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Figure 29—Removing Skein

b. Front Axle Shaft Removal (figs. 28 to 30).

(1) EQUIPMENT.

EXTENSION, 10-in.	**PAN**, drain
HAMMER, 1 lb	**PUNCH**, taper
HANDLE, ratchet	**WRENCH**, open-end, 9/16-in.
HANDLE, speed	**WRENCH**, skein nut
JACK, hydraulic	**WRENCH**, socket, 5/8-in.
MALLET, wooden	**WRENCH**, wheel nut

(2) PROCEDURE.

(a) Remove Front Wheel (par. 158).

JACK, hydraulic	**WRENCH**, wheel nut

(b) Remove Front Wheel Hub (par. 160).

WRENCH, skein nut

(c) Remove Brake Dust Shield Assembly.

EXTENSION, 10-in.	**WRENCH**, socket, 5/8-in.
HANDLE, ratchet	

Remove 12 nuts and lock washers (5/8-in. socket wrench, 10-in. extension, and ratchet handle) that hold oil slinger and dust shield assembly to front axle socket assembly (fig. 28). Remove oil slinger and the dust shield from the 12 studs. **NOTE:** It is not necessary to disconnect flexible

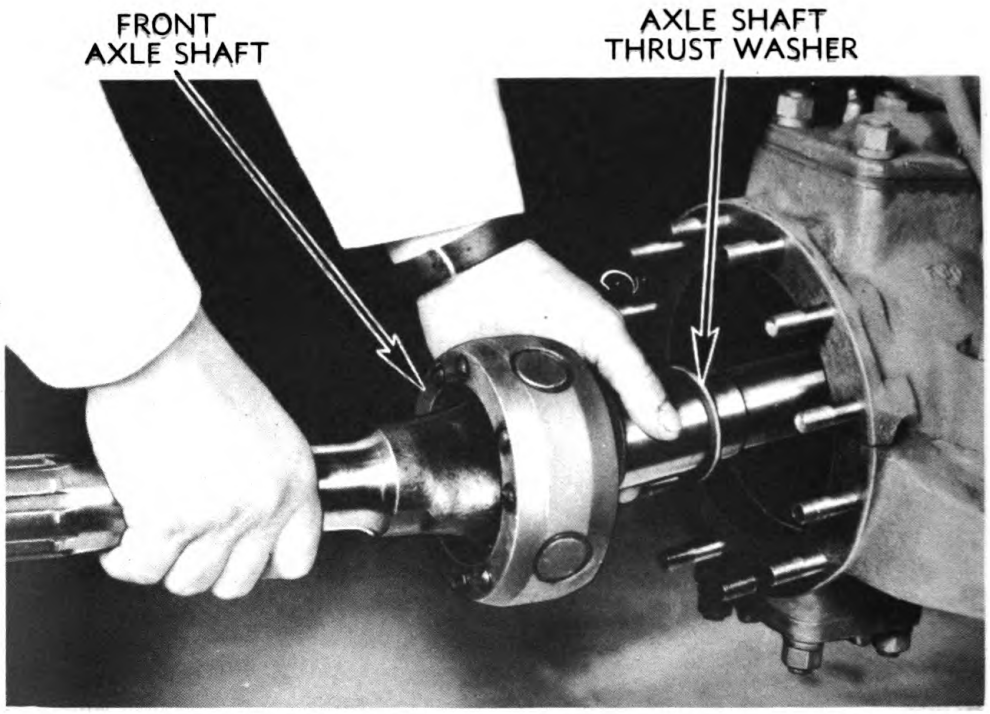

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Figure 30—Removing Front Axle Shaft

brake hose. The dust shield can be removed from skein, placed on top of front axle housing, and wired to the frame.

(d) Remove Front Axle Skein.

MALLET, wooden
PAN, drain

Place drain pan under socket assembly to catch grease. Hit end of skein with wooden mallet to loosen it on studs in socket assembly and then pull the skein from axle shaft (fig. 29).

(e) Remove Front Axle Shaft.

The axle shaft assembly can now be pulled out of axle housing by hand (fig. 30).

c. Front Axle Shaft Installation (fig. 31).

(1) EQUIPMENT.

EXTENSION, 10-in.
HAMMER, 1 lb
HANDLE, ratchet
HANDLE, speed
JACK, hydraulic
MALLET, wooden
PAN, drain
PUNCH, taper
WRENCH, open-end, 9/16-in.
WRENCH, skein nut
WRENCH, socket, 5/8-in.
WRENCH, wheel nut

(2) PROCEDURE.

(a) Installing Front Axle Shaft. Enter the front axle shaft assembly in the axle housing. Be sure axle shaft thrust washer is placed on long

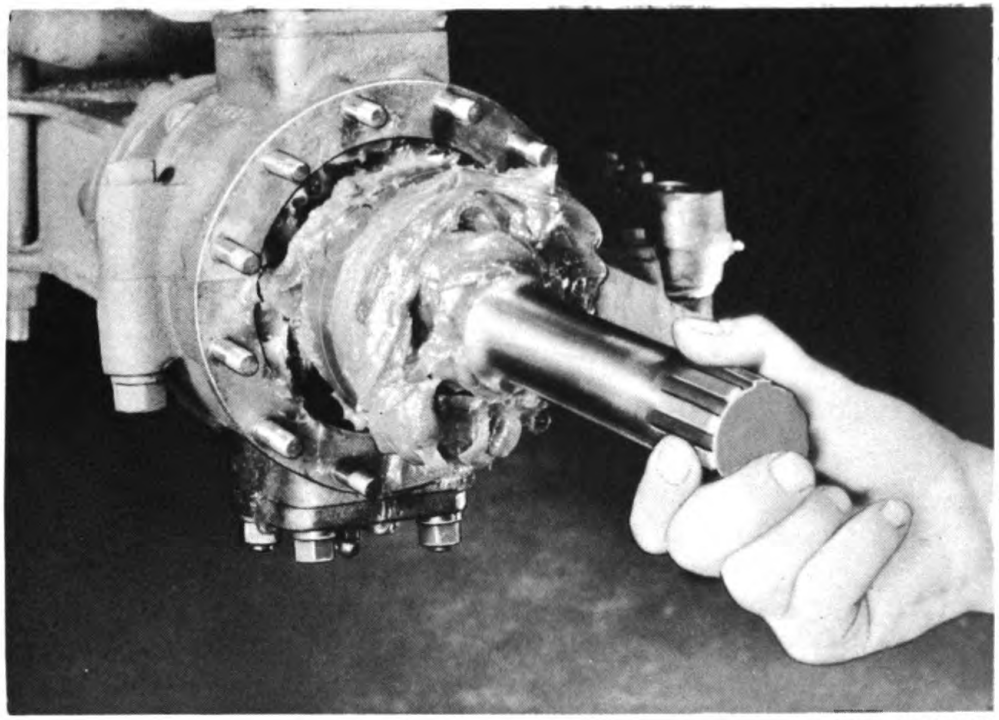

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Figure 31—Installing Grease Packed Axle Shaft

member of shaft (fig. 30). Rotate the shaft slowly until the spline enters the differential side gear. Pack the ball member and axle shaft universal joint with lubricant (fig. 31) (section VI) Lubrication Guide.

(b) Replace Front Axle Skein.

MALLET, wooden

Place skein over outer member of axle shaft, having oil drain slot in skein to the bottom. Drive the skein onto studs (wooden mallet).

(c) Replace Brake Dust Shield Assembly.

EXTENSION, 10-in.
HANDLE, ratchet
WRENCH, socket, 5/8-in.

Place the shield assembly on the 12 studs in the socket assembly, having brake wheel cylinder to the top. Place an oil slinger, 12 nuts, and lock washers; tighten nuts (5/8-in. socket, 10-in. extension, and ratchet handle).

(d) Replace Front Wheel Hub (par. 160).

WRENCH, skein nut

(e) Replace Front Wheel (par. 158).

JACK, hydraulic
WRENCH, wheel nut

d. Front Axle Socket Description (fig. 32). The front axle socket consists of two halves that fit over the axle ball member and pivot on

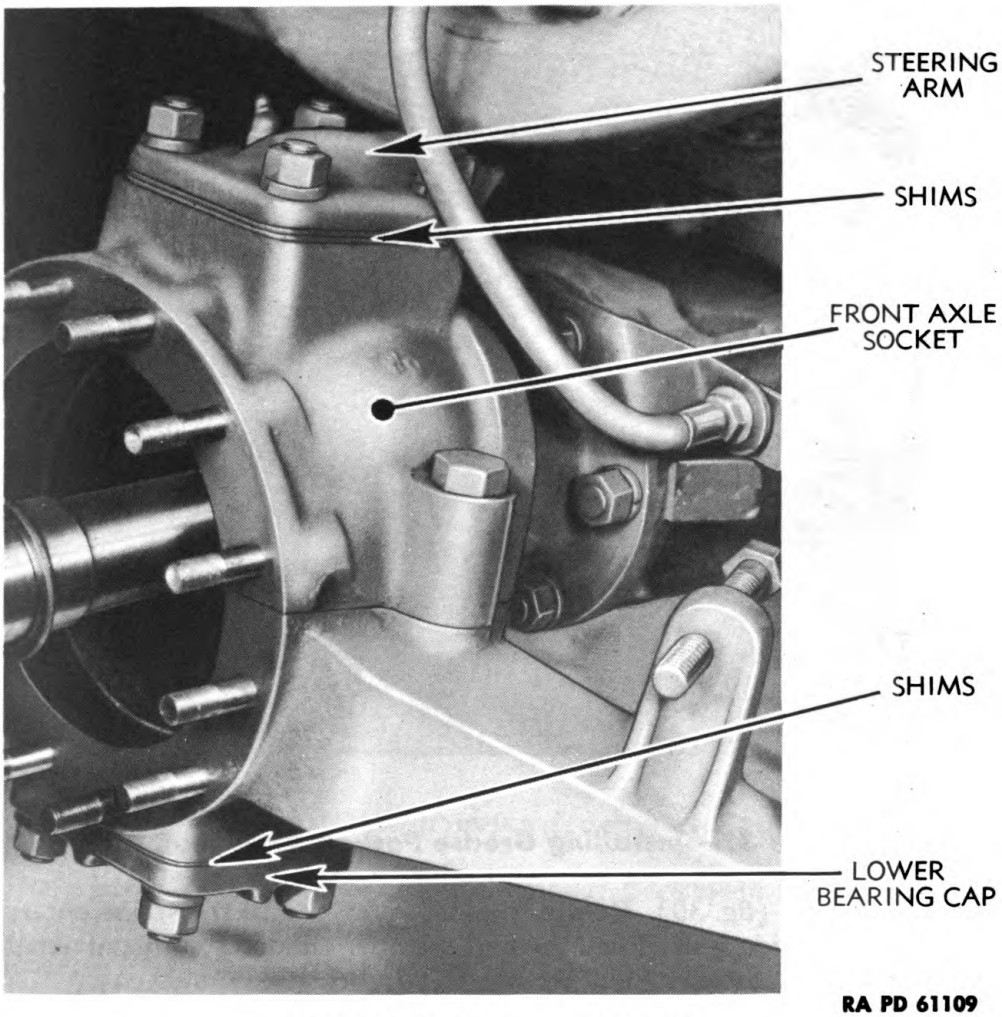


Figure 32—Front Axle Socket

taper bearings. The adjustment of the ball and socket is made by adding or removing shims from between the adjusting plate, steering arm, and socket. Wear will cause end play in the steering socket and should be removed to prevent bearing failures.

e. Front Axle Socket Adjustment (fig. 32).

(1) EQUIPMENT.

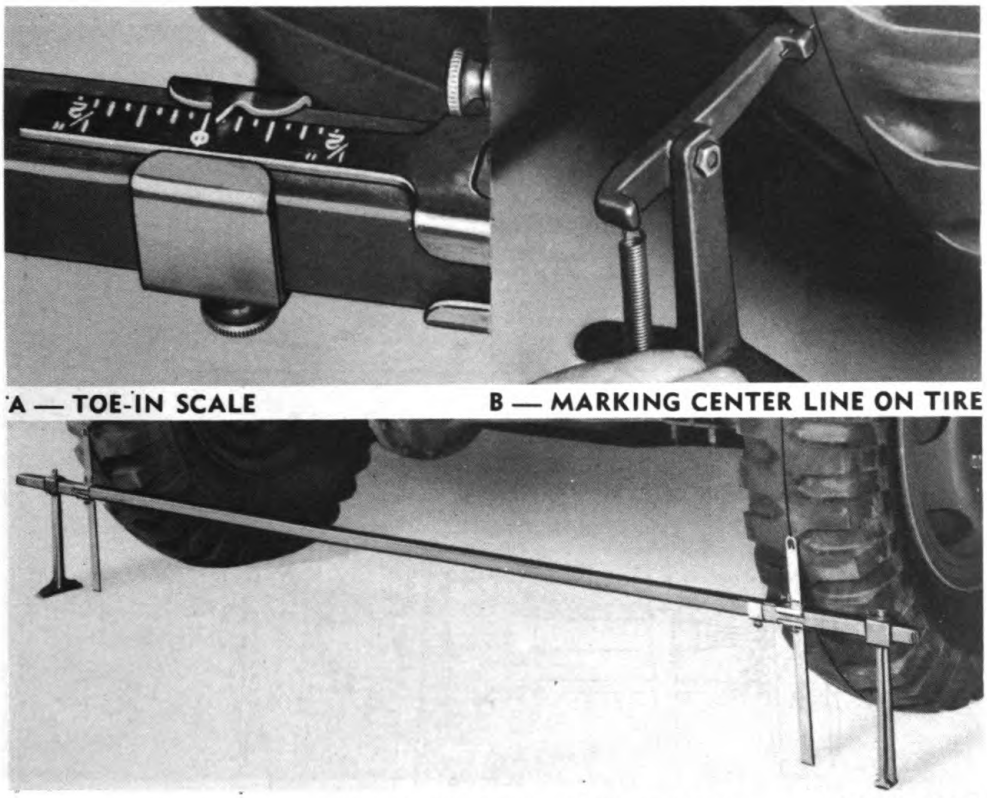
HAMMER	WRENCH, open-end, 7/16-in.
JACK, hydraulic	WRENCH, open-end, 9/16-in.
PUNCH, flat	WRENCH, open-end, 5/8-in.
WRENCH, box, 3/4-in.	WRENCH, wheel nut

(2) PROCEDURE.

(a) Remove Wheel (par. 158).

JACK, hydraulic	WRENCH, wheel nut

(b) Remove Front Wheel Brake Hose (par. 65).



A — TOE-IN SCALE B — MARKING CENTER LINE ON TIRE

C — TOE-IN MEASURING APPARATUS RA PD 61110

Figure 33—Toe-in Adjustment

HAMMER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 5/8-in.

(c) Adjust Ball Sockets.

HAMMER
PUNCH
WRENCH, box, 3/4-in.

Check end play by working socket up and down and determine amount of slack. Check clearance between ball and socket at the top and bottom; it should be evenly divided. Remove the eight nuts and lock washers from the steering arm and bearing cap and the lower bearing cap (3/4-in. box wrench). Remove the lower bearing cap and steering arm and bearing cap by tapping lightly (hammer and punch). Remove sufficient shims to remove all end play from the socket. Thoroughly tighten the lower bearing cap and the steering arm and bearing cap with the eight lock washers and nuts (3/4-in. box wrench). Recheck the adjustment to make sure socket is not too tight and that all end play has been removed. After the bearing caps are replaced, there should be a small amount of drag when rotating the socket, but it should not bind.

(3) INSTALL FRONT BRAKE HOSE (par. 65).

HAMMER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 5/8-in.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

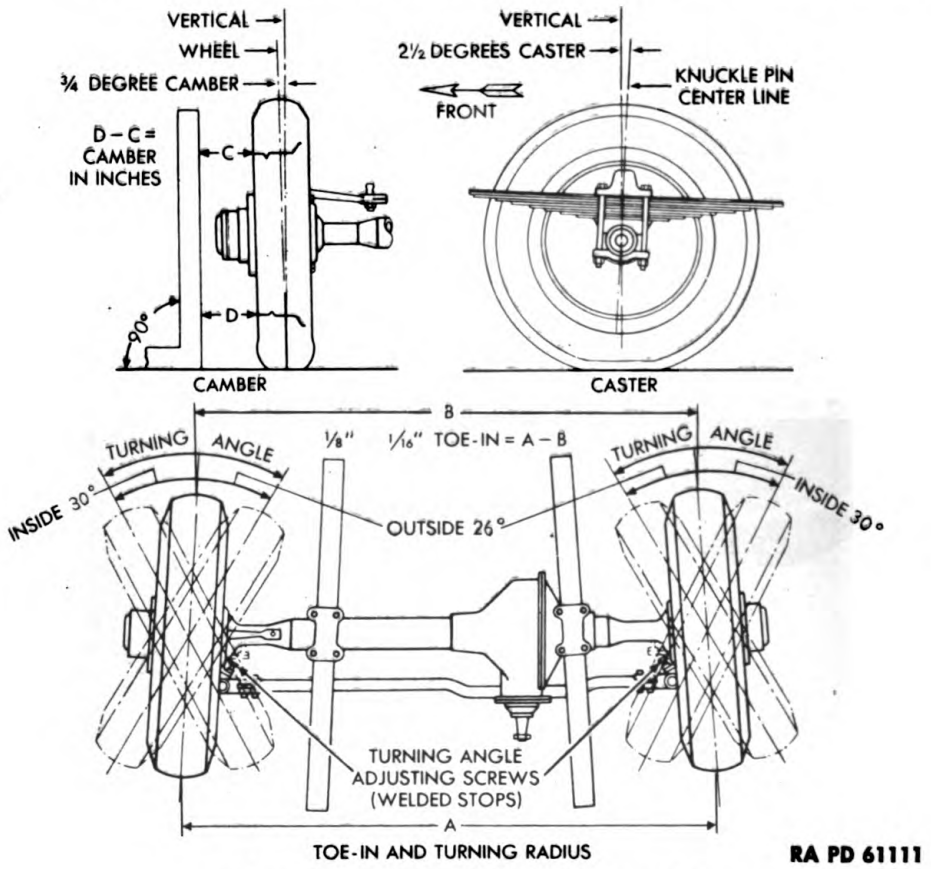


Figure 34—Toe-in Alinement Chart

(4) INSTALL FRONT WHEEL (par. 158).

JACK, hydraulic
WRENCH, wheel nut

f. Toe-in Adjustment (figs. 33-34).

(1) EQUIPMENT.

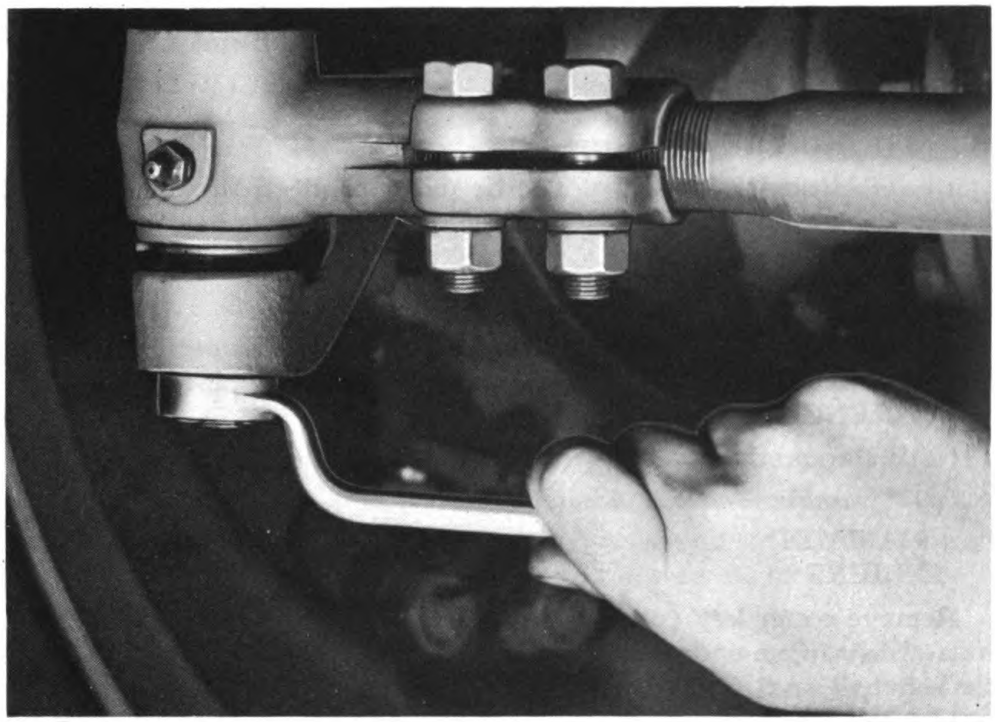
PLIERS
WRENCH, open-end, ¾-in.
WRENCH, open-end, 15⁄16-in.
WRENCH, pipe, 12-in.

(2) PROCEDURE.

(a) The front wheels are usually closer together in front of the axle than at the rear. The difference between these two points is commonly called "toe-in." When the toe-in is within the recommended limits, wheels are said to be in correct alinement. Wheel toe-in is originally set at ⅛-in., plus or minus 1⁄16-in., and should be maintained at this figure (fig. 34).

(b) The toe-in adjustment is made by placing the toe-in measuring apparatus in between the sidewalls of the front tires (C—fig. 33). Be sure there is no wobble in the tires (B—fig. 33). Disconnect one end of the tie rod (par. 42 **b** (2) *(b)*). Turn the tie rod end in or out until the recommended toe-in is maintained (A—fig. 33 and fig. 34).

(c) After correct adjustment has been obtained, connect the tie rod end. See (par. 42 **c** (2) *(a)*). Clamp the tie rod end to the tie rod by tightening the two bolts and nuts (¾-in. and 15⁄16-in. open-end wrenches).



RA PD 61112

Figure 35—Removing Tie Rod End

g. Front Axle Stop Bolt Adjustment.

(1) EQUIPMENT.

JACK, hydraulic

WRENCH, open-end, ¾-in.

(2) PROCEDURE.

(a) The front axle has a bolt and set screw for adjusting the turning angle of the front wheels. In making this adjustment jack up the front wheels (hydraulic jack) so that they will turn freely. Turn the steering wheel from one side to the other to make sure that the socket on the front axle is hitting the stop bolt, rather than the steering lever shaft hitting the end of the cam and tube assembly. If the stop bolts are not adjusted properly, all the strain will be taken up by the lever shaft against the end of the worm and tube assembly, and in a short time trouble will be experienced in the steering assembly.

(b) The steering angle of the front wheels should range from 26 degrees to 30 degrees (fig. 34). The adjustment is made by loosening the lock nut (¾-in. open-end wrench) on the set screw, and then turning the set screw in or out until the proper radius is maintained. After making this adjustment turn the wheels to the extreme right and extreme left, and rotate them slowly to make sure that there is no binding action at the universal joint of the front axle. If there is a binding action, the stop bolts

will have to be adjusted because the steering angle is too great, allowing this binding action.

(c) Tighten the set screw lock nut (¾-in. open-end wrench) and lower the vehicle.

42. TIE ROD (fig. 35).

a. Tie Rod Description. The tie rod is connected to the right and left steering arms and is located at the rear of the axle housing.

b. Tie Rod Removal.

(1) EQUIPMENT.

HAMMER
PLIERS
WRENCH, open-end, ¾-in.
WRENCH, open-end, 15/16-in.
WRENCH, pipe, 12-in.

(2) PROCEDURE.

(a) Remove Tie Rod Assembly.

HAMMER
PLIERS
WRENCH, open-end, 15/16-in.

Remove cotter key (pliers) from each tie rod ball stud nut. Remove nuts (15/16-in. open-end wrench) from each tie rod ball stud (fig. 35). Drive tie rod ball stud from steering arms (hammer). NOTE: Be cautious not to damage threads.

(b) Remove Tie Rod End.

WRENCH, open-end, ¾-in.
WRENCH, pipe

Remove two bolts, nuts, and lock washers (¾-in. open-end wrench) that clamp tie rod end to tie rod. Screw tie rod end from tie rod (pipe wrench). NOTE: The left tie rod end has a right-hand thread and the right tie rod end has a left-hand thread.

c. Tie Rod Installation.

(1) EQUIPMENT.

WRENCH, open-end, ¾-in.
WRENCH, pipe

(2) PROCEDURE.

(a) Install Tie Rod End.

WRENCH, open-end, ¾-in. (2)
WRENCH, pipe

Screw tie rod end on tie rod (pipe wrench). See note (par. 42 **b** (2) *(b)*). Adjust length of tie rod for proper toe-in (par. 41 **f**). Replace two bolts, nuts, and lock washers clamping tie rod end to tie rod and tighten (two ¾-in. open-end wrenches).

(b) Install Tie Rod.

HAMMER
PLIERS
WRENCH, open-end, 15/16-in.

Put tie rod ball studs into position in steering arms. Replace nuts and tighten securely (15/16-in. open-end wrench). Enter cotter key in nuts (pliers).

FRONT AXLE

43. FRONT AXLE STEERING ARM.

a. Front Axle Steering Arm Removal.

(1) EQUIPMENT.

HAMMER, 1 lb
HOSE, brake bleeder
PLIERS
SCREWDRIVER, heavy-duty
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 15/16-in.

(2) PROCEDURE.

(a) Remove Drag Link.

PLIERS
SCREWDRIVER

Remove cotter keys (pliers) from drag link ends. Remove drag link end plugs (screwdriver). Remove the drag link bearings and pull drag link from steering and Pitman arm ball studs.

(b) Remove Steering Arm.

HAMMER
WRENCH, open-end, 3/4-in.

Remove four nuts and lock washers (3/4-in. open-end wrench) fastening steering arm to the front axle socket. Drive the steering arm (hammer) from studs in the axle socket.

(c) Remove Brake Hose.

PLIERS
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 5/8-in.

Disconnect flexible brake hose from copper brake tube (7/16-in. open-end wrench and 5/8-in. open-end wrench). Remove metal clip (pliers) that holds brake hose into bracket. Remove brake hose from wheel cylinder (5/8-in. open-end wrench).

(d) Remove Steering Arm Ball Stud.

HAMMER
PLIERS
WRENCH, open-end, 15/16-in.

Remove cotter key (pliers) from steering arm ball stud nut. Remove nut (15/16-in. open-end wrench). Then drive ball stud from steering arm (hammer).

b. Front Axle Steering Arm Installation.

(1) EQUIPMENT.

HAMMER, 1 lb
PLIERS
SCREWDRIVER, heavy-duty
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 15/16-in.

(2) PROCEDURE.

(a) Install Steering Arm Ball Stud.

HAMMER
PLIERS
WRENCH, open-end, 15/16-in.

Drive ball stud into steering arm (hammer). Turn on castellated nut and tighten (15/16-in. open-end wrench). Enter cotter key into nut (pliers).

(b) Install Steering Arm on Front Axle Socket.

HAMMER
WRENCH, open-end, 3/4-in.

Place steering arm on front axle socket and then tap the arm in place on studs (hammer). Place the four nuts and lock washers and tighten (¾-in. open-end wrench).

(c) Install Drag Link.

PLIERS
SCREWDRIVER

Place drag link bearings in sockets of drag link and slip drag link on the steering and Pitman arm ball studs, making sure that drag link bearings are on each side of ball studs. Replace drag link end plugs and adjust until all noticeable end play is removed (screwdriver). Enter cotter key in each end plug (pliers).

(d) Install Brake Hose.

HOSE, brake bleeder
PLIERS
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 5/8-in.

Connect flexible brake hose to wheel cylinder connection (5/8-in. open-end wrench), place opposite end of brake hose into bracket, and secure with metal clip (pliers). Connect brake hose to brake line (7/16-in. open-end wrench and 5/8-in. open-end wrench). Bleed brake (par. 60).

44. FRONT AXLE ASSEMBLY REMOVAL.

a. Equipment.

CHAIN
CHISEL, 6-in.
HAMMER, 1 lb
HANDLE, socket
HOIST, chain
HOSE, brake bleeder
JACK, hydraulic
PLIERS
RATCHET and drag link adjuster
SCREWDRIVER, heavy duty
WRENCH, box, ½-in.
WRENCH, box, 15/16-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, socket, 1 7/16-in.
WRENCH, wheel nut

b. Procedure.

(1) DISCONNECT DRAG LINK (par. 144 c).

PLIERS
RATCHET and drag link adjuster

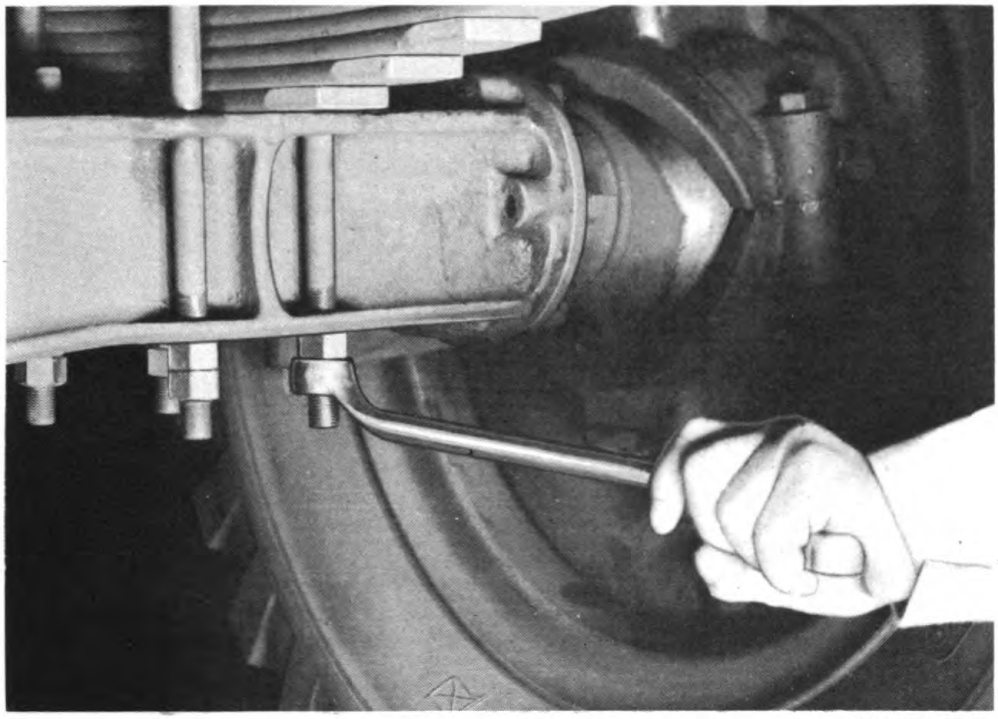
(2) DISCONNECT FRONT UNIVERSAL JOINT.

CHISEL, 6-in.
HAMMER, 1 lb
WRENCH, box, ½-in.

(a) Straighten the locks (6-in. chisel and hammer) retaining the cap bolts in the bearing cover plates.

(b) Remove eight cap bolts (½-in. box wrench) two in each bearing cover plate and then remove cover and lock plates.

(c) Tap the yoke (hammer) on propeller shaft sufficiently to start universal bearing from yoke ear. Remove the bearing and then tap (hammer) the yoke on the opposite side enough to remove the opposite bearing. The center cross can now be tipped back and the propeller shaft yoke removed.



RA PD 61113

Figure 36—Removing Spring U-Bolt Nut

(d) Remove the bearings from opposite yoke in the same manner and then remove center cross.

(3) DISCONNECT BRAKE HOSE.

PLIERS **WRENCH, open-end, 5/8-in.**
WRENCH, open-end, 7/16-in.

Disconnect the flexible brake hose from the brake line (7/16-in. and 5/8-in. open-end wrenches). NOTE: Care should be observed not to twist the flexible hose. Remove clip (pliers) holding brake hose into bracket.

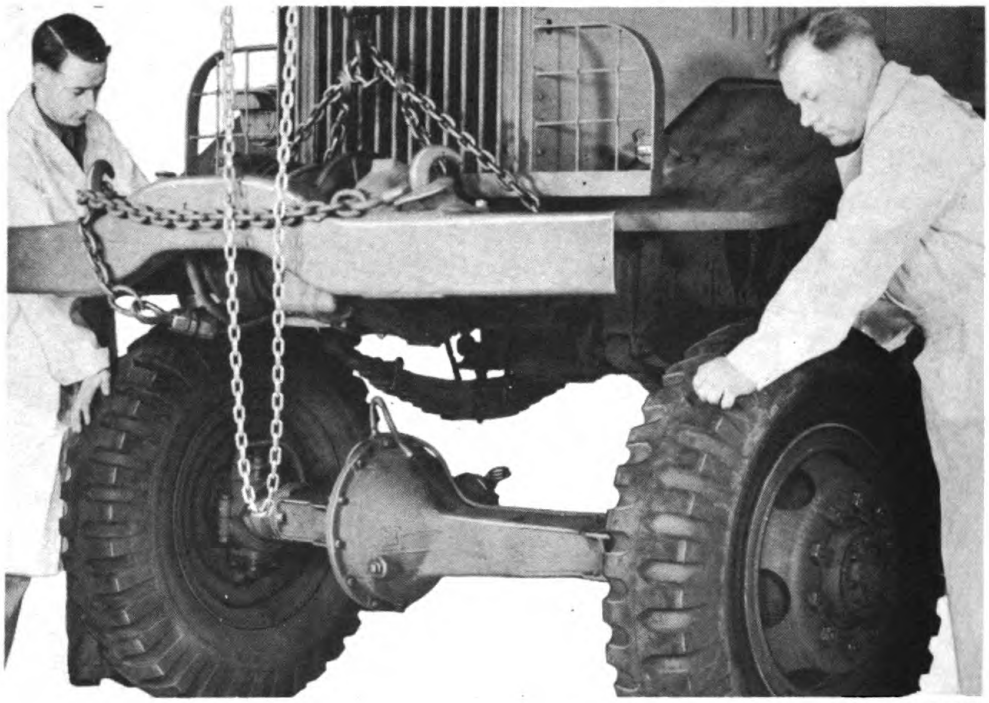
(4) REMOVE FRONT SPRING U-BOLTS.

CHAIN **HOIST, chain**
HAMMER **WRENCH, box, 15/16-in.**

Remove 16 nuts (15/16-in. box wrench) fastening spring U-bolts to axle housing. Fasten chain around side channels of bumper and raise front end of vehicle (chain hoist) and front springs from axle housing and at same time drive the spring U-bolts up through axle housing. NOTE: In emergency when chain hoist is not available, vehicle can be lifted with winch cable.

(5) REMOVE AXLE ASSEMBLY FROM UNDER VEHICLE.

After axle is free from springs it can be rolled from under the vehicle (fig. 37). Hold wheels in a vertical position while removing the assem-



RA PD 61114

Figure 37—Remove Front Axle Assembly

bly. This is necessary as the socket joints will allow the wheels to move sideways.

(6) REMOVE WHEELS (par. 158).

JACK, hydraulic
WRENCH, wheel nut

(7) REMOVE PINION SHAFT UNIVERSAL JOINT YOKE.

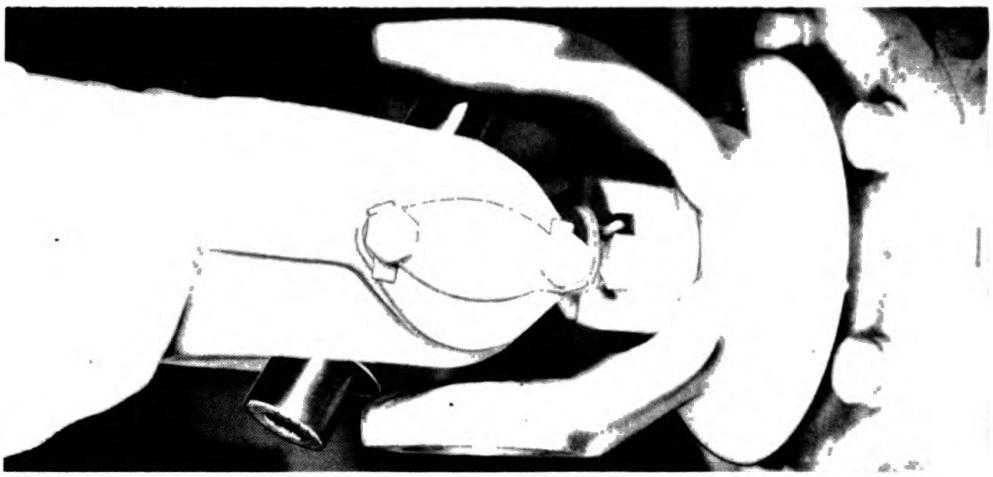
HAMMER
HANDLE, socket
PLIERS
WRENCH, socket, 1 7/16-in.

Remove cotter key (pliers) from differential pinion nut. Remove the pinion shaft nut and flat washer (1 7/16-in. socket and socket handle). Drive universal joint yoke (hammer) from pinion shaft.

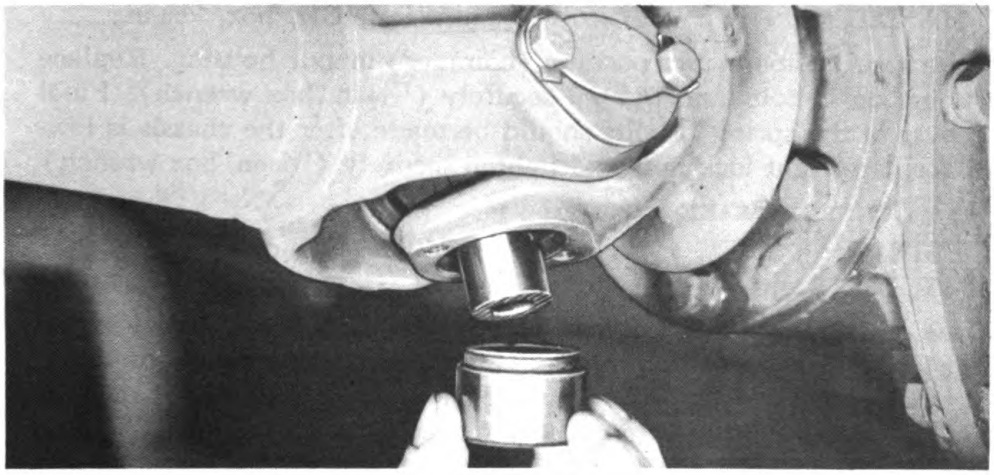
45. FRONT AXLE ASSEMBLY INSTALLATION (fig. 38).

a. Equipment.

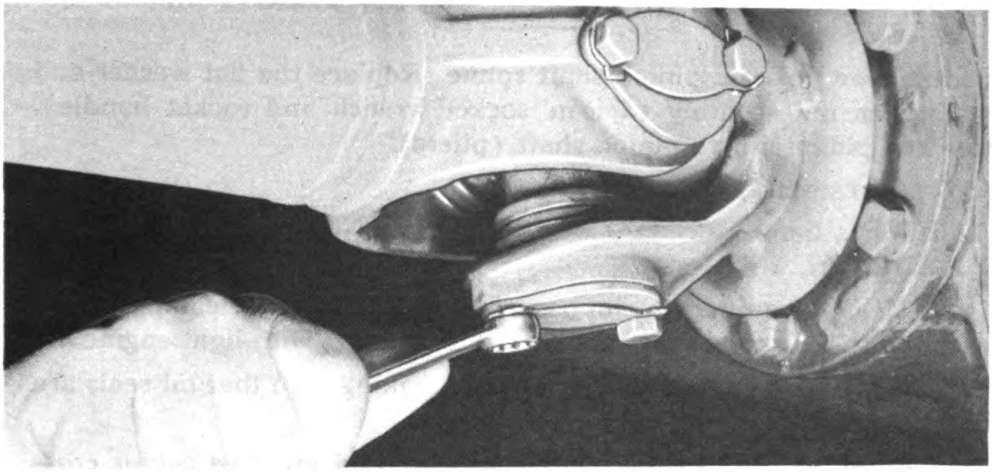
BLEEDER, brake
CHAIN
CHISEL, 6-in.
GUN, pressure
HAMMER, 1 lb
HANDLE, socket
HOIST, chain
JACK, hydraulic
PLIERS
WRENCH, box, 1/2-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, open-end, 15/16-in.
WRENCH, socket, 1 7/16-in.
WRENCH, wheel nut (standard)



A.—INSTALLING CENTER CROSS IN YOKE



B.—INSTALLING UNIVERSAL BEARING



C.—TIGHTENING UNIVERSAL BEARING CAP

RA PD 61115

Figure 38—Installation of Universal Joint

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

b. Procedure.

(1) INSTALL WHEELS (par. 158).

CHAIN
HOIST, chain
JACK, hydraulic
WRENCH, wheel nut (standard)

Raise front axle (hydraulic jack or chain hoist and chain) and install wheels and tires.

(2) INSTALL FRONT AXLE ASSEMBLY UNDER CHASSIS.

CHAIN
HOIST, chain

Raise chassis (chain and chain hoist) high enough to allow front axle assembly to roll under the springs. Roll axle assembly under chassis and then lower chassis so that spring tie bolt heads enter each drilling at top of axle housing.

(3) REPLACE SPRING U-BOLTS.

HAMMER
WRENCH, box, 1 5/16-in.

Drive spring U-bolts into position (hammer) in axle housing. Replace eight nuts on U-bolts and tighten securely (1 5/16-in. box wrench). Final tightening of the spring U-bolts should be made after the chassis is lowered. Replace eight lock nuts and tighten securely (1 5/16-in. box wrench).

(4) CONNECT BRAKE HOSE.

PLIERS
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 5/8-in.

Place end of hose through hose bracket and fasten with bracket clip (pliers). Connect brake line to brake hose (7/16-in. open-end wrench and 5/8-in. open-end wrench). NOTE: Care should be observed not to twist the flexible brake hose as it may get damaged.

(5) INSTALL PINION SHAFT U-JOINT YOKE.

HANDLE, socket
PLIERS
WRENCH, socket, 1 7/16-in.

Slide pinion yoke on pinion shaft spline. Replace the flat washer and nut. Tighten nut securely (1 7/16-in. socket wrench and socket handle). Cotter key pinion nut to pinion shaft (pliers).

(6) ASSEMBLE UNIVERSAL JOINT.

CHISEL, 6-in.
HAMMER, 1 lb
WRENCH, box, 1/2-in.

(a) Clean the universal joint parts in SOLVENT, dry-cleaning, before attempting to assemble; lubricate each internal part with light engine oil.

(b) Place center cross in pinion yoke, making sure that oil seals are in good condition (A—fig. 38).

(c) Enter needle bearings into yoke ears and into the center cross (B—fig. 38).

(d) Place bearing cover plates and lock plates on each yoke ear and fasten with cap bolts (1/2-in. box wrench) (C—fig. 38)

FRONT AXLE

(7) REPLACE DRAG LINK (par. 144 c).

PLIERS
SCREWDRIVER, heavy duty

(8) BLEED BRAKES (par. 60 d).

HOSE, brake bleeder
WRENCH, open-end, 7/16-in.

(9) LUBRICATE UNIVERSAL JOINT. See Lubrication Guide (section VI).

(10) LUBRICATE FITTINGS AND CHECK OIL LEVEL IN AXLE HOUSING. See Lubrication Guide (section VI).

GUN, pressure
WRENCH, open-end, 5/8-in.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Section XV

REAR AXLE

46. REAR AXLE DESCRIPTION (fig. 42).

a. The rear axle is similar in construction to the front axle. It has the same differentials, bearings, and gears, and is the full-floating spiral bevel gear driven type, which permits the axle shafts to be removed with the weight of the vehicle on its wheels.

47. REAR AXLE TROUBLE SHOOTING.

a. Noise in Axle.

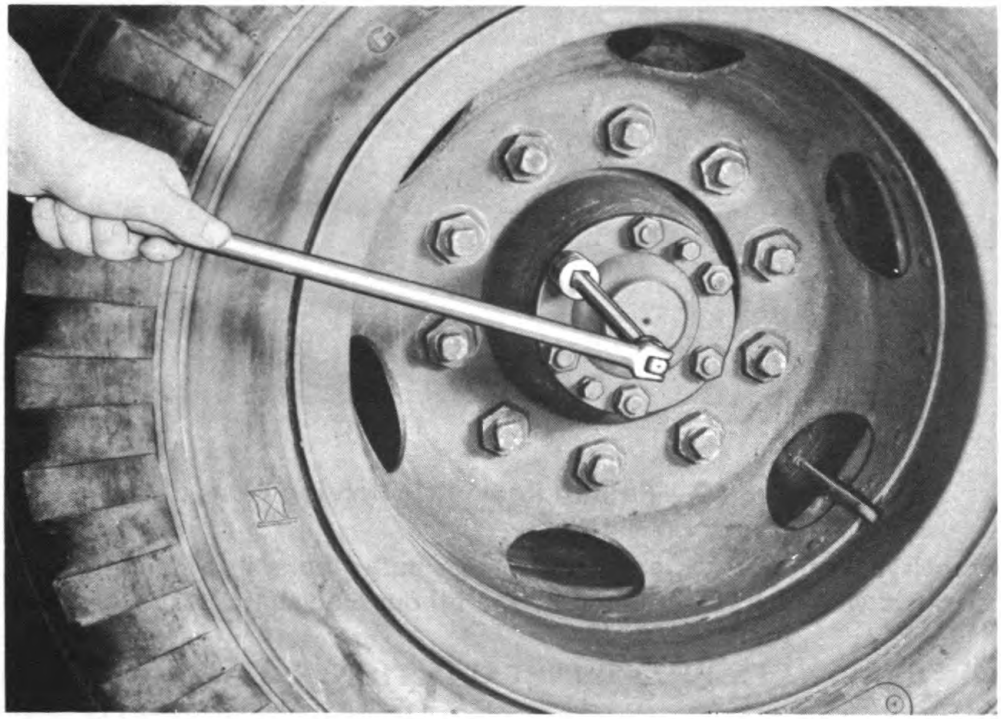
Possible Cause	Possible Remedy
(1) Broken teeth in ring gear or pinion (snapping noise).	Replace axle assembly (pars. 50 and 51) or report to higher authority.
(2) Wheel bearings out of adjustment (continuous hum).	Adjust wheel bearings (par. 162).
(3) Lack of grease or poor ring gear and pinion adjustment (hum when pulling).	Check lubricant—See Lubrication Guide (section VI), or report to higher authority.
(4) Lack of grease or poor ring gear and pinion adjustment (hum when coasting).	Check lubricant—See Lubrication Guide (section VI), or report to higher authority.
(5) Worn or broken differential or pinion bearings.	Replace axle assembly (pars. 50 and 51) or report to higher authority.

b. Backlash.

(1) Poor ring gear and pinion adjustment.	Report to higher authority.
(2) Worn differential or pinion bearings.	Report to higher authority.
(3) Worn splines on either end of axle shaft assembly.	Replace worn axle shaft assembly (pars. 48 and 49).
(4) Loose nuts on wheel driving flange.	Tighten flange nuts (par. 49 **b** (1)).
(5) Worn splines on pinion shaft or propeller shaft yoke.	Report to higher authority.

c. Grease Leakage.

(1) Loose bolts in axle housings.	Tighten bolts.
(2) Poor pinion oil seal.	Report to higher authority.
(3) Poor wheel oil seals.	Replace wheel oil seals (par. 161).
(4) Loose driving flange nuts or poor gasket.	Tighten nuts or replace driving flange gasket (par. 49 b (1)).



RA PD 61116

Figure 39—Removing Rear Driving Flange Nuts

48. REAR AXLE SHAFT REMOVAL.

a. Equipment.

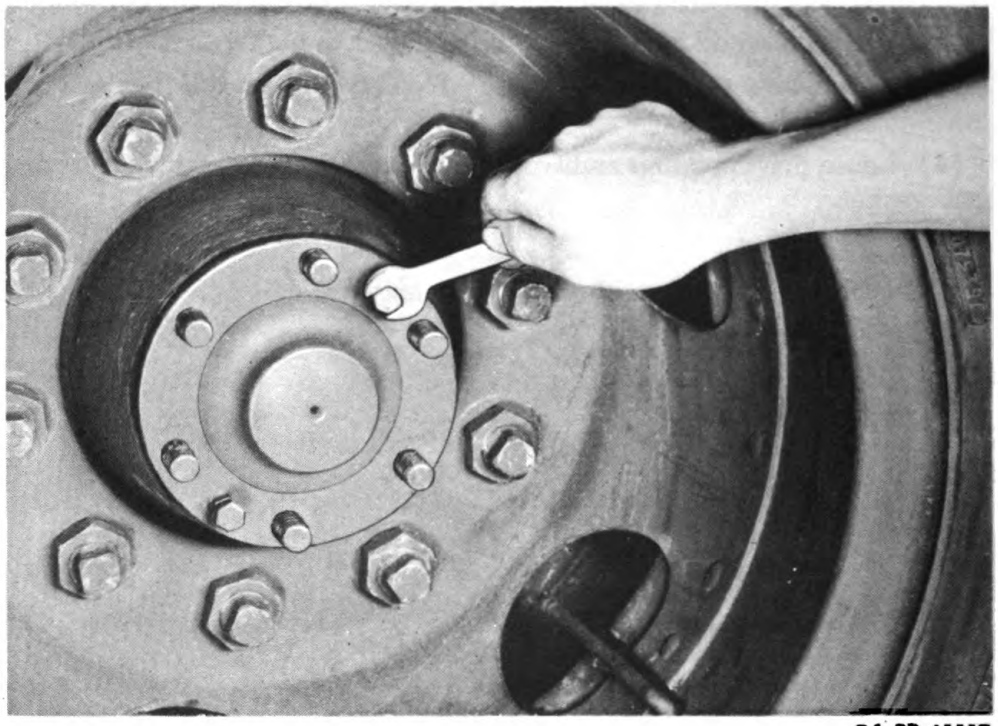
EXTENSION, 5-in.	WRENCH, open-end, 9/16-in.
HANDLE, flex, 18-in.	WRENCH, socket, 15/16-in.

b. Procedure.

(1) Remove Rear Axle Shaft.

EXTENSION, 5-in.	WRENCH, open-end, 9/16-in.
HANDLE, flex, 18-in.	WRENCH, socket, 15/16-in.

Remove the six nuts and lock washers holding axle shaft flange to the wheel (flex handle, 5-in. extension, and 15/16-in. socket wrench). Loosen the two lock nuts on the axle shaft flange puller bolts (9/16-in. open-end



RA PD 61117

Figure 40—Pulling Rear Axle Driving Flange

wrench). Turn the two axle shaft flange puller bolts into flange (9/16-in. open-end wrench) (figs. 39 and 40). Pull out axle shaft.

49. REAR AXLE SHAFT INSTALLATION.

a. Equipment.

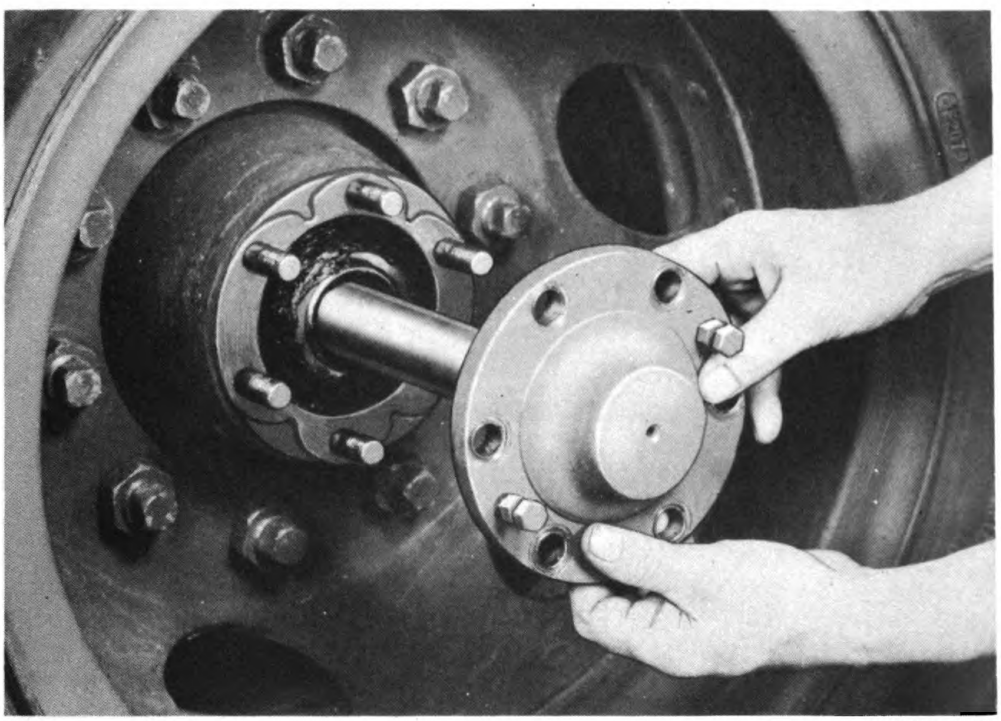
EXTENSION, 5-in.	WRENCH, open-end, 9/16-in.
HANDLE, flex, 18-in.	WRENCH, socket, 15/16-in.

b. Procedure.

(1) INSTALLING REAR AXLE SHAFT.

EXTENSION, 5-in.	WRENCH, open-end, 9/16-in.
HANDLE, flex	WRENCH, socket, 15/16-in.

Slide axle shaft into axle housing and enter spline into side gear of differential (fig. 41). Turn axle shaft until the flange bolt holes are lined up with the studs on the wheel. Turn axle shaft flange puller bolts back flush with the flange (9/16-in. open-end wrench). Push axle shaft all the way in, so flange is up against wheel. Tighten the six nuts and lock washers holding axle shaft flange to the wheel (flex handle, 5-in. extension, and 15/16-in. socket wrench). Tighten lock nuts on flange puller bolts (9/16-in. open-end wrench).



RA PD 61118

Figure 41—Installing Rear Axle Shaft

50. REAR AXLE ASSEMBLY REMOVAL.

a. Equipment.

CHAIN
CHISEL, 6-in.
HAMMER, 1 lb
HANDLE, socket
HOIST, chain
JACK, hydraulic
PLIERS
WRENCH, box, ½-in.
WRENCH, box, 15/16-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, socket, 1 7/16-in.
WRENCH, wheel nut (standard)

b. Procedure.

(1) DISCONNECT REAR UNIVERSAL JOINT.

CHISEL, 6-in.
HAMMER, 1 lb
WRENCH, box, ½-in.

(a) Straighten wings on lock plate (6-in. chisel and hammer) to free cap bolts in bearing cover plates.

(b) Remove cap bolts (½-in. box wrench) from the four bearing cover plates. Remove cover and lock plates.

(c) Tap the yoke (hammer) on propeller shaft sufficiently to start the universal bearing from yoke ear. Remove the bearing and then tap (hammer) the yoke on opposite side enough to remove other bearing.

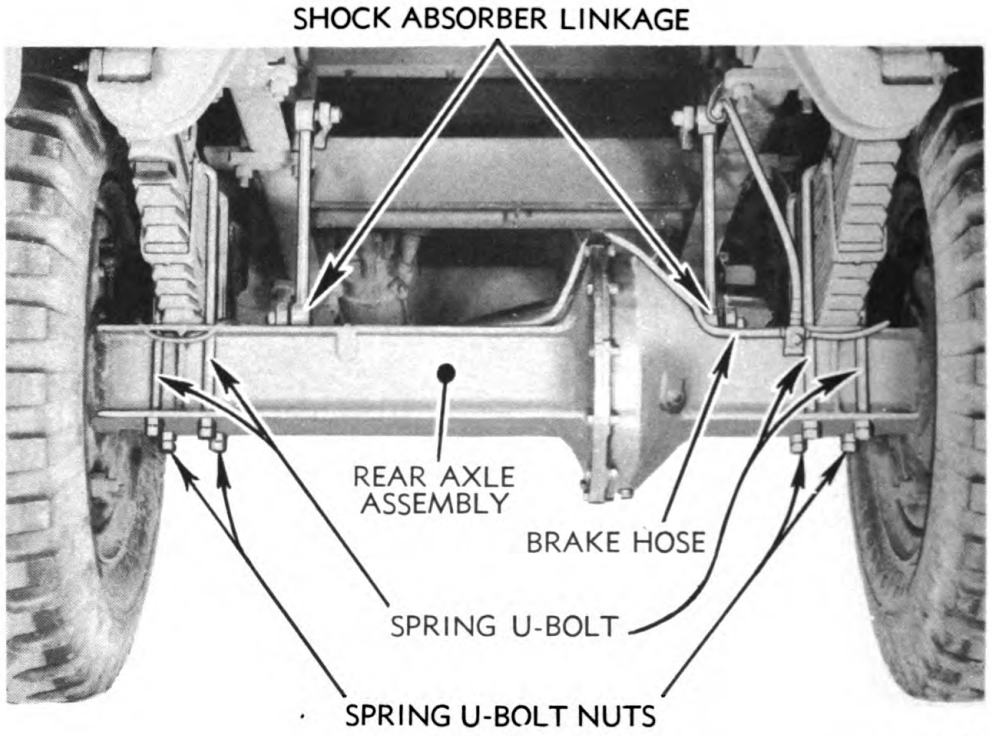


Figure 42—Rear Axle Assembly Installed

The center cross can now be tipped back and yoke on propeller shaft removed from center cross.

(d) Remove bearings from pinion yoke in same manner and then remove center cross.

(2) DISCONNECT BRAKE HOSE.

PLIERS
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 5/8-in.

Disconnect the flexible brake hose from the brake line (5/8-in. open-end wrench and 7/16-in. open-end wrench). **NOTE:** Care should be observed not to twist the flexible hose. Remove metal clip (pliers) holding brake hose into bracket (fig. 42).

(3) REMOVE REAR SPRING U-BOLTS.

CHAIN
HAMMER
HOIST, chain
WRENCH, box, 15/16-in.

Remove 16 nuts (15/16-in. box wrench) holding spring U-bolts to axle housing. Drive U-bolts (hammer) up through axle housing (fig. 42). **NOTE:** Be careful not to damage threads.

(4) DISCONNECT SHOCK ABSORBER LINKAGE.

WRENCH, box, 15/16-in.

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Figure 43—Removing Rear Axle Assembly

Remove two nuts and lock washers (15/16-in. box wrench) fastening shock absorber linkage to axle housing (fig. 42). Remove linkage from axle housing.

(5) REMOVE REAR AXLE ASSEMBLY FROM UNDER VEHICLE.

CHAIN	HOIST, chain

Fasten (chain) around frame at rear of chassis and raise (chain hoist) until the rear springs are free from axle housing. Roll rear axle assembly from under vehicle.

(6) REMOVE WHEELS (par. 158).

JACK, hydraulic	WRENCH, wheel nut (standard)

(7) REMOVE PINION SHAFT YOKE.

HAMMER	PLIERS
HANDLE, socket	WRENCH, socket, 1 7/16-in.

Remove cotter key (pliers). Remove nut and flat washer from pinion shaft (1 7/16-in. socket wrench and socket handle). Drive yoke from pinion shaft (hammer).

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

51. REAR AXLE ASSEMBLY INSTALLATION (fig. 42).

a. Equipment.

CHAIN
CHISEL, 6-in.
HAMMER, 1 lb
HANDLE, socket
HOIST, chain
HOSE, brake bleeder
JACK, hydraulic
PLIERS
WRENCH, box, 7/16-in.
WRENCH, box, 1/2-in.
WRENCH, box, 5/8-in.
WRENCH, box, 15/16-in.
WRENCH, socket, 1 7/16-in.
WRENCH, wheel nut (standard)

b. Procedure.

(1) INSTALL REAR WHEELS.

CHAIN
HOIST, chain
JACK, hydraulic
WRENCH, wheel nut

Raise rear axle (hydraulic jack or chain hoist and chain) and install wheels (refer to par. 158) in wheel section.

(2) INSTALL REAR AXLE ASSEMBLY UNDER CHASSIS.

CHAIN
HOIST, chain

Raise chassis (chain and chain hoist) high enough to clear axle housing. Roll the rear axle assembly under chassis and lower chassis onto axle housing. Have axle housing in position, so that spring center bolt heads will enter recess in top of housing.

(3) REPLACE SPRING U-BOLTS.

HAMMER
WRENCH, box, 15/16-in.

Drive spring U-bolts (hammer) into position in axle housing (fig. 42). Replace eight nuts on U-bolts and tighten securely (15/16-in. box wrench). Replace eight lock nuts and tighten securely (15/16-in. box wrench).

(4) CONNECT BRAKE HOSE.

PLIERS
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 5/8-in.

Place end of brake hose through brake hose brackets and fasten with metal clips (pliers). Connect brake tube to flexible brake hose (7/16-in. open-end wrench and 5/8-in. open-end wrench). NOTE: Care should be observed not to twist the flexible brake hose.

(5) INSTALL PINION SHAFT U-JOINT YOKE.

HANDLE, socket
PLIERS
WRENCH, socket, 1 7/16-in.

Slide universal joint yoke onto spline of pinion shaft. Place flat washer and nut on pinion shaft and tighten nut (1 7/16-in. socket wrench and socket handle) securely. Enter cotter key in pinion nut (pliers).

(6) ASSEMBLE REAR UNIVERSAL JOINT (par. 131).

CHISEL, 6-in.
HAMMER, 1 lb
WRENCH, box, 1/2-in.

REAR AXLE

(7) CONNECT SHOCK ABSORBER LINKAGE (fig. 42).

WRENCH, box, 15/16-in.

Connect shock absorber linkage to rear axle housing (15/16-in. box wrench).

(8) BLEED BRAKES (par. 60 d).

HOSE, brake bleeder WRENCH, open-end, 7/16-in.

(9) LUBRICATE REAR AXLE. See Lubrication (section VI).

WRENCH, open-end, 5/8-in.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Section XVI

BODY ASSEMBLY

52. BODY.

a. Body Construction. The cargo body is an all-wood construction with metal stake pocket brackets; the corner stake pockets act as a reinforcement for the body. Seats and lazy-backs are made of either white or red oak; the bows and longitudinal sills are hardwood. A tool box is provided in the rear bolster with a latch, padlock, and chain. Splash guards are bolted to the body and can be easily removed.

b. Body Maintenance. All woodwork has been properly oil treated and filled and the treatments should last eight to twelve months. After that normal care customarily extended to wooden parts is required. Tighten the hold-down and mounting bolts securely at least once every 6000 miles. Inspect and tighten all other bolts which may become loose, due to hard usage. Repair immediately, if possible, all incipient breakages to avoid loss of important parts or complete incapacity of the body.

c. Body Mud Shields (fig. 44). The body mud shields are made of steel and supported by brackets bolted to the body sills.

d. Body Mud Shield Removal.

(1) EQUIPMENT.

WRENCH, open-end, 9/16-in. WRENCH, open-end, 5/8-in.

(2) PROCEDURE.

(a) Remove Mud Shield Brace (Upper End).

WRENCH, open-end, 5/8-in.

Remove two nuts and lock washers (5/8-in. open-end wrench) from the top end of the mud shield brace.

(b) Remove Mud Shield.

WRENCH, open-end, 5/8-in.

Remove four nuts and lock washers (5/8-in. open-end wrench) holding mud shield to body. Remove mud shield and braces from bolts.

(c) Remove Braces from Shield.

WRENCH, open-end, 9/16-in. WRENCH, open-end, 5/8-in.

Hold brace bolt head (9/16-in. open-end wrench) and then loosen nut on opposite side (5/8-in. open-end wrench). Remove lock washers and brace from mud shield.

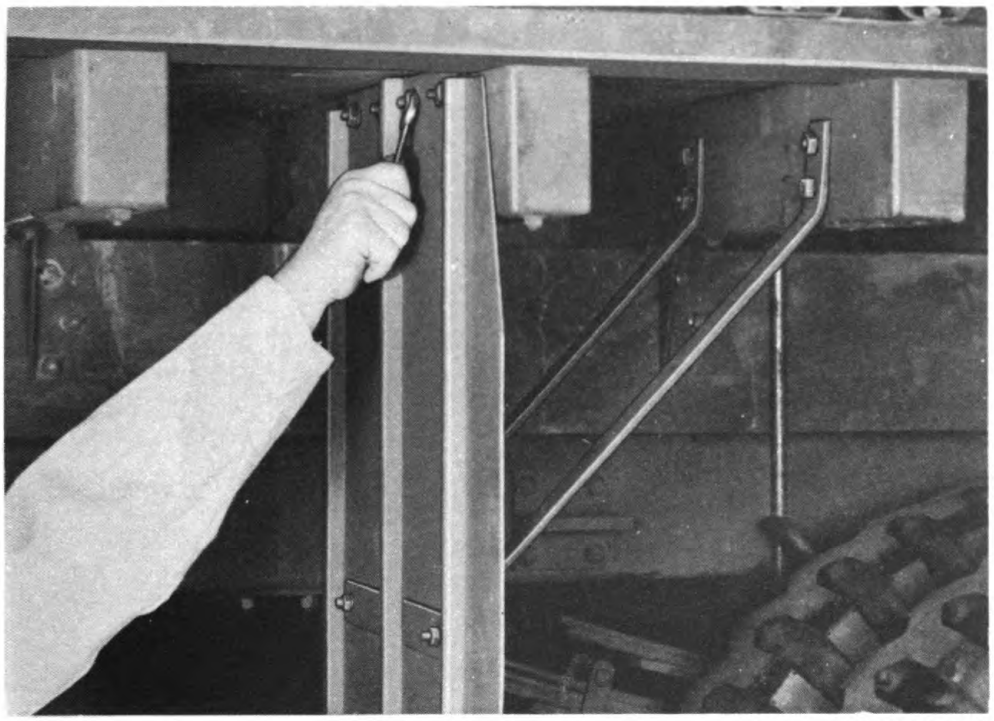

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Figure 44—Installing Mudshield Bolts

e. Body Mud Shield Installation (fig. 44).

(1) EQUIPMENT.

WRENCH, open-end, 9/16-in. **WRENCH**, open-end, 5/8-in.

(2) PROCEDURE.

(a) Install Braces on Mud Shield.

WRENCH, open-end, 9/16-in. **WRENCH**, open-end, 5/8-in.

Place brace on mud shield and enter bolt, lock washer, and nut. Tighten nut temporarily (9/16-in. and 5/8-in. open-end wrenches).

(b) Install Shield and Braces.

WRENCH, open-end, 9/16-in. **WRENCH**, open-end, 5/8-in.

Raise shield up to body and enter body sill bolts (fig. 44). Place lock washers and nuts on bolts and tighten (5/8-in. open-end wrench). Finish tightening bolts holding braces and shield (9/16-in. and 5/8-in. open-end wrenches).

f. Tarpaulin Description and Maintenance. The tarpaulin is made of cotton duck, flame and waterproofed. Care should be taken that it is dried out good before rolling up or bundling together for long periods. When in use be sure it is properly tied down to avoid flopping around in the wind, thereby subjecting it to damage.

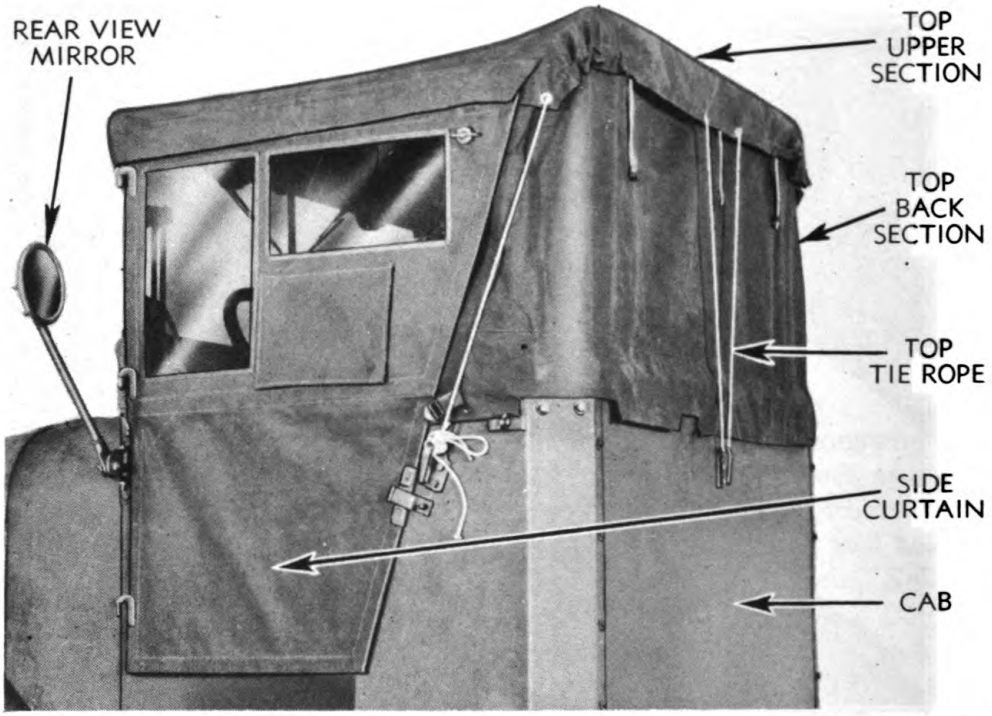

Figure 45—Cab and Top

g. Tarpaulin Removal.

(1) PROCEDURE.

Remove Tarpaulin. Untie the 14 ropes holding the tarpaulin to the body. Loosen the four end curtain ropes and remove them from the bows and slide the tarpaulin from the chassis.

h. Tarpaulin Replacement.

(1) PROCEDURE.

(a) Install Tarpaulin. Slide the tarpaulin over the bows on the chassis body. Attach the end curtains to the bows with the four ropes. Attach the entire tarpaulin to the chassis body hooks with the 14 remaining ropes.

53. CAB (figs. 45, 46, and 47).

a. Cab Description. The cab is of all-metal construction with a canvas top that is attached above the windshield in front and held at the back of the cab with ropes. The canvas top is removable and may be stored behind the seat back. The seat frames are of metal construction with provision for a tool box underneath the driver's seat. The one-piece adjustable windshield is constructed for greater visibility and may be set at any angle between the open and closed position by loosening thumb screws at each side.

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Figure 46—Installing Upper Top Section

b. Side Curtain Removal.

(1) PROCEDURE. Open curtain door approximately half-way until guide on lower hinge pin lines up with the slot in lower hinge. Lift curtain up and from the three hinges.

c. Side Curtain Installation.

(1) PROCEDURE. With curtain at right angle to cab, enter the three hinge pins on curtain into the hinges on cab.

d. Top Removal.

(1) PROCEDURE.

(a) Loosen Rear of Top. Untie rope at each rear corner of cab and unhook rope at rear center of cab panel.

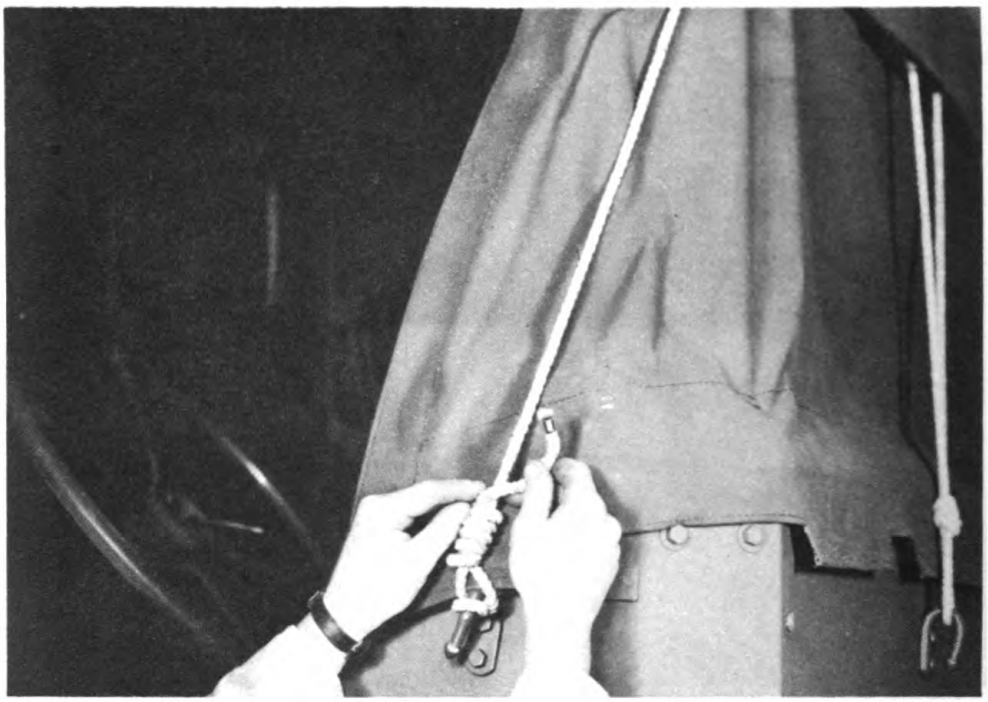
(b) Loosen Front of Top. Unfasten leather holders at each top corner of windshield.

(c) Remove Top. Slide top to either side from guide at top of windshield.

(d) Loosen Lower Rear Section of Top. Unfasten rope and strap at each lower corner of top rear section. Unhook rope from rope hooks just above back cushions.

(e) Loosen Top Bow. Loosen wing nuts that clamp top bow to cab.

(f) Remove Rear Curtain. Lift rear curtain and bow from cab.



RA PD 65829

Figure 47—Fastening Tie Rope

e. Top Installation (figs. 46-47).

(1) PROCEDURE.

(a) Install Top Bow. Enter top bow into guides at rear of cab and tighten wing nuts.

(b) Fasten Top Rear Curtain Hold-down Rope and Straps. Hook rope on rope hooks above back cushion. Tie rope ends at each side of top bow. Fasten strap to clips inside of cab at each side of seat.

(c) Install Upper Section of Top. Slide the sewed in rope of the upper section into channel at top of windshield (fig. 46).

(d) Fasten Front Upper Section of Top. Fasten the leather fastener at each end of windshield.

(e) Fasten Rear Upper Section of Top. Hook rope on rope hook at center of rear cab panel. Tie ends of rope to rope hook at each rear corner of cab (fig. 47).

54. WINDSHIELD (figs. 48-49).

a. Windshield Frame and Glass Removal.

(1) EQUIPMENT.

SCREWDRIVER WRENCH, open-end, 3/8-in.

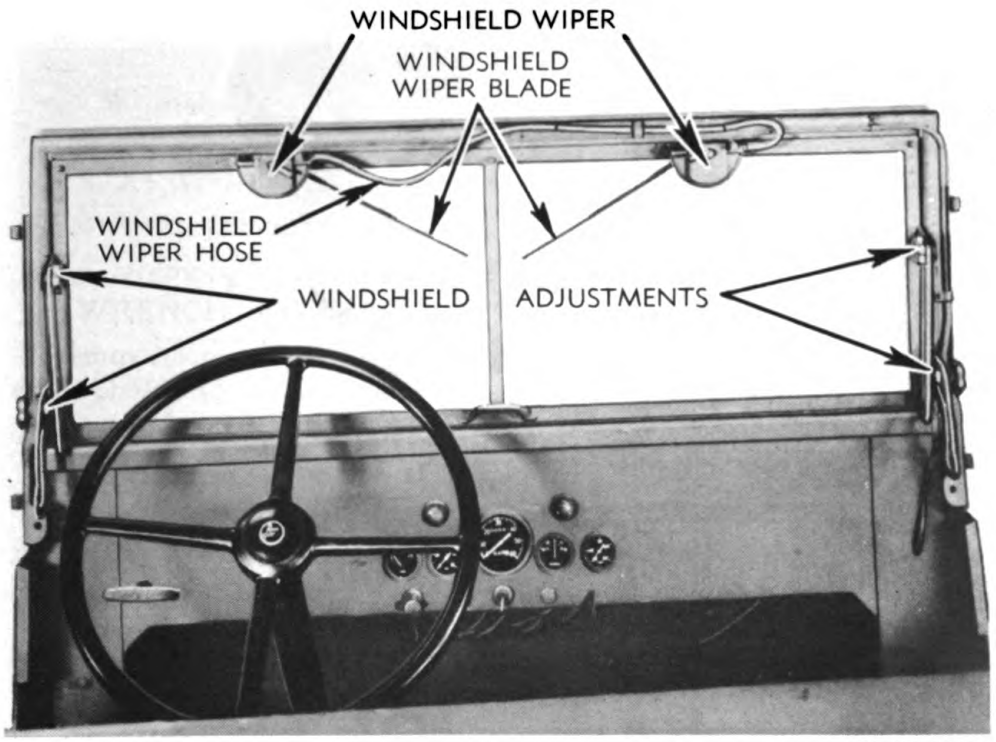


Figure 48—Windshield and Wiper Assembly

(2) PROCEDURE.

(a) Remove Windshield Wipers (par. 54 e).

SCREWDRIVER WRENCH, open-end, 3/8-in.

(b) Remove Windshield Frame and Glass Assembly.

SCREWDRIVER

Remove the two screws in the windshield throw-out arms, one in each arm (screwdriver). Straighten the outside edge of the windshield top hinge channel (screwdriver). Raise the windshield to the open position and slide the frame and glass assembly from the top hinge (fig. 49).

b. Windshield Installation.

(1) EQUIPMENT.

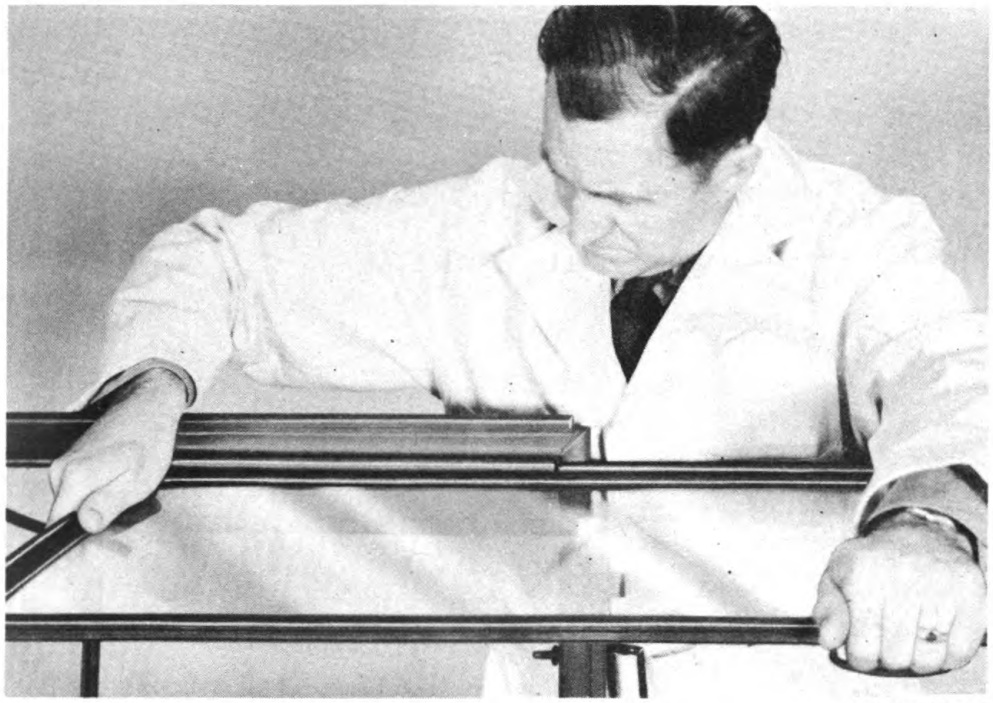
PLIERS WRENCH, open-end, 3/8-in.
SCREWDRIVER

(2) PROCEDURE.

(a) Install Windshield Frame and Glass Assembly.

PLIERS SCREWDRIVER

Slide the windshield frame and glass assembly into the top frame channel hinge (fig. 49). Lock the end of the top channel hinge by slightly bending the outer edge of the top channel hinge (pliers). Fasten the two throw-out brackets to the windshield with the two screws (screwdriver).



RA PD 65831

Figure 49—Installing Windshield Frame

(b) Install Windshield Wipers (par. 54 f).

SCREWDRIVER WRENCH, open-end, 3/8-in.

c. Windshield Wiper.

(1) WINDSHIELD WIPER DESCRIPTION. The windshield wipers are attached to the top side of the windshield frame and are a vacuum type (fig. 49).

d. Windshield Wiper Trouble Shooting.

(1) INOPERATIVE WIPER.

Possible Cause	Possible Remedy
(a) Plugged vacuum line.	Clean line.
(b) Broken vacuum line fittings.	Replace broken fittings.
(c) Leaking cover gasket.	Replace wiper assembly (par. 54 e and f).
(d) Worn or broken wiper mechanism.	Replace wiper assembly (par. 54 e and f).
(e) Leaking wiper valve.	Replace wiper assembly (par. 54 e and f).
(f) Leaking vacuum hose or fittings.	Tighten fittings and replace hose assembly.
(g) Broken paddle shaft.	Replace wiper assembly (par. 54 e and f).

(2) WIPER DOES NOT STOP WHEN SHUT OFF.

Defective control valve.	Replace wiper assembly (par. 54 e and f).

e. Windshield Wiper Assembly Removal.

(1) EQUIPMENT.

SCREWDRIVER, 6-in. WRENCH, open-end, 3/8-in.

(2) PROCEDURE.

(a) Remove Wiper Arm and Blade.

WRENCH, open-end, 3/8-in.

Remove acorn nut (3/8-in. open-end wrench), securing wiper arm to wiper shaft and remove the arm.

(b) Wiper Body Removal.

SCREWDRIVER, 6-in.

Remove vacuum hose from vacuum inlet on wiper body. Remove two stove bolts (6-in. screwdriver), holding wiper body to top of windshield frame.

f. Windshield Wiper Assembly Installation.

(1) EQUIPMENT.

SCREWDRIVER, 6-in. WRENCH, open-end, 3/8-in.

(2) PROCEDURE.

(a) Install Windshield Wiper.

SCREWDRIVER, 6-in.

Place two stove bolts through holes in top of windshield frame and start into wiper body. Tighten screws (6-in. screwdriver). Slide wiper vacuum hose onto wiper vacuum inlet pipe.

(b) Windshield Wiper Blade and Arm Assembly Replacement.

WRENCH, open-end, 3/8-in.

Place wiper arm assembly on wiper shaft. Secure with acorn nut (3/8-in. open-end wrench).

55. HOOD (figs. 50-51).

a. Hood Description. The hood is a one-piece pressed steel construction. It is anchored to the cab cowl by two hinges and can be raised and held in position by a hood prop. The hood is held down in front by a latch on each side.

b. Hood Removal.

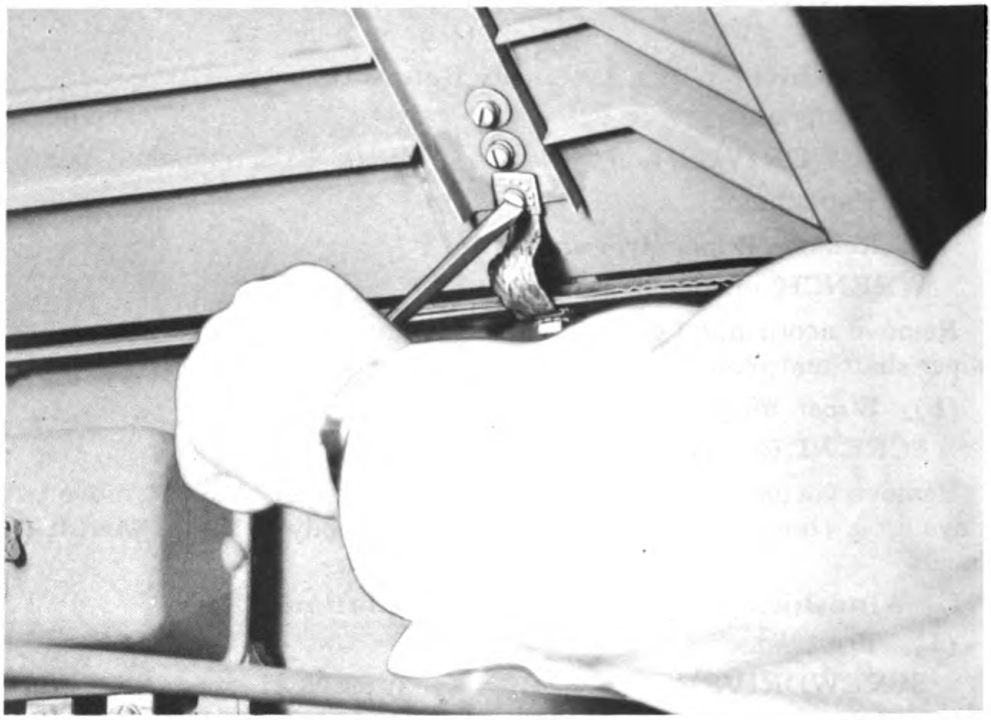
(1) EQUIPMENT.

SCREWDRIVER WRENCH, open-end, 7/16-in.
WRENCH, open-end, 3/8-in.

(2) PROCEDURE.

(a) Removing Rear Hinges.

SCREWDRIVER



RA PD 65832

Figure 50—Removing Hood

Unlatch hood and place in open position by using hood prop. Remove six screwhead bolts (screwdriver) from hood hinges at rear of hood (fig. 50).

(b) Removing Hood Prop Bracket.

SCREWDRIVER WRENCH, open-end, 7/16-in.

Remove two stove bolts (screwdriver and 7/16-in. open-end wrench) from front center of hood panel and lay hood prop and hood prop hinge on top of engine. Hood may then be lifted from vehicle.

(c) Remove Hood Hooks.

SCREWDRIVER WRENCH, open-end, 3/8-in.

Remove six 3/16-in. stove bolts (screwdriver and 3/8-in. open-end wrench), three bolts at each front corner of hood.

c. Hood Installation.

(1) EQUIPMENT.

SCREWDRIVER WRENCH, open-end, 7/16-in.
WRENCH, open-end, 3/8-in.

(2) PROCEDURE.

(a) Replace Hood, Hood Prop, and Bracket.

SCREWDRIVER WRENCH, open-end, 7/16-in.

Place hood on vehicle, raise to open position, and place two ¼-in. stove bolts in holes in front center of hood. Then place hood prop hinge in position and bolt securely (screwdriver and 7/16-in. open-end wrench).

(b) Connect Hood to Hinges.

SCREWDRIVER

Place hood in position on bottom side of hinge. Insert screwhead bolts and tighten securely (screwdriver).

(c) Replace Hood Hooks.

SCREWDRIVER
WRENCH, open-end, 3/8-in.

Replace six 3/16-in. stove bolts (screwdriver and 3/8-in. open-end wrench), three on each side at front of hood.

d. Hood Removal.

(1) EQUIPMENT.

PLIERS
SCREWDRIVER
WRENCH, open-end, 7/16-in.

(2) PROCEDURE.

(a) Remove Prop.

PLIERS
SCREWDRIVER
WRENCH, open-end, 7/16-in.

Raise the hood to the open position. Remove the two cotter keys (pliers) from the hood prop rod. Remove the hood prop rod from the hinge and clip and catch the lower hood prop clip to prevent it from falling into chassis. Remove the two nuts and lock washers holding hood prop hinge (screwdriver and 7/16-in. open-end wrench) to the hood. Remove the hinge and bolts.

e. Hood Prop Installation.

(1) EQUIPMENT.

PLIERS
SCREWDRIVER
WRENCH, open-end, 7/16-in.

(2) PROCEDURE.

(a) Install Hood Prop.

PLIERS
SCREWDRIVER
WRENCH, open-end, 7/16-in.

Fasten the top prop hinge with the two bolts, nuts, and lock washers (screwdriver and 7/16-in. open-end wrench) to the front center panel of the hood. Place the lower prop clip over the radiator stay rod and insert the prop rod into the hinge and prop clip. Fasten top and bottom end of prop rod with cotter keys (pliers).

f. Hood Side Panel Removal.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 7/16-in.

(2) PROCEDURE.

SCREWDRIVER
WRENCH, open-end, 7/16-in.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Remove four stove bolts (screwdriver and 7/16-in. open-end wrench) attaching front of hood panel to radiator brush guard. Remove two stove bolts (screwdriver and 7/16-in. open-end wrench) at rear of panel attaching panel to cab. Remove bolt (screwdriver and 7/16-in. open-end wrench) attaching bond strap to front of panel. Lift up rear of panel and out to remove.

g. Hood Side Panel Installation (fig. 51).

(1) EQUIPMENT.

SCREWDRIVER — WRENCH, open-end, 7/16-in.

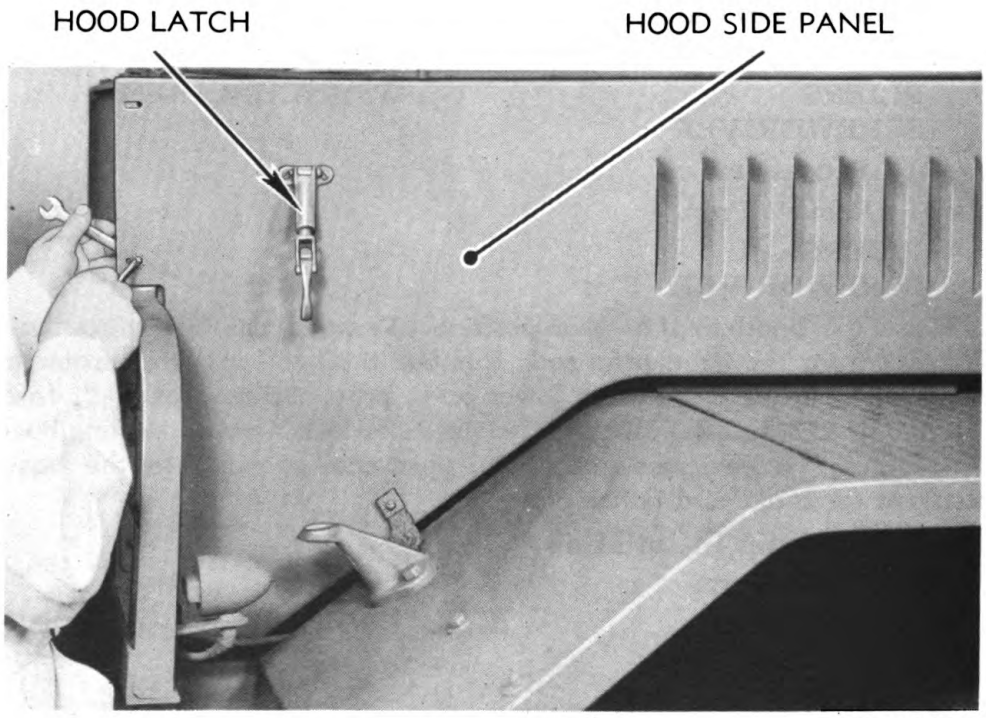


Figure 51—Installing Hood Side Panel

(2) PROCEDURE.

SCREWDRIVER — WRENCH, open-end, 7/16-in.

Enter hood side panel by holding rear of panel up and outward and then place front of panel in position. Push panel in and down to get rear of panel in place. Replace bolts, front and rear (fig. 51). Make sure shakeproof washers are placed under the nut and head of each front bolt and between the panel and brush guard. Tighten nuts securely (screwdriver and 7/16-in. open-end wrench). Enter bolt in bond strap with shakeproof washer under head and nut of bolt and one between bond strap and panel and tighten (screwdriver and 7/16-in. open-end wrench).

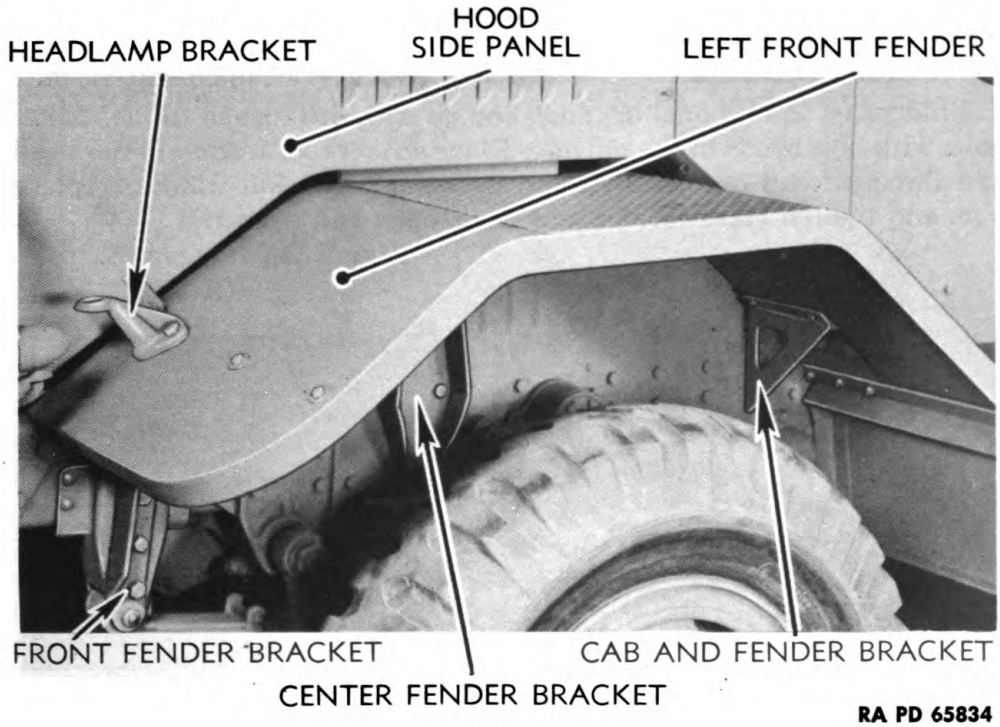


Figure 52—Left Fender Installed

56. FENDERS (figs. 52, 53, and 54).

a. Fender Description. The fenders are made of pressed steel and are supported by front, center, and rear brackets (fig. 52).

b. Fender Side Panel Removal.

(1) EQUIPMENT.

SCREWDRIVER — WRENCH, open-end, 7/16-in.

(2) PROCEDURE.

(a) Remove Fender to Panel Bolts.

SCREWDRIVER — WRENCH, open-end, 7/16-in.

Remove the seven bolts, nuts, and three shakeproof washers from each bolt (screwdriver and 7/16-in. open-end wrench).

(b) Remove Panel to Frame Bolts.

SCREWDRIVER — WRENCH, open-end, 7/16-in.

Remove the four bolts, nuts, and three shakeproof washers from each bolt, fastening fender side panels to frame (screwdriver and 7/16-in. open-end wrench). Remove panels.

c. Fender Side Panel Installation.

(1) EQUIPMENT.

SCREWDRIVER — WRENCH, open-end, 7/16-in.

(2) PROCEDURE.

(a) Assemble Panel to Frame.

SCREWDRIVER WRENCH, open-end, 7/16-in.

Hold panel so all panel drillings line up with drillings in frame. Enter bolts with bolt heads to the outside. Place shakeproof washer under head and threaded end of each bolt and between panel and frame. Replace nuts and tighten (screwdriver and 7/16-in. open-end wrench).

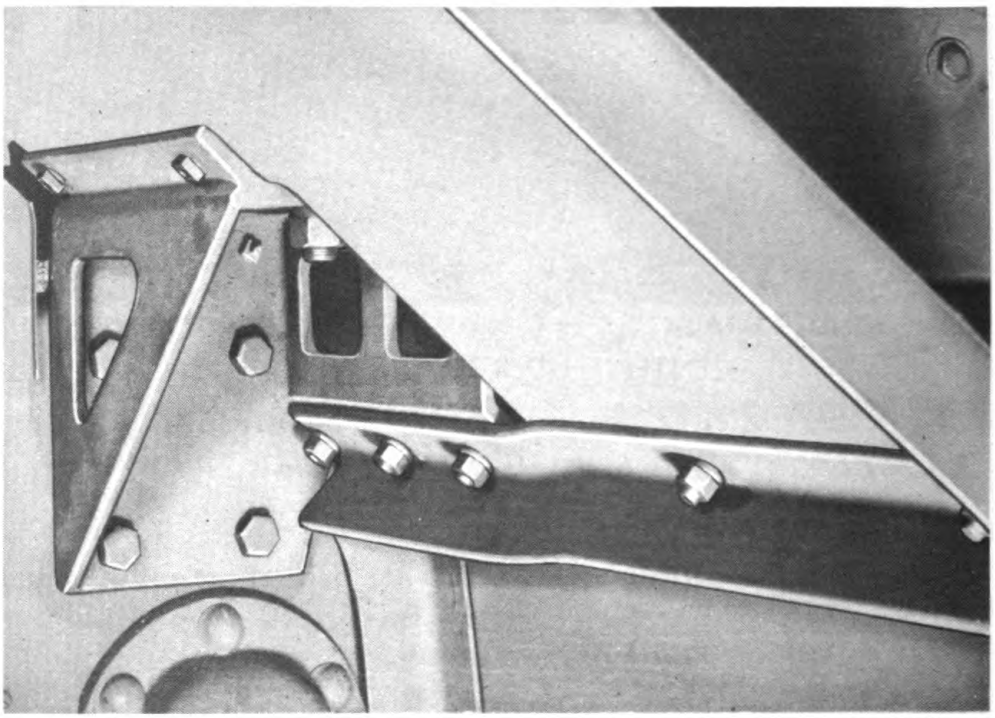


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Figure 53—Left Rear Cab and Fender Bracket

(b) Assemble Panel to Fender.

SCREWDRIVER WRENCH, open-end, 7/16-in.

Enter each bolt with bolt head towards the outside. Place shakeproof washers under head and threaded end and between panel and fender. Replace nuts and tighten (screwdriver and 7/16-in. open-end wrench).

d. Fender Removal.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in. (2)
WRENCH, open-end, 3/4-in. (2)

(2) PROCEDURE.

(a) Remove Hood Side Panel (par. 55 f).

SCREWDRIVER
WRENCH, open-end, 7/16-in.

(b) Remove Fender Side Panel (par. 56 b).

SCREWDRIVER
WRENCH, open-end, 7/16-in.

(c) Remove Horn (par. 88 d).

WRENCH, open-end, 7/16-in. (2)
WRENCH, open-end, 3/4-in. (2)

(d) Remove Right Fender.

SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in. (2)
WRENCH, open-end, 3/4-in. (2)

Remove the four fender-to-front-bracket bolts, nuts, and lock washers (two 9/16-in open-end wrenches and two 3/4-in. open-end wrenches). Lay the headlamp on the brush guard. Remove the three center bracket bolts, nuts, and lock washers (screwdriver and 7/16-in open-end wrench). Remove the five bolts, nuts, and shakeproof lock washers fastening fender to cab bracket (screwdriver, 7/16-in. open-end wrench, and two 9/16-in. open-end wrenches). Remove the bolt, nut, and shakeproof lock washer holding bonding strap to the cab (7/16-in. open-end wrench and screwdriver). Remove the two bolts, nuts, and shakeproof lock washers holding vacuum check valve bracket to fender (screwdriver and 7/16-in. open-end wrench). Remove fender.

(e) Remove Left Front Fender.

SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in. (2)
WRENCH, open-end, 3/4-in. (2)

Remove the four bolts, nuts, and lock washers holding fender to the front fender bracket (two 9/16-in. open-end wrenches and two 3/4-in. open-end wrenches). Lay the headlamp bracket on the brush guard. Remove the four bolts, nuts, and lock washers holding the battery box to the fender (two 9/16-in. open-end wrenches. Remove the two bolts, nuts, and lock washers holding the fender to the center fender bracket (screwdriver and 7/16-in. open-end wrench). Remove the five fender to cab bracket bolts, nuts, and shakeproof lock washers (screwdriver, 7/16-in. open-end wrench, and two 9/16-in. open-end wrenches). Remove the one bolt, nut, and shakeproof lock washers holding bonding strap to the cab (7/16-in. open-end wrench and screwdriver). Remove the fender.

e. Fender Installation (figs. 53-54).

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in. (2)
WRENCH, open-end, 3/4-in. (2)

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

(2) PROCEDURE.

(a) Install Left Front Fender (fig. 53).

SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in. (2)
WRENCH, open-end, 3/4-in. (2)

Place the fender in position on the fender brackets. Connect the bonding strap and tighten with a bolt, nut, and shakeproof lock washers (screwdriver and 7/16-in. open-end wrench). Insert the five fender to cab bracket

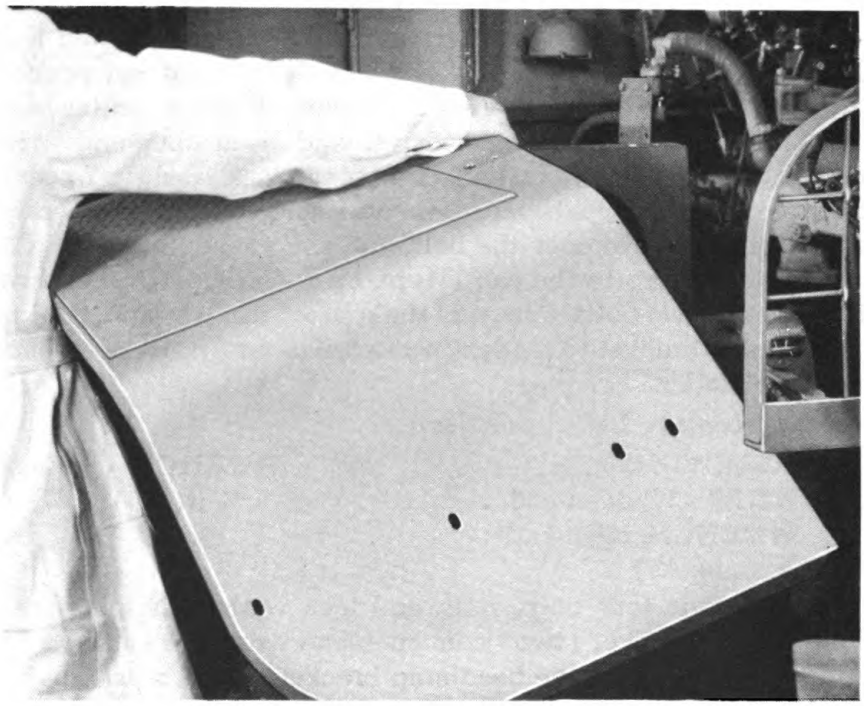

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Figure 54—Installing Right Fender

bolts and tighten them with the five nuts and shakeproof lock washers (screwdriver, 7/16-in. open-end wrench, and two 9/16-in. open-end wrenches) (fig. 53). Insert the two bolts into the center fender bracket and tighten them with the two nuts and lock washers (screwdriver and 7/16-in. open-end wrench. Insert the bolts into the headlamp bracket. Insert four bolts into the front fender bracket and tighten the bolts with the four nuts and lock washers (two 9/16-in. open-end wrenches and two 3/4-in. open-end wrenches). Place the battery box on the fender and tighten with the four bolts, nuts, and lock washers (two 9/16-in. open-end wrenches).

BODY ASSEMBLY

(b) Install Right Front Fender (fig. 54).

SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in. (2)
WRENCH, open-end, 3/4-in. (2)

Place the fender in position on the fender brackets (fig. 54). Insert the two bolts into the vacuum check valve bracket and tighten bracket to the fender with the two nuts and shakeproof lock washers (screwdriver and 7/16-in. open-end wrench). Attach and tighten the bonding strap to the cab with one bolt, nut, and two shakeproof lock washers (screwdriver and 7/16-in. open-end wrench). Insert the five rear fender bracket bolts and tighten thoroughly with the five nuts and shakeproof lock washers (screwdriver, 7/16-in. open-end wrench, and two 9/16-in. open-end wrenches). Insert the three bolts into the center fender bracket and tighten the three bolts with the three nuts and lock washers (screwdriver and 7/16-in. open-end wrench). Place the headlamp and bracket on the fender and insert the bolts and tighten the lamp bracket with the two nuts and lock washers (two 3/4-in. open-end wrenches). Insert the two outer front fender bracket bolts and tighten with the nuts and lock washers (two 9/16-in. open-end wrenches).

(c) Install Horn (par. 88 e).

WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in. (2)
WRENCH, open-end, 3/4-in. (2)

(d) Install Fender Side Panels (par. 56 c). Fender Side Panel Installation.

SCREWDRIVER
WRENCH, open-end, 7/16-in.

(e) Install Hood Side Panel (par. 55 g).

SCREWDRIVER
WRENCH, open-end, 7/16-in.

f. Brush Guard Removal (fig. 55).

(1) EQUIPMENT.

PLIERS
SCREWDRIVER
WRENCH, box, 15/16-in.
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 7/8-in.

(2) PROCEDURE.

(a) Remove Hood Side Panel Bolts (Front).

SCREWDRIVER
WRENCH, open-end, 7/16-in.

Remove four stove bolts and shakeproof washers (screwdriver and 7/16-in. open-end wrench) from each side of hood side panels attached to brush guard (fig. 51).

(b) Remove Blackout Marker Light Wires.

SCREWDRIVER
WRENCH, open-end, 3/8-in.

Remove nut (3/8-in. open-end wrench) from junction block on each side panel and loosen wires. Loosen wire clips (screwdriver) and remove wires.

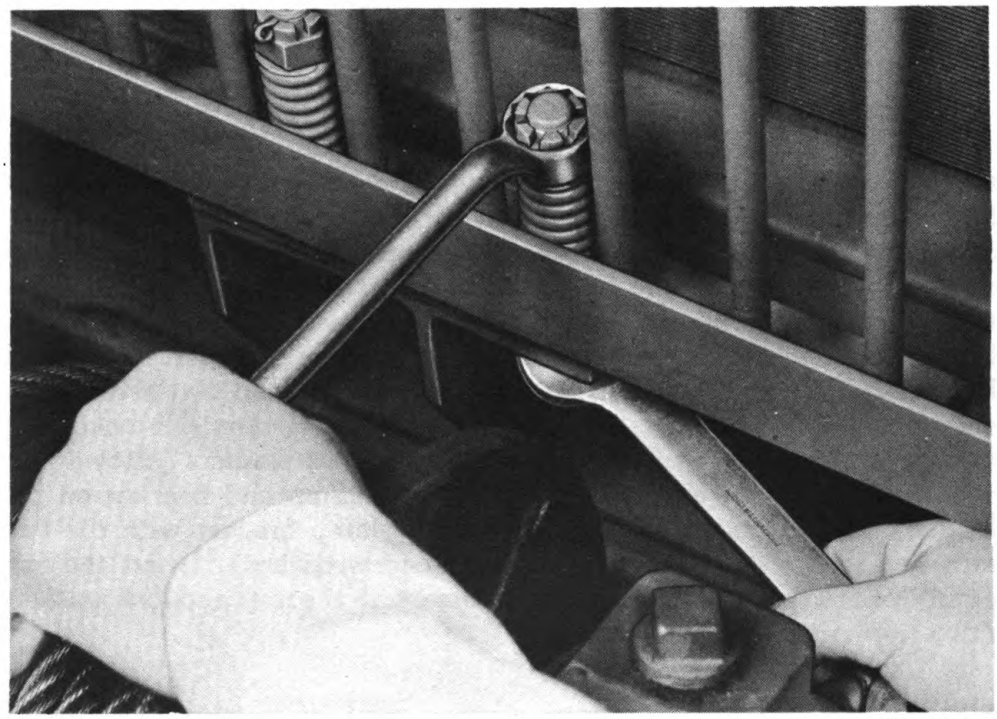

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Figure 55—Removing Brush Guard Mounting Bolts

(c) Remove Bonding Straps

SCREWDRIVER
WRENCH, open-end, 7/16-in.

Remove two stove bolts and washers (screwdriver and 7/16-in. open-end wrench) fastening bonding straps to brush guard.

(d) Disconnect Brush Guard Stay Rods.

WRENCH, open-end, 3/4-in.

Remove the two nuts and lock washers (3/4-in. open-end wrench) from the brush guard stay rods that are attached to the top side of the brush guard.

(e) Remove Brush Guard Mounting Bolts and Springs (fig. 55).

PLIERS
WRENCH, open-end, 7/8-in.
WRENCH, box, 15/16-in.

Remove ~~cotter keys~~ (pliers) from bolts. Remove two nuts (7/8-in. open-end wrench and 15/16-in. box wrench) and remove bolts and tension springs (fig. 55). Remove the brush guard from the stay rods and lift from chassis.

g. Brush Guard Installation.

(1) EQUIPMENT.

PLIERS
SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 3/4-in.

WRENCH, box, 15/16-in. WRENCH, open-end, 7/8-in.
WRENCH, open-end, 3/8-in.

(2) PROCEDURE.

(a) Install Brush Guard.

PLIERS WRENCH, open-end, 7/8-in.
WRENCH, open-end, 3/4-in. WRENCH, socket, 15/16-in.

Slide brush guard onto stay rods and place in front of radiator. Line up the mounting holes and enter the mounting bolts from the bottom. Place a tension spring on each bolt and turn on the two castellated nuts. Tighten

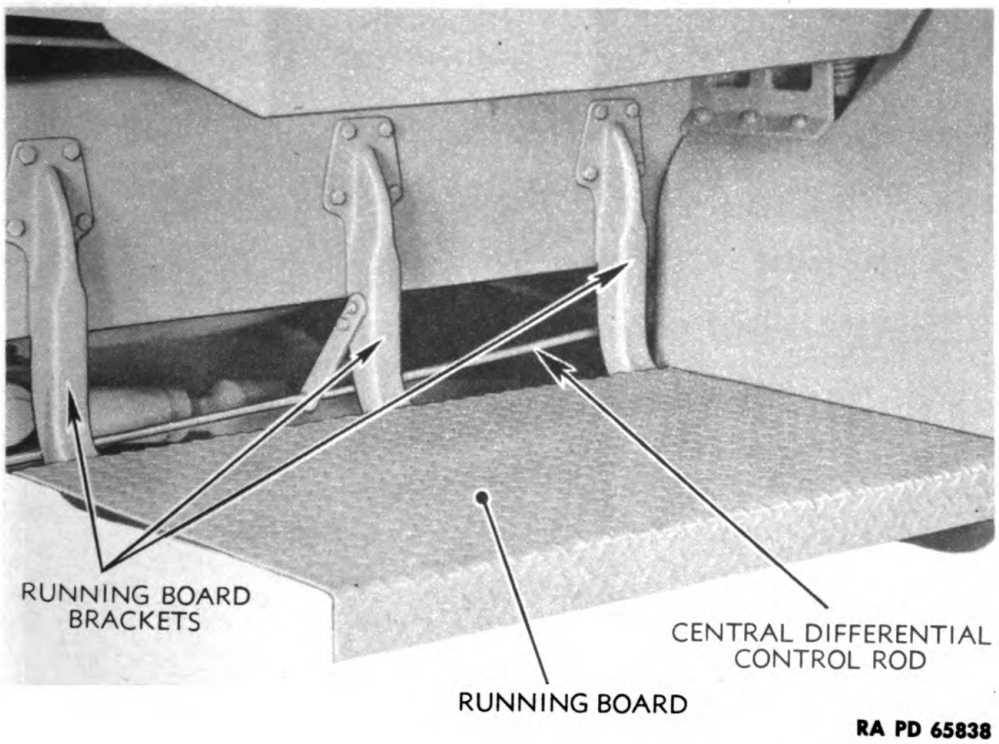

Figure 56—Running Board and Brackets

nuts (3/4-in. open-end wrench), until the tension springs are depressed approximately 1/8-in. Enter cotter keys in each bolt (pliers).

(b) Replace Bonding Straps.

SCREWDRIVER WRENCH, open-end, 7/16-in.

Secure the two bonding straps to bottom of brush guard with two stove bolts and washers (screwdriver and 7/16-in. open-end wrench).

(c) Connect Blackout Marker Light Wires.

SCREWDRIVER WRENCH, open-end, 3/8-in.

Connect each blackout light wire to junction block on hood side panel with nut and lock washer (3/8-in. open-end wrench). Anchor wires to hood side panels with wire clips (screwdriver).

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

57. RUNNING BOARDS.

a. Running Board Description (figs. 56-57). The running boards are constructed of twelve-gage diamond plate steel and are held by three brackets. They are turned over at the edge to make them very rigid and are suspended independently at the rear of the fenders (fig. 56).

b. Running Board Removal.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 7/16-in.

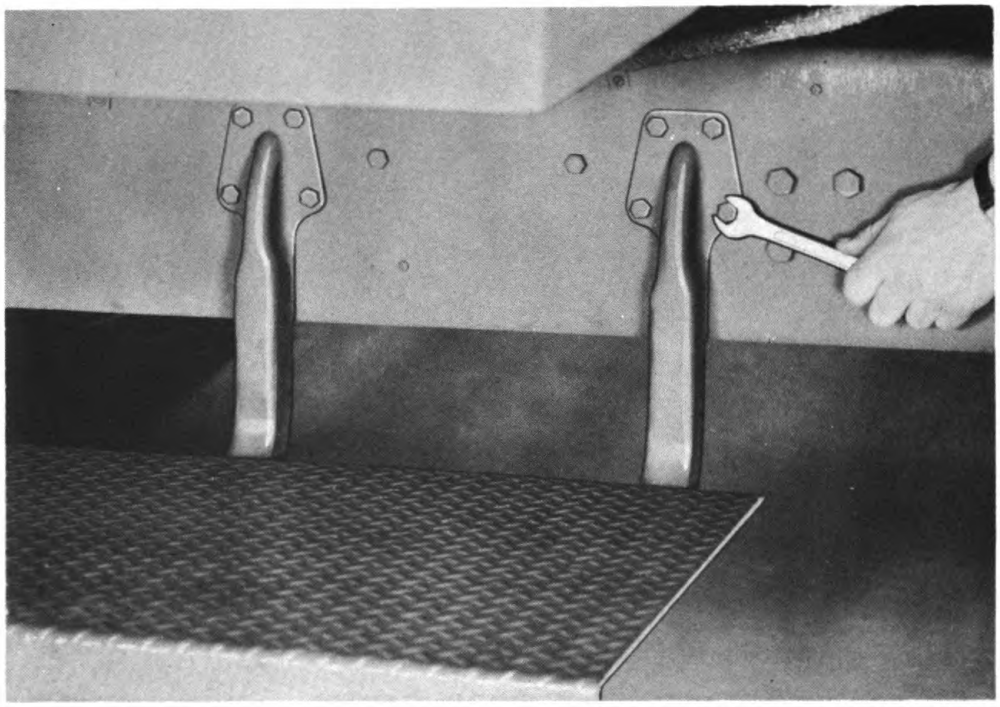

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Figure 57—Removing Running Board Bracket

(2) PROCEDURE.

SCREWDRIVER
WRENCH, open-end, 7/16-in.

Remove the nine flat head bolts (screwdriver and 7/16-in. open-end wrench), fastening board to brackets. Lift board from brackets.

c. Running Board Installation.

(1) EQUIPMENT.

SCREWDRIVER, 10-in., heavy-duty
WRENCH, open-end, 7/16-in.

(2) PROCEDURE.

SCREWDRIVER
WRENCH, open-end, 7/16-in.

Place running board on the three brackets with extension to rear of truck. Install the nine flat head bolts, lock washers, nuts, and tighten securely (7/16-in. open-end wrench).

d. Running Board Bracket Removal (fig. 56).

(1) EQUIPMENT.

SCREWDRIVER, 10-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in. (2)

(2) PROCEDURE.

Remove the three bolts, nuts, and lock washers holding the bracket to the running board (10-in. screwdriver and 7/16-in. open-end wrench). Remove the four bolts, nuts, and lock washers (two 9/16-in. open-end wrenches) holding the bracket to the frame (fig. 57). Remove the bracket. NOTE: There are three running board brackets and the removal of each is made the same as described above.

e. Running Board Bracket Installation.

(1) EQUIPMENT.

SCREWDRIVER, 10-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in. (2)

(2) PROCEDURE.

Place the running board bracket on the frame and enter the four bolts, nuts, and lock washers; tighten with two 9/16-in. open-end wrenches. Fasten the running board bracket to the running board with the three bolts, nuts, and lock washers (screwdriver and 7/16-in. open-end wrench). NOTE: There are three running board brackets attached to each running board. The installation of each of the brackets is made as described above.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Section XVII

BRAKES

58. BRAKE SYSTEM DESCRIPTION AND TABULATED DATA.

a. Brake System Description. The service brakes on the front and rear wheels are actuated under a hydraulic system and are composed of wheel cylinders, master cylinder, brake pedal, hydrovac power cylinder, and check valve. The parking brake is a manually operated unit and attached to the transfer case. It consists of a brake band, drum, control rods, and a lever located in the cab.

b. Brake System Operation. The hydraulic brake system (fig. 58) comprises a master cylinder in which hydraulic pressure is originated and to which are connected fluid lines and hose which connect to the wheel cylinders. The master cylinder piston is connected through linkage to the brake pedal and force applied to the pedal is transmitted to the master cylinder piston and, in turn, fluid is forced to the hydrovac power cylinder. From there the pressure is increased through vacuum and transferred to each wheel cylinder.

c. Hydrovac Power Cylinder Operation.

(1) In the released position, the pistons of the hydrovac unit are vacuum suspended with balanced pressure on both sides. They are held in the rear position by a spiral spring.

(2) The first movement of the brake pedal moves the master cylinder piston, causing fluid to flow into the slave cylinder where some of it is by-passed to the relay valve.

(3) The fluid pressure in the relay valve shuts off the vacuum and admits air at atmospheric pressure to the rear side of the power cylinder pistons, causing them to move forward. The power cylinder pistons move the slave cylinder piston by means of the slave cylinder piston rod. As soon as the slave piston moves forward, no more fluid can flow from the master cylinder line to the wheel cylinder line. The pressure of the fluid from the master cylinder is instead directed against the rear end of the slave cylinder piston and bypassed to the relay valve.

(4) Forward motion of the slave cylinder piston produces a high pressure in the wheel brake lines and in the wheel cylinders which operate the brakes. Total force acting to push the slave cylinder piston forward is that produced by the brake pedal pressure, plus the force exerted by the power cylinder piston rod on the slave cylinder piston rod.

d. Brake Tabulated Data.

(1) SERVICE BRAKES.

Make ..... Lockheed hydraulic
Type ..... Internal expanding
Brake size (inches):
  Front ..... 16 in. x 2½ in.
  Rear ..... 17½ in. x 4 in.
No. of shoes per brake 2
Type of anchor ..... Eccentric stud
Wheel cylinder size (inches):
  Front ..... 1½ in.
  Rear ..... 1¾ in.
Master cylinder size (inches) ..... 1¾ in.
Hydrovac power cylinder:
  Make ..... Bendix

(2) PARKING BRAKE.

Make ..... FWD
Size (inches) ..... 10 in. x 3 in.

59. BRAKE SYSTEM TROUBLE SHOOTING.

a. Service Brake Trouble Shooting.

(1) BRAKE PEDAL STRIKES FLOORBOARD.

Possible Cause	Possible Remedy
(a) Lining wear.	Readjust brake shoes (par. 60 **e**) or replace (par. 61).
(b) Improperly adjusted pedal.	Adjust pedal linkage (par. 60 **c**).
(c) Air in hydraulic lines.	Bleed lines (par. 60 **d**).
(d) Insufficient hydraulic fluid.	Refill master cylinder and bleed lines (par. 60 **d**).

(2) BRAKES COMPLETELY INOPERATIVE.

(a) Failure of linkage between pedal and master cylinder.	Repair linkage (par. 60 **e**).
(b) Broken line or hose.	Replace or repair broken section (par. 65).
(c) Failure of cylinder cups in either master cylinder or wheel cylinders.	Replace defective master cylinder (par. 64) or defective wheel cylinders (par. 63).

(3) ALL BRAKES DRAG.

(a) Insufficient shoe clearance.	Readjust shoes (par. 60 **e**).
(b) Mineral oil in system.	Report to higher authority.
(c) Weak return springs.	Replace springs (par. 61).
(d) Improper pedal adjustment.	Adjust pedal linkage (par. 60 **e**).

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Possible Cause	Possible Remedy
(4) ONE BRAKE DRAGS.	
(a) Insufficient shoe clearance.	Readjust shoes (par. 60 **e**).
(b) Weak or broken return spring.	Replace springs (par. 61).
(c) Loose wheel bearings.	Adjust bearings (par. 157).
(d) Brake shoes seized to anchor pin.	Lubricate anchor pin bearing.
(5) TRUCK PULLS TO ONE SIDE.	
(a) Grease soaked lining.	Replace brake shoes (par. 61). Install new wheel bearing oil seals (par. 160).
(b) Improperly adjusted shoes.	Readjust shoes (par. 60 **e**).
(c) Brake backing plate loose on axle.	Tighten nuts holding backing plate (par. 41).
(d) Front spring U-bolts loose.	Tighten nuts on U-bolts (par. 138).
(e) Tires not properly inflated.	Inflate to 65 lbs.
(f) Different makes of lining.	Install correct brake shoes.
(6) SPONGY PEDAL.	
(a) Brakes not properly adjusted.	Adjust shoes (par. 60 **e**).
(b) Air in hydraulic lines.	Bleed lines (par. 60 **d**).
(7) EXCESSIVE PEDAL PRESSURE—POOR STOP.	
(a) Brake shoes improperly adjusted.	Adjust shoes (par. 60 **e**).
(b) Brake pedal leverage wrong.	Check linkage hook-up.
(c) Grease soaked linings.	Replace brake shoes (par. 61). Install new wheel bearing oil seals (par. 160).
(d) Scored brake drums.	Report to higher authority.
(e) Inoperative hydrovac cylinder.	Replace hydrovac cylinder (par. 64).
(8) LIGHT PEDAL PRESSURE—SEVERE BRAKES.	
(a) Brake shoes not properly adjusted.	Adjust shoes (par. 60 **e**)
(b) Loose brake backing plate.	Tighten backing plate to axle (par. 41).
(c) Defective oil seals.	Clean or replace brake shoes (par. 60 **e**). Install new wheel oil seals (par. 160).
(9) INOPERATIVE HYDROVAC UNIT.	
(a) Broken or loose vacuum line between intake manifold and hydrovac unit.	Tighten line connections or replace broken hoses (par. 60-64).

Possible Cause	Possible Remedy
(b) Defective check valve between intake manifold and vacuum reserve tank.	Replace check valve (par. 64 **d**).
(c) Air in hydrovac unit.	Bleed unit (par. 60 **d**).

b. Parking Brake Trouble Shooting.

(1) BRAKE DOES NOT HOLD.

(a) Improper adjustment.	Correct adjustment (par. 60 **f**).
(b) Oil soaked lining.	Clean lining or replace brake band assembly (par. 66); faulty oil seal, report to higher authority.
(c) Broken linkage between hand brake lever and brake band.	Repair or replace linkage (par. 66 **e**).
(d) Brake lining worn.	Replace brake band assembly (par. 66).

(2) HAND BRAKE LEVER WILL NOT STAY IN APPLIED POSITION.

(a) Brake segment worn or broken.	Replace lever (par. 66 **e** and **f**).
(b) Segment pawl worn or broken.	Replace lever (par. 66 **e** and **f**).
(c) Linkage between grip latch lever and pawl broken or out of adjustment.	Replace linkage (par. 66 **e** and **f**).
(d) Spring under grip latch lever lost or broken.	Replace lever (par. 66 **e** and **f**).

(3) HAND BRAKE HARD TO APPLY.

(a) Linkage rusted or seized.	Oil linkage.

60. BRAKE SYSTEM MAINTENANCE AND ADJUSTMENTS.

a. Hydraulic Brake Maintenance.

(1) Check and replenish master cylinder fluid level at monthly inspection periods. Make sure that all dirt is removed from around filler plug to prevent entrance to cylinder reservoir. Level should be ½ inch from reservoir top or cover. Fill with genuine hydraulic fluid. Check pedal to make certain it has free play or lash before pressure stroke starts. Check pedal for binding on pedal shift—lubricate if necessary. A mixture of engine oil and graphite is usually satisfactory for pedal mounting and clevis pins. Be sure pedal returns sharply to "OFF" position; if not, replace pedal return spring (par. 154 **b** (2)). Check front and rear wheel bearing adjustment; brakes cannot be adjusted properly when bearings are loose—shoes will not remain centralized in the drum. Always pull at least one wheel for inspection for average condition of linings and drums. Dust shields must be tight to provide rigid support for the brakes. Loose or sprung dust shields will be evident by drum not being equally spaced to backing plate at all points around the drum, assuming axle shaft is not sprung and wheel bearings are properly adjusted.

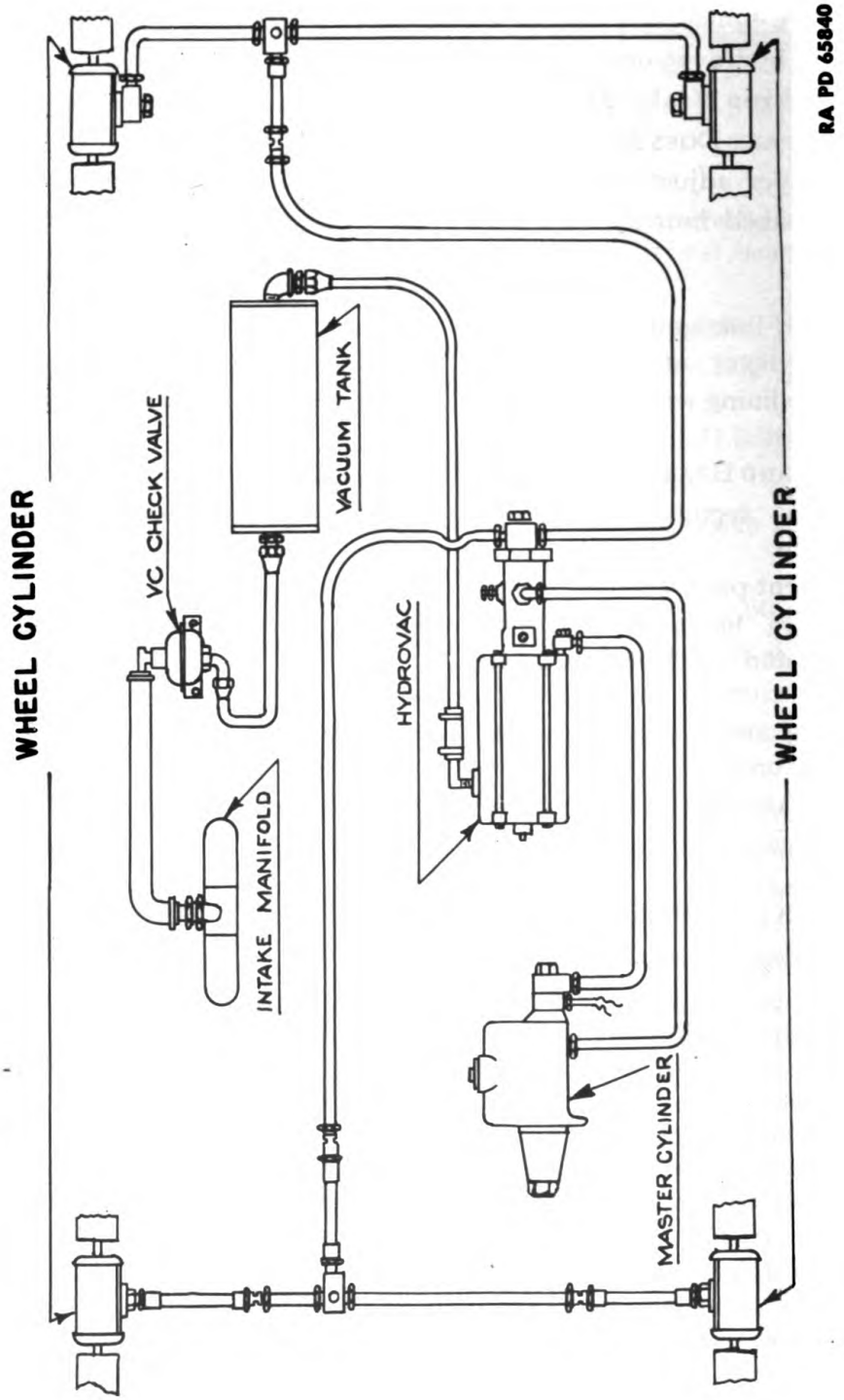

Figure 58—Hydraulic Brake System

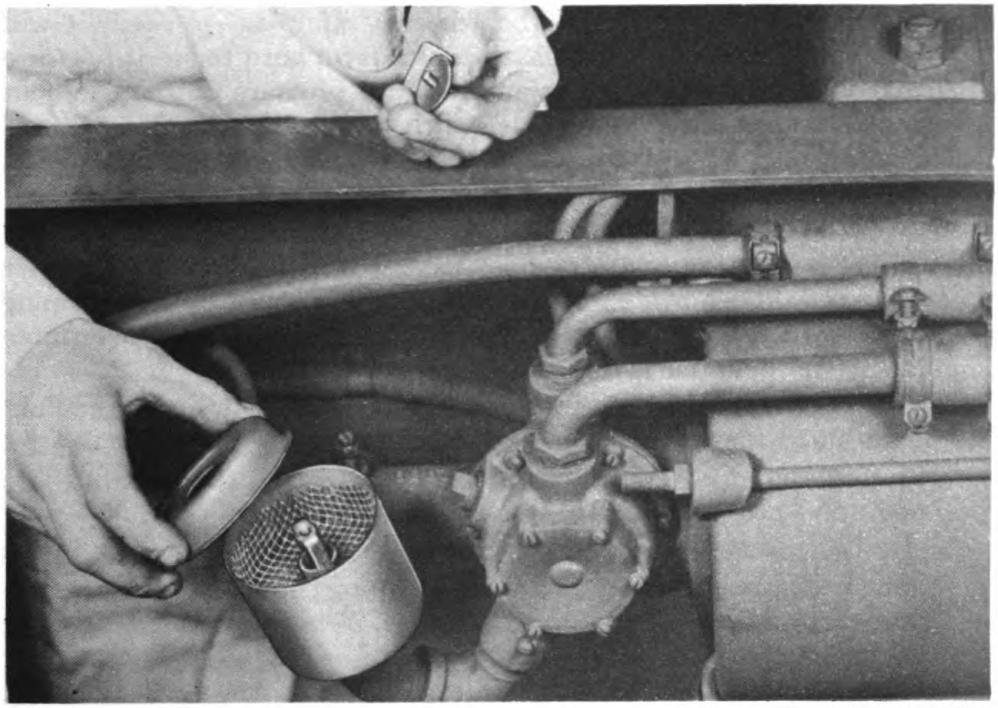

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Figure 59—Removing Power Cylinder Air Cleaner Cover

(2) Inspect condition of front and rear oil seals. Also, check wheel bearing lubricant, as an excessive amount will cause seepage through grease retainers and make it necessary to replace lining. Inspect grease level in differential case for proper level.

b. Hydrovac Power Cylinder Maintenance (fig. 59). The outside of the hydrovac unit should be cleaned thoroughly and lubricated every 6000 miles of operation. If the vehicle operates less than 6000 miles, the lubrication should be done monthly. All hose connection clamps should be tightened and all pipe fittings and hydraulic connections checked for looseness. The air cleaner should be removed, disassembled, and cleaned at least once a month. If the truck is operating under dirty conditions, the air cleaner should be cleaned more frequently. Remove the cover screw (fig. 59) and remove the element and wash thoroughly in SOLVENT, dry-cleaning. Allow to dry, then dip the element in light engine oil and let it drain. Clean all dirt from the inside of the air cleaner housing and reassemble. Refer to Lubrication Guide (sec. VI).

c. Brake Pedal Tests.

(1) The following are a few practical tests which can be made by any mechanic. The experience of going through these will eventually enable the mechanic to diagnose quite a few of the ordinary service problems on the hydraulic brake system.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

(a) Get in driver's seat and push on brake pedal to determine if brake will apply; if there is at least a 2-inch "reserve" before pedal strikes floorboards; if pedal goes to floorboards try "pumping" to see if it will "build up"; if pressure can be built up, hold down hard to see if pressure will leak off; after holding ½ minute, reduce pressure on foot without releasing pedal and then press fairly lightly to see if pedal "leaks down" under light pressure—this test will reveal a master cylinder cup which is thin and permitting pressure to leak off or bypass within the master cylinder and without showing signs of leaking on the outside of the master cylinder.

(b) If pedal goes to floorboard and cannot be built up by pumping (pushing down several times in rapid succession) — then determine whether master cylinder is full of fluid.

(c) If fluid level is low in master cylinder, refill with hydraulic fluid and again make the foregoing pedal tests.

(d) If the fluid is OK in the master cylinder and the pedal can be "pumped up"—proceed with "Minor Brake Adjustment" (par. 60 **e**).

(e) If master cylinder fluid level is found low or master cylinder reserve tank is empty, refill and then before making pedal tests inspect master cylinder for any external signs of leakage. Where accessible, feel the master cylinder boot to determine if wet with brake fluid; squeeze boot with fingers; if fluid is expelled around or through boot, it is an indication that the master cylinder is leaking and should be removed, inspected, or replaced (par. 63).

(f) If no evidence of leaks is apparent at the master cylinder, inspect all fluid lines along the frame, all hose and hose connections, and bottom edges of all brake flanges and the inner side wall of tires for signs of brake fluid leakage. If no external signs of leaks are found, but pedal still leaks off under pressure, pull all four wheels and inspect the wheel cylinders.

(g) If no external fluid losses are found but pedal "eases down" under constant but light foot pressure, it is a fairly good indication that pressure is "bypassing" within the master cylinder, in which case remove and replace.

(h) If pedal has a "springy" feel—this is usually evidence that the brake shoes are improperly set or have been relined with incorrect thickness of lining. Improper brake shoe setting would indicate need of a major brake adjustment. Before making a decision on this type of condition, it is well to road test the vehicle to determine if you have a "hard" pedal and a "poor" stop. After road test, it will be best to pull wheels, check lining thickness, contact, drum condition, fit of shoes to drum and anchor adjustment to determine exact cause of difficulty.

(i) If pedal has a "spongy" feel, it is usually evidence of air in the hydraulic system which condition can be eliminated by "bleeding."

(j) If pedal "jams" or binds, check for mechanical interference; also, check to see if piston stopwire in master cylinder is broken; also, check master cylinder mountings and linkage and if a booster is used, check mechanical linkage between master cylinder and booster.

d. Bleeding the Hydraulic System.

(1) EQUIPMENT.

HOSE, bleeder	WRENCH, adjustable, 12-in.
JAR, glass	WRENCH, open-end, ½-in.
MEASURE, 1-qt	(2)

(2) REASONS FOR BLEEDING.

(a) Since the proper operation of the hydraulic brake system requires a "solid column" of fluid (without air bubbles) at all points in the pressure system, it becomes necessary under certain conditions to "bleed"

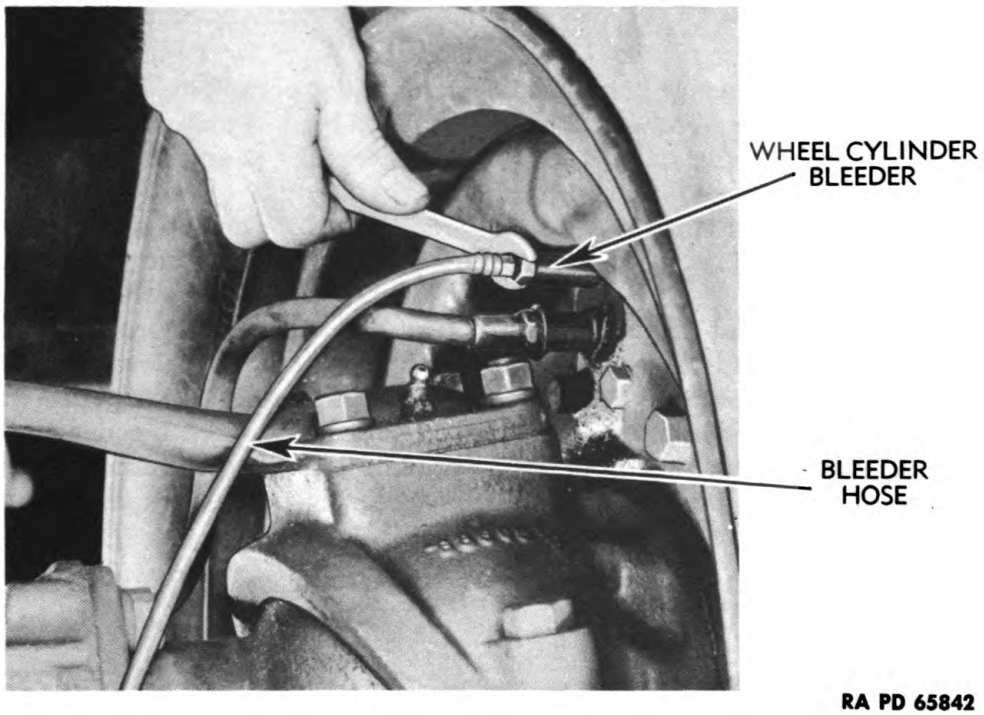

Figure 60—Bleeding Front Wheel Cylinder

fluid from the system in order to expel air bubbles which have become mixed with the fluid. The system must be absolutely free from air at all times.

(b) When a wheel cylinder, master cylinder, power cylinder, hose, pipe line, or any part of the system has been broken or disconnected, allowing air to enter.

(c) When air has been drawn into some part of the system through neglect or misadjustment, such as air drawn into master cylinder around a worn master cylinder secondary cup; air drawn into cylinders by misadjustment; improper fluid level in master cylinder.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

(d) When brakes have been adjusted too tight or parking brake has been left on, causing overheating and boiling or gassing of the brake field.

(e) When it becomes necessary to replace fluid.

(3) PROCEDURE.

(a) Fill Master Cylinder.

MEASURE, 1-qt
WRENCH, adjustable, 12-in.

Carefully clean all dirt from around the master cylinder filler plug. Remove filler plug (12-in. adjustable wrench). Fill master cylinder to within ½ inch from filler plug hole with hydraulic brake fluid. **NOTE:** Before bleeding the wheel cylinder lines, it is first necessary to bleed the hydrovac power cylinder.

(b) Bleeding the Hydrovac Power Cylinder.

HOSE, bleeder
JAR, glass
WRENCH, open-end, ½-in.

Disconnect the vacuum line at the vacuum inlet port. The unit is bled at the three bleeder screws and they should be bled in order 1, 2, and 3, starting at the bleeder nearest to cylinder. Bleeding is accomplished by removing in the order named the small cap screw (½-in. open-end wrench) and inserting the standard (bleeder hose). The end of the tube should hang in a glass jar with a small amount of brake fluid. The end of the tube should be below the surface of the liquid. Unscrew the bleeder connection nut about three-fourths of a turn and depress the brake pedal slowly by hand and then allow the pedal to return very slowly to its "OFF" position. Continue this pumping until no more air is expelled at the end of the bleeder tube. Repeat this operation at each bleeder connection. Master cylinder supply tank should be kept filled with the proper amount of fluid to prevent any air from entering in the system at the master cylinder.

(c) Bleeding the Wheel Cylinders.

JAR, glass
WRENCH, open-end, ½-in. (2)

Remove cap screw from bleeder connection (two ½-in. open-end wrenches). Thread bleeder drain hose into this opening (fig. 60). Allow bleeder hose to hang in a clean glass jar. Care must also be taken not to drain the master cylinder reservoir during this operation, otherwise, air will enter and make "rebleeding" necessary. Reservoir must be full during the bleeding operation. Loosen bleeder screw one full turn and depress the brake pedal slowly; then, allow pedal to return to the "OFF" position. Repeat this operation approximately ten times, which provides a pumping action to force fluid through the line and expels all air. This operation must be repeated at all four wheels to bleed the entire system. Watch flow from bleeder hose, keeping hose submerged in the fluid in container. When air bubbles cease to appear, or when the steam is a clear solid mass, close bleeder connection. Remove the bleeder hose and replace the cap screw (½-in. open-end wrench). Fluid withdrawn during the "bleeding" operation should not be used again.

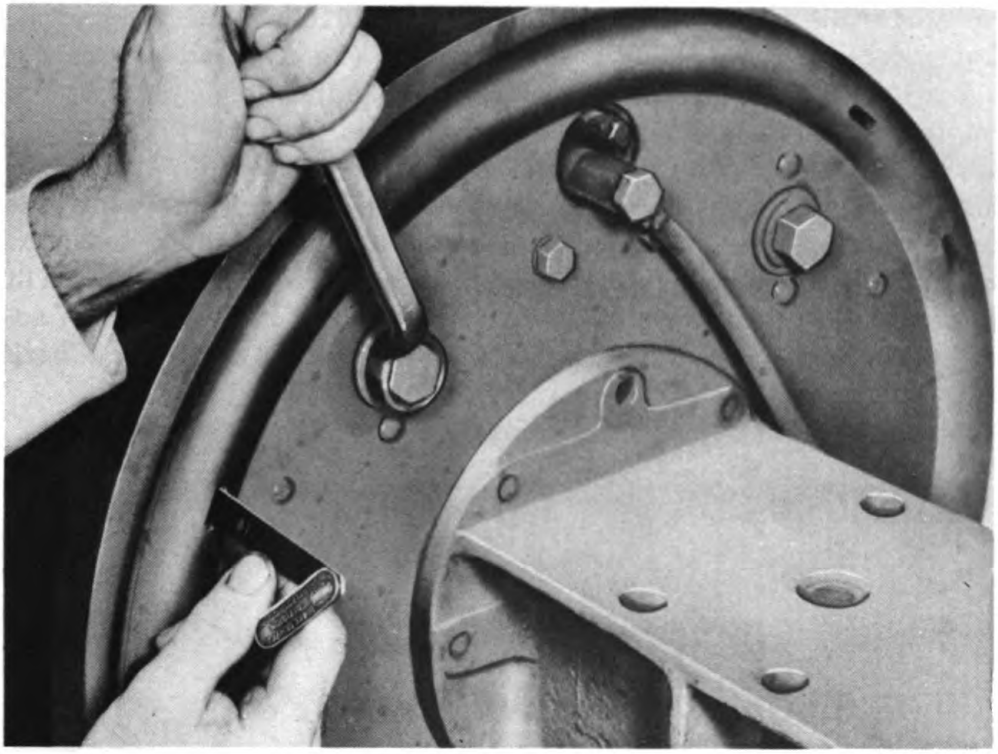

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Figure 61—Rear Brake Shoe Minor Adjustment

e. Service Brake Adjustment (figs. 61, 62, 63).

(1) EQUIPMENT.

GAGE, feeler, 0.005-in.
GAGE, feeler, 0.010-in.
JACK, hydraulic
PLIERS
WRENCH, open-end, ½-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 11/16-in.
WRENCH, open-end, ¾-in.
WRENCH, open-end, ⅞-in.
WRENCH, open-end, 1 1/16-in.
WRENCH, open-end, 1¼-in.

(2) SERVICE BRAKE ADJUSTMENTS.

General. The brakes have provisions for minor and major adjustments. Minor adjustment compensates for liner wear. Major adjustment becomes necessary when a minor adjustment will not provide a satisfactory brake or when brakes have been dismantled, shoes relined, or replaced. A satisfactory adjustment cannot be obtained when linings are worn to rivet heads, brake drums are scored, eccentric or bell mouth. Always make sure hand lever is in the fully released position before attempting either minor or major adjustments.

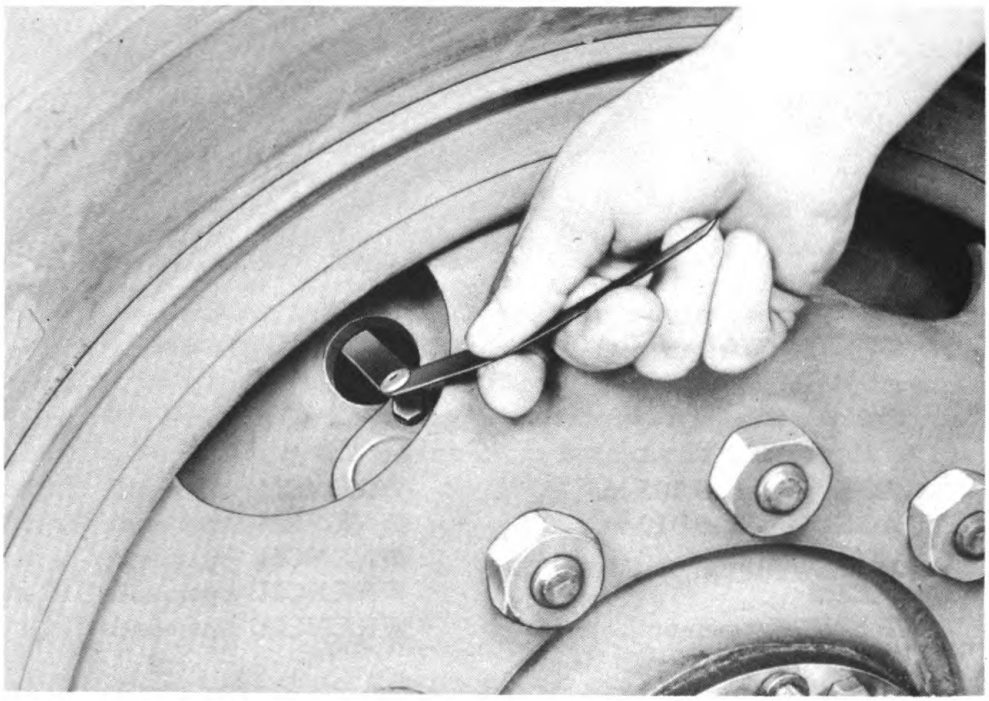
(3) PROCEDURE.

(a) Service Brake Minor Adjustment (figs. 61 and 62).

GAGE, feeler, 0.010-in.
JACK, hydraulic
WRENCH, open-end, 11/16-in.
WRENCH, open-end, ⅞-in.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Place a hydraulic jack under the axle housing in a safe manner and raise until the wheel rotates freely. Insert a 0.010-in. feeler gage in the upper slot in the dust shield of the rear brake (fig. 61), and in the opening at the outside of the front wheel (fig. 62), adjust lining clearance by rotating the cam adjustment, front wheel ($^{11}/_{16}$-in. open-end wrench), rear wheel ($^{7}/_{8}$-in. open-end wrench), toward rim of wheel with wrench pointing upward (fig. 61). This brings the shoes into closer contact with the brake drum as noted by resistance when turning the wheel by hand. Next back off the adjustment until wheel rotates freely. Make this adjustment at each shoe in each wheel. The brakes have a friction spring on this adjustment which keeps the adjusting cam locked in any position. Check



RA PD 65844

Figure 62—Checking Front Brake Shoe Clearance

pedal reserve. On the average installation this should be approximately half of the total pedal travel. If this amount cannot be obtained, the adjustment should be rechecked. If pedal is found spongy or not solid, this is an indication of air in the system and the brakes should be bled. Tap brake drums with wrench; if they ring clear, the wheels are free. If, however, a dead sound is noted, check for drag caused by worn or improperly adjusted wheel bearings, loose wheels, or eccentric drums. When adjustment is completed remove hydraulic jack from under vehicle.

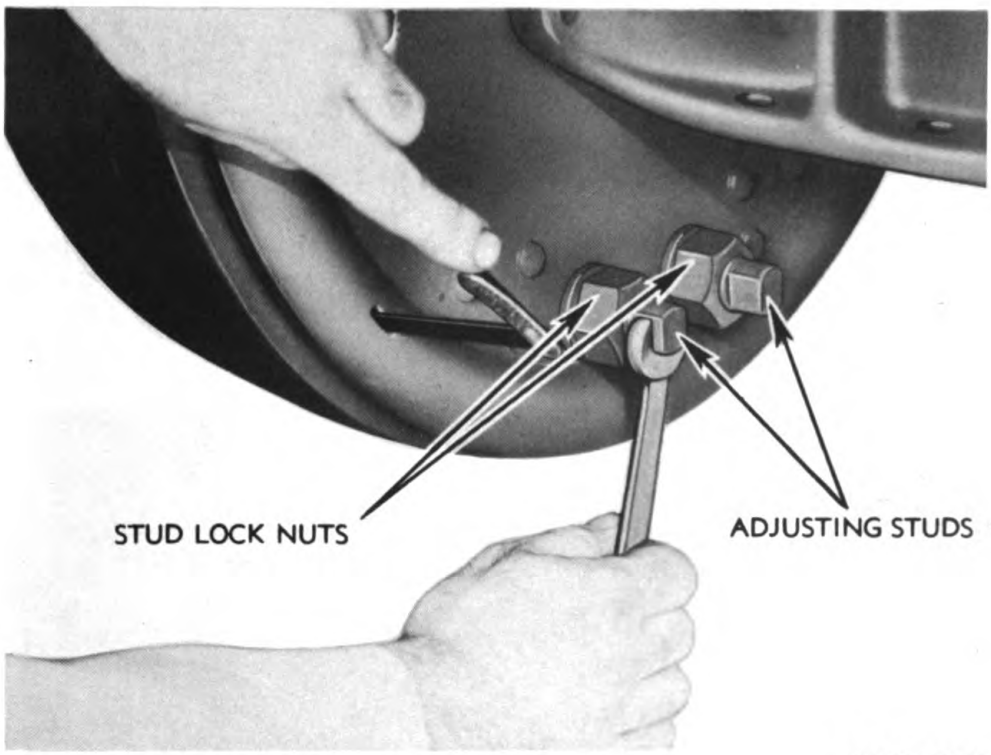


Figure 63—Rear Brake Shoe Major Adjustment

(b) Service Brake Major Adjustment (fig. 63).

GAGE, feeler, 0.005-in.	WRENCH, open-end, 1 1/16-in.
GAGE, feeler, 0.010-in.	WRENCH, open-end, 7/8-in.
JACK, hydraulic	WRENCH, open-end, 1 1/16-in.
WRENCH, open-end, 1/2-in.	WRENCH, open-end, 1 1/4-in.
WRENCH, open-end, 9/16-in.	WRENCH, open-end, 1 1/16-in.

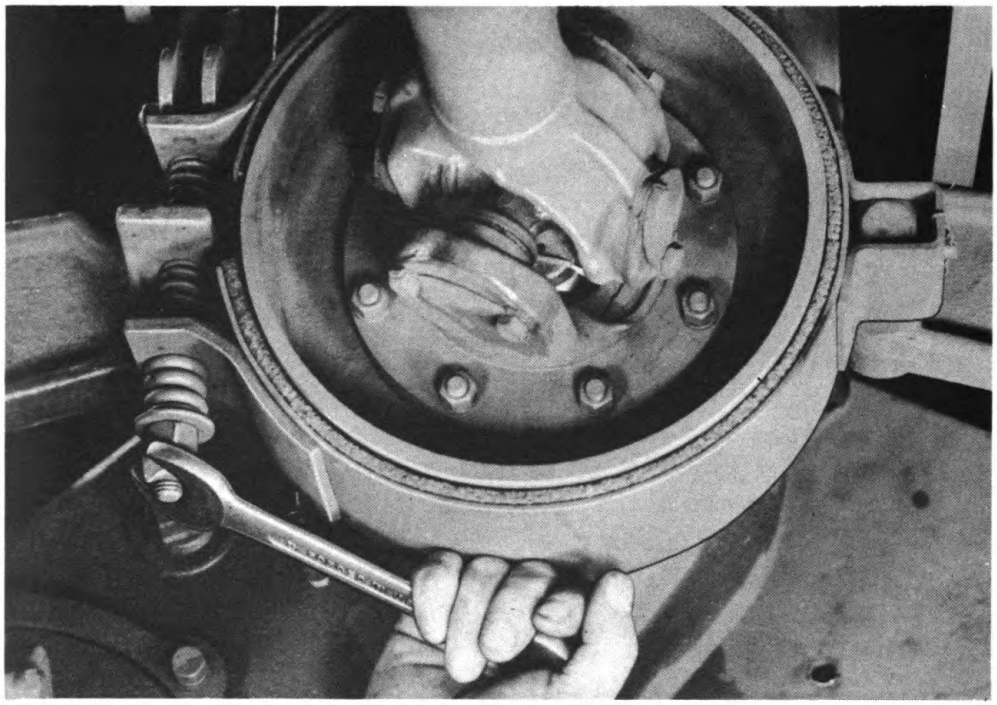
When brake shoes are relined or in cases where a minor adjustment will not re-establish the proper pedal reserve, it is necessary to adjust the eccentric anchor pins to correct the relation of the brake shoe arc to the contour of the drum. Place a hydraulic jack under the axle housing in a safe manner and raise until the wheel rotates freely. Loosen the anchor pin lock nut on inside of dust shield (front wheel—1 1/16-in. open-end wrench, rear wheel—1 1/4-in. open-end wrench). Enter feeler gage in slots of dust shield in rear wheel or inspection hole of front wheel. Adjust the anchor pin with (front wheel) 1/2-in. open-end wrench, and (rear wheel) 9/16-in. open-end wrench, until brake shoe clearance at the bottom is 0.005-inch and 0.010 inch at the top (fig. 63). Clearances are measured with feeler gage located 1 1/2 inches from ends of lining. Adjust anchor pin and adjusting cam until feeler gages are snug between lining and drum. Tighten the anchor pin lock nut (front wheel—1 1/16-in. open-end wrench,

and rear wheel—1¼-in. open-end wrench). Repeat this operation on each shoe in each wheel.

(c) Service Brake Linkage Adjustment.

PLIERS WRENCH, open-end, ¾-in.

Remove the cotter key (pliers) from the brake rod (brake pedal to master cylinder) on the bell crank. Remove the yoke pin. Slide the piston in the master cylinder to the extreme released position. Loosen the lock nut on the brake rod yoke (¾-in. open-end wrench). Be sure brake pedal is in the released position. Adjust length of brake rod, so that pedal



RA PD 65846

Figure 64—Adjusting Parking Brake Band

pad will have ½ inch free travel before pressure stroke starts. Lock the brake rod yoke with the lock nut (¾-in. open-end wrench). Lock the yoke pin with a cotter key (pliers).

f. Parking Brake Adjustment (fig. 64).

(1) EQUIPMENT.

PLIERS WRENCH, open-end, ⅞-in.
SCREWDRIVER, 4-in.

(2) PROCEDURE.

(a) Adjust Brake Anchor.

PLIERS SCREWDRIVER, 4-in.

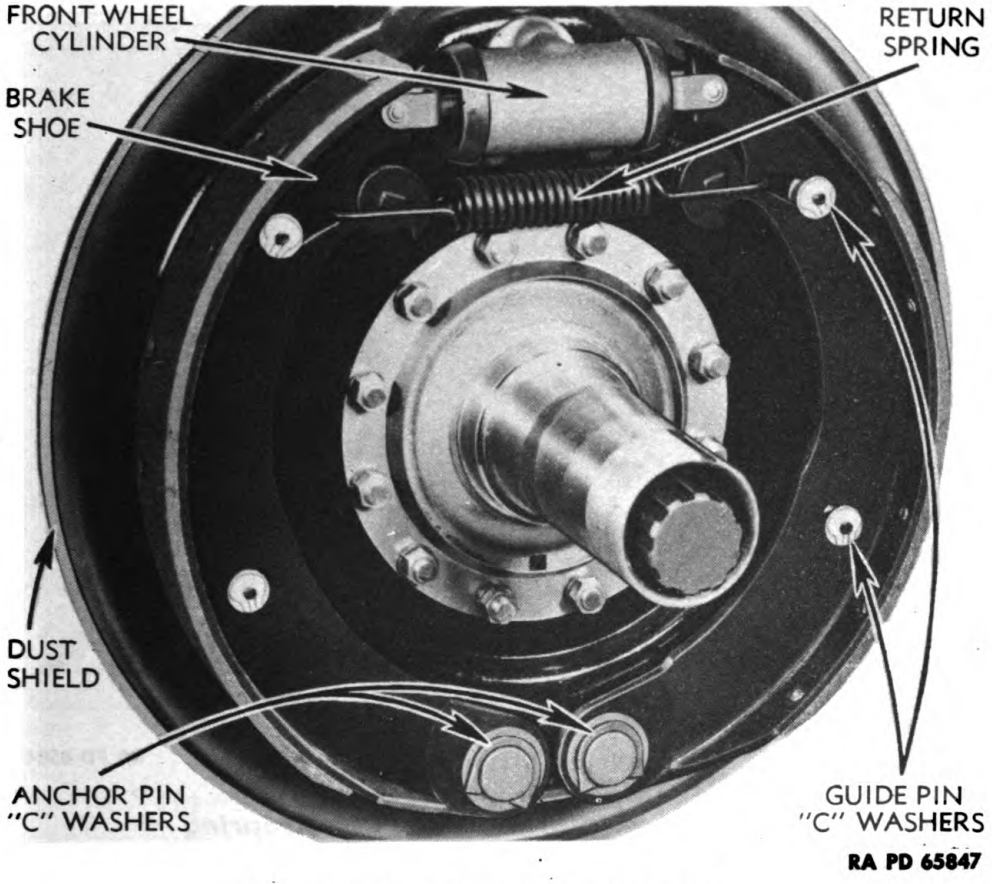


Figure 65—Front Brake Assembly

Remove adjusting screw lock wire (pliers). Turn adjusting screw in (screwdriver) to bring band to 1/16 inch from drum. Re-lock adjusting screw securely with new wire (pliers).

(b) Adjust Lower Brake Band.

SCREWDRIVER, 4-in. **WRENCH**, open-end, 7/16-in.

Remove lock nut (7/16-in. open-end wrench). Turn adjusting screw in (4-in. screwdriver and 7/16-in. open-end wrench) until band clearance at bottom is 1/16 inch. Replace lock nut (7/16-in. open-end wrench).

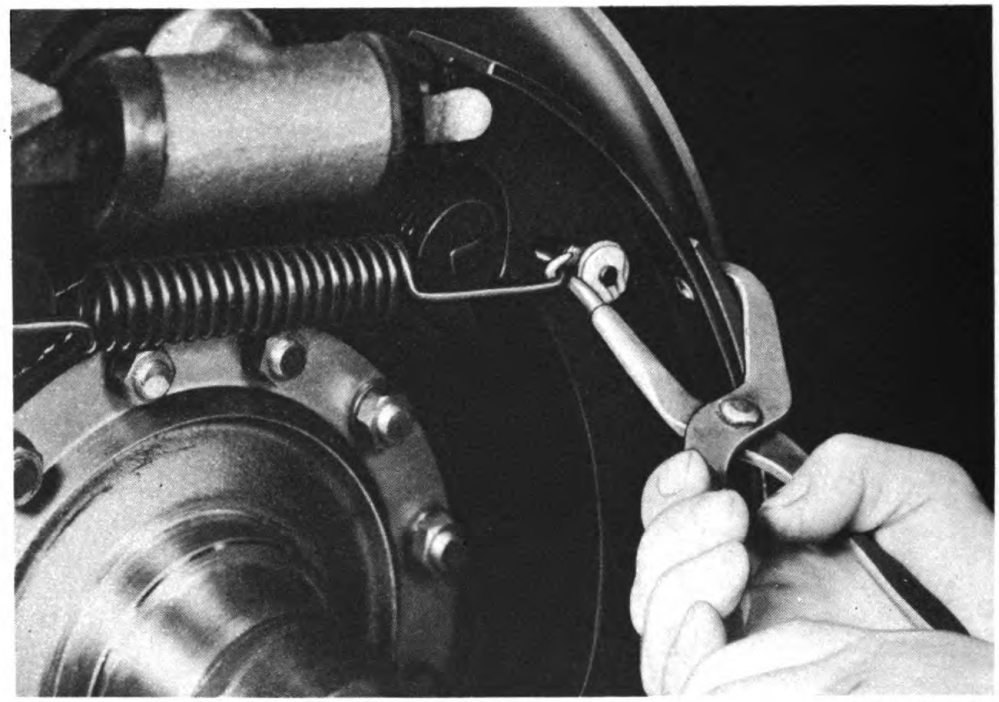
(c) Adjust Brake Adjusting Bolt.

PLIERS **WRENCH**, open-end, 7/8-in.

Remove cotter key (pliers) from end of bolt. Release lock nut (7/8-in. open-end wrench) (fig. 64). Tighten adjusting nut (7/8-in. open-end wrench), so that brake band clearance on drum is 1/16 inch. Tighten lock nut (7/8-in. open-end wrench). Replace cotter key in bolt (pliers).

61. HYDRAULIC BRAKE SHOE ASSEMBLY.

a. Brake Shoe Description. Wheel brake units are located within the drum and supported by dust shields. Each shoe is lined with molded



RA PD 65848

Figure 66—Removing Brake Return Spring

brake lining, and is supported at the lower end by eccentric anchor pins and connected at the top to the actuating wheel cylinder (fig. 65).

b. Front Brake Shoe Removal.

(1) EQUIPMENT.

PLIERS, ¼-in.
PLIERS, brake (41-P-1509)
PLIERS, snap ring, (41-P-1572)
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, skein nut, (68869)
WRENCH, socket, 5/8-in.
WRENCH, wheel nut, (standard)

(2) PROCEDURE.

(a) Remove Front Wheel (par. 158).

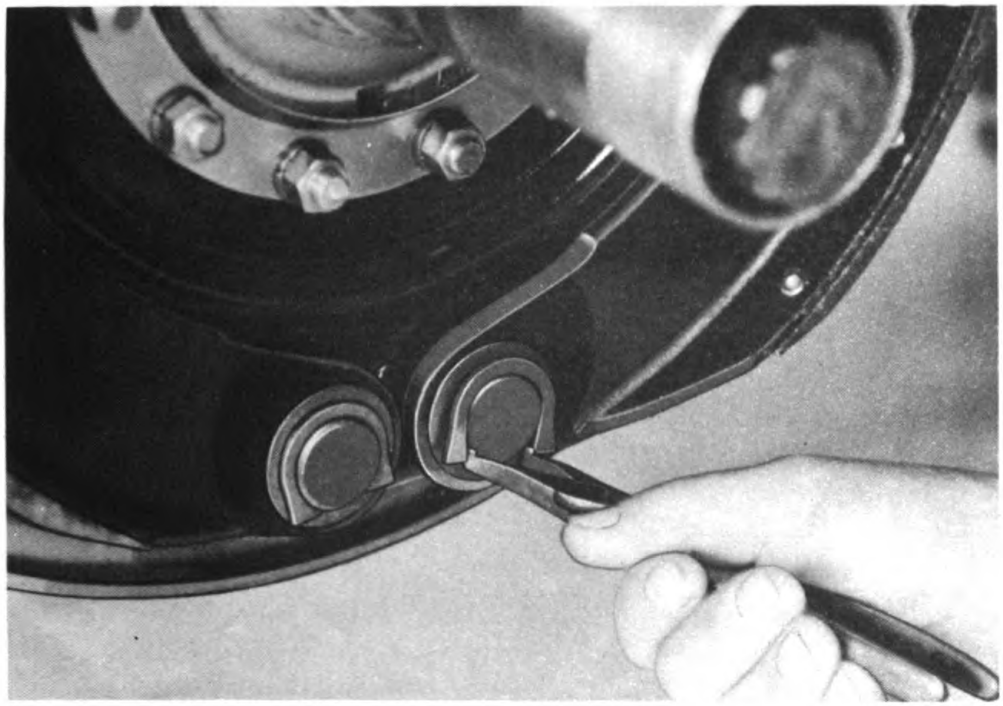
WRENCH, wheel nut

(b) Remove Front Hub Assembly (par. 160).

WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, skein nut, (68869)
WRENCH, socket, 5/8-in.

(c) Remove Brake Shoe Return Spring.

PLIERS, brake



RA PD 65849

Figure 67—Removing Anchor Pin "C" Washer

Remove the return spring (brake pliers) from the top or toe of the brake shoes (fig. 66).

(d) Remove Guide Pin "C" Washers.

PLIERS, snap ring

Spread the four guide pin "C" washers and remove them from guide pin. Remove four guide pin flat washers (snap ring pliers).

(e) Remove Anchor Pin "C" Washers and Straps.

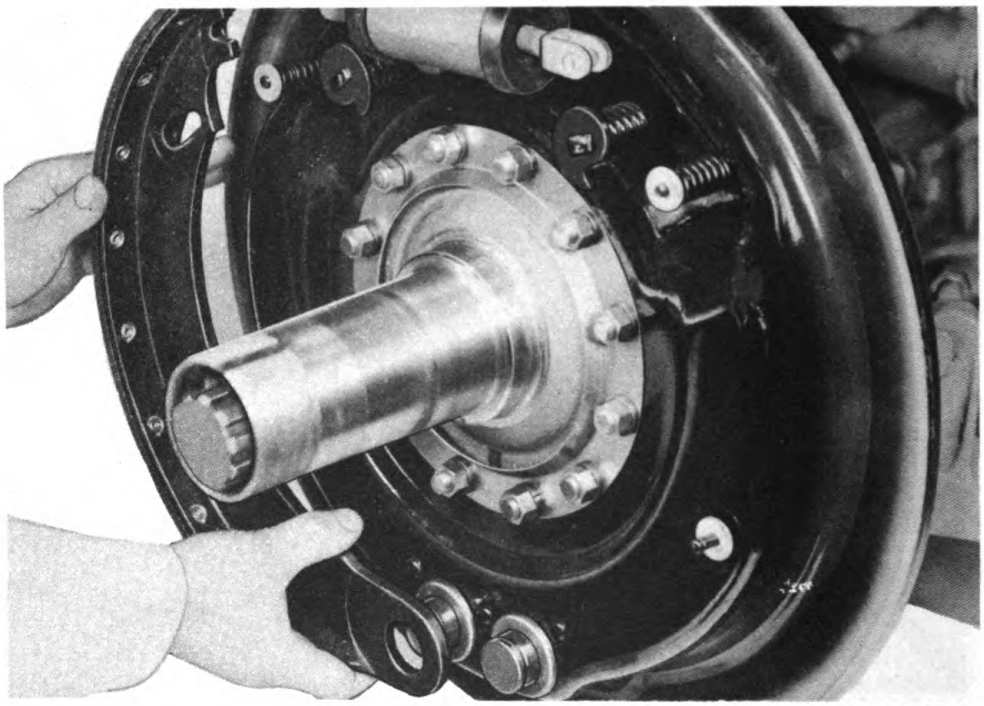
PLIERS, snap ring, (41-P-1572)

Spread the two anchor pin "C" washers and remove "C" washers (snap ring pliers). Remove anchor pin strap. Lift brake shoes from anchor pin (fig. 67).

c. Front Brake Shoe Installation (fig. 68).

(1) EQUIPMENT.

GAGE, feeler, 0.005-in.
GAGE, feeler, 0.010-in.
HAMMER, 2-lb
PLIERS
PLIERS, brake
PUNCH, ¼-in.
WRENCH, box, 1 1/16-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, ½-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, open-end, 11/16-in.
WRENCH, skein nut
WRENCH, socket, 5/8-in.



RA PD 65850

Figure 68—Installing Front Brake Shoe

(2) PROCEDURE.

(a) Install Brake Shoes and Anchor Pin "C" Washers.

HAMMER PLIERS

Place brake shoes on anchor and guide pins (fig. 68). Forward shoe with long lining toward front and shoe with short lining toward the rear. Place anchor pin strap on anchor pin (hammer). Slip anchor pin "C" washers in slot on anchor pin. Lock anchor pin "C" washers by squeezing the ends together (pliers).

(b) Install Guide Pin "C" Washers.

PLIERS

Place guide pin flat washers on guide pin. Slide guide pin "C" washers in slot on guide pin. Lock guide pin "C" washers by squeezing the ends together (pliers).

(c) Install Brake Shoe Return Spring.

PLIERS, brake

Connect brake shoe return spring on upper or toe end of brake shoes (brake pliers).

(d) Install Wheel Hub Assembly (par. 160).

HAMMER
PUNCH
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, skein nut
WRENCH, socket, 5/8-in.

(e) Install Front Wheels (par. 158).

WRENCH, wheel nut

(f) Adjust Front Brake Shoes (par. 60 e (3) *(b)*).

GAGE, feeler, 0.005-in.
GAGE, feeler, 0.010-in.
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 11/16-in.
WRENCH, open-end, 1 1/16

d. Rear Brake Shoe Removal.

(1) EQUIPMENT.

PLIERS, brake
PLIERS, snap ring
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, skein nut
WRENCH, socket, 5/8-in.
WRENCH, wheel nut (standard)

(2) PROCEDURE.

(a) Remove Rear Wheels (par. 159)

WRENCH, wheel nut

(b) Remove Rear Axle Shaft (par. 48).

EXTENSION, 5-in.
HANDLE, flex, 18-in.
WRENCH, open-end, 9/16-in.
WRENCH, socket, 15/16-in.

(c) Remove Rear Wheel Hub Assembly (par. 160)

WRENCH, skein nut, No. 68869

(d) Remove Brake Shoe Spring

PLIERS, brake

Remove the return spring from the brake shoes (brake pliers).

(e) Remove Guide Pin "C" Washers

PLIERS, lock ring

Spread the guide pin "C" washers and remove them from the guide pin (lock ring pliers). Remove guide pin flat washers.

(f) Remove Anchor Pin "C" Washers and Strap

PLIERS, lock ring

Spread the anchor pin "C" washers and remove "C" washers (lock ring pliers). Remove anchor pin strap. Lift brake shoes from anchor pin.

e. Rear Brake Shoe Installation.

(1) EQUIPMENT.

GAGE, feeler, 0.005-in.
GAGE, feeler, 0.010-in.
HAMMER
PLIERS
PLIERS, brake
PLIERS, lock ring
PUNCH
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, open-end, 7/8-in.
WRENCH, open-end, 1 1/4-in.
WRENCH, skein nut
WRENCH, socket, 5/8-in.
WRENCH, wheel nut

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

(2) PROCEDURE

(a) Install Brake Shoes

HAMMER
PLIERS

Place brake shoes on anchor pin and guide pins of dust shield. Forward shoe has long lining and rear has short lining. Place anchor pin strap on anchor pin (hammer). Slip anchor pin "C" washers into slot on anchor pin. Lock anchor pin "C" washers by squeezing the ends together (pliers).

(b) Install Guide Pin "C" Washers.

PLIERS

Place guide pin flat washers on guide pins. Slide guide pin "C" washers in slot on guide pin. Lock guide pin "C" washers by squeezing the ends together (pliers).

(c) Install Rear Brake Shoe Return Spring

PLIERS, brake

Install brake shoe return spring (brake pliers) by connecting the spring to each shoe at the top or toe.

(d) Install Rear Wheel Hub Assembly (par. 161).

HAMMER
PUNCH
WRENCH, skein nut

(e) Install Rear Axle Shaft (par. 49)

EXTENSION, 5-in.
HANDLE, flex, 18-in.
WRENCH, open-end, 9/16-in.
WRENCH, socket, 15/16

(f) Install Rear Wheels (par. 159)

WRENCH, wheel nut

(g) Adjust Rear Brake Shoes (par. 60 e (3) *(b)*).

GAGE, feeler, 0.005-in.
GAGE, feeler, 0.010-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 7/8-in.
WRENCH, open-end, 1 1/4-in.

f. Front Brake Drum Removal (fig. 69).

(1) EQUIPMENT.

EXTENSION, 6-in.
HAMMER, 1-lb
HANDLE, flex
HANDLE, speed
JACK, hydraulic
PUNCH, taper
WRENCH, Budd wheel nut (Standard)
WRENCH, open-end 9/16-in.
WRENCH, skein nut
WRENCH, socket, 5/8-in.
WRENCH, socket, 1 1/16-in.

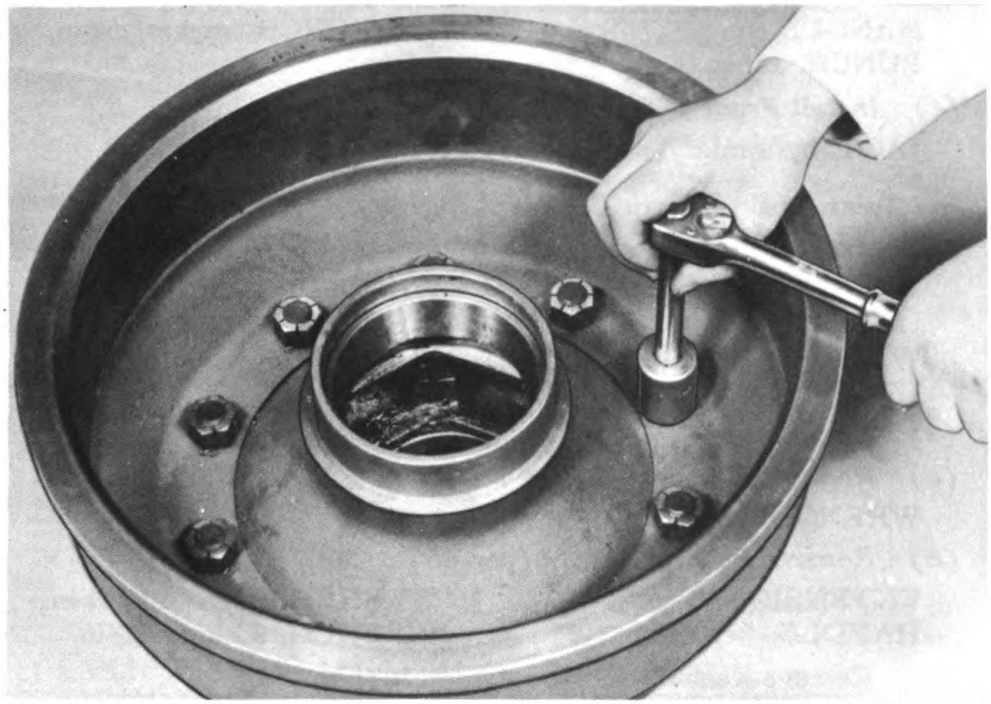
(2) PROCEDURE.

(a) Remove Front Wheel (par. 156)

JACK, hydraulic
WRENCH, skein nut
WRENCH, socket, 5/8-in.
WRENCH, wheel nut (Standard)

(b) Remove Front Wheel Hub (par. 160)

HAMMER, 1-lb
HANDLE, speed
PUNCH, taper
WRENCH, open-end, 9/16-in.
WRENCH, skein nut
WRENCH, socket, 5/8-in.



RA PD 65851

Figure 69—Removing Brake Drum Jaw Nut

(c) Remove Brake Drum from Hub

EXTENSION, 6-in.
HANDLE, flex
WRENCH, socket, 1⅛-in.

Remove the ten jam nuts (1⅛-in. socket wrench, 6-in. extension, and flex handle) fastening drum to hub and then lift drum from hub studs (fig. 69).

g. Front Brake Drum Installation.

(1) EQUIPMENT.

HAMMER, 1-lb
HANDLE, speed
JACK, hydraulic
PUNCH, taper
WRENCH, Budd wheel (standard)
WRENCH, open-end, 9/16-in.
WRENCH, socket, 5/8-in.
WRENCH, socket, 1⅛-in.

(2) PROCEDURE.

(a) Install Brake Drum on Front Wheel Hub

EXTENSION, 6-in.
HANDLE, flex
WRENCH, socket, 1⅛-in.

Place brake drum on the ten studs in wheel hub. Turn on ten jam nuts and tighten securely (1⅛-in. socket, 6-in. extension, and flex handle).

(b) Install Front Wheel Hub (par. 160)

HAMMER, 1-lb
HANDLE, speed
PUNCH, taper
WRENCH, open-end, 9/16-in.
WRENCH, socket, 5/8-in.

(c) Install Front Wheel (par. 158)

JACK, hydraulic
WRENCH, wheel nut

h. Rear Brake Drum Removal (fig. 69).

(1) EQUIPMENT.

EXTENSION, 5-in.
HANDLE, flex, 18-in.
WRENCH, open-end, 9/16-in.
WRENCH, skein nut
WRENCH, socket, 15/16-in.
WRENCH, socket, 1 1/16-in.
WRENCH, wheel nut (standard)

(2) PROCEDURE.

(a) Remove Rear Wheel (par. 159)

WRENCH, wheel nut

(b) Remove Rear Axle Shaft (par. 48)

EXTENSION, 5-in.
HANDLE, flex, 18-in.
WRENCH, open-end, 9/16-in.
WRENCH, socket, 15/16-in.

(c) Remove Rear Wheel Hub Assembly (par. 161)

WRENCH, skein nut.

(d) Remove Rear Brake Drum

EXTENSION, 5-in.
HANDLE, flex, 18-in.
WRENCH, socket, 1 1/16-in.

Remove the ten jam nuts holding the brake drum to the wheel hub (5-in. extension, 18-in. flex handle, and 1 1/16-in. socket wrench). Remove the brake drum from the wheel hub (fig. 69).

i. Rear Brake Drum Installation.

(1) EQUIPMENT.

EXTENSION, 5-in.
HANDLE, flex, 18-in.
WRENCH, open-end, 9/16-in.
WRENCH, skein nut
WRENCH, socket, 15/16-in.
WRENCH, socket, 1 1/16-in.
WRENCH, wheel nut (standard)

(2) PROCEDURE.

(a) Install Rear Brake Drum

EXTENSION, 5-in.
HANDLE, flex, 18-in.
WRENCH, socket, 1 1/16-in.

Place the brake drum on the wheel hub. Tighten the brake drum to the wheel hub with the ten jam nuts (5-in. extension, 18-in. flex handle, and 1 1/16-in. socket wrench).

(b) Install Rear Wheel Hub Assembly (par. 161).

HAMMER
PUNCH
WRENCH, skein nut

(c) Install Rear Axle Shaft (par. 49).

EXTENSION, 5-in.
HANDLE, flex, 18-in.
WRENCH, open-end, 9/16-in.
WRENCH, socket, 15/16-in.

(d) Install Rear Wheels (par. 159).

WRENCH, wheel nut

62. HYDRAULIC BRAKE WHEEL CYLINDER.

a. Hydraulic Brake Wheel Cylinder Description. The wheel cylinder contains two pistons, their purpose being to transmit the pressure evenly to each of the two brake shoes. The cylinder has two boots to protect the internals from foreign matter, two pistons which are connected to the brake shoes, two cups which seal the cylinder, one spring, one inlet fitting which is the means of connecting the cylinder to the system, and one bleeder screw to expel air from the system.

b. Front Wheel Cylinder Removal.

(1) EQUIPMENT.

HANDLE, speed
PLIERS
PLIERS, brake
WRENCH, adjustable, 12-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, skein-nut
WRENCH, socket, 5/8-in.

(2) PROCEDURE.

(a) Remove Front Wheel Hub Assembly (par. 160).

HANDLE, speed
WRENCH, open-end, 9/16-in.
WRENCH, skein nut
WRENCH, socket, 5/8-in.

(b) Disconnect Brake Hose (fig. 70).

WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.

Loosen tube nut on end of brake hose at axle housing bracket (7/16-in. open-end wrench) (fig. 70). Remove brake hose clip (pliers). Withdraw hose from bracket. Remove brake hose from wheel cylinder (5/8-in. open-end wrench).

(c) Remove Brake Shoe Spring (fig. 66).

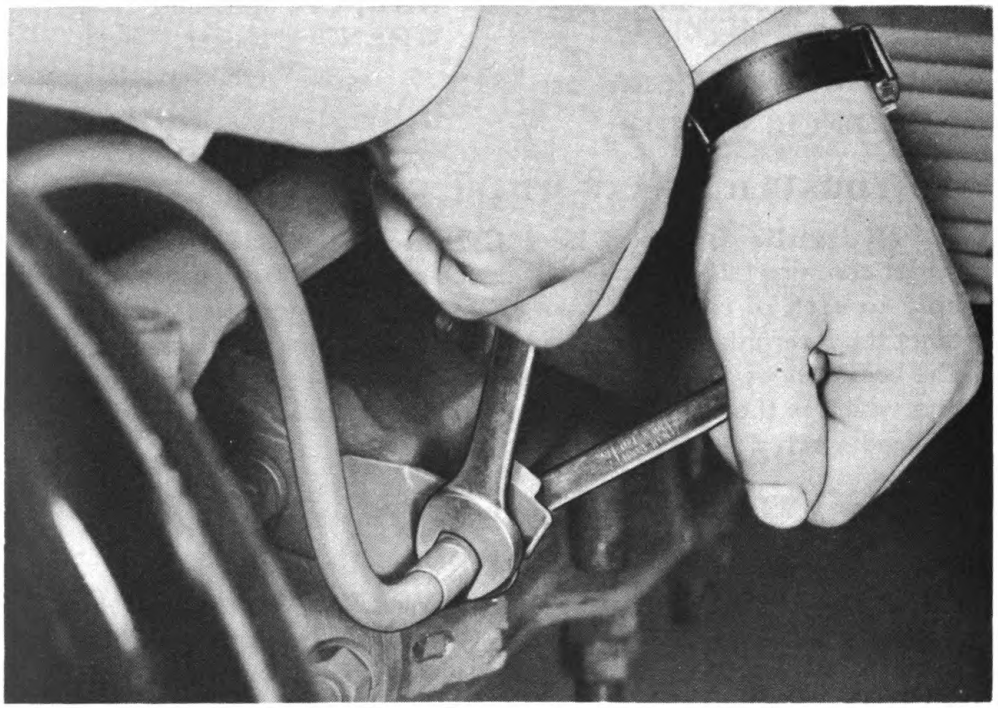
PLIERS, brake

Disconnect brake shoe return spring (brake pliers) (fig. 66). Spread the top or toe ends of the brake shoes.

(d) Remove Front Brake Cylinder.

WRENCH, open-end, 7/16-in.

Remove the two cap screws and lock washers attaching front brake cylinder to dust shield (7/16-in. open-end wrench) (fig. 71). Remove brake cylinder.



RA PD 65852

Figure 70—Disconnecting Flexible Brake Hose

c. Front Wheel Cylinder Installation (figs. 65 and 72).

(1) EQUIPMENT.

HANDLE, speed
HOSE, bleeder
JAR, glass
MEASURE, 1-qt
PLIERS
PLIERS, brake
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, skein nut
WRENCH, socket, 5/8-in.

(2) PROCEDURE.

(a) Replace Front Brake Cylinder (fig. 72).

WRENCH, open-end, 7/16-in.

Insert front brake cylinder in dust shield (fig. 72). Tighten securely with the two cap screws and lock washers (7/16-in. open-end wrench).

(b) Replace Brake Shoe Return Spring.

PLIERS, brake

Fasten brake shoe return spring to brake shoes (brake pliers).

(c) Connect Brake Hose

WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.

RA PD 65853

Figure 71—Disconnecting Wheel Cylinder

Connect brake hose to brake cylinder (⅝-in. open-end wrench). Insert hose in bracket on axle housing. Insert brake hose clip (pliers). Tighten tube nut on end of brake hose at axle housing bracket (7/16-in. open-end wrench).

(d) Replace Front Wheel Hub Assembly (par. 160).

HANDLE, speed
WRENCH, open-end, 9/16-in.
WRENCH, open-end, ⅝-in.
WRENCH, skein nut

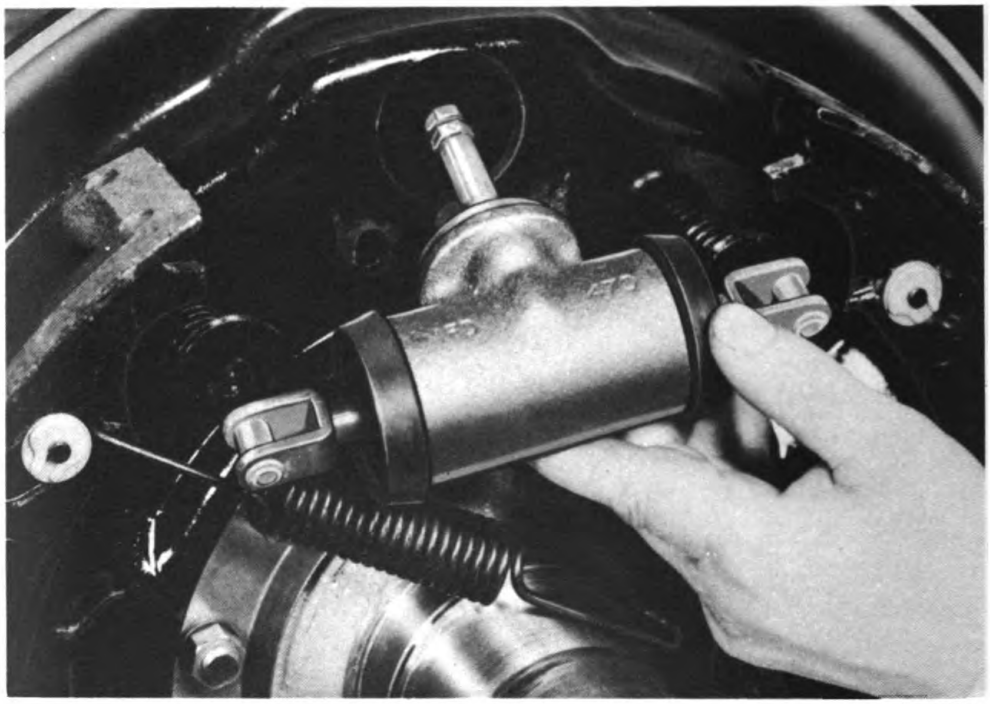
(e) Bleed Brake Lines (par. 60 d).

HOSE, bleeder
JAR, glass
MEASURE, 1-qt
WRENCH, adjustable, 12-in.
WRENCH, open-end, ½-in.

d. Rear Wheel Cylinder Removal.

(1) EQUIPMENT.

EXTENSION, 6-in.
HANDLE, ratchet
JACK, hydraulic
PLIERS, brake
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, ¾-in.
WRENCH, skein nut
WRENCH, socket, 15/16-in.
WRENCH, wheel nut (standard)



RA PD 65854

Figure 72—Installing Wheel Cylinder

(2) PROCEDURE.

(a) Remove Rear Wheel (par. 159).

JACK, hydraulic
WRENCH, wheel nut (standard)

(b) Remove Rear Axle Shaft (par. 48).

EXTENSION, 6-in.
HANDLE, ratchet
WRENCH, open-end, 9/16-in.
WRENCH, socket, 15/16-in.

(c) Remove Rear Axle Hub (par. 161).

WRENCH, skein nut

(d) Remove Rear Wheel Cylinder.

PLIERS, brake
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 3/4-in.

Remove the hydraulic line from the wheel cylinder (7/16-in. open-end wrench). Remove the brake shoe return spring (brake pliers) from the brake shoes (fig. 66). Remove the fitting on the wheel cylinder (3/4-in. open-end wrench). Remove the two 3/8-in. cap screws and lock washers holding the wheel cylinder to the dust shield (9/16-in. open-end wrench). Remove the wheel cylinder assembly.

e. Rear Wheel Cylinder Installation.

(1) EQUIPMENT.

EXTENSION, 6-in.	WRENCH, adjustable, 12-in.
HAMMER	WRENCH, open-end, 7/16-in.
HANDLE, ratchet	WRENCH, open-end, 1/2-in.
HOSE, bleeder	WRENCH, open-end, 9/16-in.
JACK, hydraulic	WRENCH, open-end, 3/4-in.
JAR, glass	WRENCH, skein nut
MEASURE, 1-qt	WRENCH, socket, 15/16-in.
PLIERS, brake	WRENCH, wheel nut (standard)
PUNCH	

(2) PROCEDURE.

(a) Install Wheel Cylinder.

PLIERS, brake	WRENCH, open-end, 5/8-in.
WRENCH, open-end, 7/16-in.	WRENCH, open-end, 3/4-in.
WRENCH, open-end, 9/16-in.	

Place the wheel cylinder spacer and wheel cylinder on to the dust shield and tighten securely with the two 3/8-in. cap screws and lock washers (9/16-in. open-end wrench). Insert and tighten the brake hose connection (3/4-in. open-end wrench). Connect the hydraulic line to the wheel cylinder (7/16-in. open-end wrench).

(b) Install Rear Axle Hub (par. 161).

HAMMER	WRENCH, skein nut, No. 68869
PUNCH	

(c) Install Rear Axle Shaft (par. 49).

EXTENSION, 6-in.	WRENCH, open-end, 9/16-in.
HANDLE, ratchet	WRENCH, socket, 15/16-in.

(d) Install Rear Wheels (par. 159).

JACK, hydraulic	WRENCH, wheel nut (standard)

(e) Bleed Wheel Cylinders (par. 60 d).

HOSE, bleeder	WRENCH, adjustable, 12-in.
JAR, glass	WRENCH, open-end, 7/16-in.
MEASURE, 1-qt	

63. HYDRAULIC BRAKE MASTER CYLINDER (fig. 73).

a. Master Cylinder Description. The master cylinder stores the fluid to actuate the service brakes under the control of the brake pedal (fig. 73).

b. Master Cylinder Assembly Removal (fig. 73).

(1) EQUIPMENT.

PLIERS	WRENCH, open-end, 7/16-in.
SCREWDRIVER	WRENCH, open-end, 1/2-in.
WRENCH, adjustable, 12-in.	WRENCH, open-end, 9/16-in.
WRENCH, box, 9/16-in.	

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

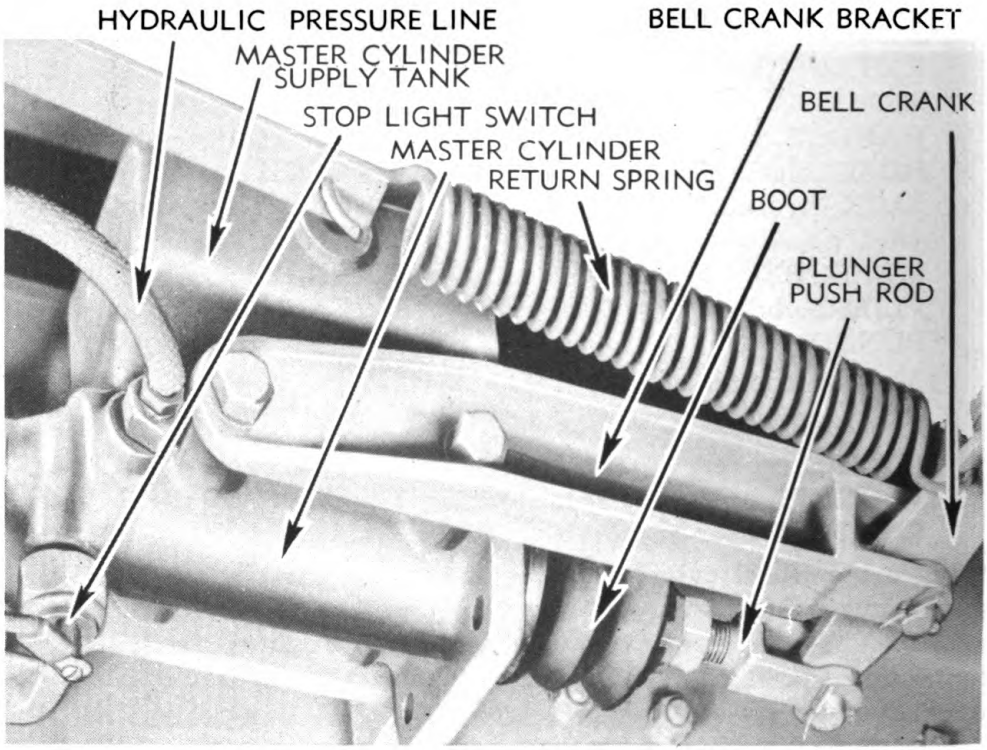


Figure 73—Master Cylinder Installed

(2) PROCEDURE.

(a) Disconnect Stop Light Wires.

SCREWDRIVER

Remove the two screws (screwdriver) holding the stop light wires to the stop light switch (fig. 73). Remove the wires.

(b) Disconnect Hydraulic Lines.

WRENCH, open-end, 7/16-in.

Disconnect the two nuts (7/16-in. open-end wrench) holding the hydraulic lines to the master cylinder (fig. 73). Pull the hydraulic lines away from the cylinder.

(c) Disconnect Brake Rod.

PLIERS

Remove the cotter pin from the brake rod yoke pin (pliers) and remove yoke pin. Lay the brake rod to one side.

(d) Remove Master Cylinder Assembly.

PLIERS
WRENCH, box, 9/16-in.
WRENCH, open-end, 9/16-in.

Remove the four bolts, nuts, and lock washers (9/16-in. open-end wrench and 9/16-in. box wrench) fastening the master cylinder assembly to the

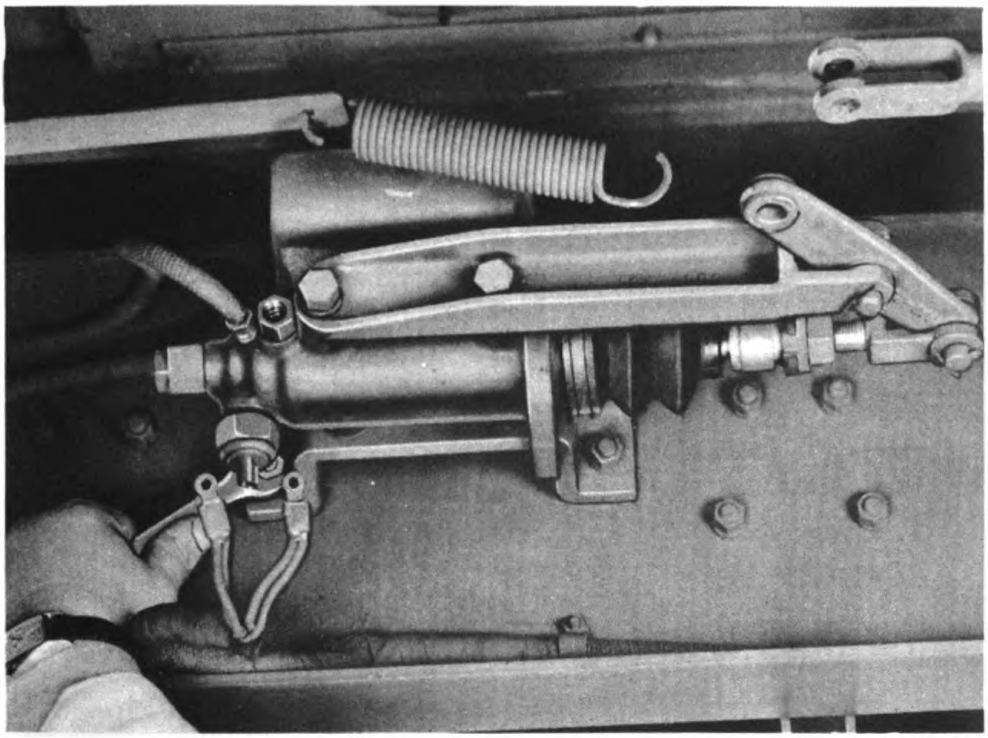


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Figure 74—Installing Master Cylinder Mounting Bolt

frame. Disconnect the pull back spring (pliers) and remove the master cylinder assembly.

(e) Remove Master Cylinder Brackets.

WRENCH, open-end, 9/16-in.

Remove the five cap bolts and lock washers holding the brackets to the master cylinder (9/16-in. open-end wrench). Remove the brackets.

c. Master Cylinder Assembly Installation (figs. 73 and 74).

(1) EQUIPMENT.

HOSE, bleeder
JAR, glass
MEASURE, 1-qt
PLIERS
SCREWDRIVER
WRENCH, box, 9/16-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.

(2) PROCEDURE.

(a) Install Master Cylinder Brackets.

WRENCH, open-end, 9/16-in.

Bolt the master cylinder brackets to the master cylinder assembly with the five cap bolts and lock washers (9/16-in open-end wrench).

(b) Install Master Cylinder Assembly (fig. 74).

WRENCH, box, 9/16-in.
WRENCH, open-end, 9/16-in.

Connect the pull back spring. Place the master cylinder assembly on the frame and bolt it into place with the four bolts, nuts, and lock washers (9/16-in. open-end wrench and 9/16-in. box wrench) (fig. 74).

(c) Connect Brake Rod.

PLIERS

Fasten the brake rod to the master cylinder arm with a yoke pin and lock yoke pin with a new cotter key (pliers).

(d) Connect Hydraulic Lines (fig. 73).

WRENCH, open-end, 7/16-in.

Connect the two hydraulic lines to the master cylinder assembly with the two line fittings (7/16-in. open-end wrench).

(e) Connect Stop Light Wires (fig. 73).

SCREWDRIVER

Fasten the two stop light wires to the stop light switch on the master cylinder assembly with the two small screws (screwdriver) (fig. 73).

(f) Bleed Brakes (par. 60 d).

HOSE, bleeder
JAR, glass
MEASURE, 1-qt
WRENCH, adjustable, 12-in.
WRENCH, open-end, 7/16-in.

64. HYDROVAC POWER CYLINDER (fig. 75).

a. Hydrovac Power Cylinder Description. The hydrovac booster system is an auxiliary power unit that applies additional force to the hydraulic brake system. The hydrovac unit is a combined hydraulic and vacuum booster system, using the vacuum created in the engine intake manifold as an operating force. It is a self-contained unit and is so constructed that in case of engine failure and consequent loss of vacuum, the hydraulic fluid from the master cylinder bypasses the hydrovac unit and the brakes will function with the regular hydraulic system (fig. 75).

b. Hydrovac Power Cylinder Removal.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, box, 9/16-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.

(2) PROCEDURE.

(a) Disconnect Hydrovac Lines.

WRENCH, open-end, 7/16-in.

Disconnect the four hydraulic lines (7/16-in. open-end wrench) from the hydrovac power cylinder.

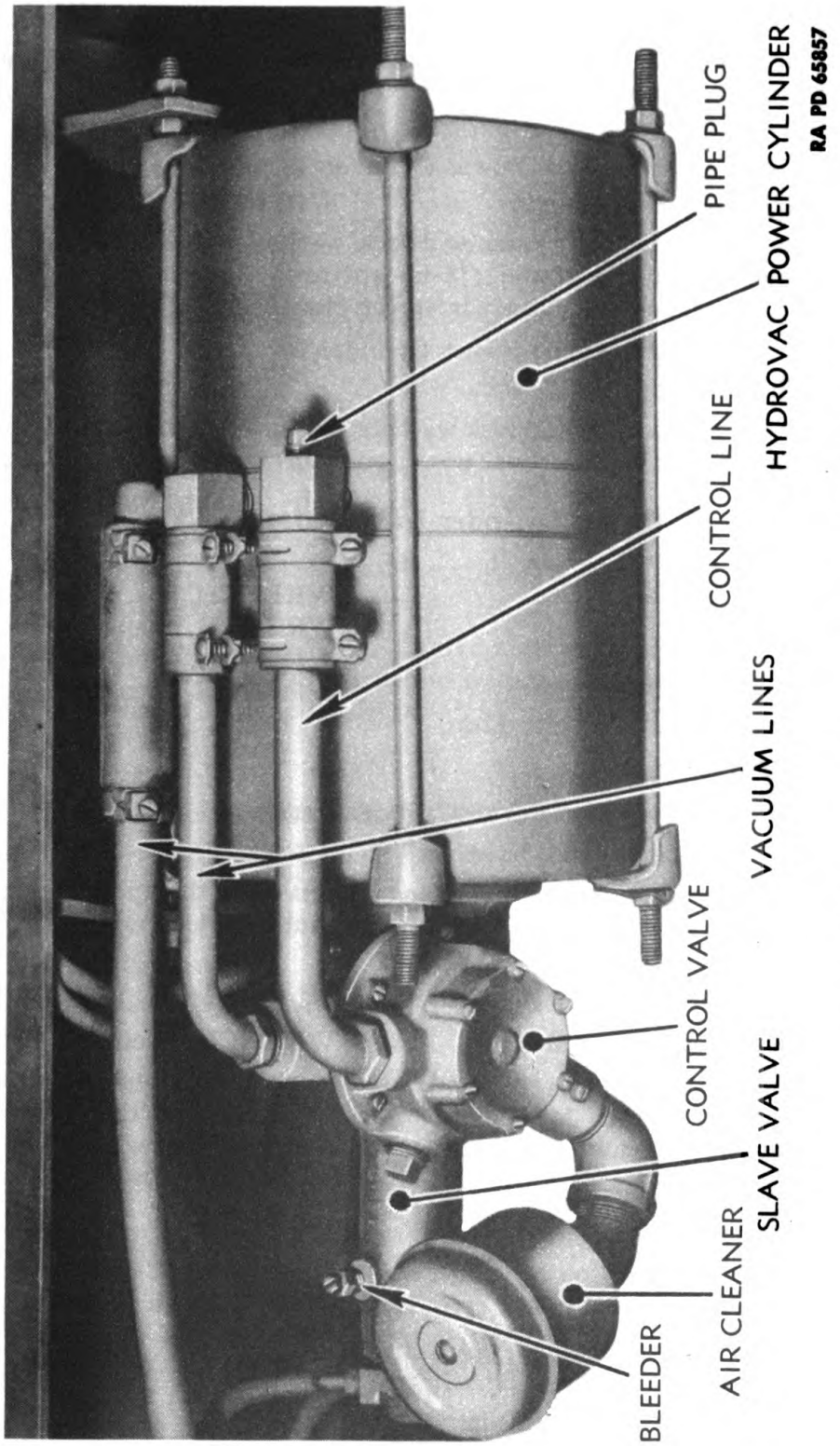

Figure 75—Hydrovac Power Cylinder Installed

(b) Disconnect Vacuum Line.

SCREWDRIVER

Loosen the hose clamp on the vacuum line from the reserve tank to the hydrovac power cylinder (screwdriver). Pull the hose from the hydrovac power cylinder.

(c) Remove Hydrovac Power Cylinder.

WRENCH, box, 9/16-in. WRENCH, open-end, 9/16-in.

Remove the four bolts, nuts, and lock washers holding the hydrovac power cylinder to the frame (9/16-in. open-end wrench and 9/16-in. box wrench). Remove the cylinder from the chassis.

(d) Remove Hydrovac Power Cylinder Brackets.

WRENCH, open-end, 9/16-in.

Remove the four nuts and lock washers (9/16-in. open-end wrench) holding the brackets to the hydrovac power cylinder. Remove the brackets.

c. Hydrovac Power Cylinder Installation (fig. 75).

(1) EQUIPMENT.

HOSE, bleeder
JAR, glass
MEASURE, 1-qt
SCREWDRIVER
WRENCH, adjustable, 12-in.
WRENCH, box, 9/16-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 9/16-in.

(2) PROCEDURE.

(a) Install Hydrovac Power Cylinder Brackets.

WRENCH, open-end, 9/16-in.

Place the hydrovac power cylinder brackets on to the hydrovac power cylinder. Fasten the brackets with the four nuts and lock washers (9/16-in. open-end wrench).

(b) Install Hydrovac Power Cylinder.

WRENCH, box, 9/16-in. WRENCH, open-end, 9/16-in.

Place the hydrovac power cylinder and bracket assembly into position in the frame. Tighten the assembly to the frame with the four bolts, lock washers, and nuts (9/16-in. open-end wrench and 9/16-in. box wrench).

(c) Connect Vacuum Line (fig. 75).

SCREWDRIVER

Push the vacuum line running from the reserve tank on to the connection of the hydrovac power cylinder (fig. 75). Tighten the hose clamp securely (screwdriver).

(d) Connect Hydrovac Lines.

WRENCH, open-end, 7/16-in.

Connect and tighten the four hydraulic lines to the hydrovac power cylinder (7/16-in. open-end wrench).

(e) Bleed Hydrovac Power Cylinder (par. 60 d).

HOSE, bleeder
JAR, glass
MEASURE, 1-qt
WRENCH, adjustable, 12-in.
WRENCH, open-end, 7/16-in.

d. Check Valve Removal.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 3/8-in. (2)

(2) PROCEDURE.

Loosen the two hose clamps and pull the vacuum hose from the check valve (screwdriver). Remove the two 1/4-in. bolts, nuts, and lock washers holding the check valve to the fender (two 3/8-in. open-end wrenches). Remove the check valve.

e. Check Valve Installation.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 3/8-in. (2)

(2) PROCEDURE.

Fasten the check valve to the fender with the two 1/4-in. bolts, lock washers, and nuts (two 3/8-in. open-end wrenches). Push the two vacuum hoses on to the check valve fittings and tighten the hose clamps (screwdriver).

65. BRAKE LINES AND LINKAGE.

a. Service Brake Linkage Removal.

(1) EQUIPMENT.

PLIERS

(2) PROCEDURE.

(a) Remove Brake Linkage.

PLIERS.

Remove the three cotter keys from the yoke pins in the bell crank on the master cylinder (pliers). Remove the yoke pins and remove the bell crank. Remove the cotter key from the yoke pin on the brake pedal (pliers). Remove the yoke pin and then the brake rod.

b. Service Brake Linkage Installation.

(1) EQUIPMENT.

PLIERS

(2) PROCEDURE.

(a) Install Brake Linkage.

PLIERS

Place the brake rod on to the brake pedal and enter the yoke pin into the yoke and brake pedal. Lock the yoke pin with a cotter key (pliers).

Slide the bell crank into position on the master cylinder. Insert the three yoke pins into the rod yokes and bell crank and lock the yoke pins with three cotter keys (pliers).

c. Hydraulic Brake Line and Bracket Removal.

(1) EQUIPMENT.

HAMMER
SCREWDRIVER
WRENCH, box, 7/16-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 5/8-in.

(2) PROCEDURE.

(a) Remove Hydraulic Line from Hydrovac Power Cylinder to Rear Brake Hose.

SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 5/8-in.

Disconnect the line nut (7/16-in. open-end wrench) at the bottom of the hydrovac power cylinder. Loosen the three clips (screwdriver and 7/16-in open-end wrench) holding the copper tubing to the frame. Disconnect the hydraulic line at the rear flexible hose (5/8-in. and 7/16-in. open-end wrenches). NOTE: Be careful when removing the connections, that the lines are not twisted. Remove the hydraulic line from the clips in the frame.

(b) Remove Rear Brake Hose.

HAMMER
WRENCH, open-end, 5/8-in.

Remove the clip from the brake hose at the rear hose bracket by tapping the brake hose clip toward the top (hammer). Remove the brake hose at the axle tee by turning hose nut to the left (5/8-in. open-end wrench).

(c) Remove Hydraulic Line from Rear Axle Tee to Right Rear Wheel Cylinder.

WRENCH, open-end, 7/16-in.

Disconnect the line (7/16-in. open-end wrench) at the rear axle tee and at the right rear brake cylinder. Remove the hydraulic line.

(d) Remove Hydraulic Line from Rear Axle Tee to Left Rear Wheel Cylinder.

WRENCH, open-end, 7/16-in.
WRENCH, open-end, 5/8-in.

Disconnect the line at the rear axle tee and at the left rear wheel cylinder (7/16-in. open-end wrench). Loosen the two clips on the rear axle housing (7/16-in. open-end wrench and 5/8-in. open-end wrench). Remove the hydraulic line from the clips. NOTE: It is not necessary to remove the clips to allow hydraulic line removal.

(e) Remove Hydraulic Line from Hydrovac Power Cylinder to Front Brake Hose Bracket.

SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 5/8-in.

Loosen the tube nut (7/16-in. open-end wrench) at the top rear connection of the hydrovac power cylinder. Loosen the six clips, holding the hydraulic line to the frame (screwdriver and 7/16-in. open-end wrench), two clips on the cross member and four on the right frame side member. Loosen the tube nut (7/16-in. open-end wrench and 5/8-in. open-end wrench) connecting the hydraulic line to the front brake hose. While removing the tube nut, hold the brake hose from twisting with the 5/8-in. open-end wrench. Turn the clips to free the hydraulic line and remove from the chassis. This brake line is 176-in. long.

(f) Remove Brake Hose from Front Frame Bracket to Front Axle Tee.

HAMMER **WRENCH** open-end, 5/8-in.

Tap the brake hose clip toward the top at the brake hose front frame bracket (hammer) and remove same. Remove the hose from the frame bracket. Loosen the brake hose at the front axle tee (5/8-in. open-end wrench). Remove the hose.

(g) Remove Hydraulic Line from Front Axle Tee to Right Front Wheel.

WRENCH, open-end, 7/16-in. **WRENCH**, open-end, 5/8-in.

Loosen the tube nut (7/16-in. open-end wrench) at the front axle tee. Hold the right brake hose (5/8-in. open-end wrench) from turning and loosen the tube nut at the hose connection (7/16-in. open-end wrench). Remove the hydraulic line. This line is 24-in. long.

(h) Remove Right Front Brake Hose.

HAMMER **WRENCH**, open-end, 5/8-in.

Tap the brake hose clip (hammer) toward the top and remove clip. Remove the brake hose from the bracket. Loosen the brake hose at the wheel cylinder connection (5/8-in. open-end wrench) and remove the hose. This hose is 14-in. long.

(i) Remove Right Front Axle Hose Bracket.

WRENCH, open-end, 3/4-in.

Loosen and remove the axle ball cap screw and lock washer (3/4-in. open-end wrench) holding the brake hose bracket. Remove the bracket.

(j) Remove Hydraulic Line from Front Axle Tee to Left Front Wheel Hose Bracket.

WRENCH, open-end, 7/16-in. **WRENCH**, open-end, 5/8-in.

Loosen the clip on the axle housing (7/16-in. open-end wrench) holding the hydraulic line to the axle housing. Loosen the tube nut (7/16-in. open-end wrench) at the axle housing tee connection. Hold the left front brake hose (5/8-in. open-end wrench) from turning and loosen the tube nut at the hose connection (7/16-in. open-end wrench). Remove the hydraulic line. This line is 42 1/2-in. long.

(k) Remove Left Front Brake Hose.

HAMMER
WRENCH, open-end, 5/8-in.

Tap the brake hose clip (hammer) toward the top and remove. Remove the brake hose from the bracket. Loosen the brake hose at the wheel cylinder connection (5/8-in. open-end wrench) and remove the hose. This hose is 14-in. long.

(l) Remove Left Front Hose Bracket.

WRENCH, open-end, 3/4-in.

Loosen and remove the axle ball cap screw and lock washer (3/4-in. open-end wrench) holding the brake hose bracket and remove the bracket.

(m) Remove Front Frame Hose Bracket.

WRENCH, box, 7/16-in.
WRENCH, open-end, 7/16-in.

Remove the three bolts, nuts, and lock washers (7/16-in. open-end wrench and 7/16-in. box wrench) holding the bracket to the frame side member. Remove the bracket.

(n) Remove 5/16-in. Pressure Line from Master Cylinder to Hydrovac Power Cylinder.

SCREWDRIVER
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 7/16-in.

Loosen the tube nut (1/2-in. open-end wrench) on the 5/16-in. pressure line connected to the master cylinder. This is the pressure line next to the frame side channel. Loosen the tube nut (1/2-in. open-end wrench) on the 5/16-in. pressure line connected to the hydrovac cylinder. Loosen the two clips (screwdriver and 7/16-in. open-end wrench) holding the pressure line to the frame. Turn the clips from the pressure line and remove line. This pressure line is 72-in. long.

(o) Remove 1/4-in. Pressure Line from Master Cylinder to Hydrovac Cylinder.

SCREWDRIVER
WRENCH, open-end, 7/16-in.

Loosen the tube nut (7/16-in. open-end wrench) on the 1/4-in. pressure line connected to the master cylinder. Loosen the tube nut (7/16-in. open-end wrench) on the 1/4-in. pressure line connected to the hydrovac cylinder. Loosen the two clips holding the line to side channel, turn them from the pressure line (7/16-in. open-end wrench and screwdriver) and remove the pressure line from the chassis. This pressure line is 74-in. long.

d. Tube Cutting and Flaring (fig. 76).

(1) EQUIPMENT.

TOOL, flaring.

(2) PROCEDURE.

(a) Tube Cutting (A—fig. 76). Simply place the copper, brass, or block tin tubing (A) in the "V" (B) of the tool. Then, turn the wheel

handle (C) until the cutting wheel (D) rests rather heavily on the tubing. Turn the tool completely around the pipe and at the end of the revolution, turn down the wheel handle (C) a little more. Repeat the above operation until the pipe is cut completely through. Only three or four turns of the tool are necessary to effect a clean flawless cut. When tubing is not to be flared, ream out end of tubing with reamer on end of tube cutter.

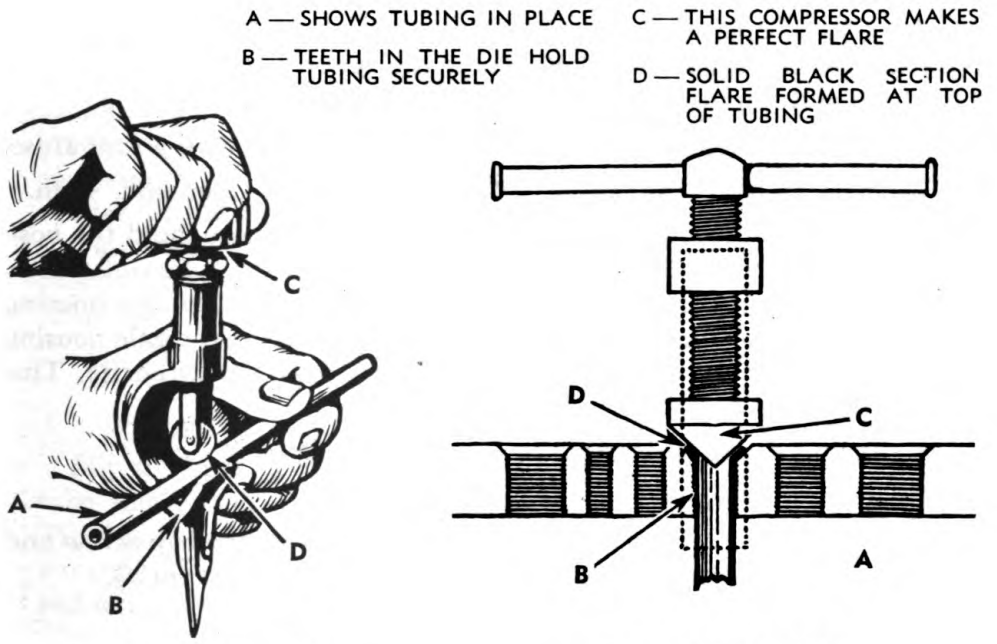

Figure 76—Tube Cutting and Flaring

(b) Tube Flaring (B—fig. 76). It is a matter of utmost simplicity to make perfect flares with the flaring tool. Loosen the two wing nuts which will permit the separation of the two halves of the tool. Insert the copper, brass, or block tin tubing into the die of the corresponding size so that it is approximately level with the top of the die. Tighten wing nuts, put a drop of oil on compressor "C" and place yoke over bars of tool, so that beveled end of compressor "C" is over the tubing. Turn the compressor screw down firmly, which will give a 45 degree flare.

e. Hydraulic Brake Line and Bracket Installation.

(1) EQUIPMENT.

HAMMER	WRENCH, open-end, 7/16-in.
SCREWDRIVER	WRENCH, open-end, 1/2-in.
WRENCH, box, 7/16-in.	WRENCH, open-end, 5/8-in.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

(2) PROCEDURE.

(a) Install Left Front Brake Hose Bracket.

WRENCH, open-end, 3/4-in.

Place the bracket on the left front axle ball, insert the cap screw and lock washer, and tighten (3/4-in. open-end wrench).

(b) Install Left Front Brake Hose.

HAMMER WRENCH, open-end, 5/8-in.

Connect and tighten the plain end of the brake hose to the wheel cylinder (5/8-in. open-end wrench). Enter the slotted end of the brake hose into the brake hose bracket. Enter the brake hose clip in the slots of the hose and tap into place (hammer). This hose is 14-in. long.

(c) Install Hydraulic Line from Front Axle Tee to Left Front Hose.

WRENCH, open-end, 7/16-in. WRENCH, open-end, 5/8-in.

Connect the hydraulic line to the left front brake hose, hold the hose (5/8-in. open-end wrench) from turning, and tighten the tube nut (7/16-in. open-end wrench). Connect and tighten the tube nut at the axle housing tee connection (7/16-in. open-end wrench). Slip the clip on the axle housing over the hydraulic line and tighten same (7/16-in. open-end wrench). This line is 42 1/2-in. long.

(d) Install Right Front Axle Brake Hose Bracket.

WRENCH, open-end, 3/4-in.

Place the bracket on the right front axle ball, insert the cap screw and lock washer, and tighten the cap screw (3/4-in. open-end wrench).

(e) Install Right Front Brake Hose.

HAMMER WRENCH, open-end, 5/8-in.

Connect and tighten the plain end of the brake hose to the wheel cylinder connection (5/8-in. open-end wrench). Enter the slotted end of the brake hose into the brake hose bracket. Place the brake hose clip in the slots on the hose coupling and tap in place (hammer). This hose is 14-in. long.

(f) Install Hydraulic Line from Front Axle Tee to Right Hand Brake Hose.

WRENCH, open-end, 7/16-in. WRENCH, open-end, 5/8-in.

Connect the hydraulic line to the right front brake hose, hold the brake hose (5/8-in. open-end wrench) from turning, and tighten the tube nut (7/16-in. open-end wrench). Connect and tighten the tube nut at the axle housing tee (7/16-in. open-end wrench). This hydraulic line is 24-in. long.

(g) Install Hose Bracket in Right Side of Frame.

WRENCH, box, 7/16-in. WRENCH, open-end, 7/16-in.

Place the bracket onto the frame and attach with the three bolts, nuts, and lock washers (7/16-in. open-end wrench and 7/16-in. box wrench).

BRAKES

(h) Install Brake Hose from Front Frame Bracket to Front Axle Tee.

HAMMER **WRENCH**, open-end, 5/8-in.

Connect and tighten the plain end of the brake hose to the front axle tee (5/8-in. open-end wrench). Enter the slotted end through the frame hose bracket. Slip the brake hose clip into the slots of the brake hose and tap in place (hammer). This hose is 14-in. long.

(i) Install Hydraulic Line from Hydrovac Power Cylinder to Front Frame Bracket.

SCREWDRIVER **WRENCH**, open-end, 5/8-in.
WRENCH, open-end, 7/16-in.

Slide the hydraulic line into place on the inside of the right frame channel. Connect the line and then hold the hose at the front frame hose bracket (5/8-in. open-end wrench) and tighten the tube nut (7/16-in. open-end wrench). Tighten the tube nut on the other end to the top rear connection of the hydrovac power cylinder (7/16-in. open-end wrench). Slip the six clips (two on the cross member and four on the frame side channel) over the hydraulic line and tighten securely (screwdriver and 7/16-in. open-end wrench). This line is 176-in. long.

(j) Install Hydraulic Line from Rear Axle Tee to Left Rear Wheel Cylinder.

WRENCH, open-end, 7/16-in. **WRENCH**, open-end, 5/8-in.

Slip the clips on the axle housing over the hydraulic line. Tighten the tube nut (7/16-in. open-end wrench) to the wheel cylinder connection. Tighten the opposite tube nut to the rear axle tee (7/16-in. open-end wrench). Tighten the two clips (7/16-in. open-end wrench and 5/8-in. open-end wrench). This line is 43 1/4-in. long.

(k) Install Hydraulic Line from Rear Axle Tee to Right Rear Wheel Cylinder.

WRENCH, open-end, 7/16-in.

Place the hydraulic line in its proper position on the rear axle housing. Connect and tighten the tube nut to the wheel cylinder connection (7/16-in. open-end wrench). Connect and tighten the tube nut at the rear axle tee (7/16-in. open-end wrench). This line is 19 3/4-in. long.

(l) Install Brake Hose.

HAMMER **WRENCH**, open-end, 5/8-in.

Connect and tighten the end without the slot onto the rear axle tee (5/8-in. open-end wrench). Enter the slotted end through the rear hose bracket. Connect the hose at the rear hose bracket by tapping the brake hose clip into the slot of the hose connection (hammer). This hose is 21-in. long.

(m) Install Rear Hose Bracket in Right Frame Channel.

WRENCH, box, 7/16-in. **WRENCH**, open-end, 7/16-in.

Place the hose bracket onto the right frame channel. Tighten hose bracket securely with the three bolts, nuts, and lock washers (7/16-in. open-end wrench and 7/16-in. box wrench).

(n) Install Hydraulic Line from Rear Hose Bracket to Hydrovac Power Cylinder.

SCREWDRIVER
WRENCH, open-end, 5/8-in.
WRENCH, open-end, 7/16-in.

Slide the hydraulic line from the rear along the right frame channel and under the bottom end of the fourth cross member. Connect the hydraulic line to the fittings of the hydrovac power cylinder and rear hose bracket. Tighten the tube nut on the fitting of the hydrovac power cylinder (7/16-in. open-end wrench). Tighten the tube nut at the rear hose bracket connection (7/16-in. open-end wrench and 5/8-in. open-end wrench). Slip the three clips over the hydraulic line and tighten them thoroughly (screwdriver and 7/16-in. open-end wrench). Two of the clips are on the cross member and one on the frame side member. This hydraulic line is 69-in. long.

(o) Install 1/4-in. Pressure Line from Master Cylinder to Hydrovac Power Cylinder.

SCREWDRIVER
WRENCH, open-end, 7/16-in.

Slide the 1/4-in. pressure line into position in left frame side channel. Connect and tighten the tube nut (7/16-in. open-end wrench) to the master cylinder connection farthest away from frame. Connect the tube nut (7/16-in. open-end wrench) to the hydrovac cylinder (second connection from front). Slide the two clips in the frame side channel over the pressure tube and tighten securely (screwdriver and 7/16-in. open-end wrench). This line is 74-in. long.

(p) Install 5/16-in. Pressure Line Master Cylinder to Hydrovac Cylinder.

SCREWDRIVER
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 7/16-in.

Slide the 5/16-in. pressure line into position in the left frame channel. Connect and tighten the tube nut (1/2-in. open-end wrench) to the master cylinder connection nearest frame. Connect and tighten the tube nut (1/2-in. open-end wrench) to the hydrovac cylinder connection (first connection from front). Slide the two clips in the frame side channel over the pressure line. Tighten clips securely (screwdriver and 7/16-in. open-end wrench).

66. PARKING BRAKE

a. Parking Brake Removal.

(1) EQUIPMENT.

HAMMER, 1 lb
PLIERS
SCREWDRIVER, 4-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 7/8-in.
WRENCH, open-end, 1 1/16-in.

(2) PROCEDURE.

(a) Remove Brake Anchor Adjusting Screw.

PLIERS — SCREWDRIVER, 4-in.

Remove lock wire (pliers) and the adjusting screw (screwdriver) from the brake anchor.

(b) Disconnect Brake Rod.

HAMMER, 1 lb — PLIERS

Remove cotter pin (pliers) from the brake rod end pin. Drive the brake rod end pin from brake rod end and from cam lever (hammer).

(c) Disconnect Brake Spacer Link.

WRENCH, open-end, 11/16-in. — WRENCH, open-end, 3/4-in.

Remove brake spacer link from frame cross member by holding head (3/4-in. open-end wrench) of brake spacer link shoulder screw and loosening nut (11/16-in. open-end wrench), remove nut and lock washer, and remove shoulder screw.

(d) Remove Brake Adjusting Screw.

PLIERS — WRENCH, open-end, 7/8-in.

Remove cotter pin (pliers) from lower end of adjusting bolt. Remove two nuts (7/8-in. open-end wrench) and remove the flat washer and spring. Pull the brake adjusting screw from the brake band and remove the spring between the brake band ends.

(e) Remove Lower Band Adjusting Screw.

SCREWDRIVER — WRENCH, open-end, 7/16-in.

Remove the lock nut from the fillister head machine screw (7/16-in. open-end wrench and screwdriver). Remove the nut from the adjusting screw (screwdriver and 7/16-in. open-end wrench). Pull the adjusting screw out from the bottom.

(f) Remove Brake Band.

HAMMER

Tap the band slightly (hammer) removing same from the brake band support stud. Remove the brake band by sliding it over the alinement joint shaft.

b. Parking Brake Installation.

(1) EQUIPMENT.

HAMMER, 1 lb
SCREWDRIVER, 4-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 7/8-in.

(2) PROCEDURE.

(a) Install Band on Support Stud.

HAMMER

Place brake band anchor spring in hole of brake band support stud.

Slip band around alinement shaft and tap into position (hammer) over band support stud; be careful that coil spring remains in position.

(b) Install Lower Band Adjusting Screw.

SCREWDRIVER — WRENCH, open-end, 7/16-in.

Place screw up through hole at bottom of band and adjust (screwdriver and 7/16-in. open-end wrench) for 1/8-in. clearance between band and drum.

(c) Install Brake Adjusting Bolt.

PLIERS — WRENCH, open-end, 7/8-in.

Place adjusting bolt through from the top, inserting the cut washer between top of band and head of bolt. Place one of the brake release springs on bolt between top of adjusting bolt guide and brake band end. Place another spring on bolt under adjusting bolt guide and above lower end of band, place adjusting bolt spring under lower end of band, follow with cut washer, replace the two 1/2-in. nuts, and adjust (7/8-in. open-end wrench) to 1/16-in. clearance between brake drum and band. Tighten lock nut (7/8-in. open-end wrench). Install cotter key in lower end of adjusting bolt (pliers).

(d) Install Brake Spacer Link.

WRENCH, open-end, 3/4-in.

Enter brake spacer link shoulder bolt and tighten (3/4-in. open-end wrench).

(e) Install Brake Rod.

PLIERS

Place brake rod end between two sides of brake cam lever, line up holes, and install brake rod end pin. Enter cotter key in pin (pliers).

(f) Install Brake Anchor Clip Adjusting Screw.

PLIERS — SCREWDRIVER, 4-in.

Enter adjusting screw in brake band support stud and adjust (screwdriver) brake band to 1/16-in. clearance. Wide adjusting screw (pliers) securely in place.

(g) Adjusting Parking Brake. Refer to paragraph 60 f in Brake System Maintenance and Adjustment.

c. Parking Brake Drum Removal.

(1) EQUIPMENT.

HAMMER, 1 lb	WRENCH, open-end, 7/16-in.
HANDLE, socket	WRENCH, open-end, 9/16-in.
PLIERS	WRENCH, open-end, 3/4-in.
PULLER, gear, No. 7167	WRENCH, open-end, 7/8-in.
SCREWDRIVER	WRENCH, socket, 1 5/8-in.

(2) PROCEDURE.

(a) Remove Parking Brake Band (par. 66 a).

HAMMER, 1 lb	WRENCH, open-end, 7/16-in.
PLIERS	WRENCH, open-end, 3/4-in.
SCREWDRIVER, 4-in.	WRENCH, open-end, 7/8-in.

(b) Disconnect Rear Companion Flange of Alinement Joint.

WRENCH, open-end, 9/16-in.

Remove the eight nuts, lock washers, and bolts (9/16-in. open-end wrench) holding the rear companion flanges together.

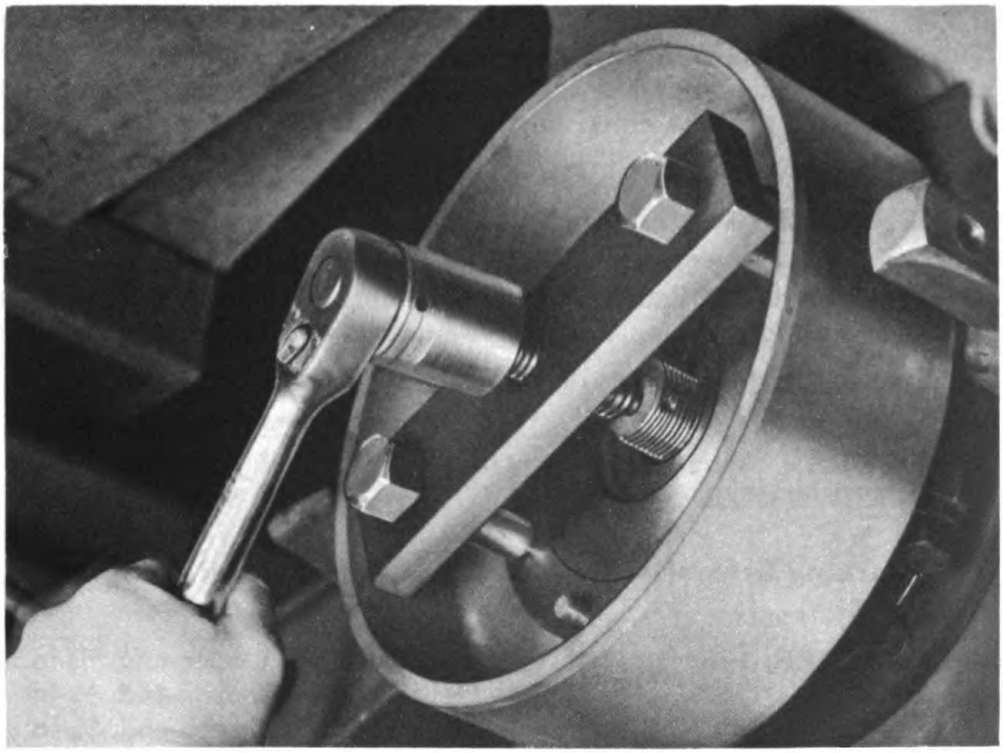

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Figure 77—Pulling Parking Brake Drum

(c) Remove Companion Flange from Transfer Mainshaft (fig. 77).

HANDLE, socket
PLIERS
PULLER, No. 7167
WRENCH, socket, 1 5/8-in.

Remove cotter key (pliers) from lock nut in mainshaft. Remove nut (1 5/8-in. socket wrench and socket handle) from mainshaft. Pull the companion flange (No. 7167 puller) from the transfer mainshaft. The brake drum will come off with the companion flange (fig. 77).

d. Parking Brake Drum Installation.

(1) EQUIPMENT.

HAMMER, 1 lb
HANDLE, socket
PLIERS
SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 7/8-in.
WRENCH, socket, 1 5/8-in.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

(2) PROCEDURE.

(a) Install Brake Drum and Companion Flange on Transfer Mainshaft.

HAMMER
HANDLE, socket
PLIERS
WRENCH, socket, 1⅝-in.

Place the brake drum on the mainshaft and then enter the companion flange keyway in key on mainshaft and then drive (hammer) the flange into position. Place a nut and tighten securely (1⅝-in. socket wrench and socket handle). Enter a cotter key in mainshaft nut (pliers).

(b) Connect Companion Flanges and Brake Drum.

WRENCH, open-end, 9/16-in.

Insert the eight bolts through the holes in the brake drum, the transfer mainshaft companion flange, and the alinement shaft rear flange. Place lock washers and nuts and tighten (9/16-in. open-end wrench).

(c) Replace Parking Brake Band Assembly (par. 66 b).

HAMMER, 1 lb
PLIERS
SCREWDRIVER, 4-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, ¾-in.
WRENCH, open-end, ⅞-in.

e. Parking Brake Controls and Linkage Removal.

(1) EQUIPMENT.

HAMMER, 1 lb
PLIERS
SCREWDRIVER, 4-in.
WRENCH, open-end, ½-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, ¾-in.
WRENCH, open-end, ⅞-in.

(2) PROCEDURE.

(a) Remove Brake Adjusting Bolt (par. 66 a (2) *(d)*).

PLIERS
WRENCH, open-end, ⅞-in.

(b) Disconnect Brake Spacer Link (par. 66 a (2) *(c)*).

WRENCH, open-end, ¾-in.

(c) Remove Floor Boards.

WRENCH, open-end, ½-in.

Remove six bolts and washers (½ degree open-end wrench) securing floor boards to cab frame. Remove the rear board first.

(d) Remove Hand Brake Lever.

PLIERS
WRENCH, open-end, 9/16-in.

Remove cotter key from brake rod end (pliers), remove brake rod end pin, and then the brake rod. Remove two cap screws and lock washers (9/16-in. open-end wrench) that hold brake lever to right side of transmission case.

f. Parking Brake Controls and Linkage Installation.

(1) EQUIPMENT.

HAMMER, 1 lb
PLIERS
SCREWDRIVER, 4-in.
WRENCH, open-end, ½-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, ¾-in.
WRENCH, open-end, ⅞-in.

(2) PROCEDURE.

(a) Install Brake Adjusting Bolt (par. 66 b (2) *(c)*).

PLIERS
WRENCH, open-end, ⅞-in.

(b) Install Hand Brake Lever.

PLIERS
WRENCH, open-end, 9/16-in.

Connect hand lever to right side of transmission case with two bolts (9/16-in. open-end wrench). Place brake rod end pin through rod and lower hole in lever. Enter cotter key (pliers).

(c) Install Floor Boards.

WRENCH, open-end, ½-in.

Place floor boards into position in cab, beginning with the front board. Secure boards to cab frame with six bolts and plain washers (½-in. open-end wrench).

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Section XVIII

CLUTCH

67. CLUTCH DESCRIPTION AND TABULATED DATA.

a. Clutch Description. The clutch is a single dry disk type. It is controlled by the clutch pedal and used to transmit power from the engine to transmission.

b. Clutch Operation.

(1) The clutch provides a means of engaging and disengaging the engine from the transmission and other drive units for starting, shifting gears, and stopping the vehicle. This type of clutch is known as a "push" clutch, which means that when the clutch pedal is released it pushes the release bearing in toward the flywheel and relieves the driven plate. The clutch uses only one pressure spring and as this spring does not come in contact with the hot pressure plate, there is no loss of spring pressure due to heat.

(2) The hinged levers are provided with raised edges, which, because of their fanlike action, force cooling air through the clutch spring and into the clutch. All levers bear against the pressure plate on continuous, circular fulcrum. This provides a uniform pressure and assures that the movement of the pressure plate toward the flywheel will be in a place parallel to the friction face of the flywheel itself. This arrangement also makes it possible for the clutch to pick up the driven plate smoothly.

(3) The clutch should be fully engaged while driving, and the driver should never drive with his foot on the pedal, as this will cause clutch slippage and premature wear. The clutch should be engaged or "let in" gradually and not suddenly. A well-adjusted clutch takes hold gradually, will not slip, and releases instantly when the pedal is depressed.

c. Clutch Tabulated Data.

Make	W. C. Lipe, Inc.
Type	Single plate
Size	13-in.
Facings:	
Area—sq in. (total)	178 sq in.
Outside diameter	12⅞ in.
Inside diameter	7¼ in.
Thickness	9/64 in.
Number of adjusting shims	6 per stud, 24 total
Thickness of shims	0.015 in.

CLUTCH

68. CLUTCH TROUBLE SHOOTING.

a. Clutch Slips.

Possible Cause	Possible Remedy
Clutch pedal does not have proper floor board clearance.	Adjust pedal (par. 69 c (2) *(h)*).
Oily or greasy clutch facings.	Clean pressure plate or install new clutch disk (pars. 70 and 71).
Worn clutch facings.	Install new clutch disk assembly (pars. 70 and 71).
Warped clutch disc.	Install new clutch disk assembly (pars. 70 and 71).
Weak or broken clutch spring.	Replace complete clutch assembly (pars. 70 and 71).
Warped clutch pressure plate.	Replace complete clutch assembly (pars. 70 and 71).

b. Clutch Drags.

Oily or greasy clutch facings.	Clean pressure plate or install new clutch disk (pars. 70 and 71).
Warped clutch disk.	Install new clutch disk assembly (pars. 70 and 71).
Dry or defective clutch release bearing.	If dry, grease release bearing (refer to Lubrication (section VI)); if defective, replace complete clutch (pars. 70 and 71) or notify higher authority.
Flywheel bearing may be dry or damaged.	Replace bearing (pars. 70 and 71).

c. Noisy Clutch.

Dry clutch release bearing.	Grease release bearing sparingly (refer to Lubrication (section VI)).
Dry or damaged flywheel pilot bearing.	Replace bearing (pars. 70 and 71).

69. CLUTCH MAINTENANCE AND ADJUSTMENTS.

a. Clutch Maintenance. The clutch release bearing and release shafts should be lubricated sparingly once every 1,000 miles. Refer to Lubrication Guide in section VI for location of grease fittings.

b. When to Make a Clutch Adjustment. Never wait for a clutch to slip before adjusting it. Then, it is too late to make an adjustment, because facings quickly disintegrate once they become burned through slippage, and are short-lived thereafter. As the facings wear, the clutch sleeve moves toward the release bearing and the sleeve (clutch in engaged position). This reduced clearance will result in a reduction of the pedal "lash" which is defined as the first easy movement of the clutch

pedal. When the "lash" of the clutch pedal is reduced to approximately ½ inch, the clutch should be adjusted immediately.

c. Clutch Adjustment.

(1) EQUIPMENT.

EDGE, straight	SCREWDRIVER
HANDLE, ratchet	WRENCH, open-end, ½-in.
PLIERS, sharp-nosed	WRENCH, open-end, ⅞-in.
PULLER, cotter pin	WRENCH, socket, 9/16-in.
SCALE, 6-in.	

(2) PROCEDURE.

(a) Blocking Clutch Pedal. Block the pedal in released position (A—fig. 78). This is necessary because otherwise the adjusting straps and studs may become bent or the threads of the stud or nut may become stripped.

(b) Loosen Adjusting Nuts.

HANDLE, ratchet	WRENCH, socket, 9/16-in., and ratchet handle

Back off the adjusting nuts five full turns each (9/16-in. socket wrench and ratchet handle). There are four adjusting strap nuts.

(c) Shim Clearance. Engage the clutch by removing the block (C, fig. 78). This will permit the adjusting plate to move out of contact with the adjusting shims.

(d) Shim Removal.

PLIERS, sharp-nosed	PULLER, cotter pin

Remove one shim from under each of the adjusting straps with sharp-nosed pliers, or insert cotter pin puller in small hole of shim (D, fig. 78). Be sure no portion of the shim is left between the adjusting plate and flywheel ring; also, that the same number of shims are removed from under each strap. A good practice is to recheck after adjustment to be sure that the same number of shims are left under each strap. One shim removed from each strap reduces dimension A (B, fig. 79) one 3/32 of an inch.

(e) Clutch Straps Adjusted (A, fig. 79).

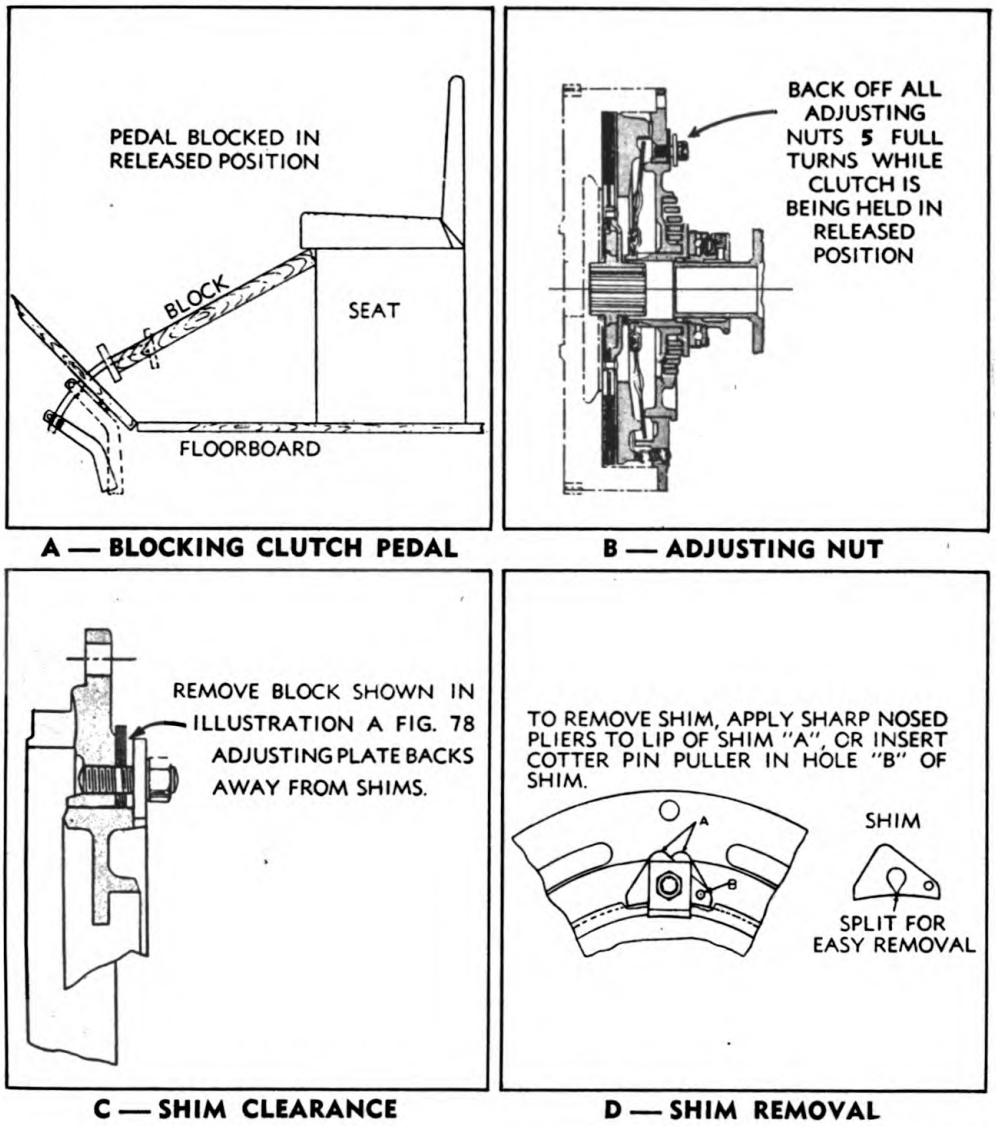
HANDLE, ratchet	WRENCH, socket, 9/16-in.

Release the clutch as in (A, fig. 78) by blocking pedal in released position. Then tighten all adjusting strap nuts (9/16-in. socket wrench and ratchet handle).

(f) Checking Clutch Clearance (B, fig. 79).

EDGE, straight	SCALE, 6-in.

Measure the distance (6-in. scale) from machined surface which supports the shims to face of clutch sleeve, against which the release bearing acts (see dimension A in B, fig. 79). Dimension A should be 1 inch, plus 1/16 inch, minus 0. This measurement can be done by means of a straight



A — BLOCKING CLUTCH PEDAL

B — ADJUSTING NUT

C — SHIM CLEARANCE

D — SHIM REMOVAL

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Figure 78—Clutch Adjustments

edge and scale, or with two scales holding the straight edge in place by pushing the release bearing into contact with straight edge.

(g) Release Bearing Clearance (C, fig. 79).

When the distance "A" (B, fig. 79) from the machined surface supporting the shims to the face of the clutch sleeve is correct, check the distance from the release bearing to the clutch sleeve (C, fig. 79). This should not be less than ⅛ inch and not more than 5/32 inch. It may be necessary to adjust the pedal linkage to obtain the proper clearance of ⅛ inch or 5/32 inch, because of wear or improper initial adjustment; otherwise, do not adjust the pedal linkage.

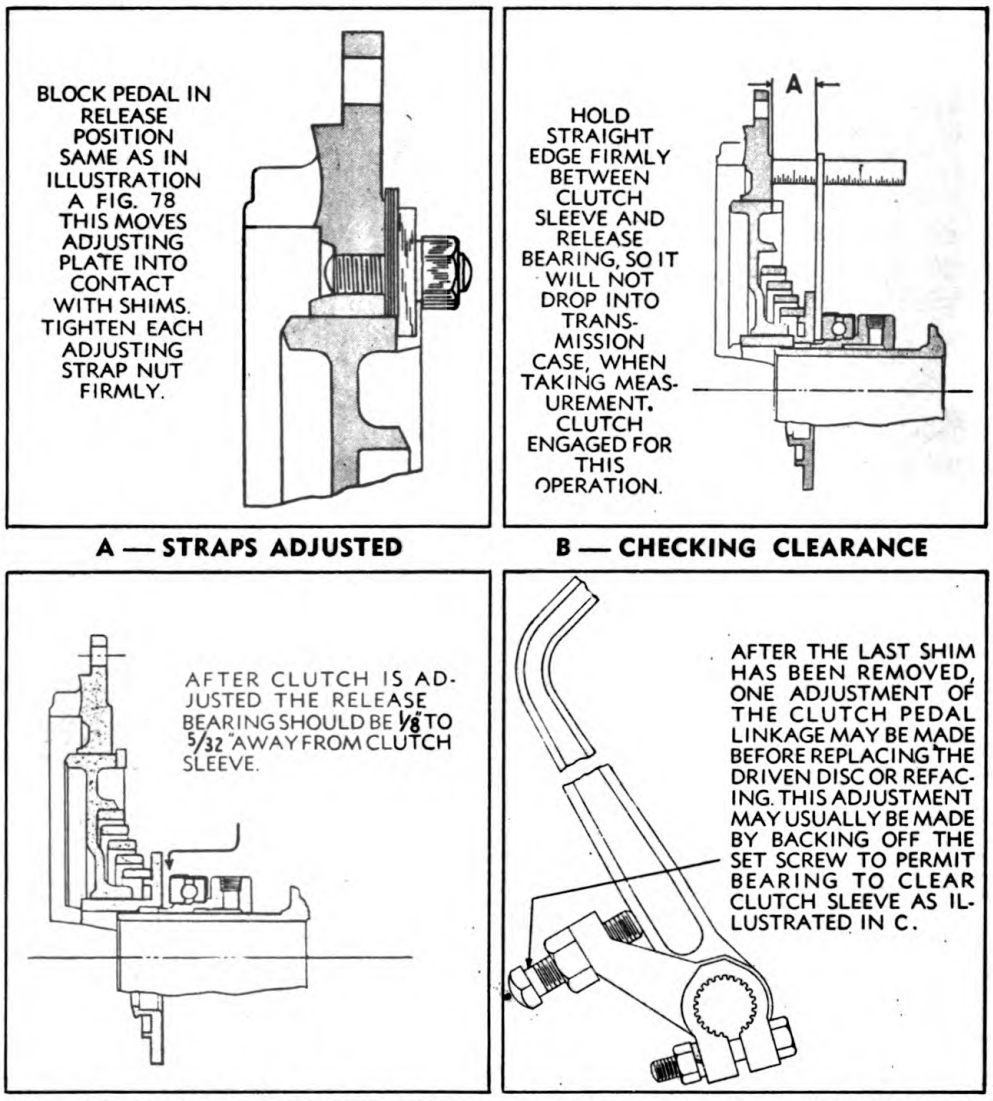

Figure 79—Clutch and Pedal Adjustments

(h) Clutch Pedal Adjustment (D, fig. 79).

WRENCH, open-end, 7/8-in. WRENCH, open-end, 1/2-in.

After all shims have been removed, it is possible to make one pedal adjustment (D, fig. 79). However, we would advise against doing this and suggest instead that new facings, or preferably a new driven disk assembly, be installed. Clutch pedal floor board clearance should be 1½ inch. Adjust by loosening lock nut on clutch pedal adjusting arm assembly (½-in. open-end wrench and 7/8-in. open-end wrench) and turning the adjusting screw either in or out (½-in open-end wrench) to give 1½ inch clearance between the clutch lever and the underside of the floor board. After adjustment is made, lock adjusting screw with lock nut (7/8-in. open-end wrench and ½-in. open-end wrench).

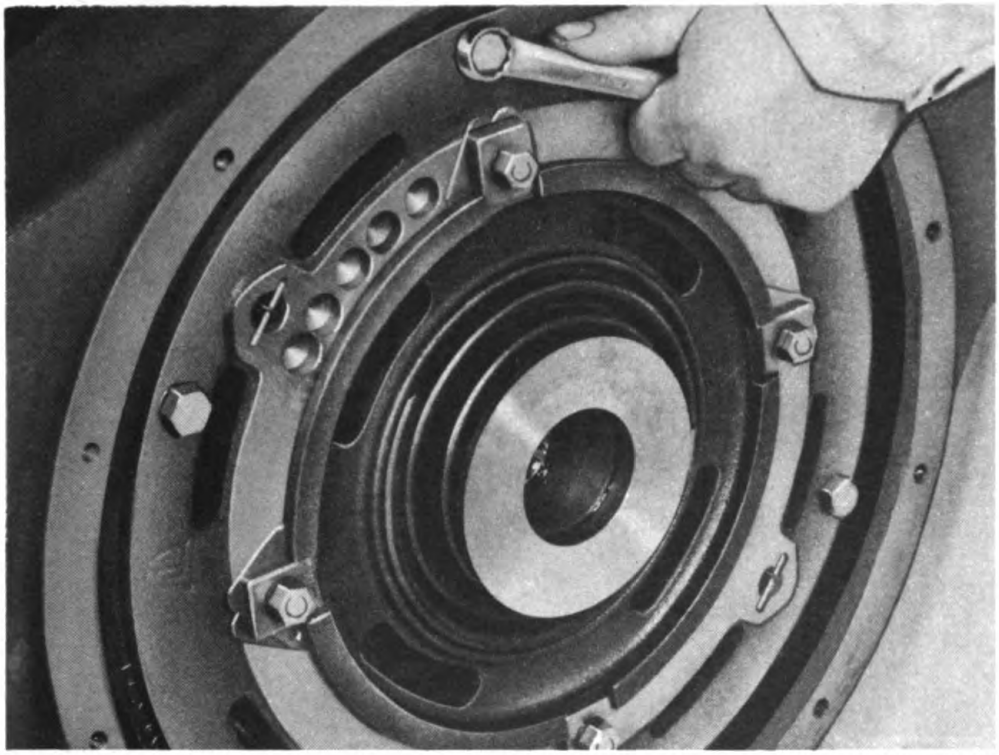

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Figure 80—Removing Clutch Bolt

70. CLUTCH REMOVAL (fig. 80).

a. Equipment.

BAR, pinch
CHAIN
HAMMER
HANDLE, ratchet
HOIST, chain
PLIERS
PULLER, bearing, No. 41-P-2951-30
SCREWDRIVER
WRENCH, box, 3/4-in.
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 3/4-in.
WRENCH, socket, 5/8-in.

b. Procedure.

(1) REMOVE TRANSMISSION, par. 153.

BAR, pinch
CHAIN
HAMMER
HOIST, chain
PLIERS
SCREWDRIVER
WRENCH, box, 3/4-in.
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 3/4-in.

(2) REMOVE CLUTCH ASSEMBLY FROM FLYWHEEL (fig. 80).

HANDLE, ratchet
WRENCH, socket, 5/8-in.

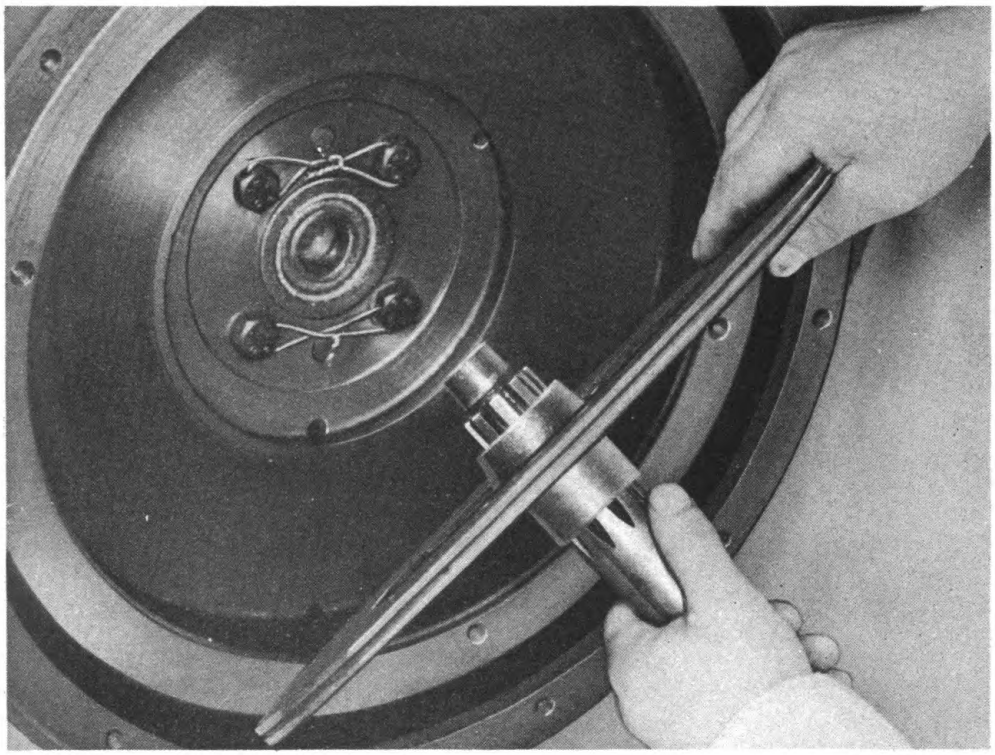

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Figure 81—Installing Clutch Disk

Remove the 12 cap bolts and lock washers (⅝-in. socket wrench and ratchet handle) that attach the clutch assembly into flywheel (fig. 80). Remove the clutch and pressure plate assembly. The clutch driven disk and facing assembly can now be lifted from flywheel.

(3) REMOVE FLYWHEEL PILOT BEARING.

PULLER, clutch pilot bearing, No. 41-P-2951-30

Place the bearing puller in the pilot bearing and pull the bearing from the flywheel (bearing puller).

71. CLUTCH INSTALLATION (fig. 81).

a. Equipment.

CHAIN
GUN, pressure
HAMMER
HANDLE, ratchet
HOIST, chain
PLIERS
PUNCH, taper
SCREWDRIVER
SHAFT, transmission drive end (used)
WRENCH, box, 9/16-in.
WRENCH, open-end, 9/16-in., (2)
WRENCH, open-end, ¾-in. (2)
WRENCH, open-end, ⅞-in.
WRENCH, socket, ⅝-in.

b. Procedure.

(1) INSTALL FLYWHEEL PILOT BEARING.

HAMMER
PUNCH, flat

Drive the flywheel pilot bearing (hammer and flat punch) into the flywheel.

(2) INSTALL CLUTCH ASSEMBLY IN FLYWHEEL.

HANDLE, ratchet
SHAFT, drive end (used)
WRENCH, socket, 5/8-in.

(a) Place clutch lining and disk assembly in flywheel with the long side of the clutch disk hub toward the rear (fig. 81).

(b) Place clutch pressure plate assembly into flywheel and start the 12 cap screws and lock washers. Enter an old drive end shaft through clutch disk hub and into the flywheel pilot bearing to center the clutch disk.

(c) Enter the 12 cap bolts and tighten evenly and securely (5/8-in. socket wrench and ratchet handle). Then remove the clutch disk alining tool (drive end shaft).

(3) INSTALL TRANSMISSION. Refer to paragraph 154 in Transmission section.

CHAIN
GUN, pressure
HAMMER
HOIST, chain
PLIERS
PUNCH, taper
SCREWDRIVER
WRENCH, box, 9/16-in.
WRENCH, open-end, 9/16-in., (2)
WRENCH, open-end, 3/4-in. (2)
WRENCH, open-end, 7/8-in.

Section XIX

COOLING SYSTEM

72. COOLING SYSTEM DESCRIPTION.

a. The cooling system consists of a radiator, fan shroud, thermostat, centrifugal water pump, fan belt, hoses and connections. The engine utilizes a pressure cooling system in which water from the bottom of the radiator is led to 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. When the engine is cold and until it reaches operating temperature, all or part of the water leaving the top of the engine is returned directly to the water pump for recirculation, effectuating a quick warm-up. The capacity of the cooling system is 23 quarts.

b. Cold Weather Suggestions.

(1) COVER THE RADIATOR. For efficient winter operation and to avoid excessive wear, covering part or all of the radiator is imperative. Temperatures given in paragraph 76 c should be maintained winter and summer. To avoid cooling system freeze-ups, a solution of denatured alcohol and water or ethylene glycol is recommended, because it is non-corrosive and will not damage the radiator, pump, or other parts.

(2) The following table gives freezing temperatures of ethylene glycol and water:

% Pure Methyl Wood Alcohol	% Denatured Wood Alcohol	% Ethylene Glycol "Prestone"	% Radiator Glycerine (G.P.A.)	Freezes at Degrees	
				°F	°C
13	17	16	37	20	- 7
20	26	25	55	10	-12
27	34	33	70	0	-18
32	40	39	81	-10	-23
37	46	44	92	-20	-29
40	53	48	100	-30	-35

COOLING SYSTEM

73. COOLING SYSTEM TROUBLE SHOOTING.

a. Overheating.

Possible Cause	Possible Remedy
(1) Lack of water.	Refill system.
(2) Loose fan and water pump belt.	Adjust belt (par. 75 **c**).
(3) Broken fan belt.	Replace belt (par. 75 **b** and **c**).
(4) Thermostat stuck closed.	Clean or replace thermostat (par. 76).
(5) Defective water pump.	Replace pump (par. 78).
(6) Clogged system.	Flush and clean (par. 74).
(7) Clogged radiator core.	Clean radiator core (par. 74). Disconnect radiator from engine, so that foreign material from core will not be deposited in engine.
(8) Incorrect timing.	Correct timing (par. 96).
(9) Defective hose.	Replace hose (par. 77 **d**).

b. Overcooling.

(1) Thermostat stuck open.	Clean or replace thermostat (par. 76).

c. Loss of Water.

(1) Defective hose.	Replace hose (par. 77 **c**).
(2) Loose connections.	Tighten connections.
(3) Loose or open drain cocks.	Tighten and check.
(4) Loose crankcase freeze out plugs.	Report to higher authority.
(5) Defective cylinder head gasket.	Replace gasket (pars. 97 and 98).
(6) Defective gasket at top water pipe.	Replace gasket (par. 76 **d** and **e**).
(7) Cracked cylinder wall or valve seat.	Replace engine (pars. 104 and 105) or report to higher authority.
(8) Defective radiator (leaks).	Seal or replace radiator (par. 77 **b** and **c**).
(9) Leak at water pump shaft packing.	Tighten gland nut or replace packing (par. 78 **b**).

d. Noise.

(1) Defective water pump.	Replace (par. 78 **d** and **e**).
(2) Loose pulleys.	Tighten.
(3) Loose fan belts.	Tighten (par. 75 **c**).
(4) Fan loose on bracket.	Tighten (par. 75 **c**).

74. COOLING SYSTEM MAINTENANCE.

a. Inspection. All hose connections should be examined frequently and replaced if they show signs of disintegration. Cylinder head bolts should be checked to see that they are tight (73 to 75 lb pull on torque

wrench) and that there are no leaks around the cylinder head. The fan belt should be inspected and if it is worn, cracked, or oil soaked, it should be replaced.

b. Cleaning the Cooling System. At least once a year the cooling system should be given a treatment with washing soda solution to remove the sludge and sediment that accumulates. The easiest way is to drain the system, measure the amount of water withdrawn, and put back half of that quantity of fresh water. Then, bring to a boil the same amount of water, and add all the common washing soda that it will dissolve. While it is still hot, add it to the cooling system to completely fill it. Run the engine as usual for 24 hours, then drain, flush thoroughly, and refill with clean water.

c. Cleaning with Acid. It will sometimes be found more convenient to shut down the engine, and dissolve the scale and sludge with an acid solution which works quicker, but must be handled with greater care. A solution of hydrochloric (commercially known as muriatic) acid mixed with equal parts of water can be introduced into the system after it has been drained, and thoroughly flushed with clear water. This should be allowed to stand in the cooling system as long as any foaming occurs. When the foaming has stopped, drain the system thoroughly, flush it with clear water, repeat the treatment. When no foaming is observed with the fresh acid solution, it indicates that the scale has completely dissolved, and the system is clean. The acid can then be drained, the system again flushed, and it is ready for service. Be sure to check all water connections and tighten them against water leaks after the engine has been running long enough to bring it up to temperature.

d. Inadequate Cooling.

(1) OVERHEATING. When an engine overheats, it is due to either one or two conditions: inadequate cooling capacity for peculiar conditions under which it is operated, or some internal change in the engine or cooling system itself. The first trouble, unless it is due to clogged or restricted air passages, is usually beyond the control of the operator; the second, directly in his hands.

(2) CHECK OIL AND WATER FIRST. This is a universal rule for safety.

(3) LACK OF CIRCULATION. If the system is full of water, the agitation observed through the radiator filler opening will indicate the amount and character of the circulation. If there is no agitation, it indicates, either complete stoppage of the system somewhere, or that the water pump is not operating. If light weight hose is used, it is possible for the lower hose, connecting the radiator and water pump, to collapse due to pump suction, and thus shut off water circulation. New hose or a brass spring slipped inside the hose will correct this trouble. After an engine has been in service for a long time, it is possible for the inner lining of the hose connections to come loose and shut off or restrict the flow of cooling water. Lack of circulation may also be caused by obstructions in the radiator due to deposits from the water used, or to oatmeal, bran, or similar material used to remedy a water leak. An obstructed radiator is

usually indicated by the tendency of the water to run out the overflow pipe whenever the system is filled with water, and the engine is running at governed top speed.

(4) LEAK STOPPERS CAUSE OVERHEATING. Do not use oatmeal, bran, or similar remedies to stop a leak. Such substances are likely to get into the water pump or its connections, and obstruct them. This will cause serious overheating.

(5) ALKALI WATER COMMON CAUSE. When an engine is used in a country where there is much alkali or lime in the water, it should be cooled with rain or distilled water, if possible. Otherwise, the cylinders will soon lime up, and when this scale becomes thick enough, the cylinders will overheat and crack. When alkali water must be used, it is advisable to use a softening treatment, such as "Scalina" or "Quick Solvent." If this is not practical, fill the system once a season, and then never change the water, and add only what is necessary to keep the system full. In this way, the minimum quantity of alkali is added, and scaling is reduced to a minimum.

(6) FAN BELT SLIPPING. A belt stretches as it is used, and unless it is adjusted to take up the slack, it will not drive the fan fast enough to properly cool the engine. Convenient means are provided to adjust the belt tension, so there should be no excuse for running with a slack belt. A properly adjusted fan belt should have one inch deflection.

(7) CARBURETOR CHOKE. The 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 mixture always heats up the engine, wastes fuel, and burns the exhaust valves. Always see that the choke valve is wide open when the engine is running. If the carburetor is improperly adjusted, it will cause heating like a partially closed choke valve.

(8) LEAKY VALVES. Leaky valves, especially the exhaust valves, will cause an engine to overheat. They become very hot due to the gas leaking past them, and then cause pre-ignition which further aggravates the trouble.

(9) LEAKY PISTON RINGS. Piston rings, which leak, permit the hot gases of the explosion to blow by, and heat up the pistons. This carries or burns the lubricant from the cylinder and piston walls. Heating the piston causes it to expand, thus reducing the clearance between it and the cylinder wall. This increases the piston friction, and with reduced lubrication, it not only causes overheating, but seriously damages the cylinders and pistons.

(10) IMPROPER SPARK TIMING. Do not run with a retarded spark. On the other hand, the engine should not be run with too much spark advance. When pre-ignition takes place, overheating follows. The bearings will also be unduly punished by the severity of the explosion.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

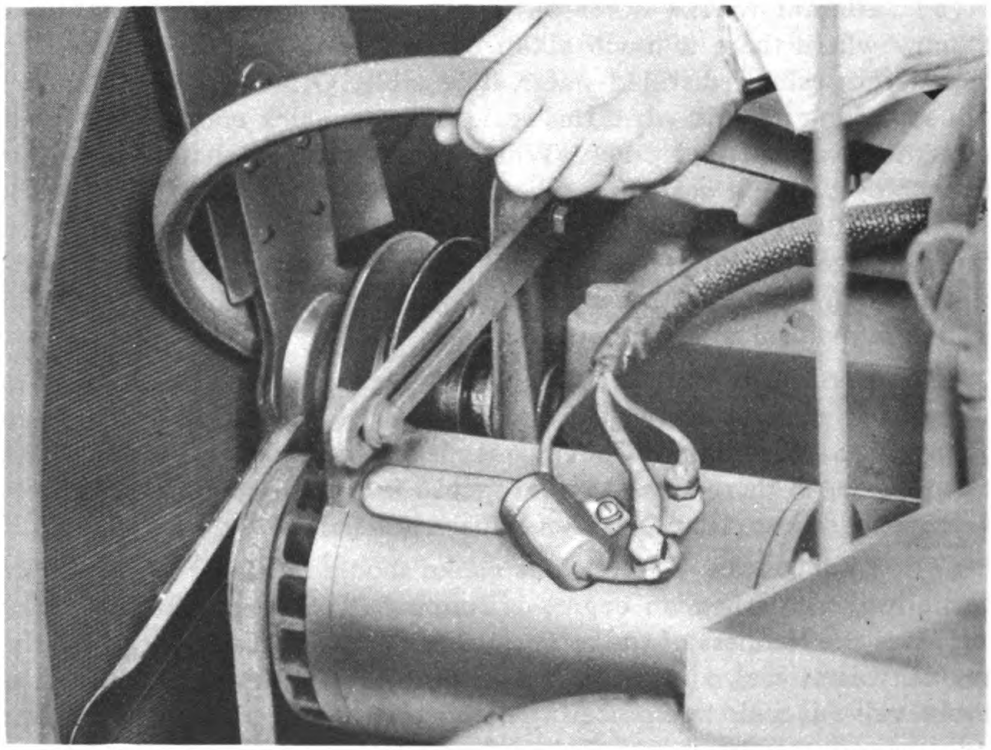
75. FAN.

a. Fan Description. The fan has four blades, and is 20 inches in diameter. It is enclosed in a shroud and driven with a single "V" type belt.

b. Fan Belt Removal.

(1) EQUIPMENT.

WRENCH, open-end, 5/8-in. WRENCH, open-end, 1 1/16-in.



RA PD 65864

Figure 82—Installing Fan Belt

(2) PROCEDURE.

(a) Loosen Fan Shaft Lock Nut.

WRENCH, open-end, 1 1/16-in.

Loosen the fan shaft lock nut at rear of fan bracket (1 1/16-in. open-end wrench).

(b) Removing Belt.

WRENCH, open-end, 5/8-in.

Lower fan pulley assembly by turning adjusting bolt (5/8-in. open-end wrench). Slip belt from lower crankshaft pulley and water pump drive pulley; then remove fan belt by slipping it between radiator core and over fan blades.

c. Fan Belt Installation (fig. 82).

(1) EQUIPMENT.

WRENCH, open-end, 5/8-in. WRENCH, open-end, 1 1/16-in.

(2) PROCEDURE.

(a) Install Belt on Pulleys. Make sure fan assembly is in its lowest adjustable position. Place one-half of belt between radiator core and fan blades and lower through shroud and around blades (fig. 82). Enter belt on crankshaft pulley first, then fan, and water pump drive shaft pulleys.

(b) Adjust Belt Tension (par. 75 c).

WRENCH, open-end, 5/8-in. **WRENCH**, open-end, 1 1/16-in.

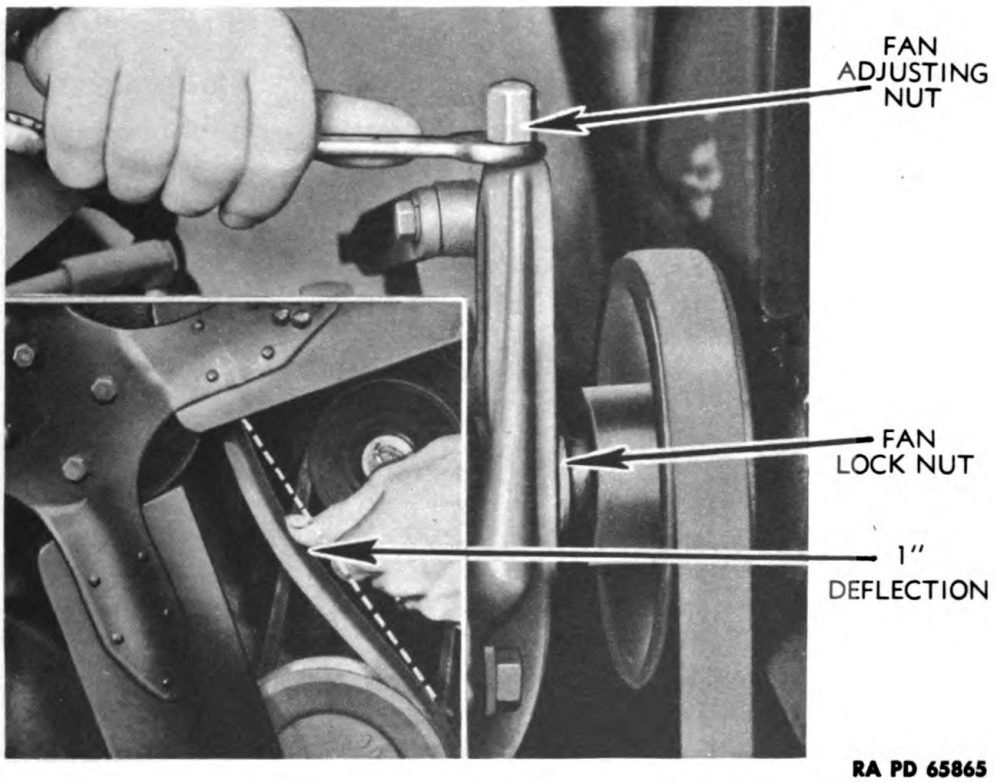


Figure 83—Adjusting Fan Belt

d. Fan Belt Adjustment (fig. 83).

WRENCH, open-end, 5/8-in. **WRENCH**, open-end, 1 1/8-in.

Loosen the lock nut on the fan spindle (1 1/8-in. open-end wrench) just enough to permit the fan assembly to be moved up or down with the adjusting bolt (fig. 83). Tighten or loosen the fan belt until there is 1-inch deflection (5/8-in. open-end wrench). Tighten the lock nut on the fan spindle securely (1 1/8-in. open-end wrench). NOTE: A fan belt should never be adjusted too tight. Too tight a belt causes excessive friction and rapid wear of the belt.

e. Fan Assembly Removal (fig. 84).

(1) EQUIPMENT.

WRENCH, open-end, 1/2-in. **WRENCH**, open-end, 3/4-in.
WRENCH, open-end, 5/8-in. **WRENCH**, open-end, 1 1/16-in.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

(2) PROCEDURE.

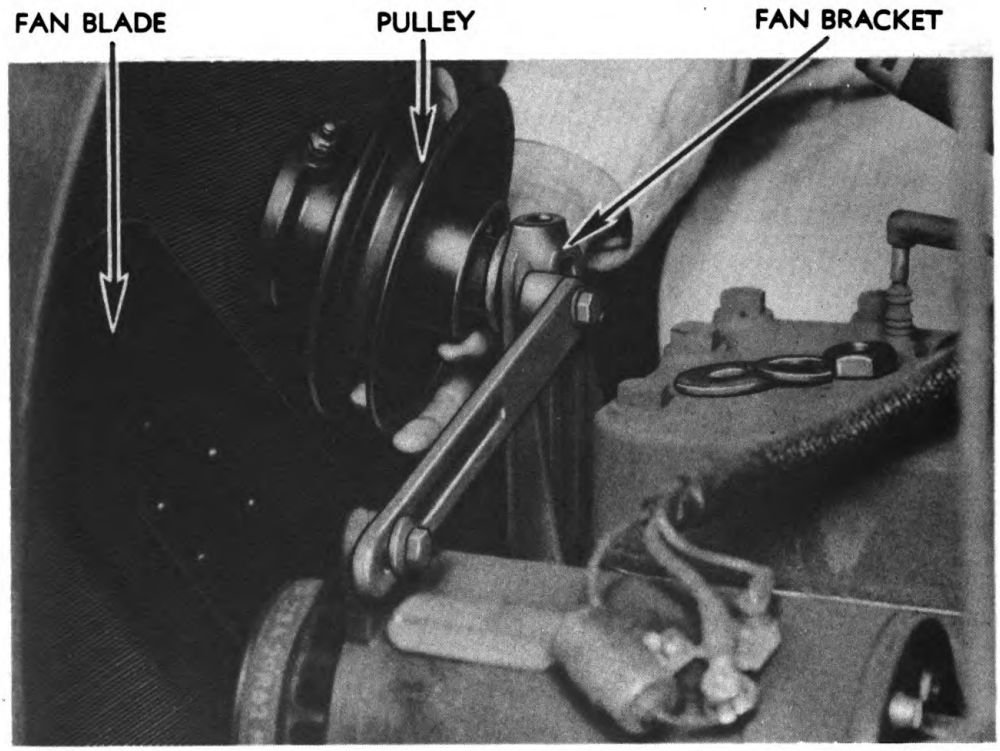
(a) Remove Fan Belt (par. 75 b).

WRENCH, open-end, 5/8-in. WRENCH, open-end, 1 1/16-in.

(b) Remove Fan Blade.

WRENCH, open-end, 1/2-in.

Remove the four cap bolts from the fan blade and hub (1/2-in. open-end wrench). Drop fan blades to bottom of shroud and pull out.



RA PD 65866

Figure 84—Removing Fan Pulley

(c) Remove Fan Pulley and Shaft Assembly (fig. 84).

WRENCH, open-end, 5/8-in. WRENCH, open-end, 1 1/16-in.

Remove adjusting screw (5/8-in. open-end wrench). Remove fan shaft to bracket nut (1 1/16-in. open-end wrench). Raise the assembly to top of bracket slot and slide forward to remove from bracket (fig. 84).

(d) Remove Bracket.

WRENCH, open-end, 1/2-in. WRENCH, open-end, 3/4-in.

Remove the three nuts and washers, fastening bracket to engine (3/4-in. open-end wrench). Remove generator bracket cap screw (1/2-in. open-end wrench). Remove bracket from studs.

COOLING SYSTEM

f. Fan Assembly Installation.

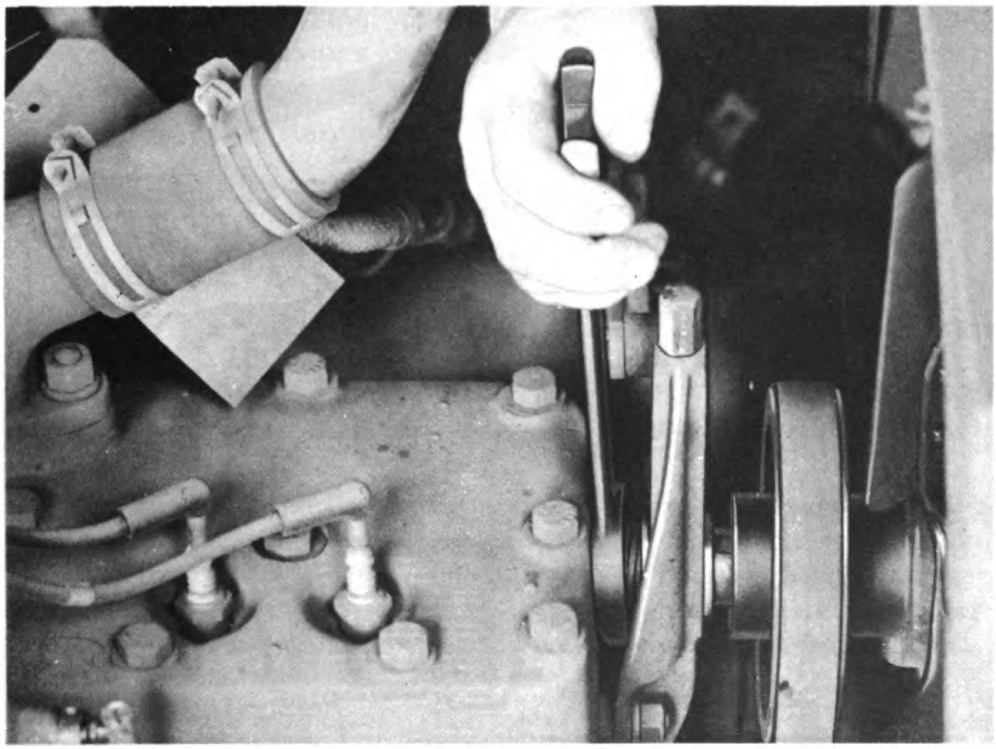
(1) EQUIPMENT.

WRENCH, open-end, ½-in.
WRENCH, open-end, ⅝-in.
WRENCH, open-end, ¾-in.
WRENCH, open-end, 1 1/16-in.

(2) PROCEDURE.

(a) Install Fan Bracket.

WRENCH, open-end, ½-in.
WRENCH, open-end, ¾-in.



RA PD 65867

Figure 85—Installing Fan Shaft Lock Nut

Place fan bracket on the three studs in front of motor block. Fasten with the nuts and washers (¾-in. open-end wrench). Enter bolt, lock washer, and nut in generator bracket to fan bracket and tighten (½-in. open-end wrench).

(b) Install Pulley.

SHELLAC
WRENCH, open-end, ⅝-in.

Lay fan blade into bottom of shroud. Make sure that by right-hand rotation the fan will force air toward the engine. Shellac a new gasket to front end of fan pulley with holes matching pulley tapped holes. Make sure the spacing washer is on shaft; then insert into bracket. Install adjusting bolt (⅝-in. open-end wrench) through top of bracket and into shaft. Install flat washer, lock washer, and nut on fan shaft loosely (fig. 85).

(c) Install Blades.

WRENCH, open-end, ½-in.

Place fan blade on fan pulley and line up drillings; enter cap bolts with lock washers and tighten (½-in. open-end wrench).

(d) Install Fan Belt (par. 75 c).

WRENCH, open-end, ⅝-in. WRENCH, open-end, 1 1/16-in.

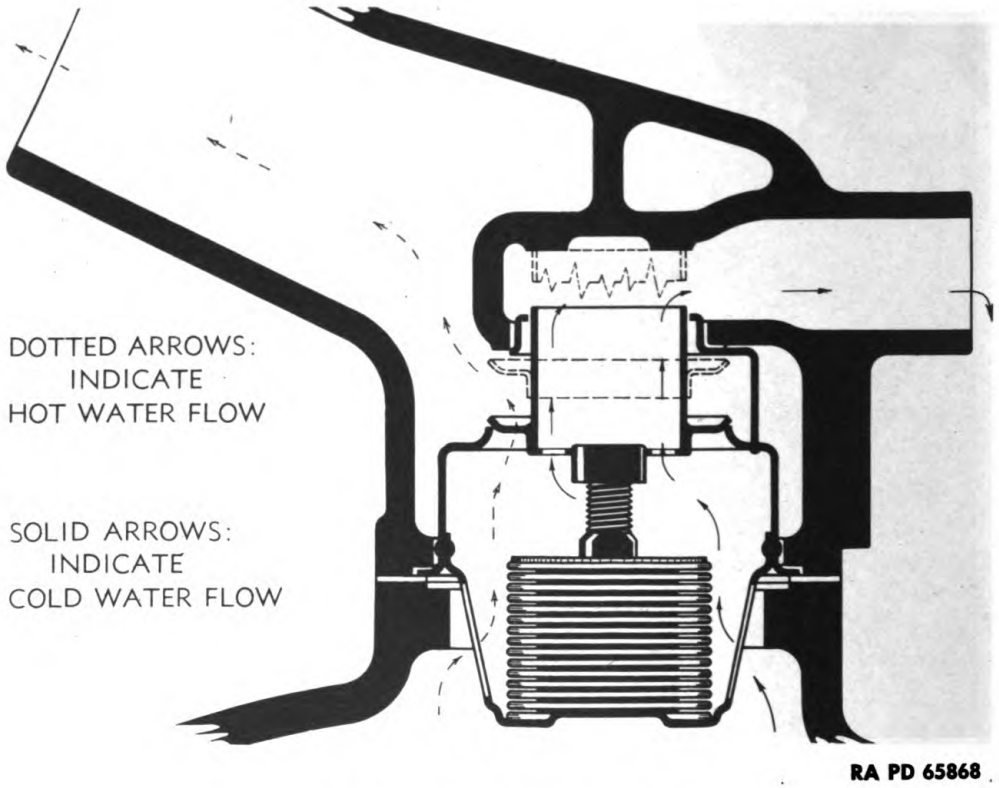


Figure 86—Thermostat

76. THERMOSTAT (fig. 86).

a. Thermostat Description. The bypass thermostat consists principally of a housing, bellows, and valve, the entire assembly being mounted at the water outlet on top of the cylinder head (fig. 86).

b. Thermostat Operation. When the engine is cold, the entire volume of water leaving the engine is returned directly to the water pump, bypassing the radiator and providing recirculation that assures warm water surrounding the entire length of the cylinder walls almost immediately. As the water becomes hot, the bellows in the thermostat begin to expand to permit part of the water to flow to the radiator; and at normal operating temperature the bellows are fully expanded to direct the full volume of water to the top of the radiator. If the thermostat is

ever removed for any cause, the bypass line must be blocked to insure full flow of water through the radiator (fig. 66).

c. Water Temperature. Except when the engine has just been started, water should enter at a temperature of not less than 150 F and should leave the top of the engine at 170 F to 190 F. The addition of a small amount of water daily is a fair indication that the engine is operating at an efficient temperature. An engine that is cooled too much is as much to be avoided as one that is undercooled. If the engine is to be idled for long periods of time, it may be necessary to cover part or all of the radiator to make sure that proper operating temperatures are maintained. Overcooling causes condensation and crankcase dilution which usually results in excessive wear.

d. Thermostat Removal.

(1) EQUIPMENT.

EXTENSION, 10-in.
HANDLE, flex
SCREWDRIVER
SOCKET, thin wall, ¾-in.
WRENCH, open-end, ¾-in.

(2) PROCEDURE.

(a) Remove Upper Water Housing.

EXTENSION, 10-in.
HANDLE, flex
SCREWDRIVER
SOCKET, thin wall, ¾-in.
WRENCH, open-end, ¾-in.

Loosen clamp (screwdriver) attaching hose to upper water housing and slide hose off water housing. Remove nut (flex handle, extension, and ¾-in. thin wall socket) at rear of housing. Take shakeproof washer off and remove coil mounting bracket and remaining shakeproof washer. Remove nut (¾-in. open-end wrench) and lock washer at front of water housing. Housing may then be lifted off.

(b) Remove Thermostat. Thermostat may be lifted out with fingers after water housing is removed.

e. Thermostat Installation.

(1) EQUIPMENT.

EXTENSION, 10-in.
HANDLE, flex
SCREWDRIVER
SOCKET, thin wall, ¾-in.
WRENCH, open-end, ¾-in.

(2) PROCEDURE.

(a) Installation of Thermostat.

Place thermostat in cylinder head. Be sure the bellow of thermostat is down into cylinder head.

(b) Replace Water Housing.

EXTENSION, 10-in.
HANDLE, flex
SCREWDRIVER
SOCKET, thin wall, ¾-in.
WRENCH, open-end, ¾-in.

Inspect upper water housing gasket to determine condition. Place gasket and upper water housing on studs. Place lock washer and nut on

front stud and tighten (¾-in. open-end wrench). Place a shakeproof washer on rear stud and then place coil mounting bracket and then one more shakeproof washer. Place nut and tighten (flex handle, 10-in. extension, and ¾-in. thin wall socket). Replace hose on upper water housing and tighten clamp (screwdriver).

77. RADIATOR.

a. Radiator Description. The radiator is a tubular construction. The core is supported in steel anchorage and bolted in a support that is bolted to the front cross member through a cushion.

b. Radiator Assembly Removal.

(1) EQUIPMENT.

EXTENSION, 5-in.
PAN, drain
PLIERS
RATCHET
SCREWDRIVER
WRENCH, box, 15/16-in.
WRENCH, open-end, ⅜-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, ½-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, ¾-in.
WRENCH, open-end, ⅞-in.
WRENCH, socket, ⅞-in.

(2) PROCEDURE.

(a) Drain Cooling System.

PAN, drain
PLIERS

Open drain cocks (pliers) at radiator outlet pipe and cylinder block; allow cooling liquid to drain into pan (fig. 14).

(b) Remove Hood (par. 55).

SCREWDRIVER
WRENCH, open-end, ⅜-in.
WRENCH, open-end, 7/16-in.

(c) Remove Motor Fan Blade.

WRENCH, open-end, ½-in.

Remove the four cap screws and lock washers holding fan blade to fan hub (½-in. open-end wrench). Remove fan blade.

(d) Remove Brush Guard (par. 56 f).

PLIERS
SCREWDRIVER
WRENCH, box, 15/16-in.
WRENCH, open-end, ⅜-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, ¾-in.
WRENCH, open-end, ⅞-in.

(e) Disconnect Radiator Stay Rod.

PLIERS

Remove the cotter pin in the yoke pin holding the stay rod to the radiator (pliers). Remove the yoke pin.

(f) Loosen Radiator Hold-Down Studs.

EXTENSION, 5-in.
RATCHET
WRENCH, socket, ¾-in.

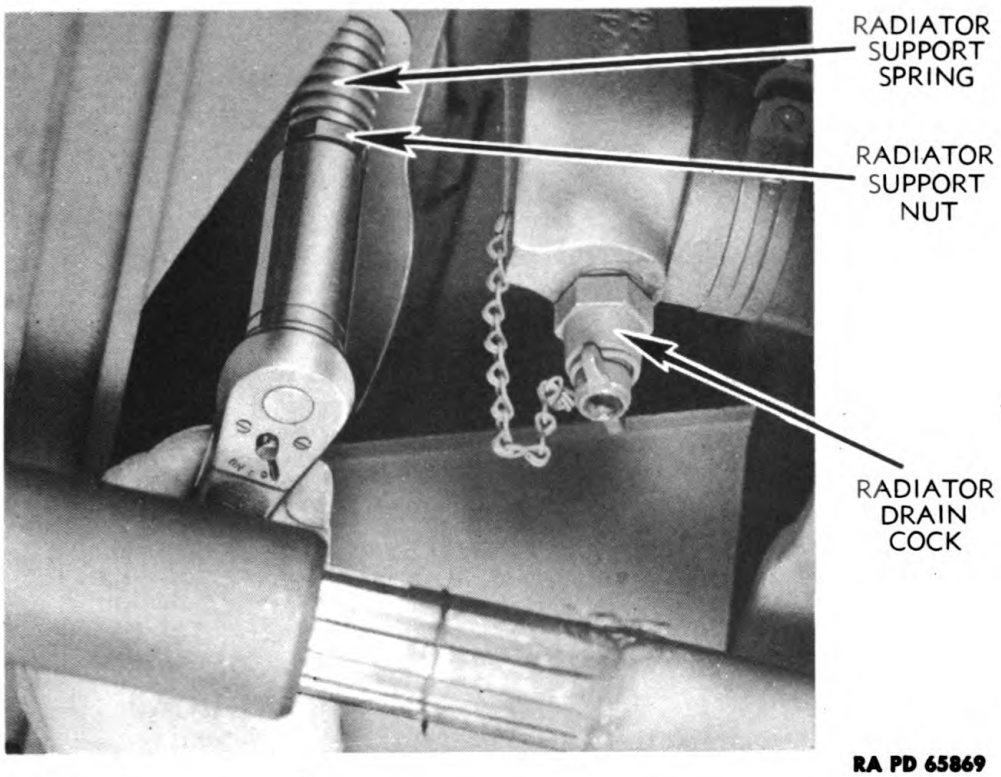


Figure 87—Removing Radiator Support Nut

Remove the four nuts, plain flat washers, and springs from the two radiator hold-down studs (5-in. extension, ratchet, and ¾-in. socket wrench (fig. 87).

(g) Loosen Radiator Hose.

SCREWDRIVER

Loosen the hose clamp on the top and bottom radiator hose (screwdriver) (fig. 88). Remove the radiator core.

c. Radiator Assembly Installation (figs. 88 and 89).

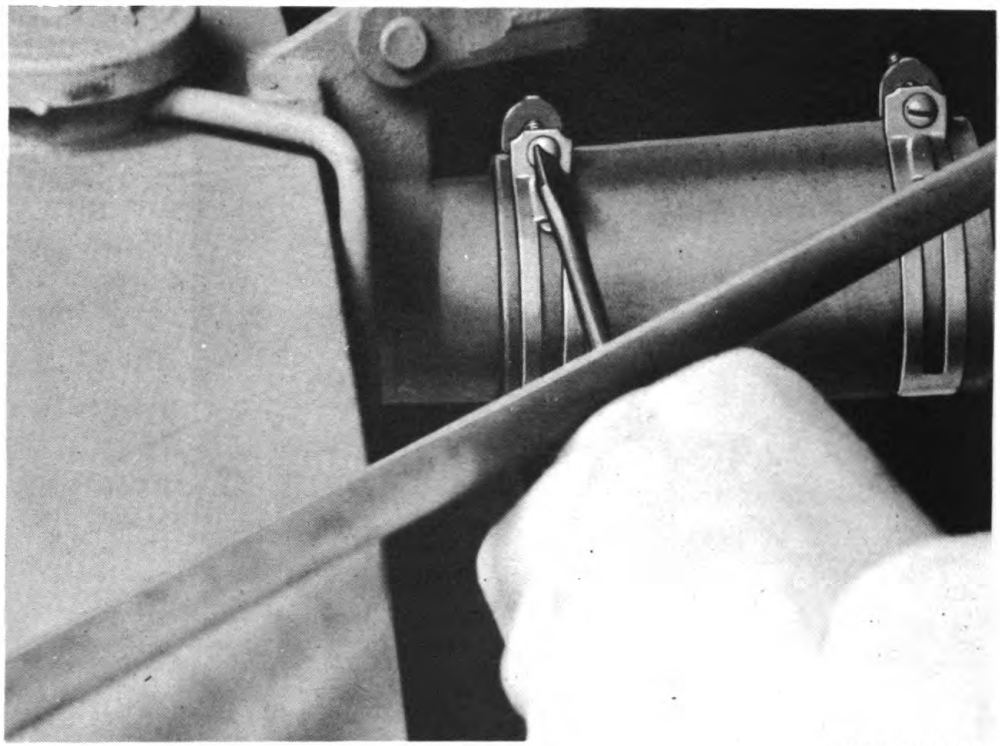
(1) EQUIPMENT.

EXTENSION, 5-in.
PAN, drain
PLIERS
RATCHET
SCREWDRIVER
WRENCH, box, 15/16-in.
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 7/8-in.
WRENCH, socket, 3/4-in.

(2) PROCEDURE.

(a) Install Radiator Core.

EXTENSION, 5-in.
PLIERS
RATCHET
WRENCH, socket, 3/4-in.



RA PD 65870

Figure 88—Removing Hose Clamp

Place rubber blocks on radiator hold-down studs. Place radiator core assembly in position on front cross member and slide bottom and top radiator hose on radiator connections. Fasten radiator stay rod to radiator with the yoke pin and cotter key (pliers).

(b) Install Fan Blade.

WRENCH, open-end, ½-in.

Place the fan blade on the fan hub and enter the four cap screws and lock washers. Tighten with ½-in. open-end wrench.

(c) Fasten Radiator Hold-Down Stud Nuts.

EXTENSION, 5-in. WRENCH, socket, ¾-in.
RATCHET

Check the distance between the radiator and fan blade, making sure it is equally spaced at top, bottom right, and left side. Place the coil springs, flat washers, and lock washers on the hold-down studs (fig. 89). Draw down radiator with hold-down stud nuts until the springs have depressed ¼ inch and then lock them securely with the lock nuts (5-in. extension, ratchet, and ¾-in. socket wrench).

(d) Tighten Hose Clamps (fig. 88).

SCREWDRIVER

Tighten the top and bottom hose clamps securely (screwdriver) (fig. 88).

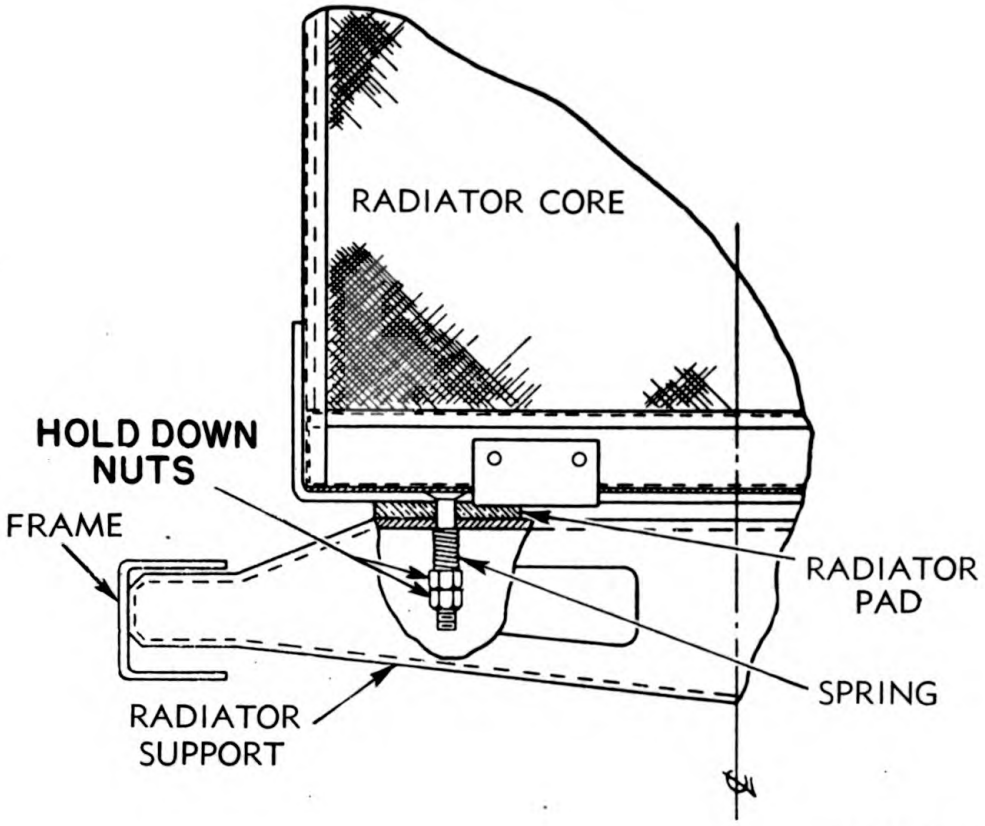


Figure 89—Radiator Support Stud

(e) Install Brush Guard (par. 56 g).

PLIERS
SCREWDRIVER
WRENCH, box, 15/16-in.
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 3/4-in.

(f) Install Hood (par. 55).

SCREWDRIVER
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 7/16-in.

(g) Refill Cooling System.

PLIERS

Close drain cocks (pliers) at radiator outlet pipe and cylinder block (fig. 14). Fill cooling system with cooling liquid. Check thoroughly for leaks. Start motor and warm up properly. Recheck cooling system and add additional cooling liquid if required.

d. Radiator Hose Removal.

(1) EQUIPMENT.

PAN, drain
PLIERS
SCREWDRIVER

(2) PROCEDURE.

(a) Drain Cooling System (fig. 14).

PAN, drain PLIERS

Open drain cocks (pliers) at radiator outlet pipe and cylinder block (fig. 14). Allow cooling liquid to drain into pan.

(b) Remove Radiator Hose (Upper or Lower).

SCREWDRIVER

Loosen the two hose clamp bolts (screwdriver) on the hose and then pull the hose from water pipe. The upper and lower radiator hose are removed in the same manner.

e. Radiator Hose Installation.

(1) EQUIPMENT.

PLIERS SCREWDRIVER

(2) PROCEDURE.

(a) Install Radiator Hose (Upper or Lower).

SCREWDRIVER

Thoroughly clean the outside surface of the water pipes. Place the hose clamps over the water pipe. Push the radiator hose on to the water pipe and radiator connection. Slide the hose clamps over the radiator hose and tighten them securely (screwdriver).

(b) Fill Cooling System (step c (2) *(g)* above).

PLIERS

78. WATER PUMP.

a. Water Pump Description. The water pump is a vane type and is driven by the fan belt. It is supported by a bracket at the front end of the engine. The pump may be removed without disturbing other components of the cooling system.

b. Water Pump Packing.

WRENCH, water pump

Besides the regular inspection of the water pump, it will be necessary occasionally to repack the pump. This is a simple operation which entails only the unscrewing of the packing nut (water pump wrench). Remove the old packing and replace with new. The packing nut should be tightened, so that it is snug but not so tight that the packing binds the shaft.

c. Water Pump Lubrication. Refer to Lubrication (section VI). The front bearing of the water pump is lubricated with C.G. general purpose grease through a grease cup located near the drive pulley. The rear bushing is lubricated with water pump grease through a grease cup. The grease cups should be given one full turn every 500 miles.

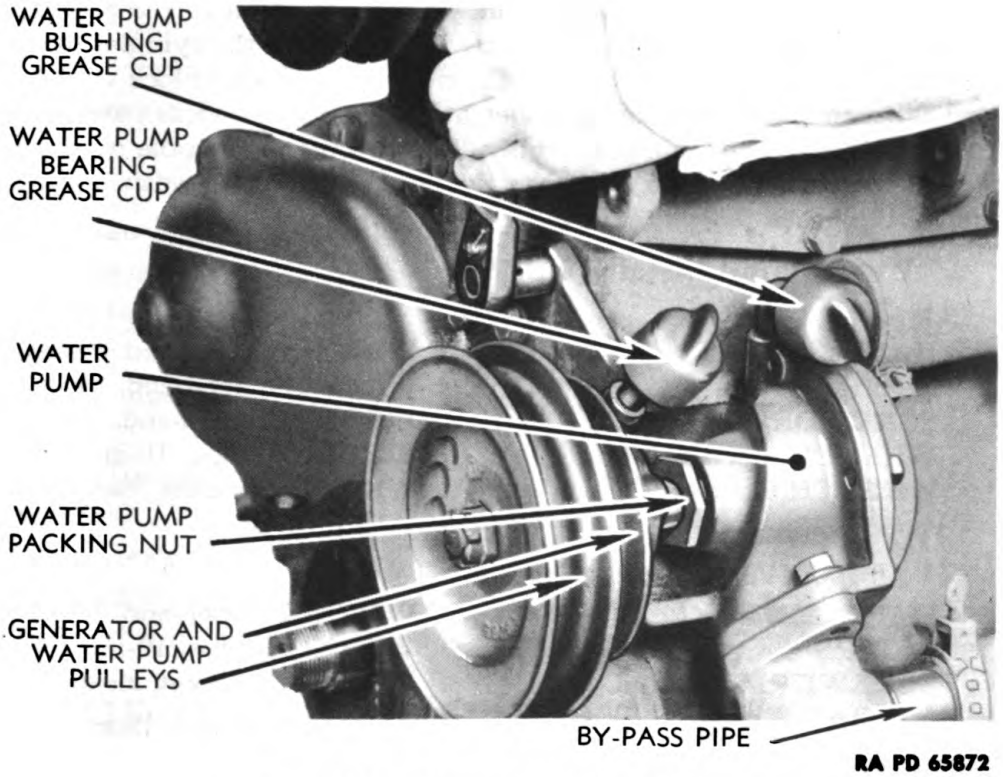


Figure 90—Removing Water Pump

d. Water Pump Removal (fig. 90).

(1) EQUIPMENT.

HANDLE, ratchet
PLIERS
SCREWDRIVER, 6-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in. (2)
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, open-end, 1 1/16-in.
WRENCH, pipe, 10-in.
WRENCH, socket. 9/16-in.

(2) PROCEDURE.

(a) Remove Fan Belt **(par. 75 b).**

WRENCH, open-end, 5/8-in.
WRENCH, open-end, 1 1/16-in.

(b) Remove Generator **(par. 82).**

SCREWDRIVER, 6-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in. (2)

(c) Remove Water Pump.

HANDLE, ratchet
PLIERS
SCREWDRIVER, 6-in.
WRENCH, open-end, 9/16-in.
WRENCH, pipe, 10-in.
WRENCH, socket, 9/16-in.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Loosen the radiator water outlet hose (screwdriver). Loosen the bypass hose connection at the water pump (pliers). Remove the two cap bolts and lock washers holding the water inlet elbow to the cylinder block (9/16-in. open-end wrench). Remove the three cap bolts and lock washers from the front pump bracket (ratchet handle and 9/16-in. socket wrench) (fig. 90). Remove the pump assembly. Remove the pipe nipple from the pump (10-in. pipe wrench). Loosen the hose clamps (screwdriver) and remove the hoses.

e. Water Pump Installation.

(1) EQUIPMENT.

HANDLE, ratchet
PLIERS
SCREWDRIVER, 6-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, open-end, 1 1/16-in.
WRENCH, pipe, 10-in.
WRENCH, socket, 9/16-in.

(2) PROCEDURE.

(a) Install Water Pump.

HANDLE, ratchet
PLIERS
SCREWDRIVER, 6-in.
WRENCH, open-end, 9/16-in.
WRENCH, pipe, 10-in.
WRENCH, socket, 9/16-in.

Insert the pipe nipple in the water pump and tighten thoroughly (10-in. pipe wrench). Slide the hoses over the connections on the water pump. Place the water pump into position and tighten the three cap bolts and lock washers holding the front bracket to the cylinder block (ratchet handle and 9/16-in. socket wrench). Enter the two cap bolts and lock washers into the water inlet elbow, place a new gasket into position between the block and water inlet elbow, and tighten the water inlet elbow securely to the cylinder block (9/16-in. open-end wrench). Slide the bypass on to the water pump pipe nipple. Tighten all hose clamps securely (pliers and screwdriver). Lubricate pump thoroughly (see Lubrication Guide (section VI)).

(b) Install Generator (par. 82).

SCREWDRIVER, 6-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in. (2)

(c) Install Fan Belt (par. 75 c).

WRENCH, open-end, 5/8-in.
WRENCH, open-end, 1 1/16-in.

Section XX

ELECTRICAL SYSTEM

79. ELECTRICAL SYSTEM DESCRIPTION AND TABULATED DATA.

a. Electrical System Description. The electrical system consists of a generator, current and voltage regulator, battery, battery filter, and starting motor. The system is a single wire and is energized from a storage battery with negative terminal grounded to the engine. The system has radio interference suppression to prevent interference with radio communication.

b. Electrical System Tabulated Data.

(1) BATTERY.

Make	Willard
Type	6-volt
Amp hr capacity at 20 hr rate	153
Number of plates	19
Insulation	Thread Rubber
Weight	60 lb

(2) GENERATOR.

Make	Auto-Lite
Model	GEG
Volts	6
Rotation	Clockwise
Drive	Belt
Control	Current and voltage regulator
Brushes	2

(3) GENERATOR REGULATOR.
Make ..... Auto-Lite
Model ..... VRY
Type ..... Vibrating

(4) STARTING MOTOR.
Make ..... Auto-Lite
Model ..... MAB
Volts 6
Rotation ..... Clockwise
Drive ..... Right hand outboard Bendix
Brushes 4
Starting switch ..... Mounted separate

(5) DISTRIBUTOR.
Make ..... Auto-Lite
Model ..... IGC
Breaker arms 1
Type of control ..... Full automatic
Rotation ..... Left hand (viewed from top)

(6) IGNITION COIL.
Make ..... Auto-Lite
Type 6-volt

(7) SPARK PLUGS.
Make ..... Champion
Size ..... 14 MM

(8) HORN.
Make ..... Delco-Remy
Type 6-volt

(9) LIGHTS.
Headlight ..... Corcoran-Brown
Blackout marker light ..... Industrial Lamp Corp.
Blackout stop light ..... Industrial Lamp Corp.

(10) SWITCHES AND GAGES.
Dimmer switch ..... Delco-Remy
Ignition switch ..... United Specialties Co.
Instrument light switch ..... Douglas
Stop light switch ..... Wagner Electric Co.
Lighting switch ..... Douglas
Starter switch ..... Auto-Lite
Ammeter ..... Auto-Lite
Fuel gage ..... Auto-Lite

80. ELECTRICAL SYSTEM TROUBLE SHOOTING.

a. Battery.

(1) DISCHARGED.

Possible Cause	Possible Remedy
(a) Faulty generator.	Replace generator (par. 82 c and d) or refer to generator trouble shooting (par. 80 b).

ELECTRICAL SYSTEM

Possible Cause	Possible Remedy
(b) Shorted wiring system.	Check wiring (par. 89).
(c) Loose battery terminals.	Tighten terminals (par. 81 **g**).
(d) Defective ground connection.	Replace ground cable (par. 81 **g**).
(e) Generator output too low.	Report to higher authority.
(f) Dry battery.	Refill (par. 81 **b**).
(g) Discharged battery.	Recharge (par. 81 **d**).
b. Generator.	
(1) NO OUTPUT.	
(a) Sticking brushes.	Clean brushes, check brush spring tension (par. 82 **b**).
(b) Worn brushes.	Report to higher authority or replace generator (par. 82 **c** and **d**)
(c) Burned regulator points.	Report to higher authority or replace regulator (par. 83 **d** and **e**).
(d) Loose or defective wiring.	Check wiring and tighten.
(e) Dirty commutator.	Clean (par. 82 **b**).
(f) Defective field coils or armature.	Replace generator (par. 82 **c** and **d**).
(2) NOISY GENERATOR.	
(a) Loose pulley.	Tighten pulley.
(b) Loose generator mounting.	Tighten generator (par. 82 **d**).
(c) Worn generator bearings.	Replace generator (par. 82 **c** and **d**)
c. Generator Regulator and Filter.	
(1) INOPERATIVE REGULATOR.	
(a) Burned regulator points.	Replace regulator (par. 83 **d** and **e**) or report to higher authority.
(b) Defective wiring.	Check wiring (par. 89).
(c) Improper regulator adjustments.	Replace regulator (par. 83 **d** and **e**) or report to higher authority.
(2) DEFECTIVE FILTER.	
(a) Defective filter may cause ignition system failure.	Remove wires from filter connections and connect these wires together or replace filter (par. 83 **h**).
d. Starting Motor.	
(1) INOPERATIVE STARTING MOTOR.	
(a) Loose or defective wiring.	Check and tighten (par. 84 **d** and **e**).
(b) Dirty or sticking brushes.	Clean (par. 84 **c**).
(c) Dirty commutator.	Clean (par. 84 **c**).
(d) Worn brushes or commutator.	Replace starter (par. 84 **d** and **e**) or report to higher authority.
(e) Faulty starter switch.	Replace switch (par. 90 **f**).
(f) Discharged battery.	Recharge (par. 81 **d**).

Possible Cause	Possible Remedy
(g) Worn bushings in starter.	Replace starter (par. 84 **d** and **e**).
(h) Starter operates but does not engage.	Remove starting motor and clean Bendix drive gear and shaft (par. 84 **d** and **e**).

e. Distributor.

(1) MOTOR MISSING UNDER LOAD.

(a) Points too close.	Adjust to 0.020-in. (par. 85 **b**).
(b) Cracked or dirty distributor cap or rotor.	Replace defective part or clean (par. 85 **b**).
(c) Loose or defective wires.	Inspect or replace (par. 85 **b**).

(2) MOTOR KICKS BACK IN STARTING.

(a) Improper distributor advance.	Adjust distributor (par. 85 **f**).

(3) MOTOR SLUGGISH OR HEATS.

(a) Late distributor setting.	Adjust distributor (par. 85 **f**).

(4) MOTOR PINGS.

(a) Early distributor setting.	Adjust distributor (par. 85 **f**).

(5) HARD STARTING.

(a) Burned or improperly adjusted contact points.	Clean, replace, or adjust points (par. 85 **c**).
(b) Faulty condenser.	Replace (par. 85 **g**).

(6) UNEVEN MOTOR OPERATION.

(a) Defective ignition coil.	Replace coil (par. 86).

f. Spark Plugs.

(1) ENGINE MISSING ON ONE OR MORE CYLINDERS.

(a) Dirty or defective spark plugs.	Clean, replace or adjust spark plugs to 0.025-in. point clearance (par. 87).
(b) Sluggish motor.	Clean and adjust plugs (par. 87).
(c) Defective wiring.	Check wiring.
(d) Leaking plugs or gaskets.	Replace plugs or gaskets (par. 87 **c** and **d**).

81. BATTERY.

a. Battery Description. The battery is located on the left side and is a Willard standard duty type having a rated capacity of 153 ampere hours. It is built with a safety-fill construction, which prevents overfilling.

b. Battery Care and Servicing.

(1) Most important in the care of an automotive storage battery is the fact that its period of useful service is definitely limited if the truck's system continually requires more current than can be supplied by the generator. The battery should be used as a source of energy only for starting the truck or operating the parking lights for a limited time. If due to accessory loads or wiring defects the truck ammeter shows a constant discharge the battery will run down and give trouble even though it is more than amply large for normal requirements.

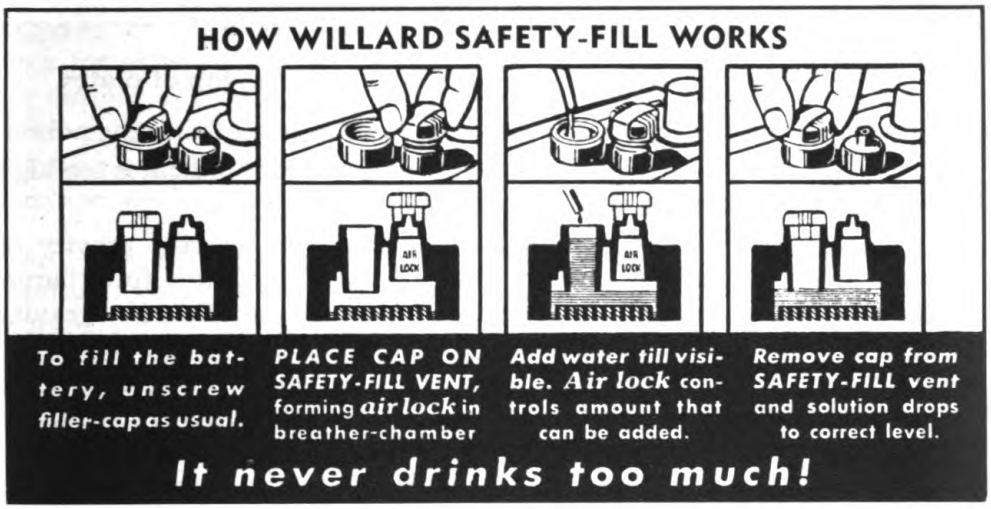


Figure 91—Battery Safety Fill

(2) To give long and satisfactory service a battery should be kept with its electrolyte level between ¼-in. and ⅜-in. above the tops of the separators and the specific gravity of the electrolyte maintained above 1.260. Never fill cells too full of water as spraying will result when the battery is being charged. This spraying will wet the battery top and the battery will be slowly discharged as a result of the short circuit formed. Damage will also result from corrosion of the battery hanger.

(3) The electrolyte level should be maintained by adding only water of high purity—preferably distilled water. The specific gravity is held in the proper range by watching the charging rate and giving the battery outside charging when necessary. Extra caution should be observed in maintaining the state of charge within safe limits during cold weather.

(4) The battery should be held securely in place by the clamps to avoid danger in breaking the container. Excessive force should be avoided when tightening the clamp nuts. Battery terminals should be firmly clamped to the battery posts. A coat of vaseline on the terminals will prevent corrosion.

(5) The battery is built with "Safety-Fill" construction, which prevents overfilling and spraying of acid (fig. 91).

(6) ADDING WATER TO BATTERY.

(a) Unscrew filler cap.

(b) Force filler cap down over the vent tube thus forming an air lock in breather chamber.

(c) Add distilled or approved water until it is near the top of the filler well.

(d) Remove filler cap from vent tube and solution will then drop to correct level.

(e) Screw cap in filler well. CAUTION: If when checking the liquid level the electrolyte is found to be even with the bottom of the filled well,

take a hydrometer reading and then return solution to the cell as directed above. Discard any excess of electrolyte.

(f) The proper electrolyte level is ⅜-in. above the top of plates.

c. Battery Inspection. Every two weeks check the following points:

(1) Check electrolyte level. Excessive use of water indicates too high charge rate. (Check generator regulator setting.)

(2) Take hydrometer reading to determine the specific gravity of the electrolyte. Specific gravity reading of 1.275 indicates full charge. Specific gravity reading of 1.225 indicates ½ charge. Specific gravity reading of 1.150 indicates complete discharge. The temperature of electrolyte must be taken into account to get the true specific gravity reading. If the temperature of the electrolyte is 80 F, no correction is needed. If the electrolyte temperature is below 80 F, subtract two points from the hydrometer reading for every 5 below 80 F. If the temperature is above 80 F, the correction is to be added. Example: Temperature 60 F, hydrometer reading 1.280, True Sp. Gr. 1.272. Temperature 90 F hydrometer reading 1.280, True Sp. Gr. 1.284. If the corrected hydrometer reading is below 1.225, the battery should be recharged from an outside source. If the individual cell readings vary more than 15 or 20 points from each other, it is an indication that the battery may be nearing the end of its life.

(3) See that terminal connections are clean and tight.

(4) Check voltage regulator settings.

d. Battery Maintenance.

(1) Charged batteries not in service will show a gradual and continuous drop in specific gravity as the acid will slowly react with the active materials even where there is no closed external circuit. This drop, when the batteries are kept below 70 F, will not average much more than 0.001 per day over a month's time. In order to hold the batteries in storage in a satisfactory condition, they should be recharged or "boosted" every thirty days if possible. This boosting as well as any other recharging should be done at a current rate about equal to one ampere per positive plate per cell. This means that a fifteen-plate automotive type battery should be charged at a rate of about 7.0 amp. Certain types of charging equipment known as "constant potential" units have difficult charging characteristics and directions for their use as supplied by the manufacturer should be carefully followed. Never use constant potential equipment for giving a battery its initial charge or for recharging a badly discharged battery.

(2) Batteries that have been allowed to reach extremely low stages of charge through long continued overload or idle standing must be given particular care in recharging. Due to the discharged condition the charge voltage reading will be low, and if thrown directly on the line of a constant potential charging generator, the current is apt to reach a dangerously high value with resultant overheating, gassing of water, and low current efficiency. Consequently, a badly discharged battery receiving this treatment may get many times the power input required to recharge a battery with no apparent good results.

(3) Such batteries should be charged at low rates (from three to four amperes for all normal automotive type batteries) and continued at low rates for at least sixty hours before any decision is made as to whether the battery is worth further attention. Naturally, any observed irregularity in gravity or charge voltage readings between cells should be watched closely as an indication of internal short circuits or cracked partition walls.

e. Battery Temperature Correction. Determination of specific gravity is easily accomplished by the use of a commercial hydrometer supplied for this purpose. These are usually calibrated to read accurately only when the electrolyte is at a certain specified temperature. Standards commonly used are 80 F. When taking readings at temperatures other than the specified standard, it is necessary to make corrections. For every ten degrees the temperature is above the standard, 0.004 must be added to the observed reading. For every ten degrees below standard, 0.004 must be subtracted from the observed reading. Specific gravity readings without corrections for temperature are practically meaningless.

f. Battery Freezing Point. The freezing point of the electrolyte depends on its specific gravity and the condition of battery charge. The following table gives the freezing temperatures of the battery solution at various specific gravities:

Value of Specific Gravity	Freezing Temp. Deg. F.	Value of Specific Gravity	Freezing Temp. Deg. F.
1.100	18	1.220	-31
1.120	13	1.240	-50
1.140	8	1.260	-75
1.160	1	1.280	-92
1.180	-6	1.300	-95
1.200	-17		

g. Battery Cable Replacement (figs. 92 and 93).

(1) EQUIPMENT.

PULLER, battery terminal, Stock No. 41-P-2900
WRENCH, open-end, 9/16-in.

(2) PROCEDURE.

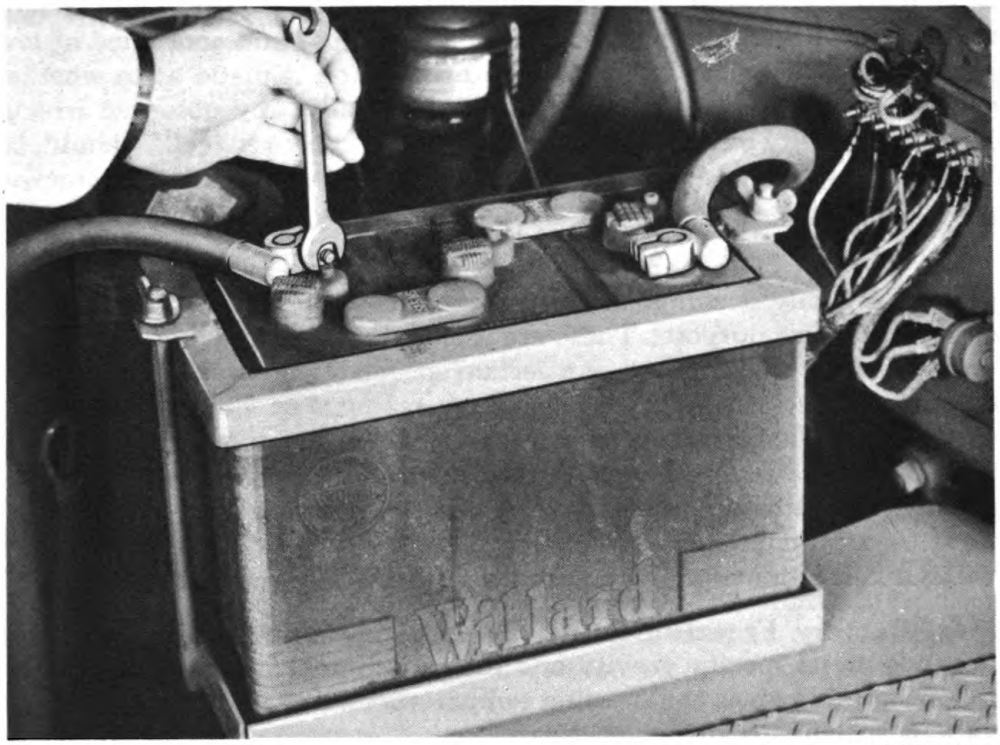
(a) Remove Negative Cable (figs. 92 and 93).

PULLER, battery terminal, Stock No. 41-P-2900
WRENCH, open-end, 9/16-in.

Disconnect cable terminal from front battery post (battery terminal puller and 9/16-in. open-end wrench) (figs. 92 and 93). Disconnect grounded end of cable from motor block near rear of generator (9/16-in. open-end wrench).

(b) Install Negative Cable.

WRENCH, open-end, 9/16-in.



RA PD 65874

Figure 92—Loosening Battery Cable Terminal

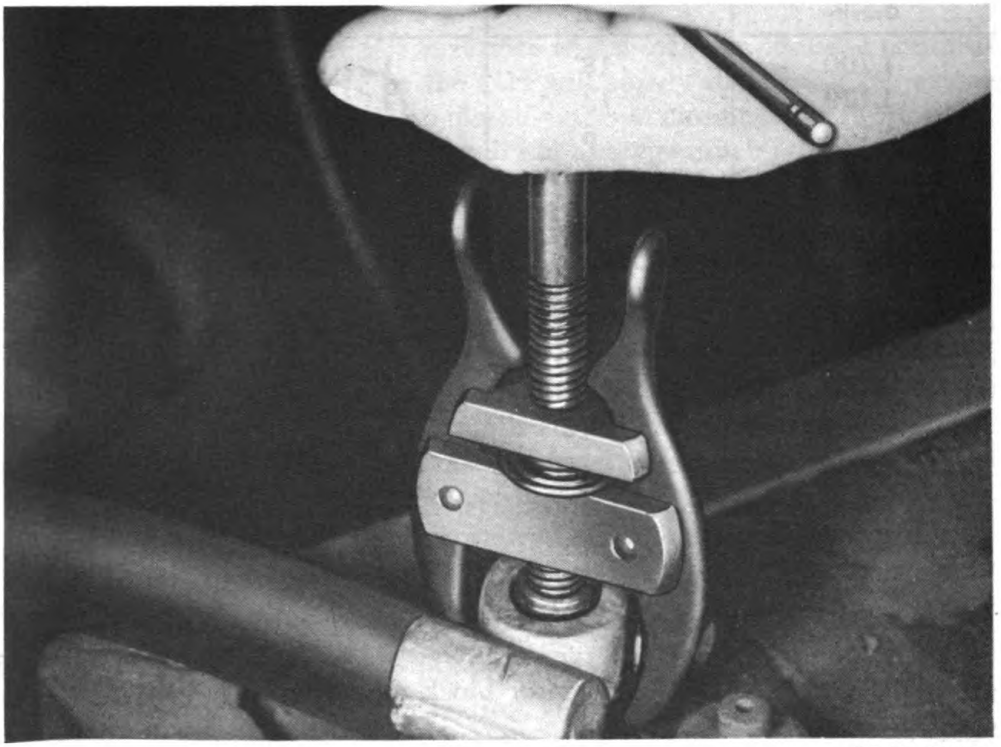


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Figure 93—Pulling Battery Cable Terminal

Place cap bolt in grounded end of cable and turn in motor block near rear end of generator and tighten (9/16-in. open-end wrench). Place cable terminal on front battery post and tighten (9/16-in. open-end wrench).

(c) Remove Positive Cable.

PULLER, battery terminal, Stock No. 41-P-2900
WRENCH, open-end, 9/16-in.

Remove cable terminal from rear battery post (battery terminal puller and 9/16-in. open-end wrench). Remove cable from starter switch (9/16-in. open-end wrench).

(d) Install Positive Cable.

WRENCH, open-end, 9/16-in.

Place cable on starter switch bolt with lock washer and nut, and tighten (9/16-in. open-end wrench). Place cable terminal on rear battery post and tighten (9/16-in. open-end wrench).

h. Battery Cable Repair.

(1) EQUIPMENT.

HACKSAW
HAMMER
PULLER, battery terminal, Stock No. 41-P-2900
WRENCH, open-end, 9/16-in.

(2) PROCEDURE.

Remove old terminal from battery post (battery terminal puller and 9/16-in. open-end wrench). Remove terminal from cable by sawing (hacksaw) cable off as close to terminal as possible. Strip insulation from cable about 1¼ inch and slide new terminal on cable, positive or negative, whichever is needed. Pound terminal together (hammer) on cable and solder, if soldering equipment is available. Place terminal in place on battery and tighten (9/16-in. open-end wrench).

i. Battery Removal.

(1) EQUIPMENT.

PULLER, battery terminal, Stock No. 41-P-2900
WRENCH, open-end, 9/16-in.

(2) PROCEDURE.

(a) Remove Battery Cables from Battery Posts.

PULLER, battery terminal
WRENCH, open-end, 9/16-in.

Loosen battery cable terminal nuts (9/16-in. open-end wrench). Remove the terminals from the battery posts (battery terminal puller).

(b) Remove Battery Top Frame.

Remove the two wing nuts, holding the battery top frame to battery and lift the top frame from the battery. Battery can now be removed.

j. Battery Installation.

(1) EQUIPMENT.

HAMMER, 1 lb
WRENCH, open-end, 9/16-in.

(2) PROCEDURE.

(a) Install Battery in Battery Tray.

Lift the battery and place in the battery tray. Place battery top frame on the two hold-down studs and replace the two wing nuts.

(b) Connect Battery Post Terminals.

HAMMER, 1 lb WRENCH, open-end, 9/16-in.

Clean the battery posts and cable terminals and coat with vaseline. Connect the cable terminals to the battery posts. Tap the terminal on to the post (hammer) and tighten (9/16-in. open-end wrench).

82. GENERATOR.

a. Generator Description. The generator is a six-volt, heavy-duty, clockwise, two-brush unit driven from a V-belt connected to the water pump pulley. The terminals have a capacitor to reduce radio interference.

b. Generator Maintenance.

(1) EQUIPMENT.

SCREWDRIVER VOLTMETER

(2) INSPECTION.

(a) The head band should be removed (screwdriver) and the commutator and brushes inspected at regular intervals.

(b) Inspect the commutator. If the commutator is dirty or discolored, it can be cleaned by holding a piece of 00 flint paper against it while turning the armature slowly. Blow the sand out of the generator after cleaning the commutator. If the commutator is rough or worn the generator should be removed from the truck and completely overhauled or replaced (par. 82 **c** and **d**).

(c) Inspect the brushes. The brushes should slide freely in their holders. If the brushes are oil-soaked or if they are worn to less than one-half their original length, the brushes should be replaced, or replace generator (par. 82 **c** and **d**).

(3) WIRING.

(a) Visual Inspection. Inspect all wiring from the generator to the regulator, from the regulator to the battery, and from the battery to ground for worn or frayed insulation, broken wires, and for loose and corroded connections. Repair or replace any defective wiring.

(b) Voltage Drop. Run the generator and turn on lights, so that the generator charges at about 10 amperes. With an accurate reading (voltmeter) measure the voltage from the generator "A" terminal to the regulator "A" terminal, from the generator "F" terminal to the regulator "F" terminal, and from the regulator "B" terminal to the battery post. The voltage reading for any of these tests should not be more than 0.1 volt at the 10-ampere charging rate. At the same charging rate the voltmeter should show no reading when measured from the generator frame to the regulator base, the generator frame to the battery ground

post, or to the regulator base and the battery ground post. If larger readings are obtained, the high resistance should be eliminated.

(4) OPERATION.

(a) Run the generator at about 10 to 15 amperes and note the commutator action. If there is excessive arcing between the brushes and commutator, remove the generator.

(b) Replace the generator head band.

c. Generator Removal.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in. (2)

(2) PROCEDURE.

(a) Disconnect Wires.

SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in.

Remove ground wire (screwdriver), field wire (7/16-in. open-end wrench), and armature wire (1/2-in. open-end wrench) from the generator.

(b) Remove Generator from Engine.

WRENCH, open-end, 1/2-in. (2)

Remove generator adjusting bracket clamp bolt, flat washer, and lock washer (1/2-in. open-end wrench). Move generator away from engine and remove belt. Remove the two lower bracket bolts, nuts, and lock washers (two 1/2-in. open-end wrenches). Generator may now be removed.

d. Generator Installation (figs. 94, 95 and 96).

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in. (2)

(2) PROCEDURE.

(a) Install Generator.

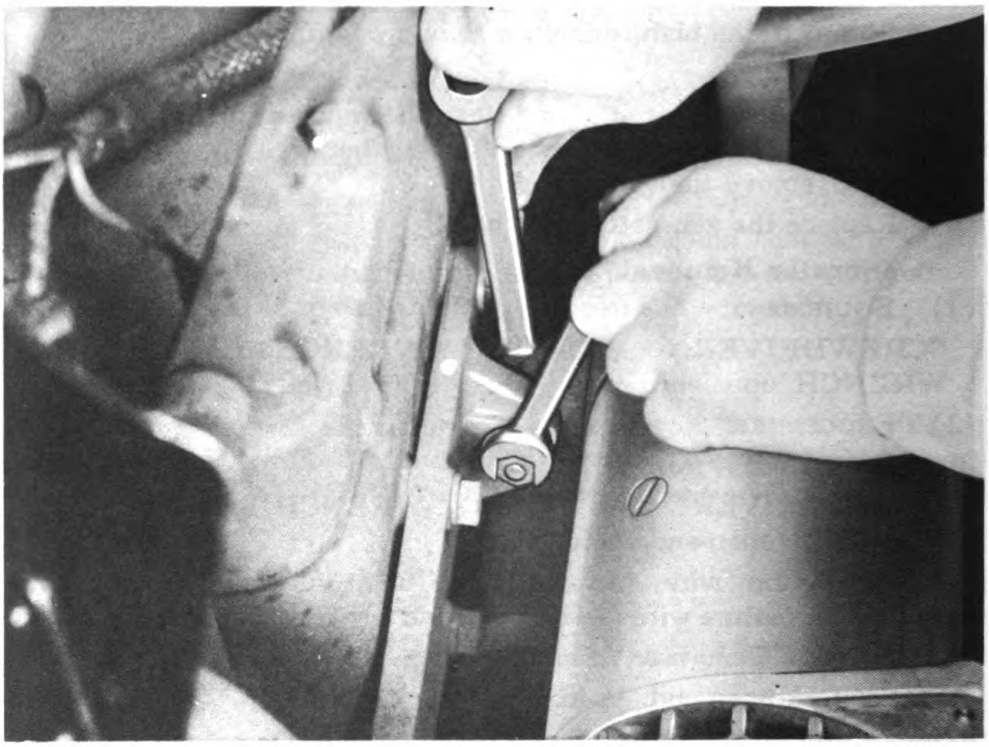
WRENCH, open-end, 1/2-in. (2)

Place the generator in the generator bracket with drive pulley toward the front (fig. 94). Enter the two bracket bolts, washers, and nuts; leave the nuts loose until fan belt is adjusted (fig. 94). Place the generator belt on the pulleys. Install the generator adjusting bracket cap bolt, flat washer, and lock washer (fig. 95). Adjust the fan belt by moving the generator toward the engine (fig. 96). Adjust until it has approximately 1/2-inch deflection. Tighten the adjusting cap bolt and the two bracket bolts (1/2-in. open-end wrench).

(b) Connect Generator Wires (fig. 95).

SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in.

Install black and yellow wire and capacitor body to ground (screwdriver) using shakeproof washer between generator body and capacitor



RA PD 65876

Figure 94—Installing Generator

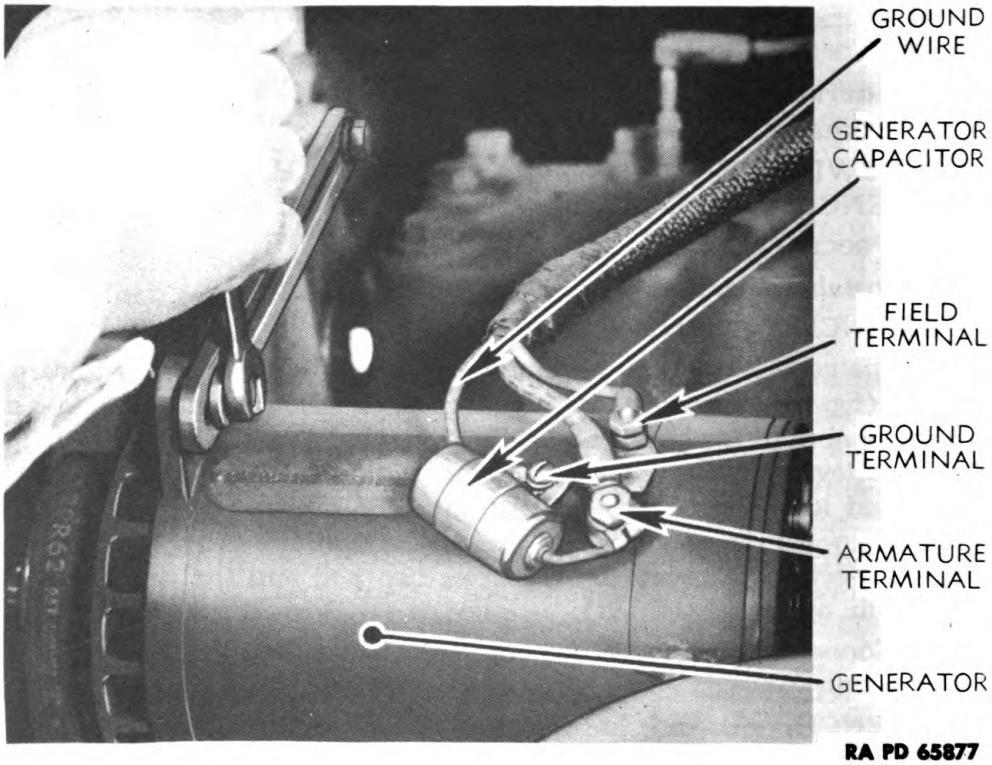


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Figure 95—Tightening Generator Belt Adjusting Strap

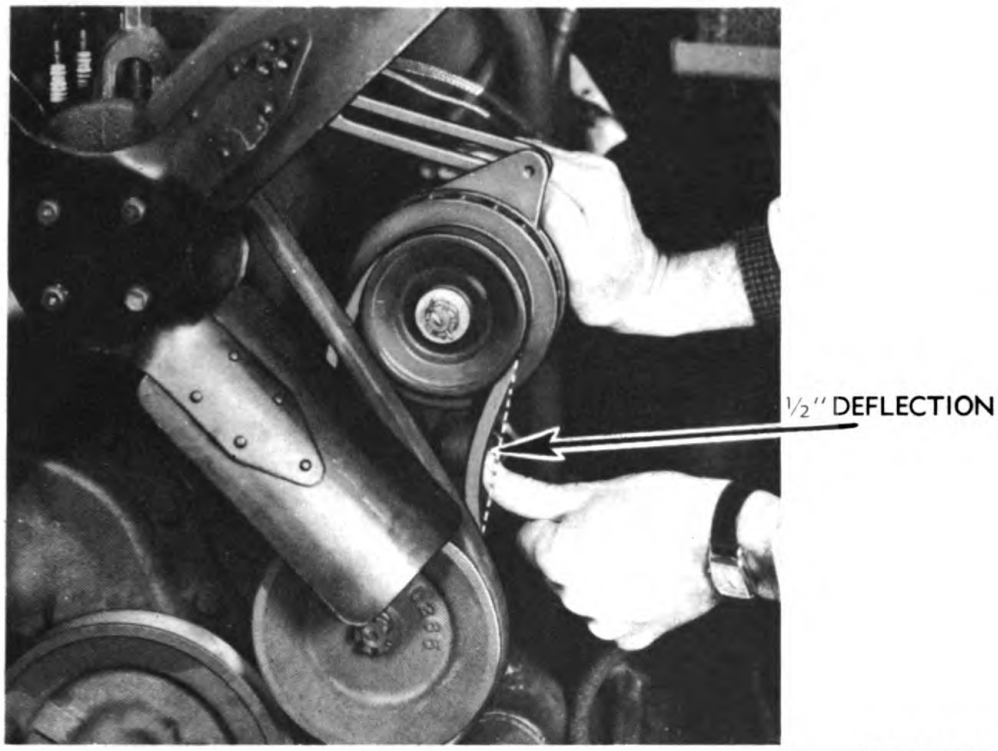

Figure 96—Adjusting Generator Belt

(fig. 95). Connect the blue wire to the field terminal (FIELD) (7/16-in. open-end wrench) (fig. 95). Connect the brown and black wire and capacitor wire to the armature terminal (ARM) (½-in. open-end wrench) (fig. 95).

e. Generator Belt Removal.

(1) EQUIPMENT.

WRENCH, open-end, ½-in. **WRENCH, open-end, 1 1/16-in.**
WRENCH, open-end, 5/8-in.

(2) PROCEDURE.

(a) Remove Fan Belt **(par. 75 b).**

WRENCH, open-end, 5/8-in. **WRENCH, open-end, 1 1/16-in.**

(b) Remove Generator Drive Belt.

WRENCH, open-end, ½-in.

Remove the bolt from generator adjusting bracket (½-in. open-end wrench). Pull generator away from engine. Remove belt.

f. Generator Belt Installation.

(1) EQUIPMENT.

WRENCH, open-end, ½-in. **WRENCH, open-end, 1 1/16-in.**
WRENCH, open-end, 5/8-in.

(2) PROCEDURE.

(a) Install Generator Belt.

Pull generator away from engine; place the generator belt around the generator and water pump drive pulleys. Move generator toward engine. Enter a cap bolt with lock washer through the generator adjusting bracket and into generator housing. Leave cap bolt loose until belt is adjusted.

(b) Adjust Generator Drive Belt (par. 82 d).

WRENCH, open-end, ½-in.

(c) Fan Belt Installation (par. 75 c).

WRENCH, open-end, ⅝-in. WRENCH, open-end, 1 1/16-in.

83. GENERATOR REGULATOR AND FILTER.

a. Generator Regulator Description. The regulator is used with the shunt type generator and has three units with a separate function to perform. These three units are the circuit breaker, voltage regulator, and the current limiting regulator.

b. Generator Regulator Operation.

(1) CUT-OUT RELAY. The function of a cut-out relay is to automatically close and open the circuit between the generator and storage battery when the generator voltage falls below that of the battery.

(2) VOLTAGE REGULATOR. The function of the voltage regulator is to hold the generated voltage at a predetermined value as long as the circuit values allow the voltage to build up to the operating voltage (voltage output at maximum rpm is 8.0 volts).

(3) CURRENT REGULATOR. The function of the current limiting regulator is to limit the output of the generator to its maximum safe output of 40 amps.

c. Generator Regulator Maintenance. If inspection reveals loose or faulty contacts, improper operation, or if the voltage as indicated by the voltmeter is consistently above or below normal, the unit should be replaced.

d. Generator Regulator Removal.

(1) EQUIPMENT.

SCREWDRIVER, 6-in. WRENCH, open-end, ½-in. (2)

(2) PROCEDURE.

(a) Disconnect Wires.

SCREWDRIVER

Remove the cap screw and lock washer (screwdriver) attaching the blue generator wire and capacitor lead from the regulator field terminal "F". Remove the cap screw and lock washer (screwdriver) attaching the brown generator wire and capacitor lead from the regulator armature terminal (ARM). Remove the cap screw and lock washer (screwdriver)

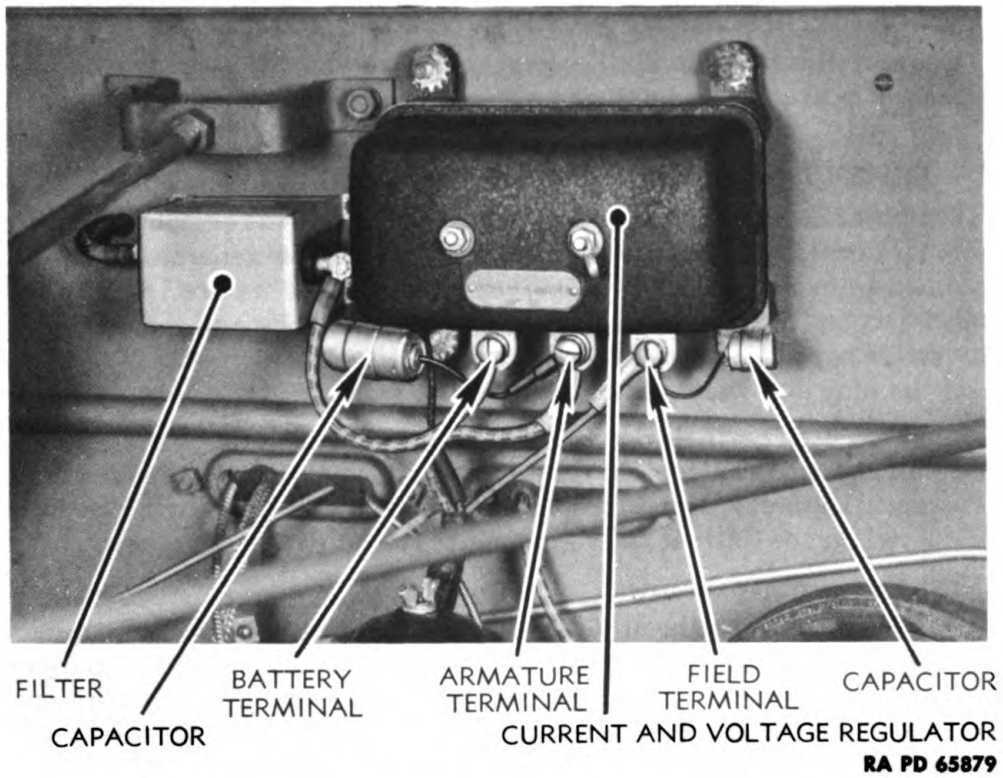

Figure 97—Generator Regulator and Filter Installed

attaching the brown battery wire from the regulator battery terminal (BAT). Disconnect the blue and white ground wire from the regulator (screwdriver).

(b) Remove Regulator.

WRENCH, open-end, ½-in. (2)

Remove the four mounting nuts and eight washers (two ½-in. open-end wrenches) from the regulator base. Remove regulator from dash.

(c) Remove Capacitors from Regulator.

SCREWDRIVER

Remove the cap screw and lock washer (screwdriver) holding each capacitor to the regulator base.

e. Generator Regulator Installation (fig. 97).

(1) EQUIPMENT.

SCREWDRIVER

WRENCH, open-end, ½-in. (2)

(2) PROCEDURE.

(a) Install Regulator.

WRENCH, open-end, ½-in. (2)

Bolt the regulator to the dash with four bolts, nuts, and lock washers (two ½-in. open-end wrenches). Place shakeproof washers between regulator and dash and one under each unit.

(b) Install Capacitors (fig. 97).

SCREWDRIVER

Connect the bracket of the large capacitor to the right side of the regulator base, and the small capacitor to the left side (screwdriver).

(c) Connect Wires (fig. 97).

SCREWDRIVER

Connect the brown wire leading from the filter to the regulator battery (BAT) terminal (screwdriver). Connect the brown generator wire and the lead from the large capacitor to the regulator armature (ARM) terminal (screwdriver). Connect the blue generator wire and the lead from the small capacitor to the regulator field terminal (screwdriver). Connect the blue and white ground wire to the regulator base (screwdriver).

f. Filter Description (fig. 97). To prevent interference with radio communication, the electrical system is equipped with filtered power lines, resistance suppressed distributor, spark plugs, and bonding. The filter is located on the dash at the right side of the generator regulator.

g. Filter Maintenance.

(1) The filter has been placed in series with power lines to regulator field terminal. If it appears that failure of the ignition or the charging system is due to open circuited filter, the circuit can be checked by connecting a jumper across the terminals of the filter unit. If the filter is grounded, disconnect wires from the filter terminals and connect these wires together.

(2) In the event of excessive radio interference:

(a) Due to Ignition.

Check distributor, spark plugs, and suppressors.

Tighten braided bonding straps.

Tighten radiator and fender supporting bolts.

(b) Due to Generator.

Tighten regulator to generator bond.

Defective or dirty commutator, brushes, and holders.

Excessively discharged battery, causing high charging rate.

(c) Due to Erratic Noises.

Failure of high tension insulation.

Loose wiring connections or corroded distributor cap towers.

Defective switches or gages.

h. Filter Removal.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 5/16-in.

(2) PROCEDURE.

Remove the two wires from the filter (screwdriver) by removing the two screws. Remove the four bolts, nuts, and eight shakeproof lock

washers holding the filter to the dash (5/16-in. open-end wrench and 3/8-in. open-end wrench). Remove the filter.

i. Filter Installation.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 5/16-in.

Bolt the filter to the dash with the four bolts, nuts, and eight shakeproof lock washers (5/16-in. open-end wrench and 3/8-in. open-end wrench). Fasten the two wires to the filter with the screws and shakeproof lock washers. NOTE: One wire connects to the positive side of the ammeter and to the filter. The other wire connects to the filter and to the battery terminal of the voltage regulator.

j. Regulator Capacitor Removal.

(1) EQUIPMENT.

SCREWDRIVER

(2) PROCEDURE.

(a) Remove Regulator Field Capacitor.

SCREWDRIVER

Remove the screw and lock washer (screwdriver) from the regulator field terminal. Remove the screw and lock washer holding capacitor to regulator ground (screwdriver). Remove the capacitor.

(b) Remove Regulator Armature Capacitor.

SCREWDRIVER

Remove the screw and lock washer (screwdriver) from the regulator armature terminal. Remove the screw and lock washer holding the capacitor to the regulator ground (screwdriver). Remove the capacitor.

k. Regulator Capacitor Installation.

(1) EQUIPMENT.

SCREWDRIVER

(2) PROCEDURE.

(a) Install Regulator Armature Capacitor.

SCREWDRIVER

Fasten the capacitor to the regulator ground with the screw and lock washer (screwdriver). Fasten the capacitor wire terminal to the regulator armature terminal with the screw and lock washer (screwdriver).

(b) Install Regulator Field Capacitor.

SCREWDRIVER

Place the screw and lock washer on to the capacitor and fasten it to the regulator ground (screwdriver). Connect the capacitor wire terminal to the regulator field terminal with screw and lock washer (screwdriver).

l. Generator Capacitor Removal.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 1/2-in.

(2) PROCEDURE.

Remove the nut and lock washer (½-in. open-end wrench) from the generator armature terminal. Remove the screw and shakeproof lock washer from the generator ground (screwdriver). Remove the capacitor.

m. Generator Capacitor Installation.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, ½-in.

(2) PROCEDURE.

Fasten the capacitor to the generator ground terminal with a screw and shakeproof lock washer (screwdriver). Fasten the capacitor wire terminal to the generator armature terminal with a nut and lock washer (½-in. open-end wrench).

n. Ammeter Capacitor Removal.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, ⅜-in.

(2) PROCEDURE.

Remove the nut and lock washer from the positive terminal of the ammeter (⅜-in. open-end wrench). Remove the bolt, nut, and shakeproof lock washers holding the capacitor to the dash (⅜-in. open-end wrench and screwdriver). Remove the capacitor.

o. Ammeter Capacitor Installation.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, ⅜-in.

(2) PROCEDURE.

Fasten the capacitor to the dash with a bolt, nut, and shakeproof lock washers (screwdriver and ⅜-in. open-end wrench). Place the capacitor wire terminal on to the positive terminal of the ammeter and tighten with the nut and lock washer (⅜-in. open-end wrench).

p. Coil Capacitor Removal.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 9/16-in.
WRENCH, open-end, ⅜-in.

(2) PROCEDURE.

Remove the capacitor wire from the coil by removing the nut and lock washer (⅜-in. open-end wrench). Remove the bolt, nut, and lock washer (screwdriver and 9/16-in. open-end wrench) holding the capacitor to the coil mounting bracket. Remove the capacitor.

q. Coil Capacitor Installation.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 9/16-in.
WRENCH, open-end, ⅜-in.

(2) PROCEDURE.

Attach the capacitor to the coil mounting bracket with a bolt, nut,

and lock washer (screwdriver and 9/16-in. open-end wrench). Place the capacitor wire terminal on the positive coil terminal and fasten it with nut and lock washer (3/8-in. open-end wrench).

r. Distributor and Spark Plug Suppressor Removal.

(1) PROCEDURE.

(a) Remove Distributor Suppressor.

Pull the capacitor from the distributor center terminal. Hold the wire and turn the suppressor to the left to remove from wire.

(b) Remove Spark Plug Suppressor.

Pull the suppressor from the spark plug. Hold the spark plug wire and turn the suppressor to the left to remove from wire.

s. Distributor and Spark Plug Suppressor Installation.

(1) PROCEDURE.

(a) Install Capacitor on Spark Plug.

Insert the wire into the capacitor and turn to the right to tighten same. Push capacitor on the spark plug.

(b) Install Distributor Capacitor.

Insert the wire into the capacitor and turn to the right to tighten. Push the capacitor into the center terminal of the distributor.

84. STARTING MOTOR (fig. 98).

a. Starting Motor Description. The starting motor is a heavy-duty four-brush unit and is attached to the flywheel housing on the left side of the engine.

b. Starting Motor Operation. The starting motor cranks the engine when the circuit between the starting motor and storage battery is completed at the starter switch. Power is transmitted to the engine flywheel ring gear through a Bendix drive. The starting motor merely cranks the engine electrically, eliminating hand cranking.

c. Starting Motor Maintenance. Remove the head band at regular intervals and perform the following operations:

(1) INSPECTION.

(a) Commutator. If the commutator is dirty, it can be cleaned by holding a piece of 00 flint paper against it while turning the armature slowly. Blow the sand out of the motor after cleaning. If the commutator is rough or worn, the starting motor should be replaced (par. 84 **d** and **e**).

(b) Brushes. The brushes should slide freely in their holders and should not be oil-soaked. If the brushes are oil-soaked or are worn to less than one-half of their original length, starting motor should be replaced (par. 14 **d**).

(c) Wiring. Check the wiring for broken wires, frayed insulation, and for corroded connections. Particular attention should be paid to the ground connections.

(d) Starting Switch. Check the voltage drop across the starting switch to see that it does not exceed 0.05 volts per 100 amperes.

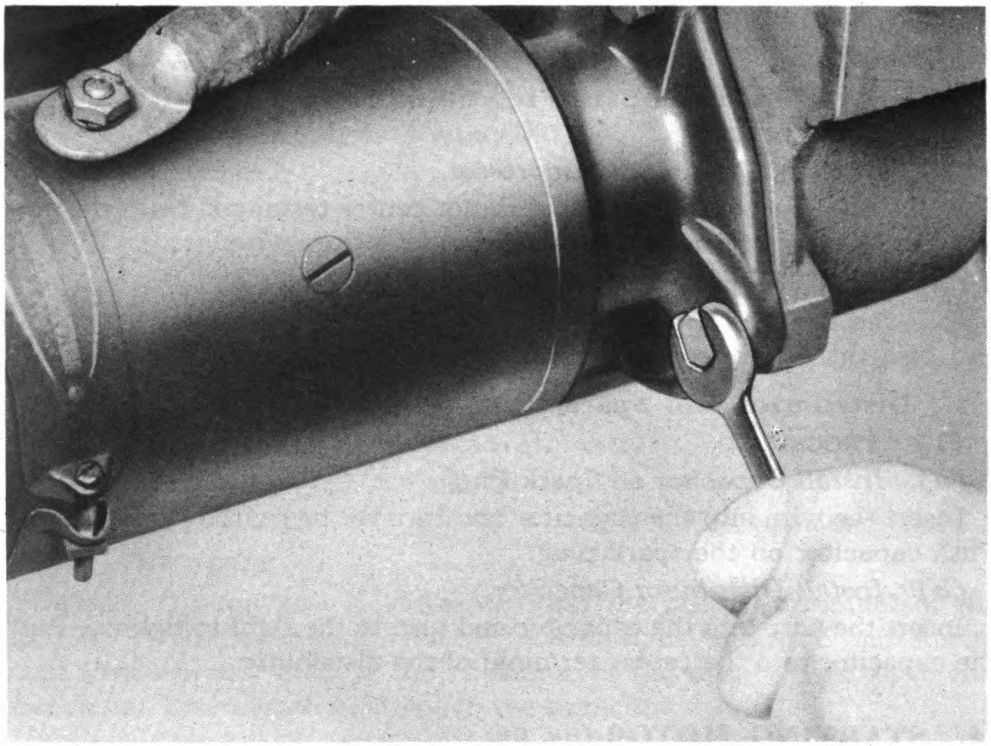

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Figure 98—Installing Starting Motor

(e) Replace the head band.

(2) LUBRICATION. The oiler in the commutator end cap should be given 3 to 5 drops of medium engine oil every 5000 miles.

d. Starting Motor Removal.

(1) EQUIPMENT.

WRENCH, open-end, 9/16-in.

(2) PROCEDURE.

(a) Remove Battery Cable.

WRENCH, open-end, 9/16-in.

Remove cable at starting motor (9/16-in. open-end wrench).

(b) Remove Starting Motor.

WRENCH, open-end, 9/16-in.

Remove the three cap bolts (9/16-in. open-end wrench) from the starting motor to flywheel housing. Pull starting motor out and down under frame.

e. Starting Motor Installation.

(1) EQUIPMENT.

WRENCH, open-end, 9/16-in.

(2) PROCEDURE.

(a) Install Starting Motor in Flywheel Housing.

WRENCH, open-end, 9/16-in.

Enter starting motor in flywheel housing with terminal to top. Install and tighten the three cap bolts and lock washers (9/16-in. open-end wrench) (fig. 98).

(b) Install Battery Cable.

WRENCH, open-end, 9/16-in.

Install cable to starting motor terminal (9/16-in. open-end wrench).

85. DISTRIBUTOR.

a. Distributor Description. The distributor is mounted on the top side of the engine and is driven from the camshaft. The distributor advances the spark by means of centrifugal governor.

b. Distributor Maintenance and Adjustments.

(1) EQUIPMENT.

SCALE, spring, No. 41-T-3383-55 SCREWDRIVER

(2) The distributor cap should be removed at regular intervals and inspection made of cap, rotor, breaker points, and condenser.

(3) The distributor cap should be visually inspected for:

(a) Cracks.

(b) Carbon runners.

(c) Evidence of arcing.

(d) Corroded high tension terminals.

(e) After a distributor cap has had normal use, the inside of the cap inserts will become slightly burned on the inside tip. If these inserts are badly burned or if they are burned at any other point, the cap should be replaced. If none of the above conditions are found, the distributor cap should be thoroughly cleaned and set aside for reassembly.

(4) The rotor should be visually inspected for:

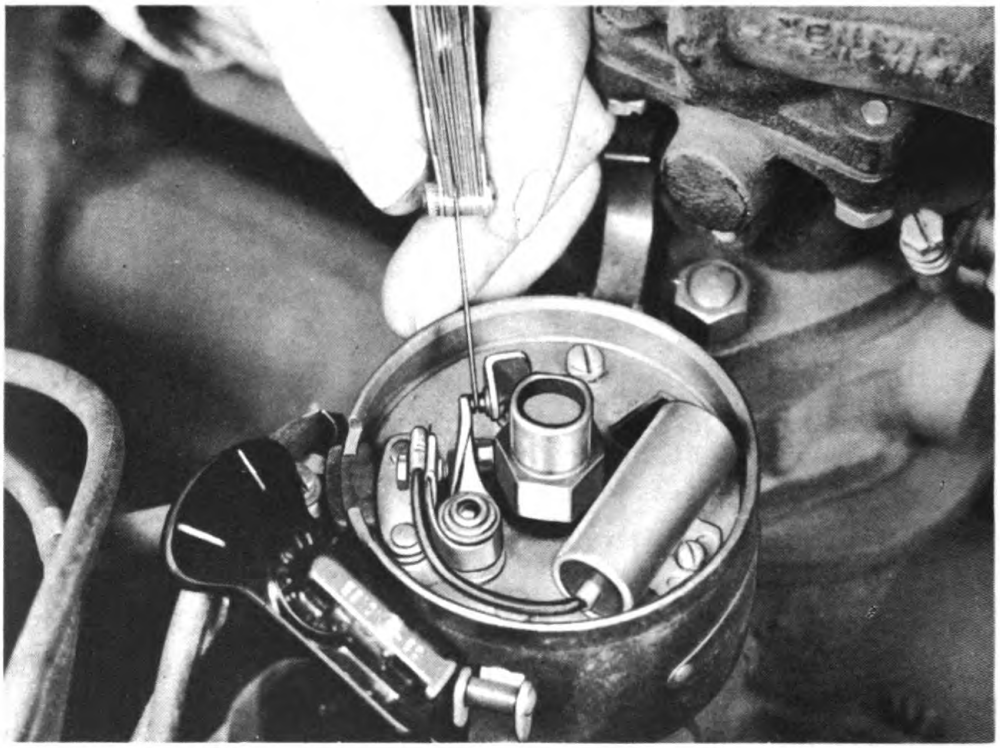
(a) Cracks.

(b) Evidence of incorrect burning at the end of the metal strip.

(c) After a rotor has had normal use, the end of the contact will become burned. If this burning is not excessive and is found only on the end of the metal strip, the rotor need not be replaced. If burning is found on the top of the strip, it indicates the rotor is too short and needs replacing. Usually when this condition is found, the distributor cap inserts will be burned on their horizontal face and the cap will also need replacing. If none of these conditions are found, thoroughly clean the rotor and set aside for reassembly.

(5) INSPECT BREAKER CONTACTS (fig. 99).

(a) If the contacts are a grayish color and are not burned or pitted, they need not be replaced.



RA PD 65881

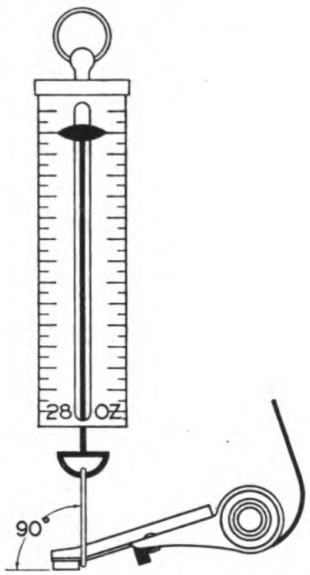
Figure 99—Checking Breaker Arm Spring Tension

(b) Breaker contact gap should be 0.020 inch. Check with a feeler gage and readjust if necessary (screwdriver and feeler gage). After adjusting, retighten the lock screw and then recheck the gap (fig. 99).

(c) Check contact point alinement. The contacts should be alined, so as to make contact near the center of the contact surfaces. Bend the stationary contact bracket to secure proper alinement and then recheck the gap.

(d) Contact point pressure should be 17 to 20 ounces. Check with spring scale hooked on the breaker arm at the contact and pull on a line perpendicular to the breaker arm (fig. 100). Take the reading just as the points separate. This pressure should be within the limits, as too low a pressure will cause missing at high speeds and too high pressure will cause excessive cam wear. Adjust the point pressure by loosening the screw holding the end of the contact arm spring (screwdriver) and slide the end of the spring in or out as necessary. Retighten the screw and recheck the pressure (screwdriver and spring scale).

(6) INSPECT CONDENSER. Inspect the condenser for broken wires or frayed insulation and clean and tighten the connection to the terminal. Be sure the condenser is firmly mounted to the base plate.



RA PD 65882

Figure 100—Testing Distributor Spring Tension

(7) INSPECT GOVERNOR MECHANISM.

(a) Free Operation. Hold the distributor shaft and turn the cam to the left as far as it will go and release. The cam should immediately return to its original position with no drag or restriction. If the governor action is sluggish, the distributor should be replaced (par. 85 **d** and **e**).

(8) SPARK TEST. Remove the distributor cap, then hand crank the engine over slowly until the circuit breakers are closed. Remove secondary coil wire from the center of the distributor cap, then turn on the ignition switch. Hold the end of the coil wire within 5/16 inch off a ground on the engine or frame, then, with the finger, open and close the timing breaker several times, which should produce sizable red sparks having a good body. If the sparks are thin and break up, also blue in color, this indicates that the sparks are weak. This might be due to a defect in the coil, but it should not be replaced until carefully checking the more likely causes, as outlined in the following paragraphs:

(9) CAUSES FOR CONTACT BURNING.

(a) Too close spacing. Proper clearance is 0.020 inch which should be measured with a feeler gage.

(b) Accumulation of oil, dirt, or other foreign matter on the surfaces. Keep clean and smooth and perfectly alined.

(c) Improper ventilation.

(d) Weak or insecurely grounded condenser.

(e) High generator voltage. This condition will not only cause excessive contact burning, but will also burn the circuit breaker springs, destroying the tension. The generator charging rate should be set just high enough to keep the battery properly charged to operate the starter,

lights, and other similar accessories. The voltage should be tested by connecting a voltmeter in the circuit from coil terminal to the ground.

(10) LUBRICATION.

(a) Add 3 to 5 drops of medium engine oil to the oiler on the outside of the base every 2,000 miles.

(b) Add 1 drop only of light oil to the breaker arm hinge pin each 5,000 miles, or whenever a new breaker arm is installed. (Do not overlubricate.)

(c) Saturate the felt in the top of the breaker cam with light oil every 5,000 miles.

(d) A light wipe of high melting point grease should be applied to the cam every 2,000 miles.

(e) Fill the pockets in the laminated governor weights with a high melting point grease every 15,000 miles.

(f) Add one drop of light oil to each of the slots in the governor yoke every 15,000 miles.

c. Breaker Point Replacement (figs. 101 and 102).

(1) EQUIPMENT.

SCREWDRIVER, 3-in.

(2) PROCEDURE.

(a) Remove Cap and Rotor. Remove wires from spark plugs 1, 2, and 3 by pulling straight up on suppressor with fingers. Release the two distributor cap to body clips. Lift distributor cap up and move to rear of engine. Remove rotor by pulling straight up with fingers.

(b) Removing Breaker Point and Arm (fig. 101).

SCREWDRIVER, 3-in.

Remove screw (3-in. screwdriver) from breaker arm spring anchor plate to release breaker arm spring (fig. 101). Lift breaker arm straight up to release from breaker arm pivot pin. Remove screw (screwdriver) in center of breaker point bracket and remove breaker point and bracket assembly off breaker arm pivot pin.

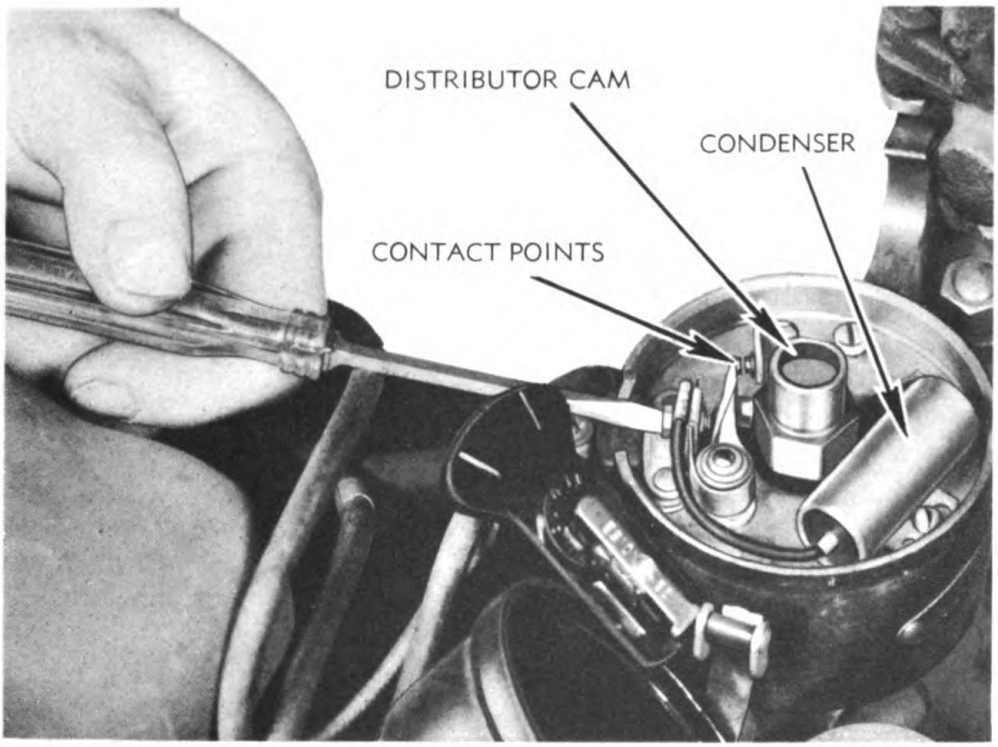
(c) Install New Breaker Arm and Point.

SCREWDRIVER, 3-in.

Place new breaker point and bracket assembly over breaker arm pivot pin and drop in place. Enter screw in center of breaker point bracket and tighten (3-in. screwdriver). Slide breaker arm over breaker arm pivot pin. Place breaker arm spring and copper strap on the cam side of breaker arm spring anchor bracket. Enter screw with lock washer and plain flat washer through condenser terminal, anchor bracket, breaker arm strap, and spring. Turn on nut and tighten (screwdriver). Adjust points to proper clearance (par. 85 **b** (5)).

(d) Replace Rotor and Cap.

Line up spring on rotor with flat spot on cam and push rotor down with fingers (fig. 102). Place distributor cap on distributor body and line up



RA PD 65883

Figure 101—Removing Distributor Contact Point

slot in cap with raised edge on body. Press distributor spring clips in place with fingers. Connect spark plug wires to spark plugs according to metal tags on wires. Press suppressors down with fingers and snap in place.

d. Distributor Removal.

(1) EQUIPMENT.

GAGE, feeler, 0.005-in.
HAMMER
PUNCH, ⅛-in. end
SCREWDRIVER
WRENCH, open-end, 7/16-in.

(2) PROCEDURE.

(a) Remove Distributor from Cylinder Head.

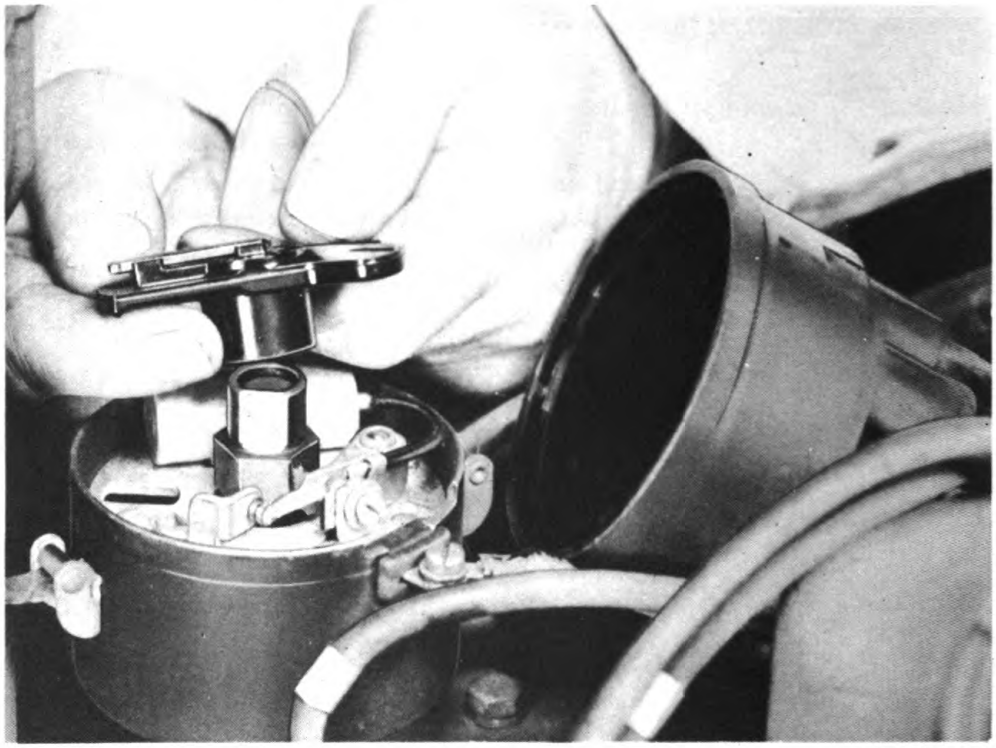
SCREWDRIVER
WRENCH, open-end, 7/16-in.

Pull high tension wires from distributor cap. Disconnect primary wire at the side of the distributor (screwdriver). Remove hold-down clamp bolt (7/16-in. open-end wrench). Lift distributor from cylinder head.

(b) Remove Distributor Coupling.

HAMMER
PUNCH

Drive out pin which fastens coupling to distributor shaft (hammer and punch). Remove coupling and spacer washer.



RA PD 65884

Figure 102—Removing Distributor Rotor

e. Distributor Installation (fig. 103).

(1) EQUIPMENT.

DRILL, 9/64-in., and electric motor	HAMMER
GAGE, feeler, 0.005-in.	SCREWDRIVER
	WRENCH, open-end, 7/16-in.

(2) PROCEDURE.

(a) Assemble Coupling to Shaft.

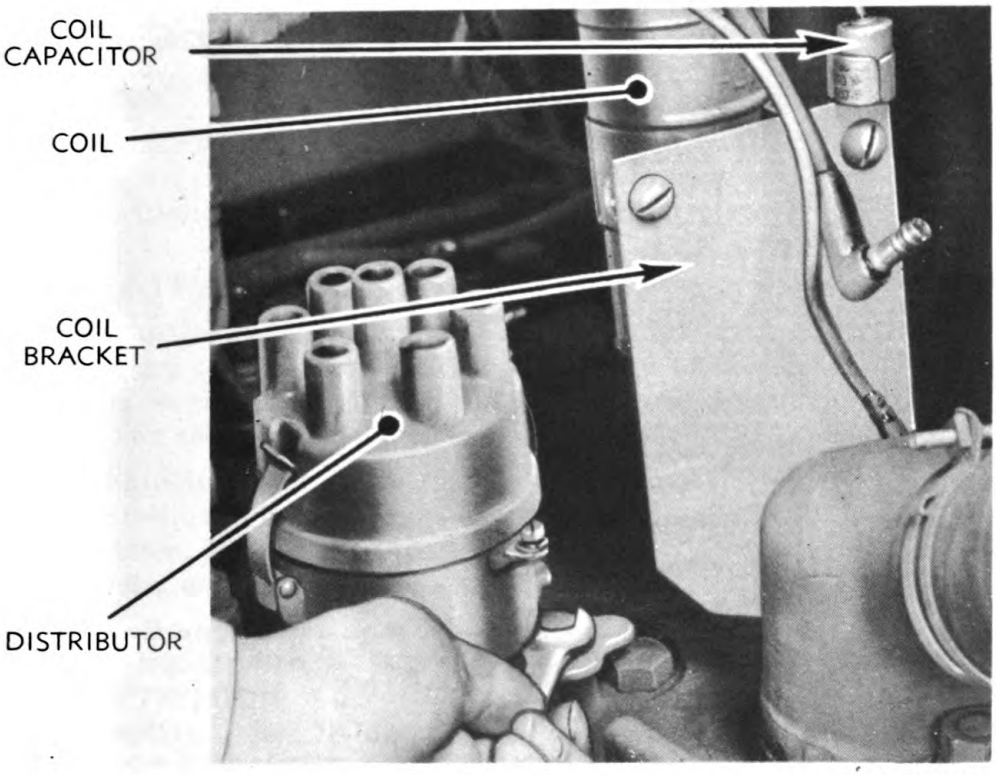
DRILL, 9/64-in., and electric motor	GAGE, feeler, 0.005-in.
	HAMMER

First assemble spacer washer to bottom end of distributor drive shaft; then, the coupling. Insert a feeler gage 0.005-in. between coupling and spacer washer, holding coupling tight. Drill hole through coupling and shaft (9/64-in. drill and electric motor). Drive in pin (hammer) and peen each end to keep in place.

(b) Assemble to Engine.

SCREWDRIVER	WRENCH, open-end, 7/16-in.

Enter distributor into cylinder head with distributor cap removed. While lowering into place, turn distributor rotor until the offset coupling drops into place. Install and tighten the hold-down arm bolt (7/16-in. open-end wrench) (fig. 103). Connect the primary wire to the distributor



RA PD 65885

Figure 103—Installing Distributor Hold-Down Bolt

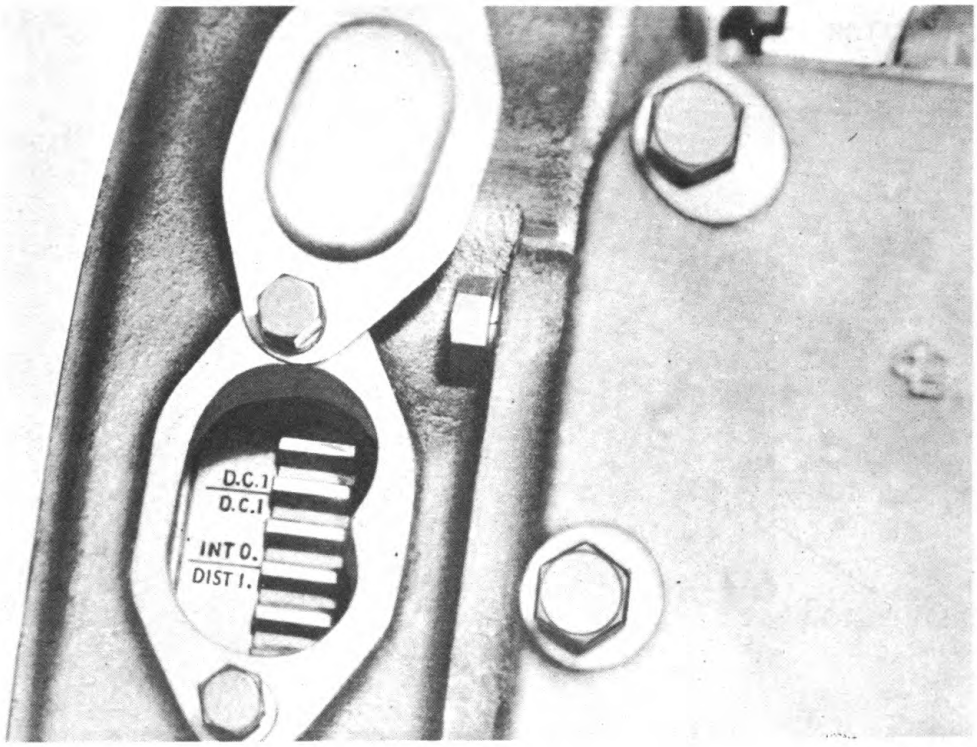
terminal with a screw and lock washer (screwdriver). Insert high tension wires in the distributor cap, the coil wire to the center pocket in the cap, and the spark plug wires in their order 1-5-3-6-2-4.

f. Distributor Timing.

SCREWDRIVER WRENCH, open-end, 9/16-in.

(1) REMOVE WIRES FROM SPARK PLUGS 1, 2, and 3. Snap off the two distributor cap springs and lift cap off distributor. Turn the engine over with starting crank until No. 1 cylinder is ready to fire and on top dead center (T.D.C.—1) note the flywheel marks through inspection plate on top of flywheel housing (9/16-in. open-end wrench). Stop the rotation on the flywheel mark distributor No. 1 (DST—1). Note the rotation of the distributor, when viewing the top. Check the contact spacing which should be 0.020 inch. Loosen the distributor hold-down clamp (screwdriver). Turn the distributor body until the breaker points are ready to open. Tighten the hold-down clamp. Replace distributor cap, making sure the cap springs are firmly in place. Replace the spark plug wires 1, 2, and 3.

(2) INCORRECT TIMING. This will cause the engine to overheat, resulting in a loss of power and also a miss. Check the initial timing as in (par. 85 f (1)).



RA PD 65886

Figure 104—Flywheel Markings

g. Distributor Condenser Replacement.

(1) EQUIPMENT.

SCREWDRIVER

(2) PROCEDURE.

(a) Removing Distributor Cap and Rotor.

Remove spark plug wires from cylinders 1, 2, and 3, by pulling straight up on suppressor with fingers. Release cap to body clips with fingers and lift distributor cap off and place to the rear side of the distributor. Release rotor by pulling straight up with fingers. Do not use pliers; they may damage rotor.

(b) Removing Condenser.

SCREWDRIVER

Remove screw (screwdriver), attaching condenser body to breaker plate. Remove screw (screwdriver), attaching condenser terminal to breaker point spring anchor bracket. Condenser may then be removed.

(c) Installing Condenser.

SCREWDRIVER

Place condenser in distributor, insert screw through condenser mounting bracket and into threaded hole in breaker plate, and tighten (screwdriver). Place the other screw with lock washer and flat washer through

condenser terminal and through breaker point spring anchor bracket. Place nut and tighten (screwdriver). To replace rotor, be sure that the spring in rotor is lined up with flat surface on cam; then, push on with fingers. Place cap on distributor, making sure offset in distributor cap lines up with offset in distributor body. Press distributor cap to body clips in place with fingers and put spark plug wires back on by pressing suppressors down with fingers. NOTE: Replace wires according to number.

86. IGNITION COIL.

a. Ignition Coil Description. The ignition coil converts low voltage primary current, from generator or battery, to a higher voltage which is strong enough to jump the spark plug gaps. The coil is secured to a bracket on the upper water manifold of the engine.

b. Ignition Coil Maintenance. If in doubt as to coil's performance, substitute a unit known to be satisfactory and check the difference in operation; proceed as in paragraph 85 b (8). Terminals must be kept tight, clean, and dry.

c. Coil and Mounting Bracket Removal.

(1) EQUIPMENT.

EXTENSION, 5-in.
HANDLE, flex, 18-in.
SCREWDRIVER
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 9/16-in.
WRENCH, socket, 3/4-in.

(2) PROCEDURE.

(a) Remove Secondary Wire.

Remove secondary wire from center of coil by pulling straight up with fingers.

(b) Remove Primary and Capacitor Wire.

WRENCH, open-end, 3/8-in.

Remove nut (3/8-in. open-end wrench) from positive terminal at top of coil and remove positive primary wire and capacitor wire. Remove nut (3/8-in. open-end wrench) from negative primary wire terminal at top of coil and then remove wire.

(c) Remove Coil.

SCREWDRIVER
WRENCH, open-end, 9/16-in.

Remove two stove bolts (screwdriver and 9/16-in. open-end wrench) and shakeproof washers, one bolt on each side of coil. Coil and capacitor may then be removed.

(d) Remove Coil Bracket.

EXTENSION
HANDLE, flex
WRENCH, socket, 3/4-in., thin wall

Remove nut fastening coil bracket to cylinder head and remove bracket (flex handle, extension, and 3/4-in. socket).

d. Coil and Mounting Bracket Installation (fig. 103).

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 9/16-in.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

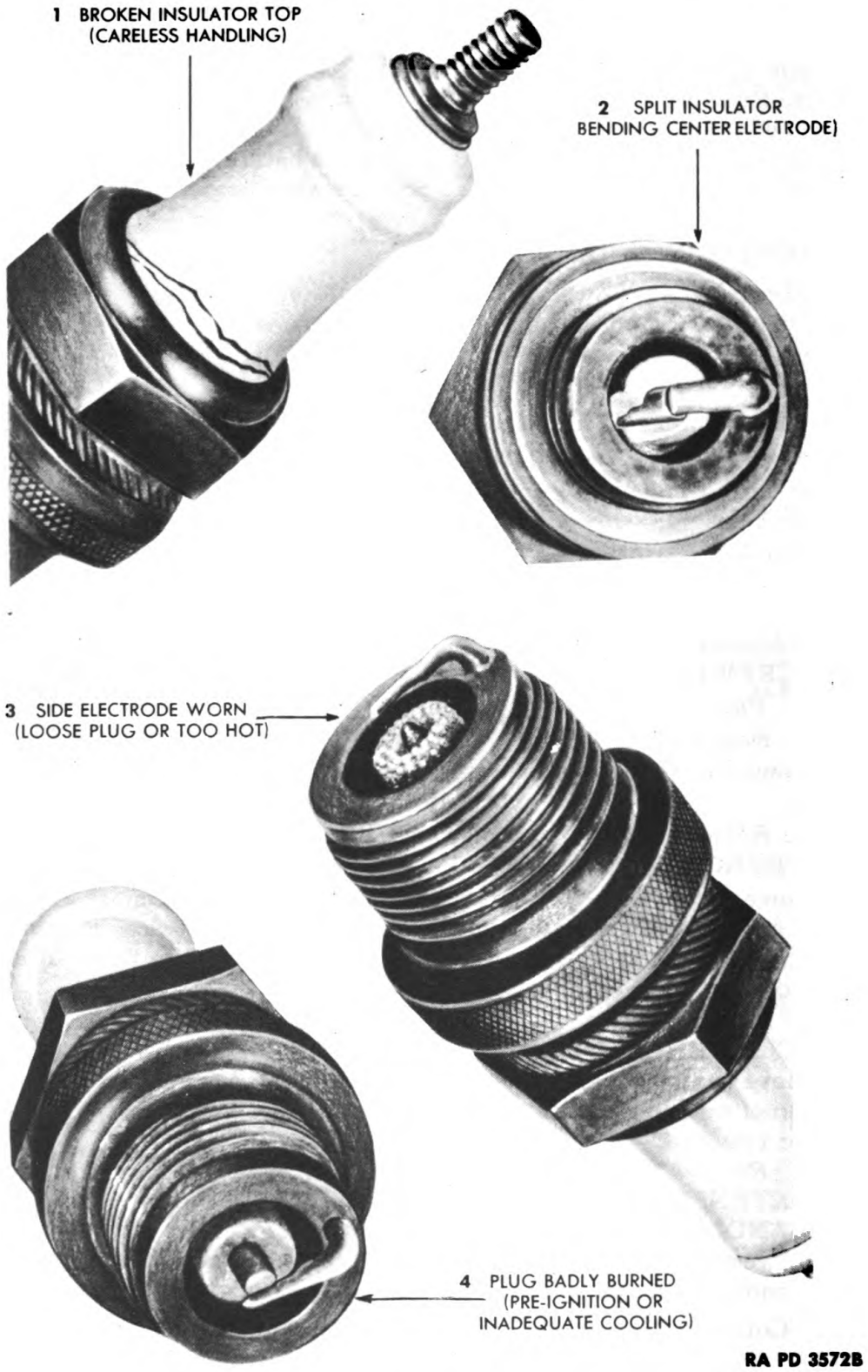


Figure 105—Spark Plug Application and Operating Conditions

ELECTRICAL SYSTEM

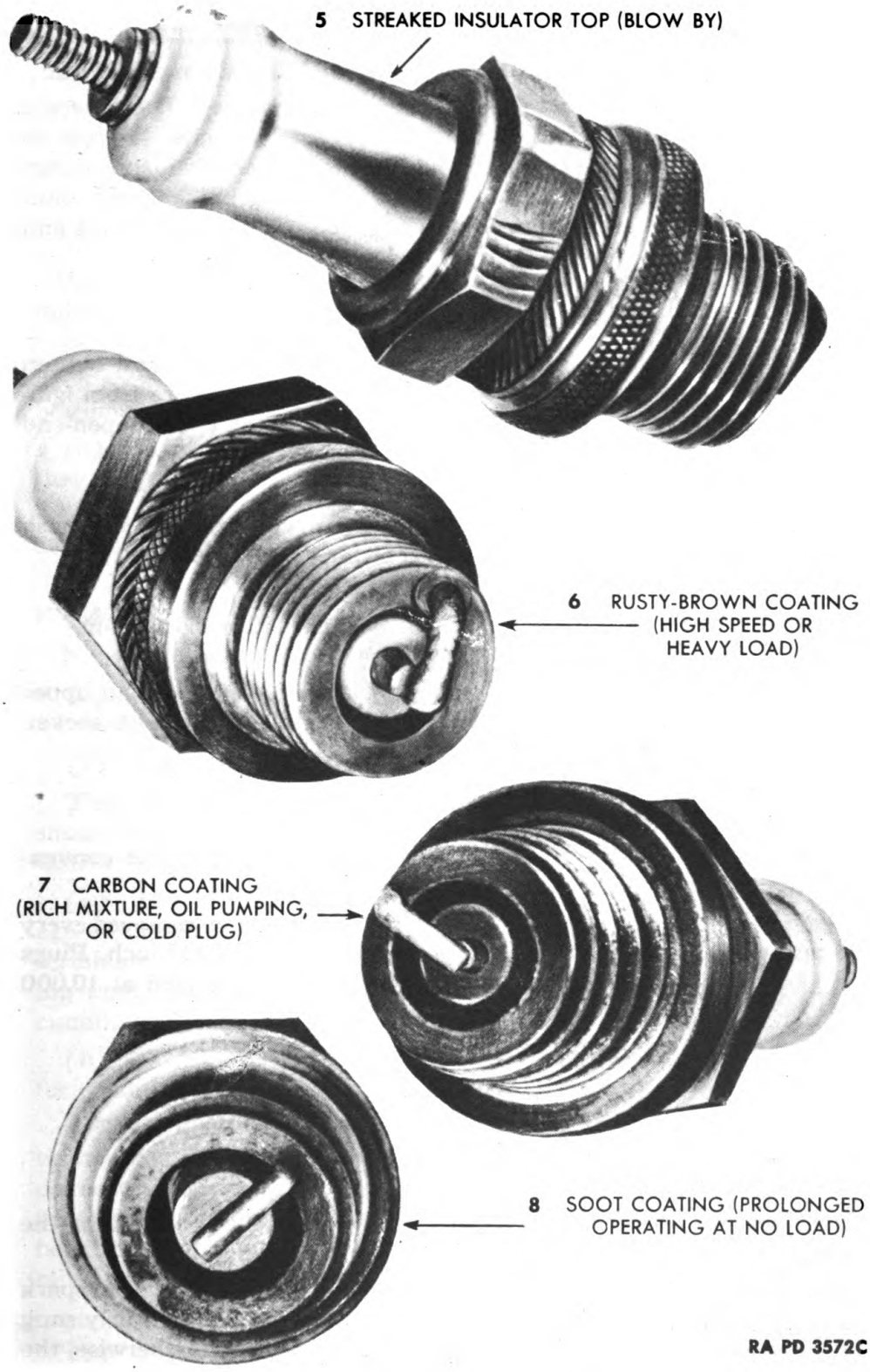


Figure 106—Spark Plug Application and Operating Conditions

(2) PROCEDURE.

(a) Install Coil to Mounting Bracket.

SCREWDRIVER WRENCH, open-end, 9/16-in.

Enter the two stove bolts in the coil mounting bracket. Then place a shakeproof washer on each of the bolts. Place the capacitor bracket on bolt farthest from the distributor and then enter another shakeproof washer on each bolt. Place the coil on the mounting bracket and enter another shakeproof washer on each bolt (fig. 103). Turn on the nuts and tighten (screwdriver and 9/16-in. open-end wrench).

(b) Connect Primary and Capacitor Wires.

WRENCH, open-end, 3/8-in

Place wire from distributor on negative terminal of coil and tighten nut (3/8-in. open-end wrench). Place capacitor wire and wire from ignition switch on positive terminal of coil and tighten nut (3/8-in. open-end wrench).

(c) Connect Coil Secondary Wire.

Place wire leading from center of distributor in center of coil and push in with fingers. Be sure this wire is down as far as possible.

(d) Install Coil and Mounting Bracket.

EXTENSION WRENCH, socket, 3/4-in.
HANDLE, flex

Place the coil and mounting bracket on the rear stud of the upper water outlet. Replace a lock washer and nut; tighten with 3/4-in. socket, thin wall, flex handle, and extension.

87. SPARK PLUGS.

a. Spark Plug Description. The spark plugs are of the conventional type. Spark plug size is 14 mm.

b. Spark Plug Maintenance. Spark plugs should be removed every 1000 miles and the gaps checked with a feeler gage to 0.025 inch. Plugs should be cleaned and tested every 5,000 miles and changed at 10,000 miles.

c. Spark Plug Removal.

(1) EQUIPMENT.

HANDLE, socket WRENCH, deep socket, 13/16-in.

(2) PROCEDURE.

(a) Remove the wires from the top of the spark plugs by pulling the plug suppressor in the direction the plug points.

(b) Slide the 13/16-in. deep socket wrench down over the spark plug, as far as it will go. NOTE: Be sure that the wrench fits fairly snug over the six-sided portion (hex) of the spark plug shell. Otherwise, the wrench will slip off and break the insulator.

(c) Unscrew the spark plug by turning it counterclockwise.

(d) Take the gasket off the lower end of the plug or remove it from the cylinder head.

(e) Clean and adjust the gaps to 0.025 inch or replace, if necessary.

d. Spark Plug Installation.

(1) EQUIPMENT.

HANDLE, socket
WRENCH, deep socket, $^{13}/_{16}$-in.

(2) PROCEDURE.

(a) Place a new gasket on the spark plug and wipe the spark plug hole in the cylinder head clean.

(b) Screw the spark plug in the cylinder head and tighten ($^{13}/_{16}$-in. deep socket wrench and socket handle). NOTE: Tighten down until it bottoms and then turn down only a quarter to a half turn more.

(c) Insert the suppressors on the spark plugs by pushing down until they snap on.

88. HORN.

a. Horn Description. The electric horn is a vibrating type, and is mounted on the right front fender.

b. Horn Maintenance.

(1) EQUIPMENT.

VOLTMETER

(2) PROCEDURE.

The following conditions affect the performance of the horn and should be checked before attempting to make any adjustments to the instruments:

(a) Low Horn Voltage. If the horn produces a weak signal, the voltage at the horn should be noted. Connect a voltmeter across the horn terminals. Voltage reading should not be less than 5 volts. A lower reading would indicate either a low battery, or a high resistance in the horn circuit.

(b) Low Battery. Check the battery with a voltmeter or hydrometer for condition of charge. If low, the battery should be replaced.

(c) Loose or Corroded Connections in Horn Circuit. Clean and tighten connections wherever necessary. Check for defective wiring by connecting separate test leads from the horn to the battery. A loose connection or poor contact at the horn push button switch may cause the horn to operate intermittently. Shunt around the horn button to determine whether there is a poor contact at the push-button switch.

c. Horn Adjustment.

(1) EQUIPMENT.

AMMETER
SCREWDRIVER
WRENCH, open-end, ½-in.

(2) PROCEDURE.

No adjustments should be necessary on new horns, as they are carefully adjusted and tested before they leave the factory. However, if the tone is not satisfactory after checking the above conditions, it will be necessary to adjust the horn. Remove the back shell from the horn (screwdriver). Connect ammeter in circuit at the horn and adjust current consumption by varying position of adjusting nut. Loosen adjusting lock nut and turn adjusting nut (½-in. open-end wrench and screwdriver) to the left to increase the current, to the right to decrease the current. Increasing the current increases the volume. Too much current will cause the horn to have a sputtering sound. This adjustment is very sensitive. Move nut 1/10 turn at a time and lock in position each time before trying the horn. If ammeter is not available, adjust according to sound. The correct air gap between the armature and core is very important for proper tone. The gap must be uniform across the entire surface of the armature. The width of the gap may be determined by using a feeler gage. Adjustments are made by means of the air gap adjusting nuts.

d. Horn Removal.

(1) EQUIPMENT.

EXTENSION, 6-in.	WRENCH, open-end, 7/16-in.
HANDLE, ratchet	WRENCH, open-end, 3/4-in.
SCREWDRIVER, 6-in.	WRENCH, socket, 3/4-in.

(2) PROCEDURE.

(a) Remove Horn Wires.

SCREWDRIVER

Remove the two screws and washers (screwdriver) holding the horn wires to the horn.

(b) Remove Horn from Fender.

EXTENSION, 6-in.	WRENCH, open-end, 3/4-in.
HANDLE, ratchet	WRENCH, socket, 3/4-in.
WRENCH, open-end, 7/16-in.	

Remove nuts and lock washers from two bolts attaching horn to fender (7/16-in. open-end wrench, 3/4-in. open-end wrench, 3/4-in. socket wrench, 6-in. extension, and ratchet handle). Remove the horn and bolts.

(c) Horn Button and Wire Removal (par. 142).

e. Horn Installation.

(1) EQUIPMENT.

EXTENSION, 6-in.	WRENCH, open-end, 7/16-in.
HANDLE, ratchet	WRENCH, open-end, 3/4-in.
SCREWDRIVER	WRENCH, socket, 3/4-in.

(2) PROCEDURE.

(a) Install Horn on Fender.

EXTENSION, 6-in.	WRENCH, open-end, 3/4-in.
HANDLE, ratchet	WRENCH, socket, 3/4-in.
WRENCH, open-end, 7/16-in.	

Place two bolts through horn bracket and through fender. Replace two lock washers and nuts and tighten (7/16-in. open-end wrench, 3/4-in. open-end wrench, 3/4-in. socket wrench, 6-in. extension, and ratchet handle).

(b) Replace Horn Wires.

SCREWDRIVER

Connect the wires to horn terminals (screwdriver) with two screws and washers.

(c) Horn Button and Wire Removal (par. 142).

89. WIRING SYSTEM (figs. 107 and 108).

a. Wiring System Description. The wiring system is composed of several harnesses, chassis, regulator, generator, and tilt-ray switch (figs. 107 and 108).

b. Wiring System Maintenance.

(1) One of the most important things when wiring a vehicle is to use the right weight wire in all cases, because too light a wire will not carry the current properly, causing the wire to heat up excessively and fail. The starting circuit is a very heavy cable as this cable carries the largest load; the charging circuit where it does not coincide with the starting circuit has cables of medium weight, and the lighting has a light cable. Without exception all the connections of the starting and lighting system must be made exactly as indicated in the diagram if entirely satisfactory results are to be obtained from the equipment.

(2) In checking the lighting system, it is well to first check the fuses, next examine the connections at the motor starting switch or battery to see that they are tight and making good electrical contact. When headlights brighten excessively at high speed of motor, examine the charging circuit for high resistance. When the instrument panel light and tail light flicker at low speed, it is an indication of high resistance in the charging circuit. This resistance may be due to a broken or damaged cable or dirty or poorly soldered terminal or even to a loose connection.

(3) It is very important that the wiring of the vehicle be properly cared for and it is well to inspect the different terminals and connections at regular intervals. The battery terminal should be given special attention each time the battery is filled.

(4) If ammeter or indicator registers discharge with all the lights off when the engine idles, look for a short circuit in wiring from battery to switch or battery to junction block. If, after checking these parts, the trouble is not corrected, it may be due to a defective ammeter and a simple test can be made by disconnecting one of the battery terminals, either at the battery or in the battery line. If the ammeter hand turns to zero, it is evident that the trouble is leakage of current due to short circuit which must be remedied immediately before battery becomes discharged. If the ammeter hand does not return to zero after disconnecting battery, it is evident that ammeter is not working properly and should

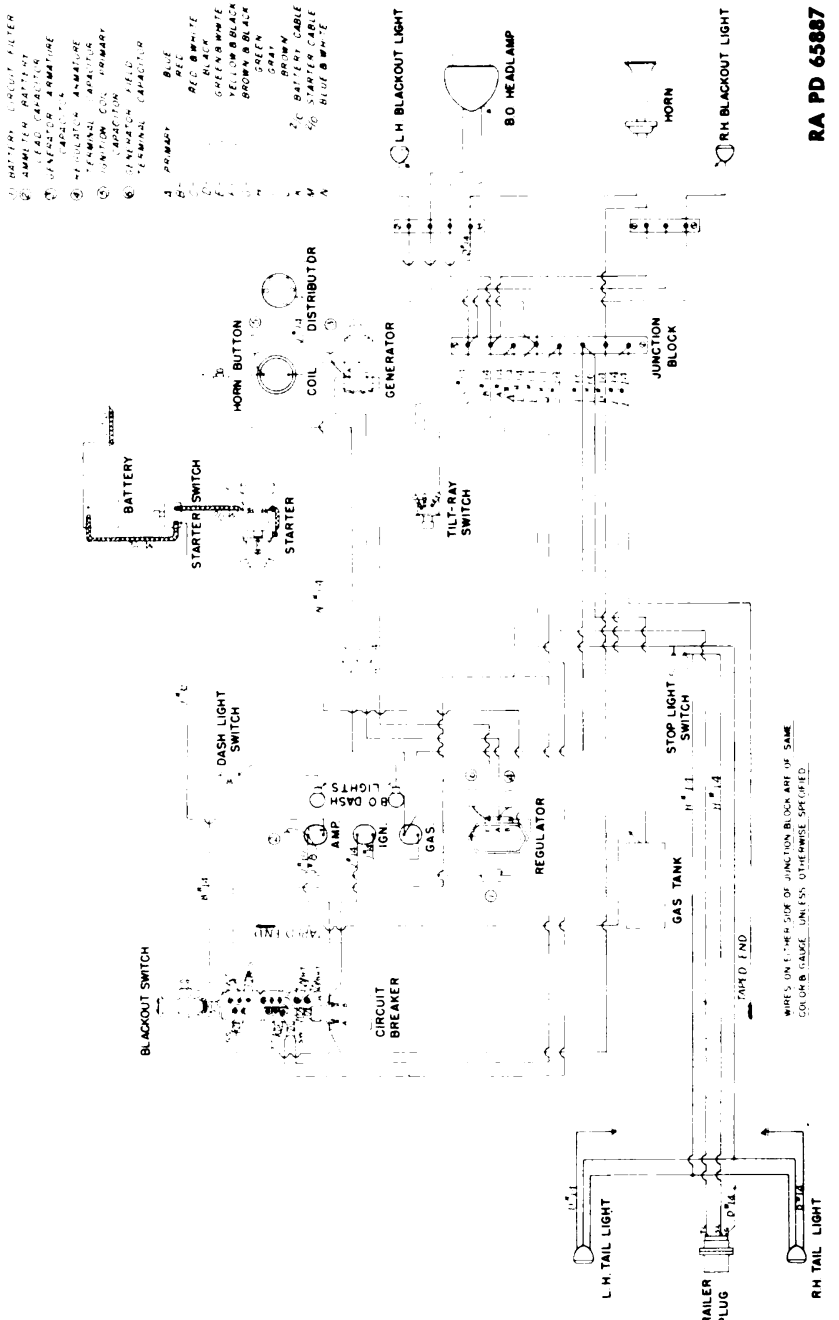
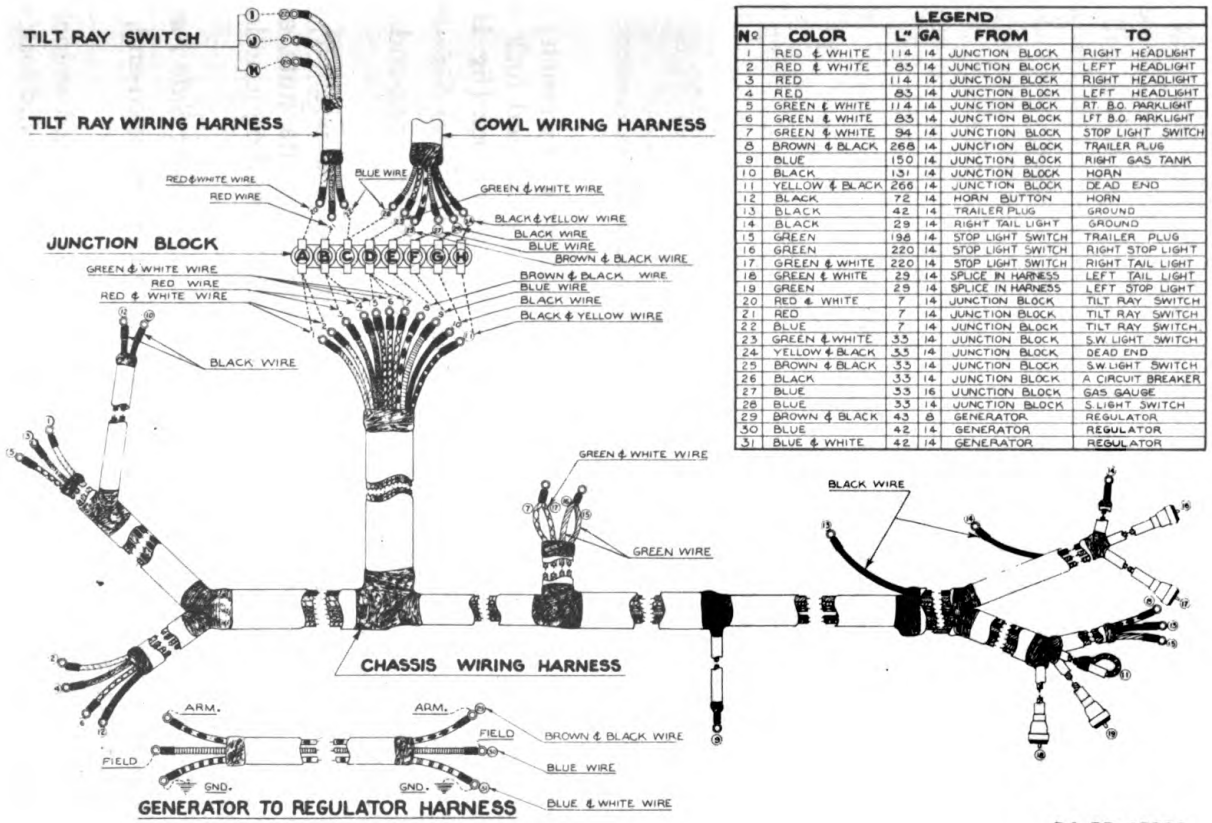


Figure 107—Wiring Diagram



LEGEND					
N°	COLOR	L"	GA	FROM	TO
1	RED & WHITE	114	14	JUNCTION BLOCK	RIGHT HEADLIGHT
2	RED & WHITE	85	14	JUNCTION BLOCK	LEFT HEADLIGHT
3	RED	114	14	JUNCTION BLOCK	RIGHT HEADLIGHT
4	RED	85	14	JUNCTION BLOCK	LEFT HEADLIGHT
5	GREEN & WHITE	114	14	JUNCTION BLOCK	RT B.O. PARKLIGHT
6	GREEN & WHITE	85	14	JUNCTION BLOCK	LFT B.O. PARKLIGHT
7	GREEN & WHITE	94	14	JUNCTION BLOCK	STOP LIGHT SWITCH
8	BROWN & BLACK	268	14	JUNCTION BLOCK	TRAILER PLUG
9	BLUE	150	14	JUNCTION BLOCK	RIGHT GAS TANK
10	BLACK	131	14	JUNCTION BLOCK	HORN
11	YELLOW & BLACK	266	14	JUNCTION BLOCK	DEAD END
12	BLACK	72	14	HORN BUTTON	HORN
13	BLACK	42	14	TRAILER PLUG	GROUND
14	BLACK	29	14	RIGHT TAIL LIGHT	GROUND
15	GREEN	198	14	STOP LIGHT SWITCH	TRAILER PLUG
16	GREEN	220	14	STOP LIGHT SWITCH	RIGHT STOP LIGHT
17	GREEN & WHITE	220	14	STOP LIGHT SWITCH	RIGHT TAIL LIGHT
18	GREEN & WHITE	29	14	SPLICE IN HARNESS	LEFT TAIL LIGHT
19	GREEN	29	14	SPLICE IN HARNESS	LEFT STOP LIGHT
20	RED & WHITE	7	14	JUNCTION BLOCK	TILT RAY SWITCH
21	RED	7	14	JUNCTION BLOCK	TILT RAY SWITCH
22	BLUE	7	14	JUNCTION BLOCK	TILT RAY SWITCH
23	GREEN & WHITE	33	14	JUNCTION BLOCK	S.W. LIGHT SWITCH
24	YELLOW & BLACK	33	14	JUNCTION BLOCK	DEAD END
25	BROWN & BLACK	33	14	JUNCTION BLOCK	S.W. LIGHT SWITCH
26	BLACK	33	14	JUNCTION BLOCK	A CIRCUIT BREAKER
27	BLUE	33	16	JUNCTION BLOCK	GAS GAUGE
28	BLUE	33	14	JUNCTION BLOCK	S.LIGHT SWITCH
29	BROWN & BLACK	43	8	GENERATOR	REGULATOR
30	BLUE	42	14	GENERATOR	REGULATOR
31	BLUE & WHITE	42	14	GENERATOR	REGULATOR

Figure 108—Wiring Harness

be corrected. If all lights go out look for an open or short circuit between the switch and battery. It may also be possible that the connections are defective at the lighting switch or the fuses may be burned out.

(5) In case the starter will not turn the motor over, you should first check your battery to see if it is well charged. Constantly trying to start with a low battery will result in a worn starter commutator. If the starter appears too weak to turn the motor past compression look for either a low battery or loose or corroded connections in the starter circuit. Easier starting may be secured in cold weather if the clutch is also released; this disconnects the motor from the transmission. In this way, it will not be necessary for the starter to turn the motor and also transmission gears at the same time. If all these items have been checked and the starter still does not work properly, it would be well to make complete inspection of the starter. It may be that the commutator needs smoothing or other repairs are needed. When smoothing commutator, either in starter or generator, use No. 00 flint paper, but never use emery paper.

c. Junction Block Removal (fig. 107).

(1) EQUIPMENT.

SCREWDRIVER, 6-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 3/8-in.

(2) PROCEDURE.

(a) Remove Junction Block from Dash.

SCREWDRIVER, 6-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 3/8-in.

Remove eight nuts and lock washers (3/8-in. open-end wrench) holding wires to junction block. Remove the two bolts, nuts, and lock washers holding junction block to dash. Remove the junction block (fig. 109).

(b) Remove Junction Block from Right-Hand Fender Side Panel.

SCREWDRIVER, 6-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 3/8-in.

Remove the three nuts and washers (3/8-in. open-end wrench) holding the wires to the junction block. Remove the two bolts, nuts, and lock washers (screwdriver and 7/16-in. open-end wrench) holding junction block to fender side panel. Remove the junction block.

(c) Remove Junction Block from Left-Hand Fender Side Panel.

SCREWDRIVER, 6-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 3/8-in.

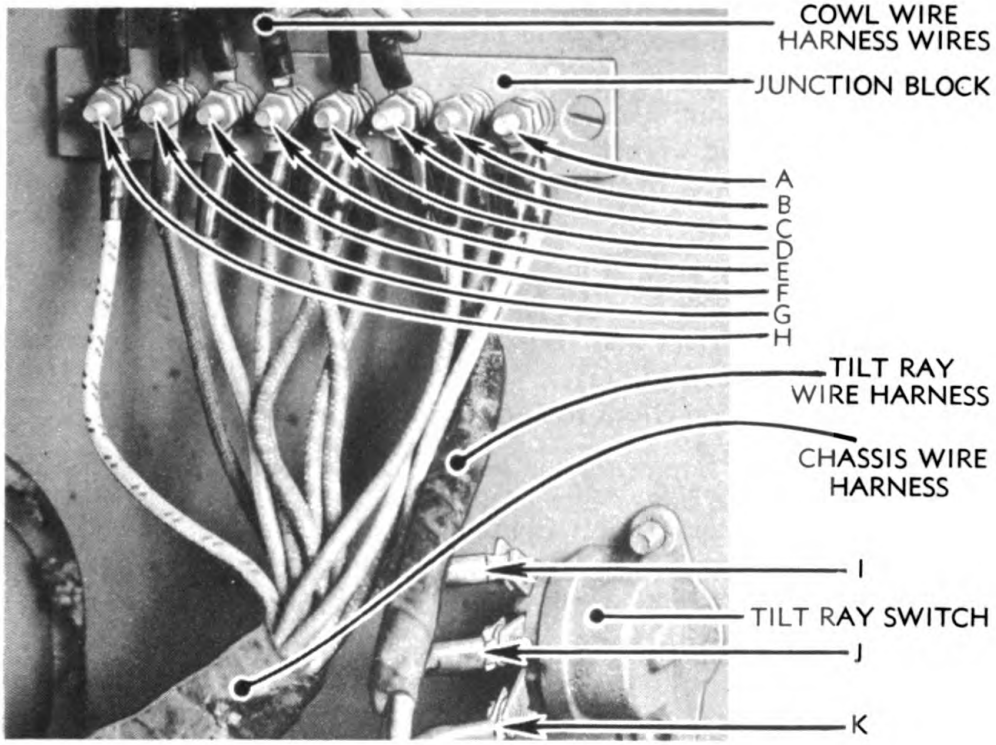
Remove the four nuts and lock washers (3/8-in. open-end wrench) holding wires to junction block. Remove the two bolts, nuts, and lock washers (screwdriver and 7/16-in. open-end wrench) from the junction block. Remove junction block.

d. Junction Block Installation.

(1) EQUIPMENT.

SCREWDRIVER, 6-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 3/8-in.

ELECTRICAL SYSTEM



KEY	DESCRIPTION	FROM	TO
A	Red and White Wire	Junction Block	Head Lights
B	Red Wire	Junction Block	Head Lights
C	Blue Wire	Junction Block	Tilt-Ray Switch
C	Blue Wire	Junction Block	S. Light Switch
D	Green and White Wire	Junction Block	Marker and Tail Lights
D	Green and White Wire	Junction Block	S. Light Switch
E	Brown and Black Wire	Junction Block	Trailer Tail Light
E	Brown and Black Wire	Junction Block	S. W. Light Switch
F	Blue Wire	Junction Block	Fuel Tank Unit
F	Blue Wire	Junction Block	Gas Gauge
G	Black Wire	Junction Block	Horn
G	Black Wire	Junction Block	A. Circuit Breaker
H	Yellow and Black Wire	Junction Block	Dead End
H	Yellow and Black Wire	Junction Block	Dead End
I	Blue Wire	Tilt-Ray Switch	Junction Block
J	Red Wire	Tilt-Ray Switch	Junction Block
K	Red and White Wire	Tilt-Ray Switch	Junction Block

RA PD 65889

Figure 109—Junction Block and Wiring

(2) PROCEDURE.

(a) Install Junction Block to Dash.

SCREWDRIVER, 6-in.
WRENCH, open-end 3/8-in.
WRENCH, open-end, 7/16-in.

Fasten junction block to dash with two bolts, nuts, and lock washers (screwdriver and 7/16-in. open-end wrench). Connect wires to junction block (3/8-in. open-end wrench) (fig. 109) (par. 89 f (2) *(g)*).

(b) Install Junction Block to Right Fender Side Panel.

SCREWDRIVER
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 7/16-in.

Fasten junction block to right fender side panel with two bolts, nuts, and washers (screwdriver and 7/16-in. open-end wrench). Connect wires to junction block (par. 69 f *(i)*).

(c) Install Junction Block to Left Fender Side Panel.

SCREWDRIVER
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 7/16-in.

Fasten junction block to left front fender side panel with two bolts, nuts, and lock washers (screwdriver and 7/16-in. open-end wrench). Connect wires to junction block (par. 89 f (2) *(h)*).

e. Chassis Wiring Harness Removal.

(1) EQUIPMENT.

IRON, soldering
SCREWDRIVER
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 7/16-in.

(2) PROCEDURE.

(a) Remove Wires from Right Fender Junction Block.

WRENCH, open-end, 3/8-in.

Remove the three wires (3/8-in. open-end wrench) from the junction block on the right front fender. Red wire is service headlight, the red and white wire is the dimmer, and the green and white is the blackout light.

(b) Remove Horn Wires.

SCREWDRIVER, 6-in.

Remove the two black wires from the horn terminal (screwdriver).

(c) Remove Wires from Left Front Fender Junction Block.

WRENCH, open-end, 3/8-in.

Remove the four wires (3/8-in. open-end wrench) from the junction block on the left front fender. The red wire connects to the bright headlight, the red and white wire to the dimmers, the green and white to the blackout light, and the black wire to the horn terminal.

(d) Remove Wires from Junction Block on Dash.

WRENCH, open-end, 3/8-in.

Remove the eleven wires (3/8-in. open-end wrench) from the junction block on the front left side of the dash. Red wires connect to headlight (bright), red and white wires to headlight dimmer, green and white to

blackout parking light and stop light, brown and black to trailer plug, blue to fuel tank, black to the horn, and yellow and black to a dead end.

(e) Remove Stop Light Switch Wires.

SCREWDRIVER, 6-in.

Remove the wires (screwdriver) from the stop light switch on the master cylinder. NOTE: There are only two terminals, as these wires are doubled up. Red and green with white wires are connected to one terminal and the two green wires to the other terminal.

(f) Remove Wire from Fuel Tank Gage Unit.

SCREWDRIVER, 6-in.

Remove the blue wire (screwdriver) from the fuel gage unit on the fuel tank. Loosen the clip holding the wire to the fuel tank (screwdriver).

(g) Remove Wires from Right Stop Light and Tail Light.

IRON, soldering
WRENCH, open-end, 3/8-in.
SCREWDRIVER, 6-in.

Disconnect the green stop light wire and green and white tail light wire by turning the socket plug one-quarter turn to the right. The wires are soldered to the plug terminals and must be removed by heating them (soldering iron). Remove the black ground wire on the stop and tail light connection (3/8-in. open-end wrench). Remove the black ground wire on the right side of the cross member (3/8-in. open-end wrench and screwdriver).

(h) Remove Wires from Left Stop Light and Tail Light.

IRON, soldering
WRENCH, open-end, 3/8-in.
SCREWDRIVER

Disconnect the green stop light wire and green and white tail light wire by turning the socket plug one-quarter turn to the right. These wires are soldered to the plug terminals and must be removed by heating them (soldering iron).

(i) Remove Wires from Trailer Plug.

SCREWDRIVER, 6-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 3/8-in.

Remove the cap on the back of the trailer plug by removing the nut (7/16-in. open-end wrench). Remove the cap. Remove the black and brown junction block to trailer plug wire (3/8-in. open-end wrench). Remove the green stop light switch to trailer plug wire (3/8-in. open-end wrench). Remove the black trailer plug ground wire (3/8-in. open-end wrench).

(j) Remove Wires from Chassis.

SCREWDRIVER
WRENCH, open-end, 3/8-in.

Remove the fifteen clips holding the wiring harness to the chassis side channel and cross members (screwdriver and 3/8-in. open-end wrench). Pull the harness assembly from the chassis.

f. Chassis Wiring Harness Installation.

(1) EQUIPMENT.

IRON, soldering
WRENCH, open-end, 3/8-in.
SCREWDRIVER

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

(2) PROCEDURE.

(a) Install Wires in Chassis.

SCREWDRIVER
WRENCH, open-end, 3/8-in.

Slide the harness assembly into place in the left side frame channel. Attach the harness assembly to the frame side channel and cross members with the fifteen clips, bolts, nuts, and lock washers (screwdriver and 3/8-in. open-end wrench).

(b) Connect Trailer Plug Wires.

SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 3/8-in.

Connect the green (stop light switch to right-hand stop light) wire to the trailer plug terminal marked TS and tighten it with a nut and lock washer (3/8-in. open-end wrench). Connect the brown and black (junction block to trailer plug) wire to the trailer plug terminal marked TL and tighten with a nut and lock washer (3/8-in. open-end wrench). Connect the black (right-hand tail light to ground) wire to the terminal marked GR on the trailer plug and tighten with nut and lock washer (3/8-in. open-end wrench). Slide the cap over the trailer plug and tighten cap with a nut (7/16-in. open-end wrench). Fasten the black ground wire to the frame with the bolt, nut, and lock washer (screwdriver and 3/8-in. open-end wrench).

(c) Connect Left Stop and Tail Light Wires.

IRON, soldering

Solder a socket plug to each stop and tail light wire (soldering iron). Enter the plugs in the left stop and tail light and turn one-quarter turn to the left. The plug with the green wire in the bottom connection (stop light) and the plug with the green and white wire in the top connection (tail light). Tape the yellow and black (junction block to dead end) wire.

(d) Connect Right Stop and Tail Light Wires.

IRON, soldering
WRENCH, open-end, 3/8-in.
SCREWDRIVER

Solder a socket plug to each stop and tail light wire (soldering iron). Enter the socket plugs in the stop and tail light and turn the plugs one-quarter turn to the left. The green wire is placed in the lower connection (stop light) and the green and white wire in the top connection (tail light). Attach the black ground wire to the ground connection of the stop and tail light with a nut and washer (3/8-in. open-end wrench). Connect the other end of the black ground wire to the frame cross member with a bolt, nut, and lock washer (screwdriver and 3/8-in. open-end wrench).

(e) Connect Fuel Gage Unit Wire.

SCREWDRIVER, 6-in.

Connect the blue (junction block to fuel tank) wire to the fuel tank unit with a screw and lock washer (screwdriver). Attach the wire to the fuel tank with a clip and tighten with a screw and lock washer (screwdriver).

(f) Connect Stop Light Switch Wire.

SCREWDRIVER, 6-in.

Connect the terminal with the two green (stop light switch to trailer plug and stop light switch to right stop light) wires to the stop light switch terminal nearest the frame with a screw (screwdriver). Connect the terminal with the two green and white (junction plug to stop and tail light switch and stop light switch to right tail light) wires to the opposite stop light terminal with a screw (screwdriver).

(g) Connect Wires to Junction Block on Dash (fig. 109).

WRENCH, open-end, 3/8-in.

1. Connect the wires to the junction block in the following manner with eight lock washers and nuts (3/8-in. open-end wrench):

2. Two red and white wires (junction block to right headlight and junction block to left headlight).

3. Two red wires (junction block to right headlight and junction block to left headlight).

4. Three green and white wires (junction block to right blackout marker light and junction block to left blackout marker light).

5. Brown and black wire (junction block to trailer plug).

6. Blue wire (junction block to fuel tank).

7. Black wire (junction block to horn).

8. Yellow and black wire (junction block to dead end).

(h) Connect Wires to Left Front Fender Junction Block.

WRENCH, open-end, 3/8-in.

Connect the wires to the left front fender junction block in the following manner with four lock washers and nuts (3/8-in. open-end wrench): The green and white (junction block to left blackout marker light) wire to the terminal nearest the radiator. The red and white (junction block to left headlight) wire on terminal, second from the front. The red, (junction block to left headlight) wire on terminal, third from front. The black (horn button to horn) wire on terminal, fourth from front.

(i) Connect Wires to Right Front Fender Junction Block.

WRENCH, open-end, 3/8-in.

Connect the wires to the left front fender junction block in the following manner with three lock washers and nuts (3/8-in. open-end wrench): Connect the green and white (junction block to right blackout marker light) wire to the terminal nearest the radiator. The red and white (junction block to right headlight) wire to terminal, second from radiator. The red (junction block to right headlight) wire to terminal, third from radiator.

(j) Connect Horn Wires.

SCREWDRIVER, 6-in.

Connect the two black (horn button to horn and junction block to horn) wires to the horn with screws and lock washers (screwdriver).

g. Generator to Regulator Wire Harness Removal.

(1) EQUIPMENT.

SCREWDRIVER, 10-in.
WRENCH, open-end, 3/8-in.
WRENCH; open-end, 7/16-in.
WRENCH, open-end, 1/2-in.

(2) PROCEDURE.

Loosen the two wire clips on the generator (3/8-in. open-end wrench and screwdriver). Remove the two nuts, lock washers, and the one screw holding the three wires (screwdriver, 7/16-in. open-end wrench, and 1/2-in. open-end wrench). Remove the three screws and lock washers from the regulator (screwdriver) and remove the three wires. Slide the two wire clips from the wire harness and remove the harness assembly.

h. Generator to Regulator Wire Harness Installation.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in.

(2) PROCEDURE.

Connect the blue and white wire to the ground terminals of the generator and regulator and tighten them with the two cap screws and lock washers (screwdriver). Connect the brown and black wire to the generator armature terminal and tighten with nut and lock washer (1/2-in. open-end wrench). Fasten the other end of the brown and black wire to the regulator armature terminal and tighten with cap screw (screwdriver). Connect the blue wire to the field terminal of the generator and tighten with the nut and lock washer (7/16-in. open-end wrench). Fasten the other end of the blue wire to the regulator field terminal and tighten with the screw and lock washer (screwdriver). Attach the wiring harness to the generator with the two clips (screwdriver and 3/8-in. open-end wrench).

i. Regulator to Ammeter Wire Harness Removal.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 3/8-in.

(2) PROCEDURE.

(a) Remove Wire from Ammeter to Battery Circuit Filter.

SCREWDRIVER
WRENCH, open-end, 3/8-in.

Remove the nut and lock washer on the ammeter (3/8-in. open-end wrench) positive side. Remove the screw and lock washer on the battery circuit filter (screwdriver). Remove the brown and black wire.

(b) Remove Wire from Battery Circuit Filter to Regulator.

SCREWDRIVER

Remove the two screws and lock washers from the regulator and battery circuit filter (screwdriver), attaching wire.

j. Regulator to Ammeter Wire Harness Installation.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 3/8-in.

(2) PROCEDURE.

(a) Connect Wire to Regulator and Battery Circuit Filter.

SCREWDRIVER WRENCH, open-end, 3/8-in.

Connect the short brown and black wire to the battery terminal of the regulator with the screw and lock washer (screwdriver). Connect the opposite terminal of the wire to the battery circuit filter with the screw and lock washer (screwdriver). This is the battery circuit filter terminal on the regulator side.

(b) Connect Wire to Battery Circuit Filter and Ammeter.

SCREWDRIVER WRENCH, open-end, 3/8-in.

Connect the long brown and black wire to the battery circuit filter with the screw and lock washer (screwdriver). Slide the wire through the opening in the dash. Tighten the other end of the wire to the positive side of the ammeter with the nut and lock washer (3/8-in. open-end wrench).

k. Junction Block to Tilt-Ray Switch Wire Harness Removal.

(1) EQUIPMENT.

SCREWDRIVER, 6-in. WRENCH, open-end, 3/8-in.

(2) PROCEDURE.

Remove the five nuts and three lock washers (3/8-in. open-end wrench) from terminals "a", "b", and "c" of the junction block on the dash. Remove the wires from the junction block. Remove the three screws and flat washers from the three tilt-ray switch terminals (screwdriver). Remove the wire harness assembly.

l. Junction Block to Tilt-Ray Switch Wire Harness Installation.

(1) EQUIPMENT.

SCREWDRIVER WRENCH, open-end, 3/8-in.

(2) PROCEDURE.

Connect the wires to the tilt-ray switch in the following manner: red and white wire on the bottom terminal, the red wire on the center terminal, and the blue wire on the top terminal (screwdriver). Connect the wires to the junction block on the dash in the following manner: the red and white wire on terminal "a", the red wire on terminal "b", and the blue wire on terminal "c" (3/8-in. open-end wrench). The wires from the chassis harness are attached in the same manner: the two red and white wires to terminal "a", the two red wires to terminal "b", and the blue wire from the cab harness to "c" (3/8-in. open-end wrench).

m. Junction Block to Light Switch Wire Harness Removal.

(1) EQUIPMENT.

SCREWDRIVER WRENCH, open-end, 6-in.

(2) PROCEDURE.

Remove the eleven nuts and six lock washers attaching wires to the junction block (3/8-in. open-end wrench). Remove screw and two wires (green and white and brown and black) (screwdriver) from the left

rear headlight switch. Remove screw and blue wire (screwdriver) from the right rear headlight switch terminal. Remove the nut, washer, and wire (3/8-in. open-end wrench) from the fuel gage. Remove the screw and black wire (screwdriver) from the circuit breaker of the light switch. Loosen the two wire clips (screwdriver and 3/8-in. open-end wrench) and slide them from the wire harness. Remove the wire harness assembly.

n. Junction Block to Instrument Wire Harness Installation.

(1) EQUIPMENT.

SCREWDRIVER — WRENCH, open-end, 3/8-in.

(2) PROCEDURE.

(a) Enter one end of the wiring harness through the opening of the dash. Connect the wires to the junction block on the dash with the eleven nuts and six lock washers (3/8-in. open-end wrench) and to the light switch with the three bolts, nuts, and lock washers (screwdriver and 3/8-in. open-end wrench). Attach the wires in the following manner:

(b) Connect the pale blue wire to "c" terminal of the junction block and the opposite end to the right rear terminal of the headlight switch.

(c) Connect the green and white wire to terminal "d" of the junction block and the opposite end to the left rear headlight switch terminal.

(d) Connect the brown and black wire to terminal "e" of the junction block and the opposite end to the left rear headlight switch terminal.

(e) Connect the bright blue wire to terminal "f" of the junction block and the opposite end to the fuel gage.

(f) Connect the black wire to terminal "g" of the junction block and the opposite end to the circuit breaker on the light switch.

(g) Connect the yellow and black wire to terminal "h" of the junction block and tape the other end, as this is a dead end.

90. SWITCHES.

a. Ignition Switch. The ignition switch is a key type that has two positions: "off" and "on".

(1) IGNITION SWITCH REMOVAL.

(a) Equipment.

PLIERS — WRENCH, open-end, 3/8-in.

(b) Procedure.

Remove the two nuts and washers (3/8-in. open-end wrench) attaching wires to switch and remove the wires. Remove the nut (pliers) holding switch to instrument panel and remove the switch.

(2) IGNITION SWITCH INSTALLATION.

(a) Equipment.

PLIERS — WRENCH, open-end, 3/8-in.

(b) Procedure.

Position switch in instrument panel and tighten with round nut (pliers). Connect the coil and fuel gage wires with a nut and washer to the lower

terminal of the ignition switch (3/8-in. open-end wrench). Connect the light switch wire with a nut and washer to the upper terminal of the ignition switch (3/8-in. open-end wrench).

b. Headlight Switch.

(1) This switch has four positions. When the switch button is all the way in, all lights are turned off. Pulling the switch out to the first position turns on the blackout headlamp, the blackout tail lamps, and also connects the circuit for the blackout stop lamps, the circuit being completed through the stop light switch when the brakes are applied.

(2) To turn on the main headlights, it is necessary to push in on the blackout button, and while holding it in, pull the switch button out to the main headlight position. When the lighting switch button is pulled all the way out, all lights are turned off and connections are made for the use of the service stop lights during daylight driving.

c. Headlight Switch Removal.

(1) EQUIPMENT.

SCREWDRIVER	WRENCH, open-end, 1/2-in.
WRENCH, open-end, 3/8-in.	WRENCH, open-end, 3/4-in.

(2) PROCEDURE.

(a) Remove the three wires from the circuit breaker (3/8-in. open-end wrench).

(b) Remove the three screws and washers (screwdriver) holding wires to the switch.

(c) Loosen the set screw in the switch knob; turn knob from switch.

(d) Loosen the cap screw in base of switch (1/2-in. open-end wrench), push in safety button, and remove the switch outer cap.

(e) Remove the nut (3/4-in. open-end wrench) holding switch to instrument panel and then remove the switch.

d. Headlight Switch Installation.

(1) EQUIPMENT.

SCREWDRIVER	WRENCH, open-end, 1/2-in.
WRENCH, open-end, 3/8-in.	WRENCH, open-end, 3/4-in.

(2) PROCEDURE.

(a) Place switch in the instrument panel and fasten with nut and lock washer (3/4-in. open-end wrench).

(b) Put on the switch outer cap and secure with cap screw (1/2-in. open-end wrench).

(c) Turn switch knob on to switch and secure with lock screw (screwdriver).

(d) *Install Headlight Switch Wires* (par. 89 **n**).

SCREWDRIVER	WRENCH, open-end, 3/8-in.

e. Tilt-Ray Switch. The tilt-ray switch is a foot operated, push button type.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

(1) TILT-RAY SWITCH REMOVAL.

(a) Equipment.

SCREWDRIVER, 6-in.

(b) Procedure.

Remove the three screws and washers (screwdriver) and remove the wires from the switch. Remove the two screws (screwdriver) holding the switch in the dash.

(2) TILT-RAY SWITCH INSTALLATION.

(a) Equipment.

SCREWDRIVER, 6-in.

(b) Procedure.

Place the tilt-ray switch on the dash and attach with two screws (screwdriver). Connect wires (par. 89 l).

f. Starter Switch Removal.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 7/16-in.

(2) PROCEDURE.

Remove the two nuts and lock washers from the starter switch and remove the battery cables and ignition wire (9/16-in. open-end wrench). Remove the two stove bolts, nuts, and lock washers holding starter switch to dash (screwdriver and 7/16-in. open-end wrench). Remove starter switch.

g. Starter Switch Installation.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 7/16-in.

(2) PROCEDURE.

Tighten the starter switch to the dash with the two stove bolts, nuts, and lock washers (screwdriver and 7/16-in. open-end wrench). Fasten the two battery cables to the starter switch and the ignition wire to the live side of the starter switch with the two nuts and lock washers (9/16-in. open-end wrench).

91. CIRCUIT BREAKER.

a. Circuit Breaker Description. There are no fuses in the light circuit, instead there is a circuit breaker located in the headlight switch. The circuit breaker is a protective device designed to open the circuit when a current in excess of what it is intended to carry passes through its winding. All current for lights and accessories passes through it.

b. Circuit Breaker Operation. The circuit breaker breaks the current at about 25 amperes, but after opening, allows about 5 amperes to pass through, which keeps it vibrating. Thus, the circuit breaker protects the battery from rapid discharge when trouble develops. The cir-

cuit breaker will continue to vibrate until the trouble is found and corrected.

92. HEAD LAMPS.

a. Head Lamp Description. The head lamp has a shroud over the lens and only one lamp is mounted to the right front fender. Another head lamp bracket is mounted on the left front fender in the event the lamp is changed to the opposite side.

b. Headlight Bulb Removal.

(1) EQUIPMENT.

SCREWDRIVER

(2) PROCEDURE.

Remove the three screws holding the headlight rim to the headlight (screwdriver). Remove the headlight rim assembly and bulb.

c. Headlight Bulb Installation.

(1) EQUIPMENT.

SCREWDRIVER

(2) PROCEDURE.

Slide the bulb into the headlight socket and turn to the right to lock it. Place the headlight rim assembly on to the headlight and tighten with the three screws (screwdriver).

d. Head Lamp Removal.

(1) EQUIPMENT.

WRENCH, open-end, 3/8-in. WRENCH, open-end, 3/4-in.

(2) PROCEDURE.

Remove the two headlight wires from the right-hand hood side panel junction block (3/8-in. open-end wrench). Remove the nut, lock washer, and flat washer (3/4-in. open-end wrench) holding head lamp to the head lamp bracket and remove the head lamp.

e. Head Lamp Installation.

(1) EQUIPMENT.

WRENCH, open-end, 3/8-in. WRENCH, open-end, 3/4-in.

(2) PROCEDURE.

Install the head lamp on to the right head lamp bracket. Place a flat washer, lock washer, and tighten the nut (3/4-in. open-end wrench). Connect the wire to the junction block on right-hand hood side panel with lock washer and nut (3/8-in. open-end wrench).

f. Blackout Marker Light. Two small front marker lamps equipped with standard blackout devices are mounted on the right and left side of the brush guard.

g. Blackout Marker Light Bulb Removal.

(1) EQUIPMENT.

SCREWDRIVER

(2) PROCEDURE.

Remove the screw holding the cover to the front of the marker lamp (screwdriver). Remove the cover. Remove the light bulb from the socket.

h. Blackout Marker Light Bulb Installation.

(1) EQUIPMENT.

SCREWDRIVER

(2) PROCEDURE.

Insert the bulb into the socket. Place the cover over the marker lamp and tighten it with the screw (screwdriver).

i. Blackout Marker Light Removal.

(1) EQUIPMENT.

WRENCH, open-end, 3/8-in. WRENCH, open-end, 1/2-in.

(2) PROCEDURE.

Remove the nut on the bottom of the parking light (1/2-in. open-end wrench). Disconnect the wire from the junction block on the fender by removing the nut and lock washer (3/8-in. open-end wrench).

j. Blackout Marker Light Installation.

(1) EQUIPMENT.

SCREWDRIVER WRENCH, open-end, 1/2-in.

WRENCH, open-end, 3/8-in.

(2) PROCEDURE.

Place the blackout parking light on the bracket and tighten with a nut (1/2-in. open-end wrench). Connect the wire to the fender junction block with nut and lock washer (3/8-in. open-end wrench).

93. TAIL AND STOP LIGHT.

a. Tail and Stop Light Description. These are a combination blackout unit and are mounted in the rear of the cargo body, one on the left side and one on the right side. The upper element is the blackout tail lamp and the lower element is the stop light. The upper and lower elements are separately sealed replaceable units.

b. Stop and Taillight Bulb Removal.

(1) EQUIPMENT.

SCREWDRIVER

(2) PROCEDURE.

Remove the two screws from the stop and taillight cover (screwdriver). Remove the cover and the stop and taillight element.

c. Stop and Taillight Bulb Installation.

(1) EQUIPMENT.

SCREWDRIVER

(2) PROCEDURE.

Enter the element into the stop and taillight. Slide the cover on the stop and taillight and fasten it with the two screws (screwdriver).

d. Stop and Taillight Removal.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in.

(2) PROCEDURE.

Disconnect the two socket plugs, stop and taillight, by turning the plug to the left. Remove the nut and washer from the ground terminal (3/8-in. open-end wrench) and remove the ground wire. Remove the four nuts from the stop and taillight (1/2-in. open-end wrench) and remove the assembly.

e. Stop and Taillight Installation.

(1) EQUIPMENT.

WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in.

(2) PROCEDURE.

Enter the stop and taillight into position on the bracket. Tighten the assembly to the bracket with the four nuts (1/2-in. open-end wrench). Fasten the ground wire with a nut and washer (7/16-in. open-end wrench). Enter the light socket plug with the green and white wire on the top connection and the plug with the green wire in the lower connection.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Section XXI

ENGINE

94. ENGINE DESCRIPTION AND TABULATED DATA (figs. 110 and 111).

a. Engine Description. The engine is a heavy-duty, six-cylinder "L"-head type. The engine number is on the rear left side below tappet cover, The cylinders are numbered from the fan, and motor runs in a clockwise direction from cranking location.

b. Engine Tabulated Data.

Make	Waukesha
Model	BZ
Number of cylinders	6
Firing order	1-5-3-6-2-4
Bore	4
Stroke	4¼-in.
Displacement (cu in.)	320
Compression ratio	5.95 to 1
Brake h. p. (maximum)	95
Automotive manufacturers' association h. p.	38.4
Torque—maximum (ft-lb)	224
Maximum recommended speed rpm	2800
governed speed rpm	2800
Crankcase capacity (refill)	10 qt
Oil filler location	Left rear side
Oil pressure (maximum) at 2800 rpm	45 lb
Oil pressure (minimum) at 350 rpm	15 lb
Oil pressure regulator	Spring relief valve (right side)
Valve clearance:	
Intake (cold)	0.010-in.—0.012-in.
Exhaust (cold)	0.014-in.—0.016-in.

ENGINE

Weight—bare	700 lb
Cooling system:	
Water capacity, engine only, quarts	10
Operating temperatures—water entering engine, not less than	150 F
Water leaving top of engine	170 F to 190 F

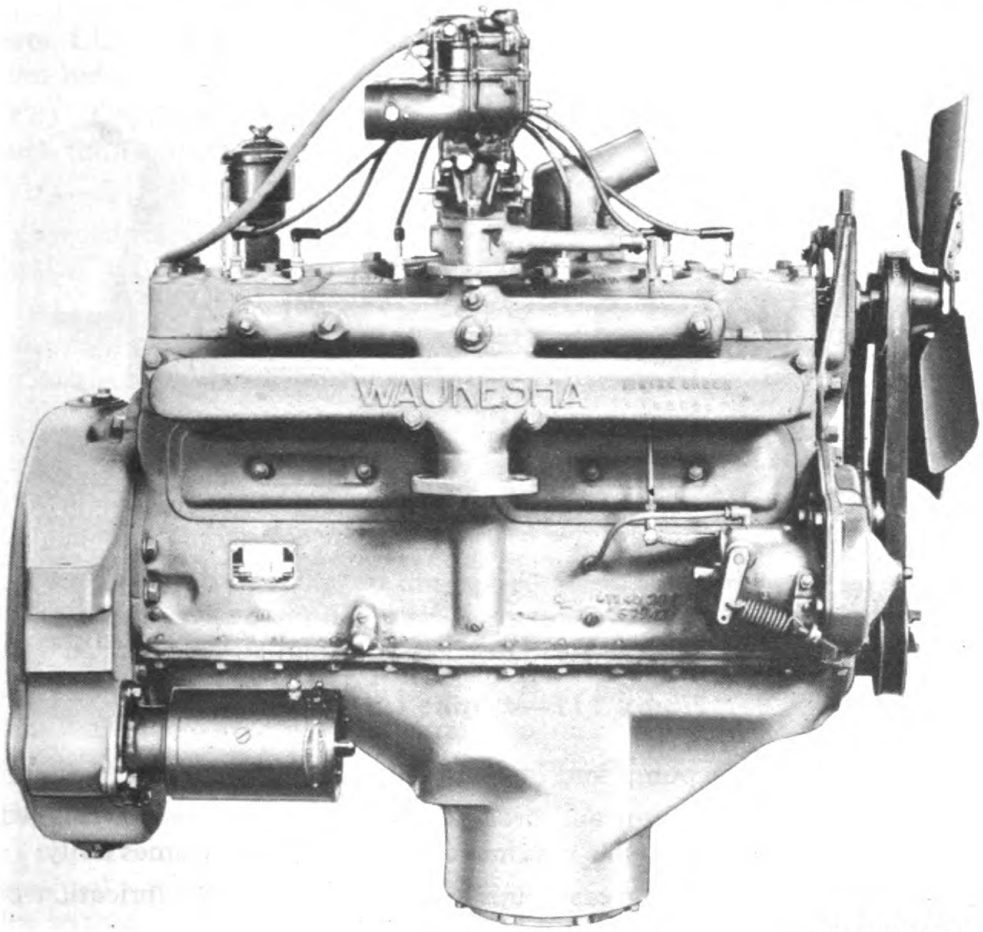


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Figure 110—Engine Right Side

95. ENGINE INSPECTION AND TROUBLE SHOOTING.

a. Engine Inspection. Regular systematic inspection and maintenance will insure good performance and prolong the life of the engine. It does not pay to correct troubles on operating time. Follow a schedule that will reveal any necessary attention or repairs before it becomes serious. The purpose of this section is to suggest a working schedule that will keep the engine in good condition and accomplish a saving of time.

(1) DAILY INSPECTION.

(a) Check oil and water level. See that the quantity of both are suitable.

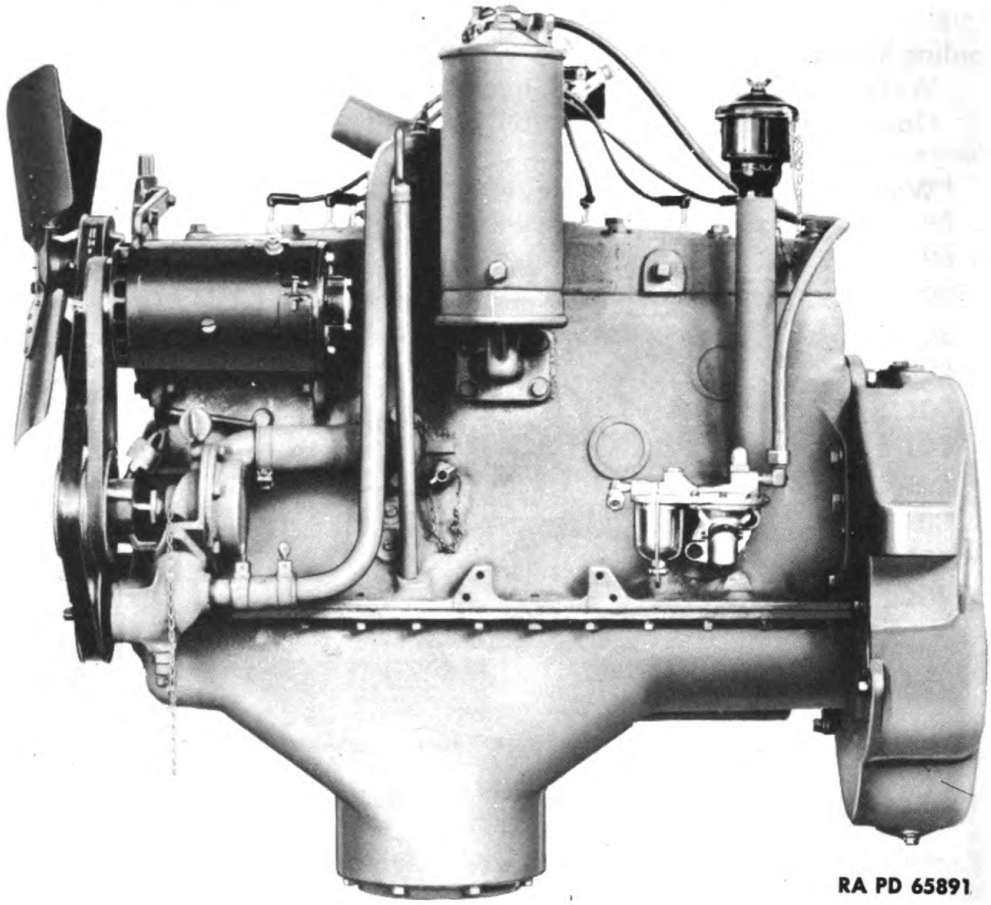

Figure 111—Engine Left Side

(b) Check water pump and fan lubrication.

(c) See that carburetor and breather of air cleaners are not clogged. In some extreme services, this may need attention several times daily.

(d) Go over all the grease cups to assure adequate lubrication of working parts. See Lubrication Guide in section VI.

(2) WEEKLY INSPECTION.

(a) Clean the engine thoroughly on the outside, using **SOLVENT**, dry-cleaning, and a brush to remove all the accumulated grease and dirt.

(b) Drain the oil filter sediment trap. Replace filter element, if necessary (par. 102).

(c) Clean the spark plugs and see that the insulators are not cracked (par. 87). Set spark gaps to 0.020-in. When replacing, see that all the spark plug gaskets are tight.

(d) Check for water leaks at the cylinder head gaskets, water manifold flanges, water pump gland, and hose connections. Stop any leaks.

(e) Check the condition of the crankcase oil, and if necessary, change it (see Lubrication Guide, section VI). When the oil is drained, drain the

filter, and replace the filter element, and clean the screen at the oil pump intake.

(f) Test the compression in the cylinders; they should have approximately 85 pounds at cranking speed. If the compression is weak, it may be necessary to inspect tappet clearance or grind valves (par. 99).

(3) MONTHLY INSPECTION.

(a) Check valve tappet clearance (par. 99 **d**).

(b) See that all wire terminals are tight on the wires and binding posts. Clean all oil or dirt from them and if any wires are chafed, replace them before they cause trouble (par. 89).

(c) Clean distributor contact points and adjust gaps (par. 85). Check spark timing after cleaning the contact points (par. 85).

(d) Adjust fan belt.

(e) Make all inspections outlined in (par. 95 **a** (1) (2)) and decide whether to regrind the valves.

(4) ENGINE LAY-UP. When an engine is to be laid up two weeks or more, considerable damage may be done unless the following suggestions are carried out:

(a) Drain the water and lubricating oil from the engine.

(b) With the pistons down and through each spark plug opening pour at least one ounce of engine oil in the cylinder, and distribute the oil by cranking the engine for several revolutions.

(c) Cover all openings in the engine, exhaust pipe outlet, carburetor intake breather, and similar parts into the engine to prevent rusting or entry of any foreign matter.

(d) Cover all the outside finished parts with a rust-preventing compound, slushing grease, or transmission oil. When restoring engine to service, it is advisable to replace all water hose connections.

b. Engine Trouble Shooting.

(1) To correct a fault or malfunction in an engine, the organization personnel should understand the principal functions of engine operation, so that a diagnosis can be made to locate a fault. Some of the causes, such as starting motor fails to crank engine, engine cranks but fails to start, have symptoms that are easy to remedy. The types of trouble that may be experienced and the possible remedy are as follows:

(2) STARTING MOTOR FAILS TO CRANK ENGINE.

Possible Cause	Possible Remedy
(a) Discharged battery.	Test battery and replace (par. 81).
(b) Loose battery connections.	Tighten battery terminals.
(c) Starting motor shorted.	Replace (par. 84).
(d) Starting motor bendix drive locked in flywheel.	Shift transmission in high gear and rock back and forth or loosen starting motor bolts (par. 84).

TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

( ) ENGINE CRANKS BUT FAILS TO START.

Possible Cause	Possible Remedy
(a) Starting motor cranks engine too slowly.	Weak battery—charge or replace (par. 81). Faulty starting motor—replace (par. 84).
(b) Lack of fuel.	Check fuel tank supply.
(c) Fuel lines clogged.	Clean fuel filter (par. 119). Clean fuel pump bowl (par. 118).
(d) Poor ignition.	Distributor breaker points burned or pitted—replace (par. 85 c). Weak ignition coil—replace (par. 86). Weak condenser — replace (par. 85 b). Loose terminals on ignition wires—tighten.
(e) Improper fuel mixture.	Check choke and adjust (par. 117).

(4) ENGINE STARTS AND THEN STOPS.

(a) Fuel mixture too rich.	Open choke—adjust (par. 117).
(b) Engine idles too slowly.	Check carburetor adjustment (par. 117).
(c) Suction of air through manifold.	Check manifold gaskets—tighten or replace (par. 100).
(d) Air cleaner clogged.	Clean and refill (par. 122).
(e) Water in fuel.	Drain fuel system.
(f) Fuel system clogged.	Clean fuel filter, fuel pump, and check for obstruction in fuel lines.

(5) ENGINE MISSING ON ONE OR MORE CYLINDERS. To determine which cylinder is causing the trouble, run the engine at idling speed, and short each spark plug by placing a screwdriver from the spark plug to the cylinder head. This will prevent the spark plug from firing. If the engine speed and exhaust remains the same with the spark plug shorted that means this particular cylinder is not functioning. If the engine speed slows down and vibrates, this cylinder is functioning.

(a) Fouled or cracked spark plug.	Test spark plug, clean and replace (par. 87).
(b) Exhaust or intake valve stuck.	Remove valve cover and check valves. Free the stuck valve with SOLVENT, dry-cleaning. If still stuck, remove cylinder and determine trouble.
(c) Exhaust or intake valve spring broken.	Replace with a new one (par. 99).
(d) Improper valve adjustment.	Adjust valve tappet clearance (par. 99).

ENGINE

(6) LACK OF POWER.

Possible Cause	Possible Remedy
(a) Defective ignition system.	Refer to trouble shooting (par. 80 **c**).
(b) Defective fuel supply.	Refer to trouble shooting (par. 116).
(c) Air cleaner restriction.	Clean and renew oil (par. 122).
(d) Overheated.	Refer to paragraph 97.
(e) Engine too cool.	Check thermostat operation or cover radiator.

(7) OVERHEATING.

(a) Defective cooling system.	Refer to trouble shooting (par. 73).
(b) Defective ignition system.	Refer to trouble shooting (par. 80).

(8) EXCESSIVE OIL CONSUMPTION.

(a) Overheating.	Refer to paragraph 101.
(b) Improper grade of oil.	Refer to Lubrication Guide (section VI).
(c) Oil level too high.	Maintain proper level.
(d) Oil leaks at gaskets, seals, or lines.	Check and repair leaks.
(e) Broken or worn pistons or piston rings.	Report to higher authority.
(f) Worn connecting rod or main bearings.	Report to higher authority.
(g) Worn valve guides.	Report to higher authority.

(9) LOW OIL PRESSURE.

(a) Improper grade of oil.	Change to proper grade (refer to Lubrication, section VI).
(b) Oil diluted or dirty.	Change oil (refer to Lubrication, section VI).
(c) Oil pump screen or lines clogged.	Clean (par. 101 **b**).
(d) Improper oil relief valve adjustment.	Adjust (par. 101 **c**).
(e) Worn or loose main or connecting rod bearings.	Report to higher authority or replace motor (pars. 104-105).
(f) Defective oil pump.	Report to higher authority.

(10) POPPING, SPITTING, AND SPARK KNOCK.

(a) Defective ignition system.	Refer to paragraph 85.
(b) Improper carburetor adjustment.	Refer to paragraph 117.

Possible Cause	Possible Remedy
(c) Inferior or low octane fuel.	Use correct fuel.
(d) Excessive carbon deposits.	Clean (par. 97).
(e) Valves sticking.	Remove valves and clean (par. 99).
(11) SQUEALING NOISE.	
(a) Dry water pump shaft.	Lubricate (refer to Lubrication Guide, section VI).
(b) Seized camshaft or crankshaft bearings.	Report to higher authority or replace motor (pars. 104-105).
(c) Dry generator bearings.	Lubricate. Refer to Lubrication Guide (section VI).

NOTE: It is sometimes difficult to determine if an unusual noise is in the engine or in some other unit of the vehicle. To definitely isolate a noise in the engine, depress the clutch pedal; if the noise disappears, it is then in some other unit of the vehicle.

(12) LOUD KNOCK.	
(a) Loose or burned out connecting rod bearings.	Report to higher authority or replace motor (pars. 104-105).
(b) Broken piston.	Report to higher authority or replace motor (pars. 104-105).
(c) Broken valve.	Replace valve (par. 99).
(13) DULL, HEAVY THUMP.	
(a) Loose or burned out main bearings.	Report to higher authority.
(14) LIGHT CLICKING OR RATTLING NOISE.	
(a) No oil in engine.	Stop engine immediately and fill with oil. Refer to Lubrication (section VI). Check for leaks.
(b) Sticking valve.	Remove valve and clean (par. 99).
(c) Broken valve spring.	Replace (par. 99).
(d) Worn or loose timing gears.	Report to higher authority.
(e) Loose fan or generator pulleys.	Tighten (pars. 75-82).

96. ENGINE TUNE-UP (fig. 112).

a. Equipment.

BRUSH, wire
FILE, point
GAGE, feeler
HYDROMETER
SCREWDRIVER
TESTER, compression 434-64
WRENCH, box, 5/8-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 3/4-in.
WRENCH, spark plug
WRENCH, tappet, 1/2-in.
WRENCH, tappet, 9/16-in.
WRENCH, tension, 43A-49975

b. Procedure.

(1) Engine performance can be kept at a high standard of efficiency by maintaining a few simple adjustments. Today's high compression engines and high speeds demand accurate settings of the ignition and fuel system for maximum performance.

(2) BATTERY. Check the battery with a hydrometer to determine the specific gravity of the electrolyte (par. 81). A weak battery should be recharged or replaced. Clean and tighten the battery connections.

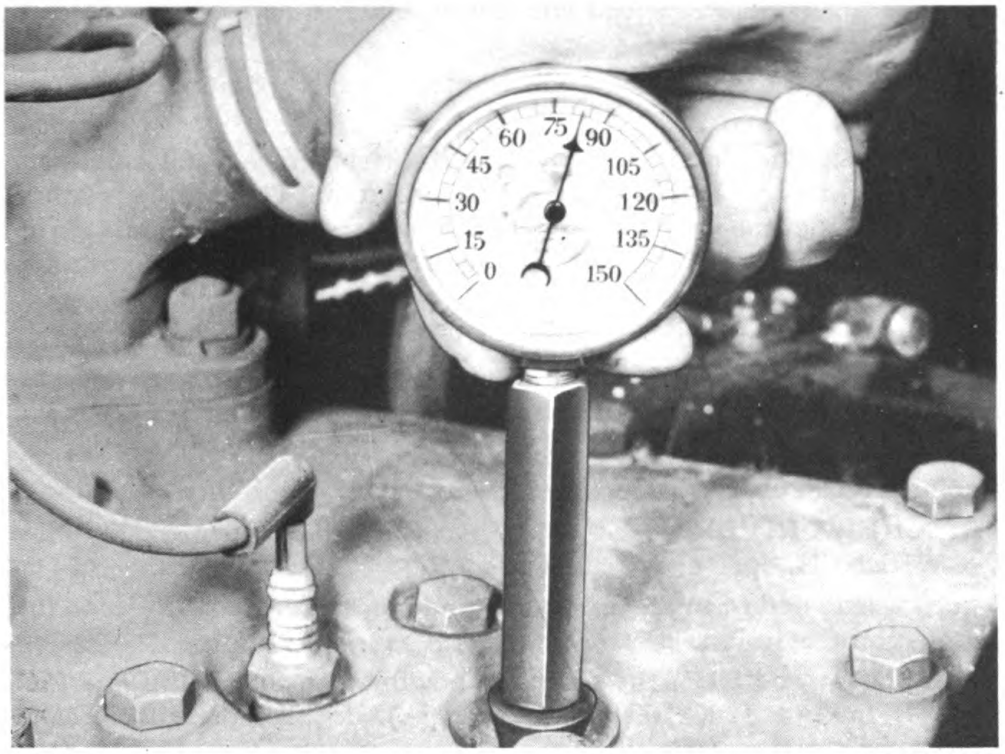

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Figure 112—Testing Compression

(3) COMPRESSION TEST (fig. 112). Remove the spark plug wire terminals and then the spark plugs (spark plug wrench). The compression should be tested with the engine warm by cranking with the starting motor. Throttle should be wide open. Compression tests depend upon cranking speeds and engine temperature. Place a compression tester in the spark plug opening and turn the engine several revolutions and take a reading of each cylinder (fig. 112). If the reading indicated by the compression gage is reasonably high (105 pounds), and uniform, not varying more than 10 pounds between cylinders, the compression pressure may be considered normal. If the compression test shows an abnormal condition, check the valve tappet clearance. If they are correct, inspect the valves and regrind. An extremely low reading in two adjacent cylinders might indicate a blown cylinder head gasket.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

(4) VALVE TAPPET ADJUSTMENT (par. 99).

GAGE, feeler
SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, tappet, 1/2-in.
WRENCH, tappet, 9/16-in.

(5) IGNITION SYSTEM.

BRUSH, wire
FILE, point
GAGE, feeler
SCREWDRIVER
WRENCH, open-end, 3/8-in.
WRENCH, spark plug

(a) Clean the spark plugs and adjust the gaps to 0.025-in. (par. 87). Too wide a gap reduces speed and power, and too narrow a gap causes uneven engine idling.

(b) Clean and adjust the distributor contact points to 0.020-in. (par. 85).

(c) Check the distributor cap and rotor for cracks and corrosion. Inspect the wires for breaks and cracked insulation. Tighten the primary wire terminals at the ignition switch and ammeter (screwdriver and 3/8-in. open-end wrench). Test the high voltage from the coil to the distributor (par. 85).

(d) Check the distributor timing (par. 85).

(e) Replace the spark plugs (spark plug wrench). Use a new gasket. Snap the spark plug wire terminals on the plugs in their proper firing order, 1-5-3-6-2-4.

(6) FUEL SYSTEM.

SCREWDRIVER
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 3/4-in.

(a) Clean and refill the air cleaner and oil cap breather. Refer to the Lubrication Guide in section VI.

(b) Drain and clean the sediment bowl on the fuel pump and fuel filter (9/16-in. and 3/4-in. open-end wrenches). Inspect the gaskets and replace if necessary (par. 119).

(c) Adjust the carburetor idling screw (screwdriver) and throttle stop screw, so that engine idles evenly (par. 117).

(7) CYLINDER HEAD AND MANIFOLD.

WRENCH, box, 5/8-in.
WRENCH, tension, (43A-49975)

(a) Tighten the cylinder head bolts (tension wrench) to 73-75 ft lb (par. 97). NOTE: The cylinder head should be tightened while the engine is warm.

(b) Tighten all manifold studs (5/8-in. box wrench). If gaskets show signs of leaks and cannot be tightened, replace gaskets (par. 101).

(8) COOLING SYSTEM.

SCREWDRIVER

(a) Tighten all hose connections (screwdriver) and check for water leaks. Also, check the fan and generator belts for condition and tension.

(b) Replenish the cooling liquid to its proper level.

(9) ROAD TEST. Road test the vehicle as a final check for other mechanical difficulties, which may affect performance.

97. CYLINDER HEAD AND GASKET REMOVAL.

a. Equipment.

HANDLE, flex
LIFTER, engine (7126)
PAN, drain
PLIERS
SCRAPER, carbon
SCREWDRIVER
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, socket, 3/4-in., with extension and ratchet

b. Procedure.

(1) DRAIN COOLING SYSTEM.

PAN, drain
PLIERS

Place hood in open position and then drain cooling system by placing drain pan under engine. Open drain cocks (pliers) at radiator outlet pipe and cylinder block. Allow cooling liquid to drain in pan.

(2) DISTRIBUTOR REMOVAL.

WRENCH, open-end, 7/16-in.

Disconnect spark plug wires. Remove coil primary wire from distributor (screwdriver) and pull out the secondary wire from the coil. Remove distributor hold-down clamp bolt (7/16-in. open-end wrench). Lift out distributor.

(3) REMOVE SPARK PLUGS (par. 87).

WRENCH, spark plug

(4) REMOVE COIL AND COIL BRACKET ASSEMBLY.

EXTENSION, ratchet
HANDLE, ratchet
WRENCH, open-end, 3/8-in.
WRENCH, socket, 3/4-in.

Remove nut (3/8-in. open-end) from ignition wire terminal on top of coil. Remove ignition wire and replace terminal nut temporarily to prevent losing it. Remove the nut (3/4-in. socket, extension, and ratchet) that holds the coil bracket to the cylinder head water outlet. Remove shakeproof lock washer and coil and coil bracket assembly. Remove the remaining shakeproof lock washer.

(5) REMOVE TOP WATER PIPE AND HOSES.

SCREWDRIVER

Loosen the top radiator hose clamp (screwdriver). Loosen the cylinder head water outlet hose clamp (screwdriver). Remove the top water pipe and hose assembly.

(6) DISCONNECT THERMOSTAT BYPASS WATER LINE FROM CYLINDER HEAD WATER OUTLET.

PLIERS

Loosen hose clamp (pliers) next to cylinder head water outlet, and pull hose from bypass connection in the cylinder head water outlet.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

(7) DISCONNECT TEMPERATURE GAGE LINE.

WRENCH, open-end, 5/8-in.

Remove temperature gage line (5/8-in. open-end wrench) from union in cylinder head. NOTE: Place line to one side, so that it will not become bent or broken.

(8) DISCONNECT BREATHER CAP CHAIN FROM CYLINDER HEAD.

WRENCH, open-end, 9/16-in.

Remove nut (9/16-in. open-end wrench) lock washer, and breather cap chain, anchoring clip from stud in cylinder head.

(9) REMOVE CYLINDER HEAD BOLTS.

HANDLE, flex

WRENCH, socket, 3/4-in.

Start at the front of the cylinder head and remove the cylinder head bolts (3/4-in. socket wrench and flex handle). NOTE 1: The right-hand rear corner of the cylinder head is held with a stud rather than a bolt. A bonding strap is also attached to this stud. Remove the stud nut (3/4-in. socket wrench and flex handle) shakeproof lock washers, and bonding strap from the stud.

NOTE 2: The two brackets holding the generator wire harness in place are fastened to the cylinder head with two cylinder head bolts. When the cylinder head bolts are removed, these brackets are automatically removed. Move the wire harness to one side, so that it will be out of the way when lifting the cylinder head off the cylinder block.

(10) LIFT CYLINDER HEAD FROM CYLINDER BLOCK AND REMOVE CYLINDER HEAD GASKET.

LIFTER, engine (7126)

Screw special engine-lifting tool into spark plug hole in cylinder head. With one hand on the lifting tool and the other on the cylinder head water outlet, lift the cylinder head straight up until it slides off the stud at the right-hand rear corner of the cylinder head. Lift cylinder head gasket off cylinder block. NOTE: Do not remove the stud from the right-hand rear corner of the cylinder block as this acts as a guide to line up the cylinder head holes when replacement of gasket and cylinder head is made.

(11) CLEAN CARBON FORMATION FROM CYLINDER HEAD, CYLINDER BLOCK, AND TOP OF PISTONS AND VALVES.

RAG, cleaning

SCRAPER, carbon (43A-16)

Scrape carbon and any scale formations from cylinder head, cylinder block, top of pistons, and valves (carbon scraper). Wipe cylinder walls and all parts clean. NOTE: When scraping carbon from the tops of the pistons and valves, revolve the engine by the use of the fan until each piston to be scraped is flush with the top of the cylinder block. At the same time clean the valves that are closed. This will help prevent loose carbon or other formations from falling into the cylinders and valve ports.

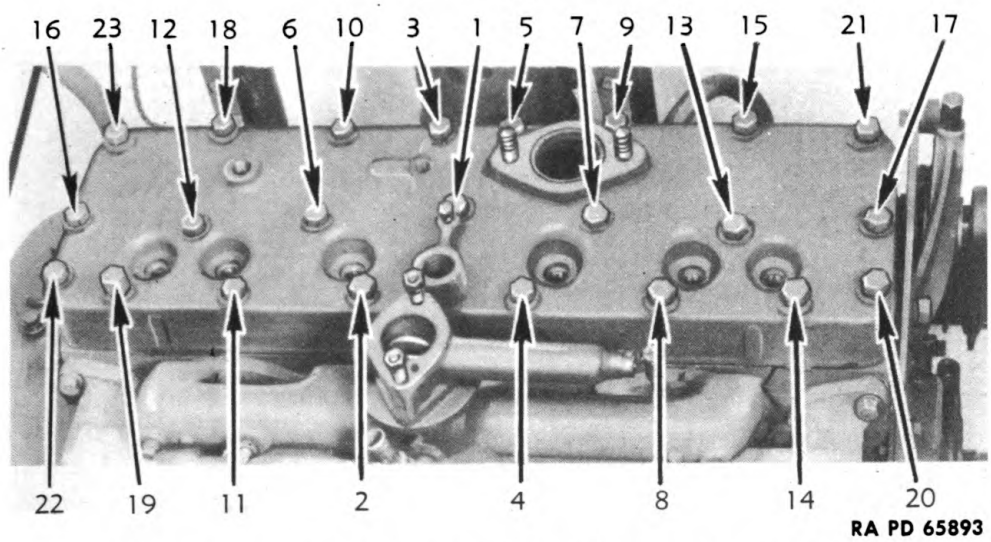


Figure 113—Cylinder Head Bolt Tightening Diagram

98. CYLINDER HEAD AND GASKET INSTALLATION (figs. 113 and 114).

a. Equipment.

EXTENSION, 3-in.
LIFTER, engine (7126)
PLIERS
RATCHET
SCREWDRIVER
WRENCH, head tension (43A-49975)
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, socket, 3/4-in.

b. Procedure.

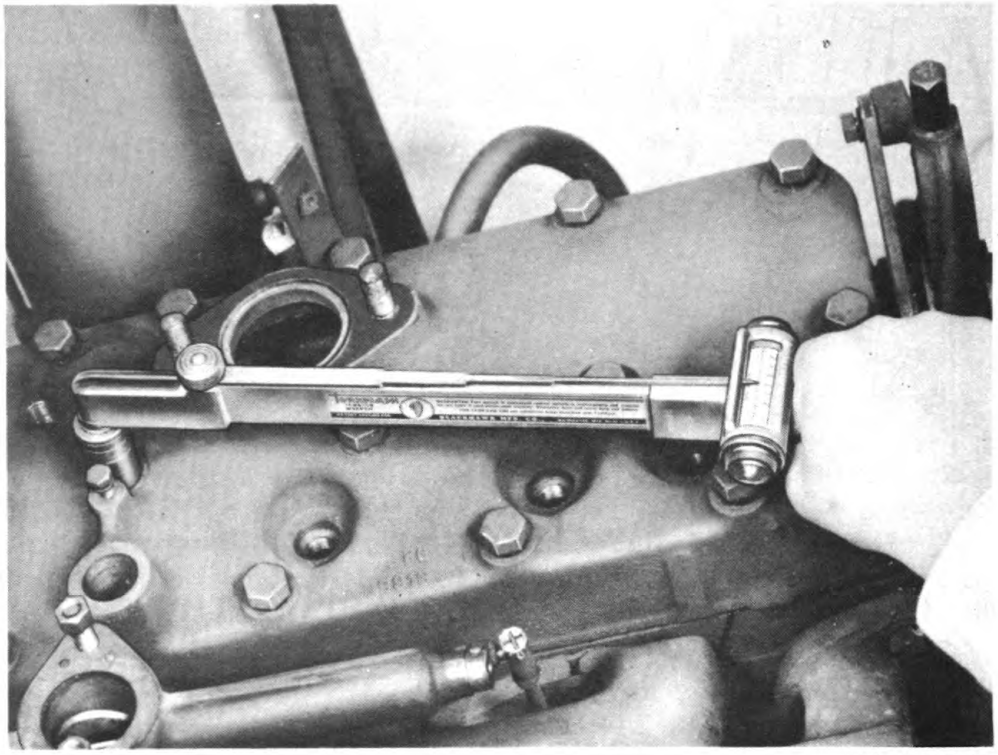
(1) CYLINDER HEAD GASKET INSTALLATION.

Place new cylinder head gasket on cylinder block. NOTE: The gasket is stamped, "This side up." Line up gasket holes with holes in cylinder block.

(2) INSTALL CYLINDER HEAD.

EXTENSION, 3-in.
SOCKET, 3/4-in.
WRENCH, head tension (43A-49975)

Install cylinder head on cylinder block with all holes in line. Sort out head bolts, select the three bolts which are 1/2-in. longer than the rest, and install these three loosely in the center section of head. Then, install the balance of the bolts which are of one length, making sure that generator harness brackets and bonding strap are in place. Use shakeproof washers on each side of bond strap. Remove engine lifter. The cylinder head bolts should be tightened evenly in rotation (fig. 113), beginning at the center of the head and working to the outside (3/4-in. socket, extension, and head tension wrench). Each bolt should be tightened with a head tension wrench, and the foot-pounds of torque with threads clean and dry should be between 73 and 75; if threads are cleaned and oiled, applied torque



RA PD 65894

Figure 114—Tightening Cylinder Head

should be reduced about 10 per cent (fig. 114). The final tightening should be done after the engine is run and thoroughly warmed up, and a torque reading should be checked at 500 miles of service.

(3) CONNECT BREATHER CAP CHAIN.

WRENCH, open-end, 9/16-in.

Attach clip to head at rear of breather tube on 3/8-in. stud, using lock washer and nut (9/16-in. open-end wrench).

(4) CONNECT TEMPERATURE GAGE COUPLING.

WRENCH, open-end, 5/8-in.

Connect temperature gage line coupling to fitting in cylinder front of breather tube (5/8-in. open-end wrench).

(5) CONNECT BYPASS WATER LINE.

PLIERS

Connect water line hose to water outlet manifold (pliers).

(6) INSTALL TOP WATER PIPE AND HOSES.

SCREWDRIVER

Check condition of radiator hoses before installing. Enter bottom hose to water outlet; then top hose to radiator connection. Slip hose on piping approximately 1 inch. Tighten hose clamps (screwdriver).

(7) INSTALL COIL AND BRACKET ASSEMBLY.

EXTENSION
RATCHET
SOCKET, 3/4-in.
WRENCH, open-end, 3/8-in.

Place bracket with shakeproof washers on each side on water outlet rear stud. Tighten (ratchet, extension, and 3/4-in. socket). Connect primary wire from ignition switch to the positive terminal of coil (3/8-in. open-end wrench).

(8) ASSEMBLE DISTRIBUTOR TO ENGINE.

WRENCH, open-end, 7/16-in.

Remove distributor cap and then enter the driven shaft and distributor body into place. Turn rotor arm until driven coupling drops into place. At this time the distributor hold-down clamp will lower to top of engine head. Install the clamp bolt into cylinder head (7/16-in. open-end wrench). Replace cap. Replace spark plug wires according to number on metal band attached to each wire. Connect wire from distributor to coil negative terminal (3/8-in. open-end wrench).

(9) INSTALL SPARK PLUGS.

WRENCH, spark plug

Place the spark plugs with new gaskets in the plug openings and tighten (spark plug wrench).

(10) FILL COOLING SYSTEM.

PLIERS

Install radiator and cylinder block drain plugs (pliers). Replenish cooling system while engine is idling to prevent air pockets. Check for water leaks.

99. VALVES.

a. Valve Grinding.

(1) EQUIPMENT.

COMPOUND, valve-grinding
EXTENSION
GAGE, feeler
HANDLE, flex
HANDLE, ratchet
LIFTER, valve (14-KD-390)
PAN, drain
PLIERS
RAG, wiping
SCRAPER, carbon (43A-16)
SCREWDRIVER
SPRING, valve lifter
TOOL, valve grinder
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, open-end, 3/4-in.
WRENCH, spark plug
WRENCH, tappet, 1/2-in.
WRENCH, tappet, 9/16-in.

(2) PROCEDURE.

(a) Drain Radiator.

PAN, drain
PLIERS

Open the drain cock on the lower water pipe (pliers) and drain the cooling liquid into a drain pan (drain pan).

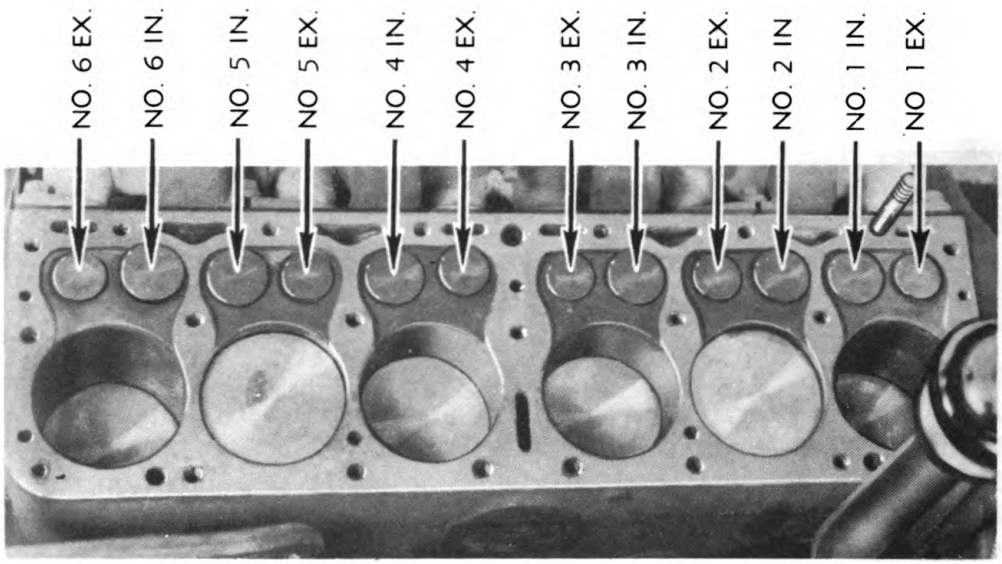


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Figure 115—Valve Location

(b) Remove Cylinder Head (par. 97).

EXTENSION	WRENCH, open-end, 3/8-in.
HANDLE, flex	WRENCH, open-end, 7/16-in.
HANDLE, ratchet	WRENCH, open-end, 9/16-in.
PLIERS	WRENCH, open-end, 5/8-in.
SCRAPER, carbon (43A-16)	WRENCH, socket, 3/4-in.
SCREWDRIVER	

(c) Remove Right Hand Hood Side Panel (par. 55 **f**).

SCREWDRIVER	WRENCH, open-end, 7/16-in.

(d) Remove Right Hand Fender Side Panel (par. 56 **b**).

SCREWDRIVER	WRENCH, open-end, 7/16-in.

(e) Remove Valve Door Cover (fig. 116).

WRENCH, open-end, 9/16-in.

Remove the four nuts (fig. 116) and copper washers holding the valve door cover to the cylinder block (5/8-in. open-end wrench). Remove the valve door cover.

(f) Remove Valves (fig. 117).

LIFTER, valve (14-KD-380)

NOTE: Place wiping rags around the valve tappets and be sure all openings into the crankcase are covered. If this is not done the valve keepers may drop into the oil pan (fig. 117).

Turn the motor over by pulling on the fan belt until the valve nearest the radiator (exhaust valve) is completely closed. Place the lifter underneath the valve springs (valve lifter) and compress the valve spring (fig. 117). Remove the two valve keepers and valve lifter.

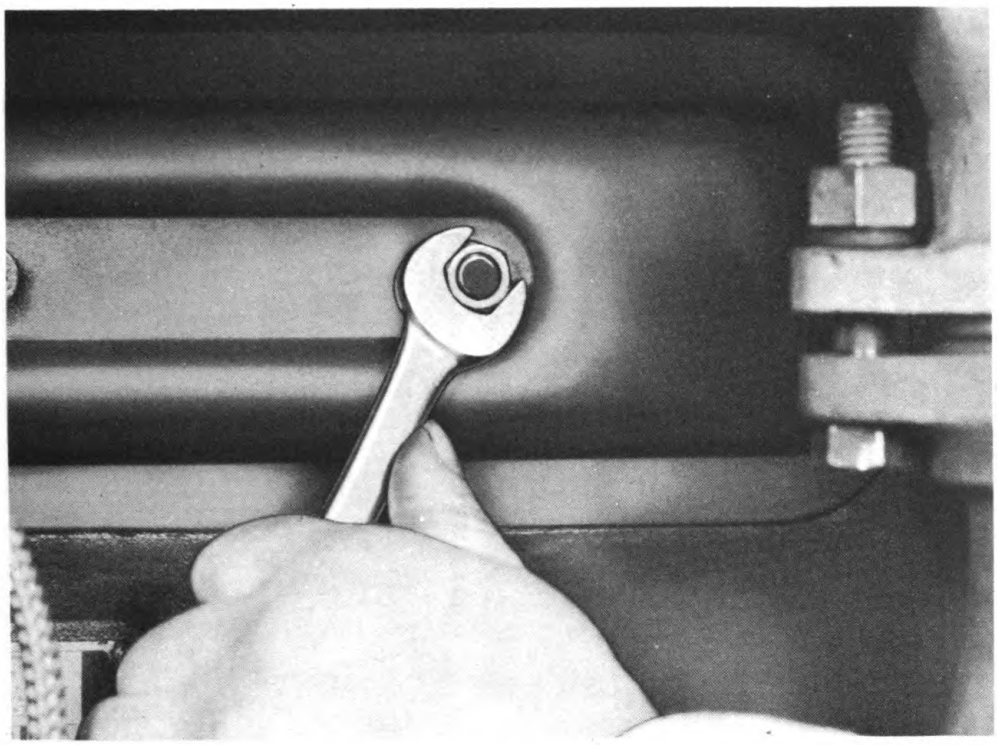

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Figure 116—Removing Valve Cover

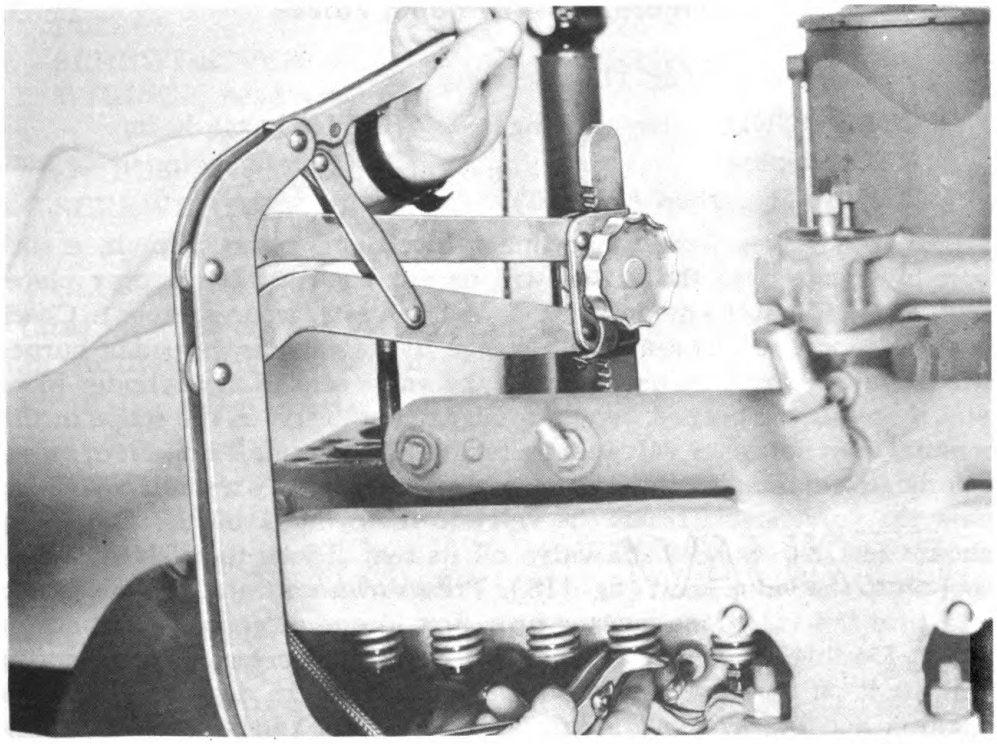

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Figure 117—Removing Valve Keepers

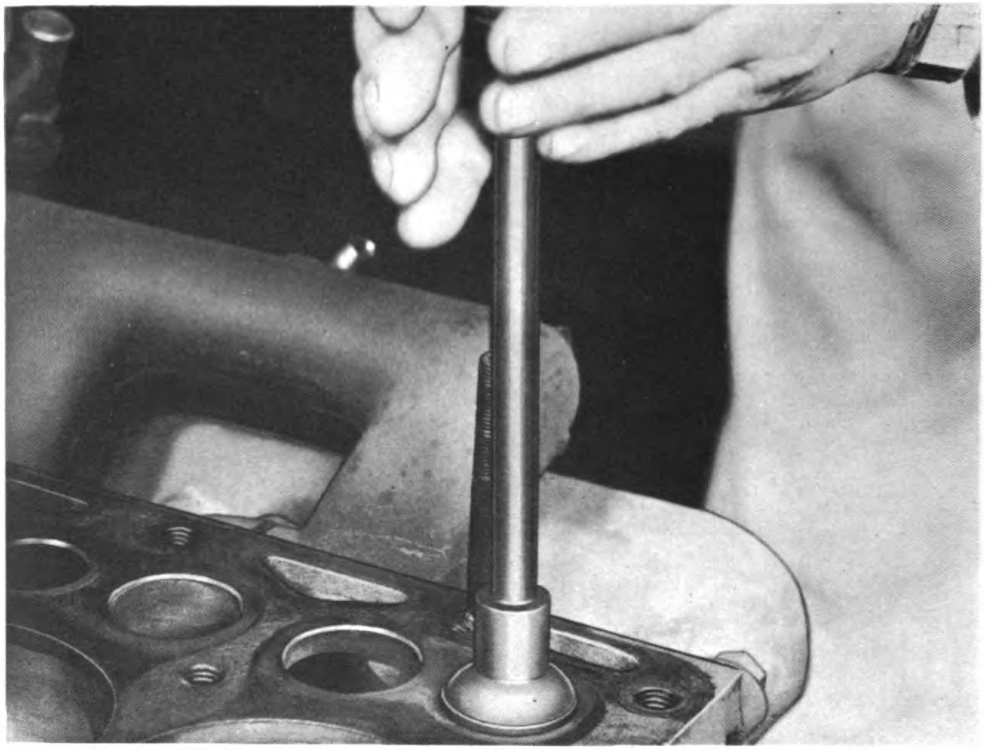

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Figure 118—Grinding Valves

(g) Grind Valve (fig. 118).

COMPOUND, valve-grinding
RAGS, wiping
SCRAPER, carbon (43A-16)
SPRING, coil, ¾-in.
TOOL, valve grinder

Pull the valves from the cylinder block and place them in a rack suitably marked, so the valves will be put back in their proper places (fig. 115). Clean the cylinder block and valves (carbon scraper). Check the valve for a burned seat and warpage. If the valve is warped or burned a new valve should be used. Check the valve seat in the cylinder block and if the seat is burned, report to higher authority, as the scope in this manual does not cover valve seat refacing. Place a small amount of valve-grinding compound over the entire valve face, and slip a small coil spring over the valve stem. Insert the valve in the cylinder block. The spring should just barely hold the valve off its seat. Place the valve-grinding tool on to the valve head (fig. 118). Press down until the valve is seated and turn the valve one-quarter turn, first in one direction and then the other. Do this three or four times and release the pressure so the spring will lift it off its seat. Now turn the valve 10 to 15 degrees to another position and repeat the grinding. When all pits and grooves have disappeared clean the valve and valve seat thoroughly. Place eight or ten pencil marks evenly spaced on the valve face. Drop the valve into the

block and turn it one-quarter turn and remove the valve. A perfect seat will be indicated if every pencil mark shows where the valve has rubbed it. If any pencil marks are left untouched repeat the grinding operation. NOTE: Each of the 12 valves is ground in the manner described above.

(h) Install Valves (fig. 115)

LIFTER, valve (14-KD-380)

Place the valve into its place in the cylinder block (fig. 115) and compress the valve spring (valve lifter). Slide the two valve keepers into the slot on the valve stem and release the lifter. Be sure the valve keepers are in their proper place when the valve spring has been released.

(i) Adjust Valve Clearance (par. 99 b (2) *(d)*).

GAGE, feeler
WRENCH, tappet, ½-in.
WRENCH, tappet, 9/16-in.

(j) Install Valve Door Covers.

WRENCH, open-end, 9/16-in.

Slide the valve door covers on to the studs and tighten them with the four nuts and copper washers.

(k) Install Right Hand Fender Side Panel (par. 56 c).

SCREWDRIVER
WRENCH, open-end, 7/16-in.

(l) Install Cylinder Head (par. 98).

EXTENSION
HANDLE, flex
HANDLE, ratchet
PLIERS
SCREWDRIVER
WRENCH, head tension (43A-49975)
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, socket, ¾-in.

(m) Install Right Hood Side Panel (par. 55 g).

SCREWDRIVER
WRENCH, open-end, 7/16-in.

(n) Fill Radiator

PLIERS

Close the drain cock on the lower pipe (pliers). Pour the cooling liquid from the drain pan back into the radiator.

b. Valve Adjustment.

(1) EQUIPMENT.

GAGE, feeler
SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, spark plug
WRENCH, tappet, ½-in.
WRENCH, tappet, 9/16-in.

(2) PROCEDURE.

(a) Remove Fender Side Panel (par. 56 b).

SCREWDRIVER
WRENCH, open-end, 7/16-in.

(b) Remove Valve Covers.

WRENCH, open-end, 9/16-in.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Remove the four nuts and copper washers (9/16-in. open-end wrench) holding the two valve covers on to the cylinder block. Remove the two plate covers.

(c) Remove Spark Plugs.

WRENCH, spark plug

Remove all six spark plugs (spark plug wrench). NOTE: This is necessary to permit the motor to be turned by pulling on the fan belt.

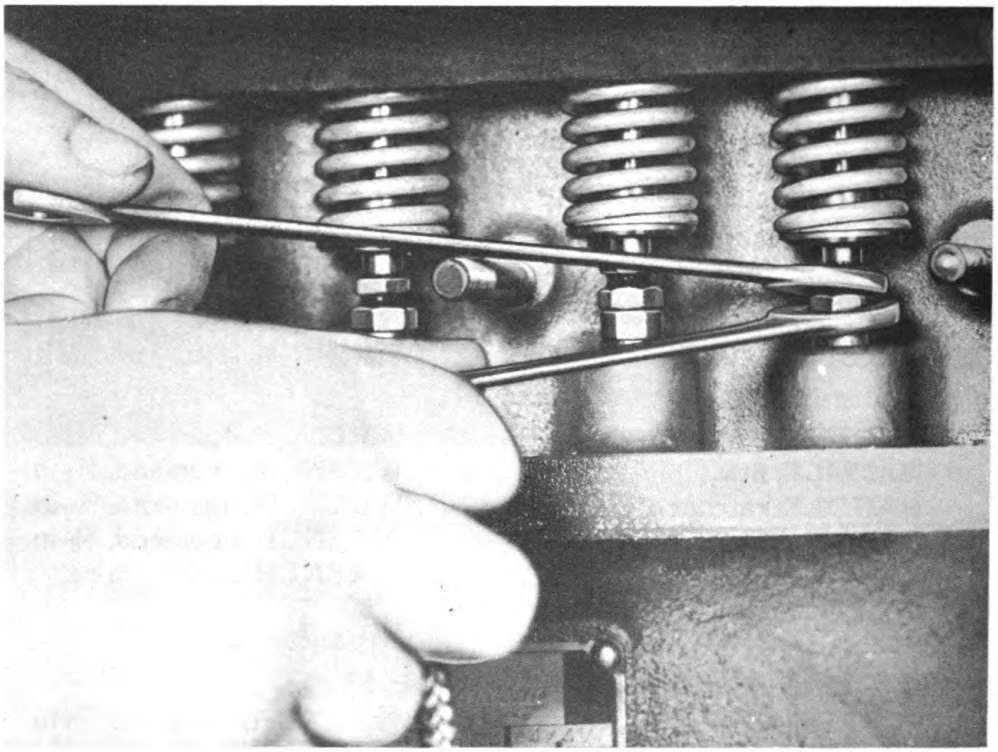

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Figure 119—Adjusting Valve Tappets

(d) Adjust Valve Clearance.

GAGE, feeler
WRENCH, tappet, 1/2-in.
WRENCH, tappet, 9/16-in.

Turn the motor over by pulling on the fan belt until the exhaust valve in cylinder No. 1 (cylinder nearest radiator) is wide open.

Loosen the jam nut (1/2-in. tappet wrench and 9/16-in. tappet wrench) on the intake valve tappet adjusting bolt (fig. 119).

Adjust the clearance between the intake valve stem and tappet to a loose 0.010-in. or a tight 0.012-in. (feeler gage, 1/2-in. tappet wrench, and 9/16-in. tappet wrench). Tighten the lock nut on the tappet adjustment (1/2-in. tappet wrench and 9/16-in tappet wrench). Recheck the adjustment to make sure the clearance remained at the clearance specified (fig. 120).

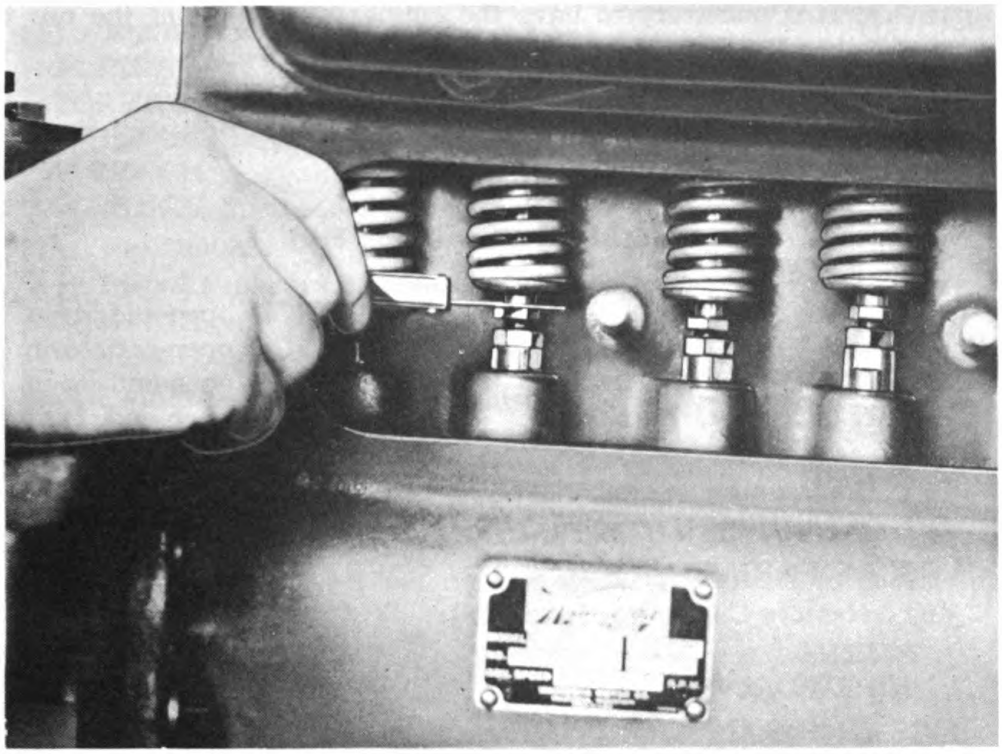

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Figure 120—Checking Valve Tappet Clearance

Turn the motor over by pulling on the fan belt until the intake valve in cylinder No. 1 (cylinder nearest radiator) is wide open.

Loosen the jam nut (½-in. tappet wrench and 9/16-in. tappet wrench) on the exhaust valve tappet adjustment.

Adjust the clearance between the exhaust valve stem and tappet to a loose 0.014-in. or a tight 0.016-in. (feeler gage, ½-in. tappet wrench, and 9/16-in. tappet wrench). Tighten the lock nut on the tappet (½-in. tappet wrench and 9/16-in. tappet wrench). Recheck the adjustment to make sure the clearance remained at the clearance specified. **NOTE:** Each individual cylinder has the valves adjusted in the same manner as described above. All clearance settings must be made with the motor at room temperatures. Always adjust and check tappets with the lifter on the base of the cam.

(e) Install Spark Plugs.

WRENCH, spark plug

Install and tighten the six spark plugs (spark plug wrench) in the cylinder head and connect the spark plug wires.

(f) Install Valve Plate Covers.

WRENCH, open-end, 9/16-in.

Check the gaskets on the valve plate covers and if they are not in good condition replace them. Slide the valve plate covers on to the studs and

tighten them with the four copper washers and nuts (9/16-in. open-end wrench). It is necessary to have the copper washer under the nut to prevent oil leakage at this point.

(g) Install Fender Side Panel (par. 56 c).

SCREWDRIVER — WRENCH, open-end, 7/16-in.

100. MANIFOLD.

a. Manifold and Gasket Removal (fig. 110).

(1) EQUIPMENT.

PLIERS — WRENCH, open-end, 7/16-in.
SCREWDRIVER — WRENCH, open-end, 1/2-in.
WRENCH, box, 5/8-in. — WRENCH, open-end, 9/16-in.
WRENCH, box, 11/16-in. — WRENCH, open-end, 7/8-in.
WRENCH, box, 3/4-in.

(2) PROCEDURE.

(a) Remove Right Hood Panels (par. 55 f).

SCREWDRIVER — WRENCH, open-end, 7/16-in.

(b) Remove Carburetor (par. 117).

PLIERS — WRENCH, open-end, 9/16-in.
SCREWDRIVER — WRENCH, open-end, 3/4-in.

(c) Remove Governor Butterfly Valve Assembly.

PLIERS — SCREWDRIVER

Disconnect the governor arm ball joint (screwdriver and pliers). Remove governor butterfly assembly from manifold.

(d) Remove Fender Side Panel (par. 56 b).

SCREWDRIVER — WRENCH, open-end, 7/16-in.

(e) Disconnect Exhaust Coupling (par. 110).

WRENCH, open-end, 3/4-in. — WRENCH, open-end, 7/8-in.

(f) Remove Brake and Windshield Vacuum Lines.

SCREWDRIVER — WRENCH, open-end, 1/2-in.

Disconnect brake vacuum hose at manifold (screwdriver). Disconnect windshield vacuum line at manifold (1/2-in. open-end wrench).

(g) Remove Manifold.

WRENCH, box, 5/8-in.

Remove the six nuts and washers attaching manifold to cylinder block (5/8-in. open-end wrench). Remove the two nuts (5/8-in. open-end wrench) from the side of the manifold. Pull the linkage bracket from manifold studs. Remove manifold and gaskets from studs.

(h) Remove Brake and Windshield Vacuum Fittings.

WRENCH, adjustable, 10-in. — WRENCH, open-end, 11/16-in.
WRENCH, open-end, 1/2-in.

Remove the brake vacuum street ell from manifold (10-in. adjustable wrench) and then the windshield wiper vacuum line elbow (1/2-in. open-end wrench) and adaptor (11/16-in. open-end wrench).

ENGINE

b. Manifold and Gasket Installation.

(1) EQUIPMENT.

PLIERS
SCREWDRIVER
WRENCH, adjustable, 10-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, open-end, 11/16-in.
WRENCH, open-end, 3/4-in.

(2) PROCEDURE.

(a) Install Brake and Windshield Vacuum Fittings.

WRENCH, adjustable, 10-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 11/16-in.

Install windshield vacuum line reducer (11/16-in. open-end wrench) into second opening from rear of intake manifold. Then, install elbow (7/16-in. open-end wrench) into reducer. Install brake vacuum line street ell into center intake manifold opening (10-in. adjustable wrench).

(b) Install Manifold Gaskets.

Place new manifold gaskets on the studs. NOTE: The gasket is stamped, "This side out."

(c) Install Manifold.

WRENCH, box, 5/8-in.

Slide the manifold on the studs in the side of the cylinder block. Place the carburetor linkage bracket on the two studs at the lower side of manifold. Place thin flat washers on the carburetor linkage bracket studs and the two end studs on the manifold and then place heavier washers on the balance of the studs. Tighten nuts evenly and securely, beginning at the center (5/8-in. box wrench).

(d) Install Brake and Windshield Vacuum Lines.

SCREWDRIVER
WRENCH, open-end, 1/2-in.

Connect the windshield vacuum line to the rear elbow (1/2-in. open-end wrench). Connect brake vacuum line to the center street ell (screwdriver).

(e) Install Exhaust Pipe Coupling (par. 110).

WRENCH, open-end, 3/4-in.
WRENCH, open-end, 7/8-in.

(f) Install Fender Side Panels (par. 56 c).

SCREWDRIVER
WRENCH, open-end, 7/16-in.

(g) Install Governor Valve Housing.

PLIERS
SCREWDRIVER

Place new gasket on manifold. Install governor valve housing on manifold with extension towards front of engine. Connect linkage ball joint to governor arm (screwdriver and pliers).

(h) Install Carburetor (par. 117).

PLIERS
SCREWDRIVER
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 3/4-in.

(i) Install Right Hood Panel (par. 55 g).

SCREWDRIVER
WRENCH, open-end, 7/16-in.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

101. OIL PAN AND OIL PRESSURE ADJUSTMENT (fig. 121).

a. Oil Pan and Gasket Replacement.

(1) EQUIPMENT.

HANDLE, speed	SOCKET, 9/16-in.
KNIFE, putty	WRENCH, open-end, 9/16-in.
PAN, drain	WRENCH, open-end, 1 1/8-in.

(2) PROCEDURE.

(a) Drain Oil.

PAN, drain — WRENCH, open-end, 1 1/8-in.

Place pan under engine and remove oil drain plug (1 1/8-in. open-end wrench). After oil is drained, replace drain plug.

(b) Remove Dust Shield.

WRENCH, open-end, 9/16-in.

Remove five cap bolts (9/16-in. open-end wrench) holding dust shield to flywheel housing at rear of oil pan. Drop shield straight down until it is out of groove in oil pan.

(c) Removing Oil Pan.

HANDLE, speed — SOCKET, 9/16-in.

Remove twenty-six cap bolts (speed handle and 9/16-in. socket), thirteen on each side of oil pan. Drop pan straight down.

(d) Cleaning Pan.

KNIFE, putty

Clean oil pan with SOLVENT, dry-cleaning, and wipe dry. Remove the old gaskets (putty knife).

(e) Installing Gaskets.

Shellac new gaskets in place on pan and let dry. NOTE: This will keep gaskets in place while pan is being installed on engine.

(f) Installing Pan.

HANDLE, speed — SOCKET, 9/16-in.

Lift pan in place on engine base and be sure gaskets are not damaged. Replace cap bolts and lock washer and tighten (speed handle and 9/16-in. socket). Do not cut off ends of new gaskets.

(g) Installing Dust Shield.

WRENCH, open-end, 9/16-in.

Place dust shield in groove in pan and push straight up to get in position. Replace cap bolts and lock washer and tighten (9/16-in. open-end wrench).

(h) Lubrication.

Fill engine crankcase with engine oil to proper level (see section VI).

b. Oil Pump Screen Maintenance.

(1) EQUIPMENT.

KNIFE, putty — WRENCH, open-end, 9/16-in.

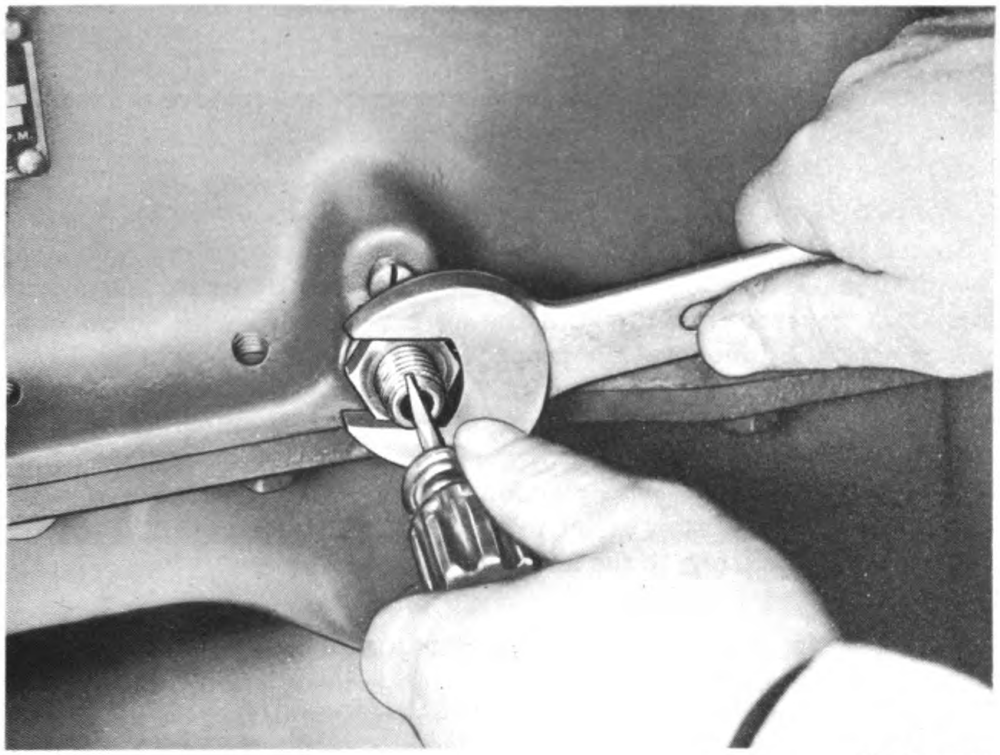

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Figure 121—Adjusting Oil Pressure

(2) PROCEDURE.

(a) It is a good plan to clean the oil screen every time the oil is changed. This can be accomplished by removing the cover plate (9/16-in. open-end wrench) from the bottom of the pan (after the oil has been drained from the system, of course) and reaching through the opening to scrub the screen with a stiff wire brush soaked in gasoline. If it seems necessary to give the screen a more thorough cleaning, unscrew and remove the oil pan (par. 101) and then unscrew the two cap screws (9/16-in. open-end wrench) which hold the screen frame to the goose-necked oil inlet pipe. Then set the screen and frame in gasoline long enough to soften the carbon which may be hard and tough. A putty knife is the best tool for removing it; a blunt stick requires too much pressure and may break through the screen itself, while a sharp instrument may cut through.

(b) Replace the screen on the oil pump and tighten with the two cap screws (9/16-in. open-end wrench).

(c) Replace the oil pan (par. 101).

(d) Refill with new engine oil (see Lubrication Guide, section V).

c. Oil Pressure Adjustment (fig. 121).

(1) EQUIPMENT.

SCREWDRIVER, 6-in. WRENCH, open-end, 15/16-in.

(2) PROCEDURE.

(a) Remove Acorn Nut.

WRENCH, open-end, 15/16-in.

Remove the acorn nut from the adjusting screw and remove the copper washer (15/16-in. open-end wrench).

(b) Adjust Oil Pressure (fig. 121).

SCREWDRIVER, 6-in. WRENCH, open-end, 15/16-in.

Loosen the lock nut on the adjusting screw (15/16-in. open-end wrench). The oil pressure should read 40 to 45 pounds with the motor warm and running at governor speed. Turn the oil pressure adjusting screw one-quarter turn at a time until the proper oil pressure is obtained (fig. 121). Then, hold the adjusting screw with the screwdriver to prevent it from turning while tightening the lock nut. Tighten the lock nut (15/16-in. open-end wrench). Place the copper washer over the adjusting screw and tighten the acorn nut (15/16-in. open-end wrench). **NOTE:** To increase the pressure turn the adjusting screw to the right. To reduce the oil pressure turn the adjusting screw to the left.

d. Crankcase Ventilator.

(1) CRANKCASE VENTILATOR DESCRIPTION. The later model vehicle is provided with a crankcase ventilator that is installed in the manifold and piped into the valve cover. The purpose of the crankcase ventilator is to insure a constant circulation of fresh air through the crankcase and to evacuate "blow-by" gases before they can condense into sludge and varnish-forming deposits.

(2) CRANKCASE VENTILATOR SERVICE. The oil breather should be serviced at regular intervals to insure an unrestricted flow of clean fresh air to the crankcase. The function of the breather is to remove dirt from the fresh air that ventilates the crankcase.

(a) Remove the oil bath breather.

(b) Wash the cleaning element thoroughly in SOLVENT, dry-cleaning, and dip in a medium grade crankcase oil.

(c) Remove oil from oil cup, scrape out any accumulated dirt, and fill cup to indicated oil level with a medium grade crankcase oil.

(d) Replace breather. Particular care should be given the oil filler cap on the top cover of the breather; if there is any doubt about the gasket seal, replace the gasket.

102. OIL FILTER (figs. 122 and 123)

a. Oil Filter Description. The oil filter is located on the left side of the engine and has a replaceable element. The filter should be cleaned at regular intervals and the element changed when the engine oil begins to discolor.

b. Oil Filter Element Removal (fig. 122).

(1) EQUIPMENT.

WRENCH, open-end, 5/8-in.

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Figure 122—Removing Oil Filter Element

(2) PROCEDURE.

(a) Removing Element (fig. 122).

WRENCH, open-end, 5/8-in.

Loosen bolt on top of oil filter (5/8-in. open-end wrench). Remove cover and lift element out with ring attached to element (fig. 122).

(b) Cleaning and Replacing Element.

WRENCH, open-end, 5/8-in.

To clean the oil filter, remove drain plug (5/8-in. open-end wrench) at the bottom of filter. Flush filter with waste oil and wipe out clean. Install a new element and cover gasket. Replace cover and tighten nut securely (5/8-in. open-end wrench). Start engine and check for leaks.

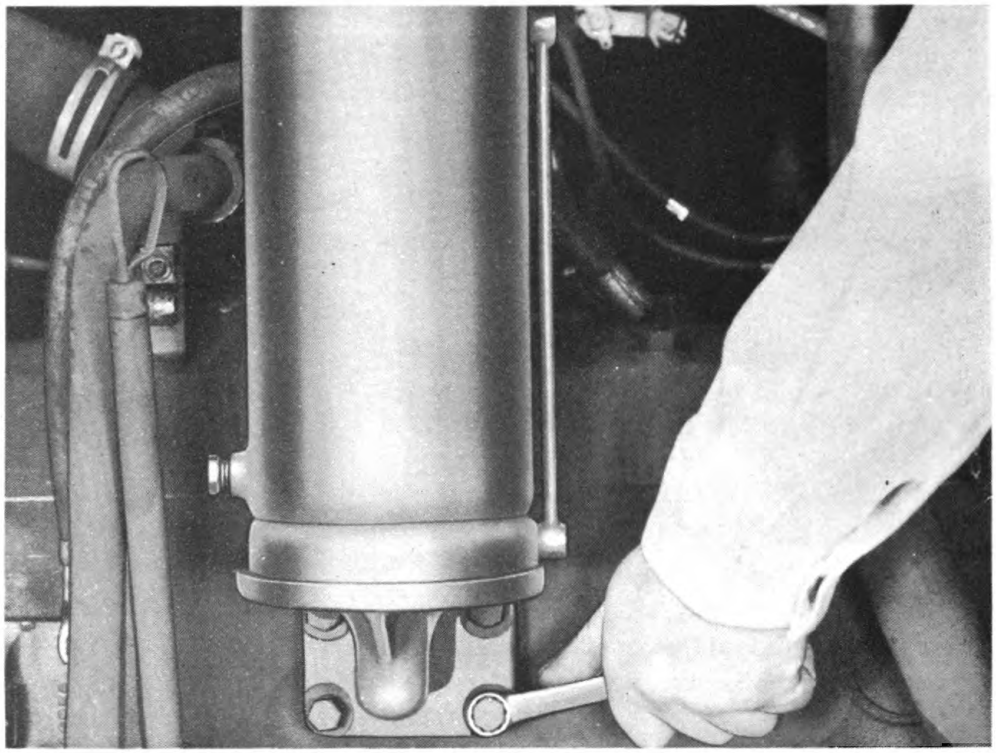
c. Oil Filter Removal.

(1) EQUIPMENT.

WRENCH, open-end, 9/16-in.

(2) PROCEDURE.

Remove the four 3/8-in. cap screws and lock washers holding the oil filter base to the motor block (9/16-in. open-end wrench) (fig. 123). Remove the oil filter.



RA PD 65903

Figure 123—Removing Oil Filter Assembly

d. Oil Filter Installation.

(1) EQUIPMENT.

WRENCH, open-end, 9/16-in.

(2) PROCEDURE.

Check the gasket and if gasket is damaged use a new gasket. Place the gasket and oil filter assembly on to the motor block and tighten it securely with the four 3/8-in. cap screws and lock washers (9/16-in. open-end wrench). Add one quart of oil to the motor. Start the motor and check for oil leaks.

103. OIL LINE.

a. Pressure Gage Oil Line Removal.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.

(2) PROCEDURE.

Disconnect the oil line (9/16-in. open-end wrench) on the right side of engine (5/8-in. and 9/16-in. open-end wrenches). Disconnect the oil line from the pressure gage (5/8-in. and 9/16-in. open-end wrenches). Loosen clip (screwdriver and 7/16-in. open-end wrench) holding line to dash, and remove line.

b. Pressure Gage Oil Line Installation.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.

(2) PROCEDURE.

Enter oil line through hole in dash and connect one end to oil gage and the other end to the engine (9/16-in. and 5/8-in. open-end wrenches). Anchor oil line to clip on engine side of dash (screwdriver and 7/16-in. open-end wrench).

104. ENGINE REMOVAL (figs. 124, 125 and 126).

a. Equipment.

BAR, pinch
CHAIN
EXTENSION, 6-in.
HAMMER, 1 lb
HANDLE, flex
HANDLE, ratchet
HOIST, chain
LIFTER, motor (7124)
PLIERS
PULLER, clutch pilot bearing (ordnance No. 41-P-2906-15)
PULLER, battery terminal (41-P-2900)
PUNCH, flat
SCREWDRIVER, 6-in.
WRENCH, adjustable, 18-in.
WRENCH, socket head set screw, 1/4-in.
WRENCH, box, 9/16-in.
WRENCH, box, 15/16-in.
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 11/16-in.
WRENCH, open-end, 7/8-in.
WRENCH, open-end, 1 1/16-in.
WRENCH, pipe, 6-in.
WRENCH, pipe, 10-in.
WRENCH, spark plug
WRENCH, socket, 9/16-in.
WRENCH, socket, 3/4-in.

b. Procedure.

(1) REMOVE HOOD (par. 55 b).

PLIERS
SCREWDRIVER, 6-in.

(2) REMOVE HOOD SIDE PANELS (par. 55 f).

SCREWDRIVER, 6-in.
WRENCH, open-end, 7/16-in.

(3) REMOVE BRUSH GUARD (par. 56 f).

PLIERS
WRENCH, box, 15/16-in.
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 7/8-in.

(4) REMOVE RADIATOR (par. 77 b).

EXTENSION, 6-in.
HANDLE, ratchet
PLIERS
SCREWDRIVER
WRENCH, open-end, 1/2-in.
WRENCH, socket, 3/4-in.

(5) REMOVE BRUSH GUARD STAY RODS FROM DASH ON CAB.

WRENCH, open-end, 3/4-in.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Remove two nuts and lock washers (¾-in. open-end wrench) from stay rods on inside of cab and remove the stay rod assembly.

(6) REMOVE RADIATOR STAY ROD FROM DASH BRACKET.

WRENCH, open-end, ¾-in.

Remove the nut and lock washer (¾-in. open-end wrench) from stay rod located inside of dash bracket. Remove the stay rod.

(7) REMOVE BATTERY (par. 81).

PULLER, battery terminal (41-P-2900)
WRENCH, open-end, 9/16-in.

(8) REMOVE COIL (par. 86).

EXTENSION, 6-in.
HANDLE, ratchet
SCREWDRIVER
WRENCH, open-end, ⅜-in.
WRENCH, open-end, ¾-in.

(9) DISCONNECT GENERATOR WIRE HARNESS.

SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, ½-in.

Remove screw and lock washer (screwdriver) attaching capacitor and ground wire to generator. Remove nut and washer (7/16-in. open-end wrench) attaching field wire to generator. Remove nut and washer (½-in. open-end wrench) attaching armature wire to generator. Loosen the two generator harness clips (screwdriver and 7/16-in. open-end wrench) and lay harness on side.

(10) DISCONNECT STARTING MOTOR CABLE.

WRENCH, open-end, 9/16-in.

Remove nut and lock washer (9/16-in. open-end wrench) holding cable to starting motor. Lay cable on fender.

(11) DISCONNECT CHOKE WIRE.

SCREWDRIVER

Loosen screw (screwdriver) attaching choke wire to carburetor arm. Loosen screw (screwdriver) attaching choke assembly to carburetor anchor bracket. Remove the choke and lay to one side.

(12) DISCONNECT TEMPERATURE GAGE.

WRENCH, open-end, ⅝-in.

Disconnect coupling (⅝-in. open-end wrench) holding temperature gage wire to side of cylinder head.

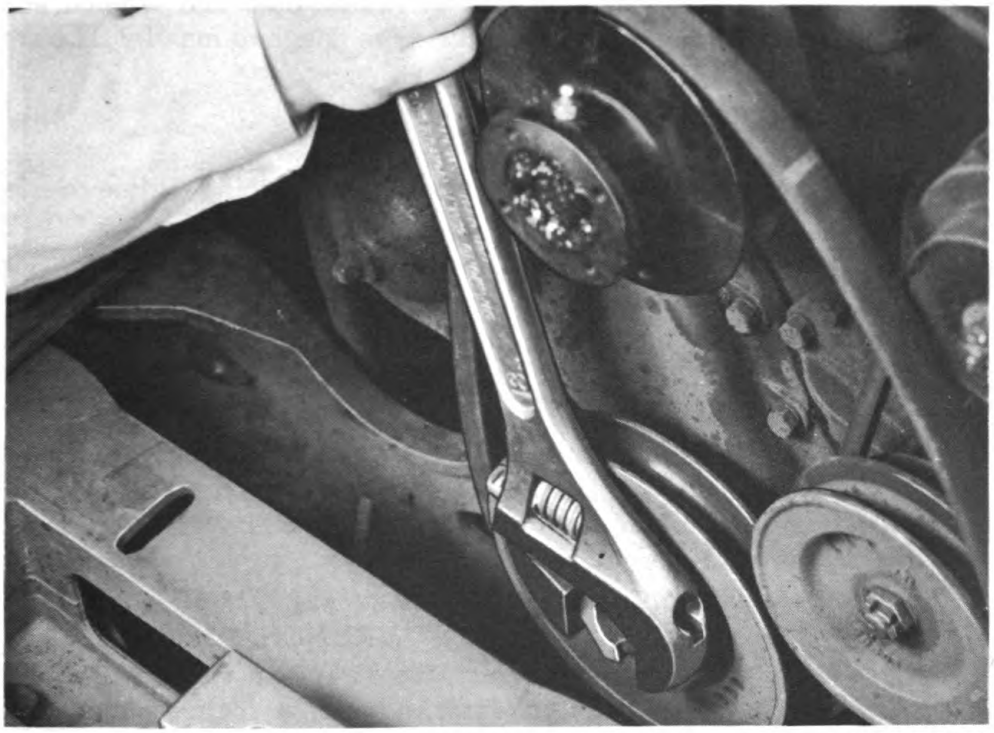
(13) DISCONNECT BONDING STRAPS.

EXTENSION, 4-in.
HANDLE, ratchet
WRENCH, socket, ¾-in.

Remove nut (¾-in. socket wrench, extension, and ratchet handle) and two lock washers from cylinder head stud. Remove bonding strap from stud.

(14) DISCONNECT WINDSHIELD WIPER LINE.

WRENCH, open-end, ½-in.



RA PD 65904

Figure 124—Removing Crankshaft Jaw Nut

Remove the coupling (½-in. open-end wrench) attaching the windshield wiper line to the intake manifold.

(15) DISCONNECT AIR CLEANER.

SCREWDRIVER, 6-in.

Loosen clamp screw at carburetor (screwdriver). Loosen clamp screw (screwdriver) holding cleaner tube elbow to air cleaner base. Remove tube and elbow.

(16) REMOVE FENDER SIDE PANELS (RIGHT SIDE) (par. 56 b).

SCREWDRIVER WRENCH, open-end, 7/16-in.

(17) REMOVE ACCELERATOR LINKAGE CROSS-SHAFT EXTENSION ARM (RIGHT SIDE).

WRENCH, open-end, 7/16-in.

Loosen clamp bolt in extension arm and remove the extension arm from the cross shaft.

(18) DISCONNECT BRAKE VACUUM HOSE.

SCREWDRIVER, 6-in.

Loosen clamp (screwdriver) holding brake vacuum hose to intake manifold and remove the hose.

(19) REMOVE EXHAUST PIPE.

WRENCH, open-end, 7/8-in. WRENCH, open-end, 15/16-in.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Remove nuts, lock washers, and bolts (7/8-in. open-end wrench and 15/16-in. open-end wrench) holding exhaust pipe flange to manifold. Lower pipe from manifold.

(20) DISCONNECT OIL GAGE LINE.

WRENCH, open-end, 5/8-in.

Remove the coupling (5/8-in. open-end wrench) holding oil line to side of engine.

(21) DISCONNECT FUEL PUMP LINE.

WRENCH, open-end, 3/4-in. WRENCH, open-end, 7/8-in.

Disconnect fuel pump flexible line from line running to fuel filter (3/4-in. open-end wrench and 7/8-in. open-end wrench).

(22) REMOVE FAN BELT.

WRENCH, open-end, 5/8-in. WRENCH, open-end, 1 1/16-in.

Loosen the fan shaft lock nut (1 1/16-in. open-end wrench). Lower fan hub in bracket by backing off on fan adjusting bolt (5/8-in. open-end wrench). Remove the fan belt from the pulleys.

(23) REMOVE CRANKSHAFT FAN PULLEY (fig. 124).

BAR, pinch WRENCH, adjustable, 18-in.

Remove the starting crank jaw nut (fig. 124) and shims (18-in. adjustable wrench) from end of crankshaft and remove the fan pulley. Use (pinch bar) to pry pulley from crankshaft.

(24) REMOVE REAR ENGINE HANGER BOLTS.

PLIERS WRENCH, open-end, 7/8-in.
SCREWDRIVER WRENCH, open-end, 15/16-in.
WRENCH, open-end, 1/2-in.

(a) Remove Floor and Toe Boards (par. 153).

PLIERS WRENCH, open-end, 1/2-in.
SCREWDRIVER

(b) Remove Engine Hanger Bolts.

PLIERS WRENCH, open-end, 15/16-in.
WRENCH, open-end, 7/8-in.

Remove cotter keys (pliers) from the right and left bolts. Remove the nuts from the hanger bolts (7/8-in. open-end wrench and 15/16-in. open-end wrench) and then remove the springs and bolts.

(25) REMOVE FRONT ENGINE SUPPORT.

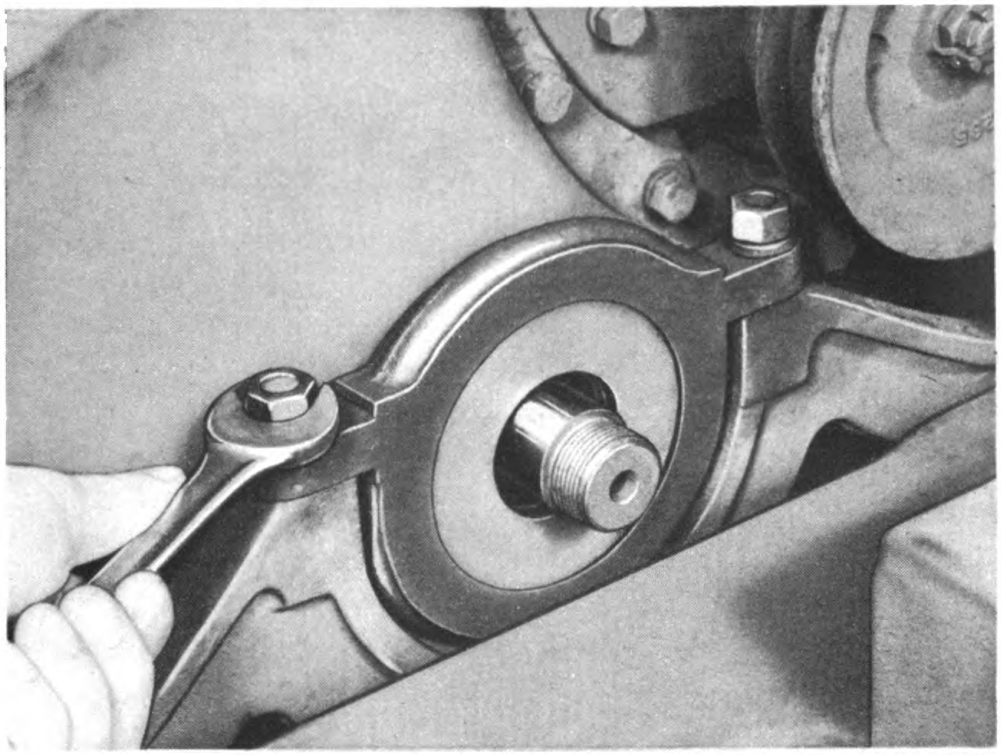
BAR, pinch WRENCH, open-end, 3/4-in.

Pry the motor to the rear (pinch bar) so that the nut on right stud will clear timing gear case. Remove the two nuts and lock washers (3/4-in. open-end wrench) (fig. 125).

(26) DISCONNECT SHORT-COUPLED PROPELLER SHAFT (ALINEMENT JOINT).

WRENCH, box, 9/16-in. WRENCH, open-end, 9/16-in.

Remove the eight nuts, lock washers, and bolts holding alinement joint to transmission companion flange (9/16-in. box wrench and 9/16-in. open-end wrench). Lower front end of alinement joint.



RA PD 65905

Figure 125—Removing Engine Front Support Nut

(27) DISCONNECT BRAKE, CLUTCH, AND POWER TAKE-OFF LINKAGE AND SPEEDOMETER CABLE.

PLIERS SCREWDRIVER, 6-in.

Remove cotter key and pin (pliers) holding brake rod to brake pedal. Remove clutch pedal pull back spring (pliers). Remove cotter key and pin (pliers) connecting PTO shift lever to PTO shifter shaft. Remove screw (screwdriver) holding speedometer cable to clutch inspection cover.

(28) REMOVE CLUTCH AND BRAKE LEVERS.

HAMMER WRENCH, open-end, 9/16-in. (2)

Loosen the lock bolt (two 9/16-in. open-end wrenches) holding the clutch pedal adjusting arm assembly to the clutch pedal shaft. Drive the adjusting arm assembly from the pedal shaft (hammer). Clutch and brake lever and spacer can now be removed from the clutch pedal shaft.

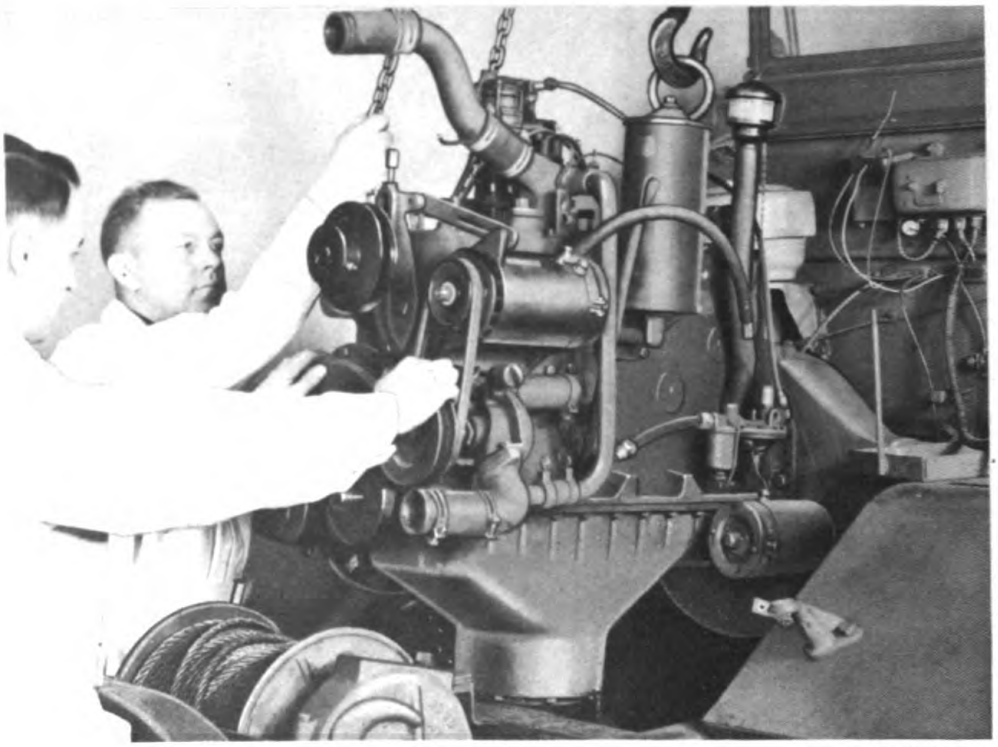
(29) REMOVE TRANSMISSION COVER (par. 153).

WRENCH, open-end, 9/16-in.

(30) REMOVE POWER TAKE-OFF SHIFT LEVER.

PLIERS

Remove cotter key (pliers) and plain washer holding shift lever and remove the lever.



RA PD 65906

Figure 126—Engine Removal

(31) DISCONNECT WINCH PROPELLER SHAFT (par. 171 a).

HAMMER
PUNCH, flat
WRENCH socket head set screw, ¼-in.

(32) REMOVE ENGINE (fig. 126).

BAR, pinch
HOIST, chain
LIFTER, motor (7126)

Enter motor lifter in rear hole in cylinder head and attach to chain hoist. Raise motor from front motor support using caution that all connections are free. As motor is raised, it will have to be removed forward out of chassis or else move the chassis back (fig. 126). Rear motor hanger on left side will have to be guided around the steering column by swinging motor to right. A pinch bar will be needed in some places to maneuver motor around and out of chassis.

c. When an engine replacement is necessary, the following units and parts will have to be removed:

(1) REMOVE GENERATOR FROM ENGINE (par. 82).

SCREWDRIVER, 6-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, ½-in.

(2) REMOVE STARTER FROM ENGINE (par. 84).

WRENCH, open-end, 9/16-in.

(3) REMOVE FUEL PUMP (par. 118).

EXTENSION, 3-in.
HANDLE, ratchet
WRENCH, open-end, 3/4-in.
WRENCH, socket, 1/2-in.

(4) REMOVE TEMPERATURE GAGE FITTING FROM CYLINDER HEAD.

WRENCH, open-end, 7/8-in.

Remove the reducer fitting (7/8-in. open-end wrench) from side of cylinder head.

(5) REMOVE NEGATIVE BATTERY CABLE.

WRENCH, open-end, 9/16-in.

Remove cap bolt and lock washer (9/16-in. open-end wrench) fastening battery cable to generator mounting bracket. Replace the cap bolt and washer (9/16-in. open-end wrench).

(6) REMOVE UPPER WATER PIPE.

SCREWDRIVER

Loosen hose clamp (screwdriver) and remove the pipe and hose from the top water manifold.

(7) REMOVE GENERATOR WIRE HARNESS BRACKETS.

HANDLE, flex
WRENCH, socket, 3/4-in.

Remove the two cylinder head bolts (3/4-in. socket wrench and flex handle) fastening the brackets. Remove the brackets and replace the nuts (3/4-in. socket wrench and flex handle).

(8) REMOVE CARBURETOR (par. 117 c).

WRENCH, open-end, 3/8-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 3/4-in.

(9) REMOVE DISTRIBUTOR (par. 85).

WRENCH, open-end, 7/16-in.

(10) REMOVE SPARK PLUG (par. 87).

WRENCH, spark plug

(11) REMOVE VACUUM FITTINGS FROM MANIFOLD.

WRENCH, open-end, 1 1/16-in.
WRENCH, pipe, 10-in.

Remove windshield wiper connection (1 1/16-in. open-end wrench). Remove brake vacuum line connection (10-in. pipe wrench).

(12) REMOVE OIL GAGE FITTING.

WRENCH, pipe, 6-in.

Remove fitting from right side of crankcase (6-in. pipe wrench).

(13) REMOVE ACCELERATOR LINKAGE BRACKET FROM MANIFOLD.

WRENCH, open-end, 5/8-in.

Remove two nuts and flat washers (5/8-in. open-end wrench). Remove the bracket and replace the two nuts and washers (5/8-in. open-end wrench).

(14) REMOVE TRANSMISSION FROM ENGINE.

CHAIN
HOIST, chain
WRENCH, open-end, 9/16-in.

Remove the twelve cap screws and washers (9/16-in. open-end wrench) holding transmission to flywheel housing and then remove transmission with chain hoist.

(15) REMOVE CLUTCH FROM FLYWHEEL (par. 70).

HANDLE, ratchet
PULLER, clutch pilot bearing (ordnance No. 41-P-2906-15)
WRENCH, socket, 5/8-in.

(16) REMOVE FRONT MOTOR SUPPORT TRUNNION BEARING.

Slide bearing from trunnion on timing gear case.

105. ENGINE INSTALLATION (figs. 127 and 128).

a. Equipment.

BAR, pinch
CHAIN
EXTENSION, 6-in.
HAMMER, 1 lb
HANDLE, flex
HANDLE, ratchet
HOIST, chain
LIFTER, motor (7126)
PLIERS
PUNCH, flat
PUNCH, taper
SCREWDRIVER, 6-in.
WRENCH, adjustable, 18-in.
WRENCH, socket head set screw, 1/4-in.
WRENCH, box, 9/16-in.
WRENCH, box, 15/16-in.
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, open-end, 11/16-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 7/8-in.
WRENCH, open-end, 1 1/16-in.
WRENCH, pipe, 10-in.
WRENCH, pipe, 6-in.
WRENCH, socket, 9/16-in.
WRENCH, socket, 5/8-in.
WRENCH, socket, 3/4-in.
WRENCH, spark plug

b. Procedure.

(1) INSTALL CLUTCH ASSEMBLY IN THE FLYWHEEL (par. 70).

ALINER, clutch plate (use drive end gear)
HAMMER
HANDLE, ratchet
WRENCH, socket, 5/8-in.

(2) INSTALL TRANSMISSION ON ENGINE.

CHAIN
HOIST, chain
PUNCH, taper
WRENCH, open-end, 9/16-in.

Place a chain around the transmission and connect to a chain hoist. Raise the transmission and enter the drive end gear spline into the clutch disk. Slide the transmission up to the flywheel housing. Line up drillings with taper punch and install the 12 cap screws and tighten them evenly (9/16-in. open-end wrench).

(3) INSTALL ACCELERATOR LINKAGE BRACKET.

WRENCH, open-end, 5/8-in.

Remove the two nuts and flat washers (5/8-in. open-end wrench) from the manifold side studs. Install accelerator linkage bracket, replace the washers, and tighten the two nuts (5/8-in. open-end wrench).

ENGINE

(4) INSTALL OIL GAGE LINE FITTING.

WRENCH, pipe, 6-in.

Install fitting in side of crankcase and tighten (10-in. pipe wrench).

(5) INSTALL VACUUM FITTINGS IN MANIFOLD.

WRENCH, open-end, 1 1/16-in. WRENCH, pipe, 10-in.

Install windshield wiper vacuum fitting into rear opening in intake manifold (1 1/16-in. open-end wrench). Install brake vacuum connection in manifold (10-in. pipe wrench).

(6) INSTALL SPARK PLUGS.

WRENCH, spark plug

Install six spark plugs and washers in cylinder head and tighten (spark plug wrench).

(7) INSTALL DISTRIBUTOR (par. 85).

WRENCH, open-end, 1/2-in.

(8) INSTALL CARBURETOR (par. 117).

WRENCH, open-end, 3/8-in. WRENCH, open-end, 9/16-in.
WRENCH, open-end, 7/16-in. WRENCH, open-end, 3/4-in.

(9) INSTALL GENERATOR WIRE HARNESS BRACKETS.

HANDLE, flex WRENCH, socket, 3/4-in.

Remove the third and sixth cylinder head bolts (3/4-in. socket wrench and flex handle) from left side of engine. Put on the harness brackets and replace the two bolts and tighten (3/4-in. socket wrench and flex handle).

(10) INSTALL UPPER WATER PIPE.

SCREWDRIVER

Place the upper water pipe and hose on the top water manifold; tighten the hose clamp (screwdriver.)

(11) INSTALL NEGATIVE BATTERY CABLE.

WRENCH, open-end, 9/16-in.

Remove the top rear cap bolt and washer from the generator mounting bracket (9/16-in. open-end wrench). Fasten the battery cable to the engine with the cap bolt and washer (9/16-in. open-end wrench).

(12) INSTALL TEMPERATURE GAGE REDUCER FITTING.

WRENCH, open-end, 7/8-in.

Install the reducer fitting into side of cylinder head and tighten (7/8-in. open-end wrench.)

(13) INSTALL FUEL PUMP (par. 118).

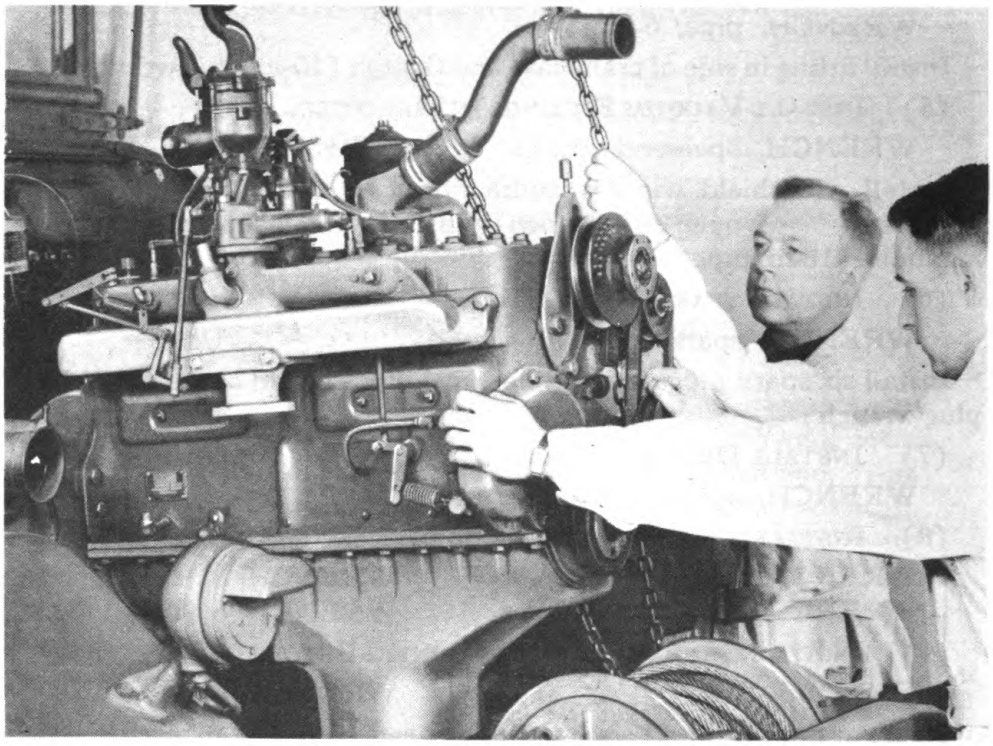
EXTENSION, 3-in. WRENCH, socket, 1/2-in.
WRENCH, open-end, 3/4-in.

(14) INSTALL STARTING MOTOR (par. 84).

WRENCH, open-end, 9/16-in.

(15) INSTALL GENERATOR (par. 82).

SCREWDRIVER WRENCH, open-end, 1/2-in.
WRENCH, open-end, 7/16-in.



RA PD 65907

Figure 127—Engine Installation

(16) INSTALL FAN (par. 74).

WRENCH, open-end, 5/8-in. WRENCH, open-end, 11/16-in.

(17) INSTALL ENGINE IN CHASSIS.

BAR, pinch LIFTER, motor (7126)

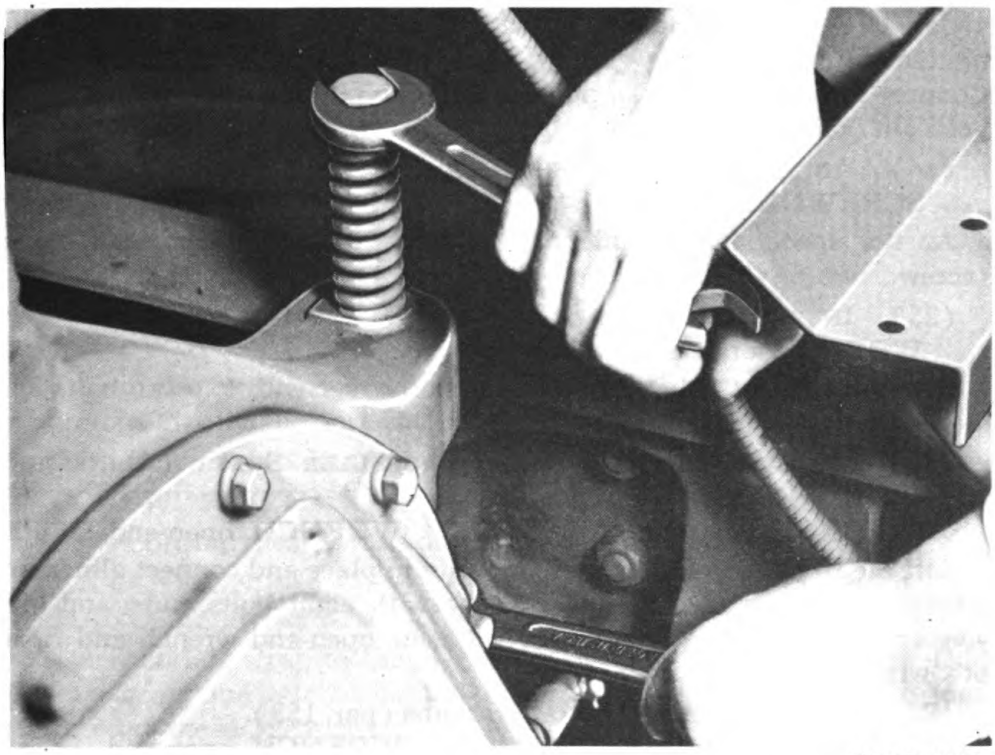
HOIST, chain

Install the front motor support trunnion bearing on to the timing gear case trunnion. Enter the motor lifter into the rear lifter hole in the cylinder head and attach to chain hoist hole in the cylinder head and attach to chain hoist. Raise engine with the chain hoist and enter into position in the chassis, using care not to damage any of the accessories. The rear end of the engine will have to be swung to the right to clear the steering column. A pinch bar can be used to maneuver engine around and into proper location (fig. 127).

(18) INSTALL FRONT ENGINE SUPPORT NUTS.

WRENCH, open-end, 3/4-in.

Attach the two nuts and lock washers to the front engine support studs and tighten (3/4-in. open-end wrench). NOTE: The engine must be in a slightly raised position before the nuts can be started. The thin nut is to be fastened to the stud on the right-hand side.



RA PD 65908

Figure 128—Installing Rear Motor Support Bolt

(19) INSTALL REAR ENGINE SUPPORT BOLTS (fig. 128).

PLIERS
WRENCH, open-end, 7/8-in.
WRENCH, open-end, 15/16-in.

Enter the left bolt from the bottom side of the rear engine support and the right bolt from the top side. Place a coil spring, flat washer, and nut on each bolt and tighten until the springs have depressed 1/8 inch (fig. 128). Enter cotter keys in each nut (pliers).

(20) INSTALL WINCH PROPELLER SHAFT (par. 171).

HAMMER
PUNCH, flat
WRENCH, socket head set screw, 1/4-in.

(21) INSTALL PTO SHIFT LEVER.

PLIERS

Connect the lever to the PTO lever bracket, place a flat washer, and enter a cotter key (pliers). Connect the shift rod to the shifter shaft with a yoke pin, and enter a cotter key (pliers).

(22) INSTALL TRANSMISSION COVER (par. 154 a).

WRENCH, open-end, 9/16-in.

(23) INSTALL CLUTCH AND BRAKE LEVERS.

HAMMER, 1-lb
PLIERS
WRENCH, open-end, 9/16-in. (2)

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Place spacer on clutch pedal shaft and follow with brake and clutch pedal. Drive on the clutch pedal adjusting arm assembly (hammer) and tighten (9/16-in. open-end wrench). Connect clutch pedal pull back spring. Connect brake rod to brake pedal with yoke pin and enter cotter key in yoke pin (pliers).

(24) ANCHOR SPEEDOMETER CABLE.
SCREWDRIVER, 6-in.

Anchor speedometer cable clip to screw in clutch inspection cover (screwdriver).

(25) INSTALL HAND BRAKE LEVER.
WRENCH, open-end, 9/16-in.

Fasten hand brake lever to transmission cover with two cap bolts and lock washers (9/16-in. open-end wrench).

(26) CONNECT SHORT-COUPLED PROPELLER SHAFT (ALINEMENT JOINT).
WRENCH, box, 9/16-in. WRENCH, open-end, 9/16-in.

Lift the front end of the alinement joint in place and connect alinement joint to transmission companion flange with eight bolts, nuts, and lock washers. Tighten the bolts securely (9/16-in. open-end wrench and 9/16-in. box wrench).

(27) INSTALL TOE AND FLOOR BOARDS (par. 153).
PLIERS WRENCH, open-end, 1/2-in.
SCREWDRIVER, 6-in.

(28) INSTALL CRANKSHAFT FAN PULLEY.
HAMMER WRENCH, adjustable, 18-in.

Line up keyway in pulley with key in crankshaft and drive the pulley on (hammer). Turn the starting crank jaw nut with shims on the crankshaft and tighten (18-in adjustable wrench).

(29) INSTALL FAN BELT.
WRENCH, open-end, 5/8-in. WRENCH, open-end, 1 1/16-in.

Place the belt over the pulleys and adjust it (par. 75) (5/8-in. open-end wrench). Tighten fan shaft lock nut (1 1/16 open-end wrench).

(30) CONNECT FUEL PUMP LINE.
WRENCH, open-end, 3/4-in. WRENCH, open-end, 7/8-in.

Connect flexible fuel line to the fuel pump (3/4-in. open-end wrench and 7/8-in. open-end wrench).

(31) CONNECT OIL GAGE LINE.
WRENCH, open-end, 5/8-in.

Connect the flexible oil gage line to connection on right side of engine (5/8-in. open-end wrench).

(32) CONNECT EXHAUST PIPE (par. 110).
WRENCH, open-end, 7/8-in. WRENCH, open-end, 1 5/16-in.

(33) CONNECT BRAKE VACUUM LINE.
SCREWDRIVER

Enter vacuum hose on manifold connection and tighten hose clamp (screwdriver).

ENGINE

(34) CONNECT WINDSHIELD WIPER LINE.

WRENCH, open-end, ½-in.

Connect wiper line to fitting on the manifold (½-in. open-end wrench).

(35) INSTALL EXTENSION ARM TO ACCELERATOR CROSS-SHAFT LINKAGE.

WRENCH, open-end, 7/16-in.

Place extension arm on right end cross-shaft and tighten clamp bolt (7/16-in. open-end wrench).

(36) CONNECT AIR CLEANER.

SCREWDRIVER

Place air cleaner tube on to carburetor and then place elbow in base of carburetor. Tighten the hose clamps (screwdriver).

(37) INSTALL THE RIGHT FENDER SIDE PANELS (par. 56).

SCREWDRIVER
WRENCH, open-end, 7/16-in.

(38) CONNECTING BONDING STRAP.

EXTENSION, 4-in.
HANDLE, ratchet
WRENCH, socket, ¾-in.

Fasten bonding strap to the cylinder head stud (¾-in. socket wrench, 4-in. extension, and ratchet handle). NOTE: This bonding strap is also connected to the air cleaner bracket.

(39) CONNECT TEMPERATURE GAGE.

WRENCH, open-end, 5/8-in.

Couple the temperature gage line to the left side of the cylinder head (5/8-in. open-end wrench).

(40) CONNECT CHOKE WIRE.

SCREWDRIVER

Slide the choke wire lock into the anchor bracket on the carburetor and at the same time enter the choke wire in the carburetor choke arm. Tighten the anchor bracket and choke arm swivel set screw (screwdriver).

(41) CONNECT STARTING MOTOR CABLE.

WRENCH, open-end, 9/16-in.

Connect the starter cable to the starting motor terminal with the nut and lock washer (9/16-in. open-end wrench).

(42) CONNECT GENERATOR HARNESS WIRES.

SCREWDRIVER
WRENCH, open-end, ½-in.
WRENCH, open-end, 7/16-in.

Fasten the harness wires to the harness brackets on the cylinder head with the two clamps (screwdriver and 7/16-in. open-end wrench). Connect the capacitator lead and the blue and white wire to the generator ground (screwdriver). Connect the blue wire to the generator field terminal with the nut and lock washer (7/16-in. open-end wrench). Connect the brown and black wire to the generator armature terminal with the nut and lock washer (½-in. open-end wrench).

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

(43) INSTALL COIL (par. 86).

EXTENSION, 6-in.
HANDLE, ratchet
SCREWDRIVER
WRENCH, open-end, 3/8-in.
WRENCH, socket, 3/4-in.

(44) INSTALL BATTERY (par. 81).

WRENCH, open-end, 9/16-in.

(45) INSTALL RADIATOR (par. 77).

EXTENSION, 6-in.
HANDLE, ratchet
PLIERS
SCREWDRIVER, 6-in.
WRENCH, open-end, 1/2-in.
WRENCH, socket, 3/4-in.

(46) INSTALL BRUSH GUARD STAY ROD ON DASH.

WRENCH, open-end, 3/4-in.

Fasten the stay rod to the dash by sliding rods through the openings in the dash and tighten them with the two nuts and lock washers (3/4-in. open-end wrench).

(47) INSTALL RADIATOR STAY ROD TO DASH.

WRENCH, open-end, 3/4-in.

Fasten the radiator stay rod to the bracket on the dash with the nut and lock washer (3/4-in. open-end wrench).

(48) INSTALL BRUSH GUARD (par. 56).

PLIERS
WRENCH, box, 15/16-in.
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 7/8-in.

(49) INSTALL HOOD SIDE SHIELDS (par. 55).

SCREWDRIVER, 6-in.
WRENCH, open-end, 7/16-in.

(50) INSTALL HOOD (par. 55).

PLIERS
SCREWDRIVER, 6-in.

(51) FILL COOLING SYSTEM.

PLIERS

Close the two drain cocks in radiator and engine block (pliers) and fill cooling system with clean water or anti-freeze solution.

(52) FILL ENGINE CRANKCASE.

WRENCH, open-end, 1 1/8-in.

Tighten oil pan drain plug (1 1/8-in. open-end wrench). Fill crankcase to proper level with engine oil. (See Lubrication, section VI.)

(53) LUBRICATE FAN, WATER PUMP, STARTING MOTOR, GENERATOR, AND DISTRIBUTOR.

(See Lubrication, section VI.)

CAN, oil
GUN, grease

Section XXII

EXHAUST SYSTEM

106. EXHAUST SYSTEM DESCRIPTION (figs. 129 and 130).

The exhaust system consists of an exhaust pipe, muffler and tail pipe. The exhaust pipe is clamped to the manifold and inlet of the muffler. The tail pipe is clamped to the outlet of the muffler and frame.

107. EXHAUST SYSTEM MAINTENANCE.

Inspection should be made at regular intervals to make sure that all connections are tight. Whenever the exhaust flange is removed, a new gasket should be installed. Exhaust leakage may occur if the flange is not tight, and will, therefore, burn the gasket. It should be checked within a day after a new gasket has been installed. Keep muffler tail pipe open, as a closed pipe will affect engine performance.

108. TAIL PIPE.

a. Tail Pipe Removal.

BAR, pinch, 12-in.
HAMMER
WRENCH, open-end, 9/16-in.
(2)

Loosen muffler tail pipe clamp and bracket clamp attached to frame (two 9/16-in. open-end wrenches). Open frame bracket clamp with a pinch bar. Drive pipe from muffler (hammer). Remove by sliding out of muffler and frame bracket.

b. Tail Pipe Installation.

WRENCH, open-end, 9/16-in. (2)

Slide rear of pipe into frame bracket, then into muffler. Tighten both clamps (9/16-in. open-end wrenches).

109. MUFFLER (fig. 129).

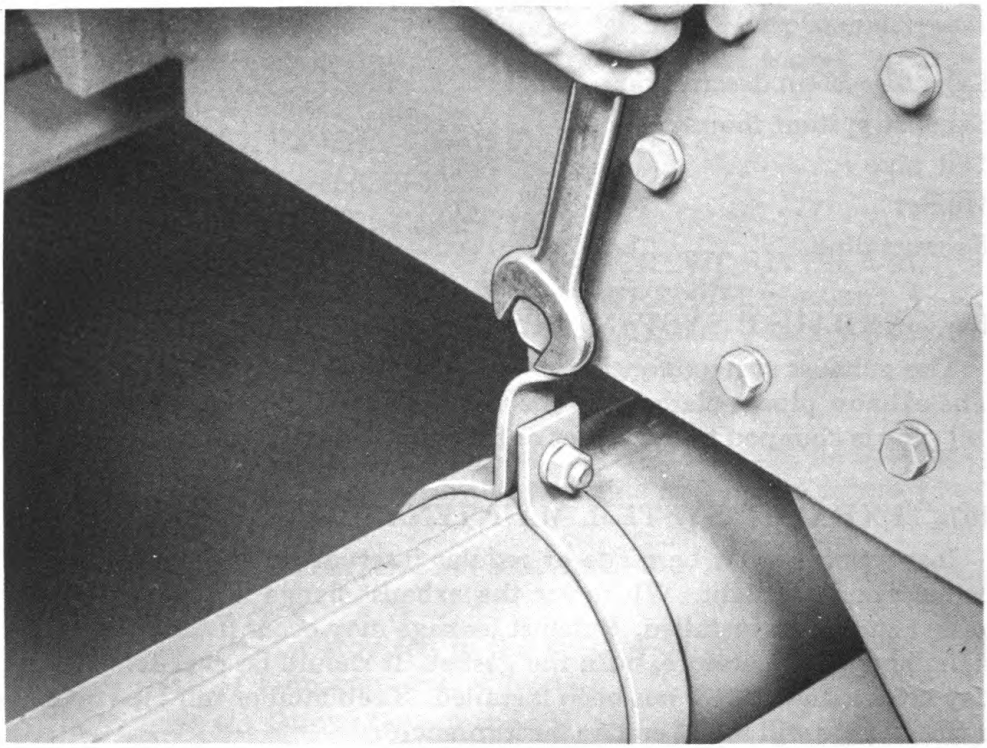
a. Muffler Removal.

(1) EQUIPMENT.

BAR, pinch, 12-in.
HAMMER
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 3/4-in.

(2) PROCEDURE.

(a) Remove Tail Pipe (par. 108 a).



RA PD 65909

Figure 129—Removing Muffler Bracket Bolt

(b) Remove Muffler Bracket and Clamp.

WRENCH, open-end, 9/16-in. WRENCH, open-end, 3/4-in.

Loosen clamp at front end of muffler (9/16-in. open-end wrench). Remove muffler bracket bolt (3/4-in. open-end wrench). If necessary drive the muffler from the exhaust pipe (hammer). Remove muffler clamp bolt (9/16-in. open-end wrench) and slide muffler bracket from the muffler (fig. 129). Remove the exhaust and tail pipe clamps.

b. Muffler Installation.

(1) EQUIPMENT.

WRENCH, open-end, 9/16-in. WRENCH, open-end, 7/8-in.
WRENCH, open-end, 3/4-in.

(2) PROCEDURE.

(a) Install Muffler to Exhaust Pipe and Bracket.

WRENCH, open-end, 9/16-in. WRENCH, open-end 3/4-in.

Slip a clamp over the large end of the muffler opening and then enter the muffler on the exhaust pipe; tighten the clamp nuts (9/16-in. open-end wrench). Slip muffler bracket over muffler and line up with hole in transfer case bracket. Install bolt, lock washer, and nut and tighten (3/4-in. open-end wrench). Tighten muffler clamp bolt (9/16-in. open-end wrench).

(b) Assemble Tail Pipe to Muffler (par. 108 b).

EXHAUST SYSTEM

110. EXHAUST PIPE.

a. Exhaust Pipe Removal.

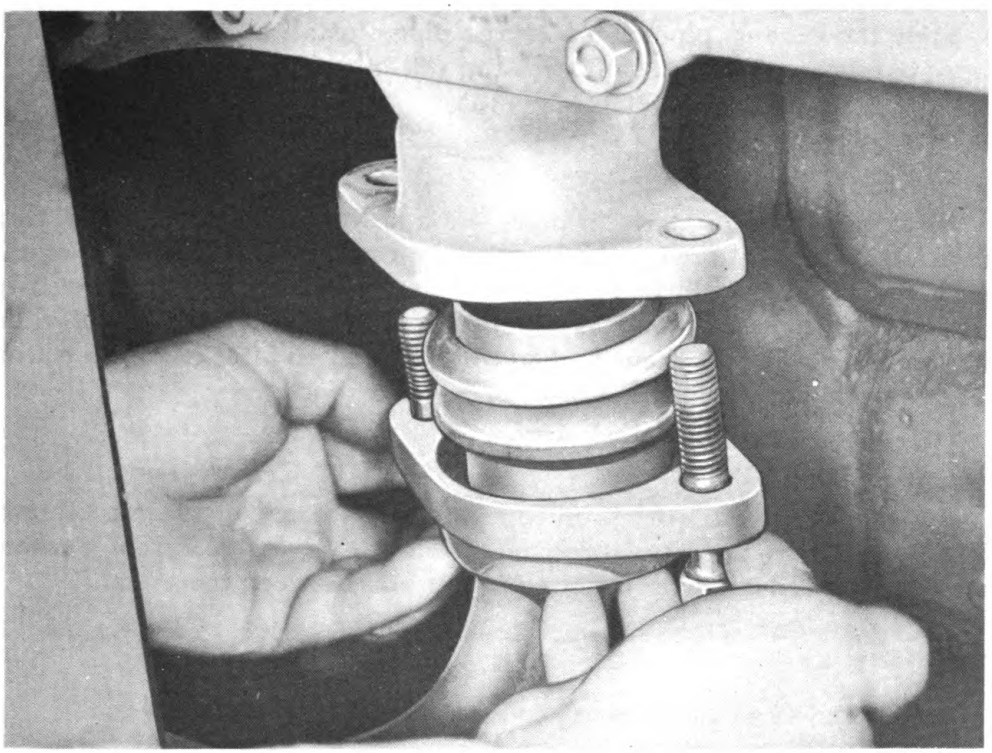
(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 7/8-in.

(2) PROCEDURE.

(a) Remove Rear Fender Splash Apron.

SCREWDRIVER
WRENCH, open-end, 7/16-in.



RA PD 65910

Figure 130—Installing Exhaust Pipe Flange

Remove rear fender splash apron bolts (screwdriver and 7/16-in. open-end wrench).

(b) Remove Exhaust Pipe Front Section.

WRENCH, open-end, 9/16-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 7/8-in.

Remove the exhaust pipe coupling bolts (3/4-in. and 7/8-in. open-end wrenches). Loosen clamp holding the two pipe sections together (9/16-in. open-end wrench). Remove front exhaust pipe and clamp from rear exhaust pipe.

(c) Remove Rear Exhaust Pipe.

WRENCH, open-end, 9/16-in.

Loosen muffler clamp (9/16-in. open-end wrench). Pull pipe out toward the front.

b. Exhaust Pipe Installation (fig. 130).

(1) EQUIPMENT.

SCREWDRIVER, 6-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 7/8-in.

(2) PROCEDURE.

(a) Install Rear Section.

WRENCH, open-end, 9/16-in.

Slide the exhaust pipe clamp on the pipe. Install the rear section into front of muffler. Tighten muffler clamp (9/16-in. open-end wrench).

(b) Install Front Section (fig. 130).

WRENCH, open-end, 9/16-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 7/8-in.

Slide manifold clamp on to pipe, and a new exhaust pipe gasket. Slip rear end of pipe into rear exhaust pipe. Slip front end into exhaust manifold (fig. 130). Install the two exhaust pipe clamp bolts. Tighten evenly and not too tight (3/4- and 7/8-in. open-end wrenches), as clamp can be broken if unevenly tightened when cold. Retighten after engine is warm. Tighten exhaust pipe clamp (9/16-in. open-end wrench).

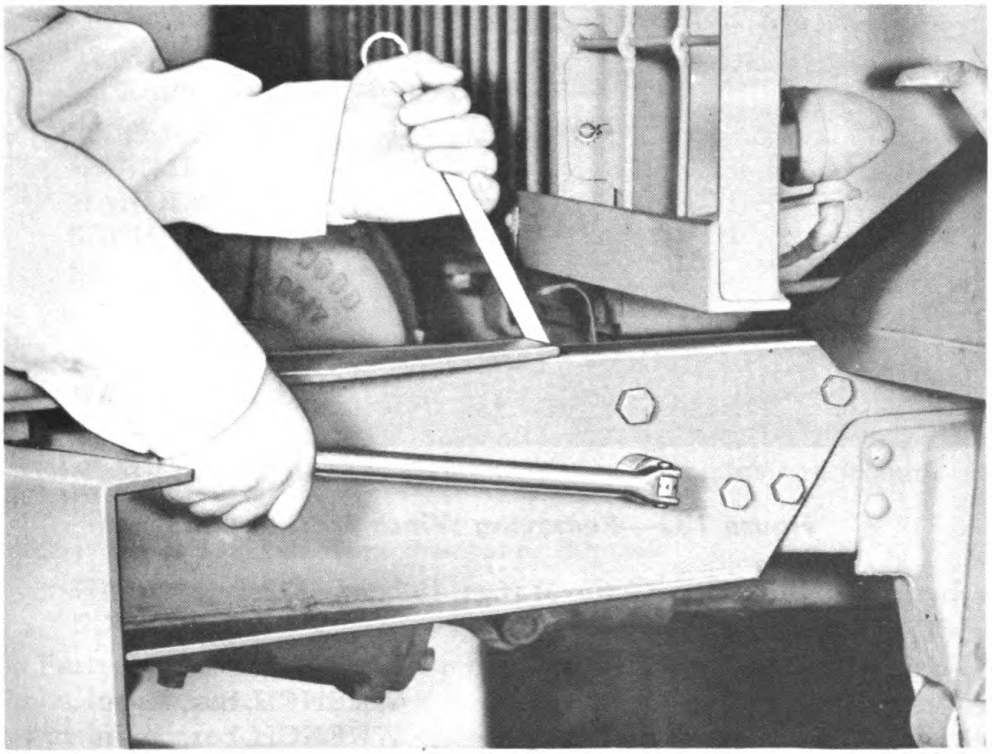
(c) Install Fender Splash Apron.

SCREWDRIVER
WRENCH, open-end, 7/16-in.

Install the rear splash apron to right front fender and frame (screwdriver and 7/16-in. open-end wrench). Make sure the shakeproof washers are used under head and nut of each bolt and between the metal.

SECTION XXIII

FRAME



RA PD 65911

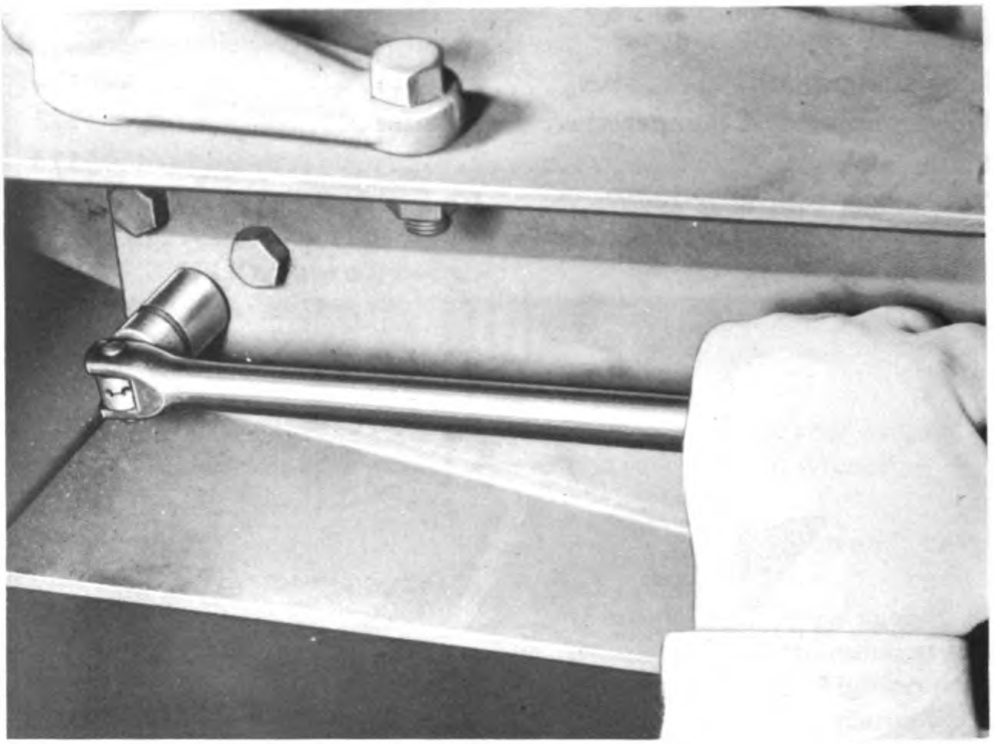
Figure 131—Removing Front Bumper Bolts

111. FRAME DESCRIPTION.

The frame design features simplicity and great strength. The frame side rails and cross members are constructed of channel steel riveted together. Braces and brackets are used to provide additional resistance to twisting. The frame, having a rugged design, requires very little attention to maintain.

112. FRONT BUMPER AND BUMPERETTES.

a. Front Bumper and Bumperette Description. A bumper is mounted in front of the frame and also supports the front mounted winch. Two bumperettes are mounted on the rear of the frame at opposite sides of the pintle hook.



RA PD 65912

Figure 132—Removing Winch Bracket Bolts

b. Front Bumper Removal (figs. 131 and 132).

(1) EQUIPMENT.

EXTENSION, 5-in.
HAMMER, 2 lb
HANDLE, flex, 18-in.
SOCKET, 3/4-in.
SOCKET, 7/8-in.
SOCKET, 1 1/16-in.
WRENCH, box, 3/4-in.
WRENCH, box, 15/16-in.
WRENCH, box, 1-in.

(2) PROCEDURE.

(a) Remove Bumper Side Member Bolts (fig. 131).

HANDLE, flex, 18-in.
SOCKET, 3/4-in.
SOCKET, 7/8-in.
WRENCH, box, 3/4-in.
WRENCH, box, 15/16-in.

Remove the seven bolts (fig. 131) from each side of the bumper and frame (3/4-in. socket and flex handle, 3/4-in. box wrench, 7/8-in. socket, and 15/16-in. box wrench).

(b) Remove Bumper to Winch Front Brackets (fig. 132).

EXTENSION
HANDLE, flex, 18-in.
SOCKET, 3/4-in.
SOCKET, 1 1/16-in.
WRENCH, box, 3/4-in.
WRENCH, box, 1-in.

Remove the three bolts (fig. 132) that fasten the winch to each front bracket to bumper (3/4-in. socket, flex handle, and 3/4-in. box wrench).

Then remove two bolts that fasten these brackets to winch (1-in. box wrench, 1 1/16-in. socket, extension, and flex handle). Remove brackets from bumper.

(c) Remove Tow Hooks (par. 114).

EXTENSION
HANDLE, flex
SOCKET, 1 1/16-in.
WRENCH, box, 1-in.

(d) Remove Bumper from Frame.

HAMMER

Drive the bumper (hammer) from the frame and winch.

c. Front Bumper Installation.

(1) EQUIPMENT.

EXTENSION, 5-in.
HAMMER, 2-lb
HANDLE, flex, 18-in.
SOCKET, 3/4-in.
SOCKET, 7/8-in.
SOCKET, 1 1/16-in.
WRENCH, box, 3/4-in.
WRENCH, box, 15/16-in.
WRENCH, box, 1-in.

(2) PROCEDURE.

(a) Install Bumper into Frame.

HAMMER

Lift bumper into position, so sides will enter outside of frame side members. Drive bumper to rear (hammer) until all bumper to frame holes line up.

(b) Install Winch Front Bracket to Bumper.

HANDLE, flex, 18-in.
SOCKET, 3/4-in.
WRENCH, box, 3/4-in.

Fasten each winch front mounting bracket to the bumper with three bolts, lock washers, and nuts (3/4-in. socket, flex handle, and 3/4-in. box wrench).

(c) Install Front Bracket to Winch.

EXTENSION, 5-in.
HANDLE, flex, 18-in.
SOCKET, 1 1/16-in.
WRENCH, box, 1-in.

Install the bolt fastening each bracket to winch with head of bolt up. Place lock washers and nuts; tighten (1-in. box wrench, 1 1/16-in. socket, 5-in. extension, and flex handle).

(d) Install Tow Hooks (par. 114).

HANDLE, flex, 18-in.
SOCKET, 7/8-in.
SOCKET, 1 1/16-in.
WRENCH, box, 15/16-in.
WRENCH, box, 1-in.

d. Rear Bumperette Removal (fig. 133).

(1) EQUIPMENT.

HANDLE, flex
RATCHET
SOCKET, 7/8-in.
SOCKET, 15/16-in.
SOCKET, 1 1/16-in.

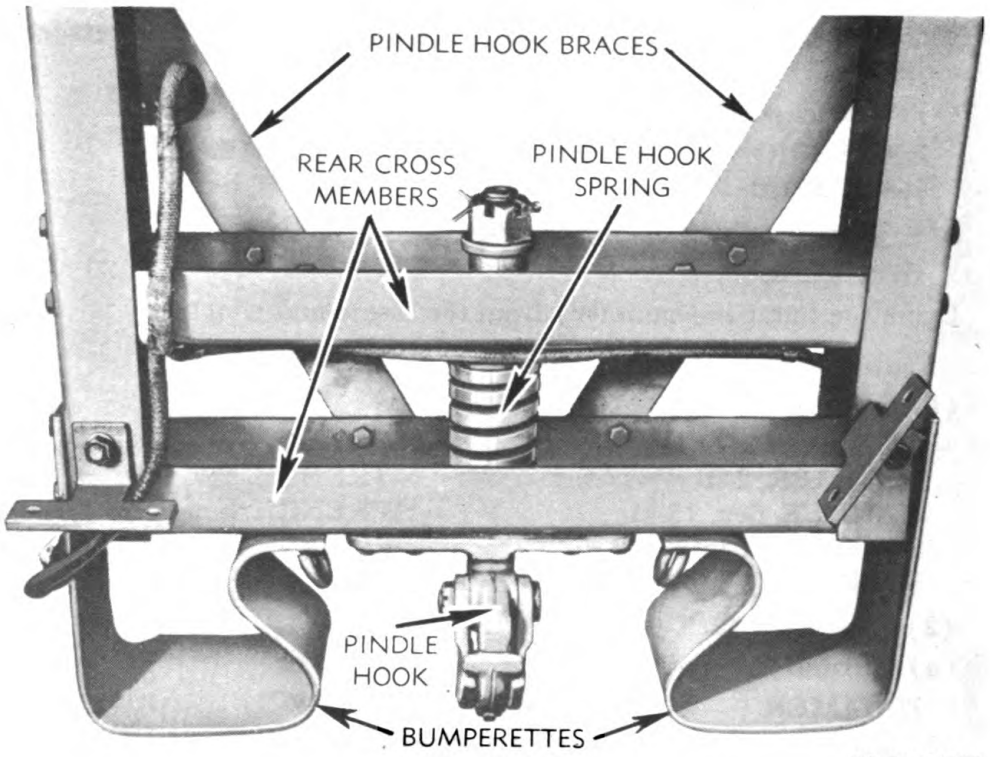


Figure 133—Bumperettes and Pintle Hook Installation

(2) PROCEDURE.

(a) Remove Bolts from Side Member.

HANDLE, flex	SOCKET, 7/8-in.
RATCHET	SOCKET, 15/16-in.

Remove bolts fastening bumper to side of frame (7/8- and 15/16-in. sockets, ratchet, and flex handle) (fig. 133).

(b) Remove Bolts from Rear Cross Member.

HANDLE, flex	SOCKET, 15/16-in.
RATCHET	SOCKET, 1 1/16-in.

Remove the four bolts fastening bumper to rear of frame (15/16-in. and 1 1/16-in. sockets, ratchet, and flex handle).

e. Rear Bumperette Installation.

(1) EQUIPMENT.

HANDLE, flex	SOCKET, 15/16-in.
RATCHET	SOCKET, 1 1/16-in.
SOCKET, 7/8-in.	

(2) PROCEDURE.

(a) Install Bumper to Frame Side Member.

HANDLE, flex	SOCKET, 7/8-in.
RATCHET	SOCKET, 15/16-in.

Place bumper on frame and enter the four bolts with bolt heads to the outside. Replace lock washer, nuts, and tighten (7/8- and 15/16-in. sockets, ratchet, and flex handle) (fig. 133).

(b) Install Rear Bumperette Bolts.

HANDLE, flex	SOCKET, 7/8-in.
RATCHET	SOCKET, 1 1/16-in.

Enter the four bolts through the bumperette and frame cross member, place lock washers, and tighten nuts (7/8- and 1 1/16-in. sockets, ratchet, and flex handle).

113. PINTLE HOOK.

a. Pintle Hook Description. A pintle (tow) hook is provided at the rear of the frame. It is held in place by the two rear frame cross members and additional supports bolted diagonally from the cross member to the frame side channels. A heavy coil spring provides a means of absorbing the starting shock (fig. 133).

b. Pintle Hook Removal.

PLIERS	WRENCH, adjustable, large

Remove cotter pin (pliers) and the castle nut (adjustable wrench) which secure the unit. Pull out pintle hook.

c. Pintle Hook Installation.

PLIERS	WRENCH, adjustable, large

Enter the pintle hook through the rear cross member and spring. Place a flat washer and turn on the castellated nut and tighten (adjustable wrench). Install cotter pin, full size of hole (pliers).

d. Pintle Hook Spring, Bracket, and Rear Cross Member Removal.

(1) EQUIPMENT.

HANDLE, flex	WRENCH, open-end, 3/4-in.
PLIERS	WRENCH, socket, 3/4-in.
RATCHET	WRENCH, socket, 7/8-in.
WRENCH, adjustable, large	WRENCH, socket, 15/16-in.

(2) PROCEDURE.

(a) Pintle Hook Removal (par. 113 b).

PLIERS	WRENCH, adjustable, large

(b) Rear Cross Member Removal.

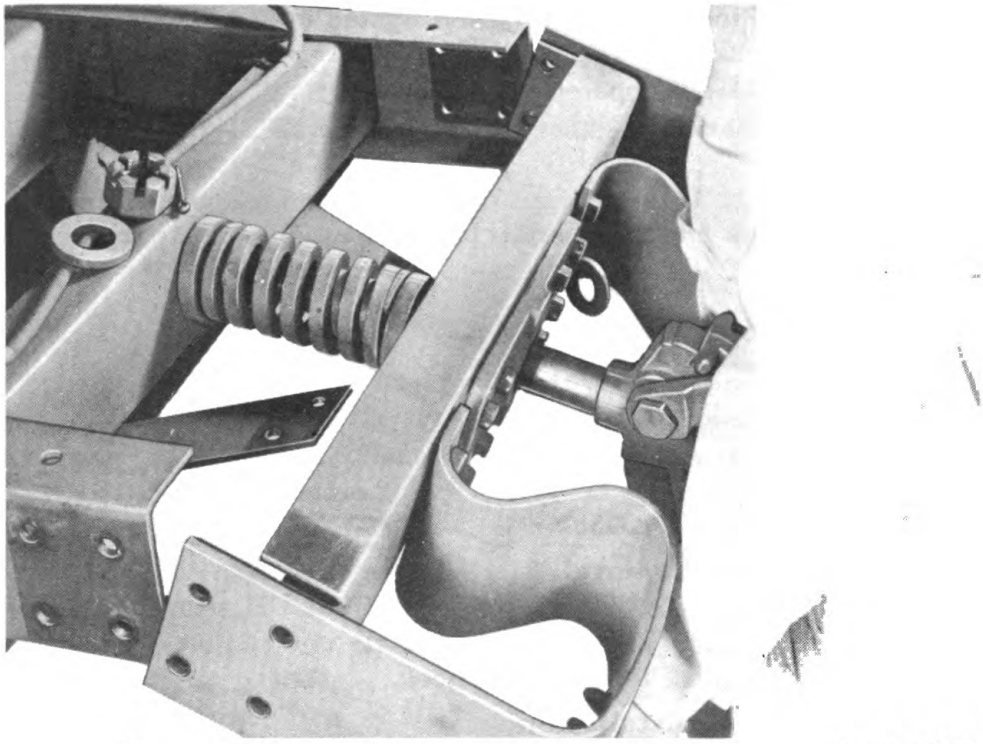
HANDLE, flex	SOCKET, 7/8-in.
RATCHET	SOCKET, 15/16-in.

Remove the eight bolts (7/8- and 15/16-in. sockets, ratchet, and flex handle), attaching the rear cross member and bumperettes to the frame.

(c) Pintle Hook Brace Removal.

RATCHET	WRENCH, socket, 3/4-in.
WRENCH, open-end, 3/4-in.	

Remove four bolts (3/4-in. socket, ratchet, and 3/4-in. open-end wrench), attaching the pintle hook brace to the frame and rear cross member.



RA PD 65914

Figure 134—Installing Rear Cross Member and Pintle Hook

(d) Pintle Hook Spring Removal.

Pull the rear cross member and bumperettes from the frame. The pintle hook spring and spring collars will then be free to remove.

e. Pintle Hook Spring, Bracket, and Rear Cross Member Installation.

(1) EQUIPMENT.

BAR, pinch
HAMMER
HANDLE, flex
PLIERS
RATCHET
SOCKET, ¾-in.
SOCKET, ⅞-in.
SOCKET, 15/16-in.
WRENCH, adjustable to 2⅜-in.
WRENCH, open-end, ¾-in.

(2) PROCEDURE.

(a) Install Pintle Hook Spring and Collars.

Place front collar and spring into riveted cross member; install rear collar into rear cross member. Slide rear cross member into frame and against pintle hook spring (fig. 134).

(b) Install Pintle Hook and Rear Cross Member.

BAR, pinch
HANDLE, flex
HANDLE, ratchet
WRENCH, adjustable, large
WRENCH, socket, ⅞-in.

Slide the pintle hook through the rear cross member and pintle hook spring. Place a flat washer and turn on the castellated nut. Tighten the nut (adjustable wrench and pinch bar) until the rear cross member bolt holes line up with the frame drillings. NOTE: The pinch bar is used to keep the pintle hook from turning when nut is tightened. Enter the eight bolts through the bumperettes, rear cross member, and frame. Use lock washers and tighten nuts (7/8-in. socket, ratchet, and flex handle).

(c) Install Pintle Hook Brace (fig. 133).

HANDLE, ratchet
WRENCH, open-end, 3/4-in.
WRENCH, socket, 3/4-in.

Place the pintle hook brace in line with drillings in the rear cross member and frame. Enter the four bolts, place lock washers, and tighten nuts (3/4-in. open-end wrench and 3/4-in. socket wrench with ratchet handle).

114. TOW HOOKS.

a. Tow Hook Location. Two towing hooks are mounted to the front bumper.

b. Front Tow Hook Removal.

HANDLE, flex
SOCKET, 7/8-in.
SOCKET, 1-in.
WRENCH, open-end, 15/16-in.
WRENCH, open-end, 1 1/16-in.

Remove the two bolts (15/16- and 1 1/16-in. open-end wrenches, 7/8- and 1-in. sockets, and flex handle). Remove the hook.

c. Front Tow Hook Installation.

HANDLE, flex
SOCKET, 7/8-in.
SOCKET, 1-in.
WRENCH, open-end, 15/16-in.
WRENCH, open-end, 1 1/16-in.

Place tow hooks on each side of the front bumper with hook to front. Install the two bolts with bolt heads up (15/16- and 1 1/16-in. open-end wrenches, 7/8- and 1-in. sockets, and flex handle).

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

SECTION XXIV

FUEL SYSTEM

115. FUEL SYSTEM DESCRIPTION AND TABULATED DATA.

a. Fuel System Description. The fuel system consists of a 40-gallon main fuel tank, fuel lines, fuel filter, fuel pump, and carburetor. The fuel tank is mounted to the left side of the frame back of the cab. The fuel pump is located on the left rear side of the engine and the fuel filter is mounted on the fuel tank bracket.

b. Fuel System Tabulated Data.

(1) CARBURETOR.

Make ..... Zenith
Model 29BW12

(2) FUEL PUMP.

Make ..... AC
Type ..... Mechanical

(3) FUEL FILTER.

Make ..... AC
Type ..... Screen

(4) FUEL TANK.

Make ..... FWD
Capacity ..... 40 gal

(5) AIR CLEANER.

Make ..... Air Maze
Type ..... Oil bath
Capacity ..... 1.5 pt

116. FUEL SYSTEM TROUBLE SHOOTING.

a. Carburetor and Intake Manifold.

(1) LACK OF FUEL AT CARBURETOR.

Possible Cause	Possible Remedy
(a) Empty gas tank.	Refill gas tank.
(b) Pinched or broken fuel lines.	Replace or repair lines.

Possible Cause	Possible Remedy
(c) Dirt in fuel lines.	Clean out lines.
(d) Defective fuel pump.	Replace fuel pump (par. 118).
(e) Dirt in fuel filter.	Clean filter (par. 119).
(f) Loose fuel pump sediment bowl.	Tighten bowl seat nut (par 118 b).
(2) FLOODING CONDITION IN CARBURETOR.	
(a) Worn needle valve and seat.	Replace carburetor (par. 117).
(b) Improper float level.	Replace carburetor (par. 117).
(c) Dirt on needle valve seat.	Tap carburetor bowl sharply. If this does not stop flooding, replace carburetor (par. 117).
(d) Closed choke valve.	Push in choke control knob.
(e) Improper choke valve setting.	Adjust choke cable on choke valve operating lever (par. 117 b).
(3) ENGINE RUNS IRREGULARLY (BACKFIRES IN MUFFLER).	
(a) Carburetor mixture too rich.	Adjust carburetor (par. 117 b).
(b) Cracked manifold.	Replace manifold (par. 100).
(c) Defective intake or exhaust manifold gaskets.	Replace gaskets (par. 100).
(d) Defective gasket between carburetor and manifold.	Replace gasket (par. 117 c and d).
(e) Loose intake or exhaust manifold.	Tighten manifold nuts (par. 100).
(f) Carburetor mixture too lean.	Adjust carburetor (par. 117 b).
b. Fuel Pump.	
(1) LACK OF FUEL AT PUMP INLET.	
(a) Empty gas tank.	Refill gas tank.
(b) Pinched or broken fuel lines.	Replace or repair lines (par. 121).
(c) Dirt in line from gas tank to pump.	Clean lines.
(d) Dirt in fuel filter.	Clean filter (par. 119 b).
(e) Defective diaphragm.	Replace fuel pump (par. 118 c).
(f) Defective fuel pump.	Replace fuel pump (par. 118 c).
(2) LEAKS AT FUEL PUMP.	
(a) Loose inlet or outlet connections.	Tighten connections.
(b) Loose cover screws (leak at diaphragm).	Tighten screws alternately (par. 118 b).
(c) Loose sediment bowl seat nut or poor gasket.	Tighten nut or replace gasket (par. 118).

117. CARBURETOR (figs. 135 to 139).

a. Carburetor Description. The carburetor, which is located on the center right side of the engine, is a down-draft type incorporating an

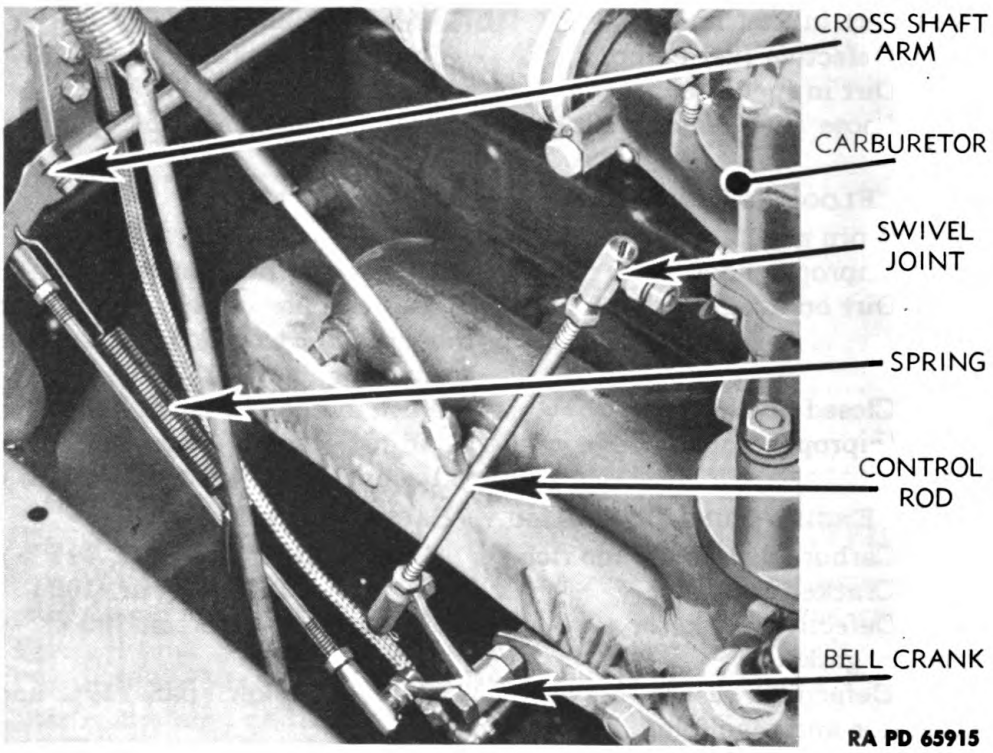


Figure 135—Carburetor and Controls Installed

Figure 136—Adjusting Idling Screw

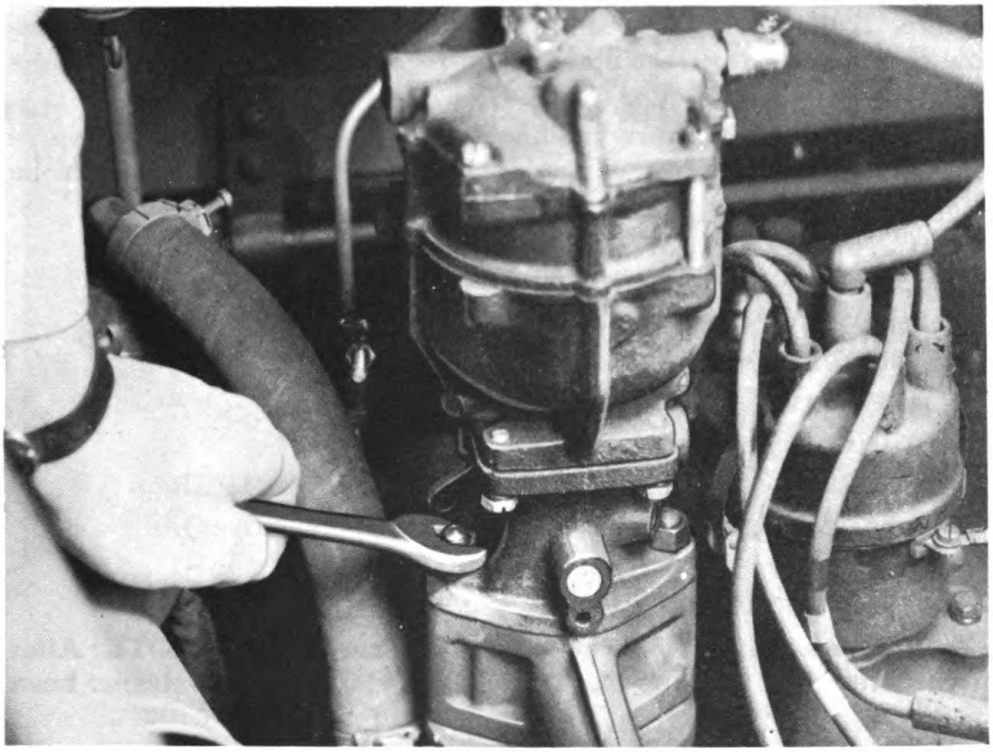


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Figure 137—Removing Carburetor

enclosed mechanical accelerating pump. Metering jets are fixed, with the exception of the idling mixture adjusting screw.

b. Carburetor Adjustment (fig. 136).

SCREWDRIVER

(1) Warm the engine to at least 120 F. The throttle stop screw should be turned in clockwise (screwdriver) against the stop pin to hold the throttle just slightly open. Adjust the throttle stop screw to obtain the desired idling speed of the engine.

(2) The idling adjusting screw should be from one to one and a half full turns off its seat. Adjust the idling adjusting screw (screwdriver) to obtain smooth idling when engine has become thoroughly warmed up (fig. 136). Turning the screw in (clockwise) cuts off air, making the idling mixture richer; turning it out (counterclockwise) admits more air, making the mixture leaner.

(3) If it becomes necessary to turn the screw in less than one-half turn off the seat to obtain good idling of the engine, it would indicate either an air leak or a restriction in the flow of fuel for idling. Look for air leaks at the manifold flange, at carburetor throttle body to intake gasket, and at carburetor bowl to cover gasket, due to loosened assembly screws or to damaged gaskets. A badly worn throttle shaft will produce sufficient air leakage to affect the idling mixture. Dirt or other foreign matter in the

idling jet calibration will restrict the flow of fuel for idling and affect the mixture. If the idling jet becomes completely clogged, it will be impossible to run the engine at idling speed regardless of adjustment of the idling screw.

(4) The choke control should be checked to see that the choke valve is fully open with the button against the panel and full closed with the button fully out.

c. Carburetor Removal (fig. 137).

(1) EQUIPMENT.

PLIERS	WRENCH, open-end, 9/16-in.
SCREWDRIVER	WRENCH, open-end, 3/4-in.

(2) PROCEDURE.

(a) Disconnect Throttle Linkage.

PLIERS SCREWDRIVER

Disconnect throttle arm ball joint (pliers and screwdriver).

(b) Disconnect Air Cleaner Hose.

SCREWDRIVER

Loosen the air cleaner hose at carburetor (screwdriver). NOTE: After the carburetor is disconnected, it can be pulled from the air cleaner hose.

(c) Disconnect Fuel Line.

WRENCH, open-end, 3/4-in.

Disconnect the fuel line connection at the carburetor (3/4-in. open-end wrench).

(d) Disconnect Choke Assembly.

SCREWDRIVER

Remove the choke wire from carburetor (screwdriver).

(e) Remove Carburetor (fig. 137).

WRENCH, open-end, 9/16-in.

Remove the two carburetor to manifold stud nuts (9/16-in. open-end wrench) (fig. 137). Remove carburetor from manifold and air cleaner hose. Remove gasket.

d. Carburetor Installation.

(1) EQUIPMENT.

PLIERS	WRENCH, open-end, 9/16-in.
SCREWDRIVER	WRENCH, open-end, 3/4-in.

(2) PROCEDURE.

(a) Install Carburetor on Manifold.

WRENCH, open-end, 9/16-in.

Use new carburetor gasket. Enter carburetor air intake into air cleaner hose, set carburetor body on the two manifold studs, and tighten nuts (9/16-in. open-end wrench).

(b) Connect Throttle Linkage.

PLIERS SCREWDRIVER

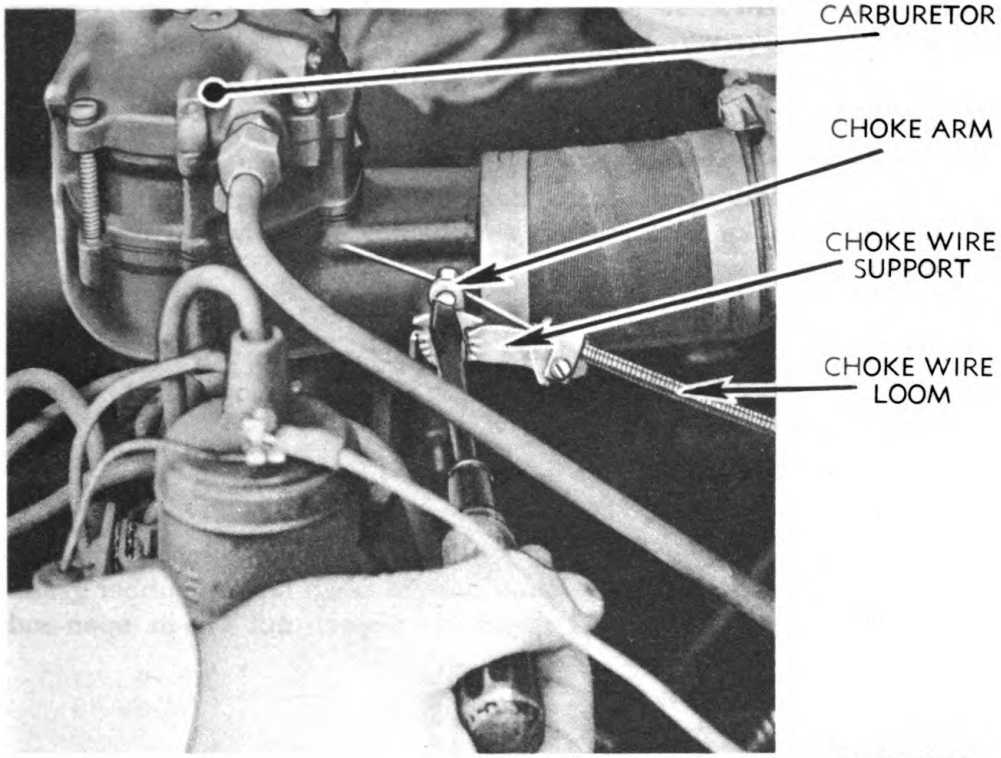

Figure 138—Connecting Choke Wire

Connect linkage ball joint to throttle arm (screwdriver). Enter cotter pin in ball joint, full size of hole (pliers).

(c) Air Cleaner Hose Connection.

SCREWDRIVER

Tighten all air cleaner hose clamps (screwdriver).

(d) Connect Choke Wire.

SCREWDRIVER

Connect the choke wire to the carburetor (screwdriver). **NOTE:** The choke wire guide should be placed about ½ inch through the carburetor choke bracket. Make sure choke wire is pushed in before tightening.

(e) Connect Carburetor Fuel Line.

WRENCH, open-end, ¾-in.

Connect the fuel line to the carburetor pipe fitting (¾-in. open-end wrench).

e. Choke Control Removal.

(1) EQUIPMENT.

SCREWDRIVER **WRENCH**, open-end, 9/16-in.

(2) PROCEDURE.

(a) Disconnect Choke from Carburetor.

SCREWDRIVER

Loosen swivel set screw in carburetor choke arm (screwdriver). Loosen clamp bolt in choke wire support bracket (screwdriver). Pull wire from swivel and bracket.

(b) Remove Choke Assembly from Instrument Panel.

WRENCH, open-end, 9/16-in.

Remove nut underneath instrument panel (9/16-in. open-end wrench) which fastens choke wire assembly to panel. Choke wire can now be pulled out.

f. Choke Control Installation (fig. 138).

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 9/16-in.

(2) PROCEDURE.

(a) Install Choke Assembly in Instrument Panel.

WRENCH, open-end, 9/16-in.

Enter 2-inch choke wire through hole in panel to left of ignition switch. Slip the 3/8-inch nut over wire. Enter wire through hole in rubber grommet to right of throttle wire. Tighten the 3/8-inch nut (9/16-in. open-end wrench) and fasten choke control to panel.

(b) Connect Choke Wire.

SCREWDRIVER

Enter wire through support bracket on carburetor and through choke arm swivel. Tighten support bracket set screw (screwdriver) (fig. 138). Make sure choke button on instrument panel is pushed in; then tighten swivel set screw in choke arm (screwdriver) with arm to the front.

g. Hand Throttle Removal.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 7/16-in. (2)

(2) PROCEDURE.

(a) Remove Hand Throttle from Accelerator Linkage (fig. 139).

SCREWDRIVER
WRENCH, open-end, 7/16-in. (2)

Loosen swivel set screw (screwdriver) on cross shaft arm (fig. 139). Loosen bolt fastening wire to throttle control support (7/16-in. open-end wrench). Pull wire from swivel and bracket.

(b) Remove Throttle from Instrument Panel.

WRENCH, open-end, 9/16-in.

Remove nut (9/16-in. open-end wrench) underneath panel which fastens throttle control button to panel. Assembly can now be pulled out.

h. Hand Throttle Installation (fig. 139).

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 7/16-in.

(2) PROCEDURE.

(a) Install Throttle in Instrument Panel.

WRENCH, open-end, 9/16-in.

Enter throttle wire through hole to right of ignition switch on dash. Slip the 3/8-inch nut over wire. Next insert wire through rubber grommet in hole to the left of choke wire. Tighten the 3/8-inch nut (9/16-in. open-end wrench) to fasten throttle wire to panel.

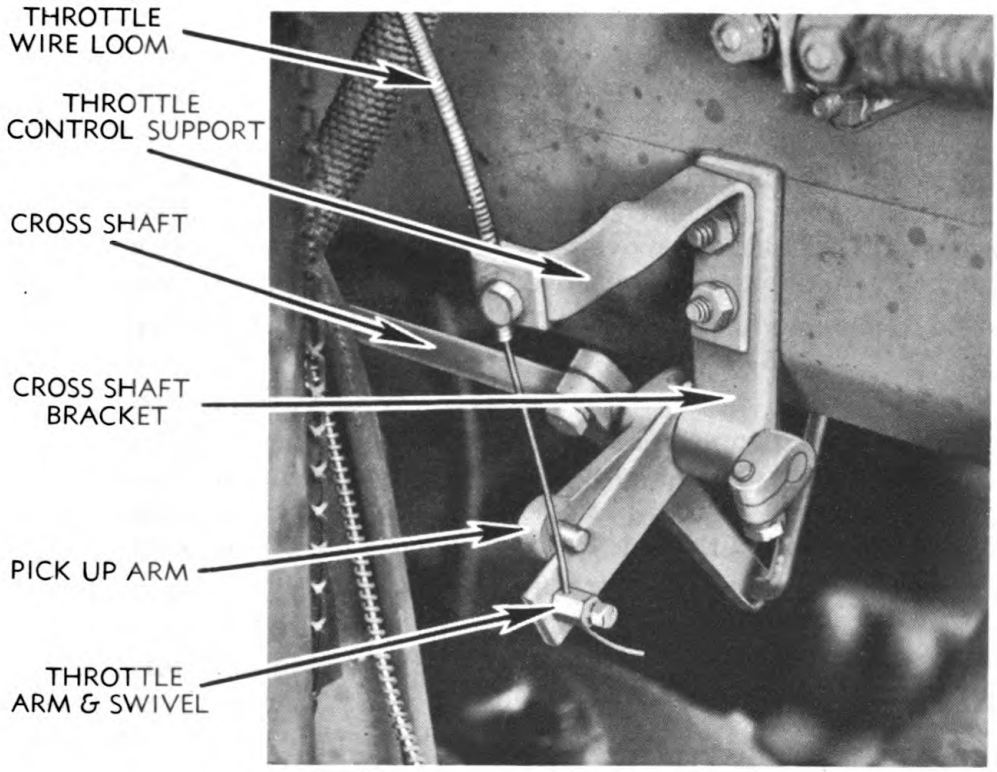

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Figure 139—Hand Throttle Linkage

(b) Install Hand Throttle Accelerator to Linkage (fig. 139).

SCREWDRIVER
WRENCH, open-end, 7/16-in. (2)

Insert wire through throttle control support and into swivel of the free cross shaft lever (fig. 139). Tighten bolt in control support (two 7/16-in. open-end wrenches). Hold the free throttle lever close to pin in pick-up lever. Tighten swivel set screw (screwdriver).

i. Carburetor Linkage Removal (figs. 135 and 139).

(1) EQUIPMENT.

PLIERS
SCREWDRIVER
WRENCH, open-end, 7/16-in. (2)
WRENCH, open-end, 9/16-in. (2)

(2) PROCEDURE.

(a) Remove Hood Side Panels (par. 55).

SCREWDRIVER WRENCH, open-end, 7/16-in.

(b) Remove Carburetor Arm Ball Joints (fig. 135).

WRENCH, open-end, 7/16-in.

Remove the two nuts and lock washers holding the ball joints (fig. 135) to the carburetor and bell crank arms (7/16-in. open-end wrench). Remove the ball joint and rod assembly. Loosen the two ball joint lock nuts (7/16-in. open-end wrench) on the rod. Turn the ball joint assemblies and lock nuts from the rod.

(c) Remove Bell Crank (fig. 135).

WRENCH, open-end, 9/16-in. (2)

Remove the nut and lock washer (two 9/16-in. open-end wrenches) from the bolt holding the bell crank to the bell crank bracket attached to the manifold (fig. 135). Remove the bell crank. Remove the lock nut from the bell crank bolt (two 9/16-in. open-end wrenches) and remove the bolt.

(d) Remove Control Rod from Bell Crank to Cross Shaft Arm (fig. 135).

PLIERS WRENCH, open-end, 7/16-in.

Remove the two nuts and lock washers holding the ball joints to the bell crank and cross shaft arm (7/16-in. open-end wrench). Disconnect the pull back spring (fig. 135). Remove the control rod assembly. Remove the ball joints from the rod (7/16-in. open-end wrench and pliers).

(e) Remove Extension Arm from Cross Shaft.

WRENCH, open-end, 7/16-in.

Loosen the extension arm clamp belt (7/16-in. open-end wrench). Slide the extension arm from the cross shaft.

(f) Disconnect Hand Throttle.

SCREWDRIVER

Loosen the throttle control swivel set screw (screwdriver) on the floating cross shaft arm (fig. 139). Pull the wire out of the swivel.

(g) Remove Cross Shaft and Brackets.

WRENCH, open-end, 7/16-in. (2)

Remove the four bolts, nuts, and lock washers (two 7/16-in. open-end wrenches) fastening the two cross shaft brackets to the dash. Unscrew the accelerator push button from the push rod. Remove the cross shaft and brackets.

(h) Disassemble Cross Shaft.

PLIERS WRENCH, open-end, 7/16-in.

Loosen the cross shaft clamp collar cap bolt (7/16-in. open-end. wrench). Loosen push rod lever cap bolt (7/16-in. open-end wrench). The collar, two brackets, and the three remaining levers can now be removed from the cross shaft. Remove the cotter pin (pliers) fastening push rod to lever. Remove the push rod.

j. Carburetor Linkage Installation.

(1) EQUIPMENT.

PLIERS
SCREWDRIVER
WRENCH, open-end, 7/16-in. (2)
WRENCH, open-end, 9/16-in. (2)

(2) PROCEDURE.

(a) Assemble Cross Shaft Linkage.

PLIERS
WRENCH, open-end, 7/16-in.

Assemble the clamp collar to the end of the cross shaft and tighten clamp collar cap bolt (7/16-in. open-end wrench). Slide the cross shaft mounting bracket onto the cross shaft and next to the collar (with the offset in the mounting bracket toward the front). Slide the hand throttle lever onto the shaft with the swivel toward the mounting bracket. Slide the pick-up lever on the shaft with the pick-up pin toward the hand throttle lever (fig. 139). Slide the push rod lever on the cross shaft. Slide the second cross shaft mounting bracket on the cross shaft with the offset toward the front. Connect the accelerator push rod to the push rod lever and lock it with a cotter pin (pliers).

(b) Assemble Cross Shaft to Dash.

WRENCH, open-end, 7/16-in. (2)

Place accelerator push rod into hole in the floor board and fasten button. Fasten the cross shaft brackets to the dash with the four bolts, nuts, and lock washers (two 7/16-in. open-end wrenches).

(c) Install Bell Crank to Bracket (fig. 135).

WRENCH, open-end, 9/16-in. (2)

Place the bolt through the bell crank and tighten the lock nut (two 9/16-in. open-end wrenches) to the bell crank, leaving enough clearance to permit the bell crank to turn freely on the bolt (fig. 135). Place bell crank bolt into bell crank bracket and tighten in place with the nut and lock washer (two 9/16-in. open-end wrenches).

(d) Assemble and Install Carburetor Rod and Ball Joints.

PLIERS
WRENCH, open-end, 7/16-in.

Turn a ball joint lock nut on each end of the carburetor rod and then turn a ball joint on the rod ends and lock them with the lock nut (7/16-in. open-end wrench and pliers). Connect the control rod ball joints to the bell crank and carburetor arm with the two nuts and lock washers (7/16-in. open-end wrench).

(e) Assemble and Install Control Rod from Bell Crank to Cross Shaft.

PLIERS
SCREWDRIVER
WRENCH, open-end, 7/16-in.

Assemble ball joints on bell crank to cross shaft control rod in the same manner as in *(d)* above. Place cross shaft lever on cross shaft. Connect the rod and ball joint assembly to the bell crank cross shaft lever and cross shaft arm and tighten with the two nuts and lock washers (7/16-in. open-end wrench).

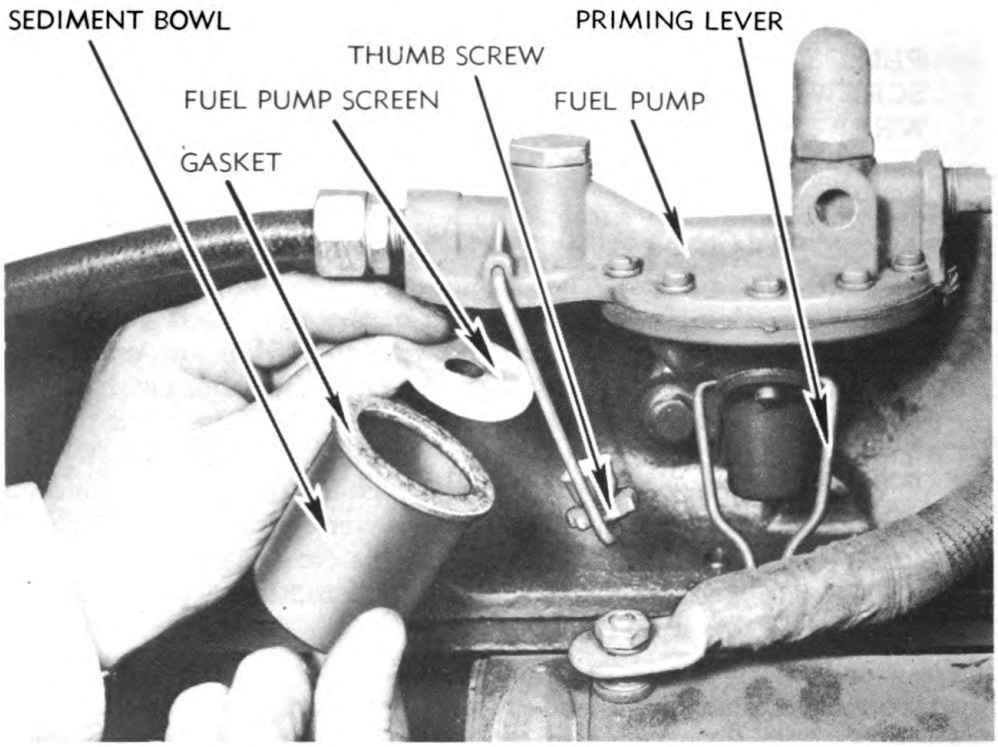

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Figure 140—Installing Sediment Bowl and Screen

(f) Adjust Linkage.

WRENCH, open-end, 7/16-in.

Hold carburetor arm in the wide open position, which is down. Tighten accelerator arm when the button is about ½ inch from the floor board (7/16-in. open-end wrench). Push carburetor arm to the closed position, which is up, and connect pull back spring. Tighten cross shaft lever bolt on right end of cross shaft (7/16-in. open-end wrench).

(g) Adjust Hand Throttle.

SCREWDRIVER **WRENCH**, open-end, 7/16-in.

Slide the hand throttle wire through the swivel on the floating cross shaft arm. Push the hand throttle to the closed position. Tighten the swivel set screw (screwdriver). Adjust the pick-up lever so the pin is just above the floating arm. Tighten the cap screw in the pick-up lever to the cross shaft (7/16-in. open-end wrench).

(h) Install Hood Side Panels (par. 55).

SCREWDRIVER **WRENCH**, open-end, 7/16-in.

118. FUEL PUMP (fig. 140).

a. Fuel Pump Description. The fuel pump is mounted on the left side of the engine. Fuel is pumped from the fuel tank and forced to the carburetor by the vacuum mechanism in the fuel pump.

b. Fuel Pump Maintenance (fig. 140).

(1) The fuel pump connections should be checked at regular intervals for leaks. Body screws which retain the diaphragms must be kept tight to prevent air and fuel leaks and the mounting cap screws must be tight.

(2) The sediment bowl should be removed at regular intervals and the bowl and screen thoroughly cleaned. Loosen the thumb screw at the bottom of the sediment bowl and swing the wire loop and nut to one side. Remove the bowl, gasket, and screen. Thoroughly rinse the fine mesh wire screen in SOLVENT, dry-cleaning. Dry it, being careful not to bend the

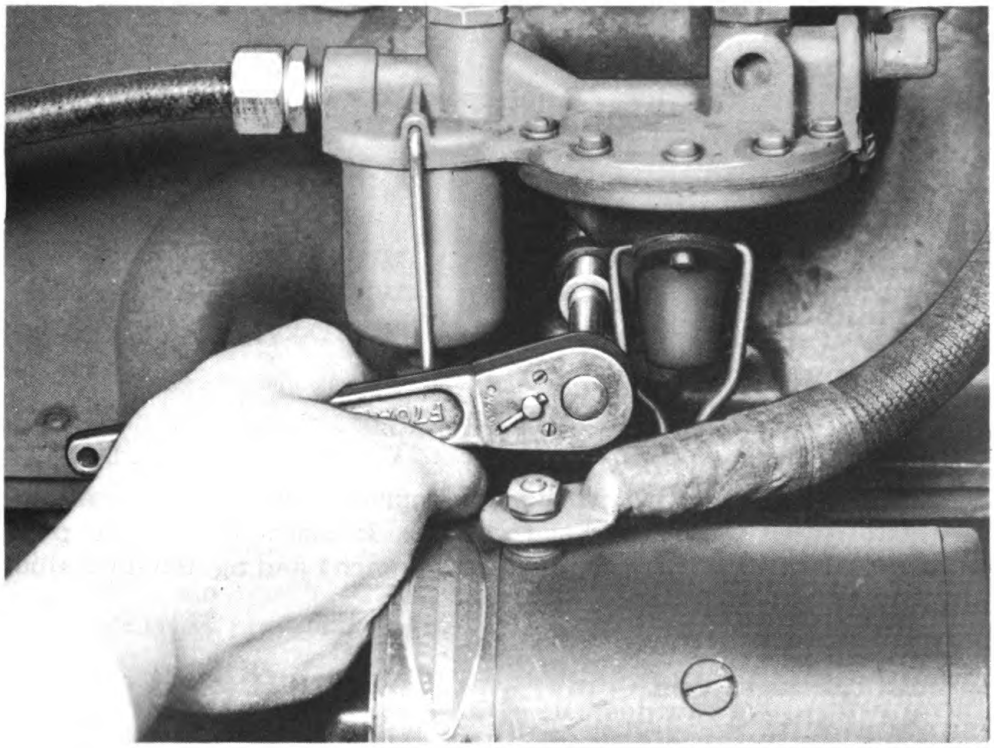

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Figure 141—Tightening Fuel Pump Mounting Bolt

screen. Clean the bowl and be sure no lint is left in it. Place a new gasket in position and enter the screen and bowl in place (fig. 140), swing the wire loop over the bowl, and tighten the thumb screw securely. NOTE: Be sure the bowl seat has not fallen off.

c. Fuel Pump Removal.

(1) EQUIPMENT.

EXTENSION, 3-in.
RATCHET
WRENCH, open-end, 7/8-in.
WRENCH, open-end, 15/16-in.
WRENCH, socket, 1/2-in.

(2) PROCEDURE.

(a) Remove Fuel Lines.

WRENCH, open-end, ¾-in. WRENCH, open-end, 15/16-in.

Disconnect fuel line coupling leading to fuel tank (15/16-in. open-end wrench). Disconnect fuel line leading to carburetor (¾-in. open-end wrench).

(b) Remove Fuel Pump Assembly.

EXTENSION, 3-in. WRENCH, socket, ½-in.
RATCHET

Remove cap bolts (ratchet, 3-in extension, and ½-in. socket wrench) attaching fuel pump to motor block. Fuel pump may then be removed.

(c) Remove Fuel Pump Fittings.

WRENCH, open-end, ½-in. WRENCH, open-end, ⅞-in.

Remove straight fitting (⅞-in. open-end wrench). Remove elbow (½-in. open-end wrench).

d. Fuel Pump Installation.

(1) EQUIPMENT.

EXTENSION, 3-in. WRENCH, open-end, ⅞-in.
RATCHET WRENCH, open-end, 15/16-in.
WRENCH, open-end, ¾-in. WRENCH, socket, ½-in.

(2) PROCEDURE.

(a) Replacing Fuel Pump Fittings.

WRENCH, open-end, ½-in. WRENCH, open-end, ⅞-in.

Replace straight fitting in threaded opening of fuel pump marked "IN" and tighten (⅞-in. open-end wrench). Replace elbow in fuel pump on side marked "OUT" (½-in. open-end wrench) and tighten until elbow points up.

(b) Install Fuel Pump.

EXTENSION, 3-in. WRENCH, socket, ½-in.
RATCHET

Insert cap bolts through mounting bracket of fuel pump and put new gasket on cap bolts. Place in position on motor block and tighten (ratchet, 3-in. extension, and ½-in. socket wrench) (fig. 141).

(c) Connect Fuel Lines.

WRENCH, open-end, ¾-in. WRENCH, open-end, 15/16-in.

Connect fuel line coupling leading from fuel tank (15/16-in. open-end wrench). Connect fuel line coupling leading from the carburetor (¾-in. open-end wrench).

119. FUEL FILTER (figs. 142 and 143).

a. Fuel Filter Description. The fuel filter is mounted on the fuel tank front bracket. The purpose of the filter is to clean the fuel before it reaches the fuel pump.

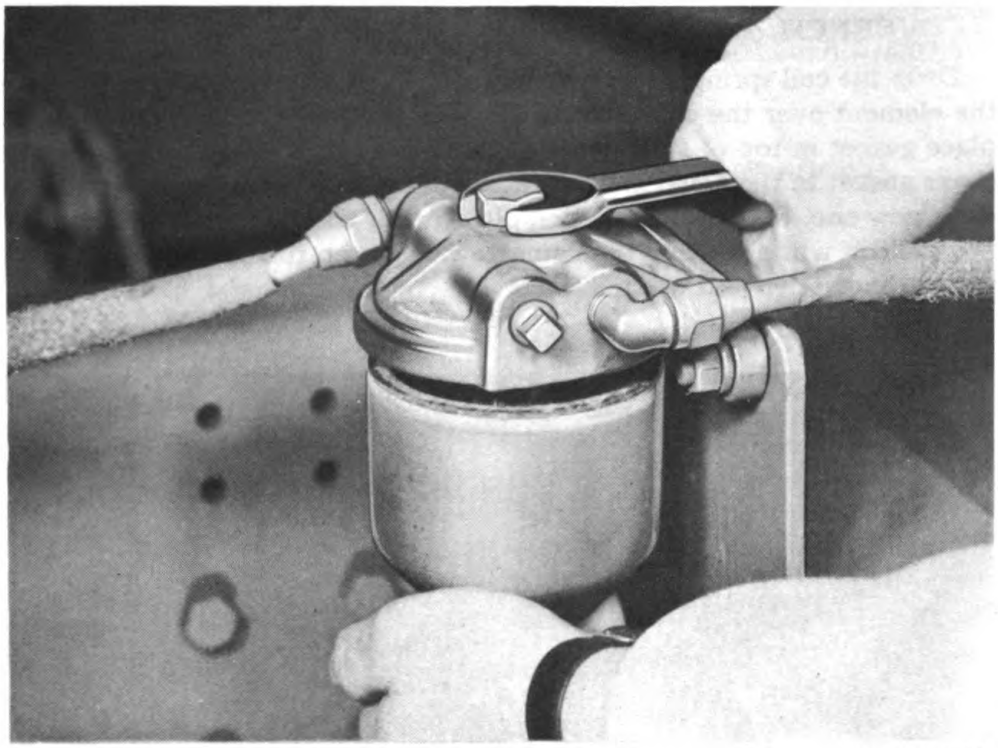

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Figure 142—Removing Fuel Filter Cover Bolt

b. Fuel Filter Maintenance (figs. 142 and 143).

(1) EQUIPMENT.

PAN, drain
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 9/16-in.

(2) PROCEDURE.

(a) **The fuel filter has a cleanable element, which does not need replacing unless damaged. It should be removed at regular intervals and cleaned.**

(b) Drain Water Only.

WRENCH, open-end, 9/16-in.

Remove drain plug at bottom of filter (9/16-in. open-end wrench). Allow water to drain and replace plug.

(c) Clean Filter **(figs. 142 and 143).**

PAN, parts washing
WRENCH, open-end, 3/4-in.

Remove cover bolt (3/4-in. open-end wrench) (fig. 142). Remove bowl from body. Remove filter element and spring from bowl (fig. 143). Swish the filter element back and forth in SOLVENT, dry-cleaning, to remove lint and foreign particles from between disks, then blow out with compressed air if available.

(d) Reassemble Filter.

WRENCH, open-end, ¾-in.

Drop the coil spring down over the center tube to the bottom. Replace the element over the center tube. Be sure that the recess is on top. Replace gasket in top of strainer; if damaged, use new gasket. Replace the cover gasket in the cover casting; if the old gasket is broken or damaged, use a new one. Set strainer shell in place under the cover casting and push up. Hold it while starting the cap screw. Tighten the cover cap securely with ¾ inch open-end wrench.

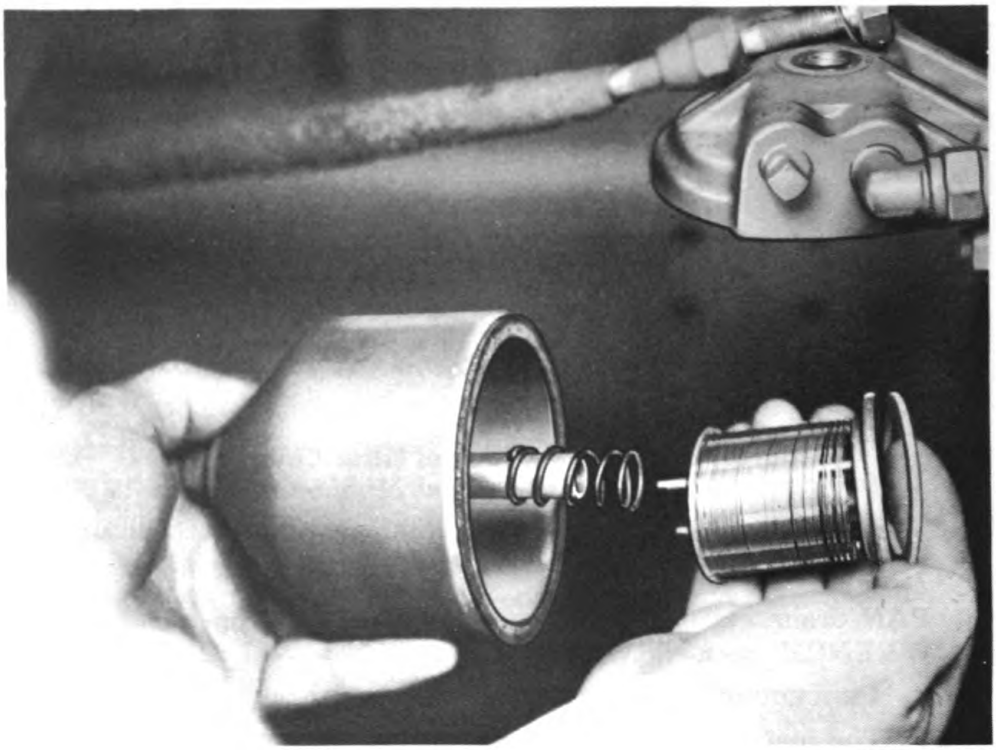

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Figure 143—Removing Fuel Filter Element

c. Fuel Filter Removal.

(1) EQUIPMENT.

WRENCH, open-end, ½-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, ¾-in.

(2) PROCEDURE.

(a) Disconnect Fuel Lines.

WRENCH, open-end, ¾-in.

Disconnect both inlet and outlet lines at fuel filter (¾-in. open-end wrench).

(b) Removing Filter.

WRENCH, open-end, 9/16-in.

Remove the two bracket bolts and fuel filter (9/16-in. open-end wrench).

(c) Remove Fuel Line Fittings.

WRENCH, open-end, 1/2-in.

Remove the two elbows from fuel filter (1/2-in. open-end wrench).

d. Fuel Filter Installation (fig. 144).

(1) EQUIPMENT.

WRENCH, open-end, 1/2-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 9/16-in.

(2) PROCEDURE.

(a) Install Fuel Filter.

WRENCH, open-end, 9/16-in.

Place fuel filter to match drillings in bracket and then enter bracket bolts, lock washers, and nuts; tighten with 9/16 inch open-end wrench.

(b) Install Elbows.

WRENCH, open-end, 1/2-in.

Install one elbow in threaded opening stamped "OUT" and one in the opening stamped "IN" (1/2-in. open-end wrench).

(c) Connect Fuel Lines.

WRENCH, open-end, 3/4-in.

Connect line from fuel tank to the filter elbow marked "IN," and the line from the fuel pump to the filter elbow marked "OUT" (3/4-in. open-end wrench).

120. FUEL TANK (fig. 144).

a. Fuel Tank Description (fig. 144). The fuel tank is strapped rigidly to the frame. The straps should be inspected occasionally and tightened, as any movement may wear a hole and cause leakage.

b. Fuel Tank Removal (fig. 144).

(1) EQUIPMENT.

BLOCKING
SCREWDRIVER, 6-in.
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 15/16-in.

(2) PROCEDURE.

(a) Remove Fuel Line and Fuel Gage Wire.

SCREWDRIVER
WRENCH, open-end, 3/4-in.

Remove the fuel gage wire from the fuel tank (screwdriver). Disconnect fuel line at the tank connection (3/4-in. open-end wrench).

(b) Remove Fuel Tank.

BLOCKING
WRENCH, open-end, 15/16-in.

Place blocking underneath the fuel tank to prevent it from falling to the ground (blocking). Remove the eight nuts from the fuel tank straps (15/16-in. open-end wrench). Remove the fuel tank straps. Remove the fuel tank from the brackets and lower it to the ground.

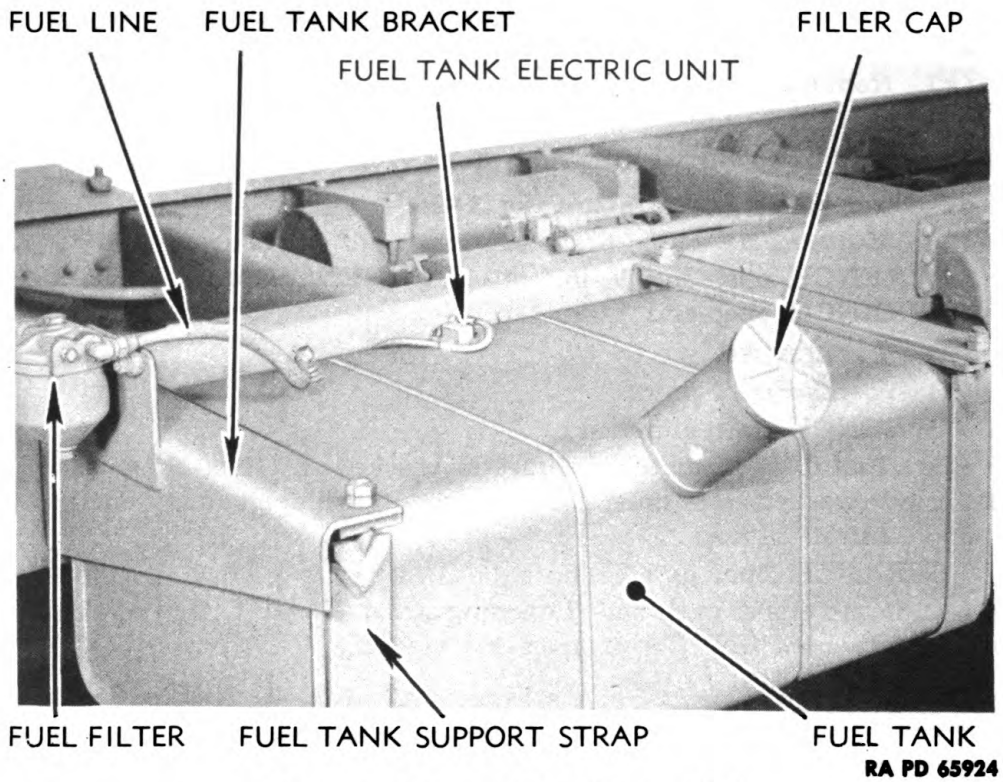


Figure 144—Fuel Tank Installed

(c) Remove Fuel Tank Suction Pipe.

WRENCH, open-end, ¾-in.

Loosen and remove the fuel suction pipe from the fuel tank (½-in. open-end wrench).

c. Fuel Tank Installation (fig. 144).

(1) EQUIPMENT.

BLOCKING
SCREWDRIVER, 6-in.
WRENCH, open-end, ½-in.
WRENCH, open-end, ¾-in.
WRENCH, open-end, 15/16-in.

(2) PROCEDURE.

(a) Install Fuel Tank.

BLOCKING
WRENCH, open-end, 15/16-in.

Slide fuel tank into position on the brackets. Place blocking under the fuel tank to hold it in position (blocking). Place a wood strip between each bracket and the fuel tank and then enter the fuel tank straps up from lower side of fuel tank and into fuel tank brackets. Fasten the fuel tank straps with the eight nuts (15/16-in. open-end wrench) (fig. 144). Remove the blocking.

(b) Install the Fuel Tank Suction Pipe.

WRENCH, open-end, ½-in.

Enter the suction pipe in the fuel tank and tighten (½-in. open-end wrench).

(c) Install Gas Line and Fuel Gage Wire.

SCREWDRIVER — WRENCH, open-end, ¾-in.

Place the fuel gage wire on the fuel tank unit and fasten with the terminal screw (screwdriver). Connect and tighten the fuel line at the fuel tank connection (¾-in. open-end wrench).

d. Fuel Tank Bracket Removal.

(1) EQUIPMENT.

BLOCKING — WRENCH, open-end, ¾-in.
SCREWDRIVER, 6-in. — WRENCH, open-end, 15/16-in.
WRENCH, box, ¾-in.

(2) PROCEDURE.

(a) Remove Fuel Tank (par. 120 b).

BLOCKING — WRENCH, open-end, ¾-in.
SCREWDRIVER — WRENCH, open-end, 15/16-in.

(b) Remove Fuel Tank Brackets.

WRENCH, box, ¾-in. — WRENCH, open-end, ¾-in.

Loosen the fuel line (¾-in. open-end wrench) at the fuel filter (filter to fuel pump). Remove the three bolts, nuts, and lock washers (¾-in. open-end wrench and ¾-in. box wrench) holding the front fuel tank bracket to the frame. Remove the bracket. Remove the three bolts, nuts, and lock washers (¾-in. open-end wrench and ¾-in. box wrench) holding the rear fuel tank bracket, and remove the bracket.

e. Fuel Tank Bracket Installation.

(1) EQUIPMENT.

BLOCKING — WRENCH, open-end, ¾-in.
SCREWDRIVER — WRENCH, open-end, 15/16-in.
WRENCH, box, ¾-in.

(2) PROCEDURE.

(a) Install Fuel Tank Brackets.

WRENCH, box, ¾-in. — WRENCH, open-end, ¾-in.

Insert the three bolts into the rear fuel tank bracket. Place the bracket onto the frame and bolt it into place with the three bolts, nuts, and lock washers (¾-in. open-end wrench and ¾-in. box wrench). Insert the three bolts into the front fuel tank bracket. Place the bracket onto the frame and bolt it in place with the three bolts, nuts, and lock washers (¾-in. open-end wrench and ¾-in. box wrench). Connect and tighten the fuel line at the filter (¾-in. open-end wrench).

(b) Install Fuel Tank (par. 120 c).

BLOCKING — WRENCH, open-end, ¾-in.
SCREWDRIVER — WRENCH, open-end, 15/16-in.

f. Fuel Tank Electric Unit Removal.

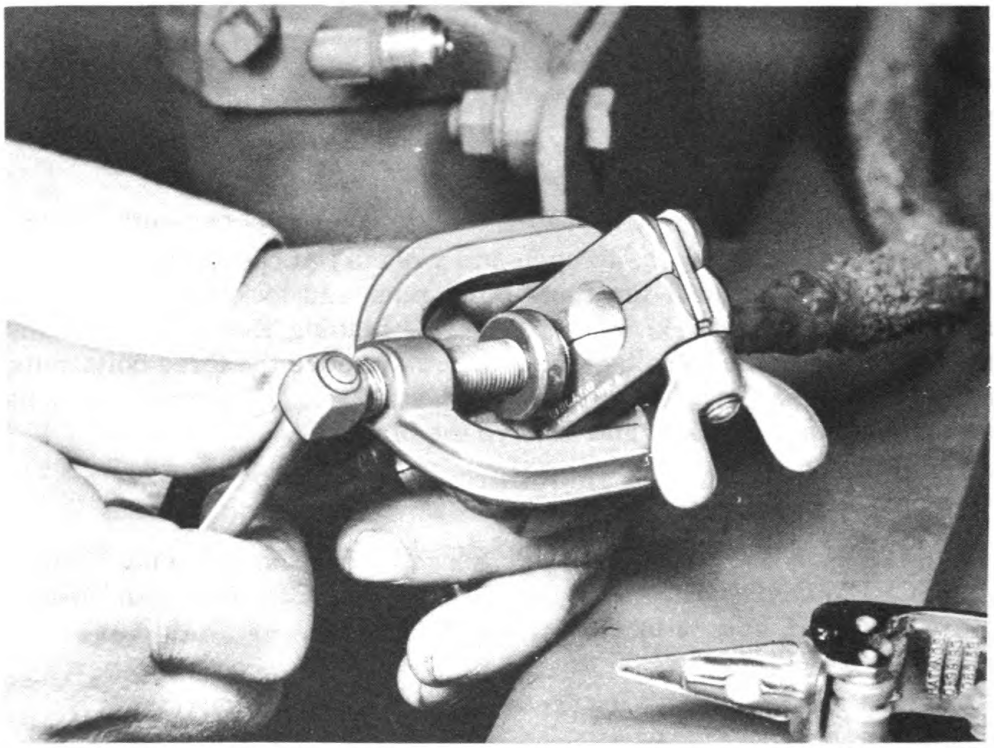
SCREWDRIVER

Remove the fuel gage wire (screwdriver). Remove the four screws holding the fuel tank electric unit to the tank (screwdriver). NOTE: One of the screws has an attached clip to hold the gas gage wire. Remove the unit from the fuel tank.

g. Fuel Tank Electric Gage Installation.

SCREWDRIVER

Place a new gasket on the fuel tank electric unit. Enter the gage in the opening in the tank and insert the four screws. Place the fuel gage wire under the clip and then tighten the four screws (screwdriver). Connect the fuel gage wire to the tank unit terminal (screwdriver).



RA PD 65925

Figure 145—Flaring Fuel Line

121. FUEL LINES.

a. Fuel Line Description. Fuel lines running from the fuel loom tank to the carburetor are composed of copper tubing with a protecting loom and connections. A short flexible hose is connected between the fuel pump and fuel tank line to compensate for vibration encountered between the engine and frame.

b. Fuel Pump Line Maintenance (fig. 145). The fuel lines should be checked occasionally for loose fittings and leaks. If a worn or cracked pipe appears near the end of the line, it can be repaired by cutting the

broken end and reflaring the pipe (fig. 145). Refer to paragraph 65 **d** for additional information on repairs.

c. Fuel Tank to Filter Fuel Line Removal.

(1) EQUIPMENT.

TOOL, flaring and cutting, 6C-FL-335
WRENCH, open-end, ½-in.
WRENCH, open-end, ¾-in.

(2) PROCEDURE.

(a) Remove Fuel Line.

WRENCH, open-end, ¾-in.

Disconnect nuts from fittings (¾-in. open-end wrench) at each end of fuel line and remove line.

(b) Remove Fittings.

WRENCH, open-end, ½-in.

Remove elbow fittings (½-in. open-end wrench) from top of fuel tank and fuel filter.

(c) Remove Loom and Fittings from Fuel Line.

TOOL, cutting, 6C-FL-335

Cut fuel line (cutting tool) behind each brass nut, untape ends of loom from fuel line, and slide loom from line.

d. Fuel Tank to Filter Fuel Line Installation.

(1) EQUIPMENT.

RULE, 12-in.
TOOL, flaring and cutting 6C-FL-335
WRENCH, open-end, ½-in.
WRENCH, open-end, ¾-in.

(2) PROCEDURE.

(a) Assemble Fuel Line.

RULE, 12-in.
TOOL, flaring and cutting, 6C-FL-335

Measure off (12-in. rule) 15 inches of ⅜-inch tubing and cut (cutting tool). Place loom over the tubing and tape each end to line. Place nuts on each end of tubing and flare (flaring tool) ends of line.

(b) Replace Elbow Fittings.

WRENCH, open-end, ½-in.

Install elbow fittings (½-in. open-end wrench) in top of fuel tank and into fuel filter.

(c) Install Fuel Line (Tank to Filter).

WRENCH, open-end, ¾-in.

Connect pipe fittings on line to elbow fittings on tank and filter (¾-in. open-end wrench).

e. Fuel Filter to Fuel Pump Line Removal.

(1) EQUIPMENT.

SCREWDRIVER
TOOL, flaring and cutting, 6C-FL-335
WRENCH, open-end, ½-in.
WRENCH, open-end, ¾-in.
WRENCH, open-end, 15/16-in.

(2) PROCEDURE.

(a) Remove Fuel Line.

SCREWDRIVER
WRENCH, open-end, 15/16-in.
WRENCH, open-end, 3/4-in.

Disconnect fuel line (3/4-in. open-end wrench) at fuel filter. Disconnect fuel line (3/4-in. open-end wrench and 15/16-in. open-end wrench) at flexible line into fuel pump. Loosen the two fuel line clamps in frame (screwdriver). Remove line.

(b) Remove Fuel Pump Flexible Line.

WRENCH, open-end, 15/16-in.

Disconnect and remove flexible line from fuel pump (15/16-in. open-end wrench).

(c) Remove Fittings.

WRENCH, open-end, 1/2-in.
WRENCH, open-end, 7/8-in.

Remove elbow fitting (1/2-in. open-end wrench) from fuel filter. Remove straight fitting (7/8-in. open-end wrench) from fuel pump.

(d) Remove Loom and Fittings from Copper Line.

TOOL, cutting, 6C-FL-335

Cut pipe line (cutting tool) in back of each fitting nut, remove tape from each end of loom, and slide loom from fuel line.

f. Fuel Filter to Fuel Pump Line Installation.

(1) EQUIPMENT.

TOOL, flaring and cutting, 6C-FL-335
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 7/8-in.
WRENCH, open-end, 15/16-in.

(2) PROCEDURE.

(a) Assemble Fuel Line.

RULE, 12-in.
TOOL, flaring and cutting, 6C-FL-335

Measure off 75 inches of 3/8-inch tubing (12-in. rule) and cut (cutting tool). Place loom over tubing and tape each end securely. Place nuts on each end of tubing and flare (flaring tool) the ends of tubing.

(b) Install Fuel Pump and Filter Fittings.

WRENCH, open-end, 1/2-in.
WRENCH, open-end, 7/8-in.

Install elbow fitting (1/2-in. open-end wrench) in fuel filter. Install straight fitting (7/8-in. open-end wrench) in fuel pump.

(c) Install Fuel Line (Filter to Fuel Pump).

SCREWDRIVER
WRENCH, open-end, 15/16-in.
WRENCH, open-end, 3/4-in.

Connect short flexible line to fuel pump (15/16-in. open-end wrench). Connect forward end of tubing to flexible line (3/4-in. open-end wrench and 15/16-in. open-end wrench). Connect fuel line to elbow fitting in fuel filter (3/4-in. open-end wrench). Secure line to frame channel with two clamps (screwdriver).

g. Fuel Pump to Carburetor Fuel Line Removal.

(1) EQUIPMENT.

TOOL, flaring and cutting, (6C-FL-335)
WRENCH, open-end, ½-in.
WRENCH, open-end, ¾-in.

(2) PROCEDURE.

(a) Remove Fuel Line.

WRENCH, open-end, ¾-in.

Disconnect fitting (¾-in. open-end wrench) at fuel pump and carburetor and remove the fuel line.

(b) Remove Fittings from Line.

TOOL, flaring and cutting, 6C-FL-335

Cut the line (cutting tool) just back of each fitting nut and remove the nuts.

(c) Remove Fittings from Carburetor and Fuel Pump.

WRENCH, open-end, ½-in.

Remove the fittings (½-in. open-end wrench) from the fuel pump and carburetor.

h. Fuel Pump to Carburetor Fuel Line Installation.

(1) EQUIPMENT.

RULE, 12-in.
TOOL, flaring and cutting, 6C-FL-335
WRENCH, open-end, ½-in.
WRENCH, open-end, ¾-in.

(2) PROCEDURE.

(a) Assemble Fuel Line.

RULE, 12-in.
TOOL, flaring and cutting, 6C-FL-335

Measure off and cut 30 inches of ⅜-in. tubing (cutting tool). Place fitting nuts on each end of tubing and flare ends (flaring tool) of tubing.

(b) Install Fittings.

WRENCH, open-end, ½-in.

Install fittings and tighten (½-in. open-end wrench) in carburetor and fuel pump.

(c) Install Fuel Line (Filter to Fuel Pump).

WRENCH, open-end, ¾-in.

Connect and tighten (¾-in. open-end wrench) the fitting nuts on the line to the fuel pump and carburetor.

122. AIR CLEANER.

a. Air Cleaner Description. The air cleaner is an oil bath type and it is mounted on the right side of the dash. The air is passed through an oil bath on its way to the engine. The oil retains the dirt and permits the air to bubble up clean and pass on to the carburetor.

b. Air Cleaner Maintenance.

(1) Service of the oil bath air cleaner depends entirely upon the number of miles and dust conditions encountered. For average operation on paved roads, it is suggested that the filter be serviced every 1,000 miles. When operating on gravel roads or under dusty conditions, the filter should be serviced every 500 miles. If, however, dusty conditions are abnormal, it should be serviced more frequently.

(2) SERVICING AIR CLEANER (fig. 22). This is a simple and easy operation. Unscrew wing nut and remove assembly, and entire assembly is then open for inspection. Drain dirty oil from pump and drain sludge from bottom. Refill to lower bead with OIL, engine, seasonal grade, and replace. Should filter element need cleaning, swish up and down and sideways in SOLVENT, dry-cleaning, and allow to dry.

c. Air Cleaner Removal.

SCREWDRIVER
WRENCH, open-end, 9/16-in. (2)

Loosen the hose clamp on the carburetor air intake (screwdriver). Remove the four bolts, nuts, and lock washers, holding the air cleaner to the dash (two 9/16-in. open-end wrenches). Remove the air cleaner.

d. Air Cleaner Installation.

SCREWDRIVER
WRENCH, open-end, 9/16-in. (2)

Place the air cleaner on the dash and attach with the four bolts, nuts, and lock washers (two 9/16-in. open-end wrenches). Slide the hose over the carburetor air intake and tighten the hose clamp (screwdriver).

SECTION XXV

INSTRUMENTS AND GAGES

123. INSTRUMENT AND GAGE DESCRIPTION.

a. The instruments and gages are located on the panel in front of the driver and are grouped in a visible place.

124. OIL GAGE.

a. Oil Gage Description. The oil gage is graduated from 0 to 80 pounds. With the engine warm, the operating range is from 40 to 45 pounds.

b. Oil Gage Removal.

WRENCH, open-end, 3/8-in. WRENCH, open-end, 5/8-in.
WRENCH, open-end, 9/16-in.

Disconnect the oil line from the oil gage (9/16- and 5/8-in. open-end wrenches). Remove two nuts and lock washers (3/8-in. open-end wrench) clamping gage into instrument panel and remove the oil gage. Remove the oil line fitting from the gage (9/16-in. open-end wrench).

c. Oil Gage Installation.

WRENCH, open-end, 3/8-in. WRENCH, open-end, 5/8-in.
WRENCH, open-end, 9/16-in.

Tighten oil line fitting into oil gage (9/16-in. open-end wrench). Place gage into position in instrument panel, install U-clamp, and turn on two nuts and lock washers and tighten (3/8-in. open-end wrench). Connect flexible oil line to the oil gage and tighten (9/16- and 5/8-in. open-end wrenches).

125. FUEL GAGE.

a. Fuel Gage Description. The fuel gage is graduated in a range, "EMPTY, 1/4, 1/2, 3/4, and FULL." The ignition switch must be turned on before any reading is taken.

b. Fuel Gage Removal.

WRENCH, open-end, 3/8-in.

Remove two nuts (3/8-in. open-end wrench) holding wires to gage. Remove the wires and two washers. Remove the next nut (3/8-in. open-end wrench). Gage can now be removed from instrument panel.

c. Fuel Gage Installation.

WRENCH, open-end, 3/8-in.

Place gage in the instrument panel, install U-clamp, turn on two nuts, and tighten (3/8-in. open-end wrench). Place the two washers, wires, and nuts, and tighten (3/8-in. open-end wrench). NOTE: The yellow wire is on the right-hand terminal of the gage and the blue wire on the left side.

126. AMMETER.

a. Ammeter Description. The ammeter is graduated from minus 0 to 50 amperes and plus 0 to 50 amperes. Readings toward the minus side indicate a discharge of the battery. Readings toward the plus side indicate the supply of current input in the battery. The total output of the generator depends on the charged condition of the battery.

b. Ammeter Removal.

WRENCH, open-end, 3/8-in.

Remove the two wire terminal nuts and lock washers (3/8-in. open-end wrench). Remove the four wires from the terminals. The brown wire on left terminal is connected to the filter, the yellow wire is connected to the headlight switch, the brown wire on right terminal is connected to starter switch, and the black wire is connected to the capacitor next to ammeter. Remove the two nuts (3/8-in. open-end wrench) holding the U-clamp and gage to instrument panel. Gage can now be removed.

c. Ammeter Installation.

WRENCH, open-end, 3/8-in.

Place ammeter in the instrument panel and fasten with insulated U-clamp and two nuts (3/8-in. open-end wrench). Connect the brown wire from the starter switch and the black wire from the capacitor on to the right-hand ammeter terminal and fasten in place with nut and lock washer (3/8-in. open-end wrench). Connect the brown wire from the filter and the yellow wire from the light switch to the left-hand ammeter terminal and fasten in place with nut and lock washer (3/8-in. open-end wrench).

127. SPEEDOMETER.

a. Speedometer Description. The speedometer registers the miles per hour from 0 to 60, total mileage of 99,999 miles, and trip miles from 0 to 999. The speedometer is driven by a flexible shaft which is connected to an adapter at the transfer case.

b. Speedometer Removal.

PLIERS

Disconnect speedometer cable (pliers). Remove two wing nuts and lock washers holding speedometer into instrument panel and remove speedometer.

c. Speedometer Installation.

(1) EQUIPMENT.

PLIERS

(2) PROCEDURE.

(a) Place speedometer in instrument panel and fasten in place with U-clamp, two lock washers, and wing nuts.

(b) Connect speedometer cable to speedometer (pliers).

127a. TEMPERATURE GAGE.

a. Temperature Gage Description. The temperature gage is graduated from 100 to 200 degrees. Normal operating temperature is from 160 to 190 degrees.

b. Temperature Gage Removal.

(1) EQUIPMENT.

SCREWDRIVER	WRENCH, open-end, 7/16-in.
WRENCH, open-end, 3/8-in.	WRENCH, open-end, 5/8-in.

(2) PROCEDURE.

(a) Remove the heat element from cylinder head (5/8-in. open-end wrench).

(b) Remove the grommet retainer (screwdriver and 7/16-in. open-end wrench) from dash. Remove the rubber grommet from the retainer and pull the temperature gage wire inside the cab.

(c) Remove the two nuts and lock washers (3/8-in. open-end wrench) holding the clamp and gage into instrument panel. Remove the gage.

c. Temperature Gage Installation.

(1) EQUIPMENT.

SCREWDRIVER	WRENCH, open-end, 7/16-in.
WRENCH, open-end, 3/8-in.	WRENCH, open-end, 5/8-in.

(2) PROCEDURE.

(a) Place temperature gage in instrument panel and fasten in place with U-clamp and two nuts and lock washers (3/8-in. open-end wrench).

(b) Run heat indicator wire through grommet in dash and fasten grommet (screwdriver and 7/16-in. open-end wrench).

(c) Connect the heat element to the cylinder head coupling and tighten (5/8-in. open-end wrench).

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Section XXVI

PROPELLER SHAFTS

128. PROPELLER SHAFT DESCRIPTION (fig. 146).

a. The propeller shafts are used to transmit power from the engine to the front and rear axles. The propeller shafts are in three lengths equipped with universal joints. The longest shaft is located between the transfer case and rear axle, the medium shaft between the transfer case and front axle, and the shortest shaft (alinement shaft) as a coupling between the transfer case and transmission. The short propeller shaft is composed of two universal joints with companion flanges at each end and one slip yoke. The two longer axle propeller shafts are composed of two universal joints each with a tube between the joints. The universal joints are attached to the transfer case and axle pinion shafts. The universal joint slip yokes are connected to the transfer case jackshafts.

129. PROPELLER SHAFT MAINTENANCE.

a. Propeller Shaft Inspection. The universal joints should be checked at regular intervals for excessive oil leakage. Replace oil seals, if necessary. The tapered yokes should be drawn tight to eliminate any chance of becoming loose. If they are not tightened properly, they will turn on the shaft and wear the key and also the keyway. When installing a propeller shaft, make certain that the two yokes attached to the axle pinion shaft and transfer case are parallel; the short-coupled propeller shaft is installed the same way.

b. Lubrication. All needle bearing joints should be lubricated with a good grade of lubricant of a mineral base. Do not use grease. It will tend to destroy the needle bearings, as grease is of such density that it may clog the oil passages and also will not work in between the rollers and properly lubricate either the rollers or the serrated ends of the trunnions which require lubrication on the thrust surfaces. The needle bearing journals are provided with a relief valve which is assembled in the center of the center cross. This not only prevents damage to the oil seals, when extremely high pressure is used in forcing the lubricant, but also serves as a means to indicate when the joint is completely filled, any excess lubricant being expelled through the relief valve.

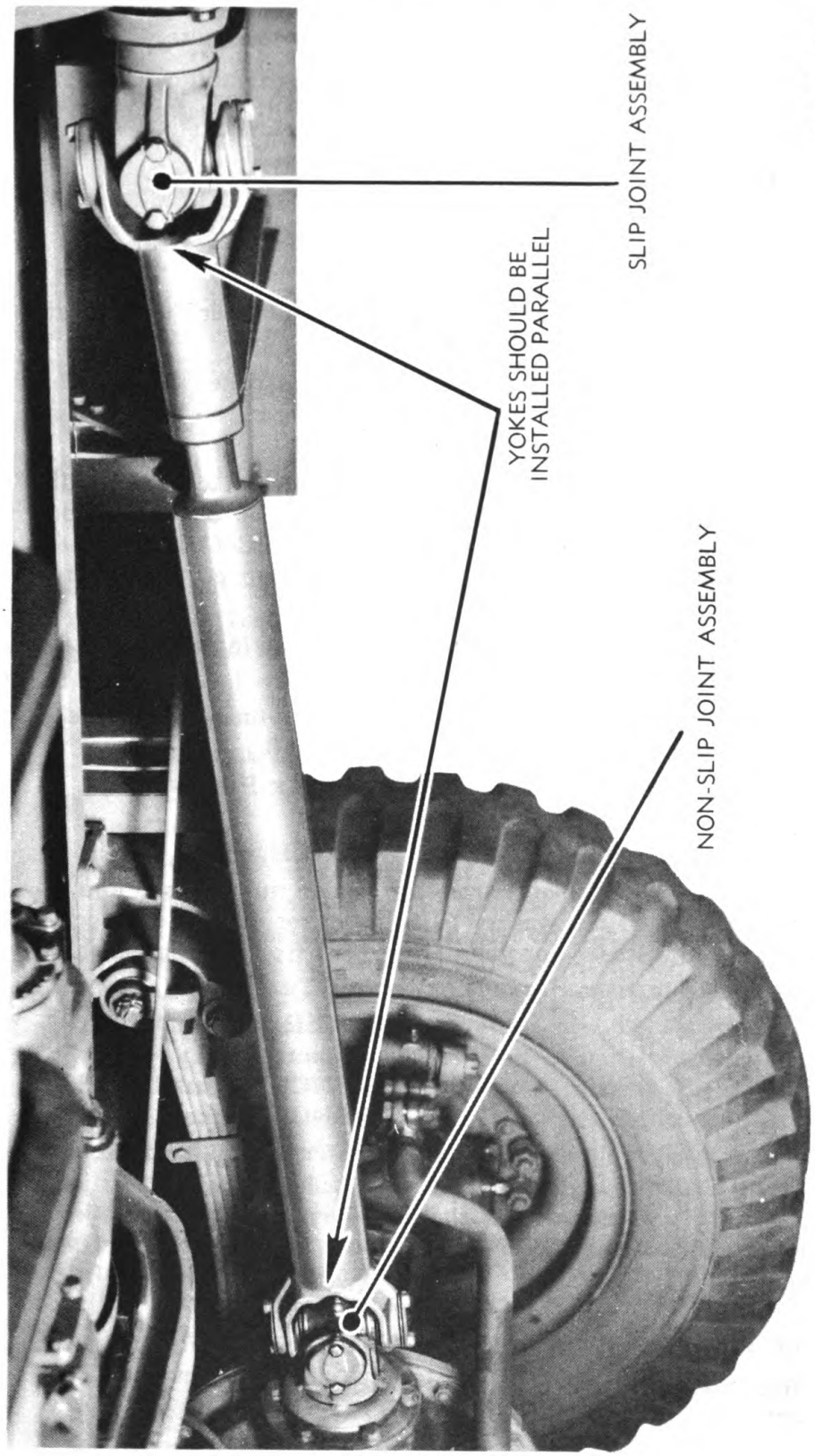


Figure 146—Front Propeller Shaft Installed

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

130. AXLE PROPELLER SHAFT REMOVAL.

a. Equipment.

CHISEL, 6-in.	PLIERS
HAMMER, 1-lb	WRENCH, box, ½-in.
HANDLE, socket	WRENCH, socket, 1 7/16-in.

b. Procedure.

(1) DISASSEMBLE UNIVERSAL JOINT.

CHISEL, 6-in.	WRENCH, box, ½-in.
HAMMER	

(a) Bend locks on lock plate (6-in. chisel and hammer) to free cap bolts holding bearing cover plate.

(b) Remove the eight cap screws (four in each yoke) holding the bearing cover plate that retains the universal bearing in the joint (½-in. box wrench). Remove lock plates.

(c) Drive on yoke ear of propeller shaft sufficiently to start needle bearing out of yoke ear (hammer). Remove the bearing. Drive on opposite yoke ear enough to remove the opposite bearing. Center cross may now be tipped back and yoke on propeller shaft removed from center cross.

(d) Remove the needle bearings in the other yoke in the same manner and then remove the center cross.

(e) By removing the dust cap on the rear of the universal joint slip yoke, the yoke may be slipped from the propeller shaft.

(2) REMOVE UNIVERSAL JOINT YOKE FROM AXLE PINION SHAFT.

HAMMER	PLIERS
HANDLE, socket	WRENCH, socket, 1 7/16-in.

Remove the cotter key (pliers) from the pinion nut. Loosen and remove the pinion nut and flat washer (1 7/16-in. socket wrench and socket handle). Tap the universal joint yoke (hammer) from the pinion shaft.

(3) REMOVE UNIVERSAL JOINT YOKE FROM TRANSFER JACKSHAFT.

HAMMER	PULLER, universal joint (7166)
HANDLE, socket	WRENCH, adjustable, 12-in.
PLIERS	WRENCH, socket, 1 7/16-in.

Remove the cotter key (pliers) from the transfer jackshaft nut. Loosen and remove the nut holding the universal joint yoke to the transfer jackshaft (1 7/16-in. socket wrench and socket handle). Pull universal joint yoke from the jackshaft. (Universal joint puller 7166 and 12-in. adjustable wrench.)

131. AXLE PROPELLER SHAFT INSTALLATION (fig. 146).

a. Equipment.

CHISEL	HAMMER, 1-lb
GUN, grease	WRENCH, box, ½-in.

PROPELLER SHAFTS

b. Procedure.

(1) ALINEMENT OF PROPELLER SHAFT YOKES.

When installing the propeller shaft in the vehicle, the non-slip yoke of the jackshaft and the pinion shaft yoke should be parallel and the two yokes on the propeller shaft should also be parallel.

(2) INSTALL UNIVERSAL JOINT YOKE ON TRANSFER JACKSHAFT.

HAMMER	PLIERS
HANDLE, socket	WRENCH, socket, 1 7/16-in.

Enter a key in the keyway of the jackshaft (hammer) and then slide the universal joint yoke on to the transfer jackshaft and tap same into place (hammer). Place the pinion nut on the jackshaft and tighten (socket handle and 1 7/16-in. socket wrench). Lock the pinion nut by inserting a cotter key (pliers).

(3) INSTALL UNIVERSAL JOINT YOKE ON AXLE PINION SHAFT.

HAMMER	PLIERS
HANDLE, socket	WRENCH, socket, 1 7/16-in.

Slide the universal joint yoke on the spline of the axle pinion shaft. Tap into place (hammer). Place a flat washer on the pinion shaft. Turn the pinion nut on the pinion shaft and tighten thoroughly (socket handle and 1 7/16-in. socket wrench). Lock the pinion nut by inserting a cotter key (pliers).

(4) ASSEMBLE UNIVERSAL JOINT.

CHISEL	WRENCH, box, 1/2-in.
HAMMER	

Place the center cross in the universal joint yoke ears on the pinion shaft. Insert the needle bearing cup into the yoke ear and tap into position (hammer). Be sure bearing enters center cross properly and that the slots in the bearing are lined up with the cap screw holes in the yoke ear. Place cover plate and lock plate on yoke ear and fasten it in place with the two cap bolts (1/2-in. box wrench). Secure the cap bolts by bending wings on lock plate tightly against cap bolt heads (hammer and chisel). Install the opposite universal bearings in the same manner. Place the propeller shaft universal joint yoke over the center cross. Enter the needle bearing cups in the yoke ears and tap lightly into position. Line up slots in bearing cups with the cap bolt holes in the yoke ears. Place cover plate and locking plate on the yoke ear and fasten with the two cap bolts (1/2-in. box wrench). Lock the cap bolts by bending wings of locking plate tightly against cap bolt heads (hammer and chisel). NOTE: Front and rear propeller shaft universal joints are all assembled in the same manner as described in the foregoing.

(5) LUBRICATE UNIVERSAL JOINTS (see Lubrication Guide, section VI).

GUN, grease

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

132. SHORT-COUPLED PROPELLER SHAFT REMOVAL (ALINEMENT JOINT).

a. Equipment.

WRENCH, open-end, 9/16-in. (2)

b. Procedure.

Remove the eight 3/8-in. bolts, nuts, and lock washers (two 9/16-in. open-end wrenches) holding the short-coupled propeller shaft to the rear companion flange. Remove the eight 3/8-in. bolts, nuts and lock washers holding the short-coupled shaft to the front companion flange (two 9/16-in. open-end wrenches). Remove the shaft assembly.

133. SHORT-COUPLED PROPELLER SHAFT INSTALLATION (ALINEMENT JOINT).

a. Equipment.

WRENCH, open-end, 9/16-in. (2)

b. Procedure.

Slide the short-coupled propeller shaft into place on the companion flanges between the transmission and transfer case. Bolt the propeller shaft to the front and rear companion flanges with the sixteen 3/8-in. bolts, nuts, and lock washers (two 9/16-in. open-end wrenches). NOTE: The slip yoke end of the short-coupled propeller shaft must be fastened to the companion flange on the transfer case companion flange.

Section XXVII

SPRINGS AND SHOCK ABSORBERS

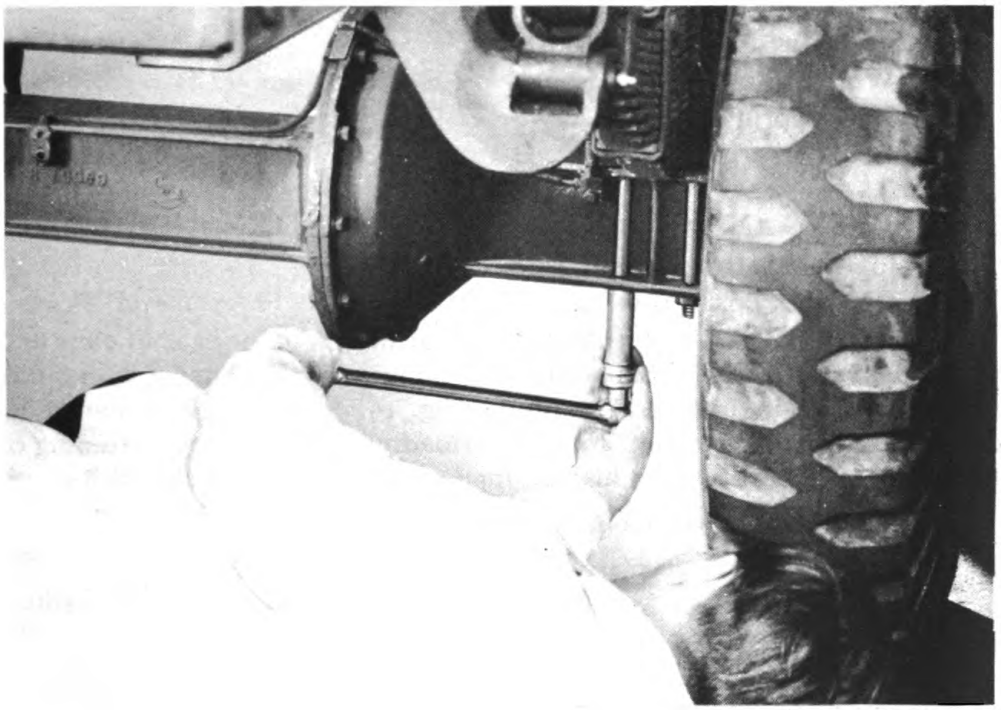


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Figure 147—Tightening Spring U-Bolt

134. SPRING AND SHOCK ABSORBER DESCRIPTION (figs. 147, 148, and 149).

a. The springs are semi-elliptic type and are anchored at the front and shackled at the rear. Two springs are used to suspend the vehicle on the front axle and two for the rear axle. Double-acting shock absorbers are used to control the action of the springs. The shock absorber is bolted to the frame above each spring; a connecting link is attached to the shock absorber and spring.

135. SPRING AND SHOCK ABSORBER TROUBLE SHOOTING.

a. Hard Riding.

Possible Cause	Possible Remedy
(1) Insufficient lubrication.	Lubricate springs. Refer to Lubrication Guide (section VI).

Possible Cause	Possible Remedy
(2) Broken shackle bolts.	Replace (par. 138).
(3) Overloading or uneven load.	Lighten or change distribution of load.
b. Excess Flexibility.	
(1) Broken spring leaves.	Replace spring (par. 138).
(2) Lack of fluid in shock absorber.	Replenish fluid. Refer to Lubrication Guide (section VI).
(3) Improper action of shock absorber.	Replace (par. 137).
c. Excessive Noise.	
(1) Worn spring bolts.	Replace (par. 138).
(2) Loose spring clips.	Tighten clips.
(3) Broken spring leaves.	Replace spring (par. 138).

136. SPRING AND SHOCK ABSORBER MAINTENANCE (fig. 147).

a. Spring Maintenance.

WRENCH, box, 15/16-in. WRENCH, open-end, 5/8-in.

The springs should be checked at regular intervals for broken clips and spring leaves. Spring U-bolts and clips should be tightened (15/16-in. box wrench and 5/8-in. open-end wrench) (fig. 147). The springs should be checked for evidence of settling or overloading, indicated by flattening of the spring. A check should also be made for binding in the shackles.

b. Shock Absorber Inspection.

(1) EQUIPMENT.

HAMMER WRENCH, open-end, 7/8-in.
WRENCH, adjustable, 12-in.

(2) PROCEDURE.

(a) Adjustments, which are made at the factory to establish shock absorber resistance, should not be changed. Normally, the only care shock absorbers require is replenishing the fluid. The filler plug in the reservoir should be removed in the spring and fall or at intervals of 6,000 miles, whichever occurs first, and the reservoir filled to the bottom of filler plug hole (12-in. adjustable wrench). Use genuine shock absorber fluid. Substitute fluids, grease, or oil should never be used.

(b) In order to remove any air that may be trapped in the working chamber, due to low fluid, disconnect link (hammer and 7/8-in. open-end wrench) and pump lever several times through its full range of travel. This will draw the fluid from the auxiliary reservoir into the working chamber. Add more fluid and repeat pumping. When working chamber is properly filled, there will be uniform resistance and no "rubbery" feeling or lost motion. Refill reservoir to bottom of filler plug hole. (See figure 27, Lubrication section). CAUTION: A shock absorber filled above this level may leak, therefore, do not overfill. The space between this fluid level and top of reservoir is air space required for expansion. Replace link (7/8-in. open-end wrench) and filler plug 12-in. adjustable wrench).

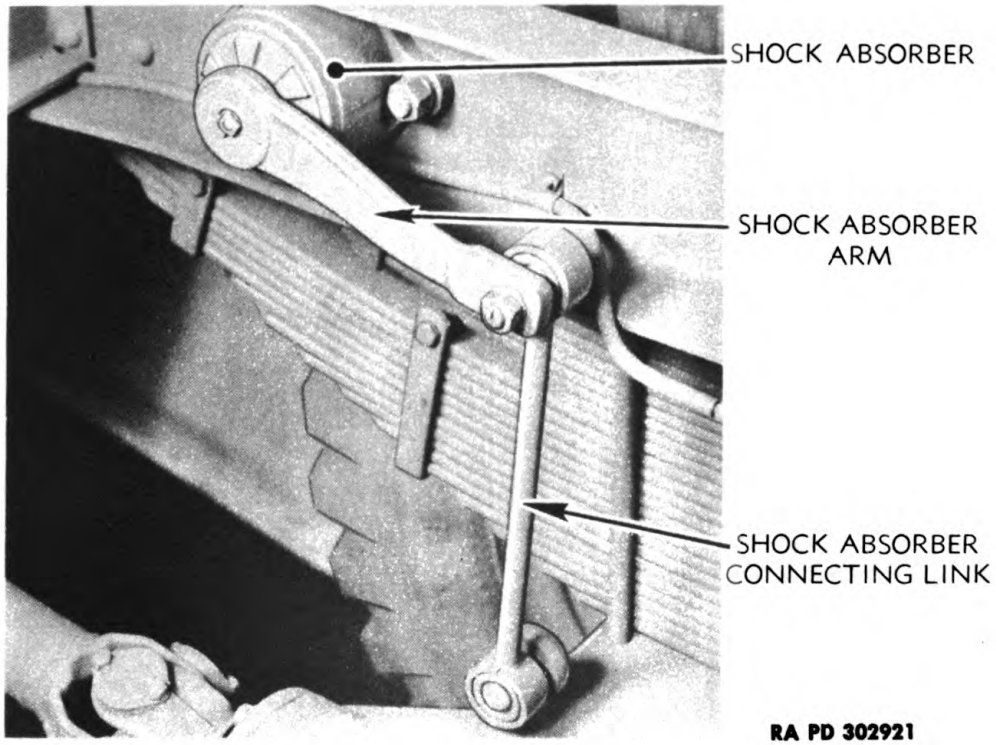

Figure 148—Rear Shock Absorber Installed

137. SHOCK ABSORBER REPLACEMENT (figs. 148 and 149).

a. Equipment.

HAMMER
WRENCH, open-end, 15/16-in.
WRENCH, open-end, 7/8-in.

b. Procedure.

(1) DISCONNECT LINKAGE.

HAMMER
WRENCH, open-end, 7/8-in.

Remove arm link nut (7/8-in. open-end wrench). Drive tapered bolt out (hammer).

(2) REMOVE SHOCK ABSORBER FROM FRAME.

WRENCH, open-end, 7/8-in.
WRENCH, open-end, 15/16-in.

Remove the two bolts fastening shock absorber to frame (7/8- and 15/16-in. open-end wrenches). Remove shock absorber.

(3) INSTALL SHOCK ABSORBER IN FRAME.

WRENCH, open-end, 7/8-in.
WRENCH, open-end, 15/16-in.

Place shock absorber on inside of frame channel with arm towards the rear. Install two bolts through the frame and shock absorber, place lock washers on bolts, and tighten nuts (7/8- and 15/16-in. open-end wrenches).

(4) INSTALL LINKAGE.

SCREWDRIVER
WRENCH, open-end, 7/16-in.

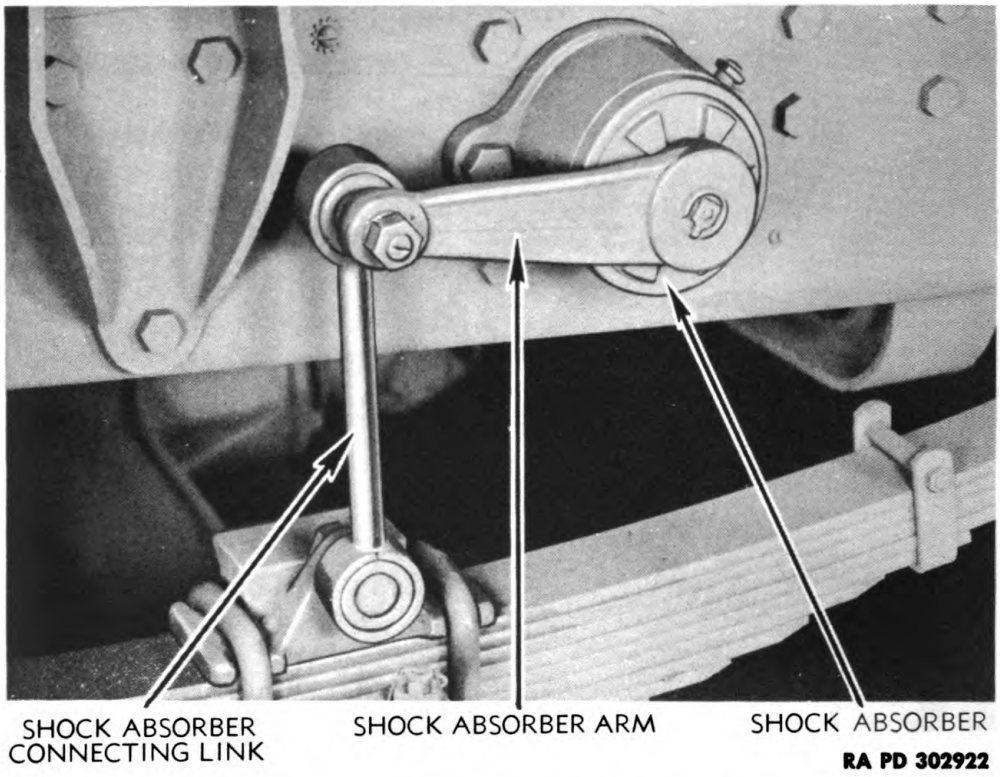

Figure 149—Front Shock Absorber Installed

Insert connecting link tapered bolt into arm. Tighten nut (screwdriver and 7/8-in. open-end wrench).

(5) LUBRICATION. Refer to Lubrication Guide (section VI). **NOTE:** When replenishing fluid in shock absorber after removing from vehicle, it is important that the shock absorber be held in the same position that it would be mounted on the vehicle and surplus fluid be permitted to run out.

138. SPRING REPLACEMENT.

a. Rear Spring Removal.

(1) EQUIPMENT.

CHAIN	PLIERS
EXTENSION, 6-in.	PUNCH
HAMMER	WRENCH, box, 15/16-in.
HANDLE, ratchet	WRENCH, socket, 1 1/16-in.
HOIST, chain	

(2) PROCEDURE.

(a) Remove Spring Shackle Bolts.

CHAIN	HOIST, chain
EXTENSION, 6-in.	PLIERS
HAMMER	PUNCH
HANDLE, ratchet	WRENCH, socket, 1 1/16-in.

Raise rear of vehicle (chain and chain hoist) enough to release tension from spring that is being removed. Remove cotter keys from front spring shackle bolt and from lower rear spring shackle bolt (pliers). Remove nuts (1 1/16-in. socket wrench, ratchet, and 6-in. extension) from front spring shackle bolt and from lower rear spring shackle bolt. Remove the two shackle bolts by driving them from the hangers (hammer and punch).

(b) Remove Spring U-bolts.

HAMMER
WRENCH, box, 15/16-in.

Remove eight nuts (15/16-in. box wrench) from U-bolts holding spring to axle; drive U-bolts from the axle housing (hammer). Remove spring block from top of spring.

(c) Remove Spring.

HOIST, chain

Raise truck about 6 inches higher (chain hoist). Remove spring from axle housing toward the rear.

(d) Remove Rear Spring Shackle.

HAMMER
HANDLE, ratchet
PLIERS
PUNCH
WRENCH, socket, 1 1/16-in.

Remove cotter key (pliers) from shackle bolt nut. Remove nut (1 1/16-in. socket wrench and ratchet) and drive shackle bolt from spring and shackle (hammer and punch).

b. Rear Spring Installation.

(1) EQUIPMENT.

CHAIN
EXTENSION, 6-in.
HAMMER
HANDLE, ratchet
HOIST, chain
PLIERS
WRENCH, box, 15/16-in.
WRENCH, open-end, 5/16-in.
WRENCH, socket, 1 1/16-in.

(2) PROCEDURE.

(a) Install Rear Shackle on Spring.

HAMMER
HANDLE, ratchet
PLIERS
WRENCH, socket, 1 1/16-in.

Place shackle on spring and line up holes, insert shackle bolt, and drive in place (hammer). Turn nut on shackle bolt and tighten (1 1/16-in. socket wrench and ratchet handle). Insert cotter key (pliers) in nut and shackle bolt.

(b) Install Spring on Rear Axle Housing.

HANDLE, ratchet
WRENCH, box, 15/16-in.

Place spring on rear axle housing from rear of truck, enter spring tie bolt in recess on top side of axle housing, place spring block on top of spring, and insert U-bolts over spring and through holes in axle housing. Turn nuts on U-bolts and tighten (15/16-in. box wrench and ratchet handle).

(c) Install Spring Shackle Bolts.

EXTENSION, 6-in.	PLIERS
HAMMER	WRENCH, open-end, 5/16-in.
HANDLE, ratchet	WRENCH, socket, 1 1/16-in.
HOIST, chain	

Lower chassis (chain hoist) until shackle bolt holes line up, drive (hammer) in the bolts and turn on the nuts and tighten (1 1/16-in. socket, 6-in. extension, and ratchet handle). Place new cotter keys in shackle bolt nuts (pliers). Replace worn grease fittings (5/16-in. open-end wrench) and lubricate all spring bolts. See Lubrication Chart, section VI.

c. Front Spring Assembly Removal.

(1) EQUIPMENT.

CHAIN	PLIERS
HAMMER	PUNCH, taper
HANDLE, flex	WRENCH, box, 15/16-in.
HOIST, chain	WRENCH, socket, 1 1/16-in.

(2) PROCEDURE.

(a) Remove Spring U-bolt.

HAMMER	WRENCH, box, 15/16-in.

Remove the eight nuts (15/16-in. box wrench) from the spring U-bolts and drive U-bolts (hammer) from the axle housing.

(b) Remove Shackle Bolts.

CHAIN	PLIERS
HAMMER	PUNCH, taper
HANDLE, flex	WRENCH, socket, 1 1/16-in.
HOIST, chain	

Loop chain around convenient place at front of chassis and raise chassis (chain hoist) sufficiently to remove weight from the spring. Remove shackle bolt cotter keys (pliers). Remove shackle bolt nuts (1 1/16-in. socket wrench and flex handle). Drive shackle bolts from springs (hammer and taper punch) and remove the spring from the axle housing.

d. Front Spring Assembly Installation.

(1) EQUIPMENT.

CHAIN	PLIERS
GUN, grease	PUNCH, taper
HAMMER	WRENCH, box, 15/16-in.
HANDLE, flex	WRENCH, socket, 1 1/16-in.
HOIST, chain	

(2) PROCEDURE.

(a) Install Front Spring.

HAMMER	WRENCH, box, 15/16-in.

Place spring on axle housing, so that spring center bolt rests in recess on top of axle housing. Drive the spring U-bolts through the axle housing (hammer). Put on the double nuts and tighten (15/16-in. box wrench).

SPRINGS AND SHOCK ABSORBERS

(b) Install Shackle Bolts.

HAMMER
HANDLE, flex
PLIERS
PUNCH, taper
WRENCH, socket, 1 1/16-in.

Lower chassis (chain hoist) to line up spring shackle holes; drive in the shackle bolts (hammer and punch). Put on the shackle bolt nuts and tighten (1 1/16-in. socket wrench and flex handle). Cotter key the nuts (pliers). Lower chassis (chain hoist) and remove the chain. Lubricate the shackle bolts (grease gun).

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Section XXVIII

STEERING GEAR

139. STEERING GEAR DESCRIPTION (fig. 150).

The steering gear is of a cam and twin lever type and is located on the left side of the vehicle. The steering gear housing is mounted in a bracket bolted to the frame above the front axle and the steering column is supported by a bracket. The steering wheel is of the three-spoke type, having a diameter of 20 inches.

140. STEERING GEAR TROUBLE SHOOTING.

a. Hard Steering.

Possible Cause	Possible Remedy
(1) Lack of lubrication.	Lubricate steering gear, tie rod ends, steering sockets, and drag link. Refer to Lubrication Chart, (section VI).
(2) Steering gear too tight.	Readjust (par. 141).
(3) Drag link too tight.	Readjust (par. 141).
(4) Under-inflated tires.	Inflate to 65 pounds.
(5) Improper toe-in.	Adjust (par. 41).

b. Loose Steering.

(1) Improper steering gear adjustment.	Readjust (par. 141).
(2) Loose ball joints.	Readjust (par. 141).
(3) Loose steering socket bearings.	Readjust socket (par. 41).
(4) Worn steering gear.	Replace steering gear (par. 142).

c. Shimmy.

(1) Loose steering.	Readjust system (par. 141).
(2) Improper toe-in.	Readjust (par. 41).

d. Road Shock.

(1) Improper drag link adjustment.	Readjust drag link (par. 141).
(2) Incorrect shock absorber action.	Check fluid (par. 136).
(3) Steering gear improperly adjusted.	Readjust (par. 141).

STEERING GEAR

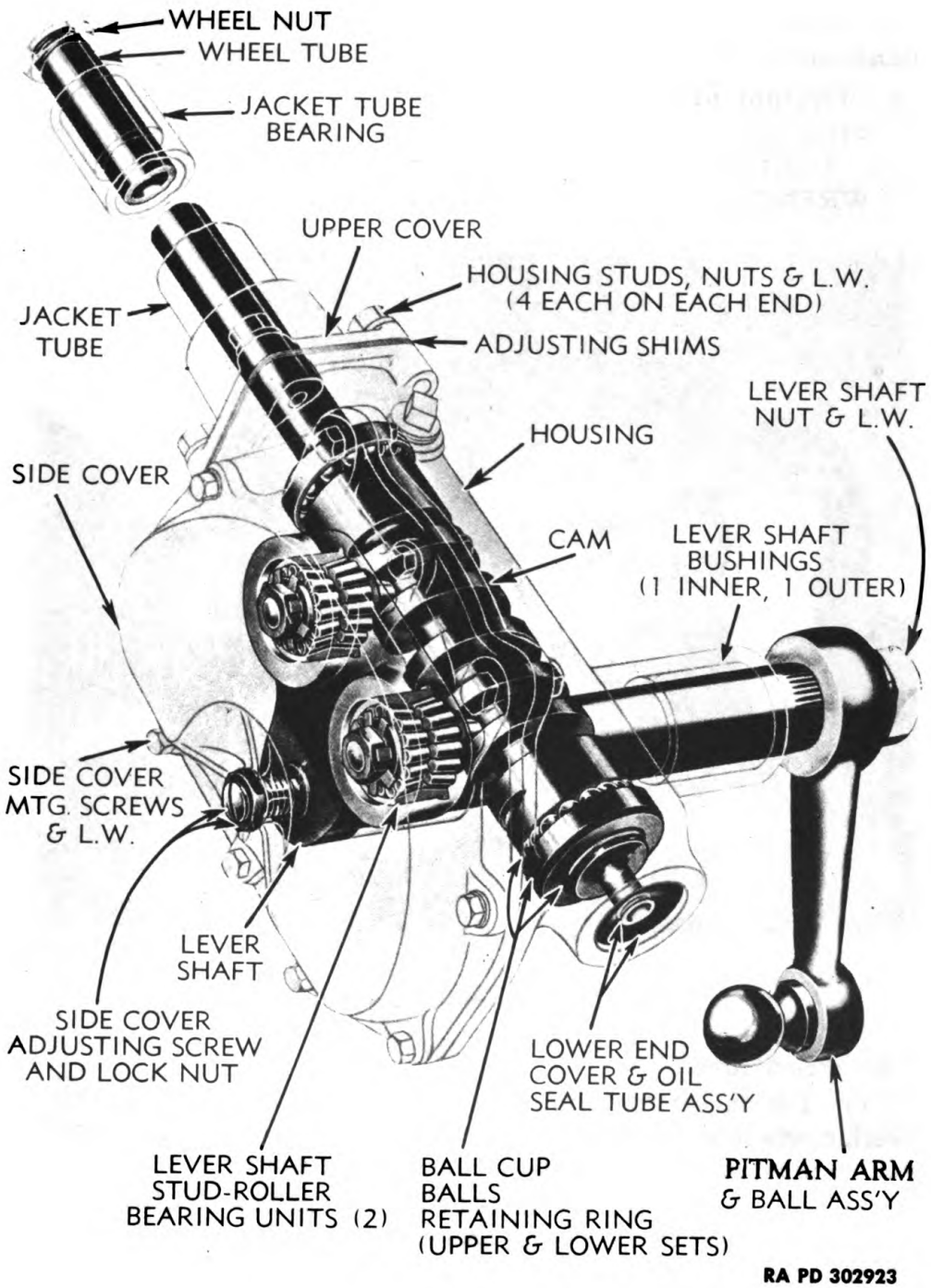

Figure 150—Phantom View of Steering Gear

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

141. STEERING GEAR ADJUSTMENTS.

The steering gear is designed to have no backlash through the center position and but slight backlash at each end of travel. There are two adjustments to the steering gear and must be made in the following order:

a. Equipment.

PULLER, pitman arm, 43DD-CG-250
WRENCH, adjustable, 12-in.
WRENCH, open-end, ½-in.
WRENCH, open-end, ¾-in.

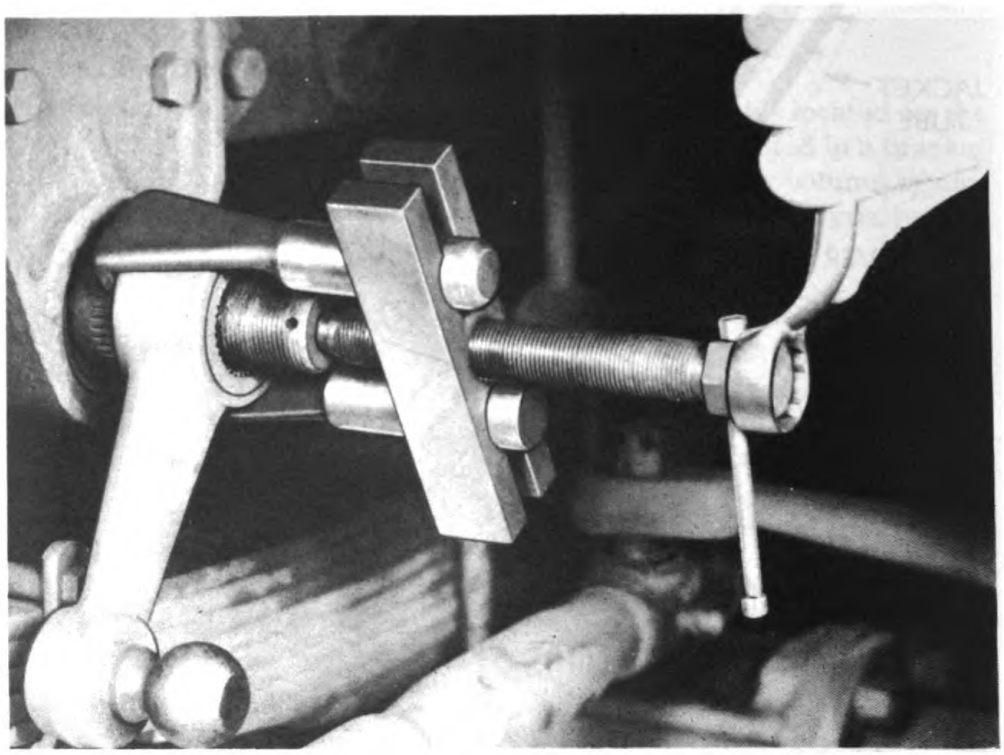

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Figure 151—Removing Pitman Arm

b. Procedure.

(1) Disconnect the pitman arm (fig. 151) (par. 153). Turn the steering wheel and if any excessive binding or looseness is found, the trouble may be assumed to be in the steering gear.

(2) The first adjustment should be the thrust bearings. Remove the four upper cover screws (½-in. open-end wrench) and the clamp bolt (¾-in. open-end wrench). Loosen the U-clamp on the steering column (¾-in. open-end wrench). Raise the cover to permit removal of the shims. A combination of shims are used between paper shims. Clip and remove one or more shims as required to remove end play in the thrust bearings. Replace cover and tighten screws (½-in. open-end wrench). Tighten the two clamp bolts (¾-in. open-end wrench.)

(3) Next, adjust the side cover adjusting screw to a barely perceptible drag on the steering wheel. The adjustment should be made through the mid-position. Do not adjust in positions off mid-position, as backlash at these points is normal and not objectionable. To adjust, loosen the lock nut (12-in. adjustable wrench) and tighten side cover adjusting screw (offset screwdriver) while the steering wheel is turned slowly from extreme left to extreme right, until a very slight drag is felt on the steering wheel in the straight ahead steering position. Tighten the lock nut (12-in. adjustable wrench). CAUTION: The gear must not bind at any place; only a very slight drag should be felt. A closer adjustment will not correct any steering condition, but will damage and wear the steering gear and impair operation.

(4) The steering gear should be approximately in its mid-position when the front wheels are straight ahead. Turn the steering wheel to the right as far as possible; then rotate the wheel in the opposite direction as far as possible and note the total number of turns. Turn the wheel back just one-half of this total movement, thus placing the gear in mid-position. Place front wheels straight ahead. The serrated end of the steering shaft and pitman arm should line up or nearly so. Place the pitman arm on the steering shaft and tighten with a nut and lock washer (12-in. adjustable wrench).

142. STEERING GEAR REPLACEMENT.

a. Equipment.

HAMMER	WRENCH, box, 15/16-in.
HANDLE, ratchet	WRENCH, open-end, 3/8-in.
PLIERS	WRENCH, open-end, 7/16-in.
PULLER, pitman arm, 43DD-CG-250	WRENCH, open-end, 3/4-in.
PUNCH, taper, 6-in.	WRENCH, open-end, 7/8-in.
SCREWDRIVER, 10-in.	WRENCH, socket, 3/4-in.
WRENCH, adjustable, 12-in.	WRENCH, socket head set screw, 1/4-in.

b. Procedure.

(1) REMOVE PITMAN ARM.

PULLER, arm, 43DD-CG-250	WRENCH, adjustable, 12-in.

Remove the nut and lock washer holding the pitman arm to the steering gear (12-in. adjustable wrench). Pull the pitman arm from the shaft (arm puller 43DD-CG-250).

(2) REMOVE STEERING WHEEL.

HAMMER	SCREWDRIVER, 10-in.
HANDLE, ratchet	WRENCH, socket, 1 7/16-in.

Remove the horn button by turning one-quarter turn with the hand. This will permit the horn button to slide out of the slots and be removed. Remove the three screws holding the horn button base plate (screwdriver). Disconnect the lower end of the horn wire from the junction block (3/8-in. open-end wrench). Pull the horn wire and horn base plate

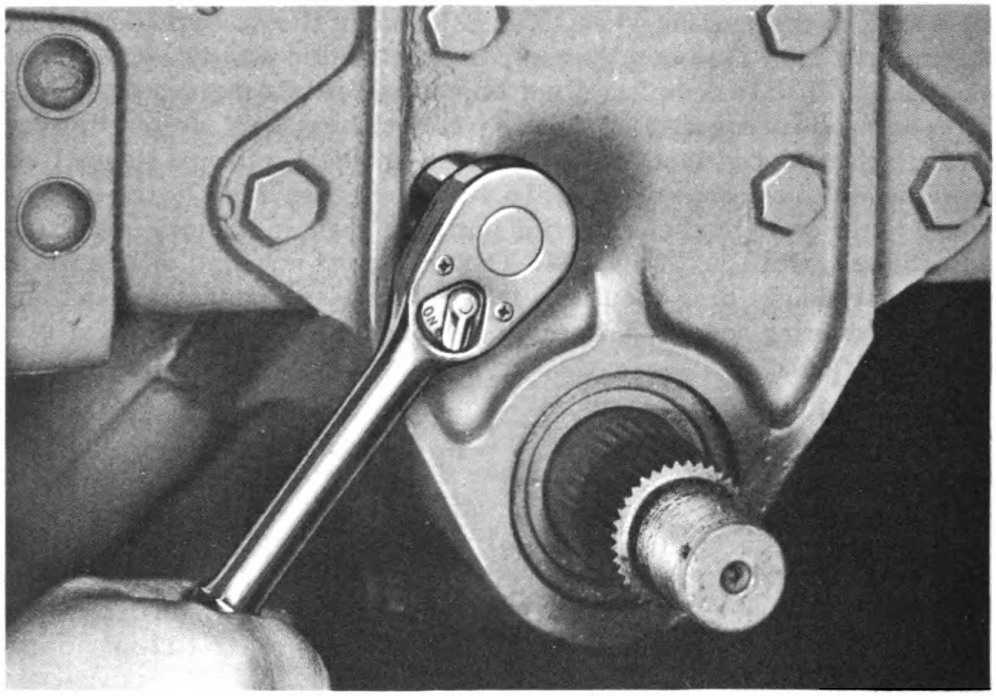

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Figure 152—Removing Steering Gear Outer Bracket

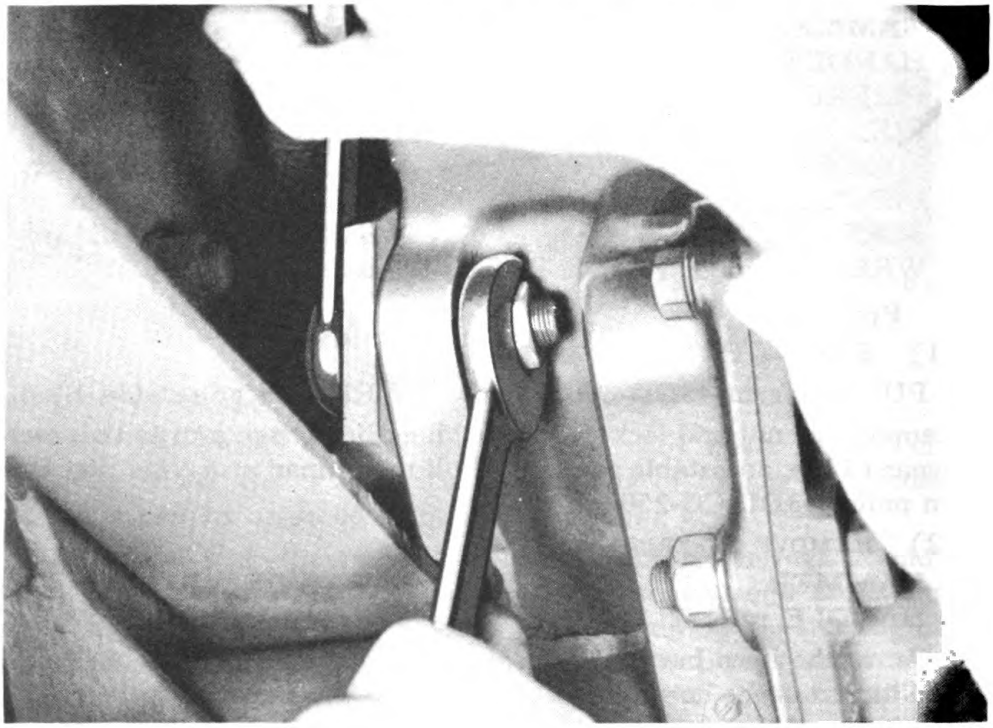

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Figure 153—Removing Steering Gear Inner Bracket

assembly out of the steering gear toward the top. Remove the steering wheel nut (1 7/16-in. socket wrench and ratchet handle). Remove the steering wheel by tapping next to the steering gear tube (hammer).

(3) REMOVE STEERING GEAR LOWER BRACKETS.

HANDLE, ratchet
WRENCH, box, 15/16-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 7/8-in.
WRENCH, socket, 3/4-in.
(2)

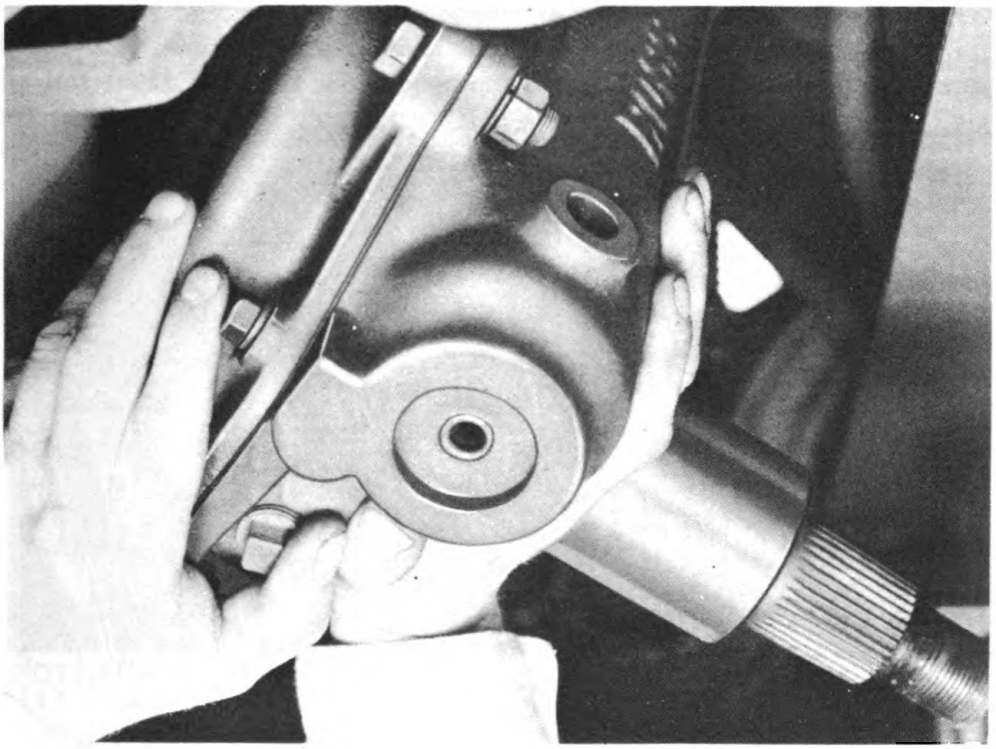

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Figure 154—Removing Steering Gear Assembly

Remove the six bolts, nuts and lock washers (3/4-in. open-end wrench, 3/4-in. socket wrench, and ratchet handle) holding the inner and outer steering gear brackets to the frame (fig. 152). Remove the bolt, nut and lock washer holding inner steering gear bracket (fig. 153) to the steering gear (two 3/4-in. open-end wrenches). Remove the inner bracket. Loosen the clamp bolt in the steering gear outer bracket (7/8-in. open-end wrench and 15/16-in. box wrench). Remove the outer steering gear bracket.

(4) REMOVE WINCH DRIVE SHAFT (par. 171).

HAMMER
PUNCH, taper, 6-in.
WRENCH, socket head set screw, 1/4-in.

(5) REMOVE STEERING GEAR U-CLAMP.

WRENCH, open-end, 3/4-in.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

Remove the two nuts and lock washers from the steering gear U-clamp (¾-in. open-end wrench). Remove the clamp holding the electrical wires to the steering gear tube (screwdriver and 7/16-in. open-end wrench). Remove the U-clamp. The steering gear can now be lowered to the floor on the underside of the chassis (fig. 154).

(6) INSTALL STEERING GEAR LOWER BRACKETS.

HANDLE, ratchet
WRENCH, box, 15/16-in.
WRENCH, open-end, ¾-in.
WRENCH, open-end, ⅞-in.
WRENCH, socket, ¾-in.

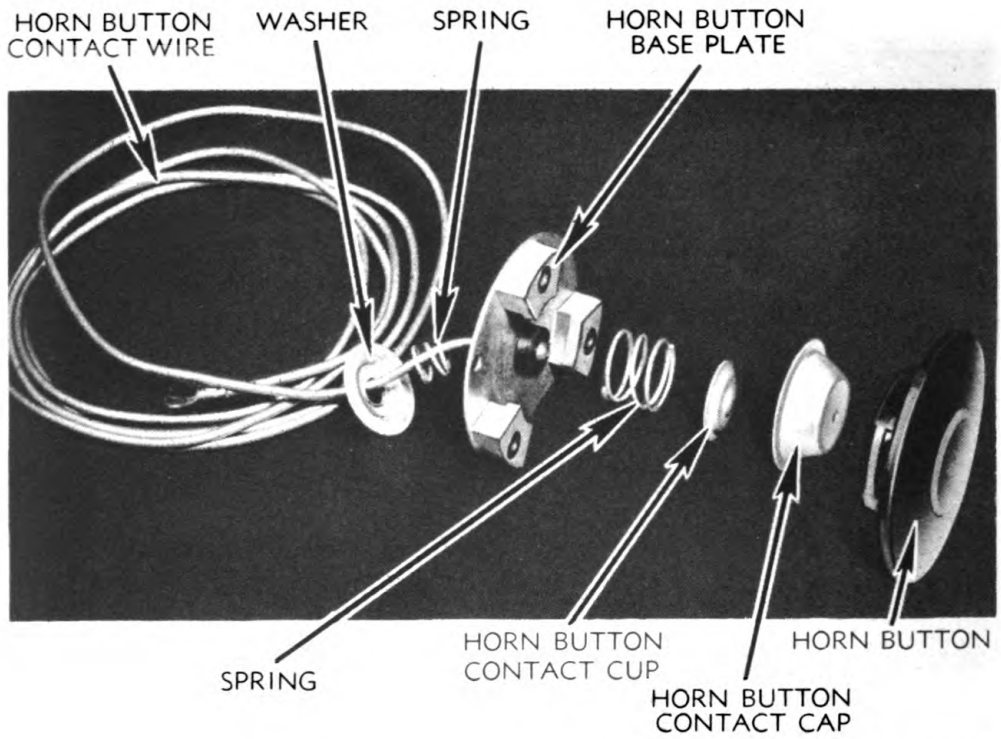

Figure 155—Horn Button and Related Parts

Place the steering gear assembly into position in the chassis from the underside of the vehicle. Slide the outer steering bracket on bottom left side of the steering gear. Tighten the inner steering gear bracket to the steering gear with a bolt, nut and lock washer (two ¾-in. open-end wrenches). Attach the inner and outer steering gear bracket to the frame side channel with six bolts, nuts and lock washers (¾-in. open-end wrench, ratchet handle, and ¾-in. socket wrench).

(7) INSTALL STEERING GEAR U-CLAMP.

WRENCH, open-end, ¾-in.

Slide the U-clamp over the steering gear column and through the bracket. Tighten the U-clamp with the two nuts and lock washers (¾-in.

open-end wrench). Attach the electrical wire harness to the steering gear tube with a clamp (screwdriver and 7/16-in. open-end wrench).

(8) INSTALL STEERING WHEEL (fig. 155).

HANDLE, ratchet
PLIERS
SCREWDRIVER, 10-in.
WRENCH, socket, 1 7/16-in.

Place the steering wheel on the steering gear shaft and tighten with the steering wheel nut (1 7/16-in. socket wrench). Enter a piece of wire through the steering gear tube. Fasten the horn wire to the top end of the wire and pull the horn wire through the steering gear tube (pliers). Insert the three screws holding the horn base plate to the steering wheel (screwdriver). Fasten the lower end of the horn wire to the junction block on the left front fender (3/8-in. open-end wrench). Place the horn button into the steering wheel and turn one-quarter turn with the hand. This will permit the prongs on the horn button to slide into the slots of the base plate holding the horn button in place (fig. 155).

(9) INSTALL PITMAN ARM (par. 143).

HAMMER
WRENCH, adjustable, 12-in.

(10) INSTALL WINCH DRIVE SHAFT (par. 171).

HAMMER
WRENCH, socket head set screw, 1/4-in.

143. PITMAN ARM REPLACEMENT.

a. Equipment.

ADJUSTER, drag link (Screwdriver type 7168)
HANDLE, ratchet
PLIERS
PULLER, 43DD-CG-250, snap-on

b. Procedure.

(1) REMOVE DRAG LINK.

HANDLE, ratchet
PLIERS
RATCHET (screwdriver attachment 7168)

Remove drag link at pitman arm end (par. 144).

(2) REMOVE PITMAN ARM.

PULLER, 43DD-CG-250, snap-on
WRENCH, adjustable, 12-in.

Remove the nut and lock washer from the pitman arm shaft (12-in. adjustable wrench). Place the puller on the pitman arm and remove the arm (puller, 43DD-CG-250, and 12-in. adjustable wrench).

(3) INSTALL PITMAN ARM.

HAMMER
PLIERS
WRENCH, adjustable, 12-in.

Center the steering gear by turning the steering wheel to the right as far as possible. Then rotate the wheel in the opposite direction as far as possible and note the total number of turns. Turn wheel back just one-half of this total movement, thus placing the gear in mid-position. Place

front wheels straight ahead. Slide pitman arm on the serrated end of the steering gear shaft. Tap lightly (hammer) and tighten pitman arm with nut and lock washer (12-in. adjustable wrench). The ball on the pitman arm stud should now line up, or nearly so, with the ball socket on the drag link. If necessary, the pitman arm can be shifted on the serrated end of the steering gear shaft to change the ball stud position.

(4) INSTALL DRAG LINK (par. 144).

ADJUSTER, drag link (Screwdriver type 7168)
PLIERS
RATCHET

144. DRAG LINK.

a. Drag Link Description. The drag link is a connecting link between the pitman arm and the front axle steering arm. It has adjustable ball sockets which are spring loaded.

b. Drag Link Adjustment.

ADJUSTER, drag link (Screwdriver type 7168)
PLIERS

Remove the cotter key (pliers) from the end of the drag link. Turn the adjusting plug until it is tight (drag link adjuster) and back off one-quarter turn. Lock the adjusting plug with a new cotter key (pliers). Follow this same procedure for the opposite end.

c. Drag Link Removal.

ADJUSTER, drag link (Screwdriver type 7168)
HAMMER
HANDLE, ratchet
PLIERS
WRENCH, box, 15/16-in.

Remove the cotter key (pliers) from the drag link pitman arm end. Remove the drag link end plug (ratchet handle and drag link adjuster—screwdriver type). Remove the outer drag link bearing and then remove the drag link from the pitman arm. Turn the left wheel in toward the front of the truck. Remove the cotter pin (pliers) from the steering arm ball stud. Remove the nut from the steering arm ball stud (15/16-in. box wrench). Drive the ball stud from the steering arm (hammer).

d. Drag Link Installation.

ADJUSTER, drag link (Screwdriver type 7168)
HAMMER
PLIERS
WRENCH, box, 15/16-in.

Insert the ball stud into the steering arm. Tap slightly (hammer) into position. Tighten the nut on ball stud (15/16-in. box wrench). Lock the ball stud nut with a cotter key (pliers). Slide the drag link over the pitman arm ball stud. Insert the drag link end plug (drag link adjuster—screwdriver type). Lock the drag link end plug with the cotter key (pliers).

Section XXIX

TRANSFER CASE

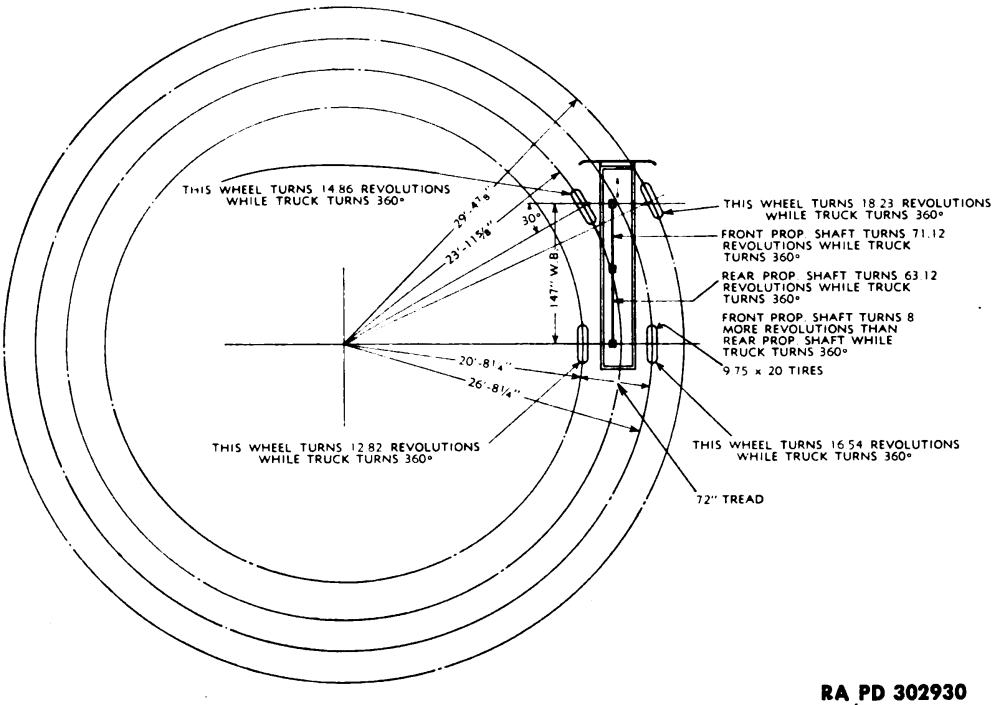

Figure 156—Chart Explaining Center Differential

145. TRANSFER CASE DESCRIPTION.

a. General. The transfer case is mounted in the frame to the rear of the transmission. Its object is to transmit power from the transmission to the front and rear axle and provides additional speed reduction for any selection of transmission gears.

b. Construction and Function.

(1) The parts making up this unit are all enclosed in the transfer case. They consist of a mainshaft, upper and lower sprocket, silent chain, center differential, a differential locking device, and jackshafts connected

to the propeller shafts. The silent chain cushions a sudden jerk and thus minimizes strains on other working parts. When kept properly lubricated and adjusted, it will invariably last the life of the vehicle. The chain should be checked for slack at 6,000-mile intervals and should have approximately ½-in. perceptible slack.

(2) The center differential is composed of two differential and pinion gears similar to those in the front and rear axles. The purpose of the center differential is to compensate for differences in distance traveled by the front and rear wheels, just as the differential compensates for difference in distance between the two rear wheels when rounding corners or

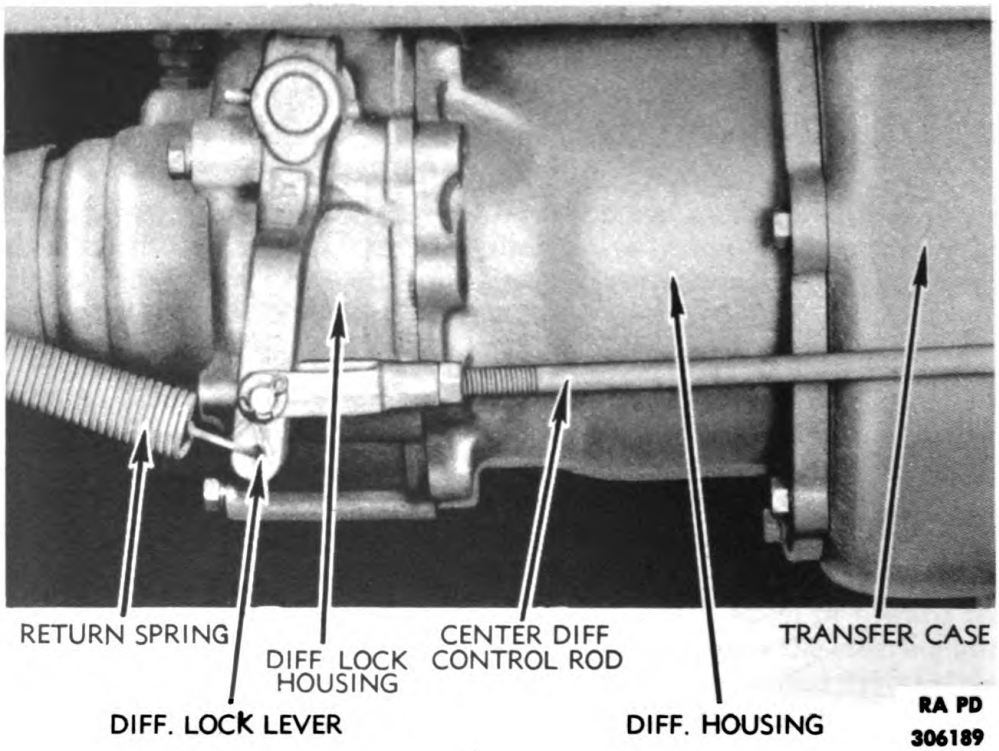

Figure 157—Differential Locking Control

traveling over uneven terrain. If a solid drive were used in the transfer case, the rear wheels would be compelled to slip when rounding corners, because the front wheels travel about twice as far as the rear wheels do. Without the use of a center differential, rapid tire wear would be experienced and the entire driving members would also be under a continual strain, because they would be compelled to take up the strain, up to the point of slipping the wheels. See figure 156 for explanation of the center differential.

(3) The center differential locking device is a sliding jaw clutch unit and is attached to the center differential housing (fig. 157). It is manu-

ally controlled from the cab. Locking the center differential merely cuts out the action of the differential gears and transmits the power equally through both propeller shafts. When the differential is unlocked, either propeller shaft can turn, depending on the tire traction. For locking and unlocking the center differential, refer to paragraph 6. The locking device should be used only for emergency work, however, and should be unlocked as soon as possible. To operate constantly with a locked center differential places undue and unnecessary strains on all driving parts. Some are under the impression that the truck will drive on all four wheels only when the center differential is locked. This is not true. The truck drives on all four wheels without the center differential lock engaged.

146. TRANSFER CASE TROUBLE SHOOTING.

a. Unusual Noises and Vibrations.

Possible Cause	Possible Remedy
(1) Worn front and rear jackshaft bearings.	Report to higher authority.
(2) Loose transfer drive chain.	Adjust chain (par. 147).
(3) Lack of lubricant.	Add lubricant. Refer to Lubrication Guide (section VI).

b. Transfer Case Heats Excessively.

(1) Lack of lubricant.	Add lubricant. Refer to Lubrication Guide (section VI).
(2) Too much lubricant.	Drain to proper level.
(3) Chain adjustment too tight.	Adjust (par. 147).
(4) Air vent plugged.	Clean vent on transfer case.

c. Grease Leakage.

(1) Too much lubricant.	Drain to proper level.
(2) Defective oil seals.	Replace seals (par. 149A).
(3) Loose bolts.	Tighten.
(4) Plugged air vent (causing pressure).	Clean vent.

147. SILENT CHAIN ADJUSTMENT (fig. 158).

a. Equipment.

HAMMER
PUNCH
SCREWDRIVER
WRENCH, adjustable, 10-in.
WRENCH, open-end, 9/16-in.

b. Procedure.

(1) Loosen all the cap bolts (9/16-in. open-end wrench) around the clamp rings at the front and rear side of the transfer case. The clamp rings or scales are numbered from 1 to 21 (fig. 158). Remove the cap bolts at number one on the scale. With these two bolts removed and the

balance of the bolts loosened, the eccentric housings will be free to turn. Remove the pipe plug at the side of the transfer case (10-in. adjustable wrench) and note the slack in the chain. It should have approximately ½-inch perceptible slack and can be checked with a screwdriver or tips of fingers.

(2) Proceed to turn the front and rear eccentric housings (punch and hammer) until the pointer approaches the next highest number (fig. 158). Proceed with the adjustment until the chain is taut and then turn the eccentric housing back one number. Care should be taken that the point-

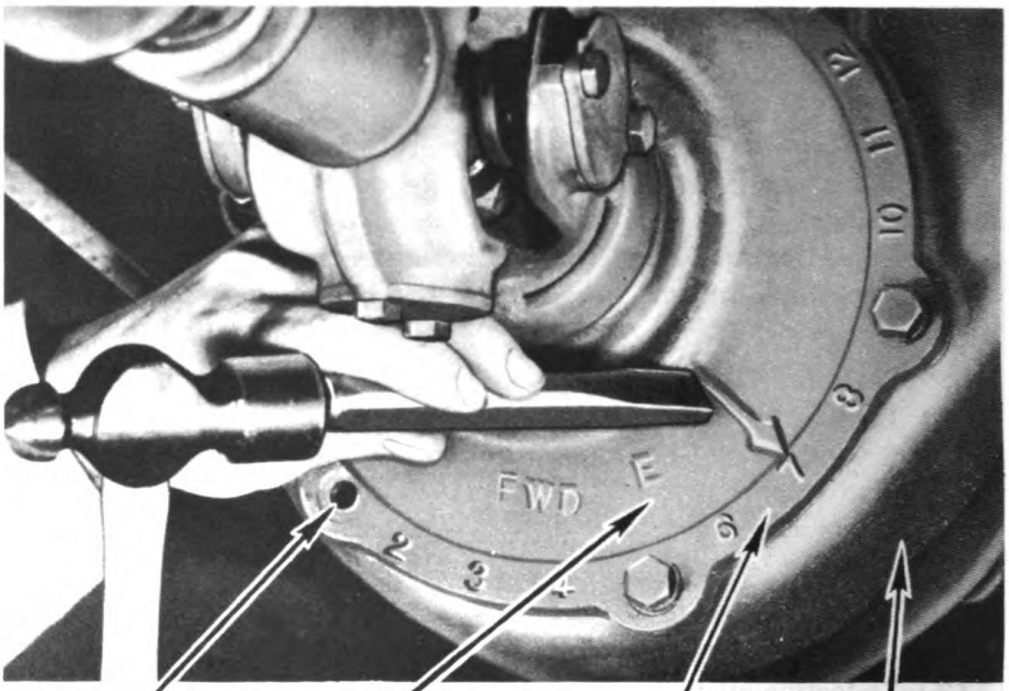

Figure 158—Silent Chain Adjustment

ers on both eccentric housings (front and rear) correspond with the same numbers on the clamp rings. Insert the two cap bolts that were removed and tighten all the bolts evenly (9/16-in. open-end wrench).

(3) If the locking lever on the transfer case should happen to strike the frame when making a chain adjustment, remove the cap bolts (9/16-in. open-end wrench) from the differential front housing and differential lock housing (fig. 157) and then turn the differential front housing until the lever is in a vertical position. Replace and tighten the cap bolts (9/16-in. open-end wrench).

TRANSFER CASE

148. TRANSFER CASE REMOVAL.

a. Equipment.

CHISEL, 6-in.
EXTENSION, 6-in.
HAMMER, 1-lb
HANDLE, flex
JACK, hydraulic
LIFTER, transfer case 7172
PLIERS
SCREWDRIVER, 6-in.
WRENCH, adjustable, 10-in.
WRENCH, box, ½-in.
WRENCH, box, 15/16-in.
WRENCH, open-end, 9/16-in. (2)
WRENCH, open-end, ¾-in. (2)
WRENCH, open-end, ⅞-in.
WRENCH, socket, ⅞-in.
WRENCH, socket, 1⅝-in.

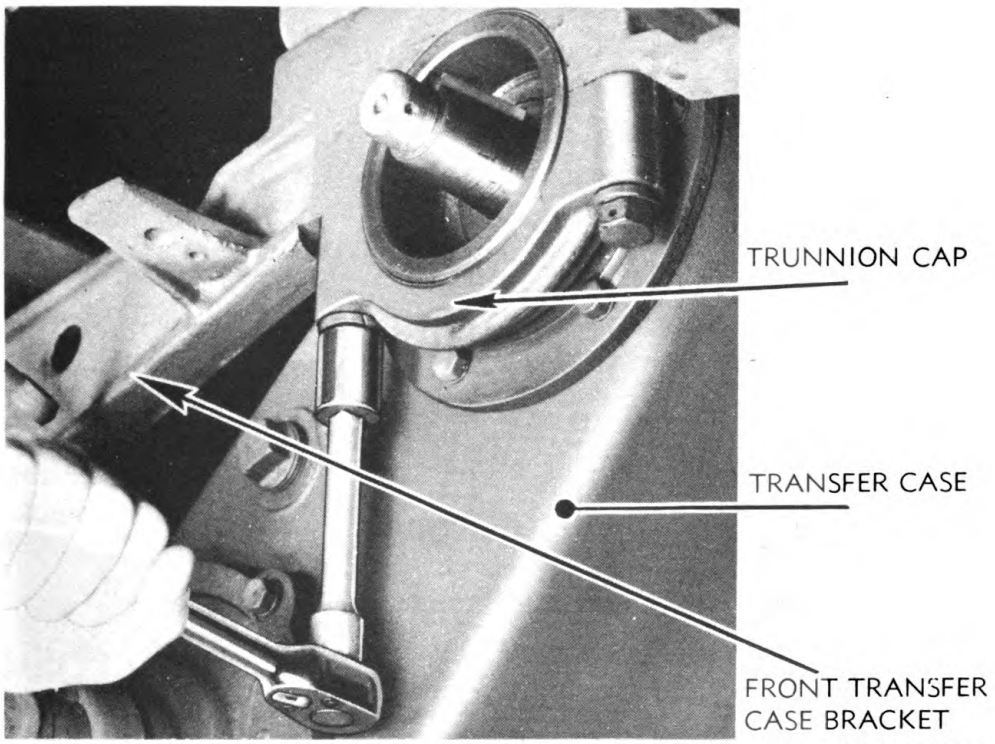

Figure 159—Removing Transfer Case Trunnion Cap Bolt

b. Procedure.

(1) DISCONNECT THE SHORT-COUPLED PROPELLER SHAFT.

WRENCH, open-end, 9/16-in. (2)

Remove the eight nuts, lock washers and bolts (two 9/16-in. open-end wrenches) from the rear flange of the short-coupled propeller shaft.

(2) REMOVE EMERGENCY BRAKE BAND (par. 66).

PLIERS
SCREWDRIVER, 6-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, ¾-in.
WRENCH, open-end, ⅞-in.

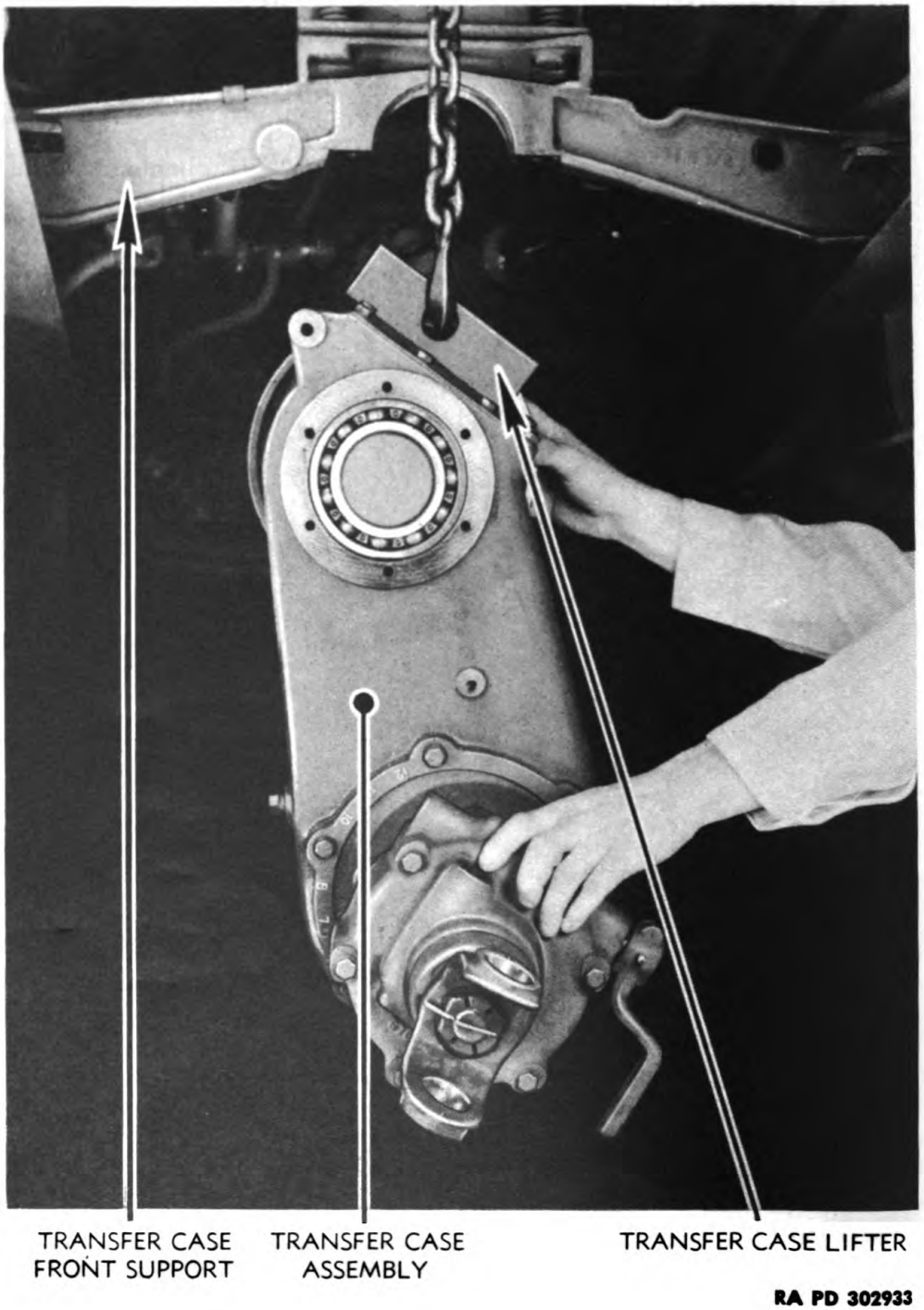

Figure 160—Removing Transfer Case

TRANSFER CASE

(3) REMOVE PROPELLER SHAFTS (par. 130).

CHISEL, 6-in.
HAMMER, 1-lb
WRENCH, box, ½-in.

(4) REMOVE SPEEDOMETER CABLE AND ADAPTER.

PLIERS
WRENCH, adjustable, 10-in.

Remove speedometer cable (pliers) from the adapter. Remove speedometer adapter from the transfer case (10-in. adjustable wrench). Remove the speedometer adapter sleeve (10-in. adjustable wrench) and then pull out the speedometer driven gear.

(5) DISCONNECT THE DIFFERENTIAL LOCK.

PLIERS

Remove the pull back spring (pliers). Remove cotter key from yoke pin (pliers) and remove the yoke pin.

(6) REMOVE MUFFLER (par. 109).

WRENCH, open-end, 9/16-in. (2)
WRENCH, open-end, ¾-in. (2)

(7) REMOVE TRANSFER CASE REAR SUPPORT.

JACK, hydraulic
PLIERS
WRENCH, box, 15/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, ⅞-in.

Remove the seven bolts (9/16-in. open-end wrench) holding rear support bracket to transfer case. Use hydraulic jack to support the transfer case. Remove the two transfer case rear support bolts (pliers, ⅞-in. open-end wrench, and 15/16-in. box wrench) and remove the rear support.

(8) REMOVE THE TRANSFER CASE.

EXTENSION, 6-in.
HANDLE, flex
LIFTER, transfer case, 7172
PLIERS
WRENCH, socket, ⅞-in.

Remove the wire holding the bolt heads in the front transfer case support cap. Remove the two bolts (⅞-in. socket wrench, 6-in. extension, and flex handle) (fig. 159). Remove two cap bolts (½-in. box wrench) from the top cover of the transfer case and attach the lifter (7172). Connect a chain hoist and lower transfer case to floor (fig. 160).

(9) REMOVE TRANSFER CASE BRAKE WHEEL.

HANDLE, flex
PLIERS
PULLER, brake wheel, 7167
WRENCH, socket, 1⅝-in.

Remove cotter key (pliers) holding nut to transfer case mainshaft. Remove the nut (1⅝-in. socket wrench and flex handle). Then remove the brake drum with (puller 7167).

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

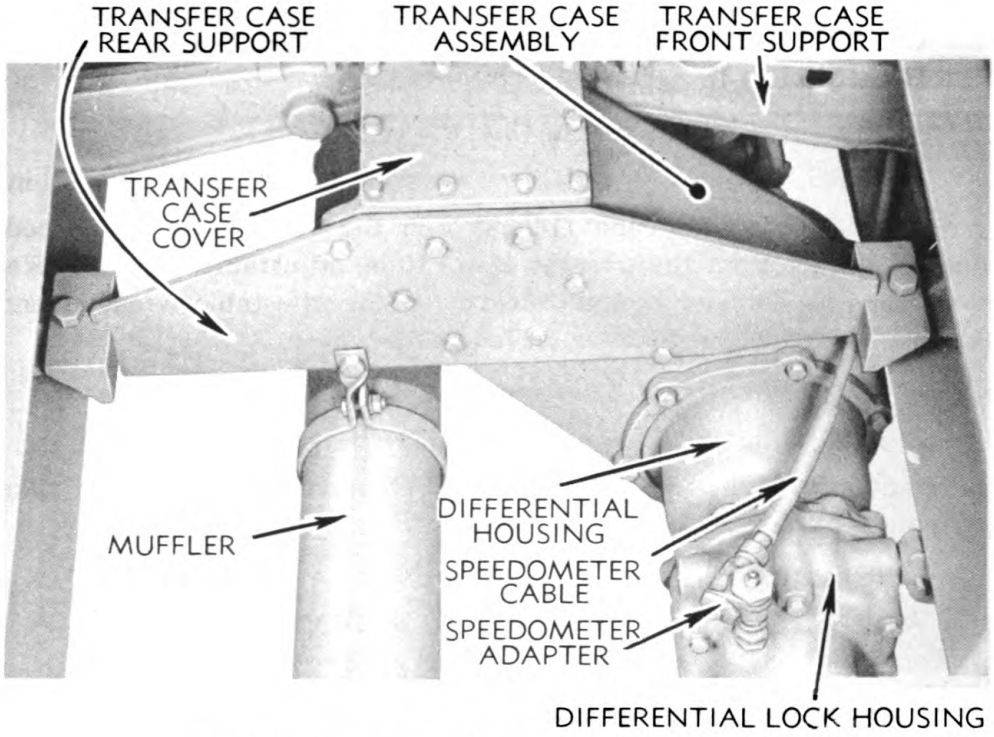

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Figure 161—Transfer Case Installed

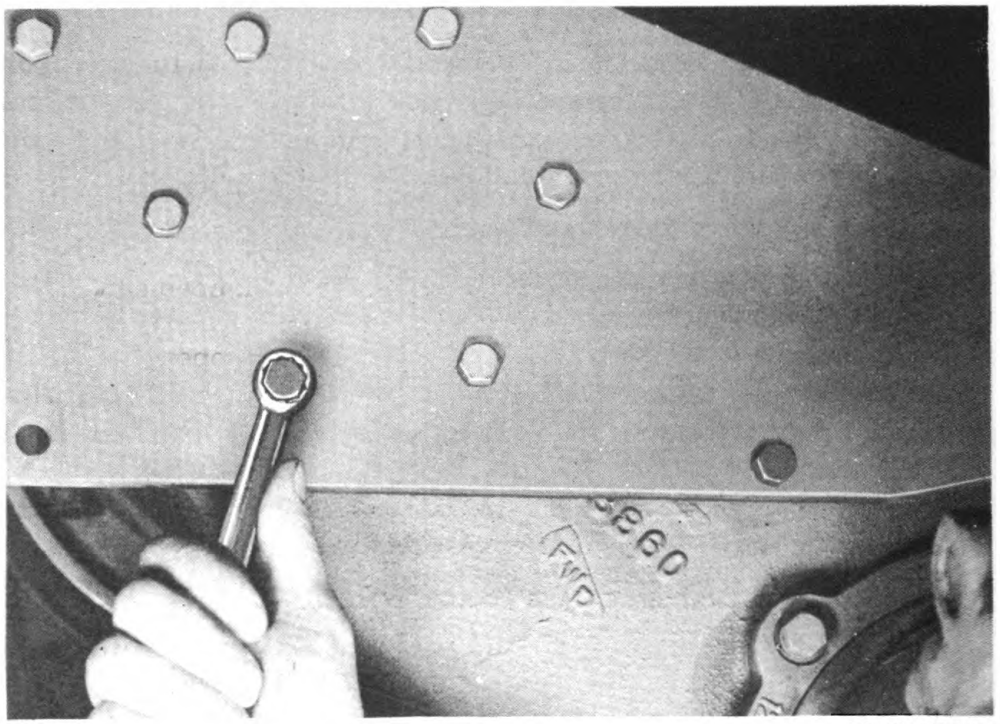

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Figure 162—Installing Rear Transfer Case Support Bolt

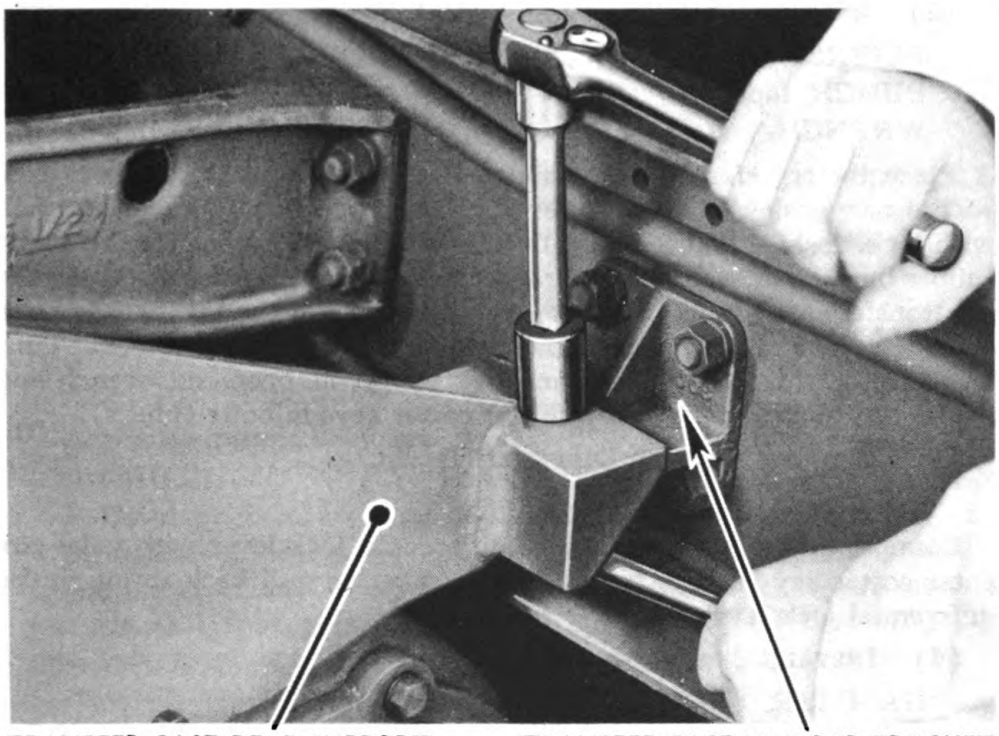

Figure 163—Installing Transfer Case Hanger Bracket Bolt

149. TRANSFER CASE INSTALLATION (figs. 161, 162 and 163).

a. Equipment.

CHISEL, 6-in.	WRENCH, adjustable, 10-in.
GUN, grease	WRENCH, box, ½-in.
HAMMER, 1-lb	WRENCH, box, 15/16-in.
HANDLE, flex	WRENCH, extension, 6-in.
HOIST, chain	WRENCH, open-end, 9/16-in. (2)
JACK, hydraulic	
LIFTER, transfer case, 7172	WRENCH, open-end, ¾-in. (2)
PLIERS	
PUNCH, taper	WRENCH, socket, ⅞-in.
SCREWDRIVER, 6-in.	WRENCH, socket, 1⅝-in.

b. Procedure.

(1) INSTALL TRANSFER CASE TO FRONT SUPPORT.

EXTENSION, 6-in.	PLIERS
HANDLE, flex	WRENCH, socket, ⅞-in.

Attach the transfer case lifter 7172 to the upper cover (½-in. box wrench) and connect to chain hoist. Raise transfer case in position in the front support. Place the front trunnion cap and install the two cap bolts and lock washers (⅞-in. socket wrench, 6-in. extension, and flex handle). Wire the two bolt heads together (pliers) (fig. 161).

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

(2) INSTALL REAR TRANSFER CASE SUPPORT.

PLIERS
PUNCH, taper
WRENCH, box, 15/16-in.
WRENCH, open-end, 9/16-in. (2)
WRENCH, open-end, 7/8-in.

Place the transfer case rear support in position on the transfer case with a new gasket. Enter the seven cap screws (fig. 162) and one bolt with lock washers and tighten (two 9/16-in. open-end wrenches). Enter a rubber bushing in each hanger bracket hole. Place a rubber pad between the transfer case support and hanger bracket. Enter the two hanger bolts and then place another rubber pad and steel plate on the bottom. Turn on the nuts with lock washers and tighten (7/8-in. open-end wrench and 15/16-in. box wrench) (fig. 163). Enter cotter keys in bolts (pliers).

(3) CONNECT CENTER DIFFERENTIAL LOCK.

PLIERS

Connect differential lock rod to differential lock lever with yoke pin, enter cotter key in yoke pin (pliers) and fasten pull back spring to the differential lock lever (pliers).

(4) INSTALL BRAKE WHEEL.

HAMMER, 1-lb.
HANDLE, flex
PLIERS
WRENCH, socket, 1 5/8-in.

Place key in transfer case mainshaft, place brake drum over mainshaft, enter companion flange on to transfer case mainshaft (hammer), turn on nut, and tighten securely (1 5/8-in. socket wrench and flex handle). Enter cotter key in nut (pliers).

(5) INSTALL EMERGENCY BRAKE BAND (par. 66).

PLIERS
SCREWDRIVER, 6-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 7/8-in.

(6) CONNECT THE SHORT-COUPLED PROPELLER SHAFT.

WRENCH, open-end, 9/16-in. (2)

Place the short-coupled propeller shaft in place and enter the eight bolts from the rear. Install nuts and lock washers and tighten (two 9/16-in. open-end wrenches).

(7) CONNECT PROPELLER SHAFTS (par. 130).

CHISEL, 6-in.
GUN, grease
HAMMER, 1-lb
WRENCH, box, 1/2-in.

(8) CONNECT SPEEDOMETER CABLE.

PLIERS
WRENCH, adjustable, 10-in.

Install speedometer adapter (10-in. adjustable wrench). Fasten speedometer cable to adapter (pliers).

(9) LUBRICATE TRANSFER CASE AND PROPELLER SHAFT U-JOINTS. Refer to Lubrication Guide, section VI.

GUN, grease

149a. TRANSFER CASE OIL SEAL REPLACEMENT.

a. Jackshaft Oil Seal Replacement.

(1) EQUIPMENT.

CHISEL
IRON, flat piece
HAMMER
HANDLE, ratchet
PLIERS
PULLER, universal joint, 7166
PUNCH
WRENCH, adjustable, 12-in.
WRENCH, open-end, ½-in.
WRENCH, socket, 1⅝-in.

(2) PROCEDURE.

(a) Disconnect Universal Joint.

CHISEL
HAMMER
WRENCH, open-end, ½-in.

Straighten the wings on the two lock plates that secure the four bolts to the jackshaft universal yoke (hammer and chisel). Remove the four cap screws (½-in. open-end wrench) and remove the two cover plates and locking plates. Tap the yoke lightly (hammer) to start the two needle cup assemblies from the yoke and pull the needle cup assemblies from the universal joint yoke. Separate the universal joint.

(b) Remove Universal Joint Yoke from Jackshaft.

HANDLE, ratchet
PLIERS
PULLER, universal joint, 7166
PUNCH
WRENCH, adjustable, 12-in.
WRENCH, socket, 1⅝-in.

Remove the cotter key from the jackshaft (pliers). Remove the jackshaft nut (ratchet handle and 1⅝-in. socket wrench). Pull the universal joint yoke from the jackshaft (universal joint puller 7166 and 12-in. adjustable wrench). Remove the key from the jackshaft (hammer and punch). Split the oil seal in two halves (hammer and chisel) and remove the oil seal.

(c) Install Oil Seal and Universal Joint Yoke.

DRIVER, jackshaft oil seal, 7129
HAMMER
HANDLE, ratchet
PLIERS
SLEEVE, oil seal installing, 7144
WRENCH, socket, 1⅝-in.

Slide the oil seal installing sleeve, 7144, on to the jackshaft. Slide the oil seal into place on the housing and then drive the seal into place (hammer and jackshaft oil seal driver, 7129). Place the jackshaft key in position (hammer). Slide the universal joint yoke on the jackshaft and tighten it with the jackshaft nut (ratchet handle and 1⅝-in. socket wrench). Lock the nut with a cotter key (pliers).

(d) Connect Universal Joint.

CHISEL
HAMMER
WRENCH, open-end, ½-in.

Slide the universal joint center cross into the yoke. Slide the two needle bearing assemblies into the yoke and on the center cross with slots toward the cap screw holes. Place the two cover plates and cover plate locks on the yoke and tighten them with the four cap screws (½-in. open-end wrench). Lock the cap screws by bending the wings of the locking plates against the cap screw heads (hammer and chisel).

b. Transfer Mainshaft Oil Seal Replacement.

(1) EQUIPMENT.

CHISEL	SCREWDRIVER
DRIVER, upper oil seal, 7130	SLEEVE, oil seal installing, 7128
HAMMER	WRENCH, adjustable, 12-in.
HANDLE, flex	WRENCH, open-end, 9/16-in. (2)
PLIERS	WRENCH, socket, 1⅝-in.
PULLER, brake wheel, 7167	
PUNCH	

(2) PROCEDURE.

(a) Disconnect the Short-coupled Propeller Shaft (par. 132).

WRENCH, open-end, 9/16-in. (2)

(b) Remove Parking Brake Drum (par. 66).

HANDLE, flex	WRENCH, adjustable, 12-in.
PLIERS	WRENCH, socket, 1⅝-in.
PULLER, brake wheel, 7167	

(c) Remove Oil Seal.

CHISEL	PUNCH
HAMMER	SCREWDRIVER

Remove the mainshaft key (hammer and punch). If the oil seal does not fit too tight, it may be removed with a screwdriver. If the oil seal has a tight fit in the mainshaft front cover, it may be removed by cutting it in half (hammer and chisel).

(d) Install Oil Seal.

DRIVER, upper oil seal, 7130	SLEEVE, oil seal installing, 7128
HAMMER	

Slide the oil seal in position on the transfer mainshaft, using an oil seal installing sleeve, 7128. Drive the oil seal into place (oil seal driver 7130, and hammer).

(e) Install Parking Brake Drum (par. 66).

HAMMER, 1-lb	PLIERS
HANDLE, flex	WRENCH, socket, 1⅝-in.

(f) Connect the Short-coupled Propeller Shaft (par. 132).

WRENCH, open-end, 9/16-in. (2)

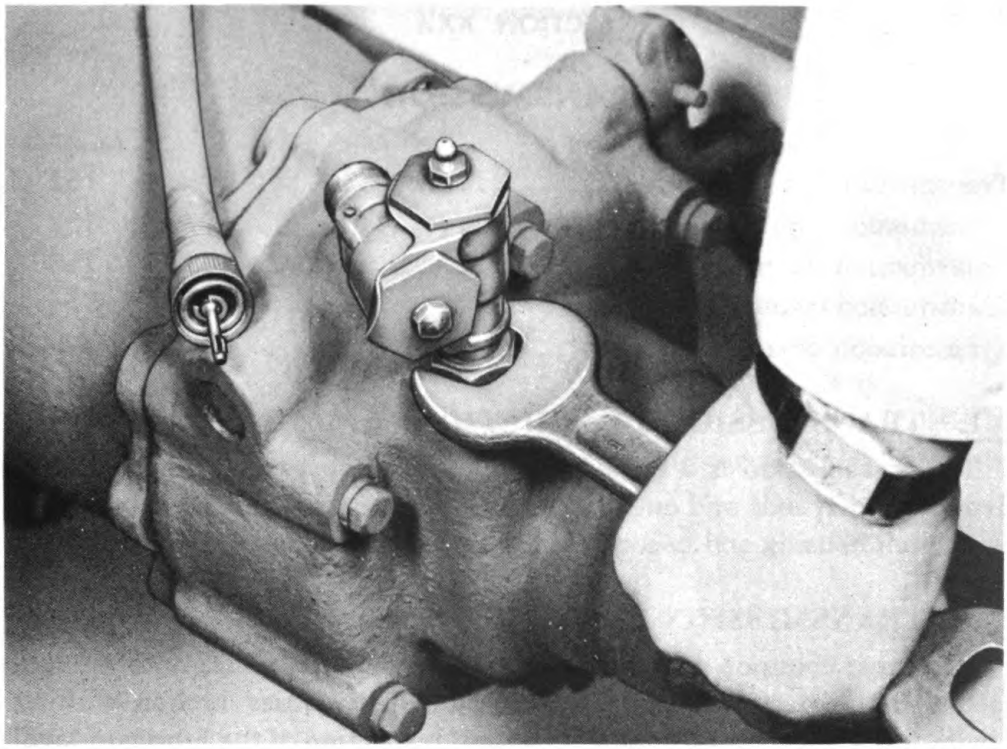

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Figure 164—Installing Speedometer Adapter

150. SPEEDOMETER ADAPTER REPLACEMENT.

a. Equipment.

PLIERS
WRENCH, open-end, 1-in.

b. Procedure.

(1) REMOVE CABLE.

PLIERS

Remove the cable from speedometer adapter (pliers).

(2) REMOVE ADAPTER.

WRENCH, open-end, 1-in.

Remove the adapter coupling from the transfer case. Do not remove the connection in transfer housing (1-in. open-end wrench). Remove adapter.

(3) INSTALL ADAPTER.

WRENCH, open-end, 1-in.

Install adapter into transfer case housing coupling, making sure the offset in driven shaft is lined up with slot in adapter. Tighten nut (1-in. open-end wrench) (fig. 164).

(4) INSTALL CABLE.

PLIERS

Slip speedometer cable into adapter; make sure slots are fitted. Tighten nut (pliers).

SECTION XXX

TRANSMISSION

151. TRANSMISSION DESCRIPTION (fig. 165).

The transmission is a constant mesh and clash type. It incorporates five forward speeds and one reverse speed. The transmission is bolted to the clutch housing and becomes a part of the unit power plant assembly.

152. TRANSMISSION TROUBLE SHOOTING.

The most common abuse to which a transmission is likely to be subjected is the inexpert shifting of gears, which causes broken shifting levers, forks, springs and shafts. Frequent inspection of the lubricant level and the gaskets, to insure against lubricant leakage, is the major service requirement.

a. Gears Difficult to Shift.

Possible Cause	Possible Remedy
(1) Clutch dragging.	Adjust clutch (par. 69).
(2) Transmission oil too heavy.	Change lubricant. Refer to Lubrication Guide (section VI).
(3) Center control pivot pin worn or loose.	Replace cover (par. 154A).
(4) Shifting yoke slots worn.	Replace cover (par. 154A).

b. Oil Leakage.

(1) Transmission overfilled.	Drain to proper level. Refer to Lubrication Guide (section VI).
(2) Cover loose or gasket damaged.	Tighten or replace gasket (par. 154A).
(3) Universal joint companion flange hub worn.	Report to higher authority.

c. Gear Interference.

(1) Shifting yokes may be sprung.	Replace cover (par. 154A).
(2) Shafts have excessive end play.	Replace cover (par. 154A).

TRANSMISSION

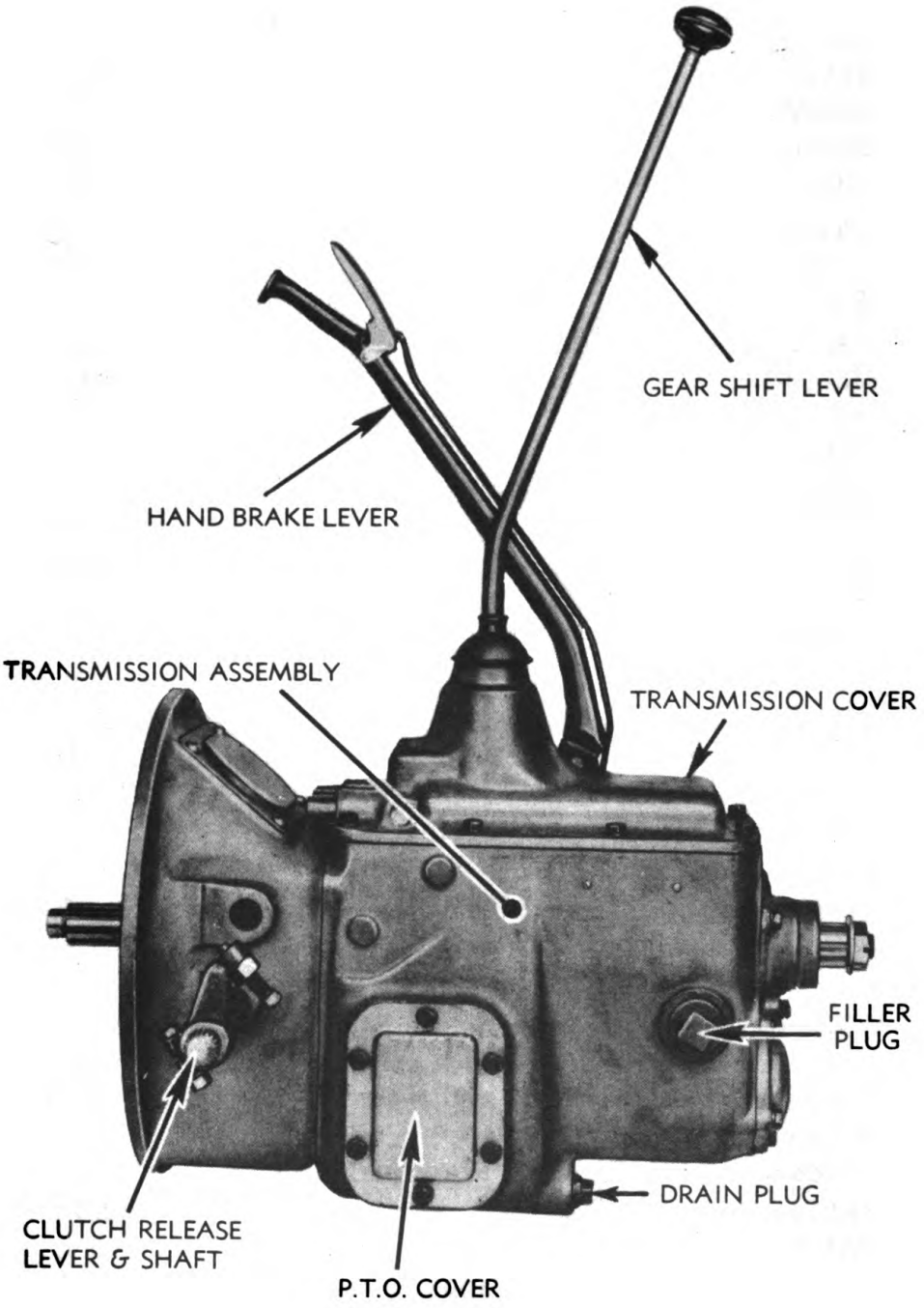

Figure 165—Transmission

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

153. TRANSMISSION REMOVAL.

a. Equipment.

BAR, pinch
CHAIN
HAMMER
HOIST, chain
PLIERS
SCREWDRIVER
WRENCH, box, 9/16-in.
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 3/4-in.

b. Procedure.

(1) REMOVE FOOT ACCELERATOR AND ACCELERATOR BUTTON.

PLIERS

Pull accelerator pedal up all the way. Depress the spring catch and slide pedal down and off the pedal bracket. Remove the accelerator button from the accelerator rod (pliers).

(2) REMOVE CLUTCH AND BRAKE PEDALS.

WRENCH, open-end, 3/4-in.

Remove nut and lock washer from each pedal (3/4-in. open-end wrench) where it fastens to brake and clutch levers just below toe boards, and remove pedals and felt pads from toe boards.

(3) REMOVE FLOOR BOARDS.

SCREWDRIVER
WRENCH, open-end, 1/2-in.

Remove the seven cap screws (1/2-in. open-end wrench) holding floor boards to cab frame. Remove the six wood screws (screwdriver) fastening the two floor boards together. Then remove the rear board first.

(4) REMOVE TOE BOARDS.

WRENCH, open-end, 1/2-in.

Remove the eight cap screws holding the toe boards to the cab frame; remove the left-hand board first.

(5) REMOVE CAB BASE CROSS CHANNEL SUPPORT.

WRENCH, box, 9/16-in.
WRENCH, open-end, 9/16-in.

Remove the two bolts, nuts and lock washers (9/16-in. open-end wrench and 9/16-in. box wrench) from each end of the cab base cross channel and remove cross channel.

(6) REMOVE MUFFLER TAIL PIPE (par. 108).

BAR, pinch, 12-in.
HAMMER
WRENCH, open-end, 9/16-in.
(2)

(7) REMOVE MUFFLER (par. 109).

BAR, pinch, 12-in.
HAMMER
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 3/4-in.

(8) REMOVE EXHAUST PIPE REAR SECTION (par. 110).

WRENCH, open-end, 9/16-in.

(9) DISCONNECT ALINEMENT JOINT.

WRENCH, box, 9/16-in.
WRENCH, open-end, 9/16-in.

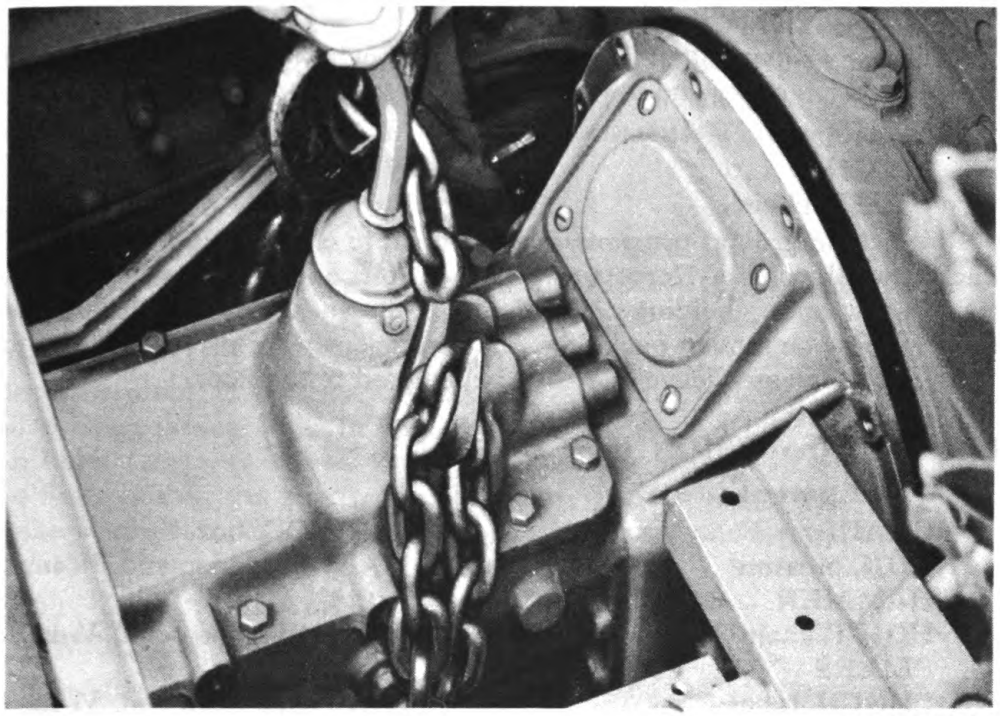

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Figure 166—Removing Transmission

Remove the eight nuts, lock washers and bolts (9/16-in. open-end wrench and 9/16-in. box wrench) holding the front companion flange of the alinement joint to the transmission mainshaft companion flange. This will allow alinement shaft to drop down at the front end.

(10) DISCONNECT SPEEDOMETER CABLE.

SCREWDRIVER

Remove screw (screwdriver) in clutch inspection cover that anchors speedometer cable.

(11) DISCONNECT CLUTCH AND BRAKE LEVERS.

PLIERS

Disconnect the clutch pull back spring (pliers) from bracket at top of PTO. Remove cotter pin (pliers) from brake rod yoke pin and remove pin from yoke.

(12) DISCONNECT PTO PROPELLER SHAFT.

HAMMER, 1-lb

WRENCH, socket head set screw, 1/4-in.

Loosen hollow head set screw (1/4-in. socket head set screw wrench) at PTO end of propeller shaft. Slide snap ring at front end of propeller shaft about two inches back from original position. Drive (1-lb hammer) propeller shaft toward front end of truck to release from PTO drive end.

(13) DISCONNECT PARKING BRAKE.

WRENCH, open-end, 9/16-in.

Remove two cap bolts (9/16-in. open-end wrench) holding parking brake to transmission cover and lower brake lever to floor.

(14) REMOVE TRANSMISSION.

CHAIN,
HOIST, chain
WRENCH, open-end, 9/16-in.

Place chain around transmission and hook to chain hoist. Remove the slack from the chain. Remove the 12 cap bolts and lock washers (9/16-in. open-end wrench) holding transmission to flywheel housing. Transmission can now be moved back (fig. 166) sufficiently for drive end gear to clear clutch release sleeve and then be lowered to the floor.

154. TRANSMISSION INSTALLATION.

a. Equipment.

CHAIN
GUN, pressure
HAMMER
HOIST, chain
PLIERS
PUNCH, taper
SCREWDRIVER
WRENCH, box, 9/16-in.
WRENCH, open-end, 9/16-in.
(2)
WRENCH, open-end, 3/4-in.
(2)
WRENCH, open-end, 7/8-in.

b. Procedure.

(1) INSTALL TRANSMISSION ASSEMBLY.

CHAIN
HAMMER
HOIST, chain
PLIERS
PUNCH, taper
SCREWDRIVER
WRENCH, box, 9/16-in.

Place chain around transmission and hook to chain hoist. Raise transmission to proper level so transmission drive end gear will enter the clutch disk spline. Move transmission ahead until spline on drive end gear strikes clutch disk hub. Shift the transmission in high gear and turn the mainshaft sufficiently to match spline on drive end gear with spline in clutch disk and slide transmission into position. Line up drilling in clutch and flywheel housing (taper punch) and start the 12 cap bolts and washers. Tighten the cap bolts evenly (9/16-in. box wrench).

(2) CONNECT CLUTCH AND BRAKE LEVERS.

PLIERS
WRENCH, open-end, 9/16-in.

Hook clutch lever return spring (pliers) to bracket at top of power take-off. Connect the foot brake rod to lever with yoke pin and enter cotter key (pliers). Connect parking brake lever to transmission cover with two cap bolts (9/16-in. open-end wrench).

(3) ANCHOR SPEEDOMETER CABLE.

SCREWDRIVER

Anchor speedometer cable to cap screw in clutch inspection cover (screwdriver).

(4) CONNECT ALINEMENT JOINT.

WRENCH, box, 9/16-in. WRENCH, open-end, 9/16-in.

Raise the front end of the alinement joint and line up the flanges. Enter the eight bolts through the alinement joint flanges. (Enter bolts from front side of flange.) Place lock washers and nuts and tighten evenly (9/16-in. open-end wrench).

(5) INSTALL FLOOR AND TOE BOARDS.

SCREWDRIVER WRENCH, open-end, 1/2-in.
WRENCH, box, 9/16-in. WRENCH, open-end, 9/16-in.

Place the cab base cross channel support and fasten with four bolts, lock washers and nuts (9/16-in. open-end wrench and 9/16-in. box wrench). Place the metal toe boards, the left one first. Have the foot accelerator rod entered through hole in left toe board. Secure toe boards with eight cap bolts (1/2-in. open-end wrench). Place the floor boards—the front one first. Fasten the boards to cab frame with seven cap bolts and flat washers (1/2-in. open-end wrench). Enter the six wood screws (screwdriver) that hold the two floor boards together.

(6) INSTALL CLUTCH AND BRAKE PEDALS.

WRENCH, open-end, 3/4-in.

Enter the clutch and brake pedals through the left toe board with felt bumper pad on each pedal and fasten pedals to the clutch and brake levers (3/4-in. open-end wrench).

(7) INSTALL FOOT ACCELERATOR PAD AND BUTTON.

PLIERS

Turn on and tighten (pliers) the foot accelerator button to the foot accelerator rod. Replace foot accelerator pad.

(8) INSTALL REAR EXHAUST PIPE (par. 110).

WRENCH, open-end, 9/16-in. (2) WRENCH, open-end, 3/4-in. (2)

(9) INSTALL MUFFLER (par. 109).

WRENCH, open-end, 9/16-in. WRENCH, open-end, 7/8-in.
WRENCH, open-end, 3/4-in.

(10) INSTALL TAIL PIPE (par. 108).

WRENCH, open-end, 9/16-in. (2)

(11) CHECK CLUTCH RELEASE BEARING AND TRANSMISSION LUBRICATION. Refer to Lubrication Guide, section VI.

154a. TRANSMISSION COVER REPLACEMENT.

a. Equipment.

SCREWDRIVER, 6-in. WRENCH, open-end, 9/16-in.
WRENCH, open-end, 1/2-in.

b. Procedure.

(1) REMOVE FLOOR BOARDS (par. 153 b (3)).

SCREWDRIVER WRENCH, open-end, 1/2-in.

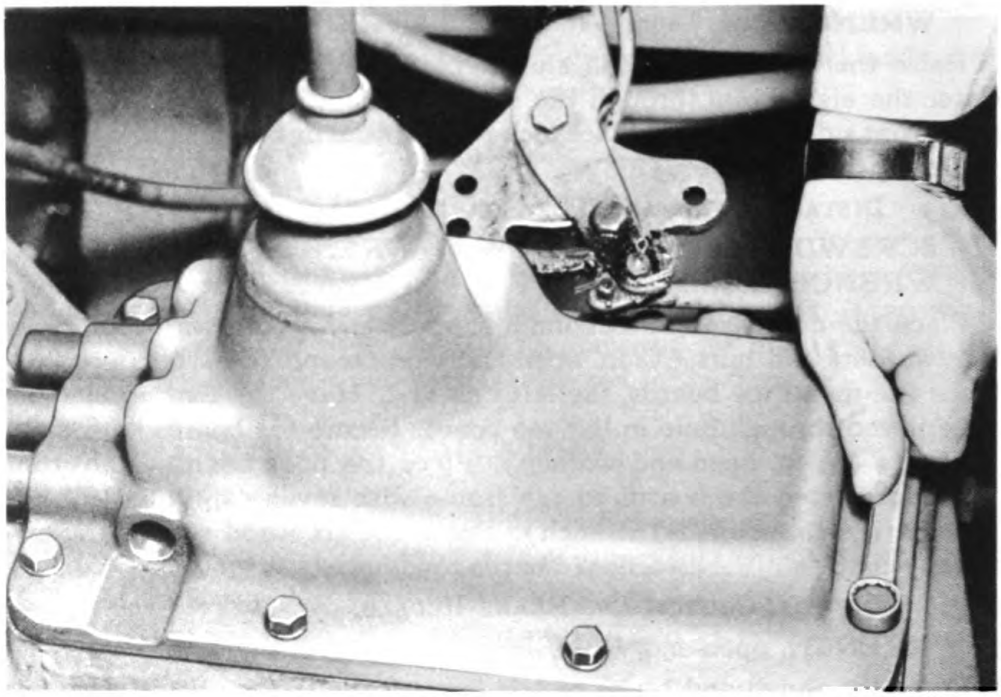

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Figure 167—Installing Transmission Cover

(2) REMOVE TRANSMISSION COVER.

WRENCH, open-end, 9/16-in.

Remove two cap bolts and lock washers (9/16-in. open-end wrench) attaching emergency brake lever to the transmission cover. Remove eight cap bolts and washers holding cover to transmission. Lift the cover from transmission.

(3) INSTALL TRANSMISSION COVER.

WRENCH, open-end, 9/16-in.

(a) Place shifter forks in cover in neutral position.

(b) Place transmission gears in neutral position.

(c) Install new cover gasket.

(d) Lower the cover on to the transmission, making sure the shifter forks enter the sliding gears.

(e) Bolt cover to transmission with eight cap bolts and washers (9/16-in. open-end wrench) (fig. 167).

(f) Bolt emergency brake lever to transmission cover with two cap bolts and lock washers (9/16-in. open-end wrench).

(4) REPLACE FLOOR BOARDS (par. 154 b (5)).

SCREWDRIVER, 6-in. WRENCH, open-end, 1/2-in.

Section XXXI

WHEELS

155. WHEEL AND TIRE DESCRIPTION.

a. Wheel Description. The wheels are a demountable 20 x 8, steel disk, ventilated type, complete with rim. The rim is so designed that it has a removable side ring which is held in place by a split locking ring. The locking ring is fastened permanently to the side ring with two rivets. The ring is of spring design, so that it can be sprung from its seat in the wheel in the removal of the side ring. It retains its shape and tension and easily snaps in place when reinstalled. The wheel has ten mounting holes for the purpose of fastening it to the hub. These holes are chamfered, so that the wheel nuts will hold the wheel securely in place and prevent any movement which might tend to wear the wheel studs.

b. Tire Description. The tires are of a popular make and of conventional design, with conventional tubes and standard type flap. The tire tread is a high-traction, non-directional type. Each tire is of ten-ply construction, 9.00 x 20 size. The size and ply are marked on the side of the tire. As in 9.00 x 20, the first figure (9.00) is the width in inches when the tire is properly mounted, inflated and carrying no load. The second figure (20) is the inside diameter of the bead in inches. This dimension is sometimes referred to as the rim diameter. The proper inflation of these tires is 60 pounds per square inch.

156. WHEEL TROUBLE SHOOTING.

a. Wheel Wobble.

Possible Cause	Possible Remedy
(1) Loose wheel bearings.	Adjust (par. 157).
(2) Loose wheel studs or cap nuts.	Tighten (par. 158 b (3)).
(3) Bent or broken wheel.	Replace (pars. 158 and 159).

Possible Cause	Possible Remedy
b. Shimmy.	
(1) Loose wheel bearings.	Adjust (par. 157).
(2) Defective steering mechanism.	Refer to trouble shooting in Steering Gear, section XXVIII.
(3) Improper toe-in, caster, or camber angle.	Refer to (par. 41 f).
c. Wheels Do Not Track.	
(1) Bent frame.	Report to higher authority.
(2) Axles shift on springs.	Locate properly and tighten spring clips (par. 138).
(3) Broken spring bolts.	Replace (par. 138).
(4) Broken spring.	Replace (par. 138).
d. Grease Leaks.	
(1) Defective wheel bearing oil seals.	Replace (pars. 161 and 162).
(2) Loose wheel driving flange or defective gasket.	Tighten flange nuts or replace gasket (pars. 48 and 160).
e. Wheel Noises.	
(1) Improper wheel bearing adjustment.	Adjust (par. 157).
(2) Lack of lubrication.	Lubricate (par. 157).
(3) Worn or broken wheel bearings.	Replace (pars. 161 and 162).
(4) Loose wheel studs or cap nuts.	Tighten (pars. 158 and 159).

157. WHEEL MAINTENANCE AND ADJUSTMENTS.

a. Wheel Maintenance. Inspect wheels at intervals to determine if they are sprung or cracked, and have any discrepancies repaired. Check the ten wheel cap nuts to be sure that they are all tight. It is well to check and tighten these nuts daily for the first 500 to 1,000 miles to compensate for the "setting in" of the clamping surfaces. Use the wrench provided for this purpose. Do not use any extra extension. Apply no force other than direct hand effort. Successively tighten opposite nuts to prevent cocking the wheel on the studs. Never use oil on wheel studs or nuts. For proper adjustment of the wheel bearings, refer to paragraph 157 **c** and **d.**

b. Wheel Lubrication. Pack wheel bearings every 6,000 miles in accordance with instructions contained in section VI. For removal of wheel bearings, refer to paragraphs 160 and 161. Clean wheel bearing thoroughly in SOLVENT, dry-cleaning. Dry the bearing thoroughly. Submerge the bearing in light engine oil and then work wheel bearing grease (see Lubrication, section VI) between the bearing rollers with the palm of hands until the lubricant is well worked in. Clean the wheel hub

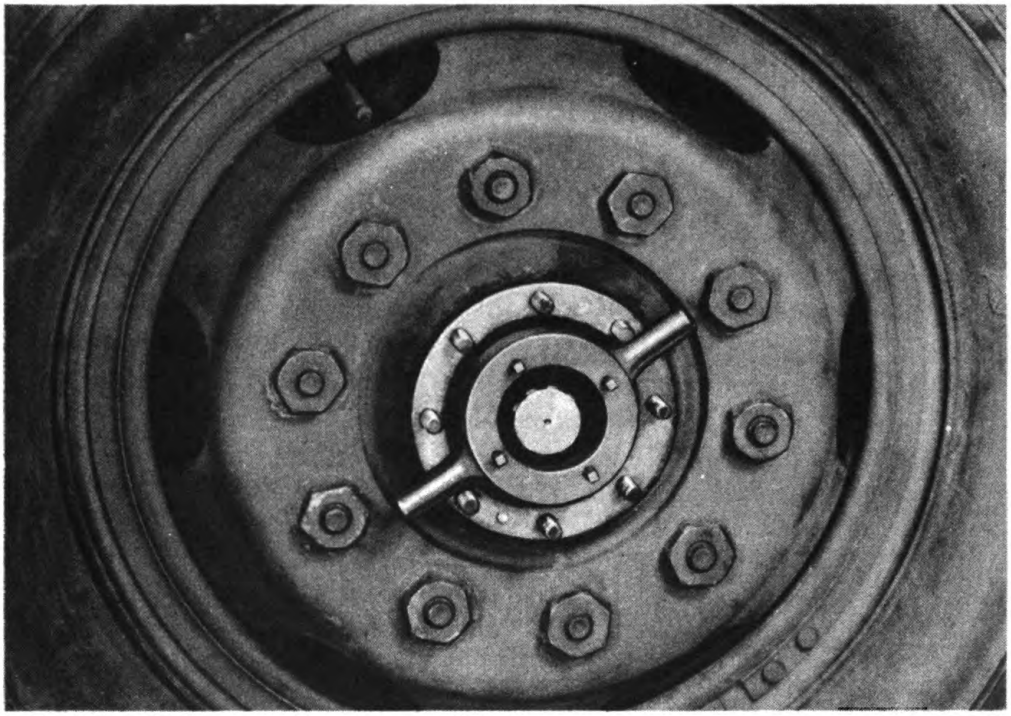

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Figure 168—Skein Nut Wrench in Wheel

and skein and pack one and one-half pounds of wheel bearing grease inside the front wheel hub and around the skein and two pounds in each rear hub.

c. Front Wheel Bearing Adjustment.

(1) EQUIPMENT.

HAMMER
HANDLE, speed
JACK, hydraulic
PUNCH
WRENCH, open-end, 9/16-in.
WRENCH, skein nut (68869)
WRENCH, socket, 5/8-in.

(2) PROCEDURE.

(a) Raise Vehicle.

JACK, hydraulic

Place hydraulic jack under axle housing and raise vehicle until wheel is clear.

(b) Remove Driving Flange (par. 160).

WRENCH, open-end, 9/16-in.
WRENCH, socket, 5/8-in.

(c) Remove Skein Lock Nut.

WRENCH, skein nut (68869)

Place skein nut wrench in wheel and remove skein lock nut by turning wheel to the left. Remove skein nut and adjusting nut lock washer.

(d) Bearing Adjustment.

WRENCH, skein nut (68869)

Place skein nut wrench in wheel and turn wheel to the right until the adjusting nut is tight (fig. 168). Then back off adjusting nut one-quarter turn.

(e) Lock Adjustment.

WRENCH, skein nut (68869)

Place adjusting nut lock washer on skein, so that curved wings stick over adjusting nut. Turn skein lock nut on to skein and tighten securely (skein nut wrench 68869). Lock adjusting nut by bending a wing of the lock into slot of adjusting nut (hammer and punch).

(f) Replace Driving Flange (par. 160).

WRENCH, open-end, 9/16-in.
WRENCH, socket, 5/8-in.

(g) Remove Hydraulic Jack from Vehicle.

d. Rear Wheel Bearing Adjustment.

(1) EQUIPMENT.

EXTENSION, 5-in.
HAMMER
HANDLE, flex, 18-in.
PUNCH, 1/4-in.
WRENCH, open-end, 9/16-in.
WRENCH, socket, 15/16-in.
WRENCH, skein nut (68869)

(2) PROCEDURE.

(a) Remove Rear Axle Shaft (par. 161).

EXTENSION, 5-in.
HANDLE, flex, 18-in.
WRENCH, open-end, 9/16-in.
WRENCH, socket, 15/16-in.

(b) Adjust Wheel Bearings.

HAMMER
PUNCH
WRENCH, skein nut (68869)

Place the skein nut wrench in the outer skein nut and turn wheel counterclockwise until nut is removed, remove the lock washer and then place the skein nut wrench on the inner nut and turn the wheel clockwise until tight; then back off adjusting nut one-quarter turn. Replace lock washer on skein, so one wing of lock washer lines up with slot in adjusting nut. Turn lock nut on skein and tighten (skein nut wrench). Lock inner or adjusting nut by bending wing of lock washer in slot (hammer and punch).

(c) Install Rear Axle Shaft (par. 161).

EXTENSION, 5-in.
HANDLE, flex, 18-in.
WRENCH, open-end, 9/16-in.
WRENCH, socket, 15/16-in.

158. FRONT WHEEL REPLACEMENT.

a. Equipment.

JACK, hydraulic
WRENCH, wheel nut, 1 1/2-in. (standard)

b. Procedure.

(1) RAISE VEHICLE (FRONT).

JACK, hydraulic

Place jack under axle on side of vehicle that is to be raised. Jack up vehicle until truck wheel is clear.

(2) REMOVE WHEEL.

WRENCH, wheel nut, 1½-in. (hexagon end)

Remove ten cap nuts at outside of wheel (1½-in. wheel nut wrench). NOTE: The mounting nuts have either a right-hand or left-hand thread. The left wheel nuts have a left-hand thread and the right wheel nuts a right-hand thread. The directions of all the threads on one side of the vehicle are the same. If the direction of the thread cannot be readily ascertained by the letters "R" and "L" stamped on the nut, turn the nut alternately left and right with the wheel wrench, using increasing force until it loosens. If possible, keep the brakes set while loosening the nuts. If this is not possible, loosen the nuts one turn before jacking the wheel clear. However, do not remove the nuts with the wheel on the ground. The weight of the vehicle will bind or strip the threads.

(3) INSTALLING WHEEL.

JACK, hydraulic

WRENCH, wheel nut, 1½-in. (standard)

Raise vehicle (hydraulic jack) to a position high enough so wheel may be placed on wheel studs. Place front wheel on studs, so that one of the openings in the disk lines up with the inspection plate in the brake drum. The dished section of the wheel should extend over the brake drum. The wheel is held on the hub with a ball end type of cap nut which fits into corresponding ball seats in the wheel. The stud holes in the wheel have considerable clearance around the studs, so that the load is not carried directly on the studs but through the cap nuts. The ball seats center the wheel and hold it in line. Tighten the cap nuts (wheel nut wrench) in accordance with the type of thread stamped on the nut. NOTE: Final tightening should be made after the wheel is lowered to the ground.

159. REAR WHEEL REPLACEMENT.

a. Equipment.

JACK, hydraulic

WRENCH, wheel nut (standard)

b. Procedure.

(1) REMOVE OUTER REAR WHEEL.

JACK, hydraulic

WRENCH, wheel nut

Place jack under rear axle on the side that wheel is to be removed. Raise the jack until the wheel clears the ground. See NOTE in paragraph 158 b (2) for wheel nut removal. Remove the ten outer hexagon wheel nuts (wheel nut wrench). Remove the outer wheel.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

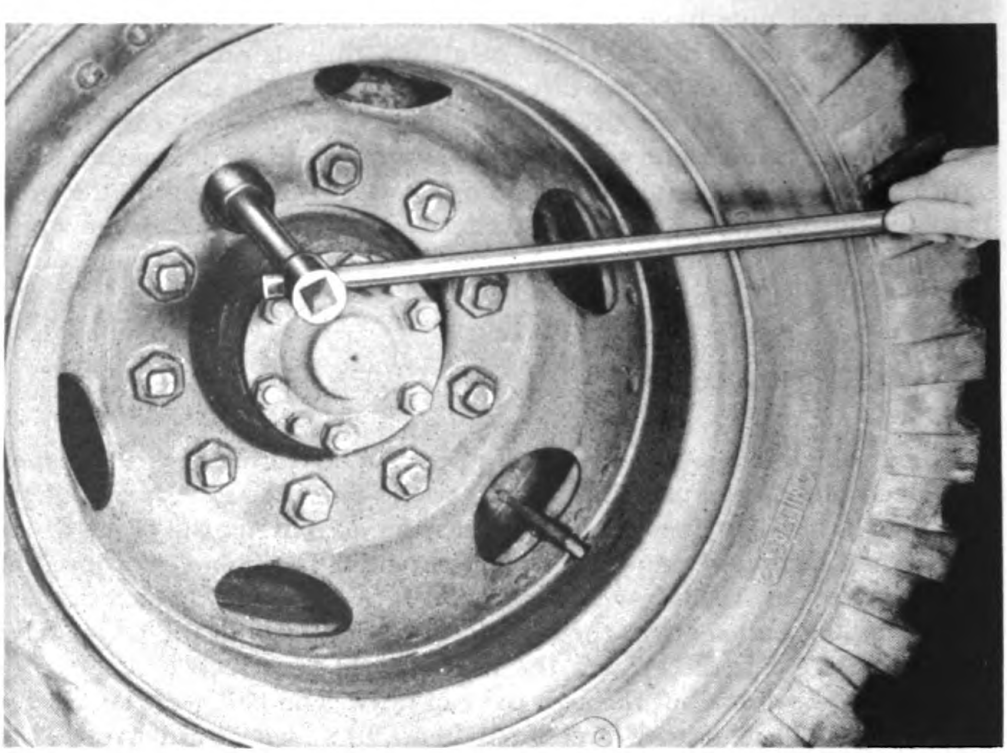
(2) REMOVE INNER REAR WHEEL.

JACK, hydraulic — WRENCH, wheel nut

Remove the ten inner wheel nuts (wheel nut wrench square end). Remove the rear inner wheel. **NOTE:** Rotation of the inner nuts is the same as the outer.

(3) INSTALL INNER REAR WHEEL.

JACK, hydraulic — WRENCH, wheel nut (standard)



RA PD 302942

Figure 169—Tightening Rear Wheel Nut

Raise the axle to the proper height (hydraulic jack). Slide the inner wheel on the wheel studs, dished part of wheel toward the frame. Tighten the inner wheel with the ten inner wheel nuts, square head (wheel nut wrench, square end).

(4) INSTALL OUTER REAR WHEEL.

JACK, hydraulic — WRENCH, wheel nut (standard)

Slide the outer wheel on the wheel studs, dished part of wheel to the outside. Tighten the wheel with the ten outer wheel nuts (wheel nut wrench, hexagon end) (fig. 169).

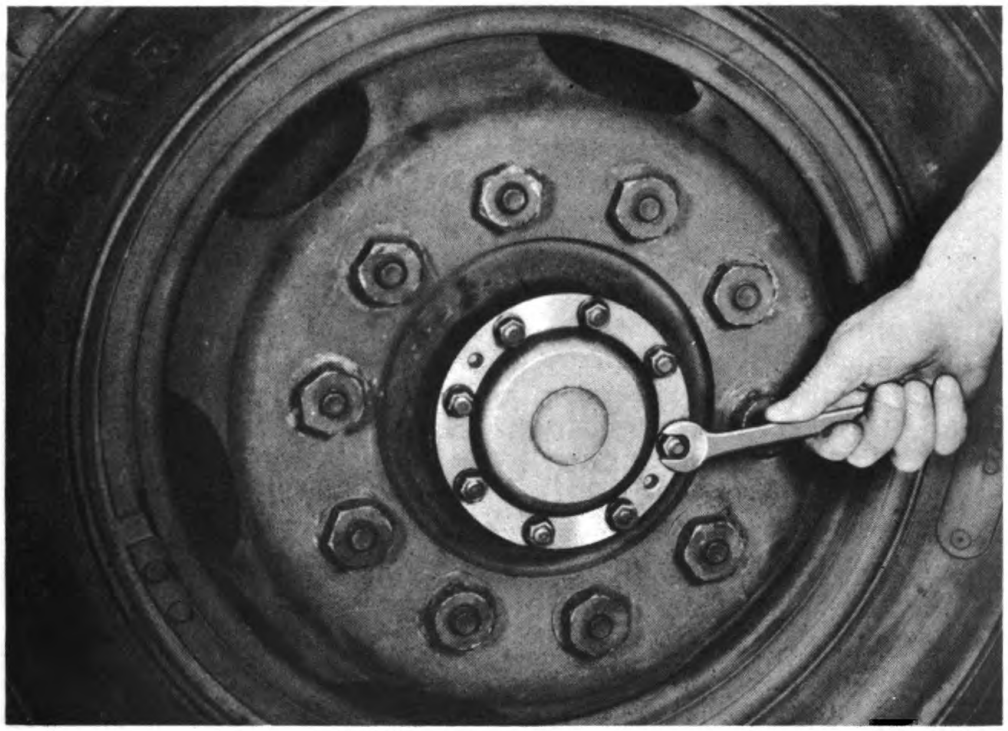


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Figure 170—Removing Front Driving Flange Nut

160. FRONT WHEEL HUB REPLACEMENT.

a. Equipment.

HAMMER, 1-lb
HANDLE, speed
JACK, hydraulic
PUNCH, taper
WRENCH, open-end, 9/16-in.
WRENCH, skein (68869)
WRENCH, socket, 5/8-in.
WRENCH, wheel nut, 1 1/2-in. (standard)

b. Procedure.

(1) REMOVE FRONT WHEEL AND TIRE (par. 158).

JACK, hydraulic
WRENCH, wheel nut, 1 1/2-in. (standard)

(2) REMOVE DRIVING FLANGE.

HANDLE, speed
WRENCH, open-end, 9/16-in.
WRENCH, socket, 5/8-in.

Remove eight nuts and lock washers (5/8-in. socket wrench and speed handle). Pull flange with two 3/8-in. SAE bolts placed in holes provided for pulling (9/16-in. open-end wrench) (fig. 171).

(3) REMOVE FRONT AXLE SKEIN NUTS.

WRENCH, skein nut (68869)

Place skein nut wrench in slots of lock nut; handle of wrench will project through driving flange studs. Remove skein lock nut by rotating

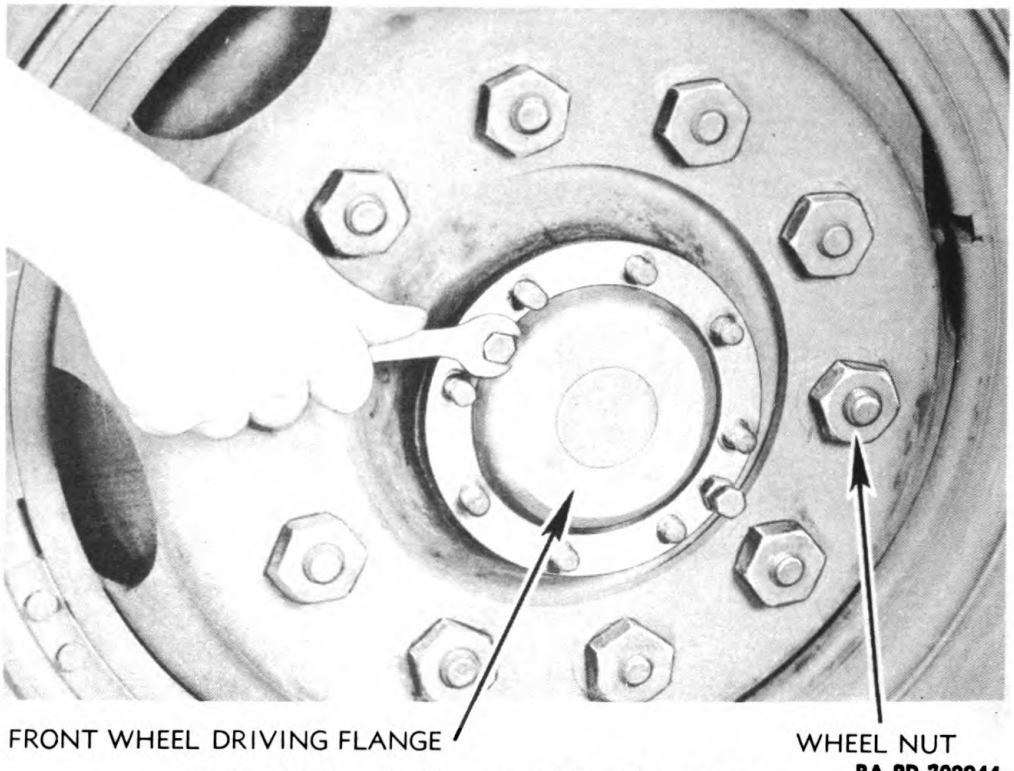

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Figure 171—Pulling Front Driving Flange

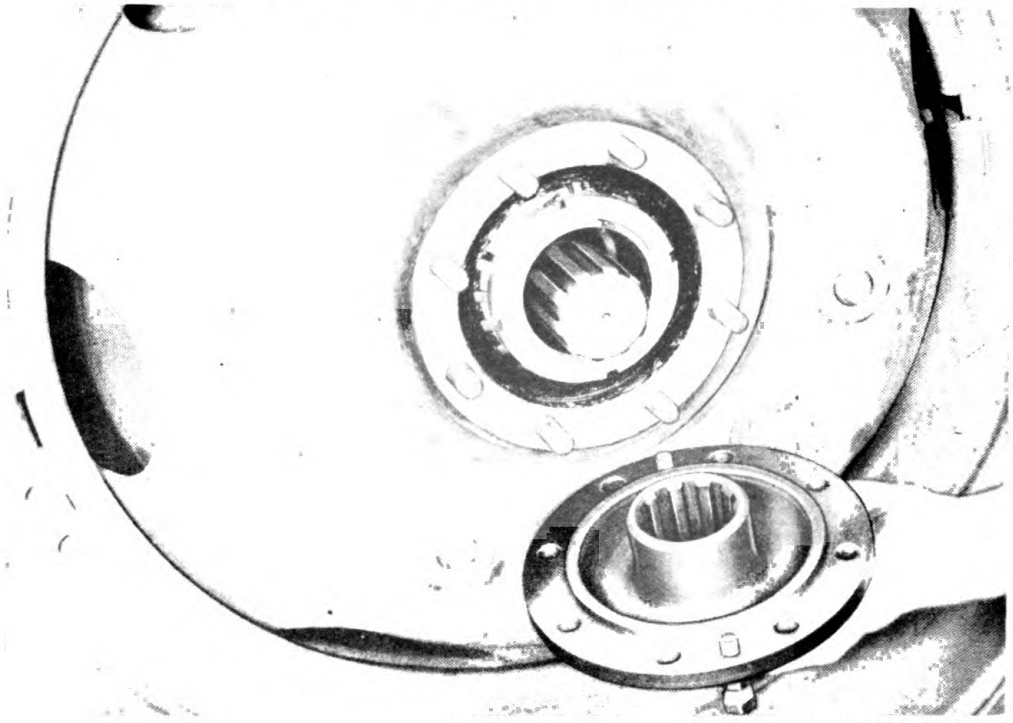

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Figure 172—Installing Driving Flange

wheel counterclockwise. Remove skein lock nut and then the lock washer. Remove inner adjusting nut in same manner; then remove hub from skein. NOTE: Be careful not to let outer bearing fall in dirt.

(4) REPLACE HUB ASSEMBLY ON SKEIN.

HAMMER, 1-lb
PUNCH, taper
WRENCH, skein nut (68869)

Examine grease seal inside of hub and replace if in damaged condition (par. 162 b (5)). Check for sufficient grease on wheel bearings (par. 157 b). Place wheel hub on to skein, install outer wheel bearing, and tap into position (taper punch and hammer). Turn inner skein nut on skein with beveled side away from bearing. Adjust nut (skein nut wrench) by turning to the right until it is tight; then back off adjusting nut one-quarter turn (fig. 168). Place lock washer on skein with curved wings against inner nut in such a position that one wing of washer will fit slot in skein nut. Install outer skein lock nut and tighten (skein nut wrench). Lock the inner nut by turning the lock washer wing into a slot of the nut.

(5) INSTALL DRIVING FLANGE.

HAMMER
HANDLE, speed
WRENCH, socket, 5/8-in.

Install a new gasket on the wheel hub and then enter driving flange on to axle shaft spline (fig. 172); then place on to studs in wheel hub. Drive into position (hammer). Replace eight nuts and lock washers attaching driving flange to hub (5/8-in. socket wrench and speed handle).

(6) INSTALL FRONT WHEEL AND TIRE (par. 158).

JACK, hydraulic
WRENCH, wheel nut, 1 1/2-in. (standard)

161. REAR WHEEL HUB AND BEARING REPLACEMENT (fig. 173).

a. Equipment.

EXTENSION, 5-in.
HAMMER
HANDLE, flex, 18-in.
PUNCH, flat
WRENCH, open-end, 9/16-in.
WRENCH, skein nut (68869)
WRENCH, socket, 15/16-in.

b. Procedure.

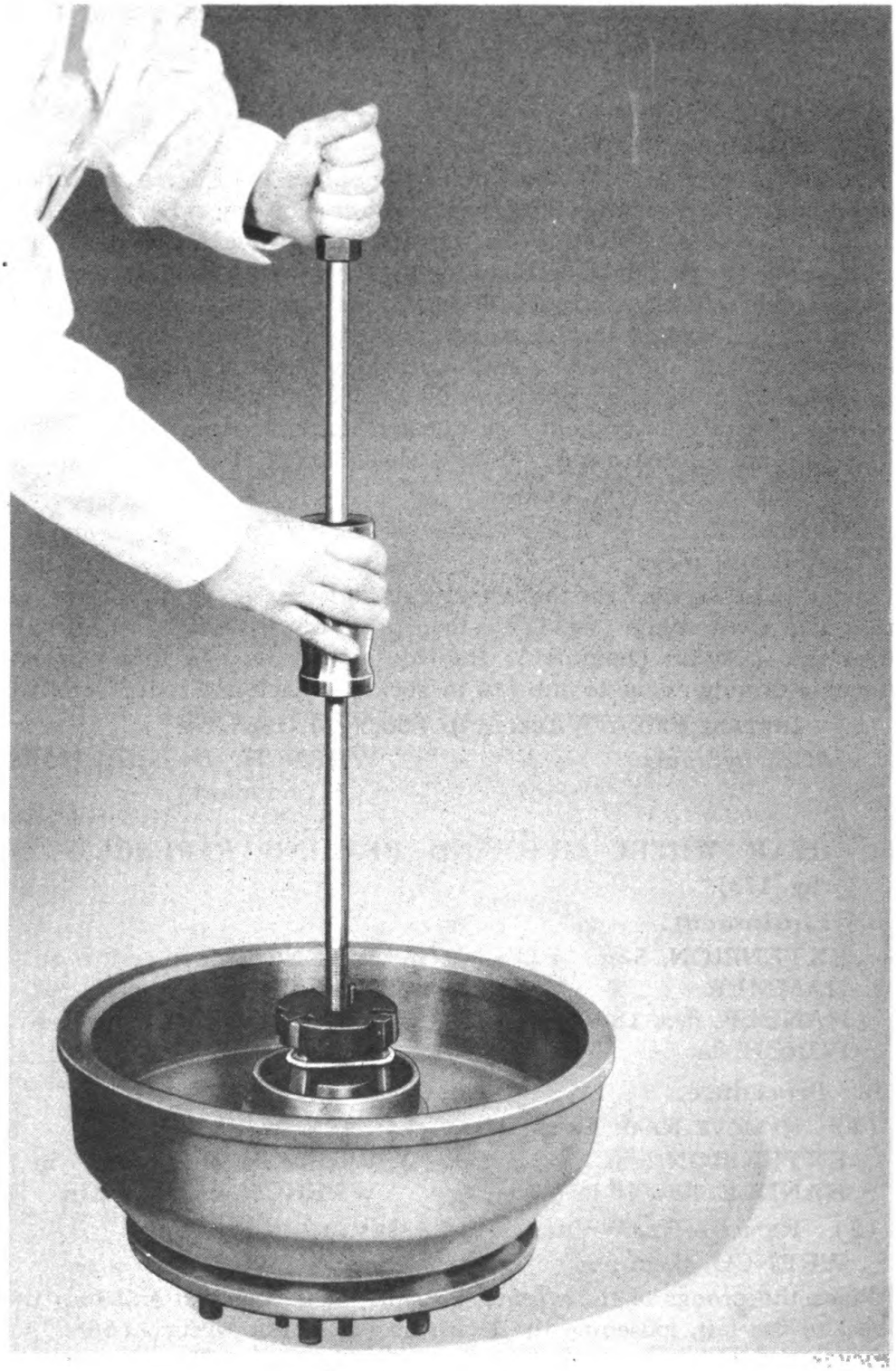
(1) REMOVE REAR AXLE SHAFT (par. 48).

EXTENSION, 5-in.
HANDLE, flex, 18-in.
WRENCH, open-end, 9/16-in.
WRENCH, socket, 15/16-in.

(2) REMOVE REAR WHEEL HUB ASSEMBLY.

WRENCH, skein nut (68869)

Place the prongs of the wrench into the skein lock nut and turn the wheel to the left, loosening the lock nut (skein nut wrench (68869)). Remove the adjusting nut lock washer from the skein. Place the wrench on the adjusting nut and rotate the wheel to the left to remove the adjusting nut (skein nut wrench (68869)). Now slide the rear wheel hub assembly from the axle skein.



RA PD 302946

Figure 173—Pulling Wheel Bearing Cup

(3) REMOVE REAR BEARING AND OIL SEAL.

HAMMER PUNCH

Drive the rear bearing cone and oil seal from the rear wheel hub assembly (hammer and flat punch). The oil seal will come out of the hub assembly with the rear bearing cone. Care must, however, be taken not to damage the bearing or oil seal.

(4) REMOVE BEARING CUPS.

HAMMER PUNCH
PULLER, snap-on (BR-16)

Insert puller into wheel hub and adjust to proper tension on bearing cup (fig. 173). Pull out bearing cup (puller, snap-on (BR-16)). If a puller is not available, the races may be driven out of the hub (hammer and punch).

(5) LUBRICATE WHEEL BEARINGS (par. 157 b).

(6) INSTALL WHEEL BEARINGS AND CUPS.

HAMMER PUNCH, flat face
IRON, flat piece

Insert wheel bearing cups in hub and drive same into place (hammer and punch). Care must be taken to drive the cups in evenly, so that they will not wedge in hub or be damaged. Place inner wheel bearing cone into bearing cup. Insert oil seal with leather facing bearing. Tap oil seal very carefully, using flat piece of iron while it is against the bearing (hammer and flat piece of iron). For packing the rear wheel hub and skein, see paragraph 157 b.

(7) INSTALL REAR WHEEL HUB ASSEMBLY.

HAMMER WRENCH, skein nut
PUNCH (68869)

Slide the wheel hub assembly on to the axle skein. Push the outer wheel bearing on the skein and in the wheel bearing cup. Turn the bearing adjusting nut on the skein, enter the skein nut wrench, and turn the wheel to the right. Tighten adjusting nut and back off one-quarter turn. Enter the adjusting nut lock washer on the skein with one wing in line with slot in adjusting nut. Start the skein lock nut by turning it to the right. Place the skein nut wrench on the lock nut and turn the wheel to the right until the lock nut is tight (skein nut wrench (68869)). Lock the adjusting nut by turning one wing of the lock washer into a slot of the inner or adjusting nut (hammer and punch).

(8) INSTALL REAR AXLE SHAFT (par. 48).

EXTENSION, 5-in. WRENCH, open-end, 9/16-in.
HANDLE, flex, 18-in. WRENCH, socket, 15/16-in.

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

162. FRONT WHEEL BEARING REPLACEMENT.

a. Equipment.

HAMMER
HANDLE, speed
JACK, hydraulic
PULLER, snap-on, (BR-16)
PUNCH
WRENCH, open-end, 9/16-in.
WRENCH, skein nut (68869)
WRENCH, socket, 5/8-in.
WRENCH, wheel nut, 1 1/2-in. (standard)

b. Procedure.

(1) REMOVE FRONT WHEEL AND TIRE (par. 158).

JACK, hydraulic
WRENCH, wheel nut, 1 1/2-in. (standard)

(2) REMOVE FRONT WHEEL HUB ASSEMBLY (par. 160).

HAMMER
HANDLE, speed
PUNCH
WRENCH, open-end, 9/16-in.
WRENCH, skein nut (68869)
WRENCH, socket, 5/8-in.

(3) REMOVE BEARING CUPS FROM HUB.

HAMMER
PULLER, snap-on (BR-16)
PUNCH

Remove oil seal and inner bearing cone by driving the bearing cone out (hammer and punch). Drive bearing cups out of hub assembly or use bearing snap-on puller (BR-16) (par. 161 b (4)). Be sure to place the punch through the hub and on to the wide side of the cup (hammer and punch). Bearing cups must be driven out evenly, so that they will not bind in the hub.

(4) INSTALL FRONT WHEEL BEARING CUPS.

HAMMER
DRIVER, wheel bearing cup, (7157)

Place front wheel bearing cups (inner and outer) in hub assembly with thin part of cup toward the outside. Drive cups firmly and evenly into place (hammer and wheel bearing cup driver (7157)).

(5) INSTALL FRONT WHEEL BEARING CONE AND OIL SEAL.

HAMMER
PUNCH

Place inner wheel bearing cone in hub assembly. Thoroughly check oil seal and if leather of seal is damaged, a new seal should be used. Before installing a new oil seal, dip in light engine oil. Place oil seal in hub and tap in place until it rests against bearing cup (hammer and punch).

(6) LUBRICATING AND PACKING WHEEL BEARINGS (par. 157 b).

(7) INSTALL WHEEL HUB ASSEMBLY (par. 160).

HAMMER
HANDLE, speed
PUNCH
WRENCH, open-end, 9/16-in.
WRENCH, skein nut, (68869)
WRENCH, socket, 5/8-in.

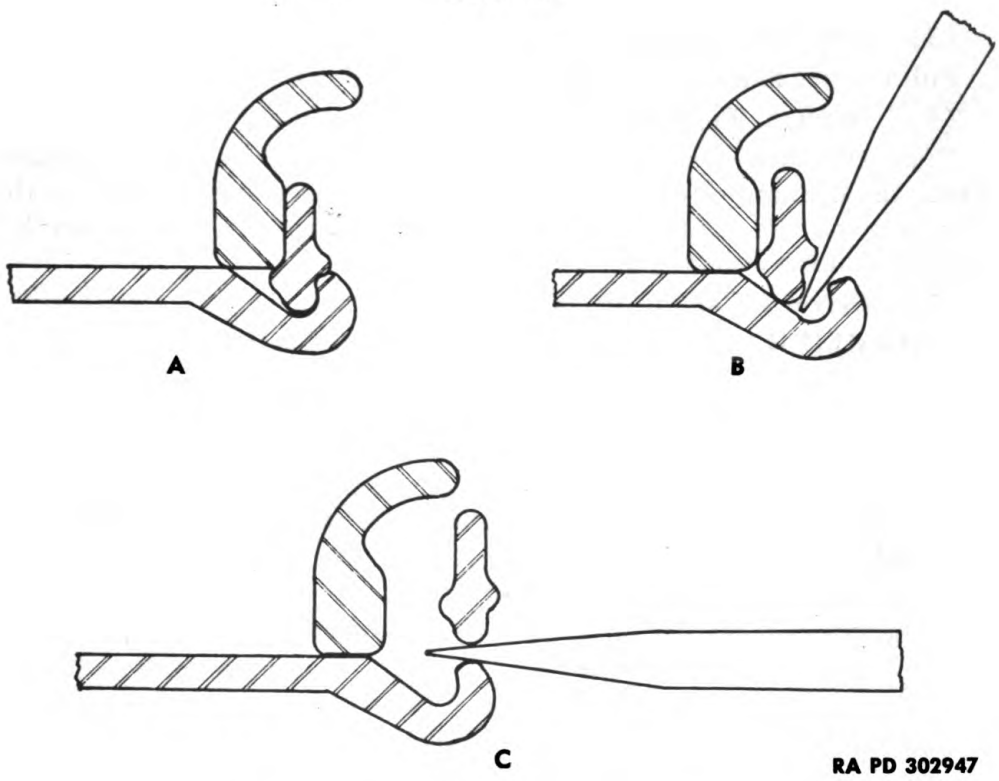


Figure 174—Removing Lock Ring

(8) INSTALL FRONT WHEEL AND TIRE (par. 158).

JACK, hydraulic
WRENCH, wheel nut, 1½-in. (standard)

163. TIRE CASING AND TUBE REPLACEMENT (fig. 174).

a. Equipment.

HAMMER
IRONS, tire
JACK, hydraulic
SCREWDRIVER, heavy
WRENCH, wheel nut (standard)

b. Procedure.

(1) REMOVE WHEEL (par. 158).

JACK, hydraulic
WRENCH, wheel nut (standard)

(2) REMOVE CASING FROM WHEEL (fig. 174).

HAMMER
IRONS, tire
SCREWDRIVER, heavy

Deflate the tire completely. Tap the side ring slightly (hammer). Insert heavy screwdriver into the recess of the clamp ring (B—fig. 174) and pry this side of the ring out of the groove in the side ring (C—fig. 174) (heavy screwdriver). Pry the clamp ring from the wheel (tire irons). Remove the casing and tube assembly.

(3) REMOVE TIRE FLAP AND TUBE (no tools required).

Pull the tire flap from the casing. Pull the tube from the casing.

(4) INSTALL TUBE AND FLAP (no tools required).

Place the tube into the casing with the valve stem toward outside. Place the opening of the casing flap over the valve stem and place the flap into the tire. Check the tube and flap, making sure that they lay smoothly in the casing.

(5) INSTALL CASING ON WHEEL.

HAMMER
IRONS, tire
SCREWDRIVER, heavy

Place the casing on the wheel, making sure valve stem is centered in valve stem opening in the wheel. Place the side ring on to the wheel and pry it down (tire irons), so that the clamp ring can be entered. Wedge the clamp ring into place (tire irons and screwdriver). Tap clamp ring thoroughly into place (hammer).

(6) INSTALL WHEEL (par. 158).

JACK, hydraulic
WRENCH, wheel nut (standard)

164. TIRE SERVICE.

a. General. Tire servicing means maintaining proper air pressure, removing and repairing damaged or worn casings, tubes, and rims, and mounting the tires so that the maximum life will be realized. Regardless of how well designed or how well built a casing, tube or rim may be, it cannot give satisfactory performance unless it receives constant care and maintenance.

b. Tire Inspection. At every opportunity, check the tires for air pressure and look for nails, glass, stones, and other material stuck in the tread or between duals. Unless removed completely, such foreign matter will be imbedded deeper and eventually damage the casing.

c. Tire Chains. Chains are sometimes necessary to provide extra traction. Not intended for continuous use, they should be used only when necessary and removed as soon as possible. Single chains fit one tire and dual chains fit both tires of a dual. Chains must be properly fitted and installed to prevent cutting the tires. They must be loose enough to creep on the tires and tight enough, so that they will not strike the body or be pulled off. Damaged cross links can be repaired or replaced.

Section XXXII

WINCH AND POWER TAKE-OFF

165. WINCH AND POWER TAKE-OFF DESCRIPTION (fig. 175).

a. Winch Description. The winch is mounted at the front end of the truck and is supported between the two side frame rails. Power for operating the winch is transmitted from the main transmission through the power take-off.

b. Power Take-off Description. The power take-off is bolted to the left side of the transmission and power is transmitted to the winch through a drive shaft.

c. Winch and Power Take-off Operation. The winch is controlled by a power take-off shifter lever in the cab, operating the take-off in either of two forward speeds or one reverse speed. Neutral points are between each of the gear speeds and a lock for the shift lever will secure the take-off in one of the neutral points.

166. WINCH MAINTENANCE AND ADJUSTMENTS.

a. Equipment.

HAMMER
PLIERS
PUNCH, taper
WRENCH, box, 7/16-in.
WRENCH, open-end, 7/16-in.

b. Procedure.

(1) SHEAR PIN MAINTENANCE.

HAMMER
PLIERS
PUNCH, taper

The forward universal joint is connected to the winch worm shaft by a special shear pin to prevent overload of power take-off and chassis frame. When it shears—due to quick jerk on winch line or due to overload—the collar on drive shaft will prevent shaft from slipping too far into rear joint and there is no possibility of forward end of shaft dropping free when safety pin is sheared. The proper distance between the drive shaft collar and universal joint hub is 3/4 inch. When pin shears, slide shaft down into rear splined yoke and worm joint hub will then be clear of shear pin hole in worm shaft. Drive out parts of old shear pin (taper punch and ham-

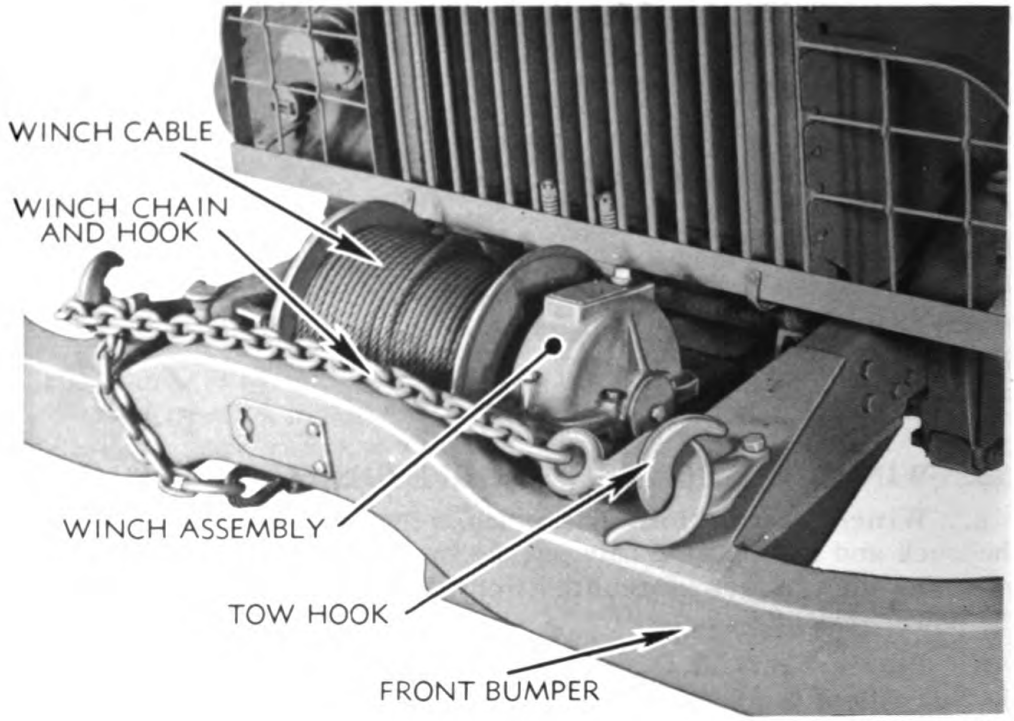


Figure 175—Winch Assembly Installed

mer), pull shaft forward to line up holes in joint and worm shaft, and insert new shear pin (hammer). Be sure to insert a new cotter pin in shear pin (pliers). CAUTION: Use only standard shear pin. To substitute a cap screw or a rivet of different steel may wreck the chassis frame or the take-off or joints. The standard shear pin is a soft metal with special characteristics. Each morning, be sure to have two spare shear pins with cotter keys in your kit and if one is used, be sure it is replaced that same day. Do not hold up a convoy of trucks while you are trying to borrow a shear pin from some other driver.

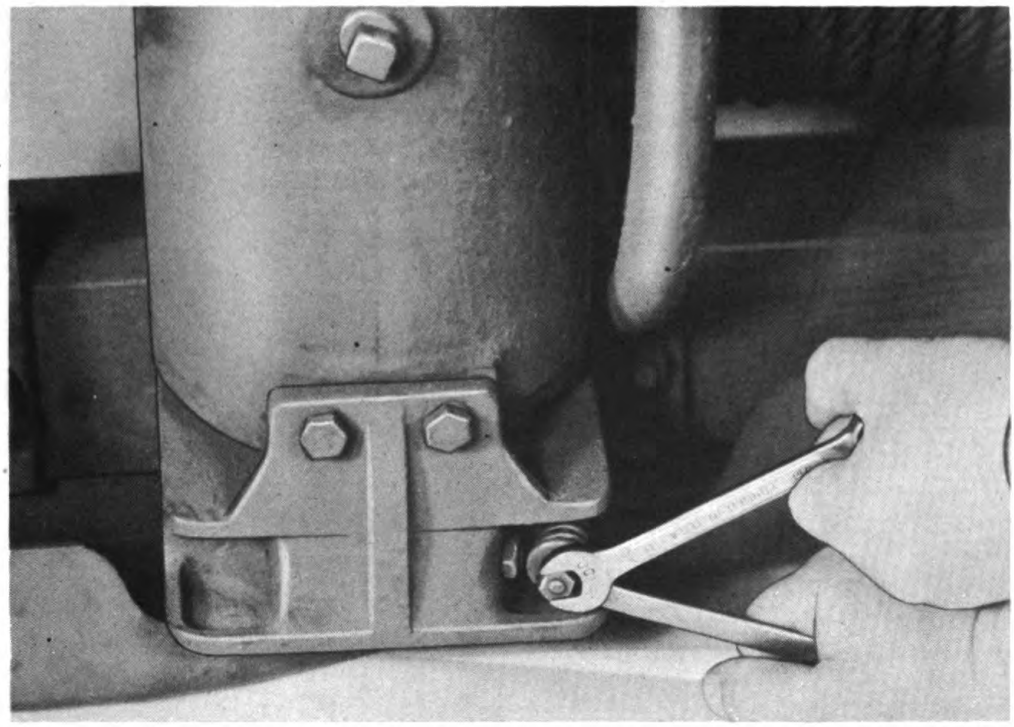
(2) DRAG BRAKE MAINTENANCE.

This brake is only in use when jaw clutch is "OUT" and rope is being pulled off by hand, preparatory to hooking onto load. The only object of this brake is to keep drum from spinning during the uncoiling process. If brake does not give sufficient drag, replace drag brake lining (par. 168).

(3) AUTOMATIC BRAKE MAINTENANCE AND ADJUSTMENT.

WRENCH, box, 7/16-in. WRENCH, open-end, 7/16-in.

This is a band brake—around a disk, keyed to the worm shaft—and prevents the load from overhauling the worm gearing when the take-off is in neutral or after shear pin has failed. To test it, have the truck at the top of a steep grade, fasten the winch line to another truck at the bottom, and start pulling it up grade. After a short haul, depress the clutch pedal. The winch will stop pulling and the truck being pulled should not



RA PD 302949

Figure 176—Adjusting Automatic Brake

roll backward. If it does, loosen the jam nut and tighten the adjusting nut (7/16-in. open-end wrench and 7/16-in. box wrench) under the brake case (fig. 176) by one-half turn; set the lock nut tight and repeat the pulling and stopping test. If the foregoing will not give desired results, it is evident that the band should be replaced (par. 168). CAUTION: The lining used on the automatic worm brake is a special type developed especially for this purpose. Do not substitute ordinary brake lining, filled with gummy material which will boil out, stick to the disk, and cause jerky brake action.

(4) WINCH AND POWER TAKE-OFF LUBRICATION. The winch has a filler plug at top of cover, drain plug under housing, and an oil level plug on the side. Fill to level of oil level plug. See Lubrication Guide in section VI. There are alemite fittings in each end of winch drum and also on end frame. If the sliding clutch should stick, clean shaft with SOLVENT, dry-cleaning; re-oil with light oil.

167. WINCH CABLE AND HOOK REPLACEMENT.

a. Equipment.

WRENCH, open-end, 3/4-in.

b. Procedure.

(1) REMOVE CABLE ASSEMBLY.

WRENCH, open-end, 3/4-in.

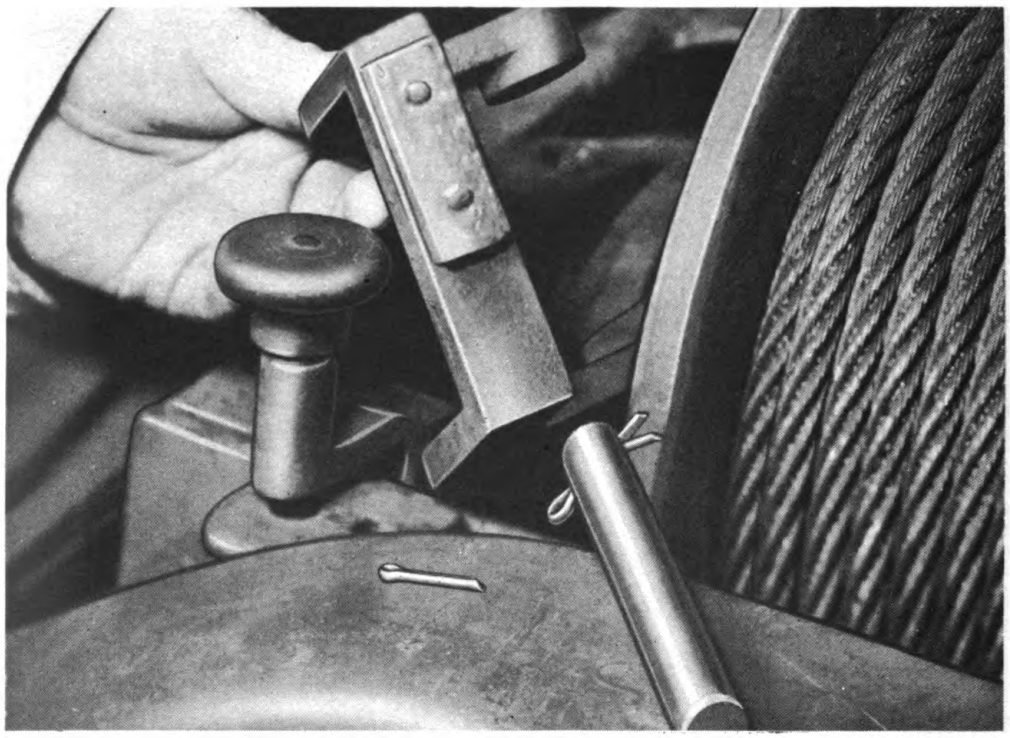


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Figure 177—Installing Winch Drag Brake

Shift winch clutch into disengaged position. Pull winch cable from winch drum. Remove nuts and lock washers from winch cable U-clamp (¾-in. open-end wrench). Remove U-clamp and cable.

(2) INSTALL CABLE ASSEMBLY.

WRENCH, open-end, ¾-in.

Unroll cable in front of truck. Enter cable underneath bumper and between cable guide and winch spool. Place U-clamp over end of cable. Insert U-clamp into holes in spool. Tighten U-clamp securely with U-clamp nuts and lock washers (¾-in. open-end wrench). Shift winch clutch into engaged position. Start engine and shift power take-off into low speed and wind up cable evenly.

168. WINCH BRAKE.

a. Winch Drag Brake Removal.

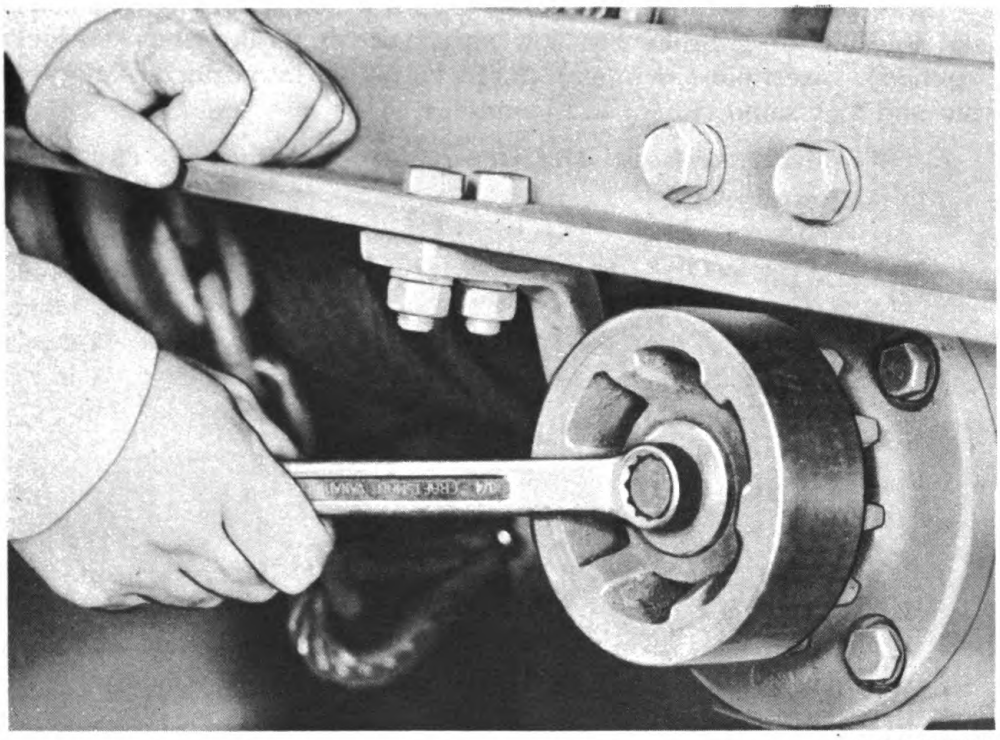
HAMMER
PLIERS
PUNCH, taper, ¼-in.

Remove cotter key from pin (pliers). Drive pin out of drag brake lining bracket (hammer and punch). Remove drag brake assembly.

b. Winch Drag Brake Installation.

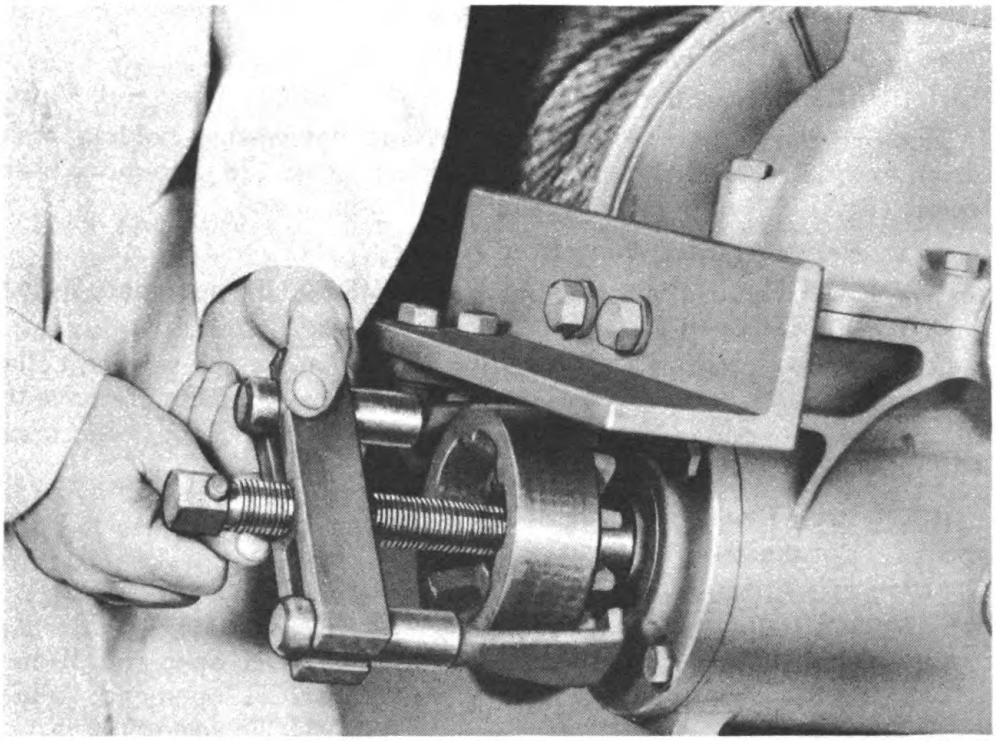
HAMMER
PLIERS
PUNCH, taper, ¼-in.

WINCH AND POWER TAKE-OFF



RA PD 302951

Figure 178—Removing Winch Brake Drum Cap Bolt



RA PD 302952

Figure 179—Removing Winch Brake Drum

Insert brake assembly with lining toward winch spool (fig. 177). Line up holes in drag brake bracket with those in brake anchor bracket (punch). Insert pin (hammer). Insert cotter pin into drag brake bracket pin and lock same (pliers and hammer).

c. Winch Brake Band and Drum Removal (figs. 178 and 179).

(1) EQUIPMENT.

EXTENSION, 5-in.
HAMMER, 2-lb
HANDLE, flex, 18-in.
PULLER, gear, 6-in. jaws
WRENCH, box, 7/16-in.
WRENCH, box, 3/4-in.
WRENCH, box, 15/16-in.
WRENCH, box, 1-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, socket, 3/4-in.
WRENCH, socket, 7/8-in.
WRENCH, socket, 1 1/16-in.

(2) PROCEDURE.

(a) Remove Bumper (par. 112 b).

HAMMER, 2-lb
HANDLE, flex
WRENCH, box, 3/4-in.
WRENCH, box, 15/16-in.
WRENCH, socket, 3/4-in.
WRENCH, socket, 7/8-in.

(b) Removing Housing and Brake Band.

WRENCH, open-end, 9/16-in.

Remove the four cap screws and washers holding brake housing and brake band to winch. Slide housing and band forward, removing same (9/16-in. open-end wrench).

(c) Removing Brake Drum (figs. 178 and 179).

PULLER, gear, 6-in. jaw
WRENCH, open-end, 3/4-in.

Remove the cap screw, lock washer, and flat washer holding brake drum to winch shaft (3/4-in. open-end wrench) (fig. 178). Remove brake drum (fig. 179) with puller (gear puller, 6-in. jaws).

(d) Remove Brake Band from Housing.

WRENCH, box, 7/16-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.

Remove the lock nut and adjusting nut. Remove the washer, collar, and spring (7/16-in. open-end wrench and 7/16-in. box wrench). Remove the nut from anchor end of band and remove band from housing (9/16-in. open-end wrench).

d. Winch Brake Drum and Band Installation.

(1) EQUIPMENT.

EXTENSION, 5-in.
HAMMER, 2-lb
HANDLE, flex, 18-in.
PULLER, gear, 6-in. jaw
PUNCH, 6-in.
WRENCH, box, 7/16-in.
WRENCH, box, 3/4-in.
WRENCH, box, 15/16-in.
WRENCH, box, 1-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.
WRENCH, socket, 3/4-in.
WRENCH, socket, 7/8-in.
WRENCH, socket, 1 1/16-in.

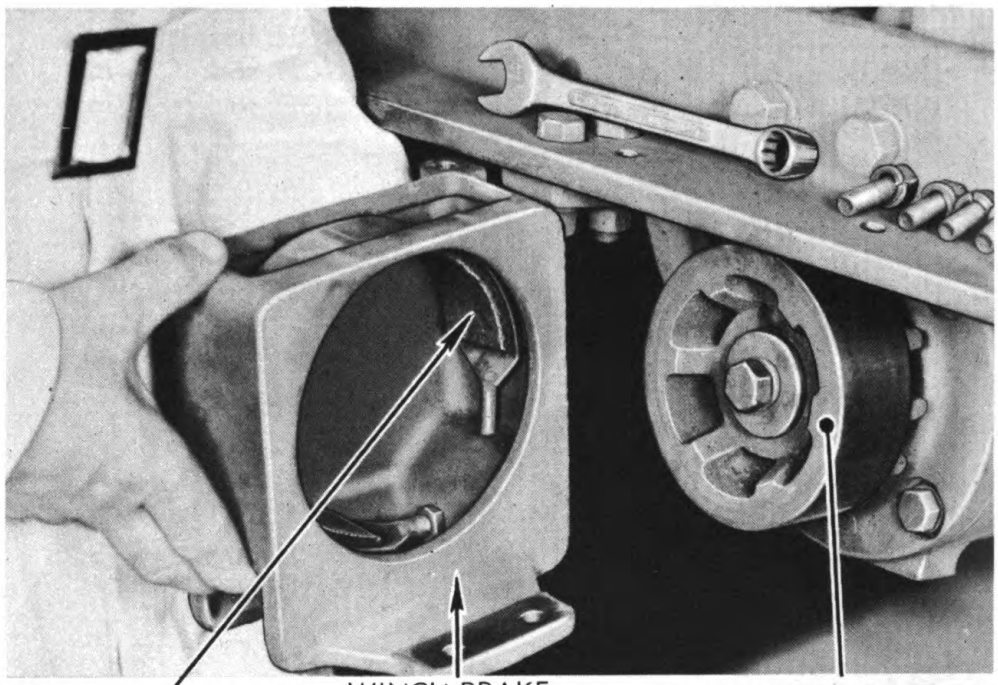


Figure 180—Installing Winch Brake Band and Housing

(2) PROCEDURE.

(a) Installing Brake Drum.

HAMMER, 2-lb
PUNCH, 6-in.
WRENCH, open-end, ¾-in.

Place brake drum on shaft. Make sure keyway is lined up with woodruff key on shaft. Drive brake drum on shaft (hammer and 6-in. punch). Tighten drum on shaft with cap screw, flat washer, and lock washer (¾-in. open-end wrench).

(b) Installing Brake Band in Housing.

WRENCH, box, 7/16-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 9/16-in.

Place brake band in housing and tighten the two nuts on anchor end, one nut on inside of housing and the other on outside (9/16-in. open-end wrench). Place spring and washer with collar (collar toward housing) on adjusting end of band and tighten with nut. Lock adjustment with lock nut (7/16-in. open-end wrench and 7/16-in. box wrench).

(c) Install Brake Band and Housing.

WRENCH, open-end, 9/16-in.

Slide housing and brake band toward the rear and over the winch brake drum (fig. 180). Tighten housing to the winch with the four cap bolts and lock washers (9/16-in. open-end wrench).

(d) Install Bumper (par. 112 c).

HAMMER, 2-lb
HANDLE, flex
WRENCH, box, 3/4-in.
WRENCH, box, 15/16-in.
WRENCH, socket, 3/4-in.
WRENCH, socket, 7/8-in.

169. WINCH REMOVAL.

a. Equipment.

CHAIN
EXTENSION, 5-in.
HAMMER, 2-lb
HANDLE, flex, 18-in.
HOIST, chain
WRENCH, box, 3/4-in.
WRENCH, box, 15/16-in.
WRENCH, box, 1-in.
WRENCH, socket, 3/4-in.
WRENCH, socket, 7/8-in.
WRENCH, socket, 1 1/16-in.

b. Procedure.

(1) REMOVE BUMPER SIDE MEMBER BOLTS (par. 112 b (2) *(a)*).

HANDLE, flex, 18-in.
WRENCH, box, 3/4-in.
WRENCH, box, 15/16-in.
WRENCH, socket, 3/4-in.
WRENCH, socket, 7/8-in.

(2) REMOVE WINCH REAR BRACKET BOLTS.

HANDLE, flex, 18-in.
WRENCH, box, 15/16-in.
WRENCH, socket, 7/8-in.

Remove the four bolts, nuts, and lock washers fastening the rear winch bracket to the frame front cross member (15/16-in. box wrench, 7/8-in. socket wrench, and flex handle).

(3) REMOVE WINCH AND BUMPER ASSEMBLY FROM FRAME.

CHAIN
HAMMER, 2-lb
HOIST, chain

Place rope or chain around bumper and hook to chain hoist. Take up slack in chain. Remove winch and bumper assembly by sliding forward. At times the assembly will have to be driven with hammer.

(4) REMOVE WINCH FRONT BRACKET BOLTS.

EXTENSION, 5-in.
HANDLE, flex, 18-in.
WRENCH, box, 1-in.
WRENCH, socket, 1 1/16-in.

Remove the two bolts, nuts, and lock washers fastening the winch front bracket to the bumper bracket (1-in. box wrench, flex handle, extension, and 1 1/16-in. socket wrench).

(5) REMOVE WINCH REAR BRACKET.

EXTENSION, 5-in.
HANDLE, flex, 18-in.
WRENCH, box, 1-in.
WRENCH, socket, 7/8-in.
WRENCH, socket, 1 1/16-in.

Remove the two cap screws and lock washers holding mounting bracket to winch housing (flex handle and 7/8-in. socket wrench). Remove the bolt, nut, and lock washer holding rear mounting bracket to right winch mounting bracket (flex handle, 1-in. box wrench, and 1 1/16-in. socket wrench). Lift out rear mounting bracket.

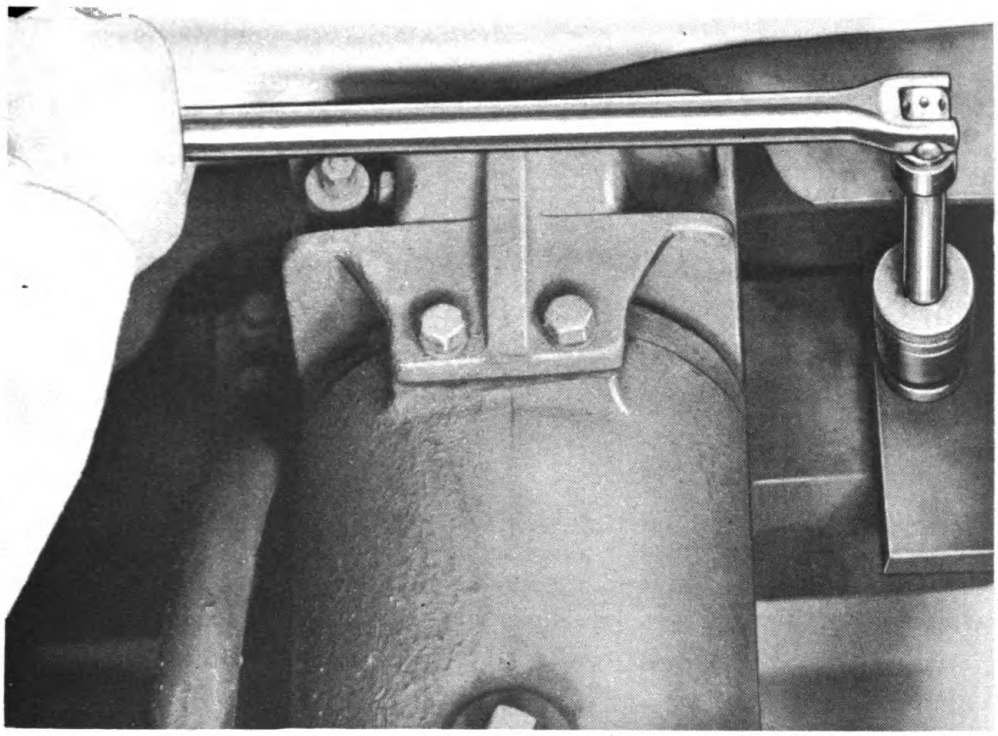


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Figure 181—Installing Winch Front Bracket Bolt

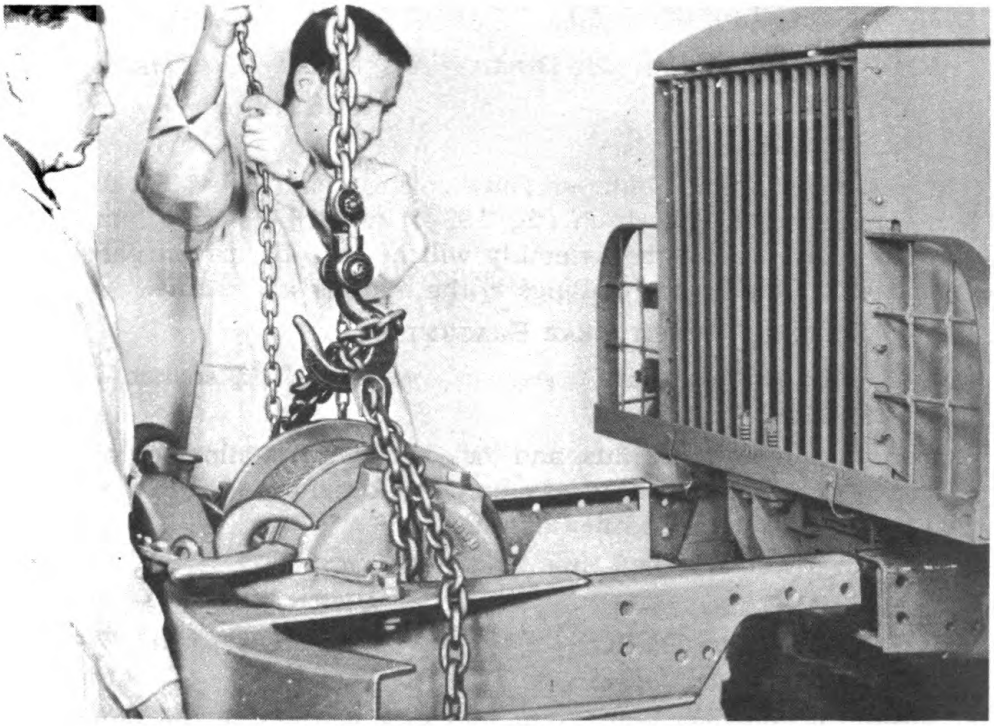

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Figure 182—Installing Winch and Bumper Assembly

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

170. WINCH INSTALLATION.

a. Equipment:

CHAIN
EXTENSION, 5-in.
HAMMER, 2-lb
HANDLE, flex, 18-in.
HOIST, chain
WRENCH, box, 3/4-in.
WRENCH, box, 15/16-in.
WRENCH, box, 1-in.
WRENCH, socket, 3/4-in.
WRENCH, socket, 7/8-in.
WRENCH, socket, 1 1/16-in.

b. Procedure.

(1) INSTALL WINCH REAR MOUNTING BRACKET.

EXTENSION, 5-in.
HANDLE, flex, 18-in.
WRENCH, box, 1-in.
WRENCH, socket, 7/8-in.
WRENCH, socket, 1 1/16-in.

Place rear mounting bracket on winch and fasten to housing with two cap screws and lock washers (flex handle and 7/8-in. socket wrench). Bolt right side of bracket to winch right hand bracket with bolt, nut, and lock washer (flex handle, 1-in. box wrench, and 1 1/16-in. socket wrench).

(2) INSTALL WINCH FRONT BRACKET BOLTS.

EXTENSION
HANDLE, flex
WRENCH, box, 1-in.
WRENCH, socket, 1 1/16-in.

Install and tighten the two bolts, nuts, and lock washers (fig. 181) fastening the winch front bracket to the bumper bracket (1-in. box wrench, flex handle, extension, and 1 1/16-in. socket wrench).

(3) INSTALL WINCH AND BUMPER ASSEMBLY TO FRAME.

CHAIN
HAMMER, 2-lb
HOIST, chain

Place chain around bumper and hook to chain hoist; lift winch and bumper assembly in position (fig. 182). Install by sliding bumper side members past frame; the assembly will have to be driven part way on (hammer). Line up the drillings in the bumper and frame.

(4) INSTALL WINCH REAR BRACKET BOLT.

HANDLE, flex, 18-in.
WRENCH, box, 15/16-in.
WRENCH, socket, 7/8-in.

Insert the four bolts, nuts, and lock washers fastening the rear winch bracket to the frame front cross member and tighten (15/16-in. box wrench, 7/8-in. socket wrench, and flex handle).

(5) INSTALL BUMPER SIDE MEMBER BOLT.

HANDLE, flex, 18-in.
WRENCH, box, 3/4-in.
WRENCH, box, 15/16-in.
WRENCH, socket, 3/4-in.
WRENCH, socket, 7/8-in.

Insert the fourteen bolts, nuts, and lock washers in the bumper side members to frame and tighten (flex handle, 7/8-in. socket wrench, 15/16-in. box wrench, 3/4-in. socket wrench, and 3/4-in. box wrench).

WINCH AND POWER TAKE-OFF

171. WINCH DRIVE SHAFT.

a. Winch Drive Shaft Removal.

(1) EQUIPMENT.

HAMMER, 2-lb
PLIERS
PUNCH, taper, ¼-in.
WRENCH, socket head set screw, ¼-in.

(2) PROCEDURE.

(a) Remove Winch Drive Shaft Front Universal Joint.

HAMMER
PLIERS
PUNCH, taper, ¼-in.

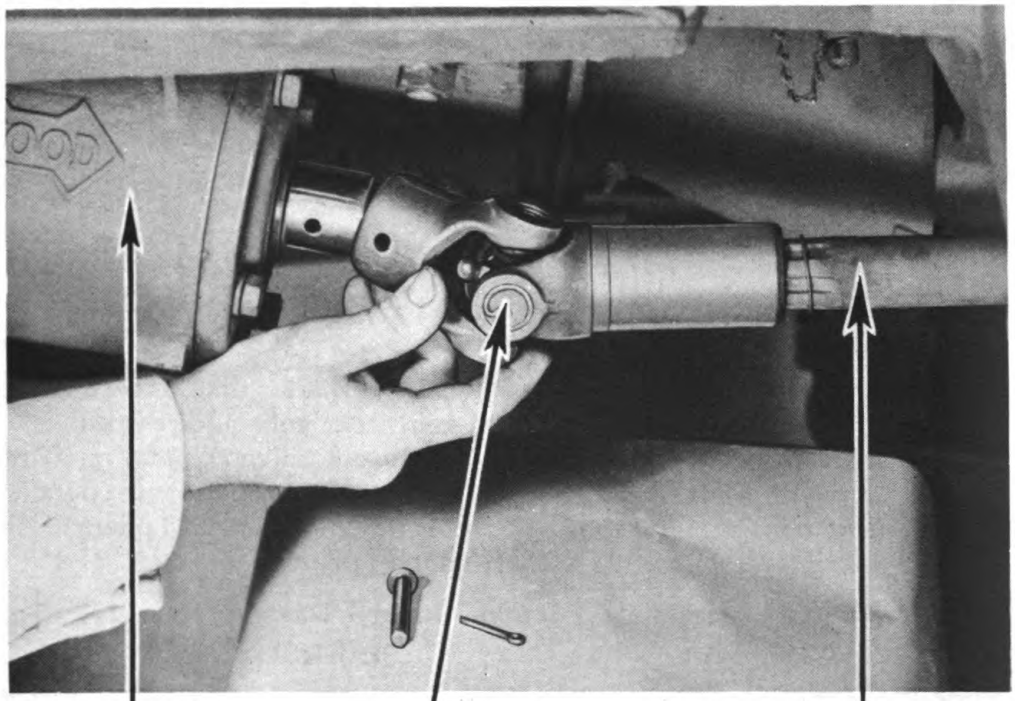

Figure 183—Removing Winch Drive Shaft Universal Joint

Remove cotter key from winch drive shaft shear pin (pliers). Drive out shear pin (hammer and punch). Remove lock ring on winch drive shaft spline (pliers). Move universal joint toward front of truck to remove from winch drive shaft and then remove universal joint assembly from drive shaft spline (fig. 183).

(b) Remove Winch Drive Shaft Rear Universal Joint.

HAMMER
WRENCH, socket head set screw, ¼-in.

Remove the two headless set screws fastening joint to shafts (¼-in. socket head set screw wrench). Tap joint lightly to remove from power

take-off shaft (hammer). Then drive universal joint from winch drive shaft hammer.

b. Winch Drive Shaft Installation.

(1) EQUIPMENT.

HAMMER
PLIERS
PUNCH, taper, ¼-in.
WRENCH, socket head set screw, ¼-in.

(2) PROCEDURE.

(a) Install Winch Drive Shaft Rear Universal Joint.

HAMMER
WRENCH, socket head set screw, ¼-in.

Drive universal joint on winch drive shaft (hammer). Fasten joint to shaft with headless set screw (hammer and socket head set screw wrench). Drive the other end of joint on power take-off shaft and fasten with headless set screw (¼-in. socket head set screw wrench and hammer).

(b) Install Winch Drive Shaft Front Universal Joint.

HAMMER
PLIERS
PUNCH, taper, ¼-in.

Slide front universal joint on winch drive shaft spline and carefully check same to see that front universal joint front yoke and rear universal joint rear yoke are properly lined up. Drive front universal joint on winch shaft (hammer). Line up shear pin hole in joint and winch shaft (punch). Insert shear pin (hammer). Insert cotter key in shear pin (pliers). Replace lock ring on winch drive shaft spline (pliers).

c. Winch Drive Shaft Universal Joint Disassembly.

HAMMER, 1-lb
PLIERS

Remove the four snap rings in the universal joint yokes (pliers). Tap yoke to remove bushings (hammer). Remove grease retainers from center cross and separate the joint.

d. Winch Drive Shaft Universal Joint Assembly.

HAMMER
PLIERS

Place center cross in universal joint yoke. Place grease retainers on to center cross with cork of grease retainer toward the outside. Place bushings on center cross and tap lightly into place (hammer). Insert snap rings in yokes (pliers).

172. WINCH CLUTCH SHIFTER REPLACEMENT.

a. Equipment.

HAMMER
PLIERS
PUNCH, taper, ¼-in.
WRENCH, box, ⅝-in.
WRENCH, open-end, ⅝-in.

b. Procedure.

(1) REMOVE SHIFTER SHAFT.

HAMMER PUNCH
PLIERS

Remove pin in winch drag brake bracket (par. 168 a (2)).

(2) BRAKE TENSION BOLT REMOVAL.

WRENCH, box, 5/8-in. WRENCH, open-end, 5/8-in.

Remove brake tension bolt and spring (5/8-in. open-end wrench and 5/8-in. box wrench). Withdraw shifter shaft.

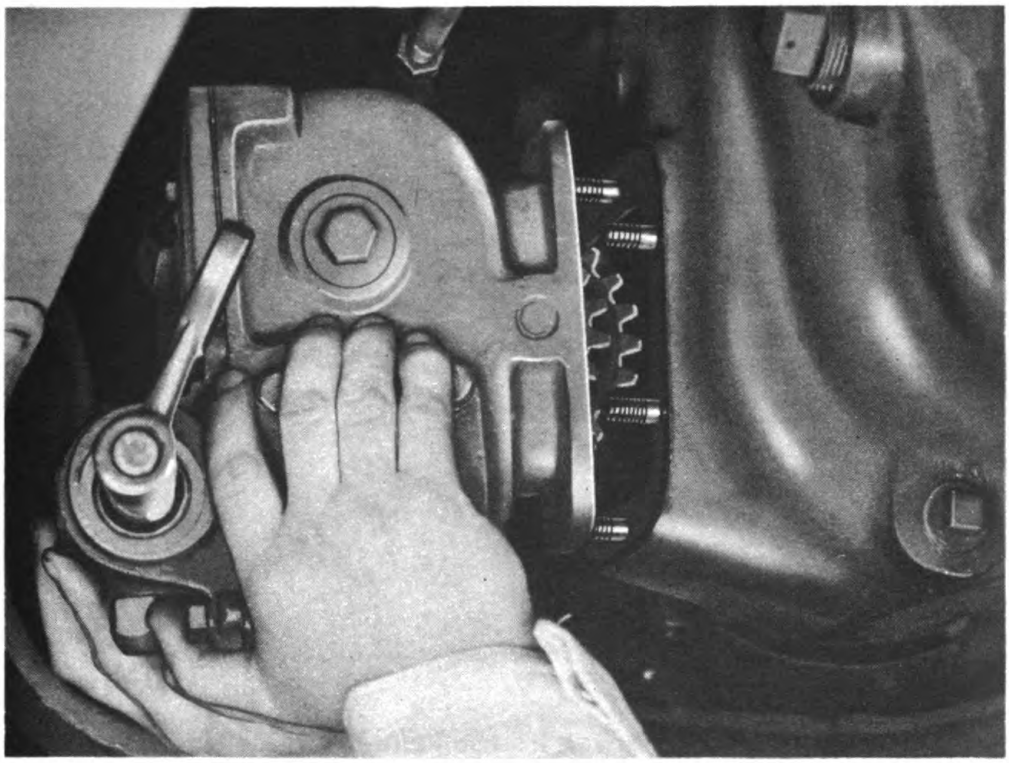

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Figure 184—Installing Power Take-Off

(3) INSTALL DRAG BRAKE TENSION BOLT.

WRENCH, box, 5/8-in. WRENCH, open-end, 5/8-in.

Insert shifter shaft. Place spring on drag brake tension bolt. Insert brake tension bolt in brake shifter shaft with spring toward brake spool. Tighten nut on brake tension bolt and lock with lock nut (5/8-in. open-end wrench and 5/8-in. box wrench).

(4) INSTALL SHIFTER SHAFT.

HAMMER PUNCH
PLIERS

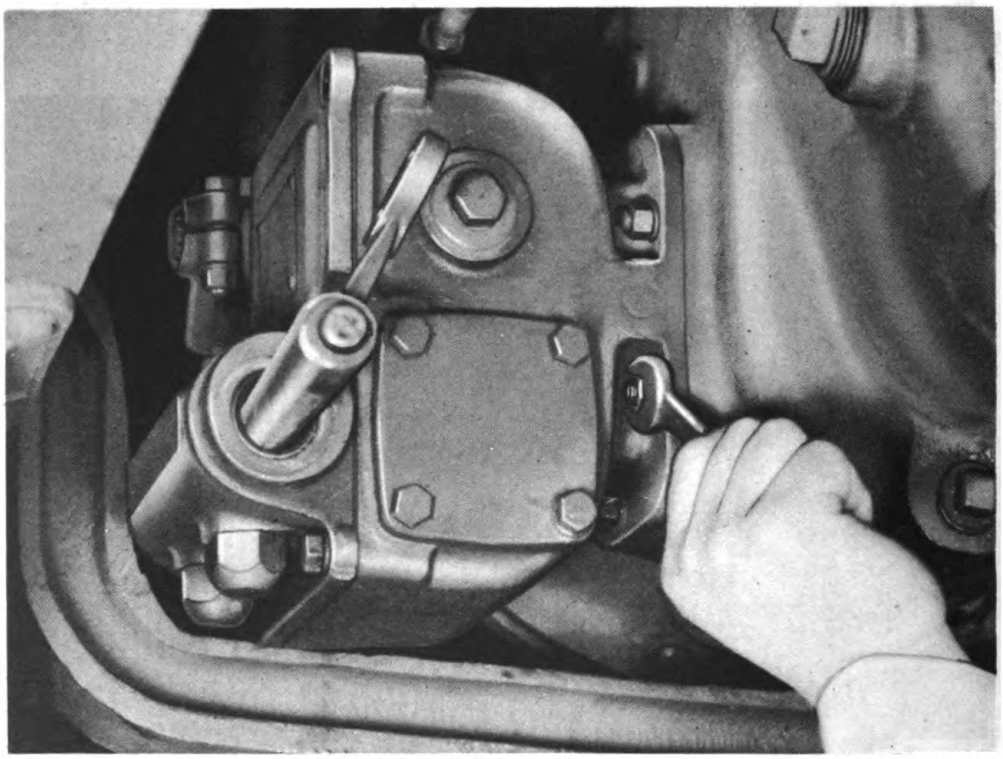
Insert pin in winch spool brake bracket (par. 168 b (2)).

4-TON TRUCK, 4 x 4 (FOUR WHEEL DRIVE MODEL HAR-1)

173. POWER TAKE-OFF REPLACEMENT.

a. Equipment.

HAMMER
PAN, drain
PLIERS
PUNCH, flat
WRENCH, adjustable, 10-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in.
WRENCH, socket head set screw, 1/4-in.



RA PD 302958

Figure 185—Tightening Power Take-Off Mounting Nut

b. Procedure.

(1) DRAIN TRANSMISSION.

PAN, drain
WRENCH, open-end, 5/8-in.

Remove transmission drain plug (5/8-in. open-end wrench) and drain lubricant into drain pan.

(2) DISCONNECT POWER TAKE-OFF SHIFT ROD.

PLIERS

Remove cotter key (pliers) from yoke pin and pull pin (pliers) from the shifter shaft and shift rod.

(3) DISCONNECT POWER TAKE-OFF PROPELLER SHAFT.

HAMMER, 1-lb
PUNCH, flat
WRENCH, socket head set screw, 1/4-in.

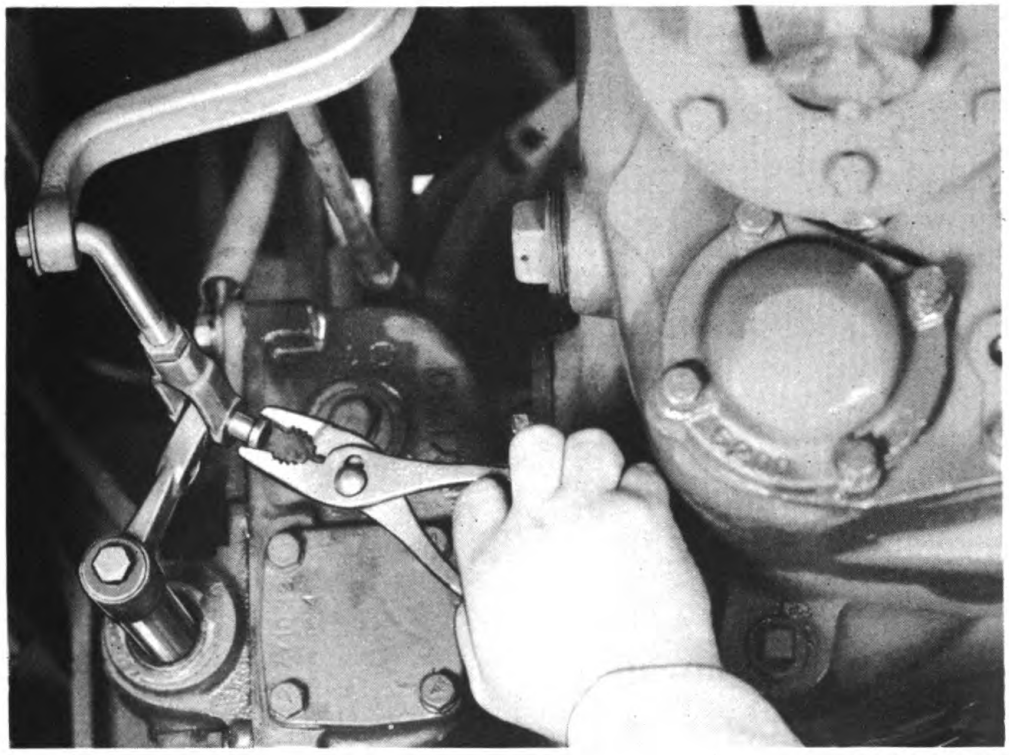
WINCH AND POWER TAKE-OFF

Remove the socket head set screw (¼-in. socket head set screw wrench) from the propeller shaft yoke connected to the power take-off. Drive yoke from shaft (hammer and punch).

(4) REMOVE POWER TAKE-OFF.

WRENCH, open-end, 9/16-in.

Remove the six nuts and lock washers holding the power take-off to transmission and remove the take-off.



RA PD 302959

Figure 186—Connecting Power Take-Off Linkage

(5) INSTALL POWER TAKE-OFF.

WRENCH, open-end, 9/16-in.

Place a new gasket on the six studs of transmission case. Place power take-off on the studs (fig. 184) and fasten in place with six nuts and lock washers (9/16-in. open-end wrench) (fig. 185).

(6) CONNECT POWER TAKE-OFF PROPELLER SHAFT.

HAMMER, 1-lb
PUNCH, flat
WRENCH, socket head set screw, ¼-in.

Line the keyway in the rear yoke of the propeller shaft with the key in the power take-off shaft. Drive yoke (hammer and flat punch) into position. Replace the socket head set screw and tighten (¼-in. socket head set screw wrench).

(7) CONNECT LINKAGE.

PLIERS

Connect shift rod to shifter shaft with yoke pin (fig. 186) and enter cotter key (pliers) in yoke pin.

(8) REFILL TRANSMISSION.

WRENCH, adjustable, 10-in. WRENCH, open-end, 5/8-in.

Replace drain plug (5/8-in. open-end wrench). Remove the oil filler plug (10-in. adjustable wrench) and fill transmission with lubricant (See Lubrication Guide, section VI).

REFERENCES

STANDARD NOMENCLATURE LISTS.

Truck 4 ton, 4 x 4, Cargo (Four Wheel Drive HAR-1) . . . SNL G-531
Cleaning, preserving and lubricating materials . . . . . SNL K-1
Current Standard Nomenclature Lists are as tabulated here. An up-to-date list of SNL's is maintained as the "Ordnance Publications for Supply Index" . . . . . OPSI

EXPLANATORY PUBLICATIONS.

Automotive.

Automotive brakes . . . . . TM 10-565
Automotive electricity . . . . . TM 10-580
Inspection . . . . . TM 10-545
Internal combustion engine . . . . . TM 10-570
Automotive power transmission units . . . . . TM 10-585
Fuels and carburetion . . . . . TM 10-550

Lubrication.

Automotive lubrication . . . . . TM 10-540
Cleaning, preserving, lubricating and welding materials . . TM 9-850

Maintenance.

Echelon system of maintenance . . . . . TM 10-525
Maintenance and repair . . . . . TM 10-520
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(For explanation of symbols, see FM 21-6)